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INTERNATIONAL TELECOMMUNICATION UNION

RADIOCOMMUNICATION SECTOR

Conference Preparatory Meeting

CPM Report on technical, operational and regulatory/procedural matters to be considered by the 1997 World Radiocommunication Conference

GENEVA, 1997

PREFACE

This CPM Report to the 1997 World Radiocommunication Conference was prepared in response to Resolution 1086 of the ITU Council to assist the ITU Member States and the Radiocommunication Sector Members who will be involved in the deliberations at WRC-97. The Report was prepared and approved by the CPM at its second meeting, 5 - 16 May 1997. The Report is structured to generally follow the topics of the WRC-97 agenda and its contents follow the outline approved by the CPM-96. A cross-reference list is provided to facilitate finding specific topics within the framework of the WRC-97 Agenda. The Report comprises seven Chapters and two Annexes.

This Report represents the best information on technical, operational and regulatory/procedural issues relevant to the WRC-97 agenda available at the time of its preparation and should provide a good basis for the discussions at the Conference.

Robert W. Jones
Director Radiocommunication Bureau

Cross-reference between WRC-97 Agenda Items and the Sections of the CPM Report

WRC-97 Agenda Item	Section of the CPM Report to WRC-97
1. on the basis of proposals from administrations and the Report of the Conference Preparatory Meeting, and taking account of the results of WRC-95, to consider and take appropriate action in respect of the following topics:	
1.1 requests from administrations to delete their country footnotes or to have their country's name deleted from footnotes, if no longer required, within the limits of Resolution 26 (WRC-95),	
1.2 issues remaining from WRC-95 including consideration of the VGE Report in accordance with Resolution 71 (WRC-95) and any essential changes to Articles S4, S7, S8, S9, S11, S13, S14 and Appendices S4 and S5 of the simplified RR adopted by WRC-95 to ensure consistency between all of their provisions,	Chapter 1
1.3 review of Appendix 28 (S7) to the RR, taking into account Resolution 60 (WARC-79), Resolution 712 (Rev.WRC-95) and Recommendation 711 (WARC-79),	Chapter 7, §7.1
1.4 examination of, and taking necessary decisions on, the question of the HF bands allocated to the broadcasting service in the light of developments to date and the results of the studies carried out by the Radiocommunication Sector, and review of Article 17 (S12) of the RR in accordance with Resolution 530 (WRC-95),	Chapter 2
1.5 based on the results of the studies to be carried out under Recommendation 720 (WRC-95), consider changes to the RR, as appropriate,	Chapter 7, §7.2
1.6 matters related to the maritime mobile and maritime mobile-satellite services:	Chapter 3
1.6.1 the provisions of Chapters IX (Appendix S13) and NIX (Chapter SVII) of the RR, as stipulated in Resolution 331 (Mob-87), and appropriate action in respect of the issues dealt with in Resolutions 200 (Mob-87), 210 (Mob-87) and 330 (Mob-87), including maritime certification and licensing issues related to Chapter SIX of the RR, taking into account that the global maritime distress and safety system (GMDSS) shall be fully implemented in 1999,	Chapter 3, §3.1.1
1.6.2 the use of Appendix 18 (S18) to the RR in respect of the VHF band for maritime mobile communications, and the use and extension of UHF channels contained in S5.287, taking into account Resolution 310 (Mob-87),	Chapter 3, §3.1.2
1.6.3 Article 61 (S53) of the RR relating to the order of priority of communications in the maritime mobile service and in the maritime mobile-satellite service,	Chapter 3, §3.1.3
1.6.4 review, and if necessary, revision of the provisions related to the NAVTEX coordination in order to release ITU from the obligation to undertake operational coordination for this service operating on 490 kHz, 518 kHz and 4 209.5 kHz, in the light of the consultations undertaken with the International Maritime Organization (IMO) (see Resolution 339 (WRC-95),	Chapter 3, §3.1.4
1.6.5 use of the new digital technology in the maritime radiotelephony channels,	Chapter 3, §3.1.5
1.7 review of Appendix 8 to the RR taking into account Recommendation 66 (Rev.WARC-92),	Chapter 7, §7.3
1.8 the possible deletion of all secondary allocations from the band 136 -137 MHz, which is allocated to the aeronautical mobile (R) service on a primary basis, in accordance with Resolution 408 (Mob-87) and in order to meet the special needs of the aeronautical mobile (R) service,	Chapter 3, §3.2
1.9 taking into account the needs of other services to which the relevant frequency bands are already allocated:	

1.9.1 issues concerning existing and possible additional frequency allocations and regulatory aspects as related to the mobile-satellite and fixed-satellite services including consideration of Resolutions 116 (WRC-95), 117 (WRC-95), 118 (WRC-95), 121 (WRC-95), 214 (WRC-95), 215 (WRC-95), 714 (WRC 95), 715 (WRC-95), 717 (WRC-95) and Rec. 717 (Rev.WRC-95),	Chapter 4
1.9.2 Resolution 211 (WARC-92), Resolution 710 (WARC-92) Resolution 712 (Rev.WRC-95), Resolves 1 Resolution 712 (Rev.WRC-95), Resolves 2 Resolution 712 (Rev.WRC-95), Resolves 3 Resolution 712 (Rev.WRC-95), Resolves 4 Resolution 712 (Rev.WRC-95), Resolves 5	Chapter 5, §5.1 Chapter 5, §5.2 Chapter 5, §5.3 Chapter 5, §5.4 Chapter 5, §5.5 Chapter 5, §5.6 Chapter 5, §5.7
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1.9.4 frequency allocation issues related to the needs of the Earth exploration-satellite service, which are not covered in the above-mentioned Resolutions, namely:	Chapter 5
1.9.4.1 allocation of frequency bands above 50 GHz to the EESS (passive) service,	Chapter 5, §5.8
1.9.4.2 frequency allocations near 26 GHz to the EESS (space-to-Earth),	Chapter 5, §5.9
1.9.4.3 the existing frequency allocations near 60 GHz and, if necessary, their re-allocation, with a view to protecting the Earth exploration-satellite (passive) service systems operating in the unique oxygen absorption frequency range from about 50 GHz to about 70 GHz,	Chapter 5, §5.10
1.9.5 allocations to the space research service (space-to-space) near 400 MHz,	Chapter 5, §5.11
1.9.6 the identification of suitable frequency bands above 30 GHz for use by the fixed service for high-density applications,	Chapter 7, §7.5
1.10 review of Appendices 30 (S30) and 30A (S30A) for Regions 1 and 3 in response to Resolution 524 (WARC-92), and taking particular account of resolves 2 of that Resolution, in accordance with Resolution 531 (WRC-95) and taking into account Recommendation 35 (WRC-95),	Chapter 6
2. to examine the revised ITU-R Recommendations incorporated by reference in the RR which have been communicated by the associated Radiocommunication Assembly, in accordance with Resolution 28 (WRC-95); and decide whether or not to update the corresponding references in the RR in accordance with principles contained in the Annex to Resolution 27 (WRC-95),	Chapter 1
3. to consider such consequential changes and amendments to the RR as may be necessitated by the decisions of the Conference,	
4. in accordance with Resolution 94 (WARC-92), to review those resolutions and recommendations of world administrative radio conferences and world radiocommunication conferences which are relevant to agenda items 1 and 2 above with a view to their possible revision, replacement or abrogation,	Chapter 7, §7.6
5. to review, and take appropriate action on, the report from the Radiocommunication Assembly submitted in accordance with Nos. 135 and 136 of the Convention (Geneva, 1992),	
6. to identify those items requiring urgent actions by the radiocommunication study groups in preparation for the 1999 World Radiocommunication Conference (WRC-99),	
7. to consider the final report of the Director, BR on activities related to Res. 18 (Kyoto, 1994),	
8. in accordance with Article 7 of the Convention (Geneva, 1992):	
8.1 to consider and approve the report of the Director of the Radiocommunication Bureau on the activities of the Radiocommunication Sector since the last Conference,	
8.2 to recommend to the Council items for inclusion in the agenda for the WRC-99, and to give its views on the preliminary agenda for the 2001 Conference and on possible agenda items for future conferences	

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INTRODUCTION TO THE CPM-97 REPORT

This CPM Report to WRC-97 is provided to assist the ITU Member States, the Radiocommunication Sector Members and International and Regional Organizations in preparing for the 1997 World Radiocommunication Conference. It represents the best information on technical, operational and regulatory/procedural issues relevant to the WRC-97 agenda, available at the time of its preparation.

I.1 Origin and purpose of CPM-97

The 1995 World Radiocommunication Conference resolved to hold the next World Radiocommunication Conference in 1997, in Geneva. The agenda for the Conference (Appendix I.1) was recommended to and established by the Council at its 1996 session. At the same time, the Council instructed the Director of the Radiocommunication Bureau "... to make the necessary arrangements to convene meetings of the Conference Preparatory Meeting and to prepare a report to WRC-97 ...".

The 1995 Radiocommunication Assembly by its Resolution ITU-R 2 confirmed that preparatory studies for a WRC are to be carried out by a Conference Preparatory Meeting (CPM) and nominated Mr. R. Taylor (USA) as the Chairman of CPM-97, Mr. R.N. Agarwal (India) as the Vice-Chairman and Mr. T. Bøe (Norway) as the Vice-Chairman on preparation for WRC-99.

All administrations of the ITU Member States and Radiocommunication Sector Members were invited to participate in preparation of the CPM Report to WRC-97.

I.2 Organization of the ITU-R Conference preparation

The 1996 Conference Preparatory Meeting (Geneva, 14-16 February 1996) organized and coordinated preparatory studies for WRC-97 and identified preliminary studies for WRC-99. A structure for the Report to WRC-97 was agreed together with a preparatory process, the working procedures; a chapter structure was also developed. The Chairman appointed a Rapporteur for each chapter to assist him in managing the development and flow of draft report contributions.

The ITU-R preparations for WRC-97 were concentrated in the following Task Groups and Working Parties (listed in the order of the Study Groups):

Study Group 1 chaired by Mr. R. Mayher (USA), TG 1/3 chaired by Mr. A. Azoulay (France), TG 1/4 chaired by Mr. D. Bacon (UK), WP 1A chaired by Mr. T. Jeacock (UK).

Study Group 3 chaired by Mr. L. Barclay (UK), WP 3K chaired by Mr. E.J. Haakinson (USA), WP 3L chaired by Mr. R. Hanbaba (France), WP 3M chaired by Mr. M.P.M. Hall (UK).

Study Group 4 chaired by Mr. E. Hauck (Switzerland), WP 4A chaired by Mr. A.G. Reed (UK), WP 4B chaired by Mr. D. Weinreich (USA), WP 4-9S chaired by Mr. K.R.E. Dunk (UK) and later by Mr. W. Rummler (USA).

Study Group 7 chaired by Mr. H. Kimball (USA), WP 7B chaired by Mr. R.M. Taylor (USA), WP 7C chaired by Mr. J. Saint-Etienne (France), WP 7D chaired by Mr. J.B. Whiteoak (Australia), JWP 7-8R chaired by Mr. W.G. Long (USA).

Study Group 8 chaired by Mr. E. George (Germany), WP 8A chaired by Mr. O. Villany (Hungary), WP 8B chaired by Mr. R.L. Swanson (USA), WP 8C chaired by Mr. P.E. Kent (UK), WP 8D chaired by Mr. K. Kosaka (Japan) (acting Chairman), TG 8/2 chaired by Mr. P.L. Rinaldo (USA).

Study Group 9 chaired by Mr. M. Murotani (Japan), WP 9B chaired by Mr. A. Hashimoto (Japan) (acting Chairman), WP 9D chaired by Mr. G.F. Hurt (USA).

Study Group 10 chaired by Mr. A. Magenta (Italy), TG 10/5 chaired by Mr. W.G. Richards (USA), WP 10B chaired by Mr. F. Conway (Canada).

Study Group 11 chaired by Mr. M. Krivosheev (Russia), WP 11C chaired by Mr. S. Perpar (Slovenia), WP 10-11S chaired by Mr. R. Zeitoun (Canada).

Special Committee for Regulatory/Procedural Matters chaired Mr. A. Berrada (Morocco).

I.3 Participation

606 delegates participated in the meeting of CPM-97 from 72 ITU Member States, 54 ITU-R Sector Members and 18 International and Regional Organizations.

I.4 Documentation

146 contributions including the draft CPM Report (Document CPM97/1 + Addenda 1 and 2) were submitted for consideration by the CPM-97 meeting in May 1997. They were attributed to the following seven Chapter Groups for preparation of the final text for each Chapter.

Chapter	Chairman	Rapporteur	BR Secretary
1	R.N. Agarwal (India) A. Berrada (Morocco) Assistant	R.N. Agarwal (India)	T. Gavrilov
2	I. Davey (UK)	K. Hunt (EBU)	G. Rossi
3	P. Lansman (Finland)	T. Bøe (Norway)	W. Frank
4	N. Kisrawi (Syria)	E. Miller (USA)	F. Leite
5	B. Younes (USA)	R. Jacobsen (Australia)	A. Matas
6	R. Barton (Australia)	S. Sadhu (ABU)	G. Mesias
7	D. Sward (Canada)	C. Van Diepenbeek (Netherlands)	L. Casado

Four contributions were considered by the Plenary Meeting.

I.4.1 Contribution related to the use by NGSO systems of frequency bands between 10 and 18 GHz

Following the introduction of a contribution relating to this issue, some administrations expressed the view that the issue is not part of the agenda of WRC-97. The CPM considered that it had no authority to decide whether an issue is or is not on the agenda of the Conference. However, the CPM wishes to bring the following views to the attention of WRC-97:

- some administrations considered that, as a matter of principle, NGSO systems in the FSS/BSS in the frequency bands/Regions subject to Appendices 30, 30A or 30B should not be authorized;
- some administrations considered that the use by NGSO systems in the bands of Appendices 30, 30A is prohibited by the existing provisions (see No. S5.441 and Resolution 506);

- some administrations considered that the technical studies submitted to the CPM need to be pursued and to be critically reviewed by the ITU-R Study Groups.

I.4.2 Contribution related to regulatory/procedural provisions applicable to NGSO systems

The use of NGSO systems and the application of No. 2613 or Resolution 46 have been the subject of detailed consideration in the ITU-R Study Groups and a number of conclusions were adopted in their respect. The CPM received a contribution intended to include in the CPM Report a detailed explanation of these matters, however, some administrations considered that this cannot be done without re-opening discussions on compromises reached after difficult negotiations. The authors of the contribution are of the view that, in the absence of absolute design constraints (limits or mandatory application of specific mitigation techniques which either avoid the need for coordination or facilitate such coordination), it can be expected that the combination of thresholds and a coordination procedure such as Resolution 46 would lead to significant difficulties for all GSO and NGSO systems sharing the same band. Other administrations recalled that WRC-95 considered that No. 2613 and Resolution 46 are mutually exclusive and that this is reflected in the RRB Rules of Procedure.

I.4.3 Contribution related to the maritime mobile-satellite service at 14 GHz

The CPM received a contribution intended to provide a technical/operational basis to modify the Table of Frequency Allocations with the view to replace the current allocation to the land mobile-satellite service on a secondary basis in the band 14 - 14.5 GHz by another secondary allocation to the mobile-satellite service, except aeronautical, in the same band. The contribution indicates that the transmissions by maritime mobile earth stations will not increase the probability of interference; however, aeronautical mobile-satellite applications would require additional studies.

I.4.4 Contribution related to consideration of Resolution 528 (WARC-92) on the BSS (sound)

The aim of this contribution is to simply draw attention, through the CPM, to the fact that some form of preparatory work might be necessary with regard to Resolution 528, and in that respect it might be appropriate for CPM-97 to consider it. CPM-97 noted this contribution and forwarded it to the Chairman of the CPM for WRC-99.

I.5 Preparation of the CPM Report to WRC-97

On the basis of the reports from the relevant groups, a draft consolidated CPM Report was prepared by the Chapter Rapporteurs, and the Chairmen of the relevant SGs/TGs/WPs. The work was coordinated by Mr. R. Taylor (USA), the Chairman, CPM-97, Mr. R.N. Agarwal (India) and Mr. T. Bøe (Norway), the Vice-Chairmen of CPM-97. Staff of the Radiocommunication Bureau provided the required assistance. The draft CPM Report was distributed to all Members of the ITU and to members of the Radiocommunication Sector wishing to participate in the CPM as Document CPM 97/1 + Addenda 1 and 2.

The CPM-97 met in Geneva from 5 to 16 May 1997 to consider the draft CPM Report (Document CPM 97/1 + Addenda 1 and 2), together with contributions from the ITU membership and additional material submitted by the Study Groups and the Radiocommunication Bureau.

Editorial work was carried out by the Editorial Group chaired by Mr. L. Bourgeat, France and involving Mr. J. Shaw, United Kingdom and Mr. P. Garcia Barquero, Spain.

The meeting finally approved the CPM Report to WRC-97.

I.6 Presentation and structure of the Report

The Report is structured to follow the topics of the WRC-97 agenda. Its outline was developed and approved by the first CPM at its meeting in February 1996. A cross-reference list is provided to facilitate finding specific topics within the framework of the WRC-97 agenda.

The Report comprises seven Chapters and one Annex.

Chapter 1 contains material relating to the regulatory/procedural matters and covers WRC-97 agenda items 1.2 and 2.

The need for regulatory/procedural texts was foreseen by CPM-96 and is reflected in the Chapter's structure. Administrations may wish to note that, in some sections of this Report, regulatory/ procedural texts have not been developed, it being recognized that multiple possible options may lead to multiple possible regulatory/procedural considerations.

Chapter 2 contains material relating to HF broadcasting WRC-97 (agenda item 1.4).

Chapter 3 concerns the maritime and aeronautical services WRC-97 (agenda items 1.6 and 1.8).

Chapter 4 contains material relating to the mobile-satellite and fixed-satellite services WRC-97 (agenda item 1.9.1).

Chapter 5 contains material relating to the space science services WRC-97(agenda items 1.9.2, 1.9.4, 1.9.5).

Chapter 6 contains material relating to Appendices 30 and 30A of the Radio Regulations WRC-97(agenda item 1.10).

Chapter 7 contains material relating to Appendix 28 of the Radio Regulations WRC-97 (agenda item 1.3), the adaptive MF/HF systems WRC-97 (agenda item 1.5), spurious emissions WRC-97 (agenda item 1.7), the wind profilers WRC-97 (agenda item 1.9.3) and the fixed service above 30 GHz WRC-97 (agenda item 1.9.6). It also contains suggestions for action by WRC-97 on Resolutions and Recommendations pertaining to issues arising from consideration of WRC-97 agenda items 1 and 2 WRC-97 (agenda item 4).

Annex 1 indicates the parts of the simplified Radio Regulations referring to the ITU-R Recommendations.

Annex 2 contains a list of the ITU-R Recommendations including certain draft new Recommendations which are referred to in the text of this Report. The final version of this list reflecting the decisions of the 1997 Radiocommunication Assembly will be prepared by the Radiocommunication Bureau and made available to the 1997 World Radiocommunication Conference.

Appendix I.1 contains the text of Council Resolution 1086 on the WRC-97 Agenda.

Appendix I.2 is a report from the Vice-Chairman of the CPM-97 (Chairman designate CPM-99). This report is provided for information only. It should be noted that the future of the CPM is being considered within the RAG and is subjec to review and possible revision at the 1997 Radiocommunication Assembly.

Administrations of Member States represented at the CPM who signed the Declaration No. 53 appearing in the Final Acts of WRC-95, recalled their concern and extended it to the parts of this report relating to Appendices S30 and S30A.

APPENDIX I.1

RESOLUTION 1086

WORLD RADIOCOMMUNICATION CONFERENCE (WRC-97), 1997

The Council,

noting

that Resolution 718 of the World Radiocommunication Conference (Geneva, 1995)

a) resolved to recommend to the Council that a world radiocommunication conference be held in Geneva in late 1997 for a period of four weeks;

b) recommended its agenda, and invited the Council to establish it;

c) invited the Council to make provisions for WRC-97 and to initiate as soon as possible the necessary consultation,

resolves

to convene a World Radiocommunication Conference (WRC-97) in Geneva from 27 October to 21 November 1997, with the following agenda:

1 on the basis of proposals from administrations and the Report of the Conference Preparatory Meeting, and taking account of the results of WRC-95, to consider and take appropriate action in respect of the following topics:

1.1 requests from administrations to delete their country footnotes or to have their country's name deleted from footnotes, if no longer required, within the limits of Resolution 26 (WRC-95);

1.2 issues remaining from WRC-95 including consideration of the VGE Report in accordance with Resolution 71 (WRC-95) and any essential changes to Articles S4, S7, S8, S9, S11, S13, S14 and Appendices S4 and S5 of the simplified Radio Regulations adopted by WRC-95 to ensure consistency between all of their provisions;

1.3 review of Appendix 28 (S7) to the Radio Regulations, taking into account Resolution 60 (WARC-79), Resolution 712 (Rev.WRC-95) and Recommendation 711 (WARC-79);

1.4 examination of, and taking necessary decisions on, the question of the HF bands allocated to the broadcasting service in the light of developments to date and the results of the studies carried out by the Radiocommunication Sector, and review of Article 17 (S12) of the Radio Regulations in accordance with Resolution 530 (WRC-95);

1.5 based on the results of the studies to be carried out under Recommendation 720 (WRC-95), consider changes to the Radio Regulations, as appropriate;

1.6 matters related to the maritime mobile and maritime mobile-satellite services:

1.6.1 the provisions of Chapters IX (Appendix S13) and NIX (Chapter SVII) of the Radio Regulations, as stipulated in Resolution 331 (Mob-87), and appropriate action in respect of the issues dealt with in Resolutions 200 (Mob-87), 210 (Mob-87) and 330 (Mob-87), including maritime certification and licensing issues related to Chapter SIX of the Radio Regulations, taking into

account that the global maritime distress and safety system (GMDSS) shall be fully implemented in 1999;

1.6.2 the use of Appendix 18 (S18) to the Radio Regulations in respect of the VHF band for maritime mobile communications, and the use and extension of UHF channels contained in S5.287, taking into account Resolution 310 (Mob-87);

1.6.3 Article 61 (S53) of the Radio Regulations relating to the order of priority of communications in the maritime mobile service and in the maritime mobile-satellite service;

1.6.4 review, and if necessary, revision of the provisions related to the NAVTEX coordination in order to release ITU from the obligation to undertake operational coordination for this service operating on 490 kHz, 518 kHz and 4 209.5 kHz, in the light of the consultations undertaken with the International Maritime Organization (IMO) (see Resolution 339 (WRC-95));

1.6.5 use of the new digital technology in the maritime radiotelephony channels;

1.7 review of Appendix 8 to the Radio Regulations taking into account Recommendation 66 (Rev.WARC-92);

1.8 the possible deletion of all secondary allocations from the band 136 - 137 MHz, which is allocated to the aeronautical mobile (R) service on a primary basis, in accordance with Resolution 408 (Mob-87) and in order to meet the special needs of the aeronautical mobile (R) service;

1.9 taking into account the needs of other services to which the relevant frequency bands are already allocated:

1.9.1 issues concerning existing and possible additional frequency allocations and regulatory aspects as related to the mobile-satellite and fixed-satellite services including consideration of Resolutions 116 (WRC-95), 117 (WRC-95), 118 (WRC-95), 121 (WRC-95), 214 (WRC-95), 215 (WRC-95), 714 (WRC-95), 715 (WRC-95), 717 (WRC-95) and Recommendation 717 (Rev.WRC-95);

1.9.2 Resolutions 211 (WARC-92), 710 (WARC-92) and Resolution 712 (Rev.WRC-95);

1.9.3 Recommendation 621 (WARC-92);

1.9.4 frequency allocation issues related to the needs of the Earth exploration-satellite service, which are not covered in the above-mentioned Resolutions, namely:

1.9.4.1 allocation of frequency bands above 50 GHz to the Earth exploration-satellite (passive) service;

1.9.4.2 frequency allocations near 26 GHz to the Earth exploration-satellite service (space-to-Earth);

1.9.4.3 the existing frequency allocations near 60 GHz and, if necessary, their re-allocation, with a view to protecting the Earth exploration-satellite (passive) service systems operating in the unique oxygen absorption frequency range from about 50 GHz to about 70 GHz;

1.9.5 allocations to the space research service (space-to-space) near 400 MHz;

1.9.6 the identification of suitable frequency bands above 30 GHz for use by the fixed service for high-density applications;

1.10 review of Appendices 30 (S30) and 30A (S30A) for Regions 1 and 3 in response to Resolution 524 (WARC-92), and taking particular account of *resolves* 2 of that Resolution, in accordance with Resolution 531 (WRC-95) and taking into account Recommendation 35 (WRC-95);

2 to examine the revised ITU-R Recommendations incorporated by reference in the Radio Regulations which have been communicated by the associated Radiocommunication Assembly, in accordance with Resolution 28 (WRC-95); and decide whether or not to update the corresponding references in the Radio Regulations, in accordance with principles contained in the Annex to Resolution 27 (WRC-95);

3 to consider such consequential changes and amendments to the Radio Regulations as may be necessitated by the decisions of the Conference;

4 in accordance with Resolution 94 (WARC-92), to review those Resolutions and Recommendations of world administrative radio conferences and world radiocommunication conferences which are relevant to agenda items 1 and 2 above with a view to their possible revision, replacement or abrogation;

5 to review, and take appropriate action on, the report from the Radiocommunication Assembly submitted in accordance with Nos. 135 and 136 of the Convention (Geneva, 1992);

6 to identify those items requiring urgent actions by the Radiocommunication Study Groups in preparation for the 1999 World Radiocommunication Conference (WRC-99);

7 to consider the Final Report of the Director of the Radiocommunication Bureau on activities related to Resolution 18 (Kyoto, 1994);

8 in accordance with Article 7 of the Convention (Geneva, 1992):

8.1 to consider and approve the Report of the Director of the Radiocommunication Bureau on the activities of the Radiocommunication Sector since the last Conference;

8.2 to recommend to the Council items for inclusion in the agenda for WRC-99, and to give its views on the preliminary agenda for the 2001 Conference and on possible agenda items for future conferences,

invites administrations

to submit their proposals for the work of WRC-97 on the basis of the revised Radio Regulations as adopted by WRC-95 and in accordance with the provisions of Article 30 of the Convention (Geneva, 1992),

instructs the Director of the Radiocommunication Bureau

to make the necessary arrangements to convene meetings of the Conference Preparatory Meeting and to prepare a report to WRC-97,

instructs the Secretary-General

1 to make all the necessary arrangements, in agreement with the Director of the Radiocommunication Bureau, for the convening and holding of the Conference;

2 to communicate this Resolution to concerned international and regional organizations.

APPENDIX I.2

PROGRESS REPORT ON PREPARATIONS FOR CPM-99

Preparations for CPM-99 started, in principle, at RA-95 with the election of a Vice-Chairman for CPM-97 who will continue to serve as Chairman for CPM-99 and with the establishment of the draft agenda for WRC-99.

Attempts have been made to reduce extra meetings and travel, and discussions have taken place in the RAG as well as in the CVC meetings.

It is envisaged to hold the CPM99/1 in the week immediately following WRC-97. This CPM99/1 will be followed by a CVC meeting to organize the work within the Study Groups. This arrangement permits the maximum possible time for the necessary studies to be conducted.

These meetings are scheduled for the end of November 1997 as follows:

Monday 24	Tuesday 25	Wednesday 26	Thursday 27	Friday 28
-	CPM	CPM	CVC	CVC

The CPM preparation for WRC-99, in accordance with Resolution 720 (WRC-95), is shown in the table.

No.	**WRC-99 agenda item**	**Responsible Study Group**
1	**2.2** consideration of Article **S25** concerning the amateur and amateur-satellite services	**SG 8**
2	**2.3** examination of the adequacy of the frequency allocations for HF broadcasting from about 4 MHz to 10 MHz taking into account the planning procedures, if any, adopted by WRC-97 and the needs of other existing services	**SGs 10, 8, 9**
3	**2.4** review of the channel arrangements in HF bands for the maritime mobile service, taking into account the use of new digital technology	**SG 8**
4	**2.5** definition of a new category of orbit, namely the quasi-geostationary orbit, to be considered as falling under the regulations applicable to the geostationary orbit or non-geostationary orbits	**SG 4**

Some studies have already started in some Study Groups and Study Group 9 has already prepared an interim report on issues studied by that Study Group.

The CPM-97 Report has identified additional topics that could be considered for inclusion in the WRC-99 agenda.

These topics are as follows:

1) review of Appendix S7 [28] of the Radio Regulations;

2) revision of the limits for spurious emission for space services (Appendix S3);

3) consideration of incorporation of limits for out-of-band emissions in the Radio Regulations.

An update on the progress on these issues could be made available at WRC-97.

T. Boe (Norway)
Vice-Chairman CPM-97

CHAPTER 1

SIMPLIFIED PROCEDURES

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1 Review of issues remaining from WRC-95 and recommend any essential changes to Articles S4, S7, S8, S9, S11, S13 and S14 and Appendices S4 and S5 of the Simplified Radio Regulations adopted by WRC-95 to ensure consistency between all of their provisions (Agenda item 1.2) 2

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1 Review of issues remaining from WRC-95 and recommend any essential changes to Articles S4, S7, S8, S9, S11, S13 and S14 and Appendices S4 and S5 of the Simplified Radio Regulations adopted by WRC-95 to ensure consistency between all of their provisions (Agenda item 1.2)

1.1 Article S4

Article S4 was reviewed and no inconsistency was discovered between this Article and the other procedures of the Radio Regulations. No need for changes was identified in respect to this article (see also Section 1.3.5).

1.2 Article S7

Article S7 was reviewed and no inconsistency was discovered between this Article and the other procedures of the Radio Regulations. No need for changes was identified in respect to this article.

1.3 Article S8, Status of assignments

1.3.1 Radio Regulations before WRC-95

Under the Radio Regulations in force prior to WRC-95, there are three categories of frequency assignments recorded in the Master Register:

a) Assignments having the right to international protection from harmful interference

- This right is mentioned in RR 1416 as benefiting any frequency assignment bearing a date in Column 2a of the Master Register and in other cases specified under RR 1416. This therefore applies, under specified conditions, only to: assignments of class A stations in the HF fixed service bands, in particular assignments resulting from the application of RR 1218;
- all frequency assignments in the bands approximately below 4 000 kHz, having received a favourable finding with respect to RR 1240 and 1241;
- those assignments which are in conformity with the plans of Appendices **25**, **26** and **27** (Appendices 30, 30A and 30B, although they are part of an international treaty, are not indicated among these appendices);
- frequency assignments to coast radiotelegraphy stations in the bands listed in RR 4209 having received a favourable finding with respect to RR 1240 and 1242.

b) Assignments having international recognition

RR 1217 and 1491 indicate that any frequency assignment shall be notified if it is desired to obtain international recognition for the use of this frequency. It may be assumed that this international recognition is applicable to all assignments recorded in the Master Register with a favourable finding with respect to the conformity with the Constitution/Convention, the Table of Frequency Allocations and the other provisions of the Radio Regulations. The Rules of Procedure of the Radio Regulations Board make the same assumption.

This right is also mentioned in RR 341, which states that new assignments shall be made in such a way as to avoid causing harmful interference to assignments "in accordance with the Table of Frequency Allocations and the other provisions of these Regulations, the characteristics of which are recorded in the MIFR".

c) Assignments recorded for information only

This is the case in particular for assignments not in conformity with the Constitution/Convention, the Table of Frequency Allocations and the other provisions of the Radio Regulations with the exception of those provisions relating to the applicable coordination procedure probability of harmful interference, e.g. not in conformity with RR 1240, 1352 or 1503.

If the use of such assignments results in causing actual harmful interference into assignments in conformity with RR 1240, 1352 or 1503, the station using the former assignments shall, on receipt of advice thereof, immediately eliminate this harmful interference (RR 1419, 1420, 1560).

In this case, an administration cannot claim protection for a receiving frequency assignment in a satellite radiocommunication service.

1.3.2 VGE proposals

The VGE proposed a new article, Article **S8**, relating to the status of assignments recorded in the Master Register. This article was intended to formulate in a more precise way what is now spread over a number of provisions in various articles and appendices of the Radio Regulations.

Following its review, the VGE proposed to keep the existing three types of status, but with different applicability.

Under these proposals

a) The right to international protection from harmful interference would be extended under **S8.2** to any assignments recorded in the Master Register with the indication that it is in accordance with a world or regional[1] allotment or assignment plan (e.g. Appendices **30**, **30A**, **30B**, ST61, GE75) or subsequent modification thereof.

   There would be no routine technical examination in the HF bands, but any assignments in the HF bands that were made following the assistance procedures (selected by BR) would have the right to protection from harmful interference, even though assignments made previously by administrations and not causing interference would not have that right.

b) There would be a right to international recognition (**S8.3**) for those assignments recorded in the Master Register with the indication that they are in accordance with the Table of Frequency Allocations and the associated provisions of these regulations (to be determined by Rules of Procedure). This right would mean that other administrations shall take it into account when making their own assignments in order to avoid harmful interference.

c) An assignment not in accordance with the Table of Frequency Allocations and the associated provisions would be recorded for information (**S8.4**), only when the notifying administration states that it will be operated in accordance with **S8.5** (equivalent to RR 1419, 1420 and 1560).

In summary, the VGE proposals would either extend the previous "definitions" (provision a)) or keep them unchanged (provisions b) and c) parallel provisions b) and c) of the previous situation). During the VGE discussions, there was a suggestion to have an additional status introduced as "the right to continue in operation without disturbance". This would have been used for those assignments which have successfully completed an open, transparent coordination procedure - or a plan modification procedure - without success, but have received a favourable conclusion from an

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[1] In the case of a regional plan, such protection shall be limited to the countries which are parties to the regional agreement.

examination by the Bureau with regard to potential interference. The VGE decided however that little would be gained from this action and the concept was abandoned (VGE Report, Part A, section 3.2.11).

1.3.3 WRC-95 decisions

The WRC-95 decision was based on the view expressed by a majority of administrations. However, a significant minority was opposed to this decision. WRC-95 agreed in Article **S8** to have only two types of status, international recognition and for information.

a) Right to international recognition (**S8.3**)

Any assignment recorded with a favourable finding under **S11.31** (conformity with the Table and the "other provisions"), **S11.34** (conformity with a Plan) and **S11.41** (4 month joint operation without interference), as appropriate, shall have the right to international recognition.

This is the right proposed in VGE **S8.3,** but applied to the assignments listed in VGE **S8.2** and **S8.3.** WRC-95 considered the option of keeping VGE proposed **S8.2**, but this provision was suppressed after a formal vote.

b) For information

As per VGE **S8.4,** non-conforming assignments are for information only.

Under the existing Radio Regulations, the VGE proposals as well as the WRC-95 Regulations, all complaints of harmful interference are to be resolved between the administrations on a bilateral basis with no reference to the status or preference being given to those assignments having a higher status.

1.3.4 Consistency within the simplified procedures regarding the status of assignments

Concerning the simplified procedures, the status of assignments recorded in the Master Register, as defined under Article **S8**, has not led to identifying any inconsistency at this stage, within the Articles concerned, with the exception of **S8.3** in relation to **S8.1** and **S4.3**.

1.3.5 Proposed solution

After significant efforts to identify an acceptable solution to establish a clear presentation of the status of assignments recorded in the Master Register, the following is proposed.

NOC **S4.3**
MOD **S8.3**

Any frequency assignment recorded in the Master Register with a favourable finding under Nos~~.~~ **S11.31** ~~to **S11.34** and **S11.41**, as appropriate,~~ shall have the right to international recognition. For such an assignment, this right means that other administrations, ~~recognizing No. **S4.3** , recognizing No. **S4.2** and **S4.3**,~~ shall take it into account when making their own assignments, in order to avoid harmful interference. In addition, frequency assignments in frequency bands subject to a coordination or to a plan shall have a status derived from the application of the procedures relating to the coordination or from those associated with the plan.

1.4 Article S9 and S11 and Appendix S5

Significant inconsistencies have been identified within the provisions of Article **S9**, in particular in relation to Appendices **S30** and **S30A**. Possible solutions to correct these inconsistencies are provided in Section 1.4.3.

A general difficulty identified within Article **S9** is that the current drafting of the entry points in the procedure (**S9.7** to **S9.21**) and of the associated points in the Table of Appendix **S5** is not consistent throughout the procedure. A way of ensuring this consistency would be to clearly state for each of these provisions in Article **S9**, the following elements:

– which station (transmit/receive, earth/terrestrial, ...) is the reason for seeking coordination;

– in which service, frequency band, geographic area, conditions;

– in respect of which station;

– in which service, frequency band, geographic area, conditions;

– possible exceptions.

A possible example of such a drafting is provided hereafter in the case of **S9.7**:

S9.7 a) for a station in a satellite network using the geostationary-satellite orbit, in any space radiocommunication service, in a frequency band and in a region where this service is not subject to a Plan, in respect of any other satellite network using that orbit, in any space radiocommunication service in a frequency band and in a region where this service is not subject to a Plan, with the exception of the coordination under No. **S9.17A**.

Also, the specific conditions used in identifying the affected administration (such as "when the coordination areas of the earth station includes the territory of another country") should only appear in the associated provisions of Appendix **S5**, in the column "threshold/condition".

It would also be necessary to explicitly identify the administration from which coordination is to be sought, even though this may be obvious in many cases. Such a clarification would be needed in particular, in the case of coordination among earth and terrestrial stations, where the administration from which coordination is to be sought is any administration the territory of which is contained, either partially or completely, within the coordination area (see possible addition ADD **S9.6.2**).

There is also an ambiguity as to the meaning of the heading of the column "Frequency bands" in Table **S5-1**. It should be clarified that this column contains the frequency band applicable to the station which is at the origin of the coordination request.

1.4.1 Relationship with Resolution 46

To address the need to map the existing provisions under Resolution 46 into Articles **S9** and **S11** and Appendix **S5** and ensure that these simplified provisions appropriately reflect those adopted by WRC-95 under Resolution 46 (WRC-95), a detailed comparison was undertaken, the conclusion of which is that the only significant differences between the two procedures are the following:

- Current Table **S5-2** does not include threshold values to use for coordination above 3 GHz (this only concerns the band 15.45 - 15.65 GHz).
- S9.49 states that in the case an administration fails to reply to the Bureau within 30 days of the Bureau's request, the use of its own assignment will not cause harmful interference to the assignment for which coordination was requested. The corresponding point under Resolution 46 (par. 2.18.3), does not cover the case of terrestrial station which have been notified. Section 1.4.1.3 contains a proposal to correct this difficulty (see **S9.52C**)).

1.4.2 Relationship with Appendices S30 and S30A

Concerning the relationship between Articles **S9** and **S11** on one hand and Appendices S30 and S30A on the other hand, it appears that the current text of Articles **S9** and **S11** is not consistent in that **A.S9.3** refers the coordination of other services with Appendices 30 and 30A Plans to these Appendices, whereas **S9.8, S9.9, S9.17A, S9.18** and **S9.19** address this coordination, and **A.S11.1** refers the notification of assignments in the Plans to Appendices 30 and 30A, but does not address consistently the notification of assignments to other services in the same frequency bands where assignments in the Plans could be affected.

In order to clarify this relationship and resolve these inconsistencies, two possible approaches have been considered, which are described in more detail in Section 6.5.1.2 of this Report. Approaches 1 and 2 differ by the location of the procedures relating to Appendices 30 and 30A Plans, and possibly by the degree of simplification.

Under Approach 1, the procedures relating to the other services in respect of the Plans are located in Appendices 30 and 30A (current Articles 6 and 7 of these Appendices and associated provisions) and several provisions under **S9** are either modified or suppressed. Under Approach 2, these procedures are located in Articles **S9** and **S11** (Final Acts of WRC-95) and Articles 6 and 7 of Appendices 30 and 30A are no longer needed.

1.4.3 Examples of possible modifications to Article S9 and Appendix S5

On the basis of the above considerations, the following examples of possible modifications to Article **S9** and Appendix **S5** have been developed. To clarify the differences between the two approaches, provisions specific to Approach 1 are given in the left-hand column, those specific to Approach 2 are provided in the right-hand column. The provisions common to both approaches are provided in the middle column. It can be seen that both approaches differ for only a small number of provisions and that there is the same number of provisions requiring modifications under both approaches. Only those parts where modifications are proposed to the current text of these provisions, as it appears in the Final Acts of WRC-95, are reproduced.

In these examples, no attempt has been made to modify the substance of the procedures applying to other services in respect of Appendices 30 and 30A. In this way, Article **S9** would contain provisions applicable to these services which would be equivalent to those currently contained in Articles 6 and 7 of Appendices 30 and 30A and the other relevant provisions of the Radio Regulations (e.g. Resolution 34 and **S5.491**), where appropriate. Any change of substance which may be required in these provisions to resolve possible difficulties identified in the procedures of Appendices 30 and 30A is to be addressed under agenda item 1.10 (see Section 6.5.4 of this Report).

1.4.4 Article S11

Potential inconsistencies within Article **S11** or between this Article and the other procedures of the Radio Regulations in particular Appendices S30, S30A and S30B, have been identified. Examples of possible modifications to resolve these inconsistencies under both Approaches 1 and 2 in respect of Article **S11** are provided below.

Explanations or comments are in *italics* and given in boxes under the relevant provision, proposed modifications to the text of Article **S11** appearing in the Final Acts of WRC-95 are double-underlined.

Article **S9**		
Text specific to Approach 1	**Text common to both Approaches 1 or 2**	**Text specific to Approach 2**
	Procedure for Effecting Coordination with or Obtaining Agreement of Other Administrations[1, 2, 3, 4] **Section I. Advance Publication of Information on Planned Satellite Networks or Satellite Systems** **MOD** **A.S9.1** [1] For the application of the provisions of this Article with respect to stations in a space radiocommunication service using frequency bands covered by the fixed-satellite service allotment plan, see also Appendix **S30B** ~~and Resolution **107 (Orb-88)**~~. • *Reason: Consequential to the suppression of Resolution 107, as proposed by the CPM.*	
MOD **A.S9.3** [3] See Appendices **S30** and **S30A** respectively for the coordination of: a) proposed modifications to the Appendices **S30** Plan for the broadcasting-satellite service in the frequency bands 11.7 - 12.2 GHz (in Region 3), 11.7 - 12.5 GHz (in Region 1) and 12.2 - 12.7 GHz (in Region 2), with respect to frequency assignments in the same service or in other services to which these bands are allocated; b) frequency assignments in other services to which the frequency bands referred to in a) above are allocated, with respect to assignments in the broadcasting-satellite service which are subject to Appendix **S30** Plans;	~~**A.S9.3** [3] See Appendices **S30** and **S30A** for the coordination of frequency assignments of other services in relation to stations of the broadcasting satellite service and to stations of feeder links for this service in the bands covered by those Appendices~~	**MOD** **A.S9.3** [3] See Article T4/Appendices **S30** and **30A** respectively for the coordination of proposed modifications to: – the Appendix **30** Plans for the broadcasting-satellite service in the frequency bands 11.7 - 12.2 GHz (in Region 3), 11.7 - 12.5 GHz (in Region 1) and 12.2 - 12.7 GHz (in Region 2) with respect to frequency assignments in the same service or other services to which these bands are also allocated, *and* – the Appendix **30A** Plans for the feeder-link stations utilizing the fixed-satellite service (Earth-to-space) in the frequency band 17.3 - 17.8 GHz (in Region 2) and in the frequency bands 14.5 - 14.8 GHz and 17.3 - 18.1 GHz in Regions 1 and 3 with respect to frequency assignment in the same service or in other services to which these bands are also allocated.

c) proposed modifications to the Appendices **S30A** Plan for the feeder links to the broadcasting-satellite service in the frequency bands 17.3 - 17.8 GHz (in Region 2), and 14.5 - 14.8 GHz and 17.3 - 18.1 GHz (in Regions 1 and 3), with respect to frequency assignments in the same service or in other services to which these bands are allocated; d) frequency assignments in other services to which the frequency bands referred to in c) above are allocated, with respect to assignments in the fixed-satellite service (Earth-to-space) which are subject to Appendix **S30A** Plan. For the broadcasting-satellite service and for the feeder links in the fixed-satellite service for the broadcasting-satellite service in Region 2, Resolution **42 (Orb-85)** is also applicable. • *Reason: Reflect the current provisions of Articles 15 and 15A, which is the current entry point to Appendices 30 and 30A procedures.*		For the broadcasting-satellite service and for feeder links in the fixed-satellite service for the broadcasting-satellite service in Region 2, Resolution **42 (Rev.Orb-88)** is also applicable. • *Reason: Reflect the current provisions of Articles 15 and 15A.*
	Section I - Advance Publication of Information on Planned Satellite Networks or Satellite Systems	
	MOD **S9.2** Amendments to the information sent in accordance with the provisions of No. **S9.1** shall also be sent to the Bureau as soon as they become available. ~~For geostationary-satellite networks and non-geostationary-satellite networks which are subject to Section II of Article **S9**,~~ The use of an additional frequency band will require the application of the advance publication procedure for this band. ~~For non-geostationary-satellite networks which are not subject to Section II of Article **S9**, the use of an additional frequency band or an extension of the service area will require the application or recommencing, respectively, of the advance publication procedures for these modifications (see Resolution 48 (WRC-95)).~~	

	• *Reason: The reference to the service area in the last sentence may create difficulties in cases where the coverage area of a system is not modified, but the service area is augmented by the addition of one or several countries. This addition would normally result in no increase interference. On the other hand, the term "coverage area" is not defined in Article 1 of the Radio Regulations. Finally, there is a need for equal treatment for all types of satellite systems.*	
	Sub-Section IIA. Requirement and Request for Coordination **MOD S9.6** Before an administration[1,2] notifies to the Bureau or brings into use a frequency assignment in any of the cases listed below, it shall effect coordination, as required, with other administrations identified under No. **S9.27**:	
	MOD S9.6.1 [1] In the case of coordination of an assignment in a satellite network ~~in relation to another satellite network~~, an administration may act on behalf of a group of named administrations. Whenever, under this provision, an administration acts on behalf of a group of named administrations, all members of the group retain the right to respond in respect of their own services which could affect or be affected by the proposed assignment ~~networks or systems~~. **ADD S9.6.2** [2] In all cases, the coordination of an earth station with terrestrial stations or other earth stations operating in the opposite direction of transmission shall remain within the authority of the administration on the territory of which this station is located. • *Reason: This addition proposed by the SC has a more general scope than the case of multi-administration systems.*	

	MOD **S9.7** a) for a station in a satellite network using the geostationary-satellite orbit, in any space radiocommunication service, in a frequency band and in a region where this service is not subject to a Plan, in respect of any other satellite network using that orbit, ~~for~~ in any space radiocommunication service~~s and frequency bands except those covered by the Plans of Appendices **S30, S30A** and **S30B**~~ in a frequency band and in a region where this service is not subject to a Plan, with the exception of the coordination under No **S9.17A**. • *Note: There is no provision for the coordination of a receive space station in the FSS (Earth-to-space) in the bands 10.7 - 10.95 GHz and 11.2 - 11.45 GHz with Appendix 30B Plan.*	
SUP S9.8		**MOD** **S9.8** b)~~[2]~~ for a transmitting space station ~~of the fixed satellite service~~ using the geostationary-satellite orbit, in any space radiocommunication service where this service is not subject to a plan, in a frequency band ~~shared~~ which is also allocated to the broadcasting- satellite service and subject to ~~on an equal primary basis with the~~ Appendix **S30** plan ~~for the broadcasting satellite service~~, in respect of ~~stations of the latter service which are subject to the Appendix **S30**~~ this Plan; • *Reason: Take account of **S5.491**.*

~~[2] Application of these provisions is suspended pending the decision of the 1997 World Radiocommunication Conference on revision of Appendices **30** and **30A** with respect to Articles **6** and **7** of those two Appendices.~~

SUP S9.9		**MOD** **S9.9** c)[2] for a ~~transmitting~~ space station of any space ~~the fixed satellite~~ service using the geostationary-satellite orbit in a frequency band ~~shared on an equal primary basis with~~which is also allocated to the fixed satellite service for the feeder links of the broadcasting-satellite service and~~which are~~ is subject to the Appendix **S30A** Plan, in respect to this Plan, with the exception of the coordination under No **S9.17A**; • *Reason: Take account of the BSS allocation in Region 2 in the bands 17.3 - 17.8 GHz, as currently reflected in Article 7 of Appendix 30A.* • *Note: The case of a transmit feeder link earth station in Region 2 coordinating with a receive space station in Region 1 and 3 is not currently covered by Article 7 of Appendix 30A.*
	MOD **S9.11** d) for a space station in the broadcasting-satellite service in any band shared on an equal primary basis with terrestrial services and ~~in which there is no plan for~~where the broadcasting-satellite service is not subject to a plan, in respect of terrestrial services;	
	NOC **S9.11A** e) for a station for which the requirement to coordinate is included in a footnote of the Table of Frequency Allocations referring to this provision: **MOD** **S9.13** ii) 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 the coordination under No. **S9.17A**;	

	MOD **S9.17** f)[3] 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** and under Article 4/T4 of Appendix **30** and Article 4/T4 of Appendix **30A**;	
MOD **S9.17A** g) 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~~, with the exception of the frequency bands subject to Appendix 30A Plans;		**MOD** **S9.17A** g) 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~~;
	MOD **S9.18** h) 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 an earth station, with the exception of the coordination under No. **S9.16** and **S9.19**;	

[3] ~~Application of these provisions is suspended pending the decision of the 1997 World Radiocommunication Conference on revision of Appendices **30** and **30A** with respect to Articles **6** and **7** of those two Appendices.~~

		ADD **S9.18 A** h) for any receiving station of a terrestrial service in the frequency bands covered by Appendix **30A**, in respect of a feeder link earth station in conformity with Appendix **30A** Plan. • *Reason: Reflect Article 6 of Appendix 30A.*
MOD **S9.19** i)[4] for any transmitting station of a terrestrial service in a frequency band shared on an equal primary basis with the broadcasting-satellite service except where this service is subject to the Appendix 30 Plan; • ***Note:*** *For unplanned BSS, coordination criteria need to be developed.*		**MOD** **S9.19** i)[4] for any transmitting station of a terrestrial service in a frequency band shared on an equal primary basis with the broadcasting-satellite service or also allocated to this service; • ***Note:*** *This is intended to reflect, among others, Article 6 of Appendix S30. There may be a need to limit the scope of this provision to the protection of "original" assignments in the Plan. The coordination criteria in the case of Appendix S30 can be found in Appendix S30. For unplanned BSS, coordination criteria need to be developed.*
MOD **S9.32** If the responsible administration concludes that coordination is not required under Nos. **S9.7** ~~to S9.9~~, it shall send the relevant information pursuant to Appendix **S4** to the Bureau for action under No. **S9.34**.		

[4] ~~The application of these provisions with respect to the bands and services of Articles **6** and **7** of Appendices **30** and **30A** is suspended pending the decision of the 1997 World Radiocommunication Conference on revision of Appendices **30** and **30A**.~~

MOD **S9.41** Following receipt of the Weekly Circular referring to a request~~s~~ for coordination under No~~s~~. **S9.7** ~~to S9.9~~, an administration believing that it should have been included in the request shall, within four months of the date of publication of the relevant Weekly Circular, inform the initiating administration and the Bureau, giving its technical reasons for doing so, and shall request that its name be included.		
	MOD **S9.43** ~~Following action under No. **S9.41**, t~~Those administrations not responding under **S9.41** within the time limit specified in No. **S9.41** shall be regarded as unaffected and the provisions of Nos. **S9.48** and **S9.49** shall apply. • *Reason: Inconsistency between the action taken under **S9.41** (respond within 4 months) and the fact that in this case, there was no action under **S9.41**.*	
	Sub-Section IIB. Acknowledgement of Receipt of a Request for Coordination	
	Sub-Section IIC. Action Upon a Request for Coordination	
	MOD **S9.50** An administration having received a request for coordination under Nos. **S9.7** to **S9.21**, or having been included in the procedure following action under No. **S9.41**, shall promptly examine the matter with regard to interference which may be caused to, or in certain cases, by its own assignments[2], identified in accordance with Appendix **S5**[3].	

	• *Reason: The current text is misleading in that it implies that Appendix **S5** is used to evaluate interference levels, whereas it is mentioned here to indicate that only those assignments which have been identified in accordance with Appendix **S5** are to be considered in the coordination process.*	
MOD S9.51 Following its action under No. **S9.50**, the administration with which coordination was sought under Nos. **S9.7** ~~to S9.9~~ shall, within four months of the date of the relevant Weekly Circular, either inform the requesting administration and the Bureau of its agreement or act under No. **S9.52**.		
	MOD S9.52 If an administration, following its action under Nos. **S9.50**, does not agree to the request for coordination, it shall, within ~~the same~~ four-months of the date of dispatch of the coordination data, or from the date of publication of the information under **S9.38** ~~period~~, inform the requesting administration of its disagreement and shall provide information concerning its own assignments upon which that disagreement is based. It shall also make such suggestions as it is able to offer with a view to satisfactory resolution of the matter. A copy of that information shall be sent to the Bureau. Where the information relates to terrestrial stations or earth stations operating in the opposite direction of transmission within the coordination area of an earth station, only that information relating to existing radiocommunication stations or to those to be brought into use within the next three months for terrestrial stations, or three years for earth stations, shall be treated as notifications under Nos. **S11.2** or **S11.9**.	

	• *Reason: The reference to the "same" four month period is misleading in the case of coordination under **S9.11, S9.12, S9.13, S9.14** and **S9.21**, where there is no mention of such a period until this paragraph.*	
	MOD **S9.52C** For coordination requests under Nos. **S9.11** to **S9.14** and **S9.21**, an administration not responding under No. **S9.52** within the same four-month period shall be regarded as unaffected and, in the cases of **S9.11** to **S9.14**, the provisions of Nos. **S9.48** and **S9.49** shall apply. However, **S9.49** shall not apply to assignments to terrestrial stations which have been notified to the Bureau prior to the expiry of the same four-month period nor to assignments to terrestrial stations notified in accordance with *resolves* 1 of Resolution 716. • *Reason**:** Alignment of **S9.52C** with 2.16 d) of Resolution 46 (Rev.1 WRC-95). Similar provision should also be applied to the benefit of terrestrial services under **S9.11**.*	

APPENDIX S5

Identification of Administrations with Which Coordination Is to Be Effected or Agreement Sought Under the Provisions of Article S9

	MOD 1 For the purpose of effecting coordination under Article **S9**, except in the case under No. **S9.21**, and for identifying the administrations with which coordination is to be effected, the frequency assignments to be taken into account are those in the same frequency band as the planned assignment, pertaining to the same service or to another service to which the band is allocated with equal rights or a higher category[1] of allocation, which might affect or be affected, as appropriate, and which are:	
	a) in conformity with No. **S11.31**[2]; and	
	b) either recorded in the Master Register with a favourable finding with respect to No. **S11.32**; or	
	c) recorded in the Master Register with an unfavourable finding with respect to No. **S11.32** and a favourable finding with respect to No. **S11.32bis** or No. **S11.33**, as appropriate; or	
	d) coordinated under the provisions of Article **S9**; or	

[1] The coordination between an earth station and terrestrial stations under Nos**. S9.15**, **S9.16**, **S9.17**, **S9.18** and **S9.19**, or between earth stations operating in opposite directions of transmission under **S9.17A**, applies only to assignments in bands allocated with equal rights.

[2] For the purpose of effecting coordination, an assignment for which the process of obtaining agreement under No. **S9.21** has been initiated is considered to be in conformity with No. **S11.31** with respect to No. **S9.21.**

	e) included in the coordination procedure with effect from the date of receipt[3] by the Bureau, in accordance with No. **S9.34**, of the basic characteristics as specified in Appendix **S4**, or from the date of dispatch, in accordance with No. **S9.29** of the appropriate information listed in Appendix **S4**; or • *Reason: In the case of earth stations or terrestrial stations subject to **S9.15** to **S9.19**, the rights are starting from the date of dispatch of Appendix **S4** information. This point is not mentioned in f) below.*	
	ebis) Where appropriate, in conformity with a world or regional allotment or assignment plan and the associated provisions • *Reason: **Match** S11.34.*	
	f) for terrestrial radiocommunication stations or earth stations operating in the opposite direction of transmission[4], in addition, operating in accordance with these Regulations, or to be so operated prior to the date of bringing the earth station assignment into service, or within the next three years from the date of dispatch of coordination data under No. **S9.29**, whichever is the longer, or from the date of the publication referred to in No. **S9.38**, as appropriate.	

[3] See No. **S9.1** concerning the date to be considered as the date of receipt by the Bureau of the information relating to the coordination of a satellite network or the notification of a frequency assignment.

[4] The associated space network characteristics must have been communicated to the Bureau under No. **S9.2B**.

	• *Reason: The sequence of "and" and "or" leads to the conclusion that terrestrial and earth stations are only concerned with f).*	
	• *Note: In the case of S9.19, the BSS earth stations to be taken into account in the coordination have to be notified or coordinated or under coordination. This is not possible since they are not specific stations.*	

Note: In Table S5.1, under Approach 1, S9.8, S9.9 are deleted. Consequential amendments to S9.17A and S9.19 are also necessary.

TABLE S5.1

Technical conditions for coordination (See Article S9)

	Reference of Article S9	Case	Frequency bands (and Region) of the service for which coordination is sought	Threshold/Condition	Calculation method	Remarks
MOD	No. **S9.7** GSO/GSO	A station in a satellite network using the geostationary-satellite orbit, in any space radiocommunication service, in a frequency band and in a region where this service is not subject to a Plan, in respect of any other satellite network using that orbit, ~~for~~ in any space radiocommunication service in a frequency band and in a region where this service is not subject to a Plan, with the exception of the coordination under No **S9.17A**.	Any frequency band allocated to a space service, where this service is not subject to a Plan, ~~except those mentioned in the plans of Appendices **S30**, **S30A** and **S30B**~~	Value of $\Delta T/T$ exceeds 6%	Appendix **S8**	

MOD	No. **S9.8** GSO/GSO	A transmitting space station ~~of the fixed satellite service~~ using the geostationary-satellite orbit, in any space radiocommunication service where this service is not subject to a plan, in a frequency band shared on an equal primary basis with the Appendix **S30** plan for the broadcasting-satellite service, in respect of ~~stations of the latter service which are subject to the Appendix **S30**~~ this Plan;	11.7 - 12.2 GHz (R2) 12.2 - 12.7 GHz (R3) 12.5 - 12.7 GHz (R1)	i) There is an overlap in the necessary bandwidths of the space stations ~~of FSS and BSS~~; and ii) the power flux-density (pfd) of the transmitting space station ~~of the **FSS**~~, assumed under free space propagation conditions, exceeds, on the territory of another administration located in another region, the following value: ~~given in Annex 4 of Appendix **S30** on the territory of another administration located in another region~~. -147 dB(W/m^2/27 MHz) for $0° \le \theta < 0.44°$, -138 + 25 log θ dB(W/m^2/27 MHz) for $0.44° \le \theta < 19.1°$, -106 dB(W/m^2/27 MHz) for $19.1° \le \theta$, where θ is the difference in degrees between the longitudes of the space stations.	Check by using the assigned frequencies and bandwidths;	~~See also Article **7** of Appendix **S30**.~~ ~~The application of these provisions with respect to the bands and services of Articles **6** and **7** of Appendices **30** and **30A** is suspended pending the decision of WRC-97 on revision of Appendices **30** and **30A**.~~

MOD	No. **S9.9** GSO/GSO	A Space station of any space ~~the fixed satellite~~ service using the geostationary-satellite orbit in a frequency band shared on an equal primary basis with the feeder links of the broadcasting-satellite service which are subject to Plan the Appendix **S30A** in respect to this Plan, with the exception of the coordination under No. **S9.17A**;	17.7 - 18.1 GHz (R1) 17.7 - 18.1 GHz (R3) 17.7 - ~~17.8~~ 18.1 GHz (R2)	i) Value of $\Delta T_S/T_S$ exceeds 4% ~~(see Section 1 of Annex 4 of Appendix **S30A**);~~ and ii) geocentric inter-satellite angular separation is less than 3° or greater than 150°	i) Case II of Appendix **S8** ii) Annex I of Appendix **S8**	The threshold/ conditions do not apply when the geocentric angular separation, between the ~~a~~ transmitting space station ~~in the fixed-satellite service~~ and the ~~a~~ receiving feeder link space station ~~in the feeder-link Plan~~, exceeds 150° of arc and the free-space power flux-density of the transmitting space station ~~in the fixed satellite service~~ does not exceed a value of -137 dB(W/m^2/MHz) on the surface of the Earth at the equatorial limb. ~~The application of these provisions with respect to the bands and services of Articles **6** and **7** of Appendices **30** and **30A** is suspended pending the decison of WRC-97 on revision of Appendices **30** and **30A**.~~
			17.8 - 18.1 GHz (R2)	Value of $\Delta T_S/T_S$ exceeds 6%	i) Case I of Appendix **S8**	

MOD	No. **S9.11** GSO/terrestrial	A space station in the broadcasting-satellite service in any band shared on an equal primary basis with terrestrial services and ~~in which there is no plan for~~where the broadcasting-satellite service 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 (R3) 17.~~3~~7- 17.8 GHz (R2) 21.4 - 22 GHz (R1, R3) 40.5 - 42.5 GHz 84 - 86 GHz	Condition: Bandwidths overlap	Check by using the assigned frequencies and bandwidths	
MOD	No. **S9.13** GSO/Non-GSO	A station in a satellite network using the geostationary-satellite orbit in the frequency bands for which a footnote refers to **S9.11bis** in respect of any other satellite network using a non-geostationary-satellite orbit, with the exception of the coordination under **S9.17A**	See Table **S5-1A**	Condition: Bandwidths overlap	Check by using the assigned frequencies and bandwidths	

MOD	No. **S9.14** Non-GSO/ terrestrial, GSO/terrestrial	a space station in a satellite network in the frequency bands for which a footnote refers to **S9.11A** in respect of stations of terrestrial services where threshold(s) is (are) exceeded	See Table **S5-1A**	For a non-GSO space station: See ~~Table S5-2~~ **Section 1 of Annex 1** *Reason: Table **S5-2** does not exist*	See ~~Table S5-2~~ **Section 1 of Annex 1** • *Reason: Table **S5-2** does not exist*	
NOC	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 **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 **S5-1A**	The coordination area of the earth station covers the territory of another administration	See Section **2** of Annex **1**	

MOD	No. **S9.16** terrestrial/ non-GSO	A transmitting station of a terrestrial service within the coordination area of an earth station in a non-geostationary-satellite network in frequency bands for which a footnote refers to **S9.11A**	See Table **S5-1A**	Transmitting terrestrial station is situated within the coordination area of a receiving earth station ~~which has already been coordinated~~		The coordination area of the affected earth station has already been determined using the calculation method of No. **S9.15**
MOD	No. **S9.17** GSO, non-GSO/ terrestrial	A specific earth station or a typical mobile earth station in frequency bands above 1 GHz allocated with equal rights to space and terrestrial services in ~~relation to~~ respect of terrestrial stations, where the coordination area of the earth station includes the territory of another country	Any frequency band allocated to a space service, except ~~those mentioned in the plans of Appendix **S30**~~**:** 11.7 - 12.5 GHz (R1) 11.7 - 12.2 GHz (R3) 12.2 - 12.7 GHz (R2)	The coordination area of the earth station covers the territory of another administration	Appendix **S7** (For earth stations in the radiodetermination-satellite service (RDSS) in the bands 1 610 - 1 626.5, 2 483.5 - 2 500 and 2 500 - 2 516.5 MHz, see Remarks column) 1) The coordination area of aircraft earth stations is determined by increasing the service area by 1 000 km with respect to the aeronautical mobile service (terrestrial) or 500 km with respect to terrestrial services other than the aeronautical mobile service.	***Note**: For RDSS earth stations, a uniform coordination distance of 400 km corresponding to an airborne earth station shall be used. In cases where the earth stations are all ground-based, a coordination distance of 100 km shall be used.*

					2) For receiving earth stations in the meteorological-satellite service in frequency bands shared with 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.	~~The application of these provisions with respect to the bands and services of Articles **6** and **7** of Appendix **30A** is suspended pending the decision of WRC-97 on revision of Appendix **30A**.~~
MOD	No. **S9.17A** GSO, non-GSO/ GSO, non-GSO	A 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, 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 a coordinated earth station	Any frequency band allocated to a space service	The coordination area of the earth station covers the territory of another administration or the earth station is located within the coordination area of a~~n coordinated~~ earth station	i~~) for bands in Table **S5-1A**, see Table **S5-2**~~ ~~ii) see Recommendations ITU-R IS.847, IS.848 and IS.849~~ Appendix S7 (WRC-97) (a special section needs to be included in Appendix S7 to protect the service area in the case of Appendices 30 and 30A)	~~The application of these provisions with respect to the bands and services of Articles **6** and **7** of Appendices **30** and **30A** is suspended pending the decision of WRC-97 on revision of Appendices **30** and **30A**.~~

MOD	No. **S9.18** terrestrial/GSO, non-GSO	Any transmitting station of a terrestrial service in the bands mentioned in No. **S9.17** within the coordination area of an earth station in a frequency band allocated with equal rights to terrestrial and space radio-communication services, with the exception of the coordination under **S9.16 and S9.19**	Any frequency band allocated to a space service~~, except those mentioned in Appendices **S30** and **S30A**~~**.**	Transmitting terrestrial station is situated within the coordination area of a~~n already coordinated~~ receiving earth station	See remarks	The coordination area of the affected earth station has already been determined using the calculation method of No. **S9.17**
ADD	No. **S9.18 A** terrestrial/GSO, non-GSO	Any receiving terrestrial station in the frequency bands covered by Appendix 30A, located within the coordination area of a broadcasting satellite service feeder link earth station.	17.7 - 18.1 GHz	Receiving terrestrial station is situated within the coordination area of a feeder link earth station in conformity with Appendix 30A Plan.		
MOD	No. **S9.19** terrestrial/GSO	A transmitting station of a terrestrial service in a frequency band shared on an equal primary basis with the BSS	11.7 - 12.7~~2~~ GHz ~~(R3) 11.7 - 12.5 GHz (R1) 12.2 - 12.7 GHz (R2)~~ (R1, 2 and 3) and the bands listed in No. **S9.11** • *Reason: Current draft does not take into account interregional sharing.*	i) Necessary bandwidths overlap; and ii) the pfd of the terrestrial station at the edge of the BSS service area exceeds the permissible level	i) Check by using the assigned frequencies and bandwidths ii) Annex 3 to Appendix **S30** for the band~~s covered by that Appendix~~ 11.7-12.7 GHz. • *Note: For unplanned BSS, the coordination criteria need to be developed.*	~~See also Article **6** of Appendix **S30**~~ ~~The application of these provisions with respect to the bands and services of Articles **6** and **7** of Appendices **30** and **30A** is suspended pending the decision of WRC-97 on revision of Appendices **30** and **30A**.~~

Approach 1	COMMON TO APPROACH 1 AND APPROACH 2	Approach 2
	ARTICLE S11 **Notification and Recording of Frequency Assignments**[1]	
Section I. Notification **MOD A.S11.1** ~~1 For the notification and recording of assignments in the following Regions and frequency bands see also the appropriate Appendices:~~ See Appendices **S30** and **S30A** respectively, for the notification and recording of: a) frequency assignments to stations in the broadcasting-satellite service in the frequency bands 11.7 - 12.2 GHz (in Region 3), 11.7 - 12.5 GHz (in Region 1) and 12.2 - 12.7 GHz (in Region 2), b) frequency assignments in other services to which the frequency bands referred to in a) above are allocated, so far as their relationship to the broadcasting satellite service which is subject to Appendix S30 is concerned, c) frequency assignments to feeder-link stations in the fixed-satellite service (Earth-to-space) in the frequency bands 14.5 - 14.8 GHz in Region 1 (see No. **863**) and in Region 3, 17.3 - 18.1 GHz in Regions 1 and 3, and 17.3 - 17.8 GHz in Region 2 and other services in these bands, d) frequency assignments in the same service or in other services to which the frequency bands referred to in c) above are allocated, so far as their relationship to the fixed-satellite service (Earth-to-space) in these bands is concerned. For the broadcasting-satellite service in Region 2 and for feeder links in the fixed-satellite service for the broadcasting-satellite service in Region 2, Resolution **42 (Rev.Orb-88)** is also applicable.		**Section I. Notification** **MOD A.S11.1** 1 For the notification and recording of assignments in the following Regions and frequency bands see the appropriate ~~Appendices~~provisions:

See also Appendix 30B for the notification and recording of assignments in the following frequency bands: **All Regions, fixed-satellite service only** 4 500 - 4 800 MHz (space-to-Earth) 6 725 - 7 025 MHz (Earth-to-space) 10.7 - 10.95 GHz (space-to-Earth) 11.2 - 11.45 GHz (space-to-Earth) 12.75 - 13.25 GHz (Earth-to-space)		
~~Region 1~~	**~~Region 2~~**	**~~Region 3~~**	**~~Appendix~~**
~~11.7 - 12.5 GHz~~	~~12.2 - 12.7 GHz~~	~~11.7 - 12.2 GHz~~	**~~S30~~**
~~14.5 - 14.8 GHz~~ ~~17.3 - 18.1 GHz~~	~~17.3 - 17.8 GHz~~	~~14.5 - 14.8 GHz~~ ~~17.3 - 18.1 GHz~~	**~~S30A~~**
~~All Regions, fixed-satellite service only~~ ~~4 500 - 4 800 MHz~~ ~~(space-to-Earth)~~ ~~6 725 - 7 025 MHz~~ ~~(Earth-to-space)~~ ~~10.7 - 10.95 GHz~~ ~~(space-to-Earth)~~ ~~11.2 - 11.45 GHz~~ ~~(space-to-Earth)~~ ~~12.75 - 13.25 GHz~~ ~~(Earth-to-space)~~		~~See also S30B~~	**~~See also Appendix 30B~~**

Region 1	**Region 2**	**Region 3**	**Provisions**
11.7 - 12.5 GHz	12.2 - 12.7 GHz	11.7 - 12.2 GHz	~~Section 2 of Article S10~~ **Article T5/Appendix S30**
14.5 - 14.8 GHz 17.3 - 18.1 GHz	17.3 - 17.8 GHz	14.5 - 14.8 GHz 17.3 - 18.1 GHz	~~Section 2 of Article S10~~ **Article T5/Appendix S30A**
All Regions, fixed-satellite service only 4 500 - 4 800 MHz (space-to-Earth) 6 725 - 7 025 MHz (Earth-to-space) 10.7 - 10.95 GHz (space-to-Earth) 11.2 - 11.45 GHz (space-to-Earth) 12.75 - 13.25 GHz (Earth-to-space)		~~See also S30B~~	See also Appendix S30B

	MOD S11.14 Frequency assignments ~~for~~to ship stations and ~~for~~to mobile stations of other services, ~~for~~to stations in the amateur service, ~~for~~to earth stations in the amateur-satellite service, and those ~~for~~to broadcasting stations in the high frequency bands 5 950 - 6 200 kHz, 7 100 - 7 300 kHz (Regions 1 and 3), 9 500 - 9 900 kHz, 11 650 - 12 050 kHz, 13 600 - 13 800 kHz, 15 100 - 15 600 kHz, 17 550 - 17 900 kHz, 21 450 - 21 850 kHz, 25 670 - 26 100 kHz~~,~~ which are subject to Article **S12A** ~~applies~~ shall not be notified under this Article.	
	MOD S11.18 Stations covered by the allotment ~~or assignment~~ plan of Appendices **S25, S26, S27**;	
	MOD S11.21 d) any terrestrial stations in bands shared with space services which exceed the limits specified in Table II of Appendix S7 and in S21.3;~~, which exceed the limits specified in No. **S21.3**, in accordance with No. **S21.7**;~~**2**	
	• *Addition to reflect RR 1226 which covers bands where trans-horizon systems may operate with e.i.r.p. greater than +55 dBW.*	
	ADD S11.21A e) any terrestrial stations in bands listed in Table S21-2;**2**	
	• *Addition to cover RR 1227 in bands shared with space services (Earth-to-space).*	
	(MOD) S11.22 ~~e)~~f) earth stations whose coordination area extends to the territory of another administration;**2**	
	(MOD) S11.23 ~~f)~~g) earth stations whose interference potential is greater than that of a coordinated typical earth station.**2**	
	NOC S11.20.1 to S11.23.1 [2] In these cases, individual notices of frequency assignments are required for frequency bands allocated with equal rights to terrestrial and space services where coordination is required under Appendix **S5**, Table S5-1.	

	• *S11.24: RR 1231 stated that terrestrial assignments notified after that limit should bear a remark to indicate the non conformity. This provision is useless since there is no indication related to this non conformity (assignment is supposed to be recorded and enjoy status if other conditions are filled).*	
	MOD S11.25 Notices relating to assignments for stations in space services, and for terrestrial stations involved in the coordination ~~of~~with a satellite network, shall reach the Bureau not earlier than three years before and not later than three months before the assignments are brought into use. However, in case of disagreement relating to the coordination of an earth station under S9.17, the terrestrial stations located within the coordination area, which are operated or planned to be operated shall be communicated to the Bureau and the Bureau shall consider as notifications only those of these stations already operated or brought into use within three months.	
	• *S11.25: Precision to consider the case when there is disagreement for a terrestrial station involved in a space coordination. In this latter case, only terrestrial stations which are in use or to be operated within 3 months may be notified under S11.2.*	
	• *S11.25: In Article 13 (1496) the space research service was afforded to submit notification 30 days after the date of putting into use, in bands where this service was the sole or the sole primary service.*	
	• *RR 1497 stated that space assignments notified after that limit should bear a remark to indicate the non conformity. This provision is useless since there is no indication related to this non conformity (assignment is supposed to be recorded and enjoy status if other conditions are filled).*	
	• *In Article 12, 1233 referred to service or regional agreement to be communicated to the Board.*	

	Section II. Examination of Notices and Recording of Frequency Assignments in the Master Register	
	MOD S11.27 Notices not containing ~~the basic~~those characteristics specified in Appendix **S4** as mandatory or required shall be returned with comments to help the notifying administration to complete and submit them again, unless the information not provided is immediately forthcoming in response to an inquiry of the Bureau.	
	• *MOD S11.27: Alignment with S4 where items are specified mandatory or required in certain cases. Other items are supposed optional. Alignment with RR 1234 To avoid unnecessary delays, it should be possible to provide missing information, avoiding loss of anteriority, if the case maybe (see RR 1234 and 1498).*	
	• *RR 1222 contained the mandatory indication of the class of operation for fixed stations in HF bands. This is covered in Appendix S4 (item 7B).*	
	MOD S11.31.3 [3] Notices relating to radio astronomy stations are ~~only~~ examined with respect to No. **S11.31** only.	
NOC 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 No. **S9.7** could not be successfully completed (see also No. **S9.65**);[4] or		**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 No. **S9.7** ~~or S9.8, as appropriate,~~ could not be successfully completed (see also No. **S9.65**);[4] or

		d) with respect to the probability of harmful interference that may be caused to assignments in conformity with the appropriate regional Plan under Appendix S30**,** for those cases for which the notifying administration states that the procedure for coordination under No. **S9.8** could not be successfully completed (see also No. **S9.65**); or
		• *MOD S11.32A: Modification to take into consideration provision 7.4.5.3 of Appendix S30 for GSO FSS coordination with respect to BSS . There are currently, however, no criteria to allow the Bureau to perform such an examination. This provision might therefore be suspended in the case of S9.8 until such time these criteria are developed. This examination is not undertaken in Appendix 30A.*
	NOC S11.32A.1 4 The examination of such notices with respect to any other frequency assignment for which a request for coordination under **S9.7** 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 same number using the most recent information available.	
	*Note: Modification of **S11.32A.1 is not required because under the Plan modification procedure, there is no technical examination against other space services***	
		NOC 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. **S9.17 5**, **S9.17A** ~~or~~ **S9.18 5** ~~could~~ not be successfully completed (see also No. **S9.65**);**6** or

		g) with respect to the probability of harmful interference that may be caused to assignments in conformity with the appropriate regional Plan in Appendix S30, for those cases for which the notifying administration states that the procedure for coordination under No. **S9.19**[5] could not be successfully completed (see also No. **S9.65**) [6]; or
		• *MOD S11.33: modification to take into consideration provision 6.3.10 of Appendix S30 for terrestrial assignments with respect to BSS. There are currently, however, no criteria to allow the Bureau to perform such an examination in any of the cases covered in **S11.33**. This provision might therefore be suspended until such time these criteria are developed. This examination is not undertaken in Appendix 30A.*
MOD S11.36 When the examination with respect to No. **S11.31** leads to a favourable finding, the assignment shall be recorded in the Master Register or examined further with respect to Nos. **S11.32** to **S11.34**, as appropriate. When the finding with respect to No. **S11.31** is unfavourable, the assignment shall be recorded in the Master Register only if ~~it includes a reference to~~ the administration ~~is deemed to have undertaken~~ shall undertake that it will be operated in accordance with ~~under the provision~~ No. **S4.4**, otherwise the notice shall be returned with an indication of the appropriate action.		**MOD S11.36** When the examination with respect to No. **S11.31** leads to a favourable finding, the assignment shall be recorded in the Master Register or examined further with respect to Nos. **S11.32** to **S11.34**, as appropriate. When the finding with respect to No. **S11.31** is unfavourable, the assignment shall be recorded in the Master Register only if the notice includes a specific reference to the fact that the station will be operated in accordance with No. **S4.4** and in the cases where one of the appropriate regional Plans in Appendix 30 could be affected, only if, in addition, the finding with respect to **S11.32, S11.32A** or **S11.33** as applicable, is favourable[1]. O~~o~~therwise the notice shall be returned with an indication of the appropriate action. In the latter case, the notifying administration shall undertake not to bring into use the frequency assignment as long as the above conditions remain unchanged.
• *S11.36: As per Article 7 of Appendix 30, 7.4.11.3.*		• *MOD **S11.36** needed in order to reflect Articles 6 and 7 of Appendix 30.*

	ADD S11.36A If harmful interference to the reception of any station whose assignment is in accordance with S11.31 is actually caused by the use of a frequency assignment which is not in conformity with S11.31, the station using the latter frequency assignment shall, on receipt of advice thereof, immediately eliminate this harmful interference.	
	• *ADD S11.36A: New provision to cover RR 1267, 1271, 1420 and 1560 since S4.4 does not cover this obligation. This is a repetition of S8.5.*	
	(MOD) S11.37 When the examination with respect to No. **S11.32** leads to a favourable finding, the assignment shall be recorded in the Master Register indicating the administrations with which the coordination procedure has been completed[1]. When the finding is unfavourable, the notice shall be returned to the notifying administration, with an indication of the appropriate action, if Nos. **S11.32A** or **S11.33** do not apply.	
ADD S11.37.1 [1]When the agreement of the administrations affected has been obtained only for a specified period, the Bureau shall be notified accordingly and the frequency assignment shall be recorded in the Master Register with a note indicating that the frequency assignment is valid only for the period specified. The notifying administration using the frequency assignment over a specified period shall not subsequently use this circumstance to justify continued use of the frequency beyond the period specified if it does not obtain the agreement of the administration(s) concerned.		**ADD S11.36.1 to S11.37.1** [1]When the agreement of the administrations affected has been obtained only for a specified period, the Bureau shall be notified accordingly and the frequency assignment shall be recorded in the Master Register with a note indicating that the frequency assignment is valid only for the period specified. The notifying administration using the frequency assignment over a specified period shall not subsequently use this circumstance to justify continued use of the frequency beyond the period specified if it does not obtain the agreement of the administration(s) concerned.
ADD S11.37.1: addition needed to reflect time limited agreements, as under Articles 6 and 7 of Appendix 30.		• **ADD S11.36.1 to S11.37.1:** *addition needed to reflect time limited agreements, as under Articles 6 and 7 of Appendix 30.*

	NOC S11.38 When the examination with respect to Nos. **S11.32A** or **S11.33** leads to a favourable finding, the assignment shall be recorded in the Master Register indicating the names of the administrations with which coordination was completed and those with which it was not completed but in respect of which the finding was favourable. When the finding is unfavourable, the notice shall be returned with an indication of the appropriate action.	
	MOD S11.39 When the examination with respect to No. **S11.34** leads to a favourable finding, the assignment shall be recorded in the Master Register. When the finding is unfavourable, the notice shall be returned to the notifying administration, with an indication of the appropriate action. However, notices under Appendices **S25, S26** and **S27** shall be treated as follows:	
	• *S11.39: Modification to cover Rule of Procedure under RR 1245 for assignments not in conformity with the agreement or Plan.*	
	NOC S11.39A In the case of a notice in conformity with the technical principles of Appendix **S27**, but not in conformity with the Allotment Plan, the Bureau shall examine whether the protection specified in Appendix **S27** is afforded to the allotments in the Plan and to assignments already recorded in the Master Register with a favourable finding.	

	NOC S11.39B When the examination under **S11.39A** leads to a favourable finding, the assignment shall be recorded in the Master Register. When the finding is unfavourable, the assignment shall be recorded in the Master Register with a symbol indicating that it shall cause no harmful interference to any frequency assignment which is either in conformity with the Allotment Plan or recorded in the Master Register with a favourable finding with respect to **S11.39A**.	
	NOC S11.39C A notice in conformity with the technical principles of Appendix **S26**, but not in conformity with the Allotment Plan, shall be examined with respect to the allotments in Part III of Appendix **S26**.	
	NOC S11.39D When the examination under **S11.39C** leads to a favourable finding, the assignment shall be recorded in the Master Register. When the finding is unfavourable, the assignment shall be recorded in the Master Register with a symbol indicating that it shall cause no harmful interference to any frequency assignment which is either in conformity with the Allotment Plan or recorded in the Master Register with a favourable finding with respect to **S11.39C**.	
	ADD S11.39E In the case of a notice not in conformity with the Allotment Plan of Appendix **S25**, the assignment may be recorded provisionally in the Master Register on the condition that the administration has initiated the procedure of Appendix **S25** in accordance with 1.23 of Section I of Appendix **S25**.	
	• *ADD S11.39E: New provision to cover RR 1320A. It is to be noted that former Article 16 (Procedure for bringing up to date the frequency allotment Plan for coast stations in HF bands) is to be found in Appendix S25 together with the Allotment Plan.*	

	MOD S11.41 After a notice is returned under No. **S11.38**, should the notifying administration resubmit the notice and insist upon its reconsideration, the Bureau shall enter the assignment provisionally in the Master Register with an indication of those administrations whose assignments were the basis of the unfavourable finding[7]. The entry shall be changed from provisional to definitive recording in the Master Register only if the Bureau is informed that the new assignment has been in use, together with the assignment which was the basis for the unfavourable finding, for at least four months without any complaint of harmful interference being made[8] (see Nos. **S11.47** and **S11.49**).	
	• *S11.41: Covers RR 1260 for terrestrial services, but the period without interference was 2 months instead of 4, and RR 1544 for space services.*	
		ADD S11.41.2 [8] Provisions **S11.41** to **S11.42** are not applicable when the assignments which were the basis for the unfavourable finding are in conformity with the appropriate regional Plan in Appendix 30.
		• ADD S11.41.2:Modification required to reflect Articles 6 and 7 of Appendix 30.
	MOD S11.44 The notified date of bringing into use of any assignment to a space station of a satellite network shall be no later than [six] years following the date of ~~publication~~receipt by the Bureau of the relevant ~~Weekly Circular referred to in No. **S9.2B**~~ **complete** information under S9.1. Any change in the characteristics in accordance with **S11.43A** shall be brought into use no later than [6] years following the date of receipt of the information. The notified date of bringing into use will be extended at the request of the	

	notifying administration by not more than three years.	
	• *The information received has to be complete to start the clock.* • *The extension also applies in the case of a new or modified assignment.*	
	ADD S11.44A A notice not conforming to S11.44 shall be returned to the notifying administration with a recommendation to restart the advance publication procedure.	
	• *ADD S11.44A: New provision to cover the Rule of Procedure under RR 1501.*	
		ADD S11.47 A If harmful interference to the reception of any broadcasting-satellite station whose frequency assignment is in conformity with the appropriate regional Plan in Appendix 30 is actually caused by the use of a frequency assignment which is not in conformity with **S11.31**, the station using the latter frequency assignment shall, upon receipt of advice thereof, immediately eliminate this harmful interference.
		• **ADD S11.47** required to reflect Article 7 of Appendix 30.

	MOD S11.48 If after the expiry of the period of [six] years, plus the extension specified in No. **S11.44**, as appropriate, from the date of ~~publication of the relevant Weekly Circular~~ receipt of the complete information referred to in **S9.1**, the administration responsible for the satellite network has not submitted the Appendix **S4** information for notification under No. **S11.2** and has not brought the frequency assignments to stations of the network into use, the corresponding information published under Nos. **S9.2B** and **S9.38** shall be cancelled only after the administration concerned has been informed, at least three months before the expiry date referred to in **S11.44**.	
	• *S11.48: Consistency with S9.1. The 6 years period is from the date of receipt of the information (not the date of the publication).* • *The addition of the word "corresponding" is essential because only those assignments not brought in service within the time period are deleted*	

	(Proposed modifications to Appendix S30B)	
	ARTICLE 8	
	Procedure for Notification and Recording in the Master Register of Assignments in the Planned bands for the Fixed-Satellite Service	
	MOD 8.1 Any assignment for which the relevant procedure of Article 6 has been successfully applied shall be notified to the Board in accordance with Article ~~13~~ **S11** of the Radio Regulations.	
	MOD 8.2 Upon reception by the Board of a complete notice under Article ~~13~~ **S11**, a PDA of zero degrees (operational stage) shall be associated with this assignment.	
	MOD 8.3 Such an assignment shall not be subject to the procedures for advance publication and coordination contained in Sections I and II of Article ~~11~~ **S9** of the Radio Regulations[1]. Consequently, the provisions of Article ~~13~~ **S11** of the Radio Regulations shall continue to be applicable except with regard to ~~No. 1504~~ **S11.32** and related provisions ~~(see Resolution 107)~~.	
	Resolution No. 107 (Orb-88) was applicable for networks communicated until 5 October 1988, they shall be in operation or cancelled before the WRC-97. Such networks should then be considered as recorded assignments, and enjoy related status, or cancelled.	
	MOD 8.4 No provision of this Appendix shall be considered as modifying the requirements under ~~Sections III and IV of Article 11~~ **S9.17**, **S9.17A** and **S9.18** of the Radio Regulations relating to coordination between the fixed-satellite service and stations of terrestrial services sharing the planned bands on an equal primary basis.	

[1] For existing systems in Part B of the Plan see Section IB of Article 6.

1.5 Article S13

Potential inconsistencies within Articles **S11, S13 and S14** or between these Articles and the other procedures of the Radio Regulations in particular Appendices S30, S30A and S30B, have been identified. Examples of possible modifications to resolve these inconsistencies in respect of Article **S13** are provided below.

Explanations or comments are in *italics* and given in boxes under the relevant provision, proposed modifications to the text of Article **S13** appearing in the Final Acts of WRC-95 are double-underlined.

ARTICLE S13

Instructions to the Bureau

NOC **Section I. Assistance to Administrations by the Bureau**

NOC **S13.1** When an administration has difficulty in applying the procedures of Article **S9** the Bureau shall, upon request, endeavour to assist in cases where:

NOC **S13.2** a) there is disagreement about the level of interference that may result from a proposed modification of a plan or from a request for coordination; or

NOC **S13.3** b) agreement to a proposed modification of a plan or a decision on a request for coordination cannot be reached for any other reason; or

NOC **S13.4** c) a special study of the case is required.

NOC **S13.9** When an administration has difficulty in resolving a case of harmful interference and seeks the assistance of the Bureau, the latter shall, as appropriate, help in identifying the source of the interference and seek the cooperation of the responsible administration in order to resolve the matter, and prepare a report for consideration by the Board, including draft recommendations to the administrations concerned.

NOC **S13.10** When an administration so requests, the Bureau shall, using such means at its disposal as are appropriate in the circumstances, conduct a study of reported cases of alleged contravention or non-observance of these Regulations and shall prepare a report for consideration by the Board, including draft recommendations to the administrations concerned.

Section II. Maintenance of the Master Register and of World Plans by the Bureau

NOC **S13.11** The Bureau shall be solely responsible for maintenance of the Master Register in accordance with the Rules of Procedure, and shall:

NOC **S13.12** a) following consultation with administrations, from time to time make any necessary adjustments to the format, structure and presentation of data in the Master Register;

S13.12: For space services, the administrations were asked in No. 1569 to confirm the use of the assignment at intervals not exceeding two years; Moreover, the Bureau was asked to verify the use or the conformity of the use and to cancel or modify the entry after the administration's agreement or without response within 3 months (1 574 - 1 575). For terrestrial services, the administrations were asked to notify the deletion of unused assignments (1 436).

ADD **S13.12A** b) whenever it appears from reliable information available that a recorded assignment has not been brought into regular operation in accordance with the notified required characteristics as specified in Appendix **S4**, or is not being used in accordance with those characteristics, the Bureau shall consult the notifying administration and, subject to its agreement or in the event of no response withing 3 months of the dispatch of a reminder, shall either cancel, or suitably modify, or retain the basic characteristics of the entry.

S13.12A: To reflect Nos. 1574 and 1575.

SUP **S13.13**

(MOD) **S13.14** ~~b)~~c) enter in the Master Register and publish in the Preface to the International Frequency List (IFL) all frequencies prescribed by these Regulations for common use;

(MOD) **S13.15** ~~c)~~d) make appropriate entries in the Master Register resulting from its examinations of frequency assignment notices in accordance with Article **S11**;

(MOD) **S13.16** ~~d)~~e) maintain and periodically update the Preface to the IFL.

NOC **S13.17** The Bureau shall also compile, for publication by the Secretary-General in the form of the IFL, comprehensive listings of entries extracted from the Master Register and such other extracts as may periodically be required.

MOD **S13.17A** The Bureau shall maintain master copies of all world frequency allotment or assignment plans contained in appendices to these Regulations, or adopted by world conferences convened by the Union, including, where applicable, the margins associated with each assignment or allotment, and incorporating any modifications resulting from the successful application of the relevant modification procedure, and shall provide such copies in an appropriate form for publication by the Secretary-General when justified by circumstances.

S13.17A This provision should be modified to cover the specific requirements to contain the margins of the plans, for the appropriate plans (e.g. Appendices S30, S30A and S30B), and to refer to the procedures applicable for modifying the plans. The BR is requested to study and indicate the situation for those plans which do not contain margins.

Section III. Maintenance of the Rules of Procedure by the Bureau

NOC S13.18 The Board shall approve a set of Rules of Procedure to govern its own activities and those of the Radiocommunication Bureau in the application of the Radio Regulations, to ensure the impartial, accurate and consistent processing of frequency assignment notices and to assist in the application of these Regulations.

NOC S13.19 The Rules of Procedure shall include, inter alia, calculation methods and other data required for the application of these Regulations. These shall be based upon the decisions of world radiocommunication conferences and the Recommendations of the Radiocommunication Sector. Where requirements arise for new data for which there are no such decisions or Recommendations the Bureau shall develop such data in accordance with Nos. **S13.20** and **S13.21**, and shall revise them when appropriate decisions or Recommendations are available.

MOD S13.20 The Bureau shall, when appropriate, prepare draft modifications or additions to the Rules of Procedure which shall be made available for comment before being submitted to the Board. Each draft modification or addition shall be published and circulated to the Member States of the Union by means of circular-letters of the Bureau at least 3 months prior to the first Board meeting which is to consider it.

S13.20 The BR is requested to study means of shortening the three months period.

NOC S13.21 The Bureau shall submit to the Board the final drafts of all proposed changes to the Rules of Procedure. The Rules of Procedure approved by the Board shall be published and shall be open for comment by administrations. In case of continuing disagreement, the matter shall be submitted by the Director in his report, with the agreement of the concerned administration, to the next world radiocommunication conference. The Director of the Bureau shall also inform the appropriate study groups of this matter. Pending resolution of the matter, the Board and the Bureau shall continue to use the particular Rule of Procedure in dispute but, following resolution of the matter by a decision of a world radiocommunication conference, the Board shall promptly review and revise as necessary the Rules of Procedure and the Bureau shall review all relevant findings.

NOC S13.22 If an administration, or the Board or the Bureau identifies a need for a special study, in relation to the Rules of Procedure, of any provisions of these Regulations or of a regional agreement with an associated frequency

allotment or assignment plan, the case shall be handled under Nos. **S13.20** and **S13.21**. The same shall apply if as a consequence of the review of a finding or other action by the Board it is necessary to re-examine the Rules of Procedure.

NOC **S13.23** The Rules of Procedure shall be maintained and published in a form that will facilitate easy modification and maximize their value to administrations and other users.

1.6 Article S14

Article S14 was reviewed and no inconsistency was discovered between this Article and the other procedures of the Radio Regulations. A possible improvement to No. S14.9 was identified that might be considered by the Conference.

ARTICLE S14

Procedure for the Review of a Finding or Other Decision of the Bureau

NOC **S14.1** Any administration may request a review of a finding, a review of the results of a special study under these Regulations or under a regional agreement and plan, or a review of any other decision of the Bureau. The review of a finding may also be undertaken on the initiative of the Bureau itself when it considers this is justified.

NOC **S14.2** For this purpose, the administration concerned shall submit a request for a review to the Bureau; it shall also cite the relevant provisions of the Radio Regulations and other references and shall state the redress or other action it seeks.

NOC **S14.3** The Bureau shall promptly acknowledge receipt of the request and shall consider the matter forthwith. Thereafter, every effort shall be made with the administration concerned to resolve the matter without adversely affecting the interests of other administrations.

NOC **S14.4** If the outcome of the review successfully resolves the matter with the requesting administration without adversely affecting the interests of other administrations, the Bureau shall publish an outline of the review, the arguments, the settlement and any implications affecting other administrations for the information of all Members of the Union.

S14.4: In Nos. 1425 and 1467 the Board had the possibility to change the entry in the Master Register. In case of non conforming assignments, this however would apply only if reference is made to No. S4.4 (342). Moreover, it would be difficult to change the status of an assignment without affecting the interests of other administrations.

NOC **S14.5** If the outcome of the review does not successfully resolve the matter, or if it would adversely affect the interests of other administrations, the Bureau shall prepare a report and send it in advance to the administration which requested the review and to any others concerned in order to enable

them, if they so desire, to address the Board. The Bureau shall then send the report with all supporting documentation to the Board.

NOC **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. However, if the administration which requested the review disagrees with the Board's decision it may raise the matter at a world radiocommunication conference.

NOC **S14.7** The Bureau shall then initiate all other necessary action decided by the Board.

NOC **S14.7A** Following resolution of the matter by a decision at a world radiocommunication conference, the Bureau shall promptly take the consequential actions, including a request to the Board for reviewing all relevant findings, if necessary.

MOD **S14.8** The minutes of the meetings of the Radio Regulations Board shall be published and circulated to the Members of the Union by means of circular-letters of the Bureau as being made well as widely available in electronic form.

MOD **S14.9** A copy of all documents of the Board, including its minutes, shall be available for public inspection in the offices of the Bureau as well as being made widely available in electronic form. Documents on the agenda of a Board meeting shall, in addition, be accessible prior to the meeting.

The modification to No. S14.9 is proposed to facilitate Member States' and ITU-R Sector Members' timely awareness of Board activity. Administrations that are unable to consult documents at ITU headquarters or without electronic means to access the documents may request the Bureau to provide them by fax when they are of reasonable size.

1.7 Resolutions

1.7.1 Resolution 107

Resolution 107 (Orb-88) contains transitional arrangements to protect some satellite networks for which Article 11 procedures had been initiated in the frequency bands subject to Appendix 30B plan before the establishment of this plan. Since the status of these networks has been satisfactorily resolved since 1988, this resolution could be suppressed.

1.7.2 Resolution 110

Resolution 110 (Orb-88) contains "Improved Procedures for Certain Bands of the Fixed Satellite Service". These improved procedures relate to the MPM concept (Multilateral Planning Meetings). WRC-95 suppressed the provisions in Article **S9 (S9.56** to **S9.57**) dealing with MPMs. In the report of WRC-95 Committee 4 to WRC-95 Committee 6 (Doc. 275) where it indicated the decision to suppress Nos. S9.56 to S9.57, there was a note to delete Resolution 110, however, this point was not picked up by WRC-95 Committee 6 nor was it detected in Plenary. It is therefore proposed that Resolution 110 be suppressed.

1.8 Resolution 48

Resolution 48 invites the Bureau, in cooperation with the SC in particular, to investigate what parameters might require a new advance publication, and what significant changes to these parameters would require a new advance publication. It was concluded that the following provision appearing in No. **S9.2** should be retained**,** i.e. to require a new advance publication in the following case:

- the use of an additional frequency band for both GSO and NGSO networks.

Additional criteria to determine the need for a new advance publication would have to be considered.

However, some administrations have further considered the question of the restarting of the API, and have concluded that that there could be further simplification of the procedures by merging the API and coordination phases which would at the same time address the questions raised by Resolution 48.

Other administrations were of the view that the merging of the two procedures may create some difficulties which will need to be considered.

1.9 Incorporation by reference

In response to Resolution 27 (WRC-95), the CPM-97 has examined the concept of incorporation by reference as it pertains to provisions of the Radio Regulations which contain mandatory language. The CPM-97 recommends that, in addition to the principles contained in the Annex to Resolution 27, the mandatory incorporation by reference shall be explicit and use the appropriate regulatory language (i.e. "shall").

The Annex to the CPM report contains a comprehensive table prepared by the Director of the Radiocommunication Bureau listing the provisions of the Radio Regulations using incorporation by reference and providing an initial assessment of each reference by identifying the following: whether the incorporation is mandatory or not mandatory; whether it explicitly refers to a specific ITU-R Recommendation or refers to "relevant" or "appropriate" ITU-R Recommendations; and whether further study may be needed.

When considering proposals to WRC-97, administrations are urged to use the results of the BR studies as contained in Annex 1 to this report to determine:

- whether each reference is mandatory or non-mandatory;
- whether the mandatory provisions should be changed into non-mandatory references (use words such as "should" or "may");
- whether the linking language is clearly mandatory (use the word "shall");
- whether the incorporated ITU-R Recommendation(s) are explicitly identified;
- where referenced ITU-R Recommendations are not explicitly identified, determine which ones should be so identified;
- whether text incorporated from ITU-R Recommendations should be placed directly into the Radio Regulations instead of using incorporation by reference;
- whether the incorporated ITU-R Recommendation is suitable as treaty status text; and, if not, decide whether to limit the reference to a specific portion of the ITU-R Recommendation or to place the mandatory text directly into the Radio Regulations.
- the required modifications to Resolution 27 (WRC-95).

1.10 Identification of stations (Article S19)

No modification was proposed to Article **S19**.

The CPM-97 noted that Resolution 71(WRC-95) instructed the Secretary General and the Director, BR to submit a report to WRC-97 in respect to the application of Article S19.-

CHAPTER 2

HF BROADCASTING
(WRC-97 agenda item 1.4)

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2.1 WRC Agenda Item 1.4

Examination of, and taking necessary decisions on, the question of the HF bands allocated to the broadcasting service in the light of developments to date and the results of the studies carried out by the Radiocommunication Sector, and review of Article 17 [S12A] of the Radio Regulations in accordance with Resolution 530 (WRC-95).

2.2 Summary of existing planning methods and coordination procedures and identification of relevant ITU-R Recommendations and Resolutions

2.2.1 Article 17

The procedures for use of the HF bands allocated exclusively to the broadcasting service are contained in Article 17 of the Radio Regulations. These procedures have been in place since 1959 but were modified by WARC-HFBC-87.

2.2.2 HFBC planning system

WARC-HFBC-84 adopted technical criteria and planning principles for an HFBC Planning System. Based on these guidelines, the IFRB developed a computerized planning system which was used to carry out planning exercises.

WARC-HFBC-87 reviewed the results of the planning exercises and found the planning system unsatisfactory. Given the limited spectrum and the large number of requirements, a significant number of broadcasts were not provided with an acceptable reception quality. Consequently, WARC-HFBC-87 adopted a revised Article 17, together with Resolution 515, containing planning principles, an Improved HFBC Planning System and a revised consultation procedure, and, by its Resolution 511 instructed the IFRB to undertake the improvements in the software of the HFBC planning system, to test the system and to submit the results to administrations and to the recommended future HFBC planning conference.

In 1991 the IFRB reported on the tests and improvements requested by the successive world administrative radio conferences and concluded that, even with additional allocations, a planning method based on all the requirements of administrations could not be developed and implemented in an economical way.

2.2.3 Alternative planning procedures

The 1993 Radiocommunication Assembly approved Question ITU-R 212/10 with a request to complete the studies by 1997, so that an alternative planning procedure might be adopted by WRC-97.

Although not utilized by the HF broadcasting service, frequency allotments could be considered as a planning method for this service. It is noted that frequency allotment plans exist for services such as the maritime mobile service (Appendix 25 of Radio Regulations), in some bands of the aeronautical mobile services (Appendices 26 and 27), space services (WARC-88 (Appendix 30B)), and certain broadcasting services.

2.2.4 HF bands allocated to the broadcasting service

WARC-79 allocated the additional HF bands listed in No. 531 of the Radio Regulations to the broadcasting service and, by its Resolution 8 took action for the transfer of existing fixed-service assignments to other bands. WRC-95 subsequently released these bands, with conditions, with effect from 1 January 1996

WARC-92 allocated further additional HF bands to the broadcasting service, as listed in No. 521A of the Radio Regulations, but limited their use to single-sideband transmissions. By its Resolution 21, it took action to transfer existing fixed and mobile-service assignments to other bands. The transfer is currently in progress, but the relevant bands are allocated to these services on a primary basis until 1 April 2007 under provisions of Nos. S5.136, S5.143, S5.146 and S5.151 of the Radio Regulations.

Resolution 508 (WARC-79), Resolution 511 (WARC-HFBC-87), and Resolution 523 (WARC-92), recommended the convening of a world radiocommunication conference for the planning of the HF bands allocated to the broadcasting service.

Resolution 20 of the Plenipotentiary Conference (Kyoto, 1994) stipulated that broadcasting in both the WARC-79 and WARC-92 bands shall not be allowed until planning is completed and the conditions stipulated in the Radio Regulations are fulfilled.

Resolution 517 (WARC-HFBC-87), also provided a timetable for double sideband emissions to be replaced by single sideband emissions by 31 December 2015. It specified that this date should be periodically reviewed by competent future world administrative radio conferences in light of the latest available statistics on the distribution of SSB transmitters and receivers, and that at least one such review shall take place before the year 2000.

2.2.5 Decisions of WRC-95

WRC-95, in its Resolution 529 (WRC-95), resolved that the broadcasting service may use the WARC-79 bands on an interim basis from 1 January 1996, on the basis of the consultation procedure of Article 17 until new procedures are adopted by WRC-97 and taking into account the provisions of No. 531 of the Radio Regulations.

Resolution 529 (WRC-95) in *resolves* 2 "invited WRC-97 to consider the new HFBC planning procedure being developed in the Radiocommunications Sector with a view to its adoption, and, if that procedure is adopted, to decide on a suitable date for its introduction, which should be the nearest possible date after the conclusion of that Conference".

Other studies in Resolution 529 (WRC-95) include the following "*resolves*":

3.1 Review of the planning principles contained in Article 17.

The results of this review are given in Section 2.4.1.1.1.

3.2 Devise a means to protect other primary services in the additional bands allocated by WARC-92 to this broadcasting service.

The ITU-R recommends that this matter be treated as given in Section 2.4.2.1.

3.3 Recommend a date or dates by which the other primary services in the above additional allocations will no longer be protected.

The ITU-R endorses the date of 1/4/2007 which is contained in RR 521C, RR 528A, and 529B. Also see Section 2.4.2.2.

3.4 Recommend criteria to be used by the Bureau to test the recommended HFBC planning procedure.

The ITU-R recommends the tests described in Section 2.4.2.3.

3.5 Consider a time table for the introduction of SSB transmissions.

The ITU-R recommends the transition plan contained in Section 2.4.2.2.

4 Consider bringing forward the date of availability of the HF bands allocated by WARC-92 to the broadcasting service.

The ITU-R recommends the date and process contained in the transition plan in Section 2.4.2.2.

2.3 Analysis of existing planning methods and coordination procedures

The following chapter gives an analysis of the procedures applied, developed and proposed for HF broadcasting. It should be noted that Article 17 as currently applied by the Bureau is that version contained in the Final Acts of WRC-95, namely Article S12A [17].

2.3.1 Current version of Article 17 of the Radio Regulations

2.3.1.1 An outline of the current version of Article 17:

– Section I (Introduction) and Section II (Planning Principles) call for compliance with, and list, a set of principles governing the planning of the HF bands allocated exclusively to the broadcasting service.

– Section III (Planning System) calls for testing of the Improved HFBC Planning System in accordance with these principles and with Resolution 511 (HFBC-87), for adoption, if found acceptable, by a competent radio conference.

– Section III was addressed by the 1992 World Administrative Radio Conference (WARC-92), which did not find the Improved Planning System appropriate; rather, it instructed the International Frequency Registration Board (IFRB), whose functions have in the meantime been assumed largely by the Bureau, to propose a "flexible, simplified planning method, which could be used for the subsequent development of a planning system." (Resolution 523 WARC-92).

– Section IV (Consultation Procedure) outlines the procedure to be followed by administrations in notifying their HFBC schedules. Periodically, administrations submit to the Bureau seasonal schedules of their HF broadcasting stations. The submissions are presently due approximately four months prior to the beginning of the season in question. Two or more administrations may submit coordinated schedules.

– Section V (Preliminary Examination and Preparation of the Tentative HF Broadcasting Schedule) calls for the Bureau to consolidate all administrations schedules in a combined schedule and to prepare a Tentative High Frequency Broadcasting Schedule (the Schedule).

– Section VI (Technical Examination and Revision of the Tentative Schedule) provides for continued technical examination by the Bureau for the purpose of improving the Tentative Schedule in agreement with administrations. Administrations are called upon to notify amendments to the Tentative Schedule for inclusion in weekly circulars; the amendments are now incorporated into the Schedule which is re-issued on monthly diskettes.

– Section VII (Publication of the HF Broadcasting Schedule) provides for publication, following the end of a broadcasting season, of a final schedule incorporating the Tentative Schedule and amendments to it. This publication is available on diskette.

– Section VIII contains Miscellaneous Provisions.

2.3.1.2 Comments on Section IV of Article 17 as currently applied

It should be noted that in carrying out the Article 17 Procedure as currently applied by the Bureau:

– the Schedule provides insufficient information on incompatibilities between transmission requirements;

– the technical bases for determining incompatibilities between transmission requirements are too simplistic as they do not incorporate current analytical models;
– the time-scale, between the initial submission and/or modification of transmission requirement data by administrations and the publication of the Schedule, is too long;
– the Schedule, in practice, does not reflect fully the actual usage of the HFBC bands, due in part to the lateness and/or inaccuracy of the data supplied to the Bureau by some administrations.

However the Article 17 Procedure:

– has operated continuously since 1959;
– allows full flexibility for all administrations in entering their transmission requirements, both prior to the start of a season and at any time during a season;
– allows all administrations to coordinate their transmission requirements and to resolve incompatibilities on a bilateral or multilateral basis, prior to and after submitting their requirements to the Bureau for inclusion in the Schedule;
– provides, through the Schedule, information on the overall intended usage of the HFBC bands; for many administrations, particularly those in some developing countries, this is the only information available to them about the usage of the HFBC bands;
– provides, through amendments to the Schedule (that incorporate all modifications notified to the Bureau by administrations), monthly updates on the overall intended usage of the HFBC bands.

2.3.2 Comments on Section III of current version of Article 17

An outline of the Improved HFBC Planning System is provided, and where appropriate, comments made on some aspects of this Section III.

– since 1979, the world's administrations and broadcasters, together with the ITU, have spent considerable time, effort and financial investment attempting to devise a satisfactory planning system for the HFBC bands;
– this effort culminated in the Improved HFBC Planning System (including the Consultation Procedure) described in Resolution No. 515 (HFBC-87).

This Improved HFBC Planning System is made up of two main procedures. Each procedure was tested in different parts of the HF bands allocated exclusively to the broadcasting service:

– the first procedure relates to the Planning Procedure;
– the second procedure is based on a Consultation Procedure.

What essentially differentiated these two procedures was not only the fact that they were applied in different frequency sub-bands but also that the frequency assignments were made using different approaches:

– in the case of the Planning Procedure, the frequency to be assigned was selected by a centralised planning system;
– in the case of the Consultation Procedure, the assigned frequency was selected by the administration;
– the Improved HFBC Planning System included additional constraints, such as frequency continuity, preset frequency, preferred frequency band and preferred frequencies;

– the Improved HFBC Planning System allowed modifications to a requirement only if those modifications did not increase the level of interference to existing assignments in the planned bands. In those cases where the modified requirement did increase the level of interference to existing requirements within the planned bands, the modified requirement was transferred and treated under the Consultation Procedure;
– the IFRB reported these difficulties to the 1991 Administrative Council, which conveyed them to WARC-92 in Document No. 7127 (CA46-46). WARC-92 instructed the IFRB, in Resolution No. 523, "to make a comprehensive report to the next competent WARC on the planning trials undertaken since WARC-HFBC-84 and, on the basis of the experience acquired, to propose a flexible, simplified planning method, which could be used for the subsequent development of a planning system.";
– the Director of the Radiocommunication Bureau, in his expanded role encompassing all radio-related activities within the reorganized ITU, sent a report to the 1993 Radiocommunication Assembly. He described the report as completing the tasks assigned to the IFRB in Resolution No. 523;
– in the report, the Director reviewed the difficulties experienced by the IFRB during the planning exercises and advanced as alternatives an allotment planning approach and an improved procedure under Article 17. He emphasized that under both approaches the keyword for successful planning was coordination;
– concluding his report, the Director proposed that the necessary studies be undertaken in the framework of regulatory procedures to be developed in the Radiocommunication Sector. In response, the 1993 Radiocommunication Assembly adopted Question ITU-R 212/10 to study alternative planning procedures for HF broadcasting and complete its work by 1997.

2.3.3 Coordination process

2.3.3.1 Regulatory basis of coordination

Article 17 provides a procedure for the collection and dissemination of HFBC scheduling data. It also allows for the coordination of transmission requirements by administrations to resolve incompatibilities on a bilateral or multilateral basis prior to and after submitting their requirements to the Bureau for inclusion in the Tentative HF Broadcast Schedule.

2.3.3.2 Structure of existing coordination groups

Informal multilateral coordination of HF usage has been undertaken by several Groups:

– the "Western" Group, comprising 6 broadcasters from Europe and North America, have regularly coordinated their seasonal frequency usages with satisfactory results since 1963;
– the "OIRT" Group, comprising administrations or broadcasters from the 7 East European countries and some other countries, have also regularly coordinated their seasonal frequency usages with satisfactory results since 1963;
– the FACSMAB (Frequency Allocation Committee Singapore, Malaysia and Brunei), which in allocating frequencies for various services, includes coordination of the HF requirements of broadcasters in the Member countries;
– the "HFCC" (HF Coordination Conference) group of International Broadcasters has, since 1991, developed from the "OIRT" Group by the inclusion of administrations and broadcasters from Western Europe, North America and Asia.
– since conducting a trial of the coordination process in August 1996, the ABU have decided to hold regular Coordination Conferences for the Asia Pacific Region.

2.3.3.3 Description of the work process of the HFCC

As of August 1996, the HFCC Group consists of about 73 participants from 49 broadcasting organizations or administrations with very different numbers of transmission requirements and different levels of frequency management experience. This group is achieving practical resolution of many mutual incompatibilities between the respective transmission requirements.

Admission to the HFCC is open to any broadcasting organization or administration wishing to participate and who accepts the principles of coordination. However, the development of other regional coordination groups is strongly encouraged.

The total number of frequency hours that is coordinated currently within the HFCC group represents approximately two thirds of the total worldwide broadcasting frequency hours scheduled in the HF bands.

The HFCC meets twice yearly to coordinate schedules for each of two HF broadcasting seasons. The meetings are held about six weeks prior to the start of the winter and summer seasons respectively.

The HFCC is steered by a small group, including the last and the next host. It takes care of the administrative procedures such as the circulation of necessary information amongst the members.

HFCC meetings have been hosted in turn by members of the Group. The participating organizations submit their tentative seasonal schedules in the form of requirements on diskette to an agreed member of the group. (A seasonal schedule covers a period between the dates when the European clocks change). Such a seasonal schedule includes either the time period equivalent to the winter-time period in Europe or the period equivalent to summer-time period. As of January 1996 the winter season consists of the months November to March inclusive. The summer season consists of the months April to October inclusive.

Technical characteristics for each requirement include frequency, power, antenna type, bearing, slew angle, location of the transmitting station, days of operation (daily operation by default), modulation type, and sub-period of operation (A requirement can be entered for any sub-period within the schedule period. If there is more than one such sub-period, separate requirements are entered for each).

Target areas are specified by CIRAF zones and/or quadrants.

Software has been developed to assist the data entry process and to analyse the incompatibilities between 2 or more requirements. Requirements targeted at the same CIRAF zone and/or quadrants, at the same time on co-channel or adjacent (+/- 5 kHz) channels are classified as "Collisions" which require coordination.

The process currently used in the HFCC is as follows:

1. at the Plenary of an HFCC Meeting, the venue and date of the next meeting are confirmed, with the meeting being held about 6 weeks prior to the start of the appropriate broadcasting season;
2. at this Plenary, one organization of the HFCC agrees to receive the schedules and to prepare the Combined Tentative Schedule and Collision lists for the next meeting;
3. all participating organizations send their schedules to the organization responsible for data collection and analysis, by diskette, e-mail attachment or modem to arrive no later than 5 weeks prior to the next meeting;
4. all schedules are validated with any queries being referred to the originator for clarification;

5. the Combined Tentative Schedule and Collision lists are then sent to each participating organization, on diskette, e-mail attachment or modem to arrive no later than 2 weeks prior to the meeting;
6. changes to requirements are collected by midday on the day before the start of the meeting;
7. a small number of amended Combined Tentative Schedules are prepared for reference and new Collision lists are distributed to all participants at the start of the meeting;
8. bilateral discussions take place during each day to try to resolve Collisions.

   Collisions are resolved by:

   – one or both parties making changes to their requirements until both parties accept the solution;
   – agreeing that nothing further can be achieved or
   – agreeing that there is no problem in practice.
9. by 1600 hours local time each day, all changes to requirements are collected and processed to produce new Collision lists and a small number of amended Tentative Schedules. These are available at the start of the next day's proceedings;
10. the process described in 8 and 9 is repeated each day;
11. on the final day of the meeting, final changes are collected by 1300 hours local time to allow the preparation of diskettes for each participating organization. The diskettes contain the agreed Combined Schedule, with the Requirements and Collision lists for each participating organization to allow further bilateral discussions to continue after the meeting closes (if required);
12. before the start of the broadcasting season, any further changes are sent to the organization responsible for the data collection to allow a Final Schedule to be prepared and issued within the first 2 weeks of the broadcasting session;
13. any subsequent changes are sent to all other members of HFCC during the course of the broadcasting season by the organization making the change.

2.3.3.4 Advantages of the HFCC Coordination process

The current informal coordination process used in HFCC has resulted in a significantly reduced number of incompatibilities. Over a number of HFCC meetings, a pattern of frequency usage has evolved which only varies slowly with changes in propagation and programme requirements. This pattern of frequency usage gives frequency continuity which is appreciated by the listeners and greatly simplifies the frequency to solve the frequency problem and coordination processes.

Information on actual spectrum occupancy and quick access to this information, is a requirement for effective frequency management. This is provided in the HFCC process by knowledge of proposed frequency usage and exchange of monitoring information.

– Since the start of the HFCC, a good balance between "give" and "take" has been achieved.
– Most potential problems are resolved immediately.
– Face-to-face contact between frequency managers leads to mutual understanding and better cooperation. Bilateral discussions continue during the Season, between HFCC meetings, to resolve outstanding problems and to find ways of avoiding them in future.
– All participants are moving towards a common technical approach.
– Exchange of experience and mutual assistance leads to an increased level of knowledge of transmission possibilities and opportunities. This leads to higher efficiency both in terms of

cost and spectrum economy and can lead to a reduction in frequency hours resulting in fewer collisions and higher quality for the listener.

– This evolutionary approach to frequency management has been attracting more participants.

– Closer cooperation is prompting better use of transmission facilities, e.g. air-time exchanges between organizations

At the HFCC meeting held in Bern (5 to 9 February 1996), the views of the participants representing 29 organizations were sought regarding the effectiveness of the coordination process. The responses may be summarized as:

86% of participants considered that the HFCC process is "**quite or very" effective**;

55% of participants considered that more than **60%** of their collisions were resolved;

93% of participants considered that coordination is the **correct approach** for HFBC.

2.3.4 Allotment planning

– Frequency allotment plans exist for services such as the maritime mobile service (Appendix 25 of Radio Regulations), the aeronautical mobile services (Appendices 26 and 27), space services (WARC-88 (Appendix 30B)), and certain broadcasting services.

– An allotment plan approach for HF broadcasting has been discussed since WARC-79 and the following concerns have been noted:

  – broadcasters need to have a given channel available for the full duration of each transmission requirement diurnal and seasonal, whereas (in general) other services currently using allotment planning require access to a channel for only a short period of time, and so can share the use of channels by making use of time sharing;

  – broadcasting service transmissions are one-way communications and so in practice possible corrective measures (e.g. real-time change of frequency and/or band) are not viable for broadcast transmissions, as they are in two-way communication services such as the mobile services;

  – broadcasting service transmissions necessarily use a wide range of transmitter powers and antenna types which limit the frequency reuse factor considerably;

Since 1979, nothing has happened to remove these fundamental concerns.

2.3.5 Conclusions concerning the analysis of HFBC Planning Methods and coordination procedures

2.3.5.1 Conclusions concerning Sect. IV of Article 17 as currently applied

Any new planning process for the HFBC bands should retain both the simplicity and flexibility of the Article 17 Procedure as currently applied by the Bureau. However, Article 17 in its present form does not meet the needs of all administrations and/or broadcasters and therefore is unsatisfactory as an ongoing procedure for planning the HFBC bands;

Since some groups of administrations and/or broadcasters have successfully coordinated their transmission requirements for over 30 years, informal coordination should be encouraged on the broadest scale possible;

Several elements of the Article 17 Procedure, including coordination, should form the basis of a new, simple and flexible planning procedure;

Furthermore, an improved version of the consultation procedure could also form the basis of a future HFBC planning system

2.3.5.2 Conclusions concerning Sect. III of current version of Article 17, (the improved HFBC Planning System)

The results of the planning exercises show that without any substantial increase in frequency spectrum or a reduction in requirements, it was impossible to develop acceptable plans using the Improved HFBC Planning System. Further, the consultation procedure was never fully tested under real conditions. It would not be useful to pursue this approach any further.

The ITU-R endorses Resolution 523 (WARC-92) which concluded that the idea of a detailed assignment plan is not appropriate for the HFBC bands.

2.3.5.3 Conclusions concerning the coordination process

Regular coordination of their respective transmission requirements between appropriate regional groups of administrations/broadcasters, to resolve and/or to reduce incompatibilities, should be actively promoted. Regional administrative and broadcasting organizations (such as CITEL, ASBU, etc.) are encouraged to establish such regional coordination groups.

Using the example of existing informal coordination groups, ways should be found to encourage, facilitate and better organize this coordination, in order to make it ongoing and more widespread.

Such coordination of transmission requirements should be achieved through a series of regular multilateral regional meetings of appropriate administrations/broadcasters.

An exchange between regional groups of their respective requirements and results of their coordination should be actively promoted to enable the resolution and/or the reduction of mutual incompatibilities.

The following items should be addressed in addition:

– improvement by provision of software for the selection of the appropriate HF bands;

– improvement by application of a performance assessment method;

– provisions must be made for inter-regional or global coordination.

2.3.5.4 Conclusions concerning Allotment Planning

The ITU-R reviewed the Allotment Planning Method presented by the Radiocommunication Bureau.

This allotment plan is more flexible than other allotment plans. However HF broadcasts are operated:

– via a continually time varying medium (ionosphere);

– in a heavily congested part of the frequency spectrum;

– for international long distance services that cross national and regional boundaries

Taking these problems into account, the ITU-R concluded that an allotment planning method was unlikely to produce a successful HFBC planning system and need not be considered any further.

2.4 Proposed coordination procedure and response to Resolution 529

2.4.1 Introduction

The CPM is of the view that the main framework of the seasonal planning procedure approach contained in Article 17 should be retained and modified to allow for a flexible solution for the

establishment of the seasonal schedules in all the bands allocated exclusively to the high frequency broadcasting service. The modified seasonal planning may consist of:

– the set of principles contained in Article 17 as they may be modified;

– a coordination process through which the administrations and broadcasters coordinate, directly or in regional or interregional meetings, the actual projected uses for a given season;

– a number of provisions defining steps of the coordination process, as few in number as possible, leaving for the sake of flexibility further details to be contained in the RRB Rules of Procedure;

– participation by the Bureau in coordination meetings to take care of requirements of developing countries which request assistance: there may be a need to specify precisely the case for assistance by the Bureau.

The CPM considers that this report responds to the purposes of Resolution 508 (WARC-79) and Resolution 523 (WARC-92).

2.4.2 HFBC Coordination Procedure

2.4.2.1 Guiding Principles

The coordination procedure shall apply to all HF bands allocated exclusively to the broadcasting service between 5 900 kHz and 26 100 kHz.

The coordination procedure shall be based on the principle of equal rights of all countries, large or small, to equitable access to these bands. In planning, an attempt shall also be made to achieve efficient use of these frequency bands, account being taken of the technical and economic constraints that may exist in certain cases.

All broadcasting requirements formulated by administrations, shall be taken into account and treated on an equitable basis, so as to guarantee the equality of rights referred to above, and to enable each administration to provide a satisfactory service.

The coordination procedure shall be based solely on the broadcasting requirements expected to become operational during the period of the schedule. It shall furthermore be flexible in order to take into account new broadcasting requirements and modifications to the existing broadcasting requirements.

All broadcasting requirements, national[1] and international, shall be treated on an equal basis, with due consideration of the differences between these two kinds of broadcasting requirements.

In the coordination procedure, an attempt shall be made to ensure, as far as practicable, continuity of use of a frequency or of a frequency band.

For efficient spectrum use, the number of frequencies used shall be the minimum necessary to provide a satisfactory quality of reception. Whenever possible, only one frequency should be used.

The coordination procedure shall include an agreed technical analysis, see Description 4, which shall be carried out in a timely manner.

The coordination procedure should:

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[1] An HF broadcasting requirement is considered as being for the purposes of national coverage when the transmitting station and its associated required service area are both located within the territory of the same country.

– be simple to implement;
– operate at reasonable cost;
– provide sufficient information to facilitate coordination.

2.4.2.2 Coordination Principles

The coordination procedure should encourage administrations or HF broadcasters empowered to make changes, to pursue a continual coordination process to resolve incompatibilities, both at face-to-face meetings (regional or worldwide, bilateral or multilateral) or by correspondence (telephone, facsimile, electronic mail, etc.)

In the process of coordinating broadcasting requirements, an attempt shall be made to coordinate the maximum number of submitted requirements with the quality level acceptable to administrations/broadcasters.

In order to ensure maximum success, administrations and broadcasters shall show the utmost goodwill and mutual cooperation, and give due consideration to all the relevant technical and operational factors involved.

2.4.2.3 The coordination process

The Bureau, in preparing the schedules, includes information from three sources:

1. broadcast schedules submitted by administrations which specify frequencies;
2. the previous schedule for the same period where an administration fails to submit its schedule;
3. frequencies selected by the Bureau in cases where administrations have indicated the need for assistance by the intentional omission of frequencies for their submitted schedules.

These three categories of "frequency requirements" are described, where appropriate, within the coordination procedure described below.

Administrations shall submit their projected broadcasting schedules in the relevant frequency bands to the Bureau twice a year. These schedules should take account of the suitability of the chosen frequency band for each requirement, see Description 1.

The following schedule periods are recommended:

Schedule A: Last Sunday of March - Last Sunday of October.

Schedule B: Last Sunday of October - Last Sunday of March.

Implementation of a new schedule shall start at 0100 UTC on the mentioned dates.

These schedule periods are chosen for reasons of an efficient coordination process. Many broadcasters change their schedules at these dates.

If an Administration considers it necessary to take account of propagation changes during the schedule period, it is recommended, for reasons of spectrum efficiency, that such requirements should be implemented on:

First Sunday of May,

First Sunday of September.

Other start and stop dates within a schedule period may be used to cater for requirements that have different schedule periods e.g. special events, clock changes on different dates not coincident with the schedule period etc.

The closing dates for receipt by the Bureau of the A and B schedules, from administrations are given in Description 2. These closing dates are set sufficiently far in advance of the start of a seasonal schedule to allow administrations and the Bureau enough time to undertake all the necessary subsequent actions, including compatibility analyses and any informal coordination that is required.

Administrations may include in their schedules assignments up to one year in advance of their use.

In those cases where administrations do not indicate their use of a new schedule, the Bureau will use the previous schedule for the same administration and schedule period. The Bureau will follow this practice for two consecutive schedule periods. Thereafter the Bureau will notify the administration concerned that the Schedule will not include their broadcasting requirements unless the administration advises otherwise. A note in the schedule shall be used to identify such requirements. Administrations shall notify the Bureau if they have decided to stop HF broadcasting.

Administrations are encouraged to coordinate their schedules with other administrations as far as possible prior to submission. An administration may submit on behalf of a group of administrations their coordinated schedules the frequencies of which shall however have no priority for use over those submitted by other administrations.

It is desirable that in each schedule, the frequencies to be used in a given reception area should be repeated from the equivalent schedule in the previous year, or from the previous schedule. However, this should be consistent with changes in propagation conditions.

Administrations shall submit their individual and/or coordinated schedules containing all the relevant data in accordance with the information contained in Descriptions 2 and 3.

Upon receipt of the schedules the Bureau shall validate the data where necessary, consolidate the schedules, perform a compatibility analysis in accordance with Description 4, and shall send to administrations this consolidated schedule (the Tentative Schedule) and the results of the compatibility analysis. The Tentative Schedule shall include all assignments where administrations gave no alternatives, the selections made by the Bureau from any alternatives given, and the frequencies selected by the Bureau in cases where the need for its assistance was indicated by the intentional omission of frequencies from the individual schedules.

Administrations should consider the Tentative Schedule and should coordinate their frequency schedules to resolve and/or to minimize, as far as possible, any incompatibilities identified by the technical examination carried out by the Bureau, or by the monitoring results of similar assignments, or by a combination of both the technical examination and monitoring information.

This coordination could be achieved in a number of ways, through correspondence (including by electronic means), through bilateral meeting, through multilateral meetings of appropriate administrations and/or broadcasters, or through a combination of each of those ways.

Following this process of coordination, administrations shall inform the Bureau, as quickly as possible, of any changes to their requirements which they intend to make. The Bureau shall prepare the High Frequency Broadcasting Schedule (the Schedule) and shall perform a new compatibility analysis. The Bureau shall publish the Schedule and the results of the compatibility analysis at the start of the relevant broadcasting season.

Administrations shall notify the Bureau of changes to their schedules as quickly as possible and the Bureau shall update the Schedule, perform new compatibility analyses and publish the updated Schedule and the results of their analyses two months and four months after the start of the relevant season.

Description 2 shows, in flow chart form, the above coordination process and the associated timetable of actions by administrations and the Bureau.

2.4.3 Response to Resolution 529 (WRC-95)

2.4.3.1 Protection of other services

The ITU-R proposes that:

– The other primary services in the additional bands allocated by WARC-92 to the broadcasting service shall be protected until 1 April 2007.

– Before 29 March 1998, the Bureau shall send to each Administration a list of all its frequency assignments in these bands, encouraging all administrations to verify the list and delete unused assignments.

– If harmful interference is caused by a broadcasting station to another primary service, the Administrations involved should be encouraged to deal with the problem by direct coordination between their operating organizations, as foreseen in RR 1946 [S15.26].

2.4.3.2 Transition from double side band (DSB) emissions to single side band (SSB) emissions

Resolution 517 (WARC-HFBC-87) describes a transition plan for DSB emissions to be replaced by SSB emissions. The plan began in 1987. The conclusion of the plan was scheduled for 31 December 2015 when SSB emissions with a 12 dB carrier reduction are to be used. The Resolution specifies that the date of the conclusion of the plan is to be periodically reviewed by competent future world administrative conferences in the light of the latest available statistics on the worldwide distribution of SSB transmitters and receivers. One such review shall take place before the year 2000.

Recognizing that rapid developments are taking place in digital sound broadcasting technologies, all references to SSB in this chapter should take such new techniques into account.

The ITU-R has considered bringing forward the date of availability of the HF bands allocated by WARC-92 to the broadcasting service. As indicated in S5.136, S5.143, S5.146 and S5.151, after 1 April 2007 the existing services may not cause harmful interference to the broadcasting service:

The ITU-R proposes that a progressively increasing portion of these bands should be reserved for SSB usage only starting 29 March 1998. The proposed percentage of spectrum and dates should be considered by WRC-97 and reviewed by future WRCs on the basis of proposals made by administrations in the light of the availability of suitable transmitters and receivers for SSB or any new HF broadcasting techniques recommended by ITU-R.

Table 2.1 gives a draft outline of a timetable for the introduction of SSB emissions in the WARC-92 bands as well as the other bands allocated to HF broadcasting. In this context, any new HF broadcasting techniques recommended by the ITU-R could be used in place of, or in addition to, SSB.

TABLE 2.1

Possible timetable for the introduction of SSB emissions in the bands allocated to HF Broadcasting

1987	29.3.1998	1.1.2005	1.4.2007	31.12.2015

<table>
<tr><td>WARC 92
Extension-bands</td><td></td><td>See NOTE A</td><td>See NOTE B</td></tr>
<tr><td rowspan="2">pre-WARC-79 (ART 17) bands
and WARC 79 extension-bands</td><td colspan="2" rowspan="2">See NOTE C</td><td></td></tr>
<tr><td>See NOTE D</td></tr>
</table>

NOTE A: Progressive increase in the parts of HF bands allocated to the broadcasting service for use by SSB emissions (with 12 dB carrier reduction relative to p.e.p.) sharing with the primary services.

The progressive increase is indicated as the percentage of spectrum in each extension band for use by SSB as a function of time.

15% 29.3.1998 25% 1.1.2000 50% year ( ) 75% year ( ) 100% 1.4.2007

A set of possible frequencies which could be used by SSB from the years 1998 and 2000 is given in Table 2.2 and should be reviewed by future WRCs

NOTE B: Broadcasting service primary exclusively with SSB emissions with fixed and mobile services being secondary.

NOTE C: Transition period from DSB to SSB as specified in Annex to Res. 517 (HFBC 1987).

During the early part of the transition period SSB emissions will be mainly received by conventional DSB receivers using envelope detection. In order to avoid undue deterioration of reception quality, SSB emissions intended for reception by DSB receivers will require a carrier reduction not exceeding 6 dB relative to p.e.p.

NOTE D: Progressive increase in the parts of HF bands allocated to the broadcasting service for use exclusively by SSB emissions (with 12 dB carrier reduction relative to p.e.p.)

The progressive increase is indicated as the percentage of spectrum for exclusive use by SSB as a function of time.

15% 1.1.2005 25% 1.4.2007 50% year ( ) 75% year ( ) 100% 31.12.2015

A set of possible frequencies which could be used by SSB from the years 2005 and 2007 is given in Table 2.3 and should be reviewed by future WRCs.

2.4.3.3 Testing the HFBC Coordination Procedure

This section provides an outline of the recommended criteria to be used in the testing of the coordination procedure.

It is recommended that each software module, required by the coordination procedure, is developed and tested before conducting a test of the full coordination procedure. This will allow time to modify some aspects of the procedure in light of the results of these tests.

2.4.3.3.1 Software development

The coordination procedure will require a number of software modules to be developed, tested and supplied to administrations by the Bureau. This will ensure that the same software modules are used by administrations and the Bureau for the analysis of the schedules. This software should be developed by the Bureau with assistance from administrations.

Data capture of requirements

A new module will be required that permits the capture of all data elements detailed in Description 2. This module should also contain validation routines that prevent inconsistent data being captured and sent to the Bureau for processing.

Propagation calculation

This new module should calculate the signal strength and other necessary data at all relevant test points as described in Descriptions 1 and 4.

This module should also include an option that allows administrations to select the optimum frequency bands for their requirements.

The output format of the data and medium should be such that it allows easy publication and distribution of the results to all administrations.

Compatibility analysis

This module should use the output of the propagation calculation to provide a technical analysis of a requirement both alone and in the presence of other requirements as in Description 4. This analysis is used in the coordination process.

The values for the parameters given in Description 4 should be user selectable but the recommended default values should be used in the absence of other values.

The results of this analysis should be capable of being displayed in a graphical format for a defined service area as in Description 4.

2.4.3.3.2 Test procedure

When available, the new data capture software should be sent to administrations and used in the submission of requirements under Article 17.

The data captured using this new software can be used by the Bureau to test the propagation calculation software.

When this software is complete, it should be sent to administrations to provide assistance in selecting the optimum band for their requirements before submission to the Bureau.

The results of the propagation calculation can be used to test the technical analysis module by both the Bureau and administrations. It may require a period of consultation to reach an agreed presentation of results.

Once these software modules are fully developed, a full test of the planning procedure can be conducted.

2.5 Advantages and disadvantages of the proposed coordination procedure

2.5.1 Advantages of a method based on a coordination procedure

The proposed coordination procedure would lead to:

– Common technical approach:

usage of the same updated prediction method;

usage of the same updated antenna diagram method of calculation;

usage of uniform requirement data presentation.

– Quick access to actual spectrum occupancy data due to the regular exchange of more accurate and up to date information on participants seasonal transmission requirements.
– Better cooperation and mutual understanding between frequency managers due to face-to-face contacts.

As a consequence most potential problems can be solved on the spot. If necessary coordination may continue after the coordination meetings to resolve outstanding problems.

The coordination procedure further leads to:

– Equal treatment for national and international requirements;
– To greater continuity of frequency usage as far as propagation conditions allow.
– Sharing of frequency management skills and experience.
– The possibility to exchange monitoring data, providing a measure of success of the coordination process.

2.5.2 Disadvantages of a method based on a coordination procedure

The following constraints of a coordination procedure have been considered:

– The success of the coordination procedure depends on the commitment of HF-Broadcasters to the coordination process.
– The possibility that not all incompatibilities may be solved to full satisfaction. (This possibility is common to all planning systems.)
– The financial burden concerning communication and attendance, in particular for developing countries, at coordination meetings.

2.5.3 Possible improvements of a coordination process

Present coordination is done on a regional basis. Owing to long distance propagation characteristics of the HF broadcasting service, there is a need to expand the coordination process to a global process. To prevent too serious time constraints during a global coordination conference it may be better to gain further experience in regional coordination meetings before developing at once into a global system. During this phase a possible link between simultaneous regional meetings can be realized by exchanging requirement databases via for example electronic mail. Such a gradually growing process would initially avoid the large administrative overheads associated with a centrally organized conference and reduce the need and expense of long distance travel.

During a coordination meeting frequency managers should work together to realise as far as possible an optimization of spectrum usage to avoid waste of spectrum.

Special consideration should be given to the accommodation of requirements with low radiated power.

2.6 Regulatory and Procedural Considerations

2.6.1 Proposed Article S12

PROPOSED ARTICLE S12~~OF VGE~~

MOD

Seasonal Planning of and Procedure for the HF Bands Allocated Exclusively to the Broadcasting Service Between 5 9505 900 kHz and 26 100 kHz[1]

Section I. Introduction

MOD S12.1

When applying the procedure of this Article administrations are urged to comply to the maximum possible extent with the principles contained in Section II of this Article.

The use of the frequency bands allocated exclusively to the HFBC between 5 900 and 26 100 kHz shall be based on the principles given below and shall be in conformity with seasonal planning based on a coordination procedure between administrations (referred in this Article as the Procedure) described in S12.2 to S12.45. An administration may authorize a broadcasting organization (referred to in this Article as a broadcaster) to act on its behalf in this coordination.

Section II. PlanningPrinciples

MOD S12.2

(1) The [planning pProcedure] of the high frequency bands allocated to the broadcasting service shall be based on the principle of equal rights of all countries, large or small, to equitable access to these bands. In planning, an aAttempts shall also be made to achieve efficient use of these frequency bands, account being taken of the technical and economic constraints that may exist in certain cases. On the basis of the foregoing, the following planning principles shall be applied.

MOD S12.3

(2) All the broadcasting requirements, current or future, formulated by the administrations, shall be taken into account and treated on an equitable basis, so as to guarantee the equality of rights referred to in No. **S12.2**, and to enable each administration to provide a satisfactory service.

MOD S12.4
~~S12.6~~

(53) The periodical planning pProcedure shall be based solely on the broadcasting requirements expected to become operational during the planning schedule period. It shall furthermore be flexible in order to take into account new broadcasting requirements and modifications to the existing broadcasting requirements.

---

[1] Resolution 529 should be modified to take account of the application of this Procedure in the frequency band allocations to the HFBC service.

MOD **S12.5**
~~**S12.4****

(~~3~~4) All broadcasting requirements, national~~1~~2 and international, shall be treated on an equal basis, with due consideration of the differences between these two kinds of broadcasting requirements.

MOD **S12.6**
~~**S12.5**~~

(~~4~~5) In the ~~planning p~~Procedure, an attempt shall be made to ensure, as far as practicable, continuity of use of a frequency or of a frequency band. ~~However, such continuity should not prevent equal and technically optimum treatment of all broadcasting requirements.~~

MOD **S12.7**

(6) The Procedure shall be based on double-side band or single-side band emissions. Other modulation techniques recommended by ITU-R shall be permitted in place of double-sideband or single-sideband emissions, provided that the level of interference caused to existing emissions is not increased.

MOD **S12.8**

(7) For efficient spectrum use, ~~only one frequency should be used, whenever possible, to meet a given broadcasting requirement in a given required service areas; in any case~~ the number of frequencies used ~~will~~shall be the minimum necessary to provide a ~~specified~~satisfactory quality of reception. Whenever practicable, only one frequency should be used.

MOD **S12.9**

(8) The procedure shall include a technical analysis, as specified in the RRB Rules of Procedure.[3]

MOD **S12.10**

(9) The Procedure should encourage administrations or broadcasters empowered to make changes, to pursue a continual coordination process to resolve incompatibilities at meetings (regional or worldwide, bilateral, multilateral) or by correspondence.

MOD **S12.11**

(10) Regional groups[4] , which will facilitate bilateral and multilateral coordination among the administrations and broadcasters in various regions of the world, shall be identified. Administrations and broadcasters shall be urged to participate in the relevant coordination groups. However, such participation would be on a voluntary basis.

MOD **S12.12**

(11) Action by the Bureau to coordinate requirements on behalf of administrations whose requirements do not exceed (a value to be defined by a WRC) is part of the seasonal planning and should be undertaken on request from those administrations.

MOD ~~1~~2 An HF broadcasting ~~use~~requirement is considered as being for the purposes of national coverage when the transmitting station and its associated required service area are both located within the territory of the same country.

[3] See action required in Section 2.6.2.

[4] Not related to ITU Regions.

MOD **S12.13**
~~**S12.10**~~

(~~10~~12) In the process of coordinating broadcasting requirements, ~~first stage of the equitable application of a new planning procedure~~, an attempt ~~will~~ shall be made to ~~include~~obtain agreement to the maximum number of submitted requirements ~~achieving the desired~~with the quality level acceptable to administrations or broadcasters. ~~The remaining requirements will be processed on the understanding that lower quality levels would be acceptable~~

Comment by the CPM: The coordination process referred to in this provision should be explained in more detail (whether it is an annual or semi-annual meeting, under the auspices of ITU or not, etc.).

MOD **S12.14**

(13) The other primary services in the additional bands allocated by WARC-92 to the broadcasting service shall be protected until 1 April 2007, and assignments to these other primary services should be taken into account in the Procedure of this Article.

MOD **S12.15**

(14) In order to ensure maximum success from the Procedure, administrations and broadcasters shall show the utmost goodwill and mutual cooperation, and give due consideration to all the relevant technical and operational factors involved.

MOD

Section III. ~~Planning System~~The Procedure

MOD S12.16
~~S12.13~~ Twice yearly administrations shall submit their projected seasonal broadcasting schedules in the relevant frequency bands to the Bureau. These schedules shall cover the following ~~seasons and shall be implemented at 0001 UTC on the first Sunday of each period concerned~~ seasonal periods:

MOD S12.17 Schedule A: Last Sunday in March to last Sunday in October

MOD S12.18 Schedule B: Last Sunday in October to last Sunday in March

MOD S12.19 Implementation of these schedules shall start at 0100 UTC

MOD S12.20 If an administration considers it necessary to take account of propagation changes during the schedule period, it is recommended, for reasons of spectrum efficiency, that such requirements should be implemented on:

MOD S12.21 First Sunday of May;

MOD S12.22 First Sunday of September.

MOD S12.23 Implementation of these changes shall start at 0100 UTC on these dates.

MOD S12.24 Other start and stop dates within a schedule period may be used to cater for requirements that have different schedule periods e.g. special events, clock changes on different dates not coincident with the schedule period etc.

MOD S12.25
~~S12.21~~ Administrations may include in their schedules assignments up to one year in advance of their use ~~provided that the characteristics are not expected to change during that period~~.

MOD S12.26 In those cases where an administration does not indicate its use of a new schedule, the Bureau shall use the assignments for the previous schedule for this administration and this new schedule period. A note in the Schedule shall be used to identify such requirements. The Bureau shall follow this practice for two consecutive schedule periods.

MOD S12.27 Following the action taken in No. **S12.26**, the Bureau shall notify the administration concerned that the Schedule will not include their broadcast requirements unless the administration advises otherwise.

MOD S12.28 When an administration decides to cease its broadcasting service in the HF bands, it shall notify the Bureau of such decision.

MOD **S12.29**

~~S12.22~~ The frequencies in the schedules should be those that will be used during the season concerned, and they should be the minimum number required to provide satisfactory reception of the programmes in each of the areas and for each of the periods intended. To the maximum possible extent in each schedule the frequencies to be used in each reception area should be repeated from season to season.

MOD **S12.30**

~~S12.23~~ Administrations are encouraged to coordinate their schedules with other administrations as far as possible prior to submission. An administration may submit on behalf of a group of administrations their coordinated schedules the frequencies of which shall however have no priority for use over those submitted by other administrations.

ADD **S12.31**

~~S12.24~~ The closing dates for receipt by the Bureau of the schedules relating to the two seasons mentioned in No. ~~**S12.13**~~**S12.17** and **S12.18** ~~and the four seasons mentioned in No.S12.16~~ shall be established and published by the Bureau.

ADD **S12.32**

~~S12.25~~ The schedules shall be submitted with the relevant data contained in Appendix **S4** ~~in accordance with the practices recommended in the Rules of Procedure~~.

ADD **S12.33**

~~S12.26~~ Upon receipt of the schedules the Bureau shall, in accordance with the Rules of Procedure ~~consolidate them~~, validate the data where necessary, perform a compatibility analysis, ~~identify such incompatibilities as it may be able,~~ and prepare the Tentative High Frequency Broadcasting Schedule (the Tentative Schedule). This schedule shall include all assignments where administrations gave no alternatives, the selections made by the Bureau from any alternatives given, and the frequencies selected by the Bureau in cases where the need for its assistance was indicated by their intentional omission from the individual schedules.

ADD **S12.34**

~~S12.27~~ The Tentative Schedule shall be published at least two months before the start of each of the two ~~seasons~~schedule periods in Nos. ~~S12.13~~ S12.17 and S12.18.

ADD **S12.35**

~~S12.28~~ Administrations should ~~consider~~examine the Tentative Schedule and should coordinate their frequency schedules to resolve and/or to minimize, as far as possible, any incompatibilities identified by the compatibility analysis, or by the monitoring results of similar assignments, or by a combination of both~~before or during~~

~~the season, they should, as quickly as possible, inform the Bureau of any changes they intend to make from their original submission and the reasons for those changes. The Bureau shall publish this information regularly and up date the Schedule as appropriate~~.

ADD S12.36 Coordination shall be achieved through bilateral or multilateral meetings of administrations or broadcasters or other means acceptable to the parties concerned.

ADD S12.37 Administrations, either jointly or separately, shall inform the Bureau, as quickly as possible, but no later than two weeks prior to the start of the schedule period, of any changes to their requirements resulting from the coordination process. The Bureau shall prepare a new consolidated High Frequency Broadcasting Schedule (the Schedule), and shall perform a new compatibility analysis. The Bureau shall publish the Schedule and the results of the compatibility analysis at the start of the relevant broadcasting season.

ADD S12.38 Administrations shall notify the Bureau of changes to their schedules as quickly as possible and the Bureau shall update and make available the Schedule on a monthly basis. The Bureau shall perform new compatibility analyses and publish the updated Schedule and the results of these analyses every two months during the season.

ADD S12.39 To facilitate the coordination process, the Bureau shall forward the Tentative Schedule to these regional[5] groups.

ADD S12.40 Regional groups should consider interfacing with administrations and broadcasters through the use of e-mail, news-groups, bulletin boards and other forms of electronic data transfer as appropriate.

ADD S12.41 Each regional group should consider appointing a Steering Committee to ensure smooth progress of the coordination process.

ADD S12.42 During and after the coordination process, the regional groups shall exchange schedule data among themselves with a view to further enhancing the efficacy of the coordination process.

---

[5] Not related to ITU Regions.

MOD **S12.43**

~~**S12.29**~~ One month after the end of a ~~After each~~ season, the Bureau shall publish the Final High Frequency Broadcasting Schedule (the Final Schedule). If any changes have been notified to the Bureau since the previous consolidated schedule, the Bureau shall also perform a compatibility analysis and publish it with the Final Schedule~~consult the administrations concerned, the actual frequencies used and shall periodically publish the results to administrations~~.

ADD **S12.44** The Bureau should, as and when required, convene joint meetings of the representatives of all the regional groups to develop strategies for further reduction of incompatibilities and to discuss related matters. The outcome of these meetings shall be circulated among the regional groups and administrations.

MOD **S12.45**

~~**S12.30**~~ In a case of harmful interference, involving the application of the provisions of Article **S15**, administrations are urged to exercise the utmost goodwill and mutual cooperation taking into account all the relevant technical and operational factors of the case.

2.6.2 Regulatory text still to be developed

In considering the information and Procedure described in Section 2.4, WRC-97 may note that guidelines should be given to the RRB for the development of their Rules of Procedure in the form of regulatory provisions and/or Resolutions.

In considering the timetable for the introduction of SSB transmissions and other previously mentioned techniques in the bands allocated to HF broadcasting, WRC-97 may note that regulatory text and/or ITU Resolutions/Recommendations will need to be developed as appropriate.

DESCRIPTION 1

Selection of suitable frequency band(s)

General

In order to assist broadcasters and administrations in the preparation of their HF broadcasting requirements, the Bureau will prepare and distribute suitable computer software. This should be easy to use and the output should be easy to understand.

User input data

The user must be able to enter:

– the name of the transmitting station (for reference purposes);
– the geographic coordinates of the transmitting station;
– the transmitter power;
– the bands which are available for use;
– hours of transmission;
– sun spot number;
– months during which a service is required;
– the available antenna types, together with the relevant directions of maximum radiation;
– the required coverage area specified as a set of CIRAF Zones and quadrants (or by means of relevant geographic information).

It is desirable that the software should be able to store the above information, once it has been entered correctly, and provide the user with an easy means of recalling any previously entered information.

Methodology and data

The software shall use:

– Recommendation ITU-R BS.705 for the calculation of antenna patterns;
– Recommendation ITU-R P.533 for the prediction of wanted field strength values;
– Recommendation ITU-R P.842 for the calculation of reliability values.

The set of 911 test points (agreed at WARC 1987) shall be used, supplemented where necessary with test points based on a geographic grid.

The software shall calculate the field strength values and the fading margins at each test point inside the required service area for each of the frequency bands declared to be available, taking account of the relevant transmitting antenna characteristics for each frequency band. The desired RF signal to noise ratio shall be user selectable with a default value of 34 dB.

The dates for which calculations are made shall be user selectable, the default values being:

– 0.5 month after the start of the season;
– mid-point of the season;
– 0.5 month before the end of the season.

The times for which calculations are made shall be user selectable, the default values being:

– 30 minutes past the hour in which the requirement starts;

– 30 minutes past each successive hour until the hour in which the requirement stops.

Software output data

For rapid assessment of suitable bands, the software shall calculate:

– the basic service reliability (BSR) for each available band and for the relevant test points from the set of 911 test points;

– the basic area reliability (BAR) for each available band and for the relevant test points from the set of 911 test points.

In order to provide information about the geographic distribution of wanted signal values within the required service area, additional results should be available from the software:

– a listing should be available giving, for each of the available bands, the basic circuit reliability (BCR) for each of the test points (from the set of 911 test points) inside the required service area.

In some cases, a graphical display of the BCR values throughout the required service area may be desirable. These values should be calculated at test points at 2 degree intervals of latitude and longitude throughout the required service area.

The BCR values should be displayed graphically as a set of coloured or hatched "pixels" scaled in steps of 10 percent. It should be noted that:

– reliability values relate to the use of a single frequency band;

– reliability values are a function of the desired RF signal to noise ratio (user selectable);

– the field strength values should be calculated by the supplied software on the user's own computer hardware. The software supplied should calculate the relevant reliability values based on these field strength values and the user supplied desired signal to noise values.

DESCRIPTION 2

Time sequence for the coordination process

In the sequence outlined below, the start date for a given schedule period is defined as D and the end date for the same schedule period is defined as E.

Date	**Action**
D-4 months	Closing date for Administrations to send their schedules[2] to the Radiocommunications Bureau (Bureau) preferably by electronic mail or on 3.5" diskette (720 kByte or 1.44 MBytes). Schedule data will be made available via TIES as soon as it has been processed.
D-2 months	Bureau to send to Administrations a consolidated schedule (the Tentative Schedule) together with a complete compatibility analysis[3].
D-2 weeks	Closing date for receipt of amendments from Administrations to correct errors and other changes resulting from the coordination process to ensure that this information appears in the Schedule for date D.
D	Bureau to issue the High Frequency Broadcasting Schedule and compatibility analysis.
D to E	Administrations to correct errors and coordinate change requirements sending information to Bureau as it becomes available.
	Bureau to issue updates of the Schedule and compatibility analysis at intervals of two months.
E	Closing date for receipt of final operational schedules from Administrations to Bureau. No input is needed if there have been no changes to the information previously sent.
E+1 month	Bureau to send to Administrations the final consolidated schedule (the Final Schedule) together with a compatibility analysis.

Figure 1 shows, in flow chart form, the coordination process and the associated timetable of actions by administrations and the Bureau.

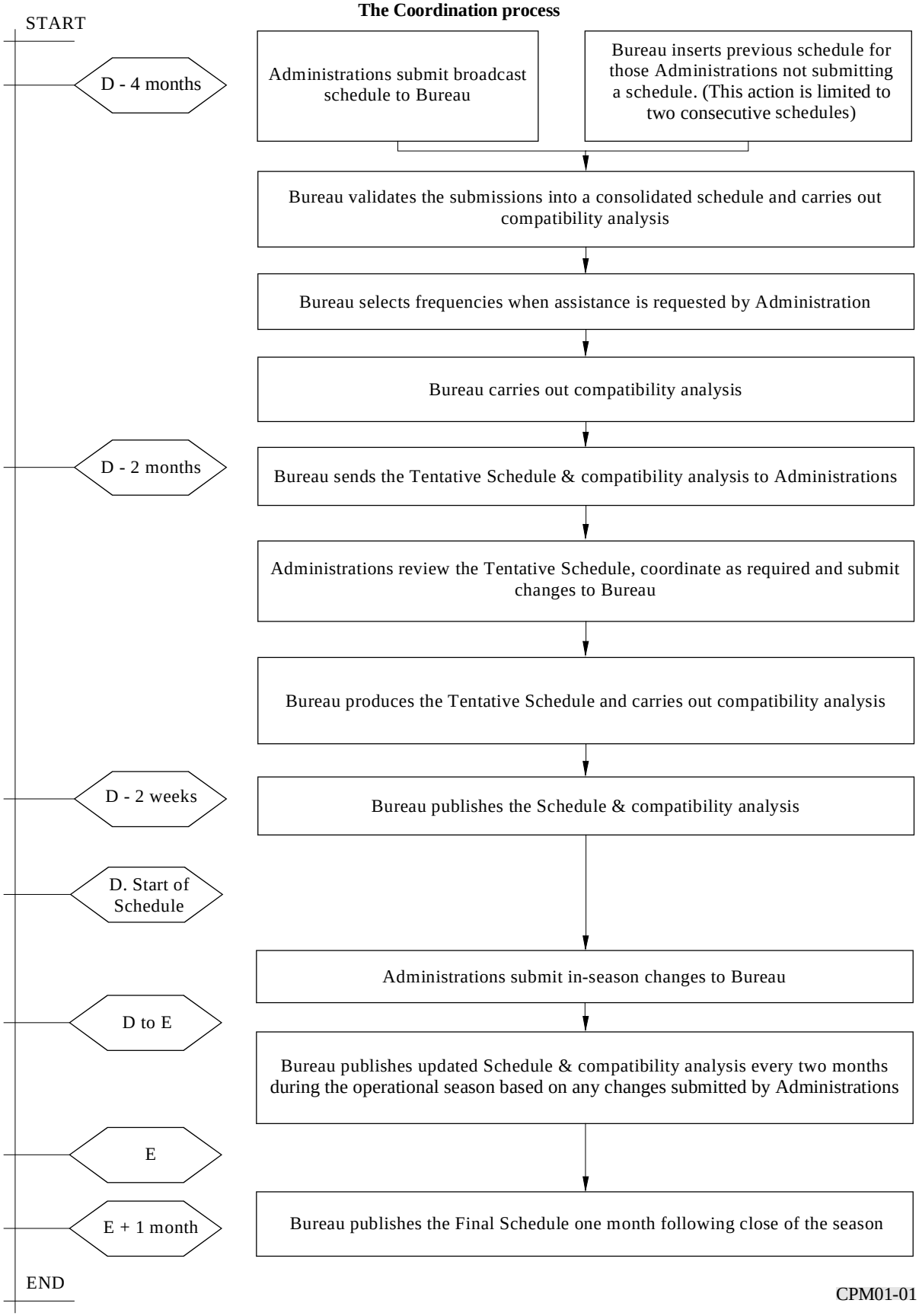
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[2] See Description 3.

[3] See Description 4. The schedules and the results of the analyses should be available on CD-ROM and in TIES.

FIGURE 1

The Coordination process



DESCRIPTION 3

Specification of input data for a requirement

The fields needed for a given requirement and their specifications are:

– Frequency in kHz, up to 5 digit integer;

– Start Time, as 4 digit integer;

– Stop Time, as 4 digit integer;

– Target service area, as a set of up to 12 CIRAF zones and quadrants up to a maximum of 30 characters;

– Site Code, a 3 character code from a list of codes, or a site name and its geographic coordinates;

– Power in kW, up to 4 digit integer;

– Azimuth of maximum radiation, as indicated below;

– Slew angle, up to 2 digit integer representing the difference between the azimuth of maximum radiation and the direction of unslewed radiation;

– Antenna Code, up to 3 digit integer from a list of values, or a full antenna description, as given in Recommendation ITU-R BS.705;

– Days of operation, as indicated below;

– Start Date, in the case that the requirement starts after the start of the schedule;

– Stop Date, in the case that the requirement stops before the end of the schedule;

– Modulation choice, to specify if the requirement is to use DSB or SSB (see Recommendation ITU-R BS.640). This field may be used to identify any other type of modulation when this has been defined for use by HFBC in an ITU-R Recommendation;

– Administration code;

– Broadcasting organization code, as indicated below;

– Identification number;

– Identification of synchronization with other requirements.

DESCRIPTION 4

Compatibility analysis

General

In order to assess the performance of each requirement in the presence of noise and the potential interference from other requirements using the same or adjacent channels, it is necessary to calculate the relevant reliability values. The Bureau will prepare suitable software to enable this to be done, taking account of user requirements in terms of desired signal-to-noise and signal-to-interference ratios.

Input data

The programme schedule for a given season - this may be either an initial consolidated schedule (to permit assessment of those requirements which need coordination) or the High Frequency Broadcasting Schedule (to provide assessment of the likely performance of requirements during the relevant season).

Methodology and data

The software shall use:

– Recommendation ITU-R BS.705 for the calculation of antenna patterns;

– Recommendation ITU-R P.533 for the prediction of the wanted field strength values at each test point for each wanted requirement;

– Recommendation ITU-R P.533 for the prediction of the potentially interfering field strength values from all other co-channel or adjacent channel requirements at each test point for each wanted requirement;

– Recommendations 517 (HFBC-87) and ITU-R BS.560 for adjacent channel RF protection ratios;

– Recommendation ITU-R P.842 for the calculation of reliability values.

The set of 911 test points (agreed at WARC 1987) shall be used, supplemented where necessary with test points based on a geographic grid.

The software shall calculate the wanted and unwanted field strength values and the fading margins at each test point inside the required service area.

The desired RF signal to noise and RF protection ratios shall be user selectable, the default values being 34 dB and 17 dB (co-channel case) respectively. The latter values shall be used by the Bureau for its compatibility analyses.

The dates for which a compatibility analysis is made shall be user selectable, the default values being:

– 0.5 month after the start of the season;

– mid-point of the season;

– 0.5 month before the end of the season.

These default values shall be used by the Bureau for its compatibility analyses.

The times for which a compatibility analysis is made shall be user selectable, the default values being:

– 30 minutes past the hour in which the requirement starts;

– 30 minutes past each successive hour until the hour in which the requirement ends.

These default values shall be used by the Bureau for its compatibility analyses.

Software output data

For rapid assessment of the performance of a requirement, the software shall calculate:

– the overall service reliability (OSR) for the relevant test points from the set of 911 test points;

– the overall area reliability (OAR) for the relevant test points from the set of 911 test points.

In order to provide information about the geographic distribution of wanted and unwanted signal values for a given requirement, additional results should be available from the software:

– a listing should be available giving the overall circuit reliability (OCR) for each of the relevant test points from the set of 911 test points.

In some cases, a graphical display of the OCR values throughout a required service area may be desirable. These values will need to be calculated by the user (with the supplied software and on the user's own computer hardware) at test points at 2 degree intervals of latitude and longitude throughout the required service area. The OCR values should be displayed graphically as a set of coloured or hatched pixels in steps of 10 per cent. It should be noted that:

– reliability values relate to the use of a single frequency;

– reliability values are a function of the desired RF signal to noise and RF protection ratios(both user selectable);

– the field strength values for the test points (from the set of 911 test points) inside the required service area should be calculated by the Bureau. The software supplied should calculate the relevant reliability values based on these pre-calculated field strength values and the user supplied desired signal to noise and signal to interference values.

– the field strength values for the test points at 2 degree intervals should be calculated using the supplied software on the user's own computer hardware. The software supplied should calculate the relevant reliability values based on these field strength values and the user supplied desired signal to noise and signal to interference values.

TABLE 2.2

POSSIBLE EXCLUSIVE SPECTRUM FOR SSB OR OTHER ITU-R RECOMMENDED HFBC SYSTEM 1992 EXTENSION BANDS								
Frequency Band		**Bandwidth**	**Exclusive SSB Spectrum available from 29.3.1998 to 31.12.1999**			**Exclusive SSB Spectrum available from 1.1.2000**		
From (kHz)	To (kHz)	(kHz)	(15% of total)			(25% of total)		
			Frequency Band		**Bandwidth**	**Frequency Band**		**Bandwidth**
			From (kHz)	To (kHz)	(kHz)	From (kHz)	To (kHz)	(kHz)
5900	5950	50						
7300	7350	50						
9400	9500	100						
11600	11650	50						
12050	12100	50						
13570	13600	30	13570	13600	30	13570	13600	30
15600	15800	200	15760	15800	40	15750	15800	50
17480	17550	70						
18900	19020	120	18970	19020	50	18900	19020	120
	Total (kHz)	**790**			**120**			**200**

TABLE 2.3

POSSIBLE EXCLUSIVE SPECTRUM FOR SSB OR OTHER ITU-R RECOMMENDED HFBC SYSTEM PRE 1979 BANDS AND 1979 EXTENSION BANDS								
Frequency Band		**Bandwidth**	**Exclusive SSB Spectrum available from 1.4.2005 to 31.3.2006**			**Exclusive SSB Spectrum available from 1.1.2007**		
From (kHz)	To (kHz)	(kHz)	(15% of total)			(25% of total)		
			Frequency Band		**Bandwidth**	**Frequency Band**		**Bandwidth**
			From (kHz)	To (kHz)	(kHz)	From (kHz)	To (kHz)	(kHz)
5950	6200	250						
7100[4]	7300[4]	200						
9500	9900	400	9500	9550	50	9500	9550	50
11650	12050	400	12000	12050	50	11975	12050	75
13600	13800	200	13770	13800	30	13725	13800	75
15100	15600	500	15550	15600	50	15450	15600	150
17550	17900	350	17550	17650	100	17550	17700	150
21450	21850	400	21750	21850	100	21700	21850	150
25670	26100	430	26000	26100	100	25950	26100	150
	Total (kHz)	**3130**			**480**			**800**

[4] Regions 1 and 3 only.

CHAPTER 3

MARITIME AND AERONAUTICAL SERVICES
(WRC-97 Agenda items 1.6, 1.8)

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3.1 WRC-97 Agenda Item 1.6

Matters related to the maritime mobile and maritime mobile-satellite services.

3.1.1 Agenda Item 1.6.1

To consider and take appropriate action in respect of the provisions of Chapters **IX** [Appendix **S13**] and **NIX** [Chapter **SVII**] of the Radio Regulations, as stipulated in Resolution **331 (Mob-87)**, and appropriate action in respect of the issues dealt with in Resolutions **200 (Mob-87)**, **210 (Mob-87)** and **330 (Mob-87)**, including maritime certification and licensing issues related to Chapter [**SIX**] of the Radio Regulations, taking into account that the global maritime distress and safety system (GMDSS) shall be fully implemented in 1999.

3.1.1.1 Review of Chapter IX (Appendix S13) as stipulated in Resolution 331 (Mob-87)

The International Convention for the Safety of Life at Sea (SOLAS), 1974, as amended, prescribes that ships subject to the SOLAS Convention shall be fitted for the GMDSS by 1 February 1999.

The IMO in its contribution to WRC-95 (Document CPM95/46) stated that there is a need to amend the present Radio Regulations on watchkeeping on 500 kHz, 2 182 kHz and VHF channel 16, at WRC-97, in order to make it possible for IMO Member Governments and ITU Member Administrations to release stations in the international maritime service from the listening watch on 500 kHz, 2 182 kHz and VHF channel 16 in an orderly manner at an appropriate point in time after 1 February 1999.

It is expected that a number of ships not subject to the SOLAS Convention will make use of the frequencies and techniques described in Chapter IX (Appendix S13) for some time after January 1999.

Consideration should therefore be given not to leave these ships without regulatory control and to retain Chapter IX for some time after January 1999, properly amended to accomodate the request made by IMO.

Consideration should be given to make the provisions in Chapter IX (Appendix S13) on use of the frequency 500 kHz voluntary as from 1 February 1999, and to place Chapter IX (Appendix S13) on the agenda for WRC-2001.

3.1.1.2 Chapter NIX (SVII)

Since the beginning of the GMDSS implementation period in 1992, the GMDSS has been affected by a high rate of false alerts, failure to cancel or acknowledge the transmission of false alerts, the use of improper or unregistered MMSIs (Maritime Mobile Service Identities), and a lack of telecommunication interoperability between GMDSS and non-GMDSS ships. It has also been noted that Chapter NIX (SVII) does not contain any reference to the obligations on ships to transmit danger messages in accordance with Chapter V of the International Convention for the Safety of Life at Sea (SOLAS) 1974, as amended see **f)**.

Some of the above matters could be covered by the Radio Regulations; others by conference Resolutions.

a) Communication between GMDSS and non-GMDSS ships

Provision No. N3080 (S31.18) requires, where practicable, GMDSS ships to maintain watch on 156.650 MHz (Channel 13) for communication related to safety of navigation. Non-GMDSS ships will continue to keep watch on 156.8 MHz (Channel 16) and 2 182 kHz. Whenever contact needs to be made between the two categories of ship, the appropriate frequency(ies) should be used. It is

recommended that a standard procedure be included in the Radio Regulations and, in view of the fact that it will apply in emergency and non-emergency situations, be included in both Chapter NIX (SVII) and Chapter IX (Appendix S13).

b) Difficulties experienced by Search and Rescue (SAR) authorities in contacting vessels

This is a general watch keeping problem and is considered to be a result of non-compliance with applicable international regulations.

c) Assignment of MMSIs for non-SOLAS vessels fitted with DSC

Two problems have been identified:

i) administrative arrangements;

ii) the eventual shortage of MMSIs.

The administration of the service is a national matter; however, it has international concern for ships which are not subject to the SOLAS Convention.

The finite supply of MMSIs is of international concern but the time when it begins to cause difficulties will be affected by national practice.

If the problem becomes urgent, then a future WRC should be requested to initiate urgent studies on the subject.

d) The keeping of records of ship information for use by SAR authorities

The introduction of new systems and technologies in maritime radiocommunications during the last 30 years has brought about a situation in which an individual ship can be known by several identity codes. There is a clear necessity for accurate records of these identities - possibly related to ships' IMO numbers - and for them to be updated at regular, frequent intervals. The records should include a list of ships' radiocommunication facilities. The ITU List of Ship Stations and Call Signs have been in existence for many years but have long been criticised for being permanently out of date. The responsibility for keeping the ITU informed of changes lies with governments and they should be urged to take the matter seriously.

It appears that in some countries there are legal obstacles to the sharing of ship information with foreign SAR authorities in an emergency. Governments should be urged to seek ways of overcoming such obstacles.

e) Promulgation of procedures for cancelling false alerts

The adoption by the IMO Assembly of Resolution A.814 (19) covering measures to avoid false alerts, and actions to take in the event that one was transmitted inadvertently has been noted. This action could be strengthened by the insertion in Chapter NIX (SVII) of a requirement on all stations for false alerts to be formally cancelled.

The ITU and IMO procedures in this respect should be identical. Governments should promulgate the information by notices to mariners and other appropriate nautical publications.

f) Transmission of danger messages by ships

Chapter V of SOLAS sets out the requirements on ships concerning the transmission of danger messages. In order to provide proper regulatory support for this requirement, an entry in the Radio Regulations should be made in Section V of Article N40 (S33), Transmission of Maritime Safety Information.

g) Protection of distress and safety frequencies in the 12 and 16 MHz bands

The GMDSS distress traffic frequencies 12 290 kHz and 16 420 kHz are also used for routine calling. This has caused considerable worldwide interference to distress communications. WRC-97 should consider this problem and take appropriate action.

3.1.1.3 Resolution 331 "Introduction of the GMDSS and continuation of existing distress and safety provisions"

Consideration should be given to update the Resolution to reflect the situation at the time of WRC-97, to take into account the request by IMO mentioned in section 3.1.1.1, and to assist administrations in their consideration of developments in the forthcoming years.

3.1.1.4 Resolution 200 "Class of emission to be used for distress and safety purposes on the carrier 2 182 kHz"

Provision No. 2973 in Chapter IX (Appendix S13) states that the class of emission for radiotelephony on 2 182 kHz shall be H3E and that A3E emissions are also allowed for distress, urgency and safety when using equipment intended solely for those purposes. J3E is permitted for follow-up communications after a distress alert on 2 187.5 kHz. Other emissions are permitted for 2 182 kHz EPIRBs.

Resolution 200 notes the advantages of using J3E and resolves to place the question of the date for transferring entirely to J3E emissions on the agenda of the next competent WRC.

The continuation in force, for the time being, of No. 2973 of Chapter IX (Appendix S13)* and its eventual suppression (as a part of Chapter IX (Appendix S13)) meets the intent of Resolution 200 which is, consequently, superfluous and Resolution 200 could therefore be suppressed at WRC-97.

3.1.1.5 Resolution 210 "Date of entry into force of the 10 kHz guardband for the frequency 500 kHz in the Mobile Service (Distress and Calling)"

This Resolution resolves that the date for the implementation of the 10 kHz guardband on 500 kHz shall be the date of the full implementation of the GMDSS. This date has been set by IMO as 1 February 1999 when, simultaneously, 490 kHz becomes the frequency for NAVTEX broadcasts in national languages.

In order to allow for some residual use of 500 kHz by Morse telegraphy ships after 1 February 1999, a guardband should be retained but reduced by 10 kHz to permit the unhindered use of 490 kHz as described above. This could be achieved by amending No. 3018 (in Appendix S13) which would eventually be deleted with the rest of Chapter IX (Appendix S13). Resolution 210 could therefore be deleted at WRC-97.

3.1.1.6 Resolution 330 "Frequencies for routine (Non-Distress) calling in the band 1 605 to 4 000 kHz"

This Resolution deals with the question of whether there is a need for a frequency for the purpose of routine (non-distress) calling by radiotelephony in the above-mentioned band.

The requirements of non-GMDSS ships are not compatible with DSC. Such vessels currently use 2 182 kHz. WRC-97 has to consider whether there will be a need for a routine-calling frequency after January 1999 but nevertheless considered the options. There appeared to be two possibilities:

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* (See Section 3.1.1.1 above.)

i) to allow the vessels to continue to use 2 182 kHz;

ii) to allocate a frequency other that 2 182 kHz.

The continued use of 2 182 kHz as a general calling frequency by non-GMDSS ships, in addition to its status in the GMDSS, raised questions about the need to retain the current restrictions on its use viz:

a) observance of the silence periods; and

b) ceasing transmissions in the event that distress working is in progress.

In view of all these uncertainties, it seems to be too soon to take a final decision. Instead, this should be deferred until the time that Chapter IX is suppressed. In the meantime, IMO should be requested to examine fully the needs of non-SOLAS vessels and to advise the ITU accordingly.

3.1.1.7 Maritime Licensing

Ship station licences issued in accordance with Article 24 (S18) of the Radio Regulations enable ships to use their radio stations within the territorial waters of the country that issued the licence and within international sea areas.

Arrangements to allow the use of ship stations within territorial waters of another country may be developed as needed on a bilateral or regional basis.

Licences issued in accordance with Article 24 are presently issued to each individual ship station. The requirement for individual licensing is however only implied by Article 24 and such requirements can be a significant regulatory burden on an administration and its licensees. In certain other areas of communications administrations have already exempted individual users from requiring a licence by adopting a class or general licence instead of individual licences, and this arrangement has worked well. An administration must however use other methods to ensure it has the necessary safeguards in place to ensure its regulatory and spectrum management responsibilities are met.

Article 24 could be amended to allow an administration to license ships using class/general licences or by rule, instead of issuing individual licences for stations which remain within that administration's territory, once the administration has determined that it will satisfy its regulatory and spectrum management responsibilities by other means.

The introduction of the GMDSS has lead to changes in radio equipment. Some types of equipment have become obsolete and there are new aspects or characteristics to new equipments, such as the MMSI number, which need to be recorded by administrations. Recommendation No. 7 describes the standard form for ship station licences. Due to the changes mentioned above there are now certain data fields which are obsolete, and new data fields which need to be added to the form. Recommendation No. 7 should therefore be amended to take account of the necessary deletion and addition of fields.

The recording of MMSI numbers by the issuing administration is necessary for a number of reasons, the most important of which is to provide a database for SAR operations. To date administrations have not maintained thorough records of all their licensed ship stations, particularly for their non-SOLAS vessels, and have not fulfilled their obligation to inform the ITU of this data. If licensing by class/general licences or by rule is to be adopted for certain classes of vessel, this could become a greater problem unless certain safeguards are put in place.

It is proposed that a Resolution should remind administrations of their responsibility to maintain a database of the MMSI numbers allocated to all the ship stations licensed by that administration and

to inform the ITU of these MMSIs. With a more complete database maintained by each administration and by the ITU, the requirements of SAR operations will be fulfilled.

3.1.1.8 Article 25 (S19)

The regulatory aspects of dealing with assignments of numbering resources to administrations (non members) and other regulatory issues relating to the Maritime Mobile Service should be handled within the context of the overall studies of regulatory matters being undertaken by the Special Committee on Regulatory and Procedural Matters. Referring in particular to Article 25, there is a need to develop a Resolution concerning the shortage of numbering resources for NBDP and particularly for SSFC systems. Since most domestic uses of these resources are not notified to the ITU due to the domestic nature of ship operations and considering that these vessels usually do not have requirements for other long range equipment, in many cases, these numbers can be reused within an administration e.g. the same number could be used on one domestic vessel for NBDP while it could also be used by another domestic vessel for use with SSFC equipment.

Modifications could be made to No. 2147 (S19.96) which would reflect the need for Administrations to immediately notify the ITU with ship particulars when making assignments of selective call numbers to ships.

3.1.1.9 Maritime Certification

Article 55 (S47) of the Radio Regulations stipulates the conditions under which a radio station of a ship is to be controlled by an operator. The Article further identifies the categories of certificates and the conditions for the issue of such certificates for operators of ship stations on-board vessels subject to compulsory carriage of radio installations. The lower two of the four certificates described are the General Operator's Certificate (GOC) and the Restricted Operator's Certificate (ROC). The GOC provides for operators of any of the GMDSS sub-systems and equipment, and the ROC provides for operators on board vessels fitted with GMDSS sub-systems and equipment required for vessels which exclusively sail within A1 sea areas.

The requirements provided by the Radio Regulations for the GOC and ROC are brief. For additional guidance concerning the knowledge, training, or examination requirements for holders of these certificates, administrations should look to the International Convention on Standards of Training, Certification, and Watchkeeping for Seafarers (STCW), 1978, as amended. This details the training and knowledge requirements for operators on vessels subject to SOLAS and other IMO agreements. These requirements are detailed and the level of skill required is high. The application of these certificates to those operators on vessels not subject to IMO requirements may in certain cases be too severe. Article 56 No. 3993 (S48.7) currently provides the vehicle for administrations to require personnel of ship stations and ship earth stations for which a radio installation is not compulsory to be adequately qualified and certificated in accordance with the administration's requirements. However, there is a need expressed by many administrations for additional guidance on this regulation. It is therefore proposed that No. 3993 (S48.7) include a reference to a Resolution containing this guidance. The Resolution will contain descriptions of two certificates developed in Europe for the non-compulsory fit sector, the Long Range Certificate and the Short Range Certificate, and will request the ITU-R to develop a Recommendation to subsequently replace the Resolution. The changes suggested to No. 3993 (S48.7) are given in 3.1.1.10.3.

3.1.1.10 Regulatory and Procedural Considerations

3.1.1.10.1 VHF Transponder for Automatic Identification Systems

The WRC-97 could designate, preferably on a world wide basis, one dedicated 25 kHz VHF simplex channel and another 25 kHz VHF simplex channel for dedicated use in specific areas where required.

3.1.1.10.2 Identification of Stations

ARTICLE 25 (S19)

ADD S19.96A

5 digit ship station selective call numbers are assigned to SSFC equipment (as described in Recommendation ITU-R M.257-3) for calling in the radiotelephony and for phasing of the NBDP equipment (as described in Recommendation ITU-R M.476-5). Within one administration the same 5 digit number may be used:

– for identification of ship stations fitted with both SSFC and NBDP equipment;

– for identification of ship stations of two different ships fitted with either SSFC or NBDP equipment only.

3.1.1.10.3 Maritime Certification

A need has been expressed by many administrations for additional guidance to Article 56 RR 3993 (S48.7). The following amendments aim to provide this guidance.

MOD S48.7

5. The personnel of ship stations and ship earth stations for which a radio installation is not compulsory under international agreements and which use the frequencies and techniques prescribed in Chapter SVII shall be adequately qualified and certificated in accordance with the administration's requirements. If an administration requires further guidance concerning appropriate qualifications and certification, this may be found in Resolution (to be developed in accordance with 3.1.1.9). This Resolution describes two certificates, the Long Range Certificate and the Short Range Certificate, which are implemented by certain administrations for personnel of ship stations and ship earth stations for which a radio installation is not compulsory under international agreements.

3.1.2 Agenda Item 1.6.2

To consider and take appropriate action in respect of the use of Appendix **18 [S18]** to the RR in respect of the VHF band for maritime mobile communications, and the use and extension of UHF channels contained in **S5.287**, taking into account Resolution **310 (Rev.Mob-87)**

3.1.2.1 Appendix 18 (S18)

3.1.2.1.1 Functions of Appendix 18 use

Although there may be some differences in various parts of the world in the usage of maritime VHF and the problems experienced, the important functions of the maritime mobile service worldwide include distress watch, distress calling, SAR operations, vessel traffic service, and ship-to-ship communications. These important functions and services must continue to be available to ships, regardless of developments in the technical or regulatory fields.

The key problems with maritime VHF include: congestion on calling and port working channels, which could compromise safety and operational efficiency; interference between users; and increasing localized demand for various services. There are fundamental aspects of maritime VHF which need to be reviewed and revised accordingly.

3.1.2.1.2 Improved efficiency in the use of the band 156 - 174 MHz by stations in the Maritime Mobile Service

Question ITU-R 96/8 has been an active Question for many years. Studies carried out to date for this Question have indicated that the use of new techniques in the VHF band may ultimately be needed to provide for the increasing demands for differing types of communications in different parts of the world. New digital modulation schemes would appear to be the ultimate solution to meet all the demands for the future, and particularly the new data applications. Due to the reliance upon the international VHF maritime mobile service, particularly for distress and safety communications, the introduction of new systems and the removal of the existing equipment using the current analogue modulation on 25 kHz channels must be a carefully phased process lasting over an extended period.

Studies are also ongoing in the land mobile community to develop standards which offer significant improvement in spectrum efficiency. The potential market for such technology in the maritime community is insufficient to independently develop the new technology even when applied on a global basis. Therefore, the ultimate solution is likely to be strongly influenced by the standard adopted by the land mobile community with a strong emphasis on cost. This is expected to be after WRC-97. However, requirements are growing for improved spectrum use for a variety of applications by the maritime community.

This section suggests some steps for migrating to the more efficient technologies, and some initial steps which can be taken by WRC-97 to provide flexibility for administrations to meet their interim requirements, while maintaining compatibility with the vast number of ships and pleasure craft now using the band in accordance with Appendix 18.

3.1.2.1.3 Possible short term actions in the maritime mobile service

The short term actions referred to are those possible WRC-97 actions with respect to Appendix 18, such as revisions to the footnotes to the table.

Recommendation ITU-R M.1084 emphasizes the need for administrations not to introduce interim solutions which will prejudice the implementation of technology which would provide a long term solution to meet future requirements. Any interim solution which includes a change of technology, could prejudice, if not prevent, the subsequent introduction of advanced technology selected to meet the present and future requirements of the maritime sector. An internationally agreed solution for the use of the maritime VHF frequency band is vital because the worldwide maritime communication system must not be fragmented in such a way that it prevents the effective operation of international distress and safety communications.

However, there may need to be sufficient flexibility in the current use of Appendix 18 for administrations to provide a solution to the problems of congestion, whilst retaining the ability to achieve a lasting solution for a spectrally efficient service. Report ITU-R M.2010 considers methods of improving efficiency in the use of the band 156 - 174 MHz, including measures of a more short term nature, and Recommendation ITU-R M.1084 considers methods administrations can adopt to achieve interim relief of local congestion. Administrations are cautioned to avoid distress and safety channels and other channels which may affect the safety of international shipping. The two short-term methods presented in Recommendation ITU-R M.1084 are given below.

3.1.2.1.3.1 Interleaved narrow-band channels

Recommendation ITU-R M.1084 Annex 2 describes a method of implementing narrow-band channels at 12.5 kHz offset spacing, which would provide administrations with local relief to congestion in the short term. It also proposes how administrations might migrate from the existing 25 kHz spaced channels to 12.5 kHz and subsequently to a future technology which provides for the long term solution.

3.1.2.1.3.2 Use of existing 25 kHz channel spacing

Recommendation ITU-R M.1084 also describes a method of utilizing the existing channel spacing and avoiding the need for expenditure on a change of technology and a replanning of the frequency bands. It proposes the use of certain two frequency or duplex channels in single frequency or simplex mode, thereby effectively providing additional channels.

The flexibility available in the use of the spectrum and a means of exploiting that flexibility are detailed below. National administrations should be able to exercise their own judgement as to how it can best be used in their areas. It should be noted that this proposal will not provide additional channels for use in areas which have already implemented these measures.

Minimal amendments to Appendix 18 (such as modifications or additional footnotes) would allow administrations to consider implementation of the ideas given below, subject to coordination between interested and affected administrations. The measures described below could provide administrations with the additional flexibility to achieve relief of local congestion in the 25 kHz channels of Appendix 18.

a) Administrations should be allowed to utilize two frequency or duplex channels in a single frequency or simplex mode.

b) After thorough study concerning the issues associated with deleting the guardbands around channel 16, administrations could be allowed to use these channels for speech communication.

c) Administrations should be allowed to disregard the sequence numbering (use priorities). This would allow administrations to make full use of those channels which are currently under-utilized.

d) Administrations should be allowed to assign both ship movement and port operations channels to either category of service. This would provide additional flexibility in areas where there is a significantly higher demand for one service over the other. Appendix 18 could allow administrations to treat the categories port operations and ship movement as one category.

e) Administrations should be allowed to make those duplex channels currently reserved for public correspondence available for ship movement where public correspondence is under-utilized.

f) Administrations should be allowed to designate channel(s) for automatic identification systems (AIS) and surveillance systems, e.g. upper leg of split duplex channels. Use of such data systems would be expected to decrease the need for speech communications.

3.1.2.1.4 Solution to congestion in the maritime mobile service

It is widely accepted that in order to meet both the present and future requirements of the maritime mobile service, the international community needs to adopt a lasting solution which uses the latest digital or narrow-band technology. Agenda Item 1.6.5 of the WRC-97 is concerned with the use of digital technology in the maritime radiotelephony channels (see Section 3.1.5.2).

Studies are in progress throughout the international community in response to Question ITU-R 96/8 and the following ITU-R documents have been produced. Report ITU-R M.2010 presents a survey of various technologies and systems, and describes two particular systems in greater detail. Draft new Recommendation ITU-R M.[Document 8/54] gives the essential characteristics of one system which may meet the future requirements of the maritime mobile service. Systems described therein use digital technology, offering advanced features and providing for an improved and efficient use of the spectrum.

Further studies in response to Question 96/8 are necessary. These should, at first, fully assess:

- the services and facilities required for the VHF maritime mobile service both now and in the future;
- the suitability of any potential new technology to provide such services;
- the implications for the migration strategy necessary to introduce the new technology.

These studies should be accelerated and the results agreed as soon as practicable.

The migration from VHF FM systems to bandwidth efficient digital technology will require extensive forward planning to ensure that the core functionality of maritime VHF, especially the existing distress and safety systems, is not compromised. In the early stages of the transition process, distress and safety working must continue on the same basis as at present, all users having access to at least channel 70 DSC. Compared with past reductions in VHF channel bandwidth the move to new, more bandwidth efficient technology will be complex because the new technologies may be incompatible with existing radio equipment. A phased transition process is therefore envisaged. Recommendation ITU-R M.1084 considers a possible migration from analogue to digital technology.

3.1.2.1.5 Frequency requirement for a ship Automatic Identification System

In response to requests from the International Maritime Organization concerning the introduction of a global ship Automatic Identification System (AIS), a preliminary draft new Recommendation and a draft new Report have been developed. IMO will inform WRC-97 of its decision on AIS requirements.

In summary, one of the AIS being developed operates in a broadcast mode. All mobile stations broadcast their position, speed and other data at short intervals i.e. 1 second to 3 minutes depending on navigational status), speed, and rate of turn. All other mobile or shore-based stations in the vicinity receive these messages.

Because ship-to-ship reports are line-of-sight, can not tolerate interference, and require a substantial data rate, two VHF simplex frequencies in the maritime mobile band are anticipated. Because of its robustness and widespread application for mobile digital communications, GMSK/FM is utilized. Thus a 25 kHz VHF simplex channel which allows approximately 2 000 reports per minute is

desired. Use of 12.5 kHz channels result in approximately 1 000 reports per minute and since in some areas, up to 3 000 reports per minute may be required, two 25 kHz VHF simplex channels are desired. At least one channel is desired on a global basis and in specific areas where required, a second 25 kHz VHF FM Channel should be made available.

If WRC-97 is unable to dedicate a single channel on a world-wide basis, large geographical area use of a common channel will be needed. As much commonality as possible within these geographical areas should be attempted. In cases where this can not be achieved, every attempt should be made to easily identify the boundary of the geographical area.

3.1.2.1.6 Use and extension of UHF channels contained in S5.287 taking into account Resolution 310

RR 669 (S5.287) currently provides six UHF frequencies for on-board communications. Considerable experience has clearly shown that with ships operating in close proximity, the limited number of available frequencies has resulted in severe interference and in some cases significant safety problems. In recognition of these problems some administrations have unilaterally assigned additional UHF frequencies for shipborne use. In view of the above and taking into account the studies requested in Resolution 310, WRC-97 is requested to direct the acceleration of these studies and designate additional UHF frequencies for immediate use for maritime purposes.

3.1.3 Agenda Item 1.6.3

To consider and take appropriate action in respect of Article **61 [S53]** of the RR relating to the order of priority of communications in the maritime mobile service and in the maritime mobile-satellite service

3.1.3.1 Article 61 (S53)

The priority of communications, with 10 categories, was established to assist radio officers on ships and in coast stations to decide the order in which radiotelegrams (by radiotelegraphy), radiotelephone and radiotelex calls should be transmitted. It was important that these priorities were observed so that the most urgent traffic would be cleared first if there were restrictions on communications, for example due to the level of traffic or propagation conditions. Article 61 also provides for fully automated systems, where Category 1 shall receive priority.

Improvements in radio technology and greater provision of coast stations now provide ships with the facility of uninterrupted access to shore communications services. These improvements in communications have already affected current operational arrangements to the extent that the majority of the 10 levels of priority defined in Article 61 are not widely used today within the maritime service. The GMDSS is expected to further improve this level of communication, and given the introduction of Digital Selective Calling (DSC) and scanning receivers, communications traffic on a ship will be able to be transmitted with little delay.

The IMO Subcommittee on Radiocommunications & Search and Rescue have confirmed an earlier request for four levels of priority for all fully automated systems being designed now for use in the future as part of the GMDSS. No intent was expressed to redesign existing systems to meet these levels but for those satellite and terrestrial systems being designed today, separate priority levels for Distress, Urgency, Safety, and Routine should be provided.

Study of the current 10 categories of priority for communications using non-automated systems in the maritime mobile and maritime mobile satellite service brings to light several of the present

10 categories which are obsolete or could be subsumed into one of the 4 new categories given above. For example, categories 4, 5, and 6 fall within the categories of Urgency and Safety as defined by Article N 40 (RR N 3196 to N 3202) (Article S33 (RR S33.1-S33.7)), and categories 7, 8, 9, and 10 are either obsolete or would now be considered as forms of Routine communication.

It is proposed that the 4 categories of priority requested for all fully automated systems in the GMDSS, should be extended for use by all parts of the maritime mobile and maritime mobile satellite service.

Although Article 61 currently requires fully automated systems to provide the 2 levels of priority, Distress and Routine, it is noted that Inmarsat communication systems offer distress priority for distress alerting purposes in the ship to shore direction, but subsequent communications in the direction of shore to ship, for example for Search and Rescue (SAR) activities, do not carry the same priority status. In a distress incident which attracted high levels of interest recently this showed the danger of SAR messages being blocked by commercial traffic occupying all available circuits to a SAR vessel. Another reason for addressing these priority issues is the possibility that commercial regional satellite systems could be permitted to participate in the GMDSS.

The necessity for fully automated satellite systems to provide a distress priority in both the ship to shore and shore to ship directions should be emphasized through a Resolution or an amendment to Article 61 or in relevant ITU-T Recommendations.

3.1.4 Agenda Item 1.6.4

to consider and take appropriate action in respect of review, and if necessary, revision of the provisions related to the NAVTEX coordination in order to release ITU from the obligation to undertake operational coordination for this service operating on 490 kHz, 518 kHz and 4 209.5 kHz, in the light of the consultations undertaken with the IMO (see Resolution **339)**

3.1.4.1 Resolution 339 "Coordination of NAVTEX services"

The ITU-R has not seen a need to amend the procedure described in the Annex to this Resolution, furthermore, the Resolution requires only the Secretary-General to consult with the IMO and to Report to WRC-97.

WRC-97 should take further action based on the report of the Secretary-General.

3.1.5 Agenda Item 1.6.5

to consider and take appropriate action in respect of use of new digital technology in maritime radiotelephony channels

3.1.5.1 Digital technology in the maritime HF radiotelephony channels

There is an urgent need to make provision for the use of digital technology within the existing maritime HF radiotelephone planned bands. This would enable existing, and future commercial operators to make more economical use of the available spectrum and would facilitate the use of new technologies and equipment being introduced into the maritime environment. Studies have been conducted to identify and assess the level of interference between adjacent channels carrying different modes of emission and to predict improvement to communications throughput.

There is also potential to permit the use of this digital technique in channels presently allocated to Morse telegraphy in the HF maritime mobile bands.

3.1.5.2 Digital technology in the maritime VHF radiotelephony channels

Digital technologies for use in the VHF maritime radiotelephony channels have been the subject of ITU-R studies in recent years: Question ITU-R 96/8 refers. There are problems of congestion in the channels described within Appendix 18 (S18) in many parts of the world and there is a need to make changes which would improve the efficiency of use of this frequency band. Agenda Item 1.6.2 of WRC-97 is concerned with this issue. Digital technologies offer the greatest improvements in spectrum efficiency and system performance, and will have the potential to meet present as well as future requirements of the maritime mobile service at VHF. A rapid expansion in data services, as seen in many other fields of application, is a particular demand for which digital technologies will be most suitable.

Digital standards which will offer significant improvement in spectrum efficiency are currently under development for the land mobile service. The maritime VHF equipment market, even when applied on a global basis, is insufficient to independently develop new digital technology standards. The development of a cost-effective digital solution for the maritime mobile service is therefore likely to be strongly influenced by the standard adopted for the land mobile service. A draft new Recommendation to be considered by ITU-R Study Group 8 in June 1997 describes a modern digital technology which would lead to improved efficiency of the available maritime spectrum and meet the requirements of the maritime mobile service as these develop in the future.

Renewed effort is required into studies of the particular requirements of the maritime mobile service both now and in the future, and into appropriate systems and technologies to meet such requirements. Report ITU-R M.2010 describes a number of systems identified so far by studies carried out for Question ITU-R 96/8. Any change in technology in the maritime VHF frequency band will also need detailed study in order to retain the vital integrity of the international distress and safety services throughout the transition from one technology to another. Transitional arrangements must be developed which will provide for an evolution from one system to the next. Recommendation ITU-R M.1084 considers possible transitional arrangements. Conclusions from these studies are required as soon as possible in order to achieve a resolution to the congestion problems within the channels of Appendix S18.

3.2 Agenda Item 1.8

the possible deletion of all secondary allocations from the band 136 - 137 MHz, which is allocated to the AM (R) service on a primary basis, in accordance with Resolution **408 (Mob-87)** and in order to meet the special needs of the AM (R) service

The deletion of all secondary allocations, while recognizing sufficient transitional arrangements for still existing services, should be considered by WRC-97.

CHAPTER 4

MOBILE-SATELLITE AND FIXED-SATELLITE SERVICES (WRC-97 Agenda item 1.9.1)

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To consider and take appropriate action in respect of "issues concerning existing and possible additional frequency allocations and regulatory aspects as related to the mobile-satellite and fixed-satellite services including consideration of WRC-95 Resolutions **118, 116, 714, 117, 121, 214, 715, 717, 215** and Recommendation **717 (Rev.WRC-95)**".

4.1 Mobile-Satellite Service below 1 GHz

4.1.1 Resolution 214 "Sharing studies relating to consideration of the allocation of bands below 1 GHz to the non-GSO MSS" and

Recommendation 717 (Rev.WRC-95) "Frequency sharing in bands shared by the MSS and the FS, MS and other terrestrial services below 3 GHz"

4.1.1.1 Sharing between non-GSO MSS Earth-to-space links and the land mobile service in the band 148 - 149.9 MHz

4.1.1.1.1 Summary of technical and operational studies and analysis of their results

The ITU-R studied the technical and operational issues relating to sharing between the land mobile service and the non-GSO MSS in the band 148 - 149.9 MHz. In many administrations this band is very heavily used by the land mobile service, and the operation of existing and planned land mobile services must be safeguarded, taking into account the stringent protection requirements of some land mobile base station receivers.

Sharing between non-GSO MSS and terrestrial fixed and mobile systems in the uplink direction can be accomplished by designing the MSS systems to operate in a narrow-band, frequency-agile fashion. MSS systems can also employ wideband, low-power density, spread-spectrum transmissions which will provide sufficient margin against interference to other services. Both of these transmission techniques reduce the probability of interference to fixed and mobile systems. In addition, the nature of the data-only services provided by MSS systems and the markets served by them are amenable to incorporation of other interference reduction techniques such as short, sub-second length data bursts and low-duty cycle transmission. For FDMA mobile earth stations, Recommendation ITU-R M.1039-1 notes that an optimum length of transmission might be up to 500 ms and a time duration of 1% in 1-15 minutes has been suggested for sharing with certain analogue voice services. However, the figures given for the time duration are still under study. In many cases the mobility of the users also reduces the coupling that can occur between mobile earth stations (MESs) and other services operating in the band. However, some MESs are intended for fixed applications.

In one study, a single non-GSO MSS network was modelled with the following major characteristics: 48 satellites in 8 orbital planes in 950 km altitude circular orbits; narrow-band frequency division multiplexing for the Earth-to-space transmissions; operation in a store-and-forward mode; transmissions within 500 ms frames containing digital packets; satellite use of a band scanning receiver to implement a dynamic channel activity assignment system that assigns unused channels to earth stations for uplink transmissions; and uplink data rates of 2.4, 4.8, and 9.6 kbits/s. The land mobile station was modelled with the following characteristics: an analogue, frequency modulation system (or digitally modulated, binary-FSK system); a vertically polarized antenna having 0 dBi gain towards the satellite; 10 metre antenna height product (consistent with Recommendation ITU-R M.1039-1); minimum received signal power assumed to be -140 dBW; and channel bandwidths of 6.25, 12.5 and 25.0 kHz. The analysis assumed multiple worst-case conditions: 1) non-GSO MSS MESs transmitting at 100% of capacity, 24 hours per day, 2) terrestrial

stations and non-GSO MSS MESs geographically clustered in the same areas, and 3) dynamic channel avoidance not employed. For the conditions stated, if the land mobile station is operated at push-to-talk rates of 0.01 Erlang, the land mobile station would experience a mean time between interference events of 11 hours. For a variety of channelization plans, MES bit rates, and terminal distributions, the mean time between observed interference events for the type of land mobile user studied was found to range from 10 hours to 21 months. The land mobile user would observe the interference event as a single, short-term event. Since in general the non-GSO MSS network will be able to identify active mobile channels, the actual interference from non-GSO MSS MESs into a given land mobile station will be much less than that calculated under the worst-case assumptions used.

The band analysed worldwide would appear to have a sufficient number of unused channels available to support the non-GSO MSS operation of a single non-GSO MSS network. The simulation program of this same study was used to determine the number of land mobile stations within the satellite footprint that can operate in the shared spectrum and still provide an average of at least 6 clear channels per satellite for the non-GSO MSS uplinks. Four different land mobile station activity factors, three land mobile channelization plans, and three MES uplink data rates were considered. The results indicate that with 25 kHz land mobile system channelization, 2.4 kbps MES uplink data rate, and 0.003 Erlang activity factor, 77 000 terrestrial mobile stations could operate within a satellite footprint (12 million km^2) and still leave a minimum of 6 clear channels for MES uplink transmission in 1 MHz of shared bandwidth. For the same conditions, but in 5 MHz of shared bandwidth, 570 000 terrestrial mobile stations could operate. For 6.25 kHz land mobile system channelization and all other parameters remaining the same, 190 000 terrestrial mobile stations could operate in 1 MHz of shared bandwidth and 1.5 million terrestrial mobile stations could operate in 5 MHz of shared bandwidth. These results indicate that for frequency sharing situations as studied, a single non-GSO MSS network in this band could find a sufficient number of channels to operate. Sophisticated narrow-band FDMA technologies such as DCAAS (Dynamic Channel Activity Assignment System) can reduce probabilities of interference by scanning the allocated bandwidth. The use of digital parallel processing, fast Fourier transform will speed band usage characterization, and as a result would allow for larger segments of the band to be characterized. The use of DCAAS significantly reduces the potential for interference between MESs of a single non-GSO MSS network and terrestrial services with land mobile stations modelled as described above, since occupied channels detected by DCAAS are avoided. There may be occasions where satellite DCAAS scanning receivers will not detect LMS channel activity. These probabilities on average are extremely low, however, the impact on certain land mobile services has to be studied.

Narrow-band non-GSO MSS networks may use dynamic channel assignment techniques to avoid channels being actively used by land mobile stations. A dynamic channel assignment technique, such as DCAAS, could be used as described in Annex 2 to Recommendation ITU-R M.1039-1.

After the environment is measured by the DCAAS scanning receivers, there will be an accumulation of time required to identify and use the "clear" channels (including processing and transmission time). Within this interval, which is typically less than one second, a terrestrial land mobile station may begin a transmission on a channel that a non-GSO MSS MES has begun to use. Depending on the proximity between the MES and the land mobile receiver, interference could be caused to the land mobile receiver. Although such simultaneous transmissions can be expected to occur only a small percentage of the time, further studies are necessary to determine the protection requirements of the incumbent systems and whether this interference is tolerable.

From recent demonstration tests undertaken by one administration, involving in orbit non-GSO MSS satellites of another administration, it was concluded that non-GSO MSS satellites utilizing the

DCAAS technique are capable of detecting land mobile station transmissions within their satellite beam coverage area, and that DCAAS will not assign an uplink channel when signals or high levels of noise are observed in that channel. Tests with an analogue voice land mobile system and a single non-GSO MSS network confirmed that deliberate co-channel MES transmissions could be observed, however the effect on users of the analogue voice land mobile system should be imperceptible, in terms of carrier squelch activation or for a call in progress when DCAAS is employed. Based on the test results, the use of DCAAS will facilitate sharing between MSS and land mobile systems characterized for this study, especially when taking into account the probability studies by the ITU-R (see Recommendation ITU-R M.1039-1).

In preparation for WRC-97, account should be taken of the information developed by the ITU-R regarding the characteristics of various terrestrial mobile systems operating below 1 GHz and particular land mobile modelling considerations that would be relevant to sharing with non-GSO MSS systems. Further studies are required on the following cases:

– interference into land mobile systems which utilize short burst digital acquisition signals, and for systems with higher traffic loading rates than those studied. Additional information is required on the availability and performance requirements of such land mobile channels taking into account the occupancy of digital voice and control channels and the probability of collisions in simultaneous acquisition requests during peak traffic periods, and their susceptibility to short MES data bursts. When such information becomes available, studies should be undertaken on the potential interference of an MSS system, utilizing DCAAS, to eliminate interference into such land mobile systems;

– interference into land mobile receive base stations with low loading rates located at high elevation points with high gain antennas (approximately 6-10 dB).

4.1.1.1.2 Methods to satisfy the agenda item, their relative advantages and disadvantages

The results of the analyses and simulations presented to date show that frequency sharing between narrow-band, Earth-to-space links for a single non-GSO MSS below 1 GHz network and analogue, frequency modulated (or digitally modulated, binary-FSK) land mobile services, as described in Section 4.1.1.1.1, would produce infrequent interference to the land mobile service in the frequency band examined, 148 - 149.9 MHz. The results indicate that sharing, as studied, could allow a single non-GSO MSS network to find a sufficient number of channels to operate in the Earth-to-space direction. The conclusion reached to date, as a result of an in orbit demonstration test, is that it is feasible for narrow-band uplinks of a single non-GSO MSS using DCAAS to share spectrum with certain land mobile services currently in operation in some countries in this band. However, further studies are needed to assess the interference potential to other land mobile systems when DCAAS is used as discussed in Section 4.1.1.1.1. It should be noted that the MSS DCAAS system does not assign uplink channels when no channels are available.

4.1.1.1.3 Regulatory and procedural considerations

Recommendation ITU-R M.1039-1 addresses the use of dynamic channel activity assignment techniques to avoid MSS system use of channels that are in active use by the land mobile service. An appropriate provision of the Radio Regulations could make specific reference to this Recommendation in regard to the described narrow-band MSS system, whilst identifying the constraints the MSS systems would impose on the land mobile service.

In view of the recent tests being conducted by some administrations and the possible additional test results indicated in Section 4.1.1.3, WRC-97 might review RR No. S5.221 which even includes some countries proposing to utilize such mobile satellite services. Such a review should consider the views of those administrations listed in this footnote who have sought protection from harmful interference into their fixed and land mobile operations.

4.1.1.2 Sharing studies between non-GSO MSS Earth-to-space links and the land mobile service to support additional allocations to the non-GSO MSS below 1 GHz

4.1.1.2.1 Summary of technical and operational studies and analysis of their results

Sharing studies between non-GSO MSS below 1 GHz (Earth-to-space links) and the land mobile service were performed at 460 MHz. The modelling, technical characteristics, and assumptions stated in Section 4.1.1.1 were used. (The non-GSO MSS network had the following major characteristics: 48 satellites in 8 orbital planes in 950 km altitude circular orbits; narrow-band frequency division multiplexing for the Earth-to-space transmissions; operation in a store-and-forward mode; transmissions within 500 ms frames containing digital packets; satellite use of a band scanning receiver to implement a dynamic channel activity assignment system that assigns unused channels to earth stations for uplink transmissions; and uplink data rates of 2.4, 4.8, and 9.6 kbps. The land mobile station was modelled with the following characteristics: an analogue, frequency modulation system (or digitally modulated, binary-FSK system); a vertically polarized antenna having 0 dBi gain towards the satellite; 10 metre antenna height product (consistent with Recommendation ITU-R M.1039-1); minimum received signal power assumed to be -140 dBW; and channel bandwidths of 6.25, 12.5 and 25.0 kHz). The analysis results were virtually the same as in Section 4.1.1.1, concerning mean time between interference events and availability of at least six non-GSO MSS Earth-to-space channels. Also it was determined that the technical characteristics of the LMS system used in the analyses referred to in Section 4.1.1.1 are used by certain LMS systems currently operating in frequency bands below 1 GHz. Sharing may be feasible in other bands below 1 GHz where the characteristics of the land mobile systems currently in use are similar to those studied by the ITU-R. Sharing with other types of terrestrial land mobile systems needs further study as discussed in Section 4.1.1.1.1.

The results of Section 4.1.1.1 were based upon co-channel sharing between certain LMS and MSS systems in a bandwidth of 1.0 MHz. The results obtained may be applied to larger shared bandwidths, if the conditions of operation within the larger bandwidth are similar to those described in Section 4.1.1.1. In such cases:

1) the probability of interference to the LMS from one non-GSO MSS system would be much less than the values as calculated in Section 4.1.1.1 for a 1 MHz shared bandwidth, or alternatively, multiple non-co-channel non-GSO MSS systems could operate in the greater shared bandwidth with the same probability of interference as calculated in Section 4.1.1.1; and

2) a sufficient number of clear channels could be found for uplinks for multiple non-GSO MSS systems.

4.1.1.2.2 Methods to satisfy the agenda item, their relative advantages and disadvantages for additional allocations to non-GSO MSS below 1 GHz

Results of studies identified in Section 4.1.1.2.1 should be taken into account in addition to the technical and operational characteristics of the systems operating in the bands being considered for additional allocations on a worldwide basis for the non-GSO MSS below 1 GHz. However, some administrations place a priority on the provision of communications services by terrestrial means, and some other administrations place a priority on the provision of these communications services by NGSO MSS systems.

4.1.1.2.3 Regulatory and procedural considerations for additional allocations to the non-GSO MSS below 1 GHz

Recommendation ITU-R M.1039-1 addresses the use of dynamic channel activity assignment techniques by MSS systems to avoid the use of channels that are in active use by land mobile systems. Recommendation ITU-R M.1039-1 also notes that an optimum length of mobile earth station transmission to facilitate sharing with certain terrestrial analogue voice services might be up to 500 ms and a time duration of 1% in 1-15 minutes has been suggested, but the latter figure is still under study. Since non-GSO MSS sharing with LMS depends upon MSS systems using these characteristics, an appropriate provision of the Radio Regulations could make specific reference to this Recommendation in regard to narrow-band MSS systems, whilst identifying the constraints the MSS systems would impose on the land mobile service. It should be noted that there are administrations with the opinion that there should be no operational and technical constraints on the development of terrestrial fixed and mobile services.

4.1.1.2.4 Technical considerations for additional Earth-to-space allocations to the non-GSO MSS below 1 GHz

The dynamic channel assignment techniques described Sections 4.1.1.2.1 and 4.1.1.9 were developed to facilitate sharing between the non-GSO MSS and fixed and land mobile services in bands below 1 GHz. These techniques are being currently applied to the existing non-GSO MSS allocation at 148 - 149.9 MHz. They can also be applied to the Region 2 allocations in the bands 455 - 456 MHz and 459 - 460 MHz, which are available to non-GSO MSS. Should WRC-97 make new Earth-to-space allocations for non-GSO MSS below 1 GHz service, application of these techniques may be useful in order to facilitate sharing with the fixed and land mobile services.

4.1.1.3 Planned results of experiments carried out on the basis of Article S15, Section IV (Article 19) of the Radio Regulations on sharing between the non-GSO MSS and other radio services on certain frequencies below 1 GHz

An experimental satellite is planned to be launched into low-Earth orbit in 1997. The tests include participation by Brazil, Colombia, Germany, Indonesia, Mongolia, Poland, Senegal, the United States and Uruguay. The tests will be tailored to the individual needs of the participating countries, but will include analysis of band usage, satellite payload performance and downlink interference. The results of these tests will be reported to WRC-97 and will be provided to interested administrations and the WMO prior to WRC-97 if available.

4.1.1.4 Sharing between the RNSS and the MSS in the frequency band 149.9 - 150.05 MHz and 399.9 - 400.05 MHz

4.1.1.4.1 Summary of technical and operational studies and analysis of their results

Studies were conducted on the feasibility of sharing between the RNSS and the MSS in the frequency band 149.9 - 150.05 MHz and 399.9 - 400.05 MHz. ITU-R is developing draft new

Recommendation [8D/XP] "Methodology of Estimating Feasibility of Sharing between MSS Systems and Existing RNSS Systems in the Frequency Band 149.9 - 150.05 MHz and 399.9 - 400.05 MHz" which presents information on the existing RNSS system and on MSS systems planned for operation in the said frequency band. The document deals with methods and criteria for the RNSS system to be used for assessment sharing with MSS systems operating in both space-to-Earth and Earth-to-space directions.

4.1.1.4.2 Methods to satisfy the agenda item and their relative advantages

Frequency band	Methods to be used for providing sharing between MSS and RNSS in the frequency bands 149.9 - 150.05 MHz and 399.9 - 400.05 MHz	
MHz	Space-to-Earth	Earth-to-space
149.9 - 150.05	MSS space station maximum pfd limitation to -153 dB(W/m^2/4 kHz)	• maintaining a coordination distance: a) from 177 to 360 km for MSS user terminals; b) from 261 to 660 km MSS gateway stations (see NOTE 3); • using MES-controlled frequency avoidance techniques to avoid transmission on the same frequency during periods of RNSS transmissions in the same area; • limiting minimum elevation angle for MSS gateway earth stations with azimuth directed towards navigable waterways.
399.9 - 400.05	MSS space station maximum pfd limitation to -156 dB(W/m^2/4 kHz)	• maintaining a coordination distance: a) from 97 to 280 km for MSS user terminals; b) from 162 to 629 km MSS gateway stations; • using MES-controlled frequency avoidance techniques to avoid transmission on the same frequency during periods of RNSS transmissions in the same area; • limiting minimum elevation angle for MSS gateway earth stations with azimuth directed towards navigable waterways.

NOTE 1 - Sharing between maritime and aeronautical MSS (Earth-to-space) with existing RNSS systems in the frequency bands 149.9 - 150.05 MHz and 399.9 - 400.05 MHz is complicated by the requirement to either maintain the required coordination distances or utilize MES terminals which can sense and avoid transmissions on active RNSS channels. For fixed gateway stations, minimum antenna elevation angles must be observed if operating within a computed coordination distance from a navigable waterway.

NOTE 2 - It should be regarded that interference may occur between TSYKADA transmitters and LEO MSS spaceborne receivers. LEO MSS operators will have to understand that this interference may curtail their operations during spacecraft mutual visibility events. In addition MSS system operators must ensure that their spacecraft receivers are designed to accommodate strong interfering signals without damage.

NOTE 3 - The example coordination distances given for MSS gateway stations are maximal due to certain simplifying assumptions that were made (i.e. constant maximum power and gain for the earth station and no site shielding). Coordination distances calculated for specific gateway earth station sites will be less than these values.

4.1.1.4.3 Regulatory and procedural consideration

To facilitate sharing between the RNSS and the MSS in the space-to-Earth direction, the Radio Regulations may include appropriate limitations on emissions from MSS space stations. The limitations might be maximum power flux-densities at the Earth's surface of:

-153 dB(W/m^2/4 kHz) in the frequency band 149.9 - 150.05 MHz;

-156 dB(W/m^2/4 kHz) in the frequency band 399.9 - 400.05 MHz.

For sharing between the RNSS and the MSS in the Earth-to-space direction, coordination distance calculation methods such as those included in Recommendation ITU-R M.1185 may be used.

4.1.1.5 Sharing between the MSS (space-to-Earth) and meteorological-satellite or Earth exploration-satellite services in the 401 - 403 MHz band

4.1.1.5.1 Summary of technical and operational studies and analysis of their results

WRC-95 recognized there is a need to make spectrum available on a worldwide basis for the non-GSO mobile-satellite service (MSS) and that WRC-97 will consider additional allocations on a worldwide basis for non-GSO MSS below 1 GHz (Resolution 214) under agenda item 1.9.1. Under agenda item 1.9.2, WRC-97 will consider upgrading the meteorological-satellite (MetSat) for the protection of a significant number of Data Collection Platforms (DCPs) operating throughout the world and earth exploration-satellite (EES) services from a secondary to a co-primary basis with meteorological aids which has been proven feasible in the 401 - 403 MHz band (See draft new Recommendation ITU-R SA.[Doc. 7/70]). Sharing between the non-GSO MSS downlinks and the GSO EES or MetSat receivers would be feasible provided the power received by an EES or MetSat receiver in the reference bandwidth from a non-GSO MSS constellation does not exceed the sharing criteria in Recommendation ITU-R SA.1164. For coordination purposes both the short- and long-term sharing criteria in Recommendation ITU-R SA.1164 should be converted into an equivalent pfd at the GSO and be used for the evaluation of permissible levels of interference into EES or MetSat. The sharing studies do not take into consideration other users of the band 401 - 403 MHz, in particular MetAids (refer to Section 4.1.1.6). The sharing criteria for future MetSat systems operating at higher data rates needs further study. However, sharing between non-GSO MSS and non-GSO MetSat or non-GSO EES is not feasible.

4.1.1.5.2 Methods to satisfy the agenda item and their relative advantages

Any space-to-Earth allocation for non-GSO MSS in the band 401 - 403 MHz should take into consideration not only the results of sharing studies between non-GSO MSS and MetSat or EES but also other uses of allocated services, in particular MetAids.

4.1.1.5.3 Regulatory and procedural considerations

Any sharing between non-GSO MSS (space-to-Earth) and MetSat or EES will require a pfd value at the GSO to protect these services. Such a pfd value should be established using the sharing criteria for GSO MetSat and GSO EES given in Recommendation ITU-R SA.1164.

4.1.1.6 Sharing between meteorological aids and non-GSO MSS in the band 401 to 406 MHz

4.1.1.6.1 Summary of technical and operational studies and analysis of their results

Sharing studies completed to date have shown that co-channel sharing with currently proposed non-GSO MSS systems is not generally feasible due to excessive interference to both the MetAids system and to the MSS system. Therefore, any sharing of the band 401 to 406 MHz would require

band segmentation. One study recently submitted to ITU-R indicates that sharing on a co-channel basis may be feasible with feeder links of certain non-GSO MSS systems using spread spectrum techniques with the following limitations:

1) the MSS downlink pfd does not exceed -177 dBW/m^2/4 kHz (-158.3 dBW/m^2/300 kHz);

2) the MSS ground station must accept interference from MetAids.

It is noted that there are worldwide allocations to mobile-satellite systems (space-to-Earth), meteorological aids, meteorological satellites (space-to-Earth) and space operations (space-to-Earth) on a co-primary basis in the band 400.15 to 401 MHz and that the use by these services is on a coordination basis.

Meteorological aids systems are essential for making upper air measurements; the amount of spectrum required by meteorological users including WMO (station spacing requirement of 250 km), other civilian and defence related users in most geographic areas is about 5 MHz in the band 401 to 406 MHz using the currently available technology. The WMO's assessment of spectrum requirements for MetAids operated in this band indicates that 5 MHz is required until the year 2010. Some administrations indicated that they may consolidate MetAids operations in less than 5 MHz of spectrum in the 401 - 406 MHz band prior to the year 2010. Other administrations indicated that they will retain 5 MHz in order to preserve MetAids operations.

Further, WRC-97 will consider an upgrade to the meteorological satellite (Earth-to-space) and the earth exploration-satellite (Earth-to-space) service allocations (for the protection of a significant number of DCPs operating throughout the world) in the band 401 to 403 MHz to co-primary with the meteorological aids service, under agenda item 1.9.1. This will impose constraints on the frequencies available to the meteorological aids services in some locations and these constraints could be expected to increase with time as the requirements of the meteorological-satellite services and the earth exploration-satellite services increase.

Whilst development of improved meteorological aids systems is continuing in order to minimize the bandwidth required by these systems, as outlined in Recommendation ITU-R SA.1165, these improvements will significantly increase the cost of the equipment. In the next 5 to 10 years these improvements would likely be used by administrations to meet increasing spectrum requirements for meteorological aids systems. It should be noted that many administrations may incur a modest cost increase in the operation of MetAids in the next 5-10 years in order to switch to a different wind finding system than that currently used due to the decommissioning of the OMEGA Radionavigation system in late 1997 and/or to meet the higher network densities.

Further band segmentation would significantly increase the operational costs and would have a detrimental impact on meteorological aids operations. Further studies are required with a view to identifying any spectrum which could be made available for use by MSS.

4.1.1.6.2 Methods to satisfy the agenda item

Band segmentation should be considered to the extent that it does not drive the operational costs of MetAids networks above the available financial resources. If this is not practical then alternative bands should be considered for the MSS. Because of the need to have adequate financial resources and the timing of the availability of improved technology, sufficient time would be required for those administrations planning to consolidate MetAids operations in a bandwidth less than 5 MHz in the 401 - 406 MHz band. These administrations are urged to identify the amount of time required for such consolidation of MetAid operations in time for WRC-97, taking in to account the urgent need to make additional spectrum available on a worldwide basis for the MSS below 1 GHz.

Studies submitted to the ITU-R suggest that feeder links for certain non-GSO MSS systems using spread spectrum techniques may be able to share the band 401 to 406 MHz, on a co-frequency basis, with the meteorological aids service with the following limitations:

1) the MSS downlink pfd does not exceed -177 dBW/m^2/4 kHz (-158.3 dBW/m^2/300 kHz), which may be achieved by spreading transmitted energy over as wide a frequency range as possible;

2) the MSS ground station must accept interference from MetAids.

4.1.1.7 Sharing between MSS downlinks and COSPAS/SARSAT satellite receivers at 406 - 406.1 MHz

COSPAS/SARSAT is a worldwide search and rescue system operated by a number of administrations, consisting of Earth-to-space links operating under an MSS allocation and No. S5.266 (649) in the band 406 - 406.1 MHz. COSPAS/SARSAT networks use several low-Earth orbit satellites that receive low power emergency position indicating radio beacons (EPIRBs) at an orbit altitude of about 850 km. An interference criterion of -190 dBW/m^2/Hz at the satellite receiver has been established in Recommendation ITU-R SM.1051.

The two likely interference paths from an MSS downlink to a COSPAS/SARSAT receiver are: 1) limb of the Earth, and 2) MSS mainbeam into COSPAS/SARSAT backlobe if an MSS satellite is directly above a COSPAS/SARSAT satellite.

The results of a preliminary analysis (using a typical MSS orbit of 950 km and a nominal SARSAT orbit of 850 km) indicate in this specific case an additional loss of about 45 dB is required to meet the interference protection criteria. Analysis of other non-GSO MSS orbit altitudes and the COSPAS orbit of 1 000 km need to be considered. The burden of meeting the protection criteria for both the SARSAT and COSPAS satellites lies entirely upon the non-GSO MSS, if WRC-97 makes any allocations to MSS in the lower adjacent band.

4.1.1.8 Sharing between non-GSO MSS and the radiolocation service below 1 GHz

Typical characteristics of radiolocation stations in the 420 - 450 MHz bands

	Land based	**Airborne**	**Maritime**
Power (dBW)	68	63-85	56
Antenna gain (dBi)	0[1]	22[2] or 0[1]	0[3]
Emission curve:			
-3 dB	1 MHz	5 MHz	2 MHz
-20 dB	2 MHz	7 MHz	3 MHz
-70 dB	34 MHz	30 MHz	20 MHz
Antenna height	30 metres	6-12 km	9 metres
NOTE 1 - Nominal sidelobe/backlobe gain. NOTE 2 - Main beam gain. NOTE 3 - Median gain of rotating antenna.			

4.1.1.9 Sharing between non-GSO MSS below 1 GHz Earth-to-space links and the fixed service and analysis of their results

4.1.1.9.1 Summary of technical and operational studies and analysis of their results

It has been shown that an analogue DCAAS, can detect with a 99.9% probability a 2.5 kHz signal from a 65-milliwatt terrestrial transmitter in the 450 - 470 MHz band. DCAAS could significantly reduce the possibility of interference to terrestrial fixed systems from co-channel Earth-to-space MESs transmissions. However, a simple DCAAS system would reject as possible channel assignments to individual MES all those on which it detects any signal above a certain threshold.

DCAAS may be supplemented by additional sharing techniques which may permit more efficient use of bands below 1 GHz shared with the fixed service, and still protect terrestrial fixed systems. These techniques require further study. DCAAS may also be implemented by using digital parallel processing technique and will speed up the rate at which the spectrum is scanned. This would allow for larger segments of the band to be characterized. Further study will establish the benefits of digital implementation over analogue.

4.1.1.9.2 Methods to satisfy the agenda item and their relative advantages for additional allocations to non-GSO MSS below 1 GHz

Results of studies identified in Section 4.1.1.9.1 should be taken into account in considering additional allocations on a worldwide basis for the non-GSO MSS below 1 GHz.

4.1.1.10 Sharing with the Radio Astronomy Service

The Radio Astronomy Service (RAS) has primary allocations in the frequency ranges 150.05 - 153 MHz (Primary in Region 1, Australia and India), 322 - 326.8 MHz, 406.1 - 410 MHz, 608 - 614 MHz (Primary in Region 2, India, China and the African Broadcasting Area). Inputs were received for some LEO MSS below 1 GHz which may utilize feeder links above 1 GHz near 1.4 GHz which, depending on results of WRC-97, could potentially affect the RAS (1 400 - 1 427 MHz). See Section 4.1.1.10.2.

4.1.1.10.1 Interference and Sharing Criteria

Threshold levels for interference detrimental to radio astronomy measurements, for cases of both spectral line and continuum observations, are in Tables 1 and 2 of Recommendation ITU-R RA.769. The tolerable percentage of time lost due to interference is generally considered to be 10% of the time in cases where the strength of an interfering signal varies as a result of time varying propagation conditions. (Section 4.2.4 of the ITU-R Handbook on Radio Astronomy) In cases where the transmitter power itself varies the mean power of the interferer should not exceed the harmful threshold. For some types of observation a 10% failure rate due to interference imposes severe restrictions on the radio astronomer.

The annex of Recommendation ITU-R RA.769-1 describes the methodology for calculating the sensitivity of various radio astronomy systems currently in use. It also provides, for typical values of system parameters, tabulated levels of interference which are detrimental to both continuum and spectral-line measurements for various bands allocated to the radio astronomy service.

Although the parameters assumed used to derive the levels prescribed in Recommendation ITU-R RA.769-1 are typical for many types of radio astronomy systems and measurements, other values for these parameters can be used with the methodology to calculate levels of detrimental interference for a specific radio astronomy system.

The levels prescribed in the Annex of Recommendation ITU-R RA.769-1 should be applied or referenced for purposes consistent with the assumptions used to derive them.

Recommendation ITU-R RA.1031 calculates coordination parameters for sharing with terrestrial transmitters of other services.

4.1.1.10.2 Sharing Considerations

It is rarely possibly for radio astronomy to share co-channel with any other service whose transmitters are within line-of-sight of the observatory.

Because of the extreme sensitivity of radio astronomy observations, interference from unwanted (spurious and out-of-band) emissions from transmitters with allocations in other bands can also be a problem. However, interference to radio astronomy can be avoided using various techniques. These techniques include using low power transmitter levels, choice of modulation, bit shaping, output filtering, band limiting filters. Use of these techniques can minimize the band separation necessary to attain the recommended interference threshold levels for out-of-band emissions. Where these measures are insufficient to avoid interference to radio astronomy stations from Earth-to-space transmissions, it is necessary to use geographic separation (see draft new Recommendation ITU-R M. [8D/XN] (Doc. 8/56). For MSS feeder uplinks, radio astronomy can be protected by the site selection of the MSS earth stations.

4.1.1.11 Sharing of MSS (space-to-Earth) with the broadcasting service

4.1.1.11.1 Television in the frequency ranges 470 - 582 MHz and 582 - 960 MHz

The protection requirements specified in the Tables 4.1 and 4.2 have been derived from published information about the needs of the broadcasting service (See Recommendation ITU-R BT.655-4 for protection ratios for analogue television, Recommendation ITU-R BT.417-4 for minimum field strengths to be protected and Recommendation ITU-R IS.851-1 for interservice sharing between the broadcasting and mobile radio services) with the assumption that the interfering signal is a narrow band MSS source. Broadcasting systems which are currently using frequencies in the bands 470 - 582 MHz and 582 - 960 MHz and a terrestrial digital system planned to be in use in the near future, have been included. The ITU-R is currently developing the planning parameters for terrestrial digital television. Table 4.1 relates to the case of continuous interference (Grade 4 impairment) and to the case of a narrow band MSS transmitting in the most sensitive portion of an analogue television channel or in a digital television channel. Table 4.2 relates to interference in the least sensitive portion of an analogue television channel.

It must be emphasised that the studies conducted so far have only considered the protection requirements for television. Studies on sharing between MSS and television are required.

Although terrestrial digital television services will be deployed in a number of countries (in this frequency range) over the next few years, it is also to be expected that the analogue television service will continue in many countries for many years. This is probably especially true for those countries which are relatively under-developed, where the man-made noise levels are low and where the protection requirements are most stringent simply because the noise and existing interference levels are low. However, it is likely that digital television represents the future in all countries.

The values of maximum tolerable interfering power flux-density derived in Table 4.1 are comparable to those derived elsewhere. The differences are primarily the result of different assumed bandwidths and receiver noise figures.

In order to protect existing and planned broadcasting services according to Recommendation ITU-R IS.851-1, contributions of all interfering sources have to be combined using a method specified in that Recommendation. Since the pfd values in Tables 4.1 and 4.2 were derived without the inclusion of any protection margin the interference contributions from sources other than MSS, even those from other broadcasting stations have also to be taken into account in these calculations.

It is noted that the frequency band 162 - 230 MHz is not proposed for sharing with MSS and is not considered in this Report.

Near the channel edges for AM/VSB television systems, as defined below, the protection ratios given in Table 4.1 may drop by 13 to 20 dB (see Recommendation ITU-R IS.851-1). Table 4.2 shows the maximum permissible interfering power flux-density for the same frequency bands as Table 4.1, assuming that the narrow-band interfering signal is in the lower protection parts of the analogue television channel, as defined below. The interfering effects of a non-GSO MSS will depend on its specific characteristics (e.g. duty-cycle, duration, periodicity, etc.).

Definition of the region for lower protection ratios and commensurately higher permissible power flux levels

– NTSC: from 60 kHz below, to 40 kHz above the upper edge of the channel (i.e. 100 kHz total);

– systems B, D, G, H, I, K, K1 and L: from 100 kHz below, to the upper edge of the channel.

Since the interference near the vision, colour and sound carriers is potentially more harmful to television than interference near the channel edges, and since the protection ratios given in Tables 4.1 and 4.2 have not been verified by experimental means, further study is needed.

AM/VSB television systems have higher protection requirements than digital television systems in the most sensitive parts of the channel. However, digital television systems exhibit essentially flat protection requirements over the entire occupied channel.

TABLE 4.1

Maximum power flux-densities for narrow-band non-GSO MSS for continuous interference (grade 4 impairment)

Transmitting in the most sensitive part of an analogue television channel or in a digital television channel.

Identifier	**Analogue television**				**Digital television**		**Note**
	470 - 582 MHz		**582 - 960 MHz**		**470 - 580 MHz**	**582 - 960 MHz**	
	high-noise area	**low-noise area**	**high-noise area**	**low-noise area**			1
Nominal bandwidth (MHz)					6 to 8	6 to 8	
Receiver noise figure (dB)					5	5	2
Receiver noise input (dBW)					-131.0	-131.0	
Assumed receiving antenna gain (dB)					9	9	3
Receiving antenna discrimination (dB)	0	0	0	0	0	0	4
Required C/N ratio (dB)					(20)	(20)	5
Minimum power flux-density (dBW/m^2)					-107.0	-102.0	5
Minimum field strength (dBµV/m)	53	48	58	53			1
Derived power flux-density (dBW/m^2)	-92.8	-97.8	-87.8	-92.8			1,6
Derived equivalent minimum field strength (dBµV/m)					38.8	43.8	5, 6
Protection ratio (dB)	58	58	58	58	(30)	(30)	5, 7
Maximum interfering power flux-density (dBW/m^2)	-150.8	-155.8	-145.8	-150.8	-137*	-132	1,8,9
Equivalent maximum interfering field strength (dBµV/m)	-5.0	-10.0	0.0	-5.0	8.8	13.8	1,6

* This value also applies to a Region 2 study at 615 MHz.

TABLE 4.2

Maximum Power Flux-Densities for Narrow-Band non-GSO MSS for Continuous Interference (Grade 4 impairment) transmitting in the least sensitive part of a television channel*

Identifier	Analogue television only				Note
	470 - 582 MHz	**470 - 582 MHz**	**582 - 960 MHz**	**582 - 960 MHz**	10
	high noise area	low-noise area	high noise area	low noise area	
Protection ratio (dB)	41	41	41	41	
Maximum interfering power flux-density (dBW/m^2)	-133.8	-138.8	-128.8	-133.8	

* For Australia, and any other countries in Region 3 which have a second FM sound carrier in the uppermost 100 kHz of a television channel, the relevant protection ratio is 57 dB and the maximum interfering power-flux density values are 16 dB lower than the values shown in this table.

Notes to Tables 4.1 and 4.2:

1) The values given in Table 1 of Rec. ITU-R IS.851-1 for 50% time and 90% of locations are relevant for Regions 1 and 3 in areas where man-made noise levels are significant. However, in areas where man-made noise levels are low, the appropriate values for 50% time and 90% of locations are 12 dB below the 50% time and 50% of locations value; that is, 53 dBmV/m for 470 - 582 MHz and 58 dBmV/m for 582 - 960 MHz. Such values are expected to apply in a relatively large number of developing countries, in particular and in rural areas in other countries (see, for example Rec. ITU-R BT.417-4). The value of minimum field strength given for 470 - 582 MHz and 582 - 960 MHz is often reduced by 5 dB in countries where the television broadcasting networks are relatively sparse. In such cases, the derived power flux-density and maximum interfering signal levels must also be reduced by 5 dB.

2) 5 dB is regarded as a minimum realistic value taking account of the need to maintain low intermodulation levels.

3) A receiving antenna gain of 9 dB, including feeder loss, is assumed in the derivation of the signal levels.

4) Analogue and digital television applications use directional antennas, but these are very often horizontally polarized and have wide beamwidths in the vertical plane, thus there is no discrimination against interfering signals originating in a satellite.

5) The required C/N+I ratios and the protection ratios for digital television systems are nominal values. The protection ratio values will be about 10 dB lower than the required C/N value for a given system.

   The actual values are less important than the difference between them. It is for this reason that some values have been placed in parentheses. Further study within the relevant ITU-R study group is needed to establish all relevant protection ratio values for different digital television systems.

6) Conversion between power flux-density (*f)* and equivalent field strength *E*) is by means of the formula $E = f + 145.8$ where *E* is in dBmv/m and f is in dBW/m^2.

7) The protection ratio value for analogue television is for the case of, so-called, continuous interference and will apply when the MSS signals are near the vision and sound carriers. it must be noted that different television systems in different parts of the world use a range of vision carrier frequencies and the value quoted is thus appropriate for the general case. however, it must also be noted that the term continuous is really a misuse as it is applied to the case of 50% time interference. in those cases where interference is really continuous, in other words present for 100% of the time, it is common practice, in Europe at least, to add 3 dB to the relevant protection ratio values.

8) For the digital television systems, the power flux-density quoted is the total power flux-density tolerable within the television channel. if there are multiple MSS carriers in the same pass band, their interfering power flux densities must be added together.

9) For the analogue system, the power flux-density quoted is the interference power tolerable under the assumption that the MSS signal has relatively narrow bandwidth in which the change in protection ratio is less than 2 dB. This assumption has been adopted in order to reuse a protection ratio value which already appears within Recommendation ITU-R BT.655-4. It must be noted that this is the value for single entry and it is assumed that the MSS signal is near the vision carrier of the television carrier. If these are multiple narrow band or wide band MSS signals within the television pass-band, the protection requirement will be based on the power-sum of the individual interference components. Each of these components consists of the power of an MSS signal with a bandwidth to which is added the relevant protection ratio, being dependent on the frequency difference between the MSS carrier and the vision carrier frequency. The total from the power summation process must not exceed the interfering power value for the single entry case shown in the table.

10) The values in Table 4.2 need to be reviewed by the relevant ITU-R Study Groups.

4.1.1.11.2 FM Sound Broadcasting and Digital sound broadcasting

ITU-R has reviewed the Broadcasting Services Protection Criteria that could be used in sharing situations between the non-GSO mobile-satellite service and the existing FM sound broadcasting service or the Digital Sound Broadcasting (DSB) service. Tables 4.3 and 4.4 show the maximum allowable interfering pfd assuming MSS as a narrow band and a broad band system. The values are the aggregate interference level. Single entry interference values should be lower. For MSS systems with many satellites in operation, the values should be lower by a factor proportional to the number of satellites. These following values are still preliminary and are applicable for all elevation angles. Sharing studies between MSS and sound broadcasting are required.

TABLE 4.3

FM Sound Broadcasting Services Protection Criteria (Assuming Interference from Narrow band non-GSO MSS)[1]

Minimum Field Strength (dBµV/m)	48
Protection ratio (dB)	55
Maximum allowable interfering pfd (dBW/m^2/4 kHz)	-169.1

[1] In-band on-channel digital sound broadcasting systems are under development to operate in Band II and may require even lower maximum allowable interfering pfds.

TABLE 4.4

Terrestrial Digital Sound Broadcasting (DSB) Services (Digital System A) Protection Criteria (Assuming Interference from Broad band non-GSO MSS)

Frequency Band	I (45 - 70 MHz)	II (88 - 108 MHz)	III (170 - 240 MHz)
Minimum Field Strength (dBµV/m)	25	31	35
Protection ratio (dB)[1]	24	24	24
Maximum allowable interfering pfd (dBW/m^2/4 kHz)	-171	-164	-161
Maximum allowable interfering pfd (dBW/m^2)	-145	-139	-135

[1] Assuming MSS is a broadband digital service, based on 10 dB below normal noise floor.

4.1.1.12 Sharing studies between existing services and non-GSO MSS below 1 GHz feeder links using FDMA transmissions in certain bands near 1 400 MHz

An analysis has been performed on the various methods of sharing between non-GSO MSS below 1 GHz using FDMA narrow band feeder links and the various primary services in certain bands near 1 400 MHz. The rationale for initiating this analysis is that the use of feeder links at frequencies above 1 GHz will relieve the frequency congestion found in the bands below 1 GHz. Further studies are necessary before any specific frequency band near 1 400 MHz can be taken into consideration for MSS allocation for non-GSO feeder links.

4.1.1.13 Sharing among non-GSO MSS networks below 1 GHz

The Radiocommunication Bureau has identified at least 23 non-GSO MSS networks at frequencies below 1 GHz, at some state of coordination under Resolution 46. These systems are required to share spectrum with other services and among themselves. Other sections of this report discuss the inter-system sharing scenarios, while this section presents a summary of the intra-system techniques. The specific intra-system sharing techniques employed by non-GSO MSS networks below 1 GHz depends on the characteristics of the transmitted signal. There are two basic types of transmissions: narrow-band (NB) signals using FDMA techniques and wideband (WB) signals using CDMA techniques. In addition, different sharing techniques are used depending on the direction of the transmission, i.e., Earth-to-space (E-s) or Space-to-Earth (s-E) and whether it is a

service link or a feeder link. A discussion of these sharing techniques has been presented in various ITU-R Recommendations, including Recommendations ITU-R M.1039 and ITU-R M.1087, and other contributions to the CPM preparatory effort.

Table 4.5 presents a summary of the possible sharing techniques for these different transmission types. For the entries in the top row of the table, the first signal type is the potential interferer and the second is the interferee. For instance, NB/WB implies a narrow-band transmitted signal producing potential interference into a wideband system receiver. For the WB/WB sharing scenario, the orthogonal codes technique requires comparable power at the victim spacecraft for uplinks and comparable pfds on the ground for the downlinks. Also, the channel positioning technique in the NB/WB service space-to-Earth portion of the table implies off-setting the narrow-band channels from the centre of the wideband signal. The band segmentation technique for the same entry implies the two systems are operating in different band segments. The actual selection of sharing techniques is system specific, but it should result in a balance between the need to co-exist with other MSS networks and the need to meet system requirements.

TABLE 4.5

Sharing techniques among non-GSO MSS below 1 GHz networks

LINK TYPES	NB/NB	NB/WB	WB/NB	WB/WB
SERVICE E-s into SERVICE E-s	- Dynamic channel avoidance	- Band segmentation - Active Filtering	- Band segmentation - Low pfd	- Orthogonal codes - Matching pfd
FEEDER E-s into FEEDER E-s	- Band segmentation - Geographical separation	- Band segmentation - Geographical separation	- Band segmentation - Geographical separation	- Orthogonal codes - Geographical separation
SERVICE s-E into SERVICE s-E	- Band segmentation	- Band segmentation - Channel positioning	- Low pfd	- Orthogonal codes
FEEDER s-E into FEEDER s-E	- Band segmentation - Polarization discrimination	- Band segmentation - Polarization discrimination	-Low pfd -Polarization discrimination	- Orthogonal codes - Matching pfd
SERVICE s-E into FEEDER s-E	- Band segmentation	- Low pfd - Channel positioning - Polarization discrimination	- Low pfd - Polarization discrimination	- Orthogonal codes - Matching pfd
FEEDER s-E into SERVICE s-E	- Band segmentation	- Channel positioning - Low pfd	- Channel positioning - Low pfd	- Orthogonal codes - Matching pfd
SERVICE E-s into FEEDER E-s	- Band segmentation	- Band segmentation	- Band segmentation	- Band segmentation - Orthogonal codes
FEEDER E-s into SERVICE E-s	- Band segmentation - Dynamic channel avoidance	- Band segmentation	- Band segmentation	- Orthogonal codes - Matching pfd

4.1.1.14 Spectrum requirements for the non-GSO MSS below 1 GHz and associated feeder links

A total of 1.525 MHz (space-to-Earth) and 1.9 MHz (Earth-to-space) of primary spectrum is presently allocated worldwide to the MSS below 1 GHz and 300 kHz (Earth-to-space) is allocated for land mobile satellite service on a worldwide primary basis. In addition, 2 MHz (Earth-to-space) in Region 2 is available for the MSS below 1 GHz. The Radiocommunication Bureau has identified 23 non-GSO MSS networks, at frequencies below 1 GHz, at some state of coordination under Resolution 46. However, it also appears that many of the proposed networks cannot be implemented in the existing allocations because there is not enough spectrum to allow the development of all of these systems in an economically viable manner. Furthermore, it is likely that a number of these systems may not be implemented for reasons not connected with spectrum availability.

The ITU-R had previously identified 7 to 10 MHz of additional spectrum required for MSS below 1 GHz. This was identified in the CPM Report for WRC-95 and is also stated in *considering* b) of Resolution 214. An extensive study carried out by an administration in 1996 identified a need for spectrum above the current allocations to provide for certain applications until the year 2002. This study identified a spectrum requirement for service links of the order of 17 MHz on a shared basis, and an additional 4 MHz of shared spectrum for feeder links. However, some administrations do not support the claim for an additional 21 MHz of spectrum made by the study. In arriving at the conclusions regarding spectrum requirements and market demand, the study took into account the ability of present and future competing terrestrial and satellite technologies to provide these applications. However, some administrations believe that these applications are being, and will be, provided by other satellite systems (e.g. 1 - 3 GHz MSS) and/or terrestrial communications systems and place a priority on the provision of these communications by these services. Some other administrations place a priority on the provision of communications by these services through the use of non-GSO MSS systems below 1 GHz. It is recognized that the competitive technologies which may be employed will have different costs associated with their implementation, including both the cost of equipment and usage. In the case of some mobile-satellite systems operating voice systems within the 1 - 3 GHz range, the overall system costs are expected to be higher than those for mobile-satellite systems operating below 1 GHz and providing a data only service.

The MSS allocation requirements include both service and feeder links (which usually operate within the service bands). In general, the inbound and outbound allocations should be approximately balanced for CDMA systems. A wider uplink allocation, however, leads to a more benign sharing situation; the wideband MSS system can operate with a lower power density by spreading over wider bandwidths. One system, with FDMA uplinks and TDMA downlinks requires approximately five times the downlink bandwidth as uplink bandwidth. Narrow-band MSS systems with dynamic channel selection will occupy any given sub-channel less often and will require a greater bandwidth to achieve a given message rate. Thus, the uplink and downlink allocations do not necessarily have to be equal. Sophisticated narrow-band FDMA technologies such as DCAAS can reduce probabilities of interference by scanning the allocated bandwidth. The use of digital parallel processing applied to the fast Fourier transform will speed band usage characterization, and as a result would allow for larger segments of the band to be characterized. The study referred to above estimates that on a worldwide basis an average of 3.2 million non-GSO MSS users would be provided service in each 1 MHz of bandwidth for uplinks, and 6.1 million users per MHz for downlinks, when the data rates and frequency of use among the various users are taken into account.

4.1.1.15 Regulatory considerations concerning frequency sharing in bands shared by the MSS and the FS, MS and other terrestrial services below 1 GHz

The mobile earth stations of mobile-satellite systems planned and operating on a global basis and below 1 GHz must share spectrum with other radio services. Ideally, these systems would use the same frequency assignment from within the same allocation in every country in which they operate. However, due to differences in regional and domestic spectrum allocations and use, it will likely be difficult to allocate common worldwide spectrum to achieve this goal. For example, WRC-95 was able to identify 2 MHz of spectrum for NGSO MSS below 1 GHz in Region 2, but concerns on the potential for interference into the existing and planned services in Regions 1 and 3 prevented its allocation in those regions.

The bands below 1 GHz are heavily used by many administrations. However, it is considered appropriate to investigate new approaches within ITU-R that might allow new spectrum efficient technologies to develop while protecting existing and planned services.

One such approach would be a method where a broad allocation may be made to a service. Within that broad allocation, specific frequencies may be identified for this service. The frequencies identified could vary by geographical area with a view to providing frequencies that could be used by this service which requires global allocations. The identified frequencies should be such that they would cause minimal impact on existing or planned services. The frequency range allocated could be the range over which the satellite is capable of tuning. Further, from within that broad allocation administrations could identify frequencies with minimal impact on their existing services.

In the case of NGSO MSS systems below 1 GHz, frequency-agile transmitter technology would allow them to use only uplink frequencies appropriate for a certain geographical area in the Earth-to-space direction. Technical characteristics that may facilitate use of this approach are provided in Section 4.1.1.1.

The concept of broad allocations has not been studied by the ITU-R. The identification of frequencies within a geographical area may not be possible due to the differing use of the bands by the administrations within the geographical area. Given the global nature of these satellite services, the broad allocation may allow mobile earth stations to access the satellite system on frequencies that may not be authorized in the region or the country in which the MES is located. Such use may or may not cause interference to existing and planned services and in the long term may or may not lead to placing constraints on the development of the existing services. A broad allocation may also hamper frequency harmonization efforts for other services, which are carried out by ITU or regional telecommunications organizations. ITU-R studies on this concept are required before any allocation to NGSO MSS below 1 GHz could be based on this concept.

4.1.2 Resolution 215 "Coordination process among non-geostationary mobile-satellite systems"

4.1.2.1 Sharing among non-GSO MSS networks below 1 GHz

The methodology described in Recommendations ITU-R SA.1021, ITU-R SA.1022 and ITU-R SA.1023 has been applied to derive sharing criteria for low-Earth orbit mobile-satellite systems operating in the 137 - 138 MHz band using either narrow-band modulation with FDMA, or wideband modulation with DS-SSMA techniques. For details, see Recommendations ITU-R M.1230, ITU-R M.1231 and ITU-R M.1232.

ITU-R is developing new Recommendation ITU-R M.[8D/XQ] "General methodology for evaluating the effect of interference from narrow-band MSS transmitters to spread-spectrum receivers in the low-Earth orbit mobile-satellite service operating below 1 GHz using the

carrier-to-noise density method" (see Document 8/55) which addresses a method to compute the effect of narrow-band interference on spread-spectrum systems. The relative advantage of this method is that it allows easy comparison of systems proposing to share spectrum in the same frequency band without detailed knowledge of the spread-spectrum receiver system.

Sharing of certain frequency bands among MSS downlinks has proven feasible, for example at 137 - 138 MHz and 400.15 - 401 MHz.

Sharing of certain frequency bands among MSS uplinks has proved to be feasible through use of frequency and geographic separation (e.g., at the 148 - 149.9 MHz band).

Sharing criteria to assist in the coordination of non-GSO MSS networks has been developed for some frequency bands allocated to the non-GSO MSS as per Resolution 215.

4.1.3 Resolution 714 "Power flux-density level applicable in the frequency band 137 - 138 MHz shared by the MSS and terrestrial services"

4.1.3.1 Summary of technical and operational studies and analysis of their results

Experience to date has shown:

1) two MSS satellites are operating the 137 - 138 MHz band. These satellites are the initial satellites in a constellation of 34 satellites and are being coordinated with pfds of -125 dBW/m^2 per 4 kHz;
2) most of the other satellites in the band in question are operating in the meteorological satellite or space research service where the meteorological satellites operate with pfds between -130 and -125 dBW/m^2 per 4 kHz;
3) there have been no reports of interference;
4) the narrow-band MSS constellation uses frequency planning that divides usage of the assigned constellation frequencies among multiple satellites, producing only a small occupancy of any assigned frequency as seen from a point on the Earth;
5) one MSS system has been operating, on a limited basis, for approximately two years with no complaints;
6) coordination experience to date has demonstrated that the coordination threshold of -125 dBW/m^2 per 4 kHz is a useful and valid coordination criteria;
7) even if experience to date indicates that a level of -125 dBW/m^2 per 4 kHz permits sharing, sharing studies demonstrate in certain cases that this value of pfd is not sufficient to protect AMS (OR).

4.1.3.2 Methods to satisfy the agenda item and their relative advantages

The large number of advance publications and coordination requests presently filed for this band seems to indicate that today the use of the band has reached a steady state situation in which new systems entering the band could be replacing only old systems, so that the overall interference effect to terrestrial systems would not increase.

Nevertheless, to provide protection with regard to AMS (OR), without unduly increasing the coordination burden on the MSS and terrestrial services, the following approach would be applied. Future non-GSO MSS systems with a pfd exceeding -140 dBW/m^2 per 4 kHz would coordinate, via RR No. S9.11A Resolution 46, with those administrations that are listed in RR No. S5.206 as of 1 November 1996 and with the aeronautical mobile (OR) systems of those administrations that are listed in RR No. S5.204 as of 1 November 1996. For this purpose, "future non-GSO MSS systems"

are defined as those systems which submit their coordination request to the BR after 1 November 1996.

However, any replacement of satellites using similar parameters (e.g. from which the interference effects to terrestrial systems will not increase) to an existing non-GSO MSS network which had submitted its coordination request to the BR before the above 1 November 1996 date would need to coordinate only if its pfd exceeded -125 dBW/m^2 per 4 kHz. It should be noted that such replacements with respect to the existing system may need to be reflected in coordination request filing modifications. The interference effects of these replacements would be limited by the requirement to maintain compatibility with the other non-GSO MSS systems, in particular the CDMA systems, and by the requirement to meet the -125 dBW/m^2 in 4 kHz pfd coordination threshold.

Resolution 714 should be suppressed and the reference to it in relationship to this pfd threshold value should be removed from RR No. S5.208 provided that the above proposal is endorsed by WRC-97.

4.1.3.3 Regulatory and procedural considerations

The Radio Regulations should be modified to clarify that the pfd value is a threshold for coordination and is not a limit. Regulations need to be developed to satisfy Section 4.1.3.2.

4.2 Mobile-Satellite Service in the band 1 - 3 GHz

4.2.1 Resolution 215 "Coordination process between non-geostationary mobile-satellite systems"

4.2.1.1 Summary of technical and operational studies and analysis of their results

An analysis was performed for sharing between MSS systems using different multiple access technologies in the 1 610 - 1 626.5 MHz band in the Earth-to-space direction. Conclusions of this analysis are presented in the following sections. The results of the analysis can generally be extended to other MSS bands in the 1 - 3 GHz range and in the other direction, i.e. space-to-Earth.

4.2.1.1.1 Co-directional, co-frequency, co-coverage non-GSO MSS systems using different access technologies in 1 - 3 GHz band in the Earth-to-space and space-to-Earth directions

An analysis has been performed on uplink parameters which impact on sharing between global non-GSO MSS systems using different access technologies (FDMA/TDMA and CDMA) under a co-directional, co-frequency, co-coverage scenario. It was shown that it would not be possible to modify these parameters in such a way as to acceptably control the intersystem interference between an FDMA/TDMA MSS system and a CDMA-based system serving the same area with the same frequencies.

4.2.1.1.2 Co-directional, co-frequency, co-coverage non-GSO MSS systems using the same access technologies in 1 - 3 GHz in the Earth-to-space and space-to-Earth directions

For the case between two FDMA/TDMA MSS systems the result will be the same as for different technologies. For example, the possibility of increasing the received signal power in order to overcome the intersystem interference was considered. In this case it was shown that all of the techniques available to increase the desired signal receive power would also increase the interfering signal receive power.

However, for systems which are both using CDMA access technologies, depending on the parameters chosen, sharing is possible. The basis for such sharing is found in Recommendation ITU-R M.1186, "Technical considerations for the coordination between MSS networks utilizing code division multiple access (CDMA) and other special spectrum technologies in the 1 - 3 GHz band".

4.2.1.2 Methods to satisfy the agenda item and their relative advantages

Codirectional, co-frequency, co-coverage spectrum sharing between presently proposed FDMA/TDMA and CDMA global non-GSO MSS systems in 1 - 3 GHz, and among FDMA/TDMA non-GSO MSS systems, is not practicable. However, depending on the parameters chosen, co-frequency sharing between CDMA systems is feasible.

Given that global coverage is an essential element of non-GSO MSS systems and noting that there are several potential users in the 1 - 3 GHz range, there are a number of non-co-frequency, co-coverage, band sharing scenarios:

1) there could be band segmentation between networks using FDMA/TDMA and also between FDMA/TDMA networks and those using CDMA whereby there would be technical sharing conditions at only a small number of boundaries. There would be a need for coordination between systems using the same access technique and sharing the same band segment. Under this scenario, however, the apportionment of the segments may cause difficulties;

2) there could be interleaving of the RF carriers of the potential networks throughout the band. This would require more detailed, clearly defined, technical interface sharing arrangements at a large number of boundaries, and this would require a higher level of cooperation among the potential networks to achieve this in order to make the most efficient use of the band. However, it is currently considered that this will be operationally complex to implement and lead to inefficiency in spectrum usage.

Various bandsharing scenarios may be available to non-GSO MSS systems and since spectrum is allocated on a long-term basis, the use of such MSS allocations should not place regulatory constraints on the basis of frequency access schemes.

Further studies may be required under Resolution 215 to define coordination techniques in order to reduce uncertainties during satellite design.

4.2.2 Recommendation 717 (Rev.WRC-95) "Frequency sharing in bands shared by the MSS and the FS, MS and other terrestrial services below 3 GHz"

4.2.2.1 Summary of technical and operational studies

4.2.2.1.1 Sharing with fixed service

ITU-R prepared draft new Recommendation ITU-R F.1246 on the reference bandwidth for the fixed service to be used in frequency coordination with MSS space stations. It recommends that the current reference bandwidth (1 MHz for FDP calculation of digital FS systems and 4 kHz for pfd threshold levels to protect digital and analogue systems) should be replaced by the following with respect to both FDP and pfd:

– 1 MHz reference bandwidth should be used for protection of digital FS systems.

– Both 1 MHz and 4 kHz reference bandwidths should be used for protection of analogue FS systems for telephony. In this case, if the coordination threshold applicable to 1 MHz reference bandwidth is X dB(W/m^2), the additional coordination threshold appropriate for 4 kHz reference bandwidth is X-18 dB(W/m^2).

– 1 MHz reference bandwidth should be used for protection of analogue FS systems for television.

Based on the conclusions of draft new Recommendation ITU-R F.1246, the ITU-R prepared draft revisions of Recommendations ITU-R IS.1141 (Doc. 8/61) and ITU-R IS.1142 (Doc. 8/62) dealing respectively with coordination threshold levels for non-GSO and GSO MSS space stations sharing frequency bands with FS in the 1 - 3 GHz range. The new thresholds in terms of pfd for a 1 MHz reference bandwidth are 24 dB higher than those previously specified for a 4 kHz reference bandwidth and are applied with respect to all FS systems. The revised thresholds for a 4 kHz reference bandwidth are applied only to analogue FS systems for telephony and are 6 dB less stringent than the previous thresholds.

In addition, ITU-R has developed a draft new Recommendation ITU-R F.1245 presenting a mathematical model of average radiation patterns for point-to-point fixed service antennas and a draft new Recommendation ITU-R F.[Doc. 9/92] presenting reference radiation patterns of omnidirectional and other antennas in point-to-multipoint systems of the fixed service.

4.2.2.1.2 Sharing with the radio astronomy service

Frequency sharing in the 1 610.6 - 1 613.8 and 1 660 - 1 660.5 MHz bands between the mobile-satellite service (Earth-to-space) and the radio astronomy service has been studied by the ITU-R, resulting in the development of draft new Recommendation ITU-R M.[8D/XN], which provides a set of principles and a methodology that may be used to determine the geographical separation needed around radio astronomy sites for the protection of the radio astronomy observations from emissions of land and maritime mobile earth stations. Further studies are required to establish if the principles of draft new Recommendation ITU-R M.[8D/XN] could also be applied to aircraft earth stations.

The protection of radio astronomy observations is provided using a three-step approach to determine geographical separation areas around the radio astronomy site in terms of separation distances, by default, restriction zones and exclusion zones. The determination of these areas is intended to facilitate sharing between the two services by providing a progressively detailed assessment of the interference from mobile earth stations into the radio astronomy service.

The draft new Recommendation provides a methodology which can be used for the calculations for separation distances by default and restriction zones. Exclusion zones should be defined by means of detailed assessment of the systems involved and measurements if necessary.

4.2.2.1.3 Sharing with radionavigation-satellite service

1) Recommendation ITU-R M.1088 - Considerations for sharing with systems of other services operating in the bands allocated to the radionavigation-satellite service, provides a technical description and characteristics of the Global Positioning System (GPS) that could be useful in the evaluation of sharing with other services.

2) Draft new Recommendation ITU-R M.[8D/XO] (Doc. 8/59) - "Interference protection evaluation model for the radionavigation-satellite service in the 1 559 - 1 610 MHz band", provides a model for use in the initial evaluation of the potential to cause interference to a radionavigation-satellite system operating in the subject band.

3) Studies are currently being undertaken to evaluate interference to the radionavigation-satellite service, including space-to-space applications, from emissions in the same band and from systems operating in other bands.

Some administrations and ICAO consider that no final decisions should be taken regarding the potential for in-band sharing between the ARNS/RNSS and MSS downlink applications until the competent bodies of the ITU-R and ICAO have completed relevant sharing studies. Furthermore, these same competent bodies would have to review the studies submitted to this CPM by one administration and one operating agency.

Other administrations, recognizing that no allocation currently exists for RNSS (space-to-space) applications in this band, believe that an appropriate MSS pfd limit for operations in the 1 559 - 1 567 MHz could be developed at this time. Studies on sharing between ARNS/RNSS (space-to-Earth) and MSS downlinks, conducted by some administrations, have been submitted to the CPM and will be submitted to the ICAO GNSS panel for their consideration.

4) Studies on the compatibility between MSS (space-to-Earth) in the 1 559 - 1 567 MHz band and RNSS and ARNS in the 1 559 - 1 610 MHz band, including the ICAO Global Navigation Satellite System (GNSS) and its augmentations, have been conducted outside the ITU. See Section 4.2.3.4.

Draft new Recommendation ITU-R M.[Doc. 8/57] - "Considerations for sharing with systems of other services operating in the bands allocated to the radionavigation-satellite and aeronautical radionavigation services and the Global Navigation Satellite System (GLONASS-M)", provides a technical description and characteristics of the GLONASS-M that could be useful in the evaluation of sharing with other systems.

4.2.2.1.4 Sharing within existing allocations in the bands 1 525 - 1 559 MHz and 1 626.5 - 1 660.5 MHz

No outstanding or urgent studies relating to frequency sharing between the mobile-satellite service and terrestrial services (radio astronomy, FS, aeronautical telemetry) in the bands 1 525 - 1 559 MHz and 1 626.5 - 1 660.5 MHz have been identified.

4.2.2.2 Analysis of the results

Draft new Recommendation ITU-R F.1246 gives the basis for new coordination threshold levels for the mobile-satellite service with respect to the fixed service which figure in the draft revisions of Recommendations ITU-R IS.1141 and ITU-R IS.1142. Draft new Recommendation ITU-R M.[8D/XN] provides one set of principles and methodology which may be used to determine the geographical separation needed around radio astronomy sites for the protection of the radio astronomy observations from emissions of mobile earth stations.

4.2.2.3 Methods to satisfy the agenda item

When coordinating the mobile-satellite service with the fixed service, the new coordination threshold levels that are given in Tables 1 and 2 of draft revisions of both Recommendations ITU-R IS.1141 and ITU-R IS.1142 are intended to replace the relevant values in the table in Annex 2 to Resolution 46 (Rev.WRC-95) and the table in 1.2.3.1 of Annex 1 to Appendix S5 of the Radio Regulations. These Recommendations have been proposed to be updated to reflect the above conclusions concerning the reference bandwidth.

When coordinating mobile earth stations of the MSS with the radio astronomy service, the principles and methodology developed by the ITU-R in draft new Recommendation ITU-R M.[8D/XN] can be applied, provided the Recommendation is adopted.

Consideration should be given to updating the antenna radiation patterns, as given in Annex 2 to Resolution 46 (Rev.WRC-95) and in Annex 1 to Appendix S5, for stations in the fixed service based on draft new Recommendations ITU-R F.1245 and ITU-R F.[Doc. 9/92].

4.2.2.4 Advantages and disadvantages

The proposed coordination threshold levels for the MSS with respect to the fixed service will give a greater flexibility in satellite design for MSS networks and will facilitate coordination between those MSS networks and FS systems in the 1 - 3 GHz range which may be affected (see Annex 2 to draft new Recommendation ITU-R F.1246).

On the other hand, the proposed coordination threshold levels will correspond to a slightly increased interference from MSS space stations into analogue FS systems for telephony. However, the analyses summarized in draft new Recommendation ITU-R F.1246 demonstrate that the increase of interference will not be significant and will be acceptable for the operation of analogue FS systems for telephony.

The methodology provided by draft new Recommendation ITU-R M.[8D/XN] may facilitate the coordination of mobile earth stations with the radio astronomy service and may, in some cases, result in reduced separation distances. The new methodology may require detailed topographical data and measurements for individual radio astronomy sites.

4.2.2.5 Regulatory and procedural considerations

Regarding the terrestrial services, regulatory considerations seem to be limited to modifying the table in Annex 2 to Resolution 46 (Rev.WRC-95) and the table in 1.2.3.1 of Annex 1 to Appendix S5 (WRC-95) on the basis of Tables 1 and 2 of the draft revisions of Recommendations ITU-R IS.1141 and ITU-R IS.1142.

ITU-R has updated the standard computation program (SCP) methodology contained in Recommendation ITU-R IS.1143, Annex 1 to determine the need for coordination of non-GSO MSS space-to-Earth systems with the FS (see section 4.2.4.1.1). This Recommendation has been proposed to be updated to take into account an improved methodology for implementation of the SCP. The ITU-R has established an expert group that will (in collaboration with the BR) develop an appropriate software tool.

Regarding the protection of the radio astronomy service in the bands 1 610.6 - 1 613.8 MHz and 1 660 - 1 660.5 MHz, a regulatory provision could be developed to provide a reference to the principles and methodology developed by the ITU-R when coordinating mobile earth stations with the radio astronomy service provided that draft new Recommendation ITU-R M.[8D/XN] is approved.

Incorporation of the new antenna radiation patterns of draft new Recommendations ITU-R F.1245 and ITU-R F.[Doc. 9/92] into Annex 2 to Resolution 46 (Rev. WRC-95) may be done by replacing the antenna pattern in Section A2.1.2.2.2.1 of Annex 2 with the antenna pattern given in *recommends* 2.2 of draft new Recommendation ITU-R F.1245 and by replacing the text and the formulae in "Antenna pattern" of Section A2.1.2.2.2.3 of Annex 2 with the reference radiation patterns in *recommends* 2.1 and 2.2 of draft new Recommendation ITU-R F.[Doc. 9/92]. Similar amendments may be made to Annex 1 to Appendix S5 (WRC-95).

4.2.2.6 Use of the bands 2 500 - 2 535 MHz and 2 655 - 2 690 MHz by the aeronautical mobile-satellite service

Studies are being undertaken by some countries in Region 3 with respect to the use of these bands by the aeronautical mobile-satellite service for operations solely within national boundaries. Further studies are needed with respect to the coordination zone for aeronautical mobile-satellite service earth station.

4.2.3 Resolution 213 (Rev.WRC-95) "Sharing studies concerning possible use of the band 1 675 - 1 710 MHz by the MSS"

Two areas of study are identified in Resolution 213: 1) with respect to the 1 675 - 1 710 MHz band, completion of technical and operational studies of the feasibility of sharing between the MSS (Earth-to-space) and the meteorological satellite (space-to-Earth) (MetSat), meteorological aids (MetAids), fixed and mobile services (FS and MS); and 2) investigation of a potentially suitable MSS downlink band that may assist in meeting the spectrum requirements of the MSS.

4.2.3.1 Sharing between MSS (E-s) and MetSat (s-E) services in the band 1 675 - 1 710 MHz

4.2.3.1.1 Technical and operational studies

The ITU-R has under study the feasibility of sharing in the 1 675 - 1 710 MHz band between the MSS and MetSat and produced a draft revision of Recommendation ITU-R SA.1158. The CPM considered this study as well as a follow-up study of time sharing at 1 698 - 1 710 MHz that was defined but not completed in the earlier work. The studies consider the different uses of this band by the MetSat service in three sub-bands and concludes the following.

4.2.3.1.2 Results of studies

1 675 - 1 690 MHz band

Sharing is considered feasible if an appropriate separation distance is kept at all times between MetSat and MSS earth stations, as determined pursuant to coordination under Resolution 46 (No. S9.11A). Studies have shown that typical separation distances would be up to 55 km for NGSO MSS systems and up to 70 km for GSO MSS systems. The mobile earth station locations will have to be determined with sufficient accuracy relative to the required separation distances. Coordination of mobile earth stations in this band would therefore be subject to the ability of MSS systems to respect these separation distances through location determination capabilities. In addition, coordination of mobile earth stations with GVAR (Region 2) and S-VISSR (Region 3) MetSat earth stations will be required with some administrations. Further study is required to determine whether GVAR and S-VISSR transmissions could be re-accommodated above 1 690 MHz in future generations of satellites.

1 690 - 1 698 MHz band

Sharing of this band is not feasible due to the existence of many thousands of earth stations receiving data from geostationary meteorological satellites.

1 698 - 1 710 MHz band

Hundreds of MetSat earth stations have already been deployed in this band. It is expected that this number will increase significantly because a number of new MetSat systems are planned for this band (e.g., of the order of 15 MetSat satellites before the year 2010). Draft revised Recommendation ITU-R SA.1158 (Document 7/BL/8) shows that, depending on satellite altitude, high levels of interference would be caused by the MetSat satellite systems to most non-GSO MSS satellite systems with orbital heights below about 1 500 km. Special design considerations may have to be taken into account for non-GSO MSS systems in order to reduce the expected interference from MetSats. The same study also indicates that geostationary MSS satellites would not receive unacceptable interference. It is expected that coordination of mobile earth stations based on exclusion zones (separation distances) would not be feasible due to the large number of MetSat earth stations. A preliminary study of the effectiveness of coordination based on time sharing has been presented to the CPM but has not yet been considered by the relevant ITU-R study group. On this basis, limited spectrum resources may be available for use by MSS systems. However, in such cases, it is expected that the coordination burden will be substantial. In order to comply with the RR provisions of No. S5.377, MSS systems should use the band 1 698 - 1 710 MHz only as a supplement to another uplink band.

The band 1 700 - 1 710 MHz is also allocated to the FS on a co-primary basis and is used extensively by some administrations. Some of these administrations use this band for broadcasting relays.

4.2.3.1.3 Regulatory and procedural considerations

Protection of the MetSat service in the band 1 675 - 1 690 MHz must be ensured by a proper footnote. The following text delineates principles that should be considered in supplementing the provisions of No. S5.377:

Mobile-satellite systems using the 1 675 - 1 690 MHz band shall not cause harmful interference to earth stations of the meteorological-satellite service. 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 defined in Recommendation ITU-R SA.1158. The mobile-satellite system shall have position determination capabilities to ensure compliance with this provision.

Further study is required of the effectiveness and practicality of time sharing in the band 1 698 - 1 710 MHz taking into account the expected deployment of future MetSat systems and typical characteristics of MSS systems, including orbital altitudes below those of MetSats.

4.2.3.2 Sharing between MSS and MetAids services in the band 1 675 - 1 700 MHz

4.2.3.2.1 Summary of technical and operational studies and analysis of their results

Draft new Recommendation ITU-R SA.[Document 7/38] analyses the feasibility of sharing between MSS and MetAids services in the band 1 675 - 1 700 MHz.

Sharing studies completed to date indicate that co-channel sharing between currently proposed MSS systems and MetAids operated in the band 1 675 - 1 700 MHz is not feasible due to unacceptable levels of interference to MetAids systems and non-GSO MSS systems. While the GSO MSS may

accept interference from MetAids, the protection to MetAids from mobile earth stations requires further study in order to demonstrate the practicability of such sharing. It should also be noted that cross-border coordination would be required between mobile earth stations and MetAids when such different uses are made of parts of this spectrum in neighbouring countries. Studies also indicate that time sharing is not feasible due to the nature of both services. Band segmentation during the coordination process or on a national or regional basis would be a feasible method of providing MSS spectrum in this band. The WMO's assessment of spectrum requirements of MetAids operated in many countries in this band indicates that their requirements can be confined to 12 MHz by the year 2010. In other countries, the requirement may be less than 12 MHz. The use of the band 1 675 to 1 700 MHz by the MetAids service indicates that there is scope for reducing the MetAids service bandwidth occupancy. On the other hand, segmentation of the band may have a detrimental impact on MetAids operations if it requires improvements to radiosondes which greatly increase the operational cost of MetAids. WMO is taking steps to gain a better understanding of the current and future operations of member administrations and study the economic impacts of spectrum sharing.

4.2.3.2.2 Methods to satisfy the agenda item, their relative advantages and disadvantages

In view of the results of the sharing studies noted above, band segmentation during the coordination process, or on a national or regional basis, would be possible alternatives for MSS and MetAids to share spectrum in this band at the present time. Radiosondes are expendable items, and therefore must be kept simple in design and low in cost. Improvements in the MetAids transmitter frequency tolerance and occupied bandwidth and the selectivity of MetAids receivers would certainly lower spectrum requirements, allowing band segmentation, but may also raise the operational cost of MetAids networks. Data collected by MetAids in one country benefit other member nations of the WMO by providing essential data for weather analysis, warnings and forecasts. Therefore, band segmentation as described above should be considered only to the extent that it does not drive operational costs of MetAids networks above available financial resources. The impact on operational cost can be minimized by allowing adequate time for change to improved equipment, taking into account the requirements for implementation of MSS. It should be noted that the proliferation of GVAR (Region 2) and S-VISSR (Region 3) MetSat earth stations in the territory of some administrations may require the concentration of MetAids operations in spectrum not used by these earth stations.

4.2.3.3 Relating to the use of a portion of the band 1 492 - 1 525 MHz as an associated downlink band for MSS operations within the band 1 675 - 1 710 MHz

Further invites 2 of Resolution 213 invites the "ITU-R to investigate a potentially suitable downlink band that may assist in meeting the spectrum requirements of the MSS". One option to identify downlink bands is to examine existing regional MSS allocations and assess the feasibility of extending these bands to other regions. One such allocation considered was 1 517 - 1 525 MHz which is part of a Region 2 MSS allocation in the band 1 492 - 1 525 MHz. This band is also allocated to the fixed and mobile services worldwide.

In Region 2, the use of the band for aeronautical mobile telemetry has priority over other uses made by the MS. Studies have shown that the pfd generated by MSS satellites in the same area as telemetry receiving stations must be limited to low levels in order to protect the telemetry receivers. Recommendation ITU-R M.[8B/XA] (Doc. 8/53) indicates that the provisional coordination triggers are pfd levels of -181 dBW/m^2/4 kHz for low elevation angles rising to -150 dBW/m^2/4 kHz at high elevation angles. The disparity between this value and the pfd levels generated by MSS downlinks indicates that co-frequency, co-coverage sharing is not feasible. One administration in North America makes extensive use of this band for aeronautical telemetry making co-coverage, non-co-frequency sharing difficult. Co-frequency, non-co-coverage operation is possible where

sufficient separation can be achieved between the operational areas of the aeronautical telemetry systems and the MSS coverage areas.

The band 1 517 - 1 525 MHz is currently in use by some administrations for FS. In addition, it is planned for use by unidirectional FS links by some other administrations. Recommendations ITU-R IS.1141 and ITU-R IS.1142 are applicable to sharing between MSS (s-E) and FS in the 1 517 - 1 525 MHz band and summarize the resultant coordination thresholds and coordination procedures to be followed in the event that the thresholds are exceeded. FS links will require protection noting that most MSS systems will give rise to pfd levels higher than the applicable coordination thresholds.

For administrations using or planning to use FS systems in the band 1 492 - 1 525 MHz, the use of the band for MSS downlink operations would pose significant technical and operational constraints on FS use, given the general difficulties of sharing between MSS and FS. It should be noted that FS and MS systems have similar characteristics and sharing constraints. With respect to the MS, RR No. S5.348A specifies, for Japan, the coordination threshold as -150 dBW/m^2/4 kHz (for all angles of arrival) to protect MS use in its territory. No additional information is available concerning other land mobile uses in the band.

4.2.3.4 Relating to the use of the band 1 559 - 1 567 MHz as an associated downlink band for MSS operations within the band 1 675 - 1 710 MHz

The band 1 559 - 1 567 MHz was also considered as a potential MSS downlink band under Resolution 213.

Some administrations recognize that the primary use of this band is for the radionavigation-satellite service, in particular for the Global Navigation Satellite System (GNSS) and its components GPS and GLONASS. These administrations who have conducted studies, are of the view that they have taken into account the appropriate technical parameters of GNSS (e.g., Recommendation ITU-R M.1088 for GPS), and are of the opinion that an MSS pfd limit of -112 dB(W/m^2/MHz) would protect future RNSS systems, e.g. E-NSS-1, as well as pseudolites operating co-frequency, while imposing an equitable burden on the development of MSS and future RNSS systems in the band 1 559 - 1 567 MHz. The same studies indicated that MSS (space-to-Earth) transmissions in the band 1 559 - 1 567 MHz would protect GPS and GLONASS through conformance with an MSS pfd limit of -104 dB(W/m^2/MHz). These studies will also be submitted to the ICAO GNSS Panel for their consideration.

Some administrations and ICAO consider that no ITU-R study has been performed to determine the effect of in-band interference to existing GPS receivers in critical safety-of-life applications. As a result, they are of the opinion that the only supporting study (performed by an operating agency) should not be used as a basis for a decision regarding this band, because of numerous technical challenges found in another administration's study. Some administrations and ICAO are of the opinion that future studies, such as those that use relevant evaluation criteria and realistic receiver characteristics are essential before considering a new allocation in an established band and in particular, ICAO standards for GNSS must be used when considering a band for reallocation which is currently allocated to ARNS/RNSS worldwide and which is currently used for worldwide navigation.

This band is also allocated to the FS in a number of administrations. Sharing between MSS and FS is treated in existing Recommendations ITU-R IS.1141 and ITU-R IS.1142.

4.2.4 Resolution 716 "Use of frequency bands 1 980 - 2 010 MHz and 2 170- 2 200 MHz in all three regions and 2 010 - 2 025 MHz and 2 160 - 2 170 MHz band in Region 2 by the FS and MSS and associated transition arrangements"

The ITU-R is requested to develop various tools for use by administrations to assist in the detailed coordination of MSS systems and in the possible replanning of their terrestrial fixed networks in the 2 GHz range.

4.2.4.1 Summary of technical and operational studies and analysis of their results

There are two principal radio-frequency channel arrangements used by the existing fixed systems, Recommendations ITU-R F.283 and ITU-R F.382. Recommendation ITU-R F.283 provides the channel arrangements for the two sub-bands 1 900 - 2 100 MHz and 2 100 - 2 300 MHz. Recommendation ITU-R F.382 provides channel arrangements for the band 1 900 - 2 300 MHz.

Recommendation ITU-R F.1098, developed, in response to Resolution 113 (WARC-92), as a result of WARC-92 allocations, provides channel arrangements for new fixed systems in the band 1 900 - 2 300 MHz..

4.2.4.1.1 Necessary tools to assess the impact of interference in the detailed coordination of 2 GHz MSS satellite networks with the terrestrial FS networks as required in request 1.1 of Resolution 716

Fixed service shared with MSS space-to-Earth allocations

Recommendations ITU-R IS.1141 and ITU-R IS.1142 give coordination threshold levels between non-GSO MSS (space-to-Earth) and GSO MSS (space-to-Earth) on one hand and FS systems on the other hand sharing the same frequency bands in the 1 - 3 GHz range, respectively.

Recommendation ITU-R IS.1143 (Annexes 2 and 3) gives a system specific methodology for coordination of non-GSO MSS space stations (space-to-Earth) with the FS sharing the same frequency bands.

In addition, ITU-R developed draft new Recommendation ITU-R M. [Doc. 8/77] for considering, in detailed coordination, the impact of MSS satellite interference to 2 GHz line-of-sight FS systems. This new Recommendation details the basis for a methodology to be used in order to compute the radio-frequency C/(N+I) statistics of FS systems, taking into account MSS interfering carrier (I) and wanted FS carrier (C) levels. The wanted FS carrier levels are estimated taking into account parameters on relevant FS station, carrier, antenna path and intra-FS degradation together with predictions of typical multi-path levels according to the latest version of Recommendation ITU-R P.530 or alternative propagation models as appropriate. The MSS interfering levels are estimated taking into account MSS constellation orbital parameters, MSS spot beam carrier and antenna parameters and if needed MSS spot beam traffic loading and frequency plans.

The C/(N+I) statistics can be compared with applicable ITU-R Recommendations for performance of digital and analogue FS systems in order to assess, for example, if these ITU-R performance objectives are still respected for a given FS system subject to interference from the given MSS system.

4.2.4.1.2 Necessary planning tools to assist those administrations considering a replanning of their terrestrial fixed networks in the 2 GHz range as required in request 1.2 of Resolution 716

The ITU-R developed Recommendation ITU-R F.[Doc. 9/91] to provide guidance material to administrations in relation to regulatory, technical and operational measures which may be

considered for implementing as necessary national transitional plans for existing FS systems operating within the relevant 2 GHz MSS allocations. Draft new Recommendation ITU-R F.[Doc. 9/91] does not consider the impact on transition planning due to interference from multiple MSS systems, which is still under investigation by the ITU-R. The Recommendation includes a methodology to assess the impact of intra-FS interference for a given FS system. This methodology, based *inter alia* on Recommendation ITU-R F.1095, may be useful to administrations who may wish to assess the impact of replanning existing FS systems with a view to avoiding FS channel overlap with the 2 GHz MSS allocations, in particular the MSS Earth-to-space allocations. Such replanning could in general be possible either by transitioning FS systems to operate in accordance with Recommendation ITU-R F.1098 channel or in some cases reusing in existing FS systems otherwise unused channels on certain hops consistent with Recommendations ITU-R F.382-6 and ITU-R F.283-6 channel plans.

4.2.4.2 Methods to satisfy the agenda item

ITU-R has developed various Recommendations cited above to facilitate the coordination of MSS with the FS. Administrations, on completion of relevant ITU-R development work, are also expected to have at their disposal certain tools to facilitate such coordination.

4.2.4.3 Regulatory and procedural considerations

Coordination of MSS with the FS in the band referred to in Resolution 716 (WRC-95) will continue to be fully subject to Resolution 46 (Rev.WRC-95) provisions.

4.2.5 Sharing within existing allocations in the bands 1 525 - 1 559 MHz and 1 626.5 - 1 660.5 MHz

4.2.5.1 Summary of technical and operational studies and analysis of their results

The use of portions of the bands 1 525 - 1 559 MHz and 1 626.5 - 1 660.5 MHz (referred to as the 1.5/1.6 GHz bands) on a generic basis by various global and regional MSS systems has led to the recognition that the spectrum requirements of GMDSS and AMS(R)S distress and safety communications should be re-evaluated in order to ensure that these requirements will continue to be fulfilled. Experience is being gained with the potential benefits of generic MSS in relation to operation under partitioned allocations for land and maritime MSS and AMS(R)S, including flexible use of the spectrum and orbit resources and practical implementation of the coordination process (Article S9). Several planned MSS systems will operate generically and some existing generic MSS systems are operating in the maritime and land mobile-satellite allocations through certain footnotes. Certain technical and operational safeguards for accessing the spectrum for GMDSS and AMS(R)S distress and safety communications are essential to enable all or parts of the spectrum allocated for those communications to be re-allocated, on a global basis, for generic MSS use. However, the major international organizations, IMO and ICAO, responsible for the safety-related GMDSS and AMS(R)S, respectively, have expressed serious concerns about the effectiveness and practicality of these safeguards in providing the required protection and availability for distress and safety communications when spectrum is shared with non-safety related communications and systems, especially since inter-system pre-emption and prioritization is not presently considered feasible. Other concerns have been expressed with regard to the regional non-uniformity of the current allocations. These concerns and potential benefits associated with generic MSS allocations are the subject of ongoing studies within ITU-R.

4.2.5.2 Regulatory and procedural considerations

Any re-allocation of current allocations for GMDSS and AMS(R)S distress and safety communications to generic MSS allocations must be accompanied by suitable technical, operational and regulatory safeguards that effectively ensure continued access to the spectrum needed to meet the requirements developed by the IMO and ICAO for those distress and safety communications taking into account that several existing and planned systems will operate generically. These safeguards must be developed without delay.

If a generic allocation is to be made, provisions must first be adopted to provide the necessary protection for distress and safety communication. They include but are not limited to the following:

- regulatory provisions calling for priority and immediate availability for distress and safety communication;
- ITU-R Recommendations on procedures, satellite resource allocations for safety communications. AMS(R)S and GMDSS performance and interference criteria. Some have already been developed by the ITU-R (e.g. Recommendations ITU-R M.830, ITU-R M.1037, ITU-R M.1089, etc.);
- coordination procedures which will take into account the requirements of the safety services.

In addition, consideration should be given to the adoption of the necessary regulatory provisions to provide protection to the other primary services within the 1.5/1.6 GHz bands.

The re-allocation of the spectrum within the 1.5/1.6 GHz bands to the mobile-satellite service and re-evaluation of spectrum for the global use by GMDSS and AMS(R)S systems would necessitate the enactment of certain new regulatory provisions within the Radio Regulations or clarification of certain existing provisions; these aspects need also to be taken into account in these studies.

A possible Resolution could be developed by WRC-97, calling for studies and evidence to be completed by 1999. The results of these studies should satisfy the requirements for aeronautical and maritime distress and safety communications. This approach might fail to address generic MSS networks that may be implemented in the interim.

4.2.6 MSS spectrum requirements in the 1 - 3 GHz range

There is a very large number (243 as of 1 May 1997) of Advance Publications for MSS satellite networks, both of the GSO and non-GSO type, in the 1 - 3 GHz range. However, it is recognized that some of these networks may not be implemented. Among all MSS allocations, the greatest number of MSS networks are in coordination at 1 525 - 1 559/1 626.5 - 1 660.5 MHz, which has led to severe coordination difficulties. This has been especially apparent in Regions 1 and 3. Studies conducted for WRC-97 have estimated that the MSS may require around 2 x 250 MHz of spectrum at the year 2010 in the 1 - 3 GHz range. The current MSS allocations will provide about 2 x 100 MHz in Regions 1 and 3, and 2 x 140 MHz in Region 2 as of the year 2000. In order to help meet part of the MSS spectrum demand the MSS systems should be encouraged to use more spectrum efficient techniques. Existing regulatory and technical constraints in these MSS allocations may be reviewed taking into account the needs of other existing and planned services that will require protection and tenure.

Nevertheless, the feasibility of adopting at WRC-97 limited additional spectrum for MSS in the 1 - 3 GHz range in order to facilitate the future long-term growth of MSS services, may be studied by administrations taking into account the relevant conclusions of the ITU-R studies and the priorities of administrations.

4.2.7 Resolution 717 (WRC-95)

Resolution 717 (WRC-95) resolves to review at WRC-97, the MSS allocations in the 2 GHz range that result from the decisions of this Conference with a view to harmonizing in the long term, if necessary, common, primary worldwide MSS allocations in the 2 GHz range, having due regard for the continuing protection of terrestrial services. Several administrations noted that Resolution 717 did not request the ITU-R to study this matter.

Opinions on the harmonization of 2 GHz MSS allocations are given at Section 4.2.7.2.

Administrations are nevertheless invited to review the material contained herein in relation to the decisions that they may make with regard to Resolution 717 (WRC-95) and Resolution 716 (WRC-95), as appropriate, with respect to 2 GHz MSS allocations.

It is noted that the 2 GHz MSS allocations made at WARC-92 have been modified at WRC-95, where further allocations were made in Region 2. Resolution 212 (WRC-95) identified the WARC-92 MSS (1 980 - 2 010/2 170 - 2 200 MHz) bands for the satellite components of IMT-2000 (formally known as FPLMTS).

4.2.7.1 Views on the technical and operational issues related to the 2 GHz MSS allocations

4.2.7.1.1 Channel pairing differences

Some Administrations consider that the use of different go/return spacings of MSS allocations in each Region as shown in Table 4.6, may lead to denials of channel pairs when MSS global systems using different go/return spacings are concurrently operated in an area. This may lead to wasting of spectrum.

Other administrations do not consider that use of different go/return spacings of MSS allocations in each Region leads to denials of channel pairs. Due to the coordination constraints at 2 GHz, these administrations consider that some MSS systems are already being planned to operate with unpaired frequencies in the MES transmit and receive bands to maximize spectrum efficiency with only minor cost impact for MES terminal production for those MSS systems.

TABLE 4.6

Possible go/return spacings of MSS allocations in Regions 1, 2 and 3

	Primary allocations after the year 2005 (bandwidths shown in brackets)		**Duplex spacing**
	Earth - space	**space - Earth**	
R1 and R3	1 980 - 2 010 (30) MHz	2 170 - 2 200 (30) MHz	190 MHz
R2	1 980 - 2 025[1] (45) MHz	2 160 - 2 200 (40) MHz	175 - 180 MHz
14 countries of R2	1 990[2] - 2 025 (35) MHz	2 160 - 2 200 (40) MHz	170 - 175 MHz
MSS spectrum common to all Regions	1 990 - 2 010 (20) MHz	2 170 - 2 200 (30) MHz	180 - 190 MHz

[1] See RR footnote No. S5.389E: "The use of the bands 2 010 - 2 025 MHz and 2 160 - 2 170 MHz by the mobile-satellite service in Region 2 shall not cause harmful interference to or constrain the development of the fixed and mobile services in Regions 1 and 3."

[2] RR footnote No. S5.389B constrains the MSS when using the band 1 980 - 1 990 MHz to not cause harmful interference or constrain the development of fixed and mobile services in 14 Region 2 countries. This footnote effectively reduces the accessible MSS band to 1 990 - 2 025 MHz in these 14 countries.

4.2.7.1.2 Access to common spectrum for the satellite component of IMT-2000/FPLMTS

Some administrations consider that WARC-92 had a requirement to identify 30 + 30 MHz common worldwide primary allocations for the satellite component of IMT-2000/FPLMTS. As shown in Table 1 above, different regional allocations of MSS (as a result of WRC-95 decisions) mean that in reality there is no longer a usable common primary 30 MHz wide MSS uplink for all regions. Furthermore the common spectrum is unbalanced, i.e. 20 MHz uplink and 30 MHz downlink. This effectively means that there is only a paired 20 MHz uplink/downlink common across all regions and the additional 10 MHz in the downlink is of little use, yet has the capacity to deny other types of service. One of the principles adopted by the World Telecommunication Policy Forum (WTPF), 1996, urges national policy makers, GMPCS (Global Mobile Personal Communications by Satellite) system operators and GMPCS system providers to consider maximum competition in the provision of GMPCS services, except where this is precluded by spectrum availability or by specific technical or operational considerations. This WTPF principle on competition can be achieved only if there is adequate availability of worldwide MSS allocations and hence access to the 2 GHz bands is a key ingredient to accommodate the continued implementation of GMPCS in the near-to-mid time-frame.

Other administrations consider that in Region 2, notwithstanding access issues to the 1 980 - 1 990 MHz range, there is at least 2 x 35 MHz available to MSS in various time-frames in the 1 990 - 2 025 MHz and 2 165 - 2 200 MHz range. The 2 x 35 MHz available in Region 2 and the 2 x 30 MHz available in Regions 1 and 3 in the 1 980 - 2 010/2 170 - 2 200 MHz range should be sufficient to accommodate requirements of both regional and global MSS systems at 2 GHz. These administrations further consider that in Region 2 regional MSS systems could be designed to operate in the Region 2 specific MSS allocations, while global systems could operate in both the Regions 1 and 3 and Region 2 MSS allocations as necessary. Therefore these administrations consider that a 2 x 20 MHz usable block of spectrum for MSS on a common worldwide basis at 2 GHz is sufficient.

4.2.7.1.3 Access to terrestrial mobile spectrum

Some administrations consider that within Region 1 and Region 2 there is some homogeneous adoption and use of the respective Region's MS band plans. However the situation in Region 3 countries is not straightforward. Countries in Region 3 may adopt a mixture of European standard and U.S. standard terrestrial cellular systems. This is because some countries already have the concurrent use of AMPS and GSM systems in the 800/900 MHz bands. All of these existing cellular systems have natural pairings and inter-working ability with appropriate technologies in the 2 GHz bands. For example, AMPS at 800 MHz can be paired and inter-work with either D-AMPS (IS-136) or CDMA (IS-95) at 2 GHz. A similar situation applies to GSM and its derivatives. Some administrations consider that this leads to a denial of access to terrestrial mobile spectrum. Countries in Region 3 may need to utilize MSS bands corresponding to both Region 1 and Region 2 MSS allocations, regardless of the traffic needs. This would be at the expense of most of USA-PCS block C and its FDD paired equivalent. Harmonized MSS allocations worldwide (exactly aligned primary allocations) could result in optimum use of spectrum, and would enable efficient coordination of MSS with MS.

Other administrations consider that countries in Region 3 may not adopt a mixture of European and U.S. terrestrial cellular standards at 2 GHz. It is reasonable to expect that there will also be a Japanese 2 GHz cellular standard. Those countries in Region 3 which utilize GSM at 900 MHz and wish concurrent use in the higher frequency band have the option of utilizing the DCS-1800 standards. Those countries in Region 3 which utilize the AMPs at 800 MHz could use D-AMPS (IS-136) or even CDMA (IS-95) at 2 GHz in a manner which avoids use of the 1 980 - 1 990 MHz band. Furthermore those Region 3 countries wishing to utilize IS-95, IS-136 and DCS-1900 cellular technologies designed to operate in the 1 850 - 1 990 MHz band may need to consider the impact such implementation would have on the future accommodation at 2 GHz of planned third generation mobile systems being developed for implementation around the year 2000 in accordance with the WARC-92 IMT-2000/FPLMTS bands.

4.2.7.1.4 Global roaming issues with IMT-2000/FPLMTS

The 2 GHz MSS bands have also been identified for use by the satellite component of IMT-2000. The terrestrial component of IMT-2000 may have different radio interfaces and spectrum band plans in various regions of the world.

Therefore, some administrations consider that the satellite component of IMT-2000 could provide an opportunity for a truly common global component, which could be used to support global roaming. A common worldwide 2 GHz MSS allocation could reduce the cost and complexity of terminals required to support global roaming.

Other administrations consider that dual-band, dual-mode terrestrial MS terminals will be developed to facilitate global and regional roaming for IMT-2000 with, additionally, global and regional MSS systems providing the capability via dual-mode satellite and terrestrial terminals to facilitate similar global and regional roaming for IMT-2000. These administrations therefore do not consider it is necessary to obtain exact alignment of MSS allocations in all three Regions in order to achieve global roaming of IMT-2000.

4.2.7.1.5 Harmonization issues of duplex spacing between terrestrial IMT-2000 and satellite component of IMT-2000

Some administrations note that Recommendation ITU-R M.1036 *recommends* 4.1 recommends that: *"A common frequency division duplex spacing between the terrestrial and satellite components of FPLMTS would facilitate inter-operability between these components and result in reduced cost and*

complexity for interoperable terminals ..." Where the terrestrial IMT-2000 and the satellite component of IMT-2000 duplex spacings are the same, and if the present un-harmonized MSS allocations in different regions remain, there is a potential for conflict between the satellite component of IMT-2000 and other MSS operators. This conflict will arise from the use of other duplex spacings by non-IMT-2000 MSS operators.

Other administrations note that cellular standards evolved from, for example, D-AMPS (IS-136) or CDMA (IS-95) may be proposed for consideration as IMT-2000 terrestrial component systems. These administrations further expect that European and Japanese systems under development within the WARC-92 IMT-2000 bands (in particular within 1 885 - 1 980 MHz, 2 010 - 2 025 MHz and 2 110 - 2 170 MHz) will be proposed for consideration as IMT-2000 terrestrial component systems. In this scenario there will be no common duplex spacing between various terrestrial mobile standards being developed in the United States and those developed in Europe and Japan, irrespective of regional MSS allocation differences at 2 GHz. Therefore, MSS satellite systems providing the satellite component of IMT-2000 at 2 GHz must, as a consequence of different regional terrestrial standards developments, be capable of coping with different standards for the terrestrial component of IMT-2000, which will necessitate different duplex spacings and frequency band pairing for the terrestrial mode terminals. However, if in Region 1 and Region 3 the use of IMT-2000 satellite and terrestrial components is developed in accordance with WRC-95 MSS allocations, it is entirely feasible for both the satellite and terrestrial component of IMT-2000 in Regions 1 and 3 to achieve the same 190 MHz nominal transmit/receive frequency spacing. These administrations therefore consider that in view of the above there would be no conflicts between the satellite component of IMT-2000 and other MSS operators arising from duplex spacing issues.

4.2.7.1.6 Issues related to application of Recommendation ITU-R F.1098

The WARC-92 2 GHz MSS allocations resulted in conflicts with the existing FS channel plans. To ease the shift of FS links which are in conflict with these MSS allocations, Recommendation ITU-R F.1098 channel plans were developed.

Some administrations consider that the present un-harmonized MSS allocation is leading to some uncertainty in the use of the Recommendation ITU-R F.1098 plan and resistance to its adoption. This is because attempts to harmonize MSS allocations could result in possible changes to the different Annexes in the Recommendation ITU-R F.1098 plan. FS operators require a stable destination for links displaced from the FS channel plans affected by MSS allocations. Until these FS links are cleared, MSS introduction could continue to be hampered by the difficulties of coordination.

Other administrations note that some administrations in all three Regions and in particular in Regions 1 and 3, pursuant to WARC-92 and WRC-95 decisions (including Resolution 716) in relation to the 1 980 - 2 010/2 170 - 2 200 MHz MSS allocations, have implemented arrangements for transition of FS systems, for example in accordance with Recommendation ITU-R F.1098, in order to avoid overlap with these 2 x 30 MHz WRC-95 allocations in Regions 1 and 3. These administrations, in accordance with Resolution 716, have provided FS operators with security of tenure outside of the above 2 GHz MSS allocations in Regions 1 and 3 which cannot be changed retroactively. For example, CEPT and other administrations have planned and implemented FS systems in bands adjacent to the 1 980 - 2 010/2 170 - 2 200 MHz range. These administrations note that significant decisions and commitments have already been made at a national and regional level on such transitional arrangements intended to facilitate the introduction of MSS systems in Regions 1 and 3 and to minimize the difficulties of coordination between the MSS systems and FS in the 1 980 - 2 010/2 170 - 2 200 MHz range.

4.2.7.1.7 Issues in relation to usable access to the band 2 010 - 2 025 MHz for MSS

Some administrations are of the opinion that presently the 1 980 - 2 010 and 2 170 - 2 200 MHz MSS bands are also unusable for MSS systems. As such, transition plans for reaccommodating existing 2 GHz services must be developed and implemented for ***all*** 2 GHz MSS bands - before MSS operations commence. Administrations should note that technical and economic issues associated with transition within any 2 GHz MSS band is likely to be significant. It should be noted that one administration in North America plans to implement transition plans for the 1 990 - 2 025 MHz and 2 160 - 2 200 MHz bands.

Other administrations note the assumption that the bands 2 010 - 2 025 MHz will be usable for MSS uplinks is not valid. It is noted that even in Region 2, one administration in North America presently has significant terrestrial use of the 2 010 - 2 025 MHz MSS band, which will give rise to unacceptable interference to any MSS satellites in the 2 010 - 2 025 MHz and it is unclear how economically viable MSS access would be provided in the 2 010 - 2 025 MHz range. These administrations also note that in many Region 1, 2 and 3 countries that there is very extensive use of the 2 010 - 2 025 MHz range by existing line-of-sight and troposcatter FS links, operated mainly in accordance with national FS channel plans. These FS systems will give rise to unacceptable interference to MSS satellite receivers in the 2 010 - 2 025 MHz range in key coverage areas in all three Regions. It should also be noted that above 2 025 MHz there are other very high-powered pulsed mode non-fixed government terrestrial stations in some countries in Region 1, which will cause harmful out-of-band interference to sensitive MSS satellite receivers. Finally it should be noted that in the band above 2 025 MHz, space systems also operate in the space-to-space direction which could potentially give rise to out-of-band interference to MSS satellite receivers. Therefore, these administrations believe that the band 2 010 - 2 025 MHz will not in practice be usable for operational MSS systems on a global basis.

4.2.7.1.8 Terrestrial mobile requirements at 2 GHz

Some administrations believe that administrations should provide for the implementation of multiple, global MSS systems in common global 2 GHz bands. The minimum data rate required for the satellite component of IMT-2000 is 9.6 kbit/s. However, provision of even higher data rates is desired by some administrations. In this regard, the ITU-R noted that there is a possible need for additional spectrum for both the terrestrial and satellite components of IMT-2000 - beyond that currently allocated.

Other administrations in Regions 1 and 3 have identified the bands 2 160 - 2 170 MHz and 2 010 - 2 025 MHz for future use by the IMT-2000 terrestrial component. For example, the bands 1 900 - 1 980 MHz, 2 010 - 2 025 MHz, and 2 110 - 2170 MHz have already been identified as the core band for IMT-2000/UMTS terrestrial component by CEPT administrations in accordance with WARC-92 decisions. It should be noted that sharing between IMT-2000 terrestrial component and MSS uplinks would not be possible; for example, in the band 2 010 - 2 025 MHz. The ITU-R has received information which indicates a possible need for additional spectrum for the terrestrial component of IMT-2000 beyond that identified by WARC-92. Some administrations in Regions 1 and 3 consider that no additional spectrum for MSS at 2 GHz should be identified in order not to hinder the future development of the IMT-2000 terrestrial component applications.

4.2.7.2 Opinions on harmonization of 2 GHz MSS allocations

Some administrations believe that there is a need to seek global harmonization of the 2 GHz MSS allocations for the reasons identified above, including difficulties in utilizing parts of these allocations made by WARC-92. The following are two possible options that address this need:

a) adopt on a common worldwide basis in all three Regions, the bands 1 980 - 2 025/ 2 160 - 2 200 MHz;

b) adopt on a common worldwide basis in all three Regions, the bands 1 990 - 2 025/ 2 165 - 2 200 MHz.

Other administrations believe that the bands 1 980 - 2 010 MHz and 2 170 - 2 200 MHz allocated on a worldwide basis by WARC-92 provide for the required harmonization, and no further action is required by WRC-97. These administrations believe that any adjustments to the 2 GHz MSS allocations such as options a) and b) above, should not be considered due to the difficulties that will be caused to existing and planned services.

Regional telecommunication organizations have expressed their views on the need for harmonization of the 2 GHz MSS allocations:

- The APT in Region 3 has adopted a provisional position that there should be no change to the existing 2 GHz MSS allocations including any shift of the frequency bands. In general the APT does not favour additional allocations for the MSS in the 2 GHz bands.
- CEPT in Region 1 considers that the existing 2 GHz MSS allocations are already harmonized. Therefore the CEPT has adopted a position not to support any shift or increase in 2 GHz MSS allocations. The CEPT has placed a clear priority on the development of IMT-2000 services in the bands adjacent to existing 2 GHz MSS allocations.
- CITEL in Region 2 has adopted a Resolution that indicates the 1 850 - 1 990 MHz band is intended for use by PCS systems. Another Resolution has been adopted supporting the concept of harmonization of the 2 GHz MSS allocations worldwide through the inclusion of the Region 2 allocation in Region 1 and Region 3, taking into account Resolution 716 (WRC-95) and Resolution 717 (WRC-95). The method by which this harmonization could be achieved has not been agreed within CITEL as of the date of CPM-97.

Many of the African countries have serious concerns with regard to the possibility of any increase or change in the 2 GHz allocations for MSS. Any such increase or change to the 2 GHz MSS allocations would cause difficulties due to requirements for protection for existing terrestrial FS, as well as advanced plans for the introduction of MSS and new terrestrial FS within this area of the frequency spectrum that form, in many of these countries, a cardinal part of achieving Universal Service. As a result a change in the 2 GHz MSS allocations cannot be supported by these African countries.

The majority of the Arab countries present at CPM-97 consider that due to requirements for protection of existing and planned terrestrial fixed services in the 2 GHz band there should not be any additional allocation to MSS in the 2 GHz band.

A country in Region 2 considers that the spectrum block of 2 x 20 MHz common in the three Regions already constitutes a harmonized allocation for the development of MSS on a worldwide basis.

4.2.7.3 Methods to satisfy the agenda item

Resolution 717 urges administrations to review their specific situations in order to assist, if necessary, in the long term development of common, primary worldwide MSS allocations in the 2 GHz range.

4.3 Non-GSO MSS feeder links

Throughout Section 4.3 of this report references to LEO A, GSO 13, LEO B, etc. relate to types of satellite network whose characteristics can be found in draft new Recommendation ITU-R S.[Doc. 4/61].

4.3.1 Resolution 115 "Calculation of the pfd at the geostationary-satellite orbit in the band 6 700 - 7 075 MHz used for feeder links of non-geostationary-satellite systems in the MSS in the space-to-Earth direction"

4.3.1.1 Summary of technical and operational studies and analysis of their results

Draft new Recommendation ITU-R S.[Doc. 4/16] has been developed, which prescribes a method of determining the maximum level of aggregate pfd (in W/m^2 in any 4 kHz band) at any location in the GSO, within ±5° inclination, caused by the satellites of a given non-geostationary network. The method is explained in detail as a series of five steps.

The ITU-R has applied this method to examples of currently planned NGSO feeder downlinks (space-to-Earth), and the results meet the limit of -168 dB(W/m^2 per 4 kHz) contained in RR No. S22.5A of the Radio Regulations.

4.3.1.2 Methods to satisfy the agenda item and their relative advantages

The method outlined in Section 4.3.1.1 resulted from the combination of two independently developed methods, and fully meets the requirements of Resolution 115. It is considered unnecessary for alternative methods to be developed.

4.3.1.3 Regulatory and procedural considerations

It is suggested that consideration be given to the addition of the following sentence to RR No. S22.5A; "A method for the calculation of the power flux-density can be found in Recommendation ITU-R S.[Doc. 4/16]".

4.3.2 Resolution 116 "Allocation of frequencies to the FSS (space-to-Earth) in the band 15.4 - 15.7 GHz for feeder links of non-geostationary-satellite networks in the MSS"

Criteria have been developed for sharing between of NGSO MSS feeder links (space-to-Earth) and the aeronautical radionavigation service in the band 15.4 - 15.7 GHz and for the protection of the radio astronomy service in the band 15.35 - 15.4 GHz.

4.3.2.1 Summary of technical and operational studies and analysis of the results

This band is allocated to the aeronautical radionavigation service (ARNS) and to feeder links of non-geostationary-satellite systems (NGSO) in the MSS (space-to-Earth).

The characteristics of ARNS systems operating in the band 15.4 - 15.7 GHz were collected and include surface detection radars (SBR), mobile and transportable and shipborne aircraft landing systems (ALS) including the space shuttle scanning beam landing system (MSBLS), airborne multipurpose radionavigation/radiolocation/weather radars (MPR), and airborne radar sensing and measurement systems (RSMS).

4.3.2.1.1 Interference from NGSO satellites into ARNS receivers

Calculations based on these characteristics with an interference threshold of 10% of ARNS system noise have confirmed that the maximum pfd value in RR provision No. S5.511A of -146 dB(W/m^2 per MHz) at the surface of the Earth is necessary for the protection of SBR systems at angles of arrival below about 5 degrees while the maximum value in RR No. S5.511A of -111 dB(W/m^2 per MHz) is necessary for the protection of ALS and MSBLS at all angles of arrival.

Currently, aircraft emissions are not permitted in the 15.45 - 15.65 GHz band. However, MPR and RSMS systems are in operation in this band and it has been shown that a maximum pfd value of -111 dB(W/m^2 per MHz) is necessary for the protection of the RSMS.

RR provision No. S4.10 would not need to be applied to the MPR. However, since these systems use a narrow beam scanning antenna, interference will occur for short periods of time when the main lobe is directed at a satellite. Because of these factors, a I/N of up to 40% could be tolerated during these short periods of time which equates to a pfd of -127 dB(W/m^2 per MHz) for angles of arrival below about 20 degrees.

The pfd limit of -146 dB(W/m^2 per MHz) implies the use of very large earth station antennas (greater than 15 metre diameter), which are not considered practical. However, the SBRs can be accommodated in the 15.63 - 15.7 GHz band and this would remove this restriction in the 15.43 - 15.63 GHz band, leaving a pfd limit of -127 dB(W/m^2 per MHz) for the protection of the MPR and RSMS.

Use of the band 15.63 - 15.7 GHz would not be feasible for feeder links because of the severe pfd limitation imposed by the SBR.

Draft new Recommendation ITU-R S.[Document 4/53] has been prepared giving the pfd limits as a function of angle of arrival. It may be feasible to design and operate feeder links in the space-to-Earth direction with pfd limits given in this draft new Recommendation. However, the exact constraints of this pfd limit on future MSS systems operating feeder links in this band requires further study.

4.3.2.1.2 Interference from ARNS transmitters into feeder-link Earth stations

Emission limits on ARNS stations have been developed from studies performed under Resolution 117 in order to protect NGSO MSS feeder-link receive space stations and draft new Recommendation ITU-R S.[Document 4/46] has been developed defining these limits. Based on these limits, coordination distances have been developed and are included in draft new Recommendation ITU-R S.[Document 4/53].

In the band 15.43 - 15.63 GHz, MPR and RSMS emissions would be geographically limited, the dominant area of operation of the MPR is over the ocean which in most cases will be beyond the coordination distance of feeder-link earth stations, and thus would not require coordination. Operation of the RSMS is limited to aircraft approaching an airport, therefore, the operation of the MPR and the RSMS in this band should be permitted even though geographical constraints would apply. Since the pfd proposed in Section 4.3.2.1.1 will not protect the SBR, it could not operate in this band and thus interference into feeder-link earth stations are not to be considered.

The ALS and MSBLS surface based stations, the RSMS and the MPR would operate with an elevation angle constraint of 5 degrees on the feeder-link earth station, so that only the antenna side lobes are directed toward the horizontal plane. With this elevation angle constraint the coordination distance for the ALS is 150 km. The coordination distance for the MPR is 600 km and about 60 km to a runway on which a RSMS equipped aircraft intends to land.

4.3.2.1.3 Interference from NGSO satellites into radio astronomy receivers in the 15.35 - 15.4 GHz band

Recommendation ITU-R RA.769-1 provides threshold levels of detrimental interference for the primary radio astronomy service in the band 15.35 - 15.4 GHz. These levels are -156 dB(W/m^2) and -233 dB(W/m^2 per Hz) at the surface of the Earth. Assuming that the per Hz value can be extrapolated to one MHz, this would be -173 dB(W/m^2 per MHz). A value of -127 dB(W/m^2 per MHz) applies for angles of arrival up to about 20 degrees, rising to -111 dB(W/m^2 per MHz) above about 40 degrees in the 15.43 - 15.63 GHz band. This requires about 46 dB discrimination at 15.4 GHz rising to 62 dB above 40 degrees. A value of 62 dB is achievable with a 6 pole (0.1 dB ripple) filter in 30 MHz with a 50 MHz passband. Operation of space-to-Earth links very near 15.4 GHz does not seem possible. However, if the 15.4 - 15.43 GHz band is not used by feeder links there would be a 30 MHz guard band in which band pass filters and other means could be employed to protect the radio astronomy service in the 15.35 - 15.4 GHz band.

The out-of-band emission levels of the feeder links should take into account the needs of the radio astronomy service in the band 15.35 - 15.4 GHz.

4.3.2.2 Methods to satisfy the agenda item and their relative advantages

The method indicated in Section 4.3.2.1 involves placing a hard pfd limit on satellite emissions to protect the ARNS stations and provides coordination distances for the protection of feeder-link earth stations from ARNS station emissions using the emission limits for the ARNS station given in draft new Recommendation ITU-R S.[4A/XP] (Document 4/46). This simple method is widely used in the sharing of space services and terrestrial services and is practical for this case. Additionally, the feeder links would be limited to the band 15.43 - 15.63 GHz, which results in a frequency separation to provide protection of the radio astronomy service.

A pfd limit of -127 dB(W/m^2 per MHz) would need to be implemented to protect ARNS systems for angles of arrival below about 20 degrees.

A possible alternative using the pfd of -111 dB(W/m^2 per MHz) from RR No. S5.511A would place no constraints on the minimum feeder-link earth station antenna diameter, but would effectively preclude operation of the MPR.

4.3.2.3 Regulatory and procedural considerations

Adoption of this method for the sharing of space-to-Earth NGSO feeder links with the aeronautical radionavigation service may entail modifications of appropriate sections in RR No. S5.511A and in Resolution 46 (Rev.WRC-95); specifically A2.1.3, A2.2.1, and in Tables 3 and 4 of A2.3. However, RR No. S5.511A provides adequate regulatory provisions for the radio astronomy service.

RR No. S5.511B may need to be either deleted or modified in order for airborne systems such as the MPR and RSMS to operate in the band 15.43 - 15.63 GHz.

Appropriate pfd limits to protect the aeronautical radionavigation service may need to be inserted in Table S21-4.

4.3.3 Resolution 117 "Allocation of frequencies to the FSS (Earth-to-space) in the band 15.45 - 15.65 GHz for use by feeder links of non-geostationary-satellite networks operating in the MSS"

Criteria have been developed for sharing of NGSO MSS feeder links (Earth-to-space) with the aeronautical radionavigation service in the band 15.45 - 15.65 GHz, as given in draft new Recommendation ITU-R S.[Doc. 4/46].

4.3.3.1 Summary of technical and operational studies and analysis of the results

This band is allocated to the aeronautical radionavigation service (ARNS) and to feeder links of non-geostationary-satellite systems (NGSO) in the MSS (Earth-to-space).

The characteristics of ARNS systems operating in the band 15.4 - 15.7 GHz were collected and include surface detection radars (SBR), mobile and transportable and shipborne aircraft landing systems (ALS) including the space shuttle scanning beam landing system (MSBLS), airborne multipurpose radionavigation/radiolocation/ weather radars (MPR), and radar sensing and measurement systems (RSMS). Currently, aircraft emissions are not permitted in the 15.45 - 15.65 GHz band and therefore these systems would not need to receive protection in this band.

However, the MPR and RSMS systems are in operation in this band. The dominant area of operation of the MPR is over the ocean, which in most cases will be beyond the coordination distance of feeder-link earth stations and thus would not require coordination. Therefore, the operation of the MPR in this band should be permitted even though geographical constraints would apply. RSMS are operating on approaching aircraft, therefore a coordination would be needed between the earth station and the relevant airport where operation of the RSMS system should be permitted.

4.3.3.1.1 Interference from ARNS emissions into NGSO satellites

In previous ITU-R studies the effect of radar pulse interference into fixed-satellite service QPSK carriers was established (Recommendation ITU-R S.1068). It is assumed that the Earth-to-space feeder-link carriers will be digital PSK and are not more sensitive to interference than uncoded QPSK carriers.

Calculations based on the characteristics of the ALS, MPR and RSMS using the relationships given in Recommendation ITU-R S.1068 have resulted in emission limitations on the ARNS stations expressed as an effective e.i.r.p. An expression relating the basic "radar" parameters (peak power, pulse width, duty cycle, etc.) to the effective e.i.r.p. is used to determine compliance with emission limitations.

Draft new Recommendation ITU-R S.[Doc. 4/46] has been prepared giving the emission limitations as a function of elevation angle at the ARNS stations.

With these emission limitations on the ARNS stations the minimum feeder-link earth station e.i.r.p. required can be determined by the feeder-link designer. In general, the minimum e.i.r.p. requirements are in the 60 - 70 dBW range. Feeder-link earth station e.i.r.p.s in this range are readily achievable. It is noted that interference may be the dominant factor in determining the feeder-link up path e.i.r.p.

The estimation of minimum e.i.r.p. requirements is to demonstrate that sharing is feasible. However, no minimum e.i.r.p. would be placed on the feeder-link earth station. The implementation of an Earth-to-space feeder link to operate in the interference environment defined in draft new Recommendation ITU-R S.[Doc. 4/46] would be at the discretion of the designer/operator. No coordination requirement would be placed on the aeronautical radionavigation service.

In the studies of the sharing situation in the space-to-Earth direction (Section 4.3.2) it was found that a shift of this band to 15.43 - 15.63 GHz would eliminate consideration of the SBR and thus relax the pfd limit for feeder links (see draft new Recommendation ITU-R S.[Doc. 4/53]). The Earth-to-space band also needs to be shifted to 15.43 - 15.63 GHz, which would eliminate the need to consider up path interference into the space segment of the feeder links from the SBR.

4.3.3.1.2 Interference from feeder-link earth stations into ARNS receivers

Interference to the SBR, which is surface based, and aircraft in the ALS systems, the MPR, and RSMS have been studied. However, only the ALS, MPR and RSMS needed further consideration. The aircraft are in an airspace in which the ALS is used and which is defined by the location of the ALS surface based component. Coordination distances have been calculated with respect to these locations. A feeder-link earth station emission limit of 54 dB(W/MHz) toward the horizontal plane was used. The pfd limits given in No. S5.511A and confirmed by studies under Resolution 116 were used as the protection criteria; -127 dB(W/m^2 per MHz) for the MPR, -111 dB(W/m^2 per MHz) for the RSMS and -111 dB(W/m^2 per MHz) for the ALS. From these parameters, the necessary propagation loss was computed and the corresponding distances determined.

The coordination distances are about 515 km for the ALS, as measured from its surface based component, 310 km for the RSMS and 600 km for the MPR. Reducing the emission density from the feeder-link earth station toward the horizon can reduce these distances. If the earth station antenna elevation angle is limited so that only the side lobes are directed toward the horizontal plane, the value of 54 dBW may be reduced and a significant reduction of the emission density could be achieved. However, this would not significantly reduce the distance for the ALS, the RSMS and the MPR, because of the large line of sight distances from the aircraft.

These coordination distances are reflected in draft new Recommendation ITU-R S.[Doc. 4/46].

The MPR would normally operate in areas which are more than 600 km from feeder-link earth stations (e.g., ocean areas). Operation of the MPR within 600 km would require coordination outside the bands 15.4 - 15.43 GHz and 15.63 - 15.7 GHz. Although the RSMS is also an airborne system, the fact it is only used on approach (within 50 km of an airport) makes it possible to coordinate with a specific location.

4.3.3.2 Methods to satisfy the agenda item and their relative advantages

The method described in Section 4.3.3.1 specifies limits on the emissions from ARNS stations directed toward the satellites and provides coordination distances from feeder-link earth stations to the location of ARNS stations as given in draft new Recommendation ITU-R S.[Doc. 4/46]. With respect to interference to satellites, the Earth-to-space feeder links are to be designed and operated in the interference environment defined by these limits with no coordination requirement being placed on the aeronautical radionavigation service.

An alternative method for limiting the ARNS station emissions was initially studied in which the average e.i.r.p. was limited to a maximum value (see RR No. S5.511C). The method described in Section 4.3.3.1 is a more accurate and definitive method.

An alternative method was initially studied in which a minimum feeder-link earth station e.i.r.p. would also be specified based on the ARNS station emission limits but this requirement is not necessary. This allows maximum flexibility in the design and operation of the Earth-to-space feeder links.

A downward shift of 20 MHz of this band to 15.43 - 15.63 GHz is also needed to align with the same need in the space-to-Earth direction (see Section 4.3.2).

4.3.3.3 Regulatory and procedural considerations

Adoption of the method for sharing Earth-to-space NGSO feeder links with the aeronautical radionavigation service would entail modifications in RR No. S5.511C and in Resolution 46 (Rev.WRC-95); specifically A2.2.4, A2.2.5 and in Tables 3 and 4 of A2.3.

RR provision No. S5.511B may need to be either deleted or modified in order for airborne systems such as the MPR and/or RSMS to operate in the band 15.43 - 15.63 GHz.

4.3.4 Resolution 119 "Sharing between the FSS and the FS in the 19.3 - 19.6 GHz band when used by the FSS to provide feeder links for non-geostationary-satellite systems in the MSS"

Resolution 119 *resolves to instruct the ITU-R*

1 to study as a matter of urgency, the criteria of maximum permissible interference from earth stations operating bidirectionally in the 19.3 - 19.6 GHz band to stations in the fixed service;

2 to study possible modification of the power flux-density limits at the surface of the Earth in this band applicable to feeder links of non-geostationary-satellite networks in the mobile-satellite service, keeping in view the different rain characteristics in many parts of the world.

4.3.4.1 Summary of technical and operational studies and analysis of their results

In respect of *resolves* 1

Recommendation ITU-R SF.1005 recommends a tightening of the criteria of maximum interference from earth stations operating in reverse band working to stations of the fixed service. The ITU-R has reviewed this, and related Recommendations, for estimation of interference from reverse band non-GSO earth stations to fixed service terminals operating in the 19.3 - 19.6 GHz band. The ITU-R has concluded that the existing measures provide adequate protection for the FS without imposing unreasonable constraints on reverse-band or forward-band non-GSO feeder links.

In respect of *resolves* 2

The existing pfd limits (in Table S21-4 of Article S21) in the band 19.3 - 19.6 GHz are:

Limit in dB(W/m^2) for angle of arrival (δ) above the horizontal plane			Reference bandwidth
0° - 5°	5° - 25°	25° - 90°	
-115	-115 + 0.5(δ-5)	-105	1 MHz

Past studies carried out by ITU-R have tended to conclude that, if Recommendation ITU-R SF.1005 is applied in respect of reverse-band emissions, these pfd limits are adequate to protect the fixed service and will not place unreasonable constraints on forward-band feeder links of MSS systems. All proposed MSS systems, the characteristics of which are known to the ITU-R, are easily able to meet these limits.

It may be noted that these pfd limits are independent of the current allocation to Earth-to-space feeder links for non-GSO MSS systems in this band.

Studies have taken into consideration fade margins appropriate to all parts of the world, including those with high rainfall rates. Using the pfd mask adopted by WRC-95, simulations have shown that

for an FS station located at 45°, the short-term and long-term interference criteria were met without any undue constraint on the minimum earth station operating elevation angle. It was also shown that the level of interference would be reduced further if a minimum earth station operating elevation angle was assumed.

It was also noted that for a FS station located further north or at high latitudes, the interference level or the percentage of time interference could be slightly higher, however, this increase should not be significant enough to change the conclusion due to the fact that the interference level is well below the interference criteria for the FS. Additionally, from a practical view point all the visible satellites will not be simultaneously operational in such situations and would only occur for those MSS constellations with high inclinations.

It is concluded that the existing pfd levels in Table S21-4 of Article S21 are sufficient to protect the FS.

4.3.4.2 Methods to satisfy the agenda item and their relative advantages

The ITU-R considers that no changes to the Radio Regulations are needed in respect of Resolution 119 at this time.

4.3.4.3 Regulatory and procedural considerations

In view of the above, there are no regulatory or procedural considerations.

4.3.5 Resolution 121 "Development of interference criteria and methodologies for coordination between feeder links of non-geostationary-satellite networks in the MSS and geostationary-satellite networks in the FSS in the bands 19.3 - 19.6 GHz and 29.1 - 29.4 GHz"

4.3.5.1 Summary of technical and operational studies and analysis of their results

4.3.5.1.1 Permissible interference criteria

Draft new Recommendation ITU-R S.[Doc. 4/49] has been prepared, entitled "Maximum permissible levels of interference in a satellite network (GSO/FSS; non-GSO/FSS; non-GSO/MSS feeder links) for a hypothetical reference digital path in the fixed-satellite service caused by other codirectional networks below 30 GHz". This draft new Recommendation, which has been developed in collaboration with groups studying the performance objectives of non-GSO systems, addresses both long-term limits, which are similar to those in earlier Recommendations relating to interference between GSO networks, and short-term limits which are now needed because of the nature of interference from and to non-GSO networks. Methodologies for deriving interference limits applicable to specific situations are contained in the draft new Recommendation.

4.3.5.1.2 Interference mitigation techniques to assist coordination

Six primary techniques for mitigating interference between feeder links for NGSO/MSS networks and GSO/FSS networks in the bands 29/19 GHz have been studied. These interference mitigation techniques could be useful in facilitating sharing between GSO/FSS networks and NGSO/MSS feeder-link networks in the bands 29/19 GHz.

Adaptive power control

The studies to date have shown that the use of adaptive uplink power control will ease the overall coordination between networks and that the use of adaptive uplink power control may be used to maintain system performance during times of increased levels of interference. Draft new

Recommendation ITU-R S.[Doc. 4/15] has been developed on the use of uplink power control to mitigate interference between GSO/FSS networks and feeder links of NGSO/MSS networks.

Use of high gain antennas

A study addressing sharing on both downlinks and uplinks between a single GSO FSS network which employs small aperture earth station terminals and co-located NGSO MSS feeder links using either low-Earth orbits (LEO) or medium-Earth orbits (MEO) investigated the effects of varying the antenna sizes of either the GSO FSS earth station or of the NGSO space station. The simulations showed that restricting the GSO earth station minimum antenna size to 1.0 m results in interference levels below the aggregate criteria currently proposed for LEO A. The interference level is generally higher for the MEO case than the LEO case, and for a GSO earth station antenna size of 1.8 m, exceeds the interference criteria in all links.

Geographic isolation between earth stations

A study confirmed that geographic isolation of earth stations is an effective interference mitigation method. Maintaining a minimum latitudinal separation between competing GSO/LEO earth stations of 2° is required to reduce the interference to acceptable levels. In the GSO/MEO case, separations greater than 2° in latitude are required to reduce the interference to acceptable levels.

It has been shown that the geographic separation of the earth stations of the two systems, combined with the use of high gain antennas, would be more effective in mitigating interference than either of the two techniques separately.

Satellite diversity

The use of satellite diversity has been considered as a mitigation technique to avoid mainbeam to mainbeam interference by switching traffic to an alternative satellite. This technique would have a number of system design and network operational implications which the network operators would have to consider before implementing this technique. Certain designs of NGSO MSS feeder-link systems are not compatible with the implementation of satellite diversity.

Site diversity

The use of site diversity (i.e. the use of an alternate earth station located far enough away from the primary site to provide sufficient antenna discrimination to maintain acceptable interference levels) as an interference mitigation technique will depend on the NGSO MSS space station antenna beamwidth. For example to be effective in mitigating interference between a LEO B feeder-link network and a GSO/FSS network (GSO-13) in the bands 29/19 GHz, earth station diversity would require LEO B satellite antennas that are so large as to be impractical. A satellite antenna diameter of 13 metres would be required to achieve earth station separations of 40 km, with perfect pointing. With the actual LEO B satellite antenna, large separations on the order of 500 km between primary and diversity earth station sites would be required. As both the primary and the diversity sites would have to be coordinated with other NGSO system earth stations operating in the same frequency bands, the technique would have a substantial negative effect on co-frequency sharing between NGSO MSS feeder-link earth stations.

Results of another study show that site diversity is possible for the case of one GSO network and one NGSO MSS feeder-link network sharing the same frequency. Site diversity also requires that this feature be incorporated into the NGSO feeder-link design at conception. If a LEO A-type system were to be designed to accommodate a 2° site separation distance, a 10 dB reduction in the interference into the LEO A uplink would result, and the interference criteria would be met in all links. Results similar to those of the preceding paragraph indicate that larger site separations

distances, which are not operationally practical for the LEO B MEO MSS feeder-link system, are required to reduce the interference between GSO and MEO systems to acceptable levels.

Although both site diversity and geographic separation of earth stations can, in theory, reduce interference levels, the required separation distances (and the operational feasibility thereof) need to be evaluated on a case-by-case basis and for a greater range of system characteristics.

Traffic management

Traffic management techniques by GSO/FSS networks for mitigation of interference between GSO/FSS and NGSO/MSS feeder-link systems have been explored and shown to have merit if used during coordination. Further investigations are required to determine whether the use of traffic management techniques by NGSO/MSS feeder links has merit.

Summary

The use of any of the above interference mitigation techniques must be fully evaluated against the operational complexity and costs in implementing in the actual systems. From the ITU-R studies the first three techniques appear to offer the most benefit in improving the sharing between NGSO MSS feeder links and GSO/FSS networks.

4.3.5.2 Methods to satisfy the agenda item and their relative advantages

Section 4.3.5.1 is considered to cover the requirements of Resolution 121, and thus to satisfy the agenda.

4.3.5.3 Regulatory and procedural considerations

The outcome of the work in this section is judged to be appropriate for ITU-R Recommendations, rather than the Radio Regulations.

4.3.6 Resolution 120 "Use of the bands 19.3 - 19.7 GHz and 29.1 - 29.5 GHz by feeder links for non-GSO MSS networks"

WRC-95 resolved that WRC-97 should consider the removal of the application of RR No. S22.2 (2613) of the Radio Regulations for feeder links of non-GSO MSS networks with respect to FSS networks in the bands 19.6 - 19.7 GHz and 29.4 - 29.5 GHz. It is noted that WRC-95 also designated spectrum for NGSO MSS feeder links in the 5/7 GHz and 15/19 GHz bands. The 15/19 GHz bands could be used to accommodate additional traffic demands. For further information concerning the use of the 15/19 GHz bands by NGSO MSS feeder links, refer to Sections 4.3.2 and 4.3.3 of this Report.

4.3.6.1 Summary of technical and operational studies and analysis of their results

4.3.6.1.1 Sharing between feeder links of non-GSO MSS networks and GSO FSS networks

Sharing studies called for in the WRC-95 Resolutions have been conducted, and the results thereof have been considered in the ITU-R. On the basis of these studies, co-frequency sharing between medium-Earth orbit (MEO) NGSO MSS feeder links and GSO FSS systems has been shown to be feasible across the bands 29.1 - 29.5 GHz (Earth-to-space) and 19.3 - 19.7 GHz (space-to-Earth). In the case of low-Earth orbit (LEO) MSS feeder links, studies, and in some cases, practice has confirmed that co-frequency sharing between LEO MSS feeder links and GSO/FSS systems is feasible for certain GSO/FSS systems in the same bands. However, coordination with existing GSO systems has been difficult. Use of uplink power control and sufficient separation of earth stations are useful mitigation techniques. Continuing efforts are being made to identify other interference

mitigation techniques that would facilitate successful co-frequency coordination between NGSO MSS feeder links and GSO FSS systems.

The conclusions accepted by WRC-95 regarding sharing between NGSO/MSS feeder links and the fixed service apply equally to LEO and MEO feeder-link systems in both pairs of bands.

4.3.6.1.2 Sharing between feeder links of non-GSO MSS networks

The feeder-link characteristics of two NGSO/MSS systems that would operate in the bands 29.1 - 29.5 GHz and 19.3 - 19.7 GHz have been notified to the ITU-R. One of those systems is a LEO MSS system (LEO A) requiring a minimum of 200 MHz of spectrum in each direction, and the other is a MEO MSS system (LEO B) that currently intends to operate in the 300 MHz of spectrum in each direction that was designated in the above bands for NGSO MSS feeder link use at WRC-95, and which also intends to utilize the additional 100 MHz of spectrum in each direction that is to be considered for designation for use by NGSO MSS feeder links at WRC-97. Two independent studies, both using the characteristics of the LEO A and LEO B systems, have shown that, with modest earth station separation (of the order of several hundred kilometres), the feeder links of a LEO MSS system can share frequencies in these 29/19 GHz bands with the feeder links of a MEO MSS system.

In the case of feeder-link sharing between two non-GSO MSS systems, one a LEO system, and the other a MEO system, it has been concluded that the two systems operating co-frequency and co-polarization could share provided the earth stations would have a minimum separation of 250 km. The separation would be less if the systems operate on opposite polarizations. Further work has been done to determine whether, and under what conditions, more than two NGSO/MSS feeder-link systems can operate co-frequency. Assume that a third non-GSO MSS system, a LEO system, now wishes to operate co-frequency with the existing LEO A (i.e. LEO) and the notified LEO B (i.e. MEO) MSS feeder-link systems. The additional interference from a second, co-frequency LEO MSS feeder-link network would require increased separation distances (of 400 to 500 km) from earth stations of the other MSS systems, depending upon relative polarization.

The above studies are based on sharing between three NGSO MSS feeder-link systems that would operate in one geographical area. The studies show that the feeder-link earth stations of the above two MSS systems (one LEO and one MEO) cannot co-exist in 300 MHz of spectrum in the 20/30 GHz bands with the feeder links of a second LEO MSS system having characteristics similar to LEO A. However, the three systems could co-exist in 400 MHz of spectrum. With an additional 100 MHz of spectrum in each direction, feeder links of two LEO MSS systems, each requiring 200 MHz in each direction, could be given non-overlapping assignments in the 29.1 - 29.5 GHz and 19.3 - 19.7 GHz bands, so that co-frequency sharing among feeder-link systems would be confined at any particular frequency to, at most, one LEO and one MEO system. The ability to accommodate feeder links of two LEO MSS and one MEO MSS systems in the 29.1 - 29.5 GHz and 19.3 - 19.7 GHz bands would not affect the feasibility of sharing between feeder links of NGSO/MSS systems and GSO/FSS systems described earlier in this section.

In summary, if an additional LEO-A type MSS system were to operate in the same region or regions it would be necessary to designate the bands 29.4 - 29.5 GHz and 19.6 - 19.7 GHz for use by NGSO MSS feeder links.

4.3.6.1.3 Coordination between feeder links of non-GSO MSS networks and GSO FSS networks

An evaluation of completed coordinations between LEO MSS feeder-link networks and existing GSO/FSS systems in the 19.4 - 19.6 GHz/29.1 - 29.3 GHz bands indicates that severe operational constraints have been imposed on LEO MSS feeder-link operations, despite the small number of

coordinations that have taken place. In addition, coordination of individual earth stations have further complicated the use of this spectrum. These constraints have significantly reduced the amount of the 200 MHz available for use. This is in spite of the fact that the LEO A uplink and downlink feeder link were originally chosen in a off-set band pairing to facilitate coordination and avoid as much as possible coordination with existing GSO networks.

The LEO B MSS feeder-link system, which intends to operate in 400 MHz of spectrum in each direction, as indicated in Section 4.3.6.1.2 above (including the entire band designated at WRC-95 for feeder links and the 100 MHz specified for consideration at WRC-97), has not yet completed international coordination, and it cannot be confirmed that successful coordination will be achievable within the 300 MHz band designated at WRC-95. It is anticipated that the designation of the additional 100 MHz in each direction for use by NGSO MSS feeder links would provide flexibility for the coordination of the LEO B and GSO/FSS networks.

Due to the large number of coordinations that would be required for LEO MSS feeder links to use the final 100 MHz of spectrum being considered pursuant to Resolution 120 for removal of RR No. S22.2, the constraints to be imposed upon LEO MSS feeder-link operations, if a second LEO A type MSS system were to be operated in the same region, could become untenable unless RR No. S22.2 were removed.

Draft new Recommendation ITU-R S.[4A/XB] "Maximum Permissible Levels of Interference in a Satellite Network (GSO/FSS; Non-GSO/FSS; Non-GSO/MSS Feeder links) for a HRDP in the FSS caused by other codirectional networks below 30 GHz" could be used in the application of Resolution 46. This Recommendation provides a methodology which can be applied in inter-network coordination between non-GSO MSS feeder links and between non-GSO MSS feeder links and GSO FSS networks.

4.3.6.1.4 Future non-GSO MSS feeder-link spectrum requirements

Another factor that must be considered is the spectrum requirements of non-GSO MSS satellite systems. Present non-GSO MSS systems have been based on designs of either 200 or 300 MHz of feeder-link spectrum. However, the traffic and system capacity requirements are changing and the availability of the additional 100 MHz of feeder-link spectrum to be considered at WRC-97 would, in addition to providing desirable coordination flexibility, allow additional channels per service link beam. These additional channels could be used either to increase system capacity or to improve inter-service sharing through lower pfd levels. It is normal for technical and economic reasons that the next generation of a system would use the same and possibly additional contiguous spectrum.

Some of this feeder-link spectrum requirement might be reduced if additional features such as on-board processing or higher order satellite multiplexing were incorporated on the future systems. However, systems such as LEO B, which utilizes simple frequency translating repeaters, has service links which utilize an average of approximately 5 MHz per beam (61 beams total), for a total of 300 MHz of feeder-link spectrum. Also, second generation systems could increase the number of beams per satellite or increase the bandwidth per beam. In either scenario, additional feeder-link spectrum would be required. In addition more MSS LEO/MEO systems have been notified to the BR requiring additional spectrum.

4.3.6.1.5 Sharing between the feeder links for NGSO MSS systems and the fixed service

Studies show that the coordination distances between FS stations and non-GSO MSS feeder-link earth stations are comparable to the coordination distances between FS stations and GSO FSS earth stations. For information concerning pfd limits, see Section 4.3.4.

4.3.6.2 Methods to satisfy the agenda item and their relative advantages

Based on mutual interference considerations in isolation from other factors, the feeder links of two NGSO MSS systems (LEO A and LEO B) can operate in 300 MHz on a co-frequency basis.

Given the requirement for co-frequency, codirectional sharing between GSO/FSS and NGSO/MSS feeder links, the intention of the LEO B operator to utilize the additional 100 MHz identified in Resolution 120, and recognizing both the difficulties that certain systems have encountered and the prospective need to accommodate additional NGSO/MSS feeder links in a way that does not worsen the NGSO/GSO sharing environment, the additional 100 MHz of spectrum identified in Resolution 120 (WRC-95) should be considered for designation for use by NGSO/MSS feeder links, and consideration should be given to the removal of RR No. S22.2 from the bands 29.4 - 29.5 GHz and 19.6 - 19.7 GHz, and Resolution 46 (Rev.WRC-95) used in its place.

4.3.6.3 Regulatory and procedural considerations

If it is decided to designate the additional 2 x 100 MHz of spectrum for NGSO MSS feeder links, it will be appropriate to consider the removal of RR No. S22.2 and the application of Resolution 46/RR No. S9.11A in the 29.4 - 29.5 GHz and 19.6 - 19.7 GHz bands.

Depending on its conclusions in respect of these two frequency bands, the Conference may need to amend RR Nos. S5.523A, B, and/or C.

4.3.7 Recommendation 104 "Development of pfd and e.i.r.p. limits to be met by feeder links of non-geostationary-satellite networks in the MSS for the protection of geostationary-satellite networks in the FSS in bands where No. S22.2 of the RR applies"

Recommendation **104 (WRC-95)** requests that the ITU-R continue to study, as a matter of urgency, the possibility of developing e.i.r.p. and pfd limits to be met by non-GSO/MSS feeder links in order to protect GSO/FSS networks in accordance with RR No. S22.2 in bands where Resolution **46 (Rev.WRC-95)** does not apply.

4.3.7.1 Interpretation of RR No. S22.2

Concerning the language of RR No. S22.2, and how this regulation is to be interpreted, two fundamental views emerged, as outlined below.

One view is that RR No. S22.2 imposes an absolute obligation on non-GSO operators in the FSS bands to protect operating GSO/FSS networks from unacceptable interference. Under this view, it does not matter whether a subject non-GSO system has been in operation for several years and a newly-launched GSO/FSS operator is demanding protection from unacceptable interference; in particular, the level of unacceptable interference is not the result of bilateral discussions; there is no obligation on the part of the GSO/FSS operator to coordinate with the earlier non-GSO operator; and RR No. S22.2 requires the latter to ensure that the appropriate protection is provided.

The other view is that RR No. S22.2, by its language, does not impose the entire burden of combating unacceptable interference on the non-GSO system. Under this interpretation, there are three conditions that must be met before a non-GSO system would be required to cease or reduce transmissions in order to protect a GSO/FSS system that is operating in FSS bands in accordance with the Radio Regulations:

1) the administrations of the systems involved must engage in bilateral or multilateral discussions and reach agreement as to a level of "accepted interference" (see RR No. S1.168);

2) both affected systems must be in operation; and

3) the non-GSO system must exceed the level of interference agreed to.

If any of these conditions is not met, RR No. S22.2 would not be able to be invoked to affect the operations of any non-GSO satellites.

These diverging interpretations of this provision of the Radio Regulations result in an ambiguous regulatory status for both existing and future GSO and NGSO systems in the bands where this provision applies, with consequential risks for both types of systems.

4.3.7.2 Summary of studies and analysis of their results

Despite the difficulties that the ambiguity of RR No. S22.2 has created with respect to the completion of the course of action recommended in Recommendation 104, some studies have been carried out to demonstrate a method to develop limits that would apply to NGSO MSS feeder-link systems and ensure protection of any GSO/FSS system, irrespective of its design. Such limits might restrict operations of NGSO MSS feeder-link systems that would cause no harmful interference into any existing GSO FSS system.

Although more studies are required, the studies performed indicate that in such a situation, where the burden of such protection is more on the NGSO MSS feeder-link network than on the GSO FSS networks, e.i.r.p. and pfd limits might be developed to accomplish this result by applying one of the methodologies contained in draft new Recommendation ITU-R S.[Document 4/49] to a comprehensive set of GSO FSS system parameters. Such limits would be designed to keep interference into GSO/FSS networks from NGSO MSS feeder-link networks within an acceptable range. Since these limits would be established by considering only the characteristics of the GSO systems to be protected, these limits could, in principle, apply to any type of NGSO system, and not just to NGSO MSS feeder-link systems. It is important to note that such limits could place significant constraints on NGSO systems not designed to meet these limits.

Although any limits that might be derived from this methodology would not be intended to protect NGSO MSS feeder-link systems against GSO FSS systems, NGSO MSS feeder-link systems designed to meet them might also be able, in certain cases, to operate in the interference environment created by GSO FSS systems operating within the current limits applicable to GSO FSS systems (i.e., earth station off-axis e.i.r.p. density and space station pfd limits). It is important to note that if a given degree of angular discrimination is provided by a mitigation technique to the GSO systems,

the same degree of angular discrimination is provided to the NGSO MSS feeder-link system using this technique.

In a study by one administration, limits were developed based on the above methodology, by considering the characteristics of a representative sample of GSO FSS systems to be protected.

It was shown that, for one NGSO/FSS system (F-SATMULTI 1B), which is intended to operate in the unplanned 10 - 11/14 GHz bands, which is currently heavily used by GSO/FSS systems (and by other services), compliance with e.i.r.p. and pfd limits derived using the above methodology was accomplished through the use of the mitigation technique of exclusion zones/orbital avoidance. It was also shown that this NGSO/FSS system would also be protected from the GSO/FSS systems used in the above sample.

Given the current uncertainty as to the GSO system parameters that will be operational in more lightly used FSS frequency bands, the derivation of suitable limits in such bands would be more difficult than it would be in currently heavily used FSS frequency bands where GSO system characteristics are well known. The effect of establishing limits on possible future changes to GSO networks in heavily-used FSS bands was not examined.

The approach taken in the studies reported in the above paragraphs is not suited for sharing situations where more burden would be placed on the GSO FSS systems or the burden would be equally shared between the GSO and NGSO MSS feeder-link systems.

The establishment of e.i.r.p. and pfd limits may not be a suitable approach for all types of NGSO MSS feeder-link networks in every FSS band. Other types of sharing and/or protection criteria could be developed using different principles. For example, there may be FSS frequency bands where sharing and/or protection criteria are developed to enable the burden to be shared equally between NGSO MSS feeder link and GSO/FSS networks, and/or where more burden is placed on the GSO/FSS networks than it is on NGSO MSS feeder-link networks.

Whether the burden is placed on GSO or NGSO MSS feeder links, there is a need to be very specific as to which bands are to be considered for the development and application of such limits, taking into consideration the protection of the Plans.

In the case of the frequency bands between 11.7 and 12.7 GHz, Resolution 506 (Rev.Orb-88), for the purpose of protecting the BSS Plans in Appendix S30, prohibits the use of any orbit other than GSO by systems in BSS band between 11.7 and 12.7 GHz.

More work is needed to ensure that adequate protection criteria are developed to protect the BSS feeder-link Plan (Appendix S30A) and to assess the feasibility of NGSO MSS feeder-link networks satisfying the limits that could be established to meet these protection criteria.

More work is also needed to achieve the same objectives in the case of the protection of the Appendix S30B bands.

4.3.7.3 Regulatory and procedural considerations

The diverging interpretations of RR No. S22.2 that are discussed in Section 4.3.7.1 above result in an ambiguous regulatory status for both existing and future GSO and NGSO systems in the bands where this provision applies, with consequential risks for both types of systems. Although the establishment of limits or other sharing/protection criteria along the lines described in the studies referenced in Section 4.3.7.2 above (whether they are hard e.i.r.p. and pfd limits or the application of other sharing and/or protection criteria) requires more examination, such measures could lead to a more satisfactory regulatory situation than is currently available under RR No. S22.2 in the specific bands where they may be applied. This approach requires a thorough band-by-band review and the

establishment, for each band, of the rules that may apply in the development of the protection criteria and/or other considerations.

In Article S9 of the Radio Regulations there is currently no formal procedure for coordination between NGSO and GSO systems.

In cases where NGSO MSS feeder-link systems bear more of the burden than GSO/FSS systems, one approach to the regulatory status of NGSO MSS feeder-link systems and GSO/FSS systems could be as follows:

– any NGSO MSS feeder-link system would have to meet the developed limits, and this could be the subject of a conformity finding by the Bureau at the time of notification;

– any GSO system would also have to meet limits (e.g. earth station off-axis e.i.r.p. density as per Recommendation ITU-R S.524 and space station pfd limits as per Article **S21),** and this could also be the subject of a conformity finding by the Bureau at the time of notification;

– there would be no coordination between NGSO MSS feeder-link systems and GSO/FSS systems, the above limits being sufficient to avoid the need for such coordination;

As an alternative to pfd and e.i.r.p. limits even in bands where more of the sharing/protection burden is placed on NGSO MSS feeder-link systems than on GSO/FSS systems, there could be discussions between administrations. Other types of sharing and/or measures to allow co-frequency operation to be developed specifically and/or applied for the types of systems and bands involved could be addressed in the course of these discussions.

In other FSS frequency bands, sharing and/or protection criteria could be developed to enable the burden to be shared equally between NGSO MSS feeder link and GSO/FSS networks, and/or more burden could be placed on GSO/FSS networks than on NGSO MSS feeder-link networks.

The above has been based on the following. First, any limits or sharing/protection criteria would have to be developed on a band-by-band basis, in view of the results of studies to be performed in the ITU-R. Second, the application of limits or sharing/protection criteria would have to be decided by WRCs on a case-by-case basis for specific bands. Third, limits or sharing/protection criteria would not be applied retroactively. Finally, and in all cases, care should be taken to ensure that any measures imposed are not so restrictive on either GSO FSS or NGSO MSS feeder-link systems as to inhibit innovation.

4.4 Non-GSO FSS networks

Throughout Section 4.4 of this Report references to GSO 13, LEO SAT-1, F-SATMULTI 1A, etc. relate to types of satellite networks whose characteristics can be found in draft new Recommendation ITU-R S.[Document 4/61].

4.4.1 Resolution 118 "Use of the bands 18.8 - 19.3 GHz and 28.6 - 29.1 GHz by non-geostationary fixed-satellite service systems"

It is noted that WRC-95 considered that technical studies are required to ascertain the extent to which sharing of the frequency bands 20/30 GHz is feasible between GSO and NGSO systems, between NGSO systems and between NGSO and terrestrial systems, and requested the ITU-R to study, as a matter of urgency, the criteria to be applied for the sharing situations in the 20/30 GHz bands with a view to facilitating sharing, and taking account of existing and planned systems, and to recommend the required revisions of the Radio Regulations.

4.4.1.1 Summary of technical and operational studies and analyses of their results

4.4.1.1.1 Interference between NGSO FSS networks

The feasibility of frequency sharing between NGSO FSS operating in the 18.8 - 19.3 GHz and 28.6 - 29.1 GHz bands was investigated. Identical NGSO FSS communication parameters and ground segments based on the LEO SAT-1 network were assumed. Multiple near polar orbit constellations were separated spatially by either interleaving orbital planes or interleaving satellites within the same planes. The studies conclude that co-directional co-frequency sharing between several such homogeneous NGSO FSS systems appears to be feasible, with the application of mitigation techniques at high latitudes. Sharing principles and mitigation techniques that enhance sharing potential have been identified. The feasibility of frequency sharing between two or more non-homogeneous NGSO FSS systems has not been investigated.

4.4.1.1.2 Interference between NGSO and GSO FSS networks without the use of mitigation techniques

The feasibility of frequency sharing between geostationary and non-geostationary networks of the fixed-satellite service operating in the 18.8 - 19.3 GHz and 28.6 - 29.1 GHz bands was investigated. Studies were performed independently by several administrations. Both analytical and simulation techniques were employed to evaluate the duration and frequency of interference between the GSO and NGSO networks. In these studies the characteristics of three different NGSO FSS networks and eight different GSO FSS networks were considered.

The studies concluded that, for the LEO SAT-1 and LEO-G NGSO FSS systems as currently planned, the worst case interference from satellites of a NGSO FSS network to earth stations of a FSS GSO network, and the interference from earth stations of a GSO network to satellites of a NGSO network would be severe.

Independent analyses with the published parameters for the above systems have demonstrated that co-directional co-frequency sharing between the GSO FSS systems and NGSO FSS systems in question may be feasible if appropriate mitigation techniques that reduce the interference level from each system into the other are employed.

In response to the request in Resolution 118 for the studies to include the criteria to be applied for sharing situations, draft new Recommendation ITU-R S.[Document 4/49], described in Section 4.3.5.1.1, has been designed to include the methodologies to determine the permissible levels of interference to and from NGSO FSS networks. The methodology to determine the permissible level of interference to NGSO FSS networks has not been completed yet.

4.4.1.1.3 Interference mitigation techniques to improve sharing possibilities between GSO and NGSO FSS networks

The following have been identified as techniques which may reduce the interference between NGSO FSS and GSO FSS networks operating in the 20/30 GHz bands:

- satellite diversity;
- restricted operational elevation angles;
- high gain antennas;
- geographical isolation of earth stations;
- adaptive power control;
- signal design and network traffic management;

- site diversity;
- exclusion zone;
- hybrid systems;
- GSO arc avoidance;
- residual interference limitation;
- optimization of the constellation;
- satellite footprint shift.

Some studies have shown that satellite diversity has the potential to reduce the interference between GSO and NGSO FSS networks to typically acceptable levels by avoiding main-beam-to-main-beam interference. Satellite diversity requires that anytime an in-line event could occur two satellites must be visible to the earth station to provide a secondary path. However, satellite diversity, applied to GSO networks, has the disadvantage that it requires a significant increase in space segment resources and use of either an additional antenna or a more costly antenna at each GSO earth station. Some studies have shown that application of satellite diversity to NGSO FSS networks may have significant implementation and operational implications.

In studies of modified versions of the LEOSAT-1 network, this necessitated either substantially increasing the number of satellites, which is clearly not desirable, or reducing the minimum operational elevation angle of the network. A reduced operational elevation angle has many implications. These include increased beam scanning range, more complex transmitters, significantly larger, more expensive user and satellite antennas, increased blockage and potentially reduced ability to share with FS stations, decreased availability due to increased rain attenuation, etc. Studies with F-SATMULTI 1A indicated that satellite diversity could be accommodated with lesser impact if considered during initial network design. Further study may be needed to evaluate the implications that this technique would have on other types of NGSO FSS networks.

One study describing computer simulations concerning the application of satellite diversity to LEOSAT-1 type networks was submitted to the CPM. This study concluded that satellite diversity would allow frequency sharing even in the presence of large number of GSO networks. Some administrations disagreed with the technical assumptions and general conclusions of this study. One of these administrations questioned the technical merits of this study. The technical merits were not generally debated.

Studies have shown that restricting the operational elevation angle of NGSO FSS networks to above some minimum angle would provide for frequency sharing with GSO networks which restrict their operation to elevation angles below some maximum angle, e.g. 30-33 degrees in the case of sharing with LEOSAT-1. A disadvantage associated with restricted operational elevation angles is that it substantially restricts the geographical service area of a GSO satellite, although not necessarily of a system including multiple GSO satellites. For locations that would have been served at a higher elevation angle the impact of restricted elevation angle on rain attenuation can be significant.

Higher gain antennas have narrower beamwidths. Therefore, increasing antenna gain can potentially reduce the duration and frequency with which a given interference level is exceeded. One study modelling the LEO SAT-1 NGSO FSS constellation and a single GSO network employing CDMA, showed that use of a 1.8 m GSO earth station antenna can reduce the percentage of time that I_0/N_0 exceeds -12.2 dB to substantially less than 0.87% of the time. The disadvantages associated with higher gain antennas are the extra cost to implement them, the larger size required is not practicable for ubiquitous deployment, and the magnitude of interference events into higher gain receive antennas may be increased.

Use of geographical isolation of earth stations can be an effective interference mitigation technique when applied to the low deployment density, high data rate, "gateway" stations of either a GSO or NGSO FSS network. By providing enough separation between earth stations of two systems, sufficient antenna discrimination can be achieved to allow frequency sharing. This technique is even more effective for gateway stations when used in combination with high gain antennas and site diversity. The disadvantage is that it may not be applicable to the ubiquitous user terminals planned for most FSS networks in the 20/30 GHz bands.

Studies have shown that there are advantages in the use of adaptive uplink power control in both GSO and NGSO FSS systems for mitigating the effects of degraded propagation. Adaptive uplink power control can potentially be used to mitigate interference. However, in this case, it can potentially result in increased levels of interference between networks if not properly designed. This increase in interference requires further quantification**.**

It has been shown that a GSO network designed to use CDMA on the uplink and downlink, combined with network traffic management techniques using temporal occupancy masks or power density limits, can improve the feasibility of sharing with NGSO FSS networks. One study modelling the LEO SAT-1 NGSO FSS constellation and a single GSO network employing CDMA, showed that use of this technique in the GSO system can reduce the percentage of time that I_0/N_0 exceeds -12.2 dB to less than 0.87% of the time. The disadvantages of using traffic management to mitigate interference are that it may add cost and complexity to a network and restrict the capacity and quality of service that a network could provide. Also, while traffic management may offer an equitable method to use the same frequency band, this method falls short of unrestricted usage of the band by all system proponents because by definition, traffic limitations are placed on one or more systems in the band.

Site diversity can potentially be used to avoid in-line interference events between GSO and NGSO FSS networks by providing a second earth station antenna located some distance (typically several tens of km) from the primary earth station. The site separation distance is dependent on the satellite antenna beam characteristics. This technique requires a terrestrial communications link between the two sites. This technique is more suited to systems employing large gateway-type earth stations and would not be practicable for the small, ubiquitous, low-cost terminals planned for most FSS networks in the 20/30 GHz bands.

Studies have shown that restricting the coverage areas through the implementation of exclusion zones may be an effective way to allow sharing between NGSO and GSO systems. This would impose constraints on either the number of NGSO satellites or NGSO satellite antenna design or both to insure full coverage of the Earth, and imply a minimum diameter of the GSO earth station antenna to reduce the exclusion zone. However, implementation of the exclusion zone concept in systems in which the constellation is optimized for this purpose could potentially permit NGSO and GSO networks to share the band.

The merits of hybrid systems involving NGSO and GSO components should also be investigated.

Some studies have shown that NGSO avoidance of the GSO arc by a given angular limit is a technique to reduce interference significantly from NGSO networks into GSO FSS networks and also reduce interference from GSO networks into NGSO networks. This technique can also use satellite diversity and residual interference limitation.

Residual interference limitation permits reduction of the noise produced by NGSO satellite transmit antennas while shutting down beams producing in-line or quasi in-line interference. This technique may impose some constraints on the required antenna isolation pattern or other constraints in some cases. The effectiveness of this technique in mitigating interference between GSO FSS networks and NGSO FSS networks has been studied for one NGSO network and should be further studied.

Optimization of the constellation for the NGSO FSS satellite network has also been identified as a technique to limit the interference level produced by the NGSO FSS network into the GSO FSS networks. For instance, increasing the satellite altitude and optimizing the satellite orbit inclination angle and the phasing between satellites can improve the constellation coverage and its ability to cope with avoidance of the GSO arc. This may impose some constraints on the design of the NGSO FSS constellation and the network itself.

The satellite footprint shift technique requires the NGSO satellites to shift the centre of their service coverage area from the sub-satellite point to a point towards the equator. This shift increases the off-axis angle between the NGSO communication links and potential GSO links, thus reducing interference between the two networks. The disadvantage of this technique is the problem associated with the required lower operational elevation angles for the NGSO FSS network.

One study submitted to the CPM concluded that, for F-SATMULTI 1A which has been optimized to use mitigation techniques to share with GSO systems, even the worst case interference from NGSO satellites to earth stations of a GSO FSS network and from earth stations of a GSO FSS network to NGSO satellites would not be severe (the C/I ratio always remains above the minimum long term threshold). This study should be reviewed by the ITU-R.

Summary of mitigation techniques studies

Detailed studies of sharing and potential interference between NGSO and GSO FSS networks have produced a list of mitigation techniques that might be used to reduce the frequency and duration of interference. Whilst further study is needed to evaluate fully the operational complexity and implementation costs of each of these techniques individually and, where appropriate, in combination; in general it is considered that satisfactory ways of co-frequency sharing by NGSO FSS and GSO FSS networks can be found where the burden is placed on either the GSO or NGSO network. This will have to be evaluated on a case-by-case basis.

In the case of satellite diversity applied to an NGSO network, mitigation is achieved with the burden placed mostly on the NGSO network. In the case of restricted elevation angles, mitigation is achieved, with the burden placed mostly on the GSO network. However the operational and cost implications of a given mitigation technique depend on the network architecture. The use of satellite diversity as a mitigation technique can have substantial operational and cost implications on the LEOSAT-1 system. However, the current design of that system facilitates the use of the restricted elevation angle mitigation technique. Studies with F-SATMULTI 1A indicated that satellite diversity could be accommodated with significantly lesser impact if considered during initial network design. Operational impacts were also identified for GSO systems when mitigating interference to NGSO FSS systems.

4.4.1.1.4 Interference between NGSO FSS network and FS stations

Sharing appears to be feasible in the uplink band based on typical FS station e.i.r.p.s and the specific characteristics of LEO SAT-1.

E.i.r.p. levels from FS stations as high as 55 dBW are permitted by the Radio Regulations (Article S21 and Recommendation ITU-R SF.406-8) with no restrictions on the bandwidth or elevation angle. Therefore, there may be a need to review the e.i.r.p. limits, considering bandwidth and elevation angle, for FS transmitters operating in the bands referenced in Resolution 118.

Sharing appears to be feasible in the downlink band based on system-specific characteristics of the LEO SAT-1 non-GSO FSS network. The minimum operational elevation angle restrictions of LEO SAT-1 are instrumental in promoting a favourable sharing environment. One study presented at the CPM concluded that the incorporation of satellite beam diversity into a system of the LEO SAT-1 type would cause only a minor increase in the short term interference to the FS receiver.

Pfd levels of -115/-105 dB(W/m^2/MHz) are the limits permitted by the current Radio Regulations (Article S21.16). Some studies indicated that lower pfd levels would be needed at elevation angles of less than 25° to protect FS receivers from non-GSO systems with more than about 100 space stations. Two studies have indicated that a pfd mask of -130/-105 dB(W/m^2/MHz) would ensure protection of the FS. Further study is needed to determine whether, and the degree to which, the -130/-105 dB(W/m^2/MHz) pfd mask could be relaxed while maintaining protection of the FS. Another study submitted to the CPM concluded that the existing regulatory limits are sufficient. Some administrations disagreed with the technical assumptions and general conclusions of this study.

Frequency sharing between earth stations of a non-GSO FSS network and FS stations

Studies show that the coordination distances between FS and non-GSO FSS earth stations are comparable to the coordination distances between FS stations and GSO FSS earth stations.

However, sharing between the FSS (GSO as well as non-GSO) and the FS should also take into consideration the impact of the proposed high density deployment of both services, which requires special attention. If the distance between FSS earth stations and FS stations are smaller than the separation distances required to facilitate co-frequency sharing, geographical deployment and operational restrictions may be necessary. Such restrictions may constrain the use of one or both services in the same area.

Co-frequency sharing between non-GSO FSS earth station terminals and fixed stations is considered feasible, provided detailed station-to-station coordination can be achieved.

Studies have shown that as the minimum operational elevation angle of non-GSO FSS systems is lowered, the required separation distances between the non-GSO FSS earth stations and FS stations is increased.

4.4.1.2 Methods to satisfy the agenda item and their relative advantages

At WRC-95, 400 MHz was made available for immediate NGSO FSS use by waiving RR No. S22.2 and requiring the application of Resolution 46 coordination procedures. Another 100 MHz was frozen until WRC-97, with action identified for that Conference that would consider designation of its use by NGSO FSS systems.

Many studies requested in Resolution 118 have been performed. Results of these studies support the following conclusions:

- Codirectional co-frequency sharing between several homogeneous NGSO FSS networks appears to be feasible through the use of spatial separation.
- Codirectional co-frequency sharing between NGSO and GSO FSS systems may be feasible, if appropriate interference mitigation techniques are employed.
- NGSO and GSO FSS systems can be designed to make efficient use of the spectrum.
- The maximum capacity that can be provided to any point on Earth, to any single user and to any group of users, by a broadband system is ultimately limited by the spectrum available to that system. Therefore, to be competitive with other broadband systems, NGSO FSS systems need access to an adequate amount of spectrum, that permits individual downlink channels and total area capacity competitive with other service options. Some administrations expressed the view that 500 MHz are required for NGSO FSS systems to provide services comparable to GSO FSS systems. Other administrations expressed the view that 400 MHz is sufficient for NGSO FSS. It is noted that most GSO systems at 20/30 GHz have requested access to orbital slots with at least 1 000 MHz and many have requested access to more.
- The spectrum required for use where two or more non-homogeneous NGSO FSS systems share the same bands may require further study.

4.4.1.3 Regulatory and procedural considerations

It is recommended that, in the discussions at WRC-97 concerning the possible non-application of RR No. S22.2 in the bands 18.8 - 18.9 GHz and 28.6 - 28.7 GHz, the following factors, as well as the discussion contained in Section 4.4.1.2 and the relative merits of GSO FSS and NGSO FSS are taken into account:

- the number of 20/30 GHz NGSO FSS networks likely to be implemented and their respective spectrum requirements;
- the feasibility of NGSO FSS networks sharing frequencies with each other in addition to GSO FSS networks and networks of the fixed and mobile services taking into consideration mitigation techniques. Some regulatory means such as the development of appropriate technical sharing criteria may be required to facilitate the application of these techniques;
- the application of Resolution 46-type coordination procedures to allow coordination among NGSO FSS, GSO FSS and FS systems in this band;
- if means to mitigate "in-line" interference are provided by the networks, then coordination would be facilitated.

CHAPTER 5

SPACE SCIENCE SERVICES
(WRC-97 agenda items 1.9.2, 1.9.4, 1.9.5)

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5 Space science services

Throughout this Chapter 5, the techniques of active and passive sensing are addressed. For clarification these techniques are described as:

Active sensing

Active sensing is the measurement on board a spacecraft of signals transmitted by the sensor and then reflected, refracted or scattered by the Earth's surface or its atmosphere.

There are four basic types of active sensors:

1. Radar scatterometers are useful for determining the roughness of large objects such as ocean waves.
2. Radio altimeters are used to determine the height of the Earth's land and ocean surfaces.
3. Imaging radars (synthetic aperture radars) are used to produce high resolution images of land and ocean surfaces.
4. Precipitation and cloud radars are used for meteorology and for climate studies.

Passive sensing

Passive sensing is the measurement on board of a spacecraft of the natural electromagnetic energy emitted and scattered by the Earth and constituents of its atmosphere.

A single observation at a single frequency cannot be used to estimate a single physical parameter (ocean surface temperature, for example). Observations must be made simultaneously at several frequencies and combined with models for the frequency dependence of emissions resulting from individual physical parameters before solutions can be obtained.

5.1 Agenda Item 1.9.2, Resolution 211 (WARC-92)

“Use by the MS of the frequency bands 2 025 - 2 110 MHz and 2 200 - 2 290 MHz”

5.1.1 Summary of technical and operational studies

Recommendation ITU-R SA.1154 has been prepared in response to Resolution 211 (WARC-92) which asks for appropriate provisions to enable the mobile service to share with space science services in the bands 2025-2110 MHz and 2200-2290 MHz. The Recommendation sets forth the levels of acceptable interference to the stations in the space science services from the emissions of mobile systems, and the technical and operating characteristics of mobile systems that will not cause the aggregate interference to stations of the space science services to exceed acceptable levels.

5.1.2 Analysis of the results of studies

The 2025-2110 MHz and 2200-2290 MHz bands are used intensively for tracking, telemetry and command (TT&C) of unmanned and manned Earth-orbiting satellites and space vehicles either through Earth-to-space and space-to-Earth links (for satellites in all types of orbits) or through space-to-space links using geostationary data relay satellites (DRS). There exists a large expensive space science infrastructure comprising both Earth stations and spacecraft at these frequencies.

Sharing between space science services and both high density and conventional mobile systems is not feasible; the introduction of these mobile systems into the 2025-2110 MHz and 2200-2290 MHz bands may prohibit the continued operation of space research, space operation and Earth-exploration satellite services systems.

Sharing with specific types of MS systems is feasible for which guidelines can be found in Recommendation ITU-R SA.1154.

5.1.3 Methods to satisfy the Agenda Item

Option A: Modify Resolution 211 (WARC-92) to indicate:

a) that the ITU-R has completed its studies;

b) that Recommendation ITU-R SA.1154 validates and confirms the cautions contained in this Resolution; and,

c) that Recommendation ITU-R SA.1154 shall apply to systems and stations in the mobile service that are introduced into the bands. Consequential changes would be made to **No. S5.391** which applies to the 2025-2110 MHz and 2200-2290 MHz bands in the Table of Allocations.

Option B: Revise **No. S5.391** to incorporate the provisions of Recommendation ITU-R SA.1154 by reference and suppress Resolution 211 (WARC-92).

Option C. Summarize the provisions of Recommendation ITU-R SA.1154 and incorporate them into [Article 27] and suppress Resolution 211 (WARC-92).

5.1.4 Advantages and disadvantages

Option A

Advantages

1) avoids the as yet unclear resolution of the issue of incorporation of ITU-R Recommendations by reference;

2) maintains the essential cautions to mobile system providers within the Radio Regulations; and

3) applies the provisions of Recommendation ITU-R SA.1154 to mobile systems introduced into the bands.

Disadvantages

This option requires the retention of Resolution 211 and the application of Recommendation ITU-R SA.1154 through a reference in this Resolution. This would lead to more complex regulations which goes against the VGE Recommendation concerning the simplification of the Radio Regulations.

Option B

Advantages

Offers a simple way to incorporate the complex results of studies contained in Recommendation ITU-R SA.1154 into the Radio Regulations in a clear and unambiguous way.

Disadvantages

Imposes a need to resolve the issues concerning the incorporation of ITU-R Recommendations into the Radio Regulations by reference.

Option C

Advantages

Avoids the issue concerning the incorporation of ITU-R Recommendations into the Radio Regulations.

Disadvantages

Recommendation ITU-R SA.1154 is a complex and relatively voluminous document that may be difficult to summarize in a manner consistent with other provisions of [Article 27].

5.1.5 Regulatory and Procedural Considerations

Regulatory considerations appear to be limited to the general issues concerning the incorporation of ITU-R Recommendations into the Radio Regulations by reference.

5.2 Agenda Item 1.9.2, Resolution 710 (WARC-92)

"Primary service requirements for the Meteorological-Satellite and Earth-Exploration Satellite services in the band 401 - 403 MHz"

Resolution 710 resolves that the secondary allocation to the Met Sat and EES services in the band 401 - 403 MHz be examined by a competent WRC with the intent of raising the allocation to primary status.

5.2.1 Summary of technical and operational studies

The band 401 - 403 MHz is allocated to Meteorological Aids on a primary basis, and: to Earth Exploration-satellite (Earth to Space); Meteorological-satellite (Earth-to-Space); Fixed and Mobile (except aeronautical mobile) on a secondary basis. Additionally, the band 401 - 402 MHz is allocated to Space Operations (Space to Earth) on a primary basis.

The meteorological aids service utilizes this band to receive data from radiosondes at terrestrial based stations. This is a downlink mode. The EES and meteorological-satellite (MetSat) services use this band to collect data from airborne, land based and maritime data collection platforms.

Studies completed to date indicate that radiosondes cannot operate co-channel with non-geostationary EES and MetSat systems, but coordination in frequency, distance and time can allow sharing to occur in the 401 - 403 MHz band. Frequency sharing with GSO EES and MetSat systems is feasible in the 401 - 403 MHz band provided that acceptable distance and/or frequency separation between EES or MetSat data collection platform transmitters and meteorological aid terrestrial receivers is maintained. It should also be noted that any further reduction in meteorological aids spectrum availability to accommodate other services, will result in higher levels of interference from meteorological aids to EES because of higher concentration of radiosondes in the reduced spectrum space.

5.2.2 Analysis of Results

Studies indicate that sharing is feasible between GSO and NGSO EES including MetSat and meteorological aids in the band 401- 403 MHz, provided that the EES conditions related to EIRP uplink limitations, and transmission durations per message as stated in draft new Recommendation ITU-R SA.[Doc. 7/70] are met. Additionally, co-ordination is required between meteorological aids operators and EES operators prior to the implementation of any EES systems not satisfying the above criteria.

5.2.3 Methods to satisfy the Agenda Item

An upgrade of the EES and MetSat allocations to primary is feasible provided the emissions from the data collection platforms are controlled in both power spectral density and in transmission time. The specific conditions are given in the recommends of draft new Recommendation ITU-R SA. [Doc. 7/70]. EES and MetSat data collection platforms may also be able to function without meeting these restrictions in certain operational environments if they are coordinated with meteorological aid operators prior to implementation.

5.2.4 Advantages and Disadvantages

Advantages

An upgrade of the allocation will ensure continued viable operation of the critical mission objectives of the EES and MetSat data collection programs as the other allocated services seek to increase their own levels of activity.

Disadvantages

An upgrade of the allocation could place additional pressure on the radiosonde operations in the band if and when those operations are required to increase their own use of the 401 - 403 MHz band because of other users coming into this portion of the spectrum.

5.3 Agenda Item 1.9.2, Resolution 712 (Rev.WRC-95), resolves 1

Consideration of "provision of up to 3 MHz of frequency spectrum for the implementation of telecommand links in the space research and space operation services in the frequency range between 100 MHz and 1 GHz".

5.3.1 Technical and operational studies

NOTE - This agenda item is intended to address the shortfall in telecommand (uplink) frequency allocations, compared with available telemetry (downlink) allocations in 0.1-1.0 GHz region. Space-to-Earth allocations provide some 14.45 MHz of total allocated bandwidth, while Earth-to-space allocations provide only 2.4 MHz of total allocated bandwidth.

Existing ITU-R Recommendations provide the methodology and criteria necessary to determine sharing conditions within specific frequency bands in the range between 100 MHz and 1 GHz. These specific sharing conditions have not yet been studied. Draft new Question ITU-R [7/29] calls for further studies on this matter.

5.3.2 Analysis of the results of studies

It may be advantageous before taking action to permit these studies to be completed. In this event WRC-97 may consider it appropriate to defer consideration of this agenda item to WRC-99, by which time all relevant studies should be complete.

5.3.3 Methods to satisfy the Agenda Item

Option A.- Defer consideration of this Agenda item to WRC-99.

5.3.4 Advantages and disadvantages

Option A:

Advantages

Band specific sharing studies should be completed by 1998.

5.3.5 Regulatory and Procedural Considerations

No action required.

5.4 Agenda Item 1.9.2, Resolution 712 (Rev. WRC-95), resolves 2

Consideration of "provision of up to 3.5 MHz of frequency spectrum to the Earth exploration-satellite service (active) in the frequency range 420-470 MHz".

Active spaceborne sensors are needed to enable the monitoring of forests. The need for assessment and systematic observations of forest cover and the extent and rate of forest degradation in tropical and temperate regions has been strongly expressed in Agenda 21 of the UNCED conference in 1992.

5.4.1 Summary of technical and operational studies

Study of the band 420-470 MHz has resulted in focusing on the band 430-440 MHz due to sharing considerations with other services.

A number of studies have been carried out by various administrations leading to the following recommendations and reports:

Draft Revision of Recommendation ITU-R SA.577-4 [Doc.7/49] contains preferred bandwidths and necessary bandwidths for spaceborne active remote sensors;

Draft Revision of Recommendation ITU-R SA.1166 [Doc.7/51] contains the performance and interference criteria for active spaceborne sensors;

Draft New Recommendation ITU-R SA.[Doc.7/11] addresses the feasibility of sharing between active spaceborne sensors and other services in the range 410-470 MHz;

5.4.2 Analysis of the results of studies

5.4.2.1 Active sensor requirements for an allocation in the frequency range 420-470 MHz

The draft revision of Recommendation ITU-R SA.577-4 [Doc.7/49] establishes requirements for the operation of spaceborne synthetic aperture radars (SAR) at a frequency near 400 MHz to measure soil moisture, tropical biomass and for documentation of geological history and climate change. SARs at these frequencies can provide data that are unattainable by any other means.

Within the range 420-470 MHz, draft new Recommendation ITU-R SA. [Doc. 7/11] identifies the band 430-440 MHz as the best option due to sharing and/or compatibility considerations with existing services.

5.4.2.2 Bandwidth requirements for active spaceborne sensors

The agenda item contemplates provision of up to 3.5 MHz of frequency spectrum. Studies have shown that bandwidths of 10 to 40 MHz are necessary (draft revision of Recommendation ITU-R SA.577-4 [Doc.7/49]) for some measurements of soil moisture and biomass. However, other studies have also shown that minimum bandwidths of 5 to 10 MHz (depending upon the application) are required.

5.4.2.3 Compatibility and feasibility of sharing with other services in the band 420-470 MHz

5.4.2.3.1 Sharing with fixed and mobile services

Spaceborne SARs would produce power flux-densities at the surface of the Earth in excess of the levels likely to be imposed in frequency bands near 400 MHz allocated to the fixed and mobile services in order to protect fixed and mobile operations. Even though interference to fixed or mobile

receivers is likely to be infrequent, the interference duration may be sufficiently long to significantly disrupt mobile and/or fixed service operations.

5.4.2.3.2 Sharing with the amateur and amateur-satellite services

In the band 430 - 440 MHz, amateur services have allocations on a co-primary basis in Region 1 and on a secondary basis in Regions 2 (except in countries listed in No. S5.278, where it is primary) and 3. Further, in accordance with No. S5.282 the amateur-satellite service may operate in the band 435 - 438 MHz subject to not causing harmful interference to other services operating in accordance with the Radio Regulations.

There would be periods where some impact on reception by amateur services would be likely. However, due to the nature of amateur services and the long duration between times that an amateur receiver is exposed to transmissions by a SAR, it appears that SARs and the amateur service may be able to coexist.

One study indicates that there may be the potential of significant interference during brief periods of visibility of the SAR satellites to amateur and amateur-satellite services.

Further study is needed to determine the duration and frequency of interference between the Earth exploration-satellite service and the amateur and amateur-satellite services.

5.4.2.3.3 Compatibility with wind profiler radars

Operation in separate frequency bands is necessary for spaceborne SARs and wind profiler radars in order to preclude interference to the SARs.

5.4.2.3.4 Compatibility with terrestrial radars

ITU-R has determined that there is a potential for unacceptable interference from spaceborne SARs to the terrestrial space object tracking radars listed in Table 1 operating in the frequency band 430 - 440 MHz if a SAR is within line-of-sight of the terrestrial radars. The per cent of time over the long term that an active spaceborne sensor is within line-of-sight of a terrestrial radar is relatively low; however, the maximum duration of visibility will be approximately 8-15 minutes for the sensors studied. It has been determined that the degree of compatibility is highly dependent upon the characteristics (and associated mission) of the spaceborne SARs, and that a spaceborne SAR intended for certain missions can be designed such that the compatibility situation is considerably improved. An in-depth analysis, and possibly field testing effort would be necessary to reach final consensus on the compatibility of a particular spaceborne SAR with terrestrial radiolocation tracking systems in this frequency band.

TABLE 1

Space object tracking radars operating in 430 - 440 MHz

Radar location	Latitude	Longitude
Massachusetts (US)	41.8 N	70.5 W
Texas (US)	31.0 N	100.6 W
California (US)	39.1 N	121.5 W
Georgia (US)	32.6 N	83.6 W
Florida (US)	30.6 N	86.2 W
N. Dakota (US)	48.7 N	97.9 W

Alaska (US)	64.3 N	149.2 W
Thule (Greenland)	76.6 N	68.3 W
Fylingdales Moor (UK)	54.5 N	0.4 W
Pirinclik (Turkey)	37.9 N	40.0 E

The ITU-R has concluded that, taking into account the SAR processing gain, the interference to SARs caused by terrestrial radars is acceptable in the most probable antenna side-lobe to side-lobe coupling configuration. Since terrestrial radars in this frequency range are used for space object identification, tracking, and cataloguing, mainbeam illumination of the spaceborne SARs will occur routinely on a daily basis for periods of up to 30 seconds. For the SARs studied, these events will cause receiver saturation and can approach receiver burn-out levels if the spaceborne SAR receives the terrestrial radar emissions at angles near antenna boresight.

Operation by geographical separation (that is, spaceborne SAR operation beyond line-of-sight to the terrestrial radars) has been studied. Observation of significant portions of the land mass in the northern hemisphere will be denied to the spaceborne sensors under such a restriction. However, it does appear that if the SARs are limited to operations beyond line-of-sight of terrestrial radars an appreciable portion of the tropical forests can still be observed, which is a primary mission for sensors at these frequencies.

In addition to the terrestrial tracking radars that operate in the 430 - 440 MHz band, a radar is located in Arecibo, Puerto Rico (United States) that is used for important atmospheric research programmes. It is an upward looking radar and there is a potential for interference from a spaceborne SAR. There will be a need to coordinate operations of the spaceborne SAR and the Arecibo radar. Such coordination is feasible since schedules for operation of the radar are known several weeks in advance as are the times that the SAR will be visible and its planned operations.

5.4.3 Methods to satisfy the agenda item

The spaceborne sensors postulated for operation in the frequency band 430 - 440 MHz cannot be considered technically compatible with terrestrial tracking radars without restrictions upon the spaceborne sensors. Spaceborne SARs could conceivably operate in the band with either 1) a restriction to operate beyond line-of-sight of the terrestrial radars listed in Table 1; or 2) technical limits placed upon the sensors and commensurate operational measures which will need to be determined. Measures might be needed to minimize interference to fixed, mobile and amateur services in countries where primary allocations to the fixed and mobile services are provided by the Radio Regulations.

5.4.4 Advantages and disadvantages of the proposed method

5.4.4.1 Advantages

Operation out of line-of-sight of the terrestrial radars would allow observation of significant tropical biomass while avoiding interference to terrestrial tracking radars.

5.4.4.2 Disadvantages

Spaceborne sensors would be unable to make observations over the entire world if they are restricted from operating within line-of-sight of terrestrial tracking radars. Regulatory provisions would be

needed to limit operation of sensors within line-of-sight of these radars. Terrestrial receivers located in areas where sensing is conducted could experience some degree of interference.

5.5 Agenda Item 1.9.2, Resolution 712 (Rev. WRC-95) resolves 3

Consideration of "use of existing allocations by space-based active sensors operating in the Earth exploration-satellite and space research services in the frequency bands shared with the radiolocation or radionavigation services, between 1 and 25 GHz, with a view to the possibility of establishing common worldwide primary allocations"

5.5.1 Summary of technical and operational studies

Footnote S5.333 establishes the majority of the allocations for space-based active sensors in the frequency range between 1 and 25 GHz. It stipulates that "In the bands 1215-1300 MHz, 3100-3300 MHz, 5250-5350 MHz, 8550-8650 MHz, 9500-9800 MHz and 13.4-14.0 GHz, radiolocation stations installed on spacecraft may also be employed for the Earth exploration-satellite and space research services on a secondary basis". The band 9975-10025 MHz is also allocated to the meteorological-satellite service on a secondary basis by Footnote S5.479. The remaining allocations between 1 and 25 GHz are in the frequency band 17.2-17.3 GHz where the Earth exploration-satellite (active) and space research (active) services are allocated on a secondary basis and 24.05-24.25 GHz where the Earth exploration-satellite (active) service is allocated on a secondary basis. The radiolocation service is allocated on a primary basis in all of these bands. Other services are also allocated in the frequency bands considered in this section as shown in Table 5.1. Several bands are included where there is no allocation for space-based active sensors.

TABLE 5.1

Frequency bands considered for spaceborne active sensor allocations

Allocation to Services		
Region 1	**Region 2**	**Region 3**
1215 - 1240	RADIOLOCATION RADIONAVIGATION-SATELLITE (space-to-Earth) S5.329 S5.330 S5.331 S5.333	
1240 - 1260	RADIOLOCATION RADIONAVIGATION-SATELLITE (space-to-Earth) S5.329 Amateur S5.330 S5.331 S5.333 S5.334	
1260 - 1300	RADIOLOCATION Amateur S5.282 S5.330 S5.331 S5.333 S5.334	
3100 - 3300	RADIOLOCATION S5.149 S5.333 S5.428	
5150 - 5250	AERONAUTICAL RADIONAVIGATION FIXED-SATELLITE (Earth-to-space) S5.446 S5.447 S5.447A S5.447B S5.447C	
5250 - 5255	RADIOLOCATION Space Research S5.333 S5.448	
5255 - 5350	RADIOLOCATION S5.333 S5.448	
5350 - 5460	AERONAUTICAL RADIONAVIGATION S5.449 Radiolocation	
5460 - 5470	RADIONAVIGATION S5.449 Radiolocation	
8500 - 8750	RADIOLOCATION S5.333 S5.468 S5.469	
9500 - 9800	RADIOLOCATION RADIONAVIGATION S5.333	
9800 - 10000	RADIOLOCATION Fixed S5.477 S5.478 S5.479	
13.25 - 13.4	AERONAUTICAL RADIONAVIGATION S5.497 S5.498 S5.499	

13.4 - 13.75	RADIOLOCATION Standard Frequency and Time Signal-Satellite (Earth-to-space) Space Research S5.333 S5.499 S5.500 S5.501
17.2 - 17.3	RADIOLOCATION Earth Exploration-Satellite (active) Space Research (active) S5.512 S5.513
24.05 - 24.25	RADIOLOCATION Amateur Earth Exploration-Satellite (active) S5.150

A number of studies have been carried out by various administrations leading to the following recommendations and reports:

Draft revision of Recommendation ITU-R SA.577-4 [Doc. 7/49] contains preferred frequencies and necessary bandwidths for spaceborne active remote sensors;

Draft revision of Recommendation ITU-R SA.1166 [Doc. 7/51] contains the performance and interference criteria for active spaceborne sensors in some frequency bands;

Draft new Recommendation ITU-R [Doc. 7/116-8/93] contains criteria for compatible operation of terrestrial radar receivers in the presence of emissions from active spaceborne sensors in the band 13.4-13.75 GHz;

Draft new Recommendation ITU-R [Doc. 7/98-8/47] addresses selection of active spaceborne sensor emission characteristics to mitigate the potential for interference to terrestrial radars operating in frequency bands from 1 to 10 GHz;

Preliminary draft new Recommendation ITU-R [7C/TEMP/101] reflects the results of tests conducted to determine compatibility between spaceborne active sensors and radionavigation-satellite service receivers in the 1215-1260 MHz band;

Recommendation ITU-R M.1088 provides a technical description and characteristics of the global positioning system (GPS) that could be useful in evaluation of sharing with other services.

Draft new Recommendation ITU-R M.[Doc. 8/57] contains considerations for sharing with systems of other services operating in the bands allocated to the radionavigation-satellite and aeronautical radionavigation services and the global navigation satellite system (GLONASS-M).

5.5.2 Analysis of the results of studies

ITU-R developed technical characteristics and performance and interference criteria for active spaceborne sensors in all of the frequency bands shown in Table 1 except for the bands 9 975-10 025 MHz and 24.05-24.25 GHz where no contributions were received. However, the ITU-R was informed that there is a continuing requirement for the present allocation in the band 24.05-24.25 GHz. Similarly, technical characteristics and performance and interference criteria were developed for radiolocation/radionavigation radars in these bands.

A sizable experience base was found to exist for active spaceborne sensors operating in common frequency bands with radiolocation/radionavigation systems. Spaceborne altimeters have operated in

the 5250-5350 MHz band and the 13.4-14 GHz band. Spaceborne scatterometers have operated in these same two bands. Spaceborne synthetic aperture radars have operated in the 1215-1300 MHz, 3100-3300, 5250-5350 MHz and 9500-9800 MHz bands. Intermittent operational experience gained over a period of more than 20 years shows that active spaceborne sensors and radionavigation and radiolocation systems have operated in common frequency bands with no record of identified instances of harmful interference to either the active spaceborne sensors or to the radionavigation and radiolocation systems.

ITU-R concluded that, for active sensors that will operate in the range of 1 to 10 GHz, it may be necessary to limit selection of sensor design parameters to meet the terrestrial radar interference criteria that were adopted as the basis for compatibility studies. Draft new Recommendation ITU-R [Doc. 7/98-8/47] addresses this topic. Significantly, it has been determined that the known sensor missions can be satisfactorily carried out while observing the terrestrial radar interference criteria. In this same frequency range, it may also be necessary to design sensors to mitigate potential interference to the sensors. For example, use of spot-beam scatterometers rather than fan-beam scatterometers can greatly enhance the tolerance for unwanted emissions from terrestrial radars. Also, limiting receiver gain of spaceborne synthetic radars and use of fast recovery limiters in their design reduces susceptibility of the sensors to unwanted emissions.

Draft new Recommendation ITU-R [7/116-8/93] contains criteria for the design envelopes of spaceborne sensors in the 13.4 - 13.75 GHz band. These criteria have been based on analyses and compatibility tests that were conducted using known sensor parameters and a sensitive terrestrial radar that operates in the band. Adherence to these design envelopes ensures compatibility in the band.

ITU-R has completed its studies on 8 separate frequency bands in which it has determined that compatibility exists between active spaceborne sensors and radiolocation/radionavigation systems. It has not reached conclusions regarding three other bands and two bands were not addressed. Simulations and probabilistic analyses were conducted to evaluate the compatibility between active spaceborne sensors and shipborne radars in the 3 100 - 3 300 MHz band. It was determined that spaceborne sensors would not cause interference to the shipborne radars but conflicting conclusions regarding interference to spaceborne sensors were indicated by the differing analysis approaches. While the simulation method indicated that interference from the shipborne radars was tolerable, the probabilistic method indicated that significant interference could occur. Therefore, compatibility in the 3 100 - 3 300 MHz band could not be concluded with a sufficient degree of confidence. In addition to examining bands where allocations for active spaceborne radars currently exist, the ITU-R has examined compatibility in the 13.25 - 13.4 GHz band since it has been determined that a bandwidth of 500 MHz is required for precision altimetry. This bandwidth is unavailable in the 13.4 - 14.0 GHz band because the fixed-satellite (Earth-to-space) allocation added to the 13.75 - 14.0 GHz band at WARC-92 makes that sub-band unusable for sensors due to interference from fixed-satellite emissions.

The ITU-R has also been informed of the need for an expansion of the bandwidth available for altimeters and synthetic aperture radars in the band 5 250 - 5 350 MHz and has examined the feasibility of operation of altimeters and SARs in the adjacent 5 150 - 5 250 MHz and 5 350 - 5 470 MHz bands. Studies indicate compatibility exists in the 5 350 - 5 460 MHz band with both radiolocation systems and aeronautical radionavigation systems. Studies related to the 5 150 - 5 250 MHz and 5 460 - 5 470 MHz bands are incomplete.

ITU-R has determined that, for the sensors and radiolocation/radionavigation systems that have been analysed, compatibility exists in the bands 1 215 - 1 300 MHz, 5 250 - 5 350 MHz, 5 350 - 5 460 MHz, 8 550 - 8 650 MHz, 9 500 - 9 800 MHz, 13.25 - 13.4 GHz, 13.4 - 13.75 GHz and 17.2 -

17.3 GHz. As noted above, the ITU-R did not examine the 9 975 - 10 025 MHz band nor the 24.05 - 24.25 GHz band and was unable to reach a conclusion regarding the 3 100 - 3 300 MHz band, the 5 150 - 5 250 MHz band and the 5 460 - 5 470 MHz band. In order to ensure compatibility, sensor designs need to respect the interference criteria established for radiolocation systems in the frequency range between 1 and 10 GHz and to select design parameters to mitigate potential interference from terrestrial radars to the sensors. Future sensor designs for the 13.4 - 13.75 GHz band need to stay within the envelope of parameters given in draft new Recommendation ITU-R [7/116-8/93].

5.5.2.1 1 215 - 1 300 MHz band

Synthetic aperture radar is the only type of spaceborne sensor that has been identified to operate in the 1 215-1 300 MHz band.

Operational experience of 1 215 - 1 300 MHz SARs on SEASAT, SIR-C and JERS-1 supports the existence of compatibility with respect to interference to and from terrestrial radars.

Sharing with other than Air Route Surveillance Radars (ARSR) appears to be feasible if sensors operating in frequency bands 1-10 GHz are designed to mitigate potential interference to terrestrial radars by appropriate selection of parameters. Draft new Recommendation ITU-R [Doc. 7/98-8/47] pertains to the selection of emission characteristics of active spaceborne sensors to mitigate this interference potential.

CCIR Report 695-2 (1986) concludes that there is compatibility between active spaceborne sensors in this band and older models of ARSRs, which are still in operation.

Compatibility tests have been conducted between simulated SAR signals and a state-of-the-art ARSR. The results show that degradation of the ARSR performance was just detectable when the interference-to-noise (I/N) ratio is approximately +35 dB for the case where there was no on-tune rejection (OTR) of the SAR signal. When OTR was present there was a corresponding increase in the I/N that could be accommodated before degradation of the ARSR performance was observed. There was no noticeable increase in false targets associated with the presence of SAR signals in any of the tests.

A simulation of about 200 orbits of a spaceborne SAR was performed. Since the 1 215 - 1 300 MHz band is heavily used by terrestrial radars and a particular radar is subject to interference from other terrestrial radars, interference criteria for interference from SARs were established based on an I/N of +26 dB not to be exceeded for longer than 12 seconds. It was found that the ARSR interference criteria were not exceeded. SARs of the type studied can therefore be considered compatible with respect to interference to ARSRs in the 1 215 - 1 300 MHz band.

Studies indicate that sharing between the radionavigation-satellite service and spaceborne radars in the 1 215 - 1 260 MHz band is possible. Test results show that the unwanted signals from a spaceborne SAR such as SIR-C will have a negligible effect on reception of GPS signals for both acquisition and tracking phases, even taking into consideration GPS antenna gain differentials and the possible inclusion of a new GPS L5 frequency into this band. Analysis results show that while a single SAR may be compatible with GLONASS receivers, four or more spaceborne SARs, each with duty cycles of about 5%, and visible to a GLONASS receiver could cause unacceptable interference due to the aggregate duty cycle of the interfering signals. Given the small number of spaceborne SARs likely to be in orbit at the same time, and also given the likely diversity in orbital characteristics of the spaceborne SARs, the probability is negligibly small that four spaceborne SAR mainbeams would illuminate a GLONASS receiver at the same time. Further, two or more SARs

would never simultaneously observe the same scene because the resulting mutual interference would preclude acquisition of usable data.

It can be concluded that spaceborne sensors and radiolocation systems of the types studied are compatible in the 1 215 - 1 300 MHz band based on the information available. It can be further concluded that spaceborne sensors and existing radionavigation-satellite systems are compatible in the 1 215 - 1 260 MHz band. RR S 4.10 applies to the radionavigation satellite service in this band.

Sufficient frequency separation between wind profiler radars and spaceborne SARs is recommended since co-frequency sharing between the two is not feasible in the band 1215-1300 MHz.

5.5.2.2 3 100 - 3 300 MHz band

Synthetic aperture radars, scatterometers and altimeters are potential sensors that could use the 3100-3300 MHz band. To date, one synthetic aperture radar has operated occasionally in the band since 1991.

Based on the results of analyses, altimeters like the one studied are compatible with terrestrial airborne radars. A scatterometer or SAR with the characteristics studied may cause lengthy periods of unacceptable degradation in the performance of the terrestrial airborne radars. However, it has been identified that the situation can be considerably improved through selection of the spaceborne sensor characteristics such that compatibility should be feasible. Draft New Recommendation ITU-R [Doc. 7/98-8/43] addresses the selection of emission characteristics with the goal of improving the compatibility situation with terrestrial radars.

Analyses showed that land and airborne radiolocation systems would not cause interference to spaceborne sensors in excess of their interference and availability criteria.

Analyses of the compatibility between active spaceborne sensors and shipborne radars based on simulations and probabilistic analyses, while concluding that the sensors would not cause interference to the shipborne radars, obtained conflicting results with regard to compatibility with respect to interference into the spaceborne sensors. It was therefore not possible to conclude that there would be compatibility between shipborne radars and spaceborne sensors. The differing results are thought to be attributed to the difficulty in modelling of the extremely complex and dynamic shipborne radar beam positioning patterns together with the dynamics of the spaceborne sensor antenna scans of all three types of sensors but in particular the image forming SAR. Because of the ubiquitous nature of these shipborne radars, and their high duty ratio, high power and upward directed antenna scans, it is possible that there could be significant and unrecoverable periods of harmful interference to spaceborne sensors. Thus, it cannot be positively concluded that there is compatibility between these spaceborne active sensors and terrestrial systems. In accordance with S.5.149, administrations are urged to take all practicable steps to protect the radio astronomy service from harmful interference.

5.5.2.3 5 250 - 5 350 MHz band

Synthetic aperture radars, altimeters and scatterometers are the types of spaceborne sensors that can use the 5 250-5 350 MHz band. All three types have operated in this frequency band beginning in 1991 and continue to operate at the present date. Operational experience has resulted in no reports of interference.

Interference criteria were developed for terrestrial radars operating in this band and simulations of 1200 orbits of each of the three types of sensors were performed using known or postulated sensor characteristics. It was found that the altimeter produced a low enough occurrence of interference events to be considered compatible. The characteristics of both the synthetic aperture radar and the

scatterometer produced an unacceptable number of interference events. However, another analysis showed that the synthetic aperture radar design characteristics can be modified to eliminate the potential interference. The scatterometer that was considered has a high transmit power which can be readily reduced to insure compatibility with the terrestrial radars. No processing gain was assumed for the terrestrial radars although it is known that integrator and digital processing modes used in many terrestrial radars will have a mitigating effect on interference.

Simulations to determine interference to active spaceborne sensors from terrestrial radars, taking on-tune rejection factors and fraction of time coincidence into account, found that the terrestrial radars would not cause unacceptable interference to either synthetic aperture radars, scatterometers or altimeters.

It can be concluded that active spaceborne sensors and radiolocation systems are compatible in the 5250-5350 MHz band provided that spaceborne synthetic aperture radars and scatterometer design parameters are selected to satisfy the terrestrial radar interference criteria. Spaceborne sensor mission objectives can be satisfied while meeting these criteria.

5.5.2.4 5 150 - 5 250 and 5 350 - 5 470 MHz

A need has been identified to expand the bandwidth available for altimeters in the 5250-5350 MHz band from 100 MHz to 320 MHz in order to satisfy a requirement for height measurements with a standard deviation of 1 to 2.5 cm. It has also been identified that the current 100 MHz allocation may not be sufficient to support synthetic aperture radar applications.

Assuming that the characteristics for radiolocation systems in the band 5 350 - 5 470 MHz would be similar to those in the band 5 250 - 5 350 MHz, the conclusion that active spaceborne sensors and radiolocation systems are compatible, provided that spaceborne synthetic aperture radar design parameters are selected to satisfy the terrestrial radar interference criteria, would also apply to these bands.

An analysis assessing potential interference from spaceborne altimeters into airborne weather radars operating in the aeronautical radionavigation service in the band 5 350 - 5 460 MHz has been performed. The results of this analysis indicate that spaceborne altimeters will not cause undue degradation to the performance of aeronautical radionavigation service systems. An analysis assessing potential interference from airborne weather radars into spaceborne altimeters has been performed and the results indicate that spaceborne altimeters can operate in the presence of emissions from airborne weather radars operating in the aeronautical radionavigation service. Thus, it may be concluded that spaceborne altimeters and aeronautical radionavigation service systems are compatible. An analysis assessing potential interference from spaceborne SARs into airborne weather radars operating in the aeronautical radionavigation service has been performed. The results of this analysis indicate that spaceborne SARs will not cause undue degradation to the performance of the aeronautical radionavigation service systems for the most likely case of side-lobe to side-lobe antenna coupling. The mainbeam to side-lobe coupling event duration is only 0.25 - 0.5 seconds as the spacecraft passes by. An analysis assessing interference from airborne weather radars into spaceborne SARs has been performed and the results indicate that spaceborne SARs can operate in the presence of emissions from airborne weather radars operating in the aeronautical radionavigation service for the likely case of side-lobe to side-lobe coupling. The side-lobe to main-lobe coupling event lasts only 0.25 - 0.5 seconds as the spacecraft passes by. The SAR would point at a specific location no more than every 10 days. Based on the analysis performed, it can be concluded that spaceborne SARs and airborne weather radars are compatible in the 5 350 - 5 460 MHz band. Studies related to the 5 460 - 5 470 MHz band are incomplete.

An analysis has been performed regarding the potential interference into Microwave Landing Systems (MLS) from spaceborne altimeters. The conclusion of the analysis is that spaceborne altimeters will not cause undue degradation to the MLS system used in the analysis. ITU-R has not completed the work needed to determined compatibility between MLS systems and altimeters with respect to interference to the altimeters, nor has work been completed to determine compatibility between aeronautical radionavigation systems and SARs.

It has been concluded that spaceborne altimeters can operate compatibly in the band 5150-5250 MHz with NGSO MSS feeder links of the type studied with respect to interference into the spaceborne altimeter.

5.5.2.4.1 Spectrum sharing in the 5 150-5 250 MHz band between feeder uplinks of NGSO MSS systems and spaceborne active sensors

WRC-95 allocated the frequency band 5150 - 5250 MHz on a primary worldwide basis to the fixed-satellite (Earth-to-space) service, to be used as feeder links of mobile-satellite systems in non-geostationary orbits. Such systems are being planned and implemented in those bands. If WRC-97 finds it appropriate to allocate portions of that feeder-link spectrum also to one or more additional space services, the Radio Regulations should include, as a consequence, regulations to protect those fixed-satellite feeder-link networks from excessive levels of interference from networks of those other space services. Such interference from any one space station should not be a significant percentage of the thermal noise in the feeder link, because interference is expected to come from many sources.

To protect the mobile-satellite feeder-link system explicitly, the maximum level of interference from another space station should be expressed in terms of a power flux-density per metre squared at the interfered-with space station. Because of the nature of the radar-like signals that may be transmitted from space stations operating in the earth exploration-satellite service, it is not appropriate to specify that interference only in terms of a maximum power per metre squared per unit bandwidth. ITU-R Working Party 4A has~~Some ITU-R participants have~~ proposed initial tentative maximum limits such that interference should not exceed 1% of the thermal noise at the feeder-link receiver, and that the pfd at the NGSO MSS satellite should not be greater than -160 dB(W/m^2) in any 4 kHz bandwidth at the interfered-with space station. Some administrations participating in the work of ITU-R Joint Working Party 7-8R ~~Some participants in the work of ITU-R~~ believe that these constraints are overly conservative and may not be appropriate for pulsed interference and that further study would be in order. Determination of ~~at~~ the maximum permissible levels of both longer term or continuous short-term peak interference require further study, taking into account the overall effect of such interference on the processing of user traffic through the mobile-satellite system and its associated feeder uplinks.

Studies of sharing between a particular SAR and NGSO MSS feeder links by some ITU-R participants concluded that sharing would not be feasible in the band 5 150 - 5 250 MHz because of the much higher transmitter power of this radar. Parameters might lead to a different conclusion but such studies have not been carried out.

Based on the information available, ITU-R has not been able to conclude that sharing between spaceborne SARs and NGSO MSS feeder links is feasible. Further study would be necessary to determine SAR parameters and the interference criteria that would permit sharing. It is noted further that Footnote S5.333 does not include the band 5 150-5 250 MHz.

5.5.2.4.2 Sharing between spaceborne active sensors and wireless high speed local area networks

It has been noted that some administrations are considering the use of some parts of the frequency range 5 150 - 5 350 MHz for wireless high speed local area networks applications (for example: Hyperlan, Supernet, NII). Preliminary studies have shown that sharing would be possible between some types of hyperlans and spaceborne altimeters. An analysis of potential interference from wireless high speed local area networks into spaceborne SARs has also been performed. The results indicate that, based on the assumed characteristics of the wireless high speed local area networks (i.e., an e.i.r.p. of -6 dBW toward the sensor, a 1% activity factor and 1% of the transmitters outdoors) spaceborne SARs can operate in the presence of emissions from planned wireless high speed local area networks for densities of deployment higher than those that would cause intra-system interference and thus exceed their own self-limiting density. This conclusion is based on the parameters used in the analysis. Other values could lead to a different conclusion.

5.5.2.5 8550-8650 MHz

Synthetic aperture radars and scatterometers are the types of spaceborne sensors that could use the 8550-8650 MHz band. The available bandwidth is insufficient to be attractive for use of this band by altimeters.

Interference criteria were developed for terrestrial radars operating in this band and simulations of 1500 orbits of each of the two types of sensors were performed using known and postulated sensor characteristics. It was found that the maximum unwanted signal levels were well below the criteria levels.

Simulations to determine interference to active spaceborne sensors from terrestrial radars found that the terrestrial radars would not cause unacceptable interference to either synthetic aperture radars or scatterometers.

It can be concluded that active spaceborne sensors and radiolocation systems are compatible in the 8550-8650 MHz band.

5.5.2.6 9500-9800 MHz band

Synthetic aperture radars, altimeters and scatterometers are the spaceborne sensors that can use the 9500-9800 MHz band. One active spaceborne sensor, X-SAR, of the SIR-C/X-SAR synthetic aperture radar system has operated in this band to date. Operational experience has resulted in no reports of unacceptable interference.

Technical characteristics and interference criteria for terrestrial radars and spaceborne sensors were developed. Analyses of the potential for interference from terrestrial radars into spaceborne sensors have been performed which show that active spaceborne sensors can operate in this frequency band without exceeding their interference criteria due to unwanted signals from terrestrial radars of the type studied.

An analysis of the potential for interference from the spaceborne sensors into terrestrial radars has also been performed. It was noted that in the event of a worst case pass of the spaceborne sensors the signal levels from the sensors would exceed the interference criteria for the terrestrial radars. An analysis of the I/N at the terrestrial radar versus percent of time that the I/N is present supports the opinion that worst case coupling between an active spaceborne sensor and a terrestrial radar is an unlikely event.

Based on these studies, it can be concluded that there is compatibility between active spaceborne sensors and terrestrial radars operating in the 9500-9800 MHz band.

5.5.2.7 9975-10025 MHz band

No requirements or other information was received for the 9975-10025 MHz band and therefore no conclusions can be drawn.

5.5.2.8 13.25-13.4 GHz band

The draft revision of Recommendation ITU-R SA.577-4 [Doc.7/49] identifies a need for a bandwidth of 500 MHz in order to satisfy long-term requirements for precise altimetric measurements from space. Since 13.75-14.0 GHz is no longer viable for use by active sensors because of its allocation to the fixed-satellite service (Earth-to-space) at WARC-92, ITU-R has studied the compatibility of Doppler navigation radars in the 13.25-13.4 GHz aeronautical radionavigation service band and active spaceborne sensors.

Altimeters, scatterometers and precipitation radars are the three types of spaceborne sensors that could use the 13.25-13.4 GHz band and compatibility has been examined between all three types and Doppler navigation radars. No active sensors have operated in the band to date but excellent information is available on the characteristics of sensors in the adjacent 13.4-13.75 GHz band.

Performance and interference criteria were developed for both the spaceborne sensors and the Doppler navigation radars and sharing analyses were performed. It was shown that operation of the sensors will not result in the interference allotment considered for the Doppler navigation radars to be exceeded. A similar conclusion was reached regarding the potential for the Doppler navigation radars to produce interfering signal levels into the sensors that exceed the sensor interference thresholds for more than the permitted percentages of time.

Based on these study results, it can be concluded that spaceborne sensors of the types examined can be operated compatibly along with existing Doppler navigation radars in the frequency band 13.25-13.4 GHz without constraint upon the operations of either systems.

5.5.2.9 13.4 - 13.75 GHz band

Altimeters, scatterometers and precipitation radars are the three types of spaceborne sensors that use the 13.4-13.75 GHz band and compatibility has been examined between all three types and a representative terrestrial radar that operates in the band. The 13.4-14 GHz band has been used intermittently by spaceborne altimeters and scatterometers since 1978. The Tropical Rainfall Measuring Mission (TRMM) will be launched in 1997 and will include a precipitation radar that will operate in this band. Operational experience has resulted in no reports of interference during the 18 years that sensors have used this band.

The compatibility between spaceborne sensors and terrestrial radars in this band has been established through analyses and compatibility tests. Analysis demonstrated that desensitization of the terrestrial radar would occur too infrequently to be a factor in considerations regarding compatibility. False target effects were examined through testing.

Two series of tests have been completed to determine the potential for interference to terrestrial radars. The first series exposed the terrestrial radar to simulated waveforms of maximum pulse power density from spaceborne altimeters, scatterometers and precipitation radars. The tests demonstrated that the sensors currently in use or planned for launch would not cause undue degradation of the terrestrial radar functions. A second series of tests was conducted to establish limits on spaceborne sensor emissions that would ensure that future sensors would be compatible with terrestrial radars. The test results were used in conjunction with knowledge of terrestrial-radar mission and design to develop comprehensive compatibility criteria. These criteria are contained in Preliminary draft new Recommendation ITU-R [Doc. 7/98-8/47].

The potential for interference to spaceborne sensors was investigated through analysis and simulations which showed that all sensor types can achieve their performance objectives in the presence of a worldwide population of terrestrial radars.

Based on these study results, it can be concluded that current and planned spaceborne sensors and terrestrial radars are compatible in the 13.4 - 13.75 GHz band. Adherence to the criteria contained in draft new Recommendation ITU-R [7/116-8/93] will ensure that future sensors and terrestrial radars will continue to be compatible.

5.5.2.10 17.2-17.3 GHz band

The two types of active spaceborne sensors that could operate in the 17.2-17.3 GHz band are scatterometers and precipitation radars. No spaceborne sensors have operated in the band to date.

Interference criteria were developed for terrestrial radars operating in this band and simulations of 1500 orbits of each of the two types of sensors were performed using postulated sensor characteristics. The criteria were exceeded for a small number of times in 1500 orbits of the scatterometer. The criteria were not exceeded during 1500 orbits of the precipitation radar. The two types of sensors are considered compatible with respect to interference into terrestrial radars based on an assessment of the operational characteristics of the terrestrial radars and the low number of instances when the criteria were exceeded.

Interference criteria were developed for spaceborne scatterometers and precipitation radars. Simulations were performed for periods of 100 days for the scatterometer and 200 days for the precipitation radar to assess whether the sensor criteria were met. The results show that the interference criteria for scatterometers and precipitation radar are met.

It can be concluded that spaceborne active sensors and terrestrial radars are compatible in the 17.2-17.3 GHz band.

5.5.2.11 24.05-24.25 GHz band

ITU-R was informed that there is a continuing requirement for the present allocation in the band 24.05-24.25 GHz. However, no information was submitted that would permit evaluation of compatibility between active spaceborne sensors and terrestrial radars in the band and therefore no conclusion can be drawn.

5.5.2.12 Bands for further study

No conclusion on compatibility between shipborne radars and active spaceborne sensors in the 3 100 - 3 300 MHz band could be reached with respect to interference to the sensors. Further study would be required to determine compatibility.

Further study is necessary to determine compatibility between spaceborne altimeters and SARs with the services, including NGSO feeder uplinks, allocated in the band 5 150 - 5 250 MHz that has been identified as a candidate band to accommodate wider bandwidths for altimeters and SARs than is available in the band 5 250 - 5 350 MHz. Studies related to the 5 460 - 5 470 MHz band are incomplete.

There are no inputs to assess compatibility between space-based active sensors and radiolocation/radionavigation systems in the bands 9 975 - 10 025 MHz and 24.05 - 24.25 GHz.

5.5.3 Methods to satisfy the Agenda Item

Based on the technical and operational studies that have been conducted, WRC-97 can consider establishing common worldwide primary allocations for space-based active sensors operating in the earth exploration-satellite and space research services in the frequency range from 1 to 25 GHz. It has been shown that compatibility exists in the following frequency bands:

1 215 - 1 300 MHz;
5 250 - 5 350 MHz;
5 350 - 5 460 MHz;
8 550 - 8 650 MHz;
9 500 - 9 800 MHz;
13.25 - 13.4 GHz;
13.4 - 13.75 GHz; and
17.2 - 17.3 GHz.

In frequency bands below 10 GHz, the design of space-based active sensors should conform to draft new Recommendation ITU-R [7/98-8/47] in order to ensure compatibility with terrestrial radars.

In the band 13.4 - 13.75 GHz, the design of space-based active sensors should conform to draft new Recommendation ITU-R [7/116-8/93] in order to ensure compatibility with terrestrial radars. It would be appropriate to consider addition of the parameters contained in the Recommendation to Article S21 of the Radio Regulations.

5.5.4 Advantages and disadvantages of the proposed method

Advantages

Adoption of primary allocations for space-based active sensors in the bands where compatibility with radiolocation/radionavigation systems has been established would insure the continued availability of frequency spectrum for the environmental measurements of the Earth that these sensors can provide and that are becoming increasingly vital to the future of mankind.

Use of common frequency bands by space-based active sensors and the radiolocation and radionavigation services serves the objective of efficient use of the frequency spectrum.

Disadvantages

Constraints are necessary for spaceborne active sensors but they do not appear to inhibit the operation of the services.

5.5.5 Regulatory and procedural considerations

In the bands in which compatibility exists, modifications would be necessary to the Table of Frequency Allocations, to No. S5.333 [713], and incorporation of draft new Recommendation ITU-R [7/116-8/93] into Article S21 of the Radio Regulations.

5.6 Agenda Item 1.9.2, Resolution 712, resolves 4

Consideration of "use of existing allocations in the frequency range from 7 to 20 GHz to the earth exploration-satellite, meteorological-satellite, space research and space operations services, with a view to the possibility of establishing common worldwide primary allocations to these services in appropriate bands, taking into account Recommendation **706** (WARC-79)".

5.6.1 7 450 - 7 550 and 7 750 - 7 900 MHz band

5.6.1.1 Technical and operational studies

The meteorological-satellite (MetSat) service has a co-primary allocation in the band 7 450 - 7 550 MHz (space-to-Earth) shared with the fixed-satellite (space-to-Earth), fixed and mobile, except aeronautical mobile, services. This MetSat allocation is planned to be used by non-geostationary-satellite orbit (NGSO) systems. No other suitable bands are available for such systems. Governmental geostationary-satellite orbit (GSO) systems in the fixed-satellite service (FSS) currently use the allocation extensively for the deployment of transportable earth station terminals. The MetSat service has stated unacceptable difficulty in frequency sharing with the fixed-satellite (space-Earth) service. In order to avoid severe operational constraints on the NGSO MetSat systems (No. S22.2), the ITU-R considered moving the MetSat allocation from 7 450 - 7 550 MHz to 7 750 - 7 900 MHz (7 750 - 7 850 MHz is the preferred option). The band 7 750 - 7 900 MHz is presently allocated to the fixed and mobile services. There is currently no space service allocated in this band.

5.6.1.2 Study results concerning sharing in the band 7 750 - 7 900 MHz

An allocation to the MetSat service within the 7 750 - 7 900 MHz band will introduce the need for coordination between fixed service stations and MetSat earth stations. No more than 20 to 40 MetSat earth stations are expected worldwide, with locations at high latitudes to provide more frequent access to the satellites. Moreover, they will be deployed in rural areas with maximum terrain shielding. Separation distances have been calculated, concluding that, under the assumed conditions, no more than 10 to 50 km will be required. Receiving antennas of the MetSat earth stations are expected to have diameters of about 10 m. Initial studies indicated that a limited number of MetSat earth stations should be able to share with FS radio-relay systems, in particular where terrain shielding is employed and stations are located in rural areas.

In addition to radio-relay systems, some countries may also operate electronic news gathering (ENG) systems in the 7 750 - 7 900 MHz band. Antennas of such systems are typically smaller than those of radio-relay systems, which increases the visibility duration. On the other hand, acceptable interference levels are higher, providing a countering effect. Overall, the sharing situation is not expected to be significantly different to that for radio-relay systems.

Operation of fixed receiving stations would be protected from NGSO MetSat transmitting space stations by applying appropriate pfd limits to the MetSat service. The pfd limits given in **Table S21-4** of the Radio Regulations for the 7 250 - 7 750 MHz band are suitable to protect the fixed service in the band 7 750 - 7 900 MHz from NGSO MetSat space stations.

Introduction of GSO MetSat transmitting space stations into the 7 750 - 7 900 MHz band may cause excessive interference to existing fixed service stations since they have been planned and installed on the basis that the band is exclusively allocated to the terrestrial services and no effort has been made to restrict the pointing of the fixed service receiving antennas in the direction of the geostationary-satellite orbit.

Sharing with the mobile service has not been studied in detail because there are no known systems operating in this band. It is assumed that sharing between the MetSat and the mobile service would require separation distances between mobile stations and MetSat earth stations smaller than, or similar to, those required for the fixed service.

5.6.1.3 Methods to satisfy the agenda item

Option A

Allocate a bandwidth of 100 MHz in the band 7 750 - 7 900 MHz, preferably the sub-band 7 750 - 7 850 MHz, to the meteorological-satellite service and suppress, after the new allocation is obtained, the present MetSat allocation in the band 7 450 - 7 550 MHz. Existing systems in the latter band should be allowed to continue their operations until the end of their lifetime. Extend the pfd limits defined in Table S21-4 for the band 7 250 - 7 750 MHz to include the 100 MHz segment in the 7 750 - 7 900 MHz band (preferably 7 750 - 7 850 MHz).

Option B

Allocate a bandwidth of 100 MHz in the band 7 750 - 7 900 MHz, preferably the sub-band 7 750 - 7 850 MHz, to the meteorological-satellite service with a restriction to non-geostationary satellites and modify the existing MetSat allocation in the band 7 450 - 7 550 MHz for GSO MetSat systems only. Existing NGSO systems in the latter band should be allowed to continue their operations until the end of their lifetime. Extend the pfd limits defined in Table S21-4 for the band 7 250 - 7 750 MHz to include the 100 MHz segment in the 7 750 - 7 900 MHz band (preferably 7 750 - 7 850 MHz).

Option C

Make no change to the existing Table of Frequency Allocations.

5.6.1.4 Advantages and disadvantages

Option A

Advantages

1) Will facilitate future NGSO MetSat operations by avoiding coordination problems with GSO FSS systems in the 7 450 - 7 550 MHz band.

2) No further need for coordination between the fixed service and MetSat service in the band 7 450 MHz - 7 550 MHz.

Disadvantages

1) Introduces requirements for coordination and the possibility of exclusion zones for fixed links in the 100 MHz segment in the band 7 750 - 7 900 MHz.

2) Possible need for replanning/redesign of existing fixed networks to mitigate the possible increase in long-term interference if GSO MetSats are introduced into the band 7 750 - 7 900 MHz. A transition period before deployment of new GSO MetSats may ease the replanning necessary for the fixed service.

Option B

Advantages

1) Will facilitate future NGSO MetSat operations by avoiding coordination problems with GSO FSS systems in the 7 450 - 7 550 MHz band.

2) No further need for coordination between the fixed service and NGSO stations in the MetSat service in the band 7 450 - 7 550 MHz.

Disadvantages

Introduces requirements for coordination and the possibility of exclusion zones for fixed links in the band 7 450 - 7 550 as well as in the band 7 750 - 7 900 MHz.

Option C

Advantages

1) No coordination requirement to impose constraints on the current and future development of the fixed service in the band 7 750 - 7 900 MHz.

2) No satellite interference to existing fixed systems in the band 7 750 - 7 900 MHz.

3) Assures continued availability of access for the fixed service in the band 7 750 - 7 900 MHz as investment in such systems increases.

Disadvantages

1) Continues the need for NGSO MetSat to coordinate with GSO FSS systems in the 7 450 - 7 550 MHz band.

2) Continued operational constraints to comply with No. **S22.2** with respect to the fixed-satellite service in the band 7 450 - 7 550 MHz.

5.6.1.5 Regulatory and procedural considerations

The pfd limits applicable to the band 7 250 - 7 750 MHz should be adopted for the 100 MHz segment in the band 7 750 - 7 900 MHz. Suitable coordination parameters for inclusion in Appendix 28 to the Radio Regulations have been defined by the ITU-R. A minimum receive earth station antenna size or other antenna suitable measures may need to be identified to facilitate sharing with the fixed service.

5.6.2 7 145 - 7 235 MHz band

5.6.2.1 Technical and operational studies

NOTE - These allocations are used to provide telecommand links for scientific spacecraft with associated telemetry links in the 8.4 - 8.5 GHz band.

This band is allocated to the fixed and mobile services. It is used by the fixed service for a variety of medium and low capacity applications. **No**. **S5.460** additionally allocates the band 7 145 - 7 235 MHz to the space research service (Earth-to-space), with a portion restricted to deep space. The use of this footnote allocation is subject to agreement obtained under Article **14**/**No. S9.21.**

5.6.2.2 Analysis of the results of studies

Seventeen years of operational experience with Earth-to-space links in the frequency band 7 145 - 7 235 MHz has produced no known record of interference with other allocated services. Therefore, it may be appropriate to provide a worldwide primary status in the band 7 145 - 7 235 MHz, by removing the need for Article **14/No. S9.21** coordination associated with the **No. S5.460** allocation while maintaining the restriction to deep space in the part of band 7 145 - 7 190 MHz. Before any reallocation can be considered, there will need to be studies on the suitability of power limits in **Article S21** to ensure compatibility between the space research service and the fixed and mobile services. The limits in **Article S21** could be used on a provisional basis until the ITU-R completes studies on this matter. In addition, suitable coordination distance parameters need to be identified.

5.6.2.3 Methods to satisfy the Agenda item

Option A

Move the existing allocations in the band 7 145 - 7 235 MHz, as given in **No. S5.460,** into the Table and remove the need for Article **14/No. S9.21** coordination. The band 7 145 - 7 235 MHz would be allocated to the space research service (Earth-to-space) and the 7 145 - 7 190 MHz band segment would be restricted to deep space activities. No emissions to deep space shall be effected in the band 7 190 - 7 235 MHz.

Option B

No change to the existing allocations.

5.6.2.4 Advantages and disadvantages

Option A

Advantages

1) Provides equal allocation status for space research telecommand links, on a worldwide basis, with the associated telemetry links.

2) Assures continued availability of access to these bands as investment in systems increases worldwide.

Disadvantages

Requires coordination between fixed stations and space research earth stations.

Option B

Advantages

Retains the status quo for the fixed and mobile services.

Disadvantages

1) Provides unequal allocation status, and therefore no protection, for telecommand links initially, until successfully coordinated under Article 14/No. S9.21.

2) Continues heavy burden of coordination process for administrations making use of these allocations (Article **S9** (Articles 11 and 14)).

5.6.2.5 Regulatory and procedural considerations

Regulatory considerations seem to be limited to the practical question of how best to modify the Radio Regulations to effect these changes. It shall be noted that no avoidance of the GSO will be required from the fixed service and No. S21.3 will continue to apply in the band 7 145 - 7 235 MHz.

5.6.3 8 025 - 8 400 MHz band

5.6.3.1 Summary of technical studies

In the band 8 025 - 8 400 MHz, the fixed service has a primary allocation in all three ITU Regions while the EES service allocation is not homogeneous (primary basis in Region 2 and secondary basis in Regions 1 and 3). The fixed-satellite service (Earth-to-space) and the mobile service are allocated in 8 025 - 8 400 MHz on a primary basis in all Regions and the meteorological-satellite service (Earth-to-space) is allocated in the band 8 175 - 8 215 MHz on a primary basis in all Regions. Also, No. S5.464 provides that the band may be used by the EES service on a primary basis in 25 Region 1 and 3 countries subject to agreement obtained under No. S9.21. Further, No. S5.462 stipulates that the pfd limits in Table S.21-4 apply to the EES service in Regions 1 and 3.

The 8 025 - 8 400 MHz band is the only band allocated for EES service which is presently both technically and economically feasible for transmission of wideband data from earth exploration satellites directly to ground. Because the EES service does not have a primary allocation in Regions 1 and 3 it may be disrupted by the introduction of fixed service transmitters near EES earth stations even after successful implementation of earth stations in an interference-free environment. This possibility is not condusive to the reliable provision of services by either commercial or governmental operators.

The ITU-R has studied the feasibility of sharing between the earth exploration-satellite service and other services which are allocated in the band.

5.6.3.2 Study results

Draft new Recommendation ITU-R SA.[7/14] concludes that sharing is feasible between the EES service and other services allocated in this band.

5.6.3.2.1 Sharing between EES service and FSS or MetSat services

Limiting the power flux-density of EES space station transmissions, in accordance with No. S22.5 (2631), ensures that these stations will not interfere with the FSS and MetSat receiving space stations. Application of the methodology described in Annexes 1 and 2 of the draft new Recommendation ITU-R SA.[7/14] yields reasonable figures for required separation distances[1] between EES receiving earth stations and FSS or MetSat transmitting earth stations.

5.6.3.2.2 Sharing between EES service and fixed or mobile services

The power flux-density limits contained in No. S5.462 are designed to prevent interference to fixed or mobile receiving terrestrial stations.

Study results have shown that the fractional degradation in performance (FDP) is in compliance with Recommendation ITU-R F.1108.

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[1] Separation distances refer to the distance that could be achieved in coordination.

Application of the methodology described in Annexes 1 and 2 of the draft new Recommendation ITU-R SA.[7/14] yields separation distances ranging from less than 1 km to somewhat greater than 50 km between EES receiving earth stations and fixed or mobile transmitting terrestrial stations. The calculation of the attenuation over the interference path is based on an average case. The separation distances may be larger in the absence of obstacles.

An upgrade of the EES allocation to primary would necessitate coordination between EES earth stations and the fixed service in Regions 1 and 3. It can be noted that worldwide coordination is currently required in the 8 025 - 8 400 MHz band between the fixed service and earth stations in the primary fixed-satellite and meteorological-satellite services as well as with the earth exploration-satellite service in Region 2 and in those Regions 1 and 3 countries where No. S9.21 has been successfully applied. The coordination problem will be minimized if, as expected, there is a limited number of EES earth stations and if interference mitigation techniques such as terrain shielding are applied. Operational experience has not shown any interference, however studies have not addressed compatibility with television outside broadcast applications used by some countries.

5.6.3.3 Methods to satisfy the agenda item

Option A

Extend the primary allocation to the EES service in Region 2 in the 8 025 - 8 400 MHz band to all three Regions.

Option B

Make no change to the existing Table of Frequency Allocations.

5.6.3.4 Advantages and disadvantages of the proposed method

Option A

Advantages

Provision of a common worldwide primary allocation to the earth exploration-satellite service (space-to-Earth) in the 8 025 - 8 400 MHz band would provide the stability needed to the continued acquisition of environmental data collected by earth exploration satellites and transmitted to receiving earth stations.

Disadvantages

Some additional coordination would be required on the part of the fixed service in the event that a primary allocation is given to the EES service in Regions 1 and 3, which may under certain circumstances reduce the room for further growth of the fixed service in this band and restrict the deployment flexibility. However, coordination between the fixed service and the EES service has proven feasible in Region 2 as well as in those countries of Regions 1 and 3 where No. S9.21 has been applied.

Option B

Advantages

No additional coordination on the part of the fixed service would be required.

Disadvantages

Not providing a worldwide primary allocation for the EES would leave uninterrupted acquisition of environmental data on a worldwide scale in jeopardy.

5.6.3.5 Regulatory and procedural considerations

Provisions of Nos. S5.462 and S22.5 as well as those of Appendix S7 should be applied.

5.6.4 12.75 - 13.25 GHz and 16.6 - 17.1 GHz bands

5.6.4.1 12.75 - 13.25 GHz

5.6.4.1.1 Technical and operational studies

The fixed, mobile and fixed-satellite service have primary allocations in the 12.75 - 13.25 GHz band. The operation of FSS stations in this band is subject to the provisions of Appendix 30B. The secondary allocation at 12.75 - 13.25 GHz to the space research service (space-to-Earth) is currently constrained for use only by deep space missions. Technology development indicates that deep space systems will not use these in the foreseeable future. Meanwhile near-Earth space research systems have requirements which cannot be satisfied in the existing allocated bands.

5.6.4.1.2 Analysis of the results of studies

No studies have yet been conducted into the effects on the fixed and fixed-satellite service of suppressing the restriction to deep space associated with the space research allocations. A change in allocation status would introduce the need for links of other services to coordinate with stations of the space research service. Removal of the deep space restriction would introduce the risk of interference between transmissions in the space research service and those of other services. Before any change to the allocation status is made, studies must be carried out to assess the impact on other services.

5.6.4.1.3 Methods to satisfy the agenda item

Option A: Modify status of existing allocation to primary, worldwide, not restricted to deep space.

Option B: Make no modifications.

5.6.4.1.4 Advantages and disadvantages

Option A

Advantages

1) removal of deep space restriction resolves a shortfall in available frequency spectrum in the 10 - 20 GHz range for near-Earth space research activities;

2) enhances flexibility of limited space research spectrum in this region of the frequency spectrum;

3) assures continuity of availability to access these bands as investment in systems increases worldwide.

Disadvantages

1) Introduces additional requirements for coordination of FSS stations in this band.

1*bis*) Introduces requirements for coordination for fixed links in this band which is extensively used by the fixed service, primarily in regional and local networks.

2) Introduces risk of interference between existing and planned services from space research transmissions.

Option B

Advantages

1) No requirement to impose constraints on the current and future development of the existing services.
2) No interference to existing services.
3) Assures continuity of availability for the existing services to access these bands as investment in systems increases.

Disadvantages

The allocations would continue to be unused by the space research service, because deep space systems are being developed in frequency bands outside the range 10 - 20 GHz.

5.6.4.2 16.6 - 17.1 GHz bands

5.6.4.2.1 Technical and operational studies

The secondary allocation at 16.6 - 17.1 GHz to the space research service (Earth-to-space) is currently constrained for use only by deep-space missions. Technology development indicates that deep-space systems will not use these in the foreseeable future. Meanwhile near-Earth space research Earth-to-space systems have requirements which cannot be satisfied in the existing allocated bands.

NOTE - This modification should not affect the use of this band by other currently allocated services.

5.6.4.2.2 Analysis of the results of studies

This frequency band is allocated to the radiolocation service on a primary basis. Sharing with a limited number of Earth-to-space transmitting earth stations is considered to be feasible, as demonstrated in other bands. It may be appropriate to consider suppressing the restriction to deep space associated with this space research Earth-to-space allocation, thus making it available for use by near-Earth space research systems. The allocation could also be considered for an improvement in status to make it primary on a worldwide basis. Before any changes to the allocation status are made, studies must be carried out to assess the impact on radiolocation service systems.

5.6.4.2.3 Methods to satisfy the agenda item

Option A: Modify status of existing allocation to primary, worldwide, not restricted to deep space.

Option B: Make no modifications.

5.6.4.2.4 Advantages and disadvantages

Option A

Advantages

1) resolves a shortfall in available uplink (Earth-to-space) frequency spectrum in the 10 - 20 GHz range for near-Earth space research activities;
2) enhances flexibility and efficient use of limited space research spectrum in this region of the frequency spectrum;

3) assures continued availability of access to these bands as investment in systems increases worldwide.

Disadvantages

None known at this time.

Option B

Advantages

None known at this time.

Disadvantages

The allocations would continue to be unused, because deep-space systems are being developed in frequency bands outside the range 10 - 20 GHz.

5.6.4.2.5 Regulatory and procedural considerations

Regulatory considerations seem to be limited to the practical question of how best to modify the Radio Regulations to effect these changes and ensuring protection to the radiolocation service.

5.6.5 18.6 - 18.8 GHz

5.6.5.1 Summary of technical and operational studies

The band 18.6 - 18.8 GHz is allocated to the EES (passive) and SR (passive) services on a primary basis in Region 2 and on a secondary basis in Regions 1 and 3. The FS, the mobile service and the FSS (space-to-Earth) are allocated worldwide on a primary basis. Footnotes **S5.522** and **S5.523** request administrations to limit the power of fixed-service transmitters and the pfd produced by FSS space stations as far as possible in order to reduce the risk of interference to passive sensors. Simultaneous measurements in several different frequency bands are required to isolate the values of any one surface phenomenon (such as rain or ocean wind speed). Measurements in the 18.6 - 18.8 GHz band are essential because the band has unique characteristics that are important to obtaining measurements of environmental conditions on the Earth's land and ocean surfaces. This band is also essential to the FSS and FS for telecommunications applications.

A number of studies have been carried out by various administrations leading to the following Recommendations and Reports:

1) Recommendation ITU-R SA.515 identifies bands and bandwidths for spaceborne passive sensors;

2) Recommendation ITU-R SA.1028 contains performance criteria for sensors;

3) Recommendation ITU-R SA.1029 provides interference criteria;

4) CCIR Report 850 (Volume II, 1990) examines sharing between passive sensors at 18.6 - 18.8 GHz and the FS and FSS;

5) Recommendation ITU-R 761 recommends that in the band 18.6 - 18.8 GHz administrations should, as far as possible, endeavour to limit the power delivered into the antenna and the e.i.r.p. of fixed-service transmitters.

5.6.5.2 Analysis of the results of studies

5.6.5.2.1 Sharing between EESS (passive) and the FSS

Studies have determined that passive spaceborne sensors and FSS networks operating at the pfd limit in the Radio Regulations would not be compatible.

One study has shown that a pfd limit of -101 dBW/m^2 in a reference bandwidth of 200 MHz would be necessary to enable passive sensors to meet their interference criterion of -155 dBW in a reference bandwidth of 100 MHz (ITU-R Recommendation SA.1029). With this pfd limit, sensor data could be obtained when the sensor moves away from the Equator where the angle between the specular direction of the reflected FSS signal and the sensor antenna is greatest.

This pfd value is 19 dB lower than the current limit although it would be averaged over a bandwidth of 200 MHz rather than a bandwidth of 1 MHz. Some specific planned FSS systems would be compatible with this value but other planned systems are not and the FSS operators are concerned about the potential impact on their services.

The CPM was not able to agree on a suitable pfd limit. Further experience may show that a suitable limit can be developed and studies by the Rapporteur's Group should continue with a view to studying a less stringent pfd value which would be mutually acceptable to FSS and EESS operators. Urgent studies are required.

5.6.5.2.2 Sharing between EESS (passive) and the fixed service

One study directly submitted to CPM-97 concluded that a limit of -3 dBW on the power in the 18.6 - 18.8 GHz band delivered to an antenna of an FS station with a -10 dBi backlobe gain would enable sharing between passive sensors and the FS. Not all administrations agree with this conclusion because another study presented in WP 9D, WP 7C and the ITU-R Rapporteur Group concluded that the FS would cause excessive interference to sensors.

Both studies agree that the sensors will experience excessive interference when an FS transmitting station is within the sensor antenna 3 dB footprint. A loss of some areas where sensor data is unavailable is anticipated and is covered by a sensor data availability criterion of 99% of the Earth's surface.

The contradictory conclusions of studies result in large part because of different assumptions regarding the distribution of FS stations and the physical horizon about the FS station.

The sensor community is confident that its interference criteria will be met if the limits on transmitter power and antenna maximum backlobe gain given above are adopted and will accept any uncertainty resulting from deployment of FS networks that do not conform with the assumptions about the spatial distributions of the FS transmitters.

5.6.5.3 Methods to satisfy the agenda item

Option A - WRC-97 could consider establishing common worldwide primary allocations for the earth exploration-satellite (passive) and space research (passive) services. If this option is selected it would also be necessary to limit the power flux-density produced by a fixed-satellite system at the Earth's surface in a reference bandwidth of 200 MHz to a lower value than currently permitted by the Radio Regulations. It would also be necessary to limit the power delivered to the antenna of a fixed-service station and the backlobe gain of the antenna within the 18.6 - 18.8 GHz band.

Option B - WRC-97 could decide to maintain the allocations in the 18.6 - 18.8 GHz band without change.

5.6.5.4 Advantages and disadvantages of the proposed methods

Option A - Advantages

A primary worldwide allocation for EESS would improve the possibility of obtaining critical environmental measurements on a worldwide basis.

Option A - Disadvantages

Constraints on the characteristics of FSS and FS systems would be required.

Option B - Advantages

No additional constraints on the FS and FSS services would be required.

Option B - Disadvantages

The ability to use the 18.6 - 18.8 GHz band for worldwide spaceborne passive sensor measurements will be compromised without adoption of worldwide constraints on the characteristics of FSS and FS systems.

5.7 Agenda Item 1.9.2, Resolution 712 (Rev. WRC-95), resolves 5

Consideration of "provision of up to 500 MHz of frequency spectrum around 35 GHz and up to 1 GHz of frequency spectrum around 95 GHz for use by space-based active Earth sensors".

5.7.1 Summary of technical and operational studies

The frequency band 33.4 - 36 GHz is allocated on a primary basis to the radiolocation service. The subband 34.2 - 34.7 GHz is also allocated to the space research (Earth-to-space) (deep space service) service on a primary basis. The subband 34.7 - 35.2 GHz is also allocated to space research on a secondary basis. The subband 35.2 - 36 GHz is also allocated to the meteorological aids service on a primary basis. Radars located on spacecraft may be operated on a primary basis in the band 35.5-35.6 GHz (No. S5.551 [897]).

The frequency band 92 - 95 GHz is allocated on a primary basis to the fixed, fixed-satellite, mobile and radiolocation services. There is no allocation in this band to active spaceborne sensors.

A number of studies have been carried out by various administrations leading to the following Recommendations and Reports:

Recommendation ITU-R SA.577 contains preferred frequencies and necessary bandwidths for spaceborne active remote sensors.

Recommendation ITU-R SA.1166 contains the performance and interference criteria for active spaceborne sensors.

Draft New Recommendation ITU-R SA. [7/44] addresses the feasibility of sharing between spaceborne cloud radars and other services in the range of 92 - 95 GHz.

5.7.2 Analysis of the results of studies

5.7.2.1 Bandwidth for active sensors and compatibility between active sensors and radiolocation systems in the band 33.4 - 36 GHz

Recommendation ITU-R SA.577, as well as other studies conducted in ITU-R, confirm that a bandwidth of 500 MHz for active sensors will meet the long-term requirements for wideband altimetry.

ITU-R concludes that there is compatibility between active spaceborne sensors and radiolocation systems for the known active sensors and radiolocation systems in this band.

5.7.2.2 Active sensor requirements for an allocation in the 92 - 95 GHz band

Recommendation ITU-R SA.577 establishes requirements for spaceborne cloud radar measurements in this frequency range. The existing allocation at 78 - 79 GHz does not fully satisfy mission requirements.

5.7.2.3 Feasibility of sharing in the 92 - 95 GHz band

ITU-R concludes that compatibility between active spaceborne sensors and radiolocation systems in this band is feasible.

Draft New Recommendation ITU-R SA. [7/44] concludes that spaceborne cloud radars and the fixed and mobile services should not share common frequency bands in order to protect fixed and mobile operations. Further, spaceborne cloud radars and the fixed-satellite service should not share common frequency bands due to excessive interference to the spaceborne cloud radar. Sufficient techniques should be employed in the spaceborne radar to meet the harmful interference criterion of -222 dB(W/m^2 Hz) given in ITU-R Recommendation RA.769 in order to protect radio astronomy observations in the band 86 - 92 GHz.

The provision of a bandwidth as wide as 1 GHz of frequency spectrum around 95 GHz for use by space-based active Earth sensors would be of great concern to the radio astronomy (RA) service because of the potential detrimental impact on the operation of existing and future 3-mm radio astronomy observations.

As pointed out in No. S5.149 [533], "Emissions from spaceborne or airborne stations can be particularly serious sources of interference to the radio astronomy service."

The impact of emissions of a spaceborne cloud radar on radioastronomy observations has been analyzed. In the event of co-frequency operation, there is the possibility of irreversible damage to the radio astronomy receiver in the unlikely event of mainbeam-to-mainbeam coupling between the radio astronomy antenna and the cloud radar antenna. There is also the possibility of saturation of the radio astronomy receiver in the event of coupling between the mainbeam of the radio astronomy antenna and the side lobes of the cloud radar antenna. The power received by a radio astronomy receiver would exceed the levels desired by the radio astronomy service for continuum observations whenever the cloud radar is above elevation angles of 15 degrees if the radio astronomy receiver is tuned to within a limited frequency range near the centre frequency of the cloud radar. Radio astronomers assert that current technology limits the ability to construct notch filters that could be inserted in their receivers to reject the unwanted emissions. Several methods have been identified that can mitigate the potential impact to radio astronomy observations: 1) satellite ephemeri can be provided to radio astronomy observatories; 2) active sensor operators could turn off the satellite transmitter when in the vicinity of a limited number of radio astronomy observatories; 3) interference cancelling techniques can be employed at radio astronomy sites; and 4) notch filters can

be utilized when available. In summary, technical and operational measures can be employed to provide compatibility between spaceborne cloud radars and radio astronomy.

5.7.3 Methods to satisfy the Agenda Item

5.7.3.1 Possible solution to provision of up to 500 MHz of frequency spectrum around 35 GHz for use by space-based active Earth sensors

Modify and extend the existing primary allocation to radars located on spacecraft in the band 35.5 - 35.6 GHz by making primary allocations to the Earth exploration-satellite (active) and space research (active) services and expanding the bandwidth of the allocations to 500 MHz.

Noting that the fixed and mobile services are also allocated on a primary basis by footnote to a number of administrations in Regions 1 and 3 in the band 33.4 - 36 GHz, and that WRC-97 will consider the identification of suitable frequency bands above 30 GHz for use by the fixed service for high-density applications under agenda item 1.9.6, selection of an alternative 500 MHz band in the range of 33.4 - 36 GHz may also be considered.

5.7.3.2 Possible solution to provision of frequency spectrum around 95 GHz for use by space-based active Earth sensors

Initially it was considered to move the existing 1 GHz primary allocation for spaceborne active sensors from the band 78 - 79 GHz to the range 92 - 95 GHz.

With due regard to the importance that radio astronomers place on observations in the range of 92 - 95 GHz, an allocation of a 100 MHz wide band only can be considered in the 92 - 95 GHz band if coupled with retention of the primary allocation at 78 - 79 GHz for spaceborne active sensors. The allocation in 92 - 95 GHz could then be limited to use by spaceborne cloud radars since the lower band is suitable for use by active spaceborne sensors other than cloud radars. The allocation in the 92-95 GHz range would preferably be made in the upper part of the band, possibly 94 - 94.1 GHz which appears to have relatively few spectral lines in order to ensure protection of radio astronomy observations in the 86 - 92 GHz band.

In conjunction with the above, remove the fixed, mobile and fixed-satellite services from the 100 MHz wideband provided for use by spaceborne cloud radars.

5.7.4 Advantages and disadvantages of the proposed method

5.7.4.1 Proposed modification of allocations in the frequency band 33.4 - 36 GHz

Advantages

The requirements for frequency spectrum to carry out wideband altimetry to provide important environmental data could be satisfied.

Disadvantages

None have been identified.

5.7.4.2 Proposed realignment of allocations in the 92 - 95 GHz band

Advantages

The requirements for frequency spectrum to determine the vertical profile of clouds and their global distribution using spaceborne cloud radars, very important for determination of the Earth's radiation budget and thereby predictions of global warming, could be satisfied.

The possibility of interference to and from spaceborne cloud radars and the fixed, mobile and fixed-satellite services could be eliminated.

The existing base of experimental data at 95 GHz would continue to be applicable.

Disadvantages

The proposed deletion of fixed, mobile and fixed-satellite services from a 100 MHz wide band near 95 GHz could necessitate replanning of systems in these services.

The total bandwidth allocated to the fixed, mobile and fixed-satellite services within the 92 - 95 GHz region of the spectrum would be reduced by 100 MHz.

Adoption of technical and operational measures may be needed to ensure compatibility between spaceborne cloud radar and radio astronomy operations.

5.8 Agenda Item 1.9.4.1

To consider "allocation of frequency bands above 50 GHz to the Earth exploration-satellite (passive) service".

5.8.1 Summary of technical and operational studies

A number of studies have been carried out by various administrations leading to the following Recommendations:

Draft revised Recommendation ITU-R SA.515-2 [Document 7/28] contains the frequency bands and the associated bandwidths necessary for passive sensing of properties of the Earth's land, oceans and atmosphere including bands above 50 GHz;

Draft revised Recommendation ITU-R SA.1028 [Document 7/25 (Rev.1)] contains performance criteria for satellite passive remote sensing and stipulates radiometric resolution and viability requirements for the identified preferred frequencies including those above 50 GHz;

Draft revised Recommendation ITU-R SA.1029 [Document 7/54] contains interference criteria for satellite passive remote sensing and establishes permissible interference levels and reference bandwidths for the identified preferred frequencies including those above 50 GHz.

There are ongoing studies regarding sharing between passive spaceborne sensors and other services near 118 GHz and near 183 GHz and identifying additional bands above 50 GHz as candidates for inclusion in the list of preferred frequency bands contained in Draft revised Recommendation ITU-R SA.515-2 [Document 7/28].

5.8.2 Analysis of the results of studies

Based on work to date, it is known that additional frequency bands above 50 GHz are needed to satisfy user requirements for data essential to studies of climate and changes to the Earth's environment. Applications that have been identified include measurement of the Earth's surface and cloud parameters to be used for water vapour profiling, tridimensional sounding of water vapour in

the atmosphere, tridimensional sounding of oxygen from which atmospheric profiles of temperature can be derived and measurement of the amounts of various pollutant gases in the atmosphere.

Only preliminary studies have been performed in a limited number of frequency bands to identify the potential for sharing with other radio services in the bands of interest for passive sensing. Additional study is needed to come to conclusions regarding the feasibility of sharing in the bands where studies have already been initiated and new studies are needed for other frequency bands that have been or may be identified for passive sensor measurements.

5.8.3 Methods to satisfy the Agenda Item

Further work is required to finalize which additional frequency bands are needed and to determine the bandwidths required to perform the passive sensing measurements. Reallocation proposals being addressed under WRC-97 Agenda Item 1.9.4.3 for the 50-70 GHz band should be noted. Amendment of this text for a future WRC to address allocation of frequency bands above 75 GHz should therefore be considered.

5.9 Agenda item 1.9.4.2 EES (space-to-Earth) near 26 GHz

To consider "frequency allocations near 26 GHz to the earth exploration-satellite service (space-to-Earth)".

5.9.1 Summary of technical and operational studies

A number of studies have been carried out by various administrations leading to the following Recommendations:

Recommendation ITU-R SA.1024 (as revised by Document 7/10) contains the necessary bandwidths and preferred frequency bands for data transmission from earth exploration satellites.

Recommendations ITU-R SA.1025 (as revised by Document 7/9) and ITU-R SA.1159 (as revised by Document 7/73) contain performance criteria for space-to-Earth data transmission systems operating in the earth exploration-satellite service.

Recommendations ITU-R SA.1026 (as revised by Document 7/8) and ITU-R SA.1160 (as revised by Document 7/83) contain interference criteria for space-to-Earth data transmission systems operating in the earth exploration-satellite service.

Recommendations ITU-R SA.1027 (as revised by Document 7/75) and ITU-R SA.1161 (as revised by Document 7/84) contain sharing and coordination criteria for space-to-Earth data transmission systems operating in the earth exploration-satellite service.

Draft new Recommendation ITU-R [Document 7/74] addresses the feasibility of sharing between the earth exploration-satellite service (space-to-Earth) and the inter-satellite, fixed and mobile services in the band 25.5 - 27.0 GHz.

Recommendation ITU-R F.1094, Maximum allowable degradation in the error performance and availability of digital radio-relay systems arising from interference caused by emissions and radiation from other sources.

Recommendation ITU-R F.748, Radio-frequency channel arrangements for radio-relay systems operating in the 25, 26, and 28 GHz bands.

Recommendation ITU-R F.1102, Characteristics of radio-relay systems operating in frequency bands above about 17 GHz.

Recommendation ITU-R F.758 (as revised by Document 9/18(Rev.2)), Considerations in the development of criteria for sharing between the terrestrial fixed service and other services.

Recommendation ITU-R F.1108 (as revised by Document 9/93(Rev.1)), Determination of the criteria to protect fixed service receivers from the emissions of space stations operating in non-geostationary orbits in shared frequency bands.

5.9.2 Analysis of results of studies

5.9.2.1 Sharing between the earth exploration-satellite service (space-to-Earth) and the inter-satellite service

Draft new Recommendation ITU-R [Document 7/74] concludes that sharing between transmitting earth exploration satellites and receiving data relay satellites operating in the inter-satellite service near 26 GHz is feasible provided that the earth exploration satellite does not produce a power flux-density greater than -155 dB(W/m^2) in a 1 MHz bandwidth at any location in the geostationary orbit for more than 1% of the time. A more recent study indicates that the 1% criterion applies to the general case where the EESS and the DRS user satellite orbits are random with respect to each other. For the case of co-orbiting EESS and DRS user satellites, the criterion may need to be reduced to 0.1%.

The draft new Recommendation also states that the probability of receiving brief periods of interference from data relay satellites operating in the inter-satellite service is less than 0.1% of the time. This interference is acceptable. Thus, sharing between transmitting satellites operating in the inter-satellite service and receiving earth stations in the earth exploration-satellite service is feasible.

5.9.2.2 Sharing between the earth exploration-satellite service (space-to-Earth) and the fixed and mobile services

Draft new Recommendation ITU-R [Document 7/74] concludes that earth exploration-satellite systems operating in the band 25.5 - 27.0 GHz should be designed to operate within the currently applicable power flux-density limits in the band. These limits are designed to protect the fixed and mobile service systems operating in the band from receiving harmful interference.

A change in allocation of the earth exploration satellite service (space-to-Earth) would introduce a requirement for coordination with fixed links. Draft new Recommendation ITU-R SA.[Document 7/74], which presents a study on interference into EES earth stations, has indicated that separation distances typically in the range from 10 to 20 km would be required to meet the protection criteria of Recommendation ITU-R SA.1027 when some site shielding was assumed. Due to the small number of expected EES earth stations to be deployed worldwide (10 - 40 stations total for the four different planned systems) coordination with fixed and land mobile systems is not expected to put undue constraints on either of the services except in and adjacent to urban, and suburban FS deployment areas. The coordination problem will be minimized if there is a limited number of EES earth stations and if interference mitigation techniques such as terrain shielding are applied. However, studies have indicated that small and low-cost EES stations are in the design stage. Such stations would be unpredictable in terms of number and deployment patterns. To minimize the potential for proliferation of the EES earth stations, restrictions on the EES earth station antenna size may be appropriate. ITU-R should identify a suitable antenna size or other measures that could be undertaken by the EES in order not to constrain the use of the band by administrations deploying fixed service systems.

5.9.3 Methods to satisfy the agenda item

Option A

Upgrade the existing secondary allocation to the earth exploration-satellite service (space-to-Earth) to primary in the band 25.5 - 27.0 GHz.

Option B

Maintain the existing secondary allocation in the band.

5.9.4 Advantages and disadvantages

Option A

Advantages

The upgrade of this allocation will provide a reliable wideband data transfer capability for foreseeable future requirements in the earth exploration-satellite service. Such wideband capability presently exists as a secondary service in the Table of Allocations.

Disadvantages

Coordination constraints would be required on the part of the fixed service in the event that a primary allocation is given to the EES service. This requires close cooperation between the two services, because the wideband EES earth stations reduce the effectiveness of frequency separation, whereas the densely deployed fixed service stations reduce the effectiveness of geographical separation. A small number of EES earth stations would reduce the impact to a small number of FS deployment areas.

Option B

Advantages

1) No coordination of the fixed service with EES earth stations would be required.
2) No requirement to impose constraints on the current and future development of the fixed service.
3) Assured long-term operation and development of the fixed service.

Disadvantages

Not providing a worldwide primary allocation for the EES would make uninterrupted acquisition of high resolution, wideband environmental data on a worldwide scale quite difficult to achieve and may lead to operational constraints.

5.10 Agenda item 1.9.4.3 and Resolution 643

To consider "the existing frequency allocations near 60 GHz and, if necessary, their reallocation, with a view to protecting the Earth exploration-satellite (passive) service systems operating in the unique oxygen absorption frequency range from about 50 GHz to about 70 GHz".

Resolution 643 (WRC-95) instructs the ITU-R to "carry out the necessary studies to identify the bands most suitable for the inter-satellite service in order to enable WRC-97 to make appropriate allocations to that service” in the range 50.2 - 71 GHz.

5.10.1 Summary of technical and operational studies including consideration of Resolution 643

The frequency range under consideration includes allocations to the EESS (passive) and space research (passive) services which are shared on a co-primary basis with terrestrial active services, both fixed and mobile. Also the inter-satellite service has primary allocations in the bands under consideration. Within the frequency range under consideration, sensors on board satellites operating in the two passive services can be collectively described as "spaceborne passive sensors". A number of studies have been carried out by various administrations leading to the following Recommendations:

Recommendation ITU-R SA.515 contains the frequency bands and bandwidths used for satellite passive sensing which includes bands within the range 50.2 - 61.3 GHz.

Recommendation ITU-R SA.1028 contains performance criteria for satellite passive remote sensing.

Recommendation ITU-R SA.1029 contains interference criteria for satellite passive remote sensing.

Draft new Recommendation ITU-R SA.[7/43]* addresses the feasibility of sharing between Earth exploration-satellite service spaceborne passive sensors and inter-satellite links of geostationary and non-geostationary satellite networks near 60 GHz.

Draft new Recommendation ITU-R SA.[7/23] addresses the feasibility of sharing between Earth exploration-satellite service spaceborne passive sensors and fixed services between 50 and 60 GHz.

Draft new Recommendation ITU-R S.[Doc. 4/57]* addresses the feasibility of sharing between Earth exploration satellite service spaceborne passive sensors and inter-satellite links of geostationary satellite networks in the range 50 to 65 GHz.

Draft new Recommendation ITU-R S.[Doc. 4/58] addresses the feasibility of sharing between the ISS and Earth-to-space links in the fixed-satellite service in the band 50.4 - 51.4 GHz.

Draft new Recommendation ITU-R S.[Doc. 4/59] contains requirements and suitable frequency bands for the operation of the inter-satellite service between 50 and 70 GHz.

5.10.2 Analysis of the results of studies

5.10.2.1 Sharing between EESS (passive) and the fixed service

Considering the bands currently shared between the above services, draft new Recommendation ITU-R SA.[7/23] states that sharing is not feasible in the bands 50.2 - 50.4 GHz and 54.25 - 55.2 GHz. Sharing is stated to be feasible in the bands 55.78 - 58.2 GHz. With respect to the band 55.2 - 55.78 GHz, comprehensive studies on sharing possibilities between FS and EESS have shown that sharing could be envisaged under a number of technical conditions. However, it was not

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* Alignment of some fundamental points of difference between draft new Recommendation ITU-R SA.[7/43] and draft new Recommendation [Doc. 4/57] is being carried out and may be accomplished prior to WRC-97.

possible to define practical and efficient procedures to assure that these conditions are fulfilled on a worldwide basis. Consequently, sharing is not considered to be practicable. Furthermore, it is considered to be technically feasible to share the band presently designated as an exclusive passive band, i.e., 58.2 - 59 GHz.

The results of these studies suggest that reallocations will be necessary to ensure that the EESS (passive) service can continue to operate satisfactorily without the need for unacceptable constraints on other services.

5.10.2.2 Sharing between EESS (passive) and the mobile service

Feasibility of sharing between the EESS (passive) and the mobile service is considered similar to the feasibility of sharing between the EESS (passive) and the fixed service. Consequently, realignment of mobile allocations will be needed. As an exception, existing low-density mobile systems operating in Japan in the 54.25 - 55.78 GHz band could continue to operate in their current configuration.

5.10.2.3 Sharing between EESS (passive) and the inter-satellite service

Studies have shown that NGSO ISS networks can cause harmful interference into passive sensors. Thus, reallocation of ISS (NGSO) would be necessary to ensure that both services can operate satisfactorily without unacceptable constraints on the ISS (NGSO). ITU-R also noted four planned or existing NGSO ISS systems, none of which are expected to be able to share with passive sensors. Two of these systems are operating in the ISS allocation of 59 - 64 GHz which is not shared with EES (passive) service. Studies have shown that there are existing (and planned) systems in the band 60.3 - 64 GHz which would cause unacceptable interference, and possibly even damage, to proposed passive sensors of the EESS. Studies also showed that sharing between EESS (passive) and currently existing and planned NGSO ISS systems studied by ITU-R in the band 56.9 - 57.0 GHz was feasible, due to the semi-stationary nature of these ISS systems.

Studies of sharing between GSO ISS and EESS (passive) have concluded that it is feasible for spaceborne passive sensors to share with GSO ISS networks under all conditions, provided that a single entry pfd value of -147 dBW/m^2/100 MHz for such networks is not exceeded for all altitudes from 0 to 1 000 km above the surface of the Earth. Of the GSO ISS systems studied by the ITU-R most are expected to be able to meet the above pfd criterion.

In the band 64 - 65 GHz, the EESS (passive) and space research (passive) service have no requirements, as detailed in Recommendation ITU-R S.515. However, this band is also allocated by footnote to the radio astronomy service, and no sharing studies have been carried out on the feasibility of the ISS to share with the radio astronomy service.

5.10.2.4 Sharing between the ISS and other services

Sharing between the ISS and fixed and surface based mobile services is feasible, due to the high attenuation of signals by the atmosphere. In the band 50.4 - 51.4 GHz, sharing between ISS and GSO FSS may be feasible with certain constraints, and sharing between ISS and NGSO FSS is likely to be difficult. Extensive research failed to identify any existing or planned MSS, RNS or RNSS systems in bands between 65 - 71 GHz. Additionally, extensive liaison within the ITU-R revealed that there are no currently known technical or operational obstacles to new allocations to the ISS in this range.

5.10.2.5 Requirements for the ISS, and sharing among systems of the ISS

In identifying the bands most appropriate to the inter-satellite service in the frequency range from about 50 GHz to about 70 GHz, ITU-R conducted studies of the requirements of the ISS. The ISS networks identified typically require wide bandwidths, and form high data rate trunk links for the space segments of networks. The high data rates of these systems require contiguous bands for operation.

The ITU-R has identified ten currently existing or planned GSO ISS systems, with a total of 74 satellites, and up to 178 links. Allowing for minimal growth, the resulting requirement for a bandwidth for GSO ISS systems is 15 GHz. Sharing studies among GSO ISS networks showed that sharing is feasible among a number of GSO ISS networks, given sufficient orbital separation. ITU-R identified four existing or planned NGSO ISS systems, with 1 018 satellites, and about 7 700 links, resulting in a total requirement for bandwidth near 12 GHz, including a nominal growth factor. Sharing studies between NGSO and GSO ISS systems demonstrated that such sharing is feasible. Sharing studies among NGSO ISS have not been finalised, however, co-frequency sharing among these NGSO ISS networks is anticipated to be difficult. Requirements and suitable bands for operation of the ISS can be found in Recommendation ITU-R [Doc. 4/59].

In summary, the ITU-R studies have identified a need for up to 15 GHz for ISS including up to 12 GHz for NGSO ISS in the bands 50.2 - 71 GHz. Large, contiguous bands are required to support the wide bandwidth requirements of most of these ISS systems.

5.10.3 Methods to satisfy the agenda item

In proposing the following measures, it is recognised that the oxygen absorption band consisting of several lines near 60 GHz, represents a unique natural resource for remote temperature profile sensing in the atmosphere, not available in any other frequency band. The oxygen absorption bands are also desirable for inter-satellite use, as the absorption greatly enhances sharing between the ISS and terrestrial receivers.

5.10.3.1 Possible solution to sharing of satellite passive systems with terrestrial active systems

Make exclusive allocations to the EESS (passive) and space research (passive) services in the frequency bands 50.2 - 50.4 GHz and 54.25 - 55.78 GHz which are currently shared with the fixed and mobile services. However, this allocation should not impose undue constraints on the use of the adjacent bands by the services allocated in these bands.

In conjunction with the above, delete the allocations to the EESS (passive) and space research (passive) services in the frequency band 51.4 - 52.6 GHz and replace them with allocations to the fixed and mobile services. Add allocations to the fixed and mobile services in the band 58.2 - 59 GHz.

5.10.3.2 Possible solution to sharing of satellite passive systems with the inter-satellite service

- Add new co-primary allocation(s) to the ISS in the frequency range between 64 and 71 GHz.
- Limit the ISS use of the band 54.25 - 58.2 GHz to inter-satellite links between GSO satellites except as noted below.
- Adopt a single entry limit of -147 dBW/m^2/100 MHz for emissions produced by an ISS (GSO) network in the band 54.25 - 58.2 GHz at all altitudes from 0 to 1 000 km above the surface of the Earth, in line with Recommendation ITU-R S.[4A/XK].
- Protect currently existing and planned ISS systems compatible with passive sensors in the band 56.9 - 57 GHz.

Other sharing possibilities were considered, as detailed in draft new Recommendation ITU-R S.[Doc. 4/58], however, other alternatives did not appear to satisfy the requirements, nor provide the most efficient use of the spectrum.

5.10.4 Advantages and disadvantages

5.10.4.1 Proposed re-alignment of terrestrial services and passive space services

Advantages

The need for additional restrictions on maximum e.i.r.p. and minimum antenna performance of the terrestrial services, in order to protect passive sensors, is avoided. The proposed new allocations to fixed and mobile services would offer a larger amount of spectrum to those services.

Disadvantages

Frequency assignments of existing terrestrial systems in the bands 50.2 - 50.4 GHz and 54.25 - 55.78 GHz would have to be moved to other bands. Fixed service national and regional channel plans may need to be amended.

5.10.4.2 Proposed reallocation to the inter-satellite service

Advantages

Under the method given in Section 5.10.3.2, there would be adequate provision to satisfy in full the known requirements of the EESS (passive) and the ISS in the range 50.2 - 71 GHz, with the possible exception of either the band 60.3 - 61.3 GHz or the band 59 - 59.3 GHz for passive sensors.

Disadvantages

This method would necessitate replanning of NGSO ISS systems currently planned to operate at 54.25 - 58.2 GHz, and would place minor restrictions on GSO ISS operations in this band.

5.10.5 Regulatory and procedural considerations

If WRC-97 should decide to implement the conclusions of these studies. Article S5 [8] of the Radio Regulations would need to be modified by means of appropriate regulatory provisions to reflect the suggestions in Section 5.10.3. In particular an appropriate transitional period for the migration of mobile and fixed services will be needed.

5.11 Agenda Item 1.9.5

To consider "allocations to the space research service (space-to-space) near 400 MHz".

5.11.1 Technical and operational studies

NOTE - This allocation is used to provide communication links for astronauts engaged in extra-vehicular activities (EVA) while on orbit.

The fixed and mobile services have primary allocations in this band. Sharing between the fixed and mobile services and the space research service (space-to-space) in the frequency band 410 - 420 MHz has been studied by ITU-R and has been found to be feasible subject to the following constraints:

Power flux-density limits as identified in new Recommendation ITU-R SA.1236 must be respected to protect fixed and mobile service operations. A total allocation bandwidth of 10 MHz is required so that multiple space-to-space systems may be implemented and alternate channels may be implemented to mitigate potential interference, and to ensure unconstrained future development of fixed and mobile systems.

5.11.2 Analysis of the results of studies

The results of these studies indicate that application of the resultant technical and operational constraints on and the use of interference mitigation techniques (for example, operational or dynamic channel assignment) by the space research service systems will facilitate sharing compatibility between fixed and mobile systems and space research systems.

5.11.3 Methods to satisfy the agenda item

Option A

Improve the status of the allocation to the space research service in the band 410 - 420 MHz to primary in the Table of Frequency Allocations.

Option B

Make no change to the existing allocation.

5.11.4 Advantages and disadvantages

Option A

Advantages

1) Improved regulation of space-to-space systems.
2) Assured long-term operating environment for multinational space stations.
3) Assured long-term operating and development environment for fixed and mobile systems.
4) Should other space services be allocated to this frequency band in the future, on-orbit operations could be protected from emissions of that service by application of the protection criteria found in Recommendation ITU-R SA.609-1.

Disadvantages

None if unconstrained development of fixed and mobile systems is ensured by regulatory provisions (refer to Section 5.11.5).

Option B

Advantages

Assured long-term operating and development environment for fixed and mobile systems.

Disadvantages

1) No constraints on space-to-space systems except for the need to shut down if interference can be attributed to these systems.
2) Multinational space endeavours have no assurance of long-term band availability.
3) Existing multinational investments may be "at risk" if other services gain access to this frequency band.

5.11.5 Regulatory and procedural considerations

Application of the power flux-density limits found in new Recommendation ITU-R SA.1236, along with the application of operational and interference mitigation techniques, as identified in Sections 5.11.2 and 5.11.3, must be associated with any improvement in allocation status, in order to protect existing fixed and mobile systems, and to ensure unconstrained development of fixed and mobile systems in this frequency band for the future. Also, regulatory assurance is required that this space research application is not to be construed as a safety service.

CHAPTER 6

REVIEW OF APPENDICES 30 AND 30A
(WRC-97 Agenda item 1.10)

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6 Review of Appendices 30 and 30A

6.1 WRC Agenda Item 1.10

Review of Appendices 30 (S30) and 30A (S30A) for Regions 1 and 3 in response to Resolution 524 (WARC-92), and taking particular account of *resolves* 2 of that Resolution, in accordance with Resolution 531 (WRC-95) and taking into account Recommendation 35 (WRC-95).

6.1.1 Need for revision

Resolution 524 (WARC-92) invited the ITU-R to study, as a matter of priority, the technical possibilities for improving the efficiency and flexibility of the Plans for Regions 1 and 3 contained in Appendices 30 and 30A. In particular Resolution 524 mentions the need for a "modernization" of the Plans by taking into account technological improvements which could be used to increase the capacity of the Plans. This Resolution also invites the ITU-R to study the particular needs for high rainfall climatic zones when implementing HDTV services and the technical methods which could be used to implement this service in the 12 GHz band.

In undertaking these studies the ITU-R received many contributions from administrations and organizations which confirmed the need to review and as necessary revise the relevant parts of Appendices 30 and 30A and also suggested how the ITU-R studies might provide the most suitable guidance to a WRC consideration of any modernization of Appendices 30 and 30A.

There was a clear need to examine the procedures as the requested flexibility can largely be achieved by appropriate updating of the procedures and associated technical criteria for both Appendices 30 and 30A. If the Plans resulting from the decisions of WRC-97 are to have full ability to adapt to future requirements it will be necessary to have effective modification procedures.

Furthermore, to enable WRC-97 to revise Appendices 30 and 30A, WRC-95 adopted, and included in a Report annexed to Resolution 531 (WRC-95), material required for ITU-R, and in particular the Bureau, for the work to be carried out. The material could also serve as a guide to administrations when preparing their proposals to WRC-97. The material consists of planning principles, planning parameters, considerations on current procedures and instructions to ITU-R. In developing this material, due account was taken of Resolution 524.

6.2 Summary of technical and operational studies, including a list of relevant ITU-R Recommendations

6.2.1 Summary of Planning Exercises

In order to conduct planning exercises, WRC-95 has adopted in Section 5.4 to the Annex 1 to its Resolution 531 a methodology based on 3 Steps.

In order to ensure that the data is appropriate and up to date, the BR has already taken actions: development of merged file to put in one single file both feeder-link and down-link path of each assignment in the Appendices 30 and 30A Plans and in this regard, the BR has sent to each Administration a print out of merged assignments and has requested for comments (to implement Step 1); the BR has also requested the Administrations of the new countries to provide their beam requirements and associated test points (to implement Step 2). The BR has sent a Circular Letter informing the Administrations on the actions taken to implement paragraphs 5.3 and 5.4 of the Annex 1 to Resolution 531.

Some administrations consider that, while JWP 10-11S has the authority to decide to carry out any planning exercises, they have not been requested by the WRC-95 to do so. Consequently CPM-97 should not consider any comparison of the planning exercises prepared by JWP 10-11S and the Bureau. However, it was noted by some other administrations that Resolution 531 (WRC-95) clearly instructs the ITU-R "to take appropriate action based on matters contained in the report, particularly in respect of Section 5". Furthermore, in Annex 1, Section 5.4 of Resolution 531, "the Bureau, in cooperation with administrations and the Study Groups and on the basis of the planning principles contained in Section 2 above, is instructed to conduct planning exercises as follows and report the results of its work for the Conference Preparatory Meeting."

6.2.1.1 Planning exercises conducted by the Bureau (paragraph 5.4 of the Annex 1 to Resolution 531)

In the absence of the required budgetary resources (staff) to carry out planning exercises, the Bureau has had to rely mainly on the assistance provided by administrations in the form of periodical participation of their experts in the planning exercises. To this effect a **Planning Exercise Team (PXT)** was set up. This team is composed of representatives from the Bureau and experts from administrations, broadcasting satellite operators and international organizations. These experts participate, in their own individual capacity, in meetings organized to support the Bureau's planning exercise work. In order to provide full transparency on the activities of the Bureau in the implementation of Resolution 531 and to establish full cooperation with administrations, regional organizations and broadcasting satellite service providers, the Bureau established a **BSS Planning Consultation Group** with the objective to assist the Director of the Radiocommunication Bureau on the activities carried out by the Bureau including the planning exercise team, the progress being made on the implementation of the respective steps of the planning exercises and to give guidelines for the timely achievement of the objectives set forth in Resolution 531. This Group consists of representatives from Member States and ITU-R Sector Members. The work plan to conduct the planning exercise includes the following tasks and target dates for completion:

- Planning exercise *Step 1* (First run): modification of the existing Plan on the basis of new technical parameters (end of September 1996). This may need to be reviewed to take account of the updated current (existing) Plans (end of September 1997).
- Planning exercise *Step 2* (First run): to provide plan entries for "new" ITU Member countries and for countries having less than the minimum number of channels (preferably by end of December 1996). This step will also be reviewed once Step 1 is updated (end of September 1997, second run).
- Planning exercise (First trial run) *Step 3*[*]: to take into account, as far as possible, Article 4 modifications (preferably by end of April 1997). This Step will be reviewed once Steps 1 and 2 are updated (mid-October 1997).

The three plan files were merged in one file. i.e. the feeder link 17 and 14 GHz and the BSS 12 GHz Plan files in order to conduct simultaneous planning exercises for the feeder links and downlinks. A multi-address letter was sent on 13 March 1996 to each administration together with a printout of their respective assignments in the merged file which will be used in planning exercises. A reminder message was sent to administrations on 25 April 1996. Different comments on the merged file were received and were taken into consideration to the extent possible. To enable the calculation of the OEPM a new version of MSPACE(G) software for OEPM (C/I aggregate) and single-entry C/I calculation was developed. Software to implement Recommendation ITU-R

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[*] Step 3 will take into account Article 4 submissions to the extent processed by the Bureau.

BO.1213 in MSPACE as well as software for geographical coordinate validation and ellipse generation was also developed.

The new version of MSPACE(G) has been available on TIES since July 1996, similarly the MSPACE(G) input files for the planning exercises were placed on TIES in March 1996 and have been updated as the planning exercise process has evolved.

The Bureau has taken measures to implement Steps 1 and 2. "New" ITU Member countries were requested to provide the Bureau with their beam requirements and associated test points.

The protection of the assignments to be considered in all 3 steps (see Section 5.4 of Annex 1 to Resolution 531) was implemented on the basis that the corresponding OEPM reference situation established after each step should not be degraded by more than 0.25 dB if it was equal to 0 dB or already negative. Moreover, a minimum single entry C/I overall co-channel ratio of 28 dB for all assignments in the Step 1 has to be assured by assignments to new countries included in Step 2 and by assignments in Step 3 with respect to all assignments appearing in previous Steps of the planning exercises.

The exercises developed by the Bureau to implement Step 2 assume, as a starting point, the orbital positions and channels selected by JWP 10-11S (due to the lack of optimization software and staff limitation in the Bureau to select orbital positions and channels and also to avoid duplication of the tasks already carried out by administrations and ITU-R). Once Step 2 is finished, an updated Reference Situation is generated to continue with Step 3 of the planning exercises, after satisfying the sharing criteria as specified in Sections 2.3 and 2.4 of the Annex to Resolution 531 (WRC-95).

6.2.1.2 Planning exercises carried out by the ITU-R

The planning exercises carried out by the ITU-R have been based on the planning principles described in Section 2 of Annex 1 to Resolution 531 (WRC-95), and also in line with, Section 5.4 of Annex 1 to Resolution 531 with the following understanding.

Two groups of principles can be identified with two different levels of consideration.

The first group of 7 principles is described in Subsection 2.1 of Annex 1 to Resolution 531. Most of these planning principles come from requirements of *resolves* 1 to Resolution 524 and have to be met as a minimum.

The second group is described in Subsection 2.2 of Annex 1 to Resolution 531 and includes 4 planning principles which have to be met to the extent possible.

Finally, there appear in the planning principles adopted by WRC-95 the requirements of *resolves* 2 to Resolution 524, and also a new requirement to ensure the compatibility between the BSS in Regions 1 and 3 and those services having allocations in the planned bands in all three Regions (see Subsections 2.3 and 2.4 of Annex 1 to Resolution 531).

In order to base the development of its planning exercises on a clear understanding of these planning principles, ITU-R has completed hereafter the definition of some principles contained in Annex 1 to Resolution 531 mentioned above.

- The implementation of the planning principles defined under items 2.1.2 (capacity for new countries) and 2.1.3 (national coverage) has to take into consideration specific conditions of extremely large countries which need to be covered from several orbital positions.

- The protection of the assignments to be considered in the 3 steps (See Section 5.4 to the Annex 1 of Resolution 531) has to be established on the basis that the corresponding reference situation established after each step is not degraded by more than 0.25 dB if it was equal to 0 dB or already negative. Moreover, a minimum single entry C/I overall co-channel ratio of 28 dB for all assignments in the Step 1 has to be assured by assignments to new countries included in Step 2 and provisionally by assignments in Step 3 with respect to all assignments appearing in previous Steps of the planning exercises.
- Planning principles defined under items 2.1.5 (assure long-term flexibility) and 2.1.6 (avoid a high fill factor of the band) could be used to assess the quality of the results of different planning exercises.
- The planning principle defined under item 2.1.7 could also be used to assess this quality. However, other possibilities exist to take into account as far as possible in this process the submissions still being treated under the Article 4 procedure.
- The planning principles defined under item 2.2 could be used to implement alternative exercises provided that the minimum requirements of both Resolution 524 and Resolution 531 are met.

6.2.1.3 Methodologies of the Bureau and ITU-R for Step 1, 2 and 3

Methodology for Step 1:

For the implementation of Step 1 according to Section 5.4 of the Annex 1 to Resolution 531 in addition to the characteristics of the Plans defined in Appendices 30 and 30A, the new technical parameters referred to in Recommendation 521 (WRC-95) had been applied. Moreover, answering Section 5.2.11 of the Annex 1 to Resolution 531, and considering improvements in the technology, ITU-R differed from the BR in only that it has defined and applied new antenna patterns for both the transmit earth station and the receive space station antennas (see draft Recommendation ITU-R BO.[AAA], Document [11/40] and draft Recommendation ITU-R BO.[BBB], Document [11/43]).

There will be a need to up-date Step 1 just before WRC-97 in order to take into account the inclusion of networks having applied successfully the Article 4 modification procedure in accordance with Appendices 30 and 30A of the Radio Regulations (networks appearing in Part B publications). The opportunity should also be taken in implementing Step 1 to resolve few inconsistencies remaining in the current Plans, which can be the case, for instance, of assignments having already very low margins.

Some administrations expressed concern about the addition of new entries in the Plans, other than those for new countries or modifications exceeding the minimum number of channels per country. WRC-97 is therefore invited to address these matters. Other administrations were of the view that the provisions of Article 4 do not provide any limits on the number of channels that may be requested during the modification procedures.

Methodology for Step 2:

The ITU-R and the Bureau carried out planning exercises to implement Step 2 as defined in Section 5.4 of the Annex 1 to Resolution 531. In all exercises, Step 2 has been implemented essentially in accordance with planning principles 2.1.2 and 2.1.3 of Annex 1 to Resolution 531.

In particular, concerning planning principle 2.1.2, for countries having less than the minimum number of channels, this minimum number of channels should be five in Region 1 and four in Region 3, or in any case what would have been provided to them using the principles adopted at the 1977 BSS Conference.

In order to ensure that planning principles 2.1.5 and 2.1.6, and to the extent determined by 2.1.7 of Annex 1 to Resolution 531, are met, the following principles a), b), c) and d) have been successfully applied, thus minimizing the modification of the configuration of the current Plans:

a) assign, to the extend practicable, the same orbital location to neighbouring countries (co-location of neighbouring countries);

b) use only existing planned orbital locations (as defined after implementation of Step 1)*;

c) remove from the Plan the former assignments and use some channels and/or beams (provided that the coverage area corresponds to the service area of a new country) remaining available at existing orbital positions in providing new countries requirements;

d) assure that frequency translation for new countries are in line with principles adopted in WARC Orb-88.

However, the planning exercises carried out up to now still need to be reviewed to ensure compliance with planning principles 2.3 and 2.4 of Annex 1 to Resolution 531, that is:

a) protect the Region 2 BSS Plan and examine whether that Plan is compatible with Step 2 of planning exercises.

b) ensure the compatibility (in both directions) between the broadcasting-satellite service Plans in Regions 1 and 3 and those services sharing the same frequency bands (FSS and terrestrial services in all 3 Regions).

On the issue of the protection of Region 3 fixed-satellite service (FSS) by assignments of new countries in the Region 1 and 3 BSS Plans, particularly in the band 12.2 - 12.5 GHz, views were expressed on both sides, i.e., flexibility for future development of the FSS in Region 3 on one hand, and, on the other hand, the need for less stringent limits to protect the Region 3 FSS in that Region. Further studies of the optimum use of the band 12.2 - 12.5 GHz are presently under way.

Additional Step 2 methodologies were proposed in April 1997 which were: 1) that channels for new countries should be assigned at orbital positions that are less susceptible to being affected by other plan assignments in order to keep the number of negative OEPM to a minimum, and 2) that channels for new countries should be assigned as far as possible at orbital positions west of the intended service areas, instead of positions east of the intended service areas. These methodologies may be considered if there is a need to continue with the planning exercises.

Statistics based on the distribution of EPM and OEPM have been used as a figure-of-merit for different plans. An additional figure-of-merit was proposed in ITU-R to evaluate the various Step 2 plans. Because this additional figure-of-merit is still in the development stage, it was encouraged that studies of this additional figure-of-merit should be undertaken and that other figures-of-merit should also be introduced.

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* The Administration of Israel requested that the Bureau perform a limited exercise to assess the impact of replacing its existing location from 13°W to 4°W, in accordance with the planning principles in Annex 1 to Resolution 531 (WRC-95), and report the results to WRC-97.

Any other Administration may make a similar request.

Methodology for Step 3:

The implementation of Step 3 should be also done as defined in Section 5.4 of Annex 1 to Resolution 531.

In all the planning exercises carried out as of October 1996 by ITU-R, no complete implementation of Step 3 has been done. This was due to the very large number of Article 4 submissions received by the BR, and for which the merged files to be provided by administrations were not all available, as well as the requirement of Section 5.4 of Annex 1 to Resolution 531 to implement Steps 1 and 2 first. Nevertheless, Article 4 submissions have been taken into account to some extent in the exercises, in accordance with planning principle 2.1.7 of Annex 1 to Resolution 531, because minimum changes have been made to the configuration of the current Plans.

There could be several solutions to deal with Article 4 submissions that are still being treated under the Article 4 procedure. The CPM notes the solution put forward by the Radiocommunication Bureau to provide the following indicative reports which show, for each of the modifications submitted:

Report 1 (phase 1)

The extent to which it is compatible, on an individual basis, with the reference situation(s) resulting from the completion of the exercise(s) at Step 2. The examination of compatibility with the results of Step 2 can be carried out by performing an analysis with MSPACE for each of the modifications (e.g. approx. 200 analyses) and reporting the extent to which the OEPM and single-entry C/I criteria are all met in both directions.

The criteria for compatibility with the reference situation are that the OEPM of any assignment does not fall below -0.25 dB or, if already negative, fall more than 0.25 dB below its value in the reference situation, and the single-entry overall co-channel C/I is not less than 28 dB.[**]

Report 2 (phase 2)

The extent to which modifications submitted under Article 4 are compatible with each other. The examination of the compatibility of modifications with one another can be carried out by performing a single analysis containing only the modifications and reporting all those cases where the single entry C/I criterion is not met. In addition, the distribution of OEPM values resulting from interference between assignments previously proposed in the Article 4 modifications can be determined.

Full compatibility of any proposed modification under Step 3 would only be determined once the sharing criteria with the Region 2 Plan, other services, and those modifications previously submitted are met, in date order.

The ITU-R noted the actions decided by the Bureau to speed up the implementation in the MSPACE software database of the complex characteristics of these Article 4 systems.

[**] One Sector Member notes, however, the ITU-R proposal to apply the co-channel single entry criteria mentioned in Recommendation 521 (WRC-95) only for the purpose of the introduction of assignments for new countries in the Plan in order to produce a more homogeneous situation. In so doing the degradation of OEPM of an entry in the Plan having an OEPM less than or equal to zero should not be more than 0.25 dB and it would, therefore , be useful to apply, in Report 1, the 0.25 dB criterion only.

As clearly indicated in the *resolves* of Resolution 524 and in the planning principles of Resolution 531, ITU-R has taken note of the fact that entry into the plan of assignments to the new countries has to be done as a minimum, while Article 4 submissions not yet coordinated have to be considered as far as possible. This also reflects the view that Steps 1, 2 and 3 should be taken in sequential order.

The ITU-R has concluded that the different possibilities proposed to implement Step 3 are not all in line with the precedence of treatment of new countries over treatment of Article 4 submissions as mentioned above. Although there could be several ways of implementing Steps 1 and 2 with respect to Step 3, it was decided to indicate one possible alternative for implementing Steps 1 and 2 which is considered practical with respect to planning principle 2.1.7.

The WRC-97 is therefore invited to address the appropriate treatment of all Article 4 proposals.

6.2.2 Technical parameters adopted for ITU-R exercise

The ITU-R has defined a detailed list of the revised technical parameters for planning purposes to be applied in the revision of the Regions 1 and 3 BSS Plans (see Tables 6.1 and 6.2). Parameters adopted at WARC ORB-88 and WARC-77 are also included in these Tables.

Technical parameters used for planning exercise for Steps 1 and 2 are subject to review by WRC-97. The Step 3 planning exercise will be based on the parameters contained in Article 4 applications. These parameters may need to be reviewed in the light of WRC-97 deliberations on the Bureau's planning exercises regarding Step 3 of Resolution 531, in particular in relation to the need for a nominal orbit spacing and the use of shaped bemas with the view to technically implement the provision No. 2674.

The main uplink reference parameters (based on analogue signals but also applicable to digital signals) to conduct planning exercises in Regions 1 and 3 are given in Table 6.1.

TABLE 6.1

The main up-link reference parameters

Parameter	WARC ORB-88	ITU-R proposal
Number of channels per country	As provided in the Plan	As per 2.1.2. of Annex 1 of Res. 531 and Section 6.2.3 of this Report
Coverage area	national	national as per 2.1.3. of Annex 1 of Res. 531
Beams	elliptical	elliptical
Polarization	circular	circular
Modulation	TV-FM	TV-FM
Channel raster	19.18 MHz, adj. Channels on opposite polarization	19.18 MHz, adj. Channels on opposite polarization
Channel grouping	within 400 MHz	no restriction needed
Necessary bandwidth	27 MHz	27 MHz
Earth station transmitting antenna pattern	ORB-88	see Doc. 10-11S/TEMP/21(Rev.2)
Satellite receiving antenna pattern	ORB-88	see Doc. 10-11S/TEMP/22(Rev.3)
Satellite system noise temperature	1800 K for 17 GHz 1500 K for 14 GHz	900 K at 17 GHz* 750 K at 14 GHz*
Protection ratios co-channel	40 dB	30 dB
Protection ratios adj. channels	21 dB	22 dB
C/N	24 dB for 99% of worst month in 27 MHz BW	24 dB for 99% of worst month in 27 MHz BW
Guard band	14 MHz (lower end) 11 MHz (upper end)	14 MHz (lower end) 11 MHz (upper end), subject to review
Nominal orbital spacing	6°	6°
Cluster concept	App. 30A (ORB-88)	App. 30A (ORB-88)
Satellite Station Keeping	±0.1° N-S and E-W	±0.1° N-S and E-W
Satellite receiving antenna rotational accuracy	±1°	±1° (as agreed at ORB-88)
Satellite receiving antenna pointing error	0.2° (any direction)	0.1° (any direction)
Earth antenna pointing accuracy	1 dB degradation	1 dB degradation
Satellite antenna minimum half power beamwidth	0.6°	0.6°
Energy dispersal		600 kHz p-p, same as downlink
Earth station on-axis gain	57 dBi	57 dBi
Earth station antenna diameter	5 m (17 GHz)/6 m (14 GHz) See 3.5.1. of Annex 3 to Appendix 30A	5 m (17 GHz)/6 m (14 GHz)

* The planning exercises carried out by the ITU-R are not based on these new values.

The main downlink reference parameters (based on analogue signals but also applicable to digital signals) to conduct planning exercises in Regions 1 and 3 are given in Table 6.2.

TABLE 6.2

The main downlink reference parameters

Parameter	WARC-77	ITU-R proposal
Number of channels per country	As provided in the Plan	As per 2.1.2. of Annex 1 of Res. 531 and Section 6.2.3 of this Report
Coverage area	national	national as per 2.1.3. of Annex 1 of Res. 531
Beams	elliptical	elliptical
Polarization	circular	circular
Modulation	TV-FM	TV-FM
Channel raster	19.18 MHz, adj. Channels on opposite polarization	19.18 MHz, adj. channels on opposite polarization
Channel grouping	within 400 MHz	no restriction needed
Necessary bandwidth	27 MHz	27 MHz
Satellite transmitting antenna pattern	WARC-77 (RR App. 30, Annex 5, Sect. 3.13.3)	WARC-77 (RR App. 30, Annex 5, Sect. 3.13.3)
Earth station receiving antenna pattern	WARC-77	new, Rec. ITU-R BO.1213
Earth station figure of merit (G/T)	6 dB(K^{-1}) for ind. Recep 14 dB(K^{-1}) for community recep	11 dB(K^{-1}) for ind. recep. and 19 dB(K^{-1}) for community recep.[1]
Protection ratios co-channel	31 dB	24 dB
Protection ratios adj. Channels	15 dB	16 dB
C/N	14 dB for 99% of worst month in 27 MHz BW	14 dB for 99% of worst month in 27 MHz BW
e.i.r.p.	Typically ≈ 64 dBW	Nominally 5 dB less, adjusted in accordance of the propagation model adopted
Guard band	14 MHz (lower end) 11 MHz (upper end)	14 MHz (lower end) 11 MHz (upper end), subject to review
Nominal orbital spacing	6°	6°
Cluster concept	App. 30A (ORB-88)	App. 30A (ORB-88)
Satellite Station Keeping	±0.1° N-S and E-W	±0.1° N-S and E-W
Satellite antenna rotational accuracy	±2°	±1° (as agreed at ORB-88)
Satellite antenna pointing accuracy	±.0.1° any direction	±.0.1° any direction
Energy dispersal	600 kHz p-p	600 kHz p-p
Beamsize	no reference made	including inaccuracy of station keeping, etc., (see section 4.5)
Minimum half power beamwidth	0.6°	0.6°

In particular, in addition to the new parameters described in Rec. 521 (WRC-95), ITU-R recommends to use improved antenna patterns for both the transmit earth station antenna (Draft new Recommendation ITU-R BO.[AAA]) (Doc. 11/40) and the receive space station antenna (Draft new Recommendation ITU-R BO.[BBB]) (Doc. 11/43), as well as up (30/22 dB) and downlink (24/16 dB) protection ratios associated to the overall protection ratios (23/15 dB) defined in Rec. 521 (WRC-95). These values will thus permit the calculation of the EPM on both feeder-link and downlink, in addition to the OEPM.

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[1] These values are for clear sky conditions.

6.2.2.1 e.i.r.p. calculation method

It was noted that WRC-95 Recommendation 521 indicated that a general e.i.r.p. reduction of 5 dB was to be applied during Step 1 of the planning exercises except:

a) in the cases of notified systems which are in conformity with Appendices 30 and 30A and brought into use and for which there has been confirmation to the Bureau of the date of bringing into use of that system.

b) for beams with "high rain climatic zones" in which case "adequate" e.i.r.p. is to be provided.

The BR has requested the opinion of ITU-R with regard to the "high" rainfall climatic zones and it was proposed that this should be left for the WRC-97 Conference to establish, but it was considered appropriate to apply the 5 dB reduction to all beams except those indicated in sub-paragraph a) above. If so wished by the administration concerned, ITU-R proposes that for the beam considered, the new e.i.r.p. should be generally calculated by the formula given below, while the atmospheric attenuation (gaseous absorption + rain attenuation) is determined by the worst test point. Any degradation of receiver sensitivity due to propagation effects should not be taken into account in determining the e.i.r.p. values.

new e.i.r.p. = current e.i.r.p. - rain margin used at WARC-77 + atmospheric attenuation for an availability of 99% of the worst month using new model -5 dB

As "high rain climatic zones" is not defined in Resolution 531, there was a view that an e.i.r.p. calculation method could only be considered following the availability of such a definition at the Conference*. Furthermore, one administration considered that an alternative e.i.r.p. calculation method based on "average climatic zone" instead of the worst climatic zone (worst test point) was proposed by this administration to be developed and used for the Appendix 30 Plan review.

It was noted that the rain margin used at WARC-77 was 1 dB**. It was also agreed that the new e.i.r.p. for the beam would be the largest value determined for each of the test points in a beam. In any case, the "old" e.i.r.p. values (as contained currently in App. 30) should not be reduced by more than 5 dB (see Section 6.3.3 for further consideration on rain climatic zones).

For new countries, ITU-R proposes to start with an e.i.r.p. value of 58.9 dBW (average level of the current Plan - 5 dB) and to apply, when necessary, the formula given below:

new e.i.r.p. = 63.9 dBW - rain margin used at WARC-77 + atmospheric attenuation for an availability of 99% of the worst month using new model -5 dB

Administrations should be made aware of the fact that the resulting e.i.r.p. values will be used both as an input parameter for the planning process and as a reference value for later coordination processes, which might occur in the course of subsequent applications of the modification procedure. For spectrum efficiency, it is important to maintain, as far as possible, homogeneity of all e.i.r.p. values in the plan. In revising e.i.r.p.s, particular attention should be paid to the consequences of these revisions on the interference situation.

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* There is also an alternative proposal from one administration for a method of calculation of e.i.r.p. However, prior to the availability of definition of "high rainfall climatic zone", implementation of any e.i.r.p. calculation method is impossible.

** This value was uniformly used for establishing the plan at WARC-77 (see Doc. 27-E "Report of IFRB", Broadcasting Satellite Conference, December 29, 1976). The indication of 2 dB in Article 2.2 of Annex 5 to APP.30 was used for selecting orbital positions with appropriate elevation angles for the various assignments.

6.2.2.2 Improved antenna characteristics

See draft new Recommendations ITU-R BO.[AAA] (Doc.11/40) "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 plans at 14 GHz and 17 GHz in Regions 1 and 3", ITU-R BO.[BBB] (Doc. 11/43) "Reference receive space station antenna patterns for planning purposes to be used for elliptical beams in the revision of the Appendix 30A plans at 14 GHz and 17 GHz in Regions 1 and 3".

6.2.2.3 C/I ratio values

See draft new Recommendation ITU-R BO.[DDD] (Doc. 11/42) "Protection ratios to be used for planning purposes in the revision of the Appendixes 30 and 30A plans in Regions 1 and 3".

6.2.3 Assignments to new countries and countries with less than the minimum number of channels assigned by the 1977 BSS Conference

Resolution 531 does not clearly determine the minimum number of channels as it calls for the provision of "an initial capacity equivalent to that which would have been provided to them using the principles adopted at the WARC-77 BSS and WARC Orb-88 Conferences".

It has not been possible to identify with complete clarity the principles that were adopted by these Conferences.

The BR felt that, for planning exercise purposes, the appropriate initial capacity in Region 1, "to provide for new countries, and those having less than the minimum number of channels assigned by the WARC-77 BSS and WARC Orb-88 Conferences" should be five channels. Furthermore Resolution 531 is precise on this issue for Region 1, when it indicates in paragraph 2.1.2 of the Annex to Resolution 531 WRC-95: "for example, in Region 1 this was five channels, if available, in the specific orbital location".

No equivalent example is provided for Region 3 in the Resolution. In the absence of a clear instruction or example in Resolution 531 the Bureau, on 6 May 1996, sought the advice from the Asia Pacific Telecommunity (APT) by asking its Director to consult with the Region 3 countries. A reply was received from APT on 29 August 1996 signifying that 4 channels was the most appropriate value.

Considering the APT response, the BR concluded that a minimum number of four channels should be used for Region 3 in the planning exercises.

For new countries with particularly large areas having requested more than 5 channels, it is also proposed to provide them on a case-by-case basis with an initial capacity equivalent to that which would have been provided by the 1977 BSS and the Orb-88 Conferences.

Concerns have been raised at the implications for meeting projected requirements for "new" Region 1 countries on the orbit/frequency resources available to Region 3 countries for both BSS and FSS.

On the other hand, concerns have been expressed on the need to review the stringent sharing pfd limit used to protect FSS systems in Region 3 with the aim of achieving a more efficient use of the band 12.2 -12.5 GHz and of this orbital arc which are shared by both Regions.

An evaluation made by one administration indicates that the requirements projected by some "new" countries might utilize only a limited portion of the overall orbit/spectrum resource available in the planned frequency band. Their conclusion is that the inclusion of new frequency assignments in the BSS Plan would not limit future development of either the Region 1 and 3 BSS or the Region 3 FSS. Relevant studies are being carried out by the ITU-R.

6.2.4 National Coverage as a basis for planning and Subregional** systems

This assumption of National Coverage was introduced in order to facilitate the agreement among the various administrations. The Plan contains some exceptions to this assumption. For instance, in Europe, the beams covering the Nordic countries.

In assigning the orbit-spectrum resources to the various countries, there can be appropriate ways to ease the future development of supranational systems. One way already foreseen in the current Plans is the implementation of supranational systems by using a common orbital position for different neighbouring countries with the agreement of the countries concerned. However, requirements also exist for the accommodation of subregional systems in accordance with the decision of WRC-95.

6.2.5 Protection of operating and /or notified systems

Pursuant to principle 2.1.4 and paragraph 5.4 of Annex 1 to Resolution 531 (WRC-95), ITU-R and the Bureau in conducting planning exercises have defined the types of assignments as mentioned below:

a) Assignments notified, which are in conformity with Appendices 30 and 30A, brought into use, and for which the date of bringing into use has been confirmed to the Bureau, will be protected on the basis of the criteria set out in Appendices 30 and 30A respectively unless the responsible administrations of such networks give explicit agreement to the use of the new parameters as defined in Recommendation 521 (WRC-95). Concerns were raised by a few administrations that the use of current technical parameters for the above-mentioned systems should be limited to the currently operating or notified systems for which date of bringing into use has been confirmed to the BR, and future generations shall use the new technical parameters.

b) Assignments notified, which are in conformity with Appendices 30 and 30A, but not brought into use or notified and brought into use but for which the notified advance date of bringing into use has not been confirmed to the Bureau, will be processed applying the new parameters as defined in Recommendation 521. However, if time and resources permit, the Bureau would process them with initial (notified) parameters and provide the Conference with the results showing the impact of that action.

c) For the rest of the assignments in the Plan not falling in categories a) and b) above, the parameters of Recommendation 521 will be applied for the purposes of planning exercises.

d) Assignments published in Part B after successful completion of Article 4 procedures (not notified or notified for which the notified advance date of bringing into use has not yet been confirmed) will be processed with the new parameters of Recommendation 521 (WRC-95). For the assignments of this category the corresponding downlink e.i.r.p. reduction will not exceed 5 dB with respect to the average e.i.r.p. value of the corresponding national assignments in the Appendix 30 Plan. However, if the e.i.r.p. has already been reduced by

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** For some administrations the subregional systems in Appendices 30 and 30A are limited to intergovernmental systems.

more than 5 dB, as result of coordination/agreement, the Part B published value will be maintained.

New technical parameters were only applied to assignments in b), c) and d).

6.2.6 Long-term flexibility

The ITU-R studies carried out to date have been carried out with the underlying theme for the revision of the Appendix 30 and 30A Plans aimed at avoiding their obsolescence by a combination of utilising updated technical parameters and revised procedures that seek to ensure the long-term flexibility of the Plans.

6.2.7 List of relevant ITU-R Recommendations and Reports

Recommendation ITU-R P.618	"Propagation data and prediction methods required for the design of Earth-space telecommunications systems"
Recommendation ITU-R P.837	"Characteristics of precipitation for propagation modelling"
Recommendation ITU-R BO.1211	"Digital multi-programme emission systems for television, sound and data services for satellites operating in the 11/12 GHz frequency range"
Recommendation ITU-R BO.1213	"Reference receiving earth station antenna patterns for replanning purposes to be used in the revision of the WARC-77 BSS plans for Regions 1 and 3"
Draft new Recommendation ITU-R BO.[AAA] (Doc. 11/40)	"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 plans at 14 GHz and 17 GHz in Regions 1 and 3"
Draft new Recommendation ITU-R BO.[BBB] (Doc. 11/43)	"Reference receive space station antenna patterns for planning purposes to be used for elliptical beams in the revision of the Appendix 30A plans at 14 GHz and 17 GHz in regions 1 and 3"
Draft new Recommendation ITU-R BO.[DDD] (Doc. 11/42)	"Protection ratios to be used for planning purposes in the revision of the Appendixes 30 and 30A plans in Regions 1 and 3"
Draft new Recommendation ITU-R BO.[CCC] , (Doc. 11/38)	"Common functional requirements for the reception of Digital Multiprogramme Television emissions by satellite operating in the 11/12 GHz frequency range"
Draft new Recommendation ITU-R BO.[EEE] (Doc. 11/93)	"Protection masks and associated calculation methods for interference into broadcast satellite systems involving digital emissions"
Report [See Chapter 6 CPM97/2]	On planning exercises in preparation for the revision of Appendices 30 and 30A plans for Regions 1 and 3
Report ITU-R BO.[10-11S/R2] (Docs. 11/116)	Interference calculation methods

6.3 Analysis of results of studies relating to the possible methods of satisfying the agenda item

6.3.1 Planning exercises performed by the Bureau and ITU-R

To meet the requirements of Section 5.4 of Resolution 531 the Bureau, in cooperation with administrations and the ITU-R, has conducted planning exercise studies. In the period up to CPM-97 two separate, but closely aligned, planning exercises have been performed by the Bureau and by the ITU-R. The following sections of this report summarize both the Bureau's and ITU-R's planning exercise studies, however it must be emphasized that both studies are very closely aligned. The main differences in the technical parameters used in the studies were:

1) The Bureau bases its analysis strictly on the technical criteria contained in Recommendation 521 (WRC-95). In other words, the Bureau does not take into account the improved antenna patterns for feeder-link transmit earth stations (Draft new Recommendation ITU-R BO.[AAA]) (Document 11/40) and receiving space stations (Draft new Recommendation ITU-R BO.[BBB]) (Document 11/43).

2) In its studies the Bureau used shaped beam antenna data for the beams of HISPASAT-1 and, where applicable, for the proposed uplink beams of the Russian Federation. The ITU-R planning exercise (which did not have ready access to this shaped beam data) modelled the shaped beams using ellipses.

Additionally in the presentation and analysis of the exercises the Bureau has used the OEPM analysis method in strict accordance with Resolution 531, whereas ITU-R has, in addition to using OEPM, analysed the uplink and downlink Plans separately using the EPM analysis method.

It should also be noted that neither the Bureau's, nor the ITU-R's, studies presented to CPM-97 will represent the final situation that will be provided to WRC-97. The situation presented in this document is the best currently available information, however it is subject to revision and refinement in the period leading up to WRC-97 for the following reasons:

- if any pending Article 4 submissions successfully complete coordination and enter into the Plans there may be a need to further revise or refine the results of the exercises;
- there may also be a need to further refine the results of the exercises (for example to address inter-service or inter-regional compatibility issues).

To facilitate these revisions or refinements both the ITU-R and the Bureau, through its planning exercises team, have scheduled meetings and further studies. Results of this additional work will be forwarded to WRC-97 by the Director of the Radiocommunication Bureau.

6.3.1.1 Implementation of planning exercises

The categories, and their step implementations, discussed below have been used only for the purpose of conducting the planning exercises defined in Resolution 531. The final adoption of these assumptions is subject to confirmation by WRC-97.

Implementation of Step 1 (Modify the existing Plan assignments on the basis of the new parameters contained in Recommendation 521 (WRC-95))

For the implementation of Step 1 of the planning exercises it was necessary to define the type of assignments according to the status of their implementation. Four categories of assignments were established in accordance with the guidelines prescribed in Section 5.4 of 1 Annex to Resolution 531 (WRC-95):

Assignment Type A

Assignments notified, which are in conformity with Appendices 30 and 30A, brought into use, and for which the date of bringing into use has been confirmed to the Bureau, will be protected on the basis of the criteria set for in Appendices 30 and 30A respectively (notified parameters) and with C/I overall protection ratios of 30 dB for co-channel and 14 dB for lower and upper adjacent channels[2] unless the responsible administrations of such networks give explicit agreement to the use of the new parameters as defined in Recommendation 521 (WRC-95) [or as otherwise decided at WRC-97]. These assignments are presently the following: TV-SAT 2, HISPASAT-1, TDF 1/2, BS-3, BS-3M, BS-3N, KOREASAT-1 (analog and digital), SIRIUS and TELE-X.

Assignment Type B

Assignments notified, which are in conformity with the Appendices 30 and 30A, but not brought into use or notified and brought into use but for which the notified advance date of bringing into use has not been confirmed to the Bureau are processed by applying the new parameters as defined in Recommendation 521 (i.e. C/I overall protection ratios of 23 dB for co-channel and 15 dB for adjacent channels, new e.i.r.p. levels and new receiving earth station antenna patterns). However, if time and resources permit the Bureau will process them with initial (notified) parameters and provide the Conference with the results showing the impact of that action. These assignments are presently the following: CBSAT-1, 2 and 3.

Assignment Type C

For the other of assignments in the Plan not falling in categories A) and B) above, the parameters of Recommendation 521 are applied for planning exercises purposes. The OEPM is calculated with respect to C/I overall protection ratios of 23 dB for co-channel and 15 dB for adjacent channels.

Assignment Type D

Assignments published in Part B after successful completion of Article 4 procedures (not notified or notified but for which the notified advance date of bringing into use has not yet been confirmed) are processed with the new parameters of Recommendation 521 (WRC-95). These assignments are presently the following: HISPASAT-2, RADIOSAT, RADIOSAT-2, RADIOSAT-3, UKDBS-3, LUX-SAT, AUS (152°E and 164°E).

All Region 1 and 3 Plan entries were contained in the existing Plans as sets of independent feeder-link beams and downlink beams without any information about channel strapping between these links. WRC-95 instructed the Bureau to determine the Overall Equivalent Protection Margin (OEPM) to be used for the compatibility analysis as a "reference situation", therefore the Bureau merged these "independent" beams, by establishing strapping between feeder link and downlink channel. The Bureau examined the consistency between the beams of the two existing feeder-link Plans (14 GHz and 17 GHz), on the one hand, and beams of the downlink BSS Plan on the other hand.

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[2] The above-mentioned C/I overall values for co-channel and adjacent channels result from the combination of the feeder-link and downlink co-channel and adjacent channel protection ratios respectively, appearing in the current Plans.

The merged plan (file) was modified to replace the "current" technical parameters by new technical parameters described in Resolution 531 and Recommendation 521 (WRC-95). The parameters for assignments belonging to the type A (notified in conformity with Appendices 30, 30A and brought into use and for which the date of bringing into use has been confirmed to the Bureau) were kept unchanged. An additional field was introduced to distinguish assignments of type A from others and apply different protection ratios. The 5 dB e.i.r.p. reduction was applied for all channels with exception of the type A assignments. For type D assignments, the corresponding downlink e.i.r.p. reduction will not exceed 5 dB with respect to the average e.i.r.p. value of the corresponding national assignments in the Appendix 30 Plan. However, if the e.i.r.p. has already been reduced by more than 5 dB, as result of coordination/agreement, the Part B published value will be maintained.

The opportunity was also taken in implementing Step 1 to resolve difficulties in the current Plans. In particular, investigations have been carried out in order to provide a solution to countries identified under Step 1 with very low margins. The solution is provided by the following additional measures:

- the creation of a group between the downlink beams of Portugal: POR13300 and AZR13400;
- plus, new downlink channels arrangements at 31°W for Portuguese beams POR13300 and AZR13400 and for Cape Verde;

  (This solution is referred as "step 1" in the following sections.)
- an additional possibly improved scenario could be achieved based on new orbital position/ channels arrangements around 31°W. Because this solution makes use of an orbital position not currently in the Plan, it would require a decision of WRC-97 to be in conformity with the intent of paragraph A3 of Annex 7 of Appendix 30, whose purpose was, amongst others, to protect the orbital access of the Region 2 FSS between 37°W and 10°E.

  (This solution is referred as "alternative step 1" in the following sections.)

These proposed solutions are currently being studied.

Implementation of Step 2 (to provide plan entries for “new” ITU Member countries and for countries having less than the minimum number of channels)

Maintain the same assignments as appear in Step 1.

To **remove** the assignments of countries having a new geographical/administrative situation: the former Czechoslovakia (TCH); the former USSR (URS); the former Yugoslavia (YUG); Brunei Darussalam (BRU); the Federal Republic of Germany (D and D2 beams); the Federal Democratic Republic of Ethiopia (ETH), the Republic of Yemen (YEM); the Marshall Islands (MRL) and the Caroline Islands (CAR). However, the reference situation in this sub-step is not updated.

To **add** additional assignment(s)/channel(s) for the following Region 1 countries having less than 5 assignments in the original Plans: State of Bahrain (BHR)[2] [3]Islamic Federal Republic of Comoros (COM)[2], State of Israel (ISR)[4], Republic of Liberia (LBR)[2], Malta (MLT)[2], and the Republic of Namibia (NMB).[4]

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[2] In the Appendix 30 Plan and the Appendix 30A Plan at 17 GHz.

[3] ITU-R reported that the fifth channel of this country at orbital position (17° E) had been assigned to one of its neighbouring countries (ARS) which resulted in having 11 channels in the Plan. It is therefore proposed to create a group with this channel between these two countries.

[4] In the Appendix 30 Plan and the Appendix 30A Plan at 14 GHz.

To **add** the necessary channels for the following Region 3 countries having less than 4 channels (see also Section 3.5) in the original Plans: Brunei Darussalam (BRU)[2], Fiji (FJI) [2], Maldives (MLD) [2], and Nepal (NPL) [2]

To **add** the appropriate assignments as referred to in Section 5.4 of Annex 1 to Resolution 531 (WRC-95) for the following "new countries":

Republic of Armenia (ARM), Australia (AUS) (New minimum ellipse beams at 152°E and 164°E on downlink to cover territories which have been recently incorporated into the national territory of that administration), Azerbaijani Republic (AZE), Kingdom of Bhutan (BTN), Republic of Belarus (BLR), Republic of Bosnia and Herzegovina (BIH), Republic of Croatia (HRV), Czech Republic (CZE), Eritrea (ERI), Republic of Estonia (EST), Federal Democratic Republic of Ethiopia (ETH), Georgia (GEO), Federal Republic of Germany (D) (D and D2 beams), Republic of Kazakstan (KAZ), Republic of Kiribati (KIR), Republic of Latvia (LVA), the Former Yugoslavian Republic of Macedonia (MKD), Republic of Lithuania (LTU), Republic of the Marshall Islands (MHL), Federated States of Micronesia (FSM) [5], Republic of Moldova (MDA), Republic of Palau (PLW)[5] Republic of Uzbekistan (UZB), Kyrgyz Republic (KGZ), Russian Federation (RUS), Slovak Republic (SVK), Solomon Islands (SLM), Republic of Slovenia (SVN), Republic of Tajikistan (TJK), Turkmenistan (TKM), Tuvalu (TUV), Ukraine (UKR), Republic of Yemen (YEM) (YEM26600 and YEM26700), Federal Republic of Yugoslavia (YUG).

NOTES - The two existing channels for Brunei Darussalam were initially deleted so that they could be reintroduced, together with two additional channels, with revised uplink/downlink strapping.

The channel arrangements proposed for Brunei Darussalam are being further investigated to try to find a single frequency translation between feeder-link and down link channels.

Until the status of the Australian assignments at 98°E and 128°E is determined by the WRC-97 in respect of the successful completion of the Article 4 procedures, the initial Plan assignments for Australia at 98°E and 128°E will be included in the Planning Exercises in addition to the proposed Australian national assignments modified to be located at 152°E and 164°E.

The feeder-link beam of one Region 3 Administration (the Kingdom of Bhutan) was removed from the Step 1 file and was replaced in Step 2 by a new pair of feeder-link and downlink beams.

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[5] The beams of FSM and PLW replace the former CAR beam. The Federated States of Micronesia (FSM) is a member of the UN and the ITU. The Republic of Palau is a member of the UN but is not a member of the ITU. However, based on the Compacts of Free Association between the United States of America and the Republic of Palau, the United States of America will continue to represent the Republic of Palau as far as ITU matters are concerned.

Four channels have been assigned to each of the Federated States of Micronesia and Palau (the two Region 3 "new countries" which have replaced the former Caroline Islands which was assigned five channels in the current Appendices 30 and 30A Plans).

The Malaysian Administration requested at the CPM-97 that another channel be added to the Malaysian beam (MLA22800) in order to make the number of channels of this beam equal to the number of channels of the other Malaysian beam (MLA22700) for the same national programs.

The administration of Vietnam requested at CPM-97 the adaptation of its downlink area with its feeder-link area.

These two administrations may forward their requests directly to the Bureau.

Following from these actions a "Baseline Option" and a "national preferences" variant in relation to Step 2 of the planning exercises required under section 5.4 of Resolution 531 were considered by the Bureau. These options are summarized as follows:

- The "Baseline Option" features standard (new) ellipse parameters and associated antenna gain values and downlink e.i.r.p. values of 58.9 dBW for all new countries including the Russian Federation and Germany.
- The "national preferences" variant to the Baseline Option incorporates specific requests made by the Russian and German administrations (i.e. for the Russian Federation: uplink: steerable beam, downlink: circular beam with reduced e.i.r.p.; for Germany; characteristics of the current Plan).

The "national preferences" variant of the Baseline Option presented by the Bureau is closely aligned with the one which ITU-R has studied and presented to the CPM-97.

Implementation of Step 3 (to take account, as far as possible, of systems which have been communicated to the Bureau under Article 4 of Appendices 30 and 30A)

– same assignments as in Step 2;

– plus, take account, as far as possible, of systems which have been communicated to the Bureau under Article 4 of Appendices 30 and 30A.

The Bureau has performed a partial analysis of the studies required under phase 2 of Step 3 of the Planning exercises (the extent to which modifications submitted under Article 4 are compatible with each other). Although the data available for this study had a number of serious deficiencies, for example only 30% of Article 4 networks were made available for inclusion in the analysis, the indicative results suggested that there are likely to be a large number of internal incompatibilities between the Article 4 submissions which will require, as a minimum, coordination to be undertaken. From the results of this limited preliminary study it was concluded that extending this Phase 2 analysis to include the remaining 70% the Article 4 networks is not expected to change this result, and therefore is not considered to be a high-priority task. It was noted that the resolution of all these incompatibility problems may require significant resources by administrations. In view of the foregoing conclusion the Bureau is now focusing its efforts in relation to Step 3 studies on phase 1 of Step 3.

6.3.1.2 Analysis of Step 1 and 2

Results of the Step 1 and 2 analyses (MSPACE(G) analysis of Region 1/3 BSS-BSS compatibility) are presented in the Tables below. Although the ITU-R analysis was conducted using slightly different assumptions (refer section 6.3.1) the results of its analysis are very closely aligned with the results presented below.

STEP 1 (see NOTE 1)

Percentage (and cumulative distribution) of OEPMs in each interval range (based on the worst test point for each channel)		
OEPM interval range (dB)	OEPM cases (%)	OEPM cases (cumulative %)
+8 to +∞	20.74	20.74
+5 to +8	19.11	39.85
+2 to +5	24.61	64.46
0 to +2	14.20	78.66
-2 to 0	10.41	89.07
-5 to -2	6.91	95.99
-8 to -5	0.07	96.06
-∞ to -8	3.94	100.00

ALTERNATIVE STEP 1 (see NOTE 1)

Percentage (and cumulative distribution) of OEPMs in each interval range (based on the worst test point for each channel)		
OEPM interval range (dB)	OEPM cases (%)	OEPM cases (cumulative %)
+8 to +∞	21.64	21.64
+5 to +8	19.70	41.34
+2 to +5	23.42	64.76
0 to +2	14.28	79.03
-2 to 0	10.11	89.14
-5 to -2	6.77	95.91
-8 to -5	0.15	96.06
-∞ to -8	3.94	100.00

NOTE 1 - Step 1 and alternative Step 1 are described in Section 6.3.1.1.

STEP 1 with STEP 2 BASELINE OPTION

Percentage (and cumulative distribution) of assignments per interval of OEPMs in each interval range (based on the worst test point for each channel)		
OEPM interval range (dB)	OEPM cases(%)	OEPM cases (cumulative%)
+8 to +∞	17.89	17.89
+5 to +8	21.80	39.70
+2 to +5	24.32	64.02
0 to +2	16.57	80.58
-2 to 0	14.12	94.70
-5 to -2	5.30	100.00
-8 to -5	0.00	100.00
-∞ to -8	0.00	100.00

STEP 1 with STEP 2 "NATIONAL PREFERENCES VARIANT"

Percentage (and cumulative distribution) of assignments per interval of OEPMs in each interval range (based on the worst test point for each channel)		
OEPM interval range (dB)	OEPM cases(%)	OEPM cases (cumulative%)
+8 to +∞	22.13	22.13
+5 to +8	22.53	44.67
+2 to +5	24.12	68.79
0 to +2	15.57	84.36
-2 to 0	10.27	94.63
-5 to -2	5.37	100.00
-8 to -5	0.00	100.00
-∞ to -8	0.00	100.00

ALTERNATIVE STEP 1 with STEP 2 BASELINE OPTION

Percentage (and cumulative distribution) of assignments per interval of OEPMs in each interval range (based on the worst test point for each channel)		
OEPM interval range (dB)	OEPM cases(%)	OEPM cases (cumulative%)
+8 to +∞	18.75	18.75
+5 to +8	22.27	41.02
+2 to +5	23.19	64.21
0 to +2	16.70	80.91
-2 to 0	13.85	94.76
-5 to -2	5.17	99.93
-8 to -5	0.07	100.00
-∞ to -8	0.00	100.00

ALTERNATIVE STEP 1 with STEP 2 "NATIONAL PREFERENCES VARIANT"

Percentage (and cumulative distribution) of assignments per interval of OEPMs in each interval range (based on the worst test point for each channel)		
OEPM interval range (dB)	OEPM cases(%)	OEPM cases (cumulative%)
+8 to +∞	23.00	23.00
+5 to +8	23.00	45.99
+2 to +5	23.06	69.05
0 to +2	15.64	84.69
-2 to 0	10.01	94.70
-5 to -2	5.24	99.93
-8 to -5	0.07	100.00
-∞ to -8	0.00	100.00

6.3.1.3 Example of a revised Plan

As a result of the planning exercises described in Sections 6.3.1.1 and 6.3.1.2, an example the orbital positions, channels and polarizations that might be used in a revised Plan is presented hereafter. All the changes with respect to the current Plan are indicated in bold and underlined characters.

Solutions to very low margins due to the entry of new networks in the Plans

Beam name	Administration name/Region	Orbital position (in °W)	Orbital position (in °W) See NOTE 1		Channels	Circular polarization
AZR13400	Portugal (Azores)/1	31.0	30.0	↑ ↓A	24, 28, 32, 36, 40 **21, 25, 29, 33, 37**	left hand left hand
BFA10700	Burkina Faso/1	31.0	30.0	↑ ↓	21, 25, 29, 33, 37 21, 25, 29, 33, 37	left hand right hand
CNR13000	Spain (Canaries)/1	31.0	30.0	↑C ↓B	23, 27, 31, 35, 39 23, 27, 31, 35, 39	right hand left hand
CTI23700	Ivory Coast/1	31.0	30.0	↑ ↓	22, 26, 30, 34, 38 22, 26, 30, 34, 38	right hand left hand
E 12900	Spain/1	31.0	30.0	↑D ↓B	1, 5, 9, 13, 17 23, 27, 31, 35, 39	right hand left hand
G 02700	United Kingdom/1	31.0	33.5	↑ ↓	4, 8, 12, 16, 20 4, 8, 12, 16, 20	left hand right hand
GNB30400	Guinea-Bissau /1	31.0	30.0	↑ ↓	2, 6, 10, 14, 18 2, 6, 10, 14, 18	right hand left hand
CPV30100	Cape Verde/1	31.0	30.0	↑E ↓	4, 8, 12, 2, 6 **24, 28, 32, 36, 40**	right hand left hand
IRL21100	Ireland/1	31.0	33.5	↑ ↓	2, 6, 10, 14, 18 2, 6, 10, 14, 18	left hand right hand
ISL04900	Iceland/1	31.0	33.5	↑ ↓	21, 25, 29, 33, 37 21, 25, 29, 33, 37	right hand left hand
LBR24400	Liberia/1	31.0	33.5	↑ ↓	3, 7, 11, 15 3, 7, 11, 15	left hand right hand
POR13300	Portugal/1	31.0	30	↑ ↓A	3, 7, 11, 15, 19 **21, 25, 29, 33, 37**	right hand left hand
SRL25900	Sierra Leone/1	31.0	33.5	↑ ↓	23, 27, 31, 35, 39 23, 27, 31, 35, 39	left hand right hand
HISPASAT 1	Spain/1	30.0	30.0	↑D ↓B	1, 5, 9, 13, 17 23, 27, 31, 35, 39	right hand left hand
HISPASAT 2	Spain/1	31.0	30.0	↑C ↓	21, 23, 25, 27, 29, 31, 33, 35, 37, 39 1, 3, 5, 7, 9, 11, 13, 15, 17, 19	right hand left hand
UKDBS-3	UK/1	31.0	33.5	↑ ↓	22, 26, 30, 34, 38 22, 26, 30, 34, 38	left hand right hand

A, B, C, D: link grouped together; E: feeder-link channels at 14 GHz
NOTE 1 - This column gives the orbital positions for the alternative Step 1 described under Section 6.3.1.1

Solution for countries with less than the minimum number of channels

Beam name	Administration name/Region	Orbital position (in °E)		Channels	Circular polarization
BHR2550A	Bahrain/1	17.0	↑[A]	**23**, 27, 31, 35, 39	left-hand
			↓	**23**, 27, 31, 35, 39	right-hand
BRU3300A	Brunei/3	74.0	↑	3, **11**, 7, **15**	left-hand
			↓	12, 14, **16**, **18**	right-hand
COM2070A	Comoros/1	29.0	↑	3, 7, 11, 15, **19**	right-hand
			↓	3, 7, 11, 15, **19**	left-hand
FJI1930A	Fiji/3	152.0	↑	1, 5, 9, **13**	left-hand
			↓	1, 5, 9, **13**	right-hand
ISR1100A	Israel/1	-13.0	↑[B]	**7**,11, 1, 5, 9	left-hand
			↓	**21**, 25, 29, 33, 37	left-hand
LBR2440A	Liberia/1	-31.0	↑	3, 7, 11, 15, **19**	left-hand
			↓	3, 7, 11, 15, **19**	right-hand
MLD3060A	Maldives/3	44.0	↑	**4**, **8**, 12, 16	right-hand
			↓	**4**, **8**, 12, 16	right-hand
MLT1470A	Malta/1	-13.0	↑	4, 8, 12, 16, **20**	left-hand
			↓	4, 8, 12, 16, **20**	right-hand
NMB0250A	Namibia/1	-19.0	↑[B]	1, 5, 9, **11**, 13	right-hand
			↓	**21**, 25, 29, 33, 37	left-hand
NPL1220A	Nepal/3	50.0	↑	17, 19, 21, **23**	right-hand
			↓	17, 19, 21, **23**	left-hand

A: channel 23 grouped with beam "ARS03400", B: feeder-link channels at 14 GHz.

Countries with a new administrative/geographical situation

Beam name	Administration name/Region	Orbital position (in °E)		Channels	Circular polarization
AUS00400	Australia/3	98.0	↑D	3, 7, 11, 15, 19, 23	right-hand
			↓A	3, 7, 11, 15, 19, 23	left-hand
AUS004A0	Australia/3	98.0	↑D	3, 7, 11, 15, 19, 23	right-hand
			↓A	3, 7, 11, 15, 19, 23	left-hand
AUS004B0	Australia/3	98.0	↑D	3, 7, 11, 15, 19, 23	right-hand
			↓A	3, 7, 11, 15, 19, 23	left-hand
AUS004C0	Australia/3	98.0	↑D	3, 7, 11, 15, 19, 23	right-hand
			↓A	3, 7, 11, 15, 19, 23	left-hand
AUS00500	Australia/3	98.0	↑	1, 5, 9, 13, 17, 21	right-hand
			↓	1, 5, 9, 13, 17, 21	left-hand
AUS00600	Australia/3	98.0	↑	28, 32, 36, 40, 26, 30	left-hand
			↓	2, 6, 10, 14, 18, 22	right-hand
AUS00700	Australia/3	128.0	↑E	4, 8, 12, 16, 20, 24	right-hand
			↓B	4, 8, 12, 16, 20, 24	left-hand
AUS007A0	Australia/3	128.0	↑E	4, 8, 12, 16, 20, 24	right-hand
			↓B	4, 8, 12, 16, 20, 24	left-hand
AUS00800	Australia/3	128.0	↑	2, 6, 10, 14, 18, 22	right-hand
			↓	2, 6, 10, 14, 18, 22	left-hand

AUS00900	Australia/3	128.0	↑F ↓C	28, 32, 36, 40, 26, 30 3, 7, 11, 15, 19, 23	left-hand right-hand
AUS009A0	Australia/3	128.0	↑F ↓C	28, 32, 36, 40, 26, 30 3, 7, 11, 15, 19, 23	left-hand right-hand
AUS009B0	Australia/3	128.0	↑F ↓C	28, 32, 36, 40, 26, 30 3, 7, 11, 15, 19, 23	left-hand right-hand
AUS00401	Australia/3	152.0	↑D ↓A	3, 7, 11, 15, 19, 23 3, 7, 11, 15, 19, 23	left-hand right-hand
AUS0040A	Australia/3	152.0	↑D ↓A	3, 7, 11, 15, 19, 23 3, 7, 11, 15, 19, 23	left-hand right-hand
AUS0040B	Australia/3	152.0	↑D ↓A	3, 7, 11, 15, 19, 23 3, 7, 11, 15, 19, 23	left-hand right-hand
AUS0040C	Australia/3	152.0	↑D ↓A	3, 7, 11, 15, 19, 23 3, 7, 11, 15, 19, 23	left-hand right-hand
AUS00501	Australia/3	152.0	↑ ↓	4, 8, 12, 16, 20, 24 4, 8, 12, 16, 20, 24	right-hand left-hand
AUS00601	Australia/3	152.0	↑ ↓	28, 32, 36, 40, 26, 30 2, 6, 10, 14, 18, 22	right-hand left-hand
AUS00701	Australia/3	164.0	↑E ↓B	3, 7, 11, 15, 19, 23 3, 7, 11, 15, 19, 23	right-hand right-hand
AUS0070A	Australia/3	164.0	↑E ↓B	3, 7, 11, 15, 19, 23 3, 7, 11, 15, 19, 23	right-hand right-hand
AUS00801	Australia/3	164.0	↑ ↓	2, 6, 10, 14, 18, 22 2, 6, 10, 14, 18, 22	left-hand left-hand
AUS00901	Australia/3	164.0	↑F ↓C	27, 31, 35, 39, 25, 29 1, 5, 9, 13, 17, 21	right-hand right-hand
AUS0090A	Australia/3	164.0	↑F ↓C	27, 31, 35, 39, 25, 29 1, 5, 9, 13, 17, 21	right-hand right-hand
AUS0090B	Australia/3	164.0	↑F ↓C	27, 31, 35, 39, 25, 29 1, 5, 9, 13, 17, 21	right-hand right-hand
D 087	Federal Republic of Germany/1	-19.0	↑ ↓	2, 6, 10, 14, 18 2, 6, 10, 14, 18	right-hand left-hand
D2-216	Federal Republic of Germany/1	-1.0	↑ ↓	21, 25, 29, 33, 37 21, 25, 29, 33, 37	right-hand left-hand
ETH092	Federal Democratic Republic of Ethiopia/1	23.0	↑G ↓	2, 6, 8, 10, 12 22, 26, 30, 34, 38	right-hand left-hand
YEM266	Republic of Yemen/1	11.0	↑ ↓	2, 6, 10, 14, 18 2, 6, 10, 14, 18	left-hand right-hand
YEM267	Republic of Yemen/1	11.0	↑G ↓	1, 3, 5, 7, 9 1, 5, 9, 13, 17	right-hand left-hand

A, B, C: downlinks grouped together; D, E, F: uplinks grouped and identical;
G: uplink channels at 14 GHz

New ITU Member Countries or assumed as such for the purpose of this exercise

Beam name	Administration name/Region	Orbital position (in °E)		Channels	Circular polarization
ARM064	Armenia/1	23.0	↑	24, 28, 32, 36, 40	left-hand
			↓	24, 28, 32, 36, 40	right-hand
AZE064	Azerbaijan/1	23.0	↑	4, 8, 12, 16, 20	left-hand
			↓	4, 8, 12, 16, 20	right-hand
BIH148	Boznia Herzegovina/1	34.0	↑	2, 6, 10, 14, 18	left-hand
			↓	2, 6, 10, 14, 18	right-hand
BLR062	Belarus/1	38.0	↑	1, 5, 9, 13, 17	right-hand
			↓	1, 5, 9, 13, 17	left-hand
BTN031	Bhutan/3	86.0	↑	5, 9, 13, 17	left-hand
			↓	5, 9, 13, 17	right-hand
CZE144	Czech Republic /1	-1.0	↑	23, 27, 31, 35, 39	right-hand
			↓	23, 27, 31, 35, 39	left-hand
ERI092	Eritrea/1	23.0	↑	23, 27, 31, 35, 39	left-hand
			↓	23, 27, 31, 35, 39	right-hand
EST061	Estonia/1	23.0	↑	1, 5, 9, 13, 17	right-hand
			↓	1, 5, 9, 13, 17	left-hand
FSM000	Federated States of Micronesia/3	146.0	↑	3, 7, 11, 15	right-hand
			↓	3, 7, 11, 15	left-hand
GEO064	Georgia/1	23.0	↑	22, 26, 30, 34, 38	left-hand
			↓	22, 26, 30, 34, 38	right-hand
HRV148	Croatia/1	34.0	↑	24, 28, 32, 36, 40	left-hand
			↓	24, 28, 32, 36, 40	right-hand
KAZ066	Kazakhstan/1	44.0	↑	24, 28, 32, 36, 40	right-hand
			↓	24, 28, 32, 36, 40	left-hand
KGZ070	Kyrgyz Rep./ 1	44.0	↑	22, 26, 30, 34, 38	right-hand
			↓	22, 26, 30, 34, 38	left-hand
KIR001	Kiribati/3	176.0	↑	3, 7, 11	left-hand
			↓	3, 7, 11	left-hand
KIR002	Kiribati/3	176.0	↑	15, 19, 23	left-hand
			↓	15, 19, 23	left-hand
LTU061	Lithuania/1	23.0	↑	3, 7, 11, 15, 19	right-hand
			↓	3, 7, 11, 15, 19	left-hand
LVA061	Latvia/1	23.0	↑	21, 25, 29, 33, 37	right-hand
			↓	21, 25, 29, 33, 37	left-hand
MDA063	Moldova/1	38.0	↑	4, 8, 12, 16, 20	left-hand
			↓	4, 8, 12, 16, 20	right-hand
MHL000	Marshall Islands /3	146.0	↑	2, 6, 10, 14, 18	left-hand
			↓	2, 6, 10, 14, 18	right-hand
MKD148	FormerYug.Rep of Macedonia/1	34.0	↑	22, 26, 30, 34, 38	left-hand
			↓	22, 26, 30, 34, 38	right-hand
PLW000	Palau/3	146.0	↑	4, 8, 12, 16	left-hand
			↓	4, 8, 12, 16	right-hand
RUS001	Russian Federation/1	38.0	↑	odd: 25 to 39	right-hand
				even: 26 to 40	left-hand
			↓	odd: 25 to 39	left-hand
				even: 26 to 40	right-hand

RUS002	Russian Federation/1	56.0	↑ ↓	odd: 25 to 39 even: 26 to 40 odd: 25 to 39 even: 26 to 40	right-hand left-hand left-hand right-hand
RUS003	Russian Federation/1	86.0	↑ ↓	odd: 25 to 39 even: 26 to 40 odd: 25 to 39 even: 26 to 40	right-hand left-hand left-hand right-hand
RUS004	Russian Federation/1	110.0	↑ ↓	odd: 25 to 39 even: 26 to 40 odd: 25 to 39 even: 26 to 40	right-hand left-hand left-hand right-hand
RUS005	Russian Federation/1	140.0	↑ ↓	odd: 25 to 39 even: 26 to 40 odd: 25 to 39 even: 26 to 40	right-hand left-hand left-hand right-hand
SLM000	Solomon Islands/3	146.0	↑ ↓	1, 5, 9, 13 1, 5, 9, 13	right-hand left-hand
SVK144	Slovakia/1	-1.0	↑ ↓	3, 7, 11, 15, 19 3, 7, 11, 15, 19	right-hand left-hand
SVN148	Slovenia/1	34.0	↑ ↓	4, 8, 12, 16, 20 4, 8, 12, 16, 20	left-hand right-hand
TJK069	Tadjikistan/1	44.0	↑ ↓	1, 5, 9, 13, 17 1, 5, 9, 13, 17	right-hand left-hand
TKM068	Turkmenistan /1	44.0	↑ ↓	23, 27, 31, 35, 39 23, 27, 31, 35, 39	left-hand right-hand
TUV000	Tuvalu/3	176.0	↑ ↓	2, 6, 10, 14 2, 6, 10, 14	right-hand right-hand
UKR063	Ukraine/1	38.0	↑ ↓	3, 7, 11, 15, 19 3, 7, 11, 15, 19	right-hand left-hand
UZB071	Uzbekistan/1	44.0	↑ ↓	3, 7, 11, 15, 19 3, 7, 11, 15, 19	right-hand left-hand
YUG000	Federal Rep. of Yugoslavia/1	-7.0	↑ ↓	1, 5, 9, 13, 17 21, 25, 29, 33, 37	left-hand right-hand

6.3.1.4 Inter-region and inter-service compatibility analyses conducted by the Bureau

In addition to the Region 1 and 3 BSS-BSS compatibility investigations discussed above, planning principles 2.3 and 2.4 of Annex 1 to Resolution 531 (WRC-95) require a compatibility examination to maintain the integrity of the Region 2 Plan. It will be necessary to ensure that the new assignments at Step 2 of the Planning Exercises be compatible with the Region 2 Plan assignments. Moreover, it is further necessary to ensure the compatibility with the new assignments at Step 2 and those services sharing the same frequency bands (FSS and terrestrial services) in all three Regions.

The analysis conducted by the BR presents both:

- the incompatibility that Step 2 assignments (as assumed in this study) may have with the Region 2 Plan and the other services of the 3 Regions, and

- the incompatibility of Step 2 assignments (as assumed in this study) may have from Region 2 Plan and the other services of the 3 Regions.

The Bureau has developed several software tools to perform the above-mentioned examinations. The Bureau will report to the Conference.

6.3.1.4.1 Criteria for assessment of compatibility with the Region 2 Plan and other services (in both directions)

In the absence of specific guidance to the Bureau from WRC-95 on methodologies and sharing criteria that should be used for the compatibility analyses, in all cases of sharing, the methodologies and sharing criteria applied have been derived from Appendices 30 or 30A and their associated Rules of Procedure.

The FSS satellite systems data used in the calculations was that which was registered in SNS up to 21 March 1997 (or 17 February 1997 in some cases). Nevertheless, it is noted that many satellite networks not yet processed by the Bureau (in the order of 150) have not be taken into account in these compatibility analyses.

Compatibility analysis between the new feeder link assignments for the Region 1 and 3 BSS Plan and the Region 2 BSS Plan has been based on the present Region 2 BSS Plan assignments and the modifications of the Region 2 Plan already processed and published by the Bureau.

6.3.1.4.2 Compatibility analyses: provisional results

A summary of compatibility analysis results obtained are included in Table [z] for Step 1 and Table [v] for Step 2 .

When interpreting the data presented in Tables [v] and [z], it should be understood that:

1) the data is provisional and is subject to further refinement in the period leading up to WRC-97. In particular it will need to be refined as new satellite systems are added or if the Step 1 alternatives or the Step 2 option and its variant are refined;

2) for many of the compatibility conditions investigated, the number of identified administrations relates to conditions where there is a possibility of interference if various additional circumstances apply. Such an identification does not imply that interference is certain, it merely provides a warning flag that further investigation or coordination may be required.

TABLE [Z]: SUMMARY OF COMPATIBILITY ANALYSES FOR STEP 1

The analysis contained below reports the number of administrations that are identified when the criteria contained in Appendices 30 and 30A for modification of the Plans are applied.

1 Required compatibility with respect to interference caused to:

1.1 Feeder link

Protected assignments/service	Number of Affected Administrations	
	Step 1	Alternative Step 1
Region 2 Plan assignments	0[x] (no feederlink changes)	2[##]
Terrestrial Service	0[x] (no feederlink changes)	32[#]
Earth Station of FSS	0[x] (no feederlink changes)	0

1.2 Downlink

Protected assignments/service	Number of Affected Administrations	
	Step 1	Alternative Step 1
Region 2 Plan assignments	1	3[##]
Terrestrial Service	1	8
Space Station of FSS	3	3

2 Required compatibility with respect to interference received from:

2.1 Feeder link

Protected assignments/service	Number of Affecting* Administrations	
	Step 1	Alternative Step 1
Region 2 Plan assignments	0[x] (no feederlink changes)	2[##]
Space Station of FSS (Regions 1 and 3)	0[x] (no feederlink changes)	0
Space Station of BSS (Region 2)	0[x] (no feederlink changes)	0

2.2 Downlink

Protected assignments/service	Number of Affecting* Administrations	
	Step 1	Alternative Step 1
Region 2 Plan assignments	1	2
Terrestrial service	0	0
Space Station of FSS	2	4[##]

* An "affecting administration" is an administration/organization whose beam(s), or service(s), has been identified as being likely to cause interference to a proposed beam of a Step 1 or Step 2 country in the proposed Regions 1 and 3 Plan revision.

x In this case, 0 affected/affecting administrations means no change to the interference situation from that which was accepted in the current Plans.

If it is desired to compare the levels of interference between the current Plan orbital positions (Step 1) and the orbital position proposals of Alternative Step 1 it would be necessary to compare the coordination contours for each situation for both the current Plan positions (Step 1) and for Alternative Step 1.

The extent to which the interference changes due to the change of orbital position may need to be considered when assessing the compatibility of Alternative Step 1 with the services indicated.

NOTES - The FSS satellite systems data used in the calculations was that which was registered in SNS up to 21 March 1997 (or 17 February 1997 in some cases).

The compatibility analysis between the new feeder link assignments for the Region 1 and 3 BSS Plan and the Region 2 BSS Plan has been based on the present Region 2 BSS Plan assignments and the modifications of the Region 2 Plan already processed and published by the Bureau.

A study of the compatibility situation of the beams at 30°W and 31°W in the current Plan and each of proposed solutions in this table, could be provided with the purpose of facilitating the evaluation of the compatibility of the proposed solutions with other services, if time and resources permit.

TABLE [V]: COMPATIBILITY ANALYSES FOR STEP 2

The results below apply to the "new Countries" and channels added at Step 2. They do not include the Step 1 situation, which is reported in Table [z] above.

1 Required compatibility with respect to causing interference

1.1 Feeder link

Protected assignments/service	Number of Affected Administrations	
	Baseline option	national preferences variant
Region 2 Plan assignments	0	0
Terrestrial Service	84	84
Earth Station of FSS	1	1

1.2 Downlink

Protected assignments/service	Number of Affected Administrations	
	Baseline option	national preferences variant
Region 2 Plan assignments	0	0
Terrestrial Service	86	84
Space Station of FSS	17	17

2 Required compatibility with respect to receiving interference

2.1 Feeder link

Protected assignments/service	Number of Affecting* Administrations	
	Baseline option	national preferences variant
Region 2 Plan assignments	0	0
Space Station of FSS (Regions 1 and 3)	1	1
Space Station of BSS (Region 2)	0	0

2.2 Downlink

Protected assignments/service	Number of Affecting* Administrations	
	Baseline option	national preferences variant
Region 2 Plan assignments	0	0
Terrestrial service	0	0
Space Station of FSS	14	13

* An "affecting administration" is an administration/organization whose beam(s), or service(s), has been identified as being likely to cause interference to a proposed beam of a Step 1 or Step 2 country in the proposed Region 1/3 BSS Plan revision.

Notes - The FSS satellite systems data used in the calculations was that which was registered in SNS up to 21 March 1997 (or 17 February 1997 in some cases).

The compatibility analysis between the new feeder link assignments for the Region 1 and 3 BSS Plan and the Region 2 BSS Plan has been based on the present Region 2 BSS Plan assignments and the modifications of the Region 2 Plan already processed and published by the Bureau.

6.3.2 Plan Revision to facilitate to the extent possible (planning principle 2.2 of Annex 1 to Resolution 531 applies)

6.3.2.1 Adequate channel capacity

By adopting digital techniques, the capacity and the flexibility of the Plan can already be substantially improved without the need for change. Keeping the Plan as it stands but using digital modulation each assigned channel could provide increased programme capacity.

Each individual WARC-BSS-77 channel assigned to a service area could provide a number of EDTV programmes (Enhanced Definition TV, 16:9 aspect ratio, Recommendation ITU-R BT.601, with a bit rate of about 11 Mbit/s for each programme) or an even larger number of SDTV programmes (Standard Definition TV, equivalent to PAL and SECAM quality, with a bit rate of about 5.5 Mbit/s) which are time multiplexed on a single carrier. As an alternative to the multi-programme TV transmission, at least one HDTV programme could be transmitted.

Digital picture coding compression techniques has shown the feasibility of multi-programme TV transmission via satellite in the 12 GHz band (see Recommendation ITU-R BO.1211 and draft new Recommendation ITU-R BO. [CCC]) (Doc.11/38). Useful data rates from about 21 to 38 Mbit/s can for example be accommodated in a WARC-77 channel with suitable error protection, while 25 to 50 Mbit/s can be accommodated in a WARC-77 channel with satellite filtering at 33 MHz (-3 dB). However, these values could be reduced when taking into account the adjacent interference environment.

These assessments of an all-digital plan confirm the potential for the WARC-77 Plan to eventually accommodate an all-digital Plan in the future.

6.3.2.2 Alternative orbit locations

It is recognized that, in appropriate circumstances, it may be desirable for an administration to use an alternative orbital location to its existing location, with due consideration to be given to the other planning principles of Resolution 531. However, it is generally accepted that if alternative orbital positions were applied systematically, this will complicate any plan revision. In addition, consideration should also be given to other co-primary services to which the band is allocated.

It is also recognized that in certain orbital positions a few inconsistencies remain in the Plan and solutions based on alternative orbit locations may be useful.

6.3.2.3 Full Digital Approach

(Please see Section 6.3.2.1)

6.3.3 Additional criteria and additional studies

6.3.3.1 Power control

Article 5 of Appendix 30A, Section 5.1 contains the provision for determining the appropriate level of power control available from specified locations which can be recorded in column 9 of the Plan. Section 3.11 of the Annex 5 to Appendix 30A describes the method for calculation: it contains references to EPM, propagation model, etc., which have been updated by ITU-R, and thus might need to be reviewed with respect to modification of the calculation method. It is suggested that, as was done at WARC Orb-88, the Bureau be instructed to calculate and complete column 9 of the Plan once the revised Plan is adopted by WRC-97.

6.3.3.2 Coordination area around a feeder-link earth station

If Recommendations ITU-R IS.847-1 and IS.848-1 are accepted by WRC-97 for use in Appendices 30 and 30A, the current methods described in Annex 4 of Appendix 30A and in Appendix 28 (S7) of the Radio Regulations that the BR uses to identify the administrations affected by the operation of a transmit feeder-link earth station, by an FSS receive earth station or by a terrestrial receive station, may have to be revised and updated at WRC-99.

6.3.3.3 Rain climate zones

Recommendation ITU-R P.837 recommends rain climate zones; information for the prediction of attenuation due to rain is given in Recommendation ITU-R P.618. These contain updated information to that currently in Appendices 30/30A for Regions 1 and 3 and it is proposed that these Recommendations are adopted by the Conference for incorporation by reference.

6.3.3.4 Planning parameters

Recommendation 521 (WRC-95) described the technical parameters adopted by the WRC-95 for use in the revision of Appendices 30 and 30A in response to Resolution 524 (WARC-92).

Additionally, WRC-95 instructed the ITU-R to study the possible technical improvements that could be proposed in a similar way to CPM-97 in order to improve the situation of the feeder-link Plans (Appendix 30A). Tables 6.1 and 6.2 of Section 6.2.2 contain a consolidated list of all parameters recommended by the ITU-R for the revision of the Region 1 and 3 Plans.

6.3.3.5 Very low margins

The problem of very low EPM/OEPM values as a result of plan modification procedures was identified by the Bureau and included by WRC-95 in Section 5.2 of Resolution 531. Two reasons for such low values were determined by the BR:

- Non-reply to the request for coordination within the 4-month time limit when an administration had been identified as being affected; and the Plan was updated or will be updated accordingly.
- Low protection margins as a result of a coordination procedure for an administration having sought additional/modified entries into the Plan and having accepted such low values for these additional/modified assignments.

As a consequence, in both cases, it may happen that, due to the existing very low EPM/OEPM, these assignments are no longer identified as affected by subsequent requests for modifications/additions to the Plan applying the criterion presently in force (degradation by more than 0.25 dB if the actual value is currently zero dB or negative). This situation may be undesirable, e. g. in case a service is under operation and additional interference by a new service might actually occur.

See Section 6.5.6.8.

The actions resolving the problem of "very low OEPM" are considered consequential to the decisions taken by WRC-95.

6.3.3.6 Guardbands

As a consequence of the general 5 dB e.i.r.p. reduction adopted by the WRC-95, and assuming the same filter roll-off of 2 dB/MHz as in the current Plans, a reduction in bandwidth of about 2.5 MHz could be adopted for the guardbands at each edge of the BSS bands without any impact on the services in the adjacent frequency bands. This modification is still under consideration and studies need to be completed.

Criteria together with a compatibility evaluation method have been developed concerning frequency assignments in the guardbands of the Plans, but no Recommendation or draft Recommendation is available for consideration by WRC-97.

6.3.3.7 Linear polarization

Use of linear polarization has been proposed in certain Article 4 modifications to the Plans of Appendices 30 and 30A. ITU-R was asked to consider the use of differing polarizations in these Plans (see Resolution 531, Annex 1, Section 5.2.6). The ITU-R considered that although some new assignments using linear polarization have been accommodated in the current Plans, the general development of revised Plans by WRC-97 for Steps 1 and 2 using mixed (linear/circular) polarizations might not be advisable.

At present there are two Recommendations concerning polarization discrimination and the associated calculation method: ITU-R S.736 and BO.1213. The former recommendation was recently revised and preliminary studies were carried out in the ITU-R to evaluate and compare these methods in order to give the Bureau clear guidance as to which calculation method to apply. Studies are continuing.

6.3.3.8 Non-uniform channel spacing

Whereas the Bureau has been provided by ITU-R with a method of determining the interference for proposed BSS assignments under Article 4 which do not respect the general channelling plan on which the plan is founded, administrations are encouraged to retain, in their application of the modification procedure, the current channelling for the following reasons:

– the interference assessment can currently only be undertaken under the assumption of a worse case scenario which would not necessarily result in optimum spectrum usage;

– the current algorithm provided by ITU-R does not solve the problem arising from the overlap between two second adjacent channels, which may arise when one of the two (or both) channels do not respect the channelling plan applied in Appendix 30 due to the lack of second adjacent channel interference criteria, method and software for Regions 1 and 3.

Further studies are needed to develop complete calculation method/protection masks to treat non-standard emission (varying bandwidths, shifted centre frequencies, etc.).

6.3.3.9 Translation frequencies

Where possible the standard translation of 5.6 GHz for 17 GHz uplink channels should be used in preference to non-standard translations. In the case when a translation frequency other than 5.6 GHz is desirable for a single conversion mixing, then it is recommended that the ratio of the translation frequency to any frequency within the necessary bandwidth of the feeder-link channel must not be equal to 3/10 or 1/3.

6.3.3.10 Energy dispersal

In an all digital Plan, this issue will have a minor interest, but for a considerable time to come analogue service will remain in operation and will need energy dispersal. A power density characteristic should be included in Appendix S4 for Regions 1 and 3 (similar to the Region 2 Plan) subject to approval by WRC-97.

6.3.3.11 Service area contours and steerable beams

See Section 6.5.2.3 h).

6.3.4 Systems filed under Article 4 (Appendices 30/30A) procedures

WARC-92 and WRC-95 retained the current Appendix 30 and 30A procedures and provide no supplementary advice on methods to address Article 4 submissions to the Bureau. During the period between 1992 and 1997 the number of proposals for modification have grown from a few to very many with the number continuing to expand as WRC-97 approaches. In revising the Plans, the Conference will need to take decisions on the appropriate questions of priority raised during the preparations for the Conference by the studies of the ITU-R, the Bureau and its expert advisers, and ITU Member States.

6.3.4.1 Before the end of WRC-95

Proposals for Article 4 modifications submitted prior to WRC-95 could not assume any changes to the planning parameters decided at that Conference in Recommendation 521. On the other hand, the intention of the Resolution that new countries should be provided capacity was contained in Resolution 524.

6.3.4.2 After the end WRC-95

Proposals for modifications submitted after WRC-95 are with knowledge of the decisions contained in Resolution 531 and the implications of the way in which all systems which are not implemented or notified would be adjusted would be addressed in the revision of the Plans.

6.3.4.3 Treatment in planning exercises

In conducting its exercises the Bureau addressed these and a number of additional queries and proposals which may need to be resolved by the Conference before a Baseline Plan can be progressed. The Bureau noted in respect of the number of channels that "Resolution 531 does not clearly determine the minimum number of channels as it calls for the provision of "an initial capacity equivalent to that which would have been provided to them in using the principles adopted at WARC-77 BSS and WARC-Orb 88 Conferences".

It has not been possible to identify with complete clarity the principles that were adopted by these conferences. While the principle was given that for Region 1 the basic minimum was 5, it was necessary to consult with Region 3 administrations for that Region. General agreement was reached on 4 being the basic minimum.

What will need to be considered by WRC-97 is the number of channels appropriate for situations where it is clear WARC-77 provided for multiple beams to accommodate the needs of large countries, particularly those spanning several time zones. This matter has been discussed in respect of the consequential impact on the resources available to other countries for future BSS and other services. (See Sections 6.2.3 and 6.3.6.)

6.3.5 Integrity of the Region 2 Plan

In order that the revision of the Regions 1 and 3 Plans has no effect on the integrity of the Region 2 Plans, ITU-R has concluded that it is appropriate to apply the current criteria as defined in the Appendices 30 and 30A of the Radio Regulations.

6.3.6 Compatibility with other services in the band

For the purpose of assessing compatibility between the Regions 1 and 3 BSS Plans and the other services sharing the same frequency bands, in conducting the planning exercises, ITU-R have concluded that it is appropriate to apply the current criteria as defined in the Appendices 30 and 30A of the Radio Regulations. However, ITU-R consider it appropriate to revise the pfd threshold

defined in Annex 4 to Appendix 30 used to protect the Region 1 BSS Plan against FSS in Region 3, as well as the pfd threshold defined in Section 6 to Annex 1 to Appendix 30 to protect FSS in Region 3 against BSS in Region 1.

Concern was expressed that in assigning capacity to countries in Region 1 in excess of the minimum capacity of channels decided for that Region, the resources available to Region 3 countries for both BSS and FSS should not be unreasonably constrained.

Studies on these issues are continuing in the ITU-R (Special Rapporteur to JWP 10-11S). The result of these studies may provide guidance to the Conference in taking an appropriate view.

6.4 Methods to satisfy the agenda item

6.4.1 Planning Exercise Options

As described in Section 6.3.1 above, planning exercises have been conducted in order to prepare Reports illustrating the options available for WRC-97 to satisfy both the objectives of Resolution 524 (WARC-92) and the refinements of those objectives established by WRC-95 and contained in Resolution 531(WRC-95).

6.4.2 ITU-R Technical Refinements

As described in Section 6.3, ITU-R studies have produced additional technical refinements which can be used to further improve the **Reference Situation**. WRC-97 can choose to adopt all or some of these refinements when adopting a **Baseline Plan**[*] for the further updating of the Plans during the Conference since the improved planning software will be available to the Bureau for use in analysing the Conference decisions. A proposed set of Planning Parameter Improvements to achieve the **Baseline Plan**[*] are contained in Tables 6.1 and 6.2. The studies of ITU-R are continuing and a further update on this Annex may be available prior to the commencement of WRC-97.

6.4.3 Step 3 of the Planning Exercises

The WRC Resolution provides little, if any, direction in this Step even though it is by far the most difficult step of the planning exercise process. It is recognized that the existing Plan modification procedures remain in force until the Final Acts of WRC-97 take effect and will continue to be applied until then by Administrations and the BR.

At the time of preparing this report, the ITU-R planning exercises have not included completion of Step 3. Section 6.3.5 explains some of the complexities for addressing this part of the instructions to the Bureau. Studies by the ITU-R into ways of implementing the intent of Step 3 are continuing and will be reported by the Bureau to the Conference.

6.4.4 Possible methods of addressing the agenda item

6.4.4.1 Method Identified by ITU-R

The structure proposed in Resolution 531 offers a basis for the development of revised Plans by the Conference. Each Step may need to be confirmed by Conference decisions which will resolve issues identified during the exercises conducted by the Bureau, the ITU-R and by members.

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[*] It should be noted that the Baseline Plan referred to by ITU-R is not the same as the Baseline option in Section 6.3.1.1.

6.4.4.1.1 In finalization of Step 1, decisions are needed to:

- confirm the status of existing and notified systems and parameters to be applied to them;
- decide on the parameters to be applied to assignments in the Plans not brought into use or notified, including EIRP levels for countries in high rainfall climate zones;
- decide the parameters to be applied to modifications that have successfully completed Article 4 procedures and are published in Part B;
- resolution of very low OEPM values;
- update the list of networks published in Part B.

6.4.4.1.2 In finalization of Step 2, decisions are needed to:

- adopt proposals for beam requirements and test points for new countries;
- determine the appropriate number of channels to be allocated to countries;
- review the methods used by the BR in its development of its results;
- take into account coordination with other services during further development and address the consequential demands on resources shared between the Regions and different services which share the bands.

6.4.4.1.3 Reference Situation

After addressing the above steps and refining of the Bureau's results to take account of the Conference conclusions, the Conference will have available a confirmed Reference Situation for further progressing the revision of the Plans.

The ITU-R has identified improved technical criteria to improve the efficiency of the Plans. These proposals could be adopted to create a revised Reference Situation which could then be considered as a Baseline Plan.*

Further development of the Plans by the Conference to take account of any additional issues that may be identified in Step 3 of Section 5.4 of Resolution 531, the additional criteria contained in the Planning Principles of Section 2 of that Resolution and any matters raised in proposals to the Conference by members which may require interrelated issues to be addressed.

These include:

a) establishment of criteria meeting those planning principles adopted in Resolution 531 which may not have been fully satisfied by the Baseline Plan;

b) the extent to which WRC-97 will include consideration of Article 4 submissions not yet in the Plans;

c) take into account coordination with other services during further development and address the consequential demands on resources shared between the Regions and different services which share the bands.

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* It should be noted that the Baseline Plan referred to by ITU-R is not the same as the Baseline option in Section 6.3.1.1.

6.5 Regulatory/Procedural aspects of the revision of Appendices 30/30A for Regions 1 and 3

The regulatory/procedural aspects of the revision of Appendices 30 and 30A in Regions 1 and 3 include the following provisions:

a) the procedures for modifying the Region 1 and 3 Plans (Article 4 of Appendices 30/30A);

b) the procedures for notification, examination and recording of assignments to stations in the BSS and associated feeder-link Plans (Article 5 of Appendices 30/30A);

c) the procedures for the coordination, notification and recording of assignments to stations in other services to which the planned bands are allocated, so far as the relationship of these services with the planned services is concerned (Articles 6 and 7 of Appendices 30/30A);

d) miscellaneous procedural/regulatory provisions applying to the broadcasting-satellite service, and to the other services sharing the same bands:

- in Appendices 30 and 30A (Articles 2, 3, 8, 9, 12, 13 and 14 of Appendix 30, Articles 2, 3, 8, 10 and 11 of Appendix 30A, and various Annexes to these Appendices containing technical parameters and criteria);
- in Article **S5**, relating to the allocation of the frequency bands from 11.7 to 12.7 GHz in Regions 1, 2 and 3 to the broadcasting-satellite service and to several other services: **S5.485** (No. 836), **S5.487** (No 838), **S5.488** (No 839), **S5.491** (No 845), **S5.493** (No 847);
- in Article **S5**, relating to the allocation of the frequency bands from 14.5 GHz to 14.8 GHz and from 17.3 GHz to 18.1 GHz in Regions 1, 2 and 3 to the fixed-satellite service, for feeder links to the broadcasting-satellite service and to several other services: **S5.510** (No. 863), **S5.515** (No. 868A), **S5.516** (No. 869), **S5.517** (No. 869A) and **S5.518** (No. 869B);
- in Articles 11, 13, 14, 15 and 15A and in Articles **S9** and **S11**;
- in Article **S23**, a general provision applying to the broadcasting-satellite service: **S23. 13** (No. 2674);
- in Resolutions 32, 33, 34, 42, 106, 109, 506, 518, 519, 524 and 531;

e) the Rules of Procedure adopted by the Radio Regulations Board concerning all these provisions.*

The present experience in the application of these provisions and in the operation of broadcasting-satellite systems has highlighted the conservative nature of the technical parameters and criteria used in the Plan to determine the need for seeking agreement (Appendix 30, Annex 5 parameters, including reference antenna diagram and protection ratios, Annex 1 pfd and C/I degradation thresholds, Annex 7 limitations on the orbital locations, and similar limitations in Appendix 30A), or to determine conformity with the Plans.

Taking into account the improvements in technology, it appears that these technical parameters and criteria may need to be reviewed and suitably modified, in order to increase the flexibility of the Plan to accommodate new systems (in particular digital systems) and requirements, as well as eliminating unnecessary coordinations.

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* Concerns have been expressed on some of the Rules of Procedure by some administrations.

With the objective of improving the flexibility of the Plans and increasing their potential to meet the expected requirements of administrations, an in-depth review has been undertaken of all these provisions. On the basis of this review, proposals are made to consider the regulatory provisions on the basis of recent technical and technological improvements.

Section 4.4 of Resolution 531 refers to the desirability of facilitating the development of subregional systems. There is currently no definition of this term in the main body of the Radio Regulations, although this term is defined in Section 2.5 of Appendix 30B, for the purposes of this Appendix. Given the difficulties experienced in applying Appendix 30B procedures, there may therefore be a need to include in the main body of the Radio Regulations an appropriate definition of this term. For the purpose of this section, the term "supranational system" has been used to designate a satellite system intended to be operated by one or more administrations, with a service area extending beyond the territory of this or any of these administrations. There may be a need to define such a concept in the Radio Regulations. It is understood that, in all cases, operation of such a system is subject to the provisions of No. **S23.23** (2674).

6.5.1 Structure of the current and simplified procedures relating to Appendices 30 and 30A

6.5.1.1 Current structure of the regulatory procedures applicable in the frequency bands of Appendices 30/30A

The frequency bands associated with the Appendix 30 and 30A Plans are different in Regions 1, 2 and 3. Several terrestrial as well as space services, which are not subject to these Plans, share the same bands with an equal primary status, on a regional and/or interregional basis, either through allocations within the Table of Article **S5** itself, or through footnotes to this table.

This results in a number of different sharing situations for both the Appendices 30 and 30A bands. These situations are addressed through regulatory procedures which may appear either in Appendix 30/30A or in other parts of the Radio Regulations.

The following table provides a general outline of the sharing situations and associated procedures in the bands covered by Appendix 30 and 30A.

	Coordination or agreement to be sought by ↓	
Coordination or agreement sought from ↓	**Planned services**	**Others**
Planned services	Articles 4 and 5 of Appendix 30 Articles 4 and 5 of Appendix 30A	Article 6 and 7 of Appendices 30, 30A Articles 11, 13 and 14, Resolution 33, Resolution 34 (for interregional inter-service sharing and for sharing between unplanned and planned services)
Others	Articles 4 and 5 of Appendix 30 Articles 4 and 5 of Appendix 30A	Articles 11, 12, 13, 14 Resolution 33, Resolution 34

6.5.1.2 Relationship with the simplified procedures adopted by WRC-95

Simplified procedures (Articles **S7** through **S14**) have been adopted by WRC-95, subject to satisfactory resolution at WRC-97 of possible inconsistencies within these procedures. Work to identify and correct these inconsistencies is reported in Sections 1.3 to 1.7 of Chapter 1 of the CPM Report. One of the main difficulties encountered in carrying out this task is the relationship between the simplified procedures and the procedures of Appendices **S30** and **S30A**. Two possible approaches have been identified in order to resolve these difficulties, which differ by the location of the procedures relating to Appendices 30 and 30A Plans and possibly by the degree of simplification:

– **Approach 1 (Status quo ante WRC-95)**: In this approach, the entire set of procedures currently appearing under Appendices 30/30A would be kept within these Appendices, as was the case before WRC-95.

  The basic advantage of Approach 1 is to retain the simplicity and convenience for users of the Radio Regulations of being able to find in a single, readily accessible place - Appendix 30 - all the regulatory procedures associated with the use of the frequency range 11.7 - 12.7 GHz by two space services and four terrestrial services with primary allocations in this range. Likewise, Appendix 30A would retain all of the procedures for use of the associated feeder-link bands.

  Since a number of provisions in the current procedures refer to, or are identical with, other provisions of the Radio Regulations which were modified substantially by WRC-95, it would, at a minimum, be necessary to align them accordingly.

  Approach 1 recognizes that the existing procedures have been used for 20 years and no problems have arisen that cannot be corrected under this approach. It is the only approach consistent with the common views of Region 2 countries for maintaining the integrity of the Plans and provisions for that Region as required by Resolution 524 (WARC-92) and Resolution 531 (WRC-95). It also offers the simplest and most certain means for achieving the goals of "no substantial change" or "functional equivalence" stated for Approach 2. Finally, Approach 1 avoids the risk of unintended consequences associated with revising the still-evolving procedures of Articles **S9** and **S11** to make them applicable to the other services with allocations in the Appendices **30** and **30A** bands, in respect of the Plans.

– **Approach 2 (VGE approach)**: In this approach the procedures applicable to the other services in respect of the plans would continue to appear under Articles **S9** and **S11**, which was the approach followed by the VGE and by WRC-95, subject to review by WRC-97. [Comments of SYR to be provided]

  The basic advantage of Approach 2 is to retain the simplicity and convenience for users of the Radio Regulations of being able to find in a single, readily accessible place - Articles **S9** and **S11 -** all the regulatory procedures associated with the coordination and notification of their assignments for all unplanned space and terrestrial services in all frequency bands, including those covered by Appendices **30** and **30A**.

  This Approach would also resolve the current difficulty raised by existence of two different notification procedures for unplanned services in the bands covered by Appendix 30, one under Article 13 (**S11**), and a second one under Articles 6 or 7 of Appendix 30, with the associated risks of an assignment being recorded in the MIFR without having undergone all the appropriate processes.

No preference is given to any of these two approaches. It should be noted that both Approaches share a common attribute that, for at least one situation, an administration must consult both the body of the Radio Regulations and the Appendices to administer the frequency bands covered by Appendices 30 and 30A.

An alternative approach, intermediate between Approaches 1 and 2, was suggested at the CPM, which would be the following:

– the entire set of procedures currently contained in Appendices **S30** and **S30A** (Articles 2, 4, 5, 6 and 7 of these appendices) are located in a new article, Article **S10**;

– under Article **S10**, the present Article 4, 5, 6 and 7 of these two appendices are simplified into a unified modification procedure (Section **T4**), a unified notification procedure (Section **T5**), a unified coordination procedure for terrestrial services (Article **T6**) and a unified coordination procedure for space services (Article **T7**);

– Articles **S9** and **S11** are then to be modified to transfer Plan-related procedures (e.g. **S9.8** and **S9.9** and parts of **S9.17A** and **S9.19**) into Article **S10**, and contain the necessary links and references between Articles **S9**, **S11** and **S10**. [Comments of SYR to be provided]

Given the complexity of the subject, it was considered however that more studies would be required before such an approach can be fully endorsed. Administrations are encouraged to review this alternative approach, as well as the others, in their preparation of WRC-97.

6.5.2 Provisions for the modifications of the Plans

Existing regulatory/procedural provisions in the Radio Regulations, which are presently applicable to the Broadcasting-Satellite Service (BSS) or to the Fixed-Satellite Service (FSS), have been reviewed and compared, together with the experience gained in applying these provisions. As a result of the work of the VGE and the decisions of WRC-95, the simplified procedures that may apply to the frequency bands of Appendices 30/30A have also been reviewed.

The Bureau's experience in the application of Appendices 30 and 30A has shown that, in most cases, the problems encountered had been resolved by the BR, through appropriate modifications to the existing M-space software (implementation of shaped beams), consultation with JWP 10-11S (different polarization type, and, provisionally, non-standard parameters) or by the RRB, through the establishment of Rules of Procedure.

Based on the experience of the Bureau and the administrations in the application of Appendices 30 and 30A procedures, the studies undertaken by the ITU-R to improve the current procedures for modifications of the Plans (Articles 4 of Appendices 30 and 30A and associated technical parameters and criteria in Annexes 1, 2, 5 and 7 of Appendix 30 and in Annexes 1, 2, 3 and 4 of Appendix 30A) have focused on four main objectives: simplification, in line with the recommendations of the VGE and consistent with the decisions taken by WRC-95, completeness, flexibility and efficient use of the orbit/spectrum resource.

Satisfaction of these objectives could be facilitated by the following measures. An example of implementation of some of these measures into procedural text is provided in **Annex 1**, based on Recommendation 35 (WRC-95), which provides a basis for developing such a procedure (Article **T10**). For clarity, this example text is called Article **T4** in the following, and could apply to both Approaches 1 and 2.

6.5.2.1 Simplification

- Avoid duplications between the provisions applicable to the various Regions within the same Appendices.
- Avoid duplications between the provisions applicable to the BSS and the feeder-link Plans.
- Avoid redundant or superfluous provisions.
- Facilitate the understanding and the application of the provisions.

These objectives could be satisfied by the following approach:

- Merge Article 4 of Appendix 30 and Article 4 of Appendix 30A into a single Article **T4** used to modify both Plans.
- Merge Annex 1 of Appendix 30 and Annex 1 of Appendix 30A into a single set of provisions (Appendix **S6)** used to identify administrations affected by a modification to a Plan.
- Merge Annex 2 of Appendix 30 and Annex 2 of Appendix 30A into Appendix **S4**, as already implemented by WRC-95.

It should be noted that Article **T4** and Appendix **S6** could be located either within Appendices 30 and 30A, or alternatively, in a specific Article in the series of those of the simplified Radio Regulations adopted by WRC-95, which would apply only to Appendices 30 and 30A.

6.5.2.2 Completeness

- Address the sharing situations not presently covered by Appendices 30 and 30A

  One such situation would need to be covered with regard to the protection of the unplanned feeder links to the BSS in Region 2 from modifications in the Regions 1 and 3 feeder-link Plan (see Annex 1, Section 2.4 of Appendix **S6** and **add** 4.2.1.4.A of Article 4 of Appendix 30A).
- There may be a need to clarify the difference between additions to the Plan and modifications to an existing assignments.

Outstanding issues to be clarified

The following items may need to be clarified at WRC-97:

a) Provisions to return incomplete Annex 2 to administrations.

b) Provisions which regulate use of the guardband by space operation service (coordination between two space stations in this service operating in the guardbands and effect of transmission of BSS into guardbands).

c) Application of 4.3.13/4.2.14 of AP30/30A, in relation to the conditions requiring recommencement of the procedure when an administration modifies its initial modification proposal during the process of Article 4 (similar text from the Rules under 4.3.5(Rev.3) and 4.2.5(Rev.3)).

d) Aggregate effect from the networks under coordination which belong to the same administration and would operate simultaneously.

e) Modification to a Regional Plan requested by administrations which have no entry in this Plan (who is entitled to modify a Regional Plan).

f) Whether an earth station which should be coordinated under 4.2.1.2 of AP30A is typical or specific.

g) Whether the administrations with which coordination should be effected under 4.3.1.5 of AP30 are the ones which have an assignments to FSS transmitting space stations, the service areas of which overlap the pfd excess area or whether it is the administration whose territories are inside the intersection between the service area of the transmitting FSS space station and the area in which pfd limit is exceeded.

h) Treatment of FSS network under 4.3.1.5 of AP30 which has been received by the Bureau but not yet processed.

i) Treatment of test points at sea in terms of No. 2674

j) Treatment of uplink whose downlink is not in conformity with Annex 7 of Appendix 30.

k) Treatment of Article 4 assignments which are very similar to the assignments in Step 2.

l) Treatment of the Article 4 networks whose coordination is successfully completed before the Final Act comes into force (deadline for Part B publication in current structure).

m) Review of Appendices 30 and 30A, in particular Articles 6 and 7 to be adopted to cover cases for which the service area extends beyond the national territory (necessary provisions to be developed by WRC-97).

6.5.2.3 Flexibility and efficient use of orbit/spectrum resources

a) Time limit in case of no response to the Bureau

Introduce a time limit in the case when an administration having made a comment to a modification of the Plan does not provide an answer to the Bureau following a request for coordination by the Bureau (see **T4.21** and **T4.22**).

b) Time limit to bring in service an addition to the Plan

Ensure a maximum time interval of five years between the date of receipt of the information concerning a proposed addition to the Plan, with a maximum extension of two years to be approved by the RRB under specific, exceptional circumstances (**T4.8)**.

c) Time limit to bring in service a modification to an existing assignment in the Plan

Revised Rules of Procedure published in November 1996 in Circular CR/60 Annexes 2 and 3 state that if changed locations obtained through the Plan Modification Procedure are not brought into use within the (5+3)-year period they shall lapse and the original plan assignments shall be restored. This is not in accordance with the existing provisions in Appendices S30 and S30A.

The consequences of the revised ROPs are:

- to disadvantage any administration which wishes to change its orbital locations but is unable to bring the new assignments into use within the (5+3)-year period; and
- to affect adversely any other administrations which had taken up or wished to take up the vacated slots.

If these provisions and ROPs should apply to the Plans as revised by WRC-97, the result would be to disadvantage administrations, reducing flexibility and efficiency in the use of the planned bands.

Thus, there is a need to make provisions in the Radio Regulations to make it explicit that in the case of change of the orbital location (without the change of any characteristic other than those needed for compatibility), there is no time limit applicable for bringing into use the new locations. The changes consequential to the change of orbital location need to be developed.

It is noted that the completion of the Plan modification process may last several years during which the original entry needs to be retained together with the new one, both of them being taken into account in the processing of other modifications. There is a need for a provision limiting the time period for completion of this modification procedure to [4] years, after which the administration concerned would either revert to the original assignments (and the modification would be cancelled) or, if the modification procedure has been carried out successfully, adopt the modified assignments, in which case the original assignment would be cancelled and there would be no time limit applicable to the date of entry in service of the modified assignments.

d) Conditions for the use of additional resources

Discourage administrations to request additional resources in the Plan without using the resources allocated to them by the Plan (see **T4.7**). Some administrations noted that the proposed text, taken from the existing text in Article 4 of Appendix 30A (4.1.1), may not be sufficient to achieve this objective. Care should be exercised however, in attempting to strengthen this provision, to avoid undue constraints on the development of subregional systems.

e) Beam Group concept

The concept of grouping two or more beams to which the same channels and the same orbital position have been assigned was defined for the BSS and feeder-link Plans of Region 2 at RARC-83 (see item 9/GR of Section 10.2 of Article 10 of Appendix 30 and item 9/GR of Section 9.2 of Article 9 of Appendix 30A). The same concept was defined for the feeder-link Plan of Regions 1 and 3 at WARC-ORB 88 (see item 8 of Section 9A.2 of Article 9A of Appendix 30A). The purpose of the concept was to allow the implementation, without having to modify the Plans, of a first-generation system using a single BSS satellite which could broadcast to, and be fed from, a composite service area including all of the service areas covered by the beams in the group. The objective of such a system would be to initiate widespread service at a cost much lower than if separate satellites were used to serve each beam in the group.

In 1990, the then IFRB adopted a Rule of Procedure which extended the beam group concept to the Regions 1 and 3 BSS Plan. However, the Rule of Procedure also changed the concept in two significant ways. It precluded use of the same channel in the different beams of the group, although this was expressly permitted in the Region 2 Plans, and for the feeder-link Plan in Regions 1 and 3, and it permitted a group to include beams from more than a single orbital position.

However, this extension to multiple orbital locations, although providing flexibility to the members of the group, can lead to negative consequences, and suitable limitations have to be introduced to avoid them. The negative consequences include:

– inefficient use of the orbit-spectrum resource because two or more orbital positions are used to provide the same number of channels that could be provided from a single position;
– the opportunity to "warehouse" orbital positions because all of the channels associated with the multiple positions in the group, including those not in use at a given position, must be protected from interference;
– the possibility that administrations which agree to a proposed modification may not be identified as affected by subsequent modifications grouped with the first.

Administrations are invited to consider this issue in order to enable WRC-97 to review the scope of this concept in Regions 1 and 3 for both Appendices 30 and 30A, and ensure that the above potential negative consequences are avoided. This could involve consideration of the following questions:

– Should groups be used in the Plan modification procedure or limited to the Plan established at a Conference?
– Should groups be limited to beams of the same administration, or can they include the beams of different administrations?
– Should groups be limited to beams at the same orbital position, or can they include beams at different orbital positions?
– If groups involving multiple orbital positions are allowed, should their use be limited to the modification procedure, with a unique orbital position to be selected at the end of the procedure?

f) Satellite cluster concept/orbital offsets

As defined for, and incorporated in, the BSS and feeder-link Plans for Region 2 (see Sections 4.13 - 4.13.2 and Figure 9 of Annex 3 of Appendix 30A), "a cluster is formed by two or more satellites separated by 0.4 degrees and located at two nominal orbital positions as specified in the Plan; one position for right-hand polarized channels and the other position for left-hand polarized channels". The Region 2 Plan is based on the use of such a cluster for each beam having cross-polarized adjacent channels, so that the cross-polar discrimination of the feeder-link earth station antenna, which is reduced during rain, will be augmented by the angular discrimination of the antenna. Without this additional discrimination, the use of adjacent channels in a single beam may be seriously degraded during rain. However, satellites within a cluster may be located at any orbital position within the cluster, requiring only the agreement of the other administrations having satellites sharing the same cluster.

A similar concept was defined for Regions 1 and 3 (see Section 3.15 of Annex 3 of Appendix 30A). However, the cluster concept was not actually used in the development of the Regions 1 and 3 BSS and feeder-link Plans except for the inclusion of an orbital position offset of 0.4 degrees for two beams in the Regions 1 and 3 feeder-link Plan to resolve a specific interference situation. Further, the Regions 1 and 3 Plan did not consider rain attenuation and rain depolarization factors. It is noted that paragraph 5.2.1 c) of Article 5 of Appendix 30A does provide for the use of the cluster concept for Regions 1 and 3 under the conditions specified in Section 3.15 of Annex 3 to Appendix 30A. On the other hand, paragraph 5.2.1 c) of Article 5 of Appendix 30, which refers to Paragraph B of Annex 7 of Appendix 30, restricts the use of the cluster concept under Appendix 30 to Region 2 administrations. In either case, to change an orbital position within a cluster under the above provisions of Article 5 in all Regions does not result in modification of the Plan and therefore does not convey protection to the changed position. To secure such protection, the Article 4 modification procedure must be applied.

Administrations are invited to consider the further use in Regions 1 and 3 of the cluster concept and its implications which, in any case, will require modifications to the text of Appendices 30 and 30A to provide a consistent set of provisions.

g) Modifications involving a group of administrations

Introduce the possibility for an administration to modify the Plans involving a group of administrations (**T4.7bis)**, taking into account No. **S23.23** (2674). [Comments from SYR to be provided].

h) Use of steerable beams

Limit the use of steerable beams by the identification, under the Plan modification procedures, of suitable fixed pointing directions for which inclusion in the Plan is possible.

i) Coordination of feeder-link stations with other services

Coordination of new or modification assignments to feeder-link earth stations with other services sharing the band 17.7 - 18.1 GHz leads to a different treatment in Region 2, where only specific feeder-link earth stations can be considered in modifying the Plan, and in Regions 1 and 3, where the whole feeder link service area is to be coordinated, hence typical stations are considered. In Regions 1 and 3 however, experience has shown that in practice, agreement to modifications of the Plan is only granted after a detailed coordination, i.e. on a case-by-case basis. In all cases, it therefore appears that in practice, the end result of Appendix 30A procedures in sharing these bands with other services is equivalent to the application of Article 11, which was the approach followed for Appendix 30B under similar circumstances.

A possible solution to correct this difficulty would therefore consist in placing the coordination of new or modified feeder link earth station assignments under the general procedure of Nos. **S9.17** and **S9.17A.** A consequential change would be the deletion of paragraphs **4.2.1.2** and **4.2.1.3** of Article 4 of Appendix **S30A** (or their equivalents in the simplified procedures, paragraph **2.2** and **2.3** of Appendix **S6** and associated points (4) and (5) in Section 2 of Annex 1 to Appendix **S6**). Some administrations did not share these views.

Such an approach would also resolve another difficulty identified in this respect, i.e. that, when coordinating the feeder link service area with terrestrial services, the terrestrial stations to be taken into account are those in use or intended to be brought into use within three years of the projected date of bringing into use for the proposed modification, which could represent up to 11 years of forecast use. This may represent an unreasonable requirement on administrations planning to implement terrestrial services in the 17.8 - 18.1 GHz band.

j) Limitations on the orbital locations

Annex 7 of Appendix 30 and Section 3.15 of Annex 3 of Appendix 30A contain provisions on the orbital positions to be used when modifying the Plans. These provisions have an impact on the flexibility to modify the Region 1 and 3 Plan in the orbital arc 37°W-10°E. Modifications of these provisions could however, affect Region 2 FSS.

k) Use of non-standard parameters

Annex 5 of Appendix 30 and Annex 3 of Appendix 30A contain technical assumptions on which the Plans were established. These Annexes may need to be updated following the decisions that could be taken in this respect by WRC-97. Concerning the possibility, or desirability to use them as reflecting standard requirements that would be applied on a mandatory basis for modifying the Plans, it should be noted that there are conflicting requirements concerning the approach to be taken in this respect:

- equal treatment of all newcomers may warrant the introduction of standard antenna patterns for all transmit and receive space and earth station antennas, with protection afforded only at the level of the standard pattern;
- system characteristics less susceptible to interference or causing less interference (such as antennas performing better than the standard pattern in all directions, or reduced satellite e.i.r.p.) should be allowed;
- some of these measures would have the potential to inhibit the implementation of new technologies to a serious degree and to the potential detriment of the use of the Plan resources.

The guiding principle was taken that the use of non-standard parameters should not be precluded, as long as it does not affect the assignments in the Plan or those undergoing the plan modification process, nor unduly restrict access to the Plan through the modification procedure.

On this basis, there would be a need to clarify the way in which the Bureau should protect the use of non-standard antennas by assignments which are undergoing the Plan modification process.

One possible way of addressing this problem would be assess the interference to and from Plan assignments in such a way that new assignments should not cause greater interference to, nor seek greater protection than if they used the reference parameters. One way of implementing this approach would be, when identifying administrations under Annex 1 of Appendix 30, to calculate the EPM/OEPM on the basis of standard parameters that would appear in a Recommendation (e.g. Recommendation ITU-R BO 1213 for the receive earth station antenna radiation pattern), rather than in an annex of Appendix 30/30A. Such an approach would mean that non-standard parameters could be used, but their protection would be afforded only at the level corresponding to the standard parameters. In order to allow the Plan to evolve with technology, this recommendation could be incorporated by reference into Appendix 30/30A or into Appendix **S6**, and appropriate revisions of them taken into account, if so decided by a subsequent WRC. These revisions may include, as appropriate, any modified or additional parameters/criteria to be used in identifying affected administrations.

Another way of addressing this problem would be to avoid putting any constraint on the type of parameters to be used in view of the fact that the technologies and types of services are changing rapidly. A reason for this is that the use of different parameters, e.g. smaller antennas or reduced satellite e.i.r.p. levels, may generally be seen as self correcting ones in that it would result in lower C/I, hence not require more protection from future modifications to the Plan. However, if a single entry criterion was considered in the Article 4 process (either as a replacement of, or in addition to the EPM degradation criterion), this conclusion would no longer be valid.

l) Sharing criteria for the protection of BSS assignments from Plan modifications

As indicated in paragraph k) above, the impact of the use of non-standard parameters on the possibility of subsequent modifications to the Plans is closely related to the type of sharing criterion adopted in the Plan modification procedure for determining affected assignments in the Plan or in the Plan modification process. In Regions 1 and 3, this criterion currently corresponds to a 0.25 dB degradation in Equivalent Protection Margin (EPM) (Annex 1 of Appendix 30, Section 1, as completed by the Rules of Procedure, and endorsed by WRC-95). Two alternative criteria have been considered by the ITU-R:

– an Overall Equivalent Protection Margin (OEPM) degradation criterion, aggregating the up and downlink EPM degradation criteria, and

– a single entry criterion.

These two alternative criteria have been proposed by the ITU-R and included by WRC-95 in Resolution 531 for the purpose of conducting planning exercises. Concerning their possible adoption in the Plan modification procedure, the studies carried out by the ITU-R indicate that the adoption of a single entry criterion, either as a replacement of, or in addition to, the current criterion, would also facilitate the inclusion in the Plan of assignments which would have the potential to block future modifications to the Plan. This disadvantage could significantly outweigh the potential advantages of this alternative criterion. The adoption of the OEPM degradation criterion does not lead to difficulties in this regard.

Whatever criterion is adopted, there could be a need to impose minimum e.i.r.p. levels to avoid blockage of subsequent modifications of the Plans. Further study is required however, on the appropriate level that could be selected in this respect and on the status to be afforded to assignments currently being treated under Article 4 with an e.i.r.p. level lower than this minimum value.

m) Alternative procedural approaches

Many administrations are of the opinion that the rigidity of procedures is the main reason for a lack of flexibility of the Plans. Some administrations consider that a complete revision of WARC-BS-77 procedures would give the wanted flexibility to the Plans.

In this instance, and in view of the somewhat different status currently given to additions to the Plan and to modifications of existing assignments in the Plan (the former being subject to a time limit of 5+3 years), consideration might be given to associate different procedures to each of these two types of assignments.

For example, modifications to a Plan would constitute a distinct part of this Plan, which would be protected by somewhat more flexible procedures, such as Articles 11 and 13. The original assignments in the Plan, and their subsequent modifications, would continue to be protected by the above procedures (Article **T4** and Appendix **S6**).

Administrations are invited to investigate the feasibility of such an approach and its potential implications.

6.5.2.4 Transitional aspects relating to the implementation of the decisions of WRC-97

On the assumption that modifications to the Region 1 and 3 Plans are adopted by WRC 97, involving new criteria and procedures and that many pending proposed modifications (Step 3) to these Plans will not be taken into account by WRC-97, this Conference may wish to consider and include in its decisions the following:

a) in order to provide for the early implementation of the WRC-97 decisions, that the new procedures and technical criteria of the Appendices be used by BR and administrations as of the end of the Conference;

b) that the procedure to be followed by the Bureau and administrations to deal with outstanding modifications be as follows:

- BR should use the updated Plans and the new technical criteria to calculate the new reference situation for the Region 1/3 Plans as of the end of the Conference;
- BR should treat all pending modifications to the Plans of Appendix **S30** and Appendix **S30A** (i.e. those modifications being treated under Article 4 that have not yet completed the modification procedure) in the same date order that they were received by BR and using the new technical criteria and reference situation, identify for each pending modification the list of administrations whose agreement is required and to publish this list of affected administrations. It is noted that this would have resource implications on the BR;

- within four months from the date of the above publication, possibly affected administrations should provide comments to the BR and the notifying administration shall indicate any agreements which have been obtained previously and any new agreements;
- in those cases where the degradation of the margins (EPM or OEPM) caused by the proposed modification is no worse under the new situation arising from the revision of the Plan than under the original situation, any agreements previously obtained under the Article 4 procedures of Appendix 30 or Appendix 30A should continue to be valid as long as the orbital positions remain the same.

In addition, taking into consideration that there may be some changes to the regulatory procedures for the unplanned bands, resulting from the review under Resolution 18 (Kyoto, 1994), that could also be applied to modifications to the Plans of Appendices 30/30A, it might be appropriate for some of these changes to be implemented during the transitional period such as:

- the time period to bring modifications into use of 5 years plus a possible extension of 3 years should continue to be counted as from the date of the receipt by the Bureau of the complete information on the request for modification, except that the minimum period from the end of the Conference to bring the assignments into use should be no less than [one] year;
- any modifications involving new frequencies and/or orbit positions which have not been brought into service within this 5+3 year period should be cancelled by the Bureau after informing the notifying administration. (See paragraph 6.5.2.3 c))

It is also expected that WRC-97 will add new assignments in the Plans or modify existing assignments. This process will require verification that these do not affect and are not affected by existing or planned services sharing the same bands. In this respect the Conference may consider protection of the BSS Plan frequency assignments for “new” countries and those countries having less than the minimum number of channels (Step 2) from the other services sharing the same frequency bands at the level of the 1977 BSS Plan assignments.

Specific provisions may therefore be required to establish the rights of these new or modified assignments in the Plan in respect of these services, such as those appearing in Section 5.1.4 of Appendix 30A.

It has also been noted that in the current process of Article 4 of Appendix 30, there is no provision for proposed modifications to the Plan in order to seek protection from other services.

6.5.3 Procedures for the notification, examination and recording of assignments in the Plans

The existing procedures for the notification, examination and recording of assignments in the Plans appear in Article 5 of Appendix 30 and in Article 5 of Appendix 30A.

In reviewing these provisions, it was noted that there were only minimum differences between the three Regions and between the provisions applying under Appendix 30 and Appendix 30A, and that these differences could in general be avoided by the elimination of superfluous provisions. **Annex 2** identifies these differences and provides a comparison with a possible unified procedure (Article **T5**) that could replace both Articles 5 of Appendices 30 and 30A without any change of substance.

In both Appendices 30 and 30A, it appears that paragraph 5.2.1 c), which refers to cases when the parameters are within the envelope of an existing Plan assignment, could be suppressed since it is already covered by 5.2.1 b), with the understanding that such usage is recorded in the MIFR and not the Plan, and therefore not protected from subsequent modifications to the Plan.

In reviewing the existing procedures for notification, examination and recording, the following difficulty was identified, which may warrant further consideration by WRC-97.

In some cases, all of the required agreements cannot be obtained, however, the BSS system covered by the modification is going to be put into service. It must be recognized that there are and there will continue to be additional cases where the decisions to proceed with the implementation of the satellite network is made before all agreements have been concluded and once such decisions have been taken the system will be implemented - even if all the agreements cannot be concluded. In the existing Regulations, there is a problem in that if the agreement with an administration is still lacking, the notice will continue to be returned by the Bureau to the notifying administration until all of the agreements are obtained. This results in one administration having the ability to block a new entry into the Plan, even in the absence of valid technical reasons.

The VGE in its proposals recognized this and suggested a provision similar to the technical examination under No. 1506, however, WRC-95 had some difficulty in accepting such technical examinations.

This results in neither the Plan nor the MIFR reflecting what is really operating. It is to be noted that, under Article 14 and under Article 11 for unplanned space systems, there are provisions which permit the operation of such systems that have not concluded all of the necessary agreements to be operated and recorded in the MIFR with the obligation of protecting those assignments which led to this situation.

Two options were considered. The first option maintains the present approach. In the second option another approach to dealing with this problem was suggested with the same objective as the VGE but in a simpler process. This would result in an administration being able to operate its network but under the condition of undertaking to protect the assignments of the administration for which the agreement had not been obtained. These new assignments would not be included in the Plan, hence not affect the subsequent protection of the affected assignments, but may continue to be protected from subsequent modifications to the Plan. Significant concerns were expressed on this second option, and its regulatory implications need to be further explored.

6.5.4 Procedures applicable to unplanned services in respect of the Plans

The existing procedures in the Radio Regulations currently applicable to other than the planned services, in respect of the Plans encompass Articles 6 and 7 of Appendices 30 and 30A, as well as Articles 11, 13 and 14. As a result of the work of the VGE and the decisions of WRC-95, the latter three Articles have been included in Articles **S9** to **S14** of the simplified procedures Several provisions in these Articles (i.e. Nos. **S9.8, S9.9, S9.17** and **S9.19)** were intended to reflect Articles 6 and 7 of Appendices 30 and 30A, but their application was suspended pending the decisions of WRC-97.

Under Approach 1, Articles 6 and 7 of Appendices 30 and 30A would remain in these Appendices. Under Approach 2, they would be eliminated from these Appendices and Articles **S9** to **S14** would be revised to make them applicable to the frequency bands covered by Appendices 30 and 30A. Section 1.4.3 provides an example of possible modifications to these Articles to reflect both approaches, in which no attempt is made to modify the substance of these procedures. This section identifies the need for possible additional modifications to improve these procedures, under any of the two approaches.

There would be a need for the procedures of Articles 6 and 7 of Appendices 30 and 30A to cover sharing situations which were not identified at the time Appendices 30 and 30A have been

developed or revised, or which have emerged as a result of subsequent conferences. Those situations are as follows:

– coordination of unplanned BSS in Region 3 (12.5 - 12.7 GHz) in respect of Region 2 Appendix 30 Plan;

– coordination of unplanned BSS feeder links and terrestrial services in Region 2 (17.7 - 18.1 GHz) in respect of the Regions 1 and 3 feeder-link Appendix 30A Plan;

– coordination of unplanned BSS in Region 2 (17.3 - 17.8 GHz) in respect of Regions 1, 2 and 3 feeder-link Appendix 30A Plan;

– coordination of FSS (Earth-to-space) in Region 1 (12.5 - 12.75 GHz) in respect of Region 2 Appendix 30 Plan.

More fundamental difficulties have been identified which relate to differences in the principles applied in Regions 1 and 3 and in Region 2 concerning the relationship between the Plans and the other services, and the problems that the application of these procedures, under both approaches, would raise in the case of subregional systems. These difficulties are reported in the following paragraphs and require joint consideration of all the applicable procedures.

6.5.4.1 Treatment of feeder-link stations under Appendix 30A

Coordination of other services sharing the band 17.7 - 18.1 GHz with feeder-link stations in Appendix 30A Plans leads to a different treatment in Region 2, where only specific feeder-link stations can be considered in modifying the Plan, and in Regions 1 and 3, where typical stations can be considered but where, in practice, agreement to modifications of the Plan is only granted after a detailed coordination, i.e. on a case-by-case basis. In both cases, it seems that, in practice, the end result of Appendix 30A procedures in sharing these bands with other services is equivalent to the application of Article 11, which was the approach followed for Appendix 30B under similar circumstances (see also Section 6.5.2.3 i)).

6.5.4.2 Equitable access to orbit/spectrum resources for BSS, FSS and terrestrial services

Article 7 of Appendix 30 contains provisions for the coordination of new FSS assignments in the bands shared with the Appendix 30 Plan but only until the assignments **in conformity with this Plan**. Article 4 of Appendix 30 (paragraph 4.3.1.5) provides for protection of an FSS network against BSS modifications as soon as Appendix **S4** information is received, whereas protection of a BSS modification under Article 7 of Appendix 30 is only granted vis-à-vis FSS once the modification has been included in the Plan, which could be years after Appendix **S4** information has been received by the Bureau.

Establishing a more equitable access to the orbit/spectrum resources in all regions may be facilitated by protecting modified assignments in the Plans against other space services from the date of receipt of Appendix **S4** information.

Such an approach would also avoid the occurrence of the following situation as a result of the application of the current procedures:

– Administration A in Region 1 successfully modifies the Plan by applying Article 4. Administration B in Region 3, which has plans for an FSS network, is not identified as affected because it has not sent Appendix 3 information at the time when Administration A Annex 2 information is received by the Bureau.

– Before the Article 4 Procedure is finalized by Administration A, Administration B initiates Article 7 procedure. The administrations identified as potentially affected are those with assignments in conformity with the Plan, hence Administration A is not identified.

– Since none of the two administrations is aware of the other's plans, and no subsequent examination is done by the Bureau at the notification stage which could identify this new situation, the assignments of both administrations are recorded in the MIFR. In case of harmful interference, No. 838 would suggest that the FSS space station has to cease the interference.

It should also be noted that, in a similar sharing situation between FSS in Region 2 and BSS in Regions 1 and 3, application of Article 14 in the 11.7 - 12.2 GHz band in Region 2 FSS is putting FSS and BSS on a more equitable procedural footing. Recognizing that both services may need different protection criteria, this situation confirms that the ROP extension of the provisions of Annex 1 of Appendix 30 from the case of FSS in Region 2 (where Article 14 applies) to the case of FSS in Region 3 (where Article 14 does not apply), needs to be reviewed (see Section 6.5.5.2).

A similar situation arises in the case of Article 6, concerning equitable access to spectrum resources between BSS Plan modifications and terrestrial services.

In both cases, a possible solution to resolve these difficulties would be to start protection of modifications to the plans from the date of receipt of Annex 2 (Appendix **S4**) information by the Bureau. The possible problems associated with different delays in the lines of BSS plan modification and Article S9 need to be addressed however, in both Approaches 1 and 2. The Bureau also indicated that such a solution would increase its workload.

6.5.4.3 Interaction between the various provisions applicable to the services sharing the bands of Appendix 30 and Appendix 30A and consequences of this situation on subregional systems

6.5.4.3.1 Interaction between the provisions applicable to the services sharing Appendix 30 bands

Article 4 of Appendix 30 foresees the need for coordination of a modification to the Plan with the services of other administrations only to the extent that interference could be caused to these services by the proposed modification. In that sense, the possibility for a modification to the Plan to be protected from other services sharing the same band does not result from the application of the procedure.

The reason for this situation can be found in footnote No. 838 for Regions 1 and 3, as well as in No. 844 for Region 2. These footnotes provide a super-primary status to the Broadcasting-Satellite Service over the other primary services sharing the same band (FSS, BS, FS), in that these services shall not cause harmful interference to broadcasting-satellite stations operating in accordance with the provisions of Appendix 30 (Orb-85). This footnote is also the subject of a Rule of Procedure, which concludes that, if, despite the application of the procedures of Appendix 30, harmful interference is actually caused to a broadcasting-satellite station, the station in the other service shall cease this interference.

This conclusion means that, although Articles 6 and 7 of Appendix 30 ensure that the unplanned services can be implemented without causing harmful interference into the assignments of the Plans, successful application of these two procedures does not bring any rights.

One of the achievements of WARC-77 was to allow for sharing of the band between BSS and terrestrial services by generally allocating five channels to each country in a way that left a band of 400 MHz available for terrestrial services. With the capability of current technology to operate satellite systems over the full 800 MHz band on the same service area from the same orbital location, application of Article 4 without the need for coordination with terrestrial services (because Annex 1 pfd levels are not exceeded) now appears generally feasible. This could lead to situations

where terrestrial stations coordinated with one administration and notified under Article 6 of Appendix 30 need to stop transmission because that administration has successfully applied Article 4 for a higher number of channels without the need to coordinate with terrestrial services. A similar situation could arise in the case of the FSS, where a genuinely coordinated and notified space station would have to cease transmission. This gives concerns as to the respect of the rights of administrations to operate other than planned services within their own territory.

A similar situation could occur as a result of one administration successfully applying Article 4 to extend its service area without exceeding Annex 1 pfd limits. A terrestrial station or an FSS space station might in that case have to cease transmission, even after having objected to the publication on the basis of No. 2674.

A possible solution to this problem might be to restrict the scope of Nos. 838 to the assignments appearing in the original plan (on the assumption that these assignments have been coordinated with previous assignments in other services) and to make the Article 4 of Appendix 30 (or Article **T4**) a symmetrical process with respect to other services, by which modifications to the Plan also coordinate their protection from other services. These solutions however, have not been investigated.

Another anomaly in the application of the current procedures arises from the use of Article 6 and 7 of Appendix 30 for a regional service area. It should be recognized that the current Article 6 and 7 of Appendices 30 and 30A have been drafted by considering only situations where a BSS space station and the corresponding BSS earth stations are the responsibility of the same administration. With the increased use of subregional or supranational networks, this situation will no longer be prevailing and could cause difficulties when an administration has coordinated the use of the FS, BS or FSS with the national BSS assignments of a neighbouring country, but this country wants to use other BSS assignments associated with a supra-national system.

Under the current drafting of Article 6 of Appendix 30, if the administration responsible for the BSS space station (Administration A) is assumed to have successfully carried out Article 4 procedure with a supra-national service area, it will be contacted by Administration C (responsible for a terrestrial transmit station) to coordinate the protection of a receive BSS station on the territory of a third Administration (B). Under normal circumstances, such coordination between a terrestrial station and a receive earth station should be left to the two administrations on the territory of which the two stations are located.

In this instance, while it is recognized that No. 838 aims to protect BSS reception from harmful interference caused by another administration's radio services, particularly in border areas, extending its scope to afford protection of one administration's BSS transmissions when received in the territory of another administration might be arguable.

6.5.4.3.2 Interaction between the provisions applicable to the services sharing Appendix 30A bands

An anomaly in the application of the current procedures arises from the use of Article 6 and 7 of Appendix 30A for a supranational service area. It should be recognized that the current Article 6 and 7 of Appendices 30 and 30A have been drafted by considering only situations where a BSS feeder-link space station and the corresponding feeder-link transmit earth stations are the responsibility of the same administration. With the increased use of subregional networks, this situation will no longer be prevailing and could cause difficulties.

Under the current drafting of Article 6 of Appendix 30A, if the administration responsible for the BSS feeder-link space station (Administration A) is assumed to have successfully carried out Article 4 procedure with a supra-national service area, it will contact Administration C (responsible

for a terrestrial receive station) to coordinate the operation of a transmit feeder-link station on the territory of a third Administration (B). Under normal circumstances, such coordination between a terrestrial station and a transmit earth station should be left to the two administrations on the territory of which the two stations are located.

6.5.5 Studies concerning the sharing criteria

6.5.5.1 Sharing within the BSS in Regions 1 and 3

The adoption of the Overall Equivalent Protection Margin (OEPM) method for the establishment of the Plan has been generally supported and was adopted by WRC-95 in Resolution 531 in order to carry out planning exercises, on the assumption that it would offer more flexibility in establishing the revised Plans, by balancing the up and downlink margins.

This decision leaves open the question of using, or not, the same approach in the criteria selected to protect the assignments of the Plan in the modification procedures.

6.5.5.2 Sharing with other services

The sharing criteria with the other services are a critical element in ensuring the flexibility of the Plans.

Concerning the criteria to protect the FSS in Region 3 from modifications of the BSS plan in Region 1, studies are still in progress in order to provide adequate and equitable protections to both services sharing the same orbit/spectrum resources.

Concerning the criteria for the protection of terrestrial services from BSS plan modifications, there may be a need to reduce the number of different pfd masks currently appearing in Annex 1 of Appendix 30. For example, one administration proposed that the pfd levels appearing in No. 2574 be used.

Concerning the criteria to protect the Regions 1 and 3 BSS Plan from new FSS assignments, should WRC-97 decide to adopt the new characteristics contained in Resolution 531 concerning BSS protection ratios and BSS receive earth station antennas in Regions 1 and 3, there would be a need to update the pfd levels appearing in Annex 4 of Appendix 30; ITU-R studies have concluded that in this case, the following values may be appropriate:

$-145 + 2.0\,\theta^2$	dB(W/m^2/27 MHz)	for $0° \le \theta < 3.18°$,
$-137.2 + 25 \log\theta$	dB(W/m^2/27 MHz)	for $3.18° \le \theta < 19.4°$,
-105	dB(W/m^2/27 MHz)	for $19.4° \le \theta$.

where θ is the difference in degrees between the longitudes of the GSO BSS and GSO FSS space stations.

In all cases, any revision of these protection levels should be undertaken with care, in order to ensure continued protection of Region 2 Plans and services, and avoid imposing additional constraints on these Plans and services. As stated in *resolves* 2 of Resolution 524 (WARC-92) and referred to in Annex 1 of Resolution 531 (WRC-95), "the future conference shall ensure that the integrity of the Region 2 Plans and their associated provisions is preserved, by providing the same protection to the assignments contained in those Plans as they now receive under the relevant provisions of the Radio Regulations and by not requiring more protection from assignments in the Region 2 Plans than that currently provided under the Radio Regulations."

6.5.6 Other regulatory/procedural issues

Under Resolution 531, WRC-95 requested the ITU-R to conduct further studies in relation to the regulatory/procedural aspects of WRC-97 agenda item **1.10.** Some of these aspects, as well as other regulatory/procedural provisions have not been covered in the previous sections and are reported hereafter.

6.5.6.1 Miscellaneous provisions in the Radio Regulations

Significant difficulties have been identified and are reported in Section 5 on the exact interpretation to be given to No. 838 in the framework of modifications to the Plan including supra-national service areas or additional capacity. These difficulties should be resolved (see Section 6.5.4.3.1).

The reference to the application of Article 7 of Appendix 30 within No. 845/**S5.491** could be suppressed, under the assumption that it would be covered in an updated Article 7 (under Approach 1) or in Article **S9**/Appendix **S5** (under Approach 2).

In the case of Approach 2, the reference to the application of Resolution 34 within No. 847/**S5.493** could also be suppressed, since such a provision could be included in Article **S9**.

A similar treatment could be given to No. 868A/**S5.515** which indicates that, in the band 17.3 - 17.8 GHz, sharing between the FSS (Earth-to-space) and the BSS shall also be in accordance with the provisions of Section 1 of Annex 4 of Appendix 30A. This indication could also be suppressed.

Article S23 (No. S23.13/2674)

No. S23. 13/2674 states that "in devising the characteristics of a space station in the broadcasting satellite service, all technical means available shall be used to reduce, to the maximum extent practicable, the radiation over the territory of other countries, unless an agreement has been previously reached with such countries." WRC-95 provided guidelines to develop a Rule of Procedure on this provision. The scope of this Rule, which was adopted in 1996 by the RRB, may need to be clarified in relation to the other services sharing the same bands. Significant concerns were expressed about this Rule in relation to the cases of no reply, as well as in relation to the date of its implementation and the way it should be applied.

Resolutions

Pending the decisions of WRC-97 on agenda item **1.10**, as well as other agenda items involving BSS, consideration could be given to the review of Resolutions 519, 524 and 531 and to the suppression of Resolution 32, and, in the case where Approach 2 would be selected by WRC-97, of Resolution 34.

Resolution 506 requires administrations to ensure that their space stations in the 12 GHz frequency bands allocated to the BSS are operated in the geostationary satellite orbit and no other. Some administrations expressed the view that this resolution be extended to include the frequency bands of Appendix 30A. Several administrations objected to NGSO space stations operating in these bands. No modifications to Resolution 506 should be made until adequate studies are done with a view to assess the impact of such NGSO systems on BSS networks.

6.5.6.2 Review of other provisions in Appendices 30 and 30A

Appendices 30 and 30A contain several Articles which may have to be reviewed:

– Article 2 of Appendices 30 and 30A restate the scope of the procedures covered by these Appendices. Depending on which approach is selected in the relation to the simplified procedures, these Articles may need to be modified.
– Article 8 of Appendix 30 and Article 8 of Appendix 30A contain miscellaneous provisions which can also be found in the simplified procedures (Article **S13**).
– Article 9 of Appendix 30 mention absolute pfd limits applicable to protect terrestrial services in Regions 1 and 3 against modifications of Region 2 Plans. These provisions are in contradiction with those of Article 4 and Annex 1, which foresees coordination when these levels are exceeded.
– Article 13 of Appendix 30 and Article 10 of Appendix 30A contain provisions on interference that also appear in **S7.8**.

6.5.6.3 Procedures for subregional systems

WRC-95 considered "the desirability of facilitating the development of subregional and multinational systems in the procedures of Appendices 30 and 30A" and indicated that "guidance for the development of suitable procedures can be found in Resolution 42 and Appendix 30B".

The CPM noted that there may be a need for a suitable definition of such systems in the body of the Radio Regulations (see also the introduction of Section 6.5).

The ITU-R studies have shown that the procedures of Resolution 42 relating to the introduction of interim systems in Region 2 or the procedures for the introduction of a subregional system under Appendix 30B do not offer the same advantages as the combined application of existing provisions under Appendix 30/30A procedures (group concept, time limited agreements) and the adoption of a new provision allowing an administration to act on behalf of a group of administrations. In addition, such an approach would provide protection for interim systems, whereas Resolution 42 does not provide such protection against subsequent modifications of the Plans.

Consideration might therefore be given to reviewing Resolution 519, which calls for the development of specific provisions for interim systems for Regions 1 and 3.

6.5.6.4 Alignment of Appendices 30 and 30A

There are inclusions in the Articles of Appendix 30A adopted at WARC-88 which differ from those in Appendix 30. WRC-95 stated that it would be desirable for these to be brought into alignment as far as possible. Annexes 1 and 2 provide possible examples of such alignments.

6.5.6.5 Relationship with Appendix 30B

Although WRC-95 concluded that the planning exercises for the revision of Appendices 30/30A Plans would be complicated by attempting to align the orbital positions with those of Appendix 30B, the procedures should have enough flexibility to enable this alignment when it is needed.

Removing some of the provisions of Annex 7 of Appendix 30 and Section 3.15 of Annex 3 of Appendix 30A might facilitate such alignment. This however, should be considered with care to avoid affecting the development of Region 2 FSS.

6.5.6.6 Use of assignments in the BSS Plan for transmissions in the fixed-satellite service

In Region 2, No. **S5.492** (846) provides that "assignments to stations of the broadcasting-satellite service in the Plan for Region 2 contained in Appendix **S30** may also be used for transmissions in the fixed-satellite service (space-to-Earth), provided that such transmissions do not cause more

interference or require more protection from interference than the broadcasting-satellite service transmissions operating in conformity with the Region 2 Plan".

Extension of this provision to Regions 1 and 3 would be in line with the principle set out by WRC-95 in Resolution 531 (Section 2.2.3). This extension should provide for interregional plan protection, which is not the case in No. **S5.492**. It should also be constrained so that it in no way impairs the usage of the band for BSS purposes by other administrations.

Since no protection from or interference to the Plan is foreseen, the use of BSS assignments under this provision would be through the notification process. However, the regulatory application of this provision would require completion of the development currently undertaken by the ITU-R of methods and criteria to be applied to assess the interference of such FSS transmissions into the Plan, in order to enable the Bureau to determine conformity with No. **S5.492.** In the procedures, this implementation is currently done at the notification stage, by examination of the conformity with the provisions of No. 846, under paragraph 5.2.1 c) of Article 5 of Appendix 30.

It should be noted that with such use of a BSS assignment for FSS transmissions while still under a BSS allocation, the provisions of No. 2674 should also be applied in this case.

A parallel provision may be necessary to allow the non-feeder-link usage of the band by suitably modifying No. **S5.510 (**863) and No. **S5.516 (**869). However, since the use of the BSS downlink under No. 846 is recognized by a Rule of Procedure as still being under a BSS allocation, the corresponding uplink use in Appendix 30A bands would in principle still be considered as a feeder link to BSS, and hence be regarded as a transmission in conformity with the feeder-link Plan as long as it does not produce more interference than the feeder-link assignment on which it is based, rather than as a transmission not in conformity with the Table of Frequency Allocations. If such an interpretation was correct, there would be no need for an additional footnote under Article **S5** for this purpose.

6.5.6.7 Coexistence of analogue and digital systems

The protection ratios selected for the planning exercises and endorsed by WRC-95 have taken into account the possibility of digital assignments in the Plan and the possible coexistence of such assignments with analogue ones. It is expected that, if these protection ratios are kept in the process of modifying the Plans, together with those included in the corresponding draft new recommendation ITU-R BO.[DDD] [Document 11/42] for the feeder-link Plan, coexistence of such systems and adequate flexibility of the Plan with regard to accommodating digital systems will be ensured, with no need for specific procedural developments.

6.5.6.8 Very low EPM in the Plan

The sensitivity to interference, in terms of being identified as affected, by networks submitted to the Bureau decreases when these networks have a very low equivalent protection margins (EPM). In these cases, if, due to the above-mentioned phenomenon they are not identified as affected, the administrations concerned should be aware of this situation and must take necessary action, as appropriate. This conclusion has been included in the Rules of Procedure.

The ITU-R studies concluded that the occurrence of such situations is inherent in the EPM (or OEPM) method, but could not identify a protection criterion which would offer advantages over this criterion (see Section 6.5.2.3 l)). ITU-R also noted that, when such situations arise, it would generally be in the interest of both parties involved to resolve the situation, since the assignment causing this very low EPM to occur would generally also receive very high interference from the affected assignment.

Future occurrence of these situations could be significantly reduced if a single entry criterion was used in addition to EPM/OEPM criterion, with the establishment of an appropriate range of e.i.r.p. and other relevant parameters (see Sections 6.3.3.5 and 6.5.2.3 l)). Detailed additional studies would however be required before such an approach can be endorsed.

6.5.7 Impact on Region 2 Plan

The solutions that could be identified to resolve the difficulties highlighted in the previous paragraphs in connection with the Region 1 and 3 Plans may also be beneficial to Region 2; Region 2 administrations are encouraged to participate in the discussions under this WRC-97 agenda item in order to find ways of worldwide harmonization in this area.

Given that these solutions are not fully identified at this stage, the impact, if any, on the Region 2 planned and unplanned services due to Region 1 and 3 procedural modifications can not be determined at this time. This impact will need to be determined once suitable solutions have been fully identified.

The preservation of the integrity of the Region 2 Plan should be maintained in accordance with the requirements of Resolutions 524 and 531.

6.5.8 Conclusions

Since 1993, the ITU-R conducted extensive studies in the area of the regulatory/procedural aspects associated with the revision of Appendices 30 and 30A in Regions 1 and 3. Although a number of solutions have been identified that would have the potential to simplify the current procedures significantly and increase the flexibility of Appendices 30 and 30A Plans in Regions 1 and 3 to accommodate future requirements, these studies also identified significant difficulties relating to differences in the principles applied in Regions 1 and 3 and in Region 2 concerning the relationship between the Plans and the other services, and to the problems that the application of these procedures, either in their current form or in a simplified form, would raise in the case of subregional systems.

As a consequence of the close interaction between the frequency allocations to planned and unplanned services in the three Regions in the bands covered by Appendices 30 and 30A, resolution of these difficulties will require significant efforts by administrations in all three Regions prior to WRC-97.

ANNEX 1 TO CHAPTER 6

Example of a possible updating and/or simplification of the procedures for modification of Appendices 30 and 30A

~~**Article 4 of Appendix 30 and Article 4 of Appendix 30A into a single provision for modifying Appendices S30 and S30A Plans**~~

~~**Article T4 and Appendix S6**~~

This Annex provides two possible examples of updating and/or simplification of the procedures for the modifications of the Plans currently contained in Appendices 30 and 30A.

Under Approach 1, examples modifications to Articles 4 of Appendices 30 and 30A are provided, which might be required to suitably update these Articles in order to reflect the changes decided by WRC-95 as well as editorial errors which have been identified.

In the right-hand column, a simplified approach also taking into account these modifications is presented in the form of amendments to the text of Article **T10,** as it appears in the Annex to Recommendation 35 (WRC-95). Under this simplified approach, the criteria to determine the administrations affected would appear in an Appendix (Appendix **S6).** The sharing criteria currently applicable in Appendices 30 and 30A bands are consolidated into a single Annex to Appendix **S6.** This new Article (Article **T4)** and Appendix **S6** could replace both Articles 4 of Appendices 30 and 30A and their associated Annexes (Annex 1 of Appendix 30 and Annex 1 of Appendix 30A). This simplified approach could be used under Approach 2.

~~This annex provides a possible text for a modification procedure (Article **T4**) and its associated sharing criteria (Appendix **S6**), based on the current modification procedures of Appendices 30 and 30A Plans and, in line with Recommendation 35 on the consideration of Article **T10**.~~

~~This text of Article **T4** is presented in the form of amendments to the text of Article **T10**, in parallel with the current text of Articles 4 of Appendices 30 and 30A, to allow for a direct comparison between the current procedures and their possible simplification. In order to facilitate this comparison, the order of the current Appendices 30/30A procedures has been modified in some instances, which would not modify the scope of these procedures. When the text of Article **T10** is modified, for reasons other than the need for alignment with the current text of Articles 4 of Appendices 30/30A, the justifications for the modification are provided in the same box.~~

~~The text of Appendix **S6** is presented in the form of amendments to the current text of Articles 4 of Appendices 30 and 30A, with the corresponding justifications. This Appendix is used to identify the administrations whose services might be affected by the proposed modification.~~

~~The sharing criteria currently applicable in Appendices 30 and 30A bands are consolidated into a single Annex to Appendix **S6.**~~

Article **T4** and Appendix **S6** could be located either within Appendices 30 and 30A or in a separate Article of the Radio Regulations (e.g. Article **S10**) applying only to Appendices 30 and 30A.

APPROACH 1		SIMPLIFIED APPROACH
ARTICLE 4 OF APPENDIX 30 **Procedure for Modifications to the Plans** 4.5 *Master copy of the Plans* 4.5.1 *a)* The Bureau~~Board~~ shall maintain an up-to-date master copy of the Regions 1 and 3 Plan taking account of the application of the procedure specified in this Article. The Bureau~~Board~~ shall publish~~prepare~~ a document listing the amendments to be made to the Plan as a result of modifications made in accordance with the procedure in this Article. *b)* The Bureau~~Board~~ shall maintain an up-to-date master copy of the Region 2 Plan, including the overall equivalent protection margins of each assignment, taking account of the application of the procedure specified in this Article. This master copy shall contain the overall equivalent protection margins derived from the Plan as established by the 1983 Conference and those derived from all modifications to the Plan as a result of the successful completion of the modification procedure described in this Article. The Bureau~~Board~~ shall prepare a document listing the amendments to be made to the Plan as a result of modifications made in accordance with the procedure described in this Article. 4.5.2 The Secretary-General shall be informed by the Bureau~~Board~~ of any modifications made to the Regional Plans and shall publish an up-to-date version of those Plans in an appropriate form when justified by the circumstances.	ARTICLE 4 OF APPENDIX 30A **Procedure for Modifications to the Plans** 4.4 *Master copies of the Plans* 4.4.1 The Bureau~~Board~~ shall maintain up-to-date master copies of the Plans as well as master copies of the margin reports, including for each assignment the overall equivalent protection margins in respect of Region 2 and the feeder-link equivalent protection margins and the overall equivalent protection margins in respect of Regions 1 and 3, taking account of the application of the procedure specified in this Article. Each master copy of the margin reports shall contain the overall equivalent protection margins derived from the Plan as established by the 1983 Conference in the case of Region 2 and the feeder-link equivalent protection margins and the overall equivalent protection margins for the 1988 Conference in the case of Regions 1 and 3 and those derived from all modifications to the Plans as a result of the successful completion of the modification procedure of this Article. 4.4.2 The Secretary-General shall be informed by the Bureau~~Board~~ of any modifications made to the Regional Plans and shall publish up-to-date versions of the Plans in an appropriate form when justified by the circumstances.	ARTICLE T4 ~~T10~~ ~~(ANNEX to Recommendation 35)~~ **~~Possible~~ Procedure for the Modification of the ~~a~~ Frequency ~~Allotment or~~ Assignment Plans contained in Appendices S30 and S30A** **~~T10.1~~** ~~For the frequency allotment or assignment Plans contained in Appendices to these Regulations, the Bureau shall maintain the master copies of the Plans, incorporating any agreed modifications, and shall provide such copies in an appropriate form for publication by the Secretary-General when justified by circumstances.~~ • Reason: Covered under S13.17*bis*, which could be modified as follows to cover the specific requirement to contain the margins of the plans, for the appropriate plans: **S13.17*bis*** The Bureau shall maintain master copies of all world frequency allotment or assignment plans contained in appendices to these Regulations, or adopted by world conferences convened by the Union, including, where appropriate, the margins associated with each assignment or allotment, and incorporating any ~~agreed~~ modifications resulting from the successful application of the relevant modification procedure, and shall provide such copies in an appropriate form for publication by the Secretary-General when justified by circumstances.

4.1 When an administration intends to make a modification[2] to one of the Regional Plans, ..., the following procedure shall be applied before any notification of the frequency assignment is made to the International Frequency Registration Board (see Article 5 of this Appendix);	4.1 When an administration intends to make a modification[2] to one of the Regional Plans, ..., the following procedure shall be applied before any notification of the frequency assignment is made to the International Frequency Registration Board (see Article 5 of this Appendix);	**T4~~T10~~.2** Before notifying any assignment which is subject to the Plans of Appendix S30 or Appendix S30A, ~~a plan the~~ an administration shall ensure that it is in conformity with the corresponding Plan.**1**, **2** If the assignment is not in conformity, the administration shall apply the procedure~~2~~ of this Article to effect an appropriate modification to the Plan by seeking the agreement of those ~~e~~ administrations whose planned assignments or services which are identified in accordance with Appendix **S6**, ~~as having planned allotments or assignments which~~ may be affected by the proposed modification.
4.2 The term "frequency assignment in conformity with the Plan" used in this and the following Articles is defined in Article 1.	4.2 The term "frequency assignment in conformity with the Plan" used in this and the following Articles is defined in Article 1.	**T4~~T10~~.2.1** 1 An assignment is subject to a plan when it is for a station in a radiocommunication service and in a frequency band and in a geographical area ~~covered by~~ for which the procedures for modification of this Plan or for notification, examination and recording of assignments in this P~~p~~lan apply ~~a plan~~. An assignment is in conformity with a ~~the~~ Plan, if it appears in this ~~the~~ Plan, ~~or corresponds to an allotment in the Plan~~, or if the procedure for modification of ~~the~~ this Plan has been successfully applied to it. • *Reason: See Article 2 of Appendices 30 and 30A.* **~~T10.2.2~~** ~~2 Where an existing Plan contains a supplementary or alternative procedure, that procedure shall continue to be applied.~~ Reason: The assumption is that Articles 4, 5, 6 and 7 of Appendices 30 and 30A will be replaced by Articles S9, S10 (i.e. T4 and T5), S11 and related Appendices. Hence, no supplementary or alternative procedure would appear in the Plan. **T4.2.2** See also Article **T5** and Resolution 42.

4.1 When an administration intends to make a modification[2] to one of the Regional Plans, i.e. either: *a)* to modify the characteristics of any of its frequency assignments to a space station[3] in the broadcasting-satellite service which are shown in the appropriate Regional Plan, or for which the procedure in this Article has been successfully applied, whether or not the station has been brought into use; *or* *b)* to include in the appropriate Regional Plan a new frequency assignment to a space station in the broadcasting-satellite service; *or* *c)* to cancel a frequency assignment to a space station in the broadcasting-satellite service; the following procedure shall be applied before any notification of the frequency assignment is made to the Radiocommunication Bureau~~International Frequency Registration Board~~ (see Article 5 of this Appendix);	4.1 When an administration intends to make a modification to one of the Regional Plans, i.e. either: *a)* to modify the characteristics of any of its frequency assignments in the fixed-satellite service which are shown in the appropriate Regional Plan, or for which the procedure in this Article has been successfully applied, whether or not the station has been brought into use; *or* *b)* to include in the Plan a new frequency assignment in the fixed-satellite service; *or* *c)* to cancel a frequency assignment in the fixed-satellite service, the following procedure shall be applied before any notification of the frequency assignment is made to the Radiocommunication Bureau~~International Frequency Registration Board~~ (see Article 5 of this Appendix and Resolution **42 (Rev.Orb-88)**).	**T4~~T10~~.3** A ~~proposed~~ modification to a plan may consist of: **T4~~T10~~.4** a) a change in the characteristics of a~~n~~ frequency assignment ~~entry~~ in the Plan; or **T4~~T10~~.5** b) the inclusion of a new ~~entry~~ frequency assignment in the Plan; or **T4~~T10~~.6** c) the cancellation of ~~an entry~~ a frequency assignment in the Plan.

[2] The intention not to employ energy dispersal in accordance with paragraph 3.18 of Annex 5 shall be treated as a modification and thus subject to the appropriate provisions of this Article.

[3] The expression “frequency assignment to a space station”, wherever it appears in this Article, shall be understood to refer to a frequency assignment associated with a given orbital position. See also Annex 7 ~~and Resolution **43 (Orb-85)**~~ for the orbital limitations

4.1.1 Before an administration proposes to include in the ~~Region 2~~ Plan under the provisions of paragraph 4.1 *b)*, a new frequency assignment to a space station or to include in the Plan new frequency assignments to a space station whose orbital position is not designated in the Plan for this administration, all of the assignments to the service area involved should ~~normally~~ have been brought into service or have been notified to the Bureau~~Board~~ in accordance with Article 5 of this Appendix. ~~Should this not be the case, the administration concerned shall inform the Board of the reasons therefor.~~ 4.1.2 * The concept of a beam group in a BSS or feeder link Plan shall involve only one nominal orbital position. 4.1.3* Simultaneous transmission on the same channels/assignments that are part of the same group is permitted. For interference calculations from assignments belonging to a group into assignments that are not part of the same group, the aggregate interference from that group is to be taken into consideration in the manner described in Article **10** of Appendix **S30** and Articles **9** and **9A** of Appendix **S30A**.	4.1.1 Before an administration proposes to include in the Plan under the provisions of paragraph 4.1 *b)* a new frequency assignment for reception at a space station[1] or to include in the Plan a new frequency assignment for reception at a space station whose orbital position is not designated in the Plan to that administration, all of the assignments to the service areas involved should ~~normally~~ have been brought into service or have been notified to the Bureau in accordance with Article 5 of this Appendix. ~~Should this not be the case, the administration concerned shall inform the Board of the reasons therefor.~~ [1] The expression "frequency assignment for reception to a space station", wherever it appears in this Article, shall be understood to refer to a frequency assignment associated with a given orbital position. 4.1.2* Grouping shall involve beams from orbital positions within a single cluster as defined for all Regions in Appendix 30A. 4.1.3* Simultaneous transmission on the same channels/assignments that are part of the same group is permitted. For interference calculations from assignments belonging to a group into assignments that are not part of the same group, the aggregate interference from that group is to be taken into consideration in the manner described in Article **10** of Appendix **S30** and Articles **9** and **9A** of Appendix **S30A**.	**T4~~T10~~.7** Before an administration proposes to include in the Plan under the provisions of **T4~~T10~~.5**, a new frequency assignment to a space station or to include in the Plan new frequency assignments to a space station whose orbital position is not designated in the Plan for this administration, all the assignments to the service area involved should have been brought into service or have been notified to the Bureau in accordance with the relevant provisions of the Plan. See Ap 30A, paragraph 4.1.1, to the right. **T4.7*bis*** In proposing a modification to a plan, an administration may act on behalf of a group of named administrations, in which case all members of the group retain the right to respond in respect of their own services and assignments which could be affected by the proposed modification. *Reason: Facilitate the establishment of subregional systems (text taken from No.**S9.6.1**).* *It is assumed that administrations on behalf of which the modification is proposed have given their agreement in relation to No. S23.23 [2674]*
4.3 *Proposed modifications to a frequency assignment in conformity with one of the Regional Plans or inclusion in that Plan of a new frequency assignment.*	4.2 *Proposed modifications to a frequency assignment in conformity with one of the Regional Plans or proposed inclusion in that Plan of a new frequency assignment.*	

* Some administrations proposed to add these provisions which create difficulties for other administrations.

For Regions 1 and 3: 4.3.1 An administration proposing a modification to the characteristics of a frequency assignment in conformity with the Regions 1 and 3 Plan, or the inclusion of a new frequency assignment in that Plan, shall seek the agreement of those administrations:	*For Regions 1 and 3* 4.2.1 An administration proposing a modification to the characteristics of a frequency assignment in conformity with the Regions 1 and 3 Plan or the inclusion of a new frequency assignment in that Plan shall seek the agreement of those administrations:	• *Note: Existing provisions until par. 4.3.5 of Appendix 30/Par. 4.2.5 of Appendix 30A should appear under Appendix S6.*
4.3.1.1 of Regions 1 and 3 having a frequency assignment to a space station in the broadcasting-satellite service in the same or adjacent channel which is in conformity with the Regions 1 and 3 Plan, or in respect of which complete Annex 2 basic characteristics relating to the proposed modifications to that Plan have already been receivedpublished by the BureauBoard in accordance with the provisions of paragraph 4.3.5.1 or 4.3.6 of this Article; *or*	4.2.1.1 of Regions 1 and 3 having a feeder-link frequency assignment in the fixed-satellite service (Earth-to-space) in the same channel or an adjacent channel, in the same orbital position or an adjacent orbital position in the range ± 12.5° which appears in the Plan or in respect of which proposed modifications to the Plan have already been published by the BureauBoard in accordance with the provisions of paragraphs 4.2.6.1 and 4.2.7 of this Article; *or*	
4.3.1.2 of Region 2 having a frequency assignment to a space station in the broadcasting-satellite service with the necessary bandwidth, any portion of which falls within the necessary bandwidth of the proposed assignment, which is in conformity with the Region 2 Plan, or in respect of which complete Annex 2 basic characteristics relating to the proposed modifications to that Plan have already been receivedpublished by the BureauBoard in accordance with the provisions of paragraph 4.3.5.1 or 4.3.6 of this Article; *or*	4.2.1.2 having a frequency assignment in the band 17.7 - 18.1 GHz to an earth station in the fixed-satellite service (space-to-Earth), which is recorded in the Master Register or which has been coordinated or is being coordinated under the provisions of No. **1060** of the Radio Regulations and which is located within the coordination area of the feeder-link fixed-satellite earth station; *or*	
4.3.1.3identified in accordance with *resolves* 2 of Resolution **43 (Orb-85)**; *or*		

4.3.1.34 having no frequency assignment in the broadcasting-satellite service in the channel concerned but in whose territory the power flux-density value exceeds the prescribed limit as a result of the proposed modification or having an assignment whose associated service area does not cover the whole of the territory of the administration, and in whose territory outside that service area the power flux-density from the broadcasting-satellite space station subject to this modification exceeds the prescribed limit as a result of the proposed modification; *or*	4.2.1.3 having a frequency assignment in the bands 14.5 - 14.8 GHz or 17.7 - 18.1 GHz to a terrestrial station in use or intended to be brought into use within three years of the projected date of bringing the feeder-link modification into use, and which is located within the coordination area of the feeder-link fixed-satellite earth station; *or* 4.2.1.3*bis* of Region 2 having an assignment in the band 17.3 - 17.8 GHz in the broadcasting-satellite service in the same channel or an adjacent channel; and	
4.3.1.45 having a frequency assignment in the band 11.7 - 12.2 GHz in Region 2 or 12.2 - 12.5 GHz in Region 3 to a space station in the fixed-satellite service which is recorded in the Master Register or which has been coordinated or is being coordinated under the provisions of No. **S9.71060** of the Radio Regulations, or those of paragraph 7.2.1 of this Appendix;	4.2.1.4 having an assignment for feeder links in the fixed-satellite service (Earth-to-space) with the necessary bandwidth, any portion of which falls within the necessary bandwidth of the proposed assignment, which is in conformity with the Region 2 feeder-link Plan, or in respect of which proposed modifications to the Plan have already been published by the BureauBoard in accordance with the provisions of paragraphs 4.2.6.1 and 4.2.7 of this Article;	
	4.2.1.4a having a frequency assignment in the band 17.8 - 18.1 GHz to a receiving space station in the fixed-satellite service (Earth -to space), which is recorded in the Master Register or which has been coordinated or is being coordinated under the provisions of No. **S.9.7** of the Radio Regulations and which is located within the coordination area of the feeder-link fixed-satellite earth station; *and*	

4.3.1.5~~6~~ whose services are considered to be affected. 4.3.2 The services of an administration are considered to be affected when the limits shown in Annex 1 are exceeded.	4.2.1.5 which are considered affected. 4.2.1.6 The services of an administration are considered to be affected when the limits shown in Annex 1 to this Appendix are exceeded.	
	4.2.2 The agreement referred to in paragraph 4.2.1 is not required when an administration proposes to bring into use, with characteristics[1] appearing in the Plan, a fixed feeder-link earth station or a transportable feeder-link earth station in the bands 14.5 - 14.8 GHz or 17.3 - 18.1 GHz. [1] The power to be taken into account is obtained by adding the values specified in columns 8 and 9 of the Plan.	
For Region 2: 4.3.3 An administration proposing a modification to the characteristics of a frequency assignment in conformity with the Region 2 Plan, or the inclusion of a new frequency assignment in that Plan, shall seek the agreement of those administrations:	*For Region 2* 4.2.3 An administration proposing a modification to the characteristics of a frequency assignment in conformity with the Region 2 Plan or the inclusion of a new frequency assignment in that Plan shall seek the agreement of those administrations:	
4.3.3.1 of Region 2 having a frequency assignment in the Region 2 Plan to a space station in the broadcasting-satellite service in the same or adjacent channel which is in conformity with that Plan, or in respect of which proposed modifications to that Plan have already been published by the Bureau~~Board~~ in accordance with the provisions of paragraph 4.3.5.1 or 4.3.6 of this Article; *or*	4.2.3.1 of Region 2 having a feeder-link frequency assignment in the fixed-satellite service (Earth-to-space) in the same channel or an adjacent channel, which appears in the Plan or in respect of which proposed modifications to the Plan have already been published by the Bureau~~Board~~ in accordance with the provisions of paragraphs 4.2.6.1 and 4.2.7 of this Article; *or*	

4.3.3.2 of Regions 1 and 3 having a frequency assignment to a space station in the broadcasting-satellite service with the necessary bandwidth, any portion of which falls within the necessary bandwidth of the proposed assignment, which is in conformity with the Regions 1 and 3 Plan, or in respect of which proposed modifications to that Plan have already been published by the Bureau~~Board~~ in accordance with the provisions of paragraph 4.3.5.1 or 4.3.6 of this Article; *or*	4.2.3.2 having a frequency assignment in the band 17.7 - 17.8 GHz to an earth station in the fixed-satellite service (space-to-Earth), which is recorded in the Master Register or which has been coordinated or is being coordinated under the provisions of No. **S9.7~~1060~~** of the Radio Regulations and which is located within the coordination area of the feeder-link fixed-satellite earth station; *or*	
~~4.3.3.3 identified in accordance with *resolves* 1 of Resolution **43 (Orb-85)**; *or*~~		
4.3.3.~~3~~4 having no frequency assignment in the broadcasting-satellite service in the channel concerned but in whose territory the power flux-density value exceeds the prescribed limit as a result of the proposed modification or having an assignment whose associated service area does not cover the whole of the territory of the administration, and in whose territory outside that service area the power flux-density from the broadcasting-satellite space station subject to this modification exceeds the prescribed limit as a result of the proposed modification; *or*	4.2.3.3 having a frequency assignment in the band 17.7 - 17.8 GHz to a terrestrial station in use or intended to be brought into use within three years of the projected date of bringing the feeder-link modification into use, and which is located within the coordination area of the feeder-link fixed-satellite earth station; *or* 4.2.3.3*bis* of Region 2 having an assignment in the band 17.3 - 17.8 GHz in the broadcasting-satellite service in the same channel or an adjacent channel; *and*	
4.3.3.~~4~~5 having a frequency assignment in the band 12.5 - 12.7 GHz in Region 1 or 12.2 - 12.7 GHz in Region 3 to a space station in the fixed-satellite service which is recorded in the Master Register or which has been coordinated or is being coordinated under the provisions of No. **S9.7~~1060~~** of the Radio Regulations or those of paragraph 7.2.1 of this Appendix; *or*	4.2.3.4 having an assignment for feeder links in the fixed-satellite service (Earth-to-space) with the necessary bandwidth, any portion of which falls within the necessary bandwidth of the proposed assignment, which is in conformity with the Regions 1 and 3 feeder-link Plan, or in respect of which proposed modifications to the Plan have already been published by the Bureau~~Board~~ in accordance with the provisions of paragraphs 4.2.6.1 and 4.2.7 of this Article;	

4.3.3.5~~6~~ having a frequency assignment to a space station in the broadcasting-satellite service in the band 12.5 - 12.7 GHz in Region 3 with the necessary bandwidth, any portion of which falls within the necessary bandwidth of the proposed assignment and which *a)* is recorded in the Master Register, *or* *b)* has been coordinated or is being coordinated under the provisions of Resolution **33**, *or* *c)* appears in a Region 3 Plan to be adopted at a future administrative radio conference, taking account of modifications to that Plan which may be introduced in accordance with the Final Acts of the Conference;		
4.3.3.6~~7~~ whose services are considered to be affected. 4.3.4 The services of an administration are considered to be affected when the limits shown in Annex 1 are exceeded.	4.2.3.5 which are considered affected. 4.2.3.6 The services of an administration are considered to be affected when the limits shown in Annex 1 to this Appendix are exceeded.	
	4.2.4 The agreement referred to in paragraph 4.2.3 is not required when an administration proposes to bring into use, with characteristics appearing in the Plan, a fixed feeder-link earth station in the band 17.3 - 17.8 GHz or a transportable feeder-link earth station in the band 17.3 - 17.7 GHz. Administrations may communicate to the Bureau the characteristics of such earth stations for inclusion in the Plan.	

For all Regions: 4.3.5 An administration intending to modify characteristics in one of the Regional Plans shall send to the Bureau~~Board~~, not earlier than five years but preferably not later than eighteen months before the date on which the assignment is to be brought into use, the relevant information listed in Annex 2. Modifications to that Plan involving additions under paragraph 4.1 *b)* shall lapse if the assignment is not brought into use by that date.	*For all Regions* 4.2.5 An administration intending to modify characteristics in one of the Regional Plans shall send to the Bureau~~Board~~, not earlier than eight years but preferably not later than eighteen months before the date on which the assignment is to be brought into use, the relevant information listed in Annex 2 to this Appendix.	**T4~~T10~~.8** For the purpose of effecting a modification to a plan, the administration concerned shall, ~~having regard to the relevant provisions associated with the Plan,~~ not earlier than five years but preferably not later than eighteen months before the date on which the assignment is to be brought into use, send to the Bureau the relevant information listed in Appendix **S4** of these regulations.~~ This action shall be taken within the time limits specified in the relevant appendix.~~ An extension of two years may be approved by the Bureau under the same conditions as contained in [S11.xx]. Modifications to a Plan involving additions under paragraph T4~~10~~.5 shall lapse if the assignment is not brought into use by that date, including any approved extension. Note by SC: This time limit and its possible extension for additions to the Plan should be considered in the light of the decisions to be taken by WRC-97 in response to Resolution 18 (Kyoto '94)
	4.2.6 If an administration wishes to modify its assignments in the Plans contained in Appendix **S30 (WRC-97~~(Orb-85~~)** and in Appendix **S30A (WRC-97~~Orb-88~~)**, the eight-year period of paragraph 4.2.5 will be applicable in lieu of the five-year period specified in paragraph 4.3.5 of Appendix **S30 (WRC-97~~Orb-85~~)**.	

4.3.5.1 Where as a result of the intended modification the limits defined in Annex 1 are not exceeded, this fact shall be indicated when submitting to the Bureau~~Board~~ the information required by paragraph 4.3.5. The Bureau shall then publish this information in a special section of its weekly circular.	4.2.6.1 Where as a result of the intended modification the limits defined in Annex 1 to this Appendix are not exceeded, this fact shall be indicated when submitting to the Bureau the information required by paragraph 4.2.5. The Bureau shall then publish this information in a special section of its weekly circular.	
4.3.5.2 In all other cases the administration shall notify the Bureau~~Board~~ of the names of the administrations whose agreement it considers should be sought in order to arrive at the agreement referred to in paragraph 4.3.1 or 4.3.3, as well as of those with which agreement has already been reached. 4.3.5*bis* The Bureau shall examine each notice provisionally with respect to its conformity with the Constitution, the Convention, the Table of Frequency Allocations and the other provisions of the Radio Regulations including the Appendices thereto. Notices found not to be in conformity and which do not make specific reference to No. **S4.4** shall be returned immediately to the notifying administration.	4.2.6.2 In all other cases the administration shall notify the Bureau~~Board~~ of the names of the administrations whose agreement it considers should be sought in order to arrive at the agreement referred to in paragraphs 4.2.1 and 4.2.3 as well as of those with which agreement has already been reached.	

4.3.6 The Bureau~~Board~~ shall determine on the basis of Annex 1 the administrations whose frequency assignments are considered to be affected within the meaning of paragraph 4.3.1 or 4.3.3. The Bureau shall include the names of those administrations with the information received under paragraph 4.3.5.2 and shall publish the complete information in a special section of its weekly circular. The ~~Board~~ Bureau shall immediately send the results of its calculations to the administration proposing the modification to the appropriate Regional Plan.	4.2.7 The Bureau shall determine on the basis of Annex 1 to this Appendix the administrations whose frequency assignments are considered to be affected within the meaning of paragraphs 4.2.1 and 4.2.3. The Bureau shall include the names of those administrations with the information received under paragraph 4.2.6.2 and shall publish the complete information in a special section of its weekly circular. The Bureau shall immediately send the results of its calculations to the administration proposing the modification to the Plan.	**T4~~T10~~.9** The Bureau, upon receiving the information under No. **T4~~T10~~.8:** **T4~~T10~~.10** a) determine in accordance with Appendix **S6** the administrations whose ~~allotments or~~ assignments are considered to be affected; **T4~~T10~~.11** b) include their names in the publication ~~information received~~ under No. **T4~~T10~~.~~8~~12;** **T4~~T10~~.12** c) publish the complete information in its Weekly Circular; **T4~~T10~~.13** d) promptly inform all administrations affected of its actions and the results of its calculations, drawing their attention to the relevant Weekly Circular.
4.3.7 The Bureau~~Board~~ shall send a telegram to the administrations listed in the special section of the weekly circular drawing their attention to the information it contains and shall send them the results of its calculations	4.2.8 The Bureau~~Board~~ shall send a telegram to the administrations listed in the special section of the weekly circular drawing their attention to the information it contains and shall send them the results of its calculations.	**T4~~T10~~.13*bis*** One month before the expiry of the period referred to in paragraph **T4~~T10~~.17,** the Bureau shall send a telegram to the administrations listed in the special section of the weekly circular drawing their attention to the matter. • *Reason: Reflect current Rule of Procedure and current Article 4 text.* ***Note by Secretariat: see note following T4.17.***

4.3.8 An administration which feels that it should have been included in the list of administrations whose services are considered to be affected may, giving the technical reasons for so doing, request the ~~Board~~ Bureau to include its name. The Bureau~~Board~~ shall study this request on the basis of Annex 1 and shall send a copy of the request with an appropriate recommendation to the administration proposing the modification to the appropriate Regional Plan.	4.2.9 An administration which feels that it should have been included in the list of administrations whose services are considered to be affected may, giving the technical reasons for so doing, request the Bureau to include its name. The Bureau~~Board~~ shall study this request on the basis of Annex 1 to this Appendix and shall send a copy of the request with an appropriate recommendation to the administration proposing the modification to the Plan.	**T4~~T10~~.14** Following receipt of the Weekly Circular, an administration believing that it should have been included in the list of administrations whose services are considered to be affected may, giving the technical reasons for so doing, request the Bureau to include its name. The Bureau shall study this request on the basis of Appendix **S6** and the relevant rules of Procedure. In the event that the request to be included in the list of affected administrations is accepted by the Bureau, an addendum to the publication mentioned in **T4~~T10~~.12** shall be published by the Bureau. Should the Bureau reach a negative conclusion, it shall inform the administrations concerned.
4.3.9 Any modification to a frequency assignment which is in conformity with the appropriate Regional Plan or any inclusion in that Plan of a new frequency assignment which would have the effect of exceeding the limits specified in Annex 1 shall be subject to the agreement of all administrations whose services are considered to be affected.	4.2.10 Any modification to a frequency assignment which is in conformity with the Plan or any inclusion in the Plan of a new frequency assignment which would have the effect of exceeding the limits specified in Annex 1 to this Appendix shall be subject to the agreement of all affected administrations.	**T4.14*bis*** Any modification to a frequency assignment which is in conformity with the appropriate Regional Plan or any inclusion in that Plan of a new frequency assignment which would have the effect of exceeding the limits specified in Appendix **S6** shall be subject to the agreement of all administrations whose services are considered to be affected.
4.3.10 The administration seeking agreement or the administration with which agreement is sought may request any additional technical information it considers necessary. The administrations shall inform the Bureau~~Board~~ of such requests.	4.2.11 The administration seeking agreement or the administration with which agreement is sought may request any additional technical information it considers necessary. The administrations shall inform the Bureau~~Board~~ of such requests.	**T4~~T10~~.15** The administration seeking agreement and those with which it is sought, or the Bureau, may request any additional information they consider necessary. The Bureau shall be sent copies of any such requests and the replies.

4.3.11 Comments from administrations on the information published pursuant to paragraph 4.3.6 should be sent either directly to the administration proposing the modification or through the Bureau~~Board~~. In any event the Bureau shall be informed that comments have been made. 4.3.12 An administration that has not notified its comments either to the administration seeking agreement or to the Bureau within a period of four months following the date of the weekly circular referred to in paragraph 4.3.5.1 or 4.3.6 shall be understood to have agreed to the proposed assignment. This time limit may be extended by up to three months for an administration that has requested additional information under paragraph 4.3.10 or for an administration that has requested the assistance of the Bureau~~Board~~ under paragraph 4.3.20. In the latter case the Bureau~~Board~~ shall inform the administrations concerned of this request.	4.2.12 Comments from administrations on the information published pursuant to paragraph 4.2.7 should be sent either directly to the administration proposing the modification or through the Bureau~~Board~~. In any event the Bureau~~Board~~ shall be informed that comments have been made. 4.2.13 An administration which has not notified its comments either to the administration seeking agreement or to the Bureau~~Board~~, within a period of four months following the date of the weekly circular referred to in paragraph 4.2.6.1 or paragraph 4.2.7 shall be understood to have agreed to the proposed modification. This time-limit may be extended by up to three months for an administration which has requested additional information under paragraph 4.2.11 or for an administration which has requested the assistance of the Bureau under paragraph 4.2.21. In the latter case the Bureau shall inform the administrations concerned of this request.	**T4~~T10~~.16** Comments from administrations on the information published pursuant to **T4~~T10~~.12** should be sent either directly to the administration proposing the modification or through the Bureau. In any event the Bureau shall be informed that comments have been made. The Bureau shall inform the administration proposing the modification of the comments that have been made. **T4~~T10~~.17** An administration which has not notified its comments either to the administration seeking agreement or to the Bureau within a period of four months following the date of the weekly circular referred to in **T4~~T10~~.12** shall be understood to have agreed to the proposed modification. This time-limit may be extended by up to three months for an administration that has requested additional information under **T4~~T10~~.15** or for an administration that has requested the assistance of the Bureau under **T4~~T10~~.18.** In the latter case the Bureau shall inform the administrations concerned of this request. *Some administrations consider that the advance warning by the Bureau indicated in T4.13bis may not be sufficient.*
4.3.20 An administration may at any stage in the procedure described, or before applying it, request the assistance of the Bureau~~Board~~, particularly in seeking the agreement of another administration.	4.2.21 An administration may at any stage in the procedure described, or before applying it, request the assistance of the Bureau, particularly in seeking the agreement of another administration.	**T4~~T10~~.18** Any administration involved in this procedure may request the assistance of the Bureau in accordance with **S7.5.**in seeking agreement~~:~~ **T4~~T10.19~~** ~~a) in applying any step of this procedure;~~ **T4~~T10.20~~** ~~b) in carrying out any technical study necessary for the application of this procedure.~~

		T4~~T10~~.21 If, following action by the Bureau in response to a request for assistance under ~~No~~. **T4~~T10~~.18** the Bureau receives no reply or decision within three months of its request for a decision in the matter from an administration whose agreement has been sought, the administration which requested the agreement shall be deemed to have fulfilled its obligations under this procedure. It shall also be deemed that the administration which did not give its decision has undertaken: **T4~~T10~~.22** That no complaint will be made in respect of harmful interference affecting the services rendered by its stations which may be caused by the use of the assignment in conformity with the proposed modification to the Plan~~, and~~. • *Reason: Avoid current rigidity of the Plans in cases where, after having made a comment to the proposed modification, an administration does not respond to the Bureau's request for specifying its decision. The text proposed under T4.21 and T4.22 is the same as in similar cases under Article 6 and 7 of Appendices 30 and 30A (e.g. 6.1.10 of Appendix 30).*

4.3.13 If, in seeking agreement, an administration modifies its initial proposal, it shall again apply the provisions of paragraph 4.3.5 and the consequent procedure with respect to any other administration whose services might be affected as a result of modifications to the initial proposal.	4.2.14 If, in seeking agreement, an administration modifies its initial proposal, it shall again apply the provisions of paragraph 4.2.5 and the consequent procedure with respect to any other administration whose services might be affected as a result of modifications to the initial proposal.	**T4.22*bis*** If, in seeking agreement, an administration modifies its initial proposal, it shall again apply the provisions of **T4.8** and the consequent procedure with respect to any other administration whose services might be affected as a result of modifications to the initial proposal. If however, these modifications to the initial proposal do not lead to an increase in the interference level which would be caused to the services of another administration compared with that caused by the initial modification, further agreement from this administration is not required.
4.3.14 If no comments have been received on the expiry of the periods specified in paragraph 4.3.12, or if agreement has been reached with the administrations which have made comments and with which agreement is necessary, the administration proposing the modification may continue with the appropriate procedure in Article 5 and shall inform the Bureau~~Board~~, indicating the final characteristics of the frequency assignment together with the names of the administrations with which agreement has been reached.	4.2.15 If no comments have been received on the expiry of the periods specified in paragraph 4.2.13, or if agreement has been reached with the administrations which have made comments and with which agreement is necessary, the administration proposing the modification may continue with the appropriate procedure in Article 5 of this Appendix and shall inform the Bureau~~Board~~, indicating the final characteristics of the frequency assignment together with the names of the administrations with which agreement has been reached.	**T4~~T10~~.23** If no comments have been received on the expiry of the periods specified in **T4~~T10~~.17,** or if agreement has been reached with the administrations which have made comments and with which agreement is necessary, or if the provisions of **T4~~T10~~.21** have been applied, the administration proposing the modification shall inform the Bureau, indicating the final characteristics of the frequency assignment, together with the names of the administrations with which agreement has been reached.
4.3.17 The Bureau~~Board~~ shall publish in a special section of its weekly circular the information received under paragraph 4.3.14 together with the names of any administrations with which the provisions of this Article have been successfully applied. The frequency assignment concerned shall enjoy the same status as those appearing in the appropriate Regional Plan and will be considered as a frequency assignment in conformity with the Plan.	4.2.18 The Bureau shall publish in a special section of its weekly circular the information received under paragraph 4.2.15 together with the names of any administrations with which the provisions of this Article have been successfully applied. The frequency assignment concerned shall enjoy the same status as those appearing in the Plan and will be considered as a frequency assignment in conformity with the Plan.	**T4~~T10~~.24** The Bureau shall publish in a special section of its weekly circular the information received under **T4~~T10~~.23** together with the names of any administrations with which the provisions of this Article have been successfully applied. The Bureau shall then up-date the master copy of the Plan. The new or modified entry in the Plan shall then have the same status as others appearing in the Plan and shall be considered as being in conformity with the Plan.

4.3.18 When an administration proposing to modify the characteristics of a frequency assignment or to make a new frequency assignment receives notice of disagreement from an administration whose agreement it has sought, it should first endeavour to solve the problem by exploring all possible means of meeting its requirement. If the problem still cannot be solved by such means, the administration whose agreement has been sought should endeavour to overcome the difficulties as far as possible, and shall state the technical reasons for any disagreement if the administration seeking the agreement requests it to do so.	4.2.19 When an administration proposing to modify the characteristics of a frequency assignment or to make a new frequency assignment receives notice of disagreement from an administration whose agreement it has sought, it should first endeavour to solve the problem by exploring all possible means of meeting its requirement. If the problem still cannot be solved by such means, the administration whose agreement has been sought should endeavour to overcome the difficulties as far as possible, and shall state the technical reasons for any disagreement if the administration seeking the agreement requests it to do so.	
4.3.21 The relevant provisions of Article 5 of this Appendix shall be applied when frequency assignments are notified to the Bureau~~Board~~.	4.2.22 The relevant provisions of Article 5 of this Appendix shall be applied when frequency assignments are notified to the Bureau~~Board~~.	~~**T10.25** The relevant provisions of the Plan shall be applied when frequency assignments are notified to the Bureau.~~
4.3.15 The agreement of the administrations affected may also be obtained in accordance with this Article, for a specified period.	4.2.16 The agreement of the administrations affected may also be obtained in accordance with this Article, for a specified period.	**T4**~~**T10**~~**.25*bis*** The agreement of the administrations affected may also be obtained in accordance with this Article, for a specified period.
4.3.19 If no agreement is reached between the administrations concerned, the Bureau~~Board~~ shall carry out any study that may be requested by these administrations; the Bureau shall inform them of the result of the study and shall make such recommendations as it may be able to offer for the solution of the problem.	4.2.20 If no agreement is reached between the administrations concerned, the Bureau shall carry out any study that may be requested by these administrations; the Bureau~~Board~~ shall inform them of the result of the study and shall make such recommendations as it may be able to offer for the solution of the problem.	~~**T10.26** If no agreement is reached between the administrations concerned the Bureau shall carry out any study that may be requested by those administrations. The Bureau shall inform them of the results and of any recommendations it may be able to offer for a solution of the problem.~~ • *Reason: Already covered under T10.18.*

4.4 *Cancellation of frequency assignments* When a frequency assignment in conformity with one of the Regional Plans is no longer required, whether or not as a result of a modification, the administration concerned shall immediately so inform the Bureau~~Board~~. The Bureau~~Board~~ shall publish this information in a special section of its weekly circular and delete the assignment from the appropriate Regional Plan.	4.3 *Cancellation of frequency assignments* When a frequency assignment in conformity with one of the Regional Plans is no longer required, whether or not as a result of a modification, the administration concerned shall immediately so inform the Bureau~~Board~~. The Bureau~~Board~~ shall publish this information in a special section of its weekly circular and delete the assignment from the Plan.	**T4.26** *Cancellation of frequency assignments* When a frequency assignment in conformity with one of the Regional Plans is no longer required, whether or not as a result of a modification, the administration concerned shall immediately so inform the Bureau. The Bureau shall publish this information in a special section of its weekly circular and delete the assignment from the appropriate Regional Plan.
4.3.16 When the proposed modification to the appropriate Regional Plan involves developing countries, administrations shall seek all practicable solutions conducive to the economical development of the broadcasting-satellite systems of these countries.	4.2.17 When the proposed modification to the Plan involves developing countries, administrations shall seek all practicable solutions conducive to the economical development of the broadcasting-satellite systems of these countries.	**T4~~T10~~.27** When a proposed modification to a plan involves developing countries, administrations shall seek all practicable solutions conducive to the economic development of the ~~radiocommunications~~ broadcasting-satellite systems of those countries.

APPENDIX S6

Identification of Administrations From Which Agreement Is To Be Sought Under the Provisions of Article T4

1 Modification to Appendix S30 Plans

An administration proposing a modification to the characteristics of a frequency assignment in conformity with the appropriate regional Plan under Appendix S30, or the inclusion of a new frequency assignment in that Plan, shall seek the agreement of those administrations:

1.1 having a frequency assignment to a space station in the broadcasting-satellite service in the same or adjacent channel which is in conformity with the appropriate regional Plan, or in respect of which proposed modifications to that Plan have already been published by the Bureau in accordance with the provisions of paragraph **T4.12** ; *or*

1.2 having no frequency assignment in the broadcasting-satellite service in the channel concerned but in whose territory the power flux-density value exceeds the prescribed limit as a result of the proposed modification or having an assignment whose associated service area does not cover the whole of the territory of the administration, and in whose territory outside that service area the power flux-density from the broadcasting-satellite space station subject to this modification exceeds the prescribed limit as a result of the proposed modification; *or*

1.3 having a frequency assignment to a space station in the fixed-satellite service or in the broadcasting satellite service where it is not subject to a Plan, with the necessary bandwidth, any portion of which falls within the necessary bandwidth of the proposed assignment, and which is recorded in the Master Register or which has been coordinated or is being coordinated under the provisions of No. **S9.7**, or **S9.8** of the Radio Regulations;

- *NOTE - 1.3 replaces 4.3.1.5 and 4.3.3.5., and merges these with 4.3.3.6.*
- *Both S9.7 and S9.8 need to be referred to since an FSS network could have started coordination under S9.7 and not under S9.8 if the threshold condition to trigger coordination with BSS planned services was not exceeded. Also, coordination under S9.7 is the only one applicable in the case of an FSS receive space station (e.g. at 12.5 - 12.75 GHz in Region 1).*
- *NOTE - a) and b) under 4.3.3.6 are covered under 1.3, and S9.7 is in relation to the provisions of Resolution 34, which states that Resolution 33 and Article 11 procedures have to be followed in the case of an unplanned BSS assignment in the planned bands (12.5 - 12.75 GHz in Region 3). The scope of S9.7 needs to be modified to cover all unplanned space services with respect to all unplanned space services, in all bands. c) under 4.3.3.6 is superfluous: the future conference mentioned, if and when it takes place, could carry out the task of modifying this provision, if required. The scope of S9.8 also needs to be extended to cover all unplanned space services in respect of the planned BSS.*

1.4 whose services are considered to be affected.

1.5 The services of an administration are considered to be affected when the limits shown in Annex 1 to this Appendix are exceeded.

2 Modification to Appendix S30A Plans

An administration proposing a modification to the characteristics of a frequency assignment in conformity with the appropriate regional Plan under Appendix S30A or the inclusion of a new frequency assignment in that Plan shall seek the agreement of those administrations:

2.1 having a feeder-link frequency assignment in the fixed-satellite service (Earth-to-space) in the same channel or an adjacent channel, in the same orbital position or an adjacent orbital position which appears in the Plan or in respect of which proposed modifications to the Plan have already been published by the Bureau in accordance with the provisions of paragraph **T4.12** of the Radio Regulations, *or*

2.2 having a frequency assignment to an earth station in the fixed-satellite service (space-to-Earth) or the broadcasting satellite service where this service is not subject to a plan, which is recorded in the Master Register or which has been coordinated or is being coordinated under the provisions of No. **S9.7, S9.9** or **S9.17*bis*** of the Radio Regulations and which is located within the coordination area of the feeder-link fixed-satellite earth station; *or*

- *NOTE - The first modification is intended to include the case of the Region 2 BSS allocation in the 17.3 - 17.8 GHz band. The second modification is the consequence of the possibility for the affected administration to have started coordination in three possible different situations: **S9.7** if there was no need to coordinate with the feeder-link Plan at that time, **S9.9** is there was such a need as a result of the space station interfering into the feeder-link Plan, **S9.17bis** if the procedure between earth stations operating in opposite directions of transmission was started.*

2.3 having a frequency assignment to a terrestrial station in use or intended to be brought into use within three years of the projected date of bringing the feeder-link modification into use, and which is located within the coordination area of the feeder-link fixed-satellite earth station; *or*

2.4 having a feeder-link frequency assignment to a space station in the fixed-satellite service (Earth-to-space), with the necessary bandwidth, any portion of which falls within the necessary bandwidth of the proposed assignment, which is recorded in the Master Register or which has been coordinated or is being coordinated under the provisions of No. **S9.7** or **S9.9** of the Radio Regulations;

- *NOTE - The intent of this new provision is to correct the lack of provision under the current Radio Regulations to protect a receiving unplanned feeder-link space station in Region 2 from a transmit feeder-link earth station in Region 1 and 3 planned band. **S9.9** cannot be applied in this case since it refers to a transmit space station. The scope of **S9.9** should therefore be expanded to cover this case.*

2.5 which are considered affected.

2.6 The services of an administration are considered to be affected when the limits shown in Annex 1 to this Appendix are exceeded.

2.7 No agreement is required:

a) when an administration in Regions 1 and 3 proposes to bring into use, with characteristics[1] appearing in the Plan, a fixed feeder-link earth station or a transportable feeder-link earth station in the bands 14.5 - 14.8 GHz or 17.3 - 18.1 GHz.

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[1] The power to be taken into account is obtained by adding the values specified in columns 8 and 9 of the Plan.

b) when an administration in Region 2 proposes to bring into use, with characteristics appearing in the Plan, a fixed feeder-link earth station in the band 17.3 - 17.8 GHz or a transportable feeder-link earth station in the band 17.3 - 17.7 GHz. Administrations may communicate to the ~~Board~~ Bureau the characteristics of such earth stations for inclusion in the Plan.

ANNEX 1 TO APPENDIX S6

Limits for determining whether a service of an administration is affected by a proposed modification to the Plans[1]

Tables 1 and 2 respectively, provide the various possible cases for which a modification to one of the Plans in Appendix S30 and Appendix S30A, respectively, may affect the relevant services of another administration, in the same or another Region.

For each of these cases, Table 1 and 2 provide:

– the applicable frequency band;

– the applicable paragraph of Appendix S6 in respect of which an administration shall be considered as being affected if the applicable criteria are exceeded; and

– the type of applicable criteria, and the reference to the applicable paragraph under section 1 or 2, as applicable, in which the applicable limit is provided.

1 Limits applicable to modifications of Appendix S30 Plans

An administration shall be considered affected by a proposed modification to one of the Regional Plans contained in Appendix S30 if the limits indicated below and referred to in Table 1 are exceeded.

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[1] With respect to this Annex, except for subsection 8 *c)*, the power flux-density limits relate to the values which would be obtained assuming free-space propagation conditions.

With respect to subsection 8 *c)* of this Annex, the limits relate to the power flux-density which would be obtained assuming clear-sky propagation conditions using the method contained in Annex 5 of Appendix S30.

TABLE 1

Sharing criteria associated to Appendix S6 for the modification of Appendix 30 Plans

	Intended Modification of Appendix 30 Plan in Region		
Seeking agreement from	**Region 1**	**Region 2**	**Region 3**
BSS in Region 1 **11.7 - 12.5 GHz**	11.7 - 12.5 GHz Par. 1.1 EPM degradation (1)	12.2 - 12.5 GHz Par. 1.1 pfd limits (3)	11.7 - 12.2 GHz Par. 1.1 EPM degradation (1)
BSS in Region 2 **12.2 - 12.7 GHz**	12.2 - 12.5 GHz Par. 1.1 pfd limits (3)	12.2 - 12.7 GHz Par. 1.1 OEPM degradation (2)	12.5 - 12.7 GHz Par. 1.1 pfd limits (3)
BSS in Region 3 **11.7 - 12.2 GHz**	11.7 - 12.2 GHz Par. 1.1 EPM degradation (1)	12.5 - 12.7 GHz Par. 1.1 pfd limits (3)	11.7 - 12.2 GHz Par. 1.1 EPM degradation (1)
Unplanned BSS in Region 3 **12.5 - 12.75 GHz**	N/A	12.5 - 12.7 GHz Par. 1.4 pfd limits (3)	N/A
FSS (Earth-to-space) **in Region 1** **12.5 - 12.7 GHz**	N/A	12.5 - 12.7 GHz Par. 1.3 ΔT/T limits (7)	N/A
FSS (space-to-Earth) **in Region 1** **12.5 - 12.7 GHz**	N/A	12.5 - 12.7 GHz Par. 1.3 pfd limits (6)	N/A
FSS (space-to-Earth) **in Region 2** **11.7 - 12.2 GHz**	11.7 - 12.2 GHz Par. 1.3 pfd limits (6)	N/A	11.7 - 12.2 GHz Par. 1.3 pfd limits (6)
FSS (space-to-Earth) **in Region 3** **12.2 - 12.5 GHz** **12.5 - 12.75 GHz**	12.2 - 12.5 GHz Par. 1.3 pfd limits (6)	12.2 - 12.7 GHz Par. 1.3 pfd limits (6)	N/A
Terrestrial services in Region 1 **11.7 - 12.5 GHz** **12.5 - 12.7 GHz**	11.7 - 12.5 GHz Par. 1.2 pfd limits (8)	12.2 - 12.7 GHz Par. 1.2 pfd limits (5)	11.7 - 12.2 GHz Par. 1.2 pfd limits (8)
Terrestrial services in Region 2 **11.7 - 12.1 GHz** **12.1 - 12.2 GHz** **12.2 - 12.7 GHz**	11.7 - 12.5 GHz Par. 1.2 pfd limits (4)Annex 1 Sec. 4	12.2 - 12.7 GHz Par. 1.2 pfd limits (8)	11.7 - 12.2 GHz Par. 1.2 pfd limits (4)
Terrestrial services in Region 3 **11.7 - 12.75 GHz**	11.7 - 12.5 GHz Par. 1.2 pfd limits (8)	12.2 - 12.7 GHz Par. 1.2 pfd limits (5)	11.7 - 12.2 GHz 12.5 - 12.7 GHz Par. 1.2 pfd limits (8)

(1) To protect the Regions 1 and 3 Plan from its own modifications

The Equivalent Protection Margin (EPM) of any assignment at any test point within the service area, including the cumulative effect of any previously received request for modification to this Plan, or any previous agreement, falls more than 0.25 dB below 0 dB or, if already negative, decreases by more than 0.25 dB.

(2) To protect the Region 2 Plan from its own modifications

The Overall Equivalent Protection Margin (OEPM) of any assignment at any test point within the service area, including the cumulative effect of any previously received request for modification to this Plan, or any previous agreement, falls more than 0.25 dB below 0 dB or, if already negative, decreases by more than 0.25 dB.

(3) To protect a regional Plan from modifications to another regional Plan

The proposed modification to another regional Plan results in exceeding, for any angle of arrival, and at any point of the service area of the affected assignment, the following power flux-density values:

-147	dB(W/m^2/27 MHz)	for $0° \le \theta < 0.44°$,
$-138 + 25 \log \theta$	dB(W/m^2/27 MHz)	for $0.44° \le \theta < 19.1°$,
-106	dB(W/m^2/27 MHz)	for $19.1° \le \theta$,

where θ is the difference in degrees between the longitudes of the broadcasting-satellite space stations.

(4) To protect terrestrial services in Region 2 from modifications to the Regions 1 and 3 Plan

The proposed modification to Region 1 and 3 Plan results in exceeding a power flux-density, for any angle of arrival, and at any point of the territory, of:

-125	dB(W/m^2/4 kHz)	for BSS station using circular polarization,
-128	dB(W/m^2/4 kHz)	for BSS station using linear polarization.

(5) To protect terrestrial services in Regions 1 or 3 from modifications to the Region 2 Plan

The proposed modification to Region 2 Plan results in exceeding a power flux-density, for any angle of arrival, and at any point of the territory, of:

a) In the frequency band 12.2 - 12.7 GHz, for all the territories of administrations in Regions 1[1] and 3, for any angle of arrival:

-125	dB(W/m^2/4 kHz)	for BSS station using circular polarization,
-128	dB(W/m^2/4 kHz)	for BSS station using linear polarization;

[1] In the frequency band 12.5 - 12.7 GHz, in Region 1, these limits are applicable only to the territories of administrations mentioned in S5.494 [RR 848] and S5.496 [RR 850] of the Radio Regulations.

b) In the frequency band 12.2 - 12.5 GHz, for territories of administrations in Region 3 and those in the western part of Region 1, west of longitude 30°E:

-132	dB(W/m^2/5 MHz)	for $0° \leq \gamma < 10°$,
-132 + 4.2 (γ - 10)	dB(W/m^2/5 MHz)	for $10° \leq \gamma < 15°$,
-111	dB(W/m^2/5 MHz)	for $15° \leq \gamma < 90°$;

where γ is the angle of arrival.

c) In the frequency band 12.2 - 12.7 GHz, for territories of administrations in Region 1[2] east of longitude 30°E[3]:

-134 + 4.6975 γ^2	dB(W/m^2/5 MHz)	for $0° \leq \gamma \leq 0.8$,
-128 + 25 log γ	dB(W/m^2/5 MHz)	for $\gamma > 0.8$;

where γ is the angle of arrival.

d) In the frequency band 12.5 - 12.7 GHz, for all the territories of administrations in Regions 1[2] and 3,

-148 + 4.6975 γ^2	dB(W/m^2/4 kHz)	for $0° \leq \gamma \leq 0.8$,
-142.5 + 25 log γ	dB(W/m^2/4 kHz)	for $\gamma > 0.8$;

where γ is the angle of arrival.

(6) To protect the fixed-satellite service (space-to-Earth) in one Region from modifications to the Plan of another Region

The proposed modification results in an increase in the power flux-density at any point of the affected territory of 0.25 dB or more above that resulting from the frequency assignments in the corresponding regional Plan at the time of its entry into force.

However, where an assignment the Regions 1 and 3 Plan or its subsequent modification gives a power flux-density of less than -138 dB(W/m^2/27 MHz) anywhere in the territory of an administration of Region 2, that administration shall be considered as not being affected; where an assignment in the Region 2 Plan or its subsequent modification gives a power flux-density of less than -160 dB(W/m^2/4 kHz) anywhere in the territory of an administration of Region 1 or 3, that administration shall be considered as not being affected.

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[2] In the frequency band 12.5 - 12.7 GHz, in Region 1, these limits are applicable only to the territories of administrations mentioned in Nos. S5.494 [848] and S5.496 [850] of the Radio Regulations.

[3] See Resolution 34. WRC-97 might wish to consider this matter.

(7) To protect the fixed-satellite service (Earth-to-space) in Region 1 from modifications to the Region 2 Plan

The proposed modification results in:

– a $\Delta T/T$ greater than the $\Delta T/T$ resulting from the assignment in the Region 2 Plan as of the date of entry into force of the Final Acts; *and*

– a $\Delta T/T$ greater than 4%,

using the method of Appendix **29** (Case II).

(8) To protect terrestrial services in one Region from modifications to the Plan of another Region

a) The proposed modification to an existing assignment in a regional Plan results in an increase in the power flux-density at any point of the affected territory of 0.25 dB or more above that resulting from the frequency assignments in this Plan at the time of its entry into force, *or*

b) The proposed modification to the Regions 1 and 3 Plan results in a power flux-density at any point of the territory of an administration in Region 1 or 3 greater than the values expressed in section (5) a) or (5) b) above, *or*

c) The proposed modification to the Region 2 Plan results in a power flux-density greater than -115 dB(W/m^2) at any point of the territory of an administration in Region 2.

2 Limits applicable to modifications of Appendix S30A Plans

An administration shall be considered affected by a modification to one of the Regional feeder-link Plans contained in Appendix S30A if the limits indicated below and referred to in Table 2 are exceeded.

(1) To protect the Regions 1 and 3 feeder-link Plan from its own modifications

The Equivalent Protection Margin[4] (EPM) of any assignment at any test point within the service area, including the cumulative effect of any previously received request for modification to this Plan, or any previous agreement, falls more than 0.25 dB below 0 dB or, if already negative, decreases by more than 0.25 dB.

(2) To protect the Region 2 feeder-link Plan from its own modifications

The Overall Equivalent Protection Margin[5] (OEPM) of any assignment at any test point within the service area, including the cumulative effect of any previously received request for modification to this Plan, or any previous agreement, except in cases covered by Resolution **42 (Rev.Orb-88),** falls more than 0.25 dB below 0 dB or, if already negative, decreases by more than 0.25 dB.

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[4] For the definition of the equivalent protection margin, see Section 1.7 of Annex 3 of this Appendix.

[5] For the definition of the overall equivalent protection margin, see Section 1.14 of Annex 5 to Appendix **30 (Orb-85)**.

(3) To protect a regional feeder-link Plan from modifications to another regional feeder-link Plan

The proposed modification to another regional feeder-link Plan causes an increase in the noise temperature of the feeder-link space station which exceeds the threshold value of $\Delta T/T$ corresponding to 3%, where $\Delta T/T$ is calculated in accordance with the method given in Appendix **29**, except that the maximum power densities per hertz averaged over the worst 1 MHz are replaced by power densities per hertz averaged over the total RF bandwidth of the feeder-link carriers (24 MHz for Region 2 and 27 MHz for Regions 1 and 3).

Interim systems of Region 2 in accordance with Resolution **42 (Rev.Orb-88)** shall not be taken into consideration when applying this provision to proposed modifications to the Regions 1 and 3 Plan. However, this provision shall be applied to Region 2 interim systems with respect to the Regions 1 and 3 Plan.

(4) To protect the fixed-satellite service (space-to-Earth)

Upon the application of procedures of Section 3 of Annex 4 of Appendix S30A any part of the territory of the affected administration is included in the coordination area of the frequency assignment to a transmitting feeder-link earth station.

For the purpose of this calculation, the feeder-link transmitting earth station parameters notified by the administration, which may differ from those given in Annex 3 to this Appendix, are used.

(5) To protect a terrestrial station

Upon application of the procedures of Appendix **S7 [28]** to the Radio Regulations, any part of the territory of the affected administration is included in the coordination area of the frequency assignment to a transmitting feeder-link earth station[6].

For the purpose of this calculation, the feeder-link transmitting earth station parameters notified by the administration, which may differ from those given in Annex 3 to this Appendix, are used.

(6) To protect the fixed-satellite service (Earth-to-space) which is not subject to a Plan from modifications to the feeder-link Plan of another Region

The proposed modification to the feeder-link Plan of another Region causes an increase in the noise temperature of the feeder-link space station which exceeds the threshold value of $\Delta T/T$ corresponding to **6%**, where $\Delta T/T$ is calculated in accordance with the method given in Appendix **29**, except that the maximum power densities per hertz averaged over the worst 1 MHz are replaced by power densities per Hertz averaged over the total RF bandwidth of the feeder-link carriers.

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[6] In Regions 1 and 3, for the application of the procedures of Appendix S7, the e.i.r.p. for the feeder-link earth station is the sum of the values specified in columns 8 and 9 of the Plan.

TABLE 2

Sharing criteria associated to Appendix S6 for the modification of Appendix 30A Plans

	Intended Modification of Appendix 30A Plan in Region ↓	
Seeking agreement from ↓	**Regions 1 and 3** **14.5 - 14.8 GHz (outside Europe)** **17.3 - 18.1 GHz**	**Region 2** **17.3 - 17.8 GHz**
FSS (Earth-to-space) **(i.e. feeder links to BSS)** **Regions 1 and 3** **14.5 - 14.8 GHz (outside Europe)** **17.3 - 18.1 GHz**	**14.5 - 14.8 GHz (outside Europe)** **17.3 - 18.1 GHz** **Par. 2.1** EPM degradation (1)	**17.3 - 17.8 GHz** **Par. 2.1** ΔT/T (3)
FSS (Earth-to-space) **(i.e. feeder links to BSS)** **Region 2 <u>planned</u>** **17.3 - 17.8 GHz**	17.3 - 17.8 GHz Par. 2.1 ΔT/T (3)	**17.3 - 17.8 GHz** **Par. 1.2** OEPM degradation (2)
FSS (Earth-to-space) **(i.e. feeder links to BSS)** **Region 2 <u>unplanned</u>** **17.8 - 18.1 GHz**	**17.8 - 18.1 GHz** **Par. 2.4** ΔT/T (6)	**N/A**
FSS (space-to-Earth) **Regions 1 and 3:** **17.7 - 18.1 GHz** **Region 2:** **17.7 - 18.1 GHz until 31 March 2007** **17.8 - 18.1 GHz after 1 April 2007**	**17.7 - 18.1 GHz** **Par. 2.2** coordination area (4)	**17.7 - 18.1 GHz** **Par. 2.2** coordination area (4)
BSS **Region 2** **17.3 - 17.8 GHz** **(after 1 April 2007)**		
FS and MS **Region 1, 2, 3** **14.5 - 14.8 GHz** **17.7 - 18.1 GHz**	**14.5 - 14.8 GHz (Outside Europe)** **17.7 - 18.1 GHz** **Par. 2.3** coordination area (5)	**17.7 - 18.1 GHz** **Par. 2.3** coordination area (5)

ANNEX 2 TO CHAPTER 6

Example of a possible updating and/or simplification of ~~Article 5 of Appendix 30 and Article 5 of Appendix 30A into a single~~ the provisions for notification, examination and recording of assignments in Appendices S30 and S30A Plans

~~Article T5~~

This Annex provides two possible examples of updating and/or simplification of the procedures ~~a possible text for a unified procedure, Article **T5,**~~ for notification, examination and recording of assignments in Appendices 30 and 30A, for Regions 1, 2 and 3, currently contained in Articles 5 of Appendices 30 and 30A.

Under Approach 1, example modifications to Articles 5 of Appendices 30 and 30A are provided, which might be required to suitably update these Articles in order to reflect the changes decided by WRC-95 as well as editorial errors which have been identified.

In the right hand column, a simplified approach also taking into account these modifications is presented. This new Article (Article **T5)** could replace both Articles 5 of Appendices 30 and 30A This simplified approach could be used under Approach 2.

~~This text of Article **T5** is presented in parallel with the current text of Articles 5 of Appendices 30 and 30A, to allow for a direct comparison between the current procedures and their possible simplification. In order to facilitate this comparison, the order of the current Appendices 30/30A procedures has been modified in some instances, which would not modify the scope of these procedures.~~

Appendix 30 ARTICLE 5	Appendix 30A ARTICLE 5	ARTICLE T5
Notification, Examination and Recording in the Master Register of Frequency Assignments to Space Stations in the Broadcasting-Satellite Service	**Coordination, Notification, Examination and Recording in the Master International Frequency Register of Frequency Assignments to Feeder-Link Transmitting Earth Stations and Receiving Space Stations in the Fixed Satellite-Service**	**Procedures for the Notification of Frequency Assignments included in the Plans of Appendices S30 and S30A**
5.1 *Notification*	**5.1** *Coordination and notification*	
	5.1.1 When an administration wishes to determine whether it is possible to use, at a given location, an amount of power control which is in excess of that contained in column 9 of the Regions 1 and 3 feeder-link Plan, it shall request the Bureau~~Board~~ to determine the amount of permissible power control (not to exceed 10 dB) from that given location using the procedure contained in Section 3.11 of Annex 3 to this Appendix.	• Reason: To be dealt with under Article 4 to establish conformity with the Plan.
5.1.1 Whenever an administration intends to bring into use a frequency assignment to a space station in the broadcasting-satellite service, it shall notify this frequency assignment to the Bureau~~Board~~. For this purpose, the notifying administration shall apply the following provisions.	**5.1.2** Whenever an administration intends to bring into use a frequency assignment to a transmitting earth station or receiving space station in the fixed-satellite service in the bands between 14.5 GHz and 14.8 GHz and between 17.3 GHz and 18.1 GHz in Regions 1 and 3, and between 17.3 GHz and 17.8 GHz in Region 2, it shall notify this frequency assignment to the Bureau~~Board~~. For this purpose, the notifying administration shall apply the following provisions.	**T.5.1** Whenever an administration intends to bring into use a frequency assignment, it shall notify this frequency assignment to the Bureau. For this purpose, the notifying administration shall apply the following provisions.
	5.1.3 Before an administration in Region 1 or 3 notifies to the Bureau or brings into use any frequency assignment to a transmitting feeder-link earth station in the bands 14.5 - 14.8 GHz and 17.7 - 18.1 GHz with an e.i.r.p. greater than the sum of the values specified in columns 8 and 9 of the Plan, it shall effect coordination of this assignment with each administration whose territory lies wholly or partly within the coordination area of the planned earth station using the method detailed in Appendix **28**.	• Reason: To be dealt with under Article 4 to establish conformity with the Plan.

	5.1.4 Before an administration in Region 1 or 3 notifies to the Bureau~~Board~~ or brings into use any frequency assignment to a transmitting feeder-link earth station in the bands 14.5 - 14.8 GHz and 17.7 - 18.1 GHz, it shall effect coordination of this assignment with each administration whose territory lies wholly or partly within the coordination area of the planned earth station, using the method detailed in Appendix **28**, in respect of notices concerning stations of the mobile and fixed services in the bands 14.5 - 14.8 GHz and 17.7 - 18.1 GHz and of the fixed-satellite service (space-to-Earth) in the band 17.7 - 18.1 GHz received by the Bureau prior to 29 August 1988 for recording in the Master Register.	• Reason: Could be dealt with under a footnote to Article S5 and examined under T5.10 a)
	5.1.5 If an administration with which coordination is sought under paragraph 5.1.4 does not respond within three months, the administration intending to bring into use a frequency assignment to a feeder-link earth station shall notify this frequency assignment in accordance with paragraph 5.1.2 above~~1~~.	• Reason: Related to 5.1.4
5.1.2 For any notification under paragraph 5.1.1, an individual notice for each frequency assignment shall be drawn up as prescribed in Annex 2, the various sections of which specify the basic characteristics to be provided as appropriate. It is recommended that the notifying administration should also supply any other data it may consider useful.	**5.1.6** For any notification under 5.1.2, an individual notice for each frequency assignment shall be drawn up as prescribed in Annex 2 to this Appendix, the various sections of which specify the basic characteristics to be provided as appropriate. It is recommended that the notifying administration should also supply any other data it may consider useful.	**T.5.2** For any notification under paragraph **T.5.1**, a notice for each frequency assignment shall be drawn up as prescribed in **[App. S4]**, the various sections of which specify the basic characteristics to be provided as appropriate. It is recommended that the notifying administration should also supply any other data it may consider useful.
5.1.3 Each notice must reach the Bureau~~Board~~ not earlier than three years before the date on which the frequency assignment is to be brought into use. In any case, the notice must reach the Bureau~~Board~~ not later than three months before that date[4].	**5.1.7** Each notice must reach the Bureau not earlier than three years before the date on which the frequency assignment is to be brought into use. In any case, the notice must reach the Bureau~~Board~~ not later than three months before that date~~1~~.	**T.5.3** Each notice must reach the Bureau not earlier than three years before the date on which the frequency assignment is to be brought into use. In any case, the notice must reach the Bureau not later than three months before that date[4].

[4] Where appropriate, the notifying administration shall initiate the procedure for modifying the Plan concerned in sufficient time to ensure that this limit is observed. For Region 2, see also Resolution **42 (Orb-85)** and paragraph B of Annex 7.	[1] ~~In order to facilitate the coordination process, attention is drawn to Resolution **709 (Orb-88)**.~~	[4] Where appropriate, the notifying administration shall initiate the procedure for modifying the Plan concerned in sufficient time to ensure that this limit is observed. For Region 2, see also Resolution **42 (Orb-88)**. • Reasons: Resolution 709 has been suppressed. Conformity with paragraph B of Annex 7 to Appendix 30 dealt with conformity with the Plan.
5.1.4 Any frequency assignment the notice of which reaches the Bureau~~Board~~ after the applicable period specified in paragraph 5.1.3 shall, where it is to be recorded, bear a remark in the Master Register to indicate that it is not in conformity with paragraph 5.1.3.	**5.1.8** Any frequency assignment the notice of which reaches the Bureau~~Board~~ after the applicable period specified in paragraph 5.1.7 shall, where it is to be recorded, bear a remark in the Master Register to indicate that it is not in conformity with paragraph 5.1.7.	
5.1.5 Any notice made under paragraph 5.1.1 which does not contain the characteristics specified in Annex 2 shall be returned by the Bureau~~Board~~ immediately by airmail to the notifying administration with the relevant reasons.	**5.1.9** Any notice made under paragraph 5.1.2 which does not contain the characteristics specified in Annex 2 to this Appendix shall be returned by the Bureau~~Board~~ immediately by airmail to the notifying administration with the relevant reasons.	**T.5.5** Any notice made under paragraph T.5.1 which does not contain the characteristics specified in [App. S4/Annex 2] shall be returned by the Bureau immediately by airmail to the notifying administration with the relevant reasons.
5.1.6 Upon receipt of a complete notice, the Bureau~~Board~~ shall include its particulars, with the date of receipt, in its weekly circular, which shall contain the particulars of all such notices received since the publication of the previous circular.	**5.1.10** Upon receipt of a complete notice, the Bureau~~Board~~ shall include its particulars, with the date of receipt, in its weekly circular which shall contain the particulars of all such notices received since the publication of the previous circular.	**T.5.6.** Upon receipt of a complete notice, the Bureau shall include its particulars, with the date of receipt, in its weekly circular, which shall contain the particulars of all such notices received since the publication of the previous circular.
5.1.7 The circular shall constitute the acknowledgment to the notifying administration of the receipt of a complete notice.	**5.1.11** The circular shall constitute the acknowledgements to the notifying administration of the receipt of a complete notice	**T.5.7.** The circular shall constitute the acknowledgment to the notifying administration of the receipt of a complete notice.
5.1.8 Complete notices shall be considered by the Bureau~~Board~~ in order of receipt. The ~~Board~~ Bureau shall not postpone its finding unless it lacks sufficient data to reach a decision; moreover, the Bureau shall not act upon any notice which has a technical bearing on an earlier notice still under consideration by the Bureau until it has reached a finding with respect to such earlier notice.	**5.1.12** Complete notices shall be considered by the Bureau~~Board~~ in order of receipt. The Bureau~~Board~~ shall not postpone its finding unless it lacks sufficient data to reach a decision; moreover, the Bureau~~Board~~ shall not act upon any notice which has a technical bearing on an earlier notice still under consideration by the Bureau~~Board~~ until it has reached a finding with respect to such earlier notice	**T.5.8.** Complete notices shall be considered by the Bureau in order of receipt. The Bureau shall not postpone its finding unless it lacks sufficient data to reach a decision; moreover, the Bureau shall not act upon any notice which has a technical bearing on an earlier notice still under consideration by the Bureau until it has reached a finding with respect to such earlier notice.

		T.5.8.*bis* In notifying a frequency assignment, an administration may act on behalf of a group of named administrations, in which case any further notice (modification or deletion) relating to such an assignment shall, in the absence of information to the contrary, be regarded as having be submitted on behalf of the entire group. • Reason: To facilitate he establishment of sub-regional systems
5.2 *Examination and recording*	**5.2** *Examination and recording*	**T.5.9.** *Examination and recording*
5.2.1 The Bureau~~Board~~ shall examine each notice:	**5.2.1** The Bureau~~Board~~ shall examine each notice:	**T.5.10.** The Bureau shall examine each notice:
a) with respect to its conformity with the Constitution Convention and the relevant provisions of the Radio Regulations (with the exception of those relating to *b), c)* and *d)* below);	***a)*** with respect to its conformity with the Convention and the relevant provisions of the Radio Regulations (with the exception of those relating to *b), c), d)* and *e)* below); *and*	***a)*** with respect to its conformity with the Convention and the relevant provisions of the Radio Regulations (with the exception of those relating to *b* below);
b) with respect to its conformity with the appropriate Regional Plan; *or*	***b)*** with respect to its conformity with the appropriate Regional Plan; *or*	***b)*** with respect to its conformity with the appropriate Regional Plan.
c) with respect to its conformity with the appropriate Regional Plan, however, having characteristics differing from those in the appropriate Regional Plan in one or more of the following aspects: - use of a reduced e.i.r.p., - use of a reduced coverage area entirely situated within the coverage area appearing in the appropriate Regional Plan, - use of other modulating signals in accordance with the provisions of paragraph 3.1.3 of Annex 5, - use of the assignment for transmission in the fixed-satellite service in accordance with No. **S5.492 of** the Radio Regulations - use of an orbital position under the conditions specified in paragraph B of Annex 7; *or*	***c)*** with respect to its conformity with the appropriate Regional Plan, however, having characteristics differing from those in the Plan in one or more of the following aspects - use of a reduced e.i.r.p.,: - use of a reduced coverage area entirely situated within the coverage area appearing in the Plan - use of other modulating signals in accordance with the provisions of Section 3.1.3 to Annex 5 of Appendix S**30 (**WRC-97~~Orb-85~~**)** - in the case of Region 2, use of an orbital position under the conditions specified in paragraph B of Annex 7 to Appendix S**30 (**WRC-97~~Orb-85~~**)**, - in the case of Regions 1 and 3, use of an orbital position under the conditions specified in Section 3.15 of Annex 3 to Appendix S**30A (**WRC-97~~Orb-88~~**)**[1] - use of an antenna diameter greater	• Reason: To be dealt with under T5.10 a). • Explanatory note: See Section of notification procedure explaining why they are deleted. If no administration appears to be affected, Article 4 can be applied to be protected. However if you affect others, Article 4 must be applied.

	than 5 metres for the 17.3 - 18.1 GHz band and 6 metres for the 14.5 - 14.8 GHz band without increasing the on-axis e.i.r.p., - in the case of Region 2, use of an antenna diameter greater than 5 metres resulting in a greater on-axis e.i.r.p. if the orbital separation with any other space station is greater than 0.5° *or*	
	[1] The Bureau shall also apply this provision to paragraph 5.2.1 *c)* of Appendix **S30 (WRC-97~~Orb-85~~)** for Regions 1 and 3.	
d) with respect to its conformity with the provisions of Resolution **42 (Orb-85)**.	***d)*** for Region 2, with respect to its conformity with the provisions of Resolution **42 (Rev.Orb-88)**;	c) with respect to its conformity with the provisions of Resolution **42 (Orb-88)**.
	e) for Regions 1 and 3, with respect to its conformity with the provisions of paragraph 5.1.3 and also its conformity with paragraph 5.1.4 or 5.1.5 relating to coordination.	• Reason: Consequential of deletion of 5.1.4 and 5.1.5
5.2.2 Where the ~~Board~~ Bureau reaches a favourable finding with respect to paragraphs 5.2.1 *a)* and 5.2.1 *b)*, the frequency assignment of an administration shall be recorded in the Master Register. The date of receipt of the notice by the Bureau~~Board~~ shall be entered in Column 2d. In relations between administrations, all frequency assignments brought into use in conformity with the appropriate Regional Plan and recorded in the Master Register shall be considered to have the same status irrespective of the dates entered in Column 2d for such frequency assignments.	**5.2.2** When the Bureau~~Board~~ reaches a favourable finding with respect to paragraphs 5.2.1 *a)*, 5.2.1 *b)* and 5.2.1 *e)*, the frequency assignment of an administration shall be recorded in the Master Register. The date of receipt of the notice by the Bureau~~Board~~ shall be entered in Column 2d. In relations between administrations all frequency assignments brought into use in conformity with the Plan and recorded in the Master Register shall be considered to have the same status irrespective of the dates entered in Column 2d for such frequency assignments.	**T.5.11**. Where the Bureau reaches a favorable finding with respect to paragraphs T.5.10 a) and T.5.10 b), the frequency assignment of an administration shall be recorded in the Master Register. The date of receipt of the notice by the Bureau shall be recorded. In relations between administrations, all frequency assignments brought into use in conformity with the appropriate Regional Plan and recorded in the Master Register shall be considered to have the same status irrespective of the dates recorded for such frequency assignments.
5.2.2.1 Where the Bureau~~Board~~ reaches a favourable finding with respect to paragraphs 5.2.1 *a)* and 5.2.1 *c)*, the frequency assignment shall be recorded in the Master Register. The date of receipt of the notice by the Bureau~~Board~~ shall be entered in Column 2d. In relations between administrations, all frequency assignments brought into use in conformity with the appropriate Regional Plan and recorded in the Master Register shall be considered to have the same status irrespective of the dates entered in Column 2d for such frequency	**5.2.2.1** When the Bureau~~Board~~ reaches a favourable finding with respect to paragraphs 5.2.1 *a)*, 5.2.1 *c)* and 5.2.1 *e)*, the frequency assignment shall be recorded in the Master Register. The date of receipt of the notice by the Bureau~~Board~~ shall be entered in Column 2d. In relations between administrations, all frequency assignments brought into use in conformity with the Plan and recorded in the Master Register shall be considered to have the same status irrespective of the dates entered in Column 2d for such frequency	• Reason: Consequential of deletion of 5.2.1 c).

assignments. When recording these assignments, the BureauBoard shall indicate by an appropriate symbol the characteristics having a value different from that appearing in the appropriate Regional Plan.	assignments. When recording these assignments, the Bureau shall indicate by an appropriate symbol the characteristics having a value different from that appearing in the Plan	
5.2.2.2 Where the BureauBoard reaches a favourable finding with respect to paragraph 5.2.1 *a)* but an unfavourable finding with respect to paragraphs 5.2.1 *b)* and 5.2.1 *c)*, it shall examine the notice with respect to the successful application of the provisions of Resolution **42 (Orb-85)**. A frequency assignment for which the provisions of Resolution **42 (Orb-85)** have been successfully applied shall be recorded in the Master Register with an appropriate symbol to indicate its interim status. The date of receipt of the notice by the BureauBoard shall be entered in Column 2d. In relations between administrations all frequency assignments brought into use following the successful application of the provisions of Resolution **42 (Orb-85)** and recorded in the Master Register shall be considered to have the same status irrespective of the dates entered in Column 2d for such frequency assignments	**5.2.2.2** In the case of Region 2, when the BureauBoard reaches a favourable finding with respect to paragraph 5.2.1 *a)* but an unfavourable finding with respect to paragraphs 5.2.1 *b)* and 5.2.1 *c)*, it shall examine the notice with respect to the successful application of the provisions of Resolution **42 (Rev.Orb-88)**. A frequency assignment for which the provisions of Resolution **42 (Rev.Orb-88)** have been successfully applied shall be recorded in the Master Register with an appropriate symbol to indicate its interim status. The date of receipt of the notice by the Board Bureau shall be entered in Column 2d. In relations between administrations all frequency assignments brought into use following the successful application of the provisions of Resolution **42 (Rev.Orb-88)** and recorded in the Master Register shall be considered to have the same status irrespective of the dates entered in Column 2d for such frequency assignments. If the finding with respect to paragraph 5.2.1*d)* is unfavourable, the notice shall be returned immediately by airmail to the notifying administration.	**T.5.12** Where the Bureau reaches a favorable finding with respect to paragraph T.5.10.a) but an unfavorable finding with respect to paragraphs T.5.10.b), the notice, except those covered by T.5.13, shall be returned to the notifying administration and with such suggestions as the Bureau may be able to offer with a view to a satisfactory solution of the problem **T.5.13** In the case of notices from Region 2 administrations which have requested the application of Res. 42, the Bureau shall examine the notice with respect to the successful application of the provisions of Resolution **42 (Orb-88)**. A frequency assignment for which the provisions of Resolution **42 (Orb-88)** have been successfully applied shall be recorded in the Master Register with an appropriate symbol to indicate its interim status. If the Bureau finds that the provisions of Res. 42 have not been applied successfully, the notice shall be returned to the notifying administration.
	5.2.2.3 In the case of Regions 1 and 3, when the Bureau reaches a favourable finding with respect to paragraph 5.2.1 *a)* but an unfavourable finding with respect to paragraphs 5.2.1 *b)* and 5.2.1 *c)*, the notice shall be returned immediately by airmail to the notifying administration with the Bureau'sBoard's reasons for this finding and with such suggestions as the Board Bureau may be able to offer with a view to a satisfactory solution of the problem.	• Reason: Consequential of previous deletions

	5.2.2.4 In the case of Regions 1 and 3, when the Bureau reaches a favourable finding with respect to paragraphs 5.2.1 *a)*, 5.2.1 *b)* and 5.2.1 *c)* but an unfavourable finding with respect to paragraph 5.2.1 *e)*, the notice shall be returned immediately by airmail to the notifying administration with the Bureau~~Board~~'s reasons for this finding and with such suggestions as the Bureau may be able to offer with a view to a satisfactory solution of the problem. If the unfavourable finding under paragraph 5.2.1 *e)* is due to the coordination under paragraph 5.1.3 only not being effected, the administration shall undertake only to bring this assignment into use with an e.i.r.p. level not greater than the sum of the values specified in columns 8 and 9 of the Regions 1 and 3 Plan.	• Reason: Consequential of previous deletions
	5.2.2.5 When an assignment is recorded as a result of a favourable finding with respect to paragraph 5.2.1 *e)*, a remark shall be included indicating that coordination has been effected.	• Reason: Consequential of previous deletions
5.2.3 Whenever a frequency assignment is recorded in the Master Register, the finding reached by the Bureau~~Board~~ shall be indicated by a symbol in Column 13a.	**5.2.3** Whenever a frequency assignment is recorded in the Master Register, the finding reached by the Bureau~~Board~~ shall be indicated by a symbol in Column 13a.	**T.5.14**. Whenever a frequency assignment is recorded in the Master Register, the finding reached by the Bureau shall be indicated by a symbol.
5.2.4 Where the ~~Board~~ Bureau reaches an unfavourable finding with respect to paragraphs 5.2.1 *a)*, 5.2.1 *b)* and 5.2.1 *c)*, the notice shall be returned immediately by airmail to the notifying administration with the reasons of the Bureau~~Board~~ for this finding and with such suggestions as the Bureau~~Board~~ may be able to offer with a view to a satisfactory solution of the problem.	**5.2.4** When the Bureau reaches an unfavourable finding with respect to paragraphs 5.2.1 *a)*, 5.2.1 *b)* and 5.2.1 *c)*, the notice shall be returned immediately by airmail to the notifying administration with the Bureau~~Board~~'s reasons for this finding and with such suggestions as the Bureau may be able to offer with a view to a satisfactory solution of the problem.	• Reason: Conseque ntial of previous deletions
5.2.5 Where the notifying administration resubmits the notice and the finding of the Bureau~~Board~~ becomes favourable with respect to the appropriate parts of paragraph 5.2.1, the notice shall be treated as in paragraph 5.2.2, 5.2.2.1 or 5.2.2.2, as appropriate.	**5.2.5** When the notifying administration resubmits the notice and the finding of the Bureau~~Board~~ becomes favourable with respect to the appropriate parts of paragraph 5.2.1, the notice shall be treated as in paragraph 5.2.2, 5.2.2.1 or 5.2.2.2 as appropriate.	**T.5.15** Where the notifying administration resubmits the notice and the finding of the Bureau becomes favorable with respect to the appropriate parts of paragraph T.5.10, the notice shall be treated as in T.5.11 or T.5.13, as appropriate.

5.2.6 If the notifying administration resubmits the notice without modification and insists on its reconsideration, and if the Bureau's finding with respect to paragraph 5.2.1 remains unfavourable, the notice is returned to the notifying administration in accordance with paragraph 5.2.4. In this case, the notifying administration undertakes not to bring into use the frequency assignment until the condition specified in paragraph 5.2.5 is fulfilled. For Regions 1, 2 and 3, in the event that the ~~Board~~ Bureau has been informed of agreement to modification of the Plan for a specified period of time in accordance with Article 4, the frequency assignment shall be recorded in the Master Register with a note indicating that the frequency assignment is valid only for the period specified. The notifying administration using the frequency assignment over a specified period shall not subsequently invoke this fact to justify the continued use of the frequency beyond the period specified unless it obtains the agreement of the administration(s) concerned.	**5.2.6** If the notifying administration resubmits the notice without modification and insists on its reconsideration, and if the Bureau~~Board~~'s finding with respect to 5.2.1 remains unfavourable, the notice is returned to the notifying administration in accordance with 5.2.4. In this case, the notifying administration undertakes not to bring into use the frequency assignment until the condition specified in 5.2.5 is fulfilled.	**T.5.16** If the notifying administration resubmits the notice without modification and insists on its reconsideration, and if the Bureau's finding with respect to paragraph T.5.10.a) is favorable and the finding with respect to paragraph T.5.10.b) remains unfavorable, the notice is returned to the notifying administration. In this case, the notifying administration undertakes not to bring into use the frequency assignment until the condition specified in T5.15 is fulfilled. In the event that the Bureau has been informed of agreement to modification of the Plan for a specified period of time in accordance with **T4.25*bis***, the frequency assignment shall be recorded in the Master Register with a note indicating that the frequency assignment is valid only for the period specified. The notifying administration using the frequency assignment over a specified period shall not subsequently invoke this fact to justify the continued use of the frequency beyond the period specified unless it obtains the agreement of the administration(s) concerned.
5.2.7 If a frequency assignment notified in advance of bringing into use in conformity with paragraph 5.1.3 has received a favourable finding by the ~~Board~~ Bureau with respect to the provisions of paragraph 5.2.1, it shall be entered provisionally in the Master Register with a special symbol in the Remarks Column indicating the provisional nature of that entry.	**5.2.7** If a frequency assignment notified in advance of bringing into use in conformity with 5.1.3 has received a favourable finding by the Bureau~~Board~~ with respect to the provisions of 5.2.1, it shall be entered provisionally in the Master Register with a special symbol in the Remarks Column indicating the provisional nature of that entry.	**T.5.17** If a frequency assignment notified in advance of bringing into use in conformity with paragraph T.5.3 has received a favorable finding by the Bureau with respect to the provisions of paragraph T.5.10, it shall be entered provisionally in the Master Register with a special symbol in the Remarks Column indicating the provisional nature of that entry.
5.2.8 When the Bureau has received confirmation that the frequency assignment has been brought into use, the Bureau shall remove the symbol in the Master Register	**5.2.8** When the Bureau~~Board~~ has received confirmation that the frequency assignment has been brought into use, the Bureau~~Board~~ shall remove the symbol in the Master Register	**T.5.18** For notices recorded under paragraph T.5.17, when the Bureau has received confirmation that the frequency assignment has been brought into use, the Bureau shall remove the symbol in the Master Register.
5.2.9 The date in Column 2c shall be the date of bringing into use notified by the administration concerned. It is given for information only.	**5.2.9** The date in Column 2c shall be the date of bringing into use notified by the administration concerned. It is given for information only.	• Reason: Simplification: "Information only" means no regulatory bearing

5.3 *Cancellation of entries in the Master Register*	**5.3** *Cancellation of entries in the Master Register*	**T.5.19** *Cancellation of entries in the Master Register*
5.3.1 If an administration has not confirmed the bringing into use of a frequency assignment under paragraph 5.2.8, the Bureau~~Board~~ will make inquiries of the administration not earlier than six months after the expiry of the period specified in paragraph 5.1.3. On receipt of the relevant information, the Bureau~~Board~~ will either modify the date of coming into use or cancel the entry.	**5.3.1** If an administration has not confirmed the bringing into use of a frequency assignment under 5.2.8, the Bureau~~Board~~ will make inquiries of the administration not earlier than six months after the expiry of the period specified in 5.1.3. On receipt of the relevant information, the Bureau~~Board~~ will either modify the date of coming into use or cancel the entry.	**T.5.20** If an administration has not confirmed the bringing into use of a frequency assignment under paragraph T.5.17, the Bureau will make inquiries of the administration not earlier than six months after the expiry of the period specified in paragraph T.5.3. On receipt of the relevant information, the Bureau will either modify the date of coming into use or cancel the entry.
5.3.2 If the use of any recorded frequency assignment is permanently discontinued, the notifying administration shall so inform the Bureau~~Board~~ within three months, whereupon the entry shall be removed from the Master Register.	**5.3.2** If the use of any recorded frequency assignment is permanently discontinued, the notifying administration shall so inform the Bureau within three months, whereupon the entry shall be removed from the Master Register.	**T.5.21** If the use of any recorded frequency assignment is permanently discontinued, the notifying administration shall so inform the Bureau within three months, whereupon the entry shall be removed from the Master Register.
		T.5.22 In the case of modifications to the Plan under paragraph T.4.5, if the assignment has not been brought into use within the period specified under T.4.8, including any approved extension, the assignment shall be cancelled after the notifying administration has been informed by the Bureau. • Reason: To close the loop opened by T4.8

CHAPTER 7

OTHER MATTERS

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7.1 Review of Appendix S7 [28] of the Radio Regulations

7.1.1 WRC agenda item 1.3

Review of Appendix S7 [28] to the Radio Regulations, taking into account Resolution 60 (WARC-79), Resolution 712 (Rev.WRC-95) and Recommendation 711 (WARC-79).

7.1.2 Summary of technical and operational studies

Recognizing the forthcoming need for change within Appendix S7 [28], the ITU-R has continued to develop the following four Recommendations to provide a continuing technical basis for the revision of Appendix S7 [28]:

- *Recommendation ITU-R IS.847-1 (1993)* was prepared as an update of Appendix S7 [28]. It provides updated system parameters and propagation models, and, in addition, provides a method for the coordination area for earth stations operating to GSO satellites in slightly inclined orbits.
- *Recommendation ITU-R IS.848-1 (1993)* is essentially an addendum to Recommendation ITU-R IS.847-1 to provide a method for the determination of coordination distance between two earth stations, operating to satellites in the GSO, one of which is operating in the opposite (or "reverse band") direction of transmission.
- *Recommendation ITU-R IS.849-1 (1993)* is a second addendum to Recommendation ITU-R IS.847-1, which provides a method for determining the coordination area for earth stations operating to satellites in the non-geostationary orbit (NGSO). Within this text are three alternative approaches to the calculation of the effective earth station antenna gain in the direction of the horizon, and some rationalization of the procedure may be required.
- *Recommendation ITU-R P.620-2 (as revised in Document 3/BL/14)* provides the latest information on propagation models to be used for the determination of coordination distance at frequencies above 1 GHz.

7.1.3 Analysis of the results

Having reviewed Appendix S7 and the relevant Recommendations it was concluded that the following general principles should be used in the development of a revision[1] of Appendix S7:

- the revised Appendix S7 should specify the means of determining the need to coordinate between any earth station and terrestrial station or any two earth stations in various radiocommunication services, sharing the same frequency bands, in which geographical separation on the Earth's surface is the means by which acceptable frequency sharing is accomplished;
- the revised Appendix S7 should continue to evaluate the coordination area around a satellite earth station, rather than attempt to be the tool with which to carry out the coordination process itself. The coordination area is, and should continue to be, a result of assumptions taken about the propagation processes and the characteristics of the systems involved leading to an acceptable risk of interference while avoiding unnecessarily detailed coordination;
- the revised Appendix S7 should be used for determining the coordination area for earth stations which are not at a specified location but which may be anywhere within a service area.

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[1] This revision could incorporate the material directly and/or by reference.

Difficulties in the following three general areas were recognized in the current Appendix S7 and the relevant Recommendations:

- propagation considerations and the implications for coordination;
- expansion of the scope of the Recommendations to accommodate new requirements;
- application of Recommendation ITU-R IS.849-1 to earth stations of NGSO communications systems.

Based upon these considerations, the majority of administrations did not consider that these Recommendations, without the necessary updating, are ready to be proposed as material for updating Appendix S7. However, one administration considered that they represent a sufficient step forward so as to allow an interim revision of Appendix S7. This approach would allow an interim revision of Appendix S7 at WRC-97 based on Recommendations ITU-R IS.847-1, IS 848-1 and IS.849-1.

7.1.4 Advantages/disadvantages

Delaying the revision of Appendix S7 gives the advantage that the Recommendations can be updated to reflect the necessary changes.

The disadvantage is that of delaying the incorporation within Appendix S7 of the additional features included in Recommendations ITU-R IS.847-1, IS.848-1 and IS.849-1.

7.1.5 Regulatory and procedural considerations

The majority of administrations were of the opinion that there was not sufficient material for updating Appendix S7; it is therefore recommended to postpone the revision of Appendix S7 until WRC-99 to reflect the work completed by that time. This requires no regulatory or procedural action at this time.

7.2 Adaptive MF/HF systems

7.2.1 WRC-97 agenda item 1.5

Based on the results of studies to be carried out under Recommendation 720 (WRC-95), consider changes to the Radio Regulations, as appropriate.

7.2.2 Summary of Technical and Operational Studies, including a list of relevant ITU-R Recommendations

Draft new Recommendation ITU-R [Doc. 1/20] summarizes the spectrum considerations for adaptive systems. It discusses the regulatory structure under which adaptive and non-adaptive systems operate, including the impact on grade of service, efficiency of spectrum use, and minimization of interference. It should be noted that ITU-R has proposed a revision to the wording of Question ITU-R 204-1 to clarify the intent of the study being undertaken.

Recommendation ITU-R F.1110-1 (as revised in Document 9/118) recommends general characteristics for adaptive systems and principles for assigning frequencies. Recommendation ITU-R F.613 recommends guidance on the use of ionospheric channel sounding below 30 MHz.

7.2.3 Analysis of the results relating to the possible methods of satisfying the agenda item

7.2.3.1 Scope of the agenda item

considering a) of Recommendation 720 (WRC-95) indicates that the frequency range to be considered is 1.6 to 28 MHz. The Recommendation is concerned with "fixed and some mobile" services. This is understood to mean:

- the band should be primarily allocated to the fixed and mobile services;
- the band should not explicitly mention maritime and/or aeronautical mobile services;
- bands shared with the broadcasting service, the radiodetermination service, the amateur service or radio astronomy are not considered;
- bands allocated to the fixed and mobile services in a given Region but which are allocated in an adjacent Region to one or more of the other services are not considered;
- bands involving safety services are not considered (Nos. S5.155, S5.155A and S5.155B);
- any footnotes applicable to the proposed bands should be taken into account upon consideration of compatibility.

7.2.4 Method for satisfying the agenda item for consideration by the WRC-97

Because of the benefits to all users, it is desirable to provide more guidance in the Radio Regulations as to the use of adaptive systems. Such operation should be encouraged over the whole range of the fixed and mobile services referred in Section 7.2.3.1. However, the allocation of blocks of frequencies on a worldwide basis for the operation of adaptive systems should not be considered at this time.

7.2.5 Advantages and disadvantages

7.2.5.1 Disadvantages of the current situation

The HF spectrum has the potential to provide flexible, economic and long range communication, and in most geographical areas can provide good reliability. However only limited bandwidth is available and a satisfactory quality of service can be realized only if both long term and short term frequency management procedures are properly implemented.

HF communications utilize ionospheric propagation. The ionosphere is extremely variable in both time and space. The usable frequency range for a given circuit depends on the circuit length; on geographical location; and on time of day, the season and the epoch of the solar cycle. In addition the ionosphere is also variable over shorter time periods and has small and medium scale structures within it.

Ionospheric predictions are not suitable for real-time frequency management, since they cannot take full account of day-to-day, rapid and local variations, nor of the incidence of interfering signals. In the past, real-time circuit management has been undertaken by skilled operators who, through long experience and by careful observation of the received signals, were able to adapt to changing conditions. Such skills are no longer available. Thus it is likely that the performance of HF systems is progressively deteriorating due to lack of operator training and experience.

Resolution 23 (WRC-95) resolved not to undertake any further technical assessments of HF frequency assignments. This decision means that there is now no check as to whether a proposed assignment may cause interference, and proposals to introduce new frequency assignments are not now subject to any guidance by the Radiocommunication Bureau as to whether the assignment should be able to operate without causing interference. Thus the value of the MIFR for the fixed and mobile service bands is less clear and there may be a growing trend to operate without notification and registration.

7.2.5.2 The advantages of facilitating the use of frequency adaptive systems

The solution to the issues of improving the spectrum efficiency and system performance in the MF/HF bands, and of avoiding interference to existing and other systems is to facilitate the use of available technology using frequency agile equipment operated with automated adaptive control

systems. These systems are suitable both for single point-to-point links and for networks. It should be noted, however, that such systems can provide optimum performance and can avoid causing interference most effectively if the maximum flexibility is provided. Thus operation should not be limited to specific blocks of spectrum but should be encouraged over the whole range of fixed and mobile service bands referred to in § 7.2.3.1. above. In fact, such operation is in accord with the Radio Regulations, apart from the administrative complication of registering the relatively large numbers of frequencies selected for use by the adaptive system.

7.2.6 Regulatory and procedural considerations

7.2.6.1 To clarify the terminology, the WRC-97 might consider to adopt the following definition:

ADD S1.[...] *Frequency Adaptive system*: A frequency agile radiocommunication system using an automatic frequency selection procedure during each transmission session including calling, link establishment, link maintenance during information transfer and link disconnection.

7.2.6.2 Provision No. S4.1 [339] uses wording which may be somewhat unclear, when considering its application to frequency adaptive systems. The main requirement is to minimize spectrum usage in terms of both bandwidth and time. The technical advances of adaptive operation facilitate this, but require a choice of frequencies, in a way so as to avoid causing interference for optimum spectrum usage.

7.2.6.3 It is also desirable to introduce provisions and/or Recommendations dealing with the following matters:

- adaptive systems operating in the MF/HF bands should take active steps to avoid causing interference. For example, this may be achieved by ceasing transmission at regular intervals and by monitoring the frequency in use, wherever possible from both ends of the path. If other signals are observed on the channel, the adaptive system should move to another frequency;
- transmissions for extended periods which do not send useful information (for example the transmission of call signs, test messages or idling signals) should be strongly deprecated.

7.3 Spurious Emissions

7.3.1 WRC Agenda item 1.7

Review of Appendix S3 [8] to the Radio Regulations taking into account Recommendation 66 (Rev.WARC-92).

7.3.2 Summary of technical and operational studies

Recommendation 66 (WARC-92) recommended that ITU-R study, as a matter of urgency, the question of spurious emissions resulting from space services transmissions, to continue the study of spurious emissions in all frequency bands, establish appropriate measuring techniques for spurious emissions, study the categorizing of emissions and spurious emissions in terms of "mean" power, develop a Recommendation for these issues and submit a report to the next competent Conference on the results of its studies with a view to reviewing and including spurious and out-of-band emission limits in Appendix S3 [8] of the Radio Regulations, principally for the protection of the radio astronomy and other passive services.

The ITU-R has adopted a draft revision of Recommendation ITU-R SM.329-6 which, amongst others, defines spurious emissions, out-of-band emissions and the separation between these kinds of emissions. Furthermore, limits for spurious emissions are recommended, as well as methods of measurement.

For the purpose of setting limits, all emissions, including intermodulation products, conversion products and parasitic emissions, which fall at frequencies separated from the centre frequency of the emission by 250% or more of the necessary bandwidth of the emission will generally be considered as spurious emissions. However, this frequency separation may be dependent on the type of modulation used, the maximum bit rate in the case of digital modulation, the type of transmitter, and frequency coordination factors. For example, in the case of digital or pulsed modulation systems, the frequency separation may need to differ from the ±250% factor. For multi-channel or multi-carrier transmitters/transponders, where several carriers may be transmitted simultaneously from a final output amplifier or an active antenna, the centre frequency of the emission is taken to be the centre of the -3 dB bandwidth of the transmitter or transponder.

Within the draft revision of the Recommendation, limits for spurious emissions are divided into 3 categories:

- Category A: Recommended maximum spurious emission power levels intended for use with radio equipment and applicable to all administrations.
- Category B: Recommended maximum spurious emission power levels intended for administrations that may need to adopt more stringent limits than those given in Category A.
- Category C: Radiation limits for Information Technology (IT) equipment specified by CISPR.

Category A limits are proposed as a replacement for Appendix S3 [8] Tables.

Regarding limits on spurious emission power levels resulting from space services transmissions, the limits specified within the Category A table are design objectives until WRC-99.

The ITU-R has not yet defined limits for out-of-band emissions; further study is necessary on this issue. The ITU-R has adopted a new Question to study "Out-of-Band and Spurious Emission Limits". Unless appropriate amendments for space service spurious emissions are developed for incorporation into Category A, as mentioned in the draft revision of Recommendation ITU-R 329-6, in response to this new Question, the values presently specified in Category A for space services will become effective in the Recommendation at the time of RA-99.

7.3.3 Analysis of the results

- The limits of Category A are recommended for inclusion in Appendix S3 [8] of the Radio Regulations, with a number of explanatory footnotes;
- these limits should not become applicable before a certain period of time, which should not be less than [6][2] years;
- existing equipment should not be required to comply with the newly specified limits;
- the agenda of WRC-99 should allow consideration of spurious emissions for space services and out-of-band emissions for all services;
- radio astronomy and passive services have to be effectively protected and administrations have to take their needs into account when planning the use of the spectrum, particularly through avoiding close frequency proximity with space services.

The proposed maximum permitted spurious emission levels are applicable to all services with a number of exceptions. The Table gives limits for all spurious emissions in all frequency bands, independently of the centre frequency of the transmitter.

Up to now, no spurious emission limit requirements have applied to radiodetermination and space services systems but, because of real interference cases that have already arisen and which are expected to arise in the future, both of these types of services need to have real limits, and not design objectives. Unless new or more appropriate limits are determined, the Table 7.1 values for space services will become limits after 1999.

7.3.4 Methods to satisfy the agenda item

7.3.4.1 Limits

Include the Category A limits, as given in Table 7.1, with the associated explanation and footnotes, also given below, in Appendix S3 [8] of the Radio Regulations.

Table 7.1 indicates the maximum permitted levels of spurious emissions, in terms of power as indicated in the table, of any spurious component supplied by a transmitter to the antenna transmission line.

Spurious emissions from any part of the installation other than the antenna and its transmission line should not have an effect greater than would occur if this antenna system were supplied with the maximum permitted power at that spurious emission frequency.

For technical or operational reasons, more stringent levels than those specified in Table 7.1 may be applied to protect specific services in certain frequency bands. The levels applied to protect these services should be those agreed upon by the appropriate World Radiocommunication Conference. More stringent levels may also be fixed by specific agreements between the administrations concerned. Additionally, special consideration of transmitter spurious emissions is required for the protection of radio astronomy and other passive services.

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[2] This time period is for consideration by WRC-97.

TABLE 7.1

Spurious emission limits

Recommended attenuation values used to calculate maximum permitted spurious emission power levels intended for use with radio equipment by all countries. Measurement of spurious emissions should be performed in accordance with Annex 2 of draft revision of Recommendation ITU-R SM.329-6.

Service category in accordance with Article S1, or equipment type (Note 6)	**Attenuation (dB) below the power supplied to the antenna transmission line** (Note 7)
All services except those services quoted below:	43 + 10 log(P), or 70 dBc, whichever is less stringent
Space services (earth stations) (Notes 1 and 5)	43 + 10 log(P), or 60 dBc, whichever is less stringent
Space services (space stations) (Notes 1 and 5)	43 + 10 log(P), or 60 dBc, whichever is less stringent
Radiodetermination	43 + 10 log(PEP), or 60 dB, whichever is less stringent
Broadcasting television (Note 2)	46 + 10 log(P), or 60 dB, 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.
Broadcasting 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 and the absolute mean power level of 50 mW should not be exceeded
SSB from mobile stations (Note 3)	43 dB below PEP
Amateur services operating below 30 MHz (including with SSB) (Note 3)	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 (Note 3)	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 (Note 4)	56 + 10 log(P) or 40 dBc, whichever is less stringent
Emergency position-indicating radio beacon, Emergency locator transmitter, Personal location beacon, Search and rescue transponder, Ship emergency, lifeboat, and survival craft transmitters; and Land, aeronautical or maritime transmitters when used in emergency	No limit

P = mean power in watts supplied to the antenna transmission line, in accordance with No. S1.158 [152]. When burst transmission is used, the mean power P and the mean power of any spurious emissions are measured averaging the power over the burst duration.

PEP = peak envelope power in watts at the antenna transmission line, in accordance with No. S1.157 [151].

dBc = decibels relative to the unmodulated carrier power of the emission. In the cases which do not have a carrier, for example in some digital modulation schemes, the reference level equivalent to dBc is decibels relative to the mean power P.

Note 1 - Spurious emission limits for all space services are specified in a 4 kHz reference bandwidth.

Note 2 - For analogue television transmissions, the mean power level is defined with a specified video signal modulation. This video signal has to be chosen in such a way that the maximum mean power level (e.g., at the video signal blanking level for NTSC and PAL) is supplied to the antenna transmission line.

Note 3 - All classes of emission using SSB are included in the category "SSB".

Note 4 - Low power radio devices having a maximum output power of less than 100 mW and intended for short range communication or control purposes[3].

Note 5 - These values are design objectives. If not decided otherwise by WRC-99, this Note will not be applicable after 31.12.1999.

Note 6 - In some cases of digital modulation, pulsed modulation, and narrow-band high power transmitters for all categories of services, there may be difficulties in meeting limits in the area close to plus or minus 250% of the necessary bandwidth.

Note 7 - The e.i.r.p. method as specified in the draft revision of Recommendation ITU-R SM.329-6 should be used when it is not possible to measure the power supplied to the antenna transmission line.[4]

7.3.4.2 Examples of applying 43 + 10 log(P) to calculate attenuation requirements (as given in the draft revision of Recommendation ITU-R SM.329-6)

Where specified in relation to mean power, spurious emissions are to be at least x dB down from the total mean power P, i.e. -x dBc. The power P (in Watts) is to be measured in a bandwidth wide enough to include the total mean power. The spurious emissions are to be measured in the reference bandwidths given in the Recommendation. The measurement of the spurious emission power is independent of the value of necessary bandwidth. Because the absolute emission power limit, derived from 43 + 10log(P), can become too stringent for high power transmitters, alternative relative powers are also provided in Table 7.1.

Example 1

A land mobile transmitter, with any value of necessary bandwidth, must meet a spurious emission attenuation of 43 + 10 log(P), or 70 dBc, whichever is less stringent. To measure spurious emissions in the frequency range between 30 and 1 000 MHz, the draft revision of Recommendation ITU-R SM.329-6 *recommends* 4.1 indicates the use of a reference bandwidth of 100 kHz. For other frequency ranges, the measurement must use the appropriate reference bandwidths given in *recommends* 4.1.

With a measured total mean power of 10 Watts:

– Attenuation relative to total mean power = 43 + 10 log10 = 53 dB.

– The 53 dBc is less stringent than 70 dBc, so the 53 dBc value is used.

– Therefore: Spurious emissions must not exceed 53 dBc in a 100 kHz reference bandwidth, or converting to an absolute level, spurious emissions must not exceed 10 dBW - 53 dBc = -43 dBW in a 100 kHz reference bandwidth.

With a measured total mean power of 1 000 Watts:

– Attenuation relative to total mean power = 43 + 10 log(1 000) = 73 dB.

– The 73 dBc is more stringent than 70 dBc limit, so the 70 dBc value is used.

– Therefore: Spurious emissions must not exceed 70 dBc in a 100 kHz reference bandwidth, or converting to an absolute level, spurious emissions must not exceed 30 dBW - 70 dBc = -40 dBW in a 100 kHz reference bandwidth.

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[3] Such equipment is in general exempt from individual licensing.

[4] The e.i.r.p. method may need some modification for special cases, e.g. beam forming arrays.

Example 2

A space services transmitter, with any value of necessary bandwidth, must meet a spurious emission attenuation of 43 + 10 log(P), or 60 dBc, whichever is less stringent. To measure spurious emissions at any frequency, Note 1 of Table 7.1 indicates using a reference bandwidth of 4 kHz.

With a measured total mean power of 20 Watts:

– Attenuation relative to total mean power = 43 + 10 log(20) = 56 dB.

– The 56 dBc is less stringent than the 60 dBc limit, so the 56 dBc value is used.

– Therefore: Spurious emissions must not exceed 56 dBc in a 4 kHz reference bandwidth or converting to an absolute level, spurious emissions must not exceed 13 dBW - 56 dBc = -43 dBW in a 4 kHz reference bandwidth.

7.3.4.3 Recommended reference bandwidths

A reference bandwidth is the bandwidth within which spurious emission levels are specified. The following reference bandwidths are specified:

a) 1 kHz between 9 and 150 kHz;

b) 10 kHz between 150 kHz and 30 MHz;

c) 100 kHz between 30 MHz and 1 GHz;

d) 1 MHz above 1 GHz;

e) the reference bandwidth required for measurement of radar spurious emissions must be calculated for each radar system, and the measurement methods should be guided by Recommendation ITU-R M.1177. Therefore, for the three general types of radar pulse modulation utilized for radionavigation, radiolocation, acquisition, tracking and other radiodetermination functions, the reference bandwidths are:

   1) 1/T for fixed-frequency, non-pulse-coded radar, where T is the pulse length;

   2) 1/t for fixed-frequency, phase-coded pulsed radar, where t is the phase chip length;

   3) $\sqrt{B/T}$ for swept-frequency (FM, or chirp) radar, where B is the range of frequency sweep during each pulse and T is the pulse length.

Some administrations expressed concern with the application of the reference bandwidths given above (for example for narrow-band land mobile systems which are tunable across the 1 GHz "reference bandwidth" boundary).

7.3.5 Advantages/disadvantages

When the WRC-97 wishes to adopt the newly proposed limits for spurious emissions power levels a better protection is generally given to the various radio services.

The limits for spurious emissions for space services are a design objective until 1999.

Limits for out-of-band emissions need further study, and should be considered by a future WRC.

7.3.6 Regulatory and procedural considerations

In considering proposals from administrations based on the options shown above, WRC-97 should note that regulatory/procedural text may need to be developed, addressing the following issues:

• revise Appendix S3 [8] in accordance with the proposals given in section 7.3.4;

- adopt an agenda item for WRC-99 to allow revision of the limits for spurious emissions for space services;
- adopt an agenda item for WRC-99 to allow inclusion in the Radio Regulations of limits for out-of-band emissions;
- review Recommendation 66 (Rev.WARC-92);
- invite ITU-R to submit a report to WRC-99 on the results of its studies regarding out-of-band emissions;
- consider that these limits should not become applicable before a certain period of time, which should not be less than [6][5] years; and
- consider that existing equipment should not be required to comply with the specified limits.

7.4 Wind Profiler Radars

7.4.1 WRC-97 agenda item 1.9.3

Taking into account the needs of other services to which the relevant frequency bands are already allocated: Recommendation 621 (WARC-92).

Title of Recommendation 621 (WARC-92): "*Implementation of wind profiler radars at frequencies near 50 MHz, 400 MHz and 1 000 MHz*".

7.4.2 Summary of technical and operational studies

In accordance with Recommendation 621 (WARC-92), the need for frequency bands in the vicinity of each of the frequencies 50 MHz, 400 MHz, and 1 000 MHz to permit full performance capability of wind profiler radar operations has been expressed by the World Meteorological Organisation.

The ITU-R studied technical and sharing considerations between wind profiler radars and other services allocated in bands near 50, 400 and 1 000 MHz in order to determine suitable frequencies.

The ITU-R has approved Recommendations ITU-R M.1226, ITU-R M.1085-1 and ITU-R M.1227 on technical and operational characteristics of wind profiler radars in bands in the vicinity of 50 MHz, 400 MHz and 1 000 MHz, respectively.

It is noted that the draft new Recommendation ITU-R SA.[Doc. 7/65] further recommends that the use of frequency-modulated pulsed profiler radars be avoided in the band 1 215 - 1 300 MHz.

7.4.3 Analysis of the results of studies

7.4.3.1 Near 50 MHz

The candidate frequency bands 40 - 80 MHz are suitable for sharing with other services provided that the following conditions are satisfied: wind profiler radar density is relatively low, broadcast station density is relatively low, and sharing arrangements are made with all services operating in these ranges. These arrangements should take into account the protection of any existing system and planned new digital broadcast systems.

7.4.3.2 Near 400 MHz

In the entire range 300 - 500 MHz, the frequency bands 440 - 450 MHz and 470 - 500 MHz are considered as candidate bands.

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[5] This time period is for consideration by WRC-97.

In the case of the 470 - 500 MHz option, band sharing arrangements should be made with existing and planned broadcasting services, including digital broadcasting services.

7.4.3.3 Near 1 000 MHz

Although a single frequency band is preferable for the wind profiler radar in terms of costs, it may be difficult to attain.

The candidate frequency bands are:

- 904 - 928 MHz;
- 1 235 - 1 241 MHz (with caution regarding radionavigation[6]);
- 1 270 - 1 295 MHz;
- 1 300 - 1 375 MHz.

The above frequency bands may not be suitable for all Regions.

As frequency increases over 1 300 MHz, performance of the wind profiler radar decreases significantly.

7.4.4 Methods to satisfy the agenda item

Implement wind profiler radars in candidate bands listed below which are already allocated to the radiolocation service either by identifying the use of these bands by wind profiler radars in a footnote, or through reference in a revision of Recommendation 621 (WARC-92):

- 440 - 450 MHz;
- 904 - 928 MHz in Region 2;
- 1 235 - 1 241 MHz (see NOTE 1);
- 1 270 - 1 295 MHz;
- 1 300 - 1 375 MHz.

Where a need is identified for wind profiler radars to use bands where no radiolocation service allocation currently exists, provisions should be made for allocations to the radiolocation service, but limited to use by wind profiler radars, in the following candidate bands:

- 40 - 80 MHz;
- 470 - 500 MHz in Regions 1 and 3.

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[6] Wind profiler radar operation in this band may cause interference to the radionavigation-satellite service receivers. Sharing conditions should be determined on the basis of simulations and confirmed field tests.

Revise Recommendation 621 (WARC-92) to include the candidate bands and other decisions of the WRC-97 as appropriate.

NOTE 1 - The frequency band 1 235 - 1 241 MHz could be considered as a potential candidate band for wind profiler radars after completion of studies on compatibility with RNSS within the framework of ITU-R.

7.4.5 Advantages and disadvantages of the proposed methods

Sharing possibilities have been identified for the following bands. However, no single bands near 50 MHz, 400 MHz and 1 000 MHz are available worldwide.

It is noted that if characteristics and deployment of wind profiler radars are not controlled then harmful interference with other services will occur.

Near 50 MHz: necessary bandwidth: 0.2 to 2.2 MHz
occupied bandwidth ≤ 2.5 × necessary bandwidth

- 40 - 80 MHz:

  advantages: The frequency band 60 - 80 MHz is preferred for the following reasons:

  a) less susceptible to sporadic-E propagation;

  b) smaller antenna surface.

  disadvantages:
  - no frequency allocation for the radiolocation service;
  - sharing constraints with mobile and broadcasting services.

Near 400 MHz: necessary bandwidth: 0.3 to 2.2 MHz
occupied bandwidth ≤ 2.5 × necessary bandwidth

- 440 - 450 MHz: Special concern with the space operation service (No. S5.286 [668]). Compatibility tests are incomplete.

  advantages:
  - existing radiolocation allocation;
  - requirements for wind profiler radar operations near 400 MHz could be satisfied.

  disadvantages:
  - sharing constraints such as with fixed and mobile services.

- 470 - 500 MHz (Regions 1 and 3)

  advantages:
  - requirements for wind profiler radar operations near 400 MHz could be satisfied.

  disadvantages:
  - sharing constraints with mobile and broadcasting services.

Near 1 000 MHz: necessary bandwidth: 0.7 to 7.3 MHz
occupied bandwidth ≤ 2.5 × necessary bandwidth

- 904 - 928 MHz

  advantages:
  - superior wind profiler radar performance compared to higher frequencies;
  - existing radiolocation allocation in Region 2.

  disadvantages:
  - incompatible with primary services in Regions 1 and 3.

- 1 235 - 1 241 MHz Special concern with the RNSS (GLONAS and GPS L2 frequency) (No. S4.10 [953]). Compatibility tests are incomplete.

  advantages:
  - existing radiolocation allocation.

  disadvantages:
  - sharing constraints with RNSS (GLONAS and GPS L2 frequency) and earth exploration-satellite (active) service.

- 1 270 - 1 295 MHz

  advantages: - existing radiolocation allocation.

  disadvantages: - sharing constraints with earth exploration-satellite (active) service.

- 1300 - 1375 MHz

  advantages: - existing radiolocation allocation.

  disadvantages: - decreased wind profiler radar performance compared to lower frequencies;

  - sharing constraints with fixed service in Region 1.

7.5 Fixed service above 30 GHz

7.5.1 WRC-97 agenda item 1.9.6

The identification of suitable frequency bands above 30 GHz for use by the fixed service for high-density applications.

For clarity, the term "High Density Fixed Systems" or "HDFS" will be used throughout the text to refer to fixed service systems used in high-density applications.

7.5.2 Summary of technical and operational studies

The ITU-R chose to draw a technical demarcation between two broad categories of radio-relay systems at about 17 GHz (Recommendations ITU-R F.1101 and F.1102):

- bands below about 17 GHz, where multipath fading is the controlling propagation impairment mechanism and hop lengths of up to about 80 kilometres are typical; used for primarily high-capacity long distance and regional trunking;
- above 17 GHz, where the usable hop lengths are determined by precipitation fading and atmospheric absorption; they are on the order of 10 kilometres and shorter; used for mobile network backhaul and other trunking; medium/high density local access.

Recommendation ITU-R F.746 provides summary information on the ITU recommended radio-frequency channel arrangements for radio-relay systems including the frequency bands 17.7 - 19.7 GHz ("18 GHz"), 21.2 - 23.6 GHz ("23 GHz"), 24.25 - 29.5 GHz ("27 GHz"); 31.0 - 31.3 GHz ("31 GHz"), 36.0 - 40.5 GHz ("38 GHz") and 54.25 - 58.2 GHz ("55 GHz"). The relevant band-specific radio-frequency channel arrangements are provided in Recommendations ITU-R F.749 (38 GHz), and F.1100 (55 GHz).

Recommendation ITU-R F.1102 covers characteristics of radio-relay systems operating in frequency bands above about 17 GHz. It includes a variety of applications, hop length considerations, and digital radio implementations; the companion Recommendation ITU-R F.1101 supplements it in several important aspects, including a comparison of current and advanced modulation and coding methods.

Additional relevant aspects are covered in:

– Recommendation ITU-R F.756 on point-to-multipoint systems;

– Recommendation ITU-R F.1104 on requirements for point-to-multipoint radio systems in the local grade portion of an ISDN connection, and

– Recommendation ITU-R F.750 on SDH-based networks.

– Chapter 5 of the CPM-97 Report.

Recommendation ITU-R F.758 provides specific system parameters and other information relating to the development of sharing criteria for fixed service systems.

The types of radio-relay services that may be provided in FS frequency bands is determined largely by maximum usable hop lengths (given required performance and availability objectives) and available bandwidth. As hop lengths become shorter and frequency reuse (i.e., potential deployment density) becomes correspondingly higher moving through the bands above 17 GHz, higher and higher density FS services become more technically practical.

7.5.2.1 Impact of an increasingly competitive environment

Local access and other high density radio-relay service planning and system deployments have rapidly accelerated in the last few years in many administrations. This acceleration is due in large part to the worldwide trend towards deregulation and increased competition in the provision of local telecommunications and video distribution services. Because of cost and speed of deployment considerations, these developments are placing a major new focus on the provision of services directly to end-users via fixed wireless systems. As a result, the number of fixed service subscribers in the bands above 17 GHz worldwide is currently close to two hundred thousand and growing at a rapid rate. Some proposed new satellite systems already constrain further FS deployment and/or operation in most available bands, progressively increasing constraints arising from sharing with space and satellite services. The demand for local wireless broadband services is experiencing unprecedented growth, leading in turn to a new and pressing emphasis on the national, regional, and international designation of spectrum for the implementation of HDFS. However, HDFS deployment would be impeded under envisaged co-primary sharing constraints in bands above 30 GHz. This has formed the basis for WRC-97 agenda item 1.9.6.

7.5.2.2 HDFS characteristics

The group of ITU-R Recommendations and related references provide a framework for analysing HDFS deployment, particularly in the bands above 30 GHz.

Current HDFS data rates over individual circuit paths range from about 1.5 Mbit/s to 45 Mbit/s, and are expected to reach at least 310 Mbit/s within the next few years, as radios utilizing higher order modulation schemes become available (see draft revision of Recommendation ITU-R F.758 [see Doc. 9/18(Rev.1)]). To further increase spectral efficiency and service flexibility, advanced HDFS are likely to employ various techniques that may include dynamic allocation of bit rate, modulation, and antenna beamwidth. Finally, HDFS links may operate at elevation angles of up to about 45 degrees in dense urban environments.

7.5.2.3 HDFS deployment

The vast majority of current worldwide HDFS deployments are in the 38 GHz band, with a primary focus on urban and suburban business and industrial areas. Future HDFS deployment is expected to extend to residential areas, spearheaded by local distribution of television programmes in competition to cable TV and other new broadband fixed services offered to the home. The variety of possible current HDFS network configurations includes: conventional point-to-point (P-P), conventional point-to-multipoint (P-MP), and combinations thereof, e.g. P-P systems deployed in multisectored P-MP configurations. High density deployment of independent P-P links similarly results in clusters that assume the essential characteristics of P-MP deployment. The densest HDFS deployment cases have reached the range of 1 to 10 stations per square kilometre, and are expected to increase several fold within a few years. See also Table 7.2.

Newly developed technology enables stationary lighter than air repeaters to be located at fixed points in the stratosphere above commercial flight path altitudes and over metropolitan areas. Such radio-

relay systems using stratospheric repeaters can provide both domestic and international broadband wireless services to user terminals (see NOTE 1).

NOTE 1 - It is recognized that radio-relay systems using stratospheric repeaters could potentially be utilized to provide various other services, such as the mobile and broadcasting services. This CPM chapter focuses on HDFS applications. The technical and regulatory aspects of possible requirements for systems using stratospheric repeaters in other services should be treated as required in other appropriate venues.

TABLE 7.2

Status of high density FS in bands above 30 GHz

Bands	Usage	Room for growth
30 to 36 GHz	Light to moderate use due to limited available allocations(1)	Contingent on future availability of sufficient spectrum for HDFS
36 to about 50 GHz	Local access, inter-cell links for mobile and wireless local loop networks, optical fibre backup, local TV distribution, broadband GII access, intelligent transport, SDH access, RLANs, ATM compatible transport	Substantial 38 GHz deployments in several countries; expanded and new licensing commencing in these and additional countries. Bands below about 40 GHz are currently preferred to satisfy HDFS hop length, reuse, and antenna sizing objectives. Uses proposed in other bands. HDFS in these bands could be subject to constraints resulting from future sharing with co-primary space and satellite service systems. HDFS using stratospheric repeaters proposed to operate in 2 x 300 MHz in the range 47 - 49 GHz
Above about 50 GHz	Technically similar to 30 - 50 GHz, but over shorter hop lengths, thus limiting services offered as compared to lower HDFS bands	HDFS deployment in progress in 55 - 58 GHz. Expanding HDFS uses in this and other bands planned. Limited availability of equipment and co-primary sharing considerations, such as with EESS, are the principal restrictive factors. High absorption losses result in short hop lengths but very high frequency reuse

(1) It is noted that the fixed service has a primary allocation in the bands 31 - 31.3 GHz and 33.4 - 36 GHz (41 administrations, No. S5.549) and a secondary allocation in the band 31.5 - 31.8 GHz. Further, it is noted that there are other co-primary services in the frequency range of 31 - 36 GHz which include EES, radio astronomy, space research (R1, R3), space research (deep space), meteorological aids, mobile and radiolocation.

7.5.3 Analysis of the results of studies

The following analysis is based on the ITU-R Recommendations listed in Section 7.5.2, on ITU-R working documents covering the same subjects, and on related references.

7.5.3.1 Preferred frequency ranges

The following factors determine the preferred frequency range for HDFS applications:

- Service requirements: The achievable hop length requirements are derived from the network performance objectives of ITU-T Recommendation G.826 and market requirements which can translate into a minimum availability objective of 99.999%.
- Propagation conditions: The propagation conditions are such that usable hop length decreases with increase of frequency as illustrated in Table 7.3. The frequency bands above 50 GHz have unique propagation characteristics which are suitable for certain high density fixed service applications. The high absorption losses in this range tend to favour short hop length applications that can benefit from high frequency reuse.
- Availability of equipment: Commercial radio equipment in the 30 - 50 GHz range is now available for mass production. In bands above 50 GHz, the more compact size of the equipment, including antennas, is condusive to particular applications such as in-building local area networks.

TABLE 7.3

Representative propagation distances(1)

Frequency band	**Climatic zone B(2)**	**Climatic zone G(2)**	**Climatic zone K(2)**
	U = 0.001%	**U = 0.001%**	**U = 0.001%**
38 GHz(3)	8.2 km	3.7 km	2.7 km
55 GHz(3)	3.5 km	2.2 km	1.9 km

U% Unavailability

(1) Demonstrating achievable propagation distance based on Recommendation ITU-R F.1102.

(2) Climatic zones B, G, K are defined in Recommendations ITU-R P.620 and P.837.

(3) Antenna gain Gi: 44 dB, Transmitter output: 15 dBm, BER 10^{-3} threshold: -84.5 dBm. (See draft revised Recommendation ITU-R F.758 [Doc. 9/18(Rev.1)]).

The frequency range between 30 and 40 GHz is preferred to satisfy current and near-term future market requirements, including hop length and availability objectives. This explains the popularity of the existing 38 GHz band, which is already becoming congested in a number of countries and may be subject to constraints arising from co-primary sharing with the FSS and other space services.

HDFS using stratospheric repeaters can also make beneficial use of millimeter wave frequencies up to the sharp increase in atmospheric absorption at about 50 GHz owing to the very high elevation angles (up to 90 degrees) obtainable from a stratospheric location.

7.5.3.2 HDFS sharing considerations between 30 GHz and up to about 55 GHz

HDFS intra-service station distances are substantially smaller than inter-service separation distances. Therefore, the integrity of HDFS service areas can be severely affected by the exclusion zones required for sharing. Accordingly coordination with and by other services should be carried out for HDFS service areas instead of individual HDFS stations.

Similarly, HDFS using stratospheric repeaters use a full range of elevation angles. Thus, sharing with services other than broadcasting-satellite service feeder links located outside primary coverage areas may present difficulties in the bands proposed for such systems.

All the frequency bands above 30 GHz allocated to the fixed service are also allocated to one or more other services on a shared basis. Sharing with another service in the same deployment area would severely impair:

- achievable coverage density;
- service quality;
- cost effectiveness;
- spectral efficiency;
- rapid installation of large quantities of links.

7.5.4 Methods to satisfy the agenda item

Geographical and/or frequency separation using one or more of the following three conventional methods:

Method (1) Identify potential frequency bands for additional primary FS allocations, taking due account of the requirements of other allocated services (see NOTE 2).

Method (2) Within the existing co-primary allocations, designate frequency bands for the fixed service and the other allocated services to allow each service to optimize the trade-offs between coverage density, service quality, cost effectiveness and spectral efficiency independently.

Method (3) Further investigate the feasibility of mutually advantageous co-frequency sharing between high density fixed service and the other allocated services with the aim of increasing the overall spectral efficiency of the shared bands.

NOTE 2 - Some administrations consider that, under this method, it may be necessary, as a result of accommodating HDFS, to examine the consequences and adjust, if necessary, allocations of other co-primary services.

- Some administrations were of the view that allocations to other services are not within the scope of WRC-97 Agenda item 1.9.6. Other administrations believe that such allocations are within the scope of Agenda item 1.9.6. However, it was noted that all views should take into account Section 7.5.6. of this Report.

The following framework should be used for the designation of any suitable HDFS band.

Frequency range:

1) within the 30 to 50 GHz range, preferably below 40 GHz, for current HDFS applications; within the 47.2 - 50.2 GHz range for HDFS including stratospheric repeaters, and

2) above 50 GHz for applications requiring high atmospheric absorption characteristics.

Structure of each band:

1) about 2 GHz contiguous or, about 2 GHz made up of two or four equally split, non-adjacent subbands, and

2) for HDFS using stratospheric repeaters, one paired band of 2 x 300 MHz.

Minimum bandwidth of each subband: 400 MHz.

Generally, the achievable transmit/receive spacing from HDFS bands should be in the range of 500 MHz to 1.5 GHz, preferably around 1 GHz; for HDFS using stratospheric repeaters, a minimum transmit/receive spacing of 400 MHz is preferred.

7.5.5 Advantages and disadvantages of identified methods

Method (1):

Advantage: more suitable spectrum for HDFS will be available (see NOTE 2).

Disadvantage: may require more substantial regulatory actions.

Method (2):

Advantage: each service can optimize its deployment independently.

Disadvantage: the amount of spectrum available to each service is smaller than the full existing shared allocation.

Method (3):

Advantage: all sharing services can potentially utilize their entire allocation.

Disadvantage: the necessary sharing restrictions may severely reduce service viability and thereby offset the potential gain of utilizing the entire allocation.

7.5.6 Regulatory and procedural considerations

The methods to satisfy the agenda item could entail changes to the Radio Regulations affecting allocations in bands above 30 GHz.

WRC-97 may need to establish an agenda item for WRC-99 to address continuing study issues and related regulatory matters that may arise from the treatment of HDFS issues at WRC-97.

7.6 Review of Resolutions and Recommendations for revision, replacement or abrogations

7.6.1 WRC agenda item 4

In accordance with Resolution **94 (WARC-92)**, to review those Resolutions and Recommendations of world administrative radio conferences and world radiocommunication conferences which are relevant to agenda items 1 and 2 above with a view to their possible revision, replacement or abrogation.

7.6.2 List of Resolutions and Recommendations

The table below contains a list of Resolutions and Recommendations considered by CPM-97 as related to the sections of its Report, on which WRC-97 may take actions.

Resolutions/Recommendations
Chapter 1
Resolution 33 Relating to the Bringing into Use of Space Stations in the Broadcasting-Satellite Service, Prior to the Entry into Force of Agreements and Associated Plans for the Broadcasting-Satellite Service
Resolution 48 (WRC-95) Conditions for Recommencing the Procedures for the Advance Publication of Information
Resolution 27 (WRC-95) References to ITU-R Recommendations in the Radio Regulations
Resolution 28 (WRC-95) Revision of references to ITU-R Recommendations incorporated by reference in the RR
Resolution 107 (Orb-88) Satellite networks intended for use in the frequency bands of the plan in Appendix 30B for which information was communicated to the IFRB between 8 August 1985 and 5 October 1988
Resolution 110 (Orb-88) Improved procedures for certain bands of the Fixed-Satellite Service
Chapter 2
Resolution 508 (WARC-79) Relating to the Convening of a World Administrative Radio Conference for the Planning of the HF Bands Allocated to the Broadcasting Service
Resolution 511 (HFBC-87) Programme of Action Relating to the Improvement, testing, Adoption and Practical Implementation of the Planning system for the High Frequency Bands Allocated Exclusively to the Broadcasting Service, and Associated Provisions
Resolution 512 (HFBC-87) Operation of HFBC Transmitters in the Extended Bands Above 10 MHz
Resolution 513 (HFBC-87) Improvement in the Use of the HF Bands Allocated Exclusively to the Broadcasting Service by Avoiding Harmful Interference
Resolution 514 (HFBC-87) Procedure to be Applied by the IFRB in the Revision of the Relevant Parts of its Technical Standards Used in the HF Bands Allocated Exclusively to the Broadcasting Service
Resolution 515 (HFBC-87) Improvements to the HFBC Planning System and the Consultation Procedures

Resolution 516 (HFBC-87) Antennas to be Used for the Planning of the HF Bands Allocated Exclusively to the Broadcasting Service
Resolution 517 (HFBC-87) Transition from Double-Sideband (DSB) to Single-Sideband (SSB) Emissions in the HF Bands Allocated Exclusively to the Broadcasting Service
Resolution 523 (WARC-92) Convening of a World Administrative Radio Conference for the Planning of HF Bands Allocated to the Broadcasting Service
Resolution 529 (WRC-95) HF Broadcasting
Resolution 530 (WRC-95) Simplification of Article 17 of the Radio Regulations
Recommendation 509 (HFBC-87) Participation by Administrations in the Improvement of the Planning System for the HF Bands Allocated Exclusively to the Broadcasting Service
Recommendation 510 (HFBC-87) Planning Parameters for the Double-Sideband (DSB) System in the HF Bands Allocated Exclusively to the Broadcasting Service
Recommendation 512 (HFBC-87) Propagation Prediction Method to be Used in the HF Bands Allocated Exclusively to the Broadcasting Service
Chapter 3
Resolution 331 (Mob-87) Introduction of provisions for the GMDSS and continuation of the existing distress and safety provisions
Resolution 200 (Mob-87) Class of emissions to be used for distress and safety purposes on the carrier frequency 2 182 kHz
Resolution 210 (Mob-87) Date of entry into force of the 10 kHz guardband for the frequency 500 kHz in the Mobile Service (Distress and Calling)
Resolution 330 (Mob-87) Frequencies for routine (Non-Distress) calling in the bands between 1 605 kHz and 4 000 kHz
Resolution 310 (Rev.Mob-87) Frequency provisions for development and future implementation of ship movment telemetry, telecommand and data exchange systems

Resolution 339

Coordination of NAVTEX services
Resolution 408 (Mob-87) Use of the band 136 - 137 MHz by services other than the Aeronautical Mobile ® Service
Recommendation No. 7 (Rev.Mob-87) Adoption of Standard Forms for Ship Station and Ship Earth Station Licences and Aircraft Station and Aircraft Earth Station Licences
Chapter 4
Resolution 44 Compatibility of equipment used in the MSS
Resolution 118 Use of the bands 18.8 - 19.3 GHz and 28.6 - 29.1 GHz by non-geostationary fixed-satellite service systems
Resolution 120 Use of the bands 19.3 - 19.7 GHz and 29.1 - 29.5 GHz by feeder links for NON-GSO MSS networks
Resolution 119 Sharing between the FSS and the FS in the 19.3 - 19.6 GHz band when used by the FSS to provide feeder links for non-geostationary satellite systems in the MSS
Resolution 115 Calculation of the pfd at the geostationary-satellite orbit in the band 6 700 - 7 075 MHz used for feeder links of non-geostationary-satellite systems in the MSS in the space-to-Earth direction
Resolution 116 Allocation of frequencies to the FSS (space-to-Earth) in the band 15.4 - 15.7 GHz for feeder links of non-geostationary-satellite networks in the MSS
Resolution 714 Power flux-density level applicable in the frequency band 137 - 138 MHz shared by the MSS and Terrestrial Services
Resolution 117 Allocation of frequencies to the FSS (Earth-to-space) in the band 15.45 - 15.65 GHz for use by feeder links of non-geostationary satellite networks operating in the MSS
Resolution 121 Development of interference criteria and methodologies for coordination between feeder links of non-geostationary-satellite networks in the MSS and geostationary- satellite networks in the FSS in the bands 19.3 - 19.6 GHz and 29.1 - 29.4 GHz

Resolution 214 Sharing studies relating to consideration of the allocation of bands below 1 GHz to the non-geostationary MSS

Resolution 715 Studies concerning sharing between the Radionavigation-satellite service and the MSS in the bands 149.9 - 150.05 MHz and 399.9 - 400.05 MHz
Resolution 716 Use of frequency bands 1 980 - 2 010 MHz and 2 170 - 2 200 MHz in all three regions and 2 010 - 2 025 MHz and 2 160 - 2 170 MHz in Region 2 by the FS and MSS and associated transition arrangements
Resolution 717 Review of allocations to the MSS in the 2 GHz range
Resolution 215 Coordination process among non-geostationary mobile-satellite systems
Resolution 213 (Rev.WRC-95) Sharing studies concerning possible use of the band 1 675 - 1 710 MHz by the MSS
Recommendation 717 (Rev.WRC-95) Frequency sharing in bands shared by the MSS and the FS, MS and other terrestrial services below 3 GHz
Resolution 212 (WARC-92) Implementation of Future Public Land Mobile Telecommuniction Systems (FPLMTS)
Recommendation 104 Development of pfd and e.i.r.p. limits to be met by feeder links of non-geostationary-satellite networks in the MSS for the protection of geostationary-satellite networks in the FSS in bands where No. 2613 (S22.2) of the RR applies
Chapter 5
Resolution 211(WARC-92) Use by the MS of the frequency bands 2 025 - 2 110 MHz and 2 200 - 2 290 MHz
Resolution 710 (WARC-92) Primary service requirements for the MET-SAT and EES services in the band 401- 403 MHz
Resolution 711 (WARC-92) Possible Relocation of Frequency Assignments to Certain Space Missions from the 2 GHz Band to Bands above 20 GHz

Resolution 712 (Rev.WRC-95) Consideration by future competent WRC of issues dealing with allocations to space services: to carry out the necessary studies, taking into account the present uses of allocated bands of the following issues: **1** provision of up to 3 MHz of frequency spectrum for the implementation of telecommand links in the

space research and space operation services in the frequency range between 100 MHz and 1 GHz.
2 provision of up to 3.5 MHz of frequency spectrum to the EESS (active) in the frequency range 420 to 470 MHz.
3 use of existing allocations by space-based active sensors operating in the EES and SR services in frequency bands shared with the radiolocation or radionavigation services, between 1 and 25 GHz, with a view to the possibility of establishing common worldwide primary allocations.
4 use of existing allocations in the frequency range from 7 to 20 GHz to the EES, MetSat, SR and SO services, with a view to the possibility of establishing common worldwide primary allocations to these services in appropriate bands, taking into account Recommendation **706** (WARC-79).
5 provision of up to 500 MHz of frequency spectrum around 35 GHz and up to 1 GHz of frequency spectrum around 95 GHz for use by space-based active earth sensors.
Resolution 643 Inter-satellite links between 50 and 70 GHz
Chapter 6
Resolution 32 (WARC-79) Relating to the use of frequency assignments to terrestrial and space radiocommunication stations in the band 11.7 - 12.2 GHz in Region 3 and in the band 11.7 - 12.5 GHz in Region 1
Resolution 33 (WARC-79) Relating to the bringing into use of space stations in the BSS, prior to the entry into force of agreements and associated plans for the BSS
Resolution 34 (WARC-79) Relating to establishment of the BSS in Region 3 in the 12.5 - 12.75 GHz frequency band and to sharing with space and terrestrial services in Regions 1, 2 and 3
Resolution 42 (Orb-88) Use of interim systems in Region 2 in the broadcasting-satellite and fixed-satellite (feeder-link) services in Region 2 for the bands covered by Appendix 30 (Orb-85) and Appendix 30A (Orb-88)
Resolution 506 (Rev.Orb-88) Use by space stations operating in the 12 GHz frequency bands allocated to the BSS of the geostationary-satellite orbit and no other
Resolution 519 (Orb-88) Possible extension to Regions 1 and 3 of provisions for interim systems

Resolution 524 (WARC-92) Future consideration of the plans for the BSS in the Band 11.7 - 12.5 GHz (Region 1) and the Band 11.7 - 12.2 GHz (Region 3) in Appendix 30 and the Associated Feeder-Link Plans in Appendix 30A
Resolution 531 (WRC-95) Review of Appendices 30 and 30A of the RR
Recommendation 521 (WRC-95) Technical parameters for use in the revision of Appendices 30 and 30A in response to Resolution 524 (WARC-92)
Recommendation 35 (WRC-95) Procedures for modification of a frequency allotment or assignment plan
Chapter 7
Resolution 60 (WARC-79) Relating to information on the propagation of radio waves used in the determination of the coordination area
Resolution 712 (Rev.WRC-95) Consideration by Future Competent WRC of Issues Dealing with Allocations to Space Services - inclusion of ITU-R approved technical coordination parameters in Appendix **28** [**S7**] of the RR, taking into account Resolution **60** (WARC-79) and Recommendation **711** (WARC-79).
Recommendation 711 (WARC-79) Relating to the Coordination of Earth Stations 37
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 FSS and earth stations providing feeder links to non-geostationary-satellite networks in the MSS operating in opposite directions of transmission
Recommendation 720 (WRC-95) The flexible and efficient use of the radio spectrum by FS and some mobile services in the MF and HF bands using block allocations for adaptive systems
Recommendation 66 (Rev.WARC-92) Studies of the maximum permitted levels of spurious emissions
Recommendation 621 (WARC-92) Implementation of wind profiler radars at frequencies near 50 MHz, 400 MHz and 1 000 MHz

ANNEX 1 TO THE CPM REPORT

Provisions of the Radio Regulations referring to ITU-R and ITU-T Recommendations

A) Provisions of Articles of the simplified Radio Regulations referring to ITU-R and ITU-T Recommendations

RR Item	Remark
S5.199 S5.287 S5.288 S19.38 S19.48 S19.92 S47.26 S47.27 S47.28 S47.29 S50.9 S51.35 S51.41 S51.77 S52.25 S52.27 S52.31 S52.69 S52.159 S52.181 S52.195 S52.222.1 S52.224 S52.229 S52.231 S52.240 S55.1 S57.1	The incorporation by reference of an ITU-R Recommendation in this provision is of a **mandatory** character and the referenced text is **explicitly** identified.

S1.14 S5.511A S52.23 S52.235	The incorporation by reference of an ITU-R Recommendation in this provision seems to be of a **mandatory** character and the referenced text is **explicitly** identified. However, a **non-standard wording** is used in this respect and there may be a need to **review** this provision with a view to using a standard wording.
S3.2 S5.138 S5.458C S13.19 S19.99 S21.1 S29.13 S32.5 S32.9.3 S32.21 S32.43 S32.64 S33.17 S33.37 S33.41 S34.1 S34.2 S51.25 S52.112 S58.1*	The incorporation by reference of an ITU-R Recommendation or an ITU-T Recommendation (*) in this provision is of a **mandatory** character, but the referenced text is **not explicitly** identified. There may be a need to **review** this provision with a view to identifying the referenced text explicitly.
S5.208A S5.503A S16.6 S21.2.2 S21.4.1 S29.12 S32.7 S51.71 S52.32 S52.63 S52.148 S52.152 S52.153 S52.234 S54.2 S56.2	The incorporation by reference of an ITU-R Recommendation in this provision is of a **non-mandatory** character, but the referenced text is **explicitly** identified. No need for **review**, unless administrations wish to consider changing the character of this provision.

S1.156 S3.4 S3.7 S3.14 S5.474 S9.50.1 S15.10 S15.12.1 S15.13.1 S16.1 S19.3 S19.23 S19.24 S19.112* S19.115* S19.126* S21.6.1 S21.12.1 S21.16.1 A.S22.1 S22.22.2 S22.26 S30.1 S56.7*	The incorporation by reference of an ITU-R Recommendation or an ITU-T Recommendation (*) in this provision is of a **non-mandatory** character and the referenced text is **not explicitly** identified. No need for review, unless administrations wish to consider changing the character of this provision.
S16.2 S19.83 S52.149 S52.188 S52.192 S52.213	The incorporation by reference of an ITU-R Recommendation in this provision is of an **undefined** character, but the referenced text is **explicitly** identified. There may be a need to **review** this provision with a view to indicating the character of the referenced text (i.e., mandatory or non-mandatory).
S1.153 S1.167 S19.35 S26.6	The incorporation by reference of an ITU-R Recommendation in this provision is of an **undefined** character and the referenced text is **not explicitly** identified. There may be a need to **review** this provision with a view to indicating the character of the referenced text (i.e., mandatory or non-mandatory) and, if it becomes mandatory, to identify the referenced text explicitly.

B) Parts of Appendices S1 to S18 to the simplified Radio Regulations referring to ITU-R Recommendations

RR/Ap. Item	Remark
• AP S4, item d) • AP S5, Table S5-1, calculation method re No. S19.17A • AP S5, Annex 1, Tables 1-4	The incorporation by reference of an ITU-R Recommendation in this provision is of a **mandatory** character and the referenced text is **explicitly** identified.
• AP S1, item 3 (3.2) • AP S5, Table S5-1, threshold/condition re No. S19.21 • AP S5, Table S5-1, calculation method re No. S19.21 • AP S13, RR 3259A • AP S16 [AP11, Sect. III], item 5	The incorporation by reference of an ITU-R Recommendation in this provision is of a **mandatory** character, but the referenced text is **not explicitly** identified. There may be a need to **review** this provision with a view to identifying the referenced text explicitly.
• AP S4 • AP S5, Annex 1, paragraphs 1.2.1 and 1.2.3.2	The incorporation by reference of an ITU-R Recommendation in this provision is of a **non-mandatory** character, but the referenced text is **explicitly** identified. No need for review, unless administrations wish to consider changing the character of this provision.
AP S1, item 2 AP S2 AP S3, Table AP S3, item 12 AP S3, item 13 AP S11 (AP45, Part B, (3.)) AP S12, item 6) AP S13, RR 2937A AP S13, RR 3340	The incorporation by reference of an ITU-R Recommendation in this provision is of a **non-mandatory** character and the referenced text is **not explicitly** identified. No need for review, unless administrations wish to consider changing the character of this provision.

ANNEX 2 TO THE CPM REPORT

List of the ITU-R Recommendations related to the CPM Report to WRC-97

Chapter 2		
Recommendation ITU-R BS.560-3	Radio-frequency protection ratios in LF, MF, and HF broadcasting	1994 BS Series
Recommendation ITU-R BS.640-2	Single-sideband (SSB) system for HF broadcasting	1994 BS Series
Recommendation ITU-R BS.705-1	HF transmitting and receiving antennas characteristics and diagrams	1995 Separate publication
Recommendation ITU-R P.533-5	HF propagation prediction method	1995 P Series
Recommendation ITU-R P.842-1	Computation of reliability and compatibility of HF radio systems	1994 PI Series
Chapter 3		
Recommendation ITU-R M.257-3	Sequential single frequency selective-calling system for use in the maritime mobile service	1995 M Series, Part 3
Recommendation ITU-R M.476-5	Direct-printing telegraph equipment in the maritime mobile service	1995 M Series, Part 3
Recommendation ITU-R M.1084-1	Improved efficiency in the use of the band 156-174 MHz by stations in the maritime mobile service	1995 M Series, Part 3
DNR ITU-R M. [Doc. 8/54]	A long-term solution for improved efficiency in the use of the band 156 - 174 MHz by stations in the maritime mobile service	Document 8/54
Chapter 4		
Recommendation ITU-R M.1039-1	Co-frequency sharing between stations in the mobile service below 1 GHz and FDMA NON-GSO mobile Earth stations	1997 M Series, Parts 1, 2, 3, 4, 5
Recommendation ITU-R M.1185	Method for determining coordination distance between ground based mobile Earth stations and terrestrial stations operating in the 148.0 - 149.9 MHz band	1995 M Series, Part 5
DRR ITU-R SA.1164	Sharing and coordination criteria for service links in data collection systems in the Earth exploration- and meteorological-satellite services	Document 7/BL/13
DNR ITU-R SA. [Doc.7/70]	Sharing of the frequency band 401-403 MHz between the METSAT service, EESS and METAIDS service	Document 7/BL/7
DRR ITU-R SA.1165	Technical characteristics and performance criteria for radiosonde systems in the METAIDS service	Document 7/BL/22
DNR ITU-R SA. [Doc.7/39]	Sharing and coordination criteria for METAIDS in the 400.15 to 406 MHz and 1 668.4 to 1 700 MHz bands	Document 7/BL/23
DNR ITU-R SA. [Doc.7/41]	Interference criterias for METAIDS operated in the bands 400.15 to 406 and 1 668.4 to 1 700 MHz	Document 7/BL/24
DRR ITU-R SM. 1051-1	Priority of identifying and eliminating radio interference in the band 406-406.1 MHz	Document 1/BL/6
Recommendation ITU-R RA.769-1	Protection criteria used for radioastronomical measurements	1995 RA Series

Recommendation ITU-R RA.1031	Protection of the RA service in frequency bands shared with other services	1995 RA Series
Recommendation ITU-R BT.417-4	Minimum field strengths for which protection may be sought in planning a television service	1994 BT Series
Recommendation ITU-R BT.655-4	Radio-frequency protection ratios for AM vestigial sideband terrestrial television systems	1994 BT Series
Recommendation ITU-R IS.851-1	Sharing between the broadcasting service and the fixed and/or mobile services in the VHF and UHF bands	1995 IS Series
Recommendation ITU-R M.1087	Methods for evaluating sharing between systems in the land mobile service and spread-spectrum LEO systems in the MSS below 1 GHz	1994 M Series, Part 5
Recommendation ITU-R SA.1021	Methodology for determining performance objectives for systems in the Earth exploration-satellite and meteorological-satellite services	1994 SA Series
Recommendation ITU-R SA.1022	Methodology for determining interference criteria for systems in the Earth exploration-satellite and meteorological-satellite services	1994 SA Series
Recommendation ITU-R SA.1023	Methodology for determining sharing and coordination criteria for systems in the Earth exploration-satellite and meteorological-satellite services	1994 SA Series
Recommendation ITU-R M.1230	Performance objectives for space-to-Earth links operating in the mobile-satellite service with non-geostationary satellites in the 137 - 138 MHz band	1997 M Series, Parts 1, 2, 3, 4, 5
Recommendation ITU-R M.1231	Interference criteria for space-to-Earth links operating in the mobile-satellite service with non-geostationary satellites in the 137 - 138 MHz band	1997 M Series, Parts 1, 2, 3, 4, 5
Recommendation ITU-R M.1232	Sharing criteria for space-to-Earth links operating in the mobile-satellite service with non-geostationary satellites in the 137 - 138 MHz band	1997 M Series, Parts 1, 2, 3, 4, 5
DNR ITU-R M. [8D/XQ]	Methodology for evaluating interference from narrow-band mobile-satellite networks to spread-spectrum direct-sequence mobile-satellite networks operating with space stations in low-earth orbit at frequencies below 1 GHz	Document 8/55
DNR ITU-R M. [8D/XN]	Frequency sharing in the 1 610.6 - 1 613.8 and 1 660 - 1 660.5 MHz bands between the MSS (Earth-to-space) and the radio astronomy service	Document 8/56
Recommendation ITU-R M.1186	Technical considerations for the coordination between MSS networks utilizing CDMA and other spread spectrum techniques in the 1 - 3 GHz band	1995 M Series Part 5
DNR ITU-R M. [8D/XO]	Interference protection evaluation model for the radionavigation-satellite service in the 1 559 - 1 610 MHz band	Document 8/59
DNR ITU-R M. [Doc. 8/57]	Considerations for sharing with systems of other services operating in bands allocated to the radionavigation-satellite and aeronautical radio-navigation services and the global navigation satellite system (GLONASS-M)	Document 8/57
DNR ITU-R M. [Doc. 8B/XA]	Coordination thresholds, protection requirements and techniques for sharing between the BSS, MSS and aeronautical mobile telemetry in the bands 1 452 - 1 525 MHz and 2 310 - 2 360 MHz	Document 8/53
Recommendation ITU-R M.830	Operational procedures for mobile-satellite networks or systems in the bands 1530-1544 MHz and 1626.5-1645.5 MHz which are used for distress and safety purposes as specified for GMDSS	1995 M Series Part 5
Recommendation ITU-R M.1037	Bit error performance objectives for aeronautical mobile-satellite (R) service (AMS(R)S) radio link	1995 M Series Part 5

Recommendation ITU-R M.1089	Technical considerations for the coordination of mobile-satellite systems supporting AMS(R)S	1995 M Series Part 5
DRR ITU-R SA.1158	Sharing of the 1 675 - 1 710 MHz Band between the meteorological-satellite service (space-to-Earth) and the mobile-satellite service (Earth-to-space)	Document 7/BL/8
DNR ITU-R F. [Doc.9/20]	Mathematical model of average radiation patterns for line-of-sight point-to-point radio-relay system antennas for use in certain coordination studies and interference assessment in the frequency range from 1 to about 40 GHz	Document 9/BL/5
DNR ITU-R F. [Doc.9/29]	Reference bandwidth of receiving stations in the fixed service to be used in coordination of frequency assignments with transmitting space stations in the mobile-satellite service in the 1 - 3 GHz range	Document 9/BL/6
DNR ITU-R F. [Doc.9/92]	Reference radiation patterns of omnidirectional and other antennas in point-to-multipoint systems for use in sharing studies	Doc. 9/92 (Rev.1)
Recommendation ITU-R IS.1141	Sharing in the frequency bands in the 1-3 GHz frequency range between the non-geostationary space stations operating in the MSS and the fixed service	1995 IS Series
Recommendation ITU-R IS.1142	Sharing in the frequency bands in the 1-3 GHz frequency range between geostationary space stations operating in the MSS and the fixed service	1995 IS Series
DNR ITU-R SA. [Doc. 7/38]	Frequency sharing between the meteorological aids service and the MSS (Earth-to-space) in the 1 675 - 1 700 MHz band	Document 7/BL/25
Recommendation ITU-R F.283-5	Radio-frequency channel arrangements for low and medium capacity analogue or digital radio-relay systems operating in the 2 GHz band	1994 F Series, Part 1
Recommendation ITU-R F.382-6	Radio-frequency channel arrangements for radio-relay systems operating in the 2 and 4 GHz bands	1994 F Series, Part 1
Recommendation ITU-R F.1098-1	Radio-frequency channel arrangements for radio-relay systems in the 1 900-2 300 MHz band	1995 F Series, Part 1
Recommendation ITU-R IS.1143	System specific methodology for coordination of non-geostationary space stations (space-to-Earth) operating in the MSS with the fixed service	1995 IS Series
Recommendation ITU-R P.530-6	Propagation data and prediction methods required for the design of terrestrial line-of-sight systems	1995 P Series
Recommendation ITU-R P.452-7	Prediction procedure for the evaluation of microwave interference between stations on the surface of the Earth at frequencies above about 0.7 GHz	1995 P Series
Recommendation ITU-R P.619-1	Propagation data required for the evaluation of interference between stations in space and those on the surface of the Earth	1994 PN Series
Recommendation ITU-R F.1095	A procedure for determining coordination area between radio-relay stations of the fixed service	1994 F Series, Part 1
Recommendation ITU-R F.746-2	Radio-frequency channel arrangements for radio-relay systems	1995 F Series, Part 1
Recommendation ITU-R M.1036	Spectrum considerations for implementation of FPLMTS in the bands 1 885-2 025 MHz and 2 110-2 200 MHz	1994 M Series, Part 2
DNR ITU-R S. [4A/XH]	Use of adaptive uplink power control to mitigate interference between GSO/FSS networks and feeder links of NGSO/MSS networks.	Document 4/BL/7
DNR ITU-R S. [4A/XF]	Methodology for determining the maximum aggregate pfd at the GSO in the band 6 700 - 7 075 MHz from feeder links of non-GSO satellite systems in the MSS in the space-to-Earth direction	Document 4/BL/8

DNR ITU-R S. [4A/XC]	Analytical method to calculate visibility statistics for NGSO satellites as seen from a point on the Earth's surface.	Document 4/BL/9
DNR ITU-R S. [4A/XO]	Sharing between feeder links for the MSS and the aeronautical radionaviga-tion service in the space-to-Earth direction in the band 15.4 - 15.7 GHz and the protection of the radioastronomy service in the band 15.35 - 15.4 GHz	Doc. 4/53 (Rev.1)
PDNR ITU-R S. [4A/XP]	Sharing between feeder links for the MSS and the aeronautical radionaviga-tion service in the Earth-to-space direction in the band 15.4 - 15.7 GHz	Doc. 4/46 (Rev.1)
DNR ITU-R SF. [4/26-9/33]	Maximum allowable values of pfd at the surface of the earth produced by NGSO in the FSS used in feeder links for the MSS and sharing the same frequency bands with radio-relay systems (Parts relating to 19 GHz band)	Doc. 4/26 (Rev.1)-9/33 (Rev.1)
DNR ITU-R S. [4A/XQ]	Satellite system characteristics to be considered in frequency sharing analyses between GSO and NON-GSO satellite systems in the fixed-satellite service including feeder links for the mobile-satellite service	Doc. 4/61 (Rev.1)
DNR ITU-R S. [4A/XB]	Maximum permissible levels of interference in a satellite network (GSO/FSS; NGSO/FSS; NGSO/MSS feeder links) for a hypothetical reference digital path in the FSS caused by other codirectional networks below 30 GHz.	Doc. 4/49 (Rev.1)
DNR ITU-R S. [4A/XJ]	Analytical method for estimating interference between NGSO MSS feeder links and GSO FSS networks operating co-frequency and co-directionally.	Doc. 4/51 (Rev.1)
Chapter 5		
Recommendation ITU-R SA.1154	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 And 2 200 - 2 290 MHz bands	1995 SA Series
DNR ITU-R SA. [Doc 7/70]	Sharing of the frequency band 401-403 MHz between the meteorological satellite service, Earth exploration satellite service and meteorological aids service in the band 401-403 MHz	Document 7/BL/7
DRR ITU-R SA. 577-4	Preferred frequencies and necessary bandwidths for spaceborne active remote sensing	Document 7/BL/18
DRR ITU-R SA.1166	Performance and interference criteria for active spaceborne sensors	Document 7/BL/19
DNR ITU-R SA. [Doc.7/11]	Feasibility of sharing between active spaceborne sensors and other services in the vicinity of 410-470 MHz	Document 7/BL/20
DNR ITU-R SA. [7/116-8/93]	Protection criteria for stations in the radiolocation service from emissions from active spaceborne sensors in the band 13.4 - 13.75 GHz	Doc.7/116-8/93
DNR ITU-R SA. [7/98-8/47]	Selection of active spaceborne sensor emission characteristics to mitigate the potential for interference to terrestrial radars operating in frequency bands 1 - 10 GHz	Doc.7/98-8/47
Recommendation ITU-R M.1088	Considerations for sharing with systems of other services operating in the bands allocated to the radionavigation satellite service	1994 M Series, Part 5
DNR ITU-R M. [Doc. 8/57]	Considerations for sharing with systems of other services operating in bands allocated to the radionavigation-satellite and aeronautical radio-navigation services and the global navigation satellite system (GLONASS-M)	Document 8/57

DRR ITU-R SA. 1025-1	Performance criteria for space-to-Earth data transmission systems operating in the Earth exploration-satellite and meteorological-satellite services using satellites in low-Earth orbit	Document 7/BL/4
DRR ITU-R SA. 1026-1	Interference criteria for space-to-Earth data transmission systems operating in the Earth exploration-satellite and meteorological-satellite services using satellites in low-Earth orbit	Document 7/BL/5
DRR ITU-R SA. 1027-1	Sharing and coordination criteria for space-to-Earth data transmission systems in the Earth exploration-satellite and meteorological-satellite services using satellites in low-Earth orbit	Document 7/BL/6
DNR ITU-R SA. [7/14]	Sharing in the 8 025 - 8 400 MHz frequency band between the earth exploration-satellite service and the meteorological-satellite, fixed, fixed-satellite and mobile services in Regions 1, 2 and 3	Document 7/14
DRR ITU-R SA. 515-2	Frequency bands and bandwidths used for satellite passive sensing	Document 7/BL/14
DRR ITU-R SA.1028	Performance criteria for satellite passive remote sensing	Document 7/BL/15
DRR ITU-R SA.1029	Interference criteria for satellite passive remote sensing	Document 7/BL/16
Recommendation ITU-R F.699-3	Reference radiation patterns for line-of-sight radio-relay system antennas for use in coordination studies and interference assessment in the frequency range from 1 to about 40 GHz	1995 F Series, Part 1
Recommendation ITU-R F.761	Frequency sharing between the fixed service and passive sensors in the band 18.6 to 18.8 GHz	1994 F Series
DNR ITU-R SA. [7/44]	Feasibility of sharing between spaceborne cloud radars and other services in the range of 92 - 95 GHz	Document 7/BL/21
Recommendation ITU-R RA.769-1	Protection criteria used for radioastronomical measurements	1995 RA Series
DRR ITU-R SA.1024	Necessary bandwidths and preferred frequency bands for data transmission from Earth exploration-satellites (not including meteorological-satellites)	Document 7/BL/3
DRR ITU-R SA.1159	Performance criteria for data dissemination and direct data readout systems in the meteorological-satellite service using satellites in geostationary orbit	Document 7/BL/9
DRR ITU-R SA.1160	Interference criteria for data dissemination and direct data readout systems in the meteorological-satellite service using satellites in geostationary orbit	Document 7/BL/10
DRR ITU-R SA.1161	Sharing and coordination criteria for data dissemination and direct data readout systems in the meteorological-satellite service using satellites in geostationary orbit	1995 SA Series + Document 7/84
DNR ITU-R SA. [Doc.7/74]	Feasibility of sharing between the Earth exploration-satellite service (space-to-Earth) and the inter-satellite, fixed and mobile services in the band 25.5 - 27.0 GHz	Document 7/74
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Recommendation ITU-R F.758	Considerations in the development of criteria for sharing between the terrestrial fixed service and other services	1994 F Series, Part 1
Recommendation ITU-R F.1094-1	Maximum allowable error performance and availability degradations to digital radio-relay systems arising from interference from emissions and radiations from other sources	1995 F Series, Part 1
Recommendation ITU-R F.1102	Characteristics of radio-relay systems operating in frequency bands above about 17 GHz	1994 F Series, Part 1

Recommendation ITU-R F.1108-1	Determination of the criteria to protect fixed service receivers from the emissions of space stations operating in non-geostationary orbits in shared frequency bands	1995 F Series, Part 1
DNR ITU-R SA. [7/23]	Feasibility of sharing between spaceborne passive sensors and the fixed service from 50 to 60 GHZ	Document 7/BL/17
DNR ITU-R SA. [7/43]	Spectrum sharing between spaceborne passive sensors and inter-satellite links in the range 50.2 - 61.3 GHZ	Document 7/43
DNR ITU-R S.[4A/XK]	Feasibility of sharing between spaceborne passive sensors of the EESS and inter-satellite links of GSO networks in the range 50 to 65 GHz	Doc. 4/57
DNR ITU-R S. [4A/XG]	Requirements and suitable bands for operation of the inter-satellite service within the range 50.2 - 71 GHz	Doc. 4/59 (Rev.1)
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DNR ITU-R BO. [BBB]	Reference receive space station antenna patterns for planning purposes to be used for elliptical beams in the revision of the Appendix 30A Plans at 14 GHz and 17GHz in Regions 1 and 3	Document 11/43
DNR ITU-R BO. [DDD]	Protection ratios to be used for planning purposes in the revision of the Appendixes 30 and 30a Plans in Reg. 1 and 3	Document 11/42
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Recommendation ITU-R M.1227	Technical and operational characteristics of wind profiler radars in bands in the vicinity of 1000 MHz	Document 8/BL/25
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Recommendation ITU-R F.756	TDMA point-to-multipoint systems used as radio concentrators	1994 F Series, Part 1
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DRR = Draft Revised Recommendation
DNR = Draft New Recommendation