Documents of the World Radiocommunication Conference (WRC-2000) (Istanbul, 2000)

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INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

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WORKING GROUP 5A

Chairperson, Sub-Working Group 5A-2

CONCLUSIONS RELATING TO AGENDA ITEM 1.11

This text does not concern the English version.

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INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

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ISTANBUL, 8 MAY – 2 JUNE 2000

WORKING GROUP 5A

Chairperson, Sub-Working Group 5A-2

CONCLUSIONS RELATING TO AGENDA ITEM 1.11

1 Suppression of Resolution 219 (WRC-97)

SUP

RESOLUTION 219 (WRC-97)

Studies relating to consideration of the allocation to the non-geostationary mobile-satellite service in the meteorological aids band 405-406 MHz and the impact on primary services allocated in the adjacent bands

2 Revision of Resolution 214 (Rev.WRC-97)

MOD

RESOLUTION 214 (Rev.WRC-~~97~~2000)

Sharing studies relating to consideration of the allocation of bands below 1 GHz to the non-geostationary mobile-satellite service

The World Radiocommunication Conference (~~Geneva, 1997~~Istanbul, 2000),

considering

a) that the agenda of this Conference included consideration of additional allocations on a worldwide basis for the non-geostationary mobile-satellite service (non-GSO MSS) below 1 GHz;

b) that the 199~~7~~9 Conference Preparatory Meeting, in its Report, indicated that for the non-GSO MSS below 1 GHz there is not enough spectrum currently allocated to allow development of all the systems currently in coordination, and that, in order to meet projected MSS requirements below 1 GHz, a range of an additional 7 to 10 MHz will be required in the near future although, as well, it recognized that a number of these systems may not be implemented for reasons not connected with spectrum availability;

c) that there is an urgent need to make usable spectrum available on a worldwide basis for non-GSO MSS systems operating below 1 GHz;

d) that some non-GSO MSS systems are already operated by some administrations in existing MSS allocations and are at an advanced stage of consideration for operation in many other administrations, and that studies have been conducted within ITU-R on sharing between non-GSO MSS and certain terrestrial services which demonstrate the feasibility of sharing in the cases studied;

e) that issues concerning the technical and operational means to facilitate sharing between the terrestrial services and non-GSO MSS in the bands below 1 GHz remain to be studied;

f) that the requirements for the introduction of these new technologies have to be balanced with the needs of other services having allocations below 1 GHz;

g) that the bands below 1 GHz are extensively used by administrations for many services, although the extent to which they are used by each administration varies throughout the world~~,~~;

h) that the bands 410-430 MHz and 440-470 MHz are extensively used by existing services in Region 1, in many countries in Region 3, and in some countries in Region 2, and new terrestrial systems are planned to be introduced in these bands;

j) that studies of certain bands have not been completed,

noting

a) that additional studies may identify ~~other~~suitable bands below 1 GHz ~~which could also~~and appropriate sharing techniques to be considered ~~suitable~~ for ~~a~~ worldwide allocations to non-GSO MSS;

~~*b)* that, based on the sharing techniques being developed for MSS below 1 GHz and the current use of the band 138-470 MHz by terrestrial services, this range may be considered for further study;~~

~~c~~b) that constraints on the duration of any single transmission from an individual MSS mobile earth station and constraints on the period between consecutive transmissions from an individual MSS mobile earth station operating on the same frequency may facilitate sharing with terrestrial services;

~~d~~c) that interference mitigation techniques, such as the dynamic channel activity assignment system described in Recommendation ITU-R M.1039~~-1~~, may be used by non-GSO MSS systems below 1 GHz in the Earth-to-space direction to promote compatibility with terrestrial systems when operating in the same frequency band;

~~e~~d) that new technologies employed by some radiocommunication services, especially within the terrestrial mobile and broadcasting services, which require spectrum below 1 GHz, may have an impact on the sharing possibilities;

e) that substantial progress has been made by recently completed ITU-R studies of sharing between the non-GSO MSS below 1 GHz in the Earth-to-space direction and existing specific services, however, studies on some important issues remain to be completed;

f) that non-GSO MSS systems operating below 1 GHz have undergone advance publication by the Radiocommunication Bureau and that administrations may seek to implement further such systems;

~~*g)* that there may be a need to review constraints on the current allocations to the MSS below 1 GHz,~~

g) that the use of some sharing techniques such as those referenced in *noting c)* results in non-GSO MSS systems which have significantly greater spectrum requirements in the Earth-to-space direction than in the space-to-Earth direction,

resolves

1 that further studies are urgently required on operational and technical means to facilitate sharing between the non-GSO MSS and other radiocommunication services having allocations and operating below 1 GHz;

2 that WRC-~~99~~02/03 be invited to consider, on the basis of the results of the studies conducted within ITU-R and the studies referred to in *resolves* 1 above, additional allocations on a worldwide basis for the non-GSO MSS below 1 GHz;

3 that relevant entities and organizations be invited to participate in these sharing studies~~;~~,

~~4 that WRC-99 be invited to consider a review of the technical and regulatory constraints on non-GSO MSS allocations in the bands below 1 GHz, taking into account *considering d)*,~~

invites ITU-R

1 to study and develop Recommendations on, as a matter of urgency, the performance requirements, sharing criteria and technical and operational issues relating to sharing between ~~both~~ existing and planned systems of allocated services and non-GSO MSS below 1 GHz;

2 as a matter of urgency, to carry out studies in preparation for WRC-~~99~~02/03, ~~including a review of the operating constraints referred to in *noting c)* necessary to protect the~~

existing and planned development of all of the services to which the bands below 1 GHz are allocated, having regard to *noting dc)*;

3 as a matter of urgency, to carry out studies in preparation for WRC-9902/03 with respect to interference mitigation techniques, such as the dynamic channel activity assignment system described in Recommendation ITU-R M.1039-1, necessary to permit the continued development of all of the services to which the bands are allocated;

4 to carry out a review for a future competent conference of the technical and regulatory constraints on non-GSO MSS allocations in the bands below 1 GHz, having regard to *considering d)*;

54 to bring the results of these studies to the attention of WRC-9902/03 and the relevant preparatory meetings,

urges administrations

1 to participate actively in these studies, with the involvement of both terrestrial and satellite interests;

2 to submit to ITU-R reports on their technical studies and on their operational and frequency sharing experience with non-GSO MSS systems operating below 1 GHz,

encourages administrations

to consider the use of dynamic channel assignment techniques, such as those described in Recommendation ITU-R M.1039-1.

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COMMITTEE 5

Working Group 5B

MODIFICATIONS TO APPENDIX S18

(AGENDA ITEM 1.18)

The attached modifications to Appendix S18 “Table of transmitting frequencies in the VHF maritime mobile band” have been approved by Working Group 5B and are hereby submitted to Committee 5 for approval.

T. MIZUIKE
Chairperson, Working Group 5B

APPENDIX S18

Table of transmitting frequencies in the VHF maritime mobile band

(See Article **S52**)

MOD

NOTE – For assistance in understanding the Table, see notes *a)* to ~~*n)*~~*o)* below.

MOD

Channel designator	Notes	Transmitting frequencies (MHz)		Inter-ship	Port operations and ship movement		Public corres-pondence
		Ship stations	Coast stations		Single frequency	Two frequency	
60		156.025	160.625			x	x
01		156.050	160.650			x	x
61	*m), o)*	156.075	160.675		x	x	x
02	*m), o)*	156.100	160.700		x	x	x
62	*m), o)*	156.125	160.725		x	x	x
03	*m), o)*	156.150	160.750		x	x	x
63	*m), o)*	156.175	160.775		x	x	x
04	*m), o)*	156.200	160.800		x	x	x
64	*m), o)*	156.225	160.825		x	x	x
05	*m), o)*	156.250	160.850		x	x	x
65	*m), o)*	156.275	160.875		x	x	x
06	*f)*	156.300		x			
66		156.325	160.925			x	x
07		156.350	160.950			x	x
67	*h)*	156.375	156.375	x	x		
08		156.400		x			
68		156.425	156.425		x		
09	*i)*	156.450	156.450	x	x		
69		156.475	156.475	x	x		
10	*h)*	156.500	156.500	x	x		
70	*j)*	156.525	156.525	Digital selective calling for distress, safety and calling			
11		156.550	156.550		x		
71		156.575	156.575		x		
12		156.600	156.600		x		
72	*i)*	156.625		x			
13	*k)*	156.650	156.650	x	x		
73	*h), i)*	156.675	156.675	x	x		
14		156.700	156.700		x		
74		156.725	156.725		x		
15	*g)*	156.750	156.750	x	x		
75	*n)*	156.775			x		

Channel designator	Notes	Transmitting frequencies (MHz)		Inter-ship	Port operations and ship movement		Public corres-pondence
		Ship stations	Coast stations		Single frequency	Two frequency	
16		156.800	156.800	DISTRESS, SAFETY AND CALLING			
76	*n)*	156.825			x		
17	*g)*	156.850	156.850	x	x		
77		156.875		x			
18	*m)*	156.900	161.500		x	x	x
78		156.925	161.525			x	x
19		156.950	161.550			x	x
79		156.975	161.575			x	x
20		157.000	161.600			x	x
80		157.025	161.625			x	x
21		157.050	161.650			x	x
81		157.075	161.675			x	x
22	*m)*	157.100	161.700		x	x	x
82	*m), o)*	157.125	161.725		x	x	x
23	*m), o)*	157.150	161.750		x	x	x
83	*m), o)*	157.175	161.775		x	x	x
24	*m), o)*	157.200	161.800		x	x	x
84	*m), o)*	157.225	161.825		x	x	x
25	*m), o)*	157.250	161.850		x	x	x
85	*m), o)*	157.275	161.875		x	x	x
26	*m), o)*	157.300	161.900		x	x	x
86	*m), o)*	157.325	161.925		x	x	x
27		157.350	161.950			x	x
87		157.375			x		
28		157.400	162.000			x	x
88		157.425			x		
AIS 1	*l)*	161.975	161.975				
AIS 2	*l)*	162.025	162.025				

Notes referring to the Table

General notes

NOC

a) to *e)*

Specific notes

NOC

f) to *~~p~~l)*

MOD

m) These channels (18 and 82 to 86) may be operated as single frequency channels, subject to special arrangement between interested or affected administrations.

NOC

n)

ADD

o) These channels may be used to provide bands for initial testing and the possible future introduction of new technologies, subject to a special arrangement between interested or affected administrations. Stations using these channels or bands for the testing and the possible future introduction of new technologies shall not cause harmful interference to, and shall not claim protection from harmful interference of other stations operating in accordance with Article **S5**.

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COMMITTEE 5

Working Group 5B

MODIFICATIONS TO RESOLUTION 342

(AGENDA ITEM 1.18)

The attached modifications to Resolution 342, "Review of new technology to provide improved efficiency in the use of the band 156-174 MHz by stations in the maritime mobile service" has been adopted by Working Group 5B. The text is submitted to Committee 5 for approval.

T. MIZUIKE
Chairperson, Working Group 5B

MOD

RESOLUTION 342 (Rev.WRC-972000)

Review of new technology to provide improved efficiency in the use of the band 156-174 MHz by stations in the maritime mobile service

The World Radiocommunication Conference (Geneva, 1997Istanbul, 2000),

considering

a) that the agenda of WRC-97this Conference included the consideration of the use of new technology for the maritime mobile service in the band 156-174 MHz and the consequential revision of Appendix **S18** to the Radio Regulations in respect of maritime mobile communications and the use of new technology for maritime radiotelephony channels;

b) Recommendation **318 (Mob-87)** particularly *noting b)* and *c)*;

c) that Appendix **S18** identifies frequencies to be used for distress and safety communications on an international basis;

d) that the introduction of new technology in the maritime mobile service shall not disrupt distress and safety communications in the VHF band including those established by the International Convention for the Safety of Life at Sea (SOLAS), 1974, as amended;

e) that the date for full implementation of GMDSS was 1 February 1999;

ef) that ITU-R is conducting studies on improving efficiency in the use of this band, and that these studies are still ongoing;

fg) that changes made in Appendix **S18** should not prejudice the future use of these frequencies or the capabilities of systems or new applications required for use by the maritime mobile service;

gh) that the congestion on Appendix **S18** frequencies calls for the implementation of efficient new technologies;

hi) that the use of new technology on maritime VHF frequencies will make it possible to better respond to the emerging demand for new services,;

j) that ITU-R has adopted Recommendation ITU-R M.1312 relating to a long-term solution for improved efficiency in the use of the band 156-174 MHz by stations in the maritime mobile service;

k) that ITU-R has adopted Recommendation ITU-R M.1371 relating to technical characteristics for a universal shipborne automatic identification system using time division multiple access in the VHF maritime mobile band;

l) that there is a need to maintain some duplex channels for specific applications,

noting

that some administrations are considering adopting some of the above changes to their operations within the Appendix **S18** frequencies,

a) that the global maritime market may not be of a sufficient size to warrant the development of a new system solely for the maritime service;

b) that digital systems have been successfully implemented in the land mobile service,

noting also

that this Conference has modified Appendix **S18** together with the addition of footnote *o)* to permit the possible use on a voluntary basis of various channels or bands created by the conversion of some duplex channels to simplex channels, for the initial testing and the possible future introduction of new technology,

resolves

~~that WRC-99 should consider the use of new technology in the band 156-174 MHz and consequential revision of Appendix **S18**,~~

1 that in order to provide full worldwide interoperability of equipment on ships, there should be one technology or more than one interoperable worldwide technology implemented in Appendix **S18**;

2 that as soon as the ITU-R studies are complete, a future competent conference should consider any necessary changes to Appendix **S18** to enable the use of new technology by the maritime mobile service,

invites ITU-R

to ~~continue~~finalize the following studies~~ on the following with a view to providing a report to WRC-99~~:

a) to identify the future requirements of the maritime mobile service;

b) to identify suitable technical characteristics of the system or interoperable systems to replace existing technology;

c) to identify necessary modifications to the frequency plan contained within Appendix **S18**;

d) to recommend a ~~timetable~~transition plan for the introduction of new technology~~ and the necessary changes~~;

e) to ~~study and~~recommend how new technology can be introduced ~~without harming~~whilst ensuring compliance with the distress and safety requirements,

instructs the Secretary-General

to communicate this Resolution to the International Maritime Organization and the International Association of Lighthouse Authorities.

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COMMITTEE 5

Working Group 5B

SPACE-TO-SPACE ALLOCATION FOR THE RADIONAVIGATION-SATELLITE SERVICE

(AGENDA ITEM 1.15.2)

Working Group 5B has prepared the attached text concerning space-to-space allocation to the radionavigation-satellite service and is submitting it to Committee 5 for consideration and approval.

Takeshi MIZUIKE
Chairperson, Working Group 5B
Box 132

MOD

890-1 350 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
1 215-1 240	EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION RADIONAVIGATION-SATELLITE (space-to-Earth) (space-to-space) S5.329 ADD S5.329A SPACE RESEARCH (active) S5.330 S5.331 S5.332	
1 240-1 260	EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION RADIONAVIGATION-SATELLITE (space-to-Earth) (space-to-space) S5.329 ADD S5.329A SPACE RESEARCH (active) Amateur S5.330 S5.331 S5.332 S5.334 S5.335	

MOD

1 525-1 610 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
1 559-1 610	AERONAUTICAL RADIONAVIGATION RADIONAVIGATION-SATELLITE (space-to-Earth) (space-to-space) ADD S5.329A S5.341 S5.355 S5.359 S5.363	

ADD

S5.329A Use of systems in the radionavigation-satellite service (space-to-space) operating in the bands 1 215-1 260 MHz and 1 559-1 610 MHz is not intended to provide safety service application, and shall not impose any additional constraints on other systems or services operating in accordance with the Table of Frequency Allocations.

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COMMITTEE 5

Working Group 5D

ISSUES RELATED TO THE SHARING SITUATION IN THE FREQUENCY BAND 13.75-14 GHz

WG 5D reached the following conclusions:

Footnote S5.502

The proposed revision of footnote S5.502 is shown in Annex 1.

Some administrations were of the view that the minimum FSS earth station antenna diameter of 4.5 m should not be a mandatory requirement.

Based on the sharing studies conducted by ITU-R between non-GSO FSS systems and radionavigation and radiolocation systems, there were some proposals to extend the restriction of averaged e.i.r.p. of radars to the whole space. The agreement on the last sentence of S5.502 is subject to the decision made on the average e.i.r.p. of radars in the second sentence, as it conditions the balance of constraints between the different services.

Footnote S5.503

The proposed revision of footnote S5.503 is shown in Annex 1.

One administration proposed NOC to footnote S5.503.

New Resolution [COM5/10]

Annex 2 gives the proposed text for new Resolution [COM5/10].

Annexes: 2

ANNEX 1

MOD

S5.502 In the band 13.75-14 GHz, ~~the e.i.r.p. of any emission from~~ an earth station in the fixed-satellite service shall ~~be at least 68 dBW, and should not exceed 85 dBW, with~~ have a minimum antenna diameter of 4.5 m and the e.i.r.p. of any emission should be at least 68 dBW and should not exceed 85 dBW. In addition the e.i.r.p., averaged over one second, radiated by a station in the radiolocation or radionavigation services~~towards the geostationary-satellite orbit~~ shall not exceed 59 dBW. The protection of assignments to receiving space stations in the fixed-satellite service operating with earth stations that, individually, have an e.i.r.p. of less than 68 dBW shall not impose constraints on the operation of the radiolocation and radionavigation stations operating in accordance with the Radio Regulations. **S5.43** does not apply. See Resolution COM5/10.

MOD

S5.503 In the band 13.75-14 GHz, geostationary space stations in the space research service for which information for advance publication has been received by the Bureau prior to 31 January 1992 shall operate on an equal basis with stations in the fixed-satellite service; after that date, new geostationary space stations in the space research service will operate on a secondary basis. ~~The e.i.r.p. density of emissions from any earth station in the fixed-satellite service shall not exceed 71 dBW in any 6 MHz band in the frequency range 13.772-13.778 GHz u~~Until those geostationary space stations in the space research service for which information for advance publication has been received by the Bureau prior to 31 January 1992 cease to operate in this band~~.~~:

a) the e.i.r.p. density of emissions from any earth station in the fixed-satellite service operating with a space station in geostationary-satellite orbit shall not exceed 71 dBW in the 6 MHz band in the frequency range 13.772-13.778 GHz;

b) the e.i.r.p. density of emissions from any earth station in the fixed-satellite service operating with a space station in non-geostationary-satellite orbit shall not exceed 51 dBW in the 6 MHz band in the frequency range 13.772-13.778 GHz.

Automatic power control may be used to increase the e.i.r.p. density ~~above 71 dBW~~ in ~~any~~the 6 MHz band in this frequency range to compensate for rain attenuation, to the extent that the power-flux density at the fixed-satellite service space station does not exceed the value resulting from use by an earth station of an e.i.r.p. of 71 dBW or 51 dBW, as appropriate, in ~~any~~the 6 MHz band in clear sky conditions.

ANNEX 2

ADD

RESOLUTION [COM5/10] (WRC-2000)

Review of sharing conditions between services in the band 13.75-14 GHz

The World Radiocommunication Conference (Istanbul, 2000),

considering

a) that WARC-92 (Malaga-Torremolinos) added an allocation to the fixed-satellite service (FSS) Earth-to-space in the band 13.75-14 GHz;

b) that this band is shared with the radiolocation and radionavigation services and certain limitations have been placed on the fixed-satellite, radiolocation and radionavigation services in provision No. **S5.502**;

c) that the services operating in this band are evolving and may have new technical requirements;

d) that the band 13.772-13.778 GHz is also shared with the space research service under the conditions set out in provisions Nos. **S5.503**;

e) that in some countries, the band is also allocated to the fixed service and the mobile service (provisions Nos. **S5.499** and **S5.500**) and to the radionavigation service (provision No. **S5.501**);

f) that the GSO FSS operators have expressed interest in operating earth station antennas with a diameter less than 4.5 m in the band 13.75-14 GHz;

g) that there is a need to determine the sharing conditions affecting the radiolocation, space research and fixed-satellite services and to maintain the delicate balance between these services,

resolves to invite ITU-R

1 to conduct studies with the aim of completion in time for consideration by WRC-03 the sharing conditions stated in footnotes Nos. **S5.502** and **S5.503** with a view to reviewing the constraints in **S5.502** regarding the minimum antenna diameter of FSS earth stations operating with GSO and the constraints on the e.i.r.p. of the radiolocation service;

2 to identify and study with the aim of completion in time for consideration by WRC-03 possible alternative sharing conditions to those stated in footnotes Nos. **S5.502** and **S5.503**.

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COMMITTEE 5

Working Group 5D

Working Group 5D considered proposals for changes to certain provisions of Article S9, specifically S9.12 and S9.13, to reflect the required modifications for the implementation of provisions relevant to Resolutions 130 and 538. In the general review of these provisions the group felt that changes would be required to all provisions under S9.11A. The following text describes these changes.

Working Group 5D also considered the requirements for publication of the results of BR examination of filings for non-GSO systems, and proposed addition of a new Article S9.35A; see attached proposal.

MOD

ARTICLE S9

Procedure for effecting coordination with or obtaining agreement of other administrations[1, 2, 3, 4, 5]

Section II – Procedure for effecting coordination[8, 9]

Sub-Section IIA – Requirement and request for coordination

S9.11A *e)* for a station for which the requirement to coordinate is included either in a footnote of the Table of Frequency Allocations referring to this provision or in a Resolution referring to this provision:, the provisions in **S9.12** to **S9.16** are applicable;

S9.12 *f* i) for a station for which the requirement to coordinate is included either in a footnote of the Table of Frequency Allocations referring to this provision or to **S9.11A**, or in a Resolution referring to this provision or to **S9.11A**, in a satellite network using a non-geostationary-satellite orbit, in respect of any other satellite network using a non-geostationary-satellite orbit, ~~and in respect of any other satellite network using the geostationary-satellite orbit,~~ with the exception of coordination between earth stations operating in the opposite direction of transmission;

S9.12A *g)* for a station for which the requirement to coordinate is included either in a footnote of the Table of Frequency Allocations referring to this provision or to **S9.11A**, or in a Resolution referring to this provision or to **S9.11A**, in a satellite network using a non-geostationary-satellite orbit, in respect of any other satellite network using the geostationary-satellite orbit, with the exception of coordination between earth stations operating in the opposite direction of transmission;

S9.13 *h* ii) for a station for which the requirement to coordinate is included either in a footnote of the Table of Frequency Allocations referring to this provision or to **S9.11A**, or in a Resolution referring to this provision or to **S9.11A**, in a satellite network using the geostationary-satellite orbit, in respect of any other satellite network using a non-geostationary-satellite orbit, with the exception of coordination between earth stations operating in the opposite direction of transmission;

S9.14 *i* iii) ~~which is~~for a space station of a satellite network for which the requirement to coordinate is included either in a footnote of the Table of Frequency Allocations referring to **S9.11A** or in a Resolution referring to **S9.11A**, in respect of stations of terrestrial services where the threshold value is exceeded;

S9.15 *j* iv) ~~which is~~for either a specific earth station or typical earth station of a non-geostationary satellite network for which the requirement to coordinate is included either in a footnote of the Table of Frequency Allocations referring to **S9.11A** or in a Resolution referring to **S9.11A**, in respect of terrestrial stations in frequency bands allocated with equal rights to space and terrestrial services and where the coordination area of the earth station includes the territory of another country;

S9.16 *k* v) which is for a transmitting station of a terrestrial service for which the requirement to coordinate is included either in a footnote of the Table of Frequency Allocations referring to **S9.11A** or in a Resolution referring to **S9.11A** and which is located within the coordination area of an earth station in a non-geostationary-satellite network;

S9.17 *fl)*[13] for any specific earth station or typical mobile earth station in frequency bands above 1 GHz allocated with equal rights to space and terrestrial services, in respect of terrestrial stations, where the coordination area of the earth station includes the territory of another country, with the exception of the coordination under No. **S9.15**;

S9.17A *gm)* for any specific earth station, in respect of other earth stations operating in the opposite direction of transmission, in frequency bands allocated with equal rights to space radiocommunication services in both directions of transmission and where the coordination area of the earth station includes the territory of another country or the earth station is located within the coordination area of another earth station, with the exception of the frequency bands subject to the Appendix **S30A** Plans;

S9.18 *hn)* for any transmitting station of a terrestrial service in the bands referred to in No. **S9.17** within the coordination area of an earth station, in respect of this earth station, with the exception of the coordination under Nos. **S9.16** and **S9.19**;

S9.19 *io)* for any transmitting station of a terrestrial service in a frequency band shared on an equal primary basis with the broadcasting-satellite service, with respect to an earth station of the broadcasting-satellite service, except where this service is subject to the Appendix **S30** Plans;

S9.20 Not used.

S9.21 *jp)* for any station of a service for which the requirement to seek the agreement of other administrations is included in a footnote of the Table of Frequency Allocations referring to this provision.

S9.22 Not used.

[13] **S9.17.1** Application of this provision with respect to Articles 6 and 7 of Appendices **S30** and **S30A** is suspended pending a decision of WRC-99 on the revision of these two Appendices.

MOD

TABLE S5-1 (*continued*)

Reference of Article S9	Case	Frequency bands (and Region) of the service for which coordination is sought	Threshold/condition	Calculation method	Remarks
No. **S9.11** GSO/terrestrial	A space station in the BSS in any band shared on an equal primary basis with terrestrial services and where the BSS is not subject to a Plan, in respect of terrestrial services	620-790 MHz 1 452-1 492 MHz 2 310-2 360 MHz 2 520-2 655 MHz 2 655-2 670 MHz 12.5-12.75 GHz (Region 3) 17.7-17.8 GHz (Region 2) 21.4-22 GHz (Region 1 and 3) 40.5-42.5 GHz 84-86 GHz	Condition: bandwidths overlap	Check by using the assigned frequencies and bandwidths	
No. **S9.12** ~~1)~~Non-GSO/ non-GSO	A station in a satellite network using a non-geostationary-satellite orbit in the frequency bands for which a footnote <u>or a Resolution</u> refers to **S9.11A** <u>or to **S9.12**</u> in respect of any other satellite network using a non-geostationary-satellite orbit, with the exception of coordination between earth stations operating in the opposite direction of transmission	~~See Table S5-2~~<u>[See modifications by 4A]</u>	Condition: bandwidths overlap	Check by using the assigned frequencies and bandwidths	

No. **S9.12A** ~~2)~~Non-GSO/ GSO	A station in a satellite network using a non-geostationary-satellite orbit in the frequency bands for which a footnote or a Resolution refers to **S9.11A** or to **S9.12** in respect of any other satellite network using the geostationary-satellite orbit, with the exception of coordination between earth stations operating in the opposite direction of transmission	~~See Table S5-2~~[See modifications by 4A]	Condition: bandwidths overlap	Check by using the assigned frequencies and bandwidths	
No. **S9.13** GSO/non-GSO	A station in a satellite network using the GSO in the frequency bands for which a footnote or a Resolution refers to No. **S9.11A** or to **S9.12** in respect of any other satellite network using a non-GSO, with the exception of coordination between earth stations operating in the opposite direction of transmission	See Table S5-2	Condition: bandwidths overlap	Check by using the assigned frequencies and bandwidths	

Publication of results of examinations

MOD

ARTICLE S9

Procedure for effecting coordination with or obtaining agreement of other administrations[1, 2, 3, 4, 5]

Sub-Section IIA – Requirement and request for coordination

S9.27 Frequency assignments to be taken into account in effecting coordination are identified using Appendix **S5**.

S9.30 Requests for coordination made under Nos. **S9.7** to **S9.14** and **S9.21** shall be sent by the requesting administration to the Bureau, together with the appropriate information listed in Appendix **S4** to these Regulations.

S9.34 On receipt of the complete information sent under No. **S9.30** or No. **S9.32** the Bureau shall promptly:

S9.35 *a)* examine that information with respect to its conformity with No. **S11.31**[13*bis*];

S9.36 *b)* identify in accordance with No. **S9.27** any administration with which coordination may need to be effected[14];

S9.37 *c)* include their names in the publication under No. **S9.38;**

S9.38 *d)* publish, as appropriate, the complete information in the Weekly Circular within four months. When the Bureau is not in a position to comply with the time limit referred to above, it shall periodically so inform the administrations, giving the reasons therefore.

S9.39 Not used.

S9.40 *e)* inform the administrations concerned of its actions and communicate the results of its calculations, drawing attention to the relevant Weekly Circular.

S9.40A If the information is found to be incomplete, the Bureau shall immediately seek from the administration concerned any clarification required and information not provided.

[13*bis*] **S9.35.1** The Bureau shall include the detailed results of its examination under No. **S11.31** of compliance with the limits in Tables **S22-1** to **S22-3** inclusive in the publication under No. **S9.38**.

[14] **S9.36.1** The list of administrations identified by the Bureau under Nos. **S9.11** to **S9.14** and **S9.21** is only for information purposes, to help administrations comply with this procedure.

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

ISTANBUL, 8 MAY – 2 JUNE 2000

Addendum 1 to
Document 307-E
22 May 2000
Original: English

WORKING GROUP 5A

Chairperson, Sub-Working Group 5A-1

CONCLUSIONS RELATING TO AGENDA ITEM 1.6.1
ON THE USE OF HAPS IN IMT-2000

Add the following to *resolves* part of Resolution [COM5/13]:

ADD

RESOLUTION [COM5/13] (WRC-2000)

Use of high altitude platform stations providing IMT-2000 in the bands 1 885-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz in Regions 1 and 3, and 1 885-1 980 MHz and 2 110-2 160 MHz in Region 2

resolves

3 that administrations wishing to implement HAPS within a terrestrial IMT-2000 system shall, pending the review by WRC-2000/03 of the studies mentioned below, for the purpose of protecting fixed service stations operating in neighbouring administrations from co-channel interference, take full account of the relevant ITU-R Recommendations relating to protection values for fixed stations (see Recommendation ITU-R F.758).

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

Document 307(Rev.1)-E
24 May 2000
Original: English

ISTANBUL, 8 MAY – 2 JUNE 2000

WORKING GROUP 5A

Chairperson, Sub-Working Group 5A-1

CONCLUSIONS RELATING TO AGENDA ITEM 1.6.1
ON THE USE OF HAPS IN IMT-2000

1 Modifications to Article S5

MOD

1 710-2 170 MHz

<table>
<tr><th colspan="3">Allocation to services</th></tr>
<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr><td>1 710-1 930</td><td colspan="2">FIXED
MOBILE S5.380 ADD S5.BBB
S5.149 S5.341 S5.385 S5.386 S5.387 S5.388</td></tr>
<tr><td>1 930-1 970
FIXED
MOBILE ADD S5.BBB
S5.388</td><td>1 930-1 970
FIXED
MOBILE ADD S5.BBB
Mobile-satellite (Earth-to-space)
S5.388</td><td>1 930-1 970
FIXED
MOBILE ADD S5.BBB
S5.388</td></tr>
<tr><td>1 970-1 980</td><td colspan="2">FIXED
MOBILE ADD S5.BBB
S5.388</td></tr>
<tr><td>1 980-2 010</td><td colspan="2">FIXED
MOBILE
MOBILE-SATELLITE (Earth-to-space)
S5.388 S5.389A S5.389B S5.389F</td></tr>
<tr><td>2 010-2 025
FIXED
MOBILE ADD S5.BBB
S5.388</td><td>2 010-2 025
FIXED
MOBILE
MOBILE-SATELLITE
(Earth-to-space)
S5.388 S5.389C S5.389D
S5.389E S5.390</td><td>2 010-2 025
FIXED
MOBILE ADD S5.BBB
S5.388</td></tr>
</table>

2 025-2 110	SPACE OPERATION (Earth-to-space) (space-to-space) EARTH EXPLORATION-SATELLITE (Earth-to-space) (space-to-space) FIXED MOBILE S5.391 SPACE RESEARCH (Earth-to-space) (space-to-space) S5.392	
2 110-2 120	FIXED MOBILE ADD S5.BBB SPACE RESEARCH (deep space) (Earth-to-space) S5.388	
2 120-2 160 FIXED MOBILE ADD S5.BBB S5.388	**2 120-2 160** FIXED MOBILE ADD S5.BBB Mobile-satellite (space-to-Earth) S5.388	**2 120-2 160** FIXED MOBILE ADD S5.BBB S5.388
2 160-2 170 FIXED MOBILE ADD S5.BBB S5.388 S5.392A	**2 160-2 170** FIXED MOBILE MOBILE-SATELLITE (space-to-Earth) S5.388 S5.389C S5.389D S5.389E S5.390	**2 160-2 170** FIXED MOBILE ADD S5.BBB S5.388

ADD

S5.BBB In Regions 1 and 3, the bands 1 885-1 980 MHz , 2 010-2 025 MHz and 2 110-2 170 MHz, and in Region 2, the bands 1 885-1 980 and 2 110-2 160 MHz, may be used by high altitude platform stations as base stations to provide International Mobile Telecommunications 2000 (IMT-2000) [in accordance with Resolution [COM5/13]]. [(See Resolution [COM5/13].)] [Such use shall comply with the provisions of Resolution [COM5/13].] [These bands are allocated to the fixed, mobile and mobile-satellite services, and the use by IMT-2000 applications using high altitude platform stations as an IMT-2000 base station in these bands is based on the equality of rights between all allocated radio services and does not establish priority of assignments in these bands among stations of the primary services to which they are allocated.]

2 Modifications to Article S11

[**ADD**

S11.8A *g)* if that assignment is to be used for a high altitude platform station.]

3 New resolution

ADD

RESOLUTION [COM5/13] (WRC-2000)

Use of high altitude platform stations providing IMT-2000 in the bands 1 885-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz in Regions 1 and 3 and 1 885-1 980 MHz and 2 110-2 160 MHz in Region 2

The World Radiocommunication Conference 2000 (Istanbul, 2000),

considering

a) that the bands 1 885-2 025 MHz and 2 110-2 200 MHz, are identified in No. **S5.388** as intended for use on a worldwide basis for IMT-2000, including the bands 1 980-2 010 MHz and 2 170-2 200 MHz for the satellite component of IMT-2000;

b) that a high altitude platform station is defined in No. **S1.66A** as "a station located on an object at an altitude of 20 to 50 km and at a specified, nominal, fixed point relative to the Earth";

c) that high altitude platform stations may offer a new means of providing IMT-2000 services with minimal network build out as it is capable of providing service to a large footprint together with a dense coverage;

d) that the use of high altitude platform stations as base stations of terrestrial IMT-2000 is optional for administrations and that such use should not have any priority over other terrestrial IMT-2000 use;

e) that, in accordance with [No. **MOD S5.388** and Resolution **IMT (WRC-2000)**] [No. **S5.388** and Resolution **212 (Rev.WRC-97)**], administrations may use the bands identified for IMT-2000, including the bands noted herein, for stations of other primary services to which they were allocated;

f) that these bands are allocated to the fixed and mobile services on a co-primary basis;

g) that ITU-R has studied sharing and coordination between high altitude platform stations and other stations within IMT-2000, has considered compatibility of high altitude platform stations within IMT-2000 with some services allocated in the adjacent bands, and has established Recommendation ITU-R M.1456;

h) that ITU-R did not address sharing and coordination between high altitude platform stations and some existing systems, particularly PCS (Personal Communications Service), MMDS (Multichannel Multipoint Distribution Service), and systems in the fixed service, which are currently operating in some administrations in the bands 1 885-2 025 MHz and 2 110-2 200 MHz;

i) that in accordance with No. **S5.BBB**, high altitude platform stations may be used as base stations of terrestrial IMT-2000 in the bands 1 885-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz in Regions 1 and 3 and 1 885-1 980 MHz and 2 110-2 160 MHz in Region 2 [the use by high altitude platform stations as an IMT-2000 base station in these bands is based on the equality of rights between all allocated radio services and does not establish priority of assignments in these bands among stations of the primary services to which they are allocated],

recognizing

that the value in *resolves 1* may not be appropriate for the protection of some stations operating in these bands in the fixed and mobile services,

resolves

1 that:

a) for the purpose of protecting certain stations operating within IMT-2000 in neighbouring administrations from co-channel interference, a high altitude platform station operating as a base station to provide IMT-2000 shall not exceed a provisional value of co-channel power flux-density (pfd) level –121.5 dB (W/(m^2/MHz)) on the Earth's surface outside an administration's borders unless agreed otherwise with the affected neighbouring administration;

b) a high altitude platform station operating as a base station to provide IMT-2000, in order to protect fixed stations from interference, shall not exceed a provisional value of out-of-band pfd level on the Earth's surface in the bands 2 025-2 110 MHz of:

– –165 dB(W/(m^2/MHz)) for angles of arrival (θ) less than 5° above the horizontal plane;

– –165 + 1.75 (θ – 5) dB (W/(m^2/MHz)) for angles of arrival between 5° and 25° above the horizontal plane; and

– –130 dB(W/(m^2/MHz)) for angles of arrival between 25° and 90° above the horizontal plane,

2 that such a high altitude platform station shall, as of the end of WRC-03, operate only in accordance with such limits as are confirmed or, if appropriate, revised by WRC-03, irrespective of the date of bringing into use;

3 that administrations wishing to implement high altitude platform stations within a terrestrial IMT-2000 system shall conform with the following:

a) that for the purpose of protecting certain stations operating within ITM-2000 in neighbouring administrations from co-channel interference, administrations using high altitude platform stations as base stations to IMT-2000 shall use antennas that comply with the following antenna pattern:

$G(\psi) = G_m - 3(\psi/\psi_b)^2$	dBi	for	$0° \leq \psi \leq \psi_1$
$G(\psi) = G_m + L_N$	dBi	for	$\psi_1 < \psi \leq \psi_2$
$G(\psi) = X - 60\log(\psi)$	dBi	for	$\psi_2 < \psi \leq \psi_3$
$G(\psi) = L_F$	dBi	for	$\psi_3 < \psi \leq 90°$

where:

$G(\psi)$: gain at the angle ψ from the main beam direction (dBi)

G_m: maximum gain in the main lobe (dBi)

ψ_b: one-half of the 3 dB beamwidth in the plane of interest (3 dB below G_m) (degrees)

L_N: near-in-side-lobe-level in dB relative to the peak gain required by the system design, and has a maximum value of –25 dB

L_F: G_m - 73 dBi far side-lobe level (dBi)

$\psi_1 = \psi_b \sqrt{-L_N/3}$ degrees

$\psi_2 = 3.745\ \psi_b$ degrees

$X = G_m + L_N + 60\log(\psi_2)$ dB

$\psi_3 = 10^{(X - L_F)/60}$ degrees

The 3 dB beamwidth ($2\psi_b$) is again estimated by:

$(\psi_b)^2 = 7442/(10^{0.1Gm})$ (in $degrees^2$)

where G_m is the peak aperture gain (dBi);

b) that a high altitude platform station operating as a base station to provide IMT-2000, in order to protect mobile earth stations of the satellite component of IMT-2000 from interference, shall not exceed an out-of-band pfd level of –165 dB ($W/(m^2/4\ kHz)$) on the Earth's surface in the bands 2 160-2 200 MHz in Region 2 and 2 170-2 200 MHz in Regions 1 and 3;

4 that administrations wishing to implement high altitude platform stations within a terrestrial IMT-2000 system shall, prior to notification under Article **S11**, take into account in their bilateral coordination with administrations of neighbouring countries, the operation and growth of existing and planned systems in the fixed and the mobile service allocated on a primary basis;

5 that administrations wishing to implement high altitude platform stations within a terrestrial IMT-2000 system shall, pending the review by WRC-02/03 of the studies mentioned below, for the purpose of protecting fixed service stations operating in neighbouring administrations from co-channel interference, take full account of the relevant ITU-R Recommendations relating to protection values for fixed stations (see Recommendation ITU-R F.758),

invites ITU-R

to complete, as a matter of urgency, additional studies of high altitude platform stations sharing criteria with, between and into other systems in the bands 1 885-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz in Regions 1 and 3 and 1 885-1 980 MHz and 2 110-2 160 in Region 2, and in adjacent bands, and to report on the results of these studies on time for consideration of WRC-02/03 to allow revision of the values in *resolves* 1.

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

Document 307-E
20 May 2000
Original: English

ISTANBUL, 8 MAY – 2 JUNE 2000

WORKING GROUP 5A

Chairperson, Sub-Working Group 5A-1

CONCLUSIONS RELATING TO AGENDA ITEM 1.6.1
ON THE USE OF HAPS IN IMT-2000

1 Modifications to Article S5

MOD

1 710-2 170 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
1 710-1 930	FIXED MOBILE S5.380 S5.149 S5.341 S5.385 S5.386 S5.387 S5.388 ADD S5.BBB	
1 930-1 970 FIXED MOBILE S5.388 ADD S5.BBB	**1 930-1 970** FIXED MOBILE Mobile-satellite (Earth-to-space) S5.388 ADD S5.BBB	**1 930-1 970** FIXED MOBILE S5.388 ADD S5.BBB
1 970-1 980	FIXED MOBILE S5.388 ADD S5.BBB	
1 980-2 010	FIXED MOBILE MOBILE-SATELLITE (Earth-to-space) S5.388 S5.389A S5.389B S5.389F	
2 010-2 025 FIXED MOBILE S5.388 ADD S5.BBB	**2 010-2 025** FIXED MOBILE MOBILE-SATELLITE (Earth-to-space) S5.388 S5.389C S5.389D S5.389E S5.390	**2 010-2 025** FIXED MOBILE S5.388 ADD S5.BBB

2 025-2 110	SPACE OPERATION (Earth-to-space) (space-to-space) EARTH EXPLORATION-SATELLITE (Earth-to-space) (space-to-space) FIXED MOBILE S5.391 SPACE RESEARCH (Earth-to-space) (space-to-space) S5.392	
2 110-2 120	FIXED MOBILE SPACE RESEARCH (deep space) (Earth-to-space) S5.388 ADD S5.BBB	
2 120-2 160 FIXED MOBILE S5.388 ADD S5.BBB	**2 120-2 160** FIXED MOBILE Mobile-satellite (space-to-Earth) S5.388 ADD S5.BBB	**2 120-2 160** FIXED MOBILE S5.388 ADD S5.BBB
2 160-2 170 FIXED MOBILE S5.388 S5.392A ADD S5.BBB	**2 160-2 170** FIXED MOBILE MOBILE-SATELLITE (space-to-Earth) S5.388 S5.389C S5.389D S5.389E S5.390	**2 160-2 170** FIXED MOBILE S5.388 ADD S5.BBB

ADD

S5.BBB In Regions 1 and 3, the bands 1 885-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz, and in Region 2, the bands 1 885-1 980 MHz and 2 110-2 160 MHz, may be used by high altitude platform stations as base stations to provide International Mobile Telecommunications 2000 (IMT-2000) [in accordance with Resolution COM5/13.] [(See Resolution COM5/13.)] [Such use shall comply with the provisions of Resolution COM5/13.] [These bands are allocated to the fixed, mobile and mobile-satellite services, and the use by IMT-2000 applications using high altitude platform stations as an IMT-2000 base station in these bands is based on the equality of rights between all allocated radio services and does not establish priority of assignments in these bands among stations of the primary services to which they are allocated.]

2 Modifications to Article S11

[**ADD**

S11.8A g) if that assignment is to be used for a high altitude platform station.]

3 New Resolution

ADD

RESOLUTION COM5/13 (WRC-2000)

Use of high altitude platform stations providing IMT-2000 in the bands 1 885-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz in Regions 1 and 3, and 1 885-1 980 MHz and 2 110-2 160 MHz in Region 2

The World Radiocommunication Conference (Istanbul, 2000),

considering

a) that the bands 1 885-2 025 MHz and 2 110-2 200 MHz, are identified in No. **S5.388** as intended for use on a worldwide basis for IMT-2000, including the bands 1 980-2 010 MHz and 2 170-2 200 MHz for the satellite component of IMT-2000;

b) that a high altitude platform station (HAPS) is defined in No. **S1.66A** as “a station located on an object at an altitude of 20 to 50 km and at a specified, nominal, fixed point relative to the Earth”;

c) that HAPS may offer a new means of providing IMT-2000 services with minimal network build out as it is capable to provide service to a large footprint together with a dense coverage;

d) that the use of HAPS as base stations of terrestrial IMT-2000 is optional for administrations and that such use should not have any priority over other terrestrial IMT-2000 use;

e) that, in accordance with [No. **MOD S5.388** and Resolution **IMT (WRC-2000)**] [No. **S5.388** and Resolution **212 (Rev.WRC-97)**], administrations may use the bands identified for IMT-2000, including the bands noted herein, for stations of other primary services to which they were allocated;

f) that these bands are allocated to the fixed and mobile services on a co-primary basis;

g) that ITU-R has studied sharing and coordination between HAPS and other stations within IMT-2000 and has established Recommendation ITU-R M.1456;

h) that ITU-R did not address sharing and coordination between HAPS and some existing systems, particularly PCS (Personal Communications Service) and MMDS (Multichannel Multipoint Distribution Service), which are currently operating in some administrations in the bands 1 885-2 025 MHz and 2 110-2 200 MHz;

i) that in accordance with No. **S5.BBB**, HAPS may be used as base stations of terrestrial IMT-2000 in the bands 1 885-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz in Regions 1 and 3, and 1 885-1 980 MHz and 2 110-2 160 MHz in Region 2. [The use by HAPS as an IMT-2000 base station in these bands is based on the equality of rights between all allocated radio services and does not establish priority of assignments in these bands among stations of the primary services to which they are allocated],

noting

that the value in *resolves* 1 *b)* may not be appropriate for the protection of some stations operating in these bands in the fixed and mobile services,

resolves

1 that administrations wishing to implement HAPS within a terrestrial IMT-2000 system [shall conform with the following] [(see Recommendation ITU-R M.1457) should give due consideration to the minimum performance characteristics and operational conditions given in Recommendation ITU-R M.1456, in particular]:

a) that for the purpose of protecting certain stations operating in neighbouring administrations from co-channel interference, administrations using HAPS as base stations to IMT-2000 shall use antennae that comply with the following antenna pattern:

$G(\psi) = G_m - 3(\psi/\psi_b)^2$ dBi for $0° \le \psi \le \psi_1$
$G(\psi) = G_m + L_N$ dBi for $\psi_1 < \psi \le \psi_2$
$G(\psi) = X - 60\log(\psi)$ dBi for $\psi_2 < \psi \le \psi_3$
$G(\psi) = L_F$ dBi for $\psi_3 < \psi \le 90°$

where:

$G(\psi)$: gain at the angle ψ from the main beam direction (dBi)

G_m: maximum gain in the main lobe (dBi)

ψ_b: one-half of the 3 dB beamwidth in the plane of interest (3 dB below G_m) (degrees)

L_N: near-in-side-lobe level in dB relative to the peak gain required by the system design, and has a maximum value of –25 dB

L_F: G_m - 73 dBi far side-lobe level (dBi)

$\psi_1 = \psi_b \sqrt{-L_N/3}$ degrees

$\psi_2 = 3.745\,\psi_b$ degrees

$X = G_m + L_N + 60\log(\psi_2)$ dB

$\psi_3 = 10^{(X - L_F)/60}$ degrees

The 3 dB beamwidth ($2\psi_b$) is again estimated by:

$(\psi_b)^2 = 7442/(10^{0.1G_m})$ (in degrees^2)

where G_m is the peak aperture gain (dBi);

b) that a HAPS operating as a base station to provide IMT-2000 [shall] [should] not exceed a co-channel power flux-density (pfd) level of –121.5 dB (W/(m^2/MHz)) on the Earth’s surface outside an administration’s borders unless agreed otherwise with the affected neighbouring administration;

c) that a HAPS operating as a base station to provide IMT-2000, in order to protect mobile earth stations of the satellite component of IMT-2000 from interference, [shall] [should] not exceed an out-of-band pfd level of –165 dB (W/(m^2/4 kHz)) on the Earth’s surface in the bands 2 160-2 200 MHz in Region 2 and 2 170-2 200 MHz in Regions 1 and 3;

d) that a HAPS operating as a base station to provide IMT-2000, in order to protect fixed stations from interference, [shall] [should] not exceed an out-of-band pfd level on the Earth's surface in the bands 2 025-2 110 MHz of:

– –165 dB(W/(m^2/MHz)) for angles of arrival (θ) less than 5° above the horizontal plane;

– –165 + 1.75 (θ - 5) dB (W/(m^2 /MHz)) for angles of arrival between 5° and 25° above the horizontal plane; and

– –130 dB(W/(m^2/MHz)) for angles of arrival between 25° and 90° above the horizontal plane;

[2 that administrations wishing to implement HAPS within a terrestrial IMT-2000 system shall, prior to notification under Article **S11**, take into account in their bilateral consultations with administrations of neighbouring countries, the operation and growth of existing systems in the mobile service and systems in the other services allocated on a primary basis,]

invites ITU-R

to complete, as a matter of urgency, additional studies of HAPS sharing criteria with, between and into other systems in the bands 1 885-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz in Regions 1 and 3, and 1 885-1 980 MHz and 2 110-2 160 in Region 2, and in adjacent bands, and to report on the results of these studies on time for consideration of WRC-02/03.

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

Document 308-E
22 May 2000
Original: English

ISTANBUL, 8 MAY – 2 JUNE 2000

WORKING GROUP 5D

Drafting Group 5D ad hoc

The ad hoc Drafting Group reviewed the proposals from administrations and produced the following draft revision of footnote S5.488 and an associated draft resolution.

MOD

S5.488 ~~The use of the bands 11.7-12.2 GHz in the fixed-satellite service in Region 2 and 12.2-12.7 GHz by the broadcasting-satellite service in Region 2 is limited to national and subregional systems.~~ The use of the band 11.7-12.2 GHz by geostationary-satellite networks in the fixed-satellite service in Region 2 is subject to ~~previous agreement between administrations concerned and those having services, operating or planned to operate in accordance with the Table, which may be affected (see Articles **S9** and **S11**)~~the provisions of Resolution **XYZ (WRC-2000)**. For the use of the band 12.2-12.7 GHz by the broadcasting-satellite service in Region 2, see Appendix **S30**.

ADD

RESOLUTION [COM5/18] (WRC-2000)

Protection of terrestrial services in all Regions from Region 2 GSO FSS networks using the frequency band 11.7-12.2 GHz

The World Radiocommunication Conference (Istanbul, 2000),

considering

a) that, in Regions 1 and 3, the band 11.7-12.2 GHz is allocated on a co-primary status to terrestrial services and to the broadcasting-satellite service;

b) that, in Region 2, the band 11.7-12.1 GHz is allocated on a co-primary status to terrestrial services (except in the countries listed in **S5.486**) and to the fixed-satellite service;

c) that, in Region 2, the band 12.1-12.2 GHz is allocated on a co-primary status to terrestrial services in Peru (see **S5.489**) and to the fixed-satellite service;

d) that the protection of the broadcasting-satellite service in Regions 1 and 3 from the fixed-satellite service in Region 2 is assured by Article 7 and Annex 4 to Appendix **S30**;

e) that the protection of the fixed-satellite service in Region 2 from the fixed-satellite service in Region 2 is assured either by **S9** (**S9.7** or **S9.12**) or **S22**;

f) that the protection of terrestrial services in Regions 1, 2 and 3 from non-geostationary satellite systems in the fixed-satellite service in Region 2 is assured by **S21**;

g) that there is a need to protect terrestrial services in Regions 1, 2 and 3 from geostationary- satellite networks in the fixed-satellite service in Region 2;

h) that WRC-2000 has modified No. **S5.488** by revising the regulatory limitations on the operation of the GSO FSS in Region 2 in the band 11.7-12.2 GHz,

recognizing

a) that ITU-R has developed Recommendation ITU-R SF.674-1, dealing with sharing between the fixed-satellite service in Region 2 and the fixed service in the band 11.7-12.2 GHz in Region 2;

b) that the power flux-density limits contained in Article **S21** (Table **S21-4**) and applicable to the fixed-satellite service in the band 10.7-11.7 GHz afford an adequate protection to terrestrial services;

c) that the limits referred in *recognizing b)* are 2 dB less stringent than the coordination thresholds contained in Recommendation ITU-R SF.674-1,

resolves

before an administration notifies to the Bureau or brings into use, in Region 2, a frequency assignment for a GSO FSS network in the 11.7-12.2 GHz band, it shall effect coordination with any administration of Regions 1, 2, and 3 having a primary allocation to terrestrial services in the same frequency band if the power flux-density produced on its territory exceeds the following thresholds:

–124	dB(W/m^2) in 1 MHz	for 0°≤ Θ ≤ 5°
–124 + 0.5 (Θ-5)	dB(W/m^2) in 1 MHz	for 5°< Θ ≤ 25°
–114	dB(W/m^2) in 1 MHz	for Θ ≥ 25°

where Θ is the angle of arrival of the incident wave above the horizontal plane, in degrees.*

instructs the Radiocommunication Bureau

in its examination of requests for coordination or notification notices for any geostationary fixed-satellite space station operating in the band 11.7-12.2 GHz in Region 2, to determine if the power flux-density thresholds in the *resolves* are exceeded on the territory of any administration other than the notifying administration and, if so, to so notify both the notifying and the affected administrations.

____

* These values relate to the pfd and angles of arrival which would be obtained under free-space propagation conditions.

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WORKING GROUP 4A

Chairperson, Working Group 5C

LIAISON STATEMENT TO WORKING GROUP 4A
FROM WORKING GROUP 5C

Working Group 5C noted with interest draft Resolution [COM4/1] (Document DT/55). It relates very closely to an issue concerning the determination of coordination areas for an SRS deep space receiving earth station and high-density applications of the fixed service, which is being considered within this Group. We considered that the current text of the draft Resolution [COM4/1] outlined the procedure for continuing the update of Appendix S7, but did not specifically cover this issue.

We therefore request your opinion on whether or not the attached draft Resolution should be combined with draft Resolution [COM4/1].

Attachment: Draft Resolution [COM5/11]

ATTACHMENT

DRAFT NEW RESOLUTION [COM5/11]

Development of the technical basis for determining the coordination area for a deep space receiving earth station in the space research service (SRS), with transmitting high-density applications in the fixed service in the 31.8-32.3 GHz and 37-38 GHz bands

The World Radiocommunication Conference (Istanbul, 2000),

considering

a) that the band 31.8-32.3 GHz is allocated to the SRS for deep space only; the band 37-38 GHz is allocated to the space research service (deep space) (space-to-Earth); and both bands are allocated to the fixed service for the use of high density applications and other services on a primary basis;

b) that the 31.8-32.3 GHz band offers unique advantages in support of deep-space missions;

c) that the SRS earth stations operating in the band employ very high-gain antennas and very low-noise amplifiers to receive weak signals from deep space;

d) that FS stations in these bands are expected to be deployed in large numbers over urban areas of large geographical extent;

e) that studies are being initiated to characterize short-term (on the order of 0.001% of the time, commensurate with the protection criteria given in Recommendation ITU-R SA.1396 and SA.1157) anomalous propagation from transmitting stations dispersed over a large geographical area to a single receiving earth station (area-to-point propagation);

f) that preliminary ITU-R studies have indicated that the coordination distance associated with an SRS (deep space) earth station and a single urban area may be on the order of 250 km;

g) that there are currently three SRS deep-space earth stations operational or planned for operation near Goldstone (United States), Madrid (Spain) and Canberra (Australia), and there are up to ten more earth stations planned in the future,

noting

that draft Resolution [COM4/1]* provides a mechanism to update Appendix **S7** as required,

* Document DT/55

resolves to request ITU-R

to develop, as a matter of urgency, the technical basis for determining the coordination area of a SRS (deep space) receiving earth station with transmitting high-density stations in the fixed service (HDFS) in the 31.8-32.3 GHz and 37-38 GHz bands,

urges administrations

to participate actively in the aforementioned studies by submitting contributions to ITU-R.

D. JANSKY
Chairperson, Working Group 5C
Box 5

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WORKING GROUP 5B

Sub-Working Group 5B-2

MODIFICATIONS TO ARTICLE S5 OF THE RADIO REGULATIONS

(AGENDA ITEM 1.15.1)

Sub-Working Group 5B-2 submits for consideration and approval the attached modification of Article S5 and two new resolutions concerning new allocations to RNSS in the band 5 000-5 030 MHz.

T. MIZUIKE
Chairperson, Sub-Working Group 5B-2
Box 132

ARTICLE S5

MOD

4 800-5 830 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
5 000-5 150	AERONAUTICAL RADIONAVIGATION S5.367 MOD S5.444 S5.444A ADD S5.444B S5.444C	

MOD

S5.444 The band ~~5 000~~5 030-5 150 MHz is to be used for the operation of the international standard system (microwave landing system) for precision approach and landing. The requirements of this system shall take precedence over other uses of this band. For the use of this band, No. **S5.444A** and Resolution **114 (WRC-95)** apply.

ADD

S5.444B *Additional allocation:* The band 5 000-5 010 MHz is also allocated to the radionavigation-satellite service (Earth-to-space) on a primary basis. For the use of this band Resolution **COM 5B-X (WRC-2000)** applies.

ADD

S5.444C *Additional allocation:* The band 5 010-5 030 MHz is also allocated to the radionavigation-satellite service (space-to-Earth) (space-to-space) on a primary basis. In order not to cause harmful interference to the microwave landing system operating above 5 030 MHz the aggregate power flux-density radiated in bands above 5 030 MHz by all the space stations within any radionavigation-satellite service system (space-to-Earth) (space-to-space) operating in the band 5 010-5 030 MHz shall not exceed the level of –124.5 dB(W/m^2) in 150 kHz. In order not to cause harmful interference to the radio astronomy service in the band 4 990-5 000 MHz, the aggregate power flux-density radiated in the 4 990-5 000 MHz band by all the space stations within any RNSS (space-to-Earth) (space-to-space) system operating in the 5 010-5 030 MHz band shall not exceed the level of –171 dB(W/m^2) in a 10 MHz bandwidth into any radio astronomy observatory site for more than 2% of the time. For the use of this band Resolution **COM 5B-Y (WRC-2000)** applies.

ADD

RESOLUTION COM [5/15] (WRC-2000)

Studies on compatibility between stations of the radionavigation-satellite service (RNSS) (Earth-to-space) operating in the frequency band 5 000-5 010 MHz, and the international standard system (microwave landing system) operating in the 5 030-5 150 MHz band

The World Radiocommunication Conference (Istanbul, 2000),

considering

a) that the aeronautical radionavigation service is allocated on a primary basis in the band 5 000-5 250 MHz;

b) that WRC-2000 added a primary allocation to the radionavigation-satellite service (Earth-to-space) in the 5 000-5 010 MHz band;

c) that the band 5 030 to 5 150 MHz is to be used for the operation of the international standard MLS for precision approach and landing. The requirements for this system shall take precedence over other uses of this band as per footnote **S5.444**;

d) that unwanted emissions from the RNSS stations may fall into the frequency band used by the MLS;

e) that studies to determine the compatibility between these RNSS transmitters and the MLS receivers operated on board aircraft used during approach and landing have not been carried out;

f) that the MLS can be well-protected through the implementation of an adequate separation distance between the stations of the RNSS (Earth-to-space) transmitter and the MLS receiver, and other mitigation techniques,

requests ITU-R

to conduct as a matter of urgency, the appropriate technical, operational and regulatory studies to ensure that stations of the RNSS (Earth-to-space) do not cause harmful interference to the operation of the international standard MLS, and to develop, if needed, appropriate Recommendations,

urges administrations

to participate actively in the aforementioned studies by submitting contributions to ITU-R,

requests the Secretary General

to bring this Resolution to the attention of ICAO.

ADD

RESOLUTION COM [5/16] (WRC-2000)

Studies on compatibility between the radionavigation-satellite service (RNSS) (space-to-Earth) (space-to-space) operating in the frequency band 5 010-5 030 MHz, and the radio astronomy service (RAS) operating in the band 4 990-5 000 MHz

The World Radiocommunication Conference (Istanbul, 2000),

considering

a) that new radiocommunication services are developing, many of which require satellite transmitters, and need to be allocated sufficient spectrum;

b) that research in radio astronomy depends critically upon the ability to make observations at the extreme limits of sensitivity and/or precision;

c) that transmissions from RNSS space stations in the frequency band 5 010 to 5 030 MHz near the radio astronomy service operating in the band 4 990-5 000 MHz may cause interference harmful to the radio astronomy service;

d) that Recommendation ITU-R RA.769-1 recommends, *inter alia*, that all practicable steps be taken to reduce to the absolute minimum all unwanted emissions falling into RAS bands, particularly those emissions from aircraft, spacecraft and balloons;

e) that protection requirements of RAS are explained and interference threshold values detailed in the Annex to Recommendation ITU-R RA.769-1;

f) that different coupling mechanisms apply to interfering emissions from terrestrial transmitters or from transmitters on board GSO or non-GSO satellites;

g) that this Conference has revised Recommendation 66, which asks to study those frequency bands and instances where, for technical or operational reasons, out-of-band limits may be required to protect safety services and passive services such as radio astronomy, and the impact on all concerned services of implementing or not implementing such limits;

h) that administrations may require criteria to protect RAS from interference detrimental to radio astronomy observations from transmissions space-to-Earth by space stations,

noting

a) that this Conference has adopted footnotes **S5.444C** specifying a provisional pfd limit in the band 4 990-5 000 MHz, for space-to-Earth out-of-band emissions of the RNSS operating in the band 5 010-5 030 MHz;

b) that the general problem of protection of radio astronomy and passive services is under study in ITU-R *inter alia* in response to Recommendation 66,

requests ITU-R

1 to conduct, or continue to conduct, as a matter of urgency and in time for consideration by WRC-03, the appropriate technical, operational and regulatory studies to review the provisional pfd limits concerning the operation of space stations in order to ensure that the radionavigation-satellite service (space-to-Earth) (space-to-space) in the band 5 010-5 030 MHz will not cause interference detrimental to the RAS in the band 4 990-5 000 MHz;

2 to report to CPM-03 on the conclusions of the studies asked for under 1 above;

[3 to conduct, as a matter of urgency, and complete in time for consideration by WRC-02/03 the development of methodology for calculating the aggregate power level produced by RNSS systems and the compliance of this level with the limits referred to in No. **S5.444C**,]

urges administrations

1 to participate actively in the aforementioned studies by submitting contributions to ITU-R;

2 to ensure that systems designed to operate in the RNSS frequency band 5 010-5 030 MHz incorporate interference avoidance techniques, such as filtering, to the extent feasible,

resolves

1 that WRC-03 be invited to review the provisional pfd limit on the RNSS in the band 5 010-5 030 MHz;

2 that the limits stated in No. **S5.444C** shall be applied provisionally for systems for which complete notification information has been received by the Bureau after 2 June 2000;

[3 that in order to determine compliance with the provisional limits in No. **S5.444C** it is sufficient that the notifying administration provide with its notification information indicating the network's compliance with pfd limits,]

*instructs the Radiocommunication Bureau**

as of the end of WRC-03, to review and, if appropriate, revise any finding previously made on the compliance with the limits contained in frequency band 5 010-5 030 MHz of an RNSS (space-to-Earth) (space-to-space) system for which notification information has been received before the end of WRC-03. This review shall be based on the values, as revised, if appropriate, by WRC-03*.

____

* It was considered by the Drafting Group of the need to ask Committee 4 what information is needed to be provided to the Bureau to check the compliance with the pfd value specified in **S5.444C**.

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COMMITTEE 4

Report by the Chairperson of Working Group 4B

FIFTH REPORT FROM WORKING GROUP 4B TO COMMITTEE 4

AGENDA ITEM 2

At its tenth meeting on 19 May 2000, the Working Group reviewed the text of Resolution 28 (Rev.WRC-95).

The agreed revision, as reproduced in the following, is submitted to Committee 4 for consideration.

A. ALLISON
Chairperson of Working Group 4B, Box 68

MOD

RESOLUTION 28 (Rev.WRC-~~95~~2000)

Revision of references to the text of ITU-R Recommendations incorporated by reference in the Radio Regulations

The World Radiocommunication Conference (~~Geneva, 1995~~Istanbul, 2000),

considering

a) that the Voluntary Group of Experts on simplification of the Radio Regulations (VGE) proposed the transfer of certain texts of the Radio Regulations to other documents, especially to ITU-R Recommendations, using the incorporation by reference procedure;

b) that, in some cases, the provisions of the Radio Regulations imply an obligation on Member States ~~*~~ to conform to the criteria or specifications incorporated by reference;

c) that references to incorporated texts shall be explicit and shall refer to a precisely identified provision (see Resolution **27 (Rev.WRC-2000)**);

d) that all texts of ITU-R Recommendations incorporated by reference are published in a volume of the Radio Regulations;

~~d~~e) that, taking into account the rapid evolution of technology, ITU-R may revise the ITU-R Recommendations containing text incorporated by reference at short intervals;

~~*e)* that revised and approved Recommendations will not have the same legal force as the initial Recommendations, incorporated by reference until a competent world radiocommunication conference has so decided;~~

f) that following revision of an ITU-R Recommendation containing text incorporated by reference, the reference in the Radio Regulations shall continue to apply to the earlier version until such time as a competent WRC agrees to incorporate the new version;

~~f~~g) that it would be desirable ~~to ensure,~~ that texts incorporated by reference ~~in the cases provided for in the Radio Regulations, that the provisions~~ reflect the most recent technical developments,

noting

that administrations need sufficient time to examine the potential consequences of changes to ITU-R Recommendations containing text incorporated by reference and would therefore benefit greatly from being advised, as early as possible, of which ITU-R Recommendations have been revised and approved during the elapsed study period,

resolves

1 that each Radiocommunication Assembly shall communicate to the following world radiocommunication conference a list of the ITU-R Recommendations containing text incorporated by reference in the Radio Regulations which have been revised and approved during the elapsed study period;

2 that, on this basis, the WRC shallshould examine those revised ITU-R Recommendations, and decide whether or not to update the corresponding references in the Radio Regulations;

3 that, if the WRC decides not to update the corresponding references, the current referenced version shall be maintained in the Radio RegulationsITU-R shall continue publishing the ITU-R Recommendations currently referenced in the Radio Regulations;

4 that WRCs shall place the examination of Recommendations in conformity with *resolves* 1 and *resolves* 2 of this Resolution on the agenda of future WRCs,that recommended agendas for future world radiocommunication conferences should include a standing agenda item for the examination of the ITU-R Recommendations in application of this Resolution,

instructs the Director of the Radiocommunication Bureau

to provide the CPM immediately preceding each WRC with a list, for inclusion in the CPM Report, of those ITU-R Recommendations containing texts incorporated by reference that have been revised or approved since the previous WRC, or that may be revised in time for following WRC,

urges administrations

1 to participate actively in the work of the Radiocommunication Study Groups and the Radiocommunication Assembly in the revision of those Recommendations to which mandatory references are made in the Radio Regulations.;

2 to examine any indicated revisions of ITU-R Recommendations containing text incorporated by reference and to prepare proposals on possible updating of relevant references in the Radio Regulations.

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WORKING GROUP 5B

Sub-Working Group 5B-1

MODIFICATIONS TO ARTICLE S52 AND APPENDIX S17 AND A NEW RESOLUTION

(AGENDA ITEM 1.7)

The following texts:

– modification of Article S52;

– modification of Appendix S17; and

– draft new Resolution “Study on the interference caused to the distress and safety frequencies 12 290 kHz and 16 420 kHz by routine calling”,

have been approved by Sub-Working Group 5B-1. They are submitted to Working Group 5B for consideration and approval.

Sub-Working Group 5B-1 also considered Resolution 346 (WRC-97). Since the issue of HF frequencies and in particular the distress and safety frequencies will be considered again at WRC-03, Sub-Working Group 5B-1 suggests to maintain Resolution 346 unchanged.

Sub-Working Group 5B-1 recommends that the new draft Resolution “Study on the interference caused to the distress and safety frequencies 12 290 kHz and 16 420 kHz by routine calling” be forwarded to GT PLEN-2 because it may have an impact on the consideration of agenda items of future conferences.

Pekka LÄNSMAN
Chairperson, Sub-Working Group 5B-1

1 Modification of Article S52

ARTICLE S52

Special rules relating to the use of frequencies

Section VI – Use of frequencies for radiotelephony

C2 – Call and reply

ADD

S52.220A Administrations should encourage the coast stations and ship stations under their jurisdiction to use digital selective calling techniques for call and reply.

ADD

S52.220B When calling by radiotelephony is necessary, it should be done (in the order of preference):

ADD

S52.220C 1) on the national frequencies assigned to the coast stations; or

ADD

S52.220D 2) when this is not possible, on the calling frequencies listed under **S52.221** or **S52.221A** below.

MOD

S52.221 § 97 1) Ship stations may use the following carrier frequencies for calling in radiotelephony:

4 125 kHz[3, 4, 5]
6 215 kHz[4, 5]
8 255 kHz
12 290 kHz[5] (see also No. **S52.221A**)
16 420 kHz[5] (see also No. **S52.221A**)
18 795 kHz
22 060 kHz
25 097 kHz

[3] **S52.221.1** In the United States, the carrier frequency 4 125 kHz is also authorized for common use by coast and ship stations for single-sideband radiotelephony on a simplex basis, provided the peak envelope power of such stations does not exceed 1 kW (see also No. **S52.222.2**).

[4] **S52.221.2** The carrier frequencies 4 125 kHz and 6 215 kHz are also authorized for common use by coast and ship stations for single-sideband radiotelephony on a simplex basis for call and reply purposes, provided that the peak envelope power of such stations does not exceed 1 kW. The use of these frequencies for working purposes is not permitted (see also Appendix **S13** and No. **S52.221.1**).

[5] **S52.221.3** The carrier frequencies 4 125 kHz, 6 215 kHz, 8 291 kHz, 12 290 kHz and 16 420 kHz are also authorized for common use by coast and ship stations for single-sideband radiotelephony on a simplex basis for distress and safety traffic.

ADD

S52.221A Calling on the carrier frequencies 12 290 kHz and 16 420 kHz shall cease as soon as possible and no later than 31 December 2003. Alternative carrier frequencies 12 359 kHz and 16 537 kHz may be used by ship stations and coast stations for calling in simplex basis provided that the peak envelope power does not exceed 1 kW.

MOD

S52.222 2) Coast stations may use the following carrier frequencies for calling in radiotelephony[6]:

4 417 kHz[7]
6 516 kHz[7]
8 779 kHz
13 137 kHz (see No. **S52.222A**)
17 302 kHz (see No. **S52.222A**)
19 770 kHz
22 756 kHz
26 172 kHz

ADD

S52.222A The carrier frequencies 13 137 kHz and 17 302 kHz shall not be used as calling frequencies after 31 December 2003. Alternative carrier frequencies 12 359 kHz and 16 537 kHz may be used by ship stations and coast stations for calling in simplex basis provided that the peak envelope power does not exceed 1 kW.

MOD

S52.224 § 99 1) Before transmitting on the carrier frequencies 4 125 kHz, 6 215 kHz, 8 291 kHz, 12 290 kHz or 16 420 kHz a station shall listen on the frequency for a reasonable period to make sure that no distress traffic is being sent (see No. **S52.221A** and Recommendation ITU-R M.1171).

---

6 **S52.222.1** These frequencies may also be used by coast stations with class H2B emission, when using the selective calling system defined in Recommendation ITU-R M.257-3.

7 **S52.222.2** The carrier frequencies 4 417 kHz and 6 516 kHz are also authorized for common use by coast and ship stations for single-sideband radiotelephony on a simplex basis, provided that the peak envelope power of such stations does not exceed 1 kW. The use of 6 516 kHz for this purpose should be limited to daytime operation (see also No. **S52.221.1**).

2 Modification of Appendix S17

APPENDIX S17

Frequencies and channelling arrangements in the high-frequency bands for the maritime mobile service

PART B – Channelling arrangements

Section I – Radiotelephony

MOD

5 The following frequencies in Sub-Section A are allocated for calling purposes:

– Channel No. 421 in the 4 MHz band;

– Channel No. 606 in the 6 MHz band;

– Channel No. 821 in the 8 MHz band;

– Channel No. 1221 in the 12 MHz band;

– Channel No. 1621 in the 16 MHz band;

– Channel No. 1806 in the 18 MHz band;

– Channel No. 2221 in the 22 MHz band;

– Channel No. 2510 in the 25 MHz band.

The use of channels 1221 and 1621 for calling purposes shall cease as soon as possible and no later than 31 December 2003 (see **S52.221A** and **S52.222A**).

The remaining frequencies in Sub-Sections A, B, C-1 and C-2 are working frequencies.

Sub-Section A

Table of single-sideband transmitting frequencies (kHz) for duplex (two-frequency) operation

NOC to the tables

MOD notes after the tables

1 These coast station frequencies may be paired with a ship station frequency from the table of simplex frequencies for ship and coast stations (see Sub-Section B) or with a frequency from the band 4 000-4 063 kHz (see Sub-Section C-1) to be selected by the administration concerned.

2 For the use and notification of these frequencies, see Resolution **325 (Mob-87)**[*].

3 These channels may also be used for simplex (single frequency) operation.

4 For the conditions of use of the carrier frequency 4 125 kHz, see Nos. **S52.224** and **S52.225**, and Appendix **S15**.

5 For the conditions of use of the carrier frequency 6 215 kHz, see Appendices **S13** and **S15**.

6 These coast station frequencies may be paired with a ship station frequency from the table of simplex frequencies for ship and coast stations (see Sub-Section B) or with a frequency from the band 8 100-8 195 kHz (see Sub-Section C-2) to be selected by the administration concerned.

7 For the conditions of use of the carrier frequency 8 291 kHz, see Appendix **S15**.

8 For the conditions of use of the carrier frequency 12 290 kHz, see Nos. **S52.221A** and **S52.222A** and Appendix **S15**.

9 For the conditions of use of the carrier frequency 16 420 kHz, see Nos. **S52.221A** and **S52.222A** and Appendix **S15**.

* The frequencies followed by an asterisk are calling frequencies (see Nos. **S52.221** and **S52.222**).

Sub-Section B

Table of single-sideband transmitting frequencies (kHz) for simplex (single-frequency) operation and for intership cross-band (two-frequency) operation

(See § 4 of Section I of this Appendix)

MOD

4 MHz band[1]		**6 MHz band**		**8 MHz band**[2]		**12 MHz band**	
Carrier frequency	**Assigned frequency**	**Carrier frequency**	**Assigned frequency**	**Carrier frequency**	**Assigned frequency**	**Carrier frequency**	**Assigned frequency**
4 146	4 147.4	6 224	6 225.4	8 294	8 295.4	12 353	12 354.4
4 149	4 150.4	6 227	6 228.4	8 297	8 298.4	12 356	12 357.4
		6 230	6 231.4			~~12 359~~	~~12 360.4~~
						12 362	12 363.4
						12 365	12 366.4

1 These frequencies may be used for duplex operation with coast stations operating on Channel Nos. 428 and 429 (see Sub-Section A).

2 These frequencies may be used for duplex operation with coast stations operating on Channel Nos. 834 up to and including 837 (see Sub-Section A).

* This Resolution was abrogated by WRC-95.

MOD

16 MHz band		18/19 MHz band		22 MHz band		25/26 MHz band	
Carrier frequency	**Assigned frequency**	**Carrier frequency**	**Assigned frequency**	**Carrier frequency**	**Assigned frequency**	**Carrier frequency**	**Assigned frequency**
16 528	16 529.4	18 825	18 826.4	22 159	22 160.4	25 100	25 101.4
16 531	16 532.4	18 828	18 829.4	22 162	22 163.4	25 103	25 104.4
16 534	16 535.4	18 831	18 832.4	22 165	22 166.4	25 106	25 107.4
~~16 537~~	~~16 538.4~~	18 834	18 835.4	22 168	22 169.4	25 109	25 110.4
16 540	16 541.4	18 837	18 838.4	22 171	22 172.4	25 112	25 113.4
16 543	16 544.4	18 840	18 841.4	22 174	22 175.4	25 115	25 116.4
16 546	16 547.4	18 843	18 844.4	22 177	22 178.4	25 118	25 119.4

For use of frequencies 12 359 kHz and 16 537 kHz see Nos. **S52.221A** and **S52.222A**.

ADD

RESOLUTION [COM5/12]

Study on the interference caused to the distress and safety frequencies 12 290 kHz and 16 420 kHz by routine calling

The World Radiocommunication Conference (Istanbul, 2000),

considering

a) that the distress and safety frequencies 12 290 kHz and 16 420 kHz are the ship station transmitting frequencies of the maritime radiotelephony channels 1221 and 1621;

b) that at the date of this conference some coast stations continue using channels 1221 and 1621 for calling purposes and have indicated a wish to continue calling on these channels in the future;

c) that this conference decided to cease calling on channels 1221 and 1621 on 31 December 2003 at the latest;

d) that replacement channels may need to be made available for the coast stations mentioned under *considering b)* in accordance with the procedure of Appendix **S25**;

e) that there are differing opinions as to whether calling on channels 1221 and 1621 causes significant interference to distress and safety communications;

f) that this issue can be resolved by analysing the results of an ITU-R study;

g) that this conference has adopted additional measures that may significantly reduce this interference;

h) that IMO and several Member States have requested that the distress and safety frequencies 12 290 kHz and 16 420 kHz be reserved solely for that purpose;

i) that the full implementation of the cessation of calling on 31 December 2003 on the distress and safety frequencies 12 290 kHz and 16 420 kHz will allow this issue to be reconsidered by the next world radiocommunication conference,

resolves

1 to invite ITU-R to study the interference to the distress and safety frequencies 12 290 kHz and 16 420 kHz caused by routine calling on channels 1221 and 1621;

2 to invite the Radiocommunication Bureau, in consultation with administrations, to organize monitoring programmes for the support of these studies;

3 to urge administrations to participate actively in these studies;

4 to invite ITU-R to complete the study under *resolves* 1 and report to the next world radiocommunication conference,

instructs the Secretary-General

to communicate this Resolution to the International Maritime Organization,

invites Council

to place this issue on the agenda of the next world radiocommunication conference.

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COMMITTEE 5

Chairperson, Working Group 5C

RESOLUTION [COM5/14] (WRC-2000)

Feasibility of use by high altitude platform stations in the fixed and mobile services in the frequency bands above 3 GHz allocated exclusively for terrestrial radiocommunications

The World Radiocommunication Conference (Istanbul, 2000),

considering

a) that ITU has among its purposes “to promote the extension of the benefit of the new telecommunication technologies to all the world’s inhabitants” (No. 6 of the Constitution of the ITU (Geneva, 1992));

b) that systems based on new technologies using High Altitude Platform Stations (HAPS) has potential applicability to various services such as high-capacity, competitive services to urban and rural areas;

c) that WRC-97 made provision for the use of HAPS within the fixed service in the bands 47.2-47.5 GHz and 47.9-48.2 GHz (see also Resolution 122);

d) that the visible area from a HAPS is likely to be within a country or neighbouring countries, considering the altitude of HAPS;

e) that some administrations intend to operate the HAPS system in the bands allocated exclusively by the Table of Frequency Allocations or footnotes for terrestrial radiocommunications such as the fixed and mobile service,

recognizing

a) ITU-R studies relating to geometrical coordination distance for the visible distance from HAPS, as described in Recommendation ITU-R F.1501,

resolves

to invite ITU-R, as a matter of urgency, to carry out regulatory and technical studies to determine the feasibility of facilitating HAPS systems in the fixed and mobile services in bands above 3 GHz allocated exclusively by the Table of Frequency Allocations or footnotes for terrestrial radiocommunications, taking account of existing use and future requirements in these bands, and any impact on allocations in adjacent bands,

encourages administrations

to contribute actively to the sharing studies in accordance with this draft Resolution.

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

Document 314-E*
22 May 2000
Original: English

ISTANBUL, 8 MAY – 2 JUNE 2000

COMMITTEE 4

Lithuania (Republic of)

PROPOSALS FOR THE WORK OF THE CONFERENCE

AGENDA ITEM 1.1

The Lithuanian Administration makes the following proposals for the work of the World Radiocommunication Conference (WRC-2000) with regard to agenda item 1.1 in respect of footnotes contained in Article S5.

MOD LTU/314/1

S5.164 *Additional allocation:* in Albania, Germany, Austria, Belgium, Bosnia and Herzegovina, Bulgaria, Côte d'Ivoire, Denmark, Spain, Finland, France, Gabon, Greece, Ireland, Israel, Italy, Jordan, Lebanon, Libya, Liechtenstein, Lithuania, Luxembourg, Madagascar, Mali, Malta, Morocco, Mauritania, Monaco, Nigeria, Norway, the Netherlands, Poland, Syria, the United Kingdom, Senegal, Slovenia, Sweden, Switzerland, Swaziland, Togo, Tunisia, Turkey and Yugoslavia the band 47-68 MHz, in Romania the band 47-58 MHz and in the Czech Republic the band 66-68 MHz, are also allocated to the land mobile service on a primary basis. However, stations of the land mobile service in the countries mentioned in connection with each band referred to in this footnote shall not cause harmful interference to, or claim protection from, existing or planned broadcasting stations of countries other than those mentioned in connection with the band.

MOD LTU/314/2

S5.221 Stations of the mobile-satellite service in the band 148-149.9 MHz shall not cause harmful interference to, or claim protection from, stations of the fixed or mobile services operating in accordance with the Table of Frequency Allocations in the following countries: Albania, Algeria, Germany, Saudi Arabia, Australia, Austria, Bahrain, Bangladesh, Barbados, Belarus, Belgium, Benin, Bosnia and Herzegovina, Brunei Darussalam, Bulgaria, Cameroon, China, Cyprus, Congo, the Republic of Korea, Croatia, Cuba, Denmark, Egypt, the United Arab Emirates, Eritrea, Spain, Estonia, Ethiopia, Finland, France, Gabon, Ghana, Greece, Guinea, Guinea Bissau, Hungary, India, the Islamic Republic of Iran, Ireland, Iceland, Israel, Italy, Jamaica, Japan, Jordan, Kazakstan, Kenya, Kuwait, Latvia, The Former Yugoslav Republic of Macedonia, Lebanon, Libya, Liechtenstein, Lithuania, Luxembourg, Malaysia, Mali, Malta, Mauritania, Moldova, Mongolia, Mozambique, Namibia, Norway, New Zealand, Oman, Uganda, Uzbekistan, Pakistan, Panama, Papua New Guinea, Paraguay, the Netherlands, Philippines, Poland, Portugal, Qatar, Syria,

* Pursuant to Resolution 26 (Rev.WRC-97) the secretariat notes that this contribution was received on 22 May 2000.

Kyrgyzstan, Slovakia, Romania, the United Kingdom, Russian Federation, Senegal, Sierra Leone, Singapore, Slovenia, Sri Lanka, South Africa, Sweden, Switzerland, Swaziland, Tanzania, Chad, Thailand, Togo, Tonga, Trinidad and Tobago, Tunisia, Turkey, Ukraine, Viet Nam, Yemen, Yugoslavia, Zambia, and Zimbabwe.

MOD LTU/314/3

S5.235 *Additional allocation:* in Germany, Austria, Belgium, Denmark, Spain, Finland, France, Israel, Italy, Liechtenstein, Lithuania, Malta, Monaco, Norway, the Netherlands, the United Kingdom, Sweden and Switzerland, the band 174-223 MHz is also allocated to the land mobile service on a primary basis. However, the stations of the land mobile service shall not cause harmful interference to, or claim protection from, broadcasting stations, existing or planned, in countries other than those listed in this footnote.

MOD LTU/314/4

S5.296 *Additional allocation:* in Germany, Austria, Belgium, Cyprus, Denmark, Spain, Finland, France, Ireland, Israel, Italy, Libya, Lithuania, Malta, Morocco, Monaco, Norway, the Netherlands, Portugal, Syria, the United Kingdom, Sweden, Switzerland, Swaziland and Tunisia, the band 470-790 MHz is also allocated on a secondary basis to the land mobile service, intended for applications ancillary to broadcasting. Stations of the land mobile service in the countries listed in this footnote shall not cause harmful interference to existing or planned stations operating in accordance with the Table of Frequency Allocations in countries other than those listed in this footnote.

MOD LTU/314/5

S5.316 *Additional allocation*: in Germany, Bosnia and Herzegovina, Burkina Faso, Cameroon, Côte d'Ivoire, Croatia, Denmark, Egypt, Finland, Israel, Kenya, the Former Yugoslav Republic of Macedonia, Libya, Liechtenstein, Lithuania, Monaco, Norway, the Netherlands, Portugal, Syria, Sweden, Switzerland and Yugoslavia, the band 790-830 MHz, and in these same countries and in Spain, France, Gabon and Malta, the band 830-862 MHz, are also allocated to the mobile, except aeronautical mobile, service on a primary basis. However, stations of the mobile service in the countries mentioned in connection with each band referred to in this footnote shall not cause harmful interference to, or claim protection from, stations of services operating in accordance with the Table in countries other than those mentioned in connection with the band.

MOD LTU/314/6

S5.359 *Additional allocation:* in Germany, Saudi Arabia, Armenia, Austria, Azerbaijan, Belarus, Benin, Bulgaria, Cameroon, Spain, France, Gabon, Georgia, Greece, Guinea, Guinea-Bissau, Hungary, Jordan, Kazakstan, Kuwait, Latvia, Libya, Lithuania, Mali, Mauritania, Moldova, Mongolia, Nigeria, Uganda, Uzbekistan, Pakistan, Poland, Syria, Kyrgyzstan, the Democratic People's Republic of Korea, Romania, Russian Federation, Senegal, Swaziland, Tajikistan, Tanzania, Turkmenistan, Ukraine, Zambia and Zimbabwe the bands 1 550-1 645.5 MHz and 1 646.5-1 660 MHz are also allocated to the fixed service on a primary basis. Administrations are urged to make all practicable efforts to avoid the implementation of new fixed-service stations in the bands 1 550-1 555 MHz, 1 610-1 645.5 MHz and 1 646.5-1 660 MHz.

ADD LTU/314/7

S5.359A *Additional allocation:* in Lithuania, the band 1 559-1 610 MHz is also allocated to the fixed service on a primary basis until 1 January 2005. After this date, the fixed service may continue to operate on a secondary basis until 1 January 2015 upon which time this allocation shall be no longer be valid. Administrations are urged to take all practicable steps to protect the radionavigation-satellite service and the aeronautical-radionavigation service and not authorize new frequency assignments to fixed service systems in this band.

MOD LTU/314/8

S5.447 *Additional allocation:* in Germany, Austria, Belgium, Denmark, Spain, Finland, France, Greece, Israel, Italy, Japan, Jordan, Lebanon, Liechtenstein, Lithuania, Luxembourg, Malta, Morocco, Norway, Pakistan, the Netherlands, Portugal, Syria, the United Kingdom, Sweden, Switzerland and Tunisia, the band 5 150-5 250 MHz is also allocated to the mobile service, on a primary basis, subject to agreement obtained under No. **S9.21**.

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

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ISTANBUL, 8 MAY – 2 JUNE 2000

WORKING GROUP 4B

Chairperson, Working Group 5C to Chairperson, Working Group 4B

Working Group 5C has agreed Document 283 which restructures the allocation table above 71 GHz. In addition, it considered Documents 252 and Addendum 1 to Document 51 from the Malaysian Administration.

These last documents indicate that the allocation restructuring in Document 283 will impact the allocations in which the Malaysian Administration has submitted advance publication and request for coordination information for satellite networks.

The Malaysian Administration is willing to adjust its filings accordingly, but does not wish to lose the filing dates for these networks. As this is a procedural matter, Working Group 5C requests your Working Group to address this issue.

D. JANSKY
Chairperson, Working Group 5C,
Box 5

Attachments: Documents 252 (edited version) and Addendum 1 to Document 51

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

ISTANBUL, 8 MAY – 2 JUNE 2000

Edited version
Document 252-E
17 May 2000
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WORKING GROUP 5C

Note by the Chairperson, Sub-Working Group 5C-2

MODIFICATION OF BRINGING INTO USE AND ADMINISTRATIVE DUE DILIGENCE REQUIREMENTS AS A CONSEQUENCE OF ALLOCATION CHANGES ABOVE 71 GHz

Agenda item 1.16 for WRC-2000 is "to consider allocation of frequency bands above 71 GHz to the Earth exploration-satellite (passive) and radio astronomy services, taking into account Resolution 723 (WRC-97)". The purpose is to adjust allocations above 71 GHz to satisfy science service requirements and to relieve, to the extent possible, interference from active radio services in the same or adjacent allocations. Section 4.1 of the CPM Report identifies requirements for each of the science services and reports the results of sharing studies between the science services and other active services. Methods to satisfy the agenda item are reflected in the many proposals on this agenda item and require many changes to the allocations for both passive and active radio services.

Many of these modified active bands are satellite bands. Space stations with frequencies in these modified bands for which complete Appendix S4 coordination information or notification information is considered as having been received by the Bureau by the end of WRC-2000 should be given consideration in light of these events in the following manner:

1) responsible administrations should be able to resubmit the relevant Appendix S4 information, while retaining the original date of the receipts;

2) the resubmitted Appendix S4 coordination information or notification information shall be excluded from the cost-recovery procedures;

3) the Bureau should allow sufficient time to the responsible administration for the preparation required to resubmit the Appendix S4 coordination information or notification information.

To accomplish this modification see draft new Resolution [COM5/8].

S. SAYEENATHAN (India)
Chairperson, Sub-Working Group 5C-2
Box 757

Attachment: Draft new Resolution [COM5/8]

RESOLUTION [COM5/8] (WRC-2000)

Modification of bringing into use and administrative due diligence requirements as a consequence of allocation changes above 71 GHz

The World Radiocommunication Conference (Istanbul, 2000),

considering

a) that pursuant to agenda item 1.16 identified in Resolution **721 (WRC-97)**, the preparatory work for WRC-2000 considered the allocation of frequency bands above 71 GHz to the Earth exploration-satellite (passive) and radio astronomy services;

b) that agenda item 1.16 took into account Resolution **723 (WRC-97)**, which also included consideration of the allocation of frequency bands above 71 GHz to the space research (passive) service;

c) that changes made to the allocations for these passive science services were accompanied by consequential changes to allocations above 71 GHz to active services;

d) that the allocation changes have caused delays in the design and development of space stations planning to use these allocations;

e) that the delays also impact transmitters and receivers, on the same space stations, planning to use frequencies below 71 GHz;

f) that advance publication or request for coordination information for satellite networks in the fixed-satellite, mobile-satellite, or broadcasting-satellite services which included the use of frequencies above 71 GHz may have been received by the Bureau;

g) that this advance publication or request for coordination information for satellite networks in the fixed-satellite, mobile-satellite, or broadcasting-satellite services would be based upon the frequency allocations in force at the time the information was submitted;

h) that No. **S11.44** requires that the notified date of bringing into use of any space station of a satellite network be no later than [nine] years (for advance publication information received prior to 22 November 1997) or [seven] years (for advance publication information received on or after 22 November 1997) following the date of receipt by the Bureau of the advance publication information under No. **S9.1**;

i) that No. **S11.44B** allows the notified date of bringing into use to be extended by the Bureau only if the due diligence information required by Resolution **49 (WRC-97)** is provided for the satellite network; if the procedure for effecting coordination has commenced; and if the notifying administration certifies that the reason for the extension is one or more specific circumstances listed in Nos. **S11.44C** through **S11.44I**;

j) that none of the specific circumstances listed in Nos. **S11.44C** through **S11.44I** includes changes to the frequency allocations as a result of world radiocommunication conference decisions;

k) that in order to provide the necessary protection to the passive science services, satellite networks in the fixed-satellite, mobile-satellite, or broadcasting-satellite services employing frequencies above 71 GHz with advanced publication or request for coordination information which is considered as having been received by the Bureau prior to [2 June 2000], must be adhered to the revised Table of Frequency Allocations resulting from WRC-2000,

resolves

1 that, for satellite networks employing frequencies above 71 GHz in the fixed-satellite, mobile-satellite, or broadcasting-satellite services, with advance publication or request for coordination information which is considered as having been received by the Bureau prior to [2 June 2000], the Bureau will extend the notified date of bringing into use under No. **S11.44** up to [22 November 2006] or nine years from the date of receipt of advance publication information by the Bureau, whichever date comes earlier (for advance publication information received by the Bureau prior to 22 November 1997) and 2 June 2007 under **S11.44B** through **S11.44I** or seven years from the date of receipt of advance publication information by the Bureau, whichever date comes earlier (for advance publication information received by the Bureau on and after [22 November 1997)] at the request of the notifying administration;

2 that, notwithstanding the notified date of bringing into use in *resolves* 1, there shall be no change in the date that the advance publication or request for coordination information is considered as having been received by the Bureau;

3 that, for any satellite network subject to this Resolution, the notifying administration shall have until [31 December 2000] to inform the Bureau of a re-submission of the Appendix **S4** advance information and coordination information for the space station to reflect the proposed modification in the frequency band above 71 GHz and that this Appendix **S4** information be excluded from the cost recovery procedures;

4 that the provisions contained in **S11.44B** through **S11.44I** are applicable with respect to the date of bringing into use communicated to the Bureau under *resolves* 3;

5 that, for any satellite network subject to this Resolution and Resolution **49 (WRC-97)**, the notifying administration shall have until the new date of bringing into use under *resolves* 3 to send the administrative due diligence information to the Bureau, including any revision of administrative due diligence information submitted before [2 June 2000];

6 that the foregoing *resolves* apply to any satellite network qualified under *resolves* 1, including transmitters and receivers in the same network employing frequencies below 71 GHz;

7 that any extension of the bringing into use date or due diligence requirements granted under the conditions specified in this Resolution shall be revoked and the date requirements in effect prior to the extension shall apply to all frequency bands utilized by any satellite network that does not bring into use the frequency bands above 71 GHz within the time limitations;

8 that [six] months before the expiry date specified in *resolves* 3, the Bureau will provide administrations with a list of the networks to which this Resolution applies and the options under the foregoing *resolves*;

9 that satellite networks employing frequencies above 71 GHz with advanced publication or request for coordination information which is considered as having been received by the Bureau prior to [2 June 2000], shall adhere to the revised Table of Frequency Allocations resulting from WRC-2000.

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

ISTANBUL, 8 MAY – 2 JUNE 2000

Addendum 1 to
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COMMITTEE 5

Malaysia

PROPOSAL FOR THE WORK OF THE CONFERENCE

Agenda item 1.16 - to consider the allocation of frequency bands above 71 GHz to the Earth exploration-satellite (passive) and radio astronomy services, taking into account Resolution 723 (WRC-97)

With a view to accommodating the need for additional frequency bands above 71 GHz to satisfy user requirements for passive sensing of the Earth's environmental conditions, the Malaysian Administration would like to submit for review the following proposal as a compromise solution to space stations with frequencies in the proposed modified band, for which complete Appendix S4 coordination information or notification information, is considered as having been received by the Bureau by the end of WRC-2000.

MLA/51/2

The Malaysian Administration proposes that space stations with frequencies in the proposed modified bands, for which complete Appendix S4 coordination information or notification information, is considered as having been received by the Bureau by the end of WRC-2000, shall be permitted the following:

a) to resubmit the relevant Appendix S4 information, while retaining the original dates of receipt;

b) the resubmitted Appendix S4 coordination information or notification information shall be excluded from the cost-recovery procedures;

c) the Bureau shall allow sufficient time to the responsible administration for the preparation to resubmit the Appendix S4 coordination information or notification information.

Reasons:

a) A non-retroactive impact on space stations with frequencies in the proposed modified band, for which complete Appendix S4 coordination information or notification information, is considered as having been received by the Bureau by the end of WRC-2000.

b) The resubmitted Appendix S4 coordination information or notification information should not be treated as a new filing. Thus, cost-recovery procedures should not apply.

c) In view of the proposed change in direction of the frequency bands 71-74 GHz and 81-84 GHz, a new set of the design budgets for these space stations would have to be created.

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COMMITTEE 4

Japan

PROPOSALS FOR THE WORK OF THE CONFERENCE

The Administration of Japan makes the following proposal for the work of the World Radiocommunication Conference (WRC-2000) under agenda item 1.1 with respect to the footnotes in Article S5:

MOD J/316/1

S5.139 *Different category of service:* in Armenia, Azerbaijan, Belarus, Georgia, Japan, Kazakstan, Latvia, Lithuania, Moldova, Mongolia, Uzbekistan, Kyrgyzstan, Russian Federation, Tajikistan, Turkmenistan and Ukraine, the allocation of the band 6 765-7 000 kHz to the land mobile service is on a primary basis (see No. **S5.33**).

MOD J/316/2

S5.278 *Different category of service:* in Argentina, Colombia, Costa Rica, Cuba, Guyana, Honduras, Japan, Panama and Venezuela, the allocation of the band 430-440 MHz to the amateur service is on a primary basis (see No. **S5.33**).

______

[*] Pursuant to Resolution 26 (Rev.WRC-97) the secretariat notes that this contribution was received on 22 May 2000.

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

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COMMITTEE 4

Russian Federation

PROPOSAL FOR THE WORK OF THE CONFERENCE

The Russian Federation considers it necessary to submit to WRC-2000 proposals concerning agenda items 1.1 and 1.4 relating to the relevant footnote contained in Article S5 of the Radio Regulations.

MOD RUS/317/1

S5.551D *Additional allocation:* in Algeria, Saudi Arabia, Bahrain, Benin, Cameroon, Egypt, United Arab Emirates, Israel, Jordan, Kuwait, Lebanon, Libya, Mali, Morocco, Mauritania, Nigeria, Oman, Qatar, Syria, Russian Federation, Tunisia and Yemen, the band 40.5-42.5 GHz is also allocated to the fixed-satellite service (space-to-Earth) on a primary basis. The use of this band by the fixed-satellite service shall be in accordance with Resolution **134 (WRC-97)**.

____

* Pursuant to Resolution 26 (WRC-97) the secretariat notes that this contribution was received on 22 May 2000.

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WORKING GROUP 5D

Drafting Group 5D ad hoc

TWO POSSIBLE COMPROMISE POSITIONS ON RESOLUTION 130 AND ASSOCIATED TOPICS

At the meeting of WG 5D on the morning of 19 May it was suggested that two possible compromise positions would be:

- to suppress both *resolves* 5 and *resolves* 6 of Resolution 130;
- to retain both of those *resolves*.

At subsequent meetings of an ad hoc Group, a working document was discussed.

This revised version of the working document attempts to define possible ways of implementing the two approaches.

This document does NOT present all proposals from administrations on this subject - it merely indicates two possible approaches.

Also, other elements are included (S5.487A) which have not yet been covered by other drafting groups of WG 5D.

Approach 1 : Suppression of both *resolves*

SUP

RESOLUTION 130 (WRC-97)

Use of non-geostationary systems in the fixed-satellite service in certain frequency bands

ADD

resolves

that, as of 22 November 1997, in the frequency bands specified in Tables **S22-1A**, **S22-1B**, **S22-1C** and **S22-2** of Article **S22**, non-GSO FSS systems for which complete notification or coordination information, as appropriate, has been received by the Bureau after 21 November 1997 shall be subject to the power limits in Article **S22**, as revised by this Conference;

ADD

resolves

that, in any case where complete coordination or notification information, as appropriate, is considered as having been received between 22 November 1997 and the end of WRC-2000 for a non-GSO FSS network operating in the frequency bands specified in Tables **S22-1A**, **S22-1B**, **S22-1C** and **S22.2** of Article **S22**, the responsible administration shall submit before [1 January 2001] all necessary supplementary information to permit the Bureau to make a finding in compliance with the limits contained in Article **S22** as revised by WRC-2000;

SUP

Section VI – Earth station off-axis power limitations in the fixed-satellite service

MOD

S5.441 The use of the bands 4 500-4 800 MHz (space-to-Earth), 6 725-7 025 MHz (Earth-to-space) by the fixed-satellite service shall be in accordance with the provisions of Appendix **S30B**. The use of the bands 10.7-10.95 GHz (space-to-Earth), 11.2-11.45 GHz (space-to-Earth) and 12.75-13.25 GHz (Earth-to-space) by geostationary-satellite systems in the fixed-satellite service shall be in accordance with the provisions of Appendix **S30B**. The use of the bands 10.7-10.95 GHz (space-to-Earth), 11.2-11.45 GHz (space-to-Earth) and 12.75-13.25 GHz (Earth-to-space) by non-geostationary-satellite systems in the fixed-satellite service ~~shall be in accordance with the provisions of Resolution **130 (WRC-97)**~~is subject to the application of the provisions of No. **S9.12** for coordination with other non-geostationary-satellite systems in the fixed-satellite service. The provisions of Resolution **130 (Rev.WRC-2000)** apply.

MOD

S5.484A The use of the bands 10.95-11.2 GHz (space-to-Earth), 11.45-11.7 GHz (space-to-Earth), 11.7-12.2 GHz (space-to-Earth) in Region 2, 12.2-12.75 GHz (space-to-Earth) in Region 3, 12.5-12.75 GHz (space-to-Earth) in Region 1, 13.75-14.5 GHz (Earth-to-space), 17.8-18.6 GHz (space-to-Earth), 19.7-20.2 GHz (space-to-Earth), 27.5-28.6 GHz (Earth-to-space), 29.5-30 GHz (Earth-to-space) by non-geostationary~~ and geostationary~~ satellite systems in the fixed-satellite service is subject to application of the provisions of ~~Resolution **130 (WRC-97)**. The use of the band 17.8-18.1 GHz (space-to-Earth) by non-geostationary fixed-satellite service systems is also subject to the provisions of Resolution **538 (WRC-97)**~~No. **S9.12** for the coordination with other non-geostationary-satellite systems in the fixed-satellite service. The provisions of Resolution **130 (Rev.WRC-2000)** and Resolution **538 (Rev.WRC-2000)** apply.

MOD

S5.487A *Additional allocation:* in Region 1, the band 11.7-12.5 GHz, in Region 2, the band 12.2-12.7 GHz and, in Region 3, the band 11.7-12.2 GHz, are also allocated to the fixed-satellite service (space-to-Earth) on a primary basis, limited to non-geostationary systems and subject to the application of the provisions of ~~Resolution **538 (WRC-97)**~~No. **S9.12** for coordination with other non-geostationary-satellite systems in the fixed-satellite service. The provisions of Resolution **538 (Rev.WRC-2000)** apply.

Approach 2 : Retention of both *resolves*

SUP

RESOLUTION 130 (WRC-97)

Use of non-geostationary systems in the fixed-satellite service in certain frequency bands

ADD

resolves

that, as of 22 November 1997, in the frequency bands specified in Tables **S22-1A**, **S22-1B**, **S22-1C** and **S22-2** of Article **S22**, non-GSO FSS systems for which complete notification or coordination information, as appropriate, has been received by the Bureau after 21 November 1997 shall be subject to the power limits in Article **S22**, as revised by this Conference;

ADD

resolves

that, in any case where complete coordination or notification information, as appropriate, is considered as having been received between 22 November 1997 and the end of WRC-2000 for a non-GSO FSS network operating in the frequency bands specified in Tables **S22-1A**, **S22-1B**, **S22-1C** and **S22.2** of Article **S22**, the responsible administration shall submit before [1 January 2001] all necessary supplementary information to permit the Bureau to make a finding in compliance with the limits contained in Article **S22** as revised by WRC-2000;

MOD

Section VI – GSO ~~E~~earth station off-axis power limitations in the fixed-satellite service[11,12]

MOD

S22.26 § 9 The level of equivalent isotropically radiated power (e.i.r.p.) emitted by an earth station shall within a geostationary-satellite network not exceed the following values for any off-axis angle φ which is ~~2.5~~3° or more off the main-lobe axis of an earth station antenna:

Off-axis angle	*Maximum e.i.r.p.*
~~2.5~~3° ≤ φ ≤ 7°	(~~39~~42 – 25 log φ) dB(W/40 kHz)
7° < φ ≤ 9.2°	~~18~~21 dB(W/40 kHz)
9.2° < φ ≤ 48°	(~~42~~45 – 25 log φ) dB(W/40 kHz)
48° < φ ≤ 180°	~~0~~3 dB(W/40 kHz)

MOD

S22.27 For FM-TV emissions with energy dispersal, the limits in No. **S22.26** above may be exceeded by up to 3 dB provided that the off-axis total e.i.r.p. of the transmitted FM-TV carrier does not exceed the following values:

Off-axis angle	*Maximum e.i.r.p.*
~~2.5~~3° ≤ φ ≤ 7°	(~~53~~56 – 25 log φ) dBW
7° < φ ≤ 9.2°	~~32~~35 dBW
9.2° < φ ≤ 48°	(~~56~~59 – 25 log φ) dBW
48° < φ ≤ 180°	~~14~~17 dBW

MOD

S22.28 FM-TV carriers which operate without energy dispersal should be modulated at all times with programme material or appropriate test patterns. In this case, the off-axis total e.i.r.p. of the emitted FM-TV carrier shall not exceed the following values:

Off-axis angle	*Maximum e.i.r.p.*
~~2.5~~3° ≤ φ ≤ 7°	(~~53~~56 – 25 log φ) dBW
7° < φ ≤ 9.2°	~~32~~35 dBW
9.2° < φ ≤ 48°	(~~56~~59 – 25 log φ) dBW
48° < φ ≤ 180°	~~14~~17 dBW

MOD

[11] **S22.VI.1** ~~The provisions of this section are suspended pending the review of the values in Nos. **S22.26**, **S22.27** and **S22.28** by WRC-99~~The provisions of this section are not intended to be used for coordination of, or to evaluate interference between, GSO FSS networks (see RR **S9.50.1**).

ADD

[12] **S22.VI.2** Although the provisions of this section cover off-axis power limitations in all directions, operators of GSO FSS earth stations are not required to provide information on the typical performance of the earth station antennas in more than two orthogonal planes. [CPM report, Section 3.1.2.2.4 refers.]

NOC

S22.29

ADD

S22.30 The e.i.r.p. limits given in Nos. **S22.26, S22.27** and **S22.28** do not apply to earth station antennas ready to be in service[13] prior to 2 June 2000 nor to earth stations associated with a satellite network in the fixed-satellite service for which complete coordination or notification information has been received before 2 June 2000.

ADD

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[13] **S22.30.1** "Ready to be in service" relates to the case where antennas have been installed but the start of service has been delayed due to *force majeure*.

ADD

S22.31 Telecommand and ranging carriers transmitted to geostationary satellites in the fixed-satellite service in normal mode of operation (i.e. earth station transmitting telecommand and ranging carriers to a directive receiving antenna on the space station) may exceed the levels given in **S22.26** by no more than 16 dB in the frequency bands 12.75-13.25 GHz and 13.75-14.5 GHz. In all other modes of operation, and in case of *force majeure*, telecommand and ranging carriers transmitted to geostationary satellites in the fixed-satellite service are exempted from the levels given in **S22.26**.

ADD

S22.32 § 10 The level of equivalent isotropically radiated power (e.i.r.p.) density emitted by an earth station within a geostationary-satellite network in the 29.5-30 GHz frequency band shall not exceed the following values for any off-axis angle φ which is 3° or more off the main-lobe axis of an earth station antenna:

Off-axis angle	*Maximum e.i.r.p. density*
3° ≤ φ ≤ 7°	(28 – 25 log φ) dB(W/40 kHz)
7° < φ ≤ 9.2°	7 dB(W/40 kHz)
9.2 < φ ≤ 48°	(31 – 25 log φ) dB(W/40 kHz)
48° < φ ≤ 180°	–1 dB(W/40 kHz)

ADD

S22.33 The e.i.r.p. limits given in **S22.32** do not apply to earth station antennas ready to be in service prior to [XXXX] nor to earth stations associated with satellite networks in the fixed-satellite service which have been brought into use before 2 June 2000.

ADD

S22.34 Telecommand and ranging[***] carriers transmitted to geostationary satellites in the fixed-satellite service in normal mode of operation (i.e. earth station transmitting telecommand and ranging carriers to a directive receiving antenna on the space station) may exceed the levels given in **S22.32** by no more than 10 dB[**] in the frequency band 29.5-30 GHz. In all other modes of operation, and in case of *force majeure,* telecommand and ranging carriers transmitted to geostationary satellites in the fixed-satellite service are exempted from the levels given in **S22.32**.

ADD

S22.35 For GSO systems in which the earth stations are expected to transmit simultaneously in the same 40 kHz band, e.g. for the GSO systems employing CDMA, the maximum e.i.r.p., values in **S22.32** should be decreased by 10*log(N) dB, where N is the number of earth stations which are in the receive satellite beam of the satellite to which these earth stations are communicating and which are expected to transmit simultaneously on the same frequency.

[***] Measurement of the distance to the satellite.

[**] Further studies are required to confirm the value of 10 dB.

ADD

S22.36 Earth stations operating in the 29.5-30 GHz frequency band should be designed in such a manner that 90% of the their peak off-axis e.i.r.p. density levels do not exceed the values given in **S22.32**. Further study is needed to determine the off-axis angular range over which these exceedances would be permitted, taking into account the interference level into adjacent satellites. The statistical processing of the off-axis e.i.r.p. density peaks should be dealt with using the method given in Recommendation ITU-R S.732.

ADD

S22.37 The values given in **S22.26** to **S22.28** and **S22.32** apply under clear-sky conditions. During rain-fade conditions, the values may be exceeded by earth stations when implementing uplink power control.

ADD

S22.38 FSS earth stations operating in the 29.5-30 GHz band, which have lower elevation angles to the GSO will require higher e.i.r.p. levels relative to the same terminals at higher elevation angles to achieve the same power flux-densities at the GSO due to the combined effect of increased distance and atmospheric absorption. Earth stations with low elevation angles may exceed the levels given in **S22.32** by the following amount:

Elevation angle to GSO (ε)	*Increase in e.i.r.p. density (dB)*
ε ≤ 5°	2.5
5 < ε ≤ 30°	0.1(25 – ε) + 0.5

ADD

S22.39 The values in **S22.32** applicable to the off-axis angle range from 48° to 180° are intended to account for spillover effects.

MOD

S5.441 The use of the bands 4 500-4 800 MHz (space-to-Earth), 6 725-7 025 MHz (Earth-to-space) by the fixed-satellite service shall be in accordance with the provisions of Appendix **S30B**. The use of the bands 10.7-10.95 GHz (space-to-Earth), 11.2-11.45 GHz (space-to-Earth) and 12.75-13.25 GHz (Earth-to-space) by geostationary-satellite systems in the fixed-satellite service shall be in accordance with the provisions of Appendix **S30B**. The use of the bands 10.7-10.95 GHz (space-to-Earth), 11.2-11.45 GHz (space-to-Earth) and 12.75-13.25 GHz (Earth-to-space) by a non-geostationary-satellite systems in the fixed-satellite service ~~shall be in accordance with the provisions of Resolution **130 (WRC-97)**~~is subject to the application of the provision of No. **S9.12** for coordination with other non-geostationary-satellite systems in the fixed-satellite service. Non-geostationary-satellite systems in the fixed-satellite service shall not claim protection from geostationary-satellite networks in the fixed-satellite service operating in accordance with the Radio Regulations, irrespective of the dates of receipt by the Bureau of the complete notification information for the non-GSO FSS systems and of the complete coordination information for the GSO networks.

MOD

S5.484A The use of the bands 10.95-11.2 GHz (space-to-Earth), 11.45-11.7 GHz (space-to-Earth), 11.7-12.2 GHz (space-to-Earth) in Region 2, 12.2-12.75 GHz (space-to-Earth) in Region 3, 12.5-12.75 GHz (space-to-Earth) in Region 1, 13.75-14.5 GHz (Earth-to-space), 17.8-18.6 GHz (space-to-Earth), 19.7-20.2 GHz (space-to-Earth), 27.5-28.6 GHz (Earth-to-space), 29.5-30 GHz (Earth-to-space) by a non-geostationary and geostationary satellite systems in the fixed-satellite service is subject to application of the provisions of Resolution **130 (WRC-97)**. The use of the band 17.8-18.1 GHz (space-to-Earth) by non-geostationary fixed-satellite service systems is also subject to the provisions of Resolution **538 (WRC-97)**No. **S9.12** for coordination with other non-geostationary-satellite systems in the fixed-satellite service. Non-geostationary-satellite systems in the fixed-satellite service shall not claim protection from geostationary-satellite networks in the fixed-satellite service operating in accordance with the Radio Regulations, irrespective of the dates of receipt by the Bureau of the complete notification information for the non-GSO FSS systems and of the complete coordination information for the GSO networks.

MOD

S5.487A *Additional allocation:* in Region 1, the band 11.7-12.5 GHz, in Region 2, the band 12.2-12.7 GHz and, in Region 3, the band 11.7-12.2 GHz, are also allocated to the fixed-satellite service (space-to-Earth) on a primary basis, limited to non-geostationary systems and subject to the provisions of Resolution **538 (WRC-97)**No. **S9.12** for coordination with other non-geostationary-satellite systems in the fixed-satellite service. Non-geostationary-satellite systems in the fixed-satellite service shall not claim protection from geostationary-satellite networks in the fixed-satellite service operating in accordance with the Radio Regulations, irrespective of the dates of receipt by the Bureau of the complete notification information for the non-GSO FSS systems and of the complete coordination information for the GSO networks.

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

Document 319-E
22 May 2000
Original: English

ISTANBUL, 8 MAY – 2 JUNE 2000

WORKING GROUP 5D

Chairperson, Working Group 5D

The meeting of the ad-hoc drafting group on 20 May identified that WG 5D had not yet allocated footnote S5.491 to any of the drafting groups.

The drafting group noted that all proposals for change were the same, and that one administration had proposed NOC. For reference one of the proposals for change is duplicated below.

MOD ASP/20/147

S5.491 *Additional allocation:* in Region 3, the band 12.2-12.5 GHz is also allocated to the fixed-satellite (space-to-Earth) service on a primary basis~~, limited to national and sub-regional systems~~. The power flux-density limits in Article **S21**, Table **S21-4** shall apply to this frequency band. The introduction of the service in relation to the broadcasting-satellite service in Region 1 shall follow the procedures specified in Article 7 of Appendix **S30**, with the applicable frequency band extended to cover 12.2-12.5 GHz.

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INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

Corrigendum 1 to Document 320-E
25 May 2000
Original: English

ISTANBUL, 8 MAY – 2 JUNE 2000

COMMITTEE 4

Estonia (Republic of)

PROPOSALS FOR THE WORK OF THE CONFERENCE

The Republic of Estonia submits the following modification to proposal EST/320/3 according to agreement reached with the Russian Federation:

MOD EST/320/3

S5.176 *Additional allocation:* in Australia, China, the Republic of Korea, the Philippines, the Democratic People's Republic of Korea, Estonia (subject to agreement obtained under No. **S9.21**) and Western Samoa, the band 68-74 MHz is also allocated to the broadcasting service on a primary basis.

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

Document 320-E[*]
22 May 2000
Original: English

ISTANBUL, 8 MAY – 2 JUNE 2000

COMMITTEE 4

Estonia (Republic of)

PROPOSALS FOR THE WORK OF THE CONFERENCE

The Republic of Estonia submits the following proposals for the work of the World Radiocommunication Conference (WRC-2000) under agenda item 1.1 concerning deletion of country names from footnotes and in accordance with the decision of the Plenary meeting on addition of country names to the footnotes contained in Article S5 of the Radio Regulations:

MOD EST/320/1

S5.447 *Additional allocation:* in Germany, Austria, Belgium, Denmark, Spain, Estonia, Finland, France, Greece, Israel, Italy, Japan, Jordan, Lebanon, Liechtenstein, Luxembourg, Malta, Morocco, Norway, Pakistan, the Netherlands, Portugal, Syria, the United Kingdom, Sweden, Switzerland and Tunisia, the band 5 150-5 250 MHz is also allocated to the mobile service, on a primary basis, subject to agreement obtained under No. **S9.21**.

MOD EST/320/2

S5.211 *Additional allocation:* in Germany, Saudi Arabia, Austria, Bahrain, Belgium, Bosnia and Herzegovina, Denmark, the United Arab Emirates, Spain, Estonia, Finland, Greece, Ireland, Israel, Kenya, Kuwait, The Former Yugoslav Republic of Macedonia, Liechtenstein, Luxembourg, Mali, Malta, Norway, the Netherlands, Qatar, the United Kingdom, Slovenia, Somalia, Sweden, Switzerland, Tanzania, Tunisia, Turkey and Yugoslavia, the band 138-144 MHz is also allocated to the maritime mobile and land mobile services on a primary basis.

MOD EST/320/3

S5.176 *Additional allocation:* in Australia, China, the Republic of Korea, the Philippines, the Democratic People's Republic of Korea, Estonia and Western Samoa, the band 68-74 MHz is also allocated to the broadcasting service on a primary basis.

Reasons: As the use of this band by broadcasting service is decreasing, there is need to change existing *Alternative allocation* for this frequency band to enable use by other services according to Table of Frequency Allocations in RR S5.

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[*] Pursuant to Resolution 26 (Rev.WRC-97) the secretariat notes that this contribution was received on 22 May 2000.

MOD EST/320/4

S5.175 *Alternative allocation:* in Armenia, Azerbaijan, Belarus, ~~Estonia,~~ Georgia, Kazakstan, Latvia, Lithuania, Moldova, Mongolia, Uzbekistan, Kyrgyzstan, Russian Federation, Tajikistan, Turkmenistan and Ukraine, the bands 68-73 MHz and 76-87.5 MHz are allocated to the broadcasting service on a primary basis. The services to which these bands are allocated in other countries and the broadcasting service in the countries listed above are subject to agreements with the neighbouring countries concerned.

Reasons: Consequential modification to proposal EST/320/3.

MOD EST/320/5

S5.177 *Additional allocation:* in Armenia, Azerbaijan, Belarus, Bulgaria, ~~Estonia,~~ Georgia, Kazakstan, Latvia, Lithuania, Moldova, Mongolia, Uzbekistan, Poland, Kyrgyzstan, Russian Federation, Tajikistan, Turkmenistan and Ukraine, the band 73-74 MHz is also allocated to the broadcasting service on a primary basis, subject to agreement obtained under No. **S9.21**.

Reasons: Consequential modification to proposal EST/320/3.

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

Document 321-E*[*]
22 May 2000
Original: Russian

ISTANBUL, 8 MAY – 2 JUNE 2000

COMMITTEE 4

Belarus (Republic of), Ukraine

PROPOSAL FOR THE WORK OF THE CONFERENCE

Belarus and Ukraine consider it necessary to submit to WRC-2000 proposals concerning agenda items 1.1 and 1.4 relating to the relevant footnote contained in Article **S5** of the Radio Regulations.

MOD BLR/UKR/321/1

S5.551D *Additional allocation:* in Algeria, Saudi Arabia, Bahrain, Belarus, Benin, Cameroon, Egypt, United Arab Emirates, Israel, Jordan, Kuwait, Lebanon, Libya, Mali, Morocco, Mauritania, Nigeria, Oman, Qatar, Syria, Tunisia, Ukraine and Yemen, the band 40.5-42.5 GHz is also allocated to the fixed-satellite service (space-to-Earth) on a primary basis. The use of this band by the fixed-satellite service shall be in accordance with Resolution **134 (WRC-97)**.

[*] Pursuant to Resolution 26 (WRC-97) the secretariat notes that this contribution was received on 22 May 2000.

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

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ISTANBUL, 8 MAY – 2 JUNE 2000

COMMITTEE 5

SUMMARY RECORD

OF THE

SECOND MEETING OF COMMITTEE 5
(ALLOCATIONS AND ASSOCIATED ISSUES)

Tuesday, 16 May 2000, at 1430 hours

Chairperson: Mr Chris Van DIEPENBEEK (Netherlands)

Subjects discussed		**Documents**
1	Approval of the summary record of the first meeting of Committee 5	173
2	Report of the Chairperson of Working Group 5A	186, 211
3	Oral report by the Chairperson of Working Group 5B	-
4	Report of the Chairperson of Working Group 5C	210
5	Report of the Chairperson of Working Group 5D	176, 194(Rev.1)
6	Questions referred to Committee 5 by Committee 4	197, 199
7	Consideration of resolutions and recommendations of earlier conferences	-
8	Schedule of work	177

1 Approval of the summary record of the first meeting of Committee 5 (Document 173)

1.1 Document 173 was **approved**.

2 Report of the Chairperson of Working Group 5A (Documents 186 and 211)

2.1 The **Chairperson of Working Group 5A** said that, with regard to WRC agenda item 1.6, the terrestrial component of IMT-2000 was being dealt with by Working Group 5A, while the satellite component and HAPS issues relating to IMT-2000 were being considered in Sub-Working Group 5A-1; generic MSS allocation issues, under agenda item 1.10, and MSS allocation below 1 GHz, under agenda item 1.11, were being considered in Sub-Working Group 5A-2. Work was proceeding well, all documents had been introduced and detailed discussions were under way. On the terrestrial component, agreement had been reached on a framework for consensus on item 1.6.1 and good progress was being made towards a package solution. One drafting group had been set up to consider appropriate text for bands below 1 GHz.

2.2 Two matters had been settled. With regard to agenda item 1.6.2, in the light of the CPM Report (§ 1.1.3.1) and concurrent proposals, Working Group 5A had readily concluded that there was no need for the identification of a global radio control channel to facilitate multimode terminal operation and worldwide roaming of IMT-2000. That conclusion was presented in Document 186.

2.3 With regard to agenda item 1.11, it had likewise been rapidly agreed that there was no need for modification of the constraints on existing allocations for non-geostationary MSS below 1 GHz and there were accordingly no proposed changes to the Radio Regulations. Those conclusions were presented in Document 211.

2.4 Documents 186 and 211 were **approved**.

3 Oral report by the Chairperson of Working Group 5B

3.1 The **Chairperson of Working Group 5B** reported that, after the establishment of two sub-working groups, Sub-Working Group 5B-1 had begun by considering issues of protection of distress and safety communications in the HF bands (WRC agenda item 1.7) and had already reached consensus on the use of digital selective calling and national frequencies. Discussions were now continuing on the frequencies 12 and 16 MHz, where there were still diverse views on the exclusive use of the channels for distress and safety communications. It had been agreed to revise Resolution 207 (Mob-87) accordingly. With respect to the maritime mobile service in the band 156-174 MHz (agenda item 1.18), consensus had been reached on the introduction of simplex mode and on the development and testing of digital systems on a voluntary basis. Discussions were continuing in order to reconcile different views on channel selection for those purposes.

3.2 Sub-Working Group 5B-2 had set up two drafting groups to consider RNSS-related issues under agenda item 1.15. Under agenda item 1.15.1, candidate bands had been identified for both the space-to-Earth and Earth-to-space directions, but the amount of spectrum and the frequency bands were still under discussion. There were also different views on pfd limits, although protection of ARNS was generally supported. With regard to agenda item 1.15.2, there had been agreement on a new allocation of the space-to-space direction, but discussion was still under way on the associated footnotes. Under agenda item 1.15.3, it had been agreed to add footnotes to cease operation of the fixed service in the current RNSS band, and a text had already been drafted to that effect.

3.3 Agenda item 1.9 had proved more controversial. Working Group 5B had generally agreed that there should be no change to the band 1 559-1 567 MHz, and the majority had also supported the deletion of Resolution 220 (WRC-97), although some administrations considered that deletion of Resolution 220 was conditional, depending on other associated decisions. Alternative proposals for a new allocation to MSS in the band below 1 525 MHz had met with some opposition on the grounds that such a new allocation was not consistent with the agenda item. No consensus had emerged despite a lengthy discussion, and Working Group 5B was consequently requesting Committee 5 to consider the issue at the current meeting and give it clear guidance so that it could proceed with its work on that item, including consideration of Resolutions 213 (Rev.WRC-95) and 220 (WRC-97).

3.4 The **Chairperson** invited comments on conference agenda item 1.9 and on the proposal to consider an alternative band.

3.5 The **delegate of France**, supported by the **delegates of Finland, Sweden** and **Germany**, said that the European common proposal was for an alternative downlink allocation to MSS in the band 1 518-1 525 MHz, in view of studies indicating that use of the band 1 559-1 567 MHz by MSS was creating difficulties for the radionavigation-satellite service. The proposal fell within the scope of agenda item 1.9 and of Resolution 213 (Rev.WRC-95). Whatever decision was made, the issue should be discussed by the committee and the conference.

3.6 The **delegate of the United Arab Emirates** drew attention to his country's proposal, contained in Document 22, for an additional allocation to MSS in the bands 1 518-1 525 MHz for the downlink and 1 683-1 690 MHz for the uplink. He had explained to Working Group 5B the reason for the proposal and its relevance to agenda item 1.9. It was important to hold further discussions on the issue, since the CPM Report stated that the band 1 683-1 690 MHz for the uplink was feasible for allocation to MSS. The **delegates of India, Nigeria** and **Indonesia** supported that view.

3.7 The **delegate of Russia**, supported by the **delegate of Uzbekistan**, said that the issue did not come under agenda item 1.9. Committee 5 would do better to concern itself with other, potentially more difficult, issues.

3.8 The **delegate of the United States** said that the terms of agenda item 1.9 were clear. Resolution 213 (Rev.WRC-95) had merely provided a starting point for ITU-R studies; but no preparation had been done, so any decision would not be solidly based. He understood the requirements of MSS, but the only way to find a band for it was to examine specific bands, with the participation of all interested delegations and with thorough preparation. Meanwhile, for the sake of its credibility, the conference should adhere to its agenda.

3.9 The **delegate of Papua New Guinea** said that agenda item 1.9 was absolutely specific regarding the bands to which Resolution 213 was to be applied. Furthermore, the majority of administrations supported the deletion of Resolution 220.

3.10 The **delegate of the United Kingdom** said that some delegations had confused the question of whether the conference was competent to address the issue with the substance of the European proposal. He was engaged in informal consultations, which he optimistically considered could overcome substantive objections. As for the procedural aspect, his delegation was confident that the conference was competent to deal with the issue, given that there had been a long discussion on the band 1 559-1 610 MHz at WRC-97, resulting in Resolution 220, which in turn was clearly a response to Resolution 213 and the need to find a suitable downlink.

3.11 The **delegate of China**, supported by the **delegate of the Islamic Republic of Iran**, said that ITU-R had not carried out studies on the band 1 518-1 525 MHz, so it was premature for the conference to express an opinion on the matter.

3.12 The **delegate of Japan** agreed with the delegates of Russia, the United States and China that a detailed study was lacking, but MSS was heavily used and it would be desirable to find a suitable frequency band for it. He was therefore in favour of continuing the discussion within Committee 5.

3.13 The **delegate of the United Arab Emirates** said that studies had been carried out: they were reflected in Document 22. Moreover, the proposed bands had already been allocated in Region 2 and a similar allocation could be made in Regions 1 and 3.

3.14 The **delegate of the United States** said that, while it was understandable to wish to link one resolution with another for the purposes of discussion, Resolution 213 (Rev.WRC-95) related to the study of a specific band; it did not directly concern agenda item 1.9. As for the allocation in Region 2, he noted that no actual use had been made of the allocation, owing to the difficulty of sharing with systems already within the band, so it should not be held up as a success.

3.15 The **Chairperson** recalled that the matter had been under discussion since WRC-95. It was important not to fall into the trap of postponing difficult issues. Given the divergent views, he suggested that, rather than discussing procedure, the committee should encourage the delegation of the United Kingdom to continue to engage in consultations on the substance of the European proposal, which would give those opposing it the opportunity to argue their point. Meanwhile, Working Group 5B should discuss whether sufficient technical material was available for delegations to reach a decision.

3.16 The **delegate of the United States**, supported by the **delegate of China**, was willing to continue discussions, but urged that they should remain informal. If administrations making proposals could not provide sufficient technical information, his delegation reserved the right to revert to the question of whether the conference was competent to discuss the issue. The main difficulty lay in the matter of preparation: many administrations had not had an opportunity to consider any studies that had been made. Meanwhile, he hoped that other aspects of agenda item 1.9 - such as the deletion of Resolution 220 (WRC-97), for which there was overwhelming support - would not be overshadowed by the current discussion.

3.17 The **delegate of the United Kingdom** said that the third paragraph of *recognizing* 3 of Resolution 220 made clear the need to find a suitable downlink band. His delegation could therefore not agree to the deletion of the resolution until the issue was resolved.

3.18 The **delegate of France** said that the boundary between formal and informal discussions was difficult to determine. He therefore suggested that Working Group 5B should consider agenda item 1.9 in its entirety, including the proposal for an additional allocation in the band 1 518-1 525 MHz, at which time explanations could be provided in response to some of the questions that had been raised. It was preferable to continue discussions rather than to prejudge the issue.

3.19 The **delegate of the United Kingdom** said that, while he was happy to continue informal consultations, it was also important to incorporate the issue into the formal conference structure.

3.20 The **delegate of Saudi Arabia** said that, while Working Group 5B should resume its discussion of the issue, the various points of view should also be put before the Plenary.

3.21 The **delegate of Russia** said that the material relating to the new proposal had been presented at the Radiocommunication Assembly and had clearly been inadequate as a basis for further progress. There was agreement that further studies were required and it was futile to continue discussions on the issue, which was not even consistent with the agenda item. Working Group 5B had no reason to consider the matter at all.

3.22 The **Chairperson** noted that there were proposals from CEPT, the United Arab Emirates and Indonesia relating to the deletion of Resolution 220 (WRC-97). His suggestion was merely to continue work until some outcome - such as a reformulation of the resolution, specifying other possible frequency bands - was achieved.

3.23 The **delegate of Belarus** said that Resolutions 213 and 220 related to specific frequency bands, and it was clearly impossible for Working Group 5B to determine the technical criteria for using those bands. The conference should adhere to its agenda.

3.24 The **Chairperson** said that, in view of the divergence of views, he would put the matter to the Plenary. Meanwhile, he suggested that Working Group 5B should continue its work, since postponement was to nobody's advantage.

3.25 It was so **agreed**.

3.26 The **Chairperson of Working Group 5B** requested confirmation that the working group was to consider proposals for possible new allocations for bands below 1 525 MHz in conjunction with proposals to delete Resolution 220 (WRC-97).

3.27 The **Chairperson** said that the main task of Working Group 5B would be to consider whether there was enough technical material to decide on allocations in the band 1 518-1 525 MHz, bearing in mind that a group of countries could agree on the deletion of Resolution 220 only if an additional allocation could be made. In response to a query from the **delegate of France**, he confirmed that Working Group 5B should not assume that agreement had been reached on the deletion of the resolution.

4 Report of the Chairperson of Working Group 5C (Document 210)

4.1 The **Chairperson of Working Group 5C** said that the working group was making good progress; it had held two meetings and all relevant documents had been introduced. Three sub-working groups had been established to consider agenda items 1.15, 1.16 and 1.17, and 1.4, respectively; several drafting groups and an ad hoc group had also been established. At the request of the Chairperson of Committee 5 and Working Group 5B, Working Group 5C had been asked to consider draft new Resolution [AAA] (WRC-2000) on possible frequency allocations above 275 GHz, draft new Resolution [BBB] (WRC-2000) on use of the frequency band 1 215-1 300 MHz by spaceborne synthetic aperture radar, and draft new Resolution [CCC] (WRC-2000) on use of the frequency band 35.5-35.6 GHz by spaceborne precipitation radar, which were among the items proposed in Document 20 for inclusion on the agenda of the next WRC. Draft new Resolution [CCC] had been approved by the working group and was submitted to Committee 5 in Document 210 as Resolution [COM5/1] (WRC-2000). Some editorial amendments were required.

4.2 The **Chairperson**, referring to the draft new resolution in Document 210, said that *considering a)* should be amended by deleting “expanded from 35.5-35.6 GHz with footnote **S5.551** and”, and that the text of *considering b)* should be replaced by “that before WRC-97, operation on a primary basis of radars located on spacecraft was allowed in the band 35.5-35.6 GHz”. Should Committee 5 approve Document 210, the draft new resolution would be forwarded to Working Group 2 of the Plenary for consideration for inclusion on the agenda of

WRC-02. In reply to a request for clarification regarding *resolves* 2, he referred the **delegate of Canada** to the content of footnote S5.551A.

4.3 Draft new Resolution [COM5/1] (WRC-2000) on use of the frequency band 35.5-35.6 GHz by spaceborne precipitation radar, as contained in Document 210, as amended, was **approved**.

5 Report of the Chairperson of Working Group 5D (Documents 176 and 194(Rev.1))

5.1 The **Chairperson of Working Group 5D** reported that the working group had held four meetings and all relevant documents had been introduced. While some progress had been made, fixed positions were emerging on certain issues and it might prove difficult to achieve a satisfactory compromise. Nevertheless, he hoped that the working group would complete its assigned tasks by the end of the week. Working Group 5D had established four sub-working groups to deal with specific issues; three had almost completed their work, the fourth was about to hold its first meeting. Of the items being dealt with directly by the working group as a whole, work on agenda items 1.12 and 1.14 had been completed. He introduced Document 176, which contained the results of the work on agenda item 1.12, noting that the square brackets placed around the references to S9.7A and S9.7B in Resolution 121 (Rev.WRC-97), MOD S11.32A and its footnote S11.32A.1 could now be removed.

5.2 Document 176, as amended, was **approved**.

5.3 The **Chairperson** noted that Committee 5 had completed its work on agenda item 1.12.

5.4 The **Chairperson of Working Group 5D**, introducing Document 194(Rev.1), noted that, as stated in the document, the proposals contained therein should be brought to the attention of Committee 4 so that steps could be taken to include the necessary elements in Appendix S4. He therefore suggested that detailed consideration of the changes to Appendix S4 should be left to Committee 4.

5.5 It was so **agreed**.

5.6 Document 194(Rev.1) was **approved**.

5.7 The **Chairperson** noted that Committee 5 had completed its work on agenda item 1.14.

6 Questions referred to Committee 5 by Committee 4 (Documents 197 and 199)

6.1 The **Chairperson** said that, in approving Document 194(Rev.1), the Committee had changed the text of S5.511A referred to in Document 197, and there was now a clear incorporation by reference in respect of Recommendation ITU-R RA.769-1. He therefore took it that, other than providing Working Group 4B with the revised text contained in Document 194(Rev.1), no further action was required in relation to Document 197.

6.2 It was so **agreed**.

6.3 The **Chairperson**, introducing Document 199, said that it was his understanding that Recommendation ITU-R M.1174 had been revised and that Committee 5 might therefore agree that the Radio Regulations should be updated to reflect the latest version of Recommendation ITU-R M.1174.

6.4 It was so **agreed**.

7 Consideration of resolutions and recommendations of earlier conferences

7.1 The **Secretary** informed the committee that Sub-Working Group 4B-4 was considering all resolutions and recommendations of earlier conferences other than those directly covered by the WRC-2000 agenda items and would shortly forward a list of resolutions to Committee 5 for review.

7.2 The **Chairperson** suggested that, in order to save time, the resolutions recommended for review should be forwarded to the appropriate working groups without prior submission to Committee 5 as a whole.

7.3 It was so **agreed**.

8 Schedule of work (Document 177)

8.1 The **Chairperson**, introducing Document 177, drew attention to the need for Committee 5 and its associated groups to complete their work by the end of the third week of the conference at the latest and urged participants to facilitate the progress of the committee's work.

The meeting rose at 1610 hours.

The Secretary:
J. LEWIS

The Chairperson:
Chris Van DIEPENBEEK

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

ISTANBUL, 8 MAY – 2 JUNE 2000

Document 323-E*[*]
22 May 2000
Original: Spanish

COMMITTEE 4

Chile

PROPOSAL FOR THE WORK OF THE CONFERENCE

The Administration of Chile makes the following proposal for the work of the World Radiocommunication Conference (WRC-2000) under agenda item 1.1 with respect to the following footnote contained in Article S5:

MOD CHL/323/1

S5.480 *Additional allocation:* in Brazil, Chile, Costa Rica, Ecuador, Guatemala, Honduras and Mexico, the band 10-10.45 GHz is also allocated to the fixed and mobile services on a primary basis.

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[*] Pursuant to Resolution 26 (Rev.WRC-97) the secretariat notes that this contribution was received on 22 May 2000.

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

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16 May 2000
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ISTANBUL, 8 MAY – 2 JUNE 2000

COMMITTEE 5

Indonesia (Republic of)

PROPOSAL FOR THE WORK OF THE CONFERENCE

Agenda item 1.9 - MSS spectrum requirement in the 1 to 3 GHz range

1 Introduction

The issues of MSS in the 1-3 GHz band request immediate decision for additional allocation for space-to-Earth and Earth-to-space directions. Some countries are of the opinion that, to resolve this matter, reference be made to the fact that the CPM Report has made recommendations:

a) an MSS (E-s) allocation is possible in the band 1 683-1 690 MHz;

b) MSS (s-E) allocation in the band 1 559-1 567 MHz is not recommended;

c) administrations should make every effort to find an alternative MSS downlink allocation taking into account already completed sharing studies.

2 Discussion

The uplink band 1 683-1 690 MHz is in fact part of an already existing band for Region 2 for MSS (E-s). The CPM Report recognizes that in this band some countries that have MetAids or MetSat stations at unspecified locations may suffer interference from the mobile-satellite earth station. However, this interference is a highly localized problem and the regulatory authorities may choose not to allow mobile earth station operations. Implementing this action will permit MSS to be provided in all other parts of the world.

The downlink band 1 518-1 525 MHz is also part of an already existing allocation band for MSS in Region 2 (E-s). The relevant co-primary services are FS and MS (including aeronautical telemetry). Sharing studies with all these services have already been completed within ITU-R and appropriate recommendations also exist. By using the coordination threshold based on ITU-R Recommendations, the interference from MSS downlink to FS/MS receivers can be resolved. Meanwhile the interference from FS/MS transmitters to mobile-satellite earth station receivers is a highly localized problem and the regulatory authorities have the discretion to allow MSS service on a non-protected basis or not at all.

Moreover, there are two national footnotes (S5.343 and S5.348A) that ensure protection of mobile services and aeronautical telemetry from interference caused by MSS.

3 Conclusion

In view of the above facts, it is considered perfectly feasible and desirable that WRC-2000 can make the decision to allocate the uplink band 1 683-1 690 MHz and downlink band 1 518-1 525 MHz for the MSS. This allocation obviously will create a harmonized situation by not causing limitation to the development and operation of existing terrestrial and aeronautical telemetry systems.

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

Document 325-E*[*]
22 May 2000
Original: English

ISTANBUL, 8 MAY – 2 JUNE 2000

COMMITTEE 4

Paraguay (Republic of)

PROPOSALS FOR THE WORK OF THE CONFERENCE

The Administration of Paraguay makes the following proposal for the work of the World Radiocommunication Conference (WRC-2000) under agenda item 1.1 with respect to the footnote contained in Article S5:

MOD PRG/325/1

S5.480 *Additional allocation:* in Brazil, Costa Rica, Ecuador, Guatemala, Honduras, ~~and~~ Mexico and Paraguay, the band 10-10.45 GHz is also allocated to the fixed and mobile services on a primary basis.

MOD PRG/325/2

S5.481 *Additional allocation:* in Germany, Angola, China, Ecuador, Spain, Japan, Morocco, Nigeria, Oman, Paraguay, Democratic People’s Republic of Korea, Sweden, Tanzania and Thailand, the band 10.45-10.5 GHz is also allocated to the fixed and mobile services on a primary basis.

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[*] Pursuant to Resolution 26 (Rev.WRC-97) the secretariat notes that this contribution was received on 22 May 2000.

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

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22 May 2000
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ISTANBUL, 8 MAY – 2 JUNE 2000

COMMITTEE 4

Chairperson, Working Group 4A

REPORT FROM WORKING GROUP 4A

Please find attached the proposal for revision of Appendix S7.

N. KISRAWI
Chairperson, Working Group 4A

SUP

APPENDIX S7

Method for the determination of the coordination area around an earth station in frequency bands between 1 GHz and 40 GHz shared between space and terrestrial radiocommunication services

ADD

APPENDIX S7

Methods for the determination of the coordination area around an earth station in frequency bands between 100 MHz and 105 GHz

1 Introduction

This Appendix addresses the determination of the coordination area (see No. S1.171) around a transmitting or receiving earth station, that is sharing spectrum in frequency bands between 100 MHz and 105 GHz with terrestrial radiocommunication services, or with earth stations operating in the opposite direction of transmission.

The coordination area represents the area surrounding an earth station sharing the same frequency band with terrestrial stations, or the area surrounding a transmitting earth station that is sharing the same bidirectionally allocated frequency band with receiving earth stations, within which the permissible level of interference may be exceeded and hence, coordination is required. The coordination area is determined on the basis of known characteristics for the coordinating earth station and on conservative assumptions for the propagation path and for the system parameters for the unknown terrestrial stations (see Tables 1 and 2 of Annex VII), or the unknown receiving earth stations (Table 3 of Annex VII), that are sharing the same frequency band.

1.1 Overview

This Appendix contains procedures and system parameters for calculating an earth station's coordination area, including predetermined distances.

The procedures allow the determination of a distance in all azimuthal directions around a transmitting or receiving earth station, beyond which the predicted path loss would be expected to exceed a specified value for all but a specified percentage of the time. This distance is called the coordination distance (see No. S1.173). When the coordination distance is determined for each azimuth around the coordinating earth station it defines a distance contour, called the coordination contour (see No. S1.172), that encloses the coordination area.

It is important to note that although the determination of the coordination area is based on technical criteria it represents a regulatory concept. Its purpose is to identify the area within which detailed evaluations of the interference potential need to be performed in order to determine whether the coordinating earth station or any of the terrestrial stations, or in the case of a bidirectional allocation any of the receiving earth stations that are sharing the same frequency band, will experience unacceptable levels of interference. Hence, the coordination area is not an exclusion zone within which the sharing of frequencies between the earth station and other terrestrial stations or earth stations is prohibited, but a means for determining the area within which more detailed calculations need to be performed. In most cases a more detailed analysis will show that sharing within the coordination area is possible since the procedure for the determination of the coordination area is based on unfavourable assumptions with regard to the interference potential.

For the determination of the coordination area, two separate cases may have to be considered:

– for the earth station when it is transmitting and hence capable of interfering with receiving terrestrial stations or earth stations;

– for the earth station when it is receiving and hence it may be the subject of interference from transmitting terrestrial stations.

Calculations are performed separately for great circle propagation mechanisms (propagation mode (1)) and, if required by the sharing scenario (see § 1.4), for scattering from hydrometeors (propagation mode (2)). The coordination contour is then determined using the greater distance predicted by the propagation mode (1) and propagation mode (2) calculations for each azimuth around the coordinating earth station. Separate coordination contours are produced for each sharing scenario. Guidance and examples of the construction of coordination contours, and their component propagation mode (1) and propagation mode (2) contours are provided in § 1.6.

To facilitate bilateral discussion it can be useful to calculate additional contours, defining smaller areas, that are based on less conservative assumptions than those used for the calculation of the coordination contour.

1.2 Appendix structure

In this Appendix the general principles are separated from the detailed text on methods. The former is contained in the main body of this Appendix and the latter are contained in a series of annexes, enabling the user to select only those sections that are relevant for a specific sharing scenario.

Table 1 is provided to help the user to navigate through the Appendix and Annexes, it also indicates the relevant sections that need to be explored for a specific coordination case.

TABLE 1

Cross-reference between sharing scenarios and calculation methods

Applicable sections and Annexes ⇩ / Sharing scenarios of § 1.4 ⇨	§ 1.4.1 Earth station operating to a geostationary space station	§ 1.4.2 Earth stations operating to non-geostationary space stations *	§ 1.4.3 Earth stations operating to both geostationary and non-geostationary space stations	§ 1.4.4 Earth stations operating in bidirectionally allocated frequency bands	§ 1.4.5 Broadcasting satellite service earth stations	§ 1.4.6 Mobile (except aeronautical mobile) earth stations	§ 1.4.7 Aeronautical mobile earth stations
§ 1.3 Basic concepts	X	X	X	X	X	X	X
§ 1.5 Propagation model concepts	X	X	X	X	See § 1.4.1, § 1.4.2, § 1.4.3 or § 1.4.4 as applicable and § 1.6	See § 1.4.1, § 1.4.2, § 1.4.3 or § 1.4.4 as applicable and § 1.6	See § 1.4.1, § 1.4.2, § 1.4.3 or § 1.4.4 as applicable and § 1.6
§ 1.6 The coordination contour: concepts and construction	X	X	X	X			
§ 2.1 Earth statioins operating to geostationary space stations	X		X				
§ 2.2 Earth stations operating to non-geostationary space stations		X	X				
§ 3 Determination of the coordination area between earth stations operating in bidirectionally allocated frequency bands				X			
§ 4 General considerations for the determination of the propagation mode (1) required distance	X	X	X	X			
§ 5 General considerations for the determination of the propagation mode (2) required distance	X		X				
Annex I Determination of the required distance for propagation mode (1)	X	X	X	X			
Annex II Determination of the required distance for propagation mode (2)	X		X				
Annex III Antenna gain towards the horizon for earth stations operating to geostationary space stations	X		X				
Annex IV Antenna gain towards the horizon for earth stations operating to non-geostationary space stations		X	X	X			
Annex V Determination of the coordination area for a transmitting earth station with respect to receiving earth stations operating to geostationary space stations in bidirectionally allocated frequency bands				X			
Annex VI Supplementary and auxiliary contours	X	X	X	X			
Annex VII System parameters and predetermined coordination distances for determination of the coordination area around an earth station	X	X	X	X			

* For an earth station using a non-tracking antenna the procedure of § 2.1 is used. For an earth station using a non-directional antenna the procedures of § 2.1.1 are used.

1.3 Basic concepts

Determination of the coordination area is based on the concept of the permissible interference power at the antenna terminals of a receiving terrestrial station or earth station. Hence, the attenuation required to limit the level of interference between a transmitting terrestrial station or earth station and a receiving terrestrial station or earth station to the permissible interference power for p% of the time is represented by the "minimum required loss". Where, the minimum required loss is the loss that needs to be equalled or exceeded by the predicted path loss for all but p% of the time[1].

For propagation mode (1) the following equation applies:

$$L_b(p) = P_t + G_t + G_r - P_r(p) \qquad \text{dB} \qquad (1)$$

where:

- p: the maximum percentage of time for which the permissible interference power may be exceeded;
- $L_b(p)$: the propagation mode (1) minimum required loss (dB) for p% of the time; this value must be exceeded by the propagation mode (1) predicted path loss for all but p% of the time;
- P_t: the maximum available transmitting power level (dBW) in the reference bandwidth at the terminals of the antenna of a transmitting terrestrial station or earth station;
- $P_r(p)$: permissible interference power of an interfering emission (dBW) in the reference bandwidth to be exceeded for no more than p% of the time at the terminals of the antenna of a receiving terrestrial station or earth station that may be subject to interference, where the interfering emission originates from a single source;
- G_t: the gain (dB relative to isotropic) of the antenna of the transmitting terrestrial station or earth station. For a transmitting earth station, this is the antenna gain towards the physical horizon on a given azimuth; for a transmitting terrestrial station, the maximum main beam axis antenna gain is to be used;
- G_r: the gain (dB relative to isotropic) of the receiving antenna of the terrestrial or earth station that may be subject to interference. For a receiving earth station, this is the gain towards the physical horizon on a given azimuth; for a receiving terrestrial station, the maximum main beam axis antenna gain is to be used.

In the case of a receiving earth station, the permissible interference power $P_r(p)$ is specified with respect to the actual percentage of time the receiver is in operation, rather than the total elapsed time.

For propagation mode (2), a volume scattering process is involved and a modification of the above approach is necessary. Where the coordinating earth station antenna beam intersects a rain cell, a common volume may be formed with a terrestrial station beam or an earth station beam (operating in the opposite direction of transmission in bidirectionally allocated frequency bands). In the case of a terrestrial station, the assumptions are made that the terrestrial station beamwidth is relatively

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[1] When p is a small percentage of the time, in the range 0.001% to 1.0%, the interference is referred to as "short-term"; if $p \geq 20\%$, it is referred to as "long-term" (see § 1.5.3).

large in comparison with that of the coordinating earth station (terrestrial station gain values are given in Tables 1 and 2 of Annex VII) and that the terrestrial station is some distance from the common volume. The terrestrial station beam is therefore assumed to illuminate the whole rain cell, which is represented by a vertical cylinder filled with hydrometeors that give rise to isotropically scattered signals. This scattering process may give rise to unwanted coupling between the coordinating earth station and terrestrial stations or earth stations operating in bidirectionally allocated frequency bands, via the common volume.

The earth station antenna gain and its beamwidth are inter-dependent. The size of the common volume, and the number of scattered signals arising within that volume, increases as the gain of the earth station antenna transmitting or receiving those signals decreases, the one effect compensating for the other. A term which approximates the full integral required to evaluate the volume scattering process within the earth station antenna beam is included in equation (II-11). Therefore in the procedure for evaluation of interference that may arise from propagation mode (2) mechanisms a simplifying assumption can be made that the path loss is independent of the earth station antenna gain[2].

Hence for propagation mode (2), equation (1) reduces to:

$$L_x(p) = P_t + G_x - P_r(p) \qquad \text{dB} \qquad (2)$$

where:

$L_x(p)$: is the minimum loss required for propagation mode (2).

G_x: is the maximum antenna gain (dBi) assumed for the terrestrial station. Tables 1 and 2 of Annex VII give values of G_x for the various frequency bands.

To facilitate the calculation of propagation mode (2) auxiliary contours (see Annex VI) the calculation is further modified by placing the terrestrial network antenna gain G_x within the iterative loop for the propagation mode (2) required loss calculations[3].

Hence equation (2) further reduces to:

$$L(p) = P_t - P_r(p) \qquad \text{dB} \qquad (3)$$

where:

$L(p)$: the propagation mode (2) minimum required loss (dB) for p% of the time; this value must be exceeded by the propagation mode (2) predicted path loss for all but p% of the time.

For both modes of propagation, P_t and $P_r(p)$ are defined for the same radio-frequency bandwidth (the reference bandwidth). Further $L_b(p)$, $L(p)$ and $P_r(p)$ are defined for the same small percentage of the time, and these values are set by the performance criteria of the receiving terrestrial, or receiving earth station, that may be subject to interference.

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2 If the earth station antenna has a wide beamwidth, the method can still be used to determine the propagation mode (2) contour. However, the fact that the antenna beam may be wider than the rain cell and hence not actually fully filled with hydrometeors will mean that the interference potential may be slightly over-estimated.

3 See equation (II-21).

For an earth station operating to geostationary space stations, Annex III provides the numerical method for determining the minimum angle between the earth station antenna main beam axis and the physical horizon as a function of azimuth, and the corresponding antenna gain. In the case of a space station in a slightly inclined geostationary orbit, the minimum elevation angle and corresponding horizon gain will depend on the maximum inclination angle to be coordinated.

For an earth station operating to non-geostationary space stations, the antenna gain in the direction of the horizon of the earth station varies as a function of time and Annex IV provides the numerical methods for its determination.

For an earth station operating in a frequency band with a bidirectional allocation, the antenna gain to be used in determining the propagation mode (1) minimum required loss is calculated using the methods in Annex III or Annex IV, as appropriate.

Determination of the coordination area requires the calculation of the predicted path loss and its comparison with the minimum required loss, for every azimuth around the coordinating earth station, where:

1) the predicted path loss, is dependent on several factors including the length and general geometry of the interfering path (e.g., antenna pointing, horizon elevation angle), antenna directivity, radio climatic conditions, and the percentage of the time during which the predicted path loss is less than the minimum required loss; and

2) the minimum required loss is based on system and interference model considerations.

The required coordination distance is the distance at which these two losses are considered to be equal for the stated percentage of time.

In determining the coordination area the pertinent parameters of the coordinating earth station are known, but knowledge of the terrestrial stations or other earth stations sharing that frequency range is limited. Hence it is necessary to rely on assumed system parameters for the unknown terrestrial stations or the unknown receiving earth stations. Further, many aspects of the interference path between the coordinating earth station and the terrestrial stations or other earth stations (e.g. antenna geometry and directivity) are unknown.

The determination of the coordination area is based on unfavourable assumptions regarding system parameter values and interference path geometry. However, in certain circumstances, to assume that all the worst-case values will occur simultaneously is unrealistic, and leads to unnecessarily large values of minimum required loss. This could lead to unnecessarily large coordination areas. For propagation mode (1), detailed analyses, supported by extensive operational experience, have shown that the requirement for the propagation mode (1) minimum required loss can be reduced because of the very small probability that the worst case assumptions for system parameter values and interference path geometry will exist simultaneously. Therefore a correction is applied within the calculation for the propagation mode (1) predicted path loss in the appropriate sharing scenario to allow benefit to be derived from these mitigating effects. The application of this correction factor is described in more detail in § 4.4.

This correction applies to cases of coordination with the fixed service. It is frequency, distance and path dependent. It does not apply in the case of the coordination of an earth station with mobile stations, nor with other earth stations operating in the opposite direction of transmission, nor in the case of propagation via hydrometeor scatter (propagation mode (2)).

A number of propagation models are used to cover the propagation mechanisms that exist in the full frequency range. These models predict the path loss as a monotonically increasing function of distance. Therefore, coordination distances are determined by calculating the path loss iteratively for an increasing distance until either the minimum required loss is achieved, or a maximum calculation distance limit is reached (see § 1.5.3).

The iteration method always starts at a defined value of minimum distance, d_{min} in km, and iteration is performed using a uniform step size (s km) for increasing the distance. A step size of 1 km is recommended.

1.4 Sharing scenarios

The following subsections describe the basic assumptions made for the various earth station sharing scenarios. These subsections need to be read in conjunction with the information contained in Table 1 and § 1.6 which contains guidance on the development of a coordination contour. Except as discussed in §§ 1.4.5 to 1.4.7, the earth stations around which coordination areas are determined are assumed to be fixed earth stations authorized to operate at a single permanent location. In cases of earth stations that can be operated from a number of fixed locations, the coordination areas are determined for each individual location.[4]

1.4.1 Earth stations operating to geostationary space stations

For an earth station operating to a space station in the geostationary orbit, the space station appears to be stationary with respect to the Earth. However variations in gravitational forces acting on the space station and limitations in positional control mean a geostationary space station's orbital parameters are not constant. Movement from the space station's nominal orbital position in an east/west direction (longitudinal tolerance) is limited within the Radio Regulations (see No. S22.6 to No. S22.18), but movement in the north/south direction (inclination excursion) is not specified.

Relaxation in the north/south station-keeping of a geostationary space station allows its orbit to become inclined with an inclination that increases gradually with time. Therefore the determination of the coordination area requires consideration of the range of movement of the earth station antenna. Although the direction of pointing of the earth station antenna may in practice vary with time, the earth station antenna may also be pointing in one direction for considerable periods of time. Hence the gain of the earth station antenna in the direction of the horizon is assumed to be constant. For an earth station operating to a space station in an orbit as described above, an assumption of constant horizon gain as the inclination angle increases may lead to a conservative estimation of the coordination area, the degree of conservatism increases with increasing inclination angle.

For an earth station operating to a geostationary space station the coordination area is determined using the procedures described in § 2.1.

[4] While some fixed satellite systems transmit to fixed earth stations operating at unspecified locations within a service area defined by an administration, methods for determining the coordination areas are specified only for individual sites. To minimize the number of individual earth stations requiring detailed coordination in these cases, administrations may wish to develop bilateral agreements based on distances, calculated in accordance with Recommendation ITU-R SM.1448, extended from the periphery of a service area.

1.4.2 Earth stations operating to non-geostationary space stations

Earth stations operating to a non-geostationary space station may use a directional or a non-directional antenna. Furthermore, earth stations using a directional antenna may track the orbital path of a non-geostationary space station.

While an earth station operating to a geostationary space station is assumed to have a constant antenna gain towards the horizon, for an earth station antenna that is tracking the orbital path of a non-geostationary space station, the antenna gain towards the horizon will vary with time. Therefore, it is necessary to estimate the variation of the antenna gain with time towards the horizon for each azimuth in order to determine the coordination area. The procedure is described in § 2.2.

For an earth station operating to a non-geostationary space station, the motion of a relatively high gain tracking antenna reduces the probability of interference due to propagation mode (2) mechanisms and hence the propagation mode (2) required distances will be relatively short. The minimum coordination distance d_{min} (see § 1.5.3) will provide adequate protection in these cases. The propagation mode (2) contour is therefore taken to be identical to a circle represented by the minimum coordination distance. Propagation mode (2) calculations are not required in these circumstances and the coordination area is determined using the propagation mode (1) procedure in § 2.2 only.

For an earth station operating to a non-geostationary space station using a non-directional antenna, a similar situation applies, and the low gain means that propagation mode (2) required distances will be less than the minimum coordination distance. Hence for the case of non-directional antenna the propagation mode (2) contour is also coincident with the circle represented by d_{min}, and the coordination area is determined using the propagation mode (1) procedures described in § 2.1.1, only.

For an earth station operating to a non-geostationary space station using a non-tracking directional antenna, the potential for interference arising from propagation mode (2) is identical to an earth station operating to a geostationary space station. Hence, for the case of non-tracking directional antenna the coordination area is determined using both the propagation mode (1) and propagation mode (2) procedures described in § 2.1.

1.4.3 Earth stations operating to both geostationary and non-geostationary space stations

For earth stations that are sometimes intended to operate to geostationary space stations and at other times to non-geostationary space stations, separate coordination areas are determined for each type of operation. In such cases, the coordination area for the geostationary space station is determined using the procedures described in § 2.1 and, in addition, the coordination area for the non-geostationary space station is determined using the procedure described in § 2.2. For each case, the percentage of time p, is specified for all the operational time that the receiving earth station is expected to spend in reception from geostationary space stations or non-geostationary space stations as appropriate.

1.4.4 Earth stations operating in bidirectionally allocated frequency bands

For earth stations operating in some frequency bands there may be equal primary allocations to space services operating in both the Earth-to-space and space-to-Earth directions. In this case, where two earth stations are operating in opposite directions of transmission it is only necessary to establish the coordination area for the transmitting earth station, as receiving earth stations will automatically be taken into consideration. Hence, a receiving earth station operating in a bidirectionally allocated frequency band will only be involved in coordination with a transmitting earth station if it is located within the transmitting earth station's coordination area.

For a transmitting earth station operating to either geostationary or non-geostationary satellites in a bidirectionally allocated frequency band, the coordination area is determined using the procedures described in § 3.

1.4.5 Broadcasting-satellite service earth stations

For earth stations in the broadcasting-satellite service operating in the unplanned bands, the coordination area is determined by extending the periphery of the specified service area, within which the earth stations are operating, by the coordination distance which is based on a typical BSS earth station. In calculating the coordination distance no additional protection can be assumed to be available from the earth station horizon elevation angle, i.e. $A_h = 0$ dB in Annex I, for all azimuth angles around the earth station.

1.4.6 Mobile (except aeronautical mobile) earth stations

For a mobile (except aeronautical mobile) earth station, the coordination area is determined by extending the periphery of the specified service area, within which the mobile (except aeronautical mobile) earth stations are operating, by the coordination distance. The coordination distance may be represented by a predetermined coordination distance (see Table 4 of Annex VII), or it may be calculated. In calculating the coordination distance no additional protection can be assumed to be available from the earth station horizon elevation angle, i.e. $A_h = 0$ dB in Annex 1, for all azimuth angles around the earth station.

1.4.7 Aeronautical mobile earth stations

For aeronautical mobile earth stations the coordination area is determined by extending the periphery of the specified service area, within which the aeronautical mobile earth station operates, by an appropriate predetermined coordination (see Table 4 of Annex VII) distance for the respective services.

1.5 Propagation model concepts

For each mode of propagation, according to the requirements of the specific sharing scenario (see § 1.4) it is necessary to determine the predicted path loss. The determination of this predicted path loss is based on a number of propagation mechanisms.

Interference may arise through a range of propagation mechanisms whose individual dominance depends on climate, radio frequency, time percentage of interest, distance and path topography. At any one point in time, one or more mechanisms may be present. The propagation mechanisms that are considered within this Appendix in the determination of the interference potential are as follows:

– *Diffraction*: In as far as it relates to diffraction losses occurring over the earth station's local physical horizon. This effect is referred to below as "site shielding". The remainder of the path along each radial is considered to be flat and therefore free of additional diffraction losses.

– *Tropospheric scatter*: This mechanism defines the "background" interference level for paths longer than about 100 km beyond which the diffraction field becomes very weak.

– *Surface ducting*: This is the most important short-term interference mechanism over water and in flat coastal land areas, and can give rise to high signal levels over longer distances, sometimes more than 500 km. Such signals can exceed the equivalent "free-space" level under certain conditions.

– *Elevated layer reflection and refraction*: The treatment of reflection and/or refraction from layers at heights up to a few hundred metres is an important mechanism that enables signals to by-pass any diffraction losses due to the underlying terrain under favourable path geometry situations. Again the impact can be significant over long distances.

– *Hydrometeor scatter*: Hydrometeor scatter can be a potential source of interference between terrestrial link transmitters and earth stations because it may act isotropically, and can therefore have an impact irrespective of whether the common volume is on or off the great-circle interference path between the coordinating earth station and terrestrial stations, or receiving earth stations operating in bidirectionally allocated frequency bands.

In this Appendix propagation phenomena are classified into two modes as follows:

– *Propagation mode (1)*: propagation phenomena in clear air, (tropospheric scatter, ducting, layer reflection/refraction, gaseous absorption and site shielding). These phenomena are confined to propagation along the great-circle path;

– *Propagation mode (2)*: hydrometeor scatter.

1.5.1 Propagation mode (1)

For the determination of the propagation mode (1) required distances, the applicable frequency range has been divided into three parts:

– For VHF/UHF frequencies between 100 MHz and 790 MHz and for time percentages from 1% to 50% of an average year.

– From 790 MHz to 60 GHz and for time percentages from 0.001% to 50% of an average year.

– From 60 GHz to 105 GHz and for time percentages from 0.001% to 50% of an average year.

The variation in predicted path loss due to the horizon elevation angle around an earth station is calculated by the method described in § 1 of Annex I using the horizon elevation angles and distances along different radials from the earth station. For all frequencies between 100 MHz and 105 GHz the attenuation arising from the horizon characteristics is included in the value of propagation mode (1) predicted path loss, unless its use is specifically prohibited for a particular sharing scenario (see § 1.4.5 and § 1.4.6).

In the determination of the propagation mode (1) required distance, the world is divided into four basic radio-climatic zones. These zones are defined as follows.

– Zone A1: coastal land, i.e. land adjacent to a Zone B or a Zone C area (see below), up to an altitude of 100 m relative to mean sea or water level, but limited to a maximum distance of 50 km from the nearest Zone B or Zone C area; in the absence of precise information on the 100 m contour, an approximation (e.g. 300 feet) may be used. Large inland areas of at least 7 800 km² which contain many small lakes, or a river network, comprising more than 50% water, and where more than 90% of the land is less than 100 m above the mean water level may be included in Zone A1[5].

– Zone A2: all land, other than coastal land as defined in Zone A1 above.

– Zone B: "cold" seas, oceans and large bodies of inland water situated at latitudes above 30°, with the exception of the Mediterranean Sea and the Black Sea. A "large" body of inland water is defined, for the administrative purpose of coordination, as one having an area of at least 7 800 km², but excluding the area of rivers. Islands within such bodies of water are to be included as water within the calculation of this area if they have elevations lower than 100 m above the mean water level for more than 90% of their area. Islands that do not meet these criteria should be classified as land for the purposes of calculating the area of the water.

– Zone C: "warm" seas, oceans and large bodies of inland water situated at latitudes below 30°, as well as the Mediterranean Sea and the Black Sea.

1.5.2 Propagation mode (2)

For the determination of the propagation mode (2) required distance, interference arising from hydrometeor scatter can be ignored at frequencies below 1 000 MHz and above 40.5 GHz outside the minimum coordination distance (see § 1.5.3.1). Below 1 000 MHz the level of the scattered signal is very low and above 40.5 GHz, although significant scattering occurs, the scattered signal is then highly attenuated on the path from the scatter volume to the receiving terrestrial station or earth station. Site shielding is not relevant to propagation mode (2) mechanisms as the interference path is via the main beam of the coordinating earth station antenna.

1.5.3 Distance limits

The effect of interference on terrestrial and space systems often needs to be assessed by considering long and short term interference criteria. These criteria are generally represented by a permissible interference power not to be exceeded for more than a specified percentage of time.

The long-term criterion (typically associated with percentages of time ≥ 20%) protects the error performance objective (for digital systems) or noise performance objective (for analogue systems) to meet specified long-term interference criteria. This criterion will generally represent a low level of interference and hence require a high degree of isolation between the coordinating earth station and terrestrial stations, or receiving earth stations operating in bidirectionally allocated bands.

The short-term criterion is a higher level of interference, typically associated with time percentages in the range 0.001% to 1% of time, which will either make the interfered-with system unavailable, or cause its specified short-term interference objectives (error rate or noise) to be exceeded.

This Appendix addresses only the protection of the short-term criterion. There is therefore an implicit assumption that if the short-term criterion is satisfied, then any associated long-term criteria will also be satisfied. This assumption may not remain valid at short distances because additional propagation effects (diffraction, building/terrain scattering etc.) requiring a more detailed analysis become significant. A minimum coordination distance is therefore needed to avoid this difficulty. This minimum coordination distance is always the lowest value of coordination distance used. At

[5] These additional areas may be declared as coastal Zone A1 areas by administrations for inclusion in the ITU Digital World Map (IDWM).

distances equal to or greater than the minimum coordination distance, it can be assumed that interference due to continuous (long-term) propagation effects will not exceed levels permitted by the long-term criteria.

In addition to the minimum coordination distance, it is also necessary to set an upper limit to the calculation distance. Hence the coordination distance, on any azimuth, must lie within the range between the minimum coordination distance and the maximum calculation distance.

1.5.3.1 Minimum coordination distance

For reasons stated in § 1.5.3 it is necessary to set a lower limit to the coordination distance (d_{min}). The iterative calculation of the coordination distance starts at this specified minimum distance and this distance varies according to radiometeorological factors and the frequency band (see § 4.2). The same minimum coordination distance applies to both propagation mode (1) and propagation mode (2) calculations.

1.5.3.2 Maximum calculation distance

Maximum calculation distances are required for propagation modes (1) and (2). In the case of mode (1) this distance corresponds to the maximum coordination distance, d_{max1}, given in § 4.3 for each of the four radioclimatic Zones. The propagation mode (1) maximum calculation distance is therefore dependent on the mixture of radioclimatic Zones in the propagation path. This dependency is described in § 4.3.

The maximum calculation distance for propagation mode (2) is given in § 2 of Annex II.

1.6 The coordination contour: concepts and construction

The coordination distance, determined for each azimuth around the coordinating earth station, defines the coordination contour that encloses the coordination area. The coordination distance lies within the range defined by the minimum coordination distance and the maximum calculation distance.

In this Appendix the procedures determine the distance at which the minimum required loss is equal to the predicted path loss. In addition some procedures[6] require that, for any azimuth, the greater of the distances determined for propagation mode (1) and propagation mode (2) is the distance to be used in determining the coordination contour. In both these cases, the distance at which the minimum required loss is equal to the predicted path loss may or may not be within the range of valid values that define the limits for the coordination distance. Hence the distance determined from the application of all the procedures is referred to as the required distance.

The coordination area is determined by one of the following methods:

- calculating, in all directions of azimuth from the earth station, the coordination distances and then drawing to scale on an appropriate map the coordination contour; or
- extending the service area in all directions by the calculated coordination distance(s); or
- for some services and frequency bands extending the service area in all directions by a predetermined coordination distance.

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[6] The same procedures are also used to develop supplementary and auxiliary contours (see AnnexVI).

Where a coordination contour includes the potential interference effects arising from both propagation mode (1) and propagation mode (2), the required distance used for any azimuth is the greater of the propagation mode (1) and propagation mode (2) required distances.

The sharing scenarios and the various procedures contained in this Appendix are based on different assumptions. Hence the coordination area developed for one sharing scenario is likely to be based on different sharing considerations, interference paths and operational constraints than the coordination area developed under a different sharing scenario. Separate coordination areas are therefore required for each sharing scenario described in § 1.4 and each coordination area is specific to the radiocommunication services covered by the sharing scenario under which it was developed. Further, the coordination area developed for one sharing scenario cannot be used to determine the extent of any impact on the radiocommunication services covered by a different sharing scenario. Thus a coordinating earth station operating in a bidirectionally allocated frequency band and also sharing with terrestrial stations will have two separate coordination areas:

– one coordination area for determining those administrations with terrestrial services that may be affected by the operation of the coordinating earth station; and

– one coordination area for determining those administrations with receiving earth stations that may be affected by the operation of the coordinating (transmitting) earth station.

This means that the establishment of the coordination area for an earth station will generally require the determination of several individual coordination areas, each drawn on a separate map. For example, an earth station which transmits to a geostationary space station in the band 10.7-11.7 GHz will need to develop the following coordination areas with respect to:

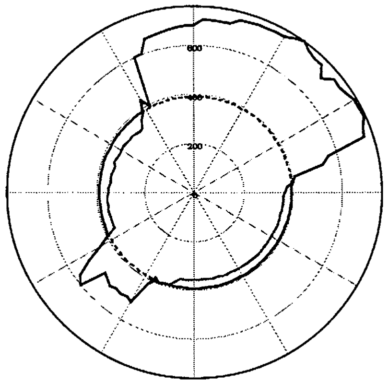
1) analogue terrestrial services which receive in the same band; this will comprise the potential effects arising from both propagation mode (1) and propagation mode (2) interference paths;

2) an earth station operating to a geostationary space station which receives in the same band, this will comprise the potential effects arising from both propagation mode (1) and propagation mode (2) interference paths;

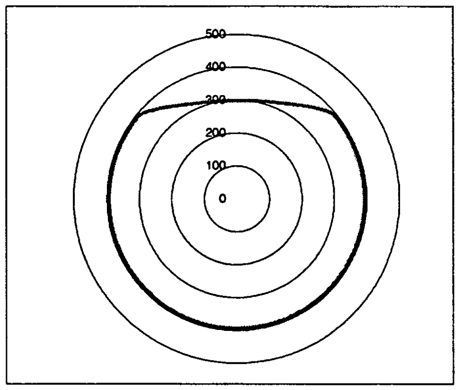
3) an earth station operating to a non-geostationary space station which receives in the same band; this will comprise the potential effects arising from propagation mode (1) interference paths.

In addition separate coordination contours are produced if the earth station both transmits and receives in bands shared with terrestrial services. However, for earth stations in bidirectionally allocated frequency bands, the coordination contours with respect to other earth stations are only produced for a transmitting earth station (see § 1.4.4).

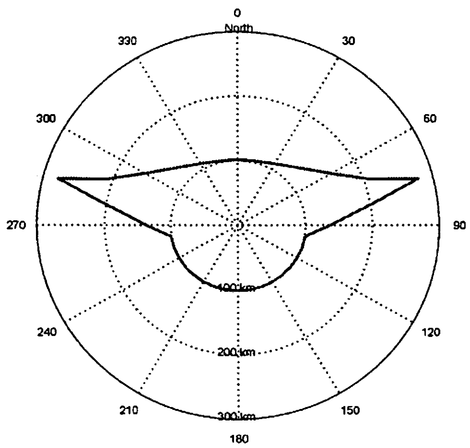
An example of the coordination area for each of the sharing scenarios in § 1.4 is provided in Figure 1. It will be noticed that for some of the sharing scenarios there is a commonality to the construction of the coordination contour (shown by a solid line) that encompasses each coordination area. For those sharing scenarios where both propagation mode (1) and propagation mode (2) interference paths need to be taken into consideration, the parts of the propagation mode (1) contour and that part of the propagation mode (2) contour located within the overall coordination contour may be drawn using dashed lines.



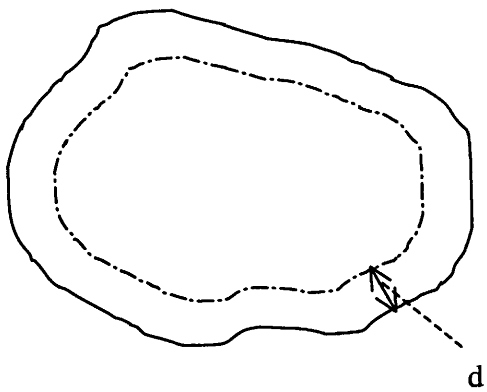
The coordination contour is an example of an earth station operating to a GSO space station in § 1.4.1 and § 1.4.3. The coordination contour is marked by the outer line and is comprised of a propagation mode (1) contour and a circular propagation mode (2) contour. The propagation mode (1) contour could also be an example of an earth station with a non-tracking directional antenna operating to a non-GSO space station in § 1.4.2.



The coordination contour is an example of an earth station with a tracking antenna operating to a non-GSO space station in § 1.4.2 and § 1.4.3.



The coordination contour is an example of an earth station operating in bidirectionally allocated frequency bands in § 1.4.4. The coordination contour has been developed from a propagation mode (1) contour for a coordinating earth station operating to a non-GSO space station with respect to unknown earth stations operating to GSO space stations. For a propagation mode (2) contour for the GSO-GSO case see Annex V.



The coordination contour is an example of an earth station operating in a specified service area in § 1.4.5, § 1.4.6, and § 1.4.7. The coordination contour is marked by the solid outer line and the specified service area by the broken inner line. The coordination distance, d, may be a constant value, or vary with azimuth, depending on the sharing scenario and the type of radiocommunication service.

FIGURE 1

Examples of coordination contours for the sharing scenarios listed in § 1.4

In addition to the coordination contour, supplementary contours and auxiliary contours (see Annex VI) may be drawn to facilitate more detailed sharing discussions. Supplementary contours are based on the coordinating earth station sharing frequency bands with other radiocommunication services, or other types of radio systems in the same service, that have less onerous sharing criteria than the radio system used for developing the coordination area. These supplementary contours may be developed by the same method used to determine the coordination contour, or by other methods as agreed on a bilateral basis between administrations. For example, the Time Variant Gain method described in § 4 of Annex VI can be used to generate supplementary contours for earth stations operating to non-geostationary space stations. Auxiliary contours are based on less conservative assumptions, with regard to the interference path and operational constraints, for the unknown terrestrial stations, or earth stations. Auxiliary contours are developed separately for propagation mode (1) and propagation mode (2) interference paths. In this context, the contours from which the coordination contour was developed are called main contours, and the auxiliary contours for propagation mode (1) and propagation mode (2) are referenced to the appropriate main contour. The variations in the assumptions used for developing auxiliary contours to the propagation mode (1) contour, or the propagation mode (2) contour, can also be applied to supplementary contours. Hence, auxiliary contours may be drawn for both a main, or a supplementary, contour.

Supplementary contours are always drawn on a separate map as they apply to other types of radio system within the same radiocommunication service, or to radio systems in different radiocommunication services. However, as auxiliary contours apply to variations in the assumptions used in developing the main, or supplementary, contour they are always drawn on the same map that contains the corresponding main, or supplementary, contour.

While the use of supplementary or auxiliary contours allows less conservative assumptions with regard to the interference path and operational constraints to be taken into consideration, earth stations may transmit or receive a variety of classes of emissions. Hence, the earth station parameters to be used in the determination of the coordination contour, and any supplementary or auxiliary contours, are those which lead to the greatest distances for each earth station antenna beam and each allocated frequency band which the coordinating earth station shares with other radiocommunication systems.

2 Determination of the earth station coordination area with respect to terrestrial stations

This section contains the procedures for determining the coordination area for the case of earth stations sharing frequency bands with terrestrial stations. These procedures cover the cases for earth stations operating to space stations in the geostationary orbit, or in non-geostationary orbits, and are described in the following subsections.

For earth stations operating to space stations in non-geostationary orbits, consideration has to be given to the potential time-varying nature of the earth station's antenna gain towards the horizon.

2.1 Earth stations operating to geostationary space stations

For an earth station operating to a geostationary space station the value of G_t and G_r towards the horizon is considered to be constant with time. The percentage of time associated with L_b in equation (1) is the same as the time percentage, p, associated with $P_r(p)$. When determining the coordination area between a coordinating earth station operating to a geostationary space station and terrestrial systems, the coordination distance on any azimuth is the greater of the propagation mode (1) and propagation mode (2) required distances. The required distances for propagation mode (1) and propagation mode (2) are determined using the procedures described in § 2.1.1 and § 2.1.2 respectively, after taking into consideration the following discussion on station-keeping.

When the north/south station-keeping of a geostationary space station is relaxed, the orbit of the space station becomes inclined with an inclination that increases gradually with time. This movement of the space station from its nominal position may require small corresponding adjustments in the elevation angle of the earth station antenna beam. Hence, to avoid considering the time variation in antenna gain in the direction of the horizon, the coordination area of an earth station operating to a space station in a slightly inclined geostationary orbit is determined for the minimum angle of elevation and the associated azimuth at which the space station is visible to the earth station (see Annex III).

2.1.1 Determination of the coordinating earth station's propagation mode (1) contour

Determination of the propagation mode (1) contour is based on great circle propagation mechanisms and it is assumed, for the interference path, that all the terrestrial stations are pointing directly at the coordinating earth station's location. The required distance, on each azimuth, for propagation mode (1) is that distance which will result in a value of propagation mode (1) predicted path loss that is equal to the propagation mode (1) minimum required loss, $L_b(p)$ dB, as defined in § 1.3.

$$L_b(p) = P_t + G_e + G_x - P_r(p) \qquad \text{dB} \qquad (4)$$

where:

- P_t: and $P_r(p)$ are as defined in § 1.3;
- G_e: the gain of the coordinating earth station antenna (dBi) towards the horizon at the horizon elevation angle and azimuth under consideration;
- G_x: the maximum antenna gain (dBi) assumed for the terrestrial station. Tables 1 and 2 of Annex VII give values for G_x for the various frequency bands.

The propagation mode (1) required distance is determined using the procedures described in § 4, and the detailed methods in Annex I. Specific guidance relevant to the application of the procedures is provided in § 4.4.

2.1.2 Determination of the coordinating earth station's propagation mode (2) contour

The required distance for hydrometeor scatter is that distance that will result in a propagation mode (2) predicted path loss equal to the propagation mode (2) minimum required loss $L(p)$, as defined in equation (3). This propagation mode (2) required distance is determined using the guidance in § 5, and the detailed methods in Annex II.

For an earth station operating to a geostationary space station having a slightly inclined orbit, the rain-scatter coordination contour for each of the satellite's two most extreme orbit positions are determined individually, using the relevant elevation angles and their associated azimuths to the satellite. The rain scatter area is the total area contained within the two resulting overlapping coordination contours.

2.2 Earth stations operating to non-geostationary space stations

For earth stations that operate to non-geostationary space stations and track the space station, the antenna gain in the direction of the horizon on any azimuth varies with time.

The method used to determine the coordination contour is the "Time Invariant Gain" (TIG) method.

This method uses fixed values of antenna gain based on the maximum assumed variation in horizon antenna gain on each azimuth under consideration. In considering the horizon gain of the antenna for either a transmitting or a receiving earth station, only the horizon gain values during the operational time are to be considered. The horizon antenna gain may be determined using Annex IV. Reference or measured antenna radiation patterns may be used as described in Annex III. The values of horizon antenna gain defined below are used for each azimuth when applying equation (4) to determine the propagation mode (1) required distances:

$$\begin{aligned} G_e &= G_{max} && \text{for} \quad (G_{max} - G_{min}) \leq 20\text{ dB} \\ G_e &= G_{min} + 20 && \text{for} \quad 20\text{ dB} < (G_{max} - G_{min}) < 30\text{ dB} \\ G_e &= G_{max} - 10 && \text{for} \quad (G_{max} - G_{min}) \geq 30\text{ dB} \end{aligned} \tag{5}$$

where:

G_e: the gain of the coordinating earth station antenna (dBi) towards the horizon at the horizon elevation angle and azimuth under consideration in equation (4);

G_{max}, G_{min}: maximum and minimum values of the horizon antenna gain (dBi), respectively, on the azimuth under consideration.

The maximum and minimum values of the horizon antenna gain, on the azimuth under consideration, are derived from the antenna pattern and the maximum and minimum angular separation of the antenna main beam axis from the direction of the physical horizon at the azimuth under consideration.

Where a single value of minimum elevation angle for the main beam axis of the earth station antenna is specified for all azimuths, the minimum and maximum values of horizon gain can be determined, for each azimuth under consideration, from the antenna pattern and the horizon elevation angle at that azimuth. The plot of the horizon elevation angle against azimuth is called the horizon profile of the earth station.

Additional constraints maybe included in the determination of the maximum and minimum values of the horizon antenna gain where an earth station is operating to a constellation of non-geostationary satellites at a latitude for which no satellite is visible at the earth station's specified minimum elevation angle over a range of azimuth angles. Over this range of azimuth angles, the minimum elevation angle of the earth station antenna main beam axis is given by the minimum elevation angle at which any satellite of the constellation is visible at that azimuth. The azimuthal dependence of this minimum satellite visibility elevation angle may be determined from consideration of the orbital altitude and inclination of the satellites in the constellation, without recourse to simulation, using the procedure in § 1.1 of Annex IV. In this case, the horizon gain to be used in the method depends on the profile of the composite minimum elevation angle. This minimum composite elevation angle at any azimuth is the greater of the minimum satellite visibility elevation angle, at the azimuth under consideration, and the specified minimum elevation angle for the earth station which is independent of the azimuth.

Thus, at each azimuth under consideration, the maximum horizon antenna gain will be determined from the minimum value of the angular separation from the earth station horizon profile at this azimuth to the profile of the minimum composite elevation angle. Similarly, the minimum horizon antenna gain will be determined from the maximum value of the angular separation from the earth station horizon profile at this azimuth to the profile of the minimum composite elevation angle. The procedure for calculating the minimum and maximum angular separations from the profile of the minimum composite elevation angle is given in § 1.2 of Annex IV.

The propagation mode (1) required distance is then determined using the procedures described in § 4, and the detailed methods in Annex I. Specific guidance relevant to the application of the propagation calculations is provided in § 4.4.

3 Determination of the coordination area between earth stations operating in bidirectionally allocated frequency bands

This section describes the procedures to be used for the determination of the bidirectional coordination area for an earth station transmitting in a frequency band allocated to space services in both Earth-to-space and space-to-Earth directions.

There are various coordination scenarios involving only non-time-varying antenna gains, or only time-varying antenna gains (both earth stations operate to non-geostationary space stations) or, one time-varying antenna gain and one non time-varying antenna gain.

The following subsections describe the methods for the determination of coordination area which are specific to each of these bidirectional cases. The procedures applicable to the coordination scenario where both earth stations operate to geostationary space stations are given in § 3.1. The other bidirectional coordination scenarios are considered in § 3.2, where particular attention is given to the approaches for using the horizon gain of the receiving earth station for each of the possible coordination scenarios in the appropriate procedure of § 2.

Table 3 of Annex VII provides the parameters that are to be used in the determination of the coordination area. Table 3 of Annex VII also indicates whether, in each band, the receiving earth stations operate to geostationary or non-geostationary space stations. In some bands, receiving earth stations may operate to both geostationary and non-geostationary space stations. Table 2 below indicates the number of coordination contours, which needs to be drawn for each coordination scenario and the section(s) containing the applicable calculation methods. When drawn, each coordination contour must be appropriately labelled.

TABLE 2

Coordination contours required for each bidirectional scenario

Coordinating earth station operating to a space station in the	**Unknown receiving earth station operating to a space station in the**	**Section containing the method to determine G_t and G_r**	**Contours required**	
			No.	**Details**
Geostationary orbit	Geostationary orbit	§ 3.1	1	A coordination contour comprising both propagation mode (1) and propagation mode (2) contours.
	Non-geostationary orbit	§ 3.2.1	1	A propagation mode (1) coordination contour.
	Geostationary or non-geostationary orbits[7]	§ 3.1.1 and § 3.2.1	2	Two separate coordination contours, one for the geostationary orbit (propagation mode (1) and mode (2) contours) and one for the non-geostationary orbit (propagation mode (1) contour).
Non-geostationary orbit	Geostationary orbit	§ 3.2.2	1	A propagation mode (1) coordination contour.
	Non-geostationary orbit	§ 3.2.3	1	A propagation mode (1) coordination contour.
	Geostationary or non-geostationary orbits[7]	§ 3.2.2 and § 3.2.3	2	Two separate propagation mode (1) coordination contours, one for the geostationary orbit and one for the non-geostationary orbit.

3.1 The coordinating and unknown earth stations operate to geostationary space stations

When both earth stations operate to space stations in the geostationary orbit, it is necessary to develop a coordination contour, comprising both propagation mode (1) and propagation mode (2) contours, using the procedures described in § 3.1.1 and § 3.1.2, respectively.

3.1.1 Determination of the coordinating earth station's propagation mode (1) contour

The procedure for the determination of the propagation mode (1) contour in this case differs from that described in § 2.2 in two ways. First, the parameters to be used for the unknown receiving earth station are those in Table 3 of Annex VII. Second and more significantly, the knowledge that both earth stations operate to geostationary satellites can be used to calculate the worst-case value of the horizon gain of the receiving earth station toward the transmitting earth station for each azimuth at the transmitting earth station. The propagation mode (1) required distance is that distance which will result in a value of propagation mode (1) predicted path loss which is equal to the propagation mode (1) minimum required loss, $L_b(p)$ dB, as defined in § 1.3, and repeated here for convenience.

$$L_b(p) = P_t + G_t + G_r - P_r(p) \quad \text{(dB)} \qquad (6)$$

[7] In this case the bidirectional frequency band may contain allocations in the Earth-to-space direction for space stations in both the geostationary orbit and non-geostationary orbits. Hence the coordinating administration will not know if the unknown receiving earth stations are operating to space stations in the geostationary orbit or non-geostationary orbit.

where:

P_t and $P_r(p)$: are as defined in § 1.3;

G_t: gain of the coordinating (transmitting) earth station antenna (dBi) towards the horizon at the horizon elevation angle and the azimuth under consideration;

G_r: the horizon gain of the unknown receiving earth station on the azimuth toward the transmitting earth station on the specific azimuth from the coordinating earth station. Values are determined by the procedure in § 2.1 of Annex V, based on parameters from Table 3 of Annex VII.

To facilitate the determination of the values of G_r to be used at an azimuth from the transmitting earth station, several simplifying approximations must be made:

– that the horizon elevation of the receiving earth station is zero degrees on all azimuths;

– that the receiving earth station operates to a space station that has zero degrees orbital inclination and may be located anywhere on the geostationary orbit that is above the minimum elevation angle, given in Table 3 of Annex VII, for the location of the receiving earth station;

– that the latitude of the receiving earth station is the same as that of the transmitting earth station;

– that plane geometry can be used to interrelate the azimuth angles at the respective earth stations, rather than using the great circle path.

The first three assumptions provide the basis for determining the horizon gain of the receiving earth station on any azimuth. The assumption of 0° horizon elevation angle is conservative since the increase in horizon antenna gain due to a raised horizon would, in practice, be more than offset by any real site shielding[8]. The last two assumptions in the list simplify the calculation of the sum of G_t and G_r along any azimuth. Since the propagation mode (1) required distances are small, in global geometric terms, these approximations may introduce a small error in the determination of the horizon gain of the receiving earth station antenna that, in any case, will not exceed 2 dB. Because of the assumption of plane geometry, for a given azimuth at the transmitting earth station the appropriate value of the horizon gain of the receiving earth station is the value on the reciprocal (i.e., ±180 degrees, see § 2.1 of Annex V) azimuth at the receiving earth station.

The propagation mode (1) required distance is then determined using the procedures described in § 4, and the detailed methods in Annex I. Specific guidance relevant to the application of the propagation calculations is provided in § 4.4.

3.1.2 Determination of the coordinating earth station's propagation mode (2) contour

The procedure for the determination of the propagation mode (2) contour for a transmitting earth station operating to a geostationary space station uses the same simplifying approximations made in § 3.1.1, but it is based on a geometrical construction that avoids the requirement for a complex propagation model (see § 3 of Annex V). Auxiliary contours cannot be used in this method, as the calculations are not based on the propagation mode (2) required loss.

[8] While no site shielding can be assumed for the receiving earth station, any site shielding that may exist at the transmitting earth station is considered by taking into account the horizon elevation angle in accordance with § 1 of Annex I.

The propagation mode (2) contour is determined using the elevation angle and the azimuth from the coordinating transmitting earth station to the space station, together with the following two considerations:

i) the minimum coordination distance (see § 4.2), which will be the required distance for some azimuths; and

ii) a worst-case required distance determined by the hydrometeor scatter geometry for a receiving earth station located in either of two 6 degree azimuth sectors. Within these sectors the receiving earth station is assumed to be operating at the minimum elevation angle to a space station in the geostationary orbit and its main beam intersects the beam for the coordinating transmitting earth station at the point where the latter beam passes through the rain height (h_R). Although the scattering can occur anywhere between the coordinating earth station and this point, the intersection of the two beams at this point represents the worst-case interference scenario. Hence, it results in the worst-case distance requirement for receiving earth stations located in the two azimuth sectors.

For an earth station operating to a space station in an inclined orbit, the lowest expected operational antenna elevation angle and its associated azimuth are used in the calculations.

The propagation mode (2) contour is determined using the method in § 3 of Annex V.

3.2 The coordinating or unknown earth stations operate to non-geostationary space stations

To determine the coordination area, the method described in § 2.2 is used. For the cases where a coordinating (transmitting) earth station operates to non-geostationary space stations, the following procedures assume that the earth station is tracking the space station, otherwise see § 1.4.2. Table 3 of Annex VII provides values of horizon antenna gain to be used in the calculations.

One or more of the following three procedures may be needed to determine the required propagation mode (1) coordination contours of Table 2. Propagation mode (2) contours are not required for any of the cases where either of the earth stations operates to space stations in non-geostationary orbits.

3.2.1 A coordinating earth station operating to a geostationary space station with respect to unknown earth stations operating to non-geostationary space stations

When the coordinating earth station operates to a space station in the geostationary orbit and the unknown earth stations operate to space stations in non-geostationary orbits, the propagation mode (1) coordination area is determined using the procedures described in § 2.1.1. The only modification needed is to use the horizon antenna gain (G_r) of the unknown receiving earth station in place of the terrestrial station gain (G_x). The appropriate values for this gain and the appropriate system parameters are contained in Table 3 of Annex VII.

3.2.2 A coordinating earth station operating to non-geostationary space stations with respect to unknown earth stations operating to geostationary space stations

When the coordinating earth station operates to space stations in non-geostationary orbits and the unknown earth stations operate to space stations in the geostationary orbit, the horizon antenna gain (G_r) for the unknown receiving earth station is determined in accordance with the simplifying approximations of § 3.1.1, as elaborated in § 2.1 of Annex V, and the parameters of Table 3 of

Annex VII. Determination of the propagation mode (1) coordination area then follows the procedure of § 2.2 by using the appropriate horizon gain of the receiving earth station at each azimuth under consideration and the appropriate system parameters from Table 3 of Annex VII.

3.2.3 The coordinating and unknown earth stations operating to non-geostationary space stations

When the coordinating earth station operates to space stations in non-geostationary orbits and the unknown earth stations operate to space stations in non-geostationary orbits, the propagation mode (1) coordination area is determined using the procedure described in § 2.2. The only modification is to use the horizon antenna gain (G_r) of the unknown receiving earth station in place of the terrestrial station antenna gain. The appropriate values for this gain and the appropriate system parameters are given in Table 3 of Annex VII.

4 General considerations for the determination of the propagation mode (1) required distance

For the determination of the propagation mode (1) required distances, the applicable frequency range has been divided into three parts. The propagation calculations for the VHF/UHF frequencies between 100 MHz and 790 MHz are based upon propagation mode (1) predicted path loss curves. From 790 MHz to 60 GHz the propagation modelling uses tropospheric scatter, ducting and layer reflection/refraction models. At higher frequencies up to 105 GHz the model is based on a free-space loss and a conservative assumption for gaseous absorption. The possible range of time percentages is different in the different propagation models.

After taking site shielding (§ 1 of Annex I) into consideration, for the coordinating earth station only, the following methods are used to determine the propagation mode (1) required distances:

– For frequencies between 100 MHz and 790 MHz the method described in § 2 of Annex I.

– For frequencies between 790 MHz and 60 GHz the method described in § 3 of Annex I.

– For frequencies between 60 GHz and 105 GHz the method described in § 4 of Annex I.

The three methods referred to above rely on a value of propagation mode (1) minimum required loss, determined according to the appropriate system parameters in Table 1, 2 and 3 of Annex VII.

4.1 Radio-climatic information

For the calculation of the propagation mode (1) required distance, the world has been classified in terms of a radio-meteorological parameter representing clear-air anomalous propagation conditions. The percentage of time β_e for which these clear-air anomalous propagation conditions exist, is latitude dependent and is given by:

$$\beta_e = \begin{cases} 10^{1.67-0.015\,\zeta_r} & \text{for } \zeta_r \leq 70^\circ \quad (7) \\ 4.17 & \text{for } \zeta_r > 70^\circ \quad (8) \end{cases}$$

with:

$$\zeta_r = \begin{cases} |\zeta| - 1.8 & \text{for } |\zeta| > 1.8^\circ \quad (9) \\ 0 & \text{for } |\zeta| \le 1.8^\circ \quad (10) \end{cases}$$

where:

ζ (in degrees) is the latitude of the earth station's location.

For frequencies between 790 MHz and 60 GHz the path centre sea level surface refractivity (N_0) is used in the propagation mode (1) calculations. This can be calculated using:

$$N_0 = 330 + 62.6\,\mathrm{e}^{-\left(\frac{\zeta - 2}{32.7}\right)^2} \qquad (11)$$

4.2 Minimum coordination distance for propagation modes (1) and (2)

The minimum coordination distance can be calculated in two steps. First calculate distance d_x using:

$$d_x = 100 + \frac{(\beta_e - 40)}{2} \text{ km} \qquad (12)$$

where:

β_e is given in § 4.1.

Then calculate the minimum coordination distance at any frequency (f in GHz) in the range 100 MHz - 105 GHz using:

$$d_{min} = \begin{cases} 100 + \frac{(\beta_e - f)}{2} & \text{km} & \text{for } f < 40 \text{ GHz} & (13) \\ \frac{(54 - f)d_x + 10(f - 40)}{14} & \text{km} & \text{for } 40 \text{ GHz} \le f < 54 \text{ GHz} & (14) \\ 10 & \text{km} & \text{for } 54 \text{ GHz} \le f < 66 \text{ GHz} & (15) \\ \frac{10(75 - f) + 45(f - 66)}{9} & \text{km} & \text{for } 66 \text{ GHz} \le f < 75 \text{ GHz} & (16) \\ 45 & \text{km} & \text{for } 75 \text{ GHz} \le f < 90 \text{ GHz} & (17) \\ 45 - \frac{(f - 90)}{1.5} & \text{km} & \text{for } 90 \text{ GHz} \le f \le 105 \text{ GHz} & (18) \end{cases}$$

The distance from which all iterative calculations start (for both propagation mode (1) and propagation mode (2)), is the minimum coordination distance (d_{min}) as given in equations (13) to (18).

4.3 Maximum coordination distance for propagation mode (1)

In the iterative calculation described in Annex I, it is necessary to set an upper limit (d_{max1}) to the propagation mode (1) coordination distance.

For frequencies less than or equal to 60 GHz and propagation paths entirely within a single Zone, the distance shall not exceed the maximum coordination distance given in Table 3 for that Zone.

For mixed paths, the required distance can comprise one or more contributions from Zones A1, A2, B and C. The aggregate distance for any one zone must not exceed the value given in Table 3. The overall required distance must not exceed the value in Table 3 for the zone in the mixed path having the largest Table 3 value. Thus a path comprising both Zones A1 and A2 must not exceed 500 km.

TABLE 3

Maximum coordination distances for propagation mode (1) for frequencies below 60 GHz

Zone	d_{max1} (km)
A1	500
A2	375
B	900
C	1 200

For frequencies above 60 GHz the maximum coordination distance d_{max1} is given by:

$$d_{max\,1} = 80 - 10\log\left(\frac{p}{50}\right) \tag{19}$$

where:

p is defined in § 1.3.

4.4 Guidance on application of propagation mode (1) procedures

As explained in § 1.3, for those cases where earth stations are sharing with terrestrial stations, it is appropriate to apply a correction factor (C_i in dB) to the worst case assumptions on system parameters and interference path geometry. This correction factor takes into account the fact that the assumption that all the worst-case values will occur simultaneously is unrealistic when determining the propagation mode (1) required distances.

The characteristics of terrestrial systems depend on the frequency band, and the value of the correction factor to be applied follows the frequency dependence given in equation (20). At frequencies between 100 MHz and 400 MHz, and between 60 GHz and 105 GHz, sharing between earth stations and terrestrial systems is a recent development and there is little established practical experience, or opportunity to analyse operational systems. Hence, the value of the correction factor is 0 dB in these bands. Between 400 MHz and 790 MHz and between 4.2 GHz and 60 GHz the value of the correction factor is reduced in proportion to the logarithm of the frequency, as indicated in equation (20).

The value of the nominal correction to be used at any frequency f (GHz) is therefore given by:

$$X(f) = \begin{cases} 0 & f \le 0.4 \\ 3.3833X(\log f + 0.3979) & 0.4 < f \le 0.79 \\ X & 0.79 < f \le 4.2 \\ -0.8659X(\log f - 1.7781) & 4.2 < f \le 60 \\ 0 & f > 60 \end{cases} \quad \text{dB} \qquad (20)$$

where:

X is 15 dB for a transmitting earth station and 25 dB for a receiving earth station.

In principle the value of the nominal correction, $X(f)$, is distance and path independent. However, there are a number of issues relating to interference potential at the shorter distances, and it is not appropriate to apply the full nominal correction at these distances. The correction factor is therefore applied proportionally with distance along the azimuth under consideration, starting with 0 dB at d_{min}, such that the full value of $X(f)$ is achieved at a nominal distance of 375 km from the earth station.

Hence, the correction is applied using the correction constant $Z(f)$ dB/km where

$$Z(f) = \frac{X(f)}{375 - d_{\min}} \quad \text{dB/km} \qquad (21)$$

The correction factor C_i (dB) is calculated in equations (I-6b) and (I-31) from the correction constant $Z(f)$ (dB/km).

At distances greater than 375 km, the correction factor C_i to be applied is the value of C_i at 375 km distance.

In addition, the correction factor is applied to its highest value only on land paths. The correction factor is 0 dB for wholly sea paths. A proportion of the correction factor is applied on mixed paths. The amount of correction to be applied to a particular path is determined by the path description parameters used for the propagation mode (1) calculation (correction factors C_i and C_{2i} in § 2 and § 3 respectively of Annex I). As the correction factor is distance dependent it is applied automatically within the iterative calculation used to determine the propagation mode (1) required distance (see Annex I).

The correction factor does not apply to the bidirectional case and therefore in the determination of the bidirectional coordination contour:

$$Z(f) = 0 \text{ dB/km}$$

For the determination of propagation mode (1) auxiliary contours, the propagation mode (1) minimum required loss $L_b(p)$ for p per cent of time (see § 1.3) equation (1) is replaced by:

$$L_{bq}(p) = L_b(p) + Q \quad \text{dB} \qquad (22)$$

where:

Q is the auxiliary contour value in dB

Note that auxiliary contour values are assumed to be negative (i.e. –5, –10, –15, –20 dB etc.).

5 General considerations for the determination of the propagation mode (2) required distance

The determination of the contour for scattering from hydrometeors (e.g., rain scatter) is predicted on a path geometry that is substantially different from that of the great-circle propagation mechanisms. Hydrometeor scatter can occur where the beams of the earth station and the terrestrial station intersect (partially or completely) at, or below, the rain height h_R (see § 3 of Annex II). It is assumed that at heights above this rain height the effect of scattering will be suppressed by additional attenuation, and it will not, therefore, contribute significantly to the interference potential. For the determination of the propagation mode (2) contour, it is assumed that the main beam of any terrestrial station exactly intersects the main beam of the coordinating earth station. The mitigating effects of partial beam intersections can be determined using propagation mode (2) auxiliary contours.

Since, to a first approximation, microwave energy is scattered isotropically by rain, interference can be considered to propagate equally at all azimuths around the common volume centred at the beam intersection (see § 1.3). Generally, the beam intersection will not lie on the great-circle path between the two stations. A common volume can therefore result from terrestrial stations located anywhere around the earth station, including locations behind the earth station.

The propagation mode (2) contour is a circle with a radius equal to the propagation mode (2) required distance. Unlike the case for propagation mode (1), the propagation mode (2) contour is not centred on the earth station's physical location, instead it is centred on a point on the earth's surface immediately below the centre of the common volume.

A common volume can exist, with equal probability, at any point along the earth station beam between the earth station's location and the point at which the beam reaches the rain height. To provide appropriate protection for/from terrestrial stations[9], the centre of the common volume is assumed to be half way between the earth station and the point at which its beam intersects the rain height. The distance between the projection of this point on to the earth surface and the location of the earth station is known as Δd (see § 4 of Annex II). The centre of the propagation mode (2) contour is therefore Δd km from the earth station on the azimuth of the earth station's main beam axis.

5.1 The required distance for propagation mode (2)

Propagation mode (2) required distances are measured along a radial originating at the centre of the rain scatter common volume. The calculation requires iteration for distance, starting at the same minimum distance defined for propagation mode (1) until either the required propagation mode (2) minimum required loss, or a latitude-dependent propagation mode (2) maximum calculation distance, is achieved. The propagation mode (2) calculations use the method described in Annex II. The calculations only need to be performed in the frequency range 1 000 MHz to 40.5 GHz. Outside this frequency range, rain scatter interference can be neglected and the propagation mode (2) required distance is set to the minimum coordination distance given by equations (13) to (18).

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9 This procedure does not apply for the case of an earth station sharing a frequency band with other earth stations operating in the opposite direction of transmission, as for that specific case the propagation mode (2) contour is based on a geometric construction.

ANNEX I

Determination of the required distance for propagation mode (1)

1 Adjustments for earth station horizon elevation angle and distance

For propagation mode (1), the required distance depends on the characteristics of the physical horizon around the earth station. The horizon is characterised by the horizon distance d_h (see below), and the horizon elevation angle ε_h. The horizon elevation angle is defined here as the angle (in degrees), viewed from the centre of the earth station antenna, between the horizontal plane and a ray that grazes the physical horizon in the direction concerned. The value of ε_h is positive when the physical horizon is above the horizontal plane and negative when it is below.

It is necessary to determine horizon elevation angles and distances for all azimuths around an earth station. In practice it will generally suffice to do this in azimuth increments of 5°. However, every attempt should be made to identify, and take into consideration, minimum horizon elevation angles that may occur between those azimuths examined in 5° increments.

For the purposes of the determination of the propagation mode (1) required distance it is useful to separate the propagation effects related to the local horizon around the earth station which, on some or all azimuths, may be determined by nearby hills or mountains, from the propagation effects on the remainder of the path. This is achieved by referencing the propagation model to a 0° horizon elevation angle for the coordinating earth station, and then to include a specific term A_h to deal with the known horizon characteristics of the earth station being coordinated. Where appropriate, A_h modifies the value of the path loss, on each azimuth, from which the propagation mode (1) required distance is derived.

There are two considerations to be taken into account that can change the level of attenuation for the propagation mode (1) path loss for the reference 0° case.

- The first is where the coordinating earth station has a positive horizon elevation angle (on a particular azimuth). In this case it will benefit from additional diffraction propagation losses over the horizon (generally referred to as site shielding). In this case the attenuation A_h is positive and reduces the value of path loss that is required, compared to the reference 0° horizon elevation angle case (see equations (I-5a) and (I-5b)).
- The second situation is where the coordinating earth station is at a location above the local foreground, and has a negative (downward) horizon elevation angle on a particular azimuth. In this case a measure of additional protection is necessary because the path angular distance along the radial is reduced and hence the path loss for a given distance will be lower than for the zero degree elevation angle case. It is convenient to deal with this effect as part of the site shielding calculation. Hence, in this case the attenuation A_h will be negative and it increases the value of the path loss that is required, compared to the reference 0° horizon elevation angle case.

The contribution made by the attenuation arising from the coordinating earth station's horizon characteristics to the propagation mode (1) minimum required loss modifies the value of path loss that then needs to be determined in the three propagation mode (1) models. The attenuation A_h is calculated for each azimuth around the coordinating earth station as follows.

The distance of the horizon (d_h), from the earth station's location, is determined by:

$$d_h = \begin{cases} 0.5 \text{ km} & \text{if no information is available about the horizon distance, or if the distance is} < 0.5 \text{ km.} \\ \text{horizon distance (km)} & \text{if this is within the range } 0.5 \text{ km} \le \text{horizon distance} \le 5.0 \text{ km.} \\ 5.0 \text{ km} & \text{if the horizon distance is} > 5.0 \text{ km.} \end{cases}$$

The contribution made by the horizon distance d_h to the total site shielding attenuation is given by A_d in dB for each azimuth using:

$$A_d = 15\left[1 - \exp\left(\frac{0.5 - d_h}{5}\right)\right]\left[1 - \exp\left(-\varepsilon_h f^{1/3}\right)\right] \quad \text{dB} \qquad \text{(I-1)}$$

where:

f is the frequency, in GHz throughout this Annex.

The total site shielding attenuation along each azimuth from the coordinating earth station is given by:

$$A_h = \begin{cases} 20\log(1 + 4.5\varepsilon_h f^{1/2}) + \varepsilon_h f^{1/3} + A_d & \text{dB} & \text{for } \varepsilon_h \ge 0^{\circ} & \text{(I-2a)} \\ 3[(f+1)^{1/2} - 0.0001f - 1.0487]\varepsilon_h & \text{dB} & \text{for } 0^{\circ} > \varepsilon_h \ge -0.5^{\circ} & \text{(I-2b)} \\ -1.5[(f+1)^{1/2} - 0.0001f - 1.0487] & \text{dB} & \text{for } \varepsilon_h < -0.5^{\circ} & \text{(I-2c)} \end{cases}$$

The value of A_h must be limited to satisfy the conditions:

$$-10 \le A_h \le (30 + \varepsilon_h) \qquad \text{(I-3)}$$

In equations I-1, I-2 and I-3 the value of ε_h must always be expressed in degrees. The limits defined in equation (I-3) are specified because protection outside these limits may not be realized in practical situations.

2 Frequencies between 100 MHz and 790 MHz

The propagation model given in this section is limited to an average annual time percentage (p) in the range 1% to 50%.

An iterative process is used to determine the propagation mode (1) required distance. First, equation I-5 is evaluated. Then commencing at the minimum coordination distance, d_{min}, given by the method described in § 1.5.3 of the main body of this Appendix, equations (I-6) to (I-9) are iterated for distances d_i (where i = 0,1,2,...etc.) incremented in steps of s (km) as described in § 1.3 of the main body of this Appendix. In each iteration d_i is referred to as the current distance. This process is continued until either of the following expressions becomes true:

$$L_2(p) \geq \begin{cases} L_1(p) & \text{for the main, or supplementary, contour} \\ L_{1q}(p) & \text{for the auxiliary contour} \end{cases} \quad \text{(I-4a)}$$

or:

$$d_i \geq \begin{cases} d_{max1} & \text{for the main, or supplementary, contour} \\ d_1 & \text{for the auxiliary contour} \end{cases} \quad \text{(I-4b)}$$

The required distance, d_1, or the auxiliary contour distance d_q are then given by the current distance for the last iteration: i.e.

$$d_1 = d_i \quad \text{(I-4c)}$$

or:

$$d_q = d_i \quad \text{(I-4d)}$$

As the eventual mix of zones along a path is unknown, all paths are treated as if they are potential land and sea paths. Parallel calculations are undertaken, the first assuming the path is all land and a second assuming it is all sea. A non-linear interpolation is then performed, the output of which depends upon the current mix of land and sea losses in the distance d_i. Where the current mix along the path includes sections of both warm sea and cold sea zones, all the sea along that path is assumed to be warm sea.

For the main, or supplementary, contour:

$$L_1(p) = L_b(p) - A_h \quad \text{(I-5a)}$$

For an auxiliary contour:

$$L_{1q}(p) = L_{bq}(p) - A_h \quad \text{(I-5b)}$$

where:

$L_b(p)$ dB and L_{bq} (p) Db are the minimum required loss required for p% of the time for the main, or supplementary, contour and the auxiliary contour of value Q dB respectively (see § 1.3 and § 1.6 of the main body of this Appendix).

Iterative calculations:

At the start of each iteration calculate the current distance for $i = 0,1,2,\ldots$ etc.:

$$d_i = d_{\min} + i\,s \quad \text{(I-6a)}$$

The correction factor, C_i dB, (see § 4.4 of the main body of this Appendix) for the distance d_i is given by:

$$C_i = \begin{cases} Z(f)(d_i - d_{min})\ \text{(dB)} & \text{for the main, or supplementary, contour} \\ 0\ \text{(dB)} & \text{for the auxiliary contour} \end{cases} \quad \text{(I-6b)}$$

where:

$Z(f)$ is given by equation (21) in § 4.4 of the main body of this Appendix.

At distances greater than 375 km the value of the correction factor (C_i in equation (I-6b)) to be applied, is the value of C_i at the 375 km distance.

The loss, $L_{bl}(p)$ for the assumption of the path being wholly land (Zones A1 or A2) is evaluated successively using:

$$L_{bl}(p) = 142.8 + 20\log f + 10\log p + 0.1 d_i + C_i \qquad \text{(I-7)}$$

The loss, $L_{bs}(p)$, for the assumption of the path being wholly cold sea (Zone B) or warm sea (Zone C) is evaluated successively using:

$$L_{bs}(p_1) = \begin{cases} \left.\begin{array}{l} 49.91\log(d_i + 1840 f^{1.76}) + 1.195 f^{0.393} (\log p)^{1.38} d_i^{0.597} \\ \quad + (0.01 d_i - 70)(f - 0.1581) + (0.02 - 2 \times 10^{-5} p^2) d_i \\ \quad + 9.72\ 10^{-9} d_i^2 p^2 + 20.2 \end{array}\right\} \text{for Zone (B)} & \text{(I-8a)} \\ \left.\begin{array}{l} 49.343\log(d_i + 1840 f^{1.58}) + 1.266 (\log p)^{(0.468 + 2.598 f)} d_i^{0.453} \\ + (0.037 d_i - 70)(f - 0.1581) + 1.95 \times 10^{-10} d_i^2 p^3 + 20.2 \end{array}\right\} \text{for Zone (C)} & \text{(I-8b)} \end{cases}$$

The predicted path loss at the current distance is then given by:

$$L_2(p) = L_{bs}(p) + \left[1 - \exp\left(-5.5\left(\frac{d_{tm}}{d_i}\right)^{1.1}\right)\right] \cdot (L_{bl}(p) - L_{bs}(p)) \qquad \text{(I-9)}$$

where:

d_{tm} (km) is the longest continuous land (inland + coastal) distance, i.e. Zone A1 + Zone A2 within the current path distance.

3 Frequencies between 790 MHz and 60 GHz

The propagation model given in this section is limited to an average annual time percentage (p) in the range 0.001% to 50%.

An iterative process is used to determine the propagation mode (1) required distance. First, equations (I-11) to (I-21) are evaluated. Then, commencing at the minimum coordination distance, d_{min}, equations (I-22) to (I-32) are iterated for distances d_i, where i = 0,1,2,...etc., incremented in steps of s (km) as described in § 1.3 of the main body of this Appendix. For each iteration d_i is referred to as the current distance. This process is continued until either of the following expressions becomes true:

$$\begin{cases} (L_5(p) \geq L_3(p)) \text{ AND } (L_6(p) \geq L_4(p)) & \text{for the main, or supplementary, contour} \\ (L_5(p) \geq L_{3q}(p)) \text{ AND } (L_6(p) \geq L_{4q}(p)) & \text{for the auxiliary contour} \end{cases} \qquad \text{(I-10a)}$$

or:

$$d_i \geq \begin{cases} d_{max1} & \text{for the main, or supplementary, contour} \\ d_1 & \text{for the auxiliary contour} \end{cases} \qquad \text{(I-10b)}$$

The required distance, d_1, or the auxiliary contour distance, d_q is then given by the current distance for the last iteration, i.e.

$$d_1 = d_i \tag{I-10c}$$

or:

$$d_q = d_i \tag{I-10d}$$

The specific attenuation due to gaseous absorption

Calculate the specific attenuation (dB/km) due to dry air:

$$\gamma_o = \begin{cases} \left[7.19\times10^{-3} + \dfrac{6.09}{f^2+0.227} + \dfrac{4.81}{(f-57)^2+1.50} \right] f^2 \times 10^{-3} & \text{for } f \le 56.77 \text{ GHz} \quad \text{(I-11a)} \\ 10 & \text{for } f > 56.77 \text{ GHz} \quad \text{(I-11b)} \end{cases}$$

The specific attenuation due to water vapour is given as a function of ρ (the water vapour density in units of g/m^3) by the following equation:

$$\gamma_w(\rho) = \left(0.050 + 0.0021\rho + \frac{3.6}{(f-22.2)^2+8.5} \right) f^2 \rho \times 10^{-4} \tag{I-12}$$

Calculate the specific attenuation (dB/km) due to water vapour for the troposcatter propagation model using a water vapour density of 3.0 g/m^3:

$$\gamma_{wt} = \gamma_w\ (3.0) \tag{I-13a}$$

Calculate the specific attenuation (dB/km) due to water vapour for the ducting propagation model using a water vapour density of 7.5 g/m^3 for paths over land, Zones A1 and A2, using:

$$\gamma_{wdl} = \gamma_w\ (7.5) \tag{I-13b}$$

Calculate the specific attenuation (dB/km) due to water vapour for the ducting propagation model using a water vapour density of 10.0 g/m^3 for paths over sea, Zones B and C, using:

$$\gamma_{wds} = \gamma_w\ (10.0) \tag{I-13c}$$

Note that the value of 10 g/m^3 is used for both zones B and C in view of the lack of data on the variability of water vapour density on a global basis, particularly the minimum values.

Calculate the frequency-dependent ducting specific attenuation (dB/km):

$$\gamma_d = 0.05 f^{1/3} \tag{I-14}$$

For the ducting model:

Calculate the reduction in attenuation arising from direct coupling into over-sea ducts (dB):

$$A_c = \frac{-6}{(1+d_c)} \qquad \text{(I-15)}$$

where:

d_c (km) is the distance from a land based earth station to the coast in the direction being considered;

d_c is zero in other circumstances.

Calculate the minimum loss to be achieved within the iterative calculations:

$$A_1 = 122.43 + 16.5 \log f + A_h + A_c \qquad \text{(I-16)}$$

For the main, or supplementary, contour:

$$L_3(p) = L_b(p) - A_1 \qquad \text{(I-17a)}$$

For an auxiliary contour:

$$L_{3q}(p) = L_{bq}(p) - A_1 \qquad \text{(I-17b)}$$

where:

$L_b(p)$ dB and L_{bq} (p) dB are the minimum required loss required for p% of the time for the main, or supplementary, contour and the auxiliary contour of value Q dB respectively (see § 1.3 and § 1.6 of the main body of this Appendix).

For the tropospheric scatter model:

Calculate the frequency-dependent part of the losses (dB):

$$L_f = 25 \log(f) - 2.5\left[\log\left(\frac{f}{2}\right)\right]^2 \qquad \text{(I-19)}$$

Calculate the non-distance-dependent part of the losses (dB):

$$A_2 = 187.36 + 10\varepsilon_h + L_f - 0.15\,N_0 - 10.1\left(-\log\left(\frac{p}{50}\right)\right)^{0.7} \qquad \text{(I-20)}$$

where:

ε_h is the earth station horizon elevation angle in degrees;

N_0 is the path centre sea level surface refractivity (see equation (11), § 4.1 to the main body of this Appendix).

Calculate the minimum required value for the distance dependent losses (dB):

For the main, or supplementary, contour:

$$L_4(p) = L_b(p) - A_2 \qquad \text{(I-21a)}$$

For an auxiliary contour:

$$L_{4q}(p) = L_{bq}(p) - A_2 \qquad \text{(I-21b)}$$

where:

$L_b(p)$ dB and L_{bq} (p) dB are the minimum required loss required for p% of the time for the main, or supplementary, contour and the auxiliary contour of value Q dB respectively (see § 1.3 and § 1.6 of the main body of this Appendix).

Iterative calculations:

At the start of each iteration calculate the current distance for $i = 0,1,2,$...etc.:

$$d_i = d_{\min} + i\, s \qquad \text{(I-22)}$$

Calculate the specific attenuation due to gaseous absorption (dB/km):

$$\gamma_g = \gamma_o + \gamma_{wdl}\left(\frac{d_t}{d_i}\right) + \gamma_{wds}\left(1 - \frac{d_t}{d_i}\right) \qquad \text{(I-23)}$$

where:

d_t (km) is the current aggregate land distance, Zone A1 + Zone A2, within the current path distance.

Calculate the following zone-dependent parameters:

$$\tau = 1 - \exp\left(-\left(4.12\times10^{-4}\,(d_{lm})^{2.41}\right)\right) \qquad \text{(I-24)}$$

where:

d_{lm} (km) is the longest continuous inland distance, Zone A2, within the current path distance;

$$\mu_1 = \left[10^{\frac{-d_{tm}}{16-6.6\tau}} + \left[10^{-(0.496+0.354\tau)}\right]^5\right]^{0.2} \qquad \text{(I-25)}$$

where:

d_{tm} (km) is the longest continuous land (i.e. inland + coastal) distance, Zone A1 + Zone A2 within the current path distance.

μ_1 shall be limited to $\mu_1 \leq 1$.

$$\sigma = -0.6 - 8.5\times10^{-9}\, d_i^{3.1}\, \tau \qquad \text{(I-26)}$$

σ shall be limited to $\sigma \geq -3.4$.

$$\mu_2 = \left(2.48 \times 10^{-4}\, d_i^2\right)^{\sigma} \quad \text{(I-27)}$$

μ_2 shall be limited to $\mu_2 \leq 1$.

$$\mu_4 = \begin{cases} 10^{(-0.935 + 0.0176\, \zeta_r) \log \mu_1} & \text{for } \zeta_r \leq 70^{\circ} \quad \text{(I-28a)} \\ 10^{0.3 \log \mu_1} & \text{for } \zeta_r > 70^{\circ} \quad \text{(I-28b)} \end{cases}$$

where:

ζ_r is given in equations (9) and (10), § 4.1 to the main body of this Appendix.

Calculate the path-dependent incidence of ducting (β) and a related parameter (Γ_1) used to calculate the time dependency of the path loss:

$$\beta = \beta_e\, \mu_1\, \mu_2\, \mu_4 \quad \text{(I-29)}$$

where:

β_e is given in equations (7) and (8), § 4.1 to the main body of this Appendix.

$$\Gamma_1 = \frac{1.076}{(2.0058 - \log\beta)^{1.012}} \exp\left(-(9.51 - 4.8\log\beta + 0.198(\log\beta)^2) \times 10^{-6} d_i^{1.13}\right) \quad \text{(I-30)}$$

Calculate the correction factor, C_{2i} dB, (see § 4.4 to the main body of this Appendix) using:

$$C_{2i} = \begin{cases} Z(f)(d_i - d_{min})\tau \ \text{(dB)} & \text{for the main, or supplementary, contour} \\ 0 \ \text{(dB)} & \text{for the auxiliary contour} \end{cases} \quad \text{(I-31)}$$

where:

$Z(f)$ is calculated using (equation 21) in § 4.4 to the main body of this Appendix.

At distances greater than 375 km the value of the correction factor (C_{2i} in equation (I-31)) to be applied, is the value of C_{2i} at the 375 km distance.

Calculate the distance-dependent part of the losses (dB) for ducting:

$$L_5(p) = (\gamma_d + \gamma_g)d_i + (1.2 + 3.7 \times 10^{-3} d_i)\log\left(\frac{p}{\beta}\right) + 12\left(\frac{p}{\beta}\right)^{\Gamma_1} + C_{2i} \quad \text{(I-32)}$$

and for tropospheric scatter:

$$L_6(p) = 20\log(d_i) + 5.73 \times 10^{-4}(112 - 15\cos(2\zeta))d_i + (\gamma_o + \gamma_{wt})d_i + C_{2i} \quad \text{(I-33)}$$

For the determination of distances for auxiliary contours, $C_{2i} = 0$ dB.

4 Frequencies between 60 GHz and 105 GHz

This propagation model is valid for average annual percentage time (p) in the range from 0.001% to 50%.

An iterative process is used to determine the propagation mode (1) required distance. First, equations (I-34) to (I-38) are evaluated. Then commencing at the minimum coordination distance, d_{min}, equations (I-39) and (I-40) are iterated for distances d_i, where $i = 0,1,2,...$etc., incremented in steps of s km as described in § 1.3 of the main body of this Appendix. For each iteration d_i is referred to as the current distance.

This process is continued until either of the following expressions becomes true:

$$L_9(p) \geq \begin{cases} L_8(p) & \text{for the main, or supplementary, contour} \\ L_{8q}(p) & \text{for the auxiliary contour} \end{cases} \quad \text{(I-33a)}$$

or:

$$d_i \geq \begin{cases} d_{max1} & \text{for the main, or supplementary, contour} \\ d_1 & \text{for the auxiliary contour} \end{cases} \quad \text{(I-33b)}$$

The required distance, d_1, or the auxiliary contour distance d_q are then given by the current distance for the last iteration: i.e.

$$d_1 = d_i \quad \text{(I-33c)}$$

or:

$$d_q = d_i \quad \text{(I-33d)}$$

Calculate the specific attenuation in dB/km for dry air in the frequency range 60 GHz to 105 GHz using:

$$\gamma_{om} = \begin{cases} \left[2\times10^{-4}\left(1-1.2\times10^{-5} f^{1.5}\right) + \dfrac{4}{(f-63)^2+0.936} + \dfrac{0.28}{(f-118.75)^2+1.771} \right] f^2 6.24\times10^{-4} \text{ dB/km} & \text{for } f > 63.26 \text{ GHz} \quad \text{(I-34a)} \\ 10 \text{ dB/km} & \text{for } f \leq 63.26 \text{ GHz} \quad \text{(I-34b)} \end{cases}$$

Calculate the specific attenuation in dB/km for an atmospheric water vapour density of 3 g/m^3 using:

$$\gamma_{wm} = \left(0.039 + 7.7\times10^{-4} f^{0.5}\right) f^2 2.369\times10^{-4} \quad \text{(I-35)}$$

Calculate a conservative estimate of the specific attenuation in dB/km for gaseous absorption using:

$$\gamma_{gm} = \gamma_{om} + \gamma_{wm} \quad \text{dB/km} \quad \text{(I-36)}$$

For the required frequency, and the value of earth station site shielding, A_h dB, as calculated using the method described in § 1 of this Annex, calculate the minimum loss to be achieved in the iterative calculations.

$$L_7 = 92.5 + 20 \log(f) + A_h \quad \text{dB} \quad \text{(I-37)}$$

For the main, or supplementary, contour:

$$L_8(p) = L_b(p) - L_7 \quad \text{dB} \qquad \text{(I-38a)}$$

For an auxiliary contour:

$$L_{8_q}(p) = L_{b_q}(p) - L_7 \quad \text{dB} \qquad \text{(I-38b)}$$

where:

$L_b(p)$ dB and $L_{bq}(p)$ dB are the minimum required loss required for $p\%$ of the time for the main or supplementary contour and the auxiliary contour of value Q dB respectively (see § 1.3 and § 1.6 of the main body of this Appendix).

Iterative calculations:

At the start of each iteration calculate the current distance for $i = 0,1,2$ etc.:

$$d_i = d_{\min} + i\,s \qquad \text{(I-39)}$$

Calculate the distance-dependent losses for the current distance:

$$L_9(p) = \gamma_{gm} d_i + 20\log(d_i) + 2.6\left[1 - \exp\left(\frac{-d_i}{10}\right)\right]\log\left(\frac{p}{50}\right) \qquad \text{(I-40)}$$

For frequencies above 60 GHz the correction factor (see § 4.4 of the main body of this Appendix) is 0 dB. Therefore a correction term has not been added to equation (I-40).

ANNEX II

Determination of the required distance for propagation mode (2)

1 Overview

The algorithm given below allows propagation mode (2) path loss, $L_r(p)$ (dB), to be obtained as a monotonic function of rainfall rate, $R(p)$ (mm/h), and with the hydrometeor scatter distance, r_i (km), as a parameter. The model is valid for average annual time percentage (p) in the range 0.001 to 10%. The procedure to determine the hydrometeor scatter contour is as follows:

a) The value of $R(p)$, is determined for the appropriate rain climatic Zones A to Q.

b) Values of $L_r(p)$, are then calculated for incremental values of r_i, starting at the minimum coordination distance d_{min}, in steps of s (km), as described in § 1.3 of the main body of this Appendix. The correct value of r_i is that for which the corresponding value of $L_r(p)$ equals or exceeds the propagation mode (2) minimum required loss L(p). This value of r_i is the propagation mode (2) required distance and is denoted d_r.

c) If the iterative calculation results in r_i equalling or exceeding the appropriate maximum calculation distance (d_{max2}) given in § 2, then the calculation is terminated and d_r is assumed to be equal to d_{max2}. Hence the iteration stops when either of the following expressions becomes true:

$$L_r(p) \geq L(p) \quad \text{(II-1a)}$$

or:

$$r_i \geq d_{\max 2} \quad \text{(II-1b)}$$

d) The contour for propagation mode (2) is a circle of radius d_r (km) centred on a point along the azimuth of the earth station antenna main beam at a horizontal distance of Δd (km) from the earth station.

2 Maximum calculation distance

As discussed in § 1.5.3 of the main body of this Appendix, it is necessary to set upper limits to the maximum distance used in the iterative calculation of the required distance. The maximum calculation distance to be used for propagation mode (2) (d_{max2}) is latitude dependent and is given in the following equation:

$$d_{max2} = \sqrt{17\,000(h_R + 3)} \text{ (km)}$$

where:

h_R is defined in equations (II-13) and (II-14).

3 Calculation of the propagation mode (2) contour

Determine $R(p)$, the rainfall rate (mm/h) exceeded on average for p% of a year. The world has been divided into a number of rain climatic zones (see Figures II-1, II-2 and II-3) which show different precipitation characteristics.

FIGURE II-1

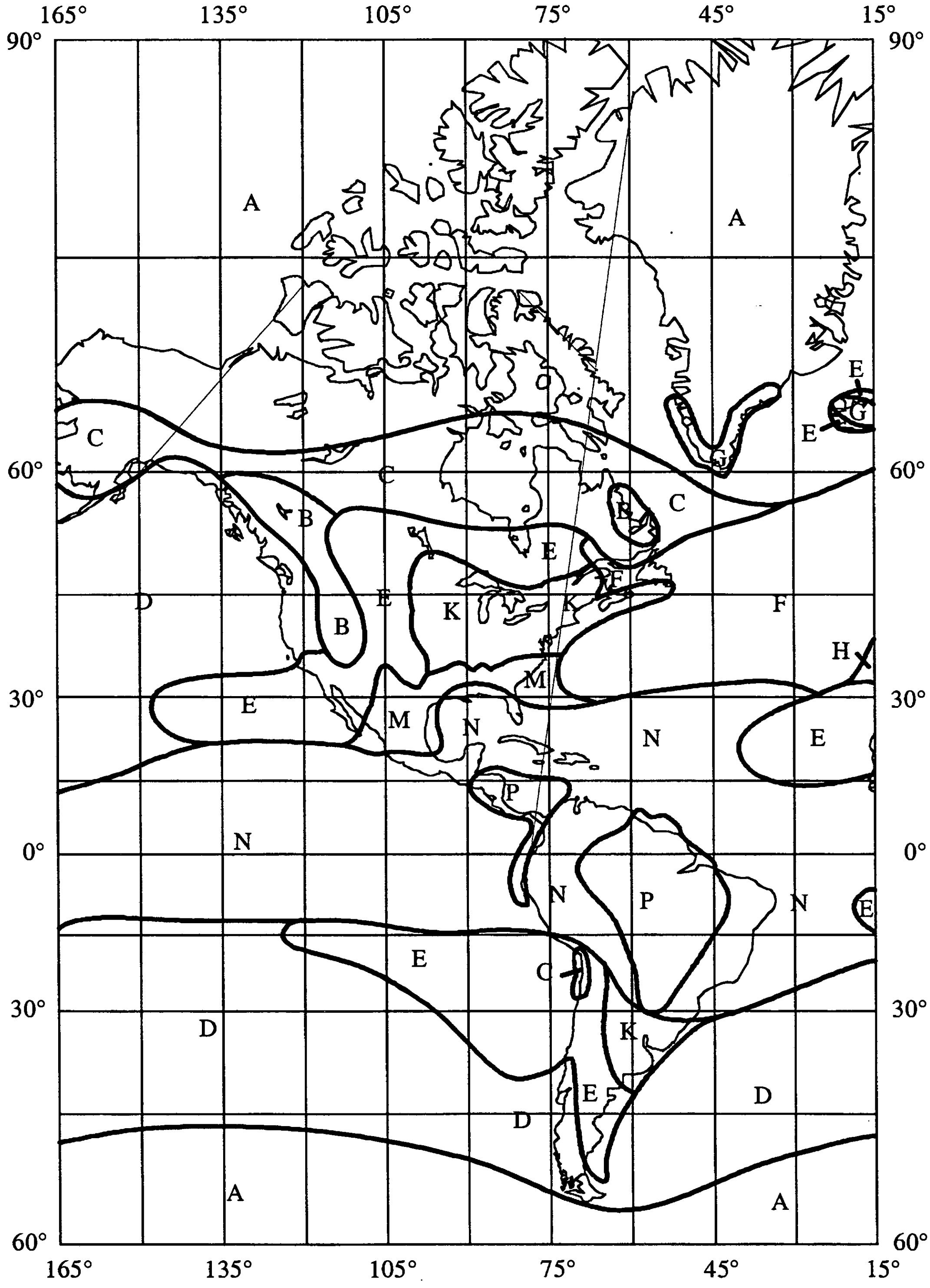

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FIGURE II-2


45°
15°
0°
15°
45°
75°
105°
60°
30°
0°
30°
60°
A
A
C
C
E
G
E
G
J
G
E
H
H
F
E
K
F
C
E
B
A
C
A
K
K
L
K
C
D
H
K
E
E
K
N
C
E
A
C
K
N
K
N
E
P
Q
P
J
N
N
K
N
E
J
C
P
N
E
K
K
F
F
D
D
A
A
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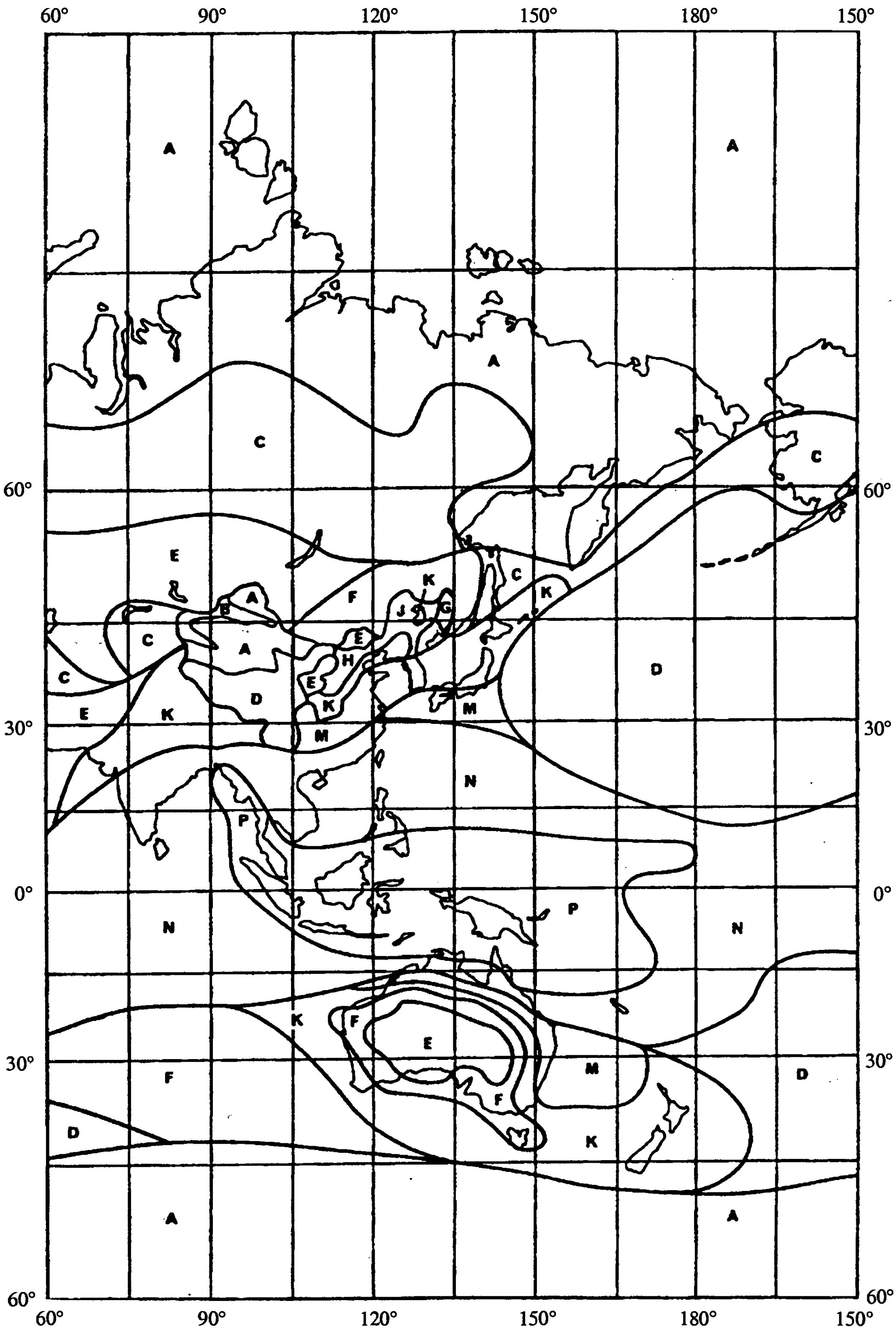
FIGURE II-3



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The curves shown in Figure II-4 represent consolidated rainfall-rate distributions, each applicable to several of these rain climatic Zones.

Determine which rain climatic Zone is applicable to the location of the earth station:

– For $0.001\% < p < 0.3\%$ and the applicable rain climatic Zone:

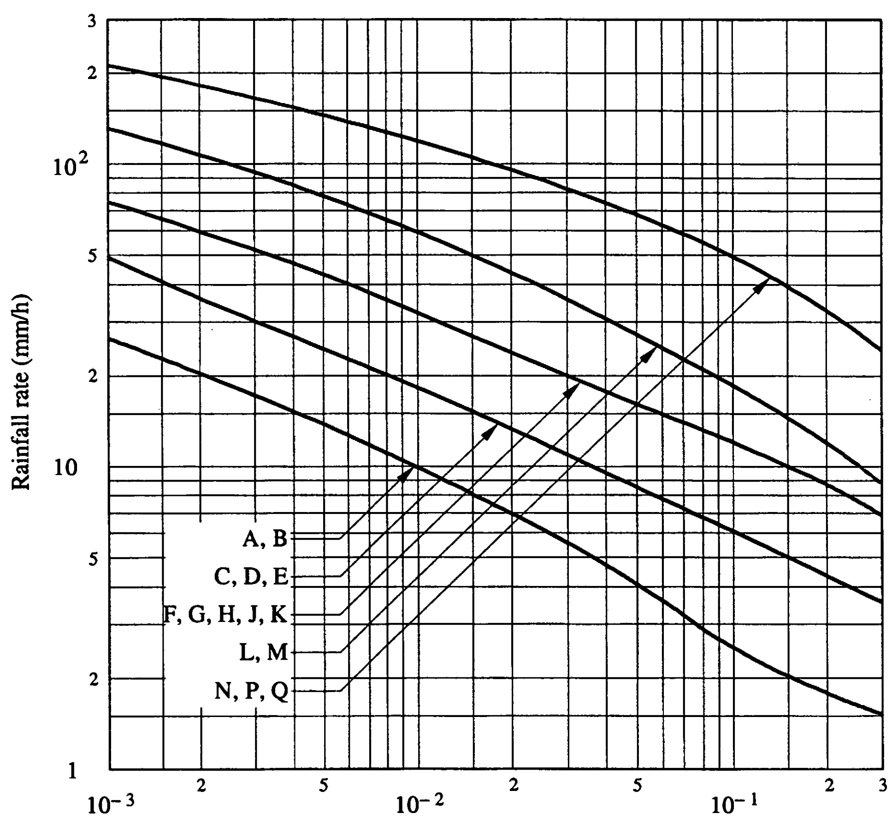
Determine $R(p)$ either from Figure II-4 or from equations (II-2 - II-6).

– For $p \geq 0.3\%$:

Use equation (II-7) with values of $R(0.3\%)$ and p_c obtained from Table II-1.

FIGURE II-4

Consolidated cumulative distributions of rainfall rate for the rain climatic zones shown in figures II-1, II-2, and II-3



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Rain climatic Zones A, B

$$R(p) = 1.1p^{-0.465} + 0.25\left[\log(p/0.001)\log^3(0.3/p)\right] - \left[\left|\log(p/0.1)\right| + 1.1\right]^{-2} \quad \text{(II-2)}$$

Rain climatic Zones C, D, E

$$R(p) = 2\,p^{-0.466} + 0.5\left[\log(p/0.001)\log^3(0.3/p)\right] \quad \text{(II-3)}$$

Rain climatic Zones F, G, H, J, K

$$R(p) = 4.17\,p^{-0.418} + 1.6\left[\log(p/0.001)\log^3(0.3/p)\right] \quad \text{(II-4)}$$

Rain climatic Zones L, M

$$R(p) = 4.9\,p^{-0.48} + 6.5\left|\log(p/0.001)\log^2(0.3/p)\right| \qquad \text{(II-5)}$$

Rain climatic Zones N, P, Q

$$R(p) = 15.6\left(p^{-0.383} + \left|\log(p/0.001)\log^{1.5}(0.3/p)\right|\right) \qquad \text{(II-6)}$$

TABLE II-1

Values of R and p_c for the different rain climatic Zone

Rain climatic zone	R (0.3%) (mm/h)	Pc (%)
A, B	1.5	2
C, D, E	3.5	3
F, G, H, J, K	7.0	5
L, M	9.0	7.5
N, P, Q	25.0	10

where:

p_c % is the reference time percentage above which the rainfall rate R(p) can be assumed to be zero.

$$R(p) = R(0.3\%)\left[\frac{\log(p_c/p)}{\log(p_c/0.3)}\right]^2 \qquad \text{(II-7)}$$

Determine the specific attenuation (dB/km) due to rain using values of k and α from Table II-2 in equation II-9. Values of k and α at frequencies other than those in Table II-2 can be obtained by interpolation using a logarithmic scale for frequency, a logarithmic scale for k and a linear scale for α.

TABLE II-2

Values of k and α for vertical polarization as a function of the frequency

Frequency (GHz)	k	α
1	0.000 0352	0.880
4	0.000 591	1.075
6	0.001 55	1.265
8	0.003 95	1.31
10	0.008 87	1.264
12	0.016 8	1.20
14	0.029	1.15
18	0.055	1.09
20	0.069 1	1.065
22.4	0.090	1.05
25	0.113	1.03
28	0.150	1.01
30	0.167	1.00
35	0.233	0.963
40	0.310	0.929
40.5	0.318	0.926

let: $R = R(p)$ (II-8)

Then the specific attenuation (dB/km) due to rain is given by:

$$\gamma_R = k\, R^{\alpha} \tag{II-9}$$

Calculate the effective diameter of the rain cell.

$$d_s = 3.5\, R^{-0.08} \tag{II-10}$$

Then, calculate the effective scatter transfer function.

$$R_{cv} = \frac{2.17}{\gamma_R d_s}\left(1 - 10^{\frac{-\gamma_R d_s}{5}}\right) \tag{II-11}$$

Calculate the additional attenuation outside the common volume.

$$\Gamma_2 = 631 k R^{(\alpha - 0.5)} \times 10^{-(R+1)^{0.19}} \tag{II-12}$$

Determine the rain height above ground, h_R (km):

For North America and Europe west of 60° E longitude:

$$h_R = 3.2 - 0.075\,(\zeta - 35) \qquad \text{for} \quad 35 \le \zeta \le 70 \tag{II-13}$$

where:

ζ is the latitude of the coordinating earth station.

For all other areas of the world:

$$h_R = \begin{cases} 5 - 0.075(\zeta - 23) & \text{for } \zeta > 23 \text{ northern hemisphere} \quad \text{(II-14a)} \\ 5 & \text{for } 0 \le \zeta \le 23 \text{ northern hemisphere} \quad \text{(II-14b)} \\ 5 & \text{for } 0 \ge \zeta \ge -21 \text{ southern hemisphere} \quad \text{(II-14c)} \\ 5 + 0.1(\zeta + 21) & \text{for } -71 \le \zeta < -21 \text{ southern hemisphere} \quad \text{(II-14d)} \\ 0 & \text{for } \zeta < -71 \text{ southern hemisphere} \quad \text{(II-14e)} \end{cases}$$

Determine the specific attenuation due to water vapour absorption (a water vapour density of 7.5 g/m^3 is used):

$$\gamma_{wr} = \left[0.06575 + \frac{3.6}{(f - 22.2)^2 + 8.5}\right] f^2\, 7.5 \times 10^{-4} \tag{II-15}$$

3.1 Iterative calculations:

Evaluate equations (II-16) to (II-21) inclusive for increasing values of r_i, where r_i is the current distance (km) between the region of maximum scattering and the possible location of a terrestrial station and $i = 0,1,2,...$etc. Continue this process until either of the conditions given in equations II-1a and II-1b is true. Then the rain-scatter required distance d_r is the current value of r_i.

$$r_i = d_{\min} + i\, s \tag{II-16}$$

Determine the loss above the rain height, L_{ar} (dB), applicable to scatter coupling:

$$L_{ar} = \begin{cases} 6.5\left[6(r_i - 50)^2 \times 10^{-5} - h_R\right] & \text{for } 6(r_i - 50)^2 \times 10^{-5} > h_R \quad \text{(II-17a)} \\ 0 & \text{for } 6(r_i - 50)^2 \times 10^{-5} \leq h_R \quad \text{(II-17b)} \end{cases}$$

Calculate the additional attenuation for the departure from Rayleigh scattering.

$$A_b = \begin{cases} 0.005\,(f - 10)^{1.7}\,R^{0.4} & \text{for } 10 \text{ GHz} < f < 40.5 \text{ GHz} \quad \text{(II-18a)} \\ 0 & \text{for } f \leq 10 \text{ GHz or when } L_{ar} \neq 0 \quad \text{(II-18b)} \end{cases}$$

Calculate the effective path length for oxygen absorption.

$$d_0 = \begin{cases} 0.7\,r_i + 32 & \text{for } r_i < 340 \text{ km} \quad \text{(II-19a)} \\ 270 & \text{for } r_i \geq 340 \text{ km} \quad \text{(II-19b)} \end{cases}$$

Calculate the effective path length for water vapour absorption.

$$d_v = \begin{cases} 0.7\,r_i + 32 & \text{for } r_i < 240 \text{ km} \quad \text{(II-20a)} \\ 200 & \text{for } r_i \geq 240 \text{ km} \quad \text{(II-20b)} \end{cases}$$

Determine the propagation mode (2) path loss, L_r (dB):

$$L_r = 168 + 20\log r_i - 20\log f - 13.2\log R - G_x + A_b - 10\log R_{cv} + \Gamma_2 + L_{ar} + \gamma_o d_0 + \gamma_{wr} d_v \quad \text{(II-21)}$$

where:

γ_o is given in equation (I-11) and

G_x is the terrestrial network antenna gain in Tables 1 or 2 of Annex VII.

4 Construction of the propagation mode (2) contour

In order to determine the centre of the circular propagation mode (2) contour, it is necessary to calculate the horizontal distance to this point from the earth station, along the azimuth of the earth station antenna main beam axis. The distance, Δd (km), to the centre of the propagation mode (2) contour is given by:

$$\Delta d = \frac{h_R}{2 \tan \varepsilon_s} \quad \text{(II-23)}$$

where:

ε_s is the earth station antenna main beam axis elevation angle and Δd shall be limited to the distance (d_r – 50) km.

The propagation mode (2) required distance d_r must lie within the range between the minimum coordination distance d_{min}, and the propagation mode (2) maximum calculation distance d_{max2}.

Draw the propagation mode (2) contour as a circle of radius d_r km around the centre determined above. The propagation mode (2) contour is the locus of points on this circle. However, if any part of the propagation mode (2) contour falls within the contour defined by the minimum coordination distance, this arc of the propagation mode (2) contour is taken to be identical to the contour based on the minimum coordination distance and the propagation mode (2) contour is then no longer circular.

ANNEX III

Antenna gain toward the horizon for earth stations operating to geostationary space stations

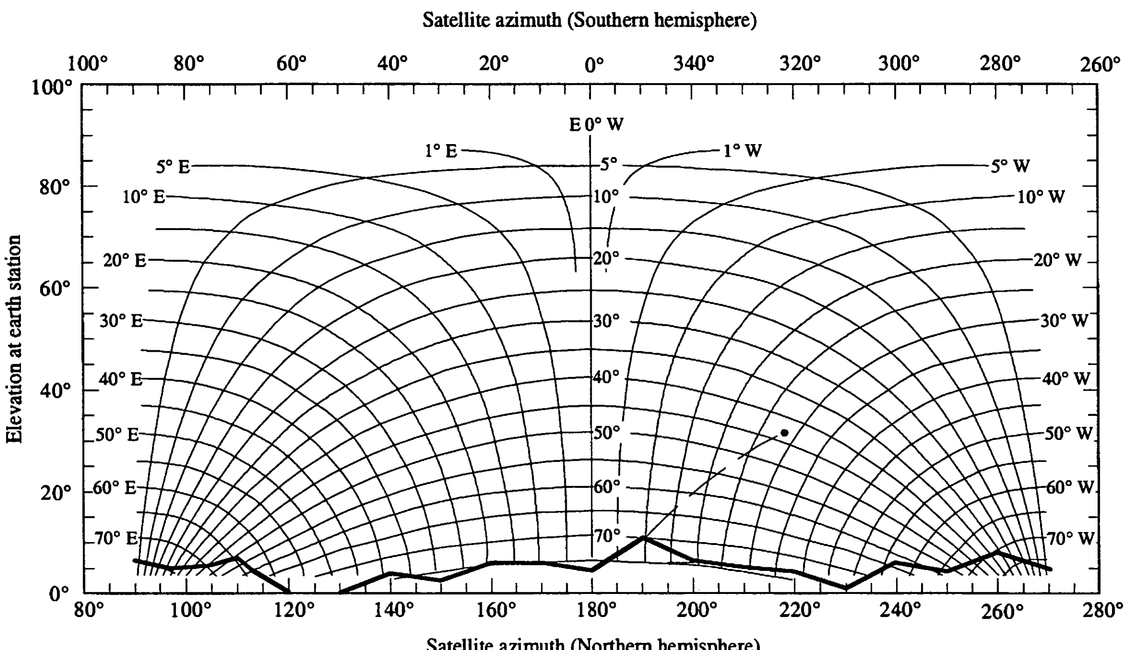
1 General

The gain component of the earth station antenna in the direction of the physical horizon around an earth station is a function of the angular separation between the antenna main beam axis and the horizon in the direction under consideration. When the earth station is used to transmit to a space station in a slightly inclined orbit, all possible pointing directions of the antenna main beam axis need to be considered. For earth station coordination, knowledge of $\varphi(\alpha)$, the minimum possible value of the angular separation that will occur during the operation of the space station, is required for each azimuth.

When a geostationary space station maintains its location close to its nominal orbital position, the earth station's main beam axis elevation angle ε_s and azimuth angle α_s to the space station from the earth station's latitude ζ are uniquely related. Figure III-1 shows the possible location arcs of positions of a space station on the geostationary orbit in a rectangular azimuth/elevation plot. It shows arcs corresponding to a set of earth station latitudes and the intersecting arcs correspond to points on the orbit with a fixed difference in longitude East or West of the earth station. Figure III-1 also shows a portion of the horizon profile $\varepsilon_h(\alpha)$. The off-axis angle $\varphi(\alpha)$ between the horizon profile at an azimuth of 190° and a space station located 28° W of an earth station at 43° N latitude is indicated by the great-circle arc shown dashed on Figure III-1.

FIGURE III-1

Position arcs of geostationary satellites with horizon and the arc from the horizon at azimuth 190° to a satellite 28° W of an earth station at 43° N latitude



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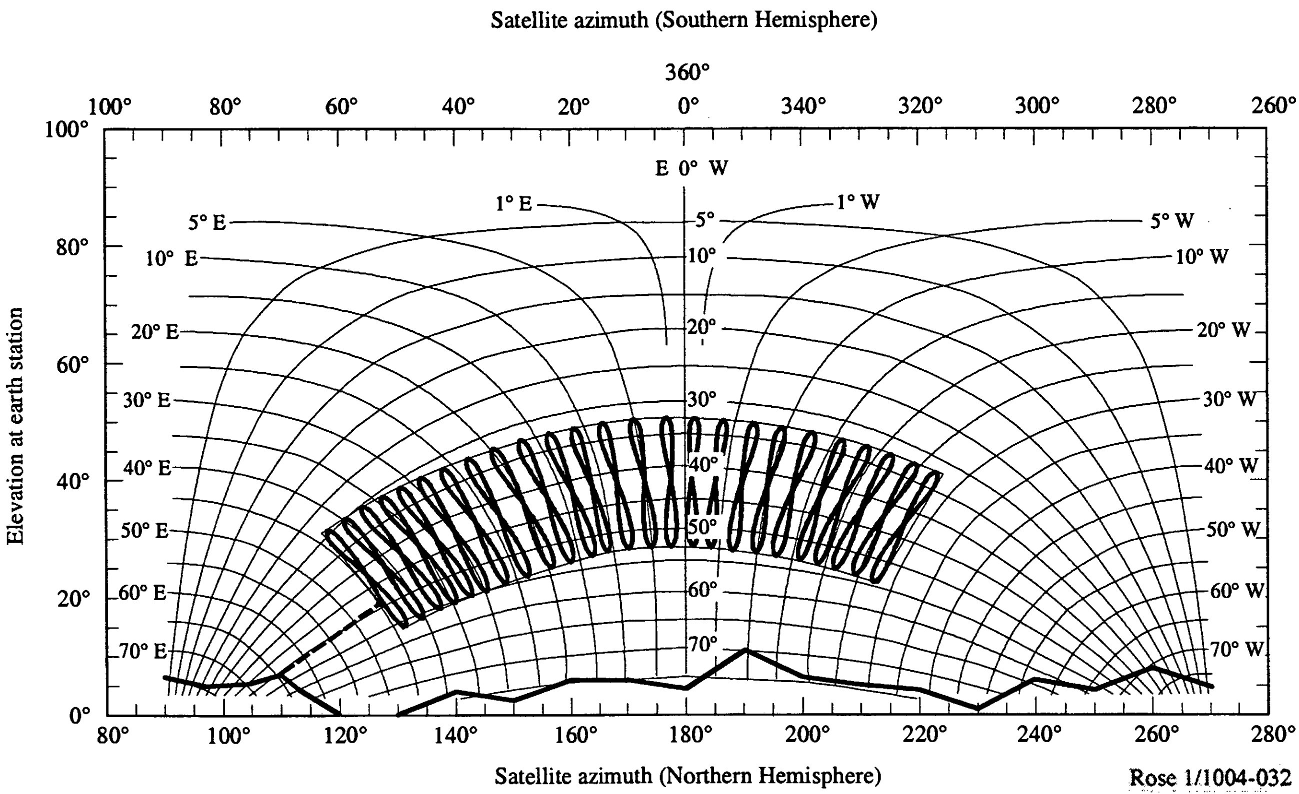
When the north/south station-keeping of a geostationary satellite is relaxed, the orbit of the satellite becomes inclined with an inclination that increases gradually with time. As viewed from the earth, the position of the satellite traces a figure eight during each 24-hour period. Figure III-2 shows the variations in the trajectories of a set of satellites, each with 10° inclination, spaced by 3° along the geostationary orbit from 28° W to 44° E with respect to an earth station at 43° N latitude. Figure III-2 also shows, with a dashed curve, the great-circle arc corresponding to the minimum off-axis angle φ(α) between a point on the trajectory of one of the satellites and the horizon profile at an azimuth of 110°.

Editorial Note - Delete the words "the envelope of" in the title caption of Figure III-2.

FIGURE III-2

Position arcs of geostationary satellites with horizon and the arc from the horizon at azimuth 110° to satellites with 10° inclination on the geostationary orbital arc from 28° W to 44° E of an earth station at 43° N latitude



For a transmitting earth station operating in a frequency band that is also allocated for bidirectional use by receiving earth stations operating to geostationary space stations, refer to § 2.1 of Annex V.

2 Determination of the angular separation φ(α)

For the determination of the off-axis angle φ(α), two cases are distinguished. These depend on whether the orbit of the space station has no inclination, or is slightly inclined. The following equations may be used in both of these cases:

$$\psi_s(i, \delta) = \text{arc cos } (\sin \zeta \sin i + \cos \zeta \cos i \cos \delta) \qquad \text{(III-1)}$$

$$\varepsilon_s(i,\delta) = \arcsin\left[\frac{K\cos\psi_s(i,\delta)-1}{\left(1+K^2-2K\cos\psi_s(i,\delta)\right)^{1/2}}\right] \qquad \text{(III-2)}$$

$$\alpha_{os}(i,\delta) = \arccos\left[\frac{\sin i - \cos\psi_s \sin\zeta}{\sin\psi_s \cos\zeta}\right] \qquad \text{(III-3)}$$

$\alpha_s(i, \delta) = \alpha_{os}(i, \delta)$ for a space station located east of the earth station ($\delta \geq 0$) (III-4)

$\alpha_s(i, \delta) = 360° - \alpha_{os}(i, \delta)$ for a space station located west of the earth station ($\delta \leq 0$) (III-5)

$\varphi(\alpha, i, \delta) = \text{arc cos } [\cos \varepsilon_h(\alpha) \cos \varepsilon_s(i, \delta) \cos (\alpha - \alpha_s(i, \delta)) + \sin \varepsilon_h(\alpha) \sin \varepsilon_s(i, \delta)]$ (III-6)

where:

ζ: latitude of the earth station (positive for north; negative for south)

δ: difference in longitude from the earth station to a space station

i: latitude of a sub-satellite point (positive for north; negative for south)

$\psi_s(i, \delta)$: great-circle arc between the earth station and a sub-satellite point

$\alpha_s(i, \delta)$: space station azimuth as seen from the earth station

$\varepsilon_s(i, \delta)$: space station elevation angle as seen from the earth station

$\varphi(\alpha, i, \delta)$: angle between the main beam and the horizon direction corresponding to the azimuth (α) under consideration when the main beam is steered towards a space station with a sub-satellite point at latitude i and longitude difference δ

α: azimuth of the direction under consideration

ε_h: elevation angle of the horizon at the azimuth, α under consideration

$\varphi(\alpha)$: angle to be used for horizon gain calculation at the azimuth under consideration, α

K: orbit radius/earth radius, which for the geostationary orbit is assumed to be 6.62.

All arcs mentioned above are in degrees.

Case 1: **Single space station, no orbital inclination**

For a space station operating with no orbital inclination at an orbital position with difference in longitude δ_0, equations (III-1) to (III-6) may be applied directly using $i = 0$ to determine $\varphi(\alpha)$ for each azimuth α. Thus:

$$\varphi(\alpha) = \varphi(\alpha, 0, \delta_0) \qquad \text{(III-7)}$$

where:

δ_0: longitude difference from the earth station to the space station.

Case 2: Single space station, in a slightly inclined orbit

For a space station operating in a slightly inclined orbit on a portion of the geostationary arc with nominal longitude difference of δ_0, the maximum orbital inclination over its lifetime, i_s, must be considered. Equations (III-1) to (III-6) may be applied to develop the minimum off-axis angle to each of four arcs in azimuth/elevation that bound the trajectory of the space station in angle and elevation. The bounding arcs correspond to the maximum and minimum latitudes of the sub-satellite points and the extremes of the difference in longitude between the earth and space stations when the space station is operating at its maximum inclination.

The determination of the minimum off-axis angles in equations (III-8), (III-9), (III-10), (III-11) and (III-12) may be made by taking increments along a bounding contour. The step size in inclination i or longitude δ should be between 0.5° and 1.0° and the end points of the respective ranges should be included in the calculation.

The horizon profile $\varepsilon_h(\alpha)$ used in the determination of $\varphi(\alpha)$ is specified at increments in azimuth α that do not exceed 5°.

Thus:

$$\varphi(\alpha) = \min_{n=1\ to\ 4} \varphi(\alpha) \qquad \text{(III-8)}$$

with:

$$\varphi_1(\alpha) = \min_{\delta_0-\delta_s \le \delta \le \delta_0+\delta_s} \varphi(\alpha, -i_s, \delta) \qquad \text{(III-9)}$$

$$\varphi_2(\alpha) = \min_{\delta_0-\delta_s \le \delta \le \delta_0+\delta_s} \varphi(\alpha, i_s, \delta) \qquad \text{(III-10)}$$

$$\varphi_3(\alpha) = \min_{-i_s \le i \le i_s} \varphi(\alpha, i, \delta_0-\delta_s) \qquad \text{(III-11)}$$

$$\varphi_4(\alpha) = \min_{-i_s \le i \le i_s} \varphi(\alpha, i_s, \delta_0+\delta_s) \qquad \text{(III-12)}$$

$$\delta_s = (i_s / 15)^2 \qquad \text{(III-13)}$$

where:

i_s: maximum operational inclination angle of the satellite orbit

δ_s: maximum longitude change from nominal value of the sub-satellite point of a satellite with orbital inclination i_s.

3 Determination of antenna gain

The relationship $\varphi(\alpha)$ is used to derive a function for the horizon antenna gain in dBi, $G(\varphi)$ as a function of the azimuth α, by using the actual earth station antenna pattern, or a formula giving a good approximation. For example, in cases where the ratio between the antenna diameter and the wavelength is equal to or greater than 35, the following equation is used:

$$G(\varphi)=\begin{cases} G_{amax}-2.5\times10^{-3}\left(\frac{D}{\lambda}\varphi\right)^2 & \text{for } 0<\varphi<\varphi_m \\ G_1 & \text{for } \varphi_m\le\varphi<\varphi_r \\ 29-25\log\varphi & \text{for } \varphi_r\le\varphi<36^\circ \\ -10 & \text{for } 36^\circ\le\varphi\le180^\circ \end{cases} \qquad \text{(III-14)}$$

$$G_l=\begin{cases} -1+15\log\left(D/\lambda\right) & \text{dBi for } D/\lambda\ge100 \\ -21+25\log\left(D/\lambda\right) & \text{dBi for } 35\le D/\lambda<100 \end{cases}$$

$$\varphi_m=\frac{20\lambda}{D}\sqrt{G_{amax}-G_l} \qquad \text{degrees}$$

$$\varphi_r=\begin{cases} 15.85\left(D/\lambda\right)^{-0.6} & \text{degrees} & \text{for } D/\lambda\ge100 \\ 100\left(\lambda/D\right) & \text{degrees} & \text{for } 35\le D/\lambda<100 \end{cases}$$

Where a better representation of the actual antenna pattern is available, it may be used.

In cases where D/λ is not given, it may be estimated from the expression:

$$20\log\frac{D}{\lambda}\approx G_{amax}-7.7$$

where:

G_{amax}: main beam axis antenna gain (dBi).

D: antenna diameter (m)

λ wavelength (m)

G_1: gain of the first side lobe (dBi)

ANNEX IV

Antenna gain toward the horizon for earth stations operating to non-geostationary space stations

This Annex presents methods which may be used to determine the antenna gain towards the horizon for earth stations operating to non-geostationary satellites using the TIG method described in § 2.2 of the main body of this Appendix.

1 Determination of the horizon antenna gain

In its simplest implementation, the TIG method depends on the minimum elevation angle of the beam axis of the earth station antenna (ε_{sys}), which is a system parameter that has the same value on all azimuths from the earth station. If the horizon elevation angle at an azimuth under consideration is ε_h degrees, the minimum separation angle from the horizon at this azimuth to any possible pointing angle for the main beam axis of the antenna (φ_{min}) is equal to the difference between these two angles ($\varepsilon_{sys} - \varepsilon_h$), but it is not less than zero degrees. The maximum separation angle from the horizon at this azimuth to any possible pointing angle for the main beam axis of the antenna (φ_{max}) is equal to the difference between the sum of these two angles and 180 degrees ($180 - \varepsilon_{sys} - \varepsilon_h$). The maximum and minimum values of horizon gain for the azimuth under consideration are obtained from the gain pattern of the earth station antenna at these off-axis angles. Where no pattern is available the pattern of § 3 of Appendix III may be used.

Additional constraints may be included in the determination of the maximum and minimum values of horizon antenna gain where an earth station operates with a constellation of non-geostationary satellites that are not in near-polar orbit. In this case, depending on the latitude of the earth station, there may be portions of the hemisphere above the horizontal plane at the earth station in which no satellite will appear. To include these visibility limitations within this method, it is first necessary to determine, for a closely spaced set of azimuth angles around the earth station, the minimum elevation angle at which a satellite may be visible. This minimum satellite visibility elevation angle (ε_v) may be determined from consideration of the visibility of the edge of the shell formed by all possible orbits having the orbital inclination and altitude of the satellites in the constellation.

The lowest elevation angle toward which the main-beam axis of the earth station antenna will point on any azimuth is the minimum composite elevation angle (ε_c), which is equal to the greater of the minimum satellite visibility elevation angle (ε_v) and the minimum elevation angle of the earth station (ε_{sys}). After the minimum composite elevation angle has been determined for all azimuths by the procedure of § 1.1 of this Annex, the resulting profile of the minimum composite elevation angles can be used, in the procedure of § 1.2 of this Annex, to determine the maximum and minimum values of horizon gain at any azimuth.

Further information and an example of this method may be found in the latest version of Recommendation ITU-R SM.1448.

1.1 Determination of satellite visibility limits

The visibility limits of a constellation of satellites can be determined from the inclination angle of the most inclined satellite and the altitude of the lowest satellite in the constellation. For this determination, six cases may be distinguished, but not all of these may be applicable for a given constellation and a given earth station latitude. The azimuth and the corresponding lower limit on the elevation angle are developed by a parametric method using a set of points on the edge of the orbital shell of the constellation. The approach is to develop this relationship for azimuths to the east of a station in the northern hemisphere. Elevation angles for azimuths to the west of the station and for all azimuths for stations in the southern hemisphere are obtained by symmetry. The following equations, which are applicable to circular orbits only, may be used for the complete determination of the horizon antenna gain in all practical cases:

$$\psi(\delta) = \arccos\,(\sin \zeta_e \sin i_s + \cos \zeta_e \cos i_s \cos \delta) \qquad \text{(IV-1)}$$

$$\varepsilon_v(\delta) = \arcsin\left[\frac{K_1 \cos[\psi(\delta)] - 1}{\left(1 + K_1^2 - 2K_1 \cos[\psi(\delta)]\right)^{1/2}}\right] \qquad \text{(IV-2)}$$

$$\alpha_0(\delta) = \arccos\left[\frac{\sin i_s - \cos[\psi(\delta)]\ \sin\zeta_e}{\sin[\psi(\delta)]\ \cos\zeta_e}\right] \qquad \text{(IV-3)}$$

with

$$\alpha(\delta) = \begin{cases} \alpha_0(\delta) \text{ and} & \\ 360 - \alpha_0(\delta) & \text{for earth stations north of the Equator} \\ 180 - \alpha_0(\delta) \text{ and} & \\ 180 + \alpha_0(\delta) & \text{for earth stations south of the Equator} \end{cases} \qquad \text{(IV-4)}$$

where:

i_s: the orbital inclination of the satellites in the constellation assumed to be positive and between 0° and 90°

ζ_e: modulus of the latitude of the earth station

δ: difference in longitude from the earth station to a point on the edge of the orbital shell of the constellation

$\psi(\delta)$: great-circle arc between the earth station and a point on the surface of the earth directly below the point on the edge of the orbital shell of the constellation

$\alpha(\delta)$: azimuth from the earth station to a point on the edge of the orbital shell

$\alpha_0(\delta)$: the principal azimuth, an azimuth between 0 and 180 degrees, from an earth station to a point on the edge of the orbital shell

$\varepsilon_v(\delta)$: elevation angle from the earth station to a point on the edge of the orbital shell

K_1: orbit radius/earth radius for the lowest altitude satellite in the constellation (earth radius = 6 378.14 km)

$\psi_m = \arccos(1/K_1)$.

All arcs mentioned above are in degrees.

For any latitude on the surface of the earth, the azimuth for which the minimum elevation angle to a satellite can be greater than zero, and the corresponding elevation angles, may be determined by implementing the calculations under the following case(s). No more than two of these cases will be applicable for any latitude. For situations not specifically addressed in the following cases, no satellite is visible at elevation angles at or below 90° on any azimuth.

Case 1: For: $\zeta_e \le i_s - \psi_m$

For this case a satellite may be visible to the horizon for all azimuths about the earth station ($\varepsilon_v = 0$).

Case 2: For: $i_s - \psi_m < \zeta_e \le \arcsin(\sin i_s \cos \psi_m)$

For this case the azimuth angles and elevation are developed parametrically by choosing a set of values of δ, uniformly spaced on the interval 0 to δ_1, and applying equations (IV-1) to (IV-4). For this purpose the spacing between values is not to exceed 1.0 degree, and the endpoints are to be included.

$$\delta_1 = \arccos\left[\frac{\cos\psi_m - \sin\zeta_e \sin i_s}{\cos\zeta_e \cos i_s}\right]$$

At any principal azimuth ($\alpha_0(\delta)$) that is not included in the set, the minimum elevation angle is zero ($\varepsilon_v = 0$), except for azimuths where Case 6 additionally applies.

Case 3: For: $\arcsin(\sin i_s \cos \psi_m) < \zeta_e < i_s$, and $\zeta_e < 180 - \psi_m - i_s$

For this case the azimuth angles and elevation are developed parametrically by choosing a set of values of δ, uniformly spaced on the interval 0 to δ_2, and applying equations (IV-1) to (IV-4). For this purpose the spacing between values is not to exceed 1.0 degree, and the endpoints are to be included.

$$\delta_2 = 2\arctan\left[\frac{\sqrt{\sin^2\psi_m - \cos^2 i_s \sin^2\delta_1}}{\sin\zeta_e \cos i_s \sin\delta_1}\right] - \delta_1$$

At any principal azimuth ($\alpha_0(\delta)$) that is not included in the set, the minimum elevation angle is zero ($\varepsilon_v = 0$), except for azimuths where Case 6 additionally applies.

Case 4: For: $i_s \le \zeta_e < i_s + \psi_m$, and $\zeta_e < 180 - i_s - \psi_m$

For this case, the minimum elevation angle is given explicitly in terms of the principal azimuth angle α_0 as follows:

$$\varepsilon_v = \begin{cases} 90 & \text{for} \quad 0 \le \alpha_0 < \alpha_2 \\ 0 & \text{for} \quad \alpha_2 \le \alpha_0 \le 180 \end{cases}$$

where

$$\alpha_2 = \arccos\left[\frac{\sin i_s - \cos\psi_m \sin\zeta_e}{\sin\psi_m \cos\zeta_e}\right]$$

Note that a minimum elevation angle of 90 degrees in this formulation indicates that no satellite is visible at elevation angles at or below 90 degrees on these azimuths, furthermore, within the range of principal azimuths where the minimum elevation angle is zero, Case 6 may additionally apply.

Case 5: For $180 - i_s - \psi_m \le \zeta_e \le 90$

For this case, a satellite may be visible to the horizon for all azimuths about the earth station ($\varepsilon_v = 0$).

Case 6: For $\zeta_e < \psi_m - i_s$

This case may occur additionally with Case 2, Case 3 or Case 4 and a satellite may be visible only above a minimum elevation angle for other principal azimuths.

For this case the other principal azimuths and the corresponding elevation angles are developed parametrically by choosing a set of values δ, uniformly spaced on the interval 0 to δ_3, and applying equations (IV-1) to (IV-4) with i_s replaced by $-i_s$. For this purpose the spacing between values is not to exceed 1.0 degree and the end points are to be included.

$$\delta_3 = \arccos\left[\frac{\cos\psi_m + \sin\zeta_e \sin i_s}{\cos\zeta_e \cos i_s}\right]$$

1.2 Determination of minimum and maximum horizon gain from the minimum visible elevation angle profile

The horizon gain of the earth station antenna is determined from the profile of values of the minimum composite elevation angle (ε_c). At any azimuth the minimum composite elevation angle is the greater of the minimum satellite visibility elevation angle at that azimuth(ε_v) and the minimum elevation angle for the earth station (ε_{sys}). The following procedure may be used to determine the maximum and minimum values of horizon antenna gain for each azimuth under consideration.

The following equation may be used to determine the angular separation from the horizon profile, at an azimuth angle α and horizon elevation angle ε_h, to a point on the profile of the minimum composite elevation angle, where the minimum composite elevation angle is ε_c at an azimuth angle of α_c:

$$\varphi(\alpha, \alpha_c) = \arccos\left[\sin\varepsilon_h(\alpha)\sin(\varepsilon_c(\alpha_c)) + \cos\varepsilon_h(\alpha)\cos(\varepsilon_c(\alpha_c))\cos(\alpha - \alpha_c)\right] \quad \text{(IV-5)}$$

where

- α: azimuth of the direction under consideration
- $\varepsilon_h(\alpha)$: elevation angle of the horizon at the azimuth, α, under consideration
- $\varepsilon_c(\alpha_c)$: minimum composite elevation angle at the azimuth, α_c
- α_c: azimuth corresponding to ε_c.

The minimum value of the separation angle φ_{min}, for the azimuth under consideration, is determined by finding the minimum value of $\varphi(\alpha, \alpha_c)$ for any azimuth α_c, and the maximum value, φ_{max}, is determined by finding the maximum value of $\varphi(\alpha, \alpha_c)$ for any azimuth α_c. The azimuth angles (α) are usually taken in increments of 5 degrees; however, to accurately determine the minimum separation angle, the values of the minimum composite elevation angle, ε_c, need to be determined for a spacing of 1 degree or less in the azimuth α_c. Where the procedures in § 1.1 of this Annex do not provide a profile of minimum composite elevation angle with a close enough spacing in azimuth angles, linear interpolation may be used to develop the necessary intermediate values. The maximum and minimum horizon antenna gains, G_{max} and G_{min}, to be used in the equations of § 2.2 of the main body of this Appendix for the azimuth under consideration, are obtained by applying the off-axis angles, φ_{min} and φ_{max}, respectively, in the earth station antenna pattern. If the earth station antenna pattern is not known then the antenna pattern in § 3 of Annex III is used. In many cases, φ_{max} will be large enough on all azimuths so that G_{min} will be equal to the minimum gain of the antenna pattern at all azimuths.

ANNEX V

Determination of the coordination area for a transmitting earth station with respect to receiving earth stations operating to geostationary space stations in bidirectionally allocated frequency bands

1 Introduction

The propagation mode (1) coordination area of a transmitting earth station, with respect to unknown receiving earth stations that operate to geostationary space stations, requires the determination of the horizon gain of the antenna of the receiving earth station at each azimuth of the transmitting earth station. Different methods then need to be applied to determine the coordination area of the coordinating earth station depending on whether it operates to geostationary or non-geostationary space stations. When both the coordinating earth station and the unknown receiving earth stations operate to geostationary space stations, it is also necessary to determine a propagation mode (2) coordination contour.

The coordination area of a transmitting earth station, with respect to unknown receiving earth stations that operate to non-geostationary space stations, can be determined by minor modifications to the methods applicable to the determination of coordination area of transmitting earth stations with respect to terrestrial stations. (See § 3.2.1 and § 3.2.3 of the main body of the Appendix.)

2 Determination of the bidirectional coordination contour for propagation mode (1)

For a transmitting earth station operating in a frequency band that is also allocated for bidirectional use by receiving earth stations operating to geostationary space stations, further development of the procedures in Annex III is needed. It is necessary to determine the horizon gain of the unknown receiving earth station, the horizon gain to be used at each azimuth at the coordinating (transmitting) earth station, for the determination of the bidirectional coordination area.

2.1 Calculation of horizon gain for unknown receiving earth stations operating to geostationary space stations

The value of G_r, the horizon gain of the receiving earth station, for each azimuth (α) at the transmitting earth station is found by the following steps:

1) The receiving earth station may be operating to any satellite in the geostationary orbit above a minimum elevation angle, (ε_{min}) contained in Table 3 to Annex VII. The maximum difference in longitude (δ_b in degrees) between the receiving earth station and its associated space station occurs at this minimum elevation angle (ε_{min}) and is given by:

$$\delta_b = \arccos\left(\frac{\sin\left(\varepsilon_{min} + \arcsin\left(\frac{\cos(\varepsilon_{min})}{K}\right)\right)}{\cos(\zeta)}\right) \qquad \text{(V-1)}$$

where:

ζ: latitude of the receiving earth station, which is assumed to be the same as the transmitting earth station, and

K: ratio of the radius of the satellite orbit to the radius of the earth and equals 6.62.

2) For each azimuth (α) at the transmitting earth station:

a) determine the azimuth α_r from the receiving earth station to the transmitting earth station:

$$\alpha_r = \alpha + 180° \quad \text{for } \alpha < 180$$

$$\alpha_r = \alpha - 180° \quad \text{for } \alpha \geq 180$$

b) for each azimuth, α_r determine the minimum angular separation, $\varphi(\alpha_r)$ between the receiving earth station main beam axis and the horizon at this azimuth using Case 1 in § 2 of Annex III. For this evaluation $\varphi(\alpha_r)$ is the minimum value of $\varphi(\alpha_r, 0, \delta_0)$ where the values of δ_0 are between $-\delta_b$ and $+\delta_b$ in steps of 1 degree or less making sure to include the end points.

The minimum angular separation, $\varphi(\alpha_r)$, may be used with the gain pattern in § 3 of Annex III to determine the horizon gain for this azimuth (α), unless a different gain pattern is referenced in Table 3 of Annex VII.

Figure V-1 shows plots of the minimum angular separation between the horizon at zero degrees elevation on an azimuth α_r and a satellite on the geostationary orbit at an elevation above 3 degrees. Plots are shown for a set of values of the station latitude (ζ), which is assumed to be the same for both transmitting and receiving earth stations. Figure V-1 also provides a scale showing the corresponding azimuth (α) of the transmitting earth station.

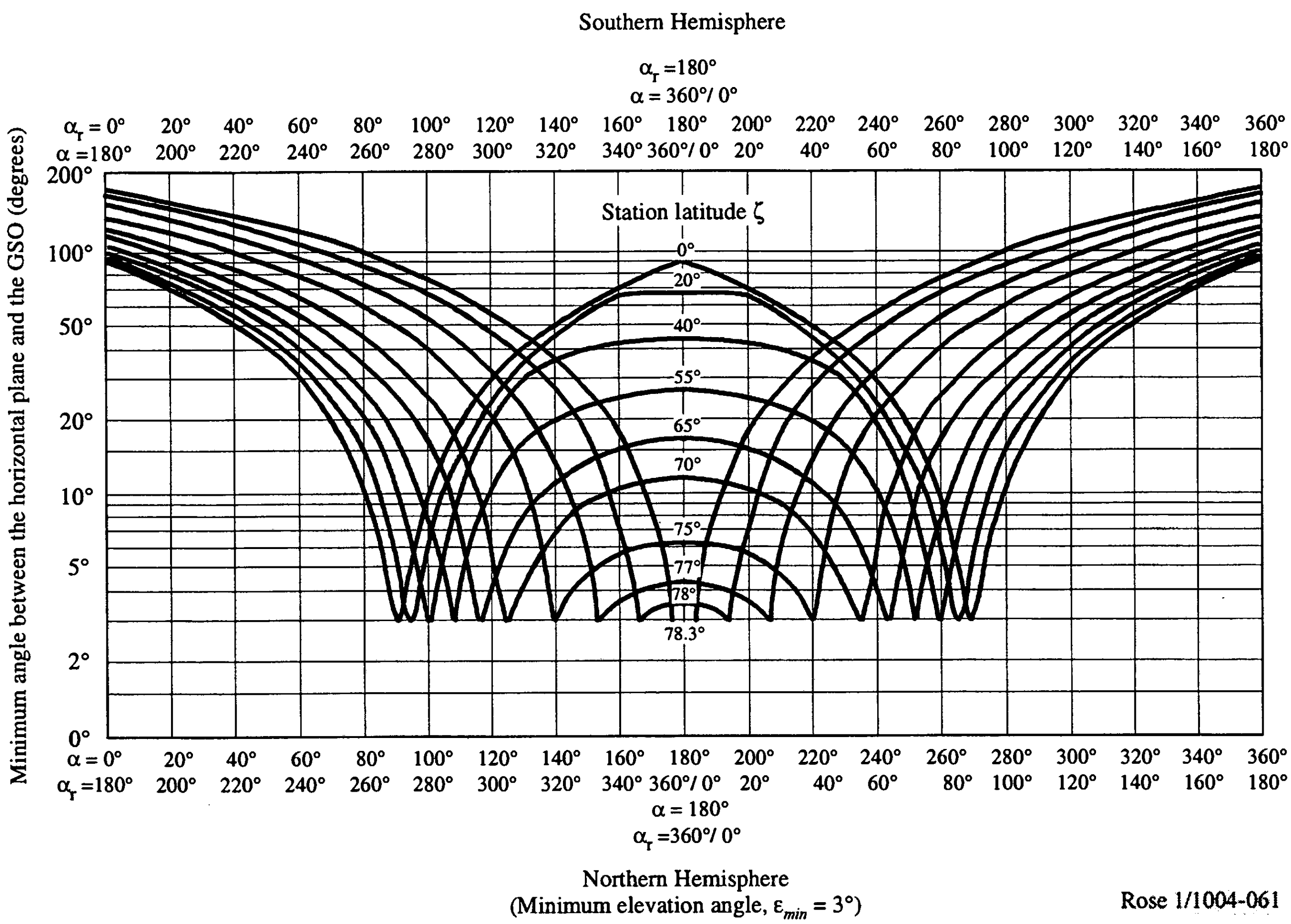


FIGURE V-1

Illustration of minimum angular distance between points on the geostationary-satellite orbit (GSO) and the horizontal plane

Further information may be found in the latest version of Recommendation ITU-R SM.1448.

3 Determination of the bidirectional rain scatter contour

The procedure for the determination of the bidirectional rain scatter area, as described in § 3.1.2 of the main body of this Appendix, is as follows:

The horizontal distance d_s (km) from the coordinating earth station to the point at which the main beam axis attains the rain height h_R is calculated by:

$$d_s = 8\,500\left(\sqrt{\tan^2 \varepsilon_s + h_R / 4\,250} - \tan \varepsilon_s\right) \text{ km} \qquad \text{(V-2)}$$

where the rain height, h_R, can be determined from equations (II-13) or (II-14) in Annex II and ε_s is the minimum elevation angle of the transmitting earth station.

The maximum calculation distance, d_{emax}, to be used in the determination of the propagation mode (2) contour, for the case of a coordinating earth station operating in bidirectionally allocated frequency bands, is dependent on the rain height. It is the greater distance determined from:

$$d_{emax} = 130.4\sqrt{h_R} \text{ km or } d_{min}$$

where the minimum coordination distance, d_{min}, is given in § 4.2 of the main body of this Appendix.

The point, at the distance d_s from the earth station, on the azimuth α_s of the coordinating earth station's main beam axis, is the geographic point immediately below the main beam axis intersection with the rain height, and is the reference point from which the maximum calculation distance d_{emax} is measured (see Figure V-2).

If the maximum calculation distance, d_{emax}, is greater than the minimum coordination distance, d_{min}, then, calculate the maximum latitude at which a receiving earth station may operate to a geostationary satellite with a minimum elevation angle ε_{min}:

$$\zeta_{max} = \arccos\left[\frac{\cos(\varepsilon_{min})}{K}\right] - \varepsilon_{min} \qquad \text{(V-3)}$$

where

ε_{min}: given in Table 3 of Annex VII and

K: ratio of the radius of the satellite orbit to the radius of the earth and equals 6.62.

If the coordinating earth station latitude in the northern hemisphere is greater than ζ_{max}, or if the coordinating earth station latitude in the southern hemisphere is less than $-\zeta_{max}$ or $-71°$, then the rain scatter contour is a circle of radius d_{min}, centred on the transmitting earth station.

For all other cases, the coordination area is developed by the following procedure:

Step 1: The unknown receiving earth station is assumed to be operating to a satellite at the minimum elevation angle ε_{min}. It is also assumed that the receiving earth station is relatively close to the coordinating earth station in geometric terms hence, a plane geometry approximation can be applied within the coordination area. If the receiving earth station's main beam axis passes through the intersection of the coordinating earth station's main beam axis with the rain height, the azimuths from the point on the ground, immediately below this intersection, to the possible locations of a receiving earth station are given by:

$$\alpha_{w1} = \arccos\left[\frac{\tan \zeta}{\tan \zeta_{max}}\right]$$

and

$$\alpha_{w2} = 360 - \alpha_{w1}$$

where:

ζ: is the latitude of the transmitting earth station.

Step 2: Mark on a map of an appropriate scale the coordinating earth station's location and draw from this location a line of distance, d_s, along the azimuth, α_s, to the point below the coordinating earth station's main beam axis intersection with the rain height.

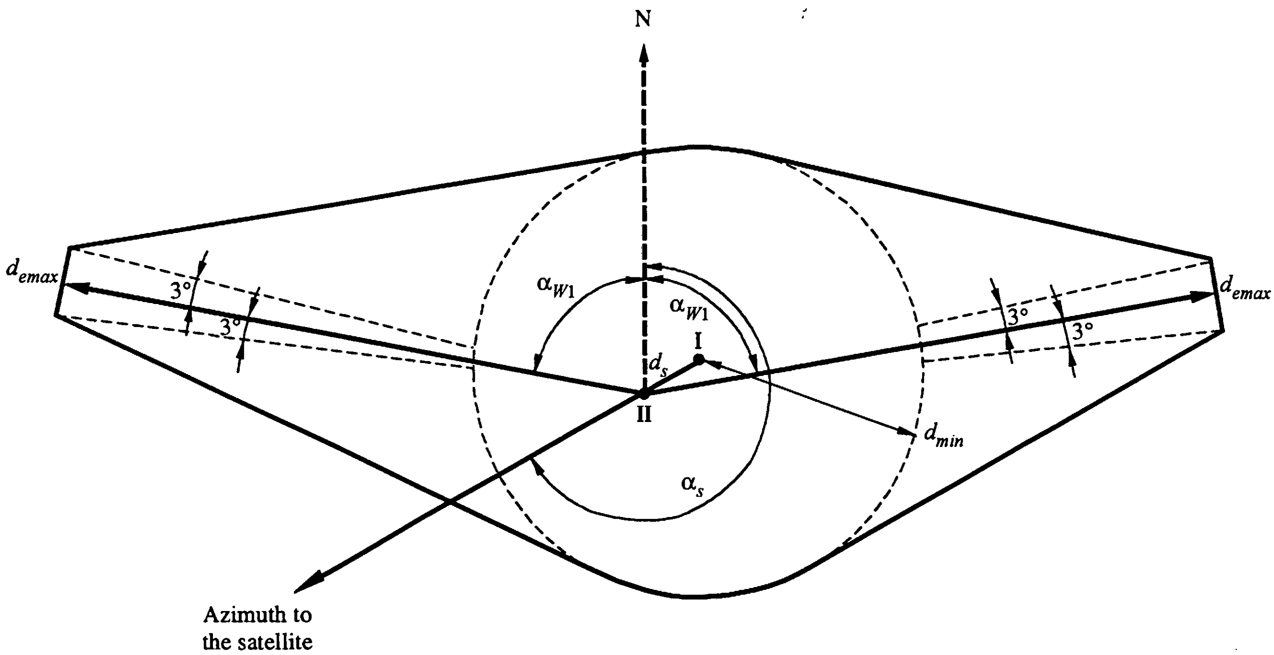
Step 3: From the main beam axis intersection point in step 2, mark on the map the distance, $d_{emax,}$ along the two azimuths, α_{w2} and α_{w1}, and on each azimuth at the distance, d_{emax}, draw two equal distance arcs of width 3° clockwise and counter-clockwise. The two arcs, each having a total width of 6°, are the first boundary elements of the bidirectional rain scatter area.

Step 4: Mark a circle of radius equal to the minimum coordination distance, d_{min}, around the coordinating earth station's location, and then draw straight lines from the northern edges of the two arc segments tangential to the northern rim of the circle, and from the southern edges of the two arc segments tangential to the southern rim of the circle.

The area bounded by the two 6° wide arcs, the four straight lines, and the circular sections (of which there is always at least one) between the two northern and the two southern tangent points with the straight lines, constitutes the bidirectional rain scatter area.

Figure V-2 illustrates the construction of the bidirectional rain scatter area for a coordinating earth station. (The resulting rain scatter area contains the possible loci of all receiving earth station locations from which a beam path towards the geostationary-satellite orbit will intersect the main beam of the transmitting earth station antenna.)

(Not to scale)



I: location of the transmitting earth station

II: point where the earth station antenna main-beam axis reaches the altitude h_R

Assumptions:

ζ = 40° N

ε_s = 10°

α_s = 254°

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FIGURE V-2

Example of the bidirectionnal rain scatter area

ANNEX VI

Supplementary and auxiliary contours

1 Introduction

The material found in this Annex is intended to assist administrations in bilateral discussions.

2 Supplementary contours

The coordination area is determined with respect to the type of terrestrial station (or in a frequency band with a bidirectional space allocation, an earth station operating in the opposite direction of transmission) that would yield the largest coordination distances. Therefore, in the case of terrestrial services, fixed stations using tropospheric scatter have been assumed to be operating in frequency bands that may typically be used by such radiocommunication systems; and fixed stations operating in line-of-sight configurations and using analogue modulation have been assumed to be operating in other frequency bands. However, other radiocommunication systems (e.g. other terrestrial stations), that have typically lower antenna gains, or otherwise less stringent system parameters, than those on which the coordination area is based, may also operate in the same frequency range. Therefore it is possible for the administration seeking coordination to identify a supplementary contour using either the methods in § 2 or § 3 of the main body of this Appendix, where they are applicable, or other agreed methods. Subject to bilateral agreement between administrations, these supplementary contours can assume the role of the coordination contour for an alternative type of radio system in the same services, or another radiocommunication service.

When a supplementary contour is to be developed for other types of systems, for example digital fixed systems, the necessary system parameters may be found in one of the adjacent columns in Tables 1, 2 and 3 of Annex VII. If no suitable system parameters are available then the value of the permissible interference power ($P_r(p)$) may be calculated using equation (1) of § 2 in Annex VII.

In addition, supplementary contours may be prepared by the administration seeking coordination to define smaller areas, based on more detailed methods, for consideration when agreed bilaterally between the concerned administrations. These contours can be a useful aid to the rapid exclusion of terrestrial stations or earth stations from further consideration. For earth stations operating to non-geostationary space stations, supplementary contours may be generated using the method in § 4 of this Annex.

Supplementary contours may be comprised of propagation mode (1) interference paths and, depending on the sharing scenario, propagation mode (2) interference paths. In addition, the propagation mode (1) element of a supplementary contour may, if appropriate for the radiocommunication service, utilize the same level of correction factor (see § 4.4 of the main body of this Appendix) that was applied in the determination of the coordination contour. However, all parts of each supplementary contour must fall on or between the contour defined by the minimum coordination distance and the corresponding propagation mode (1) or propagation mode (2) main contour.

3 Auxiliary contours

Practical experience has shown that, in many cases, the separation distance required for the coordinating earth station, on any azimuth, can be substantially less than the coordination distance since the worst case assumptions do not apply to every terrestrial station or earth station. There are two main mechanisms that contribute to the difference between the separation distance in this context and the coordination distance:

– the terrestrial station antenna gain (or e.i.r.p.), or receiving earth station antenna gain, in the direction of the coordinating earth station is less than that assumed in calculating the coordination contour;

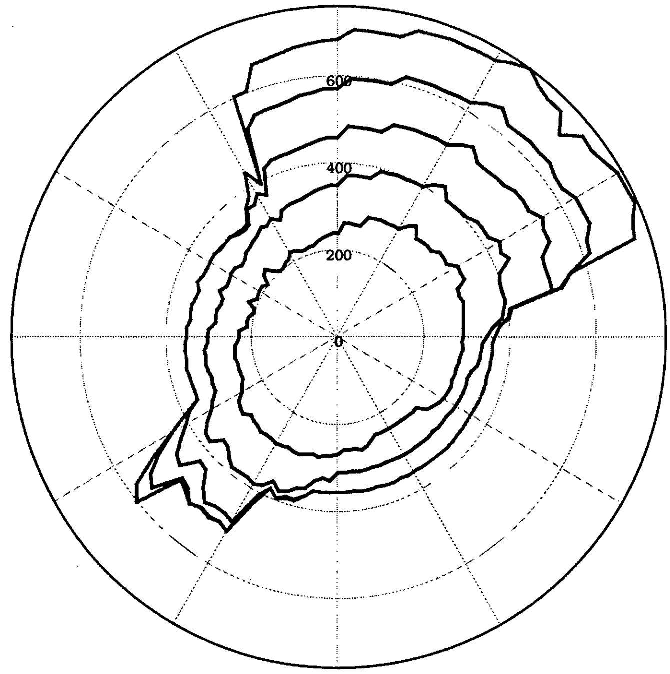
– appropriate allowance can be made, for example, for the effects of site shielding not included in the coordination distance calculations.

Auxiliary contours must use the same method as that used to determine the corresponding main or supplementary contour. In addition, all parts of each auxiliary contour must fall on or between the contour defined by the minimum coordination distance and the corresponding main or supplementary contour. Auxiliary contours may assist in the elimination from detailed coordination of terrestrial stations or earth stations that are located in the coordination area and hence have been identified as potentially affected by the coordinating earth station. Any terrestrial station or earth station that lies outside an auxiliary contour and has an antenna gain towards the coordinating earth station that is less than the gain represented by the relevant auxiliary contour need not be considered further as a significant source, or subject, of interference.

3.1 Auxiliary contours for propagation mode (1)

Propagation mode (1) auxiliary contours are calculated with values for the propagation mode (1) minimum required loss, in equation (22) in § 4.4 of the main body of this Appendix, that are progressively reduced by, for example, 5, 10, 15, 20 dB, etc., below the value derived from the parameters assumed in Tables 1, 2 and 3 of Annex VII for the corresponding main or supplementary propagation mode (1) contour, until the minimum coordination distance is reached. Propagation mode (1) auxiliary contour distances are calculated without the correction factor (see § 4.4 of the main body of this Appendix), and hence could be larger, on any azimuth, than the corresponding main, or supplementary, propagation mode (1) distance. To prevent this, in those cases where a correction factor applies to the main or supplementary contour, the maximum propagation mode (1) auxiliary contour distances on any azimuth is limited to the corresponding main or supplementary propagation mode (1) distance. In effect this means that the correction factor will limit the possible range of auxiliary contour values so that only those auxiliary contours with values greater than the applied correction factor will be shown within the main or supplementary contour (see Figure VI-1). For example, if the value of correction factor applicable to the propagation mode (1) main or supplementary contour is 10 dB, then the first auxiliary contour drawn would be for a reduction in minimum required loss of 5 dB and hence the auxiliary contour value would be –15 dB (by convention, auxiliary contours are shown as negative quantities as they represent a reduction in the terrestrial, or receiving earth station, antenna gain, or the terrestrial station e.i.r.p.).

Propagation mode (2) interference effects may still need to be considered even if propagation mode (1) interference effects have been eliminated from detailed coordination, as the propagation models are based on different interference mechanisms.



The propagation mode (1) auxiliary contours are shown for –10, –20, –30 and –40 dB adjustments in the minimum required loss.

FIGURE VI-1

Propagation mode (1) main contour and auxiliary contours

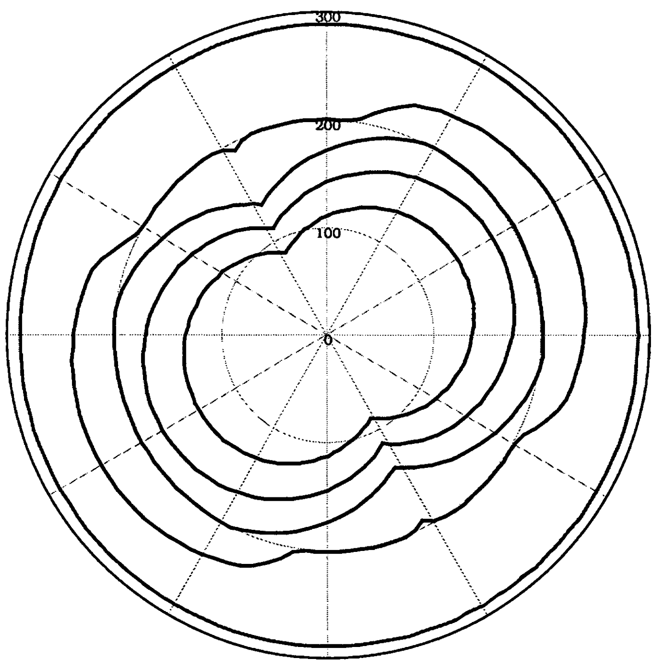
3.2 Auxiliary contours for propagation mode (2)

The propagation mode (2) contour around an earth station is calculated assuming the main beams of the coordinating earth station and the terrestrial station intersect exactly (see § 1.3 of the main body of this Appendix). However, it is unlikely that these antenna main beams will intersect exactly. It is therefore possible to generate propagation mode (2) auxiliary contours that take account of any offset in the pointing of the terrestrial station antenna beam from the direction of the coordinating earth station. This offset would result in partial beam intersections and hence a reduced interference potential. These propagation mode (2) auxiliary contours are calculated according to the method described in § 3.2.1 of this Annex.

Propagation mode (2) auxiliary contours are not generated for different values of antenna gain or e.i.r.p. but for different values of beam avoidance angle. Hence, if there is a need to consider both a lower value of antenna gain, or e.i.r.p., for the terrestrial station and propagation mode (2) auxiliary contours, it is first essential to consider the impact of the reduction in antenna gain, or e.i.r.p., on the propagation mode (2) contour. This is achieved by generating a supplementary contour (see § 2) corresponding to the lower value of antenna gain or e.i.r.p. for the terrestrial station, which is drawn on a separate map. Auxiliary mode (2) contours can then be generated inside this propagation mode (2) supplementary contour for different values of the beam avoidance angle. Hence, propagation mode (2) auxiliary contours may be most frequently applied in conjunction with a supplementary contour rather than with the coordination contour.

The correction factor discussed in § 1.3 of the main body of this Appendix does not apply to propagation mode (2) interference paths and hence is also not applicable to propagation mode (2) auxiliary contours. In addition propagation mode (2) auxiliary contours cannot be developed for the bidirectional case.

Propagation mode (2) auxiliary contours are prepared for appropriate values of terrestrial station main beam avoidance angle (see Figure VI-2). When the antenna characteristics of the terrestrial stations are known, the appropriate antenna pattern[10] should be used when determining the propagation mode (2) auxiliary contours. If this not available, the reference antenna pattern given in § 3.2.3 may be used.



The propagation mode (2) auxiliary contours are shown for terrestrial station main beam avoidance angles of 2.0, 2.7, 3.2 and 4.0 degrees respectively.

FIGURE VI-2

Propagation mode (2) main contour and auxiliary contours

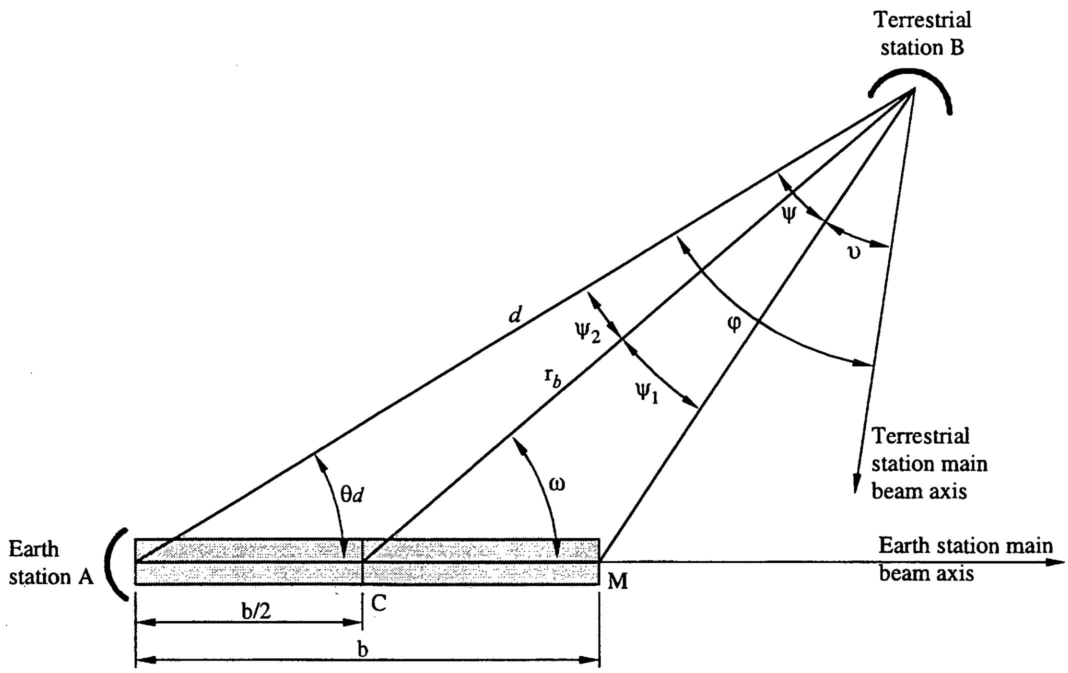
3.2.1 Determination of auxiliary contours for propagation mode (2)

Propagation mode (2) auxiliary contours allow the azimuthal offset of a terrestrial station antenna beam from the coordinating earth station's location to be taken into consideration. Figure VI-3 shows the hydrometeor scatter region projected on to the horizontal plane. In this figure the earth station and the terrestrial station are located at the points A and B respectively, where the terrestrial station is on a radial defined by the angle ω from the point C at the centre of the propagation mode (2) main, or supplementary, contour. Point C is also the centre of the auxiliary contour.

[10] The method requires the antenna pattern to be monotonic in terms of the reduction in gain either side of the main beam axis.

FIGURE VI-3

Propagation geometry in the horizontal plane



The shaded area in Figure VI-3 represents the critical region, along the earth station's main beam axis, between the earth station and the rain height. Within this critical region a common volume can be formed between the earth station beam and the beam of any terrestrial stations within the propagation mode (2) main, or supplementary, contour. This critical region's length is b and its maximum horizontal extent is at point M. Intersection of this critical region by the terrestrial station main beam axis, would result in significant hydrometeor scatter interference via main lobe to main lobe coupling.

For a given point within the propagation mode (2) main, or supplementary, contour, the angle subtended by the critical region is termed the critical angle, ψ. The protection angle, υ, represents the angle of the terrestrial station main beam axis away from the critical region. The beam avoidance angle between the terrestrial station's main beam axis and the earth station's location is φ. It is the sum of the two angles ψ and υ and it is this quantity that has a fixed value for a specific auxiliary contour. Each auxiliary contour is generated by varying the angle, ω, and deriving the distance (r_b) from point C to the auxiliary contour. As the angle ω increases from 0° to 360°, the angles ψ and υ change, but their sum remains the same.

The algorithm in § 3.2.2 of this Annex can be used to calculate the auxiliary propagation mode (2) contour for a given value of beam avoidance angle φ.

The method is based on iteratively decrementing the distance, r_b, between terrestrial station and the centre of the common volume, and starting at the main contour distance d_r, until either the shortest value of r_b is found for which the required minimum loss is achieved, or the minimum coordination distance is reached. For each value of r_b the critical angle ψ is determined and then the protection angle υ is calculated. The terrestrial station antenna gain corresponding to υ and the current distance r_b are used to obtain the propagation mode (2) path loss in equation (II-21).

The above process is repeated for each angle ω, to generate a complete auxiliary contour for a given value of beam avoidance angle φ. For some combinations of beam avoidance angle and angle ω an auxiliary contour may coincide with the main, or supplementary, propagation mode (2) contour.

3.2.2 The step-by-step algorithm

Auxiliary propagation mode (2) contours are constructed by calculating distances along radials from the centre of the circular mode (2) main, or supplementary, contour, which is the point C, at the distance b/2 from the earth station along the azimuth of its main beam axis. The distance b/2 is equal to Δd, where Δd is given by equation (II-23), see Annex II.

For the selected value of beam avoidance angle,φ, generate the auxiliary contour for values of angle, ω, ranging from 0° to 180° in steps of 1° as follows:

a) Set r_b to the main, or supplementary, mode (2) contour distance d_r calculated as described in § 3.1 of Annex II.

b) Compute ψ from:

$$\psi_1 = \text{arc tan}\left(\frac{b\sin\omega}{2r_b - b\cos\omega}\right) \qquad \text{(VI-1)}$$

$$\psi_2 = \text{arc tan}\left(\frac{b\sin\omega}{2r_b + b\cos\omega}\right) \qquad \text{(VI-2)}$$

$$\psi = \psi_1 + \psi_2 \qquad \text{(VI-3)}$$

c) If ψ > φ then the auxiliary mode (2) contour coincides with the main or supplementary mode (2) contour for the current value of ω, and the calculation for that value of ω is completed, and go to step j). Otherwise proceed through the following steps d) to i) until one of the terminating conditions described in step f) and step i) are satisfied.

d) Decrement r_b by subtracting 0.2 km from its value.

e) Recalculate the critical angle ψ using equations (VI-1), (VI-2) and (VI-3).

f) If $(0.5\ b \sin\omega/\sin\psi_2) < d_{min}$ the auxiliary mode (2) contour coincides with the minimum coordination distance d_{min} and the calculation for the current value of ω is completed and go to step j). Otherwise proceed to step g).

g) Compute the protection angle $\upsilon = \varphi - \psi$.

h) Calculate $G(\upsilon)$ the terrestrial station antenna gain at the angle υ relative to the beam axis using the reference antenna pattern given in this Annex.

i) In equation (II-21) use the gain calculated in step h) in place of G_χ and the current value of r_b in place of r_i and calculate the corresponding propagation mode (2) path loss L_r. If $L_r < L(p)$ then increment r_b by adding 0.2 km to its value and take this as the distance for the current radial. Otherwise repeat from step d).

j) Once the value of r_b has been found for the current value of angle ω, calculate the angle θ_d from the location of the earth station, and if appropriate the distance, d, to that contour point using:

$$d = 0.5\ b \sin \omega / \sin \psi_2 \qquad \text{(VI-4)}$$

$$\theta_d = \omega - \psi_2 \qquad \text{(VI-5)}$$

An auxiliary propagation mode (2) contour is symmetrical about the earth station main beam axis. Thus values of d and θ_d corresponding to the values of ω from 181° to 359° can be found by noting that results for a given value of ω are the same as for $(-\omega)$ or $(360°-\omega)$.

The step size for incrementing r_b used above, 0.2 km, is suitable for most situations. It controls the granularity of the result when viewed as a set of r_b values. For low values of earth station beam elevation the granularity becomes more noticeable in the values of d and θ_d, and a smaller step size may be used.

3.2.3 Reference radiation patterns for line-of-sight radio-relay system antennas

The reference radiation pattern for line-of-sight radio-relay system antennas in this section is used for the unknown terrestrial station antenna in the propagation mode (2) auxiliary contour calculations when the actual antenna pattern is not available.

a) In cases where the ratio between the antenna diameter and the wavelength is greater than 100, the following equation is used:

$$G(\varphi) = G_{amax} - 2.5 \times 10^{-3} \left(\frac{D}{\lambda}\varphi\right)^2 \quad \text{for} \quad 0 < \varphi < \varphi_m \qquad \text{(VI-6)}$$

$$G(\varphi) = G_1 \quad \text{for} \quad \varphi_m \le \varphi < \varphi_r \qquad \text{(VI-7)}$$

$$G(\varphi) = 32 - 25 \log \varphi \quad \text{for} \quad \varphi_r \le \varphi < 48° \qquad \text{(VI-8)}$$

$$G(\varphi) = -10 \quad \text{for} \quad 48° \le \varphi \le 180° \qquad \text{(VI-9)}$$

$$G_1 = 2 + 15 \log \frac{D}{\lambda} \qquad \text{(VI-10)}$$

$$\varphi_m = \frac{20\lambda}{D}\sqrt{G_{amax} - G_1} \qquad \text{(VI-11)}$$

$$\varphi_r = 15.85\left(\frac{D}{\lambda}\right)^{-0.6} \qquad \text{(VI-12)}$$

b) In cases where the ratio between the antenna diameter and the wavelength is less than or equal to 100, the following equation should be used:

$$G(\varphi) = G_{amax} - 2.5 \times 10^{-3} \left(\frac{D}{\lambda}\varphi\right)^2 \quad \text{for} \quad 0 < \varphi < \varphi_m \qquad \text{(VI-13)}$$

$$G(\varphi) = G_1 \quad \text{for} \quad \varphi_m \le \varphi < 100\frac{\lambda}{D} \qquad \text{(VI-14)}$$

$$G(\varphi) = 52 - 10\log\frac{D}{\lambda} - 25\log\varphi \qquad \text{for} \quad 100\frac{\lambda}{D} \leq \varphi < 48° \qquad \text{(VI-15)}$$

$$G(\varphi) = 10 - 10\log\frac{D}{\lambda} \qquad \text{for} \quad 48° \leq \varphi \leq 180° \qquad \text{(VI-16)}$$

c) In cases where only the maximum antenna gain is known, D/λ can be estimated from the following expression:

$$20\log\frac{D}{\lambda} \approx G_{a\max} - 7.7 \qquad \text{(VI-17)}$$

where

G_{amax}: main beam axis antenna gain (dBi).

D: antenna diameter (metres)

λ: wavelength (metres)

G_1: gain of the first side lobe (dBi)

4 Determination of a supplementary contour using the time variant gain (TVG) method

The TVG method requires the cumulative distribution of the time-varying horizon antenna gain of an earth station operating to a non-geostationary space station. In comparison to the TIG method, the TVG method usually produces smaller distances, but requires greater effort in determining the cumulative distribution of the horizon gain of the earth station antenna for each azimuth to be considered.

The TVG method closely approximates the convolution of the distribution of the horizon gain of the earth station antenna and the propagation mode (1) path loss. This method may produce slightly smaller distances than those obtained by an ideal convolution. An ideal convolution cannot be implemented due to the limitations of the current model for propagation mode (1). The propagation mode (1) required distance, at the azimuth under consideration, is taken as the largest distance developed from a set of calculations, each of which is based on equation (4) of the main body of this Appendix. For convenience, in these calculations, this equation may be rewritten for the *n*th calculation in the following form:

$$L_b(p_v) - G_e(p_n) = Pt + G_x - P_r(p)\ dB \qquad \text{(VI-18)}$$

with the constraint

$$p_v = \begin{cases} 100\, p/p_n & \text{for } p_n \geq 2p \\ 50 & \text{for } p_n < 2p \end{cases} \quad \text{percent}$$

where:

P_t, $P_r(p)$: as defined in equations in § 1.3 of the main body of this Appendix where p is the percentage of time associated with permissible interference power $P_r(p)$;

G_χ: the maximum antenna gain assumed for the terrestrial station (dBi). Tables 1 and 2 of Annex VII give values for G_χ for the various frequency bands;

$G_e(p_n)$: the horizon gain of the coordinating earth station antenna (dBi) that is exceeded for p_n% of the time on the azimuth under consideration;

$L_b(p_v)$: the propagation mode (1) minimum required loss (dB) for p_v% of the time; this loss must be exceeded by the propagation mode (1) predicted path loss for all but p_v% of the time.

The values of the percentages of time, p_n , to be used in equation (VI-18) are determined in the context of the cumulative distribution of the horizon gain. This distribution needs to be developed for a predetermined set of values of horizon gain spanning the range from the minimum to the maximum values for the azimuth under consideration. The notation G_e (p_n) denotes the value of horizon gain for which the complement of the cumulative distribution of the horizon gain has the value corresponding to the percentage of time p_n. The $p_n$value is the percentage of time that the horizon gain exceeds the *n*th horizon gain value. The procedure in § 4.1 may be used to develop this distribution.

For each value of p_n, the value of horizon antenna gain for this time percentage, $G_e(p_n)$, is used in equation (VI-18) to determine a propagation mode (1) minimum required loss. The propagation mode (1) predicted path loss is to exceed this propagation mode (1) required loss for no more than p_v percent of the time, as specified by the constraint to equation (VI-18). A series of propagation mode (1) distances are then determined using the procedures described in § 4 of the main body of this Appendix.

The propagation mode (1) required distance is then the maximum distance in the series of propagation mode (1) distances that are obtained for any value of p_n subject to the constraint applied to equation (VI-18). A detailed description of the method for using equation (VI-18) to determine the propagation mode (1) required distance is provided in § 4.2.

Further information, including examples, may be found in the latest version of Recommendation ITU-R SM.1448.

4.1 Determination of the horizon antenna gain distribution for the TVG method

The time variant gain (TVG) method for the determination of an earth station's supplementary contour requires the determination of the horizon antenna gain statistics for all azimuths (in suitable increments, e.g. 5°) around the earth station. In considering the horizon gain of the antenna for either a transmitting or a receiving earth station, only the horizon gain values during the operational time are to be considered. In developing the cumulative distributions of horizon gain, the percentages of time are percentages of operational time. Thus, there may be periods of time for which no horizon gain is specified.

The determination of the horizon gain distribution requires both earth station and orbital information including whether, or not, station keeping is used to maintain a single orbital path (repeating/non-repeating ground track system). The cumulative distribution of the time-varying horizon gain of a transmitting or a receiving earth station antenna operating to non-geostationary space stations is calculated as follows:

1) Simulate the constellation of the non-geostationary space station over a sufficiently long period, with a time step appropriate for the orbit altitude, to obtain a valid representation of the antenna gain variations. For repeating ground track constellations, simulate the orbital path for each satellite visible from the earth station over a period of the ground track. For non-repeating ground track constellations, simulate the orbit of a each satellite in the constellation over a period long enough to get a stable representation of the distribution.

2) At each time step, determine the azimuth and elevation angle of each satellite that is both visible at the earth station and above the minimum elevation angle at which the earth station operates. In addition to the minimum elevation angle, other criteria could be used to avoid certain geometric configurations, e.g., geostationary orbit arc avoidance (no transmission between an earth station and a non-geostationary satellite that is within +/- X degrees from the geostationary orbit arc);

3) At each step, and for each satellite in communication with the earth station, use the actual earth station antenna pattern, or a formula giving a good approximation of it, to calculate the gain towards the horizon at each azimuth and elevation angle around the earth station;

4) The horizon antenna gain varies over the range G_{min} to G_{max}. Choose a gain increment g (dB) and partition the gain range by a number of gain levels between G_{min} and G_{max},

i.e., $G = \{G_{min}, G_{min} + g, G_{min} + 2\,g, \ldots, G_{max}\}$.

These gain levels determine a set of gain intervals so that the nth gain interval ($n = 1, 2, 3, \ldots$) includes gain values equal to, or greater than, $G_{min} + (n-2)g$ and less than $G_{min} + (n-1)g$.

A value of $g = 0.1$ to 0.5 dB is recommended.

For each azimuth on the horizon around the earth station, accumulate the time that the horizon gain takes a value in each gain interval of width g (dB).

5) The probability density function (pdf) on each azimuth is determined by dividing the time in each gain interval by the total simulation time.

Determine the cumulative distribution function (cdf) of horizon gain at each azimuth by accumulating the gain density function at that azimuth. The value of the required cdf at any specific gain value is the percentage of time that the gain is less than, or equal to, that gain value.

4.2 Determination of the supplementary contour distance using the TVG method

This calculation is based on a cumulative distribution of the horizon gain of the earth station antenna for each azimuth to be considered (in suitable angular increments e.g., 5°). Appropriate distributions for this purpose may be developed by the method in § 4.1. The process for calculating the supplementary contour distance for each azimuth is described in the following procedure.

1) From the complementary cumulative distribution of the horizon antenna gain, for the azimuth under consideration, determine the percentage of time p_n that the horizon gain exceeds the level G_{en}, where

$$G_{en} = G_{min} + (n-1)g \quad (n = 1, 2, 3, \ldots) \qquad \text{(VI-19)}$$

with

G_{min}: the minimum value of horizon gain, and

g is a gain increment

2) For each percentage p_n that is equal to or greater than 2p percent, the percentage of time to be used in determining the propagation mode (1) path loss is p_v.

$$p_v = 100\, p/p_n \ \% \quad \text{for} \quad p_n \geq 2p\ \% \qquad \text{(VI-20)}$$

For each percentage of time, determine the distance, d_n (km), for which the propagation mode (1) predicted path loss is equal to the propagation mode (1) minimum required loss using the propagation model in accordance with § 4 of the main body of this Appendix and the equation

$$L_{bn}(p_v) = P_t + G_{en} + G_\chi - P_r(p) \quad \text{dB} \qquad \text{(VI-21)}$$

The values of p_v must be within the range of percentage of time of the propagation mode (1) model (see §1.5.1 of the main body of this Appendix).

3) The propagation mode (1) required distance for the azimuth under consideration is the largest of the distances, d_n (km), calculated in step 2, except when this largest distance is attained for the smallest value of p_n that is equal to or greater than $2p$ in accordance with equation (VI-20). In such cases, the propagation mode (1) required distance for the azimuth under consideration is the distance determined from equation (VI-21) with $G_{en} = G_{max}$ and $p_v = 50\%$ where G_{max} is the maximum value of horizon gain.

4) The propagation mode (1) supplementary contour distance for the azimuth under consideration is the required distance as determined in step 3, except that the distance must be between the minimum coordination distance (d_{min}) and the maximum coordination distance (d_{max1}). These limits are given in § 4.2 and § 4.3 of the main body of this Appendix respectively.

ANNEX VII

System parameters and predetermined coordination distances for determination of the coordination area around an earth station

1 Introduction

Tables 1-3 contain the system parameter values required by the methods in the main body of this Appendix to determine the coordination area around an earth station when the band is shared with terrestrial radiocommunication services or other earth stations operating in the opposite direction of transmission.

Table 1 is limited to those system parameter values required for the case of a transmitting earth station sharing with terrestrial services; Table 2 is limited to those parameter values required for the case of a receiving earth station sharing with terrestrial services; Table 3 is limited to those parameter values required for the case of a transmitting earth station which is sharing in a bidirectionally allocated band with other earth stations operating in the opposite direction of transmission.

These system parameter Tables include primary allocations to the space and terrestrial services in Article S5 of the Radio Regulations in all bands between 100 MHz and 105 GHz. Some of the columns have incomplete information. In some cases, this is because there is no requirement to calculate coordination distances as pre-determined coordination distances apply. In other cases, the service allocations are new and the systems may not be introduced for some years. Hence, the system parameters are the subject of ongoing development within the ITU-R Study Groups.

Parameters specific to the earth station, for which coordination is being sought, are provided to the BR in the format specified in RR Appendix S4 as part of the notification and coordination processes.

The row in each Table entitled "method to be used" directs the user to the appropriate section of the main body of this Appendix which describes the methods to be followed for the determination of the coordination area.

Note that the earth station for which the coordination area is to be determined is identified by the service designation given in the first row of each Table.

When a supplementary contour is to be developed, for example for digital fixed systems, the necessary system parameters may be found in one of the adjacent columns in Tables 1, 2 and 3 of this Annex. If no suitable system parameters are available then the value of the permissible interference power ($P_r(p)$) may be calculated using equation (1) of § 2.

The predetermined coordination distances specified in Table 4 are used for transmitting and receiving earth stations, in cases defined by the corresponding frequency sharing situation.

2 Calculation of the permissible interference power of an interfering emission

Tables 1, 2 and 3 contain values for the parameters which are required for the calculation of the permissible interference power of the interfering emission (dBW), in the reference bandwidth, to be exceeded for no more than $p\%$ of the time at the receiving antenna terminal of a station subject to interference, from a single source of interference, using the general formula:

$$P_r(p) = 10 \log (k\, T_e\, B) + N_L + 10 \log (10^{M_S / 10} - 1) - W \quad \text{dBW} \qquad (1)$$

where:

k: Boltzmann's constant, 1.38×10^{-23} J/K

T_e: the thermal noise temperature of the receiving system (K), at the terminal of the receiving antenna (see § 2.1 of this Annex)

N_L: link noise contribution (see § 2.2 of this Annex)

B: the reference bandwidth (Hz), i.e., the bandwidth in the receiving station that is subject to the interference and over which the power of the interfering emission can be averaged

p: the percentage of the time during which the interference from one source may exceed the permissible interference power value; since the entries of interference are not likely to occur simultaneously: $p = p_0/n$

p_0: the percentage of the time during which the interference from all sources may exceed the threshold value

n: the number of equivalent equal level, equal probability entries of interference, assumed to be uncorrelated for small percentages of the time

M_s: link performance margin (dB) (see § 2.3 of this Annex)

W: a thermal noise equivalence factor (dB) for interfering emissions in the reference bandwidth. It is positive when the interfering emissions would cause more degradation than thermal noise (see § 2.4 of this Annex).

In certain cases, an administration may have reason to believe that, for its receiving earth station, a departure from the values associated with the earth station, as listed in Table 2, may be justified. Attention is drawn to the fact that for specific systems the bandwidths B or, for example in the case of demand assignment systems, the percentages of the time p and p_0 may have to be changed from the values given in Table 2.

2.1 Calculation of the noise temperature of the receiving system

The noise temperature, in kelvins, of the receiving system, referred to the output terminals of the receiving antenna, may be determined (unless specifically given in Table 1) from:

$$T_e = T_a + (\ell_{tl} - 1)290 + \ell_{tl} T_r \quad (K) \tag{2}$$

where:

T_a: noise temperature contributed by the receiving antenna

ℓ_{tl}: numerical loss in the transmission line (e.g. a waveguide) between the antenna terminal and the receiver front end

T_r: noise temperature of the receiver front end, including all successive stages at the front end input.

For radio-relay receivers and where the waveguide loss of a receiving earth station is not known, a value of $\ell_{tl} = 1.0$ is used.

In case of determination of the coordination contours between two earth stations operating in the opposite direction of transmission, the following earth station receiving system noise temperatures should be used if the value is not provided in Table 3. This assumption is necessary because the receiving earth station takes the place of a receiving terrestrial station in the calculations.

Frequency range (GHz)	T_e (K)
$f < 10$	75
$10 < f < 17$	150
$f > 17$	300

2.2 Determination of the factor N_L

The factor N_L is the noise contribution to the link. In the case of a satellite transponder, it includes the up-link noise, intermodulation, etc. In the absence of table entries, it is assumed:

N_L = 1 dB for fixed-satellite links

N_L = 0 dB for terrestrial links.

2.3 Determination of the factor M_s

The factor M_s is the factor by which the link noise under clear-sky conditions would have to be raised to equal the permissible interference power.

2.4 Determination of the factor *W*

The factor *W* (dB) is the level of the radio-frequency thermal noise power relative to the received power of an interfering emission which, in the place of the former and contained in the same (reference) bandwidth, would produce the same interference (e.g., an increase in the voice or video channel noise power, or in the bit error ratio). The factor *W* generally depends on the characteristics of both the wanted and the interfering signals.

When the wanted signal is digital, *W* is usually equal to or less than 0 dB, regardless of the characteristics of the interfering signal.

3 Horizon antenna gain for a receiving earth station with respect to a transmitting earth station

For the determination of the coordination area of a transmitting earth station with respect to a receiving earth station in a bidirectionally allocated band, it is necessary to calculate the horizon antenna gain of the unknown earth station. In cases where the unknown receiving earth stations operate to geostationary satellites, Table 3 provides the necessary receiving earth station parameters for the calculation procedure, which is described in § 2.1 of Annex V.

In the case where the unknown receiving earth station operates to non-geostationary satellites, the horizon antenna gain to be used for all azimuths is provided in Table 3. The tabulated values were determined by using the method described in § 2.2 of the main body of this Appendix, which uses the maximum and minimum values of antenna horizon gain. For this purpose the maximum antenna horizon gain is the gain of the antenna for an off-axis angle equal to the minimum operating elevation angle. The minimum horizon gain is the gain at large off-axis angles, usually more than 36 or 48 degrees.

In determining the TIG horizon gain entries in Table 3, the difference between the maximum and minimum horizon gain did not exceed 30 dB. Consequently, the TIG horizon gain was taken as the lesser of the maximum horizon gain or 20 dB more than the minimum horizon gain. For the purpose of determining the TIG horizon gain, the reference antenna pattern of § 3 of Annex III was used, except in cases noted in the Tables where a different pattern was deemed to be more appropriate.

TABLE 1a

Parameters required for the determination of coordination distance for a transmitting earth station

Transmitting space radiocommunication service designation		Mobile-satellite		Mobile-satellite, space operation	Earth exploration-satellite, meteorological satellite		Space operation	Space research, Space operation	Mobile-satellite	Space operation		Mobile-satellite, radio-determination satellite	Mobile-satellite		Mobile -satellite		Space operation, Space research		Mobile-satellite		Space research, Space operation, Earth exploration-satellite
Frequency bands (MHz)		121.45-121.55		148.0-149.9	401-403		433.75-434.25	449.75-450.25	806-840	1 427-1 429		1 610-1 626.5	1 675-1 700		1 675-1 710		1 750-1 850		1 980-2 025		2 025-2 110 2 110-2 120 (Deep space)
Receiving terrestrial service designations		Aeronautical mobile		Fixed, mobile	Fixed, mobile, meteorological aids		Amateur, radio-location fixed, mobile	Fixed, mobile, radio-location	Fixed, mobile broadcasting, aeronautical radionavigation	Fixed, mobile		Aeronautical, radionavigation	Meteoro-logical aids		Fixed, mobile		Fixed, mobile		Fixed, mobile		Fixed, mobile
Method to be used		§ 1.4.7		§ 2.1, § 2.2	§ 2.1, § 2.2		§ 2.1, § 2.2	§ 2.1, § 2.2	§ 1.4.6	§ 2.1, § 2.2		§ 1.4.6	§ 1.4.6		§ 1.4.6		§ 2.1, § 2.2		§ 1.4.6		§ 2.1, § 2.2
Modulation at terrestrial station (1)		A	N	A	A	N		A&N	A&N	A	N		A	N	A	N	A	N	A	N	A
Terrestrial	P_0(%)			1.0				0.01	0.01	0.01	0.01				0.01	0.01	0.01	0.01	0.01		0.01
Station	n			1				2	2	2	2				2	2	2	2	2		2
interference	P(%)			1.0				0.005	0.005	0.005	0.005				0.005	0.005	0.005	0.005	0.005		0.005
parameters	N_L (dB)			-				0	0	0	0				0	0	0	0	0		0
And	M_s (dB)			-				20	20	33	33				33	33	33	33	26(2)		26(2)
Criteria	W (dB)			-				0	0	0	0				0	0	0	0	0		0
Terrestrial station	G_x (dBi) (3)			8				16	16	33	33				35	35	35	35	49(2)		49(2)
parameters	T_e (K)			-				750	750	750	750				750	750	750	750	500(2)		500(2)
Reference bandwidth	B (Hz)			14×10^3				12.5×10^3	12.5×10^3	4×10^3	10^6				4×10^3	10^6	4×10^3	10^6	4×10^3		4×10^3
Permissible interference power	$P_r(p)$ (dBW) in B			–153				–139	–139	–131	–107				–131	–107	–131	–107	–140		–140

NOTES to Table 1a:

(1) A: analogue modulation; N: digital modulation.

(2) The parameters for the terrestrial station associated with transhorizon systems have been used. Line-of-sight radio-relay parameters associated with the frequency band 1 675-1 710 MHz may also be used to determine a supplementary contour.

(3) Feeder losses are not included.

TABLE 1b

Parameters required for the determination of coordination distance for a transmitting earth station

Transmitting space radiocommunication service designation		Fixed-satellite, mobile-satellite	Fixed-satellite	Fixed-satellite	Fixed-satellite		Space operation, space research		Fixed-satellite, mobile-satellite, meteorological-satellite		Fixed-satellite		Fixed-satellite		Fixed-satellite	Fixed-satellite (3)	Fixed-satellite	Fixed-satellite (3)
Frequency bands (GHz)		2.655-2.690	5.091-5.150	5.725-5.850	5.725-7.075		7.100-7.235 (5)		7.900-8.400		10.7-11.7		12.5-14.8		13.75-14.3	15.43-15.65	17.7-18.4	19.3-19.7
Receiving terrestrial service designations		Fixed, mobile	Aeronautical radio-navigation	Radio-location	Fixed, mobile		Fixed, mobile		Fixed, mobile		Fixed, mobile		Fixed, mobile		Radiolocation radio-navigation	Aeronautical radionavigation	Fixed, mobile	Fixed, mobile
Method to be used		§ 2.1		§ 2.1	§ 2.1		§ 2.1, § 2.2		§ 2.1		§ 2.1		§ 2.1, § 2.2				§ 2.1, § 2.2	§ 2.2
Modulation at terrestrial station (1)		A			A	N	A	N	A	N	A	N	A	N			N	N
Terrestrial	p_0(%)	0.01			0.01	0.005	0.01	0.005	0.01	0.005	0.01	0.005	0.01	0.005			0.005	0.005
Station	n	2			2	2	2	2	2	2	2	2	2	2			2	2
interference	p(%)	0.005			0.005	0.0025	0.005	0.0025	0.005	0.0025	0.005	0.0025	0.005	0.0025			0.0025	0.0025
Parameters	N_L (dB)	0			0	0	0	0	0	0	0	0	0	0			0	0
And	M_s (dB)	26 (2)			33	37	33	37	33	37	33	40	33	40			25	25
Criteria	W (dB)	0			0	0	0	0	0	0	0	0	0	0			0	0
Terrestrial station	G_x (dBi) (4)	49 (2)	6		46	46	46	46	46	46	50	50	52	52			48	48
Parameters	T_e (K)	500 (2)			750	750	750	750	750	750	1 500	1 100	1 500	1 100			1 100	1 100
Reference bandwidth	B (Hz)	4×10^3	150×10^3		4×10^3	10^6	4×10^3	10^6	4×10^3	10^6	4×10^3	10^6	4×10^3	10^6			10^6	10^6
Permissible interference power	$P_r(p)$ (dBW) in B	−140	−160		−131	−103	−131	−103	−131	−103	−128	−98	−128	−98			−113	−113

NOTES to Table 1b:

(1) A: analogue modulation; N: digital modulation.

(2) The parameters for the terrestrial station associated with transhorizon systems have been used. Line-of-sight radio-relay parameters associated with the frequency band 5 725-7 075 MHz may also be used to determine a supplementary contour with the exception that G_x = 37 dBi.

(3) Feeder links of non-geostationary satellite systems in the mobile-satellite service.

(4) Feeder losses are not included.

(5) Actual frequency bands are 7 100-7 155 MHz and 7 190-7 235 MHz for space operation service and 7 145-7 235 MHz for the space research service.

TABLE 1c

Parameters required for the determination of coordination distance for a transmitting earth station

Transmitting space radiocommunication service designation		Fixed-satellite	Fixed-satellite (2)	Fixed-satellite (3)	Space research	Earth exploration-satellite, space research	Fixed-satellite, mobile-satellite, radionavigation satellite	Fixed-satellite (2)	Fixed-satellite, mobile-satellite	Fixed-satellite	Fixed-satellite
Frequency bands (GHz)		24.75-25.25 27.0-29.5	28.6-29.1	29.1-29.5	34.2-34.7	40.0-40.5	42.5-51.4	47.2-50.2	71.0-75.5	92.0-94.0	94.1-95.0
Receiving terrestrial service designations		Fixed, mobile	Fixed, mobile	Fixed, mobile	Fixed, mobile, radio-location	Fixed, mobile	Fixed, mobile, radionavigation	Fixed, mobile	Fixed, mobile	Fixed, mobile, radiolocation	Fixed, mobile, radiolocation
Method to be used		§ 2.1	§ 2.2	§ 2.2		§ 2.1, § 2.2	§ 2.1, § 2.2	§ 2.2	§ 2.1, § 2.2	§ 2.1, § 2.2	§ 2.1, § 2.2
Modulation at terrestrial station (1)		N	N	N		N	N	N	N	N	N
Terrestrial station interference parameters and criteria	p_0(%)	0.005	0.005	0.005		0.005	0.005	0.001	0.002	0.002	0.002
	n	1	2	1		1	1	1	2	2	2
	p(%)	0.005	0.0025	0.005		0.005	0.005	0.001	0.001	0.001	0.001
	N_L (dB)	0	0	0		0	0	0	0	0	0
	M_s (dB)	25	25	25		25	25	25	25	25	25
	W (dB)	0	0	0		0	0	0	0	0	0
Terrestrial station parameters	G_x (dBi) (4)	50	50	50		42	42	46	45	45	45
	T_e (K)	2 000	2 000	2 000		2 600	2 600	2 000	2 000	2 000	2 000
Reference bandwidth	B (Hz)	10^6	10^6	10^6		10^6	10^6	10^6	10^6	10^6	10^6
Permissible interference power	$P_r(p)$ (dBW) in B	−111	−111	−111		−110	−110	−111	−111	−111	−111

NOTES to Table 1c:

(1) A: analogue modulation; N: digital modulation.

(2) Non-geostationary satellites in the fixed-satellite service.

(3) Feeder links to non-geostationary-satellite systems in the mobile-satellite service.

(4) Feeder losses are not included.

TABLE 2a

Parameters required for the determination of coordination distance for a receiving earth station

Receiving space radiocommunication service designation			Space operation, space research	Meteoro-logical satellite, mobile satellite	Space research	Space research, space operation	Space operation	Mobile satellite	Meteoro-logical satellite	Mobile-satellite	Space research space operation	Space operation	Meteor-ological satellite Earth exploration-satellite	Space operation	Broad-casting satellite	Mobile satellite	Broad-casting satellite (DAB)	Mobile satellite, land-mobile satellite, maritime mobile satellite
Frequency band (MHz)			137-138	137-138	143.6-143.65	174-184	163-167 272-273(5)	335.4-399.9	400.15-401	400.15-401	400.15-401	401-402	460-470	549.75-550.25	620-790	856-890	1 452-1 492	1 492-1 530 1 555-1 559 2 160-2 200 (1)
Transmitting terrestrial service designations			Fixed, mobile	Fixed, mobile	Fixed, mobile, radio-location	Fixed, mobile, broad-casting	Fixed, mobile	Fixed, mobile	Meteor-logical aids	Meteor-logical aids	Meteor-logical aids	Meteor-logical aids, fixed, mobile	Fixed, mobile	Fixed, mobile, broad-casting	Fixed, mobile, broad-casting	Fixed, mobile, broad-casting	Fixed, mobile, broad-casting	Fixed, mobile
Method to be used			§ 2.1	§ 2.1	§ 2.1	§ 2.1	§ 2.1	§ 1.4.6	§ 1.4.6	§ 1.4.6	-	§ 2.1	§ 2.1	§ 2.1	§ 1.4.5	§ 1.4.6	§ 1.4.5	§ 1.4.6
Modulation at earth station (2)			N		N		N				N	N					N	N
Earth station Interference Parameters and criteria	p_0 (%)		0.1		0.1		1.0		0.012		0.1	0.1	0.012					10
	N		2		2		1		1		2	2	1					1
	p (%)		0.05		0.05		1.0		0.012		0.05	0.05	0.012					10
	N_L (dB)		0		0		0		0		0	0						0
	M_s (dB)		1		1		1		4.3		1	1						1
	W (dB)		0		0		0		0		0	0						0
Terrestrial Station Parameters	E (dBW) in B (3)	A	-		-		15				-	-	5				38	37(4)
		N	-		-		15				-	-	5				38	37
	P_t (dBW) in B	A	-		-		–1				-	-	–11				3	0
		N	-		-		–1				-	-	–11				3	0
	G_x (dBi)		-		-		16				-	-	16				35	37
Reference bandwidth	B (Hz)		1		1		10^3		177.5×10^3		1	1	85				25×10^3	4×10^3
Permissible interference power	$P_r(p)$ (dBW) in B		–199		–199		–173		–148		–208	–208	–178					–176

NOTES to Table 2a:

(1) In the bands 2 160-2 200 MHz, the terrestrial station parameters of line-of-sight radio-relay systems have been used. If an administration believes that, in this band 2 160-2 200 MHz transhorizon systems need to be considered, the parameters associated with the frequency band 2 500-2 690 MHz may be used to determine the coordination area.

(2) A: analogue modulation; N: digital modulation.

(3) E is defined as the equivalent isotropically radiated power of the interfering terrestrial station in the reference bandwidth.

(4) This value is reduced from the nominal value of 50 dBW for the purposes of determination of coordination area, recognizing the low probability of high power emissions falling fully within the relatively narrow bandwidth of the earth station.

(5) The fixed-service parameters provided in the column for 163-167 MHz and 272-273 MHz are only applicable to the band 163-167 MHz.

TABLE 2b

Parameters required for the determination of coordination distance for a receiving earth station

Receiving space radiocommunication service designation			Space operation (GSO and non-GSO)	Radio-navigation satellite	Meteor-ological satellite (non-GSO)	Meteor-ological satellite (GSO)	Space research near Earth (non-GSO & GSO)		Space research deep space (non-GSO)	Space operation (non-GSO and GSO)	Earth exploration-satellite (GSO)	Broadcasting satellite	Mobile satellite, radio-determination satellite	Fixed satellite, broadcasting satellite		Fixed satellite	
							Unmanned	Manned									
Frequency band (GHz)			1.525-1.535	1.559-1.610	1.670-1.710	1.670-1.710	1.700-1.710 2.200-2.290		2.290-2.300	2.200-2.290	2.200-2.290	2.310-2.360	2.4835-2.500 (6)	2.500-2.690		3.400-4.200	
Transmitting terrestrial service designations			Fixed	Fixed	Fixed, mobile, meteor-ological aids	Fixed, mobile, meteor-ological aids	Fixed, mobile		Fixed, mobile	Fixed, mobile	Fixed, mobile	Fixed, mobile, radiolocation	Fixed, mobile, radiolocation	Fixed, mobile radiolocation		Fixed, mobile	
Method to be used			§ 2.1, § 2.2	§ 2.1	§ 2.2 and (1)	§ 2.1 and (1)	§ 2.1, § 2.2		§ 2.2	§ 2.1, § 2.2	§ 2.1	§ 1.4.5	§ 1.4.6	§ 1.4.5 and § 2.1		§ 2.1	
Modulation at earth station (2)			N		N	N	N		N	N	N		N	A	N	A	N
Earth station Interference Parameters and criteria	p_0 (%)		1.0		0.006	0.011	0.1	0.001	0.001	1.0	1.0		10	0.03	0.003	0.03	0.005
	n		1		3	2	2	1	1	2	2		1	3	3	3	3
	p (%)		1.0		0.002	0.0055	0.05	0.001	0.001	0.5	0.5		10	0.01	0.001	0.01	0.0017
	N_L (dB)		0		0	0	0		0	0			0	1	1	1	1
	M_s (dB)		1		2.8	0.9	1		0.5	1			1	7	2	7	2
	W (dB)		0		0	0	0		0	0			0	4	0	4	0
Terrestrial Station Parameters	E (dBW) in B (3)	A	50		92(4)	92(4)	–27(4,5)		–27(5)	72(4)	72(4)		37	72(4)	72(4)	55	55
		N	37		-	-	–27		–27	76	76		37	76	76	42	42
	P_t (dBW) in B	A	13		40(4)	40(4)	–71(4,5)		–71(5)	28(4)	28(4)		0	28(4)	28(4)	13	13
		N	0		-	-	–71		–71	32	32		0	32	32	0	0
	Gx (dBi)		37		52	52	44		44	44	44		37	44	44	42	42
Reference bandwidth	B (Hz)		10^3		10^6	4×10^3	1		1	10^6	10^6		4×10^3	10^6	10^6	10^6	10^6
Permissible interference power	$P_r(p)$ (dBW) in B		–184		–142	–177	–216		–222	–154	–154		–176				

NOTES to Table 2b:

(1) See Table 4.

(2) A: analogue modulation; N: digital modulation.

(3) E is defined as the equivalent isotropically radiated power of the interfering terrestrial station in the reference bandwidth.

(4) In this band, the parameters for the terrestrial stations associated with transhorizon systems have been used. If an administration believes that transhorizon systems do not need to be considered, the line-of-sight radio-relay parameters associated with the frequency band 3.4-4.2 GHz may be used to determine the coordination area, with the exception that E = 50 dBW for analogue terrestrial stations; and Gx = 37 dBi. However, for the space research service only, noting footnote(5) when transhorizon systems are not considered, E = 20 dBW and Pt = –17 dBW for analogue terrestrial stations, E = –23 dBW and Pt = –60 dBW for digital terrestrial stations; and Gx = 37 dBi.

(5) These values are estimated for 1 Hz bandwidth and are 30 dB below the total power assumed for emission.

(6) In the band 2.4835-2.5 GHz the terrestrial station parameter of line-of-sight radio-relay systems have been used. If an administration believes that, in this band, transhorizon systems need to be considered, the parameters associated with the frequency band 2 500-2 610 MHz may be used to determine the coordination area.

TABLE 2c

Parameters required for the determination of coordination distance for a receiving earth station

Receiving space radiocommunication service designation		Fixed satellite		Fixed satellite radio-determination satellite	Fixed satellite	Fixed satellite		Meteoro-logical satellite (7,8)	Meteoro-logical satellite (9)	Earth exploration-satellite (7)	Earth exploration-satellite (9)	Space research (10)		Fixed satellite		Broadcasting-satellite		Fixed satellite (9)	Broad-casting satellite	Fixed satellite (7)
												Deep space								
Frequency band (GHz)		4.500-4.800		5.150-5.216	6.700-7.075	7.250-7.750		7.450-7.550	7.750-7.850	8.025-8.400	8.025-8.400	8.400-8.450	8.450-8.500	10.7-12.75		12.5-12.75 (12)		15.4-15.7	17.7-17.8	17.7-18.8 19.3-19.7
Transmitting terrestrial service designations		Fixed, mobile		Aeronautical radio-navigation	Fixed, mobile	Fixed, mobile		Fixed, mobile	Fixed, mobile	Fixed, mobile	Fixed, mobile	Fixed, mobile		Fixed, mobile		Fixed, mobile		Aeronautical radio-navigation	Fixed	Fixed, mobile
Method to be used		§ 2.1		§ 2.1	§ 2.2	§ 2.1		§ 2.1, § 2.2	§ 2.2	§ 2.1	§ 2.2	§ 2.2		§ 2.1, § 2.2		§ 1.4.5			§ 1.4.5	§ 2.1
Modulation at earth station (1)		A	N		N	A	N	N	N	N	N	N	N	A	N	A	N	-		N
Earth station interference parameters and criteria	p_0 (%)	0.03	0.005		0.005	0.03	0.005	0.002	0.001	0.083	0.011	0.001	0.1	0.03	0.003	0.03	0.003	0.003		0.003
	N	3	3		3	3	3	2	2	2	2	1	2	2	2	1	1	2		2
	p (%)	0.01	0.0017		0.0017	0.01	0.0017	0.001	0.0005	0.0415	0.0055	0.001	0.05	0.015	0.0015	0.03	0.003	0.0015		0.0015
	N_L (dB)	1	1		1	1	1	-	-	1	0	0	0	1	1	1	1	1		1
	M_s (dB)	7	2		2	7	2	-	-	2	4.7	0.5	1	7	4	7	4	4		6
	W (dB)	4	0		0	4	0	-	-	0	0	0	0	4	0	4	0	0		0
Terrestrial station parameters	E (dBW) in B (2) — A	92(3)	92(3)		55	55	55	55	55	55	55	25(5)	25(5)	40	40	55	55			35
	E (dBW) in B (2) — N	42(4)	42(4)		42	42	42	42	42	42	42	−18	−18	43	43	42	42		40	40
	P_t (dBW) in B — A	40(3)	40(3)		13	13	13	13	13	13	13	−17(5)	−17(5)	−5	−5	10	10			−10
	P_t (dBW) in B — N	0	0		0	0	0	0	0	0	0	−60	−60	−2	−2	−3	−3		−7	−5
	G_x (dBi)	52(3,4)	52(3,4)		42	42	42	42	42	42	42	42	42	45	45	45	45		47	45
Reference bandwidth(6)	B (Hz)	10^6	10^6		10^6	10^6	10^6	10^7	10^7	10^6	10^6	1	1	10^6	10^6	27 10^6	27 10^6			10^6
Permissible interference power	$P_r(p)$ (dBW) in B				−151.2			−125	−125	−154 (11)	−142	−220	−216			−131	−131			

NOTES to Table 2c:

(1) A: analogue modulation; N: digital modulation.

(2) E is defined as the equivalent isotropically radiated power of the interfering terrestrial station in the reference bandwidth.

(3) In this band, the parameters for the terrestrial stations associated with transhorizon systems have been used. If an administration believes that transhorizon systems do not need to be considered, the line-of-sight radio-relay parameters associated with the frequency band 3.4-4.2 GHz may be used to determine the coordination area.

(4) Digital systems assumed to be non-transhorizon. Therefore Gx = 42.0 dBi. For digital transhorizon systems, parameters for analogue transhorizon systems above have been used.

(5) These values are estimated for 1 Hz bandwidth and are 30 dB below the total power assumed for emission.

(6) In certain systems in the fixed-satellite service it may be desirable to choose a greater reference bandwidth B. However, a greater bandwidth will result in smaller coordination distances and a later decision to reduce the reference bandwidth may require recoordination of the earth station.

(7) Geostationary satellite systems.

(8) Non-geostationary satellites in the meteorological-satellite service notified in accordance with Radio Regulations S5.461A may use the same coordination parameters.

(9) Non-geostationary-satellite systems.

(10) Space research earth stations in the band 8.4-8.5 GHz operate with non-geostationary satellites.

(11) For large earth stations: $P_r(p) = (G - 180)$ dBW
For small earth stations: $P_r(20\%) = 2\,(G - 26) - 140$ dBW for $26 < G \leq 29$ dBi

$P_r(20\%) = G - 163$ dBW for $G > 29$ dBi

$P_r(p)\% = G - 163$ dBW for $G \leq 26$ dBi

(12) Applies to the broadcasting-satellite service in unplanned bands in Region 3.

TABLE 2d

Parameters required for the determination of coordination distance for a receiving earth station

Receiving space radiocommunication service designation			Meteoro-logical satellite	Fixed satellite	Fixed satellite (3)	Broad-casting satellite	Earth exploration-satellite (4)	Earth exploration-satellite (5)	Space research (Deep Space)	Space research		Fixed satellite (6)	Fixed satellite (5)	Mobile satellite	Broadcasting satellite, Fixed satellite	Mobile satellite	Radio-navigation	Broadcasting satellite
										Un-manned	Manned							
Frequency band (GHz)			18.1-18.3	18.8-19.3	19.3-19.7	21.4-22.0	25.5-27.0	25.5-27.0	31.8-32.3	37.0-38.0		37.5-40.5	37.5-40.5	39.5-40.5	40.5-42.5	43.5-47.0	43.5-47.0	84-86
Transmitting terrestrial service designations			Fixed, mobile	Fixed, Mobile	Fixed, mobile	Fixed, mobile	Fixed, mobile	Fixed, mobile	Fixed, radio-navigation	Fixed, mobile		Fixed, mobile	Fixed, mobile	Fixed, mobile	Broadcasting, fixed	Mobile	Mobile	Fixed, mobile, broadcasting
Method to be used			§ 2.1, § 2.2	§ 2.1, § 2.2	§ 2.2	§ 1.4.5	§ 2.2	§ 2.1	§ 2.1, § 2.2	§ 2.1, § 2.2		§ 2.2	§ 2.1	§ 1.4.6	§ 1.4.5 and § 2.1	§ 1.4.6	-	§ 1.4.5
Modulation at earth station (1)			N	N	N		N	N	N	N		N	N	N	-	N		
Earth station interference parameters and criteria	p_0 (%)			0.003	0.01		0.25	0.25	0.001	0.1	0.001	0.02	0.003					
	n			2	1		2	2	1	1	1		2					
	p (%)			0.0015	0.01		0.125	0.125	0.001	0.1	0.001		0.0015					
	N_L (dB)			0	0		0	0	0	0		1	1					
	M_s (dB)			5	5		11.4	14	1	1		6.8	6					
	W (dB)			0	0		0	0	0	0		0	0					
Terrestrial station parameters	E (dBW) in B (2)	A		-	-		-	-	-	-		-	-	-	-			
		N	40	40	40	40	42	42	−28	−28		35	35	35	44	40	40	
	P_t (dBW) in B	A		-	-		-	-	-	-		-	-	-	-			
		N	−7	−7	−7	−7	−3	−3	−81	−73		−10	−10	−10	−1	−7	−7	
	G_x (dBi)		47	47	47	47	45	45	53	45		45	45	45	45	47	47	
Reference bandwidth	B (Hz)			10^6	10^6		10^7	10^7	1	1		10^6	10^6	10^6	10^6			
Permissible interference power	$P_r(p)$ (dBW) in B			−140	−137		−120	−116	−216	−217		−140						

NOTES to Table 2d:

(1) A: analogue modulation; N: digital modulation.

(2) *E* is defined as the equivalent isotropically radiated power of the interfering terrestrial station in the reference bandwidth.

(3) Non-geostationary mobile-satellite service feeder links.

(4) Non-geostationary-satellite systems.

(5) Geostationary-satellite systems.

(6) Non-geostationary fixed-satellite systems.

TABLE 3a

Parameters required for the determination of coordination distance for a transmitting earth station in bands shared bidirectionally with receiving earth stations

Space service designation in which the transmitting earth station operates		Land mobile-satellite	Mobile-satellite	Land mobile-satellite	Earth exploration-satellite, meteoro-logical satellite	Mobile-satellite		Mobile-satellite		Fixed satellite, mobile satellite	Fixed satellite (3)		Fixed satellite	Fixed satellite, meteorological satellite	Fixed satellite
Frequency bands (GHz)		0.1499-0.15005	0.272-0.273	0.3999-0.40005	0.401-0.402	1.675-1.710		1.700-1.710		2.655-2.690	5.150-5.216		6.700-7.075	8.025-8.400	8.025-8.400
Space service designation in which the *receiving* earth station operates		Radio-navigation satellite	Space operation	Radio-navigation satellite	Space operation	Meteorological satellite		Space research near Earth		Fixed satellite, broadcasting satellite	Fixed satellite	Radio-deter-mina-tion satellite	Fixed satellite	Earth exploration-satellite	Earth exploration-satellite
								Un-Manned (10)	Manned						
Orbit(6)			Non-GSO		Non-GSO	Non-GSO	GSO	Non-GSO			Non-GSO		Non-GSO	Non-GSO	GSO
Modulation at receiving earth station (1)			N		N	N	N	N	N				N	N	N
Receiving earth station interference parameters and criteria	p_0(%)		1.0		0.1	0.006	0.011	0.1	0.001				0.005	0.011	0.083
	n		1		2	3	2	2	1				3	2	2
	p(%)		1.0		0.05	0.002	0.0055	0.05	0.001				0.0017	0.0055	0.0415
	N_L (dB)	0	0	0	0	0	0	0	0				1	0	1
	M_s (dB)	2	1	2	1	2.8	0.9	1	1	2	2	2	2	4.7	2
	W (dB)	0	0	0	0	0	0	0	0				0	0	0
Receiving earth station parameters	G_m(dBi) (2)	0	20	0	20	30	45				48.5		50.7		
	G_r (dBi) (4)	0	19	0	19	19(9)	See note (8)	10	10		10		10	10	See note (8)
	ε_{min} (5)	3°	10°	3°	10°	5°	3°	5°	5°	3°	3°	3°	3°	5°	3°
	T_e (K) (7)	200	500	200	500	370	118			75	75	75	75		
Reference bandwidth	B (Hz)	4×10^3	10^3	4×10^3	1	10^6	4×10^3	1	1				10^6	10^6	10^6
Permissible interference power	$P_r(p)$ (dBW) in B	−172	−177	−172	−208	−145	−178	−216	−216				−151	−142	−154

NOTES to Table 3a:

(1) A: analogue modulation; N: digital modulation.

(2) On-axis gain of the receive earth station antenna.

(3) Feeder links of non-geostationary-satellite systems in the mobile-satellite service.

(4) Horizon antenna gain for the receive earth station (refer to § 3 of the main body of this Appendix).

(5) Minimum elevation angle of operation in degrees (non-geostationary or geostationary).

(6) Orbit of the space service in which the receiving earth station operates (non-geostationary or geostationary).

(7) The thermal noise temperature of the receiving system at the terminal of the receiving antenna (under clear-sky conditions). Refer to § 2.1 of this Annex for missing values.

(8) Horizon antenna gain is calculated using the procedure of Annex V. Where no value of G_m is specified, a value of 42 dBi is to be used.

(9) Non-geostationary horizon antenna gain, $G_e = G_{min} + 20$ dB (see §2.2), with $G_{min} = 10 - 10 \log(D/\lambda)$, $D/\lambda = 13$ (refer to Annex III for definition of symbols)

(10) Unmanned space research is not a separate radiocommunication service and the system parameters are only to be used for the generation of supplementary contours.

TABLE 3b

Parameters required for the determination of coordination distance for a transmitting earth station in bands shared bidirectionally with receiving earth stations

Space service designation in which the transmitting earth station operates		Fixed satellite			Fixed satellite			Fixed satellite (3)	Fixed satellite	Fixed satellite	Fixed satellite (3)	Fixed satellite (3)	Earth exploration-satellite, space research			
Frequency bands (GHz)		10.7-11.7			12.5-12.75			15.43-15.65	17.3-17.8	17.7-18.4	19.3-19.6	19.3-19.6	40.0-40.5			
Space service designation in which the *receiving* earth station operates		Fixed satellite			Fixed satellite			Fixed satellite (3)	Broad-casting satellite	Fixed satellite, meteor-ological satellite	Fixed satellite (3)	Fixed satellite (4)	Fixed satellite, mobile satellite			
Orbit(7)		GSO		Non-GSO	GSO		Non-GSO	Non-GSO		GSO	Non-GSO	GSO	GSO	Non-GSO		
Modulation at receiving earth station (1)		A	N	N	A	N				N	N					
Receiving earth station Interference Parameters and criteria	p_0(%)	0.03	0.003		0.03	0.003		0.003		0.003	0.01	0.003	0.003			
	n	2	2		2	2		2		2	1	2	2			
	p(%)	0.015	0.0015		0.015	0.0015		0.0015		0.0015	0.01	0.0015	0.0015			
	N_L (dB)	1	1		1	1		1		1	0	1	1			
	M_s (dB)	7	4		7	4		4		6	5	6	6			
	W (dB)	4	0		4	0		0		0	0	0	0			
Receiving earth station parameters	G_m (dBi) (2)			51.9			31.2	48.4		58.6	53.2	49.5	50.8	54.4		
	G_r (5)	See note (9)	See note (9)	10	See note (9)	See note (9)	11(11)	10		See note (9)	10	See note (10)	See note (9)	7(12)		
	ε_{min} (6)	5°	5°	6°	5°	5°	10°	5°		5°	5°	10°	10°	10°		
	T_e (K) (8)	150	150		150	150		150		300	300	300	300			
Reference bandwidth	B (Hz)	10^6	10^6		10^6	10^6		2×10^6		10^6	10^6					
Permissible interference power	$P_r(p)$ (dBW) in B	–144	–144	–144	–144	–144	–144	–141		–138	–141					

NOTES to Table 3b:

(1) A: analogue modulation; N: digital modulation.

(2) On-axis gain of the receive earth station antenna.

(3) Feeder links of non-geostationary satellite systems in the mobile-satellite service.

(4) Geostationary-satellite systems.

(5) Horizon antenna gain for the receive earth station (refer to § 3 of the main body of the Appendix).

(6) Minimum elevation angle of operation in degrees (non-GSO or GSO).

(7) Orbit of the space service in which the receiving earth station operates (GSO or non-GSO).

(8) The thermal noise temperature of the receiving system at the terminal of the receiving antenna (under clear-sky conditions). Refer to § 2.1 of this Annex for missing values.

(9) Horizon antenna gain is calculated using the procedure of Annex V. Where no value of G_m is specified, a value of 42 dBi is to be used.

(10) Horizon antenna gain is calculated using the procedure of Annex V 160-1 100 MHz , except that the following antenna pattern may be used in place of that given in § 3 of Annex III: $G = 32 - 25 \log \phi$ for $1 \leq \phi < 48$; and $G = -10$ for $48 \leq \phi < 180$ (refer to Annex III for definition of symbols).

(11) Non-geostationary horizon antenna gain, $G_e = G_{max}$ (see § 2.2 of the main body of this Appendix) for $G = 36 - 25 \log (\phi) > -6$ (refer to Annex III for definition of symbols).

(12) Non-geostationary horizon antenna gain, $G_e = G_{max}$ (see § 2.2 of the main body of this Appendix) for $G = 32 - 25 \log (\phi) > -10$ (refer to Annex III for definition of symbols).

TABLE 4

Predetermined coordination distances

Frequency sharing situation		**Coordination distance(in sharing situations involving services allocated with equal rights) (km)**
Type of earth station	**Type of terrestrial service**	
Ground-based in the bands below 1 GHz to which S9.11A applies. Ground-based mobile in the bands within the range 1-3 GHz to which S9.11A applies	Mobile (aircraft)	500
Aircraft (mobile) (all bands)	Ground-based	500
Aircraft (mobile) (all bands)	Mobile (aircraft)	1 000
Ground-based in the bands: 400.15-401 MHz 1 675-1 700 MHz	Station in the meteorological aids service (radiosonde)	580
Aircraft (mobile) in the bands: 400.15-401 MHz 1 675-1 700 MHz	Station in the meteorological aids service (radiosonde)	1 080
Ground-based in the radiodetermination-satellite service (RDSS) in the bands: 1 610-1 626.5 MHz 2 483.5-2 500 MHz 2 500-2 516.5 MHz	Ground-based	100
Airborne earth station in the radiodetermination-satellite service (RDSS) in the bands: 1 610-1 626.5 MHz 2 483.5-2 500 MHz 2 500-2 516.5 MHz	Ground-based	400
Receiving earth stations in the meteorological-satellite service	Station in the meteorological aids service	The coordination distance is considered to be the visibility distance as a function of the earth station horizon elevation angle for a radiosonde at an altitude of 20 km above mean sea level, assuming 4/3 Earth radius (see NOTE 1)

[Transmit non-GSO MSS feeder-link earth station in the band 15.4-15.7 GHz	Aeronautical radionavigation	600]
[Receive non-GSO MSS feeder-link earth station in the band 15.4-15.7 GHz	Aeronautical radionavigation	600]
Non-GSO MSS feeder-link earth stations (all bands)	Mobile (aircraft)	500

NOTE 1 - The coordination distance, *d* (km), for fixed earth stations in the meteorological-satellite service vis-à-vis stations in the meteorological aids service assumes a radiosonde altitude of 20 km and is determined as a function of the physical horizon elevation angle ε_h (degrees) for each azimuth, as follows:

$$d = 100 \qquad \text{for} \quad \varepsilon_h \geq 11$$

$$d = 582\left(\sqrt{1 + (0.254\,\varepsilon_h)^2} - 0.254\,\varepsilon_h\right) \qquad \text{for} \quad 0 < \varepsilon_h < 11,$$

$$d = 582 \qquad \text{for} \quad \varepsilon_h \leq 0$$

The minimum and maximum coordination distances are 100 km and 582 km, and correspond with physical horizon angles greater than 11° and less than 0°.

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

Document 327-E*
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ISTANBUL, 8 MAY – 2 JUNE 2000

COMMITTEE 4

Israel (State of)

PROPOSALS FOR THE WORK OF THE CONFERENCE

In accordance with the decision taken by the Plenary Meeting of the Conference with regard to the addition of names of countries to the footnotes in Article S5, the Administration of Israel requests its inclusion in the following footnotes:

MOD ISR/327/1

S5.277 *Additional allocation:* in Angola, Armenia, Azerbaijan, Belarus, Cameroon, the Congo, Djibouti, Gabon, Georgia, Hungary, Israel, Kazakstan, Latvia, Mali, Moldova, Mongolia, Uzbekistan, Pakistan, Poland, Kyrgyzstan, Slovakia, the Czech Republic, Romania, Russian Federation, Rwanda, Tajikistan, Chad, Turkmenistan and Ukraine, the band 430-440 MHz is also allocated to the fixed service on a primary basis.

MOD ISR/327/2

S5.342 *Additional allocation:* in Belarus, Israel, Russian Federation and Ukraine, the band 1 429-1 535 MHz is also allocated to the aeronautical mobile service on a primary basis exclusively for the purposes of aeronautical telemetry within the national territory. As of 1 April 2007, the use of the band 1 452-1 492 MHz is subject to agreement between the administrations concerned.

MOD ISR/327/3

S5.350 *Additional allocation:* in Azerbaijan, Israel, Kyrgyzstan, Turkmenistan and Ukraine, the band 1 525-1 530 MHz is also allocated to the aeronautical mobile service on a primary basis.

MOD ISR/327/4

S5.363 *Alternative allocation:* in Israel and Sweden, the band 1 590-1 626.5 MHz is allocated to the aeronautical radionavigation service on a primary basis.

MOD ISR/327/5

S5.389F In Algeria, Benin, Cape Verde, Egypt, Israel, Mali, Syria and Tunisia, the use of the bands 1 980-2 010 MHz and 2 170-2 200 MHz by the mobile-satellite service shall neither cause harmful interference to the fixed and mobile services, nor hamper the development of those services prior to 1 January 2005, nor shall the former service request protection from the latter services.

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* Pursuant to Resolution 26 (Rev.WRC-97) the secretariat notes that this contribution was received on 22 May 2000.

MOD ISR/327/6

S5.481 *Additional allocation:* in Germany, Angola, China, Ecuador, Spain, Israel, Japan, Morocco, Nigeria, Oman, Democratic People's Republic of Korea, Sweden, Tanzania and Thailand, the band 10.45-10.5 GHz is also allocated to the fixed and mobile services on a primary basis.

MOD ISR/327/7

S5.499 *Additional allocation:* in Bangladesh, India, Israel and Pakistan, the band 13.25-14 GHz is also allocated to the fixed service on a primary basis.

MOD ISR/327/8

S5.512 *Additional allocation:* in Algeria, Angola, Saudi Arabia, Austria, Bahrain, Bangladesh, Bosnia and Herzegovina, Brunei Darussalam, Cameroon, the Congo, Costa Rica, Egypt, El Salvador, the United Arab Emirates, Finland, Guatemala, India, Indonesia, the Islamic Republic of Iran, Israel, Jordan, Kuwait, Libya, Malaysia, Morocco, Mozambique, Nepal, Nicaragua, Oman, Pakistan, Qatar, Singapore, Slovenia, Somalia, Sudan, Swaziland, Tanzania, Chad, Yemen and Yugoslavia, the band 15.7-17.3 GHz is also allocated to the fixed and mobile services on a primary basis.

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

Corrigendum 1 to
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WORKING GROUP 1
OF THE PLENARY

Replace page 1 of Document 328 with the attached.

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

Document 328-E
22 May 2000
Original: English

ISTANBUL, 8 MAY – 2 JUNE 2000

WORKING GROUP 1
OF THE PLENARY

Second Report of ad hoc Group 1 of GT PLEN-1

Ad hoc Group 1 of GT PLEN-1 had set up a further ad hoc Group under the chairmanship of Mr M. Panduro, Spain. The Group had the following:

Terms of reference

To produce a draft report for the consideration of GT PLEN-1 ad hoc Group 1 related to the following items:

a) Compatibility analysis of the proposed revised Appendices 30 and 30A Plans with other services and the Region 2 Plans as prepared by the IRG.

b) Review of the sharing situation described in item a) above, considering relevant proposals to WRC-2000.

Identification of documents considered by the Group

Addenda 1 and 2 to Document 14 (IAP)

Document 20 + Addendum (APT)

Document 34 + Corrigendum 3 + Addendum 4 (and Corr.1) + Addendum 17 (SG)

Addendum 12 to Document 35 (B)

Document 37 (F)

Document 130 (INT, for information)

Document 154 (CEPT + Arabs League)

Document 185 (APT)

The results, as approved by ad hoc 1 of GT PLEN-1, are included in the Appendix to this document for consideration. Once approved by GT PLEN-1, they will form the basis of relevant conference documents to change the Radio Regulations accordingly and to draft the mentioned Resolution.

C. DOSCH
Chairperson, ad hoc 1 of GT PLEN-1

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

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ISTANBUL, 8 MAY – 2 JUNE 2000

WORKING GROUP 1
OF THE PLENARY

Second Report of ad hoc Group 1 of GT PLEN-1

Ad hoc Group 1A of GT PLEN-1 had set up a further ad hoc Group under the chairmanship of Mr M. Panduro, Spain. The Group had the following:

Terms of reference

To produce a draft report for the consideration of GT PLEN-1 ad hoc Group 1 related to the following items:

a) Compatibility analysis of the proposed revised Appendices 30 and 30A Plans with other services and the Region 2 Plans as prepared by the IRG.

b) Review of the sharing situation described in item a) above, considering relevant proposals to WRC-2000.

Identification of documents considered by the Group

Addenda 1 and 2 to Document 14 (IAP)

Document 20 + Addendum (APT)

Document 34 + Corrigendum 3 + Addendum 4 (and Corr.1) + Addendum 17 (SG)

Addendum 12 to Document 35 (B)

Document 37 (F)

Document 130 (INT, for information)

Document 154 (CEPT + Arabs League)

Document 185 (APT)

The results, as approved by ad hoc 1 of GT PLEN-1, are included in the Appendix to this document for consideration. Once approved by GT PLEN-1, they will form the basis of relevant conference documents to change the Radio Regulations accordingly and to draft the mentioned Resolution.

C. DORD
Chairperson, ad hoc 1 of GT PLEN-1

APPPENDIX

1 Compatibility analysis of the proposed revised Appendices 30 and 30A Plans with other services and the Region 2 Plans as prepared by the IRG

1.1 Methodology

Document WRC2000/34 and its Corrigendum 3 describe the methodology applied by the IRG for the required compatibility analysis of the proposed revised Regions 1 and 3 Plans with other services and Region 2 BSS Plans. The Group noted this document and supports the use of this methodology but with updated sharing criteria (see section 2 of this Appendix).

During the revision of the Region 1 and Region 3 BSS and feeder-link Plans by WRC-2000, where assignments from the WRC-97 Plans were included with a conversion of modulation from analogue to digital or a change from normal roll-off to fast roll-off antenna characteristics, the coordination status afforded by the WRC-97 Plan should be preserved, since in such cases the assignments do not cause more interference or request more protection. In all other cases, the compatibility of the assignments included in the Region 1 and Region 3 BSS and feeder-link Plans shall be checked by using the criteria in this document.

1.2 Results of compatibility studies

Addendum 4 and Corrigendum 1 to Document WRC2000/34 provide the results of the compatibility studies carried out by the Bureau as required by the IRG. It was felt that, as a consequence of the need of considering the new Article 4 entries in the Plans ("existing systems" and "Part B") in the replanning process, the sharing situation described in this document may worsen. These are:

- interregional BSS-BSS compatibility;
- compatibility with terrestrial services;
- compatibility with non-planned FSS and other non-planned space services.

Consequently, it was agreed that some improvements should be made, either in the sharing criteria or through bilateral discussions between the concerned administrations during WRC-2000.

2 Review of the sharing situation described in section 1 above, considering relevant proposals to WRC-2000

2.1 Broadcasting satellite services/downlink

2.1.1 Regions 1 and 3 BSS into Region 2 BSS (section 3 of Annex 1 of APS30)

There are three Region 2 Administrations (GUY, DNK/GRL and JMC) which are potentially affected by two Region 1 Administrations (ISL and NGR) as a result of a compatibility analysis carried out by the Bureau related to the IRG Regions 1 and 3 proposed Plan. For the case of Iceland, the excesses with respect to the current criteria are lower than 2 dB (0.4 dB in case of GUY, 1.9 for DNK/GRL and 1.1 for JMC). For Niger, the relevant excesses are 8.8 dB towards GUY and 6.4 dB towards JMC. It is considered that these cases may be able to be solved on a case-by-case basis before the end of WRC-2000 in order to avoid the need for coordination with Region 2 BSS when taking this assignment into operation.

In addition, it was agreed that a WRC-2000 Resolution (still to be drafted) should request ITU-R to conduct further studies on the current sharing criteria between the Regions 1 and 3 and Region 2 BSS Plans (section 3 of Annex 1 of APS30) taking into account that these criteria have not been reviewed since WARC-77 in spite of the fact that WRC-97 had revised and WRC-2000 is about to revise the Regions 1 and 3 BSS Plans, each time using new parameters.

NOTE - It was also agreed that this compatibility analysis will be carried on the basis of BSS test points as indicated in section 4.1.2 of Attachment 3 to Document 34.

2.1.2 Region 2 BSS into Regions 1 and 3 BSS (section 3 of Annex 1 of APS30)

No potentially affected administrations were identified in the compatibility analysis carried out by the Radiocommunication Bureau (ref. Document 34, Add.4). However, it was noted that modifications to the Region 2 Plan have been recently received by the Bureau for their inclusion in the “Part B” of the Region 2 Plan and shall be protected in accordance with Resolution 532 (WRC-97).

The new Resolution to be drafted (identified in section 2.1.1 above) would also include the criteria for the interference of Region 2 BSS into Regions 1 and 3 BSS.

NOTE - It was also agreed that this compatibility analysis will be carried on the basis of BSS test points as indicated in section 4.1.2 of Attachment 3 to Document 34.

2.1.3 Regions 1 and 3, as well as Region 2, BSS into terrestrial services (sections 4, 5 and 8 of Annex 1 of APS30)

The compatibility analysis carried out by the Radiocommunication Bureau (ref. Document 34, Add.4) shows that a high number of potentially affected administrations are identified when using the current limits contained in sections 4, 5 and 8 of Annex 1 to APS30. It was felt that there is a need to harmonize these values and bring them in line with the current usage of these bands by terrestrial services. Therefore, it was agreed that the following limits shall be applied instead of the current sections 4, 5 and 8 of Annex 1 to APS30 to protect terrestrial services in the band 11.7-12.7 GHz, over the territories of those countries in the three Regions where these services are allocated on a primary basis, from interference caused by the BSS in the bands subject to APS30:

-148 dB(W/m²/4 kHz)	for $\theta \leq 5°$
$-148 + 0.5\,(\theta-5)$ dB(W/m²/4 kHz)	for $5° < \theta \leq 25°$
-138 dB(W/m²/4 kHz)	for $25° < \theta \leq 90°$

where θ represents the angle of arrival.

NOTE - In addition, the 0.25 dB allowed increase over the pfd resulting from the original plan assignments in Region 2 should be maintained.

2.1.4 Terrestrial services into Regions 1 and 3 BSS (Annex 3 of APS30)

It was noted that the current footnotes in Annex 3 are based on the technical characteristics of the 1977 Plan (–103 dB(W/m²/27 MHz) pfd wanted for BSS and 35 dB C/I protection ratios). It was agreed that these parameters would need to be updated to reflect the new technical characteristics of the Plans in Regions 1, 2 and 3. It was agreed that additional studies conducted by ITU-R are required for this case and it was proposed to include them into the new Resolution identified in section 2.1.1 above.

2.1.5 Regions 1 and 3 BSS into FSS and other non-planned space services (space-to-Earth) (section 6 of Annex 1 of APS30)

[-F/37/4, F/37/5, F/37/6, IAP/ , INT/14,]

Numerous potentially affected administrations were identified in the compatibility analysis carried out by the Radiocommunication Bureau (ref. Document 34, Add.4). It was felt that in view of the sharing conditions which are currently applied to the assessment of this sharing situation, some actions need to be taken. The following was agreed:

a) Instead of the flat pfd limit of –138 dBW/m^2/27 MHz, apply new pfd limits to protect FSS in all Regions from BSS in all Regions, as given below:

For Regions 1 and 3 BSS → Region 2 FSS:

–160 dB(W/m^2/27 MHz)	$0 < \theta < 0.054°$
(–137.46 + 17.74 log θ) dB(W/m^2/27 MHz)	$0.054° \le \theta < 3.67°$
(–141.56 + 25 log θ) dB(W/m^2/27 MHz)	$3.67° \le \theta < 11.54°$
–115 dB(W/m^2/27 MHz)	$11.54° \le \theta$

where θ corresponds to the minimum geocentric angular separation between the interfering BSS and the interfered with FSS space station.

For Region 1 BSS → Region 3 FSS:

–160 dB(W/m^2/27 MHz)	$0 < \theta < 0.054°$	
(–137.46 + 17.74 log θ) dB(W/m^2/27 MHz)	$0.054° \le \theta < 3.67°$	
[(–141.56 + 25 log θ) dB(W/m^2/27 MHz)	$3.67° \le \theta < 24.12°$	(see NOTE 1)
–107 dB(W/m^2/27 MHz)	$24.12° \le \theta$	(see NOTE 1)]
(–141.56 + 25 log θ) dB(W/m^2/27 MHz)	$3.67° \le \theta < 16.69°$	(see NOTE 2)
–111 dB(W/m^2/27 MHz)	$16.69° \le \theta$	(see NOTE 2)

NOTE 1 - For the purpose of analysing the WRC-2000 Plan. The values in these lines are to be revisited once the output of the WRC-2000 planning process is known to the Conference.

NOTE 2 - For the purpose of analysing modification requests after WRC-2000.

where θ corresponds to the minimum geocentric angular separation between the interfering BSS and the interfered with FSS space station.

For Region 2 BSS → Regions 1 and 3 FSS and into Region 3 non-planned BSS:

–160 dB(W/m^2/27 MHz)	$0 < \theta < 0.054°$
(–137.46 + 17.74 log θ) dB(W/m^2/27 MHz)	$0.054° \le \theta < 3.67°$
(–141.56 + 25 log θ) dB(W/m^2/27 MHz)	$3.67° \le \theta < 11.54°$
–115 dB(W/m^2/27 MHz)	$11.54° \le \theta$

where θ corresponds to the minimum geocentric angular separation between the interfering BSS and the interfered with FSS space station.

The new Resolution to be drafted (identified in section 2.1.1 above) would also include the above criteria for the application of APS30 by the Bureau following WRC-2000 and for further studies by ITU-R to be concluded in time for consideration by the next world radiocommunication conference.

It is understood that in the implementation of the criteria of section a), the Bureau should take into account the pertinent station keeping accuracy of the BSS and FSS space stations as filed by the notifying administration.

NOTE - In addition, the 0.25 dB allowed increase over the pfd resulting from the original plan assignments in Region 2 should be maintained.

b) Replace the text of section A3 of Annex 7 of APS30 with the following:

3 The purpose of the following orbital position and e.i.r.p. limitations is to preserve access to the GSO by the Region 2 fixed-satellite service in the frequency band 11.7-12.2 GHz. Within the orbital arc of the GSO between 37° W and 10° E, the orbital position associated with any new or modified assignment in the Regions 1 and 3 Plan or the list of additional uses shall lie within one of the portions of the orbital arc listed in Table 1. The e.i.r.p. of such assignments shall not exceed 56 dBW except at the positions listed in Table 2.

TABLE 1

Allowable portions of the orbital arc between 37° W and 10° E for new or modified assignments in the Regions 1 and 3 Plan and List

Orbital position	37° W to 36° W	33.5° W to 32.5° W	30° W to 29° W	26° W to 24° W	20° W to 18° W	14° W to 12° W	8° W to 6° W	[3.8° W to 4.2° W]	2° W to 0°	4° E to 6° E

TABLE 2

Nominal positions in the orbital arc between 37° W and 10° E at which the e.i.r.p. may exceed the limit of 56 dBW

Orbital position	37° W	33.5° W	30° W	25° W ± 0.2°	19° W ± 0.2°	13° W ± 0.2°	7° W ± 0.2°	[4° W ± 0.2°]	1° W ± 0.2°	5° E ± 0.2°

NOTE - Modifications to the list which involve orbital positions additionally used by the WRC-2000 Plans shall not exceed the pfd limit as given in the first set of formulae of section 2.1.5 (a).

It is understood that this new text also supersedes the current text of the Rules of Procedure on Annex 7 of APS30.

c) The assignments in the FSS for which, as of 31 July 2000, complete Appendix S4 data (or Appendix 3 data, as appropriate) will have been received by the Bureau under the relevant provisions of Section II of Article S9 (or Article 11, as appropriate) shall be taken into account in the pertinent compatibility analyses to be carried out by the Bureau after WRC-2000 by applying the pfd criteria of section 2.1.5 a) above.

However, assignments for which complete coordination information according to APS4 has been received by the Bureau after 12 May 2000, 1700 hours, shall be taken into account, by applying the pfd criteria of section 2.1.5 a) above, only if the orbital location is not changed from that contained in the corresponding API, or if the orbital position is changed and does then not lie within ± 1° of a position used in the R1/R3 Plans as established by WRC-2000. But if the orbital position is changed with respect to that contained in the corresponding API, and then lies within ± 1° of a position used in the R1/R3 Plans as established by WRC-2000, either the sharing criteria of –138 dB(W/m^2/27 MHz) will be applied, or the pfd values in section 2.1.5 a), whatever is higher.

NOTE - The final adoption of this section 2.1.5 [c)] is subject to the review of the updated list of filed FSS networks as of 12 May 2000 (the list in Document 37 covers all filed FSS networks as of March 2000). The Bureau announced to undertake every effort to provide that list by 23 May 2000.

2.1.6 FSS and other non-planned space services (space-to-Earth) into Regions 1 and 3 BSS (Annex 4 of APS30)

[IAP/344&345, F/37/2&3, INT/13]

[not yet discussed in ad hoc Group 1A]

This subject should be included in the draft new Resolution mentioned in section 2.1.1 above.

2.2 Associated feeder links

2.2.1 Regions 1 and 3 feeder links (planned) into Region 2 feeder links (non-planned) and vice versa

The group noted the proposal IAP/359 (Document CMR2000/14(Add.2)) which requests to add a new section 6 to Annex 1 of APS30A concerning the limits applicable to protect a frequency assignment in the band 17.8-18.1 GHz (Region 2) to a receiving feeder-link space station in the fixed-satellite service (Earth-to-space). In addition, it was concluded to include a new section in Annex 4 of APS30A in order to encompass also the reverse interference situation, i.e. Region 2 feeder links (non-planned) into Regions 1 and 3 feeder links (planned). The applicability of 3% of $\Delta T/T$ criterion (calculated in accordance with the method contained in APS8 but averaged over the total RF bandwidth) for the protection of unplanned feeder links requires further study.

This subject should be included in the draft new Resolution mentioned in section 2.1.1 above.

2.2.2 Region 2 feeder links (planned) into Region 1 and 3 feeder links (planned) and vice versa (APS8 (section 5 of Annex 1 of APS30A))

[- No proposals]

This subject should be included in the draft new Resolution mentioned in section 2.1.1 above.

2.2.3 Regions 1 and 3 feeder links into terrestrial services (APS7 (section 2 of Annex 1 of APS30A))

[- No proposals]

2.2.4 Regions 1 and 3 feeder links into FSS and other non-planned space services (space-to-Earth) (section 3 of Annex 4 of APS30A referred to in section 1 of Annex 1)

To be replaced by APS7 as agreed by the CPM.

This subject should be included in the draft new Resolution mentioned in section 2.1.1 above.

2.2.5 FSS and other non-planned space services into Regions 1 and 3 feeder links (space station into space station) (section 1 of Annex 4 of APS30A modified*)

*to take into consideration the noise temperature of the satellite system to be 600 K and $\Delta T/T$ of 6%.

[-No proposals but conclusions in Document 34 and its Corrigendum 3]

This method should be applied by the Bureau in its analyses of the WRC-2000 feeder-link Plan with respect to the compatibility with other services (and not the pfd level of –137 dB(W/m^2/MHz) as given in the current version of section 1 of Annex 4 of APS30A). After the Conference, the Bureau should continue to apply this method for the modification process, using the system noise temperature of the space station receiver as submitted by the administration in conjunction with a ΔT/T criterion of 4%.

This subject should be included in the draft new Resolution mentioned in section 2.1.1 above.

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WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

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COMMITTEE 4

China (People's Republic of)

PROPOSAL FOR THE WORK OF THE CONFERENCE

Agenda item 1.1 - requests from administrations to delete their country footnotes or to have their country name deleted from footnotes, if no longer required, in accordance with Resolution 26 (Rev.WRC-97)

MOD CHN/329/1

S5.418 *Additional allocation:* in Bangladesh, Belarus, ~~China,~~ Rep. of Korea, India, Japan, Pakistan, Russian Federation, Singapore, Sri Lanka, Thailand and Ukraine the band 2 535-2 655 MHz is also allocated to the broadcasting-satellite service (sound) and complementary terrestrial broadcasting service on a primary basis. Such use is limited to digital audio broadcasting and is subject to provisions of Resolution **528 (WARC-92)**. The provisions of No. **S5.416** and Article **S21**, Table **S21-4**, do not apply to this additional allocation.

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COMMITTEE 4

Moldova (Republic of)

PROPOSAL FOR THE WORK OF THE CONFERENCE

MOD MDA/330/2

S5.314 *Additional allocation*: in Austria, Italy, Moldova, Uzbekistan, the United Kingdom and Swaziland, the band 790-862 MHz is also allocated to the land mobile service on a secondary basis.

* Pursuant to Resolution 26 (Rev.WRC-97) the secretariat notes that this contribution was received on 22 May 2000.

INTERNATIONAL TELECOMMUNICATION UNION

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COMMITTEE 4

Moldova (Republic of)

PROPOSAL FOR THE WORK OF THE CONFERENCE

Moldova considers it necessary to submit to WRC-2000 proposals concerning agenda items 1.1 and 1.4 relating to the relevant footnote contained in Article S5 of the Radio Regulations.

MOD MDA/330/1

S5.551D *Additional allocation:* in Algeria, Saudi Arabia, Bahrain, Benin, Cameroon, Egypt, United Arab Emirates, Israel, Jordan, Kuwait, Lebanon, Libya, Mali, Morocco, Mauritania, Moldova, Nigeria, Oman, Qatar, Syria, Tunisia and Yemen, the band 40.5-42.5 GHz is also allocated to the fixed-satellite service (space-to-Earth) on a primary basis. The use of this band by the fixed-satellite service shall be in accordance with Resolution **134 (WRC-97)**.

* Pursuant to Resolution 26 (WRC-97) the secretariat notes that this contribution was received on 22 May 2000.

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

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COMMITTEE 4

Uzbekistan (Republic of)

PROPOSAL FOR THE WORK OF THE CONFERENCE

Uzbekistan considers it necessary to submit to WRC-2000 proposals concerning agenda items 1.1 and 1.4 relating to the relevant footnote contained in Article S5 of the Radio Regulations.

MOD UZB/331/1

S5.551D *Additional allocation:* in Algeria, Saudi Arabia, Bahrain, Benin, Cameroon, Egypt, United Arab Emirates, Israel, Jordan, Kuwait, Lebanon, Libya, Mali, Morocco, Mauritania, Nigeria, Oman, Uzbekistan, Qatar, Syria, Tunisia and Yemen, the band 40.5-42.5 GHz is also allocated to the fixed-satellite service (space-to-Earth) on a primary basis. The use of this band by the fixed-satellite service shall be in accordance with Resolution **134 (WRC-97)**.

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* Pursuant to Resolution 26 (WRC-97) the secretariat notes that this contribution was received on 22 May 2000.

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

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COMMITTEE 4

Peru

PROPOSALS FOR THE WORK OF THE CONFERENCE

The Administration of Peru makes the following proposal for the work of the World Radiocommunication Conference (WRC-2000) under agenda item 1.1 with respect to the footnotes contained in Article S5:

MOD PRU/332/1

S5.293 *Different category of service:* in Chile, Colombia, Cuba, the United States, Guyana, Honduras, Jamaica, Mexico ~~and~~, Panama and Peru, the allocation of the bands 470-512 MHz and 614-806 MHz to the fixed and mobile services is on a primary basis (see No. **S5.33**), subject to agreement obtained under No. **S9.21**.

MOD PRU/332/2

S5.480 *Additional allocation:* in Brazil, Costa Rica, Ecuador, Guatemala, Honduras, ~~and~~ Mexico and Peru, the band 10-10.45 GHz is also allocated to the fixed and mobile services on a primary basis.

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[*] Pursuant to Resolution 26 (Rev.WRC-97) the secretariat notes that this contribution was received on 22 May 2000.

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COMMITTEE 4

Morocco (Kingdom of)

PROPOSALS FOR THE WORK OF THE CONFERENCE

AGENDA ITEM 1.1

Introduction

WRC-97 having, in its Resolution 26, urged administrations to review footnotes, the Administration of the Kingdom of Morocco, having regard to the importance of certain services, particularly those relating to the safety of life, and to specific uses in the bands concerned, proposes that its country name be deleted from the following footnotes:

MOD MRC/333/1

S5.181 *Additional allocation:* in Germany, Austria, Cyprus, Denmark, Egypt, France, Greece, Israel, Italy, Japan, Jordan, Lebanon, Malta, ~~Morocco,~~ Monaco, Norway, Syria, Sweden and Switzerland, the band 74.8-75.2 MHz is also allocated to the mobile service on a secondary basis, subject to agreement obtained under No. **S9.21**. In order to ensure that harmful interference is not caused to stations of the aeronautical radionavigation service, stations of the mobile service shall not be introduced in the band until it is no longer required for the aeronautical radionavigation service by any administration which may be identified in the application of the procedure invoked under No. **S9.21**.

MOD MRC/333/2

S5.197 *Additional allocation:* in Germany, Austria, Cyprus, Denmark, Egypt, France, Italy, Japan, Jordan, Lebanon, Malta, ~~Morocco,~~ Monaco, Norway, Pakistan, Syria, and Sweden, the band 108-111.975 MHz is also allocated to the mobile service on a secondary basis, subject to agreement obtained under No. **S9.21**. In order to ensure that harmful interference is not caused to stations of the aeronautical radionavigation service, stations of the mobile service shall not be introduced in the band until it is no longer required for the aeronautical radionavigation service by any administration which may be identified in the application of the procedures invoked under No. **S9.21**.

MOD MRC/333/3

S5.259 *Additional allocation:* in Germany, Austria, Cyprus, the Republic of Korea, Denmark, Egypt, Spain, France, Greece, Israel, Italy, Japan, Jordan, Malta, ~~Morocco,~~ Monaco, Norway, the Netherlands, Syria and Sweden, the band 328.6-335.4 MHz is also allocated to the mobile service on a secondary basis, subject to agreement obtained under No. **S9.21**. In order to ensure that harmful interference is not caused to stations of the aeronautical radionavigation service, stations of the mobile service shall not be introduced in the band until it is no longer required for the aeronautical radionavigation service by any administration which may be identified in the application of the procedure invoked under No. **S9.21**.

MOD MRC/333/4

S5.315 *Alternative allocation*: in Greece, Italy~~, Morocco~~ and Tunisia, the band 790-838 MHz is allocated to the broadcasting service on a primary basis.

MOD MRC/333/5

S5.422 *Additional allocation:* in Saudi Arabia, Armenia, Azerbaijan, Bahrain, Belarus, Bosnia and Herzegovina, Brunei Darussalam, the Central African Republic, the Congo, Côte d'Ivoire, Cuba, Egypt, the United Arab Emirates, Eritrea, Ethiopia, Gabon, Georgia, Guinea, Guinea-Bissau, the Islamic Republic of Iran, Iraq, Israel, Jordan, Kazakstan, Lebanon, Malaysia, Mali, ~~Morocco,~~ Mauritania, Moldova, Mongolia, Nigeria, Oman, Uzbekistan, Pakistan, the Philippines, Qatar, Syria, Kyrgyzstan, Dem Rep. of the Congo, Romania, Russian Federation, Somalia, Tajikistan, Tunisia, Turkmenistan, Ukraine, Yemen, Yugoslavia and Zambia, the band 2 690-2 700 MHz is also allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis. Such use is limited to equipment in operation by 1 January 1985.

MOD MRC/333/6

S5.447 *Additional allocation:* in Germany, Austria, Belgium, Denmark, Spain, Finland, France, Greece, Israel, Italy, Japan, Jordan, Lebanon, Liechtenstein, Luxembourg, Malta, ~~Morocco,~~ Norway, Pakistan, the Netherlands, Portugal, Syria, the United Kingdom, Sweden, Switzerland and Tunisia, the band 5 150-5 250 MHz is also allocated to the mobile service, on a primary basis, subject to agreement obtained under No. **S9.21**.

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

Document 334-E
22 May 2000
Original: English

ISTANBUL, 8 MAY – 2 JUNE 2000

COMMITTEE 5

Chairperson, WORKING GROUP 5B

MSS ALLOCATION IN THE BAND 1 559-1 567 MHz

(WRC-2000 AGENDA ITEM 1.9)

Concerning the feasibility of allocation in the space-to-Earth direction to the mobile-satellite service in a portion of the 1 559-1 567 MHz frequency range, under WRC-2000, agenda item 1.9, Working Group 5B considered proposals submitted by administrations and the results of ITU-R studies in the CPM Report and does not propose a change to the Radio Regulations in the above mentioned frequency band.

T. Mizuike
Chairperson, Working Group 5B

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

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22 May 2000
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ISTANBUL, 8 MAY – 2 JUNE 2000

COMMITTEE 4

SUMMARY RECORD

OF THE

THIRD MEETING OF COMMITTEE 4

(REGULATORY AND ASSOCIATED ISSUES)

Wednesday, 17 May 2000, at 1635 hours

Chairperson: Mr H. RAILTON (RRB)

Subjects discussed		**Documents**
1	Oral report by the Chairperson of Working Group 4A	-
2	Oral report by the Chairperson of Working Group 4B	-
3	Organization of work (continued)	205
4	Documents for approval (continued)	196, 206, 223

1 Oral report by the Chairperson of Working Group 4A

1.1 The **Chairperson of Working Group 4A** said that the group had completed its consideration of all the documents which had been allocated to it. Three subgroups had initially been set up: the first for questions relating to Appendix S7, the second for questions relating to Article S13 and the third for questions relating to Resolution 49 (WRC-97) on due diligence. Seven other subgroups had also been set up to consider questions relating to Resolution 86 (Minneapolis, 1998), particularly in regard to sound broadcasting, advance publication and coordination, to Resolutions 80, 87 and 88 (Minneapolis, 1998), and to Resolution 72 (WRC-97). All of the sub-working groups should have completed their work by the end of the week.

1.2 The **Chairperson** thanked Working Group 4A and its Chairperson for the work they had accomplished.

2 Oral report by the Chairperson of Working Group 4B

2.1 The **Chairperson of Working Group 4B** said that the group, which had met three times since the preceding meeting of Committee 4, had completed its consideration of all the documents which had been allocated to it, apart from a number new proposals concerning footnotes.

2.2 Regarding agenda item 1.1, concerning the deletion of country names in footnotes, the working group had approved a number of country name deletions and was awaiting further instructions from the Plenary before taking a decision on the additional proposals it had received.

2.3 With respect to agenda item 1.2, the Chairperson was pleased to report that the group dealing with spurious emissions had drawn up a revised text of Appendix S3 and of Recommendation 66 (Rev.WRC-97), to be found in Document 206, and had decided to propose the deletion of Recommendation 507 (WARC-79). The working group had, moreover, been of the view that questions relating to spurious emissions should be considered by Working Group 2 of the Plenary with a view to inclusion on the agenda of the next WRC. The question of general limits for out-of-band emissions should, on the other hand, not be included on the agenda of the next WRC.

2.4 Regarding agenda item 1.8, she was confident that a compromise would shortly be reached.

2.5 The work carried out under agenda item 2 would be submitted to the next meeting of Committee 4. The group had, however, examined the report by the Radiocommunication Assembly and reviewed the ITU-R recommendations incorporated by reference. In so doing, it had noted that four ITU-R recommendations had not been incorporated by reference in Volume 4 of the Radio Regulations. It had proposed annexing to Resolution 27 (Rev.WRC-97) procedures relating to incorporation by reference in order to assist future conferences in that regard.

2.6 Finally, Working Group 4B had completed its revision of Resolutions 10 (WARC-79), 300 (Rev.Mob-87) and 644 (WRC-97) which had been entrusted to it under agenda item 4.

2.7 The **Chairperson** congratulated Working Group 4B and its Chairperson on the work accomplished.

3 Organization of work (continued) (Document 205)

3.1 The **Chairperson** informed the participants that Document 205 could be entrusted to Working Group 4A.

3.2 It was so **agreed**.

4 Documents for approval (continued) (Documents 196, 206 and 223)

Document 196

4.1 The **Chairperson** said that the four ITU-R recommendations that were missing in Volume 4 of the Radio Regulations had probably been overlooked by the previous WRC.

4.2 The **delegate of Saudi Arabia** said that care must be taken to ensure that such an error was not repeated in the future.

4.3 Document 196 was **approved**.

Document 206

4.4 The **Chairperson of Working Group 4B** said that the document under consideration contained proposals for the revision of Appendix S3 and of Recommendation 66 (Rev.WRC-97), and for the deletion of Recommendation 507 (WARC-79).

4.5 Regarding the draft revision of Appendix S3, the **delegate of France** requested that the English and French versions be aligned and pointed out, in respect of MOD 8 in Section II, that the expression “for example radars” did not appear at the same point in the English and French versions. Concerning the ADD 11*bis* and *ter*, the texts of both those paragraphs should be underlined throughout to indicate that they were new, and in the French version of 11*bis* the expression corresponding to “theoretical necessary bandwidth” should be corrected in line with the English wording. Likewise, at the end of Table II in the French version, the expression corresponding to “emergency transmitters” should be corrected in line with the English expression. Finally, in ADD 18 in the French version, all occurrences of the expression corresponding to “emergency transmitters” should be corrected in line with the English expression.

4.6 Those proposals for amendment of the French version were **approved**.

4.7 At the request of the **delegate of Syria**, supported by the **delegate of the United Kingdom**, it was **decided** to restore the word “lifeboat” in ADD 18.

4.8 The draft revision of Appendix S3, as amended, was **approved**.

4.9 The **Chairperson** invited the Committee to consider the draft revision of Recommendation 66 (Rev.WRC-97) on studies of the maximum permitted levels of unwanted emissions.

4.10 The **delegate of Syria** pointed out that the number of the resolution referred to in *noting c)* might well be modified, and that it would therefore be preferable to use the words “the relevant resolution”.

4.11 The **delegate of the United States** said that the only thing which needed to be indicated was that ITU-R had accomplished the task that had been entrusted to it by WRC-97 in the resolution.

4.12 The **delegate of Argentina** noted that under the terms of § 6 of the draft revision of Annex 1 to Resolution 27 (Rev.WRC-97) contained in Document DT/49 drawn up by Sub-Working Group 4B-3, “where references are non-mandatory, it is not necessary to establish specific conditions in applying the texts quoted. In such cases, reference should be made using the terminology “the most recent version” of a recommendation”. Perhaps that principle could be applied not only to incorporation by reference but also to resolutions adopted by conferences.

4.13 The **representative of the Radiocommunication Bureau** explained that there would be no new version of Resolution 722 (WRC-97), which was used in the case in point as a historical reference.

4.14 The **representative of Spain**, referring to the *noting c)* in Document 206, expressed the wish that the words “at this time” be deleted, or at least that the Spanish version be aligned on the other versions in that regard.

4.15 The **delegates of France** and **the United Kingdom** emphasized that *noting c)* was the result of a compromise and should therefore remain unchanged.

4.16 The whole of the draft revision of Recommendation 66 (Rev.WRC-97) on studies of the maximum permitted levels of unwanted emissions, contained in Document 206, was **approved**.

4.17 The **Chairperson** invited the Committee to decide on the proposed deletion of Resolution 507 (WARC-79) relating to the establishment of agreements and associated plans for the broadcasting-satellite service.

4.18 The deletion of Resolution 507 (WARC-79) was **approved**.

Document 223

4.19 The **Chairperson of Working Group 4B** said that Document 223 contained a draft revision of Resolution 10 (WARC-79) and a draft revision of Resolution 300 (Rev.Mob-87) which had been modified in the light of Document 16 containing the report of the Radiocommunication Bureau. Document 223 also contained a draft revision of Resolution 644 (WARC-79), which had been updated to take account of the new Tampere Convention.

4.20 The draft revision of Resolution 10 (WARC-79) was **approved**.

4.21 The **Chairperson** invited the Committee to consider the draft revision of Resolution 300 (Rev.Mob-87).

4.22 At the request of the **representative of the Radiocommunication Bureau**, it was **decided** to delete the square brackets around the date at the end of the *resolves*.

4.23 The draft revision of Resolution 300 (Rev.Mob-87) on the use and notification of the paired frequencies reserved for narrow-band direct-printing telegraphy and data transmission systems in the HF bands allocated on an exclusive basis to the maritime mobile service was **approved**.

4.24 The **Chairperson** invited the Committee to consider the draft revision of Resolution 644 (WARC-97).

4.25 The **delegate of Syria** pointed out that the latter part of the resolution, as from *instructs the Secretary-General*, overlapped with Resolution 36 (Rev.Minneapolis, 1998). He therefore proposed that that part of the resolution be deleted.

4.26 It was so **agreed**.

4.27 The draft revision of Resolution 644 (WRC-97) on telecommunication resources for disaster mitigation and relief operations, as amended, was **approved**.

The meeting rose at 1730 hours.

The Secretary:
P. LUNDBORG

The Chairperson
H. RAILTON

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

Document 336-E
22 May 2000
Original: English

ISTANBUL, 8 MAY – 2 JUNE 2000

Source: Document DL/60 **COMMITTEE 5**

Chairperson, Working Group 5C

DRAFT REVISION OF RESOLUTION 723 (WRC-~~97~~2000)

Consideration by a future competent world radiocommunication conference of issues dealing with allocations to science services

The World Radiocommunication Conference (~~Geneva, 1997~~Istanbul, 2000),

considering

a) that WRC-~~97~~2000 recognized the importance of proper consideration of science service issues based on technical and operational criteria developed in Radiocommunication Study Groups;

b) that circumstances did not enable the completion of all necessary studies relating to a number of proposals concerning science services;

c) that a deficiency in telecommand (uplink) frequency allocations exists, compared to available telemetry (downlink) allocations in the 100 MHz to 1 GHz range;

d) ~~that additional frequency bands above 71 GHz are needed to satisfy user requirements for passive sensing of the Earth's environmental conditions~~that certain existing allocations may provide the means to satisfy requirements for space research applications without the need for additional frequency allocations, subject to the determination of appropriate allocation status and/or sharing conditions,

resolves

that, on the basis of proposals from administrations and taking into account the results of studies in Radiocommunication Study Groups and the ~~1999~~[2000] Conference Preparatory Meeting, ~~WRC-99~~ the [2003] World Radiocommunication Conference should consider the following matters:

1) provision of up to 3 MHz of frequency spectrum for the implementation of telecommand links in the space research and space operations services in the frequency range 100 MHz to 1 GHz;

2) ~~allocation of frequency bands above 71 GHz to the Earth exploration-satellite (passive) and space research (passive) services and the radio astronomy service~~to consider incorporating the existing primary allocation to the space research service in the band 7 145-7 235 MHz, pursuant to No. **S5.460**, into the Table of Frequency Allocations;~~,~~

3) to review the allocations to the space research service (deep space) (space-to-Earth) and the inter-satellite service in the frequency range 32-32.3 GHz with a view to facilitating satisfactory operation of these services;

4) to review existing allocations to space science services near 15 GHz and 26 GHz with a view to accommodating wideband space-to-Earth space research applications,

invites ~~Radiocommunication Study Groups~~ITU-R

to complete the necessary studies, as a matter of urgency, taking into account the present use of allocated bands, with a view to presenting, at the appropriate time, the technical information likely to be required as a basis for the work of the Conference,

instructs the Secretary-General

to bring this Resolution to the attention of the international and regional organizations concerned.

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

Document 337-E
22 May 2000
Original: English

ISTANBUL, 8 MAY – 2 JUNE 2000

Source: Documents WRC2000/DL/51 and WRC2000/282

COMMITTEE 5

Chairperson, Working Group 5C

COUNTRY FOOTNOTE FOR USE OF HAPS IN THE FIXED SERVICE IN THE BANDS 27.5-28.35 GHz AND 31.0-31.3 GHz

MOD

24.75-29.9 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
27.5-28.5	FIXED ADD S5.5SSS FIXED-SATELLITE (Earth-to-space) S5.484A S5.539 MOBILE S5.538 S5.540	

MOD

29.9-34,.2 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
31-31.3	FIXED ADD S5.5RRR MOBILE Standard frequency and time signal-satellite (space-to-Earth) Space research S5.544 S5.545 S5.149	

ADD

S5.5SSS For Region 3 in Bhutan, Indonesia, Iran (Islamic Republic of), Japan, Maldives, Myanmar, Pakistan, the Dem. People's Rep. of Korea, Sri Lanka, Thailand and Viet Nam, and in Mongolia, the allocation to the fixed service in the band 27.5-28.35 GHz may also be used by high altitude platform stations. The use of the band 27.5-28.35 GHz by high altitude platform stations is limited to operation in the direction from the high altitude platform station down to the ground and shall not cause harmful interference to nor claim protection from other types of fixed-service systems or other co-primary services.

ADD

S5.5RRR For Region 3 in Bhutan, Indonesia, Iran (Islamic Republic of), Japan, Maldives, Myanmar, Pakistan, the Dem. People's Rep. of Korea, Sri Lanka, Thailand and Viet Nam, and in Mongolia, the allocation to the fixed service in the band 31.0-31.3 GHz may also be used by high altitude platform stations in the direction from ground up to the high altitude platform stations. The use of the band 31.0-31.3 GHz by high altitude platforms shall not cause harmful interference to nor claim protection from other types of fixed-service systems or other co-primary services taking into account **S5.545**. The use of HAPS in the band 31.0-31.3 GHz shall not cause harmful interference to the passive services allocated on a primary basis in the band 31.3-31.8 GHz, taking into account the interference criteria given in Recommendations ITU-R SA.1029 and ITU-R RA.769. The administrations mentioned above are urged to limit the deployment of HAPS within the band 31.0-31.3 GHz to the lower half of this band (31.0-31.15 GHz) until WRC-03.

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

Document 338-E
22 May 2000
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ISTANBUL, 8 MAY – 2 JUNE 2000

COMMITTEE 5

Chairperson, Working Group 5C

SUPPRESSION OF RESOLUTION 712 (Rev.WRC-95)

SUP

RESOLUTION 712 (Rev.WRC-95)

Consideration by a future competent World Radiocommunication Conference of issues dealing with allocations to space services

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

Document 339-E
22 May 2000
Original: English

ISTANBUL, 8 MAY – 2 JUNE 2000

WORKING GROUP 2
OF THE PLENARY

Chairperson, GT PLEN-2

DRAFT RESOLUTION [GT PLEN-2/1] (WRC-2000)

Consideration by a future competent world radiocommunication conference of issues dealing with ~~new and upgrading~~ allocations to the mobile, ~~[~~fixed~~]~~, radiolocation, Earth exploration-satellite (active), and space research (active) services in the frequency range 5 150-5 725 MHz

The World Radiocommunication Conference (Istanbul, 2000),

considering

a) that there is a need to provide ~~up to 455 MHz of~~ globally harmonized frequencies in the bands 5 150-5 350 MHz and 5 470-5 725 MHz for the mobile service for nomadic wireless access systems including radio local area networks (RLANs) ~~within certain bands in the frequency range 5 150 – 5 725 MHz~~;

b) ~~[~~that there is a need for frequencies for fixed wireless access applications in the fixed service in Region 3 in the band 5 250-5 350 MHz;~~]~~

c) that there is a need for additional spectrum for the Earth exploration-satellite service (active) and space research service (active) in the frequency range 5 460-5 570 MHz;

d) that on-going studies in ITU-R indicate that sharing in the band 5 150-5 350 MHz between RLANs and space services is feasible under specified conditions;

e) that there is a need to upgrade the status of frequency allocations to the radiolocation service in the frequency range 5 350-5 650 MHz,

recognizing

a) that sharing ~~compatibility~~ criteria between existing services and the proposed new allocations should be established;

b) that it is important to protect the existing primary services allocated in the frequency range 5 150-5 725 MHz;

c) that the existing and new allocations are interdependent, particularly with respect to the relationship between the terrestrial and the space services,

resolves

that based on proposals from administrations and taking into account the results of studies in ITU-R and the [2003] Conference Preparatory Meeting, WRC-03 should consider:

1 allocation of frequencies to the mobile service in the frequency range 5 150-5 350 MHz and 5 470-5 725 MHz for the implementation of nomadic wireless access systems including RLANs;

2 [a possible allocation in Region 3 to the fixed service in the band 5 250-5 350 MHz while fully protecting the worldwide Earth exploration-satellite (active) and space research (active) services;]

3 additional primary allocations for the Earth exploration-satellite service (active) and space research service (active) in the frequency range 5 460-5 570 MHz;

4 the review, with a view to upgrading, of the status of frequency allocations to the radiolocation service in the frequency range 5 350-5 650 MHz,

invites ITU-R

to conduct, and complete in time for WRC-03, the appropriate studies leading to technical and operational recommendations to facilitate sharing between the services stated in the *resolves* and the existing services.

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

ISTANBUL, 8 MAY – 2 JUNE 2000

Corrigendum 1 to
Document 340-E
25 May 2000
Original: English

COMMITTEE 6

SECOND SERIES OF TEXTS SUBMITTED BY COMMITTEE 5 TO THE EDITORIAL COMMITTEE

The text of Resolution [COM5/5] in Document 340 should be replaced by the text beginning on page 2.

Chris Van DIEPENBEEK
Chairperson, Committee 5

ADD

RESOLUTION [COM5/5] (WRC-2000)

Consideration by a future competent world radiocommunication conference of issues dealing with sharing between active services above 71 GHz

The World Radiocommunication Conference (Istanbul, 2000),

considering

a) that WRC-2000 made changes to the Table of Frequency Allocations above 71 GHz, following consideration of science service issues;

b) that there are several co-primary active services in some bands above 71 GHz in the Table of Frequency Allocations as revised by WRC-2000;

c) that there is limited knowledge of characteristics of active services that may be developed to operate in bands above 71 GHz;

d) that sharing criteria for sharing between active services in bands above 71 GHz have not yet been fully developed within ITU-R;

e) that sharing between multiple co-primary active services may hinder the development of each active service in bands above 71 GHz;

f) that the technology for some active services may be commercially available earlier than for some other active services;

g) that adequate spectrum should be available for the active services for which the technology is available at a later time,

noting

that sharing criteria need to be developed, to be used by a future competent conference, for determining to what extent sharing between multiple co-primary active services is possible in each of the bands,

resolves

1 that appropriate measures should be taken to fulfil the spectrum requirements for active services for which the technology is commercially available at a later time;

2 that sharing criteria be developed for co-primary active services in bands above 71 GHz;

3 that the sharing criteria developed should form a basis for a review of active service allocations above 71 GHz at a future competent conference, if necessary,

urges administrations

to note the possibility of changes to Article **S5** to accommodate emerging requirements for active services, as indicated in this Resolution, and to take this into account in the development of national policies and regulations,

invites ITU-R

to complete the necessary studies with a view to presenting, at the appropriate time, the technical information likely to be required as a basis for the work of a future competent conference,

instructs the Secretary-General

to bring this Resolution to the attention of the international and regional organizations concerned.

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

Document 340-E
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ISTANBUL, 8 MAY – 2 JUNE 2000

Source: Documents WRC2000/257(Rev.1), 281, 283, 286, 287, 302, 303, 309, 313

COMMITTEE 6

SECOND SERIES OF TEXTS SUBMITTED BY COMMITTEE 5 TO THE EDITORIAL COMMITTEE

Committee 5 has finished its consideration of agenda item 1.18. It has continued its consideration of other agenda items. As a result of these deliberations, it has unanimously adopted, at its third meeting, the attached text that is submitted for your consideration with a view to its subsequent submission to the Plenary.

Committee 6 should note that the reference to two new footnotes in *considering q)* of the modification to Resolution 122 is in square brackets pending a decision of Committee 5 on the text of these two new provisions.

Chris Van DIEPENBEEK
Chairperson, Committee 5

Annexes: 9

1 Additions to Table S21-4

TABLE **S21-4** *(end)*

Frequency band	Service*	Limit in dB(W/m2) for angle of arrival (δ) above the horizontal plane			Reference bandwidth
		0°-5°	5°-25°	25°-90°	
31.8-32.3 (GHz)	Space research	–120 [16]	–120 + 0.75(δ – 5) [16]	–105	1 MHz
32.0-33.0 (GHz)	Inter-satellite	–135	–135 + (δ – 5)	–115	1 MHz
37-38 GHz	Space research non-geostationary-satellite orbit	–120 [16]	–120 + 0.75(δ – 5) [16]	–105	1 MHz
37-38 GHz	Space research geostationary-satellite orbit	–125	–125 + (δ – 5)	–105	1 MHz

ADD

[16] **S21.16.10** During the launch and near-Earth operational phase of deep space facilities, non-GSO space research service systems shall not exceed a pfd value of:

–115 dB(W/m^2) if δ < 5°

–115 + 0.5 (δ – 5) dB(W/m^2) if 5°< δ < 25°

–105 dB(W/m^2) if δ > 25°

in any 1 MHz, where δ is the angle of arrival above the horizontal plane.

2 Revision of footnote S5.547A

29.9-34,.2 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
31.8-32	FIXED MOD S5.547A RADIONAVIGATION SPACE RESEARCH (deep space) (space-to-Earth) S5.547 S5.547B S5.548	
32-32.3	FIXED MOD S5.547A INTER-SATELLITE RADIONAVIGATION SPACE RESEARCH (deep space) (space-to-Earth) S5.547 S5.547C S5.548	
32.3-33	FIXED MOD S5.547A INTER-SATELLITE RADIONAVIGATION S5.547 S5.547D S5.548	

33-33.4	FIXED MOD S5.547A RADIONAVIGATION S5.547 S5.547E

MOD

S5.547A ~~Use of the band 31.8-33.4 GHz by the fixed service shall be in accordance with Resolution **126 (WRC-97)**.~~Administrations should take practical measures to minimize the potential interference between stations in the fixed service and airborne stations in the radionavigation service in the 31.8-33.4 GHz band, taking into account the operational needs of the airborne radar systems.

3 Suppression of Resolution 126

SUP

RESOLUTION 126 (WRC-97)

Use of the frequency band 31.8-33.4 GHz for high-density systems in the fixed service

MOD

Section IV – Table of Frequency Allocations

55.78-66 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
55.78-56.9	EARTH EXPLORATION-SATELLITE (passive) FIXED ADD S5.XXX INTER-SATELLITE S5.556A MOBILE S5.558 SPACE RESEARCH (passive) S5.547 S5.557	

ADD

S5.XXX In the band 55.78-56.26 GHz, in order to protect stations in the Earth exploration-satellite service (passive), the maximum transmitter power density delivered by a transmitter to the antenna of a fixed-service station is limited to –26 dB(W/MHz).

MOD

RESOLUTION 122 (Rev.WRC-~~97~~2000)

Use of the bands 47.2-47.5 GHz and 47.9-48.2 GHz by high altitude platform stations (HAPS) in the fixed service and by other services and the potential use of bands in the range 18-32 GHz by HAPS in the fixed service

The World Radiocommunication Conference (~~Geneva, 1997~~Istanbul, 2000),

considering

a) that the band 47.2-50.2 GHz is allocated to the fixed, mobile and fixed-satellite services on a co-primary basis;

b) that ~~this Conference has~~WRC-97 made provision for operation of high altitude platform stations, also known as stratospheric repeaters, within the fixed service in the bands 47.2-47.5 GHz and 47.9-48.2 GHz;

c) that ITU has among its purposes "to promote the extension of the benefit of the new telecommunication technologies to all the world's inhabitants" (No. 6 of the Constitution of the ITU (Geneva, 1992));

d) that systems based on new technologies using high altitude platforms will be able to provide high-capacity, competitive services to urban and rural areas;

e) that the development of any service requires major investment and that manufacturers and operators should be given the confidence to make the necessary investment;

~~e~~f) that high altitude platform systems are in an advanced stage of development and some countries have notified such systems to ITU in the band 47.2-47.5 GHz and 47.9-48.2 GHz;

~~f~~g) that WRC-97 adopted a definition of high altitude platform stations in Article **S1**, modified No. **S11.24** and added No. **S11.26** in the Radio Regulations providing for notices relating to assignments for high altitude platform stations in the bands 47.2-47.5 GHz and 47.9-48.2 GHz and that the Radio Regulations Board issued a provisional rule of procedure concerning notification periods in No. **S11.24/1228** in February 1997;

~~g~~h) that in spite of the urgency attached to the development of such systems, technical, sharing and regulatory issues should be further studied in order to achieve the most efficient use of the spectrum available for these systems;

i) that while the decision to deploy HAPS can be taken on a national basis, such deployment may affect neighbouring administrations, particularly in small countries;

~~h~~j) that technical studies ~~are required in order to ascertain the extent to which sharing of the~~ have been undertaken on the characteristics of a HAPS system in the frequency bands 47.2-47.5 GHz and 47.9-48.2 GHz ~~is feasible between systems using high altitude platforms in the fixed service and systems in the fixed, fixed-satellite and mobile services, and to ascertain the requirements to protect radio astronomy services in adjacent bands from spurious emissions~~and on the coordination and sharing requirements between HAPS systems and systems in the conventional fixed service, radio astronomy and in other services, but that further studies are still in progress on the potential for interference between such systems;

~~i~~k) that the radio astronomy service has primary allocations in the bands 42.5-43.5 GHz and 48.94-49.04 GHz;

~~*j)* that ITU-R studies are already under way on the preferred characteristics of systems using high altitude platforms and the feasibility of sharing between these systems and systems of other services and between these systems and other systems in the fixed service (Questions ITU-R 212/9, ITU-R 218/9 and ITU-R 251/4);~~

l) that ITU-R study results have been presented which indicate that in WRC-97 designated bands at 47.2-47.5/47.9-48.2 GHz, sharing between fixed-service systems using HAPS and other conventional fixed-service systems in the same area will require appropriate interference mitigation techniques to be developed and implemented;

~~k~~m) that No. **S5.552** urges administrations to reserve fixed-satellite service use of the band 47.2-49.2 GHz for feeder links for the broadcasting-satellite service, and that ~~preliminary~~ ITU-R studies indicate that high altitude platform stations in the fixed service may share with broadcasting-satellite feeder links;

~~*l)* that the development of services using high altitude platform stations in these bands requires major investment and that manufacturers and operators should be given the confidence to make the necessary investment in these applications,~~

n) that ITU-R studies in the bands 47.2-47.5 GHz and 47.9-48.2 GHz indicate that sharing between fixed-service systems using HAPS and FSS could be feasible under certain limitations, such as geographical separation between HAPS-based systems and FSS earth stations;

o) that since 47 GHz bands are more susceptible to the rain attenuation in certain areas of Region 3, the range 18-32 GHz has been proposed for Region 3 for possible identification of additional spectrum in ITU-R and preliminary ITU-R studies are in progress for these bands;

p) that the 18-32 GHz range is already heavily used by a number of different services, and a number of other types of applications in the fixed service;

q) that footnote numbers [**S5.5SSS**] and [**S5.5RRR**] permit the use of HAPS in the fixed service within the bands 27.5-28.35 and 31.0-31.3 GHz in certain countries on a non-interference, non-protection basis in order to address issues of rain attenuation associated with the 47 GHz band referenced in *considering b)* above;

r) that technical, sharing and regulatory issues should be studied in order to determine criteria for operation of HAPS in the band in *considering q)* above;

s) that the radio astronomy, EESS (passive) and space research (passive) services are allocated to the 31.3-31.8 GHz band and the space research (deep space) band is allocated to the 31.8-32.3 GHz band, and that there is a need to appropriately protect these services from unwanted emissions taking into account **S5.340** and the interference criteria in Recommendations ITU-R SA.1029 and ITU-R RA.769,

resolves

1 to urge administrations to facilitate coordination between high altitude platform stations in the fixed service operating in the bands 47.2-47.5 GHz and 47.9-48.2 GHz and other co-primary services in their territory and adjacent territories;

2 that, on a provisional basis, the procedures of Article **S9** shall be used for coordination between satellite systems and high altitude platform systems in the bands 47.2-47.5 GHz and 47.9-48.2 GHz;

3 to request ITU-R to carry out urgently studies on the appropriate technical sharing criteria for the situations referred to in *considering h)*, with priority given to the sharing with other systems in the fixed and fixed-satellite services, in particular the determination of the appropriate geographical separation from feeder links in the broadcasting-satellite service;

43 that WRC-9903 shouldis invited to review the results of these studies specified below and consider refinement of the regulatory provisions that might facilitate a broader application of these high altitude platform technologies,

requests ITU-R

1 to study the regulatory provisions that might be needed to address those cases where the deployment of HAPS in the territory of one administration may affect neighbouring administrations;

2 to continue to carry out studies on the appropriate technical sharing criteria for the situations referred to in *considering j)*;

3 taking into account the requirements of other fixed-service systems and other services, to urgently conduct studies on the feasibility of identifying suitable frequencies in addition to the 2 x 300 MHz paired band at 47 GHz for the use of HAPS in the fixed service in the range 18-32 GHz in Region 3, focusing particularly, but not exclusively, on the bands 27.5-28.35 GHz and 31.0-31.3 GHz,

instructs the Director of the Radiocommunication Bureau

1 that notices concerning high altitude platform stations that were received by the Bureau prior to 22 November 1997, and provisionally recorded in the Master International Frequency Register in accordance with the provisional rule of procedure issued by the Board, shall be maintained;

2 that from 22 November 1997, and pending review of the sharing studies in *considering hj)* and review of the notification process by WRC-9903, the Bureau shall accept notices in the bands 47.2-47.5 GHz and 47.9-48.2 GHz only for high altitude platform stations in the fixed service and for feeder links for the broadcasting-satellite service, shall continue to process notices for fixed-satellite service networks (except for feeder links for the broadcasting-satellite service) for which complete information for advance publication has been received prior to 27 October 1997, and shall inform the notifying administrations accordingly.

ANNEX 1

Modified allocation table and footnotes above 71 GHz

~~66~~71-86 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
71-74	FIXED FIXED-SATELLITE (~~Earth-to-space~~space-to-Earth) MOBILE MOBILE-SATELLITE (~~Earth-to-space~~space-to-Earth) ~~S5.149 S5.556~~	
74-75.5	FIXED FIXED-SATELLITE (~~Earth-to-space~~space-to-Earth) MOBILE BROADCASTING BROADCASTING-SATELLITE Space research (space-to-Earth) MOD S5.561	
75.5-76	~~AMATEUR~~ ~~AMATEUR-SATELLITE~~ FIXED FIXED-SATELLITE (space-to-Earth) MOBILE BROADCASTING BROADCASTING-SATELLITE Space research (space-to-Earth) MOD S5.561 ADD S5.EEE	
76-~~81~~77.5	RADIO ASTRONOMY RADIOLOCATION Amateur Amateur-satellite Space research (space-to-Earth) MOD S5.149 ~~S5.560~~	
~~76-81~~77.5-78	AMATEUR AMATEUR-SATELLITE ~~RADIOLOCATION~~ ~~Amateur~~ ~~Amateur-satellite~~ Radio astronomy Space research (space-to-Earth) ~~S5.560~~ MOD S5.149	
~~76-81~~78-79	RADIOLOCATION Amateur Amateur-satellite Radio astronomy Space research (space-to-Earth) MOD S5.149 S5.560	

~~76~~79-81	RADIO ASTRONOMY RADIOLOCATION Amateur Amateur-satellite Space research (space-to-Earth) MOD S5.149 ~~S5.560~~
81-84	FIXED FIXED-SATELLITE (~~space-to-~~Earth-to-space) MOBILE MOBILE-SATELLITE (~~space-to-~~Earth-to-space) RADIO ASTRONOMY Space research (space-to-Earth) MOD S5.149 ADD S5.DDD
84-86	FIXED FIXED-SATELLITE (Earth-to-space) ADD S5.PPP MOBILE ~~BROADCASTING~~ ~~BROADCASTING-SATELLITE~~ RADIO ASTRONOMY MOD S5.149 ~~S5.561~~

86-119.98 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
86-92	EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) MOD S5.340	
92-94	FIXED ~~FIXED-SATELLITE (Earth-to-space)~~ MOBILE RADIO ASTRONOMY RADIOLOCATION MOD S5.149 ~~S5.556~~	
94-94.1	EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION SPACE RESEARCH (active) Radio astronomy S5.562 ADD S5.FFF	
94.1-95	FIXED ~~FIXED-SATELLITE (Earth-to-space)~~ MOBILE RADIO ASTRONOMY RADIOLOCATION MOD S5.149	

95-100	FIXED MOBILE ~~S5.553~~ ~~MOBILE-SATELLITE~~ RADIO ASTRONOMY RADIOLOCATION RADIONAVIGATION RADIONAVIGATION-SATELLITE ~~Radiolocation~~ MOD S5.149 MOD S5.554 ~~S5.555~~
100-102	EARTH EXPLORATION-SATELLITE (passive) ~~FIXED~~ ~~MOBILE~~ RADIO ASTRONOMY SPACE RESEARCH (passive) MOD S5.340 S5.341
102-105	FIXED ~~FIXED-SATELLITE (space-to-Earth)~~ MOBILE RADIO ASTRONOMY MOD S5.149 S5.341
105-~~116~~109.5	~~EARTH EXPLORATION-SATELLITE (passive)~~ FIXED MOBILE RADIO ASTRONOMY SPACE RESEARCH (passive) ADD S5.CCC MOD S5.149~~S5.340~~ S5.341
~~105-116~~109.5-111.8	EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) MOD S5.340 S5.341
~~105-116~~111.8-114.25	~~EARTH EXPLORATION-SATELLITE (passive)~~ FIXED MOBILE RADIO ASTRONOMY SPACE RESEARCH (passive) ADD S5.CCC MOD S5.149~~S5.340~~ S5.341
~~105~~114.25-116	EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) MOD S5.340 S5.341
116-119.98	EARTH EXPLORATION-SATELLITE (passive) ~~FIXED~~ INTER-SATELLITE ADD S5.XXX ~~MOBILE S5.558~~ SPACE RESEARCH (passive) S5.341

119.98-158 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
119.98-120.02	EARTH EXPLORATION-SATELLITE (passive) ~~FIXED~~ INTER-SATELLITE ADD S5.XXX ~~MOBILE S5.558~~ SPACE RESEARCH (passive) ~~Amateur~~ S5.341	
120.02-122.25~~6~~	EARTH EXPLORATION-SATELLITE (passive) ~~FIXED~~ INTER-SATELLITE ADD S5.XXX ~~MOBILE S5.558~~ SPACE RESEARCH (passive) S5.138	
~~120.02-126~~122.25-123	~~EARTH EXPLORATION-SATELLITE (passive)~~ FIXED INTER-SATELLITE MOBILE MOD S5.558 ~~SPACE RESEARCH (passive)~~ Amateur S5.138	
~~120.02~~123-126	~~EARTH EXPLORATION-SATELLITE (passive)~~ ~~FIXED~~ FIXED-SATELLITE (space-to-Earth) ~~INTER-SATELLITE~~ ~~MOBILE S5.558~~ MOBILE-SATELLITE (space-to-Earth) RADIONAVIGATION RADIONAVIGATION-SATELLITE ~~SPACE RESEARCH (passive)~~ Radio astronomy ~~S5.138~~ MOD S5.554	
126-~~134~~130	~~FIXED~~ FIXED-SATELLITE (space-to-Earth) ~~INTER-SATELLITE~~ ~~MOBILE S5.558~~ MOBILE-SATELLITE (space-to-Earth) ~~RADIOLOCATION S5.559~~ RADIONAVIGATION RADIONAVIGATION-SATELLITE Radio astronomy ADD S5.QQQ MOD S5.149 MOD S5.554	

~~126~~130-134	EARTH EXPLORATION-SATELLITE (active) ADD S5.LLL FIXED INTER-SATELLITE MOBILE MOD S5.558 RADIO ASTRONOMY ~~RADIOLOCATION S5.559~~ MOD S5.149 ADD S5.FFF
134-~~142~~136	AMATEUR AMATEUR-SATELLITE ~~MOBILE S5.553~~ ~~MOBILE-SATELLITE~~ ~~RADIONAVIGATION~~ ~~RADIONAVIGATION-SATELLITE~~ Radio astronomy ~~Radiolocation~~ ~~S5.149 S5.340 S5.554 S5.555~~
136-141~~134-142~~	~~MOBILE S5.553~~ ~~MOBILE-SATELLITE~~ RADIO ASTRONOMY RADIOLOCATION ~~RADIONAVIGATION~~ ~~RADIONAVIGATION-SATELLITE~~ Amateur Amateur-satellite ~~Radiolocation~~ MOD S5.149 ~~S5.340 S5.554 S5.555~~
~~134~~141-142	FIXED MOBILE ~~S5.553~~ ~~MOBILE-SATELLITE~~ RADIO ASTRONOMY RADIOLOCATION ~~RADIONAVIGATION~~ ~~RADIONAVIGATION-SATELLITE~~ ~~Radiolocation~~ MOD S5.149 ~~S5.340 S5.554 S5.555~~
142-144	~~AMATEUR~~ ~~AMATEUR-SATELLITE~~ FIXED MOBILE RADIO ASTRONOMY RADIOLOCATION MOD S5.149

144-14~~9~~8.5	FIXED MOBILE RADIO ASTRONOMY RADIOLOCATION ~~Amateur~~ ~~Amateur-satellite~~ MOD S5.149 ~~S5.555~~
~~144~~148.5-149	EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY ~~RADIOLOCATION~~ SPACE RESEARCH (passive) ~~Amateur~~ ~~Amateur-satellite~~ ~~S5.149~~ MOD S5.340 ~~S5.555~~
149-150	EARTH EXPLORATION-SATELLITE (passive) ~~FIXED~~ ~~FIXED-SATELLITE (space-to-Earth)~~ ~~MOBILE~~ RADIO ASTRONOMY SPACE RESEARCH (passive) MOD S5.340
150-151	EARTH EXPLORATION-SATELLITE (passive) ~~FIXED~~ ~~FIXED-SATELLITE (space-to-Earth)~~ ~~MOBILE~~ RADIO ASTRONOMY SPACE RESEARCH (passive) ~~S5.149~~ MOD S5.340 ~~S5.385~~
151-15~~6~~1.5	EARTH EXPLORATION-SATELLITE (passive) ~~FIXED~~ ~~FIXED-SATELLITE (space-to-Earth)~~ ~~MOBILE~~ RADIO ASTRONOMY SPACE RESEARCH (passive) MOD S5.340
151.5-15~~6~~5.5	FIXED ~~FIXED-SATELLITE (space-to-Earth)~~ MOBILE RADIO ASTRONOMY RADIOLOCATION MOD S5.149
~~151~~155.5-156	EARTH EXPLORATION-SATELLITE (passive) ADD S5.AAA FIXED ~~FIXED-SATELLITE (space-to-Earth)~~ MOBILE RADIO ASTRONOMY SPACE RESEARCH (passive) ADD S5.CCC MOD S5.149 ADD S5.BBB

156-158	EARTH EXPLORATION-SATELLITE (passive) ADD S5.AAA FIXED ~~FIXED-SATELLITE (space-to-Earth)~~ MOBILE RADIO ASTRONOMY SPACE RESEARCH (passive) ADD S5.CCC MOD S5.149 ADD S5.BBB

158-202 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
158-1~~64~~58.5	EARTH EXPLORATION-SATELLITE (passive) ADD S5.AAA FIXED ~~FIXED-SATELLITE (space-to-Earth)~~ MOBILE RADIO ASTRONOMY SPACE RESEARCH (passive) ADD S5.CCC MOD S5.149 ADD S5.BBB	
158.5-164	FIXED FIXED-SATELLITE (space-to-Earth) MOBILE MOBILE-SATELLITE (space-to-Earth)	
164-16~~8~~7	EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) MOD S5.340	
16~~4~~7-168	~~EARTH EXPLORATION-SATELLITE (passive)~~ FIXED FIXED-SATELLITE (space-to-Earth) INTER-SATELLITE MOBILE MOD S5.558 ~~RADIO ASTRONOMY~~ ~~SPACE RESEARCH (passive)~~	
168-170	FIXED FIXED-SATELLITE (space-to-Earth) INTER-SATELLITE MOBILE MOD S5.558 MOD S5.149	
170-174.5	FIXED FIXED-SATELLITE (space-to-Earth) INTER-SATELLITE MOBILE MOD S5.558 MOD S5.149 ADD S5.QQQ ~~S5.385~~	

174.5-174.86.5	EARTH EXPLORATION-SATELLITE (passive) FIXED INTER-SATELLITE MOBILE MOD S5.558 SPACE RESEARCH (passive) S5.149 S5.385
174.58- 176.5	EARTH EXPLORATION-SATELLITE (passive) FIXED INTER-SATELLITE ADD S5.YYY MOBILE S5.558 SPACE RESEARCH (passive) S5.149 S5.385
176.5-182	EARTH EXPLORATION-SATELLITE (passive) FIXED INTER-SATELLITE ADD S5.YYY MOBILE S5.558 SPACE RESEARCH (passive) S5.149 S5.385
182-185	EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) MOD S5.340 S5.563
185-190	EARTH EXPLORATION-SATELLITE (passive) FIXED INTER-SATELLITE ADD S5.YYY MOBILE S5.558 SPACE RESEARCH (passive) S5.149 S5.385
190-200191.8	EARTH EXPLORATION-SATELLITE (passive) MOBILE S5.553 MOBILE-SATELLITE RADIONAVIGATION RADIONAVIGATION-SATELLITE SPACE RESEARCH (passive) S5.341 S5.554 MOD S5.340
191.80-200	FIXED INTER-SATELLITE MOBILE S5.553MOD S5.558 MOBILE-SATELLITE RADIONAVIGATION RADIONAVIGATION-SATELLITE MOD S5.149 S5.341 MOD S5.554
200-202	EARTH EXPLORATION-SATELLITE (passive) FIXED MOBILE RADIO ASTRONOMY SPACE RESEARCH (passive) MOD S5.340 S5.341 ADD S5.RRR

202-~~400~~1 000 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
202-2~~17~~09	EARTH EXPLORATION-SATELLITE (passive) ~~FIXED~~ ~~FIXED-SATELLITE (Earth-to-space)~~ ~~MOBILE~~ RADIO ASTRONOMY SPACE RESEARCH (passive) MOD S5.340 S5.341 ADD S5.RRR	
~~202~~209-217	FIXED FIXED-SATELLITE (Earth-to-space) MOBILE RADIO ASTRONOMY MOD S5.149 S5.341	
217-~~231~~226	~~EARTH EXPLORATION-SATELLITE (passive)~~ FIXED FIXED-SATELLITE (Earth-to-space) MOBILE RADIO ASTRONOMY SPACE RESEARCH (passive) ADD S5.CCC MOD S5.149 ~~S5.340~~ S5.341	
~~217~~226-231	EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) MOD S5.340 ~~S5.341~~	
231-~~235~~231.5	EARTH EXPLORATION-SATELLITE (passive) ~~FIXED~~ ~~FIXED-SATELLITE (space-to-Earth)~~ ~~MOBILE~~ RADIO ASTRONOMY SPACE RESEARCH (passive) ~~Radiolocation~~ MOD S5.340	
231.5-23~~5~~2	FIXED ~~FIXED-SATELLITE (space-to-Earth)~~ MOBILE Radiolocation	
~~231~~232-235	FIXED FIXED-SATELLITE (space-to-Earth) MOBILE Radiolocation	
235-238	EARTH EXPLORATION-SATELLITE (passive) ~~FIXED~~ FIXED-SATELLITE (space-to-Earth) ~~MOBILE~~ SPACE RESEARCH (passive) ADD S5.RRR ADD S5.NNN	

238-241240	FIXED FIXED-SATELLITE (space-to-Earth) MOBILE RADIOLOCATION RADIONAVIGATION RADIONAVIGATION-SATELLITE Radiolocation
238240-241	FIXED FIXED-SATELLITE (space-to-Earth) MOBILE RADIOLOCATION Radiolocation
241-248	RADIO ASTRONOMY RADIOLOCATION Amateur Amateur-satellite S5.138 MOD S5.149
248-250	AMATEUR AMATEUR-SATELLITE Radio astronomy MOD S5.149
250-252	EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) S5.149 S5.555 MOD S5.340 ADD S5.RRR
252-265	FIXED MOBILE S5.553 MOBILE-SATELLITE (Earth-to-space) RADIO ASTRONOMY RADIONAVIGATION RADIONAVIGATION-SATELLITE MOD S5.149 S5.385 S5.554 S5.555 S5.564
265-275	FIXED FIXED-SATELLITE (Earth-to-space) MOBILE RADIO ASTRONOMY MOD S5.149 ADD S5.RRR
275-4001 000	(Not allocated) MOD S5.565

NOC 5C2/S5.138

S5.138 The following bands:

6 765-6 795 kHz	(centre frequency 6 780 kHz),
433.05-434.79 MHz	(centre frequency 433.92 MHz) in Region 1 except in the countries mentioned in No. **S5.280**,
61-61.5 GHz	(centre frequency 61.25 GHz),
122-123 GHz	(centre frequency 122.5 GHz), and
244-246 GHz	(centre frequency 245 GHz)

are designated for industrial, scientific and medical (ISM) applications. The use of these frequency bands for ISM applications shall be subject to special authorization by the administration concerned, in agreement with other administrations whose radiocommunication services might be affected. In applying this provision, administrations shall have due regard to the latest relevant ITU-R Recommendations.

MOD 5C2/S5.149

S5.149 In making assignments to stations of other services to which the bands:

13 360-13 410 kHz,	23.07-23.12 GHz*,	~~150-151 GHz*,~~
25 550-25 670 kHz,	31.2-31.3 GHz,	151.5-158.5 GHz,
37.5-38.25 MHz,	31.5-31.8 GHz in Regions 1 and 3,	168.59-168.93 GHz,
73-74.6 MHz in Regions 1 and 3,	36.43-36.5 GHz*,	171.11-171.45 GHz,
150.05-153 MHz in Region 1,	42.5-43.5 GHz,	172.31-172.65 GHz,
322-328.6 MHz*,	42.77-42.87 GHz*,	173.52-173.85 GHz,
406.1-410 MHz,	43.07-43.17 GHz*,	~~174.42-175.02 GHz*,~~
608-614 MHz in Regions 1 and 3,	43.37-43.47 GHz*,	~~177-177.4 GHz*,~~
1 330-1 400 MHz*,	48.94-49.04 GHz*,	~~178.2-178.6 GHz*,~~
1 610.6-1 613.8 MHz*,	~~72.77-72.91 GHz*,~~	~~181-181.46 GHz*,~~
1 660-1 670 MHz,	76-86 GHz,	~~186.2-186.6 GHz*,~~
1 718.8-1 722.2 MHz*,	~~93.07-93.27 GHz*,~~	195.75-196.15 GHz,
2 655-2 690 MHz,	92-94 GHz,	209-226 GHz,
3 260-3 267 MHz*,	94.1-100 GHz,	241-250 GHz,
3 332-3 339 MHz*,	~~97.88-98.08 GHz*,~~	~~250-251 GHz*,~~
3 345.8-3 352.5 MHz*,	102-109.5 GHz,	252-275 GHz
4 825-4 835 MHz*,	111.8-114.25 GHz,	~~257.5-258 GHz*,~~
4 950-4 990 MHz,	128.33-128.59 GHz,	~~261-265 GHz,~~
4 990-5 000 MHz,	129.23-129.49 GHz,	~~262.24-262.76 GHz*,~~
6 650-6 675.2 MHz*,	130-134 GHz,	~~265-275 GHz,~~
10.6-10.68 GHz,	136-148.5 GHz,	~~265.64-266.16 GHz*,~~
14.47-14.5 GHz*,	~~140.69-140.98 GHz*,~~	~~267.34-267.86 GHz*,~~
22.01-22.21 GHz*,	~~144.68-144.98 GHz*,~~	~~271.74-272.26 GHz*~~
22.21-22.5 GHz,	~~145.45-145.75 GHz*,~~	
22.81-22.86 GHz*,	~~146.82-147.12 GHz*,~~	

are allocated ~~(* indicates radio astronomy use for spectral line observations)~~, administrations are urged to take all practicable steps to protect the radio astronomy service from harmful interference. Emissions from spaceborne or airborne stations can be particularly serious sources of interference to the radio astronomy service (see Nos. **S4.5** and **S4.6** and Article **S29**).

MOD 5C2/S5.340

S5.340 All emissions are prohibited in the following bands:

1 400-1 427 MHz,	
2 690-2 700 MHz,	except those provided for by Nos. **S5.421** and **S5.422**,
10.68-10.7 GHz,	except those provided for by No. **S5.483**,
15.35-15.4 GHz,	except those provided for by No. **S5.511**,
23.6-24 GHz,	
31.3-31.5 GHz,	
31.5-31.8 GHz,	in Region 2,
48.94-49.04 GHz,	from airborne stations,
50.2-50.4 GHz[2],	except those provided for by No. **S5.555A**,
52.6-54.25 GHz,	
86-92 GHz,	
100-102 GHz,	
~~105-116 GHz,~~	
109.5-111.8 GHz,	
114.25-116 GHz	
~~140.69-140.98 GHz,~~	~~from airborne stations and from space stations in the space-to-Earth direction,~~
148.5-151.5 GHz,	
164-167 GHz,	
182-185 GHz,	except those provided for by No. **S5.563**,
190-191.8 GHz,	
200-209 GHz,	
~~217-231 GHz.~~	
226-231.5 GHz,	
250-252 GHz.	

NOC

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2 **S5.340.1**

NOC 5C2/S5.341

S5.341 In the bands 1 400-1 727 MHz, 101-120 GHz and 197-220 GHz, passive research is being conducted by some countries in a programme for the search for intentional emissions of extraterrestrial origin.

MOD 5C2/S5.385

S5.385 *Additional allocation:* the band~~s~~ 1 718.8-1 722.2 MHz~~, 150-151 GHz, 174.42-175.02 GHz, 177-177.4 GHz, 178.2-178.6 GHz, 181-181.46 GHz, 186.2-186.6 GHz and 257.5-258 GHz are~~ <u>is</u> also allocated to the radio astronomy service on a secondary basis for spectral line observations.

MOD 5C2/S5.553

S5.553 In the bands 43.5-47 GHz~~,~~ <u>and</u> 66-71 GHz,~~ 95-100 GHz, 134-142 GHz, 190-200 GHz and 252-265 GHz,~~ stations in the land mobile service may be operated subject to not causing harmful interference to the space radiocommunication services to which these bands are allocated (see No. **S5.43**).

MOD 5C2/S5.554

S5.554 In the bands 43.5-47 GHz, 66-71 GHz, 95-100 GHz, <u>123-130 GHz,</u> ~~134-142 GHz, 190~~<u>191.8</u>-200 GHz and 252-265 GHz, satellite links connecting land stations at specified fixed points are also authorized when used in conjunction with the mobile-satellite service or the radionavigation-satellite service.

MOD 5C2/S5.555

S5.555 *Additional allocation:* the band~~s~~ 48.94-49.04 GHz~~, 97.88-98.08 GHz, 140.69-140.98 GHz, 144.68-144.98 GHz, 145.45-145.75 GHz, 146.82-147.12 GHz, 250-251 GHz and 262.24-262.76 GHz are~~ <u>is</u> also allocated to the radio astronomy service on a primary basis.

MOD 5C2/S5.556

S5.556 In the bands 51.4-54.25 GHz, 58.2-59 GHz~~,~~ <u>and</u> 64-65 GHz~~, 72.77-72.91 GHz and 93.07-93.27 GHz~~, radio astronomy observations may be carried out under national arrangements.

MOD 5C2/S5.558

S5.558 In the bands 55.78-58.2 GHz, 59-64 GHz, 66-71 GHz,~~ 116-134 GHz,~~ <u>122.25-123 GHz, 130-134 GHz,</u> ~~170-182 GHz and~~ <u>167-174.8 GHz</u> ~~185-190 GHz~~ <u>and 191.8-200 GHz</u>, stations in the aeronautical mobile service may be operated subject to not causing harmful interference to the inter-satellite service (see No. **S5.43**).

MOD 5C2/S5.559

S5.559 In the band~~s~~ 59-64 GHz ~~and 126-134 GHz~~, airborne radars in the radiolocation service may be operated subject to not causing harmful interference to the inter-satellite service (see No. **S5.43**).

NOC 5C2/S5.560

S5.560 In the band 78-79 GHz radars located on space stations may be operated on a primary basis in the Earth exploration-satellite service and in the space research service.

MOD 5C2/S5.561

S5.561 In the band ~~84-86~~<u>74-76</u> GHz, stations in the fixed, mobile and broadcasting services shall not cause harmful interference to <u>stations of the fixed-satellite service or stations of the</u> broadcasting-satellite stations operating in accordance with the decisions of the appropriate frequency assignment planning conference for the broadcasting-satellite service.

NOC 5C2/S5.562

S5.562 The use of the band 94-94.1 GHz by the Earth exploration-satellite (active) and space research (active) services is limited to spaceborne cloud radars.

NOC 5C2/S5.563

SUP 5C2/S5.564

S5.564

MOD 5C2/S5.565

S5.565 The frequency band 275-~~400~~1 000 GHz may be used by administrations for experimentation with, and development of, various active and passive services. In this band a need has been identified for the following spectral line measurements for passive services:

– radio astronomy service: ~~278-280 GHz and 343-348 GHz;~~ 275-323 GHz, 327-371 GHz, 388-424 GHz, 426-442 GHz, 453-510 GHz, 623-711 GHz, 795-909 GHz and 926-945 GHz;

– Earth exploration-satellite service (passive) and space research service (passive): 275-277 GHz, ~~300-302 GHz, 324-326 GHz, 345-347 GHz, 363-365 GHz and 379-381 GHz.~~ 294-306 GHz, 316-334 GHz, 342-349 GHz, 363-365 GHz, 371-389 GHz, 416-434 GHz, 442-444 GHz, 496-506 GHz, 546-568 GHz, 624-629 GHz, 634-654 GHz, 659-661 GHz, 684-692 GHz, 730-732 GHz, 851-853 GHz and 951-956 GHz.

Future research in this largely unexplored spectral region may yield additional spectral lines and continuum bands of interest to the passive services. Administrations are urged to take all practicable steps to protect these passive services from harmful interference until the ~~next competent world radiocommunication conference~~ date when the allocation table is established in the frequency band mentioned above.

ADD 5C2/S5.AAA

S5.AAA In the band 155.5-158.5 GHz, the allocation to the Earth exploration-satellite (passive) and space research (passive) services shall terminate on 1 January 2018.

ADD 5C2/S5.BBB

S5.BBB The date of entry for the allocation to the fixed and mobile services in the band 155.5-158.5 GHz shall be 1 January 2018.

ADD 5C2/S5.CCC

S5.CCC Use of this allocation is limited to space-based radio astronomy only.

ADD 5C2/S5.DDD

S5.DDD The 81-81.5 GHz band is also allocated to the amateur and amateur-satellite services on a secondary basis.

ADD 5C2/S5.EEE

S5.EEE The band 75.5-76 GHz is also allocated to the amateur and amateur-satellite services on a primary basis until the year 2006.

ADD 5C2/S5.FFF

S5.FFF Transmission from space stations of the Earth exploration-satellite service (active) that are directed into the main beam of a radio astronomy antenna have the potential to damage some radio astronomy receivers. Space agencies operating the transmitters and the concerned radio astronomy stations should mutually plan their operations to avoid, to the maximum extent possible, such occurrences.

ADD 5C2/S5.LLL

S5.LLL The allocation to the Earth exploration-satellite service (active) is limited to the band 133.5-134 GHz.

ADD 5C2/S5.NNN

S5.NNN The frequency band 237.9-238 GHz is also allocated to the Earth exploration-satellite service (active) and the space research service (active) for spaceborne cloud radars only.

ADD 5C2/S5.PPP

S5.PPP In Japan, use of the band 84-86 GHz, as the fixed-satellite service (Earth-to-space) is limited to the feeder link by the broadcasting-satellite service in the geostationary satellite.

ADD 5C2/S5.QQQ

S5.QQQ *Additional allocation*: In Korea (Republic of), the bands 128-130 GHz, 171-171.6 GHz, 172.2-172.8 GHz and 173.3-174 GHz are allocated to the radio astronomy service in a primary basis until 2015.

ADD 5C2/S5.RRR

S5.RRR In the bands 200-209 GHz, 235-238 GHz, 250-252 GHz and 265-275 GHz, ground-based passive atmospheric sensing is carried out to monitor atmospheric constituents.

ADD 5C2/S5.XXX

S5.XXX Use of the bands 116-122.25 GHz by the inter-satellite service is limited to satellites in the geostationary-satellite orbit. The single-entry power flux-density, at all altitudes from 0 km to 1 000 km above the Earth's surface and in the vicinity of all geostationary orbital positions occupied by passive sensors, produced by a station in the inter-satellite service, for all conditions and for all methods of modulation, shall not exceed –148 dBW/m^2/MHz for all angles of arrival.

ADD 5C2/S5.YYY

S5.YYY Use of the bands 174.8-182 GHz and 185-190 GHz by the inter-satellite service is limited to satellites in the geostationary-satellite orbit. The single-entry power flux-density, at all altitudes from 0 km to 1 000 km above the Earth's surface and in the vicinity of all geostationary orbital positions occupied by passive sensors, produced by a station in the inter-satellite service, for all conditions and for all methods of modulation, shall not exceed –144 dBW/m^2/MHz for all angles of arrival.

ADD Resolution [COM5/4]

RESOLUTION [COM5/4] (WRC-2000)

Consideration by a future competent world radiocommunication conference of issues dealing with sharing and adjacent band compatibility between passive and active services above 71 GHz

The World Radiocommunication Conference (Istanbul, 2000),

considering

a) that the changes made to the Table of Frequency Allocations by WRC-2000 in bands above 71 GHz were based on the requirements known at the time of the Conference;

b) that the passive service spectrum requirements above 71 GHz are based on physical phenomena and therefore are well known. These requirements are reflected in the changes made to the table of allocations by WRC-2000;

c) that several bands above 71 GHz are already used by EESS (passive) and SR (passive) because they are unique bands to measure specific atmospheric parameters;

d) that currently there is only limited knowledge of requirements and implementation plans for the active services that will operate in bands above 71 GHz;

e) that in the past, technological developments have led to viable communication systems operating at increasingly higher frequencies and that this can be expected to continue so as to make communication technology available in the future for the frequency bands above 71 GHz;

f) that in the future, there should be accommodation of alternative spectrum needs of the active and passive services when the new technologies become available;

g) that, following the revisions to the Table of Frequency Allocations by WRC-2000, sharing studies may be required for services in some bands above 71 GHz;

h) that interference criteria for passive sensors have been developed and are given in Recommendation ITU-R SA.1029;

i) that protection criteria for radio astronomy have been developed and are given in Recommendation ITU-R RA.769;

j) that several satellite downlink allocations have been made within bands adjacent to those allocated to the radio astronomy service;

k) that sharing criteria for active and passive services in bands above 71 GHz have not yet been fully developed within ITU-R;

l) that in order to ensure protection of passive services above 71 GHz, WRC-2000 avoided co-allocations of active and passive services in some bands such as 100-102 GHz, 116-122.25 GHz, 148.5-151.5 GHz, 174.8-191.8 GHz, 226-231.5 GHz and 235-238 GHz, to prevent potential sharing problems,

recognizing

that to the extent practicable, the burden of sharing among active and passive services should be equitably distributed amongst the allocated services,

resolves

that a future competent conference should consider the results of ITU-R studies with a view to revise as appropriate the Radio Regulations in order to accommodate the emerging requirements of the active services taking into account the requirements of the passive services, in bands above 71 GHz,

urges administrations

to note the possibility of changes to Article **S5** to accommodate emerging requirements for active services, as indicated in this Resolution, and to take this into account in the development of national policies and regulations,

invites ITU-R

1 to continue its studies to determine if and under what conditions sharing is possible between active and passive services in the bands above 71 GHz, such as, but not limited to, 100-102 GHz, 116-122.25 GHz, 148.5-151.5 GHz, 174.8-191.8 GHz, 226-231.5 GHz and 235-238 GHz;

2 to study means of avoiding adjacent-band interference from space services (downlinks) into radio astronomy bands above 71 GHz;

3 to take into account the principles of burden sharing to the extent practicable in their studies;

4 to complete the necessary studies, when the technical characteristics of the active services in these bands are known;

5 to develop Recommendations specifying sharing criteria for those bands where sharing is feasible,

instructs the Secretary-General

to bring this Resolution to the attention of the international and regional organizations concerned.

ADD Resolution [COM5/5]

RESOLUTION [COM5/5] (WRC-2000)

Consideration by a future competent world radiocommunication conference of issues dealing with sharing between active services above 71 GHz

The World Radiocommunication Conference (Istanbul, 2000),

considering

a) that WRC-2000 made changes to the Table of Frequency Allocations above 71 GHz, following consideration of science service issues;

b) that there are several co-primary active services in some bands above 71 GHz in the Table of Frequency Allocations as revised by WRC-2000;

c) that there is limited knowledge of characteristics of active services that may be developed to operate in bands above 71 GHz;

d) that sharing criteria for sharing between active services in bands above 71 GHz have not yet been fully developed within ITU-R;

e) that sharing between multiple co-primary active services may hinder the development of each active service in bands above 71 GHz;

f) that the technology for some active services may be commercially available earlier than for some other active services;

g) that adequate spectrum should be available for the active services for which the technology is available at a later time,

noting

that sharing criteria need to be developed, to be used by a future competent conference, for determining to what extent sharing between multiple co-primary active services is possible in each of the bands,

resolves

1 that appropriate measures should be taken to fulfill the spectrum requirements for active services for which the technology is commercially available at a later time;

2 that sharing criteria be developed for co-primary active services in bands above 71 GHz;

3 that the sharing criteria developed should form a basis for a review of active service allocations above 71 GHz at a future competent conference, if necessary,

urges administrations

to complete the necessary studies with a view to presenting, at the appropriate time, the technical information likely to be required as a basis for the work of a future competent conference,

instructs the Secretary-General

to bring this Resolution to the attention of the international and regional organizations concerned.

RESOLUTION [COM5/14] (WRC-2000)

Feasibility of use by high altitude platform stations in the fixed and mobile services in the frequency bands above 3 GHz allocated exclusively for terrestrial radiocommunications

The World Radiocommunication Conference (Istanbul, 2000),

considering

a) that ITU has among its purposes "to promote the extension of the benefit of the new telecommunication technologies to all the world's inhabitants" (No. 6 of the Constitution of the ITU (Geneva, 1992));

b) that systems based on new technologies using High Altitude Platform Stations (HAPS) has potential applicability to various services such as high-capacity, competitive services to urban and rural areas;

c) that WRC-97 made provision for the use of HAPS within the fixed service in the bands 47.2-47.5 GHz and 47.9-48.2 GHz (see also Resolution 122);

d) that the visible area from a HAPS is likely to be within a country or neighbouring countries, considering the altitude of HAPS;

e) that some administrations intend to operate the HAPS system in the bands allocated exclusively by the Table of Frequency Allocations or footnotes for terrestrial radiocommunications such as the fixed and mobile service,

recognizing

a) ITU-R studies relating to geometrical coordination distance for the visible distance from HAPS, as described in Recommendation ITU-R F.1501,

resolves

to recommend to WRC-03 to review the feasibility of facilitating HAPS systems in the fixed and mobile services in bands above 3 GHz allocated exclusively by the Table of Frequency Allocations or footnotes for terrestrial radiocommunications,

requests ITU-R

to invite ITU-R, as a matter of urgency, to carry out regulatory and technical studies to determine the feasibility of facilitating HAPS systems in the fixed and mobile services in bands above 3 GHz allocated exclusively by the Table of Frequency Allocations or footnotes for terrestrial radiocommunications, taking account of existing use and future requirements in these bands, and any impact on allocations in adjacent bands,

encourages administrations

to contribute actively to the sharing studies in accordance with this draft Resolution.

Agenda item 1.17 - worldwide allocation for the Earth exploration-satellite (passive) and space research services in the band 18.6-18.8 GHz

1 MOD

18.6-22.21 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
18.6-18.8 EARTH EXPLORATION-SATELLITE (passive) FIXED FIXED-SATELLITE (space-to-Earth) ~~S5.523~~ ADD S5.522B MOBILE except aeronautical mobile ~~Earth exploration-satellite (passive)~~ Space research (passive) ~~S5.522~~ADD S5.522A	**18.6-18.8** EARTH EXPLORATION-SATELLITE (passive) FIXED FIXED-SATELLITE (space-to-Earth) ~~S5.523~~ ADD S5.522B MOBILE except aeronautical mobile SPACE RESEARCH (passive) ~~S5.522~~ADD S5.522A	**18.6-18.8** EARTH EXPLORATION-SATELLITE (passive) FIXED FIXED-SATELLITE (space-to-Earth) ~~S5.523~~ ADD S5.522B MOBILE except aeronautical mobile ~~Earth exploration-satellite (passive)~~ Space research (passive) ~~S5.522~~ADD S5.522A

2 ADD

S5.522A The emissions of the fixed service and fixed-satellite service in the band 18.6-18.8 GHz are limited to the values given in **S21.5A** and **S21.16.2**, respectively.

3 ADD

S5.522B The use of the band 18.6-18.8 GHz by the fixed-satellite service is limited to geostationary systems and systems with an orbit of apogee greater than 20 000 km.

4 SUP

S5.522

5 SUP

S5.523

6 MOD

S21.5 3) The power delivered by a transmitter to the antenna of a station in the fixed or mobile service shall not exceed +13 dBW in frequency bands between 1 GHz and 10 GHz, or +10 dBW in frequency bands above 10 GHz, except as cited in **S21.5A**.

7 MOD

S21.6 4) The limits given in Nos. **S21.2**, **S21.3**, **S21.4** ~~and~~, **S21.5** and **S21.5A** apply, where applicable, to the services and frequency bands indicated in Table **S21-2** for reception by space stations where the frequency bands are shared with equal rights with the fixed or mobile service:

8 MOD

TABLE **S21-2** *(end)*

Frequency band	Service	Limit as specified in Nos.
. . .	. . .	. . .
18.6-18.8 GHz	Earth exploration-satellite Space research	**S21.5A**

9 ADD

S21.5A As an exception to the power levels given in No. **S21.5** the sharing environment within which the Earth exploration-satellite (passive) and space research (passive) services shall operate in the band 18.6-18.8 GHz is defined by the following limitations on the operation of the fixed service: the power of each RF carrier frequency delivered to the input of each antenna of a station in the fixed service in the band 18.6-18.8 GHz shall not exceed –3 dBW.

10 MOD

---

8 **S21.16.2** ~~The band 18.6-18.8 GHz is allocated to the earth exploration-satellite (passive) and space research (passive) services. Administrations should endeavour to reduce to a minimum the risks of interference to passive sensors. The interference criteria for satellite passive sensors are contained in Recommendation ITU-R SA.1029.~~In addition to the limits given in Table **S21-4**, in the band 18.6-18.8 GHz the sharing environment within which the Earth exploration-satellite (passive) and space research (passive) services shall operate is defined by the following limitations on the operation of the fixed-satellite service: the power flux-density across the 200 MHz band 18.6-18.8 GHz produced at the surface of the Earth by emissions from a space station under assumed free-space propagation conditions shall not exceed –95 dB(W/m^2), except for less than 5% of time when the limit may be exceeded by up to 3 dB. The provisions of No. **S21.17** do not apply in this band.

MOD

RESOLUTION 342 (Rev.WRC-~~97~~2000)

~~Review of n~~New technolog~~y~~ies to provide improved efficiency in the use of the band 156-174 MHz by stations in the maritime mobile service

The World Radiocommunication Conference (~~Geneva, 1997~~Istanbul, 2000),

considering

a) that the agenda of ~~WRC-97~~this Conference included the consideration of the use of new technology for the maritime mobile service in the band 156-174 MHz and the consequential revision of Appendix **S18** to the Radio Regulations~~ in respect of maritime mobile communications and the use of new technology for maritime radiotelephony channels~~;

b) Recommendation **318 (Mob-87)** particularly *noting b)* and *c)*;

c) that Appendix **S18** identifies frequencies to be used for distress and safety communications on an international basis;

d) that the introduction of new technology in the maritime mobile service shall not disrupt distress and safety communications in the VHF band including those established by the International Convention for the Safety of Life at Sea (SOLAS), 1974, as amended;

e) that the date for full implementation of GMDSS was 1 February 1999;

~~e~~f) that ITU-R is conducting studies on improving efficiency in the use of this band, and that these studies are still ongoing;

~~f~~g) that changes made in Appendix **S18** should not prejudice the future use of these frequencies or the capabilities of systems or new applications required for use by the maritime mobile service;

~~g~~h) that the congestion on Appendix **S18** frequencies calls for the implementation of efficient new technologies;

~~h~~i) that the use of new technology on maritime VHF frequencies will make it possible to better respond to the emerging demand for new services~~,~~;

j) that ITU-R has approved Recommendation ITU-R M.1312 relating to a long-term solution for improved efficiency in the use of the band 156-174 MHz by stations in the maritime mobile service;

k) that ITU-R has approved Recommendation ITU-R M.1371 relating to technical characteristics for a universal shipborne automatic identification system using time division multiple access in the VHF maritime mobile band;

l) that there is a need to maintain some duplex channels for specific applications,

noting

~~that some administrations are considering adopting some of the above changes to their operations within the Appendix **S18** frequencies,~~

a) that the global maritime market may not be of a sufficient size to warrant the development of a new system solely for the maritime service;

b) that digital systems have been successfully implemented in the land mobile service,

noting also

that this Conference has modified Appendix **S18** together with the addition of footnote *o)* to permit the possible use on a voluntary basis of various channels or bands created by the conversion of some duplex channels to simplex channels, for the initial testing and the possible future introduction of new technology,

resolves

that WRC-99 should consider the use of new technology in the band 156-174 MHz and consequential revision of Appendix **S18**,

1 that in order to provide full worldwide interoperability of equipment on ships, there should be one technology or more than one interoperable worldwide technology implemented in Appendix **S18**;

2 that as soon as the ITU-R studies are complete, a future competent conference should consider any necessary changes to Appendix **S18** to enable the use of new technology by the maritime mobile service,

invites ITU-R

to continuefinalize the following studies on the following with a view to providing a report to WRC-99:

a) to identify the future requirements of the maritime mobile service;

b) to identify suitable technical characteristics of the system or interoperable systems to replace existing technology;

c) to identify necessary modifications to the frequency plan contained within Appendix **S18**;

d) to recommend a timetabletransition plan for the introduction of new technology and the necessary changes;

e) to study andrecommend how new technologyies can be introduced without harmingwhile ensuring compliance with the distress and safety requirements,

instructs the Secretary-General

to communicate this Resolution to the International Maritime Organization and the International Association of Lighthouse Authorities.

APPENDIX S18

Table of transmitting frequencies in the VHF maritime mobile band

(See Article **S52**)

MOD

NOTE – For assistance in understanding the Table, see notes *a)* to ~~*n)*~~*o)* below.

MOD

Channel designator	Notes	Transmitting frequencies (MHz)		Inter-ship	Port operations and ship movement		Public corres-pondence
		Ship stations	Coast stations		Single frequency	Two frequency	
60		156.025	160.625			x	x
01		156.050	160.650			x	x
61	*m), o)*	156.075	160.675		x	x	x
02	*m), o)*	156.100	160.700		x	x	x
62	*m), o)*	156.125	160.725		x	x	x
03	*m), o)*	156.150	160.750		x	x	x
63	*m), o)*	156.175	160.775		x	x	x
04	*m), o)*	156.200	160.800		x	x	x
64	*m), o)*	156.225	160.825		x	x	x
05	*m), o)*	156.250	160.850		x	x	x
65	*m), o)*	156.275	160.875		x	x	x
06	*f)*	156.300		x			
66		156.325	160.925			x	x
07		156.350	160.950			x	x
67	*h)*	156.375	156.375	x	x		
08		156.400		x			
68		156.425	156.425		x		
09	*i)*	156.450	156.450	x	x		
69		156.475	156.475	x	x		
10	*h)*	156.500	156.500	x	x		
70	*j)*	156.525	156.525	Digital selective calling for distress, safety and calling			
11		156.550	156.550		x		
71		156.575	156.575		x		
12		156.600	156.600		x		
72	*i)*	156.625		x			
13	*k)*	156.650	156.650	x	x		
73	*h), i)*	156.675	156.675	x	x		
14		156.700	156.700		x		
74		156.725	156.725		x		
15	*g)*	156.750	156.750	x	x		
75	*n)*	156.775			x		

Channel designator	Notes	Transmitting frequencies (MHz)		Inter-ship	Port operations and ship movement		Public corres-pondence
		Ship stations	Coast stations		Single frequency	Two frequency	
16		156.800	156.800	DISTRESS, SAFETY AND CALLING			
76	*n)*	156.825			x		
17	*g)*	156.850	156.850	x	x		
77		156.875		x			
18	*m)*	156.900	161.500		x	x	x
78		156.925	161.525			x	x
19		156.950	161.550			x	x
79		156.975	161.575			x	x
20		157.000	161.600			x	x
80		157.025	161.625			x	x
21		157.050	161.650			x	x
81		157.075	161.675			x	x
22	*m)*	157.100	161.700		x	x	x
82	*m), o)*	157.125	161.725		x	x	x
23	*m), o)*	157.150	161.750		x	x	x
83	*m), o)*	157.175	161.775		x	x	x
24	*m), o)*	157.200	161.800		x	x	x
84	*m), o)*	157.225	161.825		x	x	x
25	*m), o)*	157.250	161.850		x	x	x
85	*m), o)*	157.275	161.875		x	x	x
26	*m), o)*	157.300	161.900		x	x	x
86	*m), o)*	157.325	161.925		x	x	x
27		157.350	161.950			x	x
87		157.375			x		
28		157.400	162.000			x	x
88		157.425			x		
AIS 1	*l)*	161.975	161.975				
AIS 2	*l)*	162.025	162.025				

Notes referring to the Table

General notes

NOC

a) to *e)*

Specific notes

NOC

f) to ~~*p*~~*l)*

MOD

m) These channels ~~(18 and 82 to 86)~~ may be operated as single frequency channels, subject to special arrangement between interested or affected administrations.

NOC

n)

ADD

o) These channels may be used to provide bands for initial testing and the possible future introduction of new technologies, subject to a special arrangement between interested or affected administrations. Stations using these channels or bands for the testing and the possible future introduction of new technologies shall not cause harmful interference to, and shall not claim protection from harmful interference of other stations operating in accordance with Article **S5**.

DRAFT NEW RESOLUTION [COM5/11]

Development of the technical basis for determining the coordination area for a deep space receiving earth station in the space research service, with transmitting high-density applications in the fixed service in the 31.8-32.3 GHz and 37-38 GHz bands

The World Radiocommunication Conference (Istanbul, 2000),

considering

a) that the band 31.8-32.3 GHz is allocated to the space research service for deep space only; the band 37-38 GHz is allocated to the space research service (deep space) (space-to-Earth); and both bands are allocated to the fixed service for the use of high-density applications and other services on a primary basis;

b) that the 31.8-32.3 GHz band offers unique advantages in support of deep-space missions;

c) that the space research service earth stations operating in the band employ very high-gain antennas and very low-noise amplifiers to receive weak signals from deep space;

d) that fixed-service stations in these bands are expected to be deployed in large numbers over urban areas of large geographical extent;

e) that studies are being initiated to characterize short-term (on the order of 0.001% of the time, commensurate with the protection criteria given in Recommendation ITU-R SA.1396 and SA.1157) anomalous propagation from transmitting stations dispersed over a large geographical area to a single receiving earth station (area-to-point propagation);

f) that preliminary ITU-R studies have indicated that the coordination distance associated with a space research service (deep space) earth station and a single urban area may be on the order of 250 km;

g) that there are currently three space research service deep-space earth stations operational or planned for operation near Goldstone (United States), Madrid (Spain) and Canberra (Australia), and there are up to ten more earth stations planned in the future,

noting

that draft Resolution [COM4/1]* provides a mechanism to update Appendix **S7** as required,

resolves to request ITU-R

to develop, as a matter of urgency, the technical basis for determining the coordination area of a space research service (deep space) receiving earth station with transmitting high-density stations in the fixed service (HDFS) in the 31.8-32.3 GHz and 37-38 GHz bands,

urges administrations

to participate actively in the aforementioned studies by submitting contributions to ITU-R.

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* Document DT/55.

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

Document 341-E
22 May 2000
Original: English

ISTANBUL, 8 MAY – 2 JUNE 2000

WORKING GROUP 4A

Note from Chairperson, Committee 5

In Document 309 Working Group 5C requested the opinion of Working Group 4A as to whether the draft Resolution [COM5/11] attached to that document should be combined with draft Resolution [COM4/1]. Committee 5, after further consideration of the matter in its third meeting, concluded that it would be preferable to not combine the two Resolutions. The text of draft Resolution [COM5/11] as approved by Committee 5 is being forwarded to Committee 6.

Chris Van DIEPENBEEK
Chairperson, Committee 5

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

Document 342-E
22 May 2000
Original: English

ISTANBUL, 8 MAY – 2 JUNE 2000

WORKING GROUP 2 OF THE PLENARY

Note from the Chairperson, Committee 5

Further to the reply given in Document 227 Committee 5 can now advise that no action was considered necessary on proposal ASP/20/338.

Committee 5 came to the same conclusion with respect to proposal EUR/13/12.

Chris Van DIEPENBEEK
Chairperson, Committee 5

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

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COMMITTEE 4

Note from the Chairperson of Committee 5

REVISED FREQUENCY ALLOCATIONS ABOVE 71 GHz
IMPACT ON NOTICE PROCESSING

Committee 5 has agreed to changes in frequency allocations in the bands above 71 GHz. It approved Document 283 with minor corrections at its third meeting on 22 May 2000. These allocation changes have consequential effects on the processing of frequency assignment notices already received by the Bureau which were based on the unrevised allocations. This matter has been raised by the Malaysian Administration in Addendum 1 to Document 51, in which proposals concerning the treatment of Appendix S4 information by the Bureau for such cases are made.

Committee 5 decided that these proposals are outside its items of reference and rather concern the work of Committee 4.

As a result, the matter is referred to Committee 4 for consideration.

Prior to this decision, some work was done in Sub-Working Group 5C-2 on the matter. This work was not considered by Working Group 5C nor by Committee 5. The text developed by Sub-Working Group 5C-2 can be found in Document 252, and may be of use in consideration of the proposals in Committee 4.

Chris Van DIEPENBEEK
Chairperson, Committee 5

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

Document 344(Rev.1)-E*[*]
22 May 2000
Original: English

ISTANBUL, 8 MAY – 2 JUNE 2000

COMMITTEE 4

Bosnia and Herzegovina

PROPOSALS FOR THE WORK OF THE CONFERENCE

The Administration of Bosnia and Herzegovina makes the following proposals for the work of the World Radiocommunication Conference (WRC-2000):

MOD BIH/344/1

S5.359 *Additional allocation:* in Germany, Saudi Arabia, Armenia, Austria, Azerbaijan, Belarus, Benin, Bosnia and Herzegovina, Bulgaria, Cameroon, Spain, France, Gabon, Georgia, Greece, Guinea, Guinea-Bissau, Hungary, Jordan, Kazakstan, Kuwait, Latvia, Libya, Mali, Mauritania, Moldova, Mongolia, Nigeria, Uganda, Uzbekistan, Pakistan, Poland, Syria, Kyrgyzstan, the Democratic People's Republic of Korea, Romania, Russian Federation, Senegal, Swaziland, Tajikistan, Tanzania, Turkmenistan, Ukraine, Zambia and Zimbabwe the bands 1 550-1 559 MHz, 1 610-1 645.5 MHz and 1 646.5-1 660 MHz are also allocated to the fixed service on a primary basis. Administrations are urged to make all practicable efforts to avoid the implementation of new fixed-service stations in these bands~~ 1 550-1 555 MHz, 1 610-1 645.5 MHz and 1 646.5-1 660 MHz~~.

ADD BIH/344/2

S5.359A *Additional allocation:* in Germany, Saudi Arabia, Armenia, Austria, Azerbaijan, Belarus, Benin, Bosnia and Herzegovina, Bulgaria, Cameroon, Spain, France, Gabon, Georgia, Greece, Guinea, Guinea-Bissau, Hungary, Jordan, Kazakstan, Kuwait, Latvia, Libya, Mali, Mauritania, Moldova, Mongolia, Nigeria, Uganda, Uzbekistan, Pakistan, Poland, Syria, Kyrgyzstan, Democratic People's Republic of Korea, Romania, Russia, Senegal, Swaziland, Tajikistan, Tanzania, Turkmenistan, Ukraine, Zambia and Zimbabwe the band 1 559-1 610 MHz is also allocated to the fixed service on a primary basis until 1 January 2005. After this date, the fixed service may continue to operate on a secondary basis until 1 January 2015 upon which time this allocation shall be no longer valid. Administrations are urged to take all practicable steps to protect the radionavigation-satellite service and the aeronautical-radionavigation service and not authorize new frequency assignments to fixed service systems in this band.

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[*] Pursuant to Resolution 26 (Rev.WRC-97) the secretariat notes that this contribution was received on 22 May 2000.

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

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22 May 2000
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ISTANBUL, 8 MAY – 2 JUNE 2000

COMMITTEE 4

Bosnia and Herzegovina

PROPOSALS FOR THE WORK OF THE CONFERENCE

The Administration of Bosnia and Herzegovina makes the following proposals for the work of the World Radiocommunication Conference (WRC-2000):

MOD BIH/344/1

S5.139 *Different category of service:* in Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Georgia, Kazakstan, Latvia, Lithuania, Moldova, Mongolia, Uzbekistan, Kyrgyzstan, Russian Federation, Tajikistan, Turkmenistan and Ukraine, the allocation of the band 6 765-7 000 kHz to the land mobile service is on a primary basis (see No. **S5.33**).

ADD BIH/344/2

S5.139A *Different category of service:* in Bosnia and Herzegovina.

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* Pursuant to Resolution 26 (Rev.WRC-97) the secretariat notes that this contribution was received on 22 May 2000.

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WORKING GROUP 2
OF THE PLENARY

Note from the Chairperson of Committee 5

At its third meeting, Committee 5 approved draft Resolutions relating to items intended to be considered by future conferences. These were a modified text of Resolution 122 and new Resolutions [COM5/4], [COM5/5], [COM5/11] and [COM5/14].

Two of these Resolutions proposed consideration by WRC-03 (Resolution 122 and Resolution [COM5/14]).

The texts can be found in Document 340.

Chris Van DIEPENBEEK
Chairperson, Committee 5

INTERNATIONAL TELECOMMUNICATION UNION

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COMMITTEE 3

Note from Chairperson of Committee 5

At its third meeting Committee 5 approved a revision of Resolution 122. This text instructs the Radiocommunication Bureau to carry out certain tasks and would therefore be of interest to Committee 3.

The text can be found in Document 340.

Chris Van DIEPENBEEK
Chairperson, Committee 5

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

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COMMITTEE 5

Working Group 4B

NOTE BY THE CHAIRPERSON OF WORKING GROUP 4B TO THE CHAIRPERSON OF COMMITTEE 5

REVIEW OF RESOLUTIONS AND RECOMMENDATIONS

Pursuant to WRC-2000 agenda item 4, Working Group 4B has been reviewing the Resolutions and Recommendations which are not explicitly included in the WRC-2000 agenda*. Although the following texts are not explicitly included in the agenda, Working Group 4B invites Committee 5 to review them and to take appropriate action:

Resolution 207 [WG 5B]

Resolution 212 [WG 5A]

Resolution 312 (Document 15 suggests MOD) [WG 5B]

Resolution 331 (Document 15 suggests NOC/(MOD)) [WG 5B]

Resolution 347 (Document 15 suggests NOC/(MOD)) [WG 5B]

Resolution 602 (Document 15 suggests MOD) [WG 5B]

Resolution 712 (Document 15 suggests MOD) [WG 5C]

Recommendation 14 (Document 15 suggests MOD) [WG 5B]

Recommendation 316 (Document 15 suggests SUP/(MOD) and ASP/20/324 proposes SUP) [WG 5B]

Recommendation 706 [WG 5C]

NOTE 1 - The attention of WG 5B is drawn to the fact that WG 4B has proposed the deletion of Resolution 500.

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* The scope of the review is under discussion in 4B with a view to amending Resolution 95 (WRC-97).

NOTE 2 - WG 4B considered Resolution 209 (Mob-87) and it was agreed that there should be no change (NOC). Because this text is of a maritime nature, WG 4B invites Committee 5 to review it and, if necessary, to submit a comment at the Plenary.

NOTE 3 - WG 4B considered Resolution 216 (WRC-97) and agreed on its modification. WG 4B invites Committee 5 to comment and to provide advice if any, directly to GT PLEN-2.

A. ALLISON
Chairperson, Working Group 4B
Box 68

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

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ISTANBUL, 8 MAY – 2 JUNE 2000

WORKING GROUP 1
OF THE PLENARY

Working Group 4B

NOTE BY THE CHAIRPERSON OF WORKING GROUP 4B TO THE CHAIRPERSON OF WORKING GROUP 1 OF THE PLENARY

REVIEW OF RESOLUTIONS AND RECOMMENDATIONS

Pursuant to WRC-2000 agenda item 4, Working Group 4B has been reviewing the Resolutions and Recommendations which are not explicitly included in the WRC-2000 agenda. Although the following texts are not explicitly included in the agenda, Working Group 4B invites Working Group 1 of the Plenary to review them and to take appropriate action.

The substance of the following Resolutions and Recommendations was not discussed in Working Group 4B and several administrations raised their concern regarding certain proposed actions:

Resolution 507 (Doc. 15 suggests SUP and J/133/56 proposes SUP)

Resolution 518 (Orb-88) (Doc. 15 suggests SUP and ASP/20/319 proposes SUP)

Resolution 519 (Orb-88) (Doc. 15 suggests NOC)

Resolution 524 (WARC-92) (Doc. 15 suggests SUP and ASP/20/320 proposes SUP)

Resolution 531 (WRC-95) (Doc. 15 suggests SUP)

Resolution 532 (WRC-97)

Resolution 533 (WRC-97)

Resolution 534 (WRC-97) (Doc. 15 suggests SUP and ASP/20/321 proposes SUP)

Resolution 535 (WRC-97) (Doc. 15 suggests MOD)

Resolution 536 (WRC-97) (Doc. 15 suggests NOC)

Recommendation 521 (WRC-95) (Doc. 15 suggests SUP and ASP/20/327 proposes SUP)

A. ALLISON
Chairperson, Working Group 4B
Box 68

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

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COMMITTEE 4

Working Group 4B

CORRECTIVE ACTION CONCERNING THE RENAMING OF THE WEEKLY CIRCULAR AND THE NUMBERING OF THE PROVISIONS OF THE RADIO REGULATIONS

Working Group 4B considered the issues referred to in Resolution 30 (WRC-97) and the new publication, the "International Frequency Information Circular (IFIC)". The Working Group agreed that an appropriate change of the references (from Weekly Circular to IFIC) in the forthcoming editions of the Radio Regulations, is required in various provisions of the Radio Regulations as given in the Annex.

Working Group 4B also considered the numbering of the provisions of the Radio Regulations using the prefix S in front of every provision of the Radio Regulations. It was agreed to abolish the prefix S in front of the provisions of the Radio Regulations in the forthcoming editions of the Radio Regulations.

A. ALLISON
Chairperson of Working Group 4B,
Box 68

ANNEX

Provisions of the Radio Regulations and Resolutions and Recommendations where the reference "Weekly Circular" has to be replaced by the reference "International Frequency Information Circular"

- Article S9: provisions Nos. S9.1, S9.2B, S9.3 (twice), S9.5B, S9.5D, S9.38, S9.40, S9.41 (twice), S9.51, S9.52, S9.52A, S9.55, and S9.64;
- Article S11: Nos. S11.28 and S11.43;
- Appendix S4: In Section A.13;
- Appendix S7: § 1;
- Appendix S25: Nos. S25/1.2, 1.6, 1.8, 1.9, 1.11.1, 1.11.2, 1.22, Note 2 against S25/2 Table of Added Allotments (Notes 3.1, 10);
- [Appendix S30: Nos. 4.3.5.1, 4.3.6, 4.3.7, 4.3.12, 4.3.17, 4.4, 5.1.6, 6.3.4, 7.1.3 (twice), 7.1.4, 7.1.7 (twice), 7.1.8, 7.2.3 (three times), 7.2.5 (twice), 7.2.6a, 7.2.6b, 7.4.2;][1]
- [Appendix S30A: Nos. 4.2.6.1, 4.2.7, 4.2.8, 4.2.13, 4.2.18, 4.3, 5.1.10;][1]
- Appendix S30B: Nos. 5.6, 6.2.6, 6.33, 6.34, 6.49, 6.50 and 6.54 a);
- Resolution 4: in *resolves* 1.2;
- [Resolution 8: in Annex B (§ 4) and in Annex C (§ 6);][2]
- Resolution 33: Section A (§ 2.2 - twice, § 2.3);
- Resolution 42: in the Annex (§§ 6, 8, 10, 11);
- Resolution 46: in Annex 1 (§ 1.3 - twice, §§ 1.4, 1.6, 2.7.2, 2.9, 2.17, 5.1.6);
- Resolution 49: in *resolves* 5 and 6; in Annex 1 (§§ 8, 11);
- Resolution 312: in the Annex (footnote 1);
- [Resolution 500: in *requests the Bureau*;][2]
- Resolution 533: in *resolves* 5 (twice);
- [Recommendation 35: in the Annex (Nos. T10.12, T10.13, T10.14, T10.17, T10.24).][1]

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[1] Under consideration in GT PLEN-1.

[2] Proposed for suppression.

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

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ISTANBUL, 8 MAY – 2 JUNE 2000

LIST OF DOCUMENTS ISSUED
(Documents 301 – 350)

DOCUMENT NUMBER	*SOURCE*	*TITLE*	*DESTINATION*
301 + Corr.1	SWG 5A-2	Conclusions relating to agenda item 1.11	WG 5A
302	WG 5B	Modifications to Appendix S18	C5
303	WG 5B	Modifications to Resolution 342	C5
304	WG 5B	Space-to-space allocation for the radionavigation-satellite service	C5
305	WG 5D	Issues related to the sharing situation in the frequency band 13.75-14 GHz	C5
306	WG 5D	Working Group 5D	C5
307 + (Rev.1) + Add.1	SWG 5A-1	Conclusions relating to agenda item 1.6.1 on the use of HAPS in IMT-2000	WG 5A
308	Drafting Group 5D ad hoc	Drafting Group 5D ad hoc	WG 5D
309	WG 5C	Liaison statement to Working Group 4A from Working Group 5C	WG 4A
310	SWG 5B-2	Modifications to Article S5 of the Radio Regulations	WG 5B
311	WG 4B	Fifth Report from Working Group 4B to Committee 4	C4
312	SWG 5B-1	Modifications to Article S52 and Appendix S17 and a new Resolution	WG 5B
313	WG 5C	Resolution [COM5/14] (WRC-2000)	C5

DOCUMENT NUMBER	***SOURCE***	***TITLE***	***DESTINATION***
314	LTU	Proposals for the work of the Conference	C4
315	WG 5C	Chairperson, Working Group 5C to Chairperson, Working Group 4B	WG 4B
316	J	Proposals for the work of the Conference	C4
317	RUS	Proposal for the work of the Conference	C4
318	Drafting Group 5D ad hoc	Two possible compromise positions on Resolution 130 and associated topics	WG 5D
319	WG 5D	Chairperson, Working Group 5D	WG 5D
320	EST	Proposals for the work of the Conference	C4
321	BLR/UKR	Proposal for the work of the Conference	C4
322	C5	Summary Record of the second meeting of Committee 5 (allocations and associated issues)	C5
323	CHL	Proposal for the work of the Conference	C4
324	INS	Proposal for the work of the Conference	C5
325	PRG	Proposals for the work of the Conference	C4
326	WG 4A	Report from Working Group 4A	C4
327	ISR	Proposals for the work of the Conference	C4
328 + Corr.1	Ad hoc Group 1 of WG PLEN-1	Second Report of ad hoc Group 1 of GT PLEN-1	WG PLEN-1
329	CHN	Proposal for the work of the Conference	C4
330 + Add.1	MDA	Proposal for the work of the Conference	C4
331	UZB	Proposal for the work of the Conference	C4
332	PRU	Proposals for the work of the Conference	C4
333	MRC	Proposals for the work of the Conference	C4
334	WG 5B	MSS Allocation in the band 1 559 – 1 567 MHz	C5
335	C4	Summary Record of the third meeting of Committee 4 (regulatory and associated issues)	C4
336	WG 5C	Chairperson, Working Group 5C	C5

DOCUMENT NUMBER	***SOURCE***	***TITLE***	***DESTINATION***
337	WG 5C	Country footnote for use of HAPS in the fixed service in the bands 27.5-28.35 GHz and 31.0-31.3 GHz	C5
338	WG 5C	Suppression of Resolution 712 (Rev.WRC-95)	C5
339	WG PLEN-2	Draft Resolution [GT PLEN-2/1] (WRC-2000)	WG PLEN-2
340	C5	Second series of texts submitted by Committee 5 to the Editorial Committee	C6
341	C5	Note from Chairperson, Committee 5	WG 4A
342	C5	Note from the Chairperson, Committee 5	WG PLEN-2
343	C5	Revised frequency allocations above 71 GHz Impact on notice processing	C4
344 + (Rev.1)	BIH	Proposals for the work of the Conference	C4
345	C5	Note from Chairperson of Committee 5	WG PLEN-2
346	C5	Note from Chairperson of Committee 5	C3
347	WG 4B	Review of Resolutions and Recommendations	C5
348	WG 4B	Review of Resolutions and Recommendations	WG PLEN-1
349	WG 4B	Corrective action concerning the renaming of the Weekly Circular and the numbering of the provisions of the Radio Regulations	C4
350	BR	List of documents issued (301 - 350)	-

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

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ISTANBUL, 8 MAY – 2 JUNE 2000

COMMITTEE 4

Report by the Chairperson of Working Group 4B

SEVENTH REPORT FROM WORKING GROUP 4B TO COMMITTEE 4

(Agenda item 4)

At its eleventh meeting on 22 May 2000, the Working Group reviewed the texts of Resolution 46 (Rev.WRC-97), Resolution 216 (Rev.WRC-97) and Recommendation 503 (Rev.WRC-97).

The agreed revisions, as reproduced in the following, are submitted to Committee 4 for consideration.

Furthermore, the Working Group agreed to maintain or to suppress several Resolutions and Recommendations as listed at the end of the document. Three of the proposed suppressions are in square brackets due to concerns raised by some administrations. With regard to the suppression of Resolution 50 (WRC-97), one administration noted that the invitation in *resolves* 3 was not acted upon by the 1998 Plenipotentiary Conference.

A. ALLISON
Chairperson of Working Group 4B, Box 68

(MOD)

RESOLUTION 46 (Rev.WRC-97)

Interim procedures for the coordination and notification of frequency assignments of satellite networks in certain space services and the other services to which certain bands are allocated[1*]

[*] WRC-2000 reviewed this Resolution and decided to maintain it with no change, as it is applicable to satellite networks whose frequency assignments were received by the Bureau prior to 1 January 1999.

MOD

RESOLUTION 216 (Rev.WRC-972000)

Possible broadening of the secondary allocation to the mobile-satellite service (Earth-to-space) in the band 14-14.5 GHz to cover aeronautical applications

The World Radiocommunication Conference (Geneva, 1997Istanbul, 2000),

considering

a) that the band 14-14.5 GHz was allocated to the land mobile-satellite service (Earth-to-space) on a secondary basis prior to this ConferenceWRC-97;

b) that this Conference WRC-97 replaced this by an allocation to the mobile-satellite service (Earth-to-space) except aeronautical mobile-satellite, on a secondary basis;

c) that the band 14-14.5 GHz is also allocated to the fixed-satellite (Earth-to-space), radionavigation, fixed and mobile, except aeronautical mobile, services;

d) that the services in *considering c)* need to be protected consistent with their allocation status;

de) that there is a demand for use on board aircraft, of aeronautical mobile-satellite service capabilities in order to provide location and two-way messaging two-way communication and data transmission functions, of the same type of terminals now used for land and maritime applications;

ef) that such demand justifies the consideration of possible broadening of the allocation to include aeronautical applications on a secondary basis at a future competent conference;

fg) that studies on the feasibility of such a broadening of the allocation must be completed before the aforementioned competent conference, with the participation of relevant entities and organizations;

gh) that Recommendation **34 (WRC-95)** states that future world radiocommunication conferences, whenever possible, should allocate frequency bands to the most broadly defined services with a view to providing maximum flexibility in spectrum use,

resolves

that [WRC-9902/03] should examine the possibility of broadening the secondary allocation to the mobile-satellite service (Earth-to-space) except aeronautical mobile-satellite in the 14-14.5 GHz band to include aeronautical use, subject to the satisfactory outcome of technical compatibility studies, if the ITU-R studies demonstrate that such a secondary service can be operated without causing interference to the primary services,

invites ITU-R

to complete in time for [WRC-9902/03] the technical and operational studies on the feasibility of sharing of the band 14-14.5 GHz between the services referred to in *considering c)* above and the aeronautical mobile-satellite service, with the latter service on a secondary basis,

instructs the Director of the Radiocommunication Bureau

to invite relevant entities and organizations to participate in these studies.

MOD

RECOMMENDATION 503 (Rev.WRC-~~97~~2000)

High-frequency broadcasting

The World Radiocommunication Conference (~~Geneva, 1997~~Istanbul, 2000),

considering

a) the congestion in the HF broadcasting bands;

b) the extent of co-channel and adjacent channel interference;

~~*noting*~~

~~the possibility of improving the situation by implementing pertinent ITU-R Recommendations,~~

~~*recommends that administrations*~~

~~1 pay special attention to the provisions for "out-of-band spectrum" contained in Recommendation ITU-R SM.328-9;~~

~~2 encourage, to the maximum extent possible, manufacturers to design and build HF broadcasting receivers that conform to Recommendation ITU-R SM.332-4 concerning the selectivity of receivers,~~

~~*invites administrations*~~

~~to take advantage, to the maximum extent practicable, of synchronized frequency transmitter operation, taking into account Recommendation ITU-R BS.702-1,~~

~~*invites ITU-R*~~

~~to carry out further studies in relation to the Recommendations mentioned above, taking into account the requirements of HF broadcasting, with a view to updating these three Recommendations whenever necessary.~~

c) that AM reception quality is relatively poor compared with FM broadcast or CD quality;

d) that new digital techniques have enabled significant improvements in reception quality to be obtained in other broadcasting bands;

e) that the introduction of digital modulation systems in the broadcasting bands below 30 MHz has been shown to be feasible by using low bit-rate coding;

f) that Resolution **517 (Rev.WRC-97)** invites ITU-R to continue its studies on digital techniques in HF broadcasting as a matter of urgency;

g) that urgent studies on this subject are currently carried out by ITU-R in the framework of Question ITU-R 217/10 with a view to issue a relevant Recommendation in a very short time period,

recognizing

a) that the implementation of an ITU recommended worldwide system for digital sound in the HF bands would be extremely beneficial, particularly for developing countries, since it allows for:

– mass-scale production resulting in receivers as economical as possible;

– more economical analogue-to-digital conversion of existing transmitting infrastructures;

b) that the above system would result in digital receivers having a number of advanced features such as assisted tuning, improved audio quality and robustness to co-channel and adjacent channel interference, which would greatly contribute to a better spectrum utilization,

recommends administrations

1 to draw the attention of manufacturers to this matter, to ensure that future digital receivers make full advantage of the advanced technology while maintaining low cost;

2 to encourage manufacturers to closely monitor the development of the studies carried out by ITU-R with a view to starting mass production of new low-cost digital receivers as soon as possible after the approval of relevant ITU-R Recommendation(s).

SUP	RESOLUTION 8 (Rev.Mob-87)
SUP	RESOLUTION 14
SUP	RESOLUTION 23 (WRC-95)
SUP	RESOLUTION 24 (WRC-95)
NOC	RESOLUTION 44 (Mob-87)
SUP	RESOLUTION 50 (WRC-97)
SUP	RESOLUTION 52 (WRC-97)
SUP	RESOLUTION 54 (WRC-97)
[SUP	RESOLUTION 63]
SUP	RESOLUTION 70 (WARC-92)
NOC	RESOLUTION 132 (WRC-97)
NOC	RESOLUTION 209 (Mob-87)
SUP	RESOLUTION 406
SUP	RESOLUTION 411 (WARC-92)
SUP	RESOLUTION 412 (WARC-92)
SUP	RESOLUTION 500
[SUP	RESOLUTION 703 (Rev.WARC-92)]
SUP	RESOLUTION 721 (WRC-97)

SUP	RECOMMENDATION 32 (Orb-88)
SUP	RECOMMENDATION 61
SUP	RECOMMENDATION 405
SUP	RECOMMENDATION 518 (HFBC-87)
NOC	RECOMMENDATION 606 (Mob-87)
[SUP	RECOMMENDATION 720 (WRC-95)]

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INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

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ISTANBUL, 8 MAY – 2 JUNE 2000

WORKING GROUP 5A

Chairperson, Sub-Working Group 5A2

CONCLUSIONS RELATING TO AGENDA ITEM 1.10 (MSS IN 1.5/1.6 GHz BANDS)

MOD

1 525-1 610 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
1 530-1 535 SPACE OPERATION (space-to-Earth) MOBILE-SATELLITE (space-to-Earth) MOD S5.353A Earth exploration-satellite Fixed Mobile except aeronautical mobile S5.341 S5.342 S5.351 S5.354	**1 530-1 535** SPACE OPERATION (space-to-Earth) MOBILE-SATELLITE (space-to-Earth) MOD S5.353A Earth exploration-satellite Fixed Mobile S5.343 S5.341 S5.351 S5.354	
1 535-1 559	MOBILE-SATELLITE (space-to-Earth) S5.341 S5.351 MOD S5.353A S5.354 S5.355 S5.356 S5.357 MOD S5.357A S5.359 S5.362A	

MOD

1 610-1 660 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
1 626.5-1 660	MOBILE-SATELLITE (Earth-to-space) S5.341 S5.351 MOD S5.353A S5.354 S5.355 MOD S5.357A S5.359 S5.362A S5.374 S5.375 S5.376	

MOD

S5.353A In applying the procedures of ~~No. **S9.11A**~~Section II of Article **S9** to the mobile-satellite service in the bands 1 530-1 544 MHz and 1 626.5-1 645.5 MHz, priority shall be given to accommodating the spectrum requirements for distress, urgency and safety communications of the Global Maritime Distress and Safety System (GMDSS). Maritime mobile-satellite distress, urgency and safety communications shall have priority access and immediate availability over all other mobile satellite communications operating within a network. Mobile-satellite systems shall not cause unacceptable interference to, or claim protection from, distress, urgency and safety communications of the GMDSS. Account shall be taken of the priority of safety-related communications in the other mobile-satellite services. (~~See~~The provisions of Resolution ~~**218**~~ **[COM5/22](WRC-~~97~~2000)** shall apply.)

MOD

S5.357A In applying the procedures of ~~No. **S9.11A**~~Section II of Article **S9** to the mobile-satellite service in the bands 1 545-1 555 MHz and 1 646.5-1 656.5 MHz, priority shall be given to accommodating the spectrum requirements of the aeronautical mobile-satellite (R) service providing transmission of messages with priority 1 to 6 in Article **S44**. Aeronautical mobile-satellite (R) service communications with priority 1 to 6 in Article **S44** shall have priority access and immediate availability, by pre-emption if necessary, over all other mobile-satellite communications operating within a network. Mobile-satellite systems shall not cause unacceptable interference to, or claim protection from, aeronautical mobile-satellite (R) service communications with priority 1 to 6 in Article **S44**. Account shall be taken of the priority of safety-related communications in the other mobile-satellite services. (~~See~~The provisions of Resolution ~~**218**~~**[COM5/22] (WRC-~~97~~2000)** shall apply.)

ADD

RESOLUTION [COM5/22] (WRC-2000)

Use of the bands 1 525-1 559 MHz and 1 626.5-1 660.5 MHz by the mobile-satellite service

The World Radiocommunication Conference (Istanbul, 2000),

considering

a) that prior to the World Radiocommunication Conference (Geneva, 1997) the bands 1 530-1 544 MHz (space-to-Earth) and 1 626.5-1 645.5 MHz (Earth-to-space) were allocated to the maritime mobile-satellite service and the bands 1 545-1 555 MHz (space-to-Earth) and 1 646.5-1 656.5 MHz (Earth-to-space) were allocated on an exclusive basis to the aeronautical mobile-satellite (route) service (AMS(R)S) in most countries;

b) that the World Radiocommunication Conference (Geneva, 1997) allocated the bands 1 525-1 559 MHz (space-to-Earth) and 1 626.5-1 660.5 MHz (Earth-to-space) to the mobile-satellite service (MSS) to facilitate the assignment of spectrum to multiple mobile-satellite systems in a flexible and efficient manner;

c) that the World Radiocommunication Conference (Geneva, 1997) adopted footnotes No. **S5.353A** giving priority to accommodating the spectrum requirements for distress, urgency and safety communications, and protection from unacceptable interference, to the global maritime distress and safety service (GMDSS) in the bands 1 530-1 544 MHz and 1 626.5-1 645.5 MHz and No. **S5.357A** giving priority to accommodating the spectrum requirements, and protection from unacceptable interference, to the AMS(R)S providing transmission of messages with priority 1 to 6 in Article **S44** in the bands 1 545-1 555 MHz and 1 646.5-1 656.5 MHz,

further considering

a) that coordination between satellite networks is required on a bilateral basis in accordance with the ITU Radio Regulations. In the bands 1 525-1 559 MHz (space-to-Earth) and 1 626.5-1 660.5 MHz (Earth-to-space) coordination is partially assisted by regional multilateral meetings;

b) that in these bands GSO satellite system operators presently use a capacity planning approach at multilateral coordination meetings, with the guidance and support of their administrations, to periodically coordinate access to the spectrum needed to accommodate their requirements;

c) that the GMDSS and AMS(R)S spectrum requirements are currently satisfied through the capacity planning approach and that in the bands to which Nos. **S5.353A** or **S5.357A** applies, this approach, and other methods such as intra- and inter-system prioritization, pre-emption and interoperability may assist to accommodate the expected increase of spectrum requirements for GMDSS and AMS(R)S;

d) that the feasibility of prioritization, real-time pre-emptive access and the mechanism to transfer spectrum between different mobile-satellite systems that may or may not provide GMDSS and/or AMS(R)S has yet to be established,

recognizing

a) that priority access and immediate availability of spectrum for distress, urgency and safety communications of the GMDSS and AMS(R)S communications is of vital importance for the safety of life;

b) that the ICAO has adopted Standards and Recommended Practices (SARPs) addressing satellite communications with aircraft in accordance with the Convention on International Civil Aviation;

c) that all air traffic communications as defined in Annex 10 to the Convention on International Civil Aviation fall within categories 1 to 6 of Article **S44**;

d) that Table **S15-2** of Appendix **S15** to the Radio Regulations identifies the bands 1 530-1 544 MHz (space-to-Earth) and 1 626.5-1 645.5 MHz (Earth-to-space) for distress and safety purposes in the maritime mobile-satellite service as well as for routine non-safety purposes,

resolves

1 that in the frequency coordination of the mobile-satellite services in the bands 1 525-1 559 and 1 626.5-1 660.5 MHz, administrations shall ensure accommodation of the spectrum needed for distress, urgency and safety communications of GMDSS, as elaborated upon in Articles **S32** and **S33,** in the bands where No. **S5.353A** applies and AMS(R)S communications with priority 1 to 6 of Article **S44** in the bands where No. **S5.357A** applies;

2 that administrations shall ensure the use of the latest technical advances, which may include prioritization and real-time pre-emptive access between MSS systems, when necessary and where feasible, to achieve the most flexible and practical use of the generic allocations;

3 that administrations shall ensure that mobile-satellite service operators carrying non-safety-related traffic yield capacity, as and when necessary, to accommodate the spectrum requirements of the distress, urgency and safety communication of GMDSS communications, as elaborated upon in Articles **S32** and **S33,** and AMS(R)S communications with priority 1 to 6 of Article **S44**. This could be achieved in advance through the coordination process at *resolves* 1, and, when necessary and where feasible, through prioritization and real-time pre-emptive access,

requests ITU-R

to complete studies to determine the feasibility and practicality of prioritization and real-time pre-emptive access between different networks of mobile-satellite systems as referred to in *resolves* 2 above, whilst taking into account the latest technical advances in order to maximize spectral efficiency,

invites

ICAO, IMO, IATA, administrations and other organizations concerned to participate in the studies identified in *requests ITU-R* above.

SUP

RESOLUTION 218 (WRC-97)

Use of the bands 1 525-1 559 MHz and 1 626.5-1 660.5 MHz by the mobile-satellite service

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

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COMMITTEE 4

Working Group 4B

CORRECTIVE ACTION CONCERNING TYPOGRAPHICAL ERRORS IN SOME PARTS OF THE RADIO REGULATIONS

Working Group 4B considered typographical errors noticed in the 1998 edition of the Radio Regulations. The Working Group agreed that the appropriate corrections as given in the Annex be made in the forthcoming editions of the Radio Regulations.

A. ALLISON
Chairperson of Working Group 4B,
Box 68

ANNEX

List of typographical errors concerning the alignment in the three languages (E/F/S)

Volume, page	Incorrect text	Correct text
1, p. 34, No. S5.2, in E/F/S	The map does not conform to the definition in No. S5.9	Include correct drawing according to S5.9
1, p. 63, No. S5.154, in F	Bélarus to be deleted	
1, p. 69, No. S5.177, in S 1, p. 69, No. S5.181, in S	Hungría to be deleted Bélgica, España to be deleted	
1, p. 72, No. S5.203, in F	service aéronautique	Service mobile aéronautique
1, p. 74, No. S5.212, in E	Zaire	The new designation “Democratic Republic of the Congo” is already there
1, p. 87, No. S5.311, in F	Résolutions 33 (CMR-97)	Résolutions 33 (Rév.CMR-97)
1, p. 101, No. S5.388, in F	Résolutions 212 (CMR-95)	Résolutions 212 (Rév.CMR-97)
1, p. 140, frequency band: 40-40.5 MHz, first line, in F	Exploration de la terre par satellite	EXPLORATION DE LA TERRE PAR SATELLITE
2, p. 180, title of the table, in F	S15.1	S15-1
3, p. 276, Resolution 533, *recognizing b)*, in E	position	positions

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WORKING GROUP 5D

Chairperson, WG 5D ad hoc

RESOLUTION [COM5/23] (WRC-2000)

Procedures in case the operational or additional limits in Article S22 are exceeded

The World Radiocommunication Conference (Istanbul, 2000),

considering

a) that WRC-2000 adopted in Article **S22** single-entry operational limits (see Tables **S22-4A** through **S22-4C**) and single-entry additional operational limits (see Table **S22-4A1**), applicable to non-geostationary-satellite systems in the fixed-satellite service in the space-to-Earth direction in certain parts of the frequency range 10.7-20.2 GHz;

b) that, taking into account **S22.5[H]** and **S22.5[I]**, any exceedence of the limits referred to in *considering a)* by a non-geostationary system in the fixed-satellite service to which the limits apply is a violation of No. **S22.2** of the Radio Regulations;

c) that it is important to correct in the most expeditious manner any exceedence of the limits in *considering a)*, and that this could be effected by the inclusion of appropriate procedures in the Radio Regulations;

d) that, although the growth in use of non-geostationary satellites is unlikely to lead to many cases of exceedence of the limits mentioned in *considering a)* before WRC-03, administrations may need interim procedures to address such cases, if they occur, pending the adoption of long-term procedures,

resolves

that further study is needed to develop procedures suitable for application in the long term,

urges administrations

pending the adoption of long-term procedures by a future conference to use, as an interim measure, the procedures set out in Section **VI** (see NOTE 1) of Article **S15**, as amended in NOTE 2 below, to rectify any cases of violation of No. **S22.2**,

requests ITU-R

to conduct, as a matter of urgency, and complete in time for consideration by WRC-03, the appropriate regulatory studies to develop procedures, not limited to modification of Article **S15**, for application in cases where the power limits mentioned in *considering a)* are exceeded into an operational earth station.

NOTE 1 - Although Section **VI** of Article **S15** prescribes procedures for resolving cases of harmful interference (as defined in Article **S1**), it is not intended by WRC-2000 that interference exceeding the limits mentioned in *considering a)* should necessarily be regarded as “harmful”.

NOTE 2 - For its use as interim procedures in the present context, the following items in Section VI of Article **S15** should not apply: **S15.22**, **S15.28**, **S15.36**, **S15.37**, **S15.43**, **S15.44**, **S15.45**, **S15.46**.

INTERNATIONAL TELECOMMUNICATION UNION

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Chairperson, Working Group 5A

CONCLUSIONS RELATING TO AGENDA ITEM 1.11

SUP

RESOLUTION 219 (WRC-97)

Studies relating to consideration of the allocation to the non-geostationary mobile-satellite service in the meteorological aids band 405-406 MHz and the impact on primary services allocated in the adjacent bands

MOD

RESOLUTION 214 (Rev.WRC-~~97~~2000)

Sharing studies relating to consideration of the allocation of bands below 1 GHz to the non-geostationary mobile-satellite service

The World Radiocommunication Conference (~~Geneva, 1997~~Istanbul, 2000),

considering

a) that the agenda of this Conference included consideration of additional allocations on a worldwide basis for the non-geostationary mobile-satellite service (non-GSO MSS) below 1 GHz;

b) that the 199~~7~~9 Conference Preparatory Meeting, in its Report, indicated that for the non-GSO MSS below 1 GHz there is not enough spectrum currently allocated to allow development of all the systems currently in coordination, and that, in order to meet projected MSS requirements below 1 GHz, a range of an additional 7 to 10 MHz will be required in the near future although, as well, it recognized that a number of these systems may not be implemented for reasons not connected with spectrum availability;

c) that there is an urgent need to make usable spectrum available on a worldwide basis for non-GSO MSS systems operating below 1 GHz;

d) that some non-GSO MSS systems are already operated by some administrations in existing MSS allocations and are at an advanced stage of consideration for operation in many other administrations, and that studies have been conducted within ITU-R on sharing between non-GSO MSS and certain terrestrial services which demonstrate the feasibility of sharing in the cases studied;

e) that issues concerning the technical and operational means to facilitate sharing between the terrestrial services and non-GSO MSS in the bands below 1 GHz remain to be studied;

f) that the requirements for the introduction of these new technologies have to be balanced with the needs of other services having allocations below 1 GHz;

g) that the bands below 1 GHz are extensively used by administrations for many services, although the extent to which they are used by each administration varies throughout the world~~,~~;

h) that the bands 410-430 MHz and 440-470 MHz are extensively used by existing services in Region 1, in many countries in Region 3, and in some countries in Region 2, and new terrestrial systems are planned to be introduced in these bands;

i) that studies of certain bands have not been completed,

noting

a) that additional studies may identify ~~other~~suitable bands below 1 GHz ~~which could also~~and appropriate sharing techniques to be considered ~~suitable~~ for ~~a~~ worldwide allocations to non-GSO MSS;

~~*b)* that, based on the sharing techniques being developed for MSS below 1 GHz and the current use of the band 138-470 MHz by terrestrial services, this range may be considered for further study;~~

~~c~~b) that constraints on the duration of any single transmission from an individual MSS mobile earth station and constraints on the period between consecutive transmissions from an individual MSS mobile earth station operating on the same frequency may facilitate sharing with terrestrial services;

~~d~~c) that interference mitigation techniques, such as the dynamic channel activity assignment system described in Recommendation ITU-R M.1039~~-1~~, may be used by non-GSO MSS systems below 1 GHz in the Earth-to-space direction to promote compatibility with terrestrial systems when operating in the same frequency band;

~~e~~d) that new technologies employed by some radiocommunication services, especially within the terrestrial mobile and broadcasting services, which require spectrum below 1 GHz, may have an impact on the sharing possibilities;

e) that substantial progress has been made by recently completed ITU-R studies of sharing between the non-GSO MSS below 1 GHz in the Earth-to-space direction and existing specific services, however, studies on some important issues remain to be completed;

f) that non-GSO MSS systems operating below 1 GHz have undergone advance publication by the Radiocommunication Bureau and that administrations may seek to implement further such systems;

~~*g)* that there may be a need to review constraints on the current allocations to the MSS below 1 GHz,~~

g) that the use of some sharing techniques such as those referenced in *noting c)* results in non-GSO MSS systems which have significantly greater spectrum requirements in the Earth-to-space direction than in the space-to-Earth direction,

resolves

1 that further studies are urgently required on operational and technical means to facilitate sharing between the non-GSO MSS and other radiocommunication services having allocations and operating below 1 GHz;

2 that WRC-~~99~~02/03 be invited to consider, on the basis of the results of the studies conducted within ITU-R and the studies referred to in *resolves* 1 above, additional allocations on a worldwide basis for the non-GSO MSS below 1 GHz;

3 that relevant entities and organizations be invited to participate in these sharing studies~~;~~,

~~4 that WRC-99 be invited to consider a review of the technical and regulatory constraints on non-GSO MSS allocations in the bands below 1 GHz, taking into account *considering d)*,~~

invites ITU-R

1 to study and develop Recommendations on, as a matter of urgency, the performance requirements, sharing criteria and technical and operational issues relating to sharing between ~~both~~ existing and planned systems of allocated services and non-GSO MSS below 1 GHz;

2 as a matter of urgency, to carry out studies in preparation for WRC-~~99~~02/03, ~~including a review of the operating constraints referred to in *noting c)* necessary to protect the existing and planned development of all of the services to which the bands below 1 GHz are allocated,~~ having regard to *noting ~~d~~c)*;

3 as a matter of urgency, to carry out studies in preparation for WRC-~~99~~02/03 with respect to interference mitigation techniques, such as the dynamic channel activity assignment system described in Recommendation ITU-R M.1039~~-1~~, necessary to permit the continued development of all of the services to which the bands are allocated;

~~4 to carry out a review for a future competent conference of the technical and regulatory constraints on non-GSO MSS allocations in the bands below 1 GHz, having regard to *considering d)*;~~

~~5~~4 to bring the results of these studies to the attention of WRC-~~99~~02/03 and the relevant preparatory meetings,

urges administrations

1 to participate actively in these studies, with the involvement of both terrestrial and satellite interests;

2 to submit to ITU-R reports on their technical studies and on their operational and frequency sharing experience with non-GSO MSS systems operating below 1 GHz,

encourages administrations

to consider the use of dynamic channel assignment techniques, such as those described in Recommendation ITU-R M.1039~~-1~~.

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COMMITTEE 5

Working Group 5B

MODIFICATIONS TO ARTICLE S15 AND RESOLUTION 207

(WRC-2000 AGENDA ITEM 1.7)

The following modifications to Article S15 and Resolution 207 have been approved by Working Group 5B in response to agenda item 1.7. They are submitted to Committee 5 for consideration and approval.

T. MIZUIKE
Chairperson, Working Group 5B

1 Modification of Article S15

ARTICLE S15

Interferences

Section I – Interference from Radio Stations

MOD

S15.8 § 4 Special consideration shall be given to avoiding interference on distress and safety frequencies and those related to distress and safety identified in Article **S31,** Appendix **S13** and safety and regularity of flight identified in Appendix **S27**.

Section VI – Procedure in a case of harmful interference

MOD

S15.28 § 20 Recognizing that transmissions on the distress and safety frequencies and frequencies used for the safety and regularity of flight (see Article **S31** ~~and~~, Appendix **S13** and Appendix **S27**) require absolute international protection and that the elimination of harmful interference to such transmissions is imperative, administrations undertake to act immediately when their attention is drawn to any such harmful interference.

MOD

S15.35 § 27 On being informed that a station over which it has jurisdiction is believed to have been the cause of harmful interference, an administration shall, as soon as possible, acknowledge receipt of that information by ~~telegram~~ the quickest means available. Such acknowledgement shall not constitute an acceptance of responsibility.

MOD

S15.37 § 29 An administration receiving a communication to the effect that one of its stations is causing harmful interference to a safety service shall promptly investigate the matter and take any necessary remedial action and respond in a timely manner.

2 Modification of Resolution 207

RESOLUTION 207 (~~Mob-87~~Rev.WRC-2000)

Measures to address ~~U~~unauthorized use of and interference to frequencies in the bands allocated to the maritime mobile service and to the aeronautical mobile (R) service[1]

The World ~~Administrative~~ Radiocommunication Conference ~~for the Mobile Services~~, ~~Geneva, 1987~~(Istanbul, 2000),

considering

a) that the HF frequencies currently used by the aeronautical and maritime mobile services for distress, safety and other communications, including allotted operational frequencies, suffer from harmful interference and are often subject to difficult propagation conditions;

b) that WRC-97 considered some aspects of the use of the HF bands for distress and safety communications in the context of the Global Maritime Distress and Safety System (GMDSS), especially with regard to regulatory measures;

c) that unauthorized operations using maritime and aeronautical frequencies in the HF bands are continuing to increase and are already a serious risk to HF distress, safety and other communications;

d) that some administrations have resorted to, for example, transmitting warning messages on operational HF channels as a means of deterring unauthorized users;

e) that provisions of the Radio Regulations prohibit the unauthorized use of certain safety frequencies for other than safety related communications;

f) that enforcing compliance with these regulatory provisions is becoming increasingly difficult with the availability of low-cost HF SSB transceivers;

~~a~~g) that monitoring observations of the use of frequencies in the band 2 170-2 194 kHz and in the bands allocated exclusively to the maritime mobile service between 4 063 kHz and 27 500 kHz and to the aeronautical mobile (R) service between 2 850 kHz and 22 000 kHz show that a number of frequencies in these bands are still being used by stations of other services, ~~some~~ many of which are operating in contravention of No. **S23.2**;

~~*b)* that these stations are causing harmful interference to the maritime mobile and aeronautical mobile (R) services;~~

~~c~~h) that HF radio is the sole means of communication in certain situations for the maritime mobile service and that certain frequencies in the bands mentioned in *considering ~~a~~g)* are reserved for distress and safety purposes;

~~d~~i) that HF radio is the sole means of communication in certain situations for the aeronautical mobile (R) service and that this is a safety service~~,~~;

[1] WRC-97 made editorial amendments to this Resolution.

j) that this Conference has reviewed the use of the HF bands by the aeronautical mobile (R) and maritime mobile services with a view to protecting the operational, distress and safety communications,

considering in particular

~~e~~k) that it is of paramount importance that the distress and safety channels of the maritime mobile service be kept free from harmful interference, since they are essential for the protection of the safety of life and property;

~~f~~l) that it is also of paramount importance that channels directly concerned with the safe and regular conduct of aircraft operations be kept free from harmful interference, since they are essential for the safety of life and property,

resolves

to invite ITU-R and ITU-D, as appropriate

a) to study possible technical and regulatory solutions to assist in the mitigation of interference to the operational distress and safety communications in the maritime mobile service and aeronautical mobile (R) service;

b) to increase regional awareness of appropriate practices to help mitigate interference in the HF bands, especially on distress and safety channels;

c) to report the results of the studies referred to in *resolves a)* to the next competent conference,

to urge administrations

1 to ensure that stations of services other than the maritime mobile service abstain from using frequencies in distress and safety channels and their guard bands and in the bands allocated exclusively to that service, except under the conditions expressly specified in Nos. **S4.4**, **S5.128**, **S5.129**, **S5.137** and **S4.13** to **S4.15**; and to ensure that stations of services other than the aeronautical mobile (R) service ~~refrain~~ abstain from using frequencies allocated to that service except under the conditions expressly specified in Nos. **S4.4** and **S4.13**;

2 to make every effort to identify and locate the source of any unauthorized emission capable of endangering human life or property and the safe and regular conduct of aircraft operations, and to communicate their findings to the Radiocommunication Bureau;

3 to participate in the monitoring programmes that the Radiocommunication Bureau may organize pursuant to this Resolution;

4 to make every effort to ~~ensure~~ prevent unauthorized transmissions in bands allocated to ~~that such emissions are made in appropriate bands allocated to services other than~~ the maritime mobile service and~~or~~ the aeronautical mobile (R) service;

5 to request their competent authorities to take, within their respective jurisdiction, such legislative or regulatory measures which they consider necessary or appropriate in order to prevent stations from unauthorized use of distress and safety channels or operating in contravention of No. **S23.2**~~,~~;

6 to take all necessary steps in such cases of contravention of No. **S23.2** to ensure the cessation of any transmissions contravening the provisions of the Radio Regulations on the frequencies or in the bands referred to in this Resolution;

7 to participate actively in the studies requested by this Resolution,

to invite the Radiocommunication Bureau

1 to continue to organize monitoring programmes, at regular intervals, in the maritime distress and safety channels and their guard bands and in the bands allocated exclusively to the maritime mobile service between 4 063 kHz and 27 500 kHz and to the aeronautical mobile (R) service between 2 850 kHz and 22 000 kHz, with a view to ensuring the timely distribution of monitoring data and identifying the stations of other services operating on these channels or in these bands;

2 to seek the cooperation of administrations in identifying the sources of those emissions by all available means and in securing the cessation of those emissions;

3 when the station of another service transmitting in a band allocated to the maritime mobile service or to the aeronautical mobile (R) service has been identified, to inform the administration concerned~~,~~;

4 to include the problem of interference to maritime and aeronautical distress and safety channels on the agenda of relevant regional radiocommunication seminars,

~~*requests administrations*~~

~~to take all necessary steps in such cases to ensure the cessation of any transmissions contravening the provisions of the Radio Regulations on the frequencies or in the bands referred to in this Resolution.~~

instructs the Secretary-General

to communicate this Resolution to the attention of the International Maritime Organization and the International Civil Aviation Organization and to invite them to participate in these studies.

INTERNATIONAL TELECOMMUNICATION UNION

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Working Group 5B

MODIFICATIONS TO ARTICLE S52 AND APPENDIX S17
AND A NEW RESOLUTION

(AGENDA ITEM 1.7)

The following texts:

– modification of Article S52;

– modification of Appendix S17; and

– draft new Resolution "Study on the interference caused to the distress and safety frequencies 12 290 kHz and 16 420 kHz by routine calling",

have been approved by Working Group 5B. They are submitted to Committee 5 for consideration and approval.

Working Group 5B also considered Resolution 346 (WRC-97). Since the issue of HF frequencies and in particular the distress and safety frequencies will be considered again at WRC-03, Working Group 5B suggests to maintain Resolution 346 unchanged.

Working Group 5B drew the attention of GT PLEN-2 to the new draft Resolution [COM5/12] "Study on the interference caused to the distress and safety frequencies 12 290 kHz and 16 420 kHz by routine calling" because it may have an impact on the consideration of agenda items of future conferences.

T. MIZUIKE
Chairperson, Working Group 5B

1 Modification of Article S52

ARTICLE S52

Special rules relating to the use of frequencies

Section VI – Use of frequencies for radiotelephony

C2 – Call and reply

ADD

S52.220A Administrations should encourage the coast stations and ship stations under their jurisdiction to use digital selective calling techniques for call and reply.

ADD

S52.220B When calling by radiotelephony is necessary, it should be done (in the order of preference):

ADD

S52.220C 1) on the national frequencies assigned to the coast stations; or

ADD

S52.220D 2) when this is not possible, on the calling frequencies listed under **S52.221** or **S52.221A** below.

MOD

S52.221 § 97 1) Ship stations may use the following carrier frequencies for calling in radiotelephony:

4 125 kHz[3, 4, 5]
6 215 kHz[4, 5]
8 255 kHz
12 290 kHz[5] (see also No. **S52.221A**)
16 420 kHz[5] (see also No. **S52.221A**)
18 795 kHz
22 060 kHz
25 097 kHz

---

[3] **S52.221.1** In the United States, the carrier frequency 4 125 kHz is also authorized for common use by coast and ship stations for single-sideband radiotelephony on a simplex basis, provided the peak envelope power of such stations does not exceed 1 kW (see also No. **S52.222.2**).

[4] **S52.221.2** The carrier frequencies 4 125 kHz and 6 215 kHz are also authorized for common use by coast and ship stations for single-sideband radiotelephony on a simplex basis for call and reply purposes, provided that the peak envelope power of such stations does not exceed 1 kW. The use of these frequencies for working purposes is not permitted (see also Appendix **S13** and No. **S52.221.1**).

[5] **S52.221.3** The carrier frequencies 4 125 kHz, 6 215 kHz, 8 291 kHz, 12 290 kHz and 16 420 kHz are also authorized for common use by coast and ship stations for single-sideband radiotelephony on a simplex basis for distress and safety traffic.

ADD

S52.221A Calling on the carrier frequencies 12 290 kHz and 16 420 kHz shall cease as soon as possible and no later than 31 December 2003. Alternative carrier frequencies 12 359 kHz and 16 537 kHz may be used by ship stations and coast stations for calling on a simplex basis provided that the peak envelope power does not exceed 1 kW.

MOD

S52.222 2) Coast stations may use the following carrier frequencies for calling in radiotelephony[6]:

4 417 kHz[7]
6 516 kHz[7]
8 779 kHz
13 137 kHz (see No. **S52.222A**)
17 302 kHz (see No. **S52.222A**)
19 770 kHz
22 756 kHz
26 172 kHz

ADD

S52.222A The carrier frequencies 13 137 kHz and 17 302 kHz shall not be used as calling frequencies after 31 December 2003. Alternative carrier frequencies 12 359 kHz and 16 537 kHz may be used by ship stations and coast stations for calling on a simplex basis provided that the peak envelope power does not exceed 1 kW.

MOD

S52.224 § 99 1) Before transmitting on the carrier frequencies 4 125 kHz, 6 215 kHz, 8 291 kHz, 12 290 kHz or 16 420 kHz a station shall listen on the frequency for a reasonable period to make sure that no distress traffic is being sent (see No. **S52.221A** and Recommendation ITU-R M.1171).

---

[6] **S52.222.1** These frequencies may also be used by coast stations with class H2B emission, when using the selective calling system defined in Recommendation ITU-R M.257-3.

[7] **S52.222.2** The carrier frequencies 4 417 kHz and 6 516 kHz are also authorized for common use by coast and ship stations for single-sideband radiotelephony on a simplex basis, provided that the peak envelope power of such stations does not exceed 1 kW. The use of 6 516 kHz for this purpose should be limited to daytime operation (see also No. **S52.221.1**).

2 Modification of Appendix S17

APPENDIX S17

Frequencies and channelling arrangements in the high-frequency bands for the maritime mobile service

PART B – Channelling arrangements

Section I – Radiotelephony

MOD

5 The following frequencies in Sub-Section A are allocated for calling purposes:

– Channel No. 421 in the 4 MHz band;

– Channel No. 606 in the 6 MHz band;

– Channel No. 821 in the 8 MHz band;

– Channel No. 1221 in the 12 MHz band;

– Channel No. 1621 in the 16 MHz band;

– Channel No. 1806 in the 18 MHz band;

– Channel No. 2221 in the 22 MHz band;

– Channel No. 2510 in the 25 MHz band.

The use of channels 1221 and 1621 for calling purposes shall cease as soon as possible and no later than 31 December 2003 (see **S52.221A** and **S52.222A**).

The remaining frequencies in Sub-Sections A, B, C-1 and C-2 are working frequencies.

Sub-Section A

Table of single-sideband transmitting frequencies (kHz) for duplex (two-frequency) operation

NOC to the tables

MOD notes after the tables

1 These coast station frequencies may be paired with a ship station frequency from the table of simplex frequencies for ship and coast stations (see Sub-Section B) or with a frequency from the band 4 000-4 063 kHz (see Sub-Section C-1) to be selected by the administration concerned.

2 For the use and notification of these frequencies, see Resolution **325 (Mob-87)***.(Not used)

3 These channels may also be used for simplex (single frequency) operation.

4 For the conditions of use of the carrier frequency 4 125 kHz, see Nos. **S52.224** and **S52.225**, and Appendix **S15**.

5 For the conditions of use of the carrier frequency 6 215 kHz, see Appendices **S13** and **S15**.

6 These coast station frequencies may be paired with a ship station frequency from the table of simplex frequencies for ship and coast stations (see Sub-Section B) or with a frequency from the band 8 100-8 195 kHz (see Sub-Section C-2) to be selected by the administration concerned.

7 For the conditions of use of the carrier frequency 8 291 kHz, see Appendix **S15**.

8 For the conditions of use of the carrier frequency 12 290 kHz, see Nos. **S52.221A** and **S52.222A** and Appendix **S15**.

9 For the conditions of use of the carrier frequency 16 420 kHz, see Nos. **S52.221A** and **S52.222A** and Appendix **S15**.

* The frequencies followed by an asterisk are calling frequencies (see Nos. **S52.221** and **S52.222**).

Sub-Section B

Table of single-sideband transmitting frequencies (kHz) for simplex (single-frequency) operation and for intership cross-band (two-frequency) operation

(See § 4 of Section I of this Appendix)

MOD

4 MHz band[1]		**6 MHz band**		**8 MHz band[2]**		**12 MHz band**	
Carrier frequency	**Assigned frequency**	**Carrier frequency**	**Assigned frequency**	**Carrier frequency**	**Assigned frequency**	**Carrier frequency**	**Assigned frequency**
4 146 4 149	4 147.4 4 150.4	6 224 6 227 6 230	6 225.4 6 228.4 6 231.4	8 294 8 297	8 295.4 8 298.4	12 353 12 356 12 359 12 362 12 365	12 354.4 12 357.4 12 360.4 12 363.4 12 366.4

1 These frequencies may be used for duplex operation with coast stations operating on Channel Nos. 428 and 429 (see Sub-Section A).

2 These frequencies may be used for duplex operation with coast stations operating on Channel Nos. 834 up to and including 837 (see Sub-Section A).

* This Resolution was abrogated by WRC-95.

MOD

16 MHz band		18/19 MHz band		22 MHz band		25/26 MHz band	
Carrier frequency	**Assigned frequency**	**Carrier frequency**	**Assigned frequency**	**Carrier frequency**	**Assigned frequency**	**Carrier frequency**	**Assigned frequency**
16 528	16 529.4	18 825	18 826.4	22 159	22 160.4	25 100	25 101.4
16 531	16 532.4	18 828	18 829.4	22 162	22 163.4	25 103	25 104.4
16 534	16 535.4	18 831	18 832.4	22 165	22 166.4	25 106	25 107.4
~~16 537~~	~~16 538.4~~	18 834	18 835.4	22 168	22 169.4	25 109	25 110.4
16 540	16 541.4	18 837	18 838.4	22 171	22 172.4	25 112	25 113.4
16 543	16 544.4	18 840	18 841.4	22 174	22 175.4	25 115	25 116.4
16 546	16 547.4	18 843	18 844.4	22 177	22 178.4	25 118	25 119.4

For use of frequencies 12 359 kHz and 16 537 kHz see Nos. **S52.221A** and **S52.222A**.

ADD

RESOLUTION [COM5/12]

Study on the interference caused to the distress and safety frequencies 12 290 kHz and 16 420 kHz by routine calling

The World Radiocommunication Conference (Istanbul, 2000),

considering

a) that the distress and safety frequencies 12 290 kHz and 16 420 kHz are the ship station transmitting frequencies of the maritime radiotelephony channels 1221 and 1621;

b) that at the date of this conference some coast stations continue using channels 1221 and 1621 for calling purposes and have indicated a wish to continue calling on these channels in the future;

c) that this conference decided to cease calling on channels 1221 and 1621 on 31 December 2003 at the latest;

d) that replacement channels may need to be made available for the coast stations mentioned under *considerings b)* and *c)*;

e) that there are differing opinions as to whether calling on channels 1221 and 1621 causes significant interference to distress and safety communications;

f) that this issue can be resolved by analysing the results of an ITU-R study;

g) that this conference has adopted additional measures that may significantly reduce this interference;

h) that IMO and several Member States have requested that the distress and safety frequencies 12 290 kHz and 16 420 kHz be reserved solely for that purpose;

i) that the full implementation of the cessation of calling on 31 December 2003 on the distress and safety frequencies 12 290 kHz and 16 420 kHz will allow this issue to be reconsidered by the next world radiocommunication conference,

resolves

1 to invite ITU-R to study the interference to the distress and safety frequencies 12 290 kHz and 16 420 kHz caused by routine calling on channels 1221 and 1621;

2 to invite the Radiocommunication Bureau, in consultation with administrations, to organize monitoring programmes for the support of these studies;

3 to urge administrations to participate actively in these studies;

4 to invite ITU-R to complete the study under *resolves* 1 and report to the next world radiocommunication conference,

instructs the Secretary-General

to communicate this Resolution to the International Maritime Organization,

invites Council

to place this issue on the agenda of the next world radiocommunication conference.

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

Document 358-E
23 May 2000
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ISTANBUL, 8 MAY – 2 JUNE 2000

WORKING GROUP 5A

Chairperson, Drafting Group 5A-2

RESOLUTION [COM5/24] (WRC-2000)

[Additional frequency bands identified for IMT-2000 and advanced communication applications]

The World Radiocommunication Conference (Istanbul, 2000),

considering

a) that IMT-2000 is the ITU vision of global mobile access and is scheduled to start service around the year 2000 subject to market and other considerations;

b) that IMT-2000 is an advanced mobile communication applications concept intended to provide telecommunication services on a worldwide scale regardless of location, network or terminal used;

c) that IMT-2000 will provide access to a wide range of telecommunication services supported by the fixed telecommunication networks (e.g. PSTN/ISDN), and to other services which are specific to mobile users;

d) that the technical characteristics of IMT-2000 are specified in ITU-R and ITU-T Recommendations including Recommendation ITU-R M.1457 which contains the detailed specifications of the radio interfaces of IMT-2000;

e) that the evolution of IMT-2000 is being studied within ITU-R;

f) that the review of IMT-2000 spectrum requirements at WRC-2000 concentrated on the bands below 3 GHz;

g) that at WARC-92, 230 MHz of spectrum was identified for IMT-2000 in the bands 1 885-2 025 MHz and 2 110-2 200 MHz, including the bands 1 980-2 010 MHz and 2 170-2 200 MHz for the satellite component of IMT-2000 in No. **S5.388** and under the provisions of Resolution **212 (Rev.WRC-97)**;

h) that since WARC-92 there has been a tremendous growth in mobile communications including an increasing demand for wideband multimedia capability;

i) that ITU-R studies forecasted that spectrum in the order of 160 MHz, in addition to that identified already for [initial] IMT-2000 bands in No. **S5.388** [at WARC-92] and in addition to the spectrum used for the first- and second-generation mobile systems in all three ITU Regions, will be needed to meet the projected requirements of IMT-2000 in those areas where the traffic is the highest by 2010;

j) that WRC-2000 has [identified] [additional] frequency bands in No. **S5.AAA** for IMT-2000 in order to meet the ITU-R projected additional spectrum requirement;

k) that the bands [identified] for IMT-2000 are currently used by either first- or second-generation mobile systems or applications of other radiocommunication services;

l) that Recommendation ITU-R M.1308 addresses the evolution of existing mobile communication systems to IMT-2000;

m) that the evolution of first- and second-generation cellular-based mobile systems can be facilitated if permitted to use their current frequency bands;

n) that harmonized worldwide bands for IMT-2000 are desirable to achieve global roaming and the benefits of economies of scale;

o) that the bands 1 710-1 885 MHz and 2 500-2 690 MHz are allocated to a variety of services in accordance with the relevant provisions of the Radio Regulations;

p) that the existing applications in the bands identified for IMT-2000 require spectrum below 3 GHz for technical reasons;

q) that technological advancement and market demand will promote innovation and accelerate the delivery of advanced communication applications to consumers;

r) that changes in technology may lead to the further development of communication applications, including IMT-2000,

emphasizing

that flexibility must be afforded to administrations:

– to determine, at a national level, how much spectrum to make available for IMT-2000 from within the identified bands;

– to develop their own transitions plans, if necessary, tailored to meet their specific deployment of existing systems;

– to have the ability for the identified bands to be used by all services allocated in those bands;

– to determine the timing of availability and use of the bands identified for IMT-2000, in order to meet particular market demand and other national considerations;

– to meet the particular needs of developing countries,

noting

a) that the sharing implications between services sharing in the bands identified for IMT-2000 in No. **S5.AAA** will need further study in ITU-R;

b) that studies regarding the availability of the 1 710-1 885 MHz and 2 500-2 690 MHz bands for IMT-2000 are being conducted in many countries, the results of which could have implications for the use of those bands in those countries;

c) that not all administrations may need, due to differing requirements, or be able to implement, due to the usage by and investment in the existing services, all of the IMT-2000 bands identified at this Conference;

d) that the amount of spectrum for IMT-2000 identified by WRC-2000 may not completely satisfy the expected requirements of all administrations;

e) [that administrations may implement IMT-2000 in any frequency band allocated to the mobile or mobile-satellite service;]

f) [that all or parts of the 1 710-1 885 MHz bands in Regions 1 and 3 and 1 850-1 990 MHz in Region 2 are used for second-generation mobile communication systems and the operators of such systems may wish to use these bands for IMT-2000;]

g) that services such as fixed, mobile (second-generation systems), space operations, space research and aeronautical mobile are in operation, or planned in the band 1 710-1 885 MHz, or portions of this band;

h) that services such as broadcasting-satellite, broadcasting-satellite (sound), mobile-satellite and fixed, including multipoint distribution/communication systems, are in operation or planned, in the band 2 500-2 690 MHz, or in portions of this band;

i) that the identification of several bands for IMT-2000 allows administrations to choose the best band or parts of bands for their circumstances;

j) [that the availability of the satellite component of IMT-2000 would improve the overall implementation and the attractiveness of IMT-2000 to both developed and developing countries;]

k) that ITU-R has identified additional work to address further developments in IMT-2000 applications and beyond;

l) that the IMT-2000 radio interfaces as defined in Recommendation ITU-R M.1457 are expected to evolve within the framework of ITU-R beyond those initially specified, to provide enhanced services and services beyond those envisaged in the initial implementation;

m) that the frequency bands identified for IMT-2000 in [No. **S5.388** at WARC-92] and No. **S5.AAA** [are intended for] those administrations implementing IMT-2000, without precluding any other use for other services in these bands;

n) that the provisions of No. [**XXX**] do not prevent administrations the choice to implement other technologies in the frequency bands identified for IMT-2000, based on national requirements,

recognizing

a) that some administrations are planning to use the band 2 300-2 400 MHz for IMT-2000;

b) that for some administrations the only way for implementation of IMT-2000 would be spectrum refarming requiring significant financial investment;

c) [that the frequency bands identified in No. **S5.388** are the frequency bands for initial implementation of IMT-2000;]

d) [that the frequency bands identified in No. **S5.AAA** are global frequency bands identified in addition to those in No. **S5.388**, for further implementation of IMT-2000, based on national requirements,]

resolves

1 to invite administrations implementing IMT-2000 or planning to implement IMT-2000 to make available, based on market demand and other national considerations, [additional] bands or portions of the bands identified in [No. **S5.388** and] No. **S5.AAA** for the terrestrial component of IMT-2000 to meet the forecasted growth of these systems. Due consideration should be given to the benefits of harmonized utilization of the spectrum for the terrestrial component of IMT-2000, taking into account the use and planned use of these bands by all services to which these bands are allocated;

2 [that this identification does not preclude the use of these bands by any applications by the services to which they are allocated and does not establish priority in the Radio Regulations,]

invites ITU-R

a) to study the implications of sharing of IMT-2000 with other applications and services in the bands 1 710-1 885 MHz and 2 500-2 690 MHz and the implementation, sharing and frequency arrangements of IMT-2000 in the bands 1 710-1 885 MHz and 2 500-2 690 MHz in accordance with Annex 1;

b) to develop harmonized frequency arrangements for operation of the terrestrial component of IMT-2000 in the spectrum identified in [No. **S5.AAA]**, aiming to achieve compatibility with existing frequency arrangements used by the first- and second-generation systems;

c) to continue its studies on further enhancements of IMT-2000 including the provision of Internet Protocol (IP) based applications that may require unbalanced radio resources between mobile and base station transmit;

d) to provide guidance to ensure that IMT-2000 can meet the telecommunication needs of the developing countries and rural areas;

e) to include these frequency arrangements and the results of these studies in one or more ITU-R Recommendations,

invites ITU-T

a) to complete its studies of signalling and communication protocols;

b) to develop a common worldwide intersystem numbering plan and associated network capabilities that will facilitate worldwide roaming,

further invites ITU-R and ITU-T

to commence these studies forthwith,

further resolves

[that bands referred to in No. **S5.XXX** may also be used for other advanced communication applications beyond IMT-2000,]

instructs the Director of the Radiocommunication Bureau

to facilitate to the greatest extent possible the completion of these studies and to report the results of these studies within three years,

urges administrations and Sector Members

to submit the necessary contributions to actively participate in ITU-R studies.

ANNEX 1

Request for studies by ITU

In response to Resolution [**COM5/24] (WRC-2000)**, studies that address the following should be conducted:

1 sharing implications and possibilities for all services allocated in the identified frequency bands;

2 harmonized frequency arrangements for the implementation of IMT-2000 in the bands mentioned in this Resolution that take into account the services currently using the bands and the required compatibility frequency arrangements of second-generation systems using these bands;

3 [frequency arrangements to facilitate the evolution of current mobile systems to IMT-2000 [and beyond];]

4 [means to facilitate global roaming across different regional band plans within the bands identified for IMT-2000 [and beyond];]

5 spectrum demand predictions related to traffic density and timing;

6 planning tools for adaptation of mobile radiocommunication technologies, including IMT-2000, for the needs of developing countries;

7 to maintain a database of national studies and decisions on selection of spectrum for IMT-2000.

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GT PLEN-2

Chairperson of Working Group 5B

NOTE TO THE CHAIRPERSON OF WORKING GROUP 2 OF THE PLENARY

New Resolution [COM5/12] "Study on the interference caused to the distress and safety frequencies 12 290 kHz and 16 420 kHz by routine calling", proposed by Working Group 5B for adoption at Committee 5 in Document 357, may have an impact on the consideration of agenda items of future conferences. Working Group 5B requests GT PLEN-2 to take that Resolution into account when drafting agendas of future conferences.

T. MIZUIKE
Chairperson, Working Group 5B

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

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WORKING GROUP 5A

Chairperson, Drafting Group 5A-2

MODIFICATIONS TO ARTICLE S5 FOR [ADDITIONAL] SPECTRUM ABOVE 1 GHz FOR IMT-2000

MOD

1 710-2 170 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
1 710-1 930	FIXED MOBILE S5.380 ADD S5.AAA S5.149 S5.341 S5.385 S5.386 S5.387 S5.388	

2 170-2 520 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
2 500-2 520 FIXED S5.409 S5.410 S5.411 MOBILE except aeronautical mobile ADD S5.AAA MOBILE-SATELLITE (space-to-Earth) S5.403 S5.405 S5.407 S5.408 S5.412 S5.414	**2 500-2 520** FIXED S5.409 S5.411 FIXED-SATELLITE (space-to-Earth) S5.415 MOBILE except aeronautical mobile ADD S5.AAA MOBILE-SATELLITE (space-to-Earth) S5.403 S5.404 S5.407 S5.414 S5.415A	

2 520-2 700 MHz

<table>
<tr><th colspan="3">Allocation to services</th></tr>
<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr><td rowspan="2">**2 520-2 655**
FIXED S5.409 S5.410 S5.411
MOBILE except aeronautical mobile ADD S5.AAA
BROADCASTING-SATELLITE S5.413 S5.416
S5.339 S5.403 S5.405 S5.408 S5.412 S5.417 S5.418</td><td rowspan="2">**2 520-2 655**
FIXED S5.409 S5.411
FIXED-SATELLITE (space-to-Earth) S5.415
MOBILE except aeronautical mobile ADD S5.AAA
BROADCASTING-SATELLITE S5.413 S5.416
S5.339 S5.403</td><td>**2 520-2 535**
FIXED S5.409 S5.411
FIXED-SATELLITE (space-to-Earth) S5.415
MOBILE except aeronautical mobile ADD S5.AAA
BROADCASTING-SATELLITE S5.413 S5.416
S5.403 S5.415A</td></tr>
<tr><td>**2 535-2 655**
FIXED S5.409 S5.411
MOBILE except aeronautical mobile ADD S5.AAA
BROADCASTING-SATELLITE S5.413 S5.416
S5.339 S5.418</td></tr>
<tr><td>**2 655-2 670**
FIXED S5.409 S5.410 S5.411
MOBILE except aeronautical mobile ADD S5.AAA
BROADCASTING-SATELLITE S5.413 S5.416
Earth exploration-satellite (passive)
Radio astronomy
Space research (passive)
S5.149 S5.412 S5.417 S5.420</td><td>**2 655-2 670**
FIXED S5.409 S5.411
FIXED-SATELLITE (Earth-to-space) (space-to-Earth) S5.415
MOBILE except aeronautical mobile ADD S5.AAA
BROADCASTING-SATELLITE S5.413 S5.416
Earth exploration-satellite (passive)
Radio astronomy
Space research (passive)
S5.149 S5.420</td><td>**2 655-2 670**
FIXED S5.409 S5.411
FIXED-SATELLITE (Earth-to-space) S5.415
MOBILE except aeronautical mobile ADD S5.AAA
BROADCASTING-SATELLITE S5.413 S5.416
Earth exploration-satellite (passive)
Radio astronomy
Space research (passive)
S5.149 S5.420</td></tr>
<tr><td>**2 670-2 690**
FIXED S5.409 S5.410 S5.411
MOBILE except aeronautical mobile ADD S5.AAA
MOBILE-SATELLITE (Earth-to-space)
Earth exploration-satellite (passive)
Radio astronomy
Space research (passive)
S5.149 S5.419 S5.420</td><td>**2 670-2 690**
FIXED S5.409 S5.411
FIXED-SATELLITE (Earth-to-space) (space-to-Earth) S5.415
MOBILE except aeronautical mobile ADD S5.AAA
MOBILE-SATELLITE (Earth-to-space)
Earth exploration-satellite (passive)
Radio astronomy
Space research (passive)
S5.149 S5.419 S5.420</td><td>**2 670-2 690**
FIXED S5.409 S5.411
FIXED-SATELLITE (Earth-to-space) S5.415
MOBILE except aeronautical mobile ADD S5.AAA
MOBILE-SATELLITE (Earth-to-space)
Earth exploration-satellite (passive)
Radio astronomy
Space research (passive)
S5.149 S5.419 S5.420 S5.420A</td></tr>
</table>

S5.AAA The bands or portions of the bands, 1 710-1 885 MHz and 2 500-2 690 MHz, [are intended for] [are identified for] use by administrations wishing to implement International Mobile Telecommunications-2000 (IMT-2000) [and beyond] [in accordance with Resolution **[COM5/24] (WRC-2000)**]. [This identification does not preclude the use of these bands by any application of the services to which they are allocated and does not establish priority in the Radio Regulations.] [For the implementation of IMT-2000 in these bands, and related studies, see Resolution **[COM5/24] (WRC-2000)**.]

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Source: Document WRC2000/352 **COMMITTEE 5**

Chairperson, Working Group 5A

CONCLUSIONS RELATING TO AGENDA ITEM 1.10 (MSS IN 1.5/1.6 GHz BANDS)

MOD

1 525-1 610 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
1 530-1 535 SPACE OPERATION (space-to-Earth) MOBILE-SATELLITE (space-to-Earth) MOD S5.353A Earth exploration-satellite Fixed Mobile except aeronautical mobile S5.341 S5.342 S5.351 S5.354	**1 530-1 535** SPACE OPERATION (space-to-Earth) MOBILE-SATELLITE (space-to-Earth) MOD S5.353A Earth exploration-satellite Fixed Mobile S5.343 S5.341 S5.351 S5.354	
1 535-1 559	MOBILE-SATELLITE (space-to-Earth) S5.341 S5.351 MOD S5.353A S5.354 S5.355 S5.356 S5.357 MOD S5.357A S5.359 S5.362A	

MOD

1 610-1 660 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
1 626.5-1 660	MOBILE-SATELLITE (Earth-to-space) S5.341 S5.351 MOD S5.353A S5.354 S5.355 MOD S5.357A S5.359 S5.362A S5.374 S5.375 S5.376	

MOD

S5.353A In applying the procedures of ~~No. **S9.11A**~~Section II of Article **S9** to the mobile-satellite service in the bands 1 530-1 544 MHz and 1 626.5-1 645.5 MHz, priority shall be given to accommodating the spectrum requirements for distress, urgency and safety communications of the Global Maritime Distress and Safety System (GMDSS). Maritime mobile-satellite distress, urgency and safety communications shall have priority access and immediate availability over all other mobile satellite communications operating within a network. Mobile-satellite systems shall not cause unacceptable interference to, or claim protection from, distress, urgency and safety communications of the GMDSS. Account shall be taken of the priority of safety-related communications in the other mobile-satellite services. (~~See~~The provisions of Resolution ~~**218**~~ **[COM5/22] (WRC-~~97~~2000)** shall apply.)

MOD

S5.357A In applying the procedures of ~~No. **S9.11A**~~Section II of Article **S9** to the mobile-satellite service in the bands 1 545-1 555 MHz and 1 646.5-1 656.5 MHz, priority shall be given to accommodating the spectrum requirements of the aeronautical mobile-satellite (R) service providing transmission of messages with priority 1 to 6 in Article **S44**. Aeronautical mobile-satellite (R) service communications with priority 1 to 6 in Article **S44** shall have priority access and immediate availability, by pre-emption if necessary, over all other mobile-satellite communications operating within a network. Mobile-satellite systems shall not cause unacceptable interference to, or claim protection from, aeronautical mobile-satellite (R) service communications with priority 1 to 6 in Article **S44**. Account shall be taken of the priority of safety-related communications in the other mobile-satellite services. (~~See~~The provisions of Resolution ~~**218**~~**[COM5/22] (WRC-~~97~~2000)** shall apply.)

ADD

RESOLUTION [COM5/22] (WRC-2000)

Use of the bands 1 525-1 559 MHz and 1 626.5-1 660.5 MHz by the mobile-satellite service

The World Radiocommunication Conference (Istanbul, 2000),

considering

a) that prior to the World Radiocommunication Conference (Geneva, 1997) the bands 1 530-1 544 MHz (space-to-Earth) and 1 626.5-1 645.5 MHz (Earth-to-space) were allocated to the maritime mobile-satellite service and the bands 1 545-1 555 MHz (space-to-Earth) and 1 646.5-1 656.5 MHz (Earth-to-space) were allocated on an exclusive basis to the aeronautical mobile-satellite (route) service (AMS(R)S) in most countries;

b) that the World Radiocommunication Conference (Geneva, 1997) allocated the bands 1 525-1 559 MHz (space-to-Earth) and 1 626.5-1 660.5 MHz (Earth-to-space) to the mobile-satellite service (MSS) to facilitate the assignment of spectrum to multiple mobile-satellite systems in a flexible and efficient manner;

c) that the World Radiocommunication Conference (Geneva, 1997) adopted footnotes No. **S5.353A** giving priority to accommodating the spectrum requirements for distress, urgency and safety communications, and protection from unacceptable interference, to the Global Maritime Distress and Safety System (GMDSS) in the bands 1 530-1 544 MHz and 1 626.5-1 645.5 MHz and No. **S5.357A** giving priority to accommodating the spectrum requirements, and protection from unacceptable interference, to the AMS(R)S providing transmission of messages with priority 1 to 6 in Article **S44** in the bands 1 545-1 555 MHz and 1 646.5-1 656.5 MHz,

further considering

a) that coordination between satellite networks is required on a bilateral basis in accordance with the ITU Radio Regulations. In the bands 1 525-1 559 MHz (space-to-Earth) and 1 626.5-1 660.5 MHz (Earth-to-space) coordination is partially assisted by regional multilateral meetings;

b) that in these bands GSO satellite system operators presently use a capacity planning approach at multilateral coordination meetings, with the guidance and support of their administrations, to periodically coordinate access to the spectrum needed to accommodate their requirements;

c) that the GMDSS and AMS(R)S spectrum requirements are currently satisfied through the capacity planning approach and that in the bands to which Nos. **S5.353A** or **S5.357A** applies, this approach, and other methods such as intra- and inter-system prioritization, pre-emption and interoperability may assist to accommodate the expected increase of spectrum requirements for GMDSS and AMS(R)S;

d) that the feasibility of prioritization, real-time pre-emptive access and the mechanism to transfer spectrum between different mobile-satellite systems that may or may not provide GMDSS and/or AMS(R)S has yet to be established,

recognizing

a) that priority access and immediate availability of spectrum for distress, urgency and safety communications of the GMDSS and AMS(R)S communications is of vital importance for the safety of life;

b) that the ICAO has adopted Standards and Recommended Practices (SARPs) addressing satellite communications with aircraft in accordance with the Convention on International Civil Aviation;

c) that all air traffic communications as defined in Annex 10 to the Convention on International Civil Aviation fall within categories 1 to 6 of Article **S44**;

d) that Table **S15-2** of Appendix **S15** to the Radio Regulations identifies the bands 1 530-1 544 MHz (space-to-Earth) and 1 626.5-1 645.5 MHz (Earth-to-space) for distress and safety purposes in the maritime mobile-satellite service as well as for routine non-safety purposes,

resolves

1 that in the frequency coordination of the mobile-satellite services in the bands 1 525-1 559 and 1 626.5-1 660.5 MHz, administrations shall ensure accommodation of the spectrum needed for distress, urgency and safety communications of GMDSS, as elaborated upon in Articles **S32** and **S33,** in the bands where No. **S5.353A** applies and AMS(R)S communications with priority 1 to 6 of Article **S44** in the bands where No. **S5.357A** applies;

2 that administrations shall ensure the use of the latest technical advances, which may include prioritization and real-time pre-emptive access between MSS systems, when necessary and where feasible, to achieve the most flexible and practical use of the generic allocations;

3 that administrations shall ensure that mobile-satellite service operators carrying non-safety-related traffic yield capacity, as and when necessary, to accommodate the spectrum requirements of the distress, urgency and safety communication of GMDSS communications, as elaborated upon in Articles **S32** and **S33,** and AMS(R)S communications with priority 1 to 6 of Article **S44**. This could be achieved in advance through the coordination process at *resolves* 1, and, when necessary and where feasible, through prioritization and real-time pre-emptive access,

requests ITU-R

to complete studies to determine the feasibility and practicality of prioritization and real-time pre-emptive access between different networks of mobile-satellite systems as referred to in *resolves* 2 above, whilst taking into account the latest technical advances in order to maximize spectral efficiency,

invites

ICAO, IMO, IATA, administrations and other organizations concerned to participate in the studies identified in *requests ITU-R* above.

SUP

RESOLUTION 218 (WRC-97)

Use of the bands 1525-1559 MHz and 1626.5-1660.5 MHz by the mobile-satellite service

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INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

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COMMITTEE 6

THIRD SERIES OF TEXTS SUBMITTED BY COMMITTEE 4 TO THE EDITORIAL COMMITTEE

Committee 4, at its fourth meeting, adopted the text in Document 326 as a replacement for Appendix S7 (Agenda item 1.3). Because of the size of the document and because the only modification adopted was a deletion of the two rows in square brackets in Table 4 of Annex VII, the document is not attached.

H. RAILTON
Chairperson, Committee 4

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

Document 363-E
23 May 2000
Original: English

ISTANBUL, 8 MAY – 2 JUNE 2000

COMMITTEE 6

FIRST SERIES OF TEXTS SUBMITTED BY GT PLEN-2 TO THE EDITORIAL COMMITTEE

GT PLEN-2 is continuing its consideration of items for inclusion in the agenda for the next WRC, and to give its views on the preliminary agenda for the subsequent Conference and on possible agenda items for future conferences. As a result of these deliberations, it has unanimously adopted two draft Resolutions, given in Annex, that are submitted for your consideration with a view to its subsequent submission to the Plenary.

E. GEORGE
Chairperson, GT PLEN-2, Box 134

Annex: 1

ANNEX

DRAFT RESOLUTION [GT PLEN-2/1] (WRC-2000)

Consideration by a future competent world radiocommunication conference of issues dealing with allocations to the mobile, fixed, radiolocation, Earth exploration-satellite (active), and space research (active) services in the frequency range 5 150-5 725 MHz

The World Radiocommunication Conference (Istanbul, 2000),

considering

a) that there is a need to provide globally harmonized frequencies in the bands 5 150-5 350 MHz and 5 470-5 725 MHz for the mobile service for wireless access systems including radio local area networks (RLANs);

b) that there is a need for frequencies for fixed wireless access applications in the fixed service in Region 3 in the band 5 250-5 350 MHz;

c) that there is a need for additional spectrum for the Earth exploration-satellite service (active) and space research service (active) in the frequency range 5 460-5 570 MHz;

d) that ongoing studies in ITU-R indicate that sharing in the band 5 150-5 350 MHz between RLANs and space services is feasible under specified conditions;

e) that there is a need to upgrade the status of frequency allocations to the radiolocation service in the frequency range 5 350-5 650 MHz,

recognizing

a) that sharing criteria between existing services and the proposed new allocations should be established;

b) that it is important to protect the existing primary services allocated in the frequency range 5 150-5 725 MHz;

c) that the existing and new allocations are interdependent, particularly with respect to the relationship between the terrestrial and the space services,

resolves

that based on proposals from administrations and taking into account the results of studies in ITU-R and the Conference Preparatory Meeting, WRC-03 should consider:

1 allocation of frequencies to the mobile service in the frequency range 5 150-5 350 MHz and 5 470-5 725 MHz for the implementation of wireless access systems including RLANs;

2 a possible allocation in Region 3 to the fixed service in the band 5 250-5 350 MHz while fully protecting the worldwide Earth exploration-satellite (active) and space research (active) services;

3 additional primary allocations for the Earth exploration-satellite service (active) and space research service (active) in the frequency range 5 460-5 570 MHz;

4 the review, with a view to upgrading, of the status of frequency allocations to the radiolocation service in the frequency range 5 350-5 650 MHz,

invites ITU-R

to conduct, and complete in time for WRC-03, the appropriate studies leading to technical and operational recommendations to facilitate sharing between the services stated in the *resolves* and the existing services.

RESOLUTION [GT PLEN-2/2] (WRC-2000)

Review of spectrum and regulatory requirements to facilitate emerging terrestrial wireless interactive multimedia applications

The World Radiocommunication Conference (Istanbul, 2000),

considering

a) the rapid technical evolution in several areas of telecommunications;

b) the importance of finding global solutions for new terrestrial wireless interactive multimedia applications;

c) the need for terrestrial wireless interactive multimedia applications to individual end-users;

d) the convergence between services using digital formats (such as fixed, mobile and some broadcasting applications);

e) the need for worldwide allocations to such services also calling for higher spectrum efficiency;

f) the benefit, also for developing countries, when applying new, globally harmonized equipment and spectrum allocations for the implementation of market driven universal services,

noting

a) the historical-based frequency segmentation, particularly the differences between Regions, but also the segmentation between services, of the Table of Frequency Allocations (Article **S5** of the Radio Regulations);

b) Recommendation **34 (WRC-95)**, which was derived from the recommendations of the Voluntary Group of Experts (VGE) to study alternative allocation methods, merging of services, etc. and which set the objectives to allocate frequency bands on a worldwide basis and to the most broadly defined services, wherever possible,

also noting

c) Resolution 9 of the World Telecommunication Development Conference (Valetta, 1998), calling for an active participation by the developing countries to review the global spectrum requirements for new technologies;

d) that ITU-R is currently addressing the relevant issues,

resolves

that competent WRCs include in their agendas an item to review spectrum and regulatory requirements to facilitate implementation of emerging terrestrial wireless interactive multimedia applications to respond to the convergence of technologies, in order to enable future conferences to make suitable allocations in a timely manner, to meet new requirements of new and emerging technological developments in the fixed, mobile and broadcasting services,

requests ITU-R

to pursue its studies in this area, in order to assist in the development of common, worldwide fixed and mobile allocations suitable for such new terrestrial wireless interactive multimedia technologies and applications, and to report its conclusions in time for the next competent WRC,

invites administrations

to participate in these studies and to bring proposals to future WRCs to meet the above.

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

Document 364-E
23 May 2000
Original: English

ISTANBUL, 8 MAY – 2 JUNE 2000

WORKING GROUP 5A

Chairperson, Drafting Group 5A-1

NEW RESOLUTION ON FREQUENCY BANDS FOR TERRESTRIAL COMPONENT OF IMT-2000 BELOW 1 GHz

ADD

RESOLUTION [COM5/25] (WRC-2000)

Frequency bands for terrestrial component of IMT-2000 below 1 GHz

The World Radiocommunication Conference (Istanbul, 2000),

considering

a) that parts of the band 806-960 MHz are extensively used in the three Regions by first- and second-generation mobile systems;

b) that some administrations are planning to use part of the band 698-806 MHz for IMT-2000 [and other advanced mobile communication applications];

c) that in some countries, the band 698-806 MHz is allocated to the mobile services on a primary basis;

d) that first- and second-generation mobile systems in the three Regions operate using various frequency arrangements;

e) that where cost considerations warrant installation of fewer base stations, such as sparsely populated areas, bands below 1 GHz are generally suitable for implementing mobile systems including IMT-2000,

recognizing

a) that the evolution of first- and second-generation cellular-based mobile systems can be facilitated if permitted to use their current frequency bands;

[*b)* that the use of the band 806-960 MHz for IMT-2000 does not preclude usage of this band by any application by the services to which they are allocated and does not establish priority in the Radio Regulations,] *emphasizing*

that flexibility must be afforded to administrations:

– to determine, at a national level, how much spectrum to make available for IMT-2000 from within the identified bands;

– to develop their own transition plans, if necessary, tailored to meet their specific deployment of existing systems;

– to have the ability for the identified bands to be used by all services allocated in those bands;

– to determine the timing of availability and use of the bands identified for IMT-2000, in order to meet particular market demand and other national considerations;

– to meet the particular needs of developing countries,

resolves

[1 that the identification of bands below 1 GHz, allocated to the mobile service on a primary basis, for the terrestrial component of IMT-2000 does not preclude the use of these bands by any applications by the services to which they are allocated and does not establish priority in the Radio Regulations;]

[2 to invite administrations which are implementing, or planning to implement IMT-2000, to consider the use of bands below 1 GHz and the possibility of evolution of first- and second-generation mobile systems to IMT-2000, in the frequency band identified in No. **S5.XXX**, based on market demands and other national considerations,]

invites ITU-R

to study the compatibility between mobile systems with different technical characteristics and provide guidance on any impact on spectrum arrangements.

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

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23 May 2000
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ISTANBUL, 8 MAY – 2 JUNE 2000

WORKING GROUP 5A

Chairperson, Drafting Group 5A-1

MODIFICATION TO ARTICLE S5 FOR SPECTRUM BELOW 1 GHz FOR IMT-2000 (TERRESTRIAL COMPONENT)

MOD

470-890 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
470-790 BROADCASTING S5.149 S5.291A S5.294 S5.296 S5.300 S5.302 S5.304 S5.306 S5.311 S5.312	**470-512** BROADCASTING Fixed Mobile S5.292 S5.293 **512-608** BROADCASTING S5.297 **608-614** RADIO ASTRONOMY Mobile-satellite except aeronautical mobile-satellite (Earth-to-space) **614-806** BROADCASTING Fixed Mobile S5.293 S5.309 S5.311	**470-585** FIXED MOBILE BROADCASTING S5.291 S5.298 **585-610** FIXED MOBILE BROADCASTING RADIONAVIGATION S5.149 S5.305 S5.306 S5.307
790-862 FIXED BROADCASTING S5.312 S5.314 S5.315 S5.316 S5.319 S5.321 **862-890** FIXED MOBILE except aeronautical mobile ADD S5.XXX BROADCASTING S5.322 S5.319 S5.323	**806-890** FIXED MOBILE ADD S5.XXX BROADCASTING S5.317 S5.318	**610-890** FIXED MOBILE ADD S5.XXX BROADCASTING S5.149 S5.305 S5.306 S5.307 S5.311 S5.320

MOD

890-1 350 MHz

<table>
<tr><th colspan="3">Allocation to services</th></tr>
<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr><td rowspan="3">890-942
FIXED
MOBILE except aeronautical mobile ADD S5.XXX
BROADCASTING S5.322
Radiolocation

S5.323</td><td>890-902
FIXED
MOBILE except aeronautical mobile ADD S5.XXX
Radiolocation
S5.318 S5.325</td><td rowspan="3">890-942
FIXED
MOBILE ADD S5.XXX
BROADCASTING
Radiolocation

S5.327</td></tr>
<tr><td>902-928
FIXED
Amateur
Mobile except aeronautical mobile
Radiolocation
S5.150 S5.325 S5.326</td></tr>
<tr><td>928-942
FIXED
MOBILE except aeronautical mobile ADD S5.XXX
Radiolocation
S5.325</td></tr>
<tr><td>942-960
FIXED
MOBILE except aeronautical mobile ADD S5.XXX
BROADCASTING S5.322
S5.323</td><td>942-960
FIXED
MOBILE ADD S5.XXX</td><td>942-960
FIXED
MOBILE ADD S5.XXX
BROADCASTING

S5.320</td></tr>
</table>

ADD

S5.XXX Administrations wishing to implement International Mobile Telecommunications 2000 (IMT-2000) [and beyond] may use those parts of the band 806-960 MHz which are allocated to the mobile service on a primary basis and are used or planned to be used for cellular-based mobile systems (see Resolution **[COM5/25] (WRC-2000)**). [This identification does not preclude the use of these bands by any application of the services to which they are allocated and does not establish priority in the Radio Regulations.] [For the implementation of IMT-2000 in these bands, and related studies, see Resolution **[COM5/25] (WRC-2000)**.]

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

ISTANBUL, 8 MAY – 2 JUNE 2000

Corrigendum 1 to
Document 366-E
29 May 2000
Original: English

PLENARY MEETING

MINUTES

OF THE

THIRD PLENARY MEETING

Friday, 19 May 2000, at 1435 hours

Chairperson: Mr F.M. YURDAL (Turkey)

Please replace paragraph 1.18 with the following:

1.8 The **Chairperson of Working Group 2 of the Plenary** reported that the working group was making steady progress. All the proposals for items to be included in the draft agenda of the next WRC had been examined, and an informal group had been established with a view to reducing the amount of draft agenda items to a number that can be treated by a WRC.

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

Document 366-E
23 May 2000
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ISTANBUL, 8 MAY – 2 JUNE 2000

PLENARY MEETING

MINUTES

OF THE

THIRD PLENARY MEETING

Friday, 19 May 2000, at 1435 hours

Chairperson: Mr F.M. YURDAL (Turkey)

	Subjects discussed	**Documents**
1	Oral reports by the Chairpersons of committees and working groups of the Plenary	-
2	Application of Resolution 26 (Rev.WRC-97)	180
3	Existing and Part B systems for BSS replanning (continued)	238 + Corr.1 + Corr.2
4	National preferences for the BSS replanning process	237
5	Possible measures to resolve BSS-BSS incompatibilities in the replanning process for Regions 1 and 3	292
6	First series of texts submitted by the Editorial Committee for first reading (B.1)	220
7	Approval of the minutes of the first Plenary meeting	170
8	Documents to be noted or approved	213, 215, 225, 226
9	Announcement by the United Kingdom delegation	-

1 Oral reports by the Chairpersons of committees and working groups of the Plenary

1.1 The **Chairperson of Committee 2** said that seven more sets of credentials had been deposited with the secretariat since the last Plenary meeting and urged all delegations to respect the deadline of 1900 hours on 25 May 2000 for submission of credentials to enable the committee to make its final report to the Plenary.

1.2 The **delegate of Saudi Arabia** drew attention to the transfer of powers from Eritrea to his delegation as reflected in Document 215. Notwithstanding the explanation by the **Chairperson** that the transfer of powers had already been noted by Committee 2, he said that his delegation would not be assuming the powers transferred to it until it had received an official instruction to that end from its Administration.

1.3 The **Chairperson of Committee 3** said that, although Committee 3 had not met since the last Plenary meeting, it had been monitoring closely the work of Committees 4 and 5 and of Working Groups 1 and 2 of the Plenary with a view to identifying the possible financial implications of post-conference work. Representatives of the Bureau and the Finance Department would be requested to provide information on the financial impact of such work relating, in particular, to the proposed agenda for the next WRC.

1.4 The **Chairperson of Committee 4** reported that Committee 4 had held three meetings and although steady progress was being made, some difficulties were being encountered at the working group level. He urged participants to recognize that the time for compromise had come, and trusted that a spirit of cooperation would prevail.

1.5 The **Chairperson of Committee 5** said that satisfactory progress was being made in Committee 5. Difficulties had, however, been encountered on some agenda items including item 1.4, although a compromise might be reached shortly on allocations in the band 40.5-42.5 GHz, and item 1.15, concerning issues related to the radionavigation-satellite service. As the Chairperson of Committee 4 had said, it was now time to compromise. Positions appeared entrenched on item 1.6 of the agenda relating to IMT-2000, although a package had been developed in particular with regard to the bands 1.7-1.9 GHz and 2.5-2.7 GHz. After a lengthy debate in Committee 5 on item 1.9, further consideration was being given to the quantity of technical material available as a basis for an allocation in the space-to-Earth direction to the MSS, and informal discussions on the issue were also continuing.

1.6 The **Chairperson of Committee 6** noted that the Plenary had before it the first series of texts submitted by the Editorial Committee (Document 220), and said that the committee would be making every effort to ensure that the documents it received were submitted to the Plenary for first reading as soon as possible.

1.7 The **Chairperson of Working Group 1 of the Plenary** said that although the replanning process had already begun, further important decisions had to be made and the working group had submitted a series of documents in that regard for consideration by the present Plenary meeting. Progress had been made on issues relating to technical criteria, including interservice and interregional sharing, and on regulatory and procedural matters.

1.8 The **Chairperson of Working Group 2 of the Plenary** reported that the working group was making steady progress. All the proposals for items to be included in the draft agenda of the next WRC had been examined, and an informal group had been established with a view to condensing draft agenda items where possible.

2 Application of Resolution 26 (Rev.WRC-97) (Document 180)

2.1 The **Chairperson of Committee 4**, introducing Document 180, said that Committee 4 was seeking guidance from the Plenary on two issues relating to the application of Resolution 26 (Rev.WRC-97). First, bearing in mind that agenda item 1.1 referred only to deletion of country footnotes or country names from footnotes, guidance was needed on whether or not WRC-2000 was competent to consider proposals for the addition of new country footnotes or of country names to existing footnotes. Furthermore, some proposals for additions were not in compliance with *further resolves* 1 *a)*, *b)* and *c)* of Resolution 26, and had not been submitted as stipulated in No. 316 of the Convention (Geneva, 1992) in accordance with *further resolves* 3. Second, should the conference wish to consider the proposals for the addition of country names to existing footnotes, a deadline should be set for the submission of such proposals. Committee 4 would recommend 22 May 2000 at 1200 hours.

2.2 The **Chairperson** invited participants to comment on the acceptability of considering proposals for the addition of new footnotes or of country names to existing footnotes.

2.3 The **delegate of Argentina,** recalling *further resolves* 3 of Resolution 26, pointed out that provision was made for consideration of proposals for new footnotes or for modification of existing footnotes. The ultimate objective was to harmonize the use of the radio-frequency spectrum, and proposals for the addition of country names to footnotes should therefore be considered. The **delegates of Saudi Arabia**, **India**, **France** and **Cuba** endorsed those comments.

2.4 The **delegate of Russia** pointed out that the addition of country names to footnotes could, in some cases, cause difficulties for the countries already included in the footnotes. Furthermore, the issue was not covered by agenda item 1.1, and should not be considered by the present conference. The **delegates of Belarus** and **Ukraine** supported that view.

2.5 In response to a request for clarification from the **delegate of the United States**, the **Chairperson** said that it was his understanding from *further resolves* 3 of Resolution 26 that WRC-2000 could consider proposals for new footnotes or modifications to existing footnotes.

2.6 The **delegate of Viet Nam** was in favour of the inclusion of footnotes facilitating the use of the radio-frequency spectrum for new advanced technologies or systems.

2.7 The **delegate of Canada** recalled that WRC-97 had allowed the addition of country names to footnotes subject to the deadline established by the Plenary and on condition that there was no objection from any other country. That procedure would effectively limit the scope of additions to footnotes.

2.8 The **delegate of Lebanon** was in favour of the application of that procedure at the present conference.

2.9 The **delegate of Syria**, supported by the **delegates of Brazil, India** and **Saudi Arabia,** said that objections by countries to the addition of country names to footnotes should be substantive.

2.10 The **delegate of Argentina** said that the possibility of making an objection should not be tantamount to a power of veto. The arguments for and against any proposed addition should be taken into account.

2.11 The **delegate of Russia** said that the solution lay in acting strictly in accordance with Resolution 26, thereby limiting the workload of the present conference.

2.12 The **delegate of Oman** suggested that discussion of the details of proposals for amendments to footnotes should be entrusted to Committee 5 and that the present Plenary meeting should decide only on the basic principle.

2.13 The **Chairperson** took it that proposals for the addition of country names to footnotes would be considered in accordance with Resolution 26 (Rev.WRC-97) and that objections made by neighbouring and affected countries would be taken into account.

2.14 It was so **agreed**.

2.15 The **Chairperson** then invited comments on the deadline for the submission of proposals for the addition of country names to existing footnotes, recalling that the Chairperson of Committee 4 had mentioned Monday, 22 May at 1200 hours.

2.16 The **delegate of Australia**, observing that *further resolves* 3 of Resolution 26 covered proposals for new footnotes or modification of existing footnotes, asked whether the deadline was intended to cover both types of amendments and sought clarification as to whether the addition of a country name should be treated in the same way as substantive changes to footnotes. In that respect, he drew attention to CV316, according to which the Secretary-General was to ask Member States to submit their proposals at least four months prior to the start of the conference.

2.17 The **delegate of South Africa**, referring to *urges administrations* 1 of Resolution 26, said that a clear distinction should be drawn between substantive changes to footnotes on the one hand, and the addition or deletion of country names on the other. On the basis of that distinction, she could accept the deadline proposed for the addition of country names to footnotes.

2.18 Following some comments by the **delegates of Syria** and the **Republic of Korea** in respect of the deadline in CV316 and deadlines set by conferences themselves, the **Chairperson**, supported by the **delegate of Argentina**, said that the conference itself could set deadlines for proposals and suggested that the deadline for the receipt of proposals to add country names to existing footnotes should be Monday, 22 May 2000 at 1200 hours.

2.19 It was so **agreed**.

3 Existing and Part B systems for BSS replanning (continued) (Document 238 and Corrigenda 1 and 2)

3.1 The **Chairperson of Working Group 1 of the Plenary** introduced Document 238, together with its Corrigenda 1 and 2, which contained a list of existing and Part B systems which had been received by the Radiocommunication Bureau and which constituted an updated version of Document 184 and its Addendum 1. The document under consideration proposed solutions to a number of questions raised and comments made during the second Plenary meeting.

3.2 The **delegate of Morocco** proposed the following amendments to Document 238. At the end of the second paragraph, the words “and for which due diligence information has been submitted” should replace the words “but have not been brought into use”. The same text should be inserted at the end of footnote 2 after the words “successfully completed” and at all other relevant points throughout the document. The **delegates of France**, **Syria** and **Spain** supported those amendments which more accurately reflected the agreements reached during earlier discussions.

3.3 It was so **agreed**.

3.4 The **delegate of Russia** asked whether the mention of “examination in progress” in column 15 of Table 1 in Attachment 1 to Document 238 meant that the network in question was included only provisionally in the table and that a final decision would be taken once the examination had shown that the network satisfied the relevant conditions.

3.5 The **Chairperson of Working Group 1 of the Plenary** confirmed the previous speaker’s understanding. He reported that the working group had received data on 18 existing systems and 13 Part B systems. Examination of such data usually took days, if not weeks. Nevertheless, the working group had completed the BSS/BSS compatibility examinations for all the downlinks and feeder links relating to the aforementioned systems, and the remainder would probably be completed within the coming week.

3.6 The **delegate of the Republic of Korea** said that his delegation had submitted a correction to the Bureau earlier in the week which had not been included in Document 238. He asked that the figure for the minimum downlink e.i.r.p. in column 11, row 15, of Table 1 be corrected to 51.4. He noted that that value was still below the maximum and would therefore not result in excess interference in respect of other assignments.

3.7 The **Chairperson of Working Group 1 of the Plenary** replied that his working group would check that the correction had been taken into account in its examination.

3.8 The **delegate of the Lao People's Democratic Republic** said that he had no objection to the amendment proposed by the delegate of the Republic of Korea provided that it did not affect the national system of his country.

3.9 The **Chairperson** reassured him that the Bureau would take account of any potential interference to the systems of other countries.

3.10 Document 238, along with its Corrigenda 1 and 2, was **approved** as amended.

4 National preferences for the BSS replanning process (Document 237)

4.1 The **Chairperson of Working Group 1 of the Plenary** introduced Document 237, which provided, as proposed at the second Plenary meeting, a list of the additional national preferences for the BSS replanning process described in Addenda 5-16 to Document 34 or received by the Radiocommunication Bureau before the deadline of 12 May 2000. The list had been discussed with the Bureau, and the administrations concerned had agreed to it.

4.2 The **delegate of the Democratic People’s Republic of Korea** asked whether national preferences submitted after the deadline could be considered. His Administration had been unable to meet that deadline owing to analysis difficulties. The **Chairperson** replied that the deadline for submission of information to the Bureau represented a decision of the Plenary and had been taken to allow adequate time for replanning.

4.3 The **delegate of Syria** suggested that throughout the document the abbreviation GT PLEN-1 be followed consistently by the date of the meeting to which reference was being made.

4.4 It was so **agreed**.

4.5 Document 237, as amended, was **approved**.

5 Possible measures to resolve BSS-BSS incompatibilities in the replanning process for Regions 1 and 3 (Document 292)

5.1 The **Chairperson of Working Group 1 of the Plenary**, introducing Document 292, remarked that it represented a carefully balanced text that had required much discussion. He proposed that the first sentence of the text be amended by addition of the words “and those contained in section 3 of Document 183” after “and its Corrigendum 1”, as those measures, which had been approved at the second Plenary meeting, complemented the text in Document 292. The additional measures which had been approved unanimously by the working group should assist the process of replanning and would allow the necessary flexibility for the resolution of incompatibilities.

5.2 The **delegate of Syria** suggested that the amendments proposed by the delegate of Morocco in respect of Document 183 and approved at the second Plenary meeting should also be applied to the footnotes to Document 292.

5.3 It was so **agreed**.

5.4 Document 292, as amended, was **approved**.

6 First series of texts submitted by the Editorial Committee for first reading (B.1) (Document 220)

6.1 The **Chairperson** invited the meeting to consider the Committee 4 texts taken from Documents 207 and 256 and the Committee 5 text taken from Document 224.

Appendix S42 (Table of allocation of international call sign series, ADD *4WA-4WZ, ADD E4A-E4Z and MOD VRA-VRZ)

6.2 **Approved**.

Article S5 (MOD Table 14.25-15.63 GHz, MOD S5.511A, MOD S5.541A)

6.3 In response to a query from the **delegate of Israel** concerning an apparent discrepancy between the spectrum given in the title of the table, 14.25-15.63, GHz and that shown in the body of the table, the **Chairperson of Committee 5** said that the proposed modification concerned only that part of the band shown within the table, whereas the title remained unchanged.

6.4 On that understanding, MOD Table 14.25-15.63 GHz, MOD S5.511A and MOD S5.541A were **approved**.

Article S11 (MOD S11.32A, MOD S11.32A.1, MOD S11.33, MOD S11.35)

6.5 The **Chairperson of Committee 6** noted that the square brackets around “S9.7A, S9.7B” under MOD S11.32A and MOD S11.32A.1 would be removed once Committee 5 had approved the modifications.

6.6 The **delegate of France** said that in MOD S11.32A.1, the words “in the order of their publication under the same number” referred to the existing situation which applied only to examination of notices for which a request for coordination under Article S9.7 had been received. With the addition of other articles, examination of a notice under one number would have to be completed before its examination under another. With a view to preserving the appropriate order, he proposed that the phrase be altered to read “in the order of their publication under the relevant number”. The **delegate of Morocco** supported the suggestion but proposed that the word “number” be replaced by “provision”.

6.7 It was so **agreed**.

6.8 With that amendment to MOD S11.32A.1, MOD S11.32A, MOD S11.32A.1, MOD S11.33 and MOD S11.35 were **approved**.

SUP Resolution 121 (Rev.WRC-97)

6.9 **Approved**.

SUP Resolution 123 (WRC-97)

6.10 **Approved.**

Appendix S3 (NOC §§ 1-5, MOD § 6, NOC Table I, NOC § 7, MOD § 8, NOC §§ 9-11, ADD § 11*bis*, ADD § 11*ter*, NOC § 12, MOD Table II, NOC P, PEP and dBc, NOC [10] to [13], MOD [14], NOC [15], ADD [16], ADD [17], ADD [18])

6.11 The **delegate of France** said that he would submit several editorial amendments to ADD 11*ter* directly to Committee 6 in order to align the French and English texts.

6.12 The **delegate of the Lao People's Democratic Republic** asked for clarification concerning the rationale for the attenuation value of 60 dBc in Table II for spurious emissions from broadcasting or communication FSS satellites, which he considered to be very stringent. Following remarks by the **delegate of Syria**, he agreed to consult the Chairperson of Committee 4 after the meeting.

6.13 The **Chairperson of Committee 4** proposed that in the text of ADD [18] the phrase "ship emergency lifeboat and survival craft transmitters, emergency land" be amended to read "ship emergency, lifeboat and survival craft transmitters and emergency land".

6.14 It was so **agreed**.

6.15 With that amendment to ADD [18], NOC §§ 1-5, MOD § 6, NOC Table I, NOC § 7, MOD § 8, NOC §§ 9-11, ADD § 11*bis*, ADD § 11*ter*, NOC § 12, MOD Table II, NOC P, PEP and dBc, NOC [10] to [13], MOD [14], NOC [15], ADD [16], ADD [17] and ADD [18] were **approved**.

MOD Recommendation 66 (Rev.WRC-2000)

6.16 **Approved**.

SUP Recommendation 507

6.17 **Approved**.

MOD Resolution 10 (Rev.WRC-2000)

6.18 **Approved**.

MOD Resolution 300 (Rev.WRC-2000)

6.19 The **Chairperson of Committee 4**, replying to a query from the **delegate of Spain**, confirmed that the abbreviation WMARC-74 in *considering c)* of the resolution was correct, standing for World Maritime Administrative Radiocommunication Conference 1974.

6.20 MOD Resolution 300 (Rev.WRC-2000) was **approved**.

MOD Resolution 644 (Rev.WRC-2000)

6.21 The **delegate of Spain** pointed out that "*requests the Director of the Radiocommunication Bureau*" should read "*instructs the Director of the Radiocommunication Bureau*". The **delegate of Syria** agreed and asked the Chairperson to request Committee 6 to ensure that such wording was standardized.

6.22 MOD Resolution 644 (Rev.WRC-2000), as amended, was **approved**.

6.23 The first series of texts submitted by the Editorial Committee (B.1) (Document 220), as a whole, as amended, was **approved** on first reading.

7 Approval of the minutes of the first Plenary meeting (Document 170)

7.1 The **Chairperson** invited the Plenary to examine the minutes of its first meeting. He pointed out that under section 9.1, the number of the document referred to was 110 and not 10.

7.2 The **representative of ABU** said that he would submit editorial amendments to section 15.5 of the minutes.

7.3 The minutes of the first Plenary meeting (Document 170), as amended, were **approved**.

7.4 In response to a comment from the **delegate of Syria**, the **Secretary-General** said that the report, requested of himself and the Director of BR, as referred to in § 15.1 of the minutes, had been distributed.

8 Documents to be noted or approved (Documents 213, 215, 225 and 226)

8.1 The **Chairperson** invited the meeting to consider Documents 213 and 215, bearing in mind the comments of the delegate of Saudi Arabia earlier in the present meeting with regard to the status of the transfer of powers from Eritrea to his country's delegation.

8.2 Documents 213 and 215 were **noted**.

8.3 The **Chairperson of Committee 5** introduced Documents 225 and 226, which reflected conclusions of Committee 5 with respect to agenda items 1.11 and 1.6.2. In both cases, the committee had concluded that no change to the Radio Regulations was necessary. With regard to agenda item 1.11, the committee was still working on Resolutions 214 (Rev.WRC-97) and 219 (WRC-97), which referred to further studies. It had completed consideration of agenda item 1.6.2.

8.4 Documents 225 and 226 were **approved**.

8.5 In reply to a query from the **delegate of Malaysia** regarding Documents 47 and 48, the **Chairperson of Working Group 1 of the Plenary** drew attention to the fact that the Plenary meeting had already approved various documents for the purpose of facilitating the planning process.

9 Announcement by the United Kingdom delegation

9.1 The **delegate of the United Kingdom** announced that ICO Global Communications (Operations) Ltd, based in the United Kingdom, and Teledesic Corporation, based in the United States, had joined forces to become a global provider of satellite communication services, based on the combined global networks of the two companies. The headquarters would remain in London, where the company would enjoy the full support of the United Kingdom Government.

The meeting rose at 1710 hours.

The Secretary: Y. UTSUMI	The Chairperson: F.M. YURDAL

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

Document 367-E
23 May 2000
Original: English

ISTANBUL, 8 MAY – 2 JUNE 2000

COMMITTEE 5

Working Group 5B

MODIFICATIONS TO ARTICLE S5 OF THE RADIO REGULATIONS

(AGENDA ITEM 1.15.1)

Working Group 5B submits for consideration and approval the attached modification of Article S5 and two new resolutions concerning new allocations to RNSS in the band 5 000-5 030 MHz.

Working Group 5B has drawn the attention of Committee 4 to *resolves* 3 of Resolution [COM5/16] for possible inclusion of new data elements in Appendix S4.

T. MIZUIKE
Chairperson, Working Group 5B
Box 132

ARTICLE S5

MOD

4 800-5 830 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
5 000-5 150	AERONAUTICAL RADIONAVIGATION S5.367 MOD S5.444 S5.444A ADD S5.444B S5.444C	

MOD

S5.444 The band ~~5 000~~5 030-5 150 MHz is to be used for the operation of the international standard system (microwave landing system) for precision approach and landing. The requirements of this system shall take precedence over other uses of this band. For the use of this band, No. **S5.444A** and Resolution **114 (WRC-95)** apply.

ADD

S5.444B *Additional allocation:* The band 5 000-5 010 MHz is also allocated to the radionavigation-satellite service (Earth-to-space) on a primary basis. For the use of this band Resolution **[COM5/15] (WRC-2000)** applies.

ADD

S5.444C *Additional allocation:* The band 5 010-5 030 MHz is also allocated to the radionavigation-satellite service (space-to-Earth) (space-to-space) on a primary basis. In order not to cause harmful interference to the microwave landing system operating above 5 030 MHz the aggregate power flux-density radiated in bands above 5 030 MHz by all the space stations within any radionavigation-satellite service system (space-to-Earth) operating in the band 5 010-5 030 MHz shall not exceed the level of –124.5 dB(W/m^2) in 150 kHz. In order not to cause harmful interference to the radio astronomy service in the band 4 990-5 000 MHz, the aggregate power flux-density radiated in the 4 990-5 000 MHz band by all the space stations within any RNSS (space-to-Earth) system operating in the 5 010-5 030 MHz band shall not exceed the provisional value of –171 dB(W/m^2) in a 10 MHz bandwidth into any radio astronomy observatory site for more than 2% of the time. For the use of this band Resolution **[COM5/16] (WRC-2000)** applies.

ADD

RESOLUTION [COM5/15] (WRC-2000)

Studies on compatibility between stations of the radionavigation-satellite service (RNSS) (Earth-to-space) operating in the frequency band 5 000-5 010 MHz, and the international standard system (microwave landing system) operating in the 5 030-5 150 MHz band

The World Radiocommunication Conference (Istanbul, 2000),

considering

a) that the aeronautical radionavigation service is allocated on a primary basis in the band 5 000-5 250 MHz;

b) that WRC-2000 added a primary allocation to the radionavigation-satellite service (Earth-to-space) in the 5 000-5 010 MHz band;

c) that the band 5 030 to 5 150 MHz is to be used for the operation of the international standard MLS for precision approach and landing. The requirements for this system shall take precedence over other uses of this band as per footnote **S5.444**;

d) that unwanted emissions from the RNSS stations may fall into the frequency band used by the MLS;

e) that studies to determine the compatibility between these RNSS transmitters and the MLS receivers operated on board aircraft used during approach and landing have not been carried out;

f) that the MLS can be well-protected through the implementation of an adequate separation distance between the stations of the RNSS (Earth-to-space) transmitter and the MLS receiver, and other mitigation techniques,

requests ITU-R

to conduct as a matter of urgency, the appropriate technical, operational and regulatory studies to ensure that stations of the RNSS (Earth-to-space) do not cause harmful interference to the operation of the international standard MLS, and to develop, if needed, appropriate Recommendations,

urges administrations

to participate actively in the aforementioned studies by submitting contributions to ITU-R,

requests the Secretary-General

to bring this Resolution to the attention of ICAO.

ADD

RESOLUTION [COM5/16] (WRC-2000)

Studies on compatibility between the radionavigation-satellite service (RNSS) (space-to-Earth) operating in the frequency band 5 010-5 030 MHz, and the radio astronomy service (RAS) operating in the band 4 990-5 000 MHz

The World Radiocommunication Conference (Istanbul, 2000),

considering

a) that new radiocommunication services are developing, many of which require satellite transmitters, and need to be allocated sufficient spectrum;

b) that research in radio astronomy depends critically upon the ability to make observations at the extreme limits of sensitivity and/or precision;

c) that transmissions from RNSS space stations in the frequency band 5 010 to 5 030 MHz near the radio astronomy service operating in the band 4 990-5 000 MHz may cause interference harmful to the radio astronomy service;

d) that Recommendation ITU-R RA.769-1 recommends, *inter alia*, that all practicable steps be taken to reduce to the absolute minimum all unwanted emissions falling into RAS bands, particularly those emissions from aircraft, spacecraft and balloons;

e) that protection requirements of RAS are explained and interference threshold values detailed in the Annex to Recommendation ITU-R RA.769-1;

f) that different coupling mechanisms apply to interfering emissions from terrestrial transmitters or from transmitters on board GSO or non-GSO satellites;

g) that this Conference has revised Recommendation 66, which asks to study those frequency bands and instances where, for technical or operational reasons, out-of-band emission limits may be required to protect safety services and passive services such as radio astronomy, and the impact on all concerned services of implementing or not implementing such limits;

h) that administrations may require criteria to protect RAS from interference detrimental to radio astronomy observations from space-to-Earth transmissions by space stations,

noting

a) that this Conference has adopted footnotes **S5.444C** specifying a provisional pfd limit in the band 4 990-5 000 MHz, for space-to-Earth out-of-band emissions of the RNSS operating in the band 5 010-5 030 MHz;

b) that the general problem of protection of radio astronomy and passive services is under study in ITU-R *inter alia* in response to Recommendation 66,

requests ITU-R

1 to conduct, or continue to conduct, as a matter of urgency and in time for consideration by WRC-03, the appropriate technical, operational and regulatory studies to review the provisional pfd limit concerning the operation of space stations including the development of a methodology for calculating the aggregate power levels in order to ensure that the radionavigation-satellite service

(space-to-Earth) in the band 5 010-5 030 MHz will not cause interference detrimental to the RAS in the band 4 990-5 000 MHz;

2 to report to CPM-03 on the conclusions of the studies asked for under 1 above,

urges administrations

1 to participate actively in the aforementioned studies by submitting contributions to ITU-R;

2 to ensure that systems designed to operate in the RNSS frequency band 5 010-5 030 MHz incorporate interference avoidance techniques, such as filtering, to the extent feasible,

resolves

1 that WRC-03 be invited to review the provisional pfd limit on the RNSS in the band 4 990-5 000 MHz, for space-to-Earth out-of-band emissions of the RNSS operating in the band 5 010-5 030 MHz;

2 that the limits stated in No. **S5.444C** shall be applied provisionally for systems for which complete notification information has been received by the Bureau after 2 June 2000;

3 that, as of 3 June 2000, when notifying frequency assignments to a satellite network in the radionavigation-satellite service in the bands 5 010-5 030 MHz, the responsible administration shall provide the calculated values of the aggregate power flux-density radiated in the bands above 5 030 MHz and in the band 4 990-5 000 MHz, as defined in No. **S5.444C**, in addition to the relevant characteristics listed in Appendix **S4**,

instructs the Radiocommunication Bureau

as of the end of WRC-03, to review and, if appropriate, revise any finding previously made on the compliance with the limits of out-of-band emission contained in No. **S5.444C** of an RNSS (space-to-Earth) system for which notification information has been received before the end of WRC-03. This review shall be based on the values, as revised, if appropriate, by WRC-03.

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

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ISTANBUL, 8 MAY – 2 JUNE 2000

COMMITTEE 5

Chairperson, Working Group 5D

RESOLUTION [COM 5/9] (WRC-2000)

Transitional measures for coordination between certain specific GSO FSS receive earth stations and non-GSO FSS transmit space stations in the frequency bands 10.7-12.75 GHz, 17.8-18.6 GHz, and 19.7-20.2 GHz where $\mathbf{epfd_{down}}$ limits apply

The World Radiocommunication Conference (Istanbul, 2000),

considering

a) that WRC-97 adopted, in Article **S22**, provisional equivalent power flux-density (epfd) limits to be met by non-geostationary-satellite orbit (non-GSO) systems in the fixed-satellite service (FSS) in order to protect geostationary-satellite orbit (GSO) FSS and GSO broadcasting-satellite service (BSS) networks in parts of the frequency range 10.7-30 GHz;

b) that WRC-2000 revised these limits to ensure that they provide adequate protection to GSO systems without causing undue constraints to any of the systems and services sharing these frequency bands;

c) that additional protection above that provided by the revised $epfd_{down}$ limits in *considering b)* is required for certain GSO FSS networks with specific receive earth stations having all of the following characteristics:

i) earth station antenna maximum isotropic gain greater than or equal to 64 dBi for the frequency bands 10.7-12.75 GHz or 68 dBi for the frequency bands 17.8-18.6 GHz and 19.7-20.2 GHz;

ii) G/T of 44 dB/K or higher; and

iii) emission bandwidth of 250 MHz or higher for the frequency bands below 12.75 GHz or 800 MHz or higher for the frequency bands above 17.8 GHz;

d) that, as a consequence, WRC-2000 adopted an alternative regulatory procedure to protect the earth stations referred to in *considering c)*;

e) that this regulatory procedure, specified in Nos. **S9.7A** and **S9.7B** as well as associated provisions specified in Articles **S9** (Nos. **S9.7A**, **S9.7B**, **S9.7.A.1** and **S9.7.B.1**, and **S9.7.A.2** and **S9.7.B.2**), **S11** (Nos. **S11.32A** and **S11.32A.1**), and **S22** and Appendices **S4** and **S5**, defines the conditions for effecting coordination between a specific earth station, referred to in *considering c)* in respect of a non-GSO FSS system and between a non-GSO FSS system in respect of a specific earth station referred to in *considering c)*;

f) that there was no requirement to provide the specific locations of earth stations referred to in *considering c)* prior to WRC-2000, except in respect of terrestrial stations or earth stations operating in the opposite direction of transmission under Nos. **S9.17** and **S9.17A**;

g) that the coordination of an earth station referred to in *considering c)* shall remain within the authority of the administration having this station located on its territory;

h) that complete coordination information for GSO FSS networks with typical earth station antennas having all the characteristics of *considering c)* were received by the Bureau before WRC-2000;

i) that complete notification or coordination information, as appropriate, for non-GSO FSS systems have been received by the Bureau prior to WRC-2000 and, in some cases, prior to WRC-97,

recognizing

that transitional measures are needed for the regulatory procedures referred to in *considering e)*,

resolves

1 that, in the frequency bands 10.7-12.75 GHz, 17.8-18.6 GHz and 19.7-20.2 GHz, the requirement for coordination and associated provisions referred to in *considering e)* shall be applied as from 3 June 2000;

2 that, in the frequency bands 10.7-12.75 GHz, 17.8-18.6 GHz and 19.7-20.2 GHz, the requirement for coordination under No. **S9.7A** shall be applied to specific earth stations for which complete coordination or notification information, as appropriate, is considered as having been received by the Bureau prior to 3 June 2000;

3 that, in the frequency bands 10.7-12.75 GHz, 17.8-18.6 GHz and 19.7-20.2 GHz, the requirement for coordination under No. **S9.7B** shall be applied to non-GSO FSS systems for which complete coordination or notification information, as appropriate, has been received by the Bureau after 21 November 1997;

4 that, in the frequency bands 10.7-12.75 GHz, 17.8-18.6 GHz and 19.7-20.2 GHz, the requirement for coordination under No. **S9.7B** does not apply to non-GSO FSS systems for which complete coordination or notification information, as appropriate, has been received by the Bureau before 22 November 1997 but **S22.2** applies in respect of any specific earth stations for which complete coordination information is considered as being received before 22 November 1997 if coordination under **S9.7A** has not been concluded;

5 that coordination information relating to a specific earth station received by the Bureau prior to 30 June 2000 shall be considered as complete No. **S9.7A** or No. **S9.7B** information from the date of receipt of complete coordination information of the associated GSO FSS satellite network under No. **S9.7** provided that:

5.1 the specific earth station maximum isotropic gain, lowest total receiving system noise temperature, and the necessary bandwidth are the same as those of any typical earth station included in the GSO FSS network that has previously entered coordination;

5.2 the coordination information, or notification information, as appropriate, of the GSO FSS network containing the typical earth station referred to in *resolves* 5.1 was received by the Bureau prior to 8 May 2000;

6 that, in cases other than those covered in *resolves* 5, the date of receipt by the Bureau of the complete coordination information under Nos. **S9.7A** or **S9.7B** or the complete coordination or notification information, as appropriate, of the associated GSO network, whichever is later, shall be used;

7 that the administration having the specific earth station on its territory shall submit the coordination information contained in Annex 1 to this Resolution,

requests the Director of the Radiocommunication Bureau

to identify the appropriate forms of notice and instructions to assist administrations in providing the information in Annex 1 of this Resolution immediately after WRC-2000, taking into account the deadline established by *resolves 5*,

instructs the Radiocommunication Bureau

as of the end of WRC-2000, to review and, if appropriate, identify in accordance with No. **S9.27**, any administration with which coordination may need to be effected in accordance with Nos. **S9.7A** or **S9.7B** in cases covered by *resolves* 2 and 3.

ANNEX 1 (TO RESOLUTION [COM 5/9] (WRC-2000))

Appendix S4 characteristics to be provided for specific receive GSO FSS earth stations

A.1.e.1 Type of earth station (i.e. specific)

A.1.e.2 Earth station name

A.1.e.3 Country and geographical coordinates of the antenna site

A.2.a Date of bringing into use

A.3 Operating administration or agency

A.4.c Identity of associated space station (i.e. name and nominal orbital longitude)

A.13 As appropriate, reference to the special section of the Bureau’s weekly circular

B.1 Associated satellite transmitting beam designation

B.5.a Maximum isotropic gain

B.5.c Earth station antenna reference radiation pattern

C.2.a Assigned frequency

C.3.a Assigned frequency band

C.4 Class of station and nature of service

C.5.b Lowest total receiving system noise temperature

C.7.a Class of emission and the necessary bandwidth

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INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

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ISTANBUL, 8 MAY – 2 JUNE 2000

COMMITTEE 3

Note by the Secretary-General

SITUATION OF THE ACCOUNTS OF THE WORLD RADIOCOMMUNICATION CONFERENCE AS AT 22 MAY 2000

I have the honour to submit herewith for examination by the Budget Control Committee an estimate of the expenditure of the World Radiocommunication Conference as at 22 May 2000.

YOSHIO UTSUMI
Secretary-General

ANNEX 1

Situation of the accounts of the World Radiocommunication Conference as at 22 May 2000

CHF (000)

	Budget 2000-2001	Actual Expenditure as at 22/05/2000	Commitments as at 22/05/2000	Credits available 22/05/2000
Staff costs	2'084	68	2'023	-7
Other staff costs	96	12	89	-5
Travel on duty	80		80	0
Contractual services	5	0	16	-11
Rental & maintenance of premises and equipment	80		80	0
Materials and supplies	35	14	12	9
Public and internal services	72	14	40	18
Miscellaneous	15	6	5	4
Total Budget	**2'467**	**114**	**2'345**	**8**

CHF (000)

Documentation Costs	Planned costs 2000-2001	Actual costs as at 22/05/2000	Estimates* as at 22/05/2000	Variance as at 22/05/2000
Translation	1'113	582	449	82
Typing	1'026	610	391	25
Reprography	1'585	766	602	217
Total Documentation costs	**3'724**	**1'958**	**1'442**	**324**

Documentation Volumes	Planned volumes 2000-2001	Actual volumes as at 22/05/2000	Estimates* as at 22/05/2000	Variance as at 22/05/2000
Translation (pages)	8'474	4'432	3'419	623
Typing (pages)	23'017	13'690	8'772	555
Reprography (1000 pages)	26'435	12'729	10'000	3'706

*) Based on actual workload trends and estimates

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

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COMMITTEE 4

Chairperson of Working Group 5B

NOTE TO THE CHAIRPERSON OF COMMITTEE 4

Working Group 5B is proposing to Committee 5 the adoption of a new Resolution [COM5/16], contained in Document 367. *Resolves* 3 of that Resolution requires administrations to provide, for RNSS satellite networks in the band 5 010-5 030 MHz, data elements not currently listed in Appendix S4. The attention of Committee 4 is drawn to this, for possible inclusion of relevant data elements in Appendix S4.

T. MIZUIKE
Chairperson, Working Group 5B

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

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COMMITTEE 5

Chairperson, Working Group 5D

MOD

S5.488 ~~The use of the bands 11.7-12.2 GHz in the fixed-satellite service in Region 2 and 12.2-12.7 GHz by the broadcasting-satellite service in Region 2 is limited to national and subregional systems.~~ The use of the band 11.7-12.2 GHz by geostationary-satellite networks in the fixed-satellite service in Region 2 is subject to ~~previous agreement between administrations concerned and those having services, operating or planned to operate in accordance with the Table, which may be affected (see Articles **S9** and **S11**)~~the provisions of Resolution **[COM5/18] (WRC-2000)**. For the use of the band 12.2-12.7 GHz by the broadcasting-satellite service in Region 2, see Appendix **S30**.

ADD

RESOLUTION [COM5/18] (WRC-2000)

Protection of terrestrial services in all Regions from Region 2 GSO FSS networks using the frequency band 11.7-12.2 GHz

The World Radiocommunication Conference (Istanbul, 2000),

considering

a) that, in Regions 1 and 3, the band 11.7-12.2 GHz is allocated on a co-primary status to terrestrial services and to the broadcasting-satellite service;

b) that, in Region 2, the band 11.7-12.1 GHz is allocated on a co-primary status to terrestrial services (except in the countries listed in **S5.486**) and to the fixed-satellite service;

c) that, in Region 2, the band 12.1-12.2 GHz is allocated on a co-primary status to terrestrial services in Peru (see **S5.489**) and to the fixed-satellite service;

d) that the protection of the broadcasting-satellite service in Regions 1 and 3 from the fixed-satellite service in Region 2 is assured by Article 7 and Annex 4 to Appendix **S30**;

e) that the protection of the fixed-satellite service in Region 2 from the fixed-satellite service in Region 2 is assured either by **S9** (**S9.7** or **S9.12**) or **S22**;

f) that the protection of terrestrial services in Regions 1, 2 and 3 from non-geostationary satellite systems in the fixed-satellite service in Region 2 is assured by **S21**;

g) that there is a need to protect terrestrial services in Regions 1, 2 and 3 from geostationary- satellite networks in the fixed-satellite service in Region 2;

h) that WRC-2000 has modified No. **S5.488** by revising the regulatory limitations on the operation of the GSO FSS in Region 2 in the band 11.7-12.2 GHz,

recognizing

that ITU-R has developed Recommendation ITU-R SF.674-1, dealing with sharing between the fixed-satellite service in Region 2 and the fixed service in the band 11.7-12.2 GHz in Region 2,

resolves

before an administration notifies to the Bureau or brings into use, in Region 2, a frequency assignment for a GSO FSS network in the 11.7-12.2 GHz band, it shall seek the agreement of any administration of Regions 1, 2, and 3 having a primary allocation to terrestrial services in the same frequency band if the power flux-density produced on its territory exceeds the following thresholds:

–124	$dB(W/m^2)$ in 1 MHz	for 0°≤ Θ ≤ 5°
–124 + 0.5 (Θ-5)	$dB(W/m^2)$ in 1 MHz	for 5°< Θ ≤ 25°
–114	$dB(W/m^2)$ in 1 MHz	for Θ ≥ 25°

where Θ is the angle of arrival of the incident wave above the horizontal plane, in degrees.*

instructs the Radiocommunication Bureau

in its examination of requests for coordination for any geostationary fixed-satellite space station operating in the band 11.7-12.2 GHz in Region 2, to determine if the power flux-density thresholds in the *resolves* are exceeded on the territory of any administration other than the notifying administration and, if so, to so notify both the notifying and the affected administrations.

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* These values relate to the pfd and angles of arrival which would be obtained under free-space propagation conditions.

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

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23 May 2000
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ISTANBUL, 8 MAY – 2 JUNE 2000

Source: Documents 277, 294, 298

COMMITTEE 6

FOURTH SERIES OF TEXTS SUBMITTED BY COMMITTEE 4 TO THE EDITORIAL COMMITTEE

Committee 4 at its meeting on 23 May 2000 considered agenda items 2 and 4. As a result of these deliberations, it has unanimously adopted, at this meeting, the attached text that is submitted for your consideration with a view to its subsequent submission to the Plenary.

H. RAILTON
Chairperson, Committee 4

Annex: 1

MOD

RESOLUTION 5 (Rev.WRC-2000)

Relating to technical cooperation with the developing countries in the study of propagation in tropical areas[1]

The World Administrative Radiocommunication Conference, Geneva, 1979 (Istanbul, 2000),

having noted

that the assistance provided for the developing countries by the Union in cooperation with other United Nations specialized agencies, such as the United Nations Development Programme (UNDP), in the field of telecommunication augurs well for the future,

being aware

a) of the fact that the developing countries, particularly those in tropical areas, require adequate knowledge of radio wave propagation in their territories in order to make rational and economical use of the radio spectrum;

b) of the importance of propagation in radiocommunications;

c) of the importance of the work of ITU-T and ITU-R Study Groups for the development of telecommunications in general and radiocommunications in particular,

considering

a) the need for the developing countries themselves to study telecommunications in general and propagation in particular in their territories, this being the best means of enabling them to acquire telecommunication techniques and to plan their systems effectively and in conformity with the special conditions in the tropical areas;

b) the scarcity of resources available in these countries,

resolves to invite the Secretary-General

1 to offer the assistance of the Union to developing countries in the tropical areas which endeavour to carry out national propagation studies in order to improve and develop their radiocommunications;

2 to assist these countries, if necessary with the collaboration of international and regional organizations such as the Asia-Pacific Broadcasting Union (ABU), Arab States Broadcasting Union (ASBU), African Postal and Telecommunications Union (APTU), the Panafrican Telecommunication Union (PATU) and the Union of National Radio and Television Organizations of Africa (URTNA) which may be concerned, in carrying out national propagation measurement programmes, including collecting appropriate meteorological data, on the basis of ITU-R Recommendations and Questions in order to improve the use of the radio spectrum;

3 to arrange funds and resources for this purpose from the UNDP or other sources in order to enable the Union to provide the countries concerned with adequate and effective technical assistance for the purpose of this Resolution,

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[1] WRC-97 made editorial amendments to this Resolution.

urges administrations

to submit the results of these propagation measurements to the ITU-R for consideration in its studies,

invites the Council

to follow the progress made in carrying out programmes of propagation measurements and the results achieved, and to take any action that it considers necessary.

MOD

RESOLUTION 20 (~~Mob-87~~Rev.WRC-2000)

Technical cooperation with developing countries in the field of aeronautical telecommunications

The World ~~Administrative~~ Radiocommunication Conference ~~for the Mobile Services, Geneva, 1987~~ (Istanbul, 2000),

considering

a) that the allocations of the frequency bands and the provisions concerning ~~the~~various aeronautical mobile services have been revised several times by recent conferences;

b) that some of these frequency bands and provisions ~~are intended for~~support the worldwide implementation of new aeronautical telecommunication systems;

c) that ~~these new systems will employ more advanced techniques, such as satellite communications, in combination with modern information transmission media~~on the other hand, some of these frequency bands and provisions support existing aeronautical systems that may be affected by the revision;

d) that as a consequence of *a)*, *b)* and *c)*,~~this~~ technological modernization ~~should serve~~will be necessary to maintain and improve the safety and regularity of international civil aviation, the accuracy and security of aeronautical radionavigation and the efficiency of distress and rescue systems;

e) that the developing countries may require assistance in improving the training of technical staff, as well as in introducing new systems, in coping with technological modernization and enhancing the operation of aeronautical telecommunications,

recognizing

a) the value of the assistance which, in conjunction with other international organizations, the Union has provided and may continue to provide to developing countries in the field of telecommunications~~,~~;

b) that Resolution 20 (Mob-87) adopted by the World Administrative Radio Conference for the Mobile Services (Geneva, 1987) provides a good basis for technical cooperation with developing countries in the field of aeronautical telecommunications that has been undertaken by the International Civil Aviation Organization,

~~*instructs*~~*resolves to invite the Secretary-General*

1 to encourage the International Civil Aviation Organization (ICAO) to continue its assistance to developing countries which are endeavouring to improve their aeronautical telecommunications, in particular by providing them with technical advice for the planning, establishment, operation and maintenance of equipment, as well as help with the training of staff, essentially in matters relating to the new technologies;

2 for this purpose, to seek the continued collaboration of ICAO, the United Nations Conference for Trade and Development (UNCTAD) and other specialized agencies of the United Nations, as appropriate;

~~3 to inform ICAO that this Conference has recognized the valuable cooperation provided by that organization to developing countries in its technical assistance programmes;~~

~~4~~3 to continue to give special attention to seeking the aid of the United Nations Development Programme (UNDP) and other sources of financial support, to enable the Union to render sufficient and effective technical assistance in the field of aeronautical telecommunications,

invites the developing countries

so far as possible, to give a high level of priority to and include in their national programmes of requests for technical assistance projects relating to aeronautical telecommunications and to support multinational projects in that field.

MOD

RESOLUTION 124 (Rev.WRC-~~97~~2000)

Protection of the fixed service in the frequency band 8 025-8 400 MHz sharing with geostationary-satellite systems of the Earth exploration-satellite service (space-to-Earth)

The World Radiocommunication Conference (~~Geneva, 1997~~Istanbul, 2000),

considering

a) that prior to WRC-97, the band 8 025-8 400 MHz was allocated to the Earth exploration-satellite service (space-to-Earth) on a secondary basis in Regions 1 and 3, except for those countries listed in former No. **S5.464**;

b) that the power flux-density limits given in Table **S21-4** of Article **S21** apply to emissions from space stations of the Earth exploration-satellite service (space-to-Earth);

c) that, for those administrations where the secondary allocation applied before ~~this Conference~~WRC-97, geostationary orbital avoidance was not required for the fixed service and, therefore, the power flux-density limits given in Table **S21-4** of Article **S21** may give rise to excessive interference to the fixed service;

d) that ~~the administrations identified by No. **S5.462A** have~~WRC-97 adopted provisional power flux-density limits as specified in No. **S5.462A** which are lower than those shown in Table **S21-4** of Article **S21** to protect the fixed service;

e) that prior to WRC-97, no studies ~~have~~had been conducted in this frequency band by ITU-R on the power flux-density values to apply to space stations of geostationary-satellite systems in the Earth exploration-satellite service where geostationary orbital avoidance has not been implemented by stations of the fixed service,

considering further

a) that the band 8 025-8 400 MHz is used extensively by the fixed service in accordance with ITU-R radio-frequency channel arrangements for the 8 GHz band (see Recommendation ITU-R F.386) and is also used by some countries for television outside broadcast applications~~,~~;

b) that Recommendation ITU-R F.1502 which was developed in response to Resolution 124 (WRC-97) and approved by the 2000 Radiocommunication Assembly recommends the power flux-density limits different from those in No. **S5.462A**,

resolves

~~to invite ITU-R to study, as matter of urgency, the required power flux-density limits to be applied to space stations of geostationary-satellite systems in the Earth exploration-satellite service (space-to-Earth) in the frequency band 8 025-8 400 MHz where geostationary orbital avoidance has not been implemented by the fixed service sharing the band,~~to invite a future competent world radiocommunication conference to review No. **S5.462A**, taking into account Recommendation ITU-R F.1502, and to take appropriate action.

~~*urges administrations*~~

~~to provide ITU-R with the necessary technical parameters of fixed-service links requiring protection in this frequency band.~~

MOD

RESOLUTION 27 (Rev.WRC-~~97~~2000)

~~References to ITU-R and ITU-T Recommendations~~Use of incorporation by reference in the Radio Regulations

The World Radiocommunication Conference (~~Geneva, 1997~~Istanbul, 2000),

considering

a) that the principles of incorporation by reference were adopted by the WRC-95, revised by WRC-97 and further refined~~have been revised~~ by this Conference (see Annexes 1 and 2 to this Resolution);

b) that there are provisions of the Radio Regulations containing references which ~~employ mandatory incorporation by reference but~~ fail to ~~make explicit reference to the ITU-R or ITU-T Recommendations incorporated~~distinguish adequately whether the status of the referenced text is mandatory or non-mandatory;

~~*c)* that the 1997 Conference Preparatory Meeting (CPM-97) for this Conference urged administrations to give further consideration to the status of material incorporated by reference:~~

~~– using the initial assessment provided by the Radiocommunication Bureau in the CPM Report and the set of principles given in Annex 1 to this Resolution;~~

~~– noting that mandatory references shall be explicit and use the appropriate regulatory language;~~

~~– taking into account the factors set out in Annex 2 to this Resolution;~~

~~*d)* that the Director of the Radiocommunication Bureau has drawn up a list (see Annex 1 to the CPM Report to this Conference) of the provisions of the Radio Regulations using incorporation by reference, which provides an initial assessment of the status of each reference and forms the basis for the work on appropriate referencing, examples of which are contained in Annex 3 to this Resolution;~~

~~*e)* that the Bureau has drawn up a list, contained in Annex 4 to this Resolution, of the ITU-R Recommendations to which explicit reference is made in the Radio Regulations,~~

noting

that references to Resolutions or Recommendations of a world radiocommunication conference (WRC) require no special procedures, and are acceptable for consideration, since such texts will have been agreed by a WRC,

resolves

1 that for the purposes of the Radio Regulations, the term “incorporation by reference” shall only apply to those references intended to be mandatory;

2 that when introducing new instances of incorporation by reference:

– only texts which are relevant to a specific WRC agenda item may be considered;

– for the correct method of reference, the principles set out in Annex 1 to this Resolution and the guidance contained in Annex 2 to this Resolution shall be applied;

3 that the procedure described in Annex 3 to this Resolution shall be applied during WRCs for the adoption of texts for incorporation by reference;

4 that all texts incorporated by reference at the conclusion of each WRC shall be collated and published in a volume of the Radio Regulations (see Annex 3 to this Resolution),

~~that ITU-R and ITU-T Recommendations incorporated or proposed for incorporation by reference in the provisions of the Radio Regulations be identified and examined at WRC-99, with a view to establishing the correct method of reference in accordance with the principles set out in Annex 1 to this Resolution and taking into account the factors listed in Annex 2 to this Resolution, in order to complete the simplification of the Radio Regulations in respect of incorporation by reference,~~

instructs the Director of the Radiocommunication Bureau

to bring this Resolution to the attention of the ITU-R Radiocommunication Assembly and Study Groups~~arrange for a review of the provisions of the Radio Regulations containing references to ITU-R or ITU-T Recommendations and propose suitable recommendations to the CPM-99 for inclusion in its Report to WRC-99, using the list of provisions contained in Annex 3 to this Resolution together with the guidance contained in Annexes 1 and 2 to this Resolution, and taking into account the list of ITU-R Recommendations contained in Annex 4 to this Resolution~~,

urges administrations

to ~~use the CPM Report to WRC-99 in order to prepare their proposals on incorporation by reference to that Conference~~prepare proposals to future conferences to clarify the status of references where there remain ambiguities regarding the mandatory or non-mandatory status of those references where those references are relevant to specific agenda items.

MOD

ANNEX 1 TO RESOLUTION 27 (Rev.WRC-~~97~~2000)

Principles of incorporation by reference

1 ~~Where references are non-mandatory, it is not necessary to establish specific conditions in applying the texts quoted. In such cases, reference could, for example, be made to "the latest version" of a Recommendation~~For the purposes of the Radio Regulations, the term "incorporation by reference" shall apply only to those references intended to be mandatory.

2 ~~Mandatory references to Resolutions or Recommendations of a world radiocommunication conference (WRC) are acceptable without restriction, since such texts will have been agreed by a WRC~~Where the relevant texts are brief, the referenced material should be placed in the body of the Radio Regulations rather than using incorporation by reference.

3 ~~Where mandatory references are suggested, and the relevant texts are brief, the referenced material should be incorporated in the body of the Radio Regulations~~Texts which are of a non-mandatory nature or which refer to other texts of a non-mandatory nature shall not be considered for incorporation by reference.

4 If, on a case-by-case basis, it is decided to incorporate material by reference on a mandatory basis, then the following provisions shall apply:

4.1 the ~~referenced~~ text incorporated by reference shall have the same treaty status as the Radio Regulations themselves;

4.2 the reference must be explicit, specifying the specific part of the text (if appropriate) and the version or issue number;

4.3 the ~~referenced~~ text incorporated by reference must be ~~adopted by the Plenary of a competent WRC, but should not be part of the Final Acts~~submitted for adoption by a competent WRC in accordance with *resolves* 3;

4.4 all texts incorporated by reference ~~must~~shall be ~~readily available~~published following a WRC, ~~by being published in a separate volume;~~in accordance with *resolves* 4.

~~4.~~5 ~~i~~If, between WRCs, a ~~referenced~~ text incorporated by reference (e.g. an ITU-R Recommendation) is updated, the reference in the Radio Regulations shall continue to apply to the ~~original~~earlier version incorporated by reference until such time as a competent WRC agrees to incorporate the new version ~~of the reference~~. The mechanism for considering such a step is given in Resolution **28 (Rev.WRC-~~95~~2000)**.

6 Where references are non-mandatory, it is not necessary to establish specific conditions in applying the texts quoted. In such cases, reference should be made using the terminology "the most recent version" of a Recommendation.

MOD

ANNEX 2 TO RESOLUTION 27 (Rev.WRC-972000)

Factors to be considered for the further aApplication of incorporation by reference

In reviewingWhen introducing new instances of incorporation by reference into the provisions of the Radio Regulations employing references to other texts,or reviewing existing instances of incorporation by reference, administrations and study groupsITU-R should address the following factors in order to ensure that the correct style of reference is employed for the intended purpose:

1 whether each reference is mandatory, i.e. incorporated by reference, or non-mandatory;

2 whether in existing non-mandatory references, or mandatory references which are determined to be of non-mandatory character, appropriate linking language is used, e.g. the words “should” or “may”;

32 whether in existing mandatory references shall use, or other types of reference which are determined to be of mandatory character, clear mandatory linking language is used, e.g. the word i.e. “shall”;

3 non-mandatory references, or ambiguous references that are determined to be of a non-mandatory character, shall use appropriate linking language, e.g. “should” or “may”;

4 mandatory references shall be explicitly and specifically identified, e.g. “Recommendation ITU-R M.541-8”;

5 if the intended reference material is, as a whole, unsuitable as treaty status text, the reference shall be limited to just those portions of the material in question which are of a suitable nature, e.g. “Annex A to Recommendation ITU-R Z.123-4”.

4 whether the incorporated ITU-R or ITU-T Recommendation(s) are explicitly identified;

5 where referenced ITU-R or ITU-T Recommendations are not explicitly identified, determine which ones should be identified;

6 whether text incorporated from ITU-R or ITU-T Recommendations should be placed directly in the Radio Regulations instead of using incorporation by reference;

7 if the ITU-R or ITU-T Recommendation to be incorporated is, as a whole, unsuitable as treaty status text, whether to limit the reference to those portions of the ITU-R or ITU-T Recommendation which are of a suitable nature or to place the mandatory portion directly in the Radio Regulations.

SUP

ANNEX 3 TO RESOLUTION 27 (Rev.WRC-97)

Provisions of the Radio Regulations referring to ITU-R and ITU-T Recommendations

ADD

ANNEX 3 TO RESOLUTION 27 (Rev.WRC-2000)

WRC procedures for adoption of texts for incorporation by reference

WRC-97 established the precedent of handling texts of ITU-R Recommendations incorporated by reference without reproducing them in full as conference documents (see Document WRC97/157). It is necessary and sufficient that the referenced texts be made available to delegations in sufficient time for all administrations to consult the referenced texts in their final English, Spanish and French versions. A single copy of the texts will be made available to each administration as a conference document.

During the course of each WRC a list of the texts incorporated by reference shall be developed and maintained by the working committees. This list shall be published as a conference document in line with developments during the conference. [The Editorial Committee shall monitor this process and report any deficiencies.]

Following the end of each WRC, the Bureau and General Secretariat will update the volume of the Radio Regulations serving as the repository of texts incorporated by reference in line with developments at the conference as recorded in the above-mentioned document.

SUP

ANNEX 4 TO RESOLUTION 27 (Rev.WRC-97)

List of ITU-R Recommendations referred to in the Radio Regulations[1]

MOD

RESOLUTION 127 (Rev.WRC-~~97~~2000)

Studies relating to consideration of allocations in bands around 1.4 GHz for feeder links of the non-geostationary-satellite systems in the mobile-satellite service with service links operating below 1 GHz

The World Radiocommunication Conference (~~Geneva, 1997~~Istanbul, 2000),

considering

a) that the agenda of ~~this Conference~~WRC-97 included consideration of the adoption of additional allocations for the non-geostationary (non-GSO) mobile-satellite ~~systems in the mobile-satellite~~ service (MSS);

b) that the Report of the 199~~7~~9 Conference Preparatory Meeting (CPM-9~~7~~9) stated that the Radiocommunication Bureau has identified ~~at least 23~~25 non-GSO MSS networks as of 26 November 1999 at frequencies below 1 GHz, at some stage of coordination under Resolution **46 (Rev.WRC-~~97~~2000)**, and that many of the proposed networks cannot be implemented in the existing allocations because there is not enough spectrum;

c) that CPM-97 stated that due to the extreme sensitivity of radio astronomy observations interference from unwanted (spurious and out-of-band) emissions can be a problem, but also noted that interference to radio astronomy can be avoided using various techniques including low-power transmitter levels, choice of modulation, ~~bit~~symbol shaping, output filtering and band limiting filters, the use of which can minimize the band separation necessary to meet the recommended interference threshold levels for out-of-band emissions;

~~*d)* that, since CPM-97, one administration has carried out additional analyses and hardware demonstrations with a view to determining the feasibility of sharing between non-GSO MSS feeder links and services such as the Earth exploration-satellite (passive), radio astronomy and space research (passive) services in bands around 1.4 GHz;~~

~~e~~d) that factors taken into account by ~~these~~post-CPM-97 activities in order to protect the passive services around 1.4 GHz from out-of-band emissions include: the use of narrow-band non-GSO MSS feeder-link transmissions; the use of spectrum-efficient modulation methods, such as Gaussian filtered minimum shift keying, having inherently rapid roll-off of out-of-band emissions; the use, where necessary, of band-pass filters in satellite transmitters and MSS feeder-link transmitting earth stations; and guardbands where necessary;

~~f~~e) that factors taken into account by ~~these~~post-CPM-97 activities concerning sharing with the radiolocation service include the use of conventional techniques that may be applied in MSS satellite receivers, such as intermediate frequency limiters and time diversity, which have long been employed to protect radiolocation receivers, and techniques such as transmitted waveforms employing time diversity, which have been employed to protect receivers in other services from high-power pulsed radar transmitters~~,~~;

~~d~~f) that, since CPM-97, ~~one administration has~~ITU-R studies have been carried out ~~additional analyses and hardware demonstrations~~containing theoretical analyses with a view to determining ~~the feasibility of sharing between~~if the operation of non-GSO MSS feeder links ~~and services such as~~in bands around 1.4 GHz would be compatible with the Earth exploration-satellite (passive), radio astronomy and space research (passive) services~~ in bands around 1.4 GHz~~;

g) that the theoretical analyses have indicated that sufficient reduction of out-of-band and spurious emissions could be achieved to protect the sensitive science services in the band 1 400-1 427 MHz;

h) that additional tests and measurements of feeder-link transmissions from systems having the characteristics, performance and reliability of equipment that would be used in operational systems are necessary;

i) that such additional tests and measurements will be completed prior to WRC-02/03,

recognizing

that the bands near 1.4 GHz are extensively used by many other services operating in accordance with the Radio Regulations, including fixed and mobile services,

noting

a) that Resolution **214 (Rev.WRC-97)** states under *resolves* 1. that further studies are urgently required on operational and technical means to facilitate sharing between non-GSO MSS and other radiocommunication services having allocations and operating below 1 GHz;

~~*b)* that a former resolution identified issues relating to frequency sharing between the MSS and terrestrial services at frequencies below 3 GHz as being among the urgent studies required in preparation for this Conference;~~

~~*c)* that one administration performed such studies, which were submitted to ITU-R, but these studies could not be considered due to time limitations;~~

~~d~~b) that, since WRC-95, ~~one administration has performed~~ITU-R studies have been carried out on sharing between space and terrestrial services and feeder links near 1.4 GHz for non-GSO MSS systems with service links below 1 GHz,

~~resolves~~requests ITU-R, as a matter of urgency,

1 ~~to invite ITU-R, as a matter of urgency, ~~to continue studies, and to carry out additional tests and demonstrations to validate the studies ~~to determine the~~on operational and technical measures required to facilitate sharing in portions of the band 1 390-~~1 400~~1 393 MHz between existing and currently planned services and feeder links (Earth-to-space) for non-GSO MSS systems with service links operating below 1 GHz;

2 ~~to invite ITU-R, as a matter of urgency, ~~to carry out additional tests and demonstrations to validate the studies ~~to determine~~on operational and technical means to facilitate sharing, in portions of the band ~~1 427~~1 429-1 432 MHz, between existing and currently planned services and feeder links (space-to-Earth) for non-GSO MSS systems with service links operating below 1 GHz;

3 ~~to invite ITU-R, as a matter of urgency, ~~to ~~study operational and technical measures required~~carry out additional studies, including the measurement of emissions from equipment that would be employed in operational systems to protect passive services in the band 1 400-1 427 MHz from unwanted emissions from feeder links near 1.4 GHz for non-GSO MSS systems with service links operating below 1 GHz;

resolves

~~4~~ to invite ~~a future competent conference*~~ [WRC-02/03] to consider, on the basis of completion of studies referred to in ~~*resolves*~~*requests ITU-R* 1, 2 and 3, additional allocations for feeder links on a worldwide basis for non-GSO MSS systems with service links below 1 GHz,

urges administrations

to participate actively in such studies, with the involvement of interested parties.

~~* *Note by the Secretariat* – See Resolution **722 (WRC-97)**.~~

MOD

RESOLUTION 728 (Rev.WRC-972000)

Studies relating to consideration of allocations in the broadcasting band 470-862 MHz to non-geostationary mobile-satellite services

The World Radiocommunication Conference (Geneva, 1997Istanbul, 2000),

considering

a) that the agenda of WRC-97this Conference included consideration of the adoption of additional allocations for non-geostationary mobile-satellite services (non-GSO MSSs);

b) that the Report of the 199779 Conference Preparatory Meeting (CPM-979) stated that the Radiocommunication Bureau has identified at least [2322] non-GSO MSS networks [as of 28 April 1999] at frequencies below 1 GHz, at some stage of coordination under Resolution **46**, and that many of the proposed networks cannot be implemented in the existing allocations because there is not enough spectrum;

c) that CPM-97 considered the protection requirements for analogue television in the band 470-862 MHz against a narrow-band MSS signal in the most sensitive and least sensitive portions of an analogue television channel and the protection requirements for a digital television channel, based on existing Recommendations ITU-R BT.655-4, ITU-R BT.417-4 and ITU-R IS.851-1;

d) that CPM-97 stated that the protection ratios for a narrow-band interfering signal in the least sensitive parts of an analogue television channel are to be verified by further studies;

e) that CPM-97 stated the region of lower protection requirements and commensurately higher permissible interfering power flux-density levels as being 100 kHz from the band edges of an analogue television channel, at least in some countries;

f) that CPM-97 stated that the interfering effects of a non-GSO MSS transmission will depend on its specific characteristics (e.g. duty-cycle, duration, periodicity, etc.), that interference contributions from sources other than MSS (even those from other broadcasting stations) have to be taken into account, that slightly lower values of field strength to be protected may need to be assumed in countries where television networks are relatively sparse, and that studies on sharing are necessary;

g) that the permissible aggregate interfering power flux-density resulting from these protection requirements, in some portions of an analogue television channel, may be useful in determining the feasibility of sharing with non-GSO MSS transmitter space-to-Earth links;

h) that these bands are also allocated in part to fixed and mobile terrestrial systems and radionavigation systems;

i) that, in many countries, the channels assigned for analogue television may also be used for digital television, and that during the transition period of parallel operation of analogue and digital television networks the usage of this band for television will increase,;

j) that ITU-R studies are currently under way to determine television broadcasting requirements under Question 268/11 and sound broadcasting requirements under Question 224/10,

noting

a) that on completion of studies, parts of the bands now allocated to the broadcasting service between 470 MHz and 862 MHz might be considered suitable for worldwide allocation to non-GSO MSS space-to-Earth transmissions;

b) that the bandwidth required in these television channels may be 1-2% of the total band 470-862 MHz to be shared with the above systems;

c) the need to protect the radio astronomy service in the band 608-614 MHz against interference from MSS transmissions, including unwanted emissions,

resolves

1 to invite ITU-R to carry out additional studies to determine operational and technical means that may facilitate co-frequency sharing between narrow-band non-GSO MSS (space-to-Earth) transmissions and the services to which the band 470-862 MHz is allocated, including the bands where the broadcasting service is also allocated, and including consideration of digital television systems and parallel transmissions during the transition period;

2 to invite ~~a future competent conference~~[a future competent conference/WRC-06] to consider, on the basis of the results of the studies referred to in *resolves* 1, the possibility of making additional allocations on a worldwide basis for non-GSO MSS,~~ taking into account, in particular, *considering h)* and *i)* above,~~

urges administrations

to participate actively in such studies, with the involvement of interested parties.

MOD

RESOLUTION 51 (Rev.WRC-972000)

~~Provisional application of certain provisions of the Radio Regulations as modified by WRC-97 and transitional arrangements~~Transitional arrangements relating to the advance publication and coordination of satellite networks

The World Radiocommunication Conference (~~Geneva, 1997~~Istanbul, 2000),

considering

a) that as a result of the review under Resolution 18 of the Plenipotentiary Conference (Kyoto, 1994), a number of provisions relating to the advance publication, coordination and notification of assignments for satellite networks have been modified and these should be applied provisionally as soon as possible;

b) that ~~it was~~WRC-97 decided to reduce the regulatory time-frame for bringing a satellite network into use, and to delete the advance publication information (API) if not followed by the coordination data within 24 months of the date of receipt of the API;

c) that there are a number of satellite networks for which the relevant information has been communicated to ITU prior to the end of ~~this Conference~~WRC-97, and it is necessary to provide for some transitional measures for the treatment of this information by the Radiocommunication Bureau~~,~~;

d) that WRC-97 decided that the provisions of Sections I, IA and IB of Article **S9** and provisions of Article **S11** (Nos. **S11.43A**, **S11.44**, **S11.44B** to **S11.44I**, **S11.47** and **S11.48**), as revised by WRC-97, shall be applied by the Bureau and by administrations on a provisional basis as of 22 November 1997;

e) that WRC-97 decided that, for satellite networks which are subject to coordination for which the API has been received by the Bureau prior to 22 November 1997 but the coordination data has not been received by the Bureau prior to this date, the responsible administration shall have until 22 November 1999 or the end of the period pursuant to the application of No. **1056A** of the Radio Regulations (1994 version), whichever date comes earlier, to submit the coordination data in accordance with the applicable provisions of the Radio Regulations; otherwise the Bureau shall cancel the relevant API in accordance with No. **1056A** or No. **S9.5D** as applicable;

f) that WRC-97 decided that the revised Appendix **S4** with respect to the API for satellite networks which are subject to coordination under Section II of Article **S9** shall be applied as of 22 November 1997,

resolves

~~1 that the provisions of Sections I, IA and IB of Article **S9** and provisions of Article **S11** (Nos. **S11.43A**, **S11.44**, **S11.44B** to **S11.44I, S11.47** and **S11.48**), as revised by this Conference, shall be applied by the Bureau and by administrations on a provisional basis as of 22 November 1997;~~

~~2 that, for satellite networks which are subject to coordination for which the API has been received by the Bureau prior to 22 November 1997 but the coordination data has not been received by the Bureau prior to this date, the responsible administration shall have until 22 November 1999 or the end of the period pursuant to the application of No. **1056A**, whichever date comes earlier, to submit the coordination data in accordance with the applicable provisions of the Radio Regulations; otherwise the Bureau shall cancel the relevant API in accordance with No. **1056A** or No. **S9.5D** as applicable;~~

~~3~~ that, for satellite networks for which the API has been received by the Bureau prior to 22 November 1997, the maximum allowed time period from the date of ~~receipt of the API~~publication of the Special Section of the Weekly Circular referred to in **S9.2B** to bring the relevant frequency assignments into use shall be six years plus the extension pursuant to No. **1550** of the Radio Regulations (1994 version) (see also Resolution **49 (WRC-97)**)~~;~~.

~~4 that the revised Appendix **S4** with respect to the API for satellite networks which are subject to coordination under Section II of Article **S9** shall be applied as of 22 November 1997;~~

~~5 that, for those networks which are subject to coordination for which the API has been received but not yet published prior to 22 November 1997, the Bureau shall publish only the information of the revised Appendix **S4** as modified by this Conference.~~

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INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

Document 373-E
23 May 2000
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ISTANBUL, 8 MAY – 2 JUNE 2000

Source: Document 201 **PLENARY MEETING**

Note by the Chairperson of Committee 4
to the Chairperson of the Conference

AGENDA ITEM 2
(INCORPORATION BY REFERENCE)

SUGGESTED WRC PROCEDURES FOR ADOPTION OF TEXTS
FOR INCORPORATION BY REFERENCE

The Working Group considered the mechanism that this Conference should apply in taking action under agenda item 2. The following procedures are therefore suggested for the Conference's consideration for adding or updating references to ITU-R recommendations contained in the Radio Regulations pursuant to Resolution 27 (Rev.WRC-97) and Resolution 28 (WRC-95). They are based on the procedures employed by WRC-97, and further developed by the Special Committee and contained in the CPM-99 Report (Document 3), at Annex 2 to Chapter 7.

In order for a WRC to incorporate new texts or to update references to texts already incorporated, the following working procedures should be observed:

- the actual references to recommendations liable to be incorporated must be published as conference documents, and approved on second reading by the Plenary Meeting in all cases where a WRC wishes them to be incorporated by reference;
- for a Plenary Meeting to adopt a text as being incorporated by reference on a mandatory basis, it is necessary and sufficient that a single copy of the texts has been made available to each administration as a conference document.

During the course of a WRC it will therefore be necessary to ensure that a list of the recommendations proposed for incorporation by reference is developed, maintained and published as a conference document in line with developments during the conference, and that all texts listed for mandatory incorporation are available for delegates to consult in their final English, French and Spanish versions.

By adoption of a reference to a recommendation at second reading in accordance with the above conditions, the Plenary Meeting is therefore deemed to have formally adopted the text of the recommendation.

Following the conference, the secretariat shall update Volume 4 of the Radio Regulations containing the full text of all recommendations incorporated by reference on a mandatory basis. To ensure the completeness of this volume, the committees should clearly identify their intentions with respect to recommendations incorporated.

H. RAILTON
Chairperson of Committee 4, Box 2895

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

ISTANBUL, 8 MAY – 2 JUNE 2000

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23 May 2000
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COMMITTEE 5

Chairperson, Working Group 5D

RESOLUTION [COM5/7] (WRC-2000)

Further studies on the sharing conditions between GSO networks and non-geostationary-satellite systems in the fixed-satellite service and between non-geostationary-satellite systems in the fixed-satellite service

The World Radiocommunication Conference (Istanbul, 2000),

considering

a) that WRC-2000 has adopted, in Article **S22**, epfd limits to be met by non-geostationary-satellite systems in the fixed-satellite service in order to protect GSO FSS and GSO BSS networks in parts of the frequency range 10.7-30.0 GHz;

b) that Article **S22** includes single-entry validation (Tables **S22-1A** to **S22-1D**, **S22-2** and **S22-3**), single-entry operational (Tables **S22-4A**, **S22-4B** and **S22-4C**) and for certain antenna sizes single-entry additional operational (Table **S22-4A1**) $epfd_{down}$ limits which apply to non-geostationary-satellite systems in the fixed-satellite service for the protection of GSO networks;

c) that compliance of a proposed non-GSO FSS system with the single-entry validation limits will be checked by the Bureau, under **S9.35** and **S11.31**;

d) that compliance of a proposed non-GSO FSS system with the single-entry operational and for certain antenna sizes single-entry additional operational $epfd_{down}$ limits is not subject to verification by the Bureau;

e) that Appendix **S4**, as modified by WRC-2000, requires an administration responsible for a non-GSO FSS system to commit to meeting the single-entry additional operational $epfd_{down}$ limits;

f) that administrations with assignments to geostationary networks that have been brought into use in the fixed-satellite service and/or in the broadcasting-satellite service, as well as administrations with assignments to non-geostationary systems that have been brought into use in the fixed-satellite service, in frequency bands where operational $epfd_{down}$ limits have been established, require reliable means of ascertaining that non-geostationary systems in the fixed-satellite service with overlapping frequency assignments that have been brought into use are in compliance with the single-entry operational limits referred to in *considering b)*;

g) that administrations with assignments to non-geostationary systems in the FSS in frequency bands where additional operation epfd limits have been established require reliable means of ascertaining whether their non-geostationary systems in the FSS would be in compliance with the single-entry additional operational limits referred to in *considering b)*;

h) that administrations with assignments to geostationary networks in the FSS that have been brought into use in bands where additional operational epfd limits have been established require reliable means of ascertaining whether a particular non-geostationary system in the FSS is in compliance with the single-entry additional operational limits referred to in *considering b)*,

recognizing

a) that assignments to geostationary-satellite networks in the fixed-satellite service and/or in the broadcasting-satellite service are already brought into use or will be brought into use in the frequency bands where operational $epfd_{down}$ limits and additional operational $epfd_{down}$ limits apply, and that assignments to non-geostationary systems in the fixed-satellite service subject to the limits have been submitted to the Bureau in the same bands;

b) that ITU-R has developed a recommendation containing the functional specifications for the software to be used by BR to verify the compliance of proposed non-GSO FSS systems with the single-entry validation limits included in Tables **S22-1A**, **S22-1B**, **S22-1C**, **S22-1D**, **S22-2** and **S22-3**;

c) that ITU-R has indicated that administrations will be able to check compliance of a proposed non-GSO FSS system with the single-entry operational limits by measurements at GSO earth stations and has confirmed the feasibility of such measurements;

d) that ITU-R has indicated it is not practicable for administrations to verify compliance with the single-entry additional operational $epfd_{down}$ limits by measurements at GSO earth stations;

e) that, in the light of *recognizing d)*, ITU-R is revising an existing recommendation to enable accurate predictions of the levels produced by a proposed non-GSO FSS system;

f) that ITU-R has initiated studies on the sharing criteria to be applied during the coordination between non-geostationary-satellite systems in the fixed-satellite service with a view to promoting efficient use of spectrum/orbit resources and equitable access to these resources by all countries,

recognizing further

that, taking into account Nos. **S22.5H** and **S22.5I**, it is important to discourage violations of the operational $epfd_{down}$ limits and additional operational $epfd_{down}$ limits by a non-geostationary fixed-satellite service system, but that if a violation nevertheless occurs, it should be corrected in the most expeditious manner,

resolves to invite ITU-R

1 to develop, with the aim of completion by WRC-02/03, methodologies to assess the interference levels (through measurement for operational limits or simulation for additional operational limits) that would be produced by a non-geostationary system in the fixed-satellite service in the frequency bands specified in Tables **S22-4A** through **S22-4C**, that may be used by administrations to verify compliance of an individual non-geostationary system in the fixed-satellite service with the operational limits and additional operational limits contained in Tables **S22-4A**, **S22-4A1**, **S22-4B** and **S22-4C**;

2 to develop, with the aim of completion by 2003, an appropriate recommendation or recommendations describing suitable formats for administrations operating or planning to operate non-geostationary-satellite systems in the fixed-satellite service to make available all necessary information to be used by administrations when checking compliance with the operational limits and/or the additional operational limits;

3 to develop a methodology for the generation of continuous curves of $epfd_{down}$ versus percentage time for a range of antenna diameters of the GSO FSS earth station to be protected, in order for designers of GSO FSS satellite networks to determine the expected single-entry validation and additional operational interference levels in the case of antennas of sizes other than those given in Tables **S22-1A** through **S22-1D** and **S22-4A1**;

4 to develop a methodology for the generation of values of $epfd_{up}$ for different antenna beamwidths of the GSO FSS space station to be protected, in order for designers of GSO FSS satellite networks to determine the expected single-entry interference level in the case of antenna beamwidths other than those given in Table **S22-2**;

5 to conduct, with the aim of completion by WRC-02/03, the studies relating to the sharing criteria to be applied during the coordination between non-geostationary-satellite systems in the fixed-satellite service with a view to promoting efficient use of spectrum/orbit resources and equitable access to these resources by all countries,

urges administrations

to participate actively in the aforementioned studies by submitting contributions to ITU-R,

requests the Director of the Radiocommunication Bureau

to assist in the aforementioned studies.

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

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COMMITTEE 5

Chairperson, Working Group 5D

Working Group 5D considered two possible compromise approaches on the issues related to Resolution 130 and the associated footnotes. The proposed approach is given below. Some administrations expressed a preference for an alternative approach.

John LEARY
Chairperson, Working Group 5D

SUP

RESOLUTION 130 (WRC-97)

Use of non-geostationary systems in the fixed-satellite service in certain frequency bands

ADD **(To be included in the WRC-2000 Resolution concerning transitional arrangements)**

resolves

1 that, as of 22 November 1997, in the frequency bands specified in Tables **S22-1A**, **S22-1B**, **S22-1C** and **S22-2** of Article **S22**, non-GSO FSS systems for which complete notification or coordination information, as appropriate, has been received by the Bureau after 21 November 1997 shall be subject to the power limits in Article **S22**, as revised by this Conference;

resolves

2 that, in any case where complete coordination or notification information, as appropriate, is considered as having been received between 22 November 1997 and 2 June 2000 for a non-GSO FSS network in the frequency bands specified in Tables **S22-1A**, **S22-1B**, **S22-1C** and **S22.2** of Article **S22**, the responsible administration shall, on request from the Bureau, submit all necessary supplementary information to permit the Bureau to make a finding in compliance with the limits contained in Article **S22** as revised by WRC-2000;

resolves

3 that, as of 3 June 2000, when providing coordination information for a GSO satellite network in the FSS, the responsible administration shall commit that all earth stations to which the limitations apply will meet the off-axis power limitations of Section VI of Article S22.

MOD

Section VI – GSO Eearth station off-axis power limitations in the fixed-satellite service[11, 12]

MOD

S22.26 § 9 The level of equivalent isotropically radiated power (e.i.r.p.) emitted by an earth station shall within a geostationary-satellite network not exceed the following values for any off-axis angle φ which is 2.53° or more off the main-lobe axis of an earth station antenna:

Off-axis angle		*Maximum e.i.r.p.*
2.53°	≤ φ ≤ 7°	(3942 – 25 log φ) dB(W/40 kHz)
7°	< φ ≤ 9.2°	1821 dB(W/40 kHz)
9.2°	< φ ≤ 48°	(4245 – 25 log φ) dB(W/40 kHz)
48°	< φ ≤ 180°	03 dB(W/40 kHz)

MOD

S22.27 For FM-TV emissions with energy dispersal, the limits in No. **S22.26** above may be exceeded by up to 3 dB provided that the off-axis total e.i.r.p. of the transmitted FM-TV carrier does not exceed the following values:

Off-axis angle	*Maximum e.i.r.p.*
~~2.5~~<u>3</u>° ≤ φ ≤ 7°	(~~53~~<u>56</u> – 25 log φ) dBW
7° < φ ≤ 9.2°	~~32~~<u>35</u> dBW
9.2° < φ ≤ 48°	(~~56~~<u>59</u> – 25 log φ) dBW
48° < φ ≤ 180°	~~14~~<u>17</u> dBW

MOD

S22.28 FM-TV carriers which operate without energy dispersal should be modulated at all times with programme material or appropriate test patterns. In this case, the off-axis total e.i.r.p. of the emitted FM-TV carrier shall not exceed the following values:

Off-axis angle	*Maximum e.i.r.p.*
~~2.5~~<u>3</u>° ≤ φ ≤ 7°	(~~53~~<u>56</u> – 25 log φ) dBW
7° < φ ≤ 9.2°	~~32~~<u>35</u> dBW
9.2° < φ ≤ 48°	(~~56~~<u>59</u> – 25 log φ) dBW
48° < φ ≤ 180°	~~14~~<u>17</u> dBW

MOD

[11] **S22.VI.1** ~~The provisions of this section are suspended pending the review of the values in Nos. **S22.26**, **S22.27** and **S22.28** by WRC-99~~<u>The provisions of this section shall not be used for coordination of, or to evaluate interference between, GSO FSS networks (see RR **S9.50.1**)</u>.

ADD

[12] **S22.VI.2** Although the provisions of this section cover off-axis power limitations in all directions, the radiation pattern of GSO FSS earth station antennas in more than two orthogonal planes is not required.

NOC

S22.29

ADD

S22.30 The e.i.r.p. limits given in Nos. **S22.26, S22.27**, **S22.28** and **S22.32** do not apply to earth station antennas in service or ready to be in service[13] prior to 2 June 2000 nor to earth stations associated with a satellite network in the fixed-satellite service for which complete coordination or notification information has been received before 2 June 2000.

ADD

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[13] **S22.30.1** "Ready to be in service" relates to the case where antennas have been installed but the start of service has been delayed due to *force majeure*.

ADD

S22.31 Telecommand and ranging carriers transmitted to geostationary satellites in the fixed-satellite service in normal mode of operation (i.e. earth station transmitting telecommand and ranging carriers to a directive receiving antenna on the space station) may exceed the levels given in **S22.26** by no more than 16 dB in the frequency bands 12.75-13.25 GHz and 13.75-14.5 GHz. In all other modes of operation, and in case of *force majeure*, telecommand and ranging carriers transmitted to geostationary satellites in the fixed-satellite service are exempted from the levels given in **S22.26**.

ADD

S22.32 § 10 The level of equivalent isotropically radiated power (e.i.r.p.) density emitted by an earth station within a geostationary-satellite network in the 29.5-30 GHz frequency band shall not exceed the following values for any off-axis angle φ which is 3° or more off the main-lobe axis of an earth station antenna:

Off-axis angle	*Maximum e.i.r.p. density*
3° ≤ φ ≤ 7°	(28 – 25 log φ) dB(W/40 kHz)
7° < φ ≤ 9.2°	7 dB(W/40 kHz)
9.2 < φ ≤ 48°	(31 – 25 log φ) dB(W/40 kHz)
48° < φ ≤ 180°	–1 dB(W/40 kHz)

ADD

S22.33 Not used.

ADD

S22.34 Telecommand and ranging*** carriers transmitted to geostationary satellites in the fixed-satellite service in normal mode of operation (i.e. earth station transmitting telecommand and ranging carriers to a directive receiving antenna on the space station) may exceed the levels given in **S22.32** by no more than 10 dB** in the frequency band 29.5-30 GHz. In all other modes of operation, and in case of *force majeure,* telecommand and ranging carriers transmitted to geostationary satellites in the fixed-satellite service are exempted from the levels given in **S22.32**.

ADD

S22.35 For GSO systems in which the earth stations are expected to transmit simultaneously in the same 40 kHz band, e.g. for the GSO systems employing CDMA, the maximum e.i.r.p., values in **S22.32** should be decreased by 10*log(N) dB, where N is the number of earth stations which are in the receive satellite beam of the satellite to which these earth stations are communicating and which are expected to transmit simultaneously on the same frequency.

ADD

S22.36 Earth stations operating in the 29.5-30 GHz frequency band should be designed in such a manner that 90% of their peak off-axis e.i.r.p. density levels do not exceed the values given in **S22.32**. Further study is needed to determine the off-axis angular range over which these exceedances would be permitted, taking into account the interference level into adjacent satellites. The statistical processing of the off-axis e.i.r.p. density peaks should be dealt with using the method given in Recommendation ITU-R S.732.

*** Measurement of the distance to the satellite.

** Further studies are required to confirm the value of 10 dB.

ADD

S22.37 The limits given in **S22.26** to **S22.28** and **S22.32** apply under clear-sky conditions. During rain-fade conditions, the limits may be exceeded by earth stations when implementing uplink power control.

ADD

S22.38 FSS earth stations operating in the 29.5-30 GHz band, which have lower elevation angles to the GSO will require higher e.i.r.p. levels relative to the same terminals at higher elevation angles to achieve the same power flux-densities at the GSO due to the combined effect of increased distance and atmospheric absorption. Earth stations with low elevation angles may exceed the levels given in **S22.32** by the following amount:

Elevation angle to GSO (ε)	*Increase in e.i.r.p. density (dB)*
$\varepsilon \leq 5°$	2.5
$5 < \varepsilon \leq 30°$	$0.1(25 - \varepsilon) + 0.5$

ADD

S22.39 The values in **S22.32** applicable to the off-axis angle range from 48° to 180° are intended to account for spillover effects.

MOD

S5.441 The use of the bands 4 500-4 800 MHz (space-to-Earth), 6 725-7 025 MHz (Earth-to-space) by the fixed-satellite service shall be in accordance with the provisions of Appendix **S30B**. The use of the bands 10.7-10.95 GHz (space-to-Earth), 11.2-11.45 GHz (space-to-Earth) and 12.75-13.25 GHz (Earth-to-space) by geostationary-satellite systems in the fixed-satellite service shall be in accordance with the provisions of Appendix **S30B**. The use of the bands 10.7-10.95 GHz (space-to-Earth), 11.2-11.45 GHz (space-to-Earth) and 12.75-13.25 GHz (Earth-to-space) by a non-geostationary-satellite systems in the fixed-satellite service ~~shall be in accordance with the provisions of Resolution **130 (WRC-97)**~~is subject to the application of the provision of No. **S9.12** for coordination with other non-geostationary-satellite systems in the fixed-satellite service. Non-geostationary-satellite systems in the fixed-satellite service shall not claim protection from geostationary-satellite networks in the fixed-satellite service operating in accordance with the Radio Regulations, irrespective of the dates of receipt by the Bureau of the complete coordination or notification information, as appropriate, for the non-GSO FSS systems and of the complete coordination or notification information, as appropriate, for the GSO networks. No. **S5.43** does not apply. Non-geostationary FSS systems in the above bands shall be operated in such a way that any harmful interference that may occur during their operation shall be rapidly eliminated.

MOD

S5.484A The use of the bands 10.95-11.2 GHz (space-to-Earth), 11.45-11.7 GHz (space-to-Earth), 11.7-12.2 GHz (space-to-Earth) in Region 2, 12.2-12.75 GHz (space-to-Earth) in Region 3, 12.5-12.75 GHz (space-to-Earth) in Region 1, 13.75-14.5 GHz (Earth-to-space), 17.8-18.6 GHz (space-to-Earth), 19.7-20.2 GHz (space-to-Earth), 27.5-28.6 GHz (Earth-to-space), 29.5-30 GHz (Earth-to-space) by a non-geostationary ~~and geostationary~~ satellite systems in the fixed-satellite service is subject to the application of the provisions of ~~Resolution **130 (WRC-97)**. The use of the band 17.8-18.1 GHz (space-to-Earth) by non-geostationary fixed-satellite service systems is also subject to the provisions of Resolution **538 (WRC-97)**~~No. **S9.12** for coordination with other non-geostationary-satellite systems in the fixed-satellite service. Non-geostationary-satellite systems in the fixed-satellite service shall not claim protection from geostationary-satellite networks in the fixed-satellite service operating in accordance with the Radio Regulations, irrespective of the dates of receipt by the Bureau of the complete coordination or notification information, as appropriate, for the non-GSO FSS systems and of the complete coordination or notification information, as appropriate, for the GSO networks. No. **S5.43** does not apply. Non-geostationary FSS systems in the above bands shall be operated in such a way that any harmful interference that may occur during their operation shall be rapidly eliminated.

MOD

S5.487A *Additional allocation:* in Region 1, the band 11.7-12.5 GHz, in Region 2, the band 12.2-12.7 GHz and, in Region 3, the band 11.7-12.2 GHz, are also allocated to the fixed-satellite service (space-to-Earth) on a primary basis, limited to non-geostationary systems and subject to the application of the provisions of ~~Resolution **538 (WRC-97)**~~No. **S9.12** for coordination with other non-geostationary-satellite systems in the fixed-satellite service. Non-geostationary-satellite systems in the fixed-satellite service shall not claim protection from geostationary-satellite networks in the fixed-satellite service operating in accordance with the Radio Regulations, irrespective of the dates of receipt by the Bureau of the complete coordination or notification information, as appropriate, for the non-GSO FSS systems and of the complete coordination or notification information, as appropriate, for the GSO networks. No. **S5.43** does not apply. Non-geostationary FSS systems in the above bands shall be operated in such a way that any harmful interference that may occur during their operation shall be rapidly eliminated.

APPENDIX S4

ADD

A.16 Commitment regarding compliance with off-axis power limitations

A commitment that the earth stations operating with a geostationary-satellite network in the FSS meet the off-axis power limitations given in **S22.26** to **S22.28** or **S22.32** (as appropriate) under the conditions specified in **S22.30**, **S22.31** and **S22.34** to **S22.39**, where the earth stations are subject to those power limitations.

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INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

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COMMITTEE 5

Chairperson, Working Group 5D

Working Group 5D considered two possible compromise approaches on the issues related to Resolution 130 and the associated footnotes. The proposed approach is given below. Some administrations expressed a preference for an alternative approach.

Concerning the transitional measures for non-GSO FSS systems filed between WRC-97 and WRC-2000, Working Group 5D understood that the following conditions would apply:

1) The Bureau would examine those filings for compliance with the epfd limits as revised by WRC-2000. (For examination of non-GSO FSS systems in the bands covered by Resolution 130 and Resolution 538, the Bureau will use software defined in ITU-R Recommendation BO.1503 approved by RA-2000.)

2) Administrations would be required to supply the additional data necessary for that examination.

3) By the end of the year 2000 the Bureau would issue a circular letter defining the format in which the data should be submitted, along with any other necessary information.

4) Administrations would be required to supply the data within 6 (six) months of the date of the circular letter.

Working Group 5D suggests that the above understanding should be recorded.

JOHN LEARY
Chairperson, Working Group 5D

SUP

RESOLUTION 130 (WRC-97)

Use of non-geostationary systems in the fixed-satellite service in certain frequency bands

ADD **(To be included in the WRC-2000 Resolution concerning transitional arrangements)**

resolves

1 that, as of 22 November 1997, in the frequency bands specified in Tables **S22-1A**, **S22-1B**, **S22-1C** and **S22-2** of Article **S22**, non-GSO FSS systems for which complete notification or coordination information, as appropriate, has been received by the Bureau after 21 November 1997 shall be subject to the power limits in Article **S22**, as revised by this Conference;

ADD **(To be included in the WRC-2000 Resolution concerning transitional arrangements)**

resolves

2 that, in any case where complete coordination or notification information, as appropriate, is considered as having been received between 22 November 1997 and the end of WRC-2000 for a non-GSO FSS network operating in the frequency bands specified in Tables **S22-1A**, **S22-1B**, **S22-1C** and **S22.2** of Article **S22**, the responsible administration shall submit all necessary supplementary information to permit the Bureau to make a finding in compliance with the limits contained in Article **S22** as revised by WRC-2000;

resolves

3 that, as of 3 June 2000, when providing coordination information for a GSO satellite network in the FSS, the responsible administration shall confirm that, for all earth stations to which the limitations apply, the off-axis power limitations of Section VI of Article S22 are met.

MOD

Section VI – GSO ~~E~~earth station off-axis power limitations in the fixed-satellite service[11, 12]

MOD

S22.26 § 9 The level of equivalent isotropically radiated power (e.i.r.p.) emitted by an earth station shall within a geostationary-satellite network not exceed the following values for any off-axis angle φ which is ~~2.5~~3° or more off the main-lobe axis of an earth station antenna:

Off-axis angle	*Maximum e.i.r.p.*
~~2.5~~3° ≤ φ ≤ 7°	(~~39~~42 – 25 log φ) dB(W/40 kHz)
7° < φ ≤ 9.2°	~~18~~21 dB(W/40 kHz)
9.2° < φ ≤ 48°	(~~42~~45 – 25 log φ) dB(W/40 kHz)
48° < φ ≤ 180°	~~0~~3 dB(W/40 kHz)

MOD

S22.27 For FM-TV emissions with energy dispersal, the limits in No. **S22.26** above may be exceeded by up to 3 dB provided that the off-axis total e.i.r.p. of the transmitted FM-TV carrier does not exceed the following values:

Off-axis angle	*Maximum e.i.r.p.*
~~2.5~~3° ≤ φ ≤ 7°	(~~53~~56 – 25 log φ) dBW
7° < φ ≤ 9.2°	~~32~~35 dBW
9.2° < φ ≤ 48°	(~~56~~59 – 25 log φ) dBW
48° < φ ≤ 180°	~~14~~17 dBW

MOD

S22.28 FM-TV carriers which operate without energy dispersal should be modulated at all times with programme material or appropriate test patterns. In this case, the off-axis total e.i.r.p. of the emitted FM-TV carrier shall not exceed the following values:

Off-axis angle	*Maximum e.i.r.p.*
~~2.5~~3° ≤ φ ≤ 7°	(~~53~~56 – 25 log φ) dBW
7° < φ ≤ 9.2°	~~32~~35 dBW
9.2° < φ ≤ 48°	(~~56~~59 – 25 log φ) dBW
48° < φ ≤ 180°	~~14~~17 dBW

____

MOD

[11] **S22.VI.1** ~~The provisions of this section are suspended pending the review of the values in Nos. **S22.26**, **S22.27** and **S22.28** by WRC-99~~The provisions of this section shall not be used for coordination of, or to evaluate interference between, GSO FSS networks (see RR **S9.50.1**).

ADD

[12] **S22.VI.2** Although the provisions of this section cover off-axis power limitations in all directions, data on the performance of GSO FSS earth station antennas in more than two orthogonal planes is not required.

NOC

S22.29

ADD

S22.30 The e.i.r.p. limits given in Nos. **S22.26, S22.27**, **S22.28** and **S22.32** do not apply to earth station antennas in service or ready to be in service[13] prior to 2 June 2000 nor to earth stations associated with a satellite network in the fixed-satellite service for which complete coordination or notification information has been received before 2 June 2000.

ADD

____

[13] **S22.30.1** "Ready to be in service" relates to the case where antennas have been installed but the start of service has been delayed due to *force majeure*.

ADD

S22.31 Telecommand and ranging carriers transmitted to geostationary satellites in the fixed-satellite service in normal mode of operation (i.e. earth station transmitting telecommand and ranging carriers to a directive receiving antenna on the space station) may exceed the levels given in **S22.26** by no more than 16 dB in the frequency bands 12.75-13.25 GHz and 13.75-14.5 GHz. In all other modes of operation, and in case of *force majeure*, telecommand and ranging carriers transmitted to geostationary satellites in the fixed-satellite service are exempted from the levels given in **S22.26**.

ADD

S22.32 § 10 The level of equivalent isotropically radiated power (e.i.r.p.) density emitted by an earth station within a geostationary-satellite network in the 29.5-30 GHz frequency band shall not exceed the following values for any off-axis angle φ which is 3° or more off the main-lobe axis of an earth station antenna:

Off-axis angle	*Maximum e.i.r.p. density*
3° ≤ φ ≤ 7°	(28 – 25 log φ) dB(W/40 kHz)
7° < φ ≤ 9.2°	7 dB(W/40 kHz)
9.2 < φ ≤ 48°	(31 – 25 log φ) dB(W/40 kHz)
48° < φ ≤ 180°	–1 dB(W/40 kHz)

ADD

S22.34 Telecommand and ranging*** carriers transmitted to geostationary satellites in the fixed-satellite service in normal mode of operation (i.e. earth station transmitting telecommand and ranging carriers to a directive receiving antenna on the space station) may exceed the levels given in **S22.32** by no more than 10 dB** in the frequency band 29.5-30 GHz. In all other modes of operation, and in case of *force majeure*, telecommand and ranging carriers transmitted to geostationary satellites in the fixed-satellite service are exempted from the levels given in **S22.32**.

ADD

S22.35 For GSO systems in which the earth stations are expected to transmit simultaneously in the same 40 kHz band, e.g. for the GSO systems employing CDMA, the maximum e.i.r.p., values in **S22.32** should be decreased by 10*log(N) dB, where N is the number of earth stations which are in the receive satellite beam of the satellite to which these earth stations are communicating and which are expected to transmit simultaneously on the same frequency.

ADD

S22.36 Earth stations operating in the 29.5-30 GHz frequency band should be designed in such a manner that 90% of their peak off-axis e.i.r.p. density levels do not exceed the values given in **S22.32**. Further study is needed to determine the off-axis angular range over which these exceedances would be permitted, taking into account the interference level into adjacent satellites. The statistical processing of the off-axis e.i.r.p. density peaks should be dealt with using the method given in Recommendation ITU-R S.732.

*** Measurement of the distance to the satellite.

** Further studies are required to confirm the value of 10 dB.

ADD

S22.37 The values given in **S22.26** to **S22.28** and **S22.32** apply under clear-sky conditions. During rain-fade conditions, the values may be exceeded by earth stations when implementing uplink power control.

ADD

S22.38 FSS earth stations operating in the 29.5-30 GHz band, which have lower elevation angles to the GSO will require higher e.i.r.p. levels relative to the same terminals at higher elevation angles to achieve the same power flux-densities at the GSO due to the combined effect of increased distance and atmospheric absorption. Earth stations with low elevation angles may exceed the levels given in **S22.32** by the following amount:

Elevation angle to GSO (ε)	*Increase in e.i.r.p. density (dB)*
$\varepsilon \leq 5°$	2.5
$5 < \varepsilon \leq 30°$	$0.1(25 - \varepsilon) + 0.5$

ADD

S22.39 The values in **S22.32** applicable to the off-axis angle range from 48° to 180° are intended to account for spillover effects.

MOD

S5.441 The use of the bands 4 500-4 800 MHz (space-to-Earth), 6 725-7 025 MHz (Earth-to-space) by the fixed-satellite service shall be in accordance with the provisions of Appendix **S30B**. The use of the bands 10.7-10.95 GHz (space-to-Earth), 11.2-11.45 GHz (space-to-Earth) and 12.75-13.25 GHz (Earth-to-space) by geostationary-satellite systems in the fixed-satellite service shall be in accordance with the provisions of Appendix **S30B**. The use of the bands 10.7-10.95 GHz (space-to-Earth), 11.2-11.45 GHz (space-to-Earth) and 12.75-13.25 GHz (Earth-to-space) by <u>a</u> non-geostationary-satellite systems in the fixed-satellite service ~~shall be in accordance with the provisions of Resolution **130 (WRC-97)**~~<u>is subject to the application of the provision of No. **S9.12** for coordination with other non-geostationary-satellite systems in the fixed-satellite service. Non-geostationary-satellite systems in the fixed-satellite service shall not claim protection from geostationary-satellite networks in the fixed-satellite service operating in accordance with the Radio Regulations, irrespective of the dates of receipt by the Bureau of the complete coordination or notification information, as appropriate, for the non-GSO FSS systems and of the complete coordination or notification information, as appropriate, for the GSO networks</u>.<u> No. **S5.43** does not apply.</u>

MOD

S5.484A The use of the bands 10.95-11.2 GHz (space-to-Earth), 11.45-11.7 GHz (space-to-Earth), 11.7-12.2 GHz (space-to-Earth) in Region 2, 12.2-12.75 GHz (space-to-Earth) in Region 3, 12.5-12.75 GHz (space-to-Earth) in Region 1, 13.75-14.5 GHz (Earth-to-space), 17.8-18.6 GHz (space-to-Earth), 19.7-20.2 GHz (space-to-Earth), 27.5-28.6 GHz (Earth-to-space), 29.5-30 GHz (Earth-to-space) by<u> a</u> non-geostationary ~~and geostationary-~~satellite systems in the fixed-satellite service is subject to <u>application of </u>the provisions of ~~Resolution **130 (WRC-97)**. The use of the band 17.8-18.1 GHz (space-to-Earth) by non-geostationary fixed-satellite service systems is also subject to the provisions of Resolution **538 (WRC-97)**~~<u>No. **S9.12** for coordination with other non-geostationary-satellite systems in the fixed-satellite service. Non-geostationary-satellite systems in the fixed-satellite service shall not claim protection from geostationary-satellite networks</u>

in the fixed-satellite service operating in accordance with the Radio Regulations, irrespective of the dates of receipt by the Bureau of the complete notification information for the non-GSO FSS systems and of the complete coordination information for the GSO networks. No. **S5.43** does not apply.

MOD

S5.487A *Additional allocation:* in Region 1, the band 11.7-12.5 GHz, in Region 2, the band 12.2-12.7 GHz and, in Region 3, the band 11.7-12.2 GHz, are also allocated to the fixed-satellite service (space-to-Earth) on a primary basis, limited to non-geostationary systems and subject to the provisions of ~~Resolution **538 (WRC-97)**~~No. **S9.12** for coordination with other non-geostationary-satellite systems in the fixed-satellite service. Non-geostationary-satellite systems in the fixed-satellite service shall not claim protection from geostationary-satellite networks in the fixed-satellite service operating in accordance with the Radio Regulations, irrespective of the dates of receipt by the Bureau of the complete notification information for the non-GSO FSS systems and of the complete coordination information for the GSO networks. No. **S5.43** does not apply.

APPENDIX S4

ADD

A.16 Commitment regarding compliance with off-axis power limitations

A commitment that the earth stations operating with a geostationary-satellite network in the FSS meet the off-axis power limitations given in **S22.26** to **S22.28** or **S22.32** (as appropriate) under the conditions specified in **S22.30**, **S22.31** and **S22.33** to **S22.39**, where the earth stations are subject to the limitations of those provisions.

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

Document 376-E
23 May 2000
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ISTANBUL, 8 MAY – 2 JUNE 2000

COMMITTEE 5

Working Group 5D

RESOLUTION [COM5/6] (WRC-2000)

Protection of GSO FSS and GSO BSS networks from the maximum aggregate equivalent power flux-density produced by multiple non-GSO FSS systems in frequency bands where epfd limits have been adopted

The World Radiocommunication Conference (Istanbul, 2000),

considering

a) that WRC-97 has adopted, in Article **S22**, provisional epfd limits to be met by non-GSO FSS systems in order to protect GSO FSS and GSO BSS networks in parts of the frequency range 10.7-30 GHz;

b) that WRC-2000 has revised Article **S22** to ensure the limits contained therein provide adequate protection to GSO systems without causing undue constraints to any of the systems and services sharing these frequency bands;

c) that WRC-2000 decided that a combination of single-entry validation, single-entry operational and for certain antenna sizes single-entry additional operational epfd limits, which are included in Article **S22**, along with the aggregate limits in Tables **COM5/6-1A** through **COM5/6-1D**, which apply to non-GSO FSS systems protect GSO networks in these bands;

d) that these single-entry validation limits have been derived from aggregate equivalent power flux-density (epfd) masks contained in Tables **COM5/6-1A** through **COM5/6-1D**, assuming a maximum effective number of non-GSO FSS systems of 3.5;

e) that the aggregate interference caused by all co-frequency non-GSO FSS systems in these bands into GSO FSS systems should not exceed the aggregate epfd levels in Tables **COM5/6-1A** through **COM5/6-1D**;

f) that WRC-97 decided, and WRC-2000 confirmed, that non-GSO FSS systems in these bands are to coordinate the use of these frequencies between themselves under the provisions of No. [**S9.10**] of the Radio Regulations;

g) that the orbital characteristics of such systems are likely to be inhomogeneous;

h) that as a result of this likely inhomogeneity, the aggregate epfd levels from multiple non-GSO FSS systems are not directly related to the number of actual systems sharing a frequency band, and the number of such systems operating co-frequency is likely to be small;

i) that the possible misapplication of single-entry limits should be avoided,

recognizing

a) that non-GSO FSS systems are likely to need to implement interference mitigation techniques to share frequencies among themselves;

b) that because the use of such interference mitigation techniques will likely keep the number of non-GSO systems small, the aggregate interference caused by non-GSO FSS systems into GSO systems will also likely be small;

c) that notwithstanding *considering d), considering e)* and *recognizing b)*, there may be instances where the aggregate interference from non-GSO systems could exceed the interference levels given in Tables **COM5/6-1A** through **COM5/6-1D**;

d) that administrations operating GSO systems may wish to ensure that the aggregate epfd produced by all operating co-frequency non-GSO FSS systems in the frequency bands referred to in *considering a)* above into GSO FSS and/or GSO BSS networks does not exceed the aggregate interference levels given in Tables **COM5/6-1A** through **COM5/6-1D**,

resolves

1 that administrations operating or planning to operate non-GSO FSS systems, for which coordination or notification information, as appropriate, was received after 21 November 1997, in the frequency bands referred to in *considering a)* above, individually or in collaboration, take all possible steps, including by means of appropriate modifications to their systems if necessary, to ensure that the aggregate interference into GSO FSS and GSO BSS networks caused by such systems operating co-frequency in these frequency bands does not cause the aggregate power levels shown in Tables **COM5/6-1A** through **COM5/6-1D** to be exceeded [(see No. **S22.5K**)];

2 that, in the event that the aggregate interference levels in Tables **COM5/6-1A** through **COM5/6-1D** are exceeded, administrations operating non-GSO FSS systems in these frequency bands shall expeditiously take all necessary measures to reduce the aggregate epfd levels to those in Tables **COM5/6-1A** through **COM5/6-1D** or to reduce such interference to levels that are acceptable to the affected GSO administration [(see No. **S22.5K)]**,

requests ITU-R

1 to develop, as a matter of urgency, and complete, in time for consideration by the next WRC, a suitable methodology for calculating the aggregate epfd produced by all non-GSO FSS systems operating or planning to operate co-frequency in the frequency bands referred to in *considering a)* above into GSO FSS and GSO BSS networks, which may be used to determine whether the systems are in compliance with the aggregate power levels shown in Tables **COM5/6-1A** through **COM5/6-1D**;

2 to continue its studies and to develop, as a matter of urgency, a recommendation on the accurate modelling of interference from non-GSO FSS systems into GSO FSS and GSO BSS networks in the frequency bands referred to in *considering a)* above in order to assist the administrations planning or operating non-GSO FSS systems in their efforts to limit the aggregate epfd levels produced by their systems into GSO networks and to provide guidance to GSO network designers on the maximum $epfd_{down}$ levels expected to be produced by all non-GSO FSS systems when accurate modelling assumptions are used;

3 to develop a recommendation, as a matter of urgency, that contains procedures to be used amongst administrations to ensure that the aggregate epfd limits contained in Tables **COM5/6-1A** through **COM5/6-1D** are not exceeded by operators of non-GSO FSS systems;

4 to attempt to develop measurement techniques to identify the interference levels from non-GSO systems in excess of the "aggregate" limits given in Tables **COM5/6-1A** through **COM5/6-1D** of this Resolution, and to confirm compliance with these limits,

requests the Director of the Radiocommunication Bureau

1 to assist in the development of the methodology referred to in *requests ITU-R* 1 above;

2 to report to WRC-02/03 on the results of studies in *requests ITU-R* 1 and 3 above.

ANNEX 1 (TO RESOLUTION [COM5/6] (WRC-2000))

TABLE **COM5/6-1A**[1, 3, 4]

Limits to the aggregate $epfd_{down}$ radiated by non-GSO FSS systems in certain frequency bands

Frequency band (GHz)	$epfd_{down}$ dB(W/m²)	Percentage of time during which $epfd_{down}$ may not be exceeded	Reference bandwidth (kHz)	Reference antenna diameter, and reference radiation pattern[2]
10.7-11.7 in all Regions 11.7-12.2 in Region 2 12.2-12.5 in Region 3 and 12.5-12.75 in Regions 1 and 3	–170.0 –168.6 –165.3 –160.4 –160.0 –160.0	0 90 99 99.97 99.99 100	40	60 cm Recommendation ITU-R S.1428
	–176.5 –173.0 –164.0 –161.6 –161.4 –160.8 –160.5 –160 –160	0 99.5 99.84 99.945 99.97 99.99 99.99 99.9975 100	40	1.2 m Recommendation ITU-R S.1428
	–185 –184 –182 –168 –164 –162 –160 –160	0 90 99.5 99.9 99.96 99.982 99.997 100.00	40	3 m[3*bis*] Recommendation ITU-R S.1428
	–190 –190 –166 –160 –160	0 99 99.99 99.998 100	40	10 m[3*bis*] Recommendation ITU-R S.1428

1 For certain GSO FSS receive earth stations, see also ADD **S9.7A** and ADD **S9.7B**.

2 Under this section, reference patterns are to be used only for the calculation of interference from non-GSO FSS systems into GSO FSS systems.

3 In addition to the limits shown in Table **COM5/6-1A**, the following aggregate $epfd_{down}$ limits apply to all antenna sizes greater than 60 cm in the frequency bands listed in Table **COM5/6-1A**.

100% of the time $epfd_{down}$ dB(W/(m^2·40 kHz))	**Latitude (North or South) (°)**
–160	0 < |Latitude| ≤ 57.5
–160 + 3.4(57.5 – |Latitude|)/4	57.5 < |Latitude| ≤ 63.75
–165.3	63.75 ≤ |Latitude|

3*bis* The values for the 3 metre and 10 metre antennas are applicable only for the aggregation methodologies referred to *requests ITU-R* 1.

4 For each reference antenna diameter, the limit consists of the complete curve on a plot which is linear in decibels for the epfd levels and logarithmic for the time percentages, with straight lines joining the data points.

MOD

TABLE **COM5/6-1B**[1, 3]

Limits to the aggregate $epfd_{down}$ radiated by non-GSO FSS systems in certain frequency bands

Frequency band (GHz)	$epfd_{down}$ dB(W/m²)	Percentage of time during which $epfd_{down}$ may not be exceeded	Reference bandwidth (kHz)	Reference antenna diameter, and reference radiation pattern[2]
17.8-18.6	–170 –170 –164 –164	0 90 99.9 100	40	1 m Recommendation ITU-R S.1428
	–156 –156 –150 –150	0 90 99.9 100	1 000	
17.8-18.6	–173 –173 –166 –164 –164	0 99.4 99.9 99.92 100	40	2 m Recommendation ITU-R S.1428
	–159 –159 –152 –150 –150	0 99.4 99.9 99.92 100	1 000	
17.8-18.6	–180 –180 –172 –164 –164	0 99.8 99.8 99.992 100	40	5 m Recommendation ITU-R S.1428
	–166 –166 –158 –150 –150	0 99.8 99.8 99.992 100	1 000	

1 For certain GSO FSS receive earth stations, see also ADD **S9.7A** and ADD **S9.7B**.

2 Under this section, reference patterns are to be used only for the calculation of interference from non-GSO FSS systems into GSO FSS systems.

3 For each reference antenna diameter, the limit consists of the complete curve on a plot which is linear in decibels for the epfd levels and logarithmic for the time percentages, with straight lines joining the data points.

3*bis* A non-GSO system shall meet the limits of this table in both the 40 kHz and the 1 MHz reference bandwidth.

MOD

TABLE **COM5/6-1C**[1, 3]

Limits to the aggregate $epfd_{down}$ radiated by non-GSO FSS systems in certain frequency bands

Frequency band (GHz)	**$epfd_{down}$ dB(W/m^2)**	**Percentage of time during which $epfd_{down}$ may not be exceeded**	**Reference bandwidth (kHz)**	**Reference antenna diameter, and reference radiation pattern**[2]
19.7-20.2	–182 –172 –154 –154	0 90 99.94 100	40	70 cm Recommendation ITU-R S.1428
	–168 –158 –140 –140	0 90 99.94 100	1 000	
19.7-20.2	–185 –176 –165 –160 –154 –154	0 91 99.8 99.8 99.99 100	40	90 cm Recommendation ITU-R S.1428
	–171 –162 –151 –146 –140 –140	0 91 99.8 99.8 99.99 100	1 000	
19.7-20.2	–191 –162 –154 –154	0 99.933 99.998 100	40	2.5 m Recommendation ITU-R S.1428
	–177 –148 –140 –140	0 99.933 99.998 100	1 000	
19.7-20.2	–195 –184 –175 –161 –154 –154	0 90 99.6 99.984 99.9992 100	40	5 m Recommendation ITU-R S.1428
	–181 –170 –161 –147 –140 –140	0 90 99.6 99.984 99.9992 100	1 000	

1 For certain GSO FSS receive earth stations, see also ADD **S9.7A** and ADD **S9.7B**.

2 Under this section, reference patterns are to be used only for the calculation of interference from non-GSO FSS systems into GSO FSS systems.

3 For each reference antenna diameter, the limit consists of the complete curve on a plot which is linear in decibels for the epfd levels and logarithmic for the time percentages, with straight lines joining the data points.

3*bis* A non-GSO system shall meet the limits of this table in both the 40 kHz and the 1 MHz reference bandwidth.

TABLE **COM5/6-1D**[2, 3]

Limits to the aggregate epfd$_{down}$ radiated by non-GSO FSS systems in certain frequency bands 30 cm, 45 cm, 60 cm, 90 cm, 120 cm, 180 cm, 240 cm and 300 cm BSS antennas

Frequency band (GHz)	epfd$_{down}$ dB(W/m^2)	Percentage of time during which epfd$_{down}$ level may not be exceeded	Reference bandwidth (kHz)	Reference antenna diameter, and reference radiation pattern[1]
11.7- 12.5 GHz in Region 1 11.7-12.2 GHz and 12.5-12.75 GHz in Region 3 12.2-12.7 GHz in Region 2	–160.4 –160.1 –158.6 –158.6 –158.33 –158.33	0 25 96 98 98 100	40	30 cm Recommendation ITU-R BO.1443 Annex 1
11.7-12.5 GHz in Region 1 11.7-12.2 GHz and 12.5-12.75 GHz in Region 3 12.2-12.7 GHz in Region 2	–170 –167 –164 –160.75 –160 –160	0 66 97.75 99.33 99.95 100	40	45 cm Recommendation ITU-R BO.1443 Annex 1
11.7-12.5 GHz in Region 1 11.7-12.2 GHz and 12.5-12.75 GHz in Region 3 12.2-12.7 GHz in Region 2	–171 –168.75 –167.75 –162 –161 –160.2 –160 –160	0 90 97.8 99.6 99.8 99.9 99.99 100	40	60 cm Recommendation ITU-R BO.1443 Annex 1
11.7-12.5 GHz in Region 1 11.7-12.2 GHz and 12.5-12.75 GHz in Region 3 12.2-12.7 GHz in Region 2	–173.75 –173 –171 –165.5 –163 –161 –160 –160	0 33 98 99.1 99.5 99.8 99.97 100	40	90 cm Recommendation ITU-R BO.1443 Annex 1
11.7-12.5 GHz in Region 1 11.7-12.2 GHz and 12.5-12.75 GHz in Region 3 12.2-12.7 GHz In Region 2	–177 –175.25 –173.75 –173 –169.5 –167.8 –164 –161.9 –161 –160.4 –160	0 90 98.9 98.9 99.5 99.7 99.82 99.9 99.965 99.993 100	40	120 cm Recommendation ITU-R BO.1443 Annex 1

11.7-12.5 GHz in Region 1 11.7-12.2 GHz and 12.5-12.75 GHz in Region 3 12.2-12.7 GHz in Region 2	–179.5 –178.66 –176.25 –163.25 –161.5 –160.35 –160 –160	0 33 98.5 99.81 99.91 99.975 99.995 100	40	180 cm Recommendation ITU-R BO.1443 Annex 1
11.7-12.5 GHz in Region 1 11.7-12.2 GHz and 12.5-12.75 GHz in Region 3 12.2-12.7 GHz in Region 2	–182 –180.9 –178 –164.4 –161.9 –160.5 –160 –160	0 33 99.25 99.85 99.94 99.98 99.995 100	40	240 cm Recommendation ITU-R BO.1443 Annex 1
11.7-12.5 GHz In Region 1 11.7-12.2 GHz and 12.5-12.75 GHz In Region 3 12.2-12.7 GHz In Region 2	–186.5 –184 –180.5 –173 –167 –162 –160 –160	0 33 99.5 99.7 99.83 99.94 99.97 100	40	300 cm Recommendation ITU-R BO.1443 Annex 1

1 Under this section, reference patterns are to be used only for the calculation of interference from non-GSO FSS systems into GSO BSS systems.

2 For BSS antenna diameters 180 cm, 240 cm and 300 cm, in addition to the aggregate limit shown in Table **COM5/6-1D**, the following aggregate 100% of the time $epfd_{down}$ limit also applies:

100% of the time $epfd_{down}$ dB(W/(m²·40 kHz))	**Latitude (North or South) (°)**
–160	0 ≤ │Latitude│ ≤ 57.5
–160 + 3.4 * (57.5 – │Latitude│)/4	57.5 ≤ │Latitude│ ≤ 63.75
–165.3	63.75 ≤ │Latitude│

3 For each reference antenna diameter, the limit consists of the complete curve on a plot which is linear in decibels for the epfd levels and logarithmic for the time percentages, with straight lines joining the data points.

For BSS antenna diameter 240 cm, in addition to the above aggregate 100% of the time $epfd_{down}$ limit, a –167 dB(W/(m^2 · 40 kHz)) aggregate 100% of the time operational $epfd_{down}$ limit also applies to receive antennas located in Region 2, west of 140° W, north of 60° N, pointing toward GSO BSS satellites at 91° W, 101° W, 110° W, 119° W and 148° W with elevation angles greater than 5°. [This limit is implemented during a transition period of 15 years.][*]

[*] Comment - This transitional regime would be applicable only if the pfd limits in section 5c of Annex 1 to Appendix **S30** are sufficiently relaxed.

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

ISTANBUL, 8 MAY – 2 JUNE 2000

Addendum 1 to
Document 377-E
30 May 2000
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PLENARY MEETING

Note by the Secretary-General

ITU-R RECOMMENDATIONS CONTAINING TEXTS INCORPORATED BY REFERENCE IN THE RADIO REGULATIONS

In accordance with the decisions of the sixth Plenary Meeting (30 May 2000), attached are the texts of Recommendations ITU-R S.672-4, S.1428 and BO.1443, which will be included in the forthcoming edition of Volume 4 of the Radio Regulations.

Y. UTSUMI
Secretary-General

Attachment: (1 copy per delegation)
Recommendations ITU-R S.672-4, S.1428 and BO.1443

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

Document 377-E
23 May 2000
Original: English

ISTANBUL, 8 MAY – 2 JUNE 2000

PLENARY MEETING

Note by the Secretary-General

ITU-R RECOMMENDATIONS CONTAINING TEXTS INCORPORATED BY REFERENCE IN THE RADIO REGULATIONS

In accordance with the decisions taken at the fourth meeting of Committee 4, on 23 May 2000, on the procedure relating to ITU-R Recommendations containing texts incorporated by reference in the Radio Regulations, attached are six ITU-R Recommendations of this category.

Recommendations ITU-R **SA.1154**, ITU-R **S.1256**, ITU-R **S.1340** and ITU-R **SA.1341,** that were inadvertently omitted from Volume 4 of the Radio Regulations (1998 edition), were judged to be mandatory in nature, and Committee 4 decided to include them in the forthcoming edition of Volume 4 of the Radio Regulations (Document 196 refers).

Committee 5 considered the issue of the possible update of the reference to Recommendation ITU-R **M.1174**, which appears in Volume 4 (1998 edition), and decided that the updated version (notably ITU-R **M.1174-1**) should be included in the forthcoming edition of Volume 4 of the Radio Regulations (Document 229 refers).

Attached also is the text of Recommendation ITU-R **BO.1293-1**. Volume 4 contains the text of the former version of this ITU-R recommendation (namely, ITU-R BO.1293). The issue of possible inclusion of the updated version is under consideration in GT PLEN-1.

Y. UTSUMI
Secretary-General

Attachments: (1 copy per delegation)

Recommendations ITU-R **SA.1154,** ITU-R **S.1256,** ITU-R **S.1340,** ITU-R **SA.1341,** ITU-R **M.1174-1** and ITU-R **BO.1293-1**

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

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ISTANBUL, 8 MAY – 2 JUNE 2000

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COMMITTEE 4

Draft note by the Chairperson of Committee 4 to the Chairpersons of Committee 5 and GT PLEN-1

ITU-R RECOMMENDATIONS CONTAINING TEXTS INCORPORATED BY REFERENCE IN THE RADIO REGULATIONS

DRAFT TABLE OF CONTENTS OF VOLUME 4 OF THE RADIO REGULATIONS (EDITION, 2000)

Attached is the draft table of contents of Volume 4 of the Radio Regulations (edition, 2000), which contains the provisional list of the ITU-R Recommendations containing texts incorporated by reference in the Radio Regulations.

The list will be completed on the basis of the decisions that may be taken in this regard by this conference.

Committee 5 and Working Group of the Plenary GT PLEN-1 are requested to inform Committee 4 on any decision which may lead to a change of the status of the ITU-R Recommendations containing texts incorporated by reference that are included in the attached list, as well as on the possible addition of new ITU-R Recommendations to this list. In accordance with the procedure in Document 201, the new ITU-R Recommendations containing texts that are proposed for incorporation by reference will be available for consultation in office 0/13 of the Rumeli building, level 0, opposite to Rumeli A Room (Mr W. Frank, Mrs L. Trarieux). In addition, one copy will be provided to each administration.

Following the conference, the Radiocommunication Bureau and the General Secretariat shall review the decisions taken by this conference with a view to completing the list in accordance with Resolution 27 (Rev.WRC-2000) and to publishing Volume 4 of the Radio Regulations accordingly.

A. ALLISON
Chairperson, Working Group 4B, Box 68

VOLUME 4

ITU-R Recommendations incorporated by reference

Recommendation	Title	Provision No.[1]
ITU-R M.257-3	Sequential single frequency selective-calling system for use in the maritime mobile service	**S19.38**, S19.83, **S19.92**, **S19.96A**, S52.188, **S52.222.1**, **S52.235**, S54.2, AP S13, Part A5, § 11
ITU-R TF.460-5	Standard-frequency and time-signal emissions	**S1.14**
ITU-R M.476-5	Direct-printing telegraph equipment in the maritime mobile service	**S19.83**, **S19.96A**, **S51.41**
ITU-R M.489-2	Technical characteristics of VHF radiotelephone equipment operating in the maritime mobile service in channels spaced by 25 kHz	**S51.77**, **S52.231**, **AP S13**, **Part A2, § 10 1)** AP S18, Note *e)*
ITU-R M.492-6	Operational procedures for the use of direct-printing telegraph equipment in the maritime mobile service	**S52.27**, S56.2
ITU-R M.541-8	Operational procedures for the use of digital selective-calling (DSC) equipment in the maritime mobile service	**S51.35**, S52.148, S52.149, S52.152, S52.153, **S52.159**, S54.2
ITU-R M.625-3	Direct-printing telegraph equipment employing automatic identification in the maritime mobile service	S19.83, **S51.41**
ITU-R M.627-1	Technical characteristics for HF maritime radio equipment using narrow-band phase-shift keying (NBPSK) telegraphy	S19.83, **S51.41**
ITU-R M.690-1	Technical characteristics of emergency position-indicating radio beacons (EPIRBs) operating on the carrier frequencies of 121.5 MHz and 243 MHz	**AP S13, Part A5**, **§ 1 *b)*** and **4 2)** AP S15, Table S15-2, 121.5 MHz
[ITU-R RA.769-1[2]	Protection criteria used for radioastronomical measurements	S5.208A, **S5.511A**, S29.12]
ITU-R SM.1138	Determination of necessary bandwidths including examples for their calculation and associated examples for the designation of emissions	AP S1, § 1 2) and **2 3.1)**
ITU-R SA.1154[3]	Provisions to protect the space research (SR), space operations (SO), and Earth-exploration satellite services (EES) and to facilitate sharing with the mobile service in the 2 025-2 110 MHz and 2 200-2 290 MHz bands	**S5.391**
ITU-R M.1169	Hours of service of ship stations	**S47.26**, **S47.27**, **S47.28**, **S47.29**, **S50.9**

[1] This column is provided only for convenience to delegates so that they may trace the process of incorporation by reference and will not appear in Volume 4.

[2] Committee 5 has indicated in Document 229 that this reference will be suppressed.

[3] This ITU-R Recommendation was erroneously omitted from Volume 4 (edition, 1998); see Document 196.

ITU-R M.1170	Morse telegraphy procedures in the maritime mobile service	S51.71, **S52.23**, **S52.25**, **S52.31**, S52.32, S52.63, **S52.69**, **S55.1**
ITU-R M.1171	Radiotelephony procedures in the maritime mobile service	S51.71, S52.192, **S52.195**, S52.213, **S52.224**, S52.234, **S52.240**, **S57.1**, **AP S13**, **Part A2, § 14A 1)**
ITU-R M.1172	Miscellaneous abbreviations and signals to be used for radiocommunications in the maritime mobile service	**S19.48**, S32.7, AP S13, Part A1, § 5
ITU-R M.1173	Technical characteristics of single-sideband transmitters used in the maritime mobile service for radiotelephony in the bands between 1 606.5 kHz (1 605 kHz Region 2) and 4 000 kHz and between 4 000 kHz and 27 500 kHz	**S52.181**, **S52.229**, **AP S17**, **Part B, Section I**, **§ 2, 6 *a)*** and ***b)***
ITU-R M.1174-1[4]	Characteristics of equipment used for on-board communications in the bands between 450 and 470 MHz	**S5.287**, **S5.288**
ITU-R M.1175	Automatic receiving equipment for radiotelegraph and radiotelephone alarm signals	**AP S13**, **Part A5**, **§ 9**
ITU-R M.1185-1	Method for determining coordination distance between ground based mobile earth stations and terrestrial stations operating in the 148.0-149.9 MHz band	**AP S5**, **Annex 1**, **§ 3.2**, **Table 1** Resolution 46 (Rev.WRC-97), Annex 2, Table 1
ITU-R M.1187	A method for the calculation of the potentially affected region for a mobile-satellite service (MSS) network in the 1-3 GHz range using circular orbits	AP **S4**, **§ C.11 *d)***
ITU-R BO.1213	Reference receiving earth station antenna patterns for replanning purposes to be used in the revision of the WARC BS-77 broadcasting-satellite service plans for Regions 1 and 3	**AP S30**, **§ 11.1** **AP S30**, **Annex 5**, **§ 3.7.2**
ITU-R S.1256[5]	Methodology for determining the maximum aggregate power flux-density at the geostationary-satellite orbit in the band 6 700-7 075 MHz from feeder links of non-geostationary satellite systems in the mobile-satellite service in the space-to-Earth direction	**S22.5A**
ITU-R BO.1293[-1][6]	Protection masks and associated calculation methods for interference into broadcast satellite systems involving digital emissions	**AP S30**, **Annex 5**, **§ 3.4** **AP S30A**, **Annex 3**, **§ 3.3**

4 Committee 5 has indicated in Document 229 that the updated version of the subject ITU-R Recommendation should be included.

5 This ITU-R Recommendation was erroneously omitted from Volume 4 (edition, 1998); see Document 196.

6 The updated version of this Recommendation is under consideration in GT PLEN-1; see Document 198.

ITU-R BO.1295	Reference transmit earth station antenna off-axis e.i.r.p. patterns for planning purposes to be used in the revision of the Appendix 30A (Orb-88) Plans of the Radio Regulations at 14 GHz and 17 GHz in Regions 1 and 3	**AP S30A**, **§ 9A.1** **AP S30A**, **Annex 3**, **§ 3.5.3**
ITU-R BO.1296	Reference receive space station antenna patterns for planning purposes to be used for elliptical beams in the revision of the Appendix 30A (Orb-88) Plans of the Radio Regulations at 14 GHz and 17 GHz in Regions 1 and 3	**AP S30A**, **§ 9A.1** **AP S30A**, **Annex 3**, **§ 3.7.3**
ITU-R BO.1297	Protection ratios to be used for planning purposes in the revision of the Appendices 30 (Orb-85) and 30A (Orb-88) Plans of the Radio Regulations in Regions 1 and 3	**AP S30**, **Annex 5**, **§ 3.4** **AP S30A**, **Annex 3**, **§ 3.3**
ITU-R S.1340[7]	Sharing between feeder links for the mobile-satellite service and the aeronautical radionavigation service in the Earth-to-space direction in the band 15.4-15.7 GHz	**S5.511C**
ITU-R S.1341[8]	Sharing between feeder links for the mobile-satellite service and the aeronautical radionavigation service in the space-to-Earth direction in the band 15.4-15.7 GHz and the protection of the radio astronomy service in the band 15.35-15.4 GHz	**S5.511A**

NOTE - Recommendations ITU-R IS.847-1, IS.848-1 and IS.849-1, which appeared in Volume 4 of the Radio Regulations (1998 edition), were suppressed by the Radiocommunication Assembly (Istanbul, 2000) and will not appear in the forthcoming edition of Volume 4, bearing in mind the decisions of WRC-2000 related to Appendix S7.

____

[7] This ITU-R Recommendation was erroneously omitted from Volume 4 (edition, 1998); see Document 196.

[8] This ITU-R Recommendation was erroneously omitted from Volume 4 (edition, 1998); see Document 196.

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

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ISTANBUL, 8 MAY – 2 JUNE 2000

WORKING GROUP 5B

Sub-Working Group 5B-2

MODIFICATIONS TO ARTICLE S5 OF THE RADIO REGULATIONS

(AGENDA ITEM 1.15.1)

Sub-Working Group 5B-2 is submitting for consideration and approval new allocations to RNSS in the bands 1 164-1 215 MHz (space-to-Earth), 1 260-1 300 MHz (space-to-Earth) and 1 300-1 350 MHz (Earth-to-space), as well as three new resolutions.

EDITORIAL NOTE - In this proposed modification to Article S5, No. S5.329A agreed under agenda item 1.15.2 in the bands 1 215-1 260 MHz and 1 559-1 610 MHz has been extended to the band 1 260-1 300 MHz. The text of ADD S5.329A as contained in the present document is the final text covering the above-mentioned changes.

T. MIZUIKE
Chairperson, Sub-Working Group 5B-2

ARTICLE S5

MOD

890-1 350 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
960-1 215	AERONAUTICAL RADIONAVIGATION MOD S5.328 ~~S5.328~~ADD S5.328A ADD S5.329A	

MOD

S5.328 The use of the band 960-1 215 MHz by the aeronautical radionavigation service is reserved on a worldwide basis for the ~~use and~~ development and operation of airborne electronic aids to air navigation and any directly associated ground-based facilities.

ADD

S5.328A *Additional allocation:* the band 1 164-1 215 MHz is also allocated to the radionavigation-satellite service (space-to-Earth) (space-to-space) on a primary basis. The aggregate power flux-density produced by all the space stations within all radionavigation-satellite systems at the Earth's surface shall not exceed the provisional value of –115 dB(W/m^2) in any 1 MHz band for all angles of arrival. Stations in the radionavigation-satellite service shall not cause harmful interference to nor claim protection from stations of the aeronautical-radionavigation service. The provisions of Resolution **[COM5/19] (WRC-2000)** apply.

ADD

S5.329A Use of systems in the radionavigation-satellite service (space-to-space) operating in the bands 1 215-1 300 MHz and 1 559-1 610 MHz is not intended to provide safety service application, and shall not impose any additional constraints on other systems or services operating in accordance with the Table of Frequency Allocations.

RESOLUTION [COM5/19] (WRC-2000)

Use of the frequency band between 1 164-1 215 MHz by systems of the radionavigation-satellite service (space-to-Earth)

The World Radiocommunication Conference (Istanbul, 2000),

considering

a) that in accordance with the Radio Regulations the band 960-1 215 MHz is allocated on a primary basis to the aeronautical-radionavigation service in all ITU regions;

b) that this Conference has decided to introduce a new allocation for the radionavigation-satellite service (space-to-Earth) in the frequency band 1 164-1 215 MHz with a provisional limit to the aggregate power flux-density produced by all the space stations within all radionavigation-satellite systems at the Earth's surface of –115 dBW/m^2 in any 1 MHz band for all angles of arrival;

c) that it is likely that no radionavigation-satellite service systems will be fully operational in this band before the next WRC;

d) that only a few radionavigation-satellite service systems are expected to be deployed in this band;

e) that it is unlikely that more than two systems will have overlapping frequencies,

noting

a) that the studies conducted to date by ICAO to ensure protection of current operation of distance measuring equipments (DME) indicate that a provisional power flux-density value for radionavigation-satellite service allocation in this band should be in the range of –115 to –119 dBW/m^2 in any 1 MHz band for the aggregate interference from all space stations within all radionavigation-satellite service systems operating in the same band;

b) that no methodology is available to derive an aggregate power flux-density for all radionavigation-satellite service space stations of one system from the aggregate power flux-density for all systems in No. **S5.328A**,

resolves

1 that the provisional power flux-density limit stated in No. **S5.328A** shall be applied for all radionavigation-satellite service (space-to-Earth) systems as of 2 June 2000;

2 to invite WRC-03 to review the results of the studies in *requests ITU-R* 1 and take appropriate action;

3 that the administrations planning to implement radionavigation-satellite service systems in this band shall consult each other in order to ensure that the provisional aggregate power flux-density limit is not exceeded,

requests ITU-R

1 to conduct, as a matter of urgency and in time for consideration by WRC-03, the appropriate technical, operational and regulatory studies on the overall compatibility between the radionavigation-satellite service and the aeronautical radionavigation service in the band 960-1 215 MHz, including the assessment of the need for an aggregate power flux-density limit, and the revision, if necessary, of the provisional pfd limit included in No. **S5.328A** concerning the operation of radionavigation-satellite service (space-to-Earth) systems in the frequency band 1 164-1 215 MHz;

2 to report to CPM before WRC-03 on the conclusions of these studies,

instructs the Radiocommunication Bureau

as of the end of WRC-03, to review and, if necessary, revise any finding previously made on the compliance with the limit of a radionavigation-satellite service (space-to-Earth) system for which notification information has been received before the end of WRC-03. This review shall be based on the values as revised, if necessary, by WRC-03,

requests the Secretary-General

to communicate the contents of this Resolution to the ICAO for such actions as they may consider appropriate and invite ICAO to actively participate in the study activity identified under *requests ITU-R* 1.

ARTICLE S5

MOD

890-1 350 MHz

1 215-1 240	EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION RADIONAVIGATION-SATELLITE (space-to-Earth) (space-to-space) MOD S5.329 ADD S5.329A SPACE RESEARCH (active) S5.330 S5.331 MOD S5.332
1 240-1 260	EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION RADIONAVIGATION-SATELLITE (space-to-Earth) (space-to-space) MOD S5.329 ADD S5.329A SPACE RESEARCH (active) Amateur S5.330 S5.331 MOD S5.332 S5.334 S5.335
1 260-1 300	EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION RADIONAVIGATION-SATELLITE (space-to-Earth) (space-to-space) MOD S5.329 ADD S5.329A SPACE RESEARCH (active) Amateur S5.282 S5.330 S5.331 S5.332MOD S5.333 S5.334 S5.335

MOD

S5.329 Use of the radionavigation-satellite service in the band 1 215-1 2601 300 MHz shall be subject to the condition that no harmful interference is caused to and no protection is claimed from the radionavigation service authorized under No. **S5.331**. See also Resolution **[COM5/20] (WRC-2000)**.

MOD

S5.332 In the band 1 215-1 3001 260 MHz, active spaceborne sensors in the earth exploration-satellite and space research services shall not cause harmful interference to, claim protection from, or otherwise impose constraints on operation or development of the radiolocation service, the radionavigation-satellite service and other services allocated on a primary basis.

MOD

S5.333 (SUP - WRC-97)In the band 1 260-1 300 MHz, active spaceborne sensors in the Earth exploration-satellite and space research services shall not cause harmful interference to, claim protection from, or otherwise impose constraints on operation or development of the radiolocation service and other services allocated by footnotes on a primary basis.

RESOLUTION [COM5/20] (WRC-2000)

Use of the frequency band between 1 215-1 300 MHz by systems of the radionavigation-satellite service (space-to-Earth)

The World Radiocommunication Conference (Istanbul, 2000),

considering

a) that this Conference has decided to introduce a new allocation for the radionavigation-satellite service (space-to-Earth) in the frequency band 1 260-1 300 MHz;

b) that in the band 1 215-1 260 MHz radionavigation-satellite service (space-to-Earth) systems have been successfully operated for a considerable time in a band used by radars;

c) the importance of the radionavigation service authorized in certain countries in accordance with No. **S5.331** and the radiolocation service and the necessity for adequate protection and continued operation of these services throughout the band 1 215-1 300 MHz,

resolves

that no additional constraints shall be put on radionavigation-satellite service (space-to-Earth) systems operating in the band 1 215-1 260 MHz,

requests ITU-R

1 to conduct, as a matter of urgency and in time for consideration by WRC-03, the appropriate technical, operational and regulatory studies, including the assessment of the need for a power flux-density limit concerning the operation of radionavigation-satellite service (space-to-Earth) systems in the frequency band 1 215-1 300 MHz in order to ensure that the RNSS (space-to-Earth) will not cause harmful interference to the radionavigation and the radiolocation services;

2 to report to CPM before WRC-03 on the conclusions of these studies,

requests the Secretary-General

to communicate the contents of this Resolution to the ICAO for such actions as they may consider appropriate.

ARTICLE S5

MOD

890-1 350 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
1 300-1 350	AERONAUTICAL RADIONAVIGATION S5.337 RADIOLOCATION RADIONAVIGATION SATELLITE (Earth-to-space) ~~Radiolocation~~ S5.149 ADD S5.337A	

ADD

S5.337A The use of the band 1 300-1 350 MHz by earth stations in the radionavigation-satellite service and by stations in the radiolocation service shall not cause harmful interference to nor constrain the development of the aeronautical-radionavigation service.

RESOLUTION [COM5/21] (WRC-2000)

Studies on compatibility between stations of the radionavigation-satellite service (RNSS) (Earth to space) and the radiolocation service operating in the frequency band 1300-1350 MHz

The World Radiocommunication Conference (Istanbul, 2000),

considering

a) that WRC-2000 added a primary allocation to the radionavigation-satellite service (Earth-to-space) in the 1 300-1 350 MHz band;

b) that WRC-2000 raised the status of the radiolocation service from secondary to primary in the 1 300-1 350 MHz band;

c) that studies to determine the compatibility between airborne radar systems operating in the radiolocation service and the radionavigation-satellite service have not been carried out;

d) that there is a potential for interference between ground-based beacons of the radionavigation-satellite service and airborne radiolocation systems;

e) that airborne radiolocation systems can be protected with the implementation of adequate separation distances, if necessary;

f) that a maximum of twenty ground-based beacons in the radionavigation satellite service are expected to be deployed globally,

requests ITU-R

to conduct, as a matter of urgency, the appropriate studies to ensure that stations of the radionavigation-satellite service (Earth-to-space) do not cause harmful interference to the operation of airborne radiolocation systems and to develop, if needed, appropriate recommendations,

urges administrations

to participate actively in these studies by submitting contributions to ITU-R.

INTERNATIONAL TELECOMMUNICATION UNION

ITU **WRC-2000** WORLD RADIOCOMMUNICATION CONFERENCE

ISTANBUL, 8 MAY – 2 JUNE 2000

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WORKING GROUP 5B

Chairperson, WG 5B

STRUCTURE OF WORKING GROUP 5B

The structure of Working Group 5B is as follows:

	Task: Agenda item/description	Chaired by	Box No.
Working Group 5B	1.7+1.9+1.15+1.18	Mr. T. MIZUIKE (J)	132
SWG 5B-1	1.7 + 1.18	Mr. P. LANSMAN (FIN)	872
SWG 5B-2	1.15	Mr. T. MIZUIKE (J)	132
DG 5B-2A	1.15.1	Mr. V. MEENS (F)	264
DG 5B-2B	1.15.2 + 1.15.3	Mr. D. BRANDEL (USA)	357
DG 5B-2C	Doc.78	Mr. F. B. XIE (CHN)	687
SWG 5B-3	As in DT/54 (Rev.1)	Ms. K. MOODY (NZL)	598

T. MIZUIKE
Chairperson, Working Group 5B

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

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ISTANBUL, 8 MAY – 2 JUNE 2000

WORKING GROUP 5B

Sub-Working Group 5B-3

REPORT TO WORKING GROUP 5B

Sub-Working Group 5B-2 has progressed work in accordance with its terms of reference as outlined in Document DT/54(Rev.1). The results of this work are presented in Annexes 1, 2 and 3.

K. MOODY
Chairperson, Sub-Working Group 5B-3,
Box 598

ANNEX 1

MSS downlink in the band 1 518-1 525 MHz; Summary of relevant ITU-R Recommendations

Purpose

To identify ITU-R technical studies regarding the potential for sharing of MSS downlinks in the band 1 518-1 525 MHz with other services identified in Article S5.

To ascertain if there is a technical basis for sharing.

Definition of technical basis:

The technical basis should provide quantitative guidelines for feasibility of sharing, coordination and protection of relevant services.

The methodology for calculating the above should be based on:

a) Agreed frameworks contained within ITU-R Recommendations;

b) Technical parameters of relevant services.

Region	Services (footnotes)	Relevant Recommendations	Technical Basis	Comments
1	AERONAUTICAL MOBILE S5.342	Appendix S5 M.1459	View #1 No. Further studies are required in relation to sharing between the MSS and these services. ______ View #2 Sharing between the MSS and the aeronautical	View #1: Recommendation ITU-R M.1459 provides criteria that could be used as a technical basis as part of a coordination between an administration operating aeronautical mobile telemetry and another proposing to operate a GSO mobile-satellite system. During coordination, specific systems are studied and the involved administrations arrive at agreed parameters and protection for the respective systems. However, the satellite downlink proposed for 1 518-1 525 MHz can potentially impact more than one Region and many administrations simultaneously. It is firmly believed that general studies of the feasibility of sharing between aeronautical mobile telemetry (operated worldwide by a number of widespread countries) and the mobile-satellite service must be completed in the ITU-R before a conclusion can be reached as to the technical basis for an allocation for such a downlink. ______ View #2: ITU-R Recommendation M.1459 protection criteria leads to the conclusion that co-frequency, co-coverage operation of the mobile-satellite service (space-to-Earth) and aeronautical telemetry is not possible. However, the Recommendation also leads to the conclusion that co-frequency operation over sufficiently isolated areas would be possible with state-of-the-art mobile satellites, since the pfd over any given

			mobile service is feasible if the relevant ITU-R Recommendations and coordination procedures are applied successfully.	part of the Earth can be controlled as desired. The ability to allocate an identified sub-band to any spot beam of a satellite having a couple of hundred of such narrow beams already exists. Thus it is considered to be perfectly feasible to use these frequencies to provide mobile-satellite services to areas sufficiently separated from aeronautical telemetry receiving sites. It is believed that ITU-R Recommendation M.1459 provides enough guidance to extend these mobile-satellite service allocations to Region 1 & 3. To afford protection to the aeronautical telemetry systems of administrations in Regions 1&3 footnote S5.348 could be modified to include a reference to S5.342 as well as S5.343. A global MSS allocation thus can be made while ensuring protection of aeronautical telemetry receivers worldwide.
1,2,3	FIXED S5.343 S5.344	Appendix S5 F.758-1 F.755-2 F.759 F.1094-1 F.1107 F.1108 F.699(Rev.5) F.1245 F.1246 M.1141 M.1142 M.1471 M.1143	Sharing between the MSS and the fixed service is feasible if the relevant ITU-R Recommendations and coordination procedures are applied successfully. A regulatory provision enabling administrations to initiate coordination at other appropriate pfd levels in these bands should be developed through a resolution	Recommendation ITU-R M.1141-1 provides coordination thresholds for stations in the fixed service with respect to non-GSO MSS. Recommendation ITU-R M.1142-1 provides coordination thresholds for stations in the fixed service with respect to GSO MSS. Recommendation ITU-R F.755-2 details examples of technical characteristics for point-to-multipoint systems in the fixed service. Recommendation ITU-R F.758-1 considers the development of criteria for sharing between the fixed service and other services. **Article S9 and Appendix S5** Coordination methodology for mobile-satellite service (space-to-Earth) transmissions with terrestrial Fixed services has existed for a long time in the Radio Regulations and several ITU-R Recommendations address this issue. This methodology is based on coordination thresholds derived to protect the Fixed service systems. These thresholds have been incorporated in the Radio Regulations (Appendix S5). If the coordination threshold is exceeded, coordination is carried out as per relevant provisions of Article S9. However, a regulatory provision enabling administrations to initiate coordination at other appropriate pfd levels in these bands should be developed through a resolution.

1	MOBILE except aeronautical mobile S5.341	Appendix S5 M.1388 M.1141 M.1142	Sharing between the MSS and the mobile service is feasible if the relevant coordination procedures are applied successfully.	ITU-R M.1388 specifies a coordination threshold for protection of mobile services in the band 1 452-1 492 MHz. The same level is incorporated in footnote S5.348A, which relates to the band 1 492-1 525 MHz for protection of the mobile service in Japan and is also referred to in Appendix S5. This coordination threshold, which is based on the sensitivity parameters of the mobile service system in Japan, would be as much applicable for a Region 1&3 MSS allocation as for the existing Region 2 mobile-satellite service allocation. With respect to terrestrial service interference into mobile earth station terminals, administrations could choose to limit the use of these mobile-satellite service allocations to land mobile-satellite service, in order to afford regulatory protection to the mobile-satellite service.
2	MOBILE aeronautical S5.343	Appendix S5 M.1459	View #1 No. Further studies are required in relation to sharing between the MSS and these services. View #2 Sharing between the MSS and the aeronautical mobile service is feasible if the relevant ITU-R Recommendations and coordination procedures are applied successfully	View #1: Recommendation ITU-R M.1459 provides criteria that could be used as a technical basis as part of a coordination between an administration operating aeronautical mobile telemetry and another proposing to operate a GSO mobile-satellite system. During coordination, specific systems are studied and the involved administrations arrive at agreed parameters and protection for the respective systems. However, the satellite downlink proposed for 1 518-1 525 MHz can potentially impact more than one Region and many administrations simultaneously. It is firmly believed that general studies of the feasibility of sharing between aeronautical mobile telemetry (operated worldwide by a number of widespread countries) and the mobile-satellite service must be completed in the ITU-R before a conclusion can be reached as to the technical basis for an allocation for such a downlink. View #2: ITU-R Recommendation M.1459 protection criteria leads to the conclusion that co-frequency, co-coverage operation of the mobile-satellite service (space-to-Earth) and aeronautical telemetry is not possible. However, the Recommendation also leads to the conclusion that co-frequency operation over sufficiently isolated areas would be possible with state-of-the-art mobile satellites, since the pfd over any given part of the Earth can be controlled as desired. The ability to allocate an identified sub-band to any spot beam of a satellite having a couple of hundred of such narrow beams already exists. Thus it is considered to be perfectly feasible to use these frequencies to provide mobile-satellite services to areas sufficiently separated from aeronautical telemetry receiving sites. It is believed that ITU-R Recommendation M.1459 provides enough guidance to extend these mobile-satellite service allocations to Region 1 & 3. To afford protection to the aeronautical telemetry systems of administrations in Regions 1&3 footnote S5.348 could be modified to include a reference to S5.342 as well as S5.343. A global MSS allocation thus can be made while ensuring protection of aeronautical telemetry receivers worldwide.

2,3	MOBILE S5.344 S5.348A	Appendix S5 M.1388	Sharing between the MSS and the mobile service is feasible if the relevant coordination procedures are applied successfully. The pfd level specified in footnote S5.384A should be decreased by several dB provisionally. It is recognised that further studies are required.	ITU-R M.1388 specifies a coordination threshold for protection of mobile services in the band 1 452-1 492 MHz. The same level is incorporated in footnote S5.348A, which relates to the band 1 492-1 525 MHz for protection of the mobile service in Japan and is also referred to in Appendix S5. This value is calculated as a single entry pfd value from Region 2. This single entry coordination threshold, which is based on the sensitivity parameters of the mobile service system in Japan, would be as much applicable for a Region 1&3 MSS allocation as for the existing Region 2 mobile-satellite service allocation. With respect to terrestrial service interference into mobile earth station terminals, administrations could choose to limit the use of these mobile-satellite service allocations to land mobile-satellite service, in order to afford regulatory protection to the mobile-satellite service.
2, JPN	MOBILE SATELLITE (s-E) S5.348 S5.348A	Appendix S5 M.1183 M.1086 M.1089 M.1091 M.1038 M.1186 M.1184		
1,2,3	EXTRA-TERRESTRIAL S5.341	Appendix S5		

Footnotes:

S5.341 In the bands 1 400-1 727 MHz, 101-120 GHz and 197-220 GHz, passive research is being conducted by some countries in a programme for the search for intentional emissions of extraterrestrial origin.

S5.342 *Additional allocation:* in Belarus, Russian Federation and Ukraine, the band 1 429-1 535 MHz is also allocated to the aeronautical mobile service on a primary basis exclusively for the purposes of aeronautical telemetry within the national territory. As of 1 April 2007, the use of the band 1 452-1 492 MHz is subject to agreement between the administrations concerned.

S5.343 In Region 2, the use of the band 1 435-1 535 MHz by the aeronautical mobile service for telemetry has priority over other uses by the mobile service.

S5.344 *Alternative allocation:* in the United States, the band 1 452-1 525 MHz is allocated to the fixed and mobile services on a primary basis (see also No. **S5.343**).

S5.348 The use of the band 1 492-1 525 MHz by the mobile-satellite service is subject to coordination under No. **S9.11A**. However, no coordination threshold in Article **S21** for space stations of the mobile-satellite service with respect to terrestrial services shall apply to the situation referred to in No. **S5.343**. With respect to the situation referred to in No. **S5.343**, the requirement for coordination in the band 1 492-1 525 MHz will be determined by band overlap.

S5.348A In the band 1 492-1 525 MHz, the coordination threshold in terms of the power flux-density levels at the surface of the Earth in application of No. **S.9.11A** for space stations in the mobile-satellite (space-to-Earth) service, with respect to the land mobile service use for specialized mobile radios or used in conjunction with public switched telecommunication networks (PSTN) operating within the territory of Japan, shall be -150 dB(W/m^2) in any 4 kHz band for all angles of arrival, instead of those given in Table **S5-2** of Appendix **S5.** The above threshold level of the power flux-density shall apply until it is changed by a competent world radiocommunication conference.

ANNEX 2

RESOLUTION [COM5/AB] (WRC-2000)

[Possible] [U]/[u]se of the frequency band 1 518 - 1 525 MHz by the mobile-satellite service (Regions 1 and 3)

The World Radiocommunication Conference (Istanbul, 2000),

considering

a) that WRC-2000 [considered proposals for]/[added] an allocation to the mobile-satellite service (space-to-Earth) in Regions 1 and 3 in the frequency band 1 518-1 525 MHz;

b) that the frequency band 1 518-1 525 MHz is allocated to the fixed service on a [co-]primary basis in all three Regions, to the mobile service on a [co-]primary basis in Regions 2 and 3, and to the mobile service except aeronautical mobile on a [co-]primary basis in Region 1;

c) that in Belarus, Russian Federation and Ukraine, the band 1 429-1 535 MHz is allocated to the aeronautical mobile service on a primary basis exclusively for the purposes of aeronautical telemetry within the national territory by the provisions of **S5.342**;

d) that in Region 2, the use of the band 1 435-1 535 MHz by the aeronautical mobile service for telemetry has priority over other uses by the mobile service by the provisions of **S5.343**;

e) that, as an alternative allocation in the United States, the band 1 452-1 525 MHz is allocated to the fixed and mobile services on a primary basis (see also No. **S5.343**) under the provisions of **S5.344**;

f) that there has been further development of point-to-multipoint systems in the fixed service since the time of ITU-R studies that formed the basis for the power-flux-density (pfd) values for use as coordination thresholds for protection of fixed service systems in the band 1 492-1 525 MHz that are contained in Appendix **S5**;

g) that there is a need to review the pfd values in Appendix **S5** to assure that they are adequate to protect these new point-to-multipoint systems operating in the fixed service;

h) that the [added]/[proposed] allocation to the mobile-satellite service (space-to-Earth) is intended for satellite downlink operations, which due to their potentially widespread emissions upon the Earth from either geostationary or non-geostationary systems, could have an impact upon the terrestrial mobile service, to include aeronautical mobile and aeronautical mobile telemetry, in all three Regions;

[*i)* that there are no ITU-R Recommendations or considerations within the CPM Report on the technical, regulatory or procedural matters to be considered by WRC-2000 regarding the feasibility of sharing between the MSS and existing aeronautical mobile telemetry operations,]

recognizing

a) that Recommendation ITU-R F.1338, for an adjacent frequency band, includes an allowance for consideration of pfd values other than those specified therein for use as coordination thresholds for the fixed service;

b) that Recommendation ITU-R M.1459 contains criteria for the protection of aeronautical mobile telemetry with respect to geostationary satellites in the mobile-satellite service;

c) that additional information on the characteristics of systems in both the mobile-satellite service and aeronautical mobile telemetry would facilitate studies on sharing between these services,

resolves to invite ITU-R

1 as a matter of urgency, to study [the feasibility of] sharing between the mobile-satellite service and aeronautical mobile telemetry in all Regions in the band 1 518-1 525 MHz, whilst meeting the protection criteria for the latter service as given in Recommendation ITU-R M.1459;

2 as a matter of urgency, to review the pfd levels used as coordination thresholds for MSS (space-to-Earth) with respect to the protection of point-to-multipoint FS systems in the band 1 518-1 525 MHz in Regions 1 and 3, taking into account the work already done in ITU-R Recommendations M.1141 and M.1142 and the characteristics of FS systems contained in ITU-R Recommendations F.755-2 and F.758-1, and the sharing methodologies contained in ITU-R Recommendations F.758-1, F.1107 and F.1108;

3 to bring the results of these studies to the attention of the next competent world radiocommunication conference [WRC-03],

further resolves[*]

that the following procedure should provisionally apply for coordination between the mobile-satellite service and the fixed service in the band 1 518-1 525 MHz in Regions 1 and 3, before studies referred to in *resolves* 2 are completed:

– under **S9.36.1**, the Bureau will publish the information list of administrations identified when using the threshold coordination as given in Appendix **S5**;

– following receipt of the Weekly Circular referring to requests for coordination, an administration believing that the coordination threshold of Appendix **S5** is not sufficient to protect their stations of the fixed service it should, within four months of the date of publication of the relevant Weekly Circular, inform the initiating administration and the Bureau. The Bureau should then include that administration in the request,

urges administrations

to participate actively in these studies with the involvement of terrestrial and satellite interests.

[*] This *further resolves* will not apply in the case that an allocation to the mobile-satellite service in the band 1 518-1 525 MHz is not made by WRC-2000.

ANNEX 3

RESOLUTION [COM5/CD] (WRC-2000)

Sharing studies concerning the [possible] use of the band 1 683-1 690 MHz by the mobile-satellite service

The World Radiocommunication Conference (Istanbul, 2000),

considering

a) that ITU-R has established that in order to meet projected MSS requirements in the frequency range 1 to 3 GHz, in the order of 2 times 123 MHz of spectrum will be required by 2005 and 2 times 145 MHz will be required by 2010;

b) [that WRC-2000 considered proposals for an allocation of 1 683-1 690 MHz to the MSS (Earth-to-space) in Regions 1 and 3 and suppression of the Region 2 MSS allocations in 1 675-1 683 MHz and 1 690-1 710 MHz]/[that WRC-2000 allocated the band 1 683-1 690 MHz to the MSS (Earth-to-space) in Regions 1 and 3 and suppressed the MSS allocations in Region 2 in the ranges 1 675-1 683 MHz and 1 690-1 710 MHz];

c) that the band 1 683-1 690 MHz is mainly used by meteorological-satellite (MetSat) and meteorological aids (MetAids) services;

d) that while there are only a limited number of main MetSat stations operated in this band in all three Regions, there are a large number of meteorological GVAR/S-VISSER satellite earth stations operated in some countries in Regions 2 and 3 and the locations of many of these smaller stations are unknown;

e) that there is an increase in use of these stations in Regions 2 and 3 by government, commercial and private users for public safety and enhancement of national economies;

f) that sharing between MetSat and MSS in the band 1 675-1 690 MHz is feasible if appropriate separation distances are maintained pursuant to coordination under **S9.11A**;

g) that sharing may not be feasible in those countries where a large number of MetSat stations are deployed;

h) that ITU-R Recommendation SA.1158-2 indicates that additional study is required to determine the criteria for coordination between MSS, and the MetSat service for GVAR/S-VISSR stations operated in 1 683-1 690 MHz in Regions 2 and 3;

i) that sharing of the band between MSS and MetSat in the band 1 690-1 710 MHz is not feasible;

j) that co-channel sharing between MSS and MetAids is not feasible;

k) that co-channel frequency sharing between MetAids and MetSat services is not feasible;

l) WMO identified future requirements for MetAids operations as 1 675-1 683 MHz, however some administrations will continue to require spectrum in the range 1 683-1 690 MHz for MetAids operations;

m) that [possible] MSS operation should not constrain current and future development of the MetSat service as specified in **S5.377**;

[*n)* that at WRC-2000 new coordination distance parameters were adopted which will require a review of assumptions made in earlier ITU-R studies,]

noting

that further study is not required regarding sharing between the services identified in the *considerings* above and the MSS in the band 1 675-1 683 MHz and 1 690-1 710 MHz,

requests

1 ITU-R, as a matter of urgency, and in time for WRC-03, to complete the technical and operational studies on [the feasibility of] sharing between MSS and MetSat by determining appropriate separation distances between mobile earth stations and MetSat stations, including GVAR/S-VISSR stations, in the band 1 683-1 690 MHz as stated in ITU-R Recommendation SA.1158-2;

2 ITU-R to assess, with the participation of WMO, the current and future spectrum requirements of the MetAids service taking into account improved characteristics of the MetSat service in the band 1 683-1 690 MHz and taking into account future developments,

resolves to invite

1 administrations and interested parties (e.g. WMO) to participate actively in such studies, by submitting relevant contributions;

[2 a future competent WRC to consider allocating the band 1 683-1 690 MHz to the MSS (Earth-to-space) and suppressing the allocation to the MSS in Region 2 in the bands 1 675-1 683 MHz and 1 690-1 710 MHz],

instructs the Secretary General

to bring this Resolution to the attention of WMO.

[Required regulatory provisions for the addition of a Regions 1 and 3 MSS (Earth-to-space) allocation in the band 1 683-1 690 MHz

ADD

S5.YYY Mobile-satellite systems using the band 1 683-1 690 MHz shall not cause harmful interference to nor constrain the development of the meteorological-satellite and meteorological-aids services. To avoid causing harmful interference, mobile earth stations shall not operate, except in a non-interfering signalling channel, within the exclusion zones around the meteorological earth stations. The mobile-satellite system shall have position determination capabilities to ensure compliance with this provision and the use of this band is subject to coordination under No. **S9.11A**.

SUP

S5.377]

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

Document 382-E
23 May 2000
Original: English

ISTANBUL, 8 MAY – 2 JUNE 2000

WORKING GROUP 1
OF THE PLENARY

NOTE FROM THE CHAIRPERSON OF WORKING GROUP 4A TO THE CHAIRPERSON OF GT PLEN-1

Working Group 4A is of the opinion that proposed changes to Article S9.17 mentioned below should be referred to GT PLEN-1 for their advice, as they deal with BSS matters in general before its final decision.

WG 4A adopted the change to Article S9.17, relating to the lower frequency of applicability contained in S9.17, to bring it into alignment with the proposed revisions of Appendix S7. It should be noted that a sharing scenario for broadcasting-satellite earth station and typical earth station parameters can be found in the new proposed Appendix S7.

It was stressed by two administrations, that the issue of coordination of BSS earth stations with FS services, was an extremely sensitive issue and required careful consideration before any regulatory changes are made.

Accordingly, all text in this proposal in parentheses is referred to GT PLEN-1 for its advice.

MOD

S9.17 *f)*[13] for any specific earth station [~~or~~,] typical mobile earth station [or typical earth station in the broadcasting-satellite service with parameters shown in Appendix **S7**,] in frequency bands above ~~1 GHz~~100 MHz allocated with equal rights to space and terrestrial services, in respect of terrestrial stations, where the coordination area of the earth station includes the territory of another country, with the exception of the coordination under No. **S9.15** [and Article 4 of Appendix **S30A** and the coordination of earth stations in the broadcasting-satellite service which are subject to the Appendix **S30** Plans];

N. KISRAWI
Chairperson of Working Group 4A

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

Document 383-E
24 May 2000
Original: English

ISTANBUL, 8 MAY – 2 JUNE 2000

Source: Document WRC2000/14(Add.1) (IAP/14/90) **WORKING GROUP 5C**

Chairperson, Drafting Group 5C-3-RA

S5.551B The use of the band ~~41.5~~42.0-42.5 GHz by the broadcasting-satellite service and fixed-satellite service (space-to-Earth) is subject to Resolution **128 (Rev.WRC-~~97~~2000)**. The limitation on the broadcasting-satellite service shall apply to systems where advanced publication materials are received by the Bureau after 2 June 2000. For non-geostationary fixed-satellite service systems operating in the band [41.5-42.5] GHz, see also Resolution **128 (Rev.WRC-2000)**.

____

Document 384-E
24 May 2000
Original: English

WORKING GROUP 5C

Chairperson, Drafting Group 5C-3-RA

MOD Resolution 128 (WRC-97)

DRAFT REVISION OF RESOLUTION 128 (Rev.WRC-~~97~~2000)

Allocation to the ~~fixed-~~satellite service (space-to-Earth) in the [41.5-42.5] [42-42.5] GHz band and protection of the radio astronomy service in the 42.5-43.5 GHz band

The World Radiocommunication Conference (~~Geneva, 1997~~Istanbul, 2000),

considering

a) that ~~this Conference has~~WRC-97 added a primary allocation to the fixed-satellite service (space-to-Earth) in the band 4~~1~~0.5-42.5 GHz in Regions 2 and 3 and in certain countries in Region 1, [that this Conference expanded this allocation to include all of Region 1,] and that this band is adjacent to the band 42.5-43.5 GHz which is allocated, *inter alia*, to the radio astronomy service for both continuum and spectral line observations;

b) that there is also a worldwide primary allocation to the broadcasting-satellite service in the 40.5-42.5 GHz band;

~~b~~c) that unwanted emissions from space stations in the broadcasting-satellite service and fixed-satellite service (space-to-Earth) in the band [41.5-42.5] [42-42.5] GHz may result in harmful interference to the radio astronomy service in the band 42.5-43.5 GHz;

d) that aggregate unwanted emissions from space stations in the non-geostationary fixed-satellite service (space-to-Earth) in the band [41.5-42.5][41.5-42] GHz may result in harmful interference to the radio astronomy service in the band 42.5-43.5 GHz;

~~c~~e) that various technical means may be used to reduce these unwanted emissions from space stations in the fixed-satellite service;

df) that a limited number of radio astronomy stations worldwide require protection, and that there may be means to limit the susceptibility of radio astronomy receivers to interference,

taking into account

the relevant provisions of the Radio Regulations,

resolves

that administrations shall not implement broadcasting-satellite service systems where advanced publication materials are received by the Bureau after 2 June 2000 and fixed-satellite systems in the band [41.5-42.5] [42-42.5] GHz until technical and operational measures have been identified and agreed within ITU-R to protect the radio astronomy service from harmful interference in the band 42.5-43.5 GHz,

invites ITU-R

1 to study, as a matter of urgency, the harmful interference that space stations in the broadcasting-satellite service where advanced publication materials are received by the Bureau after 2 June 2000 and the fixed-satellite service (space-to-Earth) operating in the band [41.5-42.5] [42-42.5] GHz may cause to stations in the radio astronomy service operating in the band 42.5-43.5 GHz;

2 to identify technical and operational measures that may be taken to protect stations in the radio astronomy service operating in the band 42.5-43.5 GHz, including geographical separation and out-of-band emission limits to be applied to space stations operating in the broadcasting-satellite service where advanced publication materials are received by the Bureau after 2 June 2000 and the fixed-satellite service in the band [41.5-42.5] [42-42.5] GHz, as well as measures that may be implemented to reduce the susceptibility of stations in the radio astronomy service to harmful interference;

3 to report on the results of these studies in *invites* 1 and 2 to the Conference Preparatory Meeting for WRC-9902/03;

4 to complete the ongoing ITU-R studies on aggregate unwanted emissions from non-geostationary fixed-satellite service systems operating in the band [41.5-42.5][41.5-42.0] GHz for protection of the radio astronomy service in the band 42.5-43.5 GHz,

urges administrations

1 to participate actively in the aforementioned studies by submitting contributions to ITU R,;

2 when implementing non-geostationary fixed-satellite service systems in the band [41.5-42.5] [42-42.5] GHz, to take into account the results of the studies identified in *invites ITU-R* 4,

requests

WRC-9902/03 to take appropriate action based on those studies.

____

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

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24 May 2000
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ISTANBUL, 8 MAY – 2 JUNE 2000

COMMITTEE 4

Lebanon

PROPOSALS FOR THE WORK OF THE CONFERENCE

MOD LBN/385/1

S5.181 *Additional allocation:* in Germany, Austria, Cyprus, Denmark, Egypt, France, Greece, Israel, Italy, Japan, Jordan, ~~Lebanon,~~ Malta, Morocco, Monaco, Norway, Syria, Sweden and Switzerland, the band 74.8-75.2 MHz is also allocated to the mobile service on a secondary basis, subject to agreement obtained under No. **S9.21**. In order to ensure that harmful interference is not caused to stations of the aeronautical radionavigation service, stations of the mobile service shall not be introduced in the band until it is no longer required for the aeronautical radionavigation service by any administration which may be identified in the application of the procedure invoked under No. **S9.21**.

MOD LBN/385/2

S5.197 *Additional allocation:* in Germany, Austria, Cyprus, Denmark, Egypt, France, Italy, Japan, Jordan, ~~Lebanon,~~ Malta, Morocco, Monaco, Norway, Pakistan, Syria, and Sweden, the band 108-111.975 MHz is also allocated to the mobile service on a secondary basis, subject to agreement obtained under No. **S9.21**. In order to ensure that harmful interference is not caused to stations of the aeronautical radionavigation service, stations of the mobile service shall not be introduced in the band until it is no longer required for the aeronautical radionavigation service by any administration which may be identified in the application of the procedures invoked under No. **S9.21**.

____

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

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24 May 2000
Original: English

ISTANBUL, 8 MAY – 2 JUNE 2000

COMMITTEE 4

Report by the Chairperson of Working Group 4B

SIXTH REPORT FROM WORKING GROUP 4B TO COMMITTEE 4

CORRECTIVE ACTION CONCERNING INCONSISTENCIES AND OBSOLETE PARTS OF THE RADIO REGULATIONS

Working Group 4B considered inconsistencies and obsolete parts in the 1998 edition of the Radio Regulations. The Working Group agreed, that the appropriate changes as given in the following be made.

A. ALLISON
Chairperson of Working Group 4B
Box 68

ARTICLE S5

Frequency allocations

MOD

S5.50 5) The footnote references which appear in the Table below the allocated service or services apply to more than one of the allocated services, or to the whole of the allocation concerned.

SUP

S5.81

MOD

200-495 kHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
415-435 MARITIME MOBILE S5.79 AERONAUTICAL RADIONAVIGATION S5.72	**415-495** MARITIME MOBILE S5.79 S5.79A Aeronautical radionavigation S5.80	
435-495 MARITIME MOBILE S5.79 S5.79A Aeronautical radionavigation S5.72 ~~S5.81~~ S5.82	S5.77 S5.78 ~~S5.81~~ S5.82	

MOD

495-1 800 kHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
505-526.5 MARITIME MOBILE S5.79 S5.79A S5.84 AERONAUTICAL RADIONAVIGATION	**505-510** MARITIME MOBILE S5.79 ~~S5.81~~	**505-526.5** MARITIME MOBILE S5.79 S5.79A S5.84 AERONAUTICAL RADIONAVIGATION Aeronautical mobile Land mobile
	510-525 MOBILE S5.79A S5.84 AERONAUTICAL RADIONAVIGATION	
S5.72 ~~S5.81~~	**525-535**	~~S5.81~~

SUP

S5.120

MOD

3 230-5 003 kHz

<table>
<tr><th colspan="3">Allocation to services</th></tr>
<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr><td>3 500-3 800
AMATEUR ~~S5.120~~
FIXED
MOBILE except aeronautical mobile
S5.92</td><td>3 500-3 750
AMATEUR ~~S5.120~~
S5.119</td><td rowspan="3">3 500-3 900
AMATEUR ~~S5.120~~
FIXED
MOBILE</td></tr>
<tr><td rowspan="2">3 800-3 900
FIXED
AERONAUTICAL MOBILE (OR)
LAND MOBILE</td><td rowspan="4">3 750-4 000
AMATEUR ~~S5.120~~
FIXED
MOBILE except aeronautical mobile (R)
S5.122 S5.124 S5.125</td></tr>
<tr></tr>
<tr><td>3 900-3 950
AERONAUTICAL MOBILE (OR)
S5.123</td><td>3 900-3 950
AERONAUTICAL MOBILE
BROADCASTING</td></tr>
<tr><td>3 950-4 000
FIXED
BROADCASTING</td><td>3 950-4 000
FIXED
BROADCASTING
S5.126</td></tr>
</table>

MOD

5 003-7 350 kHz

<table>
<tr><th colspan="3">Allocation to services</th></tr>
<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr><td>7 000-7 100</td><td colspan="2">AMATEUR ~~S5.120~~
AMATEUR-SATELLITE
S5.140 S5.141</td></tr>
<tr><td>7 100-7 300
BROADCASTING</td><td>7 100-7 300
AMATEUR ~~S5.120~~
S5.142</td><td>7 100-7 300
BROADCASTING</td></tr>
</table>

MOD

7 350-13 360 kHz

<table>
<tr><th colspan="3">Allocation to services</th></tr>
<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr><td>10 100-10 150</td><td colspan="2">FIXED
Amateur ~~S5.120~~</td></tr>
</table>

MOD

13 360-18 030 kHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
14 000-14 250	AMATEUR ~~S5.120~~ AMATEUR-SATELLITE	
14 250-14 350	AMATEUR ~~S5.120~~ S5.152	

MOD

18 030-23 350 kHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
18 068-18 168	AMATEUR ~~S5.120~~ AMATEUR-SATELLITE S5.154	
21 000-21 450	AMATEUR ~~S5.120~~ AMATEUR-SATELLITE	

MOD

23 350-27 500 kHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
24 890-24 990	AMATEUR ~~S5.120~~ AMATEUR-SATELLITE	

MOD

47-75.2 MHz

<table>
<tr><th colspan="3">Allocation to services</th></tr>
<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr><td rowspan="3">47-68
BROADCASTING

S5.162A S5.163 S5.164 S5.165
S5.169 S5.171</td><td>47-50
FIXED
MOBILE</td><td>47-50
FIXED
MOBILE
BROADCASTING
ADD S5.162A</td></tr>
<tr><td colspan="2">50-54
AMATEUR
S5.166 S5.167 S5.168 S5.170 ADD S5.162A</td></tr>
<tr><td>54-68
BROADCASTING
Fixed
Mobile

S5.172</td><td>54-68
FIXED
MOBILE
BROADCASTING
ADD S5.162A</td></tr>
</table>

MOD

137.175-148 MHz

<table>
<tr><th colspan="3">Allocation to services</th></tr>
<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr><td>144-146</td><td colspan="2">AMATEUR ~~S5.120~~
AMATEUR-SATELLITE
S5.216</td></tr>
</table>

MOD

75.2-137.175 MHz

<table>
<tr><th colspan="3">Allocation to services</th></tr>
<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr><td rowspan="3">75.2-87.5
FIXED
MOBILE except aeronautical mobile
S5.175 S5.179 S5.184 S5.187</td><td colspan="2">75.2-75.4
FIXED
MOBILE
S5.179</td></tr>
<tr><td>75.4-76
FIXED
MOBILE</td><td rowspan="2">75.4-87
FIXED
MOBILE
~~S5.149~~ S5.182 S5.183 S5.188</td></tr>
<tr><td rowspan="2">76-88
BROADCASTING
Fixed
Mobile
S5.185</td></tr>
<tr><td rowspan="2">87.5-100
BROADCASTING
S5.190</td><td rowspan="2">87-100
FIXED
MOBILE
BROADCASTING</td></tr>
<tr><td>88-100
BROADCASTING</td></tr>
</table>

MOD

410-470 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
455-456 FIXED MOBILE S5.209 S5.271 S5.286A S5.286B S5.286C S5.286E	**455-456** FIXED MOBILE MOBILE-SATELLITE (Earth-to-space) S5.286A S5.286B S5.286C S5.209 ~~S5.271~~	**455-456** FIXED MOBILE S5.209 S5.271 S5.286A S5.286B S5.286C S5.286E
459-460 FIXED MOBILE S5.209 S5.271 S5.286A S5.286B S5.286C S5.286E	**459-460** FIXED MOBILE MOBILE-SATELLITE (Earth-to-space) S5.286A S5.286B S5.286C S5.209 ~~S5.271~~	**459-460** FIXED MOBILE S5.209 S5.271 S5.286A S5.286B S5.286C S5.286E

MOD

4 800-5 830 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
5 150-5 250	AERONAUTICAL RADIONAVIGATION FIXED-SATELLITE ~~SERVICE~~ (Earth-to-space) S5.447A S5.446 S5.447 S5.447B S5.447C	

MOD

S5.536A Administrations installing earth exploration-satellite earth stations cannot claim protection from stations in the fixed and mobile ~~stations~~services operated by neighbouring administrations. In addition, earth stations operating in the earth exploration-satellite service should take into account Recommendation ITU-R SA.1278.

ARTICLE S14

Procedure for the review of a finding or other decision of the Bureau

MOD

S14.6 The decision of the Board on the review, to be taken in accordance with the Convention, shall be regarded as final in so far as the Bureau and the Board are concerned. That decision, together with the supporting information, shall be published as under No. **S14.4**. If this review results in a modification to a finding previously formulated by the Bureau, the Bureau shall re-apply the relevant steps of the procedure under which the previous finding had been formulated, including, if appropriate, removal of the corresponding entries from the Master Register or any consequential effect on notices subsequently received by the Bureau. However, if the administration which requested the review disagrees with the Board's decision it may raise the matter at a world radiocommunication conference.

ARTICLE S20

Service documents

SUP

S20.11

APPENDIX S4

Consolidated list and tables of characteristics for use in the application of the procedures of Chapter SIII

ANNEX 1A

List of characteristics of stations in the terrestrial services[1]

MOD

ITEM B – Notifying administration

~~Country s~~Symbol of the notifying administration.

MOD

ITEM SYNC – Synchronized network

Symbol followed by the identification ~~number~~ of the network, if the station concerned by the assignment pertains to a synchronized network.

ADD

ITEM 1AA – Usable frequency range

For MF/HF adaptive systems, the difference between the maximum and minimum assignable frequencies of a distinct frequency band.

SUP

ITEM 1D

MOD

ITEM 1E – Frequency offset, in terms of the line frequency

The carrier frequency offset expressed as a multiple of 1/12 of the line frequency of the television system concerned, expressed by a number ~~and a symbol (P or M)~~ (positive or negative).

ADD

ITEM 1E1 – Frequency offset, kHz

The carrier frequency offset, in kHz, expressed by a number (positive or negative).

SUP

ITEM 1H

MOD

ITEM 3A – Call sign or station identification

The call sign or other identification used in accordance with Article **S19**.

MOD

ITEM 4A – Name of the location of the transmitting station

The name of the locality by which the transmitting station is known or in which it is situated.

MOD

ITEM 4B – Country or geographical area

~~The country or~~Symbol of the geographical area in which the station is located.

SUP

ITEM 4F

MOD

ITEM 5A – Name of the location of the receiving station

The name of the locality by which the receiving station is known or in which it is situated.

MOD

ITEM 5B – Country or geographical area

~~The country or~~Symbol of the geographical area in which the receiving station is located.

ADD

ITEM 7A1 – Frequency stability

Frequency stability for analogue television (RELAXED, NORMAL or PRECISION).

MOD

ITEM 7AA – Type of modulation

The choice of modulation is needed in order to specify if the requirement is toFor HF broadcasting stations in their exclusive bands, a symbol which specifies the use of DSB, SSB or any new broadcasting techniques recommended by ITU-R.

ADD

ITEM 7B1 – Adjacent channel protection ratio

For assignments to stations of the broadcasting service covered by the LF/MF Broadcasting Agreement (Regions 1 and 3) (Geneva, 1975), the protection ratio (dB) to be used for adjacent channel interference calculations.

MOD

ITEM 7D – Transmission system

Symbol corresponding to the transmission system for an assignment to a VHF sound broadcasting station.

MOD

ITEM 8A – Power delivered to the antenna (dBW)

The power delivered to the antenna transmission line expressed in dBW with the exception of LF/MF sound broadcasting for which the power delivered to the antenna shall be expressed in kW.

MOD

ITEM 8B – Radiated power (dBW)

The radiated power expressed in dBW in one of the forms described in Nos. **S1.161** to **S1.163**. In the case of systems where automatic power control is applied, indicate the range of power control, expressed in dB relative to the transmitted power indicated above.

ADD

ITEM 8BA – Range of power control

In the case of systems where automatic power control is applied, the range of power control (dB) above the nominal power indicated in 8B.

MOD

ITEM 8BH – Maximum Eeffective radiated power (dBW) – horizontal

The maximum effective radiated power of the horizontally polarizationpolarized component (for VHF sound broadcasting (BC) and VHF/UHF television broadcasting (BT) assignments).

MOD

ITEM 8BV – Maximum Eeffective radiated power (dBW) – vertical

The maximum effective radiated power of the vertically polarizationpolarized component (for VHF sound broadcasting (BC) and VHF/UHF television broadcasting (BT) assignments).

MOD

ITEM 8D – Vision/sound power ratio

Vision/sound carrier power ratio for VHF/UHF analogue television broadcasting (BT) assignments.

MOD

ITEM 9A – Azimuth of maximum radiation

For a directional transmitting antenna, the azimuth of maximum radiation of the transmitting antenna in degrees (clockwise) from True North~~, or the symbol "ND" for a non-directional antenna~~.

MOD

ITEM 9AA – Central azimuth of augmentation

The central azimuth of the augmentation (centre of the span) in degrees for an assignment to an MF broadcasting station in Region 2.

MOD

ITEM 9CA – Total span of augmentation

The total span of the augmentation in degrees for an assignment to an MF broadcasting station in Region 2.

SUP

ITEM 9H

MOD

ITEM 9I – Maximum ~~agreed~~ radiation ~~in the sectors~~or r.m.s. value of radiation

The maximum ~~agreed~~ radiation~~ in the sector~~, in dB relative to a cymomotive force (c.m.f.) of 300 V or an effective monopole radiated power (e.m.r.p.) of 1 kW, determined from the nominal power of the transmitter and the theoretical gain of the antenna without allowing for miscellaneous losses.

For assignments to stations of the broadcasting service covered by the MF Broadcasting Agreement (Region 2) (Rio de Janeiro, 1981), the product of the r.m.s. characteristic field strength, calculated in the horizontal plane, and the square root of the power.

ADD

ITEM 9L – Maximum effective radiated power (dB(kW))

The maximum effective radiated power, expressed in dB relative to an e.r.p. of 1 kW on a short vertical antenna.

SUP

ITEM 9N

MOD

ITEM 9NH – Attenuation (dB) ~~in~~of the horizontally polarized component ~~plane~~ at different azimuths

The value of attenuation ~~in dB~~of the horizontally polarized component in the horizontal plane at different azimuths, with respect to the maximum e.r.p. ~~in the horizontal plane at different azimuths~~of this component, express in dB.

MOD

ITEM 9NV – Attenuation (dB) ~~in~~of the vertically polarized component ~~plane~~ at different azimuths

The value of attenuation ~~in dB~~of the vertically polarized component in the horizontal plane at different azimuths, with respect to the maximum e.r.p. ~~in the vertical plane at different azimuths~~of this component, expressed in dB.

MOD

ITEM 9Q – Type of antenna

Symbol designating a ~~S~~simple vertical antenna or ~~directional~~any other antenna.

MOD

ITEM 9R – Slew angle

For HF broadcasting stations in their exclusive bands, ~~T~~the slew angle represents the difference between the azimuth of maximum radiation and the direction of unslewed radiation.

MOD

ITEM 9T3 – Phase difference of the field

The positive or negative phase difference in the tower field with respect to the field of the reference tower, in degrees.

SUP

ITEM 9T6

MOD

ITEMS 9T9A to 9T9D – Description of top-loaded or sectionalized tower

Description of top-loaded or sectionalized towers, in~~ degrees~~ accordance with RJ81 Agreement.

SUP

ITEM 10A

MOD

ITEM 10CA – Start date

For HF broadcasting stations in their exclusive bands, ~~U~~used in the case that the requirement starts after the start of the schedule.

MOD

ITEM 10CB – Stop date

For HF broadcasting stations in their exclusive bands, ~~U~~used in the case that the requirement stops before the end of the schedule.

MOD

ITEM 10CC – Days of operation

For HF broadcasting stations in their exclusive bands, ~~U~~used when the station does not transmit every day of the week.

MOD

ITEM 11 – Coordination with other administrations

~~Country or geographical area~~ Symbol of the administration with which coordination ~~is to be~~ has been effected and the provision (No. of the Radio Regulations, regional agreement, or other arrangement) requiring such coordination.

SUP

ANNEX 1B

Table of characteristics to be submitted for stations in the terrestrial services

ADD

ANNEX 1B

Table of characteristics to be submitted for stations in the terrestrial services

Notice type	T01	T02	T03	T04	T11	T12			T13		T14	T15	T16	T17		AR S12	Notice type
Item No.	**BC**	**BT**	**BC**	**BC**	**FX**	**AL, BC[1], FA, FB, FC, FL, FP, LR, OE, RN, SS**	**FD, FG, SM**	**NL**	**AM, MA, ML, MO, MR, MS, NR, OD, SA**	**RM**	**AL[2], FA[3], FB[3], FC[2], FD[2], FG[2], FL, FP, FX[3], LR, NL[2], OE, RN, SM, SS**	**FC[4]**	**AL[5], FC[5]**	**FX**	**FA, FB, FC[2], FD[2], FG[2], FL, FP**	**BC**	**Item No.**
B	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	B
SYNC			+	+													SYNC
1A	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	1A
1AA														X	X		1AA
1B					+	+	+	+	+	+	+		+	+	+		1B
1C						+						*[6]				O	1C
1E		*[7,13]															1E
1E1		*[7, 13]															1E1
1G																O	1G
1X												*[6]	O				1X
1Y												O					1Y
1Z												+					1Z
2C	+	+	+	+	X	X	X	X	X	X	X	X		X	X		2C
3A	O	O	O	O	+	+	X	O						+	X	O	3A

X Mandatory * One of the items + Required in specific cases O Optional

Table of characteristics to be submitted for stations in the terrestrial services *(cont.)*

Notice type	T01	T02	T03	T04	T11	T12			T13		T14	T15	T16	T17		AR S12	Notice type
Item No.	**BC**	**BT**	**BC**	**BC**	**FX**	**AL, BC[1], FA, FB, FC, FL, FP, LR, OE, RN, SS**	**FD, FG, SM**	**NL**	**AM, MA, ML, MO, MR, MS, NR, OD, SA**	**RM**	**AL[2], FA[3], FB[3], FC[2], FD[2], FG[2], FL, FP, FX[3], LR, NL[2], OE, RN, SM, SS**	**FC[4]**	**AL[5], FC[5]**	**FX**	**FA, FB, FC[2], FD[2], FG[2], FL, FP**	**BC**	**Item No.**
4A	X	X	X	X	X	X	X	X				+	X	X	X	X	4A
4B	X	X	X	X	X	X	X	X					X	X	X		4B
4C	X	X	X	X	X	X	X	X	*[8]	X	*[8]	+	X	X	X	X	4C
4D									*[8]	X	*[8]						4D
4E									*[8]		*[8]	X					4E
4G			X														4G
5A					X[9]				X	X				X[9]			5A
5B					X[9]				X	X				X[9]			5B
5C					X[9]	*[10]	*[10]	*	X	X				X[9]	*[10]		5C
5D						*[10]	*[10]					X			*[10]	X	5D
5E						*[10]	*[10]	*					X		*[10]		5E
5F						*[10]	*[10]	*					X		*[10]		5F
5G					O	O	O	O				O		O	O		5G
6A					X	X	X	X	X	X	X	X	X	X	X		6A
6B					X	X	X	X	X	X	X	X	X	X	X		6B
7A	X[11]		X[11]	O	X	X	X	X	X	X	X	X	X	X	X		7A
7A1		+[7]															7A1
7AA																X	7AA
7B				X	+									+			7B
7B1			X														7B1
7C1		X															7C1
7C2		+[7]															7C2
7D	+																7D
7E					+[12]												7E

X Mandatory * One of the items + Required in specific cases O Optional

Table of characteristics to be submitted for stations in the terrestrial services *(cont.)*

Notice type	T01	T02	T03	T04	T11	T12			T13		T14	T15	T16	T17		AR S12	Notice type
Item No.	**BC**	**BT**	**BC**	**BC**	**FX**	**AL, BC[1], FA, FB, FC, FL, FP, LR, OE, RN, SS**	**FD, FG, SM**	**NL**	**AM, MA, ML, MO, MR, MS, NR, OD, SA**	**RM**	**AL[2], FA[3], FB[3], FC[2], FD[2], FG[2], FL, FP, FX[3], LR, NL[2], OE, RN, SM, SS**	**FC[4]**	**AL[5], FC[5]**	**FX**	**FA, FB, FC[2], FD[2], FG[2], FL, FP**	**BC**	**Item No.**
7F					+[12]												7F
8					X	X	X	X	X	X	X	X		X	X		8
8A			X	X	*	*	X	*	*	*	*	X		X	X	X	8A
8AB					+[12]												8AB
8B					*	*	*	*	*	*	*			+	+		8B
8BA														O	O		8BA
8BH	X	X															8BH
8BV	X	X															8BV
8D		+[7]															8D
9	X	X			X	X	X	X				X		X	X		9
9A					+	+	+	+				+		+	+	X	9A
9AA				+													9AA
9AB					+	+	+	+				+		+	+		9AB
9B					+	+	+	+									9B
9C					+	+	+	+				+		+	+		9C
9CA				+													9CA
9D	X	X			+												9D
9E	X	+	X		+	+	+	+									9E
9EA	X	+			+	+	+	+									9EA
9EB	X	X															9EB
9EC	+	+															9EC
9F				+													9F
9G					+	+	+	+			+	+		+	+		9G
9GH			+														9GH
9GV			+														9GV

X Mandatory * One of the items + Required in specific cases O Optional

Table of characteristics to be submitted for stations in the terrestrial services *(cont.)*

Notice type	T01	T02	T03	T04	T11	T12			T13		T14	T15	T16	T17		AR S12	Notice type
Item No.	**BC**	**BT**	**BC**	**BC**	**FX**	**AL, BC[1], FA, FB, FC, FL, FP, LR, OE, RN, SS**	**FD, FG, SM**	**NL**	**AM, MA, ML, MO, MR, MS, NR, OD, SA**	**RM**	**AL[2], FA[3], FB[3], FC[2], FD[2], FG[2], FL, FP, FX[3], LR, NL[2], OE, RN, SM, SS**	**FC[4]**	**AL[5], FC[5]**	**FX**	**FA, FB, FC[2], FD[2], FG[2], FL, FP**	**BC**	**Item No.**
9I				X													9I
9IA				+													9IA
9J					O	O	O	O						O	O	X	9J
9K					+[12]												9K
9L			X														9L
9NA				+													9NA
9NH	+	+															9NH
9NV	+	+															9NV
9O				+													9O
9P				O													9P
9Q			X	X													9Q
9R																X	9R
9T1				+													9T1
9T2				+													9T2
9T3				+													9T3
9T4				+													9T4
9T5				+													9T5
9T7				+													9T7
9T8				+													9T8
9T9A				+													9T9A
9T9B				+													9T9B
9T9C				+													9T9C
9T9D				+													9T9D
10B	+	+	X	X	X	X	X	X	X	X	X	X	X	X	X		10B
10CA																+	10CA

X Mandatory * One of the items + Required in specific cases O Optional

Table of characteristics to be submitted for stations in the terrestrial services *(end)*

Notice type	**T01**	**T02**	**T03**	**T04**	**T11**	**T12**			**T13**		**T14**	**T15**	**T16**	**T17**		**AR S12**	**Notice type**
Item No.	**BC**	**BT**	**BC**	**BC**	**FX**	**AL, BC[1], FA, FB, FC, FL, FP, LR, OE, RN, SS**	**FD, FG, SM**	**NL**	**AM, MA, ML, MO, MR, MS, NR, OD, SA**	**RM**	**AL[2], FA[3], FB[3], FC[2], FD[2], FG[2], FL, FP, FX[3], LR, NL[2], OE, RN, SM, SS**	**FC[4]**	**AL[5], FC[5]**	**FX**	**FA, FB, FC[2], FD[2], FG[2], FL, FP**	**BC**	**Item No.**
10CB																+	10CB
10CC																+	10CC
10D												X					10D
10E												X					10E
11	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O		11
12A	O	O	O	O	O	O	O	O	O	O	O			O	O	+	12A
12B	+	+	+	+	X	X	X	X	X	X	X			X	X		12B

X Mandatory * One of the items + Required in specific cases O Optional

[1] Outside the planned LF/MF bands and the VHF/UHF bands (up to 960 MHz), the HF bands that are governed by Article **S12**.

[2] In the non-planned bands.

[3] Outside the bands governed by Regional Agreements GE85M and GE89.

[4] In the bands governed by Appendix **S25**.

[5] In the bands governed by Regional Agreement GE85.

[6] 1C or 1X.

[7] For analogue television only if the frequency stability is normal or precision.

[8] (4C and 4D) or (4E).

[9] (5A, 5B and 5C) or (minimum three sets of 5C).

[10] (Minimum three sets of 5C) or (5D) or (5E and 5F).

[11] The necessary bandwidth only.

[12] This information may be furnished for stations in the fixed service when the parameters are used as a basis to effect coordination with another administration.

[13] 1E or 1E1.

MOD

APPENDIX S5

TABLE S5-1 (*continued*)

Reference of Article S9	**Case**	**Frequency bands (and Region) of the service for which coordination is sought**	**Threshold/condition**	**Calculation method**	**Remarks**
No. **S9.11** GSO/terrestrial	A space station in the BSS in any band shared on an equal primary basis with terrestrial services and where the BSS is not subject to a Plan, in respect of terrestrial services	620-790 MHz 1 452-1 492 MHz 2 310-2 360 MHz 2 520-2 655 MHz 2 655-2 670 MHz 12.5-12.75 GHz (Region 3) 17.73-17.8 GHz (Region 2) 21.4-22 GHz (Region 1 and 3) 40.5-42.5 GHz 84-86 GHz	Condition: bandwidths overlap	Check by using the assigned frequencies and bandwidths	
No. **S9.12** 1)Non-GSO/ non-GSO	A station in a satellite network using a non-geostationary-satellite orbit in the frequency bands for which a footnote refers to **S9.11A** in respect of any other satellite network using a non-geostationary-satellite orbit, with the exception of coordination between earth stations operating in the opposite direction of transmission	See Table [S5-21A]*	Condition: bandwidths overlap	Check by using the assigned frequencies and bandwidths	

* Under consideration in other working groups.

TABLE S5-1 (*continued*)

No. **S9.12** 2)Non-GSO/	A station in a satellite network using a non-geostationary-satellite orbit in the frequency bands for which a footnote refers to **S9.11A** in respect of any other satellite network using the geostationary-satellite orbit, with the exception of coordination between earth stations operating in the opposite direction of transmission	See Table [S5-~~2~~1A]*	Condition: bandwidths overlap	Check by using the assigned frequencies and bandwidths	
No. **S9.13** GSO/non-GSO	A station in a satellite network using the GSO in the frequency bands for which a footnote refers to No. **S9.11A** in respect of any other satellite network using a non-GSO, with the exception of coordination between earth stations operating in the opposite direction of transmission	See Table [S5-~~2~~1A]*	Condition: bandwidths overlap	Check by using the assigned frequencies and bandwidths	
No. **S9.14** Non-GSO/ terrestrial, GSO/terrestrial	For a space station in a satellite network in the frequency bands for which a footnote refers to No. **S9.11A** in respect of stations of terrestrial services where threshold(s) is (are) exceeded	See Table [S5-~~2~~1A]*	See § 1 of Annex 1 of this Appendix	See § 1 of Annex 1 of this Appendix	
No. **S9.15** Non-GSO/ terrestrial	A specific earth station or a typical earth station in respect of terrestrial stations in frequency bands for which a footnote refers to No. **S9.11A** allocated with equal rights to space and terrestrial services, where the coordination area of the earth station includes the territory of another country	See Table [S5-~~2~~1A]*	The coordination area of the earth station covers the territory of another administration	See § 2 of Annex 1 of this Appendix	

TABLE S5-1 (*continued*)

Reference of Article S9	Case	Frequency bands (and Region) of the service for which coordination is sought	Threshold/condition	Calculation method	Remarks
No. **S9.16** Terrestrial/ non-GSO	A transmitting station in a terrestrial service within the coordination area of an earth station in a non-GSO network in frequency bands for which a footnote refers to No. **S9.11A**	See Table [S5-~~2~~1A][*]	Transmitting terrestrial station is situated within the coordination area of a receiving earth station	See § 2 of Annex 1 of this Appendix	The coordination area of the affected earth station has already been determined using the calculation method of No. **S9.15**
No. **S9.21** Terrestrial, GSO, non-GSO/ terrestrial, GSO, non-GSO	A station of a service for which the requirement to obtain the agreement of other administrations is included in a footnote to the Table of Frequency Allocations, referring to No. **S9.21**	Band(s) indicated in the relevant footnote	Condition: Incompatibility established by the use of Appendices **S7**, **S8**, technical annexes of Appendices **S30**, **S30A** ~~and **S30B**~~, ~~pdf~~ pfd values specified in some of the footnotes, other technical provisions of the Radio Regulations or ITU-R Recommendations as appropriate	Methods specified in, or adapted from, Appen-dices **S7**, **S8**, **S30**, **S30A**~~,~~ ~~**S30B**~~, other technical provisions of the Radio Regulations or ITU-R Recommendations	

MOD

ANNEX 1

2.1 Sharing between feeder links of the non-GSO MSS (space-to-Earth) and terrestrial services in the same frequency bands

SUP

~~In the band 19.3-19.7 GHz for non-GSO systems, these values shall apply subject to review by the ITU-R and the results of this review should be considered by WRC-97.~~

2.3 pfd limits produced by non-GSO FSS in the 20-30 GHz band

SUP

~~In the band 18.9-19.3 GHz for non-GSO satellite systems, these values shall apply subject to review by the ITU-R and the results of this review should be considered by WRC-97.~~

APPENDIX S13[*]

Distress and safety communications (non-GMDSS)

(see Article **S30**)

Part A1 – General provisions

MOD

§ 2 The procedure specified in this ~~Chapter~~ Appendix is obligatory in the maritime mobile-satellite service and for communications between stations on board aircraft and stations of the maritime mobile-satellite service, where this service or stations of this service are specifically mentioned. Paragraphs 1, 3 3), 6 of Part A3, and paragraphs 3 1), 3 4) and 14 1) of Part A4 are also applicable.

Part A6 – Special services relating to safety

Section IV – Narrow-band direct-printing telegraphy system for transmission of navigational and meteorological warnings and urgent information to ships (NAVTEX)

MOD

§ 11 In addition to existing methods, navigational and meteorological warnings and urgent information shall be transmitted by means of narrow-band direct-printing telegraphy, with forward error correction, by selected coast stations~~ and their operational details shall be indicated in the List of Radiodetermination and Special Service Stations (see § 2 1), 4 1) and 6). Information is also published in a separate list in accordance with Resolution **339 (Rev.WRC-97)**~~.

MOD

APPENDIX S27*

Frequency allotment Plan for the aeronautical mobile (R) service and related information

(See Article **S43**)

Section II – Allotment of frequencies in the aeronautical mobile (R) service

ARTICLE 1

Area	Frequency bands (MHz)										
	3	**3.5**	**4.7**	**5.4 (Reg. 2)**	**5.6**	**6.6**	**9**	**10**	**11.3**	**13.3**	**18**
	kHz	**kHz**	**kHz**	**kHz**	**kHz**	**kHz**	**kHz**	**kHz**	**kHz**	**kHz**	**kHz**
2	2 938 2 950		4 696	~~4 696~~	5 556	6 583 6 601	8 846 8 855 8 888	10 015 10 045	11 297 11 360 11 390	13 321 13 357	17 964

ARTICLE 2

S27/222 Band **5 450-5 480 kHz (Reg. 2)** **5.4 MHz**

Frequency (kHz)	**Authorized area of use***	**Remarks***
1	**2**	**3**
5 466	R l0B 13~~1~~I	

MOD

APPENDIX S42

Table of allocation of international call sign series

Call sign series	**Allocated to**
V~~R~~SA-VSZ	United Kingdom of Great Britain and Northern Ireland

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

Document 387-E
24 May 2000
Original: English

ISTANBUL, 8 MAY – 2 JUNE 2000

COMMITTEE 4

Chairperson, Working Group 4A

SECOND REPORT FROM WORKING GROUP 4A TO COMMITTEE 4

Please find attached proposed modification to Articles S1 and S5, Resolutions 27, 72 and 60, Recommendations 105 and 711, and new Resolution [COM4/1].

In discussing a proposal to republish all circulars and Special Sections of the past ten years on CD-ROM, WG 4A considered this request based on cost recovery principles by those administrations interested in such publication. In view of the resource implications (estimated cost by the Bureau is CHF 900 000), it was decided to inform Committee 3 of this issue for its consideration.

On another issue, it was confirmed by the Bureau that inclusion in the Space Radiocommunications System (SRS) of any missing information and notes provided by the administration will be implemented within the normal activities of the Bureau.

N. KISRAWI
Chairperson, Working Group 4A
Box 50

MOD

S1.171 *coordination area:* When determining the need for coordination, t~~T~~he area ~~associated with~~surrounding an *earth station* ~~outside of which a *terrestrial station* sharing the same frequency band neither causes nor is subject to interfering *emissions* greater than a permissible level~~sharing the same frequency band with *terrestrial stations*, or surrounding a transmitting *earth station* sharing the same bidirectionally allocated frequency band with *receiving earth stations*, beyond which the permissible level of interference will not be exceeded and coordination is therefore not required.

MOD

S1.173 *coordination distance:* When determining the need for coordination, the d~~D~~istance on a given azimuth from an *earth station* sharing the same frequency with terrestrial stations, or from a transmitting earth station sharing the same bidirectionally allocated frequency band with receiving earth stations, beyond which ~~a *terrestrial station* sharing the same frequency band neither causes nor is subject to interfering *emissions* greater than a~~the permissible level of interference will not be exceeded and coordination is therefore not required.

MOD

S1.185 *inclination of an orbit* (of an earth satellite)*:* The angle determined by the plane containing the *orbit* and the plane of the Earth's equator measured in degrees between 0 and 180 and in counter-clockwise direction from the Earth's equatorial plane at the ascending node of the orbit.

MOD

S5.43 1) Where it is indicated in these Regulations that a service or stations in a service may operate in a specific frequency band subject to not causing harmful interference to another service or to another station in the same service, this means also that ~~this~~the service which is subject to not causing harmful interference cannot claim protection from harmful interference caused by this other service~~s~~ or other stations in the same service~~to which the band is allocated under Chapter **SII** of these Regulations~~.

ADD

S5.43A 1*bis*) Where it is indicated in these Regulations that a service or stations in a service may operate in a specific frequency band subject to not claiming protection from another service or from another station in the same service, this means also that the service which is subject to not claiming protection cannot cause harmful interference to this other service or other stations in the same service.

MOD

[1] **S8.1.1** The expression “frequency assignment”, wherever it appears in this Chapter, shall be understood to refer either to a new frequency assignment or to a change in an assignment already recorded in the Master Register. Additionally, wherever the expression relates to a space station in the geostationary-satellite orbit or in a non-geostationary-satellite orbit, it shall be associated with § A.4 of Annex 2A to Appendix **S4**, as relevant, and moreover wherever the expression relates to an earth station associated with a space station in the geostationary-satellite orbit or in non-geostationary orbit, it shall be associated with § A.4 *c)* of Annex 2A to Appendix S4, as relevant.

MOD

ANNEX 4 TO RESOLUTION 27 (Rev.WRC-97)

List of ITU-R Recommendations referred to in the Radio Regulations[1]

Recommendation	Title	Status[2]	Document	RR provision[3]
~~ITU-R SF.356-4~~	~~Maximum allowable values of interference from line-of-sight radio-relay systems in a telephone channel of a system in the fixed-satellite service employing frequency modulation, when the same frequency bands are shared by both systems~~	~~NOC~~	~~1997 SF Series~~	~~AP S7, § 2.3.1, Note 2~~
~~ITU-R SF.357-4~~	~~Maximum allowable values of interference in a telephone channel of an analogue angle-modulated radio-relay system sharing the same frequency bands as systems in the fixed-satellite service~~	~~MOD~~	~~1997 SF Series~~	~~AP S7, § 2.3.1, Note 2~~
~~**ITU-R IS.847-1**~~	~~Determination of the coordination area of an earth station operating with a geostationary space station and using the same frequency band as a system in a terrestrial service~~	~~NOC~~	~~1997 IS Series~~	~~**AP S5**, **Table S5-1**~~ ~~**AP S5**, **Annex 2**,~~ ~~**Tables 2** and **3**~~
~~**ITU-R IS.848-1**~~	~~Determination of the coordination area of a transmitting earth station using the same frequency band as receiving earth stations in bidirectionally allocated frequency bands~~	~~NOC~~	~~1997 IS Series~~	~~**AP S5**, **Table S5-1**~~
~~**ITU-R IS.849-1**~~	~~Determination of the coordination area for earth stations operating with non-geostationary spacecraft in bands shared with terrestrial services~~	~~NOC~~	~~1997 IS Series~~	~~**AP S5**, **Table S5-1**~~ ~~**AP S5**, **Annex 2**,~~ ~~**Tables 2** and **3**~~
~~**ITU-R M.1185-1**~~	~~Method for determining coordination distance between ground based mobile earth stations and terrestrial stations operating in the 148.0-149.9 MHz band~~	~~MOD~~	~~1997 M Series, Part 5~~	~~**AP S5**, **Annex 1**, **§ 3.2, Table 1**~~ ~~Resolution 46 (Rev.WRC-97), Annex 2, Table 1~~

SUP

RESOLUTION 60

Relating to information on the propagation of radio waves used in the determination of the coordination area

SUP

RECOMMENDATION 105 (WRC-95)

Further work by ITU-R on determination of the coordination area around earth stations operating with geostationary-satellite networks in the fixed-satellite service and earth stations providing feeder links to non-geostationary-satellite networks in the mobile-satellite service operating in opposite directions of transmission

SUP

RECOMMENDATION 711

Relating to the coordination of earth stations

MOD

RESOLUTION 72 (Rev.WRC-972000)

Regional preparations for World Radiocommunication Conferences

The World Radiocommunication Conference (GenevaIstanbul, 19972000),

considering

a) that many regional telecommunication organizations have coordinated their preparations for WRC-972000;

b) that a number ofmany common proposals have been submitted to this Conference from administrations participating in the preparations of regional telecommunication organizations;

c) that this consolidation of views at regional level, together with the opportunity for interregional discussions prior to the Conference, has eased the task of reaching a consensus during the Conference;

d) that the burden of preparation for future conferences is likely to increase;

e) that there is consequently great benefit to the Member States ‡ of coordination of preparations at regional level;

f) that the success of future conferences will depend on greater efficiency of regional coordination and interaction at interregional level prior to future conferences;

g) that some regional organizations lack the necessary resources to adequately organize and to participate in such preparations;

h) that there is a need for overall coordination of the interregional consultations,

recognizing

a) *resolves* 2 of Resolution 80 (Minneapolis, 1998)

"to support the regional harmonization of common proposals, as stated in Resolution 72 (WRC-97), for submission to world radiocommunication conferences";

b) *resolves* 3 of Resolution 80 (Minneapolis, 1998)

"to encourage both formal and informal collaboration in the interval between conferences with a view to resolving differences on new, or conference agenda issues",

noting

a) that at the World Telecommunication Development Conference (Buenos AiresValletta, 19948) many regional telecommunication organizations expressed the need for the Union to cooperate more closely with regional telecommunication organizations;

b) that consequently the Plenipotentiary Conference (KyotoMinneapolis, 19948) resolved that the Union should develop stronger relations with regional telecommunication organizations.;

c) that RA-2000 adopted [Resolution ITU-R 48] which sought greater regional presence in ITU-R study group work including WRC-related studies, *further noting*

that in some regions the relationship with the ITU-RD regional offices has proved to be of great benefit,

resolves to instruct the Director of the Radiocommunication Bureau

a) to continue consulting the regional telecommunication organizations on the means by which assistance can be given to their preparations for future world radiocommunication conferences in the following areas:

– organization of regional preparatory meetings;

– information sessions preferably before and after the second conference preparatory meeting;

– development of coordination methods;

– identification of major issues to be resolved by the future world radiocommunication conference;

– facilitation of regional and interregional informal and formal meetings;, with the objective of reaching a

– convergence of interregional views on major issues;

b) to, pursuant to ITU Radiocommunication Assembly resolution on the CPM [Resolution ITU-R 2-3], assist in ensuring that overview presentations by the CPM management of the chapters will be made at the early stages of the meeting as part of the regularly scheduled sessions, in order to facilitate the understanding by all participants of the contents of the next CPM Report;

bc) to submit a report on the results of the such consultations to both the next Plenipotentiary Conference and WRC-02/03for consideration,

invites the Plenipotentiary Conferencethe Director of the Telecommunication Development Bureau (BDT)

to consider the report submitted by the Directors of the Radiocommunication Bureau (BR) and the Telecommunications Development Bureau (BDT) and take appropriate measures to provide the necessary resources for BR and BDT to provide the necessary assistance to regional telecommunication organizations in the preparations for world radiocommunication conferences collaborate with the Director of the Radiocommunication Bureau (BR) in implementing this Resolution.

ADD

RESOLUTION [COM4/1] (WRC-2000)

The process to keep the technical bases of Appendix S7 current

The World Radiocommunication Conference (Istanbul, 2000),

considering

a) that Appendix **S7** to the Radio Regulations provides the method for the determination of the coordination area of an earth station, and the assumed technical coordination parameters for the unknown terrestrial station or earth station;

b) that the technical coordination parameters are contained in Tables 1, 2 and 3 of Annex VII of Appendix **S7 (Rev.WRC-2000)**;

c) that the technical coordination parameter tables are based on Recommendation ITU-R SM.1448;

d) that ITU-R studies on methods for the determination of the coordination area of an earth station are continuing, and the conclusions of these studies could lead to the revision of Appendix **S7**. These methods under study are:

– methods considering the cumulative impact in determining the coordination areas for high-density earth stations (fixed and mobile);

– methods to address the modelling of VHF/UHF frequencies for percentages of time below 1%;

– methods to address propagation mode(s) water vapour density for both radio climatic Zones B and C;

– refinements to propagation mode(s) to address elevation angle dependency and the displacement of the centre of propagation mode(s) contour from the coordinating earth station;

e) that the technical coordination parameter tables may also need to be modified when changes are made to the Table of Frequency Allocations at future WRCs, or due to changes in technology, or due to changes in deployment of services;

f) that the technical coordination parameter tables do not include values for all the necessary parameters of certain space radiocommunication services and terrestrial radiocommunication services sharing frequency bands with equal rights,

recognizing

a) that Recommendation ITU-R SM.1448 was developed by ITU-R as a basis for the revision of Appendix **S7**;

b) that there is a need for future WRCs to keep Appendix **S7** current with the latest techniques and to ensure protection of other radiocommunication services sharing the same frequency bands with equal rights, particularly the revision of the tables of technical coordination parameters,

requests ITU-R

to continue its study, as required, of the technical bases used for the determination of the coordination area for an earth station, including recommended values for the missing entries in the tables of technical coordination parameters (Annex VII of Appendix **S7**), to maintain the relevant ITU-R texts in a format which would facilitate the future revision of Appendix **S7**, and to assess the significance of any changes to the technical bases,

resolves

1 that when ITU-R concludes, based on its studies of the methods in *considering d)* for the determination of the coordination area for an earth station and/or the values of technical coordination parameters, that a revision of Appendix **S7** is warranted, the matter shall be brought to the attention of the Radiocommunication Assembly;

2 that, if the Radiocommunication Assembly confirms improvements of the methods in *considering d)* for the determination of the coordination area for an earth station and/or the values of technical coordination parameters have been presented by ITU-R, the Director, Radiocommunication Bureau, shall identify the matter in the Director's Report to the upcoming WRC,

invites

1 WRCs presented with any significant changes through the Director's Report to consider the revision of Appendix **S7** in light of the recommendation of the Radiocommunication Assembly, pursuant to *resolves* 1 and 2 above; and

2 each WRC, when modifying the Table of Frequency Allocations, to consider any consequential changes to the technical coordination parameters of Annex VII of Appendix **S7**, and if necessary request ITU-R to study the matter.

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

Document 388-E
24 May 2000
Original: English

ISTANBUL, 8 MAY – 2 JUNE 2000

WORKING GROUP 5A

Chairperson, Drafting Group 5A-4

CONCLUSIONS REGARDING AGENDA ITEM 1.6.1
ON THE SATELLITE COMPONENT FOR IMT-2000

ADD

RESOLUTION [COM5/26] (WRC-2000)

Use of additional frequency bands for the satellite component of IMT-2000

The World Radiocommunication Conference (Istanbul, 2000),

considering

a) that the bands 1 980-2 010 MHz and 2 170-2 200 MHz are identified for use by the satellite component of International Mobile Telecommunications 2000 (IMT-2000) through No. **S5.388** and Resolution **212 (Rev.WRC-97)**;

b) Resolutions **212 (Rev.WRC-97)**, **[COM5/24] (WRC-2000)** and **[COM5/25] (WRC-2000)** on the implementation of the terrestrial and satellite components of IMT-2000;

c) that the bands 1 525-1 544 MHz, 1 545-1 559 MHz, 1 610-1 626.5 MHz, 1 626.5-1 645.5 MHz, 1 646.5-1 660.5 MHz, 2 483.5-2 500 MHz, 2 500-2 520 MHz and 2 670-2 690 MHz are allocated on a co-primary basis to the mobile-satellite service and other services in accordance with the Radio Regulations;

d) that distress, urgency and safety communications of the Global Maritime Distress and Safety System and the aeronautical mobile-satellite (route) service have priority over all other mobile-satellite service communications in accordance with Nos. **S5.353A** and **S5.357A**,

recognizing

a) that services such as broadcasting-satellite, broadcasting-satellite (sound), mobile-satellite, fixed (including point-to-multipoint distribution/communication systems) and mobile are in operation or planned in the band 2 500-2 690 MHz, or in portions of this band;

b) that other services such as mobile services and radiodetermination-satellite service are in operation or planned in the bands 1 525-1 559/1 626.5-1 660.5 MHz and 1 610-1 626.5/2 483.5-2 500 MHz, or in portions of these bands, and that these bands, or portions thereof, are intensively used in some countries by applications other than IMT-2000 satellite component, and the sharing studies within ITU-R are not finished;

c) that studies of potential sharing and coordination between the satellite component of IMT-2000 and the terrestrial component of IMT-2000, mobile-satellite services and other high-density applications in other services such as point-to-multipoint communication/distribution systems, in the bands 2 500-2 520 MHz and 2 670-2 690 MHz bands are not finished;

d) that the bands 2 520-2 535 MHz and 2 655-2 670 MHz are allocated to the mobile-satellite, except aeronautical mobile-satellite, service for operation limited to within national boundaries as per Nos. **S5.403** and **S5.420**;

e) Resolution ITU-R 47 on studies under way on satellite radio transmission technologies for IMT-2000,

resolves

[1 that the bands 2 500-2 520 MHz and 2 670-2 690 MHz as identified for IMT-2000 in No. **S5.AAA** and allocated to the mobile-satellite service, may be used by administrations wishing to implement the satellite component of IMT-2000, however, depending on market developments, it may be possible in the longer term for bands 2 500-2 520 MHz and 2 670-2 690 MHz to be used by the terrestrial component of IMT-2000;

2 that, in addition to the frequency bands indicated in *considering a)* and *resolves* 1, the frequency bands 1 525-1 544 MHz, 1 545-1 559 MHz, 1 610-1 626.5 MHz, 1 626.5-1 645.5 MHz, 1 646.5-1 660.5 MHz and 2 483.5-2 500 MHz on a worldwide basis, may be used by administrations wishing to implement the satellite component of IMT-2000, subject to the regulatory provisions related to the mobile-satellite service in these frequency bands,]

[1 to invite administrations implementing IMT-2000 or planning to implement IMT-2000 to make available, based on market demand and other national considerations, [additional] bands or portions of the bands 1 525-1 544 MHz, 1 545-1 559 MHz, 1 610-1 626.5 MHz, 1 626.5-1 645.5 MHz, 1 646.5-1 660.5 MHz, and 2 483.5-2 500 MHz on all three Regions, and 2 500-2 520 MHz and 2 670-2 690 MHz on a national basis, for the satellite component of IMT-2000 to meet the forecasted growth of these systems. Due consideration should be given to the benefits of harmonized utilization of the spectrum for the terrestrial component of IMT-2000, taking into account the use and planned use of these bands by all services to which these bands are allocated;

2 that this identification for the satellite component of IMT-2000 does not preclude the use of these bands by any applications of the services to which they are allocated and does not establish priority in the Radio Regulations,]

invites ITU-R

1 to study the sharing and coordination issues in the above bands related to use of the mobile-satellite service allocations for the satellite component of IMT-2000 and the use of this spectrum by the other allocated services, including the radiodetermination-satellite service;

2 to report the results of these studies to a future WRC,

instructs the Director of the Radiocommunication Bureau

to facilitate to the greatest extent possible the completion of these studies.

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

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24 May 2000
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ISTANBUL, 8 MAY – 2 JUNE 2000

COMMITTEE 5

SUMMARY RECORD
OF THE
THIRD MEETING OF COMMITTEE 5
(ALLOCATIONS AND ASSOCIATED ISSUES)

Monday, 22 May 2000, at 0930 hours

Chairperson: Mr Chris Van DIEPENBEEK (Netherlands)

Subjects discussed		**Documents**
1	Oral report by the Chairperson of Working Group 5A	-
2	Report by the Chairperson of Working Group 5B	280, 302, 303, 304
3	Report by the Chairperson of Working Group 5C	51(Add.1), 252, 257(Rev.1), 281, 283, 286, 287, 309, 313

1 Oral report by the Chairperson of Working Group 5A

1.1 The **Chairperson of Working Group 5A** said that Working Group 5A had met seven times and would be holding its last meeting on Wednesday, 24 May 2000. The sub-working groups would soon be completing their work and documents would shortly be submitted to Committee 5 for consideration.

2 Report by the Chairperson of Working Group 5B (Documents 280, 302, 303 and 304)

2.1 The **Chairperson of Working Group 5B** said that not all of the matters studied by the working group had thus far been settled, but that he could already submit Documents 280, 302, 303 and 304 to the committee for consideration and approval.

Document 280

2.2 The **Chairperson of Working Group 5B**, introducing Document 280, which reflected the work done by the working group on agenda item 1.15.3, pointed out that there had been a consensus on putting an end to use of the fixed service in the band currently allocated to the radionavigation-satellite service. Referring to the table reproduced in the document under consideration (frequency allocations, MOD 1 525-1 610 MHz), he said that footnotes MOD S5.355 and MOD S5.359, which were to be placed in another part of the Table of Frequency Allocations, should be deleted. He also drew the committee's attention to the reservation expressed during a meeting of Working Group 5B by the Arab countries, which were in favour of continued operation of the fixed service in the band in question, and to the need to ensure that the country names given in the footnotes reflected the results of the discussions held by Committee 4 under agenda item 1.1.

2.3 The **delegate of Syria**, speaking on behalf of the Arab countries mentioned in the footnotes under consideration, reiterated the reservation made within the working group and repeated that it was the wish of those countries that no change should be made to the footnotes in question and that use of the fixed service should continue in the band concerned.

2.4 The reservation made by the Arab countries was **noted**.

2.5 The **Chairperson** proposed that the committee should take note of the deletion of footnotes MOD S5.355 and MOD S5.359 in the table under consideration and requested that Committee 4 provide a full list of the country names appearing in the footnotes before forwarding the footnotes to Committee 6.

2.6 It was so **agreed**.

2.7 Document 280, as amended, was **approved**.

Document 304

2.8 The **Chairperson of Working Group 5B** introduced Document 304 on space-to-space allocation for the radionavigation-satellite service (agenda item 1.15.2), which contained a proposal to add a new footnote ADD S5.329A on the use of systems in the radionavigation-satellite service (space-to-space) operating in the bands 1 215-1 260 MHz and 1 559-1 610 MHz, the aim being to reflect a number of concerns that had emerged.

2.9 The **delegate of the United Arab Emirates** noted that the working group's report was to have contained a definition of the additional constraints that were referred to in the new footnote.

2.10 The **Chairperson of Working Group 5B** explained that the document did not contain that definition since its inclusion had not been formally requested at the last meeting. It was worded as follows: “The words “additional constraints” in footnote S5.329A are intended to indicate any constraints in addition to those which are applicable prior to the entry into force of the Final Acts of WRC-2000”.

2.11 The **Chairperson** said that the definition would be reproduced in the summary record of the meeting.

2.12 The **delegate of Canada** pointed out that agenda item 1.15.1 was also concerned with the allocation of frequency bands in the space-to-space direction to the radionavigation-satellite service and that it would be necessary to include in the proposed new footnote the additional frequency bands that would be allocated under that item.

2.13 The **Chairperson** proposed that footnote ADD S5.329A should be approved, but be placed between square brackets pending approval - and inclusion in that same footnote - of the additional frequency bands allocated under agenda item 1.15.1.

2.14 It was so **agreed**.

2.15 Document 304 was **approved**, subject to any additions which might be made to footnote ADD S5.329A.

Document 302

2.16 The **Chairperson of Working Group 5B** introduced Document 302, containing proposed modifications to Appendix S18 (Table of transmitting frequencies in the VHF maritimemobile band) under agenda item 1.18. Additional crosses had been placed in the “Single frequency” column under the heading “Port operations and ship movement”, and footnotes MOD *m*) and ADD *o*) were proposed. The latter footnote provided for, among other things, the possibility of the channels in question being used to provide bands for initial testing and the future introduction of new technologies.

2.17 Document 302 was **approved**.

Document 303

2.18 The **Chairperson of Working Group 5B** introduced Document 303, concerning modifications to Resolution 342 (Rev.WRC-97) on review of new technology to provide improved efficiency in the use of the band 156-174 MHz by stations in the maritime mobile service (agenda item 1.18). The proposed modifications were intended to emphasize the importance of interoperability among the new technologies and to serve as encouragement for completion of the studies undertaken by ITU-R.

2.19 The **delegate of Germany**, referring to the title of the resolution, proposed that the words “Review of” be deleted, and, in the English version, that “new technology” be replaced by “new technologies”. The **delegate of Canada** added that it would also be appropriate to put the word “technology” in *invites ITU-R e)* into the plural.

2.20 There being no objection, those proposed modifications were **approved**.

2.21 Document 303, as amended, was **approved**.

3 Report by the Chairperson of Working Group 5C (Documents 51(Add.1), 252, 257(Rev.1), 281, 283, 286, 287, 309 and 313)

3.1 The **Chairperson of Working Group 5C** said that three sub-working groups had been set up within Working Group 5C: Sub-Working Group 5C-1 had considered questions relating to agenda item 1.5, Sub-Working Group 5C-2 had examined those relating to items 1.16 and 1.17, and

Sub-Working Group 5C-3 had been concerned with questions relating to item 1.4.
Sub-Groups 5C-1 and 5C-2 had virtually completed their work.

Document 283

3.2 The **Chairperson of Working Group 5C** said that the working group had approved Document 283 on allocations above 71 GHz (agenda item 1.16), on the understanding that it would undergo a number of editorial amendments.

3.3 The **delegate of Australia** pointed out that in the amended version of the Table of Frequency Allocations above 71 GHz, the broadcasting service appeared in the band 84-86 GHz. However, the working group had decided to transfer it into the band 74-76 GHz. That oversight should therefore be remedied.

3.4 The **delegate of France** added that that would require the consequent amendment of footnote S5.561.

3.5 The **delegate of Japan** did not recall a decision to transfer the broadcasting service into the band 74-76 GHz having been taken.

3.6 The **Chairperson of Working Group 5C** said that the broadcasting-satellite service had been transferred into the band 74-76 GHz. It was because the “terrestrial” component of broadcasting was normally associated with the broadcasting-satellite service that it had seemed logical to transfer the broadcasting service as well to that same band.

3.7 The amended version of the Table of Frequency Allocations above 71 GHz, as amended, was **approved**.

3.8 The **delegate of Japan** said that his delegation reserved the right to revert to the matter on account of the problems which might arise as a result of frequency sharing between the broadcasting service and the broadcasting-satellite service in the band 74-76 GHz.

3.9 With regard to the footnotes to the table, the **delegate of France** reiterated that footnote S5.561 would have to be amended in order to include the broadcasting service.

3.10 The part of Annex 1 containing the footnotes was **approved,** taking account of the comment made by the delegate of France and the reservation made by the delegate of Japan.

3.11 Draft new Resolution [COM5/4] (WRC-2000) (Consideration by a future competent world radiocommunication conference of issues dealing with sharing and adjacent band compatibility between passive and active services above 71 GHz) was **approved**.

3.12 Draft new Resolution [COM5/5] (WRC-2000) (Consideration by a future competent world radiocommunication conference of issues dealing with sharing between active services above 71 GHz) was **approved**.

3.13 The **Chairperson** invited the committee to consider the ADD 5C2/S4.XXX at the end of Document 283.

3.14 The **delegate of Germany**, supported by the **delegate of the United Kingdom**, considered that provision to be superfluous.

3.15 The **delegates of India** and **Canada**, on the other hand, thought that it was important to draw Resolutions [COM5/4] and [COM5/5] to the attention of administrations introducing new services.

3.16 The **delegate of Algeria** proposed that an asterisk be inserted in Article S4 referring to a footnote drawing the attention of administrations to Resolutions [COM5/4] and [COM5/5].

3.17 After consultations between the delegations concerned, it was **decided** to add, after the *resolves* in Resolutions [COM5/4] and [COM5/5], a paragraph containing the main elements of ADD 5C2/S4.XXX and with the wording: "*urges administrations* to note the possibility of changes to Article S5 to accommodate emerging requirements of active services, as indicated in this resolution, and to take this into account in the development of national policies and regulations".

3.18 It was therefore **decided** to delete ADD 5C2/S4.XXX.

3.19 The whole of Document 283, as amended, was **approved**.

3.20 Document 283 having been **approved**, the **Chairperson of Working Group 5C** drew the committee's attention to Documents 51(Add.1) and 252, containing and reflecting, respectively, Malaysia's proposals regarding space stations with frequencies in the proposed modified bands, for which complete Appendix S4 coordination information or notification information was considered as having been received by the Bureau by the end of WRC-2000. Malaysia was requesting in particular that it be possible to resubmit the relevant Appendix S4 information, while retaining the original dates of receipt.

3.21 The **delegate of Malaysia** added that cost-recovery procedures should not apply to resubmitted coordination or notification information.

3.22 It was **decided** to bring Documents 51(Add.1) and 252 to the attention of Committee 4.

Document 286

3.23 The **Chairperson of Working Group 5C** stated that Document 286 was concerned with worldwide allocation for the Earth exploration-satellite (passive) and space research services in the band 18.6-18.8 GHz (agenda item 1.17).

3.24 The **delegate of the United Kingdom** felt that the second sentence of ADD S5.522B was not necessary and might contradict the first sentence inasmuch as it did not seem to be binding in nature. He therefore proposed that it be deleted. He was supported by the **delegates of Germany** and **the United States**.

3.25 It was so **agreed**.

3.26 The **delegate of France** did not oppose that decision but would have liked to retain the idea of appropriate limits for other types of system in the band 18.6-18.8 GHz.

3.27 Document 286, as amended, was **approved**.

3.28 The **delegate of the United Arab Emirates** said that his delegation, which had been unable to participate in the work of Working Group 5C, reserved the right to revert at a later stage to the matters the group had discussed.

Document 257(Rev.1)

3.29 The **Chairperson of Working Group 5C** introduced Document 257(Rev.1), which brought together Documents 214(Rev.1) and 236 and came under agenda item 1.14.

3.30 The **delegate of Spain** asked for the three language versions of footnotes S21.16.10 and S5.547A to be aligned.

3.31 The **delegate of France** proposed that the first sentence of footnote S5.547A be maintained since it identified the band 31.8-33.4 GHz.

3.32 Document 257(Rev.1) was **approved**, taking account of the proposed amendments.

Document 287

3.33 The **Chairperson of Working Group 5C** introduced Document 287, still under agenda item 1.4, and asked that, at the request of certain delegations, the following text be included in the summary record of the meeting: "The maximum power density of –26 dB(W/MHz) was a compromise value accepted reluctantly by the majority. Any changes to the agreed upon footnote could cause the good will of the involved parties to evaporate and result in a need to revisit the issue".

3.34 With that statement, Document 287 was **approved**.

Document 281

3.35 The **Chairperson of Working Group 5C** introduced Document 281 containing the draft revision of Resolution 122 on use of the bands 47.2-47.5 GHz and 47.9-48.2 GHz by high altitude platform stations (HAPS) in the fixed service and by other services and the potential use of bands in the range 18-32 GHz by HAPS in the fixed service.

3.36 The **delegate of Canada** proposed that in *considering o)*, the words "for Region 3" should be added after the words "the range 18-32 GHz has been proposed for possible identification of additional spectrum".

3.37 The **delegate of Russia** proposed that the references to footnotes S5.5SSS and S5.5RRR, which had not yet been adopted, should be placed in square brackets.

3.38 At the request of the **delegate of Spain**, the **Chairperson** proposed the creation of a *requests ITU-R*, which would incorporate paragraphs 3, 4 and 5 of the current *resolves*.

3.39 The **delegate of Germany** felt it was important to make it clear that the studies requested of ITU-R would have to be completed in time for their findings to be studied, under a separate agenda item, by WRC-03.

3.40 The **Chairperson** proposed that *resolves* 6 should be reformulated accordingly.

3.41 The draft revision of Resolution 122 (WRC-97) was **approved**, taking account of the proposed amendments.

Document 313

3.42 The **Chairperson of Working Group 5C** introduced Document 313 containing draft new Resolution [COM5/14] (WRC-2000) (Feasibility of use of high altitude platform stations in the fixed and mobile services in the frequency bands above 3 GHz allocated exclusively for terrestrial radiocommunications).

3.43 The **delegate of Canada** proposed that the *resolves* should be reformulated to indicate that the results of the ITU-R studies would have to be examined by WRC-03.

3.44 The **delegate of Morocco** having stated that, under the Convention, a WRC could only make recommendations to, and not requests of, the following WRC, the **Chairperson** proposed that the paragraph should begin with the words: "*resolves* to recommend to WRC-03 that it consider the feasibility of facilitating …".

3.45 Draft new Resolution [COM5/14] (WRC-2000), as amended, was **approved**.

Document 309

3.46 The **Chairperson of Working Group 5C** introduced Document 309 containing draft new Resolution [COM5/11] (Development of the technical basis for determining the coordination area for a deep space receiving earth station in the space research service (SRS), with transmitting high-density applications in the fixed service in the 31.8-32.3 GHz and 37-38 GHz bands).

3.47 Referring to the liaison statement to Working Group 4A from Working Group 5C on the first page of the document under consideration, the **Chairperson** said that he did not favour combining draft new Resolution [COM4/1] with draft new Resolution [COM5/11], as the second draft was more ephemeral in nature than the first.

3.48 The **delegate of Canada** endorsed that position, pointing out that the purpose of draft Resolution [COM4/1] was to set up a mechanism for enabling Appendix S7 to be updated as needed. The results of the studies carried out by ITU-R, including the study provided for in draft new Resolution [COM5/11], would be used, under the procedure laid down by draft Resolution [COM4/1], to update Appendix S7. For her, the question of whether the results of the study referred to in draft Resolution [COM5/11] should be examined by a future conference did not arise.

3.49 Draft new Resolution [COM5/11] was **approved**.

The meeting rose at 1230 hours.

The Secretary: J. LEWIS	The Chairperson: Chris Van DIEPENBEEK

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

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24 May 2000
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ISTANBUL, 8 MAY – 2 JUNE 2000

COMMITTEE 5

Chairperson, Working Group 5B

REPORT TO COMMITTEE 5

(AGENDA ITEM 1.9)

In compliance with the direction by Committee 5, Working Group 5B completed the task with respect to technical work on possible new MSS allocation under agenda item 1.9. This report consists of three annexes as the output of the task accomplished under the following terms of reference: 1) identification of ITU-R technical studies regarding a potential sharing of MSS downlinks in the band 1 518-1 525 MHz, 2) investigation of a technical basis for sharing, 3) review of Resolution 213, and 4) consideration of S5. Annex 1 includes a table summarizing ITU-R study results and Recommendations together with comments and views on a technical basis. Views are diversified on sufficiency of the technical basis for sharing. Annexes 2 and 3 provide draft new Resolutions for sharing studies of MSS for both the downlink and the uplink, respectively. These annexes include a number of square brackets and present diversified views. The annexes are a collection of information as an output of the work of Sub-Working Group 5B-3, which has not been discussed nor approved at the Working Group 5B meetings. This technical material is submitted to Committee 5 for information to facilitate further work on agenda item 1.9.

Working Group 5B reached an agreement on NOC for the band 1 559-1 567 MHz as reported in Document 344. As a continuation of its work under agenda item 1.9, Working Group 5B reviewed Resolutions 220 and 213. Resolution 220 was considered first and there was general support for suppressing it. Nevertheless, there was also opposition to the immediate suppression because the discussion of agenda item 1.9 has not been concluded. Due to the same reason, it was considered still too early to make any decision on Resolution 213. Working Group 5B reports the outcome on this issue for further consideration and decision at the meeting of Committee 5.

T. MIZUIKE
Chairperson, Working Group 5B

ANNEX 1

MSS downlink in the band 1 518-1 525 MHz; Summary of relevant ITU-R Recommendations

Purpose

To identify ITU-R technical studies regarding the potential for sharing of MSS downlinks in the band 1 518-1 525 MHz with other services identified in Article S5.

To ascertain if there is a technical basis for sharing.

Definition of technical basis:

The technical basis should provide quantitative guidelines for feasibility of sharing, coordination and protection of relevant services.

The methodology for calculating the above should be based on:

a) Agreed frameworks contained within ITU-R Recommendations;

b) Technical parameters of relevant services.

Region	Services (footnotes)	Relevant Recommendations	Technical Basis	Comments
1	AERONAUTICAL MOBILE S5.342	Appendix S5 M.1459	View #1 No. Further studies are required in relation to sharing between the MSS and these services. View #2 Sharing between the MSS and the aeronautical	View #1: Recommendation ITU-R M.1459 provides criteria that could be used as a technical basis as part of a coordination between an administration operating aeronautical mobile telemetry and another proposing to operate a GSO mobile-satellite system. During coordination, specific systems are studied and the involved administrations arrive at agreed parameters and protection for the respective systems. However, the satellite downlink proposed for 1 518-1 525 MHz can potentially impact more than one Region and many administrations simultaneously. It is firmly believed that general studies of the feasibility of sharing between aeronautical mobile telemetry (operated worldwide by a number of widespread countries) and the mobile-satellite service must be completed in the ITU-R before a conclusion can be reached as to the technical basis for an allocation for such a downlink. View #2: ITU-R Recommendation M.1459 protection criteria leads to the conclusion that co-frequency, co-coverage operation of the mobile-satellite service (space-to-Earth) and aeronautical telemetry is not possible. However, the Recommendation also leads to the conclusion that co-frequency operation over sufficiently isolated areas would be possible with state-of-the-art mobile satellites, since the pfd over any given

			mobile service is feasible if the relevant ITU-R Recommendations and coordination procedures are applied successfully.	part of the Earth can be controlled as desired. The ability to allocate an identified sub-band to any spot beam of a satellite having a couple of hundred of such narrow beams already exists. Thus it is considered to be perfectly feasible to use these frequencies to provide mobile-satellite services to areas sufficiently separated from aeronautical telemetry receiving sites. It is believed that ITU-R Recommendation M.1459 provides enough guidance to extend these mobile-satellite service allocations to Region 1 & 3. To afford protection to the aeronautical telemetry systems of administrations in Regions 1&3 footnote S5.348 could be modified to include a reference to S5.342 as well as S5.343. A global MSS allocation thus can be made while ensuring protection of aeronautical telemetry receivers worldwide.
1,2,3	FIXED S5.343 S5.344	Appendix S5 F.758-1 F.755-2 F.759 F.1094-1 F.1107 F.1108 F.699(Rev.5) F.1245 F.1246 M.1141 M.1142 M.1471 M.1143	Sharing between the MSS and the fixed service is feasible if the relevant ITU-R Recommendations and coordination procedures are applied successfully. A regulatory provision enabling administrations to initiate coordination at other appropriate pfd levels in these bands should be developed through a resolution	Recommendation ITU-R M.1141-1 provides coordination thresholds for stations in the fixed service with respect to non-GSO MSS. Recommendation ITU-R M.1142-1 provides coordination thresholds for stations in the fixed service with respect to GSO MSS. Recommendation ITU-R F.755-2 details examples of technical characteristics for point-to-multipoint systems in the fixed service. Recommendation ITU-R F.758-1 considers the development of criteria for sharing between the fixed service and other services. **Article S9 and Appendix S5** Coordination methodology for mobile-satellite service (space-to-Earth) transmissions with terrestrial Fixed services has existed for a long time in the Radio Regulations and several ITU-R Recommendations address this issue. This methodology is based on coordination thresholds derived to protect the Fixed service systems. These thresholds have been incorporated in the Radio Regulations (Appendix S5). If the coordination threshold is exceeded, coordination is carried out as per relevant provisions of Article S9. However, a regulatory provision enabling administrations to initiate coordination at other appropriate pfd levels in these bands should be developed through a resolution.

1	MOBILE except aeronautical mobile S5.341	Appendix S5 M.1388 M.1141 M.1142	Sharing between the MSS and the mobile service is feasible if the relevant coordination procedures are applied successfully.	ITU-R M.1388 specifies a coordination threshold for protection of mobile services in the band 1 452-1 492 MHz. The same level is incorporated in footnote S5.348A, which relates to the band 1 492-1 525 MHz for protection of the mobile service in Japan and is also referred to in Appendix S5. This coordination threshold, which is based on the sensitivity parameters of the mobile service system in Japan, would be as much applicable for a Region 1&3 MSS allocation as for the existing Region 2 mobile-satellite service allocation. With respect to terrestrial service interference into mobile earth station terminals, administrations could choose to limit the use of these mobile-satellite service allocations to land mobile-satellite service, in order to afford regulatory protection to the mobile-satellite service.
2	MOBILE aeronautical S5.343	Appendix S5 M.1459	View #1 No. Further studies are required in relation to sharing between the MSS and these services. View #2 Sharing between the MSS and the aeronautical mobile service is feasible if the relevant ITU-R Recommendations and coordination procedures are applied successfully	View #1: Recommendation ITU-R M.1459 provides criteria that could be used as a technical basis as part of a coordination between an administration operating aeronautical mobile telemetry and another proposing to operate a GSO mobile-satellite system. During coordination, specific systems are studied and the involved administrations arrive at agreed parameters and protection for the respective systems. However, the satellite downlink proposed for 1 518-1 525 MHz can potentially impact more than one Region and many administrations simultaneously. It is firmly believed that general studies of the feasibility of sharing between aeronautical mobile telemetry (operated worldwide by a number of widespread countries) and the mobile-satellite service must be completed in the ITU-R before a conclusion can be reached as to the technical basis for an allocation for such a downlink. View #2: ITU-R Recommendation M.1459 protection criteria leads to the conclusion that co-frequency, co-coverage operation of the mobile-satellite service (space-to-Earth) and aeronautical telemetry is not possible. However, the Recommendation also leads to the conclusion that co-frequency operation over sufficiently isolated areas would be possible with state-of-the-art mobile satellites, since the pfd over any given part of the Earth can be controlled as desired. The ability to allocate an identified sub-band to any spot beam of a satellite having a couple of hundred of such narrow beams already exists. Thus it is considered to be perfectly feasible to use these frequencies to provide mobile-satellite services to areas sufficiently separated from aeronautical telemetry receiving sites. It is believed that ITU-R Recommendation M.1459 provides enough guidance to extend these mobile-satellite service allocations to Region 1 & 3. To afford protection to the aeronautical telemetry systems of administrations in Regions 1&3 footnote S5.348 could be modified to include a reference to S5.342 as well as S5.343. A global MSS allocation thus can be made while ensuring protection of aeronautical telemetry receivers worldwide.

2,3	MOBILE S5.344 S5.348A	Appendix S5 M.1388	Sharing between the MSS and the mobile service is feasible if the relevant coordination procedures are applied successfully. The pfd level specified in footnote S5.384A should be decreased by several dB provisionally. It is recognised that further studies are required.	ITU-R M.1388 specifies a coordination threshold for protection of mobile services in the band 1 452-1 492 MHz. The same level is incorporated in footnote S5.348A, which relates to the band 1 492-1 525 MHz for protection of the mobile service in Japan and is also referred to in Appendix S5. This value is calculated as a single entry pfd value from Region 2. This single entry coordination threshold, which is based on the sensitivity parameters of the mobile service system in Japan, would be as much applicable for a Region 1&3 MSS allocation as for the existing Region 2 mobile-satellite service allocation. With respect to terrestrial service interference into mobile earth station terminals, administrations could choose to limit the use of these mobile-satellite service allocations to land mobile-satellite service, in order to afford regulatory protection to the mobile-satellite service.
2, JPN	MOBILE SATELLITE (s-E) S5.348 S5.348A	Appendix S5 M.1183 M.1086 M.1089 M.1091 M.1038 M.1186 M.1184		
1,2,3	EXTRA-TERRESTRIAL S5.341	Appendix S5		

Footnotes:

S5.341 In the bands 1 400-1 727 MHz, 101-120 GHz and 197-220 GHz, passive research is being conducted by some countries in a programme for the search for intentional emissions of extraterrestrial origin.

S5.342 *Additional allocation:* in Belarus, Russian Federation and Ukraine, the band 1 429-1 535 MHz is also allocated to the aeronautical mobile service on a primary basis exclusively for the purposes of aeronautical telemetry within the national territory. As of 1 April 2007, the use of the band 1 452-1 492 MHz is subject to agreement between the administrations concerned.

S5.343 In Region 2, the use of the band 1 435-1 535 MHz by the aeronautical mobile service for telemetry has priority over other uses by the mobile service.

S5.344 *Alternative allocation:* in the United States, the band 1 452-1 525 MHz is allocated to the fixed and mobile services on a primary basis (see also No. **S5.343**).

S5.348 The use of the band 1 492-1 525 MHz by the mobile-satellite service is subject to coordination under No. **S9.11A**. However, no coordination threshold in Article **S21** for space stations of the mobile-satellite service with respect to terrestrial services shall apply to the situation referred to in No. **S5.343**. With respect to the situation referred to in No. **S5.343**, the requirement for coordination in the band 1 492-1 525 MHz will be determined by band overlap.

S5.348A In the band 1 492-1 525 MHz, the coordination threshold in terms of the power flux-density levels at the surface of the Earth in application of No. **S.9.11A** for space stations in the mobile-satellite (space-to-Earth) service, with respect to the land mobile service use for specialized mobile radios or used in conjunction with public switched telecommunication networks (PSTN) operating within the territory of Japan, shall be -150 dB(W/m^2) in any 4 kHz band for all angles of arrival, instead of those given in Table **S5-2** of Appendix **S5.** The above threshold level of the power flux-density shall apply until it is changed by a competent world radiocommunication conference.

ANNEX 2

RESOLUTION [COM5/AB] (WRC-2000)

[Possible] [U]/[u]se of the frequency band 1 518 - 1 525 MHz by the mobile-satellite service (Regions 1 and 3)

The World Radiocommunication Conference (Istanbul, 2000),

considering

a) that WRC-2000 [considered proposals for]/[added] an allocation to the mobile-satellite service (space-to-Earth) in Regions 1 and 3 in the frequency band 1 518-1 525 MHz;

b) that the frequency band 1 518-1 525 MHz is allocated to the fixed service on a [co-]primary basis in all three Regions, to the mobile service on a [co-]primary basis in Regions 2 and 3, and to the mobile service except aeronautical mobile on a [co-]primary basis in Region 1;

c) that in Belarus, Russian Federation and Ukraine, the band 1 429-1 535 MHz is allocated to the aeronautical mobile service on a primary basis exclusively for the purposes of aeronautical telemetry within the national territory by the provisions of **S5.342**;

d) that in Region 2, the use of the band 1 435-1 535 MHz by the aeronautical mobile service for telemetry has priority over other uses by the mobile service by the provisions of **S5.343**;

e) that, as an alternative allocation in the United States, the band 1 452-1 525 MHz is allocated to the fixed and mobile services on a primary basis (see also No. **S5.343**) under the provisions of **S5.344**;

f) that there has been further development of point-to-multipoint systems in the fixed service since the time of ITU-R studies that formed the basis for the power-flux-density (pfd) values for use as coordination thresholds for protection of fixed service systems in the band 1 492-1 525 MHz that are contained in Appendix **S5**;

g) that there is a need to review the pfd values in Appendix **S5** to ensure that they are adequate to protect these new point-to-multipoint systems operating in the fixed service;

h) that the [added]/[proposed] allocation to the mobile-satellite service (space-to-Earth) is intended for satellite downlink operations, which due to their potentially widespread emissions upon the Earth from either geostationary or non-geostationary systems, could have an impact upon the terrestrial mobile service, to include aeronautical mobile and aeronautical mobile telemetry, in all three Regions;

[*i)* that there are no ITU-R Recommendations or considerations within the CPM Report on the technical, regulatory or procedural matters to be considered by WRC-2000 regarding the feasibility of sharing between the MSS and existing aeronautical mobile telemetry operations,]

recognizing

a) that Recommendation ITU-R F.1338, for an adjacent frequency band, includes an allowance for consideration of pfd values other than those specified therein for use as coordination thresholds for the fixed service;

b) that Recommendation ITU-R M.1459 contains criteria for the protection of aeronautical mobile telemetry with respect to geostationary satellites in the mobile-satellite service;

c) that additional information on the characteristics of systems in both the mobile-satellite service and aeronautical mobile telemetry would facilitate studies on sharing between these services,

resolves to invite ITU-R

1 as a matter of urgency, to study [the feasibility of] sharing between the mobile-satellite service and aeronautical mobile telemetry in all Regions in the band 1 518-1 525 MHz, whilst meeting the protection criteria for the latter service as given in Recommendation ITU-R M.1459;

2 as a matter of urgency, to review the pfd levels used as coordination thresholds for MSS (space-to-Earth) with respect to the protection of point-to-multipoint FS systems in the band 1 518-1 525 MHz in Regions 1 and 3, taking into account the work already done in ITU-R Recommendations M.1141 and M.1142 and the characteristics of FS systems contained in ITU-R Recommendations F.755-2 and F.758-1, and the sharing methodologies contained in ITU-R Recommendations F.758-1, F.1107 and F.1108;

3 to bring the results of these studies to the attention of the next competent world radiocommunication conference [WRC-03],

further resolves[*]

that the following procedure should provisionally apply for coordination between the mobile-satellite service and the fixed service in the band 1 518-1 525 MHz in Regions 1 and 3, before studies referred to in *resolves* 2 are completed:

– under **S9.36.1**, the Bureau will publish the information list of administrations identified using the coordination threshold limits given in Appendix **S5**;

– following receipt of the Weekly Circular referring to requests for coordination, an administration believing that the coordination threshold of Appendix **S5** is not sufficient to protect their stations of the fixed service it should, within four months of the date of publication of the relevant Weekly Circular, inform the initiating administration and the Bureau. The Bureau should then include that administration in the request,

urges administrations

to participate actively in these studies with the involvement of terrestrial and satellite interests.

[*] This *further resolves* will not apply in the case that an allocation to the mobile-satellite service in the band 1 518-1 525 MHz is not made by WRC-2000.

ANNEX 3

RESOLUTION [COM5/CD] (WRC-2000)

Sharing studies concerning the [possible] use of the band 1 683-1 690 MHz by the mobile-satellite service

The World Radiocommunication Conference (Istanbul, 2000),

considering

a) that ITU-R has established that in order to meet projected MSS requirements in the frequency range 1 to 3 GHz, in the order of 2 times 123 MHz of spectrum will be required by 2005 and 2 times 145 MHz will be required by 2010;

b) [that WRC-2000 considered proposals for an allocation of 1 683-1 690 MHz to the MSS (Earth-to-space) in Regions 1 and 3 and suppression of the Region 2 MSS allocations in 1 675-1 683 MHz and 1 690-1 710 MHz]/[that WRC-2000 allocated the band 1 683-1 690 MHz to the MSS (Earth-to-space) in Regions 1 and 3 and suppressed the MSS allocations in Region 2 in the ranges 1 675-1 683 MHz and 1 690-1 710 MHz];

c) that the band 1 683-1 690 MHz is mainly used by meteorological-satellite (MetSat) and meteorological aids (MetAids) services;

d) that while there are only a limited number of main MetSat stations operated in this band in all three Regions, there are a large number of meteorological satellite earth stations operated in Regions 2 and 3 and the locations of many of these stations are unknown;

e) that there is an increase in use of these stations in Regions 2 and 3 by government, commercial and private users for public safety and enhancement of national economies;

f) that sharing between MetSat and MSS in the band 1 675-1 690 MHz is feasible if appropriate separation distances are maintained pursuant to coordination under **S9.11A**;

g) that sharing may not be feasible in those countries where a large number of MetSat stations are deployed;

h) that ITU-R Recommendation SA.1158-2 indicates that additional study is required to determine the criteria for coordination between MSS, and the MetSat service for GVAR/S-VISSR stations operated in 1 683-1 690 MHz in Regions 2 and 3;

i) that sharing of the band between MSS and MetSat in the band 1 690-1 710 MHz is not feasible;

j) that co-channel sharing between MSS and MetAids is not feasible;

k) that co-frequency sharing between MetAids and MetSat services is not feasible;

l) WMO identified future requirements for MetAids operations as 1 675-1 683 MHz, however some administrations will continue to require spectrum in the range 1 683-1 690 MHz for MetAids operations;

m) that [possible] MSS operation should not constrain current and future development of the MetSat service as specified in **S5.377**;

[*n)* that at WRC-2000 new coordination distance parameters were adopted which will require a review of assumptions made in earlier ITU-R studies,]

noting

that further study is not required regarding sharing between the services identified in the *considerings* above and the MSS in the band 1 675-1 683 MHz and 1 690-1 710 MHz,

requests

1 ITU-R, as a matter of urgency, and in time for WRC-03, to complete the technical and operational studies on [the feasibility of] sharing between MSS and MetSat by determining appropriate separation distances between mobile earth stations and MetSat stations, including GVAR/S-VISSR stations, in the band 1 683-1 690 MHz as stated in ITU-R Recommendation SA.1158-2;

2 ITU-R to assess, with the participation of WMO, the current and future spectrum requirements of the MetAids service taking into account improved characteristics, and of the MetSat service in the band 1 683-1 690 MHz taking into account future developments,

resolves to invite

1 administrations and interested parties (e.g. WMO) to participate actively in such studies, by submitting relevant contributions;

[2 a future competent WRC to consider allocating the band 1 683-1 690 MHz to the MSS (Earth-to-space) and suppressing the allocation to the MSS in Region 2 in the bands 1 675-1 683 MHz and 1 690-1 710 MHz],

instructs the Secretary General

to bring this Resolution to the attention of WMO.

[Required regulatory provisions for the addition of a Regions 1 and 3 MSS (Earth-to-space) allocation in the band 1 683-1 690 MHz

ADD

S5.YYY Mobile-satellite systems using the band 1 683-1 690 MHz shall not cause harmful interference to nor constrain the development of the meteorological-satellite and meteorological-aids services. To avoid causing harmful interference, mobile earth stations shall not operate, except in a non-interfering signalling channel, within the exclusion zones around the meteorological earth stations. The mobile-satellite system shall have position determination capabilities to ensure compliance with this provision and the use of this band is subject to coordination under No. **S9.11A**.

SUP

S5.377]

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

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COMMITTEE 5

Working Group 5D

MOD ASP/20/147

S5.491 *Additional allocation:* in Region 3, the band 12.2-12.5 GHz is also allocated to the fixed-satellite (space-to-Earth) service on a primary basis~~, limited to national and sub-regional systems~~. The power flux-density limits in Article **S21**, Table **S21-4** shall apply to this frequency band. The introduction of the service in relation to the broadcasting-satellite service in Region 1 shall follow the procedures specified in Article 7 of Appendix **S30**, with the applicable frequency band extended to cover 12.2-12.5 GHz.

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

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COMMITTEE 5

Chairperson, Working Group 5D

RESOLUTION [COM5/23] (WRC-2000)

Procedures in case the operational or additional limits in Article S22 are exceeded

The World Radiocommunication Conference (Istanbul, 2000),

considering

a) that WRC-2000 adopted in Article **S22** single-entry operational limits (see Tables **S22-4A** through **S22-4C**) and single-entry additional operational limits (see Table **S22-4A1**), applicable to non-geostationary-satellite systems in the fixed-satellite service in the space-to-Earth direction in certain parts of the frequency range 10.7-20.2 GHz;

b) that, taking into account **S22.5[H]** and **S22.5[I]**, any exceedence of the limits referred to in *considering a)* by a non-geostationary system in the fixed-satellite service to which the limits apply is a violation of No. **S22.2** of the Radio Regulations;

c) that ITU-R has identified the need for specific procedures that correct in the most expeditious manner any exceedence of the limits in *considering a)*, by the inclusion of appropriate procedures in the Radio Regulations;

d) that the growth in use of non-geostationary satellites is unlikely to lead to many cases of exceedence of the limits mentioned in *considering a)* before WRC-03,

resolves

that further study is needed to develop procedures suitable for application in the long term,

requests ITU-R

taking into consideration the guidelines in Annex 1, to conduct, as a matter of urgency, and complete in time for consideration by WRC-03, the appropriate regulatory studies to develop procedures, not limited to modification of Article **S15**, for application in cases where the power limits mentioned in *considering a)* are exceeded into an operational earth station.

ANNEX 1 TO RESOLUTION [COM5/23] (WRC-2000)

Guidelines for the development of procedures for assuring compliance with single-entry operational and additional operational limits in Section II of Article S22

1 It is essential that Member States ‡ exercise the utmost goodwill and mutual assistance in the application of the provisions of Article 45 of the Constitution and of these procedures to the settlement of problems stemming from $epfd_{down}$ interference from non-GSO fixed-satellite service systems in excess of the operational limits given in Tables **S22-4A, S22-4B,** and **S22-4C,** and/or the additional operational limits given in Table **S22-4A1** ("excess $epfd_{down}$ interference").

2 In the settlement of these problems, due consideration shall be given to all factors involved, including the relevant technical and operating factors.

3 For the purpose of these procedures, the term "administration" may include the centralizing office designated by the administration, in accordance with No. **S16.3**.

5 Administrations shall cooperate in the detection and elimination of excess $epfd_{down}$ interference.

6 Where practicable, and subject to agreement by administrations concerned, the case of excess $epfd_{down}$ interference may be dealt with directly between their operating organizations.

7 When a case of excess $epfd_{down}$ interference is reported by a receiving GSO earth station associated with a transmitting space station, which excess $epfd_{down}$ interference cannot be accepted by the affected administration, the affected administration should first attempt to identify the source of the excess $epfd_{down}$ interference.

8 If the administration having jurisdiction over the receiving earth station has difficulty in determining the source or characteristics of the excess $epfd_{down}$ interference:

a) It may send a request for cooperation to all administrations responsible for non-GSO FSS systems with overlapping frequency assignments that have been brought into use, providing all relevant details. A copy of any such request shall be sent to Bureau.

b) Upon receipt of such a request, each administration shall, as soon as possible, acknowledge receipt and send to the requesting administration within 15 days, with a copy to the Bureau, the information that may be used to identify the source of the problem. Such acknowledgement shall not constitute acceptance of responsibility.

c) If an administration fails to respond within 15 days, the affected administration may request the assistance of the Bureau, in which case Bureau shall immediately send a fax to the administration responsible for the non-GSO system, requesting action within an additional 15 days.

d) If the administration fails to respond to the Bureau within the time period established in § 8c) above, the Bureau shall enter a remark in the Remarks column of the Master Register against the relevant frequency assignments of the subject non-GSO FSS system to the effect that the responsible administration did not respond to a request for cooperation regarding an unresolved complaint of excess $epfd_{down}$ interference.

9 Once the administration having jurisdiction over the receiving GSO earth station identifies the source(s) of the excess $epfd_{down}$ interference, the affected administration may send a letter, by fax or other mutually agreed electronic means, to the administration(s) concerned and request immediate corrective action. It shall give all useful information in order that the responding administration(s) may take such steps as may be necessary to reduce the interference to the $epfd_{down}$ levels required in Table **S22-4A, S22-4A1, S22-4B,** or **S22-4C,** as appropriate, or to a higher level that is acceptable to the administration having jurisdiction over the receiving GSO earth station that is being interfered with.

10 Upon receipt of such a request, an administration shall acknowledge receipt to the requesting administration within 15 days, with a copy to the Bureau. Such acknowledgement shall not constitute acceptance of responsibility.

11 Within 15 days after receipt of a request for corrective action pursuant to § 8 above, the administration receiving the request shall either:

a) provide the requesting administration and the Bureau with information indicating that no non-geostationary FSS system for which it is responsible could have caused the excess $epfd_{down}$ interference experienced by the receiving GSO earth station; or

b) acknowledge responsibility for causing the excess $epfd_{down}$ interference and immediately reduce emissions of the interfering system into the affected receiving GSO earth station to the $epfd_{down}$ levels required in Table **S22-4A, S22-4A1, S22-4B,** or **S22-4C,** as appropriate.

In either case, a copy of the action taken shall be sent to the Bureau.

12 If an administration fails to respond within 15 days, the affected administration may request the assistance of the Bureau, in which case the Bureau shall immediately send a fax to the administration responsible for the non-GSO system, requesting action within an additional 15 days.

13 If the administration fails to respond to the Bureau within the time period established in § 12 above, the Bureau shall enter a remark in the Remarks column of the Master Register against the relevant frequency assignments of the subject non-GSO FSS system to the effect that the responsible administration did not respond to a request for cooperation regarding an unresolved complaint of excess $epfd_{down}$ interference.

14 If an administration acknowledges responsibility for causing the excess $epfd_{down}$ interference pursuant to § 11*b)* above, but fails to immediately reduce emissions of the interfering system as required:

a) The interfering administration shall have an additional 10 days to take the necessary action to correct the excess $epfd_{down}$ interference situation pursuant to No. **S15.21** of the Radio Regulations.

b) If, after the 10 day period, the interfering administration still has not reduced emissions of the interfering system as required, the Bureau shall enter a remark in the Remarks column of the Master Register against the relevant frequency assignments of the subject non-GSO FSS system to the effect that the use of the affected frequency bands by the interfering system is in violation of Nos. **S22.2** and **S22.5I** of the Radio Regulations. Notice of the entry of the remark shall be included in the Weekly Circular.

16 The Bureau shall retain any entry in the Remarks column of the Master Register made pursuant to § 8*d)*, § 13 or § 15 above shall remain in place until such time as the non-responding administration responds and/or remedies the excess $epfd_{down}$ interference, as appropriate.

17 If it is considered necessary, and particularly if the steps taken in accordance with the procedures described above have not produced satisfactory results, the administration concerned shall forward details of the case to the Bureau for its information.

18 In such a case, the administration concerned may also request the Bureau to act in accordance with the provisions of Section I of Article **S13**; but it shall then supply the Bureau with the full facts of the case, including all the technical and operational details and copies of the correspondence.

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WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

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COMMITTEE 5

Chairperson, Working Group 5D

RESOLUTION 538

The drafting group noted that:

a) provisions are required to make it mandatory for non-GSO networks field between WRC-97 and WRC-2000 to supply the supplementary information necessary for BR to review its findings;

b) it is extremely important to ensure that there are no gaps in the coverage of the regulatory provisions of WRC-97 and WRC-2000.

ANNEX 1

ADD (To be included in the WRC-2000 Resolution concerning transitional arrangements)

resolves

1.1 that a non-GSO FSS system for which complete coordination or notification information, as appropriate, is considered as having been received after 22 November 1997 with assignments in the frequency bands covered by Appendices **30** and **30A** shall comply with the limits specified in Article **S22**, as revised, by WRC-2000, relating to the non-GSO FSS system (in the bands covered by Appendices **30** and **30A**, no advance publication, coordination or notification information for non-GSO FSS systems shall be considered as having a date of receipt before 22 November 1997);

ADD (To be included in the WRC-2000 Resolution concerning transitional arrangements)

instructs the Radiocommunication Bureau

as of the end of WRC-2000, to review and, if appropriate, revise, any finding previously made on the compliance with the limits contained in Article **S22** of a non-GSO FSS system for which complete coordination or notification information, as appropriate, has been received between 22 November 1997 and the end of WRC-2000. This review shall be based on the limits in Article **S22**, as revised, by WRC-2000.

ANNEX 2

MOD

S5.520 The use of the band 18.1-18.4 GHz by the fixed-satellite service (Earth-to-space) is limited to feeder links for the broadcasting-satellite service using the geostationary-satellite orbit.*

S5.516 The use of the band 17.3-18.1 GHz by geostationary-satellite systems in the fixed-satellite service (Earth-to-space) is limited to feeder links for the broadcasting-satellite service. For the use of the band 17.3-17.8 GHz in Region 2 by feeder links for the broadcasting-satellite service in the band 12.2-12.7 GHz, see Article **S11**. The use of the bands 17.3-18.1 GHz (Earth-to-space) in Regions 1 and 3 and 17.8-18.1 GHz (Earth-to-space) in Region 2 by non-geostationary-satellite systems in the fixed-satellite service is subject to the application of the provisions of ~~Resolution **538 (WRC-97)**~~MOD **S9.10** for coordination between non-geostationary-satellite systems in the fixed-satellite service. In these bands, non-geostationary-satellite systems in the fixed-satellite service shall not claim protection from geostationary-satellite networks in the fixed-satellite service. The use of the band 17.3-17.8 GHz in Region 2 by systems in the fixed-satellite service (Earth-to-space) is limited to geostationary satellites. Non-geostationary FSS systems in the above bands shall be operated in such a way that any unacceptable interference that may occur during their operation shall be rapidly eliminated.

* In the absence of ITU-R studies, some administrations believed that NOC was appropriate.

SUP

RESOLUTION 538 (WRC-97)

Use of the frequency bands covered by Appendices S30/30 and S30A/30A by non-geostationary-satellite systems in the fixed-satellite service

ANNEX 3

RESOLUTION [COM5/17]

Possible identification of spectrum for non-GSO FSS (Earth-to-space) gateway type operations

The World Radiocommunication Conference (Istanbul, 2000),

considering

a) that WRC-2000 adopted epfd_{up} limits that apply to non-GSO FSS in the Earth-to-space direction in portions of the 10.7-30 GHz band, including the 17.3-17.8 GHz band in Regions 1 and 3;

b) that WRC-2000 decided that due to incompatibilities in the 17.3-17.8 GHz band between non-GSO FSS (Earth-to-space) and existing and planned operations (including broadcasting-satellite and radiolocation services), non-GSO FSS (Earth-to-space) operations are not allowed in Region 2 in this band;

c) that in the 10-30 GHz band, the amount of spectrum identified for use by non-GSO FSS Earth-to-space transmission is limited compared to the amount of spectrum for the space-to-Earth transmission;

d) that non-GSO FSS systems may need additional spectrum in the Earth-to-space direction for very low density gateway type operations that could be constrained minimum antenna diameter,

resolves to instruct ITU-R

to study the necessity and suitability of frequency bands for non-GSO FSS (Earth-to-space) gateway operation outside those bands allocated to the non-GSO FSS subject to **S9.11A**, on the basis of the compatibility between this type of non-GSO FSS operation and existing and planned services in these bands,

instructs the Director of the Radiocommunication Bureau

to report the results of these studies to a future competent WRC.

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

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ISTANBUL, 8 MAY – 2 JUNE 2000

COMMITTEE 3

SUMMARY RECORD

OF THE

SECOND MEETING OF COMMITTEE 3 (BUDGET CONTROL)

Wednesday, 24 May 2000, at 0930 hours

Chairperson: Mr B. GRACIE (Canada)

Subjects discussed		**Documents**
1	Situation of the accounts of WRC-2000 as at 22 May 2000	369

1 Situation of the accounts of WRC-2000 as at 22 May 2000 (Document 369)

1.1 The **Secretary**, introducing Document 369, pointed out that conference expenditure was within the limits of the budget, which, at 22 May 2000, showed a positive balance of CHF 8 000. The cost of overtime might, however, become a source of concern if actual expenditure on it proved higher than what had been forecast. In the area of documentation, it was possible for savings to be made, in particular on document reproduction. The estimates had been drawn up from actual expenditure and observed trends, but the definitive amounts would depend on how demand evolved during the remainder of the conference.

1.2 Document 369 was **noted**.

1.3 The **Chairperson** said that the committee should strive, at its following and final meeting, to establish the financial implications of the decisions that would be taken at WRC-2000. The experience of WRC-95 and WRC-97 showed that those decisions, in particular those which were connected with the agendas of the next two WRCs, could have a major impact on the work plan and volume of activity of ITU-R. That impact was twofold. First, the agendas that would be adopted for the next conferences, in particular WRC-03, would determine the preparatory activities that ITU-R and BR would have to accomplish, and therefore also the resources that they would need for that work. As the group responsible for drawing up those agendas, Working Group 2 of the Plenary would have to supply the information needed to enable the resulting requirements to be evaluated. Secondly, the new and revised resolutions and recommendations to be adopted by the conference would define new activities that ITU-R and BR would be instructed to accomplish. Here it would be for Committee 4, Committee 5 and, to some extent, Working Group 1 of the Plenary to supply the information that would enable the financial implications thereof to be evaluated.

1.4 The biennial budget for 2000-2001, adopted by the Council at its 1999 session, complied with the expenditure ceiling fixed in Decision 5 (Minneapolis, 1998). It would therefore be extremely difficult to ask the Council at its next session to open credits for 2000-2001 in addition to those already opened for that type of activity. Four solutions could be envisaged for making up the shortfall. The first would consist in absorbing the extra activities with existing resources by improving working methods and efficiency and by developing appropriate tools and mechanisms. The second would involve revising the Sector’s priorities, in other words reviewing the ITU-R operational plan for 2001 as well as the priorities laid down for the Sector in Resolution 71 (Minneapolis, 1998). The third solution would be to redistribute existing resources, particularly human resources, within BR and, possibly, throughout the Union. Finally, the fourth solution would entail collecting voluntary contributions in order to finance, at least in part, the extra ITU-R activities arising from conference decisions. That was the background to be borne in mind for the discussions to be held at the next meeting of Committee 3.

1.5 The **delegate of the United Kingdom** commented that the timing of the major Radiocommunication Sector meetings (WRC, CPM and RA) also had a bearing on the Union’s general financial situation. The radiocommunication assembly held immediately before the conference had defined a number of options in that regard, and the issue was being discussed by the delegations. It might be advisable to mention to the Steering Committee that it was an issue that should not be settled at the last minute.

1.6 The **Chairperson** said that he would raise the issue in the Steering Committee and with the Chairperson of the Plenary - an issue all the more important for the fact that, because the

Union's financial plan had not been approved at the Plenipotentiary Conference (Minneapolis, 1998), the Council was already forecasting a shortfall for the 2002-2003 biennial budget. Particular account had also to be taken of that shortfall in relation to the new activities that would be decided upon by WRC-2000 for the two years in question.

The meeting rose at 0945 hours.

The Secretary: G. EIDET	The Chairperson: B. GRACIE

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

Document 395-E
24 May 2000

ISTANBUL, 8 MAY – 2 JUNE 2000

B.2 **PLENARY MEETING**

SECOND SERIES OF TEXTS SUBMITTED BY THE EDITORIAL COMMITTEE TO THE PLENARY MEETING

The following texts are submitted to the Plenary Meeting for **first reading:**

Source	**Document**	**Title**
COM 5	340	**ARTICLE S5** – S5.149 – S5.340 – S5.385 – Table of allocations band 18.6-18.8 GHz – S5.522 – S5.522A – S5.522B – S5.523 – S5.547A – S5.553 – S5.554 – S5.555 – S5.556 – Table of allocations band 55.78-56.9 GHz – S5.XXX – S5.558 – S5.559 – Table of allocations band 71-74 GHz band 74-75.5 GHz band 75.5-76 GHz band 76-77.5 GHz band 77.5-78 GHz band 78-79 GHz band 79-81 GHz band 81-84 GHz band 84-86 GHz – S5.561 – S5.EEE

band 176.5-182 GHz
band 185-190 GHz
band 190-191.8 GHz
band 191.8-200 GHz
band 200-202 GHz

- S5.YYY
- S5.RRR
- Table of allocations

band 202-209 GHz
band 209-217 GHz
band 217-226 GHz
band 226-231 GHz
band 231-231.5 GHz
band 231.5-232 GHz
band 232-235 GHz
band 235-238 GHz
band 238-240 GHz
band 240-241 GHz
band 241-248 GHz
band 248-250 GHz
band 250-252 GHz
band 252-265 GHz
band 265-275 GHz
band 275-1 000 GHz

- S5.NNN
- S5.564
- S5.565

ARTICLE S21

- S21.5
- Table S21-2
- S21.5A
- S21.6
- Table S21-4
- S21.16.2
- S21.16.10

APPENDIX S18

RESOLUTION 122 (Rev.WRC-2000)

RESOLUTION 126 (WRC-97)

RESOLUTION 342 (Rev.WRC-2000)

RESOLUTION [COM5/4] (WRC-2000)

RESOLUTION [COM5/5] (WRC-2000)

RESOLUTION [COM5/11] (WRC-2000)

RESOLUTION [COM5/14] (WRC-2000)

Annex: 36 pages

ARTICLE S5

Frequency allocations

MOD

S5.149 In making assignments to stations of other services to which the bands:

13 360-13 410 kHz,	4 990-5 000 MHz,	92-94 GHz,
25 550-25 670 kHz,	6 650-6 675.2 MHz,	94.1-100 GHz,
37.5-38.25 MHz,	10.6-10.68 GHz,	102-109.5 GHz,
73-74.6 MHz in Regions 1 and 3,	14.47-14.5 GHz,	111.8-114.25 GHz,
150.05-153 MHz in Region 1,	22.01-22.21 GHz,	128.33-128.59 GHz,
322-328.6 MHz,	22.21-22.5 GHz,	129.23-129.49 GHz,
406.1-410 MHz,	22.81-22.86 GHz,	130-134 GHz,
608-614 MHz in Regions 1 and 3,	23.07-23.12 GHz,	136-148.5 GHz,
1 330-1 400 MHz,	31.2-31.3 GHz,	151.5-158.5 GHz,
1 610.6-1 613.8 MHz,	31.5-31.8 GHz in Regions 1 and 3,	168.59-168.93 GHz,
1 660-1 670 MHz,	36.43-36.5 GHz,	171.11-171.45 GHz,
1 718.8-1 722.2 MHz,	42.5-43.5 GHz,	172.31-172.65 GHz,
2 655-2 690 MHz,	42.77-42.87 GHz,	173.52-173.85 GHz,
3 260-3 267 MHz,	43.07-43.17 GHz,	195.75-196.15 GHz,
3 332-3 339 MHz,	43.37-43.47 GHz,	209-226 GHz,
3 345.8-3 352.5 MHz,	48.94-49.04 GHz,	241-250 GHz,
4 825-4 835 MHz,	76-86 GHz,	252-275 GHz
4 950-4 990 MHz,		

are allocated, administrations are urged to take all practicable steps to protect the radio astronomy service from harmful interference. Emissions from spaceborne or airborne stations can be particularly serious sources of interference to the radio astronomy service (see Nos. **S4.5** and **S4.6** and Article **S29**).

MOD

S5.340 All emissions are prohibited in the following bands:

1 400-1 427 MHz,	
2 690-2 700 MHz,	except those provided for by Nos. **S5.421** and **S5.422**,
10.68-10.7 GHz,	except those provided for by No. **S5.483**,
15.35-15.4 GHz,	except those provided for by No. **S5.511**,
23.6-24 GHz,	
31.3-31.5 GHz,	
31.5-31.8 GHz,	in Region 2,
48.94-49.04 GHz,	from airborne stations,
50.2-50.4 GHz[2],	except those provided for by No. **S5.555A**,
52.6-54.25 GHz,	
86-92 GHz,	
100-102 GHz,	
109.5-111.8 GHz,	
114.25-116 GHz	
148.5-151.5 GHz,	
164-167 GHz,	
182-185 GHz,	except those provided for by No. **S5.563**,
190-191.8 GHz,	
200-209 GHz,	
226-231.5 GHz,	
250-252 GHz.	

MOD

S5.385 *Additional allocation:* the band 1 718.8-1 722.2 MHz is also allocated to the radio astronomy service on a secondary basis for spectral line observations.

MOD

18.6-22.21 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
18.6-18.8 EARTH EXPLORATION-SATELLITE (passive) FIXED FIXED-SATELLITE (space-to-Earth) S5.522B MOBILE except aeronautical mobile Space research (passive) S5.522A	**18.6-18.8** EARTH EXPLORATION-SATELLITE (passive) FIXED FIXED-SATELLITE (space-to-Earth) S5.522B MOBILE except aeronautical mobile SPACE RESEARCH (passive) S5.522A	**18.6-18.8** EARTH EXPLORATION-SATELLITE (passive) FIXED FIXED-SATELLITE (space-to-Earth) S5.522B MOBILE except aeronautical mobile Space research (passive) S5.522A

SUP

S5.522

ADD

S5.522A The emissions of the fixed service and the fixed-satellite service in the band 18.6-18.8 GHz are limited to the values given in Nos. **S21.5A** and **S21.16.2**, respectively.

ADD

S5.522B The use of the band 18.6-18.8 GHz by the fixed-satellite service is limited to geostationary systems and systems with an orbit of apogee greater than 20 000 km.

SUP

S5.523

MOD

S5.547A Administrations should take practical measures to minimize the potential interference between stations in the fixed service and airborne stations in the radionavigation service in the 31.8-33.4 GHz band, taking into account the operational needs of the airborne radar systems.

MOD

S5.553 In the bands 43.5-47 GHz and 66-71 GHz, stations in the land mobile service may be operated subject to not causing harmful interference to the space radiocommunication services to which these bands are allocated (see No. **S5.43**).

MOD

S5.554 In the bands 43.5-47 GHz, 66-71 GHz, 95-100 GHz, 123-130 GHz, 191.8-200 GHz and 252-265 GHz, satellite links connecting land stations at specified fixed points are also authorized when used in conjunction with the mobile-satellite service or the radionavigation-satellite service.

MOD

S5.555 *Additional allocation:* the band 48.94-49.04 GHz is also allocated to the radio astronomy service on a primary basis.

MOD

S5.556 In the bands 51.4-54.25 GHz, 58.2-59 GHz and 64-65 GHz, radio astronomy observations may be carried out under national arrangements.

MOD

55.78-66 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
55.78-56.9	EARTH EXPLORATION-SATELLITE (passive) FIXED S5.XXX INTER-SATELLITE S5.556A MOBILE S5.558 SPACE RESEARCH (passive) S5.547 S5.557	

ADD

S5.XXX In the band 55.78-56.26 GHz, in order to protect stations in the Earth exploration-satellite service (passive), the maximum power density delivered by a transmitter to the antenna of a fixed-service station is limited to –26 dB(W/MHz).

MOD

S5.558 In the bands 55.78-58.2 GHz, 59-64 GHz, 66-71 GHz, 122.25-123 GHz, 130-134 GHz, 167-174.8 GHz and 191.8-200 GHz, stations in the aeronautical mobile service may be operated subject to not causing harmful interference to the inter-satellite service (see No. **S5.43**).

MOD

S5.559 In the band 59-64 GHz, airborne radars in the radiolocation service may be operated subject to not causing harmful interference to the inter-satellite service (see No. **S5.43**).

MOD

71-86 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
71-74	FIXED FIXED-SATELLITE (space-to-Earth) MOBILE MOBILE-SATELLITE (space-to-Earth)	
74-75.5	FIXED FIXED-SATELLITE (space-to-Earth) MOBILE BROADCASTING BROADCASTING-SATELLITE Space research (space-to-Earth) S5.561	
75.5-76	FIXED FIXED-SATELLITE (space-to-Earth) MOBILE BROADCASTING BROADCASTING-SATELLITE Space research (space-to-Earth) S5.561 S5.EEE	
76-77.5	RADIO ASTRONOMY RADIOLOCATION Amateur Amateur-satellite Space research (space-to-Earth) S5.149	

77.5-78	AMATEUR AMATEUR-SATELLITE Radio astronomy Space research (space-to-Earth) S5.149
78-79	RADIOLOCATION Amateur Amateur-satellite Radio astronomy Space research (space-to-Earth) S5.149 S5.560
79-81	RADIO ASTRONOMY RADIOLOCATION Amateur Amateur-satellite Space research (space-to-Earth) S5.149
81-84	FIXED FIXED-SATELLITE (Earth-to-space) MOBILE MOBILE-SATELLITE (Earth-to-space) RADIO ASTRONOMY Space research (space-to-Earth) S5.149 S5.DDD
84-86	FIXED FIXED-SATELLITE (Earth-to-space) S5.PPP MOBILE RADIO ASTRONOMY S5.149

MOD

S5.561 In the band 74-76 GHz, stations in the fixed, mobile and broadcasting services shall not cause harmful interference to stations of the fixed-satellite service or stations of the broadcasting-satellite service operating in accordance with the decisions of the appropriate frequency assignment planning conference for the broadcasting-satellite service.

ADD

S5.EEE The band 75.5-76 GHz is also allocated to the amateur and amateur-satellite services on a primary basis until the year 2006.

ADD

S5.DDD The 81-81.5 GHz band is also allocated to the amateur and amateur-satellite services on a secondary basis.

ADD

S5.PPP In Japan, use of the band 84-86 GHz, by the fixed-satellite service (Earth-to-space) is limited to feeder links in the broadcasting-satellite service using the geostationary-satellite orbit.

MOD

86-119.98 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
. . .		
92-94	FIXED MOBILE RADIO ASTRONOMY RADIOLOCATION S5.149	
94-94.1	EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION SPACE RESEARCH (active) Radio astronomy S5.562 S5.FFF	
94.1-95	FIXED MOBILE RADIO ASTRONOMY RADIOLOCATION S5.149	

95-100	FIXED MOBILE RADIO ASTRONOMY RADIOLOCATION RADIONAVIGATION RADIONAVIGATION-SATELLITE S5.149 S5.554
100-102	EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) S5.340 S5.341
102-105	FIXED MOBILE RADIO ASTRONOMY S5.149 S5.341
105-109.5	FIXED MOBILE RADIO ASTRONOMY SPACE RESEARCH (passive) S5.CCC S5.149 S5.341
109.5-111.8	EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) S5.340 S5.341
111.8-114.25	FIXED MOBILE RADIO ASTRONOMY SPACE RESEARCH (passive) S5.CCC S5.149 S5.341
114.25-116	EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) S5.340 S5.341
116-119.98	EARTH EXPLORATION-SATELLITE (passive) INTER-SATELLITE S5.XXY SPACE RESEARCH (passive) S5.341

ADD

S5.FFF Transmissions from space stations of the Earth exploration-satellite service (active) that are directed into the main beam of a radio astronomy antenna have the potential to damage some radio astronomy receivers. Space agencies operating the transmitters and the radio astronomy stations concerned should mutually plan their operations so as to avoid such occurrences to the maximum extent possible.

ADD

S5.CCC Use of this allocation is limited to space-based radio astronomy only.

ADD

S5.XXY Use of the band 116-122.25 GHz by the inter-satellite service is limited to satellites in the geostationary-satellite orbit. The single-entry power flux-density produced by a station in the inter-satellite service, for all conditions and for all methods of modulation, at all altitudes from 0 km to 1 000 km above the Earth’s surface and in the vicinity of all geostationary orbital positions occupied by passive sensors, shall not exceed –148 dB(W/(m^2·MHz)) for all angles of arrival.

MOD

119.98-158 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
119.98-120.02	EARTH EXPLORATION-SATELLITE (passive) INTER-SATELLITE S5.XXY SPACE RESEARCH (passive) S5.341	
120.02-122.25	EARTH EXPLORATION-SATELLITE (passive) INTER-SATELLITE S5.XXY SPACE RESEARCH (passive) S5.138	

122.25-123	FIXED INTER-SATELLITE MOBILE S5.558 Amateur S5.138
123-126	FIXED-SATELLITE (space-to-Earth) MOBILE-SATELLITE (space-to-Earth) RADIONAVIGATION RADIONAVIGATION-SATELLITE Radio astronomy S5.554
126-130	FIXED-SATELLITE (space-to-Earth) MOBILE-SATELLITE (space-to-Earth) RADIONAVIGATION RADIONAVIGATION-SATELLITE Radio astronomy S5.QQQ S5.149 S5.554
130-134	EARTH EXPLORATION-SATELLITE (active) S5.LLL FIXED INTER-SATELLITE MOBILE S5.558 RADIO ASTRONOMY S5.149 S5.FFF
134-136	AMATEUR AMATEUR-SATELLITE Radio astronomy

136-141	RADIO ASTRONOMY RADIOLOCATION Amateur Amateur-satellite S5.149
141-142	FIXED MOBILE RADIO ASTRONOMY RADIOLOCATION S5.149
142-144	FIXED MOBILE RADIO ASTRONOMY RADIOLOCATION S5.149
144-148.5	FIXED MOBILE RADIO ASTRONOMY RADIOLOCATION S5.149
148.5-149	EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) S5.340

149-150	EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) S5.340
150-151	EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) S5.340
151-151.5	EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) S5.340
151.5-155.5	FIXED MOBILE RADIO ASTRONOMY RADIOLOCATION S5.149
155.5-156	EARTH EXPLORATION-SATELLITE (passive) S5.AAA FIXED MOBILE RADIO ASTRONOMY SPACE RESEARCH (passive) S5.CCC S5.149 S5.BBB
156-158	EARTH EXPLORATION-SATELLITE (passive) S5.AAA FIXED MOBILE RADIO ASTRONOMY SPACE RESEARCH (passive) S5.CCC S5.149 S5.BBB

ADD

S5.QQQ *Additional allocation*: In Korea (Rep. of), the bands 128-130 GHz, 171-171.6 GHz, 172.2-172.8 GHz and 173.3-174 GHz are also allocated to the radio astronomy service on a primary basis until 2015.

ADD

S5.LLL The allocation to the Earth exploration-satellite service (active) is limited to the band 133.5-134 GHz.

ADD

S5.AAA In the band 155.5-158.5 GHz, the allocation to the Earth exploration-satellite (passive) and space research (passive) services shall terminate on 1 January 2018.

ADD

S5.BBB The date of entry into force of the allocation to the fixed and mobile services in the band 155.5-158.5 GHz shall be 1 January 2018.

MOD

158-202 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
158-158.5	EARTH EXPLORATION-SATELLITE (passive) S5.AAA FIXED MOBILE RADIO ASTRONOMY SPACE RESEARCH (passive) S5.CCC S5.149 S5.BBB	
158.5-164	FIXED FIXED-SATELLITE (space-to-Earth) MOBILE MOBILE-SATELLITE (space-to-Earth)	
164-167	EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) S5.340	

167-168	FIXED FIXED-SATELLITE (space-to-Earth) INTER-SATELLITE MOBILE S5.558
168-170	FIXED FIXED-SATELLITE (space-to-Earth) INTER-SATELLITE MOBILE S5.558 S5.149
170-174.5	FIXED FIXED-SATELLITE (space-to-Earth) INTER-SATELLITE MOBILE S5.558 S5.149 S5.QQQ
174.5-174.8	FIXED INTER-SATELLITE MOBILE S5.558
174.8- 176.5	EARTH EXPLORATION-SATELLITE (passive) INTER-SATELLITE S5.YYY SPACE RESEARCH (passive)
176.5-182	EARTH EXPLORATION-SATELLITE (passive) INTER-SATELLITE S5.YYY SPACE RESEARCH (passive)
. . .	

185-190	EARTH EXPLORATION-SATELLITE (passive) INTER-SATELLITE S5.YYY SPACE RESEARCH (passive)
190-191.8	EARTH EXPLORATION-SATELLITE (passive) SPACE RESEARCH (passive) S5.340
191.8-200	FIXED INTER-SATELLITE MOBILE S5.558 MOBILE-SATELLITE RADIONAVIGATION RADIONAVIGATION-SATELLITE S5.149 S5.341 S5.554
200-202	EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) S5.340 S5.341 S5.RRR

ADD

S5.YYY Use of the bands 174.8-182 GHz and 185-190 GHz by the inter-satellite service is limited to satellites in the geostationary-satellite orbit. The single-entry power flux-density produced by a station in the inter-satellite service, for all conditions and for all methods of modulation, at all altitudes from 0 km to 1 000 km above the Earth's surface and in the vicinity of all geostationary orbital positions occupied by passive sensors, shall not exceed –144 dB(W/(m^2·MHz)) for all angles of arrival.

ADD

S5.RRR In the bands 200-209 GHz, 235-238 GHz, 250-252 GHz and 265-275 GHz, ground-based passive atmospheric sensing is carried out to monitor atmospheric constituents.

MOD

202-1 000 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
202-209	EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) S5.340 S5.341 S5.RRR	
209-217	FIXED FIXED-SATELLITE (Earth-to-space) MOBILE RADIO ASTRONOMY S5.149 S5.341	
217-226	FIXED FIXED-SATELLITE (Earth-to-space) MOBILE RADIO ASTRONOMY SPACE RESEARCH (passive) S5.CCC S5.149 S5.341	
226-231	EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) S5.340	
231-231.5	EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) S5.340	
231.5-232	FIXED MOBILE Radiolocation	
232-235	FIXED FIXED-SATELLITE (space-to-Earth) MOBILE Radiolocation	
235-238	EARTH EXPLORATION-SATELLITE (passive) FIXED-SATELLITE (space-to-Earth) SPACE RESEARCH (passive) S5.RRR S5.NNN	

238-240	FIXED FIXED-SATELLITE (space-to-Earth) MOBILE RADIOLOCATION RADIONAVIGATION RADIONAVIGATION-SATELLITE
240-241	FIXED MOBILE RADIOLOCATION
241-248	RADIO ASTRONOMY RADIOLOCATION Amateur Amateur-satellite S5.138 S5.149
248-250	AMATEUR AMATEUR-SATELLITE Radio astronomy S5.149
250-252	EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) S5.340 S5.RRR
252-265	FIXED MOBILE MOBILE-SATELLITE (Earth-to-space) RADIO ASTRONOMY RADIONAVIGATION RADIONAVIGATION-SATELLITE S5.149 S5.554
265-275	FIXED FIXED-SATELLITE (Earth-to-space) MOBILE RADIO ASTRONOMY S5.149 S5.RRR
275-1 000	(Not allocated) S5.565

ADD

S5.NNN The band 237.9-238 GHz is also allocated to the Earth exploration-satellite service (active) and the space research service (active) for spaceborne cloud radars only.

SUP

S5.564

MOD

S5.565 The frequency band 275-1 000 GHz may be used by administrations for experimentation with, and development of, various active and passive services. In this band a need has been identified for the following spectral line measurements for passive services:

– radio astronomy service: 275-323 GHz, 327-371 GHz, 388-424 GHz, 426-442 GHz, 453-510 GHz, 623-711 GHz, 795-909 GHz and 926-945 GHz;

– Earth exploration-satellite service (passive) and space research service (passive): 275-277 GHz, 294-306 GHz, 316-334 GHz, 342-349 GHz, 363-365 GHz, 371-389 GHz, 416-434 GHz, 442-444 GHz, 496-506 GHz, 546-568 GHz, 624-629 GHz, 634-654 GHz, 659-661 GHz, 684-692 GHz, 730-732 GHz, 851-853 GHz and 951-956 GHz.

Future research in this largely unexplored spectral region may yield additional spectral lines and continuum bands of interest to the passive services. Administrations are urged to take all practicable steps to protect these passive services from harmful interference until the date when the allocation table is established in the above-mentioned frequency band.

ARTICLE S21

Terrestrial and space services sharing frequency bands above 1 GHz

MOD

S21.5 3) The power delivered by a transmitter to the antenna of a station in the fixed or mobile services shall not exceed +13 dBW in frequency bands between 1 GHz and 10 GHz, or +10 dBW in frequency bands above 10 GHz, except as cited in **S21.5A**.

MOD

TABLE **S21-2** *(end)*

Frequency band	Service	Limit as specified in Nos.
18.6-18.8 GHz	Earth exploration-satellite Space research	**S21.5A**

ADD

S21.5A As an exception to the power levels given in No. **S21.5**, the sharing environment within which the Earth exploration-satellite (passive) and space research (passive) services shall operate in the band 18.6-18.8 GHz is defined by the following limitations on the operation of the fixed service: the power of each RF carrier frequency delivered to the input of each antenna of a station in the fixed service in the band 18.6-18.8 GHz shall not exceed –3 dBW.

MOD

S21.6 4) The limits given in Nos. **S21.2**, **S21.3**, **S21.4**, **S21.5** and **S21.5A** apply, where applicable, to the services and frequency bands indicated in Table **S21-2** for reception by space stations where the frequency bands are shared with equal rights with the fixed or mobile services:

MOD

TABLE **S21-4** *(end)*

Frequency band	Service*	Limit in dB(W/m²) for angle of arrival (δ) above the horizontal plane			Reference bandwidth
		0°-5°	5°-25°	25°-90°	
31.8-32.3 GHz	Space research	–120 [16]	–120 + 0.75(δ – 5) [16]	–105	1 MHz
32.0-33.0 GHz	Inter-satellite	–135	–135 + (δ – 5)	–115	1 MHz
37-38 GHz	Space research, non-geostationary-satellite orbit	–120 [16]	–120 + 0.75(δ – 5) [16]	–105	1 MHz
37-38 GHz	Space research, geostationary-satellite orbit	–125	–125 + (δ – 5)	–105	1 MHz

MOD

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[8] **S21.16.2** In addition to the limits given in Table **S21-4**, in the band 18.6-18.8 GHz the sharing environment within which the Earth exploration-satellite (passive) and space research (passive) services shall operate is defined by the following limitations on the operation of the fixed-satellite service: the power flux-density across the 200 MHz band 18.6-18.8 GHz produced at the surface of the Earth by emissions from a space station under assumed free-space propagation conditions shall not exceed –95 dB(W/m^2), except for less than 5% of time, when the limit may be exceeded by up to 3 dB. The provisions of No. **S21.17** do not apply in this band.

ADD

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[16] **S21.16.10** During the launch and near-Earth operational phase of deep space facilities, non-GSO space research service systems shall not exceed a pfd value of:

–115 dB(W/m^2)	if $\delta < 5°$
–115 + 0.5 (δ – 5) dB(W/m^2)	if $5° \leq \delta \leq 25°$
–105 dB(W/m^2)	if $\delta > 25°$

in any 1 MHz band, where δ is the angle of arrival above the horizontal plane.

APPENDIX S18

Table of transmitting frequencies in the VHF maritime mobile band

(See Article **S52**)

MOD

NOTE – For assistance in understanding the Table, see notes *a)* to *o)* below.

MOD

Channel designator	**Notes**	**Transmitting frequencies (MHz)**		**Inter-ship**	**Port operations and ship movement**		**Public corres-pondence**
		Ship stations	**Coast stations**		**Single frequency**	**Two frequency**	
60		156.025	160.625			x	x
01		156.050	160.650			x	x
61	*m), o)*	156.075	160.675		x	x	x
02	*m), o)*	156.100	160.700		x	x	x
62	*m), o)*	156.125	160.725		x	x	x
03	*m), o)*	156.150	160.750		x	x	x
63	*m), o)*	156.175	160.775		x	x	x
04	*m), o)*	156.200	160.800		x	x	x
64	*m), o)*	156.225	160.825		x	x	x
05	*m), o)*	156.250	160.850		x	x	x
65	*m), o)*	156.275	160.875		x	x	x
06	*f)*	156.300		x			
66		156.325	160.925			x	x
07		156.350	160.950			x	x
67	*h)*	156.375	156.375	x	x		
08		156.400		x			
68		156.425	156.425		x		
09	*i)*	156.450	156.450	x	x		
69		156.475	156.475	x	x		
10	*h)*	156.500	156.500	x	x		
70	*j)*	156.525	156.525	Digital selective calling for distress, safety and calling			

Channel designator	Notes	Transmitting frequencies (MHz)		Inter-ship	Port operations and ship movement		Public corres-pondence
		Ship stations	Coast stations		Single frequency	Two frequency	
11		156.550	156.550		x		
71		156.575	156.575		x		
12		156.600	156.600		x		
72	*i)*	156.625		x			
13	*k)*	156.650	156.650	x	x		
73	*h), i)*	156.675	156.675	x	x		
14		156.700	156.700		x		
74		156.725	156.725		x		
15	*g)*	156.750	156.750	x	x		
75	*n)*	156.775			x		
16		156.800	156.800	DISTRESS, SAFETY AND CALLING			
76	*n)*	156.825			x		
17	*g)*	156.850	156.850	x	x		
77		156.875		x			
18	*m)*	156.900	161.500		x	x	x
78		156.925	161.525			x	x
19		156.950	161.550			x	x
79		156.975	161.575			x	x
20		157.000	161.600			x	x
80		157.025	161.625			x	x
21		157.050	161.650			x	x
81		157.075	161.675			x	x
22	*m)*	157.100	161.700		x	x	x
82	*m), o)*	157.125	161.725		x	x	x
23	*m), o)*	157.150	161.750		x	x	x
83	*m), o)*	157.175	161.775		x	x	x
24	*m), o)*	157.200	161.800		x	x	x
84	*m), o)*	157.225	161.825		x	x	x

Channel designator	Notes	Transmitting frequencies (MHz)		Inter-ship	Port operations and ship movement		Public corres-pondence
		Ship stations	Coast stations		Single frequency	Two frequency	
25	*m), o)*	157.250	161.850		x	x	x
85	*m), o)*	157.275	161.875		x	x	x
26	*m), o)*	157.300	161.900		x	x	x
86	*m), o)*	157.325	161.925		x	x	x
27		157.350	161.950			x	x
87		157.375			x		
28		157.400	162.000			x	x
88		157.425			x		
AIS 1	*l)*	161.975	161.975				
AIS 2	*l)*	162.025	162.025				

Notes referring to the Table

Specific notes

MOD

m) These channels may be operated as single frequency channels, subject to special arrangement between interested or affected administrations.

ADD

o) These channels may be used to provide bands for initial testing and the possible future introduction of new technologies, subject to special arrangement between interested or affected administrations. Stations using these channels or bands for the testing and the possible future introduction of new technologies shall not cause harmful interference to, and shall not claim protection from, other stations operating in accordance with Article **S5**.

MOD

RESOLUTION 122 (Rev.WRC-2000)

Use of the bands 47.2-47.5 GHz and 47.9-48.2 GHz by high altitude platform stations (HAPS) in the fixed service and by other services and the potential use of bands in the range 18-32 GHz by HAPS in the fixed service

The World Radiocommunication Conference (Istanbul, 2000),

considering

a) that the band 47.2-50.2 GHz is allocated to the fixed, mobile and fixed-satellite services on a co-primary basis;

b) that WRC-97 made provision for operation of HAPS, also known as stratospheric repeaters, within the fixed service in the bands 47.2-47.5 GHz and 47.9-48.2 GHz;

c) that ITU has among its purposes "to promote the extension of the benefit of the new telecommunication technologies to all the world's inhabitants" (No. 6 of the Constitution of the ITU (Geneva, 1992));

d) that systems based on new technologies using high altitude platforms will be able to provide high-capacity, competitive services to urban and rural areas;

e) that the development of any service requires major investment and that manufacturers and operators should be given the confidence to make the necessary investment;

f) that high altitude platform systems are in an advanced stage of development and some countries have notified such systems to ITU in the bands 47.2-47.5 GHz and 47.9-48.2 GHz;

g) that WRC-97 adopted a definition of HAPS in Article **S1**, modified No. **S11.24** and added No. **S11.26** providing for notices relating to assignments for HAPS in the bands 47.2-47.5 GHz and 47.9-48.2 GHz and that the Radio Regulations Board issued a provisional rule of procedure concerning notification periods in No. **S11.24/1228** in February 1997;

h) that in spite of the urgency attached to the development of such systems, technical, sharing and regulatory issues should be further studied in order to achieve the most efficient use of the spectrum available for these systems;

i) that while the decision to deploy HAPS can be taken on a national basis, such deployment may affect neighbouring administrations, particularly in small countries;

j) that technical studies have been undertaken on the characteristics of a system using HAPS in the frequency bands 47.2-47.5 GHz and 47.9-48.2 GHz and on the coordination and sharing requirements between systems using HAPS and systems in the conventional fixed service, radio astronomy and in other services, but that further studies are still in progress on the potential for interference between such systems;

k) that the radio astronomy service has primary allocations in the bands 42.5-43.5 GHz and 48.94-49.04 GHz;

l) that results of ITU-R studies have been presented which indicate that in WRC-97 designated bands at 47.2-47.5 and 47.9-48.2 GHz, sharing between fixed-service systems using HAPS and other conventional fixed-service systems in the same area will require appropriate interference mitigation techniques to be developed and implemented;

m) that No. **S5.552** urges administrations to reserve fixed-satellite service use of the band 47.2-49.2 GHz for feeder links for the broadcasting-satellite service, and that ITU-R studies indicate that HAPS in the fixed service may share with broadcasting-satellite feeder links;

n) that ITU-R studies in the bands 47.2-47.5 GHz and 47.9-48.2 GHz indicate that sharing between fixed-service systems using HAPS and the fixed-satellite service could be feasible under certain limitations, such as geographical separation between HAPS-based systems and FSS earth stations;

o) that since the 47 GHz bands are more susceptible to rain attenuation in certain areas of Region 3, the range 18-32 GHz has been proposed for Region 3 for possible identification of additional spectrum in ITU-R, and preliminary ITU-R studies are in progress for these bands;

p) that the 18-32 GHz range is already heavily used by a number of different services and a number of other types of applications in the fixed service;

q) that Nos. [**S5.5SSS**] and [**S5.5RRR**] permit the use of HAPS in the fixed service in the bands 27.5-28.35 and 31.0-31.3 GHz in certain countries on a non-interference, non-protection basis in order to address issues of rain attenuation associated with the 47 GHz bands referred to in *considering b)* above;

r) that technical, sharing and regulatory issues should be studied in order to determine criteria for the operation of HAPS in the bands referred to in *considering q)* above;

s) that the 31.3-31.8 GHz band is allocated to the radio astronomy, EESS (passive) and space research (passive) services and the 31.8-32.3 GHz band is allocated to the space research (deep space) service, and that there is a need to appropriately protect these services from unwanted emissions, taking into account No. **S5.340** and the interference criteria given in Recommendations ITU-R SA.1029 and ITU-R RA.769,

resolves

1 to urge administrations to facilitate coordination between HAPS in the fixed service operating in the bands 47.2-47.5 GHz and 47.9-48.2 GHz and other co-primary services in their territory and adjacent territories;

2 that, on a provisional basis, the procedures of Article **S9** shall be used for coordination between satellite systems and systems using HAPS in the bands 47.2-47.5 GHz and 47.9-48.2 GHz;

3 to invite WRC-03 to review the results of the studies specified below and consider refinement of the regulatory provisions that might facilitate a broader application of these high altitude platform technologies,

requests ITU-R

1 to study the regulatory provisions that might be needed in order to address those cases where the deployment of HAPS in the territory of one administration may affect neighbouring administrations;

2 to continue to carry out studies on the appropriate technical sharing criteria for the situations referred to in *considering j)* above;

3 to conduct studies, as a matter of urgency, and taking into account the requirements of other fixed-service systems and other services, on the feasibility of identifying suitable frequencies, in addition to the 2 x 300 MHz paired band at 47 GHz, for the use of HAPS in the fixed service in the range 18-32 GHz in Region 3, focusing particularly, but not exclusively, on the bands 27.5-28.35 GHz and 31.0-31.3 GHz,

instructs the Director of the Radiocommunication Bureau

1 that notices concerning HAPS that were received by the Bureau prior to 22 November 1997, and provisionally recorded in the Master International Frequency Register in accordance with the provisional rule of procedure issued by the Board, shall be maintained;

2 that from 22 November 1997, and pending review of the sharing studies in *considering j)* and review of the notification process by WRC-03, the Bureau shall accept notices in the bands 47.2-47.5 GHz and 47.9-48.2 GHz only for HAPS in the fixed service and for feeder links for the broadcasting-satellite service, shall continue to process notices for fixed-satellite service networks (except for feeder links for the broadcasting-satellite service) for which complete information for advance publication has been received prior to 27 October 1997, and shall inform the notifying administrations accordingly.

SUP

RESOLUTION 126 (WRC-97)

Use of the frequency band 31.8-33.4 GHz for high-density systems in the fixed service

MOD

RESOLUTION 342 (Rev.WRC-2000)

New technologies to provide improved efficiency in the use of the band 156-174 MHz by stations in the maritime mobile service

The World Radiocommunication Conference (Istanbul, 2000),

considering

a) that the agenda of this conference included the consideration of the use of new technologies for the maritime mobile service in the band 156-174 MHz and the consequential revision of Appendix **S18**;

b) Recommendation **318 (Mob-87),** particularly *noting b)* and *c)* thereof;

c) that Appendix **S18** identifies frequencies to be used for distress and safety communications on an international basis;

d) that the introduction of new technology in the maritime mobile service shall not disrupt distress and safety communications in the VHF band including those established by the International Convention for the Safety of Life at Sea (SOLAS), 1974, as amended;

e) that the date for full implementation of GMDSS was 1 February 1999;

f) that ITU-R is conducting studies on improving efficiency in the use of this band, and that these studies are still ongoing;

g) that changes made in Appendix **S18** should not prejudice the future use of these frequencies or the capabilities of systems or new applications required for use by the maritime mobile service;

h) that the congestion on Appendix **S18** frequencies calls for the implementation of efficient new technologies;

i) that the use of new technology on maritime VHF frequencies will make it possible to better respond to the emerging demand for new services;

j) that ITU-R has approved Recommendation ITU-R M.1312 relating to a long-term solution for improved efficiency in the use of the band 156-174 MHz by stations in the maritime mobile service;

k) that ITU-R has approved Recommendation ITU-R M.1371 relating to technical characteristics for a universal shipborne automatic identification system using time-division multiple access in the VHF maritime mobile band;

l) that there is a need to maintain some duplex channels for specific applications,

noting

a) that the global maritime market may not be of a sufficient size to warrant the development of a new system solely for the maritime service;

b) that digital systems have been successfully implemented in the land mobile service,

noting also

that this conference has modified Appendix **S18**, including with the addition of Note *o)*, to permit the possible use on a voluntary basis of various channels or bands created by the conversion of some duplex channels to simplex channels, for the initial testing and the possible future introduction of new technologies,

resolves

1 that, in order to provide full worldwide interoperability of equipment on ships, there should be one technology, or more than one interoperable worldwide technology, implemented under Appendix **S18**;

2 that, as soon as the ITU-R studies are complete, a future competent conference should consider any necessary changes to Appendix **S18** to enable the use of new technologies by the maritime mobile service,

invites ITU-R

to finalize the following studies:

a) identify the future requirements of the maritime mobile service;

b) identify suitable technical characteristics of the system or interoperable systems to replace existing technology;

c) identify necessary modifications to the table of frequencies contained in Appendix **S18**;

d) recommend a transition plan for the introduction of new technologies;

e) recommend how new technologies can be introduced while ensuring compliance with the distress and safety requirements,

instructs the Secretary-General

to communicate this resolution to the International Maritime Organization and the International Association of Lighthouse Authorities.

ADD

RESOLUTION [COM5/4] (WRC-2000)

Consideration by a future competent world radiocommunication conference of issues dealing with sharing and adjacent-band compatibility between passive and active services above 71 GHz

The World Radiocommunication Conference (Istanbul, 2000),

considering

a) that the changes made to the Table of Frequency Allocations by this conference in bands above 71 GHz were based on the requirements known at the time of the conference;

b) that the passive service spectrum requirements above 71 GHz are based on physical phenomena and therefore are well known, and are reflected in the changes made to the Table of Frequency Allocations by this conference;

c) that several bands above 71 GHz are already used by EESS (passive) and SRS (passive) because they are unique bands for the measurement of specific atmospheric parameters;

d) that there is currently only limited knowledge of requirements and implementation plans for the active services that will operate in bands above 71 GHz;

e) that, in the past, technological developments have led to viable communication systems operating at increasingly higher frequencies, and that this can be expected to continue so as to make communication technology available in the future in the frequency bands above 71 GHz;

f) that, in the future, alternative spectrum needs for the active and passive services should be accommodated when the new technologies become available;

g) that, following the revisions to the Table of Frequency Allocations by this conference, sharing studies may be required for services in some bands above 71 GHz;

h) that interference criteria for passive sensors have been developed and are given in Recommendation ITU-R SA.1029;

i) that protection criteria for radio astronomy have been developed and are given in Recommendation ITU-R RA.769;

j) that several satellite downlink allocations have been made in bands adjacent to those allocated to the radio astronomy service;

k) that, sharing criteria for active and passive services in bands above 71 GHz have not yet been fully developed within ITU-R;

l) that, in order to ensure protection of passive services above 71 GHz, this conference avoided making allocations to both active and passive services in some bands such as 100-102 GHz, 148.5-151.5 GHz and 226-231.5 GHz, so as to prevent potential sharing problems,

recognizing

that, to the extent practicable, the burden of sharing among active and passive services should be equitably distributed among the services to which allocations are made,

resolves

that a future competent conference should consider the results of ITU-R studies with a view to revising the Radio Regulations, as appropriate, in order to accommodate the emerging requirements of active services, taking into account the requirements of the passive services, in bands above 71 GHz,

urges administrations

to note the possibility of changes to Article **S5** to accommodate emerging requirements for active services, as indicated in this resolution, and to take this into account in the development of national policies and regulations, *invites ITU-R*

1 to continue its studies to determine if and under what conditions sharing is possible between active and passive services in the bands above 71 GHz, such as, but not limited to, 100-102 GHz, 116-122.25 GHz, 148.5-151.5 GHz, 174.8-191.8 GHz, 226-231.5 GHz and 235-238 GHz;

2 to study means of avoiding adjacent-band interference from space services (downlinks) into radio astronomy bands above 71 GHz;

3 to take into account the principles of burden-sharing to the extent practicable in their studies;

4 to complete the necessary studies when the technical characteristics of the active services in these bands are known;

5 to develop Recommendations specifying sharing criteria for those bands where sharing is feasible,

instructs the Secretary-General

to bring this resolution to the attention of the international and regional organizations concerned.

ADD

RESOLUTION [COM5/5] (WRC-2000)

Consideration by a future competent world radiocommunication conference of issues dealing with sharing between active services above 71 GHz

The World Radiocommunication Conference (Istanbul, 2000),

considering

a) that this conference made changes to the Table of Frequency Allocations above 71 GHz, following consideration of science service issues;

b) that there are several co-primary active services in some bands above 71 GHz in the Table of Frequency Allocations as revised by this conference;

c) that there is limited knowledge of characteristics of active services that may be developed to operate in bands above 71 GHz;

d) that sharing criteria for sharing between active services in bands above 71 GHz have not yet been fully developed within ITU-R;

e) that sharing between multiple co-primary active services may hinder the development of each active service in bands above 71 GHz;

f) that the technology for some active services may be commercially available earlier than for some other active services;

g) that adequate spectrum should be available for the active services for which the technology is available at a later time,

noting

that sharing criteria need to be developed, to be used by a future competent conference, for determining to what extent sharing between multiple co-primary active services is possible in each of the bands,

resolves

1 that appropriate measures should be taken to meet the spectrum requirements for active services for which the technology will be commercially available at a later time;

2 that sharing criteria be developed for co-primary active services in bands above 71 GHz;

3 that the sharing criteria developed should form the basis for a review of active service allocations above 71 GHz at a future competent conference, if necessary,

urges administrations

to complete the necessary studies with a view to presenting, at the appropriate time, the technical information likely to be required as a basis for the work of a future competent conference,

instructs the Secretary-General

to bring this resolution to the attention of the international and regional organizations concerned.

RESOLUTION [COM5/11] (WRC-2000)

Development of the technical basis for determining the coordination area for coordination of a receiving earth station in the space research service (deep space) with transmitting stations of high-density systems in the fixed service in the 31.8-32.3 GHz and 37-38 GHz bands

The World Radiocommunication Conference (Istanbul, 2000),

considering

a) that the band 31.8-32.3 GHz is allocated to the space research service for deep space operations only, the band 37-38 GHz is allocated to the space research service (space-to-Earth), and both bands are allocated to the fixed service for the use of high-density applications and to other services on a primary basis;

b) that the 31.8-32.3 GHz band offers unique advantages in support of deep-space missions;

c) that space research service earth stations operating in these bands employ very high-gain antennas and very low-noise amplifiers in order to receive weak signals from deep space;

d) that fixed-service stations in these bands are expected to be deployed in large numbers over urban areas of large geographical extent;

e) that studies are being initiated to characterize short-term (of the order of 0.001% of the time, commensurate with the protection criteria given in Recommendations ITU-R SA.1396 and SA.1157) anomalous propagation from transmitting stations dispersed over a large geographical area to a single receiving earth station (area-to-point propagation);

f) that preliminary ITU-R studies have indicated that the coordination distance between a space research service (deep space) earth station and a single urban area may be on the order of 250 km;

g) that there are currently three space research service (deep space) earth stations in operation or planned for operation near Goldstone (United States), Madrid (Spain) and Canberra (Australia), and there are up to ten more earth stations planned in the future,

noting

that Resolution [COM4/1] provides a mechanism to update Appendix **S7** as required, *resolves to invite ITU-R*

to develop, as a matter of urgency, the technical basis for determining the coordination area for coordination of a receiving earth station in the space research service (deep space) with transmitting stations of high-density systems in the fixed service in the 31.8-32.3 GHz and 37-38 GHz bands,

urges administrations

to participate actively in the aforementioned studies by submitting contributions to ITU-R.

RESOLUTION [COM5/14] (WRC-2000)

Feasibility of use by high altitude platform stations in the fixed and mobile services in the frequency bands above 3 GHz allocated exclusively for terrestrial radiocommunication

The World Radiocommunication Conference (Istanbul, 2000),

considering

a) that ITU has among its purposes “to promote the extension of the benefit of the new telecommunication technologies to all the world’s inhabitants” (No. 6 of the Constitution of ITU (Geneva, 1992));

b) that systems based on new technologies using high altitude platform stations (HAPS) can potentially be used for various applications such as the provision of high-capacity, competitive services to urban and rural areas;

c) that WRC-97 made provision for the use of HAPS within the fixed service in the bands 47.2-47.5 GHz and 47.9-48.2 GHz (see also Resolution 122);

d) that in view of the altitude at which HAPS are placed, the area visible from a HAPS may be within a country or also include neighbouring countries;

e) that some administrations intend to operate systems using HAPS in the bands allocated exclusively by the Table of Frequency Allocations or by footnotes for terrestrial radiocommunication such as the fixed and mobile services,

recognizing

a) ITU-R studies relating to geometrical coordination distance for the visible distance from HAPS, as described in Recommendation ITU-R F.1501,

resolves

to recommend to WRC-03 to review the feasibility of facilitating the implementation of systems using HAPS in the fixed and mobile services in bands above 3 GHz allocated exclusively by the Table of Frequency Allocations or by footnotes for terrestrial radiocommunication,

invites ITU-R

to carry out, as a matter of urgency, regulatory and technical studies to determine the feasibility of facilitating systems using HAPS in the fixed and mobile services in bands above 3 GHz allocated exclusively by the Table of Frequency Allocations or by footnotes for terrestrial radiocommunication, taking account of existing use and future requirements in these bands, and any impact on allocations in adjacent bands,

encourages administrations

to contribute actively to the sharing studies in accordance with this resolution.

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

Document 396-E
24 May 2000

ISTANBUL, 8 MAY – 2 JUNE 2000

B.3 **PLENARY MEETING**

THIRD SERIES OF TEXTS SUBMITTED BY THE EDITORIAL COMMITTEE TO THE PLENARY MEETING

The following texts are submitted to the Plenary Meeting for **first reading:**

Source	**Document**	**Title**
COM 4	362	**APPENDIX S7**

Annex: 107 pages

SUP

APPENDIX S7

Method for the determination of the coordination area around an earth station in frequency bands between 1 GHz and 40 GHz shared between space and terrestrial radiocommunication services

ADD

APPENDIX S7

Methods for the determination of the coordination area around an earth station in frequency bands between 100 MHz and 105 GHz

1 Introduction

This Appendix addresses the determination of the coordination area (see No. **S1.171**) around a transmitting or receiving earth station that is sharing spectrum in frequency bands between 100 MHz and 105 GHz with terrestrial radiocommunication services or with earth stations operating in the opposite direction of transmission.

The coordination area represents the area surrounding an earth station sharing the same frequency band with terrestrial stations, or the area surrounding a transmitting earth station that is sharing the same bidirectionally allocated frequency band with receiving earth stations, within which the permissible level of interference may be exceeded and hence coordination is required. The coordination area is determined on the basis of known characteristics for the coordinating earth station and on conservative assumptions for the propagation path and for the system parameters for the unknown terrestrial stations (see Tables 7 and 8 of Annex 7), or the unknown receiving earth stations (Table 9 of Annex 7), that are sharing the same frequency band.

1.1 Overview

This Appendix contains procedures and system parameters for calculating an earth station's coordination area, including predetermined distances.

The procedures allow the determination of a distance in all azimuthal directions around a transmitting or receiving earth station beyond which the predicted path loss would be expected to exceed a specified value for all but a specified percentage of the time. This distance is called the coordination distance (see No. **S1.173**). When the coordination distance is determined for each azimuth around the coordinating earth station it defines a distance contour, called the coordination contour (see No. **S1.172**), that encloses the coordination area.

It is important to note that, although the determination of the coordination area is based on technical criteria, it represents a regulatory concept. Its purpose is to identify the area within which detailed evaluations of the interference potential need to be performed in order to determine whether the coordinating earth station or any of the terrestrial stations, or in the case of a bidirectional allocation any of the receiving earth stations that are sharing the same frequency band, will experience unacceptable levels of interference. Hence, the coordination area is not an exclusion zone within which the sharing of frequencies between the earth station and terrestrial stations or other earth stations is prohibited, but a means for determining the area within which more detailed calculations need to be performed. In most cases a more detailed analysis will show that sharing within the coordination area is possible since the procedure for the determination of the coordination area is based on unfavourable assumptions with regard to the interference potential.

For the determination of the coordination area, two separate cases are to be considered:

– case when the earth station is transmitting and hence capable of interfering with receiving terrestrial stations or earth stations;

– case when the earth station is receiving and hence may be the subject of interference from transmitting terrestrial stations.

Calculations are performed separately for great circle propagation mechanisms (propagation mode (1)) and, if required by the sharing scenario (see § 1.4), for scattering from hydrometeors (propagation mode (2)). The coordination contour is then determined using the greater of the two distances predicted by the propagation mode (1) and propagation mode (2) calculations for each azimuth around the coordinating earth station. Separate coordination contours are produced for each sharing scenario. Guidance and examples of the construction of coordination contours, and their component propagation mode (1) and propagation mode (2) contours, are provided in § 1.6.

To facilitate bilateral discussion it can be useful to calculate additional contours, defining smaller areas, that are based on less conservative assumptions than those used for the calculation of the coordination contour.

1.2 Structure of this appendix

In this Appendix the general principles are separated from the detailed text on methods. The general principles are contained in the main body of the Appendix, while the methods are contained in a series of annexes, enabling the user to select only those sections that are relevant for a specific sharing scenario.

Table 1 is provided to help the user to navigate through the Appendix and the Annexes; it also indicates the relevant sections that need to be explored for a specific coordination case.

TABLE 1

Cross-reference between sharing scenarios and calculation methods

	Sharing scenarios of § 1.4						
Applicable sections and Annexes	§ 1.4.1 Earth stations operating with geostationary space stations	§ 1.4.2 Earth stations operating with non-geostationary space stations [1]	§ 1.4.3 Earth stations operating to both geostationary and non-geostationary space stations	§ 1.4.4 Earth stations operating in bidirectionally allocated frequency bands	§ 1.4.5 Broadcasting-satellite service earth stations	§ 1.4.6 Mobile (except aeronautical mobile) earth stations	§ 1.4.7 Aeronautical mobile earth stations
§ 1.3 Basic concepts	X	X	X	X	X	X	X
§ 1.5 Propagation model concepts	X	X	X	X	See § 1.4.1, § 1.4.2, § 1.4.3 or § 1.4.4 as applicable and § 1.6	See § 1.4.1, § 1.4.2, § 1.4.3 or § 1.4.4 as applicable and § 1.6	See § 1.4.1, § 1.4.2, § 1.4.3 or § 1.4.4 as applicable and § 1.6
§ 1.6 The coordination contour: concepts and construction	X	X	X	X			
§ 2.1 Earth stations operating with geostationary space stations	X		X				
§ 2.2 Earth stations operating with non-geostationary space stations		X	X				
§ 3 Determination of the coordination area between earth stations operating in bidirectionally allocated frequency bands				X			
§ 4 General considerations for the determination of the propagation mode (1) required distance	X	X	X	X			
§ 5 General considerations for the determination of the propagation mode (2) required distance	X		X				
Annex 1 Determination of the required distance for propagation mode (1)	X	X	X	X			
Annex 2 Determination of the required distance for propagation mode (2)	X		X				

Annex 3 Antenna gain towards the horizon for an earth station operating with a geostationary space station	X		X				
Annex 4 Antenna gain towards the horizon for earth stations operating with non-geostationary space stations		X	X	X			
Annex 5 Determination of the coordination area for a transmitting earth station with respect to receiving earth stations operating with geostationary space stations in bidirectionally allocated frequency bands				X			
Annex 6 Supplementary and auxiliary contours	X	X	X	X			
Annex 7 System parameters and predetermined coordination distances for determination of the coordination area around an earth station	X	X	X	X			

1 For an earth station using a non-tracking antenna the procedure of § 2.1 is used. For an earth station using a non-directional antenna the procedures of § 2.1.1 are used.

1.3 Basic concepts

Determination of the coordination area is based on the concept of the permissible interference power at the antenna terminals of a receiving terrestrial station or earth station. Hence, the attenuation required to limit the level of interference between a transmitting terrestrial station or earth station and a receiving terrestrial station or earth station to the permissible interference power for *p*% of the time is represented by the "minimum required loss", which is the loss that needs to be equalled or exceeded by the predicted path loss for all but *p*% of the time[1].

For propagation mode (1) the following equation applies:

$$L_b(p) = P_t + G_t + G_r - P_r(p) \qquad \text{dB} \qquad (1)$$

where:

- p: maximum percentage of time for which the permissible interference power may be exceeded
- $L_b(p)$: propagation mode (1) minimum required loss (dB) for *p*% of the time; this value must be exceeded by the propagation mode (1) predicted path loss for all but *p*% of the time
- P_t: maximum available transmitting power level (dBW) in the reference bandwidth at the terminals of the antenna of a transmitting terrestrial station or earth station
- $P_r(p)$: permissible interference power of an interfering emission (dBW) in the reference bandwidth to be exceeded for no more than *p*% of the time at the terminals of the antenna of a receiving terrestrial station or earth station that may be subject to interference, where the interfering emission originates from a single source
- G_t: gain (dB relative to isotropic) of the antenna of the transmitting terrestrial station or earth station. For a transmitting earth station, this is the antenna gain towards the physical horizon on a given azimuth; for a transmitting terrestrial station, the maximum main beam axis antenna gain is to be used
- G_r: gain (dB relative to isotropic) of the antenna of the receiving terrestrial or earth station that may be subject to interference. For a receiving earth station, this is the gain towards the physical horizon on a given azimuth; for a receiving terrestrial station, the maximum main beam axis antenna gain is to be used.

In the case of a receiving earth station, the permissible interference power $P_r(p)$ is specified with respect to the actual percentage of time the receiver is in operation, rather than the total elapsed time.

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[1] When p is a small percentage of the time, in the range 0.001% to 1.0%, the interference is referred to as "short-term"; if $p \geq 20\%$, it is referred to as "long-term" (see § 1.5.3).

For propagation mode (2), a volume scattering process is involved and a modification of the above approach is necessary. Where the coordinating earth station antenna beam intersects a rain cell, a common volume may be formed with a terrestrial station beam or an earth station beam (operating in the opposite direction of transmission in bidirectionally allocated frequency bands). In the case of a terrestrial station, the assumptions are made that the terrestrial station beamwidth is relatively large in comparison with that of the coordinating earth station (terrestrial station gain values are given in Tables 7 and 8 of Annex 7) and that the terrestrial station is some distance from the common volume. The terrestrial station beam is therefore assumed to illuminate the whole rain cell, which is represented by a vertical cylinder filled with hydrometeors that give rise to isotropically scattered signals. This scattering process may give rise to unwanted coupling between the coordinating earth station and terrestrial stations or other earth stations operating in bidirectionally allocated frequency bands, via the common volume.

The earth station antenna gain and its beamwidth are interdependent. The size of the common volume, and the number of scattered signals arising within that volume, increases as the gain of the earth station antenna transmitting or receiving those signals decreases, the one effect compensating for the other. A term which approximates the full integral required to evaluate the volume scattering process within the earth station antenna beam is included in equation (2-11). Therefore in the procedure for evaluation of interference that may arise from propagation mode (2) mechanisms a simplifying assumption can be made that the path loss is independent of the earth station antenna gain[2].

Hence for propagation mode (2), equation (1) reduces to:

$$L_x(p) = P_t + G_x - P_r(p) \qquad \text{dB} \tag{2}$$

where:

$L_x(p)$: minimum loss required for propagation mode (2)

G_x: maximum antenna gain (dBi) assumed for the terrestrial station. Tables 7 and 8 of Annex 7 give values of G_x for the various frequency bands.

To facilitate the calculation of propagation mode (2) auxiliary contours (see Annex 6) the calculation is further modified by placing the terrestrial network antenna gain G_x within the iterative loop for the propagation mode (2) required loss calculations[3].

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[2] If the earth station antenna has a wide beamwidth, the method can still be used to determine the propagation mode (2) contour. However, the fact that the antenna beam may be wider than the rain cell and hence not actually fully filled with hydrometeors will mean that the interference potential may be slightly overestimated.

[3] See equation (2-21).

Hence equation (2) further reduces to:

$$L(p) = P_t - P_r(p) \qquad \text{dB} \qquad (3)$$

where:

$L(p)$: propagation mode (2) minimum required loss (dB) for p% of the time; this value must be exceeded by the propagation mode (2) predicted path loss for all but p% of the time.

For both modes of propagation, P_t and $P_r(p)$ are defined for the same radio-frequency bandwidth (the reference bandwidth). Further, $L_b(p)$, $L(p)$ and $P_r(p)$ are defined for the same small percentage of the time, and these values are set by the performance criteria of the receiving terrestrial station or receiving earth station that may be subject to interference.

For an earth station operating with a geostationary space station, Annex 3 provides the numerical method for determining the minimum angle between the earth station antenna main beam axis and the physical horizon as a function of azimuth, and the corresponding antenna gain. In the case of a space station in a slightly inclined geostationary orbit, the minimum elevation angle and corresponding horizon gain will depend on the maximum inclination angle to be coordinated.

For an earth station operating with non-geostationary space stations, the antenna gain of the earth station in the direction of the horizon varies as a function of time and Annex 4 provides the numerical methods for its determination.

For an earth station operating in a frequency band with a bidirectional allocation, the antenna gain to be used in determining the propagation mode (1) minimum required loss is calculated using the methods in Annex 3 or Annex 4, as appropriate.

Determination of the coordination area requires the calculation of the predicted path loss and its comparison with the minimum required loss, for every azimuth around the coordinating earth station, where:

– the predicted path loss is dependent on several factors including the length and general geometry of the interfering path (e.g. antenna pointing, horizon elevation angle), antenna directivity, radio climatic conditions, and the percentage of the time during which the predicted path loss is less than the minimum required loss; and

– the minimum required loss is based on system and interference model considerations.

The required coordination distance is the distance at which these two losses are considered to be equal for the stated percentage of time.

In determining the coordination area, the pertinent parameters of the coordinating earth station are known, but knowledge of the terrestrial stations or other earth stations sharing that frequency range is limited. Hence it is necessary to rely on assumed system parameters for the unknown terrestrial stations or the unknown receiving earth stations. Furthermore, many aspects of the interference path between the coordinating earth station and the terrestrial stations or other earth stations (e.g. antenna geometry and directivity) are unknown.

The determination of the coordination area is based on unfavourable assumptions regarding system parameter values and interference path geometry. However, in certain circumstances, to assume that all the worst-case values will occur simultaneously is unrealistic, and leads to unnecessarily large values of minimum required loss. This could lead to unnecessarily large coordination areas. For propagation mode (1), detailed analyses, supported by extensive operational experience, have shown that the requirement for the propagation mode (1) minimum required loss can be reduced because of the very small probability that the worst-case assumptions for system parameter values and interference path geometry will exist simultaneously. Therefore, a correction is applied within the calculation for the propagation mode (1) predicted path loss in the appropriate sharing scenario to allow benefit to be derived from these mitigating effects. The application of this correction factor is described in more detail in § 4.4.

This correction applies to cases of coordination with the fixed service. It is frequency, distance and path dependent. It does not apply in the case of the coordination of an earth station with mobile stations, nor with other earth stations operating in the opposite direction of transmission, nor in the case of propagation via hydrometeor scatter (propagation mode (2)).

A number of propagation models are used to cover the propagation mechanisms that exist in the full frequency range. These models predict the path loss as a monotonically increasing function of distance. Therefore, coordination distances are determined by calculating the path loss iteratively for an increasing distance until either the minimum required loss is achieved, or a maximum calculation distance limit is reached (see § 1.5.3).

The iteration method always starts at a defined value of minimum distance, d_{min} (km), and iteration is performed using a uniform step size, s (km), for increasing the distance. A step size of 1 km is recommended.

1.4 Sharing scenarios

The following subsections describe the basic assumptions made for the various earth station sharing scenarios. These subsections need to be read in conjunction with the information contained in Table 1 and § 1.6 which contains guidance on the development of a coordination contour. Except as discussed in §§ 1.4.5 to 1.4.7, the earth stations around which coordination areas are determined are assumed to be fixed earth stations authorized to operate at a single permanent location. In cases of earth stations that can be operated from a number of fixed locations, the coordination areas are determined for each individual location.[4]

1.4.1 Earth stations operating with geostationary space stations

For an earth station operating with a space station in the geostationary orbit, the space station appears to be stationary with respect to the Earth. However variations in gravitational forces acting on the space station and limitations in positional control mean that a geostationary space station's orbital parameters are not constant. Movement from the space station's nominal orbital position in an east/west direction (longitudinal tolerance) is limited under the Radio Regulations (see Nos. **S22.6** to **S22.18**), but movement in the north/south direction (inclination excursion) is not specified.

Relaxation in the north/south station-keeping of a geostationary space station allows its orbit to become inclined, with an inclination that increases gradually with time. Therefore the determination of the coordination area requires consideration of the range of movement of the earth station antenna. Although the direction of pointing of the earth station antenna may in practice vary with time, the earth station antenna may also be pointing in one direction for considerable periods of time. Hence the gain of the earth station antenna in the direction of the horizon is assumed to be constant. For an earth station operating with a space station in an orbit as described above, an assumption of constant horizon gain as the inclination angle increases may lead to a conservative estimation of the coordination area, the degree of conservatism increasing with increasing inclination angle.

For an earth station operating with a geostationary space station the coordination area is determined using the procedures described in § 2.1.

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[4] While some fixed satellite systems transmit to fixed earth stations operating at unspecified locations within a service area defined by an administration, methods for determining the coordination areas are specified only for individual sites. To minimize the number of individual earth stations requiring detailed coordination in these cases, administrations may wish to develop bilateral agreements based on distances, calculated in accordance with Recommendation ITU-R SM.1448, extended from the periphery of a service area.

1.4.2 Earth stations operating with non-geostationary space stations

Earth stations operating with non-geostationary space stations may use a directional or a non-directional antenna. Furthermore, earth stations using a directional antenna may track the orbital path of a non-geostationary space station.

While an earth station operating with a geostationary space station is assumed to have a constant antenna gain towards the horizon, for an earth station antenna that is tracking the orbital path of a non-geostationary space station, the antenna gain towards the horizon will vary with time. Therefore, it is necessary to estimate the variation of the antenna gain with time towards the horizon for each azimuth in order to determine the coordination area. The procedure is described in § 2.2.

For an earth station operating with a non-geostationary space station, the motion of a relatively high gain tracking antenna reduces the probability of interference due to propagation mode (2) mechanisms and hence the propagation mode (2) required distances will be relatively short. The minimum coordination distance d_{min} (see § 1.5.3) will provide adequate protection in these cases. The propagation mode (2) contour is therefore taken to be identical to a circle whose radius is the minimum coordination distance. Propagation mode (2) calculations are not required in these circumstances and the coordination area is determined using the propagation mode (1) procedure in § 2.2 only.

For an earth station operating with a non-geostationary space station using a non-directional antenna, a similar situation applies, and the low gain means that propagation mode (2) required distances will be less than the minimum coordination distance. Hence, for the case of a non-directional antenna the propagation mode (2) contour is also coincident with the circle of radius d_{min}, and the coordination area is determined using the propagation mode (1) procedures described in § 2.1.1 only.

For an earth station operating with a non-geostationary space station using a non-tracking directional antenna, the potential for interference arising from propagation mode (2) is the same as for an earth station operating with a geostationary space station. Hence, for the case of non-tracking directional antenna the coordination area is determined using both the propagation mode (1) and propagation mode (2) procedures described in § 2.1.

1.4.3 Earth stations operating with both geostationary and non-geostationary space stations

For earth stations that are sometimes intended to operate with geostationary space stations and at other times with non-geostationary space stations, separate coordination areas are determined for each type of operation. In such cases, the coordination area for the geostationary space station is determined using the procedures described in § 2.1 and the coordination area for the non-geostationary space station is determined using the procedure described in § 2.2. For each case, the percentage of time, *p*, is specified for all the operational time that the receiving earth station is expected to spend in reception from geostationary space stations or non-geostationary space stations, as appropriate.

1.4.4 Earth stations operating in bidirectionally allocated frequency bands

For earth stations operating in some frequency bands there may be co-primary allocations to space services operating in both the Earth-to-space and space-to-Earth directions. In this case, where two earth stations are operating in opposite directions of transmission it is only necessary to establish the coordination area for the transmitting earth station, as receiving earth stations will automatically be taken into consideration. Hence, a receiving earth station operating in a bidirectionally allocated frequency band will only be involved in coordination with a transmitting earth station if it is located within the transmitting earth station's coordination area.

For a transmitting earth station operating with either geostationary or non-geostationary satellites in a bidirectionally allocated frequency band, the coordination area is determined using the procedures described in § 3.

1.4.5 Broadcasting-satellite service earth stations

For earth stations in the broadcasting-satellite service operating in the unplanned bands, the coordination area is determined by extending the periphery of the specified service area within which the earth stations are operating by the coordination distance based on a typical BSS earth station. In calculating the coordination distance, no additional protection can be assumed to be available from the earth station horizon elevation angle, i.e. A_h = 0 dB in Annex 1, for all azimuth angles around the earth station.

1.4.6 Mobile (except aeronautical mobile) earth stations

For a mobile (except aeronautical mobile) earth station, the coordination area is determined by extending the periphery of the specified service area, within which the mobile (except aeronautical mobile) earth stations are operating, by the coordination distance. The coordination distance may be represented by a predetermined coordination distance (see Table 10 of Annex 7), or it may be calculated. In calculating the coordination distance, no additional protection can be assumed to be available from the earth station horizon elevation angle, i.e. A_h = 0 dB in Annex 1, for all azimuths around the earth station.

1.4.7 Aeronautical mobile earth stations

For aeronautical mobile earth stations, the coordination area is determined by extending the periphery of the specified service area within which the aeronautical mobile earth station operates, by an appropriate predetermined coordination (see Table 10 of Annex 7) distance for the respective services.

1.5 Propagation model concepts

For each mode of propagation, according to the requirements of the specific sharing scenario (see § 1.4) it is necessary to determine the predicted path loss. The determination of this predicted path loss is based on a number of propagation mechanisms.

Interference may arise through a range of propagation mechanisms whose individual dominance depends on climate, radio frequency, time percentage in question, distance and path topography. At any given point in time, one or more mechanisms may be present. The propagation mechanisms that are considered within this Appendix in the determination of the interference potential are as follows:

– *Diffraction*: Insofar as it relates to diffraction losses occurring over the earth station's local physical horizon. This effect is referred to below as "site shielding". The remainder of the path along each radial is considered to be flat and therefore free of additional diffraction losses.

– *Tropospheric scatter*: This mechanism defines the "background" interference level for paths longer than about 100 km, beyond which the diffraction field becomes very weak.

– *Surface ducting*: This is the most important short-term interference mechanism over water and in flat coastal land areas, and can give rise to high signal levels over greater distances, sometimes exceeding 500 km. Such signals can exceed the equivalent "free-space" level under certain conditions.

– *Elevated layer reflection and refraction*: The treatment of reflection and/or refraction from layers at heights of up to a few hundred metres is an important mechanism that enables signals to by-pass any diffraction losses due to the underlying terrain under favourable path geometry situations. Here again, the impact can be significant over long distances.

– *Hydrometeor scatter*: Hydrometeor scatter can be a potential source of interference between terrestrial station transmitters and earth stations because it may act isotropically, and can therefore have an impact irrespective of whether the common volume is on or off the great-circle interference path between the coordinating earth station and terrestrial stations, or other receiving earth stations operating in bidirectionally allocated frequency bands.

In this Appendix, propagation phenomena are classified into two modes as follows:

– *Propagation mode (1)*: propagation phenomena in clear air (tropospheric scatter, ducting, layer reflection/refraction, gaseous absorption and site shielding). These phenomena are confined to propagation along the great-circle path.

– *Propagation mode (2)*: hydrometeor scatter.

1.5.1 Propagation mode (1)

For the determination of the propagation mode (1) required distances, the applicable frequency range has been divided into three parts:

– For VHF/UHF frequencies between 100 MHz and 790 MHz and for time percentages from 1% to 50% of an average year.

– From 790 MHz to 60 GHz and for time percentages from 0.001% to 50% of an average year.

– From 60 GHz to 105 GHz and for time percentages from 0.001% to 50% of an average year.

The variation in predicted path loss due to the horizon elevation angle around an earth station is calculated by the method described in § 1 of Annex 1, using the horizon elevation angles and distances along different radials from the earth station. For all frequencies between 100 MHz and 105 GHz, the attenuation arising from the horizon characteristics is included in the value of propagation mode (1) predicted path loss, unless its use is specifically prohibited for a particular sharing scenario (see § 1.4.5 and § 1.4.6).

In the determination of the propagation mode (1) required distance, the world is divided into four basic radio-climatic zones. These zones are defined as follows:

– Zone A1: coastal land, i.e. land adjacent to a Zone B or a Zone C area (see below), up to an altitude of 100 m relative to mean sea or water level, but limited to a maximum distance of 50 km from the nearest Zone B or Zone C area; in the absence of precise information on the 100 m contour, an approximation (e.g. 300 feet) may be used. Large inland areas of at least 7 800 km^2 which contain many small lakes, or a river network, comprising more than 50% water, and where more than 90% of the land is less than 100 m above the mean water level may be included in Zone A1[5].

– Zone A2: all land, other than coastal land as defined in Zone A1 above.

– Zone B: "cold" seas, oceans and large bodies of inland water situated at latitudes above 30°, with the exception of the Mediterranean Sea and the Black Sea. A "large" body of inland water is defined, for the administrative purpose of coordination, as one having an area of at least 7 800 km^2, but excluding the area of rivers. Islands within such bodies of water are to be included as water within the calculation of this area if they have elevations lower than 100 m above the mean water level for more than 90% of their area. Islands that do not meet these criteria should be classified as land for the purposes of calculating the area of the water.

– Zone C: "warm" seas, oceans and large bodies of inland water situated at latitudes below 30°, as well as the Mediterranean Sea and the Black Sea.

[5] These additional areas may be declared as coastal Zone A1 areas by administrations for inclusion in the ITU Digital World Map (IDWM).

1.5.2 Propagation mode (2)

For the determination of the propagation mode (2) required distance, interference arising from hydrometeor scatter can be ignored at frequencies below 1 000 MHz and above 40.5 GHz outside the minimum coordination distance (see § 1.5.3.1). Below 1 000 MHz, the level of the scattered signal is very low and above 40.5 GHz, although significant scattering occurs, the scattered signal is then highly attenuated along the path from the scatter volume to the receiving terrestrial station or earth station. Site shielding is not relevant to propagation mode (2) mechanisms as the interference path is via the main beam of the coordinating earth station antenna.

1.5.3 Distance limits

The effect of interference on terrestrial and space systems often needs to be assessed by considering long and short term interference criteria. These criteria are generally represented by a permissible interference power not to be exceeded for more than a specified percentage of time.

The long-term interference criterion (typically associated with percentages of time ≥ 20%) allows the error performance objective (for digital systems) or noise performance objective (for analogue systems) to be met. This criterion will generally represent a low level of interference and hence require a high degree of isolation between the coordinating earth station and terrestrial stations, or other receiving earth stations operating in bidirectionally allocated bands.

The short-term criterion is a higher level of interference, typically associated with time percentages in the range 0.001% to 1% of time, which will either make the interfered-with system unavailable, or cause its specified short-term interference objectives (error rate or noise) to be exceeded.

This Appendix addresses only the protection provided by the short-term criterion. There is therefore an implicit assumption that if the short-term criterion is satisfied, then any associated long-term criteria will also be satisfied. This assumption may not remain valid at short distances because additional propagation effects (diffraction, building/terrain scattering etc.) requiring a more detailed analysis become significant. A minimum coordination distance is therefore needed to avoid this difficulty. This minimum coordination distance is always the lowest value of coordination distance used. At distances equal to or greater than the minimum coordination distance, it can be assumed that interference due to continuous (long-term) propagation effects will not exceed levels permitted by the long-term criteria.

In addition to the minimum coordination distance, it is also necessary to set an upper limit to the calculation distance. Hence the coordination distance, on any azimuth, must lie within the range between the minimum coordination distance and the maximum calculation distance.

1.5.3.1 Minimum coordination distance

For the reasons stated in § 1.5.3, it is necessary to set a lower limit (d_{min}) for the coordination distance. The iterative calculation of the coordination distance starts at this minimum distance, and this distance varies according to radiometeorological factors and the frequency band (see § 4.2). This same minimum coordination distance applies both to propagation mode (1) and propagation mode (2) calculations.

1.5.3.2 Maximum calculation distance

Maximum calculation distances are required for propagation modes (1) and (2). In the case of mode (1), this distance corresponds to the maximum coordination distance, d_{max1}, given in § 4.3 for each of the four radioclimatic Zones. The propagation mode (1) maximum calculation distance is therefore dependent on the mixture of radioclimatic Zones in the propagation path, as described in § 4.3.

The maximum calculation distance for propagation mode (2) is given in § 2 of Annex 2.

1.6 The coordination contour: concepts and construction

The coordination distance, determined for each azimuth around the coordinating earth station, defines the coordination contour that encloses the coordination area. The coordination distance lies within the range defined by the minimum coordination distance and the maximum calculation distance.

In this Appendix, the procedures determine the distance at which the minimum required loss is equal to the predicted path loss. In addition, some procedures[6] require that, for any azimuth, the greater of the distances determined for propagation mode (1) and propagation mode (2) is the distance to be used in determining the coordination contour. In both these cases, the distance at which the minimum required loss is equal to the predicted path loss may or may not be within the range of valid values that define the limits for the coordination distance. Hence, the distance determined from the application of all the procedures is referred to as the required distance.

The coordination area is determined by one of the following methods:

– calculating, in all directions of azimuth from the earth station, the coordination distances and then drawing to scale on an appropriate map the coordination contour; or

– extending the service area in all directions by the calculated coordination distance(s); or

– for some services and frequency bands, extending the service area in all directions by a predetermined coordination distance.

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[6] The same procedures are also used to develop supplementary and auxiliary contours (see Annex 6).

Where a coordination contour includes the potential interference effects arising from both propagation mode (1) and propagation mode (2), the required distance used for any azimuth is the greater of the propagation mode (1) and propagation mode (2) required distances.

The sharing scenarios and the various procedures contained in this Appendix are based on different assumptions. Hence, the coordination area developed for one sharing scenario is likely to be based on different sharing considerations, interference paths and operational constraints than the coordination area developed under a different sharing scenario. Separate coordination areas are therefore required for each sharing scenario described in § 1.4, and each coordination area is specific to the radiocommunication services covered by the sharing scenario under which it was developed. Further, the coordination area developed for one sharing scenario cannot be used to determine the extent of any impact on the radiocommunication services covered by a different sharing scenario. Thus, a coordinating earth station operating in a bidirectionally allocated frequency band that is also allocated to terrestrial services will have two separate coordination areas:

– one coordination area for determining those administrations with terrestrial services that may be affected by the operation of the coordinating earth station; and

– one coordination area for determining those administrations with receiving earth stations that may be affected by the operation of the coordinating (transmitting) earth station.

This means that the establishment of the coordination area for an earth station will generally require the determination of several individual coordination areas, each drawn on a separate map. For example, an earth station which transmits to a geostationary space station in the band 10.7-11.7 GHz will need to develop the following coordination areas with respect to:

– analogue terrestrial services which receive in the same band; this will comprise the potential effects arising from both propagation mode (1) and propagation mode (2) interference paths;

– an earth station operating with a geostationary space station which receives in the same band; this will comprise the potential effects arising from both propagation mode (1) and propagation mode (2) interference paths;

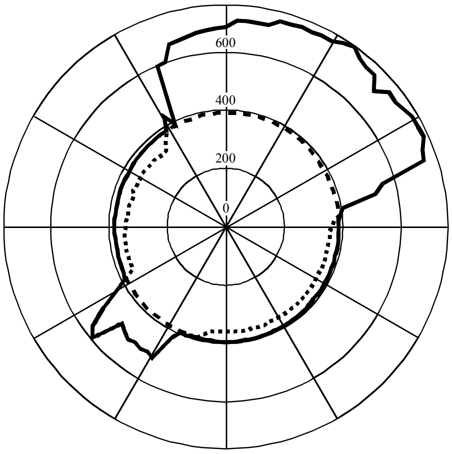
– an earth station operating with a non-geostationary space station which receives in the same band; this will comprise the potential effects arising from propagation mode (1) interference paths.

In addition, separate coordination contours are produced if the earth station both transmits and receives in bands shared with terrestrial services. However, for earth stations in bidirectionally allocated frequency bands, the coordination contours with respect to other earth stations are only produced for a transmitting earth station (see § 1.4.4).

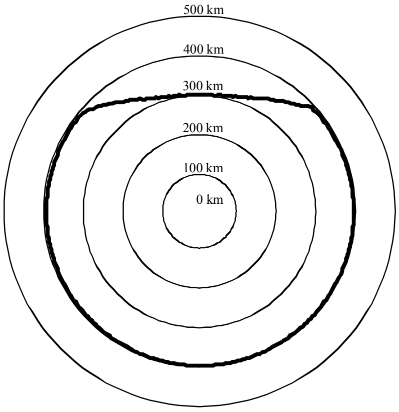
Examples of coordination contours for each of the sharing scenarios in § 1.4 is provided in Fig 1. It will be noticed that for some of the sharing scenarios there is a commonality to the construction of the coordination contour (shown by a solid line) that encompasses each coordination area. For those sharing scenarios where both propagation mode (1) and propagation mode (2) interference paths need to be taken into consideration, the parts of the propagation mode (1) contour and that part of the propagation mode (2) contour located within the overall coordination contour may be drawn using dashed lines.

FIGURE 1

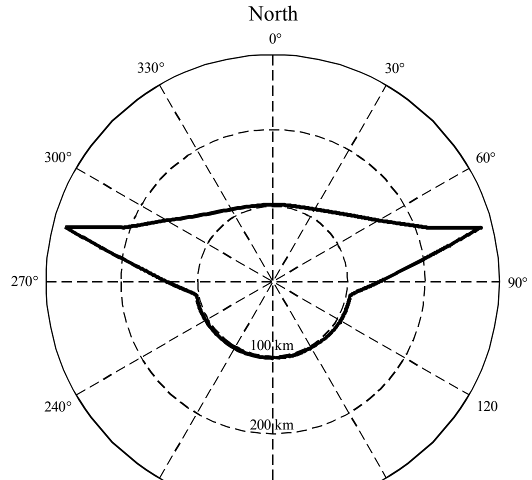
Examples of coordination contours for each of the sharing scenarios listed in § 1.4



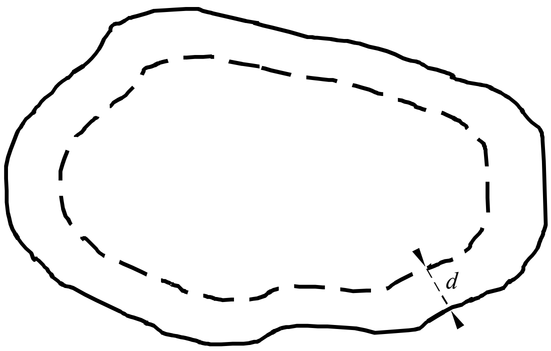
Example of the coordination contour for an earth station operating to a GSO space station in § 1.4.1 and § 1.4.3. The coordination contour is marked by the outer line and is comprised of a propagation mode (1) contour and a circular propagation mode (2) contour. The propagation mode (1) contour could also be an example of an earth station with a non-tracking directional antenna operating to a non-GSO space station in § 1.4.2.



Example of the coordination contour for an earth station with a tracking antenna operating to a non-GSO space station in § 1.4.2 and § 1.4.3.



Example of the coordination contour for an earth station operating in bidirectionally allocated frequency bands in § 1.4.4. The coordination contour has been developed from a propagation mode (1) contour for a coordinating earth station operating to a non-GSO space station with respect to unknown earth stations operating to GSO space stations. For a propagation mode (2) contour for the GSO-GSO case see Annex 5.



Example of the coordination contour for an earth station operating in a specified service area in § 1.4.5, § 1.4.6 and § 1.4.7. The coordination contour is marked by the solid outer line and the specified service area by the broken inner line. The coordination distance, *d*, may be a constant value, or vary with azimuth, depending on the sharing scenario and the type of radiocommunication service.

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In addition to the coordination contour, supplementary contours and auxiliary contours (see Annex 6) may be drawn to facilitate more detailed sharing discussions. Supplementary contours are based on the coordinating earth station sharing frequency bands with other radiocommunication services, or other types of radio systems in the same service, that have less onerous sharing criteria than the radio system used for developing the coordination area. These supplementary contours may be developed by the same method used to determine the coordination contour, or by other methods as agreed on a bilateral basis between administrations. For example, the Time Variant Gain method described in § 4 of Annex 6 can be used to generate supplementary contours for earth stations operating with non-geostationary space stations. Auxiliary contours are based on less conservative assumptions, with regard to the interference path and operational constraints, for the unknown terrestrial stations, or earth stations. Auxiliary contours are developed separately for propagation mode (1) and propagation mode (2) interference paths. In this context, the contours from which the coordination contour was developed are called main contours, and the auxiliary contours for propagation mode (1) and propagation mode (2) are referenced to the appropriate main contour. The various assumptions used for developing auxiliary contours to the propagation mode (1) contour, or the propagation mode (2) contour, can also be applied to supplementary contours. Hence, auxiliary contours may be drawn for both a main or a supplementary contour.

Supplementary contours are always drawn on a separate map as they apply to other types of radio system within the same radiocommunication service, or to radio systems in different radiocommunication services. However, as auxiliary contours apply to the various assumptions used in developing the main, or supplementary, contour they are always drawn on the same map that contains the corresponding main, or supplementary, contour.

While the use of supplementary or auxiliary contours allows less conservative assumptions with regard to the interference path and operational constraints to be taken into consideration, earth stations may transmit or receive a variety of classes of emissions. Hence, the earth station parameters to be used in the determination of the coordination contour, and any supplementary or auxiliary contours, are those which lead to the greatest distances for each earth station antenna beam and each allocated frequency band which the coordinating earth station shares with other radiocommunication systems.

2 Determination of the earth station coordination area with respect to terrestrial stations

This section contains the procedures for determining the coordination area for the case of earth stations sharing frequency bands with terrestrial stations. These procedures cover the cases for earth stations operating with space stations in the geostationary orbit, or in non-geostationary orbits, and are described in the following subsections.

For earth stations operating with space stations in non-geostationary orbits, consideration has to be given to the potential time-varying nature of the earth station's antenna gain towards the horizon.

2.1 Earth stations operating with geostationary space stations

For an earth station operating with a geostationary space station, the value of G_t and G_r towards the horizon is considered to be constant with time. The percentage of time associated with L_b in equation (1) is the same as the time percentage, p, associated with $P_r(p)$. When determining the coordination area between a coordinating earth station operating to a geostationary space station and terrestrial systems, the coordination distance on any azimuth is the greater of the propagation mode (1) and propagation mode (2) required distances. The required distances for propagation mode (1) and propagation mode (2) are determined using the procedures described in § 2.1.1 and § 2.1.2 respectively, after taking into consideration the following discussion on station-keeping.

When the north/south station-keeping of a geostationary space station is relaxed, the orbit of the space station becomes inclined with an inclination that increases gradually with time. This movement of the space station from its nominal position may require small corresponding adjustments in the elevation angle of the earth station antenna beam. Hence, to avoid considering the time variation in antenna gain in the direction of the horizon, the coordination area of an earth station operating to a space station in a slightly inclined geostationary orbit is determined for the minimum angle of elevation and the associated azimuth at which the space station is visible to the earth station (see Annex 3).

2.1.1 Determination of the coordinating earth station's propagation mode (1) contour

Determination of the propagation mode (1) contour is based on great circle propagation mechanisms and it is assumed, for the interference path, that all the terrestrial stations are pointing directly at the coordinating earth station's location. The required distance, on each azimuth, for propagation mode (1) is that distance which will result in a value of propagation mode (1) predicted path loss that is equal to the propagation mode (1) minimum required loss, $L_b(p)$ (dB), as defined in § 1.3.

$$L_b(p) = P_t + G_e + G_x - P_r(p) \qquad \text{dB} \qquad (4)$$

where:

P_t and $P_r(p)$: as defined in § 1.3

G_e: gain of the coordinating earth station antenna (dBi) towards the horizon at the horizon elevation angle and azimuth under consideration

G_x: maximum antenna gain (dBi) assumed for the terrestrial station. Tables 7 and 8 of Annex 7 give values for G_x for the various frequency bands.

The propagation mode (1) required distance is determined using the procedures described in § 4, and the detailed methods in Annex 1. Specific guidance relevant to the application of the procedures is provided in § 4.4.

2.1.2 Determination of the coordinating earth station's propagation mode (2) contour

The required distance for hydrometeor scatter is that distance that will result in a propagation mode (2) predicted path loss equal to the propagation mode (2) minimum required loss *L* (*p*), as defined in equation (3). This propagation mode (2) required distance is determined using the guidance in § 5, and the detailed methods in Annex 2.

For an earth station operating with a geostationary space station having a slightly inclined orbit, the rain-scatter coordination contours for each of the satellite's two most extreme orbit positions are determined individually, using the relevant elevation angles and their associated azimuths to the satellite. The rain scatter area is the total area contained within the two resulting overlapping coordination contours.

2.2 Earth stations operating with non-geostationary space stations

For an earth station that operates with non-geostationary space stations and whose antennas track the space stations, the antenna gain in the direction of the horizon on any azimuth varies with time. The method used to determine the coordination contour is the time invariant gain (TIG) method.

This method uses fixed values of antenna gain based on the maximum assumed variation in horizon antenna gain on each azimuth under consideration. In considering the horizon gain of the antenna for either a transmitting or a receiving earth station, only the horizon antenna gain values during the operational time are to be considered. The horizon antenna gain may be determined using Annex 4. Reference or measured antenna radiation patterns may be used as described in Annex 3. The values of horizon antenna gain defined below are used for each azimuth when applying equation (4) to determine the propagation mode (1) required distances:

$$\begin{aligned} G_e &= G_{max} && \text{for} && (G_{max} - G_{min}) \le 20\ \text{dB} \\ G_e &= G_{min} + 20 && \text{for} && 20\ \text{dB} < (G_{max} - G_{min}) < 30\ \text{dB} \\ G_e &= G_{max} - 10 && \text{for} && (G_{max} - G_{min}) \ge 30\ \text{dB} \end{aligned} \tag{5}$$

where:

G_e: the gain of the coordinating earth station antenna (dBi) towards the horizon at the horizon elevation angle and azimuth under consideration in equation (4)

G_{max}, G_{min}: maximum and minimum values of the horizon antenna gain (dBi), respectively, on the azimuth under consideration.

The maximum and minimum values of the horizon antenna gain, on the azimuth under consideration, are derived from the antenna pattern and the maximum and minimum angular separation of the antenna main beam axis from the direction of the physical horizon at the azimuth under consideration.

Where a single value of minimum elevation angle for the main beam axis of the earth station antenna is specified for all azimuths, the minimum and maximum values of the horizon gain can be determined, for each azimuth under consideration, from the antenna pattern and the horizon elevation angle at that azimuth. The plot of the horizon elevation angle against azimuth is called the horizon profile of the earth station.

Additional constraints may be included in the determination of the maximum and minimum values of the horizon antenna gain where an earth station is operating with a constellation of non-geostationary satellites at a latitude for which no satellite is visible at the earth station’s specified minimum elevation angle over a range of azimuths. Over this range of azimuth angles, the minimum elevation angle of the earth station antenna main beam axis is given by the minimum elevation angle at which any satellite of the constellation is visible at that azimuth. The azimuthal dependence of this minimum satellite visibility elevation angle may be determined from consideration of the orbital altitude and inclination of the satellites in the constellation, without recourse to simulation, using the procedure in § 1.1 of Annex 4. In this case, the horizon antenna gain to be used in the method depends on the profile of the composite minimum elevation angle. This minimum composite elevation angle at any azimuth is the greater of the minimum satellite visibility elevation angle, at the azimuth under consideration, and the specified minimum elevation angle for the earth station which is independent of the azimuth.

Thus, at each azimuth under consideration, the maximum horizon antenna gain will be determined from the minimum value of the angular separation between the earth station horizon profile at this azimuth and the profile of the minimum composite elevation angle. Similarly, the minimum horizon antenna gain will be determined from the maximum value of the angular separation from the earth station horizon profile at this azimuth to the profile of the minimum composite elevation angle. The procedure for calculating the minimum and maximum angular separations from the profile of the minimum composite elevation angle is given in § 1.2 of Annex 4.

The propagation mode (1) required distance is then determined using the procedures described in § 4, and the detailed methods in Annex 1. Specific guidance relevant to the application of the propagation calculations is provided in § 4.4.

3 Determination of the coordination area between earth stations operating in bidirectionally allocated frequency bands

This section describes the procedures to be used for determination of the coordination area for an earth station transmitting in a frequency band allocated to space services in both Earth-to-space and space-to-Earth directions.

There are various coordination scenarios, involving only non-time-varying antenna gains, or only time-varying antenna gains (both earth stations operate to non-geostationary space stations) or, one time-varying antenna gain and one non-time-varying antenna gain.

The following subsections describe the methods for the determination of coordination area which are specific to each of these bidirectional cases. The procedures applicable to the coordination scenario where both earth stations operate with geostationary space stations are given in § 3.1. The other bidirectional coordination scenarios are considered in § 3.2, where particular attention is given to the approaches for using the horizon antenna gain of the receiving earth station for each of the possible coordination scenarios in the appropriate procedure of § 2.

Table 9 of Annex 7 provides the parameters that are to be used in the determination of the coordination area. Table 9 of Annex 7 also indicates whether, in each band, the receiving earth stations operate with geostationary or non-geostationary space stations. In some bands, receiving earth stations may operate with both geostationary and non-geostationary space stations. Table 2 indicates the number of coordination contours which need to be drawn for each coordination scenario and the section(s) containing the applicable calculation methods. Once drawn, each coordination contour must be appropriately labelled.

TABLE 2

Coordination contours required for each bidirectional scenario

Coordinating earth station operating to a space station in the	Unknown receiving earth station operating to a space station in the	Section containing the method to determine G_t and G_r	Contours required	
			No.	Details
Geostationary orbit	Geostationary orbit	§ 3.1	1	A coordination contour comprising both propagation mode (1) and propagation mode (2) contours
	Non-geostationary orbit	§ 3.2.1	1	A propagation mode (1) coordination contour
	Geostationary or non-geostationary orbits[1]	§§ 3.1.1 and 3.2.1	2	Two separate coordination contours, one for the geostationary orbit (propagation mode (1) and mode (2) contours) and one for the non-geostationary orbit (propagation mode (1) contour)
Non-geostationary orbit	Geostationary orbit	§ 3.2.2	1	A propagation mode (1) coordination contour
	Non-geostationary orbit	§ 3.2.3	1	A propagation mode (1) coordination contour
	Geostationary or non-geostationary orbits[1]	§§ 3.2.2 and 3.2.3	2	Two separate propagation mode (1) coordination contours, one for the geostationary orbit and one for the non-geostationary orbit

[1] In this case, the bidirectional frequency band may contain allocations in the Earth-to-space direction for space stations in both the geostationary orbit and non-geostationary orbits. Hence, the coordinating administration will not know whether the unknown receiving earth stations are operating with space stations in the geostationary orbit or non-geostationary orbit.

3.1 Coordinating and unknown earth stations operating with geostationary space stations

When both the coordinating and the unknown earth stations operate with space stations in the geostationary orbit, it is necessary to develop a coordination contour comprising both propagation mode (1) and propagation mode (2) contours, using the procedures described in § 3.1.1 and § 3.1.2, respectively.

3.1.1 Determination of the coordinating earth station's propagation mode (1) contour

The procedure for the determination of the propagation mode (1) contour in this case differs from that described in § 2.2 in two ways. First, the parameters to be used for the unknown receiving earth station are those in Table 9 of Annex 7. Second, and more significantly, the knowledge that both earth stations operate with geostationary satellites can be used to calculate the worst-case value of the horizon antenna gain of the receiving earth station towards the transmitting earth station for each azimuth at the transmitting earth station. The propagation mode (1) required distance is that distance which will result in a value of propagation mode (1) predicted path loss which is equal to the propagation mode (1) minimum required loss, $L_b(p)$ (dB), as defined in § 1.3, and repeated here for convenience.

$$L_b(p) = P_t + G_t + G_r - P_r(p) \quad \text{dB} \tag{6}$$

where:

P_t and $P_r(p)$: are as defined in § 1.3

G_t : gain of the coordinating (transmitting) earth station antenna (dBi) towards the horizon at the horizon elevation angle and the azimuth under consideration

G_r: the horizon antenna gain of the unknown receiving earth station towards the transmitting earth station on the specific azimuth from the coordinating earth station. Values are determined by the procedure in § 2.1 of Annex 5, based on parameters from Table 9 of Annex 7.

To facilitate the determination of the values of G_r to be used at an azimuth from the transmitting earth station, several simplifying approximations must be made:

– that the horizon elevation of the receiving earth station is zero degrees on all azimuths;

– that the receiving earth station operates with a space station that has zero degrees orbital inclination and may be located anywhere on the geostationary orbit that is above the minimum elevation angle, given in Table 9 of Annex 7, for the location of the receiving earth station;

– that the latitude of the receiving earth station is the same as that of the transmitting earth station;

– that plane geometry can be used to interrelate the azimuth angles at the respective earth stations, rather than using the great circle path.

The first three assumptions provide the basis for determining the horizon antenna gain of the receiving earth station on any azimuth. The assumption of 0° horizon elevation angle is conservative since the increase in horizon antenna gain due to a raised horizon would, in practice, be more than offset by any real site shielding[7]. The last two assumptions in the list simplify the calculation of the sum of G_t and G_r along any azimuth. Since the propagation mode (1) required distances are small, in global geometric terms these approximations may introduce a small error in the determination of the horizon antenna gain of the receiving earth station antenna that, in any case, will not exceed 2 dB. Because of the assumption of plane geometry, for a given azimuth at the transmitting earth station the appropriate value of the horizon antenna gain of the receiving earth station is the value on the reciprocal (i.e. ±180º, see § 2.1 of Annex 5) azimuth at the receiving earth station.

The propagation mode (1) required distance is then determined using the procedures described in § 4, and the detailed methods in Annex 1. Specific guidance relevant to the application of the propagation calculations is provided in § 4.4.

3.1.2 Determination of the coordinating earth station's propagation mode (2) contour

The procedure for the determination of the propagation mode (2) contour for a transmitting earth station operating with a geostationary space station uses the same simplifying approximations as made in § 3.1.1, but it is based on a geometrical construction that avoids the requirement for a complex propagation model (see § 3 of Annex 5). Auxiliary contours cannot be used in this method, as the calculations are not based on the propagation mode (2) required loss.

The propagation mode (2) contour is determined using the elevation angle and the azimuth from the coordinating transmitting earth station to the space station, together with the following two considerations:

– the minimum coordination distance (see § 4.2), which will be the required distance for some azimuths; and

[7] While no site shielding can be assumed for the receiving earth station, any site shielding that may exist at the transmitting earth station is considered by taking into account the horizon elevation angle in accordance with § 1 of Annex 1.

– a worst-case required distance determined by the hydrometeor scatter geometry for a receiving earth station located in either of two 6 degree azimuth sectors. Within these sectors, the receiving earth station is assumed to be operating at the minimum elevation angle to a space station in the geostationary orbit and its main beam intersects the beam for the coordinating transmitting earth station at the point where the latter beam passes through the rain height (h_R). Although the scattering can occur anywhere between the coordinating earth station and this point, the intersection of the two beams at this point represents the worst-case interference scenario. Hence, it results in the worst-case distance requirement for receiving earth stations located in the two azimuth sectors.

For an earth station operating with a space station in an inclined orbit, the lowest expected operational antenna elevation angle and its associated azimuth are used in the calculations.

The propagation mode (2) contour is determined using the method in § 3 of Annex 5.

3.2 Coordinating or unknown earth stations operating with non-geostationary space stations

To determine the coordination area, the method described in § 2.2 is used. For the cases where a coordinating (transmitting) earth station operates with non-geostationary space stations, the following procedures assume that the earth station antenna is tracking the space station, otherwise see § 1.4.2. Table 9 of Annex 7 provides values of horizon antenna gain to be used in the calculations.

One or more of the following three procedures may be needed to determine the required propagation mode (1) coordination contours of Table 2. Propagation mode (2) contours are not required for any of the cases where either of the earth stations operates with space stations in non-geostationary orbits.

3.2.1 A coordinating earth station operating with a geostationary space station with respect to unknown earth stations operating with non-geostationary space stations

When the coordinating earth station operates with a space station in the geostationary orbit and the unknown earth stations operate with space stations in non-geostationary orbits, the propagation mode (1) coordination area is determined using the procedures described in § 2.1.1. The only modification needed is to use the horizon antenna gain (G_r) of the unknown receiving earth station in place of the terrestrial station gain (G_x). The appropriate values for this gain and the appropriate system parameters are contained in Table 9 of Annex 7.

3.2.2 A coordinating earth station operating with non-geostationary space stations with respect to unknown earth stations operating to geostationary space stations

When the coordinating earth station operates to space stations in non-geostationary orbits and the unknown earth stations operate with space stations in the geostationary orbit, the horizon antenna gain (G_r) for the unknown receiving earth station is determined in accordance with the simplifying approximations of § 3.1.1, as elaborated in § 2.1 of Annex 5, and the parameters of Table 9 of Annex 7. Determination of the propagation mode (1) coordination area then follows the procedure of § 2.2 by using the appropriate horizon gain of the receiving earth station at each azimuth under consideration and the appropriate system parameters from Table 9 of Annex 7.

3.2.3 Coordinating and unknown earth stations operating with non-geostationary space stations

When the coordinating earth station operates with space stations in non-geostationary orbits and the unknown earth stations operate with space stations in non-geostationary orbits, the propagation mode (1) coordination area is determined using the procedure described in § 2.2. The only modification is to use the horizon antenna gain (G_r) of the unknown receiving earth station in place of the terrestrial station antenna gain. The appropriate values for this gain and the appropriate system parameters are given in Table 9 of Annex 7.

4 General considerations for the determination of the propagation mode (1) required distance

For the determination of the propagation mode (1) required distances, the applicable frequency range has been divided into three parts. The propagation calculations for the VHF/UHF frequencies between 100 MHz and 790 MHz are based upon propagation mode (1) predicted path loss curves. From 790 MHz to 60 GHz the propagation modelling uses tropospheric scatter, ducting and layer reflection/refraction models. At higher frequencies up to 105 GHz, the model is based on a free-space loss and a conservative assumption for gaseous absorption. The possible range of time percentages is different in the different propagation models.

After taking site shielding (§ 1 of Annex 1) into consideration, for the coordinating earth station only, the following methods are used to determine the propagation mode (1) required distances:

– For frequencies between 100 MHz and 790 MHz, the method described in § 2 of Annex 1.

– For frequencies between 790 MHz and 60 GHz, the method described in § 3 of Annex 1.

– For frequencies between 60 GHz and 105 GHz, the method described in § 4 of Annex 1.

The three methods referred to above rely on a value of propagation mode (1) minimum required loss, determined according to the appropriate system parameters in Table 7, 8 and 9 of Annex 7.

4.1 Radio-climatic information

For the calculation of the propagation mode (1) required distance, the world has been classified in terms of a radio-meteorological parameter representing clear-air anomalous propagation conditions. The percentage of time β_e for which these clear-air anomalous propagation conditions exist, is latitude dependent and is given by:

$$\beta_e = \begin{cases} 10^{1.67-0.015\,\zeta_r} & \text{for } \zeta_r \leq 70^\circ \quad (7) \\ 4.17 & \text{for } \zeta_r > 70^\circ \quad (8) \end{cases}$$

with:

$$\zeta_r = \begin{cases} |\zeta| - 1.8 & \text{for } |\zeta| > 1.8^\circ \quad (9) \\ 0 & \text{for } |\zeta| \leq 1.8^\circ \quad (10) \end{cases}$$

where:

ζ: is the latitude of the earth station's location (in degrees)

For frequencies between 790 MHz and 60 GHz, the path centre sea level surface refractivity (N_0) is used in the propagation mode (1) calculations. This can be calculated using:

$$N_0 = 330 + 62.6\,\mathrm{e}^{-\left(\frac{\zeta-2}{32.7}\right)^2} \tag{11}$$

4.2 Minimum coordination distance for propagation modes (1) and (2)

The minimum coordination distance can be calculated in two steps. First calculate distance d_x using:

$$d_x = 100 + \frac{(\beta_e - 40)}{2} \text{ km} \tag{12}$$

where β_e is given in § 4.1.

Then calculate the minimum coordination distance at any frequency f (GHz) in the range 100 MHz to 105 GHz using:

$$d_{min} = \begin{cases} 100 + \frac{(\beta_e - f)}{2} & \text{km} \quad \text{for } f < 40 \text{ GHz} & (13) \\ \frac{(54 - f)d_x + 10(f - 40)}{14} & \text{km} \quad \text{for } 40 \text{ GHz} \le f < 54 \text{ GHz} & (14) \\ 10 & \text{km} \quad \text{for } 54 \text{ GHz} \le f < 66 \text{ GHz} & (15) \\ \frac{10(75 - f) + 45(f - 66)}{9} & \text{km} \quad \text{for } 66 \text{ GHz} \le f < 75 \text{ GHz} & (16) \\ 45 & \text{km} \quad \text{for } 75 \text{ GHz} \le f < 90 \text{ GHz} & (17) \\ 45 - \frac{(f - 90)}{1.5} & \text{km} \quad \text{for } 90 \text{ GHz} \le f \le 105 \text{ GHz} & (18) \end{cases}$$

The distance from which all iterative calculations start (for both propagation mode (1) and propagation mode (2)), is the minimum coordination distance (d_{min}) as given in equations (13) to (18).

4.3 Maximum coordination distance for propagation mode (1)

In the iterative calculation described in Annex 1, it is necessary to set an upper limit (d_{max1}) to the propagation mode (1) coordination distance.

For frequencies less than or equal to 60 GHz and propagation paths entirely within a single Zone, the distance shall not exceed the maximum coordination distance given in Table 3 for that Zone.

For mixed paths, the required distance can comprise one or more contributions from Zones A1, A2, B and C. The aggregate distance for any one zone must not exceed the value given in Table 3. The overall required distance must not exceed the value in Table 3 for the zone in the mixed path having the largest Table 3 value. Thus, a path comprising both Zones A1 and A2 must not exceed 500 km.

TABLE 3

Maximum coordination distances for propagation mode (1) for frequencies below 60 GHz

Zone	**d_{max1} (km)**
A1	500
A2	375
B	900
C	1 200

For frequencies above 60 GHz, the maximum coordination distance d_{max1} is given by:

$$d_{max\,1} = 80 - 10\log\left(\frac{p}{50}\right) \tag{19}$$

where:

p is defined in § 1.3.

4.4 Guidance on application of propagation mode (1) procedures

As explained in § 1.3, for those cases where earth stations are sharing with terrestrial stations, it is appropriate to apply a correction factor C_i (dB) to the worst case assumptions on system parameters and interference path geometry. This correction factor takes into account the fact that the assumption that all the worst-case values will occur simultaneously is unrealistic when determining the propagation mode (1) required distances.

The characteristics of terrestrial systems depend on the frequency band, and the value of the correction factor to be applied follows the frequency dependence given in equation (20). At frequencies between 100 MHz and 400 MHz, and between 60 GHz and 105 GHz, sharing between earth stations and terrestrial systems is a recent development and there is little established practical experience, or opportunity to analyse operational systems. Hence, the value of the correction factor is 0 dB in these bands. Between 400 MHz and 790 MHz and between 4.2 GHz and 60 GHz, the value of the correction factor is reduced in proportion to the logarithm of the frequency, as indicated in equation (20).

The value of the nominal correction to be used at any frequency f (GHz) is therefore given by:

$$X(f) = \begin{cases} 0 & f \le 0.4 \\ 3.3833X\left(\log f + 0.3979\right) & 0.4 < f \le 0.79 \\ X & 0.79 < f \le 4.2 \\ -0.8659X\left(\log f - 1.7781\right) & 4.2 < f \le 60 \\ 0 & f > 60 \end{cases} \quad \text{dB} \tag{20}$$

where:

X: 15 dB for a transmitting earth station and 25 dB for a receiving earth station.

In principle, the value of the nominal correction factor, $X(f)$, is distance and path independent. However, there are a number of issues relating to interference potential at the shorter distances, and it is not appropriate to apply the full nominal correction at these distances. The correction factor C_i is therefore applied proportionally with distance along the azimuth under consideration, starting with 0 dB at d_{min}, such that the full value of $X(f)$ is achieved at a nominal distance of 375 km from the earth station.

Hence, the correction is applied using the correction constant $Z(f)$ (dB/km) where

$$Z(f) = \frac{X(f)}{375 - d_{\min}} \quad \text{dB/km} \qquad (21)$$

The correction factor C_i (dB) is calculated in equations (1-6b) and (1-31) from the correction constant $Z(f)$ (dB/km).

At distances greater than 375 km, the correction factor C_i to be applied is the value of C_i at 375 km distance.

In addition, the correction factor is applied to its highest value only on land paths. The correction factor is 0 dB for wholly sea paths. A proportion of the correction factor is applied on mixed paths. The amount of correction to be applied to a particular path is determined by the path description parameters used for the propagation mode (1) calculation (correction factors C_i and C_{2i} in § 2 and § 3 respectively of Annex 1). As the correction factor is distance dependent, it is applied automatically within the iterative calculation used to determine the propagation mode (1) required distance (see Annex 1).

The correction factor does not apply to the bidirectional case and therefore in the determination of the bidirectional coordination contour:

$$Z(f) = 0 \text{ dB/km}$$

For the determination of propagation mode (1) auxiliary contours, the propagation mode (1) minimum required loss $L_b(p)$ for p per cent of time in equation (1) (see § 1.3) is replaced by:

$$L_{bq}(p) = L_b(p) + Q \quad \text{dB} \qquad (22)$$

where:

Q: auxiliary contour value (dB)

Note that auxiliary contour values are assumed to be negative (i.e. –5, –10, –15, –20 dB, etc.).

5 General considerations for the determination of the propagation mode (2) required distance

The determination of the contour for scattering from hydrometeors (e.g. rain scatter) is predicted on a path geometry that is substantially different from that of the great-circle propagation mechanisms. Hydrometeor scatter can occur where the beams of the earth station and the terrestrial station intersect (partially or completely) at, or below, the rain height h_R (see § 3 of Annex 2). It is assumed that at heights above this rain height the effect of scattering will be suppressed by additional attenuation, and it will not, therefore, contribute significantly to the interference potential. For the determination of the propagation mode (2) contour, it is assumed that the main beam of any terrestrial station exactly intersects the main beam of the coordinating earth station. The mitigating effects of partial beam intersections can be determined using propagation mode (2) auxiliary contours.

Since, to a first approximation, microwave energy is scattered isotropically by rain, interference can be considered to propagate equally at all azimuths around the common volume centred at the beam intersection (see § 1.3). Generally, the beam intersection will not lie on the great-circle path between the two stations. A common volume can therefore result from terrestrial stations located anywhere around the earth station, including locations behind the earth station.

The propagation mode (2) contour is a circle with a radius equal to the propagation mode (2) required distance. Unlike the case for propagation mode (1), the propagation mode (2) contour is not centred on the earth station's physical location, instead it is centred on a point on the earth's surface immediately below the centre of the common volume.

A common volume can exist, with equal probability, at any point along the earth station beam between the earth station's location and the point at which the beam reaches the rain height. To provide appropriate protection for/from terrestrial stations[8], the centre of the common volume is assumed to be half way between the earth station and the point at which its beam intersects the rain height. The distance between the projection of this point on to the earth surface and the location of the earth station is known as Δd (see § 4 of Annex 2). The centre of the propagation mode (2) contour is therefore Δd (km) from the earth station on the azimuth of the earth station's main beam axis.

[8] This procedure does not apply for the case of an earth station sharing a frequency band with other earth stations operating in the opposite direction of transmission, as for that specific case the propagation mode (2) contour is based on a geometric construction.

5.1 The required distance for propagation mode (2)

Propagation mode (2) required distances are measured along a radial originating at the centre of the rain scatter common volume. The calculation requires iteration for distance, starting at the same minimum distance as that defined for propagation mode (1) until either the required propagation mode (2) minimum required loss, or a latitude-dependent propagation mode (2) maximum calculation distance, is achieved. The propagation mode (2) calculations use the method described in Annex 2. The calculations only need to be performed in the frequency range 1 000 MHz to 40.5 GHz. Outside this frequency range, rain scatter interference can be neglected and the propagation mode (2) required distance is set to the minimum coordination distance given by equations (13) to (18).

ANNEX 1

Determination of the required distance for propagation mode (1)

1 Adjustments for earth station horizon elevation angle and distance

For propagation mode (1), the required distance depends on the characteristics of the physical horizon around the earth station. The horizon is characterized by the horizon distance d_h (see below), and the horizon elevation angle ε_h. The horizon elevation angle is defined here as the angle (degrees), viewed from the centre of the earth station antenna, between the horizontal plane and a ray that grazes the physical horizon in the direction concerned. The value of ε_h is positive when the physical horizon is above the horizontal plane and negative when it is below.

It is necessary to determine horizon elevation angles and distances for all azimuths around an earth station. In practice it will generally suffice to do this in azimuth increments of 5°. However, every attempt should be made to identify, and take into consideration, minimum horizon elevation angles that may occur between those azimuths examined in 5° increments.

For the purposes of the determination of the propagation mode (1) required distance it is useful to separate the propagation effects related to the local horizon around the earth station which, on some or all azimuths, may be determined by nearby hills or mountains, from the propagation effects on the remainder of the path. This is achieved by referencing the propagation model to a 0° horizon elevation angle for the coordinating earth station, and then to include a specific term A_h to deal with the known horizon characteristics of the earth station being coordinated. Where appropriate, A_h modifies the value of the path loss, on each azimuth, from which the propagation mode (1) required distance is derived.

There are two situations in which the level of attenuation for the propagation mode (1) path loss with respect to the reference 0° case can change:

– The first is where the coordinating earth station has a positive horizon elevation angle (on a particular azimuth). In this case, it will benefit from additional diffraction propagation losses over the horizon (generally referred to as site shielding). As a result, the attenuation A_h is positive and the value of the required path loss is reduced, with respect to the reference 0° horizon elevation angle case (see equations (1-5a) and (1-5b)).

– The second situation is where the coordinating earth station is at a location above the local foreground, and has a negative (downward) horizon elevation angle on a particular azimuth. In this case, a measure of additional protection is necessary because the path angular distance along the radial is reduced and hence the path loss for a given distance will be lower than for the zero degree elevation angle case. It is convenient to deal with this effect as part of the site shielding calculation. As a result, the attenuation A_h will be negative and the value of the required path loss is increased, with respect to the reference 0° horizon elevation angle case.

The contribution made by the attenuation arising from the coordinating earth station's horizon characteristics to the propagation mode (1) minimum required loss modifies the value of path loss that then needs to be determined in the three propagation mode (1) models. The attenuation A_h is calculated for each azimuth around the coordinating earth station as follows.

The distance of the horizon, d_h, from the earth station's location, is determined by:

$$d_h = \begin{cases} 0.5 \text{ km} & \text{if no information is available about the horizon distance, or if the distance is} < 0.5 \text{ km.} \\ \text{horizon distance (km)} & \text{if this is within the range } 0.5 \text{ km} \leq \text{horizon distance} \leq 5.0 \text{ km.} \\ 5.0 \text{ km} & \text{if the horizon distance is} > 5.0 \text{ km.} \end{cases}$$

The contribution made by the horizon distance d_h to the total site shielding attenuation is given by A_d (dB) for each azimuth using:

$$A_d = 15\left[1 - \exp\left(\frac{0.5 - d_h}{5}\right)\right]\left[1 - \exp\left(-\varepsilon_h f^{1/3}\right)\right] \quad \text{dB} \qquad (1\text{-}1)$$

where:

f is the frequency (GHz) throughout this Annex.

The total site shielding attenuation along each azimuth from the coordinating earth station is given by:

$$A_h = \begin{cases} 20\log(1 + 4.5\varepsilon_h f^{1/2}) + \varepsilon_h f^{1/3} + A_d & \text{dB} \quad \text{for } \varepsilon_h \geq 0^\circ \quad (1\text{-}2a) \\ 3[(f+1)^{1/2} - 0.0001f - 1.0487]\varepsilon_h & \text{dB} \quad \text{for } 0^\circ > \varepsilon_h \geq -0.5^\circ \quad (1\text{-}2b) \\ -1.5[(f+1)^{1/2} - 0.0001f - 1.0487] & \text{dB} \quad \text{for } \varepsilon_h < -0.5^\circ \quad (1\text{-}2c) \end{cases}$$

The value of A_h must be limited to satisfy the conditions:

$$-10 \leq A_h \leq (30 + \varepsilon_h) \qquad (1\text{-}3)$$

In equations (1-1), (1-2) and (1-3) the value of ε_h must always be expressed in degrees. The limits defined in equation (1-3) are specified because protection outside these limits may not be realized in practical situations.

2 Frequencies between 100 MHz and 790 MHz

The propagation model given in this section is limited to an average annual time percentage (p) in the range 1% to 50%.

An iterative process is used to determine the propagation mode (1) required distance. First, equation (1-5) is evaluated. Then, commencing at the minimum coordination distance, d_{min}, given by the method described in § 1.5.3 of the main body of this Appendix, equations (1-6) to (1-9) are iterated for distances d_i (where i = 0,1,2,...) incremented in steps of s (km) as described in § 1.3 of the main body of this Appendix. In each iteration, d_i is the distance considered. This process is continued until either of the following expressions becomes true:

$$L_2(p) \geq \begin{cases} L_1(p) & \text{for the main or supplementary contour} \\ L_{1q}(p) & \text{for the auxiliary contour} \end{cases} \tag{1-4a}$$

or:

$$d_i \geq \begin{cases} d_{max1} & \text{for the main or supplementary contour} \\ d_1 & \text{for the auxiliary contour} \end{cases} \tag{1-4b}$$

The required distance, d_1, or the auxiliary contour distance d_q, are then given by the distance for the last iteration: i.e.

$$d_1 = d_i \tag{1-4c}$$

or:

$$d_q = d_i \tag{1-4d}$$

As the eventual mix of zones along a path is unknown, all paths are treated as if they are potential land and sea paths. Parallel calculations are undertaken, the first assuming the path is all land and a second assuming it is all sea. A non-linear interpolation is then performed, the output of which depends upon the current mix of land and sea losses in the distance d_i. Where the current mix along the path includes sections of both warm sea and cold sea zones, all the sea along that path is assumed to be warm sea.

For the main or supplementary contour:

$$L_1(p) = L_b(p) - A_h \tag{1-5a}$$

For an auxiliary contour:

$$L_{1q}(p) = L_{bq}(p) - A_h \quad (1\text{-}5b)$$

where:

$L_b(p)$ (dB) and L_{bq} (p) (dB) are the minimum required loss required for p% of the time for the main or supplementary contour and the auxiliary contour with value Q (dB), respectively (see equation (22) in the main body of this Appendix).

Iterative calculations

At the start of each iteration calculate the current distance for i = 0,1,2,…:

$$d_i = d_{\min} + i\,s \quad (1\text{-}6a)$$

The correction factor, C_i (dB), (see § 4.4 of the main body of this Appendix) for the distance d_i is given by:

$$C_i = \begin{cases} Z(f)(d_i - d_{min}) \text{ (dB)} & \text{for the main or supplementary contour} \\ 0 \qquad\qquad\quad \text{(dB)} & \text{for the auxiliary contour} \end{cases} \quad (1\text{-}6b)$$

where $Z(f)$ is given by equation (21) in § 4.4 of the main body of this Appendix.

At distances greater than 375 km, the value of the correction factor (C_i in equation (1-6b)) to be applied is the value of C_i at the 375 km distance.

The loss, $L_{bl}(p)$, where it is assumed that the path is wholly land (Zones A1 or A2), is evaluated successively using:

$$L_{bl}(p) = 142.8 + 20\log f + 10\log p + 0.1 d_i + C_i \quad (1\text{-}7)$$

The loss, $L_{bs}(p)$, where it is assumed that the path is wholly cold sea (Zone B) or warm sea (Zone C), is evaluated successively using:

$$L_{bs}(p_1) = \begin{cases} \left.\begin{array}{l} 49.91\log(d_i + 1840 f^{1.76}) + 1.195 f^{0.393} (\log p)^{1.38} d_i^{0.597} \\ \quad + (0.01 d_i - 70)(f - 0.1581) + (0.02 - 2 \times 10^{-5} p^2) d_i \\ \quad\quad + 9.72\ 10^{-9} d_i^2 p^2 + 20.2 \end{array}\right\} \text{for Zone (B)} & (1\text{-}8a) \\ \left.\begin{array}{l} 49.343\log(d_i + 1840 f^{1.58}) + 1.266(\log p)^{(0.468 + 2.598 f)} d_i^{0.453} \\ + (0.037 d_i - 70)(f - 0.1581) + 1.95 \times 10^{-10} d_i^2 p^3 + 20.2 \end{array}\right\} \text{for Zone (C)} & (1\text{-}8b) \end{cases}$$

The predicted path loss at the distance considered is then given by:

$$L_2(p) = L_{bs}(p) + \left[1 - \exp\left(-5.5\left(\frac{d_{tm}}{d_i}\right)^{1.1}\right)\right] \cdot \left(L_{bl}(p) - L_{bs}(p)\right) \quad (1\text{-}9)$$

where:

d_{tm} (km): longest continuous land (inland + coastal) distance, i.e. Zone A1 + Zone A2 along the current path.

3 Frequencies between 790 MHz and 60 GHz

The propagation model given in this section is limited to an average annual time percentage (*p*) in the range 0.001% to 50%.

An iterative process is used to determine the propagation mode (1) required distance. First, equations (1-11) to (1-21) are evaluated. Then, commencing at the minimum coordination distance, d_{min}, equations (1-22) to (1-32) are iterated for distances d_i, where i = 0,1,2,..., incremented in steps of s (km) as described in § 1.3 of the main body of this Appendix. For each iteration, d_i is the distance considered. This process is continued until either of the following expressions becomes true:

$$\begin{cases} (L_5(p) \geq L_3(p)) \text{ and } (L_6(p) \geq L_4(p)) & \text{for the main or supplementary contour} \\ (L_5(p) \geq L_{3q}(p)) \text{ and } (L_6(p) \geq L_{4q}(p)) & \text{for the auxiliary contour} \end{cases} \quad (1\text{-}10a)$$

or:

$$d_i \geq \begin{cases} d_{max1} & \text{for the main or supplementary contour} \\ d_1 & \text{for the auxiliary contour} \end{cases} \quad (1\text{-}10b)$$

The required distance, d_1, or the auxiliary contour distance, d_q, is then given by the current distance for the last iteration, i.e.

$$d_1 = d_i \quad (1\text{-}10c)$$

or:

$$d_q = d_i \quad (1\text{-}10d)$$

Specific attenuation due to gaseous absorption

Calculate the specific attenuation (dB/km) due to dry air:

$$\gamma_o = \begin{cases} \left[7.19 \times 10^{-3} + \dfrac{6.09}{f^2 + 0.227} + \dfrac{4.81}{(f-57)^2 + 1.50}\right] f^2 \times 10^{-3} & \text{for } f \leq 56.77 \text{ GHz} \quad (1\text{-}11a) \\ 10 & \text{for } f > 56.77 \text{ GHz} \quad (1\text{-}11b) \end{cases}$$

The specific attenuation due to water vapour is given as a function of ρ (the water vapour density (g/m^3) by the following equation:

$$\gamma_w(\rho) = \left(0.050 + 0.0021\rho + \frac{3.6}{(f - 22.2)^2 + 8.5} \right) f^2 \rho \times 10^{-4} \tag{1-12}$$

Calculate the specific attenuation (dB/km) due to water vapour for the troposcatter propagation model using a water vapour density of 3.0 g/m^3:

$$\gamma_{wt} = \gamma_w\ (3.0) \tag{1-13a}$$

Calculate the specific attenuation (dB/km) due to water vapour for the ducting propagation model using a water vapour density of 7.5 g/m^3 for paths over land, Zones A1 and A2, using:

$$\gamma_{wdl} = \gamma_w\ (7.5) \tag{1-13b}$$

Calculate the specific attenuation (dB/km) due to water vapour for the ducting propagation model using a water vapour density of 10.0 g/m^3 for paths over sea, Zones B and C, using:

$$\gamma_{wds} = \gamma_w\ (10.0) \tag{1-13c}$$

Note that the value of 10 g/m^3 is used for both Zones B and C in view of the lack of data on the variability of water vapour density on a global basis, particularly the minimum values.

Calculate the frequency-dependent ducting specific attenuation (dB/km):

$$\gamma_d = 0.05 f^{1/3} \tag{1-14}$$

For the ducting model:

Calculate the reduction in attenuation arising from direct coupling into over-sea ducts (dB):

$$A_c = \frac{-6}{(1 + d_c)} \tag{1-15}$$

where d_c (km) is the distance from a land based earth station to the coast in the direction being considered.

d_c is zero in other circumstances.

Calculate the minimum loss to be achieved within the iterative calculations:

$$A_1 = 122.43 + 16.5 \log f + A_h + A_c \tag{1-16}$$

For the main or supplementary contour:

$$L_3(p) = L_b(p) - A_1 \tag{1-17a}$$

For an auxiliary contour:

$$L_{3q}(p) = L_{bq}(p) - A_1 \tag{1-17b}$$

where:

$L_b(p)$ (dB) and L_{bq} (p) dB are the minimum required loss required for p% of the time for the main or supplementary contour and the auxiliary contour with value Q (dB) respectively (see equation (22) in the main body of this Appendix).

For the tropospheric scatter model:

Calculate the frequency-dependent part of the losses (dB):

$$L_f = 25\log(f) - 2.5\left[\log\left(\frac{f}{2}\right)\right]^2 \tag{1-19}$$

Calculate the non-distance-dependent part of the losses (dB):

$$A_2 = 187.36 + 10\varepsilon_h + L_f - 0.15\, N_0 - 10.1\left(-\log\left(\frac{p}{50}\right)\right)^{0.7} \tag{1-20}$$

where:

ε_h: earth station horizon elevation angle in degrees;

N_0: path centre sea level surface refractivity (see equation (11), § 4.1 in the main body of this Appendix).

Calculate the minimum required value for the distance dependent losses (dB):

For the main, or supplementary, contour:

$$L_4(p) = L_b(p) - A_2 \tag{1-21a}$$

For an auxiliary contour:

$$L_{4q}(p) = L_{bq}(p) - A_2 \tag{1-21b}$$

where:

$L_b(p)$ (dB) and L_{bq} (p) (dB): minimum required loss required for p% of the time for the main or supplementary contour and the auxiliary contour of value Q (dB) respectively (see equation (22) in the main body of this Appendix).

Iterative calculations

At the start of each iteration, calculate the distance considered for $i = 0,1,2,...$:

$$d_i = d_{\min} + i\, s \tag{1-22}$$

Calculate the specific attenuation due to gaseous absorption (dB/km):

$$\gamma_g = \gamma_o + \gamma_{wdl}\left(\frac{d_t}{d_i}\right) + \gamma_{wds}\left(1 - \frac{d_t}{d_i}\right) \tag{1-23}$$

where:

d_t (km) is the current aggregate land distance, Zone A1 + Zone A2, along the current path.

Calculate the following zone-dependent parameters:

$$\tau = 1 - \exp\left(-\left(4.12 \times 10^{-4}\,(d_{lm})^{2.41}\right)\right) \tag{1-24}$$

where:

d_{lm} (km): longest continuous inland distance, Zone A2, along the path considered;

$$\mu_1 = \left[10^{\frac{-d_{tm}}{16-6.6\tau}} + \left[10^{-(0.496+0.354\tau)}\right]^5\right]^{0.2} \tag{1-25}$$

where:

d_{tm} (km): longest continuous land (i.e. inland + coastal) distance, Zone A1 + Zone A2 along the path considered.

μ_1 shall be limited to $\mu_1 \le 1$.

$$\sigma = -0.6 - 8.5 \times 10^{-9}\, d_i^{3.1}\, \tau \tag{1-26}$$

σ shall be limited to $\sigma \ge -3.4$.

$$\mu_2 = \left(2.48 \times 10^{-4}\, d_i^2\right)^{\sigma} \tag{1-27}$$

μ_2 shall be limited to $\mu_2 \le 1$.

$$\mu_4 = \begin{cases} 10^{(-0.935+0.0176\zeta_r)\log\mu_1} & \text{for } \zeta_r \le 70^{\circ} \quad \text{(1-28a)} \\ 10^{0.3\log\mu_1} & \text{for } \zeta_r > 70^{\circ} \quad \text{(1-28b)} \end{cases}$$

where:

ζ_r is given in equations (9) and (10), § 4.1 in the main body of this Appendix.

Calculate the path-dependent incidence of ducting (β) and a related parameter (Γ_1) used to calculate the time dependency of the path loss:

$$\beta = \beta_e \, \mu_1 \, \mu_2 \, \mu_4 \tag{1-29}$$

where:

β_e is given in equations (7) and (8), § 4.1 in the main body of this Appendix.

$$\Gamma_1 = \frac{1.076}{(2.0058 - \log\beta)^{1.012}} \exp\left(-(9.51 - 4.8\log\beta + 0.198(\log\beta)^2) \times 10^{-6} d_i^{1.13}\right) \tag{1-30}$$

Calculate the correction factor, C_{2i} dB, (see § 4.4 in the main body of this Appendix) using:

$$C_{2i} = \begin{cases} Z(f)(d_i - d_{min})\tau \quad \text{(dB)} & \text{for the main or supplementary contour} \\ 0 \quad \text{(dB)} & \text{for the auxiliary contour} \end{cases} \tag{1-31}$$

where $Z(f)$ is calculated using equation (21) in § 4.4 in the main body of this Appendix.

At distances greater than 375 km the value of the correction factor C_{2i} in equation (1-31) to be applied is the value of C_{2i} at the 375 km distance.

Calculate the distance-dependent part of the losses (dB) for ducting:

$$L_5(p) = (\gamma_d + \gamma_g)d_i + (1.2 + 3.7 \times 10^{-3} d_i)\log\left(\frac{p}{\beta}\right) + 12\left(\frac{p}{\beta}\right)^{\Gamma_1} + C_{2i} \tag{1-32}$$

and for tropospheric scatter:

$$L_6(p) = 20\log(d_i) + 5.73 \times 10^{-4}(112 - 15\cos(2\zeta))d_i + (\gamma_o + \gamma_{wt})d_i + C_{2i} \tag{1-33}$$

For the determination of distances for auxiliary contours, C_{2i} = 0 dB.

4 Frequencies between 60 GHz and 105 GHz

This propagation model is valid for average annual percentage time (p) in the range from 0.001% to 50%.

An iterative process is used to determine the propagation mode (1) required distance. First, equations (1-34) to (1-38) are evaluated. Then commencing at the minimum coordination distance, d_{min}, equations (1-39) and (1-40) are iterated for distances d_i, where i = 0,1,2,..., incremented in steps of s km as described in § 1.3 of the main body of this Appendix. For each iteration, d_i is the distance considered.

This process is continued until either of the following expressions becomes true:

$$L_9(p) \geq \begin{cases} L_8(p) & \text{for the main or supplementary contour} \\ L_{8q}(p) & \text{for the auxiliary contour} \end{cases} \qquad (1\text{-}33a)$$

or:

$$d_i \geq \begin{cases} d_{max1} & \text{for the main or supplementary contour} \\ d_1 & \text{for the auxiliary contour} \end{cases} \qquad (1\text{-}33b)$$

The required distance, d_1, or the auxiliary contour distance d_q are then given by the current distance for the last iteration: i.e.

$$d_l = d_i \qquad (1\text{-}33c)$$

or:

$$d_q = d_i \qquad (1\text{-}33d)$$

Calculate the specific attenuation (dB/km) for dry air in the frequency range 60 GHz to 105 GHz using:

$$\gamma_{om} = \begin{cases} \left[2 \times 10^{-4}\left(1 - 1.2 \times 10^{-5} f^{\,1.5}\right) + \dfrac{4}{(f-63)^2 + 0.936} + \dfrac{0.28}{(f-118.75)^2 + 1.771} \right] f^2\, 6.24 \times 10^{-4} \ \text{dB/km} & \text{for } f > 63.26 \text{ GHz} \quad (1\text{-}34a) \\ 10 \ \text{dB/km} & \text{for } f \leq 63.26 \text{ GHz} \quad (1\text{-}34b) \end{cases}$$

Calculate the specific attenuation (dB/km) for an atmospheric water vapour density of 3 g/m^3 using:

$$\gamma_{wm} = \left(0.039 + 7.7 \times 10^{-4} f^{\,0.5}\right) f^2\, 2.369 \times 10^{-4} \qquad (1\text{-}35)$$

Calculate a conservative estimate of the specific attenuation (dB/km) for gaseous absorption using:

$$\gamma_{gm} = \gamma_{om} + \gamma_{wm} \qquad \text{dB/km} \qquad (1\text{-}36)$$

For the required frequency and the value of earth station site shielding, A_h (dB), as calculated using the method described in § 1 of this Annex, calculate the minimum loss to be achieved in the iterative calculations:

$$L_7(p) = 92.5 + 20\log(f) + A_h \qquad \text{dB} \qquad (1\text{-}37)$$

For the main or supplementary contour:

$$L_8(p) = L_b(p) - L_7 \qquad \text{dB} \qquad (1\text{-}38a)$$

For an auxiliary contour:

$$L_{8q}(p) = L_{bq}(p) - L_7 \qquad \text{dB} \qquad (1\text{-}38b)$$

where:

$L_b(p)$ (dB) and $L_{bq}(p)$ (dB) are the minimum required loss required for p% of the time for the main or supplementary contour and the auxiliary contour of value Q (dB) respectively (see equation (22) in the main body of this Appendix).

Iterative calculations

At the start of each iteration calculate the distance for i = 0,1,2, ...:

$$d_i = d_{\min} + i\,s \qquad (1\text{-}39)$$

Calculate the distance-dependent losses for the distance:

$$L_9(p) = \gamma_{gm} d_i + 20\log(d_i) + 2.6\left[1 - \exp\left(\frac{-d_i}{10}\right)\right]\log\left(\frac{p}{50}\right) \qquad (1\text{-}40)$$

For frequencies above 60 GHz, the correction factor (see § 4.4 in the main body of this Appendix) is 0 dB. Therefore, no correction term has been added to equation (1-40).

ANNEX 2

Determination of the required distance for propagation mode (2)

1 Overview

The algorithm given below allows propagation mode (2) path loss, $L_r(p)$ (dB), to be obtained as a monotonic function of rainfall rate, $R(p)$ (mm/h), and with the hydrometeor scatter distance, r_i (km), as a parameter. The model is valid for average annual time percentage (p) in the range 0.001 to 10%. The procedure to determine the hydrometeor scatter contour is as follows:

a) The value of $R(p)$, is determined for the appropriate rain climatic Zones A to Q.

b) Values of $L_r(p)$, are then calculated for incremental values of r_i, starting at the minimum coordination distance d_{min}, in steps of s (km), as described in § 1.3 of the main body of this Appendix. The correct value of r_i is that for which the corresponding value of $L_r(p)$ equals or exceeds the propagation mode (2) minimum required loss L(p). This value of r_i is the propagation mode (2) required distance and is denoted d_r .

c) If the iterative calculation results in r_i equalling or exceeding the appropriate maximum calculation distance (d_{max2}) given in § 2, then the calculation is terminated and d_r is assumed to be equal to d_{max2}. Hence the iteration stops when either of the following expressions becomes true:

$$L_r(p) \geq L(p) \qquad (2\text{-}1a)$$

or:

$$r_i \geq d_{\max 2} \qquad (2\text{-}1b)$$

d) The contour for propagation mode (2) is a circle of radius d_r (km) centred on a point along the azimuth of the earth station antenna main beam at a horizontal distance of Δd (km) from the earth station.

2 Maximum calculation distance

As discussed in § 1.5.3 of the main body of this Appendix, it is necessary to set upper limits to the maximum distance used in the iterative calculation of the required distance. The maximum calculation distance to be used for propagation mode (2) (d_{max2}) is latitude dependent and is given in the following equation:

$$d_{max2} = \sqrt{17\,000(h_R + 3)} \text{ km}$$

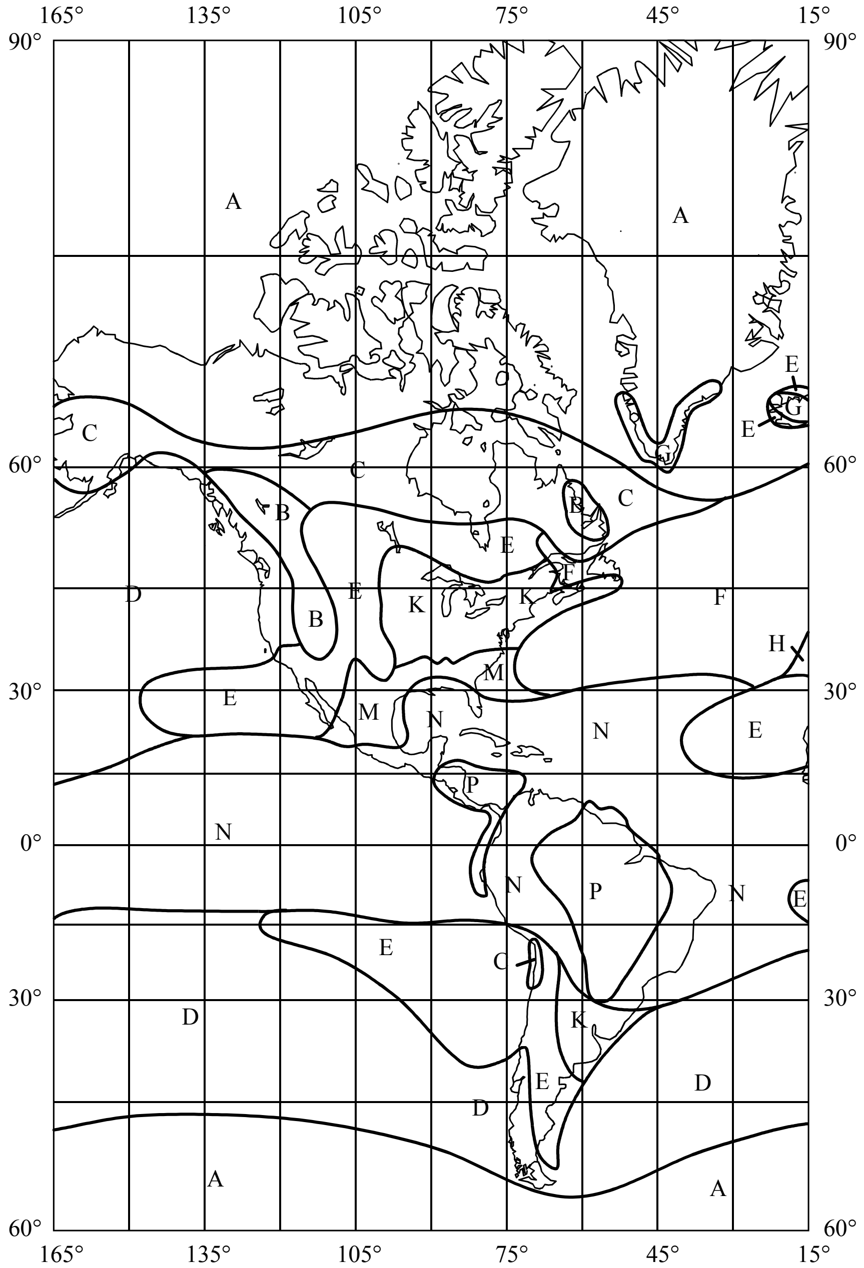
where:

h_R is defined in equations (2-13) and (2-14).

3 Calculation of the propagation mode (2) contour

Determine $R(p)$, the rainfall rate (mm/h) exceeded on average for p% of a year. The world has been divided into a number of rain climatic zones (see Figures 2-1, 2-2 and 2-3) which show different precipitation characteristics.

FIGURE 2-1



CMR2000/396-021

FIGURE 2-2

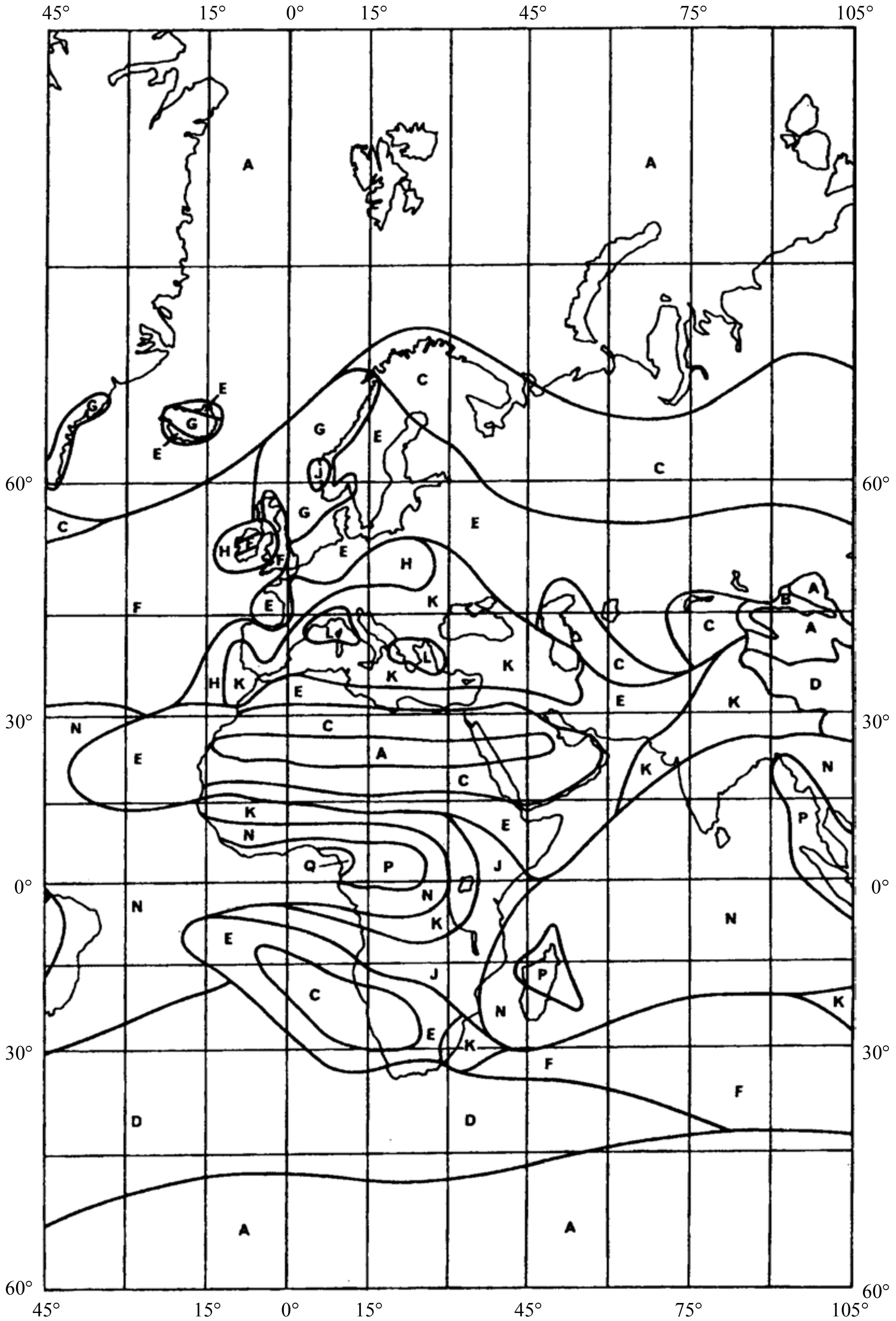
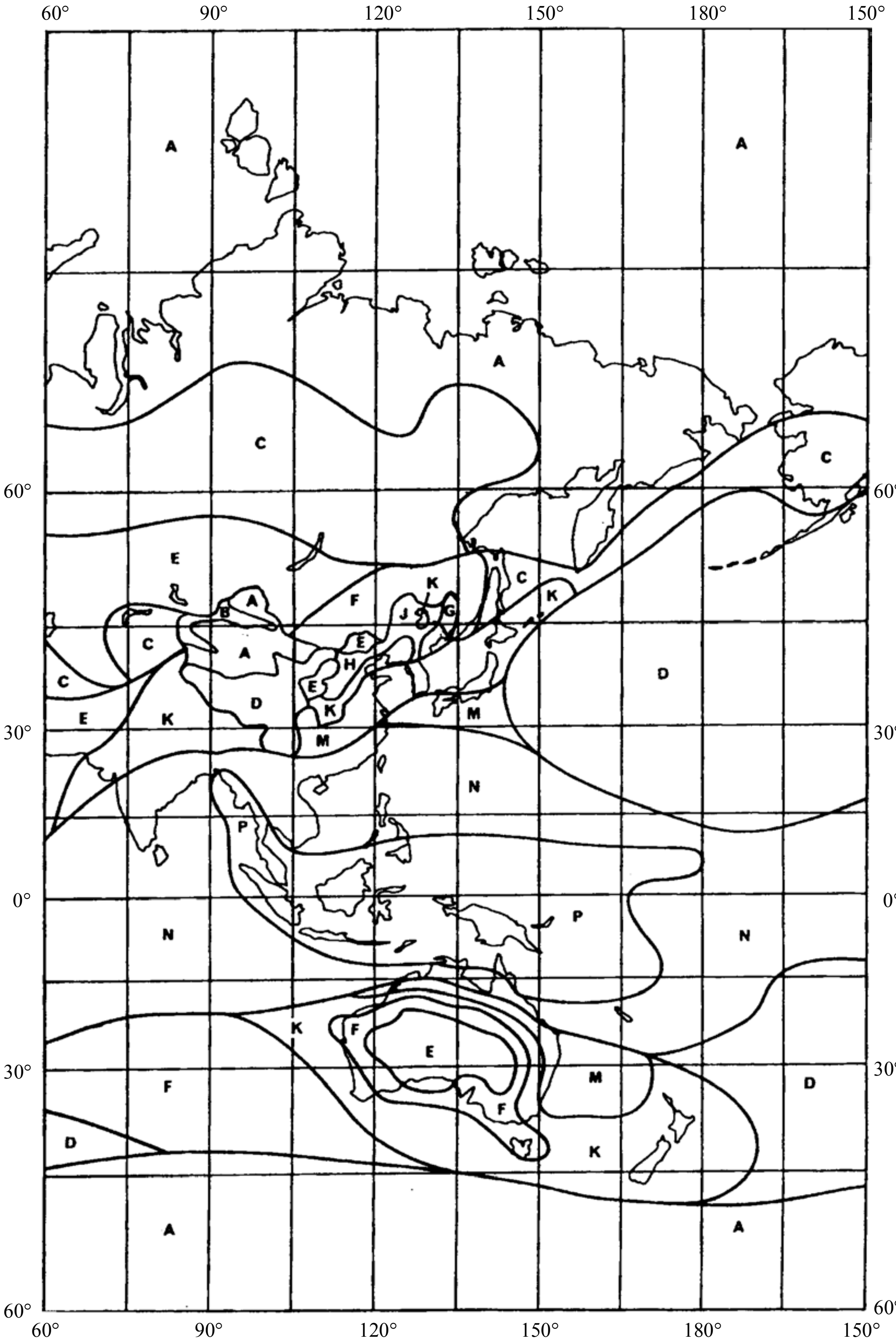

45°
15°
0°
15°
45°
75°
105°
60°
30°
0°
30°
60°
A
C
E
F
G
H
J
K
L
N
P
Q
D
B
CMR2000/396-022

FIGURE 2-3



CMR2000/396-023

The curves shown in Figure 2-4 represent consolidated rainfall-rate distributions, each applicable to several of these rain climatic zones.

Determine which rain climatic zone is applicable to the location of the earth station:

– For 0.001% < p < 0.3% and the applicable rain climatic zone:

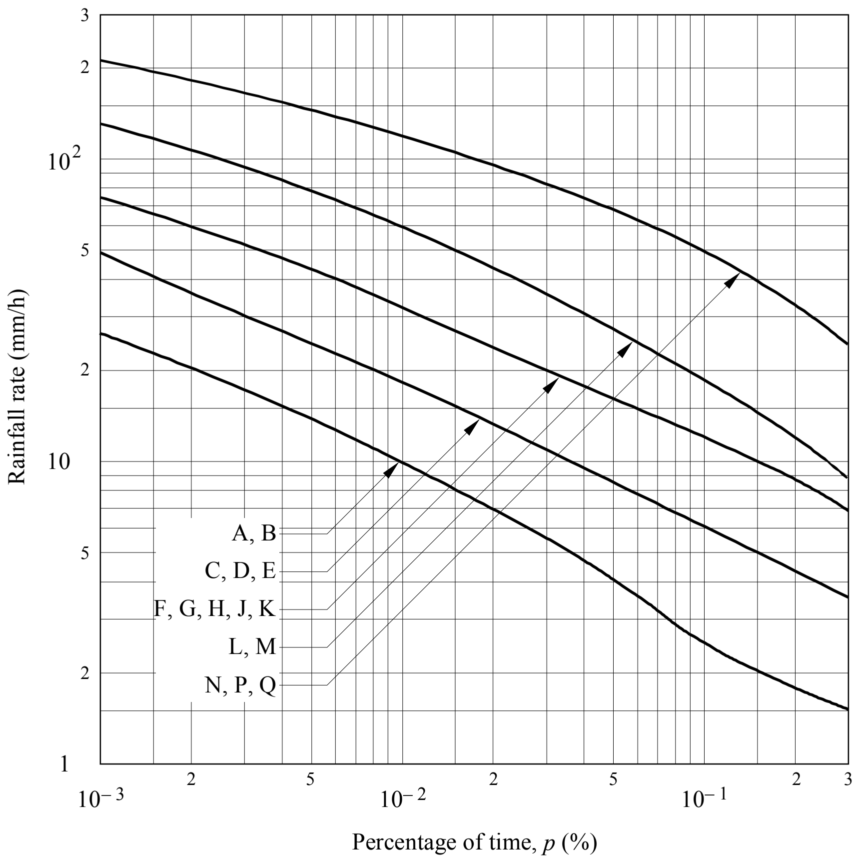
Determine $R(p)$ either from Figure 2-4 or from equations (2-2) to (2-6).

– For $p \geq$ 0.3%:

Use equation (2-7) with values of R(0.3%) and p_c obtained from Table 4-1.

FIGURE 2-4

Consolidated cumulative distributions of rainfall rate for the rain climatic zones shown in Figures 2-1, 2-2, and 2-3



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Rain climatic Zones A, B

$$R(p) = 1.1p^{-0.465} + 0.25\left[\log(p/0.001)\log^3(0.3/p)\right] - \left[\left|\log(p/0.1)\right| + 1.1\right]^{-2} \quad (2\text{-}2)$$

Rain climatic Zones C, D, E

$$R(p) = 2\,p^{-0.466} + 0.5\left[\log(p/0.001)\log^3(0.3/p)\right] \quad (2\text{-}3)$$

Rain climatic Zones F, G, H, J, K

$$R(p) = 4.17\,p^{-0.418} + 1.6\left[\log(p/0.001)\log^3(0.3/p)\right] \quad (2\text{-}4)$$

Rain climatic Zones L, M

$$R(p) = 4.9\,p^{-0.48} + 6.5\left[\log(p/0.001)\log^2(0.3/p)\right] \quad (2\text{-}5)$$

Rain climatic Zones N, P, Q

$$R(p) = 15.6\left(p^{-0.383} + \left[\log(p/0.001)\log^{1.5}(0.3/p)\right]\right) \quad (2\text{-}6)$$

TABLE 4

Values of R and p_c for the different rain climatic zones

Rain climatic zone	R (0.3%) (mm/h)	p_C (%)
A, B	1.5	2
C, D, E	3.5	3
F, G, H, J, K	7.0	5
L, M	9.0	7.5
N, P, Q	25.0	10

where:

p_c (%): reference time percentage above which the rainfall rate R(p) can be assumed to be zero.

$$R(p) = R(0.3\%)\left[\frac{\log(p_c/p)}{\log(p_c/0.3)}\right]^2 \quad (2\text{-}7)$$

Determine the specific attenuation (dB/km) due to rain using values of k and α from Table 5 in equation (2-9). Values of k and α at frequencies other than those in Table 5 can be obtained by interpolation using a logarithmic scale for frequency, a logarithmic scale for k and a linear scale for α.

TABLE 5

Values of k and α for vertical polarization as a function of the frequency

Frequency (GHz)	**K**	**α**
1	0.000 0352	0.880
4	0.000 591	1.075
6	0.001 55	1.265
8	0.003 95	1.31
10	0.008 87	1.264
12	0.016 8	1.20
14	0.029	1.15
18	0.055	1.09
20	0.069 1	1.065
22.4	0.090	1.05
25	0.113	1.03
28	0.150	1.01
30	0.167	1.00
35	0.233	0.963
40	0.310	0.929
40.5	0.318	0.926

Let:
$$R = R(p) \tag{2-8}$$

Then the specific attenuation (dB/km) due to rain is given by:

$$\gamma_R = k\, R^{\alpha} \tag{2-9}$$

Calculate the effective diameter of the rain cell:

$$d_s = 3.5\, R^{-0.08} \tag{2-10}$$

Then, calculate the effective scatter transfer function:

$$R_{cv} = \frac{2.17}{\gamma_R d_s}\left(1 - 10^{\frac{-\gamma_R d_s}{5}}\right) \tag{2-11}$$

Calculate the additional attenuation outside the common volume:

$$\Gamma_2 = 631 k R^{(\alpha - 0.5)} \times 10^{-(R+1)^{0.19}} \tag{2-12}$$

Determine the rain height above ground, h_R (km):

For North America and Europe west of 60° E longitude:

$$h_R = 3.2 - 0.075\,(\zeta - 35) \qquad \text{for} \quad 35 \le \zeta \le 70 \qquad (2\text{-}13)$$

where:

ζ is the latitude of the coordinating earth station.

For all other areas of the world:

$$h_R = \begin{cases} 5 - 0.075(\zeta - 23) & \text{for } \zeta > 23 \text{ northern hemisphere} & (2\text{-}14a) \\ 5 & \text{for } 0 \le \zeta \le 23 \text{ northern hemisphere} & (2\text{-}14b) \\ 5 & \text{for } 0 \ge \zeta \ge -21 \text{ southern hemisphere} & (2\text{-}14c) \\ 5 + 0.1(\zeta + 21) & \text{for } -71 \le \zeta < -21 \text{ southern hemisphere} & (2\text{-}14d) \\ 0 & \text{for } \zeta < -71 \text{ southern hemisphere} & (2\text{-}14e) \end{cases}$$

Determine the specific attenuation due to water vapour absorption (a water vapour density of 7.5 g/m^3 is used):

$$\gamma_{wr} = \left[0.06575 + \frac{3.6}{(f - 22.2)^2 + 8.5} \right] f^2\, 7.5 \times 10^{-4} \qquad (2\text{-}15)$$

3.1 Iterative calculations

Evaluate equations (2-16) to (2-21) inclusive for increasing values of r_i , where r_i is the current distance considered (km) between the region of maximum scattering and the possible location of a terrestrial station and i = 0,1,2,...etc. Continue this process until either of the conditions given in equations (2-1a) and (2-1b) is true. Then the rain-scatter required distance d_r is the current value of r_i .

$$r_i = d_{\min} + i\,s \qquad (2\text{-}16)$$

Determine the loss above the rain height, L_{ar} (dB), applicable to scatter coupling:

$$L_{ar} = \begin{cases} 6.5\left[6(r_i - 50)^2 \times 10^{-5} - h_R\right] & \text{for } 6(r_i - 50)^2 \times 10^{-5} > h_R & (2\text{-}17a) \\ 0 & \text{for } 6(r_i - 50)^2 \times 10^{-5} \le h_R & (2\text{-}17b) \end{cases}$$

Calculate the additional attenuation for the departure from Rayleigh scattering:

$$A_b = \begin{cases} 0.005\,(f - 10)^{1.7} R^{0.4} & \text{for } 10 \text{ GHz} < f < 40.5 \text{ GHz} & (2\text{-}18a) \\ 0 & \text{for } f \le 10 \text{ GHz or when } L_{ar} \ne 0 & (2\text{-}18b) \end{cases}$$

Calculate the effective path length for oxygen absorption:

$$d_0 = \begin{cases} 0.7\, r_i + 32 & \text{for } r_i < 340 \text{ km} & (2\text{-}19a) \\ 270 & \text{for } r_i \ge 340 \text{ km} & (2\text{-}19b) \end{cases}$$

Calculate the effective path length for water vapour absorption:

$$d_v = \begin{cases} 0.7\, r_i + 32 & \text{for} \quad r_i < 240 \text{ km} \\ 200 & \text{for} \quad r_i \geq 240 \text{ km} \end{cases} \qquad \begin{matrix} (2\text{-}20a) \\ (2\text{-}20b) \end{matrix}$$

Determine the propagation mode (2) path loss, L_r (dB):

$$L_r = 168 + 20 \log r_i - 20 \log f - 13.2 \log R - G_x + A_b - 10 \log R_{cv} + \Gamma_2 + L_{ar} + \gamma_o d_0 + \gamma_{wr} d_v \qquad (2\text{-}21)$$

where:

γ_o: as given in equation (1-11)

G_x: terrestrial network antenna gain in Tables 7 or 8 of Annex 7.

4 Construction of the propagation mode (2) contour

In order to determine the centre of the circular propagation mode (2) contour, it is necessary to calculate the horizontal distance to this point from the earth station, along the azimuth of the earth station antenna main beam axis. The distance, Δd (km), to the centre of the propagation mode (2) contour is given by:

$$\Delta d = \frac{h_R}{2 \tan \varepsilon_s} \qquad (2\text{-}23)$$

where:

ε_s: earth station antenna main beam axis elevation angle

and

Δd shall be limited to the distance (d_r – 50) km.

The propagation mode (2) required distance d_r must lie within the range between the minimum coordination distance d_{min} and the propagation mode (2) maximum calculation distance d_{max2}.

Draw the propagation mode (2) contour as a circle of radius d_r km around the centre determined above. The propagation mode (2) contour is the locus of points on this circle. However, if any part of the propagation mode (2) contour falls within the contour defined by the minimum coordination distance, this arc of the propagation mode (2) contour is taken to be identical to the contour based on the minimum coordination distance and the propagation mode (2) contour is then no longer circular.

ANNEX 3

Antenna gain towards the horizon for an earth station operating with a geostationary space station

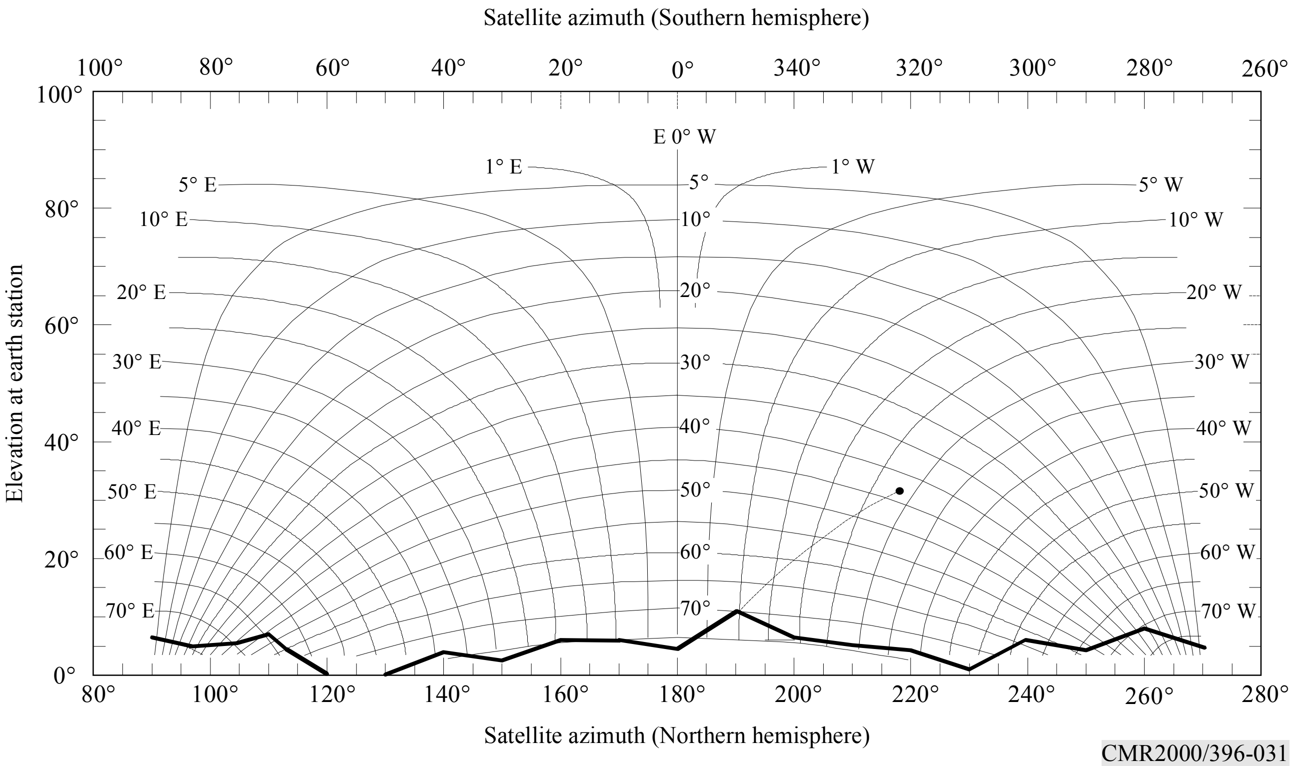
1 General

The gain component of the earth station antenna in the direction of the physical horizon around an earth station is a function of the angular separation between the antenna main beam axis and the horizon in the direction under consideration. When the earth station is used to transmit to a space station in a slightly inclined orbit, all possible pointing directions of the antenna main beam axis need to be considered. For earth station coordination, knowledge of $\varphi(\alpha)$, the minimum possible value of the angular separation that will occur during the operation of the space station, is required for each azimuth.

When a geostationary space station maintains its location close to its nominal orbital position, the earth station's main beam axis elevation angle ε_S and the azimuth angle α_S to the space station from the earth station's latitude ζ are uniquely related. Figure 3-1 shows the possible location arcs of positions of a space station on the geostationary orbit in a rectangular azimuth/elevation plot. It shows arcs corresponding to a set of earth station latitudes and the intersecting arcs correspond to points on the orbit with a fixed difference in longitude East or West of the earth station. Figure 3-1 also shows a portion of the horizon profile $\varepsilon_h(\alpha)$. The off-axis angle $\varphi(\alpha)$ between the horizon profile at an azimuth of 190° and a space station located 28° W of an earth station at 43° N latitude is indicated by the great-circle arc shown dashed on Figure 3-1.

FIGURE 3-1

Position arcs of geostationary satellites with horizon and the arc from the horizon at azimuth 190° to a satellite 28° W of an earth station at 43° N latitude



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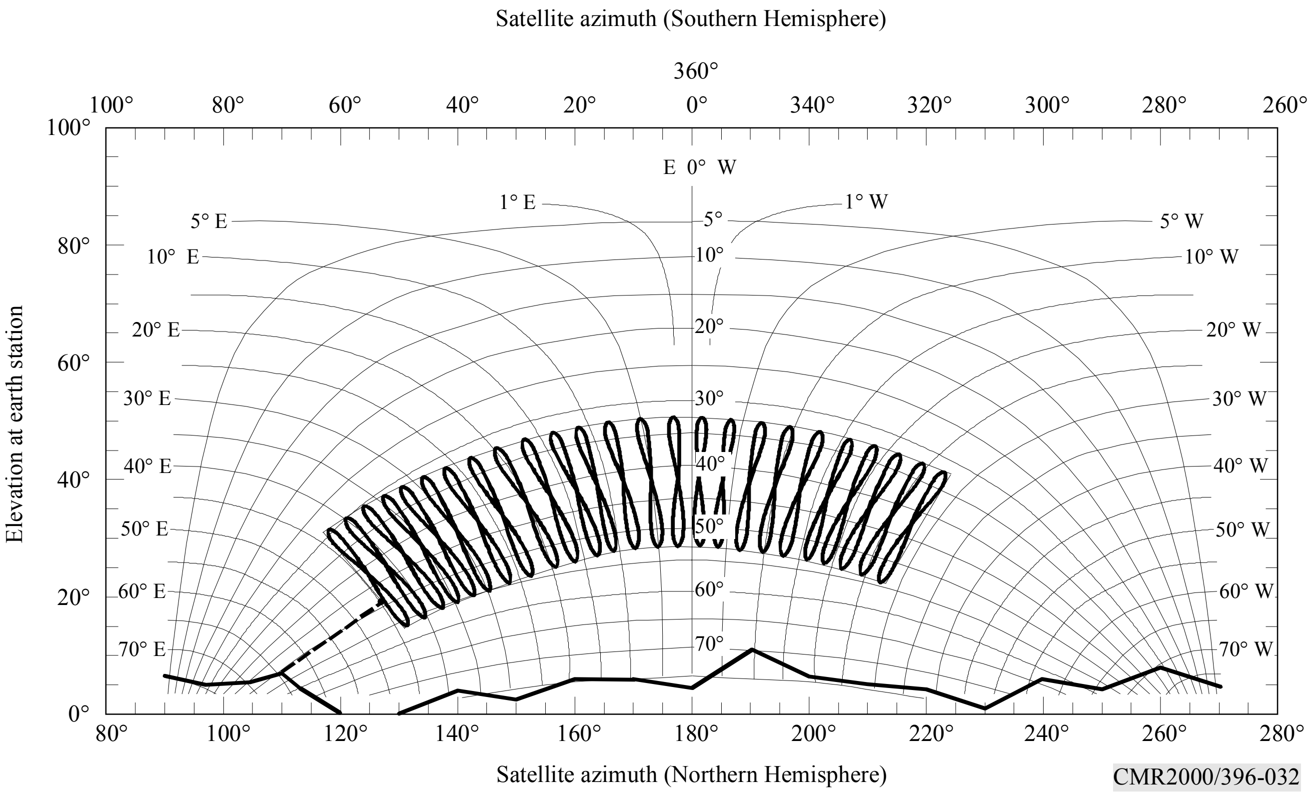
When the north/south station-keeping of a geostationary satellite is relaxed, the orbit of the satellite becomes inclined, with an inclination that increases gradually with time. As viewed from the earth, the position of the satellite traces a figure eight during each 24-hour period. Figure 3-2 shows the variations in the trajectories of a set of satellites, each with 10° inclination, spaced by 3° along the geostationary orbit from 28° W to 44° E, with respect to an earth station at 43° N latitude. Figure 3-2 also shows, with a dashed curve, the great-circle arc corresponding to the minimum off-axis angle φ(α) between a point on the trajectory of one of the satellites and the horizon profile at an azimuth of 110°.

FIGURE 3-2

Position arcs of geostationary satellites with horizon and the arc from the horizon at azimuth 110° to satellites with 10° inclination on the geostationary orbital arc from 28° W to 44° E of an earth station at 43° N latitude



For a transmitting earth station operating in a frequency band that is also allocated for bidirectional use by receiving earth stations operating with geostationary space stations, refer to § 2.1 of Annex 5.

2 Determination of the angular separation φ(α)

For the determination of the off-axis angle $\varphi(\alpha)$, two cases are distinguished. These depend on whether the orbit of the space station has no inclination, or is slightly inclined. The following equations may be used in both of these cases:

$$\psi_s(i,\delta) = \text{arc cos } (\sin\zeta \sin i + \cos\zeta \cos i \cos\delta \quad (3\text{-}1)$$

$$\varepsilon_s(i,\delta) = \arcsin\left[\frac{K\cos\psi_s(i,\delta) - 1}{\left(1 + K^2 - 2K\cos\psi_s(i,\delta)\right)^{1/2}}\right] \quad (3\text{-}2)$$

$$\alpha_{os}(i,\delta) = \arccos\left[\frac{\sin i - \cos\psi_s \sin\zeta}{\sin\psi_s \cos\zeta}\right] \quad (3\text{-}3)$$

$\alpha_s(i, \delta) = \alpha_{os}(i, \delta)$ for a space station located east of the earth station ($\delta \geq 0$) (3-4)

$\alpha_s(i, \delta) = 360° - \alpha_{os}(i, \delta)$ for a space station located west of the earth station ($\delta \leq 0$) (3-5)

$\varphi(\alpha, i, \delta) = \text{arc cos } [\cos \varepsilon_h(\alpha) \cos \varepsilon_s(i, \delta) \cos (\alpha - \alpha_s(i, \delta)) + \sin \varepsilon_h(\alpha) \sin \varepsilon_s(i, \delta)]$ (3-6)

where:

- ζ: latitude of the earth station (positive for north; negative for south)
- δ: difference in longitude between the earth station and a space station
- i: latitude of a sub-satellite point (positive for north; negative for south)
- $\psi_s(i, \delta)$: great-circle arc between the earth station and a sub-satellite point
- $\alpha_s(i, \delta)$: space station azimuth as seen from the earth station
- $\varepsilon_s(i, \delta)$: space station elevation angle as seen from the earth station
- $\varphi(\alpha, i, \delta)$: angle between the main beam and the horizon direction corresponding to the azimuth (α) under consideration when the main beam is steered towards a space station with a sub-satellite point at latitude i and longitude difference δ
- α: azimuth of the direction under consideration
- ε_h: elevation angle of the horizon at the azimuth under consideration, α
- $\varphi(\alpha)$: angle to be used for horizon gain calculation at the azimuth under consideration, α
- K: orbit radius/earth radius, which for the geostationary orbit is assumed to be 6.62.

All arcs mentioned above are in degrees.

Case 1: **Single space station, no orbital inclination**

For a space station operating with no orbital inclination at an orbital position with difference in longitude δ_0, equations (3-1) to (3-6) may be applied directly using $i = 0$ to determine $\varphi(\alpha)$ for each azimuth α. Thus:

$$\varphi(\alpha) = \varphi(\alpha, 0, \delta_0) \tag{3-7}$$

where:

δ_0: difference in longitude beween the earth station and the space station.

Case 2: **Single space station, slightly inclined orbit**

For a space station operating in a slightly inclined orbit on a portion of the geostationary arc with a nominal longitude difference of δ_0, the maximum orbital inclination over its lifetime, i_s, must be considered. Equations (3-1) to (3-6) may be applied to develop the minimum off-axis angle to each of four arcs in azimuth/elevation that bound the trajectory of the space station in angle and elevation. The bounding arcs correspond to the maximum and minimum latitudes of the sub-satellite points and the extremes of the difference in longitude between the earth and space stations when the space station is operating at its maximum inclination.

The determination of the minimum off-axis angles in equations (3-8) to (3-12) may be made by taking increments along a bounding contour. The step size in inclination i or longitude δ should be between 0.5° and 1.0° and the end points of the respective ranges should be included in the calculation.

The horizon profile $\varepsilon_h(\alpha)$ used in the determination of $\varphi(\alpha)$ is specified at increments in azimuth α that do not exceed 5°.

Thus:

$$\varphi(\alpha) = \min_{n=1 \ to \ 4} \varphi_n(\alpha) \tag{3-8}$$

with:

$$\varphi_1(\alpha) = \min_{\delta_0 - \delta_s \leq \delta \leq \delta_0 + \delta_s} \varphi(\alpha, -i_s, \delta) \tag{3-9}$$

$$\varphi_2(\alpha) = \min_{\delta_0 - \delta_s \leq \delta \leq \delta_0 + \delta_s} \varphi(\alpha, i_s, \delta) \tag{3-10}$$

$$\varphi_3(\alpha) = \min_{-i_s \leq i \leq i_s} \varphi(\alpha, i, \delta_0 - \delta_s) \tag{3-11}$$

$$\varphi_4(\alpha) = \min_{-i_s \leq i \leq i_s} \varphi(\alpha, i, \delta_0 + \delta_s) \tag{3-12}$$

$$\delta_s = (i_s / 15)^2 \tag{3-13}$$

where:

i_s: maximum operational inclination angle of the satellite orbit

δ_s: maximum longitude change from nominal value of the sub-satellite point of a satellite with orbital inclination i_s.

3 Determination of antenna gain

The relationship $\varphi(\alpha)$ is used to derive a function for the horizon antenna gain (dBi), $G(\varphi)$ as a function of the azimuth α, by using the actual earth station antenna pattern, or a formula giving a good approximation. For example, in cases where the ratio between the antenna diameter and the wavelength is equal to or greater than 35, the following equation is used:

$$G(\varphi) = \begin{cases} G_{amax} - 2.5 \times 10^{-3}\left(\frac{D}{\lambda}\varphi\right)^2 & \text{for } 0 < \varphi < \varphi_m \\ G_1 & \text{for } \varphi_m \le \varphi < \varphi_r \\ 29 - 25\log\varphi & \text{for } \varphi_r \le \varphi < 36^\circ \\ -10 & \text{for } 36^\circ \le \varphi \le 180^\circ \end{cases} \qquad (3\text{-}14)$$

$$G_1 = \begin{cases} -1 + 15\log\left(D/\lambda\right) & \text{dBi for } D/\lambda \ge 100 \\ -21 + 25\log\left(D/\lambda\right) & \text{dBi for } 35 \le D/\lambda < 100 \end{cases}$$

$$\varphi_m = \frac{20\lambda}{D}\sqrt{G_{amax} - G_1} \qquad \text{degrees}$$

$$\varphi_r = \begin{cases} 15.85\left(D/\lambda\right)^{-0.6} & \text{degrees for } D/\lambda \ge 100 \\ 100\left(\lambda/D\right) & \text{degrees for } 35 \le D/\lambda < 100 \end{cases}$$

Where a better representation of the actual antenna pattern is available, it may be used.

In cases where D/λ is not given, it may be estimated from the expression:

$$20\log\frac{D}{\lambda} \approx G_{amax} - 7.7$$

where:

G_{amax}: main beam axis antenna gain (dBi).

D: antenna diameter (m)

λ: wavelength (m)

G_1: gain of the first side lobe (dBi)

ANNEX 4

Antenna gain toward the horizon for an earth station operating with non-geostationary space stations

This Annex presents methods which may be used to determine the antenna gain towards the horizon for an earth station operating to non-geostationary satellites using the TIG method described in § 2.2 of the main body of this Appendix.

1 Determination of the horizon antenna gain

In its simplest implementation, the TIG method depends on the minimum elevation angle of the beam axis of the earth station antenna (ε_{sys}), which is a system parameter that has the same value on all azimuths from the earth station. If the horizon elevation angle at an azimuth under consideration is ε_h (degrees), the minimum separation angle from the horizon at this azimuth to any possible pointing angle for the main beam axis of the antenna (φ_{min}) is equal to the difference between these two angles ($\varepsilon_{sys} - \varepsilon_h$), but it is not less than zero degrees. The maximum separation angle from the horizon at this azimuth to any possible pointing angle for the main beam axis of the antenna (φ_{max}) is equal to the difference between the sum of these two angles and 180 degrees ($180 - \varepsilon_{sys} - \varepsilon_h$). The maximum and minimum values of horizon gain for the azimuth under consideration are obtained from the gain pattern of the earth station antenna at these off-axis angles. Where no pattern is available the pattern of § 3 of Annex 3 may be used.

Additional constraints may be included in the determination of the maximum and minimum values of horizon antenna gain where an earth station operates with a constellation of non-geostationary satellites that are not in near-polar orbit. In this case, depending on the latitude of the earth station, there may be portions of the hemisphere above the horizontal plane at the earth station in which no satellite will appear. To include these visibility limitations within this method, it is first necessary to determine, for a closely spaced set of azimuth angles around the earth station, the minimum elevation angle at which a satellite may be visible. This minimum satellite visibility elevation angle (ε_v) may be determined from consideration of the visibility of the edge of the shell formed by all possible orbits having the orbital inclination and altitude of the satellites in the constellation.

The lowest elevation angle towards which the main-beam axis of the earth station antenna will point on any azimuth is the minimum composite elevation angle (ε_c), which is equal to the greater of the minimum satellite visibility elevation angle (ε_v) and the minimum elevation angle of the earth station (ε_{sys}). After the minimum composite elevation angle has been determined for all azimuths by the procedure of § 1.1 of this Annex, the resulting profile of the minimum composite elevation angles can be used, in the procedure of § 1.2 of this Annex, to determine the maximum and minimum values of horizon gain at any azimuth.

Further information and an example of this method may be found in the latest version of Recommendation ITU-R SM.1448.

1.1 Determination of satellite visibility limits

The visibility limits of a constellation of satellites can be determined from the inclination angle of the most inclined satellite and the altitude of the lowest satellite in the constellation. For this determination, six cases may be distinguished, but not all of these may be applicable for a given constellation and a given earth station latitude. The azimuth and the corresponding lower limit on the elevation angle are developed by a parametric method using a set of points on the edge of the orbital shell of the constellation. The approach is to develop this relationship for azimuths to the east of a station in the northern hemisphere. Elevation angles for azimuths to the west of the station and for all azimuths for stations in the southern hemisphere are obtained by symmetry. The following equations, which are applicable to circular orbits only, may be used for the complete determination of the horizon antenna gain in all practical cases:

$$\psi(\delta) = \arccos\,(\sin \zeta_e \sin i_s + \cos \zeta_e \cos i_s \cos \delta) \qquad (4\text{-}1)$$

$$\varepsilon_v(\delta) = \arcsin\left[\frac{K_1 \cos[\psi(\delta)] - 1}{\left(1 + K_1^2 - 2K_1 \cos[\psi(\delta)]\right)^{1/2}}\right] \qquad (4\text{-}2)$$

$$\alpha_0(\delta) = \arccos\left[\frac{\sin i_s - \cos[\psi(\delta)]\ \sin\zeta_e}{\sin[\psi(\delta)]\ \cos\zeta_e}\right] \qquad (4\text{-}3)$$

with

$$\alpha(\delta) = \begin{cases} \alpha_0(\delta) \quad \text{and} & \\ 360 - \alpha_0(\delta) & \text{for earth stations north of the Equator} \\ 180 - \alpha_0(\delta) \quad \text{and} & \\ 180 + \alpha_0(\delta) & \text{for earth stations south of the Equator} \end{cases} \qquad (4\text{-}4)$$

where:

i_s: orbital inclination of the satellites in the constellation assumed to be positive and between 0° and 90°

ζ_e: modulus of the latitude of the earth station

δ: difference in longitude from the earth station to a point on the edge of the orbital shell of the constellation

$\psi(\delta)$: great-circle arc between the earth station and a point on the surface of the Earth directly below the point on the edge of the orbital shell of the constellation

$\alpha(\delta)$: azimuth from the earth station to a point on the edge of the orbital shell

$\alpha_o(\delta)$: the principal azimuth, an azimuth between 0° and 180°, from an earth station to a point on the edge of the orbital shell

$\varepsilon_v(\delta)$: elevation angle from the earth station to a point on the edge of the orbital shell

K_1: orbit radius/Earth radius for the lowest altitude satellite in the constellation (Earth radius = 6 378.14 km)

$\psi_m = \arccos(1/K_1)$.

All arcs mentioned above are in degrees.

For any latitude on the surface of the Earth, the azimuth for which the minimum elevation angle to a satellite can be greater than zero, and the corresponding elevation angles, may be determined by implementing the calculations under the following case(s). No more than two of these cases will be applicable for any latitude. For situations not specifically addressed in the following cases, no satellite is visible at elevation angles at or below 90° on any azimuth.

Case 1: For: $\zeta_e \le i_s - \psi_m$

For this case, a satellite may be visible to the horizon for all azimuths about the earth station (ε_v =0).

Case 2: For: $i_s - \psi_m < \zeta_e \le \arcsin(\sin i_s \cos \psi_m)$

For this case, the azimuth angles and elevation are developed parametrically by choosing a set of values of δ, uniformly spaced on the interval 0 to δ_1, and applying equations (4-1) to (4-4). For this purpose the spacing between values is not to exceed 1.0º, and the end points are to be included.

$$\delta_1 = \arccos\left[\frac{\cos\psi_m - \sin\zeta_e \sin i_s}{\cos\zeta_e \cos i_s}\right]$$

At any principal azimuth ($\alpha_0(\delta)$) that is not included in the set, the minimum elevation angle is zero (ε_v =0), except for azimuths where Case 6 additionally applies.

Case 3: For: $\arcsin(\sin i_s \cos \psi_m) < \zeta_e < i_s$, and $\zeta_e < 180 - \psi_m - i_s$

For this case, the azimuth angles and elevation are developed parametrically by choosing a set of values of δ, uniformly spaced on the interval 0 to δ_2, and applying equations (4-1) to (4-4). For this purpose the spacing between values is not to exceed 1.0º, and the end points are to be included.

$$\delta_2 = 2\arctan\left[\frac{\sqrt{\sin^2\psi_m - \cos^2 i_s \ \sin^2\delta_1}}{\sin\ \zeta_e\ \cos i_s\ \sin\delta_1}\right] - \delta_1$$

At any principal azimuth ($\alpha_0(\delta)$) that is not included in the set, the minimum elevation angle is zero (ε_v =0), except for azimuths where Case 6 additionally applies.

Case 4: For: $i_s \le \zeta_e < i_s + \psi_m$, and $\zeta_e < 180 - i_s - \psi_m$

For this case, the minimum elevation angle is given explicitly in terms of the principal azimuth angle α_0, as follows:

$$\varepsilon_v = \begin{cases} 90 & \text{for} \quad 0 \le \alpha_0 < \alpha_2 \\ 0 & \text{for} \quad \alpha_2 \le \alpha_0 \le 180 \end{cases}$$

where

$$\alpha_2 = \arccos\left[\frac{\sin i_s - \cos\psi_m \sin\zeta_e}{\sin\psi_m \cos\zeta_e}\right]$$

Note that a minimum elevation angle of 90º in this formulation indicates that no satellite is visible at elevation angles at or below 90º on these azimuths. Furthermore, within the range of principal azimuths where the minimum elevation angle is zero, Case 6 may additionally apply.

Case 5: For $180 - i_s - \psi_m \le \zeta_e \le 90$

For this case, a satellite may be visible to the horizon for all azimuths about the earth station $(\varepsilon_v = 0)$.

Case 6: For $\zeta_e < \psi_m - i_s$

This case may occur additionally with Case 2, Case 3 or Case 4 and a satellite may be visible only above a minimum elevation angle for other principal azimuths.

For this case, the other principal azimuths and the corresponding elevation angles are developed parametrically by choosing a set of values of δ, uniformly spaced on the interval 0 to δ_3, and applying equations (4-1) to (4-4) with i_s replaced by $-i_s$. For this purpose the spacing between values is not to exceed 1.0º and the end points are to be included.

$$\delta_3 = \arccos\left[\frac{\cos\psi_m + \sin\zeta_e \sin i_s}{\cos\zeta_e \cos i_s}\right]$$

1.2 Determination of minimum and maximum horizon gain from the minimum visible elevation angle profile

The horizon gain of the earth station antenna is determined from the profile of values of the minimum composite elevation angle (ε_c). At any azimuth, the minimum composite elevation angle is the greater of the minimum satellite visibility elevation angle at that azimuth (ε_v) and the minimum elevation angle for the earth station (ε_{sys}). The following procedure may be used to determine the maximum and minimum values of horizon antenna gain for each azimuth under consideration.

The following equation may be used to determine the angular separation between the horizon profile, at an azimuth angle α and horizon elevation angle ε_h, and a point on the profile of the minimum composite elevation angle, where the minimum composite elevation angle is ε_c at an azimuth angle of α_c:

$$\varphi(\alpha, \alpha_c) = \arccos\left[\sin \varepsilon_h(\alpha) \sin(\varepsilon_c(\alpha_c)) + \cos \varepsilon_h(\alpha) \cos(\varepsilon_c(\alpha_c)) \cos(\alpha - \alpha_c)\right] \qquad (4\text{-}5)$$

where:

- α: azimuth of the direction under consideration
- $\varepsilon_h(\alpha)$: elevation angle of the horizon at the azimuth under consideration, α
- $\varepsilon_c(\alpha_c)$: minimum composite elevation angle at the azimuth, α_c
- α_c: azimuth corresponding to ε_c.

The minimum value of the separation angle φ_{min}, for the azimuth under consideration, is determined by finding the minimum value of $\varphi(\alpha, \alpha_c)$ for any azimuth α_c, and the maximum value, φ_{max}, is determined by finding the maximum value of $\varphi(\alpha, \alpha_c)$ for any azimuth α_c. The azimuth angles (α) are usually taken in increments of 5°; however, to accurately determine the minimum separation angle, the values of the minimum composite elevation angle, ε_c, need to be determined for a spacing of 1° or less in the azimuth α_c. Where the procedures in § 1.1 of this Annex do not provide a profile of minimum composite elevation angle with a close enough spacing in azimuth angles, linear interpolation may be used to develop the necessary intermediate values. The maximum and minimum horizon antenna gains, G_{max} and G_{min}, to be used in the equations of § 2.2 of the main body of this Appendix for the azimuth under consideration are obtained by applying the off-axis angles, φ_{min} and φ_{max}, respectively, in the earth station antenna pattern. If the earth station antenna pattern is not known then the antenna pattern in § 3 of Annex 3 is used. In many cases, φ_{max} will be large enough on all azimuths so that G_{min} will be equal to the minimum gain of the antenna pattern at all azimuths.

ANNEX 5

Determination of the coordination area for a transmitting earth station with respect to receiving earth stations operating with geostationary space stations in bidirectionally allocated frequency bands

1 Introduction

The propagation mode (1) coordination area of a transmitting earth station with respect to unknown receiving earth stations operating with geostationary space stations requires the determination of the horizon gain of the antenna of the receiving earth station at each azimuth of the transmitting earth station. Different methods then need to be applied to determine the coordination area of the coordinating earth station, depending on whether it operates with geostationary or non-geostationary space stations. When both the coordinating earth station and the unknown receiving earth stations operate with geostationary space stations, it is also necessary to determine a propagation mode (2) coordination contour.

The coordination area of a transmitting earth station, with respect to unknown receiving earth stations that operate to non-geostationary space stations, can be determined by minor modifications to the methods applicable to the determination of coordination area of transmitting earth stations with respect to terrestrial stations. (See § 3.2.1 and § 3.2.3 of the main body of the Appendix.)

2 Determination of the bidirectional coordination contour for propagation mode (1)

For a transmitting earth station operating in a frequency band that is also allocated for bidirectional use by receiving earth stations operating with geostationary space stations, further development of the procedures in Annex 3 is needed. It is necessary to determine the horizon gain of the unknown receiving earth station, the horizon gain to be used at each azimuth at the coordinating (transmitting) earth station, for the determination of the bidirectional coordination area.

2.1 Calculation of horizon gain for unknown receiving earth stations operating with geostationary space stations

The value of G_r , the horizon gain of the receiving earth station, for each azimuth (α) at the transmitting earth station is found by the following steps:

1) The receiving earth station may be operating with any satellite in the geostationary orbit above a minimum elevation angle, (ε_{min}), contained in Table 9 in Annex 7. The maximum difference in longitude (δ_b, in degrees) between the receiving earth station and its associated space station occurs at this minimum elevation angle (ε_{min}) and is given by:

$$\delta_b = \arccos\left(\frac{\sin\left(\varepsilon_{\min} + \arcsin\left(\frac{\cos(\varepsilon_{\min})}{K}\right)\right)}{\cos(\zeta)}\right) \tag{5-1}$$

where:

ζ: latitude of the receiving earth station, which is assumed to be the same as the transmitting earth station

K: ratio of the radius of the satellite orbit to the radius of the Earth, equal to 6.62.

2) For each azimuth (α) at the transmitting earth station:

– determine the azimuth α_r from the receiving earth station to the transmitting earth station:

$$\alpha_r = \alpha + 180° \qquad \text{for } \alpha < 180$$

$$\alpha_r = \alpha - 180° \qquad \text{for } \alpha \geq 180$$

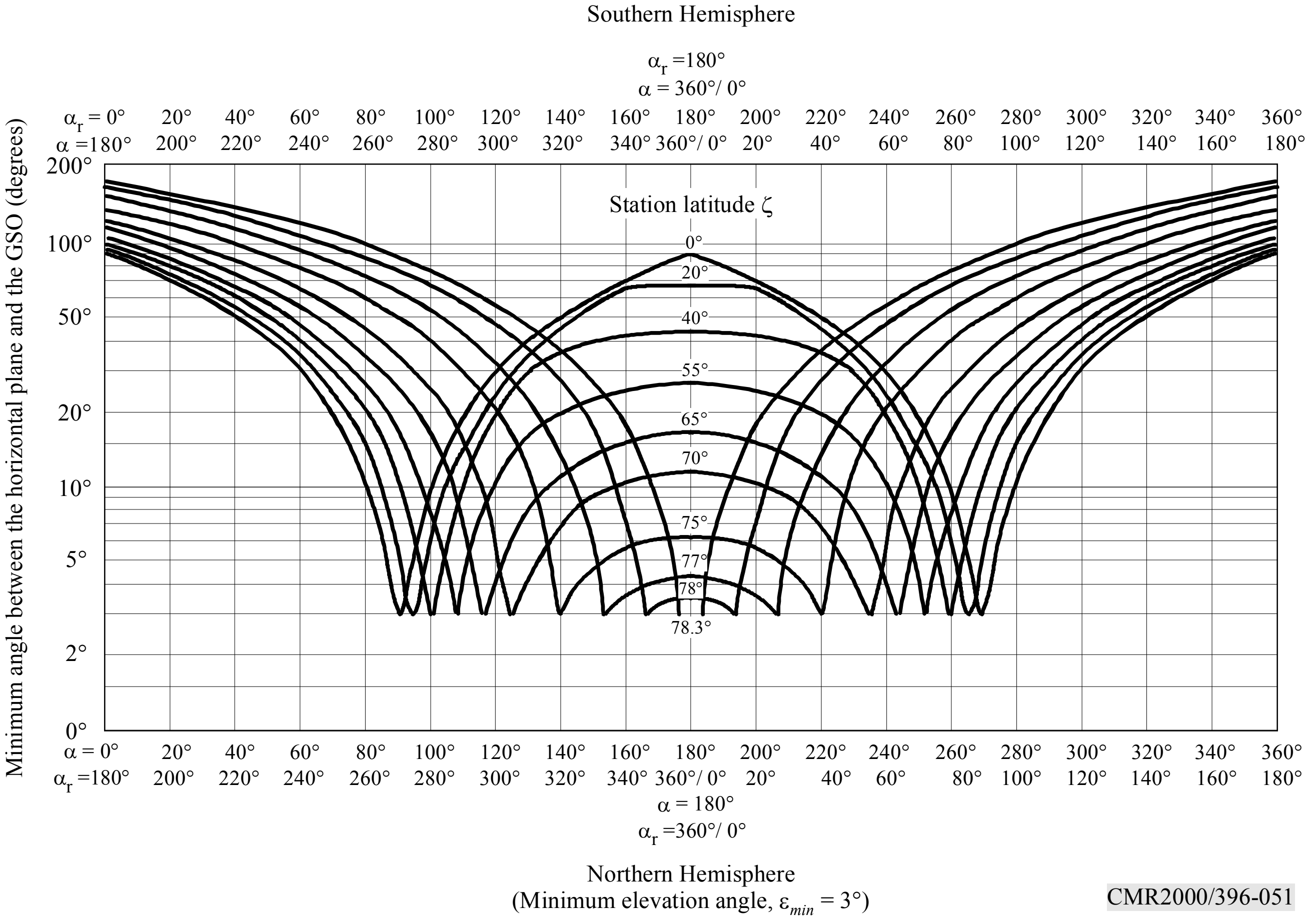
– for each azimuth α_r, determine the minimum angular separation, $\varphi(\alpha_r)$, between the receiving earth station main beam axis and the horizon at this azimuth using Case 1 in § 2 of Annex 3. For this evaluation, $\varphi(\alpha_r)$ is the minimum value of $\varphi(\alpha_r , 0, \delta_0)$, where the values of δ_0 are between $-\delta_b$ and $+ \delta_b$ in steps of 1° or less, making sure to include the end points.

The minimum angular separation, $\varphi(\alpha_r)$, may be used with the gain pattern in § 3 of Annex 3 to determine the horizon gain for this azimuth (α), unless a different gain pattern is referenced in Table 9 of Annex 7.

Figure 5-1 shows plots of the minimum angular separation between the horizon at zero degrees elevation on an azimuth α_r and a satellite on the geostationary orbit at an elevation above 3°. Plots are shown for a set of values of the station latitude (ζ), which is assumed to be the same for both transmitting and receiving earth stations. Figure 5-1 also provides a scale showing the corresponding azimuth (α) of the transmitting earth station.

FIGURE 5-1

Illustration of minimum angular distance between points on the geostationary-satellite orbit (GSO) and the horizontal plane



Further information and an example may be found in the latest version of Recommendation ITU-R SM.1448.

3 Determination of the bidirectional rain scatter contour

The procedure for the determination of the bidirectional rain scatter area, as described in § 3.1.2 of the main body of this Appendix, is as follows:

The horizontal distance d_s (km) from the coordinating earth station to the point at which the main beam axis attains the rain height h_R is calculated by:

$$d_s = 8\,500\left(\sqrt{\tan^2 \varepsilon_s + h_R / 4\,250} - \tan \varepsilon_s\right) \text{ km} \tag{5-2}$$

where the rain height, h_R, can be determined from equations (2-13) or (2-14) in Annex 2 and ε_s is the minimum elevation angle of the transmitting earth station.

The maximum calculation distance, d_{emax}, to be used in the determination of the propagation mode (2) contour, for the case of a coordinating earth station operating in bidirectionally allocated frequency bands, is dependent on the rain height. It is the greater distance determined from:

$$d_{emax} = 130.4\sqrt{h_R} \text{ km or } d_{min}$$

where the minimum coordination distance, d_{min}, is given in § 4.2 of the main body of this Appendix.

The point, at the distance d_s from the earth station, on the azimuth α_s of the coordinating earth station's main beam axis, is the geographic point immediately below the main beam axis intersection with the rain height, and is the reference point from which the maximum calculation distance d_{emax} is determined (see Figure 5-2).

If the maximum calculation distance, d_{emax}, is greater than the minimum coordination distance, d_{min}, then calculate the maximum latitude at which a receiving earth station may operate with a geostationary satellite with a minimum elevation angle ε_{min}:

$$\zeta_{max} = \arccos\left[\frac{\cos(\varepsilon_{min})}{K}\right] - \varepsilon_{min} \tag{5-3}$$

where

ε_{min}: given in Table 9 of Annex 7

K: ratio of the radius of the satellite orbit to the radius of the Earth, equal to 6.62.

If the coordinating earth station latitude in the northern hemisphere is greater than ζ_{max}, or if the coordinating earth station latitude in the southern hemisphere is less than $-\zeta_{max}$ or –71°, then the rain scatter contour is a circle of radius d_{min}, centred on the transmitting earth station.

For all other cases, the coordination area is developed by the following procedure:

Step 1: The unknown receiving earth station is assumed to be operating with a satellite at the minimum elevation angle ε_{min}. It is also assumed that the receiving earth station is relatively close to the coordinating earth station in geometric terms and hence a plane geometry approximation can be applied within the coordination area. If the receiving earth station's main beam axis passes through the intersection of the coordinating earth station's main beam axis with the rain height, the azimuths from the point on the ground immediately below this intersection to the possible locations of a receiving earth station are given by:

$$\alpha_{w1} = \arccos\left[\frac{\tan\zeta}{\tan\zeta_{max}}\right]$$

and

$$\alpha_{w2} = 360 - \alpha_{w1}$$

where ζ is the latitude of the transmitting earth station.

Step 2: Mark on a map of an appropriate scale the coordinating earth station's location and draw from this location a line of distance, d_s, along the azimuth, α_s, to the point below the coordinating earth station's main beam axis intersection with the rain height.

Step 3: From the main beam axis intersection point in Step 2, mark on the map the distance, d_{emax}, along the two azimuths, α_{w2} and α_{w1}, and on each azimuth at the distance, d_{emax}, draw two equal distance arcs of width 3° clockwise and counter-clockwise. The two arcs, each having a total width of 6°, are the first boundary elements of the bidirectional rain scatter area.

Step 4: Mark a circle of radius equal to the minimum coordination distance, d_{min}, around the coordinating earth station's location, and then draw straight lines from the northern edges of the two arc segments tangential to the northern rim of the circle, and from the southern edges of the two arc segments tangential to the southern rim of the circle.

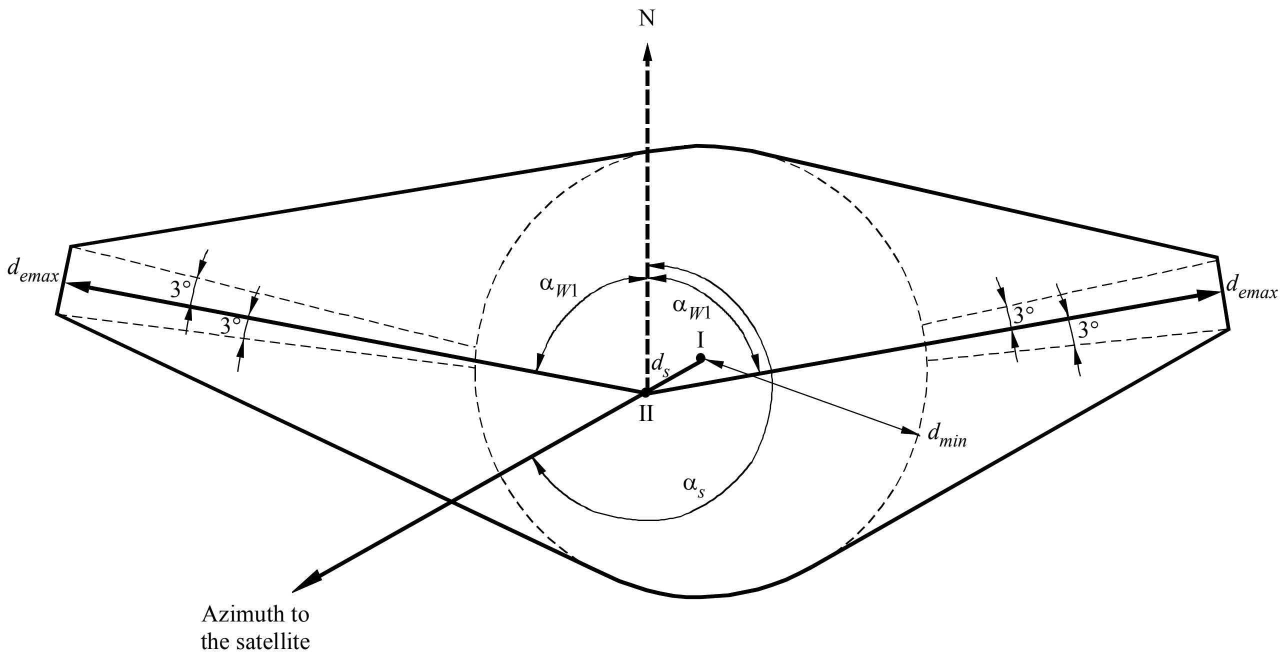
The area bounded by the two 6° wide arcs, the four straight lines, and the circular sections (of which there is always at least one) between the two northern and the two southern tangent points with the straight lines, constitutes the bidirectional rain scatter area.

Figure 5-2 illustrates the construction of the bidirectional rain scatter area for a coordinating earth station. (The resulting rain scatter area contains the possible loci of all receiving earth station locations from which a beam path towards the geostationary-satellite orbit will intersect the main beam of the transmitting earth station antenna.)

FIGURE 5-2

Example of the bidirectional rain scatter area

(not to scale)



I: location of the transmitting earth station

II: point where the earth station antenna main-beam axis reaches the altitude h_R

Assumptions:

ζ = 40° N

ε_S = 10°

α_S = 254°

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ANNEX 6

Supplementary and auxiliary contours

1 Introduction

The material found in this Annex is intended to assist administrations in bilateral discussions.

2 Supplementary contours

The coordination area is determined with respect to the type of terrestrial station (or, in a frequency band with a bidirectional space allocation, an earth station operating in the opposite direction of transmission) that would yield the largest coordination distances. Therefore, in the case of terrestrial services, fixed stations using tropospheric scatter have been assumed to be operating in frequency bands that may typically be used by such radiocommunication systems; and fixed stations operating in line-of-sight configurations and using analogue modulation have been assumed to be operating in other frequency bands. However, other radiocommunication systems (e.g. other terrestrial stations), that typically have lower antenna gains, or otherwise less stringent system parameters, than those on which the coordination area is based, may also operate in the same frequency range. Therefore, it is possible for the administration seeking coordination to identify a supplementary contour using either the methods in § 2 or § 3 of the main body of this Appendix, where they are applicable, or other agreed methods. Subject to bilateral agreement between administrations, these supplementary contours can assume the role of the coordination contour for an alternative type of radio system in the same service or another radiocommunication service.

When a supplementary contour is to be developed for other types of systems, for example digital fixed systems, the necessary system parameters may be found in one of the adjacent columns in Tables 7, 8 and 9 of Annex 7. If no suitable system parameters are available then the value of the permissible interference power ($P_r(p)$) may be calculated using equation (7-1) of § 2 in Annex 7.

In addition, supplementary contours may be prepared by the administration seeking coordination in order to define smaller areas, based on more detailed methods, for consideration when agreed bilaterally between the concerned administrations. These contours can be a useful aid for the rapid exclusion of terrestrial stations or earth stations from further consideration. For earth stations operating with non-geostationary space stations, supplementary contours may be generated using the method in § 4 of this Annex.

Supplementary contours may comprise propagation mode (1) interference paths and, depending on the sharing scenario, propagation mode (2) interference paths. In addition, the propagation mode (1) element of a supplementary contour may, if appropriate for the radiocommunication service, utilize the same level of correction factor (see § 4.4 of the main body of this Appendix) that was applied in the determination of the coordination contour. However, all parts of each supplementary contour must fall on or between the contour defined by the minimum coordination distance and the corresponding propagation mode (1) or propagation mode (2) main contour.

3 Auxiliary contours

Practical experience has shown that, in many cases, the separation distance required for the coordinating earth station, on any azimuth, can in fact be substantially less than the coordination distance, since the worst-case assumptions do not apply to every terrestrial station or earth station. There are two main mechanisms that contribute to such a difference between the separation distance and the coordination distance:

– the terrestrial station antenna gain (or e.i.r.p.), or receiving earth station antenna gain, in the direction of the coordinating earth station is less than that assumed in calculating the coordination contour;

– appropriate allowance can be made, for example, for the effects of site shielding not included in the coordination distance calculations.

Auxiliary contours must use the same method as that used to determine the corresponding main or supplementary contour. In addition, all parts of each auxiliary contour must fall on or between the contour defined by the minimum coordination distance and the corresponding main or supplementary contour. Auxiliary contours may assist in eliminating from detailed coordination terrestrial stations or earth stations that are located in the coordination area and hence have been identified as potentially affected by the coordinating earth station. Any terrestrial station or earth station that lies outside an auxiliary contour and has an antenna gain towards the coordinating earth station that is less than the gain represented by the relevant auxiliary contour need not be considered further as a significant source, or subject, of interference.

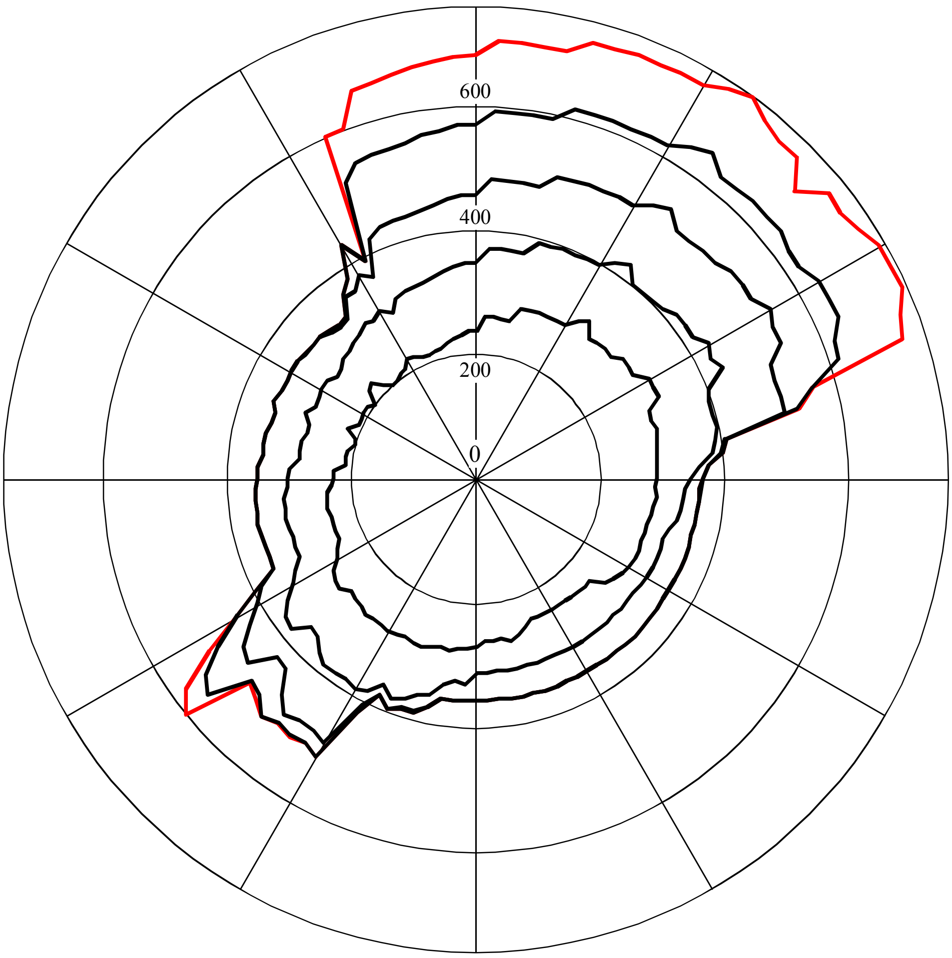
3.1 Auxiliary contours for propagation mode (1)

Propagation mode (1) auxiliary contours are calculated with values for the propagation mode (1) minimum required loss in equation (22) in § 4.4 of the main body of this Appendix that are progressively reduced by, for example, 5, 10, 15, 20 dB, etc., below the value derived from the parameters assumed in Tables 7, 8 and 9 of Annex 7 for the corresponding main or supplementary propagation mode (1) contour, until the minimum coordination distance is reached. Propagation mode (1) auxiliary contour distances are calculated without the correction factor (see § 4.4 of the main body of this Appendix), and hence could be larger, on any azimuth, than the corresponding main, or supplementary, propagation mode (1) distance. To prevent this, in those cases where a correction factor applies to the main or supplementary contour, the maximum propagation mode (1) auxiliary contour distance on any azimuth is limited to the corresponding main or supplementary propagation mode (1) distance. In effect this means that the correction factor will limit the possible range of auxiliary contour values so that only those auxiliary contours with values greater than the applied correction factor will be shown within the main or supplementary contour (see Figure 6-1). For example, if the value of correction factor applicable to the propagation mode (1) main or supplementary contour is 10 dB, then the first auxiliary contour drawn would be for a reduction in minimum required loss of 5 dB and hence the auxiliary contour value would be –15 dB (by convention, auxiliary contours are shown as negative quantities as they represent a reduction in the terrestrial, or receiving earth station, antenna gain, or the terrestrial station e.i.r.p.).

Propagation mode (2) interference effects may still need to be considered even if propagation mode (1) interference effects have been eliminated from detailed coordination, as the propagation models are based on different interference mechanisms.

FIGURE 6-1

Propagation mode (1) main contour and auxiliary contours



The propagation mode (1) auxiliary contours are shown for –10, –20, –30 and –40 dB adjustements in the minimum require loss.

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3.2 Auxiliary contours for propagation mode (2)

The propagation mode (2) contour around an earth station is calculated assuming the main beams of the coordinating earth station and the terrestrial station intersect exactly (see § 1.3 of the main body of this Appendix). However, it is unlikely that these antenna main beams will intersect exactly. It is therefore possible to generate propagation mode (2) auxiliary contours that take account of any offset in the pointing of the terrestrial station antenna beam from the direction of the coordinating earth station. This offset would result in partial beam intersections and hence a reduced interference potential. These propagation mode (2) auxiliary contours are calculated according to the method described in § 3.2.1 of this Annex.

Propagation mode (2) auxiliary contours are not generated for different values of antenna gain or e.i.r.p. but for different values of beam avoidance angle. Hence, if there is a need to consider both a lower value of antenna gain, or e.i.r.p., for the terrestrial station and propagation mode (2) auxiliary contours, it is first essential to consider the impact of the reduction in antenna gain, or e.i.r.p., on the propagation mode (2) contour. This is achieved by generating a supplementary contour (see § 2) corresponding to the lower value of antenna gain or e.i.r.p. for the terrestrial station, which is drawn on a separate map. Auxiliary mode (2) contours can then be generated inside this propagation mode (2) supplementary contour for different values of the beam avoidance angle. Hence, propagation mode (2) auxiliary contours may be most frequently applied in conjunction with a supplementary contour rather than with the coordination contour.

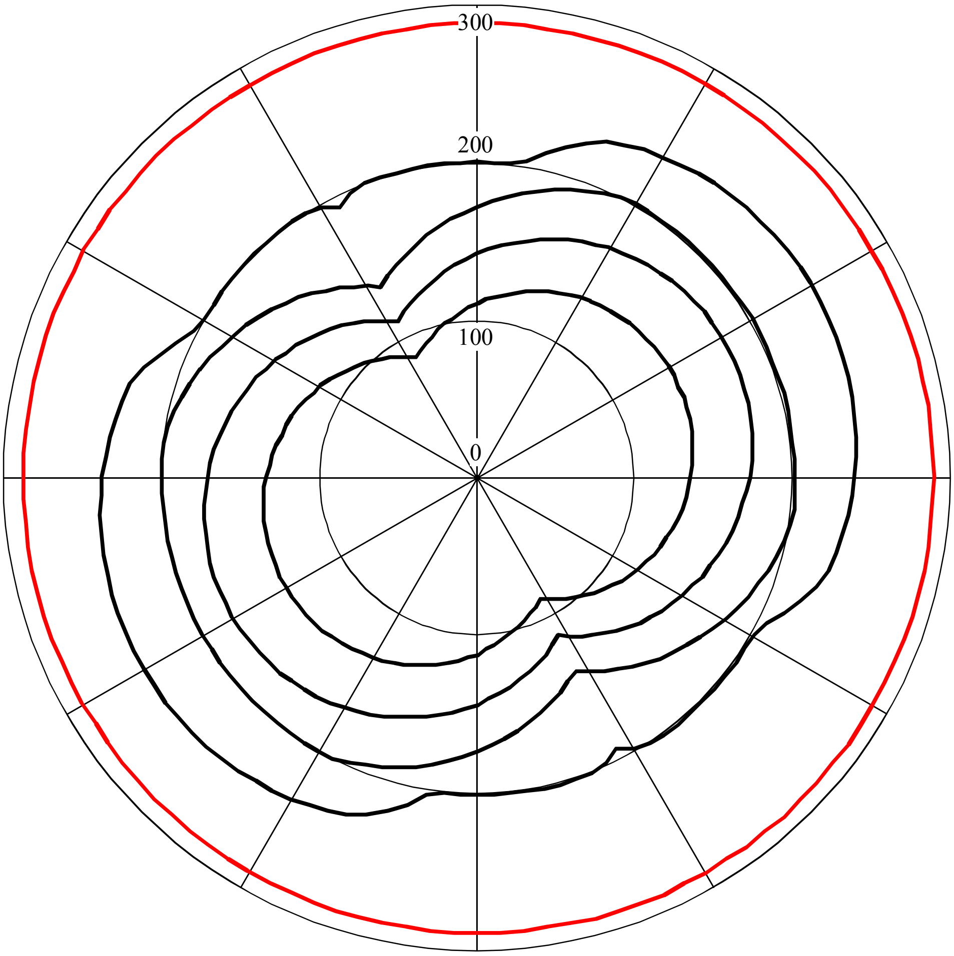
The correction factor discussed in § 1.3 of the main body of this Appendix does not apply to propagation mode (2) interference paths and hence is also not applicable to propagation mode (2) auxiliary contours. In addition propagation mode (2) auxiliary contours cannot be developed for the bidirectional case.

Propagation mode (2) auxiliary contours are prepared for appropriate values of terrestrial station main beam avoidance angle (see Figure 6-2). When the antenna characteristics of the terrestrial stations are known, the appropriate antenna pattern[9] should be used when determining the propagation mode (2) auxiliary contours. If this not available, the reference antenna pattern given in § 3.2.3 may be used.

[9] The method requires the antenna pattern to be monotonic in terms of the reduction in gain either side of the main beam axis.

FIGURE 6-2

Propagation mode (2) main contour and auxiliary contours



The propagation mode (2) auxiliary contours are shown for terrestrial station main beam avoidance angles of 2.0º, 2.7º, 3.2º and 4.0º, respectively

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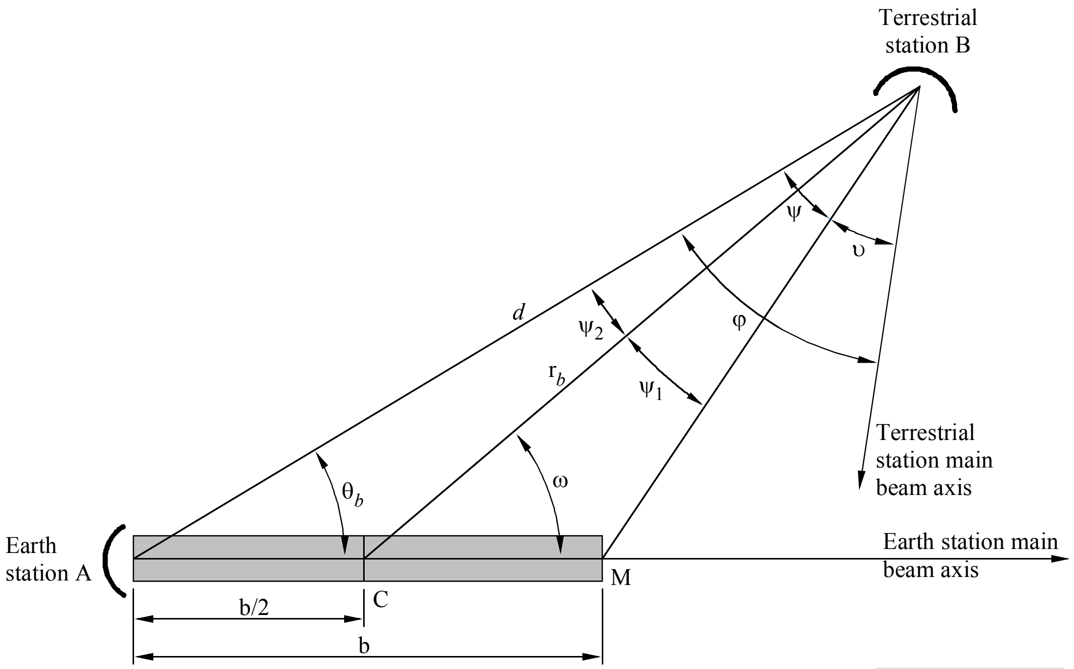
3.2.1 Determination of auxiliary contours for propagation mode (2)

Propagation mode (2) auxiliary contours allow the azimuthal offset of a terrestrial station antenna beam from the coordinating earth station's location to be taken into consideration. Figure 6-3 shows the hydrometeor scatter region projected on to the horizontal plane. In this figure, the earth station and the terrestrial station are located at the points A and B, respectively, where the terrestrial station is on a radial defined by the angle ω from the point C at the centre of the propagation mode (2) main, or supplementary, contour. Point C is also the centre of the auxiliary contour.

FIGURE 6-3

Propagation geometry in the horizontal plane



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The shaded area in Figure 6-3 represents the critical region, along the earth station's main beam axis, between the earth station and the rain height. Within this critical region a common volume can be formed between the earth station beam and the beam of any terrestrial stations within the propagation mode (2) main, or supplementary, contour. This critical region's length is b and its maximum horizontal extent is at point M. Intersection of this critical region by the terrestrial station main beam axis would result in significant hydrometeor scatter interference via main lobe-to-main lobe coupling.

For a given point within the propagation mode (2) main, or supplementary, contour, the angle subtended by the critical region is termed the critical angle, ψ. The protection angle, υ, represents the angle of the terrestrial station main beam axis away from the critical region. The beam avoidance angle between the terrestrial station's main beam axis and the earth station's location is φ. It is the sum of the two angles ψ and υ and it is this quantity that has a fixed value for a specific auxiliary contour. Each auxiliary contour is generated by varying the angle, ω, and deriving the distance (r_b) from point C to the auxiliary contour. As the angle ω increases from 0° to 360°, the angles ψ and υ change, but their sum remains the same.

The algorithm in § 3.2.2 of this Annex can be used to calculate the auxiliary propagation mode (2) contour for a given value of beam avoidance angle φ.

The method is based on iteratively decrementing the distance, r_b, between terrestrial station and the centre of the common volume, and starting at the main contour distance d_r, until either the shortest value of r_b is found for which the required minimum loss is achieved, or the minimum coordination distance is reached. For each value of r_b, the critical angle ψ is determined and then the protection angle υ is calculated. The terrestrial station antenna gain corresponding to υ and the current distance r_b are used to obtain the propagation mode (2) path loss in equation (2-21) in Annex 2.

The above process is repeated for each angle ω, to generate a complete auxiliary contour for a given value of beam avoidance angle φ. For some combinations of beam avoidance angle and angle ω, an auxiliary contour may coincide with the main, or supplementary, propagation mode (2) contour.

3.2.2 The step-by-step algorithm

Auxiliary propagation mode (2) contours are constructed by calculating distances along radials from the centre of the circular mode (2) main, or supplementary, contour, which is the point C, at the distance b/2 from the earth station along the azimuth of its main beam axis. The distance b/2 is equal to Δd, where Δd is given by equation (2-23) in Annex 2.

For the selected value of beam avoidance angle,φ, generate the auxiliary contour for values of angle, *ω*, ranging from 0° to 180° in steps of 1°, as follows:

a) Set r_b to the main, or supplementary, mode (2) contour distance d_r calculated as described in § 3.1 of Annex 2.

b) Compute *ψ* from:

$$\psi_1 = \arctan\left(\frac{b \sin \omega}{2r_b - b\cos\omega}\right) \qquad (6\text{-}1)$$

$$\psi_2 = \arctan\left(\frac{b \sin \omega}{2r_b - b\cos\omega}\right) \qquad (6\text{-}2)$$

$$\psi = \psi_1 + \psi_2 \qquad (6\text{-}3)$$

c) If ψ > φ then the auxiliary mode (2) contour coincides with the main or supplementary mode (2) contour for the current value of ω, and the calculation for that value of ω is completed, and go to step j). Otherwise proceed through the following steps d) to i) until one of the terminating conditions described in step f) and step i) is satisfied.

d) Decrement r_b by subtracting 0.2 km from its value.

e) Recalculate the critical angle ψ using equations (6-1), (6-2) and (6-3).

f) If $(0.5\ b \sin \omega / \sin \psi_2) < d_{min}$, the auxiliary mode (2) contour coincides with the minimum coordination distance d_{min} and the calculation for the current value of ω is completed - go to step j). Otherwise, proceed to step g).

g) Compute the protection angle $\upsilon = \varphi - \psi$.

h) Calculate $G(\upsilon)$, the terrestrial station antenna gain at the angle υ relative to the beam axis, using the reference antenna pattern given in this Annex.

i) In equation (2-21) in Annex 2, use the gain calculated in step h) in place of G_x and the value considered of r_b in place of r_i, and calculate the corresponding propagation mode (2) path loss L_r. If $L_r < L(p)$, then increment r_b by adding 0.2 km to its value and take this as the distance for the current radial. Otherwise, repeat from step d).

j) Once the value of r_b has been found for the current value of angle ω, calculate the angle θ_d from the location of the earth station, and if appropriate the distance, d, to that contour point using:

$$d = 0.5\, b \sin\omega / \sin\psi_2 \tag{6-4}$$

$$\theta_d = \omega - \psi_2 \tag{6-5}$$

An auxiliary propagation mode (2) contour is symmetrical about the earth station main beam axis. Thus, values of d and θ_d corresponding to the values of ω from 181° to 359° can be found by noting that results for a given value of ω are the same as for $(-\omega)$ or $(360°-\omega)$.

The step size for incrementing r_b used above, 0.2 km, is suitable for most situations. It controls the granularity of the result when viewed as a set of r_b values. For low values of earth station beam elevation, the granularity becomes more noticeable in the values of d and θ_d, and a smaller step size may be used.

3.2.3 Reference radiation patterns for line-of-sight radio-relay system antennas

The reference radiation pattern for line-of-sight radio-relay system antennas in this section is used for the unknown terrestrial station antenna in the propagation mode (2) auxiliary contour calculations when the actual antenna pattern is not available.

a) In cases where the ratio between the antenna diameter and the wavelength is greater than 100, the following equation is used:

$$G(\varphi) = G_{a\max} - 2.5\times10^{-3}\left(\frac{D}{\lambda}\varphi\right) \quad \text{for} \quad 0 < \varphi < \varphi_m \tag{6-6}$$

$$G(\varphi) = G_1 \quad \text{for} \quad \varphi_m \le \varphi < \varphi_r \tag{6-7}$$

$$G(\varphi) = 32 - 25\log\varphi \quad \text{for} \quad \varphi_r \le \varphi < 48^\circ \tag{6-8}$$

$$G(\varphi) = -10 \quad \text{for} \quad 48^\circ \le \varphi \le 180^\circ \tag{6-9}$$

$$G_1 = 2 + 15 \log \frac{D}{\lambda} \qquad (6\text{-}10)$$

$$\varphi_m = \frac{20\lambda}{D} \sqrt{G_{a\max} - G_1} \qquad (6\text{-}11)$$

$$\varphi_r = 15.85 \left(\frac{D}{\lambda} \right)^{-0.6} \qquad (6\text{-}12)$$

b) In cases where the ratio between the antenna diameter and the wavelength is less than or equal to 100, the following equation is used:

$$G(\varphi) = G_{a\max} - 2.5 \times 10^{-3} \left(\frac{D}{\lambda} \varphi \right)^2 \quad \text{for} \quad 0 < \varphi < \varphi_m \qquad (6\text{-}13)$$

$$G(\varphi) = G_1 \, G(\varphi) = G_1 \quad \text{for} \quad \varphi_m \le \varphi < 100 \frac{\lambda}{D} \qquad (6\text{-}14)$$

$$G(\varphi) = 52 - 10 \log \frac{D}{\lambda} - 25 \log \varphi \quad \text{for} \quad 100 \frac{\lambda}{D} \le \varphi < 48^\circ \qquad (6\text{-}15)$$

$$G(\varphi) = 10 - 10 \log \frac{D}{\lambda} \quad \text{for} \quad 48^\circ \le \varphi \le 180^\circ \qquad (6\text{-}16)$$

c) In cases where only the maximum antenna gain is known, D/λ can be estimated from the following expression:

$$20 \log \frac{D}{\lambda} \approx G_{a\max} - 7.7 \qquad (6\text{-}17)$$

where

G_{amax}: main beam axis antenna gain (dBi).

D: antenna diameter (m)

λ: wavelength (m)

G_1: gain of the first side lobe (dBi)

4 Determination of a supplementary contour using the time-variant gain (TVG) method

The TVG method requires the cumulative distribution of the time-varying horizon antenna gain of an earth station operating with a non-geostationary space station. In comparison to the TIG method, the TVG method usually produces smaller distances, but requires greater effort in determining the cumulative distribution of the horizon gain of the earth station antenna for each azimuth to be considered.

The TVG method closely approximates the convolution of the distribution of the horizon gain of the earth station antenna and the propagation mode (1) path loss. This method may produce slightly smaller distances than those obtained by an ideal convolution. An ideal convolution cannot be implemented due to the limitations of the current model for propagation mode (1). The propagation mode (1) required distance, at the azimuth under consideration, is taken as the largest distance developed from a set of calculations, each of which is based on equation (4) of the main body of this Appendix. For convenience, in these calculations, this equation may be rewritten for the *n*th calculation in the following form:

$$L_b(p_v) - G_e(p_n) = P_t + G_x - P_r(p)\,dB \qquad (6\text{-}18)$$

with the constraint

$$p_v = \begin{cases} 100\, p / p_n & \text{for } p_n \geq 2\,p \\ 50 & \text{for } p_n < 2\,p \end{cases} \quad \text{per cent}$$

where:

- P_t, $P_r(p)$: as defined in equations in § 1.3 of the main body of this Appendix where p is the percentage of time associated with permissible interference power $P_r(p)$
- G_x: maximum antenna gain assumed for the terrestrial station (dBi). Tables 7 and 8 of Annex 7 give values for G_x for the various frequency bands
- $G_e(p_n)$: the horizon gain of the coordinating earth station antenna (dBi) that is exceeded for p_n% of the time on the azimuth under consideration
- $L_b(p_v)$: the propagation mode (1) minimum required loss (dB) for p_v% of the time; this loss must be exceeded by the propagation mode (1) predicted path loss for all but p_v% of the time.

The values of the percentages of time, p_n , to be used in equation (6-18) are determined in the context of the cumulative distribution of the horizon antenna gain. This distribution needs to be developed for a predetermined set of values of horizon antenna gain spanning the range from the minimum to the maximum values for the azimuth under consideration. The notation $G_e(p_n)$ denotes the value of horizon antenna gain for which the complement of the cumulative distribution of the horizon antenna gain has the value corresponding to the percentage of time p_n. The p_n value is the percentage of time that the horizon antenna gain exceeds the *n*th horizon antenna gain value. The procedure in § 4.1 may be used to develop this distribution.

For each value of p_n, the value of horizon antenna gain for this time percentage, $G_e(p_n)$, is used in equation (VI-18) to determine a propagation mode (1) minimum required loss. The propagation mode (1) predicted path loss is to exceed this propagation mode (1) required loss for no more than p_v per cent of the time, as specified by the constraint associated with equation (6-18). A series of propagation mode (1) distances are then determined using the procedures described in § 4 of the main body of this Appendix.

The propagation mode (1) required distance is then the maximum distance in the series of propagation mode (1) distances that are obtained for any value of p_n, subject to the constraint associated with equation (6-18). A detailed description of the method for using equation (6-18) to determine the propagation mode (1) required distance is provided in § 4.2.

Further information, including examples, may be found in the latest version of Recommendation ITU-R SM.1448.

4.1 Determination of the horizon antenna gain distribution for the TVG method

The time-variant gain (TVG) method for the determination of an earth station's supplementary contour requires the determination of the horizon antenna gain statistics for all azimuths (in suitable increments, e.g. 5°) around the earth station. In considering the horizon antenna gain of the antenna for either a transmitting or a receiving earth station, only the horizon antenna gain values during the operational time are to be considered. In developing the cumulative distributions of horizon antenna gain, the percentages of time are percentages of operational time. Thus, there may be periods of time for which no horizon antenna gain is specified.

The determination of the horizon antenna gain distribution requires both earth station and orbital information including whether or not station keeping is used to maintain a single orbital path (repeating/non-repeating ground track system). The cumulative distribution of the time-varying horizon gain of a transmitting or a receiving earth station antenna operating with non-geostationary space stations is calculated as follows:

Step 1 Simulate the constellation of non-geostationary space stations over a sufficiently long period, with a time step appropriate for orbit altitude, to obtain a valid representation of the antenna gain variations. For repeating ground track constellations, simulate the orbital path for each satellite visible from the earth station over a period of the ground track. For non-repeating ground track constellations, simulate the orbit of each satellite in the constellation over a period long enough to get a stable representation of the distribution.

Step 2 At each time step, determine the azimuth and elevation angle of each satellite that is both visible at the earth station and above the minimum elevation angle at which the earth station operates. In addition to the minimum elevation angle, other criteria could be used to avoid certain geometric configurations, e.g. geostationary orbit arc avoidance (no transmission between an earth station and a non-geostationary satellite that is within ± Xº from the geostationary orbit arc).

Step 3 At each step, and for each satellite in communication with the earth station, use the actual earth station antenna pattern, or a formula giving a good approximation of it, to calculate the gain towards the horizon at each azimuth and elevation angle around the earth station.

Step 4 Choose a gain increment *g* (dB) and partition the gain range by a number of gain levels between G_{min} and G_{max}, i.e. $G = \{G_{min}, G_{min} + g, G_{min} + 2g, ..., G_{max}\}$.

These gain levels determine a set of gain intervals so that the *n*th gain interval (n = 1, 2, 3, …) includes gain values equal to, or greater than, $G_{min} + (n - 2)g$ and less than $G_{min} + (n - 1)g$.

A value of g = 0.1 to 0.5 dB is recommended.

For each azimuth on the horizon around the earth station, accumulate the time that the horizon gain takes a value in each gain interval of width *g* (dB).

Step 5 The probability density function (pdf) on each azimuth is determined by dividing the time in each gain interval by the total simulation time.

Step 6 Determine the cumulative distribution function (cdf) of horizon antenna gain at each azimuth by accumulating the gain density function at that azimuth. The value of the required cdf at any specific gain value is the percentage of time that the gain is less than, or equal to, that gain value.

4.2 Determination of the supplementary contour distance using the TVG method

This calculation is based on a cumulative distribution of the horizon gain of the earth station antenna for each azimuth to be considered (in suitable angular increments e.g. 5°). Appropriate distributions for this purpose may be developed by the method in § 4.1. The process for calculating the supplementary contour distance for each azimuth is described in the following procedure.

Step 1 From the complementary cumulative distribution of the horizon antenna gain, for the azimuth under consideration, determine the percentage of time p_n that the horizon gain exceeds the level G_{en}, where

$$G_{en} = G_{\min} + (n-1)g \quad (n = 1, 2, 3, ...) \qquad (6\text{-}19)$$

with

G_{min}: the minimum value of horizon gain, and

g: is a gain increment

Step 2 For each percentage p_n that is equal to or greater than 2p%, the percentage of time to be used in determining the propagation mode (1) path loss is p_v.

$$p_v = 100\, p / p_n \,\% \text{ for } \; p_n \geq 2p\% \quad (6\text{-}20)$$

For each percentage of time, determine the distance, d_n (km), for which the propagation mode (1) predicted path loss is equal to the propagation mode (1) minimum required loss, using the propagation model in accordance with § 4 of the main body of this Appendix and the equation

$$L_{bn}(p_v) = P_t + G_{en} + G_x - P_r(p) \quad dB \quad (6\text{-}21)$$

The values of p_v must be within the range of percentage of time of the propagation mode (1) model (see §1.5.1 of the main body of this Appendix).

Step 3 The propagation mode (1) required distance for the azimuth under consideration is the largest of the distances, d_n (km), calculated in Step 2, except when this largest distance is attained for the smallest value of p_n that is equal to or greater than $2p$ in accordance with equation (6-20) in Annex 6. In such cases, the propagation mode (1) required distance for the azimuth under consideration is the distance determined from equation (6-21) in Annex 6 with $G_{en} = G_{max}$ and p_v = 50% where G_{max} is the maximum value of horizon antenna gain.

Step 4 The propagation mode (1) supplementary contour distance for the azimuth under consideration is the required distance as determined in Step 3, except that the distance must be between the minimum coordination distance (d_{min}) and the maximum coordination distance (d_{max1}). These limits are given in § 4.2 and § 4.3 of the main body of this Appendix, respectively.

ANNEX 7

System parameters and predetermined coordination distances for determination of the coordination area around an earth station

1 Introduction

Tables 7 to 9 contain the system parameter values required by the methods in the main body of this Appendix to determine the coordination area around an earth station when the band is shared with terrestrial radiocommunication services or other earth stations operating in the opposite direction of transmission.

Table 7 is limited to those system parameter values required for the case of a transmitting earth station sharing with terrestrial services; Table 8 is limited to those parameter values required for the case of a receiving earth station sharing with terrestrial services; Table 9 is limited to those parameter values required for the case of a transmitting earth station which is sharing in a bidirectionally allocated band with other earth stations operating in the opposite direction of transmission.

These system parameter tables include primary allocations to the space and terrestrial services in Article **S5** in all bands between 100 MHz and 105 GHz. Some of the columns have incomplete information. In some cases, this is because there is no requirement to calculate coordination distances as pre-determined coordination distances apply. In other cases, the service allocations are new and the systems may not be introduced for some years. Hence, the system parameters are the subject of ongoing development within the ITU-R study groups.

Parameters specific to the earth station, for which coordination is being sought, are provided to BR in the format specified in Appendix **S4** as part of the notification and coordination procedures.

The row in each table entitled “method to be used” directs the user to the appropriate section of the main body of this Appendix which describes the methods to be followed for the determination of the coordination area.

Note that the earth station for which the coordination area is to be determined is identified by the service designation given in the first row of each table.

When a supplementary contour is to be developed, for example for digital fixed systems, the necessary system parameters may be found in one of the adjacent columns in Tables 7, 8 and 9 in this Annex. If no suitable system parameters are available, then the value of the permissible interference power ($P_r(p)$) may be calculated using equation (7-1) in § 2.

The predetermined coordination distances specified in Table 10 are used for transmitting and receiving earth stations, in cases defined by the corresponding frequency sharing situation.

2 Calculation of the permissible interference power of an interfering emission

Tables 7, 8 and 9 contain values for the parameters which are required for the calculation of the permissible interference power of the interfering emission (dBW), in the reference bandwidth, to be exceeded for no more than *p*% of the time at the receiving antenna terminal of a station subject to interference, from a single source of interference, using the general formula:

$$P_r(p) = 10\log(k\,T_e\,B) + N_L + 10\log(10^{M_s/10} - 1) - W \quad dBW \qquad (7\text{-}1)$$

where:

- k: Boltzmann's constant, 1.38×10^{-23} J/K
- T_e: thermal noise temperature of the receiving system (K), at the terminal of the receiving antenna (see § 2.1 of this Annex)
- N_L: link noise contribution (see § 2.2 of this Annex)
- B: reference bandwidth (Hz), i.e. the bandwidth in the receiving station that is subject to the interference and over which the power of the interfering emission can be averaged
- p: percentage of the time during which the interference from one source may exceed the permissible interference power value; since the entries of interference are not likely to occur simultaneously, $p = p_0/n$
- p_0: percentage of the time during which the interference from all sources may exceed the threshold value
- n: number of equivalent, equal level, equal probability entries of interference, assumed to be uncorrelated for small percentages of the time
- M_s: link performance margin (dB) (see § 2.3 of this Annex)
- W: a thermal noise equivalence factor (dB) for interfering emissions in the reference bandwidth; it is positive when the interfering emissions would cause more degradation than thermal noise (see § 2.4 of this Annex).

In certain cases, an administration may have reason to believe that, for its receiving earth station, a departure from the values associated with the earth station, as listed in Table 8, may be justified. Attention is drawn to the fact that for specific systems the bandwidths *B* or, for example in the case of demand assignment systems, the percentages of the time p and p_0 may have to be changed from the values given in Table 8.

2.1 Calculation of the noise temperature of the receiving system

The noise temperature (K) of the receiving system, referred to the output terminals of the receiving antenna, may be determined (unless specifically given in Table 7) from:

$$T_e = T_a + (\ell_{tl} - 1)290 + \ell_{tl} T_r \quad K \qquad (7\text{-}2)$$

where:

T_a: noise temperature (K) contributed by the receiving antenna

ℓ_{tl}: numerical loss in the transmission line (e.g. a waveguide) between the antenna terminal and the receiver front end

T_r: noise temperature (K) of the receiver front end, including all successive stages at the front end input.

For radio-relay receivers and where the waveguide loss of a receiving earth station is not known, a value of $\ell_{tl} = 1.0$ is used.

In case of determination of the coordination contours between two earth stations operating in the opposite direction of transmission, the following earth station receiving system noise temperatures should be used if the value is not provided in Table 9. This assumption is necessary because the receiving earth station takes the place of a receiving terrestrial station in the calculations.

TABLE 6

Frequency range (GHz)	**T_e (K)**
$f < 10$	75
$10 < f < 17$	150
$f > 17$	300

2.2 Determination of the factor N_L

The factor N_L is the noise contribution to the link. In the case of a satellite transponder, it includes the uplink noise, intermodulation, etc. In the absence of table entries, it is assumed:

N_L = 1 dB for fixed-satellite links

N_L = 0 dB for terrestrial links.

2.3 Determination of the factor M_s

The factor M_s is the factor by which the link noise under clear-sky conditions would have to be raised in order to equal the permissible interference power.

2.4 Determination of the factor *W*

The factor *W* (dB) is the level of the radio-frequency thermal noise power relative to the received power of an interfering emission which, in the place of the former and contained in the same (reference) bandwidth, would produce the same interference (e.g. an increase in the voice or video channel noise power, or in the bit error ratio). The factor *W* generally depends on the characteristics of both the wanted and the interfering signals.

When the wanted signal is digital, *W* is usually equal to or less than 0 dB, regardless of the characteristics of the interfering signal.

3 Horizon antenna gain for a receiving earth station with respect to a transmitting earth station

For the determination of the coordination area of a transmitting earth station with respect to a receiving earth station in a bidirectionally allocated band, it is necessary to calculate the horizon antenna gain of the unknown earth station. In cases where the unknown receiving earth stations operate with geostationary satellites, Table 9 provides the necessary receiving earth station parameters for the calculation procedure, which is described in § 2.1 of Annex 5.

In the case where the unknown receiving earth station operates with non-geostationary satellites, the horizon antenna gain to be used for all azimuths is provided in Table 9. The tabulated values were determined by using the method described in § 2.2 of the main body of this Appendix, which uses the maximum and minimum values of horizon antenna gain. For this purpose the maximum horizon antenna gain is the gain of the antenna for an off-axis angle equal to the minimum operating elevation angle. The minimum horizon antenna gain is the gain at large off-axis angles, usually more than 36º or 48º.

In determining the TIG horizon antenna gain entries in Table 9, the difference between the maximum and minimum horizon antenna gain did not exceed 30 dB. Consequently, the TIG horizon antenna gain was taken as the lesser of the maximum horizon antenna gain or 20 dB more than the minimum horizon antenna gain. For the purpose of determining the TIG horizon antenna gain, the reference antenna pattern of § 3 of Annex 3 was used, except in cases noted in the tables where a different pattern was deemed to be more appropriate.

TABLE 7a

Parameters required for the determination of coordination distance for a transmitting earth station

Transmitting space radiocommunication service designation		Mobile-satellite		Mobile-satellite, space operation	Earth exploration-satellite, meteorological satellite		Space operation	Space research, Space operation	Mobile-satellite	Space operation		Mobile-satellite, radio-determination satellite	Mobile-satellite		Mobile -satellite		Space operation, Space research		Mobile-satellite		Space research, Space operation, Earth exploration-satellite
Frequency bands (MHz)		121.45-121.55		148.0-149.9	401-403		433.75-434.25	449.75-450.25	806-840	1 427-1 429		1 610-1 626.5	1 675-1 700		1 675-1 710		1 750-1 850		1 980-2 025		2 025-2 110 2 110-2 120 (Deep space)
Receiving terrestrial service designations		Aeronautical mobile		Fixed, mobile	Fixed, mobile, meteorological aids		Amateur, radio-location fixed, mobile	Fixed, mobile, radio-location	Fixed, mobile broadcasting, aeronautical radionavigation	Fixed, mobile		Aeronautical, radionavigation	Meteoro-logical aids		Fixed, mobile		Fixed, mobile		Fixed, mobile		Fixed, mobile
Method to be used		§ 1.4.7		§ 2.1, § 2.2	§ 2.1, § 2.2		§ 2.1, § 2.2	§ 2.1, § 2.2	§ 1.4.6	§ 2.1, § 2.2		§ 1.4.6	§ 1.4.6		§ 1.4.6		§ 2.1, § 2.2		§ 1.4.6		§ 2.1, § 2.2
Modulation at terrestrial station (1)		A	N	A	A	N		A&N	A&N	A	N		A	N	A	N	A	N	A	N	A
Terrestrial	p_0(%)			1.0				0.01	0.01	0.01	0.01				0.01	0.01	0.01	0.01	0.01		0.01
Station	n			1				2	2	2	2				2	2	2	2	2		2
Interference	p(%)			1.0				0.005	0.005	0.005	0.005				0.005	0.005	0.005	0.005	0.005		0.005
Parameters	N_L (dB)			-				0	0	0	0				0	0	0	0	0		0
And	M_s (dB)			-				20	20	33	33				33	33	33	33	26(2)		26(2)
Criteria	W (dB)			-				0	0	0	0				0	0	0	0	0		0
Terrestrial station	G_x (dBi) (3)			8				16	16	33	33				35	35	35	35	49(2)		49(2)
parameters	T_e (K)			-				750	750	750	750				750	750	750	750	500(2)		500(2)
Reference bandwidth	B (Hz)			14×10^3				12.5×10^3	12.5×10^3	4×10^3	10^6				4×10^3	10^6	4×10^3	10^6	4×10^3		4×10^3
Permissible interference power	$P_r(p)$ (dBW) in B			–153				–139	–139	–131	–107				–131	–107	–131	–107	–140		–140

(1) A: analogue modulation; N: digital modulation.

(2) The parameters for the terrestrial station associated with transhorizon systems have been used. Line-of-sight radio-relay parameters associated with the frequency band 1 675-1 710 MHz may also be used to determine a supplementary contour.

(3) Feeder losses are not included.

TABLE 7b

Parameters required for the determination of coordination distance for a transmitting earth station

Transmitting space radiocommunication service designation		Fixed-satellite, mobile-satellite	Fixed-satellite	Fixed-satellite	Fixed-satellite		Space operation, space research		Fixed-satellite, mobile-satellite, meteorological-satellite		Fixed-satellite		Fixed-satellite		Fixed-satellite	Fixed-satellite (3)	Fixed-satellite	Fixed-satellite (3)
Frequency bands (GHz)		2.655-2.690	5.091-5.150	5.725-5.850	5.725-7.075		7.100-7.235 (5)		7.900-8.400		10.7-11.7		12.5-14.8		13.75-14.3	15.43-15.65	17.7-18.4	19.3-19.7
Receiving terrestrial service designations		Fixed, mobile	Aeronautical radio-navigation	Radio-location	Fixed, mobile		Fixed, mobile		Fixed, mobile		Fixed, mobile		Fixed, mobile		Radiolocation radio-navigation	Aeronautical radionavigation	Fixed, mobile	Fixed, mobile
Method to be used		§ 2.1		§ 2.1	§ 2.1		§ 2.1, § 2.2		§ 2.1		§ 2.1		§ 2.1, § 2.2				§ 2.1, § 2.2	§ 2.2
Modulation at terrestrial station (1)		A			A	N	A	N	A	N	A	N	A	N			N	N
Terrestrial	p_0(%)	0.01			0.01	0.005	0.01	0.005	0.01	0.005	0.01	0.005	0.01	0.005			0.005	0.005
Station	n	2			2	2	2	2	2	2	2	2	2	2			2	2
interference	p(%)	0.005			0.005	0.0025	0.005	0.0025	0.005	0.0025	0.005	0.0025	0.005	0.0025			0.0025	0.0025
Parameters	N_L (dB)	0			0	0	0	0	0	0	0	0	0	0			0	0
And	M_s (dB)	26 (2)			33	37	33	37	33	37	33	40	33	40			25	25
Criteria	W (dB)	0			0	0	0	0	0	0	0	0	0	0			0	0
Terrestrial station	G_x (dBi) (4)	49 (2)	6		46	46	46	46	46	46	50	50	52	52			48	48
Parameters	T_e (K)	500 (2)			750	750	750	750	750	750	1 500	1 100	1 500	1 100			1 100	1 100
Reference bandwidth	B (Hz)	4×10^3	150×10^3		4×10^3	10^6	4×10^3	10^6	4×10^3	10^6	4×10^3	10^6	4×10^3	10^6			10^6	10^6
Permissible interference power	P_r (p) (dBW) in B	–140	–160		–131	–103	–131	–103	–131	–103	–128	–98	–128	–98			–113	–113

(1) A: analogue modulation; N: digital modulation.

(2) The parameters for the terrestrial station associated with transhorizon systems have been used. Line-of-sight radio-relay parameters associated with the frequency band 5 725-7 075 MHz may also be used to determine a supplementary contour with the exception that G_x = 37 dBi.

(3) Feeder links of non-geostationary satellite systems in the mobile-satellite service.

(4) Feeder losses are not included.

(5) Actual frequency bands are 7 100-7 155 MHz and 7 190-7 235 MHz for space operation service and 7 145-7 235 MHz for the space research service.

TABLE 7c

Parameters required for the determination of coordination distance for a transmitting earth station

Transmitting space radiocommunication service designation		Fixed-satellite	Fixed-satellite (2)	Fixed-satellite (3)	Space research	Earth exploration-satellite, space research	Fixed-satellite, mobile-satellite, radionavigation satellite	Fixed-satellite (2)	Fixed-satellite, mobile-satellite	Fixed-satellite	Fixed-satellite
Frequency bands (GHz)		24.75-25.25 27.0-29.5	28.6-29.1	29.1-29.5	34.2-34.7	40.0-40.5	42.5-51.4	47.2-50.2	71.0-75.5	92.0-94.0	94.1-95.0
Receiving terrestrial service designations		Fixed, mobile	Fixed, mobile	Fixed, mobile	Fixed, mobile, radio-location	Fixed, mobile	Fixed, mobile, radionavigation	Fixed, mobile	Fixed, mobile	Fixed, mobile, radiolocation	Fixed, mobile, radiolocation
Method to be used		§ 2.1	§ 2.2	§ 2.2		§ 2.1, § 2.2	§ 2.1, § 2.2	§ 2.2	§ 2.1, § 2.2	§ 2.1, § 2.2	§ 2.1, § 2.2
Modulation at terrestrial station (1)		N	N	N		N	N	N	N	N	N
Terrestrial station interference parameters and criteria	p_0(%)	0.005	0.005	0.005		0.005	0.005	0.001	0.002	0.002	0.002
	n	1	2	1		1	1	1	2	2	2
	p(%)	0.005	0.0025	0.005		0.005	0.005	0.001	0.001	0.001	0.001
	N_L (dB)	0	0	0		0	0	0	0	0	0
	M_s (dB)	25	25	25		25	25	25	25	25	25
	W (dB)	0	0	0		0	0	0	0	0	0
Terrestrial station parameters	G_x (dBi) (4)	50	50	50		42	42	46	45	45	45
	T_e (K)	2 000	2 000	2 000		2 600	2 600	2 000	2 000	2 000	2 000
Reference bandwidth	B (Hz)	10^6	10^6	10^6		10^6	10^6	10^6	10^6	10^6	10^6
Permissible interference power	$P_r(p)$ (dBW) in B	–111	–111	–111		–110	–110	–111	–111	–111	–111

(1) A: analogue modulation; N: digital modulation.

(2) Non-geostationary satellites in the fixed-satellite service.

(3) Feeder links to non-geostationary-satellite systems in the mobile-satellite service.

(4) Feeder losses are not included.

TABLE 8a

Parameters required for the determination of coordination distance for a receiving earth station

Receiving space radiocommunication service designation			Space operation, space research	Meteoro-logical satellite, mobile satellite	Space research	Space research, space operation	Space operation	Mobile satellite	Meteoro-logical satellite	Mobile-satellite	Space research space operation	Space operation	Meteor-ological satellite Earth exploration-satellite	Space operation	Broad-casting satellite	Mobile satellite	Broad-casting satellite (DAB)	Mobile satellite, land-mobile satellite, maritime mobile satellite
Frequency band (MHz)			137-138	137-138	143.6-143.65	174-184	163-167 272-273(5)	335.4-399.9	400.15-401	400.15-401	400.15-401	401-402	460-470	549.75-550.25	620-790	856-890	1 452-1 492	1 492-1 530 1 555-1 559 2 160-2 200 (1)
Transmitting terrestrial service designations			Fixed, mobile	Fixed, mobile	Fixed, mobile, radio-location	Fixed, mobile, broad-casting	Fixed, mobile	Fixed, mobile	Meteor-logical aids	Meteor-logical aids	Meteor-logical aids	Meteor-logical aids, fixed, mobile	Fixed, mobile	Fixed, mobile, broad-casting	Fixed, mobile, broad-casting	Fixed, mobile, broad-casting	Fixed, mobile, broad-casting	Fixed, mobile
Method to be used			§ 2.1	§ 2.1	§ 2.1	§ 2.1	§ 2.1	§ 1.4.6	§ 1.4.6	§ 1.4.6	-	§ 2.1	§ 2.1	§ 2.1	§ 1.4.5	§ 1.4.6	§ 1.4.5	§ 1.4.6
Modulation at earth station (2)			N		N		N				N	N					N	N
Earth station Interference Parameters and criteria	p_0 (%)		0.1		0.1		1.0		0.012		0.1	0.1	0.012					10
	n		2		2		1		1		2	2	1					1
	p (%)		0.05		0.05		1.0		0.012		0.05	0.05	0.012					10
	N_L (dB)		0		0		0		0		0	0						0
	M_s (dB)		1		1		1		4.3		1	1						1
	W (dB)		0		0		0		0		0	0						0
Terrestrial Station Parameters	E (dBW) in B (3)	A	-		-		15				-	-	5				38	37(4)
		N	-		-		15				-	-	5				38	37
	P_t (dBW) in B	A	-		-		–1				-	-	–11				3	0
		N	-		-		–1				-	-	–11				3	0
	G_x (dBi)		-		-		16				-	-	16				35	37
Reference bandwidth	B (Hz)		1		1		10^3		177.5×10^3		1	1	85				25×10^3	4×10^3
Permissible interference power	$P_r(p)$ (dBW) in B		–199		–199		–173		–148		–208	–208	–178					–176

(1) In the band 2 160-2 200 MHz, the terrestrial station parameters of line-of-sight radio-relay systems have been used. If an administration believes that, in this band transhorizon systems need to be considered, the parameters associated with the frequency band 2 500-2 690 MHz may be used to determine the coordination area.

(2) A: analogue modulation; N: digital modulation.

(3) *E* is defined as the equivalent isotropically radiated power of the interfering terrestrial station in the reference bandwidth.

(4) This value is reduced from the nominal value of 50 dBW for the purposes of determination of coordination area, recognizing the low probability of high power emissions falling fully within the relatively narrow bandwidth of the earth station.

(5) The fixed-service parameters provided in the column for 163-167 MHz and 272-273 MHz are only applicable to the band 163-167 MHz.

TABLE 8b

Parameters required for the determination of coordination distance for a receiving earth station

Receiving space radiocommunication service designation			Space operation (GSO and non-GSO)	Radio-navigation satellite	Meteor-ological satellite (non-GSO)	Meteor-ological satellite (GSO)	Space research near Earth (non-GSO & GSO)		Space research deep space (non-GSO)	Space operation (non-GSO and GSO)	Earth exploration-satellite (GSO)	Broadcasting satellite	Mobile satellite, radio-determination satellite	Fixed satellite, broadcasting satellite		Fixed satellite	
							Unmanned	Manned									
Frequency band (GHz)			1.525-1.535	1.559-1.610	1.670-1.710	1.670-1.710	1.700-1.710 2.200-2.290		2.290-2.300	2.200-2.290	2.200-2.290	2.310-2.360	2.4835-2.500 (6)	2.500-2.690		3.400-4.200	
Transmitting terrestrial service designations			Fixed	Fixed	Fixed, mobile, meteor-ological aids	Fixed, mobile, meteor-ological aids	Fixed, mobile		Fixed, mobile	Fixed, mobile	Fixed, mobile	Fixed, mobile, radiolocation	Fixed, mobile, radiolocation	Fixed, mobile radiolocation		Fixed, mobile	
Method to be used			§ 2.1, § 2.2	§ 2.1	§ 2.2 and (1)	§ 2.1 and (1)	§ 2.1, § 2.2		§ 2.2	§ 2.1, § 2.2	§ 2.1	§ 1.4.5	§ 1.4.6	§ 1.4.5 and § 2.1		§ 2.1	
Modulation at earth station (2)			N		N	N	N		N	N	N		N	A	N	A	N
Earth station Interference Parameters and criteria	p_0 (%)		1.0		0.006	0.011	0.1	0.001	0.001	1.0	1.0		10	0.03	0.003	0.03	0.005
	n		1		3	2	2	1	1	2	2		1	3	3	3	3
	p (%)		1.0		0.002	0.0055	0.05	0.001	0.001	0.5	0.5		10	0.01	0.001	0.01	0.0017
	N_L (dB)		0		0	0	0		0	0			0	1	1	1	1
	M_s (dB)		1		2.8	0.9	1		0.5	1			1	7	2	7	2
	W (dB)		0		0	0	0		0	0			0	4	0	4	0
Terrestrial Station Parameters	E (dBW) in B (3)	A	50		92(4)	92(4)	–27(4,5)		–27(5)	72(4)	72(4)		37	72(4)	72(4)	55	55
		N	37		-	-	–27		–27	76	76		37	76	76	42	42
	P_t (dBW) in B	A	13		40(4)	40(4)	–71(4,5)		–71(5)	28(4)	28(4)		0	28(4)	28(4)	13	13
		N	0		-	-	–71		–71	32	32		0	32	32	0	0
	G_x (dBi)		37		52	52	44		44	44	44		37	44	44	42	42
Reference bandwidth	B (Hz)		10^3		10^6	4×10^3	1		1	10^6	10^6		4×10^3	10^6	10^6	10^6	10^6
Permissible interference power	$P_r(p)$ (dBW) in B		–184		–142	–177	–216		–222	–154	–154		–176				

(1) See Table 10 of this Annex.

(2) A: analogue modulation; N: digital modulation.

(3) E is defined as the equivalent isotropically radiated power of the interfering terrestrial station in the reference bandwidth.

(4) In this band, the parameters for the terrestrial stations associated with transhorizon systems have been used. If an administration believes that transhorizon systems do not need to be considered, the line-of-sight radio-relay parameters associated with the frequency band 3.4-4.2 GHz may be used to determine the coordination area, with the exception that E = 50 dBW for analogue terrestrial stations; and Gx = 37 dBi. However, for the space research service only, noting footnote[(5)] when transhorizon systems are not considered, E = 20 dBW and Pt = –17 dBW for analogue terrestrial stations, E = –23 dBW and Pt = –60 dBW for digital terrestrial stations; and Gx = 37 dBi.

(5) These values are estimated for 1 Hz bandwidth and are 30 dB below the total power assumed for emission.

(6) In the band 2.4835-2.5 GHz the terrestrial station parameters of line-of-sight radio-relay systems have been used. If an administration believes that, in this band, transhorizon systems need to be considered, the parameters associated with the frequency band 2 500-2 690 MHz may be used to determine the coordination area.

TABLE 8c

Parameters required for the determination of coordination distance for a receiving earth station

Receiving space radiocommunication service designation		Fixed satellite		Fixed satellite radio-determination satellite	Fixed satellite	Fixed satellite		Meteoro-logical satellite (7,8)	Meteoro-logical satellite (9)	Earth exploration-satellite (7)	Earth exploration-satellite (9)	Space research (10)		Fixed satellite		Broadcasting-satellite		Fixed satellite (9)	Broad-casting satellite	Fixed satellite (7)
												Deep space								
Frequency band (GHz)		4.500-4.800		5.150-5.216	6.700-7.075	7.250-7.750		7.450-7.550	7.750-7.850	8.025-8.400	8.025-8.400	8.400-8.450	8.450-8.500	10.7-12.75		12.5-12.75 (12)		15.4-15.7	17.7-17.8	17.7-18.8 19.3-19.7
Transmitting terrestrial service designations		Fixed, mobile		Aeronautical radio-navigation	Fixed, mobile	Fixed, mobile		Fixed, mobile	Fixed, mobile	Fixed, mobile	Fixed, mobile	Fixed, mobile		Fixed, mobile		Fixed, mobile		Aeronautical radio-navigation	Fixed	Fixed, mobile
Method to be used		§ 2.1		§ 2.1	§ 2.2	§ 2.1		§ 2.1, § 2.2	§ 2.2	§ 2.1	§ 2.2	§ 2.2		§ 2.1, § 2.2		§ 1.4.5			§ 1.4.5	§ 2.1
Modulation at earth station (1)		A	N		N	A	N	N	N	N	N	N	N	A	N	A	N	-		N
Earth station Interference Parameters and criteria	p_0 (%)	0.03	0.005		0.005	0.03	0.005	0.002	0.001	0.083	0.011	0.001	0.1	0.03	0.003	0.03	0.003	0.003		0.003
	n	3	3		3	3	3	2	2	2	2	1	2	2	2	1	1	2		2
	p (%)	0.01	0.0017		0.0017	0.01	0.0017	0.001	0.0005	0.0415	0.0055	0.001	0.05	0.015	0.0015	0.03	0.003	0.0015		0.0015
	N_L (dB)	1	1		1	1	1	-	-	1	0	0	0	1	1	1	1	1		1
	M_s (dB)	7	2		2	7	2	-	-	2	4.7	0.5	1	7	4	7	4	4		6
	W (dB)	4	0		0	4	0	-	-	0	0	0	0	4	0	4	0	0		0
Terrestrial Station Parameters	E (dBW) in B (2) A	92(3)	92(3)		55	55	55	55	55	55	55	25(5)	25(5)	40	40	55	55			35
	E (dBW) in B (2) N	42(4)	42(4)		42	42	42	42	42	42	42	–18	–18	43	43	42	42		40	40
	P_t (dBW) in B A	40(3)	40(3)		13	13	13	13	13	13	13	–17(5)	–17(5)	–5	–5	10	10			–10
	P_t (dBW) in B N	0	0		0	0	0	0	0	0	0	–60	–60	–2	–2	–3	–3		–7	–5
	G_x (dBi)	52(3,4)	52(3,4)		42	42	42	42	42	42	42	42	42	45	45	45	45		47	45
Reference band-width(6)	B (Hz)	10^6	10^6		10^6	10^6	10^6	10^7	10^7	10^6	10^6	1	1	10^6	10^6	27 10^6	27 10^6			10^6
Permissible interference power	$P_r(p)$ (dBW) in B				–151.2			–125	–125	–154 (11)	–142	–220	–216			–131	–131			

(1) A: analogue modulation; N: digital modulation.

(2) E is defined as the equivalent isotropically radiated power of the interfering terrestrial station in the reference bandwidth.

(3) In this band, the parameters for the terrestrial stations associated with transhorizon systems have been used. If an administration believes that transhorizon systems do not need to be considered, the line-of-sight radio-relay parameters associated with the frequency band 3.4-4.2 GHz may be used to determine the coordination area.

(4) Digital systems assumed to be non-transhorizon. Therefore Gx = 42.0 dBi. For digital transhorizon systems, parameters for analogue transhorizon systems above have been used.

(5) These values are estimated for 1 Hz bandwidth and are 30 dB below the total power assumed for emission.

(6) In certain systems in the fixed-satellite service it may be desirable to choose a greater reference bandwidth B. However, a greater bandwidth will result in smaller coordination distances and a later decision to reduce the reference bandwidth may require recoordination of the earth station.

(7) Geostationary-satellite systems.

(8) Non-geostationary-satellites in the meteorological-satellite service notified in accordance with No. **S5.461A** may use the same coordination parameters.

(9) Non-geostationary-satellite systems.

(10) Space research earth stations in the band 8.4-8.5 GHz operate with non-geostationary satellites.

(11) For large earth stations: $P_r(p) = (G - 180)$ dBW

For small earth stations: $P_r(20\%) = 2\,(G - 26) - 140$ dBW for $26 < G \leq 29$ dBi

$P_r(20\%) = G - 163$ dBW for $G > 29$ dBi

$P_r(p)\% = G - 163$ dBW for $G \leq 26$ dBi

(12) Applies to the broadcasting-satellite service in unplanned bands in Region 3.

TABLE 8d

Parameters required for the determination of coordination distance for a receiving earth station

Receiving space radiocommunication service designation		Meteoro-logical satellite	Fixed satellite	Fixed satellite (3)	Broad-casting satellite	Earth exploration-satellite (4)	Earth exploration-satellite (5)	Space research (Deep Space)	Space research		Fixed satellite (6)	Fixed satellite (5)	Mobile satellite	Broadcasting satellite, Fixed satellite	Mobile satellite	Radio-navigation	Broadcasting satellite
									Un-manned	Manned							
Frequency band (GHz)		18.1-18.3	18.8-19.3	19.3-19.7	21.4-22.0	25.5-27.0	25.5-27.0	31.8-32.3	37.0-38.0		37.5-40.5	37.5-40.5	39.5-40.5	40.5-42.5	43.5-47.0	43.5-47.0	84-86
Transmitting terrestrial service designations		Fixed, mobile	Fixed, Mobile	Fixed, mobile	Fixed, mobile	Fixed, mobile	Fixed, mobile	Fixed, radio-navigation	Fixed, mobile		Fixed, mobile	Fixed, mobile	Fixed, mobile	Broadcasting, fixed	Mobile	Mobile	Fixed, mobile, broadcasting
Method to be used		§ 2.1, § 2.2	§ 2.1, § 2.2	§ 2.2	§ 1.4.5	§ 2.2	§ 2.1	§ 2.1, § 2.2	§ 2.1, § 2.2		§ 2.2	§ 2.1	§ 1.4.6	§ 1.4.5, § 2.1	§ 1.4.6	-	§ 1.4.5
Modulation at earth station (1)		N	N	N		N	N	N	N		N	N	N	-	N		
Earth station interference parameters and criteria	p_0 (%)		0.003	0.01		0.25	0.25	0.001	0.1	0.001	0.02	0.003					
	n		2	1		2	2	1	1	1		2					
	p (%)		0.0015	0.01		0.125	0.125	0.001	0.1	0.001		0.0015					
	N_L (dB)		0	0		0	0	0	0		1	1					
	M_s (dB)		5	5		11.4	14	1	1		6.8	6					
	W (dB)		0	0		0	0	0	0		0	0					
Terrestrial station parameters	E (dBW) in B (2) A		-	-		-	-	-	-		-	-	-	-			
	E (dBW) in B (2) N	40	40	40	40	42	42	–28	–28		35	35	35	44	40	40	
	P_t (dBW) in B A		-	-		-	-	-	-		-	-	-	-			
	P_t (dBW) in B N	–7	–7	–7	–7	–3	–3	–81	–73		–10	–10	–10	–1	–7	–7	
	G_x (dBi)	47	47	47	47	45	45	53	45		45	45	45	45	47	47	
Reference bandwidth	B (Hz)		10^6	10^6		10^7	10^7	1	1		10^6	10^6	10^6	10^6			
Permissible interference power	$P_r(p)$ (dBW) in B		–140	–137		–120	–116	–216	–217		–140						

(1) A: analogue modulation; N: digital modulation.

(2) E is defined as the equivalent isotropically radiated power of the interfering terrestrial station in the reference bandwidth.

(3) Non-geostationary mobile-satellite service feeder links.

(4) Non-geostationary-satellite systems.

(5) Geostationary-satellite systems.

(6) Non-geostationary fixed-satellite systems.

TABLE 9a

Parameters required for the determination of coordination distance for a transmitting earth station in bands shared bidirectionally with receiving earth stations

Space service designation in which the transmitting earth station operates		Land mobile-satellite	Mobile-satellite	Land mobile-satellite	Earth exploration-satellite, meteorological satellite	Mobile-satellite		Mobile-satellite		Fixed satellite, mobile satellite	Fixed satellite (3)		Fixed satellite	Fixed satellite, meteorological satellite	Fixed satellite
Frequency bands (GHz)		0.1499-0.15005	0.272-0.273	0.3999-0.40005	0.401-0.402	1.675-1.710		1.700-1.710		2.655-2.690	5.150-5.216		6.700-7.075	8.025-8.400	8.025-8.400
Space service designation in which the *receiving* earth station operates		Radio-navigation satellite	Space operation	Radio-navigation satellite	Space operation	Meteorological satellite		Space research near Earth		Fixed satellite, broadcasting satellite	Fixed satellite	Radio-determination satellite	Fixed satellite	Earth exploration-satellite	Earth exploration-satellite
								Un-Manned (10)	Manned						
Orbit(6)			Non-GSO		Non-GSO	Non-GSO	GSO	Non-GSO			Non-GSO		Non-GSO	Non-GSO	GSO
Modulation at receiving earth station (1)			N		N	N	N	N	N				N	N	N
Receiving earth station interference parameters and criteria	*po*(%)		1.0		0.1	0.006	0.011	0.1	0.001				0.005	0.011	0.083
	n		1		2	3	2	2	1				3	2	2
	p(%)		1.0		0.05	0.002	0.0055	0.05	0.001				0.0017	0.0055	0.0415
	N_L (dB)	0	0	0	0	0	0	0	0				1	0	1
	M_s (dB)	2	1	2	1	2.8	0.9	1	1	2	2	2	2	4.7	2
	W (dB)	0	0	0	0	0	0	0	0				0	0	0
Receiving earth station parameters	G_m(dBi) (2)	0	20	0	20	30	45				48.5		50.7		
	G_r (dBi) (4)	0	19	0	19	19(9)	(8)	10	10		10		10	10	(8)
	ε_{min} (5)	3°	10°	3°	10°	5°	3°	5°	5°	3°	3°	3°	3°	5°	3°
	T_e (K) (7)	200	500	200	500	370	118			75	75	75	75		
Reference bandwidth	*B* (Hz)	4×10^3	10^3	4×10^3	1	10^6	$4x10^3$	1	1				10^6	10^6	10^6
Permissible interference power	P_r (*p*) (dBW) in *B*	–172	–177	–172	–208	–145	–178	–216	–216				–151	–142	–154

(1) A: analogue modulation; N: digital modulation.

(2) On-axis gain of the receive earth station antenna.

(3) Feeder links of non-geostationary-satellite systems in the mobile-satellite service.

(4) Horizon antenna gain for the receive earth station (refer to § 3 of the main body of this Appendix).

(5) Minimum elevation angle of operation in degrees (non-geostationary or geostationary).

(6) Orbit of the space service in which the receiving earth station operates (non-geostationary or geostationary).

(7) The thermal noise temperature of the receiving system at the terminal of the receiving antenna (under clear-sky conditions). Refer to § 2.1 of this Annex for missing values.

(8) Horizon antenna gain is calculated using the procedure of Annex 5. Where no value of G_m is specified, a value of 42 dBi is to be used.

(9) Non-geostationary horizon antenna gain, $G_e = G_{min} + 20$ dB (see § 2.2), with $G_{min} = 10 - 10 \log(D/\lambda)$, $D/\lambda = 13$ (refer to Annex 3 for definition of symbols)

(10) Unmanned space research is not a separate radiocommunication service and the system parameters are only to be used for the generation of supplementary contours.

TABLE 9b

Parameters required for the determination of coordination distance for a transmitting earth station in bands shared bidirectionally with receiving earth stations

Space service designation in which the transmitting earth station operates		Fixed satellite			Fixed satellite			Fixed satellite (3)	Fixed satellite	Fixed satellite	Fixed satellite (3)	Fixed satellite (3)	Earth exploration-satellite, space research			
Frequency bands (GHz)		10.7-11.7			12.5-12.75			15.43-15.65	17.3-17.8	17.7-18.4	19.3-19.6	19.3-19.6	40.0-40.5			
Space service designation in which the *receiving* earth station operates		Fixed satellite			Fixed satellite			Fixed satellite (3)	Broad-casting satellite	Fixed satellite, meteor-ological satellite	Fixed satellite (3)	Fixed satellite (4)	Fixed satellite, mobile satellite			
Orbit(7)		GSO		Non-GSO	GSO		Non-GSO	Non-GSO		GSO	Non-GSO	GSO	GSO	Non-GSO		
Modulation at receiving earth station (1)		A	N	N	A	N				N	N					
Receiving earth station Interference Parameters and criteria	p_0(%)	0.03	0.003		0.03	0.003		0.003		0.003	0.01	0.003	0.003			
	n	2	2		2	2		2		2	1	2	2			
	p(%)	0.015	0.0015		0.015	0.0015		0.0015		0.0015	0.01	0.0015	0.0015			
	N_L (dB)	1	1		1	1		1		1	0	1	1			
	M_s (dB)	7	4		7	4		4		6	5	6	6			
	W (dB)	4	0		4	0		0		0	0	0	0			
Receiving earth station parameters	G_m (dBi) (2)			51.9			31.2	48.4		58.6	53.2	49.5	50.8	54.4		
	G_r (5)	(9)	(9)	10	(9)	(9)	11(11)	10		(9)	10	(10)	(9)	7(12)		
	ε_{min} (6)	5°	5°	6°	5°	5°	10°	5°		5°	5°	10°	10°	10°		
	T_e (K) (8)	150	150		150	150		150		300	300	300	300			
Reference bandwidth	B (Hz)	10^6	10^6		10^6	10^6		2×10^6		10^6	10^6					
Permissible interference power	$P_r(p)$ (dBW) in B	–144	–144	–144	–144	–144	–144	–141		–138	–141					

[(1)] A: analogue modulation; N: digital modulation.

[(2)] On-axis gain of the receive earth station antenna.

[(3)] Feeder links of non-geostationary satellite systems in the mobile-satellite service.

[(4)] Geostationary-satellite systems.

[(5)] Horizon antenna gain for the receive earth station (refer to § 3 of the main body of the Appendix).

[(6)] Minimum elevation angle of operation in degrees (non-GSO or GSO).

[(7)] Orbit of the space service in which the receiving earth station operates (GSO or non-GSO).

[(8)] The thermal noise temperature of the receiving system at the terminal of the receiving antenna (under clear-sky conditions). Refer to § 2.1 of this Annex for missing values.

[(9)] Horizon antenna gain is calculated using the procedure of Annex 5. Where no value of G_m is specified, a value of 42 dBi is to be used.

[(10)] Horizon antenna gain is calculated using the procedure of Annex 5, except that the following antenna pattern may be used in place of that given in § 3 of Annex 3: $G = 32 - 25 \log \phi$ for $1 \le \phi < 48$; and $G = -10$ for $48 \le \phi < 180$ (refer to Annex 3 for definition of symbols).

[(11)] Non-geostationary horizon antenna gain, $G_e = G_{max}$ (see § 2.2 of the main body of this Appendix) for $G = 36 - 25 \log (\phi) > -6$ (refer to Annex 3 for definition of symbols).

[(12)] Non-geostationary horizon antenna gain, $G_e = G_{max}$ (see § 2.2 of the main body of this Appendix) for $G = 32 - 25 \log (\phi) > -10$ (refer to Annex 3 for definition of symbols).

TABLE 10

Predetermined coordination distances

Frequency sharing situation		**Coordination distance(in sharing situations involving services allocated with equal rights) (km)**
Type of earth station	**Type of terrestrial station**	
Ground-based in the bands below 1 GHz to which No. S9.11A applies. Ground-based mobile in the bands within the range 1-3 GHz to which No. S9.11A applies	Mobile (aircraft)	500
Aircraft (mobile) (all bands)	Ground-based	500
Aircraft (mobile) (all bands)	Mobile (aircraft)	1 000
Ground-based in the bands: 400.15-401 MHz 1 675-1 700 MHz	Station in the meteorological aids service (radiosonde)	580
Aircraft (mobile) in the bands: 400.15-401 MHz 1 675-1 700 MHz	Station in the meteorological aids service (radiosonde)	1 080
Ground-based in the radiodetermination-satellite service (RDSS) in the bands: 1 610-1 626.5 MHz 2 483.5-2 500 MHz 2 500-2 516.5 MHz	Ground-based	100

Airborne earth station in the radiodetermination-satellite service (RDSS) in the bands: 1 610-1 626.5 MHz 2 483.5-2 500 MHz 2 500-2 516.5 MHz	Ground-based	400
Receiving earth stations in the meteorological-satellite service	Station in the meteorological aids service	The coordination distance is considered to be the visibility distance as a function of the earth station horizon elevation angle for a radiosonde at an altitude of 20 km above mean sea level, assuming 4/3 Earth radius (see Note 1)
Non-GSO MSS feeder-link earth stations (all bands)	Mobile (aircraft)	500

Note 1 - The coordination distance, d (km), for fixed earth stations in the meteorological-satellite service vis-à-vis stations in the meteorological aids service assumes a radiosonde altitude of 20 km and is determined as a function of the physical horizon elevation angle ε_h (degrees) for each azimuth, as follows:

$$d = 100 \qquad \textit{for} \quad \varepsilon_h \geq 11$$

$$d = 582\left(\sqrt{1 + (0.254\,\varepsilon_h)^2} - 0.254\,\varepsilon_h\right) \qquad \textit{for} \quad 0 < \varepsilon_h < 11,$$

$$d = 582 \qquad \textit{for} \quad \varepsilon_h \leq 0$$

The minimum and maximum coordination distances are 100 km and 582 km, and correspond to physical horizon angles greater than 11° and less than 0°.

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

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ISTANBUL, 8 MAY – 2 JUNE 2000

B.4 **PLENARY MEETING**

FOURTH SERIES OF TEXTS SUBMITTED BY THE EDITORIAL COMMITTEE TO THE PLENARY MEETING

The following texts are submitted to the Plenary Meeting for **first reading:**

Source	**Document**	**Title**
GT PLEN-2	363	**RESOLUTION [GT PLEN-2/1] (WRC-2000)**
COM 4	372	**RESOLUTION 5 (Rev.WRC-2000)**
		RESOLUTION 20 (Rev.WRC-2000)
		RESOLUTION 27 (Rev.WRC-2000)
		RESOLUTION 51 (Rev.WRC-2000)
		RESOLUTION 124 (Rev.WRC-2000)
		RESOLUTION 127 (Rev.WRC-2000)
		RESOLUTION 728 (Rev.WRC -2000)

Annex: 16 pages

RESOLUTION [GT PLEN-2/1] (WRC-2000)

Consideration by a future competent world radiocommunication conference of issues dealing with allocations to the mobile, fixed, radiolocation, Earth exploration-satellite (active), and space research (active) services in the frequency range 5 150-5 725 MHz

The World Radiocommunication Conference (Istanbul, 2000),

considering

a) that there is a need to provide globally harmonized frequencies in the bands 5 150-5 350 MHz and 5 470-5 725 MHz for the mobile service for wireless access systems including radio local area networks (RLANs);

b) that there is a need for frequencies for fixed wireless access applications in the fixed service in Region 3 in the band 5 250-5 350 MHz;

c) that there is a need for additional spectrum for the Earth exploration-satellite service (active) and space research service (active) in the frequency range 5 460-5 570 MHz;

d) that ongoing studies in ITU-R indicate that sharing in the band 5 150-5 350 MHz between RLANs and space services is feasible under specified conditions;

e) that there is a need to upgrade the status of frequency allocations to the radiolocation service in the frequency range 5 350-5 650 MHz,

recognizing

a) that sharing criteria between existing services and the proposed new allocations should be established;

b) that it is important to protect the existing primary services having allocations in the frequency range 5 150-5 725 MHz;

c) that the existing and new allocations are interdependent, particularly with respect to the relationship between the terrestrial and the space services,

resolves

that, on proposals from administrations and taking into account the results of studies in ITU-R and the Conference Preparatory Meeting, WRC-03 should consider:

1 allocation of frequencies to the mobile service in the bands 5 150-5 350 MHz and 5 470-5 725 MHz for the implementation of wireless access systems including RLANs;

2 a possible allocation in Region 3 to the fixed service in the band 5 250-5 350 MHz, while fully protecting the worldwide Earth exploration-satellite (active) and space research (active) services;

3 additional primary allocations for the Earth exploration-satellite service (active) and space research service (active) in the frequency range 5 460-5 570 MHz;

4 review, with a view to upgrading, of the status of frequency allocations to the radiolocation service in the frequency range 5 350-5 650 MHz,

invites ITU-R

to conduct, and complete in time for WRC-03, the appropriate studies leading to technical and operational recommendations to facilitate sharing between the services referred to in the *resolves* and existing services.

MOD

RESOLUTION 5 (Rev.WRC-2000)

Technical cooperation with the developing countries in the study of propagation in tropical areas

The World Radiocommunication Conference (Istanbul, 2000),

having noted

that the assistance provided for the developing countries by the Union in the field of telecommunication in cooperation with other United Nations specialized agencies, such as the United Nations Development Programme (UNDP), augurs well for the future,

aware

a) of the fact that the developing countries, particularly those in tropical areas, require adequate knowledge of radiowave propagation in their territories in order to make rational and economical use of the radio-frequency spectrum;

b) of the importance of propagation in radiocommunications;

c) of the importance of the work of ITU-T and ITU-R study groups for the development of telecommunications in general and radiocommunications in particular, *considering*

a) the need for the developing countries themselves to study telecommunications in general and propagation in particular in their territories, this being the best means of enabling them to acquire telecommunication techniques and to plan their systems effectively and in conformity with the special conditions in the tropical areas;

b) the scarcity of resources available in these countries,

resolves to instruct the Secretary-General

1 to offer the assistance of the Union to developing countries in the tropical areas which endeavour to carry out national propagation studies in order to improve and develop their radiocommunications;

2 to assist these countries, if necessary with the collaboration of international and regional organizations such as the Asia-Pacific Broadcasting Union (ABU), Arab States Broadcasting Union (ASBU), African Telecommunication Union (ATU) and the Union of National Radio and Television Organizations of Africa (URTNA) which may be concerned, in carrying out national propagation measurement programmes, including collecting appropriate meteorological data, on the basis of ITU-R Recommendations and Questions in order to improve the use of the radio-frequency spectrum;

3 to arrange funds and resources for this purpose from the UNDP or other sources in order to enable the Union to provide the countries concerned with adequate and effective technical assistance for the purpose of this resolution,

urges administrations

to submit the results of these propagation measurements to ITU-R for consideration in its studies,

invites the Council

to follow the progress made in carrying out programmes of propagation measurements and the results achieved, and to take any action that it considers necessary.

MOD

RESOLUTION 20 (Rev.WRC-2000)

Technical cooperation with developing countries in the field of aeronautical telecommunications

The World Radiocommunication Conference (Istanbul, 2000),

considering

a) that the allocations of the frequency bands and the provisions concerning various aeronautical mobile services have been revised several times by recent conferences;

b) that some of these frequency bands and provisions support the worldwide implementation of new aeronautical telecommunication systems;

c) that on the other hand, some of these frequency bands and provisions support existing aeronautical systems that may be affected by the revision;

d) that, as a consequence of *a)*, *b)* and *c)*, technological modernization will be necessary in order to maintain and improve the safety and regularity of international civil aviation, the accuracy and security of aeronautical radionavigation and the efficiency of distress and rescue systems;

e) that the developing countries may require assistance in improving the training of technical staff, as well as in introducing new systems, in coping with technological modernization and enhancing the operation of aeronautical telecommunications,

recognizing

a) the value of the assistance which, in conjunction with other international organizations, the Union has provided and may continue to provide to developing countries in the field of telecommunications;

b) that Resolution 20 (Mob-87) adopted by the World Administrative Radio Conference for the Mobile Services (Geneva, 1987) provides a good basis for the technical cooperation with developing countries in the field of aeronautical telecommunications that has been undertaken by the International Civil Aviation Organization, *resolves to instruct the Secretary-General*

1 to encourage the International Civil Aviation Organization (ICAO) to continue its assistance to developing countries which are endeavouring to improve their aeronautical telecommunications, in particular by providing them with technical advice for the planning, establishment, operation and maintenance of equipment, as well as help with the training of staff, essentially in matters relating to the new technologies;

2 for this purpose, to seek the continued collaboration of ICAO, the United Nations Conference for Trade and Development (UNCTAD) and other specialized agencies of the United Nations, as appropriate;

3 to continue to give special attention to seeking the aid of the United Nations Development Programme (UNDP) and other sources of financial support, to enable the Union to render sufficient and effective technical assistance in the field of aeronautical telecommunications,

invites the developing countries

so far as possible, to give a high level of priority to and include in their national programmes of requests for technical assistance projects relating to aeronautical telecommunications and to support multinational projects in that field.

MOD

RESOLUTION 27 (Rev.WRC-2000)

Use of incorporation by reference in the Radio Regulations

The World Radiocommunication Conference (Istanbul, 2000),

considering

a) that the principles of incorporation by reference were adopted by the WRC-95, revised by WRC-97 and further refined by this conference (see Annexes 1 and 2 to this resolution);

b) that there are provisions in the Radio Regulations containing references which fail to distinguish adequately whether the status of the referenced text is mandatory or non-mandatory;

noting

that references to resolutions or recommendations of a world radiocommunication conference (WRC) require no special procedures, and are acceptable for consideration, since such texts will have been agreed by a WRC,

resolves

1 that for the purposes of the Radio Regulations, the term “incorporation by reference” shall only apply to those references intended to be mandatory;

2 that when introducing new instances of incorporation by reference:

– only texts which are relevant to a specific WRC agenda item may be considered;

– for the correct method of reference, the principles set out in Annex 1 to this resolution and the guidance contained in Annex 2 to this resolution shall be applied;

3 that the procedure described in Annex 3 to this resolution shall be applied during WRCs for the adoption of texts for incorporation by reference;

4 that all texts incorporated by reference at the conclusion of each WRC shall be collated and published in a volume of the Radio Regulations (see Annex 3 to this resolution),

instructs the Director of the Radiocommunication Bureau

to bring this resolution to the attention of the Radiocommunication Assembly and the ITU study groups,

urges administrations

to prepare proposals to future conferences in order to clarify the status of references, where ambiguities remain regarding the mandatory or non-mandatory status of the references in question, and where they are relevant to specific agenda items.

MOD

ANNEX 1 TO RESOLUTION 27 (Rev.WRC-2000)

Principles of incorporation by reference

1 For the purposes of the Radio Regulations, the term "incorporation by reference" shall apply only to those references intended to be mandatory.

2 Where the relevant texts are brief, the referenced material should be placed in the body of the Radio Regulations rather than using incorporation by reference.

3 Texts which are of a non-mandatory nature or which refer to other texts of a non-mandatory nature shall not be considered for incorporation by reference.

4 If, on a case-by-case basis, it is decided to incorporate material by reference on a mandatory basis, then the following provisions shall apply:

4.1 the text incorporated by reference shall have the same treaty status as the Radio Regulations themselves;

4.2 the reference must be explicit, specifying the specific part of the text (if appropriate) and the version or issue number;

4.3 the text incorporated by reference must be submitted for adoption by a competent WRC in accordance with *resolves* 3;

4.4 all texts incorporated by reference shall be published following a WRC, in accordance with *resolves* 4.

5 If, between WRCs, a text incorporated by reference (e.g. an ITU-R Recommendation) is updated, the reference in the Radio Regulations shall continue to apply to the earlier version incorporated by reference until such time as a competent WRC agrees to incorporate the new version. The mechanism for considering such a step is given in Resolution **28 (Rev.WRC-2000)**.

6 Where references are non-mandatory, it is not necessary to establish specific conditions in applying the texts quoted. In such cases, reference should be made using the terminology "the most recent version" of a Recommendation.

MOD

ANNEX 2 TO RESOLUTION 27 (Rev.WRC-2000)

Application of incorporation by reference

When introducing new instances of incorporation by reference in the provisions of the Radio Regulations or reviewing existing instances of incorporation by reference, administrations and ITU-R should address the following factors in order to ensure that the correct style of reference is employed for the intended purpose:

1 whether each reference is mandatory, i.e. incorporated by reference, or non-mandatory;

2 mandatory references shall use clear linking language, i.e. “shall”;

3 non-mandatory references, or ambiguous references that are determined to be of a non-mandatory character, shall use appropriate linking language, e.g. “should” or “may”;

4 mandatory references shall be explicitly and specifically identified, e.g. “Recommendation ITU-R M.541-8”;

5 if the intended reference material is, as a whole, unsuitable as treaty-status text, the reference shall be limited to just those portions of the material in question which are of a suitable nature, e.g. “Annex A to Recommendation ITU-R Z.123-4”.

SUP

ANNEX 3 TO RESOLUTION 27 (Rev.WRC-97)

Provisions of the Radio Regulations referring to ITU-R and ITU-T Recommendations

ADD

ANNEX 3 TO RESOLUTION 27 (Rev.WRC-2000)

Procedures applicable by WRC for the adoption of texts for incorporation by reference

WRC-97 established the precedent of handling texts of ITU-R Recommendations incorporated by reference without reproducing them in full as conference documents (see Document WRC-97/157). It is necessary and sufficient that the referenced texts be made available to delegations in sufficient time for all administrations to consult them in their final English, Spanish and French versions. A single copy of the texts will be made available to each administration as a conference document.

During the course of each WRC, a list of the texts incorporated by reference shall be developed and maintained by the committees. This list shall be published as a conference document in line with developments during the conference. [The Editorial Committee shall monitor this process and report any deficiencies.]

Following the end of each WRC, the Bureau and General Secretariat will update the volume of the Radio Regulations serving as the repository of texts incorporated by reference in line with developments at the conference as recorded in the above-mentioned document.

SUP

ANNEX 4 TO RESOLUTION 27 (Rev.WRC-97)

List of ITU-R Recommendations referred to in the Radio Regulations[1]

MOD

RESOLUTION 51 (Rev.WRC-2000)

Transitional arrangements relating to the advance publication and coordination of satellite networks

The World Radiocommunication Conference (Istanbul, 2000),

considering

a) that as a result of the review under Resolution 18 (Kyoto, 1994) of the Plenipotentiary Conference, a number of provisions relating to the advance publication, coordination and notification of assignments for satellite networks have been modified and these should be applied provisionally as soon as possible;

b) that WRC-97 decided to reduce the regulatory time-frame for bringing a satellite network into use, and to delete the advance publication information (API) if not followed by the coordination data within 24 months of the date of receipt of the API;

c) that there are a number of satellite networks for which the relevant information has been communicated to ITU prior to the end of WRC-97, and it is necessary to provide for some transitional measures for the treatment of this information by the Radiocommunication Bureau;

d) that WRC-97 decided that the provisions of Sections I, IA and IB of Article **S9** and provisions of Article **S11** (Nos. **S11.43A**, **S11.44**, **S11.44B** to **S11.44I**, **S11.47** and **S11.48**), as revised by WRC-97, were to be applied by the Bureau and by administrations on a provisional basis from 22 November 1997;

e) that WRC-97 decided that, for satellite networks which were subject to coordination for which the API had been received by the Bureau prior to 22 November 1997 but the coordination data had not been received by the Bureau prior to that date, the responsible administration would have until 22 November 1999 or the end of the period pursuant to the application of No. **1056A** of the Radio Regulations (1994 version), whichever date came earlier, to submit the coordination data in accordance with the applicable provisions of the Radio Regulations; otherwise the Bureau would cancel the relevant API in accordance with No. **1056A** or No. **S9.5D** as applicable;

f) that WRC-97 decided that the revised Appendix **S4** with respect to the API for satellite networks which were subject to coordination under Section II of Article **S9** was to be applied as of 22 November 1997,

resolves

that, for satellite networks for which the API was received by the Bureau prior to 22 November 1997, the maximum allowed time period from the date of publication of the Special Section of the International Frequency Information Circular referred to in No. **S9.2B** to bring the relevant frequency assignments into use shall be six years plus the extension pursuant to No. **1550** of the Radio Regulations (1994 version) (see also Resolution **49 (WRC-97)**).

MOD

RESOLUTION 124 (Rev.WRC-2000)

Protection of the fixed service in the frequency band 8 025-8 400 MHz sharing with geostationary-satellite systems of the Earth exploration-satellite service (space-to-Earth)

The World Radiocommunication Conference (Istanbul, 2000),

considering

a) that prior to WRC-97, the band 8 025-8 400 MHz was allocated to the Earth exploration-satellite service (space-to-Earth) on a secondary basis in Regions 1 and 3, except for those countries listed in former No. **S5.464**;

b) that the power flux-density limits given in Table **S21-4** of Article **S21** apply to emissions from space stations of the Earth exploration-satellite service (space-to-Earth);

c) that, for those administrations where the secondary allocation applied before WRC-97, geostationary orbital avoidance was not required for the fixed service and, therefore, the power flux-density limits given in Table **S21-4** of Article **S21** may give rise to excessive interference to the fixed service;

d) that WRC-97 adopted provisional power flux-density limits as specified in No. **S5.462A** which are lower than those shown in Table **S21-4** of Article **S21** to protect the fixed service;

e) that, prior to WRC-97, no studies had been conducted in this frequency band by ITU-R on the power flux-density values to apply to space stations of geostationary-satellite systems in the Earth exploration-satellite service where geostationary orbital avoidance had not been implemented by stations of the fixed service, *considering further*

a) that the band 8 025-8 400 MHz is used extensively by the fixed service in accordance with ITU-R radio-frequency channel arrangements for the 8 GHz band (see Recommendation ITU-R F.386) and is also used by some countries for television outside broadcast applications;

b) that Recommendation ITU-R F.1502, which was developed in response to Resolution 124 (WRC-97) and approved by the Radiocommunication Assembly (Istanbul, 2000), recommends power flux-density limits different from those in No. **S5.462A**,

resolves

to invite a future competent world radiocommunication conference to review No. **S5.462A**, taking into account Recommendation ITU-R F.1502, and to take appropriate action.

MOD

RESOLUTION 127 (Rev.WRC-2000)

Studies relating to consideration of allocations in bands around 1.4 GHz for feeder links of the non-geostationary-satellite systems in the mobile-satellite service with service links operating below 1 GHz

The World Radiocommunication Conference (Istanbul, 2000),

considering

a) that the agenda of WRC-97 included consideration of the adoption of additional allocations for the non-geostationary (non-GSO) mobile-satellite service (MSS);

b) that the Report of the 1999 Conference Preparatory Meeting (CPM-99) stated that the Radiocommunication Bureau has identified 25 non-GSO MSS networks as at 26 November 1999 at frequencies below 1 GHz, at some stage of coordination under Resolution **46**, and that many of the proposed networks cannot be implemented in the existing allocations because there is not enough spectrum;

c) that CPM-97 stated that due to the extreme sensitivity of radio astronomy observations interference from unwanted (spurious and out-of-band) emissions can be a problem, but also noted that interference to radio astronomy can be avoided using various techniques including low-power transmitter levels, choice of modulation, symbol shaping, output filtering and band limiting filters, the use of which can minimize the band separation necessary to meet the recommended interference threshold levels for out-of-band emissions;

d) that factors taken into account by post-CPM-97 activities in order to protect the passive services around 1.4 GHz from out-of-band emissions include: the use of narrow-band non-GSO MSS feeder-link transmissions; the use of spectrum-efficient modulation methods, such as Gaussian filtered minimum shift keying, having inherently rapid roll-off of out-of-band emissions; the use, where necessary, of band-pass filters in satellite transmitters and MSS feeder-link transmitting earth stations; and guardbands where necessary;

e) that factors taken into account by post-CPM-97 activities concerning sharing with the radiolocation service include the use of conventional techniques that may be applied in MSS satellite receivers, such as intermediate frequency limiters and time diversity, which have long been employed to protect radiolocation receivers, and techniques such as transmitted waveforms employing time diversity, which have been employed to protect receivers in other services from high-power pulsed radar transmitters;

f) that, since CPM-97, ITU-R studies have been carried out, containing theoretical analyses, with a view to determining if the operation of non-GSO MSS feeder links in bands around 1.4 GHz would be compatible with the Earth exploration-satellite (passive), radio astronomy and space research (passive) services;

g) that the theoretical analyses have indicated that sufficient reduction of out-of-band and spurious emissions could be achieved to protect the sensitive science services in the band 1 400-1 427 MHz;

h) that it is necessary to conduct additional tests and measurements of feeder-link transmissions from systems having the characteristics, performance and reliability of equipment that would be used in operational systems;

i) that such additional tests and measurements will be completed prior to WRC-03,

recognizing

that the bands near 1.4 GHz are extensively used by many other services operating in accordance with the Radio Regulations, including fixed and mobile services,

noting

a) that Resolution **214 (Rev.WRC-97)** states under *resolves* 1 that further studies are urgently required on operational and technical means to facilitate sharing between non-GSO MSS and other radiocommunication services having allocations and operating below 1 GHz;

b) that, since WRC-95, ITU-R studies have been carried out on sharing between space and terrestrial services and feeder links near 1.4 GHz for non-GSO MSS systems with service links below 1 GHz,

invites ITU-R, as a matter of urgency,

1 to continue studies, and to carry out additional tests and demonstrations to validate the studies on operational and technical means to facilitate sharing, in portions of the band 1 390-1 393 MHz, between existing and currently planned services and feeder links (Earth-to-space) for non-GSO MSS systems with service links operating below 1 GHz;

2 to carry out additional tests and demonstrations to validate the studies on operational and technical means to facilitate sharing, in portions of the band 1 429-1 432 MHz, between existing and currently planned services and feeder links (space-to-Earth) for non-GSO MSS systems with service links operating below 1 GHz;

3 to carry out additional studies, including the measurement of emissions from equipment that would be employed in operational systems to protect passive services in the band 1 400-1 427 MHz from unwanted emissions from feeder links near 1.4 GHz for non-GSO MSS systems with service links operating below 1 GHz;

resolves

to invite WRC-03 to consider, on the basis of completion of studies referred to in *requests ITU-R* 1, 2 and 3, additional allocations for feeder links on a worldwide basis for non-GSO MSS systems with service links below 1 GHz,

urges administrations

to participate actively in such studies, with the involvement of interested parties.

MOD

RESOLUTION 728 (Rev.WRC-2000)

Studies relating to consideration of allocations in the broadcasting band 470-862 MHz to non-geostationary mobile-satellite services

The World Radiocommunication Conference (Istanbul, 2000),

considering

a) that the agenda of this conference included consideration of the adoption of additional allocations for non-geostationary mobile-satellite services (non-GSO MSSs);

b) that the Report of the 1999 Conference Preparatory Meeting (CPM-99) stated that the Radiocommunication Bureau has identified at least 22 non-GSO MSS networks as at 28 April 1999 at frequencies below 1 GHz, at some stage of coordination under Resolution **46**, and that many of the proposed networks cannot be implemented in the existing allocations because there is not enough spectrum;

c) that CPM-97 considered the protection requirements for analogue television in the band 470-862 MHz against a narrow-band MSS signal in the most sensitive and least sensitive portions of an analogue television channel and the protection requirements for a digital television channel, based on existing Recommendations ITU-R BT.655-4, ITU-R BT.417-4 and ITU-R IS.851-1;

d) that CPM-97 stated that the protection ratios for a narrow-band interfering signal in the least sensitive parts of an analogue television channel are to be verified by further studies;

e) that CPM-97 stated the region of lower protection requirements and commensurately higher permissible interfering power flux-density levels as being 100 kHz from the band edges of an analogue television channel, at least in some countries;

f) that CPM-97 stated that the interfering effects of a non-GSO MSS transmission will depend on its specific characteristics (e.g. duty-cycle, duration, periodicity, etc.), that interference contributions from sources other than MSS (even those from other broadcasting stations) have to be taken into account, that slightly lower values of field strength to be protected may need to be assumed in countries where television networks are relatively sparse, and that studies on sharing are necessary;

g) that the permissible aggregate interfering power flux-density resulting from these protection requirements, in some portions of an analogue television channel, may be useful in determining the feasibility of sharing with non-GSO MSS transmitter space-to-Earth links;

h) that these bands are also allocated in part to fixed and mobile terrestrial systems and radionavigation systems;

i) that, in many countries, the channels assigned for analogue television may also be used for digital television, and that during the transition period of parallel operation of analogue and digital television networks the usage of this band for television will increase;

j) that ITU-R studies are currently under way to determine television broadcasting requirements under Question 268/11 and sound broadcasting requirements under Question 224/10,

noting

a) that on completion of studies, parts of the bands now allocated to the broadcasting service between 470 MHz and 862 MHz might be considered suitable for worldwide allocation to non-GSO MSS space-to-Earth transmissions;

b) that the bandwidth required in these television channels may be 1-2% of the total band 470-862 MHz to be shared with the above systems;

c) the need to protect the radio astronomy service in the band 608-614 MHz against interference from MSS transmissions, including unwanted emissions,

resolves

1 to invite ITU-R to carry out additional studies to determine operational and technical means that may facilitate co-frequency sharing between narrow-band non-GSO MSS (space-to-Earth) transmissions and the services to which the band 470-862 MHz is allocated, including the bands where the broadcasting service is also allocated, and including consideration of digital television systems and parallel transmissions during the transition period;

2 to invite [a future competent conference/WRC-05/06] to consider, on the basis of the results of the studies referred to in *resolves* 1, the possibility of making additional allocations on a worldwide basis for non-GSO MSS,

urges administrations

to participate actively in such studies, with the involvement of interested parties.

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

Document 398-E
24 May 2000

ISTANBUL, 8 MAY – 2 JUNE 2000

R.1 **PLENARY MEETING**

FIRST SERIES OF TEXTS SUBMITTED BY THE EDITORIAL COMMITTEE TO THE PLENARY MEETING

The following texts are submitted to the Plenary Meeting for **second reading:**

Source	**Document**	**Title**
COM 6	B.1/220	**ARTICLE S5** – Table of allocations band 14.25-15.63 GHz – S5.511A – S5.541A **ARTICLE S11** – S11.32A – S11.32A.1 – S11.33 – S11.35 **APPENDIX S3** – Section I, § 6 – Section II, § 8 – 11*bis* – 11*ter* – Table II (+ Notes) **APPENDIX S42** – Call signs **RESOLUTION 10 (Rev.WRC-2000)** **RESOLUTION 121 (Rev.WRC-97)** **RESOLUTION 123 (Rev.WRC-97)** **RESOLUTION 300 (Rev.WRC-2000)** **RESOLUTION 644 (Rev.WRC-2000)** **RECOMMENDATION 66 (Rev.WRC-2000)** **RECOMMENDATION 507**

Annex: 16 pages

ARTICLE S5

MOD

14.25-15.63 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
15.43-15.63	FIXED-SATELLITE (Earth-to-space) MOD S5.511A AERONAUTICAL RADIONAVIGATION S5.511C	

MOD

S5.511A The band 15.43-15.63 GHz is also allocated to the fixed-satellite service (space-to-Earth) on a primary basis. Use of the band 15.43-15.63 GHz by the fixed-satellite service (space-to-Earth and Earth-to-space) is limited to feeder links of non-geostationary systems in the mobile-satellite service, subject to coordination under No. **S9.11A**. The use of the frequency band 15.43-15.63 GHz by the fixed-satellite service (space-to-Earth) is limited to feeder links of non-geostationary systems in the mobile-satellite service for which advance publication information has been received by the Bureau prior to 2 June 2000. In the space-to-Earth direction, the minimum earth station elevation angle above and gain towards the local horizontal plane and the minimum coordination distances to protect an earth station from harmful interference shall be in accordance with Recommendation ITU-R S.1341. In order to protect the radio astronomy service in the band 15.35-15.4 GHz, the aggregate power flux-density radiated in the 15.35-15.4 GHz band by all the space stations within any non-GSO MSS feeder-link (space-to-Earth) system operating in the 15.43-15.63 GHz band shall not exceed the level of –156 dB(W/m^2) in a 50 MHz bandwidth, which is given in Recommendation ITU-R RA.769-1, into any radio astronomy observatory site for more than 2% of the time.

MOD

S5.541A Feeder links of non-geostationary networks in the mobile-satellite service and geostationary networks in the fixed-satellite service operating in the band 29.1-29.5 GHz (Earth-to-space) shall employ uplink adaptive power control or other methods of fade compensation, such that the earth station transmissions shall be conducted at the power level required to meet the desired link performance while reducing the level of mutual interference between both networks. These methods shall apply to networks for which Appendix **S4** coordination information is considered as having been received by the Bureau after 17 May 1996 and until they are changed by a future competent world radiocommunication conference. Administrations submitting Appendix **S4** information for coordination before this date are encouraged to utilize these techniques to the extent practicable.

ARTICLE S11

MOD

S11.32A *c)* with respect to the probability of harmful interference that may be caused to or by assignments recorded with a favourable finding under Nos. **S11.36** and **S11.37** or **S11.38**, or recorded in application of No. **S11.41**, or published under Nos. **S9.38** or **S9.58** but not yet notified, as appropriate, for those cases for which the notifying administration states that the procedure for coordination under Nos. **S9.7**, **[S9.7A**, **S9.7B**,**]** **S9.11**, **S9.12**, **S9.13** or **S9.14,** could not be successfully completed (see also No. **S9.65**);[10] or

MOD

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[10] **S11.32A.1** The examination of such notices with respect to any other frequency assignment for which a request for coordination under Nos. **S9.7**, **[S9.7A**, **S9.7B]**, **S9.12** or **S9.13**, as appropriate, has been published under No. **S9.38** but not yet notified shall be effected by the Bureau in the order of their publication under the relevant provision using the most recent information available.

MOD

S11.33 *d)* with respect to the probability of harmful interference that may be caused to or by other assignments recorded with a favourable finding in application of Nos. **S11.36** and **S11.37** or **S11.38** or in application of No. **S11.41**, as appropriate, for those cases for which the notifying administration states that the procedure for coordination or prior agreement under Nos. **S9.15**[11], **S9.16**[11], **S9.17**[11], **S9.17A** or **S9.18**[11] could not be successfully completed (see also No. **S9.65**);[12] or

MOD

S11.35 In cases where the Bureau is not in a position to conduct the examination under No. **S11.32A** or **S11.33**, the Bureau shall immediately inform the notifying administration, which may then resubmit its notice under No. **S11.41**, under the assumption that the finding under No. **S11.32A** or **S11.33** is unfavourable.

APPENDIX S3

Table of maximum permitted spurious emission power levels

(See Article **S3**)

Section I – Spurious emission limits for transmitters installed on or before 1 January 2003 (valid until 1 January 2012)

MOD

6 Radar systems are exempt from spurious emission limits under this section. The lowest practicable power of spurious emission should be achieved.

Section II – Spurious emission limits for transmitters installed after 1 January 2003 and for all transmitters after 1 January 2012

MOD

8 Guidance regarding the methods of measuring spurious emissions is given in the most recent version of Recommendation ITU-R SM.329. The e.i.r.p. method specified in that Recommendation should be used when it is not possible to accurately measure the power supplied to the antenna transmission line (for example, radars), or for specific applications where the antenna is designed to provide significant attenuation at the spurious frequencies. Additionally, the e.i.r.p. method may need some modification for special cases, e.g. beam forming radars.

ADD

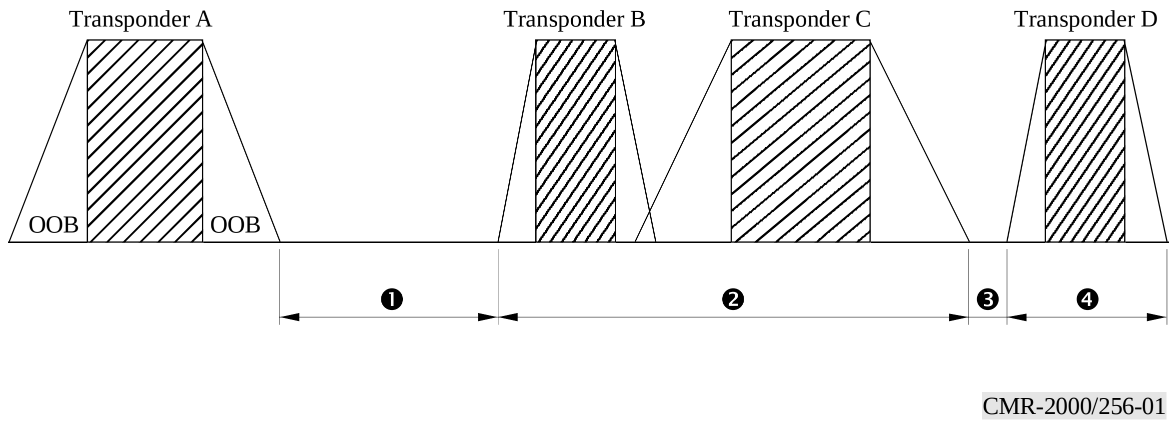
11*bis* As the bandwidth of an emitted signal becomes more and more narrow (to the limiting case of an unmodulated carrier with a theoretical necessary bandwidth of zero), the application of the term "necessary bandwidth" as used in determining the region where spurious emission limits apply to space services becomes more and more difficult. In the limiting case, ±250% of necessary bandwidth (recognized in many cases as establishing the region beyond which spurious emissions are defined) approaches zero. Beacon signals and other unmodulated signals, such as those used in uplink and downlink circuits in control and tracking of satellites, are examples of a case where it is difficult in practice to apply the concept of "necessary bandwidth" in determining where out-of-band emissions end, and spurious emissions begin. Pending further studies and definitive action by a future world radiocommunication conference for determining the portion of spectrum where spurious emission limits apply for transmitters using amplifiers to pass an essentially unmodulated signal (or a signal with very small bandwidth), the amplifier bandwidth is taken to be the necessary bandwidth.

ADD

11*ter* For the case of a single satellite operating with more than one transponder in the same service area, and when considering the limits for spurious emissions as indicated in § 11 of this Appendix, spurious emissions from one transponder may fall on a frequency at which a second, companion transponder is transmitting. In these situations, the level of spurious emissions from the first transponder is well exceeded by the fundamental or out-of-band emissions of the second transponder. Therefore, the limits of this Appendix should not apply to those spurious emissions of a satellite that fall within either the necessary bandwidth or the out-of-band region of another transponder on the same satellite, in the same service area (see Figure 1).

FIGURE 1

Example of the applicability of spurious emission limits to a satellite transponder



Transponders A, B, C and D are operating on the same satellite in the same service area. Transponder A is not required to meet spurious emission limits in frequency ranges ❷ and ❹, but is required to meet them in frequency ranges ❶ and ❸.

MOD

TABLE II

Attenuation values used to calculate maximum permitted spurious emission power levels for use with radio equipment

Service category in accordance with Article S1, or equipment type [15]	**Attenuation (dB) below the power supplied to the antenna transmission line**
All services except those services quoted below:	43 + 10 log (*P*), or 70 dBc, whichever is less stringent
Space services (earth stations) [10, 16]	43 + 10 log (*P*), or 60 dBc, whichever is less stringent
Space services (space stations) [10, 17]	43 + 10 log (*P*), or 60 dBc, whichever is less stringent
Radiodetermination [14]	43 + 10 log (*PEP*), or 60 dB, whichever is less stringent
Broadcast television [11]	46 + 10 log (*P*), or 60 dBc, whichever is less stringent, without exceeding the absolute mean power level of 1 mW for VHF stations or 12 mW for UHF stations. However, greater attenuation may be necessary on a case by case basis.
Broadcast FM	46 + 10 log (*P*), or 70 dBc, whichever is less stringent; the absolute mean power level of 1 mW should not be exceeded
Broadcasting at MF/HF	50 dBc; the absolute mean power level of 50 mW should not be exceeded
SSB from mobile stations [12]	43 dB below *PEP*
Amateur services operating below 30 MHz (including those using SSB) [16]	43 + 10 log (*PEP*), or 50 dB, whichever is less stringent

Services operating below 30 MHz, except space, radiodetermination, broadcast, those using SSB from mobile stations, and amateur [12]	43 + 10 log (*X*), or 60 dBc, whichever is less stringent, where *X* = *PEP* for SSB modulation, and *X* = *P* for other modulation
Low-power device radio equipment [13]	56 + 10 log (*P*), or 40 dBc, whichever is less stringent
Emergency transmitters [18]	No limit

MOD

[14] For radiodetermination systems (radar as defined by No. S1.100), spurious emission attenuation (in dB) shall be determined for radiated emission levels, and not at the antenna transmission line. The measurement methods for determining the radiated spurious emission levels from radar systems should be guided by Recommendation ITU-R M.1177.

ADD

[16] Earth stations in the amateur-satellite service operating below 30 MHz are in the service category “Amateur services operating below 30 MHz (including those using SSB)”.

ADD

[17] Space stations in the space research service intended for operation in deep space as defined by No. **S1.177** are exempt from spurious emission limits.

ADD

[18] Emergency position-indicating radio beacon, emergency locator transmitters, personal location beacons, search and rescue transponders, ship emergency, lifeboat and survival craft transmitters, emergency land, aeronautical or maritime transmitters.

APPENDIX S42

Table of allocation of international call sign series

Call sign series	Allocated to

ADD

*4WA-4WZ	United Nations

ADD

E4A-E4Z	Palestinian Authority[1]

MOD

VRA-VRZ	China (People's Republic of) – Hong Kong

[1] In response to Resolution 99 (Minneapolis, 1998) of the Plenipotentiary Conference.

MOD

RESOLUTION 10 (Rev.WRC-2000)

Use of two-way wireless telecommunications by the International Red Cross and Red Crescent Movement

The World Radiocommunication Conference, (Istanbul, 2000),

considering

a) that the worldwide humanitarian operations carried out by the International Red Cross and Red Crescent Movement - composed of the International Committee of the Red Cross, the International Federation of Red Cross and Red Crescent Societies and national Red Cross and Red Crescent societies - are of great importance and often indispensable;

b) that in such circumstances normal communication facilities are frequently overloaded, damaged, completely interrupted or not available;

c) that it is necessary to facilitate by all possible measures the reliable intervention of these national and international organizations;

d) that rapid and independent contact is essential to the intervention of these organizations;

e) that for the efficient and safe conduct of their humanitarian operations, these organizations rely heavily on two-way wireless telecommunication facilities, and particularly on an extensive HF and VHF radio network,

resolves to urge administrations

1 to take account of the possible needs of the International Red Cross and Red Crescent Movement for two-way wireless telecommunication means when normal communication facilities are interrupted or not available;

2 to assign to these organizations the minimum number of necessary working frequencies in accordance with the Radio Regulations;

3 to take all practicable steps to protect such communications from harmful interference.

SUP

RESOLUTION 121 (Rev.WRC-97)

Continued development of interference criteria and methodologies for fixed-satellite service coordination between feeder links of non-geostationary satellite networks in the mobile-satellite service and geostationary-satellite networks in the fixed-satellite service in the bands 19.3-19.7 GHz and 29.1-29.5 GHz

SUP

RESOLUTION 123 (WRC-97)

Feasibility of implementing feeder links of non-geostationary satellite networks in the mobile-satellite service in the band 15.43-15.63 GHz (space-to-Earth) while taking into account the protection of the radio astronomy service, the Earth exploration-satellite (passive) service and the space research (passive) service in the band 15.35-15.4 GHz

MOD

RESOLUTION 300 (Rev.WRC-2000)

Use and notification of the paired frequencies reserved for narrow-band direct-printing telegraphy and data transmission systems in the HF bands allocated on an exclusive basis to the maritime mobile service

(See Appendix **S17** (Part B, Section II))

The World Radiocommunication Conference (Istanbul, 2000),

considering

a) that certain sections of the HF bands allocated to the maritime mobile service have been reserved for narrow-band direct-printing telegraphy and data transmission systems for use on a paired frequency basis only;

b) that Appendix **S17** (Part B, Section II) contains a channelling arrangement in the maritime mobile HF bands for narrow-band direct-printing telegraphy and data systems (paired frequencies);

c) that WMARC-74 and WARC-Mob-87 established a provisional procedure for the use and notification of paired frequencies for narrow-band direct-printing telegraphy and that the application of this procedure by administrations and by the Radiocommunication Bureau was satisfactory;

d) that WRC-95 and WRC-97 modified the relevant procedures for examination of the frequency assignments in the non-planned bands,

resolves

that paired frequencies in the HF bands reserved for narrow-band direct-printing telegraphy between coast stations and ship stations shall be used by these stations, notified to the Bureau and recorded in the Master International Frequency Register in accordance with the standard procedures of Article **S11** as from 3 June 2000,

instructs the Bureau

to review the frequency assignments referred to in this resolution, which are currently recorded in the Master Register, and to modify the related findings so as to reflect the standard examination and recording procedures as stipulated in Article **S11**.

MOD

RESOLUTION 644 (Rev.WRC-2000)

Telecommunication resources for disaster mitigation and relief operations

The World Radiocommunication Conference (Istanbul, 2000),

considering

a) that ITU, in the same spirit as reflected in Articles 40 and 46 of its Constitution has specifically recognized the importance of the international use of radiocommunications in the event of natural disasters, epidemics, famines and similar emergencies;

b) that the Plenipotentiary Conference of the International Telecommunication Union (Minneapolis, 1998), in endorsing Resolution 19 of the World Telecommunication Development Conference (Valetta, 1998), adopted Resolution 36 (Rev.Minneapolis, 1998) on telecommunications in the service of humanitarian assistance;

c) that administrations have been urged to take all practical steps to facilitate the rapid deployment and effective use of telecommunication resources for disaster mitigation and disaster relief operations by reducing and, where possible, removing regulatory barriers and strengthening transborder cooperation between States,

recognizing

a) the potential of modern telecommunication technologies as an essential tool for disaster mitigation and relief operations and the vital role of telecommunications for the safety and security of relief workers in the field;

b) the particular needs of developing countries and the special requirements of the inhabitants of remote areas,

noting

that the Intergovernmental Conference on Emergency Telecommunications (ICET-98), held from 16 to 18 June 1998 in Tampere, Finland, adopted the Convention on the Provision of Telecommunication Resources for Disaster Mitigation and Relief Operations (Tampere Convention),

resolves

to invite the ITU Radiocommunication Sector to continue to study, as a matter of urgency, those aspects of radiocommunications that are relevant to disaster mitigation and relief operations, such as decentralized means of communications that are appropriate and generally available, including amateur radio facilities and mobile and portable satellite terminals,

instructs the Director of the Radiocommunication Bureau

to support administrations in their work towards the implementation of Resolution 36 (Rev.Minneapolis, 1998) and the Tampere Convention.

MOD

RECOMMENDATION 66 (Rev.WRC-2000)

Studies of the maximum permitted levels of unwanted emissions

The World Radiocommunication Conference (Istanbul, 2000),

considering

a) that Appendix **S3** specifies the maximum permitted levels of spurious emissions, in terms of the mean power level of any spurious component supplied by a transmitter to the antenna transmission line;

b) that the principal objective of Appendix **S3** is to specify the maximum permitted levels of spurious emissions that, while being achievable, provide protection against harmful interference;

c) that excessive levels of unwanted emissions may give rise to harmful interference;

d) that while out-of-band emissions can also give rise to harmful interference, the Radio Regulations do not provide general limits for these emissions;

e) that while Appendix **S3** applies generally to the mean power of a transmitter and its spurious emissions, it also takes account of a variety of emissions where interpretation of the term "mean power", and thus its measurement, would be difficult, particularly in the cases of digital modulation broadband systems, pulsed modulation and narrow-band high-power transmitters;

f) that unwanted emissions from transmitters operating in space stations may cause harmful interference, particularly emissions from wideband amplifiers which cannot be adjusted after launch;

g) that unwanted emissions may cause harmful interference to safety services and radio astronomy and space services using passive sensors;

h) that, for technical or operational reasons, more stringent spurious emission limits than the general limits in Appendix **S3** may be required to protect specific services, such as safety services and passive services in specific bands or situations;

i) that broadband digital modulation may cause unwanted emissions at frequencies far from the carrier frequency,

noting

a) that safety services and passive services have in many cases been allocated frequencies adjacent or close to those of services employing high-power transmitters;

b) that some administrations have adopted more stringent limits for spurious emissions than those specified in Appendix **S3**;

c) that, at this time, in response to *resolves* 2.3.2 of Resolution **722 (WRC-97)**, ITU-R has decided to recommend not including general out-of-band limits in the Radio Regulations,

recommends that ITU-R

1 continue the study of spurious emission levels in all frequency bands, emphasizing the study of those frequency bands, services and modulation techniques not presently covered by Appendix **S3**;

2 study the question of unwanted emissions resulting from transmitters of all services and all modulation methods, and, on the basis of those studies, develop a Recommendation or Recommendations for maximum permitted levels of spurious emissions and out-of-band emissions;

3 establish appropriate measurement techniques for unwanted emissions, where those techniques do not currently exist, including the determination of reference levels for wideband transmissions as well as the applicability of reference measurement bandwidths;

4 study the reasonable boundary of spurious emissions and out-of-band emissions with a view to defining such a boundary in Article **S1**;

5 study those frequency bands and instances where, for technical or operational reasons, more stringent spurious emission limits than the general limits in Appendix **S3** may be required to protect safety services and passive services such as radio astronomy, and the impact on all concerned services of implementing or not implementing such limits;

6 study those frequency bands and instances where, for technical or operational reasons, out-of-band limits may be required to protect safety services and passive services such as radio astronomy, and the impact on all concerned services of implementing or not implementing such limits;

7 study the matter of reference bandwidth in the space services and the option of modifying Table II of Appendix **S3** by separately identifying individual space services;

8 report the results of these studies to a competent world radiocommunication conference(s).

SUP

RECOMMENDATION 507

Relating to spurious emissions in the broadcasting-satellite service[1]

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

ISTANBUL, 8 MAY – 2 JUNE 2000

Corrigendum 2 to
Document 399(Rev.1)-E
29 May 2000
Original: English

PLENARY MEETING

Algeria (People's Democratic Republic of), Saudi Arabia (Kingdom of), Bahrain (State of), Bulgaria (Republic of), United Arab Emirates, Indonesia (Republic of), Jordan (Hashemite Kingdom of), Lao People's Democratic Republic, Lebanon, Libya (Socialist People's Libyan Arab Jamahiriya), Malaysia, Morocco (Kingdom of), Oman (Sultanate of), Qatar (State of), Syrian Arab Republic, Tonga (Kingdom of), Tunisia, Viet Nam (Socialist Republic of), Yemen (Republic of)

PROPOSALS FOR THE WORK OF THE CONFERENCE

ISSUES RELATED TO THE SHARING SITUATION IN THE FREQUENCY BAND 13.75-14 GHz

Add the name of Tunisia to the countries co-sponsoring this document.

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

ISTANBUL, 8 MAY – 2 JUNE 2000

Corrigendum 1 to Document 399(Rev.1)-E
29 May 2000
Original: English

PLENARY MEETING

Algeria (People's Democratic Republic of), Saudi Arabia (Kingdom of), Bahrain (State of), Bulgaria (Republic of), United Arab Emirates, Indonesia (Republic of), Jordan (Hashemite Kingdom of), Lao People's Democratic Republic, Lebanon, Libya (Socialist People's Libyan Arab Jamahiriya), Malaysia, Morocco (Kingdom of), Oman (Sultanate of), Qatar (State of), Syrian Arab Republic, Tonga (Kingdom of), Viet Nam (Socialist Republic of), Yemen (Republic of)

PROPOSALS FOR THE WORK OF THE CONFERENCE

ISSUES RELATED TO THE SHARING SITUATION IN THE FREQUENCY BAND 13.75-14 GHz

Add the name of Indonesia to the countries co-sponsoring this document.

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

Document 399(Rev.1)-E
26 May 2000
Original: English

ISTANBUL, 8 MAY – 2 JUNE 2000

PLENARY MEETING

Algeria (People's Democratic Republic of), Saudi Arabia (Kingdom of), Bahrain (State of), Bulgaria (Republic of), United Arab Emirates, Jordan (Hashemite Kingdom of), Lao People's Democratic Republic, Lebanon, Libya (Socialist People's Libyan Arab Jamahiriya), Malaysia, Morocco (Kingdom of), Oman (Sultanate of), Qatar (State of), Syrian Arab Republic, Tonga (Kingdom of), Viet Nam (Socialist Republic of), Yemen (Republic of)

PROPOSALS FOR THE WORK OF THE CONFERENCE

ISSUES RELATED TO THE SHARING SITUATION IN THE FREQUENCY BAND 13.75-14 GHz

MOD ALG/ARS/BHR/BUL/UAE/JOR/LAO/LBN/LBY/MLA/MRC/OMA/QAT/SYR/TON/VTN/YEM/399/1

S5.502 In the band 13.75-14 GHz, the ~~e.i.r.p. of any emission from an~~ earth station in the fixed-satellite service shall[1] ~~be at least 68 dBW, and should not exceed 85 dBW, with~~have a minimum antenna diameter of 4.5 m and the e.i.r.p. of any emission should be at least 68 dBW and should not exceed 85 dBW. In addition the e.i.r.p., averaged over one second, radiated by a station in the radiolocation or radionavigation services ~~towards the geostationary-satellite orbit~~ shall not exceed 59 dBW. The protection of assignments to receiving space stations in the fixed-satellite service operating with earth stations that, individually, have an e.i.r.p. of less than 68 dBW shall not impose constraints on the operation of the radiolocation and radionavigation stations operating in accordance with the Radio Regulations. **S5.43** does not apply. See Resolution **[COM5/10]**.

ADD ALG/ARS/BHR/BUL/UAE/JOR/LAO/LBN/LBY/MLA/MRC/OMA/QAT/SYR/TON/VTN/YEM/399/2

[1] **S5.502.1** In the band 13.75-14 GHz, administrations may authorize operation of earth stations in the fixed-satellite service with antenna diameter of less than 4.5 m, subject to ensuring that such operation shall not cause unacceptable interference to co-frequency radiolocation or radionavigation services operating in the territories of neighbouring administrations.

Reasons: To allow administrations to make flexible and efficient use of the band 13.75-14 GHz, through the use of fixed-satellite service earth stations of diameter less than 4.5 m, whilst ensuring the protection of co-primary services.

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

Document 399-E
26 May 2000
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ISTANBUL, 8 MAY – 2 JUNE 2000

COMMITTEE 4

Algeria (People's Democratic Republic of), Saudi Arabia (Kingdom of), Bahrain (State of), Bulgaria (Republic of), United Arab Emirates, Jordan (Hashemite Kingdom of), Lao People's Democratic Republic, Lebanon, Libya (Socialist People's Libyan Arab Jamahiriya), Malaysia, Morocco (Kingdom of), Oman (Sultanate of), Qatar (State of), Syrian Arab Republic, Tonga (Kingdom of), Viet Nam (Socialist Republic of), Yemen (Republic of)

PROPOSALS FOR THE WORK OF THE CONFERENCE

ISSUES RELATED TO THE SHARING SITUATION IN THE FREQUENCY BAND 13.75-14 GHz

MOD ALG/ARS/BHR/BUL/UAE/JOR/LAO/LBN/LBY/MLA/MRC/OMA/QAT/SYR/TON/VTN/YEM/399/1

S5.502 In the band 13.75-14 GHz, the~~ e.i.r.p. of any emission from an~~ earth station in the fixed-satellite service shall[1] ~~be at least 68 dBW, and should not exceed 85 dBW, with~~have a minimum antenna diameter of 4.5 m and the e.i.r.p. of any emission should be at least 68 dBW and should not exceed 85 dBW. In addition the e.i.r.p., averaged over one second, radiated by a station in the radiolocation or radionavigation services~~ towards the geostationary-satellite orbit~~ shall not exceed 59 dBW. The protection of assignments to receiving space stations in the fixed-satellite service operating with earth stations that, individually, have an e.i.r.p. of less than 68 dBW shall not impose constraints on the operation of the radiolocation and radionavigation stations operating in accordance with the Radio Regulations. **S5.43** does not apply. See Resolution **[COM5/10]**.

ADD ALG/ARS/BHR/BUL/UAE/JOR/LAO/LBN/LBY/MLA/MRC/OMA/QAT/SYR/TON/VTN/YEM/399/2

[1] **S5.502.1** In the band 13.75-14 GHz, administrations may authorize operation of earth stations in the fixed-satellite service with antenna diameter of less than 4.5 m, subject to ensuring that such operation shall not cause unacceptable interference to co-frequency radiolocation or radionavigation services operating in the territories of neighbouring administrations.

Reasons: To allow administrations to make flexible and efficient use of the band 13.75-14 GHz, through the use of fixed-satellite service earth stations of diameter less than 4.5 m, whilst ensuring the protection of co-primary services.

INTERNATIONAL TELECOMMUNICATION UNION

WRC-2000 WORLD RADIOCOMMUNICATION CONFERENCE

Document 400-E
26 May 2000
Original: French/ English/ Spanish

ISTANBUL, 8 MAY – 2 JUNE 2000

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364	Drafting Group 5A-1	New Resolution on frequency bands for terrestrial component of IMT-2000 below 1 GHz	WG 5A
365	Drafting Group 5A-1	Modification to Article S5 for spectrum below 1 GHz for IMT-2000 (terrestrial component)	WG 5A
366	PL	Minutes of the third Plenary Meeting	PL
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371	WG 5D	Chairperson, Working Group 5D	C5
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379	SWG 5B-2	Modifications to Article S5 of the Radio Regulations	WG 5B
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383	Drafting Group 5C-3-RA	Chairperson, Drafting Group 5C-3-RA	WG 5C
384	Drafting Group 5C-3-RA	Chairperson, Drafting Group 5C-3-RA	WG 5C
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[1] ALG/ARS/BHR/BUL/UAE/JOR/LAO/LBN/LBY/MLA/MRC/OMA/QAT/SYR/TON/VTN/YEM