Seventh Meeting of ICG

5-9 November 2012, Beijing, China

Radio Navigation Satellite Service

Progress report after 9th RES-609 meeting

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ITU - Radiocommunication Bureau

Committed to connecting the world

ITU in brief

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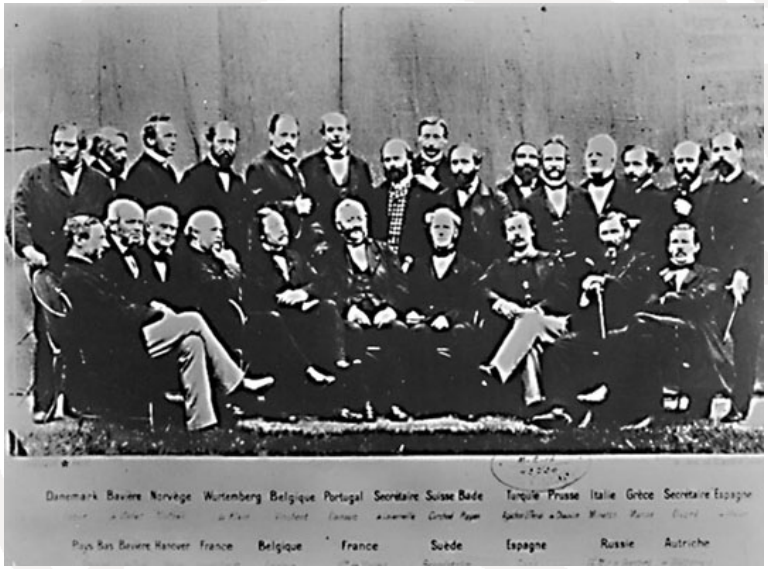
International Telecommunication Union

- Founded on 17 May 1865



- 192 Member States
> 700 Sector Members & Associates
- 750 staff / 70 nationalities
- Annual budget = $150,000,000
- http://www.itu.int

- **ITU** is the leading UN agency for information and communication technologies

ITU Mission

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"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"

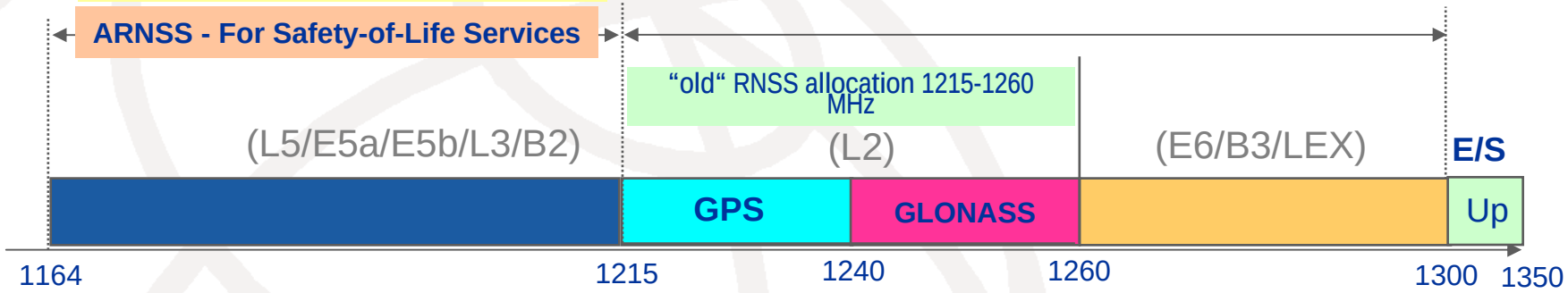
Definitions from the ITU Radio Regulations (RR)

- No. **1.43** ***radionavigation-satellite service (RNSS):***
  A radiodetermination-satellite service used for the purpose of *radionavigation*
- No. **1.59** ***safety service:***
  Any radiocommunication service used for the safeguarding of human life and property
- No. **4.10** Member States recognize that the safety aspects of radionavigation and other safety services require special measures to ensure their freedom from harmful interference; it is necessary therefore to take this factor into account in the assignment and use of frequencies.

RNSS Regulatory situation summary

RES-609 (r. WRC-07)
RNSS-ARNS Compatibility
(960)1164 - 1215 MHz

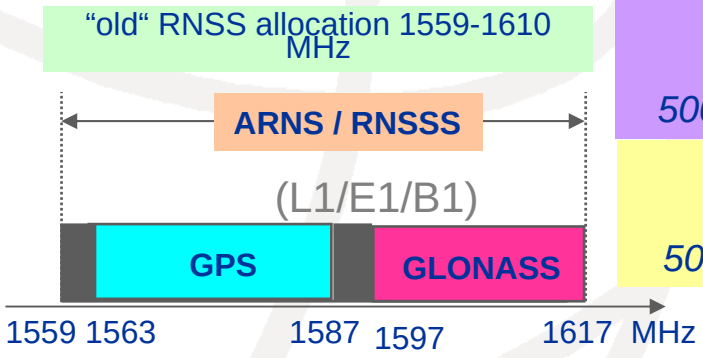
RES-608 (WRC-03)
No constrains on use of "old" RNSS
in the band 1215 – 1260 MHz



ARNSS protection
EPFD -121,5 dBW/m² in 10 MHz for all sats in view

RLS/ EESS/SRS+ (FX+MOB) - *Nos.* ***5.329, 5.330&5.332***

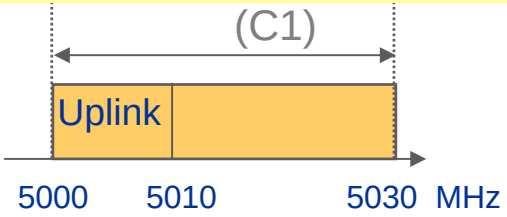
RES-610 (WRC-03)
Coordination and bilateral resolution of technical compatibility issues for RNSS networks



(FX – *secondary until 01.01.2015***)**
Nos. ***5.362B*** *&* ***5.362C***

RR No. ***5.443B***
RNSS-MLS Compatibility
5000-5010MHz => 5030-5150MHz

RES-741 (WRC-03)
RNSS-RAS Compatibility
5010-5030MHz => 4990-5000MHz



RNSS and the RR - 2

- No **1.166** *interference:* The effect of unwanted energy due to one or a combination of *emissions*, *radiations*, or inductions upon reception in a *radiocommunication* system, manifested by any performance degradation, misinterpretation, or loss of information which could be extracted in the absence of such unwanted energy.
- No **1.167** *permissible interference:* Observed or predicted *interference* which complies with quantitative *interference* and sharing criteria contained in these Regulations or in ITU-R Recommendations or in special agreements as provided for in these Regulations.
- No **1.168** *accepted interference: Interference* at a higher level than that defined as *permissible interference* and which has been agreed upon between two or more administrations without prejudice to other administrations.
- No **1.169** *harmful interference (HI): 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 Radio Regulations.

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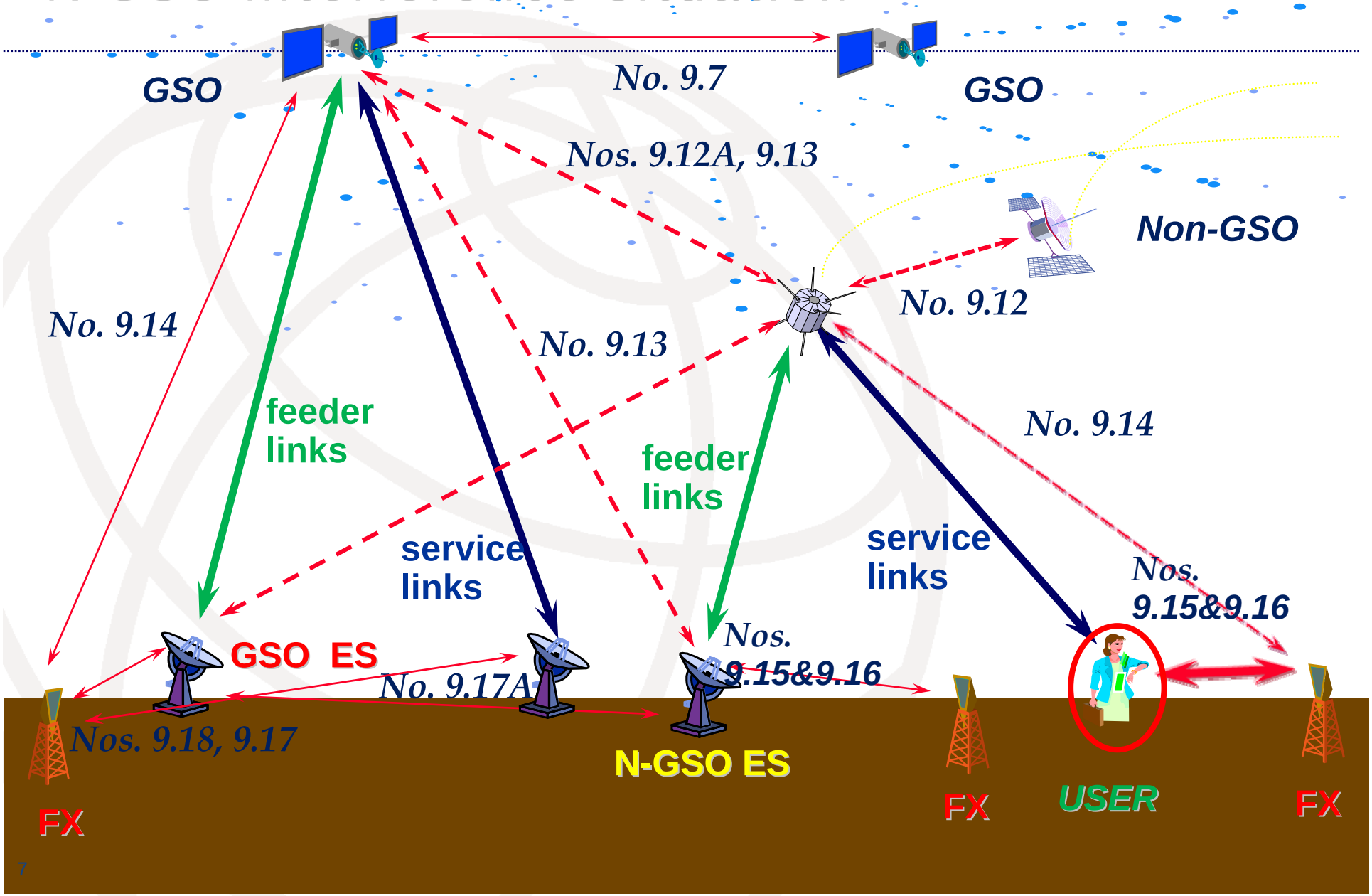
N-GSO interference situation



RNSS info 1

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- The ITU BR is maintaining a special web site and web forum – **RES-609 Consultation meeting**
  - posting of required information from administrations
  - exchange of information
  - posting the results of the epfd calculation from the participants of the RES-609 Consultation meeting
  - Posting the results of all RES-609 Consultation meetings

http://www.itu.int/ITU-R/space/res609/

RNSS progress

- ***Before 2000*** - ***2*** RNSS systems (NAVSTAR-GPS and GLONASS)
- ***WRC-2000*** created new allocations for the RNSS
- ***2000 – 2003 period*** - ***70*** new satellite filings (51 GSO and 19 N-GSO)
- ***12.2003*** – 1st RES 609 Consultation Meeting – NO epfd calculation
- ***01.2004*** - ITU BR identified **117** satellite filings representing ***66*** RNSS networks (**18** N-GSO and **48** GSO) from ***11*** administrations (CAN, CHN, D, F/ESA, F/GLS, G, I, IND, J, RUS, USA)
- ***06.2004*** - 2nd RES 609 Consultation Meeting - calculations of the aggregate equivalent PFD (epfd) for ***5*** GSO and ***4*** N-GSO
- ***06.2005*** - 3d RES 609 Consultation Meeting - calculations of the aggregate equivalent PFD (epfd) for ***14*** GSO and ***6*** N-GSO
- ***09.2006*** - 4th RES 609 Consultation Meeting - calculations of the aggregate equivalent PFD (epfd) for ***15*** GSO and ***8*** N-GSO
- ***05.2008*** - 5th RES 609 Consultation Meeting - calculations of the aggregate equivalent PFD (epfd) for ***20*** GSO and ***6*** N-GSO
- ***09.2009*** - 6th RES 609 Consultation Meeting - calculations of the aggregate equivalent PFD (epfd) for ***18*** GSO and ***6*** N-GSO
- ***06.2010*** - 7th RES 609 Consultation Meeting - calculations of the aggregate equivalent PFD (epfd) for ***21*** GSO and ***6*** N-GSO
- ***09.2011*** - 8th RES 609 Consultation Meeting - calculations of the aggregate equivalent PFD (epfd) for ***24*** GSO and ***8*** N-GSO
- ***10.2012*** - 9th RES 609 Consultation Meeting - calculations of the aggregate equivalent PFD (epfd) for ***25*** GSO and ***10*** N-GSO
- ***10.2012*** - **270** satellite filings representing ***173*** RNSS networks (**41 N-GSO** and **132 GSO**) from ***19*** administrations (ARG, ARS/ARB, B, CHN, D/GLS, EGY,F,F/GLS,G,I,I/GLS,IND,J,LUX,NIG,PNG,RUS,TUR,USA)

- G **INMARSAT-4 25E, -4A 25E, XL1, -4 143.5, -4A 143.5, -4 98W, -4A 98W** (GSO) (3)
- CHN **COMPASS-160E, 140E, 110.5E, 80E, 58.7E, -B-84E,-B-144.5E** (GSO)
- IND **INSAT-NAV(34), (55), (82), (83), (132)** (GSO)
- J **MTSAT-C-140E, -145E** (GSO)
- LUX **LUX-G6-2-E, LUX-G7-9-E2** (GSO)
- USA **LM-RPS-133W, 107.3W** (GSO)
- CHN **COMPASS-M, MEO, H** (2) (N-GSO)
- J **QZSS** (N-GSO) (4)
- RUS **GLONASS-M** (N-GSO)
- USA **NAVSTAR GPS IIRF** (N-GSO) (5)
- F/GLS **MSATNAV-2** (1) (N-GSO)
- IND **INSAT-NAV-GS** (N-GSO)

1 - The following filings remain available for Galileo and shall be treated with MSATNAV-2 filing as a single planned RNSS system for purposes of performing the epfd calculations - MSATNAV-3 and 4 (F/GLS), GALILEO-NAV-2004 (D/GLS), GALILEO-M-NAVSTAR (I/GLS), and SNS (G))

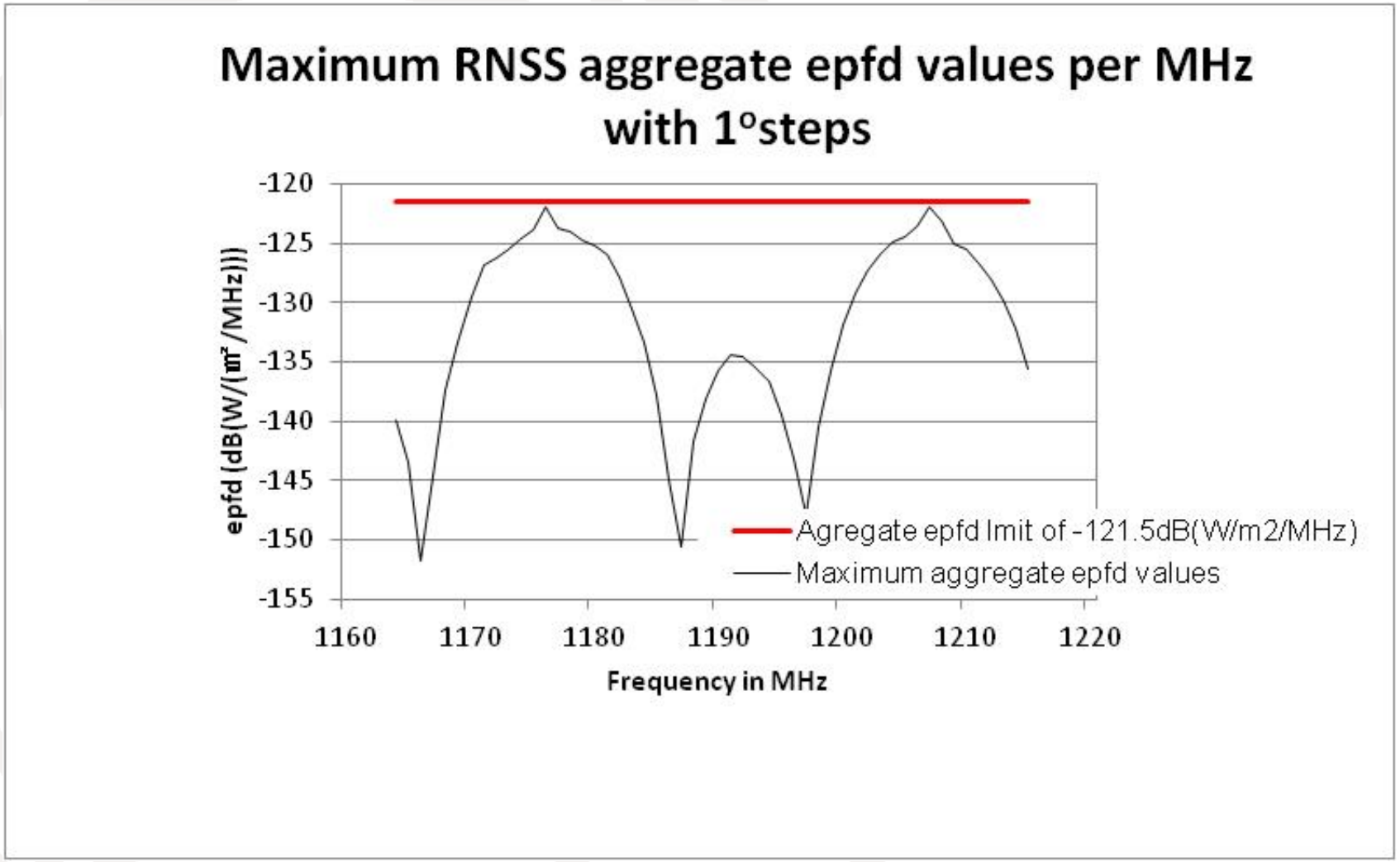
2 - Compass-M, -MEO, and -H represent a single system for purposes of the Res 609 consultation process

3 - INMARSAT filings represent a single network for the purposes of the Res **609** (Rev.WRC-07) consultation process.

4 - QZSS system shall be treated with the N-SAT-HEO2 as a single planned RNSS system for purposes of performing the epfd calculations.

5 - USRSR system shall be treated with NAVSTAR GPS-IIRF as a single planned RNSS system for purposes of performing the epfd calculations.

- The maximum epfd of all satellites associated with the referenced RNSS systems (presented on the 9th RES-609 Consultation meeting) is
  –121.93 dB (W/m^2/MHz) i.e. **0.43 dB below** the RES-609 limit of -121.5 dBW/ m^2/MHz
- It is noted that the results are based on the use of worst-case assumptions in terms of interference from RNSS into ARNS


Maximum RNSS aggregate epfd values per MHz with 1°steps
epfd (dB(W/(m² /MHz)))
-120
-125
-130
-135
-140
-145
-150
-155
1160
1170
1180
1190
1200
1210
1220
Frequency in MHz
Agregate epfd Imit of -121.5dB(W/m2/MHz)
Maximum aggregate epfd values

RNSS info 2

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- **ITU-R WP 4C** is responsible for studies related to all mobile-satellite services including ***RNSS***

  - Studies on the RNSS are very active
  - Sharing and protection criteria have been intensively investigated for existing spectrum allocation for RNSS
  - Studies are also on-going for newly allocated bands for future enhancements and newly planned RNSS systems, addressing frequency sharing with other services
  - These studies contribute not only to the development of ITU-R **M** Series Recommendations but also to **WRC-15** preparation
  - ***Free online access*** *to current ITU-R Recommendations* is provided to all users at:

http://www.itu.int/publ/R-REC/en

List of most important ITU-R Recommendations related to RNSS (1)

- ***ITU-R M.1582*** - Method for determining coordination distances, in the 5 GHz band, between the international standard microwave landing system stations operating in the aeronautical radionavigation service and stations of the radionavigation-satellite service
- ***ITU-R M.1787*** - *Description of systems and networks in the radionavigation-satellite service and technical characteristics of transmitting space stations operating in the bands 1 164-1 215 MHz, 1 215-1 300 MHz and 1 559-1 610 MHz*
- ***ITU-R M.1831*** - *A coordination methodology for RNSS inter-system interference estimation*
- ***ITU-R M.1901***- Guidance on ITU-R Recommendations related to systems and networks in the radionavigation-satellite service operating in the frequency bands 1 164-1 215 MHz, 1 215-1 300 MHz, 1 559-1 610 MHz, 5 000-5 010 MHz and 5 010-5 030 MHz
- ***ITU-R M.1902*** - Characteristics and protection criteria for receiving earth stations in the radionavigation-satellite service (space-to-Earth) operating in the band 1 215-1 300 MHz

List of most important ITU-R Recommendations related to RNSS (2)

- ***ITU-R M.1903*** - Characteristics and protection criteria for receiving earth stations in the radionavigation-satellite service (space-to-Earth) and receivers in the aeronautical radionavigation service operating in the band 1 559-1 610 MHz
- ***ITU-R M.1904*** - Characteristics, performance requirements and protection criteria for receiving stations of the radionavigation-satellite service (space-to-space) operating in the frequency bands 1 164-1 215 MHz, 1 215-1 300 MHz and 1 559-1 610 MHz
- ***ITU-R M.1905*** - Characteristics and protection criteria for receiving earth stations in the radionavigation-satellite service (space-to-Earth) operating in the band 1164-1 215 MHz
- ***ITU-R M.1906*** - Characteristics and protection criteria of receiving space stations and characteristics of transmitting earth stations in the radionavigation-satellite service (Earth-to-space) operating in the band 5 000-5 010 MHz

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Questions ?

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