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*Candidate Harmonized European Standard (Telecommunications series)*

**Electromagnetic compatibility  
and Radio spectrum Matters (ERM);  
ElectroMagnetic Compatibility (EMC)  
standard for radio equipment and services;  
Part 2: Specific conditions for radio paging equipment**

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Reference

REN/ERM-EMC-230-2

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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 has been produced by ETSI in response to a mandate from the European Commission issued under Council Directive 98/34/EC [4] (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 [2] as amended) and Directive 1999/5/EC of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity ("the R&TTE Directive" [3]).

The present document is part 2 of a multi-part deliverable. Full details of the entire series can be found in part 1 [1].

<b>National transposition dates</b>	
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## 1 Scope

The present document, together with the EN 301 489-1 [1], covers the assessment of paging equipment (receivers, transmitters and combined equipment) and associated ancillary equipment, in respect of ElectroMagnetic Compatibility (EMC).

Technical specifications related to the antenna port and emissions from the enclosure port of paging equipment are not included in the present document. Such technical specifications are found in the relevant product standards for the effective use of the radio spectrum.

The present document specifies the applicable test conditions, performance assessment and performance criteria for paging equipment and associated ancillary equipment.

Examples of paging equipment are given in annex A.

In case of differences (for instance concerning special conditions, definitions, abbreviations) between the present document and the EN 301 489-1 [1], the provisions of the present document take precedence.

The environmental classification and the emission and immunity requirements used in the present document are as stated in the EN 301 489-1 [1], except for any special conditions included in the present document.

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## 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 and/or edition number or version number) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

- [1] ETSI EN 301 489-1: "Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements".
- [2] Council Directive 89/336/EEC of 3 May 1989 on the approximation of the laws of the Member States relating to electromagnetic compatibility (EMC Directive).
- [3] Directive 1999/5/EC of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity (R&TTE Directive).
- [4] Directive 98/34/EC of the European Parliament and of the Council of 22 June 1998 laying down a procedure for the provision of information in the field of technical standards and regulations.

## 3 Definitions and abbreviations

### 3.1 Definitions

For the purposes of the present document, the terms and definitions given in the EN 301 489-1 [1], clause 3 and the following apply:

**alignment range:** frequency range over which the receiver or transmitter can be programmed and/or re-aligned to operate without any physical change of components other than programmable and frequency controlling devices

**calling function:** transmission of a message via the base transmitter to the paging receiver in order to alert and/or inform the carrier of the paging receiver

**base receiver:** receiver at a fixed location

**pocket receiver:** stand alone pocket paging receiver or a receiver being part of a pocket paging transceiver typically for portable use (portable equipment)

**base transmitter:** transmitter at a fixed location

**pocket transmitter:** stand alone pocket paging transmitter using the return channel, or a transmitter being part of a pocket paging transceiver typically for portable use (portable equipment)

**standby mode (receiver):** mode of operation in which the receiver is capable of receiving calls

**standby mode (base transmitter):** mode of operation in which the transmitter is ready to transmit, waiting for a start control signal to actual start transmitting

**standby mode (pocket transmitter):** mode of operation in which the transmitter is ready to transmit, waiting for a control signal to start the transmitting sequence

**talk-back function:** transmitting of a message from the pocket transmitter (normally combined in a transceiver) which is sent to a central receiver (base receiver) and further processed by the central processing unit

### 3.2 Abbreviations

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

CR	Continuous phenomena applied to Receivers
CT	Continuous phenomena applied to Transmitters
EMC	ElectroMagnetic Compatibility
ERMES	Enhanced Radio MESSage System
EUT	Equipment Under Test
RF	Radio Frequency
TR	Transient phenomena applied to Receivers
TT	Transient phenomena applied to Transmitters

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## 4 Test conditions

For the purposes of the present document, the test conditions of the EN 301 489-1 [1], clause 4, shall apply as appropriate. Further product related test conditions for paging equipment are specified in the present document.

### 4.1 General

For emission and immunity tests the test modulation, test arrangements, etc., as specified in the present document, clauses 4.1.1 to 4.5, shall apply.

#### 4.1.1 Receivers

Whenever a receiver is provided with a detachable antenna, the EUT shall be tested with the antenna fitted in a manner typical of normal intended use.

The individual immunity tests shall be performed with the receiver in the standby mode.

Mobile or pocket receivers:

- before the individual tests the receiver shall be set into the standby mode, a communications link shall be established and the message memory of the receiver shall be loaded with recognizable messages, if applicable (performance check);
- during the individual tests the wanted RF input signal shall **not** be applied to the receiver, except for the spot frequency test as part of the radio frequency electromagnetic field immunity test.
- after the individual tests and the termination of the required performance assessment (e.g. by means of the stored messages in the message memory of the receiver, see clauses 6.3 and 6.4) the communications link shall be re-established and another performance check shall be carried out to verify that the EUT is still operational.

Base receivers:

- base receivers are not subject to the spot frequency test as part of the radio frequency electromagnetic field immunity test;
- before the individual tests the base receiver shall be set into the standby mode, a communications link shall be established and the output of the receiver shall be monitored (performance check);
- during the individual tests the wanted RF input signal (the unmodulated carrier, see clause 4.2) **remains applied** to the base receiver;
- after the individual tests of the base receiver (see clauses 6.3 and 6.4) and the termination of the required performance assessment (e.g. by means of audio breakthrough measurements at the output of the base receiver, see clauses 6.3 and 6.4) the maintained communications link is switched off and re-established to ensure that the base receiver is still able to receive new incoming requests.

#### 4.1.2 Transmitters

Mobile and pocket transmitters:

- the mobile or pocket transmitter **is not** subject to the spot frequency test as part of the radio frequency electromagnetic field immunity test;
- the mobile or pocket transmitter shall operate in transmit mode with an unmodulated carrier, at its maximum rated output power. If unmodulated operation is not possible, the manufacturer shall specify the method of performance assessment and the acceptable degradation of performance.

Base transmitters:

- the base transmitter shall operate in the standby mode, except for the spot frequency test as part of the radio frequency electromagnetic field immunity test (see clause 7.2.2, table 1), where the transmitter shall be tested additionally operated at its maximum rated output power, modulated with normal test modulation (see clause 4.5).

## 4.2 Arrangements for test signals

The provisions of the EN 301 489-1 [1], clause 4.2 shall apply.

### 4.2.1 Arrangements for test signals at the input of transmitters

The provisions of the EN 301 489-1 [1], clause 4.2.1 shall apply with the following modifications.

Mobile and pocket transmitters:

- mobile or pocket transmitters are normally not equipped with an external modulation input port, if an external modulation input port is present, the arrangement for base transmitters shall apply.

Base transmitters:

- for base transmitters, the signal generator to be used for the normal test modulation (see clause 4.5) shall be located outside the test environment and connected to the modulation input port of the transmitter. Adequate measures shall be taken to protect the measuring equipment from the effect of all of the radiated immunity test fields within the test environment.

### 4.2.2 Arrangements for test signals at the output of transmitters

The provisions of the EN 301 489-1 [1], clause 4.2.2 shall apply with the following modifications.

Where the transmitter incorporates a RF antenna connector, the output signal of the transmitter shall be coupled to the measuring equipment via a shielded transmission line such as a coaxial cable. Where the transmitter does not incorporate a RF connector, the output signal of the transmitter shall be coupled to an antenna located within the test environment. This antenna shall be coupled by a shielded transmission line to the measuring equipment located outside of the test environment.

Base transmitters:

- base transmitters are subject to the spot frequency test as part of the radio frequency electromagnetic field immunity test (see clause 7.2.2, table 1). For this test the measuring equipment shall be a paging receiver and repetitive calls shall be transmitted and coupled to the input of the paging receiver located outside the test environment.

### 4.2.3 Arrangements for test signals at the input of receivers

The provisions of the EN 301 489-1 [1], clause 4.2.3 shall apply with the following modifications.

The level of the wanted RF input signal shall be chosen to a value significantly above the threshold sensitivity but below the overload characteristics of the receiver (the signal level should be 60 dB above the threshold sensitivity).

Where the receiver incorporates a RF antenna connector, the RF signal source shall be coupled to the input of the receiver via a shielded transmission line such as a coaxial cable. Where the receiver does not incorporate a RF connector, the RF signal source shall be presented to the receiver from another antenna located within the test environment. This antenna shall be coupled to the RF signal source via an adjustable attenuator.

Mobile and pocket receivers:

- for mobile or pocket receivers, the manufacturer shall at the time of submitting the equipment for testing, supply, if necessary, a test fixture and a message generator as stated in clause 4.5, to generate the wanted RF input signal.

## 4.2.4 Arrangements for test signals at the output of receivers

The provisions of the EN 301 489-1 [1], clause 4.2.4 shall apply.

Mobile and pocket receivers:

- for mobile or pocket receivers, during the spot frequency test as part of the radio frequency immunity test (see clause 7.2.2, table 1), the call received signal output of the receiver shall be coupled to the measuring equipment, located outside the test environment (e.g. by non-metallic means such as an acoustic tube/ coupler), and it shall be possible to assess the performance of the equipment from the call received signal(s) of the receiver.

Base receivers:

- for base receivers, the audio signal output of the receiver shall be coupled to the measuring equipment, located outside the test environment. When the receiver does not have an audio signal output, the manufacturer shall specify the method of performance assessment and the comparable degradation of performance.

## 4.3 Exclusion bands

The provisions of the EN 301 489-1 [1], clause 4.3 shall apply.

### 4.3.1 Exclusion bands for receivers

The exclusion band for receivers (including receivers of pocket transceivers), is the frequency range determined by the alignment range, as declared by the manufacturer, extended as follows:

- for receivers operating in the frequency band 25 MHz to 80 MHz, the lower frequency of the exclusion band is the lower frequency of the alignment range minus 10 % of the centre frequency of the alignment range or minus 5 MHz, whichever results in the lower frequency. For such receivers the upper frequency of the exclusion band is the upper frequency of the alignment range plus 10 % of the centre frequency of the alignment range or plus 5 MHz, whichever is greater;
- for receivers operating above 80 MHz, the lower frequency of the exclusion band is the lower frequency of the alignment range minus 5 % of the centre frequency of the alignment range or 10 MHz, whichever results in the lower frequency, and the upper frequency of the exclusion band is the upper frequency of the alignment range plus 5 % of the centre frequency of the alignment range or plus 10 MHz, whichever is greater;

NOTE: For ERMES receivers the exclusion band shall be the designated ERMES frequency band extended by 25 kHz in both directions (i.e. to lower and higher frequencies).

### 4.3.2 Exclusion band for transmitters

For transmitters operating, or intended to operate, in a channelized frequency band, the exclusion band is five times the channel spacing designated to the relevant paging service in the used frequency band, centred around the operating frequency.

## 4.4 Narrow band responses of receivers

The provision of the EN 301 489-1 [1], clause 4.4 shall apply.

## 4.5 Normal test modulation

Mobile and pocket receivers:

- for mobile or pocket receivers the wanted RF input signal, if required, shall represent selective recognizable messages repeatedly transmitted to the EUT, and its frequency shall be set to the nominal frequency selected for the EUT.

Base receivers:

- for base receivers the wanted RF input signal shall be an unmodulated carrier, set to the nominal frequency selected for the EUT. If possible that unmodulated carrier also applies for the test of the talk-back function of the base receiver.

Mobile and pocket transmitters:

- for mobile or pocket transmitters not having a modulation input port the internal equipment modulation shall be used as normal test modulation signal, and a repetitive call possibility shall be available.

Base transmitters:

for base transmitters, the normal test modulation signal to be used for the calling function shall represent selective messages and may be generated by a signal generator or encoded within the equipment. The signal generator used can be a test signal generator supplied by the manufacturer and capable of generating repetitive calls.

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## 5 Performance assessment

### 5.1 General

The provision of the EN 301 489-1 [1], clause 5.1 shall apply.

### 5.2 Standard paging equipment

For radio paging equipment of non-specialized nature or for radio paging equipment combined with an ancillary equipment, the normal test modulation, test arrangements, etc. as specified in clause 4 and its clauses shall apply.

Mobile and pocket receivers:

- for mobile or pocket receivers, the performance assessment during immunity tests is based on unintentional behaviour of the equipment. It shall be possible from the performance check before and after the test to assess the performance of the receiver from the presented messages and/or the call received alert signal(s) of the receiver (see clause 4.1.1). During the spot frequency immunity test the performance will be verified by the assessment of the successful transfer of paging calls, i.e. from the call received signal(s) of the receiver.

Base receivers:

- for base receivers, the performance assessment during immunity tests is based on the audio breakthrough level caused by the modulation of the immunity test RF source, measured by the audio test equipment with the unmodulated wanted RF carrier provided to the EUT.

Mobile and pocketed transmitters:

- for mobile or pocket transmitters, the performance assessment during immunity tests is based on the audio breakthrough level caused by the modulation of the immunity test RF source, measured by the test receiver with the EUT in transmit mode of operation.

Base transmitters:

- for base transmitters, the performance assessment during immunity tests is based on unintentional behaviour of the equipment, except during the spot frequency immunity test where the performance shall be verified by the assessment of the successful transfer of paging calls, i.e. from the call received signal(s) to the test receiver.

### 5.3 Ancillary equipment

The provision of the EN 301 489-1 [1], clause 5.4 shall apply.

### 5.4 Equipment classification

Paging 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 mobile equipment.

Paging equipment or combinations of equipment declared as being capable of being powered for intended use by AC mains shall additionally be considered as base station equipment for fixed use.

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## 6 Performance criteria

The equipment shall meet the minimum performance criteria as specified in clauses 6.1, 6.2, 6.3 and 6.4, as appropriate.

Paging equipment, for all immunity tests according to the present document, except the spot frequency test as part of the radio frequency immunity test, shall be assessed for:

- the establishment of the communications link from the base transmitter to the mobile or pocket receiver, the transmission of recognizable messages and the detection and storage of these messages in the memory of the paging receiver before and after the test (performance check);
- where applicable, the establishment of the communications link from the mobile or pocket transmitter to the base receiver, the transmission of recognizable signals and the detection of these signals by the base receiver (performance check).

### 6.1 Performance criteria for Continuous phenomena applied to Transmitters (CT)

Mobile or pocket transmitters:

- a communications link shall be established before the test and during the test the modulation of the carrier of the EUT caused by the modulation of the immunity test RF source shall be less than 25 % of the system peak modulation;
- during each individual exposure in the test sequence it shall be verified by appropriate means supplied by the manufacturer that the communication link is maintained;
- at the conclusion of the test the transmitter shall operate as intended with no loss of function;
- where the EUT is a stand alone transmitter, tests shall be repeated with the transmitter in standby mode to ensure that no unintentional transmission occurs.

Base transmitters:

- during the radio frequency immunity test no loss of functions or stored data shall occur. The transmitter output shall remain on channel and shall be unchanged from its initial power level;
- during the spot frequency test as part of the radio frequency immunity test, the transmitter shall be capable of transmitting calls to a test receiver/measuring device with a resulting call acceptance ratio of 4/5 (four out of five) or better;

- at the conclusion of the test comprising the series of individual exposures the transmitter shall operate as intended with no loss of functions;
- during the tests in standby mode no unintentional transmission shall occur.

## 6.2 Performance criteria for Transient phenomena applied to Transmitters (TT)

Mobile or pocket transmitters:

- a one-way communication link shall be established before the test and after each individual exposure it shall be verified, by appropriate means supplied by the manufacturer, that the communication link is maintained;
- at the conclusion of the test the EUT shall operate as intended with no loss of functions or stored data;
- where the EUT is a stand alone transmitter, tests shall be repeated with the transmitter in standby mode to ensure that no unintentional transmission occurs.

Base transmitters:

- the test shall be performed in standby mode, for all types of transmitters, to ensure that no unintentional transmission occurs;
- at the conclusion of the test the EUT shall operate as intended with no loss of functions or stored data.

## 6.3 Performance criteria for Continuous phenomena applied to Receivers (CR)

Mobile or pocket receivers:

- during the test no false call shall occur;
- at the conclusion of the test comprising the series of individual exposures the receiver shall operate as intended with no loss of functions or stored data (messages), as declared by the manufacturer;
- during the spot frequency test as part of the radio frequency immunity test the receiver shall provide a call received signal acceptance ratio of 4:5 (four out of five) or better;
- Where the EUT is a transceiver, under no circumstances shall the transmitter operate unintentionally during the test.

Base receivers:

- a communications link shall be established before the test and during the test the audio output of the EUT caused by the modulation of the immunity test RF source shall be less than 25 % of the system peak output voltage;
- during each individual exposure in the test sequence it shall be verified by appropriate means, supplied by the manufacturer, that the communication link is maintained;
- at the conclusion of the test, the receiver shall operate with no loss of function.

## 6.4 Performance criteria for Transient phenomena applied to Receivers (TR)

Mobile or pocket receivers:

- no false call shall occur due to the test;
- at the conclusion of the test, the receiver shall operate as intended with no loss of functions or stored data (messages), as declared by the manufacturer;
- where the EUT is a transceiver, under no circumstances shall the transmitter operate unintentionally during the test.

Base receivers:

- a communication link shall be established before the test and after each individual exposure in the test sequence it shall be verified, by appropriate means, supplied by the manufacturer, that the communication link is maintained;
- at the conclusion of the test, the receiver shall operate with no loss of function.

## 6.5 Performance criteria for ancillary equipment tested on a stand alone basis

The provision of EN 301 489-1 [1], clause 6.4 shall apply.

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# 7 Applicability overview

## 7.1 Emission

### 7.1.1 General

The applicability of EMC emission measurements for the relevant ports of radio and/or associated ancillary equipment are found in table 2 of EN 301 489-1 [1].

### 7.1.2 Special conditions

No special conditions shall apply to paging equipment in the scope of the present document.

## 7.2 Immunity

### 7.2.1 General

The applicability of EMC immunity measurements for the relevant ports of radio and/or associated ancillary equipment are found in table 3 of EN 301 489-1 [1].

## 7.2.2 Special conditions

The following special conditions set out in table 1, relate to the immunity test methods and performance criteria used in the EN 301 489-1 [1], clause 9.

**Table 1: Special conditions for EMC immunity tests**

Reference to clauses in the EN 301 489-1 [1]	Special product-related conditions, additional to or modifying the test conditions in the EN 301 489-1 [1], clause 9
<b>9.2.2: Test method;</b> <b>Radio frequency electromagnetic field</b>	<b>Spot frequency test:</b> A spot frequency test shall additionally be performed at 80, 104, 136, 165, 200, 260, 330, 430, 560, 715 and 920 MHz $\pm$ 1 MHz, excluding those frequencies that fall within the exclusion band. The test shall additionally be performed at the edge frequencies of the exclusion band.  Mobile or pocket transmitters and base receivers are exempted from the spot frequency test.

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## Annex A (informative): Definitions of the paging equipment in the scope of the present document

The following clauses provide examples of the types of equipment covered by the present document.

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### A.1 ERMES paging equipment

The present document applies to ERMES paging equipment and associated ancillary equipment operating in the ERMES Paging Service.

ERMES paging receivers are defined in ETS 300 133-5 (see bibliography).

ERMES paging transmitters are defined in ETS 300 133-6 (see bibliography).

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### A.2 On-site paging equipment

The present document applies to on-site paging equipment and associated ancillary equipment.

On-site paging equipment may comprise pocket receivers, pocket transmitters, pocket transceivers, and base transmitters or base receivers, as defined in ETS 300 224 (see bibliography), used in a privately owned and operated paging systems in a restricted and pre-defined area.

The radio-type of equipment operates in the frequency range 25 MHz to 470 MHz, and the loop-type of equipment operates in the frequency range 16 kHz to 146 kHz.

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### A.3 Wide-area paging equipment

The present document applies to wide-area paging equipment and associated ancillary equipment.

Wide-area paging equipment may comprise pocket receivers, base transmitters and associated ancillary equipment, as defined e.g. in ETS 300 719-1 (see bibliography) and is used in a privately owned and operated wide-area Paging Services as well as in public wide-area Paging Services.

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## Annex B (informative): Bibliography

ETSI ETS 300 133-5: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Enhanced Radio MESSAGE System (ERMES); Part 5: Receiver conformance specification".

ETSI ETS 300 133-6: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Enhanced Radio MESSAGE System (ERMES); Part 6: Base station conformance specification".

ETSI ETS 300 224: "Electromagnetic compatibility and Radio spectrum Matters (ERM); On-site paging service; Technical and functional characteristics for on-site paging systems, including test methods".

ETSI ETS 300 719-1: "Radio Equipment and Systems (RES); Private wide area paging service; Part 1: Technical characteristics for private wide-area paging systems".

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## History

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