Test Report
22-1-0025001T01a

Number of pages:	48	**Date of Report:**	2023-Jan-20
Testing company:	CETECOM GmbH Im Teelbruch 116 45219 Essen Germany Tel. + 49 (0) 20 54 / 95 19-0 Fax: + 49 (0) 20 54 / 95 19-150	**Applicant:**	Giraffe360 SIA
Product: **Model:**	**360 Degree Camera** **GRF-400**		
FCC ID:	2A8A7-V599	**IC:**	28899-3Q30
Testing has been carried out in accordance with:	**FCC Regulations** **Title 47 CFR, Chapter I, Subchapter A, Part 15** **Subpart E Unlicensed National Information Infrastructure Devices** § 15.407 General technical requirements		
Tested Technology:	5 GHz W-LAN (IEEE 802.11)		
Test Results:	**☒ The EUT complies with the requirements in respect of all parameters subject to the test.** The test results relate only to devices specified in this document		

Signatures:

Dipl.-Ing. Ninovic Perez	M.Sc. Patrick Marzotko
Test Lab Manager	Test Manager
Authorization of test report	Responsible of test report

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1 General information

1.1 Disclaimer and Notes

The test results of this test report relate exclusively to the test item specified in this test report as specified in chapter 2.7. CETECOM does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.
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Also we refer on special conditions which the applicant should fulfill according §2.927 to §2.948, special focus regarding modification of the equipment and availability of sample equipment for market surveillance tests.

1.2 Attestation

I declare that all measurements were performed by me or under my supervision and that all measurements have been performed and are correct to my best knowledge and belief to Industry Canada standards. All of the above requirements are met in accordance with enumerated standards.

1.3 Summary of Test Results

The EUT integrates a 5 GHz W-LAN transmitter. Other implemented wireless technologies were not considered within this test report.

Test case	Reference Clause FCC ☒	Page	Remark	Result
Duty Cycle	--	15	--	PASSED
Minimum Emission Bandwidth 6 dB	2.1049(h) §15.407(e)	--	--	PASSED
Emission Bandwidth 26 dB	2.1049(h)	23	--	PASSED
Occupied Channel Bandwidth 99%	2.1049(h)	25	--	PASSED
Frequency stability	§2.1055 §15.407(g)	--	--	NP
RF output power	§15.407(a) (1)(2)(3)(4)	16	--	PASSED
Power spectral density	§15.407(a) (1)(2)(3)(5)	21	--	PASSED
Antenna gain information	§15.407(a) (1)(2)(3)	--	--	NP
Radiated Band-Edge emissions	§15.209 §15.205 §15.407(b)(1)(2)(3)(4)	40	--	PASSED
Radiated field strength emissions below 30 MHz	§15.205 §15.209	27	--	PASSED
Radiated field strength emissions 30 MHz – 1 GHz	§15.205 §15.209 §15.407(6)(7)	31	--	PASSED
Radiated field strength emissions above 1 GHz	§15.407(6) §15.407(b)	35	--	PASSED
Transmit power control	§15.407 (h1)(h2)	--	--	NP
Dynamic frequency selection (DFS)	§15.407(h1)	--	*1)	NP
Discontinuous transmissions + Device security	§15.407(h2)	--	--	NP
AC-Power Lines Conducted Emissions	§15.407(i)	43	--	PASSED

*1) Refer to test report no. "**1-5481_22-01-02-A**"

PASSED	The EUT complies with the essential requirements in the standard.
FAILED	The EUT does not comply with the essential requirements in the standard.
NP	The test was not performed by the CETECOM Laboratory.

Decision Rule: CETECOM GmbH follows ILAC G8:2019 chapter 4.2.1 (Simple Acceptance Rule).

1.4 Summary of Test Methods

Test case	Test method
Duty Cycle	ANSI C63.10:2013, §12.2(b)(2)
Emission Bandwidth 26 dB	ANSI C63.10:2013, §6.9.2, §11.8, §12.4.1
Occupied Channel Bandwidth 99%	ANSI C63.10:2013, §12.4.2
Frequency stability	ANSI C63.10:2013, §6.8.1, §6.8.2
RF output power	ANSI C63.10:2013, §12.3
Power spectral density	ANSI C63.10:2013, §12.5
Antenna gain information	ANSI C63.10:2013, §6.10.5, §6.10.6
Radiated Band-Edge emissions	ANSI C63.10-2013; “Marker-Delta method”, §6.10.4, §12.7.4.4
Radiated field strength emissions below 30 MHz	ANSI C63.10-2013 §6.3, §6.4
Radiated field strength emissions 30 MHz – 1 GHz	ANSI C63.4-2014 §8.2.3, ANSI C63.10-2013 §6.3, § 6.5, §12.7
Radiated field strength emissions above 1 GHz	ANSI C63.4-2014 §8.3, ANSI C63.10-2013 §6.3, § 6.6, §12.7
Transmit power control	ANSI C63.10:2013, §12.3
Dynamic frequency selection (DFS)	See TR reported
Discontinuous transmissions + Device security	See Applicant’s documentation
AC-Power Lines Conducted Emissions	ANSI C63.4-2014 §7, ANSI C63.10-2013 § 6.2

2 Administrative Data

2.1 Identification of the Testing Laboratory

Company name:	CETECOM GmbH
Address:	Im Teelbruch 116 45219 Essen - Kettwig Germany
Responsible for testing laboratory:	Dipl.-Ing. Ninovic Perez
Accreditation scope:	**DAkkS Webpage: FCC ISED**
IC Lab company No. / CAB ID:	3462D / DE0005
Test location:	CETECOM GmbH; Im Teelbruch 116; 45219 Essen - Kettwig

2.2 General limits for environmental conditions

Temperature:	22±2 °C
Relative. humidity:	45±15% rH

2.3 Test Laboratories sub-contracted

Company name:	--

2.4 Organizational Items

Responsible test manager:	M.Sc. Patrick Marzotko
Receipt of EUT:	2022-Sep-01
Date(s) of test:	2022-Sep-09 to 2023-Jan-11
Version of template:	22.0901

2.5 Applicant's details

Applicant's name:	Giraffe360 SIA
Address:	Delu iela 4 LV-1004 Riga Latvia
Contact Person:	Ricards Porins
Contact Person's Email:	ricards.porins@giraffe360.com

2.6 Manufacturer's details

Manufacturer's name:	Giraffe360 SIA
Address:	Delu iela 4 LV-1004 Riga Lettland

2.7 Equipment under Test (EUT)

EUT No.*)	Sample No.	Product	Model	Type	SN	HW	SW
EUT 1	22-1-00250S04_C01	360 Degree Camera	GRF-400	N/A	N/A	GO CAM-V1.0	GO CAM-V1.0
EUT 2	22-1-00250S03_C01	360 Degree Camera	GRF-400	N/A	N/A	GO CAM-V1.0	GO CAM-V1.0

*) EUT short description is used to simplify the identification of the EUT in this test report.

2.8 Untested Variant (VAR)

VAR No.*)	Sample No.	Product	Model	Type	SN	HW	SW

*) The listed additional untested model variant(s) (VAR) is/are not object of evaluation of compliance. For further information please see Annex 5: Declaration of applicant of model differences.
If the table above does not show any other line than the headline, no untested variants are available.

2.9 Auxiliary Equipment (AE)

AE No.*)	Sample No.	Auxiliary Equipment	Model	SN	HW	SW
AE 1	22-1-00250S05_C01	USB-C PD Charger	N/A	N/A	V1.0	N/A
AE 2	22-1-00250S09_C01	Laptop	Lenovo ThinkPad	PF-2LT3A9	N/A	N/A

*) AE short description is used to simplify the identification of the auxiliary equipment in this test report. If the table above does not show any other line than the headline, no AE was used during testing nor was taken into account for evaluation.

2.10 Connected cables (CAB)

CAB No.*)	Sample No.	Cable Type	Connectors / Details	Length
CAB 1	22-1-00250S06_C01	USB Cable	USB-C	100 cm
CAB 2	22-1-00250S07_C01	USB Cable	USB-C	100 cm

*) CAB short description is used to simplify the identification of the connected cables in this test report. If the table above does not show any other line than the headline, no cable was used during testing nor was taken into account for evaluation.

2.11 Software (SW)

SW No.*)	Sample No.	SW Name	Description	SW Status
SW 1	--	MobaTerm	Personal Edition	V22.1 Build 4888

*) SW short description is used to simplify the identification of the used software in this test report. If the table above does not show any other line than the headline, no SW was used during testing nor was taken into account for evaluation.

2.12 EUT set-ups

set-up no.*)	Combination of EUT and AE	Description
1	EUT 1 + AE 1 + AE 2 + CAB 1 + CAB 2	Used for Radiated measurements
2	EUT 2 + AE 1 + AE 2 + CAB 2 + CAB 2	Used for Conducted measurements

*) EUT set-up no. is used to simplify the identification of the EUT set-up in this test report.
**) AE 2 and CAB 2 were used to set up Test mode and placed outside chamber during measurements.

2.13 EUT operation modes

EUT operating mode no.*)	Operating modes	Additional information
op. 1	WLAN_TX-Mode	With help of special test firmware TX-mode was set-up. We refer to applicants information/papers for details about necessary commands.

*) EUT operating mode no. is used to simplify the test report.

2.14 Software commands

With help of SW 1 following scripts were used to set up operating modes:

a-mode

sudo ./wl64 pkteng_stop tx
sudo ./wl64 ver
sudo ./wl64 down
sudo ./wl64 mpc 0
sudo ./wl64 phy_watchdog 0
sudo ./wl64 country ALL
sudo ./wl64 band b
sudo ./wl64 2g_rate -r 54 -b 20
sudo ./wl64 txcore -s 1 -c 1 -o 1 -k 1
sudo ./wl64 chanspec 36/20
sudo ./wl64 scansuppress 1
sudo ./wl64 up
sudo ./wl64 phy_forcecal 1
sudo ./wl64 phy_txpwrctrl 1
sudo ./wl64 txpwr1 -1
sudo ./wl64 txpwr1 -o -d 5
sudo ./wl64 pkteng_start 00:11:22:33:44:55 tx 20 1024 0

n20-mode HT20

sudo ./wl64 pkteng_stop tx
sudo ./wl64 ver
sudo ./wl64 down
sudo ./wl64 mpc 0
sudo ./wl64 phy_watchdog 0
sudo ./wl64 country ALL
sudo ./wl64 band b
sudo ./wl64 2g_rate –h 0 -b 20
sudo ./wl64 txcore -s 1 -c 1 -o 1 -k 1
sudo ./wl64 chanspec 36/20
sudo ./wl64 scansuppress 1
sudo ./wl64 up
sudo ./wl64 phy_forcecal 1
sudo ./wl64 phy_txpwrctrl 1
sudo ./wl64 txpwr1 -1
sudo ./wl64 txpwr1 -o -d 5
sudo ./wl64 pkteng_start 00:11:22:33:44:55 tx 20 1024 0

ac-mode HT20

```
sudo ./wl64 pkteng_stop tx
sudo ./wl64 ver
sudo ./wl64 down
sudo ./wl64 mpc 0
sudo ./wl64 phy_watchdog 0
sudo ./wl64 country ALL
sudo ./wl64 band b
sudo ./wl64 2g_rate -h 5 -b 20
sudo ./wl64 txcore -s 1 -c 1 -o 1 -k 1
sudo ./wl64 chanspec 36/20
sudo ./wl64 scansuppress 1
sudo ./wl64 up
sudo ./wl64 phy_forcecal 1
sudo ./wl64 phy_txpwrctrl 1
sudo ./wl64 txpwr1 -1
sudo ./wl64 txpwr1 -o -d 5
sudo ./wl64 pkteng_start 00:11:22:33:44:55 tx 20 1024 0
```

n-mode HT40

```
sudo ./wl64 pkteng_stop tx
sudo ./wl64 ver
sudo ./wl64 down
sudo ./wl64 mpc 0
sudo ./wl64 phy_watchdog 0
sudo ./wl64 country ALL
sudo ./wl64 band b
sudo ./wl64 2g_rate -h 0 -b 40
sudo ./wl64 chanspec -c 38 -b 2 -w 40 -s 0
sudo ./wl64 txcore -s 1 -c 1 -o 1 -k 1
sudo ./wl64 scansuppress 1
sudo ./wl64 up
sudo ./wl64 phy_forcecal 1
sudo ./wl64 phy_txpwrctrl 1
sudo ./wl64 txpwr1 -1
sudo ./wl64 txpwr1 -o -d 5
sudo ./wl64 pkteng_start 00:11:22:33:44:55 tx 20 1024 0
```

n-mode HT40

```
sudo ./wl64 pkteng_stop tx
sudo ./wl64 ver
sudo ./wl64 down
sudo ./wl64 mpc 0
sudo ./wl64 phy_watchdog 0
sudo ./wl64 country ALL
sudo ./wl64 band a
sudo ./wl64 5g_rate -h 5 -b 40
sudo ./wl64 chanspec -c 38 -b 2 -w 40 -s 0
sudo ./wl64 txcore -s 1 -c 1 -o 1 -k 1
sudo ./wl64 scansuppress 1
sudo ./wl64 up
sudo ./wl64 phy_forcecal 1
sudo ./wl64 phy_txpwrctrl 1
sudo ./wl64 txpwr1 -1
sudo ./wl64 txpwr1 -o -d 5
sudo ./wl64 pkteng_start 00:11:22:33:44:55 tx 20 1024 0
```

ac-mode HT80

```
sudo ./wl64 pkteng_stop tx
sudo ./wl64 ver
sudo ./wl64 down
sudo ./wl64 mpc 0
sudo ./wl64 phy_watchdog 0
sudo ./wl64 country ALL
sudo ./wl64 band a
sudo ./wl64 5g_rate -h 5 -b 80
sudo ./wl64 chanspec -c 42 -b 2 -w 80 -s 0
sudo ./wl64 txcore -s 1 -c 1 -o 1 -k 1
sudo ./wl64 scansuppress 1
sudo ./wl64 up
sudo ./wl64 phy_forcecal 1
sudo ./wl64 phy_txpwrctrl 1
sudo ./wl64 txpwr1 -1
sudo ./wl64 txpwr1 -o -d 5
sudo ./wl64 pkteng_start 00:11:22:33:44:55 tx 20 1024 0
```

3 Equipment under test (EUT)

3.1 General Data of Main EUT as Declared by Applicant

Typical use	☒ portable	☐ fixed indoor	☐ fixed outdoor	☐ vehicular
Firmware	☐ for normal use	☐ Special version for test execution		
Power supply	☒ AC Mains	single Line (L1/N) 120 V 60 Hz		
	☐ DC Mains	-		
	☒ Battery	Lithium Ion battery		
Operational conditions	T_{nom} = +21 °C	T_{max} = n/a	T_{min} = n/a	
EUT sample type	**Pre-Production**			
Weight	1.600 kg			
Size [LxWxH]	22.0 cm x 15.0 cm x 9.0 cm			
Interfaces/Ports	USB-C			
For further details refer Applicants Declaration & following technical documents				
For further details regarding radio parameters, please refer to IEEE802.11 Specification				

3.2 Detailed Technical data of Main EUT as Declared by Applicant

Frequency | Channel | B.W. (USA bands only)	U-NII 1: 5150-5250 MHz	☒ Ch 36 | 40 | 48	☒ BW 20 MHz
		☒ Ch. 38 | 46	☒ BW 40 MHz
		☒ Ch. 42	☒ BW 80 MHz
	U-NII2A: 5250-5350 MHz	☒ Ch 52 | 56 | 64	☒ BW 20 MHz
		☒ Ch. 54 | 62	☒ BW 40 MHz
		☒ Ch. 58	☒ BW 80 MHz
	U-NII 2C: 5470-5725 MHz	☒ Ch 100 | 108 | 116	☒ BW 20 MHz
		☒ Ch 120 | 124 | 128 (USA only)	
		☒ Ch 132 | 136 | 140	
		☒ Ch 102 | 110 | 118 | 126 | 134 (Ch 118 | 126 USA only)	☒ BW 40 MHz
		☒ Ch. 106 | 122 (Ch 122 USA only)	☒ BW 80 MHz
	U-NII 3: 5725 -5850 MHz	☒ Ch 149 | 157| 165	☒ BW 20 MHz
		☒ Ch 151 | 159	☒ BW 40 MHz
		☒ Ch. 155	☒ BW 80 MHz
802.11a – Mode OFDM Modulation | Data Rates	☒ BPSK | 6 Mbps / 9 Mbps ☒ QPSK | 12 Mbps / 18 Mbps ☒ 16-QAM | 24 Mbps / 36 Mbps ☒ 64-QAM | 48 Mbps / 54 Mbps		
802.11n – Mode OFDM Modulation | Data Rates	☒ HT20 (MCS0 – MCS7) | 7.2/14.4/21.7/28.9/43.3/57.8/65/72.2 Mbps		
	☒ HT40 (MCS0 – MCS7) | 15/30/45/60/90/120/135/150 Mbps		
802.11ac – Mode OFDM Modulation | Data Rates	☒ HT20 (MCS0 – MCS7) | 7.2/14.4/21.7/28.9/43.3/57.8/65/72.2 Mbps		
	☒ HT40 (MCS0 – MCS7) | 15/30/45/60/90/120/135/150 Mbps		
	☒ HT80 (MCS0 – MCS7) | 7.2/14.4/21.7/28.9/43.3/57.8/65/72.2 Mbps		
	☒ b/g/n mode ☒ Bluetooth LE (not tested within this report) ☒ Bluetooth EDR (not tested within this report		
MIMO	☐		

	Band	Mode	RMS [dBm]	EiRP [dBm]
Max. Conducted Output Power (Measured RMS Power) And EiRP (Calculated EIRP = RMS + Gain)	U-NII 1	802.11a:	3.5	8.2
		802.11n20:	3.3	8.0
		802.11ac20:	3.3	8.0
		802.11n40:	3.8	8.5
		802.11ac40:	3.9	8.6
		802.11ac80:	3.3	8.0
	U-NII 2A	802.11a:	2.3	7.0
		802.11n20:	2.5	7.2
		802.11ac20:	2.6	7.3
		802.11n40:	3.2	7.9
		802.11ac40:	3.3	8.0
		802.11ac80:	2.5	7.2
	U-NII 2C	802.11a:	1.1	5.8
		802.11n20:	1.0	5.7
		802.11ac20:	0.8	5.5
		802.11n40:	0.7	5.4
		802.11ac40:	0.6	5.3
		802.11ac80:	0.0	4.7
	U-NII 3	802.11a:	-0.2	4.5
		802.11n20:	0.0	4.7
		802.11ac20:	-0.2	4.5
		802.11n40:	0.5	5.2
		802.11ac40:	0.6	5.3
		802.11ac80:	0.2	4.9
Antenna Type(s)	internal			
Antenna Gain(s)	+4.7 dBi			
FCC label attached	No			
Test firmware / software and storage location	EUT 1 / EUT 2 + AE 1			
For further details refer Applicants Declaration & following technical documents				

Description of Reference Document (supplied by applicant)	Version	Total Pages
Infineon Wi-Fi CLM Regulatory Manual	**2022-06-10**	**79**
Giraffe360 Go Cam Test manual	**V1**	**7**

3.3 Worst case identification

WLAN mode	Data rate
a-mode	54 Mbps
n-mode 20 MHz BW	MCS0
ac-mode 20 MHz BW	MCS5
n-mode 40 MHz BW	MCS0
ac-mode 40 MHz BW	MCS5
ac-mode 80 MHz BW	MCS5

3.4 Modifications on Test sample

Additions/deviations or exclusions	--

4 Measurements

4.1 Duty-Cycle

Testing method:

The measurement is made according to relevant reference clauses:
(See Tables *Summary of Test Results* and *Summary of Test Methods* on page 5)

The necessary duty-cycle correction factor is determined on nominal conditions on middle channel only. It is assumed that no noticeable changes occur when tested on other channels or climatic conditions.

EUT settings
The EUT was instructed to send with maximum power (if adjustable) according applicants instructions.
Different modulation characteristics have been checked, e.g. data rates which EUT can operate.

A special firmware program is used for test purposes. In opposite to normal operating mode a higher duty-cycle is set in order to facilitate the measurements. This is maximized at the extent possible.

The necessary duty-cycle correction factor is determined on nominal conditions on one channel in each operable frequency-band. It is assumed that no noticeable changes occur when tested on other channels or climatic conditions. The Duty-Cycle was constant, means without variations.

Formula to calculate Duty-Cycle:

Duty cycle calculations:	Duty cycle factor: DC=	Regarding power: $10 * log(1/x)$ dB
$x = TX_{ON}/(TX_{ON} + TX_{OFF})$		Regarding field strength: $20 * log(1/x)$ dB

☐ The results were corrected in order to evaluate for worst-case result each time when average values are necessary for example average radiated emissions or similar
☒ No correction necessary: Duty-Cycle > 98%
(Remark: For more information and graphical plot see annex A1 **CETECOM_TR22-1-0025001T01a-A1**)

4.1.1 Measurement Location

Test site	120910 - Radio Laboratory 1 (TS 8997)

4.2 RF output power

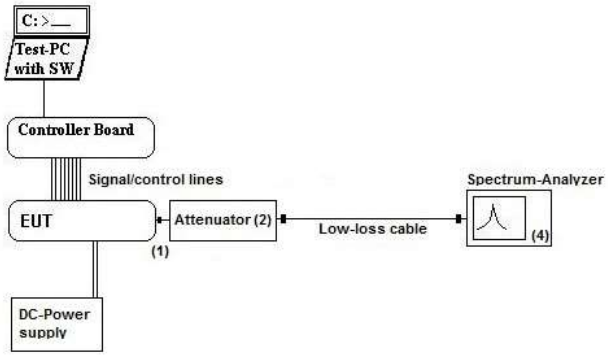
4.2.1 Description of the general test setup and methodology, see below example:

The EUT's RF-signal is coupled out by a suitable antenna coupling connector (1). The signal is first attenuated (2) then connected to spectrum-analyzer (4) for RF-conducted measurements. The specific attenuation loss is determined prior to the measurement within a set-up attenuation measurement. These are then taken into account by correcting the measurement readings of the spectrum-analyzer.

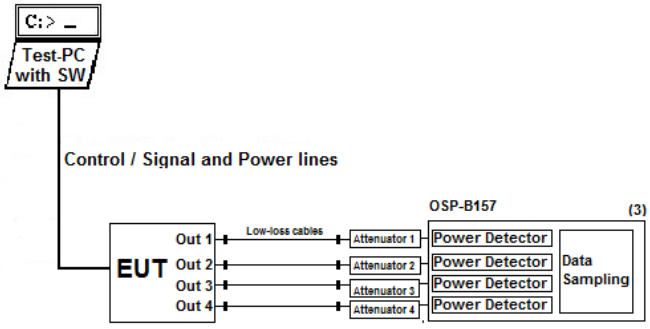
MIMO

The EUT use MIMO technology as it use multiple antennas for receive and transmit. The measurements are performed by using R&S TS8997 (Ref.No. 693) test system which is able to perform measurements simultaneously and time-synchronized on maximum 8 antenna conducted RF-ports. A common trigger ensures the sampling time is minimized so the total power represents a sampling value calculated for all 8-ports simultaneously for each time bin/frame. A high data sampling rate together with a wide band power measurement capability ensures that latest modulation schemes are correctly measured. Therefore testing method Subchapter E1 of KDB662911 is fulfilled. (measure-and-sum technique).

Schematic:



Schematic MIMO (if MIMO device):



Testing method:

The measurement is made according to relevant reference clauses:
(See Tables *Summary of Test Results* and *Summary of Test Methods* on page 7)

Measurement is made using Rohde & Schwarz TS8997 test system.

Test method	AVGSA-2 / AVGSA-2 alternative (duty-cycle < 98%, constant)
SISO	☒
MIMO	☐ Summation of values from two antenna ports
Remarks	--

The measurement was performed in non-hopping transmission mode with the carrier set to lowest/middle and highest channel.

EUT settings
The EUT was instructed to send with maximum power (if adjustable) according applicants instructions.
Different modulation characteristics have been checked, e.g. data rates which EUT can operate

4.2.2 Measurement Location

Test site	120910 - Radio Laboratory 1 (TS 8997)

4.2.3 Limit

Frequency Range [MHz]	Application	FCC Limit [mW] / [dBm] ☒
5150-5250	Outdoor access point	1000 + antenna gain max. 6dBi + Elevation > 30° 21 dBm EIRP
5150-5250	Indoor Access Point	1000 + antenna gain max. 6dBi
5150-5250	Mobile & Portable client	250 (24) + antenna gain max. 6dBi
5150-5250	Vehicle	--
5150-5250	--	--
5250-5350	--	250 (24) or 11dBm+10log10(B)
5250-5350	Vehicle	--
5470-5725	--	250 (24) or 11dBm+10log10(B) + Antenna gain < 6dBi
5725-5850	--	1000 (30) If Antenna gain more 6dBi (-> reduction necessary)

4.2.4 Result

Calculation of power limits

U-NII Band	Mode	Gain	BW	FCC cond. Output Power Limit	FCC EIRP Limit
U-NII-1 5.15-5.25GHz			**26dB**	250mW (24 dBm)	250mW (24 dBm)
	a	4.3	21.0	-	-
	n20	4.3	23.8	-	-
	ac20	4.3	27.0	-	-
	n40	4.3	40.075	-	-
	ac40	4.3	39.775	-	-
	ac80	4.3	82	-	-
U-NII-2A 5.25-5.35GHz				250mW (24 dBm) or 11dBm+10xlog(BW)	250mW (24 dBm) or 11dBm+10xlog(BW)
	a	4.3	20.9	24.2	24.2
	n20	4.3	22.0	24.4	24.4
	ac20	4.3	21.7	24.4	24.4
	n40	4.3	40.1	27.0	27.0
	ac40	4.3	39.8	27.0	27.0
	ac80	4.3	82.0	30.1	30.1
U-NII-2C 5.5-5.7GHz				250mW (24 dBm) or 11dBm+10xlog(BW)	250mW (24 dBm) or 11dBm+10xlog(BW)
	a	4.3	20.7	24.2	24.2
	n20	4.3	22	24.4	24.4
	ac20	4.3	21.5	24.3	24.3
	n40	4.3	40.375	27.1	27.1
	ac40	4.3	39.775	27.0	27.0
	ac80	4.3	105.5	31.2	31.2
U-NII-3 5.725-5.85GHz				30dBm	30dBm + 6 dBi Gain

a-mode

Operational bands:	U-NII 1	U-NII 2A	U-NII 2C	U-NII 3
Highest conducted power value over channels and modulations in dBm:	3.5	2.3	1.1	-0.4
Conducted FCC Limit [dBm]	24	24	24	30
Result:	Passed	Passed	Passed	Passed
Declared antenna Gain max:	4.3	4.3	4.3	4.3
EIRP	7.8	6.6	5.4	3.9
E.I.R.P FCC Limit [dBm]	24	24	24	30 + 6 dBi Gain
Result:	Passed	Passed	Passed	Passed

Remark: For more information and graphical plot see annex A1 **CETECOM_TR22-1-0025001T01a-A1**

n20-mode

Operational bands:	U-NII 1	U-NII 2A	U-NII 2C	U-NII 3
Highest conducted power value over channels and modulations in dBm:	3.3	2.5	0.8	0.0
Conducted FCC Limit [dBm]	24	24	24	30
Result:	Passed	Passed	Passed	Passed
Declared antenna Gain max:	4.3	4.3	4.3	4.3
EIRP	7.6	6.9	5.1	4.3
E.I.R.P FCC Limit [dBm]	24	24	24	30 + 6 dBi Gain
Result:	Passed	Passed	Passed	Passed

Remark: For more information and graphical plot see annex A1 **CETECOM_TR22-1-0025001T01a-A1**

ac20-mode

Operational bands:	U-NII 1	U-NII 2A	U-NII 2C	U-NII 3
Highest conducted power value over channels and modulations in dBm:	3.3	2.6	0.7	-0.2
Conducted FCC Limit [dBm]	24	24	24	30
Result:	Passed	Passed	Passed	Passed
Declared antenna Gain max:	4.3	4.3	4.3	4.3
EIRP	7.6	6.9	5.0	4.1
E.I.R.P FCC Limit [dBm]	24	24	24	30 + 6 dBi Gain
Result:	Passed	Passed	Passed	Passed

Remark: For more information and graphical plot see annex A1 **CETECOM_TR22-1-0025001T01a-A1**

n40-mode

Operational bands:	U-NII 1	U-NII 2A	U-NII 2C	U-NII 3
Highest conducted power value over channels and modulations in dBm:	3.8	3.0	0.7	0.6
Conducted FCC Limit [dBm]	24	24	24	30
Result:	Passed	Passed	Passed	Passed
Declared antenna Gain max:	4.3	4.3	4.3	4.3
EIRP	8.1	7.3	5.0	4.9
E.I.R.P FCC Limit [dBm]	24	24	24	30 + 6 dBi Gain
Result:	Passed	Passed	Passed	Passed

Remark: For more information and graphical plot see annex A1 **CETECOM_TR22-1-0025001T01a-A1**

ac40-mode

Operational bands:	U-NII 1	U-NII 2A	U-NII 2C	U-NII 3
Highest conducted power value over channels and modulations in dBm:	3.9	3.2	0.5	0.5
Conducted FCC Limit [dBm]	24	24	24	30
Result:	Passed	Passed	Passed	Passed
Declared antenna Gain max:	4.3	4.3	4.3	4.3
EIRP	8.2	7.5	4.8	4.8
E.I.R.P FCC Limit [dBm]	24	24	24	30 + 6 dBi Gain
Result:	Passed	Passed	Passed	Passed

Remark: For more information and graphical plot see annex A1 **CETECOM_TR22-1-0025001T01a-A1**

ac80-mode

Operational bands:	U-NII 1	U-NII 2A	U-NII 2C	U-NII 3
Highest conducted power value over channels and modulations in dBm:	3.3	2.4	-0.1	0.2
Conducted FCC Limit [dBm]	24	24	24	30
Result:	Passed	Passed	Passed	Passed
Declared antenna Gain max:	4.3	4.3	4.3	4.3
EIRP	7.6	6.7	4.2	4.5
E.I.R.P FCC Limit [dBm]	24	24	24	30 + 6 dBi Gain
Result:	Passed	Passed	Passed	Passed

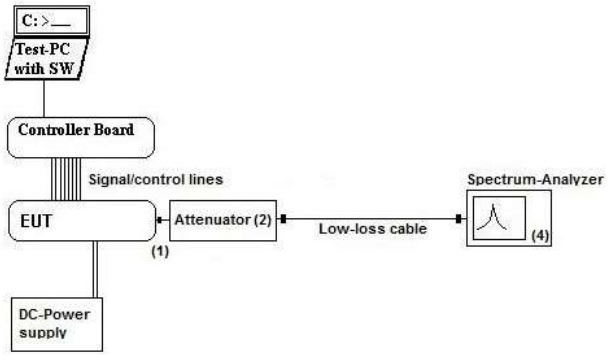
Remark: For more information and graphical plot see annex A1 **CETECOM_TR22-1-0025001T01a-A1**

4.3 Power spectral density

4.3.1 Description of the general test setup and methodology, see below example:

The EUT's RF-signal is coupled out by a suitable antenna coupling connector (1). The signal is first attenuated (2) then connected to spectrum-analyzer (4) for RF-conducted measurements. The specific attenuation loss is determined prior to the measurement within a set-up attenuation measurement. These are then taken into account by correcting the measurement readings of the spectrum-analyzer.

Schematic:



Testing method:

The measurement is made according to relevant reference clauses:
(See Tables *Summary of Test Results* and *Summary of Test Methods* on page 7)

Measurement is made using Rohde & Schwarz TS8997 test system

EUT settings
The EUT was instructed to send with maximum power (if adjustable) according applicants instructions.

4.3.2 Measurement Location

Test site	120910 - Radio Laboratory 1 (TS 8997)

4.3.3 Limit

Frequency Range [MHz]	Application	FCC Limit [mW] / [dBm] ☒
5150-5250	Outdoor access point	17 dBm / MHz
5150-5250	Indoor Access Point	17 dBm / MHz
5150-5250	Mobile & Portable client	11 dBm / MHz
5150-5250	vehicle equipment by OEM	--
5150-5250	other device	--
5250-5350	--	11 dBm / MHz
5470-5725	--	11 dBm / MHz
5725-5850	--	30 dBm / 500kHz

4.3.4 Result

20 MHz Bandwidth

Band	Channel	PSD [dBm/MHz]			Result
		a-mode	n20-mode HT20	ac20-mode	
U-NII 1	36	-6.388	-7.155	-6.332	Passed
	40	-5.940	-6.930	-5.925	Passed
	48	-7.557	-8.610	-8.112	Passed
U-NII 2A	52	-6.820	-7.924	-7.191	Passed
	56	-6.322	-7.667	-6.708	Passed
	64	-8.638	-9.782	-8.860	Passed
U-NII 2C	100	-11.116	-12.089	-11.528	Passed
	116	-10.639	-11.922	-11.028	Passed
	140	-8.855	-9.659	-9.194	Passed
U-NII 3	149	-12.014	-13.016	-12.504	Passed
	157	-12.114	-12.657	-12.255	Passed
	165	-12.111	-12.862	-12.429	Passed

Remark: for more information and graphical plot see annex A1 **CETECOM_TR22-1-0025001T01a-A1**

40 MHz Bandwidth

Band	Channel	PSD [dBm/MHz]			Result
		n40-mode	ac40-mode		
U-NII 1	38	-8.478	-8.101		Passed
	46	-9.975	-9.715		Passed
U-NII 2A	54	-9.514	-8.996		Passed
	62	-11.015	-10.359		Passed
U-NII 2C	102	-13.194	-12.581		Passed
	110	-13.794	-13.292		Passed
	134	-12.074	-11.545		Passed
U-NII 3	151	-14.760	-13.622		Passed
	159	-14.957	-14.533		Passed

Remark: for more information and graphical plot see annex A1 **CETECOM_TR22-1-0025001T01a-A1**

80 MHz Bandwidth

Band	Channel	PSD [dBm/MHz]			Result
		ac80-mode			
U-NII 1	42	-11.589			Passed
U-NII 2A	58	-12.502			Passed
U-NII 2C	106	-15.787			Passed
U-NII 3	155	-17.557			Passed

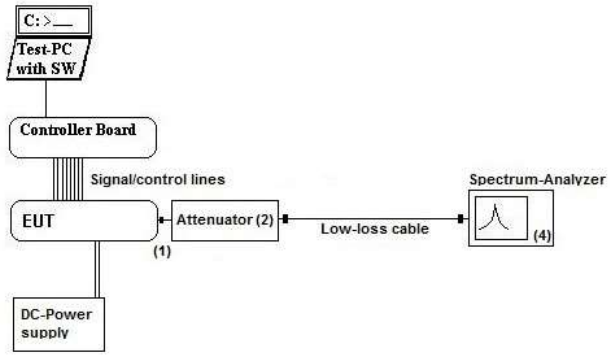
Remark: for more information and graphical plot see annex A1 **CETECOM_TR22-1-0025001T01a-A1**

4.4 Emission Bandwidth 26 dB

4.4.1 Description of the general test setup and methodology, see below example:

The EUT's RF-signal is coupled out by a suitable antenna coupling connector (1). The signal is first attenuated (2) then connected to spectrum-analyzer (4) for RF-conducted measurements. The specific attenuation loss is determined prior to the measurement within a set-up attenuation measurement. These are then taken into account by correcting the measurement readings of the spectrum-analyzer.

Schematic:



Testing method:

The measurement is made according to relevant reference clauses:
(See Tables *Summary of Test Results* and *Summary of Test Methods* on page 7)

Measurement is made using Rohde & Schwarz TS8997 test system

4.4.2 Measurement Location

Test site	120910 - Radio Laboratory 1 (TS 8997)

4.4.3 Limit

Limit [kHz]
No limit

4.4.4 Result

20 MHz Bandwidth

Band	Channel	Emission Bandwidth 26 dB [MHz]			Result
		a-mode	n20-mode HT20	ac20-mode	
U-NII 1	36	20.800000	23.800000	21.700000	Passed
	40	20.200000	21.700000	21.300000	Passed
	48	21.000000	22.200000	21.500000	Passed
U-NII 2A	52	20.600000	21.800000	21.500000	Passed
	56	20.200000	21.700000	21.400000	Passed
	64	20.900000	22.000000	21.700000	Passed
U-NII 2C	100	20.300000	21.800000	21.500000	Passed
	116	20.300000	22.000000	21.200000	Passed
	140	20.700000	21.600000	21.400000	Passed
U-NII 3	149	20.700000	22.000000	21.300000	Passed
	157	20.600000	21.700000	21.500000	Passed
	165	20.800000	22.000000	21.500000	Passed

Remark: for more information and graphical plot see annex A1 **CETECOM_TR22-1-0025001T01a-A1**

40 MHz Bandwidth

Band	Channel	Emission Bandwidth 26 dB [MHz]			Result
		n40-mode	ac40-mode		
U-NII 1	38	39.924953	39.474672		Passed
	46	40.075047	39.774860		Passed
U-NII 2A	54	39.774859	39.474672		Passed
	62	40.075047	39.774860		Passed
U-NII 2C	102	40.375235	39.774859		Passed
	110	40.375234	39.474672		Passed
	134	40.075047	39.924953		Passed
U-NII 3	151	40.225141	39.924953		Passed
	159	40.375234	39.774860		Passed

Remark: for more information and graphical plot see annex A1 **CETECOM_TR22-1-0025001T01a-A1**

80 MHz Bandwidth

Band	Channel	Emission Bandwidth 26 dB [MHz]			Result
		ac80-mode			
U-NII 1	42	82.000000			Passed
U-NII 2A	58	82.000000			Passed
U-NII 2C	106	105.500000			Passed
U-NII 3	155	82.000000			Passed

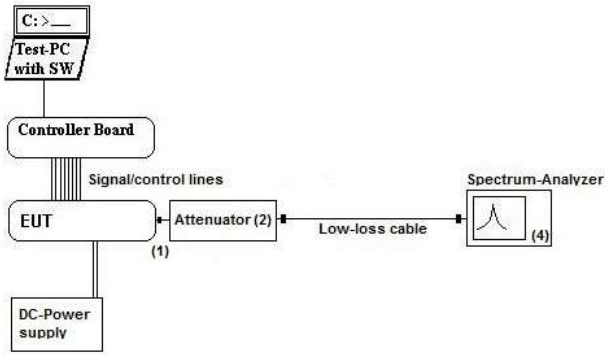
Remark: for more information and graphical plot see annex A1 **CETECOM_TR22-1-0025001T01a-A1**

4.5 Occupied Channel Bandwidth 99%

4.5.1 Description of the general test setup and methodology, see below example:

The EUT's RF-signal is coupled out by a suitable antenna coupling connector (1). The signal is first attenuated (2) then connected to spectrum-analyzer (4) for RF-conducted measurements. The specific attenuation loss is determined prior to the measurement within a set-up attenuation measurement. These are then taken into account by correcting the measurement readings of the spectrum-analyzer.

Schematic:



Testing method:

The measurement is made according to relevant reference clauses:
(See Tables *Summary of Test Results* and *Summary of Test Methods* on page 7)

Measurement is made using Rohde & Schwarz TS8997 test system

4.5.2 Measurement Location

Test site	120910 - Radio Laboratory 1 (TS 8997)

4.5.3 Limit

When the occupied bandwidth limit is not stated in the applicable RSS or reference measurement method, the transmitted signal bandwidth shall be reported as the 99% emission bandwidth, as calculated or measured.

4.5.4 Result

20 MHz Bandwidth

Band	Channel	99% Occupied Bandwidth [MHz]			Result
		a-mode	n20-mode HT20	ac20-mode	
UN-II 1	36	16.600000	18.000000	17.800000	Passed
	40	16.500000	17.800000	17.800000	Passed
	48	16.600000	18.000000	17.900000	Passed
UN-II 2A	52	16.600000	17.900000	17.800000	Passed
	56	16.500000	17.800000	17.800000	Passed
	64	16.600000	17.900000	17.800000	Passed
UN-II 2C	100	16.400000	17.900000	17.800000	Passed
	116	16.400000	17.900000	17.800000	Passed
	140	16.500000	17.900000	17.800000	Passed
UN-II 3	149	16.500000	17.900000	17.800000	Passed
	157	16.500000	17.900000	17.700000	Passed
	165	16.500000	17.900000	17.800000	Passed

Remark: for more information and graphical plot see annex A1 **CETECOM_TR22-1-0025001T01a-A1**

40 MHz Bandwidth

Band	Channel	99% Occupied Bandwidth [MHz]			Result
		n40-mode	ac40-mode		
UN-II 1	38	36.250000	36.250000		Passed
	46	36.500000	36.500000		Passed
UN-II 2A	54	36.250000	36.250000		Passed
	62	36.500000	36.500000		Passed
UN-II 2C	102	36.500000	36.250000		Passed
	110	36.750000	36.500000		Passed
	134	36.750000	36.250000		Passed
UN-II 3	151	36.500000	36.250000		Passed
	159	36.750000	36.500000		Passed

Remark: for more information and graphical plot see annex A1 **CETECOM_TR22-1-0025001T01a-A1**

80 MHz Bandwidth

Band	Channel	99% Occupied Bandwidth [MHz]			Result
		ac80-mode			
UN-II 1	42	76.000000			Passed
UN-II 2A	58	76.000000			Passed
UN-II 2C	106	76.500000			Passed
UN-II 3	155	76.000000			Passed

Remark: for more information and graphical plot see annex A1 **CETECOM_TR22-1-0025001T01a-A1**

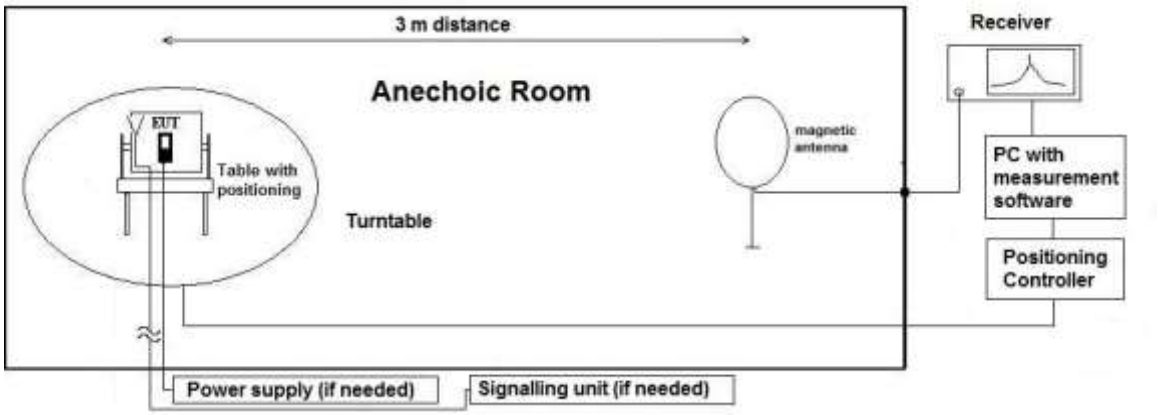
4.6 Radiated field strength emissions below 30 MHz

4.6.1 Description of the general test setup and methodology, see below example:

Evaluating the radiated field emissions are done first by an exploratory emission measurement and a final measurement for most critical frequencies determined.

The loop antenna was placed at 1 m height above ground plane and 3 m measurement distance from set-up for investigations. Because of reduced measurement distance, correction data were applied, as stated in chapter "General Limit - Radiated field strength emissions below 30 MHz". The tests are performed in the semi anechoic room recognized by the regulatory commission.

Schematic:



Testing method:

The measurement is made according to relevant reference clauses:
(See Tables *Summary of Test Results* and *Summary of Test Methods* on page 7)

Exploratory, preliminary measurements
The EUT and its associated accessories are placed on a non-conductive position manipulator (tipping device) of 0.8 m height which is placed on the turntable. By rotating the turntable (step 90°, range 0°to 360°) and the EUT itself either on 3-orthogonal axis (portable equipment) or 2-orthogonal axis (defined operational position of EUT), the emission spectrum was recorded.

The loop antenna was moved at least to 2-perpendicular axes (antenna vector in direction of EUT and parallel to EUT) in order to maximize the emissions. The results are documented in a diagram. Critical frequencies (low margin to limit) are saved within a data reduction table for further investigations. If various operating modes are supported, further investigations are made to find the worst-case. Also the interconnection cables and equipment position were varied in order to maximize the emissions.

Final measurement on critical frequencies
Based on the exploratory measurements, the most critical frequencies are re-measured by main-taining the EUT's worst-case operation mode, cable position, etc.

First a frequency zoom around the critical frequency is done to locate the frequency more precisely. After this step, for all identified critical frequencies, the maximum peak was determined.

Following parameters were varied: the turntable angle continuously in the range 0 to 360 degree, the EUT itself either over 3-orthogonal axis (not defined usage position) or 2-orthogonal axis (defined usage position).

On the determined worst-case position, a final measurement with necessary bandwidth and detector according standard has been carried out.

Formula:

$E_C = E_R + AF + C_L + D_F - G_A$

$M = L_T - E_C$

AF = Antenna factor
C_L = Cable loss
D_F = Distance correction factor (if used)
E_C = Electrical field – corrected value
E_R = Receiver reading
G_A = Gain of pre-amplifier (if used)
L_T = Limit
M = Margin

All units are dB-units, positive margin means value is below limit.

4.6.2 Sample calculation

Raw-Value [dBuV/m]	Antenna factor	Distance Correction [dB]	Cable Loss	Preamplifier	Resulting correction value [dB]	Final result [dBuV/m]	Remarks
19.83	18.9	-70.75	0.18	--	-51.67	-31.83	30 to 3 m correction used according ANSI C63.10-2013

Remark: This calculation is based on an example value at 458 kHz

4.6.3 Measurement Location

Test site	120901 - SAC - Radiated Emission <1GHz

4.6.4 Correction factors due to reduced meas. distance (f < 30 MHz):

The used correction factors when the measurement distance is reduced compared to regulatory measurement distance, are calculated according Extrapolation formulas valid for EUT's with maximum dimension of 0.625xLambda. Formula 2+3+4 as presented in ANSI C63.10, Chapter 6.4.4 are used for the calculations of proper extrapolation factors

Frequency Range	f [kHz/MHz]	Lambda [m]	Far-Field Point [m]	Distance Limit accord. 15.209 [m]	1st Condition (dmeas < Dnear-field)	2nd Condition (Limit distance bigger dnear-field)	Distance Correction accord. Formula
kHz	9	33333.33	5305.17	300	fullfilled	not fullfilled	-80.00
	10	30000.00	4774.65		fullfilled	not fullfilled	-80.00
	20	15000.00	2387.33		fullfilled	not fullfilled	-80.00
	30	10000.00	1591.55		fullfilled	not fullfilled	-80.00
	40	7500.00	1193.66		fullfilled	not fullfilled	-80.00
	50	6000.00	954.93		fullfilled	not fullfilled	-80.00
	60	5000.00	795.78		fullfilled	not fullfilled	-80.00
	70	4285.71	682.09		fullfilled	not fullfilled	-80.00
	80	3750.00	596.83		fullfilled	not fullfilled	-80.00
	90	3333.33	530.52		fullfilled	not fullfilled	-80.00
	100	3000.00	477.47		fullfilled	not fullfilled	-80.00
	125	2400.00	381.97		fullfilled	not fullfilled	-80.00
	200	1500.00	238.73		fullfilled	fullfilled	-78.02
	300	1000.00	159.16		fullfilled	fullfilled	-74.49
	400	750.00	119.37		fullfilled	fullfilled	-72.00
	490	612.24	97.44		fullfilled	fullfilled	-70.23
	500	600.00	95.49	30	fullfilled	not fullfilled	-40.00
	600	500.00	79.58		fullfilled	not fullfilled	-40.00
	700	428.57	68.21		fullfilled	not fullfilled	-40.00
	800	375.00	59.68		fullfilled	not fullfilled	-40.00
	900	333.33	53.05		fullfilled	not fullfilled	-40.00
MHz	1.00	300.00	47.75		fullfilled	not fullfilled	-40.00
	1.59	188.50	**30.00**		fullfilled	not fullfilled	-40.00
	2.00	150.00	23.87		fullfilled	fullfilled	-38.02
	3.00	100.00	15.92		fullfilled	fullfilled	-34.49
	4.00	75.00	11.94		fullfilled	fullfilled	-32.00
	5.00	60.00	9.55		fullfilled	fullfilled	-30.06
	6.00	50.00	7.96		fullfilled	fullfilled	-28.47
	7.00	42.86	6.82		fullfilled	fullfilled	-27.13
	8.00	37.50	5.97		fullfilled	fullfilled	-25.97
	9.00	33.33	5.31		fullfilled	fullfilled	-24.95
	10.00	30.00	4.77		fullfilled	fullfilled	-24.04
	10.60	28.30	4.50		fullfilled	fullfilled	-23.53
	11.00	27.27	4.34		fullfilled	fullfilled	-23.21
	12.00	25.00	3.98		fullfilled	fullfilled	-22.45
	13.56	22.12	3.52		fullfilled	fullfilled	-21.39
	15.00	20.00	3.18		fullfilled	fullfilled	-20.51
	15.92	18.85	**3.00**		fullfilled	fullfilled	-20.00
	17.00	17.65	2.81		not fullfilled	fullfilled	-20.00
	18.00	16.67	2.65		not fullfilled	fullfilled	-20.00
	20.00	15.00	2.39		not fullfilled	fullfilled	-20.00
	21.00	14.29	2.27		not fullfilled	fullfilled	-20.00
	23.00	13.04	2.08		not fullfilled	fullfilled	-20.00
	25.00	12.00	1.91		not fullfilled	fullfilled	-20.00
	27.00	11.11	1.77		not fullfilled	fullfilled	-20.00
	29.00	10.34	1.65		not fullfilled	fullfilled	-20.00
	30.00	10.00	1.59		not fullfilled	fullfilled	-20.00

4.6.5 Limit

Radiated emissions limits (3 meters)					
Frequency Range [MHz]	Limit [µV/m]	Limit [dBµV/m]	Distance [m]	Detector	RBW [kHz]
0.009 – 0.09	2400 / f [kHz]	67.6 – 20Log(f) (kHz)	300	Pk & Avg	0.2
0.09 – 0.11	2400 / f [kHz]	67.6 – 20Log(f) (kHz)	300	Quasi peak	0.2
0.11 – 0.15	2400 / f [kHz]	67.6 – 20Log(f) (kHz)	300	Pk & Avg	0.2
0.15 – 0.49	2400 / f [kHz]	67.6 – 20Log(f) (kHz)	300	Pk & Avg	9
0.49 – 1.705	24000 / f [kHz]	87.6 – 20Log(f) (kHz)	30	Quasi peak	9
1.705 - 30	30	29.5	30	Quasi peak	9

4.6.6 Result

Mode	Channel	Diagram	Maximum Level [dBµV/m] Frequency Range 0.009 – 30 MHz	Result
a-mode	36	2.01a	No peaks found	Passed
	36	2.01b	No peaks found	Passed
	52	2.02	No peaks found	Passed
	100	2.03	No peaks found	Passed
	149	2.04	No peaks found	Passed

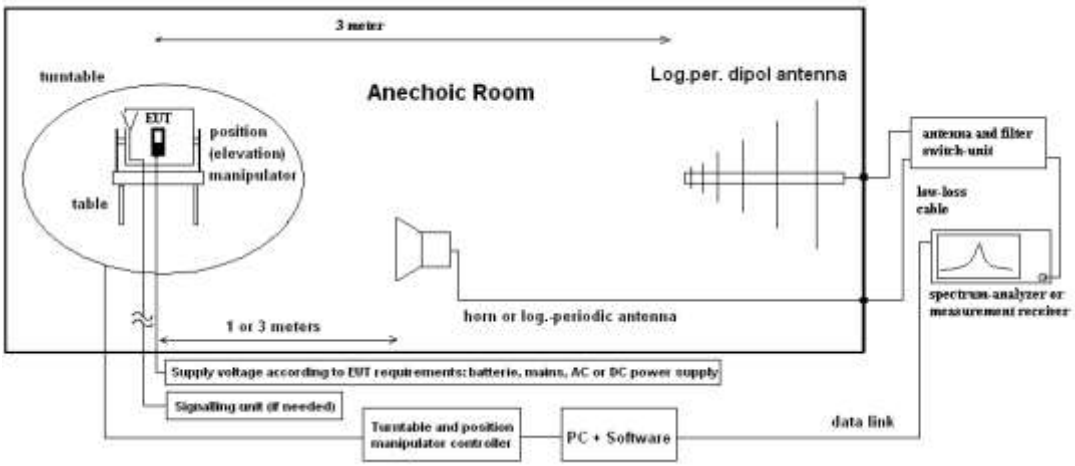
Remark: for more information and graphical plot see annex A1 **CETECOM_TR22-1-0025001T01a-A1**

4.7 Radiated field strength emissions 30 MHz – 1 GHz

4.7.1 Description of the general test setup and methodology, see below example:

Evaluating the emissions have to be done first by an exploratory emissions measurement and a final measurement for most critical frequencies. The tests are performed in a CISPR 16-1-4:2010 compliant semi anechoic room (SAR) and fully anechoic room (FAR) recognized by the regulatory commission. The measurement distance was set to 3 meter for frequencies up to 18 GHz and 2 meter above 18 GHz. A logarithmic periodic antenna is used for the frequency range 30 MHz to 1 GHz. Horn antennas are used for frequency range 1 GHz to 40 GHz. The EUT is aligned within 3 dB beam width of the measurement antenna with three orthogonal axis measurements on the EUT.

Schematic:



Testing method:

The measurement is made according to relevant reference clauses:
(See Tables *Summary of Test Results* and *Summary of Test Methods* on page 7)

Exploratory, preliminary measurements
The EUT and its associated accessories are placed on a non-conductive position manipulator (tipping device) of 0.8 m height which is placed on the turntable. By rotating the turntable (range 0° to 360°, step 90°) and the EUT itself either on 3-orthogonal axis (portable equipment) or 2-orthogonal axis (defined operational position of EUT) the emission spectrum and its characteristics was recorded with an EMI-receiver, broadband antenna and software.

Measurement antenna: horizontal and vertical, heights: 1, 0 m and 1, 82 m as worst-case determined by an exploratory emission measurements. The results are documented in a diagram. Critical frequencies (low margin to limit) are saved within a table for further investigations. If various operating modes are supported, further investigations are made to find the worst-case of them. Also the interconnection cables and equipment position were varied in order to maximize the emissions.

Final measurement on critical frequencies
Based on the exploratory measurements, the most critical frequencies are re-measured by main-taining the EUT's worst-case operation mode, cable position, etc. either on 10m OATS or 3m semi-anechoic room.
First a frequency zoom around the critical frequency is done to locate the frequency more precisely. After this step, for all identified critical frequencies, the maximum peak was determined.

Following parameters were varied: the turntable angle continuously in the range 0 to 360 degree, the EUT itself either over 3-orthogonal axis (not defined usage position) or 2-orthogonal axis (defined usage position). The measurement antenna height between 1 m and 4 m.
On the determined worst-case position, a final measurement with necessary bandwidth and detector according standard has been carried out

Formula:

$E_C = E_R + AF + C_L + D_F - G_A$ (1)

$M = L_T - E_C$ (2)

AF = Antenna factor
C_L = Cable loss
D_F = Distance correction factor (if used)
E_C = Electrical field – corrected value
E_R = Receiver reading
G_A = Gain of pre-amplifier (if used)
L_T = Limit
M = Margin

All units are dB-units, positive margin means value is below limit.

4.7.2 Sample calculation

Raw-Value [dBuV/m]	Antenna factor	Distance Correction [dB]	Cable Loss	Preamplifier	Resulting correction value [dB]	Final result [dBuV/m]	Remarks
32.7	22.25	--	3.1	--	25.35	58.05	--

Remark: This calculation is based on an example value at 800.4 MHz

4.7.3 Measurement Location

Test site	120901 - SAC - Radiated Emission <1GHz

4.7.4 Limit

Radiated emissions limits (3 meters)				
Frequency Range [MHz]	Limit [µV/m]	Limit [dBµV/m]	Detector	RBW / VBW [kHz]
30 - 88	100	40.0	Quasi peak	100 / 300
88 - 216	150	43.5	Quasi peak	100 / 300
216 - 960	200	46.0	Quasi peak	100 / 300
960 - 1000	500	54.0	Quasi peak	100 / 300

4.7.5 Result

20 MHz Bandwidth

Mode	Channel	Diagram	Maximum Level [dBµV/m] Frequency Range 30 – 1000 MHz	Result
a-mode	36	3.01a	39.49 @ 49.390 MHz	Passed
	36	3.01b	38.00 @ 50.090 MHz	Passed
	52	3.02	39.65 @ 203.990 MHz	Passed
	100	3.03	39.70 @ 397.390 MHz	Passed
	149	3.04	40.03 @ 203.990 MHz	Passed
n20-mode	40	3.05	39.68 @ 203.990 MHz	Passed
	56	3.06	40.20 @ 203.990 MHz	Passed
	116	3.07	37.82 @ 119.990 MHz	Passed
	157	3.08	40.38 @ 203.990 MHz	Passed
ac20-mode	48	3.09	37.36 @ 203.990 MHz	Passed
	64	3.10	No peaks found	Passed
	140	3.11	No peaks found	Passed
	165	3.12	No peaks found	Passed

Remark: for more information and graphical plot see annex A1 **CETECOM_TR22-1-0025001T01a-A1**

40 MHz Bandwidth

Mode	Channel	Diagram	Maximum Level [dBµV/m] Frequency Range 30 – 1000 MHz	Result
n40-mode	38	3.13	No peaks found	Passed
	46	3.14	No peaks found	Passed
	102	3.15	No peaks found	Passed
	151	3.16	No peaks found	Passed
ac40-mode	46	3.17	No peaks found	Passed
	62	3.18	No peaks found	Passed
	106	3.19	No peaks found	Passed
	159	3.20	No peaks found	Passed

Remark: for more information and graphical plot see annex A1 **CETECOM_TR22-1-0025001T01a-A1**

80 MHz Bandwidth

Mode	Channel	Diagram	Maximum Level [dBµV/m] Frequency Range 30 – 1000 MHz	Result
ac80-mode	48	3.21	No peaks found	Passed
	64	3.22	No peaks found	Passed
	140	3.23	No peaks found	Passed
	165	3.24	No peaks found	Passed

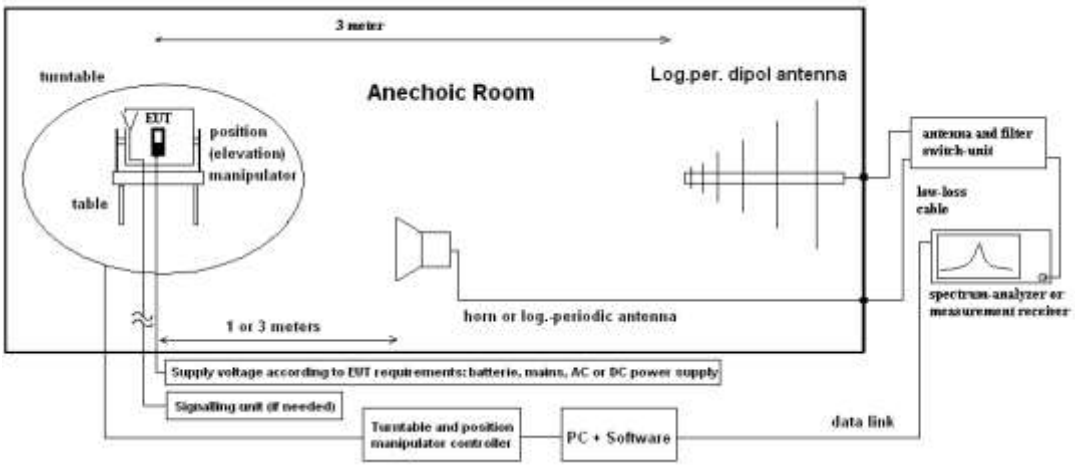
Remark: for more information and graphical plot see annex A1 **CETECOM_TR22-1-0025001T01a-A1**

4.8 Radiated field strength emissions above 1 GHz

4.8.1 Description of the general test setup and methodology, see below example:

Evaluating the emissions have to be done first by an exploratory emissions measurement and a final measurement for most critical frequencies. The tests are performed in a CISPR 18-1-4:2010 compliant fully anechoic room (FAR) recognized by the regulatory commission. The measurement distance was set to 3 meter for frequencies up to 18 GHz and 2 meter above 18 GHz. A logarithmic periodic antenna is used for the frequency range 30 MHz to 1 GHz. Horn antennas are used for frequency range 1 GHz to 40 GHz. The EUT is aligned within 3 dB beam width of the measurement antenna with three orthogonal axis measurements on the EUT.

Schematic:



Testing method:

The measurement is made according to relevant reference clauses:
(See Tables *Summary of Test Results* and *Summary of Test Methods* on page 7)

Exploratory, preliminary measurements
The EUT and its associated accessories are placed on a non-conductive position manipulator (tipping device) of 1.55 m height which is placed on the turntable. By rotating the turntable (range 0° to 360°, step 15°) and the EUT itself either on 3-orthogonal axis (portable equipment) or 2-orthogonal axis (defined operational position of EUT) the emission spectrum and its characteristics was recorded with an EMI-receiver, broadband antenna and software.
The measurements are performed in horizontal and vertical polarization of the measurement antennas. The results are documented in a diagram. Critical frequencies (low margin to limit) are saved within a table for further investigations. If various operating modes are supported, further investigations are made to find the worst-case of them. Also the interconnection cables and equipment position were varied in order to maximize the emissions.

Final measurement on critical frequencies
Based on the exploratory measurements, the most critical frequencies are re-measured by main-taining the EUT's worst-case operation mode, cable position, etc.

First a frequency zoom around the critical frequency is done to locate the frequency more precisely. After this step, for all identified critical frequencies, the maximum peak was determined.

Following parameters were varied: the turntable angle continuously in the range 0 to 360 degree, the EUT itself over 3-orthogonal axis and the height for EUT with large dimensions or three axis scan for portable/small equipment.
On the determined worst-case position, a final measurement with necessary bandwidth and detector according standard has been carried out.

Formula:

$E_C = E_R + A_F + C_L + D_F - G_A$ (1)

$M = L_T - E_C$ (2)

E_C = Electrical field – corrected value
E_R = Receiver reading
M = Margin
L_T = Limit
A_F = Antenna factor
C_L = Cable loss
D_F = Distance correction factor (if used)
G_A = Gain of pre-amplifier (if used)

All units are dB-units, positive margin means value is below limit.

4.8.2 Sample calculation

Raw-Value [dBuV/m]	Antenna factor	Distance Correction [dB]	Cable Loss + Preamplifier	Resulting correction value [dB]	Final result [dBuV/m]	Remarks
29.37	41.20	--	24.28	16.92	46.3	CableLoss and PreAmp data in one data correction file

Remark: This calculation is based on an example value at 10 GHz

4.8.3 Measurement Location

Test site 1 – 7 GHz	120904 - FAC1 - Radiated Emissions
Test site 7 – 16 GHz	120904 - FAC1 - Radiated Emissions
Test site 16 – 40 GHz	120907 - FAC2

4.8.4 Limit

Limit (3 meters)

Frequency Range [MHz]	AV Limit [µV/m]	AV Limit [dBµV/m]	Peak Limit [µV/m]	FCC Peak [dBµV/m] or [dBm/MHz] ☒
Above 1000	500	54	5000	74
5150 – 5250	--	--	--	-27dBm eirp
5250 – 5350	--	--	--	-27dBm eirp
5470 – 5725	--	--	--	-27dBm eirp (-17dBm/MHz eirp
5725 - 5850	--	--	--	Spectrum mask
--	--	--	--	--
--	--	--	--	--

4.8.5 Results for Range 1-7 GHz

20 MHz Bandwidth

Mode	Channel	Diagram	Maximum Level [dBµV/m] Frequency Range 1-7 GHz	Result
a-mode	36	4.01a1	No peaks found	Passed
	36	4.01a2	No peaks found	Passed
	52	4.02a1	No peaks found	Passed
	52	4.02a2	No peaks found	Passed
	100	4.03a1	No peaks found	Passed
	100	4.03a2	No peaks found	Passed
	149	4.04a1	No peaks found	Passed
	149	4.04a2	No peaks found	Passed
n20-mode	40	4.05a1	No peaks found	Passed
	40	4.05a2	No peaks found	Passed
	56	4.06a1	No peaks found	Passed
	56	4.06a2	No peaks found	Passed
	116	4.07a1	No peaks found	Passed
	116	4.07a2	No peaks found	Passed
	157	4.08a1	No peaks found	Passed
	157	4.08a2	No peaks found	Passed
ac20-mode	48	4.09a1	No peaks found	Passed
	48	4.09a1	No peaks found	Passed
	64	4.10a1	No peaks found	Passed
	64	4.10a2	No peaks found	Passed
	140	4.11a1	No peaks found	Passed
	140	4.11a2	No peaks found	Passed
	165	4.12a1	No peaks found	Passed
	165	4.12a2	No peaks found	Passed

Remark: for more information and graphical plot see annex A1 **CETECOM_TR22-1-0025001T01a-A1**

40 MHz Bandwidth

Mode	Channel	Diagram	Maximum Level [dBµV/m] Frequency Range 1-7 GHz	Result
n40-mode	38	4.13a1	No peaks found	Passed
	38	4.13a2	No peaks found	Passed
	46	4.14a1	No peaks found	Passed
	46	4.14a2	No peaks found	Passed
	102	4.15a1	No peaks found	Passed
	102	4.15a2	No peaks found	Passed
	151	4.16a1	No peaks found	Passed
	151	4.16a2	No peaks found	Passed
ac40-mode	46	4.17a1	No peaks found	Passed
	46	4.17a2	No peaks found	Passed
	62	4.18a1	No peaks found	Passed
	62	4.18a2	No peaks found	Passed
	106	4.19a1	No peaks found	Passed
	106	4.19a2	No peaks found	Passed
	159	4.20a1	No peaks found	Passed
	159	4.20a2	No peaks found	Passed

Remark: for more information and graphical plot see annex A1 **CETECOM_TR22-1-0025001T01a-A1**

80 MHz Bandwidth

Mode	Channel	Diagram	Maximum Level [dBµV/m] Frequency Range 1-7 GHz	Result
ac80-mode	48	4.21a1	No peaks found	Passed
	48	4.21a2	No peaks found	Passed
	64	4.22a1	No peaks found	Passed
	64	4.22a2	No peaks found	Passed
	140	4.23a1	No peaks found	Passed
	140	4.23a2	No peaks found	Passed
	165	4.24a1	No peaks found	Passed
	165	4.24a2	No peaks found	Passed

Remark: for more information and graphical plot see annex A1 **CETECOM_TR22-1-0025001T01a-A1**

4.8.6 Results for Range 7-16 GHz

20 MHz Bandwidth

Mode	Channel	Diagram	Maximum Level [dBµV/m] Frequency Range 7-16 GHz	Result
a-mode	36	4.01b1	No peaks found	Passed
	36	4.01b2	No peaks found	Passed
	52	4.02b1	No peaks found	Passed
	52	4.02b2	No peaks found	Passed
	100	4.03b1	No peaks found	Passed
	100	4.03b2	No peaks found	Passed
	149	4.04b1	No peaks found	Passed
	149	4.04b2	No peaks found	Passed
n20-mode	40	4.05b1	No peaks found	Passed
	40	4.05b2	No peaks found	Passed
	56	4.06b1	No peaks found	Passed
	56	4.06b2	No peaks found	Passed
	116	4.07b1	No peaks found	Passed
	116	4.07b2	No peaks found	Passed
	157	4.08b1	No peaks found	Passed
	157	4.08b2	No peaks found	Passed
ac20-mode	48	4.09b1	No peaks found	Passed
	48	4.09b2	No peaks found	Passed
	64	4.10b1	No peaks found	Passed
	64	4.10b2	No peaks found	Passed
	140	4.11b1	No peaks found	Passed
	140	4.11b2	No peaks found	Passed
	165	4.12b1	No peaks found	Passed
	165	4.12b2	No peaks found	Passed

Remark: for more information and graphical plot see annex A1 **CETECOM_TR22-1-0025001T01a-A1**

40 MHz Bandwidth

Mode	Channel	Diagram	Maximum Level [dBµV/m] Frequency Range 1-7 GHz	Result
n40-mode	38	4.13b1	No peaks found	Passed
	38	4.13b2	No peaks found	Passed
	46	4.14b1	No peaks found	Passed
	46	4.14b2	No peaks found	Passed
	102	4.15b1	No peaks found	Passed
	102	4.15b2	No peaks found	Passed
	151	4.16b1	No peaks found	Passed
	151	4.16b2	No peaks found	Passed
ac40-mode	46	4.17b1	No peaks found	Passed
	46	4.17b2	No peaks found	Passed
	62	4.18b1	No peaks found	Passed
	62	4.18b2	No peaks found	Passed
	106	4.19b1	No peaks found	Passed
	106	4.19b2	No peaks found	Passed
	159	4.20b1	No peaks found	Passed
	159	4.20b2	No peaks found	Passed

Remark: for more information and graphical plot see annex A1 **CETECOM_TR22-1-0025001T01a-A1**

80 MHz Bandwidth

Mode	Channel	Diagram	Maximum Level [dBµV/m] Frequency Range 7-16 GHz	Result
ac80-mode	48	4.21b1	No peaks found	Passed
	48	4.21b2	No peaks found	Passed
	64	4.22b1	No peaks found	Passed
	64	4.22b2	No peaks found	Passed
	140	4.23b1	No peaks found	Passed
	140	4.23b2	No peaks found	Passed
	165	4.24b1	No peaks found	Passed
	165	4.24b2	No peaks found	Passed

Remark: for more information and graphical plot see annex A1 **CETECOM_TR22-1-0025001T01a-A1**

4.8.7 Results for Range 16-40 GHz

20 MHz Bandwidth

Mode	Channel	Diagram	Maximum Level [dBµV/m] Frequency Range 16-40 GHz	Result
a-mode	36	4.01c	No peaks found	Passed
	52	4.02c	No peaks found	Passed
	100	4.03c	No peaks found	Passed
	149	4.04c	No peaks found	Passed
n20-mode	40	4.05c	No peaks found	Passed
	56	4.06c	No peaks found	Passed
	116	4.07c	No peaks found	Passed
	157	4.08c	No peaks found	Passed
ac20-mode	48	4.09c	No peaks found	Passed
	64	4.10c	No peaks found	Passed
	140	4.11c	No peaks found	Passed
	165	4.12c	No peaks found	Passed

Remark: for more information and graphical plot see annex A1 **CETECOM_TR22-1-0025001T01a-A1**

40 MHz Bandwidth

Mode	Channel	Diagram	Maximum Level [dBµV/m] Frequency Range 16-40 GHz	Result
n40-mode	38	4.13c	No peaks found	Passed
	46	4.14c	No peaks found	Passed
	102	4.15c	No peaks found	Passed
	151	4.16c	No peaks found	Passed
ac40-mode	46	4.17c	No peaks found	Passed
	62	4.18c	No peaks found	Passed
	106	4.19c	No peaks found	Passed
	159	4.20c	No peaks found	Passed

Remark: for more information and graphical plot see annex A1 **CETECOM_TR22-1-0025001T01a-A1**

80 MHz Bandwidth

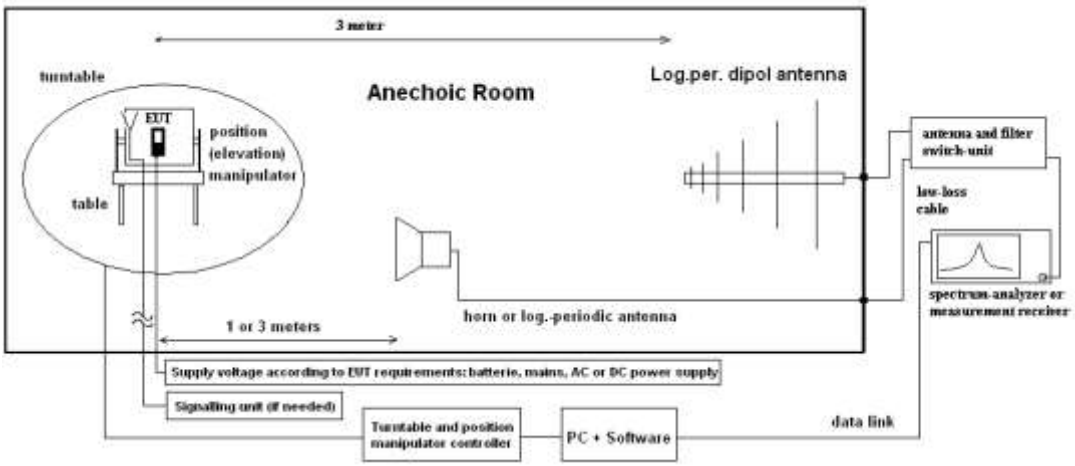
Mode	Channel	Diagram	Maximum Level [dBµV/m] Frequency Range 16-40 GHz	Result
ac80-mode	48	4.21c	No peaks found	Passed
	64	4.22c	No peaks found	Passed
	140	4.23c	No peaks found	Passed
	165	4.24c	No peaks found	Passed

Remark: for more information and graphical plot see annex A1 **CETECOM_TR22-1-0025001T01a-A1**

4.9 Band Edge

4.9.1 Description of the general test setup and methodology, see below example:

Schematic:



Testing method:

The measurement is made according to relevant reference clauses:
(See Tables Summary of Test Results and Summary of Test Methods on page 7)

For uncritical results where a measurement resolution bandwidth of 1MHz can clearly show the compliance without influencing the results, a field strength measurement was performed to show compliance.

For critical results a Marker-Delta marker method was used for showing compliance to restricted bands. The method is according ANSI C63.10:2013, Chapter 6.10.6 “Marker-Delta method”, the method consists of three independent steps:

1. Step: Prior to the measurement the fundamental radiated In-Band field strength was performed. The determined value is used as reference value.

2. Step: Second step consist of finding the relative attenuation between the fundamental emission and the maximum local out-of-band emission (within 2 MHz range around the band edge either on the band-edge directly or some modulation product if the level is greater than that on the band-edge) when measured with lower resolution bandwidth.

3. .Step: The delta value recorded in step 2 will be subtracted from value recorded in step 1, thus giving the required field strength at the band-edge. This value must fulfil the requirements for radiated spurious emissions in restricted bands in FCC §15.205 with the general limits of FCC §15.209

The EUT was instructed to send with maximum power (if adjustable) according to applicants instructions.

4.9.2 Measurement Location

Test site	120907 - FAC2

4.9.3 Limit

Frequency Range [MHz]	Limit	Detector	RBW / VBW [kHz]
5150 – 5250	≤ 5.150 GHz: 54 dBuV/m (avg), 74 dBuV/m (pk)	Average / Peak	100 / 300
5250 – 5350	≥ 5.350 GHz: 54 dBuV/m (avg), 74 dBuV/m (pk)	Average / Peak	1000 / 3000
5470 – 5725	≤ 5.460 GHz: 54 dBuV/m (avg), 74 dBuV/m (pk) 5.460 – 5.470 GHz: -27 dBm/MHz (pk) equals 68.23 dBuV/m @ 3m	Average / Peak	1000 / 3000
5725 - 5850	All emissions shall be limited to a level of −27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge5	Peak	1000 / 3000

4.9.4 Result for Restricted bands near-by

U-NII 1

Mode	Diagram	Channel	Result
a-mode	9.01a	36	Passed
	9.01b	36	Passed
n20-mode	9.05a	36	Passed
	9.05b	36	Passed
ac20-mode	9.09a	36	Passed
	9.09b	36	Passed
n40-mode	9.13a	38	Passed
	9.13b	38	Passed
ac40-mode	9.17a	38	Passed
	9.17b	38	Passed
ac80-mode	9.21a	42	Passed
	9.21b	42	Passed

Remark: For more information and graphical plot see annex A1 **CETECOM_TR22-1-0025001T01a-A1**

U-NII 2A

Mode	Diagram	Channel	Result
a-mode	9.32a	64	Passed
	9.32b	64	Passed
n20-mode	9.36a	64	Passed
	9.36b	64	Passed
ac20-mode	9.40a	64	Passed
	9.40b	64	Passed
n40-mode	9.44a	62	Passed
	9.44b	62	Passed
ac40-mode	9.48a	62	Passed
	9.48b	62	Passed
ac80-mode	9.52a	58	Passed
	9.52b	58	Passed

Remark: For more information and graphical plot see annex A1 **CETECOM_TR22-1-0025001T01a-A1**

U-NII 2C

Mode	Diagram	Channel	Result
a-mode	9.03a	100	Passed
	9.03b	100	Passed
n20-mode	9.07a	100	Passed
	9.07b	100	Passed
ac20-mode	9.11a	100	Passed
	9.11b	100	Passed
n40-mode	9.15a	102	Passed
	9.15b	102	Passed
ac40-mode	9.19a	102	Passed
	9.19b	102	Passed
ac80-mode	9.23a	106	Passed
	9.23b	106	Passed

Remark: For more information and graphical plot see annex A1 **CETECOM_TR22-1-0025001T01a-A1**

4.9.5 Result for Restricted bands near-by

U-NII 3

Mode	Diagram	Channel	Result
a-mode	9.04a	149	Passed
	9.04b	149	Passed
	9.34a	165	Passed
	9.34b	165	Passed
n40-mode	9.08a	149	Passed
	9.08b	149	Passed
	9.38a	165	Passed
	9.38b	165	Passed
ac20-mode	9.12a	149	Passed
	9.12b	149	Passed
	9.42a	165	Passed
	9.42b	165	Passed
n40-mode	9.16a	151	Passed
	9.16b	151	Passed
	9.46a	159	Passed
	9.46b	159	Passed
ac40-mode	9.20a	151	Passed
	9.20b	151	Passed
	9.50a	159	Passed
	9.50b	159	Passed
ac80-mode	9.53a	155	Passed
	9.53b	155	Passed

Remark: for more information and graphical plot see annex A1 **CETECOM_TR22-1-0025001T01a-A1**

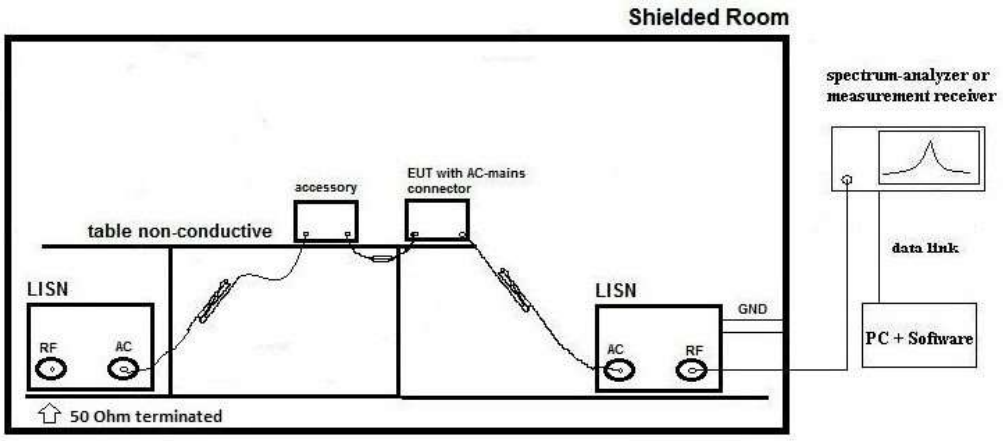
4.10 AC-Power Lines Conducted Emissions

4.10.1 Description of the general test setup and methodology, see below example:

The radio frequency voltage conducted back into the AC power line in the frequency range 150 kHz to 30 MHz has to be investigated.
Compliance should be tested by measuring the radio frequency voltage between each power line and ground at the power terminals in the stated frequency range.
A 50 Ohm / 50 µH line impedance stabilization network (LISN) is used coupling the interface to the measurement equipment.
The EUT power input leads are connected through the LISN to the AC-power source. The LISN enclosure is electrically connected to the ground plane. The measuring instrument is connected to the coaxial output of the LISN.

Tabletop devices were set-up on an 80 cm height above reference ground plane, floor standing equipment 10 cm raised above ground plane.
Measurements have been performed on each phase line and neutral line of the devices AC-power lines.
The EUT was power supplied with 120 V/60 Hz. The EUT was tested in the defined operating mode
and installed (connected) to accessory equipment according the general description of use given by the applicant.

Schematic:



Testing method:

The measurement is made according to relevant reference clauses:
(See Tables *Summary of Test Results* and *Summary of Test Methods* on page 7)

Exploratory, preliminary measurements
As a first step, determines the worst-case phase line (neutral or phase) as well as the most critical operating mode of the equipment. A complete frequency-sweep with PK-Detector is performed on each current-carrying conductor.

Final measurement on critical frequencies
For power phases and critical frequencies (Margin to AV- or QP limit lower than 3 dB) as a second step includes measurements with receivers detector set to Quasi-Peak and Average.

Formula:

$V_C = V_R + C_L$ (1)
$M = L_T - V_C$ (2)

V_C = measured Voltage –corrected value
V_R = Receiver reading
C_L = Cable loss
M = Margin
L_T = Limit

All units are dB-units, positive margin means value is below limit.

4.10.2 Measurement Location

Test site	120919 – Conducted Emission

4.10.3 Limit

Frequency Range [MHz]	QUASI-Peak [dBµV]	AVERAGE [dBµV]
0.15 – 0.5	66 to 56*	56 to 46*
0.5 – 5	56	46
5 – 30	60	50

4.10.4 Result

Diagram	Mode	Power Line	Max [dBµV]	Detector	Result
1.01	Op.1	N/L1	50.11	QP	Passed

Remark: for more information and graphical plot see annex A1 **CETECOM_TR22-1-0025001T01a-A1**

4.11 Equipment lists

ID	Description	Manufacturer	SerNo	CheckType	Last Check	Interval	Next Check
	120901 - SAC - Radiated Emission <1GHz			calchk	cal: 2015-Jul-21 chk: 2021-Jul-27	cal: 10Y chk: 12M	cal: 2025-Jul-21 chk: 2022-Jul-27
20442	Semi Anechoic Chamber	ETS-Lindgren Gmbh / Taufkirchen	-	cnn	cal: - chk: -	cal: - chk: -	cal: - chk: -
20482	filter matrix Filter matrix SAR 1	CETECOM GmbH	-	cnn	cal: - chk: -	cal: - chk: -	cal: - chk: -
20574	Biconilog Hybrid Antenna BTA-L	Frankonia GmbH / Heideck	980026L	cal	cal: 2022-Jun-15	cal: 36M	cal: 2025-Jun-15
20620	Test Receiver ESU26	Rohde & Schwarz Messgerätebau GmbH / Memmingen	100362	cal	cal: 2022-Jun-08	cal: 12M	cal: 2023-Jun-08
20885	Power Supply EA3632A	Agilent Technologies Deutschland GmbH	75305850	cnn	cal: - chk: -	cal: - chk: -	cal: - chk: -
25038	Loop Antenna HFH2-Z2	Rohde & Schwarz Messgerätebau GmbH / Memmingen	879824/13	cal	cal: 2022-Jul-04	cal: 24M	cal: 2024-Jul-04
	120904 - FAC1 - Radiated Emissions			chk	chk: 2022-Jun-30	chk: 12M	chk: 2023-Jun-30
20020	Horn Antenna 3115 (Subst 1)	EMCO Elektronik GmbH	9107-3699	calchk	cal: 2021-Aug-17 chk: 2013-Apr-20	cal: 36M chk: 12M	cal: 2024-Aug-17
20066	Notch Filter WRCT 1900/2200-5/40-10EEK	Wainwright Instruments GmbH	5	chk	chk: 2022-Jun-30	chk: 12M	chk: 2023-Jun-30
20121	Notch Filter WRCB 1879,5/1880,5EE	Wainwright Instruments GmbH	15	chk	chk: 2022-Jun-30	chk: 12M	chk: 2023-Jun-30
20122	Notch Filter WRCB 1747/1748	Wainwright Instruments GmbH	12	chk	chk: 2022-Jun-30	chk: 12M	chk: 2023-Jun-30
20254	High Pass Filter 5HC 2600/12750-1.5KK	Trilithic	23042	chk	chk: 2022-Jun-30	chk: 12M	chk: 2023-Jun-30
20287	Pre-Amplifier 25MHz - 4GHz AMF-2D-100M4G-35-10P	Miteq Inc.	379418	chk	chk: 2022-Jun-30	chk: 12M	chk: 2023-Jun-30
20290	Notch Filter WRCA 901,9/903,1SS	Wainwright Instruments GmbH	3RR	chk	chk: 2022-Jun-30	chk: 12M	chk: 2023-Jun-30
20291	High Pass Filter WHJ 2200-4EE	Wainwright Instruments GmbH	14	chk	chk: 2022-Jun-30	chk: 12M	chk: 2023-Jun-30
20302	Horn Antenna BBHA9170 (Meas 1)	Schwarzbeck Mess-Elektronik OHG / Schönau	155	cpu	chk: 2020-Apr-15	chk: 12M	
20338	Pre-Amplifier 100MHz - 26GHz JS4-00102600-38-5P	Miteq Inc.	838697	chk	chk: 2022-Jun-30	chk: 12M	chk: 2023-Jun-30
20341	Digital Multimeter Fluke 112	Fluke Deutschland GmbH / Glottertal	81650455	cal	cal: 2022-May-18	cal: 24M	cal: 2024-May-18
20439	Ultrabroadband-Antenna HL562	Rohde & Schwarz Messgerätebau GmbH	100248	calchk	cal: 2017-Mar-10	cal: 72M chk: 12M	cal: 2023-Mar-10
20448	Notch Filter WRCT 1850.0/2170.0-5/40-10SSK	Wainwright Instruments GmbH	5	chk	chk: 2022-Jun-30	chk: 12M	chk: 2023-Jun-30
20449	Notch Filter WRCT 824.0/894.0-5/40-8SSK	Wainwright Instruments GmbH	1	chk	chk: 2022-Jun-30	chk: 12M	chk: 2023-Jun-30
20484	Pre-Amplifier 2,5GHz - 18GHz AMF-5D-02501800-25-10P	Miteq Inc.	1244554	chk	chk: 2022-Jun-30	chk: 12M	chk: 2023-Jun-30
20489	Test Receiver ESU40	Rohde & Schwarz Messgerätebau GmbH / Memmingen	100030	cal	cal: 2022-Jul-20	cal: 12M	cal: 2023-Jul-20
20512	Notch Filter WRCA 800/960-02/40-6EEK (GSM 850)	Wainwright Instruments GmbH	24	chk	chk: 2022-Jun-30	chk: 12M	chk: 2023-Jun-30
20549	Log. Per. Antenna HL025	Rohde & Schwarz Messgerätebau GmbH	1000060	calchk	cal: 2021-Aug-18	cal: 36M chk: 12M	cal: 2024-Aug-18
20558	Fully Anechoic Chamber 1	ETS-Lindgren Gmbh / Taufkirchen	-	cnn	cal: - chk: -	cal: - chk: -	cal: - chk: -
20611	Power Supply E3632A	Agilent Technologies Deutschland GmbH	KR 75305854	cpu			
20670	Radio Communication Tester CMU200	Rohde & Schwarz Messgerätebau GmbH / Memmingen	106833	cal	cal: 2022-May-10	cal: 24M	cal: 2024-May-10
20690	Spectrum Analyzer FSU	Rohde & Schwarz Messgerätebau GmbH	100302/026	cal	cal: 2021-May-20	cal: 24M	cal: 2023-May-20
20720	Measurement Software EMC32 [FAC]	Rohde & Schwarz Messgerätebau GmbH	V10.xx	cnn	cal: - chk: -	cal: - chk: -	cal: - chk: -
20868	High Pass Filter AFH-07000	AtlanTecRF	16071300004	chk	chk: 2021-Jun-11	chk: 12M	chk: 2022-Jun-11
	120907 - FAC2 - Radiated Emissions			chk	chk: 2021-Aug-30	chk: 12M	chk: 2023-Jan-31
20005	AC - LISN 50 Ohm/50µH ESH2-Z5	Rohde & Schwarz Messgerätebau GmbH / Memmingen	861741/005	cal	cal: 2022-May-19	cal: 12M	cal: 2023-May-19
20133	Horn Antenna 3115 (Meas 1)	EMCO Elektronik GmbH	9012-3629	cal	cal: 2020-Apr-08	cal: 36M	cal: 2023-Apr-08
20412	Fully Anechoic Chamber 2	ETS-Lindgren Gmbh / Taufkirchen	without	cnn	cal: - chk: -	cal: - chk: -	cal: - chk: -
20729	FS-Z140	Rohde & Schwarz Messgerätebau GmbH	101004	cal	cal: 2020-May-26	cal: 36M	cal: 2023-May-26
20730	FS-Z110	Rohde & Schwarz Messgerätebau GmbH	101468	cal	cal: 2020-Jun-19	cal: 36M	cal: 2023-Jun-19
20731	FS-Z75	Rohde & Schwarz Messgerätebau GmbH / Memmingen	101022	cal	cal: 2022-May-18	cal: 36M	cal: 2025-May-18
20732	Signal- and Spectrum Analyzer FSW67	Rohde & Schwarz Messgerätebau GmbH / Memmingen	104023	cal	cal: 2022-Jun-08	cal: 12M	cal: 2023-Jun-08
20733	Harmonic Mixer FS-Z220	RPG-Radiometer Physics GmbH	101009	cal	cal: 2021-May-27	cal: 36M	cal: 2024-May-27
20734	Harmonic Mixer FS-Z325	RPG-Radiometer Physics GmbH	101005	cal	cal: 2021-May-27	cal: 36M	cal: 2024-May-27
20765	Pickett-Potter Horn Antenna FH-PP 40-60	RPG-Radiometer Physics GmbH / Meckenheim	010001	cal	cal: 2020-Sep-15	cal: 36M	cal: 2023-Sep-15
20767	Pickett-Potter Horn Antenna FH-PP 140-220	RPG-Radiometer Physics GmbH / Meckenheim	010011	cnn	cal: - chk: -	cal: - chk: -	cal: - chk: -
20811	Horn Antenna ASY-SGH-124-SMA	Antenna Systems Solutions S.L	29F14182337	cal	cal: 2021-Oct-20	cal: 36M	cal: 2024-Oct-20
20812	Pickett-Potter Horn Antenna FH-PP-325	RPG-Radiometer Physics GmbH	10024	cnn	cal: - chk: -	cal: - chk: -	cal: - chk: -
20813	Pickett-Potter Horn Antenna FH-PP 075	RPG-Radiometer Physics GmbH / Meckenheim	10006	cal	cal: 2020-Sep-09	cal: 36M	cal: 2023-Sep-09
20814	Pickett-Potter Horn Antenna FH-PP 140	RPG-Radiometer Physics GmbH	10008	cnn	cal: - chk: -	cal: - chk: -	cal: - chk: -

ID	Description	Manufacturer	SerNo	CheckType	Last Check	Interval	Next Check
20815	Pickett-Potter Horn Antenna FH-PP 110	RPG-Radiometer Physics GmbH	10014	cal	cal: 2020-Sep-04	cal: 36M	cal: 2023-Sep-04
20816	SGH Antenna SGH-26-WR10	Anteral S.L.	1144	cnn	cal: - chk: -	cal: - chk: -	cal: - chk: -
20817	Waveguide Rectangular Horn Antenna SAR-2309-22-S2	ERAVAN	13254-01	cal	cal: 2020-Jul-29	cal: 36M	cal: 2023-Jul-29
20836	1-18 GHz Amplifier	Wright Technologies, Inc., Inc.	0001	chk		chk: 36M	
20877	JS42-08001800-16-8P Verstärker	Miteq Inc.	2079991 / 2079992	chk	chk: 2020-Feb-27	chk: 36M	chk: 2020-May-27
20907	Waveguide WR-15 attenuator STA-30-15-M2	SAGE Millimeter Inc.	13256-01	cnn	cal: - chk: -	cal: - chk: -	cal: - chk: -
20908	Waveguide WR 10 attenuator STA-30-10-M2	SAGE Millimeter Inc.	13256-01	cnn	cal: - chk: -	cal: - chk: -	cal: - chk: -
20909	Waveguide Horn Antenna PE9881-24	Pasternack Enterprises, Inc.	37/2016	cnn	cal: - chk: -	cal: - chk: -	cal: - chk: -
20910	Frequency Multiplier 936VF-10/385	MI-Wave, Millimeter Wave Products Inc.	142	cnn	cal: - chk: -	cal: - chk: -	cal: - chk: -
20911	Frequency Multiplier 938WF-10/387	MI-Wave, Millimeter Wave Products Inc.	141	cnn	cal: - chk: -	cal: - chk: -	cal: - chk: -
20912	Low noise Amplifier Module 0.5-4GHz	RF-Lambda Europe GmbH	19041200083	cnn	cal: - chk: -	cal: - chk: -	cal: - chk: -
20913	Phase Amplitude Stable Cable Assembly DC-40GHz	RF-Lambda Europe GmbH	AC19040001	cnn	cal: - chk: -	cal: - chk: -	cal: - chk: -

Tools used in 'P2M1'

4.11.1 Legend

Note / remarks	Interval of calibration & Verification
12M	12 months
24M	24 months
36M	36 months
10Y	10 Years

Abbreviation Check Type	Description
cnn	Calibration and verification not necessary
cal	Calibration
calchk	Calibration plus intermediate Verification
chk	Verification
cpu	Verification before usage

5 Results from external laboratory

None	-

6 Opinions and interpretations

None	-

7 List of abbreviations

None	-

8 Measurement Uncertainty valid for conducted/radiated measurements

The reported uncertainties are calculated based on the standard uncertainty multiplied with the appropriate coverage factor **k**, such that a confidence level of approximately 95% is achieved. For uncertainty determination, each component used in the concrete measurement set-up was taken in account and it contribution to the overall uncertainty according its statistical distribution calculated.

Measurement type	Frequency range of measurement		Calculated Uncertainty based on confidence level of 95.54%	Remarks
	Start [MHz]	Stop [MHz]		
Magnetic field strength	0.009	30	4.86	Magnetic loop antenna, Pre-amp on
RF-Output power (eirp) Unwanted emissions (eirp) [dB]	30	100	4.57	without Pre-Amp
	30	100	4.91	with PreAmp
	100	1000	4.02	without Pre-Amp
	100	1000	4.26	with PreAmp
	1000	18000	4.36	without Pre-Amp
	1000	18000	5.23	with PreAmp
	18000	33000	4.92	Schwarzbeck BBHA9170 (#20302) Antenna set-up non-waveguide antenna)
	33000	50000	4.17	Set-up for Q-Band (WR-22), non-wave guide antenna
	40000	60000	4.69	Set-up U-Band (WR-19), non-waveguide antenna
	50000	75000	4.06	External Mixer set-up V-Band (WR-15)
	75000	110000	4.17	External Mixer set-up W-Band (WR-6)
	90000	140000	5.49	External Mixer set-up F-Band (WR-8)
	140000	225000	6.22	External Mixer set-up G-Band (WR-5)
	225000	325000	7.04	External Mixer set-up (WR-3)
	325000	500000	8.84	External Mixer set-up (WR-2.2)
Radiated Blocking [dB]	1000	18000	2.85	Typical set-up with microwave generator and antenna, value for 7GHz calculated
	18000	33000	4.66	Typical set-up with microwave generator and antenna
	33000	50000	3.48	WR-22 set-up
	50000	75000	3.73	WR-15 set-up
	75000	110000	4.26	WR-6 set-up
Frequency Error [kHz]	40000	77000	276.19	calculated for 77 GHz (FMCW) carrier
	6000	7000	33.92	calculated for 6.5GHz UWB Ch.5
TS 8997 conducted Parameters	30	6000	1.11	1. Power measurement with Fast-sampling-detector
	30	6000	1.20	2. Power measurement with Spectrum-Analyzer
	30	6000	1.20	3. Power Spectrum-Density measurement
	30	7500	1.20	4. Conducted Spurious emissions:
	0.009	30	2.56	5. Conducted Spurious emissions:
	2.4	2.48	1.95 ppm	6a. Bandwidth / 2-Marker Method for 2.4GHz ISM
	5.18	5.825	7.180 ppm	6b. Bandwidth / 2-Marker Method for 5GHz WLAN
	5.18	5.825	1.099 ppm	7 Frequency (Marker method) for 5GHz WLAN
	30	6000	0.11561µs	8 Medium-Utilization factor / Timing
	30	6000	1.85	9 Blocking-Level of companion device
	30	6000	1.62	9 Blocking Generator level
Conducted emissions	0.009	30	3.57	

9 Versions of test reports (change history)

Version	Applied changes	Date of release
--	Initial release	2023-Jan-20
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End Of Test Report