



International Telecommunication Union

WRC-07 outcome related to Space Services

45th Session Scientific and Technical Subcommittee of COPUOS
VIC, Vienna, Austria -11-22 February 2008

Helping the world communicate



The ITU in brief

- UN specialized agency, concerned with the development of telecommunication networks and services worldwide
- 143 years old (Founded on 17 May 1865)
- 191 Member States, 700 Sector Members
- 750 staff / 71 nationalities
- Website - **<http://www.itu.int>**



ITU is the leading UN agency for information and communication technology

- bridging the digital divide;
- stewardship of the radio spectrum;
- adopting international telecommunication standards;
- building confidence and security in the use of information and communication technologies (ICTs);
- emergency communications.



ITU and Space Radiocommunications

"To ensure *rational, equitable, efficient and economical use of the radio frequency spectrum* by all radiocommunication services - *including those using the geostationary satellite orbit or other satellite orbits* - and to carry out studies on radiocommunication matters"

Constitution of the ITU, Article 12



ITU and Space Radiocommunications

Use of the Radio-Frequency Spectrum and of the Geostationary-Satellite and Other Satellite Orbits

“Members shall endeavour to limit the number of frequencies and the spectrum used to the minimum essential to provide in a satisfactory manner the necessary services. To that end, they shall endeavour to apply the latest technical advances as soon as possible”

Constitution of the ITU, Article 44/195



ITU and Space Radiocommunications

“ ... radio frequencies and any associated orbits, *including the geostationary-satellite orbit*, are limited natural resources and that they *must be used rationally, efficiently and economically, in conformity with the provisions of the Radio Regulations*, so that countries or groups of countries may have

“ equitable access to those orbits and frequencies,

taking into account the special needs of the developing countries and the geographical situation of particular countries”

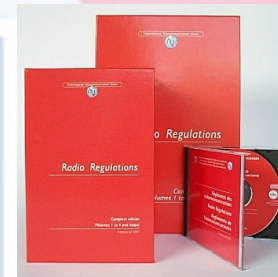
Constitution of the ITU, Article 44/196



ITU Radiocommunication Sector (ITU-R)

- Plays a vital role in global management of international radio frequency-spectrum & satellite orbits, an important components of any space-related activities
- Ensures development of legally binding Worldwide Agreements and Standards, for more than 100 years:

➤ The Radio Regulations



➤ The ITU-R Recommendations Reports and Handbooks





World Radiocommunication Conference 2007 (WRC-07)



(Geneva, 22 October – 16 November 2007)

'bringing all radio services together'

- Most rational and efficient way to exploit the limited radio frequency resources and to manage satellite orbits;
- Critical for the achievement of global connectivity goals.



WRC-07 in brief

The Radio Regulations are updated every 3/4 years at the WRCs (2003, 2007, 2011...) reflecting latest technological achievements

- 2822 delegates, 161 Member States, 94 observer organizations
- Over 3100 proposals in 350 documents, 11 800 pages translated to 6 languages of the Union, 9 Millions pages in reprography
- Over 1100 meetings, 30 meetings/day
- Provisional Final Acts (500 pages)





WRC-07 in brief

Space-related activities (WRC-07 decisions)

- Extend frequency allocations for Earth Exploration by satellite (EESS)
 - facilitating research and exploration of Earth resources and environmental elements,
 - for key services to monitor the planet and predict and monitor disasters, meteorology and climate change
- Call for urgent studies on Spectrum Management and ICT aspects for early warning, disaster mitigation and relief operations
- Reflect the latest technological achievements in the worldwide allocated spectrum/orbit resources for satellite applications



Space-related activities (WRC-07 decisions -1a)

- Resolution 80 - **Due diligence in applying the principles embodied in the ITU Constitution** - *considering and noting*
 - Articles 12 and 44 of the Constitution lay down the basic principles for the use of the radio-frequency spectrum and the geostationary-satellite and other satellite orbits;
 - those principles have been included in the Radio Regulations;
 - the Agreement between the UN and the ITU recognizes the ITU as the specialized agency responsible for taking such action as may be appropriate under its basic instrument (RR);
 - *that the Legal Subcommittee of the COPUOS has drawn up recommendations in this respect*
 - that some of the issues identified in the report have been resolved before WRC-07 (no more backlog in the Bureau processing)



Space-related activities (WRC-07 decisions -1b)

- Resolution 80 - **Due diligence in applying the principles embodied in the ITU Constitution** - *resolves*
 - to carry out studies on procedures for measurement and analysis of the application of the basic principles contained in Article 44 of the Constitution;
 - to instruct the RRB to consider and review possible draft recommendations and draft provisions linking the **formal registration procedures** (coordination and notification) and to report to each future WRC with regard to this Resolution;
 - instruct the Bureau to submit to each future WRC a detailed progress report on the action taken on this Resolution,
- invites*
 - the RAG, to make contributions to the Bureau for inclusion in his report to each future WRC;
(see doc REG08/11 from CLM)
 - administrations to contribute to the studies and to the work of the RRB



Space-related activities (WRC-07 decisions -2)

- Improve the fixed-satellite service plan's effectiveness and facilitate access to spectrum for FSS systems (Appendix 30B)
- To ensure interference compatibility between different space & terrestrial services sharing the same bands
- Use and further development of satellite systems using **highly inclined orbits**



WRC-07 AI 1.18 to review pfd limits in the band 17.7-19.7 GHz for satellite systems using highly inclined orbits, in accordance with Resolution 141 (WRC-03)

Highly Inclined Orbit (HIO) is a follow-on item from the Highly Elliptical Orbit (HEO) discussions in WRC-2003 in which Res 141 was conceived and where the ITU-R was invited to conduct appropriate technical studies

To determine if the existing pfd limits are adequate to protect FS from non-GSO HIO FSS
To determine if there are measures in which FS can mitigate interference from the non-GSO HIO FSS
And for WRC-07 to take in to account the result of these studies

Many studies carried out
However, results vary widely

Resolution 141 (WRC-03)

To determine if the pfd limits in the Article 21 are adequate to protect FS and without unduly constraining the use of non-GSO FSS systems.

Highly Inclined Orbit

apogee greater than 18000 km and an orbital inclination between 35 degrees and 145 degrees



ITU-R study OUTPUTS

Method C

More
stringent
PFD mask
for HIO
satellites
in 17.7 - 19.7
GHz

Method B

No Change
to current
Article 21
mask with
implementation
of HIO
FSS mitigation
techniques
(operational measures)

No Change to current Article 21 mask
Method A



Outcome of WRC-07

Sharing agreement between the non-GSO HIO FSS and the FS

Existing limits for

HIO type systems covered by RES (namely USCSID-P and replacement)

HIO type systems not covered by RES which C or N is received before end of WRC-07

New limits (marriage of Method A and C)

HIO type systems covered by RES which C or N are received after the WRC-07

Implementation in the Radio Regulations

Creation of a new Resolution to describe the type of HIO type systems which are to be exempted from the stricter PFD limits

Modification of the PFD Table 21-4 with additional footnote references to direct the appropriate application of the limits to the appropriate type of HIO systems

Suppression of RES141 which is the Resolution which originally called for the study of this issue



Space-related activities (WRC-07 decisions -3)

- **WRC-07 considered (with positive results) 4 main issues directly related to remote sensing**
 - extension of band for active sensors;
 - extension of band for meteorological-satellite service;
 - sharing between Earth exploration-satellite service (EESS) (passive) and active services;
 - protection of EESS (passive) from unwanted emission from actives services.



WRC-07 **AI 1.20**: Protection of EESS (passive) from unwanted emissions of active services

AI 1.20 - to consider the results of studies, and proposals for regulatory measures if appropriate, regarding the protection of the EESS (passive) from unwanted emissions of active services in accordance with **Resolution 738 (WRC-03)** - Compatibility analyses between the Earth exploration-satellite service (passive) and active services.

Note: Some of the frequencies used by the EESS (passive) sensors are chosen to study natural phenomena producing radio emissions at frequencies fixed by the laws of nature, for example:

- band 1 400-1 427 MHz is used for measuring soil moisture, and also for measuring sea surface salinity and vegetation biomass;
- bands 23.6-24 GHz, 31.3-31.5 GHz, 50.2-50.4 GHz and 52.6-54.25 GHz are vital to weather prediction and disaster management.



WRC-07 AI 1.20: Protection of EESS (passive) from unwanted emissions of active services

Based on Resolution 738 (WRC-03) *resolves 1 and 2*
EESS protection criteria derived from each band-pair.
Results of the studies are based on Rep. ITU-R SM.2092

Passive band	Active band	Active service
1400 - 1427 MHz	1350 - 1400 MHz	FS, MS, RLS, SRS
23.6 - 24.0 GHz	22.55 - 23.55 GHz	ISS
31.3 - 31.5 GHz	30.0 - 31.3 GHz	FS
50.2 - 50.4 GHz	49.7 - 50.9 GHz	FSS
52.6 - 54.25 GHz	51.4 - 52.6 GHz	FS



WRC-07 AI 1.20: Protection of EESS (passive) from unwanted emissions of active services

Methods to satisfy the agenda item - AI 1.20:

- 1:** Establish a mandatory unwanted emission power limit from a single transmitter of a specified service in adjacent or nearby band
(EESS protected but less flexibility for ADMs regarding unwanted emissions);
- 2:** Establish non-mandatory limits
(more flexibility for ADMs but sensors might not be protected);
- 3:** No power limits but strongly encourage ADMs to take all practicable steps to limit unwanted emissions
(freedom for ADMs but no guaranteed protection for EESS)



WRC-07 AI 1.20: Protection of EESS (passive) from unwanted emissions of active services

WRC-07 RESULTS

- new footnote 5.BA03 related to EESS (passive) bands *protection*, calling for a new Resolution [COM5/4]

Compatibility between the EESS (passive) and relevant active services

- the unwanted emissions of stations brought into use in the **bands and services listed in Table 1-1 below, shall not exceed the corresponding limits;**
- that ADM are urged to take all reasonable steps to ensure that unwanted emissions of active service stations in the bands and services listed in Table 1-2 below **do not exceed the recommended maximum levels**

noting that the EESS (passive) sensors provide worldwide measurements that benefit all countries, even if these sensors are not operated by their country;



WRC-07 AI 1.20: Protection of EESS (passive) from unwanted emissions of active services

WRC-07 RESULTS

Table 1-1 Mandatory limits

Passive band	Active band	Active service
23.6 - 24.0 GHz	22.55 - 23.55 GHz	ISS
31.3 - 31.5 GHz	31.0 - 31.3 GHz	FS
50.2 - 50.4 GHz	49.7 - 50.2 GHz	FSS
50.2 - 50.4 GHz	50.4 - 50.9 GHz	FSS
52.6 - 54.25 GHz	51.4 - 52.6 GHz	FS



WRC-07 AI 1.20: Protection of EESS (passive) from unwanted emissions of active services

WRC-07 RESULTS

Table 1-2 Recommended maximum levels

Passive band	Active band	Active service
1400 - 1427 MHz	1350 - 1400 MHz	FS, MS, RLS
1400 - 1427 MHz	1427 - 1429 MHz	Space operation (E-to-s)
1400 - 1427 MHz	1429 - 1442 MHz	FS, MS
31.3 - 31.5 GHz	30.0 - 31.0 GHz	FSS



Space-related activities (WRC-07 decisions -4)

- Set future course for harmonized spectrum identification for IMT – concept embracing advanced broadband mobile wireless technology for use on a global basis, ...*while*
- Safeguarding C-Band spectrum for satellite systems!

However at the same time, WRC-07 decided to:

- Suppress BSS in the band 620-790 MHz
- Suppress MSS in Regions 1 and 2 in the band 2500 -2690 MHz, introducing for FSS/BSS and MSS (R3) more stringent PFD hard limits, replacing coordination trigger limits by new PFD hard limits...



Space-related activities (WRC-07 decisions -5)

Space-related activities (studies for WRC-11)

- New frequency allocations for **Science Services**:
 - for high-resolution sensors of Meteorological satellites, essential for whether forecast, climate changes, etc.
 - for the Space research, to support the increased data requirements of planned manned and scientific missions (e.g. Moon exploration, etc.)
 - for the needs of passive systems for lightning detection in Meteorological Aids
 - for the oceanographic radar applications
 - for the future development of passive services between 275 and 3 000 GHz



Space-related activities (WRC-07 decisions -6)

Space-related activities (studies for WRC-11) (2)

- Ensure long-term spectrum availability for the new requirements of the Aeronautical Mobile by satellite
- Finalized the spectrum usage around 22 GHz for the High-Definition TV Broadcasting by satellite
- Identify global frequency allocation around 2.5 GHz for the radio-determination by satellite
- Additional allocations for advanced broadband mobile technology by satellite (the satellite component of IMT)
- Enhancement of the International Regulatory Framework and studies of new software-oriented tools for spectrum management (Cognitive Radio)
- Electronic News Gathering, Short Range Devices, etc.



ITU-R sector activities

Other important Space-related activities (regular basis)

- Development of Recommendations and Reports on
 - describing radiocommunication features of space research systems, and
 - providing guidelines on use of such systems in deep space research operations and on planets exploration
- Continue development of Handbook for the Spectrum monitoring of space emissions
- Continue frequency coordination activity for Satellite systems providing positioning and location capabilities (**RNSS**)
- Processing of satellite filings
- Provide assistance and support to Administrations and ITU-R sector members



ITU-R and Emergency Radiocommunications

- Disaster prediction, Detection, Alerting and Disaster relief.
- ITU-R studies include:
 - identification of suitable frequency bands to be used on a global/regional basis for public protection and disaster relief (**Res.647 (WRC-07)**);
 - facilitating cross-border circulation of equipment intended for use in emergency and disaster relief situations (**Tampere Convention**)
- Call for urgent studies on Spectrum Management and ICT aspects for early warning, disaster mitigation and relief operations:

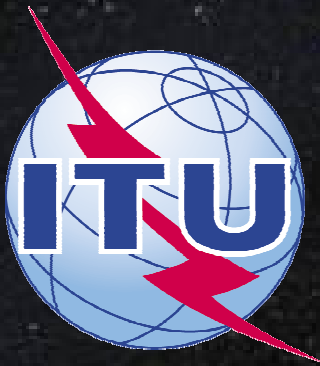
ITU Database of available frequencies



ITU's ambition

to 'Connect the World'

To achieve that goal, we need to work in partnership with other UN organizations, at first place, governments, private sector and civil society.



International Telecommunication Union

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