

Spectrum protection of global navigation satellite systems (GNSS) from unwanted emissions caused by International Mobile Telecommunications (IMT) systems in the frequency range below 3 GHz

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Falda Del Carmen, Argentina 19 – 23 March 2018

Recommendation 11S.1 «IMT-GNSS Compatibility»

ICG/REC/2016

Recommendation 11S.1 for Committee Decision

Prepared by: Working Group S

Date of Submission: 10 November 2016 (Original submission in November 2012, revised in November 2013 and 2014)

Issue Title: International Mobile Telecommunications (IMT)-GNSS Compatibility

Background/Brief Description of the I

It is widely recognized that compatibility between RNSS systems. In parallel it entering into RNSS spectrum so that reduced performance due to interference

Because international spectrum issues Telecommunication Union (ITU), it is could impact RNSS spectrum. In partic inclusion in the Radio Regulations, it si to cause harmful interference into RNSS

According to the decisions of World frequency bands below 3 GHz 470 – 6: 1518 MHz were identified for the Inter In some frequency bands this identifi

There are Global Navigation Satellites below 3 GHz which have allocations i same time according to 4.10 of Radio R aspects of radionavigation and other sa: freedom from harmful interference; it is the assignment and use of frequencies”.

Main frequency bands of the global na: 1300 MHz and 1559 – 1610 MHz. Fre their main emission with GNSS frequen of global navigation systems (1164 – emissions from IMT including out-of-b band 1559 – 1610 MHz impact of the :

bands 694 – 790 MHz and 790 – 862 MHz is possible, as well as impact of spurious emissions of IMT stations that use frequency band 1427 – 1518 MHz. In the GNSS frequency band 1164 – 1300 MHz impact of the second harmonic of IMT stations that use frequency band 470 – 694 MHz is possible, as well as impact of spurious emissions from IMT stations that operate in the frequency band 1427 – 1518 MHz.

Discussion/Analyses:

At the 9th meeting of International Committee on Global Navigation Satellite Systems (Prague, Czech Republic 9 – 14 November 2014) theoretical estimations on this matter were presented. Theoretical estimations showed that there is a possible adverse impact of unwanted emission levels (including out-of-band, spurious and harmonic interference) from base/mobile IMT stations on the frequency bands of global navigation systems (1164 – 1300 MHz and 1559 – 1610 MHz). At the inter-sessional meeting of WG-S (Vienna, Austria, 7-10 June 2016), experimental estimations were presented. These experimental estimations confirmed the results of previously presented theoretical estimations.

WG-S also agreed to continue monitoring mobile service channel plans and recognized the importance of the activities to prevent potential harmonic interference into RNSS.

Thus, one of the main tasks of WG-S is conducting studies that are aimed to prevent potential out-of-band and harmonic interference on RNSS systems, as well as investigation of specific IMT spectrum utilization plans within relevant Administration’s and regional groups.

Recommendation of Committee Action:

- 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 other satellite groups already defending satellite spectrum.

At ICG-11 (November 2016, Sochi, Russia) Recommendation 11S.1 “IMT and GNSS Compatibility” was approved.

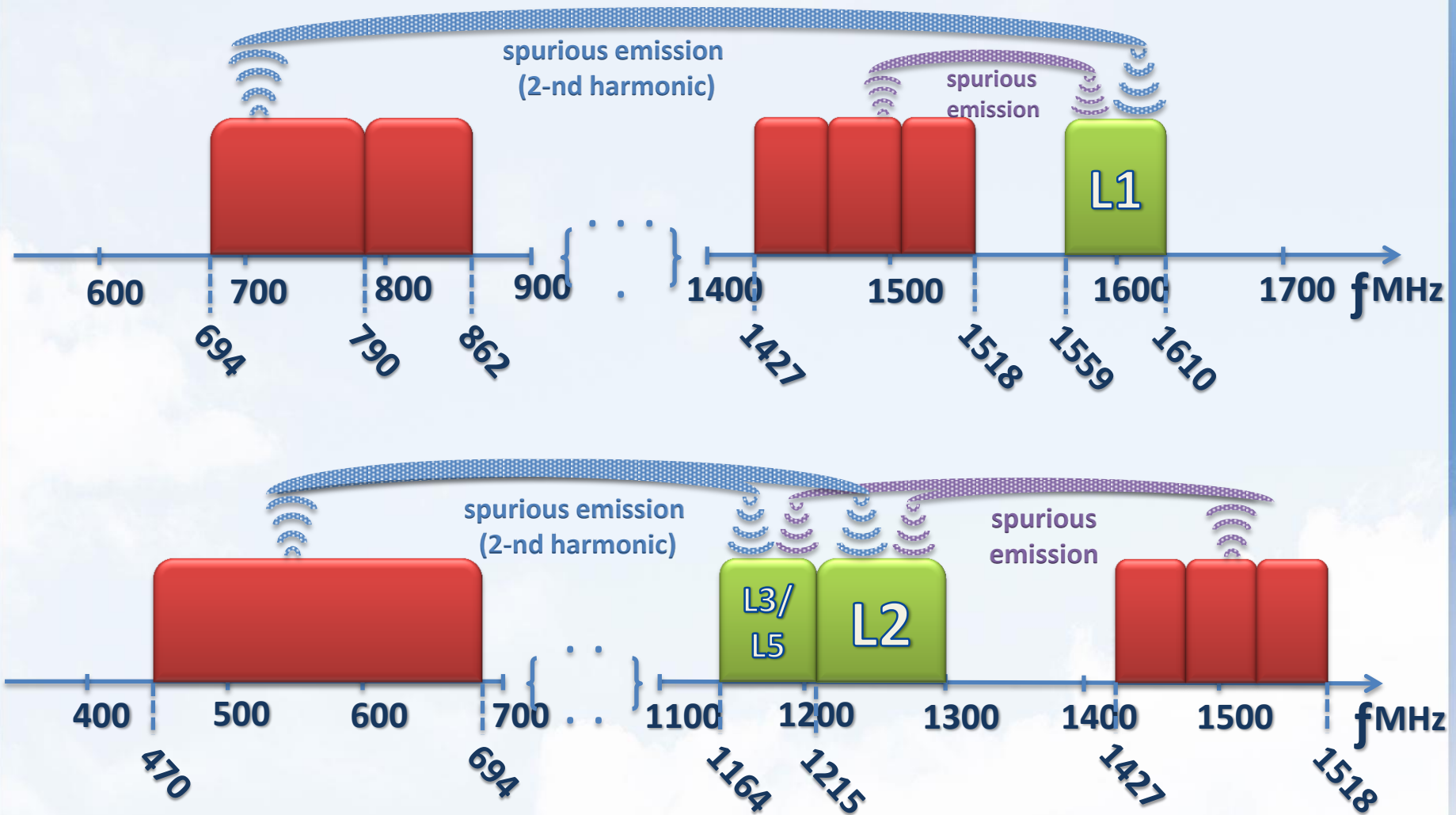
Objectives of Recommendation 11S.1 «IMT - GNSS Compatibility»

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- 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.

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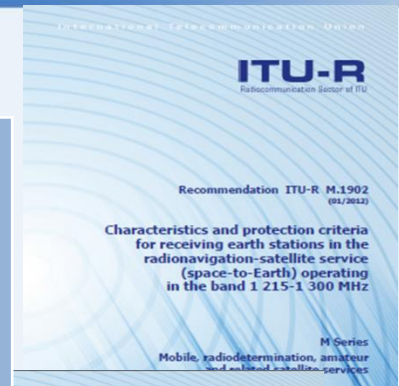
Potential impact from IMT frequency bands to GNSS frequency bands



Protection criteria for GNSS receivers

Acquisition mode threshold power density level of aggregate wideband interference at the passive antenna output (dB(W/MHz))	<u>L1</u>	<u>L2</u>	<u>L3/L5</u>
	-142... -148	-127... -156	-146... -156

- 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 of interference from IMT on GNSS

Estimation results of IMT stations (mobile/base) unwanted emissions impact to RNSS systems in the frequency band 1 164 -1 215 MHz

	1	2	3	4	5
Parameter	Air-navigation receiver №1	Aeronautical navigation receiver №2	High-precision receivers	Indoor positioning receivers	General purpose

Estimation results of unwanted emissions impact from IMT stations (mobile/base) to RNSS receivers in the frequency band 1 215 -1 300 MHz

	1	2	3	4	5	6	7
Parameter	SBAS ground reference receiver*	High-precision semi-codeless receiver*	High-precision receiver using L2C*	Air-navigation receiver (Note 10)	Indoor positioning	Others	General purpose
Maximum receiver antenna gain in upper hemisphere (dBi)	-2.0	3.0	3.0	7	6	6	6
Spurious emissions level (dB(W/MHz))	-60	-60	-60	-60	-60	-60	-60
Interference power at the receiver antenna output (dB(W/MHz))	-62	-57	-57	-53	-54	-54	-54
Tracking mode threshold power density level of aggregate wideband interference at the passive antenna output (dB(W/MHz))	-147.5	-147.4	-147.4	-140	-150	-121	-139
Required attenuation (dB)	85.5	90.4	90.4	87	96	67	85
Separation distance (m)	366	644	644	429	1227	42	346
Acquisition mode threshold power density level of aggregate wideband interference at the passive antenna output (dB(W/MHz))	-147.4	-147.4	-147.4	-146	-156	-127	-145
Required attenuation (dB)	85.4	90.4	90.4	93	102	73	91
Separation distance (m)	362	644	644	856	2448	83	690

The estimation results show that the required attenuation of unwanted emissions from mobile/base stations is from 67 dB to 102 dB. These attenuation values correspond to the separation distances from 42 m to 2 446 m.

Taking separation distance between stations of 1 m as a minimum acceptable distance the required additional attenuation of unwanted emissions from IMT stations is from 33 dB to 68 dB.

Current results in ITU

The above material was sent from the Russian Federation Communications Administration at the meeting of the International Telecommunication Union in the framework of the Working Group 4C «Efficient orbit / spectrum utilization for mobile-satellite service (MSS) and radiodetermination-satellite service (RDSS)», with the proposal to create a new report ITU-R M. [IMT-RNSS] on issue of protection of the radionavigation-satellite service systems operating in the 1164-1300 MHz frequency bands and 1559-1610 MHz from unwanted emissions of IMT systems in the frequency range below 3 GHz. As a result, WP 4C meeting approved that proposal and attached to the Report of the Chairman the preliminary draft new Report ITU-R M. [IMT-RNSS]. Currently ITU work on the Report mentioned above has not been completed yet and will be continued.

Current results in ICAO

The issue of protection for the radionavigation satellite service operating in the frequency bands 1164-1300 MHz and 1559-1610 MHz from unwanted emissions caused by IMT in the frequency range below 3 GHz was proposed by the Russian Administration to be reflected while developing the Handbook of International Civil Aviation Organization (ICAO) on “Radio Frequency Spectrum Requirements for Civil Aviation”, Volume I “ICAO spectrum strategy, policy statements and related information”. These proposals were presented at the Frequency Spectrum Management Panel (FSMP) (27 March-7 April 2017, Bangkok, Thailand) and reflected in the meeting deliverables.

Current results in RCC

In the framework of Regional Commonwealth in the field of Communications activities (RCC) (10-14 April, 2017, Kyrgyz Republic, Bishkek) on the Russian Federation initiative the development of the Report on protection of the radionavigation satellite service from interferences is started.

Current results in ICG

ICG Working Group S Meeting, 2-7 December 2017

ICG/REC/2017

WG-S RECOMMENDATION #14 Recommendation 12S-1 for ICG Decision

ICG Working Group S Meeting, 2-7 December 2017

Prepared by: → Working Group

Date of Submission: → 02 December 2017

Issue Title: → RNSS Protection

Background/Brief Description of the Issue

It is widely recognized that it is important to ensure the full benefits of RNSS are not negated by interference.

International Telecommunication Union Radio Regulations: international radio-frequency spectrum operating in frequency bands allocated to RNSS. Adjacent Band Compatibility and unwanted emissions from non-RNSS sources outside receivers are not fully able to avoid getting a adjacent band interference. It would be beneficial to address above types of interference.

Discussion/Analyses

At the 11th meeting of International Commission for Radiocommunications (ICR) (Sochi, Russian Federation, November 2016), experimental studies assessing the potential adverse impact of unwanted emission (in interference) from IMT stations on the RNSS 1610 MHz. In these studies, RNSS protection Recommendations:

- Recommendation ITU-R M.1902 «Characteristics of stations in the radionavigation-satellite service 300 MHz».
- Recommendation ITU-R M.1903 «Characteristics of stations in the radionavigation-satellite service aeronautical radionavigation service operating in the 1215 MHz».
- Recommendation ITU-R M.1905 «Characteristics of stations in the radionavigation-satellite service 1215 MHz».

WG-S held two intersessional meetings in 2017 in preparation for ICG-12 (Kyoto, Japan, December 2017). An Adjacent Band Compatibility study was presented at the first WG-S intersessional meeting (Baska, Croatia, May 2017). As a result 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/N₀ 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.

At ICG-12 (December 2017, Kyoto, Japan) Recommendation 12S.1 “RNSS Protection Criteria” was approved.

Objectives of Recommendation 12S.1 «RNSS Protection Criteria»

that ICG members should encourage national regulators to use the protection criteria in the relevant ITU-R Recommendations (M.1902, M.1903, M.1905) in order to protect GNSS from non-RNSS interference sources, including unwanted emissions.

Thank you for your attention!

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