

**Resolution 609 (WRC-03) Consultation Meeting**  
**14-16 June 2005**

**Record of Decisions Taken at the**  
**Third Resolution 609 (WRC-03) Consultation Meeting**

**(Munich, 14-16 June 2005)**

The third Resolution 609 (WRC-03) Consultation Meeting was convened, pursuant to the requirements of Resolution 609 (WRC-03), at the Bavarian Ministry of Economic Affairs, Infrastructure, Transport and Technology in Munich, Germany from 14-16 June, 2005. A list of participants is available on the Resolution 609 Forum page on the ITU web site. Approximately 50 delegates from government and industry, along with a representative of the Radiocommunication Bureau, attended the meeting. The following actions were taken:

1. The Meeting agreed to a modification to the Terms of Reference that were adopted in December 2003 and previously modified in June 2004, to address the subject of the establishment of dates for future Consultation Meetings. A copy of the modified Terms of Reference has been posted to the Resolution 609 Forum that is maintained by the BR on the ITU web site (<http://www.itu.int/ITU-R/space/res609/>).
2. The Meeting decided that the tentative dates (pursuant to § 10 of the Terms of Reference as modified at the third Resolution 609 (WRC-03) Consultation Meeting) for the fourth Resolution 609 (WRC-03) Consultation Meeting are 13-15 June 2006.
3. The Meeting agreed to minor changes to the format for the provision of RNSS system characteristics to the Consultation Meeting. These changes are to the title and introductory text to Section I-6 of the List of System Characteristics, and do not require resubmission of any data provided to this or prior Consultation Meetings. Notes have also been added in several places to reflect the possible need, in the future, to provide certain data in 1 degree increments rather than in 5 degree increments. The revised format for the List of System Characteristics is contained in Attachment 1 hereto. The following points of elaboration on the List of System Characteristics are repeated without change from prior Consultation Meetings for emphasis:
  - a. Section I-9 of Attachment 1 contains the format of the results of the epfd calculation for each RNSS individual system, in MS Excel format (see Attachment 2 at Template, Sheet 1), using 5 degree steps in latitude and longitude. For non-GSO systems, administrations should also provide the time step resolution and the number of time steps simulated.
  - b. If the calculation of the aggregate epfd of all RNSS systems is within 2 dB of the epfd limit ( $-121.5 \text{ dBW/m}^2/\text{MHz}$ ), the results for each RNSS system under Section I-9 of Attachment 1 should be provided in 1 degree steps (see Attachment 2 at Template, Sheet 2).

- c. The system spectral adjustment factors (SAF) provided under Section I-8 should be in MS Excel format (see Attachment 2 at Template, Sheet 3).

4. The Meeting considered submissions from the Indian administration regarding four geostationary orbit RNSS networks and a four-satellite non-geostationary orbit RNSS system (the non-geostationary orbit system and three of the four geostationary-orbit networks comprise a single system called IRNSS). The Meeting was able to come to general agreement on the parameters and characteristics of the four GSO networks so as to enable their inclusion in the aggregate calculation. However, there are some minor inconsistencies in the data that were not able to be fully resolved. The Meeting agreed that the effect of these discrepancies on the aggregate efd for all systems was very minor, on the order of a tenth of a dB or so, and thus the information on these networks could be included in Attachments 3 and 4, with the other networks and systems taken into account in the calculation. A note to this effect, indicating as well that India would need to provide corrected information on the four GSO networks to the next Consultation Meeting in order to continue to be taken into account, was agreed to be included in the Report to the BR. The Meeting was not able to sufficiently confirm the information on the Indian non-geostationary orbit so as to enable the inclusion of data on this system in the aggregate determination. As a result, preliminary information on the Indian non-GSO system is included in Attachment 3-A, and the Indian administration has indicated that it will provide updated and complete information on the non-GSO system in time for consideration at the fourth Resolution 609 (WRC-03) Consultation Meeting.

5. The Meeting compared the results from several different tools for determining the aggregate efd produced by all considered RNSS systems. These tools were found to be in very close agreement at all frequencies. The Meeting was satisfied with the degree of closeness of the results of calculations performed using the various calculation tools.

6. The Meeting calculated the maximum aggregate efd produced by all RNSS systems that provided characteristics to the June 2005 Meeting. The Meeting determined that under its aggregate efd calculation, the maximum efd of all satellites associated with the referenced RNSS systems was  $-125.7$  dB (W/m<sup>2</sup>/MHz), i.e. 4.2 dB below the Resolution 609 limit of  $-121.5$  dBW/m<sup>2</sup>/MHz. The meeting noted that this result is based on the use of worst-case assumptions in terms of interference from RNSS into ARNS. For example, in the case of non-GSO RNSS systems using circular orbits, the efd at a given latitude is considered equal for any longitude to that of the worst-case longitude.

7. The Meeting agreed on a Report to the Radiocommunication Bureau that contains the results of the calculation mentioned in No. 5 above, and directed that this Report be communicated to the BR in the manner contemplated in § 14 of the modified Terms of Reference. A copy of the Report to the Radiocommunication Bureau has been posted to the Resolution 609 Forum that is maintained by the BR on the ITU web site (<http://www.itu.int/ITU-R/space/res609/>).

8. The Meeting agreed that it is important, for the orderly operation of the Resolution 609 (WRC-03) consultation process and to ensure the achievement of accurate calculation results, that administrations providing information to Consultation Meetings comply with the deadlines and other requirements pertaining to information submission that are established in the Terms of Reference.

9. The Meeting received for information a copy of the BR determination of compliance with the pfd criterion as per *instructs BR 2* from Resolution 609 (WRC-03). After some discussion, the Meeting noted the document.

10. The Meeting took note that the Canadian Administration has filed a new API for a GSO RNSS network including spectrum in the 1164-1215 MHz RNSS band. This network, entitled NAV-2 107.3W, has the same technical parameters as the Canadian NAV 107.3W system, which is considered a single network with the U.S. LM-RPS-107.3W network for purposes of the Resolution 609 consultation process. The Meeting agreed to treat the NAV-2 107.3W network, along with NAV 107.3W and LM-RPS-107.3W, as a single network for purposes of the technical calculations for the Third Resolution 609 (WRC-03) Consultation Meeting.

11. The Meeting appointed Hugues De Bailliencourt to be the convener and Igor Zheltonogov to be the vice convener, for a period of three years or three meetings, whichever is shorter. The terms of the new convener and vice convener are to commence effective 1 September 2005.

12. The Meeting expressed its gratitude to the Bavarian Ministry of Economic Affairs, Infrastructure, Transport and Technology, and to EADS Astrium GmbH, for hosting the Meeting and providing extraordinary hospitality to the participants.

#### List of Attachments

Attachment 1 (Word document) – input format for RNSS system characteristics.

Attachment 2 (Excel spreadsheet):

Sheet 1. Template for new section I-9 of Attachment 1, latitude/longitude format for individual system epfd calculation results (5° steps).

Sheet 2. Template for new section I-9 of Attachment 1, longitude/latitude (note orientation change) format for individual system epfd calculation results (1° steps).

Sheet 3. Template for section I-8 of Attachment 1, spectral adjustment factors (SAF) relative to the worst 1MHz.

Attachment 3 (Word document) RNSS system characteristics considered at the meeting

Attachment 3A (Word document) Preliminary RNSS system characteristics for Indian non-geostationary satellite orbit network (not considered in the aggregate determination)

Attachment 4 (Excel spreadsheet): Simulated per-system epfd in 5 degree steps

## ATTACHMENT 1

### List of RNSS system characteristics to be provided to the Consultation Meeting per Item 11 c) of the Terms of Reference

#### **I RNSS systems characteristics**

##### **I-1 RNSS ITU publication reference**

RNSS network name	BR Network ID	ITU Publication reference	IFIC
		AR11/A/...	
		API/A/...	
		AR11/C/...	
		CR/C/...	

##### **I-2 Non-GSO satellite system constellation parameters**

$N$ : number of space stations of the non-GSO system

$K$ : number of orbital planes

$h$ : satellite altitude above the Earth (at apogee<sup>1</sup>) (km)

$h_p$ : satellite altitude above the Earth at perigee<sup>1</sup> (km)

$I$ : inclination angle of the orbital plane above the Equator (degrees).

Satellite index $I$	RAAN $\Omega_{i,0}$ (degrees)	Argument of latitude $u_{i,0}$ (degrees)	Argument of perigee of the non-GSO system <sup>1</sup> $\omega_i$
1	...		...
2	...		...
...	...		...
$N$	...		...

<sup>1</sup>Note: Applicable to non-GSO systems with elliptical orbit.

##### **I-3 GSO satellite system longitude**

LonGSO <sub>$i$</sub> : longitude of each of the GSO satellites (degrees).

**I-4 Maximum circular orbit non-GSO space station pfd versus the elevation angle at 40,000 feet above the Earth's surface (worst 1 MHz)**

Elevation angle (each 1°)	Pfd (dB(W/(m <sup>2</sup> /MHz)))
-4	pfd (-4°)
-3	pfd (-3°)
...	...
...	...
90	pfd (90°)

**I-5 GSO space station maximum pfd versus latitude and longitude at 40,000 feet above the Earth's surface (worst 1 MHz)**

Longitude (each 5°)*	0	5	...	360
Latitude (each 5°)*	Maximum pfd dB(W/m <sup>2</sup> ) in worst 1 MHz			
-90	pfd (0, -90)	...	...	...
-85	...	...	...	...
...	...	...	...	...
...	...	...	...	...
90	...	...	...	pfd (360, 90)

\* According to the Record of Decisions of the Munich meeting, there may be a need to make these determinations in 1 degree increments.

**I-6 Maximum off-axis EIRP density for non-GSO space stations with steerable beams, and antenna pointing information (worst 1MHz)**

For non-GSO systems with steerable beams, the following information is needed in order to calculate the epfd matrix:

- a) Satellite antenna pointing direction and other operational information to be used in calculating epfd values.
- b) Off-axis EIRP density:

Off-axis Angle (each 1°)*	EIRP density (dBW in worst 1MHz)
0	Eirp (0°)
1	Eirp (1°)
...	...

\* Off-axis values for smaller separation angles should be given to support the 5 degree or 1 degree calculations, as appropriate.

**I-7 Frequency/Satellite Matrix**

For non-GSO constellations where each satellite transmits different signals and/or at different central frequencies,

<u>Satellite index</u> <u>I</u>	<u>Transmitted Signal</u> <u>Central</u> <u>Frequency (MHz)</u>	<u>Attenuation of</u> <u>transmitted signal in</u> <u>worst 1 MHz (dB)</u>
<u>1</u>		
<u>...</u>		
<u>N</u>		

**I-8 GSO/non-GSO satellite system spectrum**

The level of spectrum emission in each 1 MHz relative to the spectrum value at the worst 1 MHz of the whole band (1 164-1 215 MHz) is provided below as the Spectral Adjustment Factor (SAF) in dB.

**Normalised Signal Power Spectrum**

<b>Center Frequency (MHz)</b>	<b>SAF (dB)</b>	<b>Center Frequency (MHz)</b>	<b>SAF (dB)</b>	<b>Center Frequency (MHz)</b>	<b>SAF (dB)</b>	<b>Center Frequency (MHz)</b>	<b>SAF (dB)</b>
1164		1177		1190		1203	
1165		1178		1191		1204	
1166		1179		1192		1205	
1167		1180		1193		1206	
1168		1181		1194		1207	
1169		1182		1195		1208	
1170		1183		1196		1209	
1171		1184		1197		1210	
1172		1185		1198		1211	
1173		1186		1199		1212	
1174		1187		1200		1213	
1175		1188		1201		1214	
1176		1189		1202		1215	

**I-9 Results of the epfd calculation for an individual system in the worst 1 MHz of the 1 164-1 215 MHz band**

Longitude (each 5°) <sup>2</sup>	0	5°	...	360
Latitude (each 5°) <sup>2</sup>	Maximum epfd dB(W/m <sup>2</sup> ) in worst 1 MHz			
-90	Epfd (0, -90)	...	...	...
-85	...	...	...	...
...	...	...	...	...
...	...	...	...	...
90	...	...	...	epfd (360, 90)

Additional simulation data for non-GSO systems only:

Time step (sec)	
Number of time steps	

**II. Technical Contact Person**

**Name:**  
**Tel./Fax:**  
**E-mail Address:**

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<sup>2</sup> See Record of 14-16 June 2005 Consultation Meeting. According to the Record of Decisions, there may be a need to make these determinations in 1 degree increments.

## ATTACHMENT 2



Microsoft Excel  
Worksheet

**ATTACHMENT 3**



"Attachment 3.doc"

**ATTACHMENT 3-A**



"Attachment  
3-A.doc"

## **ATTACHMENT 4**



"Att. 4 -- Per system  
epfd matrix (5 deg).x