



**Satellite Earth Stations and Systems (SES);
Mobile Earth Stations (MES),
including handheld earth stations, for Satellite Personal
Communications Networks (S-PCN) operating
in the 1,6 GHz/2,4 GHz frequency band
under the Mobile Satellite Service (MSS);
Harmonised Standard for access to radio spectrum**

ReferenceREN/SES-00442

Keywordsearth station, MES, MSS, regulation, satellite,
S-PCN

ETSI650 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 - APE 7112B
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° w061004871

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Foreword

This draft Harmonised European Standard (EN) has been produced by ETSI Technical Committee Satellite Earth Stations and Systems (SES), and is now submitted for the combined Public Enquiry and Vote phase of the ETSI Standardisation Request deliverable Approval Procedure (SRdAP).

The present document has been prepared under the Commission's standardisation request C(2015) 5376 final [i.2] 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.3].

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.

Proposed national transposition dates	
Date of latest announcement of this EN (doa):	3 months after ETSI publication
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	6 months after doa
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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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1 Scope

The present document applies to Mobile Earth Station (MES) radio equipment which have the following characteristics:

- the MES has both transmit and receive capabilities and operate in a Satellite-Personal Communications Network (S-PCN). An S-PCN MES can be a handheld, portable, vehicle-mounted, host connected, semi-fixed or fixed equipment, or can be an element in a multi-mode terminal. It consists of a number of modules with associated connections and user interface, or can be a self-contained single unit;
- these MESs are controlled and monitored by Control Monitoring Functions (CMF). The CMF is outside the scope of the present document;
- if the MES is an element in a multi-mode terminal, unless otherwise stated in the present document, its requirements apply only to the S-PCN MES element of the terminal operating in the MSS frequency bands given in table 1;
- the MES is capable in operating in all or part of the frequency bands shown in table 1.

Table 1: Mobile Satellite Service (MSS) frequency bands

MES	MSS frequency bands
Transmit	1 610 MHz to 1 626,5 MHz
Receive	1 613,8 MHz to 1 626,5 MHz
Receive	2 483,5 MHz to 2 500,0 MHz

NOTE: The relationship between the present document and essential requirements of article 3.2 of Directive 2014/53/EU [i.3] is given in annex A.

2 References

2.1 Normative references

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- [1] Void.
- [2] [Recommendation ITU-T O.153 \(10/92\)](#): "Basic parameters for the measurement of error performance at bit rates below the primary rate".
- [3] Void.
- [4] Void.
- [5] Void.
- [6] [Final Acts of the World Radiocommunication Conference \(WRC '95\); Geneva 1995](#).
- [7] [IEC 60068-2-1 \(2025\)](#): "Environmental testing - Part 2: Tests. Tests A: Cold".
- [8] [IEC 60068-2-2 \(2025\)](#): "Environmental testing - Part 2: Tests. Tests B: Dry heat".

2.2 Informative references

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- [i.1] Void.
- [i.2] [Commission Implementing Decision C\(2015\) 5376](#) final of 4.8.2015 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.3] [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.
- [i.4] [IEC 60068-2-64:2008+AMD1:2019 CSV](#): "Environmental testing. Part 2-64: Tests. Test Fh: Vibration, broadband random and guidance".

3 Definition of terms, symbols and abbreviations

3.1 Terms

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

carrier-on state (allocated a channel): state in which the MES is transmitting a carrier

carrier-off state (idle mode): radio state in which the MES does not actually transmit a carrier

CMF control message: message, normally originating from a network, to a specified terminal or set of terminals of the network which indicates to the terminal or set of terminals that it/they carry out some specific action or enter or maintain some specific state

NOTE: For test purposes CMF control messages can originate from CMF Simulator.

conducted measurement: measurement of emissions from an antenna port of the MES made by direct wired connection to the port

environmental profile: range of environmental conditions under which equipment within the scope of the present document is required to comply with the provisions of the present document

Equivalent Isotropically Radiated Power (EIRP): product of transmitter power and maximum antenna gain, equivalent to an isotropic source radiating uniformly in all directions

fellow radio station: another radio station operating in the same service, frequency band, or coordination environment as the station in question, such that it shares allocated spectrum with the mobile satellite earth terminal

handheld: MES which is self-contained and is small enough and light enough to be carried and used during a call with one hand

host-connected: MES for which connection to or integration with host equipment is necessary to offer functionality

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

in-band signals: signals which are located in the operating band plus an offset of 10 MHz outside this operating band

Installable Equipment (IE), Internally Mounted Equipment (IME) And Externally Mounted Equipment (EME): Installable Equipment (IE) is an equipment which is intended to be installed in a vehicle

NOTE: An IE consist of one or several interconnected modules. The IE is composed of modules intended to be externally mounted as defined for the intended use of the MES, and defined as Externally Mounted Equipment (EME) and the remaining modules(s) as Internally Mounted Equipment (IME).

Laboratory Test Equipment: logical grouping that contains the standard test equipment provided by a test laboratory

MSS band: continuous range of frequencies allocated by the ITU to the MSS

multi-mode: equipment that accommodates radio stations of different radio networks

narrow-band system: narrow-band system is one in which the nominal carrier frequency spacing for MESs in the earth-to-space direction is less than 300 kHz

network control channel: channel by which an MES receives general control information from the CMF(originated by a network control facility) of its S-PCN

nominated bandwidth (Bn): Bandwidth of the Mobile Earth Station (MES) radio frequency transmission which is wide enough to encompass all spectral elements of the transmission

NOTE 1: The nominated bandwidth is centred on the transmit frequency and does not exceed 5 times the occupied bandwidth.

NOTE 2: 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.

NOTE 3: The Bn is defined relative to the MES actual carrier frequency f_c .

Bn is the width of the frequency interval ($f_c - a$, $f_c + b$), where a and b can vary with f_c which are defined for the intended use of the MES. The frequency interval ($f_c - a$, $f_c + b$) does not encompass more than either:

- i) when $a = b$, 4 or less carrier frequencies for narrow-band systems;
- ii) when $a \neq b$, 1 nominal carrier frequency for narrow-band systems; or
- iii) 1 nominal carrier frequency for wide-band systems.

The frequency interval ($f_c - a$, $f_c + b$) remains within the operational band of the MES.

NOTE 4: Further explanation of nominated bandwidth is presented in annex B.

operational band: sub-portion of the 1 610 MHz to 1 626,5 MHz band which has been assigned in the earth-to-space direction to the MSS network within which the MES is operating

Portable Equipment (PE): generally intended to be self-contained, free standing and portable. A PE would normally consist of a single module, but can consist of several interconnected modules

radiated measurement: measurement of an actual radiated field

Special Test Equipment (STE): equipment which allows a test laboratory to control the MES so that the tests required by the present document can be performed

test laboratory: laboratory which performs the conformance testing of the MES against the present document

test load: test load is a substantially non-reactive, non-radiating power attenuator which is capable of safely dissipating the power from the transmitter(s)

unwanted emissions: unwanted emissions are those falling outside the nominated bandwidth in the carrier-on state, and those generated in the carrier-off state

wide-band system: wide-band system is one in which the nominal carrier frequency spacing for MESs in the Earth-to-Space direction is equal to or greater than 300 kHz

3.2 Symbols

Void.

3.3 Abbreviations

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

AK-R	Air Kerma Rate
ASD	Acceleration Spectral Density
BE _L	Lower Band Edge of the operating band
BE _U	Upper Band Edge of the operating band
B _n	Nominated Bandwidth
BW	Bandwidth
CDMA	Code Division Multiple Access
CMF	Control and Monitoring Functions
CW	Continuous Wave
dBW	decibels relative to 1 Watt
EFTA	European Free Trade Association
EIRP	Equivalent Isotropically Radiated Power
EMC	Electro-Magnetic Compatibility
EME	Externally Mounted Equipment
EN	European Standard
ERM	Electromagnetic compatibility and Radio spectrum Matters
ETS	European Telecommunication Standard
EU	European Union
EUT	Equipment Under Test
IE	Installable Equipment
IEC	International Electrotechnical Commission
IME	Internally Mounted Equipment
ITU	International Telecommunication Union
ITU-T	ITU Telecommunication Standardization Sector
MES	Mobile Earth Station
MIC	MES unique Identification Code (within its S-PCN)
MSS	Mobile Satellite Service
OATS	Open Area Test Site
PCN	Personal Communications Network
PE	Portable Equipment
R&TTE	Radio and Telecommunications Terminal Equipment
RE	Radio Equipment
RED	Radio Equipment Directive
RF	Radio Frequency
SNR	Signal to Noise Ratio
S-PCN	Satellite Personal Communications Network
STE	Special Test Equipment
TBR	Technical Basis for Regulation
WRC	World Radiocommunication Conference
ZVEI	Zentralverband Elektrotechnik- und Elektronik-industrie

4 Technical requirements specifications

4.1 Environmental profile

4.1.1 General

The technical requirements of the present document apply under the environmental profile for operation of the equipment, which shall be in accordance with its intended use, but as a minimum, shall be that specified in the test conditions contained in the present document. The equipment shall comply with all the technical requirements of the present document at all times when operating within the boundary limits of the specified operational environmental profile defined by its intended use.

The environmental profile for operation of the equipment shall include the ranges of humidity, temperature and supply voltage.

4.1.2 Temperature

The MES shall fulfil all the requirements in the full temperature ranges of:

- -10 °C to +55 °C;

taken from IEC publications 60068-2-1 [7] and 60068-2-2 [8].

4.1.3 Voltage

The nominal, lower and the higher extreme voltages shall be defined for the intended use of the MES and provided with the EUT documentation.

The MES shall fulfil all the requirements in the full voltage range between the extreme voltages.

4.2 Conformance requirements

4.2.1 Unwanted emissions outside the band 1 610 MHz to 1 626,5 MHz and the band 1 626,5 MHz to 1 628,5 MHz (carrier-on)

4.2.1.1 Justification

Protection of other radio services operating outside the band 1 610 MHz to 1 628,5 MHz from emissions caused by S-PCN MESs operating within the band 1 610 MHz to 1 626,5 MHz.

4.2.1.2 Technical requirements

The maximum EIRP density of the unwanted emissions from the MES outside the band 1 610,0 MHz to 1 626,5 MHz and the band 1 626,5 MHz to 1 628,5 MHz shall not exceed the limits in table 3.

In table 3, whenever a change of limit between adjacent frequency bands occurs, the lower of the two limits shall apply at the transition frequency.

Table 2: Void

Table 3: Maximum unwanted emissions outside the band 1 610 MHz to 1 626,5 MHz and the band 1 626,5 MHz to 1 628,5 MHz

Frequency (MHz)	Carrier-on		
	EIRP (dBW)	Measurement bandwidth	Measurement method
0,1 to 30	-66	10 kHz	Peak-hold
30 to 1 000	-66	100 kHz	Peak-hold
1 000 to 1 559	-60	1 MHz	Average
1 559 to 1 580,42	-70	1 MHz	Average (see note 1)
1 580,42 to 1 605	-70	1 MHz	Average
1 605 to 1 610	-70 to -10 (see note 2)	1 MHz	Average
1 610 to 1 626,5	Not applicable	Not applicable	Not applicable
1 626,5 to 1 628,5	Not applicable	Not applicable	Not applicable
1 628,5 to 1 631,5	-60	30 kHz	Average
1 631,5 to 1 636,5	-60	100 kHz	Average
1 636,5 to 1 646,5	-60	300 kHz	Average
1 646,5 to 1 666,5	-60	1 MHz	Average
1 666,5 to 2 200	-60	3 MHz	Average
2 200 to 12 750	-60	3 MHz	Peak hold

NOTE 1: In the sub-band 1 573,42 MHz to 1 580,42 MHz, the average measurement time is 20 ms.
NOTE 2: Linearly interpolated in dBW vs. frequency offset.

The conformance requirements apply for the full range of environmental conditions corresponding to the type of equipment as specified in clause 4.1.

4.2.1.3 Conformance test

Conformance tests are described in clause 5.2.2.

4.2.2 Unwanted emissions within the band 1 610 MHz to 1 626,5 MHz and the band 1 626,5 MHz to 1 628,5 MHz (carrier-on)

4.2.2.1 Justification

Protection of radio services and systems operating within the frequency band 1 610 to 1 628,5 MHz from unwanted emissions caused by S-PCN MESs operating in the band 1 610 MHz to 1 626,5 MHz.

4.2.2.2 Technical requirements

The maximum EIRP spectral density of the unwanted emissions from the MES within the band 1 610 MHz to 1 628,5 MHz shall not exceed the limits in tables 4, 5 or 6, as applicable.

In tables 4, 5 and 6, whenever a change of limit between adjacent frequency bands occurs, the lower of the two limits shall apply at the transition frequency.

When conflicts between multiple requirements exist, the more stringent requirement applies.

Table 4: Maximum unwanted emissions within the band 1 610,0 MHz to 1 626,5 MHz and the band 1 626,5 MHz to 1 628,5 MHz of MES operating such that the nominated bandwidth is entirely or partially contained in the frequency band 1 618,25 MHz to 1 626,5 MHz

Frequency offset (kHz) (see note 1)	Carrier - on		
	EIRP (dBW) (see note 3)	Measurement bandwidth (kHz) (see note 2)	Measurement method
0 to 160	-35	30	Average
160 to 225	-35 to -38,5	30	Average
225 to 650	-38,5 to -45	30	Average
650 to 1 365	-45	30	Average
1 365 to 1 800	-53 to -56	30	Average
1 800 to 16 500	-56	30	Average

NOTE 1: Frequency offset is determined from:

- i) the nearest edge of the nominated bandwidth of the nominal carrier closest to the MSS system operating in another operational band within the band 1 610 MHz to 1 626,5 MHz. The frequency offset is measured in the direction of the adjacent MSS system;
- ii) the upper edge of the nominated bandwidth of the carrier under test for emissions within the band 1 626,5 MHz to 1 628,5 MHz.

NOTE 2: The measurement bandwidth used can be 3 kHz if the unwanted EIRP limits are reduced correspondingly.

NOTE 3: Linearly interpolated in dBW vs. frequency offset.

Table 5: Maximum unwanted emissions within the band 1 610,0 MHz to 1 626,5 MHz and the band 1 626,5 MHz to 1 628,5 MHz of MES operating such that the nominated bandwidth is entirely contained in the frequency band 1 610,0 MHz to 1 618,25 MHz

Frequency offset (kHz) (see note 1)	Carrier - on		
	EIRP (dBW) (see note 3)	Measurement bandwidth (kHz) (see note 2)	Measurement method
0 to 160	-32	30	Average
160 to 2 300	-32 to -56	30	Average
2 300 to 18 500	-56	30	Average

NOTE 1: Frequency offset is determined from:

- i) the nearest edge of the nominated bandwidth of the nominal carrier closest to the MSS system operating in another operational band within the band 1 610 to 1 626,5 MHz. The frequency offset is measured in the direction of the adjacent MSS system;
- ii) the upper edge of the nominated bandwidth of the carrier under test for emissions within the band 1 626,5 to 1 628,5 MHz.

NOTE 2: The measurement bandwidth used can be 3 kHz if the unwanted EIRP limits are reduced correspondingly.

NOTE 3: Linearly interpolated in dBW vs. frequency offset.

Table 6: Maximum unwanted emissions of MES carriers within the operational band of CDMA carriers

Frequency offset (kHz) (see note 1)	Carrier - on		
	EIRP (dBW) (see note 2)	Measurement bandwidth (kHz)	Measurement method
0 to 70	-6 to -20	30	Average
70 to 600	-20 to -28	30	Average
600 to 2 000	-28 to -45	30	Average
2 000 to 5 000	-45 to -69	30	Average
5 000 to 16 500	-69	30	Average

NOTE 1: Frequency offset is determined from edge of nominated bandwidth.

NOTE 2: Linearly interpolated in dBW vs. frequency offset.

The conformance requirements apply for the full range of environmental conditions corresponding to the type of equipment as specified in clause 4.1.

4.2.2.3 Conformance test

Conformance tests are described in clause 5.2.3.

4.2.3 EIRP density within the operational band

4.2.3.1 Justification

To ensure that the maximum EIRP spectral density within the band 1 610 MHz to 1 626,5 MHz does not exceed the limits defined by the Final Acts of WRC-95 [6], S5.364.

4.2.3.2 Technical requirements

In any frequency sub-band of the band 1 610 MHz to 1 626,5 MHz, where the MES operates, one of the two following requirements shall apply under specific operating conditions:

- a) The MES shall not produce a mean EIRP density exceeding -3 dB (W/4 kHz), (mean limit).

NOTE: In this context, the mean is the mean over time whilst the MES is in the carrier-on mode. Or,

- b) The MES shall not produce a peak EIRP density exceeding -15 dB (W/4 kHz) (peak limit).

The specific frequency sub-band(s) and operating conditions, for which the two different limits apply, shall be defined for the intended use of the MES and provided with the EUT documentation.

These requirements apply to all types of MES, for every transmit channel of the MES in its operational band or sub-bands.

The conformance requirements apply for the full range of environmental conditions corresponding to the type of the equipment as described in clause 4.1.

4.2.3.3 Conformance test

Conformance tests are described in clause 5.2.4.

4.2.4 Unwanted emissions in carrier-off state

4.2.4.1 Justification

Protection of other radio services and systems from unwanted emissions caused by MESs in the carrier-off state.

4.2.4.2 Technical requirements

The maximum EIRP of the unwanted emissions from the MESs in the carrier-off state shall not exceed the limits in table 7.

In table 7, whenever a change of limit between adjacent frequency bands occurs, the lower of the two limits shall apply at the transition frequency.

Table 7: Maximum EIRP of the unwanted emissions in the carrier-off state

Frequency (MHz)	EIRP (dBW)	Measurement Bandwidth	Measurement method
0,1 to 30	-87	10 kHz	peak hold
30 to 1 000	-87	100 kHz	peak hold
1 000 to 12 750	-77	100 kHz	peak hold

The conformance requirements apply for the full range of environmental conditions corresponding to the type of equipment as specified in clause 4.1.

4.2.4.3 Conformance test

Conformance tests are described in clause 5.2.5.

4.2.5 MES Control and Monitoring Functions (CMF)

4.2.5.1 Void

4.2.5.2 Void

4.2.5.3 Network control authorization

4.2.5.3.1 Justification

Protection of radio services and systems from uncontrolled RF transmissions from the MES.

4.2.5.3.2 Technical requirements

During POWER-ON no transmissions shall occur from the MES.

Following POWER-ON the MES shall enter a controlled, non-transmitting (carrier-off) state. This state shall be maintained whilst the MES is not synchronized with the network control channel(s).

Without synchronizing to the network control channel(s), it shall not be possible to initiate carrier-on state.

Within 30 s of having lost the network control channel(s) the MES shall suppress transmissions (carrier-off).

The conformance requirements apply for the environmental conditions as specified in clause 4.1.

4.2.5.3.3 Conformance test

Conformance tests are described in clause 5.2.6.3.

4.2.5.4 Network control reception

4.2.5.4.1 Transmission disable/enable

4.2.5.4.1.1 Justification

Protection of radio services and systems from uncontrolled RF transmissions from the MES.

4.2.5.4.1.2 Technical requirements

An MES, which is transmitting (carrier-on), shall not continue transmissions for a period of time longer than 1 second after receipt of a transmission disable command from its CMF. After ceasing transmission the MES shall then not transmit until it receives a transmission enable command from its CMF, or until it is powered-off and then powered-on again.

An MES, which is powered-on but not transmitting (carrier-off), when it is in receipt of a transmission disable command from its CMF, shall then not transmit until it receives a transmission enable command from its CMF, or until it is powered-off and then powered-on again.

The conformance requirements apply for the environmental conditions as specified in clause 4.1.

4.2.5.4.1.3 Conformance test

Conformance tests are described in clause 5.2.6.4.1.

4.2.5.4.2 Transmit frequency control

4.2.5.4.2.1 Justification

Protection of radio services and systems from uncontrolled RF transmissions from the MES.

4.2.5.4.2.2 Technical requirements

The MES shall set the carrier frequency of its transmission according to the command of the CMF. The carrier frequency has to be controlled such, that the entire nominated bandwidth of the terminal falls completely within the operational frequency band(s) as defined for the intended use of the MES and provided with the EUT documentation.

The conformance requirements apply for the environmental conditions as specified in clause 4.1.

4.2.5.4.2.3 Conformance test

Conformance tests are described in clause 5.2.6.4.2.

4.2.5.5 Fellow radio stations in a dual-mode or multi-mode terminal

4.2.5.5.1 Justification

Protection of radio services and systems from uncontrolled RF transmissions from the MES.

4.2.5.5.2 Technical requirements

Any fellow radio station in a multi-mode MES shall not transmit without reception of a network control channel for the system for which it is designed.

The conformance requirements apply for the environmental conditions as specified for the fellow radio station.

4.2.5.5.3 Conformance test

Conformance tests are described in clause 5.2.6.5.

4.2.6 Equipment identity

4.2.6.1 Justification

Protection of radio services and systems from uncontrolled RF transmissions from the MES.

4.2.6.2 Technical requirements

Each MES shall have a unique MES Identification Code (MIC) within its S-PCN.

It shall not be possible for the user to alter the MIC using any normally accessible procedure.

The MES shall be capable of transmitting its identification code upon reception of an CMF command addressed to it.

The conformance requirements apply for the environmental conditions as specified in clause 4.1.

4.2.6.3 Conformance test

Conformance tests are described in clause 5.2.7.

4.2.7 Protection of the radio astronomy service operation in the band 1 610,6 MHz to 1 613,8 MHz

4.2.7.1 Justification

To protect the radio astronomy service in the 1 610,6 MHz to 1 613,8 MHz band from emissions produced by MESs.

4.2.7.2 Technical requirements

The MES shall be able to have its transmissions disabled as specified in clause 4.2.5.4.1.

The actual procedure used in an S-PCN network to protect the radio astronomy service in the 1 610,6 MHz to 1 613,8 MHz band can utilize additional features of the MES.

4.2.7.3 Conformance test

Conformance tests are described in clause 5.2.6.4.1.

4.2.8 Receiver Adjacent Channel Selectivity

4.2.8.1 Justification

To enable reception of a wanted signal in presence of other signals in the adjacent channel.

Adjacent channel selectivity is a measure of a receiver's ability to receive a signal at its assigned channel frequency in the presence of a signal in the adjacent channel at a given frequency offset from the centre frequency of the assigned channel.

4.2.8.2 Technical requirements

The frequency offset and relative power level of the adjacent signal compared to the wanted signal shall take the values given in table 8. The adjacent signal shall occupy the same bandwidth as the wanted signal where BW is the wanted signal occupied bandwidth. There shall be no more than 0,5 dB degradation in the receiver signal to noise ratio under these conditions.

Table 8: Adjacent Channel frequency and power level

Signal	Centre frequency offset from wanted signal	Power level relative to wanted signal
Adjacent signal	BW	12 dB

4.2.8.3 Conformance test

Conformance tests described in clause 5.2.8 shall be carried out.

4.2.9 Receiver Blocking Characteristics

4.2.9.1 Justification

To prevent high power signals outside the receive frequency band from blocking the reception of wanted signals inside the receive frequency band.

The receiving blocking characteristic is a measure of the receiver's ability to receive a wanted signal at its assigned channel frequency in the presence of an unwanted interferer on frequencies outside the received band, without this unwanted input signal causing a degradation on the performance of the receiver beyond a specified limit. Receiver blocking is specified for signals operating in the following range:

$$BE_L - 10 \text{ MHz to } BE_U + 10 \text{ MHz}$$

where BE_L and BE_U are the lower and upper edges of the operating band respectively.

4.2.9.2 Technical requirements

The receiver performance degradation, in terms of signal to noise ratio, shall not exceed 1 dB when the unwanted signal as specified in table 9 is present.

Table 9: Interferer blocking signal characteristics

Interfering Signal	Frequency Range (MHz)	Frequency offset from lower and upper edges of the wanted carrier (MHz)	Level (dBm)
CW	1 613,8 to 1 626,5	10	-40 dB (Note 1)
CW	BE _L -10 MHz to BE _U +10 MHz		-60 (notes 1 and 2)
NOTE 1: This limit was set based on current MSS terminals receiver blocking performances using CW as blocking interferer.			
NOTE 2: This requirement is set assuming that the MES receiving in the band 2483.5-2500 MHz does not operate in the same location/area as the terrestrial mobile system operating above 2500 MHz (main blocking interferer)			

4.2.9.3 Conformance test

Conformance tests described in clause 5.2.9 shall be carried out.

5 Testing for compliance with technical requirements

5.1 Environmental conditions for testing

5.1.0 General

Tests defined in the present document shall be carried out at representative points within the boundary limits of the operational environmental profile defined by its intended use, which, as a minimum, shall be that specified in the test conditions contained in the present document.

Where technical performance varies subject to environmental conditions, tests shall be carried out under a sufficient variety of environmental conditions as specified in the present document to give confidence of compliance for the affected technical requirements.

5.1.1 Specification of the environmental test conditions

The tests in clauses 5.2.2, 5.2.3, 5.2.4 and 5.2.5 shall be performed under the conditions given in table 10.

Table 10: Environmental test conditions

Equipment Category	Temperature	Voltage
Handheld	Normal	Normal condition voltage (± 1 %)
other than handheld	Normal	Higher extreme voltage (+0/-2 %)
other than handheld	Normal	Lower extreme voltage (-0/+2 %)

Normal temperature shall be between +15 °C and +35 °C.

All other tests shall be performed under normal conditions for temperature and voltage, and without vibration.

5.1.2 Tests under extreme voltage conditions

During tests under extreme voltage conditions, as defined for the intended use of the MES, the power source of the equipment shall be replaced by a test power source, capable of producing extreme test voltages as specified in clause 5.1.1. The internal impedance of the test power source shall be low enough for its effect on the test results to be negligible. For the test purposes, the voltage of the power source shall be measured at the input terminals of the equipment.

If the equipment is provided with a permanently connected power cable, the test voltage shall be measured at the point of connection of the power cable to the equipment.

In equipment with incorporated batteries, the test power source shall be applied close to the battery terminals. In each case connections shall be provided with the EUT.

During tests, the power source voltages shall be maintained within a tolerance of ± 3 % relative to the voltage at the beginning of each test.

5.2 Essential radio test suites

5.2.1 General

5.2.1.1 Presentation of equipment for testing purposes

For testing purposes, one or more preliminary or production models of the MES equipment, shall be provided for checking conformance against the technical requirements of the present document, in any case, being representative of the equipment to be brought to the market.

If the MES is intended for use with an active antenna, this shall be provided as part of the MES.

5.2.1.2 Description of equipment

The EUT documentation shall include all the information related to the MES and its testing environment according to the intended use of the MES which will enable the test laboratory to run the test suite against the MES.

This information shall include:

- self-contained or host-connected;
- single-mode or multi-mode;
- antenna:
 - active or;
 - passive, with an antenna port available or;
 - passive, no antenna port available;

NOTE 1: If the MES has an active antenna, the antenna is regarded as an integral part of the MES.

NOTE 2: If the MES uses a passive antenna, the maximum gain of any antenna intended to be used with the equipment is provided with the EUT documentation.

- the method by which the equipment can be switched into its test modes;

NOTE 3: If Simulator is required see clauses 5.2.1.4 and 5.2.1.5.2.

- the fault conditions which cause transmission shut-down;
- the nominal, the lower extreme and the higher extreme operational voltages;
- in the case of a multi-mode MES, the other modes of operation;

- if the conducted emission measurements are to be performed;
 - the gain at the frequency of the measured spurious emission, according to the intended use of the MES;
- in an information leaflet, for each S-PCN for which the MES is designed to operate:
 - 1) the name of the S-PCN;
 - 2) the maximum value of nominated bandwidth for that S-PCN, as defined for the intended use of the MES;
 - 3) the a and b values of the nominated bandwidth for each nominal carrier frequency of the MES;
 - 4) the operating frequency range(s) of the MES;
 - 5) the frequency sub-bands and operating conditions for which the different EIRP density limits apply;
 - 6) the maximum gross data rate at which the MES is designed to operate;
 - 7) the agreement of the network operator to the above information.

5.2.1.3 Testing of host-connected equipment and plug-in modules

5.2.1.3.1 Test set up arrangements

For equipment for which connection to or integration with host equipment is required to offer functionality, the EUT documentation shall identify which of the test configurations detailed in this clause shall be used.

5.2.1.3.2 Set up for combined equipment

Under this set up, a combination of MES and a specific type of host equipment shall be used for testing according to the present document.

Where more than one such combination is intended, testing shall not be repeated for combinations of MES and other host equipment where the host equipment do not influence the emissions of the UE.

Where more than one such combination is intended to be used with the risk to influencing the emissions of the UE, one combination shall be tested against the full set of requirements of the present document; other combinations shall be tested separately for radiated emissions only.

5.2.1.3.3 Set up for the use of a test jig

Under this set up, where the MES is intended for use with a variety of host equipment, the EUT shall be provided with a test jig that is compatible with the range of host equipment in which the MES is used. In particular, the test jig shall be designed such that it avoids alteration of the MES's emissions. The test jig shall allow the MES part to be powered and stimulated in the way that it will be powered and stimulated when connected to or inserted into the host equipment.

The MES shall be tested against the full set of requirements of the present document.

5.2.1.4 CMF simulator

The CMF Simulator shall provide the necessary facilities for tests which require that the MES be in operation, situated in an environment where receipt of a network control channel and of CMF commands is under the control of the test laboratory.

CMF Simulator shall provide the means to generate and to communicate to the MES, either radiated via its antenna or conducted via direct connection to its antenna port, the network control channel and the required CMF commands, under the control of the test laboratory.

The CMF Simulator shall also provide means for the test laboratory to interface its test equipment with the MES for the purpose of monitoring the MES responses.

For the other tests, where the required test mode cannot be, or is not, provided by the test facility within the MES, then the CMF Simulator shall also provide the facility to put the MES into these required test modes.

The specifications and functionalities of the CMF Simulator, together with full documentation, shall be provided with the EUT.

5.2.1.5 General test requirements

5.2.1.5.1 MES test modes

The MES is required to be placed in the following test modes in order for the tests specified within the present document to be carried out:

- 1) power-off;
- 2) power-on (applies to all the following test modes);
- 3) carrier-off;
- 4) carrier-on, maximum transmit power, in a channel (defined for the intended use of the MES and provided with the EUT documentation) in an operational band, modulated with the test modulating signal;
- 5) carrier-on, maximum transmit power, in a channel (defined for the intended use of the MES and provided with the EUT documentation) in an operational band, set by CMF command, modulated with the test modulating signal;

NOTE: If test mode 5 is available for all tests, mode 4 is not required separately.

- 6) carrier-on (detectable).

The MES shall be placed into test modes 4 or 5 either by means of a the test facility existing internally in the MES. A CMF Simulator can be used if.

5.2.1.5.2 Test arrangement for control and monitoring tests

5.2.1.5.2.1 General test arrangement for control and monitoring tests

The test arrangement shall be as shown in figure 2 for radiated and conducted measurements.

This test arrangement assumes that the STE is responsible for simulating for the MES the CMF commands or network control channel in the same way as they are received by the MES in normal operating mode. The response received by the STE from the MES shall be routed to the Laboratory Test Equipment without modification that would significantly affect the measurement.

Figure 1: Void

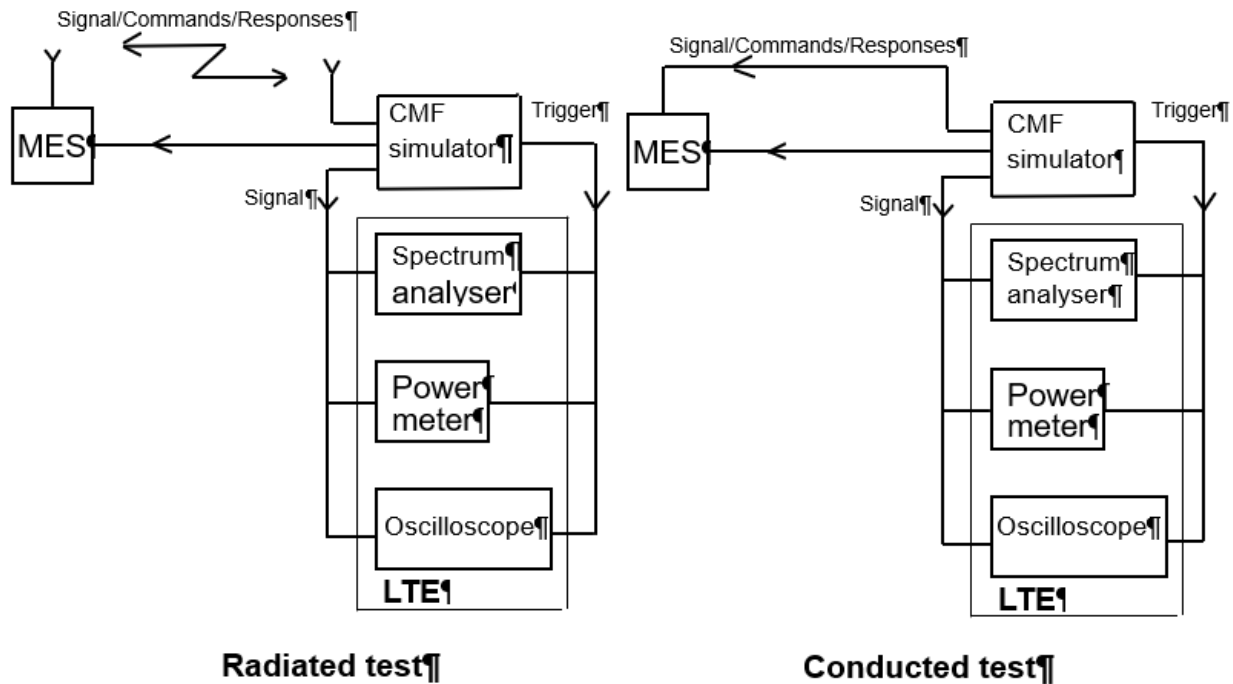


Figure 2: General test arrangement for control and monitoring tests

The dual trace storage oscilloscope, or other suitable method, can be used to monitor the response of the MES to the simulated events by measuring the time difference between the event or command reception, and the compliance with that event.

The power meter and spectrum analyser shall be used to monitor the MES output signal during all the test procedure.

5.2.1.5.2.2 Test modulating signal

The test modulating signal is a baseband signal which modulates the carrier of the MES. It is a signal representing a pseudorandom bit sequence of at least 511 bits in accordance with Recommendation ITU-T O.153 [2]. This sequence shall be continuously repeated and shall be at the maximum bit rate defined for the intended use of the MES and provided with the EUT documentation at which the MES is able to operate.

If not internally generated by the MES, this test modulating signal shall be provided by the CMF Simulator.

5.2.1.5.3 Void

Table 11: Void

5.2.1.5.4 Test methods for MES RF emissions according to the equipment type

Measurements shall be performed according to the equipment type.

Table 12: Options for testing

Equipment with passive antenna port available (external, internal or temporary)	Radiated from cabinet from 30 MHz to 4 GHz (passive antenna port connected to a dummy load), and conducted from the passive antenna port, from 100 kHz to 12,75 GHz
Equipment with no passive antenna port available	Radiated from complete MES, including its antenna, from 30 MHz to 12,75 GHz

The measurement method for radiated emissions are described in clause 5.2.1.5.5, which is the preferred method.

The measurement method for conducted emissions is described in clause 5.2.1.5.6.

5.2.1.5.5 Procedures for measurement of radiated emissions

5.2.1.5.5.1 General

Clause 5.2.1.5.5 contains methods for tests involving the measurement of a radiated field. This field can be radiated by an antenna and also by the cabinet of the equipment itself.

5.2.1.5.5.2 Test site

This test shall be performed using the following test set up and measurement procedure as specified in the following clauses.

The tests can be carried out in an Open Area Test Site (OATS) environment or in an anechoic chamber or in a semi-anechoic chamber as they can lead to comparable test results for establishing compliance. Ambient noise levels shall be at least 6 dB below the applicable unwanted emissions limit. The preferred test site is the semi-anechoic chamber.

All radiated measurement tests shall be conducted in such a way as to ensure that there is no interference to operational satellite and terrestrial systems.

In addition, it shall be verified that the test site shall ensure an ambient noise at least 6 dB lower than the lowest specification value being measured.

For each radiated measurement, the nature and the dimensions of the test set up used shall be recorded in the test report.

5.2.1.5.5.3 Test set up for radiated emissions of the MES

The tests shall be carried out with the MES at the defined environmental conditions and for the specified power supply voltages.

IE, EME and IME shall be installed with a separation of at least 0,5 m. Between the two equipment, the maximum length connection cable defined for the intended use of the MES and provided with the EUT documentation shall be installed. The height of the cable shall be between 0,5 m and 1 m. The cable shall be maintained in that position by non-metallic means. The EME shall be set, in its normal operating configuration on a non-conducting support at a height between 0,5 m and 1 m. The IME shall be set on a non-conducting support at a height between 0,5 m and 1 m. Any other associated equipment, if required for operation of the MES, shall be placed next to, and at the same height as the IME.

For PE, the equipment shall be arranged in its normal operating configuration as defined for the intended use of the MES and provided with the EUT documentation on a non-metallic table at a height between 0,5 m and 1 m.

The MES under test shall be placed on the support in its standard position and shall be switched-on.

Each antenna (MES antenna and test antenna) shall be positioned to be outside the near field of the other antenna.

The spectrum analyser noise floor shall be at least 6 dB below the minimum value to be measured.

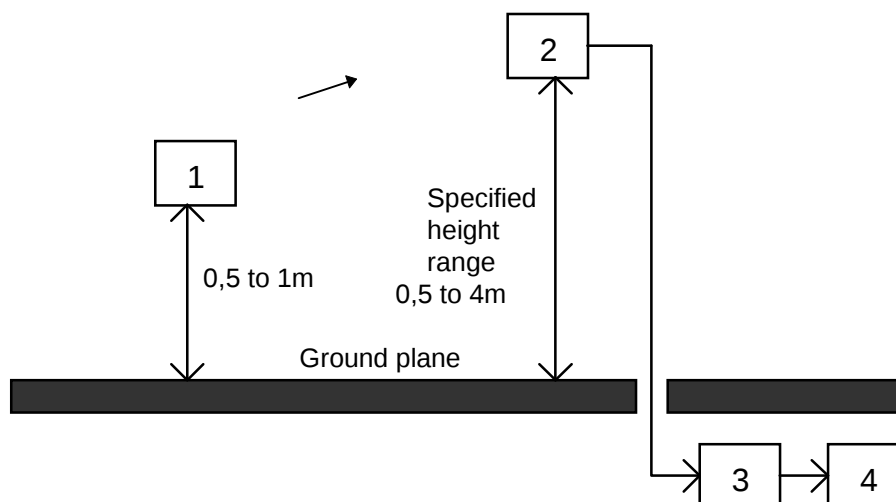
5.2.1.5.5.4 Reference position of the MES

During radiated measurements, the MES is required to be oriented specifically in relation to the test antenna connected to the Laboratory Test Equipment. This position is called the reference position and is determined as follows:

- the MES shall be placed in a mode whereby it is transmitting;
- the MES shall be rotated in both horizontal and vertical planes in order to locate the direction of maximum field strength that is detected by the test antenna. This orientation shall be called the reference position.

5.2.1.5.5.5 Measurement procedure for radiated emissions (peak)

5.2.1.5.5.5.1 Measurement procedure for peak radiated emissions of the MES



- 1) MES under test (with antenna);
- 2) Test antenna;
- 3) Input filter (if necessary);
- 4) Spectrum analyser.

Figure 3: Measurement arrangement No. 1

Measurement arrangement No. 1 of figure 3 shall be used.

- a) For each measurement bandwidth, the following actions shall be performed:
 - the MES shall be placed in the reference position as described in clause 5.2.1.5.5.4;
 - the test antenna shall have the same polarization as the MES and connected to a spectrum analyser, through an entry filter to avoid overloading the spectrum analyser;
 - the filter shall not attenuate the harmonics of the carrier;
 - the test antenna and the entry filter shall be defined for the measured frequency band;
 - the spectrum analyser shall be tuned to the measurement bandwidth to analyse;
 - the resolution bandwidth of the spectrum analyser shall be set to a suitable value to correctly perform the measurement, and the peak hold function shall be activated. The video bandwidth shall be set to at least 3 times the resolution bandwidth.
- b) In the case of unwanted emissions measurement, only the discrete signals having a level equal or greater than 6 dB below the defined limit shall be precisely measured:
 - in the case of EIRP density measurement within the nominated bandwidth, the peak level within the measurement bandwidth shall be measured;
 - the test antenna shall be raised or lowered through the specified height range to look for the maximum signal on the spectrum analyser (this may not be necessary if the test site is an anechoic chamber or an in-door test site);
 - the maximum measured value shall be recorded.
- c) The procedure is repeated from a) to b) with the other measurement bandwidths to cover all the frequency range to be analysed.

- d) In the case where the test site has been calibrated before, the absolute measurement is sufficient to determine the actual value of EIRP of the radiated emissions. The precise knowledge of distance between the MES and the test antenna, and the characteristics of the test antenna and the input filter allow the determination of the EIRP radiated by the MES.
- e) In the case where the test site cannot be calibrated, a relative measurement can be done according to the following procedure:

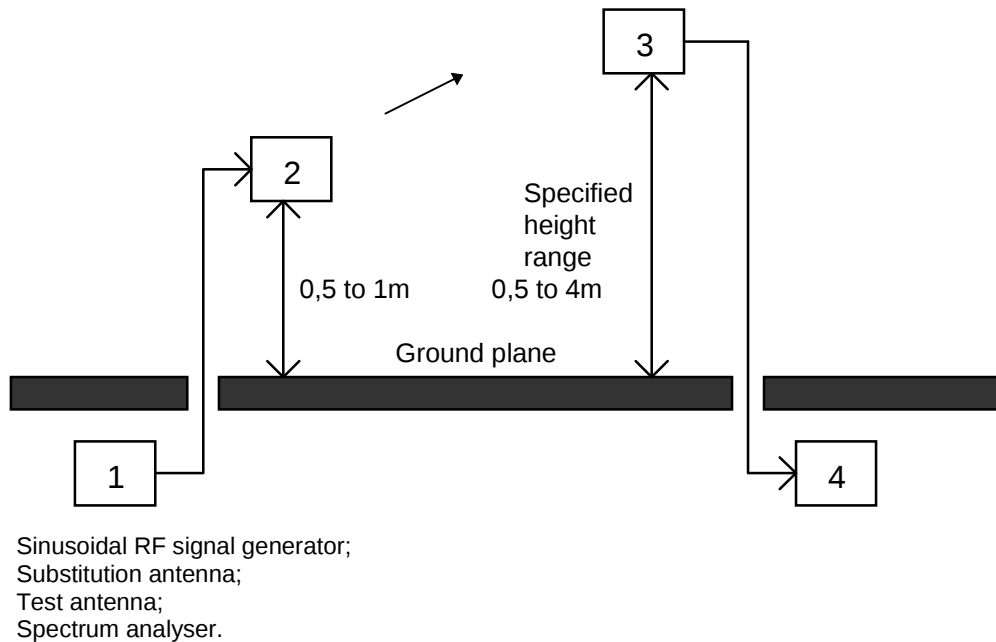


Figure 4: Measurement arrangement No. 2

- using measurement arrangement No. 2 of figure 4, a substitution antenna shall replace the MES in the same position where was the MES antenna. It shall be connected to the signal generator.
- f) The signal generator shall be tuned to each frequency at which an emission has been detected in the case of unwanted emissions measurement, or to the frequency at the middle of each measurement bandwidth in the case of EIRP density measurement, The substitution antenna shall be suitable for this frequency:
 - the spectrum analyser shall be tuned to the measurement bandwidth to analyse and put in the same conditions as for the measurement with the MES, with the peak hold function activated;
 - the level of the signal generator shall be adjusted to give the same signal level on the spectrum analyser as in b);
 - the output level of the signal generator shall be recorded. This value, after corrections due to the gain of the substitution antenna and the cable loss between the signal generator and the substitution antenna, is the radiated emission level of the MES.
- g) The procedure f) is repeated with the other measurement bandwidths to cover the whole frequency range to be analysed.
- h) The procedures a) to g) shall be repeated with test antennas of the opposite polarization for the unwanted emission measurements.

5.2.1.5.5.2 Measurement procedure for peak radiated emissions of the cabinet

This measurement procedure applies to transmitters having an antenna socket and has to be performed in addition to conducted measurements of the MES in the case of unwanted emissions.

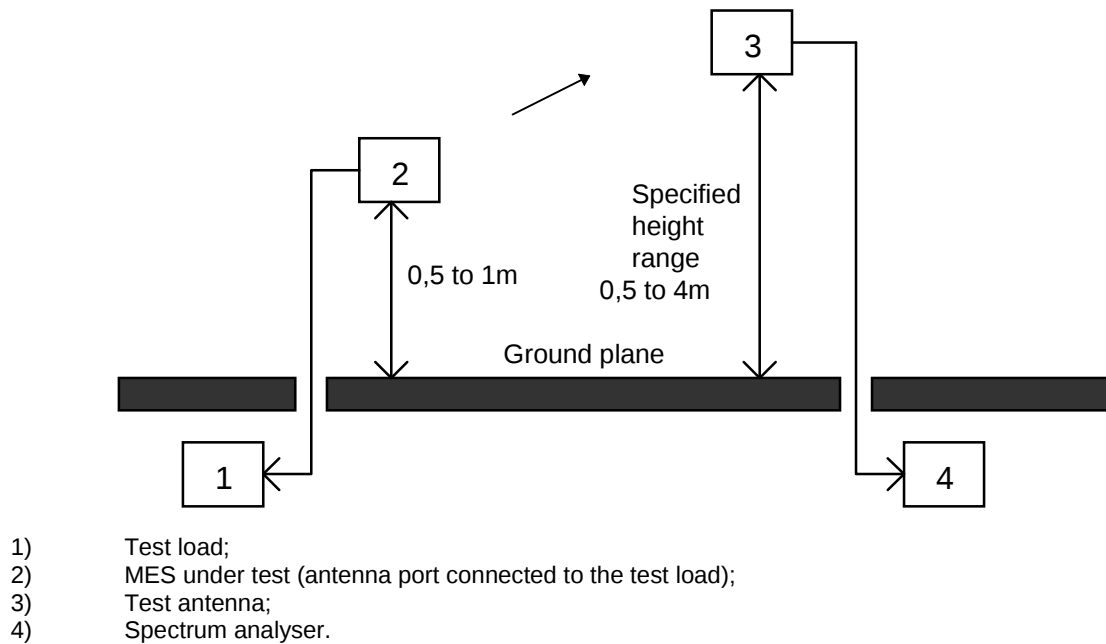


Figure 5: Measurement arrangement No. 3

Measurement arrangement No. 3 of figure 5 shall be used for measurement of radiated emissions of the cabinet.

The procedure is a peak measurement as in clause 5.2.1.5.5.5.1.

The same method as in clause 5.2.1.5.5.5.1 shall be applied with the exception that measurement arrangement No. 3 replaces measurement arrangement No. 1 (measurement arrangement No. 2 remains the same for the relative measurement).

5.2.1.5.5.6 Measurement procedure for radiated emissions (average)

5.2.1.5.5.6.1 Measurement procedure for average radiated emissions of the MES

Measurement arrangement No. 1 of figure 3 shall be used.

- a) For each measurement bandwidth, the following actions shall be performed:
 - the MES shall be placed in the reference position as described in clause 5.2.1.5.5.4;
 - the test antenna shall have the same polarization as the MES and connected to a spectrum analyser, eventually through a suitable entry filter to avoid overloading of the spectrum analyser;
 - the filter shall not attenuate the harmonics of the carrier;
 - the test antenna and the entry filter shall be set for the measured frequency band;
 - the spectrum analyser shall be tuned to the measurement bandwidth to analyse;
 - the resolution bandwidth of the spectrum analyser shall be set to the maximum value to perform the measurement, and the average function shall be activated. The video bandwidth shall be set to the same value as the resolution bandwidth.
- b) The test antenna shall be raised or lowered through the specified height range to look for the maximum received signal on the spectrum analyser (this step may not be necessary if the test site is an anechoic chamber or an indoor test site).
 The EIRP shall be averaged until the variance over the measured bandwidth is less than 1 dB. The averaged value shall be recorded.
- c) The procedure shall be repeated from a) to b) with the other measurement bandwidths to cover the whole frequency range to be analysed.

- d) In the case where the test site has been calibrated before, the absolute measurement is sufficient to determine the actual value of EIRP of the radiated emissions. The precise knowledge of distance between the MES and the test antenna, the characteristics of the test antenna and the input filter allow the determination of the EIRP radiated by the MES.
- e) In the case where the test site cannot be calibrated, a relative measurement can be done according to the following procedure:
 - using measurement arrangement No. 2 of figure 4, a substitution antenna shall replace the MES in the same position where was the MES antenna. It shall be connected to the signal generator.
- f) The signal generator shall be tuned to the centre frequency of each measurement bandwidth. The substitution antenna shall be suitable for this frequency:
 - the spectrum analyser shall be tuned to the measurement bandwidth to analyse and put in the same conditions as for the measurement with the MES with the average function activated;
 - the level of the signal generator shall be adjusted to give the same signal level on the spectrum analyser as in b) when averaged until the variance over the measured bandwidth is less than 1 dB. The output level of the signal generator shall be recorded;
 - this value, after corrections due to the gain of the substitution antenna and the cable loss between the signal generator and the substitution antenna, is the radiated emission level of the MES.
- g) The procedure f) shall be repeated with the other measurement bandwidths to cover the whole frequency range to be analysed.
- h) The procedures a) to g) shall be repeated with test antennas of the opposite polarization for the unwanted emission measurements.

5.2.1.5.5.6.2 Measurement procedure for average radiated emissions of the cabinet

This measurement procedure applies to transmitters having an antenna socket and has to be performed in addition to conducted measurements of the MES for unwanted emissions.

Measurement arrangement No. 3 of figure 5 shall be used for measurement of radiated emissions of the cabinet.

The procedure is an average measurement as in clause 5.2.1.5.5.6.1.

The same method as in clause 5.2.1.5.5.6.1 shall be applied with the exception that measurement arrangement No. 3 replaces measurement arrangement No. 1 (measurement arrangement No. 2 remains the same for the relative measurement).

5.2.1.5.6 Procedures for measurement of MES RF conducted emissions

5.2.1.5.6.1 General

Clause 5.2.1.5.6 contains the procedure for conducted emission measurements.

5.2.1.5.6.2 Test site

There are no specific requirements for the test site for conducted measurements except that they shall be performed in such a way as to ensure that there is no interference to operational satellite and terrestrial systems.

5.2.1.5.6.3 Test set-up

Measurement arrangement of figure 6 shall be used.

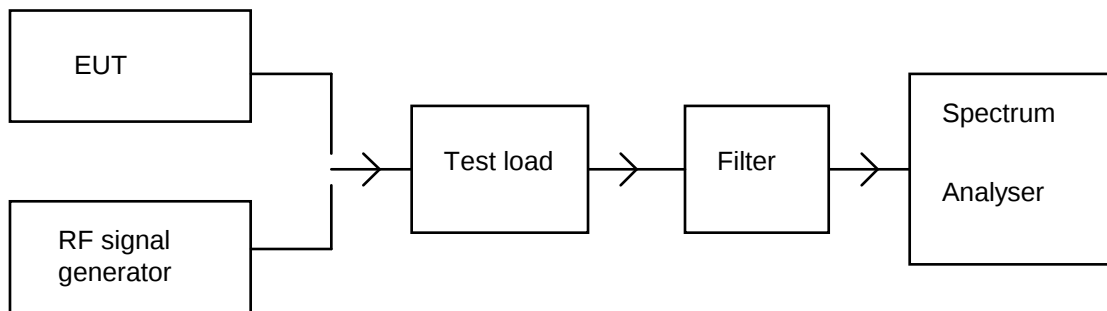


Figure 6: Measurement arrangement for conducted emissions

The antenna port of the MES shall be connected to a spectrum analyser through a test load and a filter to avoid overloading the spectrum analyser.

Precautions may be required to ensure that the test load does not generate or that the filter does not attenuate, the harmonics of the carrier. The entry filter shall be defined for the measured frequency band.

The spectrum analyser noise floor shall be at least 6 dB below the minimum value to be measured.

5.2.1.5.6.4 Measurement procedure for conducted emissions (peak)

- a) For each measurement bandwidth, the following actions shall be performed:
 - the spectrum analyser shall be tuned to the measurement bandwidth to analyse;
 - the resolution bandwidth of the spectrum analyser shall be set to a value to perform the measurement, and the peak hold function shall be activated. The video bandwidth shall be set to at least 3 times the resolution bandwidth.
- b) In the case of unwanted emissions measurement, the peak power detected value of each discrete signal having a level equal or greater than 6 dB below the specified limit shall be recorded:
 - in the case of EIRP density measurement within the nominated bandwidth, the peak power density value within the measurement bandwidth shall be recorded.
- c) The procedure shall be repeated from a) to b) with the other measurement bandwidths to cover all the spectrum band which is required to be measured.
- d) The actual value of EIRP of the equivalent radiated emissions in each measurement bandwidth shall be derived by adding either the MES maximum antenna gain or the gain defined for the intended use of the MES at the spurious emission frequency to the power value read from the spectrum analyser.

5.2.1.5.6.5 Measurement procedure for conducted emissions (average)

- a) For each measurement bandwidth, the following actions shall be performed:
 - the resolution bandwidth of the spectrum analyser shall be set to a value to perform the measurement, and the average function shall be activated. The video bandwidth shall be set to the same value as the resolution bandwidth;
 - the measurement time shall be such that the difference of the measured levels, averaged over subsequent measurement samples, is less than 1 dB, or a measurement time of 100 ms can be used if the measured values comply with the applicable limits.
- b) The averaged power density value within the measured bandwidth shall be recorded.
- c) The procedure shall be repeated from a) to b) with the other measurement bandwidths to cover the whole frequency range to be analysed.
- d) The actual value of EIRP of the radiated emissions in each measurement bandwidth shall be derived by adding the MES maximum antenna gain measured at the normal operating frequency to the power spectral density value read from the spectrum analyser.

5.2.1.5.7 Void

5.2.1.5.8 Test report

All results of the tests performed, and their test conditions, shall be recorded in a test report.

5.2.2 Unwanted emissions outside the band 1 610 MHz to 1 626,5 MHz and the band 1 626,5 MHz to 1 628,5 MHz (carrier-on)

5.2.2.1 Method of test

This test shall be carried out for the minimum and for the maximum MES transmit frequencies for which the MES is designed to operate, as defined for the intended use of the MES and provided with the EUT documentation.

The environmental test conditions are given in clause 5.1.

For each test, the MES shall be set to transmit (carrier-on) on one of the specified transmitting frequencies to be tested at its maximum power for that transmit frequency, by means of the STE or by another test facility provided with the EUT.

If there is a handover function in the MES (to allow change of frequency channel during a call), this function shall be disabled.

The transmitted carrier shall be modulated by a test signal at maximum rate as specified in clause 5.2.1.5.2.2.

In the test equipment, the spectrum analyser noise floor shall be at least 6 dB below the limits given in table 3.

The measurements are performed with the radiated or with the conducted method according to the cases defined in clause 5.2.1.5.4.

For measurements of radiated unwanted emissions, clause 5.2.1.5.5 applies, which are the preferred measurements.

For measurements of conducted unwanted emissions, clause 5.2.1.5.6 applies.

5.2.2.2 Peak measurement

In the case of peak measurement, the spectrum analyser shall be set in sweep mode and shall be operated under the following conditions:

- frequency sweep: as required for frequency range to be assessed;
- resolution bandwidth: measurement bandwidth specified in table 3;
- display bandwidth: at least three times the measurement bandwidth;
- averaging: no;
- peak hold: yes.

The sweep time shall be compatible with the calibration of the measurement equipment.

The spectrum analyser shall be stepped over the frequency ranges specified in table 3 for peak measurement.

5.2.2.3 Average measurement

In the case of average measurement, the spectrum analyser shall be set in sweep mode and shall be operated under the following conditions:

- frequency sweep: as required for frequency range to be assessed;
- resolution bandwidth: measurement bandwidth specified in table 3;
- display bandwidth: equal to the measurement bandwidth;

- averaging: yes;
- peak hold: no.

The measurement time shall be such that the difference of the measured levels, averaged over subsequent measurement samples, is less than 1 dB, or a measurement time of 100 ms can be used if the measured values comply with the applicable limits.

For a MES operating in a non-continuous carrier mode, the measurement shall be performed over the active part of the transmitted bursts. The total sample time used for measurement shall be not less than 40 % of the duration of the active part of the transmitted burst. The measurement shall be made over the random part of the burst, excluding any preambles or synchronization sequences.

The spectrum analyser shall be stepped over the frequency ranges specified in table 3 for average measurement.

5.2.2.4 Test requirements

For measurements of radiated unwanted emissions of the MES, the measured values shall in no case exceed the limits given in table 3.

For measurements of conducted unwanted emissions of the MES, the measured values plus the maximum antenna gain shall in no case exceed the limits given in table 3.

5.2.3 Unwanted emissions within the band 1 610 MHz to 1 626,5 MHz and the band 1 626,5 MHz to 1 628,5 MHz (carrier-on)

5.2.3.1 Method of test

This test shall be carried out for the minimum and for the maximum MES transmit frequency for which the MES is designed to operate, as defined for the intended use of the MES and provided with the EUT documentation.

Where available, up to two additional transmit frequencies shall also be tested. These frequencies shall be equally spaced between the minimum and maximum transmit frequencies. The transmit frequencies used for the test shall be entered in the test report.

The environmental test conditions are given in clause 5.1.

For each test, the MES shall be set to transmit (carrier-on) on one of the defined transmit frequencies to be tested, at its maximum power for that transmit frequency, by means of the STE or by another test facility provided with the EUT.

If there is a handover function in the MES (to allow change of frequency channel during a call), this function shall be disabled.

The transmitted carrier shall be modulated by a test signal at maximum rate as specified in clause 5.2.1.5.2.2.

In the test equipment, the spectrum analyser noise floor shall be at least 6 dB below the limits given in tables 4, 5 or 6 as applicable.

The measurements are performed with the radiated or with the conducted method according to the cases defined in clause 5.2.1.5.4.

For measurements of radiated unwanted emissions, clause 5.2.1.5.5 applies, which are the preferred measurements.

For measurements of conducted unwanted emissions, clause 5.2.1.5.6 applies.

5.2.3.2 Measurement method

The spectrum analyser shall be set in sweep mode and shall be operated under the following conditions:

- frequency sweep: as required for frequency range to be assessed;
- resolution bandwidth: measurement bandwidth specified in tables 4, 5 or 6, as applicable;

- display bandwidth: equal to the measurement bandwidth;
- averaging: yes;
- peak hold: no.

The measurement time shall be such that the difference of the measured levels, averaged over subsequent measurement samples, is less than 1 dB, or a measurement time of 100 ms can be used if the measured values comply with the applicable limits.

For a MES operating in a non-continuous carrier mode, the measurement shall be performed over the active part of the transmitted bursts. The total sample time used for measurement shall be not less than 40 % of the duration of the active part of the transmitted burst. The measurement shall be made over the random part of the burst, excluding any preambles or synchronization sequences.

For each of the transmit frequencies to be used for the test, measurements shall be made over the frequency ranges from 1 610 MHz to $f_c - a$ and from $f_c + b$ to 1 628,5 MHz, $f_c - a$ being the lower boundary frequency of the nominated bandwidth for the transmit frequency being tested, and $f_c + b$ being the upper boundary frequency of the nominated bandwidth for the transmit frequency being tested.

5.2.3.3 Test requirements

For measurements of radiated unwanted emissions of the MES, the measured values shall in no case exceed the limits given in tables 4, 5 or 6, as applicable, over the frequency range 1 610 MHz to 1 628,5 MHz.

For measurements of conducted unwanted emissions, the measured values plus the maximum antenna gain, shall in no case exceed the limits given in tables 4, 5 or 6, as applicable, over the frequency range 1 610 MHz to 1 628,5 MHz.

5.2.4 EIRP density within the operational band

5.2.4.1 Method of test

As a minimum, two MES transmit frequencies of each of the stated sub-band(s) shall be used for this test. These frequencies shall be the minimum and the maximum frequencies of the stated sub-band(s) for which the MES is designed to operate, as defined for the intended use of the MES and provided with the EUT documentation. Where available, the EIRP density shall also be tested at two additional transmit frequencies. These frequencies shall be equally spaced between the minimum and maximum frequencies of each of the stated sub-band(s). The measured EIRP densities and the corresponding transmit frequencies used for the test shall be entered in the test report.

The environmental test conditions are given in clause 5.1.

For each test, the MES shall be set to transmit (carrier-on) at its maximum power-on the defined transmitting frequency to be tested, by means of the STE or by another test facility provided with the EUT.

If there is a handover function in the MES (to allow change of frequency channel during a call), this function shall be disabled.

The transmitted carrier shall be modulated by a test signal at maximum rate as specified in clauses 5.2.1 and 5.2.2.

In the test equipment, the spectrum analyser noise floor shall be at least 6 dB below the values to be measured.

The measurements are performed with the conducted or with the radiated method according to the cases defined in clause 5.2.1.5.4.

For radiated measurements of transmitted EIRP density, clause 5.2.1.5.5 applies, which are the preferred measurements.

For assessment of transmitted EIRP density by conducted measurements, clause 5.2.1.5.6 applies.

5.2.4.2 Peak limit test

In the case of peak measurement, the spectrum analyser shall be set in sweep mode and shall be operated under the following conditions:

- frequency sweep: from the lower to the upper limits of the nominated bandwidth of the transmit channel under test;
- resolution bandwidth: 3 kHz (see note);
- display bandwidth: at least three times the measurement bandwidth;
- averaging: no;
- peak hold: yes.

NOTE: The measurements should be converted to equivalent values for the 4 kHz bandwidth required by the specification, using the formula $10 \log (4/3)$.

The sweep time shall be the shortest possible time consistent with proper calibration and ease of operation.

5.2.4.3 Mean limit test

In the case of average measurement, the spectrum analyser shall be set in sweep mode and shall be operated under the following conditions:

- frequency sweep: from the lower to the upper limits of the nominated bandwidth of the transmit channel under -test;
- resolution bandwidth: 3 kHz (see note);
- display bandwidth: equal to the measurement bandwidth;
- averaging: yes;
- peak hold: no.

NOTE: The measurements should be converted to equivalent values for the 4 kHz bandwidth required by the specification, using the formula $10 \log (4/3)$.

The measurement time shall be such that the difference of the measured levels, averaged over subsequent measurement samples, is less than 1 dB, or a measurement time of 100 ms can be used if the measured values comply with the applicable limits.

Alternatively, a power meter can be used with a correction factor to account for the duty cycle.

5.2.4.4 Test requirements

For measurements of radiated EIRP, the measured values shall in no case exceed the values given in clause 4.2.3.2, for each specific frequency sub-band and operating condition for which the limit applies, as defined for the intended use of the MES and provided with the EUT documentation.

For assessment of EIRP by conducted measurement, the measured values plus the maximum antenna gain, shall in no case exceed the values given in clause 4.2.3.2, for each specific frequency sub-band and operating condition for which the limit applies, as defined for the intended use of the MES and provided with the EUT documentation.

5.2.5 Unwanted emissions in carrier-off state

5.2.5.1 Method of test

The MES shall be switched-on and set in a non-transmitting (carrier-off) mode.

If there is a periodic automatic transmission of bursts (e.g. for location updating), the STE shall provide a means to inhibit it, or to trigger the measurement in order to analyse only the non-transmitting periods.

The environmental test conditions are given in clause 5.1.

In the test equipment, the spectrum analyser noise floor shall be at least 6 dB below the limits given in table 7.

The measurements are performed with the radiated or with the conducted method according to the cases defined in clause 5.2.1.5.4.

For measurements of radiated unwanted emissions, clause 5.2.1.5.5 applies, which are the preferred measurements.

For measurements of conducted unwanted emissions, clause 5.2.1.5.6 applies.

5.2.5.2 Measurement method

The spectrum analyser shall be set in sweep mode and shall be operated under the following conditions:

- frequency sweep: as required for frequency range to be assessed;
- resolution bandwidth: measurement bandwidth specified in table 7;
- display bandwidth: at least 3 times the measurement bandwidth;
- averaging: no;
- peak hold: yes.

The sweep time shall be the shortest possible time consistent with proper calibration and ease of operation.

The spectrum analyser shall be stepped over the frequency ranges specified.

5.2.5.3 Test requirements

For measurements of radiated unwanted emissions of the MES, the measured values shall in no case exceed the limits given in table 7.

For measurements of conducted unwanted emissions of the MES, the measured values plus the maximum antenna gain shall in no case exceed the limits given in table 7.

5.2.6 MES Control and Monitoring Functions (CMF)

5.2.6.1 Void

5.2.6.2 Void

5.2.6.3 Network control authorization

5.2.6.3.1 Method of test

The MES shall be cycled through its power-on and power-off states. Attempts shall be made to initiate calls using normal user operational procedures. The transmitting state of the MES shall be monitored to ensure compliance with the test requirements.

The environmental test conditions are given in clause 5.1.

5.2.6.3.2 Test procedure

The MES shall be situated in an environment where receipt of the defined network control channel(s) is controlled by the test laboratory.

- a) The MES shall be in a power-off state, situated such that it is not in receipt of a network control channel.

- b) The MES shall be powered-on.
- c) An attempt shall be made, using normal user operational procedures, to initiate a call.
- d) A network control channel shall be activated and a call shall be initiated using normal user operational procedures.
- e) The network control channel shall then be deactivated.
- f) An attempt shall be made, using normal user operational procedures, to initiate a call.
- g) The network control channel shall be reactivated and a call shall be initiated using normal user operational procedures.

Throughout this procedure, the transmission state of the MES shall be monitored.

5.2.6.3.3 Test requirement

During and after test procedure step a), the MES shall be in power-off state.

During and after test procedure step b), no transmissions shall occur (carrier-off).

During and after test procedure step c), no transmissions shall occur (carrier-off).

After test procedure step d), the MES shall be transmitting (carrier-on).

Within 30 s of test procedure step e), MES transmissions shall cease (carrier-off).

During and after test procedure step f), no transmissions shall occur (carrier-off).

After test procedure step g), the MES shall be transmitting (carrier-on).

5.2.6.4 Network control reception

5.2.6.4.1 Transmission disable/enable

5.2.6.4.1.1 Method of test

The MES shall be sent transmission enable and transmission disable commands. Attempts shall be made to initiate calls using normal user operational procedures. The transmitting state of the MES shall be monitored to ensure compliance with the test requirements.

The environmental test conditions are given in clause 5.1.

5.2.6.4.1.2 Test procedure

The MES shall be situated in an environment where receipt of the defined network control channel(s) and of CMF commands is controlled by the test laboratory.

- a) A network control channel shall be activated, the MES shall be powered-on, and a call shall be initiated using normal user operational procedures.
- b) An CMF command to disable transmissions shall be sent to the MES.
- c) Whilst the disable command applies an attempt shall be made to initiate a call using normal user operational procedures.
- d) An CMF command to enable transmissions shall be sent to the MES and a call shall be initiated using normal user operational procedures.
- e) The MES shall be set to a carrier-off mode, and an CMF command to disable transmissions shall be sent to the MES.

- f) Whilst the disable command applies an attempt shall be made to initiate a call using normal user operational procedures.
- g) An CMF command to enable transmissions shall be sent to the MES and a call shall be initiated using normal user operational procedures.

Throughout this procedure, the transmission state of the MES shall be monitored.

5.2.6.4.1.3 Test requirements

After test procedure step a), the MES shall be transmitting (carrier-on).

During test procedure step b), within 1 s of receipt of the CMF command to disable transmissions, MES transmissions shall cease (carrier-off).

During and after test procedure step c), no transmissions shall occur (carrier-off).

After test procedure step d), the MES shall be transmitting (carrier-on).

During and after test procedure steps e) and f), no transmissions shall occur (carrier-off).

After test procedure step g), the MES shall be transmitting (carrier-on).

5.2.6.4.2 Transmit frequency control

5.2.6.4.2.1 Method of test

The nominated bandwidth of the MES shall be monitored relative to the carrier frequency commanded, and relative to the operational frequency bands for the MES as defined for the intended use of the MES and provided with the EUT documentation.

The environmental test conditions are given in clause 5.1.

5.2.6.4.2.2 Test procedure

This test shall be carried out at least twice, once for the minimum and once for the maximum MES transmit frequency for which the MES is designed to operate, as defined for the intended use of the MES and provided with the EUT documentation.

Where available, two additional transmit frequencies shall also be tested. These frequencies shall be equally spaced between the minimum and maximum frequencies. The commanded transmit frequencies used for the test shall be entered in the test report.

The MES shall be situated in an environment where receipt of a network control channel and of CMF commands is controlled by the test laboratory.

- a) A network control channel shall be activated and the MES powered-on.
- b) An CMF control message shall be sent, commanding the MES to set its carrier frequency to one of the transmit frequencies to be tested.
- c) The test shall be repeated for the other transmit frequencies to be tested.

The carrier mask for the transmit frequency under test shall be monitored on a spectrum analyser, using the procedures given in clause 5.2.3.

5.2.6.4.2.3 Test requirement

The MES shall set the centre frequency of its transmission according to the CMF command.

The entire nominated bandwidth for each transmit frequency tested shall be contained completely within the operational frequency band(s) defined for the intended use of the MES and provided with the EUT documentation.

5.2.6.5 Fellow radio stations in a dual-mode or multi-mode terminal

5.2.6.5.1 Method of test

The MES shall be placed in a suitable environment which isolates the MES from the networks of its fellow modes. It shall be verified that no transmissions are made from that mode.

5.2.6.5.2 Test procedure

The MES shall be placed in an environment where the receipt of network control channel(s) of supporting networks of the fellow modes is prevented. For each fellow mode radio station, an attempt shall be made, using normal user operational procedures, to initiate a call. Throughout this procedure, the transmission state of the MES shall be monitored.

5.2.6.5.3 Test requirements

Throughout the test procedure, no transmission shall occur.

5.2.7 Equipment identity

5.2.7.1 Method of test

The transmissions of the MES in response to an CMF command to send its identification code shall be monitored and the identification code received shall be verified.

The environmental test conditions are given in clause 5.1.

5.2.7.2 Test procedure

The MES shall be situated in an environment where receipt of a network control channel and of CMF commands is controlled by the test laboratory.

- a) A network control channel shall be activated and the MES powered-on.
- b) An CMF control message shall be sent, commanding the MES to transmit its identification code.
- c) The message sent by the MES shall be analysed.

5.2.7.3 Test requirements

The MES identification code in the message sent in step c) shall be verified against the codes defined for the intended use of the MES and provided with the EUT documentation.

5.2.8 Receiver Adjacent Channel Selectivity

5.2.8.1 General

The EUT shall be provided with full documentation for the intended use of the MES.

For the purpose of this test, the EUT is the MES without its antenna connected.

5.2.8.2 Test set-up

The equipment shall be set-up as shown in figure 7.

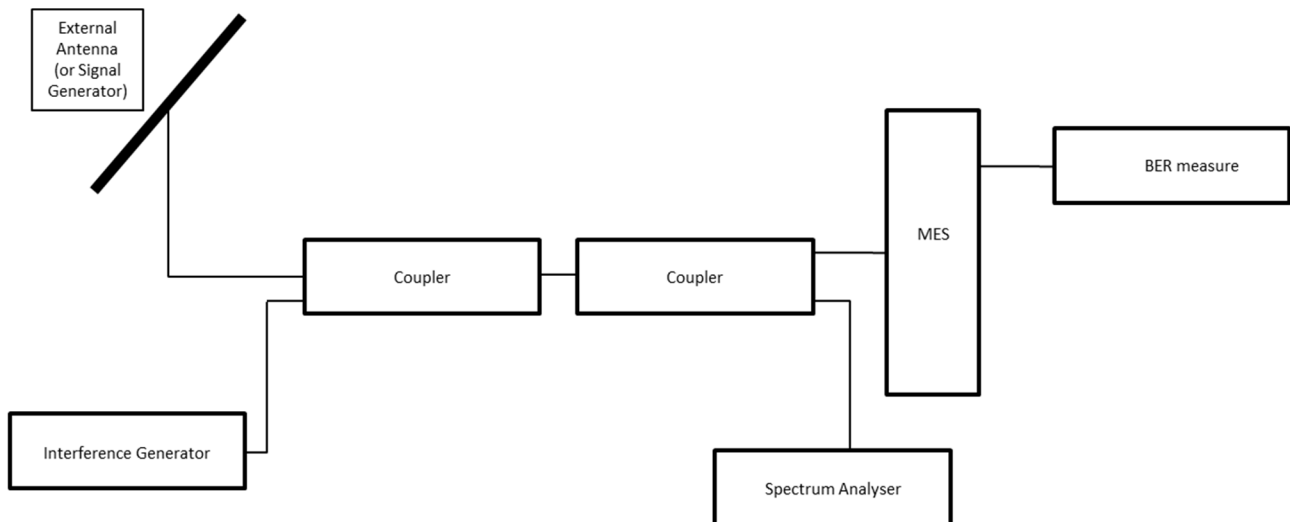


Figure 7: Measuring system set-up for Adjacent Channel Selectivity and Blocking Characteristics

5.2.8.3 Test procedure

The procedure basics are illustrated below:

- 1) The wanted signal power is adjusted such that the SNR (at the receiver input) is set to the reference level plus 1 dB. The reference level is the minimum SNR required to achieve the target performance level for a given bearer type.
- 2) Measure the SNR of the receiver, where SNR of the receiver means the SNR determined by the receiver demodulator.
- 3) Set the parameters of the interference signal generator as shown in table 8 in clause 4.2.8.2.
- 4) Add the interference signal and measure the SNR of the receiver.
- 5) The SNR achieved in step 4 shall not exceed 0,5 dB degradation compared to the SNR measured in step 2.

5.2.9 Receiver Blocking Characteristics

5.2.9.1 General

The EUT shall be provided with full documentation for the intended use of the MES.

5.2.9.2 Test set-up

The equipment shall be set-up as shown in figure 7.

5.2.9.3 Test procedure

- 1) The wanted signal power is adjusted such that the SNR (at the receiver input) is set to the reference level plus 1 dB. The reference level is the minimum SNR required to achieve the target performance level (in terms of BER) for a given bearer type.
- 2) Measure the SNR of the receiver, where SNR of the receiver means the SNR determined by the receiver demodulator.
- 3) Generate CW with the parameters as shown in table 9 in clause 4.2.9.2.
- 4) Apply the interference CW and measure the receiver SNR.
- 5) The SNR achieved in step 4 shall not exceed 1 dB degradation compared to the SNR measured in step 2.

Annex A (informative): Relationship between the present document and the essential requirements of Directive 2014/53/EU

The present document has been prepared under the Commission's standardisation request C(2015) 5376 final [i.2] 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.3].

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.

**Table A.1: Relationship between the present document and
the essential requirements of Directive 2014/53/EU [i.3]**

Harmonised Standard ETSI EN 301 441					
Requirement				Requirement Conditionality	
No	Description	Essential requirements of Directive	Clause in the present document	U/C	Condition
1	Unwanted emissions outside the band 1 610 MHz to 1 626,5 MHz and the band 1 626,5 MHz to 1 628,5 MHz (carrier-on)	3.2	4.2.1	U	
2	Unwanted emissions within the band 1 610 MHz to 1 626,5 MHz and the band 1 626,5 MHz to 1 628,5 MHz (carrier-on)	3.2	4.2.2	U	
3	EIRP density within the operational band	3.2	4.2.3	U	
4	Unwanted emissions in carrier-off state	3.2	4.2.4	U	
5	Processor monitoring	3.2			The processor monitoring function permits detection of failures of the hardware and software processors to protect radio services and systems from uncontrolled RF transmissions from the MES. Individual requirements for subsystems are not necessary for MES, as such requirements are required for the whole earth station. Therefore, the specific requirement on subsystems (processors) are not included.
6	Transmit frequency generation subsystem monitoring	3.2			Individual requirements for subsystems are not necessary for MES, as such requirements are required for the whole earth station. Therefore, the specific requirement on subsystems (processors) are not included.
7	Network control authorization	3.2	4.2.5.3	U	
8	Transmission disable/ enable	3.2	4.2.5.4.1	U	
9	Transmit frequency control	3.2	4.2.5.4.2	U	
10	Fellow radio stations in a dual-mode or multi-mode terminal	3.2	4.2.5.5	U	
11	Equipment identity	3.2	4.2.6	U	
12	Protection of the radio astronomy service operation in the band 1 610,6 MHz to 1 613,8 MHz	3.2	4.2.7	U	

Harmonised Standard ETSI EN 301 441					
Requirement				Requirement Conditionality	
No	Description	Essential requirements of Directive	Clause in the present document	U/C	Condition
13	Receiver Adjacent Channel Selectivity	3.2	4.2.8	U	
14	Receiver Blocking Characteristics	3.2	4.2.9	U	
15	Receiver co-channel rejection	3.2	4.2.8 (appearing as receiver adjacent channel selectivity)	U	
16	Single signal selectivity - receiver adjacent signal selectivity	3.2	4.2.8 (appearing as receiver adjacent channel selectivity)	U	
17	Receiver radio-frequency intermodulation	3.2			Intermodulation signals originating from other networks are rejected due to the requirements on receive antenna off-axis gain pattern and adjacent signal selectivity. Therefore, this parameter is not relevant.
18	Receiver sensitivity	3.2			There is no relation between receiver sensitivity and interference in the case of satellite communications. Therefore, a quantitative calculation is not possible.
19	Receiver spurious response rejection	3.2			Frequencies other than the image frequency are not relevant because this is covered by receiver blocking and adjacent channel requirements which are already included in the receiver parameters.
20	Receiver multiple signal selectivity - receiver adjacent signal selectivity	3.2	4.2.8 (appearing as receiver adjacent channel selectivity)	U	
21	Receiver dynamic range	3.2			Receiver dynamic range has no influence on interference. Satellite earth stations are deployed in a manner that results in a situation where it is impossible to receive a wanted signal that is high enough to produce any overloading effect (satellite systems are power limited). So that it is not necessary to specify receiver dynamic range.
22	Reciprocal mixing	3.2			It is considered that the reciprocal mixing effects are implicitly covered in HSs where comprehensive interference characteristics are specified in terms of selectivity and/or blocking requirements, thus the need for this parameter as the effects of receiver selectivity and reciprocal mixing cannot be separated.
23	Desensitization	3.2			As desensitization is a receiver effect, addressed by other parameters (including receiver blocking), its inclusion as a separate parameter is not required.

Harmonised Standard ETSI EN 301 441					
Requirement				Requirement Conditionality	
No	Description	Essential requirements of Directive	Clause in the present document	U/C	Condition
24	Receiver unwanted emissions in the spurious domain	3.2			Frequencies other than the image frequency are not relevant because this is covered by receiver blocking and adjacent channel requirements which are already included in the receiver parameters.

Key to columns:

No A unique identifier for one row of the table which may be used to identify a requirement.

Technical Requirement A textual reference to the requirement.

Essential requirements of Directive

Identification of article(s) defining the requirement in the Directive.

Clause(s) of the present document

Identification of clause(s) defining the requirement in the present document unless another document is referenced explicitly.

U/C Indicates whether the requirement is unconditionally applicable (U) or is conditional upon the intended use of the MES and provided with the EUT documentation(C).

Condition Explains the conditions when the requirement is or is not applicable for a requirement which is classified "conditional".

Presumption of conformity stays valid only as long as a reference to the present document is maintained in the list published in the Official Journal of the European Union. Users of the present document should consult frequently the latest list published in the Official Journal of the European Union.

Other Union legislation may be applicable to the product(s) falling within the scope of the present document.

Annex B (informative): Explanation of nominated bandwidth

B.1 Introduction

This annex contains a graphical representation of the nominated bandwidth definition given in clause 3.1.

B.2 Interpretation of Parameters [B_n , f_c , a , b]

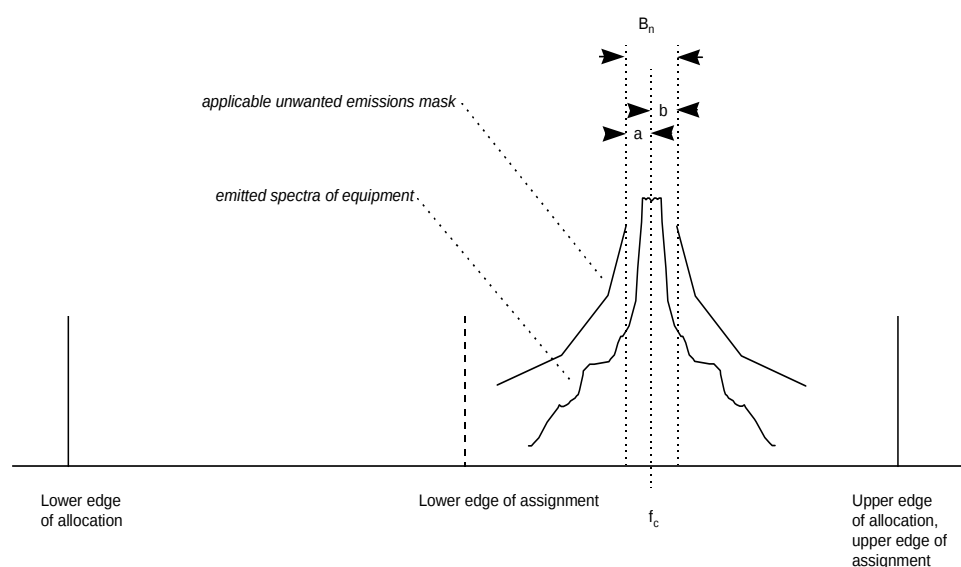


Figure B.1: Nominated bandwidth and Unwanted Emissions Mask

The centre frequency of the emitted spectra has been defined as f_c ; the values of a and b define the *nominated bandwidth* B_n . The value of B_n is chosen, such that the unwanted emissions mask is not exceeded by the emitted spectra - in this example, it can be seen that the nominated bandwidth could be reduced without exceeding the limits of the mask.

B.3 Choice of nominated bandwidth

The choice of the nominated bandwidth is defined for the intended use of the MES according to the bandwidth and shape of the spectral emission of the equipment. The optimum choice of nominated bandwidth will maximize the available operating frequency range of the MES, and this is achieved by selecting nominated bandwidth as narrow as possible without exceeding the applicable unwanted emissions masks. To illustrate this, two examples are given in figure B.2. The figures show occupied channels represented by carrier frequency (f_1 , f_2) and the unwanted emission mask.

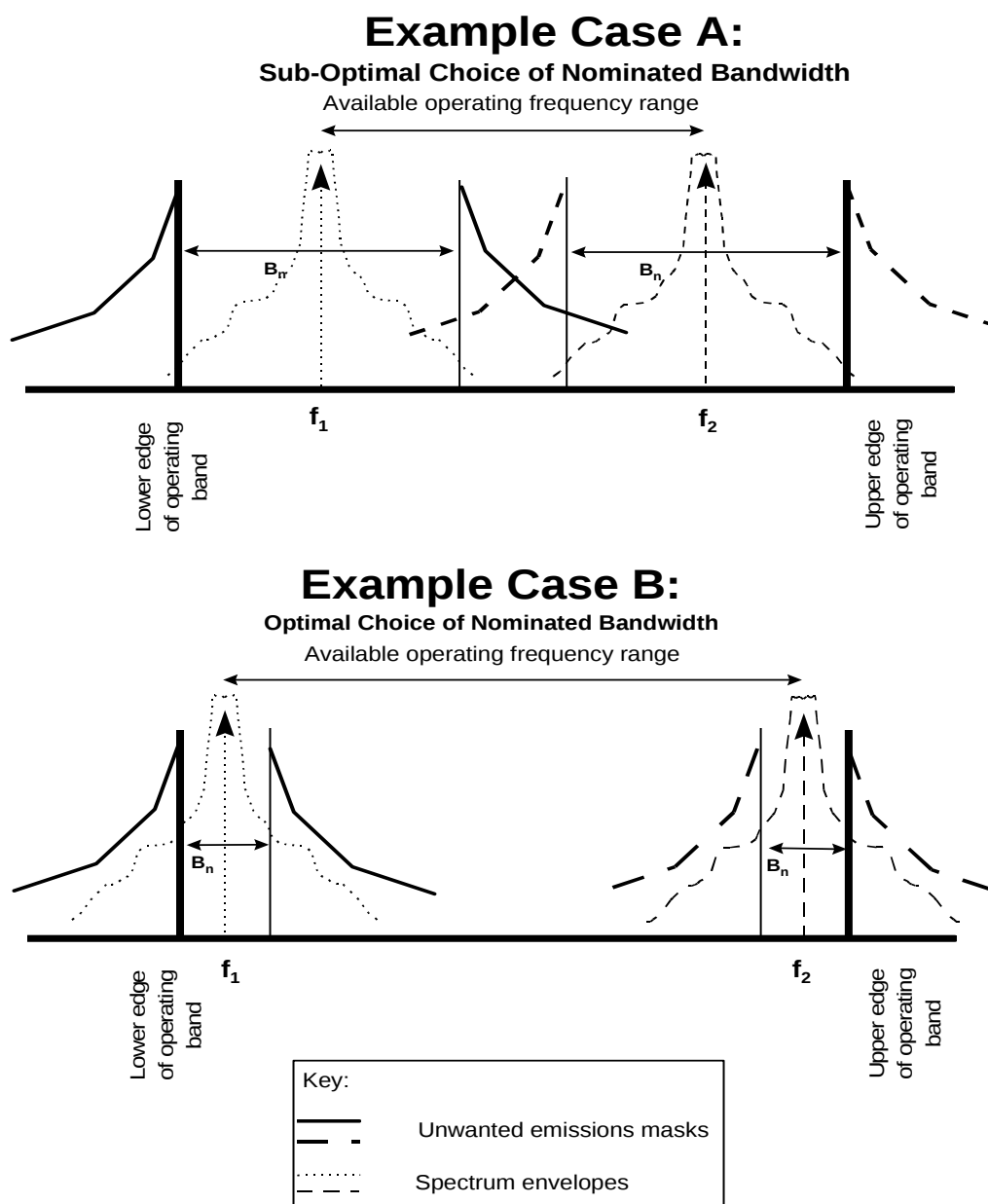


Figure B.2: Choice of nominated bandwidth

In Case A, the lower carrier (centre frequency f_1) is shown operating at its' lowest allowable frequency, with the nominated bandwidth adjacent to the edge of the assignment. Similarly, the upper carrier is shown in the highest allowable frequency, centre frequency f_2 . The available tuning range for the carrier is shown.

In Case B, a similar situation is shown, but with a smaller nominated bandwidth. The uppermost and lowermost channels are operating closer to the band edges, and thus the available tuning range is greater.

B.4 Maximum value for nominated bandwidth

The maximum value for the nominated bandwidth (B_n) is defined in clause 3.1 so that the frequency interval ($f_c - a, f_c + b$) does not encompass more than either:

- i) when $a = b$, 4 or less carrier frequencies (i.e. five channel spacing) for narrow-band systems;
- ii) when $a \neq b$, 1 nominal carrier frequency (i.e. two channel spacing) for narrow-band systems; or
- iii) 1 nominal carrier frequency (i.e. two channel spacing) for wide-band systems.

NOTE: In the following diagrams, f_c represents the actual frequency of transmission.

For case (i), the maximum value for the value of B_n is thus:

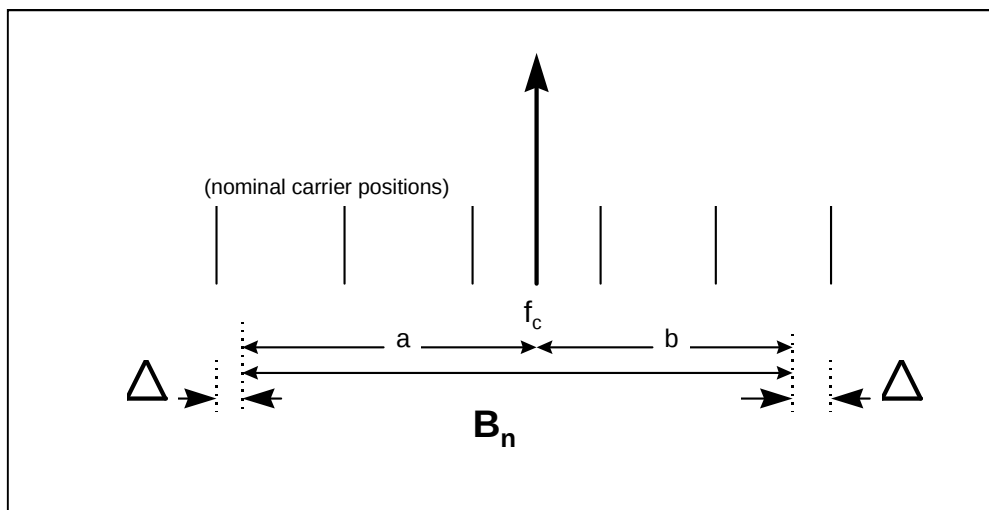


Figure B.3: Maximum value of nominated bandwidth for Case (i)

(When Δ is very small, B_n approaches 5 channel spacing and contains only 4 nominal carriers.)

For case (ii), the maximum value for the value of B_n is thus:

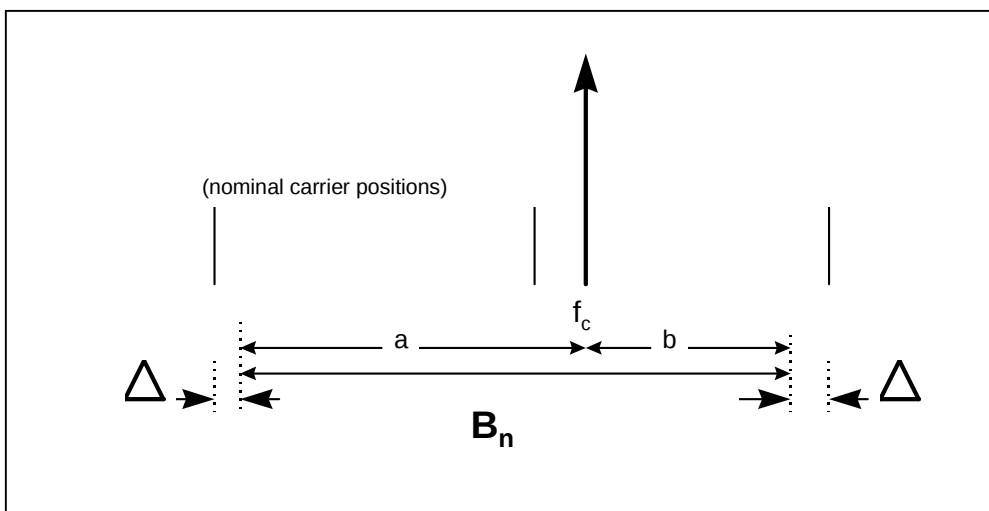


Figure B.4: Maximum value of nominated bandwidth for Case (ii)

(When Δ is very small, B_n approaches 2 channel spacing and contains only 1 nominal carrier.)

For case (iii), where the values of a and b are equal, the maximum value for the value of B_n is thus:

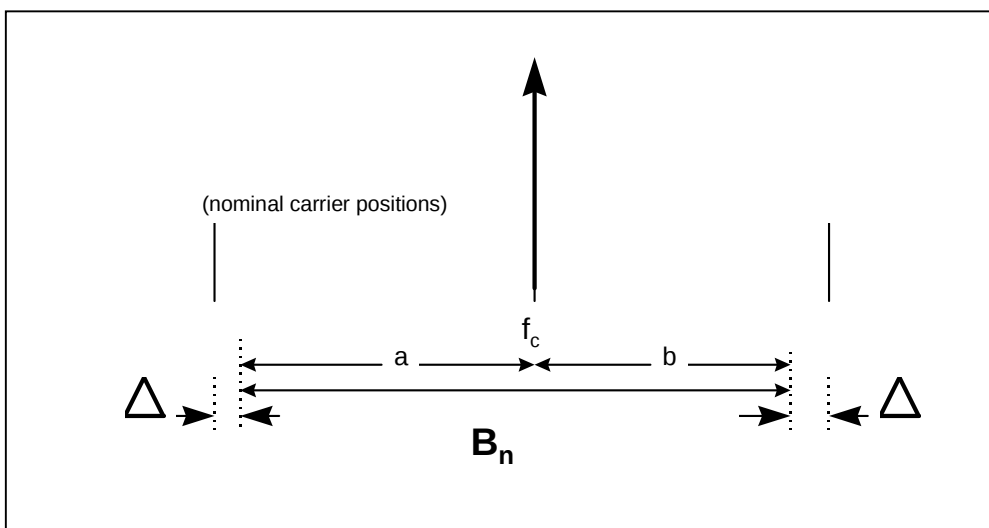


Figure B.5: Maximum value of nominated bandwidth for Case (iii)

(When Δ is very small, B_n approaches 2 channel spacing and contains only 1 nominal carrier.)

For case (iii), where the values of a and b are not equal, the maximum value for the value of B_n is thus:

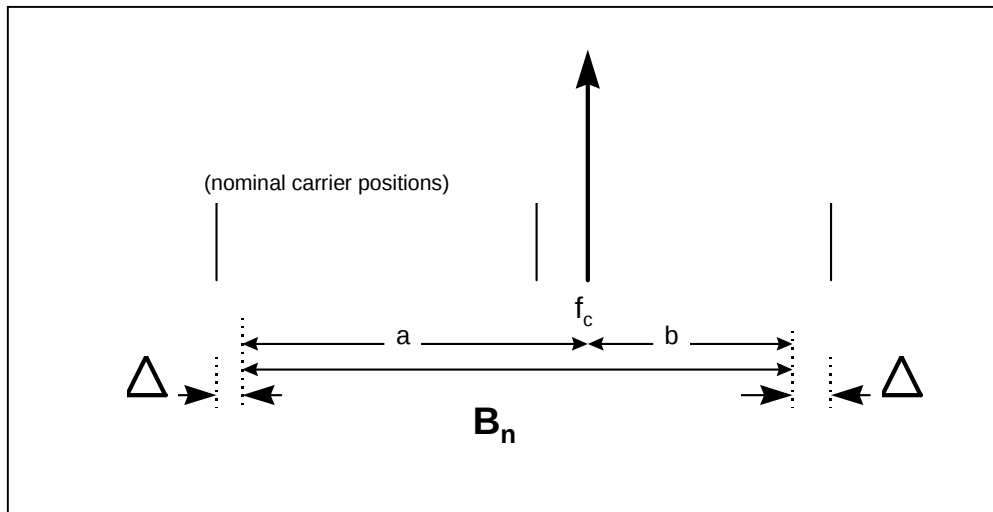


Figure B.6: Maximum value of nominated bandwidth for Case (iii)

(When Δ is very small, B_n approaches 2 channel spacing and contains only 1 nominal carrier.)

Annex C (informative): Laboratory Test Equipment and its Maximum measurement uncertainty

The measurements described in the present document are based on the following assumptions:

- the measured value related to the corresponding limit is used to decide whether an equipment meets the requirements of the present document;
- the value of the measurement uncertainty for the measurement of each parameter is included in the test report.

Table C.1 shows the recommended values for the maximum measurement uncertainty figures.

The Laboratory Test Equipment is a logical grouping that contains the measurement equipment provided by the test laboratory.

The responses of the Laboratory Test Equipment, including any test antenna, to a constant amplitude sine wave signal, are expected to remain within ± 1 dB of calibration across the frequency range of interest. The maximum values of measurement uncertainty for the Laboratory Test Equipment associated with each measurement parameter given in table C.1 for a 95 % confidence level, apply to the test cases described in the present document.

Table C.1: Maximum measurement uncertainties

Parameter	Uncertainty
Radio frequency	$\pm 1 \times 10^{-7}$
Radiated RF power	± 6 dB
Conducted Measurements	± 4 dB
Temperature	± 1 °C
Humidity	± 5 %
DC and low frequency voltages	± 3 %

Annex D (informative): Vibration characteristics

The typical characteristics for vibration of the MES at the frequency/amplitudes are given in table 2.

Table D.1: Vibration characteristics

Frequency range	ASD (Acceleration Spectral Density) random vibration
5 Hz to 20 Hz	0,96 m ² /s ³ (+0/-5 %)
20 Hz to 500 Hz	0,96 m ² /s ³ (+0/-5 %) at 20 Hz, thereafter -3 dB/Octave (+0/-5 %) (taken from IEC Publication 60068-2-64 [i.4])

Annex E (informative): Bibliography

- ETSI ETS 300 831 (V1.2.1): "EMC spectrum & Radio Matters (ERM); Electromagnetic compatibility (EMC) for Mobile Earth Stations (MES) used with Satellite - Personal Communication Networks (S-PCN) operating in the 1,5/1,6/2,4 GHz and 2 GHz Frequency Bands".
- CENELEC EN 55022 (2011): "Limits and methods of measurement of radio disturbance characteristics of information technology equipment".
- Construction of an Anechoic Chamber: Technical Report ZVEI AK-R 90/20.

Annex F (informative): Change history

Version	Information about changes	
V2.1.2	September 2025	Revision to address RED requirements
V2.1.3	October 2025	Revised by WG HARM 109
V2.1.4	October 2025	Further revised version by STF 703
V2.1.5	October 2025	Reviewed by WG HARM 117
V2.1.6	December 2025	Reviewed by WG HARM 124 to address comments from ETSI secretariat on top of version V2.1.4
V2.1.7	December 2025	Reviewed by WG HARM 125
V2.1.8	February 2026	Editorial
V2.1.9 to 2.1.10	March to April 2026	Review by WG HARM 140 and 141addressing HAS comments
V2.1.11	May 2026	Review by WG HARM 147 updating reference to preferred test site
V2.1.12	May 2026	Review by WG HARM 148 to update reference to Open Area Test Site (OATS)

History

Version	Date	Status
V1.1.1	May 2000	Publication
V2.1.1	June 2016	Publication
V2.2.0	July 2026	SRdAP process EV 20260928: 2026-07-06 to 2026-09-28