SLOVENSKI STANDARD
SIST EN 302 217-2-2 V2.1.1:2013

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Fiksni radijski sistemi - Karakteristike in zahteve za opremo in antene tipa točka-točka - 2-2. del: Digitalni sistemi, ki delujejo v frekvenčnih pasovih, kjer je izvedena frekvenčna koordinacija - Harmonizirani EN, ki zajema bistvene zahteve člena 3.2 direktive R&TTE

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

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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

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Foreword

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

The present document has been produced by ETSI in response to a mandate issued from the European Commission under Directive 98/34/EC [i.2] as amended by Directive 98/48/EC [i.64].

The title and reference to the present document are intended to be included in the publication in the Official Journal of the European Union of titles and references of Harmonized Standard under the Directive 1999/5/EC [1].

See article 5.1 of Directive 1999/5/EC [1] for information on presumption of conformity and Harmonized Standards or parts thereof the references of which have been published in the Official Journal of the European Union.

The requirements relevant to Directive 1999/5/EC [1] are summarized in annex H.

The present document is part 2, sub-part 2 of a multi-part deliverable covering 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 [6].

National transposition dates	
Date of adoption of this EN:	25 June 2013
Date of latest announcement of this EN (doa):	30 September 2013
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	31 March 2014
Date of withdrawal of any conflicting National Standard (dow):	31 March 2015

Major variants with respect to previous published version

This new version of EN 302 217-2-2 has considered, among other minor points:

- Unified frequency tolerance.
- Unified output power tolerance.
- More flexible specification for spectral lines exceeding the spectral density mask.
- New spectral efficiency classes 7 (1 024 states) and 8 (2 048 states) have been introduced for channel separations 13,75/14 MHz and above.

- Extension of the spectral efficiency classes subdivision to formally cover the whole granularity of the range spectral efficiency indexes provided for each band and channel separation. Indexes from 1 (2 states, spectral efficiency class 1) to 11 (2 048 states, spectral efficiency class 8) and to newly introduced 10 and 11 (1 024 and 2 048 states, spectral efficiency class 7 and 8) are introduced, as appropriate, for filling the gaps between the minimum and maximum indexes foreseen.

- Unified spectrum masks for classes 5, 6, 7 and 8 also for 40 MHz and for 110 MHz/112 MHz channels.

- Use, as system identification method, of the "minimum radio interface capacity (RIC)", more appropriate for new Ethernet oriented systems, in place of the previous PDH/SDH oriented one.

- Removal of the other system identification parameter based on A.1, ….., B.1,….., C.1,….., E.1, …… notations. Unique system identification is based on operating frequency band, operating radio frequency channel separation and spectral efficiency class to which a minimum RIC is associated.

- Tighter BER Receiver Signal Level (RSL) thresholds for a large number of systems; this is justified by recognizing, in previous V1.4.1 of the present document, the very large margins against the required values with respect to current equipment technology on the market and by the need for improving the link density in frequency coordinated networks.

- Significant revision of the informative annex I for guidance in the use and deployment of ATPC and "*mixed-mode*" (adaptive modulation systems).

- Clarification and distinction between "*multi-carrier*" and "*multi-channel*" systems concepts and related requirements.

- New frequency bands from 71 GHz to 76 GHz and 81 GHz to 86 GHz (additional requirements to the general ones in EN 302 217-3 [7] for equipment intended also for conventional link-by-link coordination).

In general, apart from the tightened RSL BER thresholds (see note 1), the requirements for equipment types already covered by previous versions of the present document are carried over unchanged (see notes 2 and 3); therefore, it is considered that equipment already conforming to those previous versions would not need a new test report for re-assessment of the essential requirements according to the present document. However, the legal aspects related to the Declaration of Conformity according the Directive 1999/5/EC [1] are not in the scope of the present document.

NOTE 1: The tightened RSL BER thresholds are still considered to offer a good margin to equipment on the market and also to equipment that is already in operation since several years before the date of publication of the present document.

NOTE 2: Even if considered not impacting modern synthesizer technology, few cases of more stringent frequency tolerance resulted from the unification of the requirement.

NOTE 3: The "minimum RIC" limits have been enhanced from previous V1.4.1 of the present document; however, they are considered well within the present technology capability. It should be noted that the original values, standardized in annex F of previous V1.1.3 of the present document (formally applicable up to May 2009), were already significantly higher than those reported in subsequent versions of the present document. Those "more relaxed" ones, used up to V1.4.1 of the present document as "provisional stop-gap" for early introduction of Ethernet systems among PDH/SDH oriented characteristics, will cease to be applicable after the decaying date from the OJEU of the said V1.4.1.

Attention is also drawn to the fact that older spectral power density masks, some of which have been maintained as equivalent alternative option in the annexes A through E, are supposed, in medium term maintenance process, to be discontinued. Newly assessed equipment is supposed to use the "unified masks" in clause 4.2.4.2.1.

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 [i.24].

Figure 1: Void

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 division full duplex (FDD) in frequency bands, where co-ordinated link-by-link frequency planning is applied. 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".

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

For the correct understanding and application of the requirements in the present document, the definitions summarized in EN 302 217-1 [6] are also relevant.

1.2 Spectral efficiency classes

As the maximum transmission rate in a given bandwidth depends on system spectral efficiency, different equipment classes are here defined. They are based on typical modulation formats and limited by a "minimum Radio Interface Capacity density" (Mbit/s/MHz) shown in table 0. Radio Interface Capacity (RIC) is defined in EN 302 217-1 [6].

The minimum RIC density figures in table 0 are valid only for systems operating on the most common channel separation (CS) equal or higher than 1,75 MHz and taking into account that for channel separations "about" 14 MHz (i.e. from 13,75 MHz to 15,0 MHz), "about" 28 MHz (i.e. from 27,5 MHz to 30 MHz), "about" 56 MHz (i.e. from 55 MHz to 60 MHz) and "about" 112 MHz (i.e. 110 MHz or 112 MHz) the RIC density of actual systems is evaluated only over the "nominal" 14 MHz, 28 MHz, 56 MHz and 112 MHz channel width.

Minimum RIC figures for some systems operating on 40 MHz channel separation, with RIC density lower than the minimum requirement in table 0, are defined only in annexes C and Ea. For the special cases of sub-STM-0 capacities (defined in Recommendation ITU-T G.708 [i.63] in annex D, alternative minimum RIC figures are not defined.

Table 0: Spectral efficiency classes and their minimum RIC density

Reference modulation index	Spectral efficiency class	Minimum RIC density (Mbit/s/MHz) (see note)	Description
1	1	0,57	equipment with spectral efficiency based on typical 2-states modulation scheme (e.g. 2 FSK, 2 PSK)
2	2	1,14	equipment with spectral efficiency based on typical 4-states modulation scheme (e.g. 4 FSK, 4QAM)
3	3	1,7	equipment with spectral efficiency based on typical 8-states modulation scheme (e.g. 8 PSK)
4	4L	2,28	equipment with spectral efficiency based on typical 16-states modulation scheme (e.g. 16QAM, 16 APSK)
5	4H	3,5	equipment with spectral efficiency based on typical 32-states modulation scheme (e.g. 32QAM, 32 APSK)
6	5L	4,2	equipment with spectral efficiency based on typical 64-states modulation scheme (e.g. 64QAM)
7	5H	4,9	equipment with spectral efficiency based on typical 128-states modulation scheme (e.g. 128QAM)
8	6L	5,6	equipment with spectral efficiency based on typical 256-states modulation scheme (e.g. 256QAM)
9	6H	6,3	equipment with spectral efficiency based on typical 512-states modulation scheme (e.g. 512QAM)
10	7	7	equipment with spectral efficiency based on typical 1024-states modulation scheme (e.g. 1024QAM)
11	8	7,7	equipment with spectral efficiency based on typical 2048-states modulation scheme (e.g. 2048QAM)
NOTE: When defining the minimum RIC for actual channel separations, for simplicity, it will be rounded to the suitably closer integer Mbit/s.			

All classes up to class 4H, for any CS, and classes 5L, 5H, 6L, 6H, 7 and 8, for CS < 27,5 MHz, are intended suitable for ACCP operation and, in principle, whenever appropriate, also expandable to CCDP. Classes 5L, 5H, 6L, 6H, 7 and 8, only for CS ≥ 27,5 MHz, are further subdivided in two sub-classes:

- subClass A: classes 5LA, 5HA, 6LA, 6HA, 7A and 8A are intended suitable, on the same route, for cross-polar adjacent channel (ACAP) operation only (see figure 2a).

- subClass B: classes 5LB, 5HB, 6LB, 6HB, 7B and 8B are suitable, on the same route, for ACCP operation and, in principle, whenever appropriate, also expandable to CCDP (see figure 2a).

The above classes are for system identification only and will not imply any constraint to the actual modulation format, provided that all the requirements of the selected class in the relevant parts of 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 [8], 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; actual equipment may operate within one spectral efficiency class only (*Single-mode*) or within multiple classes, either with static pre-selection of the class (*Preset-mode*) or with dynamic variation of capacity according the propagation conditions (*Mixed-mode*) (see note);

- antenna directivity class alternatives (for different network requirements).

NOTE: *Single- mode, Preset-mode and Mixed-mode* systems are defined in clause 3.1 of EN 302 217-1 [6]; additional information on *Mixed-mode* systems may be found in annex I of the present document and in TR 103 103 [i.35].

1.4 Channel arrangements and utilization

Systems in the scope of the present document are intended to operate only in full frequency division duplex (FDD). Time division duplex (TDD) applications are not in the scope of the present document.

Unidirectional systems are assumed to be an underequipped FDD system.

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 spectral 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 2a.

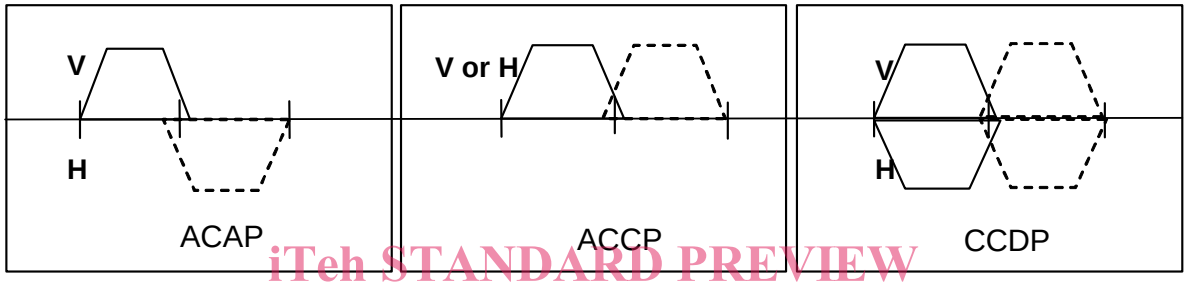

Figure 2a: Examples of channel arrangements on the same route

1.5 Payload flexibility

For quick identification of the system, the capacities in tables X.2 (where X = A, B, C, D, E, Ea represents the relevant annex) are the minimum transmitted RIC required for conformance to the present document; they are based on the "minimum RIC density" defined in clause 1.2. Only some cases of systems in annex A, due to the smaller channel separation provided, are (exceptionally) labelled with typical *gross bit rate* rather than minimum RIC capacity rates.

However, equipment may offer a variety of base band interfaces, e.g. typical hierarchical rates PDH or SDH, ISDN, Ethernet as well as mixture of these or other standardized interfaces. Mapping/multiplexing of the various base-band interfaces into common frame(s) suitable for radio transmission may be done using standardized higher hierarchical frames or other proprietary methods.

NOTE: Information on applicable base-band interfaces can be found in EN 302 217-1 [6].

Tables F.1a through F.1g in annex F summarize the "minimum RIC" considered in the present document and, when only PDH or SDH interfaces are provided, give the equivalent capacity in term of number of 2,048 Mbit/s streams provided as multiple or single multiplexed PDH or SDH interfaces. These minimum capacities will be associated to the relevant channel separation and spectral efficiency classes defined.

Equipment may operate with one single RIC payload rate or with multiple RIC payload rates (multirate systems), either statically preset (possibly coupled also with *preset-mode* operation) or, when coupled with *mixed-mode* operation, dynamically changing according to the modulation format.

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 carrying 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 (see clause G.3). 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 [8] apply. For more background information on the equipment and antenna parameters here identified as relevant to article 3.2 of R&TTE Directive [1] see EG 201 399 [i.24] and TR 101 506 [i.30].

For simplicity, the point-to-point systems refer to a number of technical requirements, common to all bands, which are described in the main body of the present document, while frequency dependent requirements 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 payloads capacity ranging from 0,0096 Mbit/s to 38 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 and 56/60 MHz):
  Systems with channel separations ranging from 1,75 MHz to 30 MHz and 56/60 MHz for minimum RIC payload rates ranging from 2 Mbit/s up to about 430 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 for minimum RIC payload rates from about 137 Mbit/s to about 300 Mbit/s or hierarchic from STM-1 to 2 × STM-1 (ACAP or ACCP) and STM-4/4 × STM-1 for CCDP operation or spread over 2 × 40 MHz channels). 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, for 18 GHz band only, up to 110 MHz) for minimum RIC payload rates ranging from 2 Mbit/s up to about 430 Mbit/s and up to 860 Mbit/s in 18 GHz band. See detailed summary in table D.2.

- Annex E: Frequency bands from 23 GHz to 55 GHz:
  #For frequency bands 23 GHz to 42 GHz, systems with channel separations ranging from 3,5 MHz to 112 MHz for minimum RIC payload rates ranging from 2 Mbit/s up to about 860 Mbit/s. See detailed summary in table E.2.
  #For frequency bands 50 GHz to 55 GHz, systems with channel separations ranging from 3,5 MHz to 56 MHz for minimum RIC payload rates ranging from 2 Mbit/s up to about 128 Mbit/s. See detailed summary in table E.2.

- Annex Ea: Frequency bands from 71 GHz to 76 GHz and 81 GHz to 86 GHz:
  Systems with channel separation ranging from 250 MHz to 2 000 MHz for minimum RIC payload rates ranging from about 140 Mbit/s up to about 3 000 Mbit/s. See detailed summary in table Ea.2.

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

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.

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