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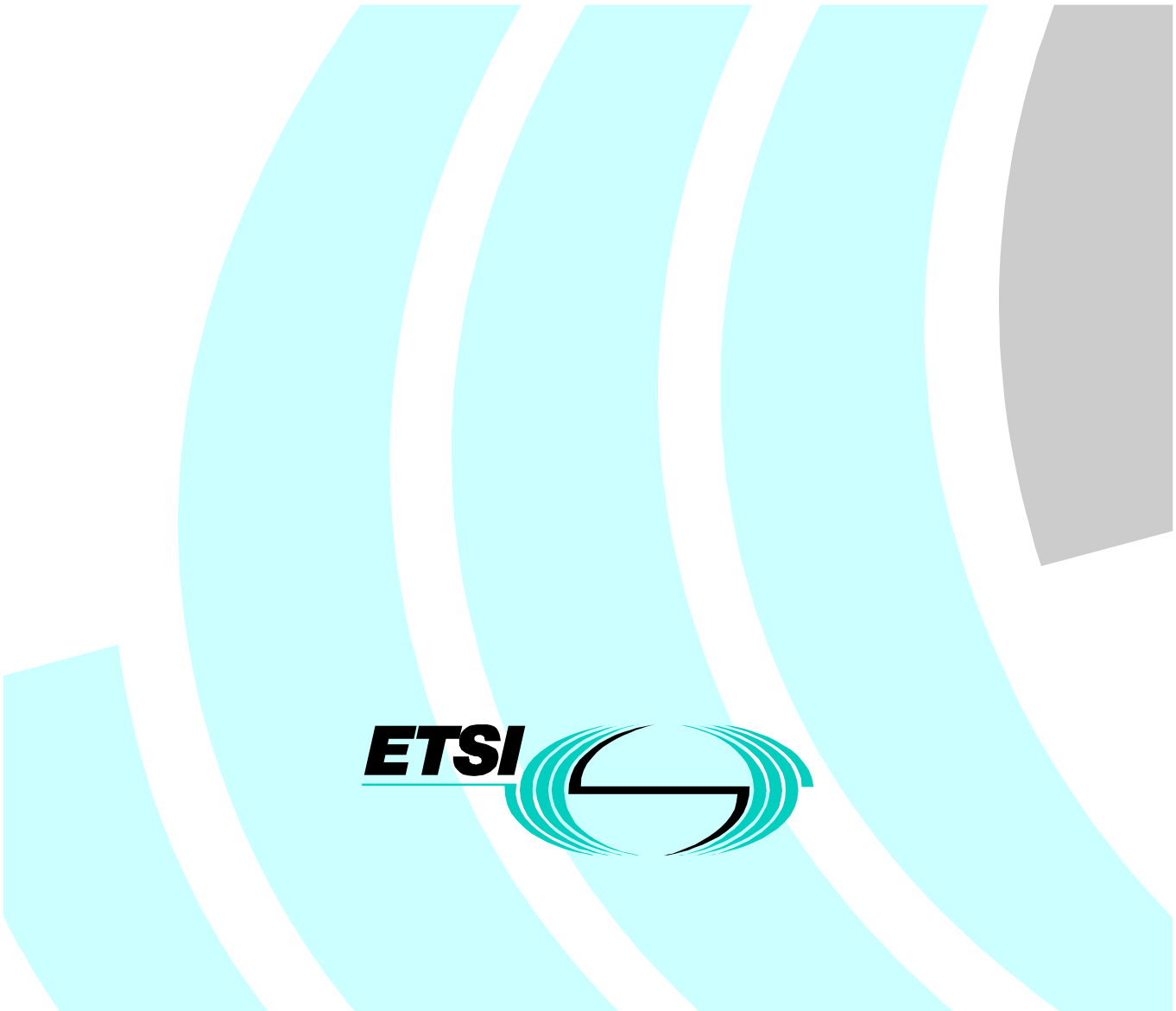
Candidate Harmonized European Standard (Telecommunications series)

Electromagnetic compatibility and Radio Spectrum Matters (ERM); Harmonized EN for CT1 and CT1+ cordless telephone equipment covering essential requirements under article 3.2 of the R&TTE directive



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Contents

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Foreword

This Candidate Harmonized European Standard (Telecommunications Series) has been produced by the ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM), and is now submitted for the ETSI standards One-step Approval Procedure.

The present document has been produced by ETSI in response to a mandate from the European Commission issued under Council Directive 98/34/EC [7] 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 Directive 1999/5/EC [1] 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").

Proposed national transposition dates	
Date of latest announcement of this EN (doa):	3 months after ETSI publication
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	6 months after doa
Date of withdrawal of any conflicting National Standard (dow):	6 months after doa

Introduction

The present document is part of a set of standards designed to fit in a modular structure to cover all radio and telecommunications terminal equipment under the R&TTE Directive [1]. Each standard is a module in the structure. The modular structure is shown in figure 1.

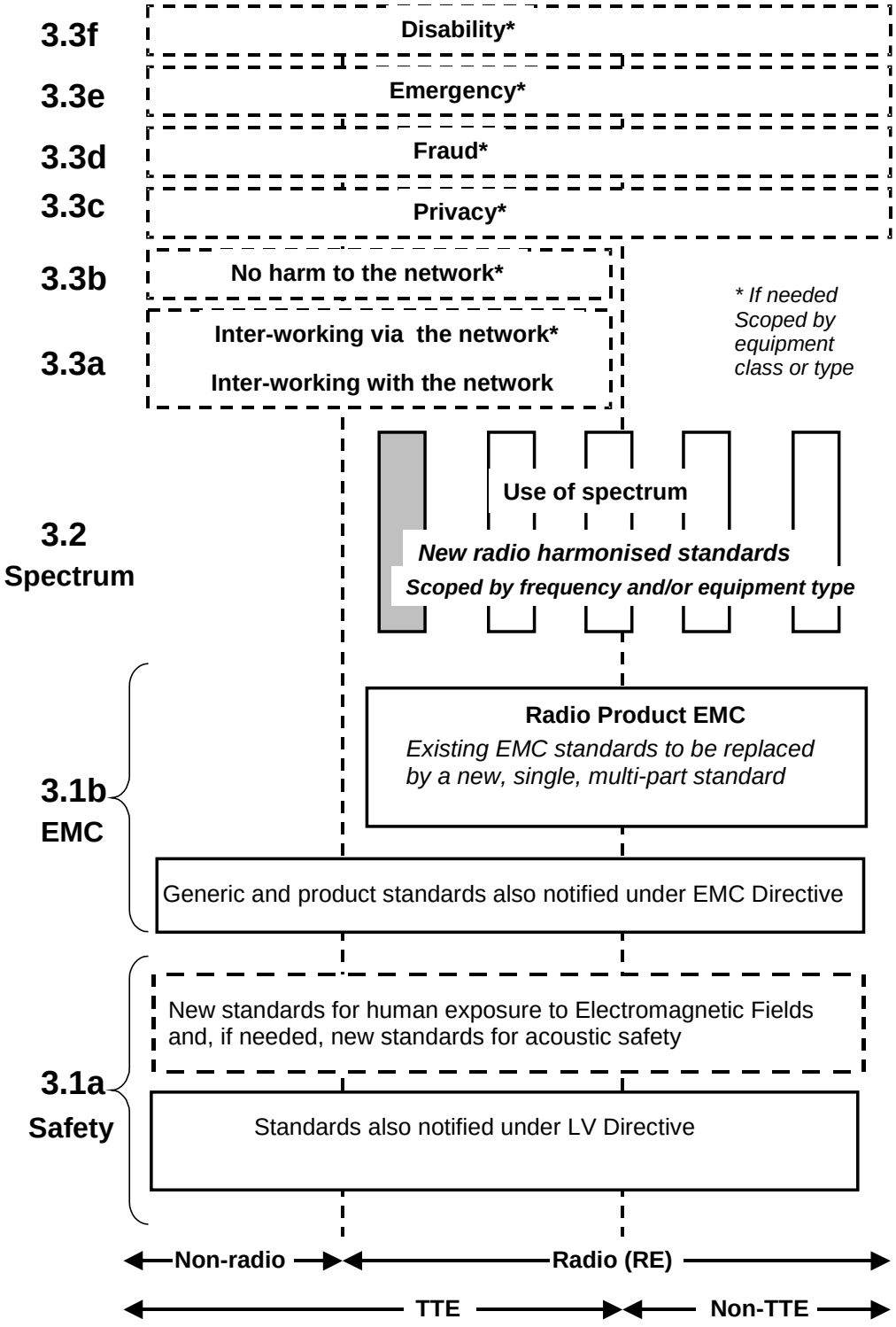

Figure 1: Modular structure for the various standards used under the R&TTE Directive [1]

The left hand edge of the figure 1 shows the different subclauses of Article 3 of the R&TTE Directive [1].

For article 3.3 various horizontal boxes are shown. Dotted lines indicate that at the time of publication of the present document essential requirements in these areas have to be adopted by the Commission. If such essential requirements are adopted, and as far and as long as they are applicable, they will justify individual standards whose scope is likely to be specified by function or interface type.

The vertical boxes show the standards under article 3.2 for the use of the radio spectrum by radio equipment. The scopes of these standards are specified either by frequency (normally in the case where frequency bands are harmonized) or by radio equipment type.

For article 3.1b the diagram shows the new single multi-part product EMC standard for radio, and the existing collection of generic and product standards currently used under the EMC Directive [2]. The parts of this new standard will become available in the second half of 2000, and the existing separate product EMC standards will be used until it is available.

For article 3.1a the diagram shows the existing safety standards currently used under the LV Directive [3] and new standards covering human exposure to electromagnetic fields. New standards covering acoustic safety may also be required.

The bottom of the figure shows the relationship of the standards to radio equipment and telecommunications terminal equipment. A particular equipment may be radio equipment, telecommunications terminal equipment or both. A radio spectrum standard will apply if it is radio equipment. An article 3.3 standard will apply as well only if the relevant essential requirement under the R&TTE Directive [1] is adopted by the Commission and if the equipment in question is covered by the scope of the corresponding standard. Thus, depending on the nature of the equipment, the essential requirements under the R&TTE Directive [1] may be covered in a set of standards.

The modularity principle has been taken because:

- it minimizes the number of standards needed. Because equipment may, in fact, have multiple interfaces and functions it is not practicable to produce a single standard for each possible combination of functions that may occur in an equipment;
- it provides scope for standards to be added:
  - under article 3.2 when new frequency bands are agreed; or
  - under article 3.3 should the Commission take the necessary decisions;

  without requiring alteration of standards that are already published;
- it clarifies, simplifies and promotes the usage of Harmonized Standards as the relevant means of conformity assessment.

1 Scope

The present document applies to CT1 and CT1+ cordless telephone terminal equipment.

These cordless telephone equipment types are capable of operating in all or any part of the frequency bands given in table 1:

Table 1: Cordless Telephone service frequency bands

	Cordless Telephone service frequency bands
Portable Part CT1	914,0125 MHz to 914,9875 MHz
Fixed Part CT1	959,0125 MHz to 959,9875 MHz
Portable Part CT1+	885,0125 MHz to 886,9875 MHz
Fixed Part CT1+	930,0125 MHz to 931,9875 MHz

It should be noted that the above frequency bands are not harmonized throughout the community.

The existence of this Harmonized Standard does not imply the availability of the above frequency spectrum for the particular types of equipment covered by the present document.

The present document is intended to cover the provisions of Directive 1999/5/EC [1] (R&TTE Directive) Article 3.2, which states that "… radio equipment shall be so constructed that it effectively uses the spectrum allocated to terrestrial/space radio communications and orbital resources so as to avoid harmful interference."

In addition to the present document, other ENs that specify technical requirements in respect of essential requirements under other parts of Article 3 of the R&TTE Directive [1] will apply to equipment within the scope of the present document.

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

2 References

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

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

[1] 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).

[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] Council Directive 73/23/EEC of 19 February 1973 on the harmonization of the laws of the Member States relating to electrical equipment designed for use within certain voltage limits (LV Directive).

[4] ETSI ETS 300 086: "Radio Equipment and Systems (RES); Land mobile group; Technical characteristics and test conditions for radio equipment with an internal or external RF connector intended primarily for analogue speech".

[5] ITU-T Recommendation O.41: "Psophometer for use on telephone-type circuits".

[6] ETSI ETR 028 (1994): "Radio Equipment and Systems (RES); Uncertainties in the measurement of mobile radio equipment characteristics".

[7] 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 in the R&TTE Directive [1], and the following terms and definitions apply:

Environmental profile: range of environmental conditions under which equipment within the scope of the present document is required to comply with the provisions of the present document.

3.2 Abbreviations

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

CFP	Cordless Fixed Part
CPP	Cordless Portable Part
CT	Cordless Telephone
EMC	Electro-Magnetic Compatibility
LV	Low Voltage
R&TTE	Radio and Telecommunications Terminal Equipment
RE	Radio Equipment

4 Principles of operation and general requirements

4.1 Procedure to set up the RF connection between fixed and portable part

Both fixed and portable part comprises a transmitter and a receiver which will perform full duplex operation. When the need for a radio frequency channel arises in any of the parts of a cordless telephone, this part will act in general as follows:

a) the initiating part searches for an idle duplex channel. A channel is considered to be idle if the initiating part of the cordless telephone senses that the radio frequency field strength on that specific channel is below a specified limit;

b) on the idle (duplex) channel, found under a), the initiating part starts transmitting signals to the desired part of the same cordless telephone. These signals contain an identification code which offers at least 999999 different combinations;

c) the receiver of each part of a cordless telephone is constantly scanning, searching for a signal which contains its matching identification code. Upon detection of this code, the receiver stops scanning and initiates its transmitter to return its identification code to the initiating part on this duplex channel;

d) as the receiver of the initiating part detects its matching identification code on the return frequency of the selected duplex channel, the duplex channel becomes available.

4.2 Operating frequencies

Due to the fact, that the operating frequencies of CT1 are not available in all countries, the equipment shall fulfil requirements for frequency set of CT1 and/or CT1+.

CT1: Channel number and Transmitting frequencies

	Portable part	Fixed part
1	914,0125 MHz	959,0125 MHz
2	914,0375 MHz	959,0375 MHz
3	914,0625 MHz	959,0625 MHz
	…	
	…	
38	914,9375 MHz	959,9375 MHz
39	914,9625 MHz	959,9625 MHz
40	914,9875 MHz	959,9875 MHz

CT1+: Channel number and Transmitting frequencies

	Portable part	Fixed part
1	885,0125 MHz	930,0125 MHz
2	885,0375 MHz	930,0375 MHz
3	885,0625 MHz	930,0625 MHz
	…	
	…	
78	886,9375 MHz	931,9375 MHz
79	886,9625 MHz	931,9625 MHz
80	886,9875 MHz	931,9875 MHz

For the frequency band of CT1+ the equipment may work with fixed blocks of more than 39 channels, if the equal use of all channels is maintained.

4.3 General requirements

4.3.1 Modulation

Only constant envelope analogue angle modulation shall be used.

4.3.2 Antenna

The antenna of the Cordless Fixed Part (CFP) and the antenna of the Cordless Portable Part (CPP), shall be an integral antenna. The CFP and the CPP may be fitted with a permanent internal or a temporary internal 50 Ω RF connector which allows access to the transmitter output and the receiver input for measurement purposes.

The use of an external antenna connector is not allowed.

4.3.3 Threshold level for field strength and minimum observation time

To determine the availability of a channel during the scanning procedure the parts of a cordless telephone shall be equipped with a detector which provides a sensing facility corresponding to the field strength. A channel shall be considered as not in use if the median level of the field strength is lower than +20 dB relative to 1 microvolt per metre. The minimum observation time before a channel is considered to be available shall be 100 milliseconds.

4.3.4 Scanning time

When a call is initiated, the scanning procedure shall start immediately.

In case the call is initiated by an incoming ringing signal from the telephone line, the scanning procedure shall start within one second after detection of the ringing signal.

When a free channel is located the initiating part shall transmit identification signals for not longer than 3 seconds. If a matching response has not been received by the initiating part after 3 seconds, it recommences searching for another free channel. In the case of an incoming call this procedure continues as long as there is an incoming ringing signal.

4.3.5 Termination of the RF connection and line connection

4.3.5.1 Termination of the RF connection

When the RF connection is to be terminated, the part of the cordless telephone which initiates the termination shall transmit 4 times a coded termination message, including the identification code which would be used for initiating a RF connection. The RF circuit shall then be disconnected and the cordless telephone shall return to the idle condition.

4.3.5.2 Interruption of a connection due to low field strength

A CPP is considered to be "out of range" if the median level of the field strength at a receiving part is at a level less than 6 dB above the level for free channel subclause 4.3.3. The line connection and RF connection in use by the cordless telephone shall be terminated automatically if the CPP has remained "out of range" for more than 10 ± 1 seconds.

4.3.6 Power supply for CPP

The supply voltage is considered to be insufficient if it is lower than the lowest voltage which is mentioned under "extreme test voltages" for the applicable type of power source. If the supply voltage is insufficient it shall not be possible to establish a RF connection. Means shall be provided to indicate the supply voltage situation on a CPP.

5 Test conditions, power sources and ambient temperatures

5.1 Normal and extreme test conditions

Tests shall be made under normal test conditions, and also, where stated, under extreme test conditions.

The test conditions and procedures shall be as specified in subclauses 5.2 to 5.5.

5.2 Test power source

During tests the power source of the equipment shall be replaced by a test power source, capable of producing normal and extreme test voltages as specified in subclauses 5.3.2 and 5.4.2. The internal impedance of the test power source shall be low enough for its effect on the test results to be negligible. For the purpose of tests, the voltage of the power source shall be measured at the input terminals of the equipment.

If the equipment is provided with a permanently connected power cable, the test voltage shall be that measured at the point of connection of the power cable to the equipment.

In equipment with incorporated batteries the test power source shall be applied as close to the battery terminals as practicable.

During tests the power source voltages shall be maintained within a tolerance of ±3 % relative to the voltage at the beginning of each test.

5.3 Normal test conditions

5.3.1 Normal temperature and humidity

The normal temperature and humidity conditions for tests shall be any convenient combination of temperature and humidity within the following ranges:

- Temperature +15°C to +35°C;
- Relative humidity 20 % to 75 %.

5.3.2 Normal test power source

5.3.2.1 Mains voltage and frequency

The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of testing according to this present document, the nominal voltage shall be the declared voltage or any of the declared voltages for which the equipment was designed. The frequency of the test power source shall be the nominal ac frequency.

5.3.2.2 Other power sources

For operation from other sources or types of battery (primary or secondary), the normal test voltage shall be that declared by the equipment manufacturer and agreed by the test laboratory.

5.4 Extreme test conditions

5.4.1 Extreme temperatures

For tests at extreme temperatures, measurements shall be made in accordance with the procedures specified in subclause 5.5, at the following upper and lower temperatures:

- 0°C to +55°C.

5.4.2 Extreme test voltages

5.4.2.1 Mains voltage and frequency

The extreme test voltage for equipment to be connected to an ac mains source shall be the nominal mains voltage ±10 %. The frequency shall be an ac frequency between 49 and 51 Hz.

5.4.2.2 Other power sources

The lower extreme test voltages for equipment with power sources using the following batteries shall be:

- for the Leclanché or the lithium type of battery: 0,85 times the nominal voltage of the battery;
- for the mercury or nickel-cadmium type of battery: 0,9 times the nominal voltage of the battery.

No upper extreme test voltages apply.

For equipment using other power sources, or capable of being operated from a variety of power sources, the extreme test voltages shall be those agreed between the equipment manufacturer and the test laboratory and shall be recorded with the results.

5.5 Procedure for test at extreme temperatures

Before measurements are made the equipment shall have reached thermal balance in the test chamber. The equipment shall be switched off during the temperature stabilizing period.

In the case of equipment containing temperature stabilization circuits designed to operate continuously, the temperature stabilization circuits may be switched on for 15 minutes after thermal balance has been obtained, and the equipment shall then meet the specified requirements. For such equipment the manufacturer shall provide for the power source circuit feeding the crystal oven to be independent of the power source of the rest of the equipment.

If the thermal balance is not checked by measurements, a temperature stabilizing period of at least one hour, or such period as may be decided by the test laboratory, shall be allowed. The sequence of measurements shall be chosen, and the humidity content in the test chamber shall be controlled so that excessive condensation does not occur.

5.5.1 Procedure for equipment designed for continuous operation

As a CT is being used for continuous operation, the test procedure shall be as follows.

Before tests at the upper extreme temperature the equipment shall be placed in the test chamber and left until thermal balance is attained. The equipment shall then be switched on in the transmit condition for a period of half an hour after which the equipment shall meet the specified requirements.

For tests at the lower extreme temperatures the equipment shall be left in the test chamber until thermal balance is attained, then switched to the standby or receive condition for a period of one minute after which the equipment shall meet the specified requirements.

6 General conditions

6.1 Arrangements for test signals applied to the receiver

Sources of test signals are applied to the receiver via an internal antenna connector or a test antenna (subclause 6.5).

If no temporary or permanent internal antenna connector is available, then the test fixture (subclause 6.4) shall be used instead.

The signal sources shall in all cases present an impedance of 50 Ω.

This requirement shall be met irrespective of whether one or more signals are applied to the receiver simultaneously.

The effects of any intermodulation products and noise produced in the signal generators should be negligible.

6.2 Receiver circuitry

6.2.1 Receiver mute or squelch circuit

The receiver mute or squelch circuit shall be made inoperative for the duration of the tests.

6.3 Normal test modulation

For normal test modulation, the modulation frequency shall be 1 kHz and the resulting frequency deviation shall be ±3 kHz.

6.4 Test fixture

The manufacturer may be required to supply a test fixture suitable to allow relative measurements to be made on the submitted sample.

The test laboratory may provide its own test fixture.

A test fixture shall provide a 50 Ω radio frequency terminal at the working frequencies of the equipment to the measuring instruments.

The performance characteristics of this test fixture under normal and extreme conditions are subject to the approval of the test laboratory.

The characteristics of interest to the test laboratory will be that:

a) the coupling loss shall not be excessive, that is, not greater than 20 dB;

b) the variation of coupling loss with frequency shall not cause errors exceeding 2 dB in the operating frequency band in measurements using the test fixture;

c) the coupling device shall not include any non-linear elements.

6.5 Test site and general arrangement for measurements involving the use of radiated fields

6.5.1 Test site

The test site shall be on a reasonably level surface or ground.

At one point on the site, a ground plane of at least 5 metres diameter shall be provided. In the middle of this ground plane, a non-conducting support, capable of rotation through 360° in the horizontal plane, shall be used to support the test sample at 1,5 metres above the ground plane.

The test site shall be large enough to allow the erection of a measuring or transmitting antenna at a distance of at least 3 metres.

The distance actually used shall be recorded with the results of the test carried out on the site. Sufficient precautions shall be taken to ensure that reflections from extraneous objects adjacent to the site and ground reflections do not degrade the measurement results.

A guidance on the use of radiation test sites is given in ETS 300 086 [4], annex A.

6.5.2 Optional indoor test site

When the frequency of the signals being measured is greater than 80 MHz, use may be made of an indoor site. If this alternative is used, this shall be recorded in the test report. The measurement site may be a laboratory room with a minimum area of 6 m by 7 m and at least 2,7 m height.

Apart from the measuring apparatus and the operator, the room shall be as free as possible from reflecting objects other than the walls, floor and ceiling.

The potential reflections from the wall behind the equipment under test are reduced by placing a barrier of absorbent material in front of it. The corner reflector around the test antenna is used to reduce the effect of the reflections from the opposite wall and from the floor and ceiling in case of horizontally polarized measurements. Similarly, the corner reflector reduces the effects of reflections from the side walls for vertically polarized measurements. For the lower part of the frequency range (below approximately 175 MHz) no corner reflector or absorbent barrier is needed. For practical reasons, the lambda/2 antenna in ETS 300 086 [4], annex A, figure A.2 may be replaced by an antenna of constant length, provided that the length is between lambda/4 and lambda at the frequency of measurement and the sensitivity of the measuring system is sufficient. In the same way the distance of lambda/2 to the apex may be varied.

The test antenna, measuring receiver, substitution antenna and calibrated generator are used in a way similar to that of the general method.

To ensure that the errors are not caused by the propagation path approaching the point at which phase cancellation between direct and the remaining reflected signals occurs, the substitution antenna shall be moved through a distance of ±0,1 m in the direction of the antenna as well as in the two directions perpendicular to this first direction.

If these changes of distance cause a signal change of greater than 2 dB, the test sample should be re-positioned until a change of less than 2 dB is obtained.

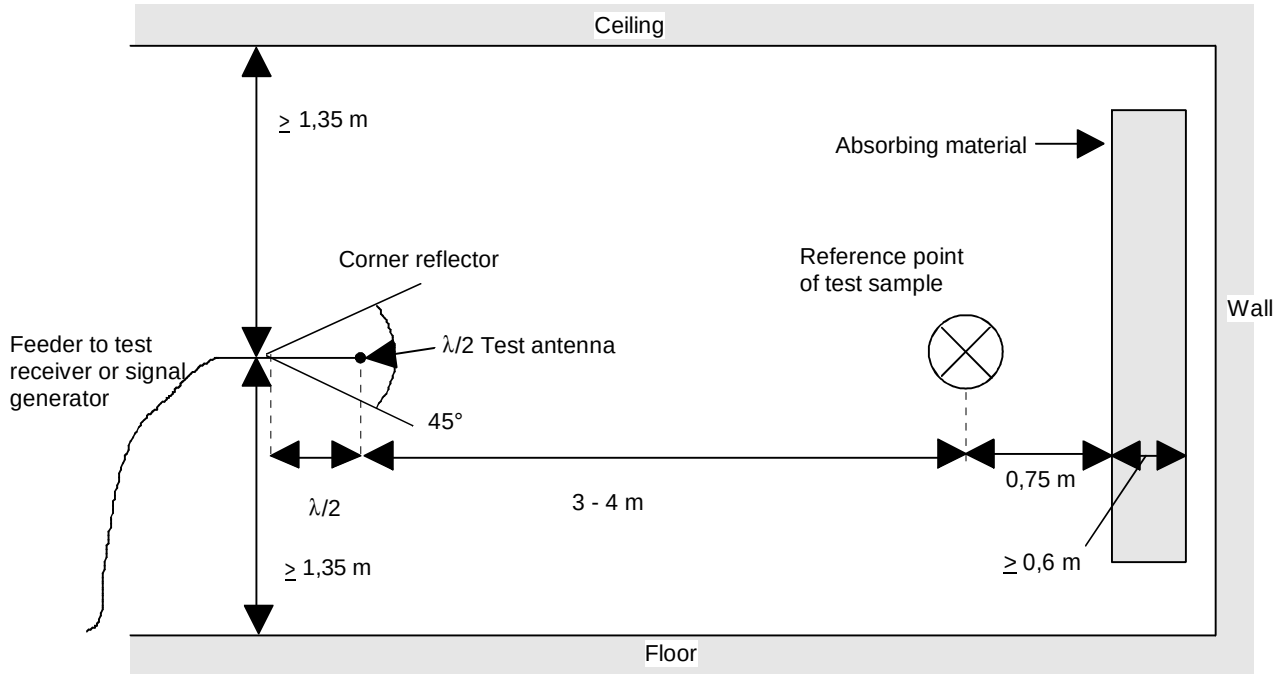

Figure 2: Indoor site arrangement (shown for horizontal polarization)

6.5.3 Test antenna

The test antenna is used to detect the radiation from both the test sample and the substitution antenna, when the site is used for radiation measurements: where necessary, it is used as a transmitting antenna, when the site is used for the measurement of receiver characteristics. This antenna is mounted on a support such as to allow the antenna to be used in either the horizontal or vertical polarization and for the height of its center above ground to be varied over the range 1 to 4 metres. Preferably a test antenna with pronounced directivity should be used. The size of the test antenna along the measurement axis shall not exceed 20 % of the measuring distance.

For radiation measurements, the test antenna is connected to a test receiver, capable of being tuned to any frequency under investigation and of measuring accurately the relative levels of signals at its input. When necessary (for receiver measurements) the test receiver is replaced by a signal source.

6.5.4 Substitution antenna

The substitution antenna shall be a lambda/2 dipole, resonant at the frequency under consideration, or a shortened dipole, calibrated to the lambda/2 dipole. The center of this antenna shall coincide with the reference point of the test sample it has replaced. This reference point shall be the volume center of the sample when its antenna is mounted inside the cabinet, or the point where an external antenna is connected to the cabinet. The distance between the lower extremity of the dipole and the ground shall be at least 30 cm.

The substitution antenna shall be connected to a calibrated signal generator when the site is used for radiation measurement and to a calibrated measuring receiver when the site is used for measurement of receiver characteristics.

The signal generator and the receiver shall be operating at the frequencies under investigation and shall be connected to the antenna through suitable matching and balancing networks.

6.5.5 Auxiliary cables

The position of auxiliary cables (power supply and microphone cables etc.) which are not adequately de-coupled may cause variations in the measuring results. In order to get reproducible results, cables and wires of auxiliaries are mounted vertically downwards (through a hole in the isolating table), and shall be fitted at the upper part with a radio frequency stop filter (for instance using ferrite cores).

7 Transmitter

7.1 Frequency error

7.1.1 Definition

The frequency error of the transmitter is the difference between the measured carrier frequency and its nominal value.

7.1.2 Method of measurement

Any channel within the declared frequency range may be selected for testing.

Either of the following two arrangements may be used:

- the equipment shall be placed in a test fixture (subclause 6.4) connected to a non-reactive non-radiating load of 50 Ω; or

- the transmitter is connected to a non-reactive non radiating load of 50 Ω through the internal antenna connector.

The carrier frequency shall be measured in the absence of modulation. The measurement shall be made under normal test conditions (subclause 5.3) and extreme test conditions (subclause 5.4).

If the equipment is constructed so that during the procedure to set-up the RF connection, the frequency is determined by a separate technique, the measurements shall be repeated while the frequency is determined by that technique.

7.1.3 Limits

The frequency error measured at least one second after a channel has been selected shall not exceed a value of ±2,5 kHz.

7.2 Carrier power

7.2.1 Definition

For the purpose of the present document, the carrier power is the declared effective radiated power in the direction of maximum field strength under specified conditions of measurement (subclause 6.5) in the absence of modulation.

7.2.2 Method of measurement under normal test conditions

Any channel within the declared frequency range may be selected for testing.

On a test site, fulfilling the requirements of subclause 6.5, the sample shall be placed on the support in a position:

a) for equipment with internal antenna, it shall stand vertically, with that axis vertical which is closest to vertical in normal use;

b) for equipment with rigid external antenna, the antenna shall be vertical;

c) for equipment with non-rigid external antenna, with the antenna extended vertically upwards by a non-conducting support.

The transmitter shall be switched on, without modulation, and the test receiver shall be tuned to the frequency of the signal being measured. The test antenna shall be orientated for vertical polarization and shall be raised or lowered through the specified height range until a maximum signal level is detected on the test receiver.

The transmitter shall be rotated through 360° until a higher maximum signal is received.

NOTE: This maximum may be a lower value than the value obtainable at heights outside the specified limits.

The transmitter shall be replaced by the substitution antenna, as defined in subclause 6.5 and the test antenna raised or lowered as necessary to ensure that the maximum signal is still received. The input signal to the substitution antenna shall be adjusted in level until an equal or a known related level to that detected from the transmitter is obtained in the test receiver.

The carrier power is equal to the power supplied to the substitution antenna, increased by the known relationship if necessary.

A check should be made at other planes of polarization to ensure that the value obtained above is the maximum. If larger values are obtained, this fact should be recorded in the test report.

7.2.3 Limits

The effective radiated power of the equipment shall not exceed 10 mW.

7.3 Adjacent channel power

7.3.1 Definition

The adjacent channel power is that part of the total power output of a transmitter under defined conditions of modulation, which falls within a specified pass band centered on the nominal frequency of either of the adjacent channels. This power is the sum of the mean power produced by the modulation, hum and noise of the transmitter.

7.3.2 Method of measurement

7.3.2.1 General remarks

Any channel within the declared frequency range may be selected for testing.

When using the test fixture for this measurement, it is important to ensure that direct radiation from the transmitter to the power measuring receiver or spectrum analyzer does not affect the results of the measurements.

7.3.2.2 Method of measurement using a power measuring receiver

The adjacent channel power shall be measured with a power measuring receiver which conforms to subclause 7.3.2.3 (referred to in subclauses 7.3.2.2 and 7.3.2.3 as the "receiver").

a) Either of the following two arrangements may be used:

   - the equipment shall be placed in a test fixture (subclause 6.4) connected to the input of the "receiver"; or

   - the transmitter is connected to the input of the "receiver" through the internal antenna connector.

   The transmitter shall be operated at the carrier power determined in subclause 7.2 under normal test conditions (subclause 5.3). The radio frequency output shall be applied to the input of the "receiver" at a level that is appropriate.

b) With the transmitter unmodulated the tuning of the "receiver" shall be adjusted so that a maximum response is obtained. This is the 0 dB response point. The receiver attenuator setting and the reading of the meter shall be recorded.

NOTE: The measurement may be made with the transmitter modulated with normal test modulation (subclause 6.3), in which case this fact shall be recorded with test results.

c) The tuning of the receiver shall be adjusted away from the carrier so that the "receiver" - 6 dB response nearest to the transmitter carrier frequency is located at a displacement from the nominal carrier frequency of 17 kHz.

d) The transmitter shall be modulated at 1 250 Hz at a level which is 20 dB greater than that required to produce a frequency deviation of ±3 kHz.

e) The "receiver" variable attenuator shall be adjusted to obtain the same meter reading as in step b) or a known relation to it.

f) The ratio adjacent channel power to carrier power is the difference between the attenuator settings in steps b) and e), corrected for any differences in the reading of the meter.

g) The measurement shall be repeated with the "receiver" tuned to the other side of the carrier.

h) The measurements shall be repeated while the transmitter is modulated with the normal modulation as declared by the manufacturer, which may include encoded information where appropriate.

7.3.2.3 Power measuring receiver specification

The power measuring receiver consists of a mixer, an IF filter, an oscillator, an amplifier, a variable attenuator and an rms value indicator. Instead of the variable attenuator with the rms value indicator it is also possible to use a rms voltmeter calibrated in dB as the rms value indicator. The technical characteristics of the power measuring receiver are given below.

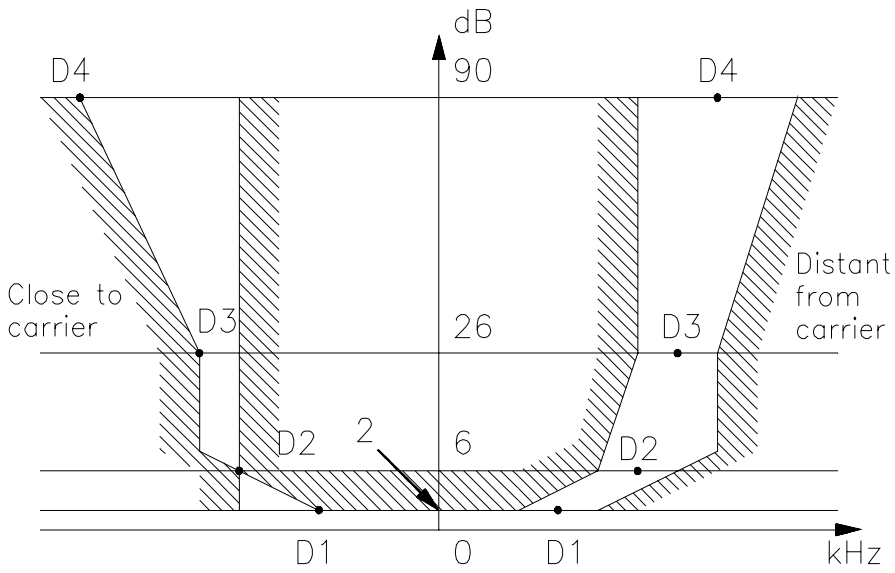

Figure 3: IF filter selectivity characteristic

The selectivity characteristic shall keep the following frequency separations from the nominal center frequency of the adjacent channel.

The attenuation characteristic shall show the frequency separations from the nominal center frequency of the adjacent channel, as given in column 2 of table 2.

The attenuation points on the slope towards the carrier shall not exceed the tolerances, as given in column 3 of table 2.

The attenuation points on the slope, distant from the carrier, shall not exceed the tolerances, as given in column 4 of table 2.

Table 2

1	2	3	4
attenuation points	**frequency separation**	**tolerance towards carrier**	**tolerance distant from carrier**
D1 (2dB)	5 kHz	+3,1 kHz	±3,5 kHz
D2 (6dB)	8 kHz	±0,1 kHz	±3,5 kHz
D3 (26dB)	9,25 kHz	-1,35 kHz	±3,5 kHz
D4 (90dB)	13,25 kHz	-5,35 kHz	+3,5 kHz and -7,5 kHz

The minimum attenuation of the filter outside the 90 dB attenuation points must be equal to or greater than 90 dB.

The variable attenuator shall have a minimum range of 80 dB and a resolution of 1 dB.

The instrument shall accurately indicate non-sinusoidal signals in a ratio of up to 10:1 between peak value and rms value.

The oscillator and the amplifier shall be designed in such a way that the measurement of the adjacent channel power of a low-noise unmodulated transmitter, whose self-noise has a negligible influence on the measurement result, yields a measured value of ≤ -90 dB referred to the carrier of the oscillator.

7.3.3 Limits

The adjacent channel power shall not exceed a value of 10 nW.

7.4 Frequency deviation

The frequency deviation is the maximum difference between the instantaneous frequency of the modulated radio frequency signal and the carrier frequency in the absence of modulation.

7.4.1 Maximum permissible frequency deviation

7.4.1.1 Definition

The maximum permissible frequency deviation is the maximum value of frequency deviation given in this present document.

7.4.1.2 Method of measurement

Any channel within the declared frequency range may be selected for testing.

Either of the following two arrangements may be used:

- the equipment shall be placed in a test fixture (subclause 6.4) connected to a non-reactive non-radiating load of 50 Ω; or

- the transmitter is connected to a non-reactive non radiating load of 50 Ω through the internal antenna connector.

The frequency deviation shall be measured by sampling the signal fed to a non-reactive non-radiating load of 50 Ω by means of a deviation meter suitable for the measurement of the maximum deviation including that due to any harmonics and intermodulation products which may be produced in the transmitter. The modulation frequency shall be varied between the lowest frequency considered to be appropriate, and 3 kHz. The level of this test signal shall be 20 dB above the level of the normal test modulation (subclause 6.3).

7.4.1.3 Limits

The maximum permissible frequency deviation shall be ±5 kHz.

7.4.2 Response of the transmitter at modulation frequencies above 3 kHz

7.4.2.1 Definition

The response of the transmitter at modulation frequencies above 3 kHz is the frequency deviation expressed as a function of modulation frequencies above 3 kHz.

7.4.2.2 Method of measurement

Either of the following two arrangements may be used:

- the equipment shall be placed in a test fixture (subclause 6.4) connected to a non-reactive non-radiating load of 50 Ω; or

- the transmitter is connected to a non-reactive non radiating load of 50 Ω through the internal antenna connector.

The transmitter shall be operated under normal test conditions (subclause 5.3). The transmitter shall be modulated with normal test modulation (subclause 6.3). With a constant input level of the modulation signal, the modulation frequency shall be varied from 3 kHz to a frequency of 25 kHz and the frequency deviation shall be measured by means of a deviation meter as described in subclause 7.3.1.2.

7.4.2.3 Limits

The frequency deviation at modulation frequencies between 3 kHz and 6 kHz shall not exceed the frequency deviation at a modulation frequency of 3 kHz. At 6 kHz the deviation shall be less than ±2,5 kHz. The frequency deviation, at modulation frequencies between 6 kHz and 25 kHz, shall not exceed that given by a linear response of frequency deviation (in decibels) against modulation frequency, starting at a point where the modulation frequency is 6 kHz and where the deviation is equal to ±2,5 kHz and having a slope of 14 dB per octave, the frequency deviation is diminishing as the modulation frequency is increased.

7.5 Intermodulation attenuation

This requirement applies only to transmitters to be used in the fixed part of the Cordless Telephone.

7.5.1 Definition

For the purpose of this present document, the intermodulation attenuation is a measure of the capability of the transmitter to inhibit the generation of signals in its non-linear elements caused by the presence of the carrier and an interfering signal reaching the transmitter via its antenna or by irradiation.

7.5.2 Method of measurement

Either of the following two arrangements may be used:

- the equipment shall be placed in a test fixture (subclause 6.4) connected to a non-reactive non-radiating load of 50 Ω; or

- the transmitter is connected to a non-reactive non-radiating load of 50 Ω through the internal antenna connector.

Initially, the fixed part of the CT shall be operated as the source in a measuring arrangement as explained in figure 4. The power of the transmitter shall be measured with a selective measuring device.

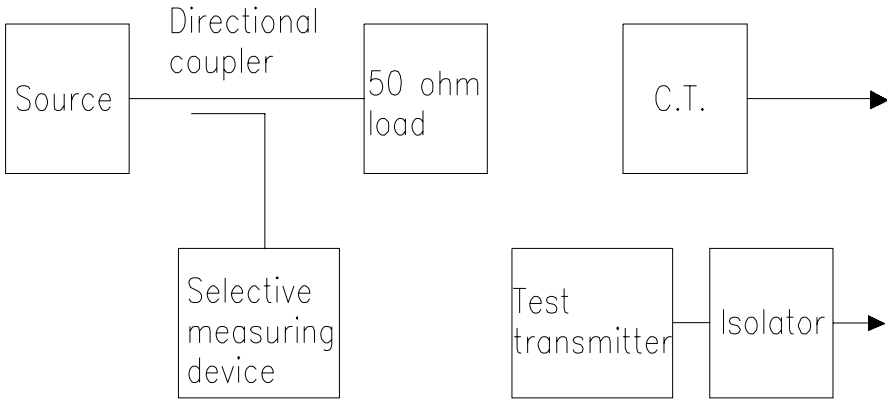

Figure 4

Then, the source shall be replaced by a test transmitter with an isolator at its outlet. The frequency of this test transmitter shall be set within 1 to 4 neighbouring channels above and below the frequency of the fixed part of the cordless telephone. The power of the test transmitter shall be adjusted to yield a reading of 30 dB below the power of the fixed part of the CT.

Subsequently the 50 Ω load shall be replaced by the test transmitter and isolator without changing its frequency and power settings. The fixed part of the CT shall be connected in place of the source.

The intermodulation attenuation shall be measured as the difference between the CT carrier power and the strongest intermodulation product.

7.5.3 Limits

The ratio of transmitter power and intermodulation power shall be at least 45 dB.

7.6 Spurious emissions

7.6.1 Definition

Spurious emissions are emissions at frequencies other than those of the carrier and side bands associated with normal modulation.

7.6.2 Method of measurement

On a test site, fulfilling the requirements of subclause 6.5, the sample shall be placed at the specified height on the support. The transmitter shall be operated without modulation at the carrier power as specified under subclause 7.2. Radiation of any spurious components shall be detected by the test antenna and receiver, over the frequency range 25 MHz to 4 GHz, except for the channel on which the transmitter is intended to operate and its adjacent channels.

At each frequency at which a component is detected, the sample shall be rotated to obtain maximum response and the effective radiated power of that component determined by a substitution measurement.

The measurements shall be repeated with the test antenna in the orthogonal polarization plane. The measurements shall be repeated with the transmitter modulated by the normal coded test signal. If possible this should be continuous modulation for the duration of the measurement.

The measurements shall be repeated with the transmitter modulated with normal test modulation (subclause 6.3).

The measurement shall be repeated with the transmitter in the "stand-by" position.

7.6.3 Limit

The power of any spurious emission shall, on any frequency and in all polarization planes, not exceed 4 nW in the frequency range up to 1 GHz and shall not exceed 250 nW in the frequency range 1 GHz to 4 GHz. In the case of measurements made in the "stand-by" position the limit is 2 nW in the frequency range up to 1 GHz and 20 nW in the frequency range 1 GHz to 4 GHz. The power of any spurious emission in the frequency ranges 65,9 MHz to 74,0 MHz and 87,5 MHz to 108 MHz which may be modulated by understandable voice communication, shall not exceed a value of 20 pW.

8 Receiver

During receiver measurements the transmitter of the cordless telephone shall be in operation except during the measurement of spurious radiations.

During the receiver measurements a possible compressor and/or expander in the equipment is allowed to be operating.

For the receiver measurements, test fixture or internal connector measurements are specified, except for measurements of:

- receiver sensitivity (subclause 8.1);
- spurious response rejection (subclause 8.5).

For test fixture or connector measurements, the RF input level is obtained from field strength values using a measured antenna factor. The antenna factor is measured during receiver sensitivity measurements subclause 8.1.

8.1 Receiver sensitivity

8.1.1 Definition

The sensitivity of the receiver is the minimum field strength of a signal, at the nominal frequency of the receiver, with normal test modulation (subclause 6.4) which will produce:

- an audio frequency output power of at least 50 % of the rated output power;
- a SINAD ratio of 20 dB measured at the output of the receiver through a telephone psophometric weighting network; in accordance with ITU-T Recommendation O.41 [5].

NOTE: SINAD ratio: SINAD = (S+N+D)/(N+D),
where:

- S - Signal power;
- N - Noise power;
- D - Distortion power.

The SINAD meter needed for the receiver measurements is specified ETS 300 086 [4].

8.1.2 Method of measurement

On a test site, fulfilling the requirements of subclause 6.5, the sample shall be placed on the support in the following position:

a) for equipment with internal antenna, it shall stand vertically, with that axis vertical which is closest to vertical in normal use;

b) for equipment with rigid external antenna, the antenna shall be vertical;

c) for equipment with non-rigid external antenna, with the antenna extended vertically upwards by a non-conducting support.

The test antenna (subclause 6.5.3) shall be at a similar distance from the receiver under test as was used between the transmitter and the test antenna in the carrier power measurement in subclause 7.2.2. The test signal fed to the test antenna from the signal source shall have a frequency equal to the nominal frequency of the receiver and shall be modulated with the normal test modulation.

An audio frequency output load, a SINAD meter and a psophometric telephone weighting network in accordance with ITU-T Recommendation O.41 [5], shall be coupled to the receiver loudspeaker/transducer via an audio test line.

Where possible, the receiver volume control shall be adjusted to give at least 50 % of the rated output power, or in the case of stepped volume controls, to the first step that provides an output power of at least 50 % of the rated output power.

The test signal output level shall be reduced until the SINAD ratio of 20 dB is obtained.

The test antenna shall be raised and lowered through the specified range of height to find the lowest level of the test signal, that produces a SINAD ratio of 20 dB. The operation shall be repeated while the equipment under test is rotated through 360 degrees.

The input signal level to the test antenna shall be maintained.

The receiver shall be replaced by a substitution antenna as defined in subclause 6.5.4.

The substitution antenna shall be orientated for vertical polarization and the length of the substitution antenna shall be adjusted to correspond to the frequency of the receiver.

The substitution antenna shall be connected to a calibrated measuring receiver.

The test antenna shall be raised and lowered through the specified range of height to ensure that the maximum signal is received.

The signal level measured with the calibrated measuring receiver shall be recorded as the field strength in dBμV/m.

The measurement shall be repeated with the test antenna and the substitution antenna orientated for horizontal polarization.

The measure of the receiver sensitivity expressed as field strength is the minimum of the two signal levels recorded as the input to the calibrated measuring receiver, corrected for the gain of the antenna if necessary.

The measurement shall be made under normal test conditions (subclause 5.3) and extreme test voltages (subclause 5.4.2 only).

With extreme test voltages, a variation of the receiver output power of ±3 dB relative to the value obtained under normal test conditions may be allowed.

8.1.3 Limits

The receiver sensitivity expressed as field strength shall not exceed 30 dB relative to 1 microvolt per metre under normal test conditions and 36 dB relative to 1 microvolt per metre with extreme test voltages.

8.2 Spurious radiation

8.2.1 Definition

Spurious radiation from receivers, are radiation at any frequency, radiated by the equipment and its antenna.

8.2.2 Method of measurement

On a test site, fulfilling the requirements of subclause 6.5, the sample shall be placed at the specified height on the support. The receiver shall be operated from the normal power source. Radiation of any spurious component, shall be detected by the test antenna and receiver.

At each frequency at which a component is detected, the sample shall be rotated to obtain maximum response and the effective radiated power of that component determined by a substitution measurement.

At each spurious radiation in the frequency range and 87,5 MHz to 108 MHz it shall be investigated whether or not this spurious emission may be modulated with understandable voice communication. The measurement shall be repeated with the test antenna in the orthogonal polarization plane. The measurement shall extend over a frequency range of 25 MHz to 4 GHz.

8.2.3 Limit

The power of any spurious radiation of the receivers shall not exceed 2 nW in the frequency range up to 1 GHz and 20 nW in the frequency range 1 GHz to 4 GHz.

The power of any spurious radiation in the frequency range 87,5 MHz to 108 MHz which may be modulated by understandable voice communication, shall not exceed a value of 20 pW.

9 Measurement uncertainties

Absolute measurement uncertainties: maximum values.

Valid up to 1 GHz for RF parameters unless otherwise stated.

- RF frequency $\pm 1*10^{-7}$.
- RF power ±2 dB.

Maximum frequency deviation:

- within 300 Hz to 6 kHz of audio frequency ±5 %;
- within 6 kHz to 25 kHz of audio frequency ±3 dB.

Deviation limitation	±5 %
Sensitivity at 20 dB SINAD	±3 dB
Radiated emission of transmitter, valid to 4 GHz	±6 dB
Radiated emission of receiver, valid to 4 GHz	±6 dB
Transmitter intermodulation	±6 dB

For the test methods, according to the present document, the measurement uncertainty figures shall be calculated in accordance with ETR 028 [6] and shall correspond to an expansion factor (coverage factor) k = 1,96 or k = 2 (which provide confidence levels of respectively 95% and 95,45% in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian).

Annex A (normative): The EN Requirements Table (EN-RT)

Notwithstanding the provisions of the copyright clause related to the text of the present document, ETSI grants that users of the present document may freely reproduce the EN-RT proforma in this annex so that it can be used for its intended purposes and may further publish the completed EN-RT.

The EN Requirements Table (EN-RT) serves a number of purposes, as follows:

- it provides a tabular summary of all the requirements;
- it shows the status of each EN-R, whether it is essential to implement in all circumstances (Mandatory), or whether the requirement is dependent on the supplier having chosen to support a particular optional service or functionality (Optional). In particular it enables the EN-Rs associated with a particular optional service or functionality to be grouped and identified;
- when completed in respect of a particular equipment it provides a means to undertake the static assessment of conformity with the EN.

Table A.1: EN Requirements Table (EN-RT)

EN Reference		EN 301 796				Comments
No.	**Reference**	**EN-R (note)**	**Status**			
1	4.3.3	Threshold level for field strength and minimum observation time	M			
2	4.3.4	Scanning time	M			
3	4.3.5	Termination of the RF connection and line connection	M			
4	4.3.6	Power supply for CPP	M			
5	7.1	Frequency error	M			
6	7.2	Carrier power	M			
7	7.3	Adjacent channel power	M			
8	7.4	Frequency deviation	M			
9	7.5	Intermodulation attenuation	M			
10	7.6	Spurious emissions	M			
NOTE: These EN-R's are justified under Article 3.2 of the R&TTE Directive.						

Key to columns:

No Table entry number;

Reference Subclause reference number of conformance requirement within the present document;

EN-R Title of conformance requirement within the present document;

Status Status of the entry as follows:

- M Mandatory, shall be implemented under all circumstances;
- O Optional, may be provided, but if provided shall be implemented in accordance with the requirements;
- O.n this status is used for mutually exclusive or selectable options among a set. The integer "n" shall refer to a unique group of options within the EN-RT. A footnote to the EN-RT shall explicitly state what the requirement is for each numbered group. For example, "It is mandatory to support at least one of these options", or, "It is mandatory to support exactly one of these options".

Comments To be completed as required.

Bibliography

The following material, though not specifically referenced in the body of the present document (or not publicly available), gives supporting information.

- ETSI I-ETS 300 235: "Radio Equipment and Systems (RES); Technical characteristics, test conditions and methods of measurement for radio aspects of cordless telephones CT1".

History

Document history			
V1.1.1	March 2000	One-step Approval Procedure	OAP 20000721: 2000-03-22 to 2000-07-21