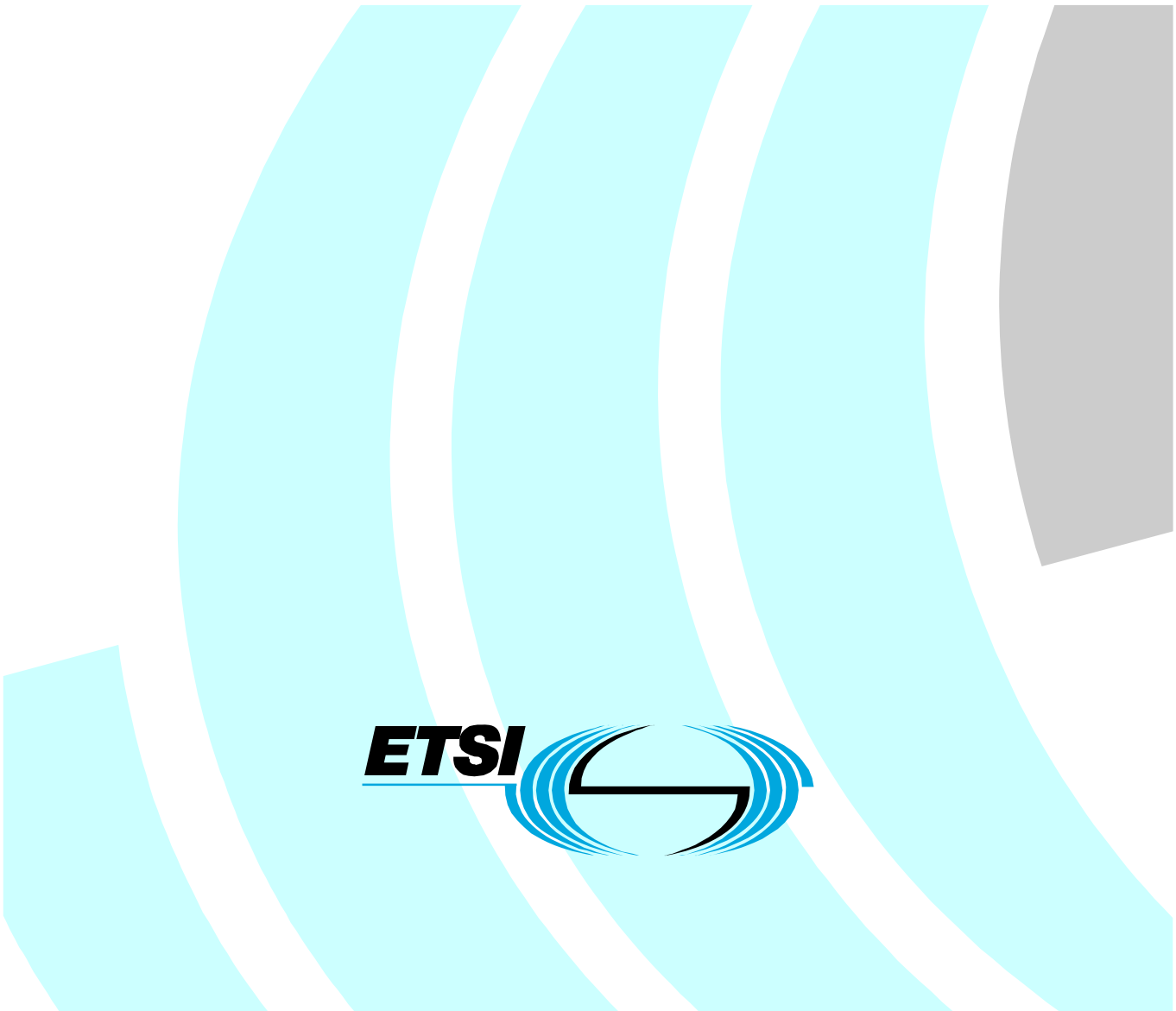
Final draft ETSI EN 302 217-4-2 V1.4.1 (2008-11)

*Harmonized European Standard (Telecommunications series)*

# Fixed Radio Systems; Characteristics and requirements for point-to-point equipment and antennas; Part 4-2: Antennas; Harmonized EN covering the essential requirements of article 3.2 of R&TTE Directive



Reference
REN/ATTM-04006

Keywords
antenna, DFRS, DRRS, FWA, point-to-point,
radio, regulation, transmission

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# Contents

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# Foreword

This Harmonized European Standard (Telecommunications series) has been produced by ETSI Technical Committee Access, Terminals, Transmission and Multiplexing (ATTM), and is now submitted for the ETSI standards One-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 [i.5] (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").

Technical Specifications relevant to Directive 1999/5/EC [1] are given in annex A.

The present document is part 4-2 of a multi-part deliverable. Full details of the entire series can be found in part 1 [3].

Few antenna Radiation Pattern Envelopes (RPE) of the lower directivity class 1 have not been carried over in the present document because no longer considered appropriate, from the system point of view, with the increasing demand of spectrum in ETSI Countries, and therefore no more suitable for essential requirements under article 3.2 of the R&TTE Directive [1] within the European Union. Nevertheless, recognizing that ETSI ENs have worldwide relevance, they are still found into EN 302 217-4-1 [i.1].

| **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 is part of a set of standards developed by ETSI and is designed to fit in a modular structure to cover all radio and telecommunications terminal equipment within the scope of the R&TTE Directive [1]. The modular structure is described in EG 201 399 [i.4] and shown in figure 1.

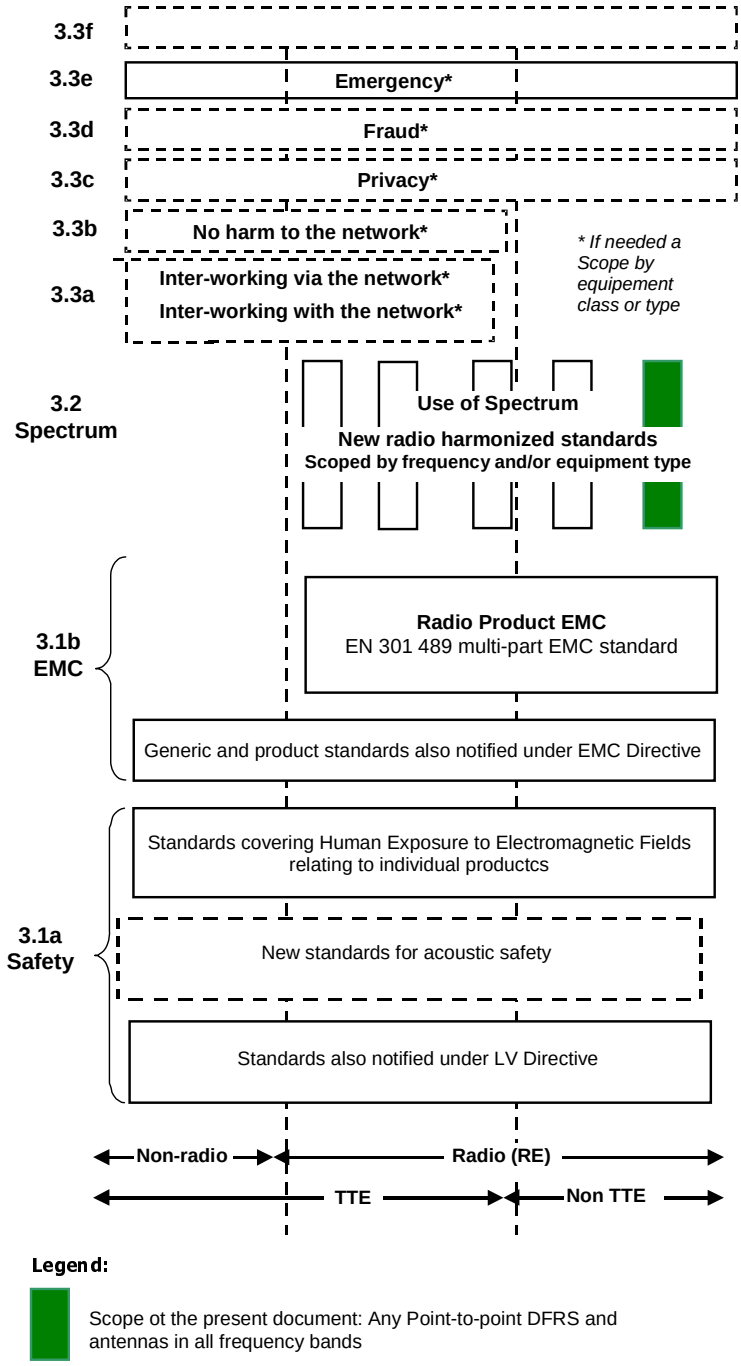



**Figure 1: Modular structure for the various standards used under the R&TTE Directive**

# 1 Scope

The present document is intended to cover the provisions of Directive 1999/5/EC [1] (R&TTE Directive) regarding article 3.2, 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*".

The present document is applicable only to antenna types that are intended for use with the systems falling within the scope of documents EN 302 217-2-2 [i.2] and EN 302 217-3 [i.3].

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 will 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.

In order to technically cover different market and network requirements, with an appropriate balance of performance to cost and effective and appropriate use of the radio spectrum, the present document, together with EN 302 217-2-2 [i.2], offers a number of system types and antennas alternatives, for selection by administrations, operators and manufacturers dependent on the desired use of the radio spectrum and network/market requirements; those options include:

- channel separation alternatives (as provided by the relevant CEPT Recommendation);
- spectral efficiency class alternatives (different complexity of modulation formats provided in radio equipment standards);
- antenna directivity class alternatives (for different network density requirement).

The present document is considered applicable to fixed radio systems products with integral antennas, for which all the technical requirements included in the present document, in EN 302 217-2-2 [i.2] and in EN 302 217-3 [i.3] apply; the present document applies, as well, to separate antenna products, to which only the relevant technical requirements apply. For more background information on the equipment and antenna parameters relevant to article 3.2 of the R&TTE Directive see EG 201 399 [i.4] and TR 101 506 [i.6].

# 2 References

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.
- Non-specific reference may be made only to a complete document or a part thereof and only in the following cases:
  - if it is accepted that it will be possible to use all future changes of the referenced document for the purposes of the referring document;
  - for informative references.

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

For online referenced documents, information sufficient to identify and locate the source shall be provided. Preferably, the primary source of the referenced document should be cited, in order to ensure traceability. Furthermore, the reference should, as far as possible, remain valid for the expected life of the document. The reference shall include the method of access to the referenced document and the full network address, with the same punctuation and use of upper case and lower case letters.

NOTE: While any hyperlinks included in this clause were valid at the time of publication ETSI cannot guarantee their long term validity.

## 2.1 Normative references

The following referenced documents are indispensable for the application of the present document. For dated references, only the edition cited applies. For non-specific references, the latest edition of the referenced document (including any amendments) 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] ETSI EN 301 126-3-1 (V1.1.2): "Fixed Radio Systems; Conformance testing; Part 3-1: Point-to-Point antennas; Definitions, general requirements and test procedures".

[3] ETSI EN 302 217-1 (V1.2.1): "Fixed Radio Systems; Characteristics and requirements for point-to-point equipment and antennas; Part 1: Overview and system-independent common characteristics".

## 2.2 Informative references

The following referenced documents are not essential to the use of the present document but they assist the user with regard to a particular subject area**.** For non-specific references, the latest version of the referenced document (including any amendments) applies.

[i.1] ETSI EN 302 217-4-1: "Fixed Radio Systems; Characteristics and requirements for point-to-point equipment and antennas; Part 4-1: System-dependent requirements for antennas".

[i.2] ETSI EN 302 217-2-2: "Fixed Radio Systems; Characteristics and requirements for point-to-point equipment and antennas; 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".

[i.3] ETSI EN 302 217-3: "Fixed Radio Systems; Characteristics and requirements for point-to-point equipment and antennas; Part 3: Equipment operating in frequency bands where both frequency coordinated or uncoordinated deployment might be applied; Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive".

[i.4] ETSI EG 201 399: "Electromagnetic compatibility and Radio spectrum Matters (ERM); A guide to the production of candidate Harmonized Standards for application under the R&TTE Directive".

[i.5] 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.

[i.6] ETSI TR 101 506: "Fixed Radio Systems; Generic definitions, terminology and applicability of essential requirements under the article 3.2 of 99/05/EC Directive to Fixed Radio Systems".

[i.7] ETSI EN 301 126-1: "Fixed Radio Systems; Conformance testing; Part 1: Point-to-point equipment - Definitions, general requirements and test procedures".

# 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 Technical requirements specifications

In the following clauses, electrical characteristics are given as function of specific classification of the antennas according to the principles referred to in EN 302 217-4-1 [i.1].

The antenna supplier shall state, for each antenna type, the frequency band of operation and antenna gain at least at the frequency band edges and at mid-band. An antenna, which employs a radome, shall meet the requirements of the present document with the radome in place. The antenna system shall radiate a linear (single or dual) polarized wave. In bands where frequency co-ordination is applied, single polarized antennas shall meet cross-polar RPE and XPD requirements also.

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

## 4.1 Environmental profile

The required environmental profile for operation of the antenna or the equipment-antenna assembly (in case of systems with integral antenna) shall be declared by the supplier. The antenna shall comply with all the technical requirements of the present document at all times when operating within the boundary limits of the declared operational environmental profile. For testing the compliance to technical requirements refer also to EN 301 126-3-1 [2] and clause 5 in the present document.

## 4.2 Radiation Pattern Envelope (RPE)

The present document defines only RPE which characteristics are considered suitable, within the European Community, and relevant to essential requirements under article 3.2 of the R&TTE Directive [1]; however, it is recognized that ETSI ENs have worldwide relevance and therefore, in other countries, there might be applications and low density radio networks that justify a different trade-off in terms of performance, size and cost. Therefore in EN 302 217-4-1 [i.1] other Class 1 antenna RPE are standardized for such purpose.

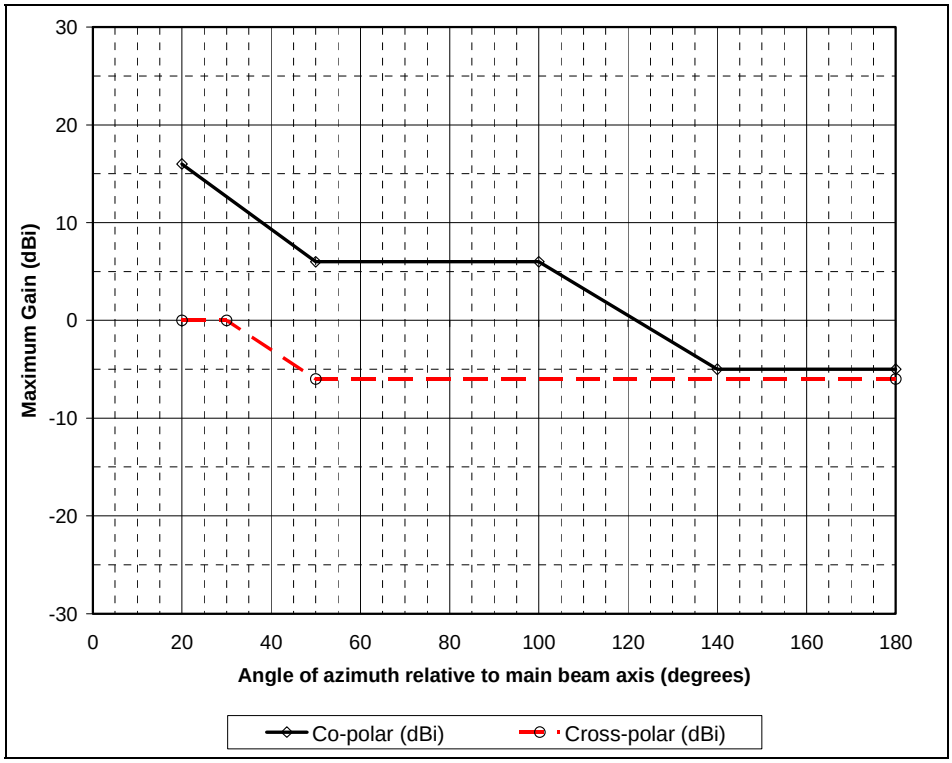
Not all classes of antennas defined in EN 302 217-4-1 [i.1] are presently represented by specific RPEs in the present document; missing RPEs are intended for future inclusion whenever the market might possibly require them. Table 1 provides for each frequency range an overview of the currently standardized antenna classes.

**Table 1: Summary of RPE classes represented in the present document**

| Frequency range (GHz) | Antenna Radiation Pattern Envelope (RPE) class |
|---|---|
| 1 to 3 | 1A, 1B, 1C, 2, 3 |
| 3 to 14 | 2, 3, 4 |
| 14 to 20 | 2, 3, 4 |
| 20 to 24 | 2, 3, 4 |
| 24 to 30 | 2, 3, 4 |
| 30 to 47 | 2, 3A, 3B, 3C, 4 |
| 47 to 66 | 2, 3A, 3B |
| 66 to 86 | 2, 3, 4 |

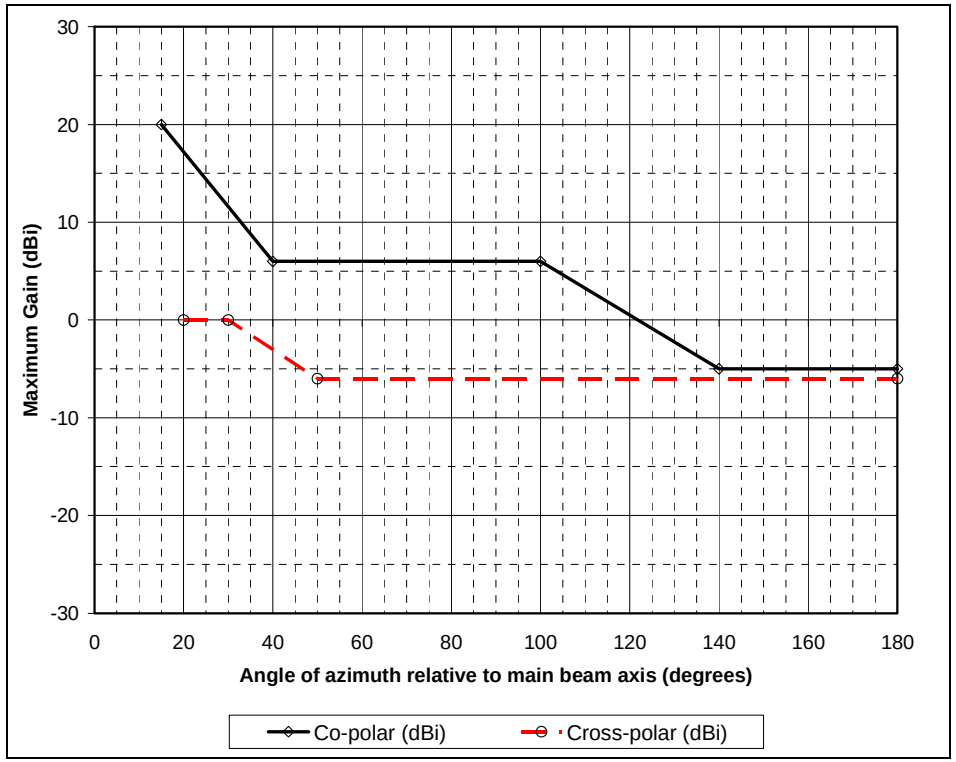
### 4.2.1 Frequency range 0: 1 GHz to 3 GHz

The choice of antenna depends on the application planned for this band, requirements of the operators and the responsible administration. Figures 2 to 7 give the RPEs for antenna classes 1, 2 and 3.



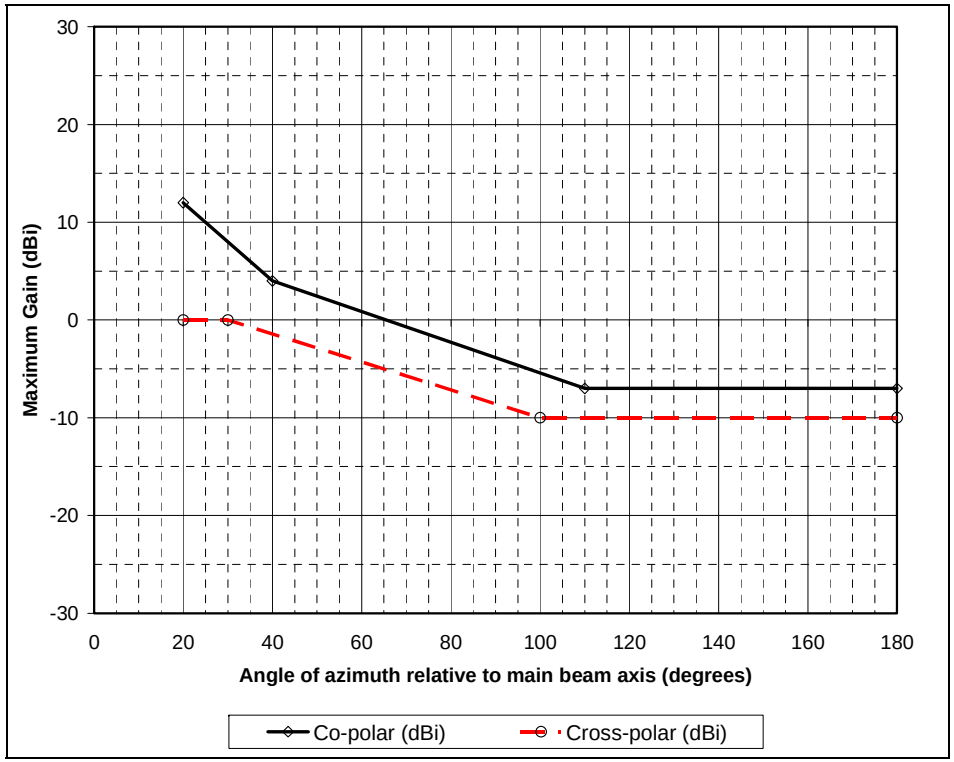

| Angle (°) | Co-polar (dBi) | Angle (°) | Cross-polar (dBi) |
|---|---|---|---|
| 20 | 16 | 20 | 0 |
| 50 | 6 | 30 | 0 |
| 100 | 6 | 50 | -6 |
| 140 | -5 | 180 | -6 |
| 180 | -5 | | |

**Figure 2: Class 1A antenna RPE (1 GHz to 3 GHz)**



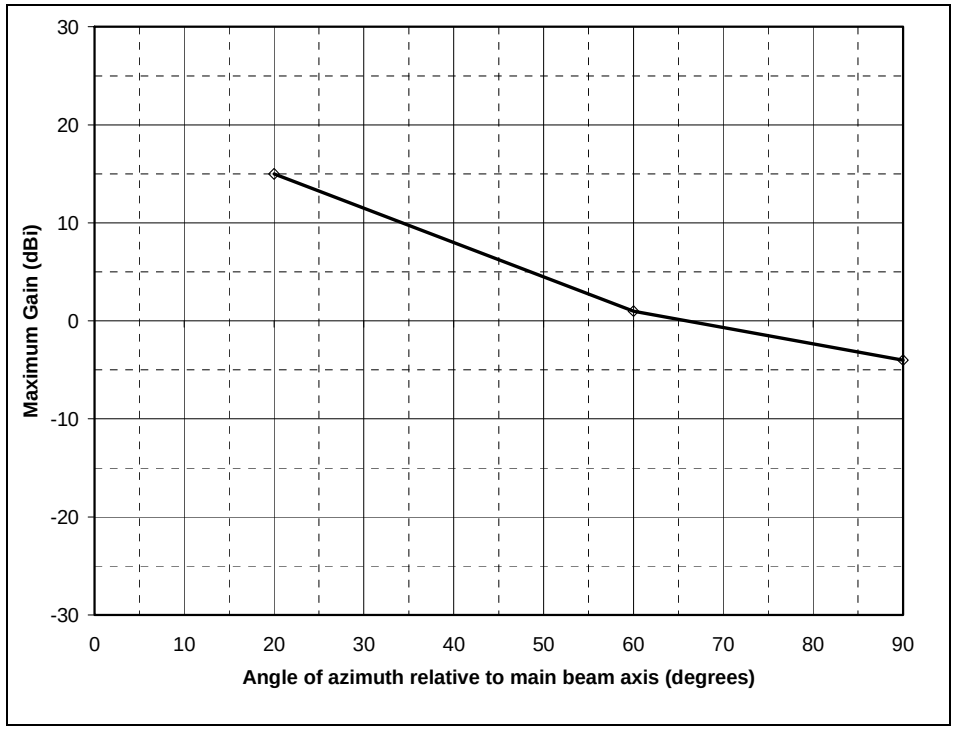

| Angle (°) | Co-polar (dBi) | Angle (°) | Cross-polar (dBi) |
|---|---|---|---|
| 15 | 20 | 20 | 0 |
| 40 | 6 | 30 | 0 |
| 100 | 6 | 50 | -6 |
| 140 | -5 | 180 | -6 |
| 180 | -5 | | |

**Figure 3: Class 1B antenna RPE (1 GHz to 3 GHz)**



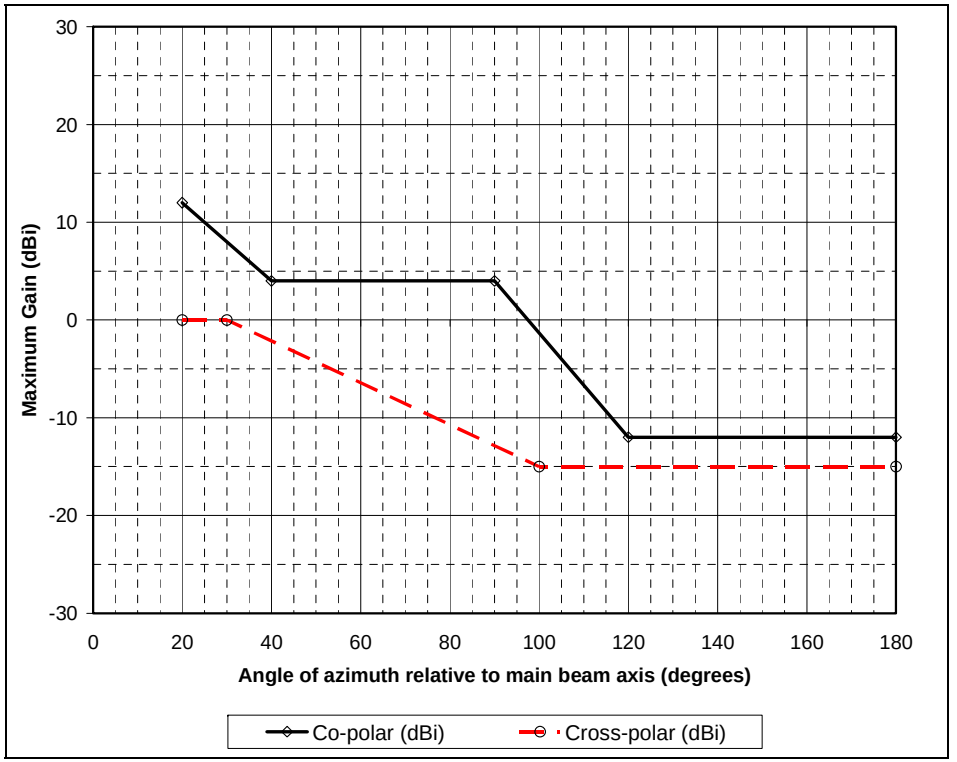

| Azimuth angle (°) | Co-polar (dBi) | Azimuth angle (°) | Cross-polar (dBi) |
|---|---|---|---|
| 20 | 12 | 20 | 0 |
| 40 | 4 | 30 | 0 |
| 110 | -7 | 100 | -10 |
| 180 | -7 | 180 | -10 |

**Figure 4: Class 1C antenna RPE (1 GHz to 3 GHz, azimuth plane)**



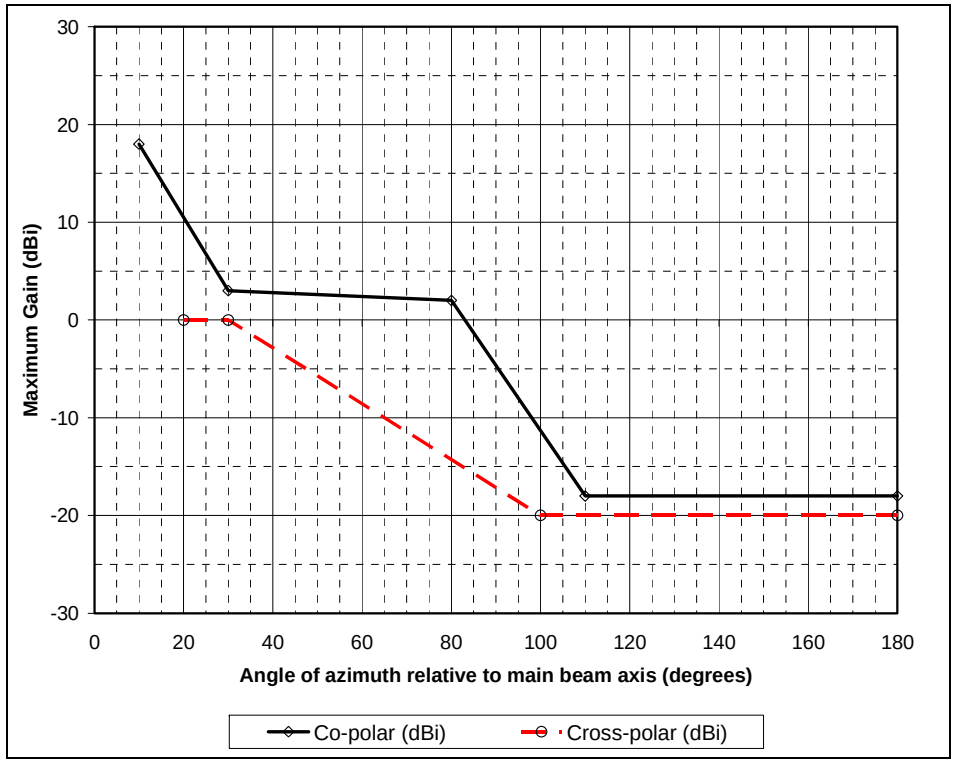

| Elevation angle (°) | dBi |
|---|---|
| 20 | 15 |
| 60 | 1 |
| 90 | -4 |

**Figure 5: Class 1C antennas RPE (1 GHz to 3 GHz, elevation plane)**




| Angle (°) | Co-polar (dBi) | Angle (°) | Cross-polar (dBi) |
|---|---|---|---|
| 20 | 12 | 20 | 0 |
| 40 | 4 | 30 | 0 |
| 90 | 4 | 100 | -15 |
| 120 | -12 | 180 | -15 |
| 180 | -12 | | |

**Figure 6: Class 2 antenna RPE (1 GHz to 3 GHz)**

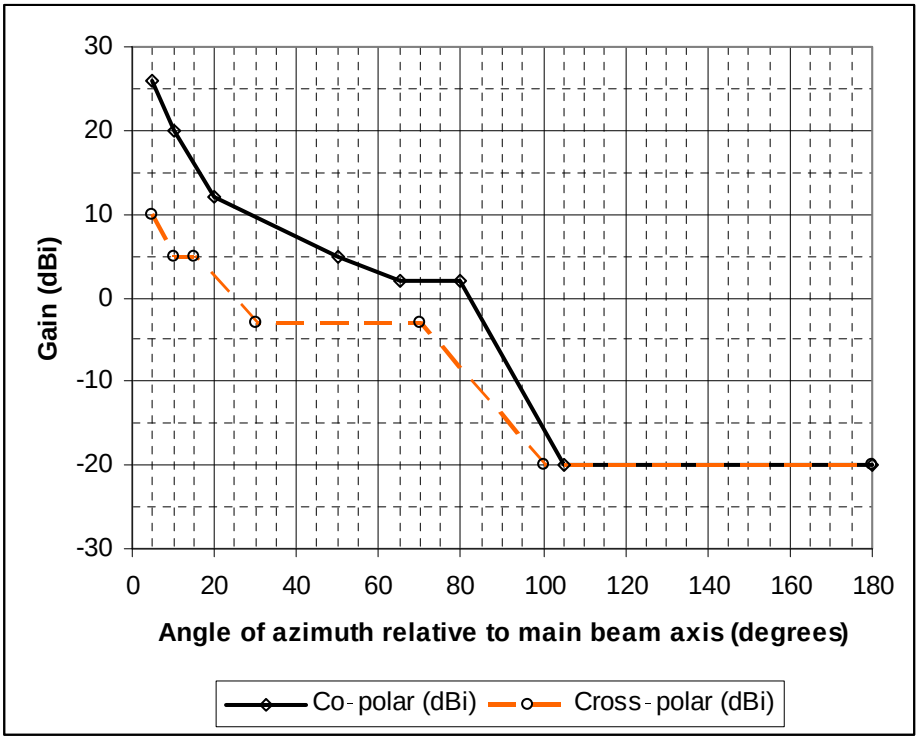



| Angle (°) | Co-polar (dBi) | Angle (°) | Cross-polar (dBi) |
|---|---|---|---|
| 10 | 18 | 20 | 0 |
| 30 | 3 | 30 | 0 |
| 80 | 2 | 100 | -20 |
| 110 | -18 | 180 | -20 |
| 180 | -18 | | |

**Figure 7: Class 3 antenna RPE (1 GHz to 3 GHz)**

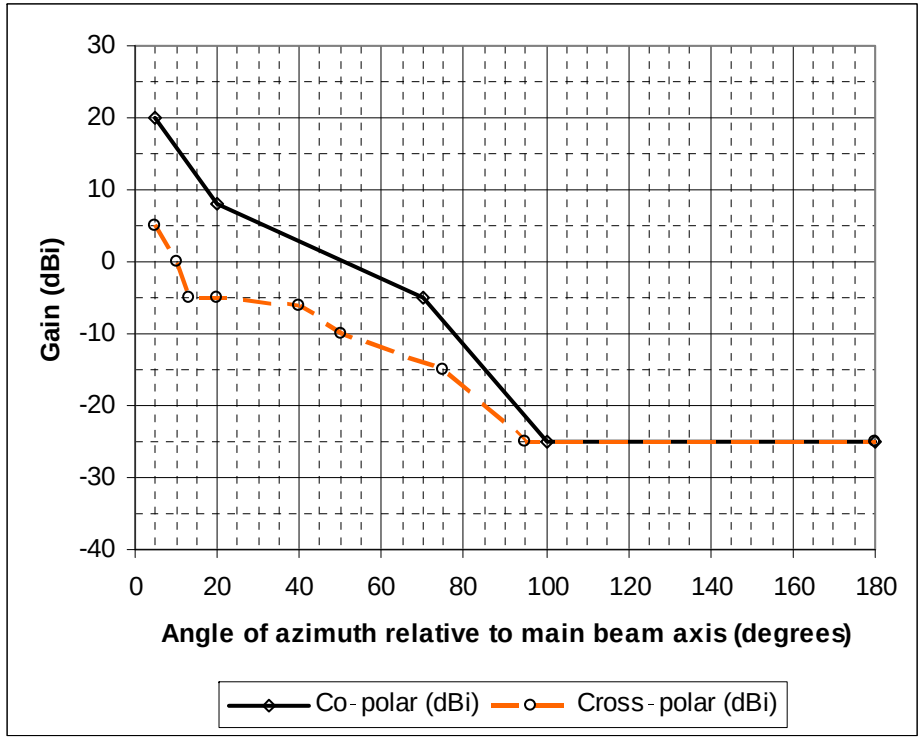
### 4.2.2 Frequency range 1: 3 GHz to 14 GHz

The choice of antenna depends on the application planned for this band, requirements of the operators and the responsible administration. Figures 8 to 10 give the RPEs for antenna classes 2, 3 and 4.



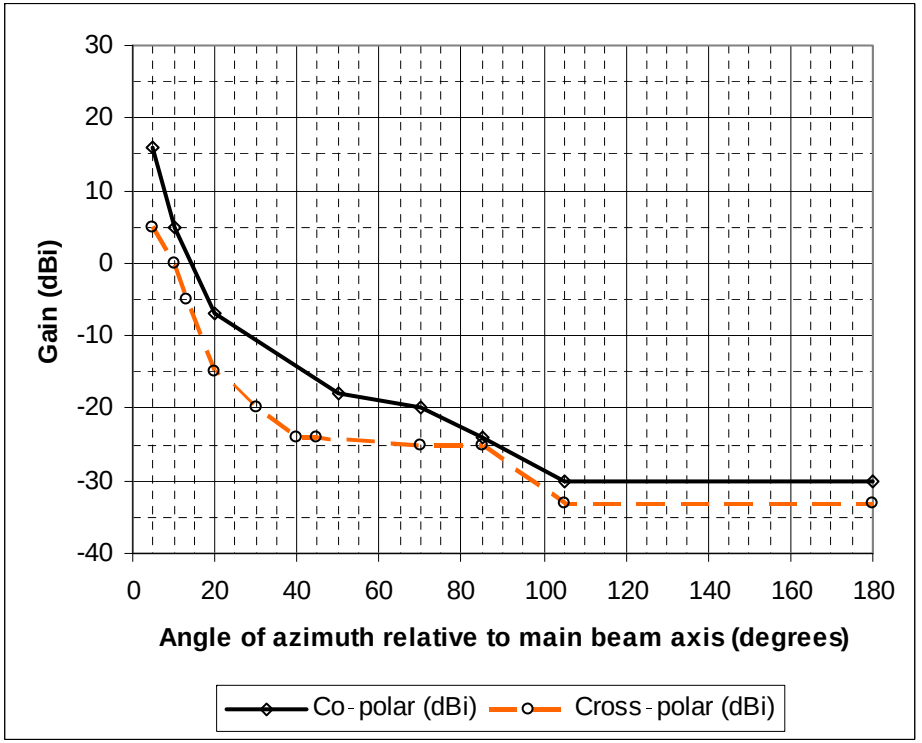

| Angle (°) | Co-polar (dBi) | Angle (°) | Cross-polar (dBi) |
|---|---|---|---|
| 5 | 26 | 5 | 10 |
| 10 | 20 | 10 | 5 |
| 20 | 12 | 15 | 5 |
| 50 | 5 | 30 | -3 |
| 65 | 2 | 70 | -3 |
| 80 | 2 | 100 | -20 |
| 105 | -20 | 180 | -20 |
| 180 | -20 | | |

**Figure 8: Class 2 antennas RPE (3 GHz to 14 GHz)**




| Angle (°) | Co-polar (dBi) | Angle (°) | Cross-polar (dBi) |
|---|---|---|---|
| 5 | 20 | 5 | 5 |
| 20 | 8 | 10 | 0 |
| 70 | -5 | 13 | -5 |
| 100 | -25 | 20 | -5 |
| 180 | -25 | 40 | -6 |
| | | 50 | -10 |
| | | 75 | -15 |
| | | 95 | -25 |
| | | 180 | -25 |

**Figure 9: Class 3 antennas RPE (3 GHz to 14 GHz)**

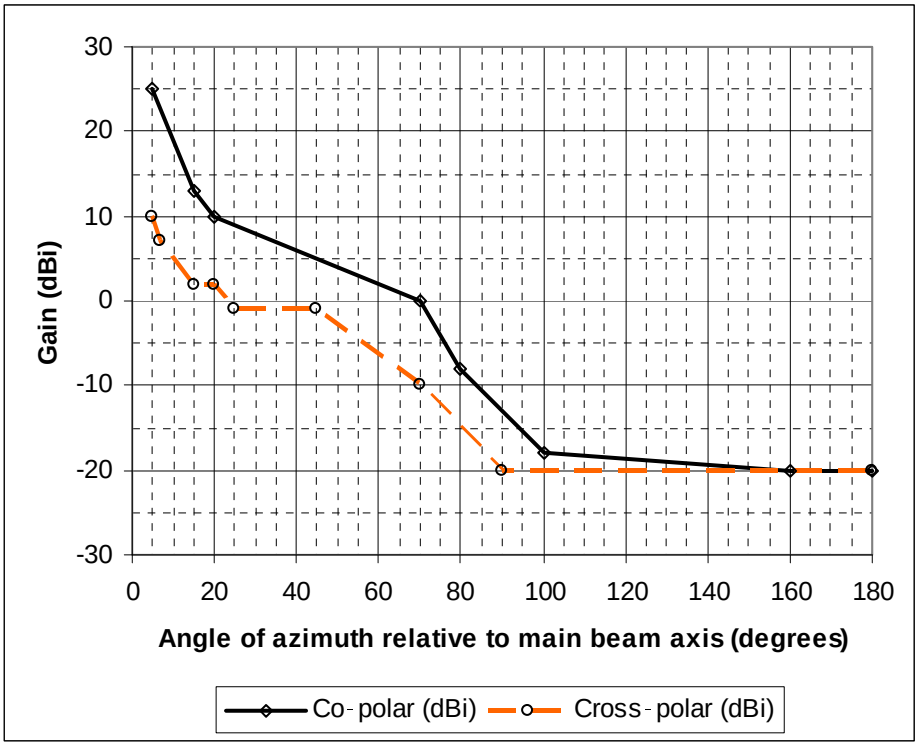



| Angle (°) | Co-polar (dBi) | Angle (°) | Cross-polar (dBi) |
|---|---|---|---|
| 5 | 16 | 5 | 5 |
| 10 | 5 | 10 | 0 |
| 20 | -7 | 13 | -5 |
| 50 | -18 | 20 | -15 |
| 70 | -20 | 30 | -20 |
| 85 | -24 | 40 | -24 |
| 105 | -30 | 45 | -24 |
| 180 | -30 | 70 | -25 |
| | | 85 | -25 |
| | | 105 | -33 |
| | | 180 | -33 |

**Figure 10: Class 4 antennas RPE (3 GHz to 14 GHz)**

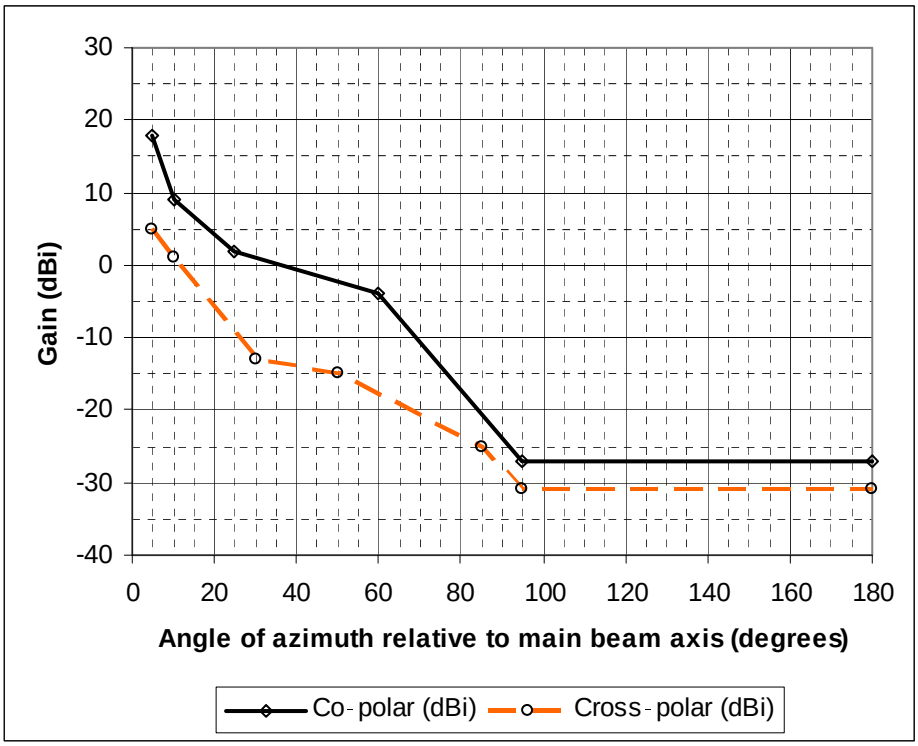
### 4.2.3 Frequency range 2: 14 GHz to 20 GHz

The choice of antenna depends on the application planned for this band, requirements of the operators and the responsible administration. Figures 11 to 13 give the RPEs for antenna classes 2 to 4.



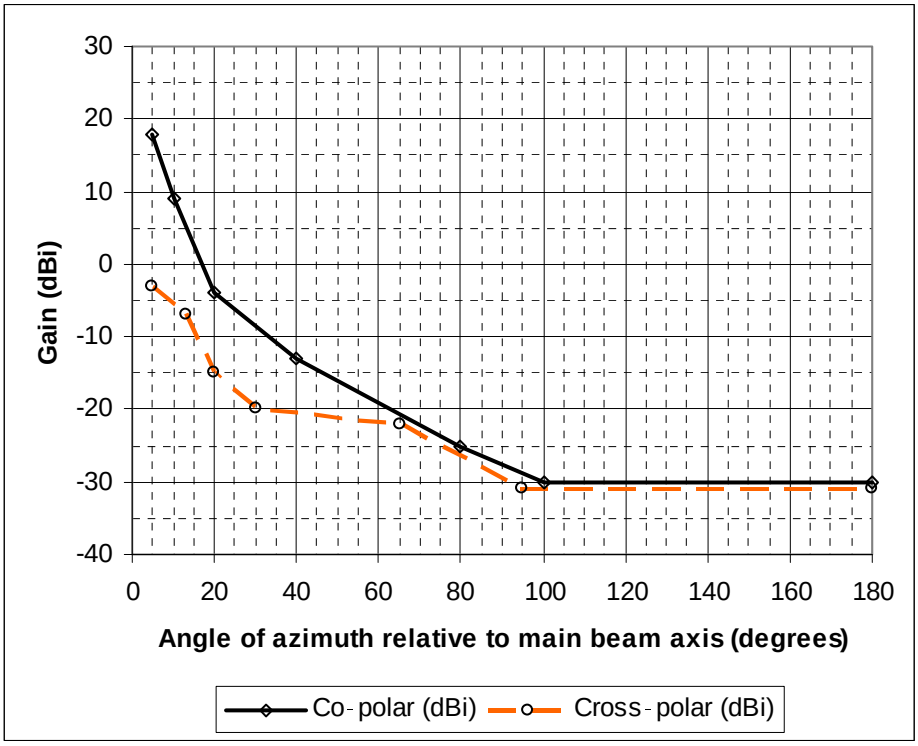

| Angle (°) | Co-polar (dBi) | Angle (°) | Cross-polar (dBi) |
|---|---|---|---|
| 5 | 25 | 5 | 10 |
| 15 | 13 | 7 | 7 |
| 20 | 10 | 15 | 2 |
| 70 | 0 | 20 | 2 |
| 80 | -8 | 25 | -1 |
| 100 | -18 | 45 | -1 |
| 160 | -20 | 70 | -10 |
| 180 | -20 | 90 | -20 |
| | | 180 | -20 |

**Figure 11: Class 2 antennas RPE (14 GHz to 20 GHz)**




| Angle (°) | Co-polar (dBi) | Angle (°) | Cross-polar (dBi) |
|---|---|---|---|
| 5 | 18 | 5 | 5 |
| 10 | 9 | 10 | 1 |
| 25 | 2 | 30 | -13 |
| 60 | -4 | 50 | -15 |
| 95 | -27 | 85 | -25 |
| 180 | -27 | 95 | -31 |
| | | 180 | -31 |

**Figure 12: Class 3 antennas RPE (14 GHz to 20 GHz)**

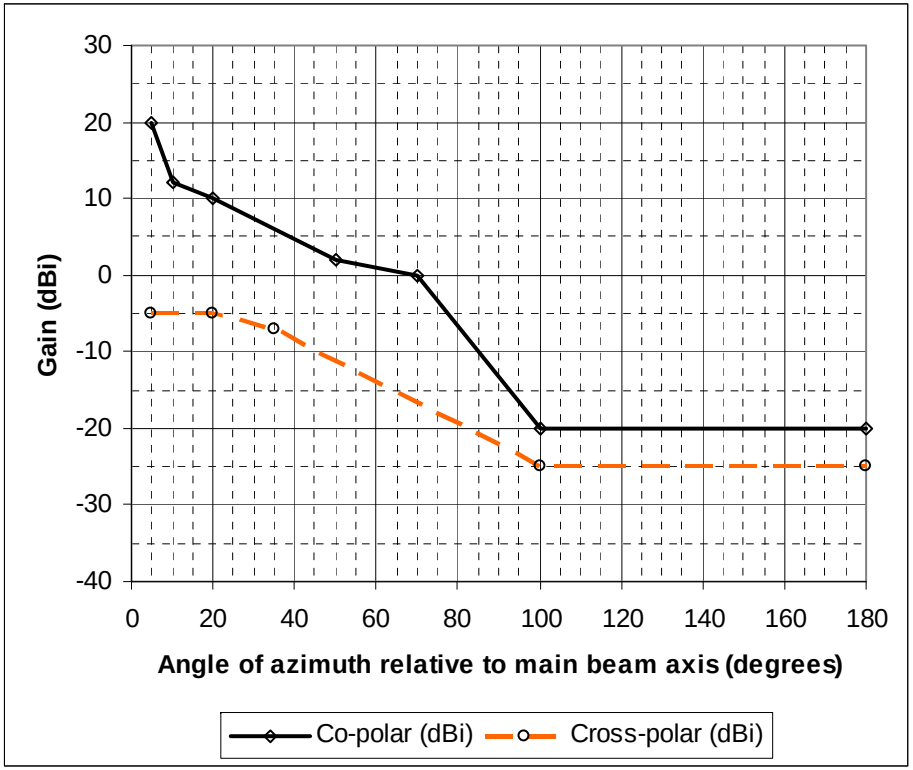



| Angle (°) | Co-polar (dBi) | Angle (°) | Cross-polar (dBi) |
|---|---|---|---|
| 5 | 18 | 5 | -3 |
| 10 | 9 | 13 | -7 |
| 20 | -4 | 20 | -15 |
| 40 | -13 | 30 | -20 |
| 80 | -25 | 65 | -22 |
| 100 | -30 | 95 | -31 |
| 180 | -30 | 180 | -31 |

**Figure 13: Class 4 antennas RPE (14 GHz to 20 GHz)**

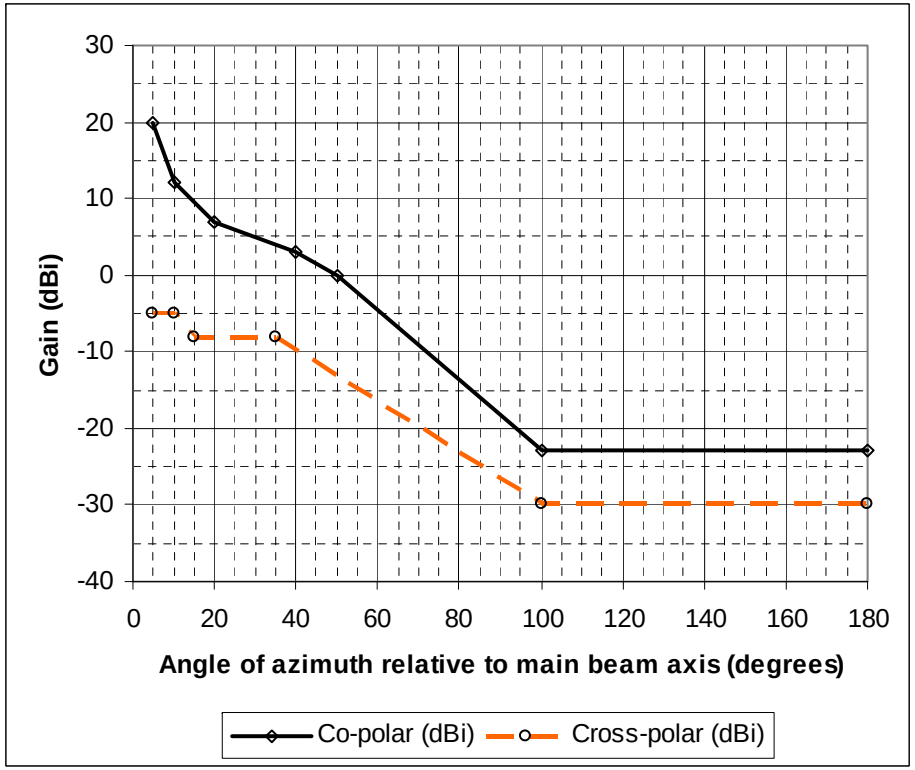
### 4.2.4 Frequency range 3: 20 GHz to 24 GHz

The choice of antenna depends on the application planned for this band, requirements of the operators and the responsible administration. Figures 14 to 16 give the RPEs for antenna classes 2 to 4.



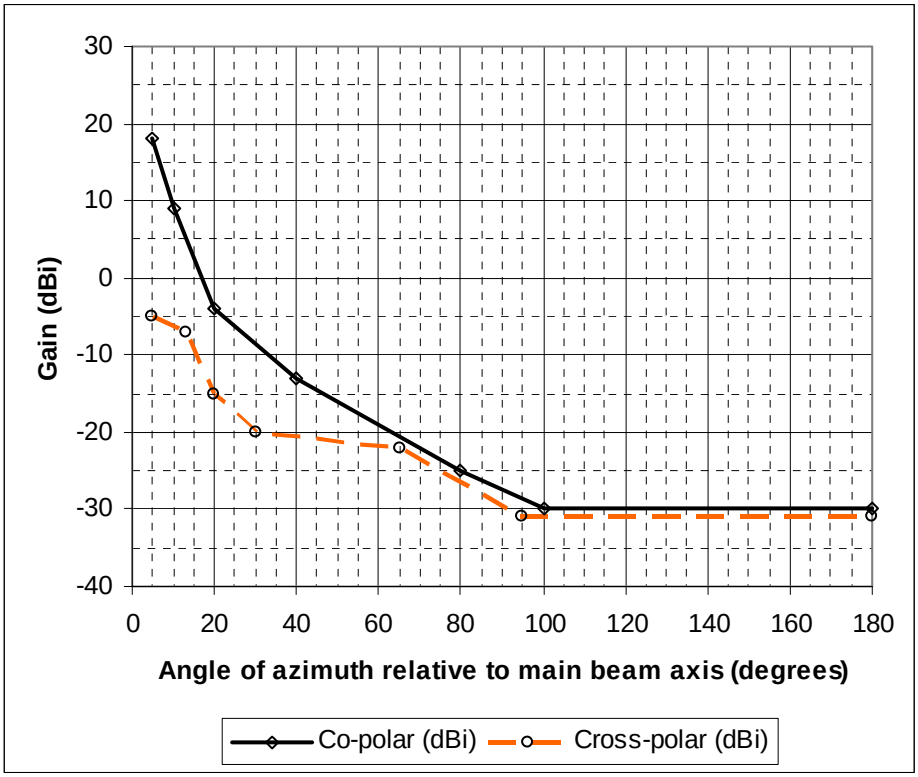

| Angle (°) | Co-polar (dBi) | Angle (°) | Cross-polar (dBi) |
|---|---|---|---|
| 5 | 20 | 5 | -5 |
| 10 | 12 | 20 | -5 |
| 20 | 10 | 35 | -7 |
| 50 | 2 | 100 | -25 |
| 70 | 0 | 180 | -25 |
| 100 | -20 | | |
| 180 | -20 | | |

**Figure 14: Class 2 antennas RPE (20 GHz to 24 GHz)**




| Angle (°) | Co-polar (dBi) | Angle (°) | Cross-polar (dBi) |
|---|---|---|---|
| 5 | 20 | 5 | -5 |
| 10 | 12 | 10 | -5 |
| 20 | 7 | 15 | -8 |
| 40 | 3 | 35 | -8 |
| 50 | 0 | 100 | -30 |
| 100 | -23 | 180 | -30 |
| 180 | -23 | | |

**Figure 15: Class 3 antennas RPE (20 GHz to 24 GHz)**

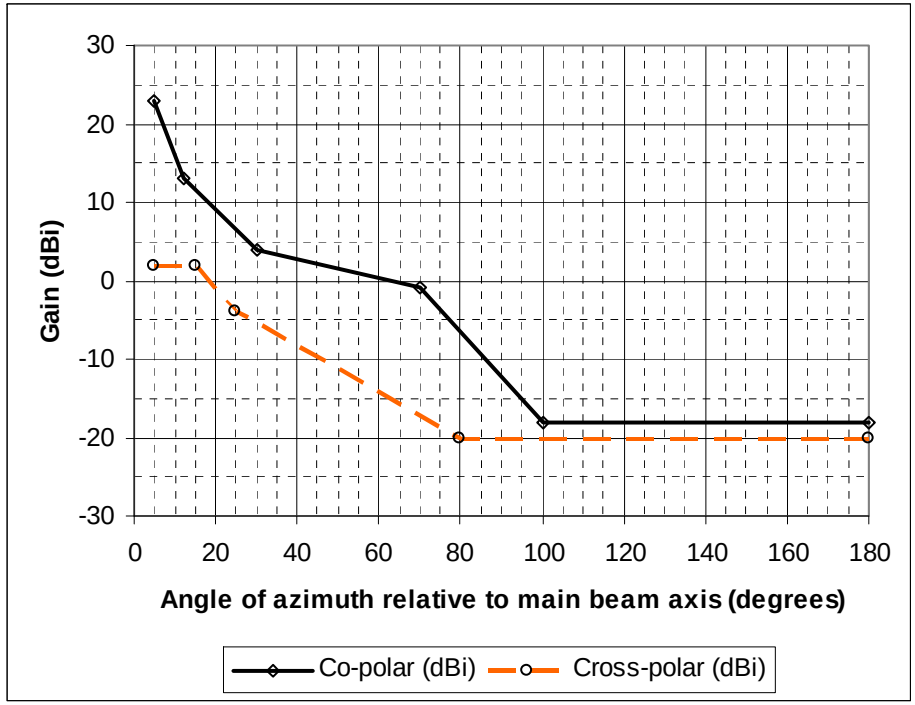



| Angle (°) | Co-polar (dBi) | Angle (°) | Cross-polar (dBi) |
|---|---|---|---|
| 5 | 18 | 5 | -5 |
| 10 | 9 | 13 | -7 |
| 20 | -4 | 20 | -15 |
| 40 | -13 | 30 | -20 |
| 80 | -25 | 65 | -22 |
| 100 | -30 | 95 | -31 |
| 180 | -30 | 180 | -31 |

**Figure 16: Class 4 antennas RPE (20 GHz to 24 GHz)**

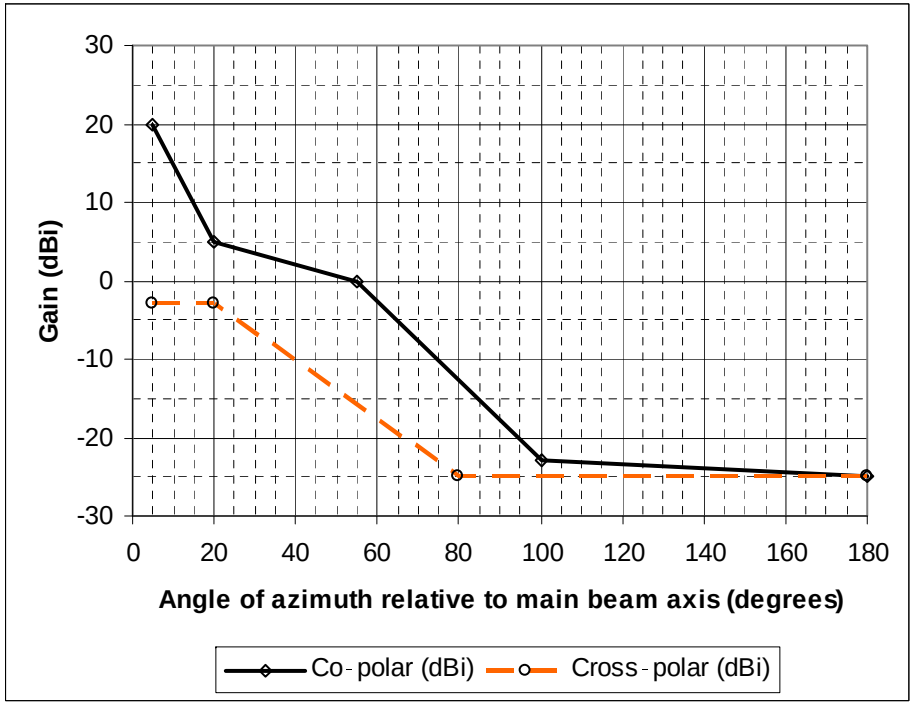
### 4.2.5 Frequency range 4: 24 GHz to 30 GHz

The choice of antenna depends on the application planned for this band, requirements of the operators and the responsible administration. Figures 17 to 19 give the RPEs for antenna classes 2 to 4.



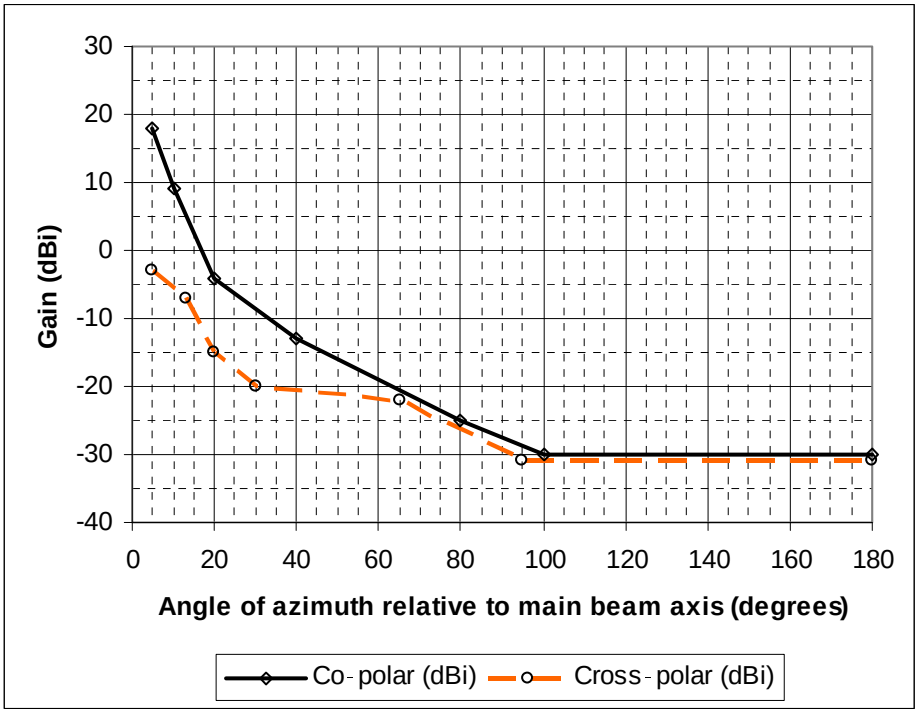

| Angle (°) | Co-polar (dBi) | Angle (°) | Cross-polar (dBi) |
|---|---|---|---|
| 5 | 23 | 5 | 2 |
| 12 | 13 | 15 | 2 |
| 30 | 4 | 25 | -4 |
| 70 | -1 | 80 | -20 |
| 100 | -18 | 180 | -20 |
| 180 | -18 | | |

**Figure 17: Class 2 antenna RPE (24 GHz to 30 GHz)**




| Angle (°) | Co-polar (dBi) | Angle (°) | Cross-polar (dBi) |
|---|---|---|---|
| 5 | 20 | 5 | -3 |
| 20 | 5 | 20 | -3 |
| 55 | 0 | 80 | -25 |
| 100 | -23 | 180 | -25 |
| 180 | -25 | | |

**Figure 18: Class 3 antennas RPE (24 GHz to 30 GHz)**

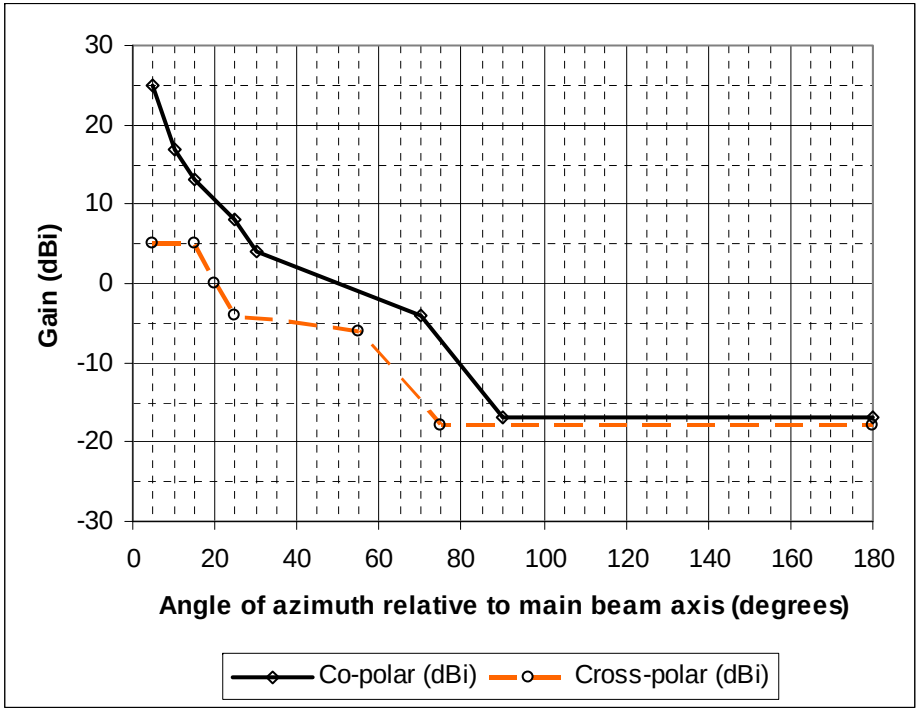



| Angle (°) | Co-polar (dBi) | Angle (°) | Cross-polar (dBi) |
|---|---|---|---|
| 5 | 18 | 5 | -3 |
| 10 | 9 | 13 | -7 |
| 20 | -4 | 20 | -15 |
| 40 | -13 | 30 | -20 |
| 80 | -25 | 65 | -22 |
| 100 | -30 | 95 | -31 |
| 180 | -30 | 180 | -31 |

**Figure 19: Class 4 antennas RPE (24 GHz to 30 GHz)**

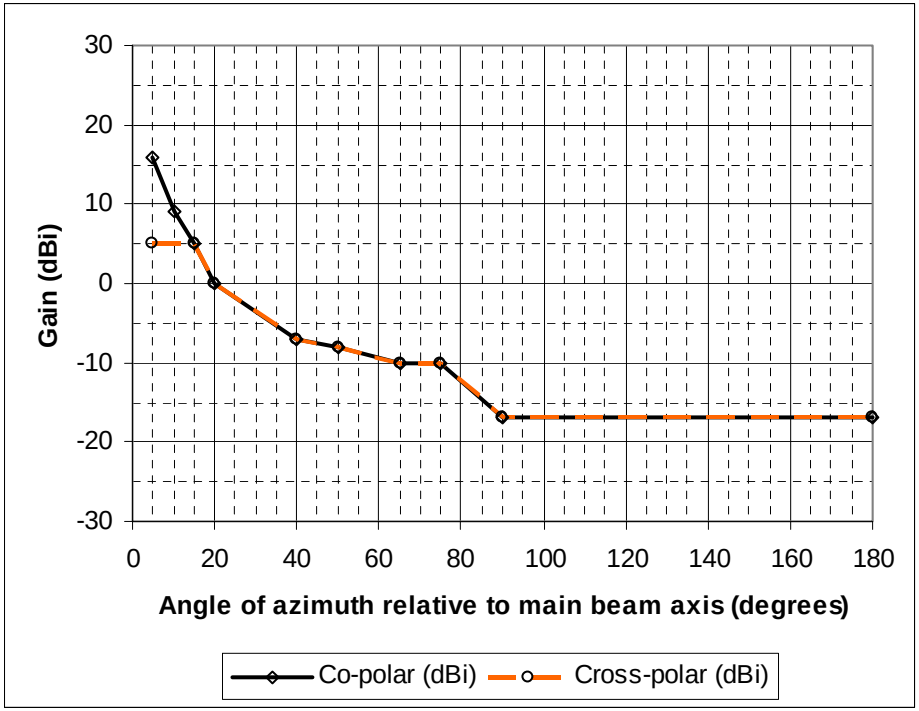
### 4.2.6 Frequency range 5: 30 GHz to 47 GHz

The choice of antenna depends on the application planned for this band, requirements of the operators and the responsible administration. Figures 20 to 24 give the RPEs for antenna classes 2, 3 and 4.



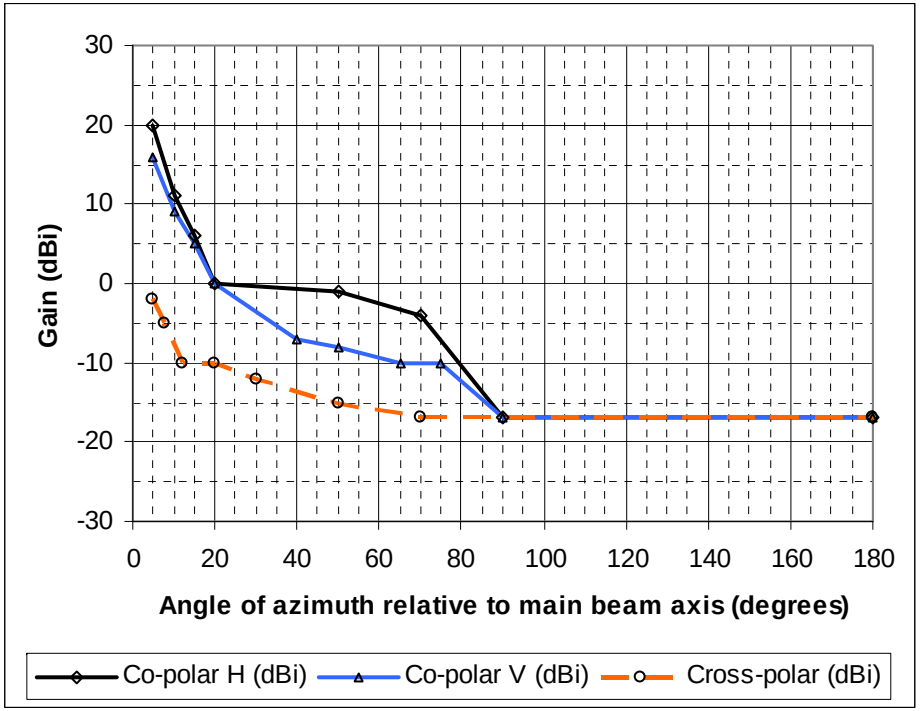

| Angle (°) | Co-polar (dBi) | Angle (°) | Cross-polar (dBi) |
|---|---|---|---|
| 5 | 25 | 5 | 5 |
| 10 | 17 | 15 | 5 |
| 15 | 13 | 20 | 0 |
| 25 | 8 | 25 | -4 |
| 30 | 4 | 55 | -6 |
| 70 | -4 | 75 | -18 |
| 90 | -17 | 180 | -18 |
| 180 | -17 | | |

**Figure 20: Class 2 antennas RPE (30 GHz to 47 GHz)**



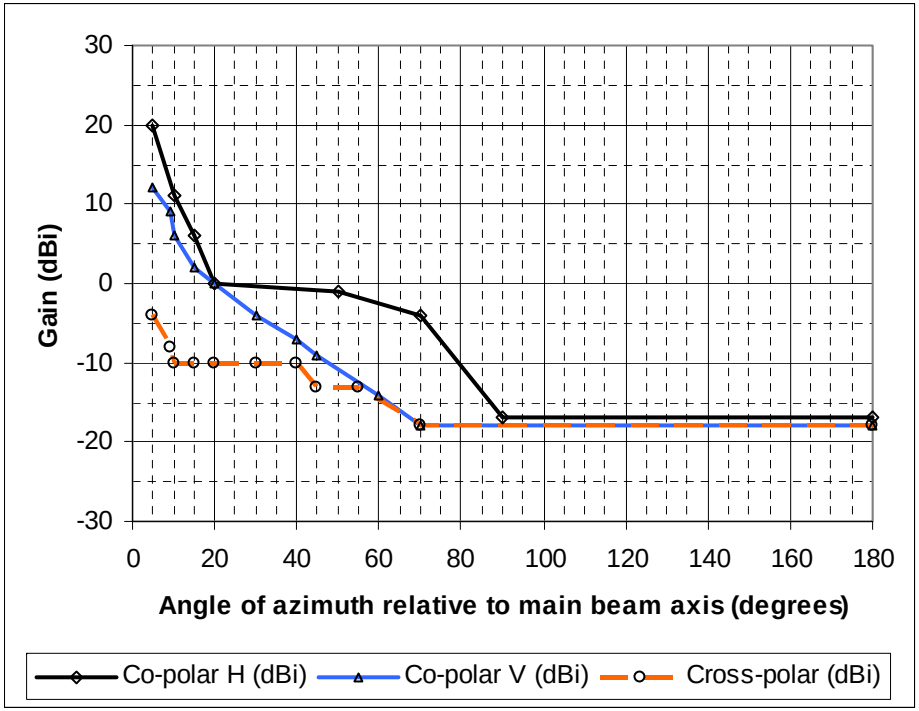

| Angle (°) | Co-polar (dBi) | Angle (°) | Cross-polar (dBi) |
|---|---|---|---|
| 5 | 16 | 5 | 5 |
| 10 | 9 | 15 | 5 |
| 15 | 5 | 20 | 0 |
| 20 | 0 | 40 | -7 |
| 40 | -7 | 50 | -8 |
| 50 | -8 | 65 | -10 |
| 65 | -10 | 75 | -10 |
| 75 | -10 | 90 | -17 |
| 90 | -17 | 180 | -17 |
| 180 | -17 | | |

**Figure 21: Class 3 A antennas RPE**
**(30 GHz to 47 GHz, applicable to single vertical polarized antennas only)**



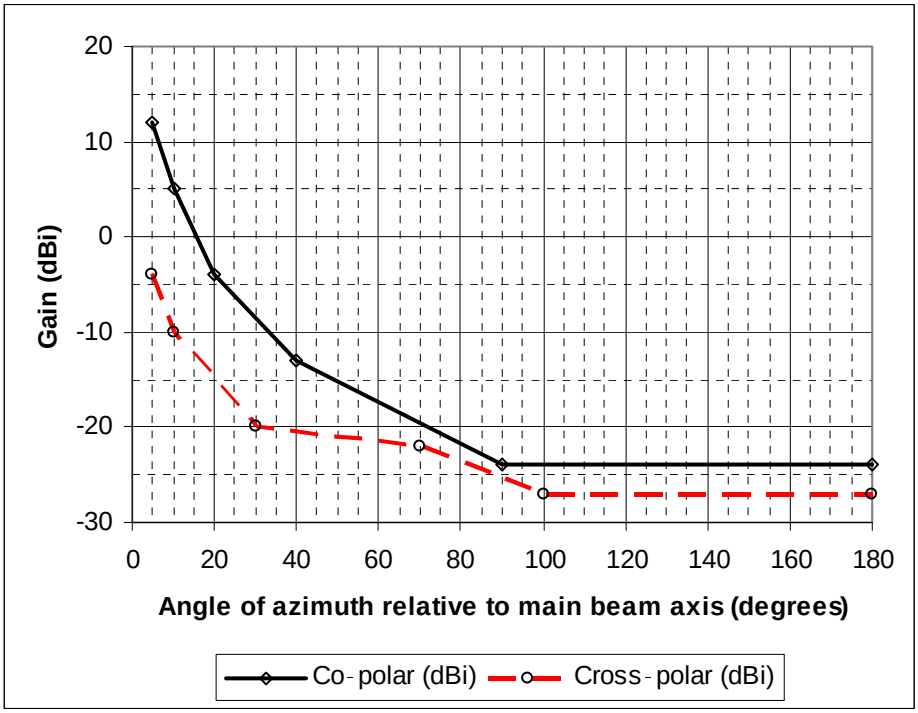

| Angle (°) | Co-polar H (dBi) | Angle (°) | Co-polar V (dBi) | Angle (°) | Cross-polar (dBi) |
|---|---|---|---|---|---|
| 5 | 20 | 5 | 16 | 5 | -2 |
| 10 | 11 | 10 | 9 | 8 | -5 |
| 15 | 6 | 15 | 5 | 12 | -10 |
| 20 | 0 | 20 | 0 | 20 | -10 |
| 50 | -1 | 40 | -7 | 30 | -12 |
| 70 | -4 | 50 | -8 | 50 | -15 |
| 90 | -17 | 65 | -10 | 70 | -17 |
| 180 | -17 | 75 | -10 | 180 | -17 |
| | | 90 | -17 | | |
| | | 180 | -17 | | |

**Figure 22: Class 3B antennas RPE (30 GHz to 47 GHz)**




| Angle (°) | Co-polar H (dBi) | Angle (°) | Co-polar V (dBi) | Angle (°) | Cross-polar (dBi) |
|---|---|---|---|---|---|
| 5 | 20 | 5 | 12 | 5 | -4 |
| 10 | 11 | 9 | 9 | 9 | -8 |
| 15 | 6 | 10 | 6 | 10 | -10 |
| 20 | 0 | 15 | 2 | 15 | -10 |
| 50 | -1 | 20 | 0 | 20 | -10 |
| 70 | -4 | 30 | -4 | 30 | -10 |
| 90 | -17 | 40 | -7 | 40 | -10 |
| 180 | -17 | 45 | -9 | 45 | -13 |
| | | 60 | -14 | 55 | -13 |
| | | 70 | -18 | 70 | -18 |
| | | 180 | -18 | 180 | -18 |

**Figure 23: Class 3C antennas RPE (30 GHz to 47 GHz)**



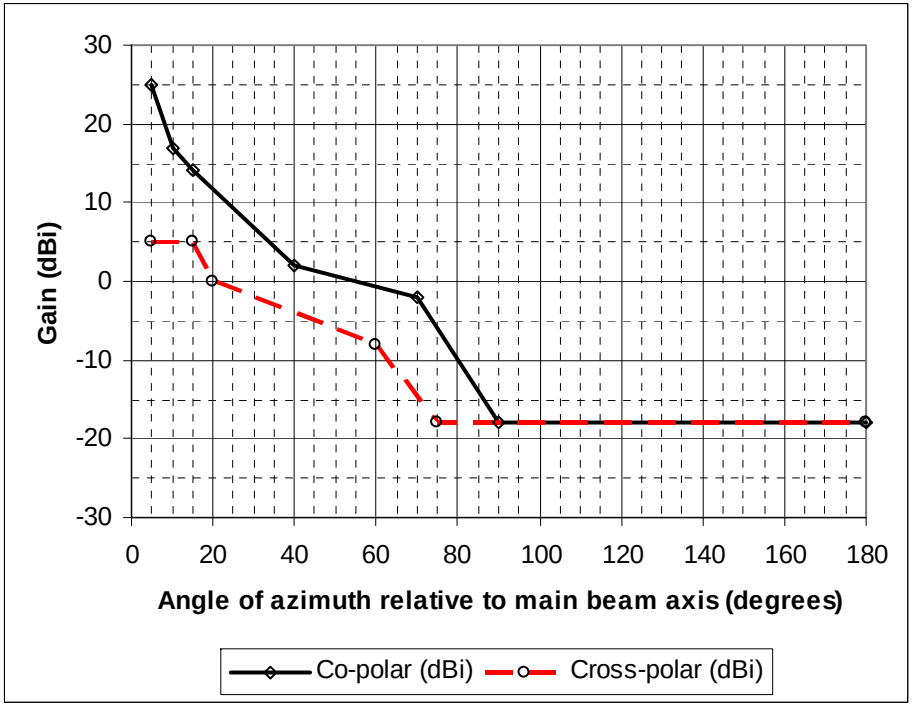

| Angle (°) | Co-polar (dBi) | Angle (°) | Cross-polar (dBi) |
|---|---|---|---|
| 5 | 12 | 5 | -4 |
| 10 | 5 | 10 | -10 |
| 20 | -4 | 30 | -20 |
| 40 | -13 | 70 | -22 |
| 90 | -24 | 100 | -27 |
| 180 | -24 | 180 | -27 |

**Figure 24: Class 4 antennas RPE (30 GHz to 47 GHz)**

### 4.2.7 Frequency range 6: 47 GHz to 66 GHz

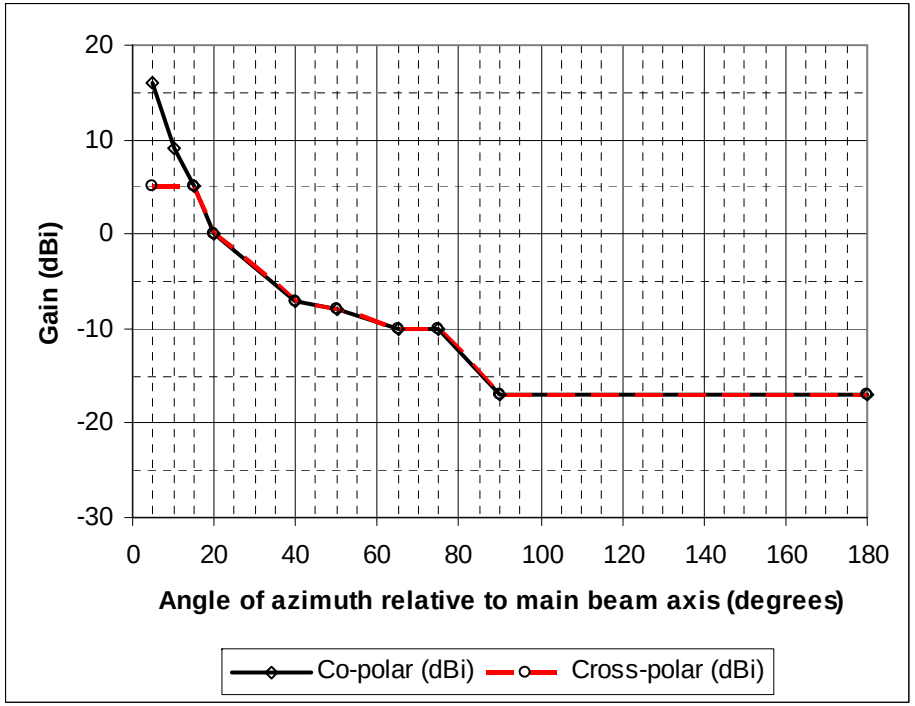
The choice of antenna depends on the application planned for this band, requirements of the operators and the responsible administration. Figures 25 to 27 give the RPEs for antenna classes 2 and 3.

NOTE: In the range from 57 GHz to 66 GHz, where simplified or no frequency co-ordination procedures are applied, cross-polar RPE is not considered as essential requirements for R&TTE Directive [1] conformance, even if the antenna is actually dual polarized. Values given below, for completeness, should be considered for reference purposes only.



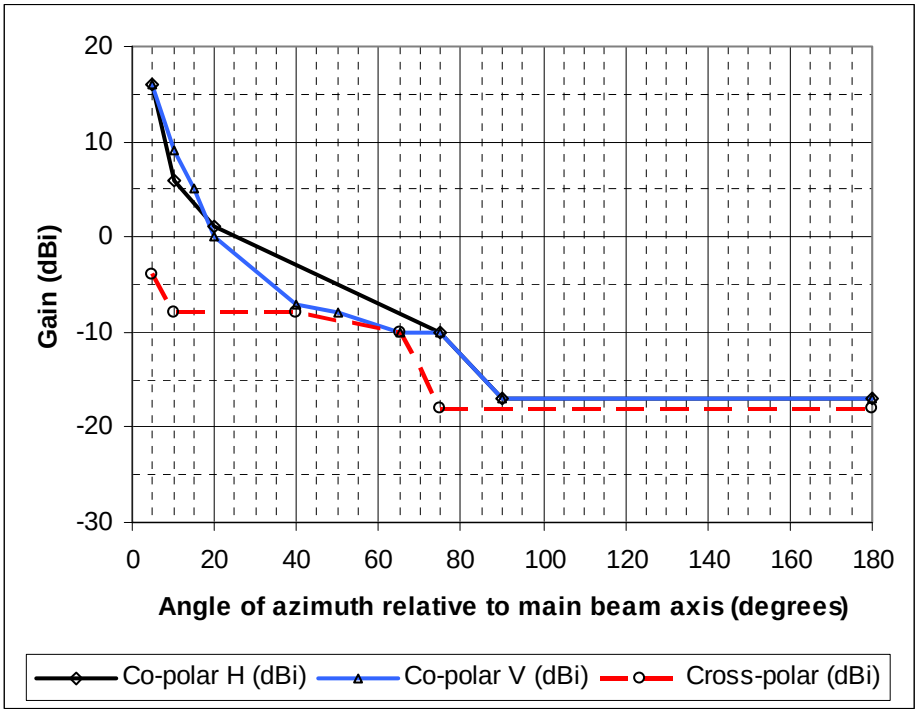

| Angle (°) | Co-polar (dBi) | Angle (°) | Cross-polar (dBi) |
|---|---|---|---|
| 5 | 25 | 5 | 5 |
| 10 | 17 | 15 | 5 |
| 15 | 14 | 20 | 0 |
| 40 | 2 | 60 | -8 |
| 70 | -2 | 75 | -18 |
| 90 | -18 | 180 | -18 |
| 180 | -18 | | |

**Figure 25: Class 2 antennas RPE (47 GHz to 66 GHz)**




| Angle (°) | Co-polar (dBi) | Angle (°) | Cross-polar (dBi) |
|---|---|---|---|
| 5 | 16 | 5 | 5 |
| 10 | 9 | 15 | 5 |
| 15 | 5 | 20 | 0 |
| 20 | 0 | 40 | -7 |
| 40 | -7 | 50 | -8 |
| 50 | -8 | 65 | -10 |
| 65 | -10 | 75 | -10 |
| 75 | -10 | 90 | -17 |
| 90 | -17 | 180 | -17 |
| 180 | -17 | | |

**Figure 26: Class 3A antennas RPE (47 GHz to 66 GHz, vertically polarized only)**

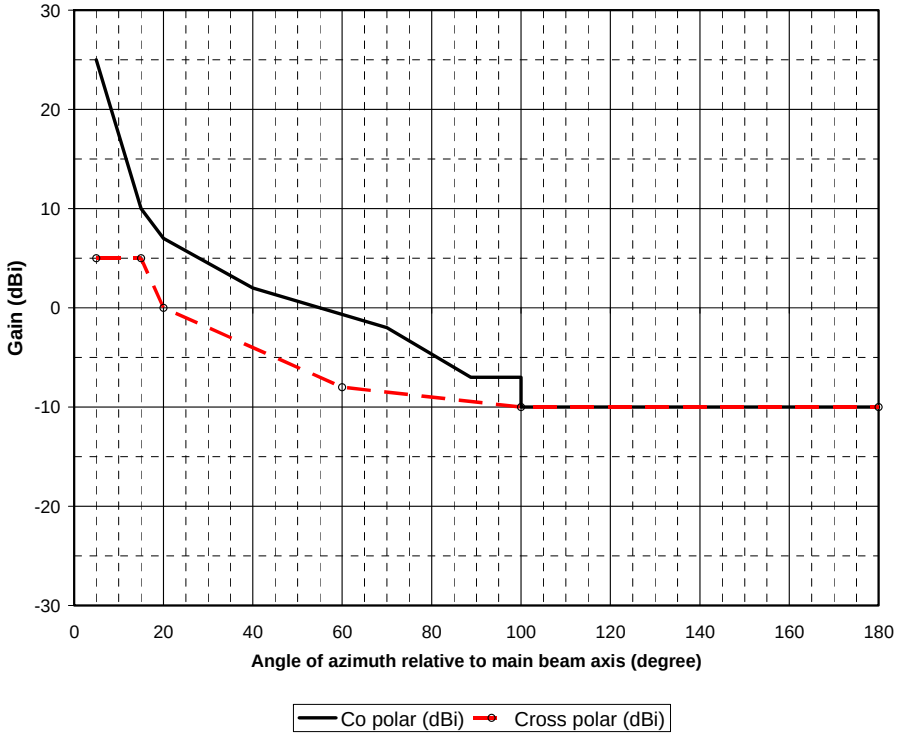



| Angle (°) | Co-polar H (dBi) | Angle (°) | Co-polar V (dBi) | Angle (°) | Cross-polar (dBi) |
|---|---|---|---|---|---|
| 5 | 16 | 5 | 16 | 5 | -4 |
| 10 | 6 | 10 | 9 | 10 | -8 |
| 20 | 1 | 15 | 5 | 40 | -8 |
| 75 | -10 | 20 | 0 | 65 | -10 |
| 90 | -17 | 40 | -7 | 75 | –18 |
| 180 | -17 | 50 | -8 | 180 | -18 |
| | | 65 | -10 | | |
| | | 75 | -10 | | |
| | | 90 | -17 | | |
| | | 180 | -17 | | |

**Figure 27: Class 3B antennas RPE (47 GHz to 66 GHz range)**

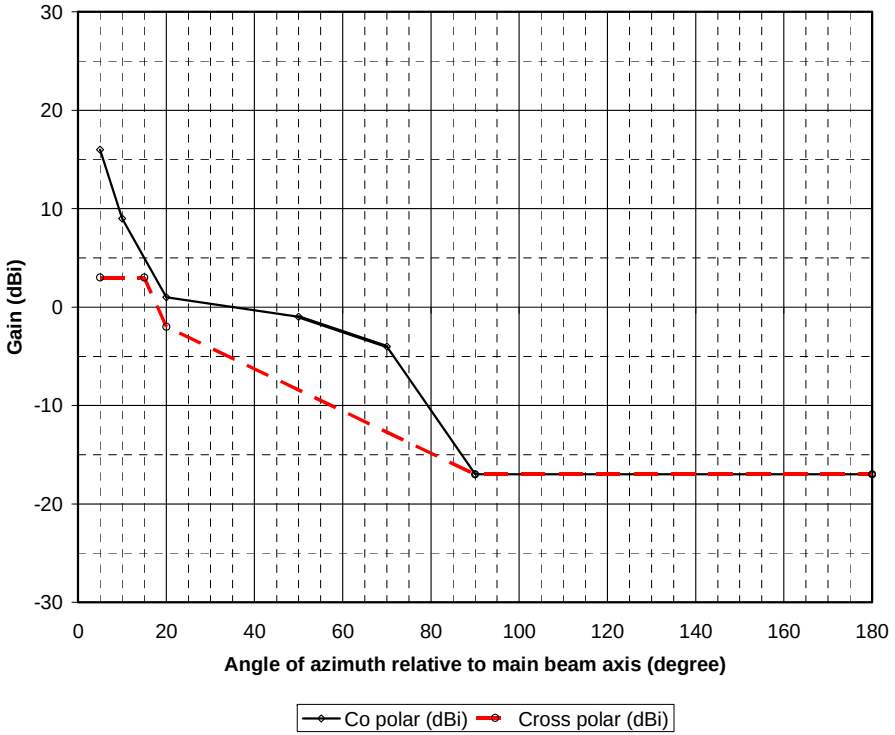
## 4.2.8 Frequency range 7: 66 GHz to 86 GHz

The choice of antenna depends on the application planned for this band, requirements of the operators and the responsible administration. Figures 28 to 30 give the RPEs for antenna classes 2, 3 and 4.



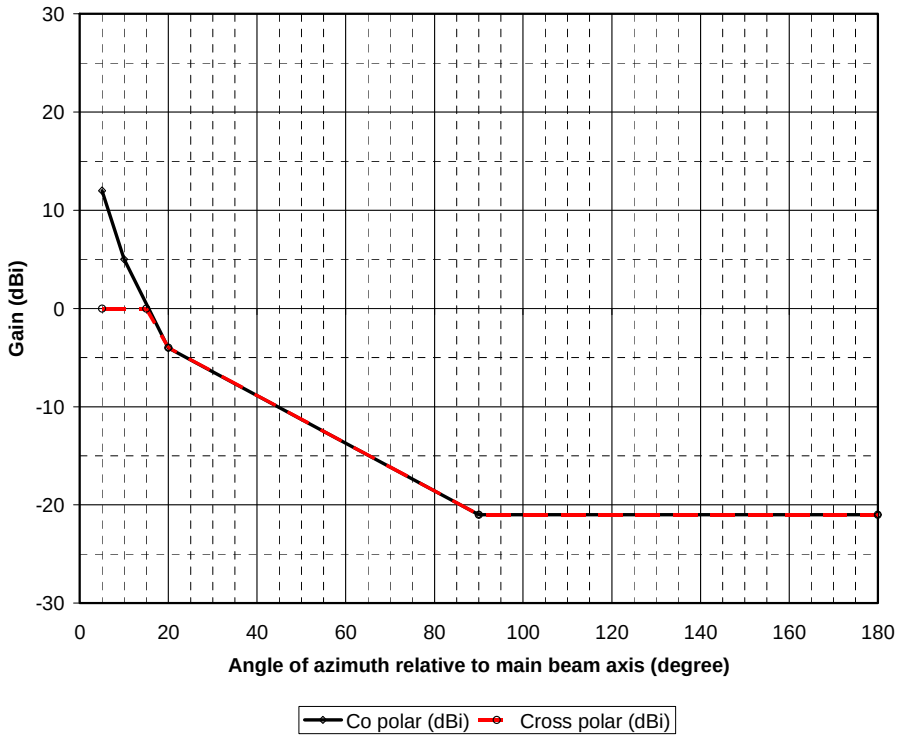

| Angle (°) | Co-polar (dBi) | Angle (°) | Cross-polar (dBi) |
|---|---|---|---|
| 5 | 25 | 5 | 5 |
| 15 | 10 | 15 | 5 |
| 20 | 7 | 20 | 0 |
| 40 | 2 | 60 | -8 |
| 70 | -2 | 100 | -10 |
| 88,75 | -7 | 180 | -10 |
| 100 | -7 | | |
| 100 | -10 | | |
| | | | |
| 180 | -10 | | |

**Figure 28: Class 2 antenna RPE (71 GHz to 86 GHz)**




| Angle (°) | Co-polar (dBi) | Angle (°) | Cross-polar (dBi) |
|---|---|---|---|
| 5 | 16 | 5 | 3 |
| 10 | 9 | 15 | 3 |
| 20 | 1 | 20 | -2 |
| 50 | -1 | 60 | -10 |
| 70 | -4 | 90 | -17 |
| 90 | -17 | 180 | -17 |
| 180 | -17 | | |

**Figure 29: Class 3 antenna RPE (71 GHz to 86 GHz)**




| Angle (°) | Co-polar (dBi) | Angle (°) | Cross-polar (dBi) |
|---|---|---|---|
| 5 | 12 | 5 | 0 |
| 10 | 5 | 15 | 0 |
| 20 | -4 | 20 | -4 |
| 90 | -21 | 90 | -21 |
| 180 | -21 | 180 | -21 |

**Figure 30: Class 4 antenna RPE (71 GHz to 86 GHz)**

# 4.3 Cross-Polar Discrimination (XPD)

## 4.3.1 Frequency range 1 GHz to 3 GHz

Two XPD categories are applicable to this frequency range:

- Category 1: Standards XPD with 20 dB minimum requirement.
- Category 2: High XPD with 25 dB minimum requirement.

The XPD corresponding to the RPEs classes referenced in clause 4.2 shall be equal to or higher than those values defined in table 2.

**Table 2: Minimum XPD for each antenna class**

| Class | Minimum XPD (dB) |
|---|---|
| 1C | 20 (XPD category 1) |
| 1A and 1B | 25 (XPD category 2) |
| 2 | 25 (XPD category 2) |
| 3 | 25 (XPD category 2) |
| NOTE: XPD values are intended to be met with respect to the azimuth plane only and within an angle twice the half power beamwidth of the co-polarized main beam. | |

### 4.3.2 Frequency range 3 GHz to 86 GHz

In this frequency range, three categories are defined according sub-ranges of frequency and minimum requirements as defined in table 3. The supplier shall declare which XPD Category the antenna refers to.

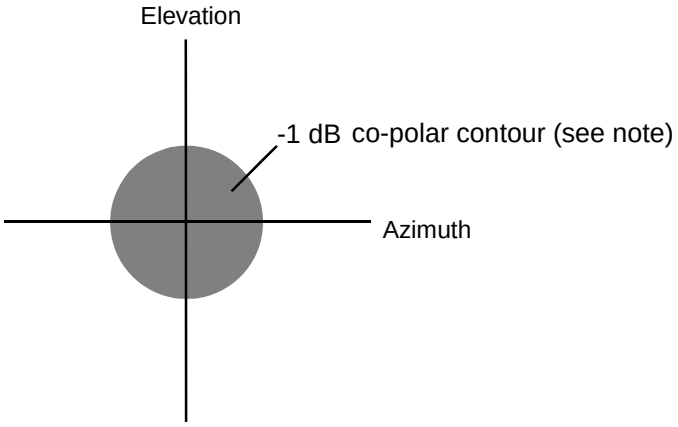
The XPD shall be equal to or higher than those values defined in table 3.

In figures 31 and 32, masks are given for XPD measurements around the main beam axis.

**Table 3: Minimum XPD requirement per frequency range and category**

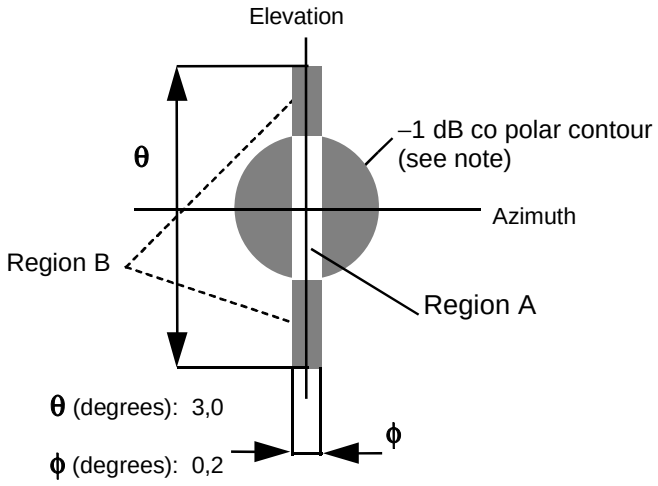
| Frequency ranges | Standard XPD | High XPD | |
|---|---|---|---|
| | Category 1 (see note 1) (dB) | Category 2 (see note 2) (dB) | Category 3 (see note 3) (dB) |
| Range 1 (3 GHz to 14 GHz) | 27 | 35 | 35<br>40 (see note 4) |
| Range 2 (14 GHz to 20 GHz) | 27 | 34 | 34 |
| Range 3 (20 GHz to 24 GHz) | 27 | 34 | 34 |
| Range 4 (24 GHz to 30 GHz) | 27 | 34 | 34 |
| Range 5 (30 GHz to 47 GHz) | 27 | 30 | 30 |
| Range 6 (47 GHz to 66 GHz) | 27 (see note 5) | Not applicable | Not applicable |
| Range 7 (66 GHz to 86 GHz) | 27 | Not applicable | Not applicable |

NOTE 1: XPD values intended to be met with respect to the azimuth plane only and within the 1 dB beamwidth of the co-polarized main beam.
NOTE 2: XPD values intended to be met within the 1 dB co-polar contour referred in figure 31.
NOTE 3: XPD values intended to be met within the 1 dB co-polar contour and the region B referred in figure 32.
NOTE 4: Additional XPD values intended to be met within region A referred in figure 30.
NOTE 5: For antennas operating in the frequency bands from 57 GHz to 66 GHz, where crosspolar discrimination is not widely used for network planning, the cross-polar part of RPE and the XPD are not considered essential requirements.




NOTE: For the dual band antennas -1 dB contour for the highest frequency band shall be used.

**Figure 31: Category 2 mask for XPD measurements around the main beam axis**




NOTE: For the dual band antennas the -1 dB and other contours for the highest frequency band shall be used.

**Figure 32: Category 3 mask for XPD measurements around the main beam axis**

## 4.4 Antenna gain

The actual antenna gain will contribute to the EIRP value, which is the basic parameter that must be taken account of in order to control interference on the network. Therefore, the antenna supplier shall declare the nominal gain and its tolerance. Those values will be used for the test report eventually required for fulfilling obligation of the R&TTE Directive [1].

In addition, for the bands 71 GHz to 76 GHz and 81 GHz to 86 GHz, the antennas under the scope of the present document shall have a minimum nominal gain of 38 dBi.

NOTE: Additional information on antenna gain may be found in EN 302 217-4-1 [i.1].

# 5 Testing for compliance with technical requirements

## 5.1 Environmental conditions for testing

The technical requirements of the present document apply under the environmental profile for intended operation of the antenna, which shall be declared by the supplier.

The environmental profile may be determined by the environmental class of the equipment, intended for outdoor usage, according to the guidance given in clause 4.4 of EN 301 126-1 [i.7].

The antenna shall comply with all the requirements of the present document at all times when operating within the boundary limits of the declared operational environmental profile.

Any test, requested to generate the test report and/or declaration of conformity in order to fulfil any Conformity assessment procedure foreseen by the R&TTE Directive [1], for integral or stand-alone DFRS antennas (technical requirements of clause 4), shall be carried-out at reference environmental conditions of the test field according to clause 4.1 of EN 301 126-3-1 [2].

The test report shall be produced according to the procedure set out by article 10 of the R&TTE Directive [1].

## 5.2 Wide radio-frequency band covering antennas specification and tests

DFRS antennas commonly cover an operating frequency range. The antenna parameters shall comply with all the requirements of the present document at any possible operating frequency.

The tests, requested to generate the test report and/or declaration of conformity in order to fulfil any Conformity assessment procedure foreseen by the R&TTE Directive [1], shall be carried-out at the highest and the lowest possible operating frequency.

## 5.3 Essential antenna test suites

Table 4 states, where applicable, the test methods for Radiation Pattern Envelope (RPE), Cross-Polar Discrimination (XPD) and gain.

**Table 4: Transmitter/receiver antenna parameters - test clauses and conditions**

| Clause | Parameter | EN 301 126-3-1 [2] reference clause for the test methods | Climatic conditions | | Other specific conditions |
|---|---|---|---|---|---|
| | | | Reference | Extreme | |
| **4** | Antenna directional requirements | | | | |
| **4.1** | Radiation Pattern Envelope (Off-axis EIRP density ) | 6.1 | X | | |
| **4.2** | Antenna gain | 6.3 | X | | Test against the declared gain |
| **4.3** | Antenna Cross-Polar Discrimination (XPD) | 6.2 | X | | |

# Annex A (normative): HS Requirements and conformance Test specifications Table (HS-RTT)

The HS Requirements and conformance Test specifications Table (HS-RTT) in table A.1 serves a number of purposes, as follows:

- it provides a statement of all the requirements in words and by cross reference to (a) specific clause(s) in the present document or to (a) specific clause(s) in (a) specific referenced document(s);
- it provides a statement of all the test procedures corresponding to those requirements by cross reference to (a) specific clause(s) in the present document or to (a) specific clause(s) in (a) specific referenced document(s);
- it qualifies each requirement to be either:
  - Unconditional: meaning that the requirement applies in all circumstances, or
  - Conditional: meaning that the requirement is dependent on the manufacturer having chosen to support optional functionality defined within the schedule.
- in the case of Conditional requirements, it associates the requirement with the particular optional service or functionality;
- it qualifies each test procedure to be either:
  - Essential: meaning that it is included with the Essential Radio Test Suite and therefore the requirement shall be demonstrated to be met in accordance with the referenced procedures;
  - Other: meaning that the test procedure is illustrative but other means of demonstrating compliance with the requirement are permitted.

**Table A.1: HS Requirements and conformance Test specifications Table (HS-RTT)**

| **Harmonized Standard EN 302 217-4-2**<br>The following requirements and test specifications are relevant to the presumption of conformity under the article 3.2 of the R&TTE Directive | | | | | | |
|---|---|---|---|---|---|---|
| **Requirement** | | | **Requirement Conditionality** | | **Test Specification** | |
| **No** | **Description** | **Reference Clause No** | **U/C** | **Condition** | **E/O** | **Reference Clause No** |
| 1 | Radiation Pattern Envelope (RPE) | 4.2 | C | See note 1 | E | EN 301 126-3-1 [2] Clause 6.1 (note 2 applies) |
| 2 | Cross Polar Discrimination (XPD) | 4.3 | C | See note 1 | E | EN 301 126-3-1 [2] Clause 6.3 (note 2 applies) |
| 3 | Gain | 4.4 | U | | E | EN 301 126-3-1 [2] Clause 6.2 (notes 2 and 3 apply) |
| NOTE 1: For antennas operating in frequency range from 57 GHz to 66 GHz where crosspolar discrimination is not widely used for network planning, the cross-polar part of RPE and the XPD are not considered essential requirements.<br>NOTE 2: Essential Requirement applies at reference (as opposed to extreme) climatic conditions.<br>NOTE 3: Test is applied against gain declared by supplier. | | | | | | |

**Key to columns:**

**Requirement:**

**No** A unique identifier for one row of the table which may be used to identify a requirement or its test specification.

**Description** A textual reference to the requirement.

**Clause Number** Identification of clause(s) defining the requirement in the present document unless another document is referenced explicitly.

**Requirement Conditionality:**

**U/C** Indicates whether the requirement is to be *unconditionally* applicable (U) or is *conditional* upon the manufacturers claimed functionality of the equipment (C).

**Condition** Explains the conditions when the requirement shall or shall not be applicable for a technical requirement which is classified "conditional".

**Test Specification:**

**E/O** Indicates whether the test specification forms part of the Essential Radio Test Suite (E) or whether it is one of the Other Test Suite (O).

NOTE: All tests whether "E" or "O" are relevant to the requirements. Rows designated "E" collectively make up the Essential Radio Test Suite; those designated "O" make up the Other Test Suite; for those designated "X" there is no test specified corresponding to the requirement . The completion of all tests classified "E" as specified with satisfactory outcomes is a necessary condition for a presumption of conformity. Compliance with requirements associated with tests classified "O" or "X" is a necessary condition for presumption of conformity, although conformance with the requirement may be claimed by an equivalent test or by manufacturer's assertion supported by appropriate entries in the technical construction file.

**Clause Number** Identification of clause(s) defining the test specification in the present document unless another document is referenced explicitly. Where no test is specified (that is, where the previous field is "X") this field remains blank.

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

The enlargement of the European Union (EU) resulted in a requirement from the EU for a larger number of languages for the translation of the titles of Harmonized Standards and mandated ENs that are to be listed in the Official Journal to support the implementation of this legislation.

For this reason the title translation concerning the present document can be consulted via the e-approval application.

# Annex C (informative): Bibliography


- ETSI EN 301 751: "Fixed Radio Systems; Point-to-Point equipments and antennas; Generic harmonized standard for Point-to-Point digital fixed radio systems and antennas covering the essential requirements under article 3.2 of the 1999/5/EC Directive".
- ETSI EN 302 217-2-1: "Fixed Radio Systems; Characteristics and requirements for point-to-point equipment and antennas; Part 2-1: System-dependent requirements for digital systems operating in frequency bands where frequency co-ordination is applied".
- 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).
- 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).

# History

| Document history | | |
|---|---|---|
| V1.1.3 | December 2004 | Publication |
| V1.2.1 | June 2006 | Publication |
| V1.3.1 | October 2007 | Publication |
| V1.4.1 | November 2008 | One-step Approval Procedure OAP 20090319: 2008-11-19 to 2009-03-19 |
| | | |