

**Before the
Federal Communications Commission
Washington, D.C. 20554**

In the Matter of)	
)	
Amendment of Parts 2, 25 and 90 of the)	
Commission's Rules to Allocate the)	ET Docket No. 96-20
13.75-14.0 GHz Band to the)	RM-8638
Fixed-Satellite Service)	

REPORT AND ORDER

Adopted: September 12, 1996

Released: September 26, 1996

By the Commission:

INTRODUCTION

1. By this action, we amend Part 2 of the Commission's Rules to allocate the 13.75-14.0 GHz band to the fixed-satellite service ("FSS") on a co-primary basis for Earth-to-space ("uplink") transmissions and make conforming revisions to the associated service rules in Parts 25 and 90. This allocation will accommodate growing demand for FSS services and will provide satellite operators with increased flexibility in the design of their systems. We also adopt domestically the international footnotes that specify the spectrum sharing criteria between incumbent services and the FSS as contained in the *Final Acts* of the 1995 World Radiocommunication Conference ("WRC-95").¹ In order to facilitate FSS entry into the 13.75-14.0 GHz band, we encourage the use of the International Telecommunication Union ("ITU") Recommendation ITU-R SA.1071 adopted at WRC-95 and the precipitation radar and altimeter critical zones developed by the National Aeronautics and Space Administration ("NASA"). The ITU Recommendation and critical zones will assist parties in assuring that no harmful interference

¹ See *Final Acts of the World Radiocommunication Conference (WRC-95)*, Geneva, 1995. The *Final Acts* apply provisionally as of June 1, 1998, "except for those revised provisions concerning new or modified frequency allocations (including any new or modified conditions applying to existing allocations) and the related provisions of S21, S22 and Appendix S4, which shall apply provisionally as of 1 January 1997." Article S59 of the *Final Acts*. The FSS allocation in the 13.75-14.0 GHz band and the associated international footnotes for the band (855A and 855B) were adopted at the 1992 World Administrative Radio Conference. See *Final Acts of the World Administrative Radio Conference for Dealing with Frequency Allocations in Certain Parts of the Spectrum (WARC-92)*, Malaga-Torremolinos, 1992. The *WARC-92 Final Acts* entered into force internationally on October 12, 1993. Thus, with regard to this proceeding, only the international footnotes for the 13.75-14.0 GHz band (renumbered and modified as S5.502, S5.503 and S5.503A) are affected by the international, provisional applicability date of January 1, 1997. Nonetheless, we are adopting these international footnotes domestically in this proceeding, and they will be effective as of the effective date of this *Report and Order*.

is caused to the space science services² prior to January 1, 2000. Additionally, we adopt a United States footnote, US337, which requires that all FSS applications requesting the use of frequencies in the 13.75-13.80 GHz band segment be coordinated on a case-by-case basis in order to minimize harmful interference to the forward space-to-space link of NASA's Tracking and Data Relay Satellite System ("TDRSS").

BACKGROUND

2. Historically, the 13.4-14.0 GHz band was exclusive Government spectrum allocated to the radiolocation service on a primary basis.³ There are currently several hundred relatively high-powered shipboard radars operated by the United States and other governments in the 13.75-14.0 GHz sub-band worldwide. In 1970, the 13.4-14.0 GHz band was made available to the non-Government radiolocation service on a secondary basis.⁴

3. The National Aeronautics and Space Administration ("NASA") uses the secondary space research allocation at 13.4-14.0 GHz for TDRSS,⁵ the space shuttle's rendezvous radar for satellite retrieval, and for active sensors that measure altitude, wind, and precipitation. TDRSS supports space missions by relaying communications between ground stations and low earth orbiting satellites or spacecraft ("LEO"), including the space shuttle, Landsat and other non-NASA flight missions, when the spacecraft are over the horizon and not capable of direct communications with ground stations. Specifically, the TDRSS forward space-to-space link is from a geostationary TDRSS satellite down to a LEO ("TDRSS forward link-to-LEO"). The center frequency for the TDRSS forward command link is at 13.775 GHz, and the bandwidth can be varied from six megahertz (13.772-13.778 GHz, or "narrowband mode") to 50 megahertz (13.75-13.8 GHz, or "wideband mode").⁶ In addition, TDRSS uses the 13.75-14.0 GHz band as

² In Recommendation ITU-R SA.1071, space science services refer to the earth exploration-satellite service and the space research service.

³ Radiolocation is defined as radiodetermination used for purposes other than those of radionavigation. Radiodetermination is defined as the determination of the position, velocity and/or other characteristics of an object, or the obtaining of information relating to those parameters, by means of the propagation properties of radio waves. Radionavigation is defined as radiodetermination used for the purpose of navigation, including obstruction warning. See 47 C.F.R. § 2.1. See also 47 C.F.R. § 2.106.

⁴ See *Amendment of Parts 2, 89, 91 and 93 of the Commission's Rules to Add Frequency Bands Newly Available to the Non-Government Radiolocation Service, Order, FCC 70-281*, adopted March 18, 1970.

⁵ In addition to the Ku-band (12/14 GHz) TDRSS system, there are S-band (2/2.3 GHz) and C-band (3.7/6.4 GHz) TDRSS systems.

⁶ Narrowband mode is used to transmit command and control data. Wideband mode is required for sending higher rate data to a spacecraft or video information to the space shuttle or space station. This data and information may include scientific data and spacecraft health and safety information. The LEO-to-TDRSS return link is at 14.9-15.1 GHz.

a downlink to communicate with earth stations at White Sands, New Mexico. An active sensor is a measuring instrument that generates a signal, transmits it to a target, and receives a reflected signal from the target. Information concerning the target is obtained by comparison of the received signal with the transmitted signal. NASA operates three types of active sensors in the band: the NASA Scatterometers ("NSCAT"), which measure wind velocity; the TOPEX-POSEIDON altimeters, which provide precise altitude measurements; and the TRMM precipitation radars, which provide rainfall data.⁷

4. At WARC-92, the 13.75-14.0 GHz band was allocated worldwide for FSS uplink operations on a co-primary basis with the radiolocation service.⁸ WARC-92 also adopted international footnotes 855A and 855B, which specified interim sharing criteria between FSS and incumbent services in the band, including TDRSS. At WRC-95, final sharing criteria between FSS and incumbent services were adopted and the above international footnotes were revised, reorganized and renumbered as S5.502, S5.503 and S5.503A.⁹ These footnotes are discussed in detail in paragraph 13, below.

5. On February 13, 1996, in response to a Petition for Rulemaking filed by Hughes Communications Galaxy, Inc. ("Hughes"), we adopted a *Notice of Proposed Rule Making* ("NPRM") in this proceeding.¹⁰ In the *NPRM*, we proposed to allocate the 13.75-14.0 GHz band for FSS uplinks, to make this frequency band available for use by both domestic and international FSS systems, and to make conforming amendments to Part 25. We also proposed to adopt

⁷ NSCAT operates in the 13.99356-13.99644 GHz band segment, TOPEX-POSEIDON operates in the 13.44-13.81 GHz band, and the TRMM precipitation radar satellite, scheduled for launch in 1997, will operate in the 13.793-13.805 GHz band segment. (In addition, the ERS-1 altimeters have emissions that extend from 13.635 GHz to 13.965 GHz.) A spaceborne altimeter is a downward-looking pulsed-radar system that is used to measure the range from the satellite to the ocean surface; this very precise height measurement assists in the production of very accurate maps of the ocean topography. Scatterometers are radar type devices that measure the near surface vector winds over the oceans; this wind data is critical to the determination of regional weather patterns and global climate.

⁸ Specifically, in order to allocate only the upper 250 megahertz of the 13.4-14.0 GHz band to the FSS, the band was subdivided into the 13.4-13.75 and 13.75-14.0 GHz bands. See *WARC-92 Final Acts*, note 1, *supra*.

⁹ See note 1, *supra*. The ITU is transitioning to new Simplified Radio Regulations, which use the "S" numbering scheme for international footnotes. In anticipation of the ITU's ultimate conversion to the Simplified Radio Regulations, we are employing the new "S" numbering scheme for international footnotes adopted in this proceeding. The Commission lists the international footnotes immediately following the Table of Frequency Allocations in Section 2.106 of the Rules. See 47 C.F.R. § 2.106. Until such time as this list is entirely revised to comport with the new "S" numbering scheme, those international footnotes that are amended to the new scheme in individual proceedings will be listed in Section 2.106 immediately prior to the list of unamended footnotes employing the old numbering scheme.

¹⁰ See *Notice of Proposed Rule Making*, 11 FCC Rcd 5923 (1996). See also Hughes' Petition for Rulemaking (RM-8638) filed on March 21, 1995; *Public Notice*, Report No. 2070, released May 3, 1995 (requesting comment on Hughes' Petition); *Order Extending Time*, DA 96-579, released April 12, 1996 (extending *NPRM* reply comment date to April 26, 1996).

domestically the international footnotes that specify the spectrum sharing criteria for the 13.75-14.0 GHz band as contained in the U.S. Proposals for WRC-95 which, with modification, were ultimately adopted as international footnotes S5.502, S5.503 and S5.503A.

6. All FSS applications that request the use of any frequencies in the 13.75-14.0 GHz band are subject to the standard process whereby the Commission coordinates such applications through the frequency assignment subcommittee ("FAS") of the Interdepartment Radio Advisory Committee ("IRAC") to ensure that harmful interference to primary Government operations is minimized.¹¹ In the *NPRM*, we observed that international footnote 855B (S5.503) addresses the protection from harmful interference of the TDRSS forward space-to-space link when the link is operated in its narrowband mode only (13.772-13.778 GHz), and tentatively concluded that additional protection would be necessary when this link is operated in its wideband mode (13.75-13.80 GHz). Therefore, we proposed to add to the Table of Frequency Allocations a new United States footnote requiring that FSS earth stations operating specifically in the 13.75-13.80 GHz band be coordinated through the FAS process on a case-by-case basis in order to minimize harmful interference to TDRSS.

7. In response to the *NPRM*, six comments and five reply comments were filed.¹² In its comments to this proceeding, NASA requests that, in addition to protecting TDRSS, we mandate technical restrictions on FSS uplinks in order to protect TRMM, TOPEX-POSEIDON and NSCAT from harmful interference.

DISCUSSION

A. Need for the Allocation

8. In the *NPRM*, we proposed to allocate the 13.75-14.0 GHz band on a primary basis to the FSS for uplink transmissions. We based this proposal on the growing demand for fixed-satellite services in the Ku-band portion of the spectrum, the need to further the competitiveness of U.S. satellite operators in domestic and international markets, and the added flexibility that the

¹¹ The National Telecommunications and Information Administration ("NTIA") is the Federal spectrum manager and the principal Executive branch advisor on telecommunications policy. IRAC is a committee within NTIA. The primary functions of IRAC are to assist in assigning frequencies to Government radio stations and in developing and executing policies, programs, procedures and technical criteria pertaining to the allocation, management, and use of the spectrum. IRAC is composed of the 20 most active Federal users of the spectrum and a liaison member from the Commission.

¹² The commenting parties are: COMSAT World Systems ("COMSAT"), GE American Communications, Inc. ("GE Americom"), Hughes, IRAC, Loral Aerospace Holdings Inc. ("Loral"), and NASA. NASA's and IRAC's comments were late-filed. We believe it to be in the public interest that NASA's and IRAC's comments be considered in this proceeding and we hereby accept them. The reply commenting parties are: COMSAT, GE Americom, Hughes, International Private Satellite Partners, Ltd. d/b/a Orion Atlantic ("Orion"), and Loral.

allocation would provide FSS system operators in designing their systems by enabling the co-location of satellites using different frequency bands at the same orbital location.

9. The commercial satellite parties to this proceeding strongly support allocating the 13.75-14.0 GHz band on a primary basis to the FSS for uplink transmissions.¹³ Specifically, Hughes states that a guiding principle in developing U.S. satellite policy should continue to be the promotion of an internationally competitive U.S. satellite industry.¹⁴ Hughes submits that the instant allocation will further this principle. Similarly, GE American Communications, Inc. ("GE Americom") indicates that the allocation will support the growth of the U.S. satellite industry by allowing U.S.-licensed FSS providers to respond competitively to the numerous proposals by satellite systems from other countries that plan to use the 13.75-14.0 GHz band.¹⁵ In this regard, GE Americom points out that it has already proposed to use the 13.75-14.0 GHz band to enter the market for the distribution of video services to Latin America.¹⁶

10. Loral Aerospace Holdings Inc. ("Loral") states that commercial demand for additional uplink spectrum exists today and that incorporating the spectrum to be made available by the proposed allocation would simplify spacecraft payload design and reduce per-channel cost.¹⁷ In addition, Loral submits that this allocation would promote efficient use of the scarce usable positions within the geostationary orbital arc and should thereby increase competition in the satellite services business.¹⁸ Specifically, Loral indicates that the allocation of this 250 megahertz of spectrum, contiguous to the existing uplink allocation at 14.0-14.5 GHz, will provide an optimum resource for improved communications links both domestically and for potential international service, by spot and/or wide area beams. Loral claims this will result in added flexibility in satellite system design, and will in turn provide customers with the ability to access a broader range of services from a given earth station. In sum, Loral urges that this spectrum allocation would enhance FSS satellite capability and system characteristics, enabling the handling

¹³ See COMSAT Comments at 1, GE Americom Comments at 1 and 4-5, Hughes Comments at 1-2, Loral Comments at 1-4, Orion Reply Comments at 2.

¹⁴ See Hughes Comments at 2.

¹⁵ See GE Americom Comments at 1.

¹⁶ GE Americom has applied for authority to construct and launch two satellites and to construct a ground spare that would use this band. See File Nos. 18/19-SAT-P/LA-96 & 20-SAT-P-96.

¹⁷ See Loral Reply Comments at 3. Loral's comments were filed under the corporate name of Loral Aerospace Holdings Inc. ("LAHI"), then a subsidiary of Loral Inc. Subsequently, Lockheed Corp. purchased the defense-related businesses of Loral Corp. and spun off the communications-related businesses of LAHI to a new parent corporation, Loral Space & Communications Ltd. The latter entity filed Loral's reply comments. To minimize confusion, we shall refer to LAHI and the latter entity, which is the successor-in-interest to LAHI in this proceeding, as Loral.

¹⁸ See Loral Comments at 2-3.

of increased volume and the development of new efficient communications services that can be provided to more users at lower costs. GE Americom makes similar observations.¹⁹

11. In addition, COMSAT World Systems ("COMSAT") and International Private Satellite Partners, Ltd. d/b/a Orion Atlantic ("Orion") argue that the proposed changes are necessary and appropriate to reflect the decision of the 1992 World Administrative Radio Conference ("WARC-92") to allocate the band worldwide on a primary basis for FSS uplink operations.²⁰ COMSAT, Hughes, Loral and Orion claim that the allocation would reduce the imbalance between the amount of spectrum allocated for FSS uplinks and downlinks in the Ku-band.²¹ Specifically, Loral points out that, according to the satellite communications service rules, while 1000 megahertz of Ku-band spectrum at 10.95-11.2 and 11.45-12.2 GHz is available to be licensed for FSS downlinks, only 500 megahertz of Ku-band spectrum at 14.0-14.5 GHz is currently available to be paired and licensed for FSS uplinks.²² Hughes states that the FSS downlink bands at 10.95-11.2 and 11.45-11.7 GHz are not paired with any uplink bands and that making the 13.75-14.0 GHz band available for FSS uplinks will provide 250 megahertz of much-needed uplink spectrum, thereby allowing U.S. satellite operators to compete more effectively in the growing international market.²³

12. Decision. We find that there is a growing demand for fixed-satellite services in the Ku-band portion of the spectrum. For example, there are over one hundred satellite systems planned worldwide that would use the 13.75-14.0 GHz band, and some of these systems are at locations particularly well-suited for the provision of service to and from the United States.²⁴ We

¹⁹ See GE Americom Comments at 4-5.

²⁰ See COMSAT Comments at 1, Orion Reply Comments at 2.

²¹ See COMSAT Comments at 2, Hughes Comments at 2, Loral Comments at 2-3, Orion Reply Comments at 2.

²² See Loral Comments at 2. See generally 47 C.F.R. § 25.202.

²³ See Hughes Comments at 2.

²⁴ We have recently proposed a uniform framework for evaluating applications by users in the United States for authority to access satellites licensed in other countries. Under this framework, non-U.S.-licensed satellite systems will generally be able to provide satellite services to, from, or within the United States to the extent that foreign markets allow effective competitive opportunities for U.S. satellite systems to provide analogous services. However, we may sometimes be faced with greater spectrum demand than we can accommodate. If there is sufficient spectrum to accommodate only a few systems, for a particular service or in a particular portion of the spectrum, the Commission will not be able to offer access to all non-U.S. systems any more that it can license all U.S. applicants. In assigning scarce frequencies we proposed to treat non-U.S. systems that pass the "effective competitive opportunities for satellites" ("ECO-Sat") test as we would U.S.-licensed systems. See *Amendment of the Commission's Regulatory Policies to Allow Non-U.S.-Licensed Space Stations to Provide Domestic and International Service in the United States, etc.*, IB Docket No. 96-111, *Notice of Proposed Rule Making*, FCC 96-210, released May 14, 1996, 61 Fed. Reg. 32398 (June 24, 1996).

believe that this allocation would complement and allow for greater use of the existing FSS downlink spectrum allocation. Further, we believe that the growing international and domestic demand for FSS services should be accommodated by making this spectrum available for FSS operations. In addition, we find that this allocation would further the competitiveness of U.S. satellite operators in domestic and international markets and would provide more open and competitive markets for consumers. In this regard, we note that the allocation of the 13.75-14.0 GHz band for uplinks would permit FSS system operators greater flexibility in designing their systems by enabling the co-location at the same orbital location of satellites that use different frequency bands. This allocation is fully supported by the commercial satellite commenters and is not opposed by the incumbent Government users as long as adequate coordination is provided. Accordingly, we allocate the 13.75-14.0 GHz band to the fixed-satellite (Earth-to-space) service on a primary basis.

B. Spectrum Sharing Issues

13. In the *NPRM*, we proposed domestically to adopt in our Table of Frequency Allocations, 47 C.F.R. § 2.106, for the 13.75-14.0 GHz band, the proposed international footnotes (designated as 855A, 855B and 855C) set forth in the U.S. Proposals to WRC-95. These proposed footnotes contain suggested sharing criteria between FSS and other operations in the 13.75-14.0 GHz band. We observed that WRC-95 had recently concluded and that we would consider the actions taken at WRC-95 pertaining to this band at the Report and Order stage of the proceeding.²⁵ WRC-95 adopted a modified version of the U.S.-proposed footnotes and renumbered them as footnotes S5.502, S5.503 and S5.503A, respectively. Specifically, international footnote S5.502 places restrictions on the fixed-satellite, radiolocation and radionavigation services in order to allow these services to share the 13.75-14.0 GHz band. International footnote S5.503 "grandfathers" those TDRSS space stations for which information for advance publication was received by the ITU's Radiocommunication Bureau prior to January 31, 1992, *i.e.*, those TDRSS space stations will operate on an equal basis with FSS stations. This footnote also specifies the maximum equivalent isotropically radiated power ("e.i.r.p.") density for FSS operations in the 13.772-13.778 GHz band segment in order to protect the TDRSS forward link-to-LEO when the link is operated in its narrowband mode. International footnote S5.503A provides for a transition period during which the spaceborne sensors (TRMM, TOPEX-POSEIDON, and NSCAT) are protected from harmful interference from FSS uplinks. At the conclusion of the transition period, spaceborne sensors in the 13.75-14.0 GHz will operate on a secondary basis to FSS uplinks. These international footnotes are largely consistent with the U.S. Proposals for WRC-95, except for the provision that the transition period pertaining to protection of TRMM precipitation radar will expire on January 1, 2000, one year less than the United States proposed. See the attached Appendix for the text of the footnotes.

14. In addition to the international footnotes, we proposed to adopt a US footnote that would require FSS licensees to coordinate all operations in the 13.75-13.80 GHz band with

²⁵ *NPRM* at ¶ 1 & n.3.

TDRSS in order to fully protect that Government operation. This footnote was proposed in order to protect the TDRSS forward link-to-LEO when the link is used in its wideband mode, *i.e.*, operating in the 13.75-13.80 GHz band. By contrast, international footnote S5.503 protects only the TDRSS forward link-to-LEO when the link is used in its narrowband mode, *i.e.*, operating in the 13.772-13.778 GHz band. We also proposed to amend the FSS service rules in Part 25 to conform them to the allocation and the technical sharing criteria of the international footnotes. Specifically, we proposed to add the 13.75-14.0 GHz band to the list of frequency bands available for FSS use, to conform the FSS power limits to those specified in the international footnotes, and make other necessary editorial changes. Finally, we tentatively concluded that it was unnecessary to amend the non-Government radiolocation service rules in Part 90 because that service operates in the 13.75-14.0 GHz band on a secondary basis and therefore already is required to protect primary services, such as the FSS, from harmful interference.

15. The proposed protection criteria were generally supported by the commenters. However, NASA requests additional protection be given to its spaceborne sensors.²⁶ Specifically, until January 1, 2000, NASA requests that FSS earth stations operating in the 13.75-14.0 GHz band be excluded from certain geographic areas in order to protect TOPEX-POSEIDON from harmful interference ("TOPEX-POSEIDON critical zones")²⁷ and that the e.i.r.p. of FSS earth stations be limited to 25 dBW in any 2 kHz band between 13.99356 and 13.99644 GHz in order to protect NSCAT. In addition, in order to protect TRMM until January 1, 2001, NASA requests that FSS earth stations operating in the 13.75-13.86 GHz band be excluded from certain geographic areas ("TRMM critical zones"),²⁸ that the e.i.r.p. density of any FSS earth station at a latitude between $\pm 55^\circ$ be limited to 61 dBW in any 600 kHz band between 13.793 and 13.805 GHz, and that the elevation angle of any FSS earth station using the 13.75-14.0 GHz band not exceed 71° . Finally with regard to TDRSS, NASA requests that FSS licensees fully coordinate all operations in the 13.75-14.0 GHz band that are within 390 kilometers of the TDRSS earth stations located at White Sands, New Mexico according to the methods and criteria of Appendix 28 of the ITU Radio Regulations.²⁹

²⁶ See NASA Comments at 2-5.

²⁷ NASA variously refers to these areas as "exclusion zones" or "critical zones." See NASA Comments at Figure 1 for the description of the TOPEX-POSEIDON critical zones.

²⁸ See NASA Comments at Figure 2 for the description of the TRMM critical zones.

²⁹ See ITU *Radio Regulations*, Edition of 1990, Revised in 1994, Volume 2, Appendix 28: "Method for the Determination of the Coordination Area Around an Earth Station in Frequency Bands between 1 GHz and 40 GHz Shared Between Space and Terrestrial Radiocommunication Services." See also Letter from Doug Boyd, CSC, to Larry Reed, International Bureau, dated June 27, 1996, wherein a NASA contractor discusses the protection contour for the Whites Sands Ground Terminal.

16. In response to NASA's request, COMSAT, GE Americom, Hughes and Loral oppose NASA's proposed exclusion of FSS earth stations from the critical zones.³⁰ They suggest that, rather than excluding FSS earth stations from the critical zones, the Commission should preserve the ability of satellite system operators to use this band by permitting them to coordinate with NASA on a case-by-case basis. They argue that this would be a fair mechanism for resolving any potential conflicting uses of spectrum. Further, Hughes states that the combination of the technical rules proposed in the *NPRM* and the identification of the precise coordinates of the critical zones would be sufficient to allow expeditious commercial use of this band without imposing any undue burden on the systems that NASA seeks to protect.³¹

17. In addition, Loral avers that adopting NASA's geographic exclusion proposal may preclude meaningful FSS use of the 13.75-14.0 GHz band within the critical zones until the year 2000 in some cases and 2001 in others.³² In particular, Loral claims that protecting NASA's systems by excluding earth stations from the critical zones may result in denying the U.S. public the benefits that would otherwise accrue if the spectrum were used without the geographical fragmentation required by NASA's proposals. Further, Loral argues that if a rule excluding FSS earth stations from the critical zones were adopted, satellite service providers who are licensed in the near term would be disadvantaged in designing and implementing new Ku-band systems. Specifically, Loral claims that either the satellite service providers would elect not to provide capability for the 13.75-14.0 GHz band into their U.S. coverage, and thus would create systems that would be drastically less efficient than systems launched after 2001, or they would design expanded capacity into their systems today that would remain unusable until 2001. In either case, efficiencies would be lost, service diminished or delayed, and higher system costs would be passed on to consumers in the form of higher rates. Finally, while recognizing the need to protect TDRSS, COMSAT and Loral nevertheless submit the longer term solution that would ensure TDRSS's protection from harmful interference and would provide it greater operational flexibility is for NASA to continue to take steps to implement the planned move of TDRSS operations to the 25.25-27.50 GHz band.³³

18. Decision. There are a number of important incumbent Government operations in the 13.75-14.0 GHz band with which the FSS must share this spectrum. Specifically, there are currently several hundred relatively high-powered mobile radars operated by United States and

³⁰ See COMSAT Reply Comments at 3-4, GE Americom Reply Comments at 2-4, Hughes Reply Comments at 3-5, and Loral Reply Comments at 3-5. We note that none of the parties address the issue of whether TRMM should be provided an additional year of protection from harmful interference from FSS operations.

³¹ See Hughes Reply Comments at 4-5.

³² See Loral Reply Comments at 3-4.

³³ See COMSAT Comments at 4, Loral Reply comments at 3. We note that the NTIA Manual has recently been amended, *inter alia*, to allocate the 25.25-27.50 GHz band to the Government inter-satellite service. See Letter from Associate Administrator, NTIA, to Chief, Office of Engineering and Technology, dated May 14, 1996.

other governments in this band worldwide; TDRSS, which is a critical national asset that provides communication links for U.S. space and satellite operations; and spaceborne sensors that provide weather and other significant data. We believe that it is imperative that these important services be protected appropriately from harmful interference from FSS operations. To provide this protection, we are adopting international footnotes S5.502, S5.503 and S5.503A and footnote US337, and are amending the applicable rules in Part 25 to make them consistent with these footnotes. See the Appendix. We believe that the protection criteria set forth in these footnotes will be adequate to protect incumbent services while permitting FSS uplinks to use the band. These international footnotes are the product of several years of development and study by ITU Radiocommunication Sector ("ITU-R") Task Groups 4/4 and 7/3 and were supported domestically by the WRC-95 Industry Advisory Committee, the National Telecommunications and Information Administration ("NTIA"), and the Commission.³⁴ We also provide below certain geographic and technical information for coordination purposes.

19. We decline to adopt the additional restrictions on FSS operations that NASA requests. These restrictions would require the Commission's FSS licensees to protect TRMM through January 1, 2001, while licensees of other countries would only be required to protect TRMM through January 1, 2000. This dichotomy would potentially place Commission FSS licensees at a competitive disadvantage vis-a-vis FSS providers licensed in other countries, and TRMM operations would still be subject to potential interference from the latter's FSS operations.³⁵ Nor will we exclude FSS earth stations from the TRMM or TOPEX-POSEIDON critical zones as requested by NASA. While it may be difficult to coordinate FSS earth stations in these zones, we nevertheless believe that FSS licensees should be allowed to attempt to coordinate such stations on a case-by-case basis. This will provide FSS licensees more flexibility in designing their systems and will enable more efficient use of this spectrum. Moreover, we believe that the FAS coordination process will assure that FSS licensees fully protect NASA's spaceborne sensors in accordance with international footnote S5.503A. Nonetheless, we encourage FSS licensees to take into consideration Recommendation ITU-R SA.1071 when designing their systems and to avoid the TRMM and TOPEX-POSEIDON critical zones whenever possible.³⁶ We believe that doing so will facilitate coordination and entry into these bands by FSS uplinks.

20. Since this is a shared Government/non-Government band, all FSS earth stations and future Government radiolocation stations proposing to transmit in the 13.75-14.0 GHz band will

³⁴ See *Preparation for International Telecommunication Union World Radiocommunication Conferences*, IB Docket No. 94-31, Report, 10 FCC Rcd 12783 (1995).

³⁵ See note 24, *supra*. We note that non-U.S.-licensed satellites may soon begin providing more extensive services to the United States.

³⁶ These critical zones are described in NASA's Comments to the NPRM at Figures 1 and 2. Since all FSS applications requesting the use of any frequency in the 13.75-14.0 GHz band must be coordinated by the Commission through the FAS on a case-by-case basis, NASA has declined to provide further details concerning its critical zones.

be coordinated by the Commission through the normal FAS process.³⁷ To facilitate this coordination process, upon the request of the IRAC,³⁸ we provide the following information for prospective licensees:

The United States Government conducts radiolocation operations aboard ships worldwide. Although we are adopting ITU Footnote S5.502 as a basic sharing criteria between FSS uplinks and radiolocation, site selection for FSS earth stations must be coordinated and adjustments may be required to preclude harmful interference. A power flux density ("PFD") value of $-167 \text{ dB(W/m}^2/4 \text{ kHz)}$ is required to protect radiolocation receivers; geographical separation of the FSS earth stations from the radar must be sufficient to yield this value. These matters will be addressed during the coordination phase with the Government.

21. With regard to TDRSS, we note that NASA currently has four geostationary space stations in the space research service operating space-to-space links in the 13.75-13.80 GHz band and space-to-Earth links in the 13.80-14.05 GHz band. These TDRSS space stations are located at four locations on the geostationary orbit. An additional TDRSS space station is planned. TDRSS satellites use the entire 13.75-14.0 GHz band as a downlink to communicate with two earth stations at the White Sands Complex in New Mexico: (1) the White Sands Ground Terminal is located at $106^\circ 36' 31''$ West Longitude and $32^\circ 29' 54''$ North Latitude; and (2) the Second TDRSS Ground Terminal is located at $106^\circ 36' 48''$ West Longitude and $32^\circ 32' 40''$ North Latitude. During the FAS process, FSS earth stations proposing to operate in the 13.75-14.0 GHz band will be coordinated with these TDRSS earth stations and with the TDRSS forward link-to-LEO in order to minimize harmful interference to their operations. Moreover, we observe that the FAS will apply the methods and criteria of Appendix 28 of the ITU Radio Regulations in order to protect the TDRSS earth stations. In this regard, we note that NASA has converted the Appendix 28 requirements into a 390 kilometer (242.3 mile) coordination radius centered at 106.6° West Longitude and 32.5° North Latitude. As mentioned earlier, we are adopting US337 in order to protect the forward link-to-LEO when this link is operated in its wideband mode. In addition, we are revising the text of US337 to clarify that the purpose of the footnote is to protect the TDRSS forward link-to-LEO in particular.

22. In the *NPRM*, we declined to amend the technical rules to specify an e.i.r.p. limit for the radiolocation service in Part 90. We did so because the non-Government radiolocation service operates in the 13.75-14.0 GHz band on a secondary basis and therefore must not cause harmful interference to any primary service, including the proposed FSS uplinks. COMSAT, the only

³⁷ The Commission submits non-Government frequency assignment applications for consideration by the FAS. If a conflict arises, the Commission will either request the applicant's assistance in its resolution or transfer the matter directly to the affected Government user(s) for resolution.

³⁸ See IRAC Comments at 1. See also note 11, *supra*.

party commenting on this issue, concurs that it is not necessary to amend Part 90.³⁹ We continue to believe that it is unnecessary to specify technical standards for providing interference protection to FSS uplinks in this band from non-Government radiolocation operations. In particular, we observe that the e.i.r.p. limit set forth in international footnote S5.502, though fully applicable to the relatively high-power Government radiolocation operations, is not pertinent to non-Government radiolocation operations, which generally operate with considerably less power. Nevertheless, in order to better inform radiolocation service users that their service is allocated on a secondary basis to the FSS, we are adding an appropriate assignment limitation to the list of frequencies available for radiolocation. See Section 90.103(b) and (c) in the Appendix.

C. No Restriction to International Service.

23. In the *NPRM*, we proposed to make the 13.75-14.0 GHz band available for use by both domestic and international FSS systems. We noted that this proposal is consistent with our action in IB Docket No. 95-41, wherein regulations that restricted international FSS operators from providing complete domestic service and restricted domestic FSS operators from providing complete international service were eliminated.⁴⁰

24. COMSAT prefers that this FSS allocation be available only for use by international systems because of the growing demand for worldwide satellite services and the need to correct the imbalance between the uplink and downlink spectrum available for FSS.⁴¹ On the other hand, GE Americom and Loral support our proposal.

25. Decision. We find that there is no need to restrict this allocation of the 13.75-14.0 GHz band for the FSS to international service only. We believe that, by treating all U.S.-licensed geostationary fixed-satellite operations in this band under the same regulatory scheme, we will better encourage the opening of markets and the intensification of competition in the fixed-satellite services for both domestic and international operations. Further, we believe that restriction of this band to international operations only is not technically justified and would needlessly impair businesses' ability to meet their customers' needs. Accordingly, we are making the 13.75-14.0 GHz band available for use by both domestic and international FSS systems.

D. GE Americom's Request.

26. In addition to supporting our decision to make the 13.75-14.0 GHz band available for use by both domestic and international FSS systems, GE Americom requests that we eliminate the prohibition on the use of the 10.95-11.2 and 11.45-11.7 GHz FSS downlink bands by

³⁹ See COMSAT Comments at 5.

⁴⁰ See *Amendment to the Commission's Regulatory Policies Governing Domestic Fixed Satellites and Separate International Satellite Systems*, IB Docket No. 95-41, *Report and Order*, 10 FCC Rcd 7789 (1995).

⁴¹ See COMSAT Comments at 4-5.

domestic systems. It argues that there is no technical basis for this latter restriction and that continuation of the prohibition would unnecessarily limit the flexibility of FSS providers and the efficiency of their frequency use.⁴² Loral supports GE Americom's proposal.⁴³ However, COMSAT and Hughes express concern that Commission consideration of this new issue here could delay the allocation of the 13.75-14.0 GHz band to the FSS, and therefore urge that such consideration be deferred to a separate proceeding.⁴⁴ We will not further consider GE Americom's request in this proceeding. The petition for rulemaking and *NPRM* address explicitly the allocation of the 13.75-14.0 GHz band only. While GE Americom and Loral in their comments have expressed a desire that we address the issue of domestic use of the 10.95-11.2 and 11.45-11.7 GHz bands as well, we do not believe this issue is properly within the scope of this proceeding. We believe that the incumbent fixed microwave licensees of those bands may be unaware of GE Americom's request and thus may not have had a reasonable opportunity to file comments in this proceeding in order to address this issue. Accordingly, we will dismiss GE Americom's request without prejudice. Nevertheless, we encourage any party desirous of ending the prohibition on the domestic use of the 10.95-11.2 and 11.45-11.7 GHz bands to file a petition for rulemaking that specifically addresses how domestic FSS downlinks could share this spectrum with existing terrestrial microwave systems operating in those bands.⁴⁵

E. Administrative Matters

27. As an administrative matter we are updating and correcting typographical errors in the Table of Frequency Allocations as noted in the *NPRM*. These changes will make the Table consistent with past Commission actions, the *WRC-92 Final Acts* and the recent changes made at *WRC-95*. Specifically, we are correcting the text of footnote US110⁴⁶ and the cross reference for the 13.4-14.0 GHz band so as to list the private land mobile radio service as a secondary, not primary, service. We are also taking this opportunity to correct and update entries in the 10.7-11.7 and 14.0-14.5 GHz band as follows. The cross reference to the service rules for the 10.7-

⁴² See GE Americom Comments at 5-8.

⁴³ See Loral Reply Comments at 1-2.

⁴⁴ See COMSAT Reply Comments at 5-6, Hughes Reply Comments at 5.

⁴⁵ We note that footnote NG104 limits FSS use of the 10.7-11.7 and 12.75-13.25 GHz bands to international systems, *i.e.*, other than domestic systems. FSS use of these bands has been restricted to international systems because the Commission believed that such systems would employ few earth stations, thereby avoiding potential interference cases between earth stations and terrestrial networks that could unduly restrict further development of terrestrial services in these bands. See *GWARC Inquiry*, 70 FCC 2d 1193, 1252 (1978); *Frequency Allocations - Satellite Services*, 26 RR 2d 1257, 1263-65 (1973).

⁴⁶ Specifically, "Government radioactive service" is corrected to read "Government radiolocation service." See *Amendment of Part 2 of the Commission's Rules Regarding Implementation of the Final Acts of the World Administrative Radio Conference, Geneva, 1979*, General Docket 80-739, *Second Report and Order*, 49 Fed. Reg. 2357 (January 19, 1984).

11.7 GHz band is updated to add Satellite Communications (25);⁴⁷ the cross reference to the maritime service rules in the 14.0-14.2 GHz band is corrected to denote that the radiolocation service operates on a secondary basis to the FSS;⁴⁸ the FSS allocation in the 14.2-14.4 GHz band is corrected to denote that the allocation is on a primary, not secondary, basis and, likewise, the cross reference to the satellite communications service rules is corrected to denote that this is a primary allocation;⁴⁹ the cross reference for the 14.2-14.4 GHz band is updated so as to list Fixed Microwave Services (101) instead of Domestic Public Fixed (21);⁵⁰ and the secondary land-mobile allocation in the 14.0-14.5 GHz band is moved from a footnote into the body of the Table.⁵¹ Finally, consistent with the WRC-95 *Final Acts*, the existing international footnotes in the 10.7-11.7 and 12.75-14.5 GHz bands are replaced with footnotes employing the new "S" numbering scheme. These footnotes are (old footnotes in parentheses): S5.149⁵² (533), S5.333 (713), S5.441⁵³ (792A), S5.484 (835), S5.497 (851), S5.498⁵⁴ (852), S5.499 (853), S5.500⁵⁵ (854) S5.501⁵⁶ (855), S5.502 (855A), S5.503 (855B), S5.503A, S5.504 (856), S5.505⁵⁷ (857),

⁴⁷ We note that only 500 megahertz of this allocation at 10.95-11.20 and 11.45-11.70 GHz has been added to Part 25. See 47 C.F.R. § 25.202(a)(1).

⁴⁸ See footnote US292 and 47 C.F.R. § 80.375(d)(2)(vi).

⁴⁹ See *Amendment of Parts 2 and 21 of the Commission Rules and Regulations to Reallocate the Local Television Transmission Service from the 11.7-12.2 GHz Band to the 14.2-14.4 GHz Band*, GEN Docket No. 87-136, Report and Order, 4 FCC Rcd 4572 (1989).

⁵⁰ See *Reorganization and Revision of Parts 1, 2, 21, and 94 of the Rule to Establish a New Part 101 Governing Terrestrial Microwave Fixed Services, etc.*, WT Docket No. 94-148, Report and Order, FCC 96-51 (released February 29, 1996), 61 Fed. Reg. 26670 (May 28, 1996).

⁵¹ In the WRC-95 *Final Acts*, the footnote allocation for the land mobile-satellite service -- international footnote 859 -- was transferred to the body of the International Table and footnote 859 was removed. We are following suit in the United States Table. Specifically, the allocation for the land mobile-satellite service is transferred from footnote US287 to the body of the non-Government column, and US287 is removed.

⁵² The text was also modified to add frequency bands from several other suppressed international footnotes, including footnote 862 in the 14.47-14.5 GHz band, and to update the cross reference.

⁵³ The text was also modified so that the direction of transmission is listed after each band.

⁵⁴ The text was also modified to change the cross reference from Article 14 to No. S9.21.

⁵⁵ The text was also modified to add Brunei Darussalam, Finland, Sri Lanka, Sweden, Thailand and to remove Afghanistan from the provisions of S5.500.

⁵⁶ The text was also modified to add Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Moldova, Kyrgyzstan, Russia, Tajikistan, Turkmenistan and Ukraine and to remove the former German Democratic Republic and the former U.S.S.R from the provisions of S5.501.

S5.506 (858), S5.508⁵⁸ (860), and S5.509⁵⁹ (861). International footnotes 859 and 862 are suppressed. Finally, since international footnotes 533, 713 and 792A also affect frequency bands not updated in this proceeding, the text of these footnotes is not deleted at this time. See the Appendix.

ORDERING CLAUSE AND EFFECTIVE DATE

28. Accordingly, IT IS ORDERED that Parts 2, 25 and 90 of the Commission's Rules, 47 C.F.R. Parts 2, 25 and 90, ARE AMENDED as set forth in the attached Appendix, effective 30 days upon publication in the Federal Register. This action is taken pursuant to Sections 4(i), 7(a), 303(c), 303(f), 303(g), and 303(r) of the Communications Act of 1934, as amended, 47 U.S.C. Sections 154(i), 157(a), 303(c), 303(f), 303(g), and 303(r).

FINAL REGULATORY FLEXIBILITY ANALYSIS

29. As required by Section 603 of the Regulatory Flexibility Act, 5 U.S.C. § 603 ("RFA"), an Initial Regulatory Flexibility Analysis ("IRFA") was incorporated into the *NPRM* in ET Docket No. 96-20.⁶⁰ The Commission sought written public comments on the proposals in the *NPRM*, including the IRFA. The Commission's Final Regulatory Flexibility Analysis ("FRFA") in this *Report and Order* conforms to the RFA, as amended by the Contract With America Advancement Act of 1996 (CWAAA), Pub. L. No. 104-121, 110 Stat. 847 (1996).⁶¹

Need For and Objective of the Rules

30. Our objective is to accommodate growing demand for fixed satellite services and to provide satellite operators with increased flexibility in the design of their systems. This action will allocate an additional 250 megahertz of uplink spectrum to the fixed-satellite service, which

⁵⁷ The text was also modified to add Brunei Darussalam, the Congo, Jordan, Oman, the People's Republic of Korea and Swaziland and to remove Kenya, Malta, Sri Lanka, Switzerland and Thailand from the provisions of S5.505.

⁵⁸ The text was also modified to add Bosnia and Herzegovina, The Former Yugoslav Republic of Macedonia, and Slovenia and to remove Finland, Jordan, the Netherlands, and Sweden from the provisions of S5.508.

⁵⁹ The text was also modified to remove the United Kingdom and Thailand from the provisions of S5.509.

⁶⁰ See 11 FCC Rcd 5923 (1996).

⁶¹ Subtitle II of the CWAAA is "The Small Business Regulatory Enforcement Fairness Act of 1996" (SBREFA), codified at 5 U.S.C. § 601 *et seq.*

we hope will open markets and increase competition in the fixed-satellite service for both domestic and international operations.

Summary of Issues Raised by the Public Comments in Response to the IRFA

31. No comments were submitted in direct response to the IRFA. We also reviewed the general comments for potential impact on small business, and no issues were raised.

Description and Estimate of Small Entities Subject to Which Rules Will Apply

32. The Commission has not developed a definition of small entities applicable to FSS licensees. Therefore, the applicable definition of small entity is the definition under the Small Business Administration (SBA) rules applicable to Communications Services, Not Elsewhere Classified. This definition provides that a small entity is expressed as one with \$11.0 million or less in annual receipts.⁶² At present there are no FSS satellite licensees in the 13.75-14.0 GHz band, and therefore, there are no small businesses currently using this band. However, we acknowledge that there may be future development of new satellite systems in this frequency band that may qualify as small entities pursuant to the SBA's definition.

33. This rule may also affect satellite communications equipment manufacturers. According to the SBA's regulations, a satellite communications equipment manufacturer must have 750 or fewer employees in order to qualify as a small business concern.⁶³ Census Bureau data indicates that there are 858 U.S. companies that manufacture radio and television broadcasting and communications equipment, and that 778 of these firms have fewer than 750 employees and would be classified as small entities.⁶⁴ The Census Bureau category is very broad, and specific figures are not available as to how many of these firms are manufacturers of satellite communications equipment; however, we acknowledge the likelihood that some of them may qualify as small entities.

Projected Reporting, Recordkeeping and Other Compliance Requirements of the Rules

34. The antennas that will use the 13.75-14.0 GHz band must have a minimum diameter of 4.5 meters. The e.i.r.p. from a earth station using the 13.75-14.0 GHz band must be at least 68 dBW and must not exceed 85 dBW, except in the frequency band 13.772-13.778 GHz, where the e.i.r.p. must be at least 68 dBW and must not exceed 71 dBW per 6 MHz. These rules are designed to ensure that FSS uplink operations will not cause harmful interference to the

⁶² 13 C.F.R. § 121.201, Standard Industrial Classification (SIC) Code 4899.

⁶³ 13 C.F.R. § 121.201, (SIC) Code 3663.

⁶⁴ U.S. Dept. of Commerce, 1992 Census of Transportation, Communications and Utilities (issued May 1995), SIC category 3663.

incumbent users of the band. These technical rules will generally effect only those small entities that manufacture earth station uplink equipment. Such equipment must comply with the requirement of Part 25 of the Commission's Rules, 47 C.F.R. Part 25. The types of professional engineering skills needed to assure such compliance would be available at any manufacturer of such equipment. In addition, the operators of the equipment must monitor the output power of the transmitter in order to ensure that the e.i.r.p. range is maintained. The types of professional skills needed to monitor the output power would be integral to the running of the system.

Steps Taken to Minimize Significant Economic Impact on Small Entities Consistent with Stated Objectives

35. The Commission considered and rejected an alternative proposal to restrict this FSS allocation to international service only. In this *Report and Order*, we decline to restrict the use of the 13.75-14.0 GHz band to international systems only. We believe that, by treating all U.S.-licensed geostationary fixed-satellite operations in this band under the same regulatory scheme, we will better encourage the opening of markets and the intensification of competition in the fixed-satellite services for both domestic and international operations. Further, we believe that restriction of this band to international operations only is not technically justified and would needlessly impair businesses' ability, including small businesses, to meet their customers' needs. Accordingly, we are making the 13.75-14.0 GHz band available for use by both domestic and international FSS systems.

36. Report to Congress: The Commission shall send a copy of this Final Regulatory Flexibility Analysis, along with this Report and Order, in a report to Congress pursuant to the Small Business Regulatory Enforcement Fairness Act of 1996, 5 U.S.C. § 801(a)(1)(A). A copy of this FRFA will also be published in the Federal Register.

FEDERAL COMMUNICATIONS COMMISSION

William F. Caton
Acting Secretary

Appendix: Final Rules

Parts 2, 25 and 90 of title 47 of the Code of Federal Regulations are amended as follows:

**PART 2-- FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS;
GENERAL RULES AND REGULATIONS**

1. The authority citation for Part 2 continues to read as follows:

AUTHORITY: Sec. 4, 302, 303, and 307 of the Communications Act of 1934, as amended, 47 U.S.C. Sections 154, 302, 303 and 307, unless otherwise noted.

2. Section 2.106, the Table of Frequency Allocations, is amended as follows:

a. Remove the existing entries for 10.7-11.7 GHz, 12.75-13.25 GHz, 13.25-13.4 GHz and 13.4-14.0 GHz in columns (1) through (7); for 14.00-14.25, 14.25-14.30 GHz, 14.3-14.4 GHz, 14.40-14.47 GHz and 14.47-14.50 GHz in columns (1) through (3); and for 14.0-14.2 GHz, 14.2-14.3 GHz, 14.3-14.4 GHz and 14.4-14.5 GHz in columns (4) through (7).

b. Add entries in numerical order for 10.7-11.7 GHz, 12.75-13.25 GHz, 13.25-13.4 GHz, 13.4-13.75 GHz, 13.75-14 GHz, 14-14.2 GHz, 14.2-14.25 GHz, 14.25-14.3 GHz, 14.3-14.4 GHz, 14.4-14.47 GHz and 14.47-14.5 GHz in columns (1) through (7).

c. Remove international footnotes 835, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861 and 862.

d. Add the note and international footnotes S5.149, S5.333, S5.441, S5.484, S5.497, S5.498, S5.499, S5.500, S5.501, S5.502, S5.503, S5.503A, S5.504, S5.505, S5.506, S5.508 and S5.509 immediately after the heading "INTERNATIONAL FOOTNOTES" and before international footnote 444.

e. Revise US110.

f. Remove US287.

g. Add US337.

§ 2.106 Table of Frequency Allocations

* * * * *

International table			United States table			FCC use designators	
Region 1 - allocation GHz	Region 2 - allocation GHz	Region 3 - allocation GHz	Government	Non-Government	Rule part(s)	Special-use frequencies	
(1)	(2)	(3)	Allocation GHz (4)	Allocation GHz (5)	(6)	(7)	
10.7 - 11.7 FIXED FIXED-SATELLITE (space-to-Earth)(Earth-to-space) \$5.441 \$5.484 MOBILE except aeronautical mobile	10.7 - 11.7 FIXED FIXED-SATELLITE (space-to-Earth) \$5.441 MOBILE except aeronautical mobile	10.7 - 11.7 FIXED FIXED-SATELLITE (space-to-Earth) \$5.441 MOBILE except aeronautical mobile	10.7 - 11.7 US211	10.7 - 11.7 FIXED FIXED-SATELLITE (space-to-Earth) \$5.441 US211 NG104 NG41	FIXED MICROWAVE (101) SATELLITE COMMUNICATIONS (28)	.	
12.75 - 13.25 FIXED FIXED-SATELLITE (Earth-to-space) \$5.441 MOBILE Space Research (deep space)(space-to-Earth)	12.75 - 13.25 FIXED FIXED-SATELLITE (Earth-to-space) \$5.441 MOBILE Space Research (deep space)(space-to-Earth)	12.75 - 13.25 FIXED FIXED-SATELLITE (Earth-to-space) \$5.441 MOBILE Space Research (deep space)(space-to-Earth)	12.75 - 13.25 US251	12.75 - 13.25 FIXED FIXED-SATELLITE (Earth-to-space) \$5.441 NG104 MOBILE US251 NGS3 NG118	AUXILIARY BROADCASTING (74) CABLE TV RELAY (78) FIXED MICROWAVE (101)	.	
13.25 - 13.4 AERONAUTICAL RADIONAVIGATION \$5.497 \$5.499	13.25 - 13.4 AERONAUTICAL RADIONAVIGATION \$5.497 \$5.499	13.25 - 13.4 AERONAUTICAL RADIONAVIGATION \$5.497 \$5.499 \$5.499	13.25 - 13.4 AERONAUTICAL NAVIGATION \$5.497 Space Research (Earth-to-space)	13.25 - 13.4 AERONAUTICAL RADIONAVIGATION \$5.497 Space Research (Earth-to-space)	AVIATION (87)	.	
13.4 - 13.75 RADIOLOCATION Standard Frequency and Time Signal-Satellite (Earth-to-space) Space Research \$5.333 \$5.500 \$5.501	13.4 - 13.75 RADIOLOCATION Standard Frequency and Time Signal-Satellite (Earth-to-space) Space Research \$5.333	13.4 - 13.75 RADIOLOCATION Standard Frequency and Time Signal-Satellite (Earth-to-space) Space Research \$5.333 \$5.499 \$5.500 \$5.501	13.4 - 13.75 RADIOLOCATION US110 G59 Standard Frequency and Time Signal-Satellite (Earth-to-space) Space Research \$5.333	13.4 - 13.75 RADIOLOCATION US110 Standard Frequency and Time Signal-Satellite (Earth-to-space) Space Research \$5.333	Private Land Mobile (90)	.	
13.75 - 14 FIXED-SATELLITE (Earth-to-space) RADIOLOCATION Standard Frequency and Time Signal-Satellite (Earth-to-space) Space Research \$5.333 \$5.500 \$5.501 \$5.502 \$5.503 \$5.503A	13.75 - 14 FIXED-SATELLITE (Earth-to-space) RADIOLOCATION Standard Frequency and Time Signal-Satellite (Earth-to-space) Space Research \$5.333 \$5.502 \$5.503 \$5.503A	13.75 - 14 FIXED-SATELLITE (Earth-to-space) RADIOLOCATION Standard Frequency and Time Signal-Satellite (Earth-to-space) Space Research \$5.333 \$5.499 \$5.500 \$5.501 \$5.502 \$5.503 \$5.503A	13.75 - 14 RADIOLOCATION US110 G59 Standard Frequency and Time Signal-Satellite (Earth-to-space) Space Research US337 \$5.333 \$5.502 \$5.503 \$5.503A	13.75 - 14 FIXED-SATELLITE (Earth-to-space) US337 RADIOLOCATION US110 Standard Frequency and Time Signal-Satellite (Earth-to-space) Space Research \$5.333 \$5.502 \$5.503 \$5.503A	SATELLITE COMMUNICATION (25) Private Land Mobile (90)	.	

International table			United States table		FCC use designators	
Region 1 - allocation GHz	Region 2 - allocation GHz	Region 3 - allocation GHz	Government	Non-Government	Rule part(s)	Special-use frequencies
(1)	(2)	(3)	Allocation GHz (4)	Allocation GHz (5)	(6)	(7)
14 - 14.2 FIXED-SATELLITE (Earth-to-space) S5.506 RADIONAVIGATION S5.504 Land Mobile-Satellite (Earth-to-space) Space Research S5.505	14 - 14.2 FIXED-SATELLITE (Earth-to-space) S5.506 RADIONAVIGATION S5.504 Land Mobile-Satellite (Earth-to-space) Space Research	14 - 14.2 FIXED-SATELLITE (Earth-to-space) S5.506 RADIONAVIGATION S5.504 Land Mobile-Satellite (Earth-to-space) Space Research S5.505	14 - 14.2 RADIONAVIGATION US292 Space Research	14 - 14.2 FIXED-SATELLITE (Earth-to-space) RADIONAVIGATION US282 Land Mobile-Satellite (Earth-to-space) Space Research	SATELLITE COM- MUNICATIONS (25) Aviation (87) Maritime (80)	
14.2 - 14.25 FIXED-SATELLITE (Earth-to-space) S5.506 RADIONAVIGATION S5.504 Land Mobile-Satellite (Earth-to-space) Space Research S5.505	14.2 - 14.25 FIXED-SATELLITE (Earth-to-space) S5.506 RADIONAVIGATION S5.504 Land Mobile-Satellite (Earth-to-space) Space Research	14.2 - 14.25 FIXED-SATELLITE (Earth-to-space) S5.506 RADIONAVIGATION S5.504 Land Mobile-Satellite (Earth-to-space) Space Research S5.505	14.2 - 14.25	14.2 - 14.25 FIXED-SATELLITE (Earth-to-space) Land Mobile-Satellite (Earth-to-space) Mobile except aeronautical mobile	SATELLITE COM- MUNICATIONS (25) Fixed Microwave (101)	
14.25 - 14.3 FIXED-SATELLITE (Earth-to-space) S5.506 RADIONAVIGATION S5.504 Land Mobile-Satellite (Earth-to-space) Space Research S5.505	14.25 - 14.3 FIXED-SATELLITE (Earth-to-space) S5.506 RADIONAVIGATION S5.504 Land Mobile-Satellite (Earth-to-space) Space Research	14.25 - 14.3 FIXED-SATELLITE (Earth-to-space) S5.506 RADIONAVIGATION S5.504 Land Mobile-Satellite (Earth-to-space) Space Research S5.505	14.25 - 14.3	14.25 - 14.3 FIXED-SATELLITE (Earth-to-space) Land Mobile-Satellite (Earth-to-space) Mobile except aeronautical mobile	SATELLITE COM- MUNICATIONS (25) Fixed Microwave (101)	
14.3 - 14.4 FIXED FIXED-SATELLITE (Earth-to-space) S5.506 MOBILE except aeronautical mobile Land Mobile-Satellite (Earth-to-space) Radionavigation-Satellite	14.3 - 14.4 FIXED-SATELLITE (Earth-to-space) S5.506 Land Mobile-Satellite (Earth-to-space) Radionavigation-Satellite	14.3 - 14.4 FIXED FIXED-SATELLITE (Earth-to-space) S5.506 MOBILE except aeronautical mobile Land Mobile-Satellite (Earth-to-space) Radionavigation-Satellite	14.3 - 14.4	14.3 - 14.4 FIXED-SATELLITE (Earth-to-space) Land Mobile-Satellite (Earth-to-space) Mobile except aeronautical mobile	SATELLITE COM- MUNICATIONS (25) Fixed Microwave (101)	
14.4 - 14.47 FIXED FIXED-SATELLITE (Earth-to-space) S5.506 MOBILE except aeronautical mobile Land Mobile-Satellite (Earth-to-space) Space Research (space-to-Earth)	14.4 - 14.47 FIXED FIXED-SATELLITE (Earth-to-space) S5.506 MOBILE except aeronautical mobile Land Mobile-Satellite (Earth-to-space) Space Research (space-to-Earth)	14.4 - 14.47 FIXED FIXED-SATELLITE (Earth-to-space) S5.506 MOBILE except aeronautical mobile Land Mobile-Satellite (Earth-to-space) Space Research (space-to-Earth)	14.4 - 14.47 Fixed Mobile	14.4 - 14.47 FIXED-SATELLITE (Earth-to-space) Land Mobile-Satellite (Earth-to-space)	SATELLITE COM- MUNICATIONS (25)	

International table			United States table		FCC use designators	
Region 1 - allocation GHz	Region 2 - allocation GHz	Region 3 - allocation GHz	Government	Non-Government	Rule part(s)	Special-use frequencies
(1)	(2)	(3)	Allocation GHz (4)	Allocation GHz (5)	(6)	(7)
14.47 - 14.5 FIXED FIXED-SATELLITE (Earth-to-space) S5.506 MOBILE except aeronautical mobile Land Mobile-Satellite (Earth-to-space) Radio Astronomy S5.149	14.47 - 14.5 FIXED FIXED-SATELLITE (Earth-to-space) S5.506 MOBILE except aeronautical mobile Land Mobile-Satellite (Earth-to-space) Radio Astronomy S5.149	14.47 - 14.5 FIXED FIXED-SATELLITE (Earth-to-space) S5.506 MOBILE except aeronautical mobile Land Mobile-Satellite (Earth-to-space) Radio Astronomy S5.149	14.47 - 14.5 Fixed Mobile S5.149 US203	14.47 - 14.5 FIXED-SATELLITE (Earth-to-space) Land Mobile-Satellite (Earth-to-space) S5.149 US203	SATELLITE COM- MUNICATIONS (25)	(7)