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| **Radiocommunication Study Groups** |  |
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CHAPTER 5

General issues

(Agenda items 2, 4 and 9.1 topics a), b), c) and d))

Agenda item 9.1(9.1-b)

# 5/9.1-b *Review of 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 (space-to-Earth) service 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)*

(**WP 5A** / **WP 3M, WP 4C[[1]](#footnote-1)\*,** **WP 7C**)

# Summary of the results of ITU-R studies

The frequency band 1 240-1 300 MHz is allocated to the RNSS (space-to-Earth) 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 (PDN) 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 PDN Report ITU-R M.[AMATEUR-RNSS] details the potential interference analysis and related studies.

Figure 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 frequency band from 1 237.8275 MHz to 1 260.735 MHz.
Note 2: In Region 2, 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 organised 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.

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 propagation model parameters typical 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 receivers. The studies indicate areas around radio amateur stations which show the potential for harmful interference into RNSS receivers the extent of which depends on specific conditions such as using narrow band 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 reference receiver operating in the frequency range 1 260-1 300 MHz. Signals representative of amateur stations were injected into the antenna port of an RNSS 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 IARU band plan (see Figure 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 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 wide-band 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 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 receivers characterised by different front-end bandwidth 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 receivers, provided that power levels remain below certain thresholds, are narrow band FM and digital data. On the other hand, wideband amateur television applications caused harmful interference even at lower power and offer lower compatibility potential.

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.

Subsequent studies provided an estimate of potential interference distance and confirmed that the impact of interference generally depends on the bandwidth and power of the interfering signal. Furthermore, these studies predicted that RNSS receiver protection criteria could be exceeded by co-frequency emissions from typical amateur stations.

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 receivers in the future. This Recommendation could include, *inter alia*, encouragement of the use of specific sub-bands with sufficient frequency offsets from the spectrum main lobes of RNSS signals to enhance the protection of RNSS 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.

1. \* WP 4C is responsible for developing studies on *resolves to invite ITU-R* 2 of Resolution **774 (WRC-19)** and sending this to WP 5A. [↑](#footnote-ref-1)