INTERNATIONAL TELECOMMUNICATION UNION

Thirty-fourth Report by the International Telecommunication Union on telecommunication and the peaceful uses of outer space

Booklet No. 43

Geneva 1995

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Geneva 1995
ISBN 92-61-05751-9

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THIRTY-FOURTH REPORT OF THE INTERNATIONAL TELECOMMUNICATION UNION ON TELECOMMUNICATION AND THE PEACEFUL USES OF OUTER SPACE

Introduction

This Report provides information on the activities of the International Telecommunication Union (ITU) with regard to outer space since the submission of the thirty-third Report in 1994.

It is submitted for the attention of the United Nations Committee on the Peaceful Uses of Outer Space (its Scientific and Technical Sub-Committee and its Legal Sub-Committee) and for information of Members of the Union.

1. International regulations for the use of orbit/spectrum resources

The Constitution and Convention of the International Telecommunication Union (Geneva, 1992), as modified by the Additional Plenipotentiary Conference (Geneva, 1992), entered into force on 1 July 1994. It contains the regulatory bases for the allocation of orbit/spectrum resources. One of the

main principles in this regard is laid down in No. 196 of the ITU Constitution (Article 44), which stipulates that *"In using frequency bands for radio services, Members shall bear in mind that radio frequencies and the geostationary-satellite orbit are limited natural resources and that they must be used rationally, efficiently and economically, in conformity with the provisions of the Radio Regulations, so that countries or groups of countries may have equitable access to both, taking into account the special needs of the developing countries and the geographical situation of particular countries".* As indicated in the above provision, further detailed regulations and procedures governing orbit/spectrum use are contained in the Radio Regulations (RR), which is a binding international treaty (No. 31 of the ITU Constitution). The legal regime embodied in the Radio Regulations, which includes the rights and obligations of countries and procedures applicable for all radiocommunication services, has been established by major ITU world radiocommunication conferences (WARCs, WRCs).

In order to put the above-mentioned principles of efficient use and equitable access into effect, two major mechanisms for the sharing of orbit and spectrum resources have been developed and implemented:

— a priori planning procedures (to meet the need for equitable access to orbit/spectrum resources);

— coordination procedures (with the aim of ensuring efficiency of orbit/spectrum use).

In the process of establishing the ITU's space-related legislation, emphasis was laid from the outset on efficient and rational utilization. This concept was implemented through a "first come, first served" procedure. This procedure ("coordination before use") is based on the principle that the right to use a satellite position is acquired through negotiation with the administrations concerned by actual usage of the same portion of the orbital segment. If applied correctly (i.e. to cover genuine requirements), the procedure offers a means of achieving efficient spectrum/orbit management; it serves to fill the gaps in the orbit as needs arise and results, in principle, in a homogeneous orbital distribution of space stations. On the basis of the Regulations, and in the frequency bands where this concept is applied, Member administrations designate the volume of orbit/spectrum resources that is required to satisfy their telecommunication requirements. It then falls to the national administrations to assign frequencies and orbital positions, to apply the appropriate procedures (international coordination and

recording) for the space segment and earth stations of their (governmental and private) networks, and to assume continuing responsibility for the networks.

The progressive exploitation of the orbit/frequency resources and the resulting likelihood of congestion of the geostationary-satellite orbit prompted ITU Member countries to consider more and more seriously the question of equitable access in respect of the orbit/spectrum resources. This resulted in the creation (and introduction into the ITU regulatory regime) of frequency/orbital position plans in which a certain amount of frequency spectrum is set aside for future use by all countries, particularly those which are not in a position, at present, to make use of these resources. These plans, in which each country has a predetermined orbital position associated with the free use, at any time, of a certain amount of frequency spectrum, together with the associated procedures, guarantee for each country equitable access to the spectrum/orbit resources, thereby safeguarding their basic rights. Such plans govern a considerable part of the frequency usage of the most resource-demanding communication services, where congestion of the geostationary-satellite orbit was foreseen by administrations.

The ITU's legal regime governing the use of the geostationary-satellite orbit is the result of more than 30 years of continuous effort by the ITU Member countries. The regulatory framework has been constantly adapted to changing circumstances and has achieved the necessary flexibility in satisfying the two major, but not always compatible, requirements of efficiency and equity. With the dramatic development in telecommunication services, increasing demand for spectrum/orbit usage for practically all space communication services has been observed. This increase is attributable to many factors. These include not only technological progress, but also political, social and structural changes around the world and their impact on the liberalization of telecommunication services, the introduction of non-GSO satellite systems for commercial communications, growing market orientation, the change in the way this widening market is shared between private and state-owned service providers and the general globalization and commercialization of communication systems. These elements led the Plenipotentiary Conference of the ITU (Kyoto, 1994-Resolution COM4/10) to call for a new in-depth review of the ITU spectrum/orbit resource allocation procedures. The results of the review process will enable the world radiocommunication conferences convened in 1995 and 1997 to further review and revise the legal regime applicable to all space applications and services.

2. Forthcoming world radiocommunication conferences of the ITU

2.1 The ITU Council, which met in May 1994, adopted the agenda for the 1995 World Radiocommunication Conference (WRC-95).

The following items are among those included in the agenda of WRC-95:

— review of the final report of the Voluntary Group of Experts (VGE) and consideration of related proposals from administrations in order to undertake a revision of the Radio Regulations;

— review of the technical constraints associated with allocations and related provisions for mobile-satellite services (MSS) below 3 GHz with a view to facilitating the use of those frequency bands;

— review of the date of entry into force of allocations in certain bands allocated to the MSS (1980-2010/2170-2200 MHz in Regions 1 and 3 and 1970-2010/2160-2200 MHz in Region 2). At present, the date of entry into force for the use of these bands by MSS is 1 January 2005, except in the United States where it is 1 January 1996;

— allocations and regulations applicable to feeder links for MSS;

— review of power limits for earth stations in the Earth exploration-satellite, space research and space operation services in the band 2025-2110 MHz;

— consideration of the results of studies on e.i.r.p. limits for earth stations in the fixed-satellite service in the band 13.75-14 GHz and on the compatibility of primary and secondary allocations in this band;

— consideration of preparatory work carried out in relation to Appendices 30 and 30A (regulatory provisions for the Broadcasting-Satellite Service and Associated Feeder-Links Plans) to enable WRC-97 to take action;

— consideration of various space service allocations in the bands between 8 and 35 GHz;

— availability of the HF bands newly allocated to the broadcasting service.

2.2 The 1993 World Radiocommunication Conference (WRC-93) which took place in Geneva, in November 1993, adopted a preliminary agenda for WRC-97, which includes the following items:

— review of the propagation information in Appendix 28 used for the determination of coordination areas in the frequency bands between 1 GHz and 40 GHz shared by space and terrestrial services;

— protection of space services in the bands 2025-2110/2200-2290 MHz;

— Earth exploration-satellite service in the bands 401-403 MHz and above 50 GHz;

— allocation issues for other unplanned space services;

— spurious emissions, wind profiler radars, multiservice satellite networks;

— examination of the issue of the HF bands allocated to the broadcasting service;

— issues related to implementation of the Global Maritime Distress and Safety System (GMDSS);

— use of Appendix 18 (transmitting frequencies in the band 156-174 MHz for stations in the maritime mobile service);

— revision of Appendices 30 and 30A for Regions 1 and 3, taking into account the need to preserve the integrity of the Region 2 Plans and their associated provisions.

3. Application of international regulations – International registration of frequency assignments for space radiocommunications and orbital positions of geostationary satellites

3.1 Since the publication of the thirty-third Report, the Radiocommunication Bureau has continued to apply the relevant provisions of the Radio Regulations annexed to the Constitution/Convention of the International

Telecommunication Union. In accordance with these provisions, administrations:

a. send information concerning their planned satellite systems to the Radiocommunication Bureau and inform the Radiocommunication Bureau whether or not comments have been received as a result of the publication of that information and of the progress made, with other administrations, in resolving difficulties that may have arisen;

b. send information to the Radiocommunication Bureau, where necessary, concerning coordination of the use of their assignments to space stations on geostationary and non-geostationary satellites or to earth stations that are to communicate with such space stations, for publication in another special section of the Weekly Circular;

c. notify their frequency assignments to the Radiocommunication Bureau for registration in the Master International Frequency Register (Master Register).

The publication, coordination, notification and registration procedures which are applicable are those prescribed in the Radio Regulations in force and in the Resolutions of the World Administrative Radio Conferences (Geneva, 1979; Geneva, 1985; Geneva, 1987; Geneva, 1988 and Málaga-Torremolinos, 1992).

3.2 In 1994, the Radiocommunication Bureau received information relating to 242 new satellite networks, which it published under the advance publication procedure. This information was submitted by the following administrations (listed in French alphabetical order):

Notifying Administration	System or network	Summary description
Saudi Arabia (Kingdom of) (on behalf of the Members of the ARABSAT organization)	ARABSAT (ARABSAT 1-D)	Satellite system which will provide the Fixed-satellite service. (4 GHz, 6 GHz)
Argentine Republic	SAC-B*	Satellite network which will provide the Space research service. (2 GHz)

*Non-geostationary

Notifying Administration	System or network	Summary description
Australia	DBSTAR 151.5E	Satellite network which will provide the Broadcasting-satellite (sound broadcasting) service. (<2 GHz, 4 GHz, 6 GHz, 7 GHz)
Belarus (Republic of) (on behalf of the Administrations of Member countries of INTERSPUTNIK)	INTERSPUTNIK (INTERSPUTNIK-17E) (INTERSPUTNIK-27E) (INTERSPUTNIK-64.5E) (INTERSPUTNIK-67.5E) (INTERSPUTNIK-114.5E) (INTERSPUTNIK-153.5E) (INTERSPUTNIK-3W) (INTERSPUTNIK-6W) (INTERSPUTNIK-16W) (INTERSPUTNIK-23W) (INTERSPUTNIK-32.5W)	Satellite system which will provide the Fixed-satellite and Mobile-satellite services. (2.5 GHz, 4 GHz, 6 GHz, 12 GHz, 14 GHz)
Belgium	MLMS*	Satellite system which in its final stage will consist of four satellites and is intended to provide the Land mobile-satellite service. (<1 GHz)
Brazil (Federative Republic of)	B-SAT (B-SAT-A) (B-SAT-B) (B-SAT-C) (B-SAT-E) (B-SAT-F) (B-SAT-G) (B-SAT-H) (B-SAT-I) (B-SAT-J) (B-SAT-K)	Satellite system which will provide the Fixed-satellite and Mobile-satellite services. (<2 GHz, 4 GHz, 6 GHz, 11 GHz, 14 GHz)

*Non-geostationary

Notifying Administration	System or network	Summary description
Brazil (Federative Republic of) *(cont.)*	SBTS (SBTS-B4) (SBTS-C1)	Satellite system which will provide the Fixed-satellite service. (4 GHz, 6 GHz, 11 GHz, 14 GHz)
	ECO-8 EQUATORIAL LEO*	Satellite network which will provide the Mobile-satellite service. (<2 GHz, 2.5 GHz, 5 GHz, 6 GHz)
Canada	ANIK-EC ANIK-ED	Satellite system which will provide domestic communication services within the Fixed-satellite service. (4 GHz, 6 GHz, 12 GHz, 14 GHz)
Chile	CESAR-1/ AMSAT-CE*	Satellite network which will provide the Amateur-satellite service. (<1 GHz, <2 GHz, 2.5 GHz)
China (People's Republic of)	APSTAR (APSTAR-2-F1) (APSTAR-2-F2)	Satellite system which will provide the Fixed-satellite service. (4 GHz, 6 GHz, 12 GHz, 14 GHz)
	CHINASAT (CHINASAT-21) (CHINASAT-22) (CHINASAT-23) (CHINASAT-24)	Satellite system which will provide the Fixed-satellite and Mobile-satellite services. (<1 GHz, 4 GHz, 6 GHz)
	FY-2A	Satellite network in the Meteorological-satellite service which is designed for observation, collection and dissemination of meteorological information. (<1 GHz, <2 GHz, 4 GHz, 6 GHz)
CUB/IK (on behalf of the Administrations of Member countries of INTERSPUTNIK)	LATAMSAT (LATAMSAT-1) (LATAMSAT-2)	Satellite system which will provide the Mobile-satellite service. (<2.5 GHz, 4 GHz, 6 GHz)
Denmark	ORSTED*	Satellite network which will provide the Earth exploration-satellite service. (2 GHz, 2.2 GHz)
Spain	MINISAT-1*	Satellite network which will provide the Earth exploration-satellite and Space research services. (2 GHz, 2.2 GHz)

*Non-geostationary

Notifying Administration	System or network	Summary description
United States of America	USASAT (USASAT-14M) (USASAT-27B) (USASAT-27C) (USASAT-27D) (USASAT-27E)	Satellite system which will provide the Fixed-satellite and Mobile-satellite services. (<2 GHz, 2 GHz, 12 GHz, 14 GHz, 20 GHz, 30 GHz)
	GOES (GOES-I) (GOES-J)	Satellite system which will provide the Mobile-satellite and Earth exploration-satellite services. (<1 GHz, <2 GHz, 2 GHz, 2.2 GHz)
	ORION-AP-1 ORION-AP-2	Satellite system which will provide the Fixed-satellite service. (11 GHz, 14 GHz)
	USLL (USLL-ATL) (USLL-PAC) (USLL-LEO)* (USLL-HEO)*	Satellite system which will provide the inter-satellite service. (56 GHz, 60 GHz)
	MICROLAB-1*	Satellite network which will provide the Space research service. (<1 GHz, 2 GHz, 2.2 GHz)
	MSSLEO-1* MSSLEO-2*	Satellite system which will provide the Mobile-satellite service. (2 GHz, 18-20 GHz, 27-30 GHz)
	STEP MISSION 03*	Satellite network which will provide the Space research service. (<2 GHz, 2.2 GHz)
	SWAS* (Submillimeter Wave Astronomy Satellite)	Satellite network which will provide the Earth exploration-satellite and Space research services. (2 GHz, 2.2 GHz)
United States of America (on behalf of the Administrations of Member countries of INTELSAT)	INTELSAT (INTELSAT-6-62E) (INTELSAT-6-64E) (INTELSAT-6-338E) (INTELSAT-6-340E)	Global communications satellite system consisting of several satellites and a large number of earth stations working together. (4 GHz, 6 GHz, 11-12 GHz, 14 GHz)

*Non-geostationary

Notifying Administration	System or network	Summary description
United States of America (on behalf of the Administrations of Member countries of INTELSAT) *(cont.)*	(INTELSAT-7-33E) (INTELSAT-7-57E) (INTELSAT-7-60E) (INTELSAT-7-62E) (INTELSAT-7-64E) (INTELSAT-7-66E) (INTELSAT-7-69E) (INTELSAT-7-85E) (INTELSAT-7-91.5E) (INTELSAT-7-95E) (INTELSAT-7-157E) (INTELSAT-7-174E) (INTELSAT-7-177E) (INTELSAT-7-180E) (INTELSAT-7-183E) (INTELSAT-7-304E) (INTELSAT-7-307E) (INTELSAT-7-310E) (INTELSAT-7-319.5E) (INTELSAT-7-325.5E) (INTELSAT-7-329E) (INTELSAT-7-330.5E) (INTELSAT-7-332.5E) (INTELSAT-7-335.5E) (INTELSAT-7-338E) (INTELSAT-7-340E) (INTELSAT-7-342E) (INTELSAT-7-359E) (INTELSAT-8-33E) (INTELSAT-8-57E) (INTELSAT-8-60E) (INTELSAT-8-62E) (INTELSAT-8-64E) (INTELSAT-8-66E) (INTELSAT-8-69E) (INTELSAT-8-85E) (INTELSAT-8-91.5E) (INTELSAT-8-95E) (INTELSAT-8-157E) (INTELSAT-8-174E) (INTELSAT-8-177E) (INTELSAT-8-180E) (INTELSAT-8-183E)	Global communications satellite system consisting of several satellites and a large number of earth stations working together. (4 GHz, 6 GHz, 11-12 GHz, 14 GHz)

Notifying Administration	System or network	Summary description
United States of America (on behalf of the Administrations of Member countries of INTELSAT) *(cont.)*	(INTELSAT-8-304E) (INTELSAT-8-307E) (INTELSAT-8-310E) (INTELSAT-8-319.5E) (INTELSAT-8-325.5E) (INTELSAT-8-329E) (INTELSAT-8-330.5E) (INTELSAT-8-332.5E) (INTELSAT-8-335.5E) (INTELSAT-8-338E) (INTELSAT-8-340E) (INTELSAT-8-342E)	Global communications satellite system consisting of several satellites and a large number of earth stations working together. (4 GHz, 6 GHz, 11-12 GHz, 14 GHz)
France	TELECOM (TELECOM-3A) (TELECOM-3B) (TELECOM-3C) (TELECOM-3D)	Satellite system which will provide the Fixed-satellite service to Metropolitan France and Overseas Departments and Territories. (4 GHz, 6 GHz)
	VIDEOSAT (VIDEOSAT-5) (VIDEOSAT-6) (VIDEOSAT-7)	Satellite system which will provide the Fixed-satellite service. (11 GHz, 14 GHz)
	SYRACUSE (SYRACUSE-A) (SYRACUSE-B) (SYRACUSE-C) (SYRACUSE-D) (SYRACUSE-E) (SYRACUSE-F) (SYRACUSE-G) (SYRACUSE-H) (SYRACUSE-I)	Satellite system which will provide the Fixed-satellite and Mobile-satellite services. (2 GHz, 2.2 GHz, 7 GHz, 8 GHz, 20-21 GHz, 43-45 GHz)
	F-SAT ICO* F-SAT LEO*	Satellite system which will provide the Mobile-satellite service. (<2 GHz, 2 GHz, 2.2 GHz, 2.5 GHz, 17-20 GHz, 27-30 GHz)
France (on behalf of Member Administrations of the European Space Agency)	CLUSTER 1-5*	Satellite network which will provide the Space research service. (<2 GHz, 2.2 GHz)
	SOHO*	Satellite network which will provide the Space research service. (<2 GHz, 2.2 GHz)

*Non-geostationary

Notifying Administration	System or network	Summary description
France (on behalf of the Administrations of Member countries of the European Telecommunication Satellite Organization)	EUTELSAT (EUTELSAT-E-44E) (EUTELSAT-E-48E) (EUTELSAT-3-12.5W) (EUTELSAT-3-14.8W) (EUTELSAT-3-4E) (EUTELSAT-3-7E) (EUTELSAT-3-10E) (EUTELSAT-3-13E) (EUTELSAT-3-16E) (EUTELSAT-3-21.5E) (EUTELSAT-3-33E) (EUTELSAT-3-36E) (EUTELSAT-3-44E) (EUTELSAT-3-48E) (EUTELSAT-3-70.5E) (EUTELSAT-3-76E) (EUTELSAT-3-80.5E) (EUTELSAT-3-83.5E) (EUTELSAT-3-88.5E)	Satellite system which will provide the Fixed-satellite service. (<1 GHz, 2 GHz, 2.2 GHz, 12 GHz, 14 GHz)
Greece	HELLAS-SAT	Satellite network which will provide the Fixed-satellite service. (14 GHz)
Hungary (Republic of)	CERS-1	Satellite network which will provide the Fixed-satellite service. (11 GHz, 14 GHz)
India (Republic of)	INSAT (INSAT-2T-48E) (INSAT-2T-55E) (INSAT-2T-74E) (INSAT-2T-83E) (INSAT-2T-93.5E)	National satellite system which will provide the Fixed-satellite service. (4 GHz, 6 GHz)
	(INSAT-2M-48E) (INSAT-2M-55E) (INSAT-2M-74E) (INSAT-2M-83E) (INSAT-2M-93.5E)	National satellite system which will provide the Fixed-satellite and Mobile-satellite services. (2.5 GHz, 2.6 GHz, 3.5 GHz, 6 GHz)
	SROSS-C2	Satellite network which will provide the Space research service. (<1 GHz, 2 GHz, 2.2 GHz)

Notifying Administration	System or network	Summary description
Indonesia (Republic of)	GARUDA (GARUDA-1) (GARUDA-2) (GARUDA-3) (GARUDA-4)	Satellite system which will provide the Fixed-satellite, Mobile-satellite and Radiodetermination-satellite services. (1.6 GHz, 2 GHz, 2.5 GHz, 3.5 GHz, 6 GHz)
	PALAPA (PALAPA-C4)	National communication satellite system providing the Fixed-satellite service. (4 GHz, 6 GHz, 11 GHz, 14 GHz)
Iraq (Republic of)	BABYLONSAT (BABYLONSAT-1) (BABYLONSAT-2) (BABYLONSAT-3)	Satellite system which will provide the Fixed-satellite service. (11-12 GHz, 14 GHz)
Italy	SICRAL (SICRAL-2A) (SICRAL-2B)	Satellite system which will provide the Fixed-satellite and Mobile-satellite services. (<1 GHz, 2 GHz, 2.2 GHz, 7-8 GHz, 12 GHz, 14 GHz, 20-21 GHz, 43-44 GHz)
	ITAMSAT-1 *	Satellite network which will provide the Amateur-satellite service. (<1 GHz)
Japan	BS-3N	Satellite network which will provide the Fixed-satellite service. (12 GHz, 14 GHz)
	SUPERBIRD (SUPERBIRD-C) (SUPERBIRD-C2)	Satellite system which will provide the Fixed-satellite service. (4 GHz, 6 GHz, 11-12 GHz, 14 GHz)
	JCSAT (JCSAT-1R) (JCSAT-2R) (JCSAT-3A) (JCSAT-3B)	Satellite system which will provide the Fixed-satellite service. (4 GHz, 6 GHz, 12 GHz, 14 GHz)
	MUSES-B *	Satellite network which will provide the Space research and radioastronomy services. (2 GHz, 2.2 GHz, 14 GHz, 15 GHz)

* Non-geostationary

Notifying Administration	System or network	Summary description
Japan *(cont.)*	JAS-2*	Satellite network which will provide the Amateur-satellite service. (<1 GHz)
Kazakhstan (Republic of)	KAZAKHSAT-42.5E	Satellite system which will provide the Fixed-satellite service. (4 GHz, 6 GHz, 11 GHz, 14 GHz)
Luxembourg	GDL-6	Satellite network which will provide the Fixed-satellite service. (11 GHz, 14 GHz)
Malaysia	MEASAT (MEASAT-IK-91.5) (MEASAT-IK-95)	Satellite system which will provide the Fixed-satellite service. (12 GHz, 14 GHz)
Malta	MELITASAT-1A	Satellite network which will provide the Fixed-satellite service. (14 GHz)
Pakistan (Islamic Republic of)	PAKSAT (PAKSAT-1) (PAKSAT-2)	Satellite system which will provide the Fixed-satellite service. (4 GHz, 6 GHz, 11-12 GHz, 14 GHz)
Netherlands (Kingdom of the)	PETALRING (PETALRING 30C-K)* (PETALRING 30C-S)* (PETALRING 60C-S)*	Satellite system which will provide the Mobile-satellite service. (2 GHz, 2.2 GHz, 2.5 GHz, 11 GHz, 14 GHz, 20-21 GHz, 27-30 GHz)
Philippines (Republic of the)	AGILA (AGILA-A1) (AGILA-A2) (AGILA-A3)	Satellite system which will provide the Fixed-satellite service. (4 GHz, 6 GHz, 11 GHz, 14 GHz)
United Kingdom of Great Britain and Northern Ireland	ASIASAT (ASIASAT-DAB-1) (ASIASAT-DAB-2)	Satellite system which will provide domestic communications services on a regional basis in the Broadcasting-satellite (sound) service. (<2 GHz, 7 GHz)
	ORIENT (ORIENT-1) (ORIENT-2)	Satellite system which will provide the Fixed-satellite service. (4 GHz, 6 GHz, 11 GHz, 14 GHz)

*Non-geostationary

Notifying Administration	System or network	Summary description
United Kingdom of Great Britain and Northern Ireland (on behalf of the Administrations of Member countries of INMARSAT)	INMARSAT (INMARSAT 3 POR WEST) (INMARSAT 3 IOR WEST)	Satellite system which will provide the Mobile-satellite and the Radionavigation-satellite services to the Pacific and Indian ocean regions. (<2 GHz, 4 GHz, 6 GHz)
Russian Federation	COMINCOM (COMINCOM-85E) (COMINCOM-76E)	Satellite system which will provide the Fixed-satellite service. (11-12 GHz, 14 GHz)
	CROSNA-1	Satellite system which will provide the Fixed-satellite service. (4 GHz, 6 GHz)
	KUPON (KUPON-1) (KUPON-2) (KUPON-3) (KUPON-4)	Satellite system which will provide the Fixed-satellite service. (10-11 GHz, 14 GHz)
	MARAFON (MARAFON-1) (MARAFON-2) (MARAFON-3) (MARAFON-4) (MARAFON-5)	Satellite system which will provide the Fixed-satellite and Mobile-satellite services. (<2 GHz, 4 GHz, 6 GHz)
	ROSCOM (ROSCOM-1) (ROSCOM-2) (ROSCOM-3) (ROSCOM-4)	Satellite system which will provide the Fixed-satellite and Mobile-satellite services. (4 GHz, 6 GHz, 11 GHz, 14 GHz, 20-21 GHz, 30-31 GHz)
	YAMAL (YAMAL-E1) (YAMAL-W1)	Satellite system which will provide the Fixed-satellite service. (3.5 GHz, 6 GHz)
	BUMERANG	Satellite network which will provide the Fixed-satellite service. (11 GHz, 14 GHz)

Notifying Administration	System or network	Summary description
Russian Federation *(cont.)*	ELEKON-STIR *	Satellite network which will provide the Mobile-satellite and Radiodetermination-satellite services. (<2 GHz, 2.5 GHz, 5 GHz, 7 GHz)
South Africa (Republic of)	GREENSAT-I* (ex GROEN-SAT-TP1)	Satellite network forming a part of the three satellite system (GREEN-SAT) which will provide the Earth exploration-satellite service. (8 GHz)
	GREENSENSE *	Satellite network which will provide the Earth exploration-satellite service. (2 GHz, 2.2 GHz, 8 GHz)
Thailand	THAICOM (THAICOM-A2B) (THAICOM-BK1) (THAICOM-BK2) (THAICOM-C1) (THAICOM-C2) (THAICOM-C3) (THAICOM-C4)	Satellite system which will provide the Fixed-satellite service. (4 GHz, 6 GHz, 12 GHz, 14 GHz)
Ukraine	UKRSAT (UKRSAT-1 C 23.5E) (UKRSAT-1 KU 23.5E) (UKRSAT-1 MOB 23.5E)	Satellite system which will provide the Fixed-satellite and Mobile-satellite services. (<2 GHz, 4 GHz, 6 GHz, 11 GHz, 14 GHz)

* Non-geostationary

3.3 In 1994, the Bureau also received, but has not yet processed, requests from administrations for advance publication for 78 new satellite networks and requests for additional frequency bands for 46 previously published networks.

3.4 In addition, in 1994 the Radiocommunication Bureau published the relevant information concerning requests for the coordination of space service assignments for geostationary-satellite and non-geostationary-satellite networks for which advance publication had already been made. Assistance to about 58 administrations in the coordination of frequency assignments to stations in the space radiocommunication services was also provided on request.

3.5 In 1994, the Radiocommunication Bureau processed and published requests from various administrations for modifications to the Broadcasting-Satellite Service Plan (Appendix 30), to the Feeder Links Plan (Appendix 30A) and under Res. 42 (Rev. ORB-88). Also, the Bureau processed notifications submitted under Article 5 of Appendices 30 and 30A. In application of various procedures of the Allotment Plan for the Fixed-Satellite Service (Appendix 30B) the Bureau received in 1994 requests from administrations for conversion of their allotments contained in Part A of the Plan into assignments; for the implementation of existing systems as contained in Part B of the Plan; or for the introduction of a sub-regional system and additional uses (Sections II and III of Article 6 of that Appendix).

3.6 In 1994, 7 405 frequency assignment notices for stations in the space radiocommunication services were submitted to the Radiocommunication Bureau for recording in the Master Register. These notices consisted of 4 454 frequency assignments relating to 97 space stations and 2 951 frequency assignments relating to 341 earth stations. During the same period, the Radiocommunication Bureau processed 9 217 frequency assignments in the above-mentioned services, of which 6 797 assignments related to space stations and 2 420 assignments related to earth stations.

3.7 The Radiocommunication Bureau has been publishing, on a quarterly basis, the Space Network List containing information on geostationary and non-geostationary space stations, communicated to the Bureau in application of the procedures of Articles 11 and 13, Resolutions 33 and 46 and Appendices 30, 30A and 30B. Part of the List, relating to geostationary space stations as submitted to the Bureau under Articles 11 and 13 of the Radio Regulations, is presented in the following table:

3.3 In 1994, the Bureau also received, but has not yet processed, requests from administrations for advance publication for 78 new satellite networks and requests for additional frequency bands for 46 previously published networks.

3.4 In addition, in 1994 the Radiocommunication Bureau published the relevant information concerning requests for the coordination of space service assignments for geostationary-satellite and non-geostationary-satellite networks for which advance publication had already been made. Assistance to about 58 administrations in the coordination of frequency assignments to stations in the space radiocommunication services was also provided on request.

3.5 In 1994, the Radiocommunication Bureau processed and published requests from various administrations for modifications to the Broadcasting-Satellite Service Plan (Appendix 30), to the Feeder Links Plan (Appendix 30A) and under Res. 42 (Rev. ORB-88). Also, the Bureau processed notifications submitted under Article 5 of Appendices 30 and 30A. In application of various procedures of the Allotment Plan for the Fixed-Satellite Service (Appendix 30B) the Bureau received in 1994 requests from administrations for conversion of their allotments contained in Part A of the Plan into assignments; for the implementation of existing systems as contained in Part B of the Plan; or for the introduction of a sub-regional system and additional uses (Sections II and III of Article 6 of that Appendix).

3.6 In 1994, 7 405 frequency assignment notices for stations in the space radiocommunication services were submitted to the Radiocommunication Bureau for recording in the Master Register. These notices consisted of 4 454 frequency assignments relating to 97 space stations and 2 951 frequency assignments relating to 341 earth stations. During the same period, the Radiocommunication Bureau processed 9 217 frequency assignments in the above-mentioned services, of which 6 797 assignments related to space stations and 2 420 assignments related to earth stations.

3.7 The Radiocommunication Bureau has been publishing, on a quarterly basis, the Space Network List containing information on geostationary and non-geostationary space stations, communicated to the Bureau in application of the procedures of Articles 11 and 13, Resolutions 33 and 46 and Appendices 30, 30A and 30B. Part of the List, relating to geostationary space stations as submitted to the Bureau under Articles 11 and 13 of the Radio Regulations, is presented in the following table:

LIST OF GEOSTATIONARY SPACE STATIONS BY ORBITAL POSITION AND FREQUENCY BANDS

(RR 1042, RR 1060, RR 1488-1491)

(31.12.1994)

Orbital position		Space station	Frequency bands GHz																		
			0	1	2	4	5	6	7	8	11	12	13	14	15	17	18	19	20	>20	>30	>40
178.00 W C	USA	USASAT-13K				4		6														
177.00 W N	USA	FLTSATCOM-A W PAC	0						7	8												
177.00 W N	USA	FLTSATCOM-C W PAC2	C0		2				C7	C8									C20			C*
177.00 W C	USAIT	INTELSAT IBS 183E				4		6			11	12		14								
177.00 W N	USAIT	INTELSAT5 183E				4		6			11			14								
177.00 W C	USAIT	INTELSAT5A 183E				4		6			11			14								
177.00 W A	USAIT	INTELSAT7 183E				C4	5	C6			C11	C12	13	C14								
177.00 W A	USAIT	INTELSAT8 183E				C4	C5	C6			C11	C12	13	C14								
175.00 W A	PNG	PACSTAR A-2		C1			5	6														
175.00 W C	PNG	PACSTAR-4				4		6				12		14								
174.00 W N	USA	ATDRS 174W			A2								A13		A15				20	A	30	
174.00 W N	USA	TDRS 174W			2								13		15							
174.00 W C	USA	USASAT-14E				4		6														
174.00 W A	USAIT	INTELSAT T 186E				4		6														
171.00 W N	USA	ATDRS 171W			A2								A13		A15				20	A	30	
171.00 W N	USA	TDRS WEST			2									14	15							
170.00 W A	RUS	ROSCOM-2				4	5	6			11			14					20		*	
170.00 W N	URS	GALS-4							7	8												
170.00 W N	URS	STATSIONAR-10				4	5	6														
170.00 W A	URS	STATSIONAR-10A				C4	5	C6														
170.00 W N	URS	STATSIONAR-D2				4		6														
170.00 W N	URS	TOR-5															18	19	20			*
170.00 W N	URS	VOLNA-7	0	1																		
168.00 W N	RUS	FOTON-3				C4	C5	6														
168.00 W N	RUS	POTOK-3				C4	C5															
165.00 W A	USA	USASAT-13L									11	12		14								
160.00 W N	RUS	ESDRN				C4	C5				11			14								
160.00 W A	RUS	MARAFON-4		1		4		6														
159.00 W N	URS	PROGNOZ-7			2	4																
155.00 W C	RUS	EXPRESS-12				4		6			11			14								
155.00 W N	URS	STATSIONAR-26				4	5	6														
148.00 W A	USA	MILSTAR-12	0		C2														C20			C*
146.00 W C	USA	USASAT-20C				4		6														
145.00 W A	MEX	MORELOS 4				4		6				12		14								
145.00 W C	URS	VOLNA-21M		1																		
145.00 W N	USA	FLTSATCOM-C W PAC3	C0		2				7	8									20			*
144.00 W A	USA	USASAT-20B				4		6														
144.00 W A	USA	USLL-PAC																				*
140.00 W C	USA	USASAT-17C				4		6														
139.00 W C	USA	ACS-3		1																		
139.00 W A	USA	ACS-3K										12		14								
139.00 W A	USA	MCS-3		1																		
139.00 W N	USA	US SATCOM 1-R				4		6														
139.00 W C	USA	USASAT-22I				4		6														

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Orbital position	Space station		Frequency bands GHz																			
			0	1	2	4	5	6	7	8	11	12	13	14	15	17	18	19	20	>20	>30	>40
138.00 W	A	MEX SOLIDARIDAD KU										12		14								
137.00 W	A	USA USASAT-17B				4		6														
137.00 W	C	USA USASAT-22G				4		6														
136.00 W	N	USA USASAT-16D										12		14								
135.00 W	N	USA GOES WEST	0	1	2																	
135.00 W	A	USA GOES-J	0	1	2																	
135.00 W	C	USA USASAT-21A				4		6														
135.00 W	N	USA USGCSS PH2 E PAC							7	8												
135.00 W	N	USA USGCSS PH3 E PAC			2				7	8												
135.00 W	N	USA USGCSS PH3B E PAC			C2				7	8												
135.00 W	A	USA USGCSS PH4 E PAC-3			2														20			*
134.00 W	C	USA USASAT-16C										12		14								
133.00 W	N	USA USASAT-11D				4		6														
133.00 W	C	USA USASAT-22A				4		6														
131.00 W	C	USA USASAT-22H				4		6														
131.00 W	A	USA USASAT-23B										12		14								
130.00 W	A	USA USGCSS PH2 E PAC-2							7	8												
130.00 W	N	USA USGCSS PH3 E PAC-2			2				7	8												
130.00 W	A	USA USGCSS PH3B E PAC-2			2				C7	C8												
130.00 W	A	USA USGCSS PH4 E PAC-2			2														20			*
130.00 W	N	USA USRDSS WEST		1	2		5	6														
129.00 W	N	USA ACS-1				4		6				12		14								
129.00 W	C	USA USASAT-24A				4		6				12		14								
127.00 W	A	USA USASAT-21B				4		6														
126.00 W	N	USA USASAT-20A				4		6														
125.00 W	C	USA USASAT-22B				4		6														
125.00 W	C	USA USASAT-23E										12		14								
122.00 W	N	USA USASAT-10A										12		14								
121.00 W	C	USA USASAT-23C										12		14								
120.00 W	A	TRD CARIBSS-1						6														
120.00 W	A	USA MILSTAR-6	0		C2														C20			C*
120.00 W	C	USA SPACENET-I				4		6				12		14								
119.00 W	A	USA OMRDSS WEST		1	2		5	6														
118.70 W	C	CAN ANIK C-3										12		14								
118.70 W	N	CAN ANIK D-1				C4		C6														
118.70 W	A	CAN ANIK E-D				4		6				12		14								
116.80 W	N	MEX MORELOS 2				4		6				12		14								
116.00 W	A	USA USASAT-27D			2														20	29		
114.90 W	C	CAN ANIK C-1										12		14								
114.90 W	N	CAN ANIK D-2				4		6														
114.90 W	A	CAN ANIK E-C				4		6				12		14								
113.00 W	C	MEX SOLIDARIDAD 2M		1								12		14								
113.00 W	C	MEX SOLIDARIDAD 2MA										12		14								
113.00 W	C	MEX SOLIDARIDAD-2				4		6				12		14								
111.10 W	N	CAN ANIK E-B				4		6				12		14								
110.00 W	N	CAN ANIK C-2										12		14								
109.20 W	C	MEX SOLIDARIDAD 1M		1								12		14								
109.20 W	C	MEX SOLIDARIDAD 1MA										12		14								
109.20 W	N	MEX SOLIDARIDAD-1				4		6				12		14								
109.00 W	C	USA USGCSS PH4 E PAC-1			2														20			44

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Orbital position	Space station		Frequency bands GHz																				
			0	1	2	4	5	6	7	8	11	12	13	14	15	17	18	19	20	>20	>30	>40
109.00 W	C	VENASA SIMON BOLIVAR-3				4		6														
107.30 W	N	CAN ANIK E-A				4		6				12		14								
106.50 W	A	CAN MSAT		C1	2						11	C12		C14								
106.50 W	A	CAN MSAT-1A		1	2							12		14								
106.00 W	A	USA MARISAT-CONUS		1		4		6														
106.00 W	C	VENASA SIMON BOLIVAR-1				4		6														
105.00 W	N	USA ATS-5	0	1																		
105.00 W	N	USA FLTSATCOM-A EAST PAC	C0						7	8												
105.00 W	N	USA FLTSATCOM-C E PAC1	C0		2				7	8									20			*
105.00 W	C	USA GSTAR-2										12		14								
103.00 W	C	USA GSTAR-1										12		14								
103.00 W	C	USA USASAT-24B				4		6				12		14								
103.00 W	C	VENASA SIMON BOLIVAR-2				4		6														
101.00 W	A	USA MCS-1		1																		
101.00 W	C	USA USASAT-16B										12		14								
101.00 W	C	USA USASAT-17A				4		6														
101.00 W	A	USA USASAT-27E			2																	
101.00 W	C	USA USASAT-7D				4		6				12		14								
100.00 W	A	USA ACS-1		C1																		
100.00 W	N	USA ACTS																19	20	*		
100.00 W	N	USA FLTSATCOM E PAC	0						7	8												
100.00 W	N	USA FLTSATCOM-B EAST PAC																	20			44
100.00 W	N	USA FLTSATCOM-C E PAC2	C0		2				7	8									20			*
100.00 W	N	USA USRDSS CENTRAL		1	2		5	6														
99.00 W	C	USA USASAT-24J				4		6				12		14								
99.00 W	C	USA WESTAR 6-S				4		6														
97.00 W	A	CUBIK LATAMSAT-2			2	4	5	6			11		13	14								
97.00 W	N	USA TELSTAR-3A				4		6														
97.00 W	C	USA USASAT-24D				4		6				12		14								
97.00 W	N	USA USASAT-6A										12		14								
96.00 W	A	USA USASAT-27C			2														20	29		
95.00 W	N	USA COMSTAR D-2				4		6														
95.00 W	C	USA USASAT-22D				4		6														
95.00 W	C	USA USASAT-24L				4		6				12		14								
95.00 W	N	USA USASAT-6C										12		14								
93.50 W	N	USA USASAT-12B				4		6														
93.00 W	C	USA USASAT-16A										12		14								
92.00 W	A	B SBTS B4				4	5	6														
91.00 W	C	USA USASAT-24K				4		6				12		14								
91.00 W	C	USA USASAT-9A										12		14								
90.00 W	C	G INM INMARSAT GSO-1A		1	2	4		6														
90.00 W	C	G INM INMARSAT GSO-2A		1	2	4		6														
90.00 W	A	USA MILSTAR-1	0		C2														C20			C*
90.00 W	A	USA USASAT-27A																19	20	29		
89.00 W	A	USA OMRDSS EAST		1	2		5	6														
89.00 W	C	USA USASAT-24E				4		6				12		14								
89.00 W	A	VENASA SIMON BOLIVAR-B				4		6														
88.50 W	N	USA SPACENET-3				4		6				12		14								
86.00 W	N	USA USASAT-3C				4		6														
85.00 W	C	ARG NAHUEL-B				4		6			11	12	13	14								

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Orbital position	Space station		Frequency bands GHz																				
			0	1	2	4	5	6	7	8	11	12	13	14	15	17	18	19	20	>20	>30	>40
85.00 W C	USA	USASAT-9C										12		14								
83.00 W A	CUBIK	LATAMSAT-1			2	4	5	6			11		13	14								
83.00 W A	USA	USASAT-24C				4		6				12		14								
82.00 W A	B	B-SAT B		1		4	5	6			11											
81.00 W C	USA	USASAT-22F				4		6														
81.00 W C	USA	USASAT-9D									11	12		14								
80.00 W C	ARG	NAHUEL-A				4		6			11	12	13	14								
79.00 W N	USA	TDRS CENTRAL			2									14	15							
79.00 W N	USA	TDRS-C2			2								13	14	15							
79.00 W N	USA	USASAT-12A				4		6														
79.00 W C	USA	USASAT-24F				4		6				12		14								
77.50 W A	B	B-SAT A		1		4	5	6			11											
77.50 W A	VENASA	SIMON BOLIVAR-A				4		6														
76.00 W A	ARG	NAHUEL-2				4		6				C12		C14								
76.00 W C	ARG	NAHUEL-D				4		6			11	12	13	14								
76.00 W C	USA	USASAT-12C				4		6														
76.00 W A	USA	USASAT-27B			2														20	29		
75.40 W A	CLM	COLOMBIA 1A				4		6														
75.00 W A	CLM	COLOMBIA 2				4		6														
75.00 W N	USA	GOES EAST	0	1	2																	
75.00 W A	USA	GOES-I	0	1	2																	
75.00 W C	USA	USASAT-18A										12		14								
74.00 W C	USA	USASAT-22E				4		6														
74.00 W C	USA	USASAT-7A				4		6														
73.00 W A	B	B-SAT C		1		4	5	6			11											
73.00 W C	USA	USASAT-18B										12		14								
72.00 W A	ARG	NAHUEL-1				4		6				C12		C14								
72.00 W C	ARG	NAHUEL-C									11	12	13	14								
72.00 W C	USA	ACS-2		1																		
72.00 W C	USA	USASAT-15B										12		14								
72.00 W N	USA	USASAT-8B				4		6														
72.00 W A	VENASA	SIMON BOLIVAR-C				4		6														
71.00 W C	USA	USASAT-18C										12		14								
70.00 W C	B	SATS-1				4		6														
70.00 W N	B	SBTS A1				4		6														
70.00 W A	B	SBTS B1				4		6														
70.00 W A	B	SBTS C1									11	12	13	14								
70.00 W C	B	SISCOMIS-3							7	8												
70.00 W N	USA	USRDSS EAST		1	2		5	6														
69.00 W C	USA	USASAT-24H				4		6				12		14								
69.00 W C	USA	USASAT-7C				4		6				12		14								
68.00 W A	USA	MILSTAR-8	0		C2														C20			C*
65.00 W C	B	SATS-2				4		6														
65.00 W N	B	SBTS A2				4		6														
65.00 W A	B	SBTS B2				4	5	6														
65.00 W A	B	SBTS C2										12		14								
65.00 W C	B	SISCOMIS-2							7	8												
62.00 W A	USA	ACS-2A		1																		
62.00 W A	USA	ACS-2K										12		14								
62.00 W A	USA	MCS-2		1																		

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Orbital position	Space station		Frequency bands GHz																				
			0	1	2	4	5	6	7	8	11	12	13	14	15	17	18	19	20	>20	>30	>40
62.00 W N	USA	TDRS 62W			2								13	14	15							
61.00 W A	B	SBTS B3				4	5	6														
61.00 W A	B	SBTS C3										12		14								
61.00 W C	B	SISCOMIS-1							7	8												
60.00 W C	BEL	SATCOM PHASE-3B							7	8												
60.00 W A	USA	USASAT-17D				4		6														
60.00 W C	USA	USASAT-25H				4		6														
60.00 W C	USA	USASAT-26H									11	12		14								
59.00 W C	ARG	NAHUEL-E				4		6			11	12	13	14								
58.00 W C	USA	USASAT-25G				4		6														
58.00 W C	USA	USASAT-26G									11	12		14								
56.00 W C	USA	USASAT-25F				4		6														
56.00 W C	USA	USASAT-26F									11	12		14								
56.00 W C	USAIT	INTELSAT5A 304E				4		6			11			14								
56.00 W A	USAIT	INTELSAT7 304E				C4	5	C6			C11	C12	13	C14								
56.00 W A	USAIT	INTELSAT8 304E				4	5	6			11	12	13	14								
55.50 W C	F ESA	MARECS ATL4		1		4		6														
55.00 W C	G INM	INMARSAT GSO-1B		1	2	4		6														
55.00 W C	G INM	INMARSAT GSO-2B		1	2	4		6														
55.00 W C	G INM	INMARSAT2 AOR-WEST		1		4		6														
55.00 W C	G INM	INMARSAT3 AOR-WEST		1		4		6														
54.00 W A	G INM	INMARSAT2 AOR-WEST-2		1		4		6														
54.00 W C	G INM	INMARSAT3 AOR-WEST-2		1		4		6														
53.00 W N	USAIT	INTELSAT IBS 307E				4		6			11	12		14								
53.00 W N	USAIT	INTELSAT5A CONT1				C4		C6			11			14								
53.00 W C	USAIT	INTELSAT6 307E				4	5	6			11			14								
53.00 W A	USAIT	INTELSAT7 307E				C4	5	C6			C11	C12	13	C14								
53.00 W A	USAIT	INTELSAT8 307E				4	5	6			11	12		14								
52.50 W N	USA	USGCSS PH3 W ATL			2				7	8												
52.50 W A	USA	USGCSS PH3B W ATL			2				C7	C8												
52.50 W A	USA	USGCSS PH4 W ATL			2														20			*
50.00 W N	USAIT	INTELSAT IBS 310E				4		6			11	12		14								
50.00 W C	USAIT	INTELSAT MCS ATL A		1		4		6														
50.00 W N	USAIT	INTELSAT5 CONT2				C4		C6			C11			C14								
50.00 W C	USAIT	INTELSAT6 310E				4	5	6			11			14								
50.00 W C	USAIT	INTELSAT7 310E				4		6			11	12		14								
50.00 W A	USAIT	INTELSAT8 310E				4	5	6			11	12	13	14								
47.00 W C	USA	USASAT-13J				4		6														
47.00 W C	USA	USASAT-25E				4		6														
47.00 W C	USA	USASAT-26E									11	12		14								
46.00 W N	USA	ATDRS 46W			A2								A13		A15				20	A	30	
46.00 W N	USA	TDRS 46W			2								13	14								
45.00 W C	USA	USASAT-13F									11	12		14								
45.00 W C	USA	USASAT-13I				4		6														
45.00 W C	USA	USASAT-25D				4		6														
45.00 W C	USA	USASAT-26D									11	12		14								
44.00 W A	F ESA	EDRSS-W			2												18	19	20	*	30	
43.50 W C	F	VIDEOSAT-3			2							12		14								
43.00 W C	USA	USASAT-25C				4		6														
43.00 W C	USA	USASAT-26C									11	12		14								

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Orbital position	Space station		Frequency bands GHz																			
			0	1	2	4	5	6	7	8	11	12	13	14	15	17	18	19	20	>20	>30	>40
42.50 W C	USA	USGCSS PH3 MID-ATL			2				7	8												
42.50 W A	USA	USGCSS PH3B MID-ATL			2				7	8												
42.50 W C	USA	USGCSS PH4 ATL3			2														20			44
41.00 W N	USA	ATDRS 41W			2								13		15				20		30	
41.00 W N	USA	TDRS EAST			2									14	15							
41.00 W C	USA	USASAT-14A				4		6														
41.00 W C	USA	USASAT-25B				4		6														
41.00 W C	USA	USASAT-26B									11	12		14								
40.50 W N	USAIT	INTELSAT IBS 319.5E				4		6			11	12		14								
40.50 W C	USAIT	INTELSAT K 319.5E									11	12		14								
40.50 W N	USAIT	INTELSAT5A 319.5E				4		6			11			14								
40.50 W A	USAIT	INTELSAT7 319.5E				C4	5	C6			C11	C12	13	C14								
40.50 W A	USAIT	INTELSAT8 319.5E				C4	C5	C6			C11	C12	13	C14								
39.00 W C	USA	USGCSS PH4 ATL2			2														20			44
37.50 W C	RUS	EXPRESS-1				4		6			11			14								
37.50 W C	URS	STATSIONAR-25				4	5	6														
37.50 W C	USA	USASAT-25A				4		6														
37.50 W C	USA	USASAT-26A									11	12		14								
35.00 W C	USA	USGCSS PH4 ATL1			2														20			44
34.50 W N	USAIT	INTELSAT6 325.5E				4	5	6			11			14								
34.50 W A	USAIT	INTELSAT7 325.5E				C4	5	C6			C11	C12	13	C14								
34.50 W A	USAIT	INTELSAT8 325.5E				C4	C5	C6			C11	C12	13	C14								
34.00 W C	G	SKYNET-4D	0						7	8												44
34.00 W A	G	SKYNET-4I																	20			*
32.50 W A	BLRIK	INTERSPUTNIK-32.5W			2	4	5	6				12	13	14								
32.00 W A	F ESA	EDRSS-WC			2												18	19	20	*	30	
32.00 W C	G INM	INMARSAT2 AOR-CL-2A		1		4		6														
32.00 W C	G INM	INMARSAT3 AOR-CL-2A		1		4		6														
31.00 W N	G	BSB-1										12		14		C17						
31.00 W N	USAIT	INTELSAT5A ATL6				4		6			11			14								
31.00 W A	USAIT	INTELSAT7 329E				C4	5	C6			C11	C12	13	C14								
31.00 W A	USAIT	INTELSAT8 329E				4	5	6			11	12		14								
30.00 W N	E	HISPASAT-1			2				7	8	11	12		14								
30.00 W C	E	HISPASAT-2A KU										12	13									
30.00 W C	E	HISPASAT-2B KU									11		13									
29.50 W A	USAIT	INTELSAT7 330.5E				4	5	6			11	12	13	14								
29.50 W A	USAIT	INTELSAT8 330.5E				4	5	6			11	12	13	14								
27.50 W N	USAIT	INTELSAT5A ATL2				4		6			11			14								
27.50 W N	USAIT	INTELSAT6 332.5E				C4	C5	C6			11			14								
27.50 W A	USAIT	INTELSAT7 332.5E				C4	5	C6			C11	C12	13	C14								
27.50 W A	USAIT	INTELSAT8 332.5E				4	5	6			11	12		14								
26.50 W A	RUS	MARAFON-6		1		4		6														
26.50 W N	URS	GALS-1							7	8												
26.50 W A	URS	STATSIONAR-17				C4	C5	C6														
26.50 W N	URS	STATSIONAR-D1				4		6														
26.50 W C	URS	TOR-1															18	19	20			*
26.50 W C	URS	VOLNA-13	0	1																		
26.00 W N	F ESA	MARECS ATL1	0	1		4		6														
25.00 W N	RUS	GALS-9							7	8												
25.00 W N	URS	STATSIONAR-8				A4	A5															

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Orbital position	Space station		Frequency bands GHz																				
			0	1	2	4	5	6	7	8	11	12	13	14	15	17	18	19	20	>20	>30	>40
25.00 W C	URS	TOR-9															18	19	20			*
25.00 W C	URS	VOLNA-1A	0	1																		
25.00 W C	URS	VOLNA-1M		1																		
24.50 W N	USAIT	INTELSAT6 335.5E				C4	C5	C6			11			14								
24.50 W A	USAIT	INTELSAT7 335.5E				C4	5	C6			C11	C12	13	C14								
24.50 W A	USAIT	INTELSAT8 335.5E				4	5	6			11	12		14								
24.00 W N	URS	PROGNOZ-1			2																	
23.00 W A	BLRIK	INTERSPUTNIK-23W			2	4	5	6				12	13	14								
23.00 W N	USA	FLTSATCOM ATL	0						7	8												
22.50 W N	USA	FLTSATCOM-B EAST ATL																	20			44
22.50 W N	USA	FLTSATCOM-C E ATL1	C0		2				C7	C8									C20			C*
22.00 W A	USAIT	INTELSAT6 338E				4	5	6			11			14								
22.00 W A	USAIT	INTELSAT7 338E				4	5	6			11	12	13	14								
22.00 W A	USAIT	INTELSAT8 338E				4	5	6			11	12	13	14								
21.50 W N	USAIT	INTELSAT K 338.5E									C11	12		C14								
21.50 W N	USAIT	INTELSAT MCS ATL C		C1		C4		C6														
21.50 W N	USAIT	INTELSAT5 ATL5				4		6			11			14								
21.50 W N	USAIT	INTELSAT5A 338.5E				4		6			11			14								
21.50 W C	USAIT	INTELSAT7 338.5E				4		6			11	12		14								
21.50 W C	USAIT	INTELSAT8 338.5E				4	5	6			11	12		14								
20.00 W A	USAIT	INTELSAT6 340E				4	5	6			11			14								
20.00 W A	USAIT	INTELSAT7 340E				4	5	6			11	12	13	14								
20.00 W A	USAIT	INTELSAT8 340E				4	5	6			11	12	13	14								
19.50 W A	RUS	YAMAL-W1				4	5	6														
19.00 W A	D	TV-SAT 2			C2							12				17						
19.00 W N	F	TDF-1			C2						11	12				17						
19.00 W A	F	TDF-2			C2						11	12				17						
19.00 W N	F ESA	L-SAT			2							12	13	14		17		19	20	28	30	
19.00 W A	I	SARIT			C2								13				18		20		30	
18.00 W N	BEL	SATCOM PHASE-3							7	8												
18.00 W N	USAIT	INTELSAT IBS 342E				4		6			11	12		14								
18.00 W N	USAIT	INTELSAT5A 342E				4		6			11			14								
18.00 W A	USAIT	INTELSAT7 342E				C4	5	C6			C11	C12	13	C14								
18.00 W A	USAIT	INTELSAT8 342E				C4	C5	C6			C11	C12	13	C14								
17.80 W C	BEL	SATCOM-4	0						7	8									20			44
17.00 W A	G INM	INMARSAT2 AOR-EAST-2		1		4		6														
17.00 W C	G INM	INMARSAT3 AOR-EAST-2		1		4		6														
16.50 W C	USA	MILSTAR-3			2														20			44
16.00 W A	BLRIK	INTERSPUTNIK-16W			2	4	5	6				12	13	14								
16.00 W N	RUS	WSDRN				C4	C5				11			14								
16.00 W N	RUS	ZSSRD-2				C4	C5				11	12	13	14								
15.50 W C	G INM	INMARSAT GSO-1C		1	2	4		6														
15.50 W C	G INM	INMARSAT GSO-2C		1	2	4		6														
15.50 W N	G INM	INMARSAT2 AOR-EAST		1		4		6														
15.50 W C	G INM	INMARSAT3 AOR-EAST		1		4		6														
15.50 W N	USA	FLTSATCOM-C E ATL2	C0		2				C7	C8									C20			C*
15.00 W C	F ESA	MARECS ATL5		1		4		6														
15.00 W N	USA	FLTSATCOM A ATL	C0						7	8												
14.80 W A	F EUT	EUTELSAT-3 14.8W			2						11	12	13	14								
14.50 W A	RUS	ROSCOM-1				4	5	6			11			14					20		*	

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Orbital position	Space station		Frequency bands GHz																			
			0	1	2	4	5	6	7	8	11	12	13	14	15	17	18	19	20	>20	>30	>40
14.50 W C	URS	GOMS-1M	0	1	2	4		6	7	8									20	29		
14.00 W C	RUS	EXPRESS-2				4		6			11			14								
14.00 W N	RUS	LOUTCH-1									C11			C14				A19		A28		
14.00 W C	URS	GOMS-1	0	1	2				7	8									20	29		
14.00 W C	URS	MORE-14		1		4		6														
14.00 W N	URS	VOLNA-2		1																		
14.00 W N	URSIK	STATSIONAR-4				C4		C6														
13.50 W N	RUS	FOTON-1				4	C5	6														
13.50 W A	RUS	MARAFON-5		1		4		6														
13.50 W N	RUS	POTOK-1				C4	C5															
13.50 W C	URS	FOTON-1				4																
13.00 W A	MLT	MELITASAT-1A										C12	13	C14								
12.50 W A	F EUT	EUTELSAT-3 12.5W			2						11	12	13	14								
12.00 W N	F ESA	HIPPARCOS			2																	
12.00 W A	USA	AFRIBSS				4		6														
12.00 W A	USA	USASAT-14L									11	12		14								
12.00 W N	USA	USGCSS PH2 ATL							7	8												
12.00 W N	USA	USGCSS PH3 ATL			2				7	8												
12.00 W C	USA	USGCSS PH3B ATL			2				7	8												
12.00 W A	USA	USGCSS PH4 ATL-4			2														20			•
11.00 W N	F	F-SAT 2			C2							12		14					C20		C30	
11.00 W C	RUS	EXPRESS-3				4		6			11			14								
11.00 W C	URS	LOUTCH-6									11			14								
11.00 W N	URS	STATSIONAR-11				4		6														
11.00 W C	URS	VOLNA-11W		1		4		6														
10.00 W C	F ESA	METEOSAT S2			2																	
10.00 W A	USA	USLL-ATL																				•
9.50 W C	RUS	KUPON-3									11			14								
9.00 W A	USA	MILSTAR-2	0		C2														C20			C•
8.00 W N	F	TELECOM-1A			2	4		6	7	8		12		14								
8.00 W N	F	TELECOM-2A			C2	C4		C6	C7	C8		C12		C14								
8.00 W A	F	TELECOM-3A				4	5	6														
8.00 W A	F	VIDEOSAT-6			C2						C11	C12	13	C14								
8.00 W A	F	ZENON-A		1	2						11			14								
7.00 W A	F	RADIOSAT									11						18					
7.00 W A	F	TELECOM-3D				4	5	6														
7.00 W A	F	VIDEOSAT-5			C2						C11	C12	13	C14								
6.00 W A	BLRIK	INTERSPUTNIK-6W			2	4	5	6				12	13	14								
5.00 W N	F	TELECOM-1B			2	4		6	7	8		12		14								
5.00 W N	F	TELECOM-2B			C2	C4		C6	C7	C8		C12		C14								
5.00 W A	F	TELECOM-3B				4	5	6														
5.00 W A	F	VIDEOSAT-7			2						C11	C12	13	C14								
4.00 W A	HNG	CERS-1									11			14								
4.00 W C	ISR	AMOS 1-B									11			14								
3.00 W A	BLRIK	INTERSPUTNIK-3W			2	4	5	6				12	13	14								
3.00 W C	URS	GALS-11							7	8												
3.00 W C	URS	TOR-11															18	19	20			•
1.00 W C	G	SKYNET-4A	0						7	8												44
1.00 W A	G	SKYNET-4F																	20			•
1.00 W N	USAIT	INTELSAT5A CONT4				4		6			11			14								

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Orbital position		Space station	Frequency bands GHz																			
			0	1	2	4	5	6	7	8	11	12	13	14	15	17	18	19	20	>20	>30	>40
1.00 W	N	USAIT INTELSAT7 359E				A4	A5	A6			11	12	A13	A14								
1.00 W	A	USAIT INTELSAT8 359E				4	5	6			11	12		14								
0.80 W	C	NOR BIFROST												14								
0.00 E	C	F LOCSTAR OUEST		1	2		5	6														
0.00 E	N	F ESA METEOSAT	0	C1	C2																	
1.00 E	C	URS GALS-15							7	8												
1.00 E	N	URS STATSIONAR-22				A4	A5															
1.00 E	C	URS TOR-15															18	19	20			*
1.00 E	C	URS VOLNA-21	0																			
1.50 E	C	ISR AMOS 1-A									11			14								
3.00 E	N	F TELECOM-1C			2	4		6	7	8		12		14								
3.00 E	N	F TELECOM-2C			C2	C4		C6	C7	C8		C12		C14								
3.00 E	A	F TELECOM-3C				4	5	6														
4.00 E	C	F EUT EUTELSAT 2-4E			2						11	12		14								
4.00 E	A	F EUT EUTELSAT-3 4E			2						11	12	13	14								
4.00 E	A	USA MILSTAR-13	0		C2														C20			C*
5.00 E	N	F ESA OTS	0								11			14								
5.00 E	N	S NOT TELE-X			2							12		14		17						
5.00 E	C	URS TOR-19															18	19	20			*
6.00 E	N	G SKYNET-4B	0						7	8												44
6.00 E	A	G SKYNET-4G																	20			*
7.00 E	N	F EUT EUTELSAT 1-3									11	12		14								
7.00 E	N	F EUT EUTELSAT 2-7E		C1	C2						C11	12		C14								
7.00 E	A	F EUT EUTELSAT-3 7E			2						11	12	13	14								
8.00 E	C	URS GALS-7							7	8												
8.00 E	A	URS STATSIONAR-18				C4	C5	C6														
8.00 E	C	URS TOR-8															18	19	20			*
8.00 E	C	URS VOLNA-15	0	1																		
10.00 E	C	F LOCSTAR CENTRE		1	2		5	6														
10.00 E	C	F ESA METEOSAT S1			2																	
10.00 E	N	F EUT EUTELSAT 2-10E		C1	C2						C11	12		C14								
10.00 E	N	F EUT EUTELSAT-1	0								11	12		14								
10.00 E	A	F EUT EUTELSAT-3 10E			2						11	12	13	14								
10.20 E	C	I ITALSAT-10.2E		1	2							12		14			18	19	20	*		
12.00 E	C	URS GALS-17							7	8												
12.00 E	N	URS PROGNOZ-2			2																	
12.00 E	A	URS STATSIONAR-27				C4	5	C6														
12.00 E	C	URS TOR-18															18	19	20			*
12.00 E	C	URS VOLNA-27	0																			
13.00 E	N	F EUT EUTELSAT 1-2	C0								C11	12		14								
13.00 E	N	F EUT EUTELSAT 2-13E		C1	C2						C11	12		C14								
13.00 E	A	F EUT EUTELSAT-3 13E			2						11	12	13	14								
13.00 E	N	I ITALSAT			2													19	20	28	*	40
13.20 E	C	I ITALSAT-13.2E		1	2							12		14			18	19	20	*		
15.00 E	A	F ZENON-B		1	2	4		6														
15.00 E	C	URS GALS-12							7	8												
15.00 E	A	URS STATSIONAR-23				C4	5	C6														
15.00 E	C	URS TOR-12															18	19	20			*
15.00 E	C	URS VOLNA-23	0																			
16.00 E	C	F EUT EUTELSAT 1-4	0																			

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	-		0	1	2	4	5	6	7	8	11	12	13	14	15	17	18	19	20	>20	>30	>40
16.00 E	N	F EUT EUTELSAT 2-16E		C1	C2						C11	12		C14								
16.00 E	A	F EUT EUTELSAT-3 16E			2						11	12	13	14								
16.00 E	C	I SICRAL-1A			2																	
16.20 E	A	I SICRAL-2A	0		2				7	8		12		14					20			*
16.40 E	A	F ESA ARTEMIS-16.4E DR			2												18	19	20	*	30	
16.40 E	A	F ESA ARTEMIS-16.4E LM		1								12		14								
16.40 E	C	I ITALSAT-16.4E		1	2							12		14			18	19	20	*		
17.00 E	A	ARS SABS-1									11			14								
17.00 E	A	BLRIK INTERSPUTNIK-17E			2	4	5	6				12	13	14								
17.00 E	A	UAE EMARSAT-1C				4	5	6			11	12		14								
19.00 E	A	F ZENON-C		1	2						11			14								
19.00 E	A	URS TOR-26															18	19	20			*
19.00 E	A	USA MILSTAR-9	0		C2														C20			C*
19.20 E	N	LUX GDL-6						C6			C11	A12	A13	C14								
19.20 E	C	LUX GDL-7									11		13	14								
20.00 E	A	ARSARB ARABSAT 1-D				4		6														
20.00 E	C	G INM INMARSAT4 GSO-1D		1	2	4		6														
20.00 E	C	G INM INMARSAT4 GSO-2D		1	2	4		6														
20.10 E	A	ARS SAUDI-FMSS-2		1	2																	
21.00 E	A	IRQ BABYLONSAT-3									11	12	13	14								
21.50 E	A	F ESA ARTEMIS-21.5E DR			2												18	19	20	*	30	
21.50 E	A	F ESA ARTEMIS-21.5E LM		1								12		14								
21.50 E	N	F EUT EUTELSAT 1-5	C0								11	12		14								
21.50 E	C	F EUT EUTELSAT 2-21.5E			2						11	12		14								
21.50 E	A	F EUT EUTELSAT-3 21.5E			2						11	12	13	14								
21.80 E	A	I SICRAL-2B	0		2				7	8		12		14					20			*
22.00 E	C	I SICRAL-1B			2																	
22.50 E	C	F LOCSTAR EST		1	2		5	6														
22.50 E	C	F ESA MARECS MED-1		1		4		6														
23.00 E	A	RUS ROSCOM-3				4	5	6			11			14					20		*	
23.00 E	C	URS GALS-8							7	8												
23.00 E	A	URS STATSIONAR-19				C4	C5	C6														
23.00 E	C	URS TOR-7															18	19	20			*
23.00 E	C	URS VOLNA-17	0	1																		
23.50 E	N	D DFS-1			2						11	12		14					20		30	
23.50 E	A	UKR UKRSAT-1 C 23.5E				4	5	6														
23.50 E	A	UKR UKRSAT-1 KU 23.5E									11		13	14								
23.50 E	A	UKR UKRSAT-1 MOB 23.5E		1							11		13									
24.00 E	A	UAE EMARSAT-1A				4	5	6			11	12		14								
25.00 E	A	G INM INMARSAT3 IOR-WEST		1		4		6														
25.50 E	C	F EUT EUTELSAT 1-8	0								11	12		14								
26.00 E	N	ARSARB ARABSAT 1-B				C4		C6														
26.00 E	C	ARSARB ARABSAT 2-B				4		6			11	12	13	14								
26.00 E	C	D DFS-6			2						11	12		14					20	29		
26.00 E	N	IRN ZOHREH-2									11			14								
27.00 E	A	BLRIK INTERSPUTNIK-27E			2	4	5	6				12	13	14								
27.00 E	C	URS TOR-20															18	19	20			*
28.50 E	N	D DFS-2			2						11	12		14					20		30	
28.50 E	A	D KEPLER 1			2						11	12		14								
29.00 E	C	ARS STRATSAT-1								8												

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				0	1	2	4	5	6	7	8	11	12	13	14	15	17	18	19	20	>20	>30	>40
29.00 E	N	USA	FLTSATCOM-C INDOCI	C0		2				C7	C8									C20			C*
30.00 E	A	IRQ	BABYLONSAT-1									11	12	13	14								
30.00 E	A	USA	MILSTAR-10	0		C2														C20			C*
30.50 E	C	ARSARB	ARABSAT 2-A				4		6				12	13									
31.00 E	N	ARSARB	ARABSAT 1-C				C4		C6														
31.00 E	N	TUR	TURKSAT-1B									11			14								
31.00 E	N	TUR	TURKSAT-K1									11			14								
32.00 E	C	F	VIDEOSAT-4			2							12		14								
32.00 E	C	URS	TOR-21															18	19	20			*
33.00 E	C	F EUT	EUTELSAT 2-33E			2						11	12		14								
33.00 E	A	F EUT	EUTELSAT-3 33E			2						11	12	13	14								
33.00 E	C	USAIT	INTELSAT5 33E				4		6			11			14								
33.00 E	C	USAIT	INTELSAT7 33E				4		6			11	12		14								
33.00 E	A	USAIT	INTELSAT8 33E				C4	C5	C6			C11	C12	13	C14								
33.50 E	C	D	DFS-5			2						11	12		14				19	20	29		
34.00 E	N	IRN	ZOHREH-1									11			14								
35.00 E	N	URS	GALS-6							7	8												
35.00 E	N	URS	PROGNOZ-3			2	4																
35.00 E	N	URS	STATSIONAR-2				C4	A5	C6														
35.00 E	N	URS	STATSIONAR-D3				4		6														
35.00 E	C	URS	TOR-2															18	19	20			*
35.00 E	C	URS	VOLNA-11	0	1																		
36.00 E	C	F EUT	EUTELSAT 1-7	0								11	12		14								
36.00 E	N	F EUT	EUTELSAT 2-36E		C1	C2						C11	12		C14								
36.00 E	A	F EUT	EUTELSAT-3 36E			2						11	12	13	14								
37.50 E	C	SEY	SEYSAT-2				4		6			11			14								
38.00 E	A	PAK	PAKSAT-1	C0			4		6			11	12		14								
39.00 E	A	GRC	HELLAS-SAT									11	12	13	14								
39.00 E	C	ISR	AMOS 1-C									11			14								
40.00 E	C	RUS	EXPRESS-4				4		6			11			14								
40.00 E	A	RUS	MARAFON-1		1		4		6														
40.00 E	C	URS	LOUTCH-7									11			14								
40.00 E	N	URS	STATSIONAR-12				4	5	6														
40.00 E	C	URS	TOR-22															18	19	20			*
40.00 E	C	URS	VOLNA-40E		1		4		6														
41.00 E	C	ARS	STRATSAT-2								8												
41.00 E	C	IRN	ZOHREH-4		1							11			14								
41.00 E	A	PAK	PAKSAT-2	0			4		6			11	12		14								
42.00 E	N	TUR	TURKSAT-1A									11			14								
42.00 E	N	TUR	TURKSAT-K2									11			14								
42.50 E	A	KAZ	KAZAKHSAT-42.5E				4		6			11			14								
42.50 E	C	SEY	SEYSAT-1				4		6			11			14								
43.00 E	C	D	EUROPE*STAR-2									11	12		14								
44.00 E	A	F EUT	EUTELSAT E 44E	0		2						11	12		14								
44.00 E	A	F EUT	EUTELSAT-3 44E			2						11	12	13	14								
45.00 E	C	D	EUROPE*STAR-1									11	12		14								
45.00 E	N	URS	GALS-2							7	8												
45.00 E	N	URS	STATSIONAR-9				4	5	6														
45.00 E	A	URS	STATSIONAR-9A				C4	5	C6														
45.00 E	N	URS	STATSIONAR-D4				4		6														

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Orbital position	Space station		Frequency bands GHz																			
			0	1	2	4	5	6	7	8	11	12	13	14	15	17	18	19	20	>20	>30	>40
45.00 E	N	URS TOR-3															18	19	20			*
45.00 E	N	URS VOLNA-3	0	1																		
45.00 E	C	URS VOLNA-3M		1																		
45.50 E	A	MLT MELITASAT-1B						6			11	12		14								
47.00 E	A	F ESA EDRSS-EC			2												18	19	20	*	30	
47.00 E	N	IRN ZOHREH-3									11			14								
47.50 E	C	D EUROPE*STAR-3									11	12		14								
48.00 E	A	F EUT EUTELSAT E 48E	0		2						11	12		14								
48.00 E	A	F EUT EUTELSAT-3 48E			2						11	12	13	14								
48.00 E	A	IND INSAT-2 48E	0			4	5	6			11			14								
48.00 E	A	IND INSAT-2M(48)			2	4		6														
48.00 E	A	IND INSAT-2T(48)				4		6														
49.00 E	A	RUS ROSCOM-4				4	5	6			11			14					20		*	
49.00 E	C	URS GALS-13							7	8												
49.00 E	N	URS STATSIONAR-24				A4	A5	6														
49.00 E	C	URS TOR-16															18	19	20			*
49.00 E	C	URS VOLNA-25	0																			
50.00 E	C	TUR TURKSAT-1C									11			14								
50.50 E	A	THA THAICOM-C1				4	5	6			11	12	13	14								
51.00 E	A	IRQ BABYLONSAT-2									11	12	13	14								
52.00 E	A	ARS SAUDI-FMSS-1		1	2																	
53.00 E	C	G SKYNET-4C	0						7	8												44
53.00 E	A	G SKYNET-4H																	20			*
53.00 E	C	RUS EXPRESS-5				4		6			11			14								
53.00 E	N	URS LOUTCH-2									C11			C14								
53.00 E	C	URS MORE-53		1		4		6														
53.00 E	C	URS TOR-23															18	19	20			*
53.00 E	N	URS VOLNA-4		1																		
53.00 E	N	URSIK STATSIONAR-5				4		6														
54.00 E	A	UAE EMARSAT-1B				4	5	6			11	12		14								
55.00 E	A	IND INSAT-2 55E	0			4	5	6			11			14								
55.00 E	A	IND INSAT-2M(55)			2	4		6														
55.00 E	A	IND INSAT-2T(55)				4		6														
55.00 E	C	RUS KUPON-1									11			14								
55.00 E	C	SNG ST-1D				4	5	6			11	12		14								
55.00 E	A	USA MILSTAR-4	0		C2														C20			C*
56.00 E	C	USA USGCSS PH4 INDOC1			2														20			44
57.00 E	C	USA USGCSS PH2 INDOC2							7	8												
57.00 E	A	USA USGCSS PH3 INDOC2			2				7	8												
57.00 E	A	USA USGCSS PH3B INDOC2			2				7	8												
57.00 E	N	USAIT INTELSAT5A INDOC2				C4		C6			C11			C14								
57.00 E	A	USAIT INTELSAT7 57E				C4	5	C6			C11	C12	13	C14								
57.00 E	A	USAIT INTELSAT8 57E				C4	C5	C6			C11	C12	13	C14								
58.00 E	C	URS TOR-13															18	19	20			*
59.00 E	A	F ESA EDRSS-E			2												18	19	20	*	30	
59.00 E	A	IRN ZOHREH-5		1							11			14								
59.50 E	A	BLRIK INTERBELAR-1			2	4	5	6				12	13	14								
60.00 E	N	USA USGCSS PH2 INDOC							7	8												
60.00 E	N	USA USGCSS PH3 INDOC			2				C7	C8												
60.00 E	A	USA USGCSS PH3B INDOC			2				7	8												

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Orbital position		Space station		Frequency bands GHz																			
				0	1	2	4	5	6	7	8	11	12	13	14	15	17	18	19	20	>20	>30	>40
60.00 E	C	USA	USGCSS PH4 INDOC2			2														20			44
60.00 E	N	USAIT	INTELSAT6 60E				4	5	6			11			14								
60.00 E	A	USAIT	INTELSAT7 60E				C4	5	C6			C11	C12	13	C14								
60.00 E	A	USAIT	INTELSAT8 60E				4		6			11	12	13	14								
61.50 E	A	IRN	ZOHREH-6		1							11			14								
62.00 E	C	URS	TOR-24															18	19	20			*
62.00 E	A	USAIT	INTELSAT6 62E				4	5	6			11			14								
62.00 E	A	USAIT	INTELSAT7 62E				4	5	6			11	12	13	14								
62.00 E	A	USAIT	INTELSAT8 62E				4	5	6			11	12	13	14								
63.00 E	N	USAIT	INTELSAT MCS INDOC A		C1		C4		C6														
63.00 E	N	USAIT	INTELSAT5A INDOC3				4		6			11			14								
63.00 E	N	USAIT	INTELSAT6 63E				4	5	6			11			14								
63.00 E	C	USAIT	INTELSAT7 63E				4		6			11	12		14								
64.00 E	C	G INM	INMARSAT GSO-1E		1	2	4		6														
64.00 E	C	G INM	INMARSAT GSO-2E		1	2	4		6														
64.00 E	C	G INM	INMARSAT3 IOR-1		1		4		6														
64.00 E	A	USAIT	INTELSAT6 64E				4	5	6			11			14								
64.00 E	A	USAIT	INTELSAT7 64E				4	5	6			11	12	13	14								
64.00 E	A	USAIT	INTELSAT8 64E				4	5	6			11	12	13	14								
64.50 E	A	BLRIK	INTERSPUTNIK-64.5E			2	4	5	6				12	13	14								
64.50 E	N	G INM	INMARSAT2 IOR-1		1		4		6														
65.00 E	C	G INM	INMARSAT2 IOR-2		1		4		6														
65.00 E	C	G INM	INMARSAT3 IOR-2		1		4		6														
65.00 E	C	URS	TOR-25															18	19	20			*
66.00 E	N	USAIT	INTELSAT MCS INDOC D		C1		C4		C6														
66.00 E	N	USAIT	INTELSAT5 INDOC4				4		6			11			14								
66.00 E	N	USAIT	INTELSAT5A 66E				4		6			11			14								
66.00 E	A	USAIT	INTELSAT7 66E				C4	5	C6			C11	C12	13	C14								
66.00 E	A	USAIT	INTELSAT8 66E				C4	C5	C6			C11	C12	13	C14								
67.50 E	A	BLRIK	INTERSPUTNIK-67.5E			2	4	5	6				12	13	14								
68.00 E	C	SNG	ST-1E				4	5	6			11	12		14								
68.00 E	C	USA	USASAT-14I				4		6				12		14								
69.00 E	C	URS	GALS-14							7	8												
69.00 E	C	URS	TOR-14															18	19	20			*
69.00 E	C	USAIT	INTELSAT5 69E				4		6			11			14								
69.00 E	C	USAIT	INTELSAT7 69E				4		6			11	12		14								
69.00 E	A	USAIT	INTELSAT8 69E				C4	C5	C6			C11	C12	13	C14								
70.00 E	C	SNG	ST-1F				4	5	6			11	12		14								
70.00 E	C	TON	TONGASAT-H70				4		6			11	12	13	14								
70.00 E	C	URS	GALS-16							7	8												
70.00 E	N	URS	STATSIONAR-20				A4	A5	6														
70.00 E	C	URS	TOR-17															18	19	20			*
70.00 E	C	URS	VOLNA-19	0																			
70.00 E	C	USA	USASAT-13N									11	12		14								
70.40 E	A	UAE	EMARSAT-1D					5	6			11	12		14								
70.50 E	A	F EUT	EUTELSAT E 70.5E			2						11	12		14								
70.50 E	A	F EUT	EUTELSAT-3 70.5E			2						11	12	13	14								
72.00 E	A	USA	FLTSATCOM INDOC	0						7	8												
72.00 E	A	USA	FLTSATCOM-B INDOC																	20			44
72.00 E	N	USA	FLTSATCOM-C INDOC2	C0		2				C7	C8									C20			C*

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Orbital position	Space station		Frequency bands GHz																			
			0	1	2	4	5	6	7	8	11	12	13	14	15	17	18	19	20	>20	>30	>40
72.00 E C	USA	USASAT-14J				4		6				12		14								
72.50 E N	USA	MARISAT-INDOC	0		2	4		6														
73.50 E C	ARS	STRATSAT-3								8												
73.50 E A	TUR	TURKSAT-1D									11	12		14								
74.00 E N	IND	INSAT-1B	0			4	5	6														
74.00 E N	IND	INSAT-2 (74)	0			4	5	6														
74.00 E C	IND	INSAT-2K (74)									11			14								
74.00 E A	IND	INSAT-2M(74)			2	4		6														
74.00 E A	IND	INSAT-2T(74)				4		6														
75.00 E A	BLRIK	INTERBELAR-2			2	4	5	6				12	13	14								
75.00 E A	RUS	YAMAL-E1				4	5	6														
75.00 E N	USA	FLTSATCOM INDOC	0						7	8												
75.00 E N	USA	FLTSATCOM-C INDOC3	C0		2				C7	C8									C20			C*
75.50 E A	CHN	CHINASAT-23	0			4		6														
76.00 E A	F EUT	EUTELSAT-3 76E			2						11	12	13	14								
76.00 E A	RUS	BUMERANG									11			14								
76.00 E A	RUS	COMINCOM-76E									11	12		14								
76.00 E C	RUS	CROSNA-1				4		6														
76.00 E N	RUS	GOMS-M	0	1	2	4		6	7	8									20	29		
76.00 E C	URS	GOMS	0						7	8									20	29		
77.00 E A	CHN	APSTAR-4				4		6				12		14								
77.00 E N	RUS	CSSRD-2				C4	C5				11	12	13	14								
77.00 E A	USA	FLTSATCOM-A INDOC	0						7	8												
77.50 E C	G	ASIASAT-D				4		6			11			14								
77.50 E C	G	ASIASAT-DK1										12		14								
78.50 E C	THA	THAICOM-A2				4		6														
78.50 E A	THA	THAICOM-A2B				4		6			11	12	13	14								
78.50 E C	THA	THAICOM-AK2										12		14								
80.00 E C	RUS	EXPRESS-6				4		6			11			14								
80.00 E N	RUS	FOTON-2				C4	C5	6														
80.00 E N	RUS	POTOK-2				C4	C5															
80.00 E N	RUS	PROGNOZ-4			C2																	
80.00 E N	URS	LOUTCH-8									11			14								
80.00 E N	URS	PROGNOZ-4			2																	
80.00 E N	URS	STATSIONAR-1				4	5	6														
80.00 E N	URSIK	STATSIONAR-13				4		6														
80.50 E A	F EUT	EUTELSAT-3 80.5E			2						11	12	13	14								
80.50 E A	INS	GARUDA-4		1	2	4	6															
81.50 E A	THA	THAICOM-B1				4	5	6														
81.50 E A	THA	THAICOM-BK1										C12	13	C14								
83.00 E N	IND	INSAT-1D	0			4	5	6														
83.00 E N	IND	INSAT-2 (83)	0			4	5	6														
83.00 E C	IND	INSAT-2K (83)									11			14								
83.00 E A	IND	INSAT-2M(83)			2	4		6														
83.00 E A	IND	INSAT-2T(83)				4		6														
83.30 E A	TON	TONGASAT AP-KU-4				4		6			C11	C12	C13	C14								
83.50 E A	F EUT	EUTELSAT-3 83.5E			2						11	12	13	14								
84.50 E A	THA	THAICOM-B2				4	5	6														
84.50 E A	THA	THAICOM-BK2										C12	13	C14								
85.00 E A	RUS	COMINCOM 85E									11	12		14								

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Orbital position	Space station		Frequency bands GHz																				
			0	1	2	4	5	6	7	8	11	12	13	14	15	17	18	19	20	>20	>30	>40
85.00 E A	RUS	MARAFON-7		1		4		6														
85.00 E N	URS	GALS-3							7	8												
85.00 E N	URS	STATSIONAR-3				A4	A5	6														
85.00 E N	URS	TOR-4															18	19	20			*
85.00 E N	URS	VOLNA-5	0	1																		
85.00 E C	URS	VOLNA-5M		1																		
85.00 E C	USA	TDRS-85E			2								13	14	15							
85.00 E C	USAIT	INTELSAT5 85E				4		6			11			14								
85.00 E C	USAIT	INTELSAT7 85E				4		6			11	12		14								
85.00 E A	USAIT	INTELSAT8 85E				C4	C5	C6			C11	C12	13	C14								
85.40 E N	RUS	STATSIONAR-D5				4		6														
85.50 E A	CHN	APSTAR-2 F1				4	5	6				12		14								
86.50 E C	RUS	KUPON-4									11			14								
87.50 E N	CHN	CHINASAT-1				4		6														
87.50 E N	CHN	DFH-3-0C				4		6														
88.00 E C	SNG	ST-1A		1		4	5	6			11	12		14								
88.50 E A	F EUT	EUTELSAT-3 88.5E			2						11	12	13	14								
89.50 E A	CHN	APSTAR-2 F2				4	5	6				12		14								
90.00 E C	RUS	EXPRESS-7				4		6			11			14								
90.00 E N	URS	LOUTCH-3									11			14								
90.00 E C	URS	MORE-90		1		4		6														
90.00 E N	URS	STATSIONAR-6				4		6														
90.00 E N	URS	VOLNA-8		1																		
90.00 E A	USA	MILSTAR-5	0		C2														C20			C*
90.50 E A	RUS	MARAFON-2		1		4		6														
91.50 E C	MLA	MEASAT-1				4		6			11	12		14								
91.50 E A	MLA	MEASAT-1K 91.5										12	13	14								
91.50 E C	USAIT	INTELSAT5A 91.5E				4		6			11			14								
91.50 E C	USAIT	INTELSAT7 91.5E				4		6			11	12		14								
91.50 E A	USAIT	INTELSAT8 91.5E				4	5	6			11	12	13	14								
91.75 E C	RUS	KUPON-2									11			14								
93.00 E A	CHN	APSTAR-3				4		6				12		14								
93.50 E N	IND	INSAT-1C	0			4	5	6														
93.50 E N	IND	INSAT-2 (93.5)	0			4	5	6														
93.50 E C	IND	INSAT-2K (93.5)									11			14								
93.50 E A	IND	INSAT-2M(93.5)			2	4		6														
93.50 E A	IND	INSAT-2T(93.5)				4		6														
95.00 E A	MLA	MEASAT-1K 95										12	13	14								
95.00 E C	MLA	MEASAT-3				4		6			11			14								
95.00 E N	RUS	CSDRN				C4	C5				11			14								
95.00 E C	USAIT	INTELSAT5A 95E				4		6			11			14								
95.00 E C	USAIT	INTELSAT7 95E				4		6			11	12		14								
95.00 E A	USAIT	INTELSAT8 95E				4	5	6			11	12	13	14								
96.50 E C	RUS	EXPRESS-8				4		6			11			14								
96.50 E N	RUS	STATSIONAR-14				C4		C6														
96.50 E N	URS	LOUTCH-9									11			14								
98.00 E A	CHN	CHINASAT-22	0			4		6														
98.00 E N	CHN	CHINASAT-3				4		6														
98.00 E A	RUS	PROGNOZ-8			2																	
98.50 E C	SNG	ST-1B		1		4	5	6			11	12		14								

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Orbital position	Space station		Frequency bands GHz																				
			0	1	2	4	5	6	7	8	11	12	13	14	15	17	18	19	20	>20	>30	>40
99.00 E C	RUS	EXPRESS-13				4		6			11			14								
99.00 E N	URS	STATSIONAR-T						6														
99.00 E N	URS	STATSIONAR-T2						6														
100.50 E A	G	ASIASAT-DBA 2							7													
100.50 E C	G	ASIASAT-E				4		6			11			14								
100.50 E C	G	ASIASAT-EK1										12		14								
101.00 E C	THA	THAICOM-A1				4		6														
101.00 E C	THA	THAICOM-AK1										12		14								
101.50 E A	CHN	CHINASAT-11									11			14								
103.00 E A	CHN	CHINASAT-21	0			4		6														
103.00 E N	CHN	DFH-3-0B				4		6														
103.00 E N	CHN	STW-2				4		6														
103.00 E C	RUS	EXPRESS-9				4		6			11			14								
103.00 E N	URS	LOUTCH-5									11			14								
103.00 E N	URS	STATSIONAR-21				C4	5	C6														
103.00 E C	URS	VOLNA-103E		1		4		6														
105.00 E A	CHN	FY-2A	0	1	2	C4		C6														
105.50 E A	CHN	CHINASAT-12									11			14								
105.50 E N	G	ASIASAT-1				4		6														
105.50 E C	G	ASIASAT-CK				4		6			11			14								
105.50 E C	G	ASIASAT-CK1										12		14								
105.50 E A	G	ASIASAT-DBA 1							7													
105.90 E C	INS	INDOSTAR-3				4		6		8												
106.10 E C	INS	INDOSTAR-1				4		6		8												
108.00 E N	INS	PALAPA-B1				4		6														
108.00 E C	INS	PALAPA-C2				4		6			11		13	14								
109.85 E A	J	BS-3N										12		14								
110.00 E C	G INM	INMARSAT GSO-1F		1	2	4		6														
110.00 E C	G INM	INMARSAT GSO-2F		1	2	4		6														
110.00 E N	J	BS-2			2							12		C14								
110.00 E N	J	BS-3			2							12		14								
110.00 E N	J	BSE			2									14								
110.00 E A	J	JMCS-2							7	8												
110.00 E C	J	N-SAT-110										12		14								
110.00 E C	SNG	ST-1C		1		4	5	6			11	12		14								
110.50 E N	CHN	CHINASAT-2				4		6														
111.50 E A	IND	INSAT-2 111.5E	0			4	5	6			11			14								
113.00 E N	INS	PALAPA-B2				4		6														
113.00 E C	INS	PALAPA-C1				4		6			11		13	14								
113.00 E C	KOR	KOREASAT-2										12		14								
114.50 E A	BLRIK	INTERSPUTNIK-114.5E			2	4	5	6				12	13	14								
114.90 E C	INS	INDOSTAR-4				4		6		8												
115.10 E C	INS	INDOSTAR-2				4		6		8												
115.50 E A	CHN	DFH-3-0D				4		6				12		14								
116.00 E C	G	ASIASAT-B				4		6														
116.00 E C	G	ASIASAT-BK				4		6			11			14								
116.00 E C	G	ASIASAT-BK1										12		14								
116.00 E C	KOR	KOREASAT-1										12		14								
118.00 E A	INS	GARUDA-1		1	2	4		6														
118.00 E N	INS	PALAPA-B3				4		6														

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Orbital position		Space station	Frequency bands GHz																			
			0	1	2	4	5	6	7	8	11	12	13	14	15	17	18	19	20	>20	>30	>40
118.00 E	C	INS PALAPA-C3				4		6			11		13	14								
120.00 E	N	J GMS-120E	0	1	2																	
120.00 E	C	J SJC-2										12		14								
120.00 E	C	THA THAICOM-A3				4		6														
120.00 E	C	THA THAICOM-AK3										12		14								
121.00 E	C	CHN DFH-3-OE				4		6														
122.00 E	C	G ASIASAT-A				4		6														
122.00 E	C	G ASIASAT-AK				4		6			11			14								
122.00 E	C	G ASIASAT-AK1										12		14								
123.00 E	A	INS GARUDA-2		1	2	4		6														
124.00 E	A	J JCSAT-3B				4		6				12	13	14								
124.00 E	C	J SCS-1B										12		14		17	18	19		*		
124.00 E	C	J SJC-1										12		14								
125.00 E	N	CHN DFH-3-0A				4		6														
125.00 E	N	CHN STW-1				4		6														
125.00 E	A	G ORIENT-1				4		6			11		13	14								
125.00 E	A	G ORIENT-2				4		6			11			14								
126.00 E	A	THA THAICOM-C2				4		6			11	12	13	14								
126.00 E	A	USA USASAT-14M									11	12		14								
127.50 E	A	CHN CHINASAT-24	0			4		6														
128.00 E	A	J JCSAT-3A				4		6				12	13	14								
128.00 E	C	J N-SAT-128										12		14								
128.00 E	C	J SCS-1A										12		14		17	18	19		*		
128.00 E	N	RUS GALS-10							7	8												
128.00 E	N	URS STATSIONAR-15				A4	A5	6														
128.00 E	N	URS STATSIONAR-D6				4		6														
128.00 E	C	URS TOR-6															18	19	20			*
128.00 E	C	URS VOLNA-9	0	1																		
128.00 E	C	URS VOLNA-9M		1																		
130.00 E	C	CHN CHINASAT-4				4		6														
130.00 E	A	G INM INMARSAT3 POR-WEST		1		4		6														
130.00 E	N	J ETS-2	0	1	2						11										34	
130.00 E	C	TON TONGASAT AP-1				4		6														
130.00 E	N	TON TONGASAT C/KU-1				C4		C6			C11	C12	C13	C14								
130.00 E	N	URS GALS-5							7	8												
130.00 E	N	URS PROGNOZ-5			2																	
130.00 E	C	URS TOR-10															18	19	20			*
131.00 E	A	CHN APSTAR-1				4		6														
132.00 E	N	J CS-2A			2	4		6								17	18	19		28		
132.00 E	N	J CS-3A			2	4		6								17	18	19		28		
132.00 E	C	J N-STAR-A			2	4		6				12		14		17	18	19	20	*	30	
133.00 E	A	USA MILSTAR-7	0		C2														C20			C*
134.00 E	A	CHN APSTAR-2				4		6				12		14								
134.00 E	N	INS PALAPA PACIFIC-1				4		6														
134.00 E	C	TON TONGASAT AP-2				4		6														
134.00 E	N	TON TONGASAT C/KU-2				C4		C6			C11	C12	C13	C14								
135.00 E	A	INS GARUDA-3		1	2	4		6														
135.00 E	N	J CSE			2	4		6								17	18	19	20	28	30	
136.00 E	N	J CS-2B			2	4		6								17	18	19		28		
136.00 E	N	J CS-3B			2	4		6								17	18	19		28		

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Orbital position		Space station	Frequency bands GHz																			
			0	1	2	4	5	6	7	8	11	12	13	14	15	17	18	19	20	>20	>30	>40
136.00 E	C	J N-STAR-B			2	4		6				12		14		17	18	19	20	*	30	
138.00 E	C	TON TONGASAT AP-3				4		6														
138.00 E	N	TON TONGASAT C/KU-3				4		6			11	12	13	14								
139.00 E	C	INS PALAPA PACIFIC-2				4		6														
139.00 E	A	USA ORION-AP-1									11	12		14								
140.00 E	C	J GMS-140E	0	1	2																	
140.00 E	N	J GMS-3	0	1	2																	
140.00 E	N	J GMS-4	0	1	2																	
140.00 E	C	RUS EXPRESS-10				4		6			11			14								
140.00 E	N	URS LOUTCH-4									11			14								
140.00 E	C	URS MORE-140		1		4		6														
140.00 E	N	URS STATSIONAR-7				4		6														
140.00 E	N	URS VOLNA-6		1																		
142.00 E	C	THA THAICOM-A4				4		6														
142.00 E	C	THA THAICOM-AK4									11			14								
142.50 E	C	TON TONGASAT AP-4				4		6														
142.50 E	C	TON TONGASAT C/KU-4				4		6			11	12	13	14								
144.00 E	C	INS PALAPA PACIFIC-3				4		6														
144.00 E	A	J JMCS-1							7	8												
144.00 E	A	J SUPERBIRD-C				4		6			11	12	13	14								
144.00 E	A	USA ORION-AP-2									11	12		14								
145.00 E	C	RUS EXPRESS-11				4		6			11			14								
145.00 E	C	URS LOUTCH-10									11			14								
145.00 E	N	URS STATSIONAR-16				4		6														
145.50 E	A	RUS MARAFON-3		1		4		6														
146.00 E	C	J N-SAT-146										12		14								
146.00 E	A	J SUPERBIRD-C2				4		6			11	12	13	14								
148.00 E	C	MLA MEASAT-2				4		6			11			14								
150.00 E	N	J ETS-5		1	2		5	6														
150.00 E	N	J JCSAT-1										C12		C14								
150.00 E	A	J JCSAT-1R				4	5	6				12	13	14								
150.00 E	A	USA MILSTAR-15	0		C2														C20			C*
150.50 E	A	INS PALAPA C4				4		6			11		13	14								
151.00 E	A	PHL AGILA-A3				4		6			11			14								
151.50 E	A	AUS DBSTAR 151.5E				4		6	7													
152.00 E	N	AUS AUSSAT A 152E										12		14								
152.00 E	C	AUS AUSSAT A 152E PAC										12		14								
152.00 E	A	AUS AUSSAT B 152E MOB		1								12		14								
152.00 E	A	AUS AUSSAT B 152E MXL		1								12		14								
152.00 E	A	USA MILSTAR-11	0		C2														C20			C*
152.50 E	A	THA THAICOM-C3				4	5	6			11		13	14								
153.00 E	A	PHL AGILA-A1				4		6			11			14								
153.50 E	A	BLR IK INTERSPUTNIK-153.5E			2	4	5	6				12	13	14								
154.00 E	N	J ETS-6-FS			C2	C4		C6								C17	C18	C19	C20	C*	C*	C43
154.00 E	N	J ETS-6-FSM																	20	*		
154.00 E	N	J ETS-6-I			2																	
154.00 E	C	J ETS-6-IS			2															23	*	43
154.00 E	N	J ETS-6-ISM																		*		
154.00 E	N	J ETS-6-MSS			2																	
154.00 E	N	J JCSAT-2										C12		C14								

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				0	1	2	4	5	6	7	8	11	12	13	14	15	17	18	19	20	>20	>30	>40
154.00 E	A	J	JCSAT-2R				4	5	6				12	13	14								
155.00 E	C	USA	USGCSS PH4 W PAC-1			2														20			44
156.00 E	N	AUS	AUSSAT A 156E										12	13	14					*			
156.00 E	N	AUS	AUSSAT A 156E PAC										12		14								
156.00 E	N	AUS	AUSSAT B 156E										12		14								
156.00 E	N	AUS	AUSSAT B 156E MC										12		14								
156.00 E	C	AUS	AUSSAT B 156E MOB		1								12		14								
156.00 E	C	AUS	AUSSAT B 156E MXL		1								12		14								
156.00 E	N	AUS	AUSSAT B 156E NZ										12		14								
156.00 E	C	AUS	AUSSAT B 156E R		1								12										
156.00 E	N	AUS	AUSSAT B 156E S										12									30	
156.50 E	A	THA	THAICOM-C4				4	5	6			11		13	14								
157.00 E	C	USAIT	INTELSAT5A 157E				4		6			11			14								
157.00 E	A	USAIT	INTELSAT7 157E				4	5	6			11	12	13	14								
157.00 E	A	USAIT	INTELSAT8 157E				4	5	6			11	12	13	14								
158.00 E	N	J	SUPERBIRD-A							7	8		C12		C14		C17	C18	C19		C*		
160.00 E	A	AUS	ACSAT-1							7	8												
160.00 E	N	AUS	AUSSAT A 160E										12	13	14								
160.00 E	N	AUS	AUSSAT A 160E PAC										12		14								
160.00 E	N	AUS	AUSSAT B 160E										12		14								
160.00 E	N	AUS	AUSSAT B 160E MC										12		14								
160.00 E	C	AUS	AUSSAT B 160E MOB		1								12		14								
160.00 E	C	AUS	AUSSAT B 160E MXL		1								12		14								
160.00 E	N	AUS	AUSSAT B 160E NZ										12		14								
160.00 E	C	AUS	AUSSAT B 160E R		1								12										
160.00 E	N	AUS	AUSSAT B 160E S										12										
160.00 E	N	J	GMS-160E	0	1	2																	
161.00 E	A	PHL	AGILA-A2				4		6			11			14								
162.00 E	N	J	SUPERBIRD-B							7	8		C12		C14		17	18	19		*		
164.00 E	A	AUS	ACSAT-2	0						7	8												
164.00 E	N	AUS	AUSSAT A 164E										12	13	14								
164.00 E	N	AUS	AUSSAT A 164E PAC										12		14								
164.00 E	C	AUS	AUSSAT B 164E		1								12		14							30	
164.00 E	C	AUS	AUSSAT B 164E MOB		1								12		14								
164.00 E	C	AUS	AUSSAT B 164E MXL		1								12		14								
166.00 E	N	URS	GOMS-2M	0	1	2	4		6	7	8									20	29		
166.00 E	C	URS	GOMS-2	0	1	2				7	8									20	29		
166.00 E	N	URS	PROGNOZ-6			2																	
166.00 E	C	USA	USASAT-14H				4		6				12		14								
167.00 E	N	RUS	VSSRD-2				C4	C5				11	12	13	14								
167.45 E	A	PNG	PACSTAR A-1		C1			5	6														
167.45 E	C	PNG	PACSTAR-3				4		6				12		14								
169.00 E	C	USA	USASAT-14G				4		6				12		14								
170.00 E	C	USA	USASAT-13M										12		14								
170.75 E	C	TON	TONGASAT C-1				4		6			11	12	13	14								
170.75 E	A	TON	TONGASAT C-1-R				4		6			11	12	13	14								
172.00 E	N	USA	FLTSATCOM W PAC	0						7	8												
172.00 E	N	USA	FLTSATCOM-B WEST PAC																	20			44
172.00 E	N	USA	FLTSATCOM-C W PAC1	C0		2				C7	C8									C20			C*
172.00 E	C	USA	USASAT-14K				4		6				12		14								

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			0	1	2	4	5	6	7	8	11	12	13	14	15	17	18	19	20	>20	>30	>40
174.00 E N	USAIT	INTELSAT5A PAC1				C4		C6			11			14								
174.00 E N	USAIT	INTELSAT7 174E				A4	A5	A6			11	12	A13	A14								
174.00 E A	USAIT	INTELSAT8 174E				C4	C5	C6			C11	C12	13	C14								
175.00 E N	USA	USGCSS PH2 W PAC							7	8												
175.00 E N	USA	USGCSS PH3 W PAC			2				C7	C8												
175.00 E A	USA	USGCSS PH3B W PAC			2				C7	C8												
175.00 E A	USA	USGCSS PH4 W PAC-3			2														20			*
176.50 E N	USA	MARISAT-PAC	0	1		4		6														
177.00 E N	USAIT	INTELSAT5A PAC2				4		6			11			14								
177.00 E N	USAIT	INTELSAT7 177E				A4	A5	A6			11	12	A13	A14								
177.00 E A	USAIT	INTELSAT8 177E				C4	C5	C6			C11	C12	13	C14								
177.50 E A	USA	MILSTAR-14	0		C2														C20			C*
178.00 E N	F ESA	MARECS PAC1	0	1		4		6														
178.00 E C	G INM	INMARSAT2 POR-2		1		4		6														
178.00 E C	G INM	INMARSAT3 POR-2		1		4		6														
179.00 E C	G INM	INMARSAT GSO-1G		1	2	4		6														
179.00 E C	G INM	INMARSAT GSO-2G		1	2	4		6														
179.00 E C	G INM	INMARSAT3 POR-1		1		4		6														
179.50 E C	G INM	INMARSAT2 POR-1		1		4		6														
180.00 E C	USA	USGCSS PH2 W PAC-2							7	8												
180.00 E A	USA	USGCSS PH3 W PAC-2			2				C7	C8												
180.00 E A	USA	USGCSS PH3B W PAC-2			2				7	8												
180.00 E A	USA	USGCSS PH4 W PAC-2			2														20			*
180.00 E N	USAIT	INTELSAT MCS PAC A		C1		C4		C6														
180.00 E N	USAIT	INTELSAT5 PAC3				4		6			11			14								
180.00 E A	USAIT	INTELSAT7 180E				C4	5	C6			C11	C12	13	C14								
180.00 E A	USAIT	INTELSAT8 180E				C4	C5	C6			C11	C12	13	C14								

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4. Studies and standardization in the field of telecommunication

4.1 *Integration of telecommunication satellites in the general network (activities of the Telecommunication Standardization Sector (ITU-T))*

The fixed-satellite and mobile-satellite services, which form part of public service telecommunications, have evolved radically in recent years. Today, the fixed-satellite service is the most widely used of all the space services and, along with the mobile-satellite service, is probably undergoing the most rapid development.

In its studies, ITU-T investigates the integration of telecommunication satellites in the general network. Accordingly, it is studying the use of telecommunication satellites for a whole range of transmissions: telephony, television, teleconference, data transmission, business services, communication between computers, aeronautical mobile and maritime mobile communications, telecommunication services to remote regions, weather forecasting, etc. Where necessary, it also investigates the signalling associated with these various types of information.

As stated in previous ITU reports on Telecommunication and the Peaceful Uses of Outer Space, numerous ITU-T study groups are developing standards, drawing up specifications and contributing to this work.

In telephony, research to improve the quality of communications involving extremely long propagation paths such as satellite communications has achieved satisfactory results, in particular by using adaptable echo cancellers.

In collaboration with the ITU Radiocommunication Sector (ITU-R), studies on the identification of transmission parameters for maritime telephone communication systems by satellite have led to the preparation of Recommendations.

In the context of modern technology, the research conducted on echo suppressors and the Recommendations on echo cancellers specifying the characteristics of non-linear processors have been notable.

A considerable amount of work has been carried out on the integrated services digital network (ISDN), drawing up Recommendations on the concepts and principles of an ISDN, its potential in terms of satellites, its

general features and functions and user/network and inter-network interfaces; here again, careful attention is given to the problems associated with satellite communications. An Intersector Coordination Group (ICG) has in fact been set up to facilitate the coordination of satellite matters.

In order to keep pace with technological development, ITU-T has approved amendments to existing Recommendations and new Recommendations on the ISDN, on interworking and on basic user access, including maintenance aspects. These Recommendations are also of significance for systems employing satellite communications. ITU-T is also currently studying applications of speech presentation in packets and the future wideband ISDN. Studies of digital speech interpolation (DSI) are still mainly concentrated on the collection of data from DSI systems operating on associated media. Those studies have resulted in Recommendations, particularly relating to digital circuit multiplication equipments (DCME) and digital circuit multiplication systems (DCMS) and to 40, 32, 24 and 16 kbit/s differential adaptive pulse coding modulation (DAPCM) and 16 kbit/s speech coding using short delay excited linear predictive coding. New Recommendations in this area have been approved by the World Telecommunication Standardization Conference (Helsinki, March 1993) and other important studies have been started.

With regard to signalling, ITU-T is now in a position to put forward Recommendations on interworking between ITU-T Signalling Systems Nos. 5, 7 and R2 and INMARSAT's Standard B maritime system. ITU-T has also approved Recommendations on the INMARSAT aeronautical mobile-satellite system and interworking between the above-mentioned systems standardized by ITU-T and INMARSAT's aeronautical system (for Signalling System No. 7, also with the Telephone User Part (TUP)). New Recommendations are to be approved shortly (Mobility Services Application Part - MSAP) to provide for all types of mobility for users and user terminal equipments in all mobile networks. ITU-T has also published a Recommendation on maritime mobile telecommunication store-and-forward services (packet mode) via satellite.

New Recommendations have been developed specifying a telephone / ISDN numbering plan and a telex numbering plan for mobile earth stations in systems operated by INMARSAT.

Related new Recommendations defining the selection procedures for subscribers in the public switched telephone network or ISDN and for subscribers in the international telex service calling a ship earth station in the INMARSAT systems have also been developed.

A new Recommendation was developed providing operational guidelines and quality of service requirements for an international point-to-multipoint telecommunication service via satellite which has been recently augmented by another Recommendation providing operational guidance and quality of service requirements for international two-way multipoint telecommunication service via satellite.

New Recommendations have been developed on the service provisions for aeronautical public correspondence supported by mobile-satellite systems and on traffic engineering aspects of mobile networks, including satellite.

Standards have been established for interworking between signalling in the mobile-satellite service and the ISDN/PSTN network, and on an upgrade of ITU-T Signalling System No. 7 to cater for additional mobile service for telephone and non-telephone applications.

In the field of telex and data transmission, studies have been carried out by ITU-T on the use of telecommunication satellites and its impact on operation and on the establishment of tariffs, not only for public services but also for maritime mobile services.

Thus, the procedures applicable to subscribers to a public data network calling ship earth stations in the maritime mobile data transmission service by satellite have been standardized, and the X.350 series Recommendations have defined the procedures for calling subscribers from a mobile data terminating equipment (DTE) by way of packet-switched data transmission services.

4.2 *Technical recommendations for radiocommunications using space techniques (radiocommunication study group activities)*

The radiocommunication study groups are the part of the Radiocommunication Sector of the ITU (ITU-R) responsible for studying technical, operational and regulatory/procedural questions on radiocommunication, for issuing relevant ITU-R Recommendations and for preparing a report to the Conference Preparatory Meeting (CPM). Current ITU-R Recommendations are contained in the Volumes of the first Radiocommunication Assembly (Geneva, 1993). ITU-R Questions are contained in Book 4 (Resolution ITU-R 5) of the first Radiocommunication Assembly. Publications of special interest for space radiocommunications are:

Topic	*Volume (Series)*
Space applications	SA Series (1994)
Radio astronomy	RA Series (1994)
Fixed service using communication satellites	S Series (1994)
Propagation in non-ionized media	PN Series (1994)
Time signals and frequency standards emissions	TF Series (1994)
Mobile-satellite services and radiodetermination-satellite service	M Series-Part 5 (1994)
Amateur-satellite service	M Series-Part 6 (1994)
Frequency sharing between fixed-satellite service and fixed service	SF Series (1994)
Broadcasting-satellite service (sound and television)	BO Series (1994)
Satellite news gathering	SNG Series (1994)
Inter-service sharing and compatibility	IS Series (1994)

The texts are prepared by experts in the field of space communication and are finally approved either by the Assembly or by correspondence. They form the basis for harmonization of the technical development of space radiocommunication systems and contain criteria for the sharing of frequency bands between the various space services and between the space services and terrestrial services.

4.2.1 *Fixed-satellite service (Radiocommunication Study Group 4)*

Twenty-one draft new and revised Recommendations were adopted by Study Group 4 in March 1994 and then approved by correspondence following the procedure of Resolution ITU-R 1. The subjects of these new Recommendations are summarized as follows:

i) Efficient orbit/spectrum utilization: Criteria for sharing between BSS feeder links and GSO/FSS links; pointing accuracy for earthward antennas on board GSO satellites; pfd values to facilitate the application of

Article 14 in Region 2 in relation to the BSS in the 11.7-12.2 GHz band; ways of reducing interference from BSS into FSS in adjacent frequency bands or from one region to another region around 12 GHz; frequency sharing between FSS and radiolocation/radionavigation services in the band 13.75-14 GHz; compatibility between FSS and the space science services in the band 13.75-14 GHz.

ii) System performance, availability and maintenance: Allowable error performance for Hypothetical Reference Digital Path (HRDP) operating at or above the primary rate; utilization of fade countermeasure strategies and techniques.

iii) Frequency sharing between FSS and fixed service: Possible use by space stations in FSS of orbits slightly inclined with respect to the GSO in bands shared with the fixed service.

iv) Satellite news gathering: An automatic transmitter identification system for analogue-modulation transmission for satellite news gathering and outside broadcasts.

In addition to the above-mentioned approved Recommendations, a number of draft new Recommendations were prepared by the various working parties and task groups on the following subjects: frequency sharing between the inter-satellite service and the radionavigation service at 33 GHz; technical criteria to be used in examinations relating to the probability of harmful interference between frequency assignments; digital satellite systems forming part of Synchronous Digital Hierarchy (SDH) transport network; connection of Very Small Aperture Terminals (VSAT) systems with packet-switched public data networks (PSPDN) based on ITU-T Recommendation X.25; carrier-to-interference calculations between earth stations and radio-relay systems.

Study Group 4 carried out intensive preparatory studies for WRC-95 with respect to the feeder links for the mobile-satellite service (MSS). Detailed discussion on the possibility of frequency sharing of non-GSO/MSS feeder links with GSO/FSS links and other non-GSO/MSS feeder links led to the following conclusions:

— forward band (or codirectional) sharing might be difficult in the 6/4 GHz and the 14/11-12 GHz bands, but may be possible in the 30/20 GHz band;

— reverse band (or bidirectional) sharing may be possible in the 6/4 GHz and the 14/11-12 GHz bands, but might not be appropriate in the 30/20 GHz band;

— sharing between two non-GSO/MSS links was considered feasible.

After close examination of the current use of each FSS band including the aeronautical radionavigation service (ARNS) bands, the candidate bands for non-GSO/MSS feeder links were prosposed for further consideration by WRC-95.

4.2.2 *Mobile-satellite services (Radiocommunication Study Group 8)*

The increasing importance of space radiocommunications for various mobile applications is reflected in the growing related activities of Study Group 8 as summarized below:

i) Mobile-satellite service: Studies are being pursued in the traditional area related to geostationary (GSO) satellite systems, where Recommendations were adopted regarding: efficient use of the orbit and spectrum in the 1-3 GHz frequency band; determination of the need for coordination; performance objectives and coordination of aeronautical (R) systems; reference radiation patterns for earth station antennas in land systems; and frequency plans for SCPC systems. Special attention is being paid to applications involving non-GSO systems and new Recommendations were adopted regarding sharing with mobile services below 1 GHz. With regard to Future Public Land Mobile Telecommunication Systems (FPLMTS), new and revised Recommendations were approved relevant to the operation of its satellite component as well as to spectrum considerations on the allocated 2 GHz band. Other general topics continue to be studied and Recommendations were revised relating to the availability of communication circuits and sharing in the 1.6 GHz band with the radioastronomy service. Study Group 8 carried out preparatory studies for the forthcoming World Radiocommunication Conference to deal with mobile-satellite issues.

ii) Radiodetermination-satellite service: The recent deployment of radionavigation space systems resulted in increasing activity for Study Group 8 in this area, in particular concerning sharing involving the Global Positioning System (GPS), where a new Recommendation was adopted.

iii) Amateur-satellite service: New Recommendations were approved concerning future amateur radio systems (FARS); disaster communications; the use of this service in developing countries; and frequency sharing.

In addition to the approved Recommendations mentioned above, the most recent studies by the various working groups of Study Group 8 resulted in draft new Recommendations in the following areas related to space activities:

coordination distances for mobile earth stations below 1GHz; calculation of the affected region for coordination of MSS networks; coordination of MSS networks using code division multiple access; propagation aspects in non-GSO/MSS system design; performance and interference objectives for digital GSO/MSS systems in the 1-3 GHz range; integration of terrestrial and MSS systems; technical characteristics of MSS systems to be used in sharing studies; and the framework for the satellite component of the FPLMTS.

4.2.3 *Science services (Radiocommunication Study Group 7)*

The following ITU-R Recommendations were approved by correspondence in 1994 in the field of space radio systems and radio astronomy:

SA Series

Recommendation ITU-R SA.515-2: "Frequency bands and bandwidths used for satellite passive sensing"

Recommendation ITU-R SA.577-3: "Preferred frequencies and necessary bandwidths for spaceborne active remote sensing"

Recommendation ITU-R SA.516-1: "Feasibility of sharing between active sensors used on Earth exploration and meteorological satellites and the radiolocation service"

Recommendation ITU-R SA.514-2: "Interference criteria for command and data transmission systems operating in the Earth exploration-satellite and meteorological-satellite services"

Recommendation ITU-R SA.363-5: "Space operation systems, frequencies, bandwidths and protection criteria"

Recommendation ITU-R SA.1012: "Preferred frequency bands for deep-space research in the 1-40 GHz range"

Recommendation ITU-R SA.1013: "Preferred frequency bands for deep-space research in the 40-120 GHz range"

Recommendation ITU-R SA.1014: "Telecommunication requirements for manned and unmanned deep-space research"

Recommendation ITU-R SA.1015: "Bandwidth requirements for deep-space research"

Recommendation ITU-R SA.1016: "Sharing considerations relating to deep-space research"

Recommendation ITU-R SA.1017: "Preferred method for calculating link performance in the space research service"

Recommendation ITU-R SA.1028: "Performance criteria for satellite passive remote sensing"

Recommendation ITU-R SA.1029: "Interference criteria for satellite passive remote sensing"

Recommendation ITU-R SA.1020: "Hypothetical reference system for the Earth exploration-satellite and meteorological-satellite services"

Recommendation ITU-R SA.1021: "Methodology for determining performance objectives for systems in the Earth exploration-satellite and meteorological-satellite services"

Recommendation ITU-R SA.1022: "Methodology for determining interference criteria for systems in the Earth exploration-satellite and meteorological-satellite services"

Recommendation ITU-R SA.1025: "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"

Recommendation ITU-R SA.1026: "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"

Recommendation ITU-R SA.1023: "Methodology for determining sharing and coordination criteria for systems in the Earth exploration-satellite and meteorological-satellite services"

Recommendation ITU-R SA.1024: "Necessary bandwidths and preferred frequency bands for data transmission for Earth exploration satellites (not including meteorological satellites)"

Recommendation ITU-R SA.1031: "Telecommunication requirements of satellite systems for geodesy and geodynamics"

Recommendation ITU-R SA.1027: "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"

Recommendation ITU-R SA.1018: "Hypothetical reference system for systems comprising data relay satellites in the Geostationary Orbit and user spacecraft in Low-Earth Orbits"

Recommendation ITU-R SA.1019: "Preferred frequency bands and transmission directions for data relay satellite systems"

Recommendation ITU-R SA.1071: "Use of the 13.75 - 14.0 GHz band by the space science services and the fixed-satellite service".

RA Series

Recommendation ITU-R RA.1031: "Protection of the radio astronomy service in frequency bands shared with other services".

Task Group 7/2 and Working Parties 7A, 7B, 7C and 7D of Study Group 7 met in Geneva in the period from 31 October to 10 November 1994. In addition to developing a number of draft new or revised ITU-R Recommendations on time signal transfer via satellite (2), space radio systems (16) and radio astronomy (4), Working Party 7B has prepared a report on power limits for earth stations in the space science services near 2 GHz, as part of a draft Conference Preparatory Meeting (CPM) report to the 1995 World Radiocommunication Conference (Agenda item 2.2).

4.2.4 *Broadcasting-satellite service (sound and television) (Radiocommunication Study Groups 10 and 11)*

Satellite broadcasting is dealt with by Working Party 10-11S, which reports to Radiocommunication Study Group 11 on satellite television broadcasting and to Study Group 10 on satellite sound broadcasting. WP 10-11S held a special meeting in Geneva in November 1994 mainly devoted to the matters assigned to it from WARC-92. The main results are as follows:

a) Recommendation ITU-R BO.1130 was modified to recommend a single worldwide system for satellite digital sound broadcasting. This Recommendation has been produced within the framework of WARC-92 Resolution No. 522

b) Recommendation ITU-R BO.789 was also modified to clearly specify the service requirements for satellite digital sound broadcasting

c) A draft new Recommendation was produced on the reference receiving earth station antenna patterns to be used for replanning purposes in the revision of the WARC-77 BSS Plans for Regions 1 and 3

d) A draft new Report was prepared on work towards a Recommendation on the review of the BSS frequency Plans for Region 1 (11.7-12.5 GHz) and Region 3 (11.7-12.2 GHz) and associated Feeder Link Plans as contained in Appendices 30 and 30A of the Radio Regulations

e) A report to the Conference Preparatory Meeting was also produced (Items c, d and e are in response to Resolution No. 524 of WARC-92)

f) A new draft Recommendation was prepared on digital multiprogramme television satellite broadcasting systems

g) A revision was made of the recommended procedures to calculate interference to BSS in the geostationary orbit.

All the above new or revised draft Recommendations will be submitted for approval to the next meeting of ITU-R Study Groups 10 and 11 in June 1995.

Finally, a special publication on satellite sound broadcasting was finalized. It deals with state-of-the-art technical information on such systems, including operational, planning and implementation procedures. This publication represents the most integrated source of information on the subject and will be available in early 1995.

5. Technical cooperation activities of the BDT

Within the framework of the Telecommunication Development Bureau (BDT), the ITU provides technical assistance to countries on space communications projects at both national and regional levels.

SPACECOM

In 1994, the BDT held its first World Telecommunication Development Conference, at which the Buenos Aires Action Plan for the Global Development of Telecommunications (BAAP) was adopted for the Development Sector (ITU-D). The BAAP makes telecommunications a principal driving force to achieve sustainable development. The Action Plan consists of 12 programmes which include, inter alia, policies, strategies and financing; integrated rural development; network planning; telematics, etc.

Within the scope of the BAAP, the BDT launched this year an inter-regional project called Space Communications Technology Applications (SPACECOM). SPACECOM was developed in association with industry as a means of furthering infrastructure and service development in developing countries, particularly in rural and remote areas, by using space communications

technology. The project participants include ITU-D members; sponsors who commit resources to the project; developing countries and user communities; regional organizations; manufacturers of earth station equipment; and space segment providers. As of November 1994, the project had a total of 17 sponsors.

The objectives of the SPACECOM project are to

— create a greater awareness on the part of developing countries of the potential benefits of space communications technology so as to enable them to establish a favourable commercial and regulatory environment;

— provide industry with a realistic assessment of needs in developing countries so that it can develop and market products which respond to those needs;

— develop and discuss suitable alternative technical and economic solutions that best respond to developing countries' needs, by helping them to select the most operational and economical media and to make the most efficient use of and derive maximum benefit from space communications technologies.

The SPACECOM project will examine the underlying constraints which hamper the improvement or development of telecommunication infrastructure and services, the most problematical of which is regulatory. The project is divided into three phases. The first phase will review the current state of the industry, future trends, and potential applications. Phase II will look at technical and economic/financial considerations, regulatory/policy issues, and implementation considerations. Phase III will consist of workshops and seminars for developing countries, the preparation of pilot projects and a final report and recommendations.

The project will produce a market assessment of the demand for space communications technology in developing countries for the short and long term, and more importantly, will provide some guidelines to assist developing countries and their development partners to exploit the potential of space technology for development.

SPACECOM is an ITU initiative to join hands with the space communications industry so as to improve and/or extend telecommunication infrastructure and services to underserved regions in several of its Member countries. It is a major step forward in closing the gap between the "haves" and the "have-nots" and in achieving sustainable development.

RASCOM

The Regional African Satellite Communication System (RASCOM) organization is now established with its headquarters in Abidjan (Côte d'Ivoire). Forty African countries have signed the Convention and 35 have signed the operating agreements. The organization has already started its operations by pooling transponders used by African countries in the INTELSAT system. An agreement was signed in April 1994 between RASCOM and INTELSAT. RASCOM has decided to use a single satellite for all African operational leases and RASCOM's future space segment requirements. INTELSAT's 804 satellite (338.5 degrees East longitude) is targeted for this purpose. The satellite is scheduled to be launched in 1996.

6. Activities of TELECOM concerned with space matters

The TELECOM unit of the ITU is responsible for the organization – on a quadrennial basis – of the World Telecommunication Exhibition and Forum event, TELECOM, as well as similar regional events in the Americas and on the Asian and African continents. The most recent regional event was held in Cairo, Egypt, in April 1994.

TELECOM has eagerly encouraged the participation of international space agencies such as INTELSAT, INMARSAT, COMSAT, EUTELSAT and PANAMSAT both in the exhibitions and the conference events. In particular, papers have been included in the technical sessions on a regular basis on the ever-increasing uses of outer space, e.g. communication satellites, remote sensing, mobile and navigational aids, as well as direct satellite broadcasting to rural and underdeveloped areas of the world.

Preparations are now well under way for TELECOM-95, the Seventh World Exhibition and Forum; the Forum programme consists of the Strategies Summit and the Technology Summit and will be published in the Spring of 1995.

7. Information and documentation activities

In pursuance of Council Resolutions Nos. 636 and 637, the General Secretariat has continued the dissemination of information on the activities and role of the ITU in space telecommunications.

Ten times a year, the ITU Newsletter publishes a list of artificial satellites launched in the previous weeks as well as articles and information regarding space techniques, telecommunications and launching devices.

A recapitulatory list of artificial satellites launched in 1993 was published as an annex to issue No. 6 of the ITU Newsletter (June 1994). This was prepared from information supplied by the Members of the Union, the Radiocommunication Bureau (BR), the Committee on Space Research (COSPAR), national space research organizations and the specialized press.

8. Cooperation with other international organizations concerned with space matters

8.1 *General*

In 1994, the ITU has continued to maintain and strengthen its cooperation with the relevant international organizations dealing with space matters, namely COSPAR, EUTELSAT, INTELSAT, INMARSAT, etc. Close collaboration has been maintained with the United Nations Office for Outer Space Affairs in Vienna. ITU has been active in making submissions to the Ad Hoc Inter-Agency Meeting on Outer Space Activities, as well as to the Draft Report of the United Nations Secretary-General on Programmes of Work for 1995 and 1996 and Future Years.

In the area of space telecommunications, the Union continues to collaborate with the specialized agencies concerned, such as the International Civil Aviation Organization (ICAO), the International Maritime Organization (IMO), the World Meteorological Organization (WMO), and the United Nations Educational, Scientific and Cultural Organization (UNESCO), as well as intergovernmental regional organizations.

8.2 *Participation of the ITU in the meeting of the United Nations Space Applications Programme*

During the Ad-Hoc Inter-Agency Meeting on Outer Space Activities which was held in Vienna from 3 to 5 October 1994, the following specific questions were considered:

— Implementation of the recommendations of the second United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE-2) and review of preparations for the next conference (UNISPACE-3)

— Coordination of plans and programmes and exchange of views on current activities in the practical applications of space technology and related areas

— Discussion of current and future plans of common interest, including consideration of the actual activities of United Nations organizations in the area of space science and technology and its applications as they relate to their mandated programmes

— Consideration of matters to be included in the integrated report of the Secretary-General on the programme of work of United Nations organizations

— In-depth review of the cooperation of organizations in the United Nations system in remote sensing activities and related geographic information systems activities

— Remote-sensing data policy for requirements of the organizations of the United Nations system

— Coordination of follow-up activities of the organizations of the United Nations system on International Space Year 1992.

The inter-agency meeting considered and approved a draft Report entitled "Coordination of outer space activities within the United Nations system: Programmes of work for 1995 and 1996 and future years".

ANNEX

Reports on progress made in the development of space communications

8.2 *Participation of the ITU in the meeting of the United Nations Space Applications Programmes*

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CAMEROON (REPUBLIC OF)

1. INTELSAT

— Participation in various INTELSAT activities in 1994.

— Implementation of IDR at the Zamengoé (Yaoundé) earth station for links with France and at the Bépanda (Douala) earth station for links with France, the United Kingdom and the United States.

— Digitization of the international transit telephone centre (ITC) in Yaoundé.

— Installation of new power supply units with multiple failsafe systems in Yaoundé and Zamengoé.

2. INMARSAT

— Participation in various INMARSAT activities in 1994.

— Pilot project for the installation of Inmarsat-M terminals as public telephone booths in four rural localities.

— Project for study of possible harmful interference between terrestrial services and the INMARSAT system in the 2 GHz band.

— Installation of Inmarsat-A, M and C terminals for users.

3. RASCOM

— Participation in various RASCOM activities.

4. Broadcasting

— National regulations governing private broadcasting, including via satellite, currently under preparation.

CANADA

1. Fixed-Satellite services (International)

In 1994, Canada's international carrier Teleglobe was engaged in establishing new earth station facilities to provide a range of services through the Intelsat, Intersputnik and the Panamsat space stations. These facilities included earth stations at Des Laurentides, operating at 'C' and 'Ku' bands for accessing the Intersputnik and the Panamsat satellite networks for video and PSTN services. An additional C-band earth station was installed at Lake Cowichan to access the Intelsat space segment for services to the Pacific Ocean Region (POR). This location allows access to Intelsat satellites over both the Atlantic and the Pacific Ocean regions. The earth station allows Teleglobe to augment its transit capability for traffic between the Atlantic and the Pacific Ocean regions as well as to provide diversity routing for increased Pacific traffic. Teleglobe has entered into several joint ventures with international carriers, with the aim of increasing its international traffic. Earth stations were installed in Malaysia and existing facilities in Ukraine were upgraded to carry digital traffic. Teleglobe continues to provide assistance to carriers in Moldova and Bellarus where facilities were installed previous years.

Canadian domestic satellite communications have been provided by the Anik satellites which are owned and operated by Telesat Canada. The Telesat space fleet comprises two generations of systems. The new generation of Anik E satellites consists of Anik E-1 and E-2 satellites, both launched in1991. The Anik E satellites are dual-band C (6/4)/Ku (14/12) design. These fixed-satellite service systems provide transmission of voice, video (including subscription television) in both digital and analogue formats and data signals within Canada. The previous generation of Anik satellites consists of Anik D (6/4 GHz band) and Anik C (14/12 GHz band) satellites.

2. Mobile-Satellite services

In 1994 Teleglobe implemented the Inmarsat M/B service which provides mobile voice and data communications to a wide range of land and maritime terminals, including the popular briefcase and vehicle-mounted types that

function like cellular phones. The service is expected to be extended to pleasure craft and small vessels. This Teleglobe service forms part of Project Condominium which provides a single point of access for Global coverage to both ocean regions. Teleglobe and Orbital Science Corporation continued preparations for the implementation of the ORBCOMM system. The system is designed to provide global two-way digital data communication services using a constellation of 26 small satellites in low earth orbit. ORBCOMM will be well-positioned to provide low-cost global mobile services, which include applications such as paging, emergency roadside communications, industrial and agriculture remote asset monitoring, and electronic mail. The first satellites will be launched early in 1995, with commercial service available by year-end 1995. Teleglobe and TRW entered into a joint venture to build and operate the TWR developed Odyssey personal communications satellite system. The 12 satellite system, scheduled to begin operation in 1999 will be capable of providing personal voice, facsimile and paging services to subscribers worldwide. The system will make it possible for a caller, using only a pocket telephone, to reach any other telephone worldwide. The Odyssey satellites, located at medium earth orbit of about 10 000 kilometres, will provide coverage for the earth's land masses and keep users "in sight" of two satellites at all times.

In 1979, the Canadian Department of Communications (now called Industry Canada) and Telesat Canada began studying and planning a commercial mobile satellite system (MSAT). In June 1993, TMI Communications, a BCE business, was established as the successor to Telesat Mobile Inc. to plan for and implement MSAT services. MSAT will provide economical voice and data communications via land vehicle, ships, aircraft and transportable terminals. The MSAT spacecraft is currently undergoing integration and testing at the David Florida Laboratory in Ottawa, Canada, to be ready for launch in 1995 with commercial service starting in mid-1995.

3. The COSPAS-SARSAT Programme

In 1988, Canada, France, the United States of America and the former Union of Soviet Socialist Republics signed the International COSPAS-SARSAT Programme Agreement. The system itself was initiated in 1979 by agencies

of the signatories to the Agreement. It uses space-borne equipment and associated ground stations to detect and locate emergency radio beacons operating on the frequencies 121.5, 243 and 406 MHz. The four initial States have since been joined in the programme by other States throughout the world operating earth stations which extend the geographical coverage of the system.

4. RADARSAT

RADARSAT is a Canadian-led cooperative programme with the United States of America, to launch and operate a remote sensing satellite. The spacecraft is scheduled for launch into a sunsynchronous polar orbit in early 1995. The objective of the RADARSAT programme is to generate data of both applications and research value related to global ice, oceans, renewable and non-renewable resources.

5. Cooperative International Space Activities

The Canadian Space Agency (CSA) is involved primarily with two partners, namely the National Aeronautical Space Administration (NASA) of the United States of America and the European Space Agency (ESA) in cooperative international space activities. Its programmes with United States include the MSAT and RADARSAT programmes and a mobile servicing system programme for the proposed space station. Other cooperative activities include the astronaut programme and the space sciences programme. Canada participates in ESA programmes in the area of satellite communications, namely, Payload and Spacecraft Development and Experimentation (PSD), Data Relay and Technology Mission (DRTM), Advanced Systems and Technology Programmes and Advanced Research in Telecommunication Systems (ARTES). Some other programmes include the European Remote Sensing Programmes ERS-1 and ERS-2, the Earth Observation Preparatory Programme (EOPP), the First Environmental Polar Platform Mission (ENVISAT), and the Manneed Space Transportation Programme (MSTP).

CYPRUS (REPUBLIC OF)

Satellite links carry a significant portion of international communications between Cyprus and the rest of the world. A number of earth stations link the island with Intelsat satellites in the Atlantic and Indian Ocean regions, and with Eutelsat satellites. Other earth stations have access to Russian and Arabsat satellites. In 1994, the number of circuits via satellite increased to approximately twelve hundred. The satellite links, coupled with five submarine fibre optic cable systems, offer a flexible and reliable international network which provides access to 224 countries around the world. During the past year, the Cyprus Telecommunications Authority (CYTA) expanded its activities in the area of space communications significantly. Additional earth stations have been installed, and the capabilities of existing earth stations upgraded in order to enhance performance and meet increased needs.

A Russian satellite earth station, with an antenna diameter of 4.8 m, was installed and commenced operation in March 1994, under an agreement between the Governments of Cyprus and the Russian Federation for the development of telecommunication services between the two countries. This station is pointed at a Russian Raduga satellite at 45° E, providing a 2 Mbit/s IDR link which, in conjunction with LRE, offers 60 PSTN circuits and video-conferencing facilites between Cyprus and Russia. A larger Russian earth station with a 7 m antenna was also installed and tested in December 1994. This station will be used for the establishment of a 2 Mbit/s link between special customers in Moscow and Cyprus via the same Raduga satellite. Commencement of operation is scheduled for January 1995.

The Authority made significant efforts in 1994 to expand its capabilities for providing television, restoration and other services using satellite communications. For this reason, in addition to the Makarios earth station site, a new earth station site was established. Two new satellite earth stations were installed and tested at the new site in 1994. The first is a 15.5 m Intelsat Revised Standard A earth station and the second is a 7 m Eutelsat Standard L earth station.

The Authority is committed to improving the quality of its service and is constantly upgrading its equipment in order to achieve this goal. Conversion of analogue circuits (FDM/FM) to digital (IDR of TDMA) continued in

1994. In addition, the introduction of circuit multiplication equipment, both DCME and LRE, was implemented at an increased rate and has resulted in significant satellite bandwidth and cost savings.

Space communications are an expanding sector of CYTA's activities and make an important contribution to the Authority's vision of making Cyprus a telecommunications hub in the eastern Mediterranean region, and one of the best radiocommunication centres in the world.

DENMARK

Nordic activities in the field of satellite telecommunications

(See also under Finland, Iceland and Norway)

INTELSAT

In 1994, the earth station using SS-TDMA and IDR traffic via Intelsat 604 at 60° E for destinations in the Indian Ocean (IOR) region was expanded with new third-generation IDR modems to open direct telephone traffic for new destinations.

In order to meet the demands for traffic growth in the IOR region, Telecom Denmark decided to construct an earth station for Intelsat 704 at 66° E. The station will be an Intelsat Standard A IDR earth station with a 16 m antenna. The supplier was selected in August 1994 and the earth station will be ready for service as from 1 June 1995.

A domestic system for traffic to the oil and gas production platforms in the North Sea has been modernized. The old analogue C-band has been replaced by a customer-located Ku-band digital system.

EUTELSAT

In 1994, the TDMA earth station in Copenhagen expanded its traffic with additional circuits to Poland, Ireland, Romania and Turkey. Various ad hoc and regular TV feeder links have been set up throughout the year from the Eutelsat earth station complex near Copenhagen.

Other systems

At the end of June 1994, Telecom Denmark established a satellite news gathering service with a 1.5 m mobile TV uplink earth station. During the following six months more than fifty TV transmissions were carried out, primarily for Danish broadcasters.

FINLAND

Nordic activities in the field of satellite telecommunications

(See also under Denmark, Iceland and Norway)

1. Telecom Finland is a signatory of the EUTELSAT, INTELSAT and INMARSAT organizations.

Telecom Finland routes part of its international telephony traffic via the Tanum Teleport in Sweden, with joint ownership of the station, and under joint Nordic use via the Aagesta earth station, also in Sweden.

Telecom Finland uses the Inmarsat (A, B and Aero) land earth stations in Eik (Norway), also jointly owned by the Nordic countries.

2. EUTELSAT

Since 1991 Telecom Finland has operated a dedicated television earth station in Helsinki, mainly used for access to the EBU network and also for occasional television transmissions. The station is also used for the uplink of television transmissions originating from the Baltic countries and Russia.

Since 1986, another earth station in Helsinki has been used for Eutelsat/SMS (satellite multiservice system) traffic, i.e. data services and videoconferencing.

Small dedicated customer terminals and transportable SNG stations have been used for business services and outside broadcasting.

Several VSAT terminals have been installed and operated by Telecom Finland at various sites in cooperation with foreign service providers.

3. Other activities

A C-band earth station has been in operation in Porvoo, some fifty kilometres east of Helsinki. The station is used as a gateway for traffic originating from various sites in CIS countries.

Some digital transponder capacity in the Tele-X satellite has been used by Telecom Finland, the Technical Research Centre of Finland and universities for service development and demonstration purposes. Tele-X is also used for transportable TV-uplink services on a regular basis.

Numerous international television programmes distributed via various satellite systems (Eutelsat, Astra, Intelsat, Tele-X, etc) have been monitored by cable network operators as well as private homes using TVRO terminals. No licensing is required in Finland.

GERMANY (FEDERAL REPUBLIC OF)

1. Earth segment facilites

In mid-1994 the fourth Standard A antenna system was brought into operation at the Fuchsstadt earth station.

The new antenna system is intended for Intelsat-based telephone and data services via a satellite positioned at 66° E (Indian Ocean).

The extension work was necessary because a space segment shortage had become apparent on the satellites previously used in the region.

The Inmarsat earth station (LES) in Raisting currently offers Inmarsat-A and C services in the eastern Atlantic region. Furthermore, Raisting LES has facilities for Inmarsat system E, which automatically routes nautical emergency calls to the shipwreck rescue enterprise *Gesellschaft zur Rettung Schiffbrüchiger* (MRCC Bremen).

In 1994 work was begun on setting up a second antenna and the technical facilities for using the Indian Ocean region. Furthermore, the technical prerequisites are being fulfilled for extending the range of services to the eastern Atlantic region. This expansion work will be completed in mid-1995.

Raisting LES will then be able to provide Inmarsat services A, C, B and M to the eastern Atlantic and the Indian Ocean.

It is also planned to bring the Inmarsat E system into service for the Indian Ocean at the same time.

2. Research in the field of satellite radio services

2.1 *Propagation tests*

In 1994 Deutsche Telekom AG's research centre started propagation tests with the 20 and 40 GHz beacons of the Italsat satellite and continued radiometer measurements at 20 and 30 GHz.

As a result, the propagation data acquired by Olympus can be further statistically secured, at least for 20 GHz. As far as interpretation of the 40 GHz results is concerned, it has been shown that radiometer measurements are imperative as only they allow a breakdown into water-vapour and liquid water attenuation.

The assessment of water-vapour attenuation for various locations in Germany (Baltic coast, Berlin, Darmstadt, Erzgebirge) shows no dramatic difference, while the liquid water attenuation from clouds and rain is different in the various locations.

For the operation of systems with extremely low reserves (up to 2 dB at 30 GHz) this means that regional differences can be ignored.

2.2 *Studies with orbiting satellites*

In order to prepare future systems with orbiting satellites, the German Aerospace Research Establisment (Deutsche Forschungsanstalt für Luft- und Raumfahrt - DLR) carried out comprehensive measurements and field trials on behalf of the international satellite organization INMARSAT and ESA.

The studies concerned the Inmarsat P project and the ESA Archimedes programme. They covered interference measurements at 1.5 GHz, 2.2 GHz and 2.5 GHz as well as recording and modelling narrowband and broadband channels for the land mobile-satellite channel; in this connection signal generators in DLR aircraft were used.

DLR carried out a field trial with two aircraft to test satellite diversity for the Inmarsat P project.

DLR contributed the system parameters for the mobile communications system and the audio broadcasting system for the phase A study of the Archimedes project.

3. Radioastromony service

The Effelsberg radio telescope was part of the global network set up to observe collision of the debris of the Shoemaker-Levi 9 comet with Jupiter.

Observations at 6 and 11 cm wavelengths revealed an increase of the radiation flux-density of some 15%. Over the following six weeks the decay of the radiation excess was to be observed. The surprising result was a further increase of the synchrotron part of the radiation continuum by some 25%.

Within the context of pulsar research, polarized pulsar rays were proven at 32 GHz. Full polarization characteristics were measured at 10.7 GHz (all four Stokes parameters, the first time at this high frequency).

4. Satellite broadcasting services

TV-SAT 2, 19° W

The use of the TV-SAT 2 satellite to transmit programmes of the cultural television channel 3Sat jointly operated by ARD, ZDF, ORF and SRG (DRS) in the D2-MAC format ceased at the end of 1994.

DSF-Kopernikus (23.5° E)

Seven sound-broadcasting programmes of the public service broadcasters continue to be transmitted via the DFS-Kopernikus 1 (FM3) satellite. Occasionally, the satellite is also used for SNG transmissions. Another trial use is to feed DAB programmes to the terrestrial pilot DAB transmitters. The beacon signals of the satellite in the 12 and 20 GHz band are assessed at the Institute for Broadcasting Technology in Munich for scientific studies of the propagation behaviour of satellite signals.

Astra (19.2° E)

The Astra satellite system is used by the public service broadcasters both for television channels and for sound broadcasting. The television channels, whose programmes are transmitted in PAL, are the first German television channel, the second German television channel, 3Sat, which is produced by ZDF, ARD, ORF and SRG (DRS), and other television channels produced by the state broadcasting corporations. Subcarriers are used for the analogue (Wegener-Panda) and trial digital (Astra Digital Radio) transmission of sound broadcasting via transponders carrying television channels. Some

broadcasters have their own earth stations with mirror diameters of up to 9 m for the uplink. The uplink for the first German television channel is achieved by means of a 9 m station at Hessischer Rundfunk in Frankfurt.

Eutelsat II-F1 (13° E)

Deutsche Welle broadcasts a television channel in PAL and sound broadcasting according to the analogue Wegener-Panda method daily throughout Europe from 7.00 pm to 6.00 am (UTC) via the Eutelsat II-F1, transponder 27, satellite.

With more television and radio providers from 13° E on future Eutelsat satellites, there will be a second attractive orbit position next to the position 19° E for direct reception, feeding into the cable network and retransmission. The development of receivers with dual systems means that all satellites from 13° E to 19° E can be received, thus already providing the widest range of television and radio programmes in the world that can be received with a single satellite receiver antenna.

Eutelsat II-F4-M (7° E)

The Eutelsat II-F4-M satellite is used for Eurovision recordings (uplink 1 + 1, 14 GHz, downlink 4 + 1, 11 GHz, TV analogue SIS) and Euroradio recordings (uplink 1 + 1, 14 GHz, radio digital 2 Mbit/s, downlink 11 GHz) in the area of the European Broadcasting Union.

Intelsat K (21.5° W)

Deutsche Welle uses the Intelsat K satellite to supply a television channel and several sound programmes to parts of North, Central and South America.

Satcom C-4 (135° W)

Deutsche Welle uses the Satcom C-4 satellite to supply a television channel and several sound programmes to North America and the Caribbean.

Intelsat VI-F1 (27.5° W)

Hessischer Rundfunk receives TTC recordings (Transatlantic Television Channels) on behalf of the European Broadcasting Union on the Intelsat VI-F1 satellite (downlink 1 + 1, 11 GHz, TV digital 2 × 17 Mbit/s).

Orion F1

RTL Television and Orion Atlantic have concluded an agreement on the use of satellite capacity on Orion F1. Under the name Newsfeed, a VSAT network is currently being set up which will connect all the outside studios with the head office in Cologne via Orion F1. News reports are broadcast, digitally compressed, in the MPEG2 standard. Furthermore, the RTL studios in New York are also linked via Orion F1, once again in digitally compressed form.

MPEG transmissions

RTL Television is the first German programme provider to use MPEG digital technology to disseminate its regional programmes. In cooperation with Deutsche Telekom AG, regional programmes are fed to the head ends and terrestrial transmitters via the DFS2 satellite in the Vidisat project. Thanks to the high data compression, it is now possible to carry five channels at the same time over one transponder. The bit rate used is 8.448 Mbit/s.

Other satellites

For SNG (satellite news gathering), the German public service broadcasters use various satellites, depending on availability, including the above-mentioned satellite systems Eutelsat II-F4-M and DSF-Kopernikus.

RTL Television has increased the number of its own SNG transmissions. In 1994, RTL Television broadcast some 450 hours of SNG programmes on its four stations.

5. Other satellite services

In 1994, Satcon GmbH in Teltow conceived completely new satellite technology applications for security against theft and the tracing and control of mobile objects on the basis of a future LEO system called "Courier", in addition to worlwide telephony. The system, which can be used in diverse ways, is particularly suitable for first aid at the scene of accidents and for breakdown services. Satcon GmbH will offer these services as of 1996. The project is possible because the results of former military branches of Russian aerospace can now be used for civil purposes.

The following frequencies have been registered with the ITU: 1 610-1 626 MHz for the uplink and 2 483-2 500 MHz for the downlink.

Spaceline Communications Services GmbH, the second largest satellite service provider in Europe, is a subsidiary of Thyssen Telecom AG, with shares also held by the Itochu Corporation and Electronic Data Systems. Spaceline offers comprehensive Europe-wide satellite-based telecommunication services, including point-to-point links, star-shaped networks, audio, data or software distribution as well as broadcasting and video services.

The highlight of the year for Spaceline was the successful realization of one of Europe's largest interactive VSAT networks of over 530 locations for Elf Oil AG.

ICELAND

Nordic activities in the field of satellite telecommunications

(See also under Denmark, Finland and Norway)

1. INTELSAT

The Intelsat Standard A earth station Skyggnir has been in operation since October 1980.

During 1994, Skyggnir 1A carried traffic and leased circuits via the Intelsat VI (F5) satellite at 335.5° E to and from Tanum in Sweden, Nittedal in Norway, Goonhilly in the United Kingdom, Fuchsstadt in Germany, Bercenay in France, Buitrago in Spain, Etam, Shenandoah and Mt. Jackson in the United States and Mill Village in Canada. Most of the circuits are type

IDR/DCMS. Towards the end of the year, some circuits were transferred from satellite to the new submarine cable, Cantat-3. At the end of 1994, the total number of international circuits routed via Skyggnir was approximately four hundred.

A 13 m Standard B antenna, Skyggnir 2B, has been in operation since 1983. The antenna is normally used for television reception only (B-MAC) and accesses a leased television channel on Intelsat VII (F2) at 359° E. This antenna also has transmission capabilities.

Occasional television programmes were transmitted from Skyggnir or received on a number of occasions during 1994.

A daily full-time news programme was received with a TVRO via the Intelsat VI (F4) satellite at 332.5° E for distribution to hotels in Reykjavik.

A 16 m Standard A earth station, in the town of Höfn on the south-east coast of Iceland, was used as a hot standby for the digital services normally carried by Skyggnir 1A. It was used in this capacity on several occasions during 1994. At the end of the year, the station was being modified for use as a restoration facility for the Cantat-3 cable circuits, via the Intelsat satellite at 310° E.

A 10 m Standard B earth station in the town of Keflavik has been in operation since October 1992 and carries IBS traffic between Iceland and the United States.

An 11 m Standard B earth station at the Skyggnir site, Skyggnir 3B, was used to carry leased circuits between the air traffic control centre in Reykjavik and Søndre Strømfjord and Ammassalik in Greenland.

2. EUTELSAT

Iceland has been a member of EUTELSAT since August 1985.

A 6 m SMS earth station at the Skyggnir site carries leased circuits between the air traffic control centre in Reykjavik and the Faroe Islands.

During 1994, a number of small TVRO antennas were used to receive news and television programmes via Eutelsat satellites for distribution to television stations and to hotels in Reykjavik. Two Rx/Tx VSAT terminals for exchange of financial data were installed in Reykjavik.

A 13 m earth station in Reykjavik was used to receive daily Eurovision transmissions via the EBU transponders on Eutelsat II (F4) at 7° E. Transmission capability was added in 1994.

A 7.7 m TVRO at Skyggnir was used to receive daily newsfeed via Eutelsat I (F5) at 13° E, for a private television station in Reykjavik.

In addition, numerous private antennas were in use by individuals for the reception of television programmes via telecommunication satellites.

3. INMARSAT

Iceland is a member of INMARSAT and makes use of the land earth stations in Eik (Norway) and Blavand (Denmark). An Inmarsat A terminal in Reykjavik is used as an emergency back-up for international air traffic control circuits.

INDIA (REPUBLIC OF)

1. Indian national satellite system (INSAT)

1.1 INSAT is a joint venture of the Department of Space, the Department of Telecommunications, the Indian Meteorological Department and the Ministry of Information and Broadcasting, four agencies of the Government of India. The last satellite of the first-generation Insat series, Insat 1-D launched in June 1990, is currently operational.

1.1.1 The second-generation Insat 2 satellites were built in India by the Indian Space Research Organization (ISRO). The first two Insat 2 satellites were launched in 1992 and 1993 from Kourou by the Ariane launch vehicle and are being used extensively.

1.2 *Insat 2 spacecraft configuration*

Insat 2 carries 20 transponders – twelve in C-band, six in extended C-band (4 500-4 800 MHz/6 725-7 025 MHz) and two in S-band – and a very high resolution radiometer with 2 km resolution in the visible band and 8 km resolution in the infrared band. A data transponder providing instantaneous alert capability for search and rescue missions operates at 406 MHz (uplink) and in extended C-band (downlink). Insat 2 is the first system in the world to use the extended C-band in accordance with the Allotment Plan of the World Administrative Radio Conference on the Use of the Geostationary-Satellite Orbit and the Space Services Utilizing It (ORB-88).

1.3 *Services provided by Insat 2*

1.3.1 Like Insat 1, Insat 2 is also a multipurpose satellite and provides the following services:

— long-distance telecommunications (telephony, data, facsimile, etc.);
— round-the-clock meteorological earth observation and data relay;
— direct TV broadcasting to augment community TV reception in rural areas;
— national and regional network of television and radio transmitters, received by tens of thousands of TVROs throughout the country;
— dedicated communication networks for the business and industrial sectors including VSAT networks; services provided by the private sector, public sector and government agencies;
— dedicated VSAT-based data networks for management information for government from districts and at block level, provided by the government agency National Informatics Centre;
— satellite news gathering, teletext and data services;
— disaster warning system (DWS) for alerts on cyclic events;
— satellite-aided search and rescue services.

1.3.2 Apart from the above, several new satellite communication application experiments and demonstrations using interactive satellite-based communication systems for development, training and continuing education have been successfully conducted using Insat. These include imparting training and continuing education to adult education instructors, the University Grants Commission's countrywide classroom viewers, industrial workers, engineering and management students, open university students/counsellors, agricultural workers and farmers. The follow-on Insat 2 series satellites will carry Ku-band transponders and MSS payload in the 2 670-2 690/2 500-2 520 MHz bands. These satellites are being built in India and are slated for launch in 1995 and 1996 respectively.

1.3.3 The ground segment for the telecommunication set-up consists of about 167 earth stations, besides earth stations for uplinking facilities for broadcasting, meteorology and VSAT-based network.

2. Indian remote sensing satellites

2.1 The two Indian remote sensing satellites, IRS 1-A launched in 1988 and IRS 1-B launched in 1991, are providing data regularly. IRA 1-A and 1B provide imagery from the two linear imaging self-scanning cameras: LISS I with a resolution of 72.5 m, and LISS II-A and LISS II-B with a resolution of 36.25 m. LISS I provides a swath of 118 km, while the composite swath of LISS II-A and LISS II-B is 145 km. The cameras operate in four spectral bands in the range of 0.45 to 0.86 micrometres.

2.2 The third satellite in the IRS series, IRS P-2, was launched in October 1994 from Sriharikota, India. IRS P-2 was built in India and launched by the Indian polar satellite launch vehicle PSLV D-2. IRS P-2 provides LISS II data with an improved resolution of 32 m and a swath of about 148 km.

2.3 The three satellites are together providing data on a more regular and frequent basis.

2.4 Satellite data products from IRS 1-A and IRS 1-B satellites are being disseminated to a wide variety of users in different forms such as photographic films, paper prints, computer compatible tapes (CCT), floppy disks

and cartridge tape products. An integrated information management system (IIMS) has been established to cater for the multi-mission data processing and dissemination operation.

2.5 Nationwide remote sensing application mission (RSAM) projects are being carried out in selected areas, such as for the preparation of thematic maps/information on various resources like ground water, wastelands, land use, forests, coastal wetlands, etc. Efforts are being made to integrate this information with conventional data sets, with a view to generating sustainable developement plans at local level. RSAM has now become an important component of socio-economic development, directly impacting and benefiting the rural population, and also achieving sustainable all-round development.

2.6 Development of the second-generation satellites in the IRS series, namely IRS 1-C and IRS 1-D, is at an advanced stage. Besides ensuring continuity in remote sensing data, IRS 1-C will have improved spatial resolution, enhanced spectral coverage, more frequent revisits and stereo viewing capability. The satellite will carry on-board recording equipment.

3. Polar satellite launch vehicle (PSLV)

PSLV D-2, the second development polar satellite launch vehicle, was successfully launched on 15 October 1994. PSLV D-2 placed the IRS P-2 satellite in the intended polar sunsynchronous orbit.

4. Scientific satellite

A low earth orbit satellite Sross C-2, carrying a satellite payload, was launched by the augmented satellite launch vehicle ASLV D-4 on 4 May 1994. Sross C-2 carries two payloads, the gamma-ray burst detector (GRB) and the retarding potential analyser (RPA). The payloads are functioning well.

5. Participation in INTELSAT and INMARSAT systems

5.1 India participates in the INTELSAT and INMARSAT multigovernmental organizations and uses their systems for providing international communications. Videsh Sanchar Nigam Limited (VSNL) is the only agency in India providing this international connectivity.

5.2 It has three Standard A earth stations, eight F2 type earth stations for accessing Intelsat satellites and one land earth station (LES) for Inmarsat applications. Three more Standard A earth stations are under construction. There are about 8 000 derived circuits from satellite-based networks.

INDONESIA

The Indonesian Administration's activities in space radiocommunication in 1994 included coordination meetings, satellite filing, satellite purchasing, satellite manufacturing and installation of TT&C.

1. Satellite frequency coordination meetings

The Indonesian Administration held satellite frequency coordination meetings with Japan, China, the United Kingdom and Malaysia. Two meetings were held with the Japanese Administration, the first in Tokyo in March 1994, the second in Jakarta in August 1994. At the meeting with the Malaysian Administration, which was held in Jakarta in April 1994, coordination of virtually all Indonesian satellites filed prior to 1994 was completed, except for Palapa C4 (at 150.5° E) with respect to Measat 2 at 148° E. The coordination meeting with China took place in Beijing in June 1994; however, for

most of the crucial networks, i.e. networks close to each other, the coordination procedure is still not complete. In June 1994, coordination was effected with the United Kingdom Administration in respect of their Asiasat satellite networks; however, the coordination of the crucial networks was not completed.

2. Satellite filing

In 1994, the Indonesain Administation submitted Appendix 3 and 4 notices to the Radiocommunication Bureau for the following new satellites:

— Appendix 3 for Palapa C4 (150.5° E).

— Appendix 4 for Palapa Pacific 4 (135.5° E) and 5 (152° E).

— Appendix 3 for Garuda 1, 2, 3 and 4 (118° E, 123° E, 135° E, 80.5° E).

— Appendix 4 for Garuda satellite feeder links (extended C-band and Ku-band).

— Additional Appendix 3 for Palapa C1, C2 and C3.

3. Installation of TT&C in Indonesia

In 1994, Indonesia began installing TT&C for Palapa C; it will be ready for testing in mid-1995.

TT&C for the Indostar satellite has been installed and will be ready for testing in 1995.

4. Satellite purchasing

The contract for purchase of the Indostar satellite has been signed and the satellite will be ready for delivery in 1996.

The study and tender process for the Garuda satellite has been completed and the contract for purchase of the satellite will be signed in March 1995.

5. Satellite manufacturing

The Palapa C satellite is being manufactured by Hughes Aircraft El Segundo, United States.

6. Miscellaneous

Apstar-1, launched in 1994, was placed at the orbital position 138° E without following the filing procedure. Palapa Pac-2 was filed at 139° E, but this orbital slot cannot be used. A letter has been sent to the Chinese Administration in connection with this matter, but no reply has been received to date.

IRAN (ISLAMIC REPUBLIC OF)

The following progress was made in space radiocommunications in the Islamic Republic of Iran in 1994:

1. Domestic and rural communications

In addition to the four transponders leased from Intelsat, the Iranian Administration has reserved a fifth transponder which will be used for telecommunication purposes.

Phase one of the VSAT project, comprising a hub and 200 terminals, is already operational.

Phase two of the VSAT project, comprising a hub and 700 terminals, has already been implemented and will be in service shortly.

Phase three of the above-mentioned project, comprising a hub and 850 terminals, is announced for tender.

2. International communications

During the past year, the Telecom Company of Iran (TCI) has changed over most of its international satellite communication services from analogue to digital, in line with Intelsat policy.

About three thousand international circuits are already in service.

The projects under way for next year are as follows:

— Development of phase two of IDR/DCME in three main international stations: Shahid Ghandi, Isfahan and Boomehen.

— Purchase of a new Standard A earth station.

LATVIA (REPUBLIC OF)

In 1994 the Latvian Telecommunication Administration issued three licences for the operation of stations in the fixed-satellite service. In addition, 27 licences were provided for the terminals pertaining to the Inmarsat satellite network.

MEXICO

Launching and bringing into operation of the Solidaridad 2 satellite

Four and a half years after work began on the construction and placing in orbit of the SOLIDARIDAD satellite system, the Solidaridad 2 satellite was successfully launched on 7 October 1994 at 2207 hours, French Guiana time.

This event marks the beginning of an important stage in Mexican telecommunications and the provision of international services.

For a total of 1 172 days, a group of 60 Mexican technicians from Mexican Telecommunications and the Mexican Institute for Communications closely monitored each stage of the construction and launch of the SOLIDARIDAD system – a task which they performed with great professionalism and dedication.

On 7 October, 22 minutes and 6 seconds after the planned ignition of the V-68 launch vehicle, Solidaridad 2 separated from the Ariane 44 L launcher, having successfully reached its transfer orbit. Over the following seven days, the apogee motor was fired in a series of manoeuvres which brought the satellite to its final orbital position of 113° W.

The satellite rotation speed was subsequently reduced, and between 15 and 18 October the critical operation was carried out of deploying the solar panels which provide the satellite with energy and the dish-reflector antennas, and of pointing them at the Sun and the Earth.

On 19 October, tests were started to verify the proper functioning of all the subsystems, particularly their communication characteristics. Testing continued until 11 November, when Solidaridad 2 operations were transferred to TELECOMM. Commercial operation began on the following day.

Increased satellite capacity in 1994

In 1994, the Mexican national satellite system consisted of three satellites, namely, the Morelos II and Solidaridad satellites, giving a total of 114 transponders, i.e. over twice the 1993 capacity provided by the MORELOS system.

In Band C, which is the one most commonly used for television, capacity increased by 50% from 48 to 72 36-MHz transponders, 18 of which are moreover switchable from the Mexican region to regions 2 and 3 covering Central and South America and the Caribbean.

In the Ku-band, used primarily for small-antenna digital systems, capacitiy increased from 16 to 40 54-MHz transponders with dual polarization and over double the power. In other words, capacity increased more than four-fold in 1994 as compared with 1993. In addition, four of the transponders cover the main cities of the eastern part of the United States and Canada.

The new L-band, which is now available with one transponder in each Solidaridad satellite, will provide mobile-satellite services to land vehicles and ships as well as rural communications using small low-cost receivers.

Replacement of Morelos 1 by Solidaridad 1

Early in the year Morelos 1 was replaced by Solidaridad 1 following the successful transfer of all previous users of Morelos 1 which, after eight years and nine months of operation, was withdrawn from its orbital position on 8 March by the Iztapalapa primary satellite control centre acting on instructions from the Ministry of Communications and Transport.

Satellite control centres

The Mexican satellite system comprises two control, telemetry and tracking centres equipped with the very latest technology and operated by highly trained national technicians: the primary control centre at Iztapalapa, D.F., which has recently been modernized, and the new alternate control centre at Hermosillo, Sonora, which has been fully operational since February 1994 and was officially inaugurated on 18 May 1994 by the President of the Republic.

Edusat network

On 31 May 1994, in the presence of the President of the Republic, the Ministers of Communications and Transport and Public Education, respectively, signed the SCT-TELECOMM-SEP agreement for the development of an educational television satellite distribution network to cover 10 000 Mexican schools. Initial investment is estimated at 62 million new pesos, to be funded out of resources transferred by SEP to TELECOMM.

MOROCCO (KINGDOM OF)

Progress made in the field of space telecommunications in Morocco in 1994 concerned essentially:

— the introduction, in April 1994, of IDR/DCMS digital carriers allowing on the one hand the extension and digitization of Morocco's domestic satellite network and, on the other, the introduction of IDR digital links with countries belonging to the ARABSAT, INTELSAT and EUTELSAT systems;

— the introduction of a Standard F1 trailer-mounted mobile earth station equipped with a 2 × 2 Mbit/s IDR digital telephony carrier and television equipment for occasional TV transmissions. This station was used for television broadcasting during the GATT meeting, the Economic Summit on the Middle East and North Africa, and the last summit of the Organization of the Islamic Conference;

— the acquisition of Inmarsat-M transportable terminals.

NORWAY

1. Nordic progress in the field of space telecommunications

(See also under Denmark, Finland and Iceland)

The Nordic land earth station (LES) Eik in Norway, jointly owned by the public network operators in Denmark, Finland, Iceland, Sweden and Norway, has been in successful operation for Inmarsat-A in the Indian Ocean region (IOR) since 1983.

Eik has also been operating the Inmarsat-A LES in the Atlantic Ocean region/East (AOR-E) since the end of 1990 and in the Atlantic Ocean region/West (AOR-W) since March 1993.

Early in 1991, Eik was expanded with an Inmarsat aeronautical ground earth station (GES) for the IOR.

Eik has also operated an Inmarsat-C LES in the IOR since September 1991.

Inmarsat-M LES has been operated by Eik in the IOR since December 1993, and since December 1994 in the AOR-E and the AOR-W.

Eik has operated an Inmarsat-B LES in the IOR since December 1994.

2. Domestic and international traffic via the INTELSAT and EUTELSAT systems

2.1 *Intelsat transponders*

Telenor International (formerly Norwegian Telecom) has leased eight Ku-band transponders on the Intelsat 702 satellite. The Ku-band transponders are used for international communications and television.

2.1.1 *NORSAT A*

The Norwegian domestic satellite system NORSAT A was established to improve communications between oil production platforms in the North Sea and the Norwegian mainland. The system has been in operation since 1976.

A half hemispheric C-band transponder on the Intelsat 702 satellite has been purchased for this purpose. Altogether, seven earth stations are in operation:

— the mainland station at Eik;
— five platform stations in the North Sea;
— the Isfjord station in the Arctic islands of Svalbard.

2.1.2 *NORSAT B*

Parts of the Intelsat 702 transponders are utilized for the NORSAT B system, which is a switched digital business communications system. The NORSAT B system comprises a main station located at Eik and several outstations in Norway and abroad, with antenna diameters of 1.8 m or 3.3 m. The data rates offered in the system range from 64 kbit/s to 2 048 Mbit/s.

Norsat B stations are presently located in nine European countries. In addition, Telenor International is providing Norsat B for mobile users, such as ferries and oil rigs.

2.1.3 *NORSAT Plus*

Telenor International is also providing a two-way VSAT system, named NORSAT Plus, which utilizes Intelsat 702 Ku-band capacity.

2.1.4 *IBS traffic*

Telenor International has C-band IBS traffic via one station at the Eik earth station and two stations at the Nittedal earth station, covering both the IOR and AOR.

2.1.5 *Fixed-satellite circuits for public switched traffic*

Telenor International has fixed-satellite links to 30 destinations. The traffic goes to the IOR and AOR via one combined C/Ku-band station at Eik and two combined C/Ku-band plus two C-band stations at Nittedal.

2.1.6 *Transit traffic*

Telenor International handles C-band transit telephone traffic to Somalia from the Eik earth station.

2.2 *Tele-X transponders*

Telenor International is utilizing one direct broadcast satellite (DBS) transponder on Tele-X.

2.3 *Eutelsat transponders*

Norway has two Standard 1 SMS stations in operation since 1987, both located at Nittedal, outside Oslo.

3. INMARSAT

Norway is one of the largest shareholders in INMARSAT, and the Nordic land earth station (LES) at Eik has provided services to ship earth stations in the IOR since 1983, and in the AOR since 1990.

4. Distribution of television programmes

Telenor International is the owner of the DBS satellite Thor. Thor is located at 0.8° W in the geostationary-satellite orbit. The coverage area is the Nordic countries. The satellite is controlled via the Aland TT&C station, located on the Aland Islands. Presently Telenor International is transmitting TV programmes on all the satellite's 5 transponders.

Thor is colocated with Intelsat 702 (1° W), and 15 TV channels are presently transmitted from this position.

OMAN (SULTANATE OF)

1. Intelsat Standard A earth station at Ibri

The final acceptance certificate was issued to Scientific Atlanta (United States) for successful implementation of the project.

This fully digital earth station, incorporating a 21 m dish antenna, works with the Intelsat AOR satellite at 18° W and provides direct circuits between Oman and the United States, the United Kingdom and Germany.

The circuits between Oman and the United Kingdom employ IESS-501 Rev. 2 digital circuit multiplication equipment (DCME).

2. New Intelsat Standard A earth station at the Al-Amerat complex

After careful evaluation of offers received, a contract was signed on 3 October 1994 with Sumitomo Corporation (Japan) for the implementation of this project. This fully digital Intelsat Revised Standard A earth station is intended to replace the 19-year old analogue Intelsat Standard A earth station, working with the IOR satellite at 60° E.

This project comprises the following:

a) a Revised Standard A earth station employing a 16 m full-motion dish antenna;

b) a new power subsystem with 450 kVa diesel generators and a 120 kVa uninterruptible power supply (UPS) in a 1 + 1 redundancy configuration;

c) two digital (SDH) back-haul links, one microwave and the other FOC, to connect the earth station with the ITMC/ITSX in the TCC building at Greater Muttrah; and

d) terrestrial equipment at ITCM, such as digital access cross-connect (DACC), low rate encoding (LRE/ADPCM) equipment, echo cancellers, etc.

The date of completion for the entire project is 3 October 1995, i.e. 12 months from the contract signature.

3. VSAT system

Offers received in response to a request for proposals for a new VSAT system in the Sultanate are under evaluation.

This new, fully digital VSAT system is proposed as an independent domestic satellite system separate from the existing analogue (SCPC/CFM) domestic satellite system.

The VSAT system will work in C-band and will include one master or control earth station with network control system (NCS) at the Al-Amerat complex near Muscat, where other earth stations are already operating. Remote VSATs, incorporating the required features and satisfying the tenderer-established and GTO-approved specifications, will be procured from the authorized local agents, installed and commissioned by the customers wishing to join the VSAT network.

These remote VSATs will be owned, operated and maintained by the users themselves.

The project is expected to be completed by the end of 1995.

PORTUGAL

1. International organizations

1.1 *INTELSAT*

A significant decrease in the utilization of SCPC service (7 circuits) was observed in 1994 due to conversion to IDR service, and its complete extinction is expected by the end of 1995.

FM/FDM to IDR conversion saw an increase to 2 272 IDR circuits (808 bearers), leaving 68 FDM circuits in operation.

Ten new correspondents were established, representing 64 different connections, and the digital TV transmission service at 8 Mbit/s was brought into use.

1.2 *EUTELSAT*

A significant decrease was recorded in TDMA/DSI circuits, of which there are now a total of 593.

CPRM has leased one transponder on Eutelsat-II (F3) 16° E for TV transmission of RTP international as well as for sound broadcasting.

The Eutelsat-10° E satellite is used for VSAT service, with 135 bidirectional remote terminals, and the hub station installed at the Sintra-7 earth station. Ninely new unidirectional terminals were brought into use. Average availability is around 99.95%.

The Euteltracs service was brought into use for radiolocation and data communications from transportation vehicles.

1.3 *INTERSPUTNIK*

One transponder was leased on Statsionar 12 (40° E) for RTP international broadcasting to the East (Macau) and Africa.
This service will continue on the next generation of the Express satellites at the same orbital position.

1.4 *INMARSAT*

Cooperation started on 1993 with Embratel (Brazil) to operate one earth station (CES) specially dedicated to Inmarsat-C microterminals.

1.5 *Panamsat*

One transponder was leased on Panamsat 1 (45° W) for RTP International broadcasting to North America, with the uplink in Greece.

2. Posat-1 project

In September 1993, the first Portuguese microsatellite was successfully launched by Ariane V-59, alongside the main passenger Spot-3, from the Guiana Space Centre in Kourou. It was placed in circular orbit with an altitude of 820 km, an inclination of 98.6° and an orbit period of 101 minutes.

A new software was developed for this satellite and for the first time a complete set of Keplerian parameters was generated based on the data obtained from the GPS receiver on board the satellite.

Posat-1 is the first microsatellite securing its own Keplerian parameters, making the tracking system of the earth station independent of the NORAD.

SAUDI ARABIA (KINGDOM OF)

The year 1994 saw the award of a 1.5 million telephone line project to AT&T. The project will involve upgrading and enhancement of the existing satellite earth stations operating into Inmarsat and Intelsat networks. To introduce new services, additional earth stations will also be commissioned. The earlier interim project for the commissioning of 190 thousand telephone lines is already in the completion stage.

The main highlights of the new expansion project are:

ARABSAT
- Modification of the existing Jeddah-8 earth station for operation with the second-generation satellite.
- Implementation of digital services: IDR, IBS and VSAT.
- Commissioning of a Ku-band antenna.

INMARSAT – Integration of Inmarsat-B/M, C and Aero services in the existing Jeddah-7 earth station for IOR.

– Installation and commissioning of a new earth station for AOR.

INTELSAT – Modification of the Riyadh-1 and 4 and Jeddah-4 and 5 earth stations for the implementation of digital services: IBS, IDR, VSAT and new TDMA.

– Replacement of the Riyadh-1 and 4 C-band antennas.

– Commissioning of Ku-band antennas for Riyadh-1 and 4.

Domestic network with ARABSAT – Installation of a VSAT network for national and regional use.

The domestic network operating with Arabsat has been expanded by commissioning new transportable earth stations. The whole network is digitized.

The Ministry of Posts and Telecommunications continued to participate actively in international and regional satellite organizations: INTELSAT, INMARSAT and ARABSAT.

1. ARABSAT

Saudi Arabia is the host country to this regional satellite organization and a major shareholder. The contract for the second-generation satellites was awarded this year and the first of the two satellites is scheduled to be launched in 1996.

1.1 *Domestic and regional network*

The Arabsat space segment is utilized for Saudi Arabia's domestic satellite network (Domsat) and other special services in various government agencies. These services include data transmission, TV distribution, teleconferencing, etc. The Domsat network consists of three fixed and nine mobile earth stations. The Jeddah-8 earth station presently carries 717 circuits to regional destinations in the Arab world.

2. INMARSAT

More than 650 Inmarsat MES terminal with 1 200 terminals IDs are presently commissioned for Inmarsat-A services under Saudi Arabia. These are maritime as well as land-based. Another fifty terminals for Inmarsat-C, M and Aero are on the commissioned list. The capacity of Jeddah-7 can accommodate more than 40 000 Inmarsat terminals in the earth station database. The Ministry of Posts and Telecommunications continued representing Saudi Arabia in INMARSAT's Assembly, Council and ATCOM, and actively participating in their sessions.

The Kingdom has taken a share in the newly formed Inmarsat Partermship company for the Inmarsat-P services.

3. INTELSAT

Presently, there are five earth stations operational in IOR and AOR. The bulk of traffic carried through those stations is as follows:

Earth station (satellite)	Number of circuits
Riyadh-4A (AOR)	867
Jeddah-4A	SEA-ME-WE Restoration
Jeddah-5A (IOR)	277
Taif (AOR)	375
Riyadh-1 (IOR)	750

SENEGAL (REPUBLIC OF)

In the field of space radiocommunications, in 1994 Senegal installed the equipment required for the introduction of IDR digital carriers at the Gandoul station.

The equipment will allow digitization of Senegal's international links with the following countries:

Canada:	1 024 Mbit/s
United Kingdom:	1 024 Mbit/s
United States/MCI:	2 048 Mbit/s
United States/AT&T:	2 048 Mbit/s
Cape Verde:	512 Mbit/s

The above links are currently being brought into service.

The Senegal-Cape Verde IDR link will probably be the first digital satellite link between two African countries.

A direct satellite link has been established with Egypt.

SLOVENIA (REPUBLIC OF)

In 1994, Slovenia established an earth station in Ljubljana (14°30'53"E, 46°03'17"N) operating on the frequencies 14.375 GHz, 14.29167 GHz, 11.075 GHz, 10.99167 GHz and made preparations to become a member of EUTELSAT and EUTELTRACS.

SPAIN

In 1994 Telefónica de España, as a signatory member of the international organizations INTELSAT, EUTELSAT and INMARSAT with a 2.659%, 13.098% and 1.396% share, respectively, continued with its digitization plan (84%), under which the latest digital techniques (TDMA, IDR) will be used to provide all type of public service with access to Intelsat Atlantic and Indian Ocean satellites as well as to the European regional system EUTELSAT.

Particular mention should be made of the increase in the use of satellite communications for applications other than international telephony, such as domestic communications, with the establishment of a link between the Spanish peninsula and the Canary Islands via the HISPASAT national system, links between islands, and the extension of rural telephony.

At the same time, business service applications via single-user earth stations and VSAT networks have increased, with 16 single-user stations and 24 VSAT networks totalling 868 terminals currently in operation.

A list of existing earth stations as at 31 December 1994 is given below.

Name of earth station	Antenna diameter (m)	Plant installed	Satellite	Organi-zation	Remarks	Code
Agüimes-1	30.0	April 71	325.5° E	INT	TF, TV, SCPC (TV Spanish peninsula and Canary Islands)	AGU-1
Agüimes-1R	04.5	Sept. 91	10° E	EUT	TVRO	AGU-1R
Agüimes-2	13.0	March 94	330° E	HIS		AGU-2
Agüimes-2R	04.5	Sept. 91	10° E	EUT	TVRO	AGU-2R
Agüimes-3	13.0	Dec. 94	330° E	HIS		AGU-3
Agüimes-4	04.57	May 90	330° E	HIS	Inter-island domestic traffic	AGU-4
Barcelona-01	04.5	June 88	7° E	EUT	TVRO (TV autonom.) (receiving station San Pedro Mártir)	BAR-1

Existing earth stations *(cont.)*

Name of earth station	Antenna diameter (m)	Plant installed	Satellite	Organi-zation	Remarks	Code
Barcelona-02	06.4	Feb. 91	10° E	EUT	SMS teleport (Castellbisbal)	BAR-2
Barcelona-03	09.2	Feb. 91	307° E	INT	IBS teleport (Castellbisbal)	BAR-3
Barcelona-04	13.0	Oct. 91	21.5° E	EUT	TVSC EUTELSAT	BAR-4
Barcelona-05	18.0	Dec. 91	335.5° E	INT	TF (IDR), TV	BAR-5
Barcelona-06	18.0	Feb. 92	63° E	INT	TF (IDR), TV, Videoconference	BAR-6
Barcelona-07	13.0	Apr. 92	338.5° E	INT	Rest. subm. cables	BAR-7
Barcelona-09	09.2	May 92	21.5° E	EUT	TVSC EUTELSAT	BAR-9
Barcelona-10	01.8	Oct. 94	10° E	EUT	SMS service (Philips)	BAR-10
Bilbao-1	04.5	Dec. 88	7° E	EUT	TVRO (TV autonom.) (receiving station Santa Maña)	BIL-1
Buitrago-1	29.0	Jan. 68	325.5° E	INT	TP, TV (TV Spanish peninsula and Canary Islands)	BUI-1
Buitrago-1R	01.5	Sep. 91	10° E	EUT	TVRO	BUI-1R
Buitrago-2	30.0	March 70	60° E	INT	TP (TDMA), TV, SCPC	BUI-2
Buitrago-3	30.0	Sept. 73	335.5° E	INT	TP, TV, SCPC	BUI-3
Buitrago-5	32.0	May 82	342° E	INT	TF, TV	BUI-5
Buitrago-6	11.0	Dec. 88	332.5° E	INT	TV, EFE agency service, VISTA-CUBA	BUI-6
Buitrago-9	13.0	July 90	63° E	INT	TV	BUI-9
E.T.T.-1	07.0	June 88	as app.	EUT/INT	TV (based at Guadalajara)	E-1
E.T.T.-2	04.5	May 89	as app.	EUT/INT	TV transportable (elliptical antenna)	E-2
E.T.T.D.-1	02.4	Aug. 89	as app.	EUT/INT	SMS/IBS trans-portable	E-6
E.T.T.D.-2 to 6	02.6	Nov. 92	as app.	EUT/INT	5 E/S transportable (2 × 2 Mbit/s) special events	—

Existing earth stations *(cont.)*

Name of earth station	Antenna diameter (m)	Plant installed	Satellite	Organi-zation	Remarks	Code
FA 1 to 2	01.9	Apr. 89	as app.	EUT/INT	Portable ES, TV (CCS Guadalajara)	—
FA 3 to 4	01.9	Feb. 91	as app.	EUT/INT	Portable ES, TV (CCS Guadalajara)	—
G.S.R.-1	04.0	Jan. 86	7° E	EUT	TVRO (based at Guadalajara)	—
G.S.R.-2	04.0	Jan. 86	10° E	EUT	TVRO (based at Guadalajara)	—
Guadalajara-01	18.0	July 85	21.5° E	EUT	TP (TDMA), TV, TRMS service	GDA-1
Guadalajara-02	13.0	Sept. 90	10° E	EUT	International TV, RNE, EFE	GDA-2
Guadalajara-03	06.4	June 88	10° E	EUT	SMS teleport (videoconference)	GDA-3
Guadalajara-04	09.2	Dec. 88	307° E	INT	IBS teleport (videoconference)	GDA-4
Guadalajara-06	13.1	Oct. 91	330° E	HIS	National telephony	GDA-6
Guadalajara-07	04.57	Dec. 88	330° E	HIS	Business service, SMS, VSAT, CLH, SAICA	GDA-7
Guadalajara-08	13.0	Feb. 91	325° E	INT	TF (IDR), TV	GDA-8
Guadalajara-09	09.2	Oct. 89	338.5° E	INT	TV occasional	GDA-9
Guadalajara-10	04.57	Dec. 88	10° E	EUT	SMS business service	GDA-10
Guadalajara-11	09.2	Nov 90	7° E	EUT	TV	GDA-11
Guadalajara-12	03.7	Apr. 90	63° E	INT	IBS relocatable	GDA-12
Hierro-1	02.4	May 94	330° E	HIS	Inter-island traffic	—
Lanzarote-1	04.57	May 90	330° E	HIS	Inter-island domestic traffic	LAN-1
Madrid-1	11.0	Dec. 89	332.5° E	INT	TVRO (EBU trans-Atlantic)	MAD-1
Madrid-2	06.4	Nov. 90	10° E	EUT	SMS teleport (Alcobendas)	MAD-2
Madrid-3	09.2	Nov. 90	307° E	INT	IBS teleport (Alcobendas)	MAD-3
Madrid-6	03.7	June 93	330° E	HIS	HUB several networks	MAD-6
Madrid-8	03.6	Aug. 89	7° E	EUT	SMS service (TIDSA)	MAD-8

Existing earth stations *(end)*

Name of earth station	Antenna diameter (m)	Plant installed	Satellite	Organi-zation	Remarks	Code
Malaga-1	04.57	Aug. 89	10° E	EUT	Domestic traffic	MAG-1
Melilla-1	04.57	June 90	10° E	EUT	Domestic traffic	MEL-1
Pace-A	01.0	Aug. 88	26° W	INM	Emergency communications	—
Pace-B	01.0	Aug. 88	26° W	INM	Emergency communications	—
Robledo-1	04.57	Dec. 88	307° E	INT	IBS (NASA)	RBL-1
Rota-1	11.0	July 87	359° E	INT	TVRO (TV USAF)	ROT-1
Santiago-1	04.5	June 88	7° E	EUT	TVRO (TV autonom.) (BS Fontecoba)	SGO-1
Sarajevo-1	01.2	May 94	330° E	HIS	Telefon.	SRJ-1
Sevilla-1	13.0	Dec. 91	21.5° E	EUT	TP (TDMA), TV	SEV-1
Sevilla-2	15.2	Feb. 92	359° E	INT	TP (IDR), TV	SEV-2
Sevilla-3	06.4	Feb. 92	10° E	EUT	SMS teleport	SEV-3
Sevilla-4	09.2	Feb. 92	307° E	INT	IBS teleport	SEV-4
Sevilla-6	03.7	March 92	10° E	EUT	SMS teleport (Pineda)	SEV-6
Sevilla-7	03.7	March 92	10° E	EUT	SMS teleport (Pineda)	SEV-7
Valencia-1	06.4	Feb. 93	10° E	EUT	SMS teleport (Peterna)	VAL-1
Valencia-2	06.4	Feb. 93	307° E	INT	SMS teleport (Peterna)	VAL-2

Notes:

TF	Frequency-division multiple access (FDMA) telephony and data
TV	Television
SCPC	Single channel per carrier telephony and data
SPADE	Telephony – SCPC multiple access demand assignment equipment
TDMA	Time-division multiple access telephony and data
IDR	Digitally carried telephony and data
TVRO	Television receive only earth station
SMS	EUTELSAT business services
IBS	INTELSAT business services
INT	INTELSAT
EUT	EUTELSAT
HIS	HISPASAT

SWITZERLAND (CONFEDERATION OF)

Swiss Telecom PTT antennas operating in the INTELSAT and EUTELSAT networks

Swiss Telecom PTT presently operates, at Leuk, three Intelsat Standard A antennas and one Eutelsat type T-2 antenna. The Intelsat antennas access the satellites located at 60° E, 325.5° E and 335.5° E. They are mainly used for intercontinental switched telephone traffic and for television. The Eutelsat antenna accesses the satellite at 21.5° E and carries only switched telephone traffic to several European countries. The new modulation and transmission techniques implemented are exclusively digital and make use of the full capabilities of the latest digital compression devices available on the market. More than one-third of the total intercontinental switched traffic of Swiss Telecom PTT is carried by satellite.

Satellite link in the European ATM pilot core network

In 1994, a Europe-wide (terrestrial) ATM pilot network started operation. EUTELSAT proposed to integrate a satellite link in this ATM pilot network, and is now coordinating the activities and providing the satellite capacity. The terrestrial infrastructure was prepared by Telefónica (Spain), Telia Research (Sweden) and Swiss Telecom PTT.

The objectives are to demonstrate the usability of satellite links in ATM networks, to identify possible specific problems in order to propose further actions, and to evaluate appropriate performance objectives for satellite links as part of ATM networks.

In October 1994, satellite loop measurements were taken from the earth station BAS-2 in Basle (Switzerland). During December 1994, the international ATM cross-connect equipment in Spain, Sweden and Switzerland was interconnected using a 34 Mbit/s satellite link according to the Intelsat IDR standard. ATM-specific measurements have been made, and no constraints have been found.

The results are being brought before ITU-R Working Party 4B. Future activities will include the demonstration of applications as well as studies on optimized satellite link parameters and forward error correction (FEC) methods.

SYRIA

The following progress was made in space radiocommunications in Syria in 1994:

— Execution of an earth station project (digital system, Standard A antenna, diameter 18 m, fully equipped to work with the system IDR-2CH.TV). The antenna is directed so as to operate with the Intelsat 605 satellite located over the Atlantic Ocean at longitude 24.5° W. The project was brought into service on 3 July 1994.

— Execution of a fibre-optic link project between the earth stations in the telephone building in Damascus and the TV building on Omaid Square. This project was brought into service in the third quarter of 1994.

THAILAND

1. National satellite network

Thailand's first domestic communications satellite, Thaicom-1, was launched into orbit at 78.5° E on 17 December 1993 and started operating in February 1994. The second Thaicom satellite, Thaicom-2, which is co-located with the first, was launched in October 1994. The next generation of Thaicom satellites, namely Thaicom-3 and 4, will have a much larger capacity than their predecessors. The satellites to be built will have 24 C-band transponders and 12 Ku-band transponders, with very high signal strengths. The footprint of the C-band transponders on Thaicom-3 and 4 will span four continents and be able to serve users in Thailand, Asia, Europe, Australia and Africa. In addition, some of the Ku-band transponders are steerable. The aim with the Ku-band transponders is to expand DTH capacity in Thailand to some 100 channels, and they may also be used by neighbouring countries with their steerable beam capability.

The upcoming Thaicom satellite expansion projects testify to Thailand's determination to develop a telecommunication infrastructure that will help sustain and support economic growth and enhance the social well-being of the population. This development is also expected to benefit neighbouring countries, and contribute to understanding and cooperation among countries in the region.

2. International telecommunications

The Communications Authority of Thailand (CAT) provides international satellite telecommunication services. CAT has three antennas located in the same common area, namely the Si Racha earth station, which links Thailand with countries in Europe, the Middle East and Asia through Intelsat satellites in the Indian Ocean region (IOR) and with countries in Central America and also Asia through Intelsat satellites in the Pacific Ocean region (POR).

3. Domestic satellite services

CAT's domestic satellite network comprises one master station, located in the compound of the Si Racha earth station, and thirty remote stations located throughout the country. The network is utilized not only for domestic services, but also to link all international telecommunication services such as overseas telephone, fax, telex, etc., from the countryside to the international telephone switching centre in Bangkok and Si Racha, CAT's international gateways, prior to transmission to the Si Racha earth station.

In addition to the Si Racha earth station, a second satellite earth station is presently under construction in the Nonthaburi telecommunication centre, which is about 10 km from Bangkok. In the initial stage of operation, it will be equipped with at least five antennas, two for international communication via Intelsat satellites in the Indian Ocean region (IOR), one for domestic services via Thaicom satellites, one for connection to Inmarsat IOR satellites and one for Palapa and Asiasat satellites. Furthermore, there will be a domestic VSAT hub station, which will be operated by a private company under licence from CAT. A third satellite earth station is now under planning, for installation at Ubon Ratchathani in north-eastern Thailand. This station, which is expected to be ready for service in around 1997/1998, will provide the connection to Intelsat POR satellites.

4. Meteorological satellite activities

With the advent of Thailand's first national satellite system Thaicom, the Meteorological Department has established the meteorological communication network (METNET) via a domestic communication satellite, consisting of one hub station, five regional stations and fifteen remote stations. These stations are located in various provinces of Thailand, as listed below:

— Hub stations (1): Bangna, Bangkok
— Regional stations (5): Chiang Mai, Ubon Ratchathani, Phuket, Songkhla, International Airport Bangkok, Bangkok
— Remote stations (15): Mae Hong Son, Hua Hin, Chiang Rai, Chantaburi, Pitsanulok, Chumpon, Nan, Surat Thani, Petchaboon, Hat Yai, Sakon Nakhon, Trang, Khon Kaen, Narathiwat, Surin.

The purpose of the METNET system is to facilitate the flow of meteorological data and process the output in a timely, reliable and cost-effective way by using very small aperture terminal (VSAT) systems. The METNET system uses a Star network topology. Traffic demand is based on the two major types of VSAT system, namely multi-channel per carrier (MCPC) and time-division multiplex/time-division multiple access (TDM/TDMA), which are employed for communication between the hub station and regional stations and between the hub station and remote stations, respectively.

5. Remote sensing applications in Thailand

The Thailand Remote Sensing Centre (TRSC) of the Institute of Scientific and Technological Research is the principal national remote sensing body. It is composed of six branches, namely General Administration, Research Coordination and Follow-up, Data analysis, Technical and Maintenance, User Service and Ground Receiving Station.

The Centre has about 80 staff members, half of whom are remote sensing specialists. The Centre's major current activities are summarized below.

5.1 *Satellite data reception*

The Thai ground station was first built in 1981 to receive MSS data from the United States Landsat satellite. The station, which is situated to the east of

Bangkok, has a radius of coverage of about 2 700 km, with the result that more than fifteen countries in the South-East Asia region can benefit from it. The station is fully operational and can receive and process Landsat MSS and TM as well as the French Spot data. Thailand has also been working closely with other countries and international bodies to keep abreast of the related technology. Thanks to these efforts, the MOS-1 receiving station was set up on the same site under cooperation between Japan and Thailand. In the area of satellite radar data, the station was upgraded for direct reception of ERS-1 and JERS-1 data with support from the European Space Agency and the National Space Development Agency of Japan, respectively.

5.2 *Data distribution*

At present, the Remote Sensing Centre has extensive archives of satellite data capable of meeting most users' needs. Data usage in the country and in the region is on the increase because of the high potential of advanced satellite systems, and it is anticipated that the amount of data distributed will continue to grow as user communities expand.

5.3 *Research grant allocation*

Each year TRSC offers a grant of three million bahts to remote sensing application projects proposed by national researchers, as a means of promoting the application of this technology in the country.

5.4 *Technical support*

The Centre has two digital image analysis systems – Meridian and MIPS – and the SPANS GIS systems, as well as an optical-mechanical projector called Procom-11, for providing support to various government agencies in their remote sensing projects. TRSC staff also give technical advice to these users and train them in the operation of the systems. In addition, TRSC makes available two digital plotters to produce hard-copy results of their analysis.

5.5 *Conduct of remote sensing projects*

The Centre, in cooperation with other agencies and under the direction of the Government, conducts studies using satellite data.

TURKEY

The main space event in Turkey in 1994 was the successful launch of Turksat-1B on 11 August 1994, as the first Turkish communications satellite in orbit. Turksat-1B was placed at its assigned geosynchronous position at 42° E. The first satellite in the series, Turksat-1A, was lost in launch failure in January 1994. Turksat-1C will be placed at 31° E in a launch planned for mid-1996. Turksat-1B has 16 transponders operating in Ku-band with a 14-14.50 GHz uplink and 10.95-11.20 GHz and 11.45-11.70 GHz downlinks. The three main geographical regions of Central Europe, Turkey and Central Asia are illuminated with a peak power level of 55 W, which allows TV reception in these areas with a 60 cm to 80 cm diameter dish antenna. With a mass of 1 070 kg, Turksat-1B has a design life of a minimum of ten years, now expected to be twelve. The satellite will be used for a variety of services such as telephony, television distribution, business communications and VSAT.

Turkish PTT finalized the evaluation of VSAT bids and has signed contracts with two consortia on a "revenue sharing basis" for the VSAT network in Turkey. The necessary space segment required by the consortia has already been assigned to the VSAT network via the Turksat-1B satellite. Turkey's VSAT network will be put into service by mid-1996, and 5 000 VSAT terminals are foreseen within the next five years.

The Turkish space sciences community is participating in the international scientific satellite experiment "Spectrum X-Gamma" together with scientific research groups from several countries, including the United Kingdom, France, Israel, Denmark and the Russian Federation. Parts of the experiment are being built by various groups in several countries, and the Russian Federation, which has the largest share in the total experiment, is coordinating and assembling varous components on a joint platform. A Turkish team has participated in the calibration and assembly procedures of some of the Spectrum X experiments.

A 2 m radio telescope system (with a Shottky-diode uncooled spectrometer) sensitive to 85-115 GHz radio emission from celestial radio sources has also been commissioned to be erected at the Marmara Research Centre near Istanbul. The telescope (dubbed MRT-2) will be ready in January 1995 and the first research programme is planned for the observation of galactic mole-

cular clouds in which strong carbon monoxide (CO), hydrogen cyanide (HCN) and other emissions are expected. These and other species of greenhouse gases are also present in the Earth's atmosphere. Use of the telescope for their observation and for observations of the Sun are envisaged. Another facility of the Turkish space science community is the national observatory being built at Bakirlitepe, near the city of Antalya. Work is proceeding on schedule for the construction of the roads and infrastructure at the 2 400 m altitude site.

The year 1994 saw an increase in the use of remote sensing satellite data and geographic information systems. What had previously been confined mostly to university and research work has been finding more applications in operational government departments. Several thematic mapping projects, for example on soil erosion, have been started by various groups using data from Landsat and Spot satellites.

The Cost-245 project of the European Union (EU) is being conducted at the Electrical and Electronic Engineering Department of the Middle East Technical University (METU) in Ankara, Turkey. The project aims at developing a TVRO-type satellite receiving antenna suitable for commercial applications. It is a flat, low-cost, high-gain, low-noise active antenna which meets the requirements of the European geostationary direct broadcast satellite (DBS) and of Turksat. The antenna should have a figure of merit of $G/T = 12.5$ dB/K, and should be dual-polarized with dual beam. Design and realization of a printed antenna structure is under way.

Research is being conducted on near-Earth space at the Aeronautical Engineering Department of METU, in Turkey:

a) The possible influence of the interplanetary magnetic field (IMF) on the ionospheric critical frequencies has been sought by employing the IMF southward and northward turnings for about two solar cycles and the critical frequencies (foF2) obtained at several ionospheric stations around Europe. The results will enable the quantification of ionospheric variability.

b) A Polish-made vertical ionosonde (VI) returned ionospheric data in Istanbul for one year. The data have been employed in instantaneous foF2 mapping over Europe. The work briefly introduced under items a) and b) are partial objectives of the EU Cost-238 project: Prediction and Retro-

spective Ionospheric Modelling Over Europe (PRIME). In the near future, the influence of the IMF turnings on electron density will also be incorporated in the above-mentioned work on variability and mapping.

c) In 1994, in principle all paper work was accomplished for Turkey to take part in the EU Cost-251 project: Improved Quality of Service in Ionospheric Telecommunication Systems Planning and Operation (IITS), due to start in 1995.

UGANDA (REPUBLIC OF)

In 1994, the Uganda Post & Telecommunications Corporation has the following FDM/FM satellite circuits via its Mpoma satellite earth station: 41 with the United Kingdom, 36 with the United States, 10 with Italy and France, 7 with Germany, 4 with Switzerland and Netherlands and 3 with Belgium, totalling 115 FDM/FM circuits.

In addition, two private FM radio stations were installed and commissioned: one operating on 88.2 MHz and the other on 91.3 MHz.

UNITED ARAB EMIRATES

1. Introduction

The United Arab Emirates is a signatory of ARABSAT, INTELSAT and INMARSAT.

The Federal Government of the United Arab Emirates has designated the Emirates Telecommunications Corporation (ETISALAT) as sole operator for the provision of telecommunication services in the United Arab Emirates.

ETISALAT provides an all-digital network in the country, with several digital services, including a digital cellular mobile network.

Global connectivity with direct links is provided for over sixty destinations, through international earth stations and international submarine cable routes, enabling ETISALAT to offer a wide range of transit services via the United Arab Emirates.

2. Arabsat network

ETISALAT operates within thirteen countries in the Arab region using the Arabsat 1C satellite.

It also provides round-the-clock TV transmission capability for TV programmes originating with the TV operators in the United Arab Emirates (Dubai & Abu Dhabi TV).

A new earth station for accessing Arabsat 2A is planned for the end of 1995. This earth station will provide for C-band and Ku-band TV leases.

3. Intelsat network

ETISALAT operates three Intelsat Standard A earth stations accessing satellites at 60° E and 63° E in the Indian Ocean region and a satellite at 342° E in the Atlantic Ocean region.

Three additional Standard A earth stations will be set up in 1995 for accessing satellites at 57° E and 66° E in the Indian Ocean region and a satellite at 359° E in the Atlantic Ocean region.

4. Inmarsat network

The Towi Al Saman earth station in the United Arab Emirates is a newly operational Standard M/B earth station providing mobile services within the Indian Ocean region coverage area of the Inmarsat network.

The earth station provides voice, fax and telex services. Data services are planned to be introduced by the end of 1995.

5. Space network

The United Arab Emirates has filed applications with the ITU for operating space networks at four orbital locations.

The aim is to provide domestic, regional and international connectivity.

4. Inmarsat network

The Towi Al Sauwan earth station in the United Arab Emirates is a newly operational Standard M/B earth station providing mobile services within the Indian Ocean region coverage area of the Inmarsat network.

The earth station provides voice, fax and telex services. Data services are planned to be introduced by the end of 1995.

5. Space network

The United Arab Emirates has filed applications with the ITU for operating space networks at four orbital locations.

The aim is to provide domestic, regional and international connectivity.

Booklet No. 29 – Eighteenth Report by the International Telecommunication Union on telecommunication and the peaceful uses of outer space (1978)

Booklet No. 30 – ITU Sixth Anniversary (1973-1978)

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Published by the International Telecommunication Union, Geneva 1995

ISBN 92-61-05751-9

Price: 12 Swiss francs