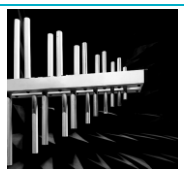
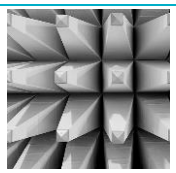




CTC advanced
member of RWTÜV group

Bundesnetzagentur

BNetzA-CAB-02/21-102

TEST REPORT

Test report no.: 1-3692/21-01-02-A

Testing laboratory

CTC advanced GmbH
Untertuerkheimer Strasse 6 – 10
66117 Saarbruecken / Germany
Phone: + 49 681 5 98 - 0
Fax: + 49 681 5 98 - 9075
Internet: https://www.ctcadvanced.com
e-mail: mail@ctcadvanced.com

Accredited Testing Laboratory:
The testing laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025 (2018-03) by the Deutsche Akkreditierungsstelle GmbH (DAkkS)
The accreditation is valid for the scope of testing procedures as stated in the accreditation certificate starting with the registration number: D-PL-12076-01.

Applicant

indurad GmbH
Belvedereallee 5
52070 Aachen / GERMANY
Phone: + 49 241 538070-28
Contact: Matthias Rabel
e-mail: matthias.rabel@indurad.com

Manufacturer

indurad GmbH
Belvedereallee 5
52070 Aachen / GERMANY

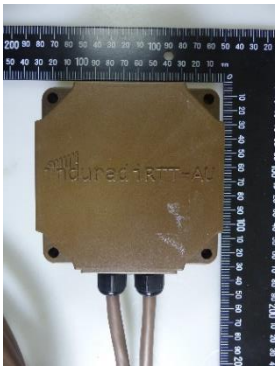
Test standard/s

FCC - Title 47 CFR Part 15	FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices

For further applied test standards please refer to section 3 of this test report.

Test Item

Kind of test item:	**iRTT AntennaUnit**
Model name:	**iRTT-AU**
FCC ID:	**2AJRSIRTTAU**
Frequency:	5925 MHz to 7250 MHz
Technology tested:	Wideband
Antenna:	Integrated antenna: Single ceramic chip antenna
Power supply:	11 V to 32 V DC
Temperature range:	-20°C to +60°C



This test report is electronically signed and valid without handwritten signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

Test report authorized:

Thomas Vogler
cn=Thomas Vogler, o=CTC advanced GmbH, ou=VOG-211118, email=thomas.vogler@ctcadvanced.com, c=DE
2022.03.23 14:42:32 +01'00'

Thomas Vogler
Lab Manager
Radio Communications

Test performed:

F. Heussner
cn=Frank Heussner, o=CTC advanced GmbH, ou=HNR-210329, email=Frank.Heussner@ctcadvanced.com, c=DE
2022.03.23 13:59:05 +01'00'

Frank Heussner
Testing Manager
Radio Communications

1 Table of contents

2 General information

2.1 Notes and disclaimer

The test results of this test report relate exclusively to the test item specified in this test report. CTC advanced GmbH 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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This test report replaces the test report with the number 1-3692/21-01-02 and dated 2022-02-14.

2.2 Application details

Date of receipt of order:	2021-12-20
Date of receipt of test item:	2022-01-04
Start of test:*	2022-01-04
End of test:*	2022-02-08
Person(s) present during the test:	Martin Gritzan (Pretests power settings)

*Date of each measurement, if not shown in the plot, can be requested. Dates are stored in the measurement software.

2.3 Test laboratories sub-contracted

None

3 Test standard/s, references and accreditations

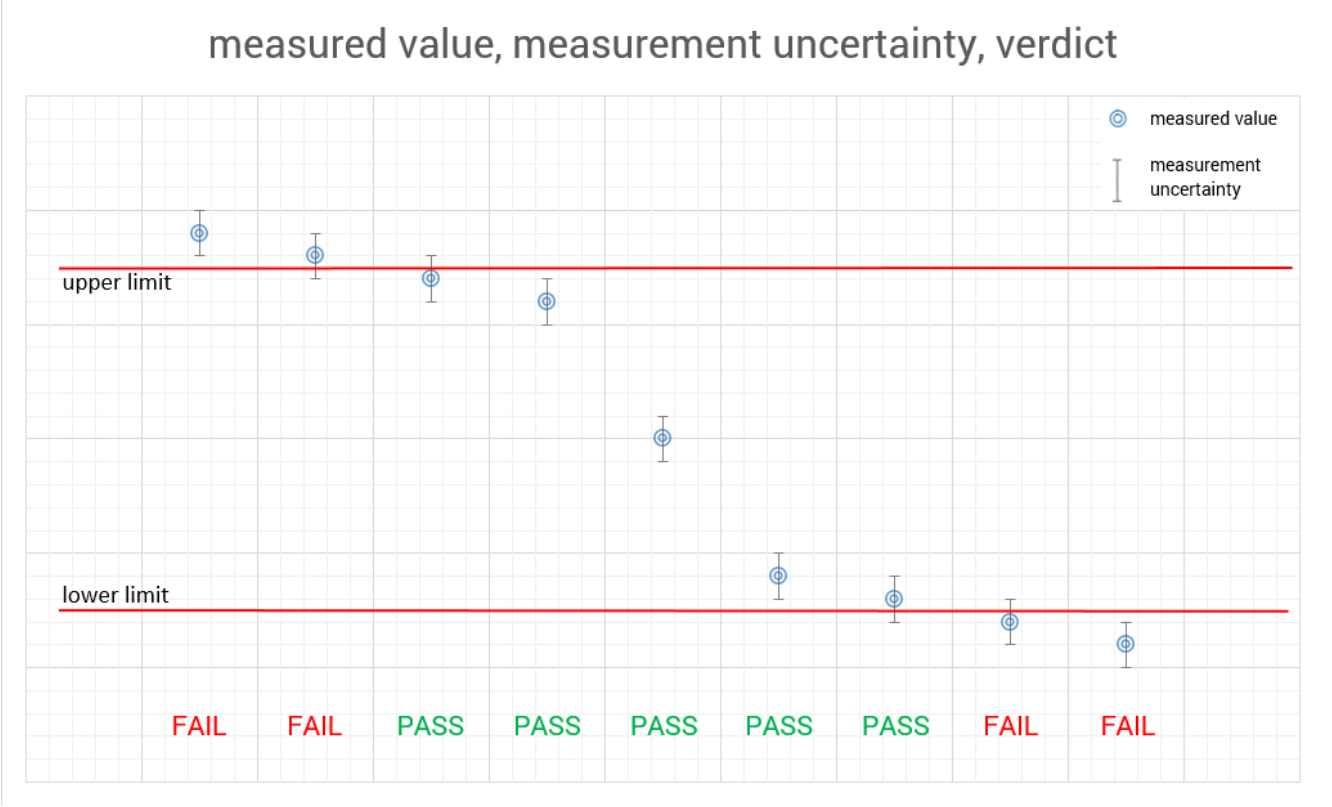
Test standard	Date	Description
FCC - Title 47 CFR Part 15		FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices

Guidance	Version	Description
ANSI C63.4-2014	-/-	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI C63.10-2013	-/-	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

Accreditation	Description
D-PL-12076-01-05	Telecommunication FCC requirements https://www.dakks.de/files/data/as/pdf/D-PL-12076-01-05e.pdf

4 Reporting statements of conformity – decision rule

Only the measured values related to their corresponding limits will be used to decide whether the equipment under test meets the requirements of the test standards listed in chapter 3.
The measurement uncertainty is mentioned in this test report, see chapter 9, but is not taken into account - neither to the limits nor to the measurement results. Measurement results with a smaller margin to the corresponding limits than the measurement uncertainty have a potential risk of more than 5% that the decision might be wrong.



5 Test environment

Temperature	:	T_{nom} T_{max} T_{min}	+22 °C during room temperature tests +60 °C during high temperature tests -20 °C during low temperature tests
Relative humidity content	:		49 %
Barometric pressure	:		990 hPa to 1010 hPa
Power supply	:	V_{nom} V_{max} V_{min}	24 V DC 32 V DC 11 V DC

6 Test item

6.1 General description

Kind of test item	:	iRTT AntennaUnit
Model name	:	iRTT-AU
S/N serial number	:	EUT 1: d9058f EUT 2: a74d05
Power setting / Pulse generation delay	:	0x62626262 / 0xC0 (Test mode EUT 1)
Hardware status	:	V2
Software status	:	n/a
Firmware status	:	v32.11 + v3.14
Frequency band	:	5925 MHz to 7250 MHz
Type of radio transmission Use of frequency spectrum	: :	Wideband
Type of modulation	:	Pulse-Code Modulation
Number of channels	:	1
Antenna	:	Integrated antenna: Single ceramic chip antenna
Power supply	:	11 V to 32 V DC
Temperature range	:	-20°C to +60°C

6.2 Additional information

The content of the following annexes is defined in the QA. It may be that not all of the listed annexes are necessary for this report, thus some values in between may be missing.

Test setup and EUT photos are included in test report: 1-3692/21-01-01_AnnexA
1-3692/21-01-01_AnnexB
1-3692/21-01-01_AnnexD

7 Description of the test setup

Typically, the calibrations of the test apparatus are commissioned to and performed by an accredited calibration laboratory. The calibration intervals are determined in accordance with the DIN EN ISO/IEC 17025. In addition to the external calibrations, the laboratory executes comparison measurements with other calibrated test systems or effective verifications. Weekly chamber inspections and range calibrations are performed. Where possible, RF generating and signaling equipment as well as measuring receivers and analyzers are connected to an external high-precision 10 MHz reference (GPS-based or rubidium frequency standard).

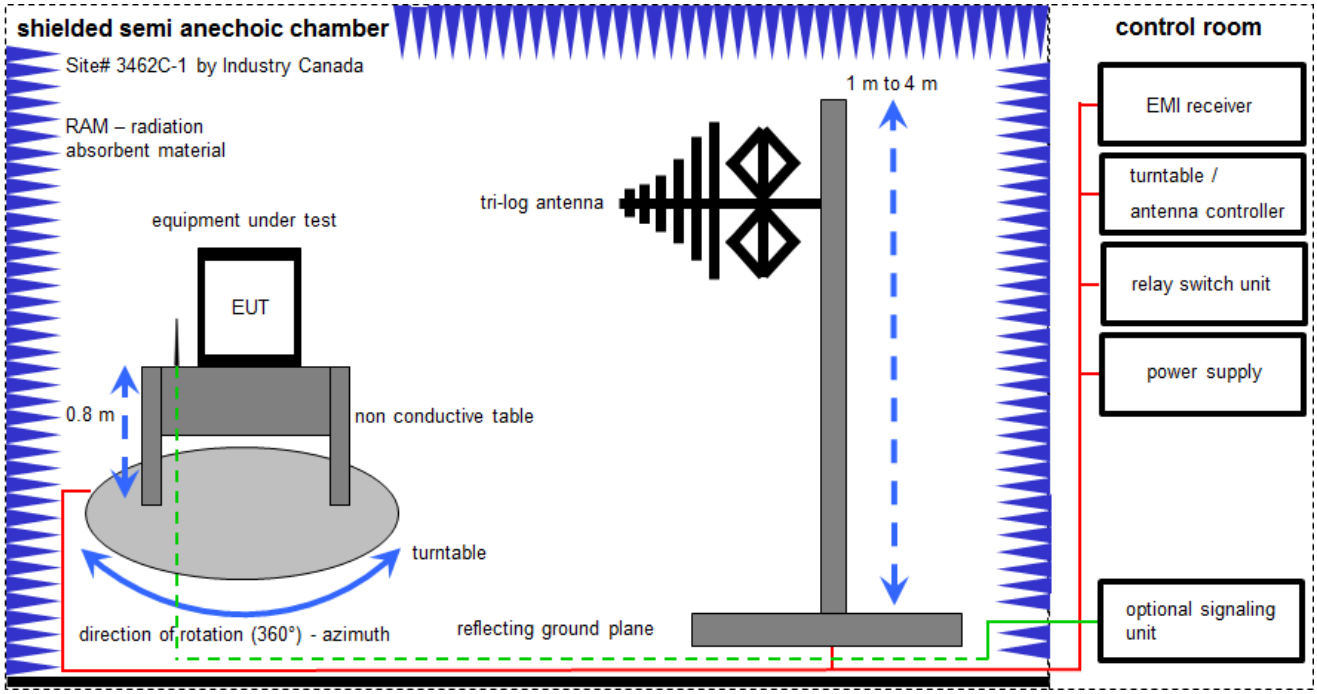
In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

Agenda: Kind of Calibration

k	calibration / calibrated	EK	limited calibration
ne	not required (k, ev, izw, zw not required)	zw	cyclical maintenance (external cyclical maintenance)
ev	periodic self verification	izw	internal cyclical maintenance
Ve	long-term stability recognized	g	blocked for accredited testing
vlkl!	Attention: extended calibration interval		
NK!	Attention: not calibrated	*)	next calibration ordered / currently in progress

7.1 Shielded semi anechoic chamber

The radiated measurements are performed in vertical and horizontal plane in the frequency range from 30 MHz to 1 GHz in semi-anechoic chambers. The EUT is positioned on a non-conductive support with a height of 0.80 m above a conductive ground plane that covers the whole chamber. The receiving antennas are conform to specifications ANSI C63. These antennas can be moved over the height range between 1.0 m and 4.0 m in order to search for maximum field strength emitted from EUT. The measurement distances between EUT and receiving antennas are indicated in the test setups for the various frequency ranges. For each measurement, the EUT is rotated in all three axes until the maximum field strength is received. The wanted and unwanted emissions are received by spectrum analyzers where the detector modes and resolution bandwidths over various frequency ranges are set according to requirement ANSI C63.



Measurement distance: tri-log antenna 10 meter

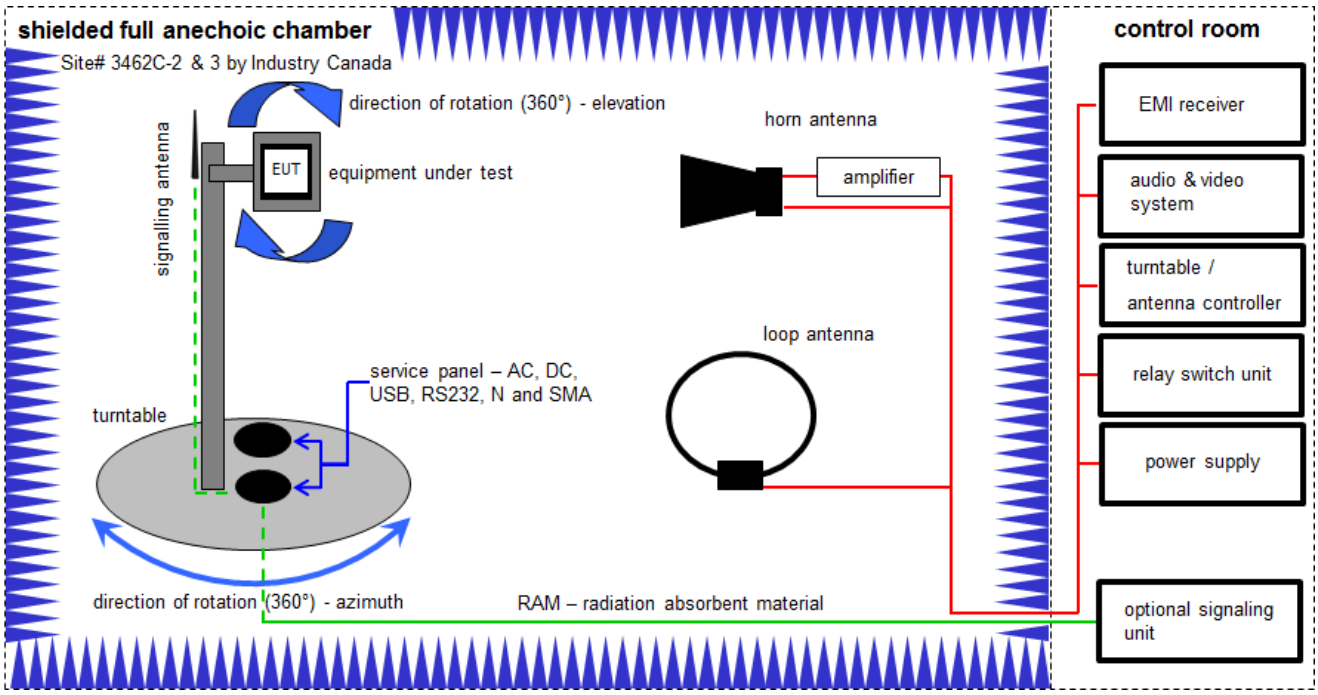
FS = UR + CL + AF
(FS-field strength; UR-voltage at the receiver; CL-loss of the cable; AF-antenna factor)

Example calculation:
FS [dBµV/m] = 12.35 [dBµV/m] + 1.90 [dB] + 16.80 [dB/m] = 31.05 [dBµV/m] (35.69 µV/m)

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	n. a.	Switch-Unit	3488A	HP	2719A14505	300000368	ev	-/-	-/-
2	n. a.	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP	2920A04466	300000580	ne	-/-	-/-
3	n. a.	Semi anechoic chamber	300023	MWB AG	-/-	300000551	ne	-/-	-/-
4	n. a.	Antenna Tower	Model 2175	ETS-Lindgren	64762	300003745	izw	-/-	-/-
5	n. a.	Positioning Controller	Model 2090	ETS-Lindgren	64672	300003746	izw	-/-	-/-
6	n. a.	Turntable Interface-Box	Model 105637	ETS-Lindgren	44583	300003747	izw	-/-	-/-
7	n. a.	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck Mess - Elektronik	318	300003696	vlKl!	30.09.2021	29.09.2023
8	n. a.	EMI Test Receiver	ESR3	Rohde & Schwarz	102587	300005771	k	08.12.2021	07.12.2022
9	n. a.	PC	TecLine	F+W	-/-	300004388	ne	-/-	-/-

7.2 Shielded fully anechoic chamber



Measurement distance: horn antenna 3 meter / 1 meter, loop antenna 3 meter / 1 meter

FS = UR + CA + AF
(FS-field strength; UR-voltage at the receiver; CA-loss of the signal path; AF-antenna factor)

Example calculation:
FS [dBµV/m] = 40.0 [dBµV/m] + (-35.8) [dB] + 32.9 [dB/m] = 37.1 [dBµV/m] (71.61 µV/m)

OP = AV + D - G + CA
(OP-radiated output power; AV-analyzer value; D-free field attenuation of measurement distance; G-antenna gain+amplifier gain; CA-loss signal path)

Example calculation:
OP [dBm] = -65.0 [dBm] + 50 [dB] - 20 [dBi] + 5 [dB] = -30 [dBm] (1 µW)

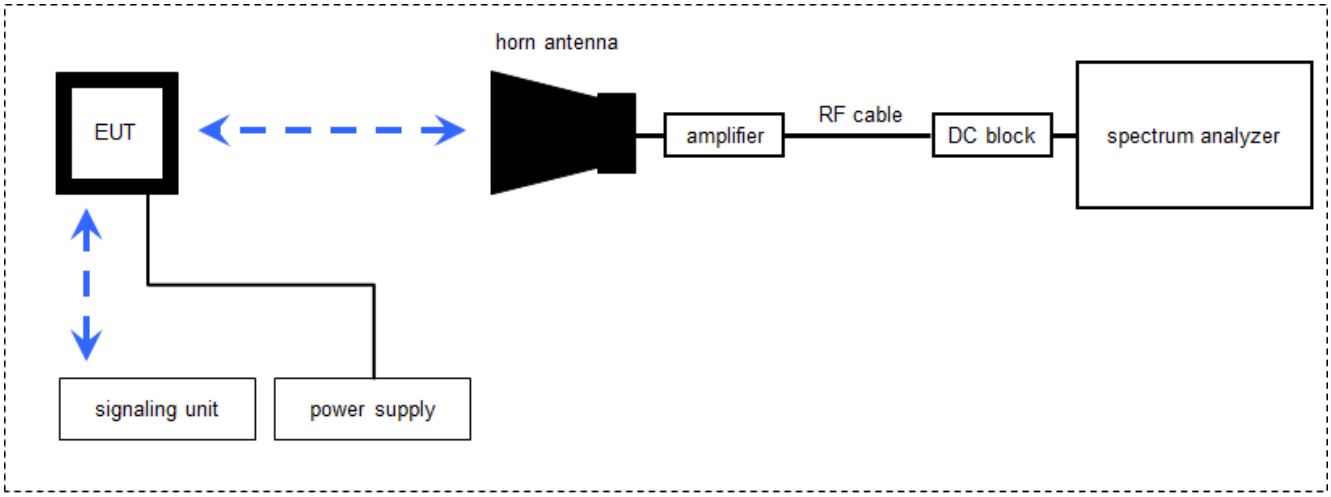
Equipment table (Chamber C):

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A,B,C	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP	2818A03450	300001040	vIKI!	09.12.2020	08.12.2023
2	A,B,C	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev	-/-	-/-
3	A,B,C	Switch / Control Unit	3488A	HP	*	300000199	ne	-/-	-/-
4	A,B,C	Variable isolating transformer	MPL IEC625 Bus Variable isolating transformer	Erfi	91350	300001155	ne	-/-	-/-
5	A,B,C	EMI Test Receiver 20Hz- 26,5GHz	ESU26	R&S	100037	300003555	k	09.12.2021	08.12.2022
6	A,B,C	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000037	300004509	ne	-/-	-/-
7	A,B,C	NEXIO EMV-Software	BAT EMC V3.16.0.49	EMCO		300004682	ne	-/-	-/-
8	A,B,C	PC	ExOne	F+W		300004703	ne	-/-	-/-
9	A	Active Loop Antenna 9 kHz to 30 MHz	6502	EMCO	2210	300001015	vIKI!	01.07.2021	30.06.2023

Equipment table (OTA):

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A,B,C	Power supply GPIB dc power supply, 0-50 Vdc, 0-2 A	6633A	HP	2851A01222	300001530	vIKI!	10.12.2019	09.12.2022
2	A,B,C	CTIA-Chamber	CTIA-Chamber AMS 8500	ETS-Lindgren Finnland		300003327	ne	-/-	-/-
3	A,B,C	CTIA-Chamber - Positioning Equipment	CTIA-Chamber - Positioning Equipment	EMCO/2		300003328	ne	-/-	-/-
4	A,B,C	Signal- and Spectrum Analyzer	FSW26	R&S	101371	300005697	k	09.12.2021	08.12.2022
5	A,B,C	PC	Precision M4800	DELL	19414201934	300004957	-/-	-/-	-/-
6	A,B,C	EMC Software Chamber A	EMC32-MEB	R&S	n.a.	300005477	-/-	-/-	-/-
7	A,B,C	RF Amplifier	AMF-7D-01001800-22-10P	NARDA-MITEQ Inc	2089864	300005633	ev	-/-	-/-
8	B, C	Lowpass Filter (Chebyshev)	WLKX14-4700-4900-21000-30SS	Wainwright Instruments GmbH	1	300005655	ev	-/-	-/-
9	A	High Pass Filter (Chebyshev)	WHNX6-8374-10600-26500-40CC	Wainwright Instruments GmbH	1	300005656	ev	-/-	-/-
10	A	Std. Gain Horn Antenna 11.90-18.00 GHz	1824-20	Flann	263	300002471	ev	-/-	-/-
11	B	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	9709-5290	300000212	ev	-/-	-/-
12	C	Breitband Doppelsteg-Hornantenne 0.5-6 GHz, 300 W	BBHA 9120 E	Schwarzbeck	212	300003214	vIKI!	22.06.2021	21.06.2024

7.3 Radiated measurements > 18 GHz



Measurement distance: horn antenna e.g. 75 cm

FS = UR + CA + AF
(FS-field strength; UR-voltage at the receiver; CA-loss signal path & distance correction; AF-antenna factor)

Example calculation:
FS [dBµV/m] = 40.0 [dBµV/m] + (-60.1) [dB] + 36.74 [dB/m] = 16.64 [dBµV/m] (6.79 µV/m)

OP = AV + D - G + CA
(OP-radiated output power; AV-analyzer value; D-free field attenuation of measurement distance;
G-antenna gain+amplifier gain; CA-loss signal path)

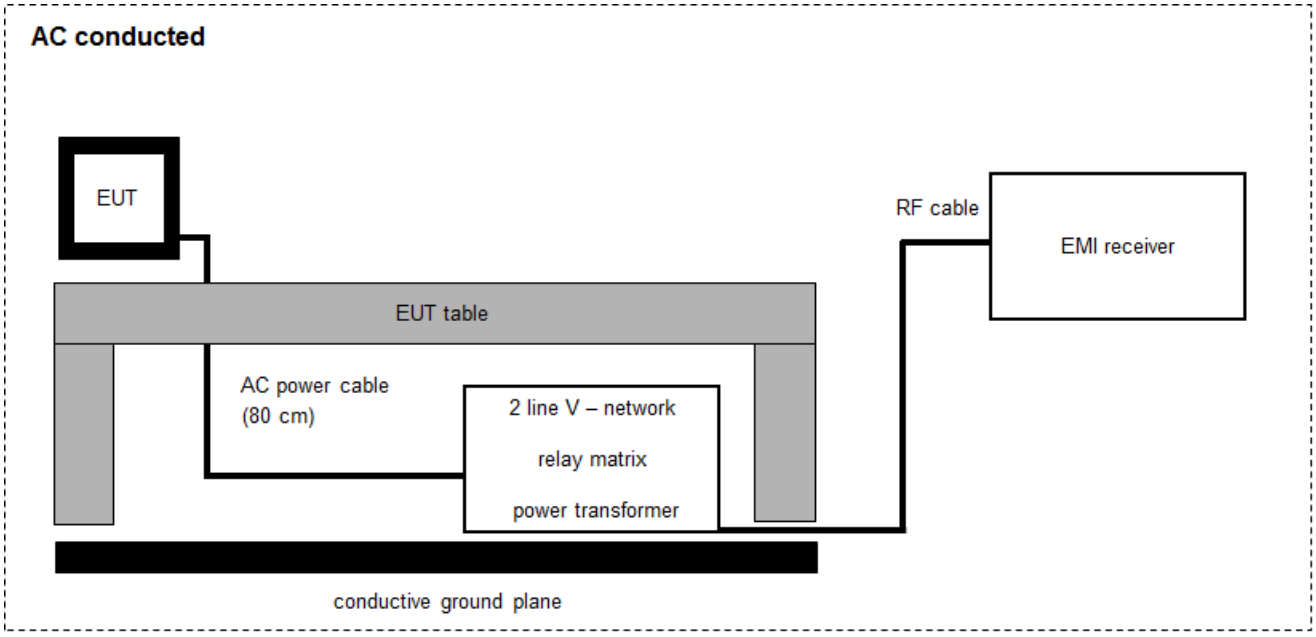
Example calculation:
OP [dBm] = -59.0 [dBm] + 44.0 [dB] - 20.0 [dBi] + 5.0 [dB] = -30 [dBm] (1 µW)

Note: conversion loss of mixer is already included in analyzer value.

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	n. a.	Spectrum Analyzer	FSW50	Rohde & Schwarz	101332	300005935	k	20.01.2022	31.01.2023
2	n. a.	Spectrum Analyzer	FSW50	Rohde & Schwarz	101560	300006179	k	19.03.2021	18.03.2022
3	n. a.	Spectrum Analyzer 2 Hz - 85 GHz	FSW85	R&S	101333	300005568	k	30.06.2021	29.06.2022
4	n. a.	Broadband LNA 18-50 GHz	CBL18503070PN	CERNEX	25240	300004948	ev	29.10.2021	28.10.2023
5	n.a.	DC Power Supply, 60V, 10A	6038A	HP	2848A07027	300001174	vlKl!	08.12.2020	07.12.2023
6	n. a.	Temperature Test Chamber	T-40/50	CTS GmbH	064023	300003540	ev	08.05.2020	07.05.2022
7	n.a.	Horn Antenna 18,0-40,0 GHz	LHAF180	Microw.Devel	39180-103-021	300001747	vlKl!	18.02.2019	17.02.2022
8	n. a.	Std. Gain Horn Antenna 18.0-26.5 GHz	638	Narda		300000486	vlKl!	21.01.2020 17.01.2022	20.01.2022 31.01.2024
9	n. a.	Std. Gain Horn Antenna 26.5-40.0 GHz	V637	Narda	82-16	300000510	vlKl!	23.01.2020 17.01.2022	22.01.2022 31.01.2024

7.4 AC conducted



FS = UR + CF + VC
(FS-field strength; UR-voltage at the receiver; CR-loss of the cable and filter; VC-correction factor of the ISN)

Example calculation:
FS [dBµV/m] = 37.62 [dBµV/m] + 9.90 [dB] + 0.23 [dB] = 47.75 [dBµV/m] (244.06 µV/m)

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	n. a.	Two-line V-Network (LISN) 9 kHz to 30 MHz	ESH3-Z5	R&S	892475/017	300002209	vIKI!	14.12.2021	13.12.2023
2	n. a.	Analyzer-Reference-System (Harmonics and Flicker)	ARS 16/1	SPS	A3509 07/0 0205	300003314	vIKI!	29.12.2021	28.12.2023
3	n. a.	Hochpass 150 kHz	EZ-25	R&S	100010	300003798	ev	-/-	-/-
4	n. a.	EMI Test Receiver	ESCI 3	R&S	100083	300003312	k	09.12.2021	08.12.2022
5	n. a.	PC	TecLine	F+W	-/-	300003532	ne	-/-	-/-

8 Sequence of testing

8.1 Sequence of testing radiated spurious 9 kHz to 30 MHz

Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, it is placed on a table with 0.8 m height.
- If the EUT is a floor standing device, it is placed directly on the turn table.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 3 m (see ANSI C 63.4) – see test details.
- EUT is set into operation.

Premeasurement*

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna height is 1 m.
- At each turntable position the analyzer sweeps with positive-peak detector to find the maximum of all emissions.

Final measurement

- Identified emissions during the pre-measurement are maximized by the software by rotating the turntable from 0° to 360°.
- Loop antenna is rotated about its vertical axis for maximum response at each azimuth about the EUT. (For certain applications, the loop antenna plane may also need to be positioned horizontally at the specified distance from the EUT)
- The final measurement is done in the position (turntable and elevation) causing the highest emissions with quasi-peak (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. A plot with the graph of the premeasurement and the limit is stored.

*)Note: The sequence will be repeated three times with different EUT orientations.

8.2 Sequence of testing radiated spurious 30 MHz to 1 GHz

Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 10 m or 3 m (see ANSI C 63.4) – see test details.
- EUT is set into operation.

Premeasurement

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height changes from 1 m to 3 m.
- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

Final measurement

- The final measurement is performed for at least six highest peaks according to the requirements of the ANSI C63.4.
- Based on antenna and turntable positions at which the peak values are measured the software maximize the peaks by changing turntable position ± 45° and antenna height between 1 and 4 m.
- The final measurement is done with quasi-peak detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement with marked maximum final results and the limit is stored.

8.3 Sequence of testing radiated spurious 1 GHz to 18 GHz

Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, a 2-axis positioner with 1.5 m height is used.
- If the EUT is a floor standing device, it is placed directly on the turn table.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 3 m (see ANSI C 63.4) – see test details.
- EUT is set into operation.

Premeasurement

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height is 1.5 m.
- At each turntable position and antenna polarization the analyzer sweeps with positive peak detector to find the maximum of all emissions.

Final measurement

- The final measurement is performed for at least six highest peaks according to the requirements of the ANSI C63.4.
- Based on antenna and turntable positions at which the peak values are measured the software maximizes the peaks by rotating the turntable from 0° to 360°. This measurement is repeated for different EUT-table positions (0° to 150° in 30°-steps) and for both antenna polarizations.
- The final measurement is done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and RMS detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement with marked maximum final results and the limit is stored.

8.4 Sequence of testing radiated spurious above 18 GHz

Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet.
- The measurement distance is as appropriate (e.g. 0.5 m).
- The EUT is set into operation.

Premeasurement

- The test antenna is handheld and moved carefully over the EUT to cover the EUT's whole sphere and different polarizations of the antenna.

Final measurement

- The final measurement is performed at the position and antenna orientation causing the highest emissions with Peak and RMS detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement and the limit is stored.

9 Measurement uncertainty

Test case	Uncertainty
Equivalent isotropically radiated power (e.i.r.p.)	Conducted value ± 1 dB Radiated value ± 3 dB
Permitted range of operating frequencies	± 100 kHz
Conducted unwanted emissions in the spurious domain (up to 18 GHz)	± 1 dB
Radiated unwanted emissions in the spurious domain (up to 18 GHz)	± 3 dB
Conducted unwanted emissions in the spurious domain (18 to 40 GHz)	± 4 dB
Radiated unwanted emissions in the spurious domain (18 to 40 GHz)	± 4 dB
Conducted unwanted emissions in the spurious domain (40 to 50 GHz)	± 4.5 dB
Radiated unwanted emissions in the spurious domain (40 to 50 GHz)	± 4.5 dB
Conducted unwanted emissions in the spurious domain (above 50 GHz)	± 5 dB
Radiated unwanted emissions in the spurious domain (above 50 GHz)	± 5 dB
DC and low frequency voltages	± 3 %
Temperature	± 1 °C
Humidity	± 3 %

10 Summary of measurement results

☒	**No deviations from the technical specifications were ascertained**
☐	There were deviations from the technical specifications ascertained
☐	This test report is only a partial test report. The content and verdict of the performed test cases are listed below.

TC Identifier	Description	Verdict	Date	Remark
RF-Testing	CFR47 §15.207, §15.209, §15.250 RSS-210, RSS-Gen	see table	2022-03-23	-/-

Test specification clause	Test case	Temperature conditions	Power source	Pass	Fail	NA	NP	Remark
§15.250 (a), (b), (e)(4) RSS-210 K.2, K.4(d)	10 dB Bandwidth	Nominal	Nominal	☒	☐	☐	☐	complies
§15.209 §15.250 (d), (e)(1-3) RSS-210 K.3, K.4(a-c) RSS-Gen	TX Radiated Emissions	Nominal	Nominal	☒	☐	☐	☐	complies
§15.250(a), (e)(4) § 2.1055 RSS-210 K.2, K.4(d)	Frequency Stability	Nominal Extreme	Nominal Extreme	☒	☐	☐	☐	complies
§15.207 RSS-Gen 8.8	Conducted Emissions < 30 MHz	Nominal	Nominal	☒	☐	☐	☐	complies

Note: NA = Not Applicable; NP = Not Performed

11 Additional comments

Reference documents: None

Special test descriptions: None

Configuration descriptions: None

Test mode:

☐ No test mode available.

☒ Special test mode/software is used.
Description of test mode (EUT 1) as declared by customer:
As a test signal a frame with 128 Bytes of randomized payload including checksum is transmitted once every 1ms. Modulation, transmission power and pulse generation parameters are equal to the application firmware. All frames are transmitted with the same power level regardless of frame length.
This test signal gives a worst-case upper boundary for the application firmware's channel usage.

Test device (EUT):

- EUT 1: WB emissions are turned on and the above described test mode is used.
- EUT 2: To verify the emissions of the digital circuitry, a specifically prepared device (EUT 2) is used in which the WB emissions are turned off.

12 Measurement results

12.1 10 dB - Bandwidth

Description:

Measurement of the -10 dB bandwidth of the wanted signal.

§15.250(a)
The −10 dB bandwidth of a device operating under the provisions of this section must be contained within the 5925-7250 MHz band under all conditions of operation including the effects from stepped frequency, frequency hopping or other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage.

§15.250(b)
The −10 dB bandwidth of the fundamental emission shall be at least 50 MHz. For transmitters that employ frequency hopping, stepped frequency or similar modulation types, measurement of the −10 dB minimum bandwidth specified in this paragraph shall be made with the frequency hop or step function disabled and with the transmitter operating continuously at a fundamental frequency following the provisions of § 15.31(m).

§15.250(e)(4)
The −10 dB bandwidth is based on measurement using a peak detector, a 1 MHz resolution bandwidth, and a video bandwidth greater than or equal to the resolution bandwidth.

Measurement:

Measurement parameter	
Detector:	Pos-Peak
Video bandwidth:	1 MHz
Resolution bandwidth:	3 MHz
Trace-Mode:	Max Hold

Limits:

§15.250(a),

Lower -10 dB point > 5925 MHz Upper -10 dB point < 7250 MHz

§15.250(b)

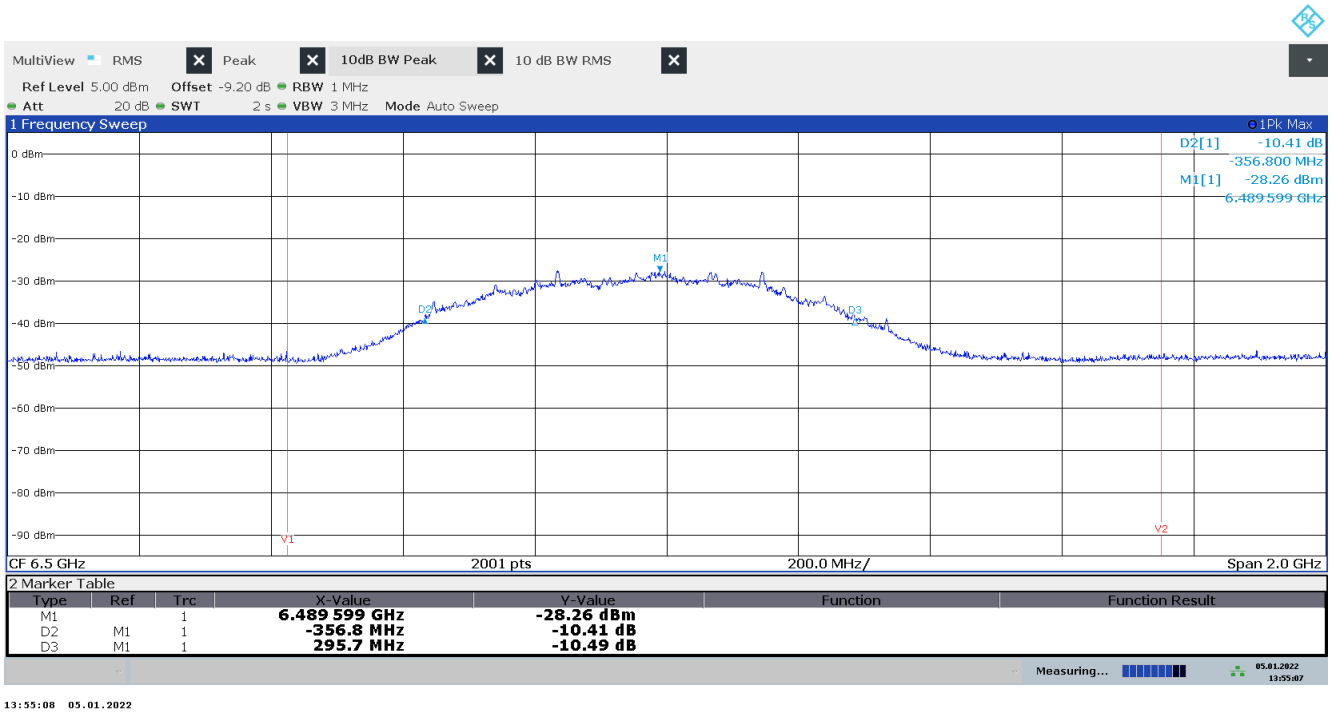
-10 dB bandwidth > 50 MHz

Results:

Lower -10 dB point [MHz]	Upper -10 dB point [MHz]	- 10 dB bandwidth [MHz]	Plot
6132.799	6785.299	652.5	1

Verdict: Compliant

Plot 1: -10 dB bandwidth (EUT 1, WB on)



12.2 TX Radiated Emissions

Description:

Measurement of the radiated emissions in transmit mode.

Measurement:

§15.250(d)(4), §15.209:

Measurement parameter	
Detector:	Peak/QPeak
Sweep time:	1 s
Resolution bandwidth:	120kHz
Video bandwidth:	≥ RBW
Trace-Mode:	Max Hold

§15.250(d)(1):

Measurement parameter	
Detector:	RMS
Sweep time:	1 ms/pt
Resolution bandwidth:	1 MHz
Video bandwidth:	3 MHz
Trace-Mode:	Max Hold

§15.250(d)(2):

Measurement parameter	
Detector:	RMS
Sweep time:	1 ms/pt
Resolution bandwidth:	30 kHz / 1 kHz
Video bandwidth:	300 kHz / 3 kHz
Trace-Mode:	Max Hold

§15.250(d)(3):

Measurement parameter	
Detector:	Pos-Peak
Resolution bandwidth:	50 MHz
Video bandwidth:	80 MHz
Span:	Zero span
Trace-Mode:	Max Hold

Limits:

Radiated emissions at or below 960 MHz (§15.250(d)(4), §15.209):

Frequency (MHz)	Field strength (µV/m)	Measurement distance (m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30	30 (29.5 dBµV/m)	30
30 – 88	100 (40 dBµv/m)	3
88 – 216	150 (43.5 dBµV/m)	3
216 – 960	200 (46 dBµV/m)	3
> 960	500 (54 dBµV/m)	3

§15.250(d)
Emissions from a transmitter operating under this section shall not exceed the following equivalent isotropically radiated power (EIRP) density levels:

§15.250(d)(1)
The radiated emissions above 960 MHz from a device operating under the provisions of this section shall not exceed the following RMS average limits based on measurements using a 1 MHz resolution bandwidth:

Frequency in MHz	EIRP in dBm
960 to 1610	-75.3
1610 to 1990	-63.3
1990 to 3100	-61.3
3100 to 5925	-51.3
5925 to 7250	-41.3
7250 to 10600	-51.3
Above 10600	-61.3

§15.250(d)(2)
In addition to the radiated emission limits specified in the table in paragraph (d)(1) of this section, transmitters operating under the provisions of this section shall not exceed the following RMS average limits when measured using a resolution bandwidth of no less than 1 kHz:

Frequency in MHz	EIRP in dBm
1164 to 1240	-85.3
1559 to 1610	-85.3

§15.250(d)(3)
There is a limit on the peak level of the emissions contained within a 50 MHz bandwidth centered on the frequency at which the highest radiated emission occurs and this 50 MHz bandwidth must be contained within the 5925-7250 MHz band. The peak EIRP limit is 20 log (RBW/50) dBm where RBW is the resolution bandwidth in megahertz that is employed by the measurement instrument. RBW shall not be lower than 1 MHz or greater than 50 MHz. The video bandwidth of the measurement instrument shall not be less than RBW. If RBW is greater than 3 MHz, the application for certification filed with the Commission shall contain a detailed description of the test procedure, calibration of the test setup, and the instrumentation employed in the testing.

Further provisions of CFR 47 §15.250:

§15.250(d)(5)
Emissions from digital circuitry used to enable the operation of the transmitter may comply with the limits in § 15.209 provided it can be clearly demonstrated that those emissions are due solely to emissions from digital circuitry contained within the transmitter and the emissions are not intended to be radiated from the transmitter's antenna. Emissions from associated digital devices, as defined in § 15.3(k), e.g., emissions from digital circuitry used to control additional functions or capabilities other than the operation of the transmitter, are subject to the limits contained in subpart B of this part. Emissions from these digital circuits shall not be employed in determining the −10 dB bandwidth of the fundamental emission or the frequency at which the highest emission level occurs.

§15.250(e)(1)
All emissions at and below 960 MHz are based on measurements employing a CISPR quasi-peak detector. Unless otherwise specified, all RMS average emission levels specified in this section are to be measured utilizing a 1 MHz resolution bandwidth with a one millisecond dwell over each 1 MHz segment. The frequency span of the analyzer should equal the number of sampling bins times 1 MHz and the sweep rate of the analyzer should equal the number of sampling bins times one millisecond. The provision in § 15.35(c) that allows emissions to be averaged over a 100 millisecond period does not apply to devices operating under this section. The video bandwidth of the measurement instrument shall not be less than the resolution bandwidth and trace averaging shall not be employed. The RMS average emission measurement is to be repeated over multiple sweeps with the analyzer set for maximum hold until the amplitude stabilizes.

§15.250(e)(2)
The peak emission measurement is to be repeated over multiple sweeps with the analyzer set for maximum hold until the amplitude stabilizes.

§15.250(e)(3)
For transmitters that employ frequency hopping, stepped frequency or similar modulation types, the peak emission level measurement, the measurement of the RMS average emission levels, and the measurement to determine the frequency at which the highest level emission occurs shall be made with the frequency hop or step function active. Gated signals may be measured with the gating active. The provisions of § 15.31(c) continue to apply to transmitters that employ swept frequency modulation.

Results:

Fundamental emission:

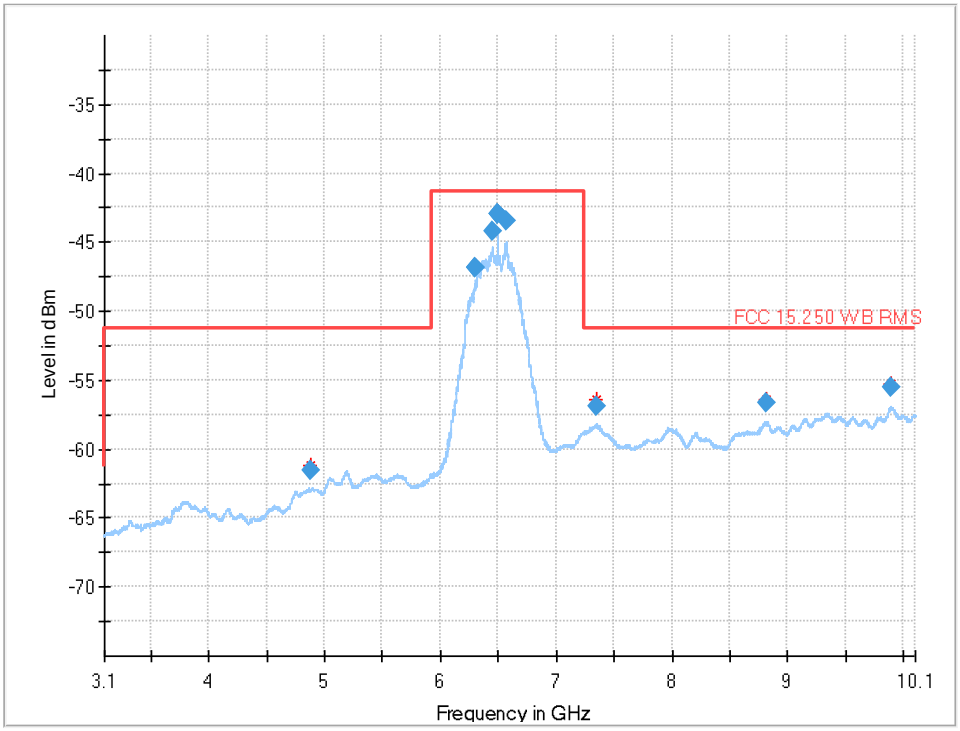
Frequency f [MHz]	Max RMS power in dBm/MHz	Max Peak power in dBm/50 MHz	Plot
6489.599	-42.95	-4.35	2, 3

Emissions outside the band:

Frequency f [MHz]	Detector	Measured level [dBµV/m]	Limit [dBµV/m]	Margin [dB]
No critical peaks found. For details, please refer to plots.				
-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-

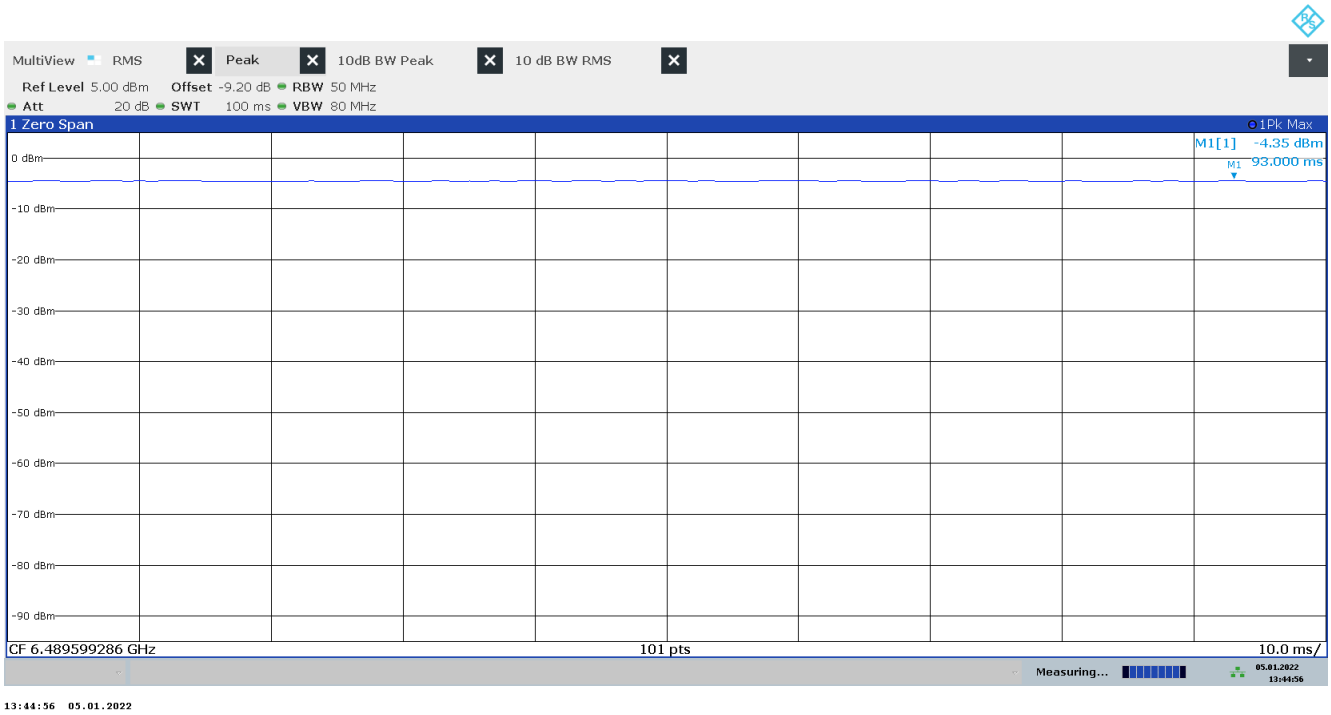
Verdict: Compliant

Plot 2: Fundamental emission: RMS (EUT 1, WB on)

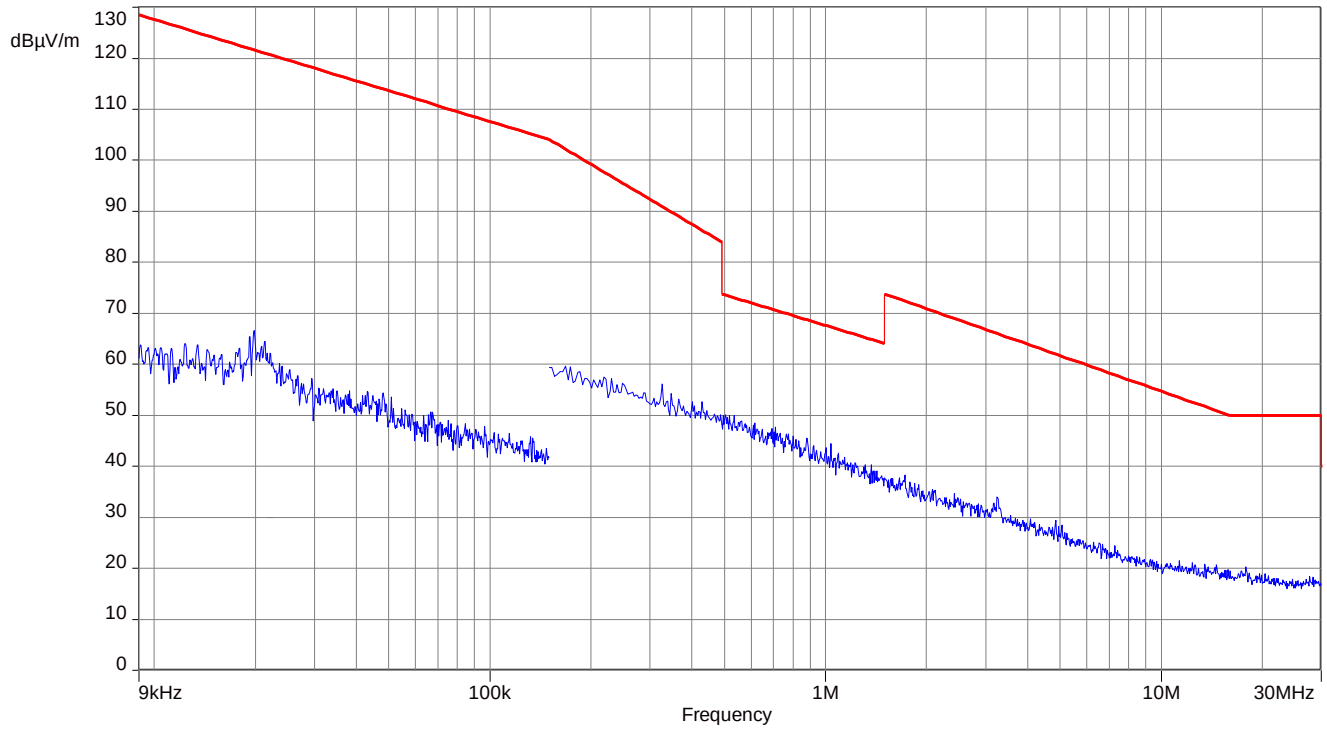


Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Bandwidth (kHz)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
4887.335714	-61.52	-51.30	10.22	1000.000	V	345.0	44.0	-118.0
6295.029857	-46.82	-41.30	5.52	1000.000	H	8.0	0.0	-116.7
6296.992143	-46.83	-41.30	5.53	1000.000	H	9.0	2.0	-116.7
6446.377714	-44.15	-41.30	2.85	1000.000	H	8.0	1.0	-116.0
6489.553857	-43.00	-41.30	1.70	1000.000	H	7.0	1.0	-116.2
6489.580000	-42.99	-41.30	1.69	1000.000	H	6.0	1.0	-116.2
6489.599286	-42.95	-41.30	1.65	1000.000	H	9.0	1.0	-116.2
6567.253857	-43.43	-41.30	2.13	1000.000	H	11.0	1.0	-115.9
7350.170429	-56.88	-51.30	5.58	1000.000	V	27.0	19.0	-113.8
8816.284571	-56.69	-51.30	5.39	1000.000	V	214.0	7.0	-114.0
9891.121429	-55.53	-51.30	4.23	1000.000	H	33.0	76.0	-112.5

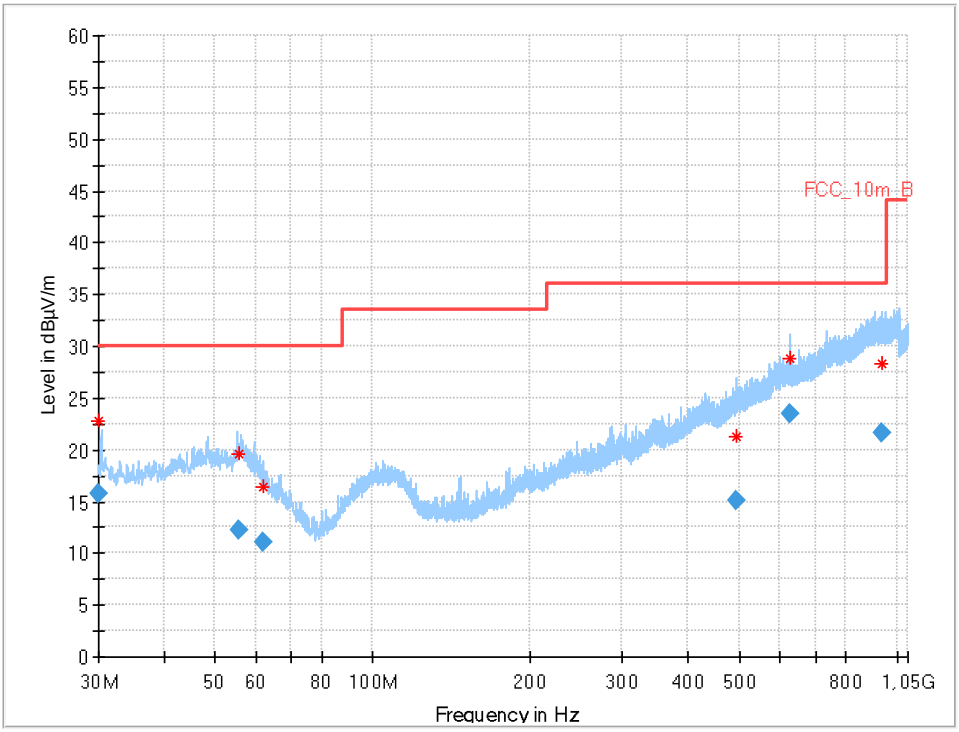
Plot 3: Fundamental emission: Max Peak (EUT 1, WB on)



Plot 4: 9 kHz to 30 MHz (EUT 1, WB on)

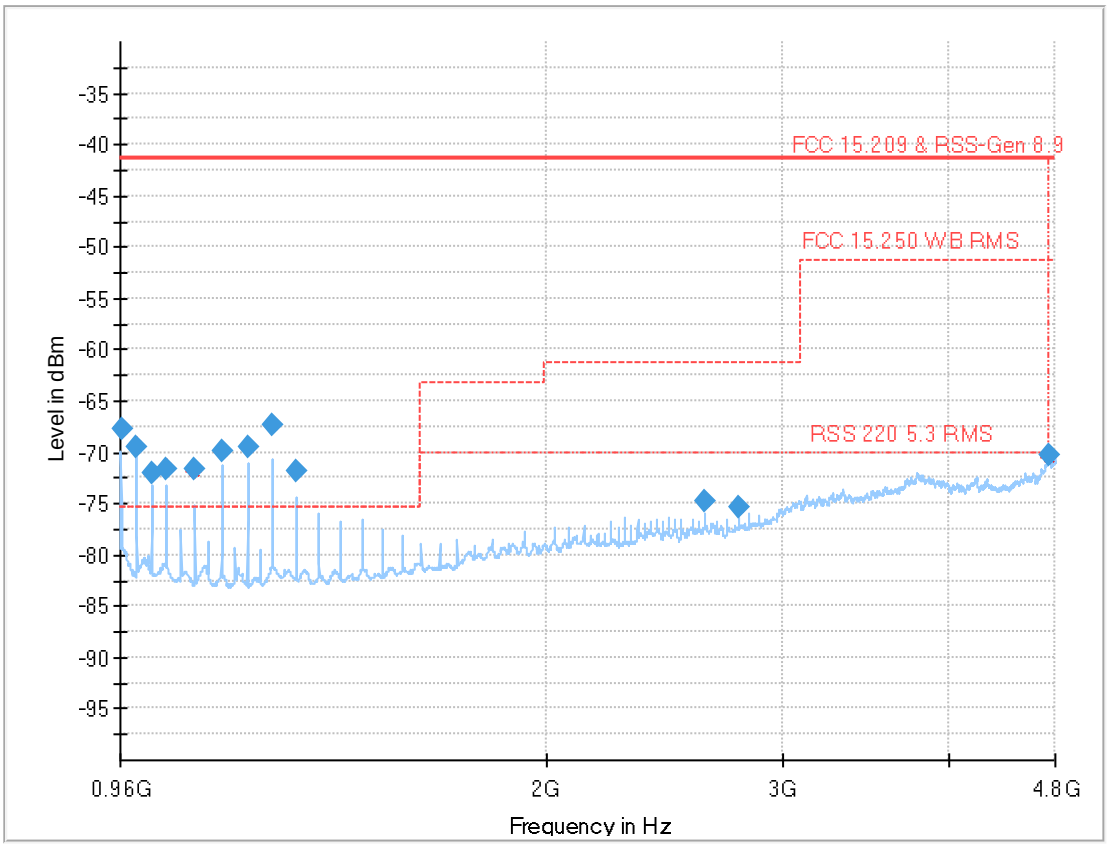


Plot 5: 30 MHz to 1 GHz (EUT 1, WB on)



Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
30.051	15.72	30.0	14.3	1000	120.0	100.0	V	150	13
55.680	12.22	30.0	17.8	1000	120.0	200.0	V	209	16
62.000	11.03	30.0	19.0	1000	120.0	367.0	V	-40	13
494.625	15.08	36.0	20.9	1000	120.0	131.0	H	135	20
623.990	23.38	36.0	12.6	1000	120.0	102.0	V	0	22
935.823	21.68	36.0	14.3	1000	120.0	250.0	H	287	26

Plot 6: 960 MHz to 4.8 GHz (EUT 1, WB on)

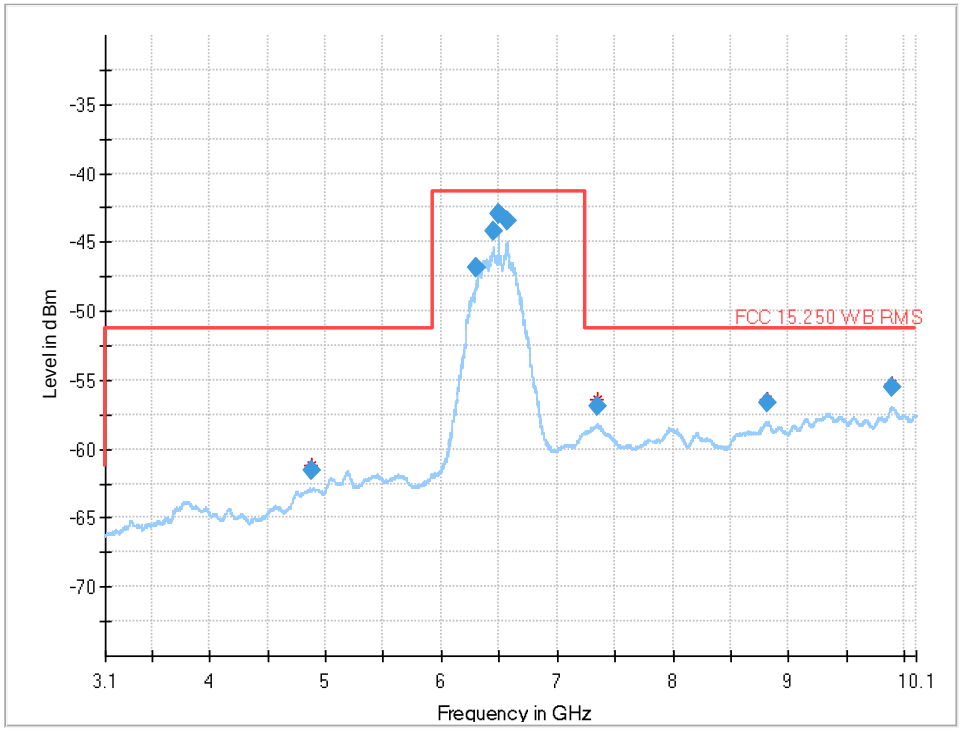


Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Bandwidth (kHz)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
961.993000	-67.78	-41.30	26.48	1000.000	V	172.0	135.0	-138.7
987.991000	-69.53	-41.30	28.23	1000.000	V	237.0	117.0	-139.6
1013.999000	-72.13	-41.30	30.83	1000.000	V	275.0	83.0	-139.0
1039.980000	-71.74	-41.30	30.44	1000.000	H	330.0	148.0	-138.7
1091.985000	-71.73	-41.30	30.43	1000.000	V	225.0	106.0	-139.0
1143.973000	-69.97	-41.30	28.67	1000.000	V	165.0	55.0	-139.5
1196.027000	-69.49	-41.30	28.19	1000.000	V	175.0	50.0	-139.7
1247.979000	-67.35	-41.30	26.05	1000.000	V	176.0	46.0	-138.7
1299.966000	-71.89	-41.30	30.59	1000.000	H	182.0	135.0	-138.6
2626.000000	-74.78	-41.30	33.48	1000.000	H	31.0	30.0	-133.7
2781.979000	-75.35	-41.30	34.05	1000.000	V	15.0	1.0	-133.4
4749.352000	-70.37	-41.30	29.07	1000.000	V	36.0	8.0	-126.1

Note: As stated by the customer and as shown on page 39 to 43, the emissions within the frequency range discussed here are presumably due to the digital circuit of the device. According to §15.250 (d)(5), emissions from digital circuitry used to enable the operation of the transmitter shall comply with the limits in §15.209, rather than the limits specified in § 15.250 (d).

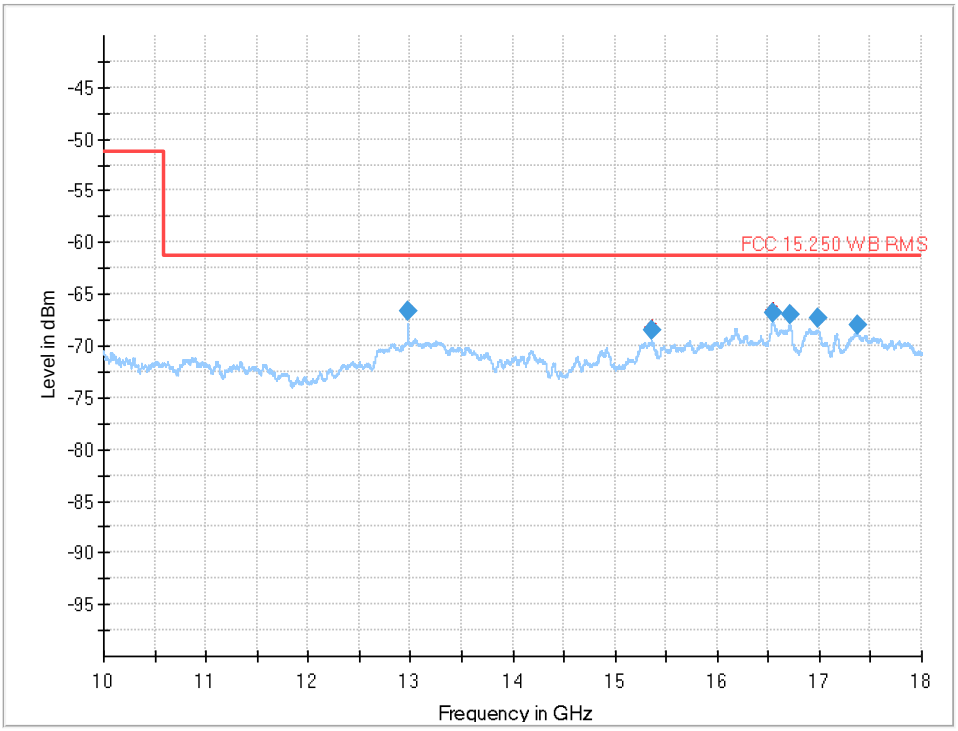
The conversion of the limit mentioned in §15.209 & RSS-Gen 8.9 is done according to ANSI C63.10-2013 9.6. Applicable limit above 960 MHz according to §15.209 / RSS-Gen 8.9: -41.3 dBm.

Plot 7: 3.1 GHz to 10.1 GHz (EUT 1, WB on)



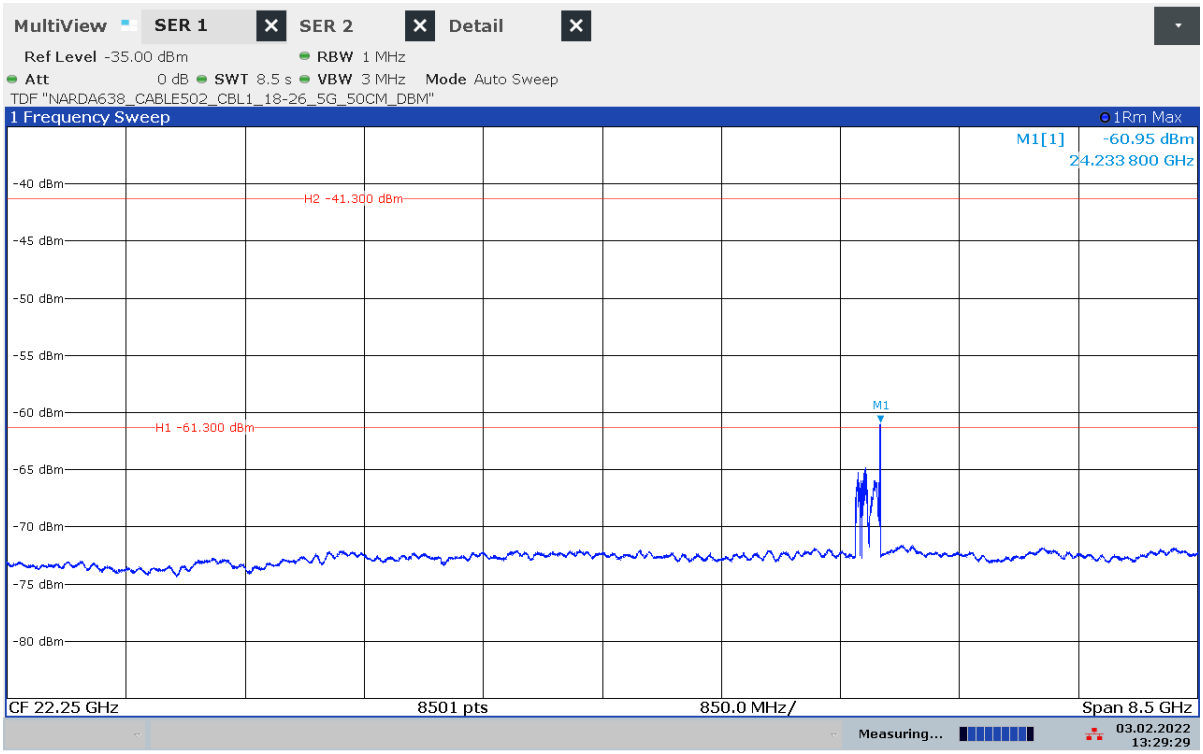
Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Bandwidth (kHz)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
4887.335714	-61.52	-51.30	10.22	1000.000	V	345.0	44.0	-118.0
6295.029857	-46.82	-41.30	5.52	1000.000	H	8.0	0.0	-116.7
6296.992143	-46.83	-41.30	5.53	1000.000	H	9.0	2.0	-116.7
6446.377714	-44.15	-41.30	2.85	1000.000	H	8.0	1.0	-116.0
6489.553857	-43.00	-41.30	1.70	1000.000	H	7.0	1.0	-116.2
6489.580000	-42.99	-41.30	1.69	1000.000	H	6.0	1.0	-116.2
6489.599286	-42.95	-41.30	1.65	1000.000	H	9.0	1.0	-116.2
6567.253857	-43.43	-41.30	2.13	1000.000	H	11.0	1.0	-115.9
7350.170429	-56.88	-51.30	5.58	1000.000	V	27.0	19.0	-113.8
8816.284571	-56.69	-51.30	5.39	1000.000	V	214.0	7.0	-114.0
9891.121429	-55.53	-51.30	4.23	1000.000	H	33.0	76.0	-112.5

Plot 8: 10.1 GHz to 18 GHz (EUT 1, WB on)



Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Bandwidth (kHz)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
12979.146250	-66.59	-61.30	5.29	1000.000	H	52.0	150.0	-125.0
15356.818750	-68.54	-61.30	7.24	1000.000	V	105.0	15.0	-124.2
16548.333750	-66.82	-61.30	5.52	1000.000	V	115.0	12.0	-121.6
16713.910000	-66.91	-61.30	5.61	1000.000	V	55.0	15.0	-122.2
16990.735000	-67.29	-61.30	5.99	1000.000	V	265.0	3.0	-121.7
17376.180000	-67.94	-61.30	6.64	1000.000	V	255.0	27.0	-121.4

Plot 9: 18 GHz to 26.5 GHz (EUT 1, WB on)



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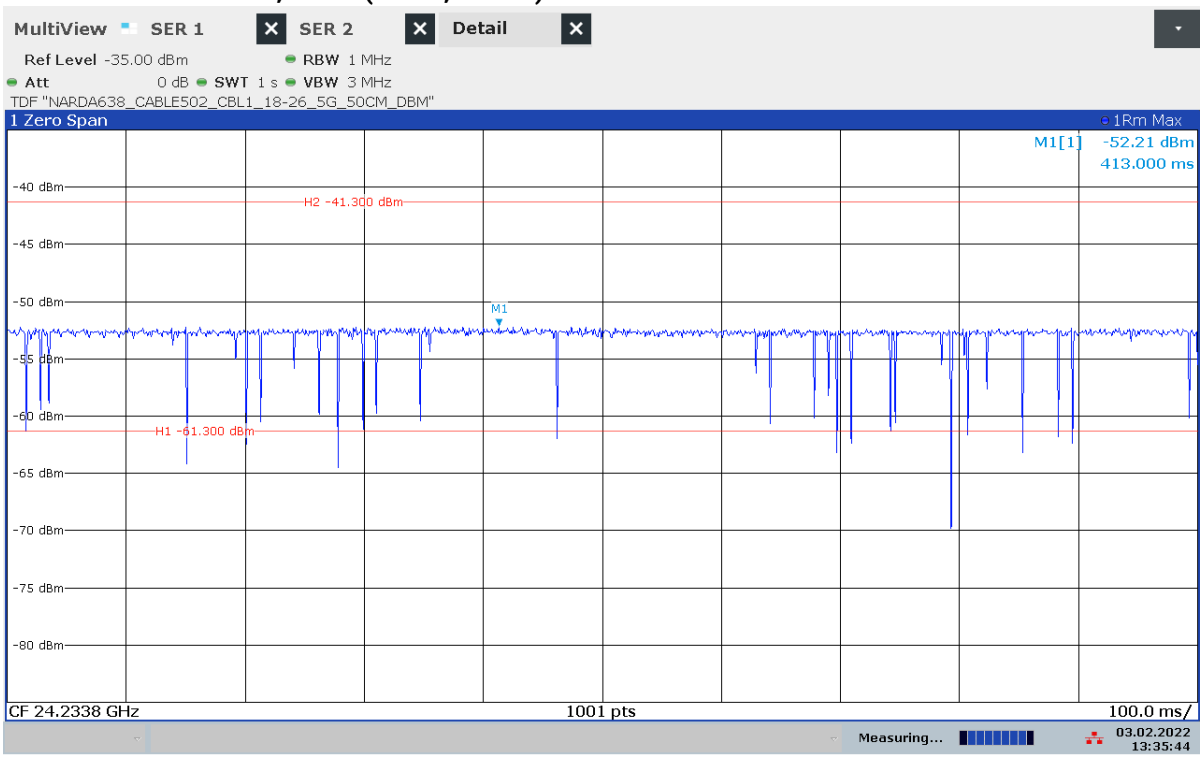
Plot 10: 18 GHz to 26.5 GHz, detail (EUT 1, WB on)



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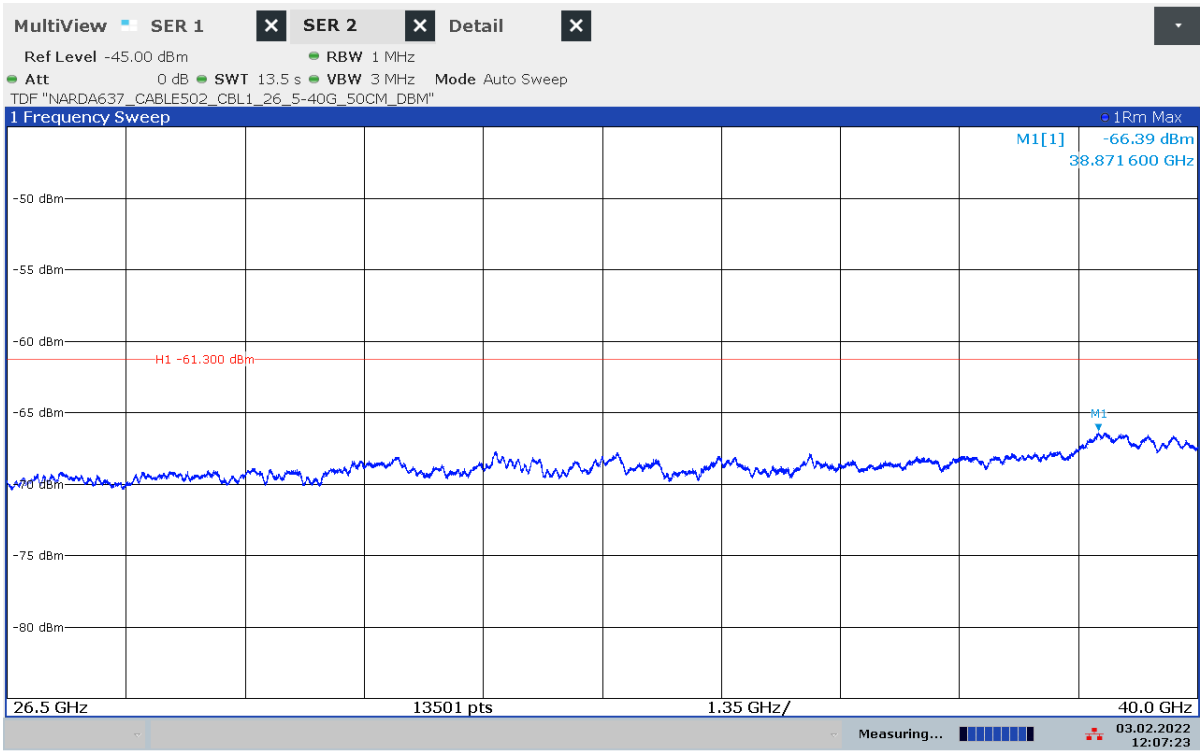
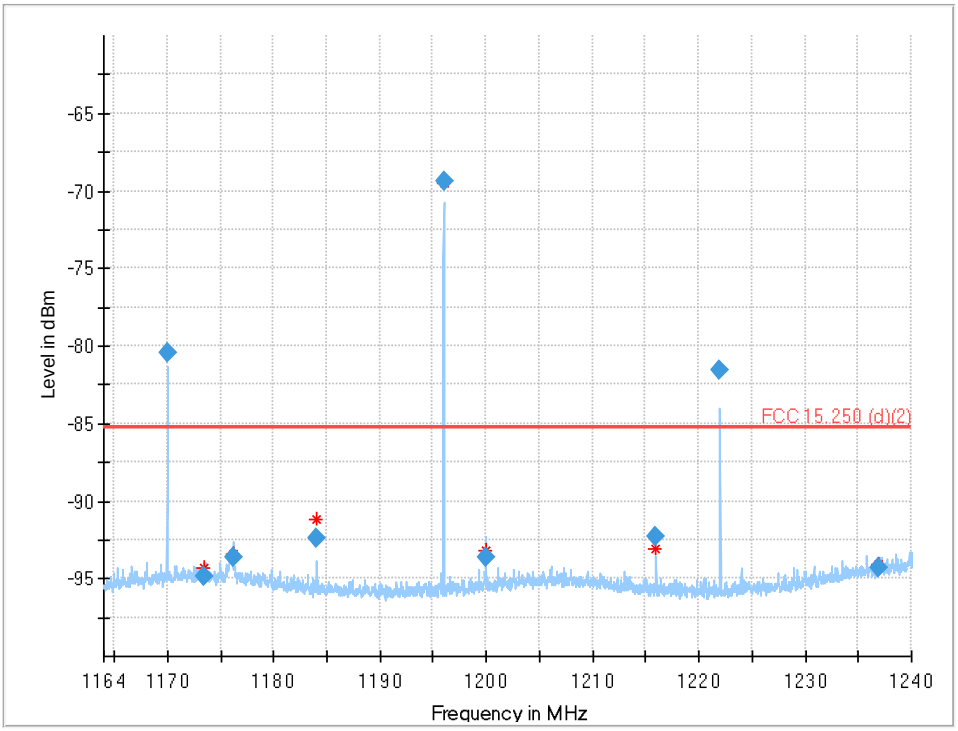
Note: See note on page 32 and detailed verification on page 39 to 43. Applicable limit above 960 MHz according to §15.209: -41.3 dBm.

Plot 11: 26.5 GHz to 40.0 GHz (EUT 1, WB on)



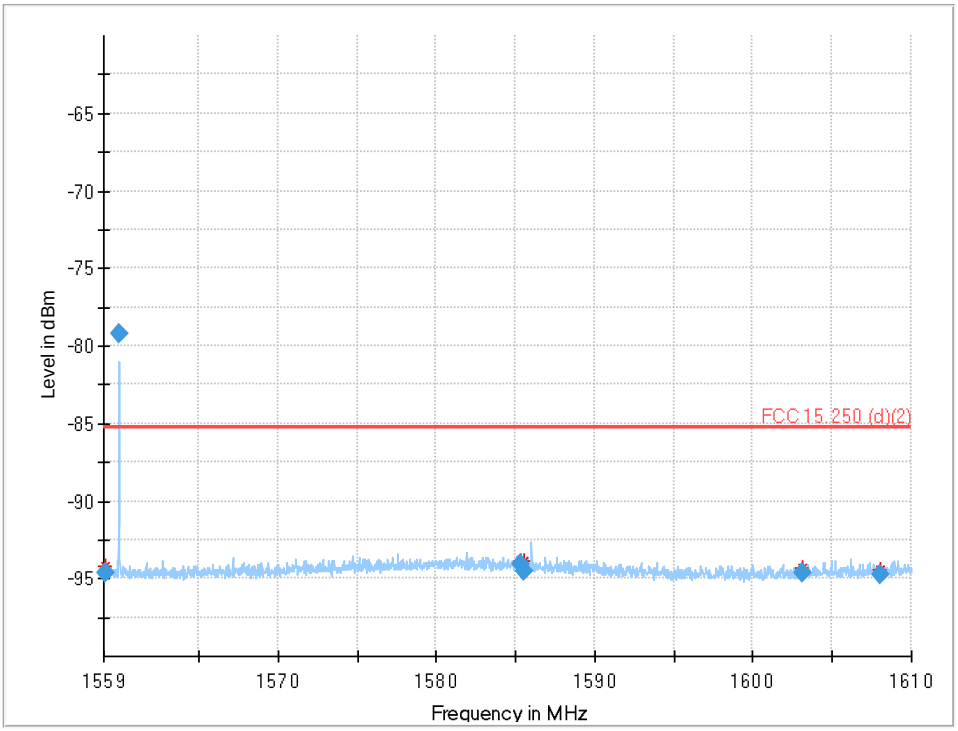
Plot 12: 1164 MHz to 1240 MHz (§15.250 (d)(2), RSS-210 K.3(b)) (EUT 1, WB on)



Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Bandwidth (kHz)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
1169.993937	-80.45	-41.30	39.15	30.000	H	353.0	0.0	-139.5
1173.499657	-94.83	-41.30	53.53	30.000	V	5.0	119.0	-139.4
1176.270753	-93.59	-41.30	52.29	30.000	V	333.0	76.0	-139.3
1183.983847	-92.44	-41.30	51.14	30.000	V	110.0	15.0	-139.2
1195.993000	-69.40	-41.30	28.1	30.000	V	172.0	52.0	-139.4
1200.007247	-93.58	-41.30	52.28	30.000	V	223.0	75.0	-139.5
1215.979320	-92.30	-41.30	51	30.000	V	151.0	15.0	-139.4
1221.992950	-81.53	-41.30	40.23	30.000	V	172.0	56.0	-139.2
1236.900843	-94.29	-41.30	52.99	30.000	V	-3.0	86.0	-138.8

Note: See note on page 32 and detailed verification on page 39 to 43. Applicable limit above 960 MHz according to §15.209: -41.3 dBm.

Plot 13: 1559 MHz to 1610 MHz (§15.250 (d)(2), RSS-210 K.3(b)) (EUT 1, WB on)



Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Bandwidth (kHz)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
1559.067997	-94.69	-41.30	53.39	30.000	H	0.0	135.0	-137.9
1559.992805	-79.24	-41.30	37.94	30.000	V	162.0	31.0	-137.9
1585.276775	-94.10	-41.30	52.8	30.000	V	5.0	72.0	-137.7
1585.550615	-94.55	-41.30	53.25	30.000	V	5.0	59.0	-137.7
1603.141175	-94.64	-41.30	53.34	30.000	V	5.0	119.0	-137.9
1608.033740	-94.71	-41.30	53.41	30.000	V	1.0	101.0	-138.0

Note: See note on page 32 and detailed verification on page 39 to 43. Applicable limit above 960 MHz according to §15.209: -41.3 dBm.

Verification of the emissions from digital circuitry:

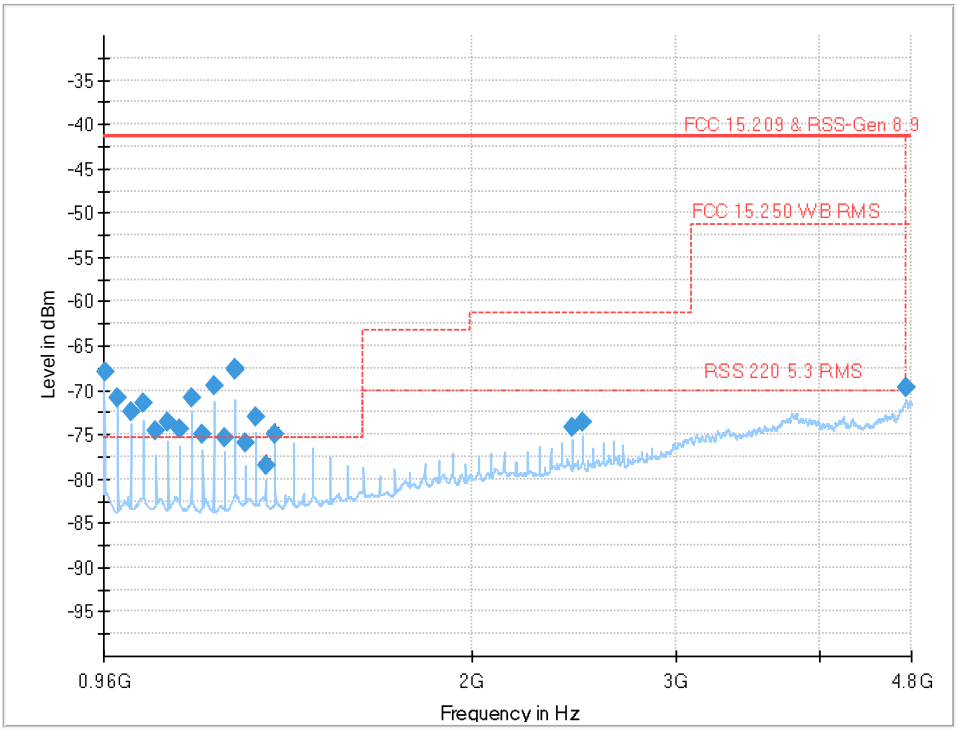
Description:
According to §15.250 (d)(5), emissions from digital circuitry used to enable the operation of the transmitter shall comply with the limits in §15.209, rather than the limits specified in § 15.250 (d).

The conversion of the limit mentioned in §15.209 is done according to ANSI C63.10-2013 9.6.
Applicable limit above 960 MHz according to §15.209: -41.3 dBm.

To verify the emissions of the digital circuitry, a specifically prepared device (EUT 2) is used in which the WB emissions are turned off.

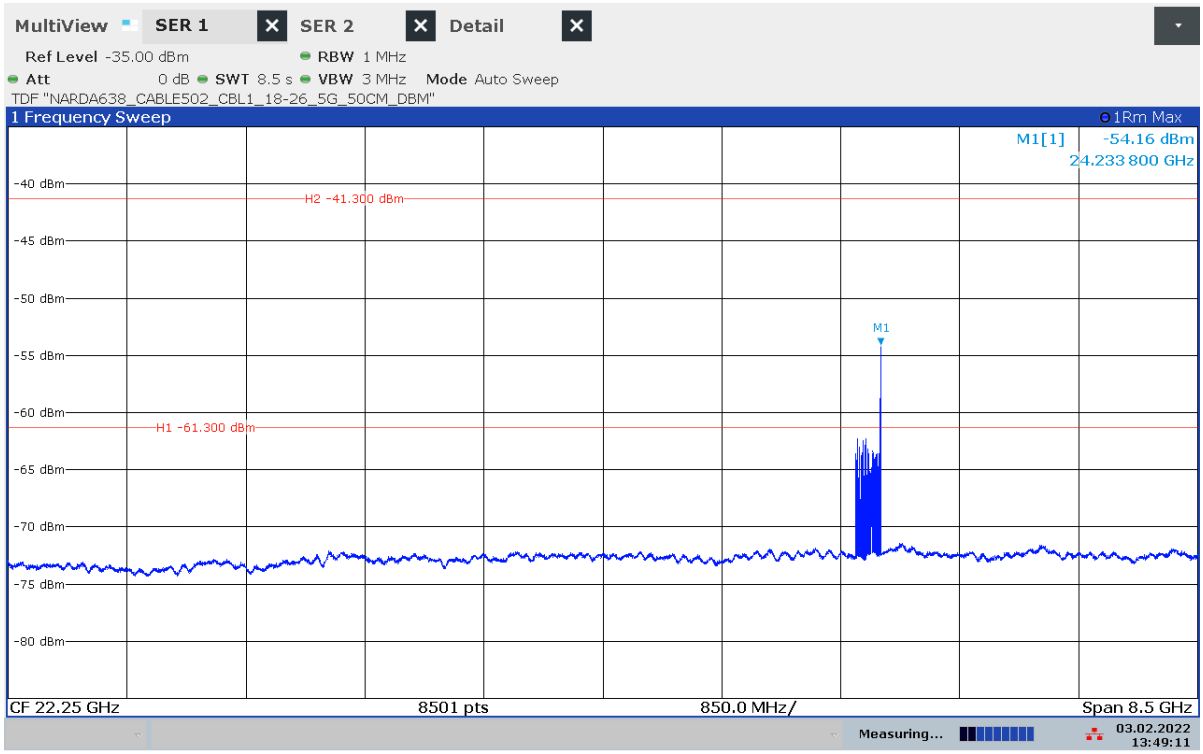
Results:
The results shown in plot 14 to 18 indicate that the emissions observed in this frequency ranges are due to the digital circuitry of the device. Hence, according to §15.250 (d)(5) / RSS-210 K.3 (f) the limits mentioned in §15.209 / RSS-Gen 8.9 are considered applicable.

Plot 14: 960 MHz to 4.8 GHz (EUT 2, WB off)



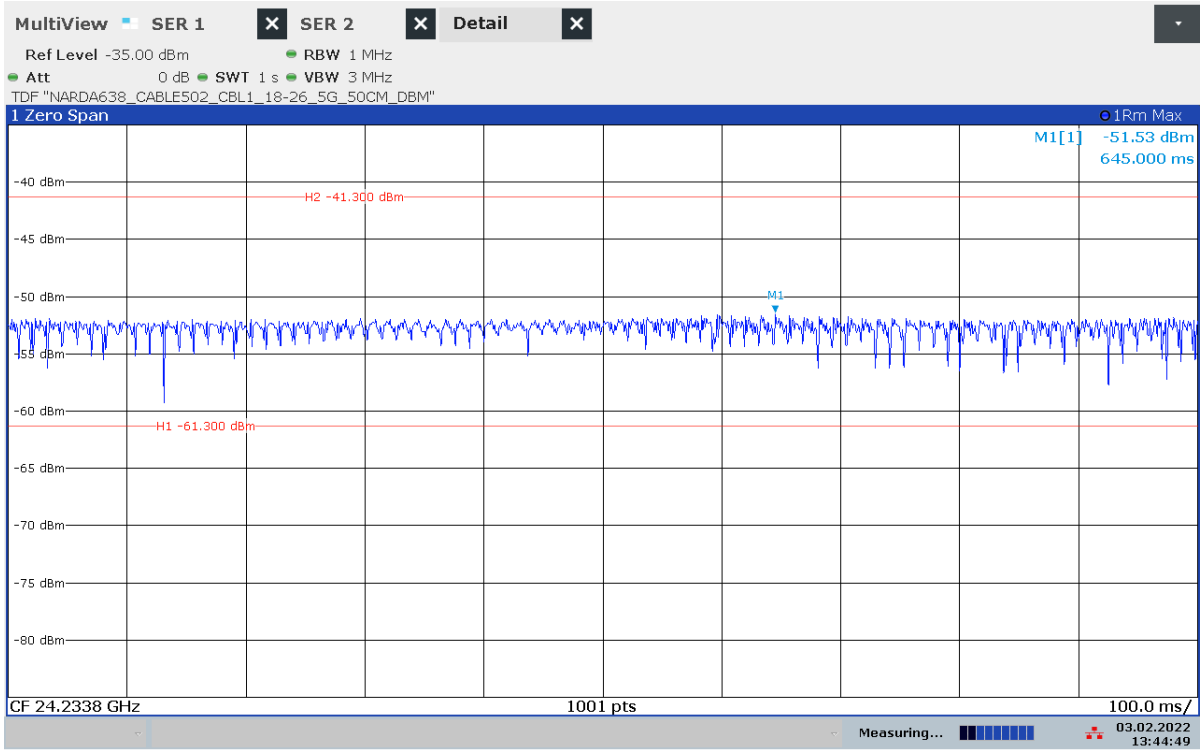
Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Bandwidth (kHz)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
961.982000	-67.99	-41.30	26.69	1000.000	H	336.0	165.0	-138.7
988.003000	-70.87	-41.30	29.57	1000.000	V	178.0	93.0	-139.6
1014.018000	-72.43	-41.30	31.13	1000.000	V	265.0	88.0	-139.0
1039.988000	-71.49	-41.30	30.19	1000.000	V	-4.0	60.0	-138.7
1065.986000	-74.64	-41.30	33.34	1000.000	V	285.0	67.0	-138.7
1092.023000	-73.52	-41.30	32.22	1000.000	V	352.0	59.0	-139.0
1118.019000	-74.45	-41.30	33.15	1000.000	V	275.0	69.0	-139.0
1144.032000	-70.79	-41.30	29.49	1000.000	V	268.0	62.0	-139.5
1169.996000	-74.94	-41.30	33.64	1000.000	V	266.0	62.0	-139.6
1196.002000	-69.50	-41.30	28.20	1000.000	V	265.0	69.0	-139.7
1222.009000	-75.39	-41.30	34.09	1000.000	V	165.0	59.0	-139.4
1248.010000	-67.56	-41.30	26.26	1000.000	H	185.0	152.0	-138.7
1248.013000	-67.64	-41.30	26.34	1000.000	H	185.0	153.0	-138.7
1273.953000	-75.89	-41.30	34.59	1000.000	V	165.0	49.0	-138.6
1299.972000	-72.98	-41.30	31.68	1000.000	V	165.0	59.0	-138.6
1325.993000	-78.42	-41.30	37.12	1000.000	V	165.0	62.0	-138.8
1352.025000	-74.89	-41.30	33.59	1000.000	H	6.0	117.0	-139.2
2443.996000	-74.13	-41.30	32.83	1000.000	H	290.0	2.0	-134.4
2496.029000	-73.57	-41.30	32.27	1000.000	H	286.0	0.0	-134.3
4748.213000	-69.68	-41.30	28.38	1000.000	V	327.0	11.0	-126.1
4752.096000	-69.63	-41.30	28.33	1000.000	H	341.0	2.0	-126.2

Plot 15: 18 GHz to 26.5 GHz (EUT 2, WB off)



13:49:11 03.02.2022

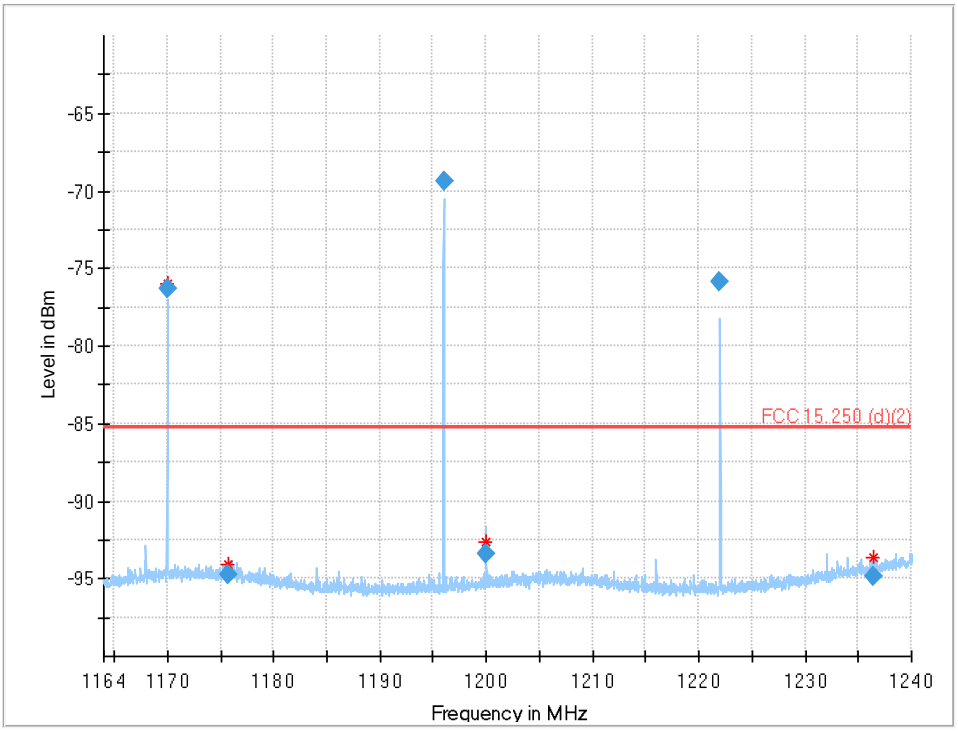
Plot 16: 18 GHz to 26.5 GHz, detail (EUT 2, WB off)



13:44:49 03.02.2022

Applicable limit above 960 MHz according to §15.209: -41.3 dBm.

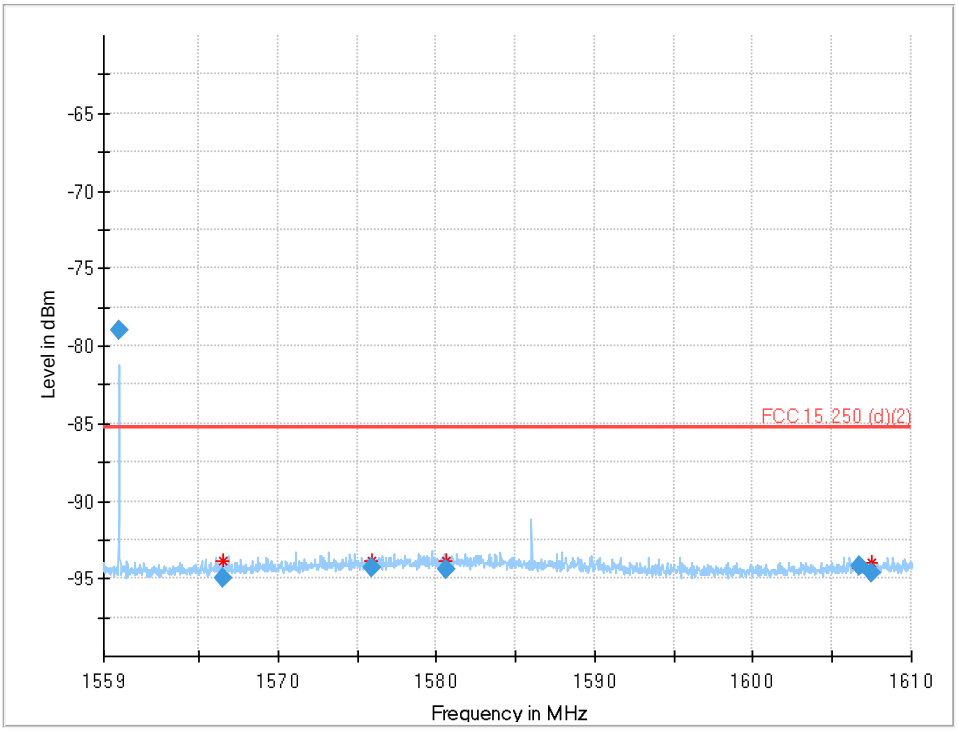
Plot 17: 1164 MHz to 1240 MHz (§15.250 (d)(2), RSS-210 K.3(b)) (EUT 2, WB off)



Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Bandwidth (kHz)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
1169.994477	-76.28	-41.30	34.98	30.000	V	172.0	63.0	-139.5
1175.786137	-94.77	-41.30	53.47	30.000	V	5.0	45.0	-139.4
1195.992250	-69.38	-41.30	28.08	30.000	V	268.0	63.0	-139.4
1200.000227	-93.45	-41.30	52.15	30.000	V	223.0	70.0	-139.5
1221.993970	-75.88	-41.30	34.58	30.000	V	166.0	57.0	-139.2
1236.419840	-94.87	-41.30	53.57	30.000	V	0.0	108.0	-138.8

Applicable limit above 960 MHz according to §15.209: -41.3 dBm.

Plot 18: 1559 MHz to 1610 MHz (§15.250 (d)(2), RSS-210 K.3(b)) (EUT 2, WB off)



Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Bandwidth (kHz)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
1559.991410	-79.03	-41.30	37.73	30.000	V	162.0	24.0	-137.9
1566.585095	-95.02	-41.30	53.72	30.000	V	-3.0	138.0	-137.8
1575.942185	-94.28	-41.30	52.98	30.000	V	5.0	157.0	-137.8
1580.630615	-94.39	-41.30	53.09	30.000	H	3.0	76.0	-137.7
1606.716080	-94.18	-41.30	52.88	30.000	H	5.0	15.0	-137.9
1607.459165	-94.59	-41.30	53.29	30.000	V	-2.0	89.0	-138.0

Applicable limit above 960 MHz according to §15.209: -41.3 dBm.

12.3 Frequency Stability

Description:

§15.250(a)
The −10 dB bandwidth of a device operating under the provisions of this section must be contained within the 5925-7250 MHz band under all conditions of operation including the effects from stepped frequency, frequency hopping or other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage.

Additional information: see chapter 12.1.

Measurement:

Measurement parameter	
Detector:	Pos-Peak
Video bandwidth:	1 MHz
Resolution bandwidth:	3 MHz
Trace-Mode:	Max Hold

Limits:

§15.250(a),

Lower -10 dB point > 5925 MHz Upper -10 dB point < 7250 MHz

§15.250(b)

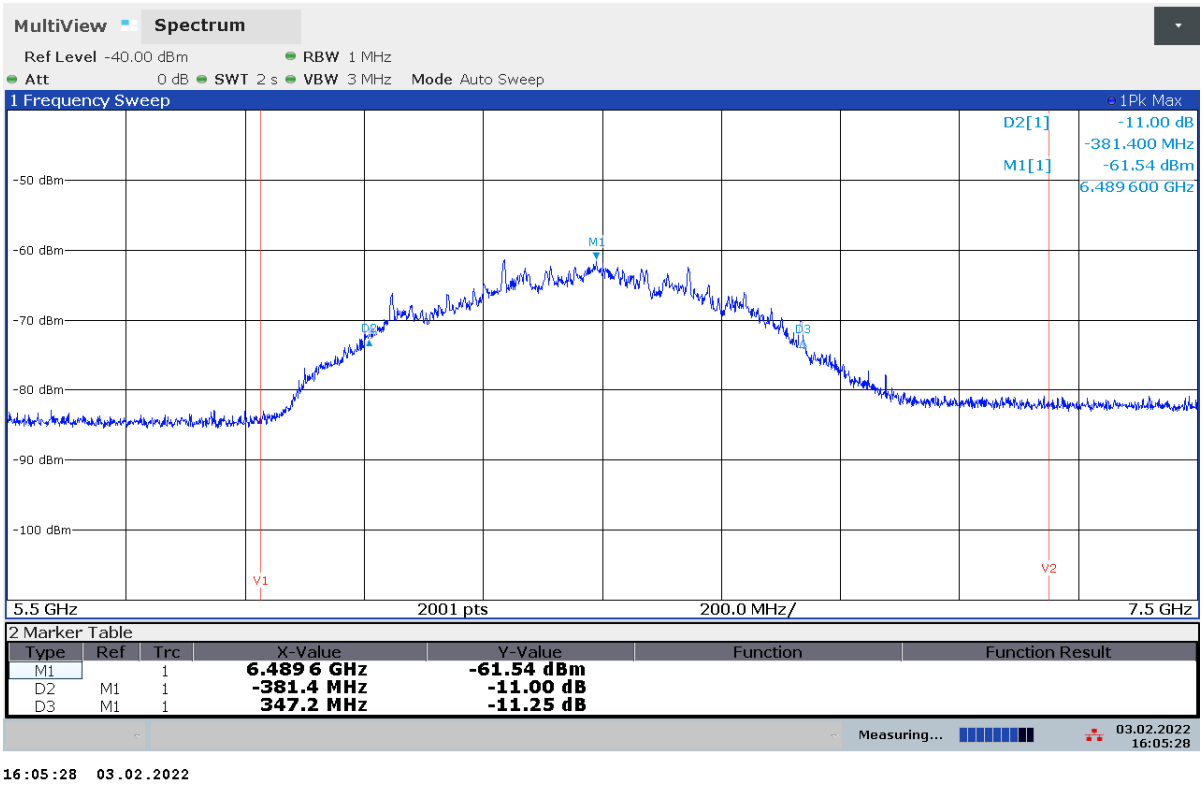
-10 dB bandwidth > 50 MHz

Results:

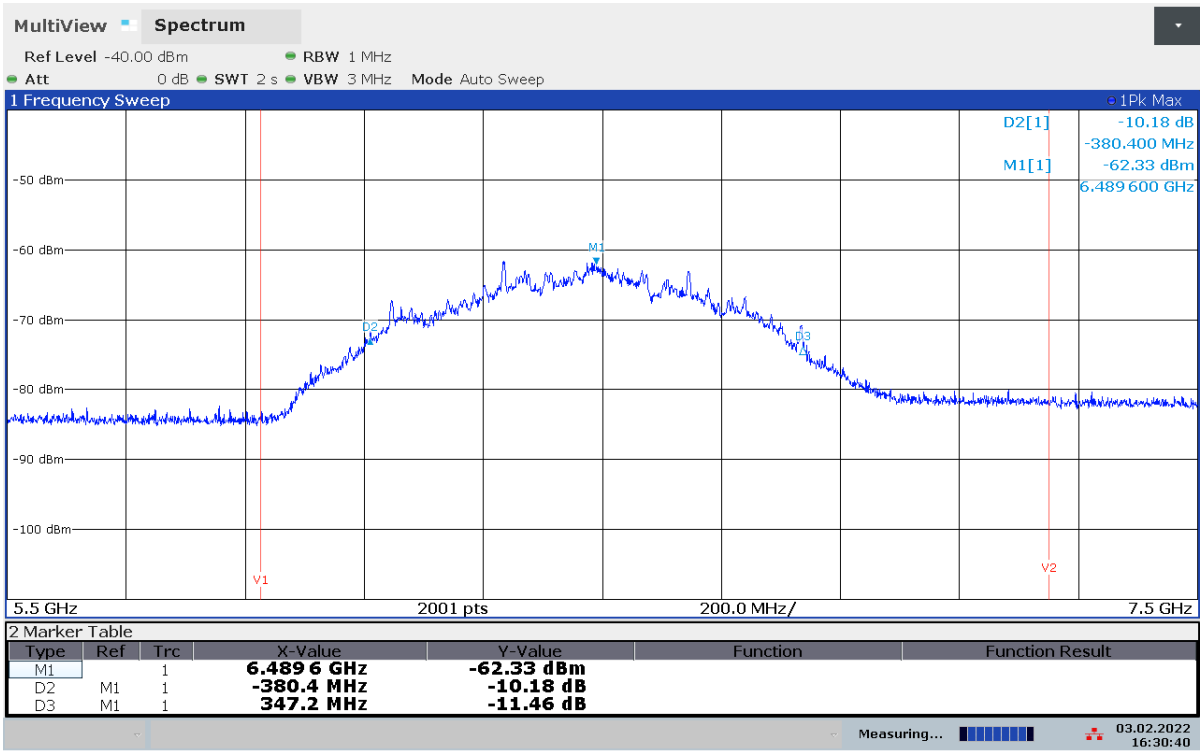
Test Condition	Lower -10 dB point [MHz]	Upper -10 dB point [MHz]	- 10 dB bandwidth [MHz]	Plot
-20 °C / V_{nom}	6108.2	6836.8	728.6	21
-10 °C / V_{nom}	6109.2	6836.8	727.6	22
0 °C / V_{nom}	6122.2	6835.8	713.6	23
+10 °C / V_{nom}	6108.2	6835.8	727.6	24
+20 °C / V_{min}	6142.2	6786.9	644.7	25
+20 °C / V_{nom}	6142.2	6801.9	659.7	26
+20 °C / V_{max}	6141.2	6785.9	644.7	27
+30 °C / V_{nom}	6142.2	6794.9	652.7	28
+40 °C / V_{nom}	6142.2	6785.9	643.7	29
+50 °C / V_{nom}	6143.2	6784.9	641.7	30
+60 °C / V_{nom}	6144.2	6759.9	615.7	31

Verdict: Compliant

Plot 19: -20 °C, Vnom (EUT 1, WB on)

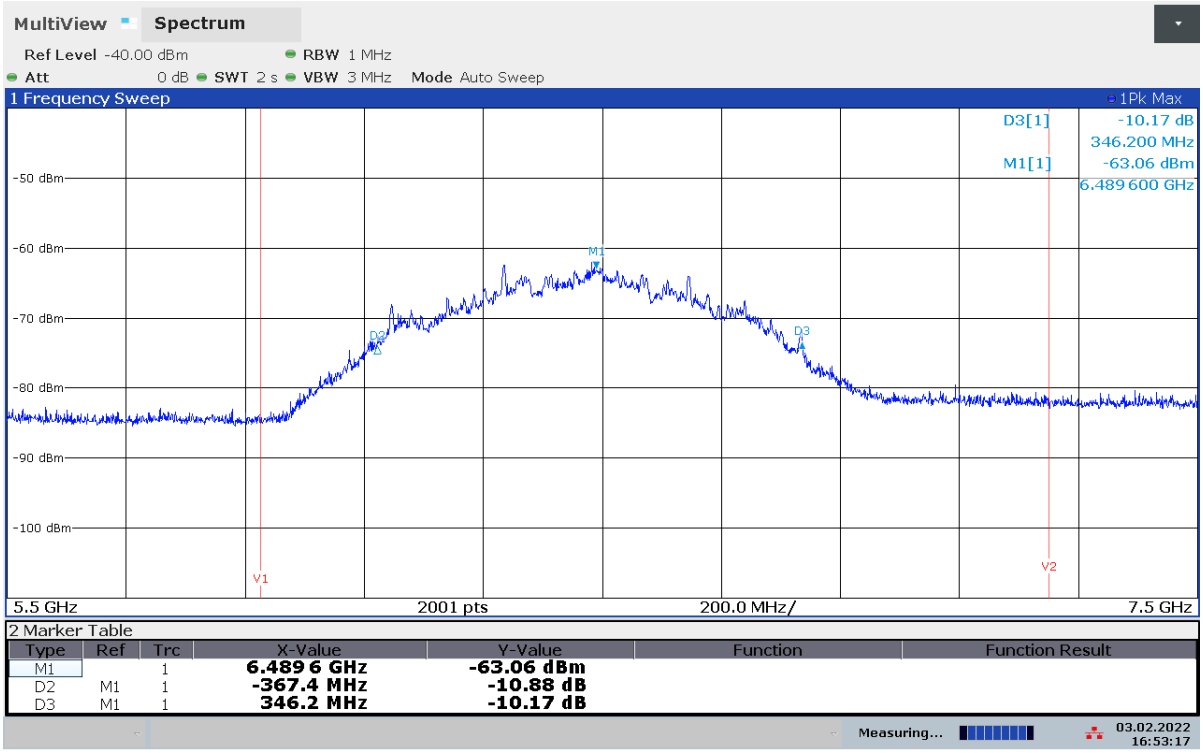


Plot 20: -10 °C, Vnom (EUT 1, WB on)



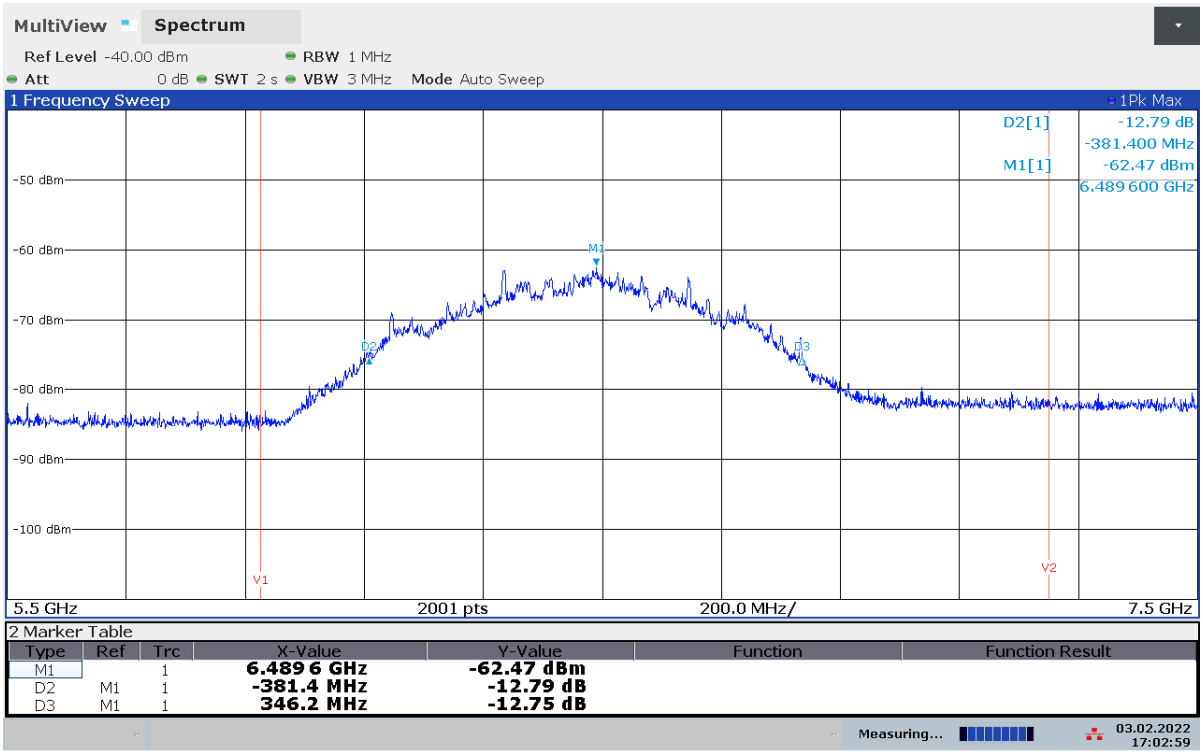
16:30:40 03.02.2022

Plot 21: 0 °C, Vnom (EUT 1, WB on)



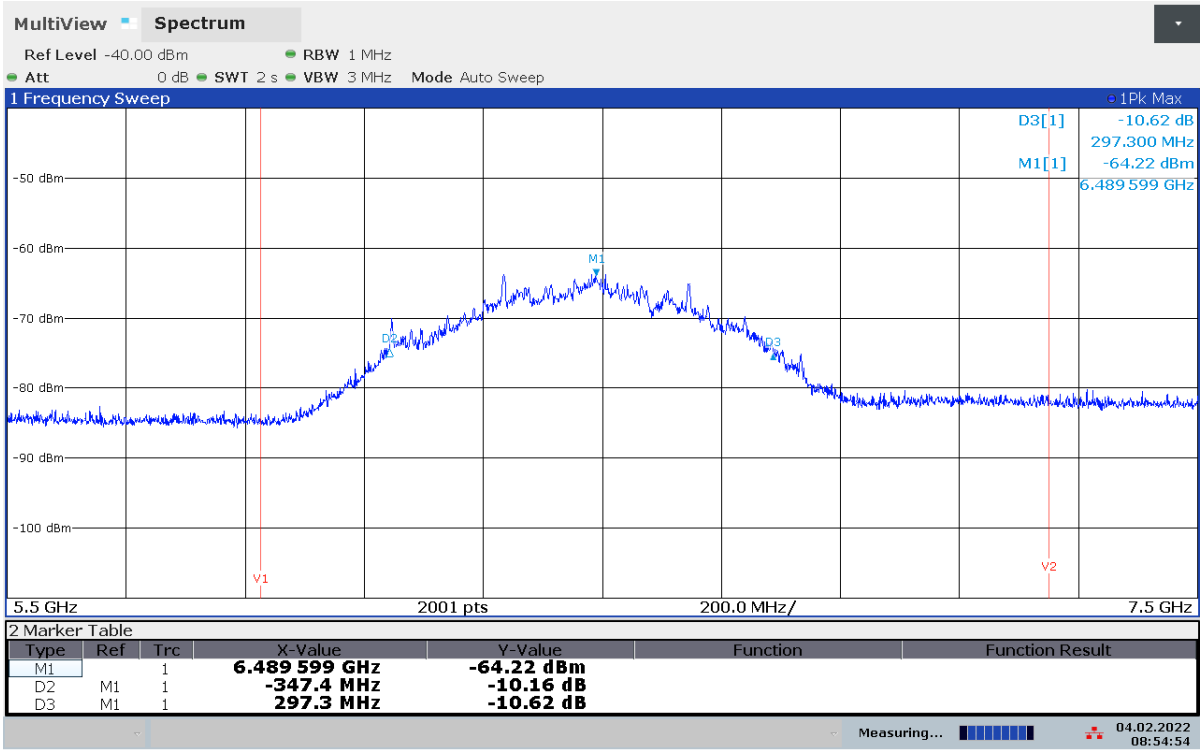
16:53:17 03.02.2022

Plot 22: +10 °C, Vnom (EUT 1, WB on)



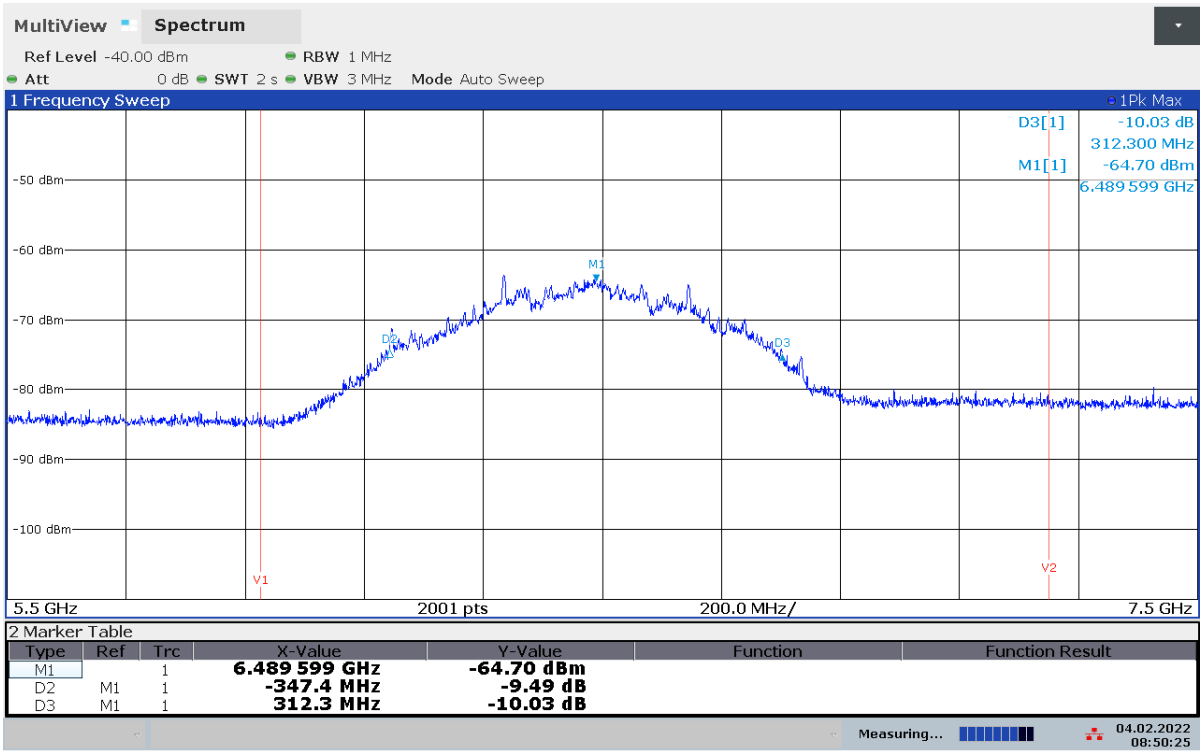
17:02:59 03.02.2022

Plot 23: +20 °C, Vmin (EUT 1, WB on)



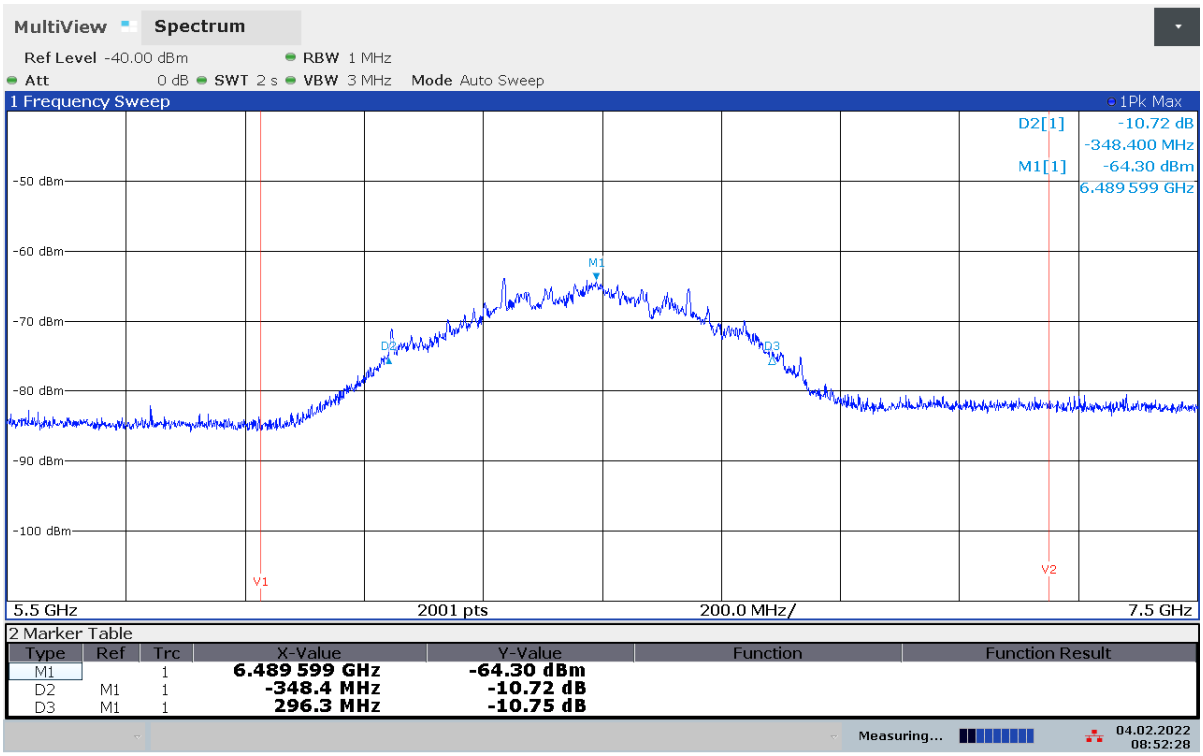
08:54:54 04.02.2022

Plot 24: +20 °C, Vnom (EUT 1, WB on)



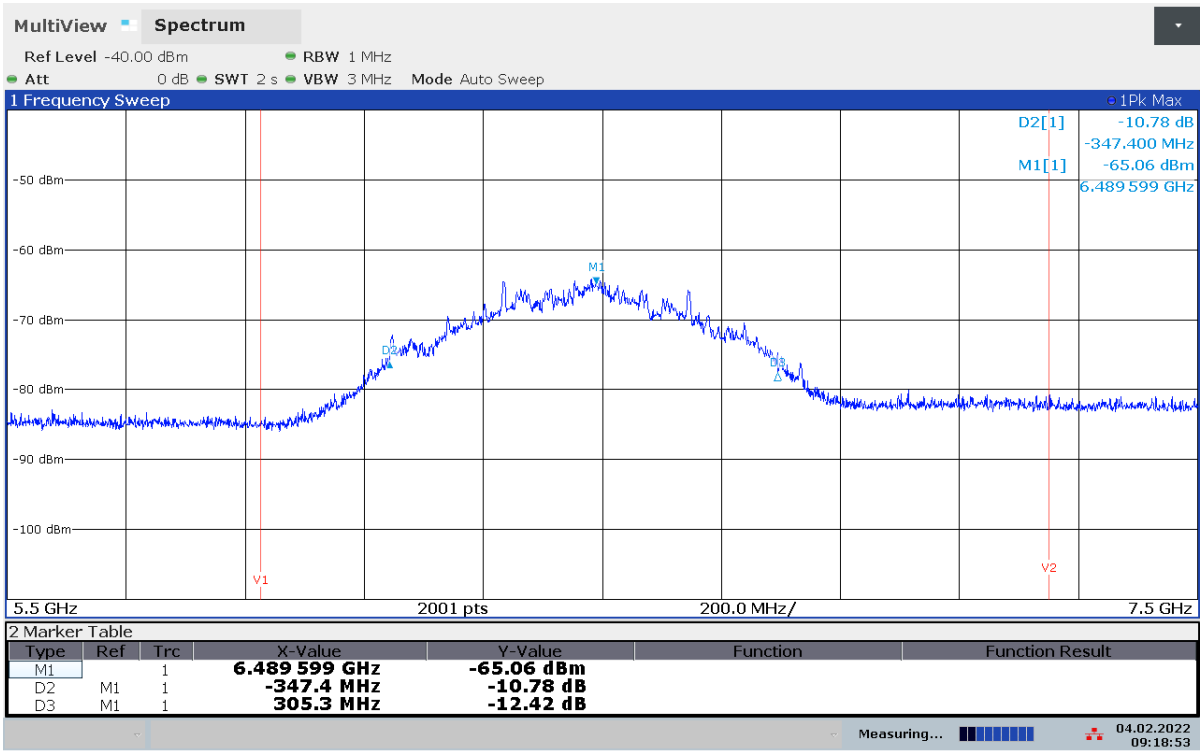
08:50:26 04.02.2022

Plot 25: +20 °C, Vmax (EUT 1, WB on)



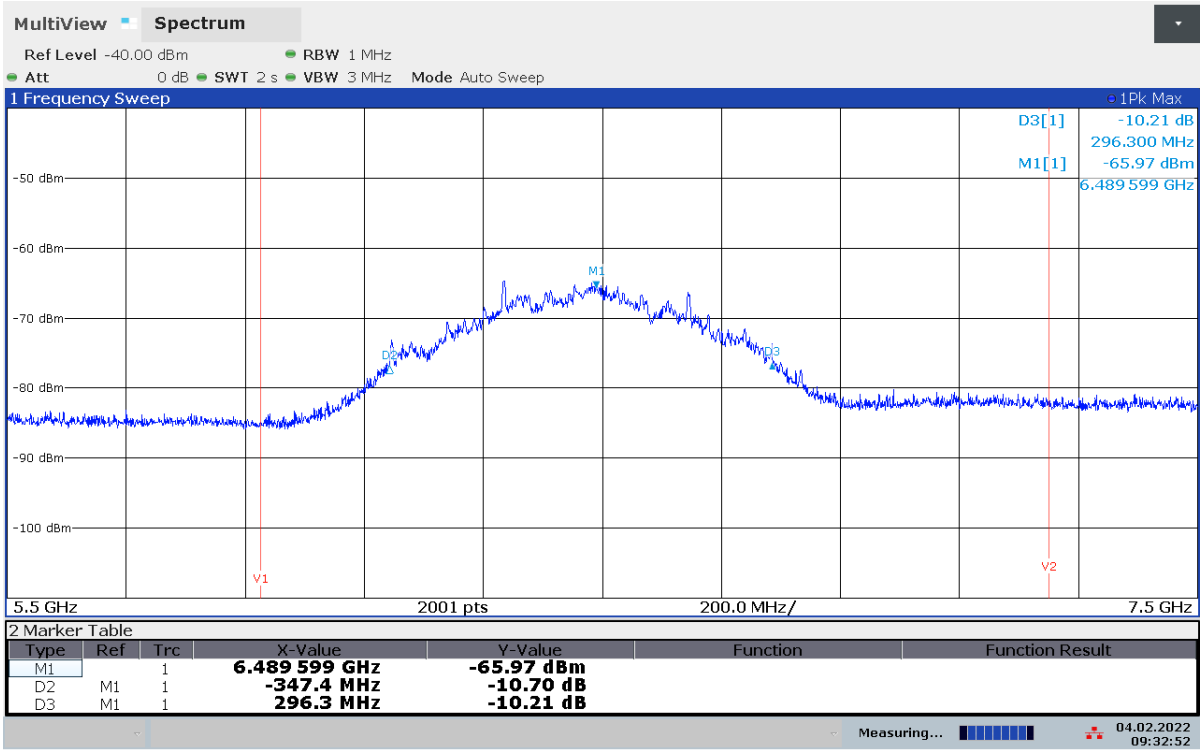
08:52:28 04.02.2022

Plot 26: +30 °C, Vnom (EUT 1, WB on)



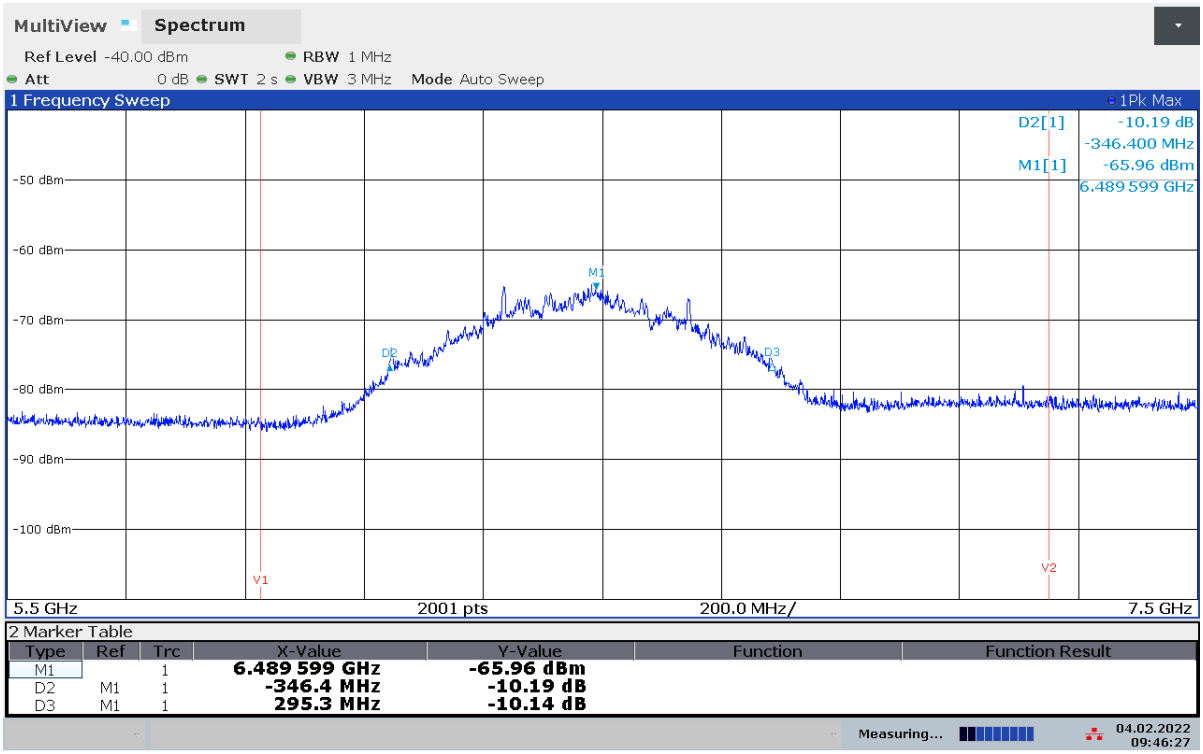
09:18:54 04.02.2022

Plot 27: +40 °C, Vnom (EUT 1, WB on)



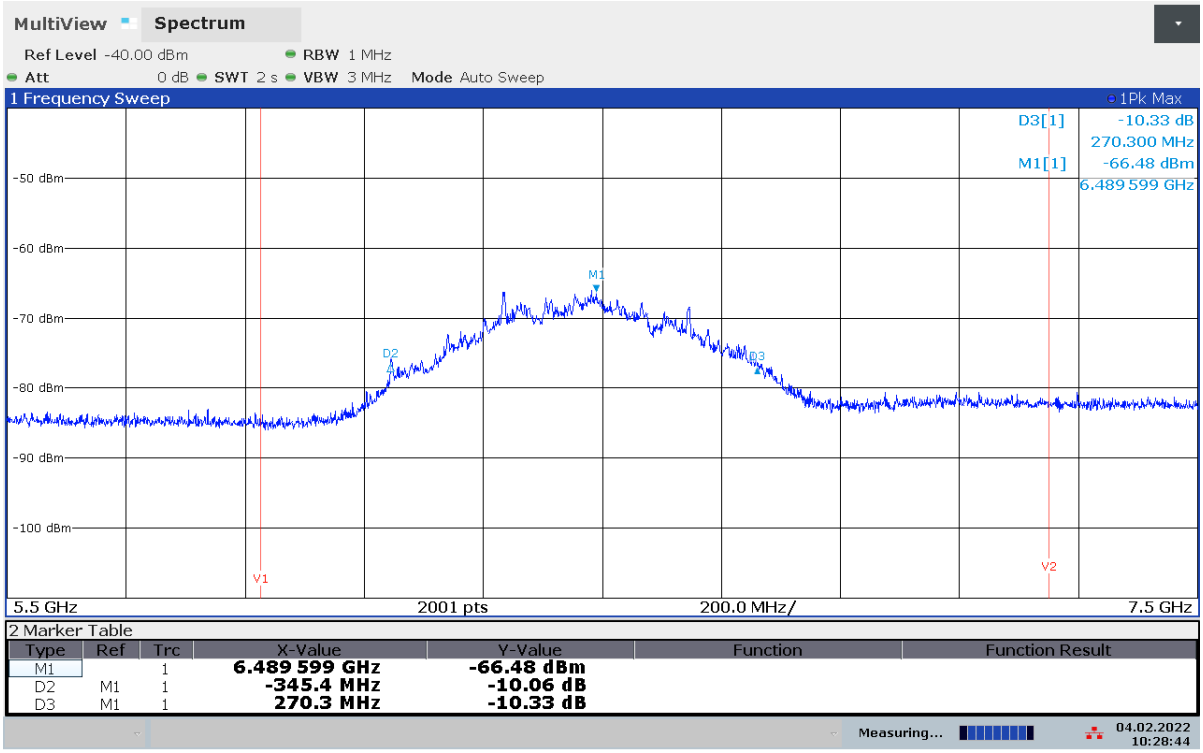
09:32:53 04.02.2022

Plot 28: +50 °C, Vnom (EUT 1, WB on)



09:46:27 04.02.2022

Plot 29: +60 °C, Vnom (EUT 1, WB on)



10:28:44 04.02.2022

12.4 Conducted emissions < 30MHz

Description:

Measurement of the conducted spurious emissions in transmit mode below 30 MHz. Both power lines, phase and neutral line, are measured. Found peaks are re-measured with average and quasi peak detection to show compliance to the limits.

Measurement:

Parameter	
Detector:	Peak - Quasi Peak / Average
Sweep time:	Auto
Video bandwidth:	F < 150 kHz: 200 Hz F > 150 kHz: 9 kHz
Resolution bandwidth:	F < 150 kHz: 1 kHz F > 150 kHz: 100 kHz
Span:	9 kHz to 30 MHz
Trace-Mode:	Max Hold

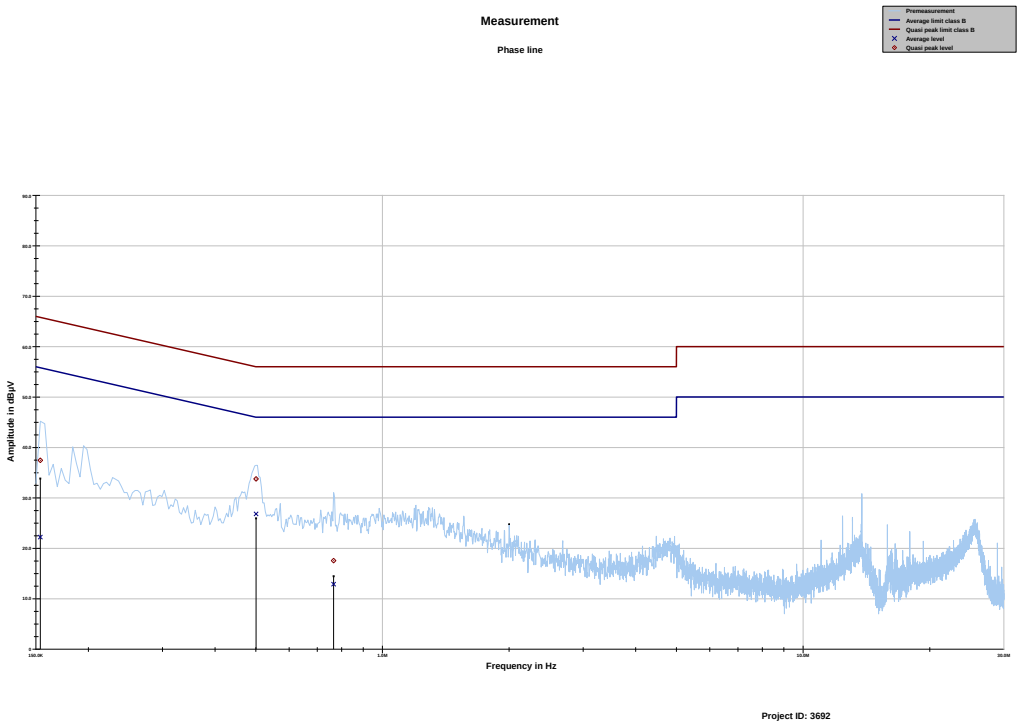
Limits:

FCC		IC
CFR Part 15.207(a)		RSS-Gen 8.8
Conducted Spurious Emissions < 30 MHz		
Frequency (MHz)	Quasi-Peak (dBµV)	Average (dBµV)
0.15 – 0.5	66 to 56*	56 to 46*
0.5 – 5	56	46
5 – 30.0	60	50

*Decreases with the logarithm of the frequency

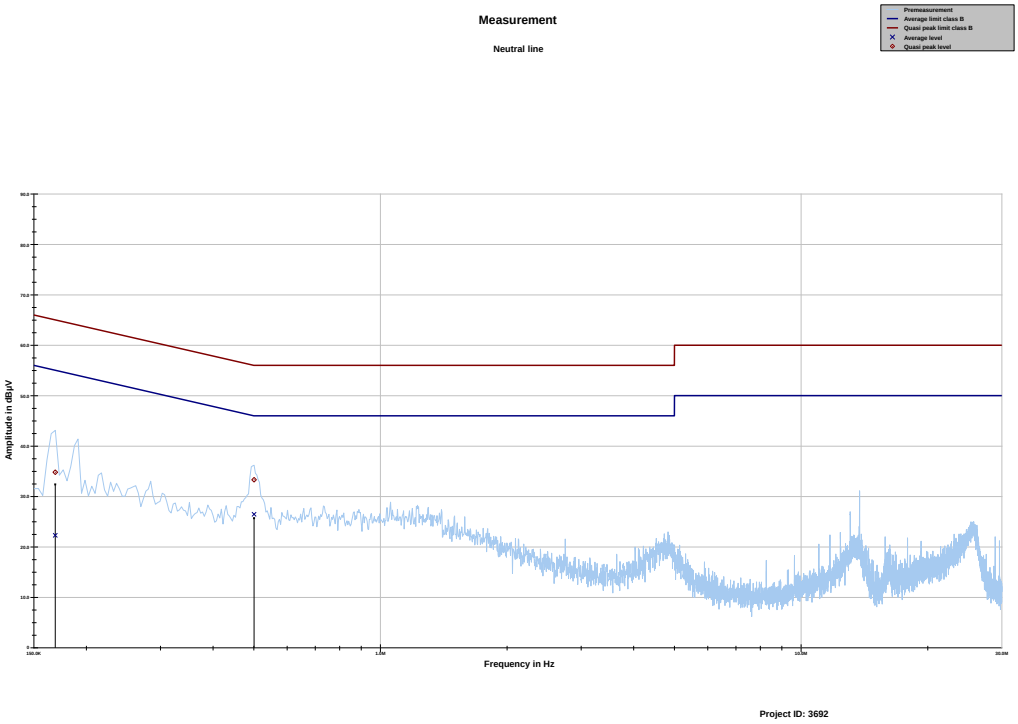
Results:

Plot 30: Phase line **(EUT 1, WB on)**



Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.153731	37.45	28.34	65.796	22.23	33.67	55.893
0.500737	33.76	22.24	56.000	26.82	19.18	46.000
0.765656	17.55	38.45	56.000	12.88	33.12	46.000

Plot 31: Neutral line **(EUT 1, WB on)**



Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.168656	34.81	30.21	65.026	22.29	33.18	55.467
0.500737	33.32	22.68	56.000	26.47	19.53	46.000

Verdict: Compliant

13 Glossary

EUT	Equipment under test
DUT	Device under test
UUT	Unit under test
GUE	GNSS User Equipment
ETSI	European Telecommunications Standards Institute
EN	European Standard
FCC	Federal Communications Commission
FCC ID	Company Identifier at FCC
IC	Industry Canada
PMN	Product marketing name
HMN	Host marketing name
HVIN	Hardware version identification number
FVIN	Firmware version identification number
EMC	Electromagnetic Compatibility
HW	Hardware
SW	Software
Inv. No.	Inventory number
S/N or SN	Serial number
C	Compliant
NC	Not compliant
NA	Not applicable
NP	Not performed
PP	Positive peak
QP	Quasi peak
AVG	Average
OC	Operating channel
OCW	Operating channel bandwidth
OBW	Occupied bandwidth
OOB	Out of band
DFS	Dynamic frequency selection
CAC	Channel availability check
OP	Occupancy period
NOP	Non occupancy period
DC	Duty cycle
PER	Packet error rate
CW	Clean wave
MC	Modulated carrier
WLAN	Wireless local area network
RLAN	Radio local area network
DSSS	Dynamic sequence spread spectrum
OFDM	Orthogonal frequency division multiplexing
FHSS	Frequency hopping spread spectrum
GNSS	Global Navigation Satellite System
C/N_0	Carrier to noise-density ratio, expressed in dB-Hz

14 Document history

Version	Applied changes	Date of release
-/-	Initial release	2022-02-14
A	Update serial number	2022-03-23

15 Accreditation Certificate – D-PL-12076-01-05

first page	last page
	

Note: The current certificate annex is published on the websites (link see below).

https://www.dakks.de/files/data/as/pdf/D-PL-12076-01-05e.pdf
or
https://ctcadvanced.com/app/uploads/2020/06/D-PL-12076-01-05_TCB_USA.pdf

########## END OF TEST REPORT ##########