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**Satellite Earth Stations and Systems (SES);
Harmonised Standard for fixed and in-motion Earth Stations
communicating with non-geostationary satellite systems
(NEST) in the 11 GHz to 14 GHz frequency bands
covering essential requirements of article 3.2 of
Directive 2014/53/EU**

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Foreword

This Harmonised European Standard (EN) has been produced by ETSI Technical Committee Satellite Earth Stations and Systems (SES).

The present document has been prepared under the Commission's standardisation request C(2015) 5376 final [i.1] to provide one voluntary means of conforming to the essential requirements of Directive 2014/53/EU on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC [i.8].

Once the present document is cited in the Official Journal of the European Union under that Directive, compliance with the normative clauses of the present document given in table A.1 confers, within the limits of the scope of the present document, a presumption of conformity with the corresponding essential requirements of that Directive, and associated EFTA regulations.

National transposition dates

Date of adoption of this EN:	20 October 2017
Date of latest announcement of this EN (doa):	31 January 2018
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	31 July 2018
Date of withdrawal of any conflicting National Standard (dow):	31 July 2019

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](#) (Verbal forms for the expression of provisions).

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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 RE Directive [i.8]. The modular structure is shown in ETSI EG 201 399 [i.2].

The present document is largely based on ETSI EN 303 979 [i.5], for ESOMPs operating with NGSO satellites.

The present document may also be applicable to the frequency band 14,0 GHz to 14,50 GHz (Earth-to-space) and 10,70 GHz to 12,75 GHz (space-to-Earth) subject to national regulation.

Annex A (informative) provides HS Requirements specifications.

Annex B (informative) Bibliography covers other supplementary information.

Recital 10 of Directive 2014/53/EU [i.8] states that "*in order to ensure that radio equipment uses the radio spectrum effectively and supports the efficient use of radio spectrum, radio equipment should be constructed so that: in the case of a transmitter, when the transmitter is properly installed, maintained and used for its intended purpose it generates radio waves emissions that do not create harmful interference, while unwanted radio waves emissions generated by the transmitter (e.g. in adjacent channels) with a potential negative impact on the goals of radio spectrum policy should be limited to such a level that, according to the state of the art, harmful interference is avoided; and, in the case of a receiver, it has a level of performance that allows it to operate as intended and protects it against the risk of harmful interference, in particular from shared or adjacent channels, and, in so doing, supports improvements in the efficient use of shared or adjacent channels*".

Recital 11 of Directive 2014/53/EU [i.8] states that "*although receivers do not themselves cause harmful interference, reception capabilities are an increasingly important factor in ensuring the efficient use of radio spectrum by way of an increased resilience of receivers against harmful interference and unwanted signals on the basis of the relevant essential requirements of Union harmonisation legislation*".

As a consequence, the present document includes both transmitting and receiving parameters aiming to maximize the efficient use of radio spectrum.

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1 Scope

The present document specifies technical characteristics and methods of measurements for fixed and in-motion Earth Stations communicating with non-geostationary satellite systems (NEST) in the 11 GHz to 14 GHz FSS frequency bands, which have the following characteristics:

- The NEST is designed for both in-motion and stationary operation.
- The NEST operates in-motion on various platforms such as trains, maritime vessels, aircraft and other vehicles and, therefore, may be subject to occasional disturbances and interruptions in the satellite link.
- The NEST is operating as part of a satellite system used for the provision of broadband communications.
- The NEST is comprised of all the equipment, electrical and mechanical, from the antenna itself to the interface with other communications equipment on a mobile platform.
- The NEST comprises one or more emitters and the system overview as given in figure 1 should be interpreted accordingly.
- The transmit and receive frequencies are shown in table 1.

Table 1: Frequency bands

	Frequency Bands
Transmit (Earth-to-space)	14,0 GHz to 14,50 GHz
Receive (space-to-Earth)	10,70 GHz to 12,75 GHz

- The NEST transmits within the frequency range from 14,0 GHz to 14,50 GHz.
- The NEST receives within the range from 10,70 GHz to 12,75 GHz.
- The NEST transmits at elevation angles of 50° or greater, relative to the horizontal plane.
- The NEST uses linear or circular polarization.
- The NEST communicates with non-geostationary satellites.
- The NEST is designed for unattended operation.
- The NEST is controlled and monitored by a Network Control Facility (NCF). The NCF is outside the scope of the present document.

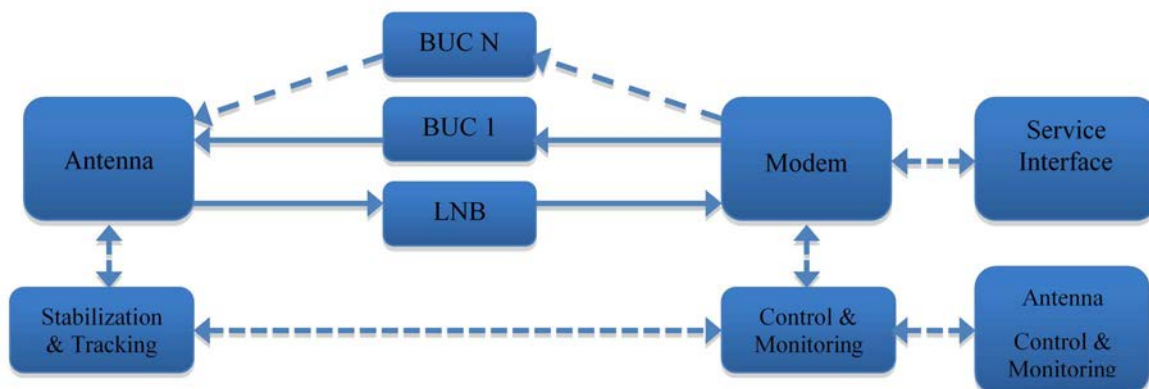


Figure 1: NEST System Overview

The present document applies to the NEST 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 covers the essential requirements of article 3.2 of Directive 2014/53/EU [i.8] under the conditions identified in annex A.

2 References

2.1 Normative references

References are specific, identified by date of publication and/or edition number or version number. Only the cited version applies.

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

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The following referenced documents are necessary for the application of the present document.

- [1] CISPR 16-1-1 Edition 4.0 (2015): "Specification for radio disturbance and immunity measuring apparatus and methods - Part 1-1: Radio disturbance and immunity measuring apparatus - Measuring apparatus".
- [2] CISPR 16-1-4 Edition 3.0 (2010): "Specification for radio disturbance and immunity measuring apparatus and methods - Part 1-4: Radio disturbance and immunity measuring apparatus - Antennas and test sites for radiated disturbance measurements".

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

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The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

- [i.1] Commission Implementing Decision C(2015) 5376 final of 04.08.2015 on a standardisation request to the European Committee for Electrotechnical Standardisation and to the European Telecommunications Standards Institute as regards radio equipment in support of Directive 2014/53/EU of the European Parliament and of the Council.
- [i.2] ETSI EG 201 399: "Electromagnetic compatibility and Radio spectrum Matters (ERM); A guide to the production of Harmonized Standards for application under the Radio & Telecommunication Terminal Equipment Directive 1999/5/EC (R&TTE) and a first guide on the impact of the Radio Equipment Directive 2014/53/EU (RED) on Harmonized Standards".
- [i.3] ETSI TS 103 052: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Radiated measurement methods and general arrangements for test sites up to 100 GHz".
- [i.4] ITU Radio Regulations (edition 2016).
- [i.5] ETSI EN 303 979 (V2.1.2): "Satellite Earth Stations and Systems (SES); Harmonised Standard for Earth Stations on Mobile Platforms (ESOMP) transmitting towards satellites in non-geostationary orbit, operating in the 27,5 GHz to 29,1 GHz and 29,5 GHz to 30,0 GHz frequency bands covering the essential requirements of article 3.2 of the Directive 2014/53/EU".
- [i.6] Recommendation ITU-R S.1503-2, Section 3.1: "Generation of Earth Station e.i.r.p density masks".

- [i.7] ETSI TR 100 028 (all parts) (V1.4.1) (12-2001): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics".
- [i.8] Directive 2014/53/EU of the European Parliament and of the Council of 16 April 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC.

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in Directive 2014/53/EU [i.8] and the following apply:

ancillary equipment: equipment used in connection with a NEST

NOTE: Equipment is considered as ancillary if the three following conditions are met:

- the equipment is intended for use in conjunction with the NEST 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 standalone basis, to provide user functions independently of the NEST; and
- the absence of the equipment does not inhibit the operation of the NEST.

antenna controller: equipment used to maintain antenna stabilization and tracking accuracy based on inputs from the Control and Monitoring Function

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 NEST may transmit and does not transmit any carrier

NOTE 1: The phrase "the NEST 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 NEST is correctly pointed towards the satellite).

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

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

Control Channel (CC): channel or channels by which NESTs receive and send control information from and to the NCF

EIRP_{max}: maximum EIRP capability of the NEST as declared by the applicant

EIRP density mask: EIRP density mask (dBW/40 kHz) declared by the applicant for the simulation described in the Recommendation ITU-R S.1503-2 [i.6] to demonstrate compliance with ITU Radio Regulations Article 22 limits [i.4]

emissions disabled radio state: radio state in which the NEST may not emit

NOTE: Examples of cases where the NEST is in this radio state:

- before system monitoring pass, before the control channel is received,
- when a failure is detected,
- when an NEST is commanded to disable, and
- when the NEST is in a location requiring cessation of emissions.

external control channel: control channel which is either:

- (i) carried by the NEST network via the same or another satellite, but not within the internal protocol of the NEST system; or
- (ii) carried by any other radio communication system

external response channel: response channel which is either:

- (i) carried by the NEST network via the same or another satellite, but not within the internal protocol of the NEST 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 NEST network via the same satellite as used for transmission of user data and within the internal protocol structure of the NEST system

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

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

nominated bandwidth: bandwidth of the NEST radio frequency transmission declared by the manufacturer

NOTE 1: The nominated bandwidth is wide enough to encompass all spectral elements of the transmission that 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 that will be taken into account by operational procedures depending on the exact transponder carrier assignment situation.

NOTE 2: The nominated bandwidth is centred on the transmit frequency and is larger than the occupied bandwidth. However, the manufacturer should be aware that the larger the declared nominated bandwidth, the fewer channels will be available within the assigned band.

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 the NEST transmit monitoring information to the NCF

spurious radiation: in the present document, any radiation outside the nominated bandwidth

transmission disabled state: radio state in which the NEST is not authorized to transmit by the NCF

transmission enabled state: radio state in which the NEST is authorized to transmit by the NCF

wanted signal occupied bandwidth (BW):

- for a digital modulation scheme: the width of the signal spectrum 10 dB below the maximum in-band power 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

3.2 Symbols

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

dB _i	ratio of an antenna gain to the gain of an isotropic antenna, expressed in decibels
dB _{sd}	ratio expressed in decibels relative to the spectral density
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:

BW	Wanted signal occupied Bandwidth
CC	Control Channel
CCF	Control Channel reception Failure
CCR	Control Channel correctly Received
CENR	Cessation of Emissions Not Required
CER	Cessation of Emissions Required
CISPR	Comité International Spécial des Perturbations Radioélectriques (International Special Committee on Radio Interference)
CMF	Control and Monitoring Functions
DC	Direct Current
EIRP	Effective Isotropic Radiated Power
EIRP _{max}	Maximum EIRP transmitted by the NEST
EMC	Electro-Magnetic Compatibility
epfd↑	Uplink equivalent power flux-density
EUT	Equipment Under Test
FEC	Forward Error Correction
FSS	Fixed Satellite Service
GEUT	Gain of EUT
GSO	Geostationary Satellite Orbit
HPA	High Power Amplifier
IPR	Intellectual Property Rights
IT _{max}	maximum Inhibit Time
LNB	Low-Noise Block down converter
LO	Local Oscillator
LV	Low Voltage
NCF	Network Control Facility
NEST	Earth Station communicating with NGSO satellite system
NGSO	Non Geostationary Satellite Orbit
R&TTE	Radio and Telecommunications Terminal Equipment
RBW	Reference BandWidth
RC	Response Channel
RE	Radio Equipment
RED	Radio Equipment Directive
RF	Radio Frequency
RMS	Root Mean Square
SMF	System Monitoring Fail
SMP	System Monitoring Pass
STE	Special Test Equipment
T _{trans}	time to transition from "Carrier off" to "Carrier on" radio state
TxD	Transmission Disable command
TxE	Transmission Enable command
VBW	Video BandWidth