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Fixed Radio Systems; Point-to-Multipoint Antennas; Antennas for point-to-multipoint fixed radio systems in the 3 GHz to 11 GHz band

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European Standard (Telecommunications series)

Fixed Radio Systems; Point-to-Multipoint Antennas; Antennas for point-to-multipoint fixed radio systems in the 3 GHz to 11 GHz band

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Foreword

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

The purpose of the present document is to define the antenna performance standards necessary to ensure optimum frequency co-ordination between the systems and/or different services by the Regulatory Authorities in the 3 GHz to 11 GHz band. These nominal frequency limits have been chosen to reflect the WRC 2000 Final Acts [6] and the frequency plans as given in CEPT Recommendation T/R 13-02 [1] and ITU-R Recommendation F.748 [5].

Point-to-multipoint antennas, whether integrated within station equipment or not, may need to meet environmental, mechanical and electrical characteristics not covered by the present document, in order that the systems will operate as intended. Additional parameters and characteristics may be subject to agreement between the equipment purchaser and the supplier; these are considered and guidance is provided in annex A.

| National transposition dates | |
|--|------------------|
| Date of latest announcement of this EN (doa): | 31 December 2005 |
| Date of latest publication of new National Standard or endorsement of this EN (dop/e): | 30 June 2006 |
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Introduction

The purpose of the present document is to define the requirements for antennas used in conjunction with Point-to-MultiPoint (P-MP) systems necessary to facilitate frequency co-ordination between services in the frequency bands 3 GHz to 11 GHz.

1 Scope

The present document specifies the essential electrical requirements for linear polarization, fixed beam antennas to be utilized with new Point-to-Multipoint (P-MP) systems, including central station and terminal station applications, operating in frequency bands from 3 GHz to 11 GHz. These systems use various multiple access schemes. Electronically steerable antennas and circularly polarized antennas are not considered in the present document.

Only in exceptional circumstances, and after a consultation period with operators and manufacturers, the Regulatory Authority may impose the use of tighter requirements than the minimum values given in the present document, in order to maximize the use of scarce spectrum resources.

For some high gain, point-to-multipoint requirements, antennas may be used having performance as per the appropriate point-to-point antenna standard. For these antennas, minimum requirements are given in EN 300 833 [8].

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] CEPT Recommendation T/R 13-02: "Preferred channel arrangements for fixed services in the range 22.0 - 29.5 GHz".
- [2] CEPT/ERC/REC 12-05: "Harmonised radio frequency channel arrangements for digital terrestrial fixed systems operating in the band 10.0 - 10.68 GHz".
- [3] CEPT/ERC/REC 14-03: "Harmonised radio frequency channel arrangements for low and medium capacity systems in the band 3400 MHz to 3600 MHz".
- [4] ITU-R Recommendation F.747: "Radio-frequency channel arrangements for fixed wireless systems operating in the 10 GHz band".
- [5] ITU-R Recommendation F.748: "Radio-frequency arrangements for systems of the fixed service operating in the 25, 26 and 28 GHz bands".
- [6] Final Acts - WRC - 2000, Istanbul.
- [7] ETSI ETS 300 019-1-4: "Equipment Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 1-4: Classification of environmental conditions; Stationary use at non-weatherprotected locations".
- [8] ETSI EN 300 833: "Fixed Radio Systems; Point-to-point antennas; Antennas for point-to-point fixed radio systems operating in the frequency band 3 GHz to 60 GHz".
- [9] ETSI EN 301 126-3-2: "Fixed Radio Systems; Conformance testing; Part 3-2: Point-to-Multipoint antennas - Definitions, general requirements and test procedures".
- [10] IEC 60154-1: "Flanges for waveguides. Part 1: General requirements".
- [11] IEC 60154-2: "Flanges for waveguides. Part 2: Relevant specifications for flanges for ordinary rectangular waveguides".

- [12] IEC 60169 (part 1 and applicable subparts): "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 following terms and definitions apply:

antenna: that part of the transmitting or receiving system that is designed to transmit or receive electromagnetic radiation

boresight: axis of the main beam in a directional antenna

Central Station (CS): base station which communicates each way with many terminal stations and, in many cases, repeater stations

co-polar pattern: diagram representing the radiation pattern of a test antenna when the reference antenna is similarly polarized, scaled in dBi or dB relative to the measured antenna gain

cross-polar pattern: diagram representing the radiation pattern of a test antenna when the reference antenna is orthogonally polarized, scaled in dBi, or dB relative to the measured antenna gain

cross-polar discrimination: difference between the peak of the co-polarized main beam and the maximum cross-polarized signal over an angle measured within a defined region

fixed beam: radiation pattern in use is fixed relative to a defined mechanical reference plane

gain: ratio of the radiation intensity in a given direction to the radiation intensity that would be obtained if the power accepted by the antenna was radiated isotropically

Half Power BeamWidth (HPBW): angle, relative to the main beam axis, between the two directions at which the measured co-polar pattern is 3 dB below the value on the main beam axis

inter-port isolation: ratio in dB of the power level applied to one port of a multi-port antenna to the power level received in any other port of the same antenna as a function of frequency

isotropic radiator: hypothetical, lossless antenna having equal radiation intensity in all directions

input port(s): flange(s) or connector(s) through which access to the antenna is provided

main beam axis: direction for which the radiation intensity is a maximum

main beam: radiation lobe containing the direction of maximum radiation

mechanical tilt: fixed angular shift in elevation of the antenna main beam axis by a change to the physical mounting

Radiation Pattern Envelope (RPE): envelope within which the radiation pattern shall fit

radiation pattern: diagram relating power flux density at a constant distance from the antenna to the direction relative to the notional antenna main beam axis. Specifically referenced in EN 302 085 to the zero degree reference direction.

radome: cover, of dielectric material, intended for protecting an antenna from the effects of its physical environment

Repeater Station (RS): radio station providing the connection via the air to both the central station and the terminal station(s). The remote station may also provide the interfaces to the subscriber equipment, if applicable.

sector angle: declared angle of coverage in azimuth of a sectored antenna, defined as 2α in EN 302 085

Terminal Station (TS): remote (out) station which communicates with a central station

tilt: fixed, angular shift of the antenna main beam axis (boresight) in the elevation plane by either electrical, electronic or mechanical means

zero degree (0°): declared direction as referenced to the antenna

reference direction: mechanical characteristics, used as reference for the RPE

reference beam direction: mechanical characteristics, used as reference for every beam RPE (applicable only to multi-beam antennae)

3.2 Symbols

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

| | |
|-----------------|--|
| α | Alpha (= half the sector angle) |
| ε | reference beam direction |
| dB _i | Decibels relative to an isotropic source |
| f_0 | Nominal centre frequency of declared antenna operating range |
| GHz | GigaHertz |
| MHz | MegaHertz |
| ROUND () | Round up or down to nearest integer |
| ABS() | Absolute value of the number |

3.3 Abbreviations

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

| | |
|------|-----------------------------|
| CS | Central Station |
| HPBW | Half Power Beam Width |
| P-MP | Point-to-MultiPoint |
| PIM | Passive InterModulation |
| RPE | Radiation Pattern Envelope |
| RS | Repeater Station |
| TS | Terminal Station |
| VSWR | Voltage Standing Wave Ratio |

4 Frequency bands

The present document applies to a number of frequency ranges within the 3 GHz to 11 GHz frequency bands considered within CEPT/ERC and ETSI for allocation to the fixed services. Suitable sub-bands for allocation to point-to-multipoint use are subject to channel plans described in references CEPT/ERC/REC 12-05 [2], CEPT/ERC/REC 14-03 [3] and ITU-R Recommendation F.747 [4].

For the purpose of the present document, the overall frequency bands 3 GHz to 11 GHz are divided into three ranges as follows:

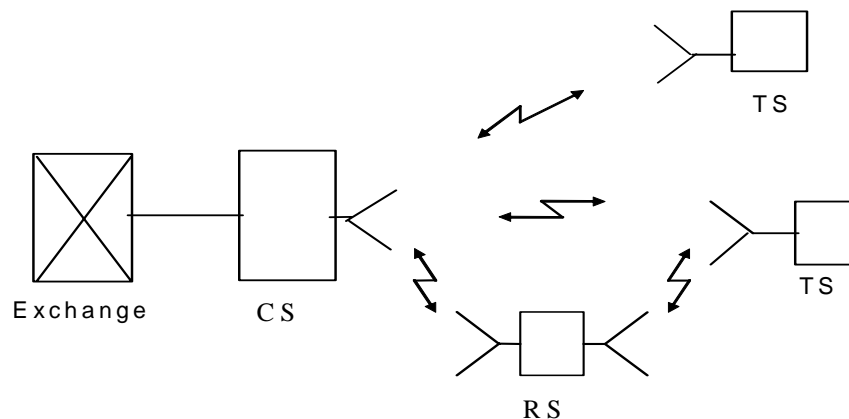
| | |
|----------|----------------------|
| range 1: | 3,0 GHz to 5,9 GHz; |
| range 2: | 5,9 GHz to 8,5 GHz; |
| range 3: | 8,5 GHz to 11,0 GHz. |

5 Types and classification of antennas

5.1 Antenna types

The present document addresses fixed beam antennas used in the Central (CS) and Terminal (TS) stations including Repeaters (RS).

The antennas are used in a system which can generally be described as in figure 1.



CS: Central Station, which is linked to all remote stations (repeater or terminal stations) by microwave transmission paths.

TS: Terminal Station (outstation with subscriber interfaces).

RS: Repeater Station (radio repeater outstation with or without subscriber interfaces). A RS may serve one or more TSs.

Figure 1: General point-to-multipoint system architecture

These antennas shall be grouped into the following types:

Central and repeater stations:

- Omni-directional;
- Sectored:
 - Single-beam;
 - Multi-beam;
- Directional, conforming to the requirements for TS antennas.

Terminal stations: Directional.

Repeater antennas can be of either Central (CS) or Terminal (TS) station types.

5.2 Antenna classifications

5.2.1 CS classes

With respect to the **azimuthal** Radiation Pattern Envelope (RPE), three classes may be identified in different frequency sub-ranges for Central Station (CS) **sectored** antennas (CS1,CS2,CS3) and two classes may be identified for multi-beam antennas (CSMB1,CSMB2):

- class CS 1;