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

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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 1 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: "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";

Part 3: "Equipment operating in frequency bands where both frequency coordinated or uncoordinated deployment might be applied; Harmonized EN covering the essential requirements of article 3.2 of the R&TTE";

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

Part 4-2: "Antennas; Harmonized EN covering the essential requirements of article 3.2 of R&TTE Directive".

National transposition dates	
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Major variants with respect to previous published version

- System options identification has been changed, in line with corresponding changes in Parts 2-1 [i.33] and 2-2 [i.34] of EN 302 217. Old systems notations (A.1, … B.1, … C.1, … D.1, … E.1 ….) have been removed and the system capacity is defined in term of minimum Radio Interface Capacity (RIC) rather than previous hierarchic PDH/SDH interfaces. Each equipment in the scope of the present document refers to a coherent set of transmitter and receiver requirements uniquely defined on the basis of the following identifying parameters:

  1) operating frequency band;

  2) operating radio frequency channel separation;

3) spectral efficiency class, to which the minimum RIC density is associated.

- Cross reference to older "historical" source ENs, no longer of interest has been moved to an annex.
- Required new and updated "definitions".
- Alignment of frequency bands and equipment options introduced in other parts of EN 302 217 series.

Introduction

(i) Generality and historical background

Digital Fixed Radio Systems (DFRS), used in European countries, had been historically specified in a relatively large number of specific European Norms produced by ETSI.

Those previous documents, already superseded by first version of this EN 302 217 series, contained both essential requirements and other requirements that, even if not considered essential under 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 (hereafter mentioned as the R&TTE Directive) [1], may be applicable.

Standards for point-to-point systems, including antennas, cover a very large range of traffic capacities, channel separations (CS), modulation formats and applications over a very wide range of frequency bands that are summarized in table 1.

Table 1: Digital Fixed Radio Systems (DFRS) parameters

Parameter	Range
Frequency bands	from 1 GHz to 86 GHz
Traffic capacities	from 9,6 kbit/s to 622 Mbit/s and to Gigabit/s and above in the highest bands
Channel separations	from 25 kHz to 112 MHz and to Gigahertz and above in the highest bands
Modulation formats	from 2 to 2 048 states (amplitude and/or phase and/or frequency modulated states)
Typical applications	**POINT-TO-POINT (P-P) CONNECTIONS:** rural and urban low/medium/high capacity links for mobile infrastructure, transport/trunk (long haul), FWA/BWA/MWA backhaul, access, governmental (non-military) links, private fixed networks, SAP/SAB P to P audio and video links **STAND ALONE ANTENNAS:** for all of the above applications when integral antennas are not employed

The regulatory framework for placing radio systems on the market, established by the R&TTE Directive [1] also requires the availability of Harmonized ENs covering the essential requirements under article 3.2 of the R&TTE Directive [1]. EN 302 217 series meet this demand by providing a rational subdivision of requirements into general, system dependent "not essential" and "essential" requirements from the perspective of the R&TTE Directive [1].

Part 1 includes system-independent common characteristics; these requirements are not essential under article 3.2 of the R&TTE Directive [1].

EN 302 217-2-2 [i.34], EN 302 217-3 [i.35] and EN 302 217-4-2 [i.37] are relevant to essential requirements under article 3.2 of the R&TTE Directive [1]. Additional system can be added for new available FS bands and for completing market available options.

In the present document, equipment is grouped into families of either similar frequency bands or applications. Five families are identified for frequency bands where frequency co-ordination is applied, corresponding, in both EN 302 217-2-1 [i.33] and EN 302 217-2-2 [i.34], to annexes referenced from A to E and one family associated with applications of packet data and combination of other signals mapped into proprietary transport modules, detailed in annex F.

A frequency bands from 1,4 GHz to 2,7 GHz;

B frequency bands from 3 GHz to 11 GHz (channel separation around 60 MHz and from 1,75 MHz up to around 30 MHz);

C frequency bands from 3 GHz to 11 GHz (channel separation 40 MHz);

D frequency bands 13 GHz, 15 GHz and 18 GHz;

E frequency bands from 23 GHz to 55 GHz;

Ea frequency bands from 71 GHz to 76 GHz and 81 GHz to 86 GHz (additional requirements when link-by-link coordination is applied);

F definition of equivalent data rates for packet data, PDH/SDH and other signals on the traffic interface.

In the same way EN 302 217-3 [i.35] three families are identified for frequency bands where either co-ordinated or uncoordinated deployment might be applied (see note), corresponding to annexes referenced from UA to UC.

UA frequency band from 57 GHz to 59 GHz;

UB frequency band from 64 GHz to 66 GHz;

UBa frequency band from 57 GHz to 66 GHz (alternative, in overlapping bands, to UA and UB);

UC frequency bands from 71 GHz to 76 GHz and 81 GHz to 86 GHz.

NOTE: In these bands, CEPT administrations might have different views on the licensing and deployment requirements, ranging among uncoordinated, user self coordination (sometimes called "light licensing") or conventional link-by-link coordination. Therefore, from R&TTE Directive [1] point of view, the minimum of characteristics are considered among essential requirements, unless there is clear evidence that link-by-link coordination is the predominant method and additional requirements are consequently defined in EN 302 217-2-2 [i.34]; in this case, the supplier may chose between a "minimal" or a more complete assessment according the extension of the market addressed.

(ii) Cross references to previously relevant ENs and TSs

The EN 302 217 series replaced and superseded a number of older standards (frequency and/or capacity oriented), which remained, only as "historical" documents, in the ETSI data base. Provided that they may still be referenced in some documentation, annex C provides, for information, an overview of the correspondence between equipment considered in those standards and part/annexes in the present document.

Table 2: Void

(iii) Summary of system options provided

A number of options for equipment implementation are identified in EN 302 217 series; the set of characteristics applicable to each option is uniquely identified through three parameters:

- operating frequency band;
- operating radio frequency channel separation (CS);
- spectral efficiency class (as defined in EN 302 217-2-2 [i.34]).

Each option so identified has a "nominal" payload requirement in term of minimum RIC (Radio Interface Capacity) to be fulfilled when packet payloads are used (e.g. Ethernet, ATM, etc.); in case PDH/SDH traffic are alternatively provided, annex F of EN 302 217-2-2 [i.34] gives the translation from the minimum RIC to the minimum hierarchic interfaces.

Table 3 summarizes the relevant cross-reference between channel separation in various Fixed Service frequency bands and the available options of equipment provided in EN 302 217 series. They are shown in term of the minimum RIC payload, which, depending on the channel separation, correspond to a specific spectral efficiency class detailed in clause 1.2 of EN 302 217-2-2 [i.34] (identified, with increasing spectral efficiency, as classes 1, 2, 3, 4L, 4H, 5L, 5H, 6L, 6H 7 and 8). In classes from 5 to 8, two further sub-classes suffix (i.e. A and B) are provided for the same channel separation depending on whether ACAP or CCDP operation is, respectively, considered for the equipment use.

The minimum RIC payload in tables 3a and 3b are the minimum required for conformance to the present document and are based on the "minimum RIC density" defined, for each spectral efficiency class, in clause 1.2 of EN 302 217-2-2 [i.34]. 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 standardised interfaces. Mapping/multiplexing of the various base-band interfaces into common frame(s) suitable for radio transmission may be done using standardised higher hierarchical frames or other proprietary methods.

Tables F.1a through F.1h in annex F of EN 302 217-2-2 [i.34] summarise 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.

The cells in tables 3a and 3b are filled only on the basis of available physical single equipment transmission capacity (up to a minimum RIC of 862 Mbit/s for class 8 systems), which is relevant for R&TTE Directive [1] Art. 3.2 assessment. Doubled capacity is, in principle, possible for any option using CCDP operation or, more in general, subdividing the payload over two channels; however, specific test procedures are provided in EN 302 217-2-2 [i.34] only for STM-4 interface or other high speed data interfaces when their payload is split over more than one equipment.

Table 3a: Cross reference of available equipment and antenna requirements in parts and annexes of EN 302 217 series: Bands from 1,4 GHz to 18 GHz

EN 302 217 series																
Common requirements ⇨		**Part 1 (present document) (System independent common characteristics)**														
Antenna requirements ⇨		**Part 4-1 (Antenna general and complementary requirements) and Part 4-2 (HS for R&TTED Art. 3.2 Antenna characteristics)**														
Equipment requirements ⇨		**Part 2-1 (system-dependent complementary characteristics) and Part 2-2 (HS for R&TTED Art. 3.2 equipment characteristics)**														
Relevant annex in Part 2-1 and Part 2-2 ⇨		**A**					**B or D**									**C**
Frequency band (GHz)⇨		1,4; 2,4	2,1; 2,6	1,4; 2,1; 2,6	2,1; 2,6		**Annex B** : 3,5 ; 4 ; U4 ; L6 ; U6 ; 7 ; 8 ; 10,5 ; 11 **Annex D** : 13 ; 15 ; 18								**Annex B :** U6	4, U4, U6, 8, 11
Minimum RIC (Mbit/s) provided with relevant equipment characteristics	**Channel separation (MHz) ⇨**	CS < 1,75 and 2	1,75	3,5	7	14	1,75	3,5	7	13,75 / 14 / 15	27,5 / 28 / 29 / 29,65 / 30	55 / 56 / 58 / 59,3 / 60	110 (note 1)	20	40
	Spectral efficiency ⇩														
	Reference index ⇩ / **Class ⇩**														
	1 / **1**	(note 2)		2											
	2 / **2**	(note 2)	2	4	8	16	2	4	8	16	32	64	128		
	3 / **3**						3	6	12	24	48	96	191		
	4 / **4L**	(note 2)	4	8	16	32	4	8	16	32	64	128	256	45	
	5 / **4H**							sSTM-14 (*)	24	49	98	196	392		
	6 / **5L**								29	58					
	6 / **5LA, 5LB**										117	235	470		168
	7 / **5H**							sSTM-22 (*)	34	68					
	7 / **5HA, 5HB**										137	274 (**)	548		137 (***) 196
	8 / **6L**								39	78					
	8 / **6LA, 6LB**										156	313	627		224
	9 / **6H**									88					
	9 / **6HA, 6HB**										176	352	705		252 (**)
	10 / **7**									98					
	10 / **7A, 7B**										196	392	784		280
	11 / **8**									107					
	8A, 8B										215	431	862		308
Equivalent capacity for hierarchic-only systems		Annex F of parts 2-1 [i.33] and 2-2 [i.34]														

NOTE 1: CS 110 MHz available only in 18 GHz band.
NOTE 2: For channel separations of 2 MHz and other various smaller than 1,75 MHz, only typical "gross bit rates" are defined.
(*): These systems are intended only for the transport of subSTM-0 capacities only in 18 GHz band.
(**): STM-4 capacity as combination of two 2 x STM-1 equipment operating on two channels in ACAP or CCDP or even non adjacent operation is also described.
(***): Minimum RIC 137 Mbit/s option is special provision only for commonality of use of 5HB/28 MHz like equipment modulation also into 40 MHz channel arrangements.

Table 3b: Cross reference of available equipment and antenna requirements in parts and annexes of EN 302 217 series: Bands from 23 GHz to 80 GHz

EN 302 217 series																							
Common requirements ⇨			Part 1 (present document) (System independent common characteristics)																				
Antenna requirements ⇨			Part 4-1 (Antenna general and complementary requirements) and Part 4-2 (HS for R&TTED Art. 3.2 Antenna characteristics)																				
Equipment requirements ⇨			Part 2-1 (system-dependent complementary characteristics) and Part 2-2 (HS for R&TTED Art. 3.2 equipment characteristics)																		Part 3 (R&TTED Art. 3.2 equipment characteristics)			
Relevant annex Part 2-2 ⇨			E											Ea (note 1)							UA	UB	UBa	UC
Frequency band (GHz) ⇨			23, 26, 28, 31, 32, 38, 42						50, 52, 55					71 to 76 and 81 to 86 (note 1)							57 to 59	64 to 66	57 to 66 (note 2)	71 to 76 81 to 86
Minimum RIC (Mbit/s) provided with relevant equipment characteristics	Spectral efficiency ⇩		Channel separation (MHz)						Channel separation (MHz)					Channel separation (MHz)							Channel size free or multiple of predefined slots			
	Reference index ⇩	Class ⇩	3,5	7	14	28	56	112	3,5	7	14	28	56	250	500	750	1 000	1 250	1 500	1 750	2 000			
	1	1							2	4(***)	8(***)	16(***)	32(***)	142	285	427	570	712	855	997	1 140	See minimum spectral efficiency reported in the annexes.		
	2	2	4(**)	8	16	32	64	128	4	8	16	32	64(***)	285	570	855	1 140(*)	1 425	1 710	1 995	2 280			
	3	3	6(**)	12	24	48	96	191	6	12	24	48	96(***)	425	850	1 275	1 700	2 125(*)	2 550	2 975	3 400			
	4	4L	8(**)	16	32	64	128	256		16	32	64	128(***)	570	1 140(*)	1 710	2 280(*)	2 850						
	5	4H		24	49	98	196	392						875	1 750	2 625								
	6	5L		29	58																			
	6	5LA, 5LB				117	235	470						1 050(*)	2 100(*)	3 150(*)								
	7	5H		34	68																			
	7	5HA, 5HB				137	274 (****)	548						1 225	2 450									
	8	6L		39	78																			
	8	6LA, 6LB				156	313	627						1 400	2 800									
	9	6H			88																			
	9	6HA, 6HB				176	352	705																
	10	7			98																			
	10	7A, 7B				196	392	784																
	11	8			107																			
	11	8A, 8B				215	431	862																
Equivalent capacity for hierarchic only systems			Annexes F of parts 2-1 and 2-2																				

NOTE 1: Requirements for the bands 71 GHz to 76 GHz and 81 GHz to 86 GHz in annex Ea of Part 2-2 [i.34] are "additional" to those reported in annex UC of Part 3 [i.35].
NOTE 2: Alternative, in overlapping bands, to annexes UA and UB.
(*): RIC rounded down to closest N × 1 Gbit/s rate shall also be considered valid.
(**) Not provided in 42 GHz band.
(***): Not provided in 50 GHz band.
(****): STM-4 capacity as combination of two 2 x STM-1 equipment operating on two channels in ACAP or CCDP or even non adjacent operation is also described.

(iv) User's guide

The requirements applicable to a specific point to point digital fixed radio systems (including its antenna) are summarised in figure 0 showing the major structure of the whole EN 302 217 series. The requirements are subdivided across the six parts of the EN series corresponding to their four major categories.

The first category (the present document) corresponds to "common" system independent characteristics which are either common to the whole family of equipment, i.e. performance and availability, environmental profiles, power supply, system block diagram, TMN interface, mechanical characteristics and baseband interfaces and parameters. The symbols and abbreviations, which apply to the EN 302 217 series, are listed in the present document. The present document defines those requirements and characteristics set out in the other parts of EN 302 217 series.

The second category (found in EN 302 217-2-1 [i.33] and EN 302 217-4-1 [i.36]) corresponds to "complementary" characteristics and requirements, which are not relevant to article 3.2 of the R&TTE Directive [1] but may guarantee better performance to the actual deployed links. Therefore, the supplier may wish to claim compliance to all or some of these requirements for showing enhanced characteristics of its product.

However, for completeness, EN 302 217-2-1 [i.33] and EN 302 217-4-1 [i.36] provide comprehensive description of the "main" and "complementary" requirements, for equipment operating in co-ordinated frequency bands and for "antennas".

Main requirements are requirements that are also related to the "essential requirements" under article 3.2 of the R&TTE Directive [1] and are further detailed in EN 302 217-2-2 [i.34], for equipment operating in co-ordinated frequency bands, and EN 302 217-4-2 [i.37], for antennas.

Complementary requirements are requirements that are not related to essential requirements under article 3.2 of the R&TTE Directive [1]. Nevertheless they are considered, having 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 made on a voluntary basis.

The limits for main and complementary requirements that are not common or parameterized for all of the equipment covered by one part, but specific to one frequency range, one RIC or PDH/SDH capacity, etc., are located in annexes.

The third category (EN 302 217-2-2 [i.34] and EN 302 217-4-2 [i.37]) is for equipment intended for frequency bands where link-by-link radio frequency coordination (either under administration control or required to the users in licensing procedure) over a specific radio frequency channels arrangement is generally used; it corresponds to essential phenomena, with respect to article 3.2 of the R&TTE Directive [1] and are consequently defined in harmonized standards. In this case a complete set of TX and RX parameters is retained essential and requirements are provided in the same format as in EN 302 217-2-1 [i.33] and EN 302 217-4-1 [i.36]. The limiting values associated with the essential requirements which are not common to all of the equipment covered by one part, but specific to one frequency range, one RIC or PDH/SDH capacity, etc, are located in annexes. Reference to each annex is the same for EN 302 217-2-1 [i.33] as in EN 302 217-2-2 [i.34]. An HS-RTT (requirements table) summarizes those requirements to be addressed in order to claim compliance.

The fourth category (EN 302 217-3 [i.35] and still EN 302 217-4-2 [i.37]) is for equipment intended for frequency bands where, for their propagation or regulatory nature, the conventional link-by-link radio frequency coordination is not generally used and a number of administrations may also apply less restrictive (and less protecting) regulatory measures. It still corresponds to essential phenomena, with respect to article 3.2 of the R&TTE Directive [1] and are consequently defined as harmonized standards. In this case a reduced set of TX and RX parameters is retained essential; however, when the coordinated deployment is considered predominant, additional set of requirements is further included in EN 302 217-2-2 [i.34] and the supplier may chose between the "minimal" or the more complete assessment according the extension of the market addressed.

To conclude, EN 302 217 series will be used as a decision tree, from the present document down to the relevant annexes/sub-annexes of parts EN 302 217-2-1 [i.33], EN 302 217-2-2 [i.34] and EN 302 217-3 [i.35].
At every level, a check of compliance is recommended to be performed.