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HARMONISED EUROPEAN STANDARD

Wireless Digital Video Links operating in the 1,3 GHz to 50 GHz frequency band; Harmonised Standard for access to radio spectrum

Reference
REN/ERM-TG17-160

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Foreword

This Harmonised European Standard (EN) has been produced by ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM).

The present document has been prepared under the Commission's standardisation request C(2015) 5376 final [i.11] to provide one voluntary means of conforming to the essential requirements of Directive 2014/53/EU on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC [i.1].

Once the present document is cited in the Official Journal of the European Union under that Directive, compliance with the normative clauses of the present document given in Table A.1 confers, within the limits of the scope of the present document, a presumption of conformity with the corresponding essential requirements of that Directive and associated EFTA regulations.

The present document covers Wireless Video Links operating between 1,3 GHz to 50 GHz.

National transposition dates	
Date of adoption of this EN:	24 October 2024
Date of latest announcement of this EN (doa):	31 January 2025
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	31 July 2025
Date of withdrawal of any conflicting National Standard (dow):	31 July 2026

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

Introduction

The present document is intended to specify the minimum performance characteristics and the methods of measurement for Wireless Video Links operating in the 1,3 GHz to 50 GHz frequency band.

The present document provides the necessary parameters for equipment to obtain common approval throughout Europe.

The present document covers the minimum characteristics considered necessary in order to make the best use of the available frequencies. It does not necessarily include all the characteristics that may be required by a user, nor does it necessarily represent the optimum performance achievable.

The present document is a testing standard based on spectrum utilization parameters and does not include performance characteristics that may be required by the user or requirements for interfacing equipment.

In preparing the present document, much attention has been given to assure a low interference probability, while at the same time allowing maximum flexibility and service to the end-user.

It does not preclude any digital modulation technique, provided that the modulated signal lies within the prescribed limits.

Electromagnetic Compatibility (EMC) requirements are covered by ETSI EN 301 489-28 [i.3].

The present document contains instructions for the presentation of equipment for testing purposes.

Transmitter Power limits are defined in the terms and conditions of the users operating licence.

The present document is intended to cover the provisions of Directive 2014/53/EU [i.1], article 3.2, which states that "*… radio equipment shall be so constructed that it both effectively uses and supports the efficient use of radio spectrum in order to avoid harmful interference*".

1 Scope

The present document applies to terrestrial wireless digital video link equipment operating in the frequency band 1,3 GHz to 50 GHz. The present document does not apply to transmitter equipment where the output power exceeds 10 W. Equipment with an integral antenna is also excluded.

NOTE: The relationship between the present document and essential requirements of article 3.2 of Directive 2014/53/EU [i.1] is given in annex A.

2 References

2.1 Normative references

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

Referenced documents which are not found to be publicly available in the expected location might be found at https://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.

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

[1] CEPT/ERC/REC 74-01E (May 2019): "Unwanted emissions in the spurious domain".

2.2 Informative references

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

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

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

[i.1] Directive 2014/53/EU of the European Parliament and of the Council of 16 April 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC.

[i.2] Void.

[i.3] ETSI EN 301 489-28: "ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 28: Specific conditions for wireless digital video links; Harmonised Standard for ElectroMagnetic Compatibility".

[i.4] Void.

[i.5] ANSI C63.5: "American National Standard for Calibration of Antennas Used for Radiated Emission Measurements in Electromagnetic Interference (EMI) Control-Calibration of Antennas (9 kHz to 40 GHz)".

[i.6] ETSI TR 102 273 (all parts): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Improvement on Radiated Methods of Measurement (using test site) and evaluation of the corresponding measurement uncertainties".

[i.7] ETSI EG 203 336: "Guide for the selection of technical parameters for the production of Harmonised Standards covering article 3.1(b) and article 3.2 of Directive 2014/53/EU".

[i.8] Void.

[i.9] Void.

[i.10] Void.

[i.11] Commission Implementing Decision C(2015) 5376 final of 4.8.2015 on a standardisation request to the European Committee for Electrotechnical Standardisation and to the European Telecommunications Standards Institute as regards radio equipment in support of Directive 2014/53/EU of the European Parliament and of the Council.

[i.12] Void.

[i.13] Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment.

3 Definition of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the terms given in Directive 2014/53/EU [i.1] and the following apply:

antenna port: port, where a radio frequency antenna is connected to equipment

channel bandwidth: minimum bandwidth within which the transmitter's necessary bandwidth can be contained

channel occupancy: ratio between the occupied bandwidth and the channel bandwidth, ($r = B_0$ / B_c)

conducted measurements: measurements that are made using a direct connection to the EUT

frequency range: range of operating frequencies over which the equipment can be adjusted

mean power: average power supplied to the antenna transmission line by a transmitter during an interval of time sufficiently long compared with the lowest frequency encountered in the modulation envelope taken under normal operating conditions

necessary bandwidth: for a given class of emission, width of the frequency band which is just enough to ensure the transmission of the information at the rate and with the quality required under specified conditions

occupied bandwidth: bandwidth containing 99 % of the total modulated signal power

operating frequency: nominal frequency at which the equipment can be operated

NOTE: This is also referred to as the operating centre frequency.

Out Of Band (OOB) emissions: unwanted emissions which fall at frequencies separated from the centre frequency of the wanted emission by less than or equal to 250 % of the channel bandwidth

port: any connection point on or within the Equipment Under Test (EUT) intended for the connection of cables to or from that equipment

quasi-error-free: transmission error rate less than one uncorrected event per hour

radiated measurements: measurements that are made using a test antenna to receive signals radiated from the EUT

spurious domain emissions: unwanted emissions at frequencies separated by more than 250 % of the channel bandwidth from the centre of the occupied spectrum

substitution antenna: antenna connected to a test signal generator for radiated tests

test antenna: antenna connected to a measurement receiver for measuring radiated signals from the EUT

unwanted emissions: spurious emissions and out of band emissions

3.2 Symbols

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

λ	wavelength in metres
β	bandwidth scale factor for spectrum analyser measurements
B_c	channel bandwidth
B_o	occupied bandwidth
d_1	largest dimension of the EUT/dipole after substitution (m)
d_2	largest dimension of the test antenna (m)
dB	decibel; logarithmic unit to express ratio between two quantities
dBd	logarithmic ratio of antenna gain relative to a dipole
dBm	power quantity relative to 1 mW
Δf	deviation from nominal carrier frequency
Δp	transmitter power accuracy
F_{block}	blocking interferer frequency offset
F_{min}	centre frequency of the lowest channel of operation
F_{med}	centre frequency of the channel closest to $(F_{max} + F_{min}) / 2$
F_{max}	centre frequency of the highest channel of operation
f	RF frequency
f_c	nominal carrier frequency
f_{TX}	measured carrier frequency for the transmitter under test
GHz	gigahertz
kHz	kilohertz
L_{XY}	loss of measurement signal path between points X and Y
MHz	megahertz
mW	milliwatt
N	integer multiplier
P_{mean}	nominal RF output power rating provided by the manufacturer
ppm	parts per million
P_{TX}	RF output power measured for the transmitter under test measured at the antenna port
P_{sens}	maximum limit of receiver sensitivity
r	channel occupancy
Γ	total symbol duration

3.3 Abbreviations

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

ACE	Active Constellation Extension
ACP	Adjacent Channel Power
ACPR	Adjacent Channel Power Ratio
ACS	Adjacent Channel Selectivity
BER	Bit Error Rate
C/N	Carrier to Noise ratio
COFDM	Coded Orthogonal Frequency Division Multiplexing
CW	Carrier Wave
DC	Direct Current
DVB-S2	Digital Video Broadcast - Satellite (second generation)
DVB-T	Digital Video Broadcast - Terrestrial
DVB-T2	Digital Video Broadcast - Terrestrial (second generation)
EC	European Commission
EFTA	European Free Trade Association
EMC	Electro-Magnetic Compatibility
ERC	former European Radio Committee in CEPT
EUT	Equipment Under Test

FEC	Forward Error Correction
FEF	Future Extension Frame
FFT	Fast discrete Fourier Transform
HEM	High Efficiency Mode
I/C	Interference to Carrier ratio
ISDB-T	Integrated Services Digital Broadcasting - Terrestrial
ISSY	Input Stream SYnchronizer
LDPC	Low Density Parity Check
MISO	Multiple Input Single Output
MPEG	Moving Picture Experts Group
NZIF	Near-Zero Intermediate Frequency
OATS	Open Area Test Site
PAPR	Peak to Average Power Ratio
PLP	Physical Layer Pipe
PSK	Phase Shift Keying
QAM	Quadrature Amplitude Modulation
QEF	Quasi Error Free
QPSK	Quadrature Phase Shift Keying
RBW	Resolution BandWidth
RF	Radio Frequency
RMS	Root Mean Square
SISO	Single Input Single Output
TFS	Time Frequency Slicing
TR	Tone Reservation
TS	Transport Stream
VBW	Video BandWidth
VSWR	Voltage Standing Wave Ratio

4 Technical requirements specifications

4.1 Environmental profile

The technical requirements of the present document apply under the environmental profile for operation of the equipment, which shall be in accordance with its intended use. The equipment shall comply with all the technical requirements of the present document at all times when operating within the boundary limits of the operational environmental profile defined by its intended use.

4.2 Conformance requirements for transmitters

4.2.1 Transmitter emission classification

For transmitter equipment, the following performance classes are defined.

Table 1: Transmitter emission classification

Emission Classification	Notes
Class 0	A set of limits defining permitted relative emission levels into adjacent channels. This class applies for transmitters where the intended use does not include operation in channels adjacent to other video link equipment.
Class 1	A set of more stringent limits defining permitted relative emission levels into adjacent channels. This class applies for transmitters where the intended use does include operation in channels adjacent to other video link equipment.

4.2.2 Transmitter test signal configurations

Table 2 contains the set of representative parameters for the transmitter that are applicable to the conformance requirements laid out in the remainder of this clause.

Table 2: Generic transmitter configuration

Parameter	Minimum value	Median value	Maximum value
Frequency (see note 1)	F_{min}	F_{med}	F_{max}
Modulation	Lowest constellation density	-	Highest constellation density
Signal bandwidth (see note 2)	Minimum B_c	-	Maximum B_c
Transmitter output power	P_{min}		P_{max}
NOTE 1: F_{min} is the centre frequency of the lowest channel of operation of the EUT. F_{med} is the closest tuneable frequency to (F_{max} + F_{min}) / 2. F_{max} is the centre frequency of the highest channel of operation of the EUT. NOTE 2: B_c is the channel bandwidth. NOTE 3: P_{min} is the minimum power output setting of the EUT. P_{max} is the maximum power output setting of the EUT.			

4.2.3 Transmitter power accuracy

4.2.3.1 Definition

The transmitter power accuracy, Δp, is the ratio, expressed in dB, of the rated output power, P_{mean} to the measured power P_{TX} at the transmitter antenna port:

$$\Delta p = 10 \times log_{10}(P_{TX}/P_{mean})$$

4.2.3.2 Limit

The transmitter power accuracy shall be within the limits given in Table 3 over the tuning range of the equipment.

Table 3: Transmitter output power accuracy limits

RF Power output accuracy, Δp (dB)	
Maximum	**Minimum**
+0,8	-1,0

4.2.3.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.2.2.

4.2.4 Transmitter frequency stability

4.2.4.1 Definition

This is quantified by the deviation Δf, from the nominal carrier frequency, f_c over the tuning range of the equipment.

4.2.4.2 Limits

The maximum permissible deviation from the nominal carrier frequency is stated in Table 4.

Table 4: Frequency Offset Δf limits

Frequency range (GHz)	Δf (ppm)
1,3 ≤ f_c < 2,0	±15
f_c ≥ 2,0	±10

Equipment with a tuning range covering more than one range as given in Table 4 shall conform to the most restrictive limit.

4.2.4.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.2.3.

4.2.5 Transmitter occupied bandwidth

4.2.5.1 Definitions

The *Occupied Bandwidth*, B_o, is the bandwidth containing 99 % of the power of the signal.

4.2.5.2 Limits

The Occupied Bandwidth shall conform to one of the following bandwidth categories, spanning no more than the allowable value listed in Table 5.

Table 5: Maximum allowable occupied bandwidth

Equipment	Maximum bandwidth (MHz)
Category 1	40
Category 2	30
Category 3	20
Category 4	10
Category 5	5
Category 6	2,5

4.2.5.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.2.4.

4.2.6 Transmitter channel occupancy

4.2.6.1 Definitions

The *channel occupancy*, r is the ratio; occupied bandwidth, B_o to the channel bandwidth, B_c i.e.:

$$r = {}^{B_o}/_{B_c}$$

4.2.6.2 Limits

The channel occupancy shall be less than or equal to the limits given in Table 6.

Table 6: Transmitter channel occupancy limits

Frequency Range (GHz)	P_{mean} (W)	Transmitter channel occupancy, r	
		Emission class 0 limits	Emission class 1 limits
$f_c < 3,8$	$P_{mean} < 0,3$	$2/3 < r < 1$	$2/3 < r < 1$
	$0,3 < P_{mean} < 1$	$1/2 < r < 1$	$2/3 < r < 1$
	$1 < P_{mean} < 10$	$1/3 < r < 1$	$2/3 < r < 1$
$3,8 < f_c < 8$	$P_{mean} < 0,3$	$2/3 < r < 1$	$2/3 < r < 1$
	$0,3 < P_{mean} < 1$	$1/2 < r < 1$	$1/2 < r < 1$
	$1 < P_{mean} < 10$	$1/3 < r < 1$	$1/3 < r < 1$
$8 < f_c < 50$	$P_{mean} < 10$	$1/3 < r < 1$	$1/3 < r < 1$
NOTE: Emission classes are defined in Table 1.			

4.2.6.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.2.5.

4.2.7 Transmitter unwanted emissions in the spurious domain

4.2.7.1 Definition

Transmitter unwanted emissions in the spurious domain are defined as emissions outside of the range:

$$f_c \pm 2{,}5\ B_c.$$

The limits are defined in terms of the mean power measured in a given measurement bandwidth.

The level of spurious emissions shall be measured by considering:

a) the power conducted from the antenna port; and

b) the power radiated by the cabinet and structure of the equipment (cabinet radiation).

4.2.7.2 Limits

The level of transmitter unwanted emissions outside the band of operation shall not exceed the limits given in Table 7.

Table 7: Transmitter emission limits in the spurious domain (from CEPT/ERC/REC 74-01E [1], Reference number 2.1.2)

<table>
<tr><th>Frequency range</th><th>Maximum power (dBm)</th><th colspan="2">Analyser RBW</th></tr>
<tr><td>30 MHz - 1 GHz</td><td>-36</td><td colspan="2">100 kHz</td></tr>
<tr><td>Except in the following bands:</td><td></td><td colspan="2"></td></tr>
<tr><td>47 MHz - 74 MHz
87,5 MHz - 118 MHz</td><td>-54</td><td colspan="2">100 kHz</td></tr>
<tr><td>174 MHz - 230 MHz
470 MHz - 862 MHz</td><td>-54</td><td colspan="2">100 kHz</td></tr>
<tr><td>1 GHz - 1,3 GHz</td><td>-30</td><td colspan="2">3 MHz</td></tr>
<tr><td rowspan="7">1,3 GHz - F_{upper}
(see note 1)</td><td rowspan="7">-30</td><td>$f_c + 2{,}5\ B_c \leq f \leq f_c + 10\ B_c$</td><td>30 kHz</td></tr>
<tr><td>$f_c + 10\ B_c < f \leq f_c + 12\ B_c$</td><td>300 kHz</td></tr>
<tr><td>$f > f_c + 12\ B_c$</td><td>3 MHz</td></tr>
<tr><td>$f_c - 10\ B_c \leq f \leq f_c - 2{,}5\ B_c$</td><td>30 kHz</td></tr>
<tr><td>$f_c - 12\ B_c \leq f < f_c - 10\ B_c$</td><td>300 kHz</td></tr>
<tr><td>$f < f_c - 12\ B_c$</td><td>3 MHz</td></tr>
<tr><td colspan="2">(see note 2)</td></tr>
<tr><td colspan="4">NOTE 1: Upper limit of the measurement range F_{upper} is dependent on the fundamental frequency of the transmission and is defined by Table 8.
NOTE 2: The frequency of measurement is denoted by f.
NOTE 3: For radiated emissions due to cabinet radiation, the above power limits apply to the effective radiated power from the cabinet.</td></tr>
</table>

Table 8: Measurement frequency limits in the spurious domain

Fundamental frequency range (GHz)	Frequency range for measurements
	Upper frequency F_{upper} (see note)
1,3 - 5,2	5th harmonic
5,2 - 13	26 GHz
13 - 50	2nd harmonic
NOTE: The test should include the entire harmonic band, including that of the modulation spectrum and not be truncated at the precise upper frequency limit stated.	

4.2.7.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.2.6.

4.2.8 Transmitter unwanted emissions in the out of band domain

4.2.8.1 Definition

Out of band emissions are unwanted emissions in the range $f_c \pm 0,5\ B_c$ to $f_c \pm 2,5\ B_c$. The unwanted emissions limits are defined in terms of the integrated power within two out of band blocks.

4.2.8.2 Limits

The level of transmitter unwanted emissions in the out of band domain shall not exceed the limits given in Table 9.

Table 9: Integrated power limits relative to P_{mean} in the out of band domain

Output power, P_{mean} (W)	Emission class (see note 1)	Each adjacent channel (dB) (see note 2)	Each alternate channel (dB) (see note 2)
$P_{mean} < 0,3$	0	-36	-42 dB
	1	-42	-48 dB
$P_{mean} \geq 0,3$	0	$-36 - 10 \log_{10} (P_{mean} / 0,3)$	$-42 - 10 \log_{10} (P_{mean} / 0,3)$
	1	$-42 - 10 \log_{10} (P_{mean} / 0,3)$	$-48 - 10 \log_{10} (P_{mean} / 0,3)$
NOTE 1: Emission classes are defined in Table 1. NOTE 2: Adjacent channel extends over $f_c \pm 0,5\ B_c$ to $f_c \pm 1,5\ B_c$. Alternate channel extends over $f_c \pm 1,5\ B_c$ to $f_c \pm 2,5\ B_c$. Where B_c is the channel bandwidth.			

4.2.8.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.2.7.

4.3 Conformance requirements for receivers

4.3.1 Receiver test signal configurations

Table 10 defines receiver configuration parameters applicable for receiver testing.

Table 10: Signal configuration for receiver tests

Parameter	Value
Video test sequence	The video sequence selected for these tests should contain movement, to minimize the number of errors missed due to error concealment techniques in the receiver.
Test frequency	F_{med}
NOTE: F_{med} is the centre frequency of the channel closest to $(F_{max} + F_{min}) / 2$.	

4.3.2 Minimum performance criterion

All receiver conformance requirements in the remainder of this clause use the Quasi Error Free (QEF) condition as minimum performance threshold, which, for the purposes of the present document is defined as the condition where there is less than one uncorrected Transport Stream (TS) error event per hour, or a BER of 1×10^{-11} at the input of the MPEG-2 TS demultiplexer. In practice, this can be a time-consuming process and various alternative methodologies for determining this threshold are laid out in clause 5.3.1.

4.3.3 Receiver sensitivity

4.3.3.1 Definition

Receiver sensitivity is the ability to receive a wanted signal at a low input power level while meeting the performance level stated in clause 4.3.3.2.

4.3.3.2 Limits

The sensitivity limits for receivers are technology dependent. For each of the required modulation-coding points, the receiver input power shall be less than or equal to the sensitivity limits for the respective modulation-coding point.

Limit values for DVB-T, DVB-T2 and DVB-S2 are defined in Table 12, Table 14 and Table 16 using signal configurations defined in Table 11, Table 13 and Table 15 respectively. For other modulation formats, the limit values given in Table 17 shall apply.

DVB-T COFDM (8 MHz Bandwidth) systems

Table 11 contains the representative DVB-T signal configuration for which the minimum receiver sensitivity values stated in Table 12 shall be met.

Table 11: DVB-T test signal configuration

Parameter	Value
FFT	2 K
Signal bandwidth (MHz)	7,61
Guard interval	1/32
TS bitrate (Mbit/s)	22,117

Table 12: DVB-T receiver sensitivity limits

Modulation	Code rate	QEF C/N (dB) (see note 1)	Sensitivity (dBm)
QPSK	1/2	3,1	-93
QPSK	2/3	4,9	-91
QPSK	3/4	5,9	-90
QPSK	5/6	6,9	-89
QPSK	7/8	7,7	-88
16-QAM	1/2	8,8	-87
16-QAM	2/3	11,1	-85
16-QAM	3/4	12,5	-84
16-QAM	5/6	13,5	-83
16-QAM	7/8	13,9	-82
64-QAM	1/2	14,4	-82
64-QAM	2/3	16,5	-80
64-QAM	3/4	18,0	-78
64-QAM	5/6	19,3	-77
64-QAM	7/8	20,1	-76
NOTE 1: Required C/N in a Gaussian channel for BER = 2E-4 after Viterbi, QEF after Reed-Solomon. NOTE 2: For ISDB-T the corresponding values for compatible modes should be used but with a 1 dB relaxation (e.g. -93 dBm would become -92 dBm.)			

DVB-T2 COFDM (8 MHz Bandwidth) systems

Table 13 contains the representative DVB-T2 signal configuration for which the minimum receiver sensitivity values stated in Table 14 shall be met.

Table 13: DVB-T2 test signal configuration

Parameter	Value
Signal bandwidth (MHz)	7,77
FFT	32 k
Carrier mode	Extended
SISO/MISO	SISO
Guard interval	1/16
Version	1.2.1
Number of symbols/frame (L_f)	62
Pilot pattern	PP4
TFS	No
FEF	Not used
Auxiliary streams	Not used
Subslices/T2 frame	1
Frames/Superframe	2
L1 post FEC type	16 k LDPC (see note 1)
TS bitrate (Mbit/s)	39,816
L1 repetition	0
L1 post extension	No
L1 post modulation	64-QAM
L1 post scrambling	None
L1_ACE_MAX	0 (see note 2)
L1 bias balancing cells	No
PAPR	L1-ACE & TR (see note 6)
PAPR: V_{clip}	3,1 V (see notes 1 and 6)
PAPR: Number of iterations	10 (see notes 1 and 6)
TS bit rate (Mbit/s)	36,552
Input mode	Mode A (single PLP mode)
Number of PLPs	1
PLP type	Data type 1
Constellation rotation	Yes
PLP FEC type	64 k LDPC
FEC Frame length	64 800 (see note 4)
Baseband Mode	High Efficiency Mode (HEM)
ISSY	None
In band signalling	Disabled
Null packet deletion	Disabled
Time interleaver length	3
Frame interval	1
Time interleaver type	0
T2 frames/Interleaver frame	1 (see note 5)
FEC Blocks/Interleaving Frame	200

NOTE 1: This parameter is preset on some modulators.
NOTE 2: This value disables L1 ACE operation.
NOTE 3: This parameter is referred to as "TR" on some modulators.
NOTE 4: This parameter is referred to as "Normal" on some modulators.
NOTE 5: Derived value is shown for information only. Forced to 1 when time interleaver type = 0.
NOTE 6: These settings do not apply to equipment that does not support PAPR reduction techniques.

Table 14: DVB-T2 COFDM receiver sensitivity limits

Modulation	Code rate	QEF C/N (dB) (see note)	Sensitivity (dBm)
QPSK	1/2	1,0	-95
QPSK	3/5	2,3	-94
QPSK	2/3	3,1	-93
QPSK	3/4	4,1	-92
QPSK	4/5	4,7	-91
QPSK	5/6	5,2	-91
16-QAM	1/2	6,0	-90
16-QAM	3/5	7,6	-88
16-QAM	2/3	8,9	-87
16-QAM	3/4	10,0	-86
16-QAM	4/5	10,8	-85
16-QAM	5/6	11,4	-85
64-QAM	1/2	9,9	-86
64-QAM	3/5	12,0	-84
64-QAM	2/3	13,5	-82
64-QAM	3/4	15,1	-81
64-QAM	4/5	16,1	-80
64-QAM	5/6	16,8	-79
256-QAM	1/2	13,2	-83
256-QAM	3/5	16,1	-80
256-QAM	2/3	17,8	-78
256-QAM	3/4	20,0	-76
256-QAM	4/5	21,3	-75
256-QAM	5/6	22,0	-74
NOTE: Required C/N in a Gaussian channel for BER = 1E-7 after LDPC with Genie-aided de-mapping.			

DVB-S2 systems

Table 15 contains the representative DVB-T signal configuration for which the minimum receiver sensitivity values stated in Table 16 shall be met.

Table 15: DVB-S2 test signal configuration

Parameter	Value
Symbol rate (Mbaud)	30

Table 16: DVB-S2 receiver sensitivity limits

Modulation	Code rate	QEF C/N (dB) (see note)	Sensitivity (dBm)
QPSK	1/4	-2,4	-98
QPSK	1/3	-1,2	-97
QPSK	2/5	-0,3	-96
QPSK	1/2	1,0	-95
QPSK	3/5	2,2	-94
QPSK	2/3	3,1	-93
QPSK	3/4	4,0	-92
QPSK	4/5	4,7	-91
QPSK	5/6	5,2	-91
QPSK	8/9	6,2	-90
QPSK	9/10	6,4	-90
8-PSK	3/5	5,5	-90
8-PSK	2/3	6,6	-89
8-PSK	3/4	7,9	-88
8-PSK	5/6	9,4	-87
8-PSK	8/9	10,7	-85
8-PSK	9/10	11,0	-85
16-PSK	2/3	9,0	-87
16-PSK	3/4	10,2	-86
16-PSK	4/5	11,0	-85
16-PSK	5/6	11,6	-84

Modulation	Code rate	QEF C/N (dB) (see note)	Sensitivity (dBm)
16-PSK	8/9	12,9	-83
16-PSK	9/10	13,1	-83
32-PSK	3/4	12,7	-83
32-PSK	4/5	13,6	-82
32-PSK	5/6	14,3	-82
32-PSK	8/9	15,7	-80
32-PSK	9/10	16,1	-80
NOTE: Required C/N in a Gaussian channel for BER = 1E-7 after LDPC with Genie-aided de-mapping.			

Generalized limits for other modulation formats

For all other systems, the minimum receiver sensitivity values defined in Table 17 shall be met.

Table 17: Receiver sensitivity limits for all other modulation formats

Throughput (bits/s/Hz) (see note 1)	Channel bandwidth (MHz) (see note 2)	Limiting C/N (dB) (see note 3)	Sensitivity (dBm) (see note 4)
1,0	2,5	0,0	-100
2,0	2,5	4,8	-95
4,0	2,5	11,8	-88
1,0	5	0,0	-97
2,0	5	4,8	-92
4,0	5	11,8	-85
1,0	10	0,0	-94
2,0	10	4,8	-89
4,0	10	11,8	-82
1,0	20	0,0	-91
2,0	20	4,8	-86
4,0	20	11,8	-79
1,0	30	0,0	-89
2,0	30	4,8	-84
4,0	30	11,8	-77
1,0	40	0,0	-88
2,0	40	4,8	-83
4,0	40	11,8	-76
NOTE 1: Product of the bits per modulation symbol and FEC code rate, e.g. for QPSK modulation and code rate ½, 2 x ½ = 1 bit/s/Hz. NOTE 2: Channel is assumed to be 80 % to 95 % occupied. If less than 80 %, the limiting C/N shall be reduced by $10\log_{10}(B_c/B_o)$. NOTE 3: C/N corresponding to channel capacity for the given throughput, calculated from Shannon-Hartley, i.e. $C/N = 10\log_{10}(2^{Throughput} - 1)$. Limiting C/N is evaluated over the channel bandwidth, B_c. NOTE 4: Sensitivity power incorporates the limiting C/N, channel bandwidth and a 10 dB implementation margin in the following manner, $sensitivity = -174\ dBm + 10\log(B_c) + 60\ dB + C/N + 10\ dB$.			

4.3.3.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.2.

4.3.4 Receiver adjacent channel selectivity

4.3.4.1 Definition

The adjacent channel selectivity is a measure of the capability of the receiver to operate satisfactorily in the presence of an unwanted signal on a given set of adjacent channels. It is defined as the ratio of unwanted signal output power to wanted signal output power in dB.

4.3.4.2 Limit

The I/C value shall be greater than or equal to the minimum adjacent channel I/C ratio given in Table 18 for the respective modulation method.

Table 18: Receiver adjacent channel selectivity limits

Test	C Wanted signal type	I Interferer signal type	C Wanted signal centre frequency (MHz)	I Interferer signal centre frequency (MHz)	I Interferer signal power (dBm)	Minimum adjacent channel I/C ratio (dB)
DVB-T	Table 12, and 16-QAM, rate 2/3 FEC	8 MHz DVB-T	F_{med}	$F_{med} \pm B_c$	-45	30
DVB-T2	Table 13, and 16-QAM, rate 5/6 FEC	8 MHz DVB-T2	F_{med}	$F_{med} \pm B_c$	-45	30
DVB-S2	Table 15, and 8-PSK, rate 5/6 FEC	DVB-S2	F_{med}	$F_{med} \pm B_c$	-47	30
All other modulation formats	4 bits/s/Hz 10 MHz bandwidth	10 MHz Same format as wanted	F_{med}	$F_{med} \pm B_c$	-42	30
NOTE 1: F_{med} is the centre frequency of the channel closest to $(F_{max} + F_{min}) / 2$. NOTE 2: B_c is the channel bandwidth of the wanted signal for the signal format being tested.						

4.3.4.3 Conformance

The conformance tests for this requirement shall be described in clause 5.3.3.

4.3.5 Receiver blocking

4.3.5.1 Definition

Blocking is a measure of the capability of the receiver to receive a wanted signal without exceeding a given degradation due to the presence of an unwanted input signal at any frequencies other than those of the spurious responses or of the adjacent channels. Blocking is the ratio in dB between the level of the unwanted signal and the level of the wanted signal.

4.3.5.2 Limit

The I/C value shall be greater than or equal to the minimum blocking I/C ratio given in Table 19 for the respective modulation method.

Table 19: Receiver blocking limits

Test	C Wanted signal type	I Interferer signal type	C Wanted signal centre frequency (MHz)	I Interferer signal centre frequency (MHz)	I Interferer signal power (dBm)	Minimum blocking I/C ratio (dB)
DVB-T	Table 12, and 16-QAM, rate 2/3 FEC	8 MHz DVB-T	F_{med}	$F_{med} \pm (B_c + F_{block})$	-35	40
DVB-T2	Table 13, and 16-QAM, rate 5/6 FEC	8 MHz DVB-T2	F_{med}	$F_{med} \pm (B_c + F_{block})$	-35	40
DVB-S2	Table 15, and 8-PSK, rate 5/6 FEC	DVB-S2	F_{med}	$F_{med} \pm (B_c + F_{block})$	-37	40
All other modulation formats	4 bits/s/Hz 10 MHz bandwidth	10 MHz Same format as wanted	F_{med}	$F_{med} \pm (B_c + F_{block})$	-32	40

NOTE 1: F_{med} is the centre frequency of the channel closest to $(F_{max} + F_{min}) / 2$.
NOTE 2: B_c is the channel bandwidth of the wanted signal for the signal format being tested.
NOTE 3: F_{block} = 5 MHz, 10 MHz, 20 MHz, 50 MHz.

4.3.5.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.4.

4.3.6 Receiver spurious emissions

4.3.6.1 Definition

Spurious emissions from the receiver are radio frequency emissions at any frequency, generated by the receiver and associated downconverter.

The level of spurious emissions shall be measured by:

a) the power level from the antenna port; and

b) the effective radiated power when radiated by the cabinet and structure of the equipment (cabinet radiation).

4.3.6.2 Limits

The level of receiver unwanted emissions shall not exceed the limits given in Table 20.

Table 20: Receiver spurious emission limits (from CEPT/ERC/REC 74-01E [1], Reference number 2.1.4)

Frequency range	Maximum power (dBm)	Analyser RBW
9 kHz - 1 GHz	-57	100 kHz
1 GHz - F_{upper} (see note 1)	-47	1 MHz

NOTE 1: Upper limit of the measurement range F_{upper} is dependent on the fundamental frequency of the transmission and is defined by Table 8.
NOTE 2: For radiated emissions due to cabinet radiation, the above power limits apply to the effective radiated power from the cabinet.

4.3.6.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.5.

5 Testing for compliance with technical requirements

5.1 Environmental conditions for testing

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

Where technical performance varies subject to environmental conditions, tests shall be carried out under a sufficient variety of environmental conditions (within the boundary limits of the operational environmental profile defined by its intended use) to give confidence of compliance for the affected technical requirements.

The test conditions shall be recorded in the test report.

5.2 Method of measurement for transmitters

5.2.1 Generic measurement setup for transmitters

Unless specified otherwise, the equipment shall be assembled according to Figure 1.

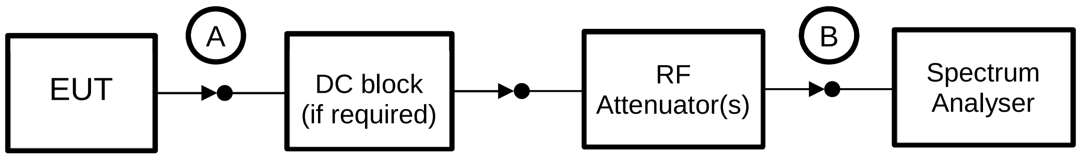

Figure 1: Generic measurement arrangement for transmitter tests

The antenna port of the EUT shall be connected to the spectrum analyser with an appropriate power attenuator having sufficient power handling and loss ratings to:

1) dissipate the EUT output power; and

2) prevent inadvertent overloading of the spectrum analyser.

Transmitters that are intended to power active antennas should have this function disabled or a DC block should be used as shown.

The measurements shall be undertaken in a 50 Ω system impedance, however, in the case where the EUT antenna port impedance is not 50 Ω, (e.g. 75 Ω) an appropriate minimum loss pad shall be inserted at the spectrum analyser port (B).

At each of the test frequencies in Table 2, the attenuation, L_{AB}, of the RF cabling, power attenuator and, if used, the DC block that connect the antenna port (A) to the spectrum analyser port (B) should be measured with a network analyser so this can be accounted for in the subsequent measurements.

5.2.2 Transmitter power accuracy

5.2.2.1 Test conditions

The conditions described in the generic measurement setup for transmitters, clause 5.2.1 shall be used during this test.

5.2.2.2 Test method

1) The spectrum analyser will be configured to measure channel power with the measurement bandwidth set to match the channel bandwidth, B_c of the EUT. Suggested spectrum analyser settings are described in Table B.1.

2) The EUT shall be configured for each of the test frequencies and settings defined in Table 2.

3) For each test frequency, the channel power will be measured.

5.2.3 Transmitter Frequency Stability

5.2.3.1 Test conditions

The conditions described in the generic measurement setup for transmitters, clause 5.2.1 shall be used during this test.

5.2.3.2 Test method

1) The spectrum analyser will be configured to measure the CW frequency. Suggested spectrum analyser settings are described in Table B.1.
2) The display markers shall be used to find the frequencies of the 20 dB down bandwidth edges.
3) The carrier centre frequency shall be calculated as the mean of these frequencies.
4) The EUT shall be configured for each of the test frequencies and settings listed in Table 2.
5) The carrier centre frequency of the EUT shall be measured at each of these test frequencies.

5.2.4 Transmitter Occupied Bandwidth

5.2.4.1 Test conditions

The conditions described in the generic measurement setup for transmitters, clause 5.2.1 shall be used during this test.

5.2.4.2 Test method

1) The spectrum analyser will be configured for signal bandwidth measurements, by selecting the occupied bandwidth profile. Suggested spectrum analyser settings are given in Table B.1.
2) The EUT shall be configured for each of the test frequencies and settings listed in Table 2.
3) For each test frequency, the occupied bandwidth shall be measured.

5.2.5 Transmitter Channel Occupancy

5.2.5.1 Test conditions

The conditions described in the generic measurement setup for transmitters, clause 5.2.1 shall be used during this test.

5.2.5.2 Test method

1) The Channel Occupancy shall be calculated using the formula given in clause 4.2.6.2 together with the bandwidth values measured in clause5.2.4.
2) This process shall be repeated for each test frequency.

5.2.6 Transmitter unwanted emissions in the spurious domain

5.2.6.1 Test conditions

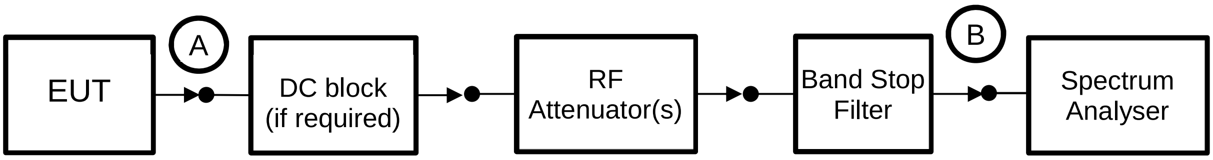

Figure 2: Measurement arrangement for transmitter conducted spurious emissions

For the measurement of conducted spurious emissions, the antenna port of the EUT shall be connected to the spectrum analyser via the apparatus shown in Figure 2. The appropriate power attenuator shall be chosen to prevent inadvertent overloading of the spectrum analyser. Transmitters that provide a DC bias on the antenna port should have this function disabled or a DC block should be used as shown. When testing higher power transmitters, it may be necessary to extend the measurement dynamic range with a band stop filter to remove the carrier frequency while leaving frequencies in the spurious domain largely unaffected. For typical spectrum analysers, the band stop attenuation and RF attenuator should be set to limit the power at port (B) to -20 dBm. The attenuation, L_{AB} , of the RF cabling and apparatus that connects the antenna port (A) to the spectrum analyser port (B), should be measured with a network analyser for the frequency ranges given in Table 2 so this loss can be accounted for in the subsequent measurements.

5.2.6.2 Test method for measurement of conducted spurious emissions

1) The EUT shall be configured for each of the test frequencies and settings defined in Table 2. Suggested spectrum analyser settings are described in Table B.3.

2) For each test frequency, the carrier power will be minimized with the band stop filter (if necessary).

3) Referring to Table 7, the spectrum analyser shall be used to perform a scan of each frequency range while the resolution bandwidth is set to the value corresponding to that range. The level of the largest spurious signals will be compared to the limit values given in Table 7.

5.2.6.3 Test method for measurement of cabinet spurious emissions

1) The test site shall fulfil the requirements of the test frequency range defined in Table 7. The test antenna shall be oriented initially for vertical polarization and connected to a measuring receiver. The bandwidth of the measuring receiver shall be adjusted for each test frequency as defined in Table 7. The input attenuator of the measuring receiver shall be adjusted until the noise floor is at least 6 dB below the spurious emission limit given in Table 7. The attenuation setting shall be recorded in the test report.

2) The transmitter under test shall be placed on the support in its standard position and the antenna port should be terminated for the cabinet spurious test.

3) The measurement receiver shall be tuned over the range defined in Table 7. The frequency of each spurious emission detected shall be noted. If the test site is disturbed by interference coming from outside the site, this qualitative search may be performed in a screened room, with a reduced distance between the transmitter and the test antenna.

4) At each frequency at which an emission has been detected, the measuring receiver shall be tuned, and the test antenna shall be raised or lowered through the specified height range until the maximum signal level is detected on the measuring receiver.

5) The EUT shall be rotated through 360° about a vertical axis, to maximize the received signal.

6) The test antenna shall be raised or lowered again through the specified height range until a maximum is obtained. This level shall be noted.

7) The substitution antenna (see clause D.1.6) shall replace the EUT in the same position and in vertical polarization. It shall be connected to the signal generator.

8) At each frequency at which an emission has been detected, the signal generator, substitution antenna and measuring receiver shall be tuned:

   a) The test antenna shall be raised or lowered through the specified height range until a maximum signal level is detected by the measuring receiver.

   b) The level of the signal generator shall be adjusted until the measuring receiver reads the same signal level as in step 6. This value shall be noted.

   c) The effective radiated power of the spurious emission at this frequency shall be calculated, accounting for the gain of the substitution antenna relative to a dipole (dBd) and the cable loss between the signal generator and the substitution antenna.

9) The frequency and level of each spurious emission measured shall be recorded in the test report.

10) Steps 3 to 9 shall be repeated with the test antenna oriented in horizontal polarization.

5.2.7 Transmitter unwanted emissions in the out of band domain

5.2.7.1 Test conditions

The conditions described in the generic measurement setup for transmitters, clause 5.2.1 shall be used during this test.

5.2.7.2 Test method

1) The spectrum analyser will be configured for ACPR measurements. The bandwidths for the transmit channel, adjacent channel and alternate channel will be set to B_c.

2) The EUT shall be configured for each of the test frequencies and settings defined in Table 2.

3) The relative power in the adjacent and alternate channels will be measured at each test frequency.

4) If these relative power levels are less than the adjacent and alternate channel limit values for the EUT emission class and P_{mean} given in clause 4.2.8.2, then the transmitter has passed the test.

5.3 Method of measurement for receivers

5.3.1 Generic measurement setup for receivers

5.3.1.1 Test arrangement

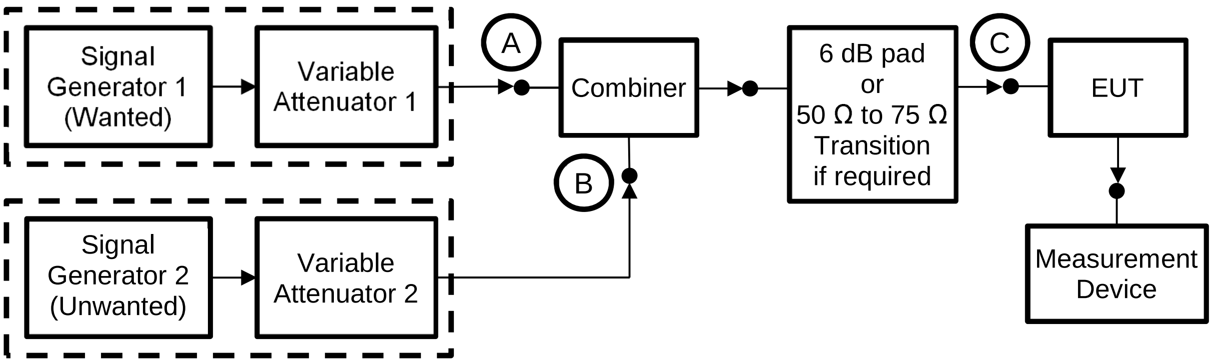

Figure 3: Generic measurement arrangement for receiver tests

For this, two generators are needed, one which provides the wanted signal, and the other the unwanted/interfering signal (when required). The wanted signal generator will incorporate the necessary TS generator and modulation capabilities to produce the RF test signals defined by Table 10 through Table 19 that are pertinent to the EUT. The interfering generator will be capable of producing the interfering signal type given by Table 18 and Table 19 pertinent to the EUT.

The two signals are combined in such a way as to maintain isolation between the generators. It is necessary to provide calibrated attenuators for control of the individual levels; very often these will be built into the generators. Where the attenuators are external, cable lengths should be kept short to avoid cross-coupling effects. The antenna port of the receiver shall be connected to the signal generators via the setup shown in Figure 1, such that the calibration point C is at the EUT input. In tests where the antenna port impedance of the receiver is 75 Ω, a 50 Ω to 75 Ω transition should be substituted for the 6 dB pad. The cable connecting this pad to the EUT should be of minimal length; ideally, the pad should be connected directly to the receiver under test. The attenuation of the L_{AC} and L_{BC} signal paths shall be measured so these losses can be accounted for in the subsequent measurements.

5.3.1.2 Choice of measurement device and QEF methods

Three methods can be used to determine the QEF threshold, each of these are suited to a different type of measurement device. The choice of method depends on the interfaces accessible on the receiver:

1) Direct method:

   - For receivers where the received TS data is available, the packets are compared to those transmitted from the signal generator and the TS BER will be computed. When this method is used the QEF condition corresponds to a TS BER of 1×10^{-11}. The measurement device for this method may be a Transport Stream Analyser or a BER test mode of the 'wanted' signal generator using a "loop back" cable from the EUT.

2) Indirect method:

   - For receivers where the received TS data is unavailable but BER telemetry from the output of the inner FEC decoder is, then this data may be used to determine the QEF condition. The measurement device for this method may be a diagnostic mode of the receiver or other data terminal equipment required to interrogate the BER registers within the receiver. The specific BER threshold for QEF depends on the signal type used:

     ▪ For DVB-T systems, the output of the Viterbi decoder shall be monitored where a BER of 2×10^{-4} corresponds to the QEF condition.

     ▪ For DVB-T2 & DVB-S2 systems, the output of the LDPC decoder shall be monitored where a BER of 1×10^{-7} corresponds to the QEF condition.

     ▪ For other systems, the necessary threshold BER at the output of the inner decoder may be calculated from the outer FEC performance at a TS BER of 1×10^{-11}.

3) Picture failure method:

   - In receivers where neither of the previous two methods is possible, the QEF threshold shall be determined from the onset of picture failure. This is the condition where the decoded video remains free of errors for a specified observation period. The measurement device for this method will be a video monitor which may either be integral to or connected to the receiver via a decoded video or TS output. To keep the observation period manageably short, the TS BER is increased past the QEF rate either by decreasing the C/N or source power into the receiver from that at which the QEF condition would result. The method proceeds by increasing the C/N or source power by small increments until the decoded video is error-free for the specified observation period. When this C/N or source power is reached, a correction factor is then used to find the actual C/N or source power that would produce the QEF threshold. The specific observation period and correction factor depend on the signal type used:

     ▪ For DVB-T systems, an observation period of 60 seconds shall be used. A correction factor of +1,3 dB is applied to the source power to find the actual QEF threshold power.

     ▪ For DVB-T2 & DVB-S2 systems, an observation period of 60 seconds shall be used. For this method, the source power is deemed equal to the QEF threshold power.

5.3.2 Receiver sensitivity

5.3.2.1 Test conditions

For this test, the conditions described in the generic measurement setup for receivers, clause 5.3.2 shall be used during this test.

5.3.2.2 Test method

1) The 'wanted' generator is configured with the parameters given by the tables in clause 4.3.3 relevant to the EUT. The parameters common to all receiver tests are given in Table 10. Table 11, Table 13 and Table 15 give receiver parameters for specific modulation types and Table 12, Table 14, Table 16 and Table 17 contain the sensitivity limits for representative modulation-coding points for those modulation types. During the sensitivity tests, the EUT is configured with every modulation-coding point given for its modulation type. The 'unwanted' generator is switched off.

2) The RF signal power of the 'wanted' generator is calculated by adding the loss value L_{AC} to the sensitivity power for the modulation-coding point being tested.

3) For each modulation-coding point, the error rate is measured using the selected method from clause 5.3.1.2 and if the QEF conditions are not met then the RF power of the 'wanted' generator is adjusted up or down until QEF is reached.

4) The receiver input power at QEF is now found by applying the corrections for L_{AC} and, if necessary, any offset required by clause 5.3.1.2.

5.3.3 Receiver adjacent channel selectivity

5.3.3.1 Test conditions

For this test, the conditions described in the generic measurement setup for receivers, clause 5.3.1 shall be used during this test.

5.3.3.2 Test method

1) Both the 'wanted' and 'unwanted' generators are configured with the parameters given in Table 18 pertaining to the EUT.

2) The power of the 'unwanted' generator is calculated by adding the loss value L_{BC} to the interferer signal power given by Table 18. The power of the 'wanted' L_{AC} generator is calculated by adding the loss value L_{AC} to the interferer signal power given by Table 18.

3) The error rate is measured using the selected method from clause 5.3.1.2 and if the QEF conditions are not met then the RF power of the 'wanted' generator is adjusted up or down until this condition is reached.

4) The I/C ratio of the 'unwanted' to 'wanted' signal power at the EUT is calculated while accounting for the losses L_{AC} and L_{BC}.

5.3.4 Receiver blocking

5.3.4.1 Test conditions

For this test, the conditions described in the generic measurement setup for receivers, clause 5.3.1 shall be used to configure the 'wanted' generator.

5.3.4.2 Test method

1) Both the 'wanted' and 'unwanted' generators are configured with the parameters given in Table 19 of pertaining to the EUT.

2) The power of the 'unwanted' generator is calculated by adding the loss value L_{BC} to the interferer signal power given in Table 19. The power of the 'wanted' L_{AC} generator is calculated by adding the loss value L_{AC} to the interferer signal power given by Table 19.

3) The error rate is measured using the selected method from clause 5.3.1.2 and if the QEF conditions are not met then the RF power of the 'wanted' generator until this condition is reached.

4) The I/C ratio of the 'unwanted' to 'wanted' signal power at the EUT is calculated while accounting for the losses L_{AC} and L_{BC}.

5.3.5 Receiver spurious emissions

5.3.5.1 Test conditions

The antenna port of the receiver under test should be connected to a spectrum analyser as shown in Figure 4. Either a 6 dB pad or matching transition shall be used, and measurements should take account of the loss introduced by the pad or transition and the associated cabling.

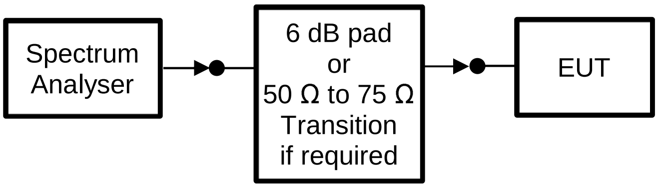

Figure 4: Measurement arrangement for receiver spurious emission tests

5.3.5.2 Test method for measurement of conducted spurious emissions

1) The EUT shall be configured for operation at F_{min}, F_{med} and F_{max}, as defined in Table 2.

2) Referring to Table 20, the spectrum analyser shall be used to perform a scan of each frequency range while the resolution bandwidth is set to the value corresponding to that range. The level of the largest spurious signals will be compared to the limit values given in Table 20. Suggested spectrum analyser settings are described in Table B.4.

5.3.5.3 Test method for measurement of cabinet spurious emissions

This method of measurement applies to receivers having a permanent antenna connector.

1) The test site shall fulfil the requirements of the test frequency range defined in Table 20. The test antenna shall be oriented initially for vertical polarization and connected to a measuring receiver. The bandwidth of the measuring receiver shall be adjusted for each test frequency as defined in Table 20. The input attenuator of the measuring receiver shall be adjusted until the noise floor is at least 6 dB below the spurious emission limit given in Table 20. The attenuation setting shall be recorded in the test report.

2) The receiver under test shall be placed on the support in its standard position and the antenna port(s) should be terminated for the cabinet spurious test.

3) The measurement receiver shall be tuned over the range defined in Table 20. The frequency of each spurious emission detected shall be noted. If the test site is disturbed by interference coming from outside the site, this qualitative search may be performed in a screened room, with a reduced distance between the transmitter and the test antenna.

4) At each frequency at which an emission has been detected, the measuring receiver shall be tuned, and the test antenna shall be raised or lowered through the specified height range until the maximum signal level is detected on the measuring receiver.

5) The EUT shall be rotated through 360° about a vertical axis, to maximize the received signal.

6) The test antenna shall be raised or lowered again through the specified height range until a maximum is obtained. This level shall be noted.

7) The substitution antenna (see clause D.1.6) shall replace the EUT in the same position and in vertical polarization. It shall be connected to the signal generator.

8) At each frequency at which an emission has been detected, the signal generator, substitution antenna and measuring receiver shall be tuned:

   a) The test antenna shall be raised or lowered through the specified height range until a maximum signal level is detected by the measuring receiver.

   b) The level of the signal generator shall be adjusted until the measuring receiver reads the same signal level as in item 6. This value shall be noted.

   c) The effective radiated power of the spurious emission at this frequency shall be calculated, accounting for the gain of the substitution antenna relative to a dipole (dBd) and the cable loss between the signal generator and the substitution antenna.

9) The frequency and level of each spurious emission measured shall be recorded in the test report.

10) Steps 3 to 9 shall be repeated with the test antenna oriented in horizontal polarization.

Annex A (informative): Relationship between the present document and the essential requirements of Directive 2014/53/EU

The present document has been prepared under the Commission's standardisation request C(2015) 5376 final [i.11] to provide one voluntary means of conforming to the essential requirements of Directive 2014/53/EU on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC [i.1].

Once the present document is cited in the Official Journal of the European Union under that Directive, compliance with the normative clauses of the present document given in Table A.1 confers, within the limits of the scope of the present document, a presumption of conformity with the corresponding essential requirements of that Directive, and associated EFTA regulations.

Table A.1: Relationship between the present document and the essential requirements of Directive 2014/53/EU

Harmonised Standard ETSI EN 302 064					
Requirement				Requirement Conditionality	
No	Description	Essential requirements of Directive	Clause(s) of the present document	U/C	Condition
1	Transmitter power accuracy	3.2	4.2.3	C	Transmitter
2	Transmitter frequency stability	3.2	4.2.4	C	Transmitter
3	Transmitter occupied bandwidth	3.2	4.2.5	C	Transmitter
4	Transmitter channel occupancy	3.2	4.2.6	C	Transmitter
5	Transmitter unwanted emissions in the spurious domain	3.2	4.2.7	C	Transmitter
6	Transmitter unwanted emissions in the out of band domain	3.2	4.2.8	C	Transmitter
7	Receiver sensitivity	3.2	4.3.3	C	Receiver
8	Receiver adjacent channel selectivity	3.2	4.3.4	C	Receiver
9	Receiver blocking	3.2	4.3.5	C	Receiver
10	Receiver spurious emissions	3.2	4.3.6	C	Receiver

Key to columns:

Requirement:

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

Description A textual reference to the requirement.

Essential requirements of Directive

Identification of article(s) defining the requirement in the Directive.

Clause(s) of the present document

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 unconditionally applicable (U) or is conditional upon the manufacturer's claimed functionality of the equipment (C).

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

Presumption of conformity stays valid only as long as a reference to the present document is maintained in the list published in the Official Journal of the European Union. Users of the present document should consult frequently the latest list published in the Official Journal of the European Union.

Other Union legislation may be applicable to the product(s) falling within the scope of the present document.

Annex B (informative): Additional information to assist measurements

The accuracy of the EUT emissions measurement is influenced by the configuration of the spectrum analyser. The following parameters are suggested as a starting point appropriate for typical spectrum analysers.

Table B.1: Suggested spectrum analyser settings

Setting	Clause 5.2.2.2	Clause 5.2.3.2	Clause 5.2.4.2	Clause 5.2.7.2
Span	1,5 × B_c	1,2 × B_c	1,5 × B_c	5,5 × B_c
Resolution bandwidth, kHz (see note)	30 × β	10 × β	30 × β	30 × β
Video bandwidth, kHz	auto	auto	auto	auto
Sweep time	500 ms	5 s	500 ms	2 s
Number of points	501	2 001	1 001	1 001
Detector	RMS	RMS	RMS	RMS
Trace mode	Clear write	Clear write	Exponential Average	Clear write
Number of averages	-	-	10	-
Measurement	Power in the channel bandwidth B_c	Delta marker -20 dB bandwidth	Occupied Bandwidth mode, 99 % power	ACP relative to channel bandwidth B_c
NOTE: Analyser measurement bandwidth should be scaled according to the channel bandwidth according to Table B.2.				

Table B.2: Spectrum analyser bandwidth scale factors for defined equipment categories

Equipment	Maximum bandwidth (MHz)	Bandwidth scale factor, β
Category 1	40	10/3
Category 2	30	10/3
Category 3	20	1
Category 4	10	1
Category 5	5	1/3
Category 6	2,5	1/3

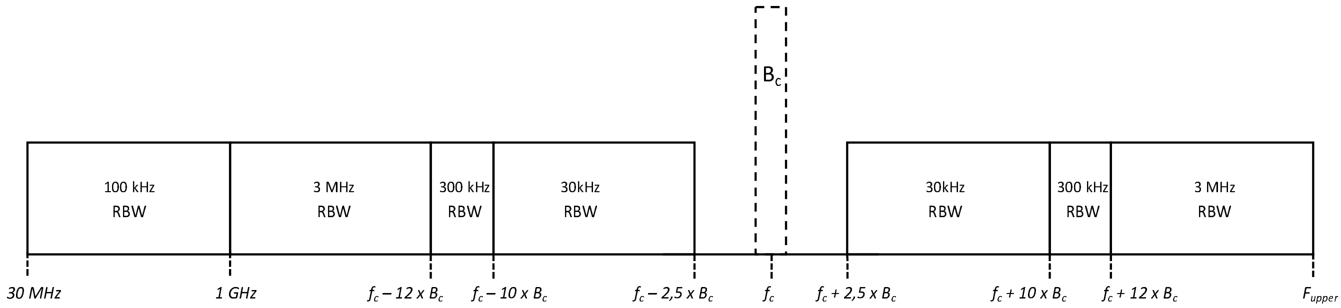

Figure B.1: Spurious domain RBW measurement settings

Table B.3: Suggested spectrum analyser settings for transmitter spurious measurements

Sweep ID	Start frequency, f_{start} (MHz)	Stop frequency f_{stop} (MHz)	Number of points (see note 1)	RBW (kHz)	VBW (kHz)	Sweep Time (see note 2)	Detector	Trace Mode	Note
1	30	1 000	19 401	100	auto	10 s	RMS	Clear/Write	3
2	1 000	$f_c - 12 \times B_c$	$(2 \times (f_{stop} - f_{start}) / 3) + 1$	3 000	auto	1 s	RMS	Clear/Write	
3	$f_c - 12 \times B_c$	$f_c - 10 \times B_c$	$(40 \times B_c/3) + 1$	300	auto	1 s	RMS	Clear/Write	
4	$f_c - 10 \times B_c$	$f_c - 3,5 \times B_c$	$(1\,300 \times B_c/3) + 1$	30	auto	10 s	RMS	Clear/Write	
5	$f_c + 3,5 \times B_c$	$f_c + 10 \times B_c$	$(1\,300 \times B_c/3) + 1$	30	auto	10 s	RMS	Clear/Write	
6	$f_c + 10 \times B_c$	$f_c + 12 \times B_c$	$(40 \times B_c/3) + 1$	300	auto	1 s	RMS	Clear/Write	
7	1 000	F_{upper}	$(2 \times (f_{stop} - f_{start}) / 3) + 1$	3 000	auto	100 s	RMS	Clear/Write	3, 4

NOTE 1: The measurement points should be rounded up either to the nearest integer or to the nearest value supported by the spectrum analyser (e.g. 1 001, 2 001, 3 001, etc.).
NOTE 2: For RMS detection, trace noise and the associated measurement uncertainty can be reduced by increasing the sweep time.
NOTE 3: It may be necessary to split this sweep into a number of smaller sweeps depending upon the capabilities of the spectrum analyser.
NOTE 4: The value of F_{upper} is given in Table 4.

Table B.4: Suggested spectrum analyser settings for receiver spurious measurements

Sweep ID	Start frequency, f_{start} (MHz)	Stop frequency f_{stop} (MHz)	Number of points (see note 1)	RBW (kHz)	VBW (kHz)	Sweep Time (see note 2)	Detector	Trace Mode	Note
1	30	1 000	20 001	100	auto	10 s	RMS	Clear/Write	1
7	1 000	F_{upper}	$(2 \times (F_{upper} - 1\,000) / 3) + 1$	3 000	auto	100 s	RMS	Clear/Write	1, 2

NOTE 1: It may be necessary to split this sweep into a number of smaller sweeps depending upon the capabilities of the spectrum analyser.
NOTE 2: The value of F_{upper} is given in Table 4.

Annex C (informative): Maximum Measurement Uncertainty

The measurements described in the present document are based on the following assumptions:

- the measured value related to the corresponding limit is 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 is included in the test report.

Table C.1 shows the recommended values for the maximum measurement uncertainty figures.

Table C.1: Maximum measurement uncertainty

Parameter	Uncertainty
Power in transmitter power accuracy, clause 5.2.2	±3 dB
Frequency in transmitter frequency stability, clause 5.2.3	±2 ppm
Bandwidth in transmitter occupied bandwidth, clause 5.2.4	5 %
Bandwidth ratio in transmitter channel occupancy, clause 5.2.5	5 %
Power in transmitter unwanted emissions in the spurious domain, clause 5.2.6	±3 dB
Power in transmitter unwanted emissions in the spurious domain radiated from cabinet, clause 5.2.6	±6 dB
Power ratio transmitter unwanted emissions in the out of band domain, clause 5.2.7	±3 dB
Wanted signal power measured in the receiver sensitivity tests, clause 4.3.3	±3 dB
I/C ratio measured in the receiver adjacent channel selectivity tests, clause 4.3.4	±3 dB
Blocking level measured in the receiver blocking tests, clause 4.3.5	±3 dB
Power in receiver unwanted emissions in the spurious domain, clause 5.3.5	±3 dB
Power in receiver unwanted emissions in the spurious domain radiated from cabinet, clause 5.3.5	±6 dB

Annex D (normative): Radiated measurement

D.1 Test sites and general arrangements for measurements involving the use of radiated fields

D.1.1 General

This clause introduces the three most commonly available test sites, an anechoic chamber, an anechoic chamber with a ground plane and an Open Area Test Site (OATS), which may be used for radiated tests. These test sites are generally referred to as free field test sites. Both absolute and relative measurements can be performed in these sites. Where absolute measurements are to be carried out, the chamber should be verified. A detailed verification procedure is described in the relevant parts of ETSI TR 102 273 [i.6] or equivalent.

NOTE: To ensure reproducibility and tractability of radiated measurements only these test sites should be used in measurements in accordance with the present document.

D.1.2 Anechoic chamber

An anechoic chamber is an enclosure, usually shielded, whose internal walls, floor and ceiling are covered with radio absorbing material, normally of the pyramidal urethane foam type. The chamber usually contains an antenna support at one end and a turntable at the other. A typical anechoic chamber is shown in Figure D.1.

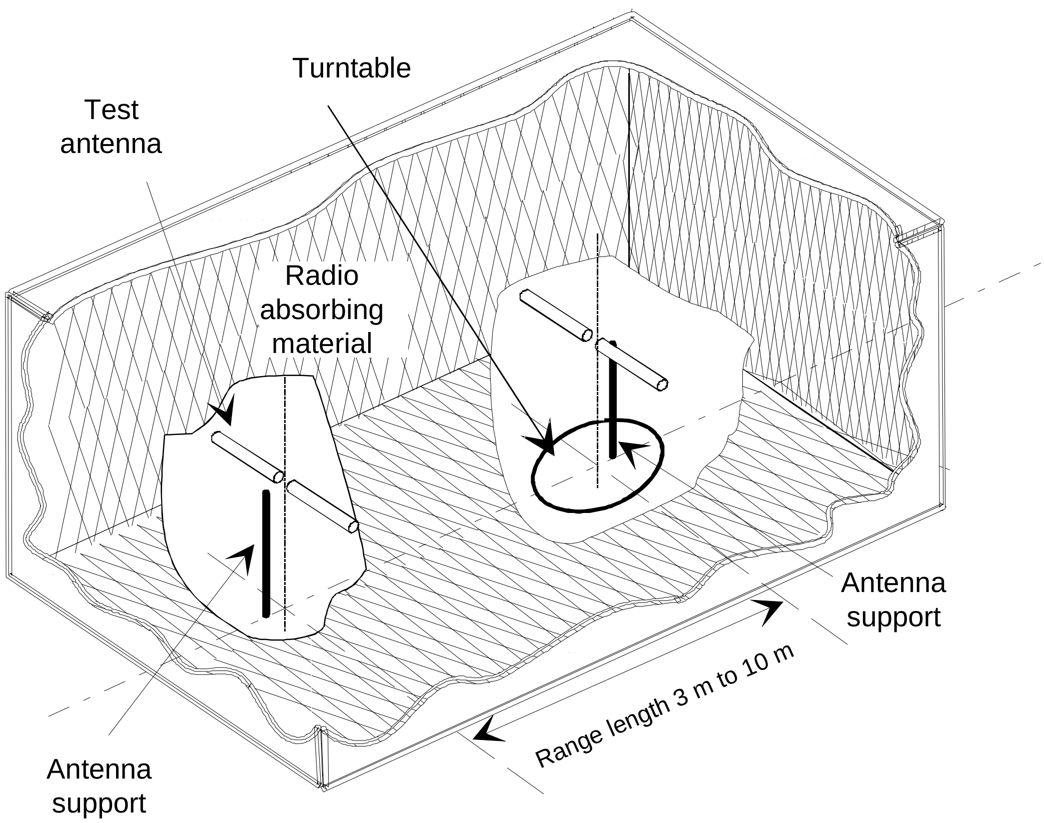

Figure D.1: A typical anechoic chamber

The chamber shielding and radio absorbing material work together to provide a controlled environment for testing purposes. This type of test chamber attempts to simulate free space conditions.

The shielding provides a test space, with reduced levels of interference from ambient signals and other outside effects, whilst the radio absorbing material minimizes unwanted reflections from the walls and ceiling which can influence the measurements. In practice it is relatively easy for shielding to provide high levels (80 dB to 140 dB) of ambient interference rejection, normally making ambient interference negligible.

A turntable is capable of rotation through 360° in the horizontal plane and it is used to support the test sample (EUT) at a suitable height (e.g. 1 m) above the ground plane. The chamber shall be large enough to allow the measuring distance of at least 3 m or $2(d_1+d_2)^2 / \lambda$ (m), whichever is greater. The distance used in actual measurements shall be recorded with the test results.

The anechoic chamber generally has several advantages over other test facilities. There is minimal ambient interference, minimal floor, ceiling and wall reflections and it is independent of the weather. It does however have some disadvantages which include limited measuring distance and limited lower frequency usage due to the size of the pyramidal absorbers. To improve low-frequency performance, a combination structure of ferrite tiles and urethane foam absorbers is commonly used.

All types of emission, sensitivity and immunity testing can be carried out within an anechoic chamber without limitation.

D.1.3 Anechoic chamber with a conductive ground plane

An anechoic chamber with a conductive ground plane is an enclosure, usually shielded, whose internal walls and ceiling are covered with radio absorbing material, normally of the pyramidal urethane foam type. The floor, which is metallic, is not covered and forms the ground plane. The chamber usually contains an antenna mast at one end and a turntable at the other. A typical anechoic chamber with a conductive ground plane is shown in Figure D.2.

This type of test chamber attempts to simulate an ideal Open Area Test Site whose primary characteristic is a perfectly conducting ground plane of infinite extent.

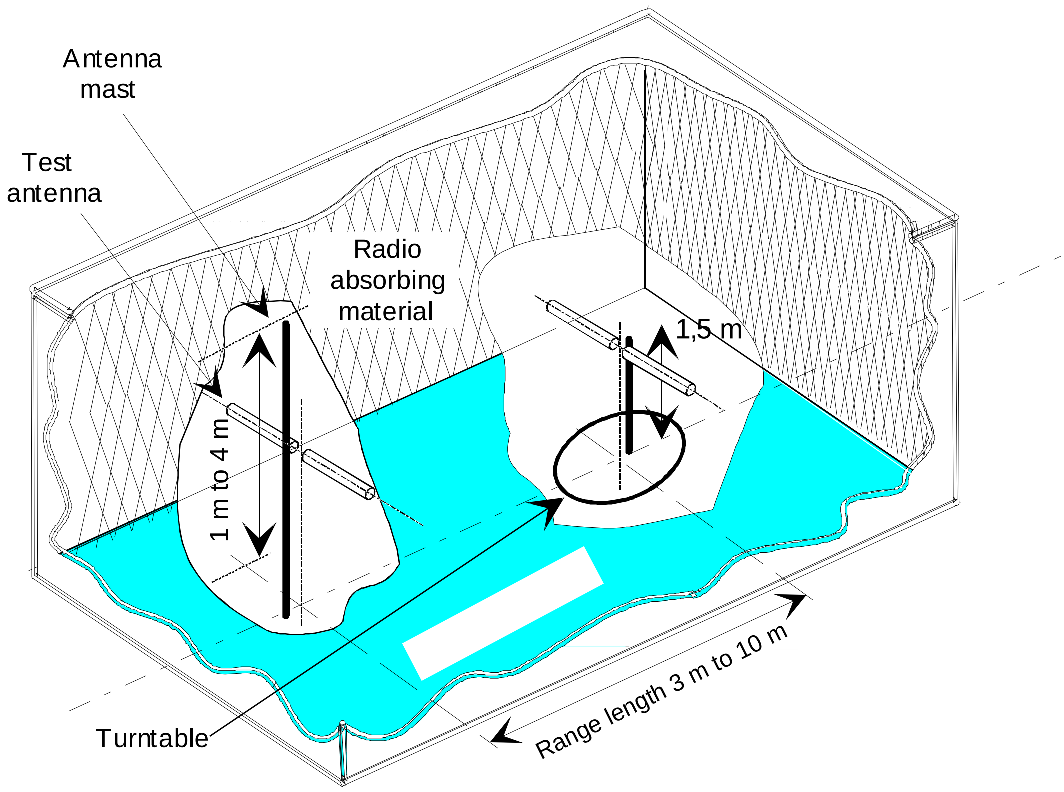

Figure D.2: A typical anechoic chamber with a conductive ground plane

In this facility, the ground plane creates the wanted reflection path, such that the signal received by the receiving antenna is the sum of the signals from both the direct and reflected transmission paths. This creates a unique received signal level for each height of the transmitting antenna (or EUT) and the receiving antenna above the ground plane.

The antenna mast provides a variable height facility (from 1 m to 4 m) so that the position of the test antenna can be optimized for the maximum coupled signal between antennas or between the EUT and the test antenna.

A turntable is capable of rotation through 360° in the horizontal plane and it is used to support the test sample (EUT) at a specified height, usually 1,5 m above the ground plane. The chamber shall be large enough to allow the measuring distance of at least 3 m or $2(d_1+d_2)^2 / \lambda$ (m), whichever is greater. The distance used in actual measurements shall be recorded with the test results.

Emission testing involves firstly "peaking" the field strength from the EUT by raising and lowering the receiving antenna on the mast (to obtain the maximum constructive interference of the direct and reflected signals from the EUT) and then rotating the turntable for a "peak" in the azimuth plane. At this height of the test antenna on the mast, the amplitude of the received signal is noted. Secondly, the EUT is replaced by a substitution antenna (positioned at the EUT's phase or volume centre) which is connected to a signal generator. The signal is again "peaked" and the signal generator output adjusted until the level, noted in stage one, is again measured on the receiving device.

Receiver sensitivity tests over a ground plane also involve "peaking" the field strength by raising and lowering the test antenna on the mast to obtain the maximum constructive interference of the direct and reflected signals, this time using a measuring antenna which has been positioned where the phase or volume centre of the EUT will be during testing. A transform factor is derived. The test antenna remains at the same height for stage two, during which the measuring antenna is replaced by the EUT. The amplitude of the transmitted signal is reduced to determine the field strength level at which a specified response is obtained from the EUT.

D.1.4 Open Area Test Site (OATS)

An Open Area Test Site comprises a turntable at one end and an antenna mast of variable height at the other end above a ground plane which, in the ideal case, is perfectly conducting and of infinite extent. In practice, whilst good conductivity can be achieved, the ground plane size has to be limited. A typical Open Area Test Site is shown in Figure D.3.

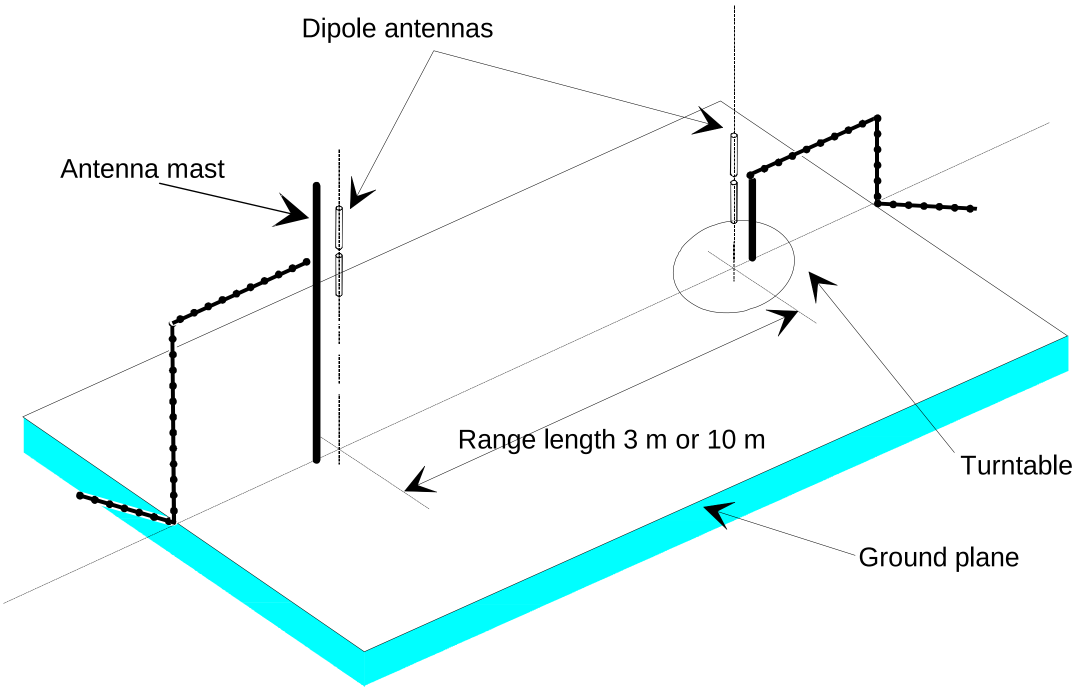

Figure D.3: A typical Open Area Test Site

The ground plane creates a wanted reflection path, such that the signal received by the receiving antenna is the sum of the signals received from the direct and reflected transmission paths. The phasing of these two signals creates a unique received level for each height of the transmitting antenna (or EUT) and the receiving antenna above the ground plane.

Site qualification concerning antenna positions, turntable, measurement distance and other arrangements are the same as for an anechoic chamber with a ground plane. In radiated measurements, an OATS is also used in the same way as an anechoic chamber with a ground plane.

Typical measuring arrangement common for ground plane test sites is presented in Figure D.4.

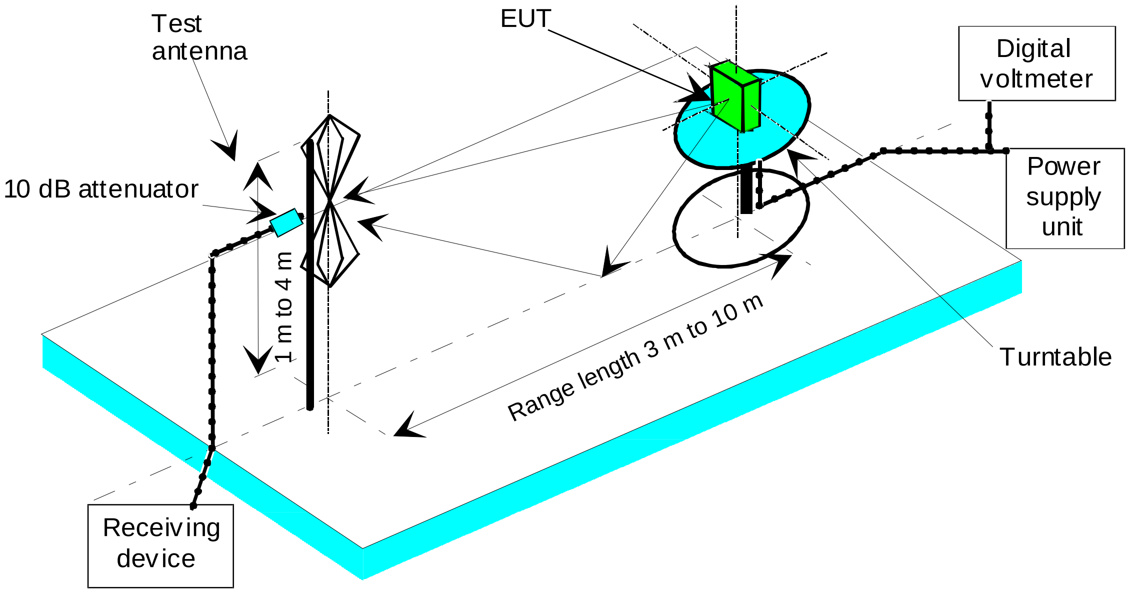

Figure D.4: Measuring arrangement on ground plane test site (OATS setup for spurious emission testing)

D.1.5 Test antenna

A test antenna is always used in radiated test methods. In emission tests (i.e. frequency error, effective radiated power, spurious emissions and adjacent channel power) the test antenna is used to detect the field from the EUT in one stage of the measurement and from the substitution antenna in the other stage. When the test site is used for the measurement of receiver characteristics (i.e. sensitivity and various immunity parameters) the antenna is used as the transmitting device.

The test antenna should be mounted on a support capable of allowing the antenna to be used in either horizontal or vertical polarization which, on ground plane sites (i.e. anechoic chambers with ground planes and Open Area Test Sites), should additionally allow the height of its centre above the ground to be varied over the specified range (usually 1 m to 4 m).

In the frequency band 30 MHz to 1 000 MHz, dipole antennas (constructed in accordance with ANSI C63.5 [i.5] are generally recommended). For frequencies of 80 MHz and above, the dipoles should have their arm lengths set for resonance at the frequency of the test. Below 80 MHz, shortened arm lengths are recommended. For spurious emission testing, however, a combination of bicones and log-periodic dipole array antennas (commonly termed "log periodics") could be used to cover the entire 30 MHz to 1 000 MHz band. Above 1 000 MHz, waveguide horns are recommended although, again, log periodics could be used.

NOTE: The gain of a horn antenna is generally expressed relative to an isotropic radiator.

D.1.6 Substitution antenna

The substitution antenna is used to replace the EUT for tests in which a transmitting parameter (i.e. frequency error, effective radiated power, spurious emissions and adjacent channel power) is being measured. For measurements in the frequency band 30 MHz to 1 000 MHz, the substitution antenna should be a dipole antenna (constructed in accordance with ANSI C63.5 [i.5] is generally recommended). For frequencies of 80 MHz and above, the dipoles should have their arm lengths set for resonance at the frequency of the test. Below 80 MHz, shortened arm lengths are recommended. For measurements above 1 000 MHz, a waveguide horn is recommended. The centre of this antenna should coincide with either the phase centre or volume centre.

D.2 Guidance on the use of radiation test sites

D.2.1 General

This clause details procedures, test equipment arrangements and verification that should be carried out before any of the radiated tests are undertaken. These schemes are common to all types of test sites described in annex D.

D.2.2 Verification of the test site

No test should be carried out on a test site which does not possess a valid certificate of verification. The verification procedures are given in ETSI TR 102 273 [i.6] or equivalent.

D.2.3 Preparation of the EUT

The provider should supply information about the EUT covering the operating frequency, polarization, supply voltage(s) and the reference face. Additional information, specific to the type of EUT should include, where relevant, carrier power, channel separation, whether different operating modes are available (e.g. high and low power modes) and if operation is continuous or is subject to a maximum test duty cycle (e.g. 1 minute on, 4 minutes off).

Where necessary, a mounting bracket of minimal size should be available for mounting the EUT on the turntable. This bracket should be made from low conductivity, low relative dielectric constant (i.e. less than 1,5) material(s) such as expanded polystyrene, balsa wood, etc.

D.2.4 Power supplies to the EUT

All tests should be performed using power supplies wherever possible, including tests on EUT designed for battery-only use. In all cases, power leads should be connected to the EUT's supply terminals (and monitored with a digital voltmeter) but the battery should remain present, electrically isolated from the rest of the equipment, possibly by putting tape over its contacts.

The presence of these power cables can, however, affect the measured performance of the EUT. For this reason, they should be made to be "transparent" as far as the testing is concerned. This can be achieved by routing them away from the EUT and down to either the screen, ground plane or facility wall (as appropriate) by the shortest possible paths. Precautions should be taken to minimize pick-up on these leads (e.g. the leads could be twisted together, loaded with ferrite beads at 0,15 m spacing or otherwise loaded).

D.2.5 Range length

The range length for all these types of the test facility should be adequate to allow for testing in the far-field of the EUT i.e. it should be equal to or exceed:

$$\frac{2(d_1 + d_2)^2}{\lambda}$$

where:

d_1: is the largest dimension of the EUT/dipole after substitution (m);

d_2: is the largest dimension of the test antenna (m);

λ: is the test frequency wavelength (m).

It should be noted that in the substitution part of this measurement, where both test and substitution antennas are half-wavelength dipoles, this minimum range length for far-field testing would be:

$$2\lambda$$

It should be noted in the test report when either of these conditions is not met so that the additional measurement uncertainty can be incorporated into the results.

NOTE 1: **For the fully anechoic chamber**, no part of the volume of the EUT should, at any angle of rotation of the turntable, fall outside the "quiet zone" of the chamber at the nominal frequency of the test.

NOTE 2: The "quiet zone" is a volume within the anechoic chamber (without a ground plane) in which a specified performance has either been proven by test or is guaranteed by the designer/manufacturer. The specified performance is usually the reflectivity of the absorbing panels or a directly related parameter (e.g. signal uniformity in amplitude and phase). It should be noted however that the defining levels of the quiet zone tend to vary.

NOTE 3: **For the anechoic chamber with a ground plane**, a full height scanning capability, i.e. 1 m to 4 m, should be available for which no part of the test antenna should come within 1 m of the absorbing panels. For both types of anechoic chamber, the reflectivity of the absorbing panels should not be worse than -5 dB.

NOTE 4: **For both the anechoic chamber with a ground plane and the Open Area Test Site**, no part of any antenna should come within 0,25 m of the ground plane at any time throughout the tests. Where any of these conditions cannot be met, measurements should not be carried out.

D.2.6 Site preparation

The cables for both ends of the test site should be routed horizontally away from the testing area for a minimum of 2 m (unless, in the case of both types of anechoic chamber, a back wall is reached) and then allowed to drop vertically and out through either the ground plane or screen (as appropriate) to the test equipment. Precautions should be taken to minimize pick up on these leads (e.g. dressing with ferrite beads or other loading). The cables, their routing and dressing should be identical to the verification setup.

NOTE: For ground reflection test sites (i.e. anechoic chambers with ground planes and Open Area Test Sites) which incorporate a cable drum with the antenna mast, the 2 m requirement may be impossible to comply with.

Calibration data for all items of test equipment should be available and valid. For test, substitution and measuring antennas, the data should include gain relative to an isotropic radiator (or antenna factor) for the frequency of the test. Also, the VSWR of the substitution and measuring antennas should be known.

The calibration data on all cables and attenuators should include insertion loss and VSWR throughout the entire frequency range of the tests. All VSWR and insertion loss figures should be recorded in the log book results sheet for the specific test.

Where correction factors/tables are required, these should be immediately available.

For all items of test equipment, the maximum errors they exhibit should be known along with the distribution of the error e.g.:

- cable loss: ±0,5 dB with a rectangular distribution;
- measuring receiver: 1,0 dB (standard deviation) signal level accuracy with a Gaussian error distribution.

At the start of measurements, system checks should be made on the items of test equipment used on the test site.

D.3 Coupling of signals

D.3.1 General

The presence of leads in the radiated field may cause a disturbance of that field and lead to additional measurement uncertainty. These disturbances can be minimized by using suitable coupling methods, offering signal isolation and minimum field disturbance (e.g. optical and acoustic coupling).

D.3.2 Data signals

Isolation can be provided by the use of optical, ultra-sonic or infra-red means. Field disturbance can be minimized by using a suitable fibre optic connection. Ultra-sonic or infra-red radiated connections require suitable measures for the minimization of ambient noise.

D.4 Standard test position

The standard position in all test sites for equipment which is not intended to be worn on a person, including handheld equipment, shall be on a non-conducting support with an ε_r as close as possible to one, height 1,5 m, capable of rotating about a vertical axis through the equipment. The position of the equipment shall be oriented according to the intended use.

Equipment which is intended to be worn on a person may be tested using a simulated man as support.

The simulated man comprises a rotatable acrylic tube filled with salt water, placed on the ground.

The container shall have the following dimensions:

- Height: 1,7 ± 0,1 m;
- Inside diameter: 300 ± 5 mm;
- Sidewall thickness: 5 ± 0,5 mm.

The container shall be filled with a salt (NaCl) solution of 1,5 g per litre of distilled water.

The equipment shall be fixed to the surface of the simulated man, at the appropriate height for the equipment.

NOTE: To reduce the weight of the simulated man it may be possible to use an alternative tube which has a hollow centre of 220 mm maximum diameter.

Annex E (informative): Coverage of parameters recommended by ETSI EG 203 336 and justification for omissions

Clause 5.3 of ETSI EG 203 336 [i.7] lists the radio equipment parameters that should be considered when producing Harmonised Standards that aim to cover the essential requirements in article 3.2 of Directive 2014/53/EU [i.1].

The intention of article 3.2 of Directive 2014/53/EU [i.1] in relation to a receiver is explained in recitals 10 and 11 of the Directive which state:

"...in the case of a receiver, it has a level of performance that allows it to operate as intended and protects it against the risk of harmful interference, in particular from shared or adjacent channels, and, in so doing, supports improvements in the efficient use of shared or adjacent channels.

Although receivers do not themselves cause harmful interference, reception capabilities are an increasingly important factor in ensuring the efficient use of radio spectrum by way of an increased resilience of receivers against harmful interference and unwanted signals on the basis of the relevant essential requirements of Union harmonisation legislation."

Table E.1 lists the parameters that are recommended by ETSI EG 203 336 [i.7] along with the corresponding clauses in the present document covering those parameters and if parameters are omitted the reasons for the omission.

Table E.1: Recommended parameters

Parameters recommended by ETSI EG 203 336 [i.7]			Covered in the present document by		Justification for omission
No	Description	Clause number	Description	Clause Number(s)	
1	Transmitter power limits	5.2.2	Omitted	-	These limits are prescribed in the terms of the licence authorization.
2	Transmitter power accuracy	5.2.3	Transmitter power accuracy	4.2.3	-
3	Spectrum mask	5.2.4	Transmitter occupied bandwidth, Transmitter channel occupancy, Transmitter unwanted emissions in spurious domain, Transmitter unwanted emissions in the out of band domain	4.2.5, 4.2.6, 4.2.7, 4.2.8	-
4	Transmitter frequency stability	5.2.5	Transmitter frequency stability	4.2.4	-
5	Transmitter intermodulation attenuation	5.2.6	Omitted	-	This parameter is relevant to transmitters using non-linear amplifiers. Such amplifiers cannot be used for digital video links.
6	Transmitter unwanted emissions in the out of band domain	5.2.7.2	Transmitter unwanted emissions in the out of band domain	4.2.8	-
7	Transmitter unwanted emissions in the spurious domain	5.2.7.3	Transmitter unwanted emissions in the spurious domain	4.2.7	-
8	Transmitter time domain characteristics	5.2.8	Omitted	-	The present document anticipates transmitters that produce a continuous, modulated RF envelope; hence the parameter is not applicable.

Parameters recommended by ETSI EG 203 336 [i.7]			Covered in the present document by		Justification for omission
No	**Description**	**Clause number**	**Description**	**Clause Number(s)**	
9	Transmitter transients	5.2.9	Omitted	-	The present document anticipates transmitters that produce a continuous, modulated RF envelope; hence the parameter is not applicable.
10	Receiver sensitivity	5.3.2	Receiver sensitivity	4.3.3	-
11	Receiver co-channel rejection	5.3.3	Omitted	-	Digital video links use COFDM signals which have a noise-like spectrum. The co-channel rejection and sensitivity are therefore related and the requirement for adequate co-channel rejection is provided by clause 4.3.3.
12	Receiver adjacent channel selectivity	5.3.4.2.1	Receiver adjacent channel selectivity	4.3.4	-
13	Receiver spurious response rejection	5.3.4.2.2	Omitted	-	A test is not included in the present document as this would require the system architecture of the receiver to be declared by the manufacturer. Such declarations are not permitted, so it is not possible to specify a practical test method.
14	Receiver blocking	5.3.4.3.1	Receiver blocking	4.3.5	-
15	Receiver radio-frequency intermodulation	5.3.4.3.2	Omitted	-	A specific test for receiver radio-frequency intermodulation response rejection is not included in the present document because intermodulation in the RF tuner will result in a degradation in the adjacent channel selectivity, which is specified in clause 4.3.4.
16	Receiver multiple signal adjacent channel selectivity	5.3.4.3.3	Omitted	-	This parameter is pertinent to receivers using NZIF technology, these receiver designs are not envisaged in the present document.
17	Receiver dynamic range	5.3.4.4.1	Omitted	-	The sensitivity, adjacent channel selectivity (clause 4.3.4) and blocking tests (clause 4.3.5) provide testing of both low- and high-level signal situations.
18	Receiver reciprocal mixing	5.3.4.4.2	Omitted	-	Reciprocal mixing effects will degrade the Adjacent Channel Selectivity (ACS). The ACS is measured with the wanted signal at a low level so any reciprocal mixing noise will cause an apparent decrease in the sensitivity of the receiver. This will make ACS requirement harder to meet.
19	Desensitization	5.3.4.4.3	Omitted	-	The receiver blocking test (clause 4.3.5) addresses this potential problem by testing performance in the presence of a large unwanted signal.
20	Receiver unwanted emissions in the spurious domain	5.3.5	Receiver spurious emissions	4.3.6	-
21	Transmitter power control	5.4.2	Omitted	-	The present document does not cover transmitters using power control.
22	Listen before talk	5.4.3	Omitted	-	The present document does not cover duplex radio systems.

Parameters recommended by ETSI EG 203 336 [i.7]			Covered in the present document by		Justification for omission
No	Description	Clause number	Description	Clause Number(s)	
23	Equipment operating under the control of a network	5.4.4	Omitted	-	The present document does not cover networked radio systems.
24	Antennas	5.5	Omitted	-	The present document does not cover radio apparatus having integral antennas.
25	Technical parameters for article 3.1(b) (EMC) of Directive 2014/52/EU [i.13]	6	Cabinet radiation	-	See note.
NOTE: EMC susceptibility testing is covered in ETSI EN 301 489-28 [i.3].					

Annex F (informative): Change history

Version	Information about changes
2.1.1	First published version covering Directive 2014/53/EU. Major changes are: • Revised Maximum allowable channel bandwidth requirements • Revised Necessary bandwidth limits • New Receiver Sensitivity in Gaussian channel requirement • New Blocking or desensitization requirement • New Adjacent channel selectivity requirement
2.1.2	Major changes are: • Revised document formatting to match ETSI skeleton • Added a new transmitter category with enhanced ACPR performance • Introduced channel occupancy test to limit channel bandwidth

History

Document history			
V1.1.1	April 2004	Publication as ETSI EN 302 064 part 1 and part 2	
V1.1.2	July 2004	Publication as ETSI EN 302 064 part 1	
V2.1.1	September 2016	Publication	
V2.1.3	July 2024	SRdAP process	EV 20241024: 2024-07-26 to 2024-10-24
V2.2.1	October 2024	Publication	