SLOVENSKI STANDARD
SIST EN 302 078 V1.1.1:2003

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Fiksni radijski sistemi ï Veļ toļ kovne antene ï Kroģno polarizirane antene za veļ toļ kovne fiksne radijske sisteme, ki delujejo v pasu od 1 GHz do 11 GHz

Fixed Radio Systems; Multipoint antennas; Circularly polarized antennas for multipoint fixed radio systems in the 1 GHz to 11 GHz band

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Contents

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Foreword

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

Antennas as components for radio relay systems 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 adoption of this EN:	14 March 2003
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Introduction

The purpose of the present document is to define the requirements for circularly polarized antennas used in conjunction with multipoint systems necessary to facilitate frequency co-ordination between services in the frequency band 1 GHz to 11 GHz.

1 Scope

The present document specifies the essential electrical requirements for circular polarization fixed beam antennas to be utilized with Multipoint (MP) systems, including central station, repeater stations, and terminal station applications, operating in frequency bands from 1 GHz to 11 GHz. These systems use various multiple access schemes. Electronically steerable antennas, and linearly polarized antennas are not considered under the present document.

Where circumstances merit, 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.

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] ETSI EN 301 126-3-2: "Fixed Radio Systems; Conformance testing; Part 3-2: Point-to-Multipoint antennas - Definitions, general requirements and test procedures".

[2] 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".

[3] SFS-EN 122150: "Sectional specification: Radio frequency coaxial connectors - Series EIA flange".

[4] IEC 60339-1: "General purpose rigid coaxial transmission lines and their associated flange connectors. Part 1: General requirements and measuring methods".

[5] IEC 60339-2: "General purpose rigid coaxial transmission lines and their associated flange connectors - Part 2: Detail specifications".

[6] 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 following terms and definitions apply:

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

axial ratio: ratio of maximum to minimum power contained in the field components of the polarization ellipse

boresight: axis of the main beam in a directional antenna

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

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

cross-polar pattern: diagram representing the radiation pattern of a test antenna when the reference antenna is polarized in the opposite sense, scaled in dB relative to the measured maximum co-polar pattern

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: angle between the two directions at which the measured co-polar pattern is 3 dB below the value on the main beam axis

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

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

left hand (anticlockwise) polarized wave: elliptically - or circularly - polarized wave, in which the electric field vector, observed in any fixed plane, normal to the direction of propagation, rotates in time in a left-hand or anticlockwise direction

main beam: radiation lobe containing the direction of maximum radiation

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

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

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

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

radome: cover of dielectric material, intended to protect an antenna from the effects of its physical environment.

Repeater Station (RS): radio station providing the connection via the air to the central station, the terminal stations and other repeater stations

NOTE: The repeater station may also provide the interfaces to the subscriber equipment if applicable.

right hand (clockwise) polarized wave: elliptically - or circularly - polarized wave, in which the electric field vector, observed in any fixed plane, normal to the direction of propagation, rotates in time in a right-hand or clockwise direction

sector angle: declared angle of coverage in azimuth of a sectored antenna, defined as 2α in EN 302 078

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 reference direction: declared direction as reference to the antenna mechanical characteristics, used as reference for RPE

3.2 Symbols

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

dBiC	Decibels relative to an isotropic circularly polarized source
dBi	Decibels relative to an isotropic radiator
GHz	Gigahertz
MHz	Megahertz
α	Alpha (= half the sector angle)
f_0	Nominal centre frequency of declared antenna operating range

3.3 Abbreviations

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

CS	Central Station
HPBW	Half Power BeamWidth
LHCP	Left Hand Circular Polarization
MP	MultiPoint
PIM	Passive InterModulation
P-MP	Point-to-Multipoint
RHCP	Right Hand Circular Polarization
RPE	Radiation Pattern Envelope
RS	Repeater Station
TS	Terminal Station
VSWR	Voltage Standing Wave Ratio

4 Frequency bands

For the purpose of the present document, the overall frequency bands 1 GHz to 11 GHz are divided into four ranges as follows:

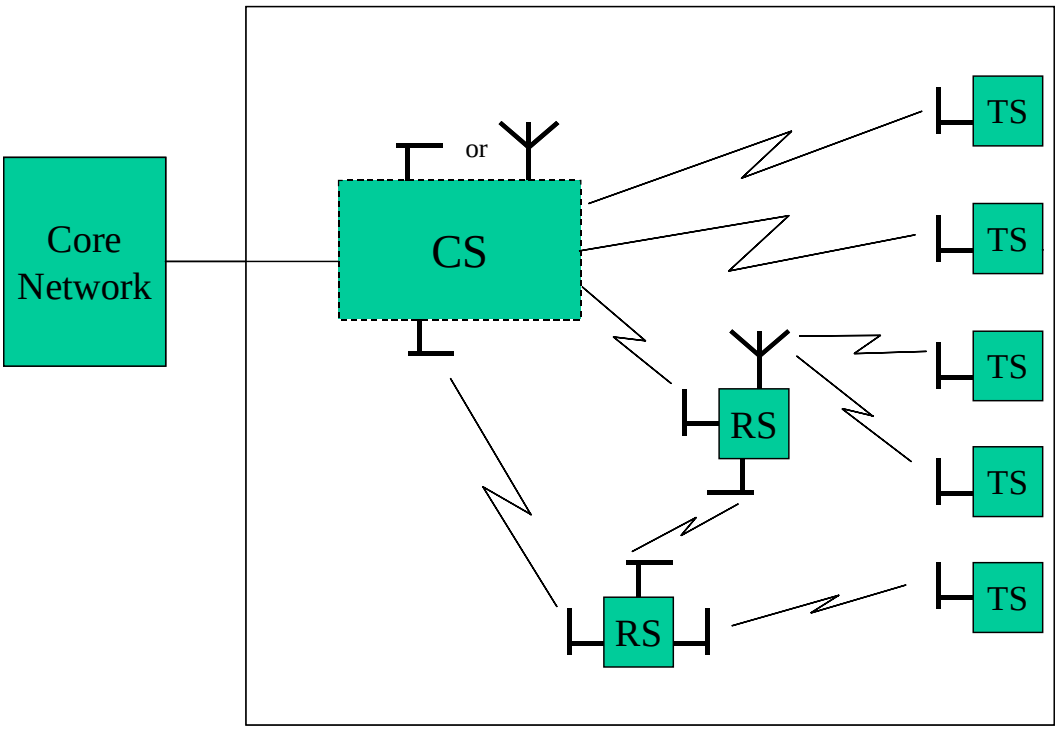
Range 1	1 GHz to 3 GHz
Range 2	3 GHz to 5,9 GHz
Range 3	5,9 GHz to 8,5 GHz
Range 4	8,5 GHz to 11 GHz

5 Types 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 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 1: General 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 Central Station (CS) classes

The appropriate Radiation Pattern Envelopes (RPE) are CS, CS1, CS2 and CS3.

5.2.2 Terminal Station (TS) classes

The Radiation Pattern Envelopes (RPE) are TS1, up to as high as TS5, in the four frequency ranges. Note that not all ranges have 5 classes.

6 Electrical characteristics

The present document defines several types of CS and TS antennas. For the purpose of the present document, an antenna is specific to a type, class, 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 the present document are all referred to this 0° reference direction.

RPE(s) and gains of defined antenna types and classes are described later in the present document.

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

6.1 Terminal Station (TS) antennas

The RPEs and gain parameters apply for antennas using either RHCP and LHCP.

6.1.1 TS Radiation Pattern Envelopes (RPE)

The co-polar and cross-polar radiation patterns for both azimuth and elevation (unless otherwise stated) shall not exceed the RPEs defined in the following list of tables. Figure 2 indicates a typical normalized template, although the number of points in the co- and cross-polar templates may vary.

Range 1 (1,0 GHz to 3,0 GHz)	Class TS 1:	Table 1
	Class TS 2:	Table 2
	Class TS 3:	Table 3
Range 2 (3,0 GHz to 5,9 GHz)	Class TS 1:	Table 4
	Class TS 2:	Table 5
	Class TS 3:	Table 6
	Class TS 4:	Table 7
	Class TS 5:	Table 8
Range 3 (5,9 GHz to 8,5 GHz)	Class TS 1:	Table 9
	Class TS 2:	Table 10
	Class TS 3:	Table 11
Range 4 (8,5 GHz to 11,0 GHz)	Class TS 1:	Table 12
	Class TS 2:	Table 13
	Class TS 3:	Table 14

The gain values defined are all relative to maximum, actual gain.