**United States of America**

DRAFT PROPOSALS FOR THE WORK OF THE CONFERENCE

**Agenda Item 9, Issue 9.1.9:** Studies relating to spectrum needs and possible allocation of the frequency band 51.4-52.4 GHz to the fixed-satellite service (Earth-to-space)

**BACKGROUND:**

Resolution **162 (WRC-15)** resolves to invite ITU-R to conduct studies considering additional spectrum needs for development of the fixed-satellite service (FSS) and conduct sharing and compatibility studies with existing services to determine the suitability of new primary allocations to the FSS in the frequency band 51.4-52.4 GHz (Earth-to-space) limited to FSS gateway links for geostationary orbit use, and the possible associated regulatory actions.

ITU-R has conducted studies required by Resolution **162 (WRC-15)**. The results of analysis of additional spectrum needs are contained in DN Report ITU-R S.[SPECTRUM\_NEEDS]. The results of sharing and compatibility studies with incumbent services including the fixed service (FS), mobile service (MS), Earth exploration-satellite service (EESS) (passive), radio astronomy service (RAS), and sharing with potential IMT-2020 applications are contained in PDN Report ITU-R S.[SPECTRUM\_SHARING].

The spectrum needs were analyzed and it was concluded that the additional allocation to the FSS being considered is beneficial to make broadband connections accessible to communities as achieved by HTS (High Throughput Satellite) systems.

Additionally, the outcome of the studies has demonstrated the possibility of sharing and compatibility with the appropriate protection measures. Studies included sharing and compatibility between FSS and other primary services in the band, such as fixed service and mobile service (including IMT-2020). Studies were also performed for the protection of Earth Exploration-Satellite Service (EESS) and Space Research Service (SRS) allocated in adjacent bands. Studies have considered FSS earth stations as small as 4.5 m but analysis of the various studies demonstrates the feasibility to use smaller FSS earth stations, as low as 2.4 m, with minimal impact.

Based on the results of the sharing and compatibility studies this proposal supports an allocation of the frequency band 51.4-52.4 GHz to the fixed-satellite service (Earth-to-space), limited to FSS gateway links for geostationary orbit use while protecting currently allocated services in the same frequency band and in adjacent bands as follows:

To protect FS stations, separation distances up to 33 km are required when assuming flat terrain and a 4.5 m earth station which means that the distance can be reduced when real terrain is taken into consideration. In the case of a 2.4 m earth station, the only impacting parameter is the change in FSS antenna peak gain and the resulting change in the transmitter power spectral density (assuming a fixed EIRP density) leading to a separation distance of 35 km.

Regarding the possible IMT-2020 applications of the MS in the same frequency band, the required separation distances between FSS earth stations and IMT base station and IMT user equipment are 260 and 330 meters, respectively.

The protection of non-GSO EESS (passive) sensors operating in the frequency band 52.6‑54.25 GHz can be achieved by limiting the FSS earth station unwanted emissions falling in the passive band.

Regarding the protection of future GSO EESS (passive) sensors, a footnote in article 5 will require coordination between a FSS network and a notified GSO EESS network when the orbital separation between the GSO EESS space station and the FSS space station is less than 1.8 degrees.

Regarding protection of EESS (passive) sensors, studies have demonstrated that the FSS earth station antenna size has only a minimal impact on the results. It is then proposed to consider FSS earth station size as small as 2.4 m.

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations  
(See No. 2.1)

MOD USA/9.1.9/1

51.4-55.78 GHz

|  |  |  |
| --- | --- | --- |
| Allocation to services | | |
| Region 1 | Region 2 | Region 3 |
| 51.4-52.4 FIXED-SATELLITE (Earth-to-space) ADD 5.A919 ADD 5.B919  FIXED  MOBILE  5.547 5.556 MOD 5.338A | | |
| 52.4-52.6 FIXED MOD 5.338A  MOBILE  5.547 5.556 | | |

**Reasons**: Creates an allocation to the FSS (Earth-to-space) in 51.4-52.4 GHz.

MOD USA/9.1.9/2

5.338A In the frequency bands 1 350-1 400 MHz, 1 427-1 452 MHz, 22.55-23.55 GHz, 30‑31.3 GHz, 49.7‑50.2 GHz, 50.4-50.9 GHz, 51.4-52.6 GHz, 81-86 GHz and 92‑94 GHz, Resolution **750 (Rev.WRC‑19)** applies.     (WRC‑19)

**Reasons:** Applies the limits for FSS ES unwanted emissions as contained in the proposed revision to Resolution **750 (Rev.WRC-15).**

ADD USA/9.1.9/1

{*Editor’s note: the new CPM text has a different formulation for that makes a similar change to describing the earth station antenna size. We propose to revise the antenna size to 2.4m*}

From previous IWG-3\_70 version:

5.A919 The use of the bands 51.4-52.4 GHz by the fixed-satellite service (Earth-to-space) is limited to earth stations in geostationary satellite networks with a minimum antenna diameter of 2.4 meters.

Latest CPM text:

5.A919 The use of the frequency band 51.4-52.4 GHz by the fixed-satellite service (Earth-to-space) is limited to geostationary satellite networks and the fixed-satellite service earth stations shall have a minimum antenna diameter of 2.4 metres.      (WRC‑19)

Reasons: Limits the new allocation to large earth stations operating in FSS GSO networks.

ADD USA/9.1.9/2

5.B919 An administration that has notified frequency assignments in the EESS on a GSO space station in the frequency band 52.6-54.25 GHz may seek the agreement of administrations who have submitted a notice under **No. 9.6** with frequency assignments in the fixed-satellite service on a GSO station that are within 1.8 degrees of the notified orbital position of GSO EESS space station.  The administration responsible for the GSO fixed-satellite service satellite network shall cooperate with the administration responsible for the GSO EESS space station and both administrations should take reasonable steps to find a mutually agreed arrangement. In the absence of a mutually agreed arrangement, the administration responsible for the GSO FSS satellite network shall take all practicable actions to minimize its unwanted emission power in the 52.6-54.25 GHz band.  The Bureau shall make no examination or finding under Articles **9** or **11** pursuant to this provision.

ARTICLE 21

Terrestrial and space services sharing frequency bands above 1 GHz

Section II − Power limits for terrestrial stations

MOD USA/9.1.9/3

TABLE **21-2**     (Rev.WRC‑19)

|  |  |  |
| --- | --- | --- |
| Frequency band | Service | Limit as specified in Nos. |
| … | … | … |
| 10.7-11.7 GHz 5 (Region 1) 12.5-12.75 GHz 5 (Nos. 5.494 and 5.496) 12.7-12.75 GHz 5 (Region 2) 12.75-13.25 GHz 13.75-14 GHz (Nos. 5.499 and 5.500) 14.0-14.25 GHz (No. 5.505) 14.25-14.3 GHz (Nos. 5.505 and 5.508) 14.3-14.4 GHz 5 (Regions 1 and 3) 14.4-14.5 GHz 14.5-14.8 GHz 51.4-52.4 GHz | Fixed-satellite | 21.2**,** 21.3and21.5 |
| … | … | … |

**Reasons:** Applies the limits in Nos. 21.2**,** 21.3and21.5 to the new allocation.

Section III − Power limits for earth stations

MOD USA/9.1.9/4

TABLE **21-3**     (Rev.WRC‑19)

|  |  |  |
| --- | --- | --- |
| Frequency band | | Services |
| … | … | … |
| 14.3-14.4 GHz 6 | (for Regions 1 and 3) |  |
| 14.4-14.8 GHz |  |  |
| 17.7-18.1 GHz |  | Fixed-satellite |
| 22.55-23.15 GHz |  | Earth exploration-satellite |
| 27.0-27.5 GHz 6 | (for Regions 2 and 3) | Mobile-satellite |
| 27.5-29.5 GHz |  | Space research |
| 31.0-31.3 GHz | (for the countries listed in No. 5.545) |  |
| 34.2-35.2 GHz | (for the countries listed in No. 5.550 with respect to the countries listed in No. 5.549) |  |
| 51.4-52.4 GHz |  | Fixed-satellite |

**Reasons:** Applies the limits in No. 21.8 to the new FSS frequency band

{*Editor’s note: this Appendix 4 text is new CPM text for AI 9.1 Issue 9 to mandate that the antenna size be provided.*}

APPENDIX 4 (REV.WRC‑15)

Consolidated list and tables of characteristics for use in the  
application of the procedures of Chapter III

ANNEX 2

Characteristics of satellite networks, earth stations  
or radio astronomy stations2    (Rev.WRC‑12)

Footnotes to Tables A, B, C and D

MOD

**TABLE C**

CHARACTERISTICS TO BE PROVIDED FOR EACH GROUP OF FREQUENCY ASSIGNMENTS   
FOR A SATELLITE ANTENNA BEAM OR AN EARTH STATION OR   
RADIO ASTRONOMY ANTENNA      (Rev.WRC‑19)

| **Items in Appendix** | ***C \_ CHARACTERISTICS TO BE PROVIDED FOR EACH GROUP OF FREQUENCY  ASSIGNMENTS FOR A SATELLITE ANTENNA BEAM OR  AN EARTH STATION OR RADIO ASTRONOMY ANTENNA*** | **Advance publication of a geostationary- satellite network** | **Advance publication of a non-geostationary-satellite network subject to coordination under Section II  of Article 9** | **Advance publication of a non-geostationary-satellite network not subject to coordination under Section II  of Article 9** | **Notification or coordination of a geostationary-satellite network (including space operation functions under Article 2A of Appendices 30 or 30A)** | **Notification or coordination of a non-geostationary-satellite network** | **Notification or coordination of an earth station (including notification under  Appendices 30A or 30B)** | **Notice for a satellite network in the broadcasting-satellite service under Appendix 30 (Articles 4 and 5)** | **Notice for a satellite network  (feeder-link) under Appendix 30A  (Articles 4 and 5)** | **Notice for a satellite network in the fixed- satellite service under Appendix 30B  (Articles 6 and 8)** | **Items in Appendix** | **Radio astronomy** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ... | ... |  |  |  |  |  |  |  |  |  |  |  |
| C.10.d.7 | the antenna diameter, in metres  In cases other than Appendix **30A**, required for fixed-satellite service networks operating in the frequency bands 13.75-14 GHz, 14.5-14.75 GHz (in countries listed in Resolution **163 (WRC‑15)** not for feeder links for the broadcasting-satellite service), 14.5-14.8 GHz (in countries listed in Resolution **164 (WRC‑15)** not for feeder links for the broadcasting-satellite service), 24.65‑25.25 GHz (Region 1) 24.65-24.75 GHz (Region 3) and 51.4-52.4 GHz and for maritime mobile-satellite service networks operating in the frequency band 14‑14.5 GHz |  |  |  | **+** | **+** |  |  | **X** |  | C.10.d.7 |  |
| ... | ... |  |  |  |  |  |  |  |  |  |  |  |

**Reasons:** Limitations for antenna diameter for the frequency band 51.4-52.4 GHz is proposed in footnote RR No. **5.A919**.

APPENDIX 7 (REV.WRC‑15)

Methods for the determination of the coordination area around an earth  
station in frequency bands between 100 MHz and 105 GHz

ANNEX 7

System parameters and predetermined coordination distances for determination of the coordination area around an earth station

MOD USA/9.1.9/5

TABLE 7c    (Rev.WRC‑19)

Parameters required for the determination of coordination distance for a transmitting earth station

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Transmitting space radiocommunication service designation | | Fixed- satellite | Fixed- satellite 2 | Fixed- satellite 3 | Space research | Earth  exploration-satellite, space research | Fixed-satellite, mobile-satellite, radionavigation-satellite | Fixed-satellite | Fixed- satellite 2 | |
| Frequency bands (GHz) | | 24.65-25.25 27.0-29.5 | 28.6-29.1 | 29.1-29.5 | 34.2-34.7 | 40.0-40.5 | 42.5-47 47.2-50.2 50.4-51.4 | 51.4-52.4 | 47.2-50.2 | |
| Receiving terrestrial  service designations | | Fixed, mobile | Fixed, mobile | Fixed, mobile | Fixed, mobile, radiolocation | Fixed, mobile | Fixed, mobile, radionavigation | Fixed, mobile | Fixed, mobile | |
| Method to be used | | § 2.1 | § 2.2 | § 2.2 |  | § 2.1, § 2.2 | § 2.1, § 2.2 | § 2.1 | § 2.2 | |
| Modulation at terrestrial station 1 | | N | N | N |  | N | N | N | N | |
| Terrestrial station interference parameters and criteria | *p*0 (%) | 0.005 | 0.005 | 0.005 |  | 0.005 | 0.005 | 0.005 | 0.001 | |
| *n* | 1 | 2 | 1 |  | 1 | 1 | 1 | 1 | |
| *p* (%) | 0.005 | 0.0025 | 0.005 |  | 0.005 | 0.005 | 0.005 | 0.001 | |
| *NL* (dB) | 0 | 0 | 0 |  | 0 | 0 | 0 | 0 | |
| *Ms* (dB) | 25 | 25 | 25 |  | 25 | 25 | 25 | 25 | |
| *W* (dB) | 0 | 0 | 0 |  | 0 | 0 | 0 | 0 | |
| Terrestrial station parameters | *Gx* (dBi) 4 | 50 | 50 | 50 |  | 42 | 42 | 42 | 46 | |
| *Te* (K) | 2 000 | 2 000 | 2 000 |  | 2 600 | 2 600 | 2 600 | 2 000 | |
| Reference bandwidth | *B* (Hz) | 106 | 106 | 106 |  | 106 | 106 | 106 | 106 | |
| Permissible interference power | *Pr*( *p*) (dBW) in *B* | −111 | −111 | −111 |  | −110 | −110 | -110 | −111 | |
| 1 A: analogue modulation; N: digital modulation.  2 Non-geostationary satellites in the fixed-satellite service.  3 Feeder links to non-geostationary-satellite systems in the mobile-satellite service.  4 Feeder losses are not included. | | | | | | | | | |

MOD USA/9.1.9/6

RESOLUTION 750 (Rev.WRC‑19)

Compatibility between the Earth exploration-satellite service (passive) and relevant active services

The World Radiocommunication Conference (Sharm el-Sheikh, 2019)

…

noting

*a)* that the compatibility studies between relevant active and passive services operating in adjacent and nearby frequency bands are documented in Report ITU-R SM.2092 and in [PDN] Report ITU-R S.[SPECTRUM\_SHARING];

*b)* that the compatibility studies between IMT systems in the frequency bands 1 375‑1 400 MHz and 1 427-1 452 MHz and EESS (passive) systems in the frequency band 1 400‑1 427 MHz are documented in Report ITU-R RS.2336;

*c)* that Report ITU-R F.2239 provides the results of studies covering various scenarios between the fixed service, operating in the frequency band 81-86 GHz and/or 92-94 GHz, and the Earth exploration-satellite service (passive), operating in the frequency band 86-92 GHz;

*d)* that Recommendation ITU-R RS.2017 provides the interference criteria for satellite passive remote sensing,

TABLE 1-1

|  |  |  |  |
| --- | --- | --- | --- |
| EESS (passive) band | Active service band | Active service | Limits of unwanted emission power from active service stations in a specified bandwidth within the EESS (passive) band1 |
| … | … | … | … |
| 52.6-54.25 GHz | 51.4-52.6 GHz | Fixed | For stations brought into use after the date of entry into force of the Final Acts of WRC‑07:  −33 dBW in any 100 MHz of the EESS (passive) band |
| 52.6-54.25 GHz | 52.1-52.4 GHz | Fixed-satellite (E‑to‑s) | For stations brought into use after the date of entry into force of the Final Acts of WRC-19:  (-37) dBW in any 100 MHz of the EESS (passive) band for earth stations with antenna elevation angles lower than (75°)  (-52) dBW in any 100 MHz of the EESS (passive) band for earth stations with antenna elevation angles equal or higher than (75°)  Latest CPM text:  For stations brought into use after the date of entry into force of the Final Acts of WRC-19:  (-39 to -34) dBW in any 100 MHz of the EESS (passive) band for earth stations with antenna elevation angles lower than (74° to 78°)  (-52 to -49) dBW in any 100 MHz of the EESS (passive) band for earth stations with antenna elevation angles equal or higher than (74° to 78°)  For earth stations operating with an FSS space station whose orbital separation Δ is equal or smaller than 3.2° from the GSO EESS (passive) space stations with nominal orbital positions: 0°, 3.5° E, 9.5° E, 41.5° E, 76° E, 79° E, 86.5° E, 99.5° E, 105° E, 112° E, 123.5° E, 133° E, 165.8° E, 3.2° W, 14.5° W, 75° W and 137° W:  −84 (dBW/100 MHz) for Δ = 0°  −84 + 200 Δ (dBW/100 MHz) for 0°< Δ < 0.1°  −67 + 22.8 Δ (dBW/100 MHz) for 0.1°=< Δ < 0.5°  −61 + 11.3 Δ (dBW/100 MHz) for 0.5° ≤ Δ < 1.9°  −47+4Δ (dBW/100MHz） for 1.9° ≤ △ ≤ 3.2° |

**Reasons:** Limit the unwanted emissions from the FSS Earth stations falling in the band 52.6‑54.25 GHz to protect the EESS (passive) according to their elevation angle.