ICG/REC/2017

WG-S RECOMMENDATION #1
Recommendation 12S-1 for ICG Decision

Prepared by:	**Working Group S**
Date of Submission:	**02 December 2017**
Issue Title:	**RNSS Protection Criteria**

Background/Brief Description of the Issue:

It is widely recognized that it is important to minimize non-RNSS emissions to RNSS so that the full benefits of RNSS are not negated by reduced performance due to interference.

International Telecommunication Union Radiocommunications (ITU-R) is responsible for managing international radio-frequency spectrum. Protection criteria for RNSS receivers operating in frequency bands allocated to RNSS are specified in ITU-R Recommendations. Adjacent Band Compatibility and unwanted emissions issues concern the interference emissions from non-RNSS sources outside of the RNSS frequency allocations. RNSS receivers are not fully able to avoid getting affected due to the proximity and high-power of adjacent band interference. It would be beneficial to quantify RNSS protection criteria for the above types of interference.

Discussion/Analyses:

At the 11th meeting of International Committee on Global Navigation Satellite Systems (Sochi, Russian Federation, November 2016), Recommendation 11S.1 «International Mobile Telecommunications (IMT)-GNSS Compatibility» was approved based on the theoretical and experimental studies assessing the potential impact from unwanted emission from IMT stations in the frequency bands below 3 GHz. These studies showed that there is a possible adverse impact of unwanted emission (including out-of-band, spurious and harmonic interference) from IMT stations on the RNSS frequency bands (1164 – 1300 MHz and 1559 – 1610 MHz). In these studies, RNSS protection criteria was taken from the following ITU-R Recommendations:

- 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».

WG-S held two intersessional meetings in 2017 in preparation for ICG-12 (Kyoto, Japan, December 2017).. Adjacent Band Compatibility study was presented at the first WG-S intersessional meeting (Baska, Croatia, May 2017). As aresult of this presentation, WG-S learned that the RNSS protection criteria specified in ITU-R Recommendations was not fully recognized for protecting RNSS from such interference mechanism. Thus, at the second intersessional meeting of WG-S (Paris, France, July 2017), WG-S agreed to create an ICG Recommendation to endorse of the applicability of RNSS protection criteria to adjacent band interference.

Within ITU-R, the protection criteria from unwanted emissions are usually more stringent than the criteria from co-frequency emissions. Therefore, it should be recognized that interference from non-RNSS services in the bands adjacent to RNSS is fairly treated when applying the same levels between the criteria for emissions from non-RNSS interference in the adjacent band and the criteria for the co-frequency emissions.

Recognizing:

a) that Recommendations ITU-R M.1902, 1903, 1905 contain protection criteria of RNSS from non-RNSS sources;

b) that the interference protection criterion of C/No degradation of 1 dB (equivalent to I/N of -6 dB) is used for the Adjacent Band Compatibility assessment;

c) that existing studies regarding interference from unwanted emissions use protection criteria referenced in recognizing a);

d) that the criterion in the above recognizing b) is consistent with the protection afforded by the application of Recommendations in recognizing a),

Recommendation:

that ICG members should encourage national regulators to use the protection criteria in the relevant ITU-R Recommendations in recognizing a), in order to protect GNSS from non-RNSS interference sources, including unwanted emissions.

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WG-S RECOMMENDATION #2
Recommendation 12S-2 for ICG Decision

Prepared by:	**Working Group S**
Date of Submission:	**06 December 2017**
Issue Title:	**3GPP Crowd Sourcing for IDM**

Background/Brief Description of the Issue:

The Working Group on Systems, Signals and Services of the International Committee on GNSS (ICG) has been discussing spectrum protection and interference detection and mitigation (IDM) for over 10 years, and has collected a great deal of information about this subject.

The Interference Detection and Mitigation (IDM) task force working under the Compatibility and Spectrum subgroup organized and completed the 6th IDM workshop focusing on both network-based and sensor-based (crowd sourcing) IDM capabilities in May 2017 in Baška.

WG-S participants have discussed how device-based, crowd-sourced GNSS interference detection could be made possible using the large number of active smartphones, most with GNSS. Based on the results of the workshop, and the subgroup meeting, WG-S proposes to engage with the leading smartphone standards developer, 3GPP, to incorporate such capabilities into their mobile device standards and enable access for crowd sourced applications.

Discussion/Analyses:

All System Providers have governmental and/or industrial members of the 3rd Generation Partnership Project (3GPP) that participate through one or more of the 7 telecommunications standard development organizations (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC)

WG-S participants have been seeking the views of their 3GPP members on the establishment of specifications for device-based GNSS interference detection.

Some access to the required chipset data is already possible in the most recent Android versions, but standards or specifications may be needed to enable sharing of the required data to enable authorized entities to determine where interference to GNSS occurs. September 2018 is a key milestone in the process of establishing 5G standards. The four step process is: Discussion Paper; Study Item – with the endorsement of 4 companies/members; Technical Report; Work Item – to modify specifications

Recommendation:

System Provider delegations to the ICG should Use the Providers Forum to reach consensus on whether or not to formally endorse a device-based detection standard through a communication to the 3GPP Technical Specifications Group (TSG) – February or June 2018

If device-based detection is endorsed by Providers, the ICG should:

- *consider presenting this recommendation to the appropriate Plenary-level 3GPP Meeting*

- *consider how data from device-based detection can be integrated into national/governmental mitigation efforts – September 2018 and beyond*

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WG-S RECOMMENDATION #3

Recommendation 12S.3 for ICG Decision

Prepared by: **Working Group S**

Date of Submission: **06 December 2017**

Issue Title: **2nd ICG WG-S Timing Workshop**

Background/Brief Description of the Issue:

ICG WG-S (WG-A) system provider (5 of 6) participants conducted five workshops on interoperability between 2013 and 2015. These workshops were designed to receive industry feedback on the technical aspects of GNSS interoperability. Among the different topics that were addressed through questions to industry were the use of GNSS time offsets between systems to maintain interoperable service provision. The feedback received led to more in depth discussion within the WG-S Interoperability and Service Standards Subgroup in 2015 and 2016. WG-S Recommendation 4 from ICG-11 led to a timing workshop that was held in Paris in conjunction with the WG-S intersessional meeting in July 2017.

Discussion/Analyses:

At the 2017 Workshop, the participants concluded that all System Providers should continue to improve the alignment of their individual system times with UTCk to benefit users. It was also recognized that currently, the only GNSS to GNSS system time offsets (G2GTOs) that are being broadcast are relative to GPS system time. The participants identified a number of possible approaches for system time interoperability, including:

1. System time offsets are calculated at the user receiver level – No Action from System Providers;
2. System Providers broadcast additional GNSS to GNSS system time offsets (G2GTOs);
3. The development of a GNSS Ensemble time, such as the MGET proposal, with the broadcast of individual system time offsets relative to the ensemble time

and agreed to hold a second workshop in 2018 focused on assessing possible approaches.

Recommendation:

Working Group S, under the direction of the Interoperability Subgroup, should conduct a second System Time Workshop in 2018, in coordination with WG-D.