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Fixed Radio Systems;
Characteristics and requirements for
point-to-point equipment and antennas;
Part 2: Digital systems operating in frequency bands
from 1,3 GHz to 86 GHz;
Harmonised Standard covering the essential requirements
of article 3.2 of Directive 2014/53/EU

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Foreword

This draft Harmonised European Standard (EN) has been produced by ETSI Technical Committee Access, Terminals, Transmission and Multiplexing (ATTM), and is now submitted for the combined Public Enquiry and Vote phase of the ETSI standards EN Approval Procedure.

The present document has been prepared under the Commission's standardisation request C(2015) 5376 final [i.64] to provide one voluntary means of conforming to the essential requirements of Directive 2014/53/EU on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC [i.1].

Once the present document is cited in the Official Journal of the European Union under that Directive, compliance with the normative clauses of the present document given in table A.1 confers, within the limits of the scope of the present document, a presumption of conformity with the corresponding essential requirements of that Directive, and associated EFTA regulations.

The present document is 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 ETSI EN 302 217-1 [4].

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

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**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 ETSI 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 ETSI EN 302 217-1 [4].

1 Scope

1.1 Generality

1.1.1 Applicability

The present document specifies the essential parameters for Point-to-point (P-P) Digital Fixed Radio Systems (DFRS) operating in frequency bands allocated to Fixed Service (FS) from 1,3 GHz to 86 GHz.

Systems in the scope of the present document are generally intended to operate in full frequency division duplex (FDD) and covers also unidirectional applications. Time division duplex (TDD) applications, when possibly applicable in a specific band, are explicitly mentioned as appropriate in annexes B through J.

The present document intends to cover the provisions of the Directive 2014/53/EU [i.1] regarding article 3.2 (see note 1).

NOTE 1: In particular recital 10 of the Directive 2014/53/EU [i.1] highlights the similar importance of TX and RX characteristics in the avoidance of harmful interference and in efficient use of shared or adjacent channels.

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 Directive 2014/53/EU [i.1] may 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.

For the correct understanding and application of the requirements in the present document, the definitions summarized in ETSI EN 302 217-1 [4] are also relevant; those definitions are generally hereby identified with the use of *italic characters* (e.g. *mixed-mode*).

Common provisions applicable for all bands are defined in clause 1.2 to clause 1.5, while band specific provisions are defined in clause 1.6.

1.1.2 Operating frequency bands

The radio systems in the scope of the present document operate in one of the frequency bands listed in tables X.2 (where X = B, C, D, E, F, G, H, I and J represents the relevant annex); "*channel-aggregation*" (see definition in ETSI EN 302 217-1 [4]) systems may operate each "*aggregated-channel*" in different bands among those listed in the above mentioned tables.

Individual radio equipment may also operate on different segments of those bands.

For channel arrangements of different bands refer to ECC and/or ITU-R recommendations; whenever a different national band arrangement is used in one EC member state, those provisions apply as well.

The above ECC and/or Recommendation ITU-Rs provide arrangements for the whole band; however, the actual frequency range(s) available for fixed links applications may vary on national basis (e.g. in the 57 GHz to 66 GHz range, where a number of applications other than FS are accommodated).

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 in table 0. They are based on typical modulation formats and limited by a "minimum Radio Interface Capacity density" (Mbit/s/MHz) required in clause 4.1.2. *Radio Interface Capacity* (RIC) is defined in ETSI EN 302 217-1 [4].

The classes reported in table 0 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 are met.

Table 0: Spectral efficiency classes

Reference modulation index	Spectral efficiency class	Description
1	1	Equipment with spectral efficiency based on typical 2-states modulation scheme (e.g. 2FSK, 2PSK)
2	2	Equipment with spectral efficiency based on typical 4-states modulation scheme (e.g. 4FSK, 4QAM)
3	3	Equipment with spectral efficiency based on typical 8-states modulation scheme (e.g. 8PSK)
4	4L	Equipment with spectral efficiency based on typical 16-states modulation scheme (e.g. 16QAM, 16APSK)
5	4H	Equipment with spectral efficiency based on typical 32-states modulation scheme (e.g. 32QAM, 32APSK)
6	5L	Equipment with spectral efficiency based on typical 64-states modulation scheme (e.g. 64QAM)
7	5H	Equipment with spectral efficiency based on typical 128-states modulation scheme (e.g. 128QAM)
8	6L	Equipment with spectral efficiency based on typical 256-states modulation scheme (e.g. 256QAM)
9	6H	Equipment with spectral efficiency based on typical 512-states modulation scheme (e.g. 512QAM)
10	7	Equipment with spectral efficiency based on typical 1 024-states modulation scheme (e.g. 1024QAM)
11	8	Equipment with spectral efficiency based on typical 2 048-states modulation scheme (e.g. 2048QAM)

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 adjacent channel co-polar (ACCP) operation and, in principle, whenever appropriate, also expandable to co-channel dual polarisation (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 can operate, on the same link, only in cross-polar adjacent channel (ACAP) operation only (see figure 1).

- subClass B: classes 5LB, 5HB, 6LB, 6HB, 7B and 8B can operate, on the same link, in ACCP operation and, in principle, whenever appropriate, also expandable to CCDP (see figure 1).

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 ETSI EN 302 217-4 [5], 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:

- adjacent channel separation alternatives (as provided by the relevant CEPT or Recommendation ITU-R) (see note 1);

- 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, including bandwidth-adaptive) (see note 2);

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

NOTE 1: This is intended as the "external" channel separation between emissions from different equipment working on certain channel arrangement; when *"channels-aggregation"* equipment are concerned, a further "internal" *aggregate* channels separation between the generated emissions will be identified, where needed in the present document.

NOTE 2: *Single- mode*, *preset-mode*, *mixed-mode*, *bandwidth-adaptive* and *channels-aggregation* systems are defined in clause 3.1 of ETSI EN 302 217-1 [4]; additional information on *Mixed-mode* systems can be found in annex P of the present document and in ETSI TR 103 103 [i.35].

1.4 Channel arrangements and utilization

Requirements for different bands are described in the individual annexes based on minimum channel separation (CS) in a single path application for a given spectral efficiency class in FDD technology. TDD specific requirements are stated as appropriate.

The possible channel arrangements may be:

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

For their illustration refer to figure 1.

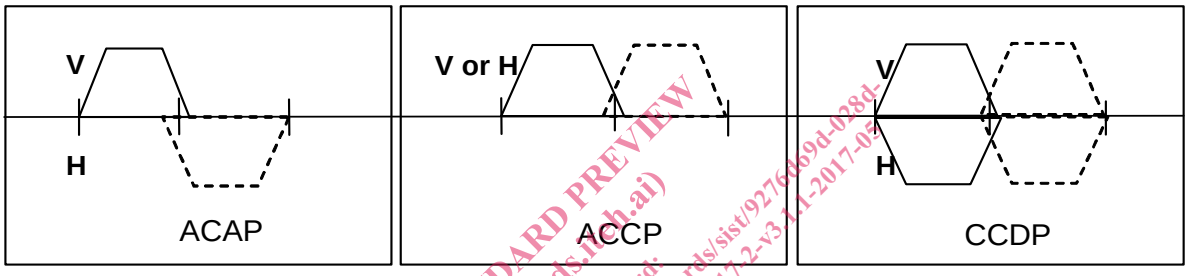

Figure 1: Examples of adjacent channel arrangements on the same route

1.5 Payload flexibility

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.

All baseband payload interfaces are possible provided that they met the overall minimum RIC required under the provisions of clause 4.1.2 and clause 4.1.3.

NOTE: Information on applicable base-band interfaces can be found in ETSI EN 302 217-1 [4].

1.6 Specific Requirements for frequency bands

The present document is intended to cover fixed radio equipment with antennas. *Integral* or *dedicated* antennas are considered for which all the technical requirements included in the present document apply and guidelines are given when *stand-alone antenna* are possibly used. Various antenna types definitions are found in ETSI EN 302 217-1 [4]; for more background information on the equipment and antenna parameters here identified as relevant to article 3.2 of Directive 2014/53/EU [i.1] see ETSI EG 203 336 [i.2] and ETSI 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 B: 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 B.2.

- Annex C: 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 C.2.

- Annex D: 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 D.2.

- Annex E: 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 E.2.

- Annex F: Frequency bands from 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 F.2.

- Annex G: Frequency bands from 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 G.2.

- Annex H: Frequency bands from 57 GHz to 66 GHz:
Systems with channel separations N × 50 MHz granularity up to 2 000 MHz, for minimum RIC payload rates ranging from about 28,5 Mbit/s up to about 3 000 Mbit/s. See detailed summary in table H.2.

- Annex I: Frequency band from 64 GHz to 66 GHz:
Systems with channel separations N × 50 MHz or N × 30MHz up to about 2 000 MHz for minimum RIC payload rates ranging from about 17 Mbit/s up to about 3 000 Mbit/s. See detailed summary in table I.2.

- Annex J: Frequency bands from 71 GHz to 76 GHz and 81 GHz to 86 GHz: Systems with channel separation ranging from 62,5 MHz to 2 000 MHz for minimum RIC payload rates ranging from about 35 Mbit/s up to about 3 000 Mbit/s. See detailed summary in table J.2.

In those annexes further subdivision is made, as appropriate, according to frequency bands, capacities and/or channel separation (see tables 2 and 3 of ETSI EN 302 217-1 [4]).

2 References

2.1 Normative 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.

The following referenced documents are necessary for the application of the present document.

[1] ETSI EN 301 126-1 (V1.1.2) (09-1999): "Fixed Radio Systems; Conformance testing; Part 1: Point-to-point equipment - Definitions, general requirements and test procedures".

[2] ETSI EN 301 126-3-1 (V1.1.2) (12-2002): "Fixed Radio Systems; Conformance testing; Part 3-1: Point-to-Point antennas; Definitions, general requirements and test procedures".