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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

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Harmonized European Standard (Telecommunications series)

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

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Foreword

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

The present document has been produced by ETSI in response to a mandate from the European Commission issued under Council Directive 98/34/EC (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 ("R&TTE Directive").

The present document is part 2-2 of a multi-part deliverable covering the Fixed Radio Systems; Characteristics and requirements for point-to-point equipment and antennas, as identified below:

Part 1: "Overview and system-independent common characteristics";

Part 2-1: "System-dependent requirements for digital systems operating in frequency bands where frequency co-ordination is applied";

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";

Part 3: "Harmonized EN covering essential requirements of Article 3.2 of R&TTE Directive for equipment operating in frequency bands where no frequency co-ordination is applied";

Part 4-1: "System-dependent requirements for antennas";

Part 4-2: "Harmonized EN covering essential requirements of Article 3.2 of R&TTE Directive for antennas".

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Introduction

The EN 302 217 series has been produced in order to rationalize a large number of previous ETSI ENs dealing with equipment and antennas for Point-to-Point (P-P) Fixed Service applications. For more details, see foreword in the EN 302 217-1 [6].

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 (see bibliography) and shown in figure 1.

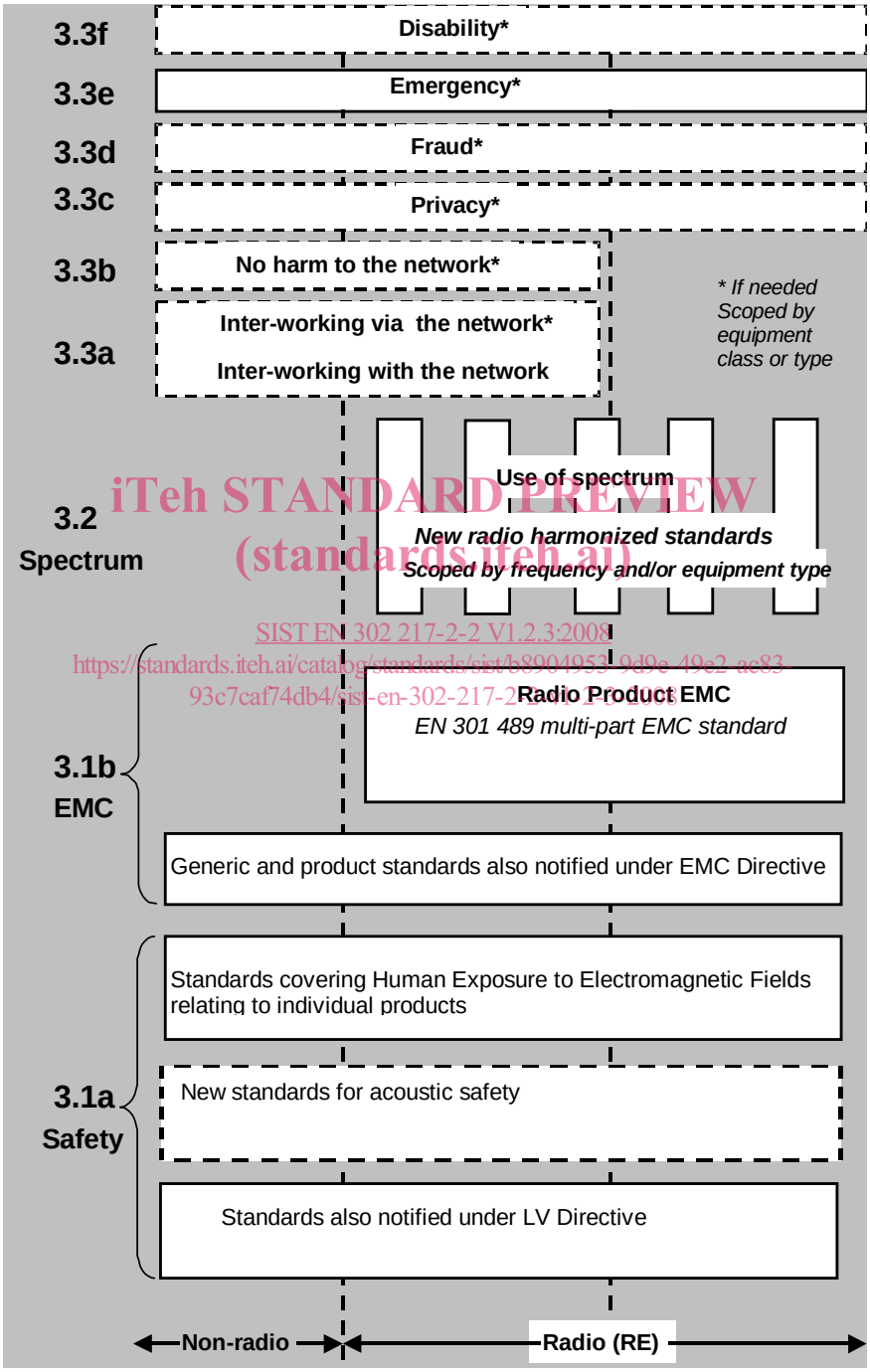

Figure 1: Modular structure for the various standards used under the R&TTE Directive

NOTE: For article 3.1b the diagram shows EN 301 489 (see bibliography), the multi-part product EMC standard for radio used under the EMC Directive 89/336/EEC (see bibliography). For Fixed Radio Systems EN, EN 301 489-1 (see bibliography) and EN 301 489-4 (see bibliography) are relevant.

1 Scope

1.1 General background

The present document specifies the essential requirements for point to point Digital Fixed Radio Systems (DFRS) operating in frequency bands, which require co-ordinated frequency planning. It is intended to cover the provisions of the R&TTE Directive [1] 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 EN 302 217 series introduces requirements for systems (equipment and antennas) that were formerly covered by EN 301 751 (see bibliography) and that are technically equivalent or less stringent requirements (see note 1). Care has been taken so that such variations will not affect any frequency planning assumption for already deployed networks. Therefore, from a strictly technical point of view, it is expected that equipment already conforming to EN 301 751(see bibliography) or previous versions of the present harmonized standard, would not need a new test report for re-assessment of essential requirements according to the present document (see note 1). However, legal implications with respect to declaration of conformity and equipment labelling are outside the scope of the present document.

NOTE 1: The only exception is with respect to class 5A equipments for system D.7 (see annex D) and for systems E.1, E.2 and E.3 (see annex E) for which a previous design objective, in EN 301 751 (see bibliography), has been transformed, in this EN 302 217-2-2, into a more stringent RSL versus BER. In this case a supplementary test report might be required (e.g. in case the technical construction file, made for declaration of conformity to EN 301 751 (see bibliography), does not give evidence of enough margin to fulfil the requirements of the present document).

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 [1] will apply to equipment within the scope of the present document.

NOTE 2: A list of such ENs is included on the web site http://www.newapproach.org.

1.2 Spectral efficiency classes

As the maximum transmission rate in a given bandwidth depends on system spectral efficiency, different equipment classes are defined:

- Class 1: equipment spectral efficiency based on typical 2-states modulation scheme (e.g. 2-FSK, 2-PSK or equivalent);
- Class 2: equipment spectral efficiency based on typical 4-states modulation scheme (e.g. 4-FSK, 4-QAM, or equivalent);
- Class 3: equipment spectral efficiency based on typical 8-states modulation scheme (e.g. 8-PSK, or equivalent) (see note 1);

NOTE 1: It is also noted that, in this class, for design commonality with other efficiency classes, the 16 QAM format is popular.

- Class 4: equipment spectral efficiency based on typical 16-states or 32-states modulation scheme (e.g. 16-QAM or 32-QAM, or equivalent);
- Class 5A: equipment spectral efficiency based on typical 64-states or 128-states modulation scheme (e.g. 64-QAM or 128-QAM, or equivalent), for cross-polar adjacent channel (ACAP) operation;
- Class 5B: equipment spectral efficiency based on typical 64-states or 128-states modulation scheme (e.g. 64-QAM or 128-QAM, or equivalent), for co-polar adjacent channel (ACCP) and frequency reuse through CCDP operation;
- Class 6A: equipment spectral efficiency based on typical 256-states or 512-states modulation scheme (e.g. 256-QAM or 512-QAM, or equivalent), for cross-polar adjacent channel (ACAP) operation;

- Class 6B: equipment spectral efficiency based on typical 256-states or 512-states modulation scheme (e.g. 256-QAM or 512-QAM, or equivalent), for co-polar adjacent channel (ACCP) and frequency reuse through CCDP operation.

NOTE 2: The above 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 EN 302 217 series are met.

1.3 System alternatives

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 302 217-4-2 [7], 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 or ITU-R Recommendation);
- spectral efficiency class alternatives (different modulation formats provided in radio equipment standards) as defined in clause 1.2 above;
- antenna directivity class alternatives (for different network requirements).

1.4 Channel arrangements and utilization

From the point of view of the transmission capacity, these systems are defined, in the relevant annexes, on the basis of their minimum Channel Separation (CS) on the same route, for a given spectrum efficiency class, taken into account by the system design. The possible channel arrangements may be:

- Adjacent Channel Alternate-Polarized (ACAP);
- Adjacent Channel Co-Polarized (ACCP);
- Co-Channel Dual-Polarization (CCDP).

These possible applications and their channel arrangements are shown in figure 2.

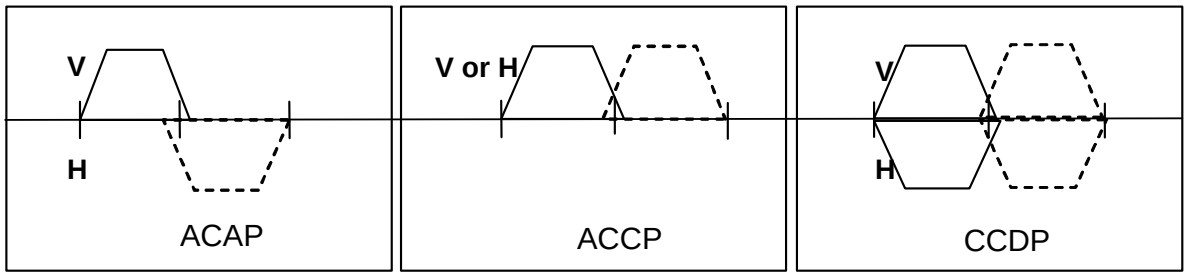

Figure 2: Examples of channel arrangements on the same route

1.5 Payload flexibility

The capacities in tables X.2 (where X = B…E represents the relevant annex) are commonly tailored on typical PDH and SDH base band interfaces, identified for simplicity with 2 Mbit/s, 2 × 2 Mbit/s, 8 Mbit/s, 2 × 8 Mbit/s, 34 Mbit/s, 2 × 34 Mbit/s, STM-0 (51 Mbit/s), 2 × STM-0 (2 × 51 Mbit/s), STM-1 (155 Mbit/s), N × STM-1 (N × 155 Mbit/s), STM-N. Systems in annex A, due to the smaller channel separation provided, are (exceptionally) labelled with typical capacity rate without specific reference to PDH/SDH rates.

Provided that they meet all requirements of the relevant annex, equivalent PDH or SDH transport rates may be used where appropriate. Such equivalence transport rates may be:

- N × 2 Mbit/s or other PDH rates in place of equivalent higher PDH rates;
- 140 Mbit/s (including 4 × 34 Mbit/s) in place of STM-1;
- any PDH mapping into STM-0 or STM-1 frames, as defined in the basic multiplexing schemes;
- N × 2 Mbit/s mapped into SDH VC12 or VC2 transport bit rates (sub-STM-0 defined, as sSTM-1k or sSTM-2n capacities, by ITU-T Recommendation G.708 (see bibliography)) in place of a PDH rate (e.g. 4 × VC12/sSTM14 or 1 × VC2/sSTM21 in place of 8 Mbit/s) (see note);
- any other signal (e.g. IP frames or ATM cells, even possibly mixed with PDH capacities) mapping into PDH or SDH frames, according present or future basic ITU-T or ETSI multiplexing schemes;

NOTE: In addition to this general principle, annex D (system D.2) presents specific characteristics for sub-STM-0 systems in the 18 GHz band.

The present document is also applicable to other base band interfaces (e.g. packet data interfaces or mixed interfaces) even if multiplexed (including compression algorithms if any) into proprietary frames; for such cases annex F gives the basic rules for applying the conventional PDH/SDH set of parameters to those equipment assessment.

The requirements of the present document apply separately to each transmitter/receiver or single transmitters or receivers used for combining complex or simple (e.g. space diversity receivers or single transmitters and receivers used for unidirectional links) fixed radio systems. Systems labelled with N × STM-1 (N = 1,2) capacity might actually be aggregated for carrying STM-4 in more than one radio frequency channel, provided that each equipment for each channel meets the channel requirements. When frequency reuse (e.g. dual polarization reuse or other frequency reuse techniques) is applied, the requirements apply independently to each transmitter/receiver; the different interference potential of frequency reuse will be dealt with in the frequency planning associated with the licensing process.

1.6 Document structure

The present document is mainly intended to cover fixed radio equipment without integral antennas. However, it also applies to fixed radio systems products with integral antennas, for which all the technical requirements included in the present document and in EN 302 217-4-2 [7] apply. For more background information on the equipment and antenna parameters here identified as relevant to article 3.2 of R&TTE Directive see EG 201 399 and TR 101 506 (see bibliography).

For simplicity, the point-to-point systems are split into separate annexes, with respect to ranges of frequency bands and channel separations, into the following families which may include a range of corresponding payload rates for covering various applications requested by the market:

- Annex A: Frequency bands from 1,4 GHz to 2,7 GHz:

  Systems with channel separations ranging from 0,025 MHz to 14 MHz for indicative payload rates ranging from 0,0096 Mbit/s to 34 Mbit/s. See detailed summary in table A.2.

- Annex B: Frequency bands from 3 GHz to 11 GHz (channel separation up to 30 MHz):

  Systems with channel separations ranging from 1,75 MHz to 30 MHz for indicative payload rates ranging from 2 Mbit/s to 2 × STM-1 Mbit/s. See detailed summary in table B.2.

- Annex C: Frequency bands from 3 GHz to 11 GHz (channel separation 40 MHz):

  Systems with channel separations 40 MHz or 2 × 40 MHz for indicative payload rates from STM-1 Mbit/s to STM-4/4 × STM-1 Mbit/s. See detailed summary in table C.2.

- Annex D: Frequency bands 13 GHz, 15 GHz and 18 GHz:

  Systems with channel separations ranging from 1,75 MHz to 55/56 MHz or 2 × 55/56 MHz for indicative payload rates ranging from 2 Mbit/s to STM-4/4 × STM-1 Mbit/s. See detailed summary in table D.2.

- Annex E: Frequency bands from 23 GHz to 55 GHz:

  Systems with channel separations ranging from 3,5 MHz to 56 MHz or 2 × 56 MHz for indicative payload rates ranging from 2 Mbit/s to STM-4/4 × STM-1 Mbit/s. See detailed summary in table E.2.

In those annexes further subdivision in sub-annexes is made, as appropriate, according to frequency bands, capacities and/or channel separation (see table 3 of EN 302 217-1 [6]).

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.

NOTE 1: While any hyperlinks included in this clause were valid at the time of publication ETSI cannot guarantee their long term validity.

NOTE 2: With regard to ETSI ENs, the third digit of the version number is not considered essential for dated reference purposes because the ETSI Technical Woking Procedures reserves this digit for editorially changed versions, thereby not affecting the technical parameters within versions with the same two initial digits. Here is reported the third digit of the latest version available at the time of the publication 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] CEPT/ERC/REC 74-01 (2005): "Unwanted Emissions in the Spurious Domain".

[3] ETSI EN 301 126-1 (V1.1.2): "Fixed Radio Systems; Conformance testing; Part 1: Point-to-point equipment - Definitions, general requirements and test procedures".

[4] 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".

[5] ETSI EN 301 390 (V1.2.1): "Fixed Radio Systems; Point-to-point and Multipoint Systems; Spurious emissions and receiver immunity limits at equipment/antenna port of Digital Fixed Radio Systems".

[6] 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".

[7] ETSI EN 302 217-4-2 (V1.2.1): "Fixed Radio Systems; Characteristics and requirements for point-to-point equipment and antennas; Part 4-2: Harmonized EN covering essential requirements of Article 3.2 of R&TTE Directive for antennas".

[8] 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".

[9] IEEE 802.3-2002: "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".

[10] ITU Radio Regulations (2004).

[11] ITU-T Recommendation O.151 (1992) Corrigendum 1 (2002): "Error performance measuring equipment operating at the primary rate and above".

[12] ITU-T Recommendation O.181 (2002): "Equipment to assess error performance on STM-N interfaces".

[13] ITU-T Recommendation O.191 (2000): "Equipment to measure the cell transfer performance of ATM connections".

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 [6] apply.

3.2 Symbols

For the purposes of the present document, the symbols given in EN 302 217-1 [6] apply.

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in EN 302 217-1 [6] apply.

4 Technical requirements specifications

Guidance and description of the phenomena relevant to "essential requirements" under article 3.2 is given in EG 201 399 (see bibliography); specific applications and descriptions for DFRS is given in TR 101 506 (see bibliography).

In the following clauses, limits are required to be met at specific reference points of the system block diagram. Reference points and the system block diagram are set out in figure 1 of EN 302 217-1 [6].

In the case of wide radio-frequency bands covering units and multirate/multiformat equipment, these specifications shall be met at any frequency, at any rate/format. However the tests, required for generating a test report and/or declaration of conformity, in order to fulfil any conformity assessment procedure with respect to the R&TTE Directive [1], shall be carried-out in accordance with the principles set out in annex G.

Testing methods and conditions for assessing all requirements are specified in clause 5, where each clause directly refers to a corresponding clause in this clause 4 (e.g. clause 5.2.2.1.1 refers to the ATPC test according the requirement in clause 4.2.2.1.1).

The requirements are intended, for applicable systems, with fully loaded STM-4 or 4 × STM-1 or 2 × STM-1 or STM-1 (according to the maximum loading required for the equipment) capacities at the base band interface. However, for CCDP application test reports, the actual contemporary loading of both polarization transmitters is not required.

NOTE: For each technical requirement in the present document, there might be additional characteristics, not considered relevant to article 3.2 of the R&TTE Directive [1]. Nevertheless they are considered important for the system itself or for deployment conditions where local antenna sharing between equipments of different suppliers is required; these additional requirements, when identified, may be found in EN 302 217-2-1 (see bibliography).