



**Fixed Radio Systems;
Characteristics and requirements for
point-to-point equipment and antennas;
Part 1: Overview, common characteristics and
system-independent requirements**

FINAL DRAFT
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Contents

Intellectual Property Rights	6
Foreword.....	6
Modal verbs terminology.....	6
1 Scope	7
2 References	7
2.1 Normative references	7
2.2 Informative references.....	10
3 Definitions, symbols and abbreviations	12
3.1 Definitions.....	12
3.2 Symbols.....	17
3.3 Abbreviations	18
4 Structure and applicability of the ETSI EN 302 217 series.....	20
4.1 Generality	20
4.2 Cross references to previously relevant ENs and TSs	21
4.3 Summary of system options provided	22
4.4 User's guide	25
5 General characteristics	27
5.1 Frequency bands and channel arrangements	27
5.2 Special compatibility requirements between systems	27
5.3 Transmission capacity and spectral efficiency.....	27
5.4 Performance and availability requirements.....	28
5.5 Environmental profiles	28
5.5.0 Introduction.....	28
5.5.1 Environmental profile declared under Directive 2014/53/EU	28
5.5.2 ETSI environmental profiles	28
5.5.2.0 Generality.....	28
5.5.2.1 Equipment intended for telecommunications applications installed in weather-protected locations (indoor locations)	29
5.5.2.2 Equipment intended for telecommunications applications installed in not-weather-protected locations (outdoor locations)	29
5.5.3 Test environment profiles	29
5.6 Power supply	29
5.6.0 Introduction.....	29
5.6.1 Power supply profile declared under Directive 2014/53/EU	30
5.6.2 ETSI power supply profile.....	30
5.7 System block diagram	30
6 Baseband interfaces and parameters.....	31
6.0 Introduction	31
6.1 Ethernet interfaces	31
6.2 Plesiochronous interfaces	31
6.3 Synchronous digital hierarchy interfaces	31
6.4 Other baseband data interfaces.....	31
7 Main requirements.....	32
7.0 Introduction	32
7.1 General requirements	32
7.1.1 System identification	32
7.1.2 System nominal loading.....	32
7.1.3 Environmental profile	32
7.2 Transmitter characteristics.....	33
7.2.1 Transmitter power and power tolerance.....	33
7.2.1.1 Maximum power and EIRP.....	33
7.2.1.2 Combined TX power and EIRP limits	33

7.2.1.3	Output power tolerance	33
7.2.2	Transmitter power and frequency control	34
7.2.2.1	Transmitter power control (ATPC and RTPC)	34
7.2.2.1.1	Automatic Transmitter Power Control (ATPC)	34
7.2.2.1.2	Remote Transmitter Power Control (RTPC)	34
7.2.2.2	Remote Frequency Control (RFC)	35
7.2.3	Radio Frequency (RF) spectrum mask	35
7.2.4	Discrete CW components exceeding the spectrum mask limit	35
7.2.4.1	Discrete CW components at the symbol rate	35
7.2.4.2	Other discrete CW components exceeding the spectrum mask limit	35
7.2.5	Unwanted emissions in the spurious domain - external	35
7.2.6	Dynamic change of modulation order	35
7.2.7	Radio frequency tolerance	35
7.2.8	Emission limitations outside the allocated band	35
7.3	Receiver characteristics	36
7.3.1	Unwanted emissions in the spurious domain - external	36
7.3.2	BER as a function of receiver signal level	36
7.3.3	Receiver selectivity	36
7.3.3.1	Introduction	36
7.3.3.2	Co-channel "external", first and second adjacent channel interference sensitivity	36
7.3.3.3	CW spurious interference (blocking and spurious response)	36
7.4	Antenna characteristics	36
8	Complementary requirements	37
8.0	Introduction	37
8.1	Branching/feeder requirements	37
8.1.1	Waveguide flanges (or other connectors)	37
8.1.2	Return loss of feeder/antenna systems at equipment antenna port (C/C' reference point)	38
8.2	Intermodulation products	38
8.3	Transmitter characteristics	39
8.3.1	Unwanted emissions - internal	39
8.3.2	Radio Frequency (RF) spectrum mask when mixed manufacturer compatibility is required	39
8.4	Receiver characteristics	40
8.4.1	Maximum input level and input level range	40
8.4.2	Unwanted emissions - internal	41
8.4.3	Image rejection	41
8.4.4	Innermost channel selectivity	42
8.5	System performance without diversity	42
8.5.1	Equipment Residual BER (RBER)	42
8.5.2	Distortion sensitivity	44
8.5.2.1	Introduction	44
8.5.2.2	Requirement	44
8.5.2.3	Assessment	45
8.5.3	Interference sensitivity for CCDP with XPIC operation	46
8.5.3.1	General	46
8.5.3.2	Co-channel "internal" interference sensitivity in flat fading conditions	46
8.6	System characteristics with diversity	46
8.6.0	Introduction	46
8.6.1	Differential delay compensation	46
8.6.2	BER performance	46
Annex A (normative):	Spectrum masks and receiver selectivity when mixed manufacturer compatibility is required	47
A.0	Introduction	47
A.1	TX masks assessment	48
A.2	Normal channels - Emission mask floor	48
A.2.1	RBER impact	48
A.2.2	Local TX to RX compatibility	48
A.2.2.1	Spectrum mask	48
A.2.2.2	Receiver selectivity	49

A.3	Innermost channels for channel arrangements from about 4 GHz to about 8,5 GHz with channel separation of 28 MHz to 30 MHz.....	49
A.3.0	Introduction	49
A.3.1	Innermost channels spectrum masks	49
A.3.2	Receiver innermost channel selectivity	51
A.4	Innermost channels for channel arrangements from about 4 GHz to 11 GHz with channel separation of 40 MHz.....	52
A.4.0	Introduction	52
A.4.1	Innermost channels spectrum masks	52
A.4.2	Receiver innermost channels selectivity.....	53
A.5	Innermost channels for 18 GHz channel arrangements with channel separation of 55 MHz	54
A.5.0	Introduction	54
A.5.1	Innermost channels spectrum masks	54
A.5.2	Receiver innermost channels selectivity.....	55
Annex B (normative):	Definition of equivalent data rates for packet data, PDH/SDH and other signals on the traffic interface.....	57
Annex C (informative):	Information on <i>Multi-channel</i> and <i>Channel-aggregation</i> differences and operation	58
Annex D (informative):	Additional information on relevant characteristics and operation.....	60
D.1	Residual Bit Error Ratio (RBER) and Residual Frame Error Ratio (RFER)	60
D.2	Measurement test set for XPI characteristics	61
D.3	Differential delay compensation range.....	62
D.4	FER/BER equivalence and FER performance measurement equipment settings (example).....	63
D.4.1	FER/BER equivalence.....	63
D.4.2	FER equipment settings and measurement techniques (example).....	64
D.5	Impact of power control (ATPC and/or RTPC), mixed-mode and bandwidth adaptive operation on spectrum mask and link design requirements.....	64
D.5.0	Introduction	64
D.5.1	ATPC and RTPC.....	64
D.5.1.1	ATPC	64
D.5.1.2	ATPC and RTPC implementation background.....	65
D.5.2	Mixed-mode and bandwidth adaptive operation impact.....	67
D.5.2.1	Mixed-mode basic concepts.....	67
D.5.2.2	Bandwidth adaptive	68
D.5.2.2.1	Basic concepts.....	68
D.5.2.2.2	Bandwidth (channel) occupancy	68
D.5.3	Impact on frequency coordination.....	68
D.5.4	Impact of operating conditions on "essential" parameters in article 3.2 of Directive 2014/53/EU	68
D.6	Typical interference sensitivity behaviour for frequency planning purpose	69
Annex E (informative):	Mechanical characteristics.....	70
Annex F (informative):	Mitigation techniques referred in ERC/DEC(00)07 (18 GHz band).....	71
Annex G (informative):	Change History	72
History		73

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Foreword

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

The present document is part 1 of a multi-part deliverable covering the Fixed Radio Systems; Characteristics and requirements for point-to-point equipment and antennas, as identified below (see note):

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

Part 2: "Digital systems operating in frequency bands from 1 GHz to 86 GHz; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU"

Part 4: "Antennas".

NOTE: In previous regulatory regime of harmonised standards under Directive 1999/5/EC more parts were published, which have been superseded since Directive 2014/53/EU [i.1] repealed Directive 1999/5/EC; they are:

Part 2-1: which technical content merged in the present document (Part 1);

Part 2-2: which technical content is merged in Part 2;

Part 3: which technical content is merged in Part 2 (with addition of a complete set of receiver parameters);

Part 4-1: which technical content is merged in Part 4;

Part 4-2: which technical content is merged in Part 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
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Modal verbs terminology

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1 Scope

The present document applies to Digital Fixed Radio Systems (DFRS) in point-to-point operation with integral and external antennas in the frequency range of 1 GHz to 86 GHz corresponding to the appropriate frequency bands 1,4 GHz to 86 GHz as described in ETSI EN 302 217-2 [18], annex B to annex J.

The present document summarizes:

- all characteristics, principles and, of utmost importance, terms and definitions that are common to all P-P equipment and antennas and its consultation is necessary when using all other parts of ETSI EN 302 217 series;
- 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 Directive 2014/53/EU [i.1] and further detailed in the Harmonised Standard ETSI EN 302 217-2 [18].
 - **Complementary requirements** are requirements that are not related to essential requirements under article 3.2 of Directive 2014/53/EU [i.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 manufacturer decision.

Technical background for most of the parameters and requirements referred to in this multi-part deliverable may be found in ETSI TR 101 036-1 [i.16].

Health and safety requirements, relevant to article 3.1a of Directive 2014/53/EU [i.1] are not considered in any part of this ETSI EN 302 217 series. CENELEC is responsible for the relevant standards.

EMC conditions and requirements, relevant to article 3.1b of Directive 2014/53/EU [i.1] and any other essential requirement relevant to article 3.3 of Directive 2014/53/EU [i.1] are not in the scope of any part of this ETSI EN 302 217 series. EMC requirements may be found in ETSI EN 301 489-1 [i.11] and ETSI EN 301 489-4 [i.12].

NOTE: A list of such harmonised standards is available on the web site <http://www.newapproach.org>.

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 referenced 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>.

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

- [1] CENELEC EN 122150: "Sectional Specification: Radio frequency coaxial connectors - Series EIA flange".
- [2] 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)".

- [3] 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".
- [4] 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".
- [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 300 019-2-1: "Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 2-1: Specification of environmental tests; Storage".
- [7] 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".
- [8] 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".
- [9] 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 weather protected locations".
- [10] 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 weather protected locations".
- [11] 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-weather protected locations".
- [12] 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-weather protected locations".
- [13] ETSI EN 300 132-2: "Environmental Engineering (EE); Power supply interface at the input to telecommunications and datacom (ICT) equipment; Part 2: Operated by -48 V direct current (dc)".
- [14] ETSI EN 300 132-3: "Environmental Engineering (EE); Power supply interface at the input to telecommunications equipment; Part 3: Operated by rectified current source, alternating current source or direct current source up to 400 V".
- [15] ETSI EN 301 126-1: "Fixed Radio Systems; Conformance testing; Part 1: Point-to-Point equipment - Definitions, general requirements and test procedures".
- [16] ETSI EN 302 099: "Environmental Engineering (EE); Powering of equipment in access network".
- [17] ETSI EN 301 126-3-1: "Fixed Radio Systems; Conformance testing; Part 3-1: Point-to-Point antennas; Definitions, general requirements and test procedures".
- [18] ETSI EN 302 217-2 (V3.1.0): "Fixed Radio Systems; Characteristics and requirements for point-to-point equipment and antennas; Part 2: Digital systems operating in frequency bands from 1 GHz to 86 GHz; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU".
- [19] ETSI EN 302 217-4 (V2.0.3): "Fixed Radio Systems; Characteristics and requirements for point-to-point equipment and antennas; Part 4: Antennas".

- [20] 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".
- [21] 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".
- [22] IEEE 802.3-2012™: "IEEE Standard for Ethernet".
- [23] Recommendation ITU-R F.746: "Radio-frequency arrangements for fixed service systems".
- [24] Recommendation ITU-R F.1668: "Error performance objectives for real digital fixed wireless links used in 27 500 km hypothetical reference paths and connections".
- [25] Recommendation ITU-R F.1703: "Availability objectives for real digital fixed wireless links used in 27 500 km hypothetical reference paths and connections".
- [26] Recommendation ITU-R P.530: "Propagation data and prediction methods required for the design of terrestrial line-of-sight systems".
- [27] Recommendation ITU-T G.703: "Physical/electrical characteristics of hierarchical digital interfaces".
- [28] Recommendation ITU-T G.704: "Synchronous frame structures used at 1544, 6312, 2048, 8448 and 44 736 kbit/s hierarchical levels".
- [29] Recommendation ITU-T G.707: "Network node interface for the synchronous digital hierarchy (SDH)".
- [30] Recommendation ITU-T G.708: "Sub-STM-0 network node interface for the synchronous digital hierarchy (SDH)".
- [31] Recommendation ITU-T G.826: "End-to-end error performance parameters and objectives for international, constant bit-rate digital paths and connections".
- [32] Recommendation ITU-T G.828: "Error performance parameters and objectives for international, constant bit-rate synchronous digital paths".
- [33] Recommendation ITU-T G.829: "Error performance events for SDH multiplex and regenerator sections".
- [34] Recommendation ITU-T G.957: "Optical interfaces for equipment and systems relating to the synchronous digital hierarchy".
- [35] Recommendation ITU-T I.356: "B-ISDN ATM layer cell transfer performance".
- [36] Recommendation ITU-T I.357: "B-ISDN semi-permanent connection availability".
- [37] Recommendation ITU-T O.151: "Error performance measuring equipment operating at the primary rate and above".
- [38] Recommendation ITU-T O.181: "Equipment to assess error performance on STM-N interfaces".
- [39] Recommendation ITU-T O.191: "Equipment to measure the cell transfer performance of ATM connections".
- [40] Recommendation ITU-T V.11: "Electrical characteristics for balanced double-current interchange circuits operating at data signalling rates up to 10 Mbit/s".
- [41] Recommendation ITU-T V.24: "List of definitions for interchange circuits between data terminal equipment (DTE) and data circuit-terminating equipment (DCE)".
- [42] Recommendation ITU-T V.28: "Electrical characteristics for unbalanced double-current interchange circuits".

- [43] Recommendation ITU-T Y.1540: "Internet protocol data communication service - IP packet transfer and availability performance parameters".

2.2 Informative 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 referenced document (including any amendments) applies.

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

- [i.1] Directive 2014/53/EU of the European Parliament and of the Council of 16 April 2014 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.2] ETSI TR 101 035: "Transmission and Multiplexing (TM); Synchronous Digital Hierarchy (SDH) aspects regarding Digital Radio Relay Systems (DRRS)".
- [i.3] 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.4] CEPT/ERC/REC 12-03: "Harmonized radio frequency channel arrangements for digital terrestrial fixed systems operating in the band 17,7 GHz to 19,7 GHz".
- [i.5] Void.
- [i.6] CEPT/ECC/REC(02)06: "Channel arrangements for digital Fixed Service Systems operating in the frequency range 7 125-8 500 MHz".
- [i.7] CEPT/ECC/REP 80: "Enhancing harmonisation and introducing flexibility in the spectrum regulatory framework".
- [i.8] CEPT/ECC/REP 198: "Adaptive modulation and ATPC operations in fixed point-to-point systems - Guideline on coordination procedures".
- [i.9] CEPT/ERC/REC 14-01: "Radio-frequency channel arrangements for high capacity analogue and digital radio-relay systems operating in the band 5 925 MHz - 6 425 MHz".
- [i.10] CEPT/ERC/REC 14-02: "Radio-frequency channel arrangements for high, medium and low capacity digital fixed service systems operating in the band 6 425-7 125 MHz".
- [i.11] ETSI EN 301 489-1: "ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements; Harmonised Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU and the essential requirements of article 6 of Directive 2014/30/EU".
- [i.12] ETSI EN 301 489-4: "ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 4: Specific conditions for fixed radio links and ancillary equipment; Harmonised Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU".
- [i.13] ETSI EN 302 217-1 (V2.1.1): "Fixed Radio Systems; Characteristics and requirements for point-to-point equipment and antennas; Part 1: Overview and system-independent common characteristics".
- NOTE: Previous superseded version of the present document not applicable in Directive 2014/53/EU [i.1] regime.
- [i.14] Void.
- [i.15] ETSI EN 300 119 (all parts): "Environmental Engineering (EE); European telecommunication standard for equipment practice".

- [i.16] 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.17] ETSI TR 101 506 (V2.1.1): "Fixed Radio Systems; Generic definitions, terminology and applicability of essential requirements covering article 3.2 of Directive 2014/53/EU to Fixed Radio Systems".
- [i.18] 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.19] 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.20] IEC 60153-2: "Hollow metallic waveguides. Part 2: Relevant specifications for ordinary rectangular waveguides".
- [i.21] IEC 60154-2: "Flanges for waveguides. Part 2: Relevant specifications for flanges for ordinary rectangular waveguides".
- [i.22] IEC 60169-1: "Radio-frequency connectors. Part 1: General requirements and measuring methods".
- [i.23] IEC 60339 (all parts): "General purpose rigid coaxial transmission lines and their associated flange connectors".
- [i.24] 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.25] 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.26] Recommendation ITU-R F.385-10: "Radio-frequency channel arrangements for fixed wireless systems operating in the 7 110-7 900 MHz band".
- [i.27] 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.28] Recommendation ITU-R F.750: "Architectures and functional aspects of radio-relay systems for synchronous digital hierarchy (SDH)-based network".
- [i.29] Void.
- [i.30] Recommendation ITU-R F.752: "Diversity techniques for point-to-point fixed wireless systems".
- [i.31] Recommendation ITU-R F.1093: "Effects of multipath propagation on the design and operation of line-of-sight digital fixed wireless systems".
- [i.32] Recommendation ITU-R F.1101: "Characteristics of digital fixed wireless systems below about 17 GHz".
- [i.33] Recommendation ITU-R F.1102: "Characteristics of fixed wireless systems operating in frequency bands above about 17 GHz".
- [i.34] Recommendation ITU-R F.1191: "Bandwidths and unwanted emissions of digital fixed service systems".
- [i.35] Void.
- [i.36] Recommendation ITU-T G.783: "Characteristics of synchronous digital hierarchy (SDH) equipment functional blocks".
- [i.37] Recommendation ITU-T G.784: "Management aspects of the synchronous digital hierarchy (SDH) transport network element".

- [i.38] Recommendation ITU-T I.414: "Overview of Recommendations on layer 1 for ISDN and B-ISDN customer accesses".
- [i.39] The Radio Regulations, Edition of 2016.
- [i.40] J. Redd: "Calculating Statistical Confidence Levels for Error-Probability Estimates" Lightwave Magazine, pp. 110-114, April 2000 (see note).

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 and of the other ETSI EN 302 217 series parts (i.e. part 2 [18] and part 4 [19]), the terms and definitions given in Directive 2014/53/EU [i.1] and the following apply:

aggregated channel: one of the two channels used in "channel-aggregation" equipment

NOTE: There is no relationship with the "aggregation" terminology used in some ITU-R and ECC recommendations on radio frequency channel arrangements; there, the "aggregation" of contiguous channels is used for determine wider channels positions.

allocated radio frequency band: Derived from the definition of "allocation (of a frequency band)" (Radio Regulations [i.39], article 1.16): "entry in the Table of Frequency Allocations of a given frequency band for the purpose of its use by one or more terrestrial or space radiocommunication services or the radio astronomy service under specific conditions. This term is also applicable to the frequency band concerned"

NOTE: From the regulatory point of view three different applications might be envisaged and used in the whole allocated band or in its dedicated segments:

- **Frequency band where frequency co-ordination is applied:** in these bands, in the licensing process, regulatory bodies enforce co-ordination rules to ensure that all links work on an "acceptable interference" bases.
- **Frequency band where frequency co-ordination is not applied:** in these bands, irrespective of any licensing process or with no licensing at all, the deployment is freely made by the user on a "first on-first served" bases without any warrantee of "acceptable interference" from the regulatory body.
- **Frequency band where self-coordination is applied:** in these bands an approach similar to the "light licensing", described in ECC Report 80 [i.7], is used. Such regimes do not mean "licence exempt" use, but rather using a simplified set of conventional licensing mechanisms and attributes within the scope decided by the administration. This planning is delegated to the licensee.

antenna: part of the transmitting or receiving system that is designed to radiate and/or receive electromagnetic waves

Automatic Transmit Power Control (ATPC): function implemented to offer a dynamic power control that delivers maximum power only during deep fading; in this way for most of the time the interference is reduced and the transmitter operates in a higher linearity mode

NOTE: When this function is used, the transmit power is dynamically changed with respect to the propagation conditions. In principle, when ATPC is implemented, three different levels of power may be identified:

- **maximum available power** (delivered, when licensing conditions permits it, only in conditions of deep fading);
- **maximum nominal power** (useable on a permanent basis when ATPC is disabled); it should be noted that this power is "nominal for the equipment" and is not to be confused with the "nominal level set link by link" by the frequency co-ordinating body. This is achieved through the use of the RTPC function or passive RF attenuators;

- **minimum power** (delivered in unfaded conditions).

Maximum nominal and maximum available power levels may be coincident or, in case of multi-state modulation formats, the maximum available power may be used to overdrive the transmitter (loosing linearity but gaining fade margin when the fade conditions have already impaired the expected RBER). Performance predictions are usually made with the maximum "available power".

More detailed information on ATPC operation can be found in ETSI TR 103 103 [i.19].

bandwidth adaptive systems: system, the capacity of which may be dynamically changed by means of bandwidth reduction during adverse propagation conditions

block assignment: application of block of spectrum assigned to one or more stations of an operator under a single exclusive licence

channels-aggregation: equipment where two radio channels (*aggregated channels*) are transmitted/received by the same radio equipment

NOTE 1: Under this category different applications are possible, to which the following more detailed definitions apply:

- 1) **channels-aggregation (single-band):** where the two *aggregated-channels* operate on the same or overlapping bands (see note 2).

NOTE 2: The two bands can also be contiguous provided that their requirements are included in the same frequency specific annex of ETSI EN 302 217-2 [18] (see also annex O.1 of ETSI EN 302 217-2 [18]).

- 2) **channels-aggregation (dual-band):** where the two *aggregated-channels* operate on non-contiguous bands.
- 3) **channels-aggregation/dual-port (equipment):** equipment where the payload capacity is transmitted through the same radio equipment at two different antenna ports over two different (in frequency and/or in polarization and/or direction) assigned radio frequency channels (see annex C) in the same or different frequency bands.
- 4) **channels-aggregation/single-port (equipment):** equipment where the payload capacity is transmitted from the same radio equipment and antenna port over two different assigned frequency channels (see annex C) in the same or different frequency bands.

channel separation (CS): distance between adjacent channels in a radio frequency channels arrangement; it represents one of the major parameter for the identification of the radio equipment use and relevant requirements

co-polar radiation pattern: diagram representing the radiation pattern of a test antenna when the reference antenna is similarly polarized, scaled in dBi or dB relative to the measured antenna gain

cross-Polar Discrimination (XPD): difference in dB between the co-polarized main beam gain and the cross-polarized one, measured within a defined angular region

cross-polar radiation pattern: diagram representing the radiation pattern of a test antenna when the reference antenna is orthogonally polarized, scaled in dBi or dB relative to the measured antenna gain

dedicated antenna: antenna specifically designed for being attached to the radio equipment (i.e. with special mechanical fixing to the antenna port of the specific radio supplied), but can be separated from the equipment (typically for transport purpose) using normal tools

environmental profile: range of environmental conditions under which equipment within the scope of the ETSI EN 302 217 series is required to comply with the provisions of the ETSI EN 302 217 series

essential characteristic: radio frequency characteristic related to the essential requirements under article 3.2 of Directive 2014/53/EU [i.1] that is capable of expression in terms of quantifiable technical essential parameters

frequency band: band of frequencies over which the performance characteristics of the equipment/antenna are set within specified limits