

# RNSS & ITU Radio Regulations

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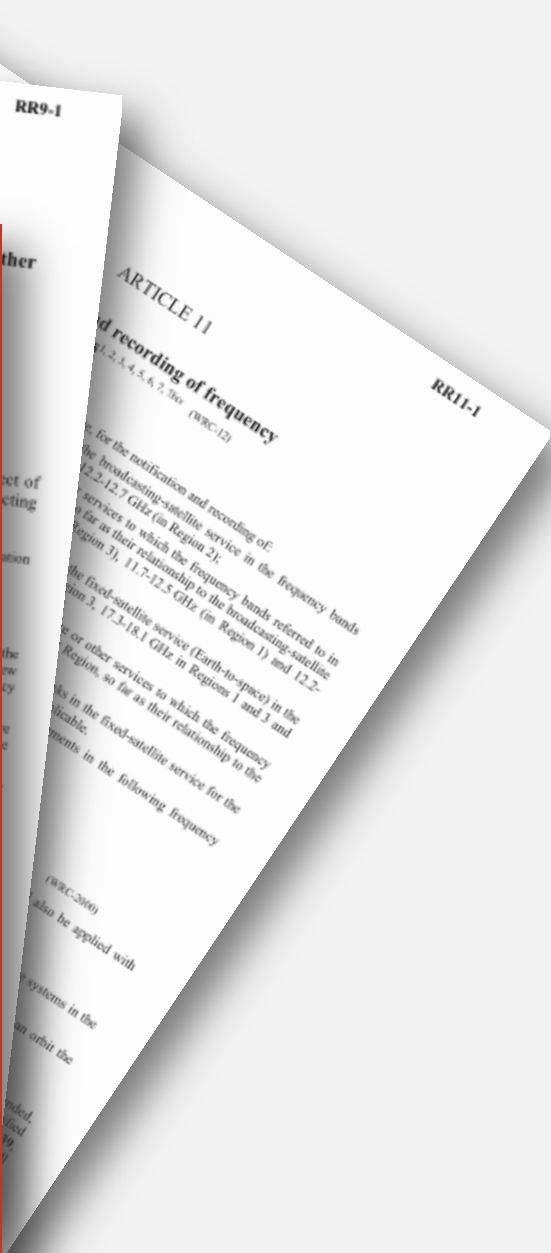
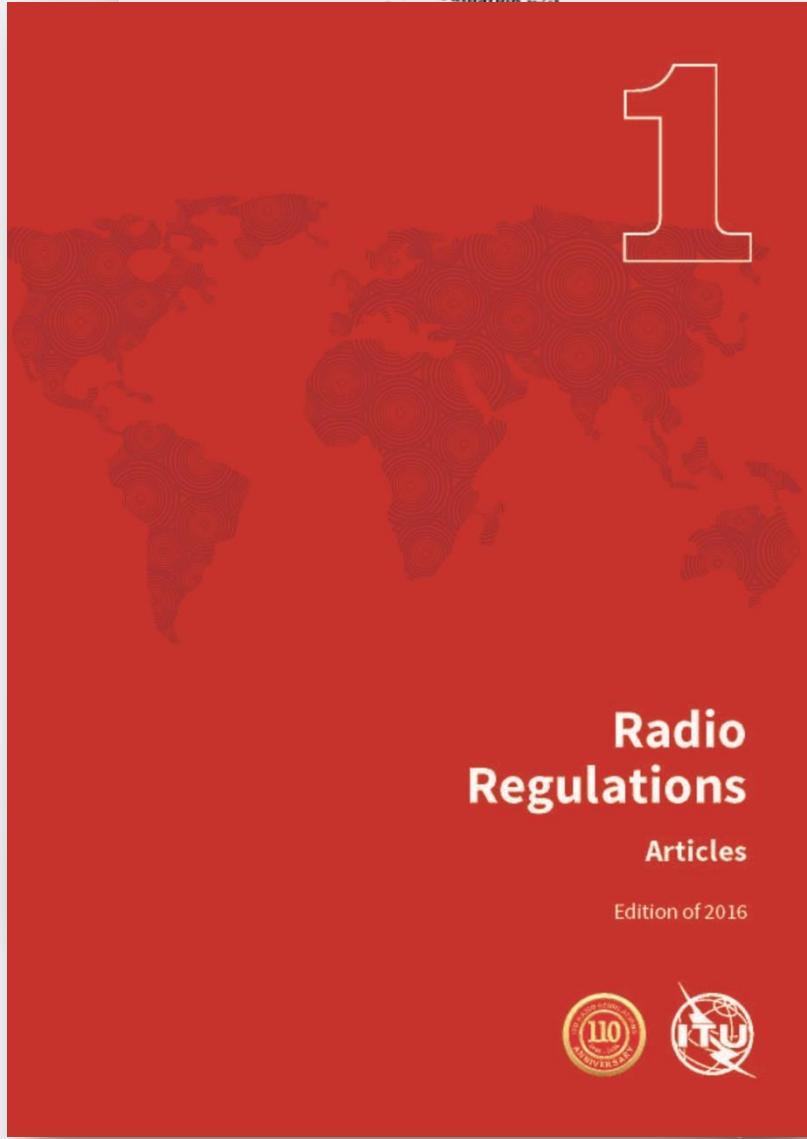
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International Telecommunication Union  
ICG-11, 6 - 11 Nov 2016, Sochi, Russian Federation





# REGULATE

use of radiocommunications



# REGULATE

use of radiocommunications

# REVISED

by WRC

# BINDING

on all Member States

[www.itu.int/pub/R-REG-RR-2016](http://www.itu.int/pub/R-REG-RR-2016)



# Radio Navigation Satellite Service (RNSS)

“A radiodetermination-satellite service  
used for the purpose of radionavigation”

No. 1.43 of Article 1 of Radio Regulations



position, velocity and/or other  
characteristics by radio waves  
propagation properties

No. 1.43 of Article 1 of Radio Regulations



Recognized by Member States  
Require special measures to ensure freedom  
from **harmful interference**  
No. 4.10 of Article 4 of Radio Regulations

**RNSS includes safety aspects**



If radiocommunication  
service used for safeguarding  
of human life & property  
No. 1.59 of Article 1 of Radio Regulations



# harmful interference



Endangers functioning of radionavigation service or other safety services .. operating in accordance with Radio Regulations

No. 1.169 of Article 1 of Radio Regulations



“**All stations**, whatever their purpose,  
must be established and operated in such a manner as  
**not to cause harmful interference**  
to radio services ... in accordance with .. Radio Regulations”

No. 197 Article 45 of ITU Constitution



# Interference Control Mechanisms



## **Allocation**

Frequency separation of stations of different services



## **Regulatory Protection**

“Not to cause harmful interference or claim protection”



## **Power Limits**

PFD to protect TERR services  
EIRP to protect SPACE services  
EPFD to protect GSO from NGSO



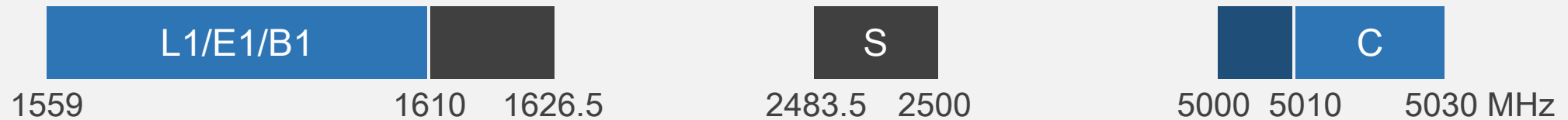
## **Coordination**




between Administrations to ensure interference-free operations conditions



# Frequency Allocation

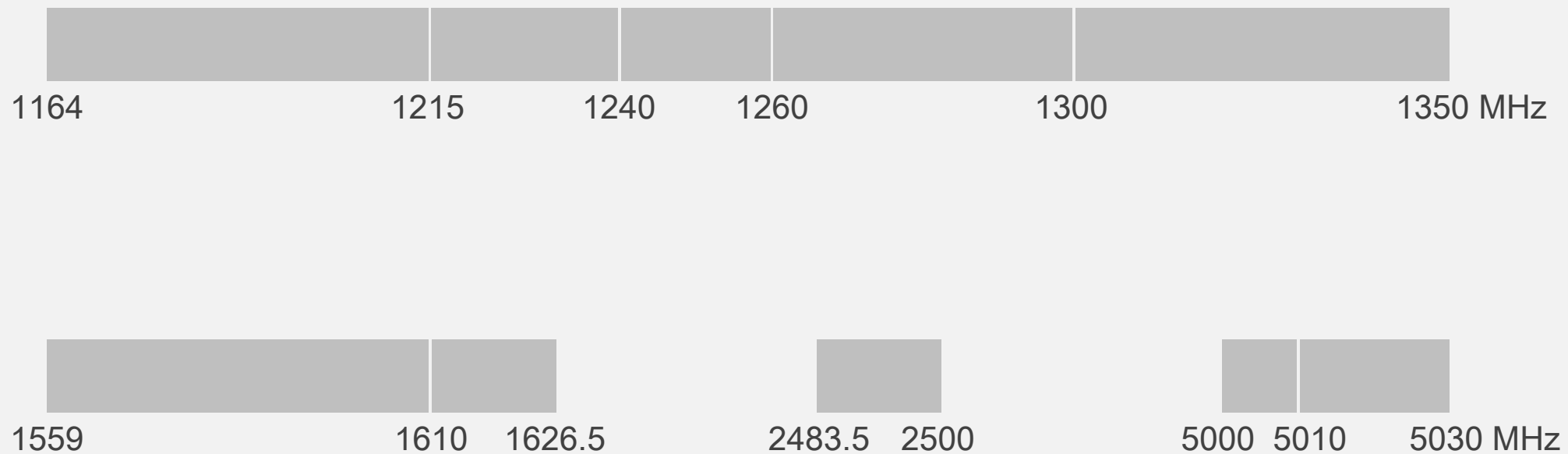
Table of Frequency Allocation in Article 5 of Radio Regulations



-  Radionavigation-Satellite Service (RNSS)
-  Radionavigation-Satellite Service (Uplink)
-  Radiodetermination-Satellite Service (RDSS)

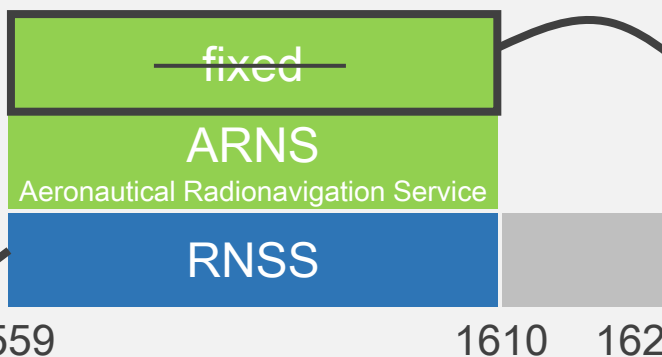
# Frequency Sharing

Table of Frequency Allocation in Article 5 of Radio Regulations



# Frequency Sharing

Table of Frequency Allocation in Article 5 of Radio Regulations



## WRC-15 Outcome

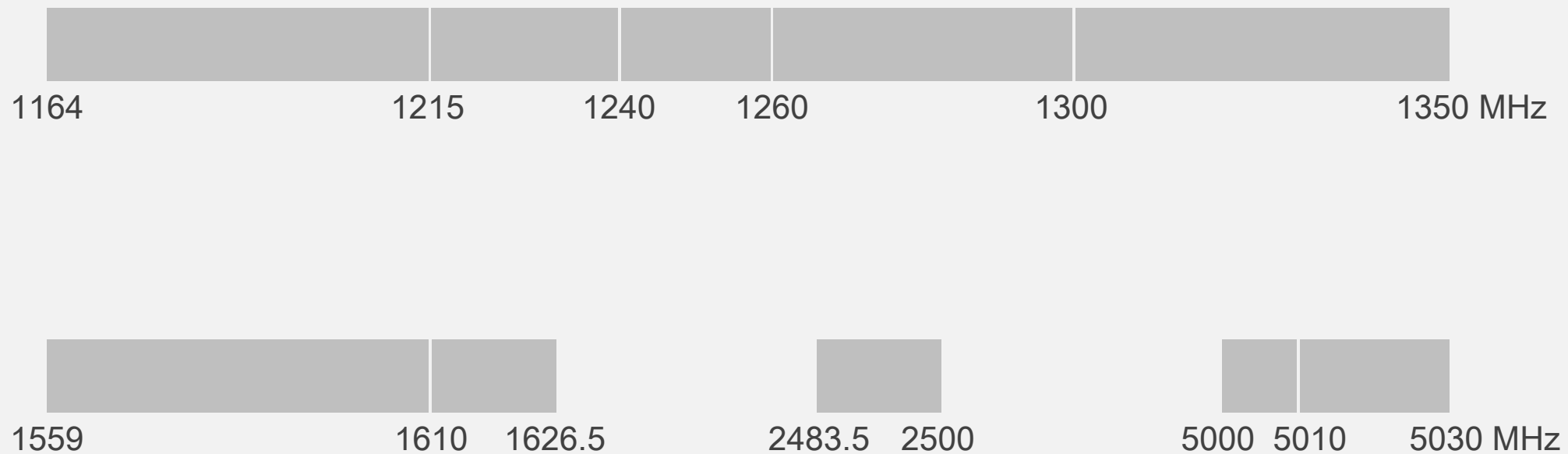
~~Additional allocation to fixed service in certain countries (Nos. 5.362B & 5.362C) on secondary basis until 1 January 2015. ... Administrations urged to protect RNSS and not authorize new frequency assignments to fixed service systems ...~~

## Coordination between RNSS

Nos. 9.12, 9.12A, 9.13 (if submitted after 01.01.2005)  
and No. 9.7 (No. 5.328B)

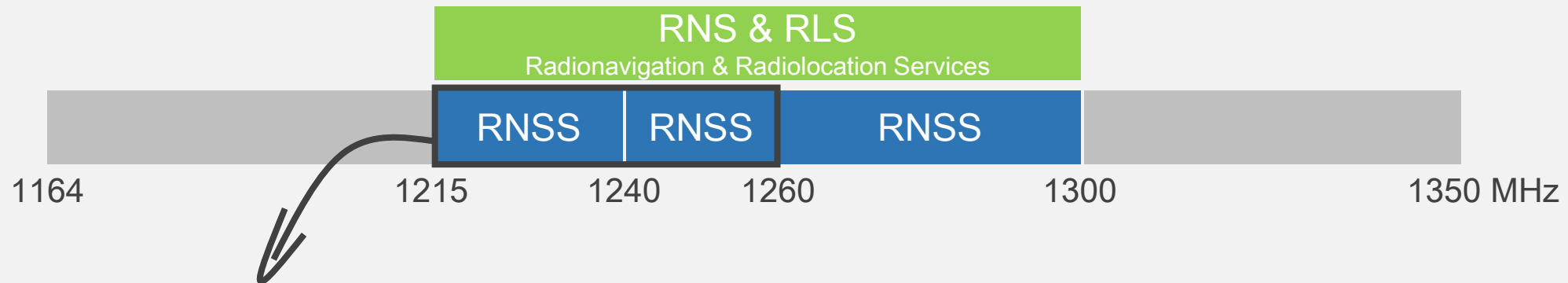
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No additional constraints for “old RNSS systems”, brought into use before 2 June 2000 (Resolution 608)

## **RNSS to protect RNS & RLS**

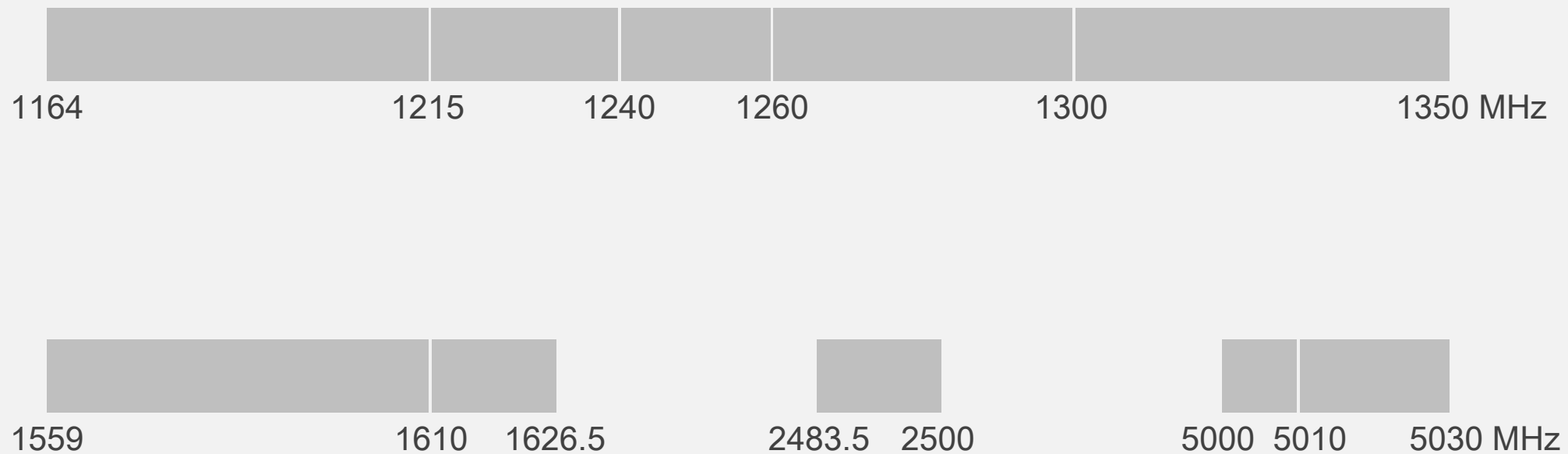
No harmful interference to / no protection claimed from RNS  
No harmful interference to RLS  
(No. 5.329)

## **Coordination between RNSS**

Nos. 9.12, 9.12A, 9.13 (if submitted after 01.01.2005) and No. 9.7 (No. 5.328B)

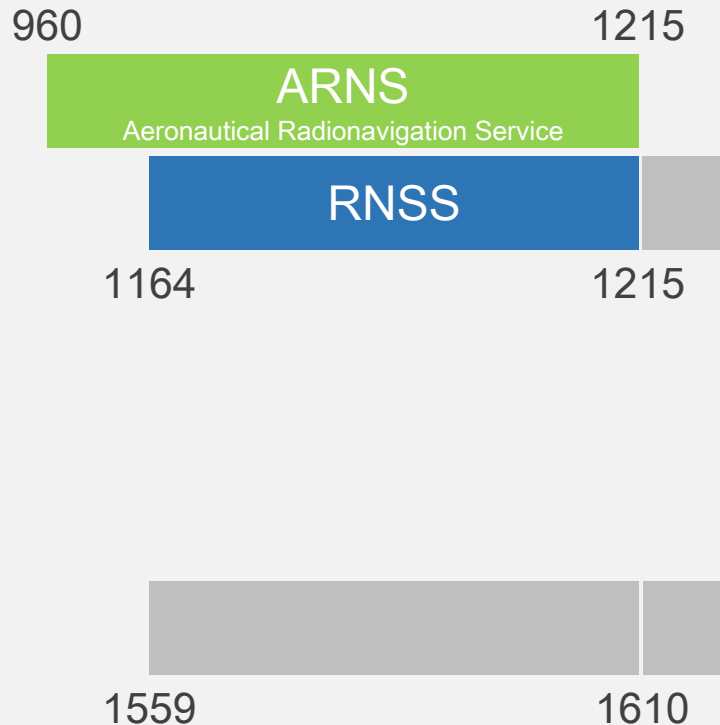
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## PFD limit per RNSS space station

$\leq -129 \text{ dB(W/m}^2\cdot\text{1MHz)}$  (REC608)

## All RNSS to share aggregate EPFD limit

$\leq -121.5 \text{ dB(W/m}^2\cdot\text{1MHz)}$  (No. 5.328A / RES609)

## RES609 Consultation Meeting

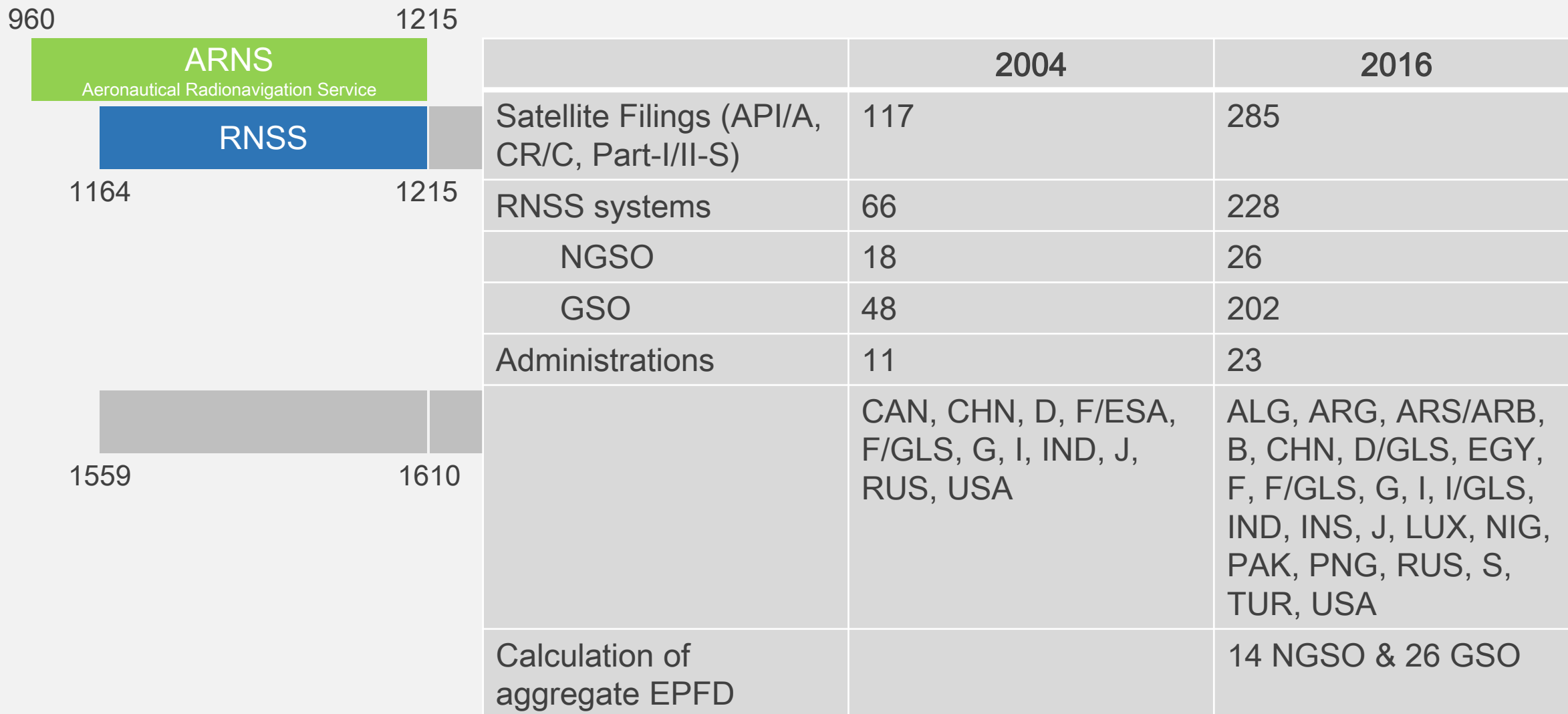
BR participates / observes / publishes results in BR IFIC Forum/Calculation/Results: [www.itu.int/ITU-R/space/res609/](http://www.itu.int/ITU-R/space/res609/)

## ‘Real’ RNSS systems only

Satisfy milestone criteria in Resolution 609 (WRC-07)

# Frequency Sharing

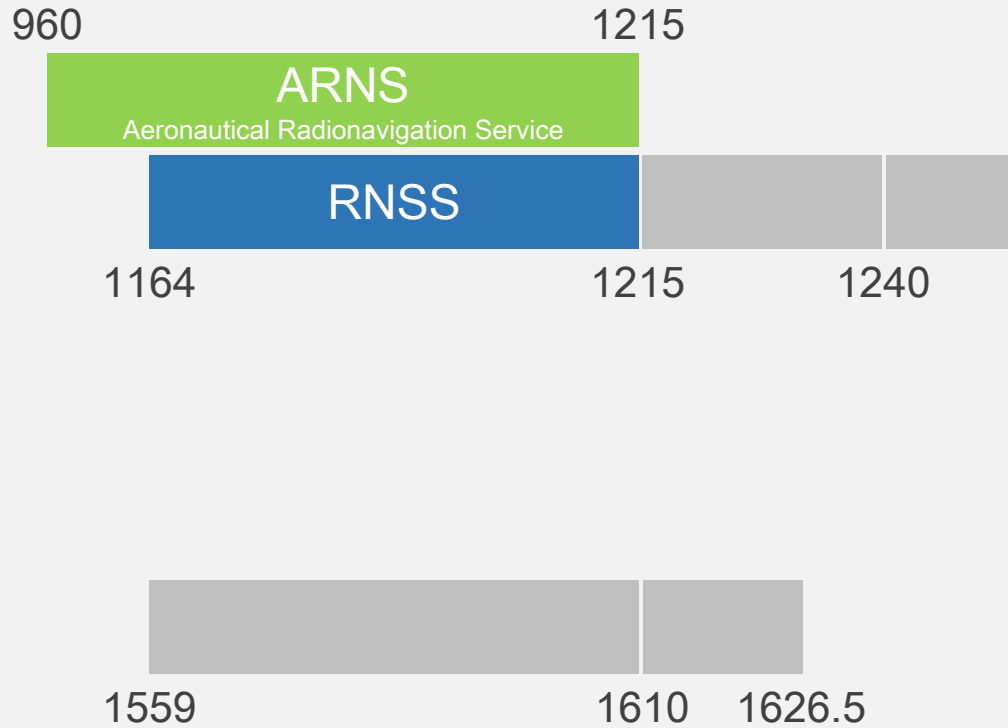
Table of Frequency Allocation in Article 5 of Radio Regulations



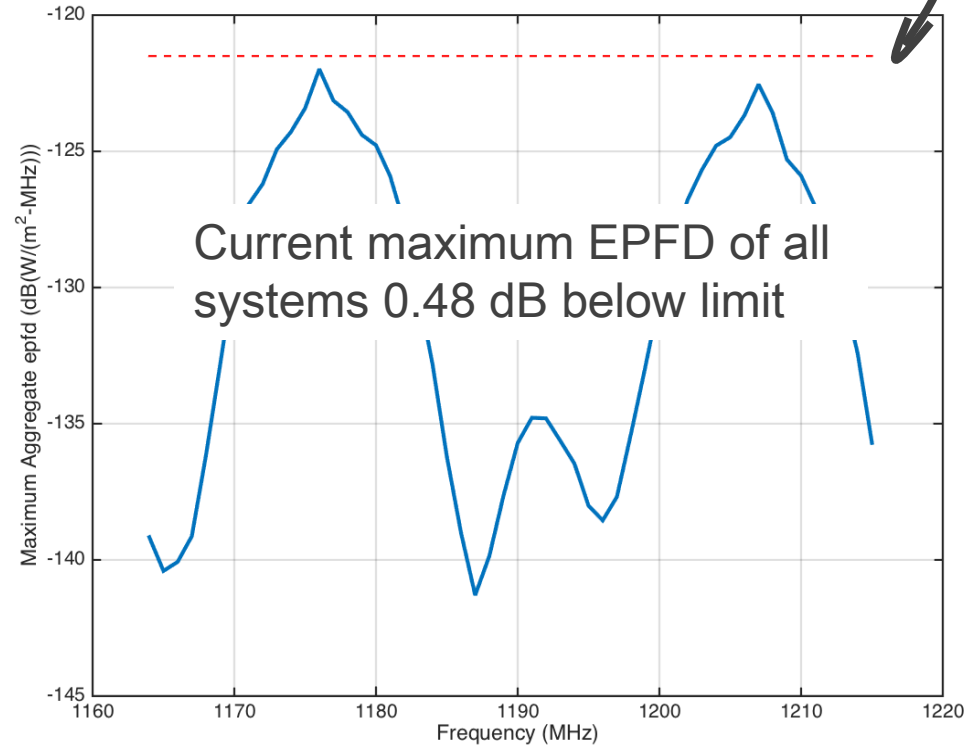


# Frequency Sharing

Table of Frequency Allocation in Article 5 of Radio Regulations



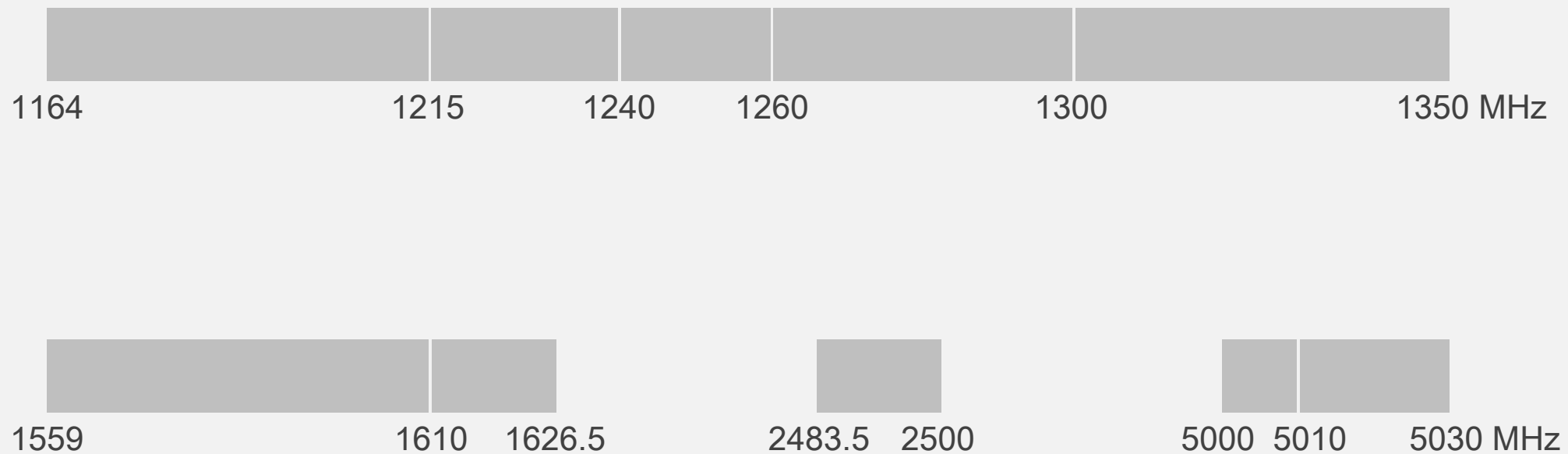
RES609 limit -121.5 dBW/ m<sup>2</sup>/MHz



13<sup>th</sup> RES609 Consultation Meeting (Sep 2016)  
 Results: [www.itu.int/en/ITU-R/space/RES609/RES609-IFIC2831.pdf](http://www.itu.int/en/ITU-R/space/RES609/RES609-IFIC2831.pdf)  
 Decisions: [www.itu.int/en/ITU-R/space/RES609/13th\\_res-609.pdf](http://www.itu.int/en/ITU-R/space/RES609/13th_res-609.pdf)

# Frequency Sharing

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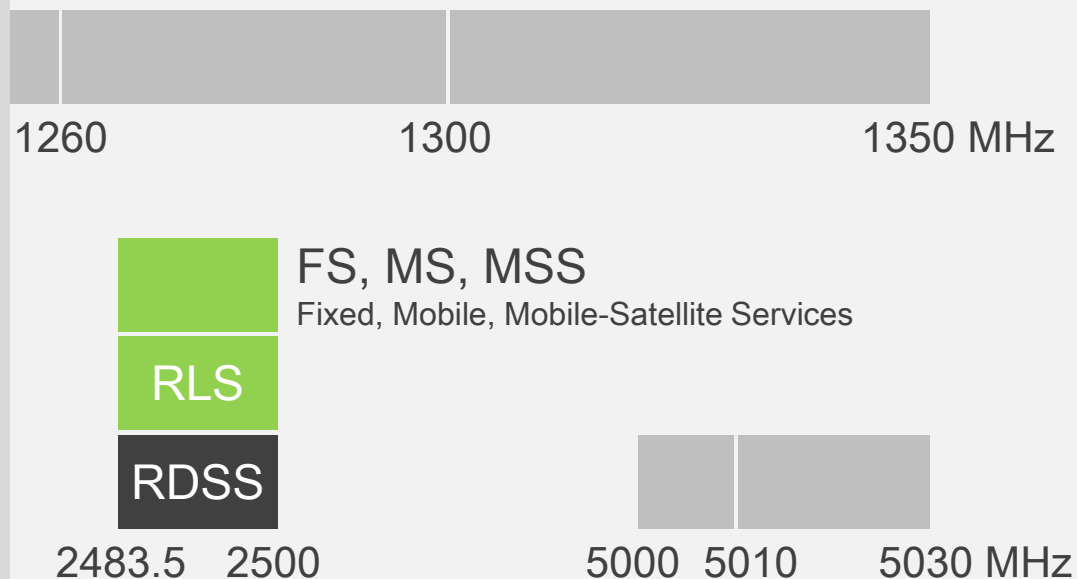
## Conditions on RDSS

No. 4.10 (safety service special measures) not applicable (No. 5.398)

Subject to coordination under No. 9.11A (No. 5.402)

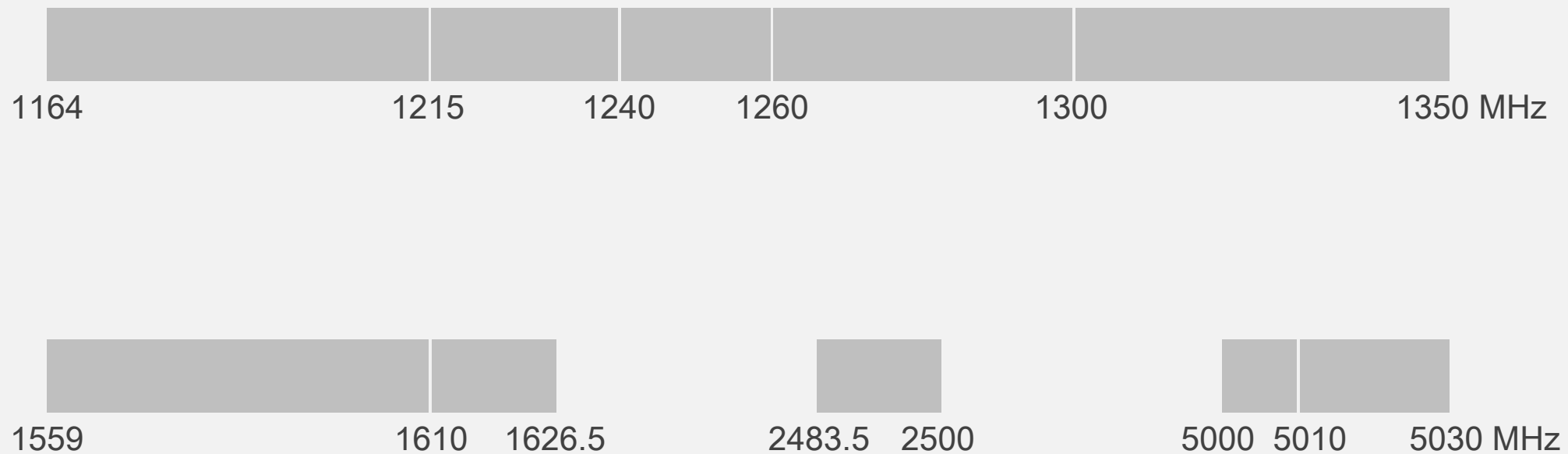
RDSS in some countries received before 18 February 2012 will retain their regulatory status (No. 5.401)

RDSS in some countries received after 17 February 2012 to protect RLS (No. 5.399)



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## RNSS to protect MLS & RA in adjacent bands

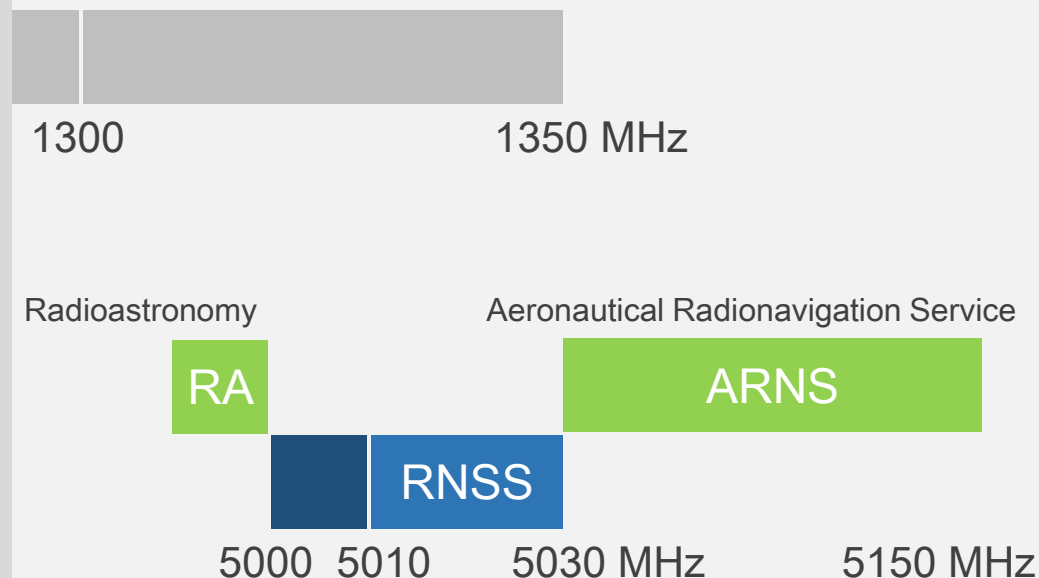
RNSS to protect MLS operating above 5030 MHz, compliance with aggregate PFD (No. 5.443B)

RNSS to protect RA

PFD  $\leq -171$  dB(W/m<sup>2</sup>.10MHz) for any GSO RNSS  
EPFD  $\leq -245$  dB(W/m<sup>2</sup>.10MHz) by all NGSO RNSS  
(RES741 (Rev.WRC-15))

## Coordination between RNSS

Nos. 9.12, 9.12A, 9.13 (if submitted after 01.01.2005)  
and No. 9.7 (No. 5.328B)



# International Recognition

Coordination, Notification & Recording Master Register



## Interference Workshop

Experts, operators, regulators

[www.itu.int/en/ITU-R/space/workshops/SISS-2016](http://www.itu.int/en/ITU-R/space/workshops/SISS-2016)



## Harmful Interference Reporting

Satellite Interference Reporting & Resolution System (SIRRS in development)

24/7 access & reporting  
193 Member States

## RNSS Related Studies

Working Party 4C is responsible  
Sharing, compatibility and protection  
Next meeting 26 Apr to 2 May 2017

[www.itu.int/go/ITU-R/wp4c](http://www.itu.int/go/ITU-R/wp4c)



## Standards on RNSS

Complete free of charge  
ITU-R Recommendations M. Series

[www.itu.int/publ/R-REC/en](http://www.itu.int/publ/R-REC/en)

## Guidance on ITU-R Recommendations

RNSS systems/networks operating in 1164 – 1215, 1215 – 1300, 1559 – 1610, 5000 – 5010, 5010 – 5030 MHz (Rec. ITU-R [M.1901-1](#))

### Transmitting RNSS Space Station

Description & technical characteristics of GLONASS, GPS, GALILEO, COMPASS, QZSS, IRNSS, etc.

1164 – 1215, 1215 – 1300, 1559 – 1610 MHz (Rec. ITU-R [M.1787-2](#))

### Inter-system Interference

Coordination methodology for 1164 – 1215, 1215 – 1300, 1559 – 1610, 5010 – 5030 MHz (Rec. ITU-R [M.1831-1](#))

### Interference evaluation method

Pulsed interference:

1164 – 1215, 1215 – 1300, 1559 – 1610 MHz (Rec. ITU-R [M.2030](#))

Continuous interference:

1164 – 1215, 1215 – 1300, 1559 – 1610 MHz (Rec. ITU-R [M.1318-1](#))

### RNSS Receivers or Earth Stations

Characteristics & protection criteria for interference analysis

1164 – 1215 MHz (Rec. ITU-R [M.1905](#))

1215 – 1300 MHz (Rec. ITU-R [M.1902](#))

1559 – 1610 MHz (Rec. ITU-R [M.1903](#))

5010 – 5030 MHz (Rec. ITU-R [M.2031-1](#))

### Protection of ARNS

from all RNSS in 1164 – 1215 MHz - Assessing Max EPFD (Rec. ITU-R [M.1642-2](#)) and protection criteria (Rec. ITU-R [M.1639-1](#))

### Receiving RNSS Space Station

Characteristics & protection criteria for interference analysis

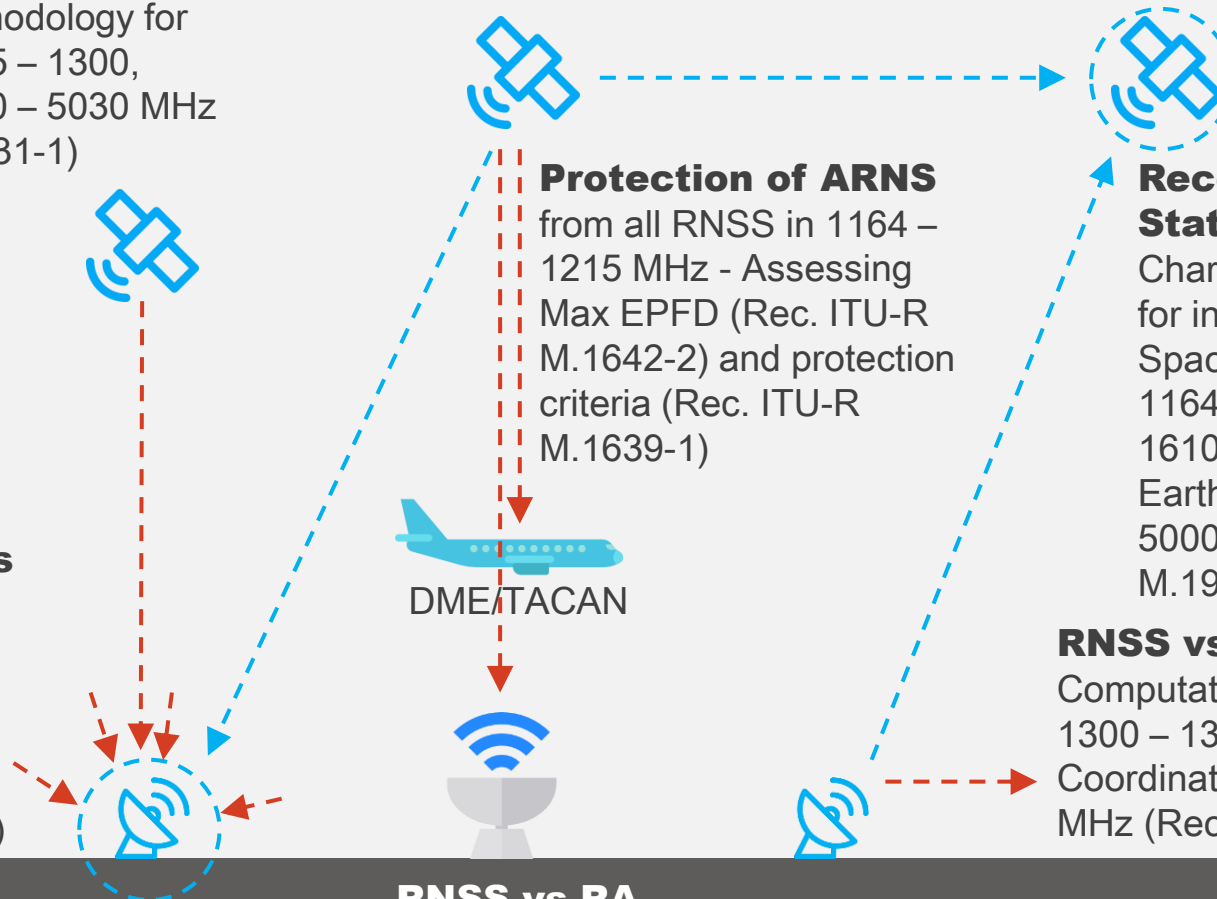
Space-to-space  
1164 – 1215, 1215 – 1300, 1559 – 1610 MHz (Rec. ITU-R [M.1904](#))

Earth-to-space  
5000 – 5010 MHz (Rec. ITU-R [M.1906-1](#))

### RNSS vs ARNS/RLS

Computation of separation distance in 1300 – 1350 MHz (Rec. ITU-R [M.1584](#))

Coordination distance in 5000 – 5010 MHz (Rec. ITU-R [M.1582](#))



### RNSS vs RA

Interference calculation NGSO RNSS vs RA (Rec. ITU-R [M.1583-1](#))

# RNSS Quick Reference

## Working Party 4C (Efficient orbit/spectrum utilization for MSS and RDSS including RNSS)

Studies conducted within Working Party 4C are aiming at a more efficient use of the orbit/spectrum resources by MSS and RDSS systems. This includes analyzing various interference situations between such systems but also with systems operating in other radiocommunication services, developing coordination methodologies, describing the potential use of MSS and RDSS systems for specific purposes like emergency situations, maritime or aeronautical telecommunications, time distribution, etc.

[www.itu.int/en/ITU-R/study-groups/rsg4/rwp4c](http://www.itu.int/en/ITU-R/study-groups/rsg4/rwp4c)

**Latest WP4C Chairman's Report** [www.itu.int/md/R15-WP4C-C-0102/en](http://www.itu.int/md/R15-WP4C-C-0102/en)

**ITU-R Reports (Free access)** [www.itu.int/pub/R-REP-M/en](http://www.itu.int/pub/R-REP-M/en)

**M.2168** - Compatibility between a proposed new aeronautical mobile (R) service (AM(R)S) system and both radionavigation-satellite service (RNSS) operating in the 5 000-5 010 MHz band and radio astronomy in the adjacent band 4 990-5 000 MHz

**M.2219** - Radionavigation-satellite service applications for the 5 000-5 010 MHz and 5 010-5 030 MHz bands

**M.2220** - Calculation method to determine aggregate interference parameters of pulsed RF systems operating in and near the bands 1 164-1 215 MHz and 1 215 1 300 MHz that may impact radionavigation-satellite service airborne and ground-based receivers operating in those frequency bands

**M.2262** - Potential interference between the ICAO standard microwave landing system (MLS) operating above 5 030 MHz and radionavigation-satellite service (RNSS) systems in the band 5 000-5 030 MHz

**M.2284** - Compatibility of radio-navigation satellite service (space-to-Earth) systems and radars operating in the frequency band 1 215-1 300 MHz

**M.2305** - Consideration of aggregate radio frequency interference event potentials from multiple Earth exploration-satellite service systems on radionavigation-satellite service receivers operating in the 1 215-1 300 MHz frequency band

**Working document preliminary draft new Report ITU-R M.[IMT-RNSS]\*** - Protection of radionavigation-satellite service receiving earth stations operating in the frequency bands 1 164-1 215 MHz, 1 215-1 300 MHz and 1 559-1 610 MHz from unwanted emissions of IMT stations in the frequency bands below 3 GHz

**Preliminary draft new Report ITU-R M.[RNSS\_Apps]\*** - RNSS applications in the 1 164-1 215 MHz, 1 215-1 300 MHz and 1 559-1 610 MHz frequency bands

**Radio Regulations (Free access)** [www.itu.int/pub/R-REG-RR-2016](http://www.itu.int/pub/R-REG-RR-2016)

**Rules of Procedures (Free access)** [www.itu.int/pub/R-REG-ROP/en](http://www.itu.int/pub/R-REG-ROP/en)

**Circular Letters** [www.itu.int/en/ITU-R/information/Pages/circulars.aspx](http://www.itu.int/en/ITU-R/information/Pages/circulars.aspx)

**RES609 Consultation Meeting** [www.itu.int/en/ITU-R/space/Pages/res609.aspx](http://www.itu.int/en/ITU-R/space/Pages/res609.aspx)

**National Spectrum Handbook (Free Access)** [www.itu.int/pub/R-HDB-21](http://www.itu.int/pub/R-HDB-21)

**List of International Monitoring Stations (List VIII)** [www.itu.int/pub/R-SP-LN.VIII](http://www.itu.int/pub/R-SP-LN.VIII)

**Workshop/Symposium on Interference**

[www.itu.int/en/ITU-R/space/workshops/SISS-2016/](http://www.itu.int/en/ITU-R/space/workshops/SISS-2016/)

[www.itu.int/en/ITU-R/space/workshops/2013-interference-geneva/](http://www.itu.int/en/ITU-R/space/workshops/2013-interference-geneva/)

**ITU-R Preparatory Studies for WRC-19** [www.itu.int/en/ITU-R/study-groups/rcpm/Pages/wrc-19-studies.aspx](http://www.itu.int/en/ITU-R/study-groups/rcpm/Pages/wrc-19-studies.aspx)

**ITU-R Recommendations (Free access)** [www.itu.int/rec/R-REC-M/en](http://www.itu.int/rec/R-REC-M/en)

**M.1318** - Evaluation model for continuous interference from radio sources other than in the radionavigation-satellite service to the radionavigation-satellite service systems and networks operating in the 1 164-1 215 MHz, 1 215-1 300 MHz, 1 559-1 610 MHz and 5 010-5 030 MHz bands

**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 (Earth-to-space)

**M.1583** - Interference calculations between non-geostationary mobile-satellite service or radionavigation-satellite service systems and radio astronomy telescope sites

**M.1584** - Methodology for computation of separation distances between earth stations of the radionavigation-satellite service (Earth-to-space) and radars of the radiolocation service and the aeronautical radionavigation service in the frequency band 1 300-1 350 MHz

**M.1639** - Protection criterion for the aeronautical radionavigation service with respect to aggregate emissions from space stations in the radionavigation-satellite service in the band 1 164-1 215 MHz

**M.1642** - Methodology for assessing the maximum aggregate equivalent power flux-density at an aeronautical radionavigation service station from all radionavigation-satellite service systems operating in the 1 164-1 215 MHz band

**M.1787\*** - Description of systems and networks in the radionavigation-satellite service (space-to-Earth and space-to-space) 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

**M.1831** - A coordination methodology for RNSS inter-system interference estimation

**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

**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

**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

**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

**M.1905\*** - Characteristics and protection criteria for receiving earth stations in the radionavigation-satellite service (space-to-Earth) operating in the band 1 164-1 215 MHz

**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

**M.2030** - Evaluation method for pulsed interference from relevant radio sources other than in the radionavigation-satellite service to the radionavigation-satellite service systems and networks operating in the 1 164-1 215 MHz, 1 215-1 300 MHz and 1 559-1 610 MHz frequency bands

**M.2031** - Characteristics and protection criteria of receiving earth stations and characteristics of transmitting space stations in the radionavigation-satellite service (space-to-Earth) operating in the band 5 010-5 030 MHz

\* New or being revised, see [www.itu.int/md/R15-WP4C-C-0102/en](http://www.itu.int/md/R15-WP4C-C-0102/en)



# **Operate Interference-free**

ITU regulatory framework (Radio Regulations, ITU-R Recommendations)

# **Prevent & Resolve Interference**

Radio Regulations contain such measures

# **Assist**

In case of harmful interference, seek assistance from  
Radiocommunication Bureau (BR) and Radio Regulations Board (RRB)

# International Telecommunication Union



[www.itu.int](http://www.itu.int)