Rules and Regulations

Title 5—ADMINISTRATIVE PERSONNEL

Chapter I—Civil Service Commission

PART 213—EXCEPTED SERVICE

Entire Executive Civil Service

Section 213.3102(v) is broadened to provide a single Schedule A exception for all Federal agencies to use in appointing boys and girls under the Youth Opportunity Campaign recently announced by the President. Effective on publication in the FEDERAL REGISTER, paragraph (v) of § 213.3102 is amended as set out below.

§ 213.3102 Entire executive civil service.

* * * * *

(v) Between June 1, 1965, and September 30, 1965, temporary summer trainee positions whose pay is fixed at the equivalent of the minimum wage established by the Fair Labor Standards Amendments of 1961 (currently $1.25 an hour) and whose duties involve laboring or other work of a routine nature requiring no specific knowledges or skills, when filled by persons appointed in furtherance of the President's Youth Opportunity Campaign. A person may not be appointed under this authority (1) unless he has reached his 16th but not his 22d birthday; or (2) for more than 700 hours.

(R.S. 1753, sec. 2, 22 Stat. 403, as amended; 5 U.S.C. 631, 633; E.O. 10577, 19 F.R. 7521, 3 CFR, 1954–1958 Comp., p. 218)

UNITED STATES CIVIL SERVICE COMMISSION,
[SEAL] MARY V. WENZEL,
Executive Assistant to the Commissioners.

[F.R. Doc. 65-5609; Filed, May 27, 1965; 8:48 a.m.]

Title 47—TELECOMMUNICATION

Chapter I—Federal Communications Commission

[Docket No. 15722; FCC 65-416]

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

Miscellaneous Amendments

In the matter of amendment of Part 2 of the Commission's rules to conform, to the extent practicable, with the Geneva (1959) Radio Regulations, as revised by the Space EARC, Geneva, 1963; Docket No. 15722.

1. The Commission adopted a notice of proposed rule making in the above-entitled matter on December 2, 1964, which was published in the FEDERAL REGISTER on December 16, 1964 (29 F.R. 17824). Interested parties were invited to file comments on or before January 15, 1965, and reply comments on or before January 25, 1965. The time for filing reply comments was subsequently extended to February 4, 1965, and was further extended to February 15, 1965. The Orders extending the reply comment period were published in the FEDERAL REGISTER on January 30, 1965 (30 F.R. 1009), and February 10, 1965 (30 F.R. 1878), respectively.

2. Comments were filed by the Committee on Radio Frequency Requirements for Scientific Research of the National Academy of Sciences (NAS), Hawaiian Telephone Co. (Hawaiian), Communications Satellite Corp. (Comsat), American Telephone & Telegraph Co. (A.T. & T.), and jointly by Aeronautical Radio, Inc. (ARINC) and Air Transport Association of America (ATA). Reply comments were filed by A.T. & T. and by Comsat, each with respect to the initial comments of the other.

3. NAS endorsed the proposals as set forth in the Commission's Notice. ARINC/ATA comments support the Commission's proposals, insofar as they are applicable to the aeronautical mobile (R) service and urge their adoption. ARINC/ATA also note the developmental work being done by the aviation industry to demonstrate the feasibility of using satellite relaying for two-way air-ground communication on long over-water flights. Prompt Commission action is requested to amend Part 87 of its rules to provide for the use of space techniques in the aeronautical mobile (R) service. The Commission is mindful of this development and plans to initiate appropriate proceedings in the near future. Additionally, ARINC/ATA invite the Commission's attention to their collective comments in Docket No. 15735, relating to the ownership and operation of earth stations in the communication-satellite service. That matter, however, is beyond the scope of this proceeding and will be resolved in due course in Docket No. 15735.

4. Hawaiian, the only communication common carrier providing regular public telephone service on and between the principal islands of the State of Hawaii, operates a number of radio-relay stations in the band 5925–6425 Mc/s but none in the band 3700–4200 Mc/s. Hawaiian, as stated in earlier filings with the Commission and repeated in this proceeding, expects to cooperate with the space communication system in the sharing of frequencies. It is now engaged in a coordinated effort with Comsat searching for a suitable earth station site in Hawaii. This search is complicated by the limited land areas available, and the degree to which the band 5925–6425 Mc/s is used by Hawaiian. Hawaiian states that any prospective earth station site in Hawaii would necessarily be within 27 miles of fixed stations now licensed to or applied for by Hawaiian. By 1972, if planned expansions are carried out to meet growing inter- and intra-island requirements, this distance will be reduced to 23 miles. Additionally, sample "coordination distance" calculations made by Hawaiian indicate that if an earth station is located at either end of the six-island Hawaiian chain, coordination would be required for all common carrier microwave stations presently located in Hawaii. Hawaiian also states that it is unaware of any usable earth station site on the Island of Oahu and believes that an attempt to operate such a station would result in interference to all of its existing and prospective facilities on that Island.

5. In dealing with the problems raised by Hawaiian, our flexibility is limited by the fact that the global communication-satellite system being considered must be operated in the internationally allocated bands 3700–4200 and 5925–6425 Mc/s. If Hawaii were to have no earth station, the global system could be implemented without fear of mutual interference resulting from Hawaiian's point-to-point microwave operations in the band 5925–6425 Mc/s. However, operations in Hawaii must be conformed to the global communication-satellite system, rather than the converse, if Hawaii is to have a terminal in the system. In light of Hawaiian's comments, this can be done only by providing an alternate band for many of its existing and future point-to-point microwave operations which otherwise would be in the band 5925–6425 Mc/s. It would not ease the problem to move them to the band 3700–4200 Mc/s since the earth station, trying to receive from the space station, would then be subjected to interference from Hawaiian's terrestrial system. The band 10,700–11,700 Mc/s is also available for common carrier fixed service use but Hawaiian states that it has limited applicability in Hawaii because of the distances to be traversed. Hawaiian, recognizing these problems, suggests that it will be necessary for the Commission to make special frequency allocation concessions in Hawaii to meet its unique needs. The Commission is taking no action at this time to resolve the problem before it. However, if and when an earth station site is mutually agreed, and the magnitude of the problem is more clearly defined, the Commission will give sympathetic consideration to the needs of Hawaiian and the earth station applicant.

6. Comsat limited its comments to a discussion of issues involving the communication-satellite service and, more specifically, to the content of the proposed footnote to the Table of Frequency Allocations, US91, reading as follows:

US91 The ultimate disposition of this band in the communication-satellite service, as between Government and non-Government, is deferred. In the meanwhile the non-Government may exploit the 4 and 6

Gc/s bands and the Government may exploit the 7 and 8 Gc/s bands for communication-satellite service systems intended to become operational. Any modification of this policy will be discussed and agreed in the FCC/DTM (IRAC) mechanism prior to the filing of applications with the IRAC for frequency assignments which are not in accordance with the foregoing.

In the Commission's notice it was proposed that the note be applied to the four bands 3700–4200, 5925–6425, 7250–7750, and 7900–8400 Mc/s, recognizing that the two lower bands would remain available only to non-Government users and the two higher bands would remain available only to Government users, insofar as nonspace activities were concerned. Comsat agreed with the Commission's proposal in that premature exclusion of non-Government usage of the 7 and 8 Gc/s bands would be avoided, but expressed concern over "the absence of provisions which will assure optimal utilization of these four bands for Communications-Satellite operations." Additionally, Comsat expressed concern over the last sentence of proposed footnote US91 on the ground that it would "require explicit modification by the IRAC [Interdepartment Radio Advisory Committee] before a non-Government application for a frequency assignment in the 7 and 8 Gc/s bands could be filed with the IRAC." This concern was based on the position that so long as a final decision has not been taken on the allocation, there must be provisions protecting non-Government's contingent rights to use the 7 and 8 Gc/s bands, otherwise future non-Government use of the bands could be foreclosed even though such use might be more beneficial to the national interest than the Government usage.

7. In light of the above Comsat proposes that the last sentence of footnote US91 be deleted and that two new sentences be added so that footnote US91, as modified, would read:

US91 The ultimate disposition of this band in the communication-satellite service, as between Government and non-Government, is deferred. In the meanwhile the non-Government may exploit the 4 and 6 Gc/s bands and the Government may exploit the 7 and 8 Gc/s bands for communication-satellite service systems intended to become operational. If required in the national interest, frequency assignments to a non-Government or Government communication-satellite service system which are contrary to this temporary allocation policy may be authorized by the FCC/DTM (IRAC) mechanism. FCC/DTM (IRAC) approval of each application for a frequency assignment within these bands to a communication-satellite service operation, whether consistent or inconsistent with this temporary allocation policy, shall be conditioned upon, among other considerations, its finding that the proposed frequency usag assures optimal utilization of these bands in the national interest.

8. A.T. & T. expresses agreement with the bulk of the Commission's proposals but it too centers its attention on the content of proposed footnote US91. Unlike Comsat, however, A.T. & T. favors immediate action to allocate 3700–4200 and 5925–6425 Mc/s exclusively to non-Government users and 7250–7750 and 7900–8400 Mc/s exclusively to Government users. In support of its position, A.T. & T. argues that "* * * Almost without exception, experience has shown that the most effective utilization of the frequency spectrum can be realized when sharing is between like users. This division of frequencies is particularly necessary between Government and non-Government users." This incompatibility is purportedly due to the differences in the way frequencies are assigned, their use regulated, and the use to which they are put.

9. Additionally, A.T. & T. interprets footnote US91 to mean that the 4 and 6 Gc/s bands could now be made available for Government communication-satellite service systems so long as they were not intended to become operational. In their view, the note also provides for assignments through the IRAC mechanism which do not conform to the interim division between Government and non-Government users. To forestall these possibilities, pending rule making to finalize definitive division of the communication-satellite service bands between Government and non-Government users, A.T. & T. proposes that US91 be amended to read as follows:

US91 The ultimate disposition of this band in the communication-satellite service, as between Government and non-Government, is deferred. In the meanwhile the non-Government may exploit the 4 and 6 Gc/s bands and the Government may exploit the 7 and 8 Gc/s bands for communication-satellite service systems.

10. A.T. & T. filed reply comments in rebuttal to Comsat's proposed treatment of US91. A.T. & T. argues that Comsat is attempting to ensure that protection of non-Government contingency rights to the use of the 7 and 8 Gc/s bands for communication-satellite service use but is ignoring the corollary which would afford the same contingency rights to Government users in the bands at 4 and 6 Gc/s. This would foster an admixture of Government/non-Government space operations with non-Government and Government terrestrial operations which would not be conducive to efficient spectrum utilization. A.T. & T. also argues that Comsat has directed its comments only to the matter of frequency sharing between Government and non-Government communication-satellite service operations and has ignored the added complexities arising from sharing between non-Government terrestrial systems and Government communication-satellite service operations. A.T. & T. reiterates its earlier proposal for the modification of US91.

11. Comsat's reply comments are directed mainly to the initial comments of A.T. & T. and the latter's proposed treatment of footnote US91. Comsat is opposed to the A.T. & T. modification except with respect to the deletion of the phrase "intended to become operational" now appearing at the end of the second sentence of US91 in the Commission's Notice. Comsat too favors deletion of the phrase, which otherwise appears to permit the use of the 4 and 6 Gc/s bands on a permanent basis for Government communication-satellites not intended for "operational" purposes. Comsat argues that the remainder of the A.T. & T. proposal would result in a premature and permanent restriction of non-Government to the 4 and 6 Gc/s bands and thus inhibit Comsat's ability to continue to develop a global system. In its view, since the Space Conference in Geneva, 1963, allocated only two-thirds the amount of space the United States had proposed for the communication-satellite service, frequency shortages are likely to develop. Therefore, Comsat takes the position that "until such time as the needs of Government and non-Government communication-satellite systems have been fully determined, the public interest will best be served by the adoption of the Corporation's proposal which attempts to preserve for the non-Government communication-satellite service the availability and usability of the 7 and 8 Gc/s bands".

12. The Commission is not persuaded that either A.T. & T. or Comsat has presented arguments sufficiently compelling to warrant a change in footnote US91 at this time. We do agree with Comsat that adoption of the A.T. & T. proposal would impose premature constraints on the communication-satellite service from a frequency availability standpoint. We do not agree with either Comsat or A.T. & T. that deletion of the phrase "intended to become operational" is desirable or necessary, nor do we agree with the interpretation they choose to place upon it. It is intended in the positive sense, i.e., that the development of an operational commercial system should go forward in the 4 and 6 Gc/s bands and that an operational Government system, if it is to be developed, should be developed in the 7 and 8 Gc/s bands. While the phrase does not preclude the use of either pair of bands for experimental systems, for example, neither is it intended as an open invitation for nonoperational systems. Each case must be judged on its merits, consistent with the allocation policy set forth in the footnote, until such time as a change appears warranted and is agreed in the FCC/DTM (IRAC) mechanism.

13. The remaining comment filed by A.T. & T. in response to the Commission's Notice is directed to proposed footnote US90 which contains the essence of the international footnote 356A, tailored to meet our national needs. As proposed by the Commission, US90 would read as follows:

US90 The band 2110–2120 Mc/s may be used by Government and non-Government stations for space telecommand at specific locations in conjunction with spacecraft engaged in deep space research, subject to such conditions as may be applied on a case-by-case basis.

A.T. & T. recommends that the footnote be amended by deleting the phrase "subject to such conditions as may be applied on a case-by-case basis," and substituting therefor the following:

subject to choice of sites and frequencies specified in § 25.203, to the coordination procedures outlined in Part 25 and to such other

conditions as may be applied on a case-by-case basis.

A.T. & T. states that "this band represents one-fourth of the frequency space available to common carriers in this area of the spectrum. The unavailability of this band because of its use for telecommand purposes would also reduce the usefulness of the associated band 2160–2180 Mc/s used for duplex operation. Since, in the international allocation, this is the only frequency band footnoted to permit deep space research telecommand operations, it appears this same limited access to this band is necessary in the United States. However, to avoid interference between common carrier operations and space research operations, coordination is required. In order for coordination procedures to be effective, it is obvious that coordination must be between all types of users of a particular frequency or frequency band. In a case such as this, where a proposal to make use of the band is likely to come from a Government entity which is not subject to normal FCC rules and regulations, the only opportunity for calling attention to necessary limitations and coordination procedures is through appropriate footnotes in the allocation table."

14. While appreciating the concern of A.T. & T. in this matter, the Commission is not adopting the proposed change to footnote US90. With or without the change, the Commission is in a position to maintain administrative control over the conditions applicable to the use of the band for deep space telecommand. The terms of any US footnote to the Table of Frequency Allocations are a matter of agreement between the Commission and the Director of Telecommunications Management (Interdepartment Radio Advisory Committee), DTM (IRAC), and are applicable equally to both Government and non-Government users. In this case, neither the DTM (IRAC) nor the Commission would authorize an additional deep space telecommand station without the concurrence of the other with respect to site, frequency, power, emission and operating conditions vis-a-vis other stations operating in the band. Additionally, as a matter of practice, we refrain from making reference to specific Commission Rules in US footnotes since the Commission could, through oversight, change the agreement represented by the US footnote merely by changing the terms of a specific rule which, generally, would not be subject to the concurrence of DTM (IRAC). As a practical matter, there is presently but one deep space telecommand station in the United States in this band and it is unlikely that a requirement for more will arise. That station is the Deep Space Instrumentation Facility at Goldstone, Calif., to which reference was made on December 5, 1962 in the Commission's Report and Order in Docket No. 14712. It is the station responsible for the commands to the Mariner flight now on its way to Mars and has been operating up to 9 hours per day since the launch of Mariner IV with no reports of interference to terrestrial systems in the band. There is on file with the Commission a "coordination distance contour" map for a virtually identical station at Goldstone to be operated in the band 2100–2110 Mc/s in Project Apollo that is applicable equally to the DSIF in the band 2110–2120 Mc/s.

15. Subsequent to the closing of the comment period, the National Academy of Sciences requested protection to radio astronomy observations of the OH complex in the band 1660–1670 Mc/s. Pursuant to Commission action taken in the Report and Order, Docket No. 14475, adopted September 11, 1963, published in the FEDERAL REGISTER on September 19, 1963 (28 F.R. 10261), the radio astronomy service was afforded allocation status in the band 1664.4–1668.4 Mc/s on a secondary basis. Although the two most pronounced OH spectral lines (whose laboratory frequencies are 1665.4 and 1667.4 Mc/s) are contained therein, the band is not wide enough to include the entire line profiles near the galactic center where doppler shifts, caused by unexpectedly high velocities, extend the lines beyond the allocated band. Other services contained within the 1660–1670 Mc/s band include meteorological aids (radiosonde) and meteorological satellites—services which appear capable of sharing, to a limited degree, with radio astronomy.

16. The bands 1660–1664.4 Mc/s and 1668.4–1670 Mc/s, as proposed in the notice in this proceeding, are allocated to both Government and non-Government services. After detailed consideration of the proposal, the DTM (IRAC) has concluded it is desirable to afford the radio astronomy service a measure of immediate relief by affording it allocation status in the 1660–1670 Mc/s band on a coequal, primary basis with the meteorological aids and meteorological-satellite services, and with the imposition of two additional US footnotes to the Table of Frequency Allocations. These footnotes, designated US99 and US101, would read as follows:

US99 In the band 1660–1700 Mc/s, the meteorological aids service (radiosonde) will to the maximum extent practicable confine its operations above the frequency 1670 Mc/s. Whenever it is necessary to operate radiosondes in the band 1660–1670 Mc/s within the United States, the radio astronomers will be notified in a timely manner.

US101 In the band 1660–1670 Mc/s, the radio astronomy service must accept such interference as may be received from the meteorological-satellite service.

17. The Commission concurs in the conclusion of the ODTM. Since there are no non-Government licensees in the band, the addition of the two US notes and the resultant amendment to the Table of Frequency Allocations affect Government services only and public notice pursuant to section 4 of the Administrative Procedure Act is not necessary or appropriate. Accordingly, these amendments are being consolidated with this proceeding.

18. Except for minor editorial corrections, therefore, but with the above addition, the Commission finds that the public interest would be served by adopting the rules set forth in its notice of proposed rule making in this proceeding.

Authority for the changes is contained in section 4(i) and 303(r) of the Communications Act of 1934, as amended.

19. *Therefore, it is ordered,* That Part 2 of the Commission's rules is amended as set forth in the Appendix below, effective July 1, 1965; *And it is further ordered,* That the proceedings in Docket No. 15722 are terminated herewith.

(Sec. 4, 48 Stat. 1066, as amended; 47 U.S.C. 154. Interprets or applies sec. 303, 48 Stat. 1082, as amended; 47 U.S.C. 303)

Adopted: May 19, 1965.

Released: May 20, 1965.

FEDERAL COMMUNICATIONS COMMISSION,
[SEAL] BEN F. WAPLE,
Secretary.

Part 2 is amended as follows:

§ 2.1 [Amended]

1. Section 2.1 is amended as follows:

a. The definition of *"Earth-space service"* is deleted.

b. The following definitions are amended to read as set forth below:

Aeronautical station. A land station in the aeronautical mobile service. In certain instances an aeronautical station may be placed on board a ship or an earth satellite.

Aircraft station. A mobile station in the aeronautical mobile service on board an aircraft or an air-space vehicle.

Earth station. A station in the space service located either on the earth's surface, including on board a ship, or on board an aircraft.

Space service. A radiocommunication service:

—between earth stations and space stations,
—or between space stations,
—or between earth stations when the signals are re-transmitted by space stations, or transmitted by reflection from objects in space, excluding reflection or scattering by the ionosphere or within the earth's atmosphere.

Space station. A station in the space service located on an object which is beyond, is intended to go beyond, or has been beyond, the major portion of the earth's atmosphere.

c. The following new definitions are added in proper alphabetical sequence:

Active satellite. An earth satellite carrying a station intended to transmit or re-transmit radiocommunication signals.

Communication-satellite earth station. An earth station in the communication-satellite service.

Communication-satellite service. A space service:

—between earth stations, when using active or passive satellites for the exchange of communications of the fixed or mobile service, or
—between an earth station and stations on active satellites for the exchange of communications of the mobile service, with a view to their re-transmis-

sion to or from stations in the mobile service.

Communication-satellite space station. A space station in the communication-satellite service, on an earth satellite.

Deep space. Space at distances from the earth equal to or greater than the distance between the earth and the moon.

Fixed earth station. An earth station intended to be used at a specified fixed point.

Meteorological-satellite earth station. An earth station in the meteorological-satellite service.

Meteorological-satellite service. A space service in which the results of meteorological observations, made by instruments on earth satellites, are transmitted to earth stations by space stations on these satellites.

Meteorological-satellite space station. A space station in the meteorological-satellite service, on an earth satellite.

Mobile earth station. An earth station intended to be used while in motion or during halts at unspecified points.

Passive satellite. An earth satellite intended to transmit radiocommunication signals by reflection.

Radio astronomy station. A station in the radio astronomy service.

Radionavigation-satellite earth station. An earth station in the radionavigation-satellite service.

Radionavigation-satellite service. A service using space stations on earth satellites for the purpose of radionavigation, including, in certain cases, transmission or re-transmission of supplementary information necessary for the operation of the radionavigation system.

Radionavigation-satellite space station. A space station in the radionavigation-satellite service, on an earth satellite.

Spacecraft. Any type of space vehicle including an earth satellite or a deep-space probe, whether manned or unmanned.

Space research earth station. An earth station in the space research service.

Space research service. A space service in which spacecraft or other objects in space are used for scientific or technological research purposes.

Space research space station. A space station in the space research service.

Space telecommand. The use of radiocommunication for the transmission of signals to a space station to initiate, modify or terminate functions of the equipment on a space object, including the space station.

Space telemetering. The use of telemetering for the transmission from a space station of results of measurements made in a spacecraft, including those relating to the functioning of the spacecraft.

Space tracking. Determination of the orbit, velocity or instantaneous position of an object in space by means of radio determination, excluding primary radar, for the purpose of following the movement of the object.

Stationary satellite. A satellite, the circular orbit of which lies in the plane of the earth's equator and which turns about the polar axis of the earth in the same direction and with the same period as those of the earth's rotation.

Terrestrial service. Any radio service defined in this Part, other than a space service or the radio astronomy service.

Terrestrial station. A station in a terrestrial service.

2. Section 2.100 is amended to read as follows:

§ 2.100 International regulations in force.

The Radio Regulations (Geneva, 1959), which became effective internationally on May 1, 1961, were incorporated to the extent practicable in Subparts A and B of this part and became effective nationally on December 1, 1961. The Radio Regulations were subsequently revised, in part, by the Extraordinary Administrative Radio Conference (Geneva, 1963) which specified January 1, 1965 as the effective date of the revision. The partial revision has also been incorporated to the extent practicable in Subparts A and B of this part and is applicable nationally, effective July 1, 1965.

3. In § 2.102, paragraphs (a), (b) (4), (5), and (6) are amended to read:

§ 2.102 Assignment of frequencies.

(a) Except as otherwise provided in this section, the assignment of frequencies and bands of frequencies to all stations and classes of stations and the licensing and authorizing of the use of all such frequencies between 10 kc/s and 90 Gc/s, and the actual use of such frequencies for radiocommunication or for any other purpose, including the transfer of energy by radio, shall be in accordance with the Table of Frequency Allocations in § 2.106.

(b) * * *

(4) Experimental stations engaged solely in ionospheric sounding by means of the technique of sweeping a band of frequencies may be authorized the use of any band or bands or frequencies not allocated, on an exclusive or shared basis, to the radio astronomy service.

(5) Experimental stations to be operated pursuant to a contractual agreement with the United States Government and intended for the sole and express purpose of developing equipment or a technique to be employed by stations belonging to and operated by the United States may be authorized the use of any frequency which is not in a band allocated, on an exclusive or shared basis, to the radio astronomy service.

(6) Experimental stations intended for the sole and express purpose of developing equipment or a technique to be employed by stations under the jurisdiction of a foreign government may be authorized the use of any frequency which is not in a band allocated to the amateur service or the radio astronomy service.

* * * * *

4. Section 2.104 is revised to read as follows:

§ 2.104 Radio astronomy station notification.

(a) Pursuant to No. 639AC, Article 9A and Section F of Appendix 1A to the international Radio Regulations (as revised, Geneva, 1963), operators of radio astronomy stations desiring international recognition of their use of specific radio astronomy frequencies or bands of frequencies for reception, should file the following information with the Commission for inclusion in the Master International Frequency Register:

(1) The center of the frequency band observed, in kc/s up to 30,000 kc/s inclusive, and in Mc/s above 30,000 kc/s.

(2) Date of putting into use (actual or foreseen, as appropriate).

(3) Name and location of the station, including geographical co-ordinates in degrees and minutes.

(4) Width of frequency band observed by the station.

(5) Antenna type and dimensions, effective area and angular coverage in azimuth and elevation.

(6) Maximum hours of reception (G.M.T.) of the frequency band shown in subparagraph (1) of this paragraph.

(7) Overall receiving system noise temperature (°K).

(8) Class of observations to be taken on the frequency band shown in subparagraph (1) of this paragraph. Class A observations are those in which the sensitivity of the equipment is not a primary factor. Class B observations are those of such a nature that they can be made only with advanced low-noise receivers using the best techniques.

(b) Observations being conducted on frequencies or frequency bands not allocated to the radio astronomy service should be reported as in paragraph (a) of this section for information purposes. Information in this category will not be submitted for entry in the Master International Frequency Register and protection from interference will not be afforded such operations by stations in other services.

5. In § 2.105, paragraph (h)(1) is amended to read as follows:

§ 2.105 Application and format of the Table of Frequency Allocations.

* * * * *

(h) * * *

(1) Any footnote consisting of three digits or three digits and a one or two letter suffix, e.g., (170) or (215A), denotes a paragraph in the Geneva (1959) Radio Regulations as amended by the Space Conference (Geneva, 1963). Where such a footnote is applicable, without modification, to the national Table of Frequency Allocations, the symbol appears in the national table as well as in Column 1, 2, 3 or 4.

* * * * *

§ 2.106 [Amended]

6. Section 2.106 is amended as follows:

a. The table is amended, in part, to read as follows:

Worldwide		Region 2		United States		Federal Communications Commission				
Band (kc/s)	Service	Band (kc/s)	Service	Band (kc/s)	Allocation	Band (kc/s)	Service	Class of station	Frequency (kc/s)	Nature of services
1	2	3	4	5	6	7	8	9	10	11
•		•		•		•	•		•	•
2495–2505		2495–2505 (203) (204)	STANDARD FREQUENCY.			2495–2505 (US68)	STARDARD FREQUENCY. Radio astronomy. (US74)	Radio astronomy. Standard frequency.	2500	RADIO ASTRONOMY. Standard frequency.
•		•		•		•	•		•	•
4995–5005	STANDARD FREQUENCY. (204) (230)					4995–5005 (US68)	STANDARD FREQUENCY. Radio astronomy. (US74)	Radio astronomy. Standard frequency.	5000	RADIO ASTRONOMY. Standard frequency.
•		•		•		•	•		•	•
9995–10005	STANDARD FREQUENCY. (204) (214) (215)					9995–10005 (215) (US83)	STANDARD FREQUENCY. Radio astronomy. (US74)	Radio astronomy. Standard frequency.	10000	RADIO ASTRONOMY. Standard frequency.
•		•		•		•	•		•	•
14990–15010	STANDARD FREQUENCY. (204) (219)					14990–15010 (US68)	STANDARD FREQUENCY. Radio astronomy. (US74)	Radio astronomy. Standard frequency.	15000	RADIO ASTRONOMY. Standard frequency.
•		•		•		•	•		•	•
15450–15762	FIXED.					15450–16460	FIXED.	Fixed.		AERONAUTICAL FIXED. INTERNATIONAL FIXED PUBLIC.
15762–15768	FIXED. Space Research. (215A)				(US100)					
15768–16460	FIXED.									
•		•		•		•	•		•	•
18030–18036	FIXED. Space Research. (215A)					18030–19990	FIXED.	Fixed.		AERONAUTICAL FIXED. INTERNATIONAL FIXED PUBLIC.
18036–19990	FIXED.				(US100)					
19990–20010	STANDARD FREQUENCY. (204) (220) (221) (221A)					19990–20000 (US68)	STANDARD FREQUENCY. Radio astronomy. (US74)	Radio astronomy. Standard frequency.	20000	Standard frequency.
						20000–20010 (US84)	STANDARD FREQUENCY. Space research.	Earth. Space. Standard frequency.		
•		•		•		•	•		•	•

Worldwide		Region 2		United States		Federal Communications Commission				
Band (Mc/s)	Service	Band (Mc/s)	Service	Band (Mc/s)	Allocation	Band (Mc/s)	Service	Class of station	Frequency (Mc/s)	Nature of stations / OF SERVICES
1	2	3	4	5	6	7	8	9	10	11
*	*			*		*	*	*	*	*
29.7-30.005	FIXED. (228) (229) (231) (232) MOBILE.			29.7-29.89	NG.	29.7-29.8	LAND MOBILE.	Base. Land mobile.		INDUSTRIAL.
						29.8-29.89	FIXED. (232)	Fixed.	29.81-29.88 (NG31)	AERONAUTICAL FIXED. INTERNATIONAL FIXED PUBLIC.
				29.89-29.91 (232)	G.					
				29.91-30	NG.	29.91-30	FIXED. (232)	Fixed.	29.92-29.99 (NG31)	AERONAUTICAL FIXED. INTERNATIONAL FIXED PUBLIC.
30.005-30.01	FIXED. (228) (229) (231) MOBILE. SPACE RESEARCH. SPACE (Satellite identification).			30-30.56	G. (US94)					
30.01-37.75	FIXED. (228) (229) (230) (231) MOBILE.			30.56-32	NG.	30.56-32	LAND MOBILE.	Base. Land mobile.		INDUSTRIAL LAND TRANSPORTATION. PUBLIC SAFETY.
				32-33 (231)	G.					
				33-34	NG.	33-33.01	LAND MOBILE.	Base. Land mobile.		LAND TRANSPORTATION.
						33.01-33.11	LAND MOBILE.	Base. Land mobile.		PUBLIC SAFETY.
						33.11-33.4	LAND MOBILE.	Base. Land mobile.		INDUSTRIAL.
						33.4-34	LAND MOBILE.	Base. Land mobile.		PUBLIC SAFETY.
				34-35 (231)	G.					
				35-36	NG.	35-35.2	LAND MOBILE.	Base. Land mobile.		INDUSTRIAL.
						35.2-35.68	LAND MOBILE.	Base. Land mobile.		DOMESTIC PUBLIC.
						35.68-36	LAND MOBILE.	Base. Land mobile.		INDUSTRIAL.
				36-37 (231)	G.					
				37-38	NG.	37-37.01	LAND MOBILE.	Base. Land mobile.		INDUSTRIAL.
						37.01-37.42	LAND MOBILE.	Base. Land mobile.		PUBLIC SAFETY.
						37.42-37.88	LAND MOBILE.	Base. Land mobile.		INDUSTRIAL.
						37.88-38	LAND MOBILE.	Base. Land mobile.		PUBLIC SAFETY.
37.75-38.25	FIXED. (228) (229) (231) MOBILE. Radio astronomy.									
38.25-41 (235) (236)	FIXED. (228) (229) (230) (231) MOBILE.			38-39	G. (US81)					

Worldwide		Region 2		United States		Federal Communications Commission				
Band (Mc/s)	Service	Band (Mc/s)	Service	Band (Mc/s)	Allocation	Band (Mc/s)	Service	Class of station	Frequency (Mc/s)	Nature of services (of stations)
1	2	3	4	5	6	7	8	9	10	11
				39–40	NG. (US94)	39–40	LAND MOBILE.	Base. Land mobile.		PUBLIC SAFETY.
				40–42 (286)	G. (US94)				40.68	Industrial, scientific and medical equipment.
*	*	*	*	*		*	*	*	*	*
68–73.0		68–73.0	FIXED. MOBILE. BROADCASTING.	*	*	*	*	*	*	*
				72–73 (US20)	NG.	72–73	FIXED. (NG1) (NG3)	Operational fixed.	72.02–72.96 (NG33)	Operational fixed.
73–74.6		73–74.6	RADIO ASTRONOMY. (283A) (283B)	73–74.6	G, NG. (US21) (US100)	73–74.6	RADIO ASTRONOMY. (US74)	Radio astronomy.		RADIO ASTRONOMY.
*	*	*	*	*		*	*	*	*	*
117.975–132	AERONAUTICAL MOBILE (R). (273) (273A)			117.975–121.975 (273) (US26) (US27) (US28) (US85)	G, NG.	117.975–121.975	AERONAUTICAL MOBILE (R).	Aeronautical. Aircraft.	118–121.4 (NG34)	Airdrome control.
									121.5	AERONAUTICAL MOBILE.
									121.6	Aeronautical search and rescue mobile; aeronautical utility land; aeronautical utility mobile.
									121.65–121.93 (NG34)	Aeronautical utility land; aeronautical utility mobile.
				121.975–123.075 (US29) (US30) (US31) (US80) (US85)	NG.	121.975–123.075	AERONAUTICAL MOBILE.	Aeronautical. Aircraft.	122.0–123.05 (NG34)	Private aircraft.
				123.075–123.575 (US32) (US33)	G, NG.	123.075–123.575	AERONAUTICAL MOBILE.	Aeronautical. Aircraft.	123.1 123.15 123.2 123.25 123.3 123.35 123.4 123.45 123.5 123.55	Flight test; flying school. Flight test. Do. Do. Flight test; flying school. Flight test. Do. Do. Flight test; flying school. Flight test.
				123.575–128.825 (US36) (US85)	G, NG.	123.575–128.825	AERONAUTICAL MOBILE (R).	Aeronautical. Aircraft.	123.6–128.8 (NG34)	AERONAUTICAL MOBILE.
				128.825–132 (US2) (US85)	NG.	128.825–132	AERONAUTICAL MOBILE (R).	Aeronautical. Aircraft.	128.85–132 (NG34)	AERONAUTICAL MOBILE.
132–136		132–136	FIXED. MOBILE. (273A) (276)	132–136 (US2) (US26) (US85)	G, NG. (US3)	132–136	AERONAUTICAL MOBILE (R).	Aeronautical. Aircraft.	132.05–135.95 (NG34)	AERONAUTICAL MOBILE.
136–137		136–137 (281A) (281B)	SPACE RESEARCH (Telemetering and tracking).	136–137	G, NG. (US100)	136–137	SPACE RESEARCH.	Space.		Telemetering; tracking

Worldwide		Region 2		United States		Federal Communications Commission				
Band (Mc/s)	Service	Band (Mc/s)	Service	Band (Mc/s)	Allocation	Band (Mc/s)	Service	Class of station	Frequency (Mc/s)	Nature of stations
1	2	3	4	5	6	7	8	9	10	11
137–138 (281E)	METEOROLOGICAL-SATELLITE. SPACE RESEARCH (Telemetering and tracking). (281F) SPACE (Telemetering and tracking).			137–138	G, NG. (US100)	137–138	METEOROLOGICAL-SATELLITE. SPACE (Telemetering and tracking).	Space.		METEOROLOGICAL-SATELLITE. SPACE.
138–143.6		138–143.6	FIXED. MOBILE. *Radiolocation.*	138–144 (US10)	G.					
143.6–143.65		143.6–143.65	FIXED. MOBILE. SPACE RESEARCH (Telemetering and tracking). *Radiolocation.*							
143.65–144		143.65–144	FIXED. MOBILE. *Radiolocation.*						143.91	Civil air patrol land; civil air patrol mobile.
144–146	AMATEUR. (284A)			144–148	AMATEUR. (284A) (US1)	144–148	AMATEUR.	Amateur.		AMATEUR.
146–148		146–148	AMATEUR.							
148–149.9 (285A)		148–149.9 (285A)	FIXED. MOBILE.	148–149.9 (US10) (US86)	G.				148.14 148.25	Civil air patrol land; civil air patrol mobile. Earth (telecommand).
149.9–150.05 (285B)	RADIONAVIGATION-SATELLITE.			149.9–150.05	G, NG. (US100)	149.9–150.05	RADIONAVIGATION-SATELLITE.	Space.		RADIONAVIGATION-SATELLITE.
150.05–174		150.05–174	FIXED. MOBILE.	150.05–150.8	G.					
				150.8–162	NG.					
(285A)		(285A)		(US86)		153.7325–154.46	LAND MOBILE.	Base. Land mobile.	154.2	PUBLIC SAFETY. (NG26) Earth (telecommand).
225–235		225–235	FIXED. MOBILE.	225–328.6 (310) (US17) (US98)	G.					
235–267 (309)	FIXED. MOBILE.								243	Survival craft and equipment.
267–272	FIXED. MOBILE. Space (telemetering). (309A) (309B)									
272–273	FIXED. MOBILE. SPACE (Telemetering). (309A)									

Worldwide		Region 2		United States		Federal Communications Commission				
Band (Mc/s)	Service	Band (Mc/s)	Service	Band (Mc/s)	Allocation	Band (Mc/s)	Service	Class of station	Frequency (Mc/s)	Nature of services
1	2	3	4	5	6	7	8	9	10	11
278–328.6 (310)	FIXED. MOBILE.									
*	*	*		*		*	*	*	*	*
335.4–399.9	FIXED. MOBILE.			335.4–399.9	G.					
399.9–400.05	RADIONAVIGATION-SATELLITE (301A)			399.9–400.05	G, NG. (US100)	399.9–400.05	RADIONAVIGATION-SATELLITE.	Space.		RADIONAVIGATION-SATELLITE.
400.05–401	METEOROLOGICAL AIDS. METEOROLOGICAL-SATELLITE. (Maintenance telemetering). SPACE RESEARCH (Telemetering and tracking).			400.05–401	G, NG.	400.05–401	METEOROLOGICAL AIDS. (US70) SPACE RESEARCH (Telemetering and tracking).	Radiosonde.		Radiosonde. Space.
401–402	METEOROLOGICAL AIDS. SPACE (Telemetering). (315A) Fixed. Mobile except aeronautical mobile.			401–402	G, NG.	401–402	METEOROLOGICAL AIDS. (US70) SPACE (Telemetering). (315A)	Radiosonde. Space.		Radiosonde. Space.
402–406 (317)	METEOROLOGICAL AIDS. Fixed. Mobile except aeronautical mobile.			402–404	G, NG.	402–404	METEOROLOGICAL AIDS. (US70)	Radiosonde.		Radiosonde.
				404–406	G, NG.	404–406	METEOROLOGICAL AIDS. (US70) Radio astronomy. (US74)	Radio astronomy. Radiosonde.		RADIO ASTRONOMY. Radiosonde.
*	*	*		*		*	*	*	*	*
420–450		420–450 (318) (319A)	RADIOLOCATION. Amateur.	420–450 (US6) (US35) (US87)	G, NG.	420–450	Amateur. (US7)	Amateur.		AMATEUR.
450–460 (318) (319A)	FIXED. MOBILE.			450–470 (US6) (US87)	NG.	450–451	LAND MOBILE.	Base. Land mobile.		Remote pickup broadcast base; remote pickup broadcast mobile.
						*	*	*	*	*
460–470	FIXED. MOBILE. Meteorological-Satellite. (318A)				(US100)	460–462.525	*	*	*	*
						*	*	*	*	*
470–890		470–890 (332)	BROADCASTING.	470–890 (NG30) (NG43) (US88)	NG. (US100)	470–890	BROADCASTING.	Television broadcasting.		
890–942		890–942 (339A) (340)	FIXED. RADIOLOCATION.	890–942 (340)	G. (US36)				915	Industrial, scientific and medical equipment.
942–960		942–960 (339A)	FIXED.	942–960	NG.	*	*	*	*	*
*	*	*		*		*	*	*	*	*

Worldwide		Region 2		United States		Federal Communications Commission				
Band (Mc/s)	Service	Band (Mc/s)	Service	Band (Mc/s)	Allocation	Band (Mc/s)	Service	Class of station	Frequency (Mc/s)	Nature of services [of stations]
1	2	3	4	5	6	7	8	9	10	11
1427-1429	FIXED. MOBILE except aeronautical mobile. SPACE (Telecommand).			1427-1429	G, NG. (US60)	1427-1429	SPACE.	Earth.		Earth (telecommand).
1429-1435		1429-1435	FIXED. MOBILE.	1429-1435	G.					
1435-1525		1435-1525	MOBILE. Fixed.	1435-1525	G, NG. (US78)	1435-1525	MOBILE.	Aeronautical telemetering.		AVIATION.
1525-1535		1525-1535	SPACE. (Telemetering.) (350A) Fixed. Mobile. (350D)	1525-1535	G, NG. (350A) (US80) (US100)	1525-1535	MOBILE. SPACE.	Aeronautical telemetering. Space.		AVIATION. Space (telemetering).
1535-1540	SPACE. (Telemetering). (350A)			1535-1540 (350A)	G, NG.	1535-1540	SPACE. (Telemetering).	Space.		Space (telemetering).
1540-1660	AERONAUTICAL RADIONAVIGATION. (352A) (352B)			1540-1660	G, NG. (332A) (332B) (US89)	1540-1660	AERONAUTICAL RADIONAVIGATION.			
1660-1664.4 (354A)	METEOROLOGICAL AIDS. METEOROLOGICAL-SATELLITE. (324A)			1660-1670	G, NG. (324A) (US74) (US99) (US100) (US101)	1660-1670	METEOROLOGICAL AIDS. METEOROLOGICAL-SATELLITE. RADIO ASTRONOMY	Radio astronomy. Radiosonde. Space.		
1664.4-1668.4 (353A) (354A)	METEOROLOGICAL AIDS. METEOROLOGICAL-SATELLITE. (324A) Radio astronomy.									
1668.4-1670 (354A)	METEOROLOGICAL AIDS. METEOROLOGICAL-SATELLITE. (324A)									
•		•		•		•	•	•	•	•
1690-1700 (354A)		1690-1700	METEOROLOGICAL AIDS. METEOROLOGICAL-SATELLITE (324A)	1690-1700	G, NG. (324A) (US99)	1690-1700	METEOROLOGICAL AIDS. METEOROLOGICAL-SATELLITE	Radiosonde. Space.		
1700-1710		1700-1710 (355A)	SPACE RESEARCH (Telemetering and tracking).	1700-1710	G, NG. (US100)	1700-1710	SPACE RESEARCH (Telemetering and tracking).	Space.		Space (telemetering and tracking).

Worldwide		Region 2		United States		Federal Communications Commission				
Band (Mc/s)	Service	Band (Mc/s)	Service	Band (Mc/s)	Allocation	Band (Mc/s)	Service	Class of station	Frequency (Mc/s)	Nature of services
1	2	3	4	5	6	7	8	9	10	11
1710-1770		1710-1770	FIXED. MOBILE.	1710-1850	G. (US100)					
1770-1790		1770-1790	FIXED. MOBILE. Meteorological-Satellite. (356AA)							
1790-2290		1790-2290 (356A)	FIXED. MOBILE.	1850-2200	NG.	*	*	*	*	*
						2110-2130 (NG10) (NG23) (US90)	FIXED.	Domestic fixed public.		
						*	*	*	*	*
				2200-2290	G.					
2290-2300		2290-2300 (356B)	SPACE RESEARCH (Telemetering and tracking in deep space).	2290-2300	G, NG. (US100)	2290-2300	SPACE RESEARCH (Telemetering and tracking in deep space).	Space.		Space (telemetering and tracking in deep space).
2690-2700 (264A) (365)	RADIO ASTRONOMY.			2690-2700	G, NG. (US74) (US100)	2690-2700	RADIO ASTRONOMY.	Radio astronomy.		
*	*	*	*	*	*	*	*	*	*	*
3300-3400		3300-3400	RADIOLOCATION. Amateur.	3300-3500	G, N.G. (US61)	*	*	*	*	*
3400-3500		3400-3500	RADIOLOCATION. COMMUNICATION-SATELLITE (satellite to earth). (374A) Amateur.							
3500-3700		3500-3700	FIXED. MOBILE. RADIOLOCATION. COMMUNICATION-SATELLITE (satellite to earth). (374A)	3500-3700	G.					
3700-4200		3700-4200	FIXED. MOBILE. COMMUNICATION-SATELLITE (satellite to earth). (374A)	3700-4200	----------	3700-4200	COMMUNICATION-SATELLITE. (374A) (US91) FIXED. (NG)	Common carrier fixed. Space.		COMMUNICATION-SATELLITE. DOMESTIC PUBLIC. (NG41)
4200-4400 (352A)	AERONAUTICAL RADIONAVIGATION.			4200-4400	G, N.G. (352A) (US47)	4200-4400	AERONAUTICAL RADIONAVIGATION.	Altimeter.		

Worldwide		Region 2		United States		Federal Communications Commission				
Band (Mc/s)	Service	Band (Mc/s)	Service	Band (Mc/s)	Allocation	Band (Mc/s)	Service	Class of station	Frequency (Mc/s)	Nature of stations
1	2	3	4	5	6	7	8	9	10	11
4400–4700	FIXED. MOBILE. COMMUNICATION-SATELLITE (earth to satellite). (392A)			4400–4990	G.					
4700–4990 (383)	FIXED. MOBILE.									
4990–5000		4990–5000 (383A)	RADIO ASTRONOMY.	4990–5000	G, NG. (US74) (US100)	4990–5000	RADIO ASTRONOMY.	Radio astronomy.		
5000–5250 (352A) (352B)	AERONAUTICAL RADIONAVIGATION.			5000–5250	G, NG. (352A) (352B)	5000–5250	AERONAUTICAL RADIONAVIGATION.			
5250–5255	RADIOLOCATION. Space research.			5250–5350	G.					
5255–5350	RADIOLOCATION.									
•		•		•		•	•	•		•
5650–5670	RADIOLOCATION. Amateur.			5650–5925 (391)	G, NG (US52)	5650–5925	Amateur.	Amateur.		
5670–5725 (389A)	RADIOLOCATION. Amateur. Space research (deep space).				(US100)					
5725–5925		5725–5925 (391)	RADIOLOCATION. Amateur.						5800	Industrial scientific & medical equipment.
5925–6425	FIXED. MOBILE. COMMUNICATION-SATELLITE (earth to satellite). (392A)			5925–6425	(392A)	5925–6425	COMMUNICATION-SATELLITE. (US91) FIXED. (NG)	Common carrier fixed. Fixed earth.		COMMUNICATION-SATELLITE. DOMESTIC PUBLIC. (NG41)
6425–7250 (392F) (393A)	FIXED. MOBILE.			6425–7125	NG.	6425–6525 (NG46)	MOBILE.	Common carrier land. Common carrier mobile.		
						•	•	•	•	•
				7125–7250	G.					
7250–7300 (374A) (392C) (392D) (392G)	COMMUNICATION-SATELLITE (satellite to earth).			7250–7300	(374A) (392D) (US100)	7250–7300	COMMUNICATION-SATELLITE (US91).	Space.		COMMUNICATION-SATELLITE.
7300–7750 (392F)	FIXED. MOBILE. COMMUNICATION-SATELLITE (satellite to earth). (374A) (392D)			7300–7750	(374A) (392D)	7300–7750	COMMUNICATION-SATELLITE (US91). METEOROLOGICAL-SATELLITE (G/NG). (US92)	Space.		COMMUNICATION-SATELLITE. METEOROLOGICAL-SATELLITE.

Worldwide		Region 2		United States		Federal Communications Commission				
Band (Mc/s)	Service	Band (Mc/s)	Service	Band (Mc/s)	Allocation	Band (Mc/s)	Service	Class of station	Frequency (Mc/s)	Nature of services / of stations
1	2	3	4	5	6	7	8	9	10	11
7750-7900	FIXED. MOBILE.			7750-7900	G.					
7900-7975	FIXED. MOBILE. COMMUNICATION-SATELLITE (earth to satellite). (392A)			7900-7975	(392A)	7900-7975	COMMUNICATION-SATELLITE. (US91). [FIXED (G). MOBILE (G)].	Earth.		COMMUNICATION-SATELLITE.
7975-8025 (392A) (392C) (392H)	COMMUNICATION-SATELLITE (earth to satellite).			7975-8025	(392A) (US100)	7975-8025	COMMUNICATION-SATELLITE. (US91)	Earth.		COMMUNICATION-SATELLITE.
8025-8400	FIXED. MOBILE. COMMUNICATION-SATELLITE (earth to satellite). (392A)			8025-8400	(392A)	8025-8400	COMMUNICATION-SATELLITE. (US91) [FIXED (G). MOBILE (G)].	Earth.		COMMUNICATION-SATELLITE.
8400-8500		8400-8500	SPACE RESEARCH. (394C)	8400-8500	G, NG. (US62) (US100)	8400-8500	SPACE RESEARCH. Fixed. Mobile.	Fixed. Mobile. Space.		
•		•		•		•		•	•	•
9500-9800	RADIOLOCATION.									
9800-10000 (401A)	RADIOLOCATION. Fixed.			9800-10000	G. (401A)					
10000-10500 (401A)	RADIOLOCATION. Amateur.			10000-10500	G, NG. (401A) (US58)	•	•	•	•	•

Worldwide		Region 2		United States		Federal Communications Commission				
Band (Gc/s)	Service	Band (Gc/s)	Service	Band (Gc/s)	Allocation	Band (Gc/s)	Service	Class of station	Frequency (Gc/s)	Nature of services / of stations
1	2	3	4	5	6	7	8	9	10	11
10.5-10.55		10.5-10.55	RADIOLOCATION. (404)	10.5-10.55	G, NG. (US59)	10.5-10.55	RADIOLOCATION.	Radiolocation land. Radiolocation mobile.		RADIOLOCATION.
10.55-10.68	FIXED. MOBILE. Radiolocation.			10.55-10.68	NG.	10.55-10.68 (NG46)	MOBILE.	Operational land. Operational mobile.		
10.68-10.7 (405B)	RADIO ASTRONOMY.			10.68-10.7	G, NG. (US70) (US100)	10.68-10.7	RADIO ASTRONOMY.			
10.7-11.7	FIXED. MOBILE.			10.7-11.7	NG.	10.7-11.7	FIXED.	Common carrier fixed.		DOMESTIC PUBLIC. (NG41)

Worldwide		Region 2		United States		Federal Communications Commission				
Band (Gc/s)	Service	Band (Gc/s)	Service	Band (Gc/s)	Allocation	Band (Gc/s)	Service	Class of station	Frequency (Gc/s)	Nature of stations / OF SERVICES
1	2	3	4	5	6	7	8	9	10	11
11.7-12.7	FIXED. MOBILE except aeronautical mobile. BROADCASTING.			11.7-13.25	NG.	11.7-12.2	MOBILE.	Common carrier land. Common carrier mobile (except aeronautical mobile).		
						12.2-12.7 (NG8)	FIXED.	International control. Operational fixed.		
12.7-13.25	FIXED. MOBILE.					12.7-13.2 (NG11)	FIXED. MOBILE.	Television pickup. Television STL.		
						13.2-13.25	FIXED. MOBILE.			
13.25-13.4	AERONAUTICAL RADIONAVIGATION. (406)			13.25-13.4	G, NG.	13.25-13.4	AERONAUTICAL RADIONAVIGATION. (406)			Airborne doppler radar.
13.4-14.0	RADIOLOCATION.			13.4-14.0	G.					
14.0-14.3	RADIONAVIGATION.			14.0-14.3	G, NG.	14.0-14.3	RADIONAVIGATION.			
14.3-14.4	RADIONAVIGATION-SATELLITE.			14.3-14.4	G, NG.	14.3-14.4	RADIONAVIGATION-SATELLITE.	Earth. Space.		RADIONAVIGATION-SATELLITE.
14.4-15.25	FIXED. MOBILE.			14.4-15.25	G.					
15.25-15.35 (409A)	SPACE RESEARCH.			15.25-15.35	G, NG. (US180).	15.25-15.35	SPACE RESEARCH.	Space.		
15.35-15.4 (409C)	RADIO ASTRONOMY.			15.35-15.4	G, NG. (US74) (US180).	15.35-15.4	RADIO ASTRONOMY.			
15.4-15.7	AERONAUTICAL RADIONAVIGATION (352A) (352B)			15.4-15.7	G, NG. (352A) (352B)	15.4-15.7	AERONAUTICAL RADIONAVIGATION.			
15.7-17.7	RADIOLOCATION.			15.7-17.7	G.					
17.7-19.3	FIXED. MOBILE.			17.7-19.3	NG.	17.7-19.3	FIXED. MOBILE.			
19.3-19.4 (409D)	RADIO ASTRONOMY.			19.3-19.4	G, NG. (US74) (US180)	19.3-19.4	RADIO ASTRONOMY.			
19.4-21.0	FIXED. MOBILE.			19.4-19.7	NG.	19.4-19.7	FIXED. MOBILE.			
				19.7-21.0	G.					
21.0-22.0	AMATEUR.			21.0-22.0	AMATEUR.	21.0-22.0	AMATEUR.	Amateur.		AMATEUR.
22.0-23.0 (410)	FIXED. MOBILE.			22.0-23.0	G. (410)				22.125	Industrial, scientific and medical equipment.
23.0-24.25	RADIOLOCATION.			23.0-24.25	G.					
24.25-25.25	RADIONAVIGATION. (411)			24.25-25.25	G, NG. (US72)	24.25-25.25	RADIONAVIGATION. (411)			
25.25-31.0	FIXED. MOBILE.			25.25-27.825	G.					
31.0-31.3 (412H)	FIXED. MOBILE. Space research.			27.825-31.3	NG. (US180)	27.825-31.3	FIXED. MOBILE.			

Worldwide		Region 2		United States		Federal Communications Commission				
Band (Gc/s)	Service	Band (Gc/s)	Service	Band (Gc/s)	Allocation	Band (Gc/s)	Service	Class of station	Frequency (Gc/s)	Nature of services
1	2	3	4	5	6	7	8	9	10	11
31.3-31.5 (412A)	RADIO ASTRONOMY.			31.3-31.5	G, NG. (US74) (US300)	31.3-31.5	RADIO ASTRONOMY.			
31.5-31.8		31.5-31.8 (406C)	SPACE RESEARCH.	31.5-31.8	G, NG. (US300)	31.5-31.8	SPACE RESEARCH.			
31.8-32.3 (412B)	RADIONAVIGATION. Space research.			31.8-33.4	G, NG. (US300)	31.8-33.4	RADIONAVIGATION. (US69)			
32.3-33.0	RADIONAVIGATION.									
33.0-33.4		33.0-33.4	RADIONAVIGATION. (412F)							
33.4-34.2 (412G)	RADIOLOCATION.			33.4-38.6	G. (US300)					
34.2-35.2 (412C) (412D)	RADIOLOCATION. Space research.									
35.2-36.0	RADIOLOCATION.									
36.0-40.0 (412E)	FIXED. MOBILE.									
				38.6-40.0	NG.	38.6-40.0	FIXED. MOBILE.			
Above 40.0	Not allocated.			40.0-88.0	G, NG.	40.0-88.0		Amateur. Experimental.		
				88.0-90.0	G, NG. (US74)	88.0-90.0	RADIO ASTRONOMY.			
				Above 90.0	G, NG.	Above 90.0		Amateur. Experimental.		

b. In the list of footnotes immediately following the Table in § 2.106, Geneva footnote numbers (234), (253), (280), (281), and (405) are deleted.

c. The following Geneva footnotes to the Table in § 2.106 are amended to read:

(215) The band 10003–10005 kc/s is also allocated, on a secondary basis, to the space research service.

(221) The band 19990–20010 kc/s is also allocated, on a secondary basis, to the space research service.

(235) The band 39.986–40.002 Mc/s is also allocated, on a secondary basis, to the space research service.

(294) The band 183.1–184.1 Mc/s is also allocated, on a secondary basis, to the space research service.

(317) The band 404–410 Mc/s in Region 2 and the band 406–410 Mc/s in Regions 1 and 3 are also allocated to the radio astronomy service. An appropriate continuous band within these limits shall be designated on a national or area basis. In making assignments to stations of other services to which these bands are allocated, administrations are urged to take all practicable steps to protect radio astronomy observations from harmful interference.

(341) The band 960–1215 Mc/s is reserved on a world-wide basis for the use and development of airborne electronic aids to air navigation and any directly associated ground-based facilities.

(365) In making assignments to stations in the fixed and mobile services, administrations are urged to take all practicable steps to protect radio astronomy observations from harmful interference.

d. The following new Geneva footnotes are added to the Table in § 2.106 in proper numerical sequence:

(215A) In Bulgaria, Cuba, Hungary, Poland, Roumania, Czechoslovakia and the U.S.S.R., the space research service is a primary service in the bands 15762–15768 kc/s and 18030–18036 kc/s.

(221A) The frequency 20007 kc/s may also be used, in emergency, in the search for, and rescue of, astronauts and space vehicles. Emissions must be confined in a band of ± 3 kc/s about this frequency.

(253A) In Region 2, fixed, mobile and broadcasting service operations previously authorized in the band 73–74.6 Mc/s may continue to operate on a non-interference basis to the radio astronomy service.

(253B) In Cuba, the band 73–74.6 Mc/s is also allocated to the fixed, mobile and broadcasting services.

(273A) In the band 117.975–132 Mc/s and in the band 132–136 Mc/s where the aeronautical mobile (R) service is authorized, the use and development, for this service, of systems using space communication techniques may be authorized but limited initially to satellite relay stations of the aeronautical mobile (R) service. Such use and development shall be subject to co-ordination between administrations concerned and those having services operating in accordance with the Table, which may be affected.

(281A) For the use of the band 136–137 Mc/s, see Recommendation No. 7A.

(281B) In Region 2, the band 136–137 Mc/s is also allocated to the fixed and mobile services until 1 January 1969. Thereafter, in Cuba, the band will continue to be allocated also to the fixed and mobile services.

(281E) In Regions 2 and 3, the band 137–138 Mc/s is also allocated to the fixed and mobile services until 1 January 1969. Thereafter, in Cuba, Malaysia, Pakistan and the Philippines, the band 137–138 Mc/s will continue to be allocated also to the fixed and mobile services.

(281F) The band 137–138 Mc/s will be used mainly for research concerning the establishment, technical improvement, and maintenance of operational space systems.

(284A) In the band 144–146 Mc/s, artificial satellites may be used by the amateur service.

(285A) The frequencies 148.25±15 kc/s and 154.2±15 kc/s may be used for space telecommand, subject to agreement among the administrations concerned and those having services operating in accordance with the Table, which may be affected.

(285B) Stations operating in the fixed and mobile services may continue to use this band until 1 January 1969. This cessation date shall not apply in Austria, Bulgaria, Cuba, Hungary, Iran, Kuwait, Morocco, Pakistan, the Netherlands, Poland, the United Arab Republic, Yugoslavia and Roumania where the fixed and mobile services will continue to have equal primary status with the radionavigation-satellite service. (See Recommendation No. 6A.)

(309A) Space stations employing frequencies in the band 267–273 Mc/s for telemetering purposes may also transmit tracking signals in the band.

(309B) In the band 267–272 Mc/s individual administrations may use space telemetering in their countries on a primary basis, subject to the agreement of the administrations concerned and those having services operating in accordance with the Table, which may be affected.

(311A) Stations operating in the fixed and mobile services may continue to use this band until 1 January 1969. This cessation date shall not apply in Bulgaria, Cuba, Greece, Hungary, Iran, Kuwait, Lebanon, Morocco, the United Arab Republic and Yugoslavia where the fixed and mobile services will continue to have equal status with the radionavigation-satellite service. (See Recommendation No. 6A.)

(315A) Space stations employing frequencies between ~01–402 Mc/s for telemetering purposes may also transmit tracking signals in this band.

(318A) In Bulgaria, Cuba, Hungary, Poland, Roumania, Czechoslovakia and the U.S.S.R., the band 460–470 Mc/s may be used, on a primary basis, by the meteorological-satellite service subject to agreement among administrations concerned and those having services, or intending to introduce services, operating in accordance with the Table, which may be affected.

(319A) The band 449.75–450.25 Mc/s may be used for space telecommand, subject to agreement among the administrations concerned and those having services operating in accordance with the Table, which may be affected.

(324A) It is intended that meteorological-satellite space stations operating in this band shall transmit to selected earth stations. The location of such earth stations is subject to agreement among administrations concerned and those having services operating in accordance with the Table, which may be affected.

(332) In Region 1, except the African Broadcasting Area, the band 606–614 Mc/s, and in Region 3, the band 610–614 Mc/s may be used by the radio astronomy service. Administrations shall avoid using the band concerned for the broadcasting service as long as possible, and thereafter, as far as practicable, shall avoid the use of such effective radiated powers as will cause harmful interference to radio astronomy observations.

In Region 2, the band 608–614 Mc/s is reserved exclusively for the radio astronomy service until the first Administrative Radio Conference after 1 January 1974 which is competent to review this provision; however, this provision does not apply to Cuba.

(339A) Specific portions of the frequency band 900–960 Mc/s may also be used, on a secondary basis, for experimental purposes in connection with space research.

(350A) Space stations employing frequencies in the band 1525–1540 Mc/s for telemetering purposes may also transmit tracking signals in the band.

(350D) In Cuba, the band 1525–1535 Mc/s is also allocated, on a primary basis, to the mobile service.

(352A) The bands 1540–1660 Mc/s, 4200–4400 Mc/s, 5000–5250 Mc/s and 15.4–15.7 Gc/s are reserved, on a world-wide basis, for the use and development of airborne electronic aids to air navigation and any directly associated ground-based or satellite-borne facilities.

(352B) The bands 1540–1660 Mc/s, 5000–5250 Mc/s and 15.4–15.7 Gc/s are also allocated to the aeronautical mobile (R) service for the use and development of systems using space communication techniques. Such use and development is subject to agreement and co-ordination between administrations concerned and those having services operating in accordance with the Table, which may be affected.

(353A) In view of the successful detection of two spectral lines in the region of 1665 Mc/s and 1667 Mc/s by astronomers, administrations are urged to give all practicable protection in the band 1664.4–1668.4 Mc/s for future research in radio astronomy.

(354A) In Algeria, Bulgaria, Cuba, Hungary, Kuwait, Lebanon, Morocco, Pakistan, Poland, the United Arab Republic, Yugoslavia, Roumania, Czechoslovakia and the U.S.S.R., the bands 1660–1670 Mc/s and 1690–1700 Mc/s are also allocated to the fixed service and the mobile, except aeronautical mobile, service.

(355A) In Cuba, the band 1700–1710 Mc/s is also allocated to the fixed and mobile services.

(356AA) In Bulgaria, Cuba, Hungary, Poland, Roumania, Czechoslovakia, and the U.S.S.R., the meteorological-satellite service, in the band 1770–1790 Mc/s, shall be on a primary basis, subject to co-ordination with the administrations concerned and those having services operating in accordance with the Table, which may be affected by the siting of earth stations.

(356A) The band 2110–2120 Mc/s may be used for telecommand in conjunction with spacecraft engaged in deep space research, subject to agreement between the administrations concerned and those having services operating in accordance with the Table, which may be affected.

(356B) In Cuba, the band 2290–2300 Mc/s is also allocated to the fixed and mobile services.

(364A) In Algeria, Bulgaria, Cuba, Hungary, India, Israel, Kuwait, Lebanon, Morocco, Pakistan, the Philippines, Poland, the United Arab Republic, Yugoslavia, Roumania, Czechoslovakia and the U.S.S.R., the band 2690–2700 Mc/s is also allocated to the fixed and mobile services.

(374A) This band may also be used for the transmission of tracking and telemetering signals associated with communication-satellite space stations operating in the same band.

(383A) In Cuba, the band 4990–5000 Mc/s is also allocated to the fixed and mobile services, and the provisions of No. 365 apply.

(389A) In Bulgaria, Cuba, Hungary, Poland, Roumania, Czechoslovakia and the U.S.S.R., the space research service is a primary service in the band 5670–5725 Mc/s.

(392A) This band may also be used for the transmission of telecommand signals associated with communication-satellite earth stations operating in the same band.

(392C) Stations of the fixed and mobile services, previously authorized in the bands 7250–7300 Mc/s and 7975–8025 Mc/s, may continue to operate until 1 January 1969. This provision does not apply to the countries listed in Nos. 392G and 392H.

(392D) As an exception, passive communication-satellite systems also may be accommodated in the band 7250–7750 Mc/s, subject to:

(a) Agreement between administrations concerned and those whose services, operating in accordance with the Table, may be affected;

(b) The co-ordination procedure laid down in Articles 9 and 9A.

Such systems shall not cause any more interference at active earth station receivers than would be caused by fixed or mobile services. Power-flux density limitations at the earth's surface after reflection from the passive communication-satellites shall not exceed those prescribed in these Regulations for active communication-satellite systems.

The maximum effective power radiated in any direction in the horizontal plane by earth stations of passive satellite systems shall not exceed +55 dbW, not taking the site shielding factor into account. If the distance between a transmitting station of a passive system and the territory of another administration exceeds 400 km, this limitation may be increased in that direction by 2 db for each 100 km in excess of 400 km up to a maximum of 65 dbW.

(392F) In the bands 7200–7250 Mc/s and 7300–7750 Mc/s, the meteorological-satellite service may use a band up to 100 Mc/s in width on a primary basis. These bands may also be used for the transmission of tracking and telemetering signals associated with meteorological-satellite space stations operating in the same band.

(392G) In Algeria, Austria, Bulgaria, Cyprus, Cuba, Ethiopia, Finland, Hungary, Japan, Kuwait, Lebanon, Liberia, Malaysia, Morocco, the Philippines, Poland, the United Arab Republic, Yugoslavia, Roumania, Sweden, Switzerland, Czechoslovakia, and the U.S.S.R., the band 7250–7300 Mc/s is also allocated to the fixed and mobile services.

(392H) In Algeria, Bulgaria, Cuba, Ethiopia, Finland, Hungary, Japan, Kuwait, Lebanon, Morocco, Poland, the United Arab Republic, Yugoslavia, Roumania, Sweden, Switzerland, Czechoslovakia, and the U.S.S.R., the band 7975–8025 Mc/s is also allocated to the fixed and mobile services.

(393A) The band 7120–7130 Mc/s may be used for telecommand in association with space services, subject to agreement between the administrations concerned and those having services operating in accordance with the Table, which may be affected.

(394C) In Cuba, the band 8400–8500 Mc/s is also allocated to the fixed and mobile services.

(401A) The band 9975–10025 Mc/s may be used by weather radar on meteorological-satellites.

(405B) In Algeria, Bulgaria, Cuba, Hungary, Japan, Kuwait, Lebanon, Pakistan, Poland, the United Arab Republic, Yugoslavia, Roumania, Czechoslovakia, and the U.S.S.R., the band 10.68–10.7 Gc/s is also allocated to the fixed and mobile services.

(409A) In Algeria, Bulgaria, Cuba, Hungary, Kuwait, Lebanon, Morocco, Pakistan, Poland, the United Arab Republic, Yugoslavia, Roumania, Czechoslovakia, and the U.S.S.R., the band 15.25–15.35 Gc/s is also allocated to the fixed and mobile services.

(409C) In Algeria, Bulgaria, Cuba, Hungary, Kuwait, Lebanon, Morocco, Pakistan, Poland, the United Arab Republic, Yugoslavia, Roumania, Czechoslovakia, and the U.S.S.R., the band 15.35–15.4 Gc/s is also allocated to the fixed and mobile services.

(409D) In Bulgaria, Cuba, Hungary, Kuwait, Lebanon, Poland, the United Arab Republic, Roumania, Czechoslovakia, and the U.S.S.R., the band 19.3–19.4 Gc/s is also allocated to the fixed and mobile services.

(412A) In Bulgaria, Cuba, Hungary, Poland, the United Arab Republic, Roumania, Czechoslovakia, and the U.S.S.R., the band 31.3–31.5 Gc/s is also allocated to the fixed and mobile services.

(412B) In Bulgaria, Cuba, Hungary, Poland, Yugoslavia, Roumania, Czechoslo-

vakia, and the U.S.S.R., the space research service is a primary service in the band 31.8–32.3 Gc/s.

(412C) In Bulgaria, Cuba, Hungary, Poland, Roumania, Czechoslovakia, and the U.S.S.R., the space research service is a primary service in the band 34.2–35.2 Gc/s.

(412D) The band 34.4–34.5 Gc/s may be used by weather radar devices on meteorological satellites for the detection of cloud.

(412E) In Bulgaria, Cuba, Hungary, Poland, Yugoslavia, Roumania, Czechoslovakia, and the U.S.S.R., the band 36.5–37.5 Gc/s is also allocated to the radio astronomy service.

(412F) In Cuba and India, the band 33–33.4 Gc/s is also allocated to the radio astronomy service.

(412G) In Bulgaria, Cuba, Hungary, Poland, Yugoslavia, Roumania, Czechoslovakia and the U.S.S.R., the band 33.4–34 Gc/s is also allocated to the radio astronomy service.

(412H) In Bulgaria, Cuba, Hungary, Poland, Roumania, Czechoslovakia, and the U.S.S.R., the space research service is a primary service in the band 31–31.3 Gc/s.

e. Footnote NG48 is deleted from the NG footnotes following the Table of Frequency Allocations in § 2.106.

f. Footnote NG41 is amended to read as follows:

NG41 Frequencies in the bands 3700–4200 Mc/s, 5925–6426 Mc/s, and 10.7–11.7 Gc/s may also be assigned to stations in the international fixed public and international control services located in U.S. Possessions in the Caribbean area.

g. Footnotes US22, US63, US64, US73, US75, and US76 are deleted from the US footnotes following the Table of Frequency Allocations in § 2.106.

h. The following US footnotes (introductory text only for US7) to the Table in § 2.106 are amended to read:

US7 In the band 420–450 Mc/s and within the following areas, the DC plate power input to the final stage of a transmitter employed in the amateur service shall not exceed 50 watts, unless expressly authorized by the Commission after mutual agreement, on a case-by-case basis, between the Federal Communications Commission Engineer in Charge at the applicable District Office and the Military Area Frequency Coordinator at the applicable military base:

* * * * *

US21 Existing Government operations and non-Government stations authorized in this band as of December 1, 1961, may continue and shall not be required to afford protection to radio astronomy observatories within the United States and its possessions. However, by international agreement, such stations must afford protection to the observatories of other countries.

US26 The bands 117.975–121.425 Mc/s, 123.575–128.825 Mc/s and 132.025–136 Mc/s are for air traffic control communications.

US35 Except as provided by footnotes US6 and US87, the only non-Government service permitted in the band 420–450 Mc/s is the amateur service. The amateur service shall not cause harmful interference to the radiolocation service.

US53 In view of the fact that the band 13.25–13.4 Gc/s is allocated exclusively to doppler navigation aids, Government and non-Government airborne doppler radars in the aeronautical radio-navigation service are permitted in the band 8750–8850 Mc/s only on the condition that they must accept any interference which may be experienced from stations in the radiolocation service in the band 8500–10000 Mc/s.

US58 In the band 10,000–10,500 Mc/s, pulsed emissions are prohibited, except for weather radars on board meteorological satellites in the band 10,000–10,025 Mc/s. The amateur service and the non-Government radiolocation service, which shall not cause harmful interference to the Government radiolocation service, are the only non-Government services permitted in this band. The non-Government radiolocation service is limited to survey operations using transmitters with a power not to exceed one watt into the antenna.

US60 The use of this band by non-Government services is limited to the space (telecommand) service.

US62 The use of this band by Government services is limited to the space research service.

US69 In the band 31.8–33.4 Gc/s, ground-based radionavigation aids are not permitted except where they operate in co-operation with airborne or shipborne radionavigation devices.

US70 The meteorological aids service allocation in the band 400.05–406 Mc/s does not preclude the operation therein of associated ground transmitters.

US72 In the band 24.25–25.25 Gc/s, Government radiolocation devices (ASDE) are permitted between 24.25–24.47 Gc/s on a shared basis.

US74 The radio astronomy service shall be protected from extra-band radiation only to the extent that such radiation exceeds the level which would be present if the offending station were operating in compliance with the technical standards or criteria applicable to the service in which it operates.

US78 In the band 1435–1525 Mc/s, the frequencies between 1435 and 1485 Mc/s will be assigned primarily for the flight testing of manned aircraft, or major components thereof; the frequencies between 1485 and 1525 Mc/s will be assigned primarily for the flight testing of unmanned aircraft and missiles or major components thereof. Included as permissible usage for aeronautical telemetering stations in the band 1435–1525 Mc/s is telemetry associated with launching and re-entry into the earth's atmosphere, as well as any incidental orbiting prior to re-entry, of manned or unmanned objects undergoing flight tests.

US81 The band 38–38.16 Mc/s may be used by both Government and non-Government radio astronomy observatories. No new assignments are to be made and Government stations in the band 38–38.16 Mc/s will be moved to other bands on a case-by-case basis, as required, to protect radio astronomy observations from harmful interference. As an exception, however, low-powered military transportable and mobile stations used for tactical and training purposes will continue to use the band. To the extent practicable, the latter operations will be adjusted to relieve such interference as may be caused to radio astronomy observations. In the event of harmful interference from such local operations, radio astronomy observatories may contact local military commands directly, with a view to effecting relief. A list of military commands, areas of coordination, and points of contact for purposes of relieving interference may be obtained upon request from the Office of Chief Engineer, Federal Communications Commission, Washington, D.C., 20554.

i. The following new US footnotes are added to the Table in § 2.106 in proper numerical sequence:

US83 Non-Government use of this band is limited to the following: 9995–10003 kc/s, radio astronomy service; 10003–10005 kc/s, radio astronomy and space research services.

US84 The non-Government use of this band is limited to the space research service.

US85 In the bands 117.975–123.075 and 123.575–136 Mc/s, the use and development, for the aeronautical mobile (R) service, of systems using space communication techniques may be authorized but limited initially to satellite relay stations of the aeronautical mobile (R) service.

US86 The frequencies 148.25 Mc/s ±15 kc/s and 154.2±.5 kc/s may be used by Government and non-Government stations for space telecommand at specific locations, subject to such conditions as may be imposed on a case-by-case basis. With respect to 154.2 Mc/s, the commands are to be limited to short duration of the order of three seconds ("Address and execute" commands). Further, on a case-by-case basis and solely to avoid harmful interference to non-Government stations in the land mobile service, a comparable replacement frequency assignment will be made available below 150.8 Mc/s, if required.

US87 The frequency 450 Mc/s, with maximum emission bandwidth of 500 kc/s, may be used by Government and non-Government stations for space telecommand at specific locations, subject to such conditions as may be applied on a case-by-case basis.

US88 Stations in the broadcasting service will not be authorized in the band 608–614 Mc/s prior to January 1, 1974. In the interim the band is available for use by the radio astronomy service. The radio astronomy service shall be protected from extra-band radiation only to the extent that such radiation exceeds the level which would be present if the offending station were operating in compliance with the technical standards or criteria applicable to the service in which it operates.

US89 The aeronautical telemetering frequencies in the band 1525–1535 Mc/s will be assigned primarily for the flight testing of unmanned aircraft and missiles or major components thereof. Included as permissible usage for aeronautical telemetering stations in the band 1525–1535 Mc/s is telemetry associated with launching and re-entry into the earth's atmosphere, as well as any incidental orbiting prior to re-entry, of manned or unmanned objects undergoing flight tests.

US90 The band 2110–2120 Mc/s may be used by Government and non-Government stations for space telecommand at specific locations in conjunction with spacecraft engaged in deep space research, subject to such conditions as may be applied on a case-by-case basis.

US91 The ultimate disposition of this band in the communication-satellite service, as between Government and non-Government, is deferred. In the meanwhile the non-Government may exploit the 4 and 6 Gc/s bands and the Government may exploit the 7 and 8 Gc/s bands for communication-satellite service systems intended to become operational. Any modification of this policy will be discussed and agreed in the FCC/DTM(IRAC) mechanism prior to the filing of applications with the IRAC for frequency assignments which are not in accordance with the foregoing.

US92 In the band 7300–7750 Mc/s, the meteorological-satellite service may use a band up to 100 Mc/s in width. This 100 Mc/s band may also be used for the transmission of tracking and telemetering signals associated with meteorological-satellite space stations operating in the same band.

US94 The bands 30.005–30.015 Mc/s and 39.986–40.02 Mc/s are also allocated, on a secondary basis, to the space research service for space station-to-earth station transmissions only.

US98 The frequency 243 Mc/s is the frequency in this band for use by Government and non-Government survival craft stations and equipment used for survival purposes.

US99 In the band 1660–1700 Mc/s, the meteorological aids service (radiosonde) will

to the maximum extent practicable confine its operations above the frequency 1670 Mc/s. Whenever it is necessary to operate radiosondes in the band 1660–1670 Mc/s within the United States, the radio astronomers will be notified in a timely manner.

US100 In the Additional Protocol to the Final Acts of the Space EARC, Geneva, 1963, a declaration on behalf of the USA states that the USA cannot accept any obligation to observe the exceptions claimed by Cuba in those footnotes to the Table of Frequency Allocations which were adopted by the EARC and which specifically name Cuba.

US101 In the band 1660–1670 Mc/s, the radio astronomy service must accept such interference as may be received from the meteorological-satellite service.

[F.R. Doc. 65-5529; Filed, May 27, 1965; 8:45 a.m.]

[Docket 15723; FCC 65-417]

PART 21—DOMESTIC PUBLIC RADIO SERVICES (OTHER THAN MARITIME MOBILE)

PART 25—SATELLITE COMMUNICATIONS

Shared Use of Certain Frequency Bands

Shared Use of Certain Frequency Bands Mobile and Communication-Satellite Services

1. The Commission adopted a Notice of Proposed Rule Making in the above-entitled matter on December 2, 1964, which was published in the FEDERAL REGISTER on December 16, 1964 (29 F.R. 17840). Interested parties were invited to file comments on or before January 15, 1965, and reply comments on or before January 25, 1965. The time for filing reply comments was subsequently extended to February 4, and was then further extended to February 15, 1965. The orders extending the reply comment period were published in the FEDERAL REGISTER on January 28, 1965 (30 F.R. 892), and February 10, 1965 (30 F.R. 1878), respectively.

2. Comments were filed by American Telephone & Telegraph Co. (A.T. & T.), Communications Satellite Corp. (COMSAT), Hawaiian Telephone Co. (Hawaiian), ITT Federal Laboratories (ITT), and Western Union Telegraph Co. (Western Union). Reply comments subsequently were filed by A.T. & T., COMSAT, and Hawaiian.

3. A.T. & T. favored strict sharing criteria and technical limitations that would protect the operations of terrestrial systems. COMSAT opposed any limitations upon space service operations more restrictive than those posed by the Final Acts of the Space Conference, Geneva, 1963, on the grounds that they would inhibit flexibility in the communication-satellite service. Hawaiian favored generally the Commission's proposal but suggested several detailed changes with respect to coordination between the sharing services. ITT limited its comments to suggested changes in the application of propagation curves intended for the calculation of coordination distances. Substantive comments by Western Union were directed only to the desirability of early coordination between space system planners and terrestrial system planners, up to 2 years in advance of the planned usage.

4. Among other things, the Commission's Notice solicited comments specifically with respect to two possible departures from technical limits set forth in the International Radio Regulations, insofar as they apply to the frequency band 5925–6425 Mc/s. First, it was suggested that 5° rather than the internationally agreed 3° might be adopted nationally as the minimum permissible antenna elevation angle for transmissions from earth stations. Second, it was suggested that +45dbW per 4 kc/s might be adopted nationally as the maximum effective radiated power in the horizontal plane from an earth station, rather than the internationally agreed +55dbW/4 kc/s. Comments were submitted on each of these points by all but ITT. Western Union expressed the view that some angle greater than 3° and some value less than +55dbW would be desirable but, absent supporting experimental data, was not prepared to recommend 5° or +45dbW or any other specific figures.

5. A.T. & T. contends that adoption of a 5° minimum angle of elevation, in both the 3700–4200 and 5925–6425 Mc/s bands, is realistic inasmuch as it will reduce the required coordination distance between earth stations and terrestrial stations without restricting unduly the operation of a communication-satellite system. A.T. & T. concedes that it would be desirable to specify as low an angle as possible, from a satellite system operational standpoint, but points out that the practical minimum angle is a function of the quality and reliability of transmission from the satellite to the earth station. Since a common antenna is generally used for both transmitting and receiving at an earth station, the minimum angle for reception might be said to dictate the minimum angle for transmission also. Additionally, however, A.T. & T. states that the lowest usable angle from a transmission standpoint depends upon the atmospheric noise introduced into the system and the signal fading that occurs at low angles of propagation through the atmosphere. Test results at the earth station site at Andover, Maine were cited in support of this argument wherein it was stated that a 50° K noise temperature was obtained between 5° and 6° for a 360° azimuthal scan of the antenna. A sharp increase in noise temperature (from 70° K to 225° K) was noted between 3.8 and 3.0° for a 360° scan of the antenna. Another test at Andover was stated to indicate that reliable transmission via Telstar was not obtained until an elevation angle of about 4.5° was reached and that severe signal fading was experienced at angles below that value. It was also argued by A.T. & T. that the higher minimum angle could reduce the coordination distance by as much as 25 percent and the area encompassed by the coordination distance contour by as much as 72 percent.

6. Comsat opposed the imposition of a 5° minimum angle, both in its comments and in its reply comments, for a number of reasons. As an example, their calculations indicate that a minimum of 5° as opposed to 3° would increase outage time by 35 percent for a given number of satellites in a medium altitude random system, or, alternately, would require the usage of 15 percent more satellites to maintain a given minimum outage time. Additionally, Comsat argues, such an increase might affect adversely the earth station's ability to establish long link communication, to communicate with countries using small earth station facilities or having monsoon rain conditions, and to use satellites which have drifted from their optimal position. With respect to reported A.T. & T. test results at Andover, Comsat expressed the opinion that the topography was such as to preclude efficient operation below 4° but that such a limitation is not inherent to all earth stations. Cited as locations where such limitations do not apply were Goonhilly Downs (England), Point Mugu (Calif.), and Raisting (Germany), where elevation angles of less than 3° are usable. Comsat makes reference to a report of November 1962, on Goonhilly Downs, for example, which indicated that no interference was detected when the antenna was rotated through 360° at 2° elevation and which indicated further that "* * * once the beacon signal has been firmly acquired, usually by the time that satellite elevation is some 1½°, the communication channel is effective and tests or demonstrations can proceed."

7. The reply comments of A.T. & T. agree with Comsat's analysis of the outage time of a random orbit satellite system as a function of minimum elevation angle, but contend that the cost of providing the extra margins in the system to ensure reliable operation at 3° might be of such magnitude as to offset any possible operational advantages.

8. Hawaiian states that there is insufficient information available to specify the minimum angle of operation, particularly without specifying the limits of side lobe radiation. Hawaiian sees no merit in limiting the elevation angle when the earth station antenna is directed seaward and away from land areas since this could decrease unnecessarily the usable time-in-view of nonsynchronous satellites and could, in some instances, unnecessarily prevent communication between a given earth station and a synchronous satellite. To cope with these matters, Hawaiian would amend Parts 21 and 25 as appropriate to provide additionally: (1) That the minimum permissible angle of elevation be determined by tests to verify theoretical calculations and that such angles be specified on the earth station license as a function of azimuth; and (2) that applicants in an area wherein coordination might be necessary be required to submit antenna radiation patterns with their applications.

9. Hawaiian offered no comment on the choice of +45dbW in lieu of +55dbW in any 4 kc/s band as an upper limit on permissible mean ERP in the horizontal plane. It is implicit in Hawaiian's comments that they are less concerned with this factor than with a workable sharing arrangement between terrestrial systems

in Hawaii and a communication-satellite system. Because of the limited available land mass in the island complex, it is probable that a reduction in permissible ERP as proposed would do little, if anything, to ease the sharing problem. Hawaiian has indicated it might be necessary to request special allocation relief in Hawaii under Part 2 and consequential changes in Part 21 to accommodate some of its existing and planned operations that would otherwise operate in the band 5925–6425 Mc/s. A determination of its needs in this regard can not be made until a site for a communication-satellite earth station has been decided upon in Hawaii.

10. A.T. & T. would prefer a permissible level of maximum ERP of something less than even the +45dbW suggested as a possible limit in the Commission's Notice, in order to minimize the total area within the coordination distance contour about an earth station site, but nonetheless, supports +45dbW as a compromise limit. A.T. & T. argues that areas that are unnecessarily large can prove expensive to both of the sharing services. If common carriers in the terrestrial service must avoid large areas to avoid interference to or from earth stations, other facilities must be made available to render service to the public within those areas at a cost which may exceed that of radio relay facilities. On the other hand, earth stations may find it necessary to establish in uneconomical locations to avoid existing radio relay stations. If so, construction and operating costs could be increased appreciably by the need for service facilities such as access roads, power and housing.

11. Comsat opposes reducing the maximum permissible ERP in the 6 Gc/s band from +55dbW to 45dbW/4 kc/s on the grounds that it would restrict space planning flexibility but would not lessen the possibility of interference to existing licensees or reduce substantially the coordination area. Comsat agrees that the reduction would facilitate the coordination process but states that "* * * the minimum coordination area is determined by the coordination area for the 4 Gc/s receiving band which is calculated on the basis of 55dbW, the maximum permissible ERP for terrestrial services (from CCIR Rec. 406)." Therefore, in their view, there is no justification for reducing earth station ERP below a value which would result in a coordination area corresponding to that for the 4 Gc/s band. Appendix 1 to Comsat's comments constituted the contribution of its representatives in the work of the U.S. Committee for CCIR Study Groups IV and IX, preparatory to the recently concluded International Interim Meeting of those groups in Monaco. That document, as interpreted by Comsat, demonstrated "that in light of the present state of the art, effective satellite-communications could require a maximum ERP of at least 52dbW/4 kc/s in order to permit reasonable flexibility. In future years, new satellite techniques and unique traffic requirements could require even a higher maximum ERP."

12. The reply comments of A.T. & T. directed to Comsat's initial comments on the 45 versus 55dbW question point out that: (1) Appendix 1 referred to above was not adopted by the U.S. Study Groups IV and IX; (2) the terrestrial transmitter power limit of 55dbW recommended by CCIR and adopted by the Space EARC is intended to protect satellite-borne receivers from harmful interference from terrestrial stations sharing in the earth-to-satellite bands; (3) there is no power limitation with respect to terrestrial transmitting stations in the satellite-to-earth bands (e.g., 3700–4200 Mc/s); and (4) in general, the coordination distance from a transmitting earth station exceeds that from its associated receiving earth station. A.T. & T. noted that as the permissible radiation in the horizontal plane increases, the coordination distance for such an earth station also increases. A.T. & T. also noted that the internationally agreed limit of +55dbW in the horizontal plane for transmitting earth stations was predicated largely on the decisions of the CCIR and the Space EARC to set a limit that would not inhibit unduly the use of earth stations operating in a "passive" communication-satellite system, where power requirements are appreciably higher than for an "active" system.

13. In addition to the specific points covered above, A.T. & T. suggested a number of changes to the Commission's proposed rules. Section 21.706(c) sets forth the showing to be made by the applicant for a terrestrial station to operate within the coordination distance contour of an existing earth station. The Commission has proposed that all such coordination distance contour maps be on file for public inspection, in the offices of the Commission's Common Carrier Bureau in Washington. A.T. & T. is of the view that such limited availability of information relating to areas involved in the coordination process will place an unnecessary burden on all applicants filing under Part 21. On the assumption that the total number of earth stations in the communication-satellite service will be small, A.T. & T. suggests that Part 21 contain a general description of the earth station sites, including a radius equal to the maximum coordination distance involved, so that a prospective applicant under Part 21 may determine readily whether a coordination problem exists. Should it appear that the applicant's proposed operation may lie within the contour, the rules should provide means by which he could have access to copies of the actual contour maps for detailed analysis of the problem. In A.T. & T.'s view, the earth station operator, if required to furnish such copies on request, will thus become aware of additional terrestrial systems to be considered for coordination purposes if there are plans for future expansion of the earth station facility. A.T. & T. would also amend the rules to state explicitly what must be done if the coordination process indicates that inter-service interference is likely to occur. In any event, they propose that arrangements be made for direct negotiations between operators of existing and planned stations.

14. The reply comments of Hawaiian support the above views of A.T. & T. insofar as they are concerned with a more positive coordination procedure. In particular, Hawaiian believes that where a new station is proposed within coordination distance of an existing station, the new station applicant should send notification directly to existing frequency-sharing licensees who are involved.

15. Comsat supported the Commission's coordination procedures as proposed and did not agree that the changes suggested by A.T. & T. are required or desired. Comsat objected specifically to the inclusion in Part 21 of a general description of the coordination areas of existing earth stations. It objected also to any requirement that maps be furnished to terrestrial station applicants by the Commission or the earth station licensee, on request. These objections are based on Comsat's belief that: (1) Commission-proposed procedures are adequate; (2) Part 21 would need amendment with the addition of each new earth station in the 4 and 6 Gc/s bands; and (3) an economic burden would be imposed upon the Commission or existing earth station licensees if required to make available an appreciable number of coordination distance contour charts. Comsat also took the position that the Commission's proposed rules in Parts 21 and 25 are detailed adequately to resolve potential interference problems arising during the coordination process. They did not agree that direct negotiations should be encouraged between existing and proposed licensees in the opposing services on the grounds that such an arrangement would place the administration of the Commission's rules in the hands of interested parties rather than those of the Commission.

16. Of the several interested parties commenting in this proceeding, only A.T. & T. made mention of the band 2110–2120 Mc/s which basically is part of a common carrier fixed band, but which, by virtue of a footnote to the Table of Frequency Allocations, is also available for deep space research. A.T. & T. recommended that normal users of the band be made aware of this shared use by an appropriate amendment to § 21.701(g) and also that § 21.706 be amended to reflect the need for coordination in the band 2110–2120 Mc/s.

17. A.T. & T. comments also invited attention to paragraph 14 of the Commission's Notice of Proposed Rule Making in Docket No. 15722, wherein it was stated that frequency bands allocated specifically to the "space service" are available to all space radiocommunication services, i.e., communication-satellite service, meteorological-satellite service, radio-navigation-satellite service and space research service. In keeping with that philosophy, A.T. & T. recommended that § 25.202 (b), (c) and (d) be modified as appropriate to show the availability of 1427–1429 Mc/s for space telecommand and 1525–1540 Mc/s for space telemetering and tracking.

18. A.T. & T. noted also that provision had not been made in the Commission's Notice for dealing with conflicting applications filed by prospective users. Appropriate hearing procedures would appear necessary, both in the case of conflicting prospective earth station applicants under Part 25 and in the case

of conflict between prospective applicants under Part 21 and Part 25. In this same vein, A.T. & T., Hawaiian and Western Union support a philosophy within the coordination process whereby recognition would be given to systems in the planning stage as well as to systems in being or for which construction was imminent. In support of this argument, A.T. & T. contends that in many cases the economies of a microwave system or an earth station can be realized fully only if the system or station can be exploited to its full capacity. In other words, a large percentage of the initial cost of either goes toward development of the initial station locations, buildings, antenna structures and power facilities. Expansion can be effected in most instances by merely adding relatively inexpensive radio equipment. It was argued, therefore, that an applicant should have some reasonable amount of assurance that future necessary expansion will not be precluded by the unavailability of frequency space. A.T. & T. states this could be accomplished, in part, by permitting under Part 25, as is now permitted under Part 21, an opportunity for interested parties to raise objections to proposals which may cause interference or which for other reasons would not appear to be in the public interest.

19. Comsat did not subscribe to recognition, in the coordination process, of systems which were purely in the planning stage. They expressed the view that it was sufficient to take into account only existing facilities and those for which construction permits had been granted.

20. As a follow-on to its earlier arguments for expanded or modified coordination procedures, A.T. & T. also suggested adoption of a common method for computing potential interference between competing services which would include the possibility of (a) propagation by forward scatter via both the main beam and the horizontal component and (b) propagation by diffraction, as well as direct line-of-sight propagation. Also in this regard, A.T. & T. suggests that even with a maximum permissible ERP of 45dbW/4 kc/s in the horizontal plane and a minimum antenna elevation angle of 5°, limits should be placed on the total power radiated by the earth station's main beam. They stated that their studies showed that interference from the main beam could be the controlling source of interference to terrestrial systems. A.T. & T. suggested a total effective power of one million kilowatts, or 90dbW, as a value "which is more than adequate for the economical operation of any reasonable satellite system yet proposed." This would be effected by adding to § 25.204 (a) a limitation specifying that the mean ERP in the main beam of the earth station antenna shall not exceed 71dbW in any 4 kc/s band. These overall views derive from the following quotation from the A.T. & T. comments.

A study of the Space EARC (Geneva, 1963) method of computing coordination distance (paragraph 25.251) indicates that the basic transmission loss via the path in the horizontal plane may not always be the controlling criterion for determining the coordination distance between an earth station and a terrestrial station. In fact, it appears that it is the propagation path between the main beam of the two antennas at low elevation angles of the earth station antenna that will usually determine the coordination distance for earth station configurations most likely to be encountered. It is concluded from this study that Section 25.204 paragraph (a) does not adequately specify or limit earth station power for coordination purposes. We recommend that the limit on power radiated from an earth station be specified in terms of (1) power in the horizontal plane, and (2) power in the main beam to provide a more meaningful calculation of the coordination distance.

21. The remaining A.T. & T. comments were devoted to:

(1) Showing that with a narrow beam antenna with its beam elevated above the horizon, the controlling transmission path may be via the common volume occupied by the two antenna beams rather than by the horizon ray; and

(2) The consequential additions and changes considered necessary to § 25.251, if one accepted the premise in (1) above, including the internationally agreed tables and charts associated therewith.

22. The comments of ITT were directed solely to this same § 25.251. These questioned the validity of using the curves contained in the Commission's proposal and suggested changes in their application to the calculation of coordination distances.

23. Comsat's reply comments relative to A.T. & T.'s proposal to impose a ceiling of +90dbW on the total ERP in the main beam of an earth station antenna did not support the proposal. Comsat pointed out: (1) The +90dbW limit is less than the powers of existing earth stations which will participate in the HS-303 experimental/commercial communication-satellite system now contemplated or the powers necessary for systems of various types proposed for use in a global system; (2) the problem of main beam interference can be resolved only through analysis of data from a series of measurement programs; (3) it is questionable whether the CCIR propagation data cited by A.T. & T. from Report 244 of Vol. II of the Xth Plenary Assembly, Geneva, 1963, is applicable to an elevated beam situation; (4) the CCIR has not adopted a coordination procedure based on elevated main beam considerations; and (5) the 19db spreading factor (90−71=19db) considered in the A.T. & T. proposal relates only to a specific FDM-FM system occupying a band of approximately 300 kc/s, which may not be adequate for other modulation methods.

24. The Commission's conclusions with respect to the several arguments presented above are contained in the ensuing paragraphs, in the same order in which they were presented earlier. Before proceeding to specific items, however, it appears necessary to re-emphasize two general premises upon which our conclusions are based. First, coordination distance contours define not the areas within which destructive interference will necessarily be caused or experienced but rather the areas within which some existing licensees might cause or experience interference and within which all prospective licensees should exercise particular caution in the engineering of new stations or systems. Second, the Space EARC (Geneva, 1963) adopted a number of amendments and additions to the international Radio Regulations previously adopted by the Administrative Radio Conference (Geneva, 1959). Among these was No. 492A, which is quoted in part, as follows:

492A § 3A. (1) Before an administration notifies to the Board, or brings into use any frequency assignment to a station in the fixed or mobile service, whether for transmitting or receiving, in a particular band allocated with equal rights to the space service and the fixed or mobile service in the frequency spectrum between one and ten Gc/s, it shall effect coordination of the assignment with any other administration which has previously effected coordination under the provisions of No. 639AD, for the establishment of an earth station, if the proposed station in the fixed or mobile service is to be located within the coordination distance of the earth station, and the necessary bandwidths of emission of the station concerned in the space service on the one hand, and the station concerned in the fixed or mobile service on the other, are separated by less than six Mc/s * * *

The Commission's proposals in this proceeding deliberately omitted reference to a minimum separation (such as the six Mc/s above) between the bandwidths of emission of stations involved in the coordination process. Proposed § 21.706 states in part, for example:

* * * If the proposed station is to be operated in the band 3700-4200 Mc/s, and lies within the coordination distance contour of a receiving earth station, the application shall be accompanied by a statement showing * * * Conversely, if the proposed station is to be operated in the band 5925-6425 Mc/s, and lies within the coordination distance contour of a transmitting earth station * * *

Similarly, § 25.203(c) speaks of "the frequency band in question", meaning 3700-4200 Mc/s or 5925-6425 Mc/s as appropriate.

25. In the Commission's opinion, it would not be in the public interest, for example, to permit the establishment of an earth station in the communication-satellite service in an area where frequency congestion due to existing terrestrial systems in the same band was such that little more than the initial frequency requirements of such an earth station could be accommodated. Similarly, it would not appear to be in the public interest to permit terrestrial systems to be installed in the same band in the same area as an existing earth station without evaluating carefully the possible future requirements of each, as well as the initial potential mutual interference problem. In other words, the Commission intends to proceed cautiously in the implementation of frequency sharing between space systems and terrestrial systems until a better appreciation of the overall subject can be attained through experience.

Minimum Angle of Elevation

26. There is considerable merit to many of the comments from each of the parties relating to the minimum angle

of elevation. The problem becomes one of weighing all the arguments and arriving at an equitable arrangement for each of the sharing services. Because of the relatively high density of terrestrial systems throughout the United States in both the 3700–4200 and 5925–6425 Mc/s bands, it is important to limit the size of areas within coordination distance of earth stations as much as possible, consistent with the need to maintain flexibility in the establishment of a communication-satellite system. This end can be achieved by adoption of a variation on the Commission's proposal to set 5° as a minimum permissible elevation angle instead of the internationally-agreed 3°. If the comments of Comsat referred to in paragraph 6 above are considered out of context, such a move might appear particularly damaging to the communication-satellite service. However, those figures relate only to a given orbital configuration and a given number of satellites and the 35 percent increase in outage time represents the difference between an outage probability of 0.0026 for a 3° minimum angle and an outage probability of 0.0035 for a 5° minimum angle. This increase of 0.0009 in outage time must be evaluated in the light of a reduction in the coordination area on the order of 72 percent, as referred to by A.T. & T. in paragraph 5. As pointed out by Comsat and Hawaiian, however, there is no merit in imposing elevation limits on paths which are directed seaward and away from land masses. This situation can be treated by adopting, in part, the suggestions made by Hawaiian wherein the minimum angle can be specified as a function of azimuth on the earth station license. Also in response to Hawaiian's suggestion, the rules will be amended to require that applications filed for earth station licenses be accompanied by appropriate earth station antenna patterns. With respect to the angle of elevation, 5° is being adopted as the normal minimum angle. However, upon special showing of need by the applicant, the Commission will give consideration to the use of angles between 3 and 5 degrees for over-land paths, and to lower angles for over-water paths, as a function of azimuth in each case.

EFFECTIVE RADIATED POWER IN THE HORIZONTAL PLANE

27. As in the case of the minimum angle of elevation, we are concerned with the problem of minimizing the area of potential interference about an earth station, consistent with the need to maintain flexibility in the establishment of a communication-satellite system. On the basis of its own calculations, the arguments of A.T. & T. in paragraphs 10 and 12 above, and the absence of persuasive arguments to the contrary by Comsat, the Commission has concluded it would be in the public interest to specify in the rules that the mean effective radiated power employed by an earth station in the band 5925–6425 Mc/s shall not exceed +45dbW per 4 kc/s of bandwidth in the horizontal plane.

AVAILABILITY OF COORDINATION DISTANCE INFORMATION

28. The Commission is persuaded that its proposal to maintain a file of earth station coordination distance contour maps in Washington, D.C., is not adequate, in and of itself, to meet the planning needs of terrestrial system operators whose home offices are well removed from Washington, D.C. Accordingly, future public notices of earth station applications accepted for filing will contain sufficient detailed information to permit interested parties to make at least preliminary determinations as to the probability of harmful interference. This information, however, will be helpful only to licensees of systems in being or prospective applicants well advanced in their planning. Therefore, for the benefit of future licensees, Part 21 will be amended to list general information relative to earth stations in the bands 3700–4200 and 5925–6425 Mc/s. Additionally, upon request, the Commission will undertake to supply licensees or prospective licensees of point-to-point microwave stations with detailed information relative to existing or proposed earth stations if, in the Commission's opinion, such terrestrial stations lie within coordination distance of the earth station in question.

29. The Commission recognizes that there is frequently much to be gained by direct negotiation between interested parties and does not agree with Comsat that such negotiations would place administration of the Commission's rules in the hands of such parties rather than with the Commission. However, such negotiations should be permissive rather than mandatory and as such need not be dealt with in the rules. Adequate procedures will be specified in the rules for the resolution of inter-service interference problems.

COORDINATION IN THE BAND 2110–2120 Mc/s

30. The Commission believes the public interest would be served by adopting the suggestion of A.T. & T. set forth in paragraph 16 above and § 21.701(g) is being amended to indicate that frequencies in the band 2110–2120 Mc/s may be made available on a case-by-case basis for telecommand transmissions by space research earth stations engaged in deep space research. Additionally, § 21.706 is being amended to reflect the need for coordination in that band.

FREQUENCY BANDS FOR TELECOMMAND, TELEMETERING AND TRACKING

31. Although the Commission is not aware of any plans by non-Government entities to use the band 1427–1429 Mc/s for space telecommand or the band 1525–1540 Mc/s for space telemetering and tracking in the communication-satellite service, the bands are available internationally for those purposes. The Commission agrees with A.T. & T. that their availability should be reflected in the rules and § 25.202 (b), (c), and (d) have been modified accordingly.

HEARING PROCEDURES FOR CONFLICTING APPLICATIONS

32. As reflected in paragraph 18 above, the Commission's proposal in this proceeding did not specify hearing procedures for conflicting applications within Part 25 for the reason that the policy and procedures relating to earth station ownership and operation are under consideration by the Commission in a separate proceeding, to wit: Notice of Proposed Rule Making or Formulation of General Policy, Docket 15735. Therefore procedures for hearings and the filing of applications will be the subject of separate proceedings and are not treated in this docket. However, Part 21 has been amended to ensure inclusion of the inter-service problem since that Part is written in very specific terms with respect to hearing procedures. Additionally, because of the long lead-time involved in the planning, design and construction of earth station facilities and the requirement for close coordination in developing a workable pattern of inter-service sharing, the Commission will give consideration to long-range planning by the contestants in resolving inter-service conflicts. Part 21 has been amended to reflect this point also. Additionally, as stated in the amended § 21.26(b) herein, the Commission will observe a policy of giving consideration to planned expansion of existing stations under Parts 21 and 25 in the shared bands 3700–4200 and 5925–6425 Mc/s.

CALCULATION OF COORDINATION DISTANCE

33. Paragraphs 20, 21, and 22 set forth proposals by A.T. & T. and ITT for substantive changes in the method of calculating coordination distance and, on the part of A.T. & T., a proposal to impose limits on the total effective radiated power in the main beam of earth station antennas. Without going into the merits of the suggestions for changing the method of calculating coordination distances we are rejecting them at this time for the practical reason that the United States is committed internationally through its treaty obligations to calculating coordination distance in the manner set forth in § 25.251. Admittedly, we could adopt different procedures for purely national application but in any instance where an earth station was within coordination distance of a national border, as calculated by internationally-agreed criteria, we would be duty bound to comply with the international procedure. We are not persuaded that there is merit to adopting two differing sets of criteria in this instance. Additionally, the coordination distance calculation procedure is the joint work of experts in the space and terrestrial microwave fields participating in the work of the International Radio Consultative Committee (CCIR) of the International Telecommunication Union (ITU) which adopted the procedure at its Xth Plenary Assembly, Geneva, 1963 in Report 209 and Recommendation 359. The procedure was adopted subsequently for inclusion in the International Radio

Regulations by the Space EARC, Geneva, October-November 1963. The U.S. Committee for Study Group IV, made up of Government and industry representatives, re-examined the content of Report 209 and Recommendation 359 in preparing for the Interim Meeting of CCIR Study Group IV and Study Group IX recently concluded (February-March) in Monaco and recommended no change in the procedure. To our knowledge, no experimental data have been collected which would warrant a change.

34. For the reason cited, and in light of the arguments by COMSAT in paragraph 23 above, we are rejecting the proposals to modify the method of calculating coordination distance and the proposal to impose a ceiling on the total ERP in the main beam of earth station antennas. These matters will be reviewed in the future in the light of experimental and operational data not now available to determine if changes are warranted.

35. In view of the foregoing: *It is ordered*, Pursuant to the authority contained in sections 4(i) and 303 of the Communications Act of 1934, as amended, that effective July 1, 1965, Parts 21 and 25 of the Commission's Rules are amended as set forth in the Appendices hereto.

36. *It is further ordered*, That the proceedings in Docket No. 15723 are hereby terminated.

(Sec. 4, 48 Stat. 1066, as amended; 47 U.S.C. 154. Interprets or applies sec. 303, 48 Stat. 1082, as amended; 47 U.S.C. 303)

Adopted: May 19, 1965.

Released: May 20, 1965.

FEDERAL COMMUNICATIONS COMMISSION,
[SEAL] BEN F. WAPLE,
Secretary.

Part 21 of the Commission's rules is amended as follows:

1. Section 21.1 is amended by adding the following new definitions in the proper alphabetical sequence:

§ 21.1 Definitions.

* * * * *

Coordination distance. For the purpose of this Part, the expression "coordination distance" means the distance from an earth station, within which there is a possibility of the use of a given transmitting frequency at this earth station causing harmful interference to stations in the fixed or mobile service, sharing the same band, or of the use of a given frequency for reception at this earth station receiving harmful interference from such stations in the fixed or mobile service.

* * * * *

Earth station. A station in the space service located either on the earth's surface, including on board a ship, or on board an aircraft.

* * * * *

Fixed earth station. An earth station intended to be used at a specified fixed point.

* * * * *

Mobile earth station. An earth station intended to be used while in motion or during halts at unspecified points.

* * * * *

2. Section 21.26(b) is amended to read as follows:

§ 21.26 Grants without a hearing.

* * * * *

(b) In making its determinations pursuant to the provisions of paragraph (a) of this section, the Commission will not consider any other application, or any other application amended so as to constitute a major change therein (as defined in § 21.33), as being mutually exclusive with the application under consideration unless such other application was substantially complete and filed with the Commission by the close of business one business day preceding the day on which the Commission takes action with respect to the application under consideration. An application filed after the date specified herein will be disposed of in accordance with the provisions of § 21.24(d). As an exception, however, in dealing with the frequency bands 3700–4200 and 5925–6425 Mc/s, which are shared on a co-equal, primary basis by the Point-to-Point Microwave Radio Service under this part and the Communication-Satellite Service under Part 25, the Commission may consider planned future expansion of existing communication-satellite earth stations as being mutually exclusive with the application under consideration if brought to the attention of the Commission by the close of business one business day preceding the day on which the Commission takes action with respect to the application under consideration. To qualify for such mutual consideration the earth station must lie within coordination distance of the site of the point-to-point station in question and the earth station licensee must be able to document his planned expansion to the satisfaction of the Commission. Reciprocal treatment shall be afforded stations in the Point-to-Point Microwave Radio Service in Part 25 of this chapter.

* * * * *

3. Section 21.107(b) is amended to read as follows:

§ 21.107 Transmitter power.

* * * * *

(b) The rated power output of a transmitter employed in these radio services shall not exceed the values shown in the following tabulation:

Frequency range:	*Rated power output*
Below 30 Mc/s	50 watts.
30 to 50 Mc/s	350 watts.
50 to 76 Mc/s	50 watts.
76 to 500 Mc/s	250 watts.
500 to 10,000 Mc/s	100 watts.[1]
Above 10,000 Mc/s	Unlimited.

[1] As an exception, in the band 5925–6425 Mc/s, the power delivered by a transmitter to the antenna of a station in the fixed service shall not exceed +55 dbw. These limitations are necessary to minimize the probability of harmful interference to reception in this band on board communication-satellite space stations.

* * * * *

4. In § 21.204, the Note is revised to read as follows:

§ 21.204 FCC publications required for reference.

* * * * *

NOTE: It is suggested that the following additional documents be obtained from the Government Printing Office and maintained for reference:

(1) Communications Act of 1934, as amended.

(2) Part 1 of this chapter, Practice and Procedure.

(3) Part 2 of this chapter, Frequency Allocations and Radio Treaty Matters; General Rules and Regulations.

(4) Part 13 of this chapter, Commercial Radio Operators.

(5) Part 17 of this chapter, Construction, Marking, and Lighting of Antenna Structures.

(6) Part 25 of this chapter, Satellite Communications.

(7) Part 42 of this chapter, Preservation of Records of Communication Common Carriers.

(8) Part 61 of this chapter, Tariffs.

(9) Part 63 of this chapter, Extension of Lines and Discontinuance of Service by Carriers.

5. Section 21.701(a) and 21.701(g) are amended to read as follows:

§ 21.701 Frequencies.

(a)(1) The following frequency bands are available for assignment to radio stations in this service on a shared basis with stations in the Communication-Satellite Service and the Local Television Transmission Service:

3700–4200 Mc/s
5925–6425 Mc/s [1]

[1] This band is not available for assignment to mobile earth stations.

(2) The following frequency band is available for assignment to radio stations in this service on a shared basis with the Local Television Transmission Service:

10700–11700 Mc/s

* * * * *

(g) On a shared basis with other common carrier fixed, international control and operational fixed radio services, frequencies in the band 2110–2200 Mc/s are available for radio stations in this service. Television transmission in this band is not authorized. Additionally, frequencies in the band 2110–2120 Mc/s may be authorized on a case-by-case basis to Government or non-Government space research earth stations for telecommand purposes in connection with deep space research.

* * * * *

6. Sections 21.706 (c) and (d) are added to read as follows:

§ 21.706 Supplementary showing required with applications.

* * * * *

(c) Part 25 of this chapter sets forth the procedure for calculating "coordina-

tion distance" in the bands shared on an equal basis by this service and the Communication-Satellite Service. This is the distance: (1) Within which an earth station transmitter might cause harmful interference to stations in this service; and (2) within which stations in this service might cause harmful interference to reception at earth stations. By international agreement, if the transmitting or receiving coordination distance contours drawn about a proposed earth station of one country overlap the boundary of another country, the first country is required to provide the second with maps showing the transmitting and receiving contours to determine if harmful interference might be caused by or to the proposed earth station. Once agreement is reached, neither country will alter its station assignment pattern in the area concerned, in a manner capable of degrading the agreed usage of the other country without further consultation with that country. Similarly, pursuant to Part 25, licensees of earth stations in the Communication-Satellite Service are required to file with the Commission, characteristics of the antena(s) to be used, and maps showing coordination distance contours for such earth stations for both the earth-to-satellite and satellite-to-earth bands. All such antenna characteristics and contour maps shall be kept on file for public inspection in the offices of the Commission's Common Carrier Bureau in Washington, D.C. Additionally, for purposes of determining the probability of interference, copies of these maps will be made available, upon request, to licensees or prospective licensees of terrestrial stations within coordination distance of an earth station for which general details are set forth in § 21.706(d). Therefore, each applicant filing pursuant to paragraph (a) of this section shall ascertain in advance of such filing if the location of the proposed station lies within the pertinent coordination distance contour of an earth station on file with the Commission. Since earth stations will be receiving only in the band 3700–4200 Mc/s and transmitting only in the bands 2110–2120 and 5925–6425 Mc/s, applicants will be guided accordingly. If the proposed station is to be operated in the band 3700–4200 Mc/s, and lies within the coordination distance contour of a receiving earth station, the application shall be accompanied by a statement showing that antenna directivity, power, terrain shielding and/or other mitigating factors are such that harmful interference will not be caused to reception at the earth station, on the basis of criteria set forth in Subpart C of Part 25. Conversely, if the proposed station is to be operated in the band 2110–2120 or 5925–6425 Mc/s, and lies within the coordination distance contour of a transmitting earth station, the application shall be accompanied by a similar statement showing that harmful interference will not be caused to reception at the applicant's station in this service.

(d) Earth stations listed herein operate in frequency bands which also are available to the Point-to-Point Microwave Radio Service. The figure shown in column 4 represents the maximum coordination distance calculated along any radial from the earth station, on an over-land path. It does not reflect the effects of possible terrain shielding along other radials nor the greater distance resulting from calculation for an over-water path or a mixed path. Used as the radius of a circle centered on the earth station, it will permit preliminary determination of the need for coordination in compliance with § 21.706(c). Proposed stations within the circle, and in the same frequency band, may be within coordination distance of the earth station. Applicants for such stations, upon request, will be supplied with copies of coordination distance contour maps and other pertinent technical data, to permit a detailed analysis of the interference potential.

(1) Transmitting earth stations—

Station location (1)	Geographical coordinates (2)	Band (Mc/s) (3)	Maximum coordinates district (station miles) (4)
Andover, Maine	44°37'59" N., 70°41'52" W	5925–6425	180
Goldstone, Calif	35°23'20" N., 116°50'53" W	2110–2120	375
Mill Village, Nova Scotia, Canada	44°11'24" N., 64°40'00" W	5925–6425	300

(2) Receiving earth stations—

Station location (1)	Geographical coordinates (2)	Band (Mc/s) (3)	Maximum coordinates district (station miles) (4)
Andover, Maine	44°37'59" N., 70°41'52" W	3700–4200	130

7. Section 21.708(a)(7) is added to read as follows:

§ 21.708 Notification of station operation at temporary fixed locations.

(a) * * *

(7) A notification of operations to be conducted within the coordination distance contours of a fixed earth station shall include compliance with the provisions of § 21.706(c).

* * * * *

8. Section 21.801(f) is amended to read as follows:

§ 21.801 Frequencies.

* * * * *

(f)(1) Frequencies in the following bands are available for assignment to television STL stations in this service on a shared basis with stations in the Communication-Satellite Service and the Point-to-Point Microwave Radio Service:

3700–4200 Mc/s
5925–6425 Mc/s

(2) The following frequency band is available for assignment to television STL stations in this service on a shared basis with stations in the Point-to-Point Microwave Radio Service:

10700–11700 Mc/s

9. Section 21.807(a)(5) is added to read as follows:

§ 21.807 Stations at temporary fixed locations.

(a) * * *

(5) Applications for such stations shall comply with the provisions of § 21.706(c).

* * * * *

10. A new § 21.809 is added, to read as follows:

§ 21.809 Stations affected by co-ordination distance procedures.

Each application for initial installation of a radio station in this service, or for installation of additional transmitters, or for authority to communicate with new points, shall comply with the provisions of § 21.706(c).

Part 25 of the Commission's rules is amended by adding new Subpart C, as follows:

Subpart C—Technical Standards

Sec.
25.201 Definitions.
25.202 Frequencies.
25.203 Choice of sites and frequencies.
25.204 Power limits.
25.205 Minimum angle of antenna elevation.
25.206 Station identification.
25.207 Cessation of emissions.
25.208 Power flux density limits.
25.251 Procedure for calculating coordination distance.

AUTHORITY: The provisions of this Subpart C issued under sec. 4, 48 Stat. 1066, as amended; 47 U.S.C. 154. Interprets or applies sec. 303, 48 Stat. 1082, as amended; 47 U.S.C. 303.

Subpart C—Technical Standards

§ 25.201 Definitions.

Active satellite. An earth satellite carrying a station intended to transmit or re-transmit radiocommunication signals.

Communication-satellite earth station. An earth station in the communication-satellite service.

Communication-satellite service. A space service:

—between earth stations, when using active or passive satellites for the exchange of communications of the fixed or mobile service, or

—between an earth station and stations on active satellites for the exchange of communications of the mobile service, with a view to their re-transmission to or from stations in the mobile service.

Communication-satellite space station. A space station in the communication-satellite service, on an earth satellite.

Coordination distance. For the purposes of this Part, the expression "coordination distance" means the distance from an earth station, within which there is a possibility of the use of a given transmitting frequency at this earth station causing harmful interference to stations in the fixed or mobile service, sharing the same band, or of the use of a given frequency for reception at this earth station receiving harmful interference from such stations in the fixed or mobile service.

Earth station. A station in the space service located either on the earth's surface, including on board a ship, or on board an aircraft.

Fixed earth station. An earth station intended to be used at a specified fixed point.

Mobile earth station. An earth station intended to be used while in motion or during halts at unspecified points.

Passive satellite. An earth satellite intended to transmit radio communication signals by reflection.

Space service. A radiocommunication service:

—between earth stations and space stations,
—or between space stations,
—or between earth stations when the signals are re-transmitted by space stations, or transmitted by reflection from objects in space excluding reflection or scattering by the ionosphere or within the earth's atmosphere.

Space station. A station in the space service located on an object which is beyond, is intended to go beyond, or has been beyond, the major portion of the earth's atmosphere.

Space telecommand. The use of radiocommunication for the transmission of signals to a space station to initiate, modify or terminate function of the equipment on a space object, including the space station.

Space telemetering. The use of telemetering for the transmission from a space station of results of measurements made in a spacecraft, including those relating to the functioning of the spacecraft.

Space tracking. Determination of the orbit, velocity or instantaneous position of an object in space by means of radiodetermination, excluding primary radar, for the purpose of following the movement of the object.

Stationary satellite. A satellite, the circular orbit of which lies in the plane of the earth's equator and which turns about the polar axis of the Earth in the same direction and with the same period as those of the earth's rotation.

Terrestrial service. Any radio service defined in this Chapter, other than a space service or the radio astronomy service.

Terrestrial station. A station in a terrestrial service.

§ 25.202 Frequencies.

(a) The following frequency bands are available for use by the communication-satellite service on a shared basis with terrestrial radio services. Precise frequencies and bandwidths of emission will be assigned on a case-by-case basis.

Satellite-to-earth	*Earth-to-satellite*
37–4200 Mc/s [1 2]	5925–6425 Mc/s [1 3]
7250–7750 Mc/s [1 2]	7900–8400 Mc/s [1 3]

[1] The ultimate disposition of these bands as between Government and non-Government services for space radiocommunication will be the subject of separate rule-making.

[2] This band may also be used for the transmission of tracking and telemetering signals associated with communication-satellite space stations operating in the same band.

[3] This band may also be used for the transmission of telecommand signals associated with communication-satellite earth stations operating in the same band.

[4] This band is not available for assignment to mobile earth stations.

(b) The following frequencies or bands of frequencies are available for space telecommand functions in conjunction with the communication-satellite service. Unless specified, precise frequencies and associated bandwidths of emission will be assigned on a case-by-case basis.

148.25 Mc/s—maximum occupied bandwidth not to exceed 30 kc/s.
154.2 Mc/s—maximum occupied bandwidth not to exceed 30 kc/s.
450.0 Mc/s—maximum occupied bandwidth not to exceed 0.5 Mc/s.
1427–1429 Mc/s.

(c) The following frequency bands are available for telemetering from communication-satellite space stations. Precise frequencies and associated bandwidths of emission will be assigned on a case-by-case basis.

136–137 Mc/s [1]
137–138 Mc/s
400.05–401 Mc/s [1]
401–402 Mc/s
1525–1540 Mc/s

[1] This band is basically a space research band and is not intended for use by operational communication-satellite systems once the desired spacecraft orbit is established.

(d) The following frequency bands are available for transmission from spacecraft for the tracking of communication-satellite space stations. Precise frequencies and associated bandwidths of emission will be assigned on a case-by-case basis.

136–137 Mc/s [1]
137–138 Mc/s
400.05–401 Mc/s [1]
1525–1540 Mc/s

[1] This band is basically a space research band and is not intended for use by operational communication-satellite systems once the desired spacecraft orbit is established.

§ 25.203 Choice of sites and frequencies.

(a) Sites and frequencies for earth stations, operating in frequency bands shared with equal rights between terrestrial and space services, shall be selected, to the extent practicable, in areas where the surrounding terrain and existing frequency usage are such as to minimize the possibility of harmful interference between the sharing services.

(b) An applicant for an earth station authorization shall calculate the coordination distance for the proposed station in accordance with the procedures set forth in § 25.251, and submit with his application a map drawn to appropriate scale indicating the location of the earth station and the coordination distances from the earth station, for both transmission and reception by the earth station, as a function of azimuth. The coordination distance for earth station reception shall be based on a power range of 0 to 55 dbW in increments of not more than 10 db. The applicant shall also submit the mechanical and electrical characteristics of the earth station antenna(s) upon which the coordination distance calculations are based.

(c) An applicant for an earth station authorization shall also make a showing, accompanied by supporting data and calculations, that existing stations operating within the frequency band in question and those for which construction permits have been issued, and located within the pertinent calculated coordination distance contours of the proposed earth station, will not be subjected to harmful interference from earth station transmissions and will not cause harmful interference to reception at the earth station.

§ 25.204 Power limits.

(a) Within the band 5925–6425 Mc/s the mean effective radiated power transmitted in any direction in the horizontal plane by a communication-satellite earth station shall not exceed +45 dbW in any 4 kc/s band.

(b) Within the band 7900–8400 Mc/s, in order to provide a capability for both active and passive communication-satellite systems, the mean effective radiated power transmitted in any direction in the horizontal plane by a communication-satellite earth station shall not exceed +55 dbW in any 4 kc/s band except upon a showing of need for greater power, in which case a maximum of +65 dbW may be authorized, consistent with the provisions of paragraphs (c) and (d) of this section.

(c) In any direction where the distance from a communication-satellite earth station operating in the band 7900–8400 Mc/s to the boundary of the territory of another administration exceeds 400 km, the limit of +55 dbW in any 4 kc/s band in paragraph (b) of this section may be increased in that direction by 2 db for each 100 km in excess of 400 km up to a maximum of +65 dbW.

(d) If, in any direction from a proposed communication-satellite earth station, the distance to the boundary of the territory of another administration is less than the coordination distance as calculated in § 25.251, the Commission will initiate discussions in the technical aspects of the proposed operation.

NOTE: For the purposes of this part, the effective radiated power transmitted in the horizontal plane shall be taken to mean the ERP actually transmitted toward the horizon, reduced by the site shielding factor that may be applicable. The value of site shielding factor shall be determined as indicated in § 25.251(e).

§ 25.205 Minimum angle of antenna elevation.

(a) Within the band 5925–6425 Mc/s, earth station antennas shall not normally be authorized for transmission at elevation angles less than 5°, measured

from the horizontal plane to the central axis of the main lobe. However, upon a showing that the transmission path will be seaward and away from land masses or upon special showing of need for lower angles by the applicant, the Commission will consider authorizing transmissions at angles between 3° and 5° in the pertinent directions. In certain instances it may be necessary to specify minimum angles greater than 5° because of interference considerations.

(b) Within the band 7900–8400 Mc/s, earth station antennas shall not be employed for transmission at elevation angles less than 3°, measured from the horizontal plane to the central axis of the main lobe.

§ 25.206 Station identification.

(a) The requirement for transmission of station identification is waived for communication-satellite earth stations and for stations the sole function of which is to transmit telecommand signals to communication-satellite space stations.

(b) The requirement for transmission of station identification is waived for communication-satellite space stations but applicants therefor shall file ephemeris data and descriptions of transmission characteristics to be used ir lieu of identifying call signs.

§ 25.207 Cessation of emissions.

Space stations shall be made capable of ceasing radio emissions by the use of appropriate devices (battery life, timing devices, ground command, etc.) that will ensure definite cessation of emissions.

§ 25.208 Power flux density limits.

(a) The total power flux density at the earth's surface, produced by an emission from a communication-satellite space station, where wide-deviation frequency (or phase) modulation is used, shall in no case exceed −130 dbW/m² for all angles of arrival. In addition, such signals shall if necessary be continuously modulated by a suitable waveform, so that the power flux density shall in no case exceed −149 dbW/m² in any 4 kc/s band for all angles of arrival.

(b) The power flux density at the earth's surface, produced by an emission from a communication-satellite space station, where modulation other than wide-deviation frequency (or phase) modulation is used, shall in no case exceed −152 dbW/m² in any 4 kc/s band for all angles of arrival.

(c) The power flux density limits specified in paragraphs (a) and (b) of this section are applicable to the frequency bands 3700–4200 Mc/s and 7250–7750 Mc/s. Systems brought into use after January 1, 1969, shall not be limited in the frequency band 7250–7300 Mc/s.

(d) Passive communication-satellite systems may be authorized in the frequency band 7250–7750 Mc/s. The power flux density produced at the earth's surface as the result of reflection from a passive communication satellite shall not exceed the limits set forth in paragraphs (a) and (b) of this section for active systems.

§ 25.251 Procedure for calculating coordination distance.

(a) *Requirements for coordination.* Coordination is required when earth stations and terrestrial stations operate in shared frequency bands with equal rights. The coordination area around an earth station is determined by ascertaining the coordination distance measured in the various azimuths from that station.

(1) For the calculation of coordination distance, two separate cases must be considered:

(i) Interference from an earth station transmitter to terrestrial station receivers; and

(ii) Interference from terrestrial station transmitters to communication-satellite, meteorological-satellite or space research earth station receivers.

(iii) In the case of subparagraph (1)(i) of this paragraph, it has been assumed for the purpose of calculation, that the terrestrial receiving station is a line-of-sight radio-relay station designed according to C.C.I.R. Recommendations. In the case of subparagraph (1)(ii) of this paragraph, it has been assumed for all applications that the earth station forms a part of a communication-satellite system. Further, in order to ensure that a safe value of coordination distance shall be obtained, it has been assumed that the receiving station antenna in each case is of typically high gain. For the same reason, appropriately low-noise sensitive receivers are assumed in all cases.

(b) *Minimum permissible basic transmission loss* (L_b). (1) The general formula for calculating the required minimum permissible basic transmission loss is:

[formula 1]

$$L_b = (P_t + G_t) - F_s - (P_r - G_r)$$

where P_t is the power in dbW supplied by the interfering transmitter to the transmission line input,

G_t is the isotropic gain in db of the transmitting antenna of the interfering station effective in the direction of the receiving station liable to interference, including the effect of all feeder losses, and losses due to any artificial screens.

F_s is the earth station site-shielding factor in db (see § 25.251(e)),

P_r is the maximum permissible interference level in dbW at the receiver input of the receiving station, and

G_r is the isotropic gain in db of the antenna of the receiving station effective in the direction of the interfering transmitter, less feeder loss and polarization discrimination if applicable.

(2) When considering interference to telephone transmission systems, particularly in the case of systems using frequency modulation, it is convenient to operate in terms of the power densities in any 4 kc/s bandwidth. Therefore, in the case of interference from an earth station transmitter to terrestrial radio-relay systems, P_t is taken as the maximum power density in any 4 kc/s bandwidth supplied by the earth station transmitter to the transmission line input, and similarly P_r is the maximum permissible power density for any 4 kc/s bandwidth at the receiver input.

(3) When considering interference from a terrestrial transmitter to an earth station receiver, it is more convenient to consider P_t and P_r of formula (1) as total powers rather than power densities.

(4) It is assumed in calculating coordination distances for both cases in § 25.251(a) that the communication-satellite system is employing carrier energy dispersal techniques when lightly loaded.

(c) *Calculation of minimum permissible basic transmission loss.* In any direction from the transmitting station, the required minimum value of permissible basic transmission loss (L_b) is obtained from the following tables 1 and 2.

TABLE 1.—Interference from a Communication-Satellite Earth Station Transmitter to a Terrestrial Line-of-Sight Radio-Relay System

	Percentage of time	Values to be assumed for coordination
Permissible total interference in any telephone channel	0.01	−40 dbm0
Permissible interference from one earth station to one radio-relay system receiver, assuming four such non-simultaneous interference entries	0.0025	−40 dbm0
Receiver transfer characteristic assuming carrier energy dispersion to distribute interference uniformly over at least 300 kc/s bandwidth		1 db [1] (light loading worst case).
Hence, maximum value of unwanted-to-wanted signal ratio at the receiver input	0.0025	−39 db
Minimum level of wanted signal at receiver input		−74 dbW [1]
Hence, permissible level of unwanted signal at receiver input, assuming carrier energy dispersion as above	0.0025	−113 dbW
Factor for conversion of interference bandwidth to 4 kc/s from 300 kc/s		−19 db
Hence, permissible level of unwanted signal at receiver input in any 4 kc/s bandwidth	0.0025	−132 dbW (per 4 kc/s).
Isotropic gain of radio-relay station antenna less feeder losses [2]		42 db
Isotropic gain of earth station antenna effective in the horizontal plane less feeder and polarization losses [3]	2.5	G_{earth} db
Power supplied by earth station transmitter to the transmission line input per 4 kc/s bandwidth		P_{earth} dbW
Earth station site-shielding factor if applicable		F_s db
Minimum permissible basic transmission loss, L_b (in decibels)	0.1	$P_{earth}+G_{earth}-F_s+174$.

[1] These figures are taken from an example of a 960-channel line-of-sight radio-relay system but the maximum permissible unwanted signal level of −113 dbW is almost independent of the number of channels carried.

[2] The value of 42 db given in table I should be used unless it is known that the terrestrial station receiving antenna gain is greater than 42 db, in which case the higher value should be used.

[3] For simplicity, the appropriate value of G_{earth} to be used shall be the maximum value obtained in the horizontal plane in the pertinent azimuthal direction rather than the value exceeded for 2.5 percent of the time. However, when site-shielding is allowed, the value to be used shall be that maximum value obtaining at the angle of elevation of the screening obstacle.

TABLE 2.—Interference from a Terrestrial Line-of-Sight Radio-Relay Transmitter to a Communication-Satellite Earth Station Receiver

	Percentage of time	Values to be assumed for coordination
Permissible total interference in any telephone channel	0.02	−38 dbmO
Permissible interference from one terrestrial station to one earth station, assuming four such nonsimultaneous interference entries.	0.005	−38 dbmO
Receiver transfer characteristic assuming carrier energy dispersion of the wanted signal.		10 db [1]
Hence, maximum value of unwanted-to-wanted signal ratio at the receiver input.	0.005	−28 db
Minimum level of wanted signal at the receiver input		−117 dbW [1]
Hence, permissible level of unwanted signal at the receiver input	0.005	−146 dbW
Isotropic gain of earth station antenna effective in the horizontal plane [2]	5	G_{earth} db
Isotropic gain of radio-relay station antenna less feeder loss		$G_{terr.}$ db
Earth station site-shielding factor if applicable		F_s db
Power supplied by terrestrial station transmitter to the transmission line input		$P_{terr.}$ dbW
Minimum permissible basic transmission loss, L_b (in decibels) [3]	0.1	$P_{terr.}+G_{terr.}+G_{earth}-F_s+145$

[1] These figures are taken from an example of a 1200-channel communication-satellite system but the maximum permissible unwanted signal level of −145 dbW is almost independent of the numbers of channels carried.

[2] For simplicity, the appropriate value of G_{earth} to be used shall be that maximum value obtained in the horizontal plane in the pertinent azimuthal direction rather than the value exceeded for 5 percent of the time. However, when site-shielding is allowed, the value to be used shall be that maximum value obtaining at the angle of elevation of the screening obstacle.

[3] The application of coordination procedures for frequency sharing of this type involves the preparation, by the entity desiring to set up an earth station, of equal-power contours of coordination distance in the various azimuthal directions for several discrete levels of radiated power from the terrestrial station.

(d) *Summary.* The formulas giving the required basic transmission loss in db (L_b) not to be exceeded for 0.1 percent of the time are summarized as follows:

(1) For coordination between an earth transmitting station and terrestrial receiving stations:

$$L_b = P_{earth} + G_{earth} - F_s + 174$$

NOTE: For the value of G_{earth}, see footnote 3 to Table 1 in paragraph (c).

(2) For coordination between terrestrial transmitting stations and a communication-satellite, meteorological-satellite or space research earth receiving station:

$$L_b = P_{terr.} + G_{terr.} - F_s + G_{earth} + 145$$

NOTE: For the value of G_{earth}, see footnote 2 to Table 2 in paragraph (c).

(e) *Site-Shielding Factor.* (1) In cases where earth stations are sited below the level of surrounding or nearby terrain it is necessary to adopt the following procedure. Thus, if in a given azimuthal direction, an obstacle provides an angle of elevation, θ, to the earth station then—for that azimuthal direction—it is necessary, in calculating coordination distance, to employ the maximum earth station antenna gain at the angle of elevation, θ, rather than the maximum gain along the horizontal.

NOTE: Compliance with this condition may lead to an incongruity when the elevation angle of the main beam coincides with or is approximately the same as θ, in that the calculated coordination distance with site shielding may exceed the calculated coordination distance along the same radial when site shielding is disregarded. In such cases, the smaller calculated coordination distance shall apply.

(2) As previously discussed, where site-shielding applies, the value of required basic transmission loss, L_b, may be reduced by a site-shielding factor, F_s, expressed in decibels. The following values of site-shielding factor shall apply when the obstacle limiting the angle of elevation is situated more than 5 kilometers away from the earth station.

Minimum angle of elevation, θ, of obstacle, as seen from earth station	Allowable value of site-shielding factor, F_s, in decibels
Below 1°	0
Between 1° and 2°	5
Between 2° and 3°	8
Between 3° and 4°	11
Between 4° and 5°	13
More than 5°	15

NOTE 1: In the case of nearer obstacles the values of site-shielding factor which apply may be obtained by multiplying the tabulated values by the fraction d/5, where d is the distance from the earth station to the obstacle in kilometers.

NOTE 2: The values of site-shielding factor shall be used with caution where terrestrial stations may be located, within coordination distance, at sites which are substantially above the horizontal plane passing through the earth station.

(f) *Equivalent Basic Transmission Loss at 4 Gc/s (L_b').* The propagation data considered in paragraph (g) of this section relates to the frequency of 4 Gc/s and it is therefore in general necessary to convert the minimum permissible basic transmission loss (L_b) into an equivalent loss at 4 Gc/s (L_b') before using these data to find the coordination distance. The equivalent loss in decibels at 4 Gc/s is given by:

$$L_b' = L_b + 13 - 21.6 \log_{10} f$$

where f is the assigned frequency in Gc/s. This relationship is shown in Figure 1 of paragraph (h) of this section.

(g) *World Radio-Climatic Conditions and Propagation Data.* (1) The propagation curves of Figure 2 are labelled Zone A, Zone B, and Zone C, and correspond to the various basic radio-climatic regions of the world as follows:

Zone A: Land
Zone B: Sea, at latitudes greater than 23.5° N. and 23.5° S.
Zone C: Sea, at latitudes between 23.5° N. and 23.5° S. inclusive.

(2) In any direction from the earth station the required coordination distance is found as follows:

(i) If the equivalent basic transmission loss L_b' is such that the coordination distance in the given direction lies wholly within one of the zones, the coordination distance may be obtained directly from Figure 2 using the appropriate curve;

(ii) If the coordination distance lies partly in one zone and partly in another, the curves for mixed paths, Figures 3, 4 and 5 should be used. These curves show the loss L_b' as a function of the path length in each of the two zones separately. Thus, if the path length in one zone and the required loss are known, the path length in the other zone can be determined. The path length in the first zone is the known distance from the earth station to the zone boundary in the direction concerned, hence the further length in the second zone can be found. The total path length, or coordination distance, is the sum of the two path lengths. Figures 3, 4 and 5 cover all cases of mixed paths in two zones as follows:

Figure 3: Zones A and B.
Figure 4: Zones A and C.
Figure 5: Zones B and C.

An example of the coordination distance calculation for a mixed path is worked out in paragraph (h) of this section.

(3) In certain geographical areas where propagation losses are known to be less than the values given by the pertinent zonal propagation curves, coordination distances should be calculated on the basis of the known propagation data.

(h) *Example of Coordination Distance Calculation for a Mixed Path.* (1) The procedure to be followed in the case of a mixed path is illustrated by the following example, in which it is assumed that a basic transmission loss of 190 db is required to avoid interference from an earth station to terrestrial services in a given direction.

(2) As shown in the diagram in Figure 6, the earth station is situated 50 km. from the coast and there is an oversea path of 150 km. before the coastline of neighboring country is reached. It is required to find the coordination distance from the earth station in the given direction using the mixed paths propagation chart in Figure 6. The procedure is as follows:

(i) Starting from the origin, the distance of 50 km. from the earth station to the coastline is set off along the A axis of the chart as indicated by the point A_1.

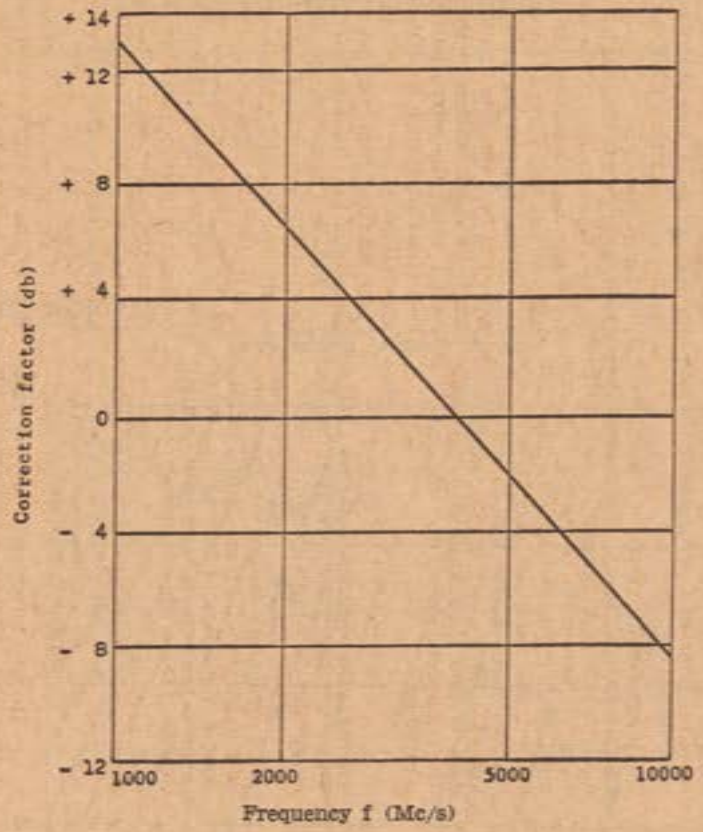
(ii) The oversea path length of 150 km. is then set off parallel to the B axis of the chart as indicated by the point B_1.

(iii) The further overland distance required is then measured parallel to the A axis from the point B_1 to the point of intersection with the 190 db curve, as indicated by X. This distance is found to be 90 km.

(iv) The coordination distance is the sum of the A and B coordinates of the point X and is equal to 50+150+90=290 km.

CORRECTION FACTOR TO BE ADDED TO THE REQUIRED LOSS L_b AT FREQUENCY f TO OBTAIN THE EQUIVALENT LOSS L_b' AT 4000 MC/S

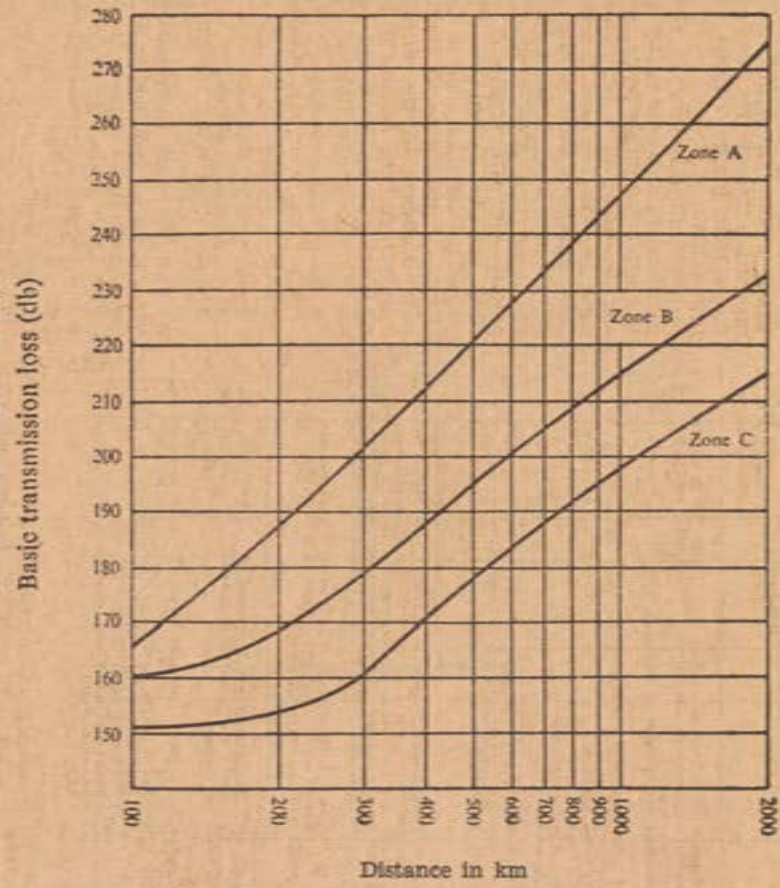
$L_b' = L_b$ + correction factor.



FCC § 25.251(h), Figure 1

SIMPLIFIED TROPOSPHERIC PROPAGATION CURVES FOR CALCULATION OF COORDINATION DISTANCE

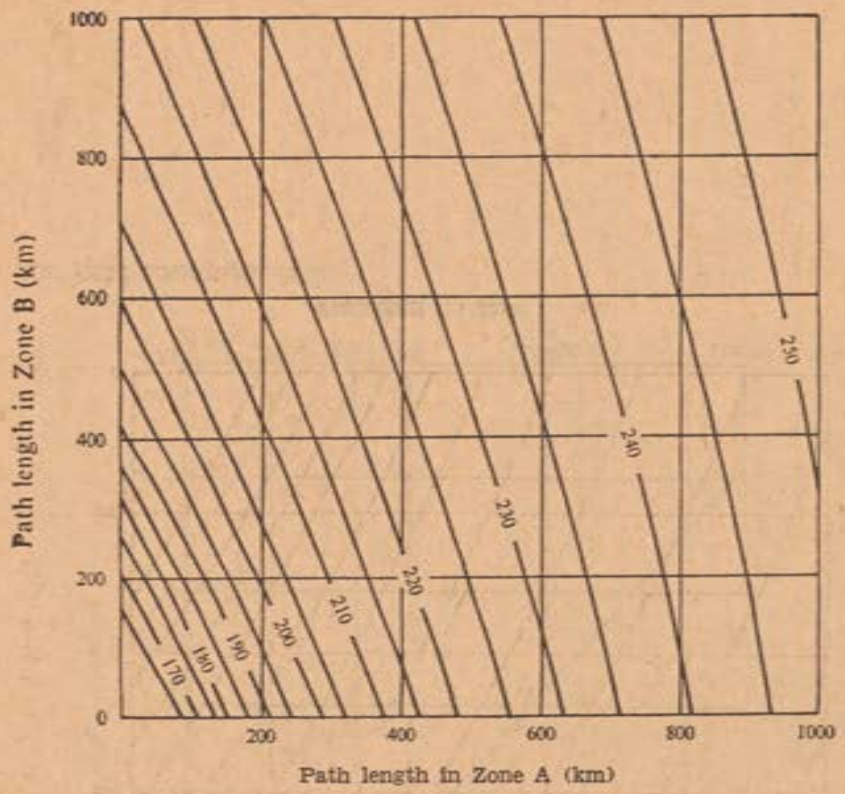
Basic transmission loss not exceeded for 0.1% of the time at 4000 Mc/s.



FCC § 25.251(h), Figure 2

CHART FOR COORDINATION DISTANCE CALCULATIONS
MIXED PATHS IN ZONES A & B

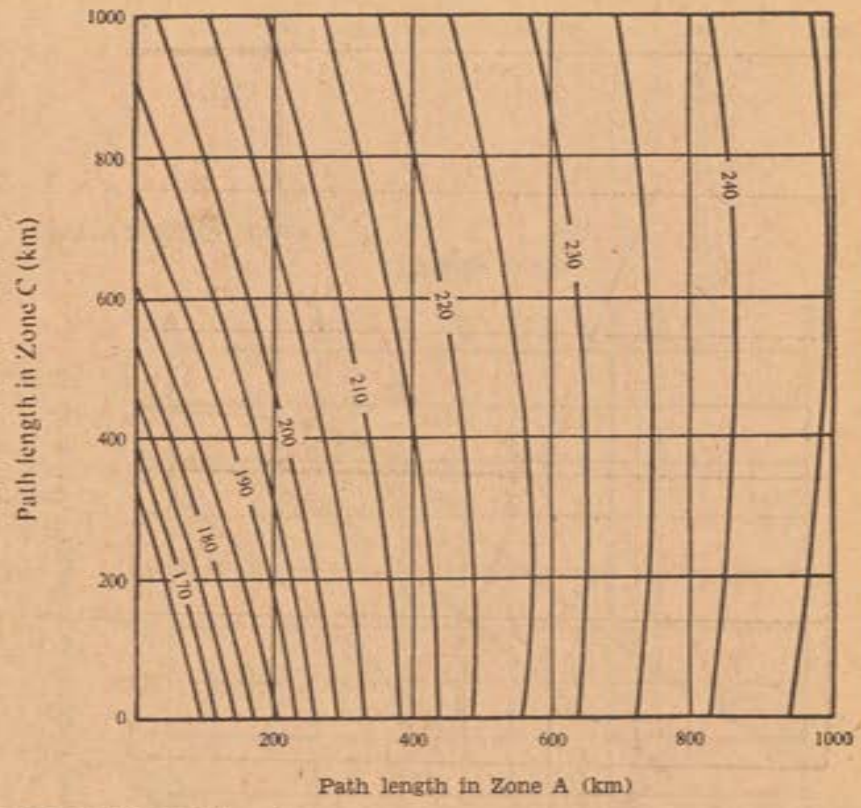
Basic transmission loss not exceeded for 0.1% of the time at 4000 Mc/s L_b' (db)



FCC § 25.251(h), Figure 3

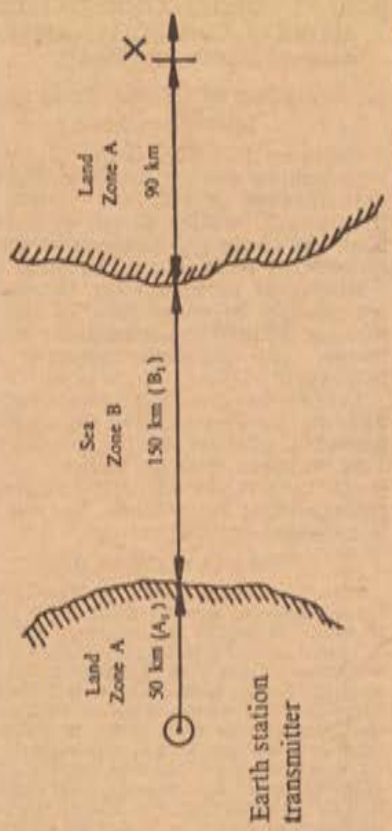
CHART FOR COORDINATION DISTANCE CALCULATIONS
MIXED PATHS IN ZONES A & C

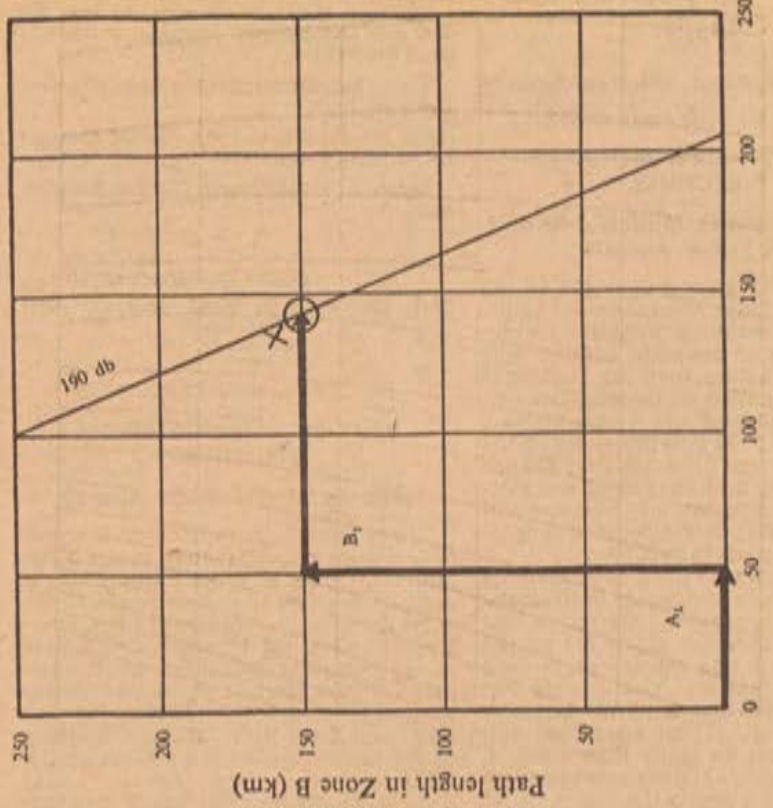
Basic transmission loss not exceeded for 0.1% of the time at 4000 Mc/s L_b' (db)



FCC § 25.251(h), Figure 4

EXAMPLE OF COORDINATION DISTANCE CALCULATION FOR MIXED PATHS



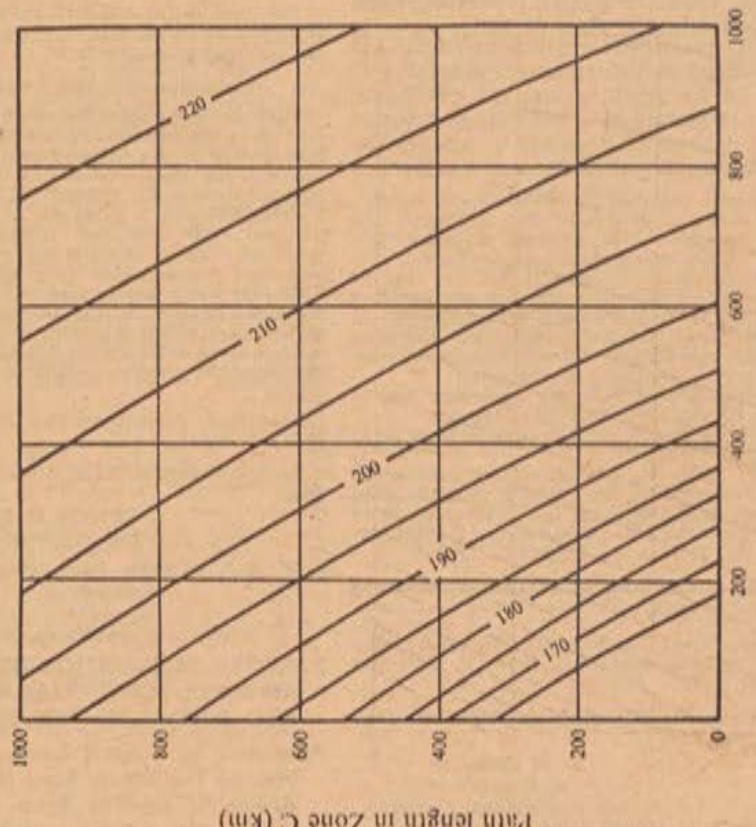


FCC § 25.251(h), Figure 6

[F.R. Doc. 65-5330; Filed, May 27, 1965; 8:45 a.m.]

CHART FOR COORDINATION DISTANCE CALCULATIONS
MIXED PATHS IN ZONES B & C

Basic transmission loss not exceeded



FCC § 25.251(h), Figure 5