

Harmful Interference to Satellite Systems and the current Challenge to GNSS

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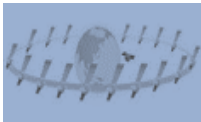
ITU and Space Services



193 Member States



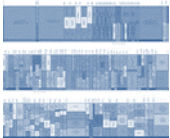
50+ years of Space Regulation



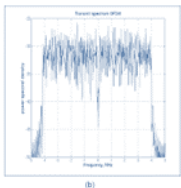
72 Members States with access to Space Resources



1900 Satellite Networks Operating



6 THz of Spectrum Coordinated and Recorded



99.94% Spectrum Free of Harmful Interference



< 0.1 % Interference Variation per year

Harmful Interference Reported to ITU

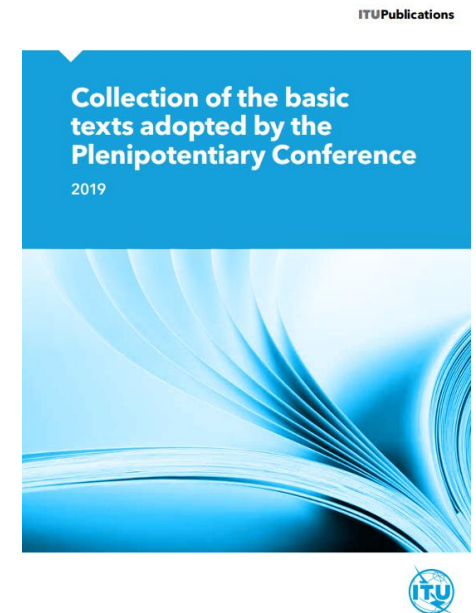


- ❑ Fixed Satellite Service, Broadcasting Satellite Service and associated Space Operations Functions in the frequency bands 6/4 GHz and 14-17-18/10-12 GHz
- ❑ Earth Exploration Satellite Service (passive) in 1400-1427 MHz band
- ❑ Mobile-Satellite-Service in the frequency bands 1 626.5-1 660.5 MHz, 1 980-2 010 MHz and 2 670-2 690 MHz
- ❑ Radio Astronomy Service in the frequency band 1610.6-1613.8 MHz
- ❑ Radio Navigation Satellite Service (RNSS) in the frequency bands 1575.42 ± 15.345 MHz (L1) and 1227.60 ± 11 MHz (L2)

➤ ITU CS No. 1003 (also RR No. 1.169):

Harmful Interference: Interference which endangers the functioning of a radionavigation service or of other safety services or seriously degrades, obstructs or repeatedly interrupts a radiocommunication service operating in accordance with the Radio Regulations.

➤ ITU CS Art. 45: All stations, whatever their purpose, must be **established and operated in such a manner as not to cause harmful interference** to the radio services or communications of other Member States or of recognized operating agencies, or of other duly authorized operating agencies which carry on a radio service, and which operate in accordance with the provisions of the Radio Regulations.



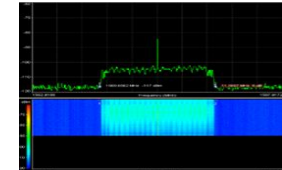
ITU Radio Regulations



- ITU RR No. 15.1: All stations are forbidden to carry out **unnecessary transmissions**, or the transmission of superfluous signals, or the transmission of false or misleading signals, or the transmission of signals without identification
- ITU RR No.15.28: Recognizing that transmissions on distress and safety frequencies and frequencies used for the **safety and regularity of flight** (see Article 31 and Appendix 27) require **absolute international protection** and that the **elimination of harmful interference to such transmissions is imperative**, administrations undertake to act immediately when their attention is drawn to any such harmful interference



Radio Navigation Satellite Service (RNSS) in the frequency bands 1575.42 ± 15.345 MHz (L1) and 1227.60 ± 11 MHz (L2)



Two types of sources of interference observed by ITU:

1) Use of transmitting devices without the required authorization or license

Radiocommunication Bureau encourages to take all possible measures at national level, including **adequate legislation and enforcement mechanisms** that prevent harmful interference cases originated by transmitting stations not in conformity with Article No. 18.1 of the Radio Regulations, which could operate in derogation of the abovementioned provisions of the ITU Constitution and Radio Regulations.

Radio Navigation Satellite Service (RNSS) in the frequency bands 1575.42 ± 15.345 MHz (L1) and 1227.60 ± 11 MHz (L2)

2) Military exercises or operations near zones of conflict

While recognizing that “Member States retain their **entire freedom with regard to military radio installations**” (see No. 202 in Article 48 of Constitution), these installations must, so far as possible, take measures to prevent harmful interference (see No. 203 in Article 48 of Constitution).

Member States are invited, when assessing the interference risks associated with conflict zones or planning military exercises, to consider that the use of satellite-based systems can potentially be impacted beyond that zone, and **further enhanced civil-military coordination is required.**



How ITU is tackling the interference problem ?

- ❑ **Prevention:** ITU-R Study Groups → RadioAssembly → World RadioConference → BR and Administrations apply RadioRegs (Coordination and Notification Procedures)
- ❑ **Correction:** Art 15 of RR → BR → Radio Regulations Board
- ❑ **SIRRS** online application to facilitate Reporting and provide Assistance (<https://www.itu.int/en/ITU-R/space/SIRRS/Pages/default.aspx>)
- ❑ **Informative Fora** to raise awareness of the impact of the interference and the need of cooperation to resolve it, presenting and discussing technical regulatory solutions.
- ❑ **International Monitoring System**
- ❑ **ITU-R Recommendations, Reports and Handbooks**
ITU-R WP-1C (spectrum monitoring) has developed Report ITU-R SM.2454-0 :
Spectrum monitoring techniques in the RNSS frequency bands

Prevention



Resolution 609 (Rev.WRC-07) Procedure:

- Consultation Meetings : Adms cooperate and agree to achieve a level of protection
- epfd produced by all RNSS systems ≤ -121.5 dBW/m² in any 1 MHz
- pfd level per space station (Recommendation 608 (Rev.WRC-07))

Guidance on ITU-R Recommendations (developed and frequently updated by WP-4C)

RNSS systems/networks operating in 1 & 5GHz: Rec. ITU-R M.1901-2
(Note: 1GHz = 1164-1215, 1215-1300, 1559-1610 MHz & 5GHz = 5000-5010/5010-5030 MHz)

Inter-system Interference

Coordination methodology for 1 & 5GHz:
Rec. ITU-R M.1831-1

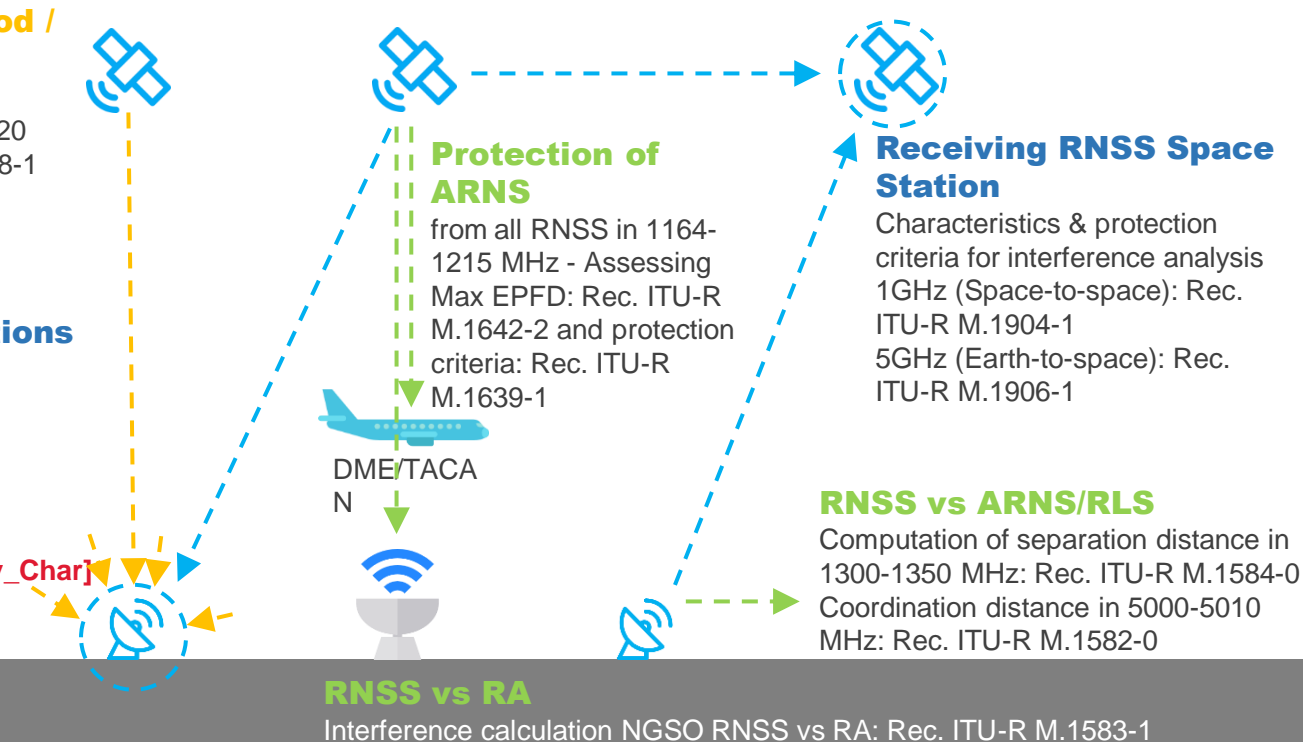
Interference evaluation method / RNSS Protection

Pulsed interference 1GHz:
Rec. ITU-R M.2030-0 & Rep. ITU-R M.2220
Cont. interf. 1 & 5GHz: Rec. ITU-R M.1318-1
Spurious emission 1GHz from IMT:
PDNReport ITU-R M. [IMT-RNSS]

RNSS Receivers or Earth Stations

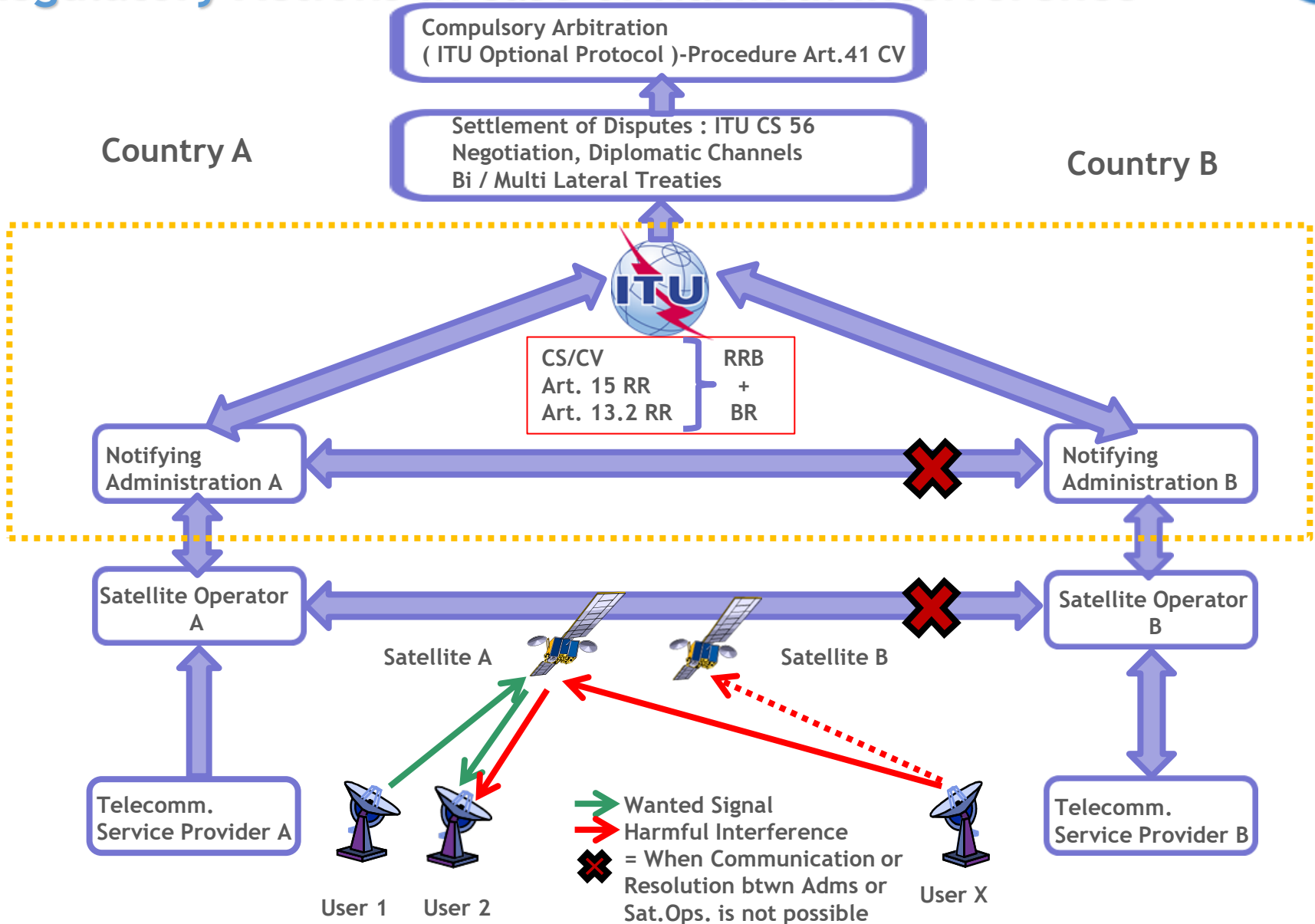
Characteristics & protection criteria for interference analysis
1164-1215 MHz: Rec. ITU-R M.1905-1
1215-1300 MHz: Rec. ITU-R M.1902-1
1559-1610 MHz: Rec. ITU-R M.1903-1
5010-5030 MHz: Rec. ITU-R M.2031-1
1GHz: **PDNReport ITU-R M. [RNSS_Rcv_Char]**

Transmitting RNSS Space Station Description & technical characteristics of GLONASS, GPS, GALILEO, COMPASS, QZSS, IRNSS, etc. in 1GHz: Rec. ITU-R M.1787-3 & 5GHz: Rec. ITU-R M.2031-1
RNSS Applications in 1GHz: Report ITU-R M.2458-0



Correction:

Regulatory Actions in case of Harmful Interference



Key Messages:



- ❑ **Main ITU-R Objective is to ensure operations of radiocommunications systems free of harmful interference**
- ❑ **Reporting Harmful Interference is key to assess actual situation and resolve the case. (RR No.15.41)**
- ❑ **ITU Member States may request Assistance from ITU-BR under No 13.2 of Radio Regulations.**
- ❑ **Different Services affected due to different nature. However, a common solution approach applies to keep the interference to a minimum level :**
 - Applications of the ITU Radio **Regulations**
 - Use **Technologies** recommended by the ITU-R
 - **Cooperation** among Administrations and Space Stakeholders