

Draft Brief on Agenda Item 1.21

Agenda item 1.21 : *to consider the results of studies, regarding the compatibility between the radio astronomy service and the active space services in accordance with Resolution 740 (WRC-03), in order to review and update, if appropriate, the tables of threshold levels used for consultation that appear in the Annex to Resolution 739 (WRC-03);*

Issue

Resolution 740 invites ITU-R to study the compatibility between the RAS and the corresponding active services as listed in the table below only, with a view to updating or developing ITU-R Recommendations, if appropriate.

The results of the studies should be considered in order to review and update, if appropriate, the tables of threshold levels for consultation in the Annex 1 of Resolution 739 (WRC-03).

Band-pairs to be considered for further studies

Space service band (MHz)	Space service	Radio astronomy service band (MHz)
137-138	MSS (space-to-Earth)	150.05-153.0 (No. 5.208A)
387-390	MSS (space-to-Earth)	322-328.6 (No. 5.208A)
400.15-401	MSS (space-to-Earth)	406.1-410 (No. 5.208A)
620-790 (No. 5.311) see Resolution 545 (WRC-03)	BSS (space-to-Earth)	608-614
1 452-1 492	BSS (space-to-Earth) (non-GSO systems only)	1 400-1 427
1 525-1 559	MSS (space-to-Earth) (non-GSO systems only)	1 400-1 427
1 525-1 559	MSS (space-to-Earth) (non-GSO systems only)	1 610.6-1 613.8
1 559-1 610	RNSS (space-to-Earth)	1 610.6-1 613.8
2 655-2 670	BSS (space-to-Earth)	2 690-2 700
2 655-2 670	FSS (space-to-Earth) (Region 2)	2 690-2 700
2 670-2 690	FSS (space-to-Earth) (Region 2)	2 690-2 700
(GHz)		(GHz)
10.7-10.95	FSS (space-to-Earth)	10.6-10.7
21.4-22.0	BSS (space-to-Earth)	22.21-22.5

Preliminary CEPT position

In order to achieve adequate protection of the radio astronomy service from interference arising from unwanted emissions of satellite services in nearby or adjacent bands, CEPT supports the inclusion of consultation thresholds in Resolution 739 for the frequency band pairs which have been studied. This consultation threshold should not impose undue constraints on the active services, particularly in the case of safety services.

Background

1. History

Unwanted emissions from satellites in the space-to-Earth direction have the potential of causing harmful interference to the radio astronomy service in nearby or adjacent bands. In order to protect the radio astronomy service operating within its allocated bands, ITU-R established task groups TG1/7 and recently TG1/9 to study the problem on a band-by-band basis, rather than mandating more stringent overall limits to unwanted satellite emissions.

TG1/7 worked out a new ITU-R Recommendation SM.1633 which provides a methodology for band by band studies and lists 20 compatibility analyses between active and passive services operating in adjacent or nearby bands. Studies for some of the band-pairs listed in Recommendation ITU-R SM.1633 are still in progress.

During WRC-03 a Resolution for Consultation (Resolution 739) was drafted with clear guidelines on how to deal with the radio astronomy band protection issue during the design and construction (pre-launch) phase of the satellite and after the launch. This Resolution contains design criteria based on radio astronomy protection levels without mandating the burden of pre-launch verification of these limits. Annex 1 of Resolution 739 provides detailed unwanted emissions threshold levels for a couple of band-pairs which should be met by the space stations operating nearby or adjacent to RAS bands. A footnote in RR Article 5 attached to the relevant bands refers to this Resolution. However some pfd and epfd levels as given in Resolution 739 need further study.

WRC-03 could not agree on all band pairs, which had been the subject of ITU-R studies. Therefore Resolution 740 calls for further studies on bands that showed potential problems during the ITU-R discussions and some band-pairs that have not been studied yet. ITU-R TG1/9 is tasked to continue the studies and propose solutions for the remaining band pairs to WRC-07.

2. Summary of the results of current ITU-R studies

During this study period in the framework of ITU-R TG1/9 the following results were achieved:

- Four new studies referring to the four frequency ranges below 1 GHz referenced in Resolution 740.
- A new study dealing with the compatibility analysis between RAS operating in the 1 400-1 427 MHz and 1 610.6-1 613.8 MHz bands and non-GSO mobile-satellite service (space-to-Earth) systems operating in the 1 525-1 559 MHz band;
- The Annex 5 of former Recommendation ITU-R SM.1633 on unwanted emissions from RNSS systems operating in the 1559 – 1610 MHz band falling in the 1610.6 – 1613.8 MHz radio astronomy band was updated;
- A new study on the impact of unwanted emissions from BSS systems operating in the 21.4 – 22 GHz band falling in the 22.21 – 22.5 GHz radio astronomy band was conducted.

The Recommendation ITU-R SM.1633 was withdrawn and all Annexes of this Recommendation which are related to protection of the RAS were placed into the Report ITU-R SM.2091.

The CPM text for WRC-07 Agenda item 1.21 was developed and agreed. Three Methods to satisfy this agenda item, excluding the no change Method, have been proposed.

No contributions were submitted and studies have not been conducted for the following band pairs:

- 1 452-1 492 MHz/1 400-1 427 MHz BSS (non-GSO systems only)/RAS
- 2 655-2 670 MHz/2 690-2 700 MHz FSS (space-to-Earth)/RAS
- 2 655-2 670 MHz/2 690-2 700 MHz BSS (non GSO systems only)/RAS
- 2 670-2 690 MHz/2 690-2 700 MHz FSS (space-to-Earth)/RAS
- 10.7-10.95 GHz/10.6-10.7 GHz FSS (space-to-Earth)/RAS

3. Results of band-by-band studies covered by Resolution 740

3.1 137-138 MHz / 150.05-153.0 MHz

The 150.05-153.0 MHz band is allocated on a primary basis to the radio astronomy service in Region 1 along with other services such as the fixed service and the mobile service (except aeronautical mobile). Additionally, this band is allocated to the radio astronomy service on a primary basis in Australia and India by RR 5.225. Radio Regulations No. 5.149 applies in this band in Region 1. This band is used by RAS for continuum (broadband) observations only, in single-dish mode.

For single-dish continuum observations, the entire 2.95 MHz width of the band 150.05-153.0 MHz is used, for which case the pfd threshold for detrimental interference is $-194 \text{ dB(W/m}^2\text{)}$.

The bands 137-137.025 MHz and 137.175-137.825 MHz are allocated to the mobile-satellite service (space-to-Earth) on a primary basis in all regions. The bands 137.025-137.175 MHz and 137.825-138 MHz are allocated to the mobile-satellite service (MSS) on a secondary basis in all regions. RR Nos. 5.208A and 5.209 apply to the MSS in this band.

The technical and operational characteristics of 4 non-GSO MSS systems using, or planned to be used in, the band for either service or gateway downlinks are described in Recommendation ITU-R M.1184-2. Those are systems L, M, P and Q. The orbital characteristics of the actual system Q are different from the ones which are given in Recommendation ITU-R M.1184-2.

The carried out studies shown that the protection of RAS would be achieved if the pfd unwanted emission level (per satellite) of each MSS non-GSO systems using the band 137-138 MHz falling into the RAS band 150.05-153 MHz should be the following:

System	L	M	P	Q
Required pfd in the passive band (dBW/m ²)	-216	-212	-193	-213

It has to be noted that for the calculation of the total amount of spurious emissions in the RAS band it was considered that spurious emissions have a constant level over the whole RAS band. This hypothesis is very stringent and clearly not realistic, as spurious emissions generally appear at some discrete frequencies.

Therefore no problem of compatibility is expected.

3.2. 322-328.6 MHz/ 387-390MHz

The 322-328.6 MHz band is allocated on a primary basis to the radio astronomy service along with other services such as the fixed service and the mobile service (except aeronautical mobile). RR No. 5.149 applies in this band.

In practice, this band is used for both continuum (broadband) and spectral line (narrow-band) observations, in single-dish as well as in Very Long Baseline Interferometry (VLBI) mode.

For single-dish continuum observations, the entire 6.6 MHz width of the band is used, for which case the pfd threshold for detrimental interference is $-189 \text{ dB(W/m}^2\text{)}$. Further compatibility studies are needed on spectral line observation.

VLBI observations, where signals from widely separated antennas are recorded and correlated after the observations, are much less susceptible to interference. This is reflected in the threshold pfd level for VLBI observations in this band, $-177 \text{ dB(W/m}^2\text{)}$, for the whole bandwidth of 10 kHz.

The band 387-390 MHz is allocated to the mobile-satellite service (space-to-Earth) on a secondary basis in all regions. RR Nos. 5.208A and 5.255 apply to the MSS in this band.

There is no information in any ITU-R Recommendation, and particularly in Recommendation ITU-R M.1184, about MSS systems using the 387-390 MHz band. But the Russian system GONETS is identified in the ITU Master Register.

The carried out studies shown that the protection of RAS would be achieved if each satellite of MSS system GONETS-M generates a pfd lower than $-198 \text{ dB(W/m}^2\text{)}$ in the radio astronomy 322-328.6 MHz band. However the analysis of the calculation results shows that there is a positive margin (more than 18 dB for continuum observations and more than 31 dB for spectral line observations) between the actual pfd radiated by GONETS-M in the RAS band and the -198 dBW/m^2 pfd per satellite determined for the protection of the radio astronomy service. This leads to a threshold pfd level for VLBI observations of $-228 \text{ dB(W/m}^2\text{)}$, for the whole bandwidth of 10 kHz in the radio astronomy 322-328.6 MHz frequency band.

For the GSO-case the levels of interference detrimental to the RAS are -189 dBW/m^2 and -204 dBW/m^2 for continuum and for spectral line observations, respectively. Four GSO satellites are currently registered in the 387-390 MHz band, but their technical characteristics are not available. Therefore no problem of compatibility is expected.

3.3. 400.15-401 MHz / 406.1-410 MHz

The 406.1-410 MHz band is allocated on a primary basis to the radio astronomy service along with other services such as the fixed service and the mobile service (except aeronautical mobile). No. 5.149 applies in this band.

This band is used for continuum (broadband) observations only, in single-dish mode.

For making single-dish continuum observations, the entire 3.9 MHz width of the band is used, for which case the threshold pfd limit for detrimental interference is $-189 \text{ dB(W/m}^2\text{)}$.

The 400.15-401 MHz band is allocated to the mobile-satellite service (space-to-Earth) on a primary basis in all regions. Nos. 5.208A and 5.209 apply to the MSS in this band.

The technical and operational characteristics of 4 non-GSO MSS systems using or planned to use the band for either service or gateway downlinks are described in Recommendation ITU-R M.1184-2. Those are systems L, N, Q and S. The orbital characteristics of the actual system Q are different from the ones which are given in Recommendation ITU-R M.1184-2.

The carried out studies shown that the protection of RAS would be achieved if pfd unwanted emission level (per satellite) of each MSS non-GSO systems using the band 400.15-401 MHz falling into the RAS band 406.1-410 MHz should be the following:

System	L	N	Q	S
Required pfd in the passive band (dBW/m^2)	-197	-185	-195	-187

It has to be noted that for the calculation of the total amount of spurious emissions in the RAS band it was considered that spurious emissions have a constant level over the whole RAS band. This hypothesis is

very stringent and clearly not realistic, as spurious emissions generally appear at some discrete frequencies.

Therefore no problem of compatibility is expected.

3.4. 608-614 MHz / 620-790 MHz

The band 608-614 MHz is allocated to the radio astronomy on a primary basis in Region 2, in India by No. 5.307 and in China by No. 5.305. This band is also allocated by No. 5.306 to the radio astronomy service on a secondary basis in Region 1, except in the African Broadcasting Area (see RR Nos. 5.10 to 5.13), and in Region 3. No. 5.149 applies to this band in Regions 1 and 3.

This band is used for continuum (broadband) observations, both in single-dish and VLBI mode.

For making single-dish continuum observations, the entire 6 MHz width of the band is used, for which case the threshold pfd limit for detrimental interference is $-185 \text{ dB(W/m}^2\text{)}$.

VLBI observations, where signals from widely separated antennas are recorded and correlated after the observations, are much less susceptible to interference. This is reflected in the threshold pfd level for VLBI observations in this band, $-172 \text{ dB(W/m}^2\text{)}$, for the whole bandwidth of 10 kHz.

The frequency band 620 – 790 MHz may be used by television stations using frequency modulation in the broadcasting-satellite service under conditions describe in No.5.311 RR. Furthermore the Resolution 545 (WRC-03) asks for studies and the development of sharing criteria and regulatory provisions, prior to WRC-07, for the protection of terrestrial services in the 620-790 MHz band from GSO BSS networks and non-GSO BSS satellite networks or systems that are planned to operate in this band.

This study shows that the protection of RAS would be achieved if the unwanted emission pfd value of Highly Elliptical Orbits (HEO) BSS constellation with three satellites orbiting in a 24-hour period is lower than -188 dBW/m^2 . It corresponds to an attenuation of 74 dB of the pfd radiated by the HEO BSS satellite at the Earth's surface in a 6 MHz bandwidth under the assumption that the maximum pfd radiated by the HEO BSS system in the 620-790 MHz band is $-113 \text{ dBW}/(\text{m}^2 \cdot 8 \text{ MHz})$, which is the maximum level indicated in Recommendation 705.

For the GSO-case the level of interference detrimental to the RAS is -185 dBW/m^2 for continuum observations. No spectral line observations are carried out in this band. Experience shows that real GSO satellites that operate in the 620-790 MHz band meet the RAS detrimental threshold level in the 608-614 MHz band. As a result, no problem of compatibility is expected.

Remark: Any change made under Agenda item 1.11 to the BSS allocation in the band 620-790 MHz may have some consequence on the inclusion of the band pair 620-790/ 608-614 MHz in Tables 1-1 and 1-2 of Resolution 739 (WRC-03).

3.5. 1 400-1 427 MHz / 1452-1492 MHz

No contributions were submitted concerning the protection of this radio astronomy band from unwanted emissions of NGSO BSS systems and studies have not been conducted for this band pair.

3.6. 1 400-1 427 MHz and 1 610.6-1 613.8 MHz / 1525 – 1559 MHz

The 1 400-1 427 MHz band is allocated to passive services only, including RAS on a primary basis. RR No. 5.340 prohibits all emissions in this band.

This band is used more intensely than any other, in all ITU-R Regions. The main radio-astronomical use of band is to make spectral line observations of cosmic neutral atomic hydrogen (also referred to as HI), which has a rest frequency of 1 420.406 MHz. The 1 400-1 427 MHz band is also used for continuum observations of broadband emissions produced by hot plasma.

In the 1 400-1 427 MHz band, for single-dish spectral line observations made using a channel bandwidth (one of the spectrometer channels) of 20 kHz, the threshold pfd for detrimental interference is -196

dB(W/m²). For making single-dish continuum observations, the entire 27 MHz width of the band is used, for which case the threshold pfd for detrimental interference is -180 dB(W/m²).

VLBI observations, where signals from widely separated antennas are recorded and correlated after the observations, are much less susceptible to interference. This is reflected in the threshold pfd level for VLBI observations in this band, -166 dB(W/m²), for a bandwidth of 20 kHz.

The 1 610.6-1 613.8 MHz band is allocated to the radio astronomy service on a primary basis, along with other services such as mobile-satellite and aeronautical radionavigation. No. 5.149 applies to this band.

The 1 610.6-1 613.8 MHz band is used for spectral line observations of the hydroxyl radical (OH). The sources of OH are small and moving at different velocities, give rise to a more complicated spectrum, consisting of a number of superimposed Gaussian line profiles of different widths and amplitudes, and slightly-different frequencies (due to the different Doppler shifts). Therefore the measurements of their size and structure often require observations using the VLBI technique.

In the 1 610.6-1 613.8 MHz band, for single-dish spectral line observations made using a channel bandwidth (one of the spectrometer channels) of 20 kHz, the threshold pfd limit is -194 dB(W/m²). This band is used only for radio line observations, not for continuum observations.

The threshold pfd level for VLBI observations in this band, -166 dB(W/m²), for a bandwidth of 20 kHz but this figure is not included in ITU-R RA.769.

The 1525 - 1559 MHz band is allocated to the mobile-satellite service (space-to-Earth) on a primary basis in all regions.

RR No. 5.356 states that the use of the 1 544-1 545 MHz band by the mobile-satellite service (space-to-Earth) is limited to distress and safety communications.

The 1525 – 1544 MHz and 1545 – 1559 MHz bands are only used by GSO systems and due to the antenna characteristics of MSS Earth stations (omni-directional antenna), it will be impossible for non-GSO systems to use this band. However, Recommendation ITU-R M.1184 gives the characteristics of one non-GSO MSS system that may use the band.

The carried out studies shown that the protection of RAS:

- in the frequency band 1400 – 1427 MHz would be achieved if pfd unwanted emission level (per satellite) of each MSS system G satellite (see Rec. ITU-R M.1184) should generate a pfd of less than -190 dB(W/m²) in the radio astronomy band;
- in the frequency band 1610.6 - 1613.8 MHz would be achieved if pfd unwanted emission level (per satellite) of each MSS system G satellite should generate a pfd of less than -205 dB(W/m²) in any 20 kHz bandwidth of the radio astronomy band.

It has to be noted that in order to calculate the total amount of spurious emissions in the RAS band it was considered that spurious emissions have a constant level in the whole RAS band. This hypothesis is very stringent and clearly not representative of the reality, as spurious emissions generally appear at some discrete frequencies. As a result, no problem of compatibility is expected.

The band 1544 - 1545 MHz has been used by the Cospas-Sarsat global search and rescue satellite-aided system over many years. Cospas-Sarsat is a satellite system designed to provide distress alert and location data to assist search and rescue (SAR) operations, using spacecraft and ground facilities to detect and locate the signals of distress beacons operating on 406 MHz or 121.5 MHz. Non-GSO satellites (LEOSAR system) relay the 121.5 MHz signals as well as data extracted from the 406 MHz signals on the frequency 1 544.5 MHz for ground processing.

The carried out studies shown that the protection of RAS:

- in the frequency band 1400 – 1427 MHz would be achieved if pfd unwanted emission level (per satellite) of each COSPAS-SARSAT satellite should generate a pfd of less than -179 dB(W/m²) in the radio astronomy band;

- in the frequency band 1610.6 - 1613.8 MHz would be achieved if pfd unwanted emission level (per satellite) of each COSPAS-SARSAT satellite should generate a pfd of less than $-193 \text{ dB(W/m}^2\text{)}$ in any 20 kHz bandwidth of the radio astronomy band.

It is feasible to meet the above-mentioned pfd level per satellite without any further constraints on the COSPAS-SARSAT system.

3.7 1559-1610 MHz/1610,6-1613,8 MHz

The 1 610.6-1 613.8 MHz band is allocated to the RAS on a primary basis along with other services such as mobile-satellite and aeronautical radionavigation. No. 5.149 applies to this band.

The 1 610.6-1 613.8 MHz band is used for spectral line observations of the hydroxyl radical (OH). The sources of OH are small and moving at different velocities, give rise to a more complicated spectrum, consisting of a number of superimposed Gaussian line profiles of different widths and amplitudes, and slightly-different frequencies (due to the different Doppler shifts). Therefore the measurements of their size and structure often require observations using the VLBI technique.

In the 1 610.6-1 613.8 MHz band, for single-dish spectral line observations made using a channel bandwidth (one of the spectrometer channels) of 20 kHz, the threshold pfd limit is $-194 \text{ dB(W/m}^2\text{)}$. This band is used only for radio line observations, not for continuum observations.

VLBI observations, where signals from widely separated antennas are recorded and correlated after the observations, are much less susceptible to interference. This is reflected in the threshold pfd level for VLBI observations in this band, $-166 \text{ dB(W/m}^2\text{)}$, for a bandwidth of 20 kHz, which has been developed for VLBI observations, but not included in ITU-R RA.769.

The band 1 559-1 610 MHz is allocated to the radionavigation-satellite service (RNSS) for transmissions from space to Earth.

There are two main types of RNSS systems: non-GSO and GSO but today there are two RNSS systems in operation (GPS and GLONASS) and two planning systems (GALILEO and Quasi Zenith Satellite System (QZSS)). All of them are non-GSO type. ICAO recognizes 1559-1610 MHz frequency band as one of the principal operational bands of international Global Navigation Satellite System (GNSS).

For the case of non-GSO RNSS constellations, an epfd threshold of $-258 \text{ dBW/m}^2/20 \text{ kHz}$ is derived from the RAS protection criterion given in Recommendation ITU-R RA.769-2 for this band. Studies have assumed that future RNSS constellations will have similar characteristics to the operational or planned ones. Two of the RNSS systems considered have more than 19.6 MHz frequency separation from the edge of the radio astronomy band. For these two systems, the epfd threshold of $-258 \text{ dBW/m}^2/20 \text{ kHz}$ translates into a pfd per satellite of $-212 \text{ dBW/m}^2/20 \text{ kHz}$ per satellite in the band 1 610.6-1 613.8 MHz. One of the systems already complies with this level. The other planned system is expected to comply with the same level.

The third system has only 0.6 MHz of separation from the edge of the radio astronomy band, and exceeds the epfd threshold by more than 20 dB. The measurements show that current PFD of unwanted emissions from a single space station is $-187 \text{ dB(W/m}^2\text{)}/20 \text{ kHz}$, when using a post-emission filter. However, in the future, emissions from each satellite of this system would possibly be able to comply with the unwanted emissions pfd limit of -194 dBW/m^2 in 20 kHz. Further reduction of unwanted emissions to the degree of filtering necessary for RNSS systems that have comparably small frequency separation from the radio astronomy band, would cause distortion and degradation of the RNSS signals. Such distorted and degraded RNSS signals may no longer be useful for navigation and positioning purposes.

The feasibility of the RAS protection to the epfd limit derived from the threshold levels given in Recommendation ITU-R RA.769-2 therefore depends primarily on the frequency separation between the RNSS system centre frequency and the edge of the RAS band.

For the HEO RNSS system considered within ITU-R, the epfd threshold derived for this band translates into a pfd of $-203 \text{ dBW/m}^2/20 \text{ kHz}$ per satellite in the band 1 610.6-1 613.8 MHz. This HEO RNSS system is expected to comply with this pfd per satellite.

One administration is of the opinion that, since RNSS is a safety service, any constraint that could cause detrimental effect to RNSS performance is not allowable. In the opinion of ICAO, the frequency band 1 559-1 610 MHz "is the main allocation available for Global Navigation Satellite System (GNSS)" and in accordance to the official policies of ICAO there is "no change to the use of this band for future GNSS

elements, including GLONASS and GPS".

Studies on the sharing and compatibility between one RNSS system and the RAS in the frequency band 1610.6-1613.8 MHz were considered at WARC-92. Based on these studies, consultations with the RAS were organized and an agreement was concluded between the operator of the RNSS system and representatives of the radio astronomy community. The RNSS operator has implemented considerable measures to mitigate interference to the RAS, in line with this agreement. This agreement provides some balance between the interests of both RNSS and RAS in the band pair 1 559-1 610 MHz/1 610.6-1 613.8 MHz.

Should a consultation process lead to more stringent limitations, the above-mentioned balance of interests would not be preserved.

Since one RNSS system might not be able to comply with such a limit, equal access of all RNSS systems to the band 1 559-1 610 MHz might not be provided.

Therefore the pfd value $-194 \text{ dB(W/m}^2\text{)/20 kHz}$ of the unwanted emissions at the Earth's surface from a single RNSS space station can be considered as acceptable value from both point of view of protection of the RAS stations operating in this frequency band and from point of view of feasibility of its implementation for future RNSS systems.

For the GSO-case the level of interference detrimental to the RAS is -194 dBW/m^2 in any 20 kHz portion of the band 1 610.6-1 613.8 MHz for spectral line observations.

3.8. 2655 – 2670 MHz and 2670 – 2690 MHz / 2690 - 2700 MHz

No contributions were submitted concerning the protection of this radio astronomy band from unwanted emissions of active services and studies have not been conducted for these band pairs.

3.9. 10.6 – 10.7 GHz/10.7 – 10.95 GHz

No study has been provided to ITU-R for this particular band pair in response to Resolution 740 (WRC-03). Previous results of study may be found in Report ITU-R SM.2091. and show that it is not feasible for FSS systems to meet the required RAS protection threshold.

3.10. 21.4 – 22.0 GHz/22.21 – 22.5 GHz

Studies were carried out in ITU-R to assess the levels of unwanted emissions generated by a GSO BSS system into the RAS band. The studies incorporated improved characteristics of the output multiplexer (OMUX) filters, spectral regrowth of digital modulated signal due to transponder non-linearity and TWT noise falling into the RAS band. The maximum pfd level in the 21 GHz BSS band to meet the RAS threshold levels given in Recommendation ITU-R RA.769-2 for the RAS band 22.21-22.5 GHz was derived to be $-102 \text{ dB(W/(m}^2 \cdot \text{MHz))}$. Resolution **525 (Rev.WRC-03)** gives a threshold pfd value of $-105 \text{ dB(W/(m}^2 \cdot \text{MHz))}$ for BSS in the band 21.4-22.0 GHz for angles of arrival between 25° and 90° above the horizontal plane. If this in-band pfd level is met by the BSS, a margin of at least 3 dB can be attained with respect to the pfd threshold level in Recommendation ITU-R RA.769-2. The details of the studies are shown in Report ITU-R BO.2071.

It should be noted that the maximum pfd level in the BSS band that allows meeting the threshold level of detrimental interference in the RAS band depends very strongly on the BSS channel bandwidth, filter characteristics and the non-linear characteristics of the transponder.

4. Summary of ITU-R CPM report

Methods to satisfy the agenda item:

4.1. Method 1

Add the threshold levels for those bands for which studies have been concluded to Tables 1-1 and 1-2 of Resolution **739 (WRC-03)** and modify *Resolves 5* so that the date of application of that Resolution for these new pairs of bands is set at the entry in force of the Final Acts of WRC-07. Remove those band pairs from the table Resolution **740 (WRC-03)**. Maintain *resolves 7* of Resolution **739 (WRC-03)** unchanged.

4.2. Method 2

This method is similar to Method 1, with the exception that the applicability of Tables 1-1 and 1-2 of Resolution **739 (WRC-03)** is not extended to cover RNSS for the band pair 1 559-1 610 MHz/1 610.6-1 613.8 MHz and that ITU-R Resolution 740 (WRC-03) is withdrawn.

4.3. Method 3

Incorporation of the threshold levels studied for the GSO case into Table 1-1 and no incorporation of the threshold levels for the non-GSO case studied into Table 1-2 of Resolution **739 (WRC-03)**.

List of relevant documents

- ITU-R Resolution 739
- ITU-R Resolution 740
- Report ITU-R SM.2091
- Recommendation ITU-R M.1583
- Recommendation ITU-R S.1586
- Recommendation ITU-R RA.1631
- Recommendation ITU-R RA.1513
- Recommendation ITU-R SM.1542
- Recommendation ITU-R RA.769
- ECC Recommendation 02-05
- ERC Recommendation 74-01
- Report of the September 2006 meeting of ITU-R TG 1/9 (Document 1/9-189)
- Annex to the Doc. CPG07/PT2(06)14 – “Report on Monitoring Glonass Emissions in the Radio Astronomy Band 1610.6-1613.8 MHz and in the Useful Band at 1.6 GHz” Doc. 030SE21(06) - Report on Monitoring Galileo Emissions in the Band 1559-1594 MHz and Unwanted Emissions in the Radio Astronomy Band 1610.6-1613.8 MHz

Actions to be taken

None

Proposals from outside CEPT

Regional telecommunication organisations

APT (January 2007)
APT Preliminary views

The threshold levels of unwanted emissions from active space services should be appropriately determined taking into account the results of ITU-R studies.

APT members support to add the threshold levels to Tables 1-1 and 1-2 for some bands for which studies have been concluded and modify the *resolves* of Resolution 739 (WRC-03) so that no retroactive provisions of this Resolution will be applied to these new band pairs. APT members also support a modification of RR No. 5.347A to insert additional frequency bands.

The table of band pairs to be considered for future studies in Resolution 740 (WRC-03) will need to be updated accordingly.

It was agreed to reconsider the significance of Resolution 739 (WRC-03), that defines the threshold values to trigger the consultation procedures, until the next APT meeting in order to decide band pairs and target values needed to be added to tables of Resolution 739 (WRC-03).

Arab Group:

No information available.

CITEL (November 2006)

Preliminary views:

Brazil, Canada, United States of America:

Compatibility studies must be undertaken in ITU-R Task Group 1/9 in order for WRC-07 to determine which, if any, frequency band pairs and corresponding threshold levels could be added to Tables 1-1 or 1-2 in the Annex to Resolution 739 (WRC-03). These studies should take into account the impact of the threshold levels on the concerned active and passive radio services to ensure equitable burden sharing between services.

CITEL administrations intend to participate in the compatibility studies within ITU-R TG 1/9.

The scope of Agenda Item 1.21 is limited to consideration of the frequency band pairs listed in the table of Resolution 740 (WRC-03) by the ITU-R for the purpose of making appropriate additions to the existing tables in Resolution 739 (WRC-03).

Any proposal for inclusion of frequency band pairs not listed in Resolution 740 (WRC-03) would be contrary to the intent, and outside the scope of this agenda item.

RCC (January 2007)

One should take into account Recommendations ITU-R **RA.1513-1** and **RA.769-2**, as well as the feasible and technically justified capabilities of active space service stations on mitigation of unwanted emissions when developing the conditions of the compatibility between the radio astronomy service and active services. Besides, it is necessary to take into account interference mitigation techniques used at the radio astronomy service stations.

In the 1610.6 – 1613.8 MHz band the protection of the radio astronomy service should not lead to additional constraints to the RNSS as this is to the safety life service.

In respect of new bands for which threshold levels used for consultation may be defined one should apply the provisions of Resolution 739 (WRC-03) not earlier than the WRC-07 completion and only regarding the active service stations assignments notified after the new limits will come into force.

International organisations

NATO (January 2007)

NATO Military Position

- (a) Spectrum access for military mobile satellite systems (space-to-Earth) at 387-390 MHz and for radionavigation-satellite systems of military interest at 1 559-1 610 MHz (Link 1) must be adequately safeguarded.
- (b) The protection requirements of the RAS are noted. They must not lead to undue constraints for the above-mentioned, essential satellite-based services.
- (c) To this end, the study results pursuant to Res. 740 (WRC-03) must be carefully considered as to their potential impact on vital active services.

ICAO (November 2006)

Protection of the radio astronomy service in the band 1 610.6 - 1 613.8 MHz should not impose undue constraints to the use of the band 1 559 - 1 610 MHz by aviation.

Regional organisations

Asia-Pacific Broadcasting Union (ABU) Views (November 2006)

Regarding the issue under Res. 740, ABU may accept Method 1 so far as the current result of ITU-R studies is only applicable to the band except the L-Band and S-Band pairs considering the following situation.

With respect to the studies of the BSS/RAS band pair 21.4-22.0 GHz / 22.21-22.5 GHz, Annex 12 of the Recommendation ITU-R SM.1633 (*editorial remark of CEPT Coordinator: today result of this study contains in the Annex 15 of the Report ITU-R SM.2091*) provides the methodology and the result of the compatibility studies between the BSS and the RAS. But, these studies need further refinement as described in *recognizing b)* of Resolution 740.