

ETSI EN 302 448 V1.1.1 (2007-12)

Harmonized European Standard (Telecommunications series)

**Satellite Earth Stations and Systems (SES);
Harmonized EN for tracking Earth Stations on Trains (ESTs)
operating in the 14/12 GHz frequency bands
covering essential requirements
under article 3.2 of the R&TTE directive**

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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
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Foreword

This Harmonized European Standard (Telecommunications series) has been produced by ETSI Technical Committee Satellite Earth Stations and Systems (SES).

The present document has been produced by ETSI in response to a mandate from the European Commission issued under Directive 98/34/EC [4] (as amended) 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 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") [1].

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

National transposition dates

Date of adoption of this EN:	7 December 2007
Date of latest announcement of this EN (doa):	31 March 2008
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	30 September 2008
Date of withdrawal of any conflicting National Standard (dow):	30 September 2009

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. The modular structure is shown in EG 201 399.

1 Scope

The present document applies to Earth Stations located on board Trains, which have the following characteristics.

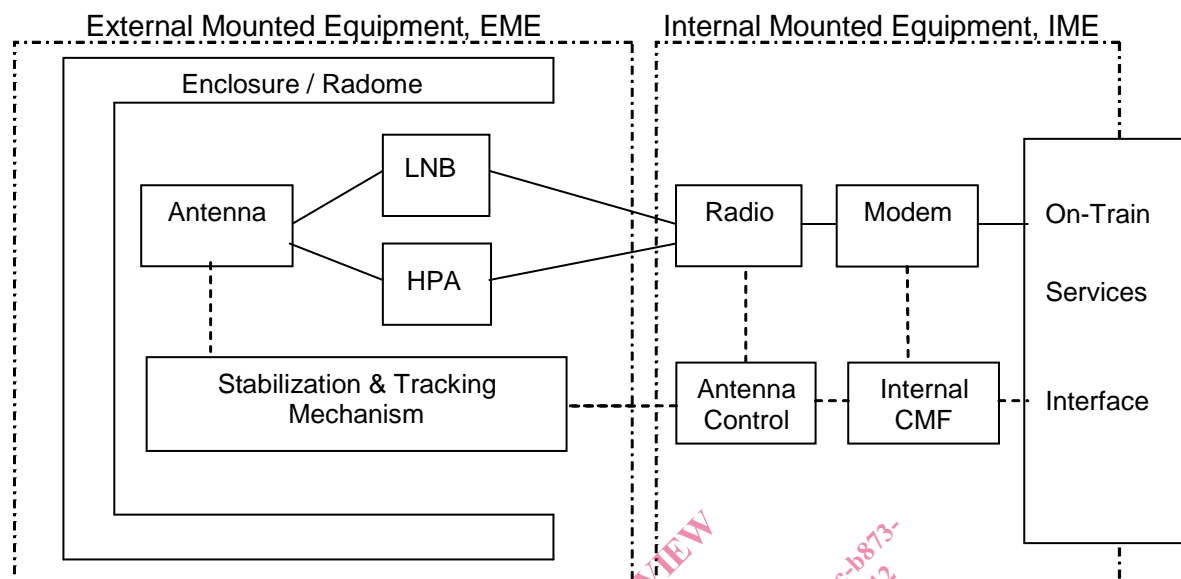


Figure 1: EST System Overview

- The EST may transmit and receive data when the train is in motion and also when the train is stationary.
- The EST operates in a railway environment and, therefore, may be subject to occasional disturbances and interruptions in the satellite link.
- The EST is operating as part of a satellite network (e.g. star, mesh or point-to-point) used for the distribution and/or exchange of information.
- The EST is comprised of all the equipment, electrical and mechanical, from the antenna itself to the interface with other communications equipment on a train (usually referred to as the terrestrial interface).
- The EST transmits on single carrier in the frequency range 14,00 GHz to 14,25 GHz, which is a portion of a band allocated to the Fixed Satellite Services (FSS) (Earth-to-space).
- The EST receives in one or more frequencies within the range from 10,70 GHz to 12,75 GHz in bands allocated to the Fixed Satellite Services (FSS) (space-to-Earth) or the Broadcast Satellite Service (BSS) (space-to-Earth), depending on the ITU Region where the EST is located.
- The EST uses linear or circular polarization.
- The EST is designed to operate through a geostationary satellite (or a cluster of co-located geostationary satellites) that is at least 3° away from any other geostationary satellite operating in the same frequencies and over the same coverage area.
- The EST transmits at elevations greater than or equal to 7° relative to the local horizon.
- The EST is designed for unattended operation.
- The EST is controlled and monitored by a Network Control Facility (NCF). The NCF is outside the scope of the present document.

The present document applies to the EST with its ancillary equipment and its various telecommunication ports, and when operated within the boundary limits of the operational environmental profile as declared by the applicant and when installed as required by the applicant's declaration or in the user documentation.

The present document is intended to cover the provisions of Directive 1999/5/EC [1] (R&TTE Directive) Article 3.2, which states that "... radio equipment shall be so constructed that it effectively uses the spectrum allocated to terrestrial/space radio communications and orbital resources so as to avoid harmful interference".

NOTE 1: Operational requirements are defined by national administrations and by relevant ECC Decisions.

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 Directive 1999/5/EC [1] (R&TTE Directive) may apply to equipment within the scope of the present document.

NOTE 2: 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>.

For online referenced documents, information sufficient to identify and locate the source shall be provided. Preferably, the primary source of the referenced document should be cited, in order to ensure traceability. Furthermore, the reference should, as far as possible, remain valid for the expected life of the document. The reference shall include the method of access to the referenced document and the full network address, with the same punctuation and use of upper case and lower case letters.

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] 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).
- [2] Void.
- [3] CISPR 16-1-5 (2003): "Specification for radio disturbance and immunity measuring apparatus and methods; Part 1-5: Radio disturbance and immunity measuring apparatus - Antenna calibration test sites for 30 MHz to 1 000 MHz".

2.2 Informative references

- [4] 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.

- [5] CEPT Recommendation T/R 25-09: "Designation of frequencies in the 900 MHz band for railway purposes".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in Directive 1999/5/EC [1] and the following apply:

ancillary equipment: equipment used in connection with an EST is considered as ancillary if the three following conditions are met:

- the equipment is intended for use in conjunction with the EST to provide additional operational and/or control features (e.g. to extend control to another position or location); and
- the equipment cannot be used on a stand alone basis, to provide user functions independently of the EST; and
- the absence of the equipment does not inhibit the operation of the EST.

applicant: manufacturer or his authorized representative within the European Community or the person responsible for placing the apparatus on the market

carrier-off radio state: radio state in which the EST may transmit and does not transmit any carrier

NOTE 1: The phrase "the EST may transmit" means that all the conditions for transmission are satisfied (e.g. in a state where transmissions are permitted, no failure detected, and the EST is correctly pointed towards the satellite).

NOTE 2: The existence of a "Carrier-off" radio state depends on the system of transmission used. For ESTs designed for continuous transmission mode there may be no "Carrier-off" state.

carrier-on radio state: radio state in which the EST may transmit and transmits a carrier

Control Channel (CC): channel or channels by which ESTs receive control information from the NCF

EIRP_{max}: maximum e.i.r.p. capability of the EST as declared by the applicant

emissions disabled radio state: radio state in which the EST must not emit

NOTE: Examples of cases where the EST is in this radio state: before system monitoring pass, before the control channel is received, when a failure is detected, when an EST is commanded to disable, and when the EST is in a location requiring cessation of emissions.

external control channel: control channel which is either (i) carried by the EST network via the same or another satellite, but not within the internal protocol of the EST system, or (ii) carried by any other radio communication system

Externally Mounted Equipment (EME): that part of the EST intended to be installed on the outside of the train (usually the roof), as declared by the applicant, or as indicated in the user documentation

NOTE 1: The EME unit is usually comprised of the following main parts:

- a) The antenna sub-system which converts the incident radiation field into a guided wave and vice versa.
- b) The Low Noise Block (LNB) down converter, which is a device that amplifies, with very low internal noise, the received signals in the Radio Frequency (RF) band and converts them to intermediate frequencies.
- c) The up-converter and the power amplifier which convert from the intermediate frequency to RF and amplify the low level RF signals for transmission through the antenna subsystem.
- d) The stabilization and tracking mechanics that ensure pointing of the antenna main beam towards the satellite within the required accuracy.

NOTE 2: The installation equipment (means of attachment) is outside the scope of the present document. However, the antenna structures and other components directly mounted on the antenna and forming an integral part of it, are subject to the specifications of the present document.

NOTE 3: Certain configurations may include more than one EME per EST. As for example, the EST may have separate transmit and receive antennas or it may have redundant transmit/receive antenna units.

external response channel: response channel which is either (i) carried by the EST network via the same or another satellite, but not within the internal protocol of the EST system, or (ii) carried by any other radio communication system

integral antenna: antenna which may not be removed during the tests according to the applicant's statement

internal control channel: control channel which is carried by the EST network via the same satellite as used for transmission of user data and within the internal protocol structure of the EST system

Internally Mounted Equipment (IME): part of the EST equipment which is installed inside the train and its connection cables with the EME

NOTE: The IME is usually comprised of:

- a) the modem and the IF radio equipment;
- b) the control logic, including that for the internal control and monitoring subsystem and the antenna tracking subsystem; and
- c) the interfaces to equipment and services onboard the train.

internal response channel: response channel which is carried by the EST network via the same satellite as used for transmission of user data and within the internal protocol structure of the EST system

maximum relative wind speed: the addition of the magnitudes of the maximum wind speed and the maximum train velocity

Network Control Facility (NCF): set of functional entities that, at system level, monitor and control the correct operation of all ESTs in a network

nominated bandwidth: bandwidth of the EST radio frequency transmission nominated by the applicant. The nominated bandwidth is centred on the transmit frequency and does not exceed 5 times the occupied bandwidth

NOTE: The nominated bandwidth is wide enough to encompass all spectral elements of the transmission which have a level greater than the specified spurious radiation limits. The nominated bandwidth is wide enough to take account of the transmit carrier frequency stability. This definition is chosen to allow flexibility regarding adjacent channel interference levels which will be taken into account by operational procedures depending on the exact transponder carrier assignment situation.

occupied Bandwidth (Bo):

- for a digital modulation scheme: the width of the signal spectrum 10 dB below the maximum in-band density;
- for an analogue modulation scheme: the width of a frequency band such that, below the lower and above the upper frequency limits, the mean power emitted is equal to 0,5 % of the total mean power of the emission.

off-axis angle: angle between the direction of the axis of the antenna main beam and the considered direction

removable antenna: antenna which may be removed during the tests according to the applicant's statement

Response Channel (RC): channel by which EST transmit monitoring information to the NCF

spurious radiation: any radiation outside the nominated bandwidth

transmission disabled state: EST is in this state when it is not authorized by the NCF to transmit

transmission enabled state: EST is in this state when it is authorized by the NCF to transmit

3.2 Symbols

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

dBc	ratio expressed in decibels relative to the e.i.r.p. of the unmodulated carrier
dB _i	ratio of an antenna gain to the gain of an isotropic antenna, expressed in decibels
dBW	ratio of a power to 1 watt, expressed in decibels
dBpW	ratio of a power to 1 picowatt, expressed in decibels
dB _μ V/m	ratio of an electric field to 1 μV/m, expressed in decibels (20 log(electric field / 1 μV/m))

3.3 Abbreviations

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

CC	Control Channel
CCF	Control Channel reception Failure
CCR	Control Channel correctly Received
CENR	Cessation of Emissions Not Requested
CEPT	Conférence Européenne des Postes et Télécommunications (European Conference of Postal and Telecommunications Administrations)
CER	Cessation of Emissions Requested
CISPR	Comité International Spécial des Perturbations Radioélectriques (International Special Committee on Radio Interference)
CMF	Control and Monitoring Functions
ECC	Electronic Communications Committee (of CEPT)
e.i.r.p.	equivalent isotropically radiated power
EMC	Electro-Magnetic Compatibility
EME	Externally Mounted Equipment
EN	European Standard
EST	Earth Station on board a Train
EUT	Equipment Under Test
FEC	Forward Error Correction
FS	Fixed Service
FSS	Fixed Satellite Service
GSO	Geostationary Satellite Orbit
HPA	High Power Amplifier
IME	Internally Mounted Equipment
IPR	Intellectual Property Rights
ITU	International Telecommunications Union
LNB	Low Noise Block down converter
LO	Local Oscillator
LV	Low Voltage
NCF	Network Control Facility
R&TTE	Radio and Telecommunications Terminal Equipment
RC	Response Channel
RF	Radio Frequency
SMF	System Monitoring Fail
SMP	System Monitoring Pass
STE	Special Test Equipment
TxD	Transmission Disable command
TxE	Transmission Enable command
WRC	ITU World Radio Conference
XPD	Cross-Polarization Discrimination

4 Technical requirements specifications

4.1 General

4.1.1 Environmental profile

The applicant shall declare the environmental profile of the EST equipment and it shall include conditions for both survivability and operation. The declared environmental profile shall include, but not be limited to, a statement of conditions regarding: train velocity, tangential and longitudinal acceleration, temperature range, damp heat, dry heat, relative humidity stress, shock and vibration, antenna pressure pulses and pressure gradients.

NOTE: For guidance on the range of values for parameters in the environmental profile, applicants should consult the following standards: EN 50155; EN 60068; EN 61373. For certain environmental parameters not covered in these standards, it may be useful to consult EN 60945 (see Bibliography).

The equipment shall comply with the performance requirements of the present document under all operational environmental conditions.

4.1.2 Operational configurations

Under operational conditions an EST may dynamically change the occupied bandwidth and other transmission parameters (e.g. FEC, modulation, symbol rate) of the transmitted signal. For each occupied bandwidth an $EIRP_{max}$ and a nominated bandwidth shall be declared by the applicant. For the purposes of verifying that the EST complies with these specifications, the applicant may declare the worst case combination of transmission parameters. The following specifications apply to the EST for each occupied bandwidth and other transmission parameters.

4.1.3 EST states and radio states

For the purpose of the present document the following four EST states are defined, without presuming the effective implementation of the EST state machine:

- "Non valid";
- "Initial phase";
- "Transmission disabled"; and
- "Transmission enabled".

The four EST states are represented on figure 2 and are used in clause 4.2.8 for the specification of the Control and Monitoring Functions (CMFs).

In the "Non-valid" state and in the "Transmission disabled" state the EST is not allowed to transmit. In the "Transmission-enabled" state the EST is allowed to transmit. In the "Initial phase" state the EST is only allowed to transmit initial bursts or is waiting for a transmit enable/disable command.

The "Initial phase" is divided into three substates:

- "Initial phase-Standby" prior to the transmission of the first initial burst or when no initial bursts are transmitted;
- "Initial phase-BurstOn" during the transmission of the initial bursts;
- "Initial phase-BurstOff" between initial bursts.

NOTE: ESTs which do not transmit initial bursts have no "Initial phase-BurstOn" state and no "Initial phase-BurstOff" state.