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**QUY CHUẨN KỸ THUẬT QUỐC GIA
VỀ TƯƠNG THÍCH ĐIỆN TỪ ĐỐI VỚI THIẾT BỊ THÔNG TIN
VÔ TUYẾN ĐIỆN**

***National technical regulation
on General Electro Magnetic Compatibility for Radio
Communications Equipment***

(for information only)

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Table of content

Foreword	7
1. GENERAL	8
1.1. Scope	8
1.2. Objective	9
1.3. Normative References	9
1.4. Definitions	11
1.4.1. Ancillary equipment	11
1.4.2. Integral antenna equipment	11
1.4.3. Non-integral antenna equipment	11
1.4.4. Fixed equipment	11
1.4.5. Port	11
1.4.6. Necessary bandwidth	12
1.4.7. Occupied bandwidth	12
1.4.8. Telecommunications port	12
1.4.9. Simplex	12
1.4.10. Product standard	12
1.4.11. Radio communications equipment:	12
1.4.12. Operating frequency range	12
1.4.13. Enclosure port	13
1.5. Abbreviations	13
2. TECHNICAL REQUIREMENTS	14
2.1. Methods of measurement and limits for EMC emissions	14
2.1.1. Emissions from the AC mains power input/output port	14
2.1.2. Emissions from the DC power input/output port	15

2.1.3. Emissions from the enclosure port of stand alone ancillary equipment	16
2.1.4. Emissions from the enclosure port of non-integral antenna equipment, and antenna input/output port of integral antenna equipment	16
2.1.5. Emissions from the antenna input/output port (spurious emissions) of non-integral antenna equipment	18
2.2. Test methods and levels for EMC immunity	20
2.2.1. Immunity of antenna port and enclosure port of integral antenna radio equipment	20
2.2.2. Immunity of antenna port of non-integral antenna radio equipment	22
2.2.3. Immunity of the enclosure port of non-integral antenna radio equipment and all classes of ancillary equipment	24
2.2.4. Immunity of the AC mains power input/output port	25
2.2.5. Immunity of the signal/control input/output port	26
2.2.6. Immunity of the telecommunication port	26
2.2.7. Immunity of the DC power port (vehicle supply)	27
2.2.8. Immunity of the DC power port (non-vehicle supply)	29
3. REGULATION ON MANAGEMENT	30
4. RESPONSIBILITY OF ORGANISATIONS/INDIVIDUALS	30
5. IMPLEMENTATION	30
ANNEX A (Normative) Technical requirements general test conditions	31
ANNEX B (Normative) Performance assessment	38
ANNEX C (Normative) Performance criteria	40

Foreword

QCVN 18:2010/BTTTT is based on ETSI EN 300 339: 1998
"Electro magnetic compatibility and Radio spectrum Matter (ERM)
- Generic Electro Magnetic Compatibility (EMC) for radio
communications equipment".

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National technical regulation

on General Electromagnetic Compatibility for radio communications equipment

1. GENERAL

1. 1. Scope

This technical standard is used as basis for type approving Electro Magnetic Compatibility (EMC) for radio communications equipment.

This technical standard is also used as one of the basis to resolve interference problems.

This technical standard may be applied to all categories of radio communications equipment with the exception of broadcast receivers. It does not apply to inductive communications equipment, ultra high power transmitter (> 10 kW), fixed service upper microwave equipment and extremely broadband data systems using spread spectrum or CDMA technology.

This technical standard specifies the applicable EMC tests, the methods of measurements, the limits and the minimum performance criteria for radio equipment operating in the frequency range 9 kHz to 3000 GHz, and any associated ancillary equipment.

This technical standard does not specify requirements for emission above 40 GHz from the antenna port or enclosure port.

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.

This technical standard may not cover those cases where a potential source of interference producing individually repeated transient phenomena or a continuous phenomena is permanently present, for example 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.

Certain products such as high power radio transmitters, which cannot be tested in a normal test laboratory environment, can be tested on-site or at the manufacturer's

premises. The general basis for the test methods and limits used to assess these products should be in accordance with the present document, where appropriate.

Compliance of radio equipment with the requirements of the present document does not signify compliance with any requirements related to the use of the equipment, for example licensing requirements.

Use of this technical standard in the case where no Harmonized radio product standard and no Harmonized product EMC standard or product family EMC standard exists: all technical specifications within this technical standard are applicable and sufficient to assess the EMC conformity of the product.

Use of this technical standard in the case where a Harmonized radio product standard exists but no Harmonized product EMC standard or product family EMC standard exists: where a Harmonized radio product standard or radio product standard exists, any technical specifications relevant to the antenna port and enclosure port contained in that radio product standard take precedence over the corresponding technical specifications in this technical standard and are to be applied instead. All other technical specifications within this technical standard remain applicable to assess the EMC conformity of the product.

1.2. Objective

This technical regulations applicable to agencies, organizations, manufacturers, importers and mining equipment, information systems radio in conformity certification activities of transceiver radio EMC.

1.3. Normative References

1. TCVN 7189:2009 (CISPR 22:2006), Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement
2. TCVN 8241-4-2:2009 (IEC 61000-4-2:2001), Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity
3. TCVN 8241-4-3:2009 (IEC 61000-4-3:2006) ElectroMagnetic Compatibility (EMC) – Part 4-3: Testing and measurement techniques - Immunity to radiated, radio-frequency, electromagnetic fields
4. IEC 61000-4-4:2004 Electromagnetic compatibility (EMC) - Part 4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test
5. TCVN 8241-4-5:2009 (IEC 61000-4-5:2005), Electromagnetic compatibility (EMC) – Part 4-5 : Testing and measurement techniques - Surge immunity

6. TCVN 8241-4-6:2009 (IEC 61000-4-6:2004) ElectroMagnetic Compatibility (EMC) – Part 4-6 : Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields
7. TCVN 8241-4-11:2009 (IEC 61000-4-11:2004), Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity
8. ETS 300 086, Radio Equipment and Systems; Land mobile service; Technical characteristics and test conditions for radio equipment with an internal or external RF connector intended primarily for analogue speech
9. ETS 300 113, Radio Equipment and Systems (RES); Land mobile service; Technical characteristics and test conditions for radio equipment intended for the transmission of data (and speech) and having an antenna connector
10. ETS 300 296 Radio Equipment and Systems (RES); Land mobile service; Technical characteristics and test conditions for radio equipment using integral antennas intended primarily for analogue speech
11. ETS 300 390, Radio Equipment and Systems (RES); Land mobile service; Technical characteristics and test conditions for radio equipment intended for the transmission of data (and speech) and using an integral antenna
12. ETR 027, Radio Equipment and Systems; Methods of Measurement for Mobile Radio Equipment
13. ETR 028, Radio Equipment and Systems (RES); Uncertainties in the measurement of mobile radio equipment characteristics
14. CISPR 16-1, Specification for radio disturbance and immunity measuring apparatus and methods
15. ISO 7637-1, Road vehicles; Electrical disturbance by conduction and coupling; Part 1: Passenger car and light commercial vehicles with nominal 12 V supply voltage – Electrical transient conduction along supply lines only
16. ISO 7637-2, 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.

1.4. Definitions

1.4.1. Ancillary equipment

Equipment used in connection with a radio communications equipment is considered as an ancillary equipment if:

- The equipment is intended for use in conjunction with a radio communications equipment to provide additional operational and/or control features, for example to extend control to another position or location; and
- The equipment cannot be used on a stand alone basis to provide user functions independently of a radio communications equipment; and
- The radio communications equipment to which it is connected is capable of providing some intended operation such as transmitting and/or receiving without the ancillary equipment. (i.e. it is not a sub unit of the main equipment essential to the main equipment's basic functions).

1.4.2. Integral antenna equipment

Radio communications equipment fitted with an antenna designed to be connected to the equipment without the use of an external connector and considered to be part of the equipment. An integral antenna may be fitted internally or externally to the equipment. In equipment of this type, the enclosure port and the antenna port are identical.

1.4.3. Non-integral antenna equipment

Radio communications equipment with a connector or waveguide flange intended for connection to an antenna either directly, or via a feeder or waveguide. In equipment of this type, the antenna port is separate from the enclosure port.

1.4.4. Fixed equipment

Equipment intended for installation in a fixed position.

1.4.5. Port

A particular interface of the specified equipment (apparatus) with the electromagnetic environment. Any connection point on an equipment intended for connection of cables to or from that equipment is considered as a port (see figure 1).

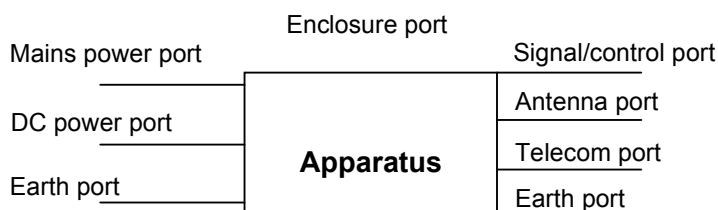


Figure 1: Examples of ports

1.4.6. Necessary bandwidth

For a given class of emission, the width of the frequency band which is just sufficient to ensure the transmission of information at the rate and with the quality required under specified conditions. For application to multi-channel or multi-carrier transmitters/transponders, where several carriers may be transmitted simultaneously from a final output amplifier or an active antenna, the necessary bandwidth is taken to be the transmitter or transponder bandwidth.

1.4.7. Occupied bandwidth

The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage $\beta/2$ of the total mean power of a given emission. Unless otherwise specified by ITU-R for the appropriate class of emission, the value of $\beta/2$ should be taken as 0.5%.

1.4.8. Telecommunications port

A port intended for direct connection to a telecommunications network.

1.4.9. Simplex

Instantaneous one-way communications link (includes semi-duplex mode).

1.4.10. Product standard

Functional standard describing frequency management parameters of radio product.

1.4.11. Radio communications equipment:

Telecommunications equipment which includes one or more radio transmitters and/or receivers and/or parts thereof for use in a fixed, mobile or portable application. It can be operated with ancillary equipment but if so, is not dependent on it for basic functionality.

1.4.12. Operating frequency range

The range(s) of continuous radio frequencies covered by the (Equipment Under Test) EUT.

1.4.13. Enclosure port

The physical boundary of the equipment onto which an electromagnetic phenomenon may radiate or impinge. In the case of integral antenna equipment, this port is inseparable from the antenna port.

1.5. Abbreviations

AC	Alternating Current
AM	Amplitude Modulation
AMN	Artificial Mains Network
B	measurement Bandwidth
BER	Bit Error Ratio
DC	Direct Current
DSB	Double Side Band full carrier
EMC	Electro Magnetic Compatibility
e.m.f	electromotive force
ESD	Electro Static Discharge
EUT	Equipment Under Test
FER	Frame Erasure Ratio
LISN	Line Impedance Stabilizing Network
PEP	Peak Envelope Power
RF	Radio Frequency
r.m.s	root mean of squares
SSB	Single Side Band suppressed carrier modulation
TDM	Time Division Multiplexed

2. TECHNICAL REQUIREMENTS

2.1. Methods of measurement and limits for EMC emissions

2.1.1. Emissions from the AC mains power input/output port

This test assesses the ability of ancillary equipment and/or radio communications equipment to limit its internal noise from being present on the AC mains power ports.

Limits:

The EUT shall meet the limits of table 1 (including the average limit and the quasi-peak limit).

The measurement frequency range extends from 150 kHz to 30 MHz, apart from the transmitter exclusion band for emission measurements when measured in transmit mode, where appropriate.

Table 1: Limits of Emissions from the AC mains power input/output port

Environmental phenomena	Frequency range, MHz	Test limits, dB μ V	Basic standard	Remarks
Conducted RF EMC emission	0.15 to 0.5	66 to 56 quasi peak 56 to 46 average	TCVN 7189:2009 (CISPR 22:2006)	(Note)
Conducted RF EMC emission	> 0.5 to 5	56 quasi peak 46 average	TCVN 7189:2009 (CISPR 22:2006)	
Conducted RF EMC emission	> 5 to 30	60 quasi peak 50 average	TCVN 7189:2009 (CISPR 22:2006)	

Note: The limit decreases linearly with the logarithm of frequency in the range 0.15 MHz to 0.50 MHz.

Measurement:

The conducted measurement technique, using the method from TCVN 7189:2009 (CISPR 22:2006) shall be used.

In the case of AC output ports, the port shall be connected via a Line Impedance Stabilizing Network (LISN) to a load drawing the rated current of the source.

In the case where the AC output port is intended to be directly connected (or via a switch or circuit breaker) to the AC power input port of the EUT, the AC output port need not be tested.

Note: In TCVN 7189:2009 (CISPR 22:2006), the term Artificial Mains Network (AMN) is used instead of LISN.

2.1.2. Emissions from the DC power input/output port

This test assesses the ability of ancillary equipment and/or radio communications equipment to limit its internal noise from being present on the DC power ports.

This test applies to DC power input/output ports which may be connected to cables longer than 3 m. Where the manufacturer specifies an AC to DC power supply converter which shall always be used to power the EUT via interconnecting cables shorter than 3 m, emissions shall be measured at the AC port of the adaptor and not on the DC port of the EUT (see subclause 2.1.1).

Limits:

The equipment shall meet the limits of Table 2.

Table 2. Limits of Emissions from the DC power input/output port

Environmental phenomena	Frequency range, MHz	Test limits, dB μ V	Basic standard	Remarks
Conducted RF EMC emission	0.15 to 0.5	66 to 56 quasi peak 56 to 46 average	TCVN 7189:2009 (CISPR 22:2006)	(Note)
Conducted RF EMC emission	> 0.5 to 5	56 quasi peak 46 average	TCVN 7189:2009 (CISPR 22:2006)	
Conducted RF EMC emission	> 5 to 30	60 quasi peak 50 average	TCVN 7189:2009 (CISPR 22:2006)	
<i>Note: The limit decreases linearly with the logarithm of frequency in the range 0.15 MHz to 0.50 MHz.</i>				

Measurement:

The conducted measurement technique, using the method from TCVN 7189:2009 (CISPR 22:2006) shall be used.

EUTs intended to be supplied with both DC leads floating or with one lead grounded shall be tested under both conditions.

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

In the case where the DC output port is directly connected (or via a switch or circuit breaker) to the DC power input port of the EUT, the DC output port need not be tested.

2.1.3. Emissions from the enclosure port of stand alone ancillary equipment

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

This test is applicable to ancillary equipment not integrated into a receiver, transmitter, or transceiver.

Limits:

The limits shall be shown in table 3 (10 m measuring distance).

Table 3: Limits of Emissions from the enclosure port of stand alone ancillary equipment

Frequency range, MHz	Limit (quasi-peak), dB μ V/m
30 to 230	30
> 230 to 1 000	37

Measurement:

The test method shall be in accordance with TCVN 7189:2009 (CISPR 22:2006).

2.1.4. Emissions from the enclosure port of non-integral antenna equipment, and antenna input/output port of integral antenna equipment

This test assesses the ability of non-integral antenna radio communications equipment to limit internal noise (spurious emissions) from being radiated from its enclosure port.

In the case of integral antenna communications equipment, this test assesses its ability to limit spurious emissions from being radiated by the antenna port, this being identical with the enclosure port for this class of equipment.

Limits:

The equipment shall meet the limits of table 4.

Table 4: Limits of Emissions from the enclosure port of non-integral antenna equipment, and antenna input/output port of integral antenna equipment

Environmental phenomena	Test frequency range	Test limits Rx, Tx Standby, dBm peak	Test limits, Tx active mode, dBm peak	Remarks
Spurious radiated RF EMC Emissions	30 to 230 MHz	-57 (2 nW)	-36 (250 nW) or -80 dB PEP, whichever is the higher level	B = 100 kHz to 120 kHz (Note 1)
Spurious radiated RF EMC Emissions	230 MHz to 1 GHz	-50 (10 nW)	-36 (250 nW) or -80 dB PEP, whichever is the higher level	B = 100 kHz to 120 kHz (Note 2)
Spurious radiated RF EMC Emissions	> 1 to 12.75 GHz	-47 (20 nW)	-30 (1 μ W) or -74 dB PEP, whichever is the higher level	B = 1 MHz (Note 4)
Spurious radiated RF EMC Emissions	> 12.75 to 40 GHz	-47 (20 nW)	-30 (1 μ W) or -74 dB PEP, whichever is the higher level	B = 1 MHz (Notes 3 and 4)
<p><i>Note 1: For transmitters intended for installation less than 10 m distance from domestic broadcast receivers, a limit of -54 dBm (4 nW) peak applies in active mode in the bands 47 MHz to 74 MHz, 87.5 MHz to 118 MHz and 174 MHz to 230 MHz.</i></p> <p><i>Note 2: For transmitters intended for installation less than 10 m distance from domestic broadcast receivers, a limit of -54 dBm (4 nW) peak applies in active mode in the band 470 MHz to 862 MHz.</i></p> <p><i>Note 3: Applicable only to radio assemblies or subassemblies which contain an antenna as an integral part of their mechanical structure.</i></p> <p><i>Note 4: Testing shall initially be performed up to 4 GHz or 2 x Fc, whichever is the higher. If any spurious emissions exceeding -10 dB with respect to the specified limit are detected above 1.5 GHz, then the test shall continue to 12,75 GHz or 2 x Fc, whichever is the higher.</i></p>				

Measurement:

For radiated measurements, either the substitution or direct power measurements may be used, whichever is suitable for the frequency range under consideration.

Guidance can be obtained from ETS 300 296, ETS 300 390, ETR 027, ETS 300 086, ETS 300 113, ETR 028 or CISPR 16-1. The test method shall be recorded in the test report.

The measuring receiver shall be tuned over the measurement frequency range and, at each frequency at which a spurious component is detected, the power level shall be measured. The measurements shall be repeated with the EUT in standby mode and receive mode. Emission measurements of a level lower than 10 dB below the limits given in table 4 need not be recorded.

The transmitter (if appropriate) shall be modulated with normal test modulation (see subclause A.5) during the test. The exclusion band as defined in subclause A.3 shall be applied.

For non-integral antenna transmitters, the antenna port shall be terminated in a suitable non-radiating load during the test.

2.1.5. Emissions from the antenna input/output port (spurious emissions) of non-integral antenna equipment

This test assesses the ability of non-integral antenna radio communications equipment to limit the levels of spurious emission conducted from its antenna port.

In the frequency range 30 MHz to 4 GHz, the conducted emissions requirements of this subclause may be replaced by radiated requirements of the EUT and all declared antennas, in accordance with subclause 2.1.4.

Limits:

The equipment shall meet the limits in table 5.

The attenuation of the non-radiating power attenuator from the antenna port to the measurement port shall be taken into consideration when assessing compliance.

If the equipment is only intended to be connected to specific antennas supplied by the manufacturer which have a reduced radiation efficiency at frequencies corresponding to those of emissions measured as being outside the allowed conducted limit, the manufacturer's declaration of antenna performance shall be considered. If the gain characteristic of the antenna is declared by the manufacturer, and it indicates gain at the spurious emission frequency sufficiently far below 0 dBi that the antenna radiation caused by the conducted spurious emission would be below the limit allowed for a radiated spurious emission, then the level of the conducted spurious emission shall be considered as acceptable.

This may be expressed as a formula:

Where: Measured conducted spurious emission at frequency f is of level x dBm, and

Declared antenna gain at frequency f is g dBi;

Then: Equivalent power radiated from antenna would be $(x + g)$ dBm = h dBm.

Result: If this is within the limit allowed in table 4 for frequency f , then the level of that conducted spurious emission shall be considered as acceptable, even if level x is above the limit allowed in table 5.

Example: A transmitter in Tx active mode has a conducted spurious emission of -24 dBm at 1.5 GHz.

- This is above the limit allowed for a conducted spurious emission at 1.5 GHz, see table 5.

- But the antenna gain at this frequency is declared to be only -30 dBi.

- Therefore the equivalent power radiated by the antenna would be only -54 dBm at 1.5 GHz.

- This is within the limit allowed for a radiated spurious emission at 1.5 GHz, see table 4.

- Therefore in this case, the level of the conducted emission is considered as acceptable.

In the event that the manufacturer declares more than one type of applicable antenna, then the consideration of antenna performance referred to above shall be limited to the type giving the greatest gain at the frequency of the spurious emission.

Table 5: Limits of Emissions from the antenna input/output port (spurious emissions) of non-integral antenna equipment

Environmental phenomena	Frequency range	Test limits Rx, Tx Standby, dBm peak	Test limits Tx active mode, dBm peak	Remarks
Spurious conducted RF Emissions	9 to 150 kHz	-57 (2 nW)	-36 (250 nW) or -70 dB PEP, whichever is the higher level	B = 1 kHz
Spurious conducted RF Emissions	> 150 kHz to 30 MHz	-57 (2 nW)	-36 (250 nW) or -70 dB PEP, whichever is the higher level	B = 9 to 10 kHz
Spurious conducted RF Emissions	> 30 MHz to 1 GHz	-57 (2 nW)	-36 (250 nW) or -80 dB PEP, whichever is the higher level	B = 100 kHz to 120 kHz (Note 2)
Spurious conducted RF Emissions	> 1 to 12.75 GHz	-47 (20 nW)	-30 (1 μ W) or -74 dB PEP, whichever is the higher level	B = 1 MHz (Note 1)
Spurious conducted RF Emissions	> 12.75 to 40 GHz	-47 (20 nW)	-30 (1 μ W) or -74 dB PEP, whichever is the higher level	B = 1 MHz (Note 1)

Note 1: Testing should initially be performed up to 4 GHz or 2 x Fc, whichever is the higher. If any spurious emissions exceeding -10 dB with respect to the specified limit are detected above 1.5 GHz, then the test shall continue to 12.75 GHz or 2 x Fc, whichever is the higher.

Note 2: For transmitters intended for installation less than 10 m distance from domestic broadcast receivers, a limit of -54 dBm (4 nW) peak applies in the bands 47 MHz to 74 MHz, 87.5 MHz to 118 MHz, 174 MHz to 230 MHz and 470 MHz to 862 MHz.

Measurement:

Guidance can be obtained from ETS 300 296, ETS 300 390, ETR 027, ETS 300 086, ETS 300 113, ETR 028 or CISPR 16-1. The test method shall be recorded in the test report.

The antenna port shall be correctly terminated with a non-radiating power attenuator of adequate power absorption capability. The output of the power attenuator shall be connected to a measuring receiver. The measuring receiver (or spectrum analyser) shall comply with the bandwidth (B) requirements in table 5. A peak detector shall be used.

The measuring receiver shall be tuned over the measurement frequency range and at each frequency at which a spurious component is detected, the power level shall be recorded as the conducted spurious emission level delivered into the specified load. The measurements shall be repeated with the EUT in standby mode and receive mode. Emission measurements of a level lower than 10 dB below the limits given in table 5 need not be recorded.

For transmitters, the exclusion band as defined in subclause A.3.1 shall be applied during the test.

If the EUT is only intended for connection to waveguide longer than two wavelengths of the cut-off frequency, the test shall be limited to frequencies above 0.7 times the cut-off frequency.

2.2. Test methods and levels for EMC immunity

2.2.1. Immunity of antenna port and enclosure port of integral antenna radio equipment

2.2.1.1. EUTs operating at frequencies up to 2 GHz

Electro Static Discharge (ESD) tests according to TCVN 8241-4-2:2009 (IEC 61000-4-2) shall be applied at levels

- ± 2 , ± 4 and ± 8 kV (air);
- ± 2 and ± 4 kV (contact),

Applying performance criteria B.

The following steps shall be performed in sequence:

a) The operating frequency of the EUT shall be set to the centre of the operating frequency range. Where the EUT has more than one operating frequency range, the following tests shall be repeated for each range;

b) A wanted signal shall be applied at a level 10 dB above that which just supports normal link performance, or at a level defined by the manufacturer;

c) For receivers, an interfering test signal shall be applied at 30 mV/m or at a level 80 dB above the wanted signal, whichever is the greater but without exceeding 3 V/m. This shall be swept over the frequency range 80 MHz to 1 GHz. The necessary forward power for the required test field strength can be calculated from the knowledge of the input power and the field strength recorded during the calibration of the field at other field strengths. The test signal shall be amplitude modulated to a depth of 80% by a sinusoidal audio signal of 1 kHz unless this coincides with the wanted audio tone, in which case the modulation shall be at 400 Hz. The frequency exclusion band of subclause A.3.3 shall apply:

- The radio link performance shall be assessed against criteria A;

- The receiver response performance for narrowband and wideband phenomena shall be assessed in accordance with subclause C.2.3.

d) For all EUTs, an interfering test signal at 3 V/m shall be applied. This shall be swept over the frequency range 80 MHz to 1 GHz. The test signal shall be amplitude modulated to a depth of 80% by a sinusoidal audio signal of 1 kHz unless this coincides with the wanted audio tone, in which case the modulation shall be at 400 Hz. The frequency exclusion bands of subclause A.3 shall apply:

- For receivers, the test at 3 V/m shall only be used to evaluate those aspects of receiver performance not related to the radio link, against performance criteria A (for link performance assessment, see (c) above);

- For transmitters in transmit and standby modes, performance shall be assessed against criteria A.

2.2.1.2. EUTs operating at frequencies on or above 2 GHz

Electro Static Discharge (ESD) tests according to TCVN 8241-4-2:2009 (IEC 61000-4-2:2001) shall be applied at levels

- ± 2 , ± 4 and ± 8 kV (air);
- ± 2 and ± 4 kV (contact),

Applying performance criteria B.

The following steps shall be performed in sequence:

a) The operating frequency of the EUT shall be set to the centre of the operating frequency range. Where the EUT has more than one operating frequency range, the following tests shall be repeated for each range;

b) A wanted signal shall be applied at a level 10 dB above that which just supports normal link performance, or at a level defined by the manufacturer;

c) For all EUTs, an interfering test signal at 3 V/m shall be applied. This shall be swept over the frequency range 80 MHz to 1 GHz. The test signal shall be amplitude modulated to a depth of 80% by a sinusoidal audio signal of 1 kHz unless this coincides with the wanted audio tone, in which case the modulation shall be at 400 Hz:

- All primary user functions shall be assessed against criteria A;

- The receiver response performance for narrowband and wideband phenomena shall be assessed in accordance with subclause C.2.3.

2.2.2. Immunity of antenna port of non-integral antenna radio equipment

2.2.2.1 Test levels and performance criteria

a) Conducted RF differential mode testing: receivers operating below 2 GHz. The following steps shall be performed in sequence:

- The frequency of the EUT shall be set to the centre of its operating range. Where it has more than one operating range, the following tests shall be repeated for each range;

- A wanted signal shall be applied at a level 10 dB above that which just supports normal link performance, or at a level defined by the manufacturer;

- An interfering test signal shall be applied and swept over the frequency range 80 MHz to 1 GHz. It shall be at a level 80 dB above the wanted signal, but without exceeding + 100 dB μ V e.m.f. The test signal shall be amplitude modulated to a depth

of 80% by a sinusoidal audio signal of 1 kHz unless this coincides with the wanted audio tone, in which case the modulation shall be at 400 Hz. The frequency exclusion band of subclause A.3.3 shall apply. Alternatively, the manufacturer may specify that the test shall be performed as in subclause 2.2.1.1 step (c) with a representative antenna fitted.

The receiver response performance for narrowband and wideband phenomena shall be assessed in accordance with subclause C.2.3.

Table 6: Test levels and performance criteria

Phenomena	Test levels		Performance criteria	Basic standard	Remarks
Conducted RF common mode	MHz	0.15 to 80	A (inside the Rx exclusion band, B applies)	TCVN 8241-4-6:2009 (IEC 61000-4-6:2004)	(Notes 1, 2 and 4)
	V(r.m.s unmod Elecromotive force (e.m.f))	3			
	% Amplitude Modulation (AM)	80			
Conducted RF differential mode			A		Follow subclause a) or b) (Notes 3 and 5)
Fast transients Common mode	kV peak	0.5	B	IEC 61000-4-4	(Notes 2 and 4)
	Tr/Th ns	5/50			
	Rep frequency kHz	5			
<p><i>Note 1: The test method shall be the current clamp injection method. The exclusion band of subclause A.3.3 shall be applied and narrowband responses (spurious responses) shall be disregarded in the measurement (see subclause C.2.3).</i></p> <p><i>Note 2: Applicable only to ports interfacing with cables whose total length may exceed 3 m.</i></p> <p><i>Note 3: Applicable to receivers.</i></p> <p><i>Note 4: Applicable only to co-axial ports.</i></p> <p><i>Note 5: Measurements shall not be performed on receivers operating on or above 2 GHz.</i></p>					

b) Conducted RF differential mode testing: receivers operating on or above 2 GHz

This test is considered technically inappropriate to this class of equipment and shall not be performed.

Justification:

- In service, the interfering signals reaching the antenna port would typically be offset by only $\pm 5\%$ from the operating frequency, and would thus lie within the exclusion band normally applied for this test;
- Fixed radio equipment with carrier frequencies on or above 2 GHz normally has directional antennas.

2.2.3. Immunity of the enclosure port of non-integral antenna radio equipment and all classes of ancillary equipment

Table 7: Test levels and performance criteria

Phenomena	Test levels		Performance criteria	Basic standard	Remarks
Radio frequency electromagnetic field	MHz	80 to 1 000	A (inside the receiver frequency exclusion band, B applies)	TCVN 8241- 4-3:2009 (IEC 61000- 4-3:2006)	(Notes 1 and 2)
	V/m root mean of squares r.m.s	3			
	% AM	80			
ESD	KV, (air)	$\pm 2, \pm 4$ and ± 8	B	TCVN 8241- 4-2:2009 (IEC 61000- 4-2:2001)	
	KV, (contact)	± 2 and ± 4			
<p><i>Note 1: The test signal shall be amplitude modulated to a depth of 80% by a sinusoidal audio signal of 1 kHz unless this coincides with the wanted audio tone, in which case the modulation shall be at 400 Hz.</i></p> <p><i>Note 2: The receiver response performance for narrowband and wideband phenomena shall be assessed in accordance with subclause C.2.3.</i></p>					

2.2.4. Immunity of the AC mains power input/output port

Table 8: Test levels and performance criteria

Phenomena	Test levels		Performance criteria	Basic standard	Remarks
Conducted RF common mode	MHz	0.15 to 80	A (inside the receiver frequency exclusion band, "B" applies)	TCVN 8241- 4- 6:2009 (IEC 61000-4- 6:2004)	(notes 1, 2 and 4)
	V (r.m.s unmod e.m.f)	3			
	% AM	80			
Fast transients common mode	kV peak	1.0	B	IEN 61000-4-4	(note 2)
	Tr/Th ns	5/50			
	Rep frequency, kHz	5			
Surges common mode (line to ground)	kV peak	1.0	B	TCVN 8241- 4- 5:2009 (IEC 61000-4- 5:2005)	(note 3)
	Tr/Th μ s	1.2/50 (8/20)			
Surges differential mode (line to line)	kV peak	0.5	B	TCVN 8241- 4- 5:2009 (IEC 61000-4- 5:2005)	(note 3)
	Tr/Th μ s	1.2/50 (8/20)			
Voltage dips	% reduction	30	B	TCVN 8241- 4- 11:2009 (EN 61000-4- 11:2004)	(note 3)
	ms	10			
	% reduction	60			
	ms	100			
Power Interruptions	% reduction	> 95	C	TCVN 8241- 4- 11:2009 (IEC 61000-4- 11:2004)	(note 3)
	ms	5 000			

Note 1: This test should be performed using the intrusive or direct connection method, where appropriate. The test method may be the current clamp injection method. Narrowband responses (spurious responses) found during testing shall be disregarded in the measurement.

Note 2: Applicable to all input ports, and to output ports interfacing with cables whose total length may exceed 3 m.

Note 3: Applicable only to input ports.

Note 4: The test signal shall be amplitude modulated to a depth of 80% by a sinusoidal audio signal of 1 kHz unless this coincides with the wanted audio tone, in which case the modulation shall be at 400 Hz.

2.2.5. Immunity of the signal/control input/output port

Table 9: Test levels and performance criteria

Phenomena	Test Levels		Performance criteria	Basic standard	Remarks
Conducted RF common mode	MHz	0.15 to 80	A (inside the receiver frequency exclusion band, "B" applies)	TCVN 8241-4- 6:2009 (IEC 61000-4- 6:2004)	(Notes 1, 2 and 3)
	V (r.m.s Unmod e.m.f)	3			
	% AM	80			
Fast transients common mode	kV peak	0.5	B	IEC 61000-4-4	(Note 3)
	Tr/Th ns	5/50			
	Rep frequency, Hz	5			

Note 1: This test should be performed using the intrusive or direct connection method, where appropriate. The test method may be the current clamp injection method. Narrowband responses (spurious responses) found during testing shall be disregarded in the measurement.

Note 2: The test signal shall be amplitude modulated to a depth of 80% by a sinusoidal audio signal of 1 kHz unless this coincides with the wanted audio tone, in which case the modulation shall be at 400 Hz.

Note 3: These tests shall be performed on ports which may have cables longer than 3 m.

2.2.6. Immunity of the telecommunication port

Table 10: Test levels and performance criteria

Phenomena	Test Levels		Performance criteria	Basic standard	Remarks
Conducted RF common mode	MHz	0.15 to 80	A (inside the receiver frequency exclusion band, B applies)	TCVN 8241- 4- 6:2009 (IEC 61000- 4- 6:2004)	(Notes 1 and 2)
	V (r.m.s unmod e.m.f)	3			
	% AM	80			
Fast transients common mode	kV peak	0.5	B	IEC 61000- 4-4	
	Tr/Th ns	5/50			
	Rep Frequency kHz	5			

Surges differential mode	kV	0.5	B	TCVN 8241- 4-5:2009 (IEC 61000- 4-5:2005)
	Tr/Th μ s	1.2/50		
Surges common mode (line to ground)	kV	0.5	B	TCVN 8241- 4-5:2009 (IEC 61000- 4-5:2005)
	Tr/Th μ s	1.2/50		
<p><i>Note 1: This test should be performed using the intrusive or direct connection method, where appropriate. The test method may be the current clamp injection method. Narrowband responses (spurious responses) found during testing shall be disregarded in the measurement.</i></p> <p><i>Note 2: The test signal shall be amplitude modulated to a depth of 80% by a sinusoidal audio signal of 1 kHz unless this coincides with the wanted audio tone, in which case the modulation shall be at 400 Hz.</i></p>				

2.2.7. Immunity of the DC power port (vehicle supply)

These tests assess the ability of ancillary and/or radio communications equipment to operate as intended in the event of transients and surges present on the DC power input ports in a vehicular environment.

These tests shall be performed on 12 V and 24 V DC power input ports of ancillary and/or radio communications equipment intended for vehicular use.

The test method shall be in accordance with ISO 7637-1 applicable to 12 V DC operated EUTs and ISO 7637-2 applicable to 24 V DC operated EUTs except that the following requirements and evaluation of test results shall apply.

EUTs designed to operate at both 12 V DC and 24 V DC without component change, module change or adjustment shall be tested according to subclause 2.2.7.2 and in addition, the pulse 4 test of subclause 2.2.7.1.

EUTs designed to operate at both 12 V DC and 24 V DC but with component change, module change or adjustment shall be tested according to subclauses 2.2.7.1 and 2.2.7.2.

Performance criteria:

Performance criteria B shall apply.

2.2.7.1. Immunity levels: 12 V DC powered equipment

Where the EUT is intended to be directly connected to the 12 V main vehicle battery, the pulses in table 11 shall apply.

Table 11: 12 V equipment directly powered from main battery, test levels

ISO 7637-1 Pulse	Level	Pulse qty	Characteristics	Test time
3a	II			5 minutes
3b	II			5 minutes
4	II	5	$V_s = -5\text{ V}$ $V_a = -2.5\text{ V}$ $t_6 = 25\text{ ms}$ $t_8 = 5\text{ s}$ $t = 5\text{ ms}$	

Where the EUT does not require a direct connection to the 12 V main vehicle battery, the pulses in table 12 shall apply, in addition to the pulses in table 11.

Table 12: 12 V equipment, extra tests where direct connection to main vehicle battery is not required

ISO 7637-1 Pulse	Level	Pulse qty	Characteristics
1	II	10	$t_1 = 2.5\text{ s}$
2	II	10	$t_1 = 2.5\text{ s}$

Where the pulses in table 12 are not applied because the manufacturer declares that the equipment requires direct connection to the vehicle battery, this shall be recorded in the test report.

2.2.7.2. Immunity levels: 24 V DC powered equipment

Where the EUT is intended to be directly connected to the 24 V main vehicle battery, the pulses in table 13 shall apply:

Table 13: 24 V equipment directly powered from main battery, test levels

ISO 7637-2 Pulse	Level	Pulse qty	Characteristics	Test time
3a	II			5 minutes
3b	II			5 minutes
4	II	5	$V_s = -10\text{ V}$ $V_a = -5\text{ V}$ $t_6 = 25\text{ ms}$ $t_8 = 5\text{ s}$ $t_r = 5\text{ ms}$	

Where the EUT does not require a direct connection to the 24 V main vehicle battery, the pulses in table 14 shall apply, in addition to the pulses in table 13.

Table 14: 24 V equipment, extra tests where direct connection to main vehicle battery is not required

ISO 7637-2 Pulse	Level	Pulse qty	Characteristics
1a	II	10	$t_1 = 2.5 \text{ s}$ $R_i = 25 \Omega$
1b	II	10	$t_1 = 2.5 \text{ s}$ $R_i = 100 \Omega$
2	II	10	$t_1 = 2.5 \text{ s}$

Where the pulses in table 14 are not applied because the manufacturer declares that the equipment requires direct connection to the vehicle battery, this shall be recorded in the test report.

2.2.8. Immunity of the DC power port (non-vehicle supply)

Table 15: Test levels and performance criteria

Phenomena	Test levels		Performance criteria	Basic standard	Remarks
Conducted RF common mode	MHz	0.15 to 80	A (inside the receiver Frequency exclusion band, 'B' applies)	TCVN 8241-4-6:2009 (IEC 61000-4-6:2004)	(Notes 1, 2 and 4)
	V (r.m.s unmod e.m.f)	3			
	% AM	80			
Fast transients Common mode	kV peak	0.5	B	IEN 61000-4-4	(Note 2)
	Tr/Th ns	5/50			
	Rep frequency kHz	5			
Surges common mode (line to ground)	kV	1.0	B	TCVN 8241-4-5:2009 (IEC 61000-4-5:2005)	(note 3)
	Tr/Th μs	1.2/50			

Note 1: This test should be performed using the intrusive or direct connection method, where appropriate. The test method may be the current clamp injection method. Narrowband responses (spurious responses) found during testing shall be disregarded in the measurement.

Note 2: Applicable to all input ports, and to output ports interfacing with cables whose total length may exceed 3 m.

Note 3: Applicable only to input ports whose cable length may exceed 10 m.

Note 4: The test signal shall be amplitude modulated to a depth of 80% by a sinusoidal audio signal of 1 kHz unless this coincides with the wanted audio tone, in which case the modulation shall be at 400 Hz.

3. REGULATION ON MANAGEMENT

3.1. The device is a radio information specified in the list of equipment to carry out conformity certification and announcement provided by the Ministry of Information and Communications issued must comply with this regulation.

3.2. In case of radio communication equipment power referred to in subclauses 3.1 standards own technique, appropriate, any technical specifications related to the antenna port and port enclosures in technical regulations that are applicable priority compared with the corresponding specifications in this regulation. The remaining specifications of this regulation is to be applied to assess the EMC compliance of equipment

4. RESPONSIBILITY OF ORGANISATIONS/INDIVIDUALS

Organizations/individuals engaged in production and trading of radio communication equipment power to make regulations conformity certification and announcement of rules and subject to inspection by the state agency under the provisions current.

5. IMPLEMENTATION

5.1. Vietnam Telecommunication Authority and local departments of Information and Communication are responsible to instruct and implement this technical regulation.

5.2. This technical regulation superseded TCN 68-192:2003.

5.3. In cases of referencing regulations changed, modified or superseded, new versions is applied.

ANNEX A

(Normative)

Technical requirements general test conditions

A.1. Test conditions and configurations

The Equipment Under Test (EUT) shall be tested under normal test conditions contained in the relevant product and basic standards or in the information accompanying the equipment, which are within the manufacturer's declared range of humidity, temperature and supply voltage.

The test configuration shall be as close to normal intended use as possible. The EUT shall be tested in a manner as close as possible to normal intended use, consistent with the requirements of the present document. In order to perform particular tests which could not be performed otherwise, special test software or hardware may be used. However, such special software or hardware shall cause test results which are representative of normal operational conditions.

Where the Radio Frequency (RF) output from the EUT transmitter normally consists of multiple independent radio frequencies, the product may be assessed by considering the characteristics of the individual RF output signals.

If the EUT covers several transmit frequency bands, the EUT shall be tested set to operate at the centre frequency of each of these bands.

Where the EUT is provided with a detachable integral antenna, it shall be tested with the antenna fitted in a manner typical of normal intended use as an integral antenna equipment, unless specified otherwise.

If the EUT is part of a system, or can be connected to ancillary equipment, then the EUT may be tested while connected to the minimum representative configuration of ancillary equipment necessary to exercise the ports.

Ports which in normal operation are connected to ancillary or other equipment through interconnecting cables shall be connected either 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 interconnecting cable. RF input/output ports shall be correctly terminated.

If the EUT has a large number of ports, then a sufficient number shall be selected to simulate actual operational conditions and to ensure that all the different types of termination are tested.

Ports which are not connected to cables during normal intended operation, for example service connectors, programming connectors or temporary connectors, shall not be connected to any cables for the purpose of EMC testing. Where cables have to be connected to these ports, or interconnecting cables have to be extended in length in order to exercise the EUT, precautions shall be taken to ensure that the evaluation of the EUT is not affected by the addition to or extension of these cables.

The test conditions, test configurations and modes of operation of the EUT shall be recorded in the test report.

A.2. Arrangements for test signals and EUT stimulating signals

For non-integral antenna radio communications equipment using other than coaxial means of connecting to the antenna port (e.g. 600 Ω balanced twin or waveguide), a suitable screened transmission line shall be used to connect the EUT to the measuring equipment.

A.2.1. Arrangements for test signals at the input to the transmitter

The transmitter shall be modulated with normal test modulation by an internal or external signal source capable of producing the appropriate drive signal (see subclause A.5.2).

A.2.2. Arrangements for test signals at the output from the transmitter

For integral antenna radio communications equipment, the wanted signal to establish a communication link shall be delivered from the equipment to an antenna located within the test environment. The measuring equipment for the wanted signal shall be located outside of the test environment.

For non-integral antenna radio communications equipment, the wanted signal to establish a communication link shall be delivered from the antenna connector by an appropriate screened cable or waveguide. The measuring equipment for the wanted signal shall be located outside of the test environment.

Adequate measures shall be taken to avoid any effect of the interfering signal on the measuring equipment.

A.2.3. Arrangements for test signals at the input to the receiver

For integral antenna radio communications equipment, the wanted input signal to establish a communication link, shall be presented to the equipment from an antenna located within the test environment. Unless specified otherwise in the present document, it shall be at a level 40 dB above that which just supports normal link performance (or less, as declared by the manufacturer), measured while the power amplifiers generating the EMC disturbance are switched on but without excitation. This level of the wanted input signal is expected to represent a normal operational signal level and should be sufficient to prevent broad band noise from the power amplifiers generating the EMC disturbance from influencing the measurement. The source of the wanted input signal shall be located outside of the test environment.

Note: It may be necessary to fit a notch filter which is tuned to the frequency of the communications link to the interfering test signal source in order to lower the noise floor sufficiently to allow valid measurements to be made.

For non-integral antenna radio communications equipment, the wanted input signal to establish a communication link shall be presented to the antenna connector by an appropriate screened transmission line. The source of the wanted input signal shall be located outside of the test environment. Unless specified otherwise in the present document, it shall be at a nominal level of 40 dB above that which just supports normal link performance (or less, as declared by the manufacturer), measured while the power amplifiers generating the EMC disturbance are switched on but without excitation.

Test signal sources which are applied to the receiver shall present a correct impedance to the receiver input. This requirement shall be met irrespective of whether one or more signals are applied to the receiver simultaneously.

A.2.4. Arrangements for test signals at the output from the receiver

For speech equipment, the audio frequency output of the receiver should be coupled via an electrically non-conductive acoustic tube to an audio distortion meter or other measuring equipment located outside of the test environment. Where it is not practical to use this technique, then other means of connecting the receiver output to an audio distortion meter or other suitable measuring equipment shall be provided. A description of the test system shall be recorded in the test report. Precautions shall be taken to ensure that any effect on the measuring equipment is minimized.

For non-speech equipment, the output of the receiver should be coupled via an electrically non-conductive means to the test equipment located outside of the test environment. If the receiver has a connector providing the receiver output, then it shall be connected to a cable as used in normal operation of the EUT, connected to test equipment outside of the test environment. Precautions shall be taken to ensure that any effect on the measuring equipment is minimized. A description of the test system shall be recorded in the test report.

A.2.5. Arrangements for the application of interfering (immunity) test signals

These are detailed in the relevant standards referred to in the present document e.g. TCVN 8241-4-2:2009 (IEC 61000-4-2:2001), TCVN 8241-4- 3:2009 (IEC 61000-4-3:2006), IEC 1000 4-4, TCVN 8241-4-5:2009 (IEC 61000-4- 5:2005), TCVN 8241-4-6:2009 (IEC 61000-4-6:2004), TCVN 8241-4-11:2009 (IEC 61000-4-11:2004).

A.3. Exclusion bands

Frequencies on which radio communications equipment is intended to operate are generally excluded from immunity tests with either conducted or radiated RF test signals. Frequencies on which transmitters are intended to operate, also out-of-band emission frequencies, are additionally excluded from EMC emission measurements.

There shall be no frequency exclusion band applied to EMC emission measurements of receivers, or ancillaries.

The RF test exclusions are referred to as "exclusion bands" and are elaborated below for the various cases.

A.3.1. Transmitter exclusion bands for EMC emission measurements

Exclusion bands shall not be applied when measuring transmitters in standby mode.

The exclusion band for typical different classes of transmitters is elaborated in table A.1.

Application of the transmitter exclusion band avoids measuring emissions which, although not located at the transmitter nominal frequency, are due to modulation (when present), or due to the shape factor of the filter in the measuring device.

Table A.1: Transmitter exclusion bands for emission measurements

Category of EUT	Width of exclusion band (notes 1 and 2)	Centre of exclusion band
Channelized equipment with $F_n < 0.05 F_c$.	$5 F_n + F_s$	F_c

Non-channelized equipment, Including direct sequence spread-spectrum equipment, or equipment with $F_n > 0.05 F_c$	$1.1 F_n + F_s$	F_c
Frequency hopping equipment	$4 F_n + F_h + F_s$	F_{ch}
<p>Where:</p> <p>F_n is the necessary bandwidth of the wanted class of emission.</p> <p>F_s is the skirt bandwidth = 20 B.</p> <p>B (the measurement bandwidth) is defined as:</p> <ul style="list-style-type: none"> 1 kHz in the frequency range 9 kHz to 150 kHz; 9 - 10 kHz in the frequency range 150 kHz to 30 MHz; 100 – 120 kHz in the frequency range 30 MHz to 1 GHz; 1 MHz in the frequency range > 1 GHz. <p>F_h is the hopping frequency range.</p> <p>F_c is the centre of transmitter necessary bandwidth.</p> <p>F_{ch} is the centre frequency of transmitter hopping range.</p> <p><i>Note 1: The extension of the exclusion bandwidth for transmitters to include 20 times the measurement bandwidth is needed to accommodate the skirt bandwidth (F_s) of the filters used in the measurement equipment. Narrower measurement bandwidths may be used. The exclusion band and measurement bandwidth shall be recorded in the test report.</i></p> <p><i>Note 2: For equipment operating on frequencies below 30 MHz, the exclusion band shall be extended at each end by 5% of the centre frequency.</i></p>		

A.3.2. Transmitter exclusion bands for immunity testing

The exclusion band extends from the centre frequency minus twice the occupied bandwidth, to the centre frequency plus twice the occupied bandwidth.

For Time Division Multiplexed (TDM) equipment, the transmitter exclusion band for immunity testing is equal to the receiver exclusion band for immunity testing.

A.3.3. Receiver exclusion bands for immunity testing

The exclusion band is the relevant operating frequency band, extended at each end by $\pm 5\%$ of the centre frequency.

A.4. Test conditions for EMC emission measurements

The measurement shall be made in the operational mode producing the largest emission in the frequency band being investigated consistent with normal applications.

An attempt shall be made to maximize the detected radiated emission, for example by moving the cables of the equipment.

Where appropriate, a single tone or a bit stream shall be used to modulate the transmitter. The manufacturer shall define the modulation with the highest emission in transmit mode.

Where the EUT has multiple operating bands, it shall be set to operate at the centre frequency of each band. Where the EUT has one or more wide operating frequency bands, there shall be at least one test per decade of frequency coverage provided by the EUT. The actual test frequencies selected shall be recorded in the test report.

A.5. Test conditions for EMC immunity tests

For the immunity tests of ancillary equipment without separate pass/fail criteria, the receiver, transmitter or transceiver coupled to the ancillary equipment shall be used to judge whether the ancillary equipment passes or fails.

A.5.1. Mode of operation

For the immunity tests of transmitters, the transmitter 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 normal test modulation (subclause A.5.2). Where possible, a continuous communication link shall be established at the start of the test, and the performance criteria in subclause C.2.1 shall apply. Where the equipment does not support a continuous communications link, the performance criteria in subclause C.2.2 shall apply.

For the immunity tests of receivers, the wanted input signal coupled to the receiver shall be modulated with normal test modulation (subclause A.5.2). Where possible, a continuous communication link shall be established at the start of the test, and the performance criteria in subclause C.2.1 shall apply. Where the equipment does not support a continuous communications link, the performance criteria in subclause C.2.2 shall apply.

A.5.2. Normal test modulation

For analogue speech equipment:

- The receiver input signal shall be set to the nominal operating frequency, modulated with a sinusoidal audio frequency of 1 kHz with modulation index as specified by the manufacturer to represent normal operation;

- Double SideBand (DSB) full carrier transmitters shall be modulated with a sinusoidal audio frequency signal of 1 kHz. The level of this audio signal shall be set to obtain at least 60% modulation depth of the RF output signal;
- Single SideBand (SSB) suppressed carrier modulation transmitters shall be modulated with a sinusoidal audio frequency signal of 1 kHz;
- Angle modulated transmitters shall be modulated with a sinusoidal audio frequency signal of 1 kHz. The level of this audio signal shall be set to obtain a deviation of 60% peak system deviation of the RF output signal;
- In the case of angle modulated equipment employing audio sidetone, an audio breakthrough test may be performed as a substitute for the above tests. The reference level for the audio breakthrough test shall be taken with a 1 kHz sinusoidal audio signal and a deviation of 60% peak system deviation. For receivers, this modulation shall be applied to the wanted signal. For transmitters, this modulation shall be applied to the RF output signal. After the reference level has been found, the 1 kHz modulation shall be removed for the duration of the audio breakthrough test.

For other equipment (digitized speech, data, specific response, etc.):

- The receiver wanted input signal shall be set to the nominal frequency of the receiver, modulated with a test signal specified by the manufacturer which represents normal operation;
- The transmitter shall be modulated with a test signal which represents normal operation as specified by the manufacturer;
- The manufacturer may supply the test modulation/demodulation equipment;
- The test signal generator (modulation) shall be able to produce a continuous stream of data or a repetitive message as appropriate;
- In the case of data equipment, the test instrumentation shall be able to produce:
 - + a readout of Bit Error Ratio (BER) or Frame Erasure Ratio (FER) of a continuous data stream; or
 - + a repetitive readout of message acceptance or an indication of bulk data throughput rate in the case of error-corrected systems.

ANNEX B

(Normative)

Performance assessment

B.1. General

The manufacturer shall supply the following information concerning the EUT, to be recorded in the test report:

- The primary user functions of the EUT to be tested during and after the EMC testing;
- The intended functions of the EUT which shall be in accordance with its user documentation;
- The type of modulation and characteristics of the transmission used for testing (random bit stream, message format, etc.);
- The ancillary equipment to be combined with the radio equipment for testing, if any;
- The method to be used to verify that a communications link is established and maintained;
- The user control functions (including volume control if appropriate) and stored data that are required for normal operation and the method to be used to assess whether these have been lost after EMC stress;
- An exhaustive list of ports, classified as power, telecom, antenna or signal/control, and the maximum lengths of cables that may be connected. Power ports shall further be classified as Alternative Current (AC) or Direct Current (DC) power;
- A list of service connectors or programming connectors;
- The bandwidth of the filter immediately preceding the demodulator in the receiver;
- Details of the operating frequency range of the EUT;
- In the case of non-integral antenna equipment, details of all antennas supplied by the manufacturer for use with it;
- Details of the mechanism for manual recovery of normal operation shall be provided in the user documentation;
- The EUT software version used during the test.

B.2. EUTs which can provide a continuous communications link

If the EUT permits the establishment of a continuous communications link, the test modulation, test arrangement etc. as required in Annex A shall apply.

B.3. EUTs which can only provide a discontinuous communications link

If the EUT does not permit a continuous communications link to be established, or in the case of ancillary equipment tested on a stand alone basis, the manufacturer shall define the method of test to determine the acceptable level of performance or degradation of performance during and/or after the test. The manufacturer shall provide the following:

- The pass/fail criteria for the EUT;
- The method of observing the performance of the EUT.

The assessment of performance to be carried out during and/or after the tests shall be simple, but at the same time give adequate proof that the primary functions of the EUT are operational.

B.4. EUT classification

Portable equipment, or combinations of equipment, declared as capable of being powered for intended use by the main battery of a vehicle shall additionally be considered as equipment intended for vehicular use.

Portable or mobile equipment or combinations of equipment declared as capable of being powered for intended use by ac mains shall additionally be considered as equipment intended for fixed use.

B.5. Ancillary equipment - methods of assessing compliance

An ancillary equipment may be:

- Declared compliant separately from a receiver, transmitter or transceiver with all the applicable immunity and EMC emission measurement clauses of the present document; or
- Declared compliant with another appropriate Harmonized EMC standard; or
- Tested whilst connected to a receiver, transmitter or transceiver, in which case compliance shall be demonstrated with the appropriate clauses of the present document.

ANNEX C
(Normative)
Performance criteria

C.1. General

The EUT shall meet the performance criteria given in table C.1.

Where the EUT is a transmitter only, tests shall be repeated with the EUT in standby mode (where this mode exists) to ensure that unintentional transmission does not occur.

Where the EUT is a transceiver, the transmitter shall not operate unintentionally during the test, under any circumstances.

The performance criteria A, B and C as indicated in table C.1 shall be used in the following manner:

- Performance criteria A for immunity tests with phenomena of a continuous nature;
- Performance criteria B for immunity tests with phenomena of a transient nature or where called for in specific subclauses of the present document;
- Performance criteria C for immunity tests with power interruptions exceeding a certain period of time.

Table C.1: Performance criteria

Criteria	During test	After test
A	Operate as intended Degradation of performance (note 1) No loss of function	Operate as intended No degradation of performance (Note 2) No loss of function
B	Loss of function (one or more)	Operate as intended No degradation of performance (Note 2) Functions self-recoverable
C	Loss of function (one or more)	Operate as intended No degradation of performance (Note 2) Functions recoverable by the operator (Note 3)

Note 1: Degradation of performance during the test is understood as a degradation to a level not below a minimum performance level specified by the manufacturer for the use of the apparatus as intended. In some cases the specified minimum performance level may be replaced by a permissible degradation of performance.

If the minimum performance level or the permissible performance degradation is not specified by the manufacturer then either of these may be derived from the product

description and documentation (including leaflets and advertising) and what the user may reasonably expect from the apparatus if used as intended.

Note 2: No degradation of performance after the test is understood as no degradation below a minimum performance level specified by the manufacturer for the use of the apparatus as intended. In some cases the specified minimum performance level may be replaced by a permissible degradation of performance. After the test no change of actual operating data or user retrievable data is allowed.

If the minimum performance level or the permissible performance degradation is not specified by the manufacturer then either of these may be derived from the product description and documentation (including leaflets and advertising) and what the user may reasonably expect from the apparatus if used as intended.

Note 3: The EUT should provide an indication of the need for manual operation to recover normal functionality of the product following EMC stress. For example, a lamp or buzzer may be used. Where this is provided, full details of the necessary recovery action and diagnostics provided by the EUT shall be recorded in the user documentation.

C.2. Assessment of receiver immunity

C.2.1. EUTs capable of establishing a continuous communications link

The establishment of the communications link at the start of the test, the maintenance of the communications link and the assessment of the recovered signal information, e.g. an audio signal, shall be used as the performance criteria to ensure that the essential functions of the EUT are evaluated during and after the test.

C.2.2. EUTs only capable of establishing a discontinuous communications link

If the EUT does not permit a continuous communications link to be established, or in the case of ancillary equipment being tested on a stand alone basis, the manufacturer shall declare, for inclusion in the test report, the acceptable level of performance or degradation of performance during and/or after testing. The performance specification shall be included in the product description and documentation.

The performance criteria specified by the manufacturer shall provide at least the same degree of immunity protection as specified in subclause C.1.

C.2.3. Assessment of receiver responses, wideband and narrowband

a) Wideband phenomena

- EUTs operating below 1 MHz

where any response causing the EUT to not meet criteria A is found over a frequency range greater than 50 times the necessary bandwidth of the radio

service in which the EUT is intended to operate, this is considered to be a wideband EMC immunity response and it is deemed to fail the test. At the manufacturer's option, the test may be repeated at offsets equal to twice and 2.5 times the declared bandwidth of the filter immediately preceding the demodulator. If in either of these two latter cases the phenomenon is not present, then the EUT shall be deemed not to fail the test. The option used to evaluate the EUT shall be recorded in the test report.

- EUTs operating above 1 MHz

where any response causing the EUT to not meet criteria A is found over a frequency range greater than 10 times the necessary bandwidth of the radio service in which the EUT is intended to operate, this is considered to be a wideband EMC immunity response and it is deemed to fail the test. At the manufacturer's option, the test may be repeated at offsets equal to twice and 2.5 times the declared bandwidth of the filter immediately preceding the demodulator. If in either of these two latter cases the phenomenon is not present, then the EUT shall be deemed not to fail the test. The option used to evaluate the EUT shall be recorded in the test report.

b) Narrowband phenomena

- EUTs operating below 1 MHz

where any response causing the EUT to not meet criteria A is found over a frequency range less than 50 times the necessary bandwidth of the radio service in which it is intended to operate, this is considered to be a receiver spurious response. All such narrowband responses shall be recorded in the test report. If any responses of this type are found, this shall constitute failure of the test unless the manufacturer declares the complete list of narrowband spurious response frequencies in the user documentation. In such cases, this list shall additionally be included as an annex to the test report.

- EUTs operating above 1 MHz

where any response causing the EUT to not meet criteria A is found over a frequency range less than 10 times the necessary bandwidth of the radio service in which it is intended to operate, this is considered to be a receiver spurious response. All such narrowband responses shall be recorded in the test report. If any responses of this type are found, this shall constitute failure of the test unless the manufacturer declares the complete list of narrowband spurious response frequencies in the user

documentation. In such cases, this list shall additionally be included as an annex to the test report.
