

Agenda item 9.1(9.1-b)

**5/9.1-b Review the amateur service and the amateur-satellite service allocations in the frequency band 1 240-1 300 MHz to determine if additional measures are required to ensure protection of the radionavigation-satellite service (space-to-Earth) operating in the same band in accordance with Resolution 774 (WRC-19);**

Resolution 774 (WRC-19) – *Studies on technical and operational measures to be applied in the frequency band 1 240-1 300 MHz to ensure the protection of the radionavigation-satellite service (space-to-Earth)*

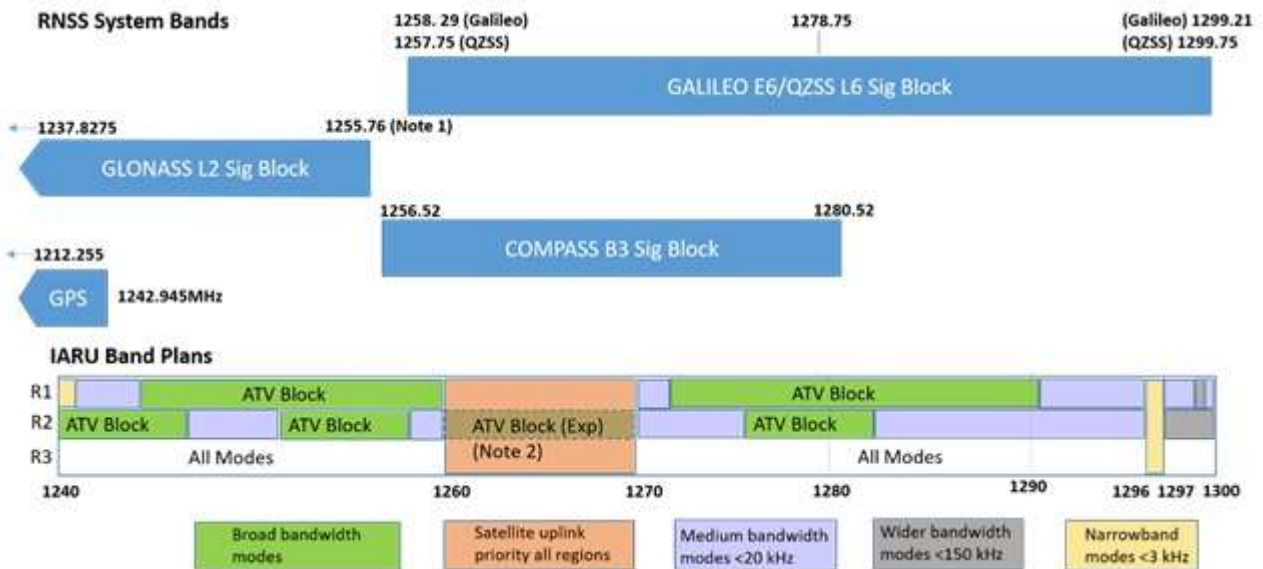
**Summary of the results of ITU-R studies**

The frequency band 1 240-1 300 MHz is allocated to the radionavigation-satellite service (RNSS) on a primary basis and used by various global and regional RNSS systems (e.g. GALILEO, GLONASS, COMPASS, GPS, QZSS) in different portions of the frequency band 1 240-1 300 MHz, for various applications, including high-accuracy location services with ubiquitous deployment of RNSS receivers. Furthermore, the band is allocated to the amateur and amateur-satellite services on a secondary basis.

Preliminary draft new Report ITU-R M.[AMATEUR.CHARACTERISTICS] provides the detailed information on the review of amateur and amateur-satellite service applications and a compilation of appropriate and relevant parameters and operational characteristics for the studies, while Report ITU-R M.2513 details the potential interference analysis and related studies.

FIGURE 5/9.1-B-1

**The relationship between the various RNSS systems usage across the range 1 240-1 300 MHz and the amateur and amateur-satellite services band plans**



Note 1: GLONASS navigation receivers manufactured before 2006 can receive navigation signals in the frequency band from 1 237.8275 MHz to 1 260.735 MHz.

Note 2: In Region 2, amateur television (ATV) is also identified for experimental use in this range.

The review of amateur and amateur-satellite applications reveals a range of narrowband and wideband emission types across the frequency range organized according to regional band plans. Operational data indicate a relatively low population of actively transmitting stations across the frequency band 1 240-1 300 MHz and operating characteristics suggest that emissions from the most common amateur stations are neither of long duration nor persistent in nature, which may help to achieve compatibility with RNSS (space-to-Earth).

Some cases of harmful interference caused by transmission from stations in the amateur service into RNSS (space-to-Earth) receivers have occurred, as recognized in Resolution **774 (WRC-19)**. As mandated by this Resolution, ITU-R has carried out studies and measurement campaigns.

## Studies

Minimum coupling loss studies using the propagation model described in Recommendation ITU-R P.1546 considering typical propagation model parameters for worst-case and average scenarios were undertaken in order to provide the assessment of the geographical extent of interference which could be caused by a representative set of transmitting stations of the amateur service into RNSS (space-to-Earth) receivers. The studies indicate areas around radio amateur stations which show the potential for harmful interference into RNSS (space-to-Earth) receivers the extent of which depends on specific conditions such as using narrowband or wideband applications and clutter.

## Receiver measurement campaigns

One measurement campaign was performed in Germany after the transmission of one amateur television station caused harmful interference to an RNSS (space-to-Earth) reference receiver operating in the frequency band 1 260-1 300 MHz. Signals representative of amateur stations were injected into the antenna port of an RNSS (space-to-Earth) receiver with 30 MHz bandwidth, at the Galileo E6 centre frequency and with frequency offsets dependent on the type of amateur emission in accordance with the International Amateur Radio Union (IARU) band plan (see Figure 5/9.1-B-1). Measurements of the post-correlation  $C/N_0$  degradation led to the observation that the worst case occurs when an interfering signal is applied on the E6 centre frequency, while frequency separation from the E6 centre frequency yields significantly lower interference levels in the Galileo E6 receiver, in particular when this interfering signal falls outside the 30 MHz bandwidth specified for the receiver used in the measurement campaign. The impact of the interfering signal on non-E6 RNSS (space-to-Earth) receivers operating in other parts of the frequency band 1 240-1 300 MHz were not considered.

An additional interference suppression unit (ISU) used in some measurement setups resulted in significant interference reduction for narrowband signals (up to 150 kHz bandwidth) at arbitrary frequency positions. The ISU did not affect the reception quality when no interferer was present. The ISU did not perform well in equalizing wideband amateur television signals.

Like the case without an ISU, the measurements with an ISU have shown that a frequency offset of a possible interferer, relative to the Galileo E6 centre frequency, helps the RNSS (space-to-Earth) receiver retain its performance.

Another measurement campaign was performed in Italy after a frequency modulated signal transmitted by an amateur radio repeater station caused harmful interference to Galileo E6 receivers multiple times. The effect of amateur service transmissions with different power levels and different central frequencies was assessed using three different RNSS (space-to-Earth) receivers characterized by different front-end bandwidths spanning approximately from 30 MHz to 40 MHz.

Results show that of the four measured amateur applications the two which show the highest compatibility potential with RNSS (space-to-Earth) receivers, provided that power levels remain below certain thresholds, are narrowband FM and digital data. On the other hand, wideband amateur television applications caused harmful interference even at lower power, and offer lower compatibility potential.

*View 1:*

*Some administrations have a view that the frequency band 1 240-1 300 MHz is also allocated worldwide on a primary basis to the RNSS in the space-to-space direction and to the Earth exploration-satellite service (EESS) (active) with clear understanding that Resolution 774 (WRC-19) concentrate only on the protection of the RNSS (space-to-Earth) receivers.*

*However, the output of the agenda item 9.1(9.1-b) presented in the working document towards a preliminary draft new (WDPDN) Recommendation ITU-R M.[AS.GUIDANCE] proposes a power level of 100 W/1 MHz at a gain of 18 dB in a number of frequency ranges for the amateur and amateur-satellite services. Such output creates a risk of unacceptable interference to RNSS and EESS (active) space receivers.*

*Calculations from only one source of potential interference in the amateur service to typical RNSS and EESS space receivers in the frequency band 1 240-1 300 MHz indicated that:*

- the level of exceedance of the RNSS space receiver protection criteria by a station in the amateur service can be as high as 13 dB;*
- the level of exceedance of the EESS space receiver protection criteria by a station in the amateur service can be as high as 38.7 dB (assuming with respect to the EESS that the receiver antenna gain of the space station subject to the interference is 10 dB in the direction of the interference source).*

*Detailed technical calculations are presented in Tables 1 and 2 of Document [CPM23-2/102](#).*

*Based on the information presented above, it is necessary to take into account the need to ensure protection for RNSS (space-to-space) and EESS (active) space receivers. Therefore, it is proposed to modify Resolution 774 (WRC-19) so that the necessary additional studies could be carried out and work on Recommendation ITU-R M.[AS.GUIDANCE] could be continued. The results of such studies should be included in the Report of the Director of the Radiocommunication Bureau to WRC-27 for the purpose of considering appropriate actions.*

*View 2:*

*Other administrations are of the view that the issues raised in View 1 above are completely out of scope for WRC-23 agenda item 9.1, topic b) and Resolution 774 (WRC-19). The BR Director's Report is intended to report on the activities of the ITU-R. It is not intended to create new studies. If there is a need for studies with respect to RNSS (space-to-space) and EESS (active) as mentioned in View 1, it is appropriate to deal with the issue under WRC-23 agenda item 10 to propose a future agenda item for WRC-27.*

*In order to satisfy this topic, the development of Recommendation ITU-R M.[AS.GUIDANCE] needs to be completed and approved for WRC-23.*

*View 3:*

*Some administrations consider that the work undertaken for agenda item 9.1, topic b) has been carried out in full agreement with the resolves of Resolution 774 (WRC-19), focused on the protection of RNSS (space-to-Earth) receivers from amateur and amateur-satellite services in the frequency band 1 240-1 300 MHz. Additional studies related to the protection of other services in*

*this frequency range can be carried out in the normal work of the ITU-R between the relevant Working Parties.*

### **Summary**

Some cases of harmful interference caused by transmissions from stations in the amateur service operating on a secondary basis into RNSS (space-to-Earth) receivers operating on a primary basis have been observed, documented and reported in two countries. More information can be found in Report ITU-R M.2513.

Recommendation ITU-R M.1902 provides the 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 which were considered when developing studies. These subsequent studies and measurements, presented in Report ITU-R M.2513, provided an estimate of potential interference distance and confirmed that the impact of interference generally depends on the bandwidth, power of the interfering signal but also upon the antenna installation height. Furthermore, these studies and measurements predicted that RNSS (space-to-Earth) receiver protection criteria could be exceeded by co-frequency emissions from typical amateur stations. Operational data indicate a relatively low population of actively transmitting stations across the frequency band 1 240-1 300 MHz and operating characteristics suggest that emissions from the most common amateur stations are neither of long duration nor persistent in nature, which may help to achieve compatibility with RNSS.

ITU-R is developing a Recommendation ITU-R M.[AS.GUIDANCE] providing guidelines in order to avoid such cases of harmful interference to the RNSS (space-to-Earth) receivers in the future. This Recommendation could include encouragement for the amateur and amateur-satellite services to use specific sub-bands with sufficient frequency offsets from the spectrum main lobes of RNSS signals, maximum emission power level and emission bandwidth restrictions to enhance the protection of RNSS (space-to-Earth) receivers in the bands under consideration.

These guidelines are intended to assist administrations and the amateur and amateur-satellite services to ensure the protection of the RNSS (space-to-Earth) in the frequency band 1 240-1 300 MHz.