

# ETSI EN 301 166-2 V1.1.1 (2001-12)

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*Candidate Harmonized European Standard (Telecommunications series)*

**Electromagnetic compatibility  
and Radio spectrum Matters (ERM);  
Land Mobile Service;  
Radio equipment for analogue and/or digital  
communication (speech and/or data) and operating on  
narrow band channels and having an antenna connector;  
Part 2: Harmonized EN covering essential requirements  
under article 3.2 of the R&TTE Directive**

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**Reference**

REN/ERM-RP02-045-2

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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 [13] (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 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"[8]).

The present document is part 2 of a multi-part deliverable covering Land Mobile Service; Radio equipment for analogue and/or digital communication (speech and/or data) and operating on narrow band channels and having an antenna connector, as identified below:

**Part 1:** "Technical characteristics and methods of measurements";

**Part 2:** "**Harmonized EN covering essential requirements under article 3.2 of the R&TTE Directive**".

<b>National transposition dates</b>	
Date of adoption of this EN:	23 November 2001
Date of latest announcement of this EN (doa):	28 February 2002
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	31 August 2002
Date of withdrawal of any conflicting National Standard (dow):	31 August 2003

# 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. Each standard is a module in the structure. The modular structure is shown in figure 1.

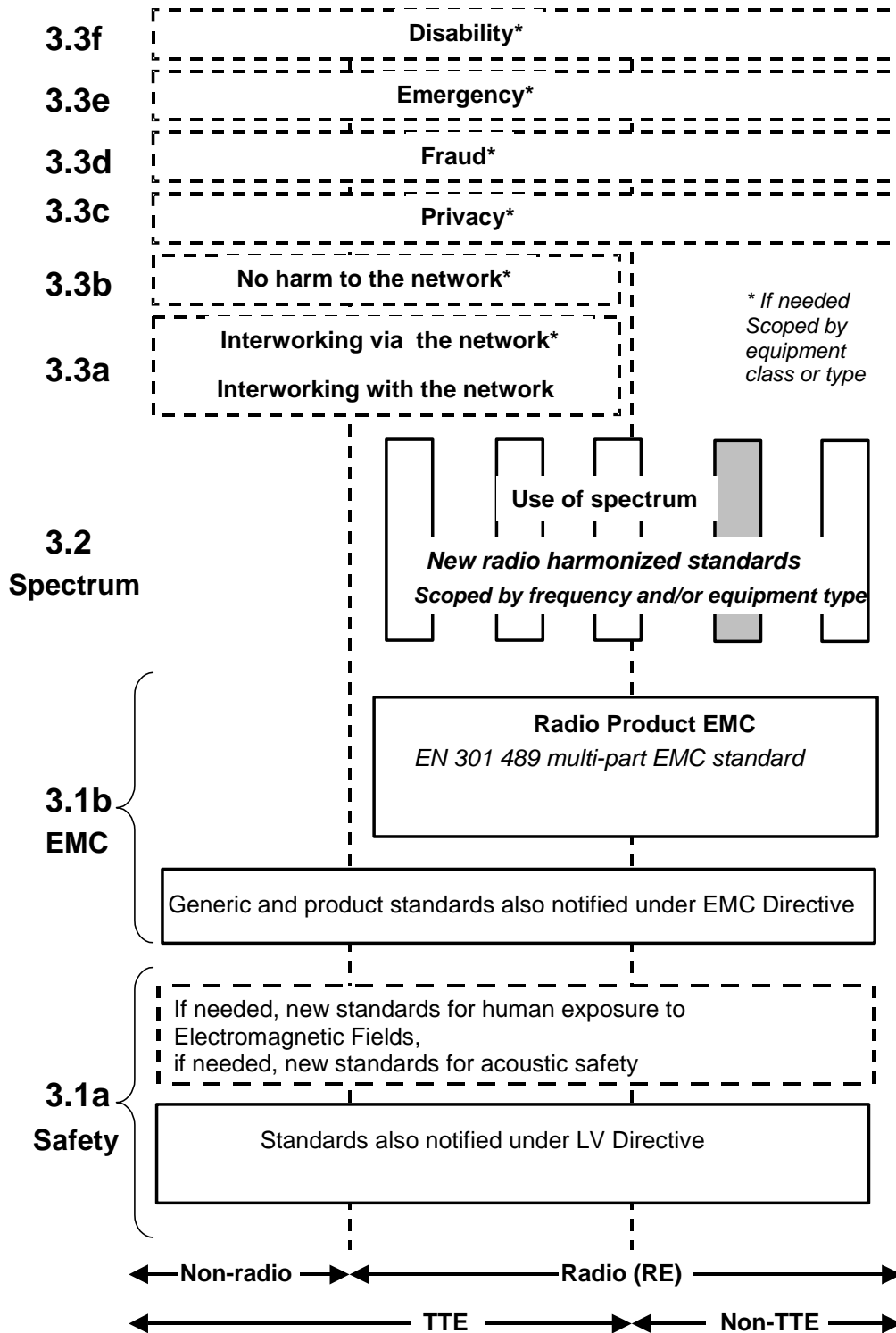


Figure 1: Modular structure for the various standards used under the R&TTE Directive

## Explanation of figure 1

The left hand edge of figure 1 shows the different clauses of article 3 of the R&TTE Directive [8].

For article 3.3 various horizontal boxes are shown. Dotted lines indicate that at the time of publication of 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.

For article 3.1b the diagram shows EN 301 489, the multi-part product EMC standard for radio used under the EMC Directive [14].

For article 3.1a figure 1 shows the existing safety standards currently used under the LV Directive [15] 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 [8] 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 [8] may be covered in a set of standards.

The modularity principle has been taken because it is expected that it would:

- minimize 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);
- provide scope for standards to be added under article 3.3 should the Commission take the necessary decisions without requiring alteration of standards that are already published;
- clarify and simplify the usage of Harmonized Standards as the relevant means of conformity assessment.

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# 1 Scope

The present document covers the co-existence requirements for radio transmitters and receivers used in stations in the Private Mobile Radio (PMR) service. It applies to use in the land mobile service, operating on radio frequencies between 30 MHz and 3 GHz, with narrow channel separations (CSP) (less than 10 kHz) and intended for speech and/or data. It is the intention of the present document to cover any Channel Bandwidths (CBW) permitted by CEPT for such systems e.g. 6,25 kHz.

In the present document different requirements are given for the different radio frequency bands, environmental conditions and types of equipment where appropriate.

In the present document, data transmission systems are defined as systems which transmit and/or receive data and/or digitized voice. The equipment comprises a transmitter and associated encoder and modulator and/or a receiver and associated demodulator and decoder.

The present document covers equipment which may use constant envelope or non-constant envelope modulation.

The types of equipment covered by the present document are as follows:

- base station: equipment fitted with antenna socket;
- mobile station: equipment fitted with antenna socket.

Handportable stations:

- a) either fitted with an antenna socket; or
- b) without an external antenna socket (integral antenna equipment) but fitted with a permanent internal or a temporary internal 50  $\Omega$  RF connector which allows access to the transmitter output and the receiver input.

Handportable station equipment without an external or internal Radio Frequency (RF) connector and without the possibility of having a temporary internal 50  $\Omega$  RF connector is not covered by the present document.

The present document is intended to cover the provisions of article 3.2 of Directive 1999/5/EC [8] (R&TTE Directive), 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 may apply to equipment within the scope of 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 TR 100 028 (V1.3.1) (all parts): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment and characteristics".
- [2] Void.
- [3] Void.
- [4] Void.



- [5] Void.
- [6] Void.
- [7] Void.
- [8] 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.
- [9] ETSI EN 301 166-1: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Land Mobile Service; Radio equipment for analogue and/or digital communication (speech and/or data) and operating on narrow band channels and having an antenna connector; Part 1: Technical characteristics and methods of measurement".
- [10] Void.
- [11] Void.
- [12] Void.
- [13] 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.
- [14] Directive 89/336/EEC of 3 May 1989 on the approximation of the laws of the Member States relating to electromagnetic compatibility.
- [15] Directive 73/23/EEC of 19 February 1973 on the harmonization of the laws of Member States relating to electrical equipment designed for use within certain voltage limits.

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## 3 Definitions, symbols and abbreviations

### 3.1 Definitions

For the purposes of the present document, the terms and definitions given in the R&TTE Directive and EN 301 166-1 [9] apply.

### 3.2 Symbols

For the purposes of the present document, the symbols defined in EN 301 166-1 [9] apply.

### 3.3 Abbreviations

For the purposes of the present document, the abbreviations defined in EN 301 166-1 [9] apply.

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## 4 Technical specifications

For equipment without an external antenna socket (integral antenna equipment) but fitted with a permanent internal or a temporary internal 50  $\Omega$  RF connector which allows access to the transmitter output and the receiver input, the following additional measurements are made using the equipment antenna connected to the station (and not using any connector):

- transmitter effective radiated power;
- transmitter radiated spurious emissions;
- receiver maximum usable sensitivity (field strength);
- receiver spurious radiations.

## 4.1 Environmental profile

The technical requirements of the present document apply under the environmental profile for operation of the equipment, which shall be declared by the manufacturer. The equipment shall comply with all the technical requirements of the present document at all times when operating within the boundary limits of the declared operational environmental profile.

## 4.2 Transmitter requirements

### 4.2.1 Frequency error

#### 4.2.1.1 Definition

The frequency error is defined in EN 301 166-1 [9] clause 7.7.1.

#### 4.2.1.2 Limit

The frequency error shall not exceed the limits in EN 301 166-1 [9], table 4.

#### 4.2.1.3 Method of measurement

The measurements specified in EN 301 166-1 [9], clause 7.7.2 shall be carried out.

### 4.2.2 Maximum power (PX) (conducted)

#### 4.2.2.1 Definition

The maximum power (conducted) is defined in EN 301 166-1 [9], clause 7.1.1.

#### 4.2.2.2 Limit

The maximum power (conducted) shall not exceed the limits in EN 301 166-1 [9], clause 7.1.3.

#### 4.2.2.3 Method of measurement

The measurements specified in EN 301 166-1 [9], clause 7.1.2. shall be carried out.

### 4.2.3 Maximum effective radiated power

#### 4.2.3.1 Definition

The maximum effective radiated power is defined in EN 301 166-1 [9], clause 7.2.1.

#### 4.2.3.2 Limit

The maximum effective radiated power shall not exceed the limits in EN 301 166-1 [9], clause 7.2.3.

#### 4.2.3.3 Method of measurement

The measurements specified in EN 301 166-1 [9], clause 7.2.2. shall be carried out.

## 4.2.4 Adjacent channel power

### 4.2.4.1 Definition

The adjacent channel power is defined in EN 301 166-1 [9], clause 7.3.1.

### 4.2.4.2 Limit

The adjacent channel power shall not exceed the limits in EN 301 166-1 [9], clause 7.3.3.

### 4.2.4.3 Method of measurement

The measurements specified in EN 301 166-1 [9], clause 7.3.2. shall be carried out.

## 4.2.5 Spurious emissions

### 4.2.5.1 Definition

The spurious emissions are defined in EN 301 166-1 [9], clause 7.4.1.

### 4.2.5.2 Limit

The spurious emissions shall not exceed the limits in EN 301 166-1 [9], 7.4.3. tables 1, 2 and 3.

### 4.2.5.3 Method of measurement

The measurements specified in EN 301 166-1 [9], clause 7.4.2 shall be carried out.

## 4.2.6 Intermodulation attenuation

### 4.2.6.1 Definition

The intermodulation attenuation is defined in EN 301 166-1 [9], clause 7.5.1.

### 4.2.6.2 Limit

The intermodulation attenuation shall not exceed the limits in EN 301 166-1 [9], clause 7.5.3.

### 4.2.6.3 Method of measurement

The measurements specified in EN 301 166-1 [9], clause 7.5.2 shall be carried out.

## 4.2.7 Transient power

### 4.2.7.1 Definition

The transient power is defined in EN 301 166-1 [9], clause 7.6.1.

### 4.2.7.2 Limit

The transient power shall not exceed the limits in EN 301 166-1 [9], clause 7.6.3.

### 4.2.7.3 Method of measurement

The measurements specified in EN 301 166-1 [9], clause 7.6.2 shall be carried out.

## 4.3 Receiver requirements

### 4.3.1 Maximum usable sensitivity

#### 4.3.1.1 Definition

The sensitivity is defined in EN 301 166-1 [9], clause 8.1.1 (analogue conducted), clause 8.2.1 (analogue field strength), clause 8.3.1 (data conducted) and clause 8.4.1 (data field strength).

In addition, for duplex equipment (equipment providing simultaneous transmission and reception), the receiver desensitization is defined in EN 301 166-1 [9], clause 9.1.1.

#### 4.3.1.2 Limit

The sensitivity shall not exceed the limits in EN 301 166-1 [9], clause 8.1.3 (analogue conducted), clause 8.2.3, table 5 (analogue field strength), clause 8.3.3 (data conducted) and clause 8.4.3, table 6 (data field strength).

In addition, for duplex equipment (equipment providing simultaneous transmission and reception), the receiver desensitization shall meet the requirements of EN 301 166-1 [9], clause 9.1.3.

#### 4.3.1.3 Method of measurement

The measurements specified in EN 301 166-1 [9], clause 8.1.2. (analogue conducted), 8.2.2 (analogue field strength), clause 8.3.2 (data conducted) and clause 8.4.2 (data field strength), as appropriate, shall be carried out.

In addition, for duplex equipment (equipment providing simultaneous transmission and reception), the measurements specified in EN 301 166-1 [9] clause 9.1.2 shall be carried out.

### 4.3.2 Co-channel rejection

#### 4.3.2.1 Definition

The co-channel rejection is defined in EN 301 166-1 [9], clause 8.10.1.

#### 4.3.2.2 Limit

The co-channel rejection shall not exceed the limits in EN 301 166-1 [9], clause 8.10.3.

#### 4.3.2.3 Method of measurement

The measurements specified in EN 301 166-1 [9], clause 8.10.2 shall be carried out.

### 4.3.3 Adjacent channel selectivity

#### 4.3.3.1 Definition

The adjacent channel selectivity is defined in EN 301 166-1 [9], clause 8.5.1.

#### 4.3.3.2 Limit

The adjacent channel selectivity shall not exceed the limits in EN 301 166-1 [9], clause 8.5.3.

#### 4.3.3.3 Method of measurement

The measurements specified in EN 301 166-1 [9], clause 8.5.2 shall be carried out.

## 4.3.4 Spurious response rejection

### 4.3.4.1 Definition

The spurious response rejection is defined in EN 301 166-1 [9] clause 8.6.1.

In addition, for duplex equipment (equipment providing simultaneous transmission and reception), the receiver spurious response rejection (with simultaneous transmission and reception) is defined in EN 301 166-1 [9] clause 9.2.1.

### 4.3.4.2 Limit

The spurious response rejection shall not exceed the limits in EN 301 166-1 [9], clause 8.6.3.

In addition, for duplex equipment (equipment providing simultaneous transmission and reception), the receiver spurious response rejection (with simultaneous transmission and reception) shall not exceed the limits in EN 301 166-1 [9], clause 9.2.3.

### 4.3.4.3 Method of measurement

The measurements specified in EN 301 166-1 [9], clause 8.6.2 shall be carried out.

In addition, for duplex equipment (equipment providing simultaneous transmission and reception), the measurements specified in EN 301 166-1 [9] clause 9.2.2 shall be carried out.

## 4.3.5 Intermodulation response rejection

### 4.3.5.1 Definition

The intermodulation response rejection is defined in EN 301 166-1 [9] clause 8.7.1.

### 4.3.5.2 Limit

The intermodulation response rejection shall not exceed the limits in EN 301 166-1 [9] clause 8.7.3.

### 4.3.5.3 Method of measurement

The measurements specified in EN 301 166-1 [9], clause 8.7.2 shall be carried out.

## 4.3.6 Blocking or desensitization

### 4.3.6.1 Definition

The blocking or desensitization is defined in EN 301 166-1 [9], clause 8.8.1.

### 4.3.6.2 Limit

The blocking or desensitization shall not exceed the limits in EN 301 166-1 [9] clause 8.8.3.

### 4.3.6.3 Method of measurement

The measurements specified in EN 301 166-1 [9], clause 8.8.2 shall be carried out.

## 4.3.7 Spurious radiations

### 4.3.7.1 Definition

The spurious radiations are defined in EN 301 166-1 [9], clause 8.9.1.

#### 4.3.7.2 Limit

The spurious radiations shall not exceed the limits in EN 301 166-1 [9], clause 8.9.3. tables 7 and 8.

#### 4.3.7.3 Method of measurement

The measurements specified in EN 301 166-1 [9], clause 8.9.2 shall be carried out.

---

## 5 Testing for compliance with technical requirements

### 5.1 Environmental conditions for testing

#### 5.1.1 Normal and extreme test-conditions

Measurements 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 EN 301 166-1 [9], clauses 5.3, 5.4 and 5.5.

#### 5.1.2 Test power source

The test power source shall meet the requirements of EN 301 166-1 [9], clause 5.2.

#### 5.1.3 Choice of samples for the measurements

Measurement shall be performed, according to the present document, on samples of equipment defined in EN 301 166-1 [9], clause 4.1.

### 5.2 Interpretation of the measurement results

The interpretation of the results recorded in a test report for the measurements described in the present document shall be as follows:

- the measured value related to the corresponding limit will be used to decide whether an equipment meets the requirements of the present document;
- the value of the measurement uncertainty for the measurement of each parameter shall be included in the test report;
- the value of the measurement uncertainty shall be, for each measurement, equal to or lower than the figures in table 1.

For the test methods, according to the present document, the measurement uncertainty figures shall be calculated in accordance with TR 100 028 [1] 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)).

Table 1 is based on such expansion factors.

The particular expansion factor used for the evaluation of the measurement uncertainty shall be stated.

**Table 1: Absolute measurement uncertainties: maximum values**

<b>Frequency</b>	$\pm 1 \times 10^{-7}$
<b>Maximum RF Power (conducted)</b>	$\pm 0,75$ dB
<b>Maximum effective radiated power</b>	$\pm 3$ dB
<b>Adjacent and alternate channels power</b>	$\pm 5$ dB
<b>Conducted emission of transmitter</b>	$\pm 4$ dB
<b>Conducted emission of transmitter, valid to 12,75 GHz</b>	$\pm 7$ dB
<b>Audio output power</b>	$\pm 0,5$ dB
<b>Sensitivity conducted</b>	$\pm 3$ dB
<b>Sensitivity radiated</b>	$\pm 6$ dB
<b>Conducted emission of receiver</b>	$\pm 3$ dB
<b>Conducted emission of receiver, valid to 12,75 GHz</b>	$\pm 6$ dB
<b>Two-signal measurement, valid to 4 GHz</b>	$\pm 4$ dB
<b>Three-signal measurement</b>	$\pm 3$ dB
<b>Radiated emission of transmitter, valid to 4 GHz</b>	$\pm 6$ dB
<b>Radiated emission of receiver, valid to 4 GHz</b>	$\pm 6$ dB
<b>Receiver desensitization (duplex operation)</b>	$\pm 2$ dB
NOTE 1: Valid up to 1 GHz for the RF parameters unless otherwise stated.	
NOTE 2: These values may also be used between 1 GHz and 3 GHz.	

For the test methods according to the present document, the uncertainty figures are valid to a confidence level of 95 % calculated according to the methods described in TR 100 028 [1].

## 5.3 Essential test suites

Essential test suites are referred to in annex III of R&TTE Directive [8].

The following essential test suites shall be used to assess the performance of equipment.

### 5.3.1 Frequency error

The measurements specified in EN 301 166-1 [9], clause 7.7.2 shall be carried out.

### 5.3.2 Maximum power (PX) (conducted)

The measurements specified in EN 301 166-1 [9], clause 7.1.2 shall be carried out.

### 5.3.3 Maximum effective radiated power

The measurements specified in EN 301 166-1 [9], clause 7.2.2 shall be carried out.

### 5.3.4 Adjacent channel power

The measurements specified in EN 301 166-1 [9], clause 7.3.2 shall be carried out.

### 5.3.5 Spurious emissions

The measurements specified in EN 301 166-1 [9], clause 7.4.2 shall be carried out.

### 5.3.6 Intermodulation attenuation

The measurements specified in EN 301 166-1 [9], clause 7.5.2. shall be carried out.

### 5.3.7 Transient power

The measurements specified in EN 301 166-1 [9], clause 7.6.2 shall be carried out.

## 5.4 Other test suites

The requirements in clauses 4.3.1 to 4.3.7 inclusive have been set on the assumption that the measurements in clauses 5.4.1 to 5.4.7 are used in order to assess the performance of the equipment.

### 5.4.1 Maximum usable sensitivity

The measurements specified in EN 301 166-1 [9] clause 8.1.2 (analogue conducted), 8.2.2 (analogue field strength), clause 8.3.2 (data conducted) and clause 8.4.2 (data field strength) as appropriate, shall be carried out.

In addition, in the case of duplex equipment (equipment providing simultaneous transmission and reception), the measurements specified in EN 301 166-1 [9] clause 9.1.2 shall be carried out.

### 5.4.2 Co-channel rejection

The measurements specified in EN 301 166-1 [9], clause 8.10.2 shall be carried out.

### 5.4.3 Adjacent channel selectivity

The measurements specified in EN 301 166-1 [9], clause 8.5.2 shall be carried out.

### 5.4.4 Spurious response rejection

The measurements specified in EN 301 166-1 [9], clause 8.6.2 shall be carried out.

In addition, in the case of duplex equipment (equipment providing simultaneous transmission and reception), the measurements specified in EN 301 166-1 [9], clause 9.2.2 shall be carried out.

### 5.4.5 Intermodulation response rejection

The measurements specified in EN 301 166-1 [9], clause 8.7.2 shall be carried out.

### 5.4.6 Blocking or desensitization

The measurements specified in EN 301 166-1 [9], clause 8.8.2 shall be carried out.

### 5.4.7 Spurious radiations

The measurements specified in EN 301 166-1 [9], clause 8.9.2 shall be carried out.



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## Annex A (informative): Bibliography

CEPT/ERC Recommendation ERC/REC 01-06: "Procedure for mutual recognition of type testing and type approval for radio equipment".

ITU-T Recommendation O.153: "Basic parameters for the measurement of error performance at bit rates below the primary rate".

IEC Publication 489-3 (2nd Edition, 1988): "Methods of measurement for radio equipment used in the mobile services. Part 3: Receivers for A3E or F3E emissions". (Appendix F)

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## History

<b>Document history</b>		
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