



International Civil Aviation Organization

**Middle East Air Navigation Planning and
Implementation Regional Group**

Fifteenth Meeting (MIDANPIRG/15)
(Bahrain, 8 – 11 June 2015)

Agenda Item 5.2.2: Specific Air Navigation issues

**AERONAUTICAL FREQUENCY SPECTRUM
IN THE MID REGION**

(Presented by the Secretariat)

SUMMARY

This paper presents the MID Region Aeronautical Frequency Spectrum issues including the support of the ICAO Position for the ITU WRC-15 and other GNSS and VSAT frequencies related issues.

Action by the meeting is at paragraph 3.

REFERENCES

- ANSIG/1 Report
- CNS SG/6 Report

1. INTRODUCTION

1.1 The pressure on the frequency spectrum, which is a scarce and finite resource, has continued to increase. The ITU World Radio Conference process has almost doubled in the last 10-15 years in terms of industry participation, while the aviation industry has not kept up with this trend, as it is needed to secure the continuing availability of adequate radio frequency spectrum to support the current and planned aeronautical CNS infrastructure requirements.

1.2 The ITU World Radio Conference (ITU WRC-15) meeting is scheduled to be held in Geneva during November 2015. In this regard, the ICAO position to WRC-15 was sent to States and concerned Organization as Attachment B to State letter E 3/5.15-13/57.

2. DISCUSSION

2.1 The meeting may wish to recall that the DGCA-MID/2 meeting urged States to ensure continuous coordination with their Radio Frequency Spectrum Regulatory Authorities (telecommunications authorities) and the regional groupings such as the Arab Spectrum Management Group (ASMG) for the support of the ICAO position at WRC and its preparatory meetings.

2.2 It is important that the Civil Aviation Authorities coordinate with their respective Frequency Regulatory Authorities and attend the regional preparatory meetings and the WRC-15 to

ensure that the approved ICAO Position is supported. In view of the foregoing, the CNS SG/6 and ANSIG/1 meeting agreed to the following Draft Conclusion:

Why	To support the ICAO Position to the WRC-15
What	ICAO Position to the WRC-15
Who	MID States
When	June 2015

DRAFT CONCLUSION I/II: SUPPORT ICAO POSITION TO WRC-15

That, States be urged to:

- a) support the ICAO Position to the WRC-15;*
- b) make necessary arrangements for the designated Civil Aviation Personnel to participate actively in the preparatory work for WRC-15 at the national level; and*
- c) attend the preparatory regional spectrum management groups meetings and WRC-15 to support and protect aviation interests.*

2.3 The meeting may wish to note that the ICAO MID Regional Office with support from ICAO HQ organized “Aeronautical Frequency Spectrum Workshop WRC-15 preparation” (AFSW) in Cairo, 16-17 February 2015, and back-to-back there was the AFSM WG-F/32 meeting from 18 to 24 February 2015. The Workshop was attended by a total of thirty two (32) participants from twelve (12) States (Bahrain, Canada, Egypt, France, Japan, Kuwait, Philippines, Saudi Arabia, South Africa, Sudan, UK and USA), and Five Organizations (Airbus, Eurocontrol, ITU, GCC and Inmarsat). The workshop agreed to the following recommendations:

- States be urged to support the:
 - ICAO Position for WRC-15;
 - Agenda Item 9.1.5, since VSAT is a crucial element of the MID Region communication infrastructure;
 - Conclusions and Recommendations of the HLSC, mainly that the WRC-15 discuss necessary spectrum allocation for space based reception of ADS-B for Global Tracking at WRC -15;
 - removal of their names from all footnotes negatively affecting Aviation Spectrum, under WRC-15 Agenda Item 8; and
 - implementation of Resolution A 38-6, mainly that States’ delegations to WRC include experts from their Civil Aviation Authorities.
- ICAO be requested to:
 - coordinate with ITU the possibility of sharing the ITU studies relevant to aviation spectrum (CPM text, and other?); and
 - consider the global tracking for general and business aviation aircraft.

- FSMP be requested to develop guidance material on interference issues, such as those from windmills; and
- States be requested to share any interference characteristics databases, and the information on Radio Act Laws.

2.4 The meeting may wish to recognize that frequency interference-free operation of GNSS is essential, and that the frequency band 1 559 - 1 610 MHz, is used for elements of GNSS and recall that the International Telecommunication Union (ITU) process, allows under footnotes No. 5.362B and 5.362C the operation of fixed service in some States on a secondary basis until 1 January 2015.

2.5 The meeting may wish to note that the following States (Iraq, Jordan, Qatar, Saudi Arabia, Sudan, Syria and Yemen) still have their names in the footnotes 5.362B and/or 5.362C. In this regard, the meeting may recall that MIDANPIRG/13, Conclusion 13/44: Protection of GNSS Signal, and urged the concerned States to delete their name from these footnotes.

2.6 The EUR FMG carried out a review of potential sources of non-intentional GNSS Radio Frequency Interference (RFI) that may affect GNSS frequencies. It was noted that future GNSS multi-constellation/dual-frequency receivers are expected to provide significant mitigation against GNSS vulnerability. However, it will not provide a full mitigation and it is important to assess and address all vulnerabilities to threats that may impact safety of GNSS-based operations.

2.7 In view of the above, the FMG conducted a review of existing and new material on GNSS vulnerabilities. As a result, some guidance material was collated as at **Appendix A**, that would provide guidance to States when establishing and enforcing their regulatory provisions on the use of GNSS, in particular regulating the use of pseudolites and GNSS repeaters that may have potential safety impact on GNSS. In addition, GNSS jammers and spoofers are seen as significant threats to GNSS.

2.8 Based on the above, the CNS SG/6 and ANSIG/1 meetings agreed to the following Draft Conclusion:

Why	To improve the protection and vulnerabilities of the GNSS frequencies.
What	Guidance to reduce GNSS radio Frequencies interference
Who	MIDANPIRG/15
When	June 2015

DRAFT CONCLUSION 1/13: GNSS RADIO FREQUENCY INTERFERENCE ISSUES

*That, States be invited to use the guidance at **Appendix A** for the development/amendment of their regulatory provisions related to the use of GNSS in particular those related to pseudolites and GNSS repeaters.*

2.9 The meeting may wish to recognize that the introduction of GNSS multi-constellation, multi-frequency will entail number of new technical and regulatory challenges beyond those already associated with current GNSS implementation.

2.10 Based on the above the meeting may wish to note that GNSS Seminar would be organized jointly by ACAC and ICAO tentatively in September 2015, to address the augmentation systems (ABAS, GBAS and SBAS), and Multi-constellations. The coordination is going on with ACAC to agree on the exact date and venue.

2.11 The CNS SG/6 and ANSIG/1 meetings were apprised of the program for managing, assessing compatibility and presenting frequency assignments called Frequency Finder developed by ICAO and recognized the necessity for training on the use of the new program. Accordingly, the following Draft Conclusion is proposed for endorsement:

Why	To improve the efficiency of allocation of the aeronautical frequencies.
What	Workshop On The use of the ICAO Frequency Finder
Who	ICAO MID Office
When	December 2016

DRAFT CONCLUSION 1/12: WORKSHOP ON THE USE OF THE ICAO FREQUENCY FINDER

That, ICAO consider the inclusion of a Workshop on the use of the new Frequency Finder in the work programme of 2016.

2.12 The meeting may wish to recall that Five (5) MID States (Egypt, Libya, Saudi Arabia, Sudan and Yemen) are members of the NAFISAT and the Tenth meeting of its Supervisory Committee had renewed the contract with ATNS and agreed that member States to register their VSAT frequencies with their TRA for onward registration in ITU Master International Frequency Register (MIFR), to support the ICAO position for the VSAT frequencies protection.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

- a) endorse the Draft Conclusions in paras. 2.2, 2.8 and 2.11;
- b) support the AFSW recommendations;
- c) urge States to designate focal points for the follow-up of the Frequency Spectrum related issues and provide their names to ICAO;
- d) support the conduct of the GNSS seminar and encourage States and users to participate actively in the seminar; and
- e) encourage States to register the VSAT frequencies as in para 2.12.

APPENDIX A

Use of GNSS pseudolites and repeaters

1. Introduction

1.1 As for all systems using the radio frequency spectrum, GNSS is vulnerable to interference and measures (radio regulatory) are in place through the provisions of the ITU Radio Regulations to protect GNSS systems from harmful interference. Technical measures such as the specification of the GNSS receiver interference mask are in Annex 10.

1.2 Despite various regulatory mechanisms being in place, including those agreed at European (CEPT) level. In the recent years harmful interference that was either caused intentionally or unintentionally has been experienced to GNSS systems.

1.3 In addition to interference caused by RF emissions, GNSS signals are also vulnerable to ionospheric scintillation which may cause loss of GNSS signals in particular in equatorial and auroral regions.

1.4 Detailed material on GNSS vulnerability and GNSS interference is in the ICAO GNSS Manual (Doc. 9849) which is currently being revised by the Navigation Systems Panel. Relevant (draft) material on interference from this Manual is reproduced in **Appendix A**

1.5 Of concern to aviation is the protection of the frequency bands 1559 – 1610 MHz, used by GLONASS and GPS and the band 1164 – 1215 MHz which is foreseen to be used by GLONASS and GPS. Also the European Galileo system and the Chinese BEIDOU system are planning to use these bands to provide GNSS signals for use by aviation. Various satellite based augmentation systems are operating in the frequency band 1559 – 1610 MHz.

2. Interference

2.1 Unintentional interference.

2.1.1 Unintentional interference is normally caused by equipment authorized to operate on GNSS frequencies under strict conditions that are aimed at not causing harmful interference to the reception of GNSS signals. Problematic is that not in all cases such equipment is being used in accordance with these conditions, thus resulting in causing harmful interference.

Equipment that can cause such interference include GNSS repeaters and GNSS Pseudolites

2.1.2 In Europe provisions were developed by the ECC/CEPT to avoid harmful interference by inappropriate use of GNSS pseudolites and GNSS repeaters. These provisions and other relevant material is available from the website of the European Communications Office (ECO) in the following Reports and Recommendation:

ECC Report 129: Technical and operational provisions required for the use of GNSS repeaters

ECC Report 145: Regulatory framework for Global Navigation Satellite System (GNSS) repeaters

ECC Recommendation (10)02, A framework for authorization regime of Global Navigation Satellite System

ECC Report 128: Compatibility Studies between Pseudolites and Services in the frequency bands 1164-1215 MHz, 1215-1300 MHz and 1559-1610 MHz

ECC REC (04)01, which declares jammers as illegal.

ECC Report 183, Regulatory Framework for Outdoor Pseudolites

2.1.3 In addition various ITU-R Recommendations provide relevant information on the compatibility and use of RNSS networks, including:

Recommendation ITU-R M.1904: 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.1901: Guidance on ITU-R Recommendations related to systems and networks in the radionavigation-satellite service operating in the frequency bands 1 164-1 215 MHz, 1 215-1 300 MHz, 1 559-1 610 MHz, 5 000-5 010 MHz and 5 010-5 030 MHz

Recommendation ITU-R M.1787: 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.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.1318: Evaluation model for continuous interference from 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, 1 559-1 610 MHz and 5 010-5 030 MHz bands

Recommendation ITU-R M.2030: 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

ITU R M.2220 which provides criteria to determine compatibility between DME and GNSS L5.

2.1.4 States are invited to consult this material with the view to develop national regulations that will enforce the operation of GNSS Pseudolites and Repeater in a manner that harmful; interference to the reception of GNSS signals by aviation is prevented. Particular attention should be given to the practicality to enforce these provisions.

2.2 Intentional interference

Intentional interference is caused by equipment of which the user has the intention to cause harmful interference to the reception of GNSS signals, either on a local (e.g. less than 100 m) scale or a large scale (e.g. in the order of 100 – 200 NM).

Equipment used to cause intentional interference includes jammers and spoofers (intentional interference that may result in an aircraft to follow a false flight path).

The sale and use for jammers developed to cause Intentional interference, (e.g. to avoid tracking of vehicles) and spoofers should be forbidden. Although difficult, these systems should not be allowed on any market (national or international).

2.3 ICAO Electronic Bulletin on Interference to GNSS Signals.

ICAO has drawn the attention of States to the need to ensure protection of GNSS signals from interference and point to the need of cooperation between national aeronautical and telecommunication authorities in the introduction and enforcement of appropriate regulations (Electronic Bulletin EB 2011/56 from 21 November refers). This Electronic Bulletin is, for the ease of reference, reproduced in **Appendix B**

3. Cooperation with ITU

3.1 Interference to GNSS systems can affect international civil aviation and [in some cases] international coordination may be required to solve such interference. A framework for cooperation in the

format of a Memorandum of Understanding between the ITU and ICAO has been established with the prime view to maximize the joint efforts of the ITU and ICAO to eliminate cases of harmful interference. This Memorandum is reproduced in Appendix C

4. **Fixed Service**

4.1 The frequency band 1559 – 1610 MHz is shared with the (terrestrial) Fixed Service. Use of this band by both the Radionavigation Satellite Service and the Fixed service in a compatible manner is not feasible. Although the allocation to the Fixed Service is on a secondary basis, attention is drawn to the fact that the Fixed Service may cause harmful interference to the reception of GNSS signals. In 2015 the allocation to the Fixed Service is expected to be withdrawn from the Radio Regulations and attention should be given to the need to secure that any operation of the Fixed Service in this band will cease by that time.

5. **Summary**

5.1 This information material highlights a number of cases where harmful interference can be caused to the reception of GNSS signals by aviation. Measures to prevent such interference are recommended together with an operational evaluation of the interference risks.

Work on the assessment of RF interference (intentional and unintentional) is ongoing in the Navigation Systems Panel.

APPENDIX A of the ICAO GNSS Manual (Doc. 9849)

Source: GNSS Manual – Chapter 5

5.8 GNSS VULNERABILITY

5.8.1 General

5.8.1.1. The most notable GNSS vulnerability lies in the potential for interference, which exists in all radionavigation bands. As with any navigation system, the users of GNSS navigation signals should be protected from harmful interference resulting in the degradation of navigation performance.

5.8.1.2 The GNSS SARPs require a specified level of performance in the presence of levels of interference as defined by the receiver interference mask. These interference levels are generally consistent with the International Telecommunication Union (ITU) regulations. Interference at levels above the mask may cause degradation or even loss of service, but such interference is not allowed to result in hazardously misleading information (HMI).

5.8.1.3 GPS and Global Navigation Satellite System (GLONASS) have filings with the ITU to operate, using spectrum allocated to the Radionavigation Satellite Service (RNSS) in the 1 559 – 1 610 MHz and 1 164 – 1 215 MHz bands. The RNSS allocation in these bands is shared with the Aeronautical Radionavigation Service (ARNS). SBAS also has a filing under the RNSS allocation in the former band. GBAS is operated in the 108 – 117.975 MHz band, shared with ILS and VOR (ARNS).

5.8.2 Sources of Vulnerability

5.8.2.1 There are a number of sources of potential interference to GNSS from both in-band and out-of-band sources. Of particular concern is the use of the 1 559 – 1 610 MHz band by point-to-point microwave links that are allowed by a number of States. The use of these links, as stated in footnotes 5.362B and 5.362C in the Radio Regulations of the ITU, is due to be phased out starting in 2005 and completed by no later than 2015. In addition, no new links should be permitted.

5.8.2.2 *Unintentional interference.* The likelihood and operational effect of interference vary with the environment. Unintentional interference is not considered a significant threat provided that States exercise proper control and protection over the electromagnetic spectrum for both existing and new frequency allocations. Furthermore, the introduction of GNSS signals on new frequencies will ensure that unintentional interference does not cause the complete loss of GNSS service (outage) although enhanced services depending upon the availability of both frequencies might be degraded by such interference.

5.8.2.3 *Intentional interference.* The risk of intentional interference depends upon specific issues that must be addressed by States. For States that determine that the risk is unacceptable in specific areas, operational safety and efficiency can be maintained by adopting an effective mitigation strategy through a combination of on-board mitigation techniques (e.g. use of inertial navigation system (INS)), procedural methods and terrestrial navigation aids.

5.8.2.4 *Ionosphere.* Scintillation can cause loss of GNSS satellite signals in the equatorial and auroral regions, but is unlikely to cause complete loss of GNSS service and will be mitigated with the addition of new GNSS signals and satellites. Ionospheric changes may limit the SBAS and GBAS services that can be

provided in the equatorial region using a single GNSS frequency. These changes must be considered when designing operations based on the augmentation systems.

5.8.2.5 *Other vulnerabilities.* System failure, operational errors and discontinuation of service could be significantly mitigated by independently managed constellations, funding and robust system design. Spoofing, the intentional corruption of signals to cause an aircraft to deviate and follow a false flight path, is mitigated through normal procedures and independent ground and collision avoidance systems.

5.8.2.6 States should assess the GNSS vulnerability in their airspace and select appropriate mitigations depending on the airspace in question and the operations that must be supported. These mitigations can ensure safe operations and enable States to avoid the provision of new terrestrial navigation aids, reduce existing terrestrial navigation aids, and discontinue them in certain areas. Fault detection features such as RAIM are built into GNSS receivers, which eliminate the risk of position errors posing threat to navigation availability. To date, no vulnerabilities have been identified that compromise the ultimate goal of a transition to GNSS as a global system for all phases of flight. The assessment of GNSS vulnerability aspects and mitigation alternatives should continue.

5.8.3 Evaluating GNSS vulnerabilities

5.8.3.1 There are three principal aspects to be considered in the evaluation of GNSS vulnerabilities.

- a) Interference and atmospheric (ionosphere) effects are of primary concern. Operational experience is the best way to assess the likelihood of unintentional interference. Each State must consider the motivation to intentionally interfere with GNSS based on the potential safety and economic impacts on aviation and non-aviation applications. Atmospheric effects are unlikely to cause a total loss (outage) of GNSS but may impact some services (e.g. approaches with vertical guidance in equatorial regions). The likelihood of specific effects can be categorized as negligible, unlikely or probable.
- b) All operations and services dependent on GNSS should be identified and considered together, since GNSS interference can potentially disrupt all GNSS receivers at the same time over a certain area. GNSS is used for navigation services as well as other services such as precision timing with communications and radar systems, and may also be used for ADS services. In these cases, GNSS represents a potential common point of failure.
- c) The impact of a GNSS outage on an operation or service should be assessed by considering the types of operations, traffic density, availability of independent surveillance and communications and other factors. The impact can be categorized as none, moderate or severe.

5.8.3.2 By considering these aspects as a function of airspace characteristics, air navigation service providers can determine whether mitigation is required and, if so, at what level. Appendix D provides examples of assessments. Mitigation is most likely to be required for vulnerabilities with major impacts that have a moderate to high likelihood of occurrence.

5.8.4 Reducing the Likelihood of Unintentional Interference

5.8.4.1 On-aircraft interference can be prevented by proper installation of GNSS equipment, its integration with other aircraft systems (e.g. shielding, antenna separation and out-of-band filtering) and restrictions on the use of portable electronic devices on board aircraft.

5.8.4.2 *Spectrum management.* Effective spectrum management is the primary means of mitigating unintentional interference from man-made transmitters. Operational experience has indicated that the threat of unintentional interference can be virtually eliminated by applying effective spectrum management. There are three aspects of effective spectrum management, namely:

- a) creation of regulations/laws that control the use of spectrum;
- b) enforcement of those regulations/laws; and
- c) vigilance in evaluating new radio frequency (RF) sources (new systems) to ensure that they do not interfere with GNSS.

INTERFERENCE TO GLOBAL NAVIGATION SATELLITE SYSTEM (GNSS) SIGNALS

1. Aviation operations increasingly rely on the global navigation satellite system (GNSS) to improve navigation performance and to support air traffic control surveillance functions.
2. However, the full benefits of GNSS can only be achieved if GNSS signals are adequately protected from electromagnetic interference which can cause loss or degradation of GNSS services.
3. Potential sources of interference to GNSS include both systems operating within the same frequency bands as GNSS and systems operating outside those bands. Interference can be intentional (“jamming”) or unintentional.
4. ICAO Member States have an essential role in ensuring protection of GNSS signals from interference. This can be achieved through cooperation of national aviation and telecommunication authorities in the introduction and enforcement of appropriate regulations controlling the use of the radio spectrum.
5. Attachment A briefly describes some sources of interference to GNSS and discusses regulatory means available to States to deal with them. Attachment B contains a list of documents that can be used as guidance for States in developing a regulatory framework.

Enclosures:

A — Sources of interference to GNSS

B — References

SOURCES OF INTERFERENCE TO THE GLOBAL NAVIGATION SATELLITE SYSTEM (GNSS)

1. INTERFERENCE TO GNSS CAUSED BY SYSTEMS TRANSMITTING IN GNSS FREQUENCY BANDS

1.1 GNSS repeaters and pseudolites

1.1.1 Certain non-aeronautical systems transmit radio signals intended to supplement GNSS coverage in areas where GNSS signals cannot be readily received (e.g. inside buildings). These systems include GNSS repeaters and pseudolites.

1.1.2 GNSS repeaters (also known as “re-radiators”) are systems that amplify existing GNSS signals and re-radiate them in real-time. Pseudolites are ground-based systems that generate ranging signals similar to those transmitted by GNSS satellites.

1.1.3 When these systems do not operate under appropriate conditions, harmful interference may be caused to the reception of the original GNSS signals by aircraft and other aeronautical systems (such as the reference receivers used in augmentation systems). This may disrupt a wide range of GNSS applications.

1.1.4 To prevent this disruption, a State needs to create a regulatory framework for the sale, ownership and operation of these systems. The framework must include regulations to ensure that use of the systems be permitted only where they have a legitimate application and their operation is not harmful to existing primary users of GNSS-based services. Additional measures may be necessary when repeaters and pseudolites are used on or in the vicinity of airports (e.g. in hangars, for testing/maintenance purposes).

1.1.5 Attachment B contains a list of documents that can be used as guidance for States developing a regulatory framework. They include interference analyses and examples of regulations currently in force in Europe and the United States.

1.2 GNSS jammers

1.2.1 GNSS jammers are devices which intentionally generate harmful interference to GNSS signals to impair or deny their reception. They may be employed for various reasons, typically with the intent of disabling devices that record and/or relay GNSS position information (e.g. for tracking or fee collection purposes). However, the interference they generate can potentially affect all users of GNSS, not only the intended targets of the jamming. Thus, they may have an impact far greater than intended by their operator.

1.2.2 Usage of GNSS jammers may proliferate further if GNSS-based fee collection or tracking services are not adequately designed, e.g. if the simple use of a jamming device enables the avoidance of the charge or tracking.

1.2.3 To prevent degradation of GNSS services due to GNSS jammers, States should implement and enforce policies and regulations that forbid the sale, export, purchase, ownership and use of GNSS jammers, and they should prohibit all actions that lead to an interruption of GNSS signals.

Adequate means of enforcement of such policies and regulations require the availability of GNSS signal monitoring capabilities. Furthermore, GNSS-based services should be designed in such a way that simple jamming does not result in denial of the service.

2. INTERFERENCE TO GNSS CAUSED BY SYSTEMS TRANSMITTING OUTSIDE THE GNSS FREQUENCY BANDS

2.1 In addition to the threats described above, systems operating outside the GNSS frequency bands that are not properly designed or are inappropriately regulated and operated may interfere with GNSS.

2.2 GNSS frequencies are protected by international agreements (ICAO *Convention on International Civil Aviation* and ITU Radio Regulations), and enable aviation services that have significant economical and societal benefits. However, there is also significant demand for electromagnetic spectrum for new applications, such as mobile phone and broadband data services, which may compromise spectrum compatibility. States should require that any such application will not interfere with GNSS signals through execution of adequate spectrum management practices.

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¹ In some States, military authorities test their equipment by occasionally transmitting jamming signals that deny service in a specific area. This activity should be coordinated with State spectrum authorities and air navigation service providers to enable them to determine the airspace affected, advise aircraft operators and develop any required contingency procedures.

ATTACHMENT B to EB 2011/56

REFERENCES

ECC Report 129: “Technical and operational provisions required for the use of GNSS repeaters”, Dublin, January 2009 (available at: <http://www.ecodocdb.dk/>, see under “ECC Reports”)

ECC Report 145: “Regulatory framework for Global Navigation Satellite System (GNSS) repeaters”, St. Petersburg, May 2010 (available at: <http://www.ecodocdb.dk/>, see under “ECC Reports”)

ECC Recommendation (10)02, “A framework for authorization regime of Global Navigation Satellite System (GNSS) repeaters” (available at: <http://www.ecodocdb.dk/>, see under “ECC Recommendations”)

United States National Telecommunications and Information Administration (NTIA) Manual of Regulations and Procedures for Federal Radio Frequency Management (Redbook), sections 8.3.28 – 8.3.30 (available at: <http://www.ntia.doc.gov/page/2011/manual-regulations-and-procedures-federalradio-frequency-management-redbook>)

Note.— The relevant sections of the NTIA Redbook only apply to the United States Federal Government users. Use of repeaters by non-government users is prohibited in the United States.

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