

**Record of Decisions Taken at the
Twelfth Resolution 609 (Rev. WRC-07) Consultation Meeting**

(Via Correspondence, September 2015)

The Twelfth Resolution 609 (Rev. WRC-07) Consultation Meeting was convened by correspondence, pursuant to the requirements of Resolution 609 (Rev. WRC-07) in 2015.

The following actions were taken in regard to Resolution 609:

1. The Meeting agreed to keep the Terms of Reference unchanged. A copy of the Terms of Reference is available in the Resolution 609 Forum that is maintained by the BR on the ITU web site (<http://www.itu.int/ITU-R/go/space-resolution609/en>).
2. The Meeting decided that the Thirteenth Resolution 609 (Rev. WRC-07) Consultation Meeting will be convened at a venue to be determined, for a period of three working days, tentatively on 6-8, September, 2016.
3. The Meeting kept the format for the List of System Characteristics which is contained in Attachment 1 hereto, so as to contain the indication whether the system or network has been brought into use or is anticipated to be brought into use within 18 months after the start of the tentative dates of the next Consultation Meeting. The following points describe the List of System Characteristics required to be submitted by Administrations:
 - 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, worksheet named "sheet 1_epfd_1_step"), using 1-degree steps in latitude and longitude. For non-GSO systems, administrations should also provide the time step and the number of time steps simulated.
 - b. The system spectral adjustment factors (SAF) provided under Section I-8 of Attachment 1 should be in MS Excel format (see Attachment 2, worksheet named "sheet 2_SAF").
4. The Meeting agreed with respect to the systems that had provided technical characteristics to a prior Consultation Meeting within the specified deadlines, that it would not be necessary for the same technical information to be provided anew to the future Consultation Meeting. The only requirement is a confirmation of these characteristics pursuant to modified §12 of the Terms of Reference.
5. The Meeting compared the results (obtained using 1-degree data) from the different tools used to determine the aggregate epfd produced by all considered RNSS systems. After discussions regarding the assumptions and methodologies used by each tool, the Meeting agreed on the specific epfd matrix to be retained for each RNSS system, with results obtained through the different tools being comparable. The Meeting agreed to continue the cross-

verification of each tool and detailed methodologies for the single system/network epfd calculation.

6. The Meeting calculated the maximum aggregate epfd produced by all RNSS systems that provided/confirmed characteristics in accordance with the procedure contained in the Terms of Reference (see attachment 4).

The Meeting noted that INSAT-NAV(131.5) was not on the list of RNSS networks and systems posted by the BR in April 2015. It also noted that India has several INSAT-NAVR GSO filings near the 131.5 degree orbital slot. However, the Meeting determined that they do not meet the Resolution 609 criteria since no network parameters have been submitted to the CM. Therefore, the Meeting did not include INSAT-NAV(131.5) in the aggregate epfd calculation.

7. The Meeting determined that under its aggregate epfd calculations mentioned in No. 6, the maximum epfd of all satellites associated with the referenced RNSS systems would not exceed $-122.00\text{dB(W/(m}^2\cdot\text{MHz))}$, i.e. 0.5 dB below the Resolution 609 limit of $-121.50\text{ dB(W/(m}^2\cdot\text{MHz))}$. The Meeting noted that this result is based on the use of worst-case assumptions in terms of interference from RNSS into ARNS.

8. The Meeting agreed on a Report to the Radiocommunication Bureau that contains the results of the calculations mentioned in Nos. 6 and 7, above, and directed that this Report be communicated to the BR in the manner contemplated in § 14 of the 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://groups.itu.int/res-609/RES-609PORTAL.aspx>).

9. The Meeting agreed that it is important, for the orderly operation of the Resolution 609 (Rev. WRC-07) consultation process and to ensure the achievement of accurate calculation results, that administrations providing information to Consultation Meetings comply with the deadlines established in the Terms of Reference.

10. 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 (Rev. WRC-07). The Meeting will continue to invite the BR to include two additional columns in the table:

- One indicating the date that the administrations reported that the frequency assignments have been brought into use
- Another column indicating the compliance with the pfd criterion taking into account the systems or networks characteristics which are available through the Resolution 609 submissions.

11. The Meeting agreed to invite administrations to determine whether the pfd level in *recommends* 1 of Recommendation 608(Rev.WRC-07) is exceeded by any space station of the corresponding RNSS systems, and to report the findings of this determination.

12. At the Eleventh Resolution 609 CM the following technical questions concerning IRNSS non-GSOs were identified:

a. IRNSS Section X-4 of Attachment 3: Maximum pfd versus Elevation Angles

The values of *maximum circular orbit non-GSO space station pfd versus the elevation angle at 40,000 feet above the Earth's surface* provided by India in Section XI-4 are not applicable to the IRNSS non-GSOs. The Meeting understood that INSAT-NAVR-GS and INSAT-NAV-NGSA utilize steerable antenna beams and, therefore, the *pfd* values are not applicable. For these types of systems, only their off-axis e.i.r.p. density is needed. (Please see question b.)

b. IRNSS Section X-6 of Attachment 3: off-axis e.i.r.p. density

- In Section X-6, the off-axis e.i.r.p. density values are provided for off-axis angles from 0 to 11 degrees. The Meeting believes that maximum off-axis e.i.r.p. density values may be needed for off-axis angles greater than 11 degrees (e.g., to 14 degrees).

- The range of off-axis angles should include all possible angles from a space station antenna main beam pointing direction to an ARNS receiver at 40,000 feet above the surface of the Earth.

- It would also be helpful to add, if applicable, a note indicating: "None of the eight non-GSO satellites of the IRNSS constellation have power control on RNSS signal transmissions."

For the Twelfth Resolution 609 CM, the India administration submitted information concerning off-axis e.i.r.p. density values. Because this information is supplementary, the Meeting agreed to treat India system having no updated information for this CM.

13. During the development of the RNSS systems in this band, there will be some temporary situations, such as the transition of some systems from one phase to another (e.g. regional to global service transition, orbital relocation, or satellite back up) that could affect the aggregate epfd. At present, recognizing the need to protect ARNS, the Meeting agreed to calculate the aggregate epfd by using the worst case epfd of such RNSS systems in both phases. Once the transition is completed, the aggregate RNSS emissions will decrease.

14. The Meeting determined that if there is a predicted exceedance of the maximum aggregate epfd by operational systems and networks, the first step to be taken in resolving the exceedance will be to have any administration with any operational satellite that exceeds the maximum per-satellite pfd level in Recommendation 608 (Rev. WRC-07) to reduce the maximum pfd produced at the surface of the Earth, for all angles of arrival, to or below -129 dB(W/m²) in any 1 MHz band under free space propagation conditions. Only if this does not resolve the exceedance should other appropriate modifications be considered under *resolves 2* of Resolution 609 (Rev. WRC-07).

15. As the Resolution 609 process has continued, the results of the aggregate epfd calculation show that the epfd level from filed RNSS systems (some operational, some planned) is nearing the maximum aggregate epfd level specified in *resolves 1* of Resolution 609 (rev. WRC-07). The Meeting agreed to consider the items listed below.

- use of actual operational link characteristics (e.g., maximum operational power levels, instead of filed parameters) should be continued to be encouraged;
- for compliance with the epfd limit specified for RNSS, new entrants are urged to take various actions including operation in other portions than the worst-case epfd frequency ranges in the band 164-1 215 MHz.

- revisions to the epfd calculation methodology to avoid the addition of different worst cases and revisiting some assumptions (e.g. orbit propagation model) may be considered in the future to produce more realistic results, rather than simple addition of worst-case of epfd calculation results of each system.

16. Because the Twelfth Resolution 609 CM was convened by correspondence, the Meeting requested and received the status of the development of RNSS systems and networks operating or planning to operate in the band 1 164-1 215 MHz. The document 'RNSS_systems_networks_status_12thRes609CM' was updated based on the above correspondence. The Meeting noted that the use of the band 1 164-1 125 MHz is by both non-geostationary and geostationary RNSS systems and networks today is substantial.

17. The Meeting expressed the urgent need that all efforts are made to ensure that all administrations with filings and concrete plans to operate RNSS systems in the 1 164-1 215 MHz band participate fully and on a continuing basis in the mandatory Resolution 609 consultation process, including submitting materials in accordance with the Terms of Reference and attending the meetings. In this regard, the Meeting encouraged the Bureau to continue reaching out to those administrations with RNSS filings in the 1 164-1 215 MHz band that have not participated fully and on a continuing basis in the Resolution 609 consultation process in an effort to get them to participate at their earliest opportunity where appropriate, and highlighting the mandatory nature of the Resolution 609 (Rev. WRC-07) Consultation Meeting for those systems/administrations with concrete plans to operate RNSS systems in the 1 164-1 215 MHz band.

List of Attachments

Attachment 1 (Word document): Input format required for RNSS system characteristics.

Attachment 2 (Excel spreadsheet):

Sheet 1 (“sheet 1_epfd_1_step”). Template for Section I-9 of Attachment 1, longitude/latitude (note orientation change) format for individual system epfd calculation results (1-degree steps).

Sheet 2 (“sheet 2_SAF”). Template for Section I-8 of Attachment 1, spectral adjustment factors (SAF) relative to the worst 1MHz.

Attachment 3 (Word document): RNSS System Characteristics provided/confirmed to be met with the submission criteria in the Terms of Reference.

Attachment 4 (Excel spreadsheet): Simulated per-system epfd of each RNSS system using the 1-degree data available in attachment 3.