R F – T E S T R E P O R T

- FCC Part 15.255, RSS-210 -

Type / Model Name	:	KY-LOC 1D.02.01
Product Description	:	Radar sensor
		HVIN: 1.1.1.1.2
Applicant	:	Kymati GmbH
Address	:	Am Hochacker 5
		85630 GRASBRUNN, GERMANY
Manufacturer	:	Kymati GmbH
Address	:	Am Hochacker 5
		85630 GRASBRUNN, GERMANY

Test Result according to the standards listed in clause 1 test standards:	**POSITIVE**

Test Report No. : 80146142-02 Rev_2	18. April 2024 Date of issue

Deutsche Akkreditierungsstelle
D-PL-12030-01-03
D-PL-12030-01-04

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1 TEST STANDARDS

The tests were performed according to following standards:

FCC Rules and Regulations Part 15, Subpart A - General (April 2024)

Part 15, Subpart A, Section 15.31	Measurement standards
Part 15, Subpart A, Section 15.33	Frequency range of radiated measurements
Part 15, Subpart A, Section 15.35	Measurement detector functions and bandwidths

FCC Rules and Regulations Part 15, Subpart C - Intentional Radiators (April 2024)

Part 15, Subpart C, Section 15.203	Antenna requirement
Part 15, Subpart C, Section 15.204	External radio frequency power amplifiers and antenna modifications
Part 15, Subpart C, Section 15.205	Restricted bands of operation
Part 15, Subpart C, Section 15.207	Conducted limits
Part 15, Subpart C, Section 15.209	Radiated emission limits, general requirements
Part 15, Subpart C, Section 15.255	Operation within the band 57-71 GHz.
ANSI C63.10: 2020	Testing Unlicensed Wireless Devices

ISED Canada Rules and Regulations

RSS-Gen, Issue 5 + Amendment 1 + 2	General Requirements for Compliance of Radio Apparatus
RSS-210, Issue 10 + Amendment 1	Licence-Exempt Radio Apparatus: Category I Equipment
ANSI C63.10: 2020	Testing Unlicensed Wireless Devices

2 EQUIPMENT UNDER TEST

2.1 Information provided by the Client

Please note, we do not take any responsibility for information provided by the client or his representative which may have an influence on the validity of the test results.

2.2 Sampling

The customer is responsible for the choice of sample. Sample configuration, start-up and operation is carried out by the customer or according his/her instructions.

2.3 Photo documentation of the EUT – Detailed photos see ATTACHMENT A

2.4 Equipment type

The EUT qualifies under FCC §15.255(c)(2)(v) / §15.255(c)(2) as a field disturbance sensor,
and under RSS-210 2.1(a) as a field disturbance sensor for fixed operation.

2.5 Short description of the equipment under test (EUT)

The EUT is a radar sensor in the operating band 61.0 GHz to 61.5 GHz and 60 GHz to 64 GHz. It determines the distance in primary or secondary radar mode. The front panel is equipped with a lense which enhances the gain of antenna 2.

Number of tested samples:	1
Serial number:	02065
Firmware ID:	3D.02

2.6 Variants of the EUT

There are no variants.

2.7 Operation frequency and channel plan

Operating frequency range 1: 61.0 GHz to 61.5 GHz

Operating frequency range 2: 60.0 GHz to 64.0 GHz.

2.8 Transmit operating modes

Two operation modes with two operating frequency ranges are available:

Primary radar mode	0.5 GHz OBW for operating frequency range 1 or 4 GHz OBW for operating frequency range 2, FMCW, passive reflection
Secondary radar mode	0.5 GHz OBW for operating frequency range 1 or 4 GHz OBW for operating frequency range 2, FMCW and FSK (The communication link between device 1 and device 2 uses the FSK), two way ranging, active reflection

2.9 Antenna

The following antennas shall be used with the EUT:

- Antenna 2 Integrated linear polarised micro strip antenna (max gain of antenna + lense: 22.5 dBi)

Note: There are two additional antennas 0 and 1 which are not equipped with an additional lense and therefore are not used in this model configuration.

2.10 Power supply system utilised

Power supply voltage	:	9 – 36 V/DC
Alternative power supply PoE	:	53.5 V/DC

2.11 Peripheral devices and interface cables

The following peripheral devices and interface cables are connected during the measurements:

- Notebook Model : ThinkPad
- AC adaptor notebook Model : Lenovo ADLX65YLC3A
- Switch with PoE+ Model : tp-link TL-SG1005P
- AC adaptor PoE switch Model : Tp-link T535131-2-DT
- LAN cable Model : CAT6 M12-RJ45

2.12 Determination of worst-case conditions for final measurement

Exploratory measurements have been made in all three orthogonal axes and the settings of the EUT are changed to locate at which position and at what setting the EUT produces the maximum of the emissions. For the further measurement, the EUT is set in X position while the receiving antenna is in vertical polarisation (in co-polarisation with EUT antennas).

As worst case, the following channels and test modes are selected for the final test:

Operating frequency range 1:

Frequency range (GHz)	Power setting	Used antenna	Modulation	Modulation type
61.0 - 61.5	P0	2	FMCW and FSK	CW

Operating frequency range 2:

Frequency range (GHz)	Power setting	Used antenna	Modulation	Modulation type
60.0 – 64.0	P24	2	FMCW and FSK	CW

Note: Only secondary mode was tested, as this mode is considered as worst case.

2.12.1 Test jig

No test jig is used.

2.12.2 Test software

For test mode TX CW and secondary radar mode, the Kymati Commander Software provided by the customer is used.

3 TEST RESULT SUMMARY

Operating in the 61.0 - 61.5 GHz band and in the 57 - 71 GHz band:

FCC Rule Part	RSS Rule Part	Description	Result
15.207(a)	RSS-Gen 8.8	AC power line conducted emissions	passed
15.255(c)(2)(v)* 15.255(c)(2)**	RSS-210 J.2.1a	EIRP	passed
15.255(d) 15.209(a)	RSS-210 J.3 RSS-Gen 8.9	Spurious emissions	passed
15.255(c)(2)** 15.255(e)*	RSS-210 J.4	Peak conducted output power	passed
15.255(c)(2)(v)* 15.255(e)(1)	RSS-210 J.4 RSS-Gen, 6.7	Emission bandwidth, 99% bandwidth	passed
15.255(f)	RSS-210 J.6	Frequency stability	passed
15.203	-	Antenna requirement	passed

Note* Applicable only for mode 1: Operating frequency range 61.0 – 61.5 GHz
Note** Applicable only for mode 2: Operating frequency range 60.0 – 64.0 GHz

3.1 Revision history of test report

Test report No	Rev.	Issue Date	Changes
801416142-02	0	31 July 2023	Initial test report
801416142-02	1	12 December 2023	2.4 updated; 5.6 results with PoE supply added
801416142-02	2	18 April 2024	2.12 test mode changed to sweeping mode; 5.2 – 5.5 results updated

The test report with the highest revision number replaces the previous test reports.

3.2 Final assessment

The equipment under test fulfils the requirements cited in clause 1 test standards.

Date of receipt of test sample : acc. to storage records

Testing commenced on : 19 January 2023

Testing concluded on : 18 April 2024

Checked by:

Thomas Weise
Digitally signed by Thomas Weise
Date: 2024.04.18 18:10:05 +02'00'

Thomas Weise
Laboratory Manager

Tested by:

Sabine Kugler
2024.04.18 16:05:33 +02'00'

Sabine Kugler
Radio Team

4 TEST ENVIRONMENT

4.1 Address of the test laboratory

CSA Group Bayern GmbH
Ohmstrasse 1-4
94342 STRASSKIRCHEN
GERMANY

4.2 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature:	15 - 35 °C
Humidity:	30 - 60 %
Atmospheric pressure:	86 - 106 kPa

4.3 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. It is noted that the expanded measurement uncertainty corresponds to the measurement results from the standard measurement uncertainty multiplied by the coverage factor k = 2. The true value is located in the corresponding interval with a probability of 95 %. The measurement uncertainty was calculated for all measurements listed in this test report on basis of the ETSI Technical Report TR 100 028 Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 1 and Part 2. The results are documented in the quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Measurement Type	Range	Confidence Level	Calculated Uncertainty
AC power line conducted emissions	0.15 MHz to 30 MHz	95%	± 3.29 dB
Output power ERP, radiated	40000 MHz to 110000 MHz	95%	± 5.41 dB
Field strength of the fundamental	1000 MHz to 40000 MHz	95%	± 2.34 dB
Field strength of the fundamental	40000 MHz to 110000 MHz	95%	± 5.41 dB
Power spectral density	40000 MHz to 110000 MHz	95%	± 5.41 dB
Spurious Emissions, conducted	9 kHz to 10000 MHz	95%	± 2.15 dB
Spurious Emissions, conducted	10000 MHz to 40000 MHz	95%	± 3.47 dB
Spurious Emissions, radiated	9 kHz to 30 MHz	95%	± 3.53 dB
Spurious Emissions, radiated	30 MHz to 1000 MHz	95%	± 4.44 dB
Spurious Emissions, radiated	1000 MHz to 40000 MHz	95%	± 2.89 dB
Spurious Emissions, radiated	40000 MHz to 60000 MHz	95%	± 5.04 dB
Spurious Emissions, radiated	60000 MHz to 90000 MHz	95%	± 5.04 dB
Spurious Emissions, radiated	75000 MHz to 110000 MHz	95%	± 5.04 dB
Spurious Emissions, radiated	110000 MHz to 170000 MHz	95%	± 5.04 dB
Spurious Emissions, radiated	140000 MHz to 220000 MHz	95%	± 5.04 dB

4.4 Conformity Decision Rule

The applied conformity decision rule is based on ILAC G8:09/2019 clause 4.2.1 Binary Statement for Simple Acceptance Rule ($w = 0$).
Details can be found in the procedure CSA_B_V50_29.

4.5 Measurement protocol for FCC and ISED

4.5.1 General information

CSA Group Bayern GmbH is recognized as wireless testing laboratory under the CAB identifier:

FCC: DE 0011
ISED: DE0009

4.5.2 General Standard information

The test methods used comply with ANSI C63.10 - "Testing Unlicensed Wireless Devices".

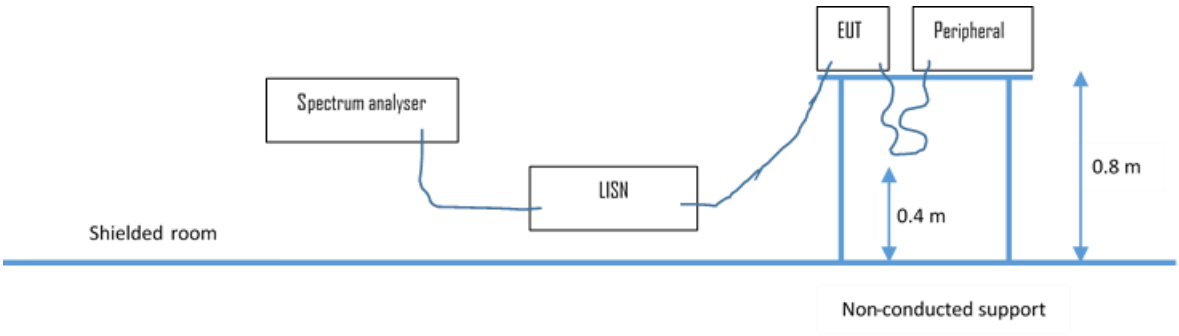
4.5.2.1 Justification

The equipment under test (EUT) is configured in a typical user arrangement in accordance with the manufacturer's instructions.

4.5.3 Details of test procedures

4.5.3.1 Conducted emission

Test setup according ANSI C63.10



The final level, expressed in dBμV, is arrived at by taking the reading directly from the Spectrum analyser. This level is compared to the limit.

To convert between dBμV and μV, the following conversions apply:

dBμV = 20(log μV)

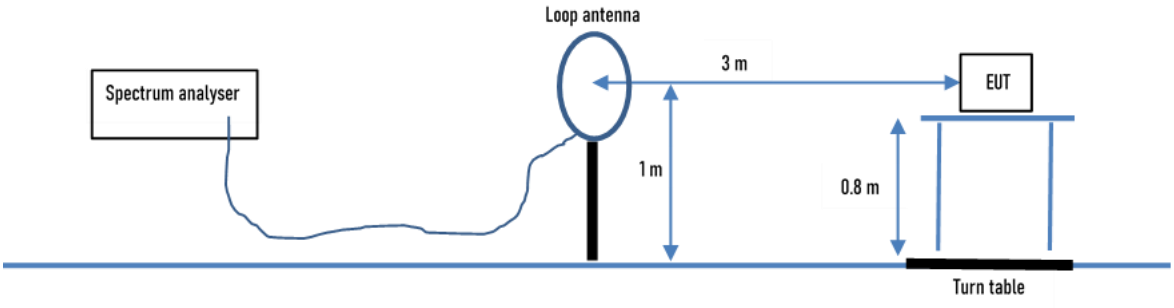
μV = Inverse log(dBμV/20)

Conducted emissions on the 50 Hz and/or 60 Hz power interface of the EUT are measured in the frequency range of 150 kHz to 30 MHz. The measurements are performed using a receiver, which has CISPR characteristic bandwidth and quasi-peak detection and a Line Impedance Stabilization Network (LISN) with 50 Ω / 50 μH (CISPR 16) characteristics. The receiver is protected by means of an impedance matched pulse limiter connected directly to the RF input. Table top equipment is placed on a non-conducting table 80 centimetres above the floor and is positioned 40 centimetres from the vertical ground plane (wall) of the screen room. If the minimum limit margin appears to be less than 20 dB with a peak mode measurement, the emission is re-measured using a tuned receiver with quasi-peak and average detection and recorded on the data sheets.

4.5.3.2 Radiated emission

4.5.3.2.1 OATS1 test site (9 kHz - 30 MHz):

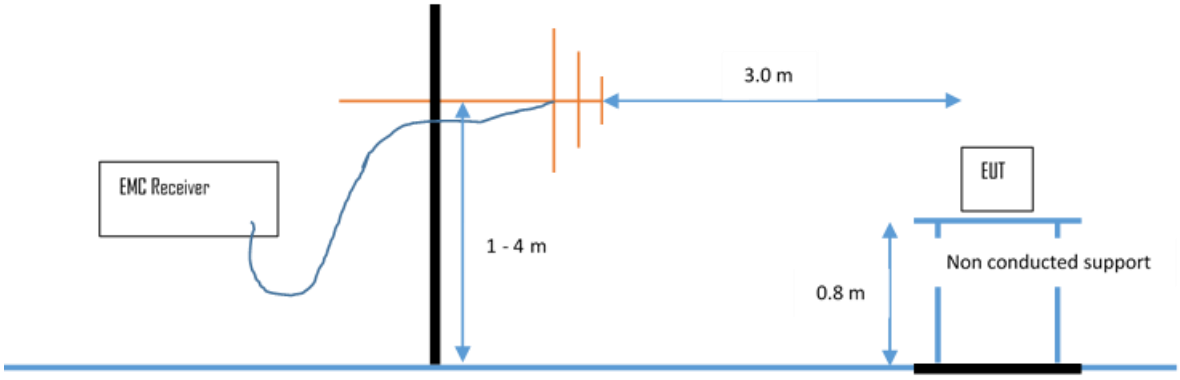
Test setup according ANSI C63.10



Emissions from the EUT are measured in the frequency range of 9 MHz to 30 MHz using a tuned receiver and a calibrated loop antenna. Table top equipment is placed on a 1.0 X 1.5 m non-conducting table 80 centimetres above the ground plane. Cables to simulators/testers (if used in this test) are routed through the center of the table and to a screened room located outside the test area. The antenna is positioned 3, 10 or 30 metres horizontally from the EUT and is repeated vertically. To locate maximum emissions from the test sample the antenna is varied along the site axis and the EUT is rotated 360 degrees.

4.5.3.2.2 OATS1 test site (30 MHz - 1 GHz):

Test setup according ANSI C63.10.



Spurious emissions from the EUT are measured in the frequency range of 30 MHz to 1000 MHz using a tuned receiver and appropriate broadband linearly polarised antennas. Measurements between 30 MHz and 1000 MHz are made with 120 kHz/6 dB bandwidth and quasi-peak detection. Table top equipment is placed on a 1.0 X 1.5 m non-conducting table 80 centimetres above the ground plane. Floor standing equipment is placed directly on the turntable/ground plane. Cables to simulators/testers (if used in this test) are routed through the center of the table and to a screened room located outside the test area. To locate maximum emissions from the test sample the antenna is varied in height from 1 to 4 metres and the EUT is rotated 360 degrees. The final level in dBµV/m is calculated by taking the reading from the EMI receiver (Level dBµV) and adding the correction factors and cable loss factor (dB). The FCC limit is subtracted from this result in order to provide the limit margin listed in the measurement protocol.

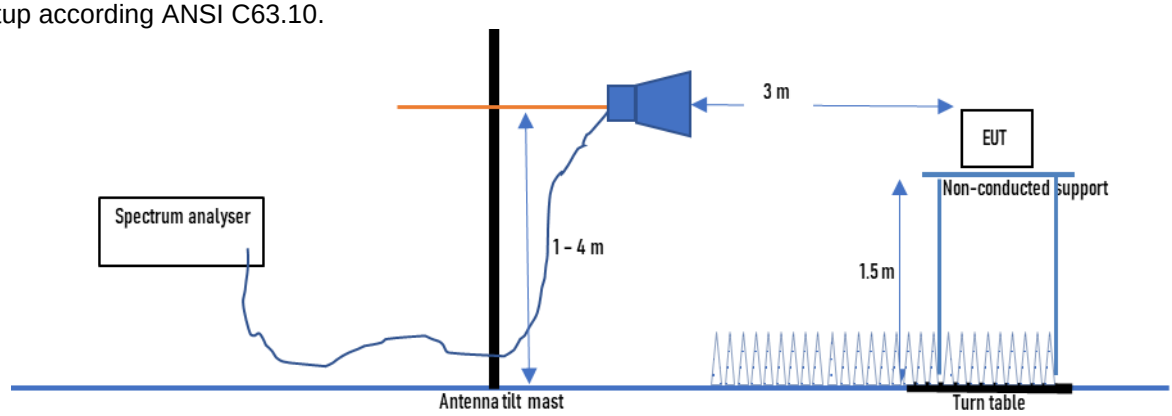
The resolution bandwidth setting:
30 MHz – 1000 MHz: RBW: 120 kHz

Example:

Frequency (MHz)	Level (dBµV)	+	Factor (dB)	=	Level (dBµV/m)	-	Limit (dBµV/m)	=	Delta (dB)
719.0	75.0	+	32.6	=	107.6	-	110.0	=	-2.4

4.5.3.2.3 Anechoic chamber 1 (1000 MHz – 18000 MHz)

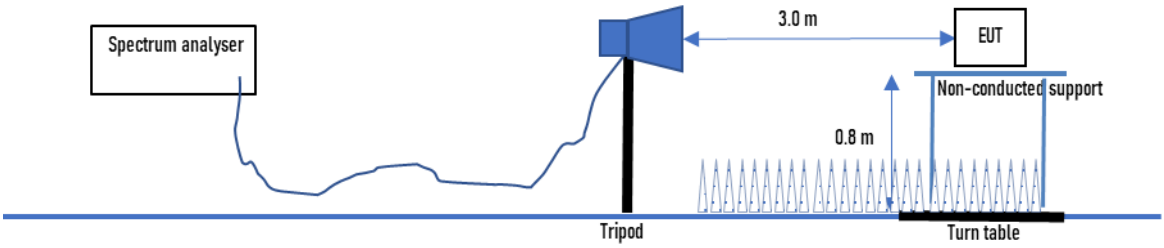
Test setup according ANSI C63.10.



Radiated emissions from the EUT are measured in the frequency range 1 GHz up to 18 GHz as specified in 47 CFR Part 15, Subpart A, Section 15.33, using a spectrum analyser and appropriate linearly polarized antennas. Table top equipment is placed on a non-conducting table, 1.5 metre above the ground plane. The turntable is fully covered with the appropriate absorber (Type VHP-12). Any controlling device is positioned such that it does not significantly influence the measurement results. Interconnecting cables that hang closer than 40 cm to the ground plane are folded back and forth in the center, forming a bundle 30 cm to 40 cm long. Measurements are made in in three orientations of the EUT and the horizontal and vertical polarization planes of measurement antenna in a fully

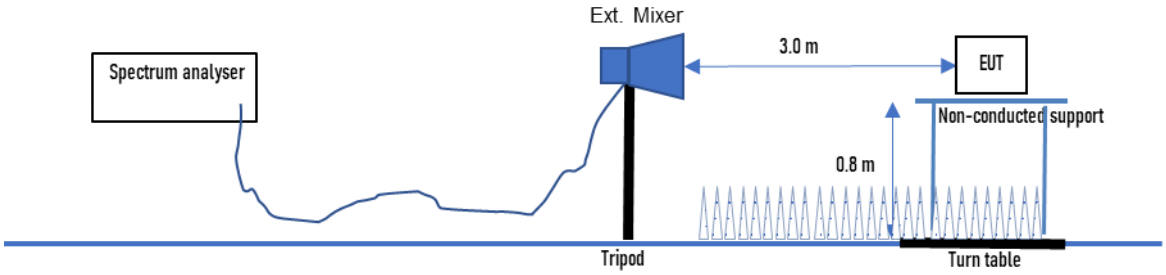
anechoic room. The measurement antenna is adjusted and the EUT orientated to permit the measurement of the maximum emission from the EUT. The conditions determined as worst-case will then be used for the final measurements.

4.5.3.2.4 Anechoic chamber 1 (18 GHz – 40 GHz)



Emissions from the EUT are measured in the frequency range 18 GHz up to 40 GHz as specified in 47 CFR Part 15, Subpart A, Section 15.33, using a spectrum analyser and appropriate linearly polarized antennas. Table top equipment is placed on a non-conducting table, 0.8 metre above the ground plane. The turntable is fully covered with the appropriate absorber (Type VHP-12). Any controlling device is positioned such that it does not significantly influence the measurement results. Interconnecting cables that hang closer than 40 cm to the ground plane are folded back and forth in the center, forming a bundle 30 cm to 40 cm long. Measurements are made in in three orientations of the EUT and the horizontal and vertical polarization planes of measurement antenna in a fully anechoic room. The measurement antenna is adjusted and the EUT orientated to permit the measurement of the maximum emission from the EUT. The conditions determined as worst-case will then be used for the final measurements. Where appropriate, the test distance may be reduced in order to detect emissions under better uncertainty. The limit are adopted.

4.5.3.2.1 Anechoic chamber 1 (40 GHz – 200 GHz)



Emissions from the EUT are measured in the frequency range 40 GHz up to 200 GHz as specified in 47 CFR Part 15, Subpart A, Section 15.33, using a spectrum analyser and external mixer with standard gain horn. Table top equipment is placed on a non-conducting table, 0.8 metre above the ground plane. The turntable is fully covered with the appropriate absorber (Type VHP-12). Any controlling device is positioned such that it does not significantly influence the measurement results. Interconnecting cables that hang closer than 40 cm to the ground plane are folded back and forth in the center, forming a bundle 30 cm to 40 cm long. Measurements are made in in three orientations of the EUT and the horizontal and vertical polarization planes of measurement antenna in a fully anechoic room. The measurement antenna is adjusted and the EUT orientated to permit the measurement of the maximum emission from the EUT. The conditions determined as worst-case will then be used for the final measurements. Where appropriate, the test distance may be reduced in order to detect emissions under better uncertainty. The limit are adopted.

5 TEST CONDITIONS AND RESULTS

5.1 AC power line conducted emissions

For test instruments and accessories used see section 6 Part **A 4**.

5.1.1 Description of the test location

Test location: Shielded Room S2

5.1.2 Photo documentation of the test set-up

See Attachment B for detailed photo documentation of the test set-up.

5.1.3 Applicable standard

According to FCC Part 15, Section 15.207(a):
Except as shown in paragraphs (b) and (c) of this Section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the given limits.

According to RSS-Gen 8.8:
Unless stated otherwise in the applicable RSS, for radio apparatus that are designed to be connected to the public utility AC power network, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the range 150 kHz to 30 MHz shall not exceed the limits in table 4, as measured using a 50 µH / 50 Ω line impedance stabilization network. This requirement applies for the radio frequency voltage measured between each power line and the ground terminal of each AC power-line mains cable of the EUT.

5.1.4 Description of Measurement

The measurements are performed following the procedures set out in ANSI C63.10 described under item 4.4.3. If the minimum limit margin appears to be less than 20 dB with a peak mode measurement, the emissions are re-measured using a tuned receiver with quasi-peak and average detection and recorded on the data sheets.

5.1.5 Test result

Frequency range: 0.15 MHz - 30 MHz

Min. limit margin -7.6 dB at 0.476 MHz

Limit according to FCC Part 15, Section 15.207(a):

Frequency of Emission (MHz)	Conducted limit (dBµV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency

Limit according to RSS-Gen 8.8:

Frequency of Emission (MHz)	Conducted limit (dBµV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency

The requirements are **FULFILLED.**

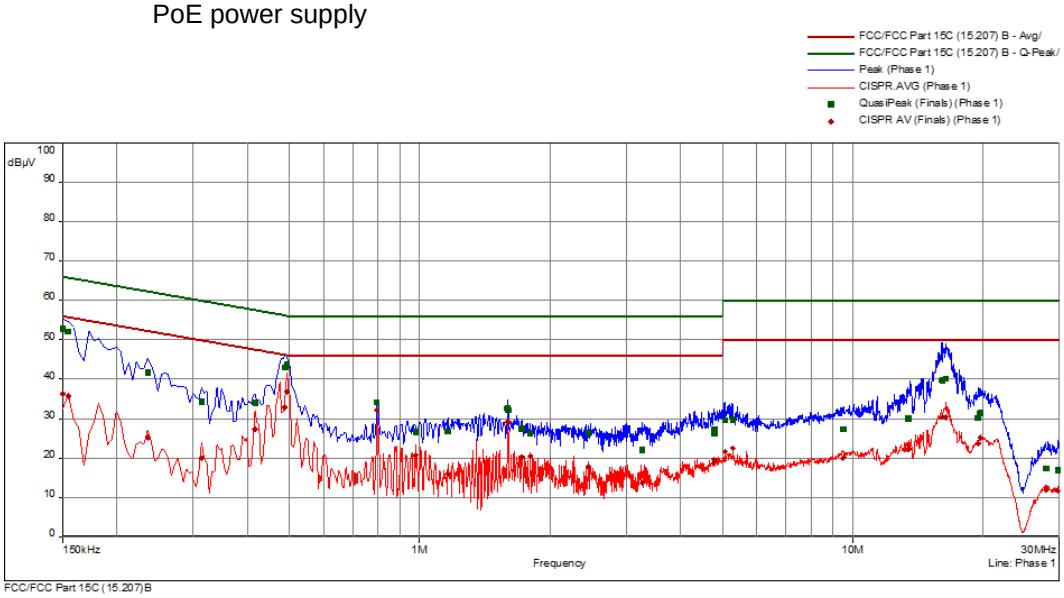
Remarks: For detailed test result please refer to following test protocols.

PoE power supply: AC adapter TP-Link, model T535131-2-DT

DC powered mode performed with commercially available laboratory DC power supply HM8143.

5.1.6 Test protocol

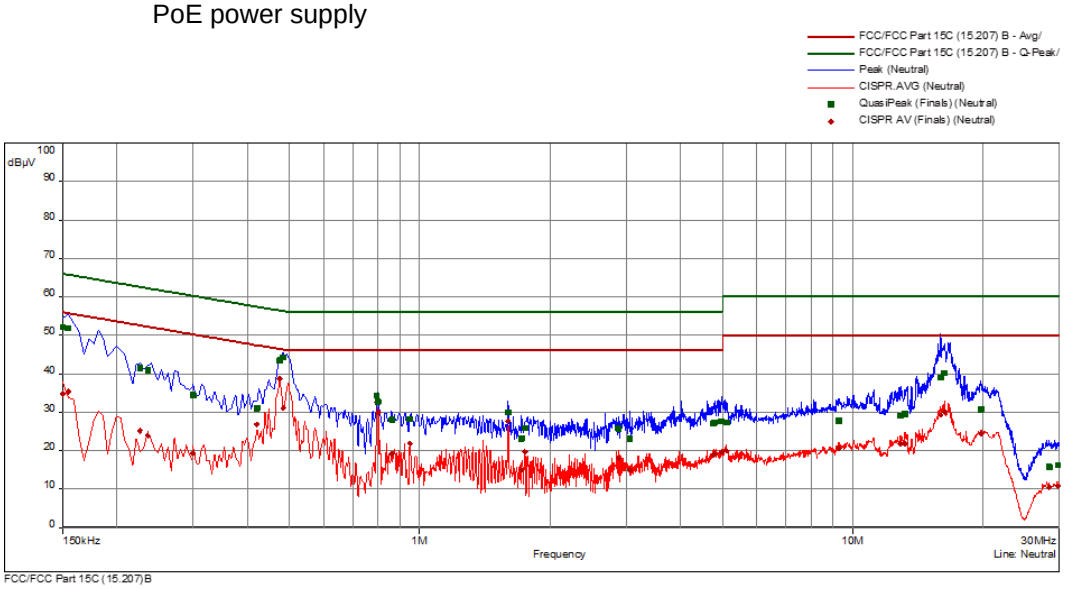
Test point L1 Result: passed
Operation mode: TX
Remarks: PoE power supply



freq	SR	QP	margin	limit	AV	margin	limit	line	corr
MHz		dB(µV)	dB	dB	dB(µV)	dB	dB		dB
0.150	1	52.8	-13.2	66.0	36.3	-19.8	56.0	Phase 1	10.1
0.155	1	52.2	-13.6	65.8	35.7	-20.0	55.8	Phase 1	10.1
0.236	1	41.7	-20.6	62.3	25.2	-27.1	52.3	Phase 1	10.1
0.314	2	34.3	-25.6	59.9	20.0	-29.9	49.9	Phase 1	10.1
0.417	2	34.1	-23.4	57.5	27.4	-20.1	47.5	Phase 1	10.2
0.489	2	42.9	-13.3	56.2	32.9	-13.3	46.2	Phase 1	10.2
0.494	2	43.7	-12.4	56.1	36.8	-9.3	46.1	Phase 1	10.2
0.798	3	34.2	-21.8	56.0	32.1	-13.9	46.0	Phase 1	10.2
0.978	3	26.6	-29.4	56.0	20.6	-25.4	46.0	Phase 1	10.2
1.163	3	26.8	-29.2	56.0	16.0	-30.0	46.0	Phase 1	10.2
1.596	4	32.6	-23.4	56.0	29.2	-16.8	46.0	Phase 1	10.3
1.601	4	32.3	-23.8	56.0	29.0	-17.0	46.0	Phase 1	10.3
1.722	4	27.5	-28.5	56.0	20.1	-25.9	46.0	Phase 1	10.3
1.799	4	26.3	-29.7	56.0	20.5	-25.5	46.0	Phase 1	10.3
2.450	5	26.3	-29.7	56.0	17.7	-28.4	46.0	Phase 1	10.3
3.264	5	22.1	-33.9	56.0	13.7	-32.4	46.0	Phase 1	10.3
4.781	5	26.3	-29.8	56.0	18.8	-27.2	46.0	Phase 1	10.4
4.790	5	27.4	-28.6	56.0	19.6	-26.4	46.0	Phase 1	10.4
5.070	6	29.6	-30.4	60.0	21.6	-28.4	50.0	Phase 1	10.4
5.295	6	29.8	-30.2	60.0	22.5	-27.6	50.0	Phase 1	10.4
9.503	6	27.2	-32.8	60.0	20.0	-30.0	50.0	Phase 1	10.6
9.525	6	27.3	-32.7	60.0	20.1	-29.9	50.0	Phase 1	10.6
13.425	7	30.1	-29.9	60.0	22.2	-27.9	50.0	Phase 1	10.8
13.484	7	30.0	-30.0	60.0	22.4	-27.7	50.0	Phase 1	10.8
16.062	7	39.7	-20.3	60.0	30.4	-19.6	50.0	Phase 1	10.9
16.391	7	40.2	-19.8	60.0	30.3	-19.7	50.0	Phase 1	10.9
19.443	8	30.2	-29.8	60.0	23.7	-26.3	50.0	Phase 1	10.9
19.709	8	31.4	-28.6	60.0	25.0	-25.0	50.0	Phase 1	10.9
27.939	8	17.3	-42.7	60.0	11.9	-38.1	50.0	Phase 1	10.9
29.775	8	17.0	-43.0	60.0	11.7	-38.3	50.0	Phase 1	10.9

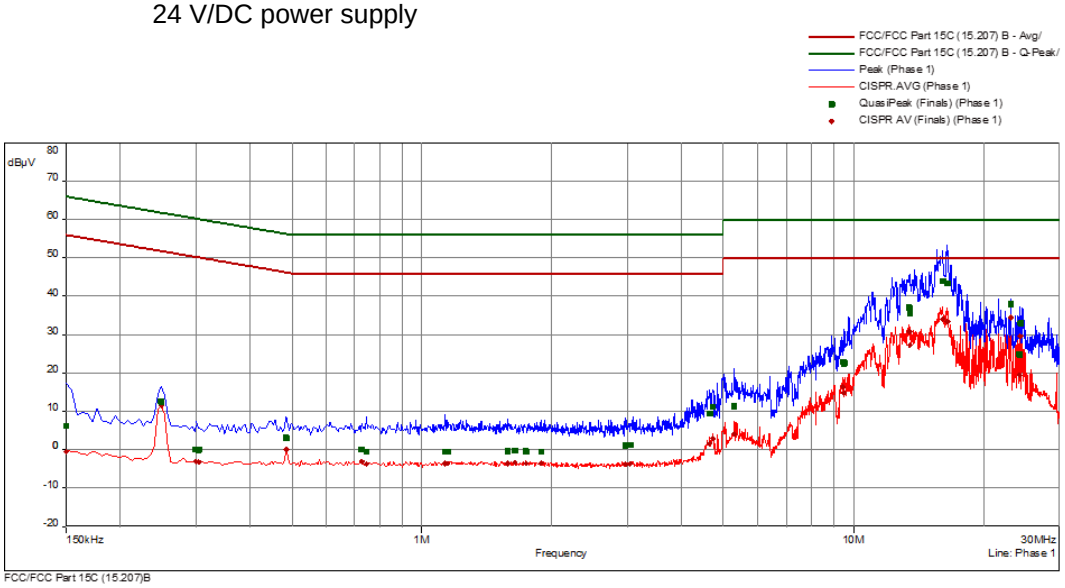
Test point: N
Operation mode: TX
Remarks: PoE power supply

Result: passed



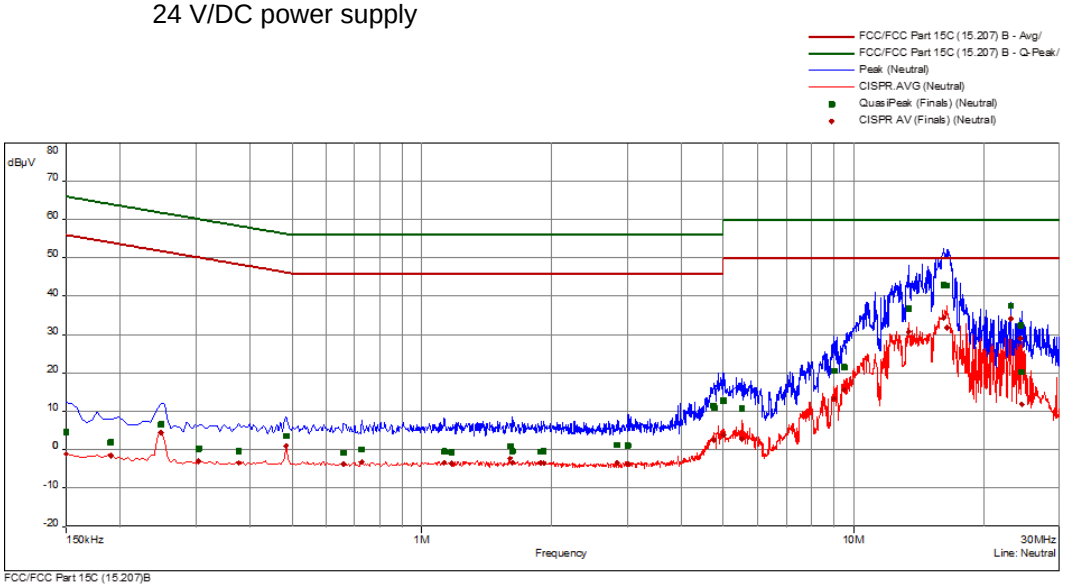
freq	SR	QP	margin	limit	AV	margin	limit	line	corr
MHz		dB(µV)	dB	dB	dB(µV)	dB	dB		dB
0.150	9	52.2	-13.8	66.0	34.8	-21.2	56.0	Neutral	10.1
0.155	9	51.9	-13.9	65.8	35.4	-20.4	55.8	Neutral	10.1
0.227	9	41.5	-21.1	62.6	25.2	-27.3	52.6	Neutral	10.2
0.236	9	41.0	-21.3	62.3	23.9	-28.3	52.3	Neutral	10.2
0.300	10	34.5	-25.8	60.2	19.4	-30.9	50.2	Neutral	10.2
0.422	10	31.0	-26.4	57.4	26.9	-20.6	47.4	Neutral	10.2
0.476	10	43.6	-12.8	56.4	38.8	-7.6	46.4	Neutral	10.2
0.485	10	44.3	-12.0	56.3	31.0	-15.2	46.3	Neutral	10.2
0.798	11	34.4	-21.6	56.0	32.6	-13.4	46.0	Neutral	10.2
0.803	11	32.9	-23.2	56.0	29.9	-16.1	46.0	Neutral	10.2
0.861	11	28.2	-27.8	56.0	19.2	-26.8	46.0	Neutral	10.2
0.951	11	28.4	-27.7	56.0	21.9	-24.1	46.0	Neutral	10.2
1.601	12	30.1	-25.9	56.0	27.7	-18.3	46.0	Neutral	10.3
1.718	12	23.3	-32.8	56.0	15.0	-31.0	46.0	Neutral	10.3
1.749	12	26.0	-30.0	56.0	19.7	-26.3	46.0	Neutral	10.3
2.877	13	25.8	-30.2	56.0	18.1	-27.9	46.0	Neutral	10.3
3.062	13	23.2	-32.9	56.0	15.0	-31.0	46.0	Neutral	10.3
4.767	13	27.1	-28.9	56.0	19.0	-27.1	46.0	Neutral	10.4
4.800	13	27.3	-28.7	56.0	19.2	-26.8	46.0	Neutral	10.4
4.980	14	27.7	-28.3	56.0	19.6	-26.4	46.0	Neutral	10.4
5.102	14	27.5	-32.6	60.0	20.1	-29.9	50.0	Neutral	10.4
9.282	14	27.7	-32.3	60.0	20.6	-29.4	50.0	Neutral	10.6
9.287	14	28.1	-32.0	60.0	20.8	-29.2	50.0	Neutral	10.6
12.903	15	29.2	-30.8	60.0	21.8	-28.2	50.0	Neutral	10.8
13.182	15	29.6	-30.4	60.0	21.8	-28.2	50.0	Neutral	10.8
15.945	15	39.1	-20.9	60.0	29.2	-20.8	50.0	Neutral	10.9
16.283	15	40.2	-19.8	60.0	30.2	-19.8	50.0	Neutral	10.9
19.740	16	30.9	-29.1	60.0	24.5	-25.5	50.0	Neutral	11.1
19.781	16	30.8	-29.2	60.0	24.4	-25.6	50.0	Neutral	11.1
28.416	16	15.9	-44.1	60.0	10.5	-39.5	50.0	Neutral	10.8
29.717	16	16.2	-43.8	60.0	10.9	-39.2	50.0	Neutral	10.8

Test point L1 Result: passed
Operation mode: TX
Remarks: 24 V/DC power supply



freq	SR	QP	margin	limit	AV	margin	limit	line	corr
MHz		dB(µV)	dB	dB	dB(µV)	dB	dB		dB
0.150	1	6.2	-59.8	66.0	-0.4	-56.4	56.0	Phase 1	10.1
0.249	1	12.6	-49.2	61.8	11.6	-40.2	51.8	Phase 1	10.1
0.300	2	0.2	-60.1	60.2	-3.0	-53.3	50.2	Phase 1	10.1
0.305	2	0.0	-60.1	60.1	-3.1	-53.2	50.1	Phase 1	10.1
0.485	2	3.2	-53.0	56.3	0.2	-46.1	46.3	Phase 1	10.2
0.726	3	0.1	-55.9	56.0	-3.0	-49.0	46.0	Phase 1	10.2
0.744	3	-0.5	-56.5	56.0	-3.6	-49.6	46.0	Phase 1	10.2
1.131	3	-0.5	-56.5	56.0	-3.5	-49.5	46.0	Phase 1	10.2
1.149	3	-0.5	-56.5	56.0	-3.5	-49.5	46.0	Phase 1	10.2
1.583	4	-0.2	-56.2	56.0	-3.4	-49.4	46.0	Phase 1	10.3
1.646	4	-0.1	-56.1	56.0	-3.2	-49.2	46.0	Phase 1	10.3
1.745	4	-0.4	-56.4	56.0	-3.5	-49.5	46.0	Phase 1	10.3
1.889	4	-0.5	-56.5	56.0	-3.5	-49.5	46.0	Phase 1	10.3
2.967	5	1.1	-54.9	56.0	-3.7	-49.7	46.0	Phase 1	10.3
3.039	5	1.2	-54.8	56.0	-3.6	-49.6	46.0	Phase 1	10.3
4.646	5	9.4	-46.6	56.0	1.7	-44.3	46.0	Phase 1	10.4
4.722	5	11.3	-44.7	56.0	3.0	-43.0	46.0	Phase 1	10.4
5.295	6	11.4	-48.6	60.0	4.2	-45.9	50.0	Phase 1	10.4
9.449	6	23.0	-37.0	60.0	16.4	-33.6	50.0	Phase 1	10.6
9.521	6	22.5	-37.5	60.0	14.9	-35.2	50.0	Phase 1	10.6
13.479	7	37.0	-23.0	60.0	30.9	-19.1	50.0	Phase 1	10.8
13.493	7	35.6	-24.4	60.0	27.4	-22.6	50.0	Phase 1	10.8
16.085	7	44.0	-16.0	60.0	34.1	-15.9	50.0	Phase 1	10.9
16.512	7	43.4	-16.6	60.0	33.4	-16.6	50.0	Phase 1	10.9
23.129	8	38.1	-21.9	60.0	34.6	-15.4	50.0	Phase 1	11.0
24.258	8	24.9	-35.2	60.0	19.5	-30.5	50.0	Phase 1	11.0
24.353	8	33.1	-26.9	60.0	29.6	-20.4	50.0	Phase 1	11.0

Test point: N Result: passed
Operation mode: TX
Remarks: 24 V/DC power supply



freq	SR	QP	margin	limit	AV	margin	limit	line	corr
MHz		dB(µV)	dB	dB	dB(µV)	dB	dB		dB
0.150	9	4.6	-61.4	66.0	-1.1	-57.1	56.0	Neutral	10.1
0.191	9	2.0	-62.0	64.0	-1.5	-55.5	54.0	Neutral	10.1
0.249	9	6.7	-55.1	61.8	4.5	-47.3	51.8	Neutral	10.2
0.305	10	0.4	-59.8	60.1	-3.0	-53.1	50.1	Neutral	10.2
0.377	10	-0.2	-58.6	58.4	-3.3	-51.7	48.4	Neutral	10.2
0.485	10	3.7	-52.5	56.3	1.1	-45.2	46.3	Neutral	10.2
0.659	11	-0.7	-56.7	56.0	-3.6	-49.6	46.0	Neutral	10.2
0.726	11	0.2	-55.8	56.0	-3.1	-49.1	46.0	Neutral	10.2
1.127	11	-0.4	-56.4	56.0	-3.3	-49.3	46.0	Neutral	10.3
1.172	11	-0.5	-56.5	56.0	-3.4	-49.4	46.0	Neutral	10.3
1.601	12	1.0	-55.0	56.0	-2.2	-48.2	46.0	Neutral	10.3
1.623	12	-0.3	-56.3	56.0	-3.3	-49.3	46.0	Neutral	10.3
1.884	12	-0.4	-56.4	56.0	-3.4	-49.4	46.0	Neutral	10.3
1.916	12	-0.3	-56.3	56.0	-3.4	-49.4	46.0	Neutral	10.3
2.837	13	1.4	-54.6	56.0	-3.3	-49.3	46.0	Neutral	10.3
3.008	13	1.2	-54.8	56.0	-3.6	-49.6	46.0	Neutral	10.3
4.745	13	11.5	-44.5	56.0	2.6	-43.4	46.0	Neutral	10.4
4.754	13	11.0	-45.0	56.0	2.7	-43.3	46.0	Neutral	10.4
4.998	14	13.0	-43.0	56.0	4.0	-42.0	46.0	Neutral	10.4
5.529	14	10.8	-49.3	60.0	3.0	-47.1	50.0	Neutral	10.5
9.021	14	20.6	-39.4	60.0	13.4	-36.6	50.0	Neutral	10.6
9.512	14	21.6	-38.4	60.0	15.7	-34.3	50.0	Neutral	10.6
13.421	15	36.8	-23.2	60.0	30.7	-19.3	50.0	Neutral	10.9
16.170	15	43.0	-17.0	60.0	34.4	-15.6	50.0	Neutral	10.9
16.476	15	42.8	-17.2	60.0	32.0	-18.0	50.0	Neutral	10.9
23.129	16	37.6	-22.4	60.0	34.2	-15.8	50.0	Neutral	11.0
24.353	16	32.5	-27.6	60.0	29.1	-20.9	50.0	Neutral	11.0
24.546	16	20.3	-39.7	60.0	11.9	-38.1	50.0	Neutral	11.0

5.2 EBW and OBW

For test instruments and accessories used see section 6 Part **CPR3, MB**.

5.2.1 Description of the test location

Test location: Anechoic chamber 1
Test distance: 1 m

5.2.2 Photo documentation of the test set-up

See Attachment B for detailed photo documentation of the test set-up.

5.2.3 Applicable standard

According to FCC Part 15, Section 15.255(c)(2)(v):
For field disturbance sensors that occupy 500 MHz or less of bandwidth and that are contained wholly within the frequency band 61.0-61.5 GHz, the average power of any emission, measured during the transmit interval, shall not exceed 40 dBm, and the peak power of any emission shall not exceed 43 dBm.

According to FCC Part 15, Section 15.255(e)(1):
Transmitters with an emission bandwidth of less than 100 MHz must limit their peak transmitter conducted output power to the product of 500 mW times their emission bandwidth divided by 100 MHz.

According to RSS-210 J.4(c):
For the purpose of this standard, emission bandwidth is defined as the instantaneous frequency range occupied by a steady radiated signal with modulation, outside which the radiated power spectral density shall be 6 dB below the maximum radiated power spectral density in the band, as measured with a 100 kHz resolution bandwidth. The centre frequency must be stationary during the measurement interval, even if not stationary during normal operation.

According to RSS-Gen 6.7:
The occupied bandwidth or the “99% emission bandwidth” is defined as the frequency range between two points, one above and the other below the carrier frequency, within which 99% of the total transmitted power of the fundamental transmitted emission is contained. The occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSSs.

5.2.4 Description of Measurement

According to FCC Part 15, Section 15.255(e)(1):
For the purposes of this paragraph, emission bandwidth is defined as the instantaneous frequency range occupied by a steady state radiated signal with modulation, outside which the radiated power spectral density never exceeds 6 dB below the maximum radiated power spectral density in the band, as measured with a 100 kHz resolution bandwidth spectrum analyzer. The center frequency must be stationary during the measurement interval, even if not stationary during normal operation (e.g., for frequency hopping devices).

The bandwidth was measured at an amplitude level reduced from the reference level of a modulated channel by a ratio of -6 dB. The reference level is the level of the highest signal amplitude observed at the transmitter at either the fundamental frequency or the first order modulation products in all typical modes of operation, including the unmodulated carrier, even if atypical.

According to RSS-Gen 6.7:
The following conditions shall be observed for measuring the occupied bandwidth and x dB bandwidth:
-The transmitter shall be operated at its maximum carrier power measured under normal test conditions.
-The span of the spectrum analyzer shall be set large enough to capture all products of the modulation process, including the emission skirts, around the carrier frequency, but small enough to avoid having other emissions (e.g. on adjacent channels) within the span.
-The detector of the spectrum analyzer shall be set to “Sample”. However, a peak, or peak hold, may be used in place of the sampling detector since this usually produces a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold (or “Max Hold”) may be necessary to determine the occupied / x dB bandwidth if the device is not transmitting continuously.
-The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the actual occupied / x dB bandwidth and the video bandwidth (VBW) shall not be smaller than three times the RBW value. Video averaging is not permitted.

Spectrum analyser settings for EBW:
RBW: 100 kHz, VBW: 3 x RBW, Detector: Max peak, Sweep time: auto, Span: > 2 EBW;

Spectrum analyser settings for OBW:
RBW: 5 MHz, VBW: 3 x RBW, Detector: Max peak, Sweep time: auto, Span: > 2 OBW;

5.2.5 Test result

operating range	f_{low}	f_{high}	EBW 6dB
	(GHz)	(GHz)	(GHz)
1	61.010	61.460	0.450
2	60.010	63.935	3.925

99% bandwidth				
operating range	Centre frequency	T_1	T_2	Measured OBW
	(GHz)	(GHz)	(GHz)	(GHz)
1	61.237	61.009	61.465	0.456
2	61.977	60.014	63.939	3.925

The requirements are **FULFILLED.**

Remarks: For detailed test results please refer to following test protocols.

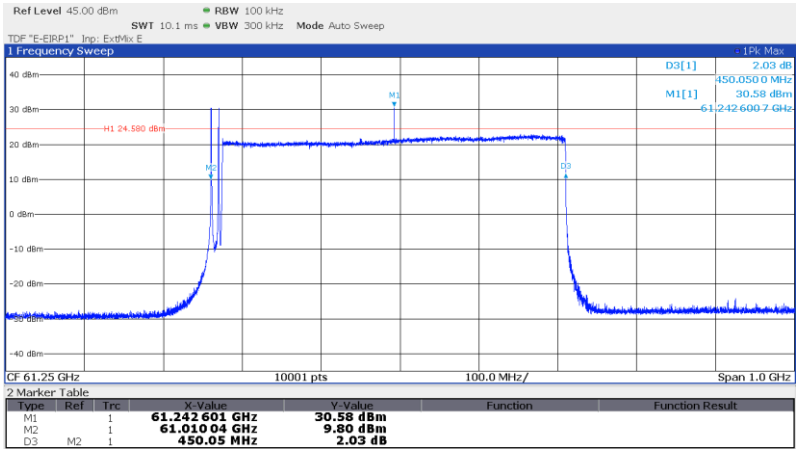
No limit defined for the occupied bandwidth!

Measurement procedure for operation range 2: To avoid overlap of wanted signal with unwanted signal (image), LO of external mixer is tuned to appropriate frequency to obtain higher ZF. VBW reduced due to high dynamic for higher ZF. For test instruments see section 6, part MB.

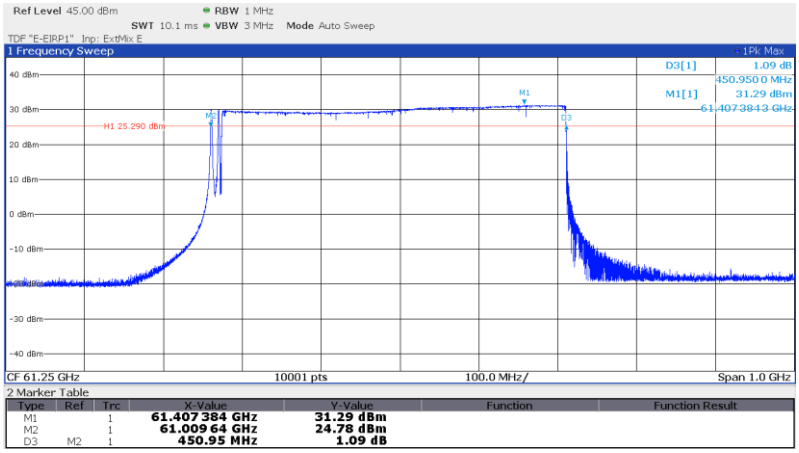
5.2.6 Test protocols

Operating frequency range 1:

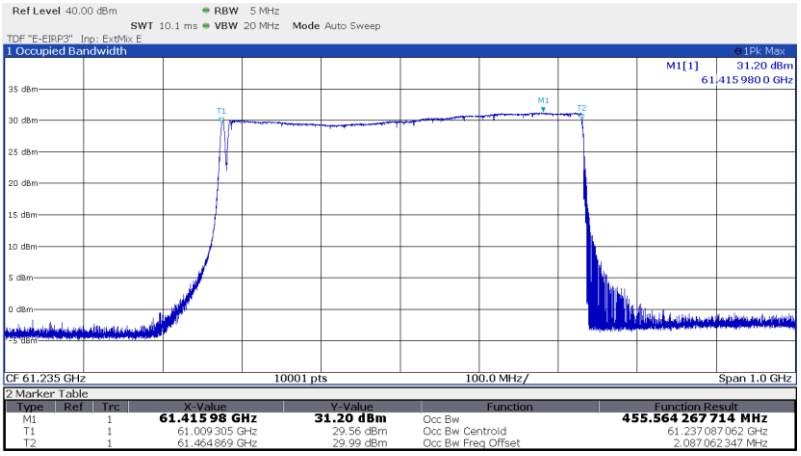
6dB EBW



Note: f_{high} below 6dB reduction due to desensitisation of FMCW part for RBW = 100kHz, see below for f_{high} with RBW = 1 MHz, where no desensitization occurs.

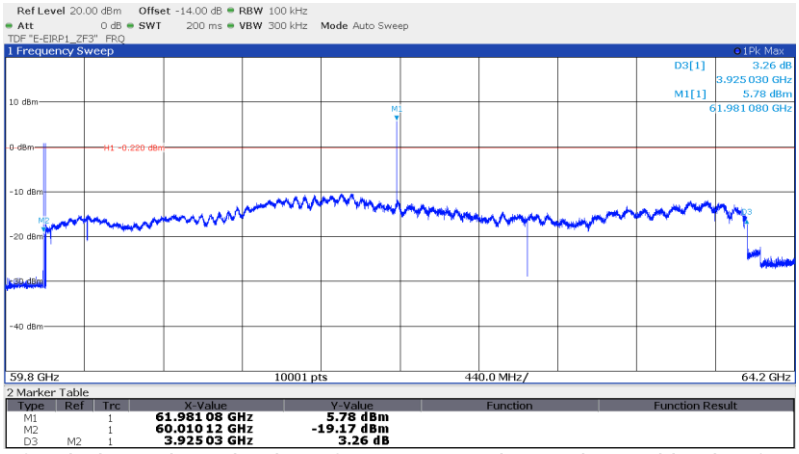


99% OBW

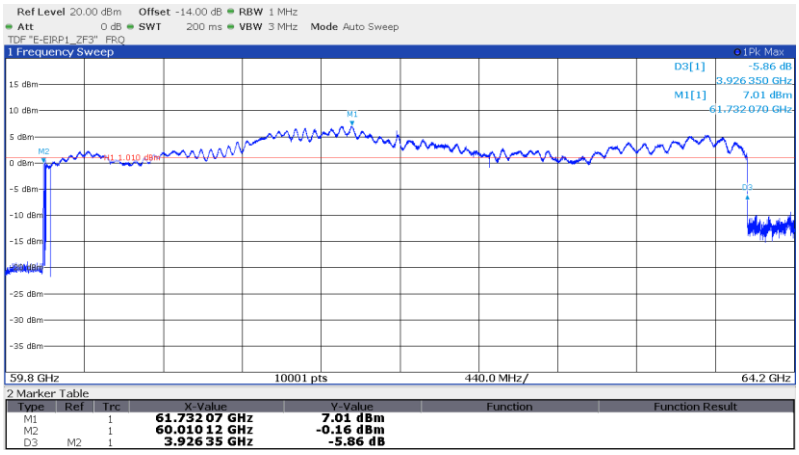


Operating frequency range 2:

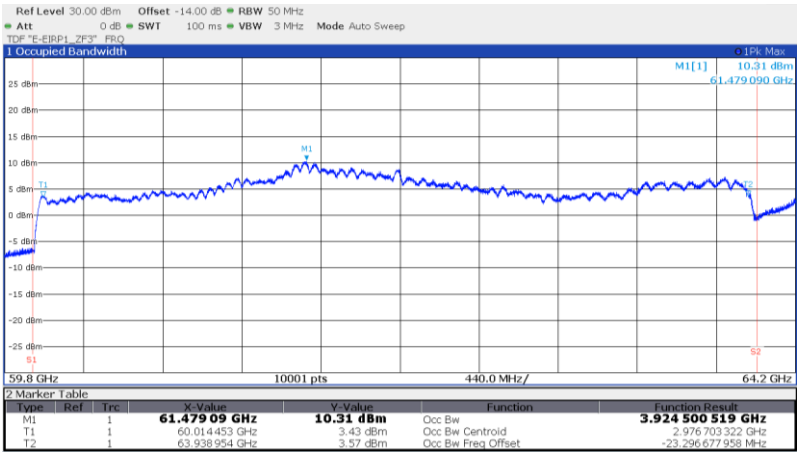
6dB EBW



Note: f_{high} below 6dB reduction of FMCW part due to desensitisation for RBW = 100kHz, see below for f_{high} with RBW = 1 MHz, where no desensitization occurs.



99% OBW



5.3 EIRP

For test instruments and accessories used see section 6 Part **CPR 3**.

5.3.1 Description of the test location

Test location: Anechoic chamber 1
Test distance: 1 m

5.3.2 Photo documentation of the test set-up

See Attachment B for detailed photo documentation of the test set-up.

5.3.3 Applicable standard

According to FCC Part 15C, Section 15.255(c)(2):
Field disturbance sensors/radars shall not exceed −10 dBm peak conducted output power and 10 dBm peak EIRP except that field disturbance sensors/radars that limit their operation to all or part of the specified frequency band may operate without being subject to a transmitter conducted output power limit if they operate in compliance with paragraph (b)(3) of this section or with one or more of the provisions below.

According to FCC Part 15C, Section 15.255(c)(2)(v):
For field disturbance sensors/radars that occupy 500 MHz bandwidth or less that are contained wholly within the frequency band 61.0–61.5 GHz, the average power of any emission, measured during the transmit interval, shall not exceed 40 dBm, and the peak power of any emission shall not exceed 43 dBm. In addition, the average power of any emission outside of the 61.0–61.5 GHz band, measured during the transmit interval, but still within the 57–71 GHz band, shall not exceed 10 dBm, and the peak power of any emission shall not exceed 13 dBm.

According to RSS-210 J.2.1:
For fixed field disturbance sensors that occupy a bandwidth of 500 MHz or less and for which the bandwidth is contained wholly within the frequency band 61.0-61.5 GHz, the equipment's average and peak e.i.r.p. in the channel bandwidth shall not exceed 40 dBm and 43 dBm respectively. In addition, the average and peak e.i.r.p. of any emission outside of the band 61.0-61.5 GHz, but still within the band 57-71 GHz, shall not exceed 10 dBm and 13 dBm respectively.

According to RSS-210 J.5(b):
Peak power density and peak transmitter output power shall be measured with a radio frequency (RF) detector that has a detection bandwidth encompassing the band 57-71 GHz and a video bandwidth of at least 10 MHz, or using an equivalent measurement method.

5.3.4 Description of Measurement

The radiated emission of the fundamental wave from the EUT is measured using a spectrum analyser and appropriate linear polarized antennas. The setup of the EUT and the measurement procedure is in accordance to ANSI C63.10, Item 9.8. The EUT is measured in TX continuous unmodulated under normal conditions.

Analyser settings:

PK measurement:	RBW: 1 MHz	VBW: 10 MHz	Detector: PK	Trace. Max hold
AV measurement:	RBW: 1 MHz	VBW: 10 MHz	Detector: RMS	Trace. Max hold

5.3.5 Test result

Operating range	Start freq. (GHz)	Stop freq. (GHz)	Antenna	Power setting	Level PK (dBm)	Limit PK (dBm)	Margin PK (dB)	Level AV (dBm)	Limit AV (dBm)	Margin AV (dB)
1	61.01	61.46	2	P0	31.9	43.0	-11.1	30.6	40.0	-9.4
2	60.01	63.921	2	P24	9.6	10.0	-0.4	-	N/A	-

EIRP limit according to FCC Part 15C, Section 15.255(c)(2):

Field disturbance sensors/radars shall not exceed −10 dBm peak conducted output power and 10 dBm peak EIRP except that field disturbance sensors/radars that limit their operation to all or part of the specified frequency band may operate without being subject to a transmitter conducted output power limit if they operate in compliance with paragraph (b)(3) of this section or with one or more of the provisions below.

EIRP limit according to FCC Part 15C, Section 15.255(c)(2)(v):

For field disturbance sensors/radars that occupy 500 MHz bandwidth or less that are contained wholly within the frequency band 61.0–61.5 GHz, the average power of any emission, measured during the transmit interval, shall not exceed 40 dBm, and the peak power of any emission shall not exceed 43 dBm. In addition, the average power of any emission outside of the 61.0–61.5 GHz band, measured during the transmit interval, but still within the 57–71 GHz band, shall not exceed 10 dBm, and the peak power of any emission shall not exceed 13 dBm.

Limit according to RSS-210 J.2.1(a):

For fixed field disturbance sensors that occupy a bandwidth of 500 MHz or less and for which the bandwidth is contained wholly within the frequency band 61.0-61.5 GHz, the equipment's average and peak e.i.r.p. in the channel bandwidth shall not exceed 40 dBm and 43 dBm respectively. In addition, the average and peak e.i.r.p. of any emission outside of the band 61.0-61.5 GHz, but still within the band 57-71 GHz, shall not exceed 10 dBm and 13 dBm respectively.

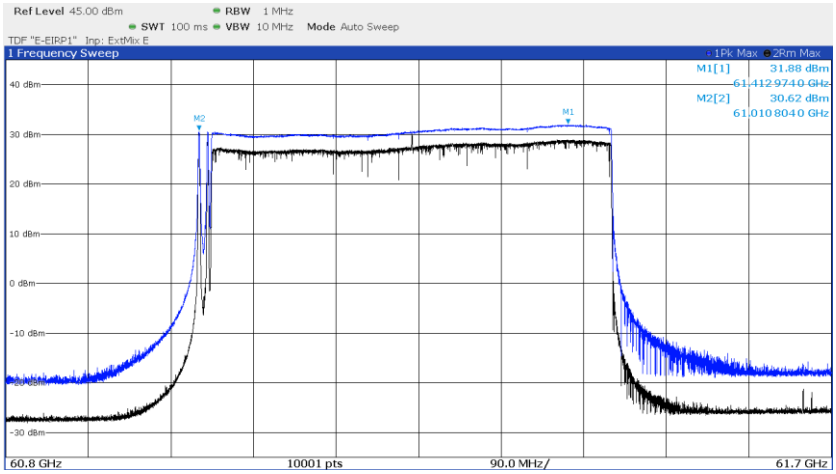
The requirements are **FULFILLED.**

Remarks: For detailed test results please refer to following test protocols.

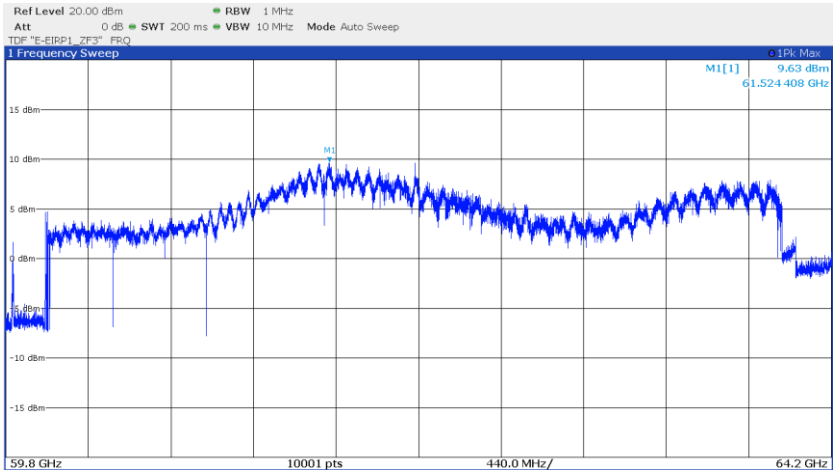
Measurement procedure for operation range 2: To avoid overlap of wanted signal with unwanted signal (image), LO of external mixer is tuned to appropriate frequency to obtain higher ZF. VBW reduced due to high dynamic for higher ZF. For test instruments see section 6, part MB.

5.3.6 Test protocols

Operating frequency range 1:



Operating frequency range 2:



5.4 Peak conducted output power

For test instruments and accessories used see section 6 Part **CPR 3**.

5.4.1 Description of the test location

Test location: Anechoic chamber 1
Test distance: 1 m

5.4.2 Photo documentation of the test set-up

See Attachment B for detailed photo documentation of the test set-up.

5.4.3 Applicable standard

According to FCC Part 15C, Section 15.255(e):
Except as specified paragraph (e)(1) of this section, the peak transmitter conducted output power shall not exceed 500 mW. Depending on the gain of the antenna, it may be necessary to operate the intentional radiator using a lower peak transmitter output power in order to comply with the EIRP limits specified in paragraph (c) of this section. (2): Peak transmitter conducted output power shall be measured with an RF detector that has a detection bandwidth that encompasses the 57–71 GHz band and that has a video bandwidth of at least 10 MHz.

According to RSS-210 J.4(a):
For devices with an emission bandwidth greater than or equal to 100 MHz, the peak transmitter output power shall not exceed 500 mW. For devices with an emission bandwidth less than 100 MHz, the peak transmitter output power shall be less than the product of 500 mW and their emission bandwidth divided by 100 MHz.

According to RSS-210 J.5(b):
Peak power density and peak transmitter output power shall be measured with a radio frequency (RF) detector that has a detection bandwidth encompassing the band 57-71 GHz and a video bandwidth of at least 10 MHz, or using an equivalent measurement method.

5.4.4 Description of Measurement

The radiated emission of the fundamental wave from the EUT is measured using a spectrum analyser and appropriate linear polarized antennas. The setup of the EUT and the measurement procedure is in accordance to ANSI C63.10, Item 9.8 and 9.11. The EUT is measured in TX continuous, FMCW stopped, under normal conditions.

Analyser settings:

PK measurement:	RBW: 1 MHz	VBW: 10 MHz	Detector: Peak	Trace. Max hold

5.4.5 Test result

Calculation of the peak transmitter output power:

Operating range	Start freq. (GHz)	Stop freq. (GHz)	Antenna	Power setting	EIRP level PK (dBm)	Antenna gain (dBi)	Conducted level PK (dBm)	Conducted level PK (mW)	Limit (mW)	Margin (mW)
1	61.01	61.46	2	P0	31.9	22.5	9.4	8.670	500	-491.3
2	60.01	63.921	2	P24	9.6	22.5	-12.9	0.052	0.100	-0.048

Limit according to FCC Part 15C, Section 15.255(c)(2):

Field disturbance sensors/radars shall not exceed −10 dBm peak conducted output power and 10 dBm peak EIRP except that field disturbance sensors/radars that limit their operation to all or part of the specified frequency band may operate without being subject to a transmitter conducted output power limit if they operate in compliance with paragraph (b)(3) of this section or with one or more of the provisions below.

Limit according to FCC Part 15C, Section 15.255(e):

Except as specified paragraph (e)(1) of this section, the peak transmitter conducted output power shall not exceed 500 mW. Depending on the gain of the antenna, it may be necessary to operate the intentional radiator using a lower peak transmitter output power in order to comply with the EIRP limits specified in paragraph (c) of this section. (1) Transmitters with an emission bandwidth of less than 100 MHz must limit their peak transmitter conducted output power to the product of 500 mW times their emission bandwidth divided by 100 MHz. For the purposes of this paragraph, emission bandwidth is defined as the instantaneous frequency range occupied by a steady state radiated signal with modulation, outside which the radiated power spectral density never exceeds 6 dB below the maximum radiated power spectral density in the band, as measured with a 100 kHz resolution bandwidth spectrum analyzer. The center frequency must be stationary during the measurement interval, even if not stationary during normal operation (e.g., for frequency hopping devices).

Limit according to RSS-210 J.4:

For devices with an emission bandwidth greater than or equal to 100 MHz, the peak transmitter output power shall not exceed 500 mW. For devices with an emission bandwidth less than 100 MHz, the peak transmitter output power shall be less than the product of 500 mW and their emission bandwidth divided by 100 MHz.
For the purposes of demonstrating compliance with this RSS, corrections to the transmitter output power may be made to compensate for antenna and circuit loss.
For the purpose of this standard, emission bandwidth is defined as the instantaneous frequency range occupied by a steady radiated signal with modulation, outside which the radiated power spectral density shall be 6 dB below the maximum radiated power spectral density in the band, as measured with a 100 kHz resolution bandwidth. The centre frequency must be stationary during the measurement interval, even if not stationary during normal operation.

Determination of the limit:

The limit is given as 500 mW (EBW 6 dB > 100 MHz)

The requirements are **FULFILLED.**

Remarks: For determination of emission bandwidth please refer to section 5.2.

5.5 Spurious emissions

For test instruments and accessories used see section 6 Part **SER1, SER 2, SER 3**.

5.5.1 Description of the test location

Test location: OATS 1
Test distance: 3 m

Test location: Anechoic chamber 1
Test distance: 3 m (1 GHz – 40 GHz)
Test distance: 1 m (40 GHz – 200 GHz)

5.5.2 Photo documentation of the test set-up

See Attachment B for detailed photo documentation of the test set-up.

5.5.3 Applicable standard

According to FCC Part 15C, Section 15.255 (d):
(1) The power density of any emissions outside the 57-71 GHz band shall consist solely of spurious emissions.
(2) Radiated emissions below 40 GHz shall not exceed the general limits in §15.209.
(3) Between 40 GHz and 200 GHz, the level of these emissions shall not exceed 90 pW/cm2 at a distance of 3 meters.
(4) The levels of the spurious emissions shall not exceed the level of the fundamental emission.

According to RSS-210 J.3:
The power of any emissions outside the band 57-71 GHz shall consist solely of spurious emissions and shall not exceed:
a) the fundamental emission levels
b) the general field strength limits specified in RSS-Gen for emissions below 40 GHz
c) 90 pW/cm2 at a distance of 3 m for emissions between 40 GHz and 200 GHz

5.5.4 Description of Measurement

The radiated emissions from the EUT are measured in the frequency range of 30 MHz to 1000 MHz using a tuned receiver and appropriate broadband linearly polarized antennas. The setup of the EUT and the measurement procedure is in accordance to ANSI C63.10, Item 9. In the frequency range above 1 GHz a spectrum analyser is used with appropriate linear polarized antennas. If the emission level in peak mode complies with the average limit testing is stopped and peak values will be reported, otherwise, the emission is measured in average mode again and reported. The EUT is measured in TX continuous mode under normal conditions.

Instrument settings:

9 kHz – 150 kHz:	RBW: 200 Hz,	Detector: Quasi peak, Mes. Time: 1 s,	
150 kHz – 30 MHz:	RBW: 9 kHz,	Detector: Quasi peak, Mes. Time: 1 s,	
30 MHz – 1 GHz:	RBW: 120 MHz,	Detector: Quasi peak, Mes. Time: 1 s,	
1 GHz – 200 GHz:	RBW: 1 MHz,VBW: 3 MHz,	Detector: Max. peak, Trace: Max. hold,	Sweep: Auto

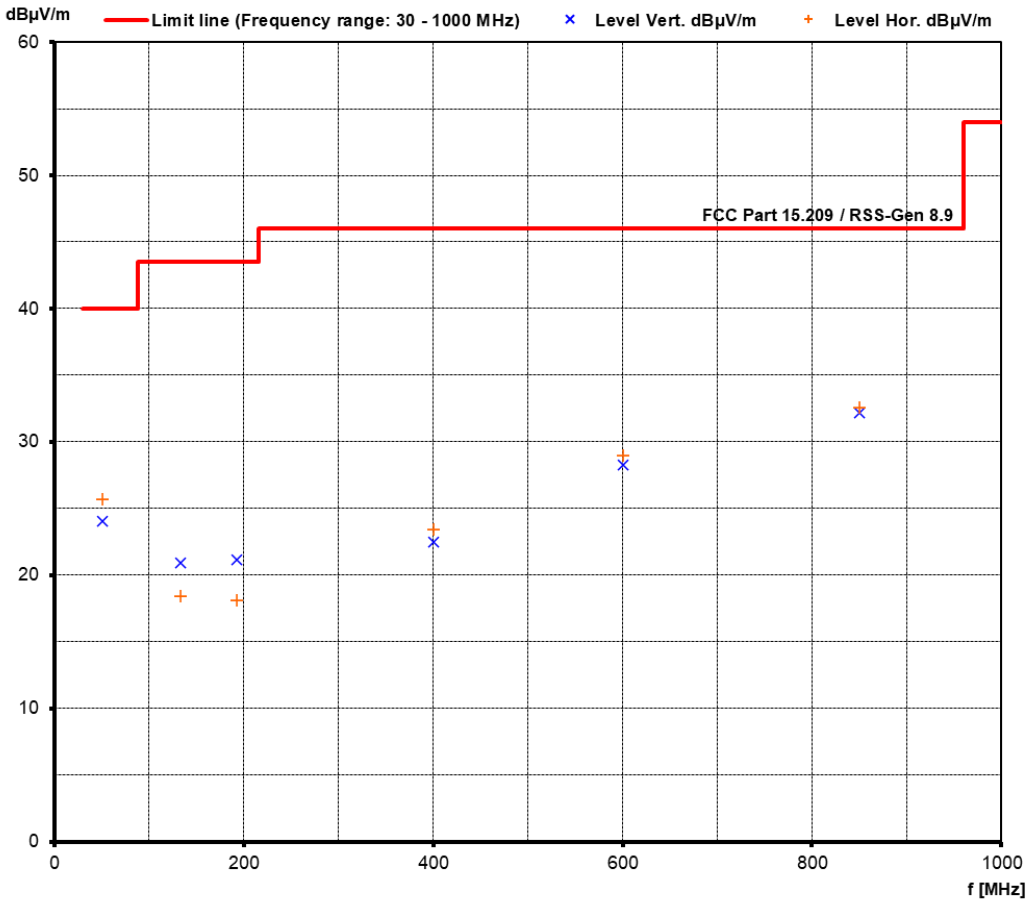
5.5.5 Test result f < 1 GHz

FCC Part 15.209 Radiated emission limits; general requirements (< 30 MHz)									
Frequency (kHz)	PK reading (dBµV)	QP reading (dBµV)	AV reading (dBµV)	Ant. factor (dB)	Distance corr. (dB)	AV level (dBµV/m)	QP level (dBµV/m)	Limit (dBµV/m)	Dlimit (dB)
207.2	64.3	50.2	24.5	20.0	-80.0	4.3	-9.8	21.3	-17.0
7000.0	25.3	16.6	9.4	20.0	-40.0	5.3	-3.4	29.5	-32.9
13783.7	28.0	9.3	-0.4	20.0	-40.0	8.0	-10.7	29.5	-40.2
23128.6	24.9	5.4	-2.2	20.0	-40.0	4.9	-14.6	29.5	-44.1
24043.6	25.5	4.6	-2.8	20.0	-40.0	5.5	-15.4	29.5	-44.9
27355.2	23.6	4.1	-4.1	20.0	-40.0	3.6	-15.9	29.5	-45.4

Note: Frequencies in bold characters fall into AV ranges

RSS-Gen 8.9 Radiated emission limits; general requirements (< 30 MHz)							
Frequency (kHz)	QP reading (dBµV)	QP calc. (dBµA)	Ant. factor (dB)	Distance corr. (dB)	Corr. QP level (dBµA/m)	Limit (dBµA/m)	Dlimit (dB)
207.2	50.2	-1.3	20.0	-80.0	-61.3	-10.2	-51.1
7000.0	16.6	-34.9	20.0	-40.0	-54.9	-21.9	-33.0
13783.7	9.3	-42.2	20.0	-40.0	-62.2	-21.9	-40.3
23128.6	5.4	-46.1	20.0	-40.0	-66.1	-21.9	-44.2
24043.6	4.6	-46.9	20.0	-40.0	-66.9	-21.9	-45.0
27355.2	4.1	-47.4	20.0	-40.0	-67.4	-21.9	-45.5

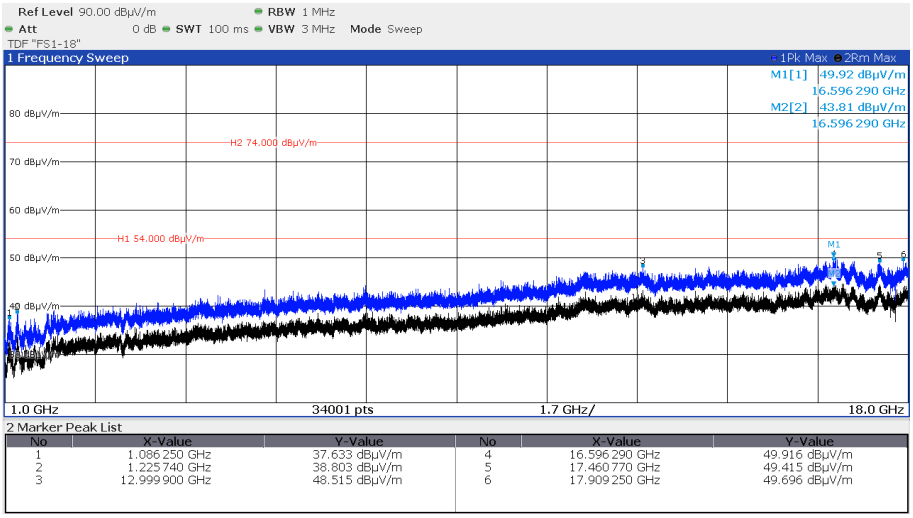
Frequency (MHz)	Reading Vert. (dBµV)	Reading Hor. (dBµV)	Correct. Vert. (dB)	Correct. Hor. (dB)	Level Vert. (dBµV/m)	Level Hor. (dBµV/m)	Limit (dBµV/m)	Dlimit (dB)
50.92	6.5	7.0	17.5	18.6	24.0	25.6	40.0	-14.4
132.94	2.3	0.6	18.6	17.8	20.9	18.4	43.5	-22.6
192.36	3.7	1.3	17.4	16.8	21.1	18.1	43.5	-22.4
400.00	-0.7	-0.1	23.2	23.5	22.5	23.4	46.0	-22.6
600.00	0.1	0.5	28.2	28.5	28.3	29.0	46.0	-17.0
850.00	0.0	0.0	32.2	32.5	32.2	32.5	46.0	-13.5



Note: For frequencies < 1 GHz the general radiated limit has been applied.

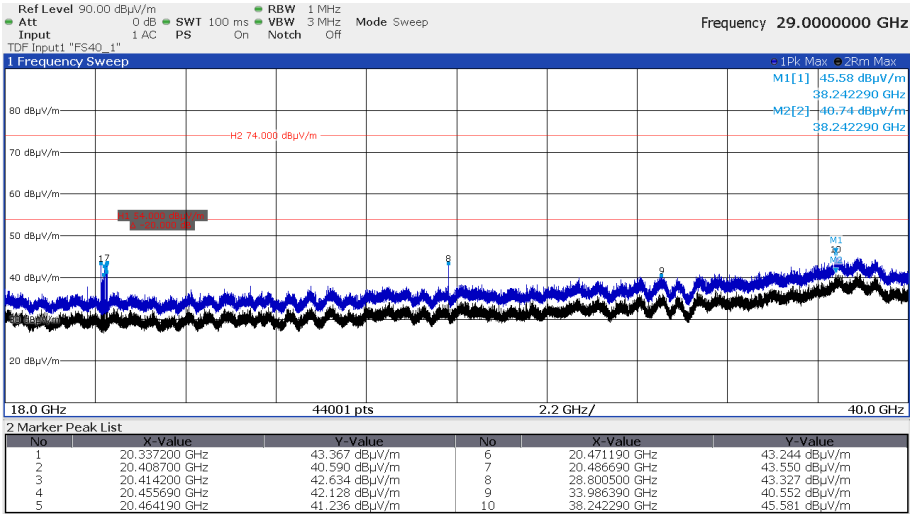
5.5.6 Test result 1 GHz < f < 40 GHz

Operating frequency range 1:



2 Marker Peak List

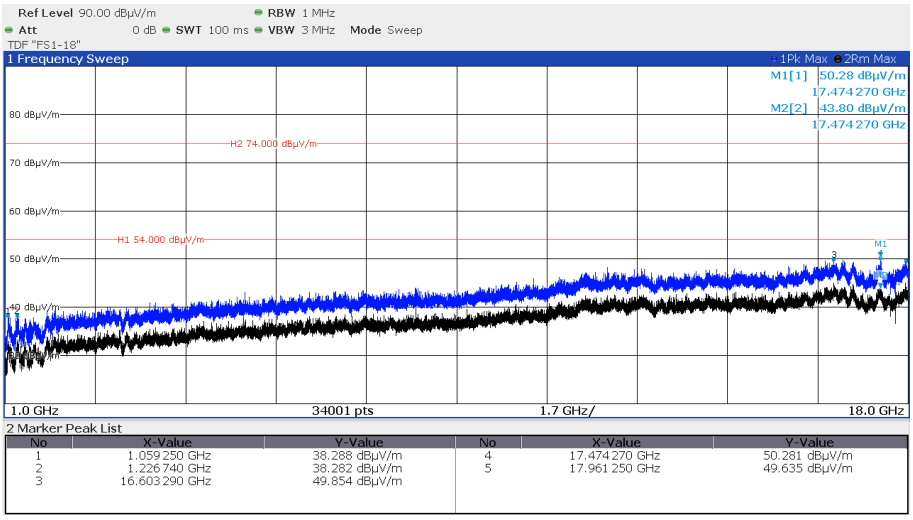
No	X-Value	Y-Value	No	X-Value	Y-Value
1	1.086 250 GHz	37.633 dBµV/m	4	16.596 290 GHz	49.916 dBµV/m
2	1.225 740 GHz	38.803 dBµV/m	5	17.460 770 GHz	49.415 dBµV/m
3	12.999 900 GHz	48.515 dBµV/m	6	17.909 250 GHz	49.696 dBµV/m

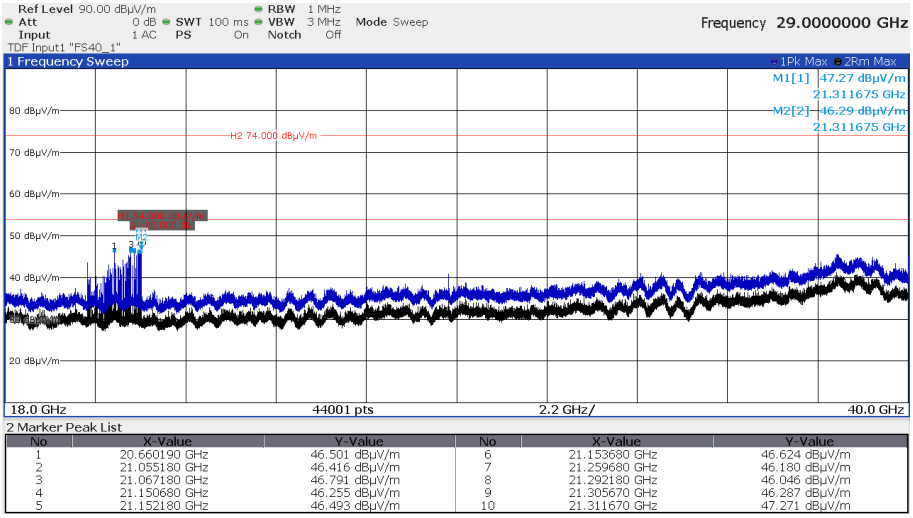


2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	20.337200 GHz	43.367 dBµV/m	6	20.471190 GHz	43.244 dBµV/m
2	20.408700 GHz	40.590 dBµV/m	7	20.486690 GHz	43.550 dBµV/m
3	20.414200 GHz	42.634 dBµV/m	8	28.800500 GHz	43.327 dBµV/m
4	20.455690 GHz	42.128 dBµV/m	9	33.986390 GHz	40.552 dBµV/m
5	20.464190 GHz	41.236 dBµV/m	10	38.242290 GHz	45.581 dBµV/m

Operating frequency range 2:





5.5.7 Test result f > 40 GHz

Determination of the EIRP emission limit for f > 40 GHz:

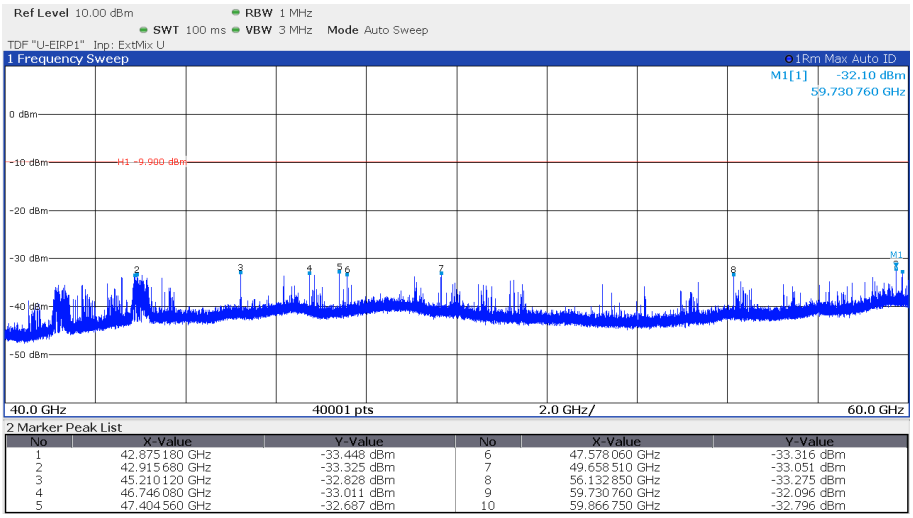
For calculation of the limit the friis formula is used.

$$P_d = \frac{P_{out} * G}{4 * \Pi * r^2}$$

P_{out} * G = EIRP;
Therefore EIRP = P_d *4*π*r^2
EIRP = -9.9 dBm

where
r is the measurement distance (3 m)
P_d is the emission density (90 pW/cm^2)

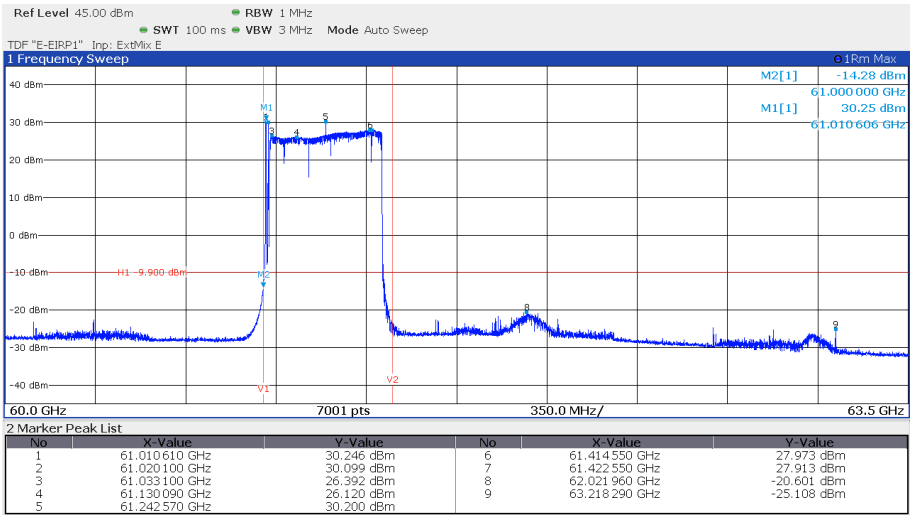
Operating frequency range 1:



2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	42.875 180 GHz	-33.448 dBm	6	47.578 060 GHz	-33.316 dBm
2	42.915 680 GHz	-33.325 dBm	7	49.658 510 GHz	-33.051 dBm
3	45.210 120 GHz	-32.828 dBm	8	56.132 850 GHz	-33.275 dBm
4	46.746 080 GHz	-33.011 dBm	9	59.730 760 GHz	-32.096 dBm
5	47.404 560 GHz	-32.687 dBm	10	59.866 750 GHz	-32.796 dBm

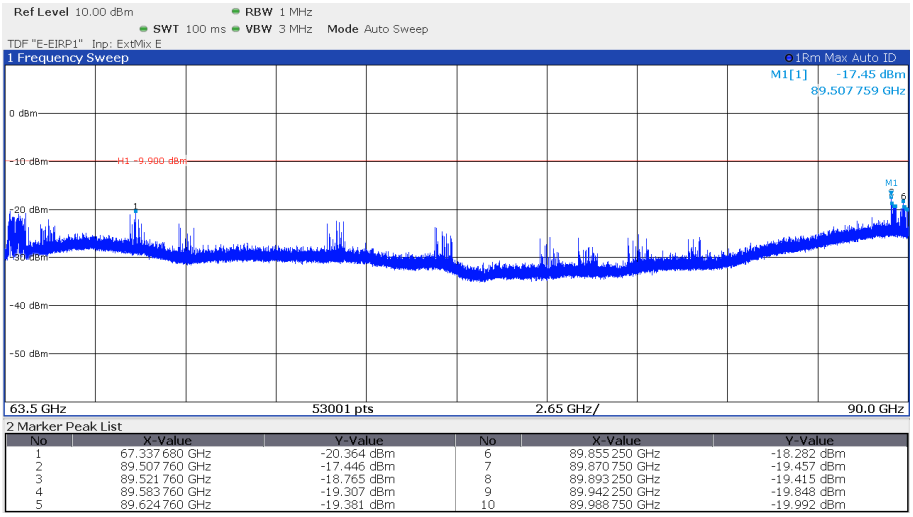
Note: To minimize unintended mixing products generated by the external mixer the AutoID function was used.



2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	61.010 610 GHz	30.246 dBm	6	61.414 550 GHz	27.973 dBm
2	61.020 100 GHz	30.099 dBm	7	61.422 550 GHz	27.913 dBm
3	61.033 100 GHz	26.392 dBm	8	62.021 960 GHz	-20.601 dBm
4	61.130 090 GHz	26.120 dBm	9	63.218 290 GHz	-25.108 dBm
5	61.242 570 GHz	30.200 dBm			

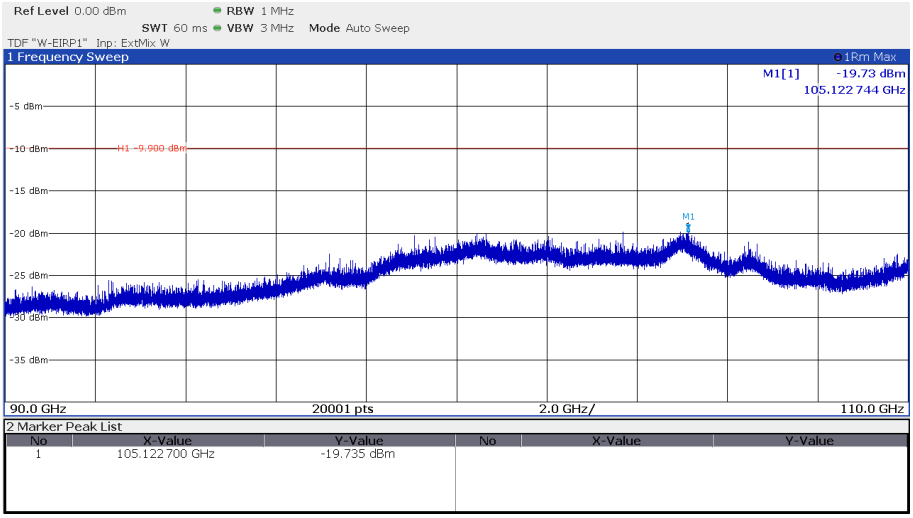
Note: V1 to V2 shows operation frequency range 1.



2 Marker Peak List

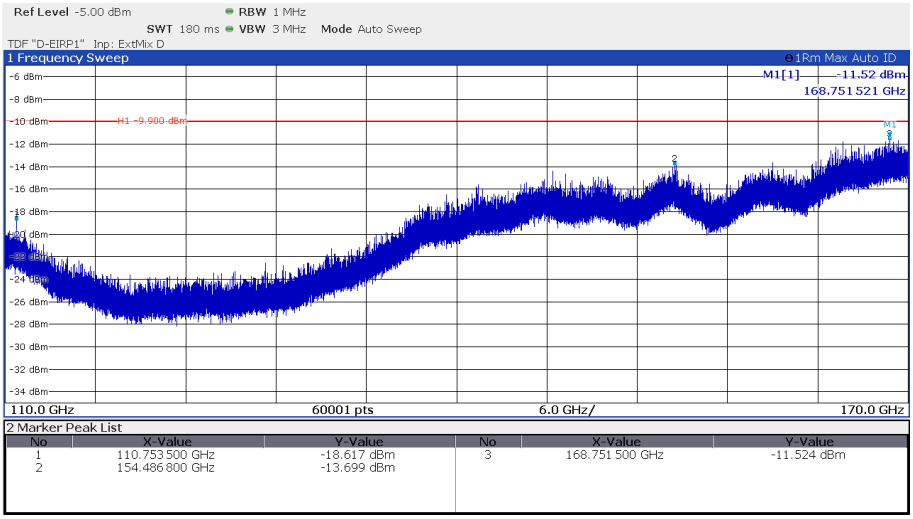
No	X-Value	Y-Value	No	X-Value	Y-Value
1	67.337 680 GHz	-20.364 dBm	6	89.855 250 GHz	-18.282 dBm
2	89.507 760 GHz	-17.446 dBm	7	89.870 750 GHz	-19.457 dBm
3	89.521 760 GHz	-18.765 dBm	8	89.893 250 GHz	-19.415 dBm
4	89.583 760 GHz	-19.307 dBm	9	89.942 250 GHz	-19.848 dBm
5	89.624 760 GHz	-19.381 dBm	10	89.988 750 GHz	-19.992 dBm

Note: To minimize unintended mixing products generated by the external mixer the AutoID function was used.



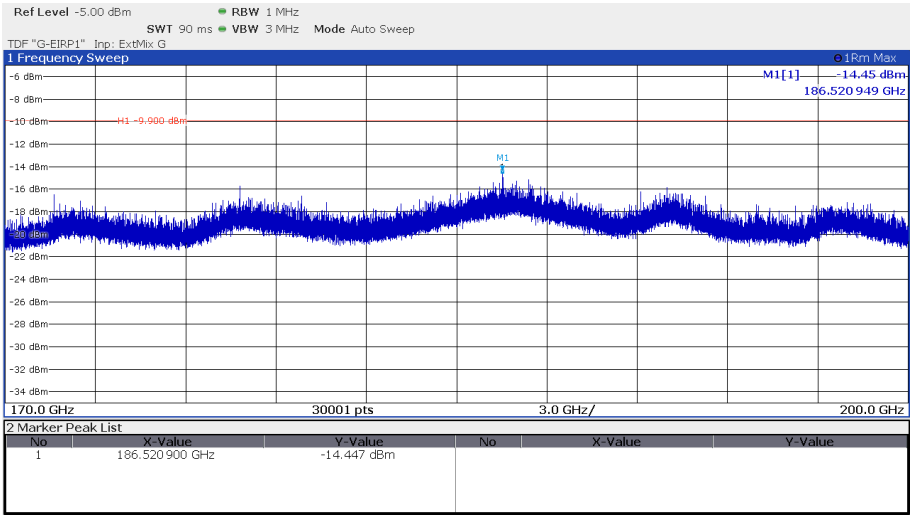
2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	105.122 700 GHz	-19.735 dBm			

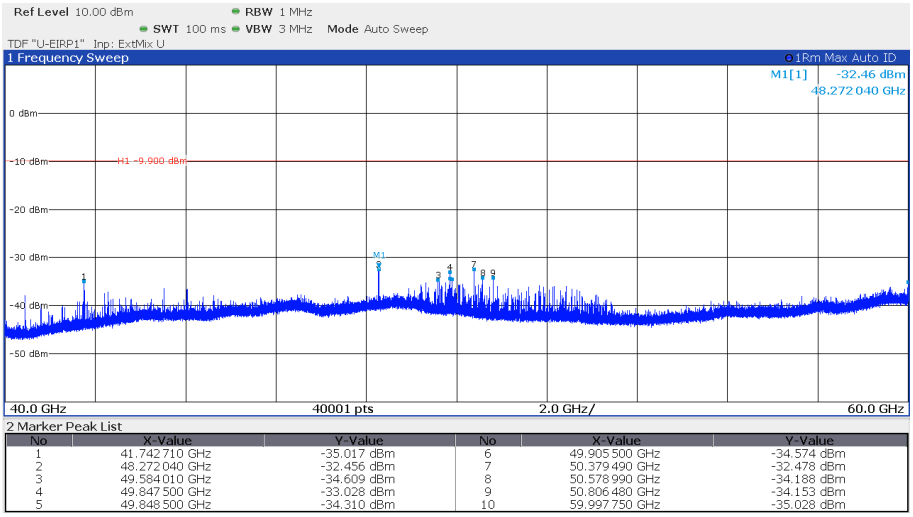


2 Marker Peak List

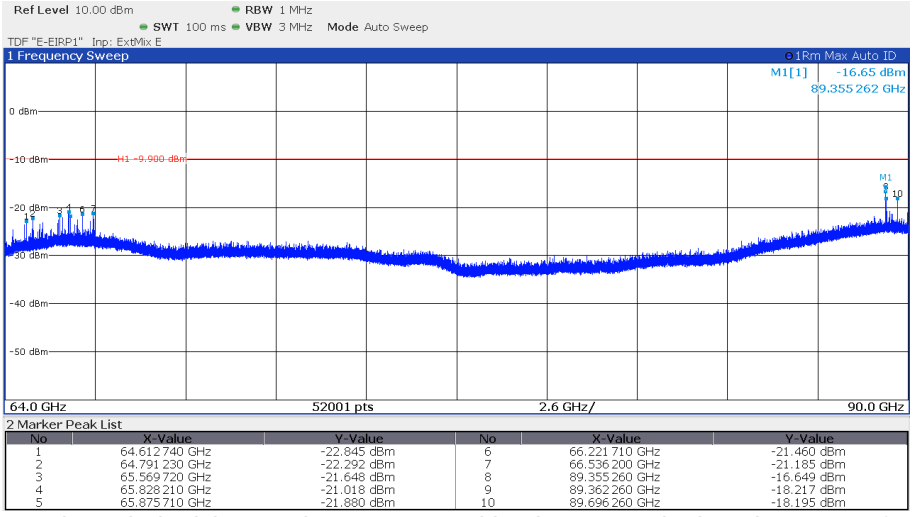
No	X-Value	Y-Value	No	X-Value	Y-Value
1	110.753 500 GHz	-18.617 dBm	3	168.751 500 GHz	-11.524 dBm
2	154.486 800 GHz	-13.699 dBm			



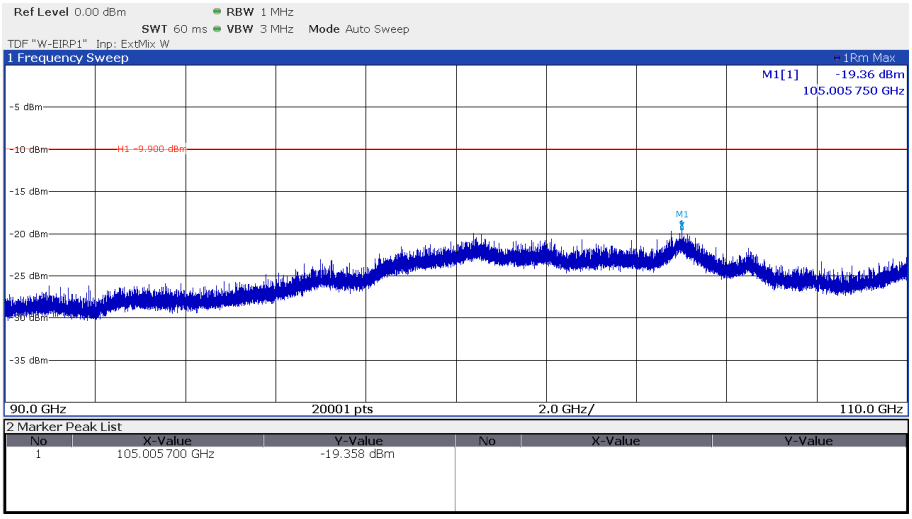
Operating frequency range 2:

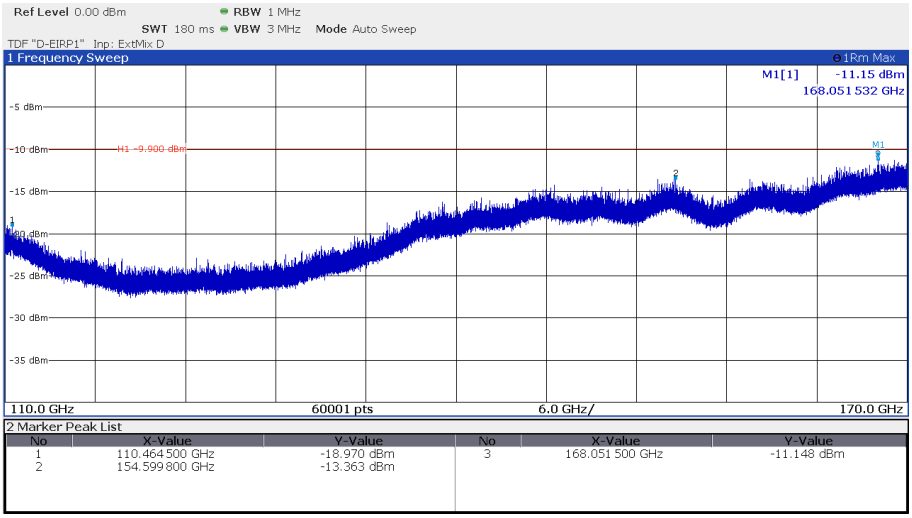


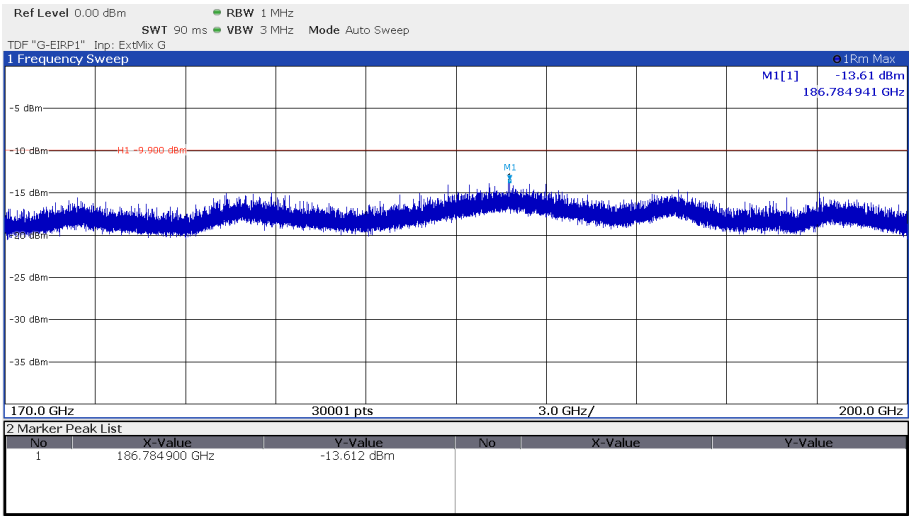
Note: To minimize unintended mixing products generated by the external mixer the AutoID function was used.



Note: To minimize unintended mixing products generated by the external mixer the AutoID function was used.


Ref Level 0.00 dBm
RBW 1 MHz
SWT 60 ms VBW 3 MHz Mode Auto Sweep
TDF "W-EIRP1" Inp: ExtMix W
1 Frequency Sweep
1Rm Max
M1[1] -19.36 dBm
105.005 750 GHz
H1 -9.900 dBm
90.0 GHz 20001 pts 2.0 GHz/ 110.0 GHz
2 Marker Peak List
No X-Value Y-Value
1 105.005 700 GHz -19.358 dBm


Ref Level 0.00 dBm
RBW 1 MHz
SWT 180 ms VBW 3 MHz Mode Auto Sweep
TDF "D-EIRP1" Inp: ExtMix D
1 Frequency Sweep
1Rm Max
M1[1] -11.15 dBm
168.051 532 GHz
H1 -9.900 dBm
110.0 GHz 60001 pts 6.0 GHz/ 170.0 GHz
2 Marker Peak List
No X-Value Y-Value
1 110.464 500 GHz -18.970 dBm
2 154.599 800 GHz -13.363 dBm
3 168.051 500 GHz -11.148 dBm


Ref Level 0.00 dBm
RBW 1 MHz
SWT 90 ms VBW 3 MHz Mode Auto Sweep
TDF "G-EIRP1" Inp: ExtMix G
1 Frequency Sweep
1Rm Max
M1[1] -13.61 dBm
186.784 941 GHz
H1 -9.900 dBm
170.0 GHz 30001 pts 3.0 GHz/ 200.0 GHz
2 Marker Peak List
No X-Value Y-Value
1 186.784 900 GHz -13.612 dBm

Average limit according to FCC Part 15C, Section 15.255(d):

(1) The power density of any emissions outside the 57-71 GHz band shall consist solely of spurious emissions.
(2) Radiated emissions below 40 GHz shall not exceed the general limits in §15.209.
(3) Between 40 GHz and 200 GHz, the level of these emissions shall not exceed 90 pW/cm^2 at a distance of 3 meters.
(4) The levels of the spurious emissions shall not exceed the level of the fundamental emission.

General radiated limit according to FCC Part 15C, Section 15.209:

Frequency (MHz)	15.209 Limits (µV/m)	Measurement distance (m)
0.009 - -0.49	2400/f(kHz)	300
0.49 – 1.705	24000/f(kHz)	30
1.705 – 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

Limit according to RSS-210 J.3:

The power of any emissions outside the band 57-71 GHz shall consist solely of spurious emissions and shall not exceed:
a) the fundamental emission levels
b) the general field strength limits specified in RSS-Gen for emissions below 40 GHz
c) 90 pW/cm^2 at a distance of 3 m for emissions between 40 GHz and 200 GHz

General radiated limit according to RSS-Gen 8.9:

Frequency (MHz)	RSS-Gen Limits (µA/m)	Measurement distance (m)
0.009 - -0.49	63.7/f(kHz)	300
0.49 – 1.705	63.7/f(kHz)	30
1.705 – 30.0	0.08	30

Frequency (MHz)	RSS-Gen Limits (µV/m)	Measurement distance (m)
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

The requirements are **FULFILLED.**

Remarks: The measurement was performed up to 200 GHz.

For frequencies < 40 GHz the general radiated limit has been applied.

Only worst-case plots are listed.

5.6 Frequency stability

For test instruments and accessories used see section 6 Part **FE1, FE2**.

5.6.1 Description of the test location

Test location: AREA4

5.6.2 Photo documentation of the test set-up

See Attachment B for detailed photo documentation of the test set-up.

5.6.3 Applicable standard

According to FCC Part 15C, Section 15.255(f):
Fundamental emissions must be contained within the frequency bands specified in this section during all conditions of operation. Equipment is presumed to operate over the temperature range −20 to + 50 degrees Celsius with an input voltage variation of 85% to 115% of rated input voltage, unless justification is presented to demonstrate otherwise.

According to RSS-210 J.6:
Fundamental emissions shall be contained within the 57-71 GHz frequency band during all conditions of operation when tested at the temperature and voltage variations specified for the frequency stability measurement in RSS-Gen.
Fundamental emissions must be contained within the frequency bands specified in this section during all conditions of operation. Equipment is presumed to operate over the temperature range −20 to + 50 degrees Celsius with an input voltage variation of 85% to 115% of rated input voltage, unless justification is presented to demonstrate otherwise.

5.6.4 Description of Measurement

The frequency stability is measured with the spectrum analyser. The sweep points are set to maximum for higher the frequency resolution or the function “frequency counter” is used. The signal is unmodulated; the marker of the analyser is set to maximum amplitude at normal temperature, the frequency is recorded. Then the maximum supply voltage is set and the marker of the analyser is set to maximum amplitude. This procedure is done again for the minimum supply voltage. The EUT is now driven at normal supply voltage but in the climatic chamber to range the temperature from -20 °C to +50 °C in steps of 10 degrees. The drifting carrier is measured by setting the marker at the analyser.

5.6.5 Result

DC power supply:

Operating frequency range 1:

Test conditions		Test result	
		Frequency (GHz)	
		Low	High
T_{min} (-20)°C	V_{nom}	61.00999645	61.45999733
T (-10)°C	V_{nom}	61.00999409	61.45999471
T (0)°C	V_{nom}	61.01000069	61.46000156
T (10)°C	V_{nom}	61.01000505	61.46000592
T_{nom} (20)°C	V_{min} (7.65 V)	61.01000954	61.46001053
T_{nom} (20)°C	V_{nom} (24.0V)	61.01001028	61.46001103
T_{nom} (20)°C	V_{max} (41.4V)	61.01001040	61.46001127
T (30)°C	V_{nom}	61.01001676	61.46001763
T (40)°C	V_{nom}	61.01001551	61.46001626
T_{max} (50)°C	V_{nom}	61.01001626	61.46001738

61.0 - 61.5 GHz frequency band:

Highest frequency f_h	61.4600176 GHz
Lowest frequency f_l	61.0099941 GHz

Operating frequency range 2:

Test conditions		Test result	
		Frequency (GHz)	
		Low	High
T_{min} (-20)°C	V_{nom}	60.00999571	63.92099857
T (-10)°C	V_{nom}	60.00999372	63.92099683
T (0)°C	V_{nom}	60.00999982	63.92100281
T (10)°C	V_{nom}	60.01000480	63.92100842
T_{nom} (20)°C	V_{min} (7.65 V)	60.01000904	63.92101290
T_{nom} (20)°C	V_{nom} (24.0V)	60.01000978	63.92101377
T_{nom} (20)°C	V_{max} (41.4V)	60.01000978	63.92101364
T (30)°C	V_{nom}	60.01001626	63.92102062
T (40)°C	V_{nom}	60.01001589	63.92102024
T_{max} (50)°C	V_{nom}	60.01001551	63.92101937

57 - 71 GHz frequency band:

Highest frequency f_h	63.9210206 GHz
Lowest frequency f_l	60.0099937 GHz

PoE power supply:

Operating frequency range 1:

Test conditions		Test result	
		Frequency (GHz)	
		Low	High
T_{min} (-20)°C	V_{nom}	61.01001115	61.46001227
T (-10)°C	V_{nom}	61.01001613	61.46001700
T (0)°C	V_{nom}	61.01002274	61.46002398
T (10)°C	V_{nom}	61.01002572	61.46002672
T_{nom} (20)°C	V_{min} (36 V)	61.00999845	61.45999932
T_{nom} (20)°C	V_{nom} (48 V)	61.01002572	61.46002672
T_{nom} (20)°C	V_{max} (57 V)	61.00999496	61.45999596
T (30)°C	V_{nom}	61.01002348	61.46002448
T (40)°C	V_{nom}	61.01002087	61.46002199
T_{max} (50)°C	V_{nom}	61.01002124	61.46002211

61.0 - 61.5 GHz frequency band:

Highest frequency f_h	61.4600267 GHz
Lowest frequency f_l	61.0099950 GHz

Operating frequency range 2:

Test conditions		Test result	
		Frequency (GHz)	
		Low	High
T_{min} (-20)°C	V_{nom}	60.01001103	63.92101489
T (-10)°C	V_{nom}	60.01001589	63.92102012
T (0)°C	V_{nom}	60.01002236	63.92102697
T (10)°C	V_{nom}	60.01002523	63.92103008
T_{nom} (20)°C	V_{min} (36 V)	60.00999832	63.92100119
T_{nom} (20)°C	V_{nom} (48 V)	60.01002547	63.92103046
T_{nom} (20)°C	V_{max} (57 V)	60.00999483	63.92099770
T (30)°C	V_{nom}	60.01002311	63.92102759
T (40)°C	V_{nom}	60.01002062	63.92102535
T_{max} (50)°C	V_{nom}	60.01002099	63.92102535

57 - 71 GHz frequency band:

Highest frequency f_h	63.9210305 GHz
Lowest frequency f_l	60.0099948 GHz

Limit according to FCC Part 15C, Section 15.255(f):

Fundamental emissions must be contained within the frequency bands specified in this section during all conditions of operation. Equipment is presumed to operate over the temperature range −20 to + 50 degrees Celsius with an input voltage variation of 85% to 115% of rated input voltage, unless justification is presented to demonstrate otherwise.

Limit according to RSS-Gen 6.11:

Fundamental emissions must be contained within the frequency bands specified in this section during all conditions of operation. Equipment is presumed to operate over the temperature range −20 to + 50 degrees Celsius with an input voltage variation of 85% to 115% of rated input voltage, unless justification is presented to demonstrate otherwise.

The requirements are **FULFILLED.**

Remarks: The carrier is always inside of the operating frequency band.

For power supply via PoE: voltages according to IEEE 802.3af applied.

Test instruments DC: refer to FE1, test instruments PoE: refer to FE2 of section 6.

5.7 Antenna requirement

According to FCC Part 15C, Section 15.203:
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit that broken antennas can be replaced by the user, but the use of a standard antenna jack is prohibited. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

The EUT has integrated antennas. No other antenna can be used with the device.

The supplied antenna meets the requirements of part 15.203.

Remarks: None.

6 USED TEST EQUIPMENT AND ACCESSORIES

All test instruments used are calibrated and verified regularly. The calibration history is available on request.

Test ID	Model Type	Equipment No.	Next Calib.	Last Calib.	Next Verif.	Last Verif.
A 4	BAT-EMC 2022.0.23.0	01-02/68-13-001				
	ESCI	02-02/03-15-001	17/06/2023	17/06/2022		
	ESH 2 - Z 5	02-02/20-05-003	12/05/2023	12/05/2020	22/08/2023	22/02/2023
	ESH 2 - Z 5	02-02/20-05-004	13/10/2025	13/10/2022	13/04/2023	13/10/2022
	N-4000-BNC	02-02/50-05-138				
	SP 103 /3.5-60	02-02/50-05-182				
	ESH 3 - Z 2	02-02/50-05-185	27/10/2025	27/10/2022	27/04/2023	27/10/2022
	HM 8143	02-02/50-10-016				
	6430	02-02/50-13-014				
Note: A4 performed on 22/03/2023						
CPR 3	FS-Z90	02-02/11-14-003	08/05/2024	08/05/2023	08/05/2024	08/05/2023
	FSW43	02-02/11-15-001	04/05/2024	04/05/2023		
	QWH-EPRR00/WR-12/60-90	02-02/24-14-004				
	UFA210A (LU7-022-1000)	02-02/50-17-030				
	UFA210A (LU7-022-1000)	02-02/50-17-031				
Note: CPR performed on 17/04/2024.						
FE1	FS-Z90	02-02/11-14-003	22/04/2023	22/04/2022	22/04/2023	22/04/2022
	FSW43	02-02/11-15-001	22/04/2023	22/04/2022		
	QWH-EPRR00/WR-12/60-90	02-02/24-14-004				
	METRAHIT WORLD	02-02/32-15-001	11/11/2023	11/11/2022		
	WK-340/40	02-02/45-05-001	03/08/2023	03/08/2022		
	VLP-1602 PRO	02-02/50-10-015				
	UFA210A (LU7-022-1000)	02-02/50-17-030				
	UFA210A (LU7-022-1000)	02-02/50-17-031				
Note: FE1 performed in the time period 19/01/2023 to 14/04/2023.						
FE2	FS-Z90	02-02/11-14-003	08/05/2024	08/05/2023	08/05/2024	08/05/2023
	FSW43	02-02/11-15-001	04/05/2024	04/05/2023		
	QWH-EPRR00/WR-12/60-90	02-02/24-14-004				
	METRAHIT WORLD	02-02/32-15-001	22/11/2024	22/11/2023		
	WK-340/40	02-02/45-05-001	27/07/2024	27/07/2023	27/01/2024	27/07/2023
	VLP-1602 PRO	02-02/50-10-015				
	UFA210A (LU7-022-1000)	02-02/50-17-030				
	UFA210A (LU7-022-1000)	02-02/50-17-031				
	EX-60310	09-16/50-23-005				
	E-6100-PoE	09-16/50-23-006				
Note: FE2 performed on 12/12/2023						
MB	FS-Z90	02-02/11-14-003	08/05/2024	08/05/2023	08/05/2024	08/05/2023
	FSW43	02-02/11-15-001	04/05/2024	04/05/2023		
	FSW43	02-02/11-21-001	22/05/2024	22/05/2023		
	QWH-EPRR00/WR-12/60-90	02-02/24-14-004				
	UFA210A (LU7-022-1000)	02-02/50-17-030				
	UFA210A (LU7-022-1000)	02-02/50-17-031				
Note: MB performed on 17/04/2024.						

SER 1	ESR 7	02-02/03-17-001	05/08/2023	05/08/2022		
	HFH 2 - Z 2	02-02/24-05-020	01/06/2025	01/06/2022	01/06/2023	01/06/2022
	NW-2000-NB	02-02/50-05-113				
	KK-EF393/U-16N-21N20 m	02-02/50-12-018				
	KK-SD_7/8-2X21N-33,0M	02-02/50-15-028				
	ANT1010A	02-02/50-16-035				

Note: SER1 performed in the time period 19/01/2023 to 16/03/2023

SER 2	ESR 7	02-02/03-17-001	05/08/2023	05/08/2022		
	VULB 9168	02-02/24-05-005	20/03/2023	20/12/2021	03/07/2023	03/07/2022
	NW-2000-NB	02-02/50-05-113				
	KK-EF393/U-16N-21N20 m	02-02/50-12-018				
	KK-SD_7/8-2X21N-33,0M	02-02/50-15-028				
	50F-003 N 3 dB	02-02/50-21-010				

Note: SER2 performed in the time period 19/01/2023 to 16/03/2023

SER 3	FS-Z110	02-02/11-14-002	08/05/2024	08/05/2023	08/05/2024	08/05/2023
	FS-Z90	02-02/11-14-003	08/05/2024	08/05/2023	08/05/2024	08/05/2023
	FSW43	02-02/11-15-001	04/05/2024	04/05/2023		
	RPG FS-Z170	02-02/11-17-001	05/06/2024	05/06/2023		
	RPG FS-Z220	02-02/11-17-002	10/05/2024	10/05/2023		
	FS-Z60	02-02/11-18-001	08/05/2024	08/05/2023	08/05/2024	08/05/2023
	AMF-6D-01002000-22-10P	02-02/17-15-004				
	LNA-40-18004000-33-5P	02-02/17-20-002				
	BBHA 9170	02-02/24-05-013	21/03/2026	21/03/2023	22/01/2025	22/01/2024
	QWH-UPRR00/WR-19/40-60	02-02/24-14-001				
	QWH-EPRR00/WR-12/60-90	02-02/24-14-004				
	QWH-WPRR00/WR-10/75-11	02-02/24-14-006				
	FH-SG-170/WR6/110-170	02-02/24-17-002				
	05-HA25/WR5/140-220	02-02/24-17-004				
	3117	02-02/24-20-007	15/11/2024	15/11/2023		
	BAM 4.5-P	02-02/50-17-024				
	NCD	02-02/50-17-025				
	UFA210A (LU7-022-1000)	02-02/50-17-030				
	UFA210A (LU7-022-1000)	02-02/50-17-031				
	KK-SF106-2X11N-6,5M	02-02/50-18-016				
	KMS116-GL140SE-KMS116-	02-02/50-20-026				

Note: SER3 performed in the time period 10/04/2024 to 18/04/2024.

- End of test report -