

**Fixed Radio Systems;
Characteristics and requirements for
point-to-point equipment and antennas;
Part 3: Harmonized EN covering essential requirements
of Article 3.2 of R&TTE Directive for equipment operating in
frequency bands where simplified or no frequency
co-ordination procedures are applied**



Reference

REN/ATTM-04001

Keywords

DFRS, digital, DRRS, FWA, point-to-point, radio,
regulation, transmission, antenna

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Sous-Préfecture de Grasse (06) N° 7803/88

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Foreword

This Harmonized European Standard (Telecommunications series) has been produced by ETSI Technical Committee Access, Terminals, Transmission and Multiplexing (ATTM), and is now submitted for the ETSI standards One-step Approval Procedure.

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").

Technical specifications relevant to Directive 1999/5/EC are given in annex A.

The present document is part 3 of a multi-part deliverable covering 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 simplified or no frequency co-ordination procedures are 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".

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

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 [7].

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 and shown in figure 1.

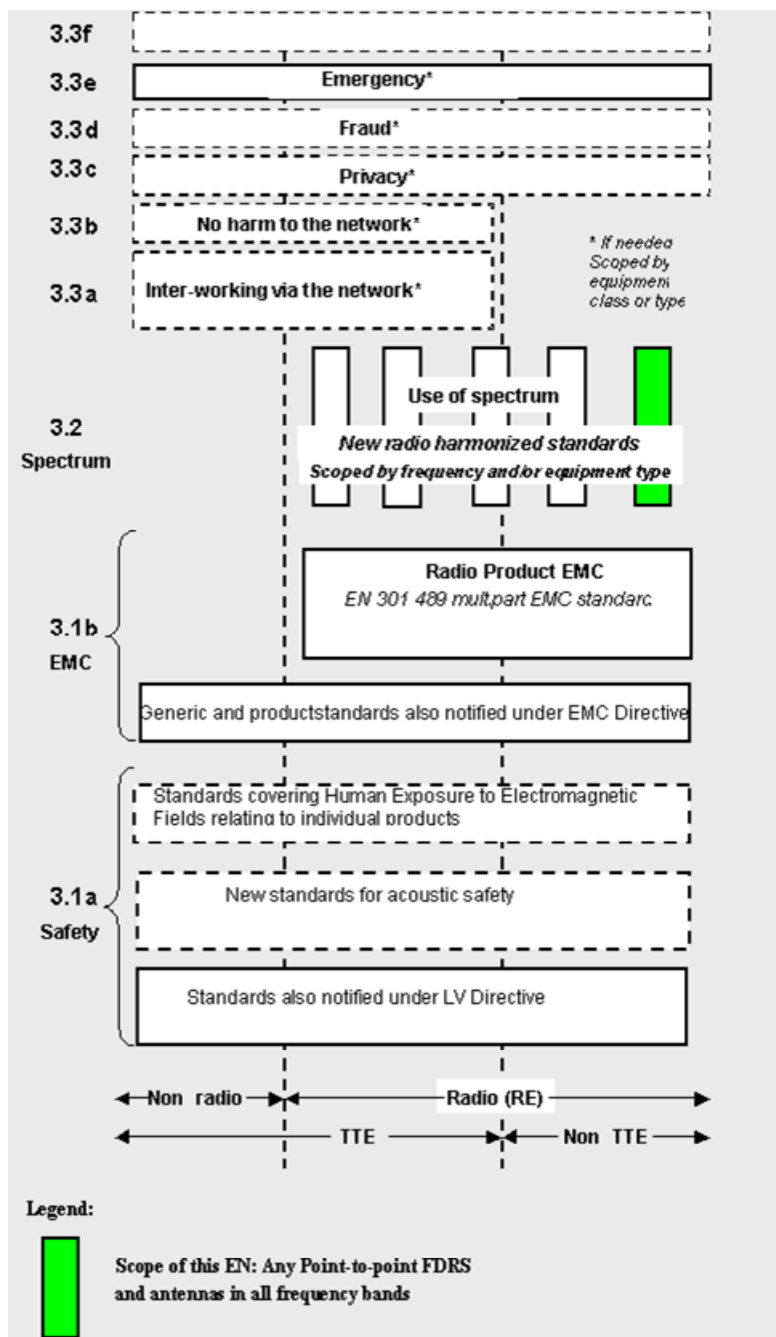


Figure 1: Modular structure for the various standards used under the R&TTE Directive

NOTE: For article 3.1b the diagram shows EN 301 489 [16], the multi-part product EMC standard for radio used under the EMC Directive 89/336/EEC [17]. For Fixed Radio Systems EN, EN 301 489-1 [18] and EN 301 489-4 [19] are relevant.

1 Scope

The present document specifies the essential requirements for point-to-point Digital Fixed Radio Systems (DFRS) operating in higher frequency bands, which might not require detailed link-by-link co-ordinated frequency planning; this imply either no co-ordination at all (i.e. the band usage is free and the user is responsible for detecting a suitable interference-free operating frequency) or simplified co-ordination procedures implying the knowledge of existing links (e.g. through a public national database) so that the impact of a possible new link could be evaluated on the basis of budgetary considerations of typical equipment receiver parameters (which will not be considered related to essential requirements of art 3.2 R&TTE Directive [1]). It is intended to cover the provisions of Directive 1999/5/EC [1] (R&TTE Directive) 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 [20] and that are technically equivalent or less stringent requirements. Therefore, from a strictly technical point of view, it is expected that equipment already conforming to the previous EN 301 751 [20] or previous versions of the present harmonized standard, would not need a new test report for re-assessment of essential requirements according this new multi-part deliverable; however, legal implications with respect to the declaration of conformity and equipment labelling are not in the scope 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: A list of such ENs is included on the web site <http://www.newapproach.org/>.

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 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 Recommendation);
- implemented procedure for free radio channel selection;
- antenna directivity class alternatives (for different network density requirement).

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 see EG 201 399 [15] and TR 101 506 [21].

For example, the frequency band 58 GHz is proposed to be used by various technologies for uncoordinated use of the band. Besides the RF-channel selection procedure, specified in clause 4.2 to avoid unacceptable interference situations, this band also benefits from the high and stable atmospheric attenuation which suppresses efficiently distant interferers (about 10 dB/km to 15 dB/km at sea level, refer to ITU-R Recommendation P.676 [22]).

For the purposes of the present document two equipment Classes are specified depending on the network requirements:

- Class A: Digital equipment which apply the automatic RF-channel selection procedure (see clause 4.2) for interference avoidance and error performance enhancement.
- Class B: Equipment without automatic RF-channel selection procedure.

Typical applications for Class A equipment are interconnection between cellular networks where, in some cases, there is a need for short length connections (up to about 500 m). The RF channel selection procedure shall be used to protect existing systems from a new system being commissioned. However, the channel selection procedure may not guarantee interference free installation or operation in all cases, due to limitations in the procedure with respect to the variety of systems.

Typical applications for Class B equipment are:

- private connections, such as video surveillance systems in 58 GHz band;
- very high capacity (of Gigabit/s order or more) over relatively short links (up to around 2 km) in 65 GHz band (e.g. for connecting large data servers).

2 References

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.
- Non-specific reference may be made only to a complete document or a part thereof and only in the following cases:
 - if it is accepted that it will be possible to use all future changes of the referenced document for the purposes of the referring document;
 - for informative references.

Referenced documents which are not found to be publicly available in the expected location might be found at <http://docbox.etsi.org/Reference>.

For online referenced documents, information sufficient to identify and locate the source shall be provided. Preferably, the primary source of the referenced document should be cited, in order to ensure traceability. Furthermore, the reference should, as far as possible, remain valid for the expected life of the document. The reference shall include the method of access to the referenced document and the full network address, with the same punctuation and use of upper case and lower case letters.

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

2.1 Normative references

The following referenced documents are indispensable for the application of the present document. For dated references, only the edition cited applies. For non-specific references, the latest edition of the referenced document (including any amendments) applies.

- [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] CEPT/ERC/REC 12-09 (2004): "Radio frequency channel arrangement for Fixed Service systems operating in the band 57,0 - 59,0 GHz which do not require frequency planning".
- [4] CEPT/ECC/REC 05-02 (2005): "Use of the 64,0 - 66,0 GHz frequency band for Fixed Service".
- [5] 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".
- [6] ETSI EN 301 126-3-1 (V1.1.1): "Fixed Radio Systems; Conformance testing; Part 3-1: Point-to-Point antennas; Definitions, general requirements and test procedures".
- [7] 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".

- [8] ETSI EN 302 217-4-2 (V1.3.1): "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".
- [9] 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".
- [10] IEEE 802.3 (2002): "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".
- [11] ITU-R Recommendation SM. 1539 (2002): "Variation of the boundary between the out-of-band and spurious domains required for the application of Recommendations ITU-R SM.1541 and ITU-R SM.329".
- [12] ITU-T Recommendation O.151 and Corrigendum 1 (2002): "Error performance measuring equipment operating at the primary rate and above".
- [13] ITU-T Recommendation O.181 (2002): "Equipment to assess error performance on STM-N interfaces".
- [14] ITU-T Recommendation O.191 (2000): "Equipment to measure the cell transfer performance of ATM connections".

2.2 Informative references

- [15] ETSI EG 201 399: "Electromagnetic compatibility and Radio spectrum Matters (ERM); A guide to the production of candidate Harmonized Standards for application under the R&TTE Directive".
- [16] ETSI EN 301 489 (All parts): "Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services".
- [17] EMC Directive 89/336/EEC: "Council Directive of 3 May 1989 on the approximation of the laws of the Member States relating to electromagnetic compatibility".
- [18] ETSI EN 301 489-1: "Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements".
- [19] ETSI EN 301 489-4: "Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 4: Specific conditions for fixed radio links and ancillary equipment and services".
- [20] ETSI EN 301 751 (V1.2.1): "Fixed Radio Systems; Point-to-Point equipments and antennas; Generic harmonized standard for Point-to-Point digital fixed radio systems and antennas covering the essential requirements under article 3.2 of the 1999/5/EC Directive".
- [21] ETSI TR 101 506: "Fixed Radio Systems; Generic definitions, terminology and applicability of essential requirements under the article 3.2 of 99/05/EC Directive to Fixed Radio Systems".
- [22] ITU-R Recommendation P.676: "Attenuation by atmospheric gases".
- [23] ITU-R Recommendation F.1191: "Bandwidths and unwanted emissions of digital radio-relay systems".
- [24] ETSI EN 302 217-2-1: "Fixed Radio Systems; Characteristics and requirements for point-to-point equipment and antennas; Part 2-1: System-dependent requirements for digital systems operating in frequency bands where frequency co-ordination is applied".

- [25] ETSI EN 302 217-2-2: "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".
- [26] ITU-R Recommendation F.1497: "Radio-frequency channel arrangements for fixed wireless systems operating in the band 55.78-59 GHz".
- [27] ITU-R Recommendation F.1101: "Characteristics of radio-relay systems below about 17 GHz".
- [28] 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".
- [29] ITU Radio Regulations (2004).

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 [7] apply.

3.2 Symbols

For the purposes of the present document, the symbols given in EN 302 217-1 [7] apply.

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in EN 302 217-1 [7] 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 [15]; specific applications and descriptions for DFRS is given in TR 101 506 [21].

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 those set out in figure 1 of EN 302 217-1 [7].

In the case of wide radio-frequency bands covering units and multirate/multiformat equipment, these specifications shall be met at any frequency and 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 B.

Testing methods and conditions for assessing all requirements are specified in clause 5, where each clause directly refers to corresponding clause in this clause.

4.1 Environmental profile

The required environmental profile for operation of the equipment shall be declared by the supplier. The equipment shall comply with all the technical requirements of the present document at all times when operating within the boundary limits of the required operational environmental profile.

For testing the compliance with technical requirements see also EN 301 126-1 [5] and clause 5 of the present document.

NOTE: With the generic term of environmental profile, it is here intended any variation of the "external" conditions (e.g. climatic and external primary/secondary power supply sources feeding the equipment to be assessed) that might affect the system parameter relevant to the "essential requirements" of article 3.2 of the R&TTE Directive [1].

4.2 RF-channel selection

RF-channel selection procedure is mandatory for Class A equipment only.

4.2.1 RF-channel selection procedure

The purpose of the RF-channel selection procedure is to detect and protect existing transmissions in order to avoid unacceptable interference situations.

At both transmission sites, radio-relay terminals shall measure during installation, the interference levels of both receive and transmit channels (see note). Only in the instance when an unoccupied channel is identified and selected as the transmission channel shall the transmit power be switched on. The interference avoidance requirements for the receiver to detect occupied channels are specified in clause 4.2.2.

The principle of protecting existing transmission shall be respected also during the antenna alignment procedure.

NOTE: If the national regulatory rules allow to change the frequency of the link during its operation, it may be considered, in order to decrease the possibility of undetected interference, to apply the RF channel selection procedure whenever appropriate (e.g. when restoring a link after a failure or by suitable automatic timed routine in conjunction with frequency agility as in clause 4.2.3).

4.2.2 Interference avoidance requirements

4.2.2.1 Interference avoidance limit

The radio relay terminal shall consider the radio channel occupied when the level of the interference is above the following limit:

- $P_i > C \text{ dBm} + 10 \log (BW/10 \text{ MHz})$.

Where:

- BW is the noise bandwidth of the receiver expressed in MHz.
- P_i is the interference power expressed in dBm measured within the receiver noise bandwidth (BW).

The value C is dependent on frequency band and is given in the relevant annexes UA to UC.

For the rationale of the interference limit formula see annex UD.

For test purpose this requirement shall be fulfilled at reference point C within the intended band of transmission:

- with a signal similar to the transmitted one;
- with a CW signal at any frequency within this band.

The value of the intended band of transmission shall be declared by the supplier.

4.2.3 Frequency agile automatic channel selection

Frequency agility is an optional feature.

If unacceptable interference which exceeds a predetermined duration is observed, an automatic change of RF-channel can be initiated using the RF-channel selection procedure described above. If an automatic RF-channel change facility is implemented a means shall be provided to disable it. Unacceptable interference criteria shall be declared by the supplier (see clause UD.3).

4.3 Transmitter requirements

The specified transmitter characteristics shall be met with the appropriate base band signals applied at one of the reference points X' of figure 1 of EN 302 217-1 [7].

The appropriate base band signals for most common digital interfaces are given in table 1.

Table 1: Test signal and type of base band interface

Type of base band signal interface at X/X'	Test signal to be applied according to:
PDH	ITU-T Recommendation O.151 [12] (PRBS)
SDH	ITU-T Recommendation O.181 [13]
ATM	ITU-T Recommendation O.191 [14]
Ethernet interface (packet data)	IEEE 1802.3 [9] and IEEE 802.3 [10]
Other than the above	Relevant standards which the interface refers to (see note)
NOTE: When standard interfaces are provided they shall comply with ITU-T standards or other standardized interface declared by the supplier. However, in some applications of these radio relay systems, interface parts may be integrated with other systems and therefore standard interfaces (X, X' reference sections) are not available under these circumstances. In the latter case the radio system assessment shall be made including those other equipment for properly supplying all loading conditions foreseen.	

4.3.1 Transmitter power

4.3.1.1 Transmitter power

Transmitter maximum mean output power at reference point C' of the system block diagram (figure 1 of EN 302 217-1 [7]) shall not exceed A dBW (including tolerance and, if applicable, ATPC/RTPC influence). The values of A are dependent on frequency band and are given in the relevant annexes UA to UC.

4.3.1.2 Equivalent Isotropically Radiated Power (EIRP)

The Equivalent Isotropically Radiated Power (EIRP) shall be limited to +B dBW. The values of B are dependent on frequency band and are given in the relevant annexes UA to UC.

NOTE: This requirement is for assessment of equipment with integral antenna only; however also equipment placed on the market without antennas should, in principle, when relevant in common practice, refer to such limitations (e.g. defining the maximum associated antenna gain).

4.3.1.3 Output Power Tolerance

The power tolerance and the nominal output power shall be declared by the supplier and shall be included in the limits in clauses 4.3.1.1 and 4.3.1.2.

4.3.2 Radio Frequency (RF) spectrum mask

The radio frequency spectrum mask is system dependent and is given in the relevant annexes UA to UC.

4.3.3 Spurious emissions

The limits of spurious emissions (or more precisely, according latest ITU-R definitions, unwanted emissions in the spurious domain), which apply at reference point C' or at point B' if C' is not available, shall conform, in any setting conditions of ATPC and RTPC if any, to:

- CEPT/ERC/REC 74-01 [2], giving the applicable limits in the spurious domain (see note 1).
- ITU-R Recommendation SM.1539 [11] giving the variation of the boundary between the out-of-band and spurious domains (see note 2).

NOTE 1: CEPT/ERC/REC 74-01 [2] based on ITU-R Recommendations SM.329 and ITU-R Recommendation F.1191 [23] gives the applicable definitions. According those Recommendations, provided that there in some bands there is no recommended channel arrangements, the frequency boundary where limits apply for fixed service systems needs to be evaluated as a function of the occupied bandwidth of the emission.

NOTE 2: ITU-Recommendation SM. 1539 [11] constitute the basis for Annex 1 of Appendix 3 of the Radio Regulations [29]. According to these references the boundary where the spurious domains begins, is considered to be offset from the nominal centre frequency of the emission by $\pm 250\%$ of the relevant Channel Separation (ChS), as far as they do not exceeded 500 MHz. Beyond this value the boundary is evaluated as: $\pm(500 \text{ MHz} + 1,5 \times \text{ChS})$. When a ChS is not defined (e.g. bandwidth size is left free), the actual occupied bandwidth (i.e. the 99 % of power of the emission) is used.

4.3.4 Radio frequency tolerance

For the purpose of the present document the frequency tolerance is as defined in Radio Regulation Art 1.151 as "The maximum permissible departure by the centre frequency of the frequency band occupied by an emission from the assigned frequency".

The maximum allowable RF frequency tolerance from the nominal carrier frequencies, by any reason, shall not exceed $\pm X$ ppm. The values are system dependent and are given in the relevant annexes UA to UC. The supplier shall declare the values of the nominal carrier frequencies.

In the type test the supplier shall state the guaranteed short-term part and the expected ageing part.

4.3.5 Antenna directional requirements

This clause is relevant for all equipment specified in annexes UA to UC when an integral antenna is provided. Stand alone antenna products are covered, for the relevant frequency band and antenna class, by EN 302 217-4-2 [8].

However, with integral antennas, it may be possible to test the antenna separately from the equipment (see note); in this case the declaration of conformity may be composed of a declaration of conformity for the equipment and a declaration of conformity for the antenna, done separately by the actual supplier(s), according to EN 302 217-4-2 [8].

NOTE: Using special tool supplied by the supplier.

4.3.5.1 Radiation Pattern Envelope (Off-axis EIRP density)

In the case of an integral antenna system and where applicable, the radiation pattern envelope (off-axis EIRP density) is essential under article 3.2 of the R&TTE Directive [1]; the clause that gives the limits of this essential phenomenon is clause 4.2 of EN 302 217-4-2 [8].

4.3.5.2 Antenna gain

In the case of an integral antenna system and where applicable, the antenna gain is essential under article 3.2 of the R&TTE Directive [1]; the clause that gives the limits of this essential phenomenon is clause 4.3 of EN 302 217-4-2 [8].

Requirements for specific bands are also referred in the relevant annexes UA to UC.

4.3.5.3 Antenna Cross-Polar Discrimination (XPD)

No requirements apply. (Cross-polar radiation pattern requirements are not relevant for equipment operating in frequency bands where no frequency co-ordination is applied).

4.4 Receiver requirements

4.4.1 Spurious emissions

The limits of spurious emissions (or more precisely, according latest ITU-R definitions, unwanted emissions in the spurious domain), which apply at reference point C or at point B' if C' is not available, shall conform to:

- CEPT/ERC/REC 74-01 [2], which gives the applicable limits.

NOTE: CEPT/ERC/REC 74-01 [2], based on ITU-R Recommendations SM.329 and ITU-R Recommendation F.1191 [23], gives the applicable definitions.

5 Testing for compliance with technical requirements

5.1 Environmental conditions for testing

The equipment shall comply with all the requirements of the present document at all times when operating within the boundary limits of the operational environmental profile declared by the supplier, including the limits of any primary/secondary power supply external to the equipment under assessment.

Boundary limits of environmental climatic conditions, which are part of the environmental profile may be determined by the environmental class of the equipment according to the guidance given in clause 4.4 of EN 301 126-1 [5].

Tests defined in the present document shall be carried out at representative points within the boundary limits of the declared operational environmental profile.

Any test, requested to generate the 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:

- For radio equipment, with respect to the same principles and procedures, for reference and extreme conditions, set out in clause 4.4 of EN 301 126-1 [5] for climatic conditions and in table 1 of EN 301 126-1 [5] and clauses 5.2 and 5.3 of the present document for power supply conditions. The requirement for test at reference or extreme conditions is set out in clauses 5.2 and 5.3 of the present document according to the principles for similar requirements in EN 301 126-1 [5].
- For integral DFRS antennas (directional phenomena of clause 4.4 of the present document), at reference environmental conditions of the test field according to clause 4.1 of EN 301 126-3-1 [6].

NOTE: It is recalled (see scope) that equipment already assessed for presumption of conformity to EN 301 751 [20] do not need a new test report.

The test report shall be produced according to the procedure described in article 10 of the R&TTE Directive [1].

Interpretation of the results recorded in a test report of the measurements described in the present document shall be as follows:

- For the purposes of test, the limits in the present document are based on the "shared risk" of measurement uncertainty, e.g. if a measurement meets the requirements of the standard, even if it is within the calculated measurement uncertainties, it shall be deemed compliant with the measurement parameter.
- If it fails to meet the requirements of a standard, even within measurement uncertainty, it is deemed to be not compliant with the measurement parameter.

Measurement uncertainty calculations should be based on the latest available ETSI guidelines.

In conclusion:

- the measured value related to the corresponding limit will be used to decide whether an equipment meets the requirements of the present document;
- the value of the measurement uncertainty for the measurement of each parameter shall be included in the test report.

An adaptor at point D or D' to IEC standard flange shall be made available by the supplier for transmit power, RF-spectrum and spurious emission measurements.

5.2 RF-channel selection

See clause 4.2.

5.3 Essential radio test suites for the transmitter

The tests, carried out to generate the 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 at climatic conditions referred to in table 2 and, when applicable for equipment with integral antenna, in table 3.

Table 2 indicates the different clauses applicable, for a given parameter, to the requirement, the test clause in the present document and the corresponding test method in the base test document EN 301 126-1 [5].

Table 2: Transmitter parameters, test clauses and conditions

Clause	Parameter	EN 301 126-1 [5] reference clause for the test methods	Climatic conditions (note 1)		Channels to be tested (note 4) B = Bottom M = Middle T = Top	Other specific conditions
			Ref	Extreme		
5.3.1.1	Transmitter power	5.2.1	X	X	BMT	Note 3
5.3.1.2	Equivalent Isotropically Radiated Power (EIRP) and EIRP density mask	6.3 of EN 301 126-3-1 [6]	X	X	BMT	Note 3
5.3.1.3	Transmitter power tolerance	5.2.1	X	X	BMT	Note 3
5.3.2	RF spectrum mask	5.2.6	X	X	BMT	Note 3
5.3.3	Spurious emissions	5.2.9	X		BMT	The tests shall be carried-out with ATPC, if any, set to maximum available power and RTPC, if any, set at minimum attenuation. Actual test shall be limited to the practical frequency range set out by recommends 3 of CEPT/ERC/ REC 74-01 [2]
5.3.4	Radio frequency tolerance	5.2.5	X	X	BMT	Note 3
NOTE 1: This refers to climatic conditions only; for other environmental and power supply conditions, please refer to EN 301 126-1 [5] which provides, for testing some parameters, combined variations also of the power supply source, see table 1 of EN 301 126-1 [5]; however, DC regulators on all the DC sources actually used for carrier generation are commonly integral to the radio equipment. When this is the case, such additional tests are considered redundant and not necessary to assess the compliance to the essential requirements of article 3.2 of the R&TTE Directive [1]. This will not imply any reduction to the supplier responsibility related to the conformance declaration, which, in any case, is valid for the whole declared environmental profile.						
NOTE 2: For equipment with integral antennas, the essential transmitter test suite clauses include the EIRP and antenna parameters, test clauses and conditions contained in table 3 and clause 5.3.1.2.						
NOTE 3: This clause requires, at extremes of temperature, testing also at extremes of voltage (see note 1).						
NOTE 4: Annex UC provides more detailed information on channels to be tested, depending on the type of equipment.						

5.3.1 Transmitter power

5.3.1.1 Transmitter power

The clause that gives the test methods for the transmitter power and transmitter power tolerance is clause 5.2.1 of EN 301 126-1 [5].

The tests, carried out to generate the test report and/or declaration of conformity in order to fulfil any conformity assessment procedure foreseen by the R&TTE Directive [1], shall be carried-out at reference and extreme climatic conditions.

For continuous signals the average power shall be measured. For burst type signals (e.g. TDD) the average power during the signal burst shall be measured.

5.3.1.2 Equivalent Isotropically Radiated Power (EIRP) and EIRP density mask

For equipment with integral antenna, the clause that provides the test methods for the EIRP and/or EIRP density mask is derived from the measurement in clause 6.3 of EN 301 126-3-1 [6].

5.3.1.3 Output power tolerance

Test methods for the transmitter power tolerance shall be in accordance with clause 5.2.1 of EN 301 126-1 [5].

5.3.2 RF spectrum mask

The clause that gives the test methods for the RF spectrum masks is clause 5.2.6 of EN 301 126-1 [5].

The tests, requested to generate the test report and/or declaration of conformity in order to fulfil any conformity assessment procedure foreseen by the R&TTE Directive [1], shall be carried-out at reference and extreme climatic conditions.

If any, the recommended spectrum analyser settings are given in the relevant annexes UA to UC.

As a general guideline, the resolution bandwidths (e.g. measured at the -3 dB points of the final IF filter) of the spectrum analyser should be equal to the reference bandwidths as given in the eirp or power density mask requirement. To improve measurement accuracy, sensitivity and efficiency, the resolution bandwidth can be different from the reference bandwidth. For instance, narrower resolution bandwidth is sometimes necessary for emissions close to the centre frequency. When the resolution bandwidth is smaller than the reference bandwidth, the result should be integrated over the reference bandwidth. When the resolution bandwidth is greater than the reference bandwidth, the result for broadband spurious domain emissions should be normalized to the bandwidth ratio. For discrete (narrow-band) signals, normalization is not applicable.

5.3.3 Spurious emissions - external

Test methods shall be in accordance with clause 5.2.9 of EN 301 126-1 [5].

The tests shall be carried-out with ATPC, if any, set to maximum available power and RTPC, if any, set at minimum attenuation; actual test shall be limited to the practical frequency ranges foreseen by recommend 3 of CEPT/ECC/REC 74-01 [2]. The test shall be carried-out at reference climatic conditions.

5.3.4 Radio frequency tolerance

The clause that gives the test methods for the radio frequency tolerance is clause 5.2.5 of EN 301 126-1 [5].

The tests shall be carried-out at reference and extreme climatic conditions.

5.3.5 Antenna and system directional requirements

Table 3: Transmitter/receiver antenna parameters, test clauses and conditions

Clause	Parameter	EN 301 126-3-1 [6] reference clause for the test methods	Climatic conditions (note 1)		Channels to be tested (note 2) B = Bottom M = Middle T = Top	Other specific conditions
			Ref	Extreme		
5.3.5	Antenna directional requirements					
5.3.5.1	Radiation Pattern Envelope (Off-axis EIRP density)	6.1	X		M	
5.3.5.2	Antenna Gain	6.3	X		M	
NOTE 1: This refers to climatic conditions only; for other environmental conditions, please refer to EN 301 126-3-1 [6].						
NOTE 2: Annex B provides more detailed information on channels to be tested, depending on the type of equipment.						

5.3.5.1 Radiation pattern envelope (Off-axis EIRP density)

The clause that gives the test methods of the radiation pattern envelope, essential phenomenon for equipment with integral antennas, is clause 6.1 of EN 301 126-3-1 [6].

5.3.5.2 Antenna gain

The clause that gives the test methods of the antenna gain, essential phenomenon for equipment with integral antennas, is clause 6.3 of EN 301 126-3-1 [6].

5.3.5.3 Antenna Cross-Polar Discrimination (XPD)

Non-essential requirement.

5.4 Essential radio test suites for the receiver

The tests, carried out to generate the 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 at reference and extreme climatic conditions according the provisions for each test summarized in table 4. For each parameter table 4 gives the applicable clauses for the requirement, for the test clause in the present document, for the corresponding clause in EN 301 126-1 [5] and possible comments and climatic conditions.

Receiving phenomena tests are considered only without the option of space diversity. However, in case of diversity applications, they do apply separately to any receiver.

Table 4: Essential receiver test suite clauses

Clause	Parameter	EN 301 126-1 [5] reference clause for the test methods	Climatic conditions		Channels to be tested B = Bottom M = Medium T = Top	Other specific conditions
			Ref	Extreme		
5.3.1	Spurious emissions	5.3.2	X		BMT	Actual test shall be limited to the practical frequency range foreseen by recommends 3 of CEPT/ERC/REC 74-01 [2]
NOTE 1: This table refers to climatic conditions only; for other environmental and power supply conditions, please refer to EN 301 126-1 [5].						
NOTE 2: All receiver test suites clauses are performed at nominal voltage only.						
NOTE 3: Annex B provides more detailed information on channels to be tested, depending on the type of equipment.						

5.4.1 Spurious emissions

The test shall be limited to the practical frequency ranges foreseen by recommends 3 of CEPT/ERC/REC 74-01 [2]. The test shall be carried-out at reference climatic conditions. Test methods shall be in accordance with clause 5.3.2 of EN 301 126-1 [5].

Annex A (normative): HS Requirements and conformance Test specifications Table (HS-RTT)

The HS Requirements and conformance Test specifications Table (HS-RTT) in table A.1 serves a number of purposes, as follows:

- it provides a statement of all the essential requirements in words and by cross reference to (a) specific clause(s) in the present document or to (a) specific clause(s) in (a) specific referenced document(s);
- it provides a statement of all the test procedures corresponding to those essential requirements by cross reference to (a) specific clause(s) in the present document or to (a) specific clause(s) in (a) specific referenced document(s);
- it qualifies each requirement to be either:
 - Unconditional: meaning that the requirement applies in all circumstances; or
 - Conditional: meaning that the requirement is dependent on the manufacturer having chosen to support optional functionality defined within the schedule;
- in the case of Conditional requirements, it associates the requirement with the particular optional service or functionality;
- it qualifies each test procedure to be either:
 - Essential: meaning that it is included with the Essential Radio Test Suite and therefore the requirement shall be demonstrated to be met in accordance with the referenced procedures;
 - Other: meaning that the test procedure is illustrative but other means of demonstrating compliance with the requirement are permitted.

Table A.1: HS Requirements and conformance Test specifications Table (HS-RTT)

Harmonized Standard EN 302 217-3 / annex (see note)						
The following essential requirements and test specifications are relevant to the presumption of conformity under Article 3.2 of the R&TTE Directive						
Essential Requirement			Requirement Conditionality		Test Specification	
No	Description	Reference: Clause No (note)	U/C	Condition	E/O	Reference: Clause No
Transmitting requirements						
1	Transmitter power	4.3.1.1	U		E	5.3.1.1
2	Equivalent isotropically radiated power	4.3.1.2	C	Only applies to systems with integral antennas	E	5.3.1.2
3	Output power tolerance	4.3.1.3	U		E	5.3.1.3
4	Adjacent channel power - Spectrum mask	4.3.2	U		E	5.3.2
5	Spurious emissions	4.3.3	U		E	5.3.3
6	Radio frequency tolerance	4.3.4	U		E	5.3.4
Antenna directional requirements						
7	Off-axis EIRP density - Radiation Pattern Envelope (RPE)	4.3.5.1	C	Only applies to systems with integral antennas	E	5.3.5.1
8	Antenna gain	4.3.5.2	C		E	5.3.5.2

Harmonized Standard EN 302 217-3 / annex (see note)						
The following essential requirements and test specifications are relevant to the presumption of conformity under Article 3.2 of the R&TTE Directive						
Essential Requirement			Requirement Conditionality		Test Specification	
No	Description	Reference: Clause No (note)	U/C	Condition	E/O	Reference: Clause No
Receiving requirements						
9	Spurious emissions	4.4.1	U		E	5.4.1
Control and monitoring function requirements						
10	Sharing protocols - Interference avoidance requirement	4.2.1	C	Class A system only	X	
NOTE: The requirement clauses for the above HS-RTT are composed of the common text clause in the main body of text and of the specific requirement clause in the relevant annex corresponding to the system for which conformance is declared. For example, if conformance for system UB is declared, the requirements for the transmitter mask are contained in clause 4.3 of the main body of text and in clauses of the annex UB.						

Key to columns:

Essential Requirement:

No A unique identifier for one row of the table which may be used to identify a requirement or its test specification.

Description A textual reference to the requirement.

Clause Number Identification of clause(s) defining the requirement in the present document unless another document is referenced explicitly.

Requirement Conditionality:

U/C Indicates whether the requirement is to be *unconditionally* applicable (U) or is *conditional* upon the manufacturers claimed functionality of the equipment (C).

Condition Explains the conditions when the requirement shall or shall not be applicable for a technical requirement which is classified "conditional".

Test Specification:

E/O Indicates whether the test specification forms part of the Essential Radio Test Suite (E) or whether it is one of the Other Test Suite (O).

NOTE: All tests whether "E" or "O" are relevant to the requirements. Rows designated "E" collectively make up the Essential Radio Test Suite; those designated "O" make up the Other Test Suite; for those designated "X" there is no test specified corresponding to the requirement. The completion of all tests classified "E" as specified with satisfactory outcomes is a necessary condition for a presumption of conformity. Compliance with requirements associated with tests classified "O" or "X" is a necessary condition for presumption of conformity, although conformance with the requirement may be claimed by an equivalent test or by manufacturer's assertion supported by appropriate entries in the technical construction file.

Clause Number Identification of clause(s) defining the test specification in the present document unless another document is referenced explicitly. Where no test is specified (that is, where the previous field is "X") this field remains blank.

Annex B (normative): Wide radio-frequency band covering units and multirate equipment specification and tests

B.1 Wide radio-frequency band covering units

Even if radio frequency front-ends for DFRS are commonly designed for covering all or part(s) of the possible operating channels, within a specific radio frequency channel arrangement, equipments can provide single radio frequency channel operation (e.g. when the RF duplexer filters is tuned to a specific channel) or offer a wider operating frequency range (e.g. wide-band RF duplexer and frequency agility by RFC function for easiness of deployment and spare parts handling by operators with large networks made by more than one assigned channels).

The equipment shall comply with all the requirements of the present document at any possible operating frequency.

The tests, carried out to generate the test report and/or declaration of conformity, required to fulfil any Conformity assessment procedure foreseen by the R&TTE Directive [1], shall be carried-out in the following way:

- 1) in the case of equipments intended for single channel operation, the test report shall be produced for one radio frequency channel arbitrarily chosen by the supplier (see figure B.1);
- 2) in the case of equipments intended for covering an operating frequency range, the test report shall be produced for the lowest, intermediate and highest possible radio frequency channel within that operating frequency range (see figure B.2);
- 3) it is not required that all the tests, required for the test report, are done on the same sample of equipment and at the same time; provided that the test report includes all the tests required by the present document, each test may be made on different samples of the same equipment, at different channel frequencies or frequency ranges and in different times (see note).

NOTE: It should be noted that, in principle, all tests are carried on the same equipment in a single test session. However, the allowance for different test sessions and equipment under test is made to cope with unpredictable events (e.g. equipment or test instruments failure during the tests, not immediately repairable) or for future revision of the present document that might introduce new or different requirement due for additional tests report. In any case this allowance is not intended as a possibility to overcome failed tests without corrective actions.

When applicable also the following additional provisions apply to the production of the test report:

- in the case of equipments covering a radio frequency channel arrangement with more than one operating frequency range, the test report shall be produced for one of the operating frequency ranges arbitrarily chosen by the supplier, using the above procedures for equipments intended for single channel operation or for covering an operating frequency range (see figures B.1 or B.2);
- in the case of equipments designed to cover, with the same requirements under the same ETSI standard, a number of fully or partially overlapping recommended and/or national radio frequency channel arrangements, similarly established across contiguous radio frequency bands allocated to Fixed Service, the test report shall be produced for one radio frequency channel arrangements arbitrarily chosen by the supplier, using the above procedures for equipments intended for single channel operation or for covering an operating frequency range (see figures B.1 and B.2).

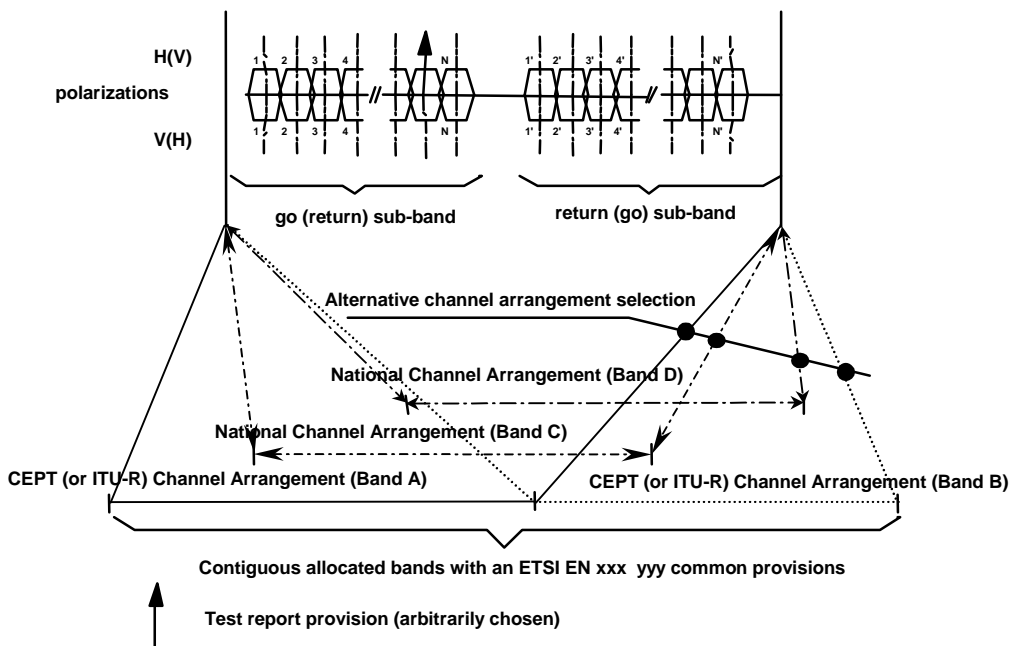


Figure B.1: Test report frequency requirement for equipments intended for single channel operation

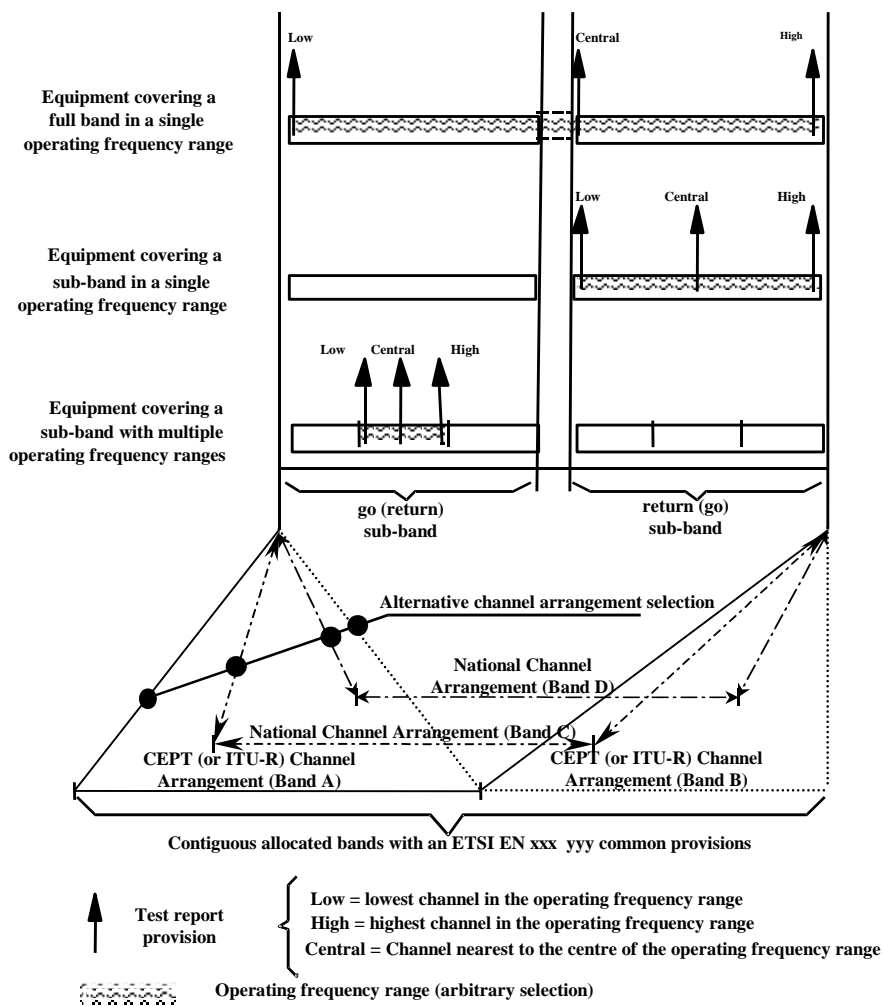


Figure B.2: Test report frequency requirements for equipments intended for covering an operating frequency range

B.2 Multirate/multiformat equipment

DFRS equipments can cover a number of different payload-rates or different modulation format through software pre-settings.

In such cases the equipment shall comply with all the requirements of the present document at any possible payload operation.

The tests, carried out to generate the test report and/or declaration of conformity, required to fulfil any Conformity assessment procedure with respect to the R&TTE Directive [1], shall be carried-out for transmitting phenomena (see clause 4.3) at any possible bit rate and modulation format, while RF channel selection (see clause 4.2) and receiving phenomena (see clause 4.4) shall be tested only at the lowest and the highest bit rate for any modulation format.

Annex UA (normative): Frequency bands around 58 GHz

UA.0 Introduction

The letter U placed ahead of the annex letter distinguishes from the Fixed Radio Systems used in bands where conventional link-by-link coordination is generally used and presented in the annexes of the other parts EN 302 217-2-1 [24] and EN 302 217-2-2 [25] of this multi-part deliverable.

The following fixed point-to-point systems are covered in this annex:

- UA.1 Radio systems for the transmission of digital signals operating at around 58 GHz, which do not require co-ordinated frequency planning.
- UA.2 Radio systems for the transmission of analogue video signals operating at around 58 GHz, which do not require co-ordinated frequency planning.

UA.1 Digital systems

UA.1.1 Frequency bands and channel arrangements

UA.1.1.1 Frequency band

This band is included within the High Density Fixed Service (HDFS) bands referred in the Radio Regulations.

The frequency band is from 57 GHz to 59 GHz as reported in CEPT/ERC/REC 12-09 [3] or in annex 2 of ITU-R Recommendation F.1497 [26] .

NOTE: The successful co-existence of Class A and Class B equipment may require the regulator to define exclusive spectrum for each equipment Class (see annex UD). CEPT/ERC/REC 12-09 [3] do not refer to band segmentation for this purpose, therefore it might be regulated at national level only.

Other national or future ITU-R or CEPT/ECC recommendations set around the rough boundary of present ITU-R or CEPT/ECC recommendations are considered applicable to systems assessed against the present document, provided that they use the same channel separation referred in clause UA.1.1.2 without frequency co-ordinated deployment.

UA.1.1.2 Radio channel arrangements

The channel arrangements are specified in CEPT/ERC/REC 12-09 [3] with either 50 MHz or 100 MHz channel raster.

UA.1.1.3 Transmission capacity

The supplier shall declare the transmission capacities and the channel spacing used. The relevant spectrum masks below shall be complied with, for all transmission capacities.

UA.1.2 Transmitter

UA.1.2.1 Transmitter power

- Transmitter maximum mean output power limit (clause 4.3.1.1):
 - A = -20 dBW.

UA.1.2.2 Equivalent Isotropically Radiated Power (EIRP)

The Equivalent Isotropically Radiated Power limit (clause 4.3.1.2):

- $B = +25$ dBW.

UA.1.2.3 Output power tolerance

Clause 4.3.1.3 applies.

UA.1.2.4 RF spectrum masks

UA.1.2.4.1 Limits

The spectrum mask for 100 MHz radio channels is shown in figure UA.1 and for 50 MHz channels in figure UA.2 as absolute power density in a required reference bandwidth.

The spectral power density masks do not include frequency tolerance and is referred to the actual carrier centre frequency and to reference point C' of figure 1 in EN 302 217-1 [7].

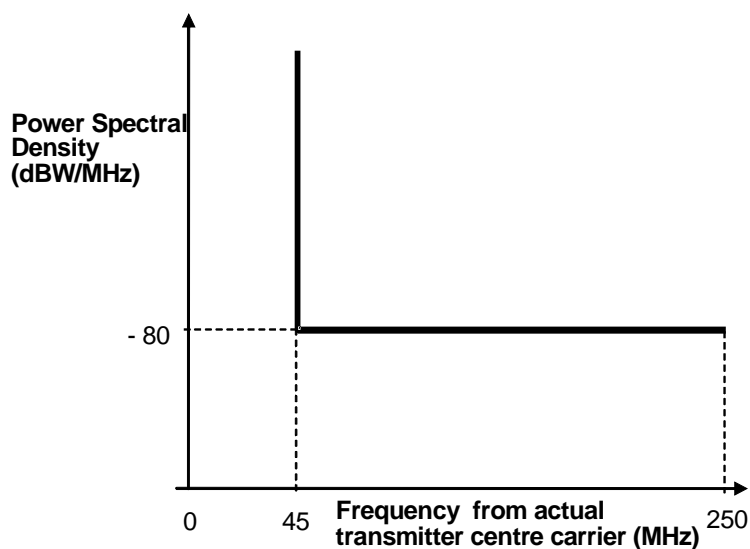


Figure UA.1: Limits of spectral power density for 100 MHz radio channels

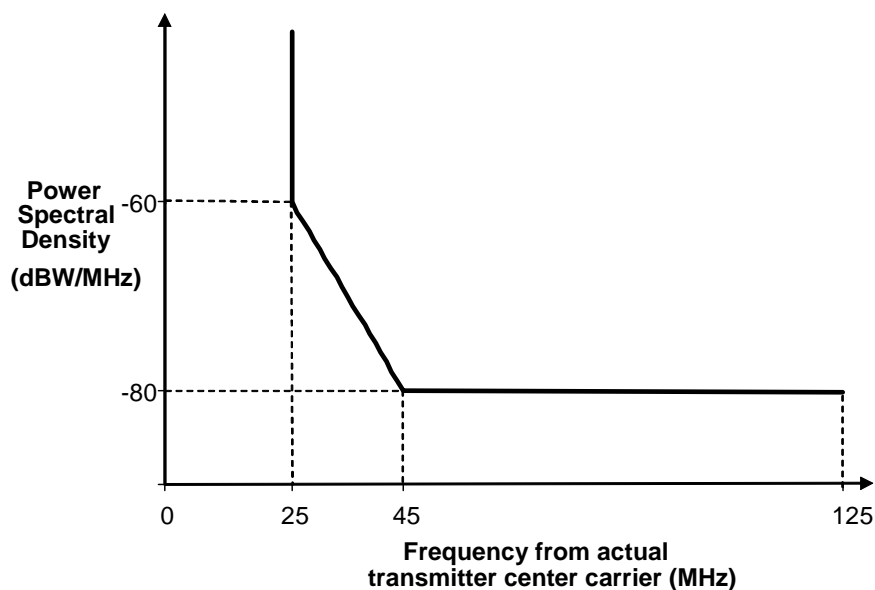


Figure UA.2: Limits of spectral power density for 50 MHz radio channels

UA.1.2.4.2 Spectrum analyser settings

The spectrum analyser setting is not of importance when absolute power density is considered, provided that suitable integration/normalization is made.

As a general guideline, the resolution bandwidths (e.g. measured at the -3 dB points of the final IF filter) of the spectrum analyser should be equal to the reference bandwidths as given in the eirp power density mask requirement. To improve measurement accuracy, sensitivity and efficiency, the resolution bandwidth can be different from the reference bandwidth. For instance, narrower resolution bandwidth is sometimes necessary for emissions close to the centre frequency. When the resolution bandwidth is smaller than the reference bandwidth, the result should be integrated over the reference bandwidth. When the resolution bandwidth is greater than the reference bandwidth, the result for broadband spurious domain emissions should be normalized to the bandwidth ratio. For discrete (narrow-band) signals, normalization is not applicable.

UA.1.2.5 Spurious emissions-external

Clause 4.3.3 shall apply.

UA.1.2.6 Radio frequency tolerance

The maximum allowable RF-frequency tolerance (clause 4.3.4):

- $\pm X = \pm 50$ ppm.

UA.1.2.7 RF-channel selection parameters

Interference avoidance limit parameter (clause 4.2.2.1):

- $C = -81$ (dBm).

UA.1.3 Receiver

Clause 4.4.1 shall apply.

UA.2 Analogue systems

Only class B equipment are defined for analogue UA.2 systems.

UA.2.1 Frequency bands and channel arrangements

UA.2.1.1 Frequency band

The frequency band is from 57 GHz to 59 GHz as reported in CEPT/ERC/REC 12-09 [3] or in annex 2 of ITU-R Recommendation F.1497 [26].

UA.2.1.2 Radio channel arrangements

The channel arrangements are specified in CEPT/ERC/REC 12-09 [3] with either 50 MHz or 100 MHz channel raster. For reader convenience, the basic parameters of the CEPT Recommendation are shown in informative annex UE.

UA.2.1.3 Transmission capacity

The supplier shall declare the analogue video transmission capacities and the channel spacing used. The relevant spectrum masks below shall be complied with, for any possible capacity and frequency deviation.

UA.2.2 Transmitter

UA.2.2.1 Transmitter power

Transmitter maximum mean output power limit (clause 4.3.1.1):

- $A = -20$ dBW.

UA.2.2.2 Equivalent Isotropically Radiated Power (EIRP)

The Equivalent Isotropically Radiated Power limit (clause 4.3.1.2):

- $B = +25$ dBW.

UA.2.2.3 Output power tolerance

Clause 4.3.1.3 shall apply.

UA.2.2.4 RF spectrum masks

Same spectrum mask in clause UA.1.2.4 shall apply.

UA.2.2.5 Spurious emissions - external

Clause 4.3.3 shall apply.

UA.2.2.6 RF frequency tolerance

The maximum allowable RF-frequency tolerance:

- $\pm X = \pm 200$ ppm.

UA.2.3 Receiver requirements

UA.2.3.1 Spurious emissions

Refer to clause 4.4.1.

Annex UB (normative): Frequency band 64 GHz to 66 GHz

UB.0 Introduction

The letter U placed ahead of the annex letter distinguishes from the Fixed Radio Systems used in bands where conventional link-by-link coordination is generally used and presented in the annexes of the other parts EN 302 217-2-1 [24] and EN 302 217-2-2 [25] of this multi-part deliverable.

In this frequency band only Class B equipment (see clause 1) are considered.

Both FDD and TDD applications are covered in this annex.

The frequency arrangement derived from the Recommendation ECC/REC(05)02 [4] has some effect on the requirements to the radio equipment; therefore, in this frequency band, two different categories of equipment are defined. For both categories the appropriate parameters as transmitter characteristics and receiver requirements are described separately in the appropriate clause.

The two categories of equipment are:

Category 1: Equipment for flexible usage of spectrum (according CEPT/ECC/REC 05-02 [4]) where no channel or block arrangement is to be complied with. The used transmitter bandwidth is referred to the occupied bandwidth as defined within the present document. The present document provides Category 1 differentiated requirements only for equipment of spectral efficiency classes 1 and 2 as defined in EN 302 217-2-2 [25].

Informative Note: Administrations might require specific measures to avoid interference (e.g. listen-before talk).

Category 2: Equipment suitable also for fixed frequency arrangements (according annex 3 of CEPT/ECC/REC 05-02 [4]) where a single or a number of contiguous frequency slots of 30 MHz size are assigned/notified to form a channel or a block. Category 2 conformance automatically implies conformance also to Category 1 requirements.

Equipment may cover both categories provided that, for each characteristic, they met the more stringent requirement.

UB.1 Frequency bands and channel arrangements

UB.1.1 Frequency band

This band is included within the High Density Fixed Service (HDFS) bands referred in the Radio Regulations.

The frequency band is from 64 GHz to 66 GHz as reported in CEPT/ECC/REC 05-02 [4].

Other national or future ITU-R or CEPT/ECC recommendations set around the rough boundary of present ITU-R or CEPT/ECC recommendations are considered applicable to systems assessed against the present document, provided that they give band usage without frequency co-ordinated deployment or using simplified co-ordination procedure similar to that referred in CEPT/ECC/REC 05-02 [4].

UB.1.2 Radio channel arrangements

The usage of the band is specified in CEPT/ECC/REC 05-02 [4]; it consider three alternatives:

- Free system bandwidth, occupying up to the whole band (TDD case).
- $ChS = n \times 30$ MHz; multiple of basic frequency slots with $n = 1 \dots 33$ (FDD case) or $n = 1 \dots 66$ (TDD case).
- Block assignment (i.e. more than one system can be arranged in the assigned block) (see note).

NOTE: Blocks made by aggregating a number of 30 MHz basic frequency slots; it is assumed that, in block assignment, inter-block coexistence rules are part of the licensing process.

UB.1.3 Spectral efficiency

According to the possible supplier declaration, equipment may be subdivided into the same spectral efficiency classes defined in EN 302 217-2-2 [25].

The minimum spectral efficiency for each class of equipment is indicated in table UB.1.

Spectral efficiency is the ratio between the peak gross bit rate and the Occupied Bandwidth (for Category 1 systems) or the used channel bandwidth (for Category 2 systems).

The supplier shall declare the spectral efficiency and occupancy in terms of the occupied bandwidth (for Category 1 systems) or the used channel bandwidth (for Category 2 systems). The relevant spectrum masks shall be complied with, for all transmission capacities offered.

The used channel bandwidth shall be coherent with the occupied bandwidth, as defined in Radio Regulations and, for Fixed Service systems in ITU-R Recommendation F.1191 [23]; the used channel bandwidth, in terms of $n \times 30$ MHz slots, shall be the size of the closest slots aggregation wider than the actual occupied bandwidth.

Table UB.1: Minimum spectral efficiency

Equipment Spectral efficiency Class	1	2	3	4	5
Minimum spectral efficiency (bit/s/Hz)	0,5	1	1,6	2,2	4
NOTE 1: Category 1 systems are limited to classes 1 and 2 only.					
NOTE 2: The above spectral efficiencies are valid as far as the actual occupied bandwidth does not exceed 2 000 MHz (full band systems); it is intended that in such cases the values in the table are incremented accordingly.					

UB.2 Transmitter

UB.2.1 Transmitter power and Equivalent Isotropically Radiated Power (EIRP)

The maximum power shall be limited, in terms of EIRP of the systems by the provisions given in the Radio Regulations (i.e. in article 21).

Further emission limitations, in terms of EIRP and/or P_{out} and/or antenna gain, might be present on a national basis.

However, in order of safeguarding a fair and efficient use of the spectrum, emissions of equipment in the scope of the present document shall be limited as follows:

$$1a) \quad \begin{aligned} \text{EIRP limit (dBm)} &\leq +85 \text{ (Radio Regulation Art 21)} \quad \text{for} \quad G_{ant} \geq 50 \text{ dBi} \\ &\leq +85 - 2 \times (50 - G_{ant}) \quad \text{for} \quad 50 \text{ dBi} > G_{ant} \geq 30 \text{ dBi} \end{aligned}$$

$$2a) \quad G_{ant} \text{ (dBi)} \geq 30$$

For equipment offering external antenna connectors the above limitation should be translated in terms of range of antenna gain that the manufacturer shall state for the use with the equipment for not exceeding the above EIRP limitations, i.e.:

$$1b) \quad \begin{aligned} \text{Minimum } G_{ant} \text{ (dBi)} &\geq P_{out} \text{ (dBm)} + 15 \quad \text{or} \\ &\geq 30 \text{ (dBi)} \quad \text{(whichever is the greater)} \end{aligned}$$

$$2b) \text{ Maximum } G_{\text{ant}} \text{ (dBi)} \leq 85 - P_{\text{out}} \text{ (dBm)}$$

where P_{out} is the maximum possible power, including tolerances, delivered to the antenna connector.

NOTE: It is assumed that the above information on antenna gain range is supplied in the user documentation.

As additional provision, equipment implementing ATPC as a permanent feature, linearly activated only by the drop of RSL in the corresponding far end receiver, while complying the above requirements 1a and 2a (or 1b and 2b as appropriate) when operating in nominal unfaded conditions, are permitted to raise their emission, during rain induced fading periods, up to a level of:

$$3a) \text{ equipment with integral antennas:} \\ \text{EIRP (dBm)} \leq +35 + G_{\text{ant}} \text{ (dBi)} \quad \text{or} \\ \leq +85 \text{ (whichever is the lower)}$$

$$3b) \text{ equipment offering external antenna connectors:} \\ P_{\text{out}} \text{ (dBm)} \leq +35$$

With the term "permanent feature" it shall be intended that ATPC can not be disabled by the user or, whenever it is possible, the output power can not be set to a value exceeding the above provisions 1a and 2a (or 1b and 2b as appropriate).

The above limitations are visually represented in figures UB.1 and UB.2.

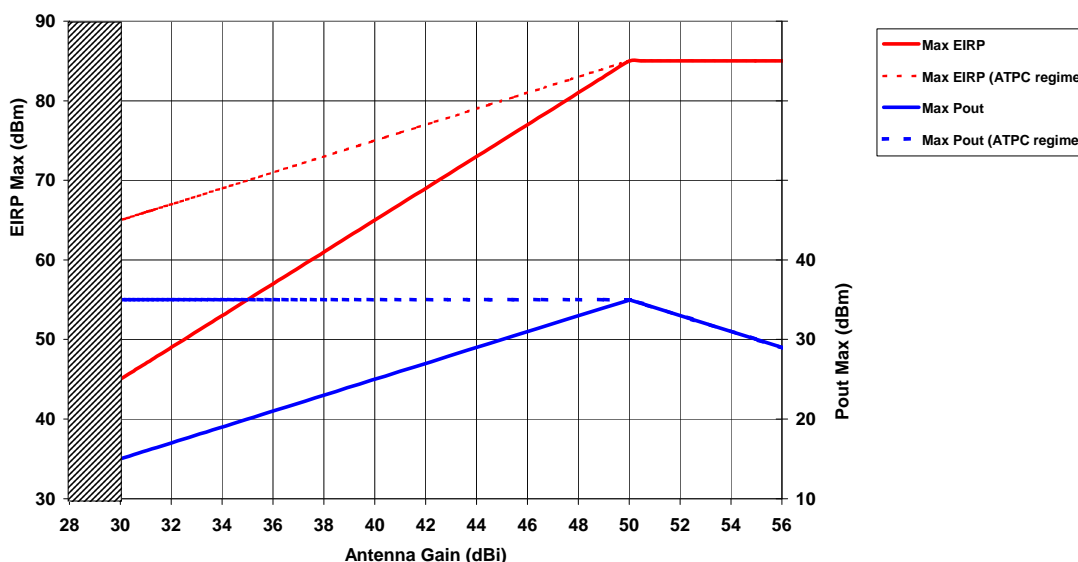
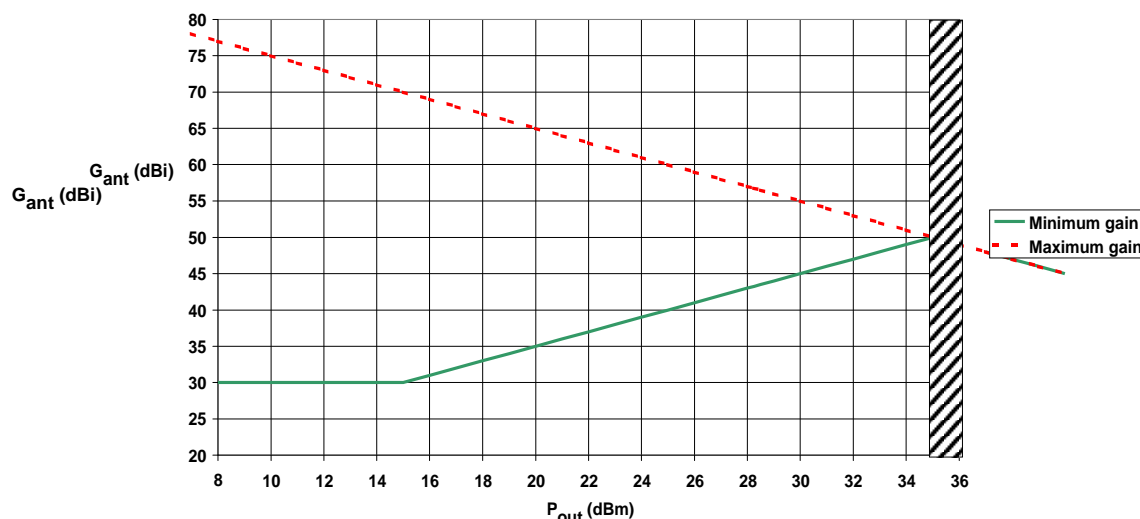


Figure UB.1: Graphical relationship among EIRP limitation, antenna gain and output power



NOTE: For equipment with permanent ATPC feature, P_{out} is intended as that in unfaded condition.

Figure UB.2: Graphical relationship between actual output power and possible range of antenna gain for matching the EIRP limits (applicable to equipment with external antenna connector)

UB.2.2 Output power tolerance

Clause 4.3.1.3 applies.

UB.2.3 EIRP density masks

UB.2.3.1 Limits

There are no mandatory requirements for the EIRP density mask for any particular system, so long as the EIRP of the emission remains within the spectral density mask limits shown in figure UB.3, applicable for both Categories of equipment is met. However, it is recommended that the manufacturer or person responsible for placing the apparatus on the market shall provide the actual transmit mask characteristics met by the equipment. Also, in order to assist administrations and operators in the planning of networks, where appropriate, the duplex arrangement (Go/Return separation) should be provided.

It should be noted that testing EIRP requirements is possible for assessing equipment with integral antenna only; equipment placed on the market without antennas shall meet an output power density mask derived from the EIRP density mask of figure UB.3 reduced by the maximum associated antenna gain (including tolerances) declared by the manufacturer.

The mask of figure UB.3 is not inclusive of frequency tolerance.

In addition, the occupied bandwidth shall remain within the specified band 64 GHz to 66 GHz. However, out-of-band emissions (i.e. those exceeding the 50 % abscissa in figure UB.3) of systems operating close to the 64 GHz to 66 GHz band edges, may still fall outside the band edges. Consequently, the EIRP spectral density falling outside of the 64 GHz to 66 GHz band edges shall be further limited to a maximum of:

- -20 dBW/MHz

This shall not be intended as a relaxation of either the emission mask of figure UB.3 or of the emissions in the spurious domain of clause UB.2.4.

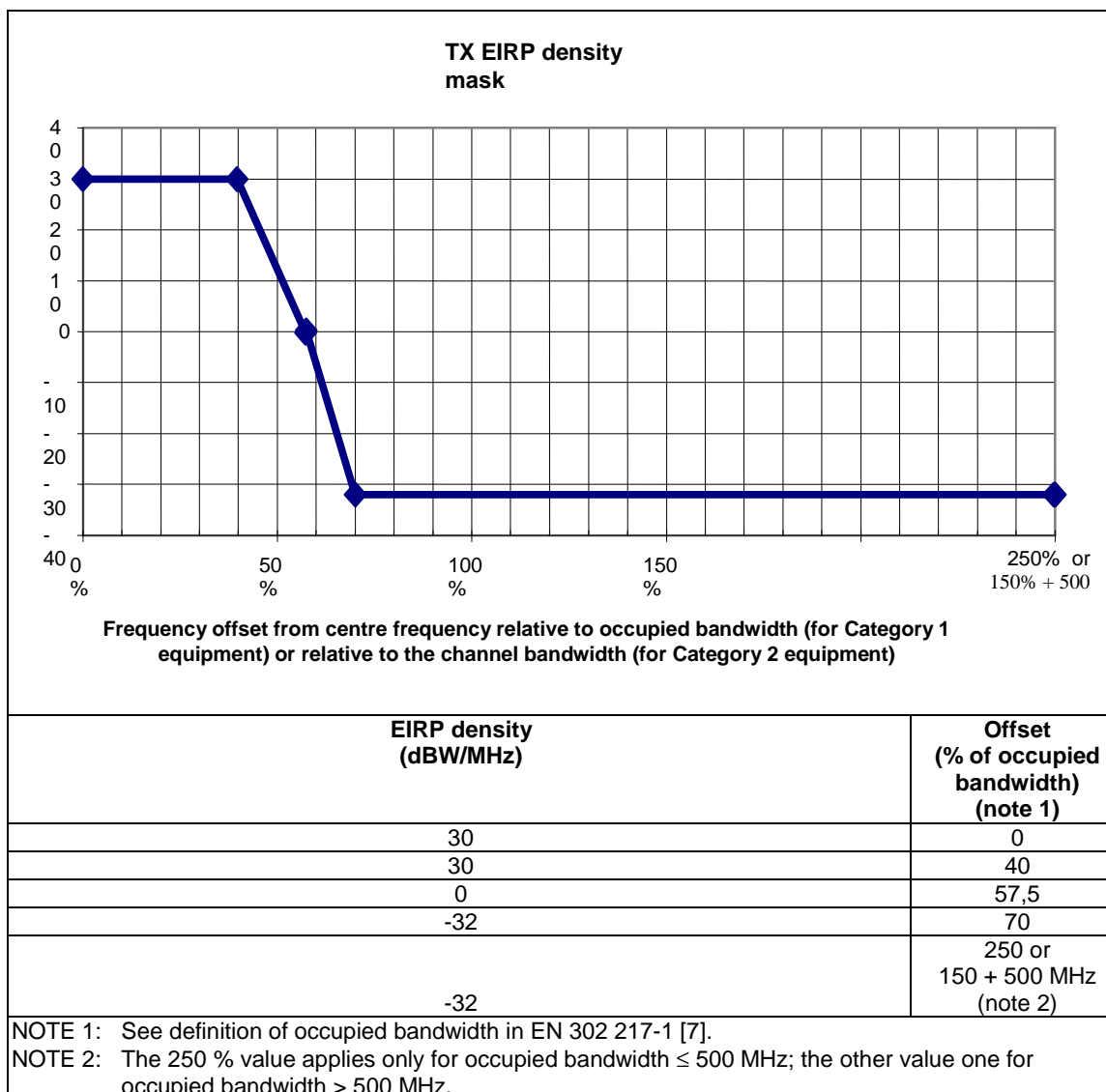


Figure UB.3: Tx EIRP spectral density mask

NOTE: The present document considers that maximum EIRP density is generally set by administrations in order to define Power Flux Density (PFD) levels as a co-ordination trigger between different geographical areas or for cross-border agreements. However, table UB.2 gives guidance, for possible maximum limits, based on currently available technology which already takes into account an allowance for the future development of higher power transmitters.

Table UB.2: Transmitter EIRP spectral density

Typical informative assumptions for deriving the EIRP limits (see note)	
Maximum power spectral density at antenna port	Maximum antenna gain
+15 dBm/MHz	+45 dB
NOTE: In actual applications trade off in these values is possible provided that EIRP density mask limits are met.	

UB.2.3.2 Spectrum analyser settings

The spectrum analyser setting is not of importance when absolute power density is considered, provided that suitable integration/normalization is made.

UB.2.4 Spurious emissions

Clause 4.3.3 shall apply.

UB.2.5 Radio frequency tolerance

The maximum allowable RF-frequency tolerance (clause 4.3.4):

- $\pm X = \pm 150$ ppm (for Category 1 equipment).
- $\pm X = \pm 50$ ppm (for Category 2 equipment).

UB.2.6 RF-channel selection parameters

No class A equipment are foreseen in this band.

UB.2.7 Antenna gain

Equipment in these frequency bands shall be associated to a directional antenna with a minimum gain of 30 dBi.

UB.3 Receiver

Clause 4.4.1 shall apply.

- NOTE (informative): Whenever, in accordance with CEPT/ECC/REC 05-02 [4], simplified spectrum co-ordination is foreseen, receiver parameters may help the co-ordination process (see annex UE).

Annex UC: Void

Annex UD (informative): Rationale for the interference limit formula

UD.1 Analysis of the quality value for the channel selection procedure

UD.1.1 Error-performance and availability requirements for Class A equipment

Class A equipment shall be designed in order to meet network error-performance and availability requirements foreseen by relevant ITU-T and ITU-R Recommendations (see EN 302 217-1 [7]). The interference limit specified in clause 4.2.2, rather than the actual threshold of the equipment, should be considered, when planning the hop length for the required fade margin due to propagation effects.

It should be noted that the specified channel selection procedure (see clause 4.2) can help to avoid interference situations between Class A equipment but cannot guarantee interference-free operation in all situations.

The frequency agility, described in clause 4.2.3, may be a useful function in interference avoidance e.g. between systems using different duplex methods or between Class A and Class B systems.

UD.1.1.1 Example in the 58 GHz band

Interference power level in existing network receivers can be in the worst case (e.g. using values applicable to 58 GHz band):

- $-71\text{dBm} - P_{\text{tx}} (\text{dBm}) + 10 \log(\text{BW}/10 \text{ MHz})$.

where:

- P_{tx} is the mean transmit power of the radio relay at the reference point D' given in figure 1 of EN 302 217-1 [7];
- BW is the noise bandwidth of the receiver.

The interference value calculated from the equation simulates the interference effect of a continuous signal. However, the true effect of a bursty signal may be approximately 3 dB higher (with 50 % duty cycle).

UD.1.2 Theoretical background

The following discussion is tailored to equipment in 58 GHz band, however the principles might be used in any band when frequency co-ordination is not applied.

The channel selection procedure targets to ensure required quality of service of 58 GHz radio links connected to public switched networks. The principle of channel selection procedure is that Class A 58 GHz radio links do not start to transmit on a channel when that channel is already in use. This would ensure continued operation of various kinds of radio links.

The channel use can be detected if the received interference power I clearly exceed the noise power. The receiver noise power is given by $N_0 NF B$ where B is the bandwidth of the interference measurement, NF is the noise figure, and $N_0 = kT$. The transmission is allowed when:

$$I/B < M N_0 NF \quad (\text{UD.1})$$

where M is the necessary margin and the noise power density N_0 . A reasonable channel use threshold is, therefore:

$$(I/B)_{\text{threshold}} = M N_0 NF \quad (\text{UD.2})$$

The suggested threshold value for various kinds of systems is -151 dBm/Hz (-81 dBm/10 MHz). It can be obtained taking Noise Figure (NF) 18 dB and margin of 5 dB or other combination of the two. See figure UD.1 for the breakdown of the margin M .

In order to avoid conflict situations, it is necessary that the interference is measured from the whole transmission bandwidth before transmission is initiated.

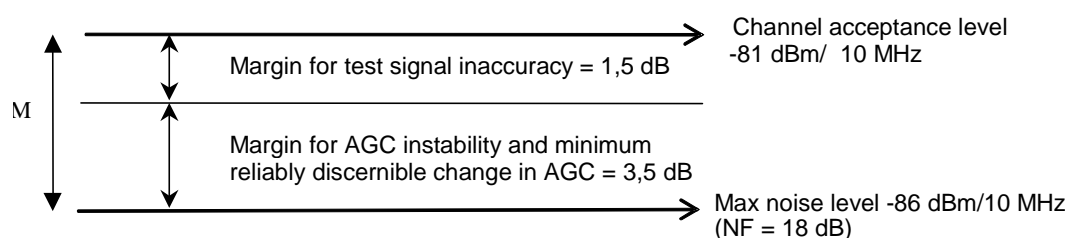


Figure UD.1: Example of definition of margin M

UD.1.3 Typical co-channel interference situation when channel rejection threshold is used

The interference level measured by a radio is generally caused by many interfering radios, but in a typical situation one interferer dominates. Therefore, we concentrate on studying the system of two radios belonging to different hops shown in figure UD.2. Radio 0 is transmitting at power P_0 and has signal bandwidth B_0 . Its antenna gain in the direction of the interfering radio 1 is $G_0(\theta_0)$. The corresponding values for radio 1 are P_1 , B_1 , and $G_1(\theta_1)$. The interference power measured in radio 0 on bandwidth B_0 , caused by radio 1, is I_0 and the interference power measured by radio 1, caused by radio 0, is I_1 .

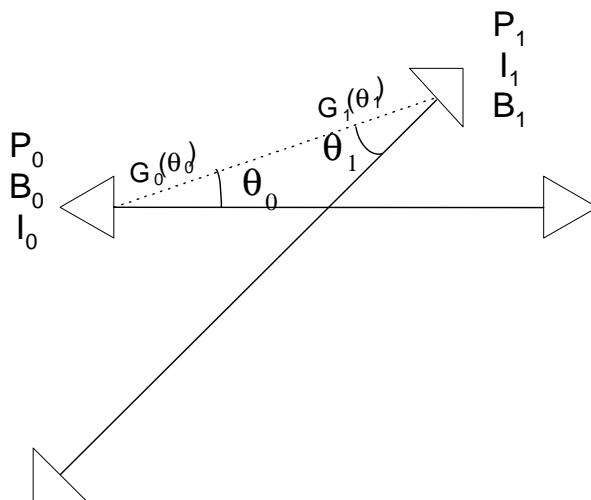


Figure UD.2: A configuration of two interfering links

Assuming that receiver bandwidth is approximately equal to transmit signal bandwidth, and assuming that $B_1 > B_0$, we write the interference powers as:

$$\begin{aligned} I_0 &= (B_0/B_1)P_1G_0(\theta_0)G_1(\theta_1)A_{12}. \\ I_1 &= P_0G_1(\theta_1)G_0(\theta_0)A_{12} \end{aligned} \quad (\text{UD.3})$$

where A_{12} is the attenuation. On the other hand, if $B_1 < B_0$, we have:

$$\begin{aligned} I_0 &= P_1G_0(\theta_0)G_1(\theta_1)A_{12}. \\ I_1 &= (B_1/B_0)P_0G_1(\theta_1)G_0(\theta_0)A_{12}. \end{aligned} \quad (\text{UD.4})$$

When the common factors $G_0(\theta_0)$, $G_1(\theta_1)$, and A_{12} are eliminated from the two equations in (UD.3) we get the relation:

$$P_1I_1/B_1 = P_0I_0/B_0. \quad (\text{UD.5})$$

The same equation is found if the common factors are eliminated from the two equations in (UD.4). Thus the antenna gains are of no concern.

If the most recently installed radio system 1 asserts the following condition:

$$I_1/B_1 < (I/B)_{\text{threshold}}, \quad (\text{UD.6})$$

we obtain, by using equation (UD.6), for the interference caused to the previously existing system 0:

$$I_0/B_0 < (P_1/P_0) (I/B)_{\text{threshold}}. \quad (\text{UD.7})$$

This indicates that the use of the channel selection threshold guarantees that the interference generated to existing radio systems is limited by equation (UD.7).

UD.2 Protection capability of the RF-channel selection procedure

RF-channel selection procedure specifies the maximum interference level of an unoccupied channel which defines the hop length rather than the noise limit. The procedure helps, however, to avoid interference situations between systems with different parameters such as transmit power or spectrum width. The procedure guarantees interference free operation for systems with relatively simple modulation methods typically up to about 500 metres. Longer hops are protected with high probability if the RF-channel with the lowest measured interference power is always selected during the procedure.

The channel selection procedure does not always protect against the adjacent channel interference when there is large difference in out-of-band spectrum of the existing system and the new system and if the distance to the interferer is fairly short.

The interference situations between systems with different duplex methods cannot be always avoided. Interferences from FDD-type systems into TDD-type systems can be avoided if the procedure is applied according to the standard in both systems. However, the procedure cannot guarantee interference free situation for FDD-type systems because duplex-frequency is not standardized. For this reason the concept of "frequency agility" was specified (see clause 4.2.3). This method may also help to avoid long outages due to interference situations between Class A and Class B systems.

UD.3 Frequency agility criteria

A means to implement criteria for the detection of unacceptable interference could be the following:

- unacceptable interference situation (corresponding to unavailability situation) is decided if during 10 consecutive seconds or more the estimated BER evaluated by an in-service proprietary method, with a level of confidence of 99 %, exceeds 10^{-3} and the actual received signal level is more than 5 dB above the receiver threshold level corresponding to $\text{BER} = 10^{-3}$. For conformance testing purposes this receiver threshold level shall be declared by the supplier. If available, the new RF-channel shall be operational again within the time declared by the supplier.

Annex UE (informative): Capacity and Receiver characteristics in the band 64 GHz to 65 GHz

UE.1 Band 64 GHz to 65 GHz

When operating in accordance within the scope of the present document, the only essential receiving phenomena are related to spurious emissions. Other receiver specifications, considered non-essential for the purpose of the present document, are shown within this annex.

All measurements, when applicable, should be carried out with the transmitters loaded with test signals defined in clause 4.8.

UE.1.1 BER as a function of receiver input signal level (RSL)

All parameters are referred to reference point C (for systems with a simple duplexer) or B (for systems with a multi-channel branching system). Losses in RF couplers (possibly used for protected systems) are not taken into account in the limits specified below.

When packet data transmission is considered, any BER requirements should be transformed into FER requirements according to the rules given in clause G.4 of EN 302 217-2-1 [24].

The typical RSL threshold values, expressed in term of power density (dBm/MHz) for required BER are indicated in table UE.1.

NOTE 1: The values in table UE.1 refer to S/N ratios in line with the theory given, for $BER=10^{-6}$ and various modulation formats, in ITU-R Recommendation F.1101 [27] and to systems implementing typical low noise front-end and error correction.

Table UE.1: Typical RSL BER thresholds

Spectral efficiency class	1 (see note1)		2 (see note 2)		3	4 (see note 3)	5 (see note 3)
	1	2	1	2	2	2	2
RSL(dBm/MHz) for $BER \leq 10^{-6}$	-88,5	-91,5	-79	-88,5	-83	-81,5 (16 QAM) -78,5 (32 QAM)	-75,5 (64 QAM) -72,5 (128 QAM)
RSL(dBm/MHz) for $BER \leq 10^{-8}$	-87	-89	-77,5	-86	-80,5	-79 (16 QAM) -76 (32 QAM)	-73 (64 QAM) -70 (128 QAM)
NOTE 1: Values are based on the simplest modulation formats (e.g. OOK/FSK) for category 1 equipment and on typical PSK formats for category 2 equipment.							
NOTE 2: Values are based on the simplest modulation formats (e.g. 4 ASK/4 FSK) for category 1 equipment and on typical 4 PSK/4 QAM formats for category 2 equipment. Category 1 systems with peak symbol rate larger than ~1 200 Mbaud/s may experience slightly worst performance (up to ~3 dB) due to the need of containing the occupied bandwidth within the available 2 000 MHz.							
NOTE 3: The range of values is related to possibly different formats within the class (e.g. 16/32 QAM in class 4 and 64/128 QAM in class 5).							

The typical RSL of actual systems can be derived integrating the values in the table over a bandwidth equal to the peak symbol-rate actually transmitted on air or, in the slightly more conservative way, over the Occupied or Channel bandwidth.

NOTE 2: The actual RSL threshold for link budget definition may be defined by the manufacturer, generally set to a BER between 10^{-6} and 10^{-3} , according to the type of traffic and quality of service to be provided.

UE.1.2 Co-channel and adjacent channel interference sensitivity

The co-channel interference is considered to be that given by a like signal completely uncorrelated with the one under test.

All Carrier to Interference ratio (C/I) measurements are referred to reference point C.

For both category of equipment, the limits of Carrier to Interference ratio (C/I) in case of co-frequency channel and first adjacent channel interference should be as specified in table UE.2, giving maximum C/I values for 1 dB and 3 dB degradation of the RSL limits specified for a BER $\leq 10^{-6}$ in clause UE.1.1.

Table UE.2: Co-channel and 1st adjacent channel interference sensitivity

C/I (dB) for BER $\leq 10^{-6}$ RSL degradation of 1 dB or 3 dB				
Spectrum efficiency class ↓	Co-channel		Adjacent channel	
	1 dB	3 dB	1 dB	3 dB
1	23	19	0	-4
2	23	19	0	-4
3	23	19	-1	-5
4	30	26	-1	-5
5	37	33	-3	-7

NOTE: For category 1 systems only classes 1 and 2 are applicable.

Test of adjacent channel C/I degradation is done with two systems of same bandwidth with centre frequencies spacing equal to the occupied bandwidth (category 1) or channel bandwidth (category 2). Assessment is not applicable for occupied or channel bandwidth exceeding 1 000 MHz.

UE.1.3 CW spurious interference

For a receiver operating at the RSL specified in clause A.1 for a BER $\leq 10^{-6}$ threshold, the introduction of a CW interferer at a level specified by clause 7.1 of EN 301 390 [28], with respect to the wanted signal and at any frequency up to the relevant upper and lower frequency limits derived from the table set out in clause 7.1 of EN 301 390 [28], but excluding frequencies either side of the wanted frequency by up to 250 % of the separation between channels using the same polarization, should not result in a BER greater than 10^{-5} .

For frequency arrangements with specific channel or block assignments channel spacing's instead of the relevant upper and lower frequency limits are applied.

This test is designed to identify specific frequencies at which the receiver may have a spurious response; e.g. image frequency, harmonics of the receive filter, etc. The actual test range should be adjusted accordingly. The test is not intended to imply a relaxed specification at all out of band frequencies elsewhere specified in the present document.

Annex UF (informative): Bibliography

- ITU-R Recommendation F.746: "Radio-frequency channel arrangements for radio-relays systems".
- ITU-R Recommendation F.1102: "Characteristics of radio-relay systems operating in frequency bands above about 17 GHz".
- ITU-R Recommendation P.530: "Propagation data and prediction methods required for the design of terrestrial line-of-sight systems".
- ITU-R Recommendation SM.329-10: " Unwanted emissions in the spurious domain ".
- ITU-R Recommendation SM.1541-1: "Unwanted emissions in the out-of-band domain".
- ITU-T Recommendation G.703 (2001) and erratum 1 (2005): "Physical/electrical characteristics of hierarchical digital interfaces".

Annex UG (informative): The EN title in the official languages

Language	EN title
Bulgarian	
Czech	
Danish	
Dutch	
English	Fixed Radio Systems; Characteristics and requirements for point-to-point equipment and antennas; Part 3: Harmonized EN covering essential requirements of Article 3.2 of R&TTE Directive for equipment operating in frequency bands where simplified or no frequency co-ordination procedures are applied
Estonian	
Finnish	
French	
German	
Greek	
Hungarian	
Icelandic	
Italian	
Latvian	
Lithuanian	
Maltese	
Norwegian	
Polish	
Portuguese	
Romanian	
Slovak	
Slovenian	
Spanish	
Swedish	

History

Document history		
V1.1.3	Publication	March 2005
V1.2.1	October 2007	One-step Approval Procedure OAP 20080208: 2007-10-10 to 2008-02-08