

# ETSI EN 301 681 V2.1.2 (2016-11)



**Satellite Earth Stations and Systems (SES);  
Harmonised Standard for Mobile Earth Stations (MES) of  
Geostationary mobile satellite systems, including handheld  
earth stations, for Satellite Personal Communications  
Networks (S-PCN) under the Mobile Satellite Service (MSS),  
operating in the 1,5 GHz and 1,6 GHz  
frequency bands covering the essential requirements  
of article 3.2 of the Directive 2014/53/EU**

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Reference

REN/SES-00390

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Keywords

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S-PCN

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# Contents

Intellectual Property Rights .....	6
Foreword.....	6
Modal verbs terminology.....	6
Introduction .....	7
1 Scope .....	8
2 References .....	8
2.1 Normative references .....	8
2.2 Informative references.....	9
3 Definitions and abbreviations.....	9
3.1 Definitions.....	9
3.2 Abbreviations .....	11
4 Technical requirement specifications .....	12
4.1 Environment profile .....	12
4.2 Conformance requirements .....	12
4.2.1 Unwanted emissions outside the band 1 626,5 MHz to 1 660,5 MHz and outside the band 1 668,0 MHz to 1 675,0 MHz (carrier-on state) .....	12
4.2.1.1 Justification .....	12
4.2.1.2 Technical requirements .....	12
4.2.1.3 Conformance test .....	15
4.2.2 Unwanted emissions within the bands 1 626,5 MHz to 1 660,5 MHz and 1 660,5 MHz to 1 662,5 MHz and within the bands 1 666,0 MHz to 1 668,0 MHz, 1 668,0 MHz to 1 675,0 MHz and 1 675,0 MHz to 1 677,0 MHz (carrier-on state) .....	15
4.2.2.1 Justification .....	15
4.2.2.2 Technical requirements .....	16
4.2.2.3 Conformance test .....	17
4.2.3 Unwanted emissions in carrier-off state.....	17
4.2.3.1 Justification .....	17
4.2.3.2 Technical requirements .....	18
4.2.3.3 Conformance test .....	18
4.2.4 MES Control and Monitoring Functions (CMF) .....	18
4.2.4.1 Self-monitoring functions/Processor monitoring .....	18
4.2.4.1.1 Justification .....	18
4.2.4.1.2 Technical requirements.....	18
4.2.4.1.3 Conformance test.....	18
4.2.4.2 Self-monitoring functions/Transmit frequency generation sub-system monitoring.....	19
4.2.4.2.1 Justification .....	19
4.2.4.2.2 Technical requirements.....	19
4.2.4.2.3 Conformance test.....	19
4.2.4.3 Network control authorization .....	19
4.2.4.3.1 Justification .....	19
4.2.4.3.2 Technical requirements.....	19
4.2.4.3.3 Conformance test.....	19
4.2.4.4 Network control reception.....	19
4.2.4.4.1 Transmission disable/enable.....	19
4.2.4.4.2 Transmit frequency control .....	20
4.2.4.5 Fellow radio stations in a dual-mode or multimode terminal.....	20
4.2.4.5.1 Justification .....	20
4.2.4.5.2 Technical requirements.....	20
4.2.4.5.3 Conformance test.....	20
4.2.5 Equipment identity.....	21
4.2.5.1 Justification .....	21
4.2.5.2 Technical requirements .....	21
4.2.5.3 Conformance test .....	21

4.2.6	Protection of the radio astronomy service operation in the band 1 660 MHz to 1 660,5 MHz and in the band 1 668,0 MHz to 1 670,0 MHz .....	21
4.2.6.1	Purpose.....	21
4.2.6.2	Technical requirements .....	21
4.2.6.3	Conformance test .....	21
4.2.7	Receiver Adjacent Channel Selectivity.....	21
4.2.7.1	Purpose.....	21
4.2.7.2	Technical requirements .....	21
4.2.7.3	Conformance test .....	22
4.2.8	Receiver Blocking Characteristics .....	22
4.2.8.1	Purpose.....	22
4.2.8.2	Technical requirements .....	22
4.2.8.3	Conformance test .....	22
5	Testing for compliance with technical requirements.....	22
5.1	Environmental conditions for testing .....	22
5.2	Radio test suites.....	23
5.2.1	General.....	23
5.2.1.1	Description of equipment.....	23
5.2.1.2	Testing of host-connected equipment and plug-in modules .....	24
5.2.1.2.1	Alternative approaches .....	24
5.2.1.2.2	Alternative A: combined equipment.....	24
5.2.1.2.3	Alternative B: use of a test jig .....	24
5.2.1.3	CMF/Special Test Equipment (STE) .....	24
5.2.1.4	General test requirements.....	24
5.2.1.4.1	MES test modes .....	24
5.2.1.4.2	Special Test Equipment (STE) .....	25
5.2.1.4.3	Laboratory Test Equipment (LTE) .....	26
5.2.1.4.4	Methods of test for MES RF emissions according to the equipment type.....	26
5.2.1.4.5	Procedures for measurement of radiated emissions.....	26
5.2.1.4.6	Procedures for measurement of conducted emissions .....	31
5.2.1.4.7	Interpretation of the measurement results.....	33
5.2.1.4.8	Test report.....	33
5.2.2	Unwanted emissions outside the band 1 626,5 MHz to 1 660,5 MHz and outside the band 1 668,0 MHz to 1 675,0 MHz (carrier-on state) .....	33
5.2.2.1	Method of test .....	33
5.2.2.2	Peak measurement.....	34
5.2.2.3	Average measurement .....	34
5.2.2.4	Test requirements .....	35
5.2.3	Unwanted emissions within the band 1 626,5 MHz to 1 660,5 MHz and the band 1 624,5 MHz to 1 626,5 MHz and 1 660,5 MHz to 1 662,5 MHz and within the band 1 668,0 MHz to 1 675,0 MHz and the band 1 666,0 MHz to 1 668,0 MHz and 1 675,0 MHz to 1 677,0 MHz (carrier-on state) .....	35
5.2.3.1	Method of test .....	35
5.2.3.2	Measurement method .....	35
5.2.3.3	Test requirements.....	36
5.2.4	Unwanted emissions in carrier-off state.....	36
5.2.4.1	Method of test .....	36
5.2.4.2	Measurement method .....	36
5.2.4.3	Test requirements .....	37
5.2.5	MES Control and Monitoring Functions (CMF) .....	37
5.2.5.1	Self-monitoring functions/Processor monitoring .....	37
5.2.5.2	Self-monitoring functions/Transmit frequency generation sub-system monitoring .....	37
5.2.5.3	Network control authorization .....	37
5.2.5.3.1	Method of test.....	37
5.2.5.3.2	Test procedure .....	37
5.2.5.3.3	Test requirements .....	38
5.2.5.4	Network control reception.....	38
5.2.5.4.1	Transmission disable/enable.....	38
5.2.5.4.2	Transmit frequency control .....	39
5.2.5.5	Fellow radio stations in a dual-mode or multimode terminal.....	40
5.2.5.5.1	Method of test.....	40
5.2.5.5.2	Test procedure .....	40

5.2.5.5.3	Test requirements .....	40
5.2.6	Equipment identity.....	40
5.2.6.1	Method of test .....	40
5.2.6.2	Test procedure.....	40
5.2.6.3	Test requirements.....	40
5.2.7	Receiver Adjacent Channel Selectivity.....	41
5.2.7.1	General .....	41
5.2.7.2	Test arrangement.....	41
5.2.7.3	Test Procedures .....	41
5.2.8	Receiver Blocking Characteristics .....	41
5.2.8.1	General .....	41
5.2.8.2	Test arrangement.....	42
5.2.8.3	Test procedures .....	42
<b>Annex A (normative):</b>	<b>Relationship between the present document and the essential requirements of Directive 2014/53/EU .....</b>	<b>43</b>
<b>Annex B (informative):</b>	<b>Bibliography.....</b>	<b>45</b>
History .....		46

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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.3] 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.5].

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.

<b>National transposition dates</b>	
Date of adoption of this EN:	12 September 2016
Date of latest announcement of this EN (doa):	31 December 2016
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	30 June 2017
Date of withdrawal of any conflicting National Standard (dow):	30 June 2018

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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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## 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 equipment within the scope of the RE Directive [i.5]. The modular structure is shown in ETSI EG 201 399 [i.1]. The determination of the parameters of the user earth stations using a given satellite for the protection of the spectrum allocated to that satellite, is considered to be under the responsibility of the satellite operator or the satellite network operators.

Following the WRC-03 decision [i.4] to allocate to MSS the bands 1 518 MHz to 1 525 MHz (space to Earth) and 1 668 MHz to 1 675 MHz (Earth to space) and the conclusions of WRC-07, a new set of emission requirements for LMESs that are capable of transmitting in the frequency band from 1 668,0 MHz to 1 675,0 MHz were specified.

The two parts of the L-band frequency allocations are treated as two sub-bands which may be used separately or in any combination. The original L-band allocation is referenced in the present document as "sub-band 1" and the extended L-band is referenced as "sub-band 2".

Table 3a is applicable for MESSs that are capable of transmitting in any combination of either or both of these sub-bands. Table 3a is recommended for all new MESSs, including MESSs that can only operate in sub-band 1.

The applicant may choose between table 3 and table 3a for new MESSs that are capable of transmitting in only the sub-band 1: the applicant has to declare which alternative is used.

The present document specifies a new set of receiver performance requirements for LMESs under the new Radio Equipment Directive 2014/53/EU [i.5].

### Figure 1: Void

Recital 10 of Directive 2014/53/EU [i.5] 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.5] 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.*"

# 1 Scope

The present document applies to S-PCN MES for Geostationary mobile satellite systems with an EIRP less than or equal to 15 dBW.

The present document sets out the minimum performance requirements and technical characteristics of Mobile Earth Stations (MES) with both transmit and receive capabilities for operation in a Satellite Personal Communication Network (S-PCN) in any combination of all or any part of the Mobile Satellite Service (MSS) frequency bands sub-band 1 and sub-band 2 defined in table 1.

These MESs are controlled and monitored by a Network Control Facility (NCF). The NCF is outside the scope of the present document.

**Table 1: Mobile Satellite Service (MSS) frequency band**

Sub-band	Transmission path	MSS frequency band
1	MESs transmit 1	1 626,5 MHz to 1 660,5 MHz
	MESs receive 1	1 525 MHz to 1 559 MHz
2	MESs transmit 2	1 668,0 MHz to 1 675,0 MHz
	MESs receive 2	1 518,0 MHz to 1 525,0 MHz

An S-PCN MES may be handheld, portable, vehicle-mounted, host connected, semi-fixed or fixed equipment, or may be an element in a multimode terminal; it may consist of a number of modules with associated connections and user interface, or may be a self-contained single unit.

If the MES is an element in a multimode 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 band given in table 1.

The present document is intended to cover the provisions of Directive 2014/53/EU [i.5] (RE Directive) article 3.2 which states that "...radio equipment shall be so constructed that it both effectively uses and supports the efficient use of radio spectrum in order to avoid harmful interference". In addition to the present document, other ENs that specify technical requirements in respect of essential requirements under other parts of article 3 of the Radio Equipment Directive (RED) [i.5] may apply to equipment within the scope of the present document.

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

## 2 References

### 2.1 Normative 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.

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

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

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

- [1] Void.
- [2] Void.
- [3] Void.
- [4] Recommendation ITU-T O.153 (1992): "Basic parameters for the measurement of error performance at bit rates below the primary rate".

- [5] CISPR 16-1-4 (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".
- [6] Void.
- [7] Void.
- [8] Void.

## 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.

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

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] ETSI EG 201 399 (V3.1.1): "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.2] Void.
- [i.3] 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.4] WRC-03 decision.

NOTE: Available at [http://www.itu.int/dms\\_pub/itu-s/oth/02/01/S020100002D4005PDFE.PDF](http://www.itu.int/dms_pub/itu-s/oth/02/01/S020100002D4005PDFE.PDF).

- [i.5] 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.

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## 3 Definitions and abbreviations

### 3.1 Definitions

For the purposes of the present document, the terms and definitions given in Directive 2014/53/EU [i.5] and the following apply:

**3dB Bandwidth (B3dB):** total width of the signal spectrum 3 dB below the maximum in-band density

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

**carrier-off state:** state in which the MES is not transmitting a carrier

**carrier-on state:** state in which the MES is transmitting a carrier

**carrier-on time (initial bursts):** period when an MES is transmitting a signal

NOTE: For MESs that transmit in a non-continuous mode, the carrier-on time only includes the times when the MES is transmitting a signal.

**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 the antenna gain in the direction considered, relative to an isotropic source radiating uniformly in all directions

**fellow radio station:** one of the (other) modes of a multimode MES

**handheld:** indicates an 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:** indicates an 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):** equipment which is intended to be installed in a vehicle

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

**Laboratory Test Equipment (LTE):** 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

**multimode:** indicates equipment that accommodates radio stations of different radio networks

**NCF 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 should carry out some specific action or should enter or maintain some specific state

NOTE: For test purposes NCF control messages may originate from Special Test Equipment (STE).

**network control channel:** channel by which an MES receives general control information from the NCF of its S-PCN

**nominated bandwidth (B<sub>n</sub>):** bandwidth of the MES radio frequency transmission that is nominated by the applicant and that is wide enough to encompass all spectral elements of the transmission necessary for communication and which have a level greater than the specified unwanted emissions limits; also the nominated bandwidth is centred on the transmit frequency and does not exceed 180 % of the 3 dB bandwidth of the signal and is within the assigned part of the MSS transmit frequency band within which the MES operates

NOTE: The nominated bandwidth is wide enough to take account of the transmit carrier frequency stability.

**operational frequency range(s):** sub-portion(s) of the band 1 626,5 MHz to 1 660,5 MHz and 1 668,0 MHz to 1 675,0 MHz in the earth-to-space direction to the MSS network, for which the equipment has been designed as declared by the applicant

**Portable Equipment (PE):** equipment generally intended to be self-contained, free standing and portable

NOTE: A PE would normally consist of a single module, but may 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

**sub-band:** contiguous portion of the operating band

NOTE: Two sub-bands are defined (see table 1).

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

NOTE: The test laboratory may be the applicant's laboratory.

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

**transmission format:** physical characteristics of the signal that is transmitted by an MES

NOTE: An MES may use more than one transmission format within a single S-PCN.

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

## 3.2 Abbreviations

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

B <sub>3dB</sub>	3dB Bandwidth
B <sub>n</sub>	Nominated Bandwidth
BW	Bandwidth
CDMA	Code Division Multiple Access
CISPR	International Special Committee on Radio Interference
CMF	Control and Monitoring Functions
EIRP	Equivalent Isotropically Radiated Power
EMC	Electro-Magnetic Compatibility
EME	Externally Mounted Equipment
EU	European Union
EUT	Equipment Under Test
IE	Installable Equipment
IEC	International Electrotechnical Commission/Committee
IME	Internally Mounted Equipment
ITU	International Telecommunications Union
ITU-T	ITU Telecommunication Standardization Sector
LTE	Laboratory Test Equipment
LTE	Long Term Evolution
MES	Mobile Earth Station
MIC	MES Identification Code
MSS	Mobile Satellite Service
NCF	Network Control Facility
PCN	Personal Communications Networks
PE	Portable Equipment
R&TTE	Radio and Telecommunications Terminal Equipment
RA	Radio Astronomy
RE	Radio Equipment
RED	Radio Equipment Directive
RF	Radio Frequency
S-PCN	Satellite Personal Communications Network
STE	Special Test Equipment
TDMA	Time Division Multiple Access
WRC	World Radiocommunication Conference

## 4 Technical requirement specifications

### 4.1 Environment profile

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

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

**Table 2: Void**

### 4.2 Conformance requirements

#### 4.2.1 Unwanted emissions outside the band 1 626,5 MHz to 1 660,5 MHz and outside the band 1 668,0 MHz to 1 675,0 MHz (carrier-on state)

##### 4.2.1.1 Justification

The technical requirements presented in this clause shall apply to all MESs that are capable of transmitting either in sub-band 1, sub-band 2, or in both sub-bands as defined in table 1 for the purpose of:

- protection of other radio services operating outside the band 1 626,5 MHz to 1 660,5 MHz from emissions caused by S-PCN MESs transmitting within the sub-band 1 frequency band as defined in table 1; and
- protection of other radio services operating outside the band 1 668,0 MHz to 1 675,0 MHz from emissions caused by S-PCN MESs transmitting within the sub-band 2 frequency band as defined in table 1.

##### 4.2.1.2 Technical requirements

Unwanted emissions from Mobile Earth Stations (LMESs) outside the band 1 626,5 MHz to 1 660,5 MHz and outside the band 1 668 MHz to 1 675 MHz shall be below the following limits.

Unless otherwise stated the specification in this clause shall apply to all types of MESs notwithstanding their transmitting capabilities within the frequency bands as defined in table 1:

- 1) For MES that are capable of transmitting within only the sub-band 1 frequency band as defined in table 1, the maximum EIRP spectral density of the unwanted emissions from the MES outside the band 1 626,5 MHz to 1 660,5 MHz shall not exceed the limits in either table 3 or table 3a. The applicant shall declare which alternative shall be used.
- 2) For MES that are capable of transmitting within only sub-band 2 frequency band or within both the sub-band 1 and sub-band 2 frequency bands, the maximum EIRP spectral density of the unwanted emissions from the MES outside the bands 1 626,5 MHz to 1 660,5 MHz and 1 668,0 MHz to 1 675,0 MHz shall not exceed the limits in table 3a.

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

**Table 3: Unwanted emissions outside the band 1 626,5 MHz to 1 660,5 MHz for MES only capable of transmitting within sub-band 1 frequency band as defined in table 1**

Frequency (MHz)	Carrier - on state		
	EIRP (dBW)	Measurement bandwidth	Measurement method (see note 6)
30 to 1 000	-66	100 kHz	Peak Hold
1 000 to 1 559	-61	1 MHz	Average
1 559 to 1 605,0	-70	1 MHz (see note 3)	Average (see note 2)
1 605,0 to 1 612,5	-70 to -58,5 (see note 4)	1 MHz (see note 3)	Average
1 612,5 to 1 616,5	-55 to -50 (see note 4)	1 MHz	Average
1 616,5 to 1 621,5	-50 to -46 (see note 4)	1 MHz	Average
1 621,5 to 1 624,5	-60	30 kHz	Average
1 624,5 to 1 625,0	-60 to -57,5 (see notes 4, 5, 7)	30 kHz	Average
1 625,0 to 1 625,125	-57,5 to -57,2 (see notes 4, 5, 7)	30 kHz	Average
1 625,125 to 1 625,8	-57,2 to -50 (see notes 4, 5, 7)	30 kHz	Average
1 625,8 to 1 626,0	-50 to -47 (see notes 4, 5, 7)	30 kHz	Average
1 626,0 to 1 626,2	-47 to -40 (see notes 4, 5, 7)	30 kHz	Average
1 626,2 to 1 626,5	-40 (see notes 5, 7)	30 kHz	Average
1 626,5 to 1 660,5	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE
1 660,5 to 1 662,5	The levels in table 4a shall apply from 1 660,5 MHz to 1 662,5 MHz		
1 662,5 to 1 665,5	-60	30 kHz	Average
1 665,5 to 1 670,5	-60	100 kHz	Average
1 670,5 to 1 680,5	-60	300 kHz	Average
1 680,5 to 1 690,5	-60	1 MHz	Average
1 690,5 to 2 250	-60	3 MHz	Average
2 250 to 12 750 (see note 1)	-60	3 MHz	Peak Hold

NOTE 1: In the band 3 253,0 MHz to 3 321,0 MHz the maximum EIRP in one, and only one, 3 MHz measurement bandwidth shall not exceed -38 dBW. Elsewhere in this band the power limit in table 3 shall be applied.  
In each of the bands 4 879,5 MHz to 4 981,5 MHz, 6 506,0 MHz to 6 642,0 MHz and 8 132,5 MHz to 8 302,5 MHz the maximum EIRP in one, and only one, 3 MHz measurement bandwidth shall not exceed -48 dBW. Elsewhere in this band the power limit in table 3 shall be applied.

NOTE 2: The average measurement method defined in clause 5.2.2.3 shall apply except that an averaging period of 20 ms shall be used in the sub-band 1 573,42 MHz to 1 580,42 MHz.

NOTE 3: Measurement bandwidths less than 1 MHz are allowable provided the power in the narrower bandwidth is integrated over 1 MHz.

NOTE 4: Linearly interpolated in dBW vs. Frequency.

NOTE 5: The power limits specified in the band 1 624,5 MHz to 1 626,5 MHz require further study. This study is important to determine whether less stringent limits may enhance spectrum efficiency and utilization immediately above 1 626,5 MHz.

NOTE 6: Peak Hold and Average measurements shall be performed as specified in clauses 5.2.2.2 and 5.2.2.3.

NOTE 7: For systems employing CDMA, the EIRP limits shall be decreased by 10 log (N) dB, where N is the maximum number of MESs in the receive beam of the satellite to which these MESs are communicating and which are expected to transmit simultaneously in the same frequency band within that same beam. This number shall be declared by the manufacturer (N = 1 in a TDMA system).

**Table 3a: Unwanted emissions outside the bands 1 626,5 MHz to 1 660,5 MHz and 1 668,0 MHz to 1 675,0 MHz for MES capable of transmitting within all or any part of sub-band 1 and sub-band 2 frequency bands as defined in table 1**

Frequency (MHz)	Carrier - on state		
	EIRP (dBW)	Measurement bandwidth	Measurement method (see note 8)
30 to 1 000	-66	100 kHz	Peak Hold
1 000 to 1 559	-61	1 MHz	Average
1 559 to 1 605,0	-70	1 MHz	Average
1 605,0 to 1 612,5	-70 to -58,5 (see note 6)	1 MHz (see note 5)	(see note 2) Average
1 612,5 to 1 616,5	-55 to -50 (see note 6)	1 MHz	Average
1 616,5 to 1 621,5	-50 to -46 (see note 6)	1 MHz	Average
1 621,5 to 1 624,5	-60	30 kHz	Average
1 624,5 to 1 625,0	-60 to -57,5 (see notes 6, 7, 9)	30 kHz	Average
1 625,0 to 1 625,125	-57,5 to -57,2 (see notes 6, 7, 9)	30 kHz	Average
1 625,125 to 1 625,8	-57,2 to -50 (see notes 6, 7, 9)	30 kHz	Average
1 625,8 to 1 626,0	-50 to -47 (see notes 6, 7, 9)	30 kHz	Average
1 626,0 to 1 626,2	-47 to -40 (see notes 6, 7, 9)	30 kHz	Average
1 626,2 to 1 626,5	-40 (see notes 7, 9)	30 kHz	Average
1 626,5 to 1 660,5	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE
1 660,5 to 1 662,5	note 1	note 1	note 1
1 662,5 to 1 666,0	-55	30 kHz	Average
1 666,0 to 1 668,0	note 2	note 2	note 2
1 668,0 to 1 675,0	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE
1 675,0 to 1 677,0	note 2	note 2	note 2
1 677,0 to 1 680,0	-60	30 kHz	Average
1 680,0 to 1 685,0	-60	100 kHz	Average
1 685,0 to 1 695,0	-60	300 kHz	Average
1 695,0 to 1 705,0	-60	1 MHz	Average
1 705,0 to 2 250	-60	3 MHz	Average
2 250 to 12 750 (see note 3)	-60	3 MHz	Peak Hold

Frequency (MHz)	Carrier - on state		
	EIRP (dBW)	Measurement bandwidth	Measurement method (see note 8)
NOTE 1:	For an MES transmitting in sub-band 1 (as defined in table 1) the limits defined in table 4a shall apply for the band 1 660,5 MHz to 1 662,5 MHz. For an MES transmitting in sub-band 2 (as defined in table 1) a limit of -55 dBW in 30 kHz shall apply for the band 1 660,5 MHz to 1 662,5 MHz.		
NOTE 2:	For an MES transmitting in sub-band 2 (as defined in table 1) the limits defined in table 4a shall apply for the bands 1 666,0 MHz to 1 668,0 MHz and 1 675,0 MHz to 1 677,0 MHz. For an MES transmitting in sub-band 1 (as defined in table 1) a limit of -55 dBW in 30 kHz shall apply for the bands 1 666,0 MHz to 1 668,0 MHz and 1 675,0 MHz to 1 677,0 MHz.		
NOTE 3:	In the bands 3 253,0 MHz to 3 321,0 MHz and 3 336,0 MHz to 3 350,0 MHz the maximum EIRP in one, and only one, 3 MHz measurement bandwidth shall not exceed -38 dBW. Elsewhere in this band the power limit in table 3a shall be applied. In the bands 4 879,5 MHz to 4 981,5 MHz and 5 004,0 MHz to 5 025,0 MHz the maximum EIRP in one, and only one, 3 MHz measurement bandwidth shall not exceed -48 dBW. Elsewhere in this band the power limit in table 3a shall be applied. In the bands 6 506,0 MHz to 6 642,0 MHz and 6 672,0 MHz to 6 700,0 MHz the maximum EIRP in one, and only one, 3 MHz measurement bandwidth shall not exceed -48 dBW. Elsewhere in this band the power limit in table 3a shall be applied. In the bands 8 132,5 MHz to 8 302,5 MHz and 8 340,0 MHz to 8 375,0 MHz the maximum EIRP in one, and only one, 3 MHz measurement bandwidth shall not exceed -48 dBW. Elsewhere in this band the power limit in table 3a shall be applied.		
NOTE 4:	The average measurement method defined in clause 5.2.2.3 shall apply except that an averaging period of 20 ms shall be used in the sub-band 1 573,42 MHz to 1 580,42 MHz.		
NOTE 5:	Measurement bandwidths less than 1 MHz are allowable provided the power in the narrower bandwidth is integrated over 1 MHz.		
NOTE 6:	Linearly interpolated in dBW vs. Frequency.		
NOTE 7:	The power limits specified in the band 1 624,5 MHz to 1 626,5 MHz require further study. This study is important to determine whether less stringent limits may enhance spectrum efficiency and utilization immediately above 1 626,5 MHz.		
NOTE 8:	Peak Hold and Average measurements shall be performed as specified in clauses 5.2.2.2 and 5.2.2.3.		
NOTE 9:	For systems employing CDMA, the EIRP limits shall be decreased by 10 log (N) dB, where N is the maximum number of MESs in the receive beam of the satellite to which these MESs are communicating and which are expected to transmit simultaneously in the same frequency band within that same beam. This number shall be declared by the manufacturer (N = 1 in a TDMA system).		

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 shall be carried out in accordance with clause 5.2.2 and clause 5.2.3.

### 4.2.2 Unwanted emissions within the bands 1 626,5 MHz to 1 660,5 MHz and 1 660,5 MHz to 1 662,5 MHz and within the bands 1 666,0 MHz to 1 668,0 MHz, 1 668,0 MHz to 1 675,0 MHz and 1 675,0 MHz to 1 677,0 MHz (carrier-on state)

#### 4.2.2.1 Justification

Protection of radio services and systems operating within the neighbouring frequency band 1 660,5 MHz to 1 662,5 MHz and other systems operating within the band 1 626,5 MHz to 1 660,5 MHz from unwanted emissions caused by S-PCN MESs transmitting in the band 1 626,5 MHz to 1 660,5 MHz.

Protection of radio services and systems operating within the neighbouring frequency band 1 666,0 MHz to 1 668,0 MHz and 1 675,0 MHz to 1 677,0 MHz and other systems operating within the band 1 668,0 MHz to 1 675,0 MHz from unwanted emissions caused by S-PCN MESs transmitting in the band 1 668,0 MHz to 1 675,0 MHz.

### 4.2.2.2 Technical requirements

If an MES is capable of transmitting in both sub-band 1 and sub-band 2 as defined in table 1, there are two different limits in this clause. The limits defined in tables 4a and 4b shall only apply for the current transmit band as defined below.

For MES transmitting in the sub-band 1 frequency band as defined in table 1:

- The maximum EIRP spectral density of the unwanted emissions from the MES within the band 1 626,5 MHz to 1 660,5 MHz shall not exceed the limits in either table 4a or 4b. The applicant shall declare which alternative shall be used.
- The maximum EIRP spectral density of the unwanted emissions from the MES within the band 1 660,5 MHz to 1 662,5 MHz shall not exceed the limits in table 4a.
- If an applicant declares to use table 3a, the maximum EIRP spectral density of the unwanted emissions from the MES within the band 1 668,0 MHz to 1 675,0 MHz shall not exceed -55 dBW in any 30 kHz measurement bandwidth.

NOTE 1: The above limit only applies if an applicant declares to use table 3a. If an applicant declares to use table 3 the limits for the band 1 668,0 MHz to 1 675,0 MHz are defined in table 3.

For MES transmitting in the sub-band 2 frequency band as defined in table 1:

- The maximum EIRP spectral density of the unwanted emissions from the MES within the band 1 668,0 MHz to 1 675,0 MHz shall not exceed the limits in either table 4a or 4b. The applicant shall declare which alternative shall be used.
- The maximum EIRP spectral density of the unwanted emissions from the MES within the bands 1 666,0 MHz to 1 668,0 MHz and 1 675,0 MHz to 1 677,0 MHz shall not exceed the limits in table 4a.
- The maximum EIRP spectral density of the unwanted emissions from the MES within the band 1 660,5 MHz to 1 662,5 MHz shall not exceed -55 dBW in any 30 kHz measurement bandwidth.

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

**Table 4a: Maximum unwanted emissions in the bands 1 626,5 MHz to 1 660,5 MHz and 1 660,5 MHz to 1 662,5 MHz caused by S-PCN MESs transmitting in the band 1 626,5 MHz to 1 660,5 MHz; and maximum unwanted emissions in the bands 1 666,0 MHz to 1 668,0 MHz, 1 668,0 MHz to 1 675,0 MHz and 1 675,0 MHz to 1 677,0 MHz caused by S-PCN MESs transmitting in the band 1 668,0 MHz to 1 675,0 MHz**

Frequency offset (kHz) (see note 1)	Carrier-on state		
	EIRP (dBW) (see note 2)	Measurement bandwidth (kHz)	Measurement method
0 to 25	0 to -15	3	Average
25 to 125	-15 to -50	3	Average
125 to 425	-50	3	Average
425 to 1 500	-50 to -65	3	Average
1 500 to 36 000	-55	30	Average

NOTE 1: Frequency offset is determined from the edge of the nominated bandwidth.  
NOTE 2: Linearly interpolated in dBW vs. Frequency offset.

**Table 4b: Maximum unwanted emissions in the bands 1 626,5 MHz to 1 660,5 MHz caused by S-PCN MESs transmitting in the band 1 626,5 MHz to 1 660,5 MHz; and maximum unwanted emissions in the bands 1 668,0 MHz to 1 675,0 MHz caused by S-PCN MESs transmitting in the band 1 668,0 MHz to 1 675,0 MHz**

Frequency offset (kHz) (see notes 1 and 3)	Carrier-on state		
	EIRP (dBW) (see note 2)	Measurement bandwidth (kHz)	Measurement method
0 to 25	0 to -15	3	Average
25 to 55	-15 to -25 (see note 4)	3	Average
55 to AB	-25 (see note 4)	3	Average
AB to (AB + 0,35 x B3dB)	-25 to -40 (see note 4)	3	Average
(AB + 0,35 x B3dB) to CD	-40	3	Average
CD to (CD + 0,25 x B3dB)	-40 to -50	3	Average
(CD + 0,25 x B3dB) to EF	-50	3	Average
EF to 1 500	-50 to -65	3	Average
1 500 to 36 000	-55	30	Average

NOTE 1: Frequency offset is determined from the edge of the nominated bandwidth.  
NOTE 2: Linearly interpolated in dBW vs. Frequency offset.  
NOTE 3: The parameters AB, CD, EF are defined below.  
NOTE 4: The limit of -25 dBW in this table is determined on the assumption that the adjacent channel interference results from a single interferer. This limit shall apply to MESs that are designed for operation in a network where the occurrence of two (or more) interferers, all transmitting with the maximum permitted level of unwanted emissions, does not exceed 0,1 % of the time; otherwise a limit of -30 dBW shall apply.

The parameters AB, CD and EF are defined as a proportion of the 3 dB Bandwidth as follows:

- AB = (55) or (100 % of the B3dB), whichever is the greater;
- CD = (95) or (200 % of the B3dB), whichever is the greater;
- EF = (125) or (300 % of the B3dB), whichever is the greater.

For systems employing CDMA, the EIRP limits in tables 4a, and 4b shall be decreased by  $10 \times \log(N)$  dB, where N is the maximum number of MESs in the receive beam of the satellite to which these MESs are communicating and which are expected to transmit simultaneously in the same frequency band within that same beam. This number shall be declared by the applicant.

NOTE 2: N = 1 in a TDMA system.

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 shall be carried out in accordance with clause 5.2.3.

### 4.2.3 Unwanted emissions in carrier-off state

#### 4.2.3.1 Justification

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

### 4.2.3.2 Technical requirements

The maximum EIRP spectral density of the unwanted emissions from the MESs in the carrier-off state shall not exceed the limits in table 5.

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

**Table 5: Maximum EIRP spectral density of the unwanted emissions in the carrier-off state**

Frequency (MHz)	EIRP (dBW)	Measurement bandwidth	Measurement method
30 to 1 000	-87	100 kHz	peak hold
1 000 to 1 525	-87	100 kHz	peak hold
1 525 to 1 559	-97 (see note 3)	100 kHz	average
1 559 to 1 610	-70	1 MHz (see note 1)	average (see note 2)
1 610 to 12 750	-87	100 kHz	peak hold
NOTE 1: Measurement bandwidths less than 1 MHz are allowable provided the power in the narrower bandwidth is integrated over 1 MHz.			
NOTE 2: The average measurement method defined in clause 5.2.2.3 shall apply except that a measurement time of 20 ms shall be used in the sub-band 1 573,42 MHz to 1 580,42 MHz.			
NOTE 3: If MES antenna gain is higher than 8 dBi, the unwanted emission limit in the band 1 525 MHz to 1 559 MHz shall be considered to be -90 dBW in 100 kHz.			

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

### 4.2.3.3 Conformance test

Conformance tests shall be carried out in accordance with clause 5.2.4.

## 4.2.4 MES Control and Monitoring Functions (CMF)

### 4.2.4.1 Self-monitoring functions/Processor monitoring

#### 4.2.4.1.1 Justification

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

#### 4.2.4.1.2 Technical requirements

The MES shall incorporate a processor monitoring function for each of its processors involved in the manipulation of traffic and in control and monitoring functions.

The processor monitoring function shall detect failure of the processor hardware and software.

Not later than 1 s after any detectable fault condition occurs, the transmissions shall be suppressed (carrier-off state) until the processor monitoring function has determined that all fault conditions have been cleared.

The fault conditions which cause transmission shutdown shall be specified by the applicant and declared by the applicant.

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

#### 4.2.4.1.3 Conformance test

Conformance tests shall be carried out in accordance with clause 5.2.5.1.

#### 4.2.4.2 Self-monitoring functions/Transmit frequency generation sub-system monitoring

##### 4.2.4.2.1 Justification

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

##### 4.2.4.2.2 Technical requirements

The MES shall incorporate a transmit frequency generation sub-system monitoring function.

Not later than 5 s after any detectable failure of the transmit frequency generation sub-system occurs, the transmissions shall be suppressed (carrier-off state) until the transmit frequency generation sub-system monitoring function has determined that all fault conditions have been cleared.

The fault conditions which cause transmission shutdown shall be specified by the applicant and declared by the applicant.

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

##### 4.2.4.2.3 Conformance test

Conformance tests shall be carried out in accordance with clause 5.2.5.2.

#### 4.2.4.3 Network control authorization

##### 4.2.4.3.1 Justification

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

##### 4.2.4.3.2 Technical requirements

During power-on no transmissions shall occur from the MES.

Following power-on the MES shall enter the carrier-off state. This state shall be maintained whilst the MES is not synchronized with the appropriate network control channel(s).

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

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

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

##### 4.2.4.3.3 Conformance test

Conformance tests shall be carried out in accordance with clause 5.2.5.3.

#### 4.2.4.4 Network control reception

##### 4.2.4.4.1 Transmission disable/enable

##### 4.2.4.4.1.1 Justification

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

#### 4.2.4.4.1.2 Technical requirements

After power-on the MES shall remain in the carrier-off state until it receives a transmission enable command. For systems where no transmission enable command is expected after power-on the MES may only transmit initial bursts.

An MES which is in the carrier-on state shall not continue transmissions for a period of time longer than 1 s after receipt of a transmission disable command. After ceasing transmissions the MES shall enter the carrier-off state until it receives a transmission enable command. For systems where no transmission enable command is expected after receipt of a transmission disable command the MES may only transmit initial bursts.

The initial bursts shall be subject to the following restrictions:

- a) an initial burst may be transmitted in a continuous or non-continuous mode (i.e. as a single burst or as a sequence of bursts);
- b) the carrier-on time of an initial burst transmission sequence shall not exceed one second;
- c) the total carrier-on time for multiple initial bursts shall not exceed 1 % of the time.

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

#### 4.2.4.4.1.3 Conformance test

Conformance tests shall be carried out in accordance with clause 5.2.5.4.1.

#### 4.2.4.4.2 Transmit frequency control

##### 4.2.4.4.2.1 Purpose

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

##### 4.2.4.4.2.2 Technical requirements

The MES shall set the carrier frequency of its transmission according to the command of the NCF. The carrier frequency has to be controlled such, that the entire nominated bandwidth of the terminal falls completely within the operational frequency range(s) specified by the applicant and declared by the applicant.

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

##### 4.2.4.4.2.3 Conformance test

Conformance tests shall be carried out in accordance with clause 5.2.5.4.2.

#### 4.2.4.5 Fellow radio stations in a dual-mode or multimode terminal

##### 4.2.4.5.1 Justification

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

##### 4.2.4.5.2 Technical requirements

Any fellow radio station in a multimode MES shall not transmit without reception of the appropriate network control channel(s) for the system for which it is designed. The conformance requirements apply for the environmental conditions as specified for the fellow radio station.

##### 4.2.4.5.3 Conformance test

Conformance tests shall be carried out in accordance with clause 5.2.5.5.

## 4.2.5 Equipment identity

### 4.2.5.1 Justification

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

### 4.2.5.2 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 MES Identification Code upon reception of an appropriate NCF command addressed to it.

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

### 4.2.5.3 Conformance test

Conformance tests shall be carried out in accordance with clause 5.2.6.

## 4.2.6 Protection of the radio astronomy service operation in the band 1 660 MHz to 1 660,5 MHz and in the band 1 668,0 MHz to 1 670,0 MHz

### 4.2.6.1 Purpose

To protect the radio astronomy service in the 1 660 MHz to 1 660,5 MHz band and the 1 668,0 MHz to 1 670,0 MHz band from emissions produced by MESs the transmissions in these frequency bands shall be capable of being disabled in the vicinity of RA stations recorded in the ITU Master International Frequency Register.

### 4.2.6.2 Technical requirements

The MES shall be able to have its transmissions disabled as specified in clause 4.2.4.4.1.

The actual procedure used in an S-PCN network to protect the radio astronomy service in the 1 660 MHz to 1 660,5 MHz band and the 1 668,0 MHz to 1 670,0 MHz band may utilize additional features of the MES.

### 4.2.6.3 Conformance test

Conformance tests shall be carried out in accordance with clause 5.2.5.4.1.

## 4.2.7 Receiver Adjacent Channel Selectivity

### 4.2.7.1 Purpose

To enable reception of a wanted signal in the 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.

### 4.2.7.2 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 6a. 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 6a: Adjacent Channel frequency and power level**

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

#### 4.2.7.3 Conformance test

Conformance tests shall be carried out in accordance with clause 5.2.7.

### 4.2.8 Receiver Blocking Characteristics

#### 4.2.8.1 Purpose

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

The 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 other than those of the spurious response or the adjacent channels, without this unwanted input signal causing a degradation of the performance of the receiver beyond a specified limit. Receiver blocking is specified for in-band signals. In-band signals are signals in the 1 508 MHz to 1 569 MHz band.

#### 4.2.8.2 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 6b is present.

**Table 6b: Test parameters for in-band blocking characteristics**

Interfering Signal	In-band Frequency Range (MHz)	Frequency offset from wanted carrier (MHz)	Level (dBm)
CW	1 508 to 1 569	5	-40 (see note)
NOTE: The -40 dBm level is set based on the performance of the design of MSS terminals. For ease of laboratory testing, the interfering signal is specified as a CW signal. Receiver blocking performance specification against a broadband signal blocking interferer, such as LTE, is under study.			

#### 4.2.8.3 Conformance test

Conformance tests shall be carried out in accordance with clause 5.2.8.

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## 5 Testing for compliance with technical requirements

### 5.1 Environmental conditions for testing

Tests defined in the present document shall be carried out at representative points within the boundary limits of the declared environmental profile.

**Table 6: Void**

## 5.2 Radio test suites

### 5.2.1 General

#### 5.2.1.1 Description of equipment

The applicant shall provide a statement which contains all of the information related to the MES and its testing environment.

This shall include:

- self-contained or host-connected;
- single mode or multimode;
- antenna:
  - active; or
  - passive, with an antenna port available; or
  - passive, no antenna port available;
- the method by which the equipment can be switched into its test modes;
- the fault conditions which cause transmission shut-down;
- the nominal, the lower extreme and the higher extreme operational voltages;
- the transmission formats for which the different EIRP spectral density limits apply and the maximum gross data rate at which the MES is designed to operate for each of those formats;
- the value(s) of nominated bandwidth for each transmission format for that S-PCN;
- the value(s) of the 3 dB bandwidth for each transmission format for that S-PCN;
- in an information leaflet, for each S-PCN for which the MES is designed to operate:
  - a) the name of the S-PCN;
  - b) the operating frequency range(s) of the MES;
  - c) the frequency sub-bands and operating conditions for which the different EIRP spectral density limits apply.

NOTE 1: In the case of a multimode MES, the other modes of operation are to be stated.

NOTE 2: If the MES has an active antenna, the antenna is regarded as an integral part of the MES and the antenna port if available is not to be used for testing.

NOTE 3: If the MES is intended for use with a passive antenna, the maximum gain of any antenna intended to be used with the equipment is to be stated.

NOTE 4: If conducted emissions measurements are to be performed, at the choice of the applicant, the maximum antenna gain at the frequency of particular measured spurious emissions may be stated.

NOTE 5: If Special Test Equipment (STE) is required, see clause 5.2.1.4.2.

NOTE 6: Transmission formats include all relevant differences in the format of the transmitted data e.g. the different modulations schemes and/or burst sizes that are used within the relevant S-PCN.

## 5.2.1.2 Testing of host-connected equipment and plug-in modules

### 5.2.1.2.1 Alternative approaches

For equipment for which connection to or integration with host equipment is required to offer functionality, two alternative approaches are permitted. The applicant shall declare which alternative shall be used.

#### 5.2.1.2.2 Alternative A: combined equipment

Under alternative A, 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 latter are substantially similar, in particular such that the host models are unlikely to significantly influence the emissions of the MES.

Where more than one such combination is intended and host equipment are not substantially similar, 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.

#### 5.2.1.2.3 Alternative B: use of a test jig

Under alternative B, where the MES is intended for use with a variety of host equipment, the applicant shall supply a suitable test jig that is representative of the range of host equipment in which the MES may be used. In particular, the test jig shall be designed such that any alteration of the MES's emissions is minimized. The test jig shall allow the MES part to be powered and stimulated in a way similar to the way it would 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.

### 5.2.1.3 CMF/Special Test Equipment (STE)

The STE shall provide the necessary facilities for tests which require that the MES be operated in its normal operating manner, situated in an environment where receipt of the appropriate network control channel(s) and of NCF commands is under the control of the test laboratory.

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

## 5.2.1.4 General test requirements

### 5.2.1.4.1 MES test modes

The MES is required to be placed in a number of different test modes in order for the various 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 state;
- 4) carrier-on state, maximum transmit power, in a specified channel within the operational frequency range(s), transmitting with a specified transmission format and modulated with the test modulating signal as specified in clause 5.2.1.4.2.2;
- 5) carrier-on state, maximum transmit power, in a specified channel within the operational frequency range(s), set by NCF command, transmitting with a specified transmission format and modulated with the test modulating signal as specified in clause 5.2.1.4.2.2;

NOTE: If this is available for all tests (4) is not required separately.

6) carrier-on state at any detectable power.

The MES may be placed into test modes 4 and 5 either by means of a special facility existing internally in the MES, or by means of a Special Test Equipment (STE).

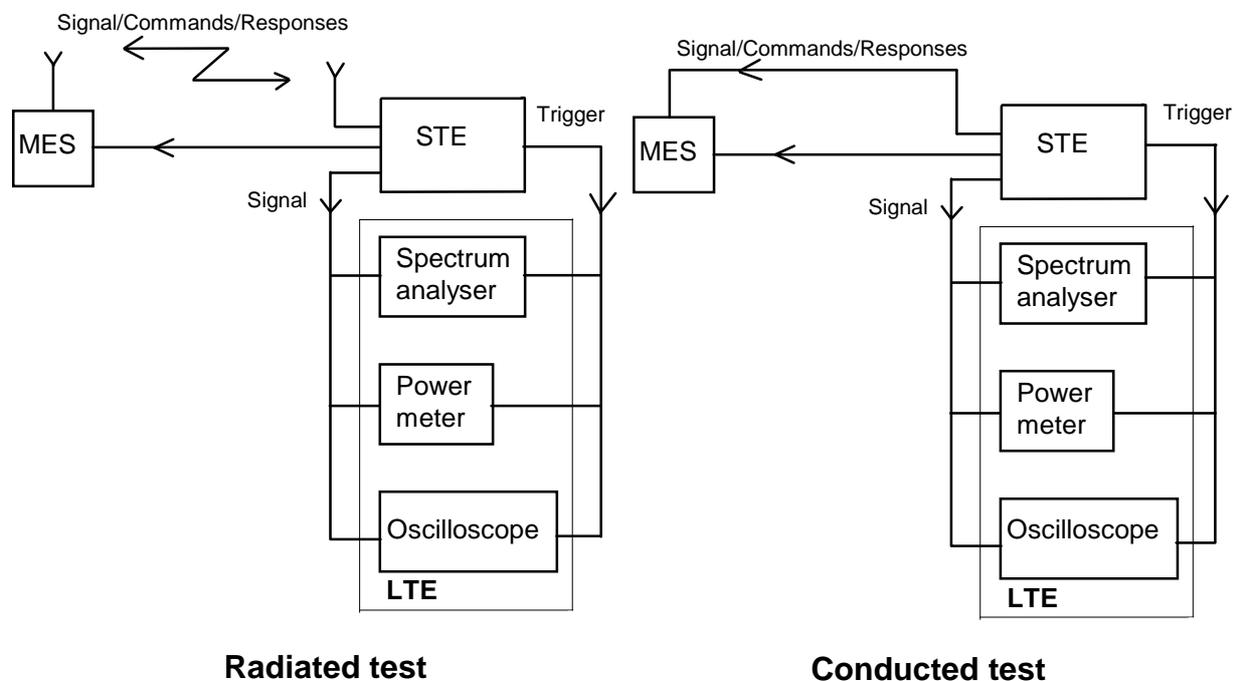
If the MES has been modified by the applicant for these tests, then full documentation showing such modification(s) shall be provided to demonstrate that the modification(s) will not cause the test results to deviate from normal operational performance.

#### 5.2.1.4.2 Special Test Equipment (STE)

##### 5.2.1.4.2.1 Use of STE for control and monitoring functions 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 NCF 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 LTE without modification that would significantly affect the measurement.



**Figure 2: General test arrangement for control and monitoring tests**

The dual trace storage oscilloscope, or other suitable method, may 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.

##### 5.2.1.4.2.2 Test modulating signal

The test modulating signal is a baseband signal which modulates the carrier of the MES and is dependent upon the type of equipment under test. It is a signal representing a pseudorandom bit sequence of at least 511 bits in accordance with Recommendation ITU-T O.153 [4], clause 2. This sequence shall be continuously repeated and shall be at the maximum bit rate declared by the applicant at which the MES is able to operate.

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

### 5.2.1.4.3 Laboratory Test Equipment (LTE)

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

It shall be verified that the responses of the LTE, including any test antenna, to a constant amplitude sine wave signal remain within  $\pm 1$  dB of calibration across the frequency range of interest.

The maximum values of measurement uncertainty for the LTE associated with each measurement parameter given in table 7 for a 95 % confidence level, shall apply as appropriate to the test cases described in the present document.

**Table 7: Measurement uncertainties**

Measured parameter	Measurement uncertainty
Radio Frequency above 1 MHz	$\pm 1$ part in $10^7$
EIRP spectral density within the operational frequency range(s)	$\pm 0,75$ dB
Unwanted radiated emissions	$\pm 6$ dB
Unwanted conducted emissions	$\pm 4$ dB

### 5.2.1.4.4 Methods of test for MES RF emissions according to the equipment type

Measurements shall be performed according to the equipment type as defined in table 8.

**Table 8: 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 (see note)	Radiated from complete MES, including its antenna, from 30 MHz to 12,75 GHz.
NOTE: Equipment with an active antenna shall be assumed to have no antenna port available.	

The methods of measurement for radiated emissions are described in clause 5.2.1.4.5.

The methods of measurement for conducted emissions are described in clause 5.2.1.4.6.

### 5.2.1.4.5 Procedures for measurement of radiated emissions

#### 5.2.1.4.5.1 General

Clause 5.2.1.4.5 contains methods for tests involving the measurement of a radiated field. This field may be radiated by an antenna and/or by the cabinet of the equipment itself.

It is recognized that for some parameters, alternative test methods may exist. It is the responsibility of the test laboratory to ensure that any alternative test method used yields results identical to those described in the present document.

#### 5.2.1.4.5.2 Test site

The standard test site shall be a calibrated open air test site, whose dimensions are appropriate to the frequency range of measurements according to the specification of CISPR 16-1-4 [5].

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 some cases operating on a test site may produce electromagnetic perturbation or, conversely, external radiation may disturb the measurement. For these reasons, and also in order to reduce the space required, or to perform tests under extreme environmental conditions, other arrangements may be used, such as:

- anechoic chamber;
- indoor test site.

In addition, it shall be verified that the test site shall be suitable with respect to ambient noise which shall be at least 6 dB lower than the lowest specification value being measured.

The methods of measurement described in this annex are based on an open air test site. If an anechoic chamber or an indoor test site are used, some changes may apply to the method of measurement. For each radiated measurement, the nature and the dimensions of the test arrangement used shall be recorded in the test report.

#### 5.2.1.4.5.3 Test set up for radiated emissions of the MES

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

For IE, EME and IME it shall be installed with a separation of approximately 0,5 m. Between the two equipment, the maximum length connection cable specified by the applicant 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 associated equipment, if required for normal 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 recommended by the applicant 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.

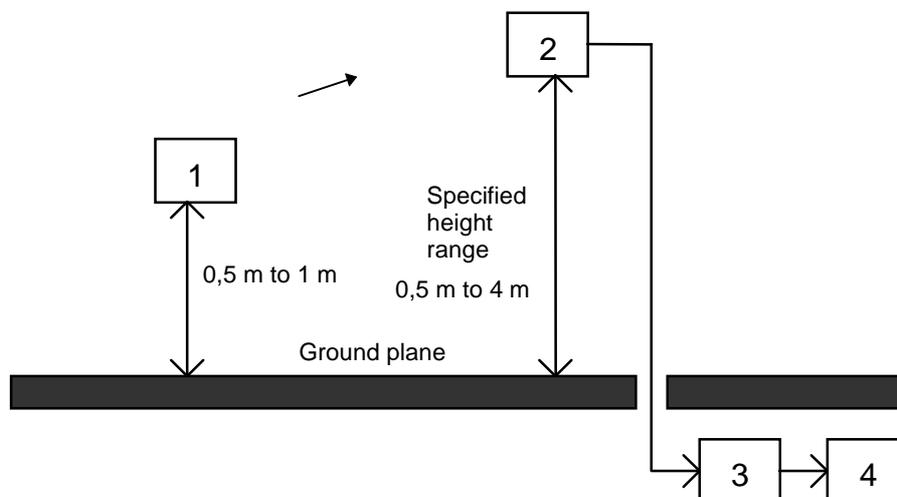
#### 5.2.1.4.5.4 Reference position of the MES

During radiated measurements, the MES is required to be oriented specifically in relation to the test antenna connected to the LTE. 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.

## 5.2.1.4.5.5 Measurement procedure for radiated emissions (peak)

## 5.2.1.4.5.5.1 Measurement procedure for peak radiated emissions of the MES



## Key:

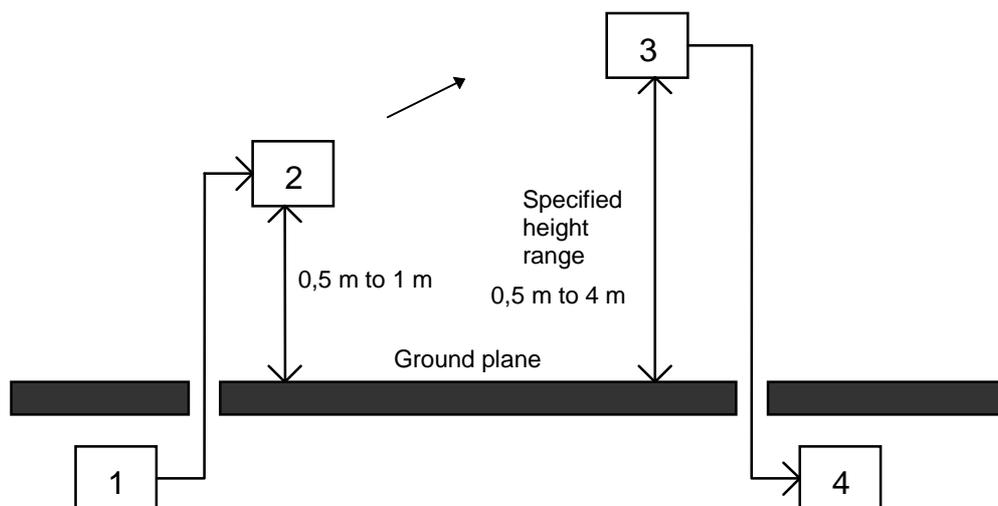
- 1) MES under test (with antenna);
- 2) Test antenna;
- 3) Input filter (if necessary);
- 4) Spectrum analyser.

**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 5.2.1.4.5.4.
  - 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.
  - Precautions may be required to ensure that the filter does not attenuate the harmonics of the carrier.
  - The test antenna and the entry filter shall be suitable for the measured frequency band, and replaced by other each time it will be necessary.
  - 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) Only the discrete signals having a level equal or greater than 6 dB below the specified limit shall be precisely 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 indoor 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.



Key:

- 1) Sinusoidal RF signal generator;
- 2) Substitution antenna;
- 3) Test antenna;
- 4) Spectrum analyser.

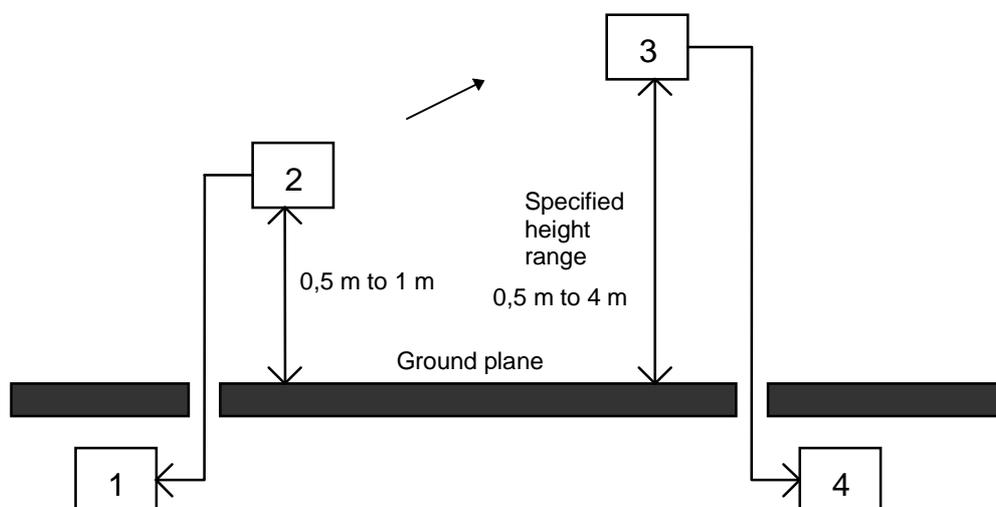
**Figure 4: Measurement arrangement No.2**

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 spectral 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 f) procedure is repeated with the other measurement bandwidths to cover the whole frequency range to be analysed.
- h) a) to g) shall be repeated with test antennas of the opposite polarization for the unwanted emission measurements.

### 5.2.1.4.5.5.2 Measurement procedure for peak radiated emissions of the cabinet

This method of measurement 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.



Key:

- 1) Test load;
- 2) MES under test (antenna port connected to the test load);
- 3) Test antenna;
- 4) Spectrum analyser.

**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 5.2.1.4.5.5.1.

The same method as in clause 5.2.1.4.5.5.1 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).

### 5.2.1.4.5.6 Measurement procedure for radiated emissions (average)

#### 5.2.1.4.5.6.1 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 5.2.1.4.5.4;
  - 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;
  - precautions may be required to ensure that the filter does not attenuate the harmonics of the carrier;
  - the test antenna and the entry filter shall be suitable for the measured frequency band, and replaced by other each time it will be necessary;
  - 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 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 f) procedure shall be repeated with the other measurement bandwidths to cover the whole frequency range to be analysed.
- h) a) to g) shall be repeated with test antennas of the opposite polarization for the unwanted emission measurements.

#### 5.2.1.4.5.6.2 Measurement procedure for average radiated emissions of the cabinet

This method of measurement 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 5.2.1.4.5.6.1.

The same method as in clause 5.2.1.4.5.6.1 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).

#### 5.2.1.4.6 Procedures for measurement of conducted emissions

##### 5.2.1.4.6.1 General

Clause 5.2.1.4.6 contains the procedure for conducted emission measurements.

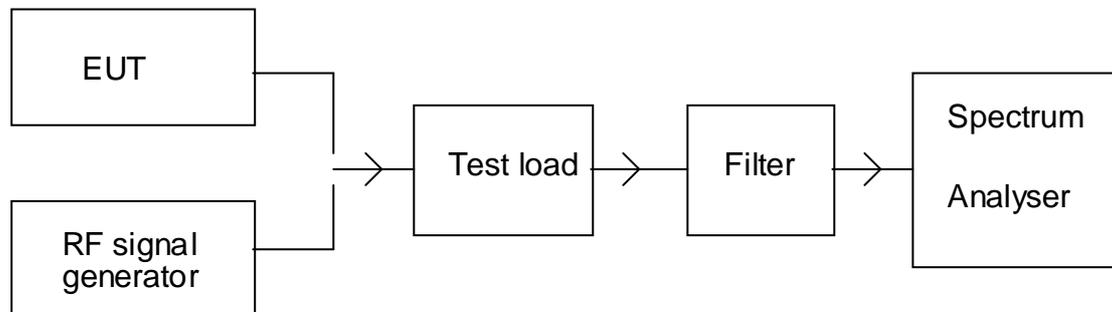
It is recognized that for some parameters, alternative test methods may exist. It is the responsibility of the test laboratory to ensure that any alternative test method used yields results identical to those described in the present document.

#### 5.2.1.4.6.2 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.

#### 5.2.1.4.6.3 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 eventually an appropriate filter to avoid overloading of 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 suitable for the measured frequency band, and replaced by another each time it will be necessary.

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

#### 5.2.1.4.6.4 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 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) 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 spectral 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(s) which are 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 declared gain at the spurious emission frequency to the power value read from the spectrum analyser.

#### 5.2.1.4.6.5 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 suitable value to correctly 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 should 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 may 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.

#### 5.2.1.4.7 Interpretation of the measurement results

The interpretation of the results for the measurements described in the present document shall be as follows:

- a) the measured value related to the corresponding limit shall be used to decide whether an equipment meets the minimum requirements of the present document;
- b) the actual measurement uncertainty of the test laboratory carrying out the measurement, for each particular measurement, shall be included in the test report;
- c) the values of the actual measurement uncertainty shall be, for each measurement, equal to or lower than the figures in clause 5.2.1.4.3.

#### 5.2.1.4.8 Test report

All results of the tests performed shall be recorded in a test report.

For each test, the test report shall also include the test conditions (status of the MES, frequency of operation), the measurement uncertainties and the environmental test conditions.

### 5.2.2 Unwanted emissions outside the band 1 626,5 MHz to 1 660,5 MHz and outside the band 1 668,0 MHz to 1 675,0 MHz (carrier-on state)

#### 5.2.2.1 Method of test

This test shall be carried out for the minimum and for the maximum MES transmit frequencies within each of the MES transmit sub-bands for which the MES is designed to operate, as specified by the applicant.

**NOTE:** For an MES capable of transmitting in both sub-band 1 or sub-band 2 as defined in table 1, this will require the minimum and maximum transmit frequencies in both sub-bands to be tested.

If the MES supports multiple transmission formats, each of the relevant transmission formats shall be tested at each frequency.

The transmit frequencies and the transmission formats 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 state) on one of the specified transmitting frequencies to be tested and in one of the specified transmission formats to be tested and shall be set to transmit at its maximum power for that transmit frequency and transmission format, by means of the STE or by another test facility provided by the applicant.

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 as specified in clause 5.2.1.4.2.2.

In the test equipment, the spectrum analyser noise floor shall be at least 6 dB below the appropriate limits given in either table 3 or table 3a as declared by the applicant.

The measurements are performed with the radiated or with the conducted method according to the cases defined in clause 5.2.1.4.4.

For measurements of radiated unwanted emissions, clause 5.2.1.4.5 applies.

For measurements of conducted unwanted emissions, clause 5.2.1.4.6 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 either table 3 or 3a as declared by the applicant;
- video bandwidth: at least three 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 in either table 3 or table 3a as declared by the applicant for peak measurement.

The results obtained shall be compared to the limits in clause 4.2.1.2 in order to prove compliance with the requirement.

### 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 either table 3 or 3a as declared by the applicant;
- video 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.

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 either table 3 or 3a as declared by the applicant for average measurement.

The results obtained shall be compared to the limits in clause 4.2.1.2 in order to prove compliance with the requirement.

#### 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 either table 3 or 3a as declared by the applicant.

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 either table 3 or table 3a as declared by the applicant.

#### 5.2.3 Unwanted emissions within the band 1 626,5 MHz to 1 660,5 MHz and the band 1 624,5 MHz to 1 626,5 MHz and 1 660,5 MHz to 1 662,5 MHz and within the band 1 668,0 MHz to 1 675,0 MHz and the band 1 666,0 MHz to 1 668,0 MHz and 1 675,0 MHz to 1 677,0 MHz (carrier-on state)

##### 5.2.3.1 Method of test

This test shall be carried out for the minimum and for the maximum MES transmit frequency within each of the MES transmit bands for which the MES is designed to operate, as specified by the applicant.

NOTE: For an MES capable of transmitting in both sub-band 1 or sub-band 2 as defined in table 1, this will require the minimum and maximum transmit frequencies in both sub-bands to be tested.

If the MES supports multiple transmission formats, each of the relevant transmission formats shall be tested at each frequency.

The transmit frequencies and the transmission formats 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 state) on one of the specified transmitting frequencies to be tested and in one of the specified transmission formats to be tested and shall be set to transmit at its maximum power for that transmit frequency and transmission format, by means of the STE or by another test facility provided by the applicant.

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 5.2.1.4.2.2.

In the test equipment, the spectrum analyser noise floor shall be at least 6 dB below the appropriate limits given in tables 3, 3a, 4a and 4b.

The measurements are performed with the radiated or with the conducted method according to the cases defined in clause 5.2.1.4.4.

For measurements of radiated unwanted emissions, clause 5.2.1.4.5 applies.

For measurements of conducted unwanted emissions, clause 5.2.1.4.6 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 3, 3a, 4a and 4b;
- video bandwidth: equal to the measurement bandwidth;
- averaging: yes;

- peak hold: no.

The measurement time should be such that the difference of the measured levels, averaged over subsequent measurement samples, is less than 1 dB.

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 an MES capable of transmitting in the sub-band 1 frequency band as defined in table 1, each of the transmit frequencies to be used for the test, measurements shall be made over the frequency ranges from 1 624,5 MHz to  $f_c - B_n / 2$  and from  $f_c + B_n / 2$  to 1 662,5 MHz,  $f_c - B_n / 2$  being the lower boundary frequency of the nominated bandwidth for the transmit frequency being tested, and  $f_c + B_n / 2$  being the upper boundary frequency of the nominated bandwidth for the transmit frequency being tested.

For an MES capable of transmitting in the sub-band 2 frequency band as defined in table 1, each of the transmit frequencies to be used for the test, measurements shall be made over the frequency ranges from 1 666,0 MHz to  $f_c - B_n / 2$  and from  $f_c + B_n / 2$  to 1 677,0 MHz,  $f_c - B_n / 2$  being the lower boundary frequency of the nominated bandwidth for the transmit frequency being tested, and  $f_c + B_n / 2$  being the upper boundary frequency of the nominated bandwidth for the transmit frequency being tested.

The results obtained shall be compared to the limits in clause 4.2.2.2 in order to prove compliance with the requirement.

### 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 3, 3a, 4a and 4b over the frequency range 1 624,5 MHz to 1 662,5 MHz and 1 666,0 MHz to 1 677,0 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 3, 3a 4a and 4b over the frequency range 1 624,5 MHz to 1 662,5 MHz and 1 666,0 MHz to 1 677,0 MHz.

## 5.2.4 Unwanted emissions in carrier-off state

### 5.2.4.1 Method of test

The MES shall be switched-on and set in the carrier-off state.

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 appropriate limits given in table 5.

The measurements are performed with the radiated or with the conducted method according to the cases defined in clause 5.2.1.4.4.

For measurements of radiated unwanted emissions, clause 5.2.1.4.5 applies.

For measurements of conducted unwanted emissions, clause 5.2.1.4.6 applies.

### 5.2.4.2 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 5;

- video 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.

The results obtained shall be compared to the limits in clause 4.2.3.2 in order to prove compliance with the requirement.

### 5.2.4.3 Test requirements

For measurements of radiated unwanted emissions of the MES, the measured values shall in no case exceed the limits given in table 5.

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 5.

## 5.2.5 MES Control and Monitoring Functions (CMF)

### 5.2.5.1 Self-monitoring functions/Processor monitoring

As it is considered impracticable to artificially induce processor faults in an MES, no test is given for the processor monitoring function.

### 5.2.5.2 Self-monitoring functions/Transmit frequency generation sub-system monitoring

As it is considered impracticable to artificially induce transmit frequency generation sub-system faults in an MES, no test is given for the transmit frequency generation sub-system monitoring function.

### 5.2.5.3 Network control authorization

#### 5.2.5.3.1 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.

#### 5.2.5.3.2 Test procedure

The MES shall be situated in an environment where receipt of the appropriate 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) the appropriate network control channel(s) shall be activated and a call shall be initiated using normal user operational procedures;
- e) the appropriate network control channel(s) shall then be deactivated;
- f) an attempt shall be made, using normal user operational procedures, to initiate a call;

- g) the appropriate network control channel(s) 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.

The results obtained shall be compared to the limits in clause 4.2.4.3 in order to prove compliance with the requirement.

### 5.2.5.3.3 Test requirements

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 state).

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

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

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

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

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

### 5.2.5.4 Network control reception

#### 5.2.5.4.1 Transmission disable/enable

##### 5.2.5.4.1.1 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 method of enabling the MES in steps (d) and (g) of the test procedure shall be declared by the manufacturer. The declared method shall conform to the requirements defined in clause 4.2.4.4.1.

The environmental test conditions are given in clause 5.1.

##### 5.2.5.4.1.2 Test procedure

The MES shall be situated in an environment where receipt of the appropriate network control channel(s) and where transmission of appropriate NCF commands is controlled by the test laboratory:

- a) the appropriate network control channel(s) shall be activated, the MES shall be powered-on, and a call shall be initiated using normal user operational procedures;
- b) the NCF shall transmit an appropriate transmission disable command to the MES;
- c) whilst the disable command applies, an attempt shall be made to initiate a call using normal user operational procedures;
- d) the MES shall be enabled by performing the procedure declared by the manufacturer and a call shall be initiated using normal user operational procedures;
- e) the MES shall be set to a carrier-off state, and an NCF 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) the MES shall be enabled by performing the procedure declared by the manufacturer and a call shall be initiated using normal user operational procedures.

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

The results obtained shall be compared to the limits in clause 4.2.4.4.1 in order to prove compliance with the requirement.

#### 5.2.5.4.1.3 Test requirements

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

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

During and after test procedure step c), only initial burst transmissions shall occur.

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

During and after test procedure steps e) and f), only initial burst transmissions shall occur.

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

Each initial burst transmission sequence shall have a total carrier-on time that is less than one second and the total carrier-on time for repeated initial bursts shall not exceed 1 % of the time.

#### 5.2.5.4.2 Transmit frequency control

##### 5.2.5.4.2.1 Method of test

The nominated bandwidth of the MES shall be monitored relative to the carrier frequency commanded, and relative to the operational frequency range(s) for the MES specified by the applicant.

The environmental test conditions are given in clause 5.1.

##### 5.2.5.4.2.2 Test procedure

For an MES capable of transmitting in the frequency band 1 626,5,0 MHz to 1 660,5 MHz. 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 specified by the applicant.

For an MES capable of transmitting in the frequency band 1 668,0 MHz to 1 675,0 MHz. 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 specified by the applicant.

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 NCF commands is controlled by the test laboratory:

- a) the appropriate network control channel(s) shall be activated and the MES powered-on;
- b) an appropriate NCF 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.

The results obtained shall be compared to the limits in clause 4.2.4.4.2 in order to prove compliance with the requirement.

#### 5.2.5.4.2.3 Test requirements

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

The entire nominated bandwidth for each transmit frequency tested shall be contained completely within the operational frequency range(s) specified by the applicant.

### 5.2.5.5 Fellow radio stations in a dual-mode or multimode terminal

#### 5.2.5.5.1 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 any of the fellow modes.

#### 5.2.5.5.2 Test procedure

The MES shall be placed in an environment where the receipt of network control channel(s) of all 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.

The results obtained shall be compared to the limits in clause 4.2.4.5.2 in order to prove compliance with the requirement.

#### 5.2.5.5.3 Test requirements

Throughout the test procedure, no transmission shall occur.

## 5.2.6 Equipment identity

### 5.2.6.1 Method of test

It is impracticable to test that each MES has a unique MES identification code (MIC) within its S-PCN, and that it is not possible for the user to alter the MIC using any normally accessible procedure. Consequently, no tests are given for these requirements.

The transmissions of the MES in response to an NCF 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.

### 5.2.6.2 Test procedure

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

- a) the appropriate network control channel(s) shall be activated and the MES powered-on;
- b) an appropriate NCF control message shall be sent, commanding the MES to transmit its MES identification code;
- c) the message sent by the MES shall be analysed.

The results obtained shall be compared to the limits in clause 4.2.5.2 in order to prove compliance with the requirement.

### 5.2.6.3 Test requirements

The MES identification code in the message sent in clause 5.2.6.2 step c) shall be verified against that supplied by the applicant for the MES.

## 5.2.7 Receiver Adjacent Channel Selectivity

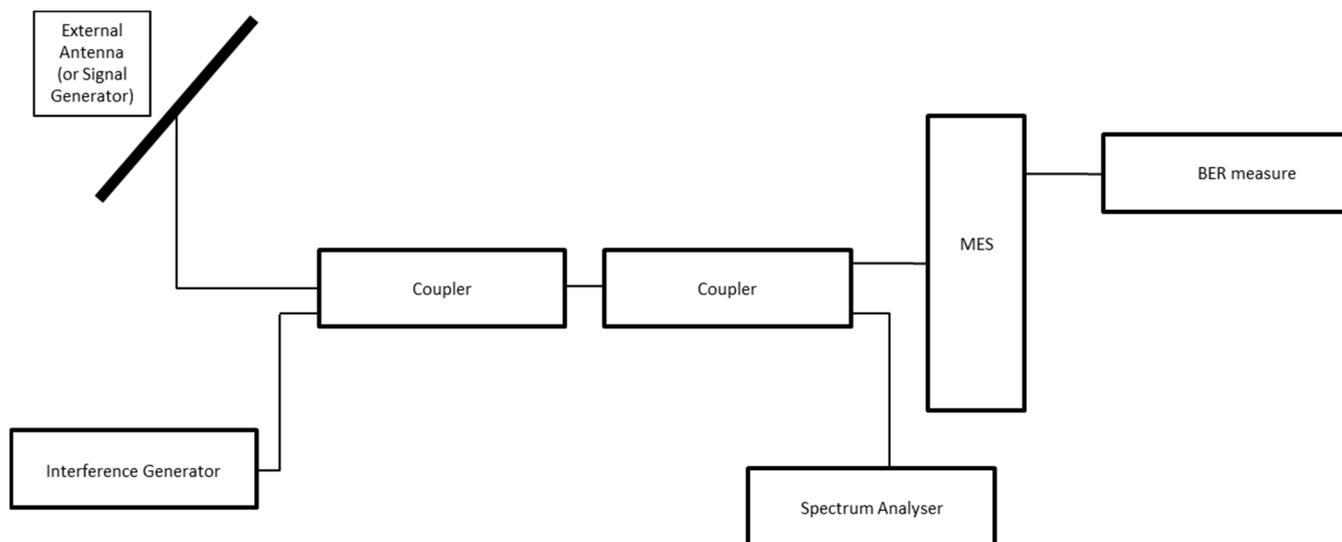
### 5.2.7.1 General

If the EUT is a MES that has been modified by the applicant for these tests then full documentation of such modification(s) shall be provided to prove that the modification(s) will simulate the required test condition.

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

### 5.2.7.2 Test arrangement

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



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

### 5.2.7.3 Test Procedures

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 6 in clause 4.2.7.2.
- 4) Add the interference signal and measure the SNR of the receiver.
- 5) The SNR achieved in step 3 shall not exceed 0,5 dB degradation compared to the SNR measured in step 2.

## 5.2.8 Receiver Blocking Characteristics

### 5.2.8.1 General

If the EUT is a MES that has been modified by the applicant for these tests then full documentation of such modification(s) shall be provided to prove that the modification(s) will simulate the required test condition.

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

### 5.2.8.2 Test arrangement

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

### 5.2.8.3 Test procedures

- 1) The wanted signal power is adjusted such that the SNR (at the receiver input) is set to the reference level plus 2 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) Generate CW with the parameters as shown in table 6a in clause 4.2.8.2.
- 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 (normative): 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.3] 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.5].

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**

Harmonised Standard ETSI EN 301 681				
The following requirements are relevant to the presumption of conformity under the article 3.2 of Directive 2014/53/EU [i.5]				
Requirement			Requirement Conditionality	
No	Description	Reference: Clause No	U/C	Condition
1	Unwanted emissions outside the band 1 626,5 MHz to 1 660,5 MHz and outside the band 1 668,0 MHz to 1 675,0 MHz (carrier-on state)	4.2.1	U	
2	Unwanted emissions within the band 1 626,5 MHz to 1 660,5 MHz and the band 1 660,5 MHz to 1 662,5 MHz and within the bands 1 666,0 MHz to 1 668,0 MHz, 1 668,0 MHz to 1 675,0 MHz and 1 675,0 MHz to 1 677,0 MHz (carrier-on state)	4.2.2	U	
3	Unwanted emissions in carrier-off state	4.2.3	U	
4	Processor monitoring	4.2.4.1	U	
5	Transmit frequency generation subsystem monitoring	4.2.4.2	U	
6	Network control authorization	4.2.4.3	U	
7	Transmission disable/ enable	4.2.4.4.1	U	
8	Transmit frequency control	4.2.4.4.2	U	
9	Fellow radio stations in a dual-mode or multimode terminal	4.2.4.5	U	
10	Equipment identity	4.2.5	U	
11	Protection of the radio astronomy service operation in the band 1 660 MHz to 1 660,5 MHz and in the band 1 668 MHz to 1 670 MHz	4.2.6	U	
12	Receiver Adjacent Channel Selectivity	4.2.7	U	
13	Receiver Blocking Characteristics	4.2.8	U	

### Key to columns:

#### Requirement:

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

**Description** A textual reference to the requirement.

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

**Requirement Conditionality:**

<b>U/C</b>	Indicates whether the requirement shall be unconditionally applicable (U) or is conditional upon the manufacturer's claimed functionality of the equipment (C).
<b>Condition</b>	Explains the conditions when the requirement shall or shall not be 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.

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## Annex B (informative): Bibliography

- ETSI EN 301 489-20: "Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard. For radio equipment and service; Part 20: Specific conditions for Mobile Earth Stations (MES) used in the Mobile Satellite Services (MSS)".
- CENELEC EN 55022: "Limits and methods of measurements of radio interferers characteristics of information technology equipment".
- IEC 60068-2-1: "Environmental testing - Part 2: Tests. Tests A: Cold".
- IEC 60068-2-2: "Environmental testing - Part 2: Tests. Tests B: Dry heat".
- IEC 60068-2-64: "Environmental testing - Part 2: Test methods - Test Fh: Vibration, broad-band random (digital control) and guidance".
- Construction of an Anechoic Chamber: Technical Report ZVEI AK-R 90/20.
- Recommendation ITU-R M.1480: "Essential technical requirements of mobile earth stations of geostationary mobile-satellite systems that are implementing the GMPCS-Memorandum of Understanding arrangements in parts of the band 1 - 3 GHz".
- Directive 1999/5/EC of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity (R&TTE Directive).
- Directive 98/34/EC of the European Parliament and of the Council of 22 June 1998 laying down a procedure for the provision of information in the field of technical standards and regulations.
- Directive 98/48/EC of the European Parliament and of the Council of 20 July 1998 amending Directive 98/34/EC laying down a procedure for the provision of information in the field of technical standards and regulations.
- ETSI EN 301 682: "Satellite Personal Communications Networks (S-PCN); Network Control Facilities (NCF) for Mobile Earth Stations (MESs), including handheld earth stations, for S-PCN in the 1,5/1,6 GHz bands, providing voice and/or data communications under the Mobile Satellite Service (MSS)".

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## History

<b>Document history</b>		
V1.2.1	January 2001	Publication
V1.3.2	January 2003	Publication
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V2.1.0	February 2016	EN Approval Procedure AP 20160512: 2016-02-12 to 2016-05-12
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