Proposals on issue of Interference Detection and Mitigation in GNSS spectrum

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Recommendation 11S.1 «IMT-GNSS compatibility»

At ICG-11 (November 2016, Sochi, Russia), Recommendation 11S.1 “IMT-GNSS compatibility” was approved.
- The ICG members are encouraged to actively participate in the ITU-R and regional work on new IMT spectrum allocations to ensure that proposals do not impact existing and future GNSS operations.

- The ICG members are recommended to encourage their administrations to ensure the protection of RDSS/RNSS from the unwanted emissions of new IMT spectrum allocations including adjacent band interference, spurious interference and harmonic interference, as a result may require the implementation of more stringent limits for IMT unwanted emissions levels in RDSS/RNSS bands.

- Members may also consider forming links with others satellite groups already defending satellite spectrum.
Potential impact from IMT frequency bands to GNSS frequency bands

Spurious emission (2-nd harmonic)
Protection criteria for GNSS receivers

<table>
<thead>
<tr>
<th>Acquisition mode threshold power density level of aggregate wideband interference at the passive antenna output (dB(W/MHz))</th>
<th>L1</th>
<th>L2</th>
<th>L3/L5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-142… -148</td>
<td>-127… -156</td>
<td>-146… -156</td>
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</table>

- Recommendation ITU-R M.1902 «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.1903 «Characteristics and protection criteria for receiving earth stations in the radionavigation-satellite service (space-to-Earth) and receivers in the aeronautical radionavigation service operating in the band 1 559 –1 610 MHz»;

- Recommendation ITU-R M.1905 «Characteristics and protection criteria for receiving earth stations in the radionavigation-satellite service (space-to-Earth) operating in the band 1 164–1 215 MHz».
The estimation results show that the required attenuation of unwanted emissions from mobile/base station is from 67 dB to 102 dB. These attenuation values correspond to the separation distances from 42 m to 2446 m.
Potential impact of television frequency bands on the L1 GNSS frequency band, using the example of a GPS receiver

The result of estimating the interference from the television station to the L1 GNSS frequency band, using the example of a GPS receiver

The results of the assessment showed that the required separation distance to attenuate unwanted emissions from the television station would be from 3 to 15 km. (for the case where the EIRP of the television station is about 1 kW).

As one of the mechanisms to reduce the effect of interference in the GNSS frequency spectrum, it is proposed to install filters on television stations.
Comparison of the IMT impact on GNSS and TV on GNSS estimation results

**IMT** → GNSS

**TV** → GNSS

Separation distance from 42 m to 2446 m.

Separation distance from 3000 m to 15000 m. (for low-power television stations)
Recommendation 12S.1 «RNSS protection criteria»

At ICG-12 (December 2017, Kyoto, Japan), Recommendation 12S.1 "RNSS protection criteria" was approved.

WG-5: RECOMMENDATION

Prepared by: Working Group
Date of Submission: 02 December 2001
Issue Title: RNSS Protection

Background/Description of the Issue
It is widely recognized that it is important to the full benefits of RNSS are not negated by its International Telecommunication Union's new managing international radio-frequency spectrum operating in frequency bands allocated to RNSS Protection criteria and unwanted emissions from non-RNSS sources outside receiver are not fully able to avoid getting adjacent band interference. It would be best above types of interference.

Discussion/Analysis
At the 11th meeting of International Committee (Sochi, Russian Federation, November 2010) Telecommunications (EMI/RF) Compatriot experimental studies assessing the potential stations in the frequency bands between 1 GHz adverse impact of unwanted emissions (which interfered) from ISM systems on the RNSS (10 MHz). In these studies, RNSS protection recommendations were:

- Recommendation ITU-R M.1902: "Chase stations in the radiocommunication services served 300 MHz."
- Recommendation ITU-R M.1903: "Chase stations in the radiocommunication satellite services, medium-power terrestrial services."
ICG members should encourage their national regulators to use the protection criteria from the relevant ITU-R Recommendations (M.1902, M.1903, M.1905) to protect GNSS from non-RNSS interference sources, including unwanted emissions.
Proposals to consider

Proposal: Development of a new ICG Recommendation

Objective: GNSS spectrum protection from non-RNSS radio services interference.

Issues under consideration:
- Acceptable levels of protection from interference and measurement methods
- Monitoring of interference environment
- Identification of interference sources
- Recommendations on the elimination/minimization of interference impact

In this regard, it is advisable to begin the preparatory work on the systematization of available information on this issue. As an example, it is proposed to start from the following:
- Systematization and categorization of various types of interference;
- Systematization and categorization of various types of GNSS receivers.

Participants are invited to discuss and include priority steps in the list.
Thank you for your attention!

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