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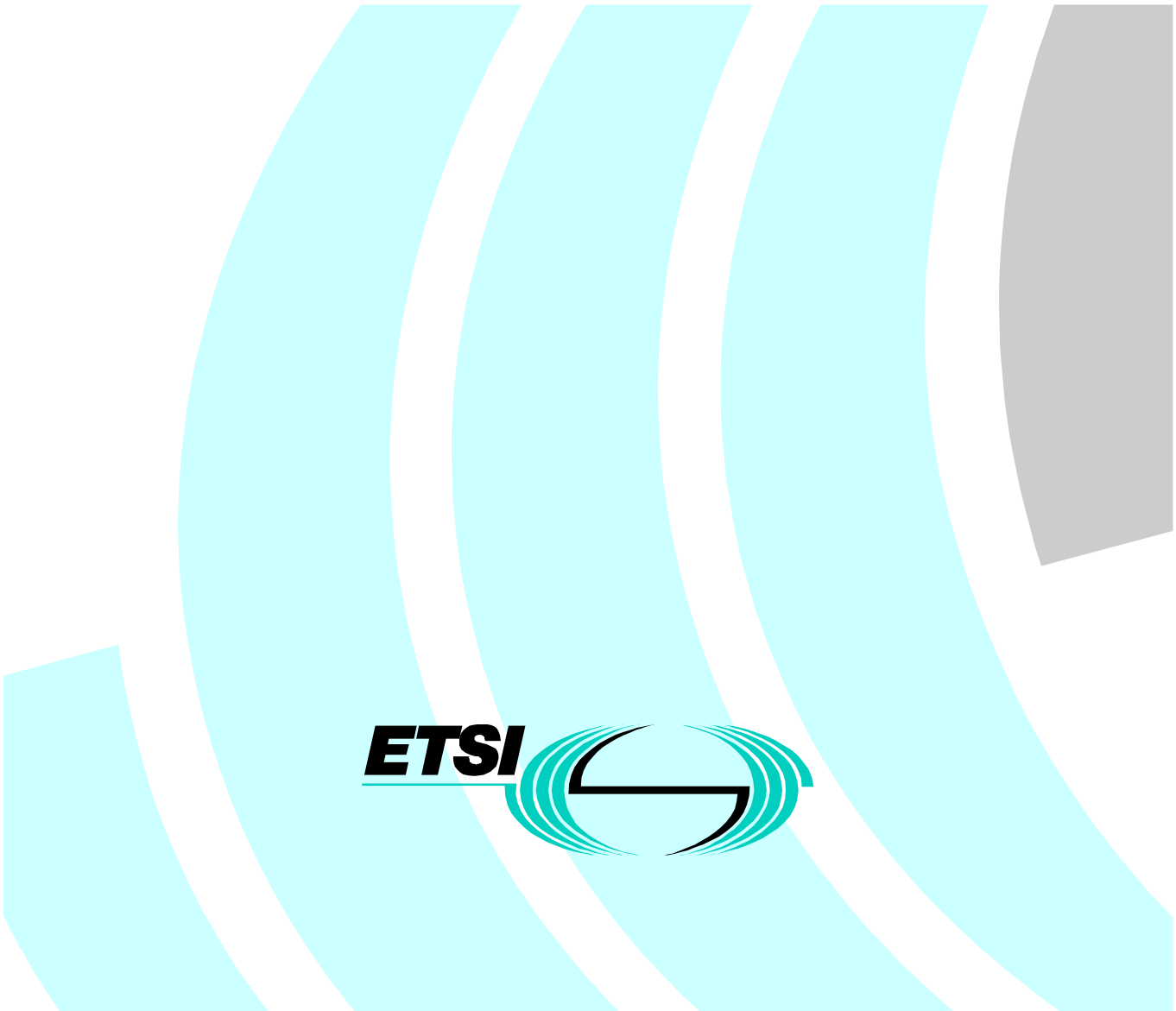
European Standard (Telecommunications series)

Transmission and Multiplexing (TM); Digital Radio Relay Systems (DRRS); Antennas for use in point-to-multipoint DRRS in the 11 GHz to 60 GHz band; Part 1: General aspects



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Foreword

This European Standard (Telecommunications series) has been produced by ETSI Technical Committee Transmission and Multiplexing (TM), and is now submitted for the Public Enquiry phase of the ETSI standards Two-step Approval Procedure.

The purpose of this multi-part document is to define requirements for antennas in conjunction with point-to-multipoint (P-MP) systems necessary to facilitate frequency co-ordination between services in the frequency bands 11 GHz to 60 GHz. The various parts are as follows:

Part 1: **"General aspects";**

Part 2: "24 GHz to 30 GHz".

The present document is organized in the following way. Part 1 gives general information about the scope, normative references, definitions, classification, normative and informative electrical and mechanical characteristics. Part 1 is the framework for further parts, where distinct values of normative characteristics for a given frequency sub-band are defined. Consequently, Part 1 in combination with another part forms the EN for a given sub-band.

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

1 Scope

This European Standard (EN) specifies the essential electrical requirements for linear polarization, fixed beam antennas to be utilized with new Point-to-Multipoint (P-MP) systems [1], including central station and terminal station applications, operating in frequency bands from 11 GHz to 60 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 [2].

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, subsequent revisions do apply.
- 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] EN 301 213-1: "Transmission and Multiplexing (TM); Digital Radio Relay Systems (DRRS); Point-to-multipoint DRRS in frequency bands in the range 24,25 GHz to 29,5 GHz using different access methods; Part 1: Basic parameters".

[2] ETS 300 833: "Transmission and Multiplexing (TM); Digital Radio Relay Systems (DRRS); Antennas used in point-to-point DRRS operating in the frequency band 3 GHz to 60 GHz".

[3] CEPT Recommendation T/R 13-02: "Preferred channel arrangements for fixed services in the range 22,0 GHz- 29,5 GHz".

[4] ITU-Recommendation F.746-1: "Radio-Frequency channel arrangements for radio-relay systems".

[5] Final Acts of the World Radiocommunications Conference (WARC-95), Geneva 1995.

[6] ETS 301 126-4: "Transmission and Multiplexing (TM); Digital Radio Relay Systems (DRRS); Conformance testing for DRRS; Part 4: Point-to-multipoint antenna specific parameters".

[7] EN 301 215-2: "Transmission and Multiplexing (TM); Digital Radio Relay Systems (DRRS); Antennas for use in point-to-multipoint DRRS in the 11 GHz to 60 GHz band; Part 2: 24 GHz to 30 GHz".

[8] 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".

3 Definitions, symbols and abbreviations

3.1 Definitions

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

antenna: That part of the transmitting or receiving system that is designed to radiate and/or receive electromagnetic waves.

boresight: The axis of the main beam in a directional antenna.

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

copolar pattern: A 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 discrimination (XPD): The difference in dB between the peak of the copolarized main beam and the maximum cross-polarized signal over an angle measured within a defined region.

cross-polar pattern: A 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.

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

gain: The 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: The angle, relative to the main beam axis, between the two directions at which the measured copolar pattern is 3 dB below the value on the main beam axis.

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

inter-port isolation: It is the 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 function of frequency.

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

main beam axis: The direction for which the radiation pattern intensity is the maximum.

main beam: The radiation lobe containing the direction of maximum radiation.

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

radiation pattern envelope: An envelope below which the radiation pattern shall fit.

radiation pattern: A diagram relating power flux density at a constant distance from an antenna to direction relative to the antenna main beam axis.

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

repeater Station: A Radio Station providing the connection via the air to both the Central Station and the Terminal Station(s). The Repeater Station may also provide the interfaces to the subscriber equipment, if applicable.

sector angle: The nominal half power beamwidth of a sectored antenna, defined as 2α in the present document (see figure 1).

terminal Station: A remote (out) station which communicates with a central station.

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

zero degree (0°) reference direction: A declared direction as referenced to the antenna mechanical characteristics, used as reference for RPE.

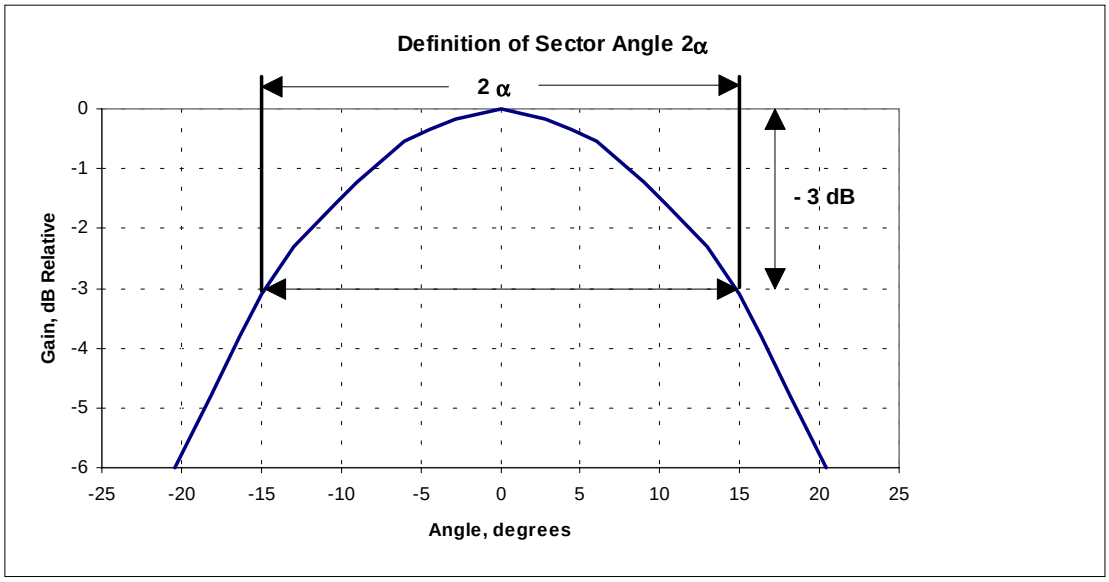


Figure 1: Showing Sector Angle 2α

3.2 Symbols

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

dB	Decibel
dBi	Decibels relative to an isotropic radiator
GHz	Gigahertz
α	Alpha (= half of the nominal HPBW of a sectored antenna)

3.3 Abbreviations

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

CS	Central Station
HPBW	Half power beamwidth
P-MP	Point-to-Multipoint
RPE	Radiation pattern envelope
RS	Repeater Station
TS	Terminal Station
VSWR	Voltage standing wave ratio
XPD	Cross-polar discrimination

4 Frequency bands

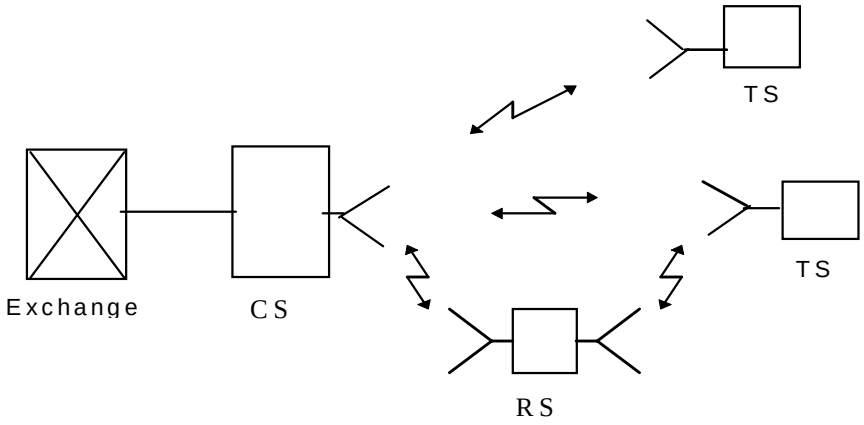
The present document applies to a number of frequency ranges within the 11 GHz to 60 GHz frequency bands as considered within CEPT/ERC and ETSI for allocation to the fixed services [3], [4] and [5].

For the purpose of this standard the overall frequency band 11 GHz to 60 GHz is divided into a number of frequency ranges, each of which are addressed in parts 2 onwards.

5 Types and classification of antennas

5.1 Antenna types

The standard 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 be described as in figure 2:



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). An RS may serve one or more TSs.

Figure 2: General point - to - multipoint system architecture

The antennas shall be grouped into the following Types:

Central and Repeater Stations:

Omni-directional;

Sectored;

Directional as per terminal stations;

Terminal Stations:

Directional.

5.2 Antenna classifications

5.2.1 CS classes

With respect to the azimuthal radiation pattern (RPE), a number of Classes may be identified in different frequency sub-ranges for central station (CS) sectored antennas:

- Class CS 1;
- Class CS 2;
- Class CS 3;
- other classes.

These Classes allow flexibility for a variety of different systems, and may be generally appropriate for lower and higher density deployments. If appropriate, the definition of antenna Classes is given in subsequent parts of the present document.

With respect to the azimuthal RPE for omnidirectional CS antennas, no requirement for separate Classes has been identified.

5.2.2 TS classes

With respect to the radiation pattern envelope (RPE), a number of Classes may be identified in different frequency sub-ranges for terminal station (TS) directional antennas:

- Class TS 1;
- Class TS 2;
- Class TS 3;
- other classes.

These Classes allow flexibility for a variety of different systemsand deployment conditions. If appropriate, the definition of antenna Classes is given in subsequent parts of the present document.

6 Electrical characteristics

For the purpose of the present document, an antenna is specific to a Type, Class, Range, the frequency range of operation and the mid-band gain. An antenna which employs a radome shall meet the requirements of the present document with the radome in place.

A 0° reference direction shall be defined for each antenna. The radiation characteristics in this standard are all referred to this 0° reference direction.

RPE(s) and gains of defined antenna Types and Classes are described in the relevant subsequent parts of the present document.

The copolar and crosspolar radiation patterns for both azimuth and elevation shall not exceed the RPE(s) defined in the distinct parts of the present document.

Specific requirements for point-to-multipoint antennas operating in the frequency band 24 GHz to 30 GHz can be found in part 2 of the present document [7].

7 Conformance tests

ETS 300 XXX [6] shall apply.

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

Annex A (informative): Additional information

A.1 Mechanical characteristics

A.1.1 Environmental characteristics

The antennas should be designed to operate within a temperature range of -45°C to +45°C with a relative humidity up to 100% for environmental conditions specified in ETS 300 019-1-4 [8].

The temperature range could be divided in two parts where at least one of the following ranges should be covered:

1) -33°C to +40°C;

2) -45°C to +45°C.

The antennas should be designed to meet wind survival ratings specified in table A.1:

Table A.1: Wind survival ratings

Antenna type	Wind velocity m/s (km/h)	Ice load (density 7 kN/m^3)
Normal duty	55 (200)	25 mm radial ice
Heavy duty	70 (252)	25 mm radial ice

A.1.2 Antenna stability

The antenna equipment should be stable under the most severe operational conditions at the site of intended application.

For installation purposes, the deviation of the antenna main beam axis should not be more than 0,3 times the smaller of the two azimuthal and elevation HPBW ,as a general guide, under the conditions specified in table A.2:

Table A.2: Antenna stability

Antenna type	Wind velocity m/s (km/h)	Ice load (density 7 kN/m^3)
Normal duty	30 (110)	25 mm radial ice
Heavy duty	45 (164)	25 mm radial ice

Further guidance can be obtained from ETS 300 019-1-4 [8].

A.2 Antenna input connectors

When flanges are provided at the input port of the antenna they should be in accordance with IEC 60154.

For antennas which are integrated to the radio equipment proprietary connection designs may be utilized.

For antennas using coaxial input ports the connectors should conform to IEC-169.

Other interconnection design should be agreed between the equipment supplier and purchaser in line with the overall system design requirements, in such a case a suitable test fixture should be agreed and used for test purposes.

A.3 VSWR at the input ports

The maximum VSWR should be agreed between the equipment supplier and purchaser in line with the overall system design requirements. For guidance antennas with a VSWR in the range of 1,9 to 1,1 are typical.

A.4 Inter-port isolation

The isolation between the input ports of a dual polarized antenna should be agreed between the equipment supplier and purchaser in line with the overall system design requirements. For guidance inter-port isolation better than 25 dB is typical.

A.5 Antenna labelling

Antennas should be clearly identified with a weather-proof and permanent label(s) showing the manufacturers name, antenna type, serial number(s) and type approval reference number which identifies the country of origin. It should be noted, that integrated antennas may share a common label with the outdoor equipment.

A.6 Passive Intermodulation (PIM) performance

For some P-MP access methods the minimum Passive Intermodulation (PIM) performance of the antenna may need to be taken into account. In such cases a passive intermodulation performance should be agreed between the equipment supplier and purchaser in line with the overall system design requirements. For guidance PIM product limits can often exceed -100 dBc.

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History

Document history			
V1.1.1	July 1998	Public Enquiry	PE 9846: 1998-07-17 to 1998-11-13