

The background features a blue gradient with binary code (0s and 1s) scattered across it. A central globe is surrounded by a network of white lines, suggesting a global communication or navigation system. A smaller globe is visible in the upper right corner.

# RadioNavigation Satellite Service

*Progress Report 2005*

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# RNSS Allocation *before WRC-2000*

L2

1215 MHz

1260 MHz



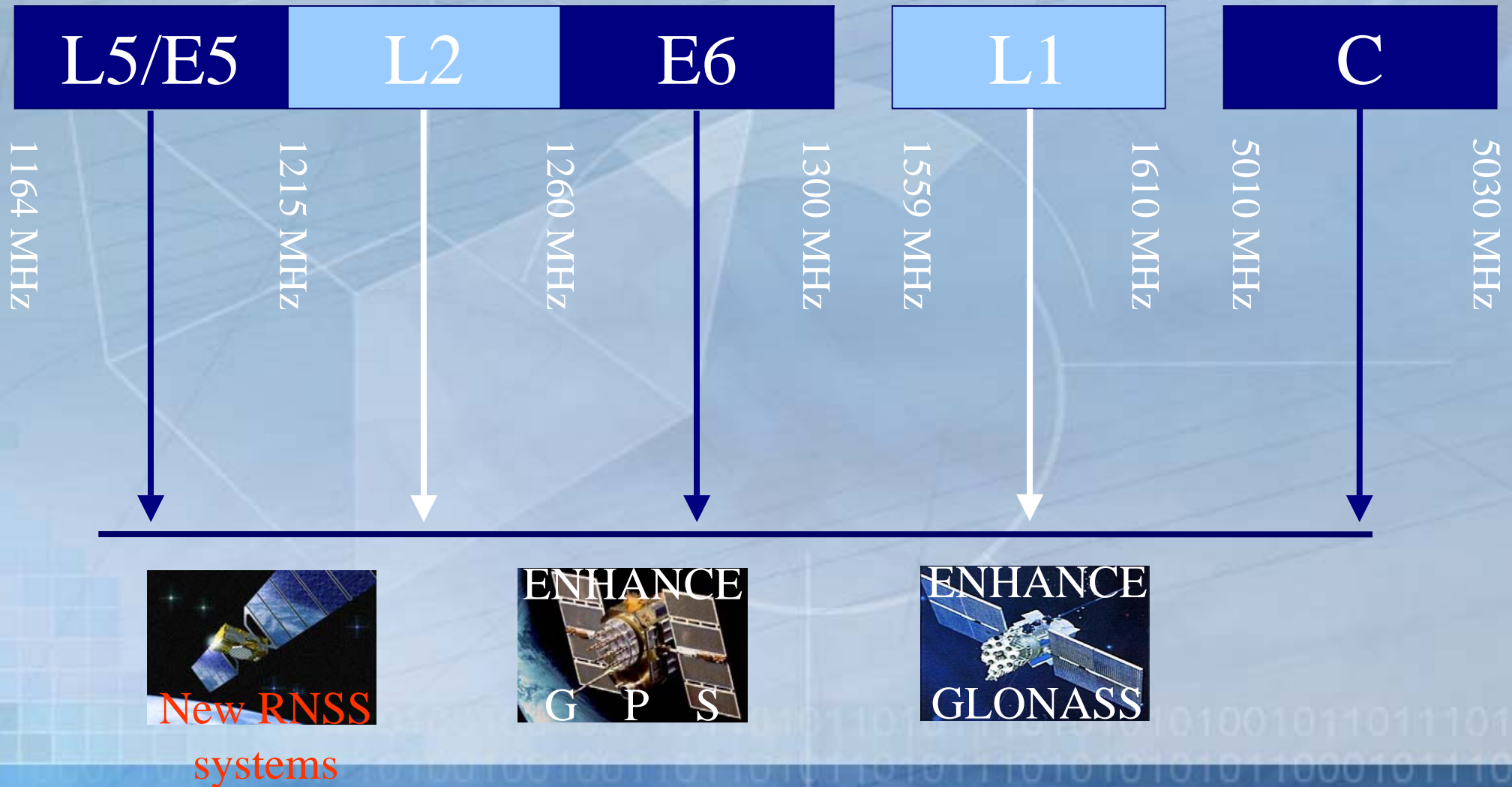
L1

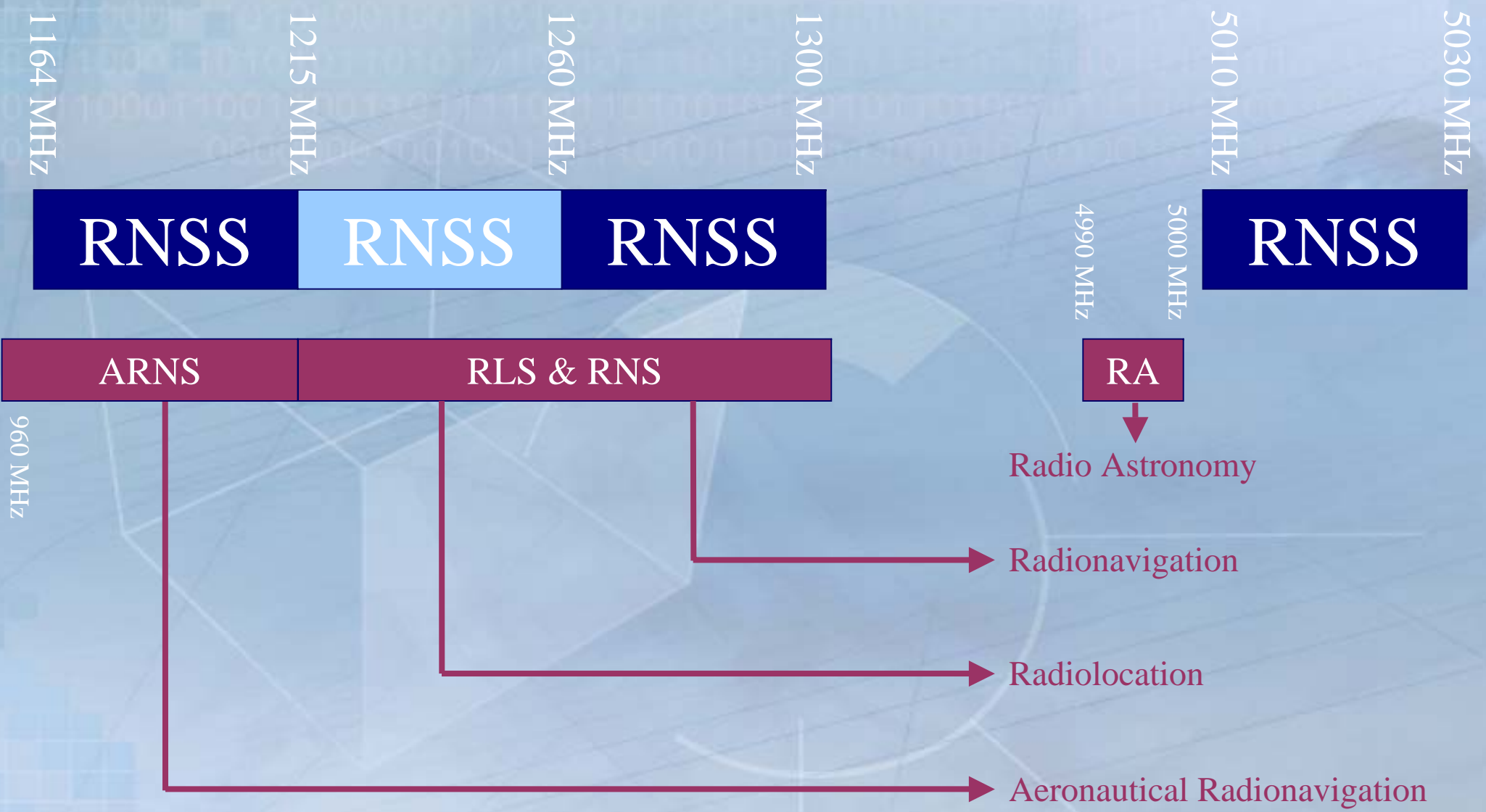
1559 MHz

1610 MHz



# WRC-2000 Added ...





# ***Outcome of WRC-03...***

# Outcome of WRC-03...

- epfd limit shared by all RNSS  
 $\leq -121.5 \text{ dB(W/m}^2\text{-1MHz)}$  (5.328A / RES-609 (WRC-03))

How to share this limit ?

'Real' RNSS systems only

Satisfy criteria annexed to  
**RES-609 (WRC-03)**



PFD limit per RNSS space station

$\leq -129 \text{ dB(W/m}^2\text{-MHz)}$   
**REC-608 (WRC-03)**



Consultation Meeting

Bureau participates/observes/  
publishes results in the IFIC  
(RES-609 (WRC-03))



1164 MHz

1215 MHz

RNSS

ARNS

960 MHz

1164 MHz

1215 MHz

RNSS

ARNS

960 MHz

## RES 609 Consultation Meeting (1)

- All ADMs operating or planning to operate RNSS systems shall, in collaboration, take all necessary steps, including, if necessary, by means of appropriate modifications to their systems, to ensure that the aggregate interference into ARNS systems caused by such RNSS systems operating in these frequency bands is ***shared equitably among the systems and does not exceed*** the **aggregate equivalent power flux-density** (epfd) protection criterion  ***$\leq -121.5 \text{ dB(W/m}^2\text{)}$  in any 1MHz band***

1164 MHz

1215 MHz

RNSS

ARNS

960 MHz

## RES 609 Consultation Meeting (2)

- that all potential RNSS system operators and ADMs are given full visibility of the process
- **no single RNSS system** shall be permitted to use up the entire interference allowance
- ADMs operating or planning to operate RNSS systems will need to **agree cooperatively** to achieve the level of protection for ARNS
- ADMs participating in this process of epfd calculation should hold Consultation meetings on a regular basis
- ADMs participating in the Consultation meeting shall designate one ADM that shall **communicate to the Bureau the results of any aggregate sharing determinations**

1164 MHz

1215 MHz

RNSS

ARNS

960 MHz

## RES 609 Consultation Meeting (3)

- ITU BR identified in January 2005 **69** RNSS systems with frequency assignments in the band 1164-1215 MHz.
- ADMs submitted for **22** satellite systems (**13** GSO and **7** Non-GSO systems) the appropriate Annex to RES-609 information
- Calculations of the equivalent PFD (epfd) level produced by all space stations of the referenced RNSS systems were compared and agreed at the third Consultation Meeting, held in Munich, Germany, June 2005.
- ITU BR received new filings from NIG (9), TUR (15) and ARS/ARB (6) during year 2005

# RES 609 Consultation Meeting **results** (1)

- CAN NAV 107.3W (GSO)
  - G INMARSAT GSO-2L & GSO-2M & GSO-2N (GSO)
  - CHN COMPASS-160E & 140E & 110.5E & 80E & 58.7E (GSO)
  - IND INSAT-NAV(34) & (82) & (83) & (132) (GSO)
  - USA LM-RPS-133W (GSO)
- 

- CHN COMPASS-M & MG & H \*\* (N-GSO)
- J N-SAT-HEO2 (N-GSO)
- RUS GLONASS-M (N-GSO)
- USA NAVSTAR GPS L5 (N-GSO)
- F/GLS MSATNAV-2 \* (N-GSO)
- IND INSAT-NAV-GS (N-GSO)

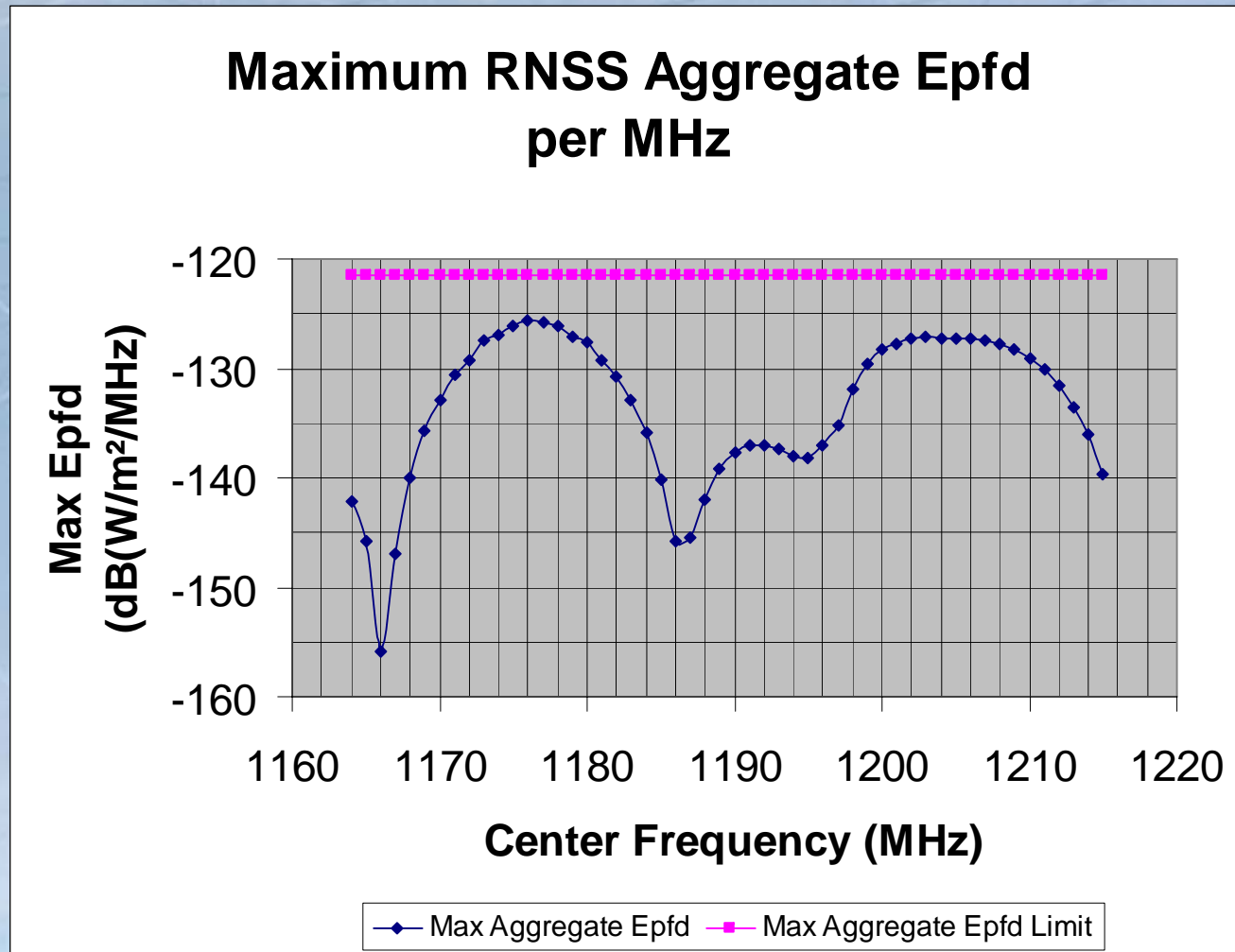
\*(the following filings remain available for Galileo and shall be treated with MSATNAV-2 filing as a single planned RNSS system for purposes of performing the epfd calculations - MSATNAV-3 and 4 (F/GLS), GALILEO-NAV-2004 (D), GALILEO-M-NAVSTAR (I), E-NSS-1 (ESA), and SNS (G))

\*\* Compass-M, Compass-MG, and Compass-H represent a single system for purposes of the Resolution 609 (WRC-03) consultation process

## RES 609 Consultation Meeting **results** (2)

- The maximum epfd of all satellites associated with the referenced RNSS systems (presented on the 3<sup>d</sup> RES-609 Consultation meeting) was -125.7 dB (W/m<sup>2</sup>/MHz) i.e. 4.2 dB below the RES-609 limit of -121.5 dBW/ m<sup>2</sup>/MHz
- It is noted that the results are based on the use of worst-case assumptions in terms of interference from RNSS into ARNS

# RES 609 Consultation Meeting *results* (3)



1215 MHz

1260 MHz

1300 MHz

RNSS

RNSS

RLS & RNS

- Retained existing protection of RNS
- Extended protection to RLS

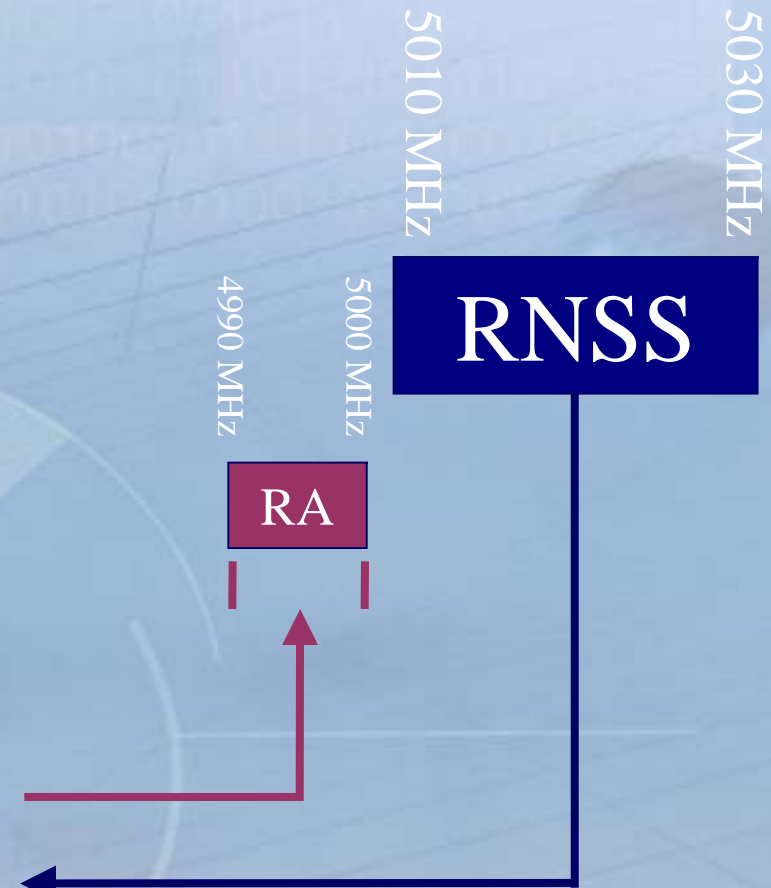
*(RR No. 5.329 (WRC-03))*

- No additional constraints, if brought into use before WRC-2000 – *see (RES-608 (WRC-03))*

## PFD limit (GSO RNSS) & EPFD limit (NGSO RNSS)

$PFD \leq -171 \text{ dB}(W/m^2 \cdot 10\text{MHz})$  for **any** GSO RNSS  
 $EPFD \leq -245 \text{ dB}(W/m^2 \cdot 10\text{MHz})$  by **all** NGSO RNSS 2% of time, over 5deg elevation; over RA band

- **RES-741 (WRC-03)**
- RR No. 5.443B also no interference to the MLS



**Coordination / Real systems**

1164 MHz	1215 MHz	1260 MHz	1300 MHz	1559 MHz	1610 MHz	5010 MHz	5030 MHz
RNSS			RNSS		RNSS		RNSS
ARNS		RLS & RNS			RA		
960 MHz	EPFD / Real Systems / Consultation Meeting		No Add. Constraints			4990 MHz	5000 MHz
			RLS & RNS Protection		PFD / EPFD		

1164 MHz

1215 MHz

1260 MHz

1300 MHz

1559 MHz

1610 MHz

5010 MHz

5030 MHz

RNSS

RNSS

RNSS

RNSS

RNSS

**WRC-03 results !**



Additional Coordination Requirements

*RR Nos. 9.12, 9.12A, 9.13 (see 5.328B / RES-610 (WRC-03))  
after 01.01.2005*

*RR No. 9.7 exists already for the GSO RNSS*

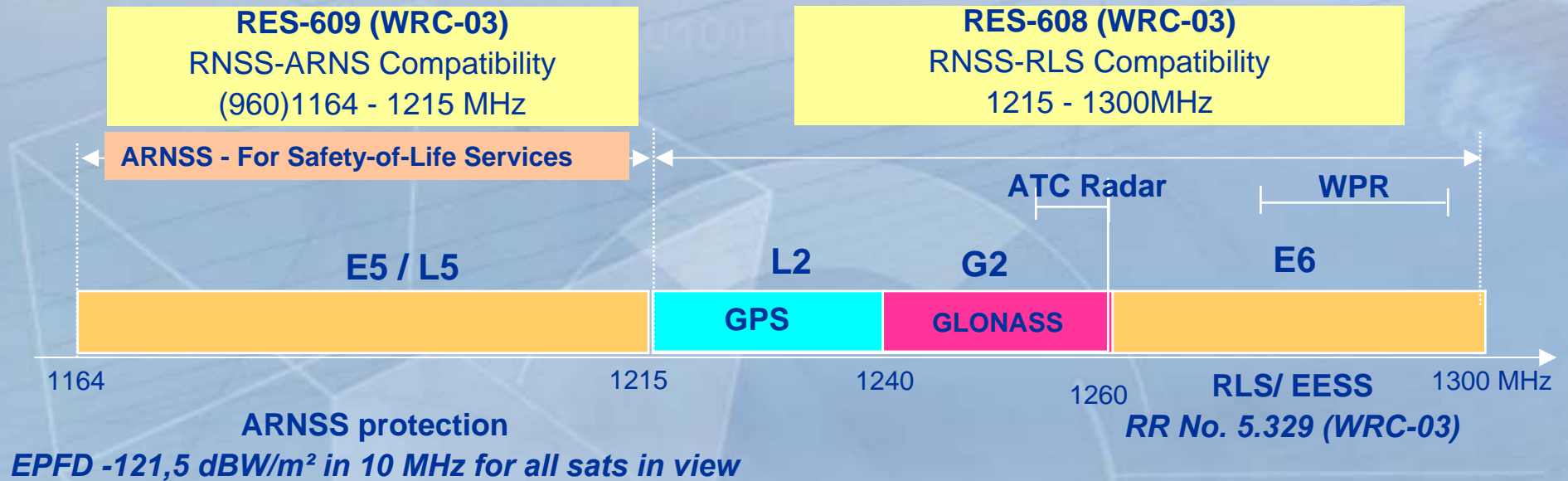
.. received after 01.01.2005

.. between 'Real' RNSS systems only

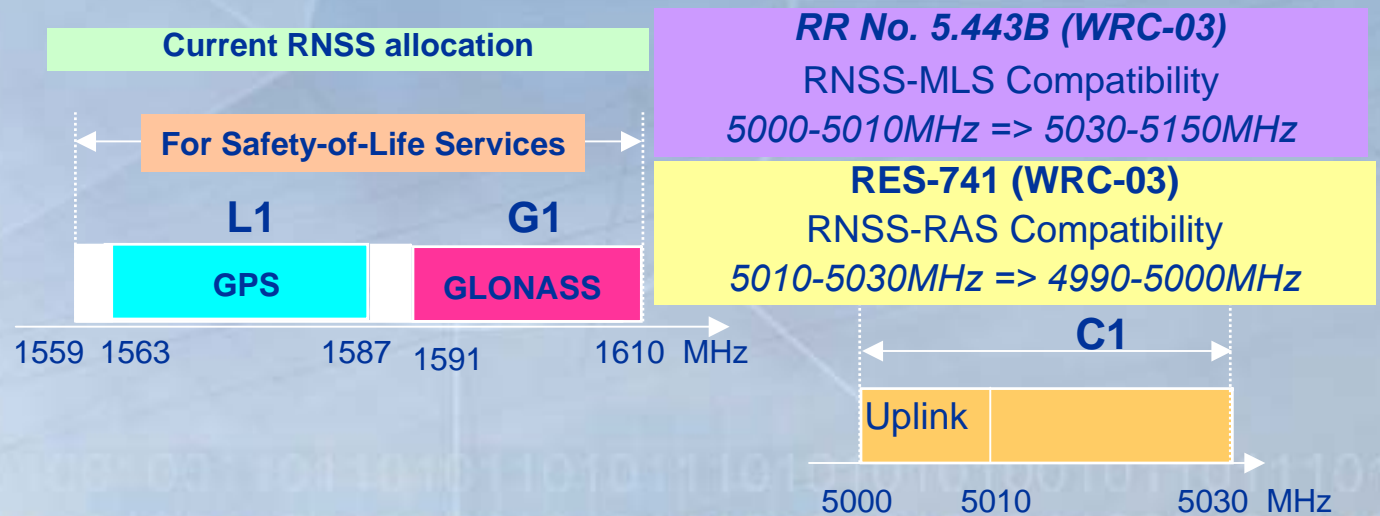
***Satisfy criteria annexed to RES-610 (WRC-03)***

# Frequency Spectrum for the RNSS

## Regulatory situation on 11.2005



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



# RNSS progress

- **Before 2000** - **2** RNSS systems
- **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
- **01.2004** - ITU BR identified **24** RNSS networks (12 GSO and 12 N-GSO) under RES-609
- **06.2004** - 2nd RES 609 Consultation Meeting - calculations of the equivalent PFD (epfd) for **5** GSO and **4** N-GSO
- **06.2005** - 3d RES 609 Consultation Meeting - calculations of the equivalent PFD (epfd) for **14** GSO and **6** N-GSO
- **11.2005** - **133** satellite filings from **13** administrations (ARS/ARB, CAN, CHN, D, F/GLS, G, I, IND, J, NIG, RUS, TUR, USA)

# RNSS info 1

- 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

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

# RNSS info 2

❖ **WP 8D** is responsible for studies related to all mobile-satellite services including **RNSS**

- Studies on the RNSS have been very active in 2005;
- 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 like radars;
- These studies contribute not only to the development of ITU-R M Series Recommendations but also to WRC-07 preparation.

# RNSS info 3

There are 282 contributions for the WP 8D activities covering the study group period from July 2003 (after WRC-03) up to November 2005 – this period will finish with a CPM-07 Report before WRC-07. Here is the non exhaustive List of major contributions related to RNSS.

- Proposals for modification of preliminary draft new Recommendation **PDNR ITU-R M.xx** - Characteristics and protection criteria for receiving earth stations of the radionavigation-satellite service (space-to-Earth) in the band 1 559-1 610 MHz
- **PDNR ITU-R M.xx** - Description of RNSS systems and networks and technical characteristics of transmitting space stations operating in RNSS systems and networks (space-to-Earth and space-to-space) in the bands 1 164-1 215 MHz, 1 215-1 300 MHz, 1 559-1 610 MHz and 5 010-5 030 MHz
- **PDNR ITU-R M.xx** - Characteristics and protection criteria for receiving Earth stations of the radionavigation-satellite service in the band 1 215-1 300 MHz
- Protection requirements for radionavigation-satellite service (RNSS)

# RNSS info 4

- **PDNR ITU-R M.x** on compatibility between UWB devices and MSS and RNSS services
- Adoption of the Report on the impact of DME emissions into RNSS receivers
- **PDNR ITU-R M.x** - Methodology for assessing the maximum aggregate epfd at an aeronautical radionavigation service station from all radionavigation-satellite service systems operating in the 1 165-1 215 MHz band
- **MOD ITU-R M.1088** - Considerations for sharing with systems of other services operating in the bands allocated to the radionavigation-satellite service
- **PDNR ITU-R M.x** on a coordination methodology for RNSS inter-system interference estimation
- Impact of Software Defined Radio (SDR) on RNSS

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***Questions ?***