Draft CEPT Brief on agenda item 1.9

1.9: to review the technical, operational and regulatory provisions applicable to the use of the band 2 500-2 690 MHz by space services in order to facilitate sharing with current and future terrestrial services without placing undue constraint on the services to which the band is allocated

Issue

The aim of WRC-07 agenda item 1.9 is to conduct studies related to the sharing between satellite and terrestrial services allocated in the band 2500-2690 MHz, with the view to define the technical and regulatory provisions applicable to satellite services in order to protect current and future terrestrial services in the band 2500-2690 MHz, without placing undue constraint on the services to which the band is allocated.

Preliminary CEPT position

1. The scope of agenda item 1.9 is limited to the review of the technical, operational and regulatory provisions applicable to transmit space stations in the band 2500 – 2690 MHz in order to protect terrestrial stations in the fixed and mobile services. The review of technical, operational and regulatory provisions applicable to terrestrial services in order to protect satellite systems in the band 2500-2690 MHz are out of the scope of this agenda item.

2. Future deployment of terrestrial IMT-2000, further development of IMT-2000 and IMT-Advanced in the band 2500 - 2690 MHz must be fully safeguarded.

3. The protection of terrestrial systems currently deployed in Europe in the band 2500-2690 MHz should be ensured.

4. The regulatory provisions adopted by WRC-03 under agenda item 1.34 successfully addressed the sharing between GSO and non GSO Broadcasting Satellite Service (sound), and terrestrial services, including IMT-2000 systems in the band 2605-2655 MHz and should remain unchanged.

5. The current article 21 power flux density limits applicable to space services would lead to interference into IMT-2000 systems considerably above the appropriate sharing criteria. It is therefore necessary to tighten these values to safeguard terrestrial systems including IMT-2000 systems, further development of IMT-2000 and IMT-Advanced in the band 2500-2690 MHz.

6. Except Broadcasting Satellite Service (sound), all space services having allocations in the frequency band 2500-2690 MHz shall be subject to Article 21 limits

7. Europe proposes to set these pfd limits to the following values, in dBW/m²/MHz:

-133	for	$0 \leq \theta \leq 5°$
$-133 + 8/20*(\theta - 5)$	for	$5 \leq \theta \leq 25°$

-125 for $25 \leq \theta \leq 90°$

with θ the angle of arrival above the horizontal plane.

8. To consider the date of application of the new provisions as an important issue and to consider that a suitable solution may be for the proposed new limits to apply to any satellite systems or networks operating in the 2500-2690 MHz band except those for which complete notification information has been received by the Radiocommunication Bureau before 17 November 2007, and whose frequency assignments in the 2500-2690 MHz band were brought into use by 31 December 2008 (the existing limits shall continue to apply to these latter systems).
9. To deactivate the No. **9.19** of the Radio Regulations : the intention of CEPT is to remove any necessity for coordination of the terrestrial services, including IMT-2000 and systems beyond with the typical earth stations of the broadcasting-satellite service in frequency band 2520-2670 MHz. Therefore, given that the provisions of No. **9.19** may place undue constraints on the terrestrial services in the band 2520-2670 MHz band, where major developments in the terrestrial services are foreseen, it is proposed to deactivate its application in this band.

Note: the deactivation of No. **9.19** is considered for the band 620-790 MHz (see CPM text on Agenda Item 1.11). An alternative proposal to this "band by band" deactivation is to deactivate the No. **9.19** for all the bands except those relating to appendix 30/30A. It should be noted that this alternative proposal is beyond AI 1.9 and could be addressed under AI.1.12.

Background

The band 2500-2690 MHz was identified by WRC-00 for IMT-2000.

In CEPT, the band 2500 – 2690 MHz is designated for terrestrial IMT-2000/UMTS systems through ECC decisions DEC(02)06 and DEC(05)05. The band is currently used by a variety of applications such as ENG/OB (programme-making), Wireless Local Loop and Point to Point Systems and it will be made available for terrestrial IMT-2000/UMTS by 1st January 2008.

It is therefore necessary to ensure that current terrestrial systems as well as IMT-2000 systems, further development of IMT-2000 and IMT-Advanced in the band 2500-2690 MHz are adequately protected from satellite systems interference, which is the scope of WRC-07 agenda item 1.9.

WRC-03 decisions under its agenda item 1.34, reviewed the technical and regulatory provisions applicable to non-GSO and GSO BSS (sound) systems in the band 2605-2655 MHz in a limited number of countries listed in RR footnotes No. 5.418 and 5.417A in order to allow the introduction of BSS (sound) systems in these countries whilst safeguarding the current and planned use of this band by terrestrial services, and in particular IMT-2000 systems, in most countries over the world. The protection of terrestrial systems from BSS (sound) interference, was achieved by adopting new regulatory and technical provisions included in the revisions of Resolution 539, footnote No. 5.418 and Appendix 5 and new footnote No. 5.417A.

The studies undertaken under WRC-03 agenda item 1.34 showed that the IMT-2000 were more susceptible to interference than systems in the fixed services. They also showed that BSS (sound) systems are designed to provide service to very small antennas (0 to 2 dBi), and need very high power signals on their service area. WRC-03 managed very wisely this challenging sharing

situation, and elaborated a decision that covered to the most extent possible, the regulatory and technical needs of terrestrial services, in particular IMT-2000 systems and the technical specificities of the BSS (sound) systems planned in a few countries in Region 3. It is worthwhile saluting and recognizing the mutual understanding efforts that helped coming to this decision. WRC-07 agenda item 1.9 conclusions should therefore not modify the solution that was elaborated on WRC-03 agenda item 1.34.

The technical and regulatory studies that addressed the sharing between BSS (sound) systems and terrestrial systems in the band 2605-2655 MHz under WRC-03 agenda Item 1.34, highlighted the fact that the technical and regulatory provisions currently applicable to space services allocated in the band 2500 – 2690 MHz, do not provide efficient safeguard to the current and future terrestrial systems in the band 2500-2690 MHz. WRC-07 agenda item 1.9 was proposed in this context.

Satellite and terrestrial allocations in the band 2500 – 2690 MHz

The following Table 1 summarizes the primary allocations in the 2 500-2 690 MHz band after 01/01/2005 and regulatory provisions applicable to the space services allocations in regard to terrestrial services.

TABLE 1

Primary Allocations in the 2 500-2 690 MHz band after 01/01/2005 and regulatory provisions applicable to the space services allocations in regard to terrestrial services

<table>
<tr><td colspan="12">2500 2515 2516.5 2520 2535 2550 … 2630 2655 2670 2690</td></tr>
<tr><td colspan="12">FSS (↓) R2 limited to national and regional systems, (No. 5.415). Table 21-4 applies under No. 9.6.3 – see Note 1 and Note 2</td></tr>
<tr><td colspan="6">FSS (↓) R3 limited to national and regional systems, (No. 5.415). Table 21-4 applies under No. 9.6.3 – see Note 1 and Note 2</td><td colspan="6"></td></tr>
<tr><td colspan="4">MSS (↓) R1, R2, R3 No. 9.11A (No. 5.414)</td><td colspan="8"></td></tr>
<tr><td colspan="3"></td><td colspan="3">MSS (↓) except AMSS No. 9.21 R1, R2, R3 within national boundaries (No. 5.403). No. 9.11A also applies.</td><td colspan="6"></td></tr>
<tr><td colspan="3"></td><td colspan="9">BSS R1, R2, R3 limited to national and regional systems and community reception, (No. 5.416). Table 21-4 applies under No. 9.6.3. – see Note 1 and Note 2</td></tr>
<tr><td colspan="3"></td><td colspan="5">BSS (sound) R3 countries in .No. 5.418 and No. 5.417A , limited to national systems (for GSO systems from 1st June 2005). pfd limits apply except in a limited area around the national boundaries where No. 9.11 applies (No. 5.418 (for GSO, from 1st June 2005 only), No. 5.417A and Resolution 539)</td><td colspan="4"></td></tr>
<tr><td colspan="2">RDSS (↓)IND and IRN (No. 5.404). Table 21-4 applies under No. 9.6.3. – see Note 1</td><td colspan="10"></td></tr>
<tr><td colspan="2"></td><td colspan="4">AMSS (↓) No. 9.21 IND and J (No. 5.415A). No. 9.11A also applies</td><td colspan="6"></td></tr>
<tr><td colspan="6"></td><td colspan="4">MSS except AMSS (↑) R1, R2, R3 No. 9.21 within national boundaries (No. 5.420). No 9.11A also applies.</td><td colspan="2">MSS (↑) R1, R2, R3 No. 9.11A (No. 5.419)</td></tr>
<tr><td colspan="6"></td><td colspan="6">FSS (↑) R2, R3 limited to national and regional systems, No. 9.21 (No. 5.415) – see Note 2</td></tr>
<tr><td colspan="6"></td><td colspan="5"></td><td>AMSS (↑) IND and J No. 9.21 (No. 5.420A)</td></tr>
<tr><td colspan="12">FS R1, R2, R3</td></tr>
<tr><td colspan="12">MS except Aeronautical MS R1, R2, R3 IMT-2000 (No. 5.384A)</td></tr>
</table>

RADIOLOCATION F (No. 5.405)				

*Note 1: WRC-03 has adopted new provision No. **9.6.3** which reads "Unless otherwise specified, coordination under any of the particular sharing situations defined in Nos. **9.7** to **9.21** is not applicable when limits for that sharing situation are specified elsewhere in these Regulations." Therefore, it is understood that when an allocation is subject to both No. **9.21** and hard limits (Table **21-4**), in the case of a space station with respect to terrestrial services, the BR shall only examine the conformity with the limits of Table **21-4**.*

*Note 2: following the decisions at WRC-03, the RRB has adopted, at its 32nd meeting (1-5 December 2003) a Rule of Procedure on No. **5.415** (also applicable to No. **5.416**) to describe the regulatory mechanism associated with the limitation to national and regional systems.*

Table 1 above shows that most of the satellite service allocations in the 2500-2690 MHz band are limited to national (or regional) systems, or to a very limited number of countries. It can also be noted that all these systems are subject to No. **9.21**, and in some cases (mainly FSS and BSS), they would finally be subject to Article **21** pfd limits according to No. **9.6.3**. The MSS allocation in the 2500-2520 MHz (space to Earth) and 2670-2690 MHz (Earth to space), from the 1st of January 2005 is the only exception. This allocation is worldwide and the sharing with terrestrial services is subject to No. **9.14** only.

This allows the establishment of three classes of sharing situations, which set out different regulatory and operational characteristics, which are:

- **Class 1**: Co-frequency sharing between national or regional limited coverage satellite systems, subject to No. **9.21,** or Article **21** pfd limits via No. 9.6.3, and terrestrial systems; this would cover (see Table 1 above):
  - The MSS allocation in the bands 2520-2535 MHz and 2655-2670 MHz (No. **5.403** and **5.420**).
  - The BSS allocation in the band 2520-2670 MHz (No. **5.416**).
  - The FSS allocation in R3 in the bands 2500-2535 MHz and 2655-2690 MHz, and in R2 in the band 2500-2690 MHz (No. **5.415**).
  - The RDSS in IND and IRN in the band 2500-2516.5 MHz (No. **5.404**).
  - The AMSS in IND and J in the band 2515-2535 MHz (No. **5.415A**).
- **Class 2**: Co-frequency sharing between worldwide MSS, subject to No. **9.14**, and terrestrial services:
  - This would cover the MSS allocation under No. **5.414** in the band 2500-2520 MHz, which may also be used for the satellite component of IMT-2000.
- **Class 3**: BSS (sound) systems in the band 2605-2655 MHz. The decisions of WRC-03 mastered the sharing situation between these systems and the terrestrial services, therefore no further studies are needed.

List of relevant documents

- ***IMT-2000 characteristics and protection criteria***

JTG 6-8-9 adopted a set of agreed characteristics for terrestrial IMT-2000 systems to be used in the interference analysis. These characteristics are provided in Annex 2 of document JTG 6-8-9/125125 (chairman's report of the last JTG 6-8-9 meeting, July 2006).

Annex 2 of document JTG 6-8-9/125 sets out that an interference situation leading to a I_{ext}/N_{th} = -10 dB ratio would have the following impact:

- an increase of 6% of the number of base stations would be necessary in rural areas and 2% in urban areas to compensate the induced coverage reduction;
- an increase of 3% to the cell load factor in urban areas.

Further information on IMT-2000 technical characteristics is provided in the following reports and recommendations:

- Report ITU-R M.2039 "Characteristics of Terrestrial IMT-2000 System for Frequency Sharing/Interference Analyses" contains the characteristics of all the 5 members of the IMT-2000 family.
- Report ITU-R M.2041 "Sharing and adjacent band compatibility in the band 2 500–2 690 MHz between terrestrial IMT-2000 and MSS".
- Recommendation ITU-R M.1646 – "Parameters and criterion to be used in co-frequency sharing and pfd threshold studies between terrestrial IMT-2000 and BSS (sound) in the 2 630-2 655 MHz band".

- ***Fixed services characteristics and protection criteria***

  JTG 6-8-9 adopted a set of agreed characteristics for terrestrial fixed systems in the band 2500-2690 MHz to be used in the interference analysis. These characteristics are provided in Annex 2 of document JTG 6-8-9/125.

- ***Methodology to assess the interference from space stations into terrestrial systems***

  JTG 6-8-9 developed and agreed on a methodology to assess the aggregate interference from various satellite systems into terrestrial systems, including IMT-2000 systems in the band 2500- 2690 MHz. This methodology is based on recommendation ITU-R M.1654 and on CEPT contributions to JTG 6-8-9 meeting. JTG 6-8-9 meeting of August 2005 reviewed this methodology, in particular with the insertion of a more accurate model for the calculation of the polarisation discrimination. The agreed methodology is defined in Annex 2 of document JTG 6-8-9/125.

- ***Regulatory aspects***

  The hard limit regulatory regime based on the specification of a power flux density mask in Article 21 of the Radio Regulations, would be the regulatory regime that ensures the long term safeguard of terrestrial systems in the band 2500-2690 MHz from satellite interference.

- ***Results of technical studies***

  CEPT presented to JTG 6-8-9 a comprehensive analysis of interference to IMT-2000 systems from satellite systems based on the agreed JTG 6-8-9 methodology and agreed input parameters. This clearly demonstrated that using the current satellite pfd mask in Article 21 of the Radio Regulations for BSS systems interference levels significantly in excess of the interference criterion will occur to IMT-2000 systems. A sensitivity analysis provided additional results analysing the impact of other interference levels which would avoid or

have only a small impact. The CEPT study indicates that a possible pfd mask that may be suitable to limit excess interference into IMT-2000 to a level that might be acceptable could be -133 / -125 dBW/m²/MHz. Such a figure would lead to interference above an I/N= -10 dB criterion at only 1 to 4 % of earth locations. A summary of the different sharing study results considered by the JTG 6-8-9 can be found in the document JTG 6-8-9/125, Annex 5.

- ***CPM text (Annex 1 of document JTG 6-8-9/125)***

  At the 5th and final JTG 6-8-9 meeting, July 2006, CEPT proposed the compromise mask -133 / -125 dBW/m²/MHz with the hope to start the discussions with a relatively narrow range of values. However, given the hardened position from the satellite community (which proposed the existing mask from the article 21 of RR : -113/-128), the CEPT finally proposed to consider the envelop of the all the masks obtained before the sensitivity analysis. This approach was supported by a number of administrations defending the terrestrial interests in this band, and accepted by all the participants.

  Although, the sharing study results included in the draft CPM text mention different satellite pfd masks, with and without sensitivity analysis, the masks expressed in the section "methods to satisfy the agenda item" are the envelop of all the proposed masks in the study results section.

Actions to be taken

Proposals from outside CEPT

European Union

Regional telecommunication organisations

APT (January 2007)

The APG supports any fair solution that satisfies all concerned parties without any undue constraint on either the terrestrial or space services.

If possible, the preferred solution would be to use a hard limit regulatory regime, based on the specification of a power flux density mask in Article 21 of the Radio Regulations (Method A in the draft CPM Report and Method B, except for MSS), would ensure the long term safeguard of terrestrial systems in the band 2 500-2 690 MHz from satellite interference, provided that no undue constraints are placed on the services to which the band is allocated on a co-primary basis. Such a regime would also be beneficial to the long-term development of space services, as a defined set of pfd limits would be known. If it is not possible to derive suitable pfd limits that are both sufficient to protect terrestrial services and allow for the operation of space services, an alternative method would be to use a coordination procedure using coordination triggers (Method B for MSS or Method C in the draft CPM Report). However, as noted in the disadvantages associated with Method B in the draft CPM Report, this coordination approach would pose difficulty to some

countries in satisfying all the required coordination procedures of Radio Regulations and in addition, may not ensure the long term protection of terrestrial services in the band 2500-2690MHz from satellite interference.

Noting that the Agenda Item seeks a solution that "*does not place undue constraint on the services to which the band is allocated*", it is important to stipulate appropriate sharing criteria and regulations to ensure that the existing systems in the 2500-2690 MHz band are protected, and that, taking into account the trend of future systems and the global harmonization, both of the existing and future systems are able to operate in this band in a well-balanced manner. Any solution should not have any retroactive implication on satellite networks and systems for which filings (complete Appendix 4 coordination information) have been received by the Radiocommunication Bureau prior to the last day of WRC-07 or the date of entry into force of the Final Acts of WRC-07[1].

The APG supports the changes proposed by the Special Committee in Document CPM07-2/2 on the example regulatory texts for the above Methods to satisfy Agenda item 1.9. These texts concern footnotes Nos. **5.403, 5.414, 5.416,** Article **59** and an associated draft new **Resolution**. In particular, the Special Committee addressed the date at which changes to provisions in the Radio Regulations relating to this Agenda Item. The Special Committee proposed that the relevant dates may be either the last day of WRC-07 or on the first of January 2009, which is the anticipated date of coming into force of WRC-07 Final Acts.

It is also noted that this Agenda Item is "to review the technical, operational and regulatory provisions applicable to the use of the band 2 500-2 690 MHz by space services", therefore the technical, operational and regulatory provision applicable to terrestrial services are out of scope of this agenda item and no new provision nor modification to the current provisions applicable to terrestrial services in Radio Regulations are required.

ATU (date of proposal)

Arab Group (July 2005)

- Support the studies being undertaken in ITU-R Joint Task Group 6-8-9 which has been explicitly created to cover this agenda item, recognizing that the most up-to-date common characteristics for terrestrial and satellite systems needs to be used in assessing protection requirements.
- Technical, operational and regulatory provisions applicable to terrestrial services are out of the scope of this agenda item.
- Sharing studies between GSO broadcasting satellite service (sound), and terrestrial services in the 2 605-2 655 MHz band have been concluded by WRC-03 and shall not be debated again.

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[1] These alternative dates are indicative and follow from the example regulatory text developed by the Special Committee for this Agenda Item. See Document CPM07-2/2.

CITEL (October 2006)

Generally speaking, the CITEL countries support the following statement: the review of technical, operational and regulatory provisions applicable to the use of the band 2 500-2 690 MHz by space services shall address full protection of current and future terrestrial services. However, certain countries have not taken any position yet (e.g.: Canada).

To summarize, CITEL elaborated two IAPs and two draft IAPs on AI 1.9:

1. IAP°1: suppression of MSS allocations in the 2500/2520 band in Region 2. This proposal is supported by the following administrations: Argentina, Brazil, Chile, Costa Rica, Peru and Uruguay.

2. IAP n°2: suppression of MSS allocations in the 2670/2690 band in Region 2. This proposal is supported by the following administrations: Argentina, Brazil, Chile, Costa Rica, Peru and Uruguay.

3. Draft IAP n°1: definition of a satellite pfd value of -136 dBW/m2/MHz at angles below 5°, and -122 dBW/m2/MHz at angles greater than 25°, that yields acceptable levels of interference to terrestrial services in the 2500-2690 MHz band. This proposal for a hard limit regime applies to all satellite services: Fixed-satellite, Broadcasting-satellite, Radiodetermination-satellite, Mobile Satellite (Space to Earth). This proposal is supported by the following administrations: Brazil, Uruguay, USA, Costa-Rica and Mexico.

4. Draft IAP n°2: suppression of the coordination threshold for the satellite services in the band 2500-2520 and in the band 2520-2535 MHz since the Draft IAPn°1 is to consider all satellite services under the hard limit regime: This proposal is supported by the following administrations: Brazil, Uruguay, USA, Costa-Rica and Mexico.

It has also to be noted that most of the CITEL Administrations have not taken any position yet. They intend to do so at the next CITEL PCCII meeting in April 2007.

RCC (September 2006)

The existing and future terrestrial services including the terrestrial segment of IMT-2000 systems and the systems beyond IMT 2000 shall be protected in the whole band 2500-2690 MHz.

The technical, operational and regulatory provisions applicable to the terrestrial services are not the subject of study under this agenda item and shall not be considered.

It is admitted to introduce more stringent values of the PFD levels from space stations of the satellite systems operating in the frequency band 2500-2690 MHz except the broadcasting satellite service systems (sound) and including these values in Table **21-4** of Article **21** of Radio Regulations.

Compatibility conditions between GSO BSS (sound), non-GSO BSS (sound) and terrestrial services in the frequency band 2605-2655 MHz were defined at WRC-03 and shall also not be revised.

International organisations

ICAO (date of proposal)

IMO (date of proposal)

NATO (date of proposal)

SFCG (date of proposal)

Regional organisations

ESA (date of proposal)

Eumetnet (date of proposal)

Eurocontrol (date of proposal)

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