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Fixed Radio Systems; Characteristics and requirements for point-to-point equipment and antennas; Part 4-1: System-dependent requirements for antennas

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Foreword

This European Standard (Telecommunications series) has been produced by ETSI Technical Committee Transmission and Multiplexing (TM).

The present document is part 4-1 of a multi-part deliverable covering the Fixed Radio Systems; Characteristics and requirements for point-to-point equipment and antennas, as identified below:

Part 1: "Overview and system-independent common characteristics";

Part 2-1: "System-dependent requirements for digital systems operating in frequency bands where frequency co-ordination is applied";

Part 2-2: "Harmonized EN covering essential requirements of Article 3.2 of R&TTE Directive for digital systems operating in frequency bands where frequency co-ordination is applied";

Part 3: "Harmonized EN covering essential requirements of Article 3.2 of R&TTE Directive for equipment operating in frequency bands where no frequency co-ordination is applied";

Part 4-1: "System-dependent requirements for antennas";

Part 4-2: "Harmonized EN covering essential requirements of Article 3.2 of R&TTE Directive for antennas".

National transposition dates	
Date of adoption of this EN:	19 November 2004
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Introduction

The purpose of the present document is to define antenna parameters, which are relevant to Fixed Radio Systems (FRS), including those considered essential for conformity to the R&TTE Directive [1]. Limits are set out in EN 302 217-4-2 [4].

Additional parameters appropriate to system implementation may be subject to agreement between the equipment purchaser and supplier. Further guidance is provided in annex B.

1 Scope

The present document summarizes all requirements for single main beam, linear polarization, directional antennas to be adopted in conjunction with Point-to-Point (PP) systems operating in the frequency range 1 GHz to 60 GHz.

Single polarization antennas, dual polarization antennas, dual band/single polarized antennas and dual band/dual polarization antennas are considered.

Description and limits for parameters relevant to essential requirements under article 3.2 of the R&TTE Directive [1] are given in EN 302 217-4-2 [4].

For other parameters and general information that does not affect the R&TTE Directive [1] "essential requirements" mentioned above, description and limits are set out in the present document.

There are a number of different antenna types for various applications, the principles by which they are classified are given in clause 5.

The present document does not cover aspects related to test procedures and test conditions, which are covered by the scope of EN 301 126-3-1 [2].

Guidance on the definition of radio parameters relevant to the essential requirements under article 3.2 of the R&TTE Directive [1] for DFRS may be found in TR 101 506 (see bibliography).

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.

Referenced documents which are not found to be publicly available in the expected location might be found at http://docbox.etsi.org/Reference.

[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] ETSI EN 301 126-3-1: "Fixed Radio Systems; Conformance testing; Part 3-1: Point-to-Point antennas; Definitions, general requirements and test procedures".

[3] ETSI EN 302 217-1: "Fixed Radio Systems; Characteristics and requirements for point-to-point equipment and antennas; Part 1: Overview and system-independent common characteristics".

[4] ETSI EN 302 217-4-2 (V1.1.2): "Fixed Radio Systems; Characteristics and requirements for point-to-point equipment and antennas; Part 4-2: Harmonized EN covering essential requirements of Article 3.2 of R&TTE Directive for antennas".

[5] IEC 60154-1: "Flanges for waveguides. Part 1: General requirements".

[6] IEC 60154-2: "Flanges for waveguides. Part 2: Relevant specifications for flanges for ordinary rectangular waveguides".

[7] IEC 60169-1: "Radio-frequency connectors. Part 1: General requirements and measuring methods".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in EN 302 217-1 [3] apply.

3.2 Symbols

For the purposes of the present document, the symbols given in EN 302 217-1 [3] apply.

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in EN 302 217-1 [3] apply.

4 Frequency bands

The present document defines the characteristics and requirements of antennas in the frequency range from 1 GHz to 60 GHz.

For technical commonalities that range is here divided into sub-ranges as follows:

Range 0: 1 GHz to 3 GHz;

Range 1: 3 GHz to 14 GHz;

Range 2: 14 GHz to 20 GHz;

Range 3: 20 GHz to 24 GHz;

Range 4: 24 GHz to 30 GHz;

Range 5: 30 GHz to 47 GHz;

Range 6: 47 GHz to 60 GHz.

5 Classification of antennas

Antenna classification presented in the present document is based on RPE and XPD parameters.

NOTE: It should be noted that in previous EN 301 751, based on EN 300 631 and EN 300 833 (see references for these ENs in the bibliography), there was an additional classification regarding "low gain" and "high gain", considered no longer appropriate since R&TTE Directive [1] came into force.

5.1 Radiation Pattern Envelope (RPE) classes

The RPE directional characteristic (co-polar and cross-polar) impacts the interference situation in the network planning and a trade-off between a highly demanding RPE and the cost/size/weight of the antennas, compatible with the constraints given by present and future networks is then advisable.

With respect to the Radiation Pattern Envelope (RPE), four classes (RPE classes 1 to 4) have been identified according maximum co-polar limits for any actual RPE mask in significant range of off-axis azimuth angles. The subdivision in those classes is also depending on given frequency ranges of operation according figures 1 to 3 and table 1.

Figures 1 to 3 are intended only for defining subdivision of antennas in directivity classes; actual limits options for declaration of conformance to essential requirements under article 3.2 of the R&TTE Directive [1] are defined only in EN 302 217-2-2 (see bibliography).

When more than one actual standardized RPE fall within the same class, a sub-class indicative (A, B, C, etc.) will be used according their more demanding RPE limit in angles closer to the intended direction.

NOTE: Figures 1 to 3 reports limits for any actual RPE mask of classes 2, 3 and 4 antennas; class 1 antennas are defined as those which actual RPE mask exceeds class 2 limits. It should also be noted that, while the above subdivision is objectively based on actual antenna characteristics, in previous EN 300 631 and EN 300 833 (see both references in the bibliography) the definition of classes 1 to 4 was based on different subjective concepts of "low, high, very high, extremely high interference potential on the network"; those definitions are no longer appropriate since R&TTE Directive [1] came into force, because of the possible connection to the regulatory frame. Nevertheless only in few cases the RPEs, transferred in the present document or in EN 302 217-4-2 [4], have actually changed class number from those previous ENs.

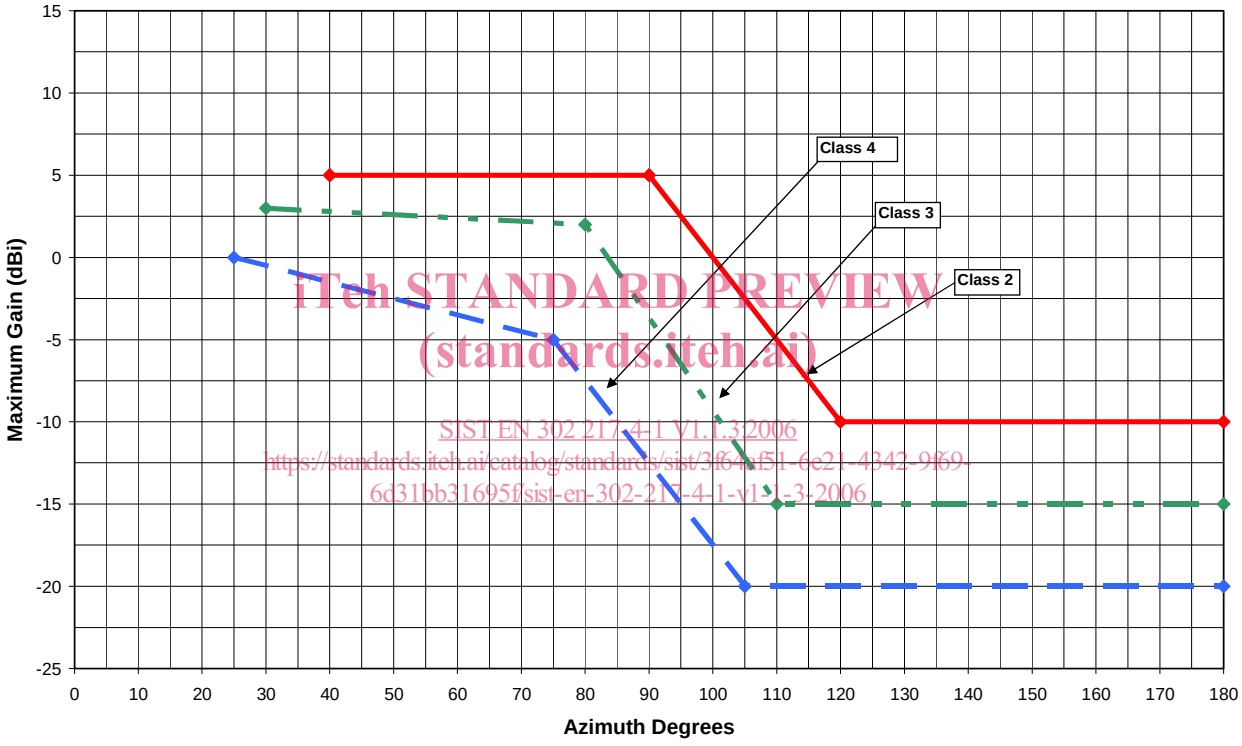

Figure 1: Co-polar limits for actual RPE masks of antenna classes in the range 1 GHz to 3 GHz (see table 1)

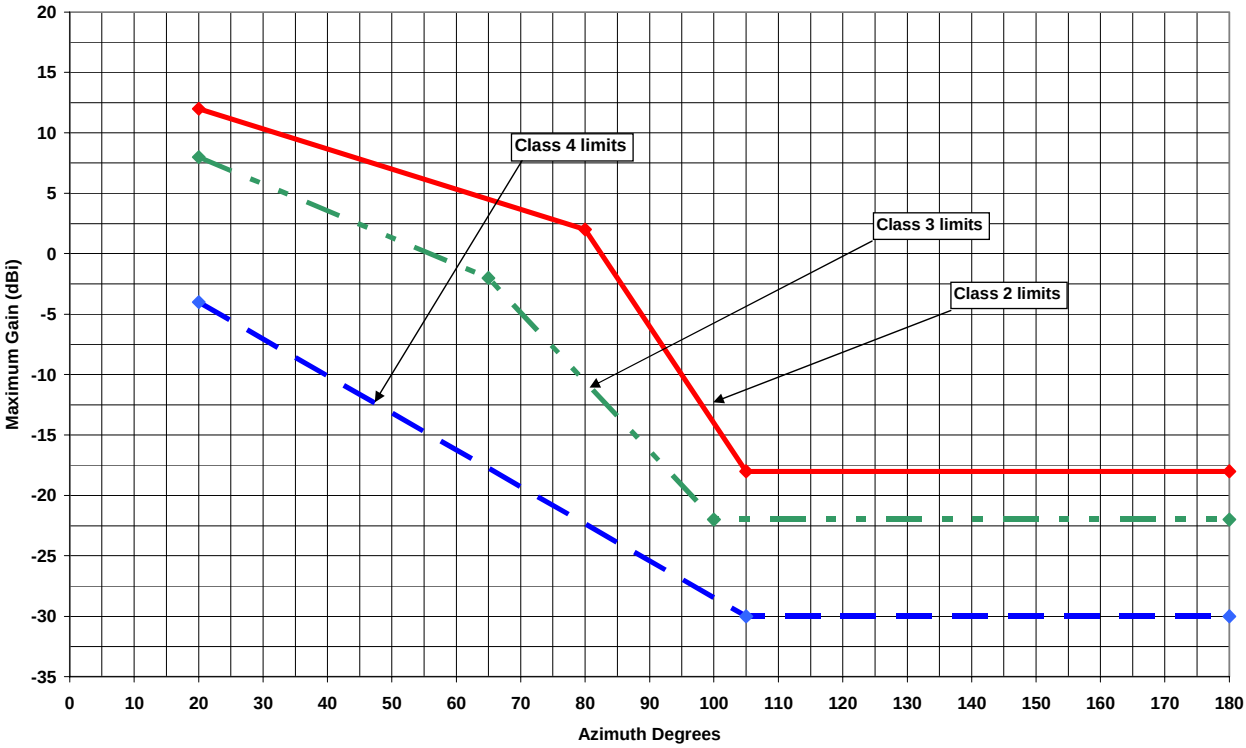

Figure 2: Co-polar limits for actual RPE masks of antenna classes in the range 3 GHz to 30 GHz (see table 1)

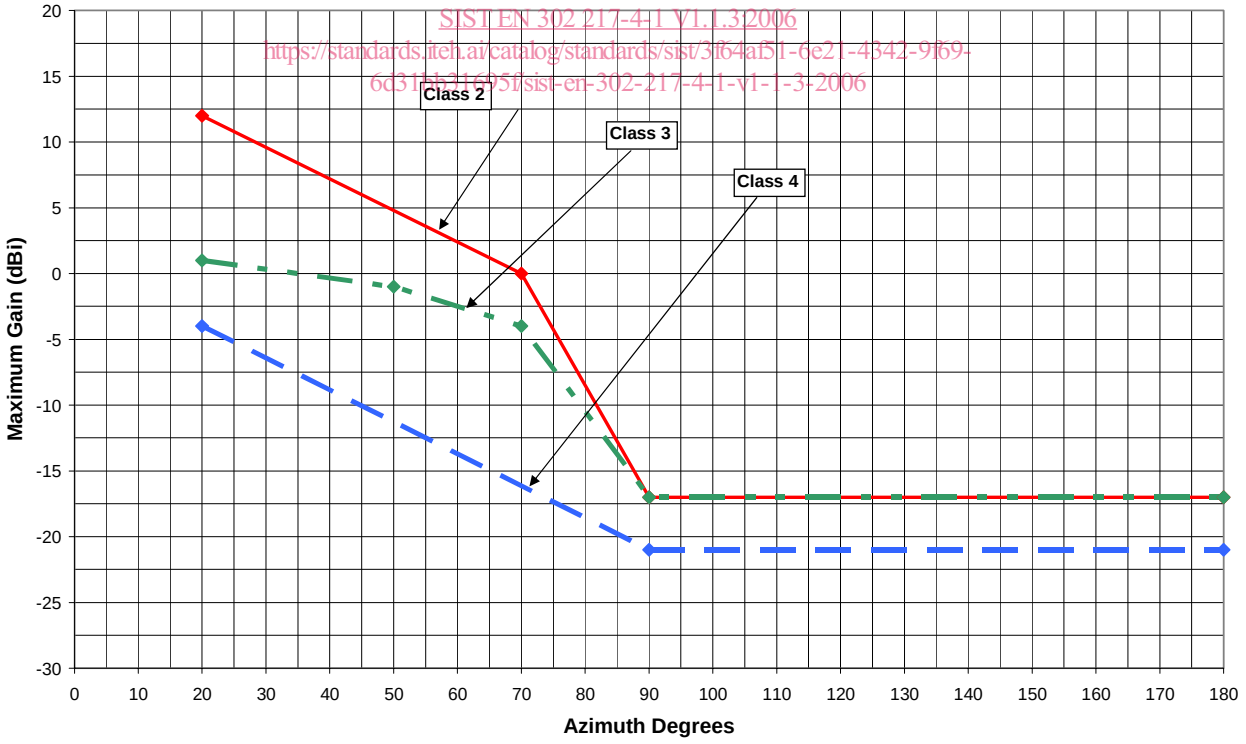

Figure 3: Co-polar limits for actual RPE masks of antenna classes in the range 30 GHz to 60 GHz (see table 1)

Table 1: Corner points of co-polar limits for actual RPE masks (see figures 1, 2 and 3)

RPE classes (see note 1)	Co-polar maximum limits for actual RPEs					
	Range 1 GHz to 3 GHz (see note 2)		Range 3 GHz to 30 GHz (see note 3)		Range 30 GHz to 60 GHz (see note 4)	
	Maximum gain (dBi)	Azimuth angle (°)	Maximum gain (dBi)	Azimuth angle (°)	Maximum gain (dBi)	Azimuth angle (°)
2	5	40	12	20	12	20
	5	90	2	80	0	70
	-10	120	-18	105	-17	90
	-10	180	-18	180	-17	180
3	3	30	8	20	1	20
	2	80	-2	65	-1	50
	-15	110	-22	100	-4	70
	-15	180	-22	180	-17	90
					-17	180
4	0	25	-4	20	-4	20
	-5	75	-30	105	-21	90
	-20	105	-30	180	-21	180
	-20	180				

NOTE 1: Class 1 antennas are defined as those which actual RPE exceeds class 2 limits.
NOTE 2: In EN 302 217-4-2 [4], no specific class 4 antenna RPE is defined for this frequency range; the corresponding limit in table 1 is set for possible future use.
NOTE 3: In EN 302 217-4-2 [4], no specific RPE are defined for class 4 antennas in the frequency range 14 GHz to 30 GHz; the corresponding limits in table 1 are set for possible future use.
NOTE 4: In EN 302 217-4-2 [4], no specific class 4 antenna RPE is defined for this frequency range; the corresponding limit in table 1 is set for possible future use.

5.2 Cross-Polar Discrimination (XPD) categories

The XPD characteristics also have impact on frequency planning (e.g. minimum angle of nodal frequency reuse of cross polarized carriers) but also on the link performance (e.g. when CCDP or ACAP operation is foreseen for systems using high sensitive modulation formats).

With respect to cross-Polar Discrimination (XPD), three XPD performance categories (XPD categories 1 to 3) have been identified (refer to EN 302 217-4-2 [4]):

XPD category 1: those antennas required to have standard cross-polar discrimination.

XPD category 2: those antennas required to have high cross-polar discrimination.

XPD category 3: those antennas required to have high cross-polar discrimination through an extended angular region.

6 Electrical characteristics

6.1 Radiation Pattern Envelope (RPE)

Co-polar and Cross-polar RPEs are relevant to the essential parameters under article 3.2 of the R&TTE Directive [1] and are stated in EN 302 217-4-2 [4].

NOTE 1: In bands where frequency co-ordination is not applied, cross-polar RPE is not considered relevant to essential requirements for R&TTE Directive [1] conformance, even if the antenna is actually dual polarized. Values are still given in EN 302 217-4-2 [4] but should be considered for reference purposes only. For definition of co-ordination in frequency bands, refer to definitions in EN 302 217-1 [3].

NOTE 2: RPEs are standardized as absolute worst-case envelope to be 100 % met by for conformance declaration purpose only. In addition, RPE masks, standardized in EN 302 217-4-2 [4] are not defined for angles close to the bore-sight direction. Therefore, information on typical main beam pattern and RPEs for common circularly-symmetric antenna types may be found in annex C.