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| Background: |
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DRAFT CEPT BRIEF ON AGENDA ITEM 9.1 Topic b

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

# ISSUE

WRC-19 through Resolution 774 (WRC-19) resolves to invite the ITU Radiocommunication Sector:

1 to perform a detailed review of the different systems and applications used in the amateur service and amateur-satellite service allocations in the frequency band 1 240 1 300 MHz;

2 taking into account the results of the above review, to study possible technical and operational measures to ensure the protection of RNSS (space-to-Earth) receivers from the amateur and amateur-satellite services in the frequency band 1 240-1 300 MHz, without considering the removal of these amateur and amateur-satellite service allocations;

# Preliminary CEPT position

* CEPT supports the protection of the RNSS
* CEPT supports the development of a new ITU-R Recommendation based on the ITU-R Reports to provide guidance towards the implementation of technical and operational measures for the continued use of the frequency band 1 240-1 300 MHz by the Amateur and Amateur-satellite services in accordance with the RR in order to protect the RNSS.
* CEPT supports that the above-mentioned measures to be applied on the use of secondary Amateur and Amateur-satellite services should be based on the results of co-existence studies and measurement campaigns.

# Background

CEPT is developing an ECC Decision on technical conditions to achieve coexistence between amateur service/ amateur-satellite service and the radionavigation-satellite receivers in the frequency band 1240 - 1300 MHz. Technical studies are conducted to develop possible scenarios with conditions or limitations that may be applied to the amateur service to ensure the future coexistence of both services and avoid cases of interference considering the allocations in the frequency band 1240-1300 MHz to the radionavigation-satellite service (RNSS) with a primary status and to the amateur service and a portion to the amateur-satellite service, both with a secondary status as well as to other services.

Globally the frequency band 1240 – 1300 MHz is allocated in the RR to the radio navigation satellite service (space-to-Earth / space-to-space) on a (co-) primary basis and the amateur service on a secondary basis. The portion 1260 – 1270 MHz is also allocated to the amateur satellite service on a secondary basis by footnote 5.282. The overall ITU allocation including other services and relevant footnotes is illustrated below:-



ITU-R WP5A has responsibility for developing the CPM text for this agenda item in collaboration with ITU-R WP 4C which has responsibility for coexistence studies under this issue.

In accordance with established band plans, the amateur services facilitate experimental radio communication activities that include long distance, weak signal reception of a range of narrow band voice and data modes. Wideband analogue and digital TV applications are also facilitated.

Systems and networks in the radionavigation-satellite service (RNSS) provide worldwide accurate information for many positioning, navigation and timing applications, including sensitive high accuracy applications in some frequency bands.

The two key RNSS systems developed in the CEPT region and providing global coverage are GLONASS and GALILEO. The relationship between the specific frequencies in use by the global set of RNSS systems and the amateur service applications in Regions 1, 2 and 3 are summarised in Figure 1.



Figure 1: Frequencies in use by the global set of RNSS systems and the amateur service applications in Regions 1, 2 and 3

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.

In accordance with resolves 1 of Resolution 774 (WRC-19) both the CEPT and ITU-R WP 5A have received and reviewed data and information regarding the different systems and applications used in the amateur and amateur-satellite services provided by both the amateur community and administrations. The information provides insight into the most popular modes of operation, the most typical operating scenarios and equipment characteristics. This data has been used to define the most relevant scenarios and characteristics for the coexistence studies in accordance with resolves 2 of Resolution 774 (WRC-19). The scenarios include Home Stations transmitting with a range of transmitter power levels, amateur-satellite uplink transmitters, earth-moon-earth (EME) operations and permanent installation transmitters. Both narrowband and wideband emissions are considered although they may not all be relevant in all scenarios.

Three key station types (Home Stations, Temporary Stations and Permanent Installations) are identified and aligned with the most popular operating modes and applications. Referring to Figure 1 above, the large majority of amateur transmitting activity takes place between Home Stations using voice, telegraphy and narrowband digital modes in the globally aligned narrowband mode section between 1296 MHz and 1297 MHz. The medium bandwidth modes are generally associated with Permanent Installations which include repeater stations relaying voice applications. The broad bandwidth mode sections generally accommodate amateur television applications (both Home Stations and Permanent Installations) with a growing trend towards more spectrally efficient and narrower bandwidth digital television.

Reviews have shown that the busiest periods are by far the scheduled radio-sport events that take place in all countries. Information on the extent and number of these and the numbers of transmitting amateur stations during these periods has been provided. These events provide the opportunity to consult published activity data from a number of the most active CEPT countries allowing the density of transmitting users in this frequency range to be estimated. Based on this survey of actively operational transmitting stations the average density of users for the most popular mode of operation is 0.0002 stations /km2 across the CEPT region. For narrow-band activity periods the maximum density of transmitting home stations and temporary “portable” stations can range from 0.00006 to 0.0016 stations per km².Information on the most “busy period” of transmitting activities has been derived and documented in the ITU-R Reports showing that the total for the individual major applications is less than 1.5% of time in a year with an aggregate of around 4% in total for all emissions.

Data is also recorded that reports the maximum numbers of actively transmitting stations which is never more than 150 in a single CEPT country and is usually considerably lower.

Permanent Stations may present higher operational periods due in part to ID signal licensing requirements and might operate in a propagation beacon mode when not re-transmitting user traffic.

## Status OF ITU-R STUDIES

Concerning the work on the draft CPM text, ITU-R WP 5A has finished the development of the draft CPM Text, which was revised at CPM23-2, for WRC-23 agenda item 9.1, topic b) that contains the summary of studies realised by ITU-R WP 4C.

ITU-R has finished developing the Draft New Report ITU-R M.[AMATEUR-RNSS] which was approved by SG4 and published as Report ITU-R [M.2513](https://www.itu.int/pub/R-REP-M/publications.aspx?lang=en&parent=R-REP-M.2513). The Report provides the results of measurements and Minimum Coupling Loss studies on the impact of amateur emissions on RNSS receivers, and is intended to eventually describe possible technical and operational measures to ensure the protection of RNSS, as per resolves 2 of Resolution 774 (WRC-19).

WP 5A is also developing a new Report called Preliminary Draft New Report ITU-R M.[AMATEUR.CHARACTERISTICS], based on its detailed review of the different systems and applications used in the amateur and amateur-satellite services in the 1240-1300 MHz range, conducted as per resolves 1 of Resolution 774 (WRC-19).

WP 4C and WP 5A have been liaising closely as the work progressed on the development of the Report ITU-R M.[2513](https://www.itu.int/pub/R-REP-M/publications.aspx?lang=en&parent=R-REP-M.2513) and are still liaising closely on the development of the Preliminary Draft New Report ITU-R M.[AMATEUR.CHARACTERISTICS]. The scope of these documents is to address the analysis and studies identified under Resolution 774 (WRC-19).

Since technical and operational measures to ensure the protection of RNSS (space-to-Earth) receivers from the amateur and amateur-satellite services in the frequency band 1240-1300 MHz might be required then WP 5A in collaboration with WP 4C have also started to develop a Preliminary Draft New Recommendation ITU-R M.[AS GUIDANCE] which could be part of the solution for this agenda item. This Recommendation intends to provide guidelines for the use of the frequency band 1 240 – 1 300 MHz by stations of amateur and amateur-satellite services, in order to encourage the use of specific sub-bands with sufficient frequency offset from RNSS receivers, maximum emission power level and emission bandwidth restrictions to enhance the protection of RNSS (space-to-Earth) receivers in the bands under consideration. At the last meeting in November 2022, WP 5A has made good progress in developing this Recommendation and multiple sub-bands, maximum emission power levels and emission bandwidth restrictions have been identified, proposed and are under revision and discussion by WP 5A and WP 4C.

Report ITU-R [M.2513](https://www.itu.int/pub/R-REP-M/publications.aspx?lang=en&parent=R-REP-M.2513) currently contains studies aiming at assessing the impact of emissions in the amateur and amateur-satellite services on RNSS receivers. In this report, there are Minimum Coupling Loss studies that provide an assessment of the geographical extent of potential interference (i.e. over which the Galileo protection criteria could be exceeded) caused by transmitting stations of the amateur service into Galileo E6 receivers, and real measurement studies. The Minimum Coupling Loss studies have shown potential interference areas around radio amateur stations.

These studies have focussed on evaluating the distances and interference exceedance level over which a signal from an amateur transmitter operating at a given power level might exceed a RNSS receiver “protection criteria”. This is a static assessment based on minimum coupling loss methodology using the Recommendation ITU-R P.1546 propagation model.

These studies have not considered the probabilities of interference from amateur stations and amateur satellite stations using deployment simulations to build up a statistical picture of RNSS received signal levels.

Amateur transmitting stations continually adjust their directional antenna azimuth pointing angle during periods of transmitting activity (the exception being Permanent Station installation having fixed antennas). This and the mobile nature of many of the RNSS receivers might lead to a continually varying signal/interference environment for any individual RNSS receiver.

An assessment of time length of potential interference from transmitting amateur-satellite uplink stations into Compass B3 receivers has been proposed in the approved Report ITU-R [M.2513](https://www.itu.int/pub/R-REP-M/publications.aspx?lang=en&parent=R-REP-M.2513) and the study has shown that a transmitting amateur-satellite uplink station could cause harmful interference to Compass B3 receivers in its adjacent area of at least 1.45 km for 2%-3% of time over a one day period.

In May/June 2021 at the European Commission Joint Research Centre (EC JRC) in the region of Varese (Italy), a number of interference events to a small number of RNSS receivers were detected and assessed by the Joint Research Centre of the European Commission and documented in Report ITU-R [M.2513](https://www.itu.int/pub/R-REP-M/publications.aspx?lang=en&parent=R-REP-M.2513). The interfering signals were considered to exceed the Galileo protection criteria. These interference events occurred between a local licensed amateur permanent station (voice traffic FM modulated repeater station) and the RNSS receivers in the EC JRC facility during the testing of the new Galileo High Accuracy Service (HAS).

Further evidence of interference was also documented in Report ITU-R [M.2513](https://www.itu.int/pub/R-REP-M/publications.aspx?lang=en&parent=R-REP-M.2513) where a few years ago at an RNSS reference receiver located in Munich (Germany) one broadband amateur application caused harmful interference to the receiver in the frequency band 1260-1300 MHz. The signal was concluded to be an amateur TV emission (analogue and digital) from a station. The interference was resolved by National regulatory measures. No further interference was reported in this area. Part of the concerned band is no longer designated to the broadband amateur application. This measure is reflected in the proposed ITU-R Recommendation.

The Joint Research Centre of the European Commission has also carried out an extensive testing campaign within its premises that had as objective the assessment of the impact of different amateur signals on a batch of professional RNSS receivers under different conditions and that can be found in Report ITU-R [M.2513](https://www.itu.int/pub/R-REP-M/publications.aspx?lang=en&parent=R-REP-M.2513). This testing was done in order to provide the most complete possible picture on the compatibility between Galileo and amateur emissions. For the moment, this testing campaign shows potential coexistence difficulties between certain amateur applications and RNSS within the E6 band.

Another measurement campaign, documented also in Report ITU-R [M.2513](https://www.itu.int/pub/R-REP-M/publications.aspx?lang=en&parent=R-REP-M.2513), was performed in Germany after the transmission of one amateur television station caused harmful interference to a Galileo reference receiver operating in the frequency range 1 260-1 300 MHz. Signals representative of amateur stations were injected into the antenna port of a Galileo 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/N0 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 1 240-1 300 MHz band were not considered. An additional Interference Suppression Unit (ISU) used in some of the measurement setups considered by Germany 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.

The tests conducted clearly show that for most of amateur emissions it is extremely challenging, if at all possible, to comply with the Recommendation ITU-R M.1902 protection criteria stated for the specific band and meant to protect RNSS receiver operation.

## Further considerations

Even if apparently few interference cases have been proven so far, those were identified just because they were happening in the proximity of Galileo infrastructures or specialized laboratories (e.g. Galileo ground centre nearby Munich, JRC in Italy). Normal users do not have the capacity to realize they are being interfered, and even less to identify the eventual source of interference. They would just experience a degradation of the service.

Furthermore, new services (e.g. Galileo High Accuracy Service, HAS, and Authentication Service, CAS) are being deployed on a worldwide and ubiquitous basis and need to be protected.

# List of relevant documents

ITU-Documentation (Recommendations, Reports, other)

* Recommendation [ITU-R M.1902](https://www.itu.int/rec/R-REC-M.1902/en) 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
* Recommendation [ITU-R M.1787](https://www.itu.int/rec/R-REC-M.1787/en) Description of systems and networks in the radionavigation-satellite service (space-to-Earth and space-to-space) and technical characteristics of transmitting space stations operating in the bands 1 164-1 215 MHz,1 215-1 300 MHz and 1 559-1 610 MHz
* Recommendation [ITU-R M.1732](https://www.itu.int/rec/R-REC-M.1732/en) Characteristics of systems operating in the amateur and amateur-satellite services for use in sharing studies
* Recommendation [ITU-R M. 1904](https://www.itu.int/rec/R-REC-M.1904-1-201909-I/) Characteristics, performance requirements and protection criteria for receiving stations of the radionavigation-satellite service (space-to-space) operating in the frequency bands 1 164-1 215 MHz, 1 215-1 300 MHz and 1 559 1 610 MHz
* Recommendation [ITU-R M.2030](https://www.itu.int/rec/R-REC-M.2030/en) Evaluation method for pulsed interference from relevant radio sources other than in the radionavigation-satellite service to the radionavigation-satellite service systems and networks operating in the 1 164-1 215 MHz, 1 215 1 300 MHz and 1 559-1 610 MHz frequency bands
* Recommendation [ITU-R P. 1546-6](https://www.itu.int/rec/R-REC-P.1546/en) Method for point-to-area predictions for terrestrial services in the frequency range 30 MHz to 4 000 MHz
* Recommendation [ITU-R S. 465](https://www.itu.int/rec/R-REC-S.465/en) Reference radiation pattern of earth station antennas in the fixed satellite service for use in coordination and interference assessment in the frequency range from 2 to 31 GHz
* Recommendation [ITU-R F. 1336-v5](https://www.itu.int/rec/R-REC-F.1336/en) Reference radiation patterns of omnidirectional, sectoral and other antennas for the fixed and mobile service for use in sharing studies in the frequency range from 400 MHz to about 70 GHz
* Report [ITU-R M. 2220](https://www.itu.int/pub/R-REP-M.2220) Calculation method to determine aggregate interference parameters of pulsed RF systems operating in and near the bands 1 164-1 215 MHz and 1 215 1 300 MHz that may impact radionavigation-satellite service airborne and ground based receivers operating in those frequency bands
* Report [ITU-R M. 2284](https://www.itu.int/pub/R-REP-M.2284) Compatibility of radio-navigation satellite service (space-to-Earth) systems and radars operating in the frequency band 1 215-1 300 MHz
* Report [ITU-R M. 2305](https://www.itu.int/pub/R-REP-M.2305) Consideration of aggregate radio frequency interference event potentials from multiple Earth exploration-satellite service systems on radionavigation-satellite service receivers operating in the 1 215-1 300 MHz frequency band
* Report ITU-R [M.2458](https://www.itu.int/pub/R-REP-M.2458) – Radionavigation-satellite service applications in the 1 164-1 215 MHz, 1 215-1 300 MHz and 1 559-1 610 MHz frequency bands
* Report ITU-R M. 2513 - Studies regarding the protection of the primary radionavigation-satellite service (space-to-Earth) by the secondary amateur and amateur-satellite services in the frequency band 1 240-1 300 MHz
* Report [ITU-R RS. 2311](https://www.itu.int/pub/R-REP-RS.2311) Pulsed radio frequency signal impact measurements and possible mitigation techniques between Earth exploration-satellite service (active) systems and RNSS systems and networks in the band 1 215-1 300 MHz
* Study Question [ITU-R 288/4](https://www.itu.int/pub/R-QUE-SG04.288) Related results of the WP 4C work on the Study Question on characteristics and operational requirements of radionavigation-satellite systems
* Study Question [ITU-R 48-7/5](https://www.itu.int/pub/R-QUE-SG05.48) Related results of the WP 5A work on the Study Question on techniques and frequency usage in the amateur service and amateur-satellite service
* Handbook [ITU-R 52](https://www.itu.int/pub/R-HDB-52) – Amateur and amateur-satellite services
* IARU R1 band plan for the band 1 240-1 300 MHz
* CPM Report to WRC-23 CEPT and/or ECC Documentation (Decisions, Recommendations, Reports)
* Draft ECC Report on the amateur service and RNSS coexistence in the band 1240 – 1300 MHz developed by SE40

EU Documentation (Directives, Decisions, Recommendations, other), if applicable

# Actions to be taken

* To study the coexistence between systems of the RNSS, and systems/applications of the Amateur service and the Amateur-satellite service.
* Develop adequate measures to be applied on use of secondary the Amateur and Amateur satellite service, based on the results of co-existence studies and measurement campaigns in order to protect the RNSS.
* Continuous liaison should be established between PTC and SE40 on the agenda item.
* Administration and interested parties are requested to further contribute on the ongoing studies to progress on these issues.
* To contribute to the development of the European Common Proposal (ECP) on WRC-23 agenda item 9.1b in support of protection of RNSS, based on the results of the available studies.

# Relevant information from outside CEPT

## RSPG (December 2022)

The RSPG recommends that the EU should support the establishment of technical conditions applicable to the secondary amateur service that provide adequate protection of the radionavigation satellite service, including various Galileo services (HAS, CAS and PRS) receivers, in the frequency band 1 260- 1 300 MHz in an ITU-R Recommendation that should be used by all ITU Member States for ensuring the protection of GNSS.

This Agenda Items requires an EU position to be proposed by the European Commission for adoption by the Council because a WRC decision may affect common rules.

## Regional telecommunication organisations

APT (November 2022)

APT Members support ITU-R studies in accordance with Resolution7 74 (WRC-19), and development of new ITU-R recommendations to protect RNSS (space-to-Earth) receivers from the amateur and amateur-satellite services in the frequency band 1240 – 1300 MHz without considering the removal of the amateur and amateur-satellite service allocations.

APT Members support no changes to the Radio Regulations under Agenda Item 9.1 Topic B.

ATU (October 2022)

Part 1: Common position:

Support the development of possible technical and operational measures to ensure the protection of RNSS (space-to-Earth) receivers from the amateur and amateur-satellite services in the frequency band 1240-1300 MHz.

Part 2: Way forward

Requests ATU administrations to:

1. continue making follow-up on the following:
	1. The possible technical and operational measures to ensure the protection of RNSS (space-to-Earth) receivers from the amateur and amateur-satellite services in the frequency band 1240-1300 MHz
	2. The detailed review of the different systems and applications used in the amateur service and amateur-satellite service allocations in the frequency band 1240-1300 MHz
2. Participate and contribute actively to WP 5A and WP 4C meetings.

Arab Group (March 2021)

Inviting ASMG administrations to contribute to the study of technical and operational measures to ensure the protection of the radionavigation-satellite service (space-to-Earth) from the amateur and amateur-satellite services in the frequency band 1 240 - 1 300 MHz.

CITEL (November 2022)

Preliminary Views

* One Administration is of the view that changes to the Radio Regulations are outside the scope of Agenda Item 9.1. For WRC-23 Agenda Item 9.1, Topic b), this Administration supports studies to be carried out under Resolution 774 (WRC-19). The results of these studies should seek to identify possible technical and operational measures to ensure the protection of RNSS (space-to-Earth) receivers from the amateur and amateur-satellite services in the frequency band 1 240-1 300 MHz, without considering the removal of these amateur and amateur-satellite service.
* Another administration supports studying the potential for interference to RNSS (space-to-Earth) receivers from amateur and amateur-satellite services in the frequency band 1 240–1 300 MHz and, if warranted, providing possible technical and/or operational measures to prevent any future cases of such interference, without considering any regulatory measures under this topic.
* A third Administration supports, without requiring any regulatory measures, the development of the new ITU-R Report aimed at providing guidelines for the implementation of technical and operational measures that allow the continued use of the 1 240-1 300 MHz frequency band by amateur services and satellite amateurs in secondary service condition, while protecting the RNSS in accordance with the RR.

RCC (June 2022)

The RCC Telecommunication Administrations are of the view that, based on outcomes of carried out studies, the technical and operational measures to ensure the protection of RNSS receivers from the stations in the amateur and the amateur-satellite services in the frequency band 1 240‑1 300 MHz need to be defined.

## International organisations

ICAO (November 2021)

To ensure that ITU-R studies under Resolution 774 (WRC-19) address whether potential mitigation measures will impact the protection of aeronautical radar systems operating under the existing aeronautical radionavigation or radiolocation service allocations.

Draft IMO position (November 2021) (5B/483)

To ensure that the protection of RNSS (space-to-Earth) receivers is guaranteed after the possible technical and operational measures envisaged under this agenda item.

NATO (October 2022)

NATO Position Statement

NATO supports identification of possible technical and operational measures to ensure the protection of RNSS (space-to-Earth) receivers from AS in the frequency band 1 240-1 300 MHz, without the removal of the amateur and amateur-satellite services.

SFCG (July 2022)

SFCG supports studies providing appropriate technical conditions applicable to the amateur service to protect RNSS.

In addition, SFCG is of the opinion that any possible change in the 1 215-1 300 MHz band should ensure that there is no adverse impact to the operation of EESS (active) and SRS (active)..

WMO and EUMETNET (February 2021)

WMO will monitor and, if necessary, contribute to the work on this Topic to ensure that wind profiler radar will not be affected.

## Other organisations

CRAF (date of proposal)

EBU (date of proposal)

ESA (October 2021)

ESA supports the SFCG Position on this Agenda item.

Furthermore, ESA supports that the studies of technical and operational measures, as called by Resolution 774 (WRC-19) should take due account of the relative status given in the Radio Regulations to the RNSS (primary) and to the amateur service (secondary). This implies in particular that the possible technical and operational measures to be identified are implemented by the amateur and amateur-satellite services to ensure the protection of RNSS in the frequency band 1 240-1 300 MHz.

Eurocontrol (October 2021)

To ensure that ITU-R studies under Resolution 774 (WRC-19) address whether potential mitigation measures will impact the protection of aeronautical radar systems operating under the existing aeronautical radionavigation or radiolocation service allocations.

GSMA (date of proposal)

IARU (April 2021)

During many years of operational experience, the secondary amateur and amateur satellite services have successfully co-existed with all the primary services in the range 1 240-1 300 MHz with very few issues. In cases where certain applications (in particular wide bandwidth, high duty cycle applications) could increase the potential for interference, careful spectrum management and national licensing conditions have minimised any risk. Radio amateurs have successfully co-existed and innovated in this frequency range for many years and IARU believes that the regulatory status of the amateur and amateur satellite services in this range is already clear. Therefore any additional regulatory, operational or technical measures incorporated into the Radio Regulations are unnecessary. Any recommendations resulting from studies under Resolution 774 can be applied on a national basis and should be based on realistic assumptions, proportionate in scope and carefully justified so as not to unnecessarily inhibit development of the amateur services.

IATA (date of proposal)