
Elektromagnetna združljivost (EMC) in zadeve v zvezi z radijskim spektrom (ERM) - Standard elektromagnetne združljivosti (EMC) za prizemni snopovni radio (TETRA) in pomožno opremo

Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for Terrestrial Trunked Radio (TETRA) and ancillary equipment

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Foreword

This 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 and EN 50082-1, and other standards where appropriate.

The present document is based on the guidance and considerations given in ETR 238 "CENELEC/ETSI standardization programme for the development of Harmonized Standards related to ElectroMagnetic Compatibility (EMC) in the field of telecommunications".

The present document has been produced by ETSI in response to a mandate from the European Commission issued under Council Directive 83/189/EEC (as amended) laying down a procedure for the provision of information in the field of technical standards and regulations. (standards.iteh.ai)

For equipment within the scope of TBR 35, the present document is intended to become a Harmonized Standard, the reference of which is intended to 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 as amended).

For equipment outside the scope of TBR 35, the present document, together with ETS 300 394-1, is intended to become a Harmonized Standard, the reference of which is intended to be published in the Official Journal of the European Communities referencing the EMC Directive.

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

National transposition dates	
Date of adoption of this EN:	6 February 1998
Date of latest announcement of this EN (doa):	31 May 1998
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	30 November 1998
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1 Scope

The present document covers the assessment of Trans-European Trunked Radio (TETRA) radiocommunications and ancillary equipment in respect of ElectroMagnetic Compatibility (EMC). Technical specifications related to the antenna port and emissions from the enclosure port of radio equipment are found in the related product standards for the effective use of the radio spectrum. The present document specifies the applicable EMC tests, the method of measurements, the limits and the minimum performance criteria for TETRA equipment and the associated ancillary equipment.

The environmental classification used in the present document refers to the environment classification used in the Generic Standards EN 50081-1 [1], EN 50082-1 [2], except for the vehicular environment class which refers to the ISO 7637 [10], [11].

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 do not cover extreme cases which may occur in any location but have 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 phenomena 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.

Compliance of 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.

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2 References

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References may be made to:

- a) specific versions of publications (identified by date of publication, edition number, version number, etc.), in which case, subsequent revisions to the referenced document do not apply; or
- b) all versions up to and including the identified version (identified by "up to and including" before the version identity); or
- c) all versions subsequent to and including the identified version (identified by "onwards" following the version identity); or
- d) publications without mention of a specific version, in which case 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] EN 50081-1 (1992): "Electromagnetic compatibility - Generic emission standard - Part 1: Residential, commercial and light industry".
- [2] EN 50082-1 (1993): "Electromagnetic compatibility - Generic immunity standard - Part 1: Residential, commercial and light industry".
- [3] EN 55022 (1994): "Limits and methods of measurement of radio disturbance characteristics of information technology equipment".
- [4] EN 61000-4-3 (modified): "Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - Section 3: Radiated, radio-frequency, electromagnetic field immunity test".

- [5] EN 61000-4-2: "Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - Section 2: Electrostatic discharge immunity test".
- [6] EN 61000-4-4: "Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - Section 4: Electrical fast transient/burst immunity test".
- [7] EN 61000-4-6: "Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - Section 6: Immunity to conducted disturbances, induced by radio-frequency fields".
- [8] EN 61000-4-11: "Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - Section 11: Voltage dips, short interruptions and voltage variations immunity tests".
- [9] EN 61000-4-5: "Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - Section 5: Surge immunity test".
- [10] 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".
- [11] 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".
- [12] ETS 300 394-1: "Radio Equipment and Systems (RES); Trans-European Trunked Radio (TETRA); Conformance testing specification; Part 1: Radio".
- [13] ITU-T Recommendation 0.153: "Basic parameters for the measurement of error performance at bit rate below the primary rate".
- [14] CISPR 16-1: "Specification for radio disturbance and immunity measuring apparatus and methods - Part 1: Radio disturbance and immunity measuring apparatus".

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3 Definitions and abbreviations

3.1 Definitions

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

ancillary equipment: Equipment (apparatus), used in connection with a receiver, transmitter or transceiver is considered as an ancillary equipment (apparatus) if:

- the equipment is intended for use in conjunction with a receiver, transmitter or transceiver to provide additional operational and/or control features to the radio equipment (e.g. 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 receiver, transmitter or transceiver; and
- the receiver, transmitter or transceiver 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 basic functions); and
- infrastructure and control equipment intended to provide the required data and communication link establishment shall be considered as ancillary equipment for the purposes of the present document.

enclosure port: The physical boundary of the apparatus onto which an electromagnetic field may radiate or impinge.

integral antenna: An antenna designed to be connected directly to the equipment with or 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.

port: A particular interface of the specified equipment (apparatus) with the external electromagnetic environment.

radio communications equipment: An apparatus which includes one or more transmitters and/or receivers and/or parts thereof.

This type of equipment (apparatus) is used in a fixed, mobile or a portable application.

3.2 Abbreviations

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

AC	Alternative Current
BER	Bit Error Ratio
BPF	Band Pass Filter
CF	Carrier Frequency
CR	Continuous phenomena applied to Receivers
CT	Continuous phenomena applied to Transmitters
DC	Direct Current
DMO	Direct Mode Operation
EMC	ElectroMagnetic Compatibility
ERP	Ear Reference Point
EUT	Equipment Under Test
IF	Intermediate Frequency
LISN	Line Impedance Stabilizing Networks
MER	Message Error Ratio
MRP	Mouth Reference Point
PDO	Packet Data Optimized
RF	Radio Frequency
SPL	Sound Pressure Level
TETRA	Trans-European Trunked Radio
TR	Transient phenomena applied to Receivers
TT	Transient phenomena applied to Transmitters
V+D	Voice plus Data

4 General test conditions

This clause defines the general test configuration and is relevant to clauses 8 and 9.

4.1 Test conditions and configurations

The equipment shall be tested under normal test conditions as specified in ETS 300 394-1 [12]:

- the tests shall be carried out at a point within the specified normal operating environmental range of temperature and humidity, with the equipment connected to the rated power supply voltage;
- the test configuration shall be as close to normal intended use as possible;
- where portable (handheld) equipment is provided with a detachable integral antenna, it shall be tested with the antenna fitted in a manner typical of normal intended use, unless specified otherwise;
- 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;
- ports which in normal operation are connected shall be connected to an ancillary equipment or to a representative piece of cable correctly terminated to simulate the input/output characteristics of the ancillary equipment, Radio Frequency (RF) input/output ports shall be correctly terminated;

- if the equipment has a large number of ports, then a sufficient number shall be selected to simulate actual operation conditions and to ensure that all the different types of termination are tested;
- ports which are not connected to cables during normal intended operation, e.g. service connectors, programming connectors, temporary connectors etc. 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 Equipment Under Test (EUT), precautions shall be taken to ensure that the evaluation of the EUT is not affected by the addition or extension of these cables;
- the test conditions, test configuration and mode of operation shall be recorded in the test report.

4.1.1 Emission measurements

This subclause defines the test conditions and configurations for the emission measurements as follows:

- the measurement shall be made in the operation mode e.g. transmit, idle and receive 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.

4.1.2 Immunity tests

This subclause defines the test conditions and configurations for the immunity tests as follows:

- the measurement shall be made in the mode of operation as required in subclause 4.1.2.1;
- for the immunity tests of ancillary equipment without a 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.

4.1.2.1 Mode of operation

For the immunity tests of transmitters, the transmitter shall be operated at its maximum rated output power, modulated with normal test modulation (subclauses 4.1.2.2 and 4.1.2.3). A communication link shall be established (subclause 4.1.2.4) at the start of the test and maintained during the test.

For the immunity tests of receivers, the wanted input signal, coupled to the receiver, shall be modulated with normal test modulation (subclauses 4.1.2.2 and 4.1.2.5). A communication link shall be established (subclause 4.1.2.6) at the start of the test and maintained during the test.

For the immunity tests of duplex transceivers, the EUT may be configured in the repeater mode, consistent with the conditions given above.

For immunity tests of transceivers which can be operated in Direct Mode Operation (DMO) a communication link may be established between two transceivers, consistent with the above.

4.1.2.2 Test modulation

The receiver wanted input signal shall be set to a frequency near to the middle of the operating band of the receiver modulated with either of the test signals listed below, the transmitter shall be set to a frequency near to the middle of the operating band of the transmitter modulated with either of the test signals listed below:

- a test signal T1 (TETRA wanted signal) in accordance with ETS 300 394-1 [12]; or
- a test signal T2 (TETRA interferer) in accordance with ETS 300 394-1 [12] which is a radio signal modulated with a bit stream produced by repeating a pseudo random sequence with a length of 511 bits in accordance with ITU-T Recommendation 0.153 [13].

For V+D equipment the test modulation signal may be a signal modulated with 1 kHz test tone.

For Packet Data Optimized (PDO) and base station V+D equipment: where the test signal T1 is internally generated, to ensure the end to end aspects have been stressed the test signal T2 shall be externally applied to data input port.

The manufacturer may have to 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.

The test signal receiver (demodulator) shall be able to produce a readout of BER of a continuous data stream or a repetitive readout of message acceptance.

4.1.2.3 Arrangements for wanted signals at the input of the transmitter

The transmitter should be modulated with normal test modulation, by an internal or external signal source capable of delivering the normal test modulation.

4.1.2.4 Arrangements for wanted signals at the output of the transmitter

For equipment without an antenna connector, 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 of the wanted signal shall be located outside of the test environment. Adequate measures shall be taken to avoid the effect of the unwanted signal on the measuring equipment.

For equipment with an antenna connector, the wanted signal, to establish a communication link shall be delivered from the antenna connector by a coaxial cable. The measuring equipment of the wanted signal shall be located outside of the test environment. Adequate measures shall be taken to avoid the effect of the unwanted signal on the measuring equipment.

For equipment under test which can support Direct Mode Operation (DMO) a TETRA transceiver may form part of the measuring system.

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4.1.2.5 Arrangements for wanted signals at the input of the receiver

For equipment without an antenna connector, the wanted input signal, to establish a communication link, shall be presented to the equipment from an antenna located within the test environment. It shall be approximately 40 dB above the minimum level necessary to achieve the performance criteria of the receiver as defined in subclause 6.4, 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 normal operation signal level and is sufficient to avoid the 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.

For equipment with an antenna connector, the wanted input signal, to establish a communication link shall be presented to the antenna connector by a coaxial cable. The source of the wanted input signal shall be located outside of the test environment and shall be approximately 40 dB above the minimum level necessary to achieve the performance criteria, measured while the power amplifiers generating the EMC disturbance are switched on but without excitation.

For equipment under test which can support Direct Mode Operation (DMO) a TETRA transceiver may form part of the measuring system.

4.1.2.6 Arrangements for wanted signals at the output of the receiver

For speech equipment the audio frequency output of the equipment should be coupled via an electrically non-conductive acoustic tube to an audio distortion meter or other measuring equipment outside of the test environment. The frequency response of the acoustic tube should be compensated so as to not accentuate the interferer over the wanted signal. Where it is not practical to use an electrically non-conductive acoustic tube, then other means of connecting the receiver output to an audio distortion meter or other measuring equipment shall be provided and recorded in the test report. Precautions shall be taken to ensure that any effect on the test is minimized.