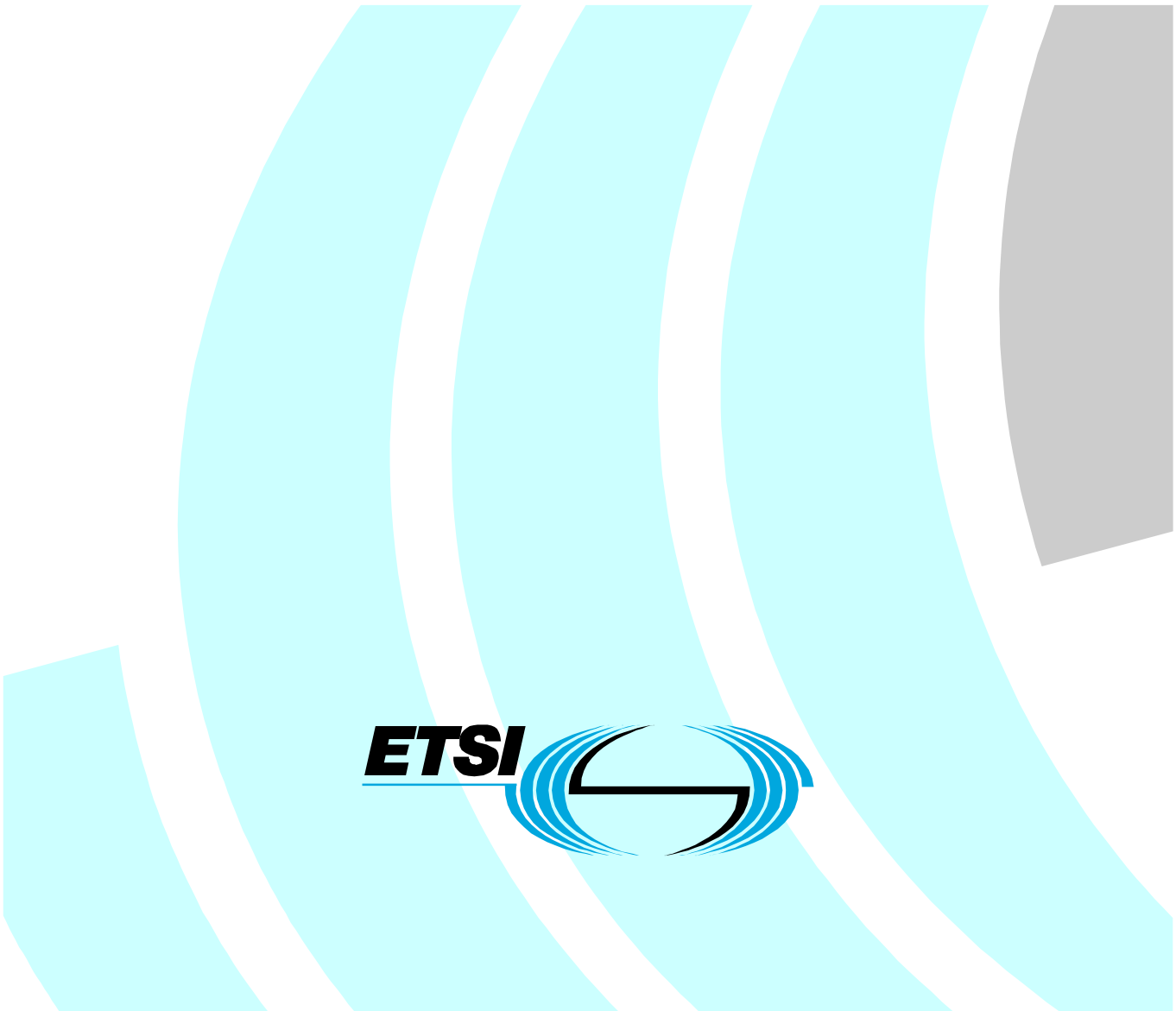
Draft ETSI EN 302 018-2 V1.1.1 (2001-11)

Candidate Harmonized European Standard (Telecommunications series)

Electromagnetic Compatibility and Radio Spectrum Matters (ERM); Transmitting equipment for the Frequency Modulated (FM) radio broadcast service; Part 2: Harmonized EN under article 3.2 of the R&TTE Directive



Reference
DEN/ERM-TG17-005-2

Keywords
audio, broadcasting, FM, radio, regulation,
terrestrial, transmitter

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Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

Contents

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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), and is now submitted for the Public Enquiry phase of the ETSI standards Two-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 [8] (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 [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").

The present document is part 2 of a multi-part deliverable covering transmitting equipment for the Frequency Modulated (FM) radio broadcast service, as identified below:

Part 1: "Technical characteristics and test methods";

Part 2: "Harmonized EN under article 3.2 of 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):	18 months after doa

Introduction

The present document adopts a 'safety net' spectrum mask principle, whereby the emissions on the antenna port of the equipment covered by the present document must remain within a defined spectrum mask at all times and under all conditions. This obviates the need to specify frequency tolerance, deviation, etc. as the manufacturer is free to trade-off these parameters as long as the emission remains within the spectrum mask.

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.

Other documents directly associated with the present document:

- EN 302 018-1;
- EN 301 489-11.

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.

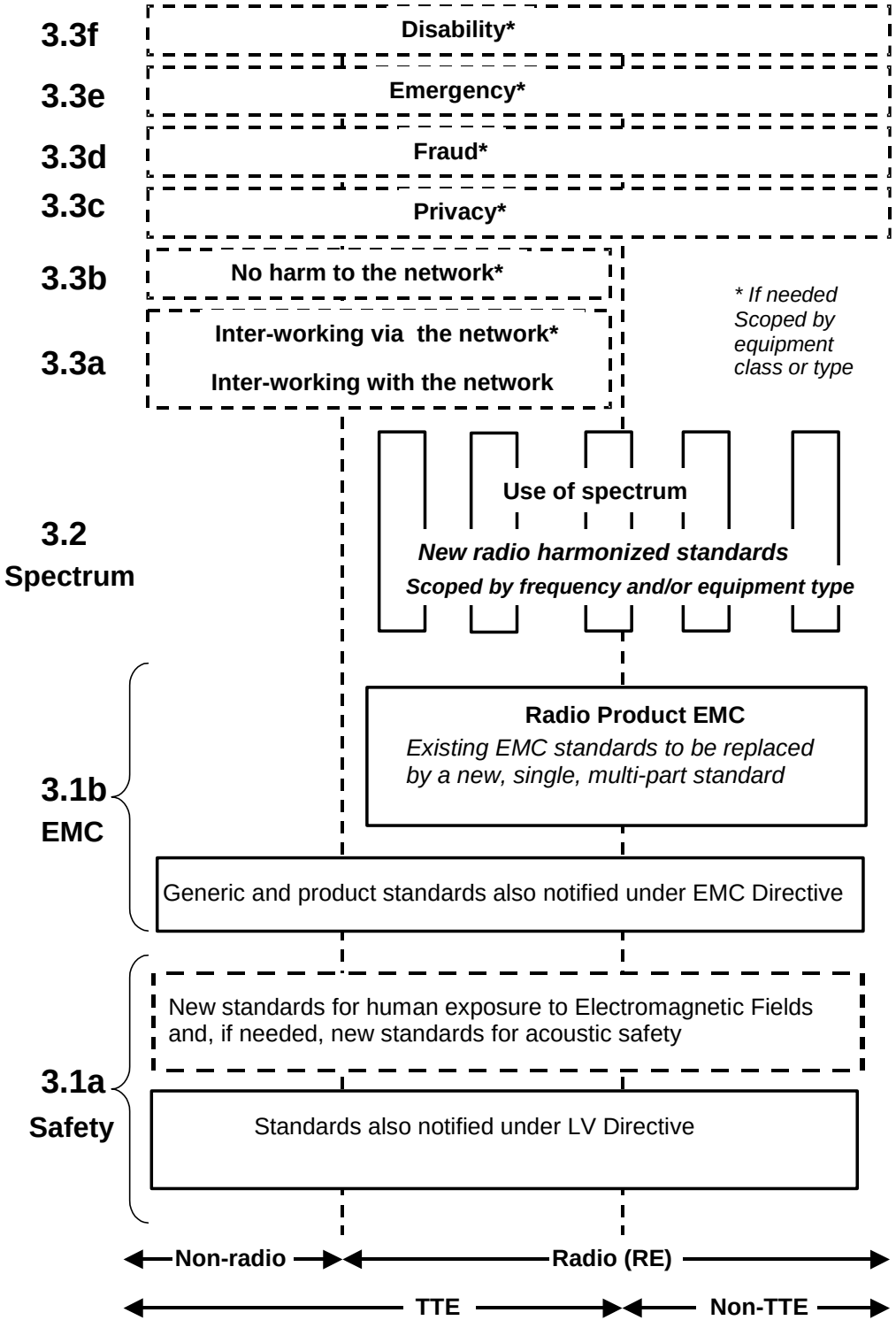

Figure 1: Modular structure for the various standards used under the R&TTE Directive [1]

1 Scope

The present document applies to Transmitting equipment for the frequency-modulated radio broadcast service.

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

- transmitting equipment for frequency modulated radio broadcast service operating in both Monophonic and Stereophonic operating in the frequency range 68 MHz to 108 MHz.

The present document is intended to cover the provisions of Article 3.2, of Directive 1999/5/EC [1] (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 [1] 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 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] 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 Member States relating to electrical equipment designed for use within certain voltage limits (LV Directive).

[4] EN 55011: "Industrial, scientific and medical (ISM) - radio-frequency equipment - Radio disturbance characteristics - Limits and methods of measurement".

[5] IEC 60489-1: "Methods of measurements for radio equipment used in the mobile services".

[6] ETSI TR 100 028 (all parts): "ElectroMagnetic Compatibility and Radio Spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics".

[7] ITU-R Recommendation SM 329-8 (2000): "Spurious emissions".

[8] 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, symbols and abbreviations

3.1 Definitions

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

broadcasting service: radio communication service in which the transmissions are intended for direct reception by the general public. This service may include sound transmissions, television transmissions or other types of transmission.

Carrier Power: average power supplied to the antenna transmission line by a transmitter during one cycle taken under the condition of no modulation

class of emission: the set of characteristics of an emission, designated by standard symbols, e.g. type of modulation of the main carrier, modulating signal, type of information to be transmitted, and also, if appropriate, any additional signal characteristics

enclosure port: physical boundary of the apparatus through which electromagnetic fields may radiate or impinge.

NOTE: In the case of integral antenna equipment, this port is inseparable from the antenna port.

Mean Power: average power supplied to the antenna transmission line by a transmitter during an interval of time sufficiently long compared with the lowest frequency encountered in the modulation envelope taken under normal operating conditions

necessary bandwidth: for a given class of emission, the width of the frequency band which is sufficient to ensure the transmission of information at the rate and with the quality required under specified conditions

out-of-band emissions: emission on a frequency or frequencies immediately outside the necessary bandwidth which results from the modulation process, but excluding spurious emissions

Reference Bandwidth: bandwidth in which the spurious emission level is specified

spurious emissions: emission on a frequency or frequencies which are outside the necessary bandwidth and the level of which may be reduced without affecting the corresponding transmission of information. Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products but exclude out of band emissions.

unwanted emissions: consist of spurious emissions and out of band emissions

3.2 Symbols

For the purposes of the present document, the following symbol applies:

μ	micro, 10^{-6}
W	watt

3.3 Abbreviations

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

AF	Audio Frequency
dBc	decibels relative to the unmodulated carrier power of the emission
EMC	Electro-Magnetic Compatibility
EUT	Equipment Under Test
FM	Frequency Modulation
LV	Low Voltage
R&TTE	Radio equipment and Telecommunications Terminal Equipment
VHF	Very High Frequency

4 Technical requirements Specifications

4.1 Antenna port measurements

4.1.1 Spurious emissions

4.1.1.1 Definition

Emission on a frequency or frequencies which are outside the necessary bandwidth and the level of which may be reduced without affecting the corresponding transmission of information. Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products but exclude out of band emissions.

4.1.1.2 Method of measurement

The test defined in clause 5.2.1 shall be applied.

4.1.1.3 Limit

Spurious emissions shall not exceed the values set out in table 1, shown additionally in figure 2, for the frequency range 9 kHz to 1 GHz.

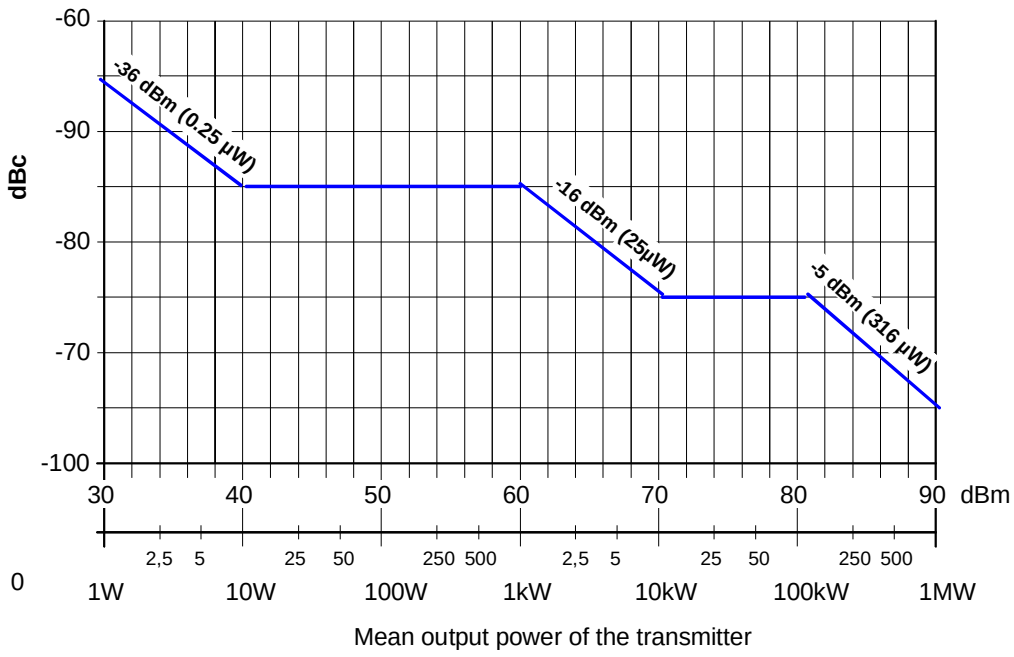

Figure 2: Spurious Emission limits for FM sound broadcasting transmitters

Table 1

Limits Mean power absolute levels (dBm) or relative levels (dBc) below the power supplied to the antenna port in the reference bandwidth	
-36 dBm	P ≤ 9 dBW
75 dBc	9 dBW < P ≤ 29 dBW
-16 dBm	29 dBW < P ≤ 39 dBW
85 dBc	39 dBW < P ≤ 50 dBW
-5 dBm	50 dBW < P
where P is the mean power of the transmitter (W)	
NOTE: Within the band 108 to 137 MHz the absolute limit of 25 μW shall apply.	

4.1.2 Out-of-band emissions

4.1.2.1 Definition

Emission on a frequency or frequencies immediately outside the necessary bandwidth which results from the modulation process, but excludes spurious emissions.

4.1.2.2 Method of measurement

The test defined in clause 5.2.2 shall be applied.

4.1.2.3 Limit

The spectrum limit mask for VHF FM sound broadcasting is shown in figure 3. The related break points are given in table 2.

Power level is measured in a 1 kHz bandwidth.

The limits shown in figure 3 apply.

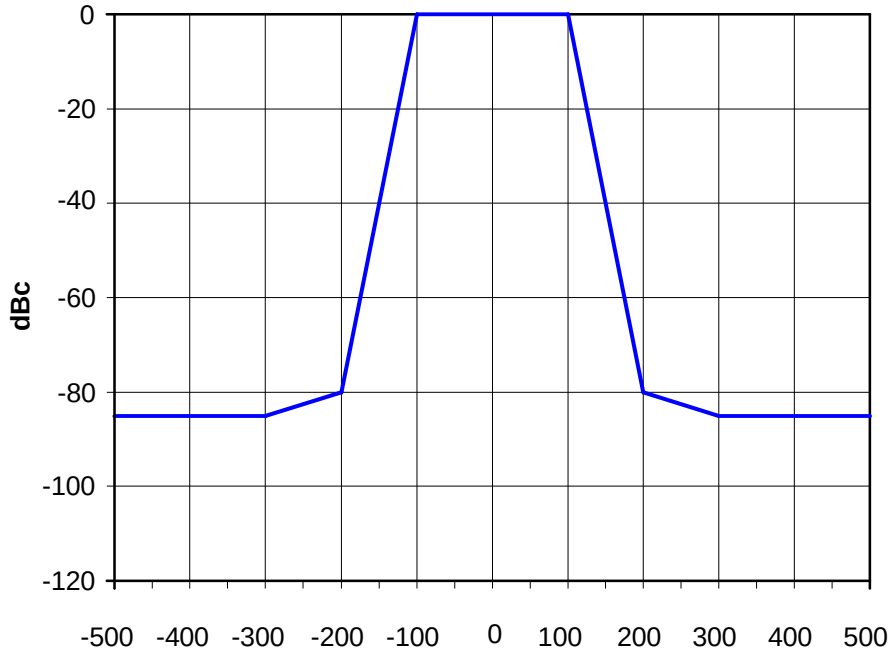

Figure 3: Out-of-Band Emission limits for FM sound broadcasting transmitters

NOTE: within the band 108 to 137 the absolute limit of 25 µW shall apply.

Table 2

Break points of spectrum limit mask for VHF FM sound broadcasting	
Frequency relative to the centre of the channel (kHz)	**Relative level (dB)**
-500	-85
-300	-85
-200	-80
-110	0
110	0
200	-80
300	-85
500	-85

4.2 Radiated Measurements

4.2.1 Cabinet radiation

4.2.1.1 Definition

Emissions from the equipment, radiated from the enclosure port, other than those present at the antenna port.

4.2.1.2 Method

The test defined in clause 5.2.3 shall be applied.

4.2.1.3 Limits

This test shall be performed at a distance of 10 m, where feasible. When size and/or power requirements necessitate testing in a manufacturing facility, other distances may be used (see notes 1, 2 and 3 below). Tests shall not be carried out in the exclusion band (2).

Table 3

Limits for radiated unwanted emissions	
Quasi-peak limits (dBµV/m) at 10 m (1) (2)	**Frequency range**
30 dBµV/m ≤ 60 + 10 $\log_{10}$ (P0/2000) ≤ 70 dBµV/m	30 MHz – 230 MHz
37 dBµV/m ≤ 67 + 10 $\log_{10}$ (P0/2000) ≤ 77 dBµV/m	> 230 MHz – 1 GHz
1) P0 = RF output power in watts. 2) The exclusion band for the transmitter extends from Fc – 300 kHz to Fc + 300 kHz, where Fc is the operating frequency in MHz.	

NOTE 1: The measurements can be carried out at other distances. In that case limits are modified according to the relation:

$$L(xm) = L(10m) + 20 \log (10/x)$$

where x = distance.

NOTE 2: Care should be taken if measuring at test distances below 10 m as this may be in the near field.

NOTE 3: In cases of dispute the measurement distance of 10 m shall take precedence.

5 Testing for compliance with technical requirements

5.1 Measurement uncertainties

Measurement uncertainty should be calculated and techniques employed to minimize its range. This uncertainty should be applied to the limit and any measurement falling below the range is deemed acceptable [6].

5.2 Essential radio test suites

5.2.1 Spurious emissions

5.2.1.1 Method of test

5.2.1.1.1 Initial conditions

Test environment:

the normal operating environment, as declared by the equipment manufacturer

Test frequencies:

a) the lowest operating frequency of the EUT;

b) the highest operating frequency of the EUT;

c) a frequency mid-way between a) and b) above.

Test arrangement (see figure A.1):

1) connect the AF Signal Generator to the EUT;

2) connect the EUT to the Test Load, via the Coupling Device;

3) connect the Spectrum Analyser to the Coupling Device.

5.2.1.1.2 Procedure

1) set the AF Signal Generator to deliver a test signal as defined in Annex A.3;

2) operate the EUT at each of the test frequencies as defined in clause 5.2.1.1.1;

3) measure the results on the Spectrum Analyser.

5.2.1.1.3 Test requirements

The results obtained shall be compared to the limits in clause 4.1.1.3 in order to demonstrate compliance.

5.2.2 Out-of-band emissions

5.2.2.1 Method of test

5.2.2.1.1 Initial conditions

Test environment:

the normal operating environment, as declared by the equipment manufacturer.

Test frequencies:

a) the lowest operating frequency of the EUT;

b) the highest operating frequency of the EUT;

c) a frequency mid-way between a) and b) above.

Test arrangement (see figure A.1):

1) connect the AF Signal Generator to the EUT;

2) connect the EUT to the Test Load, via the Coupling Device;

3) connect the Spectrum Analyser to the Coupling Device.

5.2.2.1.2 Procedure

1) set the AF Signal Generator to deliver a test signal as defined in Annex A.3;

2) operate the EUT at each of the test frequencies as defined in clause 5.2.2.1.1;

3) measure the results on the Spectrum Analyser.

5.2.2.1.3 Test requirements

The results obtained shall be compared to the limits in clause 4.1.2.3 in order to demonstrate compliance.

5.2.3 Cabinet radiation

5.2.3.1 Method of test

5.2.3.1.1 Initial conditions

Test environment:

the normal operating environment, as declared by the equipment manufacturer.

Test frequencies:

a) the lowest operating frequency of the EUT;

b) the highest operating frequency of the EUT;

c) a frequency mid-way between a) and b) above.

Test arrangement: (see figure A.1)

1) connect the AF Signal Generator to the EUT;

2) connect the EUT to the Test Load;

3) connect the Spectrum Analyser to the measuring antenna.

5.2.3.1.2 Procedure

1) set the AF Signal Generator to deliver a test signal as defined in Annex A.3;

2) operate the EUT at each of the test frequencies as defined in clause 5.2.3.1.1;

3) measure the results on the Spectrum Analyser;

4) Testing shall be carried out at a suitably calibrated test site, unless physical size is a restriction, in which case the test method shall be in accordance with EN 55011 [4]:

   - measurements shall be made outside ± 250 % of the necessary bandwidth of the transmission;
   - measurements shall be made in the operational mode producing the largest emission in the frequency band being investigated consistent with normal applications;
   - the equipment shall be configured in a manner which is representative of a normal/typical operation, where practical;
   - an attempt shall be made to maximize the detected radiated emission, e.g. by moving the cables of the equipment;
   - the configuration and mode of operation during measurements shall be precisely noted in the test report;
   - RF input/output ports shall be correctly terminated;
   - the tests shall be carried out at a point within the specified normal operating environmental range and at the rated supply voltage for the equipment.

5.2.3.1.3 Test requirements

The results obtained shall be compared to the limits in clause 4.2.1.3 in order to demonstrate compliance.

Annex A (normative): General measuring arrangements

A.1 Test frequency range

Limits on unwanted emissions for radio equipments are considered to be applicable to the range 9 kHz to 300 GHz. However, for practical measurement purposes, the frequency range of spurious emissions may be restricted. As guidance for practical purposes, the following measurement parameters in table A.1 are recommended:

Table A.1

Transmitter fundamental frequency range	Unwanted emission frequency measurement range	
	lower frequency	upper frequency
68 MHz - 108 MHz	9 kHz	1 GHz

The following reference bandwidths are to be used:

- for spurious emissions:
  - 1 kHz between 9 kHz and 150 kHz;
  - 10 kHz between 150 kHz and 1 GHz;
- for out of band emissions:
  - 1 kHz.

Video bandwidth shall be set equal to, or greater than, the reference bandwidth.

For definition of reference bandwidth, see ITU-R Recommendation SM 329-8 [7].

A.2 Test Suite

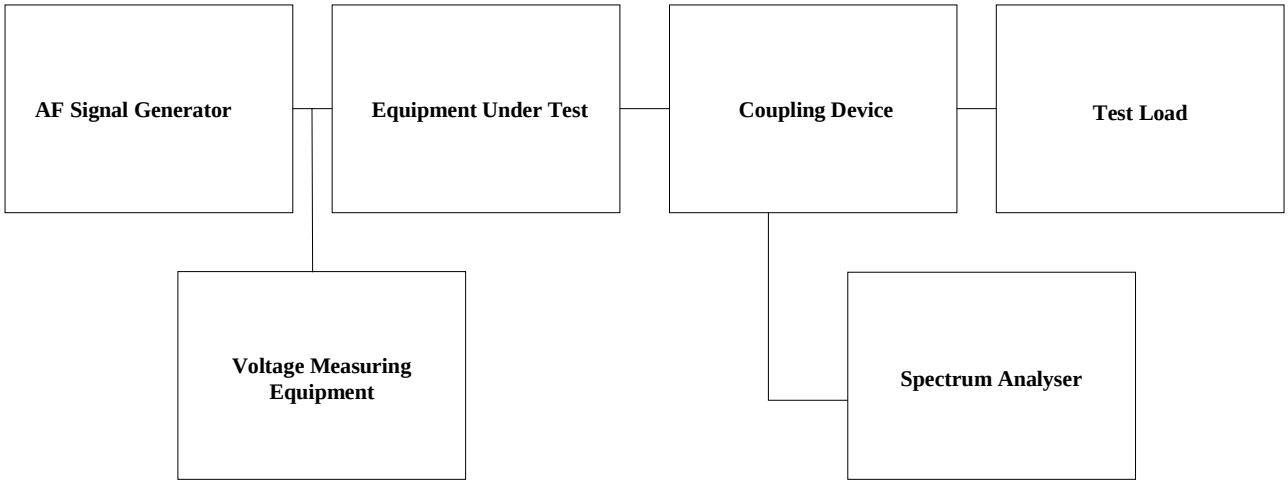

Figure A.1

A.3 Test modulating waveform

A Modulating signal sufficient to achieve Maximum modulation as declared by the manufacturer.

Where equipment is declared by the manufacturer to be suitable for use with ancillary equipment then the equipment under test shall be tested with a suitable test signal.

A.4 Testing arrangements for radiated measurements

Guidance on methods of measurement can be found in IEC 60489-1 [5].

Annex B (informative): Bibliography

- EN 302 018-1: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Transmitting equipment for the Frequency Modulated (FM) radio broadcast service; Part 1: Technical characteristics and test methods";
- EN 301 489-11: "Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 11: Specific conditions for analogue terrestrial sound broadcasting (Amplitude Modulation (AM) and Frequency Modulation (FM)) service transmitters".

Annex C (informative): The EN title in the official languages

Language	EN title
Danish	
Dutch	
English	
Finnish	
French	
German	
Greek	
Italian	
Portuguese	
Spanish	
Swedish	

History

Document history			
V1.1.1	November 2001	Public Enquiry	PE 20020329: 2001-11-28 to 2002-03-29