ETSI EN 302 645 V1.1.1 (2010-03)

Harmonized European Standard (Telecommunications series)

Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices; Global Navigation Satellite Systems (GNSS) Repeaters; Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive

Reference
DEN/ERM-TG28-0422

Keywords
navigation, radio, repeater, satellite

ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

Important notice

Individual copies of the present document can be downloaded from:
http://www.etsi.org

The present document may be made available in more than one electronic version or in print. In any case of existing or perceived difference in contents between such versions, the reference version is the Portable Document Format (PDF). In case of dispute, the reference shall be the printing on ETSI printers of the PDF version kept on a specific network drive within ETSI Secretariat.

Users of the present document should be aware that the document may be subject to revision or change of status. Information on the current status of this and other ETSI documents is available at
http://portal.etsi.org/tb/status/status.asp

If you find errors in the present document, please send your comment to one of the following services:
http://portal.etsi.org/chaircor/ETSI_support.asp

Copyright Notification

Contents

Intellectual Property Rights

IPRs essential or potentially essential to the present document may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: *"Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards"*, which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (http://webapp.etsi.org/IPR/home.asp).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Foreword

This Harmonized European Standard (Telecommunications series) has been produced by ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM).

The present document has been produced by ETSI in response to a mandate from the European Commission issued under Council Directive 98/34/EC (as amended) [i.2] laying down a procedure for the provision of information in the field of technical standards and regulations.

The present document is intended to become a Harmonized Standard, the reference of which will be published in the Official Journal of the European Communities referencing the Directive 1999/5/EC [i.1] of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity ("the R&TTE Directive").

Technical specifications relevant to Directive 1999/5/EC [i.1] are given in annex A.

National transposition dates	
Date of adoption of this EN:	12 March 2010
Date of latest announcement of this EN (doa):	30 June 2010
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	31 December 2010
Date of withdrawal of any conflicting National Standard (dow):	31 December 2011

Introduction

The present document is part of a set of standards developed by ETSI and is designed to fit in a modular structure to cover all radio and telecommunications terminal equipment within the scope of the R&TTE Directive [i.1]. The modular structure is shown in EG 201 399 [i.3].

1 Scope

The present document applies to GNSS repeaters. GNSS pseudolites as well as GNSS Receivers are not covered by the present document.

GNSS repeaters are devices designed to re-transmit GNSS signals unchanged inside buildings in order to provide a usable signal for GNSS receivers that are out of sight of the GNSS satellite constellation or that they are unable to connect to GNSS signal simulators. A number of potential uses for such devices have been identified, such as the provision of a signal for test and development purposes and avoiding the need for receivers in emergency vehicles to re-acquire lock upon leaving a garage.

These radio equipment types are capable of operating in all or part of the frequency bands given in table 1.

Table 1: Radiocommunications service frequency bands

	Radiocommunications service frequency bands
Transmit	1 164 MHz to 1 215 MHz
Receive	1 164 MHz to 1 215 MHz
Transmit	1 215 MHz to 1 300 MHz
Receive	1 215 MHz to 1 300 MHz
Transmit	1 559 MHz to 1 610 MHz
Receive	1 559 MHz to 1 610 MHz

The type of equipment covered by the present document is as follows:

- Fixed installed GNSS repeater equipment with a transmit antenna that is for indoor installation. The equipment is fitted with integral or dedicated antenna(s). The GNSS repeater consists of a linear amplifier with a predetermined maximum power output and a maximum gain between in and output channel. The intended use is inside a building with its receiving antenna outside and the transmitting antenna inside the building.

Mobile or portable GNSS repeaters are excluded from the application of the present document.

The present document fulfils the purpose of providing the requirements and associated measurement methods to fulfil the requirements of the R&TTE directive for efficient spectrum use and to protect the primary service and radio services in adjacent frequency bands.

In addition to the present document, other ENs that specify technical requirements in respect of essential requirements under other parts of article 3 of the R&TTE Directive may apply to equipment within the scope of the present document.

NOTE: A list of such ENs is included on the web site http://www.newapproach.org.

2 References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific.

- For a specific reference, subsequent revisions do not apply.
- Non-specific reference may be made only to a complete document or a part thereof and only in the following cases:
  - if it is accepted that it will be possible to use all future changes of the referenced document for the purposes of the referring document;
  - for informative references.

Referenced documents which are not found to be publicly available in the expected location might be found at http://docbox.etsi.org/Reference.

NOTE: While any hyperlinks included in this clause were valid at the time of publication ETSI cannot guarantee their long term validity.

2.1 Normative references

The following referenced documents are indispensable for the application of the present document. For dated references, only the edition cited applies. For non-specific references, the latest edition of the referenced document (including any amendments) applies.

[1] ETSI TR 100 028 (2001) (all parts): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics".

[2] CISPR 16 (2006), (parts 1-1, 1-4 and 1-5): "Specifications for radio disturbance and immunity measuring apparatus and methods; Part 1: Radio disturbance and immunity measuring apparatus".

2.2 Informative references

The following referenced documents are not essential to the use of the present document but they assist the user with regard to a particular subject area. For non-specific references, the latest version of the referenced document (including any amendments) applies.

[i.1] Directive 1999/5/EC of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity (R&TTE Directive).

[i.2] Council Directive 98/34/EC of the European Parliament and of the Council of 22 June 1998 laying down a procedure for the provision of information in the field of technical standards and regulations.

NOTE: It can be found under www.ero.dk.

[i.3] ETSI EG 201 399 (V2.1.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); A guide to the production of candidate Harmonized Standards for application under the R&TTE Directive".

[i.4] CEPT ECC Report 129: "Technical and operational provisions required for the use of GNSS repeaters".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in the R&TTE Directive [i.1] and the following apply:

combined equipment: any combination of non-radio equipment that requires a plug-in radio device to offer full functionality

dedicated antenna: antenna external to the equipment, using an antenna connector with a cable and which has been designed or developed for one or more specific types of equipment

NOTE: It is the combination of dedicated antenna and radio equipment that has to be compliant with the regulations.

frequency band: one of the frequency ranges defined in table 1 of the present document

GNSS bands: frequency bands from 1 164 MHz to 1 215 MHz, 1 215 MHz to 1 300 MHz, and from 1 559 MHz to 1 610 MHz

GNSS pseudolites: (pseudo satellites) are ground based radio transmitters that provide an alternative ranging signal, which with other pseudolites signals or satellite signals can give a navigation solution

host equipment: any equipment which has complete user functionality when not connected to the radio equipment part and to which the radio equipment part provides additional functionality and to which connection is necessary for the radio equipment part to offer functionality

integral antenna: antenna designed as a fixed part of the equipment, without the use of an external connector and as such which cannot be disconnected from the equipment by the user with the intent to connect another antenna

NOTE: An integral antenna may be fitted internally or externally. In the case where the antenna is external, a non-detachable cable not exceeding 3 m length is allowed.

plug-in radio device: radio equipment module intended to be used with or within host, combined or multi-radio equipment, using their control functions and power supply

radiated measurements: measurements which involve the absolute measurement of a radiated EM field

stand-alone radio equipment: equipment that is intended primarily as communications equipment and that is normally used on a stand-alone basis

3.2 Symbols

For the purposes of the present document, the following symbols apply:

dB	decibel
dBi	antenna gain relative to isotropic radiator in decibel
dBr	decibel relative to the maximum power
E	electrical field strength
f	frequency
f_c	nominal centre frequency
G_{total}	GNSS repeater total system gain
G	antenna gain
P	equivalent isotropically radiated power level
R	distance
µs	microsecond

3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

CEPT	European Conference of Postal and Telecommunications Administrations
e.i.r.p.	equivalent isotropically radiated power
e.r.p.	effective radiated power
EC	European Commission
ECC	Electronic Communications Committee
EM	Electromagnetic
EMC	Electro Magnetic Compatibility
GNSS	Global Navigation Satellite System
HS	Harmonized Standard
IF	Intermediate Frequency
ppm	parts per million = 10^{-6}
PSD	Power Spectral Density
RF	Radio Frequency
rms	root mean square
UUT	Unit Under Test

4 Technical requirements specifications

4.1 Environmental profile

The technical requirements of the present document apply under the environmental profile for operation of the equipment, which shall be stated by the manufacturer. The equipment shall comply with all the technical requirements of the present document at all times when operating within the boundary limits of the stated operational environmental profile.

4.2 Conformance Requirements

4.2.1 Transmit Frequency Band

4.2.1.1 Definition

The transmit frequency bands are the GNSS frequency bands, or part of these bands, in which the GNSS repeater can re-transmit received signals (see table 1).

4.2.1.2 Limits

The actual transmit frequency band should be maintained within the GNSS bands.

4.2.1.3 Conformance

Conformance tests as defined in clause 5.3.2 shall be carried out.

4.2.2 GNSS Repeater Total Gain

4.2.2.1 Definition

The total gain of the GNSS repeater, G_{total} , is the measured maximum gain of all included radio frequency amplifiers added to the sum of the declared maximum gain of all attached antennas (the declared identified maximum gain of the GNSS repeater receive antenna and the declared maximum gain of the GNSS re-broadcast antenna).

$$G_{total}\ [dB] = \text{GNSS repeater antenna gain(s)} + \text{amplifier gain} - \text{cable losses}$$

4.2.2.2 Limits

The total gain will calculated from the measured amplifier gain and the declared maximum of the antenna gains across the declared transmit frequencies within the GNSS bands. The G_{total} gain limit is 45 dB [i.4]. Installed cable losses of up to 3 dB can be assumed.

4.2.2.3 Conformance

Conformance tests as defined in clause 5.3.3 shall be carried out.

4.2.3 Output power limitation (saturation e.i.r.p.)

4.2.3.1 Definitions

The saturation output power is the maximum equivalent isotropically radiated power (e.i.r.p.) of the equipment for a sinusoidal input signal of any power level. It relates to the maximum output power level of the system when presented with a high level non-GNSS signal such as a radar pulse. It is not related to the level of re-radiated GNSS signal. Re-radiated GNSS signals would be limited to a significantly lower level by virtue of the limitation on gain given in clause 4.2.2.

4.2.3.2 Limits

The maximum output power shall not exceed -20 dBm for a sinusoidal input signal within any of the frequency bands given in table 1.

The limiting output power capability shall not exceed -27 dBm for a sinusoidal input signal with a frequency of 1 151 MHz or below.

4.2.3.3 Conformance

Conformance tests as defined in clause 5.3.4 shall be carried out.

4.2.4 Transmitter unwanted emissions in the spurious domain

4.2.4.1 Definition

These are radio frequency emissions outside the GNSS bands, other than those of the wanted emissions and associated sidebands.

4.2.4.2 Limits

The level of spurious emissions shall not exceed the limits given in tables 2 and 3.

Table 2: General transmitter spurious emission limits outside the GNSS bands

Frequency range	Maximum power, e.r.p. (above 1 GHz: e.i.r.p.)	Bandwidth
30 MHz to 47 MHz	-36 dBm	100 kHz
47 MHz to 74 MHz	-54 dBm	100 kHz
74 MHz to 87,5 MHz	-36 dBm	100 kHz
87,5 MHz to 118 MHz	-54 dBm	100 kHz
118 MHz to 174 MHz	-36 dBm	100 kHz
174 MHz to 230 MHz	-54 dBm	100 kHz
230 MHz to 470 MHz	-36 dBm	100 kHz
470 MHz to 862 MHz	-54 dBm	100 kHz
862 MHz to 1 GHz	-36 dBm	100 kHz
1 GHz to 1,164 GHz	-30 dBm	1 MHz
1,300 GHz to 1,559 GHz	-30 dBm	1 MHz
1,610 GHz to 12,750 GHz	-30 dBm	1 MHz

Table 3: Specific spurious emissions limits in geographic coverage area of systems operating in other frequency bands

System type operating in the same geographical area	Band for co-existence requirement	Maximum power, e.r.p. (above 1 GHz: e.i.r.p.)	Measurement Bandwidth
Aeronautical systems	960 MHz to 1 151 MHz	-52 dBm	1 MHz
DCS 1 800	1 805 MHz to 1 880 MHz	-47 dBm	100 kHz
	1 710 MHz to 1 785 MHz	-61 dBm	100 kHz
PCS 1 900	1 930 MHz to 1 990 MHz	-47 dBm	100 kHz
	1 850 MHz to 1 910 MHz	-61 dBm	100 kHz
UTRAN TDD	1 900 MHz to 1 920 MHz	-52 dBm	1 MHz

4.2.4.3 Conformance

Conformance tests as defined in clause 5.3.4 shall be carried out.

5 Testing for compliance with technical requirements

5.1 Conditions for testing

5.1.1 Normal and extreme test conditions

Tests defined in the present document shall be carried out under normal test conditions and where stated, under the extreme test conditions as declared by the manufacturer (see clause 4.1).

5.1.2 Test Frequencies and Operating Modes

The measurements for the RF gain and Output Power Limitation shall be performed at the lowest and highest frequency for each of the stated frequency ranges the GNSS repeater is intended to re-transmit. The measurements for transmitter and receiver spurious emissions shall be performed when operating on one of the frequencies for each of the stated frequency ranges.

If the equipment has different nominal transmit bandwidths, the measurements need to be repeated for each of the repeater transmit bandwidth.

For the purpose of testing of the GNSS repeater for its maximum gain an input signal shall be provided to the receiver front end (either the connector, or in case of an integrated antenna, to the receiving antenna).

Confirmation of the total gain of the system can be measured by sweeping a narrow band 20 kHz signal across the transmit bandwidth, the swept input signal to be set at a value of -80 dBm/20 kHz. The resultant value displayed on a spectrum analyser using peak hold shall not exceed a value of -35 dBm/20 kHz. However, if the measured saturation output power is significantly lower than -20 dBm, this lower value should be used to avoid saturation effects giving an incorrect value of gain, through clause 4.2.2.

For the purpose of testing of the GNSS repeater unwanted emissions, a white-noise input signal shall be provided to the receiver front end (either the connector, or in case of an integrated antenna, to the receiving antenna).

NOTE: Only a relatively small power is needed. Assuming a GNSS signal strength of -160 dBW/24 MHz (approximately -144 dBm/MHz) at the earth surface referenced to an isotropic antenna, and a typical receive antenna gain of 3 dBi, the typical GNSS input signal would by approximately -140 dBm/MHz.

A white-noise signal source from a signal generator shall be applied to the input of the GNSS receiver with a PSD of -105 dBm/MHz for the purpose of testing the transmit frequency range.

5.1.3 Antennas

The equipment can have either integral or dedicated antennas.