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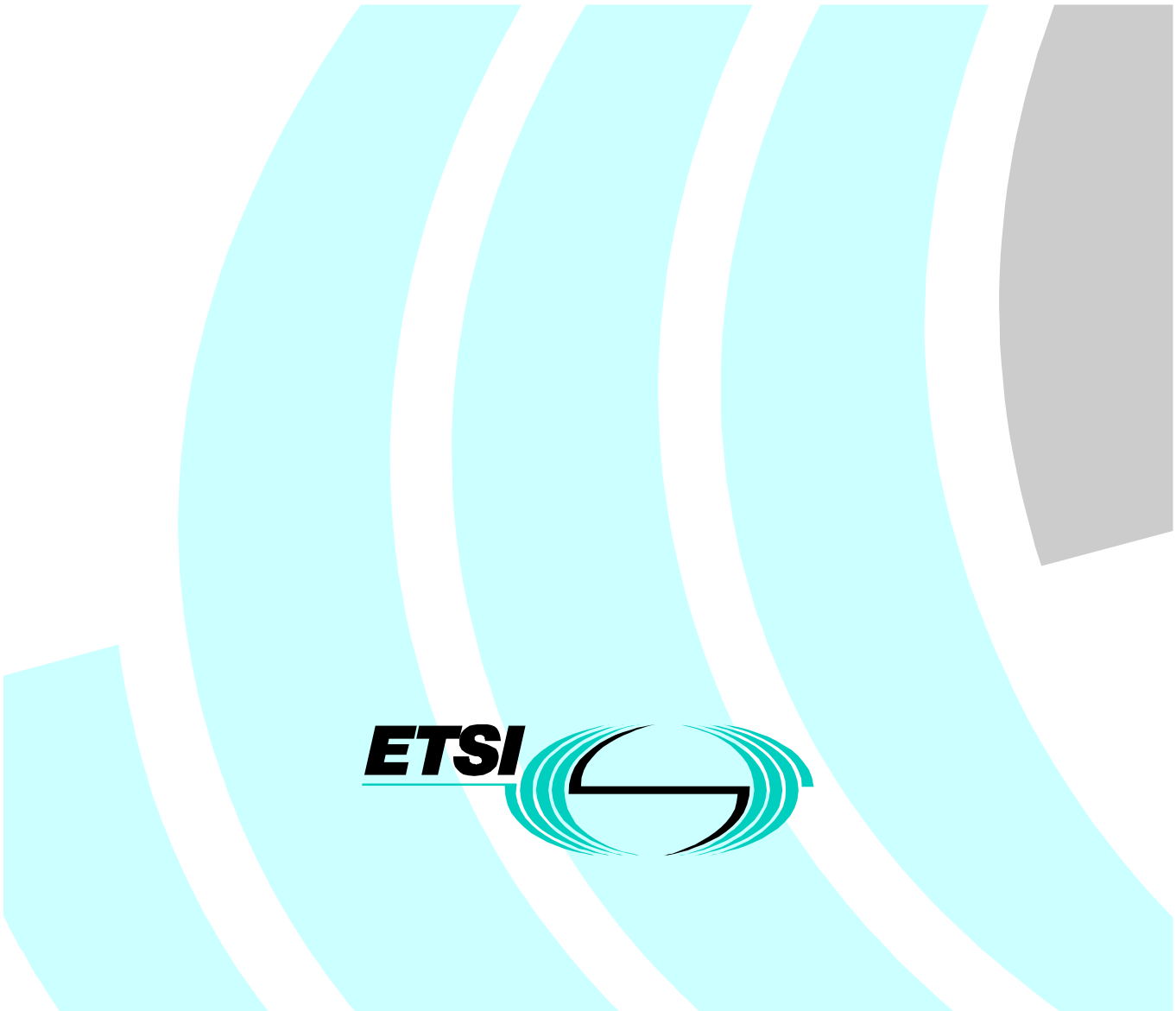
Candidate Harmonized European Standard (Telecommunications series)

Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) for Mobile Earth Stations (MES) used within Satellite Personal Communications Networks (S-PCN) operating in the 1,5/1,6/2,4 GHz and 2 GHz frequency bands



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Contents

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Foreword

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

The present document is based upon the Generic Standards EN 50081-1 [3] and EN 50082-1 [4].

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

The present document is intended to become a Harmonized Standard, the reference of which will be published in the Official Journal of the European Communities referencing the Council Directive on the approximation of the laws of the Member States relating to electromagnetic compatibility ("the EMC Directive") (89/336/EEC [1] as amended).

Technical specifications relevant to the EMC Directive are given in annex A.

For equipment which can be connected to the AC mains supply, EN 61000-3-2 [15] and EN 61000-3-3 [16] also apply where appropriate from 2001-01-01.

National transposition dates	
Date of adoption of this EN:	24 September 1999
Date of latest announcement of this EN (doa):	31 December 1999
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	30 June 2000
Date of withdrawal of any conflicting National Standard (dow):	31 December 2002

1 Scope

The present document covers the assessment of Mobile Earth Stations (MES) used within Satellite Personal Communications Networks (S-PCN), and ancillary equipment in respect of ElectroMagnetic Compatibility (EMC).

Technical specifications related to the antenna port and emissions from the enclosure port of the equipment are not included in the present document. Such specific technical specifications are found in the relevant product EN.

The present document specifies the applicable EMC tests, the test methods, the limits, and the minimum performance criteria for digital radio equipment as defined in annex B and for the associated ancillary equipment.

The environment classification used in the present document refers to the environment classification used in the Generic Standards EN 50081-1 [3] and EN 50082-1 [4], except the vehicular environment class which refers to ISO 7637-1 [13].

The EMC requirements have been selected to ensure an adequate level of compatibility for apparatus at residential, commercial, light industrial and vehicular environments. The levels, however, do not cover extreme cases which may occur in any location but with a low probability of occurrence.

The present document may not cover those cases where a potential source of interference, which is producing individually repeated transient phenomena, or a continuous phenomenon, is permanently present, e.g. a radar or broadcast site in the near vicinity. In such a case it may be necessary to use special protection applied to either the source of interference, or the interfered part, or both.

For a multimode radio station, the present document only applies to the radio station when operated in the S-PCN mode.

Compliance of S-PCN Mobile Earth Stations (MES) radio equipment to the requirements of the present document does not signify compliance to any requirements related to the use of the equipment (i.e. licensing requirements).

Compliance to the present document does not signify compliance to any safety requirements. However, it is the responsibility of the assessor of the equipment that any observations regarding apparatus becoming dangerous or unsafe as a result of the application of the tests of the present document, should be recorded in the test report.

The present document is based on the considerations and guidance given in ETR 238 [12].

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

[1] 89/336/EEC: "Council Directive on the approximation of the laws of the Member States relating to electromagnetic compatibility".

[2] CISPR 16-1: "Specification for radio disturbance and immunity measuring apparatus and methods; Part 1: Radio disturbance and immunity measuring apparatus".

[3] EN 50081-1 (1992): "Electromagnetic compatibility; Generic emission standard; Part 1: Residential, commercial and light industry".

[4] EN 50082-1 (1992): "Electromagnetic compatibility; Generic immunity standard; Part 1: Residential, commercial and light industry".

[5] EN 55022 (1998): "Limits and methods of measurement of radio disturbance characteristics of information technology equipment".

[6] EN 61000-4-2: "Electromagnetic compatibility (EMC); Part 4: Testing and measurement techniques; Section 2: Electrostatic discharge immunity test".

[7] EN 61000-4-3 (modified): "Electromagnetic compatibility (EMC); Part 4: Testing and measurement techniques; Section 3: Radiated, radio-frequency, electromagnetic field immunity test".

[8] EN 61000-4-4: "Electromagnetic compatibility (EMC); Part 4: Testing and measurement techniques; Section 4: Electrical fast transient/burst immunity test".

[9] EN 61000-4-5: "Electromagnetic compatibility (EMC); Part 4: Testing and measurement techniques; Section 5: Surge immunity test".

[10] EN 61000-4-6: "Electromagnetic compatibility (EMC); Part 4: Testing and measurement techniques; Section 6: Immunity to conducted disturbances, induced by radio-frequency fields".

[11] EN 61000-4-11: "Electromagnetic compatibility (EMC); Part 4: Testing and measurement techniques; Section 11: Voltage dips, short interruptions and voltage variations immunity tests".

[12] ETR 238: "ETSI/CENELEC standardization programme for the development of Harmonized Standards related to Electro-Magnetic Compatibility (EMC) in the field of telecommunications".

[13] ISO 7637-1 (1990): "Road vehicles; Electrical disturbance by conduction and coupling; Part 1: Passenger cars and light commercial vehicles with nominal 12 V supply voltage; Electrical transient conduction along supply lines only".

[14] ISO 7637-2 (1990): "Road vehicles; Electrical disturbance by conduction and coupling; Part 2: Commercial vehicles with nominal 24 V supply voltage; Electrical transient conduction along supply lines only".

[15] EN 61000-3-2 (1995): "Electromagnetic compatibility (EMC) - Part 3: Limits - Section 2: Limits for harmonic current emissions (equipment input current up to and including 16 A per phase)".

[16] EN 61000-3-3 (1995): "Electromagnetic compatibility (EMC) - Part 3: Limits - Section 3: Limitation of voltage fluctuations and flicker in low-voltage supply systems for equipment with rated current up to and including 16 A".

3 Definitions and abbreviations

3.1 Definitions

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

ancillary equipment: equipment (apparatus), where used in connection with a MES is considered as an ancillary equipment (apparatus) if:

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

applicant: party seeking an approval, or to place an S-PCN MES on the European market, i.e. the manufacturer of the equipment, or his authorized representative, or an equipment supplier to the European market.

carrier-on state (allocated a channel): MES is in this state when it is transmitting a signal in a continuous or a non-continuous mode.

carrier-off state (idle mode): MES is in this state when it is powered-on but not transmitting a signal, i.e. not in a carrier-on state.

enclosure port: physical boundary of the apparatus through which an electromagnetic field may radiate or impinge (see figure 1).

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

Installable Equipment (IE), Internally Mounted Equipment (IME) and Externally Mounted Equipment (EME): Installable Equipment (IE) is an equipment which is intended to be installed in a vehicle. An IE may consist of one or several modules. The IE is composed of modules intended to be externally mounted and declared by the applicant as Externally Mounted Equipment (EME). The remaining module(s) are defined as Internally Mounted Equipment (IME).

integral antenna: antenna which may not be removed during the tests, according to the applicant statement.

multimode radio station: indicates equipment that accommodates radio stations of different radio systems.

port: particular interface of the specified equipment (apparatus) with the electromagnetic environment (see figure 1).

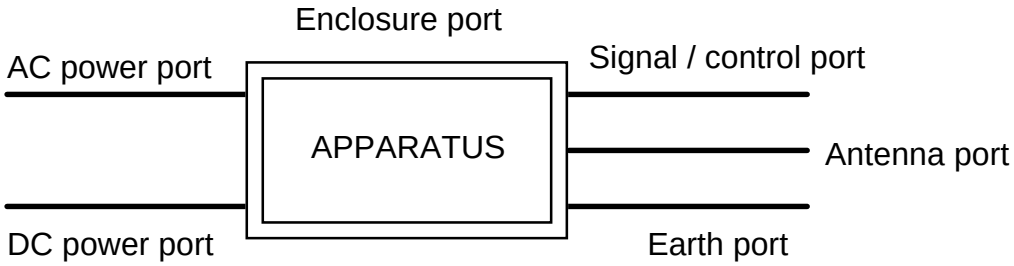

Figure 1: Examples of ports

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

NOTE: More than one of the equipment classifications can apply to certain equipment, as described in subclause 5.2, dependent upon the applicant's declaration of normal intended use.

Removable antenna: antenna which may be removed for the test according to the applicant statement.

transmission disabled state: MES is in this state when it is not authorized to transmit by the Network Control Facilities (NCF).

12V DC power input port: power input port on a V-MES designed for connection to a nominal 12V main vehicle battery.

24V DC power input port: power input port on a V-MES designed for connection to a nominal 24V main vehicle battery.

3.2 Abbreviations

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

BER	Bit Error Ratio
CP	performance criteria for Continuous Phenomena
EMC	ElectroMagnetic Compatibility
EME	Externally Mounted Equipment
EUT	Equipment Under Test
F-MES	Fixed MES
IE	Installable Equipment
IME	Internally Mounted Equipment
LISN	Line Impedance Stabilizing Network
MES	Mobile Earth Station
NCF	Network Control Facilities
PE	Portable Equipment
PEP	Peak Envelope Power
P-MES	Portable MES
QTMA	Quality of Transmission Measurement Apparatus
RF	Radio Frequency
rms	root mean square
S-PCN	Satellite Personal Communications Network
STE	Special Test Equipment
TP	performance criteria for Transient Phenomena
V-MES	Vehicle mounted MES

4 General test conditions

4.1 Test conditions

For MESs with ancillary equipment and/or various ports, the number of test configurations shall be determined. The assessment shall include sufficient representative configurations of the MES to adequately exercise the equipment. These configurations shall be recorded in the test report.

In the following clauses, the Equipment Under Test (EUT) is the MES with the selected configuration of ancillary equipment.

The equipment shall be tested under conditions which are within the applicant's declared range of humidity, temperature, and supply voltage.

The EUT operational frequencies used during the test, shall be recorded in the test report.

The test conditions shall be recorded in the test report.

The test configuration shall be as close to normal intended use as possible, and shall be recorded in the test report.

For testing and if physically separated from the MES, any voltage converter shall form part of the EUT.

Whenever the Equipment Under Test (EUT) is provided with an integral antenna, the EUT shall be tested with the antenna fitted in a manner typical of normal intended use.

For MES for which connection to a host equipment is necessary to offer additional functionality, the test configuration shall be as defined in subclause 5.4.

4.2 Arrangements for tests

In order to measure the system emission and electromagnetic immunity under operational conditions, proper arrangements shall be provided (by the applicant), e.g.:

a) A Special Test Equipment (STE) to put the MES terminal in its normal operating mode, and providing the MES with a receive signal to emulate the operational conditions of reception. This equipment shall control the EUT, when it is capable of transmission, so that it switches between the transmission disabled, carrier-on and carrier-off states. This Special Test Equipment may also be used to achieve loop back mode operation.

b) A specific Quality of Transmission Measurement Apparatus (QTMA).

EXAMPLE: The quality of transmission can concern:

- the audio signal;
- the BER;
- the message throughput;
- the continuity of the communication link; or
- a combination of them.

For the measurement of the quality of transmission, a communications link shall be established and the wanted input signal shall be applied to the Radio Frequency (RF) input of the receiver. Signal level adjustment may be performed by adjustment of the test transmitter output level such that the received signal level is as close to the normal operation signal level as possible. This signal level should be sufficient to avoid the broad band noise from the power amplifiers generating the EMC disturbance from influencing the measurement.

Adequate measures shall be taken to avoid the effects of the unwanted signal on the measuring equipment.

The Special Test Equipment (STE), the QTMA and the source of the wanted input signal shall be located outside the test environment. Adequate measures shall be taken to protect them from the effects of all the radiated fields within the test environment.

For the quality of transmission measurement the MES may be put in a specific mode for that test where the received data are looped back to the transmitter.

4.3 RF connection of test signals

Where the equipment incorporates an external antenna connector, and when agreed by the applicant the antenna shall be removed and the wanted signal to establish communications shall be delivered through that connector by a coaxial cable. Adequate measures shall be taken to minimize the effect of unwanted currents on the external conductor of the coaxial cable at the point of entry to the equipment. Adequate measures shall also be taken to avoid the effect of the unwanted signal on the measuring equipment.

Where the equipment incorporates an external antenna connector, the applicant may consider it as an integral antenna for the purpose of testing.

The test system shall be located outside of the test environment.

Where the equipment does not incorporate an external RF connector, the wanted signal to establish communications shall be delivered from the equipment to an antenna located within the test environment. Adequate measures shall be taken to protect the measuring equipment from the effect of all the radiated fields within the test environment.

5 Performance assessment

5.1 General information to be provided by the applicant

The manufacturer shall, at the time of submission of the equipment for test, declare comprehensively the intended use of the equipment, and provide full and complete documentation necessary for user operation, testing and evaluation purposes. The present documentation shall include, but need not be limited to:

- the equipment classification(s);
- the ranges of the operational parameters, e.g. the power delivered to the antenna, the frequency ranges, the operational frequencies;
- an exhaustive list of ports, classified as either power or signal/control. Power ports shall further be classified as AC or DC power;
- the ancillary equipment and/or host equipment to be combined with the MES for testing, if applicable;
- the user-control functions that are required for normal operation;
- the method and criteria to be used to assess the quality of transmission.

This information shall be in accordance with the documentation and the information leaflet accompanying the equipment and shall be recorded in the test report.

5.2 Equipment classification

The MES shall be classified in one or a combination of the following classes:

- as Vehicle mounted MES (V-MES) if declared as capable of being powered by a vehicle battery;
- as Portable MES (P-MES) if declared as capable of being powered by a stand alone battery;
- as Fixed MES (F-MES) if declared as capable of being powered either by DC or AC mains.

A V-MES is an Installable Equipment (IE); a P-MES is a Portable Equipment (PE).

5.3 Ancillary equipment

At the applicants discretion an ancillary equipment may be:

- declared compliant separately from a MES to all the applicable immunity emissions clauses of the present document;
- declared compliant to an appropriate harmonized EMC standard, for the corresponding environment;
- tested with it connected to an MES, in which case compliance shall be demonstrated to the appropriate clauses of the present document.

5.4 MES connected to host equipment

For MES parts for which connection to or integration with a host equipment is necessary in order to offer additional functionality, two alternative approaches are permitted. The applicant shall declare which alternative shall be used.

5.4.1 Alternative A: combined equipment

A combination of a MES and a specific type of host equipment is 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 equipments where the latter are substantially similar, in particular such that host models are unlikely to significantly influence the intrinsic immunity and unwanted emissions of the MES.

Where more than one such combination is intended and host equipments are not substantially similar, one combination shall be tested against all requirements of the present document; all other combinations shall be tested separately for emissions only (see clause 8).

5.4.2 Alternative B: use of a test jig

Where the MES is intended for use with a variety of host equipments, the applicant shall supply a suitable test jig that is representative of the range of host equipments in which the device is intended to be used. 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. Measurements shall be made to all requirements of the present document.

The test jig shall be designed such that alteration of the MES's intrinsic immunity and unwanted emissions is minimized.

5.5 Equipment configuration(s)

For transmitters, the EUT shall be operated at its maximum rated RF output Peak Envelope Power (PEP), or at a level not less than -6 dB relative to that power level in the event of declared thermal limitations. The transmitter shall be modulated with a test signal which represents normal operation as specified by the applicant. A communication link shall be established at the start of the test and be maintained throughout the test. A suggested test configuration is shown in figure 2.

For the immunity tests of receivers, the wanted input signal, coupled to the receiver, shall be modulated with a test signal specified by the applicant which represents normal operation. A communication link shall be established at the start of the test and be maintained throughout the test.

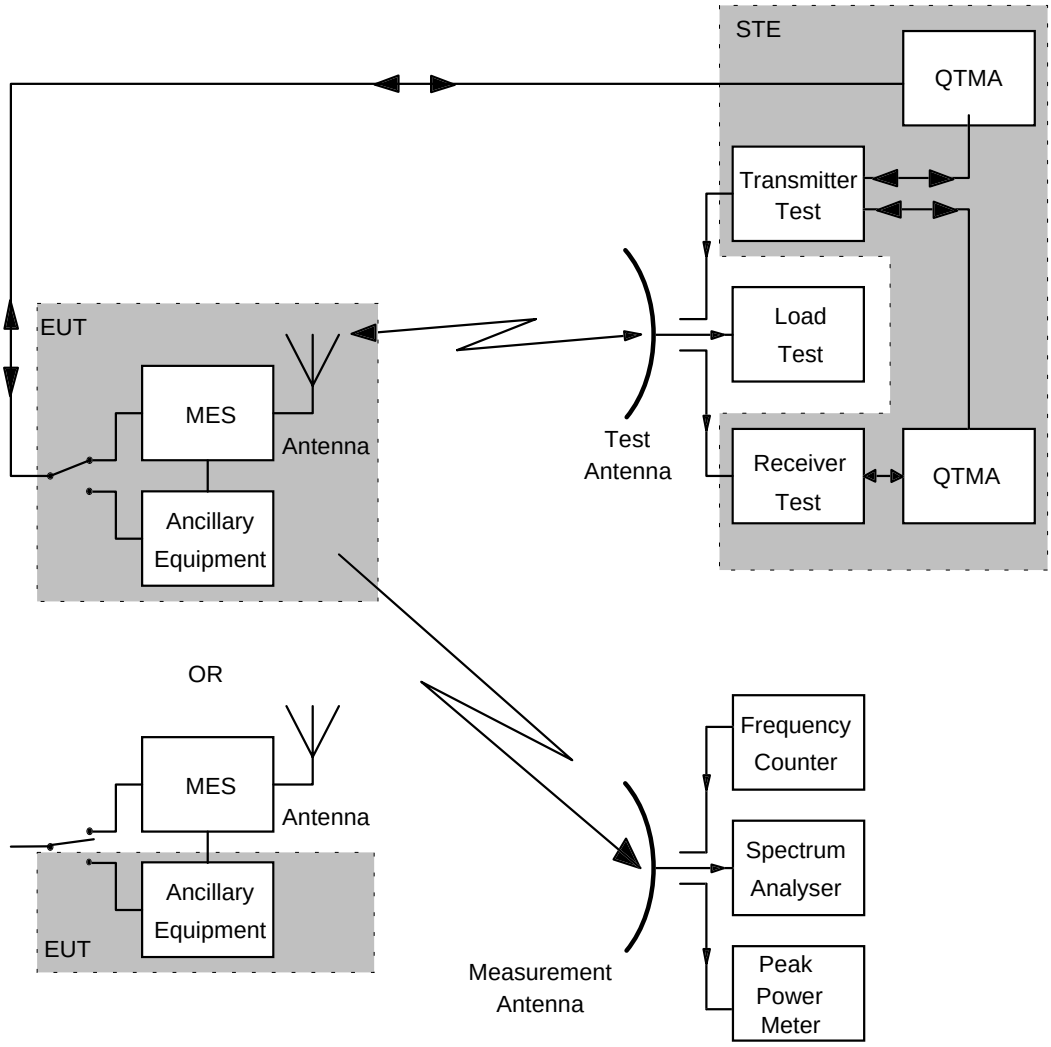

Figure 2: Suggested test configuration

6 Performance criteria

6.1 General

The establishment of a communications link at the start of the test, the maintenance of the communications link and the assessment of the recovered signal information is used as the performance criteria to ensure that the essential functions of the EUT are evaluated during and after the test.

The equipment shall meet the minimum performance criteria as specified in subclauses 6.2 and 6.3.

6.2 Performance criteria for Continuous Phenomena (CP)

The following procedures shall apply:

- during each individual exposure in the test sequence it shall be verified by the QTMA supplied by the applicant that the communications link is maintained, and that the quality of transmission observed is no worse than that declared by the applicant (subclause 5.1);
- at the conclusion of the test:
  - the EUT shall operate as intended with no loss of user control functions or stored data, as declared by the applicant;
  - the communications link has been maintained during the test; and
  - the quality of transmission observed is no worse than that declared by the applicant (subclause 5.1);
- under no circumstances shall the transmitter operate unintentionally.

6.3 Performance criteria for Transient Phenomena (TP)

The following procedures shall apply:

- after each exposure in the test sequence it shall be verified by the QTMA supplied by the applicant, that the communications link is maintained, and that the quality of transmission observed is no worse than that declared by the applicant (subclause 5.1);
- at the conclusion of the total test comprising a series of individual exposures it shall be verified that:
  - the EUT operates as intended with no loss of user control functions or stored data, as declared by the applicant;
  - the communications link has been maintained during the test; and
  - the quality of transmission observed is no worse than that declared by the applicant (subclause 5.1);
- under no circumstances shall the transmitter operate unintentionally.

7 Applicability overview tables

7.1 Emission

Table 1: Emission test requirement

Application port	EUT test requirement reference subclause in the present document			Reference document
	F-MES	V-MES	P-MES	
Enclosure/ancillary	8.2	8.2	8.2	EN 55022 [5]
DC power in/out	8.3	8.3	8.3 if applicable	EN 55022 [5] CISPR 16-1 [2]
AC mains	8.4	n.a.	n.a.	EN 55022 [5]

7.2 Immunity

Table 2: Immunity test requirement

Phenomena	Application port	EUT test requirement reference subclause in the present document			Reference document
		F-MES	V-MES	P-MES	
RF electromagnetic field (80 MHz to 1 000 MHz)	Enclosure	9.2	9.2	9.2	EN 61000-4-3 [7]
Electrostatic discharge	Enclosure	9.3	9.3	9.3	EN 61000-4-2 [6]
Fast transients common mode	Signal and control ports, DC and AC power input ports	9.4	9.4 if applicable	9.4 if applicable	EN 61000-4-4 [8]
RF common mode (0,15 MHz to 80 MHz)	Signal and control ports, DC and AC power input ports	9.5	9.5	9.5 if applicable	EN 61000-4-6 [10]
Transients and surges, vehicular environment	DC power input ports	n.a.	9.6	n.a.	ISO 7637-1 [13] and ISO 7637-2 [14]
Voltage dips and interruptions	AC mains power input ports	9.7	n.a.	n.a.	EN 61000-4-11 [11]
Surges, common and differential mode	AC mains power input ports	9.8	n.a.	n.a.	EN 61000-4-5 [9]
NOTE: n.a.: not applicable.					

8 Test methods and limits for emission tests of EUT

8.1 Test configuration

This subclause defines the requirements for test configurations described in the following subclauses. The requirements are as follows:

- the measurement shall be made in the operational mode producing the largest emission in the frequency band being investigated consistent with normal applications;
- the equipment shall be configured in a manner which is representative of normal/typical operation, where practical;
- an attempt shall be made to maximize the detected radiated emission, for example by moving the cables of the equipment;
- for MES equipment parts for which connection to a host equipment is necessary to offer functionality, the applicant shall select which of the alternative performance assessment configurations described in subclause 5.4 shall be used;
- the configuration and mode of operation during measurements shall be precisely noted in the test report;
- if the equipment has a large number of ports, then a sufficient number of them shall be selected to simulate actual operation conditions and to ensure that all the different types of termination are covered;
- ports, which in normal operation are connected to ancillary or other equipment through interconnecting cables, shall be connected to such equipment via a representative interconnecting cable, or to a representative termination to simulate the input/output characteristics of the ancillary or other equipment via a representative piece of interconnecting cable. RF input/output ports shall be correctly terminated;
- the tests shall be carried out at a point within the specified operating environmental range and at the rated supply voltage for the equipment.

8.2 Ancillary equipment enclosure

This test is applicable to ancillary equipment not integrated into a MES.

This test shall be performed on a representative configuration of the ancillary equipment intended to be measurement in a stand-alone basis.

NOTE: For measurement of unwanted emissions from the enclosure port, combinations of ancillary equipment and the MES see clause 1, Scope, paragraph 2.

8.2.1 Purpose

This test assesses the ability of the ancillary equipment to limit any radiated emission from the enclosure.

8.2.2 Test method

The test method shall be in accordance with EN 55022 [5].

8.2.3 Test limit

In accordance with EN 55022 [5], the emissions levels shall not exceed the limits given in table 3.

Table 3: Limits of radiated field strength at a test distance of 10 m

Frequency range	Limit (quasi-peak)
30 MHz - 230 MHz	30 dBµV/m
> 230 MHz - 1 000 MHz	37 dBµV/m

8.3 DC power input/output port

This test is applicable if the total cable length from the EUT to the DC power source may be longer than 3 m.

This test shall be performed on a representative configuration of the radio equipment or a representative configuration of the combination of radio and ancillary equipment.

In the case of DC output ports, the ports shall be connected via a LISN to a load drawing the rated current of the source.

8.3.1 Purpose

This test assesses the ability of the EUT to limit its internal noise from being present on the DC power input/output ports.

8.3.2 Test method

The test method shall be in accordance with EN 55022 [5] and the Line Impedance Stabilizing Networks (LISN) shall be connected to a DC power source.

A measuring receiver shall be connected to each LISN measurement port in turn and the conducted emission levels recorded. The LISN measurement ports not being used for measurement shall be terminated with a 50 Ω load.

The equipment shall be installed with a ground plane as defined in EN 55022 [5]. The reference earth point of the LISNs shall be connected to the reference ground plane with a conductor as short as possible.

8.3.3 Test limit

The conducted emissions from the EUT at the DC port shall not exceed the average limits and the quasi-peak limits given in table 4 when using, respectively, an average detector receiver and a quasi-peak detector receiver and measured in accordance with the method described in subclause 8.3.2.

If, in a frequency range, the average limit is not exceeded when using a quasi-peak detector, the equipment shall be deemed to be not exceeding both limits, and measurement with the average detector receiver is unnecessary, within this frequency range.

The EUT shall meet the limits in accordance with EN 55022 [5] (see table 4).

Table 4: Limits of conducted emissions at the DC power port

Frequency range	Quasi-peak	Average
0,15 MHz to 0,5 MHz	66 dBµV to 56 dBµV	56 dBµV to 46 dBµV
> 0,5 MHz to 5 MHz	56 dBµV	46 dBµV
> 5 MHz to 30 MHz	60 dBµV	50 dBµV
NOTE: The limit decreases linearly with the logarithm of frequency in the range 0,15 MHz to 0,50 MHz.		

8.4 AC mains power input/output port

This test is applicable to the complete EUT.

This test is not applicable to AC output ports which are connected directly (or via a switch or circuit breaker) to the AC input port.

8.4.1 Purpose

This test assesses the ability of the EUT to limit its internal noise from being present on the AC mains power input/output ports.

8.4.2 Test method

The test method shall be in accordance with EN 55022 [5].

8.4.3 Test limit

The conducted emissions from the EUT at the AC port shall not exceed the average limits and the quasi-peak limits given in table 5 when using respectively an average detector receiver and a quasi-peak detector receiver as specified in subclause 8.4.2.

If, in a frequency range, the average limit is not exceeded when using a quasi-peak detector, the equipment shall be deemed to be not exceeding both limits, and measurement with the average detector receiver is unnecessary, within this frequency range.

The EUT shall meet the limits in accordance with EN 55022 [5] (see table 5).

Table 5: Limits of conducted emissions at the AC mains port

Frequency range	Quasi-peak	Average
0,15 MHz to 0,5 MHz	66 dBµV to 56 dBµV	56 dBµV to 46 dBµV
> 0,5 MHz to 5 MHz	56 dBµV	46 dBµV
> 5 MHz to 30 MHz	60 dBµV	50 dBµV
NOTE: The limit decreases linearly with the logarithm of frequency in the range 0,15 MHz to 0,5 MHz.		

9 Test methods and levels for immunity tests for EUT

9.1 Test configuration

The requirements for test configurations are as follows:

- if the equipment is part of a system, or can be connected to ancillary equipment, then it shall be acceptable to test the equipment while connected to the minimum configuration of ancillary equipment necessary to exercise the ports;
- for the immunity tests of the EUT, a communications link shall be established between the EUT and the testing system. The EUT shall be placed in the operating mode;
- for the immunity tests of ancillary equipment, without a separate pass/fail criteria, the MES with the ancillary equipment shall be used to judge whether the ancillary equipment meets the requirements;
- for EUT for which connection to a host equipment is necessary to offer functionality the applicant shall select which of the alternative performance assessment configurations described in subclause 5.4 shall be used;
- the configuration and mode of operation during measurements shall be noted in the test report;
- if the equipment has a large number of ports, then a sufficient number of them shall be selected to simulate actual operation conditions and to ensure that all the different types of termination are covered;
- ports, which in normal operation are connected to ancillary or other equipment through interconnecting cables, shall be connected to such equipment via a representative interconnecting cable, or to a representative termination to simulate the input/output characteristics of the ancillary or other equipment via a representative piece of interconnecting cable. RF input/output ports shall be correctly terminated;
- the tests shall be carried out at a point within the specified normal operating environmental range and at the rated supply voltage for the equipment.

9.2 Radio frequency electromagnetic field (80 MHz to 1 000 MHz)

This test is applicable to the complete EUT.

9.2.1 Purpose

This test assesses the ability of the complete EUT to operate as intended in the presence of disturbing radio frequency electromagnetic field.

9.2.2 Test method and level

The test method shall be in accordance with EN 61000-4-3 [7] with the following requirements applying:

- the test level shall be 3 V/m (measured unmodulated). The test signal then shall be amplitude modulated to a depth of 80 % by a sinusoidal audio signal of 1 000 Hz;
- the test shall be performed over the frequency range 80 MHz-1 000 MHz;
- for receivers and transmitters, the stepped frequency increments shall be 1 % of the momentary frequency;
- the selected frequencies and used during the test shall be recorded in the test report.

9.2.3 Performance criteria

The performance criteria CP (see subclause 6.2) shall apply.

9.3 Electrostatic discharge

This test is applicable to the complete EUT.

9.3.1 Purpose

This test assesses the ability of the complete EUT to operate as intended in the event of an electrostatic discharge.

9.3.2 Test method and levels

The test method shall be in accordance with EN 61000-4-2 [6].

The following requirements shall apply:

- The test severity for contact discharge shall be 4 kV and for air discharge 8 kV. See EN 61000-4-2 [6], for all other details, including intermediate test levels.

9.3.3 Performance criteria

The performance criteria TP (see subclause 6.3) shall apply.

9.4 Fast transients common mode

This test is applicable to the complete EUT.

This test shall be performed on AC mains power input ports.

This test shall be performed on signal ports, control ports and DC power input/output ports which are intended to be used with cables longer than 3 m, as declared by the applicant. For ports, not intended to be used with cables longer than 3 m, a list of these ports not tested for this reason, shall be recorded in the test report.

9.4.1 Purpose

This test assesses the ability of the complete EUT to operate as intended in the event of fast transients present on one of the input/output ports.

9.4.2 Test method and levels

The test method shall be in accordance with EN 61000-4-4 [8] with the following requirements applying:

- the test level for signal and control ports shall be severity level 2 corresponding to 0,5 kV open circuit voltage as given in EN 61000-4-4 [8];
- the test level for DC power input/output ports shall be severity level 2 corresponding to 1 kV open circuit voltage as given in EN 61000-4-4 [8];
- the test level for AC mains power input ports shall be severity level 3 corresponding to 2 kV open circuit voltage as given in EN 61000-4-4 [8];
- for AC power input and DC power input/output ports the transients shall be applied (in parallel) to all the wires in the cable with reference to the cabinet reference ground, i.e. line-to-ground, (true common mode), with a source impedance of 50 Ω.

9.4.3 Performance criteria

The performance criteria TP (see subclause 6.3) shall apply.

9.5 RF common mode (0,15 MHz to 80 MHz)

This test is applicable to the complete EUT.

This test shall be performed on signal, control, DC power and AC mains power input/output ports of the EUT for F-MES which may have cables longer than 1 m.

This test shall be performed on signal, control and DC power input/output ports of the EUT for P-MES and V-MES, which may have cables longer than 2 m.

This test shall not be carried out on those of the ports declared by the applicant as not intended to be used with cables longer than stated above. The list of those ports, not tested for this reason, shall be recorded in the test report.

9.5.1 Purpose

This test assesses the ability of the complete EUT to operate as intended in the presence of a radio frequency electromagnetic disturbance on the input/output ports.

9.5.2 Test method and level

The test method shall be the current clamp injection method in accordance with EN 61000-4-6 [10].

Alternatively, this test may be performed using the intrusive method, where appropriate, see EN 61000-4-6 [10].

The following requirements apply:

- the test signal shall be amplitude modulated to a depth of 80 % by a sinusoidal audio signal of 1 kHz;
- the test signal shall be incremented by 50 kHz steps over the frequency range 150 kHz to 5 MHz and by 1 % steps of the frequency over the frequency range 5 MHz to 80 MHz;
- without modulation, the rms value of the amplitude of the test signal shall be 3 V, at a transfer impedance of 150 Ω. This test level corresponds to the severity level 2 of EN 61000-4-6 [10];
- to enable the best test method to be used an intrusive or direct connection can be made to any of the lines of any input/output port, where it is practical and the performance of the equipment is not degraded, alternatively the current clamp injection method can be used;
- the test shall be performed over the frequency range 150 kHz to 80 MHz.

9.5.3 Performance criteria

The performance criteria CP (see subclause 6.2) shall apply.

9.6 Transients and surges, vehicular environment

These tests shall be performed on 12 V and 24 V DC power input ports of EUT (MES and ancillary equipment), intended for vehicular use.

9.6.1 Purpose

These tests assess the EUT to operate as intended in the event of transients and surges present on the 12 V and 24 V DC power input ports.

9.6.2 Test method and level

The test method shall be in accordance with ISO 7637-1 [13] for 12 V DC powered equipment and ISO 7637-2 [14] for 24 V DC powered equipment:

1) The following requirements shall apply for 12 V DC powered EUT:

   a) for MESs designed for direct connection to the 12 V main vehicle battery, as stated by the applicant in its installation documentation, this shall be recorded in the test report and the following requirements in accordance with ISO 7637-1 [13] shall apply:

      - pulse 3a and 3b, level II, with the test time reduced to 5 minutes for each;

      - pulse 4, level II, 5 pulses, with the characteristics as follows:

        V_s = -5 V, V_a = -2,5 V, t_6 = 25 ms, t_8 = 5 s, t_f = 5 ms.

   b) for MESs designed for indirect connection to the 12 V main vehicle battery, as stated by the applicant in its installation documentation, this shall be recorded in the test report and the following pulses apply, in addition to the pulses in 1) a):

      - pulse 1, level II t1 = 2,5 s, 10 pulses;

      - pulse 2, level II t1 = 2,5 s, 10 pulses.

2) the following requirements shall apply for 24 V DC powered equipment:

   a) for MESs designed for direct connection to the 24 V main vehicle battery, as stated by the applicant in its installation documentation, this shall be recorded in the test report and the following requirements in accordance with ISO 7637-2 [14] shall apply:

      - pulse 3a and 3b, level II, with the test time reduced to 5 minutes for each;

      - pulse 4, level II, 5 pulses, with the characteristics as follows:

        - V_s = -10 V, V_a = -5,0 V, t_6 = 25 ms, t_8 = 5 s, t_f = 5 ms.

        The test for this pulse 4 shall be carried out as specified in ISO 7637-1 [13].

   b) for MESs designed for indirect connection to the 24 V main vehicle battery, as stated by the applicant in its installation documentation, this shall be recorded in the test report and the following pulses apply, in addition to the pulses in 2) a):

      - pulse 1a, level II t1 = 2,5 s, Ri = 25 Ω, 10 pulses;

      - pulse 1b, level II t1 = 2,5 s, Ri = 100 Ω, 10 pulses;

      - pulse 2, level II t1 = 2,5 s, 10 pulses.

For EUTs designed to operate at both DC power voltages both requirements 1) and 2) shall apply.

For EUTs designed to operate at 12 V DC power supply, but operating from a 24 V DC power adapter ancillary, then the radio equipment shall comply with the requirements in 1) and the configuration of the radio equipment and the power adapter shall comply with the requirements of 2).

9.6.3 Performance criteria

For pulses 3a and 3b, the performance criteria CP shall apply, (see subclause 6.2). For pulses 1, 1a, 1b, 2, 4 the performance criteria TP shall apply (see subclause 6.3) with the exception that the link need not have been maintained during exposure and may have to be re-established.

9.7 Voltage dips and interruptions

These tests are applicable to the EUT powered by AC mains, and shall be performed on AC mains power input ports.

9.7.1 Purpose

These tests assess the ability of the EUT to operate as intended in the event of voltage dips and interruptions present on the AC mains power input ports.

9.7.2 Test method and levels

The test method shall be in accordance with EN 61000-4-11 [11].

The test levels shall be:

- a voltage dip corresponding to a reduction of the supply voltage of 30 % for 10 ms;
- a voltage dip corresponding to a reduction of the supply voltage of 60 % for 100 ms;
- a voltage interruption corresponding to a reduction of the supply voltage of more than 95 % for 5 000 ms.

9.7.3 Performance criteria

For a voltage dip corresponding to a reduction of the supply voltage of 30 % for 10 ms the performance criteria CP shall apply (see subclause 6.2).

For a voltage dip corresponding to a reduction of the supply voltage of 60 % for 100 ms the performance criteria TP shall apply (see subclause 6.3).

For a voltage interruption corresponding to a reduction of the supply voltage of more than 95 % for 5 000 ms the performance criteria TP shall apply (see subclause 6.3). In addition, when equipment is powered solely from the AC mains supply (without the use of a parallel battery back-up) communications need not have been maintained and may have to be re-established, and volatile user data may have been lost. In the event of loss of communications and/or user data, this fact shall be recorded in the test report, the product description and the user documentation.

9.8 Surges, common and differential mode

These tests shall be performed on AC mains power input ports of the EUT.

9.8.1 Purpose

These tests assess the ability of the EUT to operate as intended in the event of surges present on the AC mains power input ports.

9.8.2 Test method and levels

The test method shall be in accordance with EN 61000-4-5 [9].

- the test level for signal ports connected to telecommunication networks shall be 0,5 kV line to ground as given in EN 61000-4-5 [9]. In this case the total output impedance of the surge generator shall be 42 Ω;
- the test level for ac mains power input ports shall be 1 kV line to ground and 0,5 kV line to line with the output impedance of the surge generator as given in the EN 61000-4-5 [9];
- the test generator shall be the 1,2/50 µsec as defined in EN 61000-4-5 [9].

9.8.3 Performance criteria

The general performance criteria TP shall apply (see subclause 6.3).

Annex A (normative): Subclauses of the present document relevant for compliance with the essential requirements of relevant EC Council Directives

Table A.1: Subclauses of the present document relevant for compliance with the essential requirements of relevant EC Council Directives

Clause/subclause number and title		Corresponding article of Council Directive 89/336/EEC [1]	Qualifying remarks
8	Test methods and limits for emission tests of EUT		
8.2	Ancillary equipment enclosure	4 (a)	
8.3	DC power input/output port	4 (a)	
8.4	AC mains power input/output port	4 (a)	
9	Test methods and levels for immunity tests for EUT		
9.2	Radio frequency electromagnetic field (80 MHz - 1 000 MHz)	4 (b)	
9.3	Electrostatic discharge	4 (b)	
9.4	Fast transients common mode	4 (b)	
9.5	RF common mode (0,15 MHz - 80 MHz)	4 (b)	
9.6	Transients and surges, vehicular environment	4 (b)	
9.7	Voltage dips and interruptions	4 (b)	
9.8	Surges, common and differential mode	4 (b)	

Annex B (normative): Definitions of the MES within the scope of the present document

B.1 MESs operating in the 1,6/2,4 GHz

The present document applies to Mobile Earth Stations (MESs) with both transmit and receive capabilities for operation in a Satellite Personal Communication Network (S-PCN)

MES equipment may be portable, vehicle mounted or fixed. Unless otherwise stated in the present document, the present document only applies to the MES component of a multi-mode terminal.

The Mobile Satellite Service (MSS) frequency bands within which the MESs operate are given in the table B.1.

Table B.1: Mobile Satellite Service (MSS) frequency bands

	MSS frequency bands
MESs transmit	1 610 MHz to 1 626,5 MHz
MESs receive	1 613,8 MHz to 1 626,5 MHz 2 483,5 MHz to 2 500 MHz

B.2 MESs operating in the 1,5/1,6 GHz

The present document applies to Mobile Earth Stations (MESs) with both transmit and receive capabilities for operation in a Satellite Personal Communication Network (S-PCN)

MES equipment may be portable, vehicle mounted or fixed. Unless otherwise stated in the present document, the present document only applies to the MES component of a multi-mode terminal.

The Mobile Satellite Service (MSS) frequency bands within which the MESs operate are given in the table B.2.

Table B.2: Mobile Satellite Service (MSS) frequency bands

	MSS frequency bands
MESs transmit	1 626,5 MHz to 1 645,5 MHz
	1 646,5 MHz to 1 660,5 MHz
MESs receive	1 525 MHz to 1 544 MHz
	1 545 MHz to 1 559 MHz

B.3 MESs operating in the 2,0 GHz

The present document applies to Mobile Earth Stations (MESs) with both transmit and receive capabilities for operation in a Satellite Personal Communication Network (S-PCN)

MES equipment may be portable, vehicle mounted or fixed. Unless otherwise stated in the present document, the present document only applies to the MES component of a multi-mode terminal.

The Mobile Satellite Service (MSS) frequency bands within which the MESs operate are given in the table B.3.

Table B.3: Mobile Satellite Service (MSS) frequency bands

	MSS frequency bands
MESs transmit	1 980 MHz to 2 010 MHz
MESs receive	2 170 MHz to 2 200 MHz

History

Document history				
V1.1.1	March 1998	Publication		
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V1.2.1	July 1999	Vote	V 9940:	1999-07-20 to 1999-09-17
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