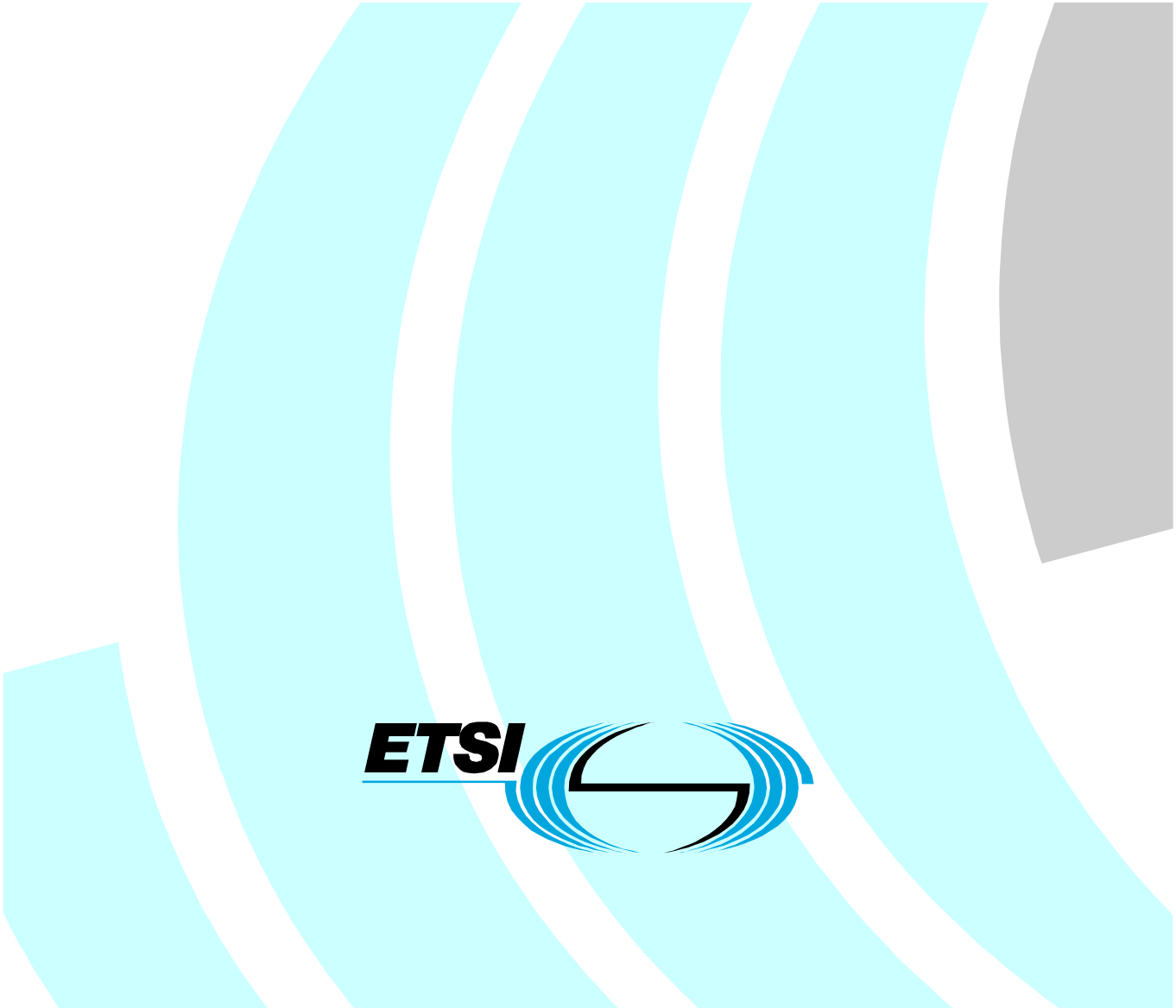
ETSI TS 102 329 V1.1.1 (2004-05)

Technical Specification

Fixed Radio Systems;
Point-to-Point equipment;
Radio equipment and antennas for use in Point-to-Point High Density applications in the Fixed Services (HDFS) frequency band 64 GHz to 66 GHz



Reference
DTS/TM-04161

Keywords
antenna, DFRS, FWA, point-to-point, radio, transmission

ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
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Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Transmission and Multiplexing (TM).

Introduction

Currently, all standardized point-to-point systems, in bands between 1 GHz and 58 GHz, have been combined into a single multi-part standard, EN 302 217 (see Bibliography), which includes Harmonized parts 2-2 and 4-2 that are relevant to article 3.2 of the Directive 1999/05/EC [1] (R&TTE Directive).

Given that CEPT/ECC have not yet released any Decision or Recommendation for harmonizing the use of the band 64 GHz to 66 GHz among EC Countries, it has been considered that it is premature that systems in the band 64 GHz to 66 GHz, subject of the present document, be directly included in that multi-part EN 302 217. The usage, in terms of planning assumptions of the band (e.g. coordinated/un-coordinated deployment, link-by-link or block assignment) and the related licensed/unlicensed regime will have direct impact on which system characteristics might be considered relevant to essential requirements under article 3.2 of the R&TTE Directive [1].

If CEPT/ECC agrees such harmonization, in the event that it will be in line with the deployment assumption (link-by-link assignment - see note) made in the scope of the present document, it is intended to be endorsed within the P-P multi-part standard (EN 302 217 (see Bibliography)) designed to fit in a modular structure to cover all radio equipment and telecommunications terminal equipment under the R&TTE Directive.

The technical specifications of High Density applications in the Fixed Service (HDFS) in the band 64 GHz to 66 GHz are described in the present document. Antenna systems suitable for use in HDFS are also described in the present document.

NOTE: A link may be assigned to operate in any bandwidth within the band, or to operate across the entire band.

1 Scope

The present document applies to High Density applications in the Fixed Service (HDFS) in the band 64 GHz to 66 GHz.

Radio frequency propagation in the band 64 GHz to 66 GHz is subject to high levels of oxygen absorption. Because of this, the band is suited to short-range applications and permits a very high re-use factor. Equipment using less complex (lower-order) modulation schemes are feasible in this band still offering suitable link lengths. Typical applications are very wide-band short connections made with simple and robust modulation formats. However no limitation is here made for other applications or for any spectral efficiency and modulation format. (The present document assumes frequency-division duplex or simplex operations only.)

For the purpose of the present document, a planning assumption is made that the system operates within a "Technology-independent assignment" of any size up to 2 GHz (see note); therefore, it includes those system characteristics that, according to the related planning assumptions, may be considered relevant to essential parameters under article 3.2 of the Directive1999/5/EC [1], 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*".

NOTE: Links may be assigned to operate in any bandwidth within the band, or to operate across the entire band. The relevant equipment parameters are referenced in the present document as well as antenna parameters.

A wide range of High Density applications in the Fixed Service (HDFS) is possible. Where appropriate, the corresponding test requirements are cross-referenced to EN 301 126-1 [2] and EN 301 126-3-1 [3].

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication and/or edition number or version number) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

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

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

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

[4] ITU-R Recommendation SM.1541-1: "Unwanted emissions in the out-of-band domain".

[5] CEPT/ERC Recommendation 74-01: "Spurious Emissions".

[6] ITU-R Recommendation SM.1045: "Frequency tolerance of transmitters".

[7] ITU-T Recommendation O.151: "Error performance measuring equipment operating at the primary rate and above".

[8] ITU-T Recommendation O.181: "Equipment to assess error performance on STM-N interfaces".

[9] ITU-T Recommendation O.191: "Equipment to measure the cell transfer performance of ATM connections".

[10] IEEE 1802.3 (2001): "Local and Metropolitan Area Networks: Conformance Test Methodology- CSMA/CD Access Method and Physical Layer Specifications - Currently Contains Attachment Unit Interface (AUI) Cable (Section 4)".

[11] IEEE 802.3 (2002): "Information technology - Telecommunications and information exchange between systems - Local and metropolitan area networks - Specific requirements - Part 3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications".

[12] ETSI EN 301 997-2 (V1.1.1): "Transmission and Multiplexing (TM); Multipoint equipment; Radio equipment for use in Multimedia Wireless Systems (MWS) in the frequency band 40,5 GHz to 43,5 GHz; Part 2: Harmonized EN covering essential requirements under article 3.2 of the R&TTE Directive".

[13] ETSI EN 301 390: "Fixed Radio Systems; Point-to-point and Multipoint Systems; Spurious emissions and receiver immunity limits at equipment/antenna port of Digital Fixed Radio Systems".

[14] ITU Radio Regulations.

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

allocated radio frequency band: entry in the table of frequency allocations of a given frequency band for the purpose of its use by one or more terrestrial or space radiocommunication services or the radio astronomy service under specific conditions

NOTE: This term shall also be applied to the frequency band concerned (RR article 1, No. 17 of ITU Radio Regulations [14]).

conformity assessment procedure: See Directive 1999/5/EC [1] annexes II, III, IV and V.

environmental profile: range of environmental conditions under which equipment, within the scope of TS 102 329, is required to comply with the provisions of TS 102 329

essential phenomenon: radio frequency phenomenon related to the essential requirements under article 3.2 of the Directive 1999/5/EC [1] that is capable of expression in terms of quantifiable technical parameters

occupied bandwidth: the width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage $\beta/2$ of the total mean power of a given emission

NOTE: For the purpose of the present document, $\beta/2$ shall be equal to 0,5 %.

operating frequency range: range(s) of radio frequency channels covered by the Equipment Under Test (EUT) without any change

radio equipment: a product or relevant component thereof capable of communication by means of the emission and/or reception of radio waves utilizing the spectrum allocated to terrestrial/space radio communication

NOTE: See article 2 of Directive 1999/5/EC [1].

3.2 Symbols

For the purposes of the present document, the following symbol apply:

dBm	decibel ratio relative to 1 milliWatt
dBW/MHz	spectral power density relative to 1 Watt in 1 MHz bandwidth

3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

BER	Bit Error Ratio
CW	Continuous Wave
DFRS	Digital Fixed Radio Systems
EIRP	Equivalent Isotropically Radiated Power
FDD	Frequency Division Duplex
FER	Frame Error Ratio
HDFS	High Density applications in the Fixed Service
OOK	On-Off Keying (also referred to as Binary Amplitude keying)
PFD	Power Flux Density
P-P	Point-to-Point
R&TTE	Radio equipment and telecommunications terminal equipment Directive
RF	Radio Frequency
RFC	Remote Frequency Control
RPE	Radiation Pattern Envelope
RSL	Receive Signal Level
TDD	Time Division Duplex
Tx	Transmitter

4 System requirements

The following clauses describe the requirements that have been considered necessary for the deployment of systems with the planning assumptions in the scope of the present document. They may be used, by equipment suppliers in agreement with a Notified Body, as reference for the phenomena relevant to essential requirements under article 3.2 of Directive 1999/5/EC [1].

NOTE: Test methods referenced below are only those considered essential for the possible assessment of conformity to article 3.2 (i.e. for the reproducibility of the results).

4.1 Phenomena description

Guidance and description of the phenomena relevant to "essential requirements" under article 3.2 is given in EG 201 399 (see bibliography); specific applications and descriptions for DFRS is given in TR 101 506 (see bibliography).

4.2 Environmental specifications and tests

The technical requirements of the present document apply under the environmental profile for intended operation of the equipment and or antennas, which shall be declared by the manufacturer or person responsible for placing the apparatus on the market.

The environmental profile may be determined by the environmental class of the equipment and antennas according to the guidance given in clause 4.4 of EN 301 126-1 [2].

The environmental profile of the equipment and antennas shall be declared by the manufacturer or person responsible for placing the apparatus on the market.

The equipment and antennas shall comply with all of the requirements of the present document at all times, when operating within the boundary limits of the required declared operational environmental profile.

Any test carried out with the intention of generating a test report and/or declaration of conformity, required to fulfil any conformity assessment procedure foreseen by the R&TTE Directive [1] for radio equipment, shall be carried out with the same principles and procedures for both reference and extreme conditions reported in clause 4.4 of EN 301 126-1 [2]. The requirement for testing at reference or extreme conditions is reported in any relevant clauses of the present document, according to the principles for similar requirements in EN 301 126-1 [2].

Any test carried out with the intention of generating a test report and/or declaration of conformity, required to fulfil any conformity assessment procedure foreseen by the R&TTE Directive 1999/5/EC [1] for integral or stand-alone antennas, shall be carried out with the same principles and procedures for both reference and extreme conditions reported in clause 4.4 of EN 301 126-1 [2]. The requirement for testing at reference or extreme conditions is reported in any relevant clauses of the present document, according to the principles for similar requirements in EN 301 126-1 [2].

The test report shall be produced according to the procedure foreseen by article 10 of the Directive 1999/5/EC [1].

4.3 Radio-frequency range for which specifications and tests for equipment are applicable

4.3.1 Radio equipment

Equipment can provide single radio frequency operation (e.g. when the RF duplexer filters are tuned to a specific operating frequency) or offer a wider operating frequency range (e.g. wide-band RF duplexer and frequency agility through the use of an RFC function). Ease of deployment and spare parts handling by operators with large networks is facilitated where more than one frequency is used.

The equipment shall comply with all the requirements of the present document at any possible operating frequency. The transmitter bandwidths of equipment are not specified. This aspect may enable manufacturers to build equipment to any bandwidth, up to 2 GHz.

The tests shall be carried out in the following way:

1) in the case of equipment intended for single frequency operation, the test report shall be produced for a single operating radio frequency arbitrarily chosen by the supplier (see figure 1);

2) in the case of equipment intended for covering an operating frequency range, the test report shall be produced for the lowest, central (intermediate) and highest possible operating radio frequencies within that operating frequency range (see figure 1);

NOTE: Figure 1 refers to FDD applications. When TDD is used the option to use the higher and lower sub-band concept does not apply.

3) it is not required that all the tests, required for the test report, are made on the same sample of equipment and at the same time; provided that the test report includes all of the tests required by the present document, each test may be made on different samples of the same equipment, at different operating frequencies or frequency ranges and at different times.

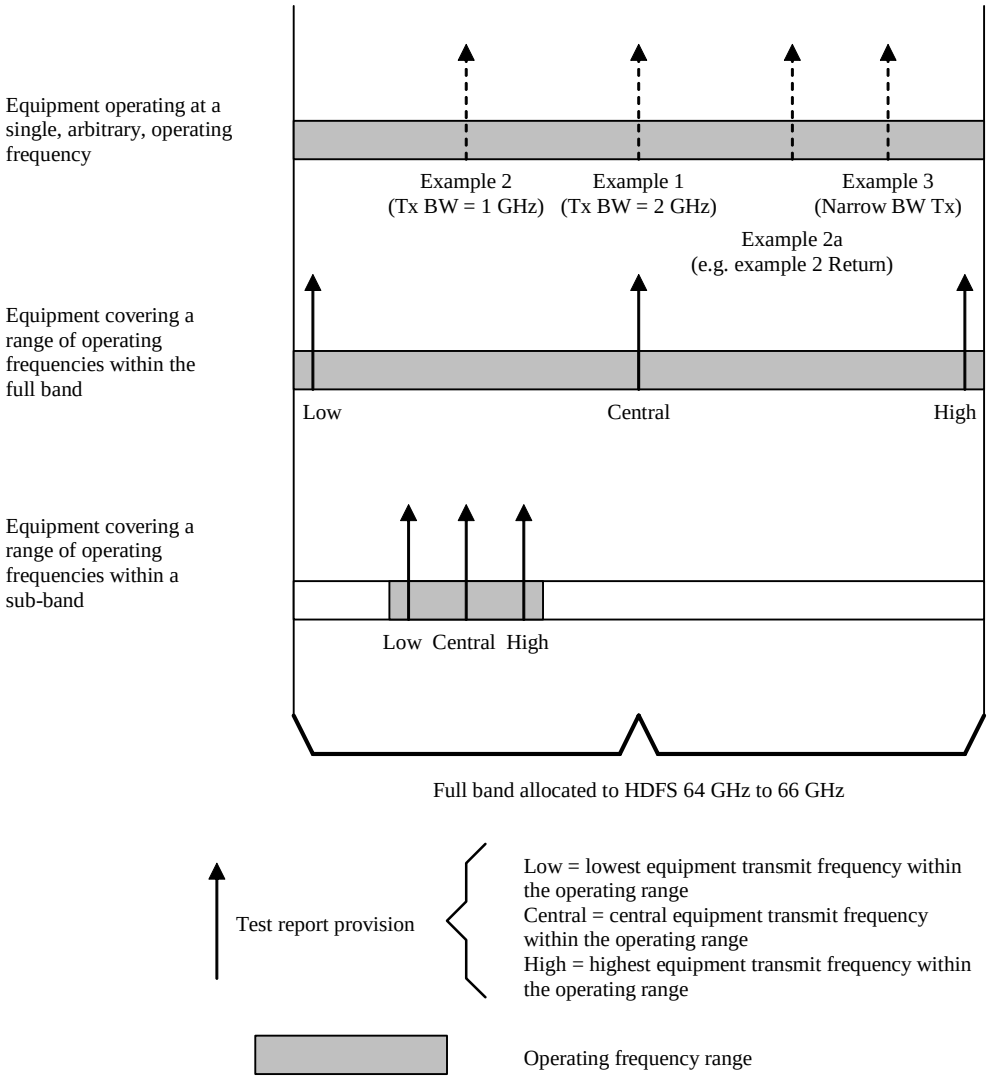


Figure 1: Test report frequency requirements for equipment intended to cover a single frequency or range of operating frequencies within 64 GHz to 66 GHz

4.3.2 Antennas for applications in the fixed service

Commonly, antennas cover an operating frequency range declared by the supplier. The antenna parameters shall comply with all the requirements of the present document within the declared operating frequency range. The tests shall be carried out at the lowest, middle and highest frequency of the relevant frequency range to produce the test report and/or declaration of conformity required (Directive 1999/5/EC [1]).

Furthermore, the tests shall be carried out according to clause 4 of EN 301 126-3-1 [3].

4.4 Multi-rate/multi-format equipment specification and tests

HDFS equipment can cover a number of different payload-rates or different modulation formats, e.g. through software presetting.

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

The tests shall be carried out for the transmitter requirements (see clause 4.5) at any offered bit-rate and modulation format, while the receiving requirements (see clause 4.7) shall be tested only at the lowest and the highest bit-rate for any modulation format.

4.5 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 B.1.

Table 1 gives the appropriate base band signals.

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	PRBS ITU-T Recommendation O.151 [7]
SDH	ITU-T Recommendation O.181 [8]
ATM	ITU-T Recommendation O.191 [9]
Ethernet interface (Packet Data)	IEEE 1802.3 [10] and IEEE 802.3 [11]
Other than the above (see note)	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.	

4.5.1 Radio frequency tolerance

The maximum radio frequency tolerance shall not exceed ±150 ppm (see ITU-R Recommendation SM.1045 [6]) for operation in the environmental profile declared by the supplier.

The limits include both short-term factors (e.g. environmental effects) and long term factors (e.g. ageing effects).

Tests shall be carried out at reference and extreme climatic conditions according to clause 4.4 of EN 301 126-1 [2], to produce the test report and/or declaration of conformity required (Directive 1999/5/EC [1]).

4.5.2 Transmitter emission limits

4.5.2.1 Maximum EIRP

The maximum EIRP, including any tolerance, shall be equal to +33 dBW.

The test can be carried out, whenever possible, with separate tests for equipment output power and antenna gain.

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

For equipment with integral antenna, the test methods for the EIRP may be derived from the gain measurement in clause 6.3 of EN 301 126-3-1 [3].

The tests shall be carried out at reference and extreme climatic conditions according to clause 4.4 of EN 301 126-1 [2] to produce the test report and/or declaration of conformity required (Directive 1999/5/EC [1]).

4.5.2.2 EIRP Spectrum density mask

The maximum power shall be limited, in terms of the power EIRP of the systems, to within the EIRP spectral density mask shown below. Those limits shall be inclusive of tolerances and, if applicable, ATPC/RTPC influence.

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

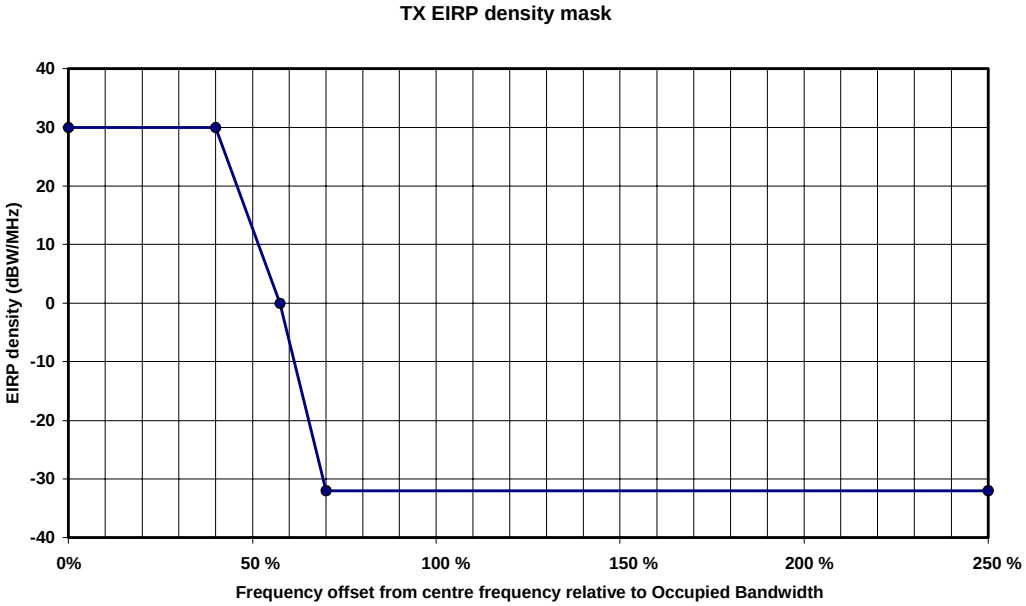
The tests shall be carried out at reference and extreme climatic conditions according to clause 4.4 of EN 301 126-1 [2] to produce the test report and/or declaration of conformity required (Directive 1999/5/EC [1]).

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 2 and that the unwanted emissions requirements specified in ITU-R Recommendation SM.1541 [4] are met. However, it is recommended that the manufacturer or person responsible for placing the apparatus on the market shall provide the 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.

The mask of figure 2 is not inclusive of frequency tolerance.

The test method for declaration of results are reported in EN 301 997-2 [12].

For regulatory reasons, the occupied bandwidth must remain within the specified band 64 GHz to 66 GHz, but emissions may fall outside of the occupied bandwidth but within the (2,5 x Occ BW) boundary for spurious emissions domain; consequently the EIRP spectral density falling outside of the band 64 GHz to 66 GHz shall not exceed -20 dBW/MHz.



EIRP density (dBW/MHz)	Offset (% of occupied bandwidth)
30	0
30	40
0	57,5
-32	70
-32	250

NOTE: See definition of occupied bandwidth in clause 3.1.

Figure 2: Tx EIRP spectral density mask

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, it introduces table 2 giving guidance, for possible maximum limits, based on currently available technology which already takes into account an allowance for the future development of higher power transmitters.

Table 2: Maximum allowed transmitter EIRP spectral density

Max EIRP spectral density (Including tolerances) (see note 2)	Typical informative assumptions for deriving the EIRP limits (see note 1)	
	Maximum power spectral density at antenna port	Maximum antenna gain
+30 dBW/MHz	+15 dBm/MHz	+45 dB
NOTE 1: In actual applications trade off in these values is possible provided that EIRP limits are met. NOTE 2: Limited to a maximum EIRP of +33 dBW.		

4.5.2.3 Spurious emissions

The equipment shall comply with the spurious emission limits defined in CEPT/ERC Recommendation 74-01 [5] (see note).

NOTE: According that Recommendation, provided that there are no recommended channel arrangements in this frequency band, the frequency boundary where limits apply for fixed service systems needs to be evaluated as a function of the occupied bandwidth of the emission.

The limits are applicable at reference point C' or at point B' if C' is not available. The equipment shall comply with the relevant requirements in any setting conditions of transmit power. Test methods shall be in accordance with clause 5.2.9 of EN 301 126-1 [2].

The tests shall be carried out to produce the test report and/or declaration of conformity required (Directive 1999/5/EC [1]) with equipment set to maximum available power. The actual test shall be limited to the practical frequency ranges foreseen by CEPT/ERC Recommendation 74-01 [5].

The test shall be carried out at reference climatic conditions according to clause 4.4 of EN 301 126-1 [2].

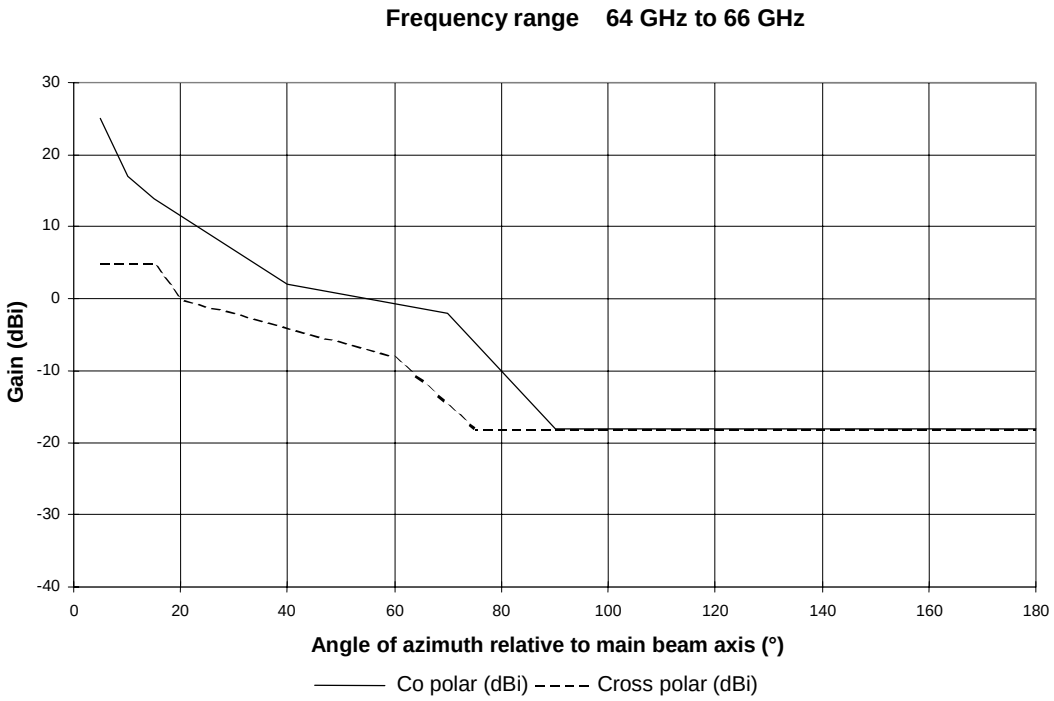
4.6 Directional phenomena

4.6.1 Off-axis EIRP density (Radiation Pattern Envelope)

Antennas shall conform to the general requirements of the present document. The Radiation Pattern Envelope (RPE) shall be tested in accordance with clause 6 of EN 301 126-3-1 [3].

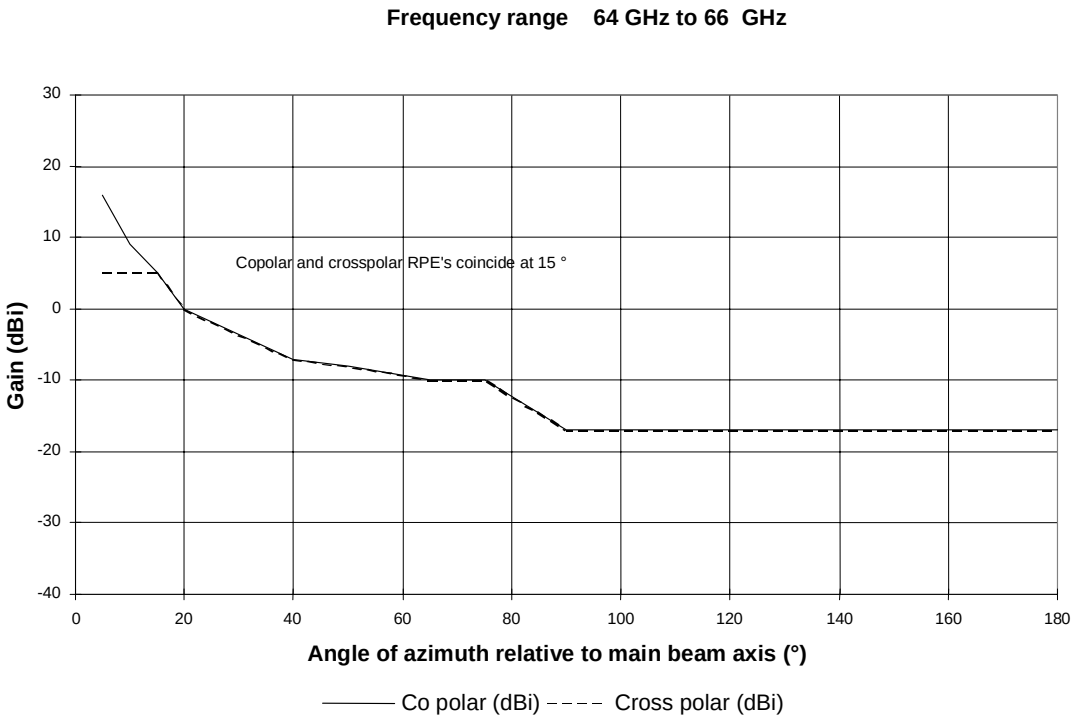
NOTE: The RPEs shown in figures 4 and 5 are identical to those shown in figures 13b (frequency range 6, Class 2) and 13c (frequency range 6, Class 3) of EN 302 217-4-2 (see bibliography).

The supplier shall declare the antenna gain. The test methods shall comply with EN 301 126-3-1 [3], clause 6.3.



Angle (°)	Co-polar (dBi)	Angle (°)	Cross-polar (dBi)
5	25	5	5
10	17	15	5
15	14	20	0
40	2	60	-8
70	-2	75	-18
90	-18	180	-18
180	-18		

Figure 3: RPEs for class 2 antennas in the frequency range 64 GHz to 66 GHz



Angle (°)	Co-polar (dBi)	Angle (°)	Cross-polar (dBi)
5	16	5	5
10	9	15	5
15	5	20	0
20	0	40	-7
40	-7	50	-8
50	-8	65	-10
65	-10	75	-10
75	-10	90	-17
90	-17	180	-17
180	-17		

Figure 4: RPEs for class 3 antennas in the frequency range 64 GHz to 66 GHz, vertically polarized only

4.6.2 Antenna gain

The antenna supplier shall declare the nominal gain and its tolerance (or maximum antenna gain).

The test methods for the EIRP shall comply with clause 6.3 of EN 301 126-3-1 [3].

4.7 Receiver requirements

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

4.7.1 Spurious emissions - external

The spurious emission limits defined in CEPT Recommendation 74-01 (2002) [5] shall apply (see note). Those limits are applicable at reference point C or at point B if C is not available.

NOTE: According Recommendation 74-01 [5] , provided that there are no recommended channel arrangements in this frequency band, the frequency boundary where limits apply for fixed service systems needs to be evaluated as a function of the occupied bandwidth of the emission.

5 Testing for compliance with technical requirements

5.1 Environmental conditions for testing

The technical requirements of the present document apply under the environmental profile for intended operation of the system, which shall be declared by the manufacturer.

The environmental profile, may be determined by the environmental class of the equipment according to the guidance given in clause 4.2 of EN 301 126-1 [2].

The equipment shall comply with all the requirements of the present document at all times when operating 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 foreseen by 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 [2];

b) for integral DFRS antennas (directional phenomena of clause 4.6 of the present document), at reference environmental conditions of the test field according to clause 4.1 of EN 301 126-3-1 [3].

The test report shall be produced according to the procedure set out by article 10 of the Directive 1999/5/EC [1].

5.2 Wide radio-frequency band covering equipment specification and tests

DFRS equipment commonly cover an operating frequency range. The equipment parameters shall comply with all the requirements of the present document at any possible operating frequency.

The tests, requested to generate the test report and/or declaration of conformity in order to fulfil any conformity assessment procedure foreseen by the Directive 1999/5/EC [1], shall be carried-out at the highest and the lowest possible operating frequency.

5.3 Radio test suites

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 1999/5/EC [1], shall be carried-out at climatic conditions referred to in table 3.

Tables 3 and 4 indicate the different clauses applicable, for a given parameter, to the requirement, the test clause in that chapter and the corresponding test method in the base test documents EN 301 126-1 [2] and EN 301 126-3-1 [3].

The test methods for the requirements considered essential are stated, where applicable, in table 3. The test methods for the requirements considered non-essential are stated, where applicable, in table 4.

Table 3: test methods for compliance with technical requirements considered essential

Clause	Relevant clause title	Test method
General		
4.2	Environmental specifications and tests	Clause A.1.3.3, EN 301 126-1 [2]
Transmitter/antenna	**--------**	**---------**
4.5.1	Frequency error/stability (radio frequency tolerance)	Clause 5.2.5, EN 301 126-1 [2]
4.5.2.1	Transmitter maximum EIRP limit	Clause 5.2.1, EN 301 126-1 [2] and/or Clause 6.3, EN 301 126-3-1 [3]
4.5.2.2	Adjacent channel power (EIRP density mask)	Clause 5.2.6, EN 301 126-1 [2] Clause 6.3, EN 301 126-3-1 [3]
4.5.2.3	Spurious Emissions	Clause 5.2.9, EN 301 126-1 [2]
4.6.1	Off-axis EIRP density (RPE)	Clause 6.1, EN 301 126-3-1 [3]
4.6.2	Antenna gain	Clause 6.3, EN 301 126-3-1 [3]
Receiver	**---------**	**---------**
4.7.1	Spurious Emissions	Clause 5.3.2, EN 301 126-1 [2]

Table 4: test methods for compliance with technical requirements (considered non-essential)

Clause	Relevant clause title	Test method
Receiver		
B.1	BER as a function of receiver input signal level RSL	Clause 5.3.3.1, EN 301 126-1 [2]
B.2	Co-channel "external" interference sensitivity	Clause 5.3.3.2, EN 301 126-1 [2]
B.3	CW spurious interference	Clause 5.3.3.4, EN 301 126-1 [2]

Annex A (informative): Receiving requirements

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, shall be carried out with the transmitters loaded with test signals defined in clause 4.5.

A.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 annex G.4. of EN 302 217-2-1 (see bibliography).

The RSL threshold values (dBm) for required BER are indicated in table A.1.

Table A.1: BER as a function of RSL

		Band →	**64 GHz**	**66 GHz**
Bit-rate (Mbit/s)	**Maximum Occupied bandwidth (MHz) (see note 1)**	**Nominal duplex separation (MHz**	**RSL for BER ≤ 10^{-6} (dBm)**	**RSL for BER ≤ 10^{-8} (dBm)**
125	500	850	-61	-59,5
155	620	850	-60	-58,5
622	1 250	(see note 2)	-48	-46,5
1 250	2 000	(see note 2)	-42	-40,5
NOTE 1: These values are relevant to the simplest spectral efficiency Class 1 (e.g. OOK) equipment as defined within EN 302 217-2-1.				
NOTE 2: The occupied bandwidth of 622 Mbit/s and 1 250 Mbit/s systems may preclude duplex operation, and therefore do not have a duplex separation value.				

Equipment working at the relevant RSL thresholds, set out in table 1, shall produce a BER equal to or less than the corresponding values (i.e. 10^{-6} or 10^{-8}).

NOTE: 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.

A.2 Co-channel "external" and adjacent channel interference sensitivity

The co-channel "external" 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.

The limits of Carrier to Interference ratio (C/I) in case of co-frequency channel and adjacent channel interference shall be as specified in table 3, 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 A.1.

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

		C/I for BER ≤10^{-6} RSL degradation of 1 dB or 3 dB			
		Co-channel		Adjacent channel	
Nominal Bit rate (Mbit/s)	**Nominal Receiver Bandwidth (MHz)**	**1 dB**	**3 dB**	**1 dB**	**3 dB**
125	250	23	19	See note	
155	310	23	19		
622	622	23	19		
1 250	1 250	23	19		
NOTE: These systems are designed to operate in a single channel duplex or simplex mode. For adjacent channel performance, see blocking requirements (clause A.3).					

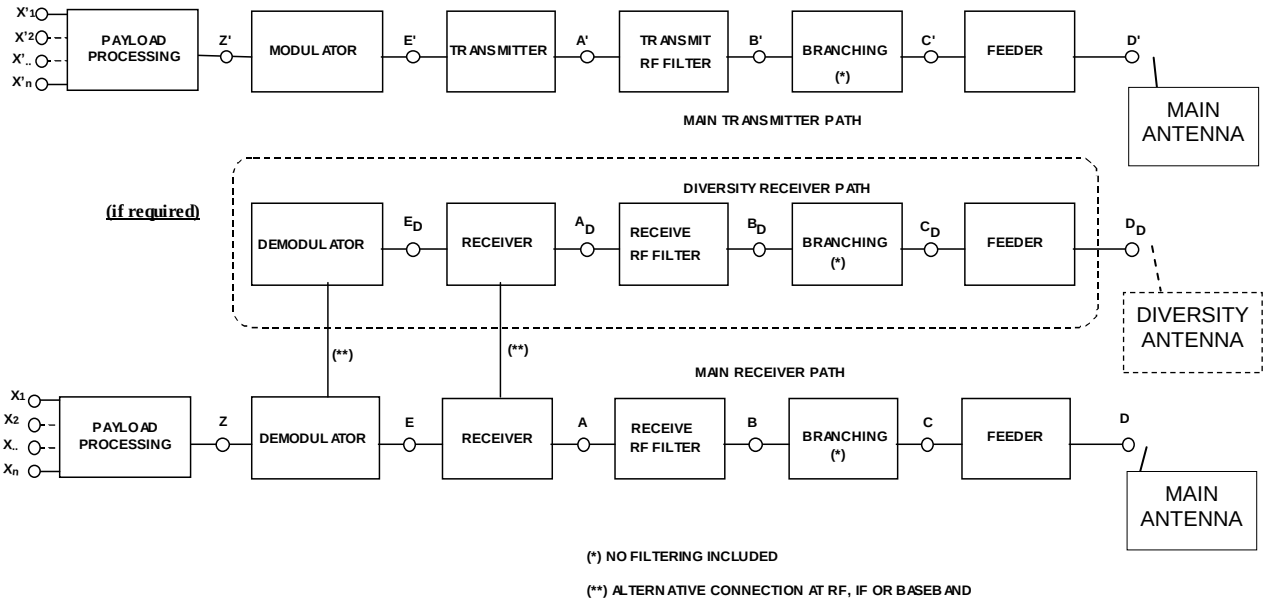
A.3 CW spurious interference

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 EN 301 390, 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 [13], but excluding frequencies either side of the wanted frequency by up to 250 % of the separation between channels using the same polarization, shall not result in a BER greater than 10^{-5}.

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

Annex B (informative): System block diagram

The reference points of the system block diagram (figure B.1) will be used in the descriptions of requirements and of test points in the other parts of the present document.



NOTE 1: For the purpose of defining the measurement points, the branching network does not include a combiner.
NOTE 2: The points shown above are reference points only and do not mandate any implementation; points C and C', D and D' in general coincide.
NOTE 3: Points B, C, B' and C' may coincide when a simple duplexer is used.
NOTE 4: Points X1, X2, …Xn and points X'1, X'2, …X'n correspond to one or more digital or analogue signal input reference points. They are generically referred to as X and X'
NOTE 5: The subdivision of "Payload processing" and the "Modulator/demodulator" blocks is functional and not physical. The first functionally contains the payload processing needed for building up the transport module (e.g. framing, multiplexing and or concentration), the latter functionally contains mo-demodulation, coding-decoding and service signals processing needed for transmission (e.g. error correction algorithms and service channels). Points Z and Z', that might not be physically available, represent the virtual points where , the radio interface capacity (RIC), referred in the provisions of annexes F of Parts 2-1 and 2-2 of the multi-part EN 302 217 shall be defined.

Figure B.1: System block diagram

Annex C (informative): Current and future systems

One of the typical applications for the present document provides cost-effective, short-range, very high-bandwidth digital links (100 Mbps to 1,25 Gbps). Due to the oxygen absorption characteristics of the band 64 GHz to 66 GHz, links are made by those systems are designed to operate co-frequency with very short re-use distances. In this case, overall re-use efficiency (bits per Hz per m^3) is more relevant than simple spectral efficiency (bits per Hz). In the short term, therefore, it is expected that equipment with only low-order modulation techniques and broad bandwidth will be available. In the longer term, however, equipment with higher-order modulation techniques and narrower bandwidths may be produced.

Some administrations may consider channelizing the band for systems operating within their country. If so, they would be advised to take into account the bandwidth and channelization of available and planned equipment. In addition, a harmonized channel scheme, such as those developed and recommended by CEPT, would ensure that similar equipment could be used in multiple countries.

Annex D (informative): Bibliography

ETSI EG 201 399 (V1.3.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); A guide to the production of candidate Harmonized Standards for application under the R&TTE Directive".

ETSI TR 101 506 (V1.1.1): "Fixed Radio Systems; Generic definitions, terminology and applicability of essential requirements under the article 3.2 of 99/05/EC Directive to Fixed Radio Systems".

ETSI EN 302 217 (all parts): "Fixed Radio Systems; Characteristics and requirements for point-to-point equipment and antennas".

History

Document history		
V1.1.1	May 2004	Publication