

United States of America

PRELIMINARY DRAFT PROPOSALS FOR WRC-2000

Attached are the preliminary draft proposals of the United States concerning the 2000 World Radiocommunication Conference (WRC-2000). These draft proposals reflect deliberations in the United States as of 4 May 1999 and will be kept up to date as the our preparatory process continues.

The United States intends to take into account comments and views expressed by other administrations as progress in proposal development continues.

This document presents our preliminary draft proposals. Each of the individual proposals has been annotated, in the individual agenda title, to indicate the date of its last revision.

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Proposals for Agenda Item 1.2

to finalize remaining issues in the review of Appendix S3 to the Radio Regulations with respect to spurious emissions for space services, taking into account Recommendation 66 (Rev.WRC-97) and the decisions of WRC-97 on adoption of new values, due to take effect at a future time, of spurious emissions for space services (20March99)

Background Information: Recommendation No. 66 (Rev. WRC-97) directs the ITU-R to submit a report to **WRC-2000** with a view to finalizing the space services spurious emissions limits in Appendix **S3** of the Radio Regulations. The United States proposes text that would remove the “design objectives” designation from the space services spurious emissions limits and make related appropriate modifications applicable to deep-space systems, satellites with spurious emissions falling within the necessary bandwidth of another transmitter on the same satellite, and amateur earth stations below 30 MHz. Also the United States proposes to adequately recognize the case of very narrowband and unmodulated signals, particularly for the space services. Furthermore, the United States proposes to correct an oversight in Appendix **S3** regarding limits for the radiodetermination service, and specify that spurious emission levels for radar systems be determined from radiated emissions.

Proposals:

APPENDIX S3

Table of Maximum Permitted Spurious Emission Power Levels

(See Article S3)

APS3

1. The following sections indicate the maximum permitted levels of spurious emissions, in terms of power as indicated in the tables, of any spurious component supplied by a transmitter to the antenna transmission line. Section 1 is applicable until 1 January 2012 to transmitters installed on or before 1 January 2003; Section 2 is applicable to transmitters installed after 1 January 2003 and to all transmitters after 1 January 2012. This Appendix does not cover out-of-band emissions. Out-of-band emissions are dealt with in No. **S4.5** of the Radio Regulations.
2. Spurious emission from any part of the installation, other than the antenna and its transmission line, shall not have an effect greater than would occur if this antenna system were supplied with the maximum permitted power at that spurious emission frequency.
3. These levels shall not, however, apply to emergency position-indicating radiobeacon (EPIRB) stations, emergency locator transmitters, ships' emergency transmitters, lifeboat transmitters, survival craft stations or maritime transmitters when used in emergency situations.
4. For technical or operational reasons, more stringent levels than those specified may be applied to protect specific services in certain frequency bands. The levels applied to protect these services, such as safety and passive services,

shall be those agreed upon by the appropriate world radiocommunication conference. More stringent levels may also be fixed by specific agreement between the administrations concerned. Additionally, special consideration of transmitter spurious emissions may be required for the protection of safety services, radio astronomy and space services using passive sensors. Information on the levels of interference detrimental to radio astronomy, Earth exploration satellites and meteorological passive sensing is given in the most recent version of Recommendation ITU-R SM.329.

5. Spurious emission limits for combined radiocommunication and information technology equipment are those for the radiocommunication transmitters.

Section I. Spurious Emission Limits for Transmitters Installed on or Before 1 January 2003 (valid until 1 January 2012)

**USA/1.2/01
MOD**

6. Radar systems are exempt from spurious emission limits under this section. ~~The measurement methods for radar systems should be guided by Recommendation ITU-R M.1177. For those radar systems for which acceptable methods of measurement do not exist, the lowest practicable power of spurious emission should be achieved.~~

TABLE I

Attenuation values and absolute mean power levels used to calculate maximum permitted spurious emission power levels for use with radio equipment

Frequency band containing the assignment (lower limit exclusive, upper limit inclusive)	For any spurious component, the attenuation (mean power within the necessary bandwidth relative to the mean power of the spurious component concerned) shall be at least that specified below and the absolute mean power levels given shall not be exceeded (Note 1)
9 kHz to 30 MHz	40 decibels 50 milliwatts 2), 3), 4)
30 MHz to 235 MHz – mean power above 25 watts – mean power 25 watts or less	60 decibels 1 milliwatts 5) 40 decibels 25 microwatts

235 MHz to 960 MHz – mean power above 25 watts – mean power 25 watts or less	60 decibels 20 milliwatts 6), 7) 40 decibels 25 microwatts 6), 7)
960 MHz to 17.7 GHz – mean power above 10 watts – mean power 10 watts or less	50 decibels 100 milliwatts 6), 7), 8), 9) 100 microwatts 6), 7), 8), 9)
Above 17.7 GHz	The lowest possible values achievable shall be employed (see Recommendation 66 (Rev.WRC-97)).

Notes to Table I

1) When checking compliance with the provisions of the table, it shall be verified that the bandwidth of the measuring equipment is sufficiently wide to accept all significant components of the spurious emission concerned.

2) For mobile transmitters which operate below 30 MHz, any spurious component shall have an attenuation of at least 40 decibels without exceeding the value of 200 milliwatts, but every effort should be made to comply with the level of 50 milliwatts wherever practicable.

3) For transmitters of a mean power exceeding 50 kilowatts which can operate on two or more frequencies covering a frequency range approaching an octave or more, while a reduction below 50 milliwatts is not mandatory, a minimum attenuation of 60 decibels shall be provided.

4) For hand-portable equipment of mean power less than 5 watts, the attenuation shall be 30 decibels, but every practicable effort should be made to attain 40 decibels attenuation.

5) Administrations may adopt a level of 10 milliwatts provided that harmful interference is not caused.

6) Where several transmitters feed a common antenna or closely spaced antennas on neighbouring frequencies, every practicable effort should be made to comply with the levels specified.

7) Since these levels may not provide adequate protection for receiving stations in the radio astronomy and space services, more stringent levels might be considered in each individual case in the light of the geographical position of the stations concerned.

8) These levels are not applicable to systems using digital modulation techniques, but may be used as a guide. Values for these systems may be provided by the relevant ITU-R Recommendations, when available (see Recommendation **66 (Rev.WRC 97)**).

9) These levels are not applicable to stations in the space services, but the levels of their spurious emissions should be reduced to the lowest possible values compatible with the technical and economic constraints to which the equipment is subject. Values for these systems may be provided by the relevant ITU-R Recommendations, when available (see Recommendation **66 Rev.WRC-97**).

Section II. Spurious Emission Limits for Transmitters Installed After 1 January 2003 and for All Transmitters After 1 January 2012

Application of these limits

7. The frequency range of the measurement of spurious emissions is from 9 kHz to 110 GHz or the second harmonic if higher.

8. Guidance regarding the methods of measuring spurious emissions is given in the most recent version of Recommendation ITU-R SM.329. The e.i.r.p. method specified in that Recommendation should be used when it is not possible to measure the power supplied to the antenna transmission line, or where it is more appropriate, due to the antenna signal attenuation characteristics. Additionally, the e.i.r.p. method may need some modification for special cases, e.g. beam-forming radars.

9. Guidance regarding the methods of measuring spurious emissions from radar systems is given in the most recent version of Recommendation ITU-R M.1177. The reference bandwidths required for proper measurement of radar spurious emissions should be calculated for each particular radar system. Thus, for the three general types of radar pulse modulation utilized for radionavigation, radiolocation, acquisition, tracking and other radiodetermination functions, the reference bandwidth values should be:

- for fixed-frequency, non-pulse-coded radar, one divided by the radar pulse length, in seconds (e.g. if the radar pulse length is 1 microsecond, then the reference bandwidth is $1/1\mu\text{s} = 1\text{ MHz}$);
- for fixed-frequency, phase coded pulsed radar, one divided by the phase chip length, in seconds (e.g. if the phase coded chip is 2 microseconds long, then the reference bandwidth is $1/2\mu\text{s} = 500\text{ kHz}$);
- for frequency modulated (FM) or chirped radar, the square root of the quantity obtained by dividing the radar bandwidth in MHz by the pulse length, in seconds (e.g. if the FM is from 1 250 to 1 280 MHz or 30 MHz

**USA/1.2/02
MOD**

during the pulse of 10 microseconds, then the reference bandwidth is $(30 \text{ MHz}/10\mu\text{s})^{1/2} = 1.73 \text{ MHz}$).

For those radar systems for which acceptable methods of measurement do not exist, the lowest practicable power of spurious emission should be achieved.

10. The spurious emission levels are specified in the following reference bandwidths:

- 1 kHz between 9 kHz and 150 kHz
- 10 kHz between 150 kHz and 30 MHz
- 100 kHz between 30 MHz and 1 GHz
- 1 MHz above 1 GHz

As a special case, the reference bandwidth of all space service spurious emissions should be 4 kHz.

11. For the purpose of setting limits, all emissions, including harmonic emissions, intermodulation products, frequency conversion products and parasitic emissions, which fall at frequencies separated from the centre frequency of the emission by $\pm 250\%$, or more, of the necessary bandwidth of the emission will generally be considered as spurious emissions. However, this frequency separation may be dependent on the type of modulation used, the maximum bit rate in the case of digital modulation, the type of transmitter and frequency coordination factors. For example, in the case of digital (including digital broadcasting) modulation systems, broadband systems, pulsed modulation systems and narrow-band high power transmitters, the frequency separation may need to differ from the $\pm 250\%$ factor. For multichannel or multicarrier transmitters/transponders, where several carriers may be transmitted simultaneously from a final output amplifier or an active antenna, the centre frequency of the emission is taken to be the centre of the -3 dB bandwidth of the transmitter or transponder and the necessary bandwidth is taken to be the transmitter or transponder bandwidth.

**USA/1.2/03
ADD**

11 bis. As an emitted signal becomes more and more narrow (to the limiting case of an unmodulated carrier with theoretical necessary bandwidth of zero), the application of the term “necessary bandwidth” as used in determining the region where spurious emission limits apply to space services, becomes more and more difficult. In the limit, $\pm 250\%$ of necessary bandwidth (generally recognised as establishing the region beyond which spurious emissions are defined), approaches zero. Beacon and other unmodulated signals, such as those used in uplink and downlink circuits in control and tracking of satellites, are examples of a case where it is difficult to practically apply the term “necessary bandwidth” in determining where out-of-band emissions end, and spurious emissions begin. Pending further studies and definitive action by a future World Radiocommunication Conference, in calculating the region where spurious emission limits apply for transmitters using amplifiers to pass essentially an unmodulated signal (or a signal with very small bandwidth), the amplifier bandwidth is taken to be the necessary bandwidth (in calculating the regions where spurious emissions apply).

USA/1.2/04
ADD

11 ter For satellites employing more than one transponder, and when considering the limits for spurious emission as indicated by Headnote 11 to Appendix S3, spurious emissions from one transponder may fall on a frequency at which a companion, second transponder is transmitting. In this situation, the level of spurious emission from the first transponder is well exceeded by fundamental emissions of the second transponder. Therefore, limits in this appendix do not apply to those spurious emissions on a satellite which fall within the bands where there are transmissions from the same satellite into the same service area.

12. Examples of applying $43 + 10 \log (P)$ to calculate attenuation requirements

Where specified in relation to mean power, spurious emissions are to be at least x dB below the total mean power P , i.e. $-x$ dBc. The power P (in watts) is to be measured in a bandwidth wide enough to include the total mean power. The spurious emissions are to be measured in the reference bandwidths given in the Recommendation. The measurement of the spurious emission power is independent of the value of necessary bandwidth. Because the absolute emission power limit, derived from $43 + 10 \log (P)$, can become too stringent for high-power transmitters, alternative relative powers are also provided in Table II.

Example 1

A land mobile transmitter, with any value of necessary bandwidth, must meet a spurious emission attenuation of $43 + 10 \log (P)$, or 70 dBc, whichever is less stringent. To measure spurious emissions in the frequency range between 30 MHz and 1 000 MHz, Recommendation ITU-R SM.329-7 *recommends* 4.1 indicates the use of a reference bandwidth of 100 kHz. For other frequency ranges, the measurement must use the appropriate reference bandwidths given in *recommends* 4.1.

With a measured total mean power of 10 watts:

- Attenuation relative to total mean power = $43 + 10 \log (10) = 53$ dBc.
- The 53 dBc is less stringent than 70 dBc, so the 53 dBc value is used.
- Therefore: Spurious emissions must not exceed 53 dBc in a 100 kHz bandwidth, or converting to an absolute level, spurious emissions must not exceed $10 \text{ dBW} - 53 \text{ dBc} = -43 \text{ dBW}$ in a 100 kHz reference bandwidth.

With a measured total mean power of 1 000 watts:

- Attenuation relative to total mean power = $43 + 10 \log (1\ 000) = 73$ dBc.
- The 73 dBc is more stringent than 70 dBc limit, so the 70 dBc value is used.
- Therefore: Spurious emissions must not exceed 70 dBc in a 100 kHz bandwidth, or converting to an absolute level, spurious emissions must not exceed $30 \text{ dBW} - 70 \text{ dBc} = -40 \text{ dBW}$ in a 100 kHz reference bandwidth.

Example 2

A space service transmitter with any value of necessary bandwidth must meet a spurious emission attenuation of $43 + 10 \log (P)$, or 60 dBc, whichever is less stringent. To measure spurious emissions at any frequency, Note 1 to Table II indicates using a reference bandwidth of 4 kHz.

With a measured total mean power of 20 watts:

- Attenuation relative to total mean power = $43 + 10 \log (20) = 56$ dBc.
- The 56 dBc is less stringent than the 60 dBc limit, so the 56 dBc value is used.
- Therefore: Spurious emissions must not exceed 56 dBc in a 4 kHz reference bandwidth, or converting to an absolute level, spurious emissions must not exceed $13 \text{ dBW} - 56 \text{ dBc} = -43 \text{ dBW}$ in a 4 kHz reference bandwidth.

USA/1.2/05
ADD

TABLE II
Attenuation values used to calculate maximum permitted spurious emission power levels for use with radio equipment

Service category in accordance with Article S1, or equipment type ¹⁵⁾	Attenuation (dB) below the power supplied to the antenna transmission line
All services except those services quoted below:	$43 + 10 \log (P)$, or 70 dBc, whichever is less stringent
Space services (earth stations) <small>^{10), 14), 16}</small>	$43 + 10 \log (P)$, or 60 dBc, whichever is less stringent
Space services (space stations) <small>^{10), 14), 17)}</small>	$43 + 10 \log (P)$, or 60 dBc, whichever is less stringent
Radiodetermination ¹⁴⁾	$43 + 10 \log (PEP)$, or 60 dB, whichever is less stringent
Broadcast television ¹⁾	$46 + 10 \log (P)$, or 60 dBc, whichever is less stringent, without exceeding the absolute mean power level of 1 mW for VHF stations or 12 mW for UHF stations. However, greater attenuation may be necessary on a case by case basis.
Broadcast FM	$46 + 10 \log (P)$, or 70 dBc, whichever is less stringent; the absolute mean power level of 1 mW should not be exceeded
Broadcasting at MF/HF	50 dBc; the absolute mean power level of 50 mW

	should not be exceeded
SSB from mobile stations ¹²⁾	43 dB below <i>PEP</i>
Amateur services operating below 30 MHz (including with SSB) ^{12), 16)}	43 + 10 log (<i>PEP</i>), or 50 dB, whichever is less stringent

TABLE II (END)

Service category in accordance with Article S1, or equipment type ¹⁵⁾	Attenuation (dB) below the power supplied to the antenna transmission line
Services operating below 30 MHz, except space, radiodetermination, broadcast, those using SSB from mobile stations, and amateur ¹²⁾	43 + 10 log (<i>X</i>), or 60 dBc, whichever is less stringent, where <i>X</i> = <i>PEP</i> for SSB modulation, and <i>X</i> = <i>P</i> for other modulation
Low-power device radio equipment ¹³⁾	56 + 10 log (<i>P</i>), or 40 dBc, whichever is less stringent
Emergency position-indicating radio beacon Emergency locator transmitter Personal location beacon Search and rescue transponder Ship emergency, lifeboat and survival craft transmitters Land, aeronautical or maritime transmitters when used in emergency	No limit

P: mean power in watts supplied to the antenna transmission line, in accordance with No. **S1.158**. When burst transmission is used, the mean power *P* and the mean power of any spurious emissions are measured using power averaging over the burst duration.

PEP: peak envelope power in watts supplied to the antenna transmission line, in accordance with No. **S1.157**.

dBc: decibels relative to the unmodulated carrier power of the emission. In the cases which do not have a carrier, for example in some digital modulation schemes where the carrier is not accessible for measurement, the reference level equivalent to dBc is decibels relative to the mean power *P*.

Notes to Table II

¹⁰⁾ Spurious emission limits for all space services are stated in a 4 kHz reference bandwidth.

¹¹⁾ For analogue television transmissions, the mean power level is defined with a specified video signal modulation. This video signal has to be chosen in such a way that the maximum mean power level (e.g. at the video signal blanking level for negatively modulated television systems) is supplied to the antenna transmission line.

¹²⁾ All classes of emission using SSB are included in the category "SSB".

¹³⁾ Low-power radio devices having a maximum output power of less than 100 mW and intended for short-range communication or control purposes; such equipment is in general exempt from individual licensing.

USA/1.2/06
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¹⁴⁾ ~~These values are "design objectives". This note will not be applicable after the 1999 World Radiocommunication Conference.~~ Radiodetermination (Radar) system spurious emission dB attenuation shall be determined for radiated emission levels, not at the antenna transmission line. The measurement methods for determining the radiated spurious emission levels from the radar systems should be guided by Recommendation ITU-R M.1177.

¹⁵⁾ In some cases of digital modulation (including digital broadcasting), broadband systems, pulsed modulation and narrow-band high-power transmitters for all categories of services, there may be difficulties in meeting limits close to $\pm 250\%$ of the necessary bandwidth.

USA/1.2/07
MOD

¹⁶⁾ ~~Limits for amateur earth stations operating below 30 MHz are those applied to "Amateur services operating below 30 MHz (including SSB)."~~ Amateur earth stations operating below 30 MHz are in the service category 'Amateur services operating below 30 MHz (including with SSB).'

USA/1.2/08
ADD

¹⁷⁾ *Deep Space* space station systems, as defined by Article **S1** and operating beyond 2×10^6 km distance from the Earth, are exempt from spurious emission limits.

Reasons: Recommendation No. **66 (Rev. WRC-97)** directs the ITU-R to submit a report to the next WRC with a view to finalizing the space services spurious emissions limits in Appendix **S3** of the Radio Regulations. The United States proposes to confirm the values in Table II and "clean up" the table by removing the "design objectives" designation from the space services spurious emissions limits. Furthermore, by clarifying the exemption of radar systems from the Section I limits, the United States proposes to correct an oversight in Appendix **S3** regarding limits for the radiodetermination service that may lead incorrectly to the application of the Section I limits to radars. Also, the United States proposes to clarify the application of the e.i.r.p. measurement method to radars particularly,

but also to other systems where antenna line measurements may not be appropriate.

Proposals for Agenda Item 1.8

to consider regulatory and technical provisions to enable earth stations located on board vessels to operate in the fixed-satellite service (FSS) networks in the bands 3 700 - 4 200 MHz and 5 925 - 6 425 MHz, including their coordination with other services allocated in these bands (20March99)

Background Information: This item concerns provision of broadband communications in the maritime context by earth stations on board vessels using frequencies and the existing space segment in the fixed-satellite service. These stations operate in three distinct modes: at sea; while stationary in port; and in motion along designated sea lanes while approaching or departing from port.

The United States considers that operations at sea (beyond the yet-to-be-determined distance for near-shore coordination) by earth stations on board vessels in the fixed-satellite service do not present a potential for interference to terrestrial stations operating in accordance with an allocation, and therefore need not be coordinated. Operations while these earth stations are stationary in port are being coordinated in the United States as fixed-satellite service earth stations. Technical and regulatory issues concern the potential for interference between in-motion operations by these earth stations while close to shore and terrestrial stations in the fixed service.

As a first approach and provided that these earth stations meet a minimum set of technical parameters, there would be no problem arising from transmissions from earth stations on board vessels which are at least a yet-to-be-determined distance from land. Although it seems to be feasible, the coordination of earth stations on board vessels moving near shore and in Stationary Modes at C Band needs further work. This includes technical and regulatory aspects, procedures, criteria, etc., which are being pursued by ITU-R.

Proposals:

3 400 - 4 200 MHz

Allocation to services		
Region 1	Region 2	Region 3
3 400-3 600 FIXED FIXED-SATELLITE (space-to-Earth) Mobile Radiolocation S5.431	3 400-3 500 FIXED FIXED-SATELLITE (space-to-Earth) Amateur Mobile Radiolocation S5.433 S5.282 S5.432	
	3 500-3 700 FIXED FIXED-SATELLITE (space-to-Earth) <u>ADD S5.ESV</u> MOBILE except aeronautical mobile Radiolocation S5.433 S5.435	
3 600-4 200 FIXED FIXED-SATELLITE (space-to-Earth) <u>ADD S5.ESV</u> Mobile	3 700-4 200 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile	

USA/1.8/01
MOD

Reasons: To establish regulatory and technical provisions for operations of earth stations on board vessels in the fixed-satellite service.

5 925 - 6 425 MHz

Allocation to services		
Region 1	Region 2	Region 3
5 925-6 425	FIXED FIXED-SATELLITE (Earth-to-space) <u>ADD S5.ESV</u> MOBILE S5.149 S5.440 S5.458	

USA/1.8/02
MOD

Reasons: To establish regulatory and technical provisions for operations of earth stations on board vessels in the fixed-satellite service.

USA/1.8/03
ADD

S5.ESV Earth stations located on board vessels may operate in the fixed-satellite service in accordance with Resolution **ESV (WRC-2000)**.

Reasons: To establish regulatory and technical provisions for operations of earth stations on board vessels in the fixed-satellite service.

USA/1.8/04
ADD

Resolution ESV (WRC-2000)

Provisions for the Use of Earth Stations in the Fixed-Satellite Service Located on board Vessels in the Bands 3 700-4 200 MHz and 5 925-6 425 MHz

The World Radiocommunication Conference (Istanbul, 2000),

considering

- a) that the technology exists to permit the operation of earth stations on board vessels (ESV) in the fixed-satellite service in the bands 3 700 - 4 200 MHz (space-to-Earth), and 5 925 - 6 425 MHz (Earth-to-space);
- b) that developmental operations on board vessels using such earth stations operating in fixed-satellite service networks have been conducted successfully for several years;
- c) that, when such a fixed-satellite service earth station of one Administration is in and near the territory of another Administration in which there are fixed service stations or other co-primary services, coordination may be necessary;
- d) that the coordination situations for such vessels include operations:
 - (i) a certain distance from the nearest point of land beyond which no coordination is necessary;
 - (ii) stationary (in port or moored);
 - (iii) in motion within the distance in (i) from the nearest point of land;
- a) that methods exist for addressing the coordination situations in d) above,

resolves

1. that an earth station on board a vessel (ESV) may operate as a station in the fixed-satellite service while receiving in the 3 700 - 4 200 MHz band and transmitting in the 5 925 - 6 425 MHz band;
2. that operation of ESV earth stations which are at least [XXX] km from land requires no coordination;
3. that when earth stations on board vessels are operated in or near a port, either at a stationary position or while in motion, using the bands 3 700 - 4 200 MHz (space-to-Earth) and 5 925 - 6 425 (Earth-to-space) of the fixed-satellite service, they will do so as follows:
 - (a) the authority over operations on radio frequencies within [XXX] km of land while in and near a port belongs with the

Administration of that territory where the port is located; however, the responsibility for the ESV station lies with the Administration that authorized the use of the ESV station;

- (b) The administration that authorizes the use of the ESV station in these bands shall ensure that they do not cause harmful interference to stations which themselves are established and operated in accordance with the Radio Regulations;
- (c) It is expected that in each port where ESVs will be operating in the fixed-satellite service in these bands:
 - (i) a set of frequencies will be established for such use that have been coordinated with all other co-primary users;
 - (ii) this set of frequencies will not include the entire allocation in these bands;
 - (iii) coordination will be accomplished between the Administration(s) with authority over the terrestrial services operating in these bands in and near that port and the Administration that authorized the ESV station to operate in these bands;
 - (iv) upon completion of such coordination, the ESV station will be authorized to operate in the fixed-satellite service in these bands in and near the port;
- (a) a list of the ESVs authorized to operate in and near a particular port and the frequencies and associated operational conditions which have been coordinated in that port will be established and maintained by the Administration responsible for that port and such list shall include a point of contact for obtaining this information;
- (b) ESV station operators must comply with the conditions established by the authorizing Administration(s);

1. that coordination of in-motion ESV stations within [XXX] km of land shall be accomplished using the provisions of Annex 1 to this Resolution.

Reasons: To establish regulatory and technical provisions for operations of earth stations on board vessels in the fixed-satellite service.

USA/1.8/05

ADD

Annex 1

To be developed

Reasons: To establish regulatory and technical provisions for operations of earth stations on board vessels in the fixed-satellite service.

Proposals for Agenda Item 1.9

**to take into account the results of ITU-R studies in evaluating the feasibility of an allocation in the space-to-Earth direction to the mobile-satellite service in a portion of the 1 559 - 1 567 MHz frequency range, in response to Resolutions 213 and 220 (WRC-97)
(20March99)**

Background Information: Proposals were made to WRC-97 to reallocate portions of the 1 559 - 1 610 MHz band which, with the exception of a fixed service allocation in some countries, currently is exclusively allocated to the radionavigation satellite service and aeronautical radionavigation service worldwide. Other proposals were made not to change the existing allocations in these bands. In Resolution **220 (WRC-97)**, the ITU-R was requested to study, as a matter of urgency, the technical criteria and operational and safety requirements to determine if sharing between the aeronautical radionavigation and radionavigation-satellite services, operating or planned to be operate, in the band 1559-1610 MHz, and the mobile-satellite service in a portion of the 1559-1567 MHz frequency range, is feasible, taking into account the essential need to protect systems operating in the aeronautical radionavigation and radionavigation-satellite services in the band 1559-1610 MHz.

There are millions of RNSS receivers in use today for a wide range of applications, including safety-of-life-critical navigation on land, at sea, and in the air. Today, most of these receivers operate with the Global Positioning System (GPS), an important element of the Global Navigation Satellite System (GNSS) that operates in the 1 559 - 1 610 MHz band.

GPS provides position and time information to users by means of one-way transmissions using RNSS (space-to-Earth) allocations. GPS is information technology that uses systems of hardware and software, as well as information (time and ephemeris) transmitted from satellites to provide derived information to the user.

GLONASS and GPS are established elements of the International Civil Aviation Organization (ICAO) GNSS, operating in the band 1 559 - 1 610 MHz. These systems are accepted by the ICAO Council for use in international civil aviation. ICAO is currently developing Standards and Recommended Practices for international application in civil aviation. The GNSS will be used during all phases of flight, including precision approaches and landing, and under all weather conditions. The latter places extensive requirements on the performance characteristics of the system. The aeronautical use of RNSS is recognized in the Radio Regulations as a safety-of-life application. GPS is the sole basis for the formation of International Atomic Time and Coordinated Universal Time (UTC) by the International Bureau of Weights and Measures. GPS is also the primary means by which clocks are synchronized within telecommunications networks for Time Division Multiple Access transmissions. Time and frequency functions are or will be available on other RNSS systems.

As Resolution **220 (WRC-97)** recognizes RNSS and ARNS systems are evolutionary and other types of GNSS are under development for operation in the band 1 559 - 1 610 MHz. There are both aeronautical and non-aeronautical safety-of-life services in the 1 559 - 1 610 MHz band, and it is well established that there is an essential need to protect systems operating in the ARNS and RNSS.

The core signal structures of the MSS and the RNSS and ARNS are fundamentally different: MSS uses a two-way signal while ARNS and RNSS transmits a weak, receive-only signal. Having systems from

a radiocommunication service operate on a co-primary, co-frequency basis in the 1 559 - 1 610 MHz band would limit ARNS and RNSS operators' flexibility to adjust their spectrum usage, and would hamper efforts to develop a GNSS that is capable of meeting evolving international needs and of providing adequate protection for international civil use worldwide.

Studies undertaken in the ITU addressed current aeronautical radionavigation and radionavigation-satellite service systems, as well as future radionavigation services planned for this band.

These studies reached the following conclusions:

- MSS (space-to-Earth) and ARNS/RNSS are fundamentally incompatible in any portion of the 1559-1567 MHz band. Not only do MSS signals disrupt ARNS/RNSS, but GNSS pseudolites disrupt MSS signals.
- The $-112 \text{ dB(W/m}^2\text{/MHz)}$ power flux-density level at the Earth's surface that is mentioned in Resolution 220 clearly would not protect existing RNSS systems (such as GPS) from harmful interference.
- The RNSS is extensively used, and is continuing to undergo a tremendous expansion which drives further evolution. These factors, along with the many critical timing, positioning, and navigation uses of RNSS sharing of the 1559-1610 MHz band, weigh conclusively against sharing any portion of the band segment at 1559-1567 MHz with any co-frequency communication service.
- The use of pseudolites in the ARNS/RNSS bands at 1559-1567 MHz is in its early stages, but is expected to increase in terms of numbers, geographic scope, and complete utilization of the frequency band in the near future. This use is incompatible with co-frequency MSS (space-to-Earth).

Proposals:

USA/1.9/01
NOC

The United States proposes that no allocation be made to the Mobile Satellite Service (space-to-Earth) in any portion of the 1559 - 1567 MHz band under agenda item 1.9.

Reasons: The current allocation, 1 559 - 1 610 MHz, is required for radionavigation services, including critical aeronautical safety applications, on a worldwide basis. Based on studies conducted in the ITU-R pursuant to Resolution **220**, sharing in this band with communications services such as the mobile-satellite service (space-to-Earth) is not possible.

USA/1.9/02
SUP

RESOLUTION 220 (WRC-97)

**~~Studies to consider the feasibility of use of
a portion of the band 1559-1610 MHz by the
mobile-satellite service (space-to-Earth)~~**

Reasons: Studies performed by the ITU-R show that co-frequency sharing between the mobile-satellite service and the radionavigation-satellite and aeronautical radionavigation services within the band 1559 - 1567 MHz is not feasible. The ITU-R studies satisfy the requirement of Resolution **220 (WRC-97)**. As a result, Resolution **220** should be suppressed.

Proposals for Agenda Item 1.11

to consider constraints on existing allocations and to consider additional allocations on a worldwide basis for the non-GSO/MSS below 1 GHz, taking account the results of ITU studies conducted in response to Res. 214 (Rev. WRC-97) and 219 (WRC-97); (20March99)

Background Information: A number of studies have been carried out since MSS allocations for non-GSO satellite systems were first agreed at WARC-92. These have led to ITU-R Recommendations which indicate the sharing techniques which are being used by those systems to share with each other and other co-primary services.

The table below (Non-GSO MSS Sharing Summary) from Recommendation ITU-RM.[YA] “Methods for achieving coordinated use of multiple non-GSO MSS systems below 1 GHz and sharing with other services in existing MSS allocations” summarizes the techniques and Recommendations applied to existing MSS allocations. Many of these techniques are being employed in practice successfully.

Non-GSO MSS Sharing Summary

	Narrow-band	Wideband
Fixed and mobile (148-149.9 MHz) (455-456 MHz and (459-460 MHz in Region 2) (454-455 MHz by footnotes)	Combination: - Dynamic channel avoidance (Rec. ITU-R M.1039) - Low duty cycle - Brief message duration - (Rec.ITU-R M. 1185)	Combination: - Low output power density - Brief message duration - Low data rate - Filtering at satellite - Geographical separation
Fixes and mobile (137-138 MHz) (400.15-401 MHz)	Ground level pfd per RR S5.208	Ground level pfd per RR S5.208
Meteorological satellites (137-138 MHz)* (400.15-401 MHz)	Assignment separation	Combination: - Low pfd at ground level - Cross polarization discrimination - Adaptive filter at satellite
Space operations Space research (137-138 MHz)	Channel avoidance	Combination: - Low pfd - Cross polarization discrimination
Space research (400.15-401 MHz)	Channel avoidance	Combination: - Low pfd - Cross polarization discrimination
Meteorological aids (400.15-401 MHz)	Channel avoidance	Combination: - Low pfd - Cross polarization discrimination

The constraints on existing allocations are reflected in the footnotes to the allocations, and in the Annex 1 to Appendix S5. These have evolved to their present form since WARC-92, and now reflect a balance with regard to sharing criteria among the primary services concerned.

These constraints have served to provide a basis for implementing non-GSO MSS systems in these bands and at the same time provide protection to other space and terrestrial services. Therefore in

respect to the constraints of the MSS in existing allocations below 1 GHz, no further modifications are needed.

Proposals:

USA/1.11/01
NOC **S9.11A** e) for a station for which the requirement to coordinate is included in a footnote of the Table of Frequency Allocations referring to this provision:

Reasons: No modifications are required to the Tables of Criteria applicable to MSS allocations for the non-GSO systems below 1 GHz as found in No **S9.11A**, or to the footnotes containing constraints which apply to the pertinent allocations.

APPENDIX S5

ANNEX 1

1 Coordination thresholds for sharing between MSS (space-to-Earth) and terrestrial services in the same frequency bands and between non-GSO MSS feeder links (space-to-Earth) and terrestrial services in the same frequency bands

1.1 Below 1 GHz

USA/1.11/02
NOC 1.1.1 In the bands 137-138 MHz and 400.15-401 MHz, coordination of a space station of the MSS (space-to-Earth) with respect to terrestrial services (except aeronautical mobile (OR) service networks operated by the administrations listed in Nos. **S5.204** and **S5.206** as of 1 November 1996) is required only if the pfd produced by this space station exceeds - 125 dB (W/m²/4 kHz) at the Earth's surface.

Reasons: No modifications are required to the Tables of Criteria applicable to MSS allocations for the non-GSO systems below 1 GHz as found in No. **S9.11A**, or to the footnotes containing constraints which apply to the pertinent allocations.

USA/1.11/03
NOC 1.1.2 In the band 137-138 MHz, coordination of a space station of the MSS (space-to-Earth) with respect to the aeronautical mobile (OR) service is required only if the pfd produced by this space station at the Earth's surface exceeds:

- – 125 dB (W/m²/4 kHz) for networks for which complete Appendix **3** coordination information has been received by the Bureau prior to 1 November 1996;
- – 140 dB (W/m²/4 kHz) for networks for which complete Appendix **S4/3** coordination information has been received by the Bureau after 1 November 1996 for the administrations referred to in § 1.1.1 above.

Reasons: No modifications are required to the Tables of Criteria applicable to MSS allocations for the non-GSO systems below 1 GHz as found in No. **S9.11A**, or to the footnotes containing constraints which apply to the pertinent allocations.

USA/1.11/04
NOC

1.1.3 In the band 137-138 MHz, coordination is also required for a space station on a replacement satellite of a MSS network for which complete Appendix 3 coordination information has been received by the Bureau prior to 1 November 1996 and the pfd exceeds -125 dB(W/m²/4 kHz) at the Earth's surface for the administrations referred to in § 1.1.1 above.

Reasons: No modifications are required to the Tables of Criteria applicable to MSS allocations for the non-GSO systems below 1 GHz as found in No. **S9.11A**, or to the footnotes containing constraints which apply to the pertinent allocations.

3.2 General considerations

USA/1.11/05
NOC

TABLE 1
Earth stations operating at frequencies below 1 GHz

Reasons: No modifications are required to the Tables of criteria applicable to MSS allocations for use by Non-GSO systems below 1 GHz, as found in No. **S9.11A**, or to the footnotes containing constraints which apply to the pertinent allocations.

Proposals for Agenda Item 1.12

to consider progress of studies on sharing between feederlinks of non-geostationary satellite networks in the mobile satellite service and geostationary-satellite networks in the fixed satellite service in the bands 19.3-19.7 GHz and 29.1-29.5 GHz, taking into account Resolution 121 (Rev.WRC-97) (20March99)

Background Information: Resolution **121** requests that the ITU-R conduct a study of sharing possibilities between GSO FSS and NGSO MSS feederlinks in the bands. In response ITU-R WP-4A of Study Group 4 has agreed a Draft New Recommendation, "Mitigation Techniques to Facilitate Coordination in the 20/30 GHz NGSO MSS Feederlinks".

The Recommendation includes the topics of Adaptive Power Control, High Gain Antennas, Geographic Isolation, Site Diversity and Link Balancing.

This Recommendation is considered to have covered the requirements of Resolution **121 (Rev. WRC-97)** and thus satisfies the agenda.

Proposals:

USA/1.12/01
MOD

S5.541A Feeder links of non-geostationary networks in the mobile-satellite service and geostationary networks in the fixed-satellite service operating in the band 29.1-29.5 GHz (Earth-to-space) shall employ uplink adaptive power control or other methods of fade compensation, such that the earth station transmissions shall be conducted at the power level required to meet the desired link performance while reducing the level of mutual interference between both networks. These methods shall apply to networks for which Appendix **S4** coordination information is considered as having been received by the Bureau after 17 May 1996 and until they are changed by a future competent world radiocommunication conference. Administrations submitting Appendix **S4** information for coordination before this date are encouraged to utilize these techniques to the extent practicable. ~~These methods are also subject to review by ITU-R (see Resolution 121 (Rev.WRC-97)).~~

Reasons: The objective of Resolution **121** has been addressed through the development of a Draft New Recommendation in Study Group 4 of the ITU-R.

USA/1.12/02

SUP

RESOLUTION 121 (Rev.WRC-97)

~~Continued development of interference criteria and methodologies for fixed-satellite service coordination between feeder links of non-geostationary satellite networks in the mobile satellite service and geostationary satellite networks in the fixed-satellite service in the bands 19.3-19.7 GHz and 29.1-29.5 GHz~~

Reasons: The objectives of Resolution 121 have been met.

Proposals for Agenda Item 1.13

on the basis of results of the studies in accordance with Resolutions 130(WRC-97), 131(WRC-97), and 538(WRC-97); (16April99)

1.13.1: *to review and, if appropriate, revise the power limits appearing in Articles S21 and S22 in relation to the sharing conditions among non-GSO FSS, GSO FSS, GSO broadcasting-satellite service (BSS), space sciences and terrestrial services, to ensure the feasibility of these power limits and that these limits do not impose undue constraints on the development of these systems and services;*

1.13.2: *to consider the inclusion in other frequency bands of similar limits in Articles S21 and S22, or other regulatory approaches to be applied in relation to sharing situations;*

Background Information: WRC-97 adopted provisional power flux density limits in certain frequency bands which would apply to non-GSO FSS systems to protect GSO FSS networks, and GSO BSS networks. Resolution **130 (WRC-97)**, *Use of Non-Geostationary Systems in the Fixed-Satellite Service in Certain Frequency Bands* and Article **S22.2** of the Radio Regulations contain provisional limits corresponding to an interference level caused by one NGSO system in the frequency bands 10.7-12.75 GHz, 17.8-18.6 GHz, and 19.7-20.2 GHz. Resolution **538**, *Use of the Frequency Bands Covered by Appendices 30 and 30A by Non-GSO Systems in the Fixed-Satellite Service*, and Article **S22** contain limits corresponding to permissible levels of interference level from a NGSO system into a GSO BSS network. Resolution **131 (WRC-97)**, *Power Flux-Density Limits Applicable to Non-GSO FSS Systems for Protection of Terrestrial Services in the Bands 10.7-12.75 GHz and 17.7-19.3 GHz*, and Article **S21** contain per-satellite power flux-density limits to protect terrestrial services. Resolutions **130** and **538** request review of the provisional limits and Resolution **131** requests review of the provisional limits and calls for further study of the current power flux-density limits.

Proposals for Agenda Item 1.13.1

Proposals:

1. Proposals to require coordination between NGSO FSS transmitting space stations and GSO receive earth stations with antenna gains greater than a specified value. These proposals include additions and/or modifications to Articles **S5**, **S9**, **S22**, Appendices **S4**, and **S5**.

USA/1.13/01
MOD

S5.441 The use of the bands 4 500-4 800 MHz (space-to-Earth), 6 725-7 025 MHz (Earth-to-space) by the fixed-satellite service shall be in accordance with the provisions of Appendix **S30B**. The use of the bands 10.7-10.95 GHz (space-to-Earth), 11.2-11.45 GHz (space-to-Earth) and 12.75-13.25 GHz (Earth-to-space) by geostationary-satellite systems in the fixed-satellite service shall be in accordance with the provisions of Appendix **S30B**. The use of the bands 10.7-10.95 GHz (space-to-Earth), 11.2-11.45 GHz (space-to-Earth), and 12.75-13.25 GHz (Earth-to-space) by non-geostationary-satellite systems in the fixed-satellite service ~~shall be in accordance with~~ is subject to the provisions of ~~Resolution 130~~

~~(WRC-97) Article S22 and No. S9.12.~~ The use of the bands 10.7-10.95 GHz (space-to-Earth) and 11.2-11.45 GHz (space-to-Earth) is subject to the provisions of No. S9.16A and S9.16B.

USA/1.13/02
MOD

S5.484A The use of the bands 10.95-11.2 GHz (space-to-Earth), 11.45-11.7 GHz (space-to-Earth), 11.7-12.2 GHz (space-to-Earth) in Region 2, 12.2-12.75 GHz (space-to-Earth) in Region 3, 12.5-12.75 GHz (space-to-Earth) in Region 1, 13.75-14.5 GHz (Earth-to-space), 17.8-18.6 GHz (space-to-Earth), 19.7-20.2 GHz (space-to-Earth), 27.5-28.6 GHz (Earth-to-space), 29.5-30 GHz (Earth-to-space) by non-geostationary- and geostationary-satellite systems in the fixed-satellite service is subject to the provisions of ~~Resolution 130 (WRC-97) Article S22 and No. S9.12.~~ The use of the bands 10.95-11.2 GHz (space-to-Earth), 11.45-11.7 GHz (space-to-Earth), 11.7-12.2 GHz (space-to-Earth) in Region 2, 12.2-12.75 GHz (space-to-Earth) in Region 3, 12.5-12.75 GHz (space-to-Earth) in Region 1, 17.8-18.6 GHz (space-to-Earth), and 19.7-20.2 GHz (space-to-Earth) is subject to the provisions of No. S9.16A and S9.16B. ~~The use of the band 17.8-18.4 GHz (space-to-Earth) by non-geostationary fixed-satellite service systems is also subject to the provisions of Resolution 538 (WRC-97).~~

Reasons: The references to Resolutions 130 (WRC-97) and 538 (WRC-97) were replaced by a reference to Article S22 where the non-transitional provisions of these resolutions are contained. The Article S9 provisions for stations for which the requirement to coordinate is included in a footnote to the Table of Frequency Allocations were specified in order to clarify the requirements for coordination under the existing No. S9.12. The proposed S9.16A and S9.16B would require coordination between NGSO FSS transmit satellites and GSO FSS receive earth stations with large antennas. GSO FSS earth stations with large antennas are not adequately protected by the EPFD levels contained in Table S22-3 and case-by-case coordination of systems operating co-frequency, co-directional links in the space-to-Earth direction is required.

ARTICLE S9

Sub-Section IIA - Requirement and request for coordination

USA/1.13/03
ADD

S9.16A vi) which is a specific earth station within a geostationary-satellite network in the fixed-satellite service in certain frequency bands subject to No. S5.441 or S5.484A, in respect of a non-geostationary satellite system in the fixed-satellite service;

Reasons: GSO FSS earth stations with large antennas are not adequately protected by the EPFD levels contained in Table S22-3 and case-by-case coordination is required. Since coordination between a NGSO FSS space station and large GSO FSS earth stations is a new type of coordination that does not currently exist in Article S9, it is necessary to add two new entry points in Article S9:

- One entry point to enable the NGSO space station administration to request coordination with administrations having specific large earth station antennas

- Another entry point to enable the reciprocal coordination to take place, i.e. the possibility for an administration planning to implement a specific large GSO earth station to request coordination with administrations having NGSO FSS transmit space stations.

USA/1.13/04
ADD

S9.16Bvii) which is a non-geostationary-satellite system in the fixed-satellite service in certain frequency bands subject to **S5.441** or **S5.484A**, in respect of a specific earth station within a geostationary satellite network in the fixed-satellite service;

Reasons: Same as the reason for **S9.16A**

TABLE **S22-3**^{ZZ}

PART A

TABLE **S22-3**^{ZZ}

PART B

USA/1.13/05
ADD

^{ZZ} -For certain receive earth stations, this Table is not applicable and coordination is required under Nos. **S9.16A** and **S9.16B**.

Reasons: The EPFD levels contained in **Table S22-3** do not adequately protect earth stations in geostationary satellite networks in the fixed-satellite service with large antenna gains. Case-by-case coordination is required by the proposed modifications to footnotes **S5.441** and **S5.484A**.

Since there is no requirement to give the specific locations of earth stations today, there may need to be a resolution written to have typical earth stations, already in coordination or notified, that meet the above criteria to be brought in as specific earth stations. In this resolution, there will have to be some guidance on priorities. Additional guidance will need to be added to the *Instructions for Filling Out the Form of Notice ApS4/II and ApS4/III Relating to Space Radiocommunication Stations* distributed by CR/65.

MOD TO APPENDIX S4

ANNEX 2B (TO APPENDIX S4)

Table of characteristics to be submitted for space and radio astronomy services

A. General characteristics of the satellite network or the earth station

(Only these two columns are reproduced. These changes need to be incorporated into the full table.)

USA/1.13/06

MOD

Items in Appendix	Notification or co-ordination of a GSO network (including Appendix S30B)
A.1.a	X
A.1.b	
A.1.c	
A.1.d	
A.1.e.1	
A.1.e.2	
A.1.e.3	<u>C^{ZZ}</u>
A.1.e.4	
A.1.f	X
A.2.a	X
A.2.b	X
A.2.c	
A.3	X
A.4.a.1	X
A.4.a.2	X
A.4.a.3	X
A.4.a.4	X
A.4.a.5	X
A.4.b	
A.4.c	
A.5	X
A.6	X
A.7.a	<u>C^{ZZ}</u>
A.7.b	<u>C^{ZZ}</u>
A.7.c	<u>C^{ZZ}</u>
A.7.d	<u>C^{ZZ}</u>
A.8	
A.9	
A.10	
A.11	

A.12	
A.13	X

X Mandatory information

O Optional information

C This information need only be furnished when it has been used as a basis to effect coordination with another administration

ZZ) Required for coordination under No. **S9.16A** or **S9.16B**.

B. Characteristics to be provided for each satellite antenna beam and for each earth station antenna

Items in Appendix	Notification or coordination of a GSO network (including Appendix S30B)
B.1	X
B.2	X
B.3.a	X
B.3.b.1	X
B.3.b.2	X
B.3.c	C
B.3.d	X
B.3.e	X
B.3.f	X
B.3.g.1	
B.3.g.2	
B.3.g.3	
B.3.g.4	
B.3.g.5	
B.3.g.6	
B.3.g.7	
B.4.a	
B.4.b	
B.5.a	<u>C^{ZZ}</u>
B.5.b	<u>C^{ZZ}</u>
B.5.c	<u>C^{ZZ}</u>
B.6	

X Mandatory information

O Optional information

C This information need only be furnished when it has been used as a basis to effect coordination with another administration

^{ZZ)} Required for coordination under No. **S9.16A** or **S9.16B**.

Reasons: This is consequential to proposed modifications to footnotes **S5.441** and **S5.484A**. Administrations will need to submit specific earth station information for earth stations associated with geostationary-satellite networks in the fixed-satellite service with maximum antenna gains as specified in the proposed addition to Appendix **S5**.

USA/1.13/07

APPENDIX S5

ADD

TABLE S5-1 (CONTINUED)

Reference of Article S9	Case	Frequency bands (and Region) of the service for which coordination is sought	Threshold/condition	Calculation method	Remarks
No. S9.16A GSO earth station/ NGSO system	A specific earth station in a geostationary satellite network in the fixed-satellite service in respect of a non-geostationary-satellite system in the fixed-satellite service.	The following frequency bands subject to S5.441 or S5.484A : 10.7-11.7 GHz (space-to-Earth), 11.7-12.2 GHz (space-to-Earth) in Region 2, 12.2-12.75 GHz (space-to-Earth) in Region 3, 12.5-12.75 GHz (space-to-Earth) in Region 1, 17.8-18.6 GHz (space-to-Earth), and 19.7-20.2 GHz (space-to-Earth)	Conditions: i) the frequency bands overlap and ii) the satellite network using the geostationary-satellite orbit has specific receive earth stations with an antenna gain greater than or equal to 64 dBi for the frequency bands 10.7-12.75 GHz or 68 dBi for the frequency bands 17.8-18.6 GHz and 19.7-20.2 GHz	i) compare frequency bands and ii) use the maximum antenna gain of the specific receive earth station in the geostationary-satellite network as given in Appendix S4 data	The thresholds/ conditions for coordination do not apply to typical receive earth stations operating in satellite networks using the geostationary-satellite orbit.

<p><u>No. S9.16B</u> <u>NGSO system/</u> <u>GSO earth</u> <u>station/</u></p>	<p><u>A non-geostationary-</u> <u>satellite system in the</u> <u>fixed-satellite service</u> <u>in respect of a specific</u> <u>earth station in a</u> <u>geostationary satellite</u> <u>network in the fixed</u> <u>satellite service.</u></p>	<p><u>The following frequency</u> <u>bands subject to S5.441 or</u> <u>S5.484A:</u> <u>10.7-11.7 GHz (space-to-</u> <u>Earth), 11.7-12.2 GHz</u> <u>(space-to-Earth) in Region</u> <u>2, 12.2-12.75 GHz (space-</u> <u>to-Earth) in Region 3,</u> <u>12.5-12.75 GHz (space-to-</u> <u>Earth) in Region 1, 17.8-</u> <u>18.6 GHz (space-to-</u> <u>Earth), and 19.7-20.2 GHz</u> <u>(space-to-Earth)</u></p>	<p><u>Conditions:</u> <u>i)the frequency</u> <u>bands overlap and</u> <u>ii) the satellite</u> <u>network using the</u> <u>geostationary-</u> <u>satellite orbit has</u> <u>specific receive</u> <u>earth stations with</u> <u>an antenna gain</u> <u>greater than or equal</u> <u>to 64 dBi for the</u> <u>frequency bands</u> <u>10.7-12.75 GHz or</u> <u>68 dBi for the</u> <u>frequency bands</u> <u>17.8-18.6 GHz and</u> <u>19.7-20.2 GHz</u></p>	<p><u>i) compare</u> <u>frequency bands</u> <u>and</u> <u>ii) use the</u> <u>maximum antenna</u> <u>gain of the specific</u> <u>receive earth station</u> <u>in the</u> <u>geostationary-</u> <u>satellite network as</u> <u>given in Appendix</u> <u>S4 data</u></p>	<p><u>The threshold/</u> <u>condition for</u> <u>coordination do not</u> <u>apply to typical receive</u> <u>earth stations operating</u> <u>in satellite networks</u> <u>using the geostationary-</u> <u>satellite orbit.</u></p>
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Reasons: This is consequential to proposed changes to footnotes **S5.441** and **S5.484A**. Earth stations with large antenna gains as defined in the condition/threshold column are not adequately protected by the EPFD levels contained in Table **S22-3** and case-by-case coordination is required.

2. Proposal to modify Articles **S5** and **S22** to clarify that there was no allocation to NGSO FSS (Earth-to-space) in the band 17.3-17.8 GHz in Region 2. Additionally, sharing studies done since WRC-97 indicate that the NGSO FSS is not compatible with the existing and allocated services.

USA/1.13/08

MOD

S5.516 The use of the bands 17.3-18.1 GHz by geostationary-satellite systems in the fixed-satellite service (Earth-to-space) is limited to feeder links for the broadcasting-satellite service. For the use of the band 17.3-17.8 GHz in Region 2 by feeder links for the broadcasting-satellite service in the band 12.2-12.7 GHz, see Article **S11**. The use of the bands 17.3-18.1 GHz (Earth-to-space) in Regions 1 and 3 and 17.8-18.1 GHz (Earth-to-space) in Region 2 by non-geostationary-satellite systems in the fixed-satellite service is subject to the provisions of Resolution **538 (WRC-97)**. The use of the band 17.3-17.8 GHz in Region 2 by systems in the fixed-satellite service (Earth-to-space) is limited to geostationary-satellites.

Reasons: Additional text to clarify the intent of the footnote. There is no allocation in the band 17.3-17.8 GHz in Region 2 for NGSO FSS (Earth-to-space). The possibility of an allocation was to be based on sharing studies between the NGSO FSS and the existing and planned services. Studies show that sharing between radiolocation stations and NGSO FSS networks is not feasible due to severe interference from operational radiolocation stations and these services are not compatible. In Region 2, the band 17.3-17.8 GHz is allocated to the BSS service beginning 1 April 2007. Studies show that transmit NGSO FSS earth stations are not compatible with receive BSS earth stations.

ARTICLE S22
Space services
Section I - Cessation of emissions

TABLE S22-1

Frequency band allocated to the broadcasting-satellite service	Antenna diameter (cm)	Equivalent pfd level (dB(W/m ² /4kHz)) which may not be exceeded during the percentage of time shown		Reference antenna radiation pattern
		99.7%	100%	
11.7-12.5 GHz in Region 1, 11.7-12.2 GHz and 12.5-12.75 GHz in Region 3	30 60 90	-172.3 -183.3 -186.8	-169.3 -170.3 -170.3	Recommendation ITU-R BO.1213
12.2-12.7 GHz in Region 2	45 100 120 180	-174.3 -186.3 -187.9 -191.4	-165.3 -170.3 -170.3 -170.3	§ 3.7.2 of Annex 5 of Appendix S30
17.3-17.8 GHz in Region 2	For further study ^{††}			
^{††} The interference from non-geostationary fixed-satellite service (non-GSO FSS) systems into geostationary broadcasting-satellite service (GSO BSS) systems operating in the frequency bands 17.3-17.8 GHz relates to the two following sharing situations: — non-GSO FSS transmit earth station into GSO receive earth station; — GSO BSS transmit space station into non-GSO FSS receive space stations. Both situations need to be studied, in particular since coexistence of receive BSS earth stations and large numbers of transmit non-GSO FSS terminals would not be feasible within the same country.				

USA/1.13/09
MOD

Reasons: WRC-97 did not allow NGSO FSS (space-to-Earth) systems to operate in the band 17.3-17.8 GHz in Region 2. Equivalent pfd (EPFD) levels, as given in **Table S22-1**, are only applicable to NGSO space-to-Earth operations. In addition, there is no allocation in the band 17.3-17.8 GHz in Region 2 for NGSO FSS (Earth-to-space). The possibility of an allocation was to be based on sharing studies between the NGSO FSS and the existing and planned services. In Region 2, the band 17.3-17.8 GHz is allocated to the BSS service beginning 1 April 2007. Studies show that transmit NGSO FSS earth stations are not compatible with receive BSS earth stations. Thus, this modification to **Table S22-1** is also consequential to the proposed modification to footnote **S5.516**.

3. Proposal to NOC footnotes in Article S5 in the band 13.75-14.0 GHz to maintain the delicate sharing situation between the fixed-satellite, radiolocation, radionavigation, and space research/Earth exploration-satellite services.

USA/1.13/10
NOC

S5.502 In the band 13.75 - 14 GHz, the e.i.r.p. of any emission from an earth station in the fixed-satellite service shall be at least 68 dBW, and should not exceed 85 dBW, with a minimum antenna diameter of 4.5 metres. In addition the e.i.r.p., averaged over one second, radiated by a station in the radiolocation or radionavigation services towards the geostationary-satellite orbit shall not exceed 59 dBW.

USA/1.13/11
NOC

S5.503 In the band 13.75 - 14 GHz, geostationary space stations in the space research service for which information for advance publication has been received by the Bureau prior to 31 January 1992 shall operate on an equal basis with stations in the fixed-satellite service; after that date, new geostationary space stations in the space research service will operate on a secondary basis. The e.i.r.p. density of emissions from any earth station in the fixed-satellite service shall not exceed 71 dBW in any 6 MHz band in the frequency range 13.772 - 13.778 GHz until those geostationary space stations in the space research service for which information for advance publication has been received by the Bureau prior to 31 January 1992 cease to operate in this band. Automatic power control may be used to increase the e.i.r.p. density above 71 dBW in any 6 MHz band in this frequency range to compensate for rain attenuation, to the extent that the power-flux density at the fixed-satellite service space station does not exceed the value resulting from use of an e.i.r.p. of 71 dBW in any 6 MHz band in clear sky conditions.

Reasons: To maintain the delicate sharing situation between the fixed-satellite, radiolocation, radionavigation, and space research/Earth exploration-satellite services, the requirements contained in the above footnotes cannot change. The restrictions specified in these footnotes are necessary for the protection of GSO FSS carriers from radar interference and also minimize the possibility of unacceptable interference to the radiolocation and radionavigation services. Studies show that there is a significant potential for unacceptable interference to NGSO FSS satellite receivers from radiolocation stations in the 13.75-14.0 GHz band.

4. Proposal to modify Article S22 to change the definition of Aggregate PFD (APFD) to take into account the GSO FSS spacecraft antenna directivity in the definition and, therefore, to change the terminology from APFD to Equivalent PFD (EPFD_{up}).

Background Information: WRC-97 incorporated into Article S22 provisional limits and a definition of an aggregate pfd (APFD) to protect GSO FSS co-frequency satellite systems from Non-GSO FSS Earth-to-space transmissions systems. The ITU-R JTG 4-9-11 was established to examine these limits. The JTG agreed to modify the definition of Aggregate PFD (APFD) to Equivalent PFD (EPFD_{up}) by the addition of the GSO FSS spacecraft antenna directivity to the definition. This resulted in modification of APFD limits to EPFD_{up} limits.

Proposal:

TABLE S22-4 (WRC-97)

PART A

USA/1.13.1/01
MOD

Frequency band (GHz)	Aggregate Equivalent (epfd) _{up} dB(W/m ²)	Percentage of time during which aggregate equivalent pfd level may not be exceeded	Reference Bandwidth (kHz)	Reference antenna beamwidth and reference radiation pattern
12.5-12.75	-170	100	4	4 degrees ITU-R S.672, L _s =-20
12.75-13.25	-186 170	100	4	4 degrees ITU-R S.672, L _s =-20
13.75-14.5	-170	100	4	4 degrees ITU-R S.672, L _s =-20

TABLE S22-4 (WRC-97)

PART B

USA/1.13.1/02
MOD

Frequency band (GHz)	Aggregate pfd dB(W/m ²)	Percentage of time during which aggregate pfd level may not be exceeded	Reference bandwidth (kHz)	Reference antenna beamwidth and reference radiation
27.5-28.6 and	-159 148	100	1 000 40	1.55 deg., ITU-R S.672, L _s =-10
29.5-30	-145 148	100	1 000	1.55 deg., ITU-R S.672, L _s =-10

USA/1.13.1/03
MOD

S22.5F The equivalent aggregate power flux density^s-density up² produced at any point in the geostationary-satellite orbit by emissions from all visible the earth stations in a non geostationary-satellite system in the fixed satellite service, for all conditions and for all methods of modulation, shall not exceed the limits given in Table **S22-4** for any percentage of time. These limits relate to the power flux-density which would be obtained under free space propagation conditions in the referenced bandwidth specified in Table **S22-4**.

USA/1.13.1/04
MOD

³ **S22.5D.1** The aggregate-equivalent power flux-density is defined as the sum of the power flux- densities produced at a point in the geostationary-satellite orbit by all the earth stations of a non-geostationary-satellite system. The aggregate-equivalent power flux-density is computed by means of the following formula:

$$apfd = 10 \cdot \log_{10} \left[\sum_{i=1}^{N_e} 10^{P_i/10} \cdot \frac{G_t(\theta_i)}{4 \pi d_i^2} \right]$$

$$EPFD_{up} = 10 \log \left(\sum_{i=1}^{N_e} 10^{P_i/10} * \frac{G_t(\mathbf{q}_i)}{4 \pi d_i^2} * \left[\frac{G_r(\mathbf{j}_i)}{G_{r,max}} \right] \right)$$

where:

- N_e : number of earth stations in the non-geostationary-satellite system with an elevation angle greater than or equal to 0° , from which the point considered in the geostationary-satellite orbit is visible;
- i : index of the earth station considered in the non-geostationary-satellite system;
- P_i : RF power at the input of the transmitting antenna of the earth station considered in the non-geostationary-satellite system in dBW in the reference bandwidth;
- θ_i : off-axis angle between the boresight of the earth station considered in the non-geostationary-satellite system and the direction of the point considered in the geostationary-satellite orbit;
- $G_t(\theta_i)$: transmit antenna gain (as a ratio) of the earth station considered in the non-geostationary-satellite system in the direction of the point considered in the geostationary-satellite orbit;
- d_i : distance in metres between the earth station considered in the non-geostationary-satellite system and the point considered in the geostationary-satellite orbit;

$\left[\frac{G_r(\mathbf{j}_i)}{G_{r,\max}} \right]$: the normalized gain characteristic of the GSO receiving beam, and

~~$apfd$: aggregate power flux density in dB(W/m²) in the reference bandwidth.~~

$epfd_{up}$: equivalent power flux-density in dB(W/m²) in the reference bandwidth;

$G_r(\varphi_i)$: receive antenna gain of the geostationary satellite as a function of the angle φ_i ;

$G_{r,\max}$: maximum gain of the geostationary receive antenna of the satellite.

Reasons: To more accurately define the interference level from co-frequency NGSO FSS systems into receive GSO satellite antennas by taking into account the GSO satellite antenna directivity. And to define acceptable $epfd_{up}$ values for the 12.55-12.75 GHz, 12.75-13.25 GHz, 13.75-14.5 GHz, 27.5-28.6 GHz and 29.5-30.0 GHz.

Proposals for Agenda Item 1.15.2

to consider the addition of the space-to-space direction to the radionavigation-satellite service allocations in the bands 1 215 - 1 260 and 1 559 - 1 610 MHz

Background: Radionavigation-Satellite Service (RNSS) systems such as the Global Positioning System and Global Navigation Satellite System are primarily being used in the space-to-Earth direction to provide service to terrestrial users. These systems are, however, also increasingly being used in the space-to-space direction by spaceborne users for such applications as spacecraft three-dimensional positioning and velocity determination; three-axis attitude control; precise time synchronization; precision orbit determination, and atmospheric science. The use of RNSS signals is presently protected only through a space-to-Earth allocation in the 1 215 - 1 260 and 1 559 - 1 610 MHz bands. Recognizing current and future operational usage of spaceborne RNSS receivers for scientific and commercial applications, it is important to add the space-to-space direction to the existing RNSS allocations so that these uses can be taken into consideration when changes to the use of these bands are contemplated.

Interference studies have been conducted to assess the sensitivity of spaceborne RNSS receivers to interference from radiolocation, Earth exploration-satellite (active), space research (active), fixed, mobile and aeronautical radionavigation services in the 1 215 - 1 260 MHz band; from the aeronautical radionavigation and fixed services in the 1 559 - 1 610 MHz band; and also their sensitivity to intra-service interference between radionavigation satellite service systems in these two bands.

The ITU-R has concluded that the addition of a space-to-space direction to the 1 215 - 1 260 MHz and 1 559 - 1 610 MHz RNSS bands will not cause any additional interference to other services since it involves no change to the space-to-Earth transmissions.

Studies demonstrate that RNSS spaceborne receivers can operate satisfactorily in the presence of interference caused by systems in other services as well as other RNSS systems. Potential interference from services in adjacent bands was also examined.

Existing coordination procedures are adequate for space-to-space operations.

Proposals:

MHz
1 215 – 1 260

Allocation to Services		
Region 1	Region 2	Region 3
USA/1.13/03 MOD	1 215-1 240	EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION RADIONAVIGATION-SATELLITE (space-to-Earth) <u>(space-to-space)</u> SPACE RESEARCH (active) S5.329 S5.330 S5.331 S5.332
USA/1.13/03 MOD	1 240-1 260	EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION RADIONAVIGATION-SATELLITE (space-to-Earth) <u>(space-to-space)</u> SPACE RESEARCH (active) Amateur S5.329 S5.330 S5.331 S5.332 S5.334 S5.335

Reasons: Provide an allocation for space-to-space use for RNSS, which will ensure the protection of space-based RNSS receivers.

MHz
1 559 – 1 610

Allocation to Services		
Region 1	Region 2	Region 3
USA/1.13/03 MOD	1 559 – 1 610	AERONAUTICAL RADIONAVIGATION RADIONAVIGATION-SATELLITE (space-to-Earth) <u>(space-to-space)</u> S5.341 S5.355 S5.359 S5.363

Reasons: Provide an allocation for space-to-space use for RNSS, which will ensure the protection of space-based RNSS receivers.

Proposals for Agenda Item 1.16

to consider allocations of frequency bands above 71 GHz to the earth-exploration satellite (passive) and radio astronomy services, taking into account Resolution 723; (20March99)

Background Information: The following tables depict an outline of the United States work toward modifications to the allocation tables above 71 GHz. These modifications will accommodate the requirements of passive sensing systems in the radio astronomy and earth-exploration satellite (passive) services. We want to stress that these tables contain a very preliminary draft of proposed changes to the allocations above 71 GHz. An appendix is included to provide additional background information on our proposed changes.

Proposals for Agenda Item 1.16

to consider allocations of frequency bands above 71 GHz to the earth-exploration satellite (passive) and radio astronomy services, taking into account Resolution 723; (20March99)

Background Information: The following tables depict an outline of the United States work toward modifications to the allocation tables above 71 GHz. These modifications will accommodate the requirements of passive sensing systems in the radio astronomy and earth-exploration satellite (passive) services. We want to stress that these tables contain a very preliminary draft of proposed changes to the allocations above 71 GHz. An appendix is included to provide additional background information on our proposed changes.

Preliminary Draft Proposal for WRC-2000 (Agenda Item 1.16)

GHz		
71 - 126		
Current Allocations	Proposed Allocations	Reason for Change/Remarks
Regions 1, 2, 3	Regions 1, 2, 3	
71-74 FIXED-SATELLITE (Earth-to-space) MOBILE MOBILE-SATELLITE (Earth-To-Space) S5.149 S5.556	71 - 74 FIXED-SATELLITE (Earth-to-space) FIXED-SATELLITE (space-to-Earth) MOBILE MOBILE-SATELLITE (Earth To Space) MOBILE-SATELLITE (space-to-Earth) S5.149 S5.556	Uplinks and downlinks in 71-74 GHz and 81-84 GHz bands interchanged. Atmospheric absorption slightly higher in 71-74 GHz band than in 81-84 GHz band. RAS Footnotes S5.149 and S5.556 deleted, in favor of allocations above 76 GHz. Reference to 72.77-72.91 GHz band in S5.149 and S5.556 deleted.
74-75.5 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE Space Research (space-to-Earth)	74 - 75.5 76 AMATEUR AMATEUR-SATELLITE BROADCASTING-SATELLITE FIXED FIXED-SATELLITE (Earth-to-space) FIXED-SATELLITE (space-to Earth) MOBILE MOBILE-SATELLITE (Earth-to-space) Space Research (space-to-Earth) S5.556 <u>MOD S5.561</u> <u>S5.EEE</u>	BSS currently allocated to the 84-86 GHz band relocated to this band, to protect RAS above 76 GHz. Atmospheric absorption slightly higher in 74-76 GHz band than in 84-86 GHz band The proposed allocations in the 74-84 GHz range preserve a contiguous 10 GHz space research downlink (secondary), required for space VLBI purposes. Footnote S5.EEE protects current Amateur and Amateur-Satellite operations in 75.5-76 GHz band until the year 200[X] Footnote S5.561 modified to recognize change in BSS allocation.
75.5-76 AMATEUR AMATEUR-SATELLITE Space Research (space-to-Earth)	FIXED-SATELLITE (space-to Earth) MOBILE MOBILE-SATELLITE (Earth-to-space) Space Research (space-to-Earth) S5.556 <u>MOD S5.561</u> <u>S5.EEE</u>	

GHz		
71 -126 (continued)		
Current Allocations	Proposed Allocations	Reason for Change/ Remarks
Regions 1, 2, 3	Regions 1, 2, 3	
76-81 RADIOLOCATION Amateur Amateur-Satellite Space Research (space-to-Earth) S5.560	76 - 77.5 <u>RADIO ASTRONOMY S5.ZZZ</u> RADIOLOCATION Amateur Amateur-Satellite Space Research (space-to-Earth) S5.560	Radio astronomy allocation and new footnote S5.ZZZ, along with RES ZZZ satisfy requirement for radio astronomy spectral line and wide band continuum observations from a few remote locations, world-wide. Amateur and amateur-satellite services shifted by 0.5 GHz, to accommodate BS, FSS and MSS downlinks at lower portion of atmospheric window. No change in sharing between services, except for introduction of RAS allocation in band. S5.560 doesn't apply to this band.
	77.5 - 78 AMATEUR AMATEUR-SATELLITE <u>Radio Astronomy</u> Space Research (space-to-Earth) <u>MOD S5.149</u>	No change in sharing between services, except for introduction of RAS allocation. Band added to those listed under S5.149 RAS added on a secondary basis.
	78 - 81 <u>RADIO ASTRONOMY S5.ZZZ</u> RADIOLOCATION Amateur Amateur-Satellite Space Research (space-to-Earth) S5.560 <u>MOD S5.149</u>	Radio astronomy allocation and new footnote S5.ZZZ, along with RES ZZZ, satisfy requirement for radio astronomy spectral line and wide band continuum observations from a few remote locations world-wide. No change in sharing between services, except for introduction of RAS allocation in band. Band added to footnote S5.149.

GHz		
71 -126 (continued)		
Current Allocations	Proposed Allocations	Reason for Change/ Remarks
Regions 1, 2, 3	Regions 1, 2, 3	
81-84 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE MOBILE-SATELLITE (space-to-Earth) Space Research (space-to-Earth)	81 - 84 FIXED FIXED-SATELLITE (space-to-Earth) FIXED-SATELLITE (Earth-to-space) MOBILE MOBILE-SATELLITE (Earth-to-space) <u>RADIO ASTRONOMY S5.ZZZ</u> <u>Space Research (space-to-Earth)</u> S5.561 <u>MOD S5.149 S5.DDD</u>	Direction of satellite downlinks reversed, to allow radio astronomy observations. Uplink paired with 71-74 GHz downlink. Radio astronomy allocation and new footnote S5.ZZZ, along with RES ZZZ, satisfy requirement for radio astronomy spectral line and wide band continuum observations from a few remote locations, world-wide. Footnote S5.DDD added to maintain amount of secondary amateur and amateur-satellite allocation. Band added to footnote S5.149.
84-86 FIXED MOBILE BROADCASTING BROADCASTING-SATELLITE S5.561	84 - 86 BROADCASTING BROADCASTING-SATELLITE FIXED FIXED-SATELLITE (Earth-to-space) MOBILE <u>RADIO ASTRONOMY S5.ZZZ</u> <u>MOD S5.149 S5.561</u>	Broadcasting Satellite allocation relocated to 74-76 GHz band. Direction of satellite downlinks reversed, to allow radio astronomy observations. Uplink paired with 74-76 GHz downlink. Radio astronomy allocation and new footnote S5.ZZZ, along with RES ZZZ, satisfy requirement for radio astronomy spectral line and wide band continuum observations from a few remote locations, world-wide. Band added to footnote S5.149.
86-92 EARTH EXPLORATION SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) S5.340	86-92 EARTH EXPLORATION SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) S5.340	NOC This band is of crucial importance to the RAS, SR(passive) and EES (passive) services; it is the window for the band around 118.75 GHz. No active services are acceptable in this band.

<p>92-94 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE RADIOLOCATION S5.149 S5.556</p>	<p>92-94 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE <u>RADIO ASTRONOMY S5.ZZZ</u> RADIOLOCATION MOD S5.149 S5.556</p>	<p>Radio astronomy allocation and new footnote S5.ZZZ, along with RES ZZZ satisfy requirement for radio astronomy spectral line and wide band continuum observations from a few remote locations world-wide. RAS interest up to now recognised via footnote.</p> <p>FSS (Earth-to-space) allocation no longer needed to balance 102-105 GHz, relocated to 71-76 GHz band.</p> <p>Band added to those listed under S5.149, footnote S5.556 no longer necessary.</p>
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GHz		
71 -126 (continued)		
Current Allocations	Proposed Allocations	Reason for Change/ Remarks
Regions 1, 2, 3	Regions 1, 2, 3	
94-94.1 RADIOLOCATION EARTH EXPLORATION-SATELLITE (active) SPACE RESEARCH (active) S 5.562	94-94.1 EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION SPACE RESEARCH (active) <u>Radio Astronomy</u> S 5.562	Radio astronomy secondary to active services. No change in sharing between services, except for introduction of RAS allocation in band.
94.1-95 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE RADIOLOCATION S5. 149 S5.556	94.1-95 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE <u>RADIO ASTRONOMY S.5.ZZZ</u> RADIOLOCATION MOD S5. 149 S5.556	Radio astronomy allocation and new footnote S5.ZZZ, along with RES ZZZ satisfy requirement for radio astronomy spectral line and wide band continuum observations from a few remote locations world-wide. No change in sharing between services, except for introduction of RAS allocation in band. Footnote S5.556 is not relevant to this band and should have been suppressed as a consequence of WRC-97 actions. Band added to those listed under S5.149. Footnote S5.556 no longer necessary. FSS (Earth-to-space) allocation no longer needed to balance 102-105 GHz, relocated to 71-76 GHz band.

<p>95-100 MOBILE S5.553 MOBILE-SATELLITE RADIONAVIGATION RADIONAVIGATION-SATELLITE Radiolocation S5.149 S5.554 S5.555</p>	<p>95-100 <u>FIXED MOD S5.553</u> MOBILE <u>MOD S5.553</u> MOBILE SATELLITE <u>RADIO ASTRONOMY S5.ZZZ</u> <u>RADIOLOCATION</u> RADIONAVIGATION RADIONAVIGATION-SATELLITE Radiolocation MOD S5.149 S5.554 S5.555</p>	<p>Radio astronomy allocation and new footnote S5.ZZZ, along with RES ZZZ satisfy requirement for radio astronomy spectral line and wide band continuum observations from a few remote locations, world-wide. Primary allocation to RAS at 97.88-98.08 GHz (footnote S5.555), for observations of 97.98 GHz CS line, no longer needed.</p> <p>Radiolocation upgraded to primary, consequential to the RAS upgrade.</p> <p>Mobile Satellite Service cannot share with the Radiolocation service.</p> <p>Band added to those listed under S5.149.</p> <p>Band deleted from footnote S5.555, which allocates the 97.88-98.08 subband to the RAS on a primary basis.</p> <p>Fixed allocation added, to keep FS totals unchanged.</p> <p>S5.553 modified to include stations in the fixed service</p>
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GHz		
71 -126 (continued)		
Current Allocations	Proposed Allocations	Reason for Change/ Remarks
Regions 1, 2, 3	Regions 1, 2, 3	
100 – 102 EARTH EXPLORATION-SATELLITE (passive) FIXED MOBILE SPACE RESEARCH (passive) S5.341	100 – 102 EARTH EXPLORATION-SATELLITE (passive) FIXED MOBILE <u>RADIO ASTRONOMY S5.ZZZ</u> SPACE RESEARCH (passive) <u>MOD S5.149 S5.341</u>	Radio astronomy allocation and new footnote S5.ZZZ, along with RES ZZZ satisfy requirement for radio astronomy spectral line and wide band continuum observations from a few remote locations, world-wide. No change in sharing between services, except for introduction of RAS allocation in band. Used by EES (passive) for limb sounding of atmospheric constituents (NO line at 100.49 GHz). Band added to those listed under S5.149
102-105 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE S5.341	102-105 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE <u>RADIO ASTRONOMY S5.ZZZ</u> <u>MOD S5.149 S5.341</u>	FSS allocation moved to 74-76 GHz band, to eliminate downlinks in the middle of the atmospheric window. Atmospheric absorption in these two windows is close. Radio astronomy allocation and new footnote S5.ZZZ, along with RES ZZZ satisfy requirement for radio astronomy spectral line and wide band continuum observations from a few remote locations, world-wide. Band added to those listed under S5.149

GHz		
71 -126 (continued)		
Current Allocations	Proposed Allocations	Reason for Change/ Remarks
Regions 1, 2, 3	Regions 1, 2, 3	
<p>105-116 EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) S5.340 S5.341</p>	<p>105 – 116 109.5 EARTH EXPLORATION-SATELLITE (passive) <u>FIXED</u> <u>MOBILE</u> RADIO ASTRONOMY SPACE RESEARCH (passive) S5.CCC S5.340 <u>MOD S5.149</u> S5.341</p>	<p>Passive sensors have no known use for, and do not need the band 105-109.5 GHz. Addition of the fixed and mobile services, relocated from 116 - 122.5 GHz band, where deletion of these services is needed to protect essential passive sensor operations Band no longer passive, consequently S5.340 should be deleted. Band added to those included under S5.149, to reflect need to protect radio astronomy in a band no longer passive. Footnote S5.CCC limits Space Research (passive) allocation to space-based radio astronomy in this band.</p>
	<p>109.5 - 111.8 EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) S5.340 S5.341</p>	<p>NOC Ozone line at 110.8 GHz used for microwave limb sounding. The 109.5-111.8 GHz band is of vital importance to radio astronomy for observations of the CO lines at 109.8 and 110.2 GHz, and for continuum observations.</p>
	<p>111.8 - 114.25 EARTH EXPLORATION-SATELLITE (passive) <u>FIXED</u> <u>MOBILE</u> RADIO ASTRONOMY SPACE RESEARCH (passive) <u>S5.CCC</u> S5.341 <u>MOD S5.149</u></p>	<p>Passive sensors do not need the band 111.8--114.25 GHz. Addition of the fixed and mobile services, relocated from 116 - 122.5 GHz band, where deletion of these services is needed to protect essential passive sensor operations. Band added to those included under S5.149, to reflect need to protect radio astronomy in a band no longer passive. New footnote S5.CCC limits Space Research (passive) allocation to space-based radio astronomy in this band.</p>

114.25-116

EARTH EXPLORATION-SATELLITE (passive)
RADIO ASTRONOMY
SPACE RESEARCH (passive)
S5.340 S5.341

NOC

The band 114.25-116 GHz is of vital importance to radio astronomy for observations of the 115.3 GHz CO line.

GHz		
71 -126 (continued)		
Current Allocations	Proposed Allocations	Reason for Change/ Remarks
Regions 1, 2, 3	Regions 1, 2, 3	
116 – 119.98 EARTH EXPLORATION-SATELLITE (passive) FIXED INTER-SATELLITE MOBILE S5.558 SPACE RESEARCH (passive) S5.138 S5.341	116 -119.98 EARTH EXPLORATION-SATELLITE (passive) FIXED INTER-SATELLITE <u>S5.XXX</u> MOBILE S5.558 SPACE RESEARCH (passive) S5.138 S5.341	This band is of crucial importance for passive sensing as it is the lower flank of the oxygen absorption band, with peak at 118.75 GHz. The associated reference window is the 86-92 GHz band. Fixed and mobile services moved down to 105 - 109.5 GHz, as sharing with passive sensors would severely restrict their operation in this band. ISS needs to be limited by footnote S5.XXX to links between GSO satellites only, with pfd limits as specified in sharing studies. S5.138 deleted, it is considered to be a misprint in the RR.

GHz		
71 -126 (continued)		
Current Allocations	Proposed Allocations	Reason for Change / Remarks
Regions 1, 2, 3	Regions 1, 2, 3	
119.98 – 120.02 EARTH EXPLORATION-SATELLITE (passive) FIXED INTER-SATELLITE MOBILE S5.558 SPACE RESEARCH (passive) Amateur S5.138 S5.341	119.98 – 120.02 EARTH EXPLORATION-SATELLITE (passive) FIXED INTER-SATELLITE <u>S5.XXX</u> MOBILE S5.558 SPACE RESEARCH (passive) Amateur S5.138 S5.341	This band is of crucial importance for passive sensing, as it is part of the upper flank of the oxygen absorption band, with peak at 118.75 GHz. The associated reference window is the 86-92 GHz band. Fixed and mobile services moved down to 105 - 109.5 GHz, as sharing with passive sensors would severely restrict them in this band. ISS needs to be limited by footnote S5.XXX to links between GSO satellites only, with pfd limits as specified in sharing studies. Secondary allocation to amateur service is also moved to 122.5-126 GHz band, to avoid interference to passive sensors.
120.02 – 126 EARTH EXPLORATION-SATELLITE (passive) FIXED INTER-SATELLITE MOBILE S5.558 SPACE RESEARCH (passive) S5.138 S5.341	120.02 – 122.25 EARTH EXPLORATION-SATELLITE (passive) FIXED INTER-SATELLITE <u>S5.XXX</u> MOBILE S5.558 SPACE RESEARCH (passive) S5.138 S5.341	This band is of crucial importance for passive sensing, as it is the lower flank of the oxygen absorption band, with peak at 118.75 GHz. The associated reference window is the 86-92 GHz band. Fixed and mobile services moved down to 105 - 109.5 GHz, as sharing with passive sensors would severely restrict them in this band. ISS needs to be limited by footnote S5.XXX to links between GSO satellites only, with pfd limits as specified in sharing studies.
	<u>122.25 - 123</u> EARTH EXPLORATION SATELLITE (passive) FIXED INTER-SATELLITE MOBILE <u>MOD</u> S5.558 SPACE RESEARCH (passive) Amateur S5.138 S5.341	Band not needed by passive sensors. Secondary amateur service allocation added to compensate loss at 119.98-120.02 GHz

USA

- 55 -

GHz		
126-200		
Current Allocations	Proposed Allocations	Reason for Change / Remarks
Regions 1,2,3	Regions 1,2,3	
126 - 134 FIXED INTER-SATELLITE MOBILE S5. 558 RADIOLOCATION S5. 559	<u>123 - 130</u> EARTH EXPLORATION SATELLITE (passive) FIXED <u>FIXED-SATELLITE</u> INTER-SATELLITE MOBILE S5.558 <u>MOBILE-SATELLITE</u> RADIOLOCATION S5. 559 <u>RADIONAVIGATION</u> <u>RADIONAVIGATION-SATELLITE</u> SPACE RESEARCH (passive) <u>Radio Astronomy</u> S5.138 S5.341 MOD S5.554	Satellite downlinks from 141-153 GHz band moved here to avoid interference to the Radio Astronomy Service. Fixed, mobile and radiolocation allocations moved to 141-153 GHz band. Sharing conditions between the ISS and the FSS, MSS, RNS and RNSS services need to be developed, but no imminent use of the band by these services is contemplated. MSS directional indicator left undefined. Footnote S5.554 suitably modified. Band deleted from S5.559
	<u>130 - 134</u> FIXED INTER-SATELLITE MOBILE <u>MOD</u> S5.558 <u>RADIO ASTRONOMY S5.ZZZ</u> RADIOLOCATION S5.559	Radio astronomy allocation and new footnote S5.ZZZ, along with RES ZZZ satisfy requirement for radio astronomy spectral line and wide band continuum observations from a few remote locations world-wide. Footnote S5.558 modified to reflect new mobile service band limit.

GHz		
126-200 (continued)		
Current Allocations	Proposed Allocations	Reason for Change / Remarks
Regions 1,2,3	Regions 1,2,3	
134-142 MOBILE S5.553 MOBILE-SATELLITE RADIONAVIGATION RADIONAVIGATION-SATELLITE Radiolocation S5.149 S5.340 S5.554 S5.555	134-136 <u>AMATEUR</u> <u>AMATEUR-SATELLITE</u> MOBILE S5.553 MOBILE SATELLITE RADIONAVIGATION RADIONAVIGATION SATELLITE <u>Radio Astronomy</u> Radiolocation S5.149 S5.340 S5.554 S5.555	Amateur and amateur-satellite services moved here from 142-144 GHz band to avoid interference to radio astronomy at higher frequencies. Radio astronomy added as secondary service to reflect coordination requirement with the amateur-satellite service.

<p><u>136 - 141</u></p> <p>MOBILE S5.553</p> <p>MOBILE SATELLITE</p> <p><u>RADIO ASTRONOMY S5.ZZZ</u></p> <p><u>RADIOLOCATION</u></p> <p>RADIONAVIGATION</p> <p>RADIONAVIGATION SATELLITE</p> <p><u>Amateur</u></p> <p><u>Amateur-Satellite</u></p> <p>Radiolocation</p> <p><u>MOD S5.149 S5.340 S5.554 S5.555</u></p>	<p>Services from 144 -149 GHz band moved here.</p> <p>Radio astronomy allocation and new footnote S5.ZZZ, along with RES ZZZ satisfy requirement for radio astronomy spectral line and wide band continuum observations from a few remote locations world-wide.</p> <p>Band added to those listed under S5.149.</p> <p>Band no longer passive and removed from S5.340</p> <p>S5.554 is no longer relevant to this band.</p> <p>S5.555 modified to reflect primary status of the RAS in the full 136-141 GHz band.</p>
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GHz		
126-200 (continued)		
Current Allocations	Proposed Allocations	Reason for Change / Remarks
Regions 1,2,3	Regions 1,2,3	
142 - 144 AMATEUR AMATEUR-SATELLITE	141 - 148.5 AMATEUR AMATEUR-SATELLITE FIXED MOBILE S5.553 MOBILE SATELLITE RADIO ASTRONOMY S5.ZZZ RADIOLOCATION RADIONAVIGATION RADIONAVIGATION-SATELLITE Amateur Amateur-Satellite Radiolocation MOD S5.149 S5.340 S5.555	Allocations transferred to this band from 126-134 GHz band. Bandwidth reduced to 7.5 GHz to accommodate EES (passive) and SR (passive) requirements in 148.5-151.5 GHz band. Radio astronomy allocation and new footnote S5.ZZZ, along with RES ZZZ satisfy requirement for radio astronomy spectral line and wide band continuum observations from a few remote locations world-wide. Band no longer passive; deleted from those listed under S5.340. Band added to those listed under S5.149 S5.555 no longer refers to any portion of this band.
144 - 149 RADIOLOCATION Amateur Amateur-Satellite S 5.149 S5.555	149-150 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE	

GHz		
126-200 (continued)		
Current Allocations	Proposed Allocations	Reason for Change / Remarks
Regions 1,2,3	Regions 1,2,3	
<p>150-151 EARTH EXPLORATION-SATELLITE (passive) FIXED FIXED-SATELLITE (space-to-Earth) MOBILE SPACE RESEARCH (passive) S5.149 S5.385</p>	<p><u>148.5 - 151.5</u> <u>EARTH EXPLORATION-SATELLITE (passive)</u> FIXED FIXED-SATELLITE (space to Earth) MOBILE <u>RADIO ASTRONOMY</u> RADIOLOCATION <u>SPACE RESEARCH (passive)</u> Amateur Amateur Satellite S 5.149 S 5.385 S5.555 <u>MOD S5.340</u></p>	<p>Current passive allocation of 150-151 GHz has insufficient bandwidth and is not adequately protected from interference. Band purely passive, added to those listed under S5.340, no longer listed under S5.149. S5.555 no longer refers to any portion of this band.</p>

GHz		
126-200 (continued)		
Current Allocations	Proposed Allocations	Reason for Change / Remarks
Regions 1,2,3	Regions 1,2,3	
151-156 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE	151.5 - 155.5 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE <u>RADIO ASTRONOMY S5.ZZZ</u> <u>RADIOLOCATION</u> <u>MOD S5.149</u>	FSS downlink allocation incompatible with primary radio astronomy requirement. Radio astronomy allocation and new footnote S5.ZZZ, along with RES ZZZ satisfy requirement for radio astronomy spectral line and wide band continuum observations from a few remote locations world-wide. Band added to those listed under S5.149 Radiolocation allocation compensates for removal from 126-134 GHz band.
156-158 EARTH EXPLORATION-SATELLITE (passive) FIXED FIXED-SATELLITE (space-to-Earth) MOBILE	155.5-158.5 EARTH EXPLORATION-SATELLITE (passive) <u>S5.AAA</u> FIXED <u>S5.BBB</u> FIXED-SATELLITE (space-to-Earth) MOBILE <u>S5.BBB</u> <u>RADIO ASTRONOMY S5.ZZZ</u> <u>SPACE RESEARCH (passive) S5.CCC</u> <u>MOD S55.149</u>	FSS downlink allocation incompatible with primary radio astronomy requirement. Radio astronomy allocation and new footnote S5.ZZZ, along with RES ZZZ satisfy requirement for radio astronomy spectral line and wide band continuum observations from a few remote locations world-wide. Band added to those listed under S5.149 EES operations in the band 155.5-158.5 GHz need to be protected until 1/1/2018. After this date the fixed and mobile services need to co-ordinate with radio astronomy sites only. Space Research (passive) allocation limited to space-based radio astronomy in this band

GHz		
126-200 (continued)		
Current Allocations	Proposed Allocations	Reason for Change / Remarks
Regions 1,2,3	Regions 1,2,3	
158 - 164 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE	158.5 - 164 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE <u>MOBILE-SATELLITE (space-to Earth)</u>	Mobile-satellite allocation added to compensate for ..
164 - 168 EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive)	164 - 168 167 EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) <u>MOD S5.340</u>	<u>NOC</u> Passive sensors require only a 3 GHz band from 164-167 GHz. This band, along with the band 148.5-151.5 GHz will become the harmonised reference window for passive sensor observations of the 183.31 GHz water vapor line. The band is also used for microwave limb sounding of the 164.38 GHz Cl O line. Band added to those listed under S5.340.
168 - 170 FIXED MOBILE	167 - 174 EARTH EXPLORATION-SATELLITE (passive) <u>FIXED</u> <u>FIXED SATELLITE (Space-to-Earth)</u>	Passive services do not need this band. Fixed, mobile, inter-satellite and fixed-satellite downlinks added.
170-174.5 FIXED INTER-SATELLITE MOBILE S5.558 S5.149 S5.385	<u>INTER-SATELLITE</u> <u>MOBILE MOD S5.558</u> RADIO ASTRONOMY SPACE RESEARCH (passive)	

GHz		
126-200 (continued)		
Current Allocations	Proposed Allocations	Reason for Change / Remarks
Regions 1,2,3	Regions 1,2,3	
174.5-176.5 EARTH EXPLORATION-SATELLITE (passive) FIXED INTER-SATELLITE MOBILE S5.558 SPACE RESEARCH (passive) S5.149 S5.385	<u>174 - 174.8</u> FIXED INTER-SATELLITE MOBILE <u>MOD</u> S5.558 MOD S5.149 MOD S5.385	Band not needed for passive uses. FSS (space-to-Earth) added, to compensate for loss of 151-158 GHz band in middle of atmospheric window. Band deleted from those listed under S5.149 and S5.385.
174.8-176.5 EARTH EXPLORATION-SATELLITE (passive) FIXED INTER-SATELLITE <u>S5.YYY</u> MOBILE S5.558 SPACE RESEARCH (passive) S5.149 S5.385	FIXED INTER-SATELLITE <u>S5.YYY</u> MOBILE S5.558 SPACE RESEARCH (passive) S5.149 S5.385	The band 174.8-191.8 GHz is of crucial importance for passive sensing of the water vapour absorption line whose peak is at 183.31 GHz.. Sharing with fixed and mobile services is not possible, so they need to be reallocated. The ISS service needs to be limited to links between GSO satellites and to a pfd limit as specified in sharing studies. Band deleted from those listed under S5.149. The band 174.8-191.8 GHz is of crucial importance for passive sensing of the water vapour absorption line whose peak is at 183.31 GHz.. Sharing with fixed and mobile services is not possible, so they need to be reallocated. The ISS service needs to be limited to links between GSO satellites and to a pfd limit as specified in sharing studies. Band deleted from those listed under S5.149, S5.385 (secondary radio astronomy allocation) deleted . Footnotes appropriately modified.

GHz		
126-200 (continued)		
Current Allocations	Proposed Allocations	Reason for Change / Remarks
Regions 1,2,3	Regions 1,2,3	
176.5-182 FIXED INTER-SATELLITE MOBILE S5.558 S5.149 S5.385	176.5-182 <u>EARTH EXPLORATION-SATELLITE (passive)</u> FIXED INTER-SATELLITE <u>S5.YYY</u> MOBILE S5.558 <u>SPACE RESEARCH (passive)</u> <u>MOD S5.149 S5.385</u>	This band is of crucial importance for passive sensing of the water vapor absorption line whose peak is at 183.31 GHz. sharing with fixed and mobile services is not possible, so they need to be reallocated. The ISS service needs to be limited to links between GSO satellites and to a pfd limit as specified in sharing studies. The band 174.8-191.8 GHz is required for sensing of the water vapour absorption line whose peak is at 183.31 GHz.
182-185 EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) S5.340 S5.563	182-185 EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) <u>MOD S5.340 S5.563</u> <u>MOD S5.149</u>	No terrestrial radio astronomy use of the band is possible due to high atmospheric absorption. Radio astronomy observations of the water vapor line from space are conducted in this band under the Space Research (passive) allocation. The band 174.8-191.8 GHz is required for sensing of the water vapour absorption line whose peak is at 183.31 GHz.

GHz		
126-200 (continued)		
Current Allocations	Proposed Allocations	Reason for Change / Remarks
Regions 1,2,3	Regions 1,2,3	
185-190 FIXED INTER-SATELLITE MOBILE S5.558 S5.149 S5.385	185-190 <u>EARTH EXPLORATION SATELLITE (passive)</u> FIXED INTER-SATELLITE <u>S5.YYY</u> MOBILE S5.558 <u>SPACE RESEARCH (passive)</u> S5.149 S5.385	This band is of crucial importance for passive sensing of the water vapor absorption line whose peak is at 183.31 GHz. Sharing with fixed and mobile services is not possible, so they need to be reallocated. The ISS service needs to be limited to links between GSO satellites and to a pfd limit as specified in sharing studies. Band deleted from those listed in S5.149.
190 - 200 MOBILE S5.553 MOBILE-SATELLITE RADIONAVIGATION RADIONAVIGATION-SATELLITE S5.341 S5.554	190 - 191.8 <u>EARTH EXPLORATION-SATELLITE (passive)</u> MOBILE S5.553 MOBILE SATELLITE (space to Earth) RADIONAVIGATION RADIONAVIGATION-SATELLITE <u>SPACE RESEARCH (passive)</u> S5.341 S5.554 <u>MOD S5.340</u>	This band is of crucial importance for passive sensing of the water vapor absorption line whose peak is at 183.31 GHz. Sharing with the mobile, mobile-satellite, RN and RNS services is not possible, and they need to be reallocated. S5.554 deleted from this band, to reflect deletion of active services, and modified to reflect change. S5.341 does not apply to this band. S5.340 modified to include this band.

<p>191.8-200 <u>FIXED MOD S5.553</u> <u>INTER-SATELLITE</u> MOBILE <u>MOD S5.553</u> MOBILE-SATELLITE RADIONAVIGATION RADIONAVIGATION-SATELLITE S5.341 MOD S5.554</p>	<p>S5.553 and S5.554 modified, to reflect deletion of terrestrial services from 190.0 -191.8 GHz band. S5.553 modified to include stations in the fixed service. ISS allocation added.</p>
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GHz 200-275		
Current Allocations	Proposed Allocations	Reason for Change / Remarks
Regions 1,2,3	Regions 1,2,3	
200-202 EARTH EXPLORATION-SATELLITE (passive) FIXED MOBILE SPACE RESEARCH (passive) S5.341	200-202 EARTH EXPLORATION-SATELLITE (passive) FIXED MOBILE <u>RADIO ASTRONOMY</u> SPACE RESEARCH (passive) S5.341 <u>MOD S5.340</u>	Band needed by EESS for atmospheric chemistry (limb sounding) and atmospheric remote sensing of nitrous oxide at 201 GHz. Fixed and mobile services needs to be relocated from this band. Radio astronomy allocation [and new footnote S5.ZZZ, along with RES ZZZ,] satisfy requirement for radio astronomy spectral line and wide band continuum observations from a few remote locations world-wide.[Band added to those listed under S5.340]

GHz		
200-275 (continued)		
Current Allocations	Proposed Allocations	Reason for Change / Remarks
Regions 1,2,3	Regions 1,2,3	
202-217 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE S5.341	202 – 217 209 <u>EARTH EXPLORATION-SATELLITE (passive)</u> FIXED FIXED-SATELLITE (Earth-to-space) MOBILE <u>RADIO ASTRONOMY</u> <u>SPACE RESEARCH (passive)</u> S5.341 <u>MOD S5.340</u>	Band needed by EES service for atmospheric chemistry (limb sounding) and atmospheric remote sensing of water vapor at 203.4 GHz and ozone at 208.5 GHz.. FSS(Earth-to-space) service relocated from this band to 217-226 GHz band. Fixed and mobile services may need to be relocated from this band after results of sharing studies with EESS are known. Radio astronomy allocation added. Band added to those listed under S5.340
(This cell is empty in the original document)	209 – 217 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE <u>RADIO ASTRONOMY S5.ZZZ</u> S5.341 <u>MOD S5.149</u>	Radio astronomy allocation and new footnote S5.ZZZ, along with RES ZZZ satisfy requirement for radio astronomy spectral line and wide band continuum observations from a few remote locations world-wide. Footnote S5.149 added Band added to those listed under S5.149

GHz		
200-275 (continued)		
Current Allocations	Proposed Allocations	Reason for Change / Remarks
Regions 1,2,3	Regions 1,2,3	
217-231 EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) S5.340 S5.541	217 – 231 226 EARTH EXPLORATION-SATELLITE (passive) <u>FIXED</u> <u>FIXED-SATELLITE (Earth-to-space)</u> <u>MOBILE</u> RADIO ASTRONOMY SPACE RESEARCH (passive) S5.341 <u>MOD S5.149</u> S5.340	Passive sensor allocation can be deleted from this band. Band no longer passive, added to those listed under S5.149, removed from list of S5.340 Band no longer passive, S5.340 deleted. MOD S5.149 added.
217-231 EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) S5.340 S5.541	<u>226 - 231 231.5</u> EARTH EXPLORATION-SATELLITE (passive) FIXED FIXED-SATELLITE (space-to-Earth) MOBILE RADIO ASTRONOMY SPACE RESEARCH (passive) Radiolocation <u>MOD S5.340 S5.341</u>	Passive sensors do not require exclusive use of the 217-231 GHz band; only the 226-231.5 GHz portion is required for limb sounding of atmospheric constituents. In addition, the band provides a 4 GHz reference window for higher frequency water vapor measurements. This band is of vital importance to the radio astronomy service for observations of the 230.5 GHz CO line. S5.340 modified to take into account that 217-226 GHz band is no longer passive. The FS, FSS (s-E), and MS services have been deleted from the 231-231.5 GHz portion of the band.
231 - 235 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE Radiolocation	231 231.5 - 235 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE Radiolocation	See previous band adjustment.

GHz		
200-275 (continued)		
Current Allocations	Proposed Allocations	Reason for Change / Remarks
Regions 1,2,3	Regions 1,2,3	
235-238 EARTH EXPLORATION-SATELLITE (passive) FIXED FIXED-SATELLITE (space-to-Earth) MOBILE SPACE RESEARCH (passive)	235-238 EARTH EXPLORATION-SATELLITE (passive) [FIXED] FIXED-SATELLITE (space-to-Earth) [MOBILE] <u>RADIO ASTRONOMY [S5.ZZZ]</u> SPACE RESEARCH (passive) [S5.340]	Passive sensors are limited to microwave limb sounding in the band 235-238 GHz. FSS (space-to-Earth) reallocated elsewhere. Fixed and mobile services may need to be relocated from this band after results of sharing studies are known. S5.340 to be added if all active services need to be relocated. Radio astronomy allocation satisfies requirement for radio astronomy spectral line and wide band continuum observations. New footnote S5.ZZZ, along with RES ZZZ to be added, if active services do not require to be reallocated.
238-241 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE Radiolocation	238-241 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE <u>RADIONAVIGATION</u> <u>RADIONAVIGATION-SATELLITE</u> Radiolocation	

<p>241-248</p> <p>RADIOLOCATION</p> <p>Amateur</p> <p>Amateur-Satellite</p> <p>S5.138</p>	<p>241-248</p> <p><u>RADIO ASTRONOMY S5.ZZZ</u></p> <p>RADIOLOCATION</p> <p>Amateur</p> <p>Amateur-Satellite</p> <p>S5.138 <u>MOD S5.149</u></p>	<p>Radio astronomy allocation and new footnote S5.ZZZ, along with RES ZZZ satisfy requirement for radio astronomy spectral line and wide band continuum observations from a few remote locations world-wide.</p> <p>Band added to those listed under MOD S5.149</p> <p>No change in sharing between services, except for introduction of RAS allocation in band.</p>
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GHz		
200-275 (continued)		
Current Allocations	Proposed Allocations	Reason for Change / Remarks
Regions 1,2,3	Regions 1,2,3	
248-250 AMATEUR AMATEUR-SATELLITE	248 -250 AMATEUR AMATEUR-SATELLITE <u>Radio Astronomy</u>	RAS added on a secondary basis. No change in sharing between active services.
250-252 EARTH EXPLORATION-SATELLITE (passive) SPACE RESEARCH (passive) S5.149 S5.555	250 - 252 EARTH EXPLORATION-SATELLITE (passive) <u>RADIO ASTRONOMY</u> SPACE RESEARCH (passive) S5.149 S5.555 <u>MOD S5.340</u>	Limb sounding of nitrous oxide near 251 GHz. Add radio astronomy to the other passive services. Addition of another passive service does not alter sharing scenario. S5.149 and S5.555 deleted. S5.340 modified, to reflect passive nature of band.
252-265 MOBILE S5.553 MOBILE-SATELLITE RADIONAVIGATION RADIONAVIGATION-SATELLITE S5.149 S5.385 S5.554 S5.555 S5.564	252-265 <u>FIXED MOD S5.553</u> MOBILE <u>MOD</u> S5.553 MOBILE-SATELLITE (<u>Earth-to-space</u>) <u>RADIO ASTRONOMY S5.ZZZ</u> RADIONAVIGATION RADIONAVIGATION-SATELLITE MOD S5.149 S5.385 MOD S5.554 S5.555 S5.564	Directional indicator added to MSS allocation, paired with 190-200 GHz band. Atmospheric absorption in this band is relatively constant and higher than in the paired downlink band. Radio astronomy allocation and new footnote S5.ZZZ, along with RES ZZZ satisfy requirement for radio astronomy spectral line (secondary allocation to radio astronomy at 257.5 - 258 GHz deleted) and wide band continuum observations from a few remote locations world-wide. Band added to those listed under MOD S5.149. Band deleted from S5.385. Footnote S5.564 no longer needed.

GHz		
200-275 (continued)		
Current Allocations	Proposed Allocations	Reason for Change / Remarks
Regions 1,2,3	Regions 1,2,3	
265-275 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE RADIO ASTRONOMY S5.149	265-275 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE RADIO ASTRONOMY <u>S 5.ZZZ</u> <u>MOD</u> S5.149	Footnote S5.ZZZ added to Radio Astronomy allocation in this band.
275-400 (Not allocated) S5.565	275 - 400 <u>1 000</u> (Not allocated) <u>MOD</u> S5.565	Change upper limit for applicability of footnote MOD S5.565, to account for various passive service needs above 275 GHz. Many lines and windows for radio astronomy and EES applications above 275 GHz.

Footnotes Applicable in the 71 - 1000 GHz Frequency Range

S5.138 The following bands:

6 765 - 6 795 kHz	(center frequency 6 780 kHz),
433.05 - 434.79 MHz	(center frequency 433.92 MHz) in Region 1 except in the countries mentioned in No S5.280,
61 - 61.5 GHz	(center frequency 61.25 GHz),
122 - 123 GHz	(center frequency 122.5 GHz), and
244 - 246 GHz	(center frequency 245 GHz)

are designated for industrial, scientific and medical (ISM) applications. The use of these frequency bands for ISM applications shall be subject to special authorization by the administration concerned, in agreement with other administrations whose radiocommunication services might be affected. In applying this provision, administrations shall have due regard to the latest relevant ITU-R Recommendations.

MODS5.149 In making assignments to stations of other services to which the bands:

13 360-13 410 kHz,	22.01-22.21 GHz*,	<u>111.8-114.25 GHz,</u>
25 550-25 670 kHz,	22.21-22.5 GHz,	140.69-140.98 GHz*,
37.5-38.25 MHz,	22.81-22.86 GHz*,	<u>141-148.5 GHz,</u>
73-74.6 MHz	23.07-23.12 GHz*,	<u>148.5-151.5 GHz,</u>
in Regions 1 and 3,	31.2-31.3 GHz,	144.68-144.98 GHz*,
150.05-153 MHz in	31.5-31.8 GHz in	145.45-145.75 GHz*,
Region 1,	Regions 1 and 3,	146.82-147.12 GHz*,
322-328.6 MHz*,	36.43-36.5 GHz*,	150-151 GHz*,
406.1-410 MHz,	42.5-43.5 GHz,	174.42-175.02 GHz*,
608-614 MHz in	42.77-42.87 GHz*,	177-177.4 GHz*,
Regions 1 and 3,	43.07-43.17 GHz*,	178.2-178.6 GHz*,
1 330-1 400 MHz*,	43.37-43.47 GHz*,	181-181.46 GHz*,
1 610.6-1 613.8 MHz*,	48.94-49.04 GHz*,	186.2-186.6 GHz*,
1 660-1 670 MHz,	72.77-72.91 GHz*,	<u>209-226 GHz,</u>
1 718.8-1 722.2 MHz*,	<u>76.5-81.5 GHz,</u>	250-251 GHz*,
2 655-2 690 MHz,	<u>81.5-84.5 GHz,</u>	257.5-258 GHz*,
3 260-3 267 MHz*,	<u>84.5-86 GHz,</u>	261-265 GHz,
3 332-3 339 MHz*,	93.07-93.27 GHz*,	262.24-262.76 GHz*,
3 345.8-3 352.5 MHz*,	<u>92-94 GHz,</u>	<u>252-265 GHz,</u>
4 825-4 835 MHz*,	<u>94.1-95 GHz,</u>	265-275 GHz,
4 950-4 990 MHz,	<u>95-100 GHz,</u>	265.64-266.16 GHz*,
4 990-5 000 MHz,	<u>100-102 GHz,</u>	267.34-267.86 GHz*,
6 650-6 675.2 MHz*,	97.88-98.08 GHz*,	271.74-272.26 GHz*,
10.6-10.68 GHz,	<u>102-105 GHz,</u>	
14.47-14.5 GHz*,	<u>105-109.5 GHz,</u>	

are allocated (* indicates radio astronomy use for spectral line observations), administrations are urged to take all practicable steps to protect the radio astronomy service from harmful interference. Emissions from spaceborne or airborne stations can be particularly serious sources of interference to the radio astronomy service (see Nos. S4.5 and S4.6 and Article S29).

MOD S5.340 All emissions are prohibited in the following bands:

1 400-1 427 MHz,
2 690-2 700 MHz except those provided for by Nos. **S5.421** and **S5.422**,
10.68-10.7 GHz except those provided for by No. **S5.483**,
15.35-15.4 GHz except those provided for by No. **S5.511**,
23.6-24 GHz,
31.3-31.5 GHz,
31.5-31.8 GHz in Region 2,
48.94-49.04 GHz from airborne stations,
50.2-50.4 GHz¹ except those provided for by No. **S5.555A**,
52.6-54.25 GHz,
86-92 GHz,
~~105-116 GHz,~~
109.5-111.8 GHz,
114.25-116 GHz,
~~140.69-140.98 GHz from airborne stations and from space stations in the space to Earth direction,~~
148.5-151.5 GHz,
164-167 GHz,
182-185 GHz except those provided for by No. **S5.563**,
190-191.8
200-202 GHz,
[202-209 GHz,]
~~217-228 GHz~~
226-231.5 GHz,
[235-238]
250-252 GHz

S5.341 In the bands 1 400 - 1 727 MHz, 101 - 120 GHz and 197 - 220 GHz, passive research is being conducted by some countries in a program for the search for intentional emissions of extraterrestrial origin.

MOD S5.385 *Additional allocation:* the bands 1 718.8 - 1 722.2 MHz, ~~150-151 GHz, 174.42-175.02 GHz,~~ 177 - 177.4 GHz, 178.2 - 178.6 GHz, 181 - 181.46 GHz, and 186.2 - 186.6 GHz and ~~257.5-258 GHz~~ are also allocated to the radio astronomy service on a secondary basis for spectral line observations.

MOD S5.553 In the bands 43.5 - 47 GHz, 66 - 71 GHz, 95 - 100 GHz, ~~134-142 GHz,~~ 190-191.8 - 200 GHz and 252 - 265 GHz, stations in the fixed and land mobile services may be operated subject to not causing harmful interference to the space radiocommunication services to which these bands are allocated (see No. **S5.43**).

MOD S5.554 In the bands 43.5 - 47 GHz, 66 - 71 GHz, 95 -100 GHz, ~~134-142~~ 126 - 134 GHz, ~~190-191.8 - 200 GHz~~ and 252 - 265 GHz, satellite links connecting land stations at specified fixed points are also authorized when used in conjunction with the mobile-satellite service or the radionavigation-satellite service.

MOD S5.555 *Additional allocation:* the bands 48.94 - 49.04 GHz, ~~97.88-98.08 GHz,~~ ~~140.69-140.98~~

~~GHz, 144.68 – 144.98 GHz, 145.45 – 145.75 GHz, 146.82 – 147.12 GHz, 250 – 251 GHz~~
and ~~262.24 – 262.76 GHz~~ are is also allocated to the radio astronomy service on a primary basis.

MOD S5.556 In the bands 51.4 - 54.25 GHz, 58.2 - 59 GHz, and 64 - 65 GHz, ~~72.77 – 72.91 GHz and 93.07 – 93.27 GHz~~, radio astronomy observations may be carried out under national arrangements.

MOD S5.558 In the bands 55.78-58.2 GHz, 59-64 GHz, 66-71 GHz, ~~123-134~~ 122.5-126 GHz, 170-182 GHz and 185-190 GHz, stations in the aeronautical mobile service may be operated subject to not causing harmful interference to the inter-satellite service (see No. **S5.43**).

MOD S5.559 In the bands 59 -64 GHz ~~and 126 – 134 GHz~~, airborne radars in the radiolocation service may be operated subject to not causing harmful interference to the inter-satellite service (see No. **S5.43**)

S5.560 In the band 78 - 79 GHz radars located on space stations may be operated on a primary basis in the earth exploration-satellite service and in the space research service.

MOD S5.561 In the band ~~84 – 86~~ 74-76 GHz, stations in the fixed, and mobile ~~and broadcasting~~ services shall not cause harmful interference to broadcasting-satellite stations operating in accordance with the decisions of the appropriate frequency assignment planning conference for the broadcasting-satellite service.

S5.562 The use of the band 94-94.1 GHz by the earth exploration-satellite (active) and space research (active) services is limited to spaceborne cloud radars.

SUP S5.564 *Additional allocation:* in Germany, Argentina, Spain, Finland, France, India, Italy, the Netherlands and Sweden, the band 261 - 265 GHz is also allocated to the radio astronomy service on a primary basis.

MOD S5.565 The frequency band 275 - ~~400~~ 1000 GHz may be used by administrations for experimentation with, and development of, various active and passive services. In this band a need has been identified for the following spectral line measurements for passive services:

- radio astronomy service: ~~278 – 280 GHz and 343 – 348 GHz~~; 275 -323 GHz, 327-371 GHz, 388 - 434 GHz, 426 - 442 GHz, 453 -510 GHz, 623 - 711 GHz and 795 - 909 GHz
- space research service (passive) and earth exploration-satellite service (passive): 275 - 277 GHz, 300299 - 3026 GHz, 32416 - 32634 GHz, 34539 - 3478 GHz, 363 - 365 GHz, and 3791.5 - 38178.5 GHz, 409 - 411 GHz, 419 - 430 GHz, 443 - 444 GHz, 485 - 487 GHz, 498 - 505 GHz, 523 - 527 GHz, 538 - 584 GHz, 624 - 629 GHz, 640 - 653 GHz and 951 - 956 GHz.

ADD S5.XXX Use of the bands 116-123 GHz by the inter-satellite service is limited to satellites in the geostationary-satellite orbit. The single-entry power flux-density, at all altitudes from 0 km to 1 000 km above the Earth's surface and in the vicinity of all geostationary orbital positions occupied by passive sensors, produced by a station in the inter-satellite service, for all conditions and for all methods of modulation, shall not exceed -148 dBW/m²/MHz for all angles of arrival.

ADD In the band 155.5-158.5 GHz, the allocation to the Earth exploration-satellite (passive) and
S5.AAA space research (passive) services shall terminate on 1 January 2018.

ADD The date of entry for the allocation to the fixed and mobile services in the band 155.5 –
S5.BBB 158.5 GHz shall be 1 January 2018.

ADD Use of this allocation is limited to space-based radio astronomy only.
S5.CCC

ADD The 81- 81.5 GHz band is also allocated to the amateur and amateur-satellite services on a
S5.DDD secondary basis.

ADD The band 75.5-76 GHz is also allocated to the amateur and amateur-satellite services on a
S5.EEE primary basis until the year 200[6].

ADD Use of the bands 174.5-182 GHz by the inter-satellite service is limited to satellites in the
S5.YYY geostationary-satellite orbit. The single-entry power flux-density, at all altitudes from 0 km
to 1 000 km above the Earth's surface and in the vicinity of all geostationary orbital
positions occupied by passive sensors, produced by a station in the inter-satellite service,
for all conditions and for all methods of modulation, shall not exceed $-144 \text{ dBW/m}^2/\text{MHz}$
for all angles of arrival.

ADD Use of this band by the radio astronomy service shall be in accordance with the terms of
S5.ZZZ Resolution *ZZZ*

RESOLUTION ZZZ

USE OF THE BANDS [] BY THE RADIO ASTRONOMY SERVICE

The World Radiocommunication Conference (Istanbul, 2000),

considering

- a) that a large number of spectral lines of astrophysical interest above 71 GHz provide unique information about cosmic processes, such as the chemistry of the interstellar medium and the formation of stars and planets, and that this information cannot be obtained from any other source;
- b) that Doppler shifted lines, which are also of great interest for astronomical studies, are found far removed from the rest frequency of some spectral lines and that highly Doppler shifted lines may offer the only means to obtain information about the very early Universe and the formation of galaxies;
- c) that mm-wave radio astronomy receivers are designed to cover substantial portions of the atmospheric windows above 70 GHz to take advantage of the information contained in spectral lines, as well as in continuum radiation;
- d) that several Administrations operate mm-wave radio astronomy observatories and that some are building or are planning to build a limited number of large new facilities to exploit the most advanced technologies; and that these facilities are intended to serve the needs of the worldwide scientific community;
- f) that mm-wave observatories must be located on high mountain tops or plateaus to take advantage of the driest possible atmospheric conditions necessary to obtain high quality observations; and require substantial investments on behalf of the scientific communities concerned, and that therefore their number will remain low,

noting

that sharing between the radio astronomy service and other terrestrial services operating in bands above 71 GHz is facilitated by the natural attenuation provided by atmospheric gases, and that it can be further facilitated by adequate geographic separation,

urges

Administrations to establish coordination zones around mm-wave radio astronomy sites operating in bands above 71 GHz. Coordination zone radii should be determined following the procedure outlined in Rec. ITU-R RA.1031-1, separately for ground based transmitters, airborne transmitters and transmitters that may be located on High Altitude Platforms (HAPS).

resolves:

1. that in the frequency bands referred to in this Resolution, co-primary status of the radio astronomy service shall be recognized within coordination zones established by Administrations. No coordination requirements should be imposed upon terrestrial services outside established coordination zones.

2. that in the bands referred to in this Resolution, co-primary services operating stations within a coordination zone should coordinate their operations with affected radio astronomy stations within five years of the date of notification of the radio astronomy site to the Radiocommunication Bureau

Annex 1 lists the radio astronomy sites that operate, or plan to operate in the bands referred to in this Resolution as of [June 8, 2000]. Observatories that operate only up to 92 GHz are identified with *** under the SITE column.

[Annex 1]*

**List of Radio Astronomical Observatories Operating
in Bands Above 71 GHz**

REGION 1

COUNTRY	SITE	LONG	LAT	ALT	DIAM	REMARKS
		o ' "	o ' "	(m)	(m)	
Finland	Metsahovi	24 23 17	60 13 04	61	13.7	
France	Bordeaux	-00 31 37	44 50 10	73	2.5	
	Plateau de Bure ¹	05 54 26	44 38 01	2552	15	
Germany	Effelsberg	06 53 00	50 31 32	369	100	
Italy	Medicina***	11 38 43	44 31 14	44	32	EVLBI
	Noto***	15 03 00	36 31 48			EVLBI
Russia	Zelichukskaya	41 26 30	43 39 12	2100		
Spain	Pico Veleta	-03 23 34	37 03 58	2870	30	
	Robledo	-04 14 57	40 25 38	761		
	Yepes	-03 06 00	40 31 30	931		
Turkey	Gebse-Kocaeli	29 26 52	40 47 06	200		

* ALL OF ANNEX 1 SHOULD BE CONSIDERED IN []

The Observatoire de Plateau de Bure interferometer consists of 3 antennas of 15 m diameter.

REGION 2

COUNTRY	SITE	LONG.	LAT.	ALT	DIAM	REMARKS
		o ' "	o ' "	(m)	(m)	
Chile	San Pedro de Atacama	67 44 00	-23 02	5000		MMA (planned) ²
	La Silla	70 44 04	-29 15 34	2300	15	SEST
	Las Campanas	70 41 10	-29 01 43	2440	4	LMSA (planned) ³
	Pampa La Bola	67 42 00	-22 58 00	4800		
	Sierra Negra	97 18 00	18 59 00	4500	50	Large Millimeter Telescope (LMT-under construction)
USA	Green Bank, WVA***	79 50 24	38 25 59	946	100	NRAO-GBT
	Socorro, NM ***	107 37 06	34 04 44	2155	25	NRAO-VLA ⁴

	St. Croix, VI ***	64 35 01	17 45 24	46	25	NRAO VLBA ⁵
	Hancock, NH ***	71 59 12	42 56 01	340	25	NRAO VLBA
	North Liberty, IO***	91 34 27	41 46 17	272	25	NRAO VLBA
	Ft. Davis, TX ***		30 38 06	1646	25	NRAO VLBA
	Los Alamos, NM ***	103 56 41	35 46 31	1997	25	NRAO VLBA
	Pie Town, NM ***	106 14 44	34 18 04	2402	25	NRAO VLBA
	Kitt Peak, AZ ***	108 07 09	31 57 23	1946	25	NRAO VLBA
	Owens Valley, CA***	111 36 45	37 13 54	1237	25	NRAO VLBA
	Brewster, WA ***	118 16 37	48 07 52	286	25	NRAO VLBA
	Mauna Kea, HI ***	119 41 00	19 48 05	3751	25	NRAO VLBA

	Kitt Peak, AZ	111 36 50	31 57 10	1930	12	NRAO 12 m
	Amherst, MA	72 20 40	42 23 33	314	13.7	FCRAO (Five Colleges Obs.)
	Owens Valley, CA	118 17 36	37 13 54	1236	10.4	Caltech ⁶
	Hat Creek, CA	121 28 24	40 49 04	1042	6.1	BIMA ⁷
	Westford, MA	71 29 19	42 37 23	122	36	Haystack Obs.
	Mauna Kea, HI	155 28 20	19 49 33	4000	10.4	J.C. Maxwell Tel. CSO
Mauna Kea, HI						

² The USA MMA (MilliMeter Array) will consist of 40 antennas of 8-m diameter, on a ring configuration. The diameter of the ring will be capable of variation, ranging from 80 m to 10 km across.

³ The Japanese LMSA (Large Southern Millimeter Array) will consist of 50 antennas of 10-m diameter.

⁴ The VLA consists of 27 antennas of 25-m diameter, arranged in a Y pattern up to 36 km across.

⁵ The VLBA consists of 10 antennas of 25 m diameter, distributed across the continental US, Hawaii and the US Virgin Islands

⁶ The Caltech Interferometer consists of 3 antennas of 10.4 m diameter

⁷ The BIMA (Berkeley-Illinois-Maryland Array) currently consists of 9 antennas of 6.1-m diameter. The final configuration will consist of 11 antennas.

REGION 3

COUNTRY	SITE	LONG. o ' "	LAT. o ' "	ALT. m	DIAM m	REMARKS
AUSTRALIA	Parkes Mopra Narrabri, NSW	148 15 44 149 05 58 149 32 56	-33 00 00 -31 16 04 -30 59 52	60	64	Austr. Tel. Compact Array
CHINA	Delingha	97 43 75	37 22 43	3200	13.7	
JAPAN	Nobeyama ⁸ Kashima Mizusawa Nagoya Mt. Fuji Kagoshima	138 28 32 140 39 46 141 08 09 136 58 24 138 45 06 130 26 32	35 56 29 35 57 15 39 08 00 35 08 55 35 21 30 31 44 52	1350 50 87 70 3776 520	45 34 10 4 1.2 20	Comm. Res. Lab. Only >300GHz VERA (planned)
KOREA	Taejon	127 22 18	36 23 54	120	13.7	

OTHER

COUNTRY	SITE	LONG. o ' "	LAT. o ' "	ALT. m	DIAM m	REMARKS
	ANTARCTICA		-90 00 00			

⁷ The Nobeyama site includes a 45 m diameter telescope, an interferometer that consists of 6 antennas of 10 m diameter, and a 60 cm diameter submillimeter telescope.

Analysis of Passive Services 71 – 275 Proposal

- The fixed service (FS) had 106.4 GHz of allocations and the proposal gives them 127.6 GHz although some 12 GHz of this may have to be deleted if microwave limb sounders cannot share with terrestrial services. Furthermore, some 26.2 GHz of the total allocation are limited by footnote S5.553, although this is not likely a problem since the same limitation had previously existed for the mobile service in the same bands.
- The mobile service (MS) had 142.4 GHz of allocations and the proposal gives them 127.6 GHz although some 12 GHz of this may have to be deleted if microwave limb sounders cannot share with terrestrial services. The cause of the remaining deficit is simply that there were no more places that mobile allocations could be made. Note that in all cases the mobile service and the fixed service are co-allocated whereas previously this was not always the case.
- For the fixed-satellite service (FSS) analysis, see next page.
- The mobile-satellite service (MSS) had 3 GHz of uplinks and 3 GHz of downlinks with 36 GHz undesignated. The proposal gives MSS 21 GHz of uplinks and 8.5 GHz of downlinks with 16.2 GHz undesignated. Although the imbalance could be viewed as a problem, the overall total bandwidth is actually a little larger than before and much of the undesignated allocations could be designated as downlinks to yield an adequate balance for future applications.
- The inter-satellite service (ISS) currently is allocated some 35 GHz of bandwidth. In the proposal, the allocation is for 27.75 GHz of ISS of any type and an additional 18.45 GHz of ISS allocations limited to inter-satellite links between GSO satellites only. The total bandwidth available for ISS is therefore actually increased to 46.2 GHz, although about 40% of that is limited in use and another 34% is shared with FSS and MSS downlinks.
- Both the amateur and amateur-satellite services (AS & ASS) have 4.5 GHz of primary allocations both currently and in the proposal, although the allocations have been relocated from their original positions in some cases.
- The radiolocation service (RS) currently has 28 GHz allocated and in the proposal has 34 GHz allocated, partially due to the requested (consequential?) upgrade from 95 – 100 GHz. Sharing in the 95 – 100 GHz band may be problematic as there is also a primary MSS Earth-to-space allocation in the band.
- The broadcast service (BS) had 2 GHz allocated which has been reduced in the proposal to 1.5 GHz. The broadcast-satellite service (BSS) currently has 2 GHz allocated and that allocation was simply shifted down in frequency somewhat (was centered at 85 GHz and is centered at 72 GHz in proposal).
- The Earth exploration-satellite service (passive) (EESS (passive)) had 62 GHz of primary allocations from 71 – 275 GHz and in the proposal has 63.8 GHz although much give and take has occurred. One 3 GHz band allocated to EESS (passive) will be released in 2018. Space research (passive) (SR (passive)) has duplicated these changes in allocations for the use of passive sensors.

However, SR (passive) limited in use to space-based radio astronomy has gotten an additional 16.2 GHz of allocations co-primary with radio astronomy allocations.

- The Earth exploration-satellite service (active) (EESS (active)) and space research (active) (SR (active)) has the exact same primary allocation for cloud radar from 94 – 94.1 GHz in the proposal as in the current allocation tables.
- The radio astronomy service (RAS) has increased its primary allocations from 48 GHz in the current tables to 135.15 GHz, although virtually all of these additional allocations are limited by footnote **S5.ZZZ**.
- The radionavigation service (RNS) and radionavigation-satellite service (RNSS) both have 36 GHz allocated currently and are proposed to have 34.2 GHz allocated due to the 1.8 GHz decrease from 190 – 200 GHz to 191.8 – 200 GHz to enable the 183.3 ± 8.5 GHz allocation for passive sensors.
- FSS allocations from 71 – 275 GHz (current):

Band (GHz)	Bandwidth (GHz)	Downlink	Uplink
71 – 75.5	4.5		X
81 – 84	3	X	
92 – 95	2.9		X
102 – 105	3	X	
149 – 164	15	X	
202 – 217	15		X
231 – 241	10	X	
265 – 275	10		X
Totals	-	31	32.4

FSS allocations 71 – 275 GHz (proposed):

Band (GHz)	Bandwidth (GHz)	Downlink	Uplink
71 - 76	5	X	
81.5 - 86	4.5		X
126 - 134	8	X	
209 - 217	8		X
158.5 - 164	5.5	X	
167 – 174.8	7.8	X	
231.5 - 235	3.5	X	
238 - 241	3	X	
217 – 226	9		X
265 - 275	10		X
Totals	-	32.8	31.5

- As can be seen from the tables, the total uplink and downlink FSS spectrum allocated in the proposal is actually slightly greater than is currently allocated. However, there are only three distinct uplink bands from 81.5 – 85 GHz, 209 – 226 GHz, and 265 – 275 GHz, while there are six distinct (non-contiguous) downlink bands from 71 – 76 GHz, 126 – 134 GHz, 158.5 – 164 GHz, 167 – 174.8 GHz, 231.5 – 235 GHz, and 238 – 241 GHz. Furthermore, the two largest of these downlink bands must be shared with an ISS allocation.

- Current Allocations from 71 – 275 GHz

Band	FS	FSS	FSS	MS	MSS	MSS	MSS	ISS	AS	ASS	RS	BS	BSS	EESS	EESS	SRS	SRS	RAS	RNS	RNSS
(GHz)		(s-E)	(E-s)		(s-E)	(E-s)	(?)						(s-E)	(p)	(a)	(p)	(a)			
71-74	3		3	3	3															
74-75.5	1.5		1.5	1.5																
75.5-76									0.5	0.5										
76-81											5									
81-84	3	3		3		3														
84-86	2			2								2	2							
86-92														6		6		6		
92-94	2		2	2							2									
94-94.1											0.1				0.1		0.1			
94.1-95	0.9		0.9	0.9							0.9									
95-100				5			5												5	5
100-102	2			2										2		2				
102-105	3	3		3																
105-116														11		11		11		
116-119.98	3.98			3.98				3.98						3.98		3.98				
119.98-120.02	0.04			0.04				0.04						0.04		0.04				
120.02-126	5.98			5.98				5.98						5.98		5.98				
126-134	8			8				8			8									
134-142				8			8												8	8
142-144									2	2										
144-149											5									
149-150	1		1	1																
150-151	1		1	1										1		1				
151-156	5		5	5																
156-158	2		2	2										2						
158-164	6		6	6																
164-168														4		4		4		
168-170	2			2																
170-174.5	4.5			4.5				4.5												
174.5-176.5	2			2				2						2		2				
176.5-182	5.5			5.5				5.5												
182-185														3		3		3		

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185-190	5			5				5												
190-200				10			10												10	10
200-202	2			2										2		2				
202-217	15	15		15																
217-231														14		14		14		
231-235	4		4	4																
235-238	3		3	3										3		3				
238-241	3		3	3																
241-248											7									
248-250									2	2										
250-252														2		2				
252-265				13			13												13	13
265-275	10	10		10															10	
Totals	106.4	31	32.4	142.4	3	3	36	35	4.5	4.5	28	2	2	62	0.1	60	0.1	48	36	36
	FS	FSS	FSS	MS	MSS	MSS	MSS	ISS	AS	ASS	RS	BS	BSS	EESS	EESS	SRS	SRS	RAS	RNS	RNSS
		(s-E)	(E-s)		(s-E)	(E-s)	(?)						(s-E)	(p)	(a)	(p)	(a)			

Proposed Allocations from 71 – 275 GHz

Band (GHz)	FS	FSS (s-E)	FSS (E-s)	MS	MSS (s-E)	MSS (E-s)	MSS (?)	ISS	ISS (GSO)	AS	ASS	RS	BS	BSS (s-E)	EESS (p)	EESS (a)	SRS (p)	SRS (RA)	SRS (a)	RAS	RNS	RNSS	
71-73	2	2		2										2									
73-76	3	3		3	3																		
76-76.5										0.5	0.5												
76.5-81.5												5									5		
81.5-84.5	3		3	3		3															3		
84.5-86	1.5		1.5	1.5									1.5								1.5		
86-92															6		6				6		
92-94	2			2								2									2		
94-94.1												0.1				0.1			0.1				
94.1-95	0.9			0.9								0.9									0.9		
95-100	5			5		5						5									5	5	5
100-102	2			2											2		2				2		
102-105	3			3																	3		
105-109.5	4.5			4.5														4.5			4.5		
109.5-111.8															2.3		2.3				2.3		
111.8-114.25	2.45			2.45														2.45			2.45		
114.25-116															1.75		1.75				1.75		
116-119.98									3.98						3.98		3.98						
119.98-120.02									0.04						0.04		0.04						
120.02-122.25									2.23						2.23		2.23						
122.25-126	3.75			3.75				3.75													3.75		
126-134		8					8	8														8	8
134-136										2	2												
136-141												5									5		
141-148.5	7.5			7.5								7.5									7.5		
148.5-151.5															3		3				3		
151.5-153	1.5			1.5								1.5									1.5		
153-155.5	2.5			2.5														2.5			2.5		
155.5-158.5	3			3											3		3				3		
158.5-164	5.5	5.5		5.5	5.5																		
164-167															3		3				3		
167-168	1	1		1				1															
168-174.8	6.8	6.8		6.8				6.8															
174.8-176.5									1.7						1.7		1.7						

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176.5-182									5.5						5.5		5.5						
182-185															3		3						
185-190									5						5		5						
190-191.8															1.8		1.8						
191.8-200	8.2			8.2				8.2	8.2												8.2	8.2	
200-202	2			2											2		2				2		
202-209	7			7											7		7				7		
209-217	8		8	8																	8		
217-226	9		9	9																	9		
226-231.5															5.5		5.5				5.5		
231.5-235	3.5	3.5		3.5																			
235-238	3			3											3		3						
238-241	3	3		3																			
241-248												7									7		
248-250									2	2											3		
250-252															2		2				2		
252-265	13			13		13															13	13	13
265-275	10		10	10																	10		
Totals	127.6	32.8	31.5	127.6	8.5	21	16	27.75	18.45	4.5	4.5	34	1.5	2	63.8	0.1	60.8	12.5	0.1	135.15	34.2	34.2	
- Before Tot	106.4	32.4	31	142.4	3	3	36	35	0	4.5	4.5	28	2	2	62	0.1	60	0	0.1	48	36	36	
Difference	21.2	0.4	0.5	-14.8	5.5	18	-20	-7.25	18.45	0	0	6	-0.5	0	1.8	0	0.8	12.5	0	87.15	-1.8	-1.8	
	FS	FSS	FSS	MS	MSS	MSS	MSS	ISS	ISS	AS	ASS	RS	BS	BSS	EESS	EESS	SRS	SRS	SRS	RAS	RNS	RNSS	
		(s-E)	(E-s)		(s-E)	(E-s)	(?)		(GSO)					(s-E)	(p)	(a)	(p)	(RA)	(a)				

Proposals for Agenda Item 1.17

to consider possible worldwide allocation for the earth exploration-satellite (passive) and space research (passive) service in the band 18.6 - 18.8 GHz, taking into account the results of the ITU-R studies (20March99)

Background Information: At present, the allocations for the Earth exploration-satellite (passive) and the space research (passive) services in the band 18.6 - 18.8 GHz are on a primary basis in Region 2, but on a secondary basis in Regions 1 and 3. This allocation must be upgraded to primary status if the long-term ability to obtain environmental data with passive spaceborne sensors is to be preserved. Compatibility between the passive sensors and the fixed and fixed-satellite services requires adoption of constraints on the parameters of the fixed and fixed-satellite systems that use the band. A pfd limit of -95 dBW/m² in a reference bandwidth of 200 MHz on geostationary systems in the fixed-satellite service will enable passive sensors to perform their mission if measurements are restricted to portions of the sensor orbit where the sensor is moving away from the equator while taking sensor data over land masses. Limiting the power delivered to any antenna of a station in the fixed service measured across the band 18.6 - 18.8 GHz band to not exceed 0 dBW along with an antenna pattern complying with Recommendation ITU-R F.699-4 will enable sharing with the fixed service.

Proposal:

**GHz
18.6 – 18.8**

Allocation to Services		
Region 1	Region 2	Region 3
18.6 – 18.8 <u>EARTH EXPLORATION-SATELLITE (passive)</u> FIXED FIXED-SATELLITE (space-to-Earth) MOD S5.523 MOBILE except aeronautical mobile Earth Exploration-Satellite (passive) Space Research (passive) MOD S5.522	18.6 – 18.8 EARTH EXPLORATION-SATELLITE (passive) FIXED FIXED-SATELLITE (space-to-Earth) MOD S5.523 MOBILE except aeronautical mobile SPACE RESEARCH (passive) MOD S5.522	18.6 – 18.8 <u>EARTH EXPLORATION-SATELLITE (passive)</u> FIXED FIXED-SATELLITE (space-to-Earth) MOD S5.523 MOBILE except aeronautical mobile Earth Exploration-Satellite (passive) Space Research (passive) MOD S5.522

USA/1.17/01
MOD

Reasons: To establish a common worldwide primary allocation to the Earth exploration-satellite (passive) services to be used for environmental measurements.

USA/1.17/02
MOD

~~S5.522 – In making assignments to stations in the fixed and mobile services, administrations are invited to take account of passive sensors in the Earth~~

~~exploration satellite and space research services operating in the band 18.6–18.8 GHz. In this band, administrations should endeavour to limit as far as possible both the power delivered by the transmitter to the antenna and the e.i.r.p. in order to reduce the risk of interference to passive sensors to the minimum. In the band 18.6 - 18.8 GHz, fixed and mobile service stations shall be limited to a total power delivered to each antenna of 0 dBW.~~

Reasons: To enable passive sensors and the fixed service to operate in the band without excessive interference to the sensors.

USA/1.17/03
MOD

S5.523 ~~In assigning frequencies to stations in the fixed satellite service in the direction space to Earth, administrations are requested to limit as far as practicable the power flux density at the Earth's surface in the band 18.6–18.8 GHz, in order to reduce the risk of interference to passive sensors in the earth exploration-satellite and space research services. In the band 18.6 - 18.8 GHz, the fixed-satellite service shall be limited to a power flux density at the Earth's surface of -95 dBW/m² in a reference bandwidth of 200 MHz for all angles of arrival.~~

Reasons: To enable passive sensors and the fixed-satellite service to operate in the band without excessive interference to the sensors.

Proposals for Agenda Item 1.20

to consider the issues related to the application of Nos. S9.8, S9.9 and S9.17 and the corresponding parts of Appendix S5 with respect to Appendices S30 and S30A, with a view to possible deletion of Articles 6 and 7 of Appendices S30 and S30A, also taking into consideration Recommendation 35 (WRC-95); (16April99)

Background Information: Annex 1 to Appendix S30 of the Radio Regulations specifies limits for determining whether a service is affected by a proposed modification to the BSS Plan or when it is necessary to seek the agreement of any other administration. Section 5 of Annex 1 specifies limits to the change in the PFD to protect the terrestrial services of administrations in Regions 1 and 3 from modifications to the Region 2 Plan.

Section 5c specifies the PFD limits for administrations in Region 1 east of longitude 30°E. This PFD limit is very tight at low angles of elevation. In order to meet this PFD limit the BSS spacecraft power must be significantly lower in parts of Alaska compared to the continental United States. As a result the provision of BSS service to Alaska, from U.S. orbital assignments at 101W, 110W and 119W, requires larger BSS receive dishes, in some cases as large as 1.8 m. This will also be the case for Region 2 administrations that propose to modify their assignments to provide service to the United States. The FCC requires provision of service to Alaska when technically feasible.

A relaxation in the PFD limit in Section 5c of Annex 1 of Appendix S30, as proposed below, would allow the use of 60 cm BSS receive dishes in Alaska for BSS service from the 101W, 110W and 119W orbital locations.

Proposals:

APPENDIX S30

ANNEX 1

5. Limits to the change in the power flux-density to protect the terrestrial services of administrations in Regions 1 and 3¹⁶

USA/1.20/01
MOD

c) in the frequency band 12.2-12.7 GHz for territories of administrations in Region 1¹⁷, east of longitude 30° E:

$$\begin{aligned} & -134 \text{ ~~121.8~~ dB(W/m}^2\text{/5 MHz)} && \text{for } \gamma \neq \text{0} \text{ ~~1.85~~ }^\circ; \\ & -134 + 4.6975 \gamma^2 \text{ ~~dB(W/m}^2\text{/5 MHz)}~~ && \text{for } 0^\circ < \gamma \leq 0.8^\circ; \\ & -128.5 + 25 \log \gamma \text{ dB(W/m}^2\text{/5 MHz)} && \text{for } \gamma > 0.8 \text{ ~~1.85~~ }^\circ; \end{aligned}$$

Reasons: To allow the provision of BSS service to all of Alaska using 60 cm receive dishes, from the U.S. BSS assignments at 101W, 110W and 119W and

¹⁶ See § 3.18 of Annex 5.

USA

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from other Administration's orbital locations who plan to provide BSS service to the United States.
