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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

Reference
REN/ATTM-04017

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ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

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Foreword

This European Standard (EN) has been produced by ETSI Technical Committee Access, Terminals, Transmission and Multiplexing (ATTM).

The present document is part 2-1 of a multi-part deliverable covering the Fixed Radio Systems; Characteristics and requirements for point-to-point equipment and antennas. Full details of the entire series can be found in part 1 [15].

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Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**may not**", "**need**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

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Introduction

The introduction of EN 302 217-1 [15] applies.

1 Scope

The present document summarizes all system-dependent requirements for Point-to-Point (P-P) equipment in applications deployed in bands where frequency co-ordination is generally applied. These requirements are introduced in two different clauses sub-sets:

- **Main requirements** are requirements that are also related to the "essential requirements" under article 3.2 of the R&TTE Directive [1] and further detailed in the Harmonized Standard EN 302 217-2-2 [16].
- **Complementary requirements** are requirements that are not related to essential requirements under article 3.2 of the R&TTE Directive [1]. Nevertheless they have been commonly agreed for proper system operation and deployment when specific deployment conditions or compatibility requirements are present. Compliance to all or some of these requirements is left to supplier decision.

Description and limits for parameters relevant to essential requirements under article 3.2 of R&TTE Directive [1] are given in the Harmonized Standard EN 302 217-2-2 [16].

For other system-dependent parameters where standardization is required but that do not affect the R&TTE Directive "essential requirements" mentioned above, description and limits are detailed in the present document in clause 6 and in the annex A, annex F and annex G.

The present document deals with Radio Frequency (RF) and base-band equipment characteristics; antenna system requirements are covered in EN 302 217-4-1 [i.9] and EN 302 217-4-2 [i.10].

The present document does not cover test procedures and test conditions which are set out in EN 301 126-1 [14].

As the maximum transmission rate in a given bandwidth depends on system spectral efficiency, equipment are subdivided in different spectral efficiency classes as defined in EN 302 217-2-2 [16].

The spectral efficiency classes are indicative only and do not imply any constraint to the actual modulation format, provided that all the requirements in the relevant parts of this Multi-part deliverable for the declared class are met.

Guidance on the definition of radio parameters relevant to the essential requirements under article 3.2 of R&TTE Directive [1] for DFRS may be found in TR 101 506 [i.6].

Technical background for most of the parameters and requirements referred to in this Multi-part deliverable may be found in TR 101 036-1 [i.5].

2 References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the reference document (including any amendments) applies.

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

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 necessary for the application of the present document.

[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] CENELEC EN 122150: "Sectional Specification: Radio frequency coaxial connectors - Series EIA flange".

[3] CEPT/ERC/DEC(00)07: "ERC Decision of 19 October 2000 on the shared use of the band 17.7 - 19.7 GHz by the fixed service and Earth stations of the fixed-satellite service (space-to-Earth)".

[4] ETSI EN 300 019-1-0: "Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 1-0: Classification of environmental conditions; Introduction".

[5] ETSI EN 300 019-1-1: "Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 1-1: Classification of environmental conditions; Storage".

[6] ETSI EN 300 019-1-2: "Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 1-2: Classification of environmental conditions; Transportation".

[7] ETSI EN 300 019-1-3: "Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 1-3: Classification of environmental conditions; Stationary use at weatherprotected locations".

[8] ETSI EN 300 019-1-4: "Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 1-4: Classification of environmental conditions; Stationary use at non-weatherprotected locations".

[9] ETSI EN 300 019-2-0: "Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 2-0: Specification of environmental tests; Introduction".

[10] ETSI EN 300 019-2-1: "Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 2-1: Specification of environmental tests; Storage".

[11] ETSI EN 300 019-2-2: "Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 2-2: Specification of environmental tests; Transportation".

[12] ETSI EN 300 019-2-3: "Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 2-3: Specification of environmental tests; Stationary use at weatherprotected locations".

[13] ETSI EN 300 019-2-4: "Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 2-4: Specification of environmental tests; Stationary use at non-weatherprotected locations".

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

[15] 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".

[16] ETSI EN 302 217-2-2: "Fixed Radio Systems; Characteristics and requirements for point-to-point equipment and antennas; Part 2-2: Digital systems operating in frequency bands where frequency co-ordination is applied; Harmonized EN covering the essential requirements of Article 3.2 of the R&TTE Directive".

[17] IEC 60153-2: "Hollow metallic waveguides. Part 2: Relevant specifications for ordinary rectangular waveguides".

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

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

[20] IEC 60339 (all parts): "General purpose rigid coaxial transmission lines and their associated flange connectors".

[21] IEC 60835-2-4: "Methods of measurement for equipment used in digital microwave radio transmission systems - Part 2: Measurements on terrestrial radio-relay systems - Section 4: Transmitter/receiver including modulator/demodulator".

[22] IEC 60835-2-8: "Methods of measurement for equipment used in digital microwave radio transmission systems - Part 2: Measurements on terrestrial radio-relay systems - Section 8: Adaptive equalizer".

[23] IEEE 802.3-2005: "IEEE Standard for Information technology - Telecommunications and information exchange between systems - Local and metropolitan area networks - Specific requirements - Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications".

[24] IEEE 1802.3-2001: "IEEE Conformance Test Methodology for IEEE Standards for Local and Metropolitan Area Networks - Specific Requirements - Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications".

[25] Void.

[26] Recommendation ITU-R F.1093-2: "Effects of multipath propagation on the design and operation of line-of-sight digital fixed wireless systems".

[27] Void.

[28] Recommendation ITU-T O.151: "Error performance measuring equipment operating at the primary rate and above".

[29] Recommendation ITU-T O.181: "Equipment to assess error performance on STM-N interfaces".

[30] Recommendation ITU-T O.191: "Equipment to measure the cell transfer performance of ATM connections".

2.2 Informative references

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] ECC/REC(02)06: "Channel arrangements for digital Fixed Service Systems operating in the frequency range 7125-8500 MHz".

[i.2] ERC/REC 12-03: "Harmonised radio frequency channel arrangements for digital terrestrial fixed systems operating in the band 17.7 GHz TO 19.7 GHz".

[i.3] ERC/REC 14-01: "Radio-frequency channel arrangements for high capacity analogue and digital radio-relay systems operating in the band 5925 MHz - 6425 MHz".

[i.4] ERC/REC 14-02: "Radio-frequency channel arrangements for high, medium and low capacity digital fixed service systems operating in the band 6425-7125 MHz".

[i.5] ETSI TR 101 036-1: "Fixed Radio Systems; Generic wordings for standards on DFRS (Digital Fixed Radio Systems) characteristics; Part 1: General aspects and point-to-point equipment parameters".

[i.6] ETSI TR 101 506: "Fixed Radio Systems; Generic definitions, terminology and applicability of essential requirements under the article 3.2 of 1999/05/EC Directive to Fixed Radio Systems".

[i.7] ETSI TR 102 243-1: "Fixed Radio Systems; Representative values for transmitter power and antenna gain to support inter- and intra-compatibility and sharing analysis; Part 1: Digital point-to-point systems".

[i.8] ETSI TR 103 103: "Fixed Radio Systems; Point-to-point systems; ATPC, RTPC, Adaptive Modulation (mixed-mode) and Bandwidth Adaptive functionalities; Technical background and impact on deployment, link design and coordination".

[i.9] 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.10] ETSI EN 302 217-4-2: "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 the R&TTE Directive".

[i.11] ETSI TR 101 854: "Fixed Radio Systems; Point-to-point equipment; Derivation of receiver interference parameters useful for planning fixed service point-to-point systems operating different equipment classes and/or capacities".

[i.12] Recommendation ITU-R F.383-9: "Radio-frequency channel arrangements for high capacity fixed wireless systems operating in the lower 6 GHz (5 925 to 6 425 MHz) band".

[i.13] Recommendation ITU-R F.384-11: "Radio -frequency channel arrangements for medium- and high-capacity digital fixed wireless systems operating in the 6 425-7 125 MHz band".

[i.14] Recommendation ITU-R F.385-10: "Radio-frequency channel arrangements for fixed wireless systems operating in the 7 110-7 900 MHz band".

[i.15] Recommendation ITU-R F.595-10: "Radio-frequency channel arrangements for fixed wireless systems operating in the 17.7-19.7 GHz frequency band".

[i.16] Recommendation ITU-R P.530-15: "Propagation data and prediction methods required for the design of terrestrial line-of-sight systems".

[i.17] J. Redd: "Calculating Statistical Confidence Levels for Error-Probability Estimates" Lightwave Magazine, pp. 110-114, April 2000.

NOTE: Available on the web at http://www.lightwaveonline.com/.

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 [15] apply.

3.2 Symbols

For the purposes of the present document, the symbols given in EN 302 217-1 [15] apply.

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in EN 302 217-1 [15] apply.

4 General characteristics

4.1 Frequency bands and channel arrangements

Frequency bands and channel arrangements, which are relevant for equipment covered by the present document, are defined by Recommendation ITU-Rs and/or ECC (or CEPT/ERC) Recommendations and are referenced in the first table of each annex A through annex Ea (i.e. table A.1 through table Ea.1) of EN 302 217-2-2 [16].

Recommendation ITU-Rs and ECC (or CEPT/ERC Recommendation , see note) recommended frequency channel arrangements, known at the date of publication of this Multi-part deliverable, are set out for reference only. In general, the channel arrangement is relevant neither to article 3.2 of the R&TTE Directive [1] nor for other requirements in the present document; only the frequency band, actual channel separation and, in some cases innermost channels separation are relevant for defining the set of parameters and test suites relevant to each system.

NOTE: CEPT Recommendations were published until 2002 as CEPT/ERC Recommendations; consequently to the restructuring of ERC under new ECC organization, Recommendations developed after that date formally changed their reference as ECC Recommendations, without changing their applicability.

Other national or future Recommendation ITU-Rs or ECC Recommendations, set around the same or close to the frequency range of present Recommendation ITU-Rs or ECC Recommendations, are considered applicable to systems assessed against this Multi-part deliverable, provided that they use the same channel separation.

Specification and tests of wide radio-frequency band covering units and *multirate* or *mixed-mode* equipment are placed in normative annex G of EN 302 217-2-2 [16]. Whenever applicable, it is also valid for assessing parameters specified in the present document.

4.2 Special compatibility requirements between systems

There shall be no requirement to operate transmitting equipment from one supplier with receiving equipment from another and, depending on the deployment conditions, it shall be possible to operate the system in vertical and/or horizontal polarization, if required by the channel arrangement.

To be compatible with certain constraints given by existing installations and/or deployments already made with systems from other supplier or for different FS applications, new systems on the same path may be subject to additional requirements, other than those derived for a single supplier or same application environment.

NOTE: This does not imply that when a single supplier is involved there are no similar requirements; however, they do not need standardization because many other technical and cost-effective solutions might be flexibly adopted under suppliers' own responsibility only.

For the purposes of this Multi-part deliverable the following set of compatibility requirements between systems has been defined:

a) There may be a requirement to multiplex different suppliers' equipment on the same polarization of the same antenna. This will not apply to systems with an integral antenna.

b) There may be a requirement to multiplex different suppliers' equipment on different polarizations of the same antenna. This will not apply to systems with an integral antenna.

4.3 Transmission capacity and spectral efficiency

See clause 1.5 of EN 302 217-2-2 [16].

5 Main requirements

The following clauses summarize requirements related to the "essential requirements" under article 3.2 of the R&TTE Directive [1] that are further detailed in EN 302 217-2-2 [16]. However, for some requirements, besides the relevant essential limits set out in EN 302 217-2-2 [16] for the purpose of their separate publishing in the Official Journal of the European Communities (OJEU) under the R&TTE Directive [1], additional, non-essential, more stringent limits are here set out in response to specific compatibility requirements by network operators when deploying new systems on the same routes with existing systems from other suppliers.

5.1 System nominal loading

The specified transmitter and receiver characteristics shall be met with the appropriate baseband signals applied at reference point X' and received from reference point X of figure 1 of EN 302 217-1 [15].

Table 1: Baseband test signals

Type of baseband signal interface at X/X'	Test signal to be applied according to…
PDH	PRBS Recommendation ITU-T O.151 [28]
SDH	Recommendation ITU-T O.181 [29]
ATM	Recommendation ITU-T O.191 [30]
Ethernet interface (packet data)	IEEE 802.3 [23], IEEE 1802.3 [24]
Other than the above	Relevant standards which the interface refers to

5.2 Environmental profile

The required environmental profile for operation of the equipment shall be declared by the supplier. The equipment shall comply with all the technical requirements of the present document at all times when operating within the boundary limits of the required operational environmental profile.

Preferably, the selected environmental profiles should be one of more ETSI profiles in EN 300 019 series (see [4] through [13]), standardized for various operating, transport and storage situations.

5.3 Transmitter characteristics

5.3.1 Transmitter power and power tolerance

5.3.1.1 Maximum power

The Maximum Output Power is an essential requirement under article 3.2 of R&TTE Directive [1] and is specified in EN 302 217-2-2 [16].

For guidance, in addition to the absolute maximum transmitter power, typical values of transmitter highest power for real equipment, of feeder loss and length, and of antenna diameter and gain are provided in TR 102 243-1 [i.7] in order to support inter-systems and intra-system compatibility and sharing analysis.

In some frequency bands, or parts of frequency bands, Recommendation ITU-Rs define specific limits in terms of output power and/or EIRP (or output power and/or EIRP density) in order to improve the compatibility with other Radio Services sharing these frequency bands with the FS.

An additional capability for output power level adjustment may be required, for regulatory purposes, in the interface regulations according to article 4.1 of the R&TTE Directive [1], in which case the range of adjustment, either by fixed or automatic attenuators, should be in increments of 5 dB or less.

In particular, for the band 18 GHz, the FS shall, where practical, implement the appropriate mitigation techniques as required in ERC/DEC(00)07 [3]. See annex H.

5.3.1.2 Transmitter output power tolerance

The power tolerance around the nominal output power together with the associated environmental profile, declared by the supplier, is considered essential under article 3.2 of R&TTE Directive [1]. For relevant limits see EN 302 217-2-2 [16].

Additionally, it should be taken into consideration that, in general, the declared profile for R&TTE Directive [1] assessment might not be coincident with the ETSI standardized ones in EN 300 019 series (see [4] through [13]), which have been specifically designed for telecommunication equipment in various deployment situations. Therefore, the supplier may decide to comply with equal or more stringent limits for operation of the system over some ETSI standardized environmental condition for which the system is designed to operate. Limits for this case are reported below.

The tolerance of the nominal output power shall be:

a) Systems operating within class 3.1 or class 3.2 of weather protected locations defined in EN 300 019-1-0 [4] and EN 300 019-1-3 [7]:
The nominal output power, when specified, shall be within ±A dB value reported in table 2.

b) Systems operating within one or more of non-weather protected locations class 4.1 and class 4.1E, defined in EN 300 019-1-0 [4] and EN 300 019-1-4 [8], and/or within class 3.3, class 3.4 and class 3.5 (particular extreme conditions of weather protected locations) defined in EN 300 019-1-0 [4], EN 300 019-1-3 [7]:
The nominal output power shall remain within ±B dB value, reported in table 2, within one or more of the above environment classes, specified by the manufacturer.

Table 2: Power tolerance for indoor operation

Operating frequency band (GHz)	± A (dB)	± B (dB)
1 to 2,7	Not defined	+2 / -1
3 to 30	±1	±2
> 31	±2	±3

5.3.2 Transmitter power and frequency control

5.3.2.1 Transmitter power control (ATPC and RTPC)

5.3.2.1.1 Automatic Transmitter Power Control (ATPC)

This functionality is relevant to essential requirements under article 3.2 of R&TTE Directive [1] and is specified in EN 302 217-2-2 [16].

Besides those essential requirements specified in EN 302 217-2-2 [16], ATPC may be requested as mandatory functionality in the licensing conditions (see note 1) for the following purposes (see note 2):

a) to enhance network density;

b) as a mitigation factor for sharing with other Services due to ECC Decisions (see note 3).

NOTE 1: User information: it is expected that Administrations explicitly state whether ATPC is used as a regulatory measure for either frequency coordination or as a mitigation technique to protect other services in its radio regulation interface for notification according to article 4.1 of the R&TTE Directive [1].

NOTE 2: User information: License conditions are under administration responsibility; in principle, from technical point of view, when used as mitigation factor, ATPC would not be used to enhance network density because this could invalidate the expected mitigation.

NOTE 3: User information: for example is in the 18 GHz band, where there is sharing between FS and FSS, ATPC will become a mandatory feature for all new equipment to be deployed after the date referred by ERC/DEC(00)07 [3], however, that Decision clarify also that actual usage of ATPC will be required by administrations only where practical and depending on local sharing conditions with satellite services and local deployment conditions in existing networks. The ATPC range is not subject to standardization.

In case a), the administration might specify that the transmitter output emission meets the spectrum mask limits set out in clause 4.2 of EN 302 217-2-2 [16] throughout an ATPC range specified in the license conditions. The manufacturer may choose to comply also with this requirement that in no case is considered essential to the assessment of article 3.2 of R&TTE Directive [1].

In case b), the administration might require that the equipment operate with ATPC enabled. This does not imply any additional constraint besides the presence of the optional ATPC functionality, which in no case is considered essential to the assessment of article 3.2 of R&TTE Directive [1].

The supplier shall declare the ATPC range within which the spectrum mask is still fulfilled; the declaration should take into account, if relevant, that the ATPC range is often interlaced and interchangeable with the available RTPC range (see note 4).