ETSI EN 302 217-3 V2.1.1 (2013-07)

Fixed Radio Systems;
Characteristics and requirements for
point-to-point equipment and antennas;
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 Directive

Reference
REN/ATTM-04020

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Contents

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Foreword

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

The present document has been produced by ETSI in response to a mandate issued from the European Commission under Directive 98/34/EC [i.19] as amended by Directive 98/48/EC [i.20].

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

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

The requirements relevant to Directive 1999/5/EC [1] are summarized in annex 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. Full details of the entire series can be found in part 1 [8].

National transposition dates	
Date of adoption of this EN:	25 June 2013
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Major variants with respect to previous published version

The present version (V2.1.1) introduces in annex UC (systems for frequency range 71 GHz to 86 GHz) the reference to additional requirements (reported in corresponding new version of EN 302 217-2-2 [9]), further applicable when conventional link-by-link coordination is assumed to be the predominant assignment methodology. Also some clarifications on the requirements in annex UC have also been included.

In addition, editorial change of terminology has been made from previous terms "Class A and Class B" (possibly confused with the spectral efficiency "class" used also in the present document) with "Type A and Type B".

Introduction of provision for equipment using permanent ATPC function also in annex UBa, in line with similar provisions in other annexes UB and UC.

Editorial improvement for the understandability of interrelation between EIRP/Pout/antenna gain requirements in annexes UB, UBa and UC.

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 [8].

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 shown in EG 201 399 [i.2].

Figure 1: Void

1 Scope

The present document specifies the essential requirements for point-to-point Digital Fixed Radio Systems (DFRS) operating in higher frequency bands, which propagation characteristics might be suitable for different simplified frequency planning (see example) rather than conventional link-by-link coordinated deployment.

This would imply that administrations may apply 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 based on the knowledge of existing links (e.g. through a public national data base) so that the impact of a possible new link could be evaluated on the basis of budgetary considerations of typical equipment receiver performances (which will not be considered related to essential requirements of article 3.2 of R&TTE Directive [1]).

The bands in the scope of the present document, to which these frequency assignment procedures apply, are specifically referred in annexes UA through UC where the applicable equipment requirements are reported.

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, and those above up to ~63 GHz, 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 Recommendation ITU-R P.676 [i.13].

The present document 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".

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 [10], 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 [10] apply. For more background information on the equipment and antenna parameters here identified as relevant to article 3.2 of R&TTE Directive [1] see EG 201 399 [i.2] and TR 101 506 [i.7].

For the purposes of the present document two equipment Types are specified, when appropriate, depending on specific network requirements:

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

2 References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

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

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 necessary for the application of the present document.

[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/Recommendation 74-01 (01-2011): "Unwanted emissions in the spurious domain".

[3] CEPT/ECC/Recommendation (05)02 (02-2009): "Use of the 64 - 66 GHz frequency band for Fixed Service".

[4] CEPT/ECC/Recommendation (09)01 (02-2009): "Use of the 57 - 64 GHz frequency band for point-to-point Fixed Wireless Systems".

[5] CEPT/ECC/Recommendation (05)07 (02-2009): "Radio frequency channel arrangements for Fixed Service Systems operating in the bands 71 - 76 GHz and 81 - 86 GHz".

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

[7] ETSI EN 301 126-3-1 (V1.1.1) (04-2000): "Fixed Radio Systems; Conformance testing; Part 3-1: Point-to-Point antennas; Definitions, general requirements and test procedures".

[8] ETSI EN 302 217-1 (V.2.1.0) (04-2013): "Fixed Radio Systems; Characteristics and requirements for point-to-point equipment and antennas; Part 1: Overview and system-independent common characteristics".

[9] ETSI EN 302 217-2-2 (V2.1.0) (04-2013): "Fixed Radio Systems; Characteristics and requirements for point-to-point equipment and antennas; Part 2-2: Digital systems operating in frequency bands where frequency co-ordination is applied; Harmonized EN covering essential requirements of Article 3.2 of R&TTE Directive for digital systems operating in frequency bands where frequency co-ordination is applied".

[10] ETSI EN 302 217-4-2 (V1.5.1) (08-2010): "Fixed Radio Systems; Characteristics and requirements for point-to-point equipment and antennas; Part 4-2: Antennas; Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive".

[11] 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".

[12] IEEE 802.3-2008: "Information technology - Local and metropolitan area networks - Specific requirements - Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications".

[13] Recommendation ITU-R SM.1539-1 (11-2002): "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".

[14] Recommendation ITU-T O.151 (10-1992) and Corrigendum 1 (05-2002): "Error performance measuring equipment operating at the primary rate and above".

[15] Recommendation ITU-T O.181 (05-2002): "Equipment to assess error performance on STM-N interfaces".

[16] Recommendation ITU-T O.191 (02-2000): "Equipment to measure the cell transfer performance of ATM connections".

2.2 Informative references

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

[i.1] Void.

[i.2] ETSI EG 201 399: "Electromagnetic compatibility and Radio spectrum Matters (ERM); A guide to the production of Harmonized Standards for application under the R&TTE Directive".

[i.3] 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".

[i.4] Void.

[i.5] Void.

[i.6] 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".

[i.7] ETSI TR 101 506: "Fixed Radio Systems; Generic definitions, terminology and applicability of essential requirements under the article 3.2 of 1999/05/EC Directive to Fixed Radio Systems".

[i.8] ETSI TR 103 103: "Fixed Radio Systems; Point-to-point systems; ATPC, RTPC, Adaptive Modulation (mixed-mode) and Bandwidth Adaptive functionalities; Technical background and impact on deployment, link design and coordination".

[i.9] Recommendation ITU-R F.1101: "Characteristics of digital fixed wireless systems below about 17 GHz".

[i.10] Recommendation ITU-R F.1191: "Necessary and occupied bandwidths and unwanted emissions of digital fixed service systems".

[i.11] Recommendation ITU-R F.1497: "Radio-frequency channel arrangements for fixed wireless systems operating in the band 55.78-59 GHz".

[i.12] Recommendation ITU-R F.2006: "Radio-frequency channel and block arrangements for fixed wireless systems operating in the 71-76 and 81-86 GHz bands".

[i.13] Recommendation ITU-R P.676: "Attenuation by atmospheric gases".

[i.14] Recommendation ITU-R SM.329-12: "Unwanted emissions in the spurious domain".

[i.15] Recommendation ITU-R SM.1541-4: "Unwanted emissions in the out-of-band domain".

[i.16] ITU Radio Regulations (2008).

[i.17] CEPT/ERC/Recommendation 12-09 (2004), withdrawn (2009): "Radio frequency channel arrangement for Fixed Service systems operating in the band 57,0 - 59,0 GHz which do not require frequency planning".

[i.18] ETSI TR 100 028: "ElectroMagnetic Compatibility and Radio Spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics".

[i.19] Directive 98/34/EC of the European Parliament and of the Council of 22 June 1998 laying down a procedure for the provision of information in the field of technical standards and regulations.

[i.20] Directive 98/48/EC of the European Parliament and of the Council of 20 July 1998 amending Directive 98/34/EC laying down a procedure for the provision of information in the field of technical standards and regulations.

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 [8] apply.

3.2 Symbols

For the purposes of the present document, the symbols given in EN 302 217-1 [8] apply.

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in EN 302 217-1 [8] 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 [i.2]; specific applications and descriptions for DFRS is given in TR 101 506 [i.7].

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 [8].

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 [6] 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 Type 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:

- $P_i > C$ dBm + 10 log (BW/10 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 informative 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 informative annex UD, 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 [8].

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	Recommendation ITU-T O.151 [14] (PRBS)
SDH	Recommendation ITU-T O.181 [15]
ATM	Recommendation ITU-T O.191 [16]
Ethernet interface (packet data)	IEEE 1802.3 [11] and IEEE 802.3 [12]
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 [8]), shall not exceed A (dBm or 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 (dBm or dBW) including tolerance and, if applicable, ATPC/RTPC influence. 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.

4.3.1.4 Automatic Transmit Power Control (ATPC)

ATPC is an optional feature. Equipment with ATPC will be subject to a supplier's declaration of ATPC ranges (see note 1) and related tolerances. The supplier shall also declare if the equipment is designed with ATPC as a fixed permanent feature.

When ATPC is used as permanent feature, different Pout and/or EIRP requirements (+A and +B limits in previous clauses) may apply to power levels delivered by the ATPC regime in both "unfaded conditions" and "full power" (see note 2). Requirements are dependent on frequency band and are given in the relevant annexes UA to UC.

NOTE 1: For the relevant power level definitions of ATPC for ATPC operation see EN 302 217-1 [8]. For additional clarification on ATPC operation see TR 103 103 [i.8].

NOTE 2: These ATPC regime power levels are identified as "*minimum power*" and "*maximum available power*", respectively, in the relevant power level definitions in EN 302 217-1 [8].

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/Recommendation 74-01 [2], giving the applicable limits in the spurious domain (see note 1).
- Recommendation ITU-R SM.1539-1 [13] and Appendix 3 of the ITU Radio Regulations [i.16], giving the variation of the boundary between the out-of-band and spurious domains (see note 2).

NOTE 1: CEPT/ERC/Recommendation 74-01 [2] based on Recommendations ITU-R SM.329-12 [i.14] and F.1191 [i.10] 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: 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 ±250 % of the relevant Channel Separation (ChS), as far as they do not exceeded 500 MHz. Beyond this value the boundary is evaluated as: ±(500 MHz + 1,5 × 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 Article 1.151 of Radio Regulations [i.16] 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, for any reason, shall not exceed ±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 [10].

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 [10].

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 [10].

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 [10].

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 to the 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/Recommendation 74-01 [2], which gives the applicable limits.

NOTE: CEPT/ERC/Recommendation 74-01 [2], based on Recommendations ITU-R SM.329-12 [i.14] and F.1191 [i.10], 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 [6].

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:

a) 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 [6] for climatic conditions and in table 1 of EN 301 126-1 [6] 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 [6].

b) 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 [7].

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 present document, 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 (e.g. TR 100 028 [i.18]).

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 [6].

Table 2: Transmitter parameters, test clauses and conditions

Clause	Parameter	EN 301 126-1 [6] reference clause for the test methods	Climatic conditions (note 1)		Channels to be tested (note 4)	Other specific conditions
			Ref	Extreme	B = Bottom M = Middle T = Top	
5.3.1.1	Transmitter power	5.2.1	X	X	BMT	See note 3
5.3.1.2	Equivalent Isotropically Radiated Power (EIRP) and EIRP density mask	6.3 of EN 301 126-3-1 [7]	X	X	BMT	See note 2
5.3.1.3	Transmitter power tolerance	5.2.1	X	X	BMT	See note 3
5.3.1.4	ATPC	5.2.3	X		M	
5.3.2	RF spectrum mask	5.2.6	X	X	BMT	See 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 ERC/Recommendation 74-01 [2]
5.3.4	Radio frequency tolerance	5.2.5	X	X	BMT	See note 3

NOTE 1: This refers to climatic conditions only; for other environmental and power supply conditions, please refer to EN 301 126-1 [6] which provides, for testing some parameters, combined variations also of the power supply source, see table 1 of EN 301 126-1 [6]; 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 B 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 [6].

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 [7].

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 [6].

5.3.1.4 ATPC

The correct operation of the ATPC function (according to the supplier's declaration) shall be tested according to the test method described in clause 5.2.3 of EN 301 126-1 [6]. The test shall be carried out at reference climatic conditions.

Other TX and RX testing shall be carried out with transmitter power level corresponding to:

- maximum available power for all transmitter and receiver requirements;
- when ATPC is used as permanent feature for enhancing the maximum EIRP/Pout limits provided in the relevant annexes UA through UC, EIRP and Pout requirements will be tested with ATPC set to both maximum unfaded and full power levels as declared by the manufacturer (note).

NOTE: In general, these power levels are intended as the specific value of "*minimum power*" and "*maximum available power*", respectively, selected by the manufacturer among a possible wider flexibility range of the equipment. It is reminded that, in this case, the user should not be able to autonomously increase those levels.

5.3.2 RF spectrum mask

The clause that give the test methods for the RF spectrum masks is clause 5.2.6 of EN 301 126-1 [6].

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 e.i.r.p. 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 [6].

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/ERC/Recommendation 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 [6].

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 [7] reference clause for the test methods	Climatic conditions (see note 1)		Channels to be tested (see note 2)	Other specific conditions
			Ref	Extreme	B = Bottom M = Middle T = Top	
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 [7]. 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 [7].

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 [7].

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 [6] 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 [6] reference clause for the test methods	Climatic conditions (see notes 1 and 2)		Channels to be tested (see note 3) B = Bottom M = Medium T = Top	Other specific conditions
			Ref	Extreme		
5.4.1	Spurious emissions	5.3.2	X		BMT	Actual test shall be limited to the practical frequency range foreseen by recommends 3 of ERC/Recommendation 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 [6].						
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 ERC/Recommendation 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 [6].

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 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 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 (see note) The following requirements and test specifications are relevant to the presumption of conformity under the article 3.2 of the R&TTE Directive [1]						
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
3bis	ATPC	4.3.1.4	C	Only applies if ATPC is provided	O	5.3.1.4
4	Adjacent channel power - Spectrum mask	4.3.2	U		O	5.3.2
5	Spurious emissions	4.3.3	U		O	5.3.3
6	Radio frequency tolerance	4.3.4	U		O	5.3.4

Harmonized Standard EN 302 217-3 (see note) The following requirements and test specifications are relevant to the presumption of conformity under the article 3.2 of the R&TTE Directive [1]						
Requirement			**Requirement Conditionality**		**Test Specification**	
No	**Description**	**Reference: Clause No (note)**	**U/C**	**Condition**	**E/O**	**Reference: Clause No**
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
Receiving requirements						
9	Spurious emissions	4.4.1	U		O	5.4.1
Control and monitoring function requirements						
10	Sharing protocols - Interference avoidance requirement	4.2.1	C	Type 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:

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 operating frequency sub-ranges (i.e. a number of pre-selectable channels within a given channel arrangement or a portion of a frequency band, covered without changing any hardware e.g. duplex filters), it is considered enough that one frequency sub-range is subject of testing. The test report shall be produced for the lowest (B, bottom), intermediate (M, median) and highest (T, top) 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: In principle, all tests are carried out on the same equipment during a single test session. However, it is permitted to have different test sessions and equipment under test to allow for unpredictable events (e.g. equipment or test instrument failure during the test session that is not immediately repairable), and for any additional tests required by a future revision of the present document. This allowance is not intended as a means to circumvent 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 figure 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).

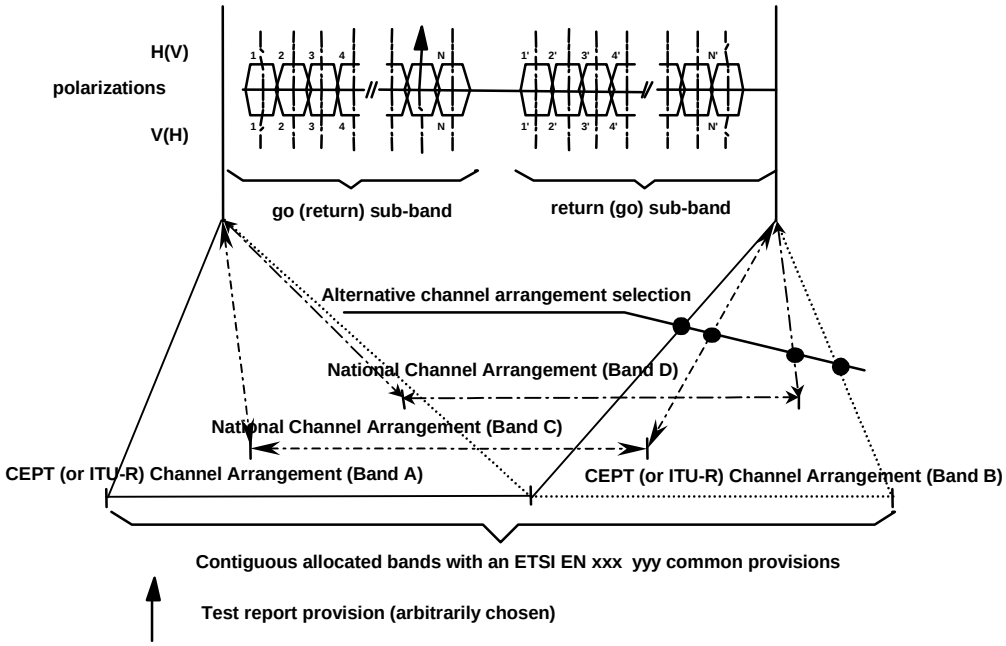


Figure B.1: Test report frequency requirement for equipments intended for single channel operation

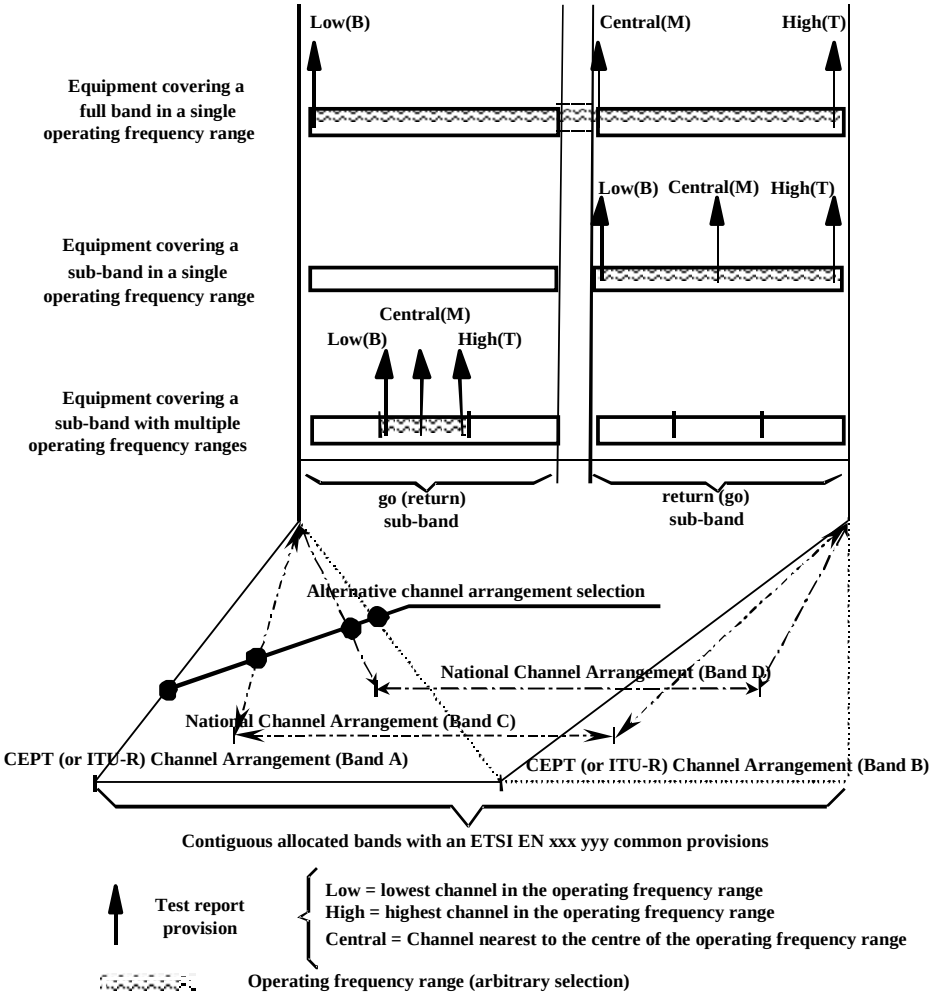


Figure B.2: Test report frequency requirements for equipments intended for covering an operating frequency range

B.2 Multirate/multiformat equipment

DFRS equipments can be designed either for a unique payload and modulation format (*single-mode* systems, see note) or for covering a number of different payload-rates (*multirate* systems, see note) or different modulation formats (i.e. different equipment classes) or different error correction codes transmitted, through software presetting or protocols, over a number of different channel separations.

In the latter case, within a certain CS, the payload and modulation presettings may offer static operation over different payload/modulation (*preset-mode* systems, see note).

For *preset-mode* systems the equipment shall comply with all the requirements of the present document at any possible combination of operating payload, modulation and codes declared.

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.

Mixed-mode (see note) and *bandwidth adaptive* (see note) systems provisions are specifically detailed, when relevant, in the appropriate places of the present document.

NOTE: *Single-mode, multirate, preset-mode, mixed-mode* and *bandwidth adaptive* systems are defined in EN 302 217–1 [8].

Annex C:
Void

Annex D (informative): Bibliography

- Recommendation ITU-R P.530: "Propagation data and prediction methods required for the design of terrestrial line-of-sight systems".
- Directive 2006/95/EC of the European Parliament and of the Council of 12 December 2006 on the harmonization of the laws of Member States relating to electrical equipment designed for use within certain voltage limits.
- Directive 2004/108/EC of the European Parliament and of the Council of 15 December 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility and repealing Directive 89/336/EEC.

Annex UA (normative): Frequency band 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 EN 302 217-2-1 [i.6] and EN 302 217-2-2 [9].

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.

NOTE: In the frequency band 57 GHz to 59 GHz equipment characteristics referred in annex UBa may also apply. The manufacturer may select the more appropriate according to the actual system and application foreseen.

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 [i.16].

The frequency band is from 57 GHz to 59 GHz intended as the lower portion of the frequency range reported in CEPT/ECC/Recommendation (09)01 [4] (see note) or in annex 2 of Recommendation ITU-R F.1497 [i.11].

NOTE: CEPT/ERC/Recommendation 12-09 [i.17] (presently withdrawn) regulated this band until year 2008. The successful co-existence of Type A and Type B equipment may require the regulator to define exclusive spectrum for each equipment Class (see annex UD). Neither CEPT/ERC/Recommendation 12-09 [i.17] nor ECC/Recommendation (09)01 [4] 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 in the scope of this annex are those previously specified in the withdrawn CEPT/ERC/Recommendation 12-09 [i.17] with either 50 MHz or 100 MHz channel raster. These channel sizes are still provided, among other options, also by CEPT/ECC/Recommendation (09)01 [4].

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 [8].

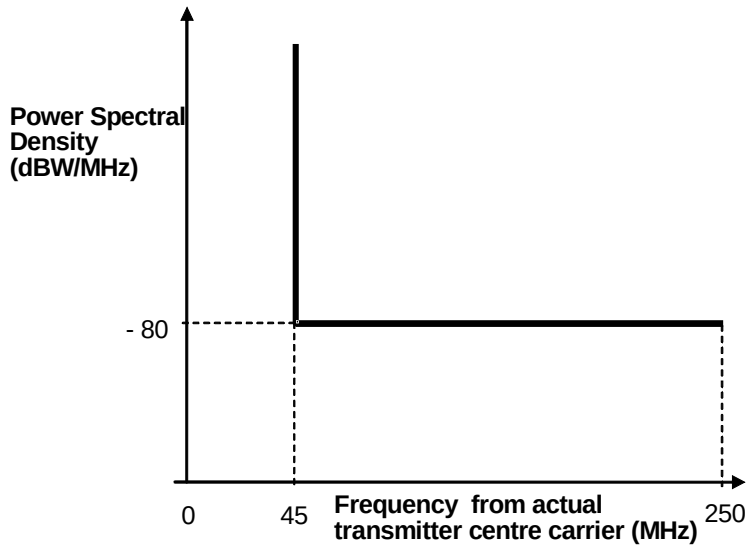


Figure UA.1: Limits of spectral power density for 100 MHz radio channels

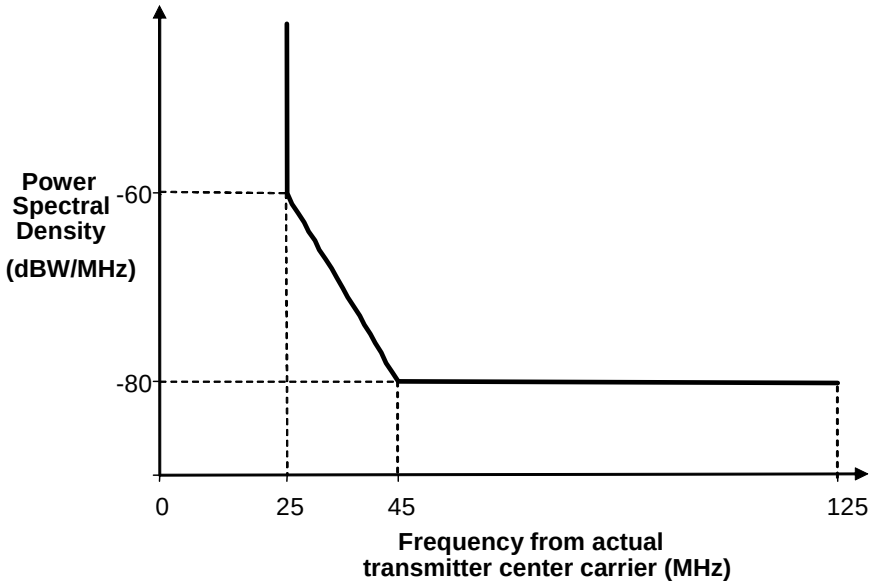


Figure UA.2: Limits of spectral power density for 50 MHz radio channels

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 e.i.r.p. 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):

- ±X = ±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 Type B equipment is 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 intended as the lower portion of the frequency range reported in ECC/Recommendation (09)01 [4] or in annex 2 of Recommendation ITU-R F.1497 [i.11].

UA.2.1.2 Radio channel arrangements

The channel arrangements in the scope of this annex are those previously specified in the withdrawn CEPT/ERC/Recommendation 12-09 [i.17] with either 50 MHz or 100 MHz channel raster. These channel sizes are still provided, among other options, also by ECC/Recommendation (09)01 [4].

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 applies.

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:

- ±X = ±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 EN 302 217-2-1 [i.6] and EN 302 217-2-2 [9].

In this frequency band only Type B equipment (i.e. without mandatory RF channel-free automatic selection, see clause 1) is considered.

Both FDD and TDD applications are covered in this annex.

The frequency arrangement derived from the recommendation ECC/Recommendation (05)02 [3] 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, when appropriate, in the various clauses of the present annex.

The two categories of equipment are:

Category 1:

Equipment for flexible usage of spectrum (according to ECC/Recommendation (05)02 [3]) 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 [9].

NOTE 1: 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 ECC/Recommendation (05)02 [3]) where a single or a number of contiguous frequency slots of 30 MHz or 50 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.

NOTE 2: In the frequency band 64 GHz to 66 GHz equipment characteristics referred in annex UBa may also apply. The manufacturer may select the more appropriate according to the actual system and application foreseen.

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 [i.16].

The frequency band is from 64 GHz to 66 GHz as reported in ECC/Recommendation (05)02 [3].

Other national or future ITU-R or ECC/Recommendations set around the rough boundary of present ITU-R or CEPT/ERC/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 ECC/Recommendation (05)02 [3].

UB.1.2 Radio channel arrangements

The usage of the band is specified in ECC/Recommendation (05)02 [3]; it considers four alternatives:

- Free system bandwidth, occupying up to the whole band (TDD case).
- ChS = n × 30 MHz; multiple of basic frequency slots with n = [1..33] (FDD case) or n = [1..66] (TDD case).
- ChS = n × 50 MHz; multiple of basic frequency slots with n = [1..19] (FDD case) or n = [1..38] (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 or 50 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 the possible supplier declaration, equipment may be subdivided into the same spectral efficiency classes defined in EN 302 217-2-2 [9].

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 nominal channel bandwidth (for category 2 systems).

The supplier shall declare the spectral efficiency and occupancy in term of the occupied bandwidth (for category 1 systems) or the nominal channel bandwidth (for category 2 systems). In case of "*preset-mode*" systems (see definition in EN 302 217-1 [8]) the bandwidths of all options, obtained through permanent preset, shall be declared and the relevant spectrum masks shall be complied with, for all options.

NOTE: "*Mixed-mode*" systems (see definition in EN 302 217-1 [8]) do not need specific provision because only one emission mask is provided for all modes.

The nominal channel bandwidth shall be coherent with the occupied bandwidth, as defined in Radio Regulations [i.16] and, for Fixed Service systems in Recommendation ITU-R F.1191 [i.10]; the nominal channel bandwidth, in terms of n × 30 MHz or n × 50 MHz slots, shall be the size of the closest slots aggregation wider than the actual occupied bandwidth.

In case of *"bandwidth adaptive"* systems (see definition in EN 302 217-1 [8]), where the system capacity may be dynamically changed by means of bandwidth reduction during adverse propagation conditions, the nominal channel bandwidth should be defined as that of the maximum bandwidth used in clear-air propagation conditions.

Table UB.1: Minimum spectral efficiency

Equipment Spectral efficiency	**Reference Index**	1	2	3	4	5	6	7
	Class	1	2	3	4L	4H	5L	5H
Minimum spectral efficiency (Mbit/s/MHz)		0,5	1	1,6	2,2	2,8	3,4	4
NOTE 1: Category 1 systems are limited to classes 1 and 2 only. NOTE 2: In any case, the actual occupied bandwidth shall not exceed 2 000 MHz (full band category 1 systems) or 1 980 MHz (full band category 2 systems).								

UB.2 Transmitter

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

The maximum power shall be limited, in term of EIRP of the systems by the provisions given in the Radio Regulations [i.16] (i.e. in article 21).

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

However, in order of safeguarding a fair and efficient use of the spectrum, maximum Pout and EIRP emissions (A and B limits referred in clauses 4.3.1.1 and 4.3.1.2) of equipment in the scope of the present document shall be limited as in following clauses as function of the antenna gain (G_{ant}).

UB.2.1.1 Equipment without ATPC as permanent feature

These are equipment that, even if ATPC is implemented, it can be freely enabled, disabled and/or preset by the user.

- **Equipment with integral antenna**

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

  2a) Minimum G_{ant} (dBi) ≥ 30.

  The above limitations automatically imply (see figure UB.1) also a limit to the maximum Pout:

  3a) Pout (dBm) $\leq G_{ant} - 15$ for $30 \text{ dBi} \leq G_{ant} < 50$ dBi
  $\leq 85 - G_{ant}$ for $G_{ant} \geq 50$ dBi.

- **Equipment offering external antenna connectors**

  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 (see note) for not exceeding the above EIRP limitations, i.e.:

  1b) Minimum G_{ant} (dBi) $\geq$ Pout (dBm) + 15 or
  ≥ 30 (dBi) (whichever is the greater).

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

  3b) Pout (dBm) $\leq +35$

  where Pout 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.

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

UB.2.1.2 Equipment implementing ATPC as permanent feature

With the term "permanent feature" it shall be intended that ATPC cannot be disabled by the user or, whenever it is possible, the maximum output power delivered, in any conditions, cannot be set to a value exceeding clause UB.2.1.1 provisions 1a, 2a and 3a (or 1b, 2b and 3b as appropriate). More information on the use of ATPC may be found in TR 103 103 [i.8].

Equipment implementing ATPC as a permanent feature, linearly activated by the drop of RSL in the corresponding far end receiver, should respect the following limitations:

- equipment with integral antennas:

  EIRP and Pout in full power ATPC regime:

  $1a_{ATPC}$) EIRP (dBm) $\leq +35 + G_{ant}$ (dBi) or
  $\leq +85$ (whichever is the lower).

  $2a_{ATPC}$) G_{ant} (dBi) ≥ 30

  The above limitations automatically imply (see figure UB.1) also a limit to the maximum Pout in full power ATPC regime:

  $3a_{ATPC}$) Pout (dBm) $\leq +35$ for $30 \leq G_{ant} < 50$ dBi
  $\leq 85 - G_{ant}$ for $G_{ant} \geq 50$ dBi.

  $4a_{ATPC}$) Minimum ATPC attenuation (dB) $\geq$ actual Pout (max delivered in full power ATPC regime) – maximum Pout (from formula 3a clause UB.2.1.1)

- equipment offering external antenna connectors:

  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 (see note) for not exceeding the above EIRP limitations, i.e.:

  $1b_{ATPC}$) Minimum G_{ant} (dBi) $\geq$ Pout (dBm) + 15; or
  ≥ 30 (dBi) (whichever is the greater).
  where Pout is intended as the maximum delivered by ATPC regime in unfaded condition

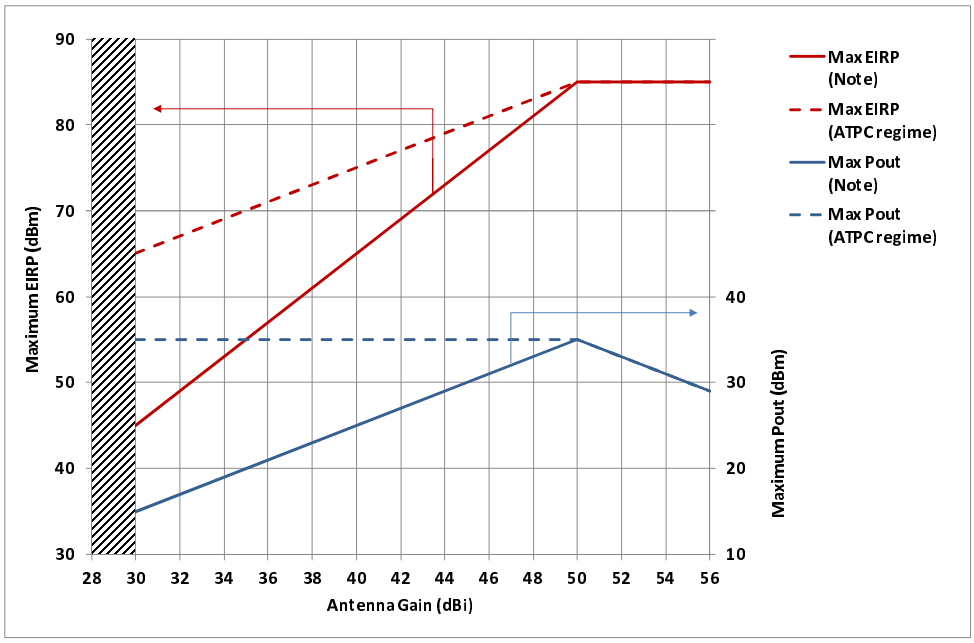
  $2b_{ATPC}$) Maximum G_{ant} (dBi) $\leq 85 -$ Pout (dBm)
  where Pout is intended as the maximum delivered in full power ATPC regime

  $3b_{ATPC}$) Pout (dBm) $\leq +35$ (in any conditions) (see note)

  $4b_{ATPC}$) Minimum ATPC attenuation (dB) $\geq$ actual Pout (max delivered in full power ATPC regime) – maximum Pout (from formula 3a clause UB.2.1.1)

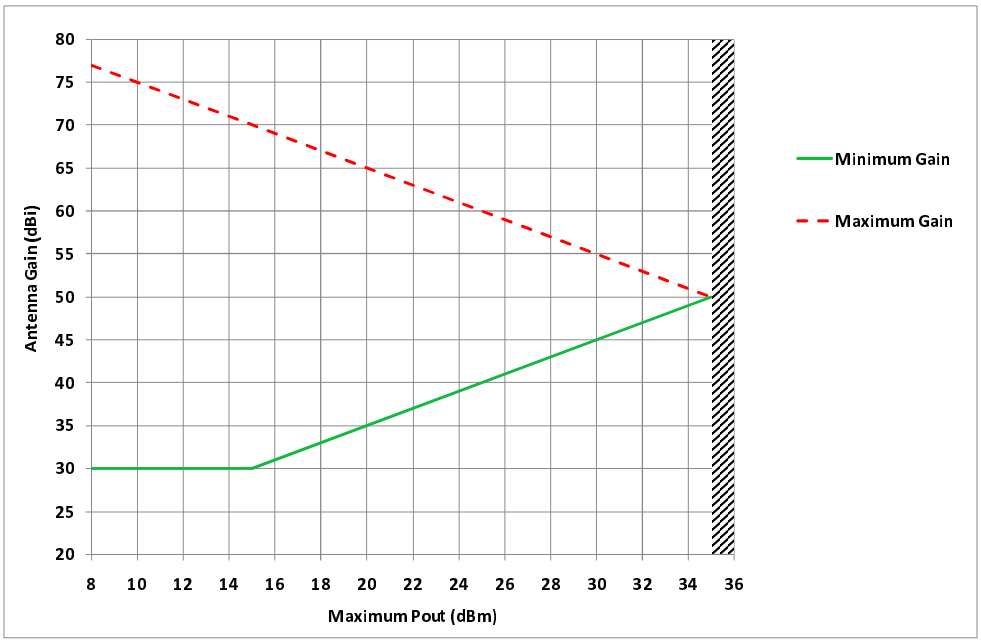
NOTE: It is assumed that the above information on antenna gain range, function of the actual Pout delivered by the equipment, is supplied in the user documentation. In addition, it should be considered that the Pout limits are generic absolute maximum, but, when coupled with actual antenna within minimum/maximum G_{ant} range described in formulas $1b_{ATPC}$ and $2b_{ATPC}$, this implies that the limitations expressed in formula 3a (clause UB.2.1.1) for the Pout in unfaded conditions and in formula $3a_{ATPC}$ (present clause) for the Pout in ATPC regime are also satisfied.

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



NOTE: For equipment with permanent ATPC feature, these are intended the maximum Pout and EIRP delivered by the ATPC regime in unfaded conditions.

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



NOTE: For equipment with permanent ATPC feature, the minimum gain is intended evaluated with the maximum Pout delivered by the ATPC regime in unfaded condition, while the maximum gain is intended evaluated with the maximum Pout in full power ATPC regime (see example).

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)

EXAMPLE: A system with permanent ATPC operating between +20 dBm (ATPC regime in unfaded condition) and +30 dBm (full power ATPC regime) may be connected to any antenna with $35 \leq G_{ant}$ (dBi) ≤ 55.

UB.2.2 Output power tolerance

Clause 4.3.1.3 applies.

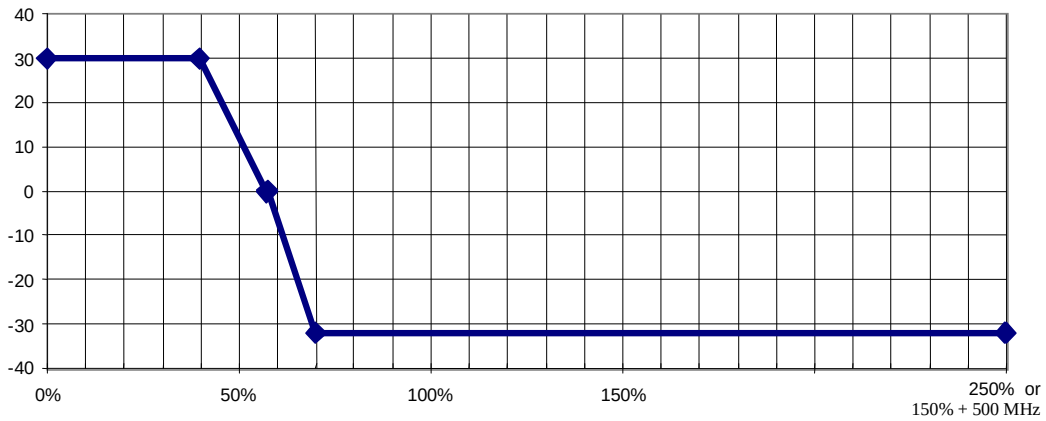
UB.2.3 EIRP density masks

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.



EIRP density (dBW/MHz)	Offset (% of occupied bandwidth) (see note 1)
30	0
30	40
0	57,5
-32	70
-32	250 or 150 + 500 MHz (see note 2)

NOTE 1: See definition of occupied bandwidth in EN 302 217-1 [8].
NOTE 2: The 250 % value applies only for occupied bandwidth ≤ 500 MHz; the other value applies for occupied bandwidth > 500 MHz (Recommendation ITU-R SM.1539-1 [13]).

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, an estimation of the possible maximum limits, based on currently available technology, and which already takes into account an allowance for the future development of higher power transmitters, may be as follows:
- Maximum power spectral density at antenna port: +15 dBm/MHz.
- Maximum antenna gain: +45 dBi.

UB.2.3.2 Emissions outside the 64 GHz to 66 GHz range

In addition, the occupied bandwidth (see definitions in EN 302 217-1 [8]) 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.

NOTE: It is assumed that the above limitation implies the inclusion in the user documentation of specific instructions on how to meet the requirement (e.g. minimum distance of the carrier from the band edges and/or maximum EIRP, etc.)

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.

UB.2.3.3 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):

- ±X = ±150 ppm (for category 1 equipment).
- ±X = ±50 ppm (for category 2 equipment).

UB.2.6 RF-channel selection parameters

No Type A equipment is 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: Whenever, in accordance with ECC/Recommendation (05)02 [3], simplified spectrum co-ordination is foreseen, receiver parameters may help the co-ordination process (see annex UE).

Annex UBa (normative): Frequency band 57 GHz to 66 GHz for point-to-point fixed wireless systems

UBa.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 EN 302 217-2-1 [i.6] and EN 302 217-2-2 [9].

Both FDD and TDD applications are covered in this annex.

Systems covered by this annex are only Type B equipment (i.e. without mandatory RF channel-free automatic selection, see clause 1) (see note 1).

NOTE 1: Type A systems operating in 57 GHz to 59 GHz band are covered in annexes UA and UD.

The frequency arrangement derived from the ECC/Recommendation (05)02 [3] and ECC/Recommendation (09)01 [4] has some effect on the requirements to the radio equipment; therefore, in this frequency band, two different categories of equipment are defined.

The two categories of equipment are:

Category 1:

Equipment for flexible usage of spectrum (according ECC/Recommendation (05)02 [3] and ECC/Recommendation (09)01 [4]) where no channel or block arrangement is to be complied with. The declared transmitter bandwidth is referred to the nominal bandwidth as defined within the present document.

NOTE 2: 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 ECC/Recommendation (05)02 [3] and ECC/Recommendation (09)01 [4]) where a single or a number of contiguous frequency slots of 50 MHz size are assigned 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.

NOTE 3: In the frequency bands 57 GHz to 59 GHz and 64 GHz to 66 GHz equipment characteristics referred in annexes UA and UB, respectively, may also apply. The manufacturer may select the more appropriate according to the actual system and application foreseen.

UBa.1 Frequency bands and channel arrangements

UBa.1.1 Frequency band

The lower (57,0 GHz to 59,0 GHz) and upper (64,0 GHz to 66,0 GHz) portions of this band are included within the High Density Fixed Service (HDFS) bands referred in the Radio Regulations [i.16].

The frequency band is the combination of the 57 GHz to 64 GHz band as reported in ECC/Recommendation (09)01 [4] and of the 64 GHz to 66 GHz band as reported in ECC/Recommendation (05)02 [3] (see note).

NOTE: Even if the above ECC Recommendations, provides a continuous frequency raster from 57 GHz to 66 GHz, the actual frequency range(s) available for fixed links applications might be reduced on national basis.

Other national or future ITU-R or ECC/Recommendations set around the rough boundary of present ITU-R or 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 ECC/Recommendation (05)02 [3].

UBa.1.2 Radio channel arrangements and nominal bandwidth

The usage of the band is specified in ECC/Recommendation (05)02 [3] and ECC/Recommendation (09)01 [4] similarly; they consider two alternatives:

- Free system bandwidth, occupying up to the whole band.
- Channel Selection = n × 50 MHz; multiple of basic frequency slots with n = [1..50]. Thus the maximum channel bandwidth is limited to 2,5 GHz.

The supplier shall declare the *nominal bandwidth* (for category 1 systems) or the *nominal channel bandwidth* (for category 2 systems), in terms of n × 50 MHz slots, in order to define the actual corresponding spectral efficiency (see clause UBa.2.3) and the RF spectrum mask (see clause UBa.2.3).

The *nominal bandwidth* or the *nominal channel bandwidth* of equipment in the scope of the present document is limited to a maximum of 2 500 MHz.

In case of "*preset-mode*" systems the *nominal bandwidth* or the *nominal channel bandwidth* of all options, obtained through permanent preset, shall be declared and the relevant spectrum masks shall be complied with, for all options.

"*Mixed-mode*" systems shall refer to the emission mask derived from the *nominal bandwidth* or the *nominal channel bandwidth* for the spectral efficiency class of the declared *reference-mode* provided by the system.

In case of *"bandwidth adaptive"*, where the system capacity may be dynamically changed by mean of bandwidth reduction during adverse propagation conditions, the *nominal bandwidth* or the *nominal channel bandwidth* should be defined from the maximum bandwidth used in clear-air propagation conditions.

NOTE: "*Nominal bandwidth"*, "*Nominal channel bandwidth"* as well as "P*reset-mode*", "*Mixed-mode*" and *"Bandwidth adaptive"* systems are defined in EN 302 217-1 [8].

UBa.1.3 Spectral efficiency

According the possible supplier declaration, equipment may be subdivided into the same spectral efficiency classes defined in EN 302 217-2-2 [9].

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

Spectral efficiency is the ratio between the peak gross bit rate and the nominal bandwidth (for category 1 systems) or the nominal channel bandwidth (for category 2 systems).

Table UBa.1: Minimum spectral efficiency

Equipment Spectral efficiency	Reference Index	1	2	3	4	5	6	7
	Class	1	2	3	4L	4H	5L	5H
Minimum spectral efficiency (Mbit/s/MHz)		0,5	1	1,6	2,2	2,8	3,4	4

UBa.2 Transmitter

UBa.2.1 Transmitter power, antenna gain and Equivalent Isotropically Radiated Power (EIRP)

The following transmitter output power, antenna gain and EIRP limits are set by ECC/Recommendation (09)01 [4]:

- Maximum EIRP: +55 dBm.
- Minimum antenna gain: +30 dBi.
- Maximum transmitter output power: +10 dBm.

In addition, in order of safeguarding a fair and efficient use of the spectrum, maximum Pout and EIRP emissions (A and B limits referred in clauses 4.3.1.1 and 4.3.1.2) of equipment in the scope of the present document shall be limited as in following clauses as function of the antenna gain (G_{ant}).

UBa.2.1.1 Equipment without ATPC as permanent feature

These are equipment that, even if ATPC is implemented, it can be freely enabled, disabled and/or preset by the user.

- **equipment with integral antennas:**

  1a) EIRP (dBm) $\leq +55$ for $G_{ant} \geq 45$ dBi.

  $\leq +10 + G_{ant}$ (dBi) for $45 \text{ dBi} > G_{ant} \geq 38$ dBi.

  $\leq -28 + 2 \times G_{ant}$ (dBi) for $38 \text{ dBi} > G_{ant} \geq 30$ dBi.

  2a) EIRP density (dBm/MHz) ≤ -10 dBm/MHz + G_{ant} (dBi).

  3a) Minimum G_{ant} (dBi) ≥ 30.

  The above limitations automatically imply (see figure UBa.1) also a limit to the maximum Pout:

  4a) Pout (dBm) $\leq G_{ant} - 28$ for $30 \text{ dBi} \leq G_{ant} < 38$ dBi
  $\leq +10$ for $38 \text{ dBi} \leq G_{ant} < 45$ dBi
  $\leq 55 - G_{ant}$ for $G_{ant} \geq 45$ dBi.

- Equipment offering external antenna connectors:

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

  1b) Pout $\leq +10$ dBm.

  2b) Pout density ≤ -10 dBm/MHz.

  3b) Minimum G_{ant} (dBi) $\geq$ Pout (dBm) +30; or
  ≥ 30 (dBi) (whichever is the greater).

  4b) Maximum G_{ant} (dBi) $\leq 55 -$ Pout (dBm).

  where Pout 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.

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

UBa.2.1.2 Equipment implementing ATPC as permanent feature

With the term "permanent feature" it shall be intended that ATPC cannot be disabled by the user or, whenever it is possible, the maximum output power delivered, in any conditions, cannot be set to a value exceeding clause UBa.2.1.1 provisions 1a, 2a, 3a and 4a (or 1b, 2b, 3b and 4b as appropriate). More information on the use of ATPC may be found in TR 103 103 [i.8].

Equipment implementing ATPC as a permanent feature, linearly activated by the drop of RSL in the corresponding far end receiver, should respect the following limitations:

- equipment with integral antennas:

  EIRP and Pout in full power ATPC regime:

  $1a_{ATPC}$) EIRP (dBm) $\leq +10 + G_{ant}$ (dBi); or
  $\leq +55$ (whichever is the lower).

  $2a_{ATPC}$) EIRP density (dBm/MHz) ≤ -10 dBm/MHz + G_{ant} (dBi).

  $3a_{ATPC}$) Minimum G_{ant} (dBi) ≥ 30.

  The above limitations automatically imply (see figure UBa.1) also a limit to the maximum Pout in full power ATPC regime:

  $4a_{ATPC}$) Pout (dBm) $\leq +10$ for $30 \text{ dBi} \leq G_{ant} < 45 \text{ dBi}$
  $\leq 55 - G_{ant}$ for $G_{ant} \geq 45$ dBi.

  $5a_{ATPC}$) Minimum ATPC attenuation (dB) $\geq$ actual Pout (max delivered in full power ATPC regime) – max Pout (from formula 4a clause UBa.2.1.1)

- equipment offering external antenna connectors:

  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 (see note) for not exceeding the above EIRP limitations, i.e.:

  $1b_{ATPC}$) Pout (dBm) $\leq +10$ (in any conditions) (see note).

  $2b_{ATPC}$) Pout density ≤ -10 dBm/MHz.

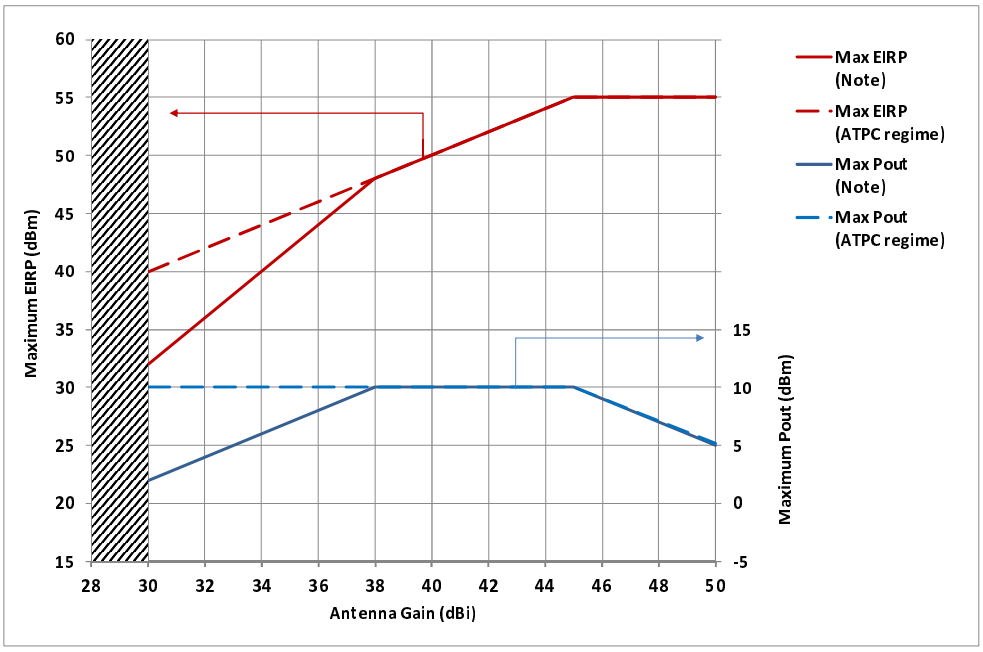
  $3b_{ATPC}$) Minimum G_{ant} (dBi) $\geq$ Pout (dBm) + 30 or
  ≥ 30 (dBi) (whichever is the greater).
  where Pout is intended as the maximum delivered by ATPC regime in unfaded condition.

  $4b_{ATPC}$) Maximum G_{ant} (dBi) $\leq 55 -$ Pout (dBm)
  where Pout is intended as the maximum delivered in full power ATPC regime.

  $5b_{ATPC}$) Minimum ATPC attenuation (dB) $\geq$ actual Pout (max delivered in full power ATPC regime) – max Pout (from formula 4a clause UBa.2.1.1)

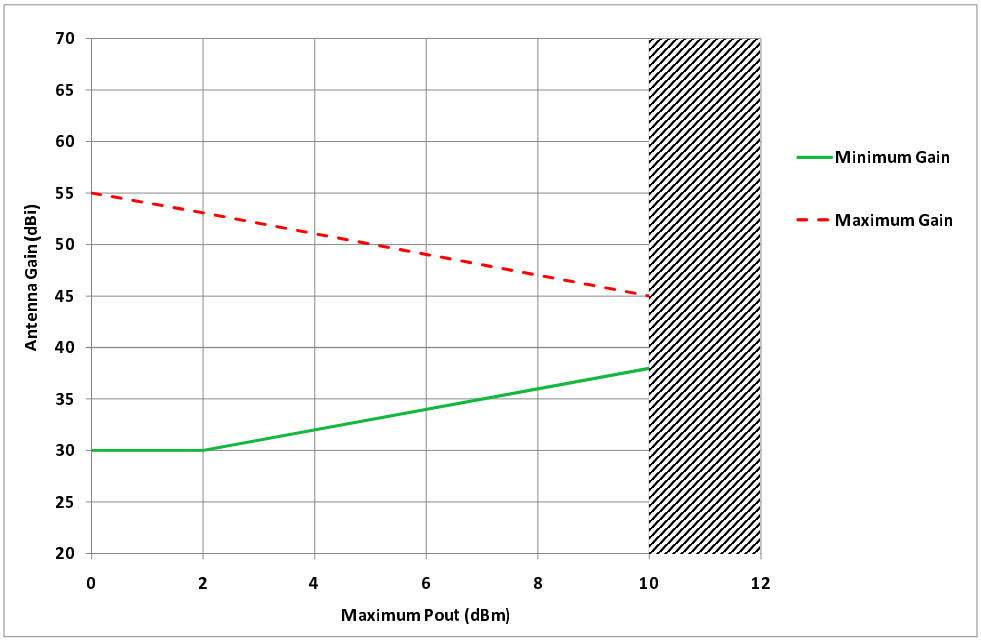
NOTE: It is assumed that the above information on antenna gain range, function of the actual Pout delivered by the equipment, is supplied in the user documentation. In addition, it should be considered that the Pout limits are generic absolute maximum, but, when coupled with actual antenna within minimum/maximum G_{ant} range described in formulas $3b_{ATPC}$ and $4b_{ATPC}$, this implies that are also satisfied the limitations expressed in formula 4a (clause UBa.2.1.1) for the Pout in unfaded conditions and in formula $4a_{ATPC}$ (present clause) for the Pout in ATPC regime.

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



NOTE: For equipment with permanent ATPC feature, these are intended the maximum Pout and EIRP delivered by the ATPC regime in unfaded conditions.

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



NOTE: For equipment with permanent ATPC feature, the minimum gain is intended evaluated with the maximum Pout delivered by the ATPC regime in unfaded condition, while the maximum gain is intended evaluated with the maximum Pout in full power ATPC regime (see example).

Figure UBa.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)

EXAMPLE: A system with permanent ATPC operating between +0 dBm (ATPC regime in unfaded condition) and +10 dBm (full power ATPC regime) may be connected to any antenna with $30 \leq G_{ant}$ (dBi) ≤ 45.

UBa.2.2 Output power tolerance

Clause 4.3.1.3 applies.

UBa.2.3 RF spectrum masks

UBa.2.3.1 Limits

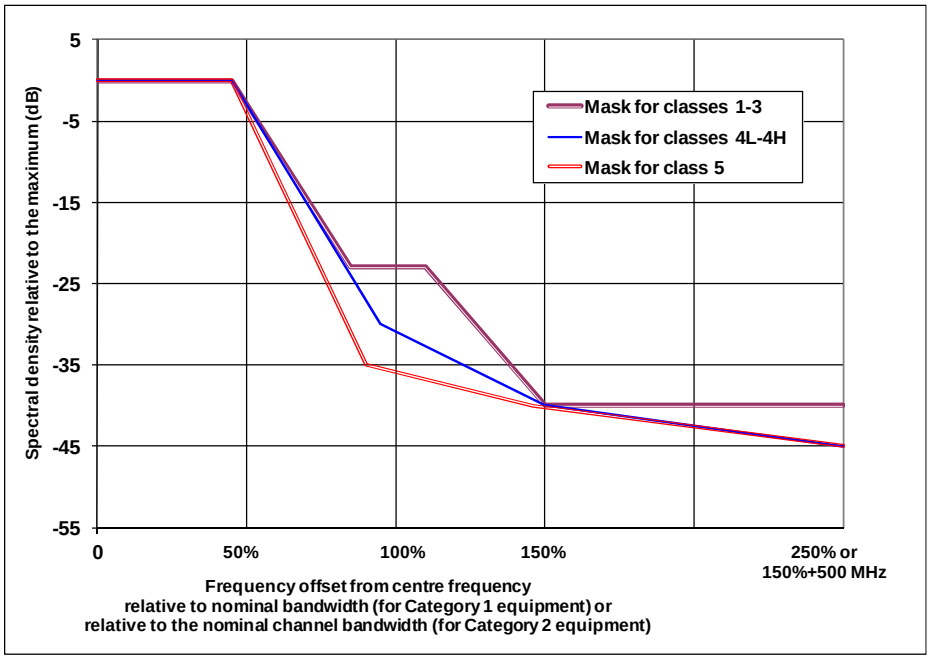
The spectrum emissions measured shall not exceed the maximum level shown in figure UBa.3 with a measurement bandwidth of 1 MHz for the appropriate maximum output power. Moreover the mask of figure UBa.3 is not inclusive of frequency tolerance.

Being a relative mask, it can be intended either an EIRP density mask (e.g. for equipment with integral antennas) or an output power density mask (e.g. equipment that can be separated from the antenna).

NOTE 1: The masks in figure UBa.3 are generic, in case the actual emission of equipment is significantly tighter it might be required that the manufacturer or person responsible for placing the apparatus on the market provides 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 also be provided.

The 0 dB reference is relative to the highest power density within the nominal bandwidth, disregarding possible CW contents related to residual of the carrier.

NOTE 2: During normal operation of bandwidth adaptive systems it is assumed that the 0 dB reference point allows dynamic shifts of the absolute spectral density based on changes in operating bandwidth.



Spectral efficiency Classes 1÷3		Spectral efficiency Classes 4L, 4H		Spectral efficiency Classes 5L, 5H	
Offset (%) (see note 1)	**Relative power density (dB/MHz)**	**Offset (%) (see note 1)**	**Relative power density (dB/MHz)**	**Offset (%) (see note 1)**	**Relative power density (dB/MHz)**
0	0	0	0	0	0
45	0	45	0	45	0
85	-23	95	-30	90	-35
110	-23	150	-40	146	-40
150	-40	250 or 150 + 500 MHz (see note 2)	-45	250 or 150 + 500 MHz (see note 2)	-45
250 or 150 + 500 MHz (see note 2)	-40				

NOTE 1: According the definition of nominal bandwidth and nominal channel bandwidth in clause UBa.1.3.
NOTE 2: The 250 % value applies only for nominal bandwidth and nominal channel bandwidth ≤ 500 MHz; the other value for nominal bandwidth and nominal channel bandwidth > 500 MHz; see Recommendation ITU-R SM.1539-1 [13].

Figure UBa.3: TX EIRP (or Pout) spectral density mask

UBa.2.3.2 Emissions outside the 57 GHz to 66 GHz range

In addition, the occupied bandwidth (see definitions in EN 301 217-1 [8]) shall remain within the specified band 57 GHz to 66 GHz.

However, out-of-band emissions (i.e. those exceeding the ± 50 % abscissa in figure UBa.3) of systems operating close to the 57 GHz to 66 GHz band edges, may still fall outside the band edges. Consequently, the EIRP spectral density falling outside of the 57 GHz to 66 GHz band edges shall be further limited to a maximum of:

- +10 dBm/MHz.

NOTE: It is assumed that the above limitation implies the inclusion in the user documentation of specific instructions on how to meet the requirement (e.g. minimum distance of the carrier from the band edges and/or maximum EIRP, etc.).

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

UBa.2.4 Spurious emissions

Clause 4.3.3 shall apply.

UBa.2.5 Radio frequency tolerance

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

- ±X = ±150 ppm; or
- ±X = ±0,02 × Occupied Bandwidth.

Whichever is the less restrictive in absolute terms.

UBa.2.6 Antenna gain

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

UBa.3 Receiver

Clause 4.4.1 shall apply.

NOTE: Whenever, in accordance with ECC/Recommendation (05)02 [3] and ECC/Recommendation (09)01 [4], simplified spectrum co-ordination is foreseen, receiver parameters may help the co-ordination process (see annex UE).

Annex UC (normative): Frequency bands 71 GHz to 76 GHz and 81 GHz to 86 GHz

UC.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 EN 302 217-2-1 [i.6] and EN 302 217-2-2 [9].

However, in this frequency band, ECC/Recommendation (05)07 [5] recognizes that, due to the negligible Oxygen absorption attenuation, the conventional link-by-link coordination may be profitably applied improving the spectrum usage. Therefore, two Category of equipment have been defined with respect to the characteristics related to article 3.2 of the R&TTE Directive [1] have been defined as follows:

- Category 1 equipment applicable when no or simplified coordination is used (see scope in clause 1 of the present document); their applicable set of characteristics is specified in the present annex UC. Both FDD and TDD systems are covered in this annex.
- Category 2 equipment applicable only to FDD systems, when conventional link-by-link coordination based on the channel arrangements defined in ECC/Recommendation (05)07 [5] or Recommendation ITU-R F.2006 [i.12] is used; they shall be subject also to additional equipment characteristics specified in EN 302 217-2-2 [9] for this frequency band. When requirements in present annex UC and those in EN 302 217-2-2 [9] lead to different limits, the more stringent apply.

NOTE: It is expected that, from the point of view of the Declaration of Conformity to the R&TTE Directive [1], Category 2 equipment will declare conformity to both EN 302 217-3 (the present document) and EN 302 217-2-2 [9].

In this frequency band only Type B equipment (i.e. without mandatory RF channel-free automatic selection, see clause 1) is considered.

UC.1 Frequency bands and channel arrangements

UC.1.1 Frequency band

The frequency bands are from 71 GHz to 76 GHz and 81 GHz to 86 GHz, which may also be coupled as go-return bands as reported in ECC/Recommendation (05)07 [5] and Recommendation ITU-R F.2006 [i.12].

The recommendation provides for administrations wishing to assign duplex channels, the use of the bands 71 GHz to 76 GHz and 81 GHz to 86 GHz as paired bands, or as a separate single bands containing internal duplex separation.

Other national or future ITU-R or ECC/Recommendations set around the rough boundary of present ITU-R or ECC/Recommendations are considered applicable to systems assessed against the present document, provided that they give band usage with simplified frequency co-ordinated deployment similar to that referred in ECC/Recommendation (05)07 [5].

UC.1.2 Radio channel arrangements

The usage of the band is specified in ECC/Recommendation (05)07 [5]; when a channel arrangements is foreseen, the recommendation considers two alternatives based on basic channels 250 MHz wide that may be aggregated for larger bandwidth system:

a) TDD or FDD channels of n × 250 MHz width (TDD: n = [1..19]; FDD: n = [1..9]) in the band 71 GHz to 76 GHz or 81 GHz to 86 GHz.

b) FDD channels of n × 250 MHz width (n = [1..19]) in the band 71 GHz to 76 GHz paired with 81 GHz to 86 GHz.

UC.1.3 Spectral occupancy and transmission capacity

The supplier shall declare the transmission capacities and the nominal channel bandwidth in term of the n × 250 MHz basic channels occupancy. In case of "*preset-mode*" systems (see definition EN 302 217-1 [8]) the bandwidths of all options, obtained through permanent preset, shall be declared and the relevant spectrum masks shall be complied with, for all options.

"*Mixed-mode*" systems (see definition in EN 302 217-1 [8]) shall refer to the emission mask of the declared *reference-mode* provided by the system.

The nominal channel bandwidth shall be coherent with the occupied bandwidth, as defined in Radio Regulations [i.16] and, for Fixed Service systems in Recommendation ITU-R F.1191 [i.10]; the nominal channel bandwidth, in terms of n × 250 MHz basic channels, shall be the size of their closest aggregation wider than the actual occupied bandwidth.

In case of *"bandwidth adaptive"* systems (see definition in EN 302 217-1 [8]), where the system capacity may be dynamically changed by mean of bandwidth reduction during adverse propagation conditions, the nominal channel bandwidth should be defined as that of the maximum bandwidth used in clear-air propagation conditions.

UC.2 Transmitter

UC.2.1 Transmitter power and Equivalent Isotropic Radiated Power (EIRP)

The maximum power shall be limited, in term of EIRP of the systems by the provisions given in the Radio Regulations [i.16] (i.e. in article 21).

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

However, in order of safeguarding a fair and efficient use of the spectrum, maximum Pout and EIRP emissions (A and B limits referred in clauses 4.3.1.1 and 4.3.1.2) of equipment in the scope of the present document shall be limited as in following clauses as function of the antenna gain (G_{ant}).

UC.2.1.1 Equipment without ATPC as permanent feature

These are equipment that, even if ATPC is implemented, it can be freely enabled, disabled and/or preset by the user.

- **Equipment with integral antenna**

1a) EIRP limit (dBm)

≤ +85 (Radio Regulation Art 21)	for	$G_{ant} \geq 55$ dBi.
$\leq +85 - (55 - G_{ant})$	for	$55 \text{ dBi} > G_{ant} \geq 45$ dBi.
$\leq +75 - 2 \times (45 - G_{ant})$	for	$45 \text{ dBi} > G_{ant} \geq 38$ dBi.

2a) Minimum G_{ant} (dBi) ≥ 38.

The above limitations automatically imply (see figure UC.1) also a limit to the maximum Pout:

3a) Pout (dBm)

$\leq G_{ant} - 15$	for	$38 \text{ dBi} \leq G_{ant} < 45$ dBi.
$\leq +30$	for	$45 \text{ dBi} \leq G_{ant} < 55$ dBi.
$\leq +85 - G_{ant}$	for	$G_{ant} \geq 55$ dBi.

- **Equipment offering external antenna connectors**

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

  1b) Minimum G_{ant} (dBi) ≥ Pout (dBm) + 15; or
  ≥ 38 (whichever is the greater).

  2b) Maximum G_{ant} (dBi) ≤ 85 – Pout (dBm).

  3b) Pout (dBm) ≤ + 30.

  where Pout 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.

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

UC.2.1.2 Equipment implementing ATPC as permanent feature

With the term "permanent feature" it shall be intended that ATPC cannot be disabled by the user or, whenever it is possible, the maximum output power delivered, in any conditions, cannot be set to a value exceeding clause UC.2.1.1 provisions 1a, 2a and 3a (or 1b, 2b and 3b as appropriate). More information on the use of ATPC may be found in TR 103 103 [i.8].

Equipment implementing ATPC as a permanent feature, linearly activated by the drop of RSL in the corresponding far end receiver, should respect the following limitations:

- equipment with integral antennas:

  EIRP and Pout in full power ATPC regime:

  $1a_{ATPC}$) EIRP (dBm) ≤ +35+ G_{ant} (dBi); or
  ≤ +85 dBm (whichever is the lower).

  $2a_{ATPC}$) Minimum G_{ant} (dBi) ≥ 38.

  The above limitations automatically imply (see figure UC.1) also a limit to the maximum Pout in full power ATPC regime:

  $3a_{ATPC}$) Pout (dBm) ≤ + 35 for 38 dBi ≤ G_{ant} < 50 dBi
  ≤ + 85 – G_{ant} for G_{ant} ≥ 50 dBi.

  $4a_{ATPC}$) Minimum ATPC attenuation (dB) ≥ actual Pout (max delivered in full power ATPC regime) – maximum Pout (from formula 3a clause UC.2.1.1)

- equipment offering external antenna connectors:

  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 (see note) for not exceeding the above EIRP limitations, i.e.:

  $1b_{ATPC}$) Minimum G_{ant} (dBi) ≥ Pout (dBm) + 15; or
  ≥ 38 (dBi) (whichever is the greater).
  where Pout is intended as the maximum delivered by ATPC regime in unfaded condition.

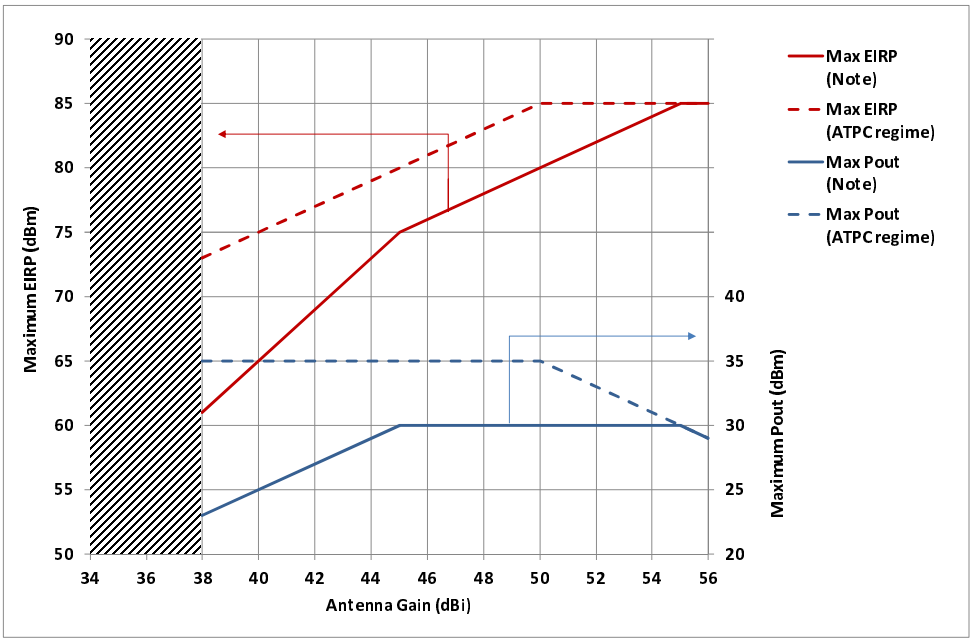
  $2b_{ATPC}$) Maximum G_{ant} (dBi) ≤ 85 – Pout (dBm)
  where Pout is intended as the maximum delivered in full power ATPC regime.

  $3b_{ATPC}$) Pout (dBm) ≤ +30 (ATPC regime in unfaded conditions) (see note)
  ≤ +35 (full power ATPC regime) (see note).

$4b_{ATPC}$) Minimum ATPC attenuation (dB) ≥ actual Pout (max delivered in full power ATPC regime) – maximum Pout (from formula 3a clause UC.2.1.1).

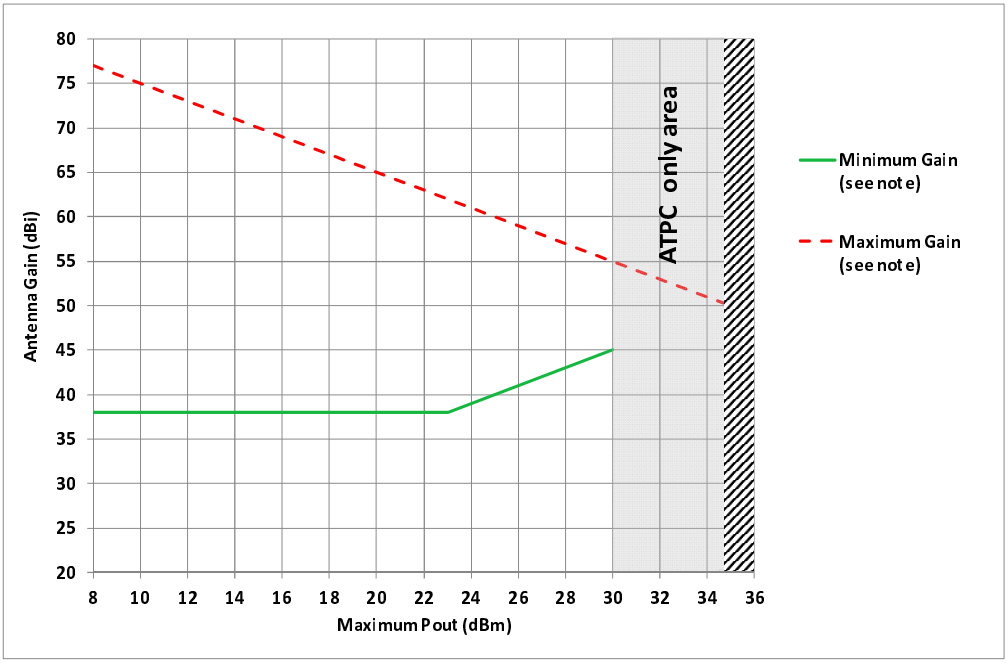
NOTE: It is assumed that the above information on antenna gain range, function of the actual Pout delivered by the equipment, is supplied in the user documentation. In addition, it should be considered that the Pout limits are generic absolute maximum, but, when coupled with actual antenna within minimum/maximum G_{ant} range described in formulas $1b_{ATPC}$ and $2b_{ATPC}$, this implies that are also satisfied the limitations expressed in formula 3a (clause UC.2.1.1) for the Pout in unfaded conditions and in formula $3a_{ATPC}$ (present clause) for the Pout in ATPC regime.

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



NOTE: For equipment with permanent ATPC feature, these are intended the maximum Pout and EIRP delivered by the ATPC regime in unfaded conditions.

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



NOTE: For equipment with permanent ATPC feature, the minimum gain is intended evaluated with the maximum Pout delivered by the ATPC regime in unfaded condition, while the maximum gain is intended evaluated with the maximum Pout in full power ATPC regime (see example).

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

EXAMPLE: A system with permanent ATPC operating between +18 dBm (ATPC regime in unfaded condition) and +32 dBm (full power ATPC regime) may be connected to any antenna with $38 \leq G_{ant}$ (dBi) ≤ 53.

UC.2.2 Output power tolerance

Clause 4.3.1.3 applies.

UC.2.3 Output power density masks

UC.2.3.1 Limits

There are no mandatory requirements for the power density mask for any particular system, so long as the emission remains within the spectral power density mask limits, relevant to the declared aggregate channel, shown in figure UC.3 (see note 1).

However, it is recommended that the manufacturer or person responsible for placing the apparatus on the market shall provide the actual power density transmit mask characteristics met by the equipment (see note 2). Also, in order to assist administrations and operators in the planning of networks, where appropriate, the duplex arrangement (Go/Return separation) should be provided.

NOTE 1: Attention is drawn to the fact that the total system power (i.e. the frequency integral of the output power density) is subject to the maximum limit of clause UC.2.1. Therefore, the wider is the systems bandwidth, the lower should become the in-band power density (see example 1).

EXAMPLE 1: Being the maximum no ATPC power limited to 0 dBW (no ATPC +30 dBm of clause UC.2.1), an ideal class 2, no ATPC, rectangular emission could perfectly match the in-band limit of the mask in figure UC.3 (i.e. the -25 dBW/MHz) only as far as its bandwidth does not exceed the value $10^{(25+0)/10}$ = 316 MHz; a 1 000 MHz bandwidth system should have at least 5 dB lower in-band power density.

NOTE 2: For this purpose, it should be noted that Recommendation ITU-R SM.1541-4 [i.15] provides guidance on the "safety net" masks, intended as "*generic limits, which generally constitute the least restrictive OoB emission limits successfully used as national or regional regulations*."

The mask of figure UC.3 is inclusive of power tolerances and, if applicable, ATPC/RTPC influence; however, it is not inclusive of frequency tolerance.

As exception, only for equipment implementing ATPC as permanent feature (see clause UC.2.1.2), in case the maximum Pout delivered in full power ATPC regime exceed the maximum permitted in the general case (+30 dBm), also the mask of figure UC.3, only whenever the Pout exceed the +30 dBm, may be exceeded by the same amount (see example 2).

EXAMPLE 2: An equipment delivering up to +33 dBm in full power ATPC regime, only when actually transmitting +33 dBm in periods of deep fading, may exceed the mask of figure UC.3 by 3 dB.

Spectral efficiency Class 2 and above		**Spectral efficiency Class 1**	
Power density (dBW/MHz)	**Offset (% of aggregated channel) (see note 1)**	**Power density (dBW/MHz)**	**Offset (% of aggregated channel) (see note 1)**
		-15	0
-25	0	-15	20
-25	50	-25	50
-30	50	-30	50
-45	57,5	-45	57,5
-45	70	-45	70
-65	125	-65	125
-75	250 or 150 + 500 MHz (see note 2)	-75	250 or 150 + 500 MHz (see note 2)
NOTE 1: Aggregated channel is intended as the aggregation of the elementary 250 MHz slots used by the system.			
NOTE 2: The 250 % value applies only for aggregate channel ≤ 500 MHz; the other value for aggregate channel > 500 MHz; see Recommendation ITU-R SM.1539-1 [13].			

Figure UC.3: Tx Power spectral density mask

UC.2.3.2 Emissions outside the 71 GHz to 76 GHz and 81 GHz to 86 GHz ranges

UC.2.3.2.1 General requirement

In addition, the occupied bandwidth shall remain within the specified bands 71 GHz to 76 GHz or 81 GHz to 86 GHz.

However, out-of-band emissions (i.e. those exceeding the 50 % abscissa in figure UC.3) of systems operating close to the 71 GHz to 76 GHz or 81 GHz to 86 GHz band edges, may still fall outside the band edges. Consequently, the output power spectral density, at antenna port, falling outside of the 71 GHz to 76 GHz band edges or below the lower band edge of 81 GHz to 86 GHz band shall be further limited to a maximum of:

- -55 dBW/MHz.

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

UC.2.3.2.2 Requirement for emissions above 86 GHz band edge

The band 86 GHz to 92 GHz is allocated to Passive Services and, in particular to Earth Exploration Satellite Service; for their protection, as required by footnote 5.340 of Radio Regulations [i.16], the unwanted emissions of fixed service systems shall respect, at the antenna port, the limit mask provided in figure UC.4.

NOTE: See also ECC/Recommendation (09)01 [4].

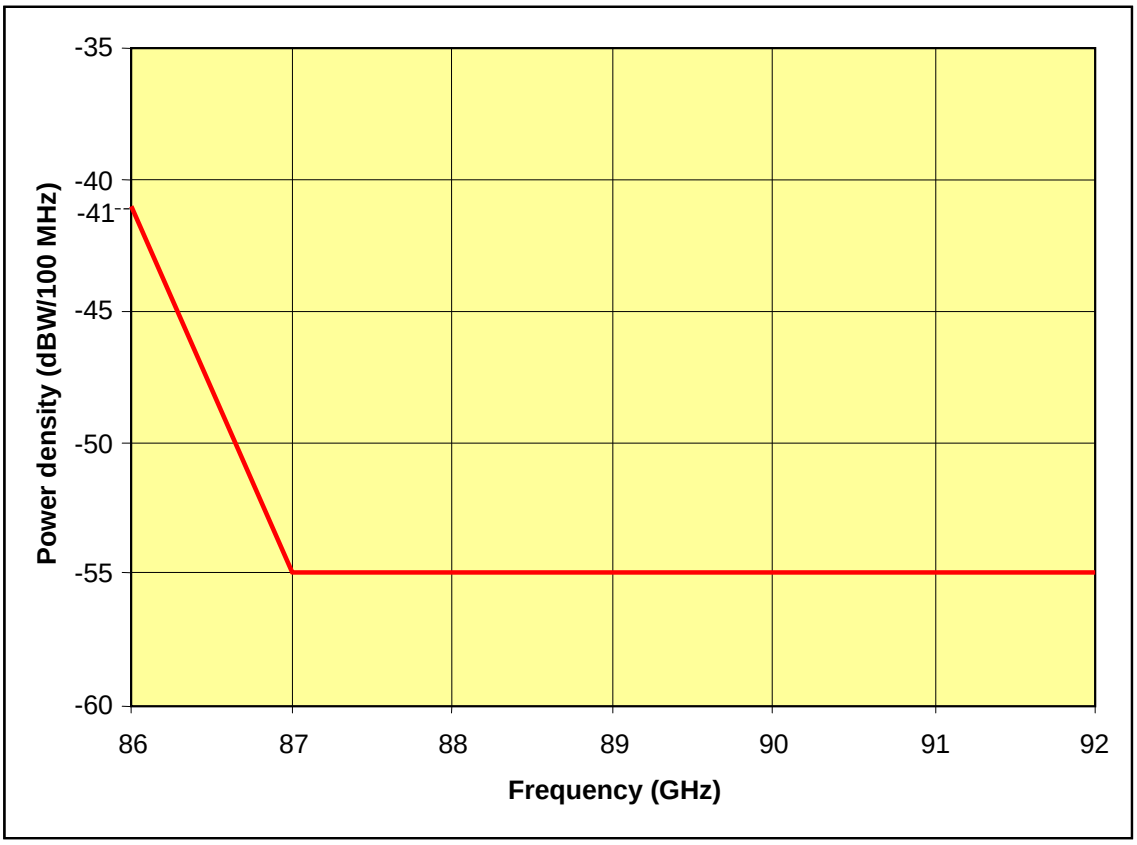


Figure UC.4: Unwanted emission power density at the antenna port

It is intended that, at the 86 GHz band edge, the first 100 MHz slot limit is centred at 86,05 GHz.

UC.2.3.2.3 Conformance statement

The supplier shall declare, for each system operation conditions (e.g. modulation format, bandwidth and antenna gain) the minimum distances of the carrier centre frequency from the band edges in order to fulfil requirements in clauses UC.2.3.2.1 and UC.2.3.2.2.

The above information shall also be reported in the user instruction.

UC.2.3.3 Spectrum analyser settings

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

NOTE: When relative power density tests are desired, recommended analyser settings may be found in clause 5.2.4 of EN 302 217-2-2 [9].

UC.2.4 Spurious emissions-external

Clause 4.3.3 shall apply.

UC.2.5 Radio frequency tolerance

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

- ±X = ±150 ppm; or
- ±X = ±0,02 × Occupied Bw.

Whichever is the less restrictive in absolute terms.

UC.2.6 RF-channel selection parameters

No Type A equipment is foreseen in this band.

UC.2.7 Antenna gain

Equipment in these frequency bands shall be associated to a directional antenna with a minimum gain of 38 dBi.

UC.2.8 Additional TX requirements for Category 2 equipment

Category 2 equipment shall also be compliant to the relevant requirements of EN 302 217-2-2 [9].

UC.3 Receiver

UC.3.1 Spurious emissions

Clause 4.4.1 shall apply.

UC.3.2 Other RX requirements for Category 1 equipment

Category 1 equipment is not subject to any other requirement relevant to article 3.2 of the R&TTE Directive [1].

However, whenever, in accordance with ECC/Recommendation (05)07 [5], simplified spectrum co-ordination is foreseen, receiver parameters may help the co-ordination process; therefore, suppliers are invited to provide other parameters useful for coordination (see clause UE.2).

UC.3.3 Additional RX requirements for Category 2 equipment

Category 2 equipment shall also be compliant to the relevant requirements of EN 302 217-2-2 [9].

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 Type A equipment

Type A equipment is usually designed in order to meet network error-performance and availability requirements foreseen by relevant ITU-T and Recommendations ITU-R (see EN 302 217-1 [8]). 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 Type 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 Type A and Type 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 dBm - Ptx (dBm) + 10 log (BW/10 MHz).

where:

- Ptx is the mean transmit power of the radio relay at the reference point D' given in figure 1 of EN 302 217-1 [8];
- 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 Type 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 NF N_0. A reasonable channel use threshold is, therefore:

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

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.

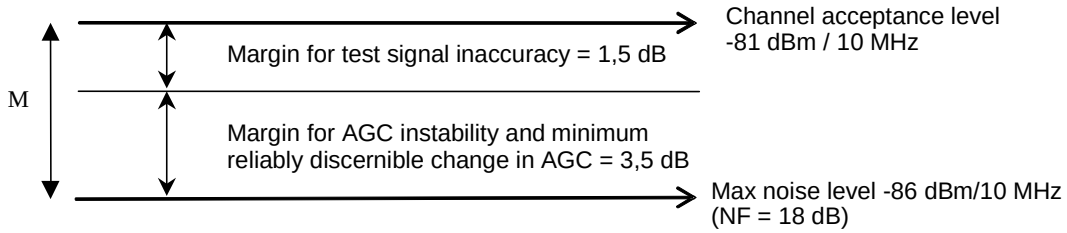


Figure UD.1: Example of definition of margin M

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.

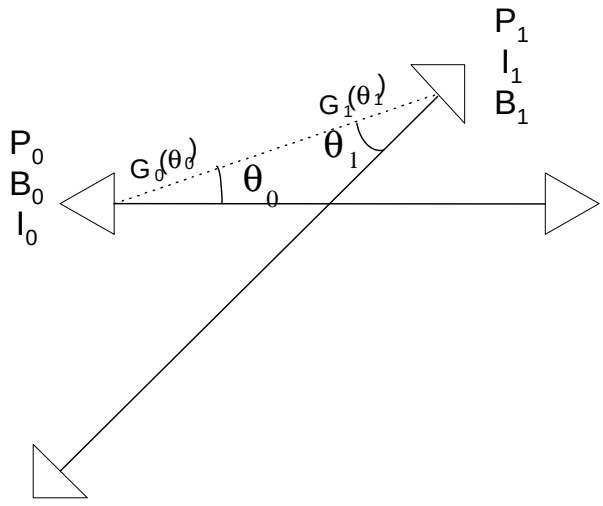


Figure UD.2: A configuration of two interfering links

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

$$I_0 = (B_0/B_1)P_1G_0(\theta_0)G_1(\theta_1)A_{12}$$

$$I_1 = P_0G_1(\theta_1)G_0(\theta_0)A_{12} \quad \text{(UD.3)}$$

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

$$I_0 = P_1G_0(\theta_0)G_1(\theta_1)A_{12}$$

$$I_1 = (B_1/B_0)P_0G_1(\theta_1)G_0(\theta_0)A_{12} \quad \text{(UD.4)}$$

When the common factors $G_0(\theta_0)$, $G_1(\theta_1)$, and A_{12} are eliminated from the two equations in (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 (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 (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 meters. 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 this annex 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 Type A and Type 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 BER = 10^{-3} (see note). If available, the new RF-channel will become operational within the time declared by the supplier.

NOTE: For conformance testing purposes this threshold level will be declared by the supplier.

Annex UE (informative): Capacity and Receiver characteristics in the bands 64 GHz to 66 GHz, 71 GHz to 76 GHz and 81 GHz to 86 GHz

UE.1 Band 64 GHz to 66 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 [i.6].

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

NOTE 1: BER 10^{-6} RSL density in table UE.5 are theoretically based on a noise figure (including duplexer losses) of 12 dB, on S/N values for uncoded modulation formats given, for BER=10^{-6}, in Recommendation ITU-R F.1101 [i.9] and on the assumption that error correction coding improvement is balancing the implementation losses. A difference of 1,5 dB between BER 10^{-6} and 10^{-8} RSL is assumed for all formats. The theoretical RSL of overall systems, under the same assumptions, can be derived integrating the values in the table over a bandwidth equal to the peak symbol-rate actually transmitted on air or, in a slightly more conservative way, over the Occupied or Channel bandwidth. RSL of actual systems would vary according their implementation differences from the above assumptions.

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.

Table UE.1: Typical RSL BER thresholds

Spectral efficiency	**Reference index**	**1**		**2**		**3**	**4**	**5**	**6**	**7**
	class	**1 (see note 1)**		**2 (see note 2)**		**3**	**4L**	**4H**	**5L**	**5H**
Equipment category		**1**	**2**	**1**	**2**	**2**	**2**	**2**	**2**	**2**
RSL(dBm/MHz) for BER ≤ 10^{-6}		-88,5	-91,5	-79	-88,5	-83	-81,5	-78,5	-75,5	-72,5
RSL(dBm/MHz) for BER ≤ 10^{-8}		-87	-90	-77,5	-87,5	-81,5	-80	-77	-74	-71

NOTE 1: Values are based on simpler modulation formats (e.g. OOK/FSK) for category 1 equipment and on PSK format for category 2 equipment.
NOTE 2: Values are based on simpler modulation formats (e.g. 4 ASK/4 FSK) for category 1 equipment and on 4 PSK formats for category 2 equipment. Category 1 systems with peak symbol rate larger than ~1 200 Mbaud/s may experience, with same noise figure assumption, slightly worst performance (up to ~3 dB) due to the need of containing the occupied bandwidth within the available 2 000 MHz.

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 ≤ 10^{-6} RSL degradation of 1 dB or 3 dB					
Spectrum efficiency ↓		Co-channel		Adjacent channel	
Reference index	class	1 dB	3 dB	1 dB	3 dB
1	1	23	19	0	-4
2	2	23	19	0	-4
3	3	23	19	-1	-5
4 and 5	4L and 4H	30	26	-1	-5
6 and 7	5L and 5H	37	33	-3	-7
NOTE: For category 1 systems only spectral efficiency 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 [i.3], 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 [i.3], 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.

UE.2 Bands 71 GHz to 76 GHz and 81 GHz to 86 GHz

UE.2.1 Capacity

The channel occupation should be coherent with the transmission capacity and the equipment spectral efficiency class (see note), according the typical Radio Interface Capacity (RIC) given, for one direction of a full-duplex FDD systems. TDD systems would match that capacity as the sum of the capacities in both directions.

NOTE: Spectral efficiency classes and their reference modulation formats are defined in EN 302 217-2-2 [9].

Even if no limitation in terms of spectral efficiency and modulation format is here made, a minimum applicable RIC figure for category 2 systems, according to the channel widths and the spectral efficiency class of operation (see note) of the systems, can be found in table Ea.2 of EN 302 217-2-2 [9]. These figures might be taken into account also for category 1 systems, with appropriate scaling to their actual occupied bandwidth.

UE.2.2 Receiver characteristics

When operating in accordance within the scope of the present document, the only essential receiving phenomena are related to spurious emissions. However, when needed as reference, receiver parameters, considered non-essential for the purpose of the present document, can be found in EN 302 217-2-2 [9].

UE.2.2.1 BER as a function of receiver input signal level (RSL)

For category 2 systems, annex Ea of EN 302 217-2-2 [9] defines this parameter in function of channel separation, transmission capacity and equipment spectral efficiency class. These figures might be taken into account also for category 1 systems, with appropriate scaling to their actual occupied bandwidth.

UE.2.2.2 Co-channel and adjacent channel interference sensitivity

For category 2 systems, annex Ea of EN 302 217-2-2 [9] defines these parameter in function of channel separation, transmission capacity and equipment spectral efficiency class. These figures might be taken into account, unchanged also for category 1 systems.

UE.2.2.3 CW spurious interference

For category 2 systems, annex Ea of EN 302 217-2-2 [9] defines this parameter in function of channel separation, transmission capacity and equipment spectral efficiency class. These figures might be taken into account, unchanged also for category 1 systems.

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V1.1.3	March 2005	Publication		
V1.2.1	February 2008	Publication		
V1.3.1	July 2009	Publication		
V2.0.0	September 2012	Public Enquiry	PE 20130122:	2012-09-24 to 2013-01-22
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