



International Civil Aviation Organization

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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

Issued under the authority of the Secretary General

**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 signals¹. 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.

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-federal-radio-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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