

TEST REPORT

Test report no.: 1-8315-24-02-04_TR1-R01



Deutsche
Akkreditierungsstelle
D-PL-12047-01-00

Testing laboratory

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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 with the registration number:

D-PL-12047-01-00.

ISED Testing Laboratory Recognized Listing Number: DE0001

FCC designation number: DE0002

Applicant

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Manufacturer

ADC Automotive Distance Control Systems GmbH

Peter-Dornier-Str. 10

88131 Lindau / GERMANY

Test standard/s

FCC - Title 47 CFR Part 95 FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 95 - Personal Radio Services

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

Test Item

Kind of test item: **SRD for RTTT and other vehicle or fixed installation**

Model name: **SRR6-B**

FCC ID: **OAYSRR6B**

Frequency: 76.5 GHz band (76 GHz – 77 GHz)
79.0 GHz band (77 GHz – 81 GHz)

Technology tested: **FMCW**

Antenna: Integrated antenna

Power supply: 6.5 V to 19 V DC by external power supply

Temperature range: -40 °C to 85 °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.

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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. cetecom 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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In no case this test report can be considered as a Letter of Approval.

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2.2 Application details

Software version for testing	176.030.105	186.030.107	195.230.107
Date of receipt of order:	2024-11-21	2025-04-02	2025-04-02
Date of receipt of test item:	2024-11-29	2025-04-03	2025-09-01
Start of test:*	2025-01-10	2025-04-24	2025-09-08
End of test:*	2025-02-13	2025-05-21	2025-09-08
Person(s) present during the test:	-/-		

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

2.3 Involved test locations

Saarbruecken lab		Essen lab	
☒	Untertuerkheimer Str. 6-10 66117 Saarbruecken Germany	☐	Im Teelbruch 116 45219 Essen Germany

2.4 Test laboratories sub-contracted

None

2.5 Laboratory listings and recognitions

	Saarbruecken	Essen
FCC	DE0002	DE0003
ISED	DE0001 3462C	DE0001 3462D

3 Test standard/s, references and accreditations

Test standard	Date	Description
FCC - Title 47 CFR Part 95	-/-	FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 95 - Personal Radio Services

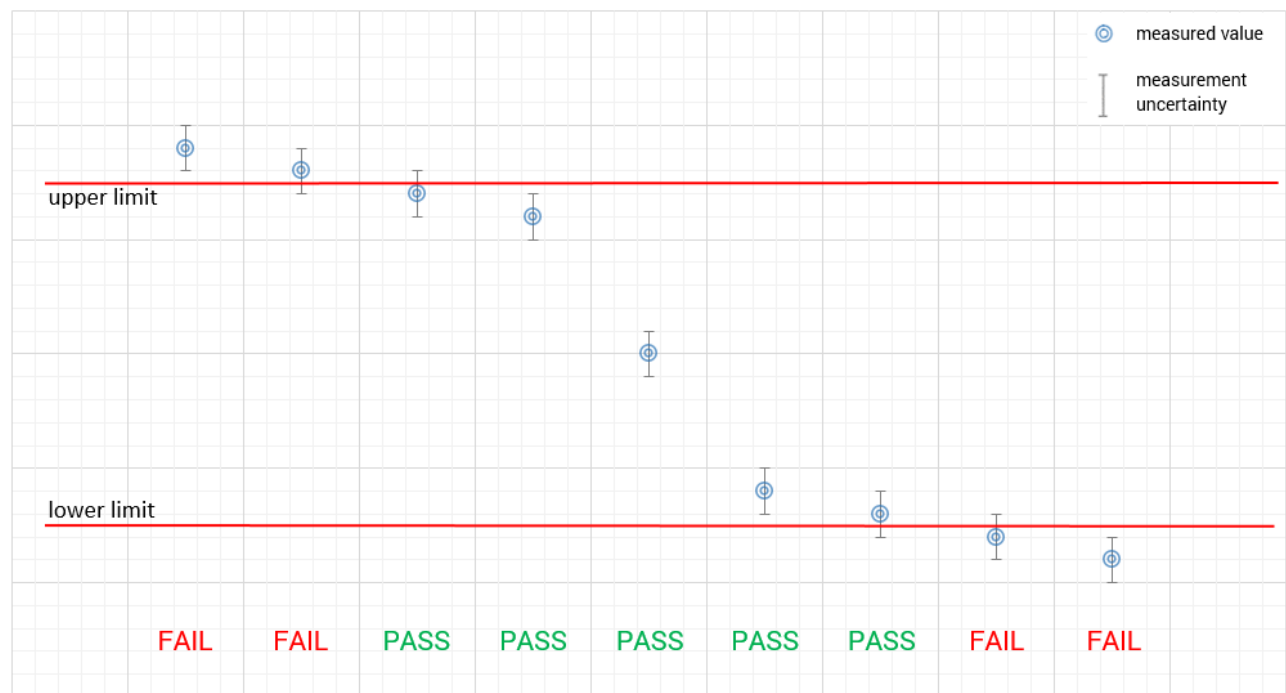
Guidance	Version	Description
ANSI C63.26-2015	-/-	American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services
76-81 GHz Radars KDB	v01r02	653005 D01 76-81 GHz Radars v01r02: EQUIPMENT AUTHORIZATION GUIDANCE FOR 76-81 GHz RADAR DEVICES

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.

measured value, measurement uncertainty, verdict



5 Test environment

Temperature :	T _{nom} T _{max} T _{min}	+20 °C during room temperature tests +85 °C during high temperature tests -40 °C during low temperature tests
Relative humidity content :		49 %
Barometric pressure :		990 hPa to 1010 hPa
Power supply	V _{nom} V _{max} V _{min}	12.0 V DC by external power supply 13.8 V DC by external power supply (1.15 * V _{nom}) 10.2 V DC by external power supply (0.85 * V _{nom})

6 Test item

6.1 General description

Kind of test item :	SRD for RTTT and other vehicle or fixed installation
Model name :	SRR6-B
S/N serial number :	EUT 5: A2C782065160000224A0200028 EUT 7: A2C782065160000224A0200016 EUT 10: A2C782065160000224A0200022 EUT 11: A2C782065160000224A0200007 EUT 21: A2C782065160000224A0200032
Hardware status :	Version B4.6
Software status :	EUT 5: Version 176.030.105 EUT 7: Version 176.030.105 EUT 10: Version 186.030.107 EUT 11: Version 186.030.107 EUT 21: Version 195.230.107
Frequency band :	76.5 GHz band (76 GHz – 77 GHz) 79.0 GHz band (77 GHz – 81 GHz)
Type of radio transmission : Use of frequency spectrum :	Modulated carrier
Type of modulation :	FMCW
Number of modes :	76.5 GHz band: 4 modes 79.0 GHz band: 4 modes
Antenna :	Integrated antenna
Power supply :	6.5 V to 19 V DC by external power supply
Temperature range :	-40 °C to 85 °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:

- 1-8315-24-01-01_TR1-A101-R01 (External photographs of EUT for measurements using software version 176.030.105 (EUT 5 and EUT 7))
- 1-8315-24-02-01_TR1-A101-R01 (External photographs of EUT for measurements using software version 186.030.107 (EUT 10 and EUT 11))
- 1-8315-24-01-01_TR1-A102-R01 (Internal photographs of EUT, provided by customer)
- 1-8315-24-01-01_TR1-A105-R01 (Test set-up photographs for measurements using software version 176.030.105 (EUT 5 and EUT 7))
- 1-8315-24-02-01_TR1-A103-R01 (Test set-up photographs for measurements using software version 186.030.107 (EUT 10 and EUT 11))
- Note: The referenced photos show EUT delivered by the customer in this project, not necessarily the exact one used for the specific tests. EUT identification shown in the photos may differ.

Additional measurement reports:

- 1-8315-24-02-02_TR1-A204-R1 (Frequency stability under extreme conditions - EUT 21 - Mode 01)
- 1-8315-24-02-04_TR1-A201-R1 (Frequency stability under extreme conditions - EUT 10 - Mode 4 (c0))

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).

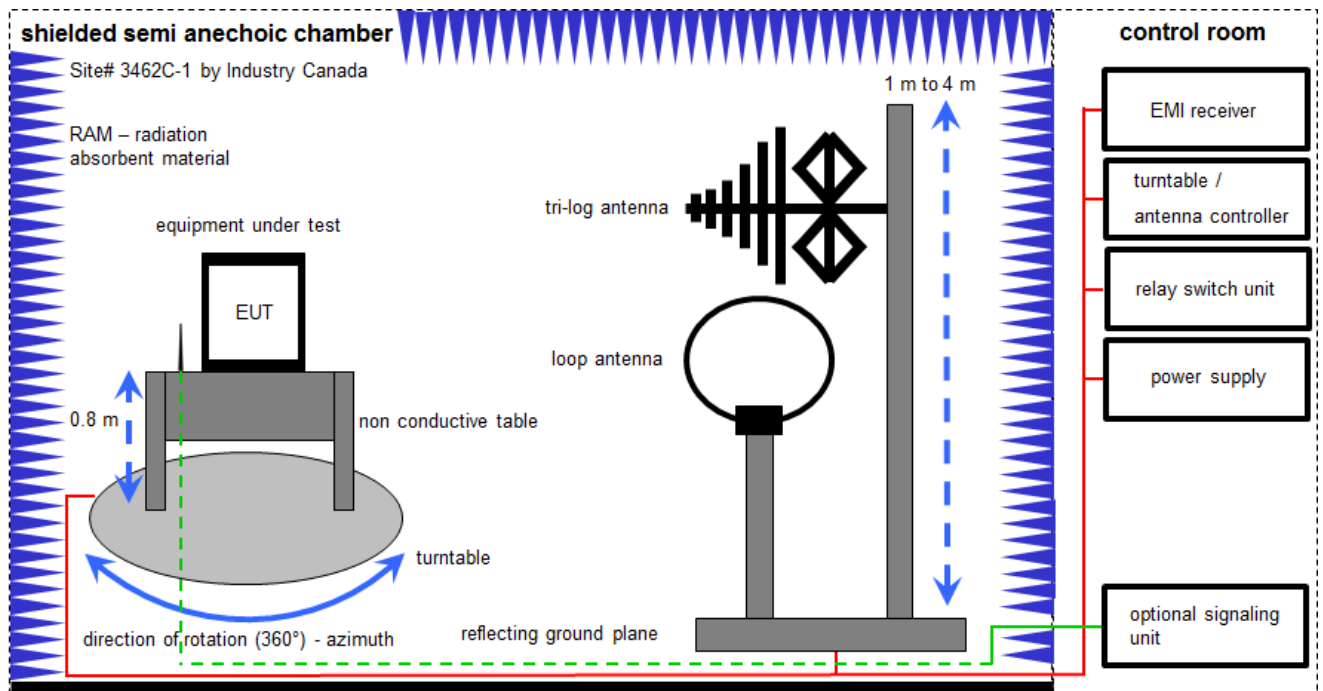
In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

Agenda: Kind of Calibration

k/cal	calibration / calibrated	EK	limited calibration
Ne/cnn	not required (k, ev, izw, zw not required)	zw	cyclical maintenance (external cyclical maintenance)
Ev/chk	periodic self verification	izw	internal cyclical maintenance
Ve	long-term stability recognized	g	blocked for accredited testing
vlk!	Attention: extended calibration interval		
NK!	Attention: not calibrated	*)	next calibration ordered / currently in progress
cpu	check prior usage		

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)

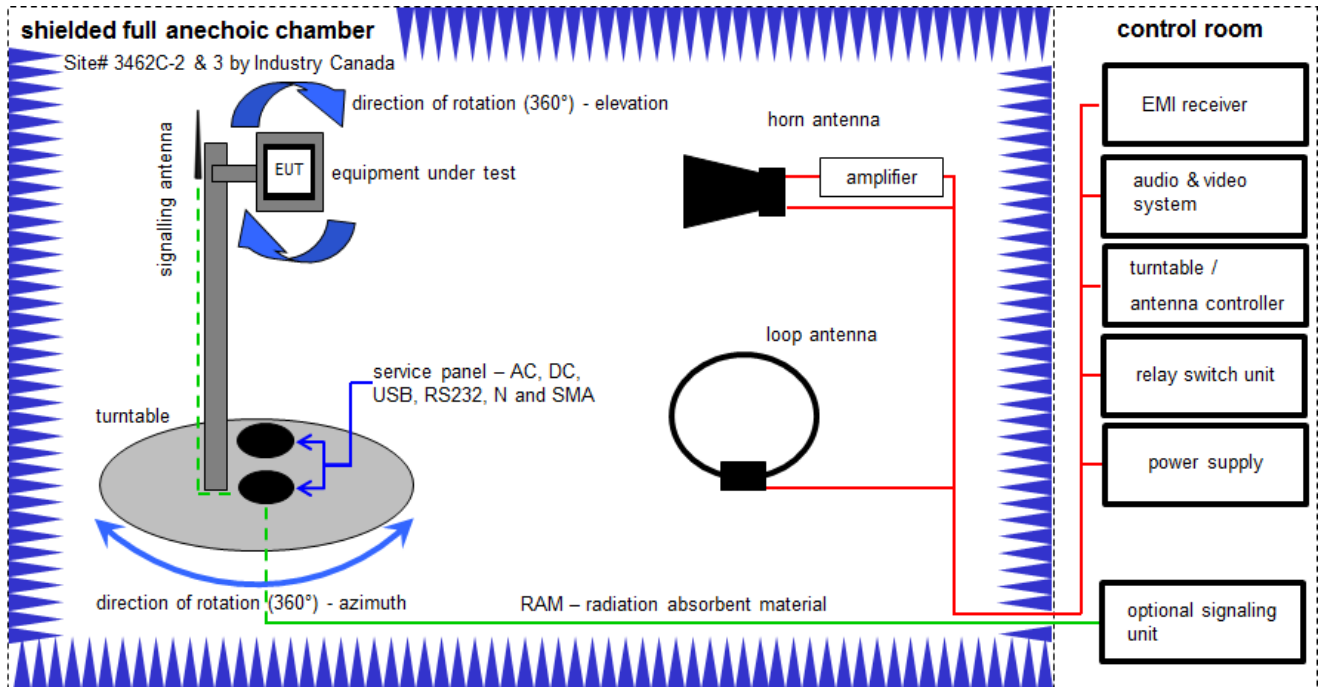
Example calculation:

$$FS \text{ [dB}\mu\text{V/m]} = 12.35 \text{ [dB}\mu\text{V]} + 1.90 \text{ [dB]} + 16.80 \text{ [dB/m]} = 31.05 \text{ [dB}\mu\text{V/m]} \text{ (35.69 } \mu\text{V/m) @ distance}$$

Equipment table:

No.	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	Semi anechoic chamber	3000023	MWB AG	*	300000551-0000	cnn	-/-	-/-
2	Turntable	2089-4.0	EMCO Elektronik GmbH / Gilching	*	300004394-0000	cnn	-/-	-/-
3	Switch-Unit	3488A	Hewlett Packard	2719A14505	300000368	cpu	-/-	-/-
4	Power Supply	6032A	Hewlett Packard	2920A04466	300000580	cnn	-/-	-/-
5	Antenna Tower	2175	ETS-Lindgren GmbH / Taufkirchen	64762	300003745	cnn	-/-	-/-
6	Positioning Controller	2090	ETS-Lindgren GmbH / Taufkirchen	64672	300003746	cnn	-/-	-/-
7	EMI Test Receiver	ESR3	Rohde & Schwarz Messgerätebau GmbH / Memmingen	102587	300005771	cal	05.12.2024	05.12.2025
8	TRILOG Broadband Antenna	VULB9163	Schwarzbeck Mess-Elektronik OHG / Schönauf	295	300003787	cal	23.05.2023	23.05.2025
9	TRILOG Broadband Antenna	VULB9163	Schwarzbeck Mess-Elektronik OHG / Schönauf	318	300003696	cal	31.01.2024	31.01.2026

7.2 Shielded fully anechoic chamber



Measurement distance: horn antenna 3 meter; loop antenna 3 meter

$$FS = UR + CA + AF$$

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

Example calculation:

$$FS [dB\mu V/m] = 40.0 [dB\mu V] + (-35.8) [dB] + 32.9 [dB/m] = 37.1 [dB\mu V/m] (71.61 \mu V/m) @ distance$$

$$OP = AV + D - G + CA$$

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

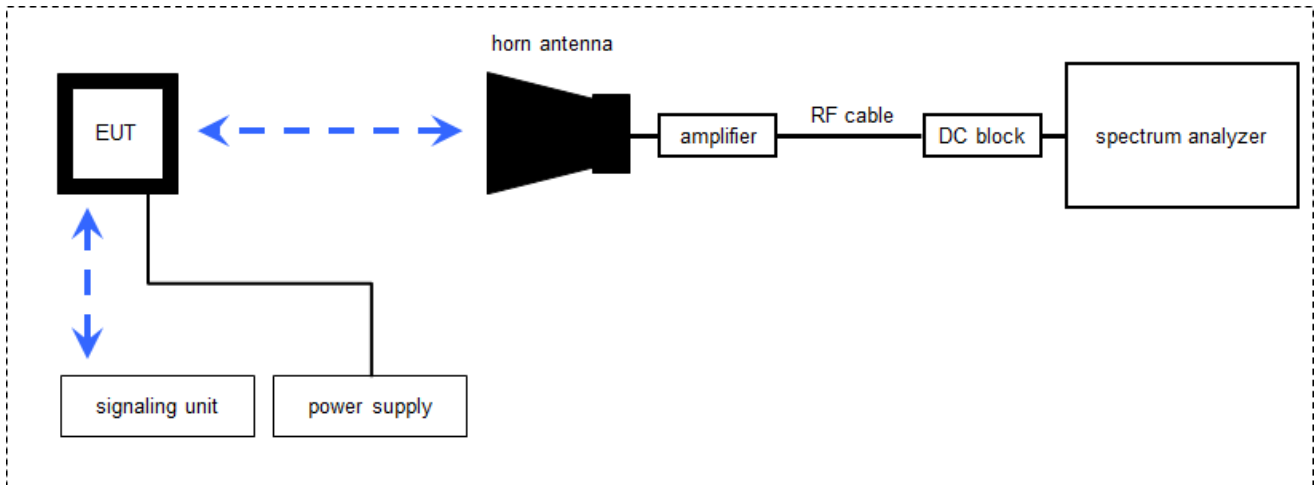
Example calculation:

$$OP [dBm] = -65.0 [dBm] + 50 [dB] - 20 [dBi] + 5 [dB] = -30 [dBm] (1 \mu W)$$

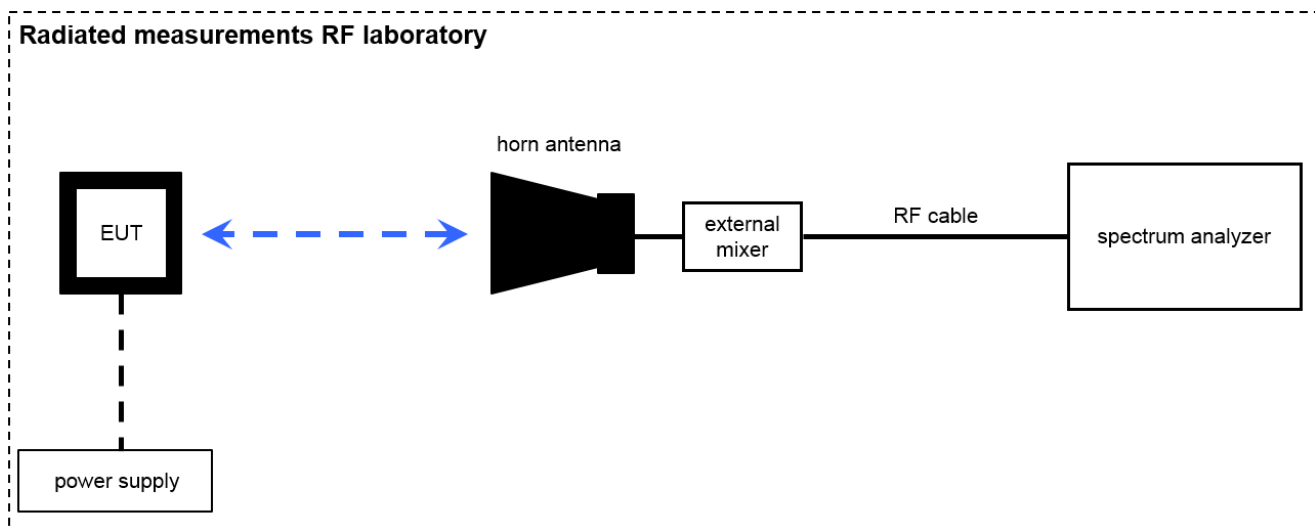
Equipment table:

No.	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	Double-Ridged Waveguide Horn Antenna	3115	EMCO Elektronik GmbH / Gilching	8812-3089	300000307	cal	09.07.2024	09.07.2026
2	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	cpu	-/-	-/-
3	Switch / Control Unit	3488A	Hewlett Packard	*	300000199	cnn	-/-	-/-
4	Highpass Filter	WHKX7.0/18G-8SS	Wainwright Instruments GmbH / Andechs	19	300003790	cnn	-/-	-/-
5	Broadband Amplifier 0.5-18 GHz	CBLU5184540	CERNEX	22049	30000448	cpu	-/-	-/-
6	4U RF Switch Platform	L4491A	Agilent Technologies Deutschland GmbH / Böblingen	MY50000037	300004509	cnn	-/-	-/-
7	NEXIO EMV-Software	BAT EMC V2022.0.32.0	Nexio	*	300004682	cnn	-/-	-/-
8	RF-Amplifier	AMF-6F06001800-30-10P-R	NARDA-MITEQ Inc	2011572	300005241	cpu	-/-	-/-
9	Active Loop Antenna	6502	EMCO Elektronik GmbH / Gilching	2210	300001015	cal	02.08.2023	02.08.2025
10.1	EMI Test Receiver 20Hz- 26,5GHz	ESU26	Rohde & Schwarz Messgerätebau GmbH / Memmingen	100037	50254	cal	22.12.2023	22.12.2024
10.2	EMI Test Receiver 20Hz- 26,5GHz	ESU26	Rohde & Schwarz Messgerätebau GmbH / Memmingen	100037	50254	cal	10.12.2024	10.12.2025
11	TRILOG Broadband Antenna	VULB9163	Schwarzbeck Mess-Elektronik OHG / Schönau	318	300003696	cal	31.01.2024	31.01.2026
12	Power Supply	HMP2020	Rohde & Schwarz Messgerätebau GmbH / Memmingen	120579	40408	cal	02.05.2023	31.05.2025

7.3 Radiated measurements > 18 GHz



7.4 Radiated measurements > 50/85 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:

$$FS \text{ [dB}\mu\text{V/m]} = 40.0 \text{ [dB}\mu\text{V]} + (-60.1) \text{ [dB]} + 36.74 \text{ [dB/m]} = 16.64 \text{ [dB}\mu\text{V/m]} \text{ (6.79 } \mu\text{V/m) @ distance}$$

$$OP = AV + D - G + CA$$

(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:

$$OP \text{ [dBm]} = -59.0 \text{ [dBm]} + 44.0 \text{ [dB]} - 20.0 \text{ [dBi]} + 5.0 \text{ [dB]} = -30 \text{ [dBm]} \text{ (1 } \mu\text{W)}$$

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

Equipment table:

No.	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	Temperature Test Chamber	T-40/50	CTS Clima Temperatur Systeme GmbH / Hechingen	064023	300003540	calchk	11.07.2024	11.07.2026
2	Power Supply	E3632A	Agilent Technologies Deutschland GmbH / Böblingen	MY40001320	400000396	cal	04.12.2024	04.12.2027
3	Signal- and Spectrum Analyzer 2 Hz - 85 GHz	FSW85	Rohde & Schwarz Messgerätebau GmbH / Memmingen	101333	300005568	cal	27.09.2024	27.09.2025
4	Broadband LNA 18-50 GHz	CBL18503070PN	CERNEX	25240	300004948	chk	22.04.2024	22.04.2026
5	Std. Gain Horn Antenna 49.9-75.8 GHz	2524-20	Flann	*	300001983	cnn	-/-	-/-
6	Std. Gain Horn Antenna 114-173 GHz	2924-20	Flann	*	300001999	cnn	-/-	-/-
7	Std. Gain Horn Antenna 145-220 GHz	3024-20	Flann	*	300002000	cnn	-/-	-/-
8	Std. Gain Horn Antenna 60-90 GHz	COR 60_90	Thomson CSF	*	300000814	cpu	-/-	-/-
9	Harmonic Mixer 3- Port, 110-170 GHz	FS-Z170	Radiometer Physics GmbH	100014	300004156	cal	15.07.2024	15.07.2025
10	Harmonic Mixer 3- Port, 140-220 GHz	SAM-220	Radiometer Physics GmbH	200001	300004157	cal	01.08.2024	01.08.2025
11	Harmonic Mixer 3- Port, 220-325 GHz	SAM-325	Radiometer Physics GmbH	100002	300004158	cal	31.07.2024	31.07.2025
12	Std. Gain Horn Antenna 33.0-50.1 GHz	2324-20	Flann	57	400000683	cnn	-/-	-/-
13	Harmonic Mixer 3- Port, 60-90 GHz	FS-Z90	Rohde & Schwarz Messgerätebau GmbH / Memmingen	101555	300004691	cal	25.07.2024	25.07.2025
14	Std. Gain Horn Antenna 217-330 GHz	32240-20	Flann	233278	300004960	cnn	-/-	-/-
15	Harmonic Mixer 3- Port, 75-110 GHz	FS-Z110	Rohde & Schwarz Messgerätebau GmbH / Memmingen	101411	300004959	cal	30.08.2024	30.08.2025
16	Harmonic Mixer 3- port, 90-140 GHz	FS-Z140	Rohde & Schwarz Messgerätebau GmbH / Memmingen	101119	300005581	cal	01.08.2024	01.08.2025
17	Harmonic Mixer 3- Port, 50-75 GHz	FS-Z75	Rohde & Schwarz Messgerätebau GmbH / Memmingen	101578	300005788	cal	10.07.2024	10.07.2025
18	Std. Gain Horn Antenna 73.8-112 GHz	2724-20	Flann	*	300001988	cnn	-/-	-/-
19	Std. Gain Horn Antenna 92.3-140 GHz	2824-20	Flann	*	300001993	cnn	-/-	-/-
20	Horn Antenna 18,0- 40,0 GHz	LHAF180	Microw.Devel	39180-103-021	300001747	cal	24.01.2024	31.01.2026
21	Power supply	N5767A	Agilent Technologies Deutschland GmbH / Böblingen	US14J1569P	300004851	cal	06.12.2023	31.12.2026
22	Signal- and Spectrum Analyzer 2 Hz - 50 GHz	FSW50	Rohde & Schwarz Messgerätebau GmbH / Memmingen	101332	300005935	cal	09.01.2025	09.01.2026
23	Harmonic Mixer 3- Port, 60-90 GHz	FS-Z90	Rohde & Schwarz Messgerätebau GmbH / Memmingen	102152	300006202	cal	10.03.2025	10.03.2026

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 $\pm 45^\circ$ 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.

8.5 Sequence of testing radiated spurious above 50 GHz with external mixers

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 for far field (e.g. 0.25 m).
- The EUT is set into operation.

Premeasurement

- The test antenna with external mixer is handheld and moved carefully over the EUT to cover the EUT's whole sphere and different polarizations of the antenna.
- Caution is taken to reduce the possible overloading of the external mixer.

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).
- As external mixers may generate false images care is taken to ensure that any emission measured by the spectrum analyzer does indeed originate in the EUT. Signal identification feature of spectrum analyzer is used to eliminate false mixer images (i.e., it is not the fundamental emission or a harmonic falling precisely at the measured frequency).
- 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 ± 3.5 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)	± 3.5 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 Far field consideration for measurements above 18 GHz

Far field distance calculation:

$$D_{ff} = 2 \times D^2 / \lambda$$

with

D_{ff} Far field distance

D Antenna dimension

λ wavelength

Spurious emission measurements:

Antenna frequency range in GHz	Highest measured frequency in GHz	D in cm	λ in cm	D_{ff} in cm
18 - 26.5	26.5	3.4	1.13	20.44
26.5 - 40	40	2.2	0.75	12.91
40 - 50	50	2.77	0.60	25.58
50 - 75	75	1.85	0.40	17.11
75 - 110	110	1.24	0.27	11.28
90 - 140	140	1.02	0.22	9.72
110 - 170	170	0.85	0.18	8.19
140 - 220	220	0.68	0.14	6.78
220 - 325	325	0.43	0.09	4.01
325 - 500	500	0.26	0.06	2.25

11 76.5 GHz Band (76 GHz – 77 GHz)

11.1 Summary of measurement results

11.1.1 Summary

☒	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	47 CFR Part 95 Subpart M	see below	2025-09-22	-/-

Test specification clause	Test case	Temperature conditions	Power source voltages	Pass	Fail	NA	NP	Remark
§2.1046 §95.3367	Radiated power	Nominal	Nominal	☒	☐	☐	☐	complies
§2.1047	Modulation characteristics	-/-	-/-	☒	☐	☐	☐	complies
§2.1049 §2.1055 §95.3379 (b)	Occupied bandwidth / Frequency stability (99% bandwidth)	Nominal Extreme	Nominal Extreme	☒	☐	☐	☐	complies
§2.1051	Spurious emissions at antenna terminals	Nominal	Nominal	☐	☐	☒	☐	see note 2, DUT has integral/internal antenna
§2.1053 §95.3379 (a)	Unwanted emissions (radiated spurious)	Nominal	Nominal	☒	☐	☐	☐	complies

Note:

- 1) NA = Not applicable; NP = Not performed
- 2) ANSI C63.26-2015 5.5.1:
“...many contemporary portable transmitters utilize integral antennas, precluding access to an antenna output port from which to perform conducted compliance measurements. For these types of transmitters, all the data necessary to demonstrate compliance must be measured in a radiated test configuration...”

11.2 Additional comments

Reference documents:

- SRR6-B_RF_Test_Input_Doc_v3.3rev2.pdf
- SRR6-B_RF_Test_Input_Doc_v4.0rev3.pdf
- SRR6-B_RF_Test_Input_Doc_v4.0rev4.pdf

Special test descriptions:

- SRR6-B_RF_Test_Input_Doc_v3.3rev2.pdf
- SRR6-B_RF_Test_Input_Doc_v4.0rev3.pdf
- SRR6-B_RF_Test_Input_Doc_v4.0rev4.pdf

Configuration descriptions:

- SRR6-B_RF_Test_Input_Doc_v3.3rev2.pdf
- SRR6-B_RF_Test_Input_Doc_v4.0rev3.pdf
- SRR6-B_RF_Test_Input_Doc_v4.0rev4.pdf

Test devices (EUT):

- EUT 7: Normal operation modes, used for general purpose testing using the initial software version 176.030.105
- EUT 5: Normal operation modes, primarily used for testing under extreme conditions using the initial software version 176.030.105
- EUT 10: Normal operation modes, used for general purpose testing using the updated software version 186.030.107
- EUT 11: Normal operation modes, used for general purpose testing using the updated software version 186.030.107
- EUT 21: Normal operation modes, used for testing under extreme conditions in the 76.5 GHz band using the updated software version 195.230.107

Associated equipment (AE):

- AE1: Control Input Display (Used to set the EUT mode)
- AE2: Vehicular Gateway (VG4)

Normal operation modes, as declared by the customer:

- As declared by the customer, the mode ID numbers were changed between the initial software version 176.030.105 and updated software version 186.030.107, with no modifications to the underlying technical characteristics.
- All measurements were performed using the previous software version 176.030.105. At the customer's request, the radiated power and occupied bandwidth measurements under normal test conditions were repeated using the updated software version to confirm that the underlying technical characteristics of the modes remain unchanged.

Mode ID		Centre frequency [GHz]	Bandwidth [MHz]	Remark
Updated SW Version 186.030.107	Initial SW Version 176.030.105			
1	1	76.492	938.4	Operation
17	25	76.492	926.7	Operation
Removed	37	76.492	934.8	-/-
44	62	76.492	801.0	EoL / Service

Details on test mode settings:

According to the customer's instructions, the following steps and commands were used to configure the test modes:

- Connect the EUT and associated equipment to an appropriate power supply
- On the Control Input Display:
 - Enter the mode ID
 - Press the "Set Mode" button
 - Press the "Start" button

11.3 Measurement results

11.3.1 Radiated power

Description:

§95.3367

The fundamental radiated emission limits within the 76-81 GHz band are expressed in terms of Equivalent Isotropically Radiated Power (EIRP) and are as shown below.

Limits:

FCC §95.3367 (a) (b)

Frequency	Limit (eirp)
76.0 - 81.0 GHz	50 dBm (Average)
76.0 - 81.0 GHz	55 dBm/MHz (PEAK)

Measurement:

Measurement parameter: Average Power	
Detector:	RMS
Resolution bandwidth:	1 MHz
Video bandwidth:	3 MHz
Trace-Mode:	Max Hold

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

Note: KDB 653005 4.(c)(1)

“Peak power measurements of swept frequency radar implementations (e.g., high sweep rate FMCW) may require a desensitization correction factor to be applied to the measurement results.”

→ Peak power measurements are therefore performed using a larger resolution bandwidth to mitigate issues with desensitization.

Measurement results for software version 176.030.105:

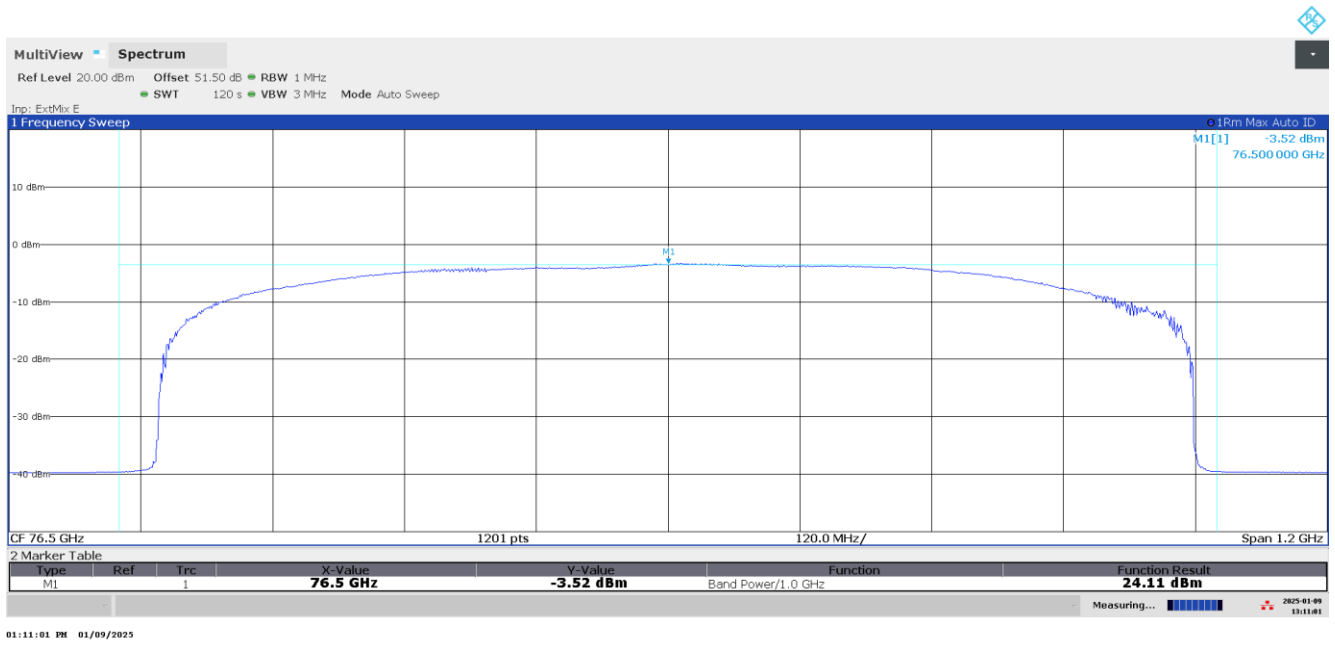
EUT	Mode	Test condition	Radiated Peak Power (EIRP)	Radiated Mean Power (EIRP)
EUT 7	01	T_{nom} / V_{nom}	34.74	24.11
EUT 7	25	T_{nom} / V_{nom}	34.62	24.08
EUT 7	37	T_{nom} / V_{nom}	34.52	24.04
EUT 7	62	T_{nom} / V_{nom}	29.43	18.98

Measurement results for software version 186.030.107:

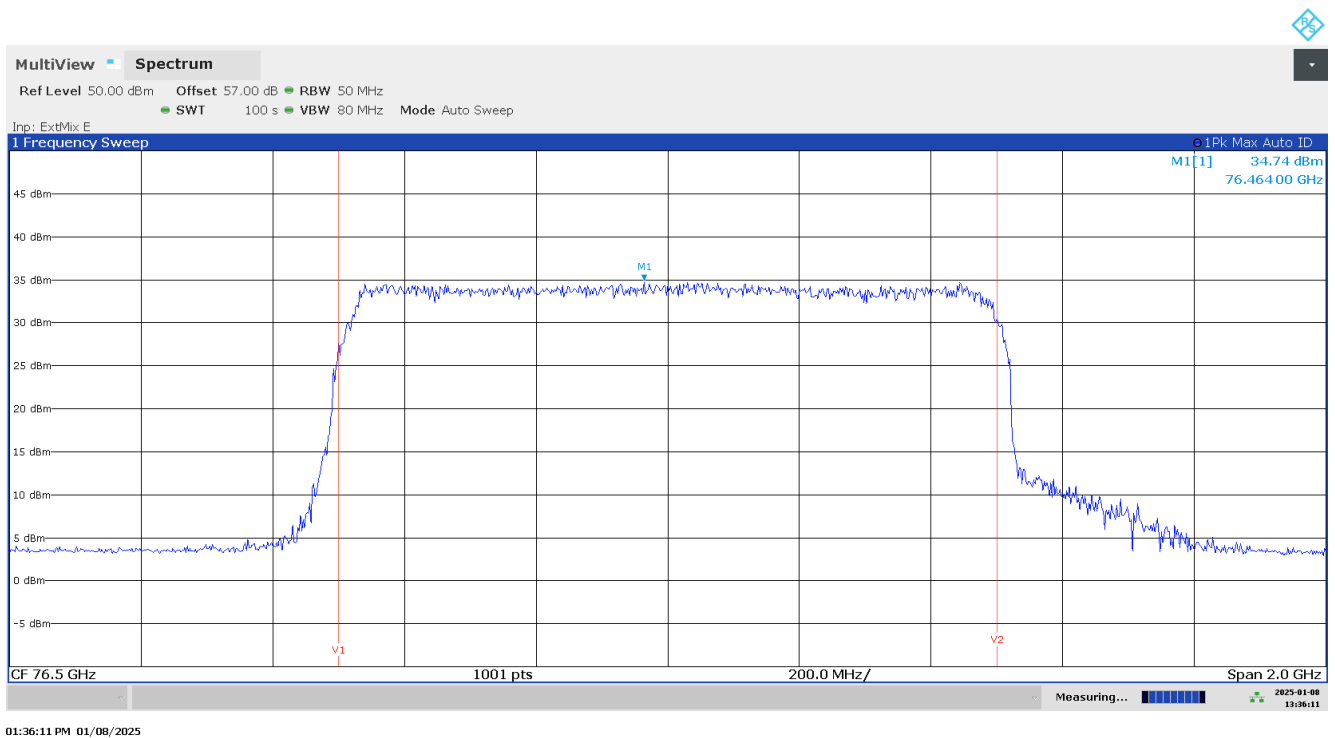
EUT	Mode	Test condition	Radiated Peak Power (EIRP)	Radiated Mean Power (EIRP)
EUT 11	01	T_{nom} / V_{nom}	34.19	23.00
EUT 11	17	T_{nom} / V_{nom}	34.07	22.93
EUT 11	44	T_{nom} / V_{nom}	28.44	16.98

Verdict: Compliant

Plot 1: Radiated Mean Power (EIRP), EUT 7, Mode 01, SW Version 176.030.105



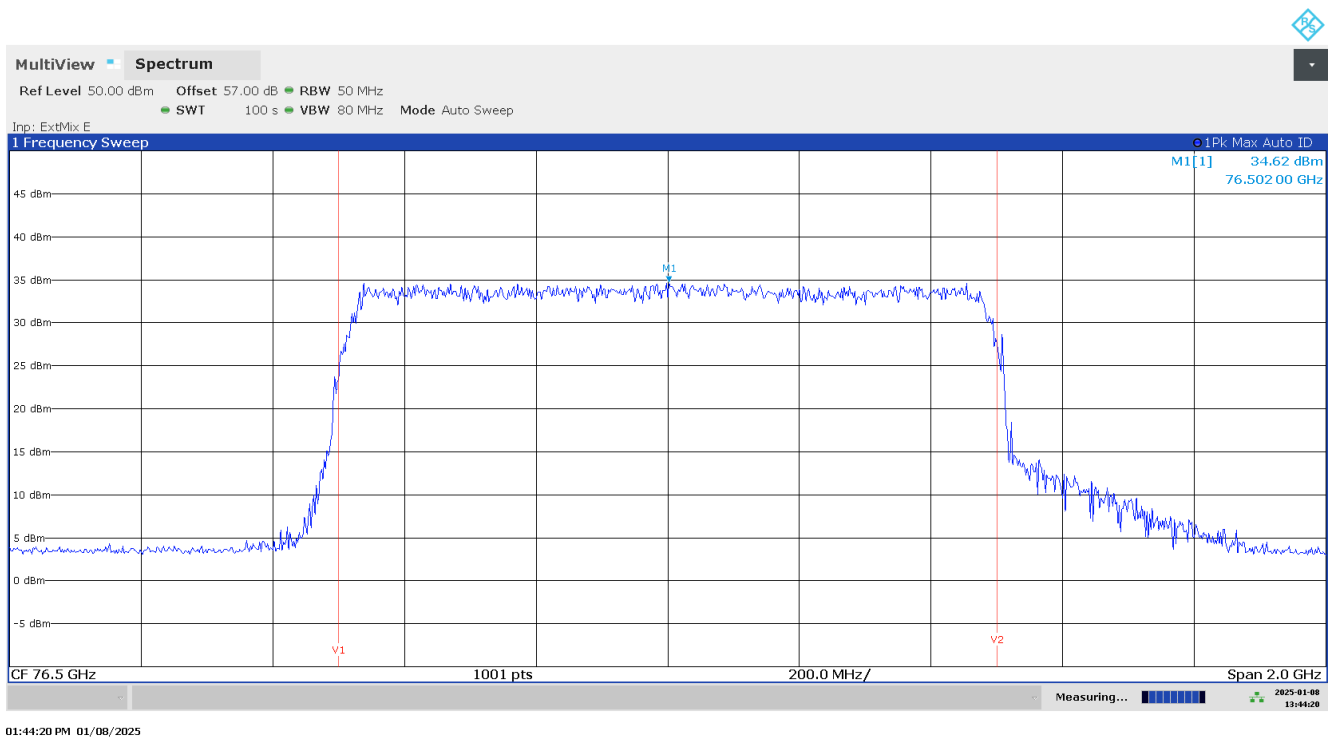
Plot 2: Radiated Peak Power (EIRP), EUT 7, Mode 01, SW Version 176.030.105



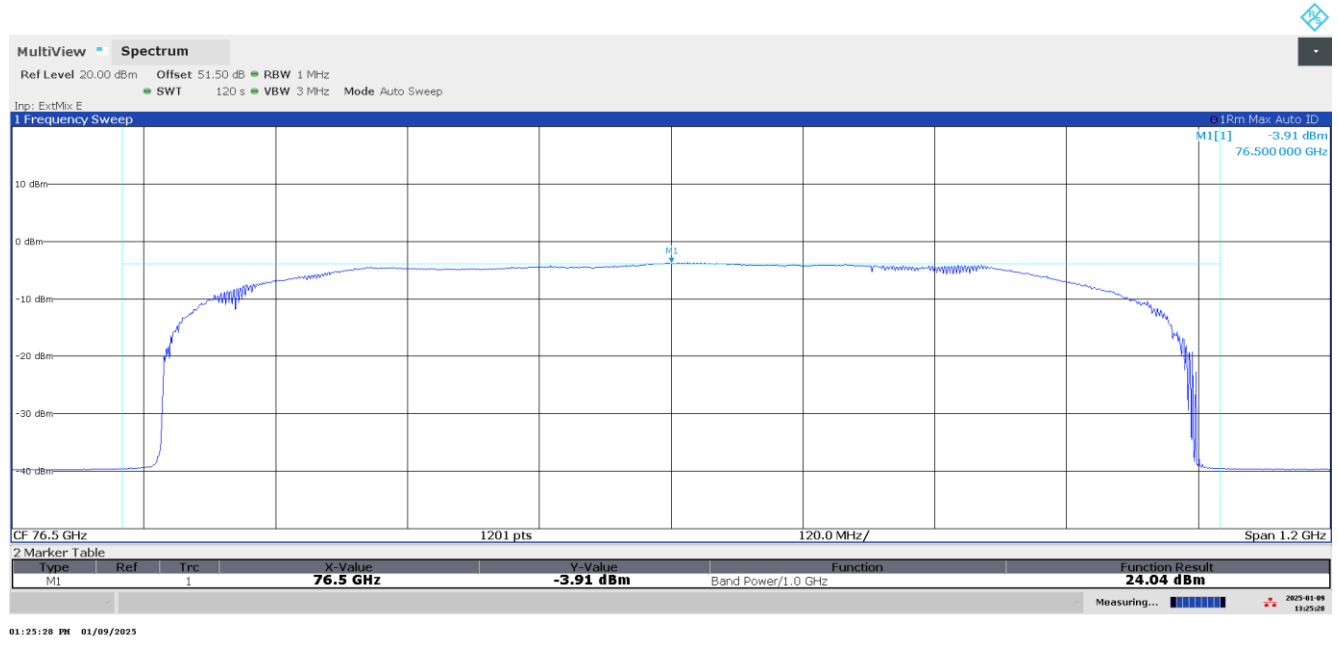
Plot 3: Radiated Mean Power (EIRP), EUT 7, Mode 25, SW Version 176.030.105



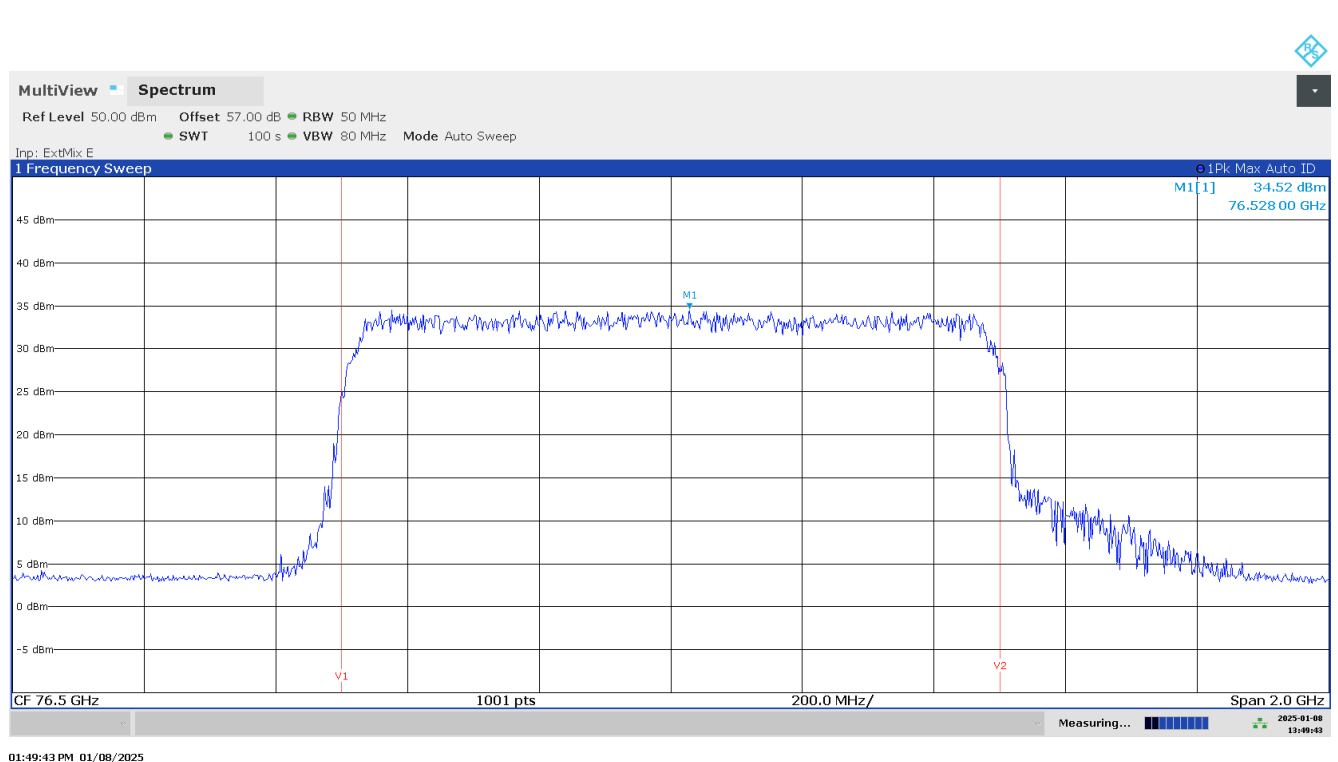
Plot 4: Radiated Peak Power (EIRP), EUT 7, Mode 25, SW Version 176.030.105



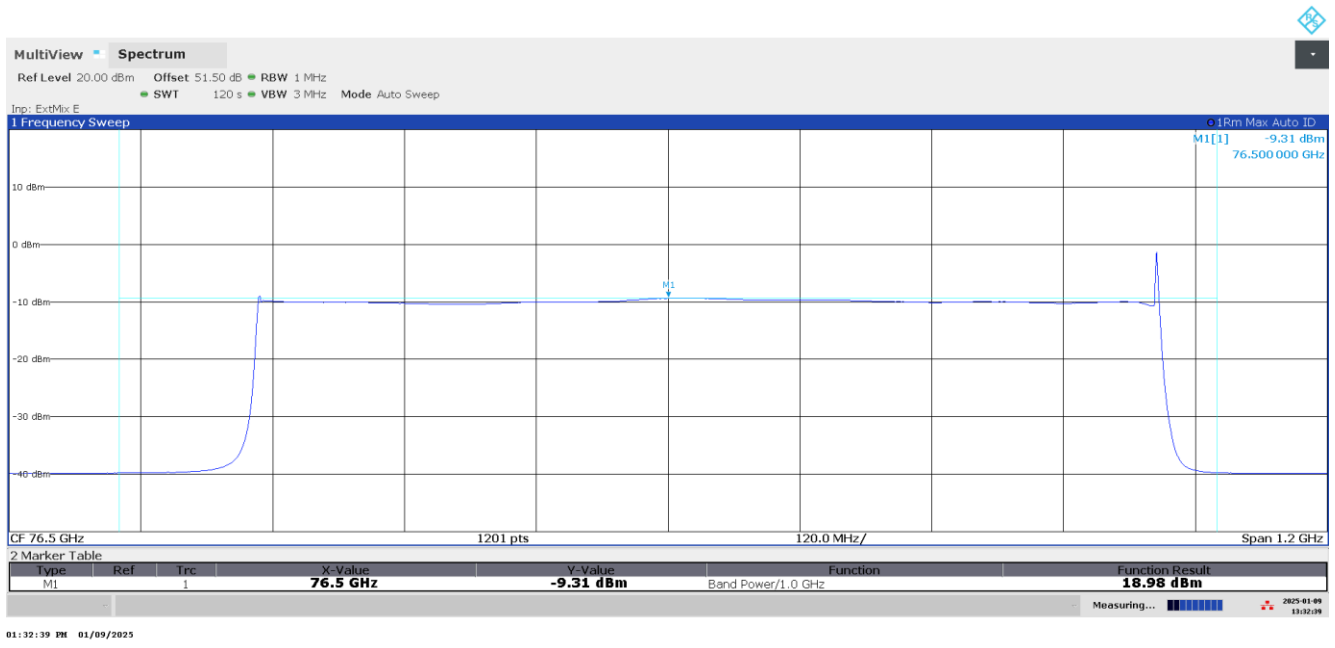
Plot 5: Radiated Mean Power (EIRP), EUT 7, Mode 37, SW Version 176.030.105



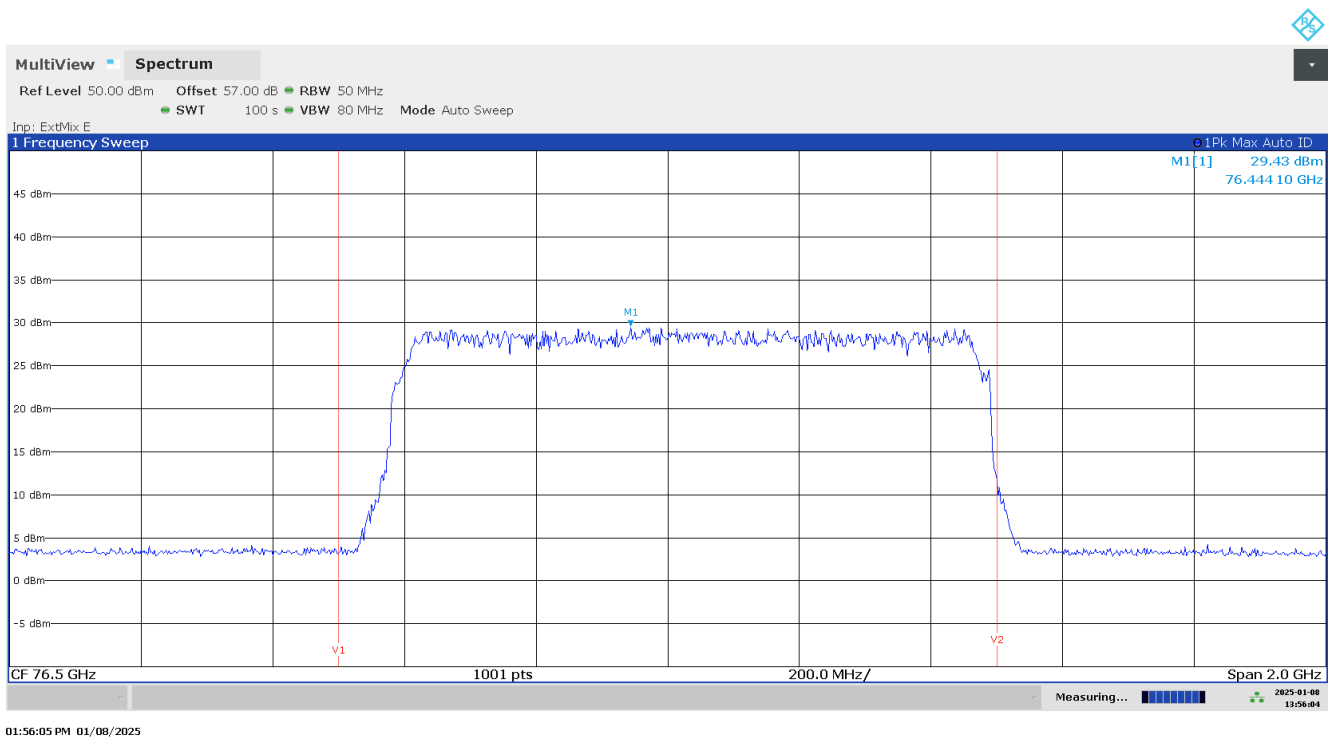
Plot 6: Radiated Peak Power (EIRP), EUT 7, Mode 37, SW Version 176.030.105



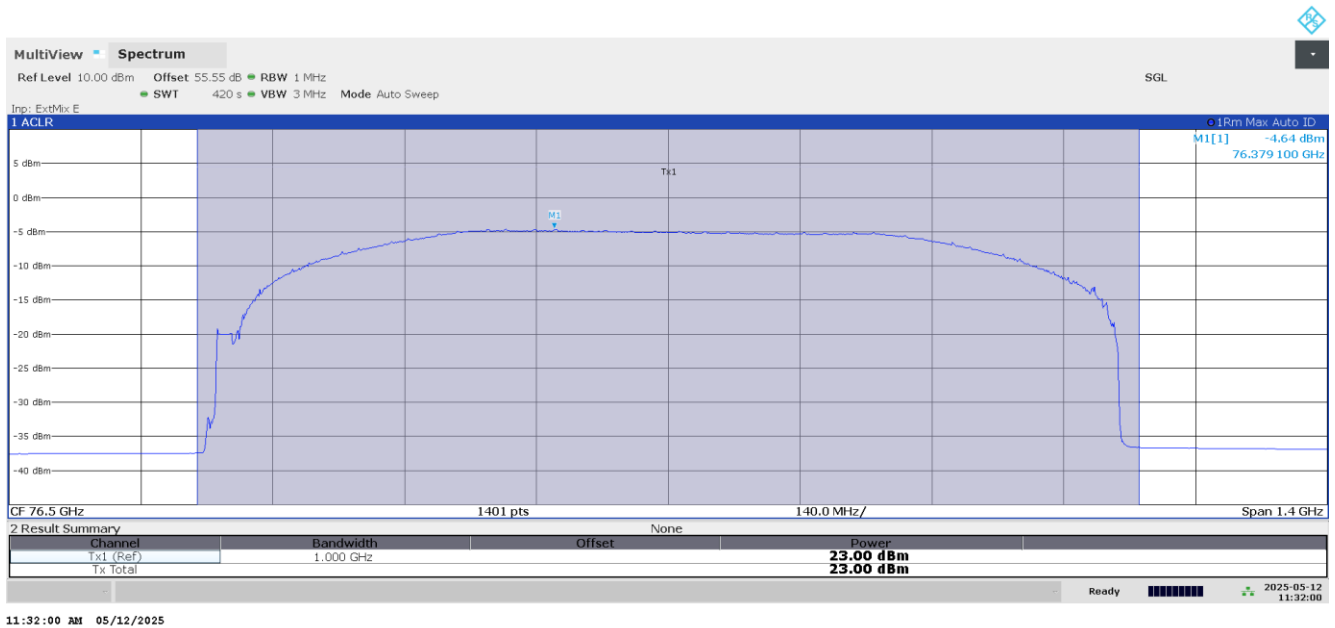
Plot 7: Radiated Mean Power (EIRP), EUT 7, Mode 62, SW Version 176.030.105



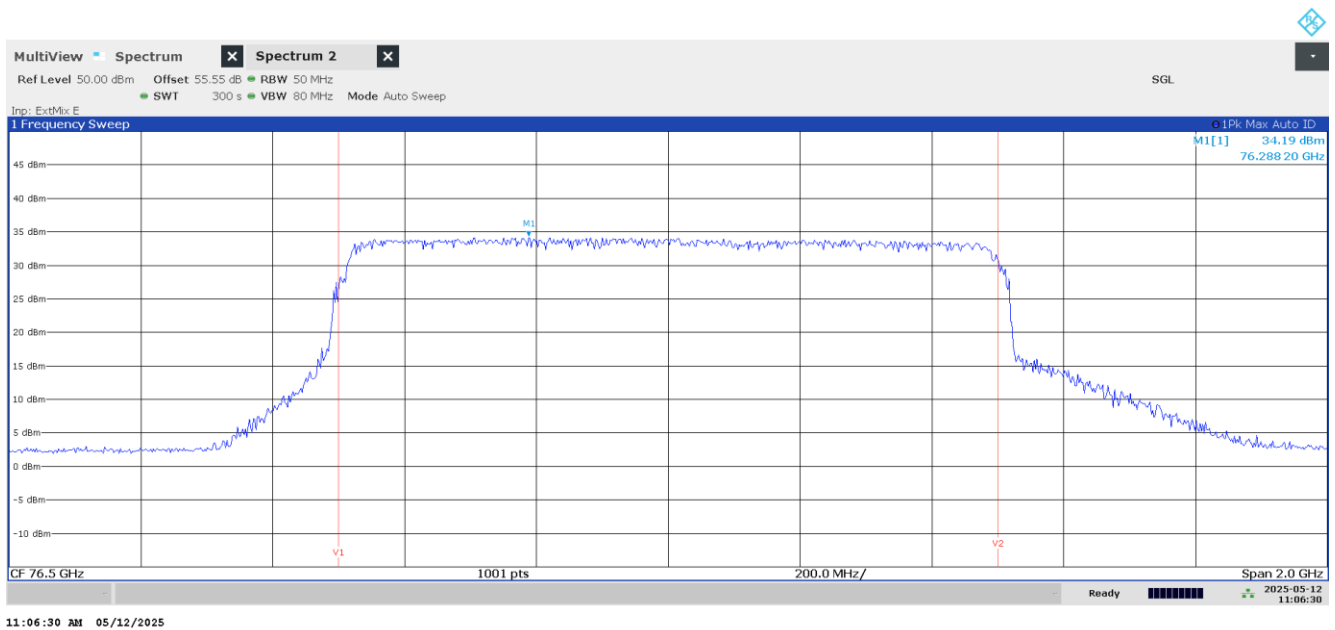
Plot 8: Radiated Peak Power (EIRP), EUT 7, Mode 62, SW Version 176.030.105



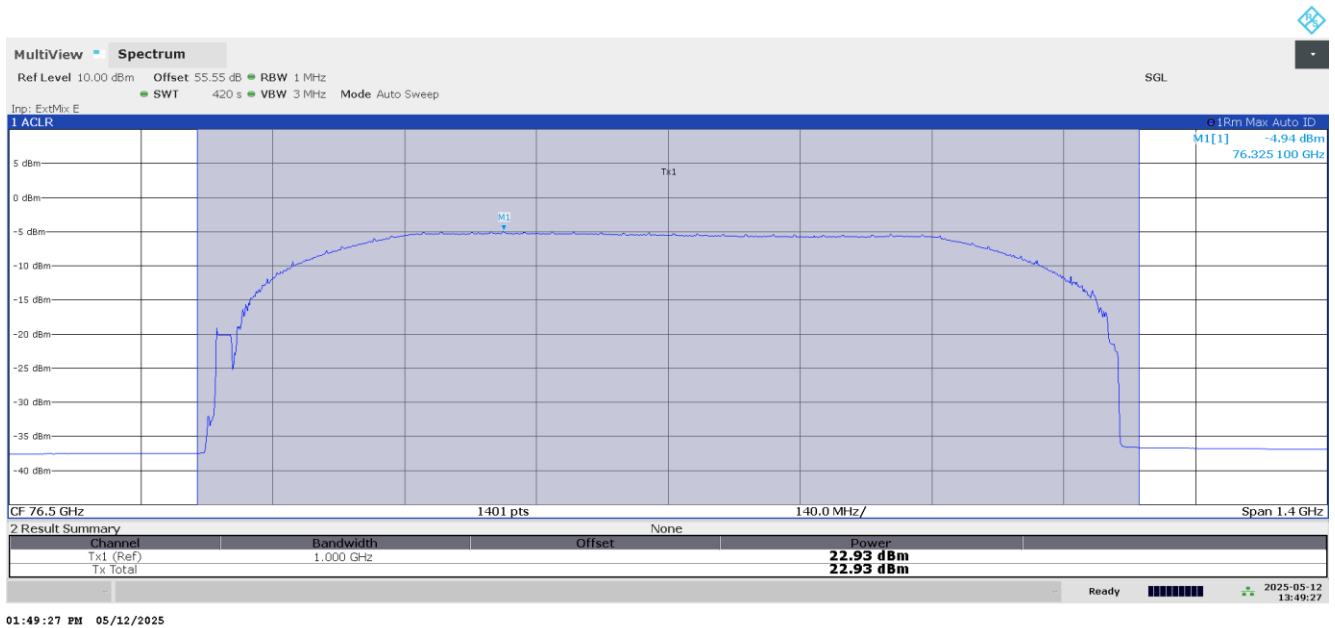
Plot 9: Radiated Mean Power (EIRP), EUT 11, Mode 1, SW Version 186.030.107



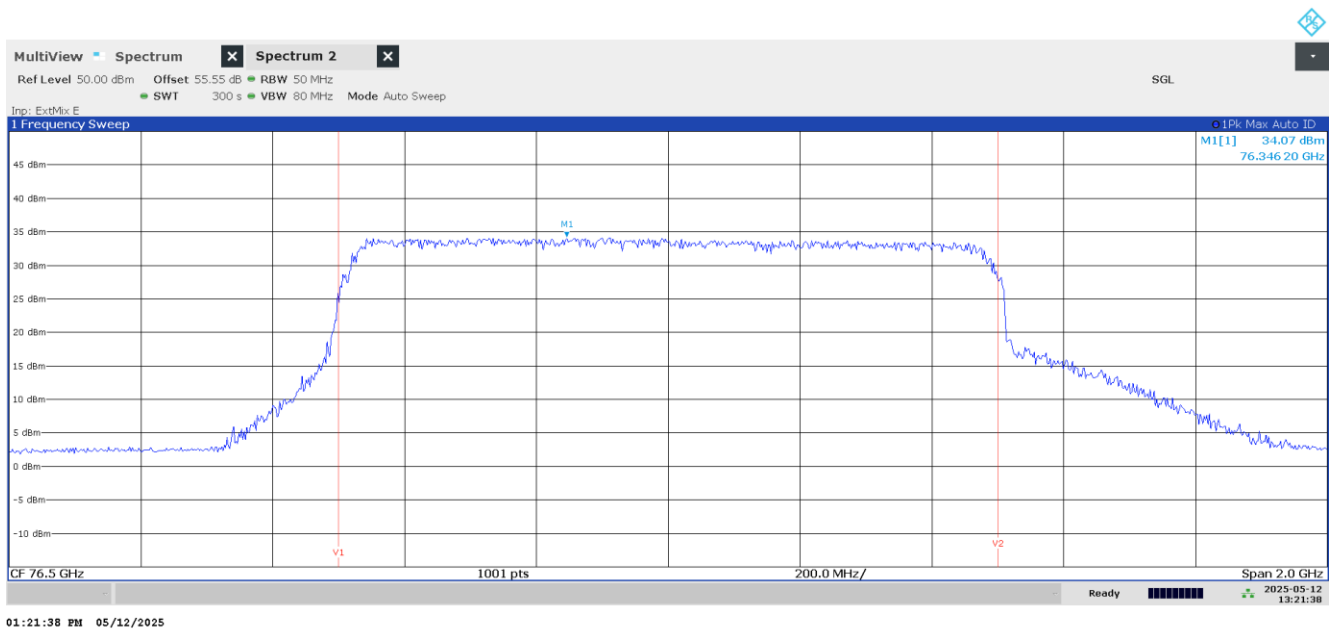
Plot 10: Radiated Peak Power (EIRP), EUT 11, Mode 1, SW Version 186.030.107



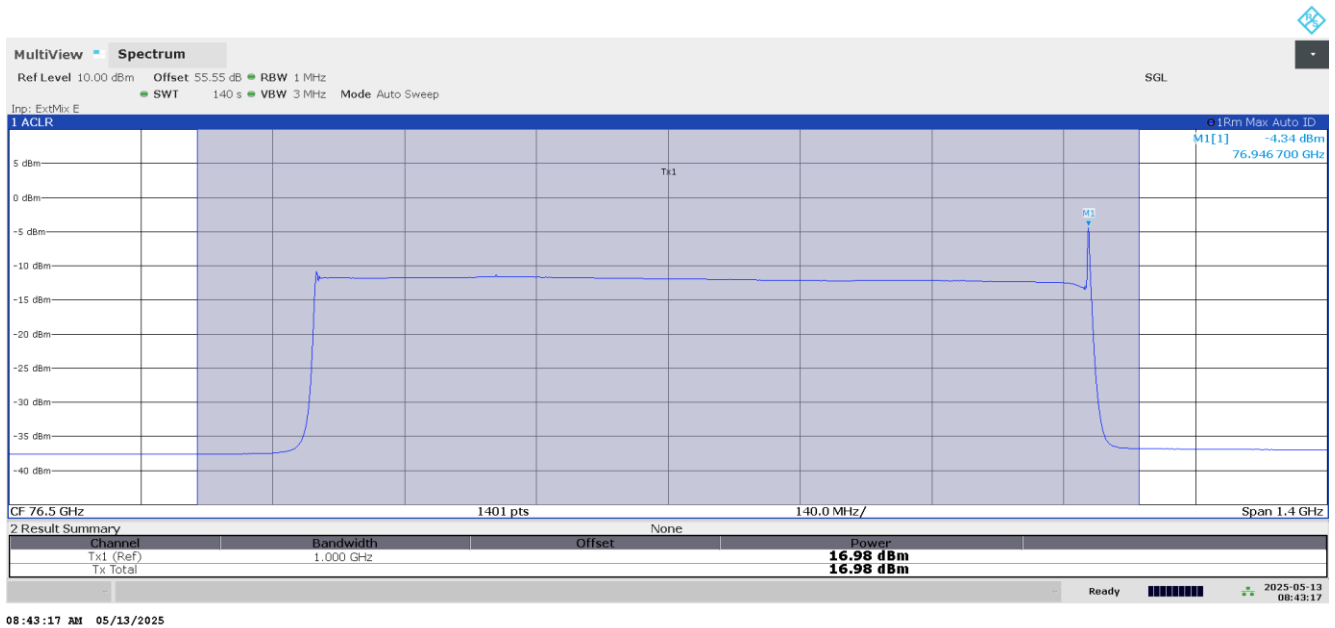
Plot 11: Radiated Mean Power (EIRP), EUT 11, Mode 17, SW Version 186.030.107



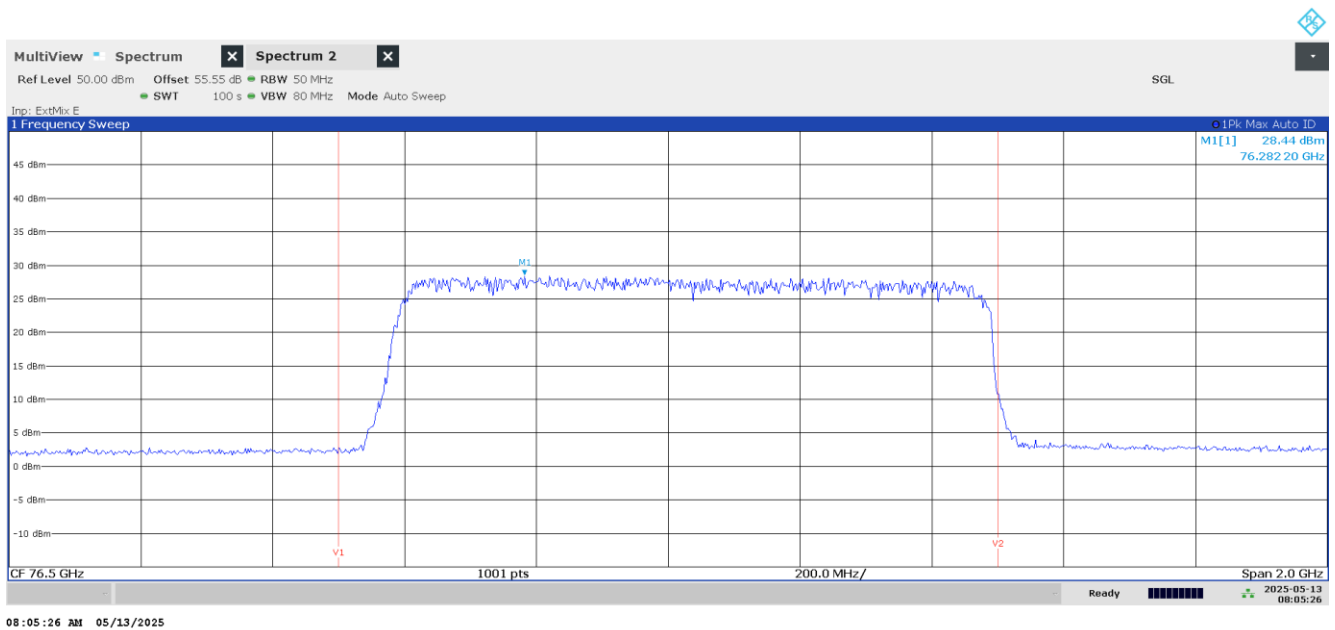
Plot 12: Radiated Peak Power (EIRP), EUT 11, Mode 17, SW Version 186.030.107



Plot 13: Radiated Mean Power (EIRP), EUT 11, Mode 44, SW Version 186.030.107



Plot 14: Radiated Peak Power (EIRP), EUT 11, Mode 44, SW Version 186.030.107



11.3.2 Modulation characteristics

Description:

§2.1047 (d) *Other types of equipment.* A curve or equivalent data which shows that the equipment will meet the modulation requirements of the rules under which the equipment is to be licensed.

KDB 653005 D01 76-81 GHz Radars v01r02, section 3 (g)

Concerning the Section 2.1047 modulation characteristics requirement, the following information should be provided:

- 1) Pulsed radar: pulse width and pulse repetition frequency (if PRF is variable, then report maximum and minimum values).
- 2) Non-pulsed radar (e.g., FMCW): modulation type (i.e., sawtooth, sinusoid, triangle, or square wave) and sweep characteristics (sweep bandwidth, sweep rate, sweep time).

Information from manufacturer on modulation characteristics:

Parameter	SRR6-B
Frequency band	76-77 GHz
Duty Cycle	Typical 41 %
Timing	Typical Cycle Time: 50ms Burst 20.3 ms (256 Ramps+Monitoring).
Modulation	FM- chirps, negative Sawtooth with linear change of center frequency over sweep bandwidth or single chirps
Sweep Bandwidth	Mode dependent: 817 / 926 / 938 MHz
Sweep rate	Max 13 MHz/ μ s
Power	Power constant during RF on
Steepness of Ramps	Steepness varies for scans and monitoring.
Calibration	No calibration routines applied
Antenna Beam Steering (Tx)	No beam steering

- Note: Information provided by customer via the additional document "SRR6-B_RF_Test_Input_Doc_v4.0rev3.pdf"

11.3.3 Occupied bandwidth / Frequency stability

Description:

§2.1049 The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission.

§95.3379 (b) 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.

Limits:

FCC
FCC §2.1049/ §95.3379 (b)
The occupied bandwidth from intentional radiators operated within the specified frequency band shall comply during all conditions of operation with the following:
Frequency range
76 GHz – 81 GHz

Measurement:

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

Results for software version 176.030.105 on EUT 7 and version 195.230.107 on EUT 21:

EUT	Mode	TEST CONDITIONS	f_L in GHz	f_H in GHz	Occupied Bandwidth (99%) in MHz
EUT 21	01	T_{min} / V_{nom}	76.049	76.971	922.1
EUT 21	01	$-30\text{ °C} / V_{nom}$	76.049	76.972	923.4
EUT 21	01	$-20\text{ °C} / V_{nom}$	76.048	76.971	923.3
EUT 21	01	$-10\text{ °C} / V_{nom}$	76.048	76.971	922.5
EUT 21	01	$0\text{ °C} / V_{nom}$	76.048	76.971	923.1
EUT 21	01	$10\text{ °C} / V_{nom}$	76.048	76.970	922.1
EUT 21	01	$T_{nom} / 10.2\text{ V}$	76.047	76.970	922.4
EUT 7	01	T_{nom} / V_{nom}	76.045	76.968	922.9
EUT 21	01	T_{nom} / V_{nom}	76.047	76.969	922.8
EUT 21	01	$T_{nom} / 13.8\text{ V}$	76.046	76.970	923.5
EUT 21	01	$30\text{ °C} / V_{nom}$	76.045	76.967	922.1
EUT 21	01	$40\text{ °C} / V_{nom}$	76.046	76.968	921.8
EUT 21	01	$50\text{ °C} / V_{nom}$	76.045	76.968	922.6
EUT 21	01	T_{max} / V_{nom}	76.048	76.971	923.7
EUT 7	25	T_{nom} / V_{nom}	76.048	76.959	911.4
EUT 7	37	T_{nom} / V_{nom}	76.046	76.961	915.4
EUT 7	62	T_{nom} / V_{nom}	76.128	76.947	819.0

Note:

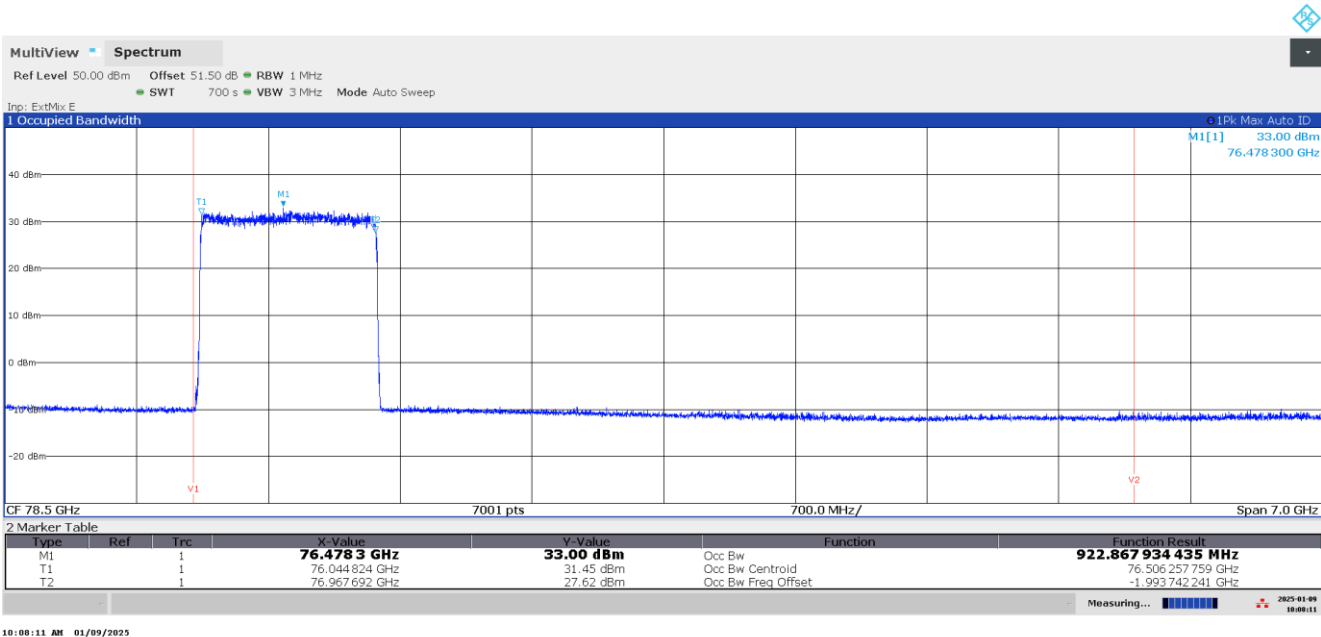
- The EUT is tested in the temperature range from -20 °C to 50 °C specified by §95.3379 (b)
- If the operating temperature range of the device specified by the manufacturer exceeds the test temperature range (-20 °C to $+50\text{ °C}$), the customer is responsible for ensuring the frequency stability and proper functioning of the device within the extended operating temperature range
- Measurements under extreme test conditions were performed using **Mode 01** as a worst-case analysis, as it is the mode with the highest occupied bandwidth under normal test conditions using software version 176.030.105 (See Plot 15)
- The plots of measurements performed using software version 195.230.107 can be found in the additional document: **1-8315-24-02-02_TR1-A204-R01**, plots of measurements performed using other software versions under normal test conditions are shown below

Results for software version 186.030.107:

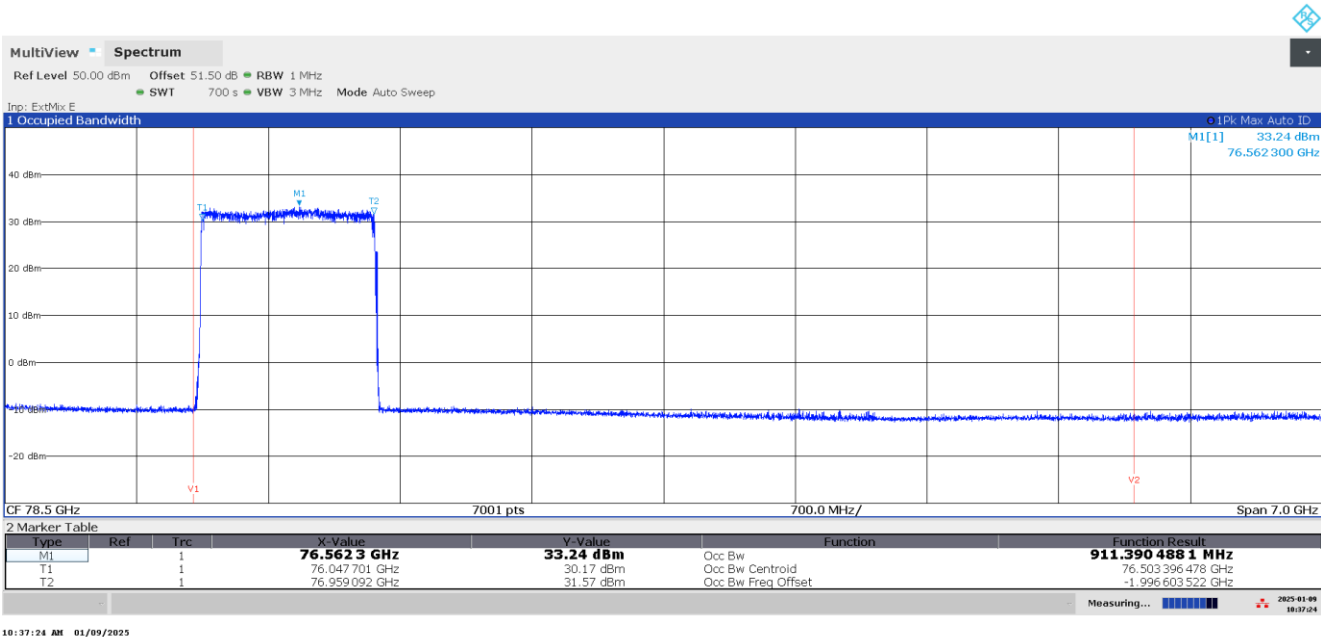
EUT	Mode	TEST CONDITIONS	f_L in GHz	f_H in GHz	Occupied Bandwidth (99%) in MHz
EUT 11	01	T_{nom} / V_{nom}	76.042	76.969	926.9
EUT 11	17	T_{nom} / V_{nom}	76.404	76.961	917.3
EUT 11	44	T_{nom} / V_{nom}	76.128	76.947	819.7

Verdict: Compliant

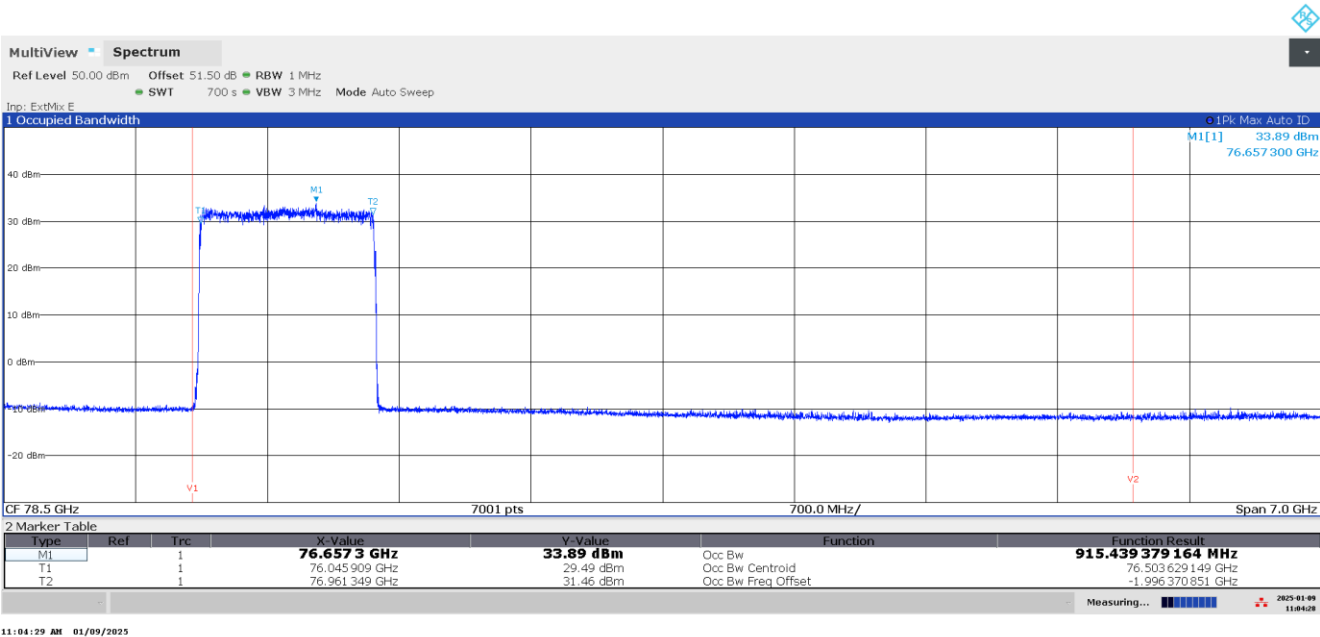
Plot 15: Occupied Bandwidth (99%), T_{nom} / V_{nom} , EUT 7, Mode 01, SW Version 176.030.105



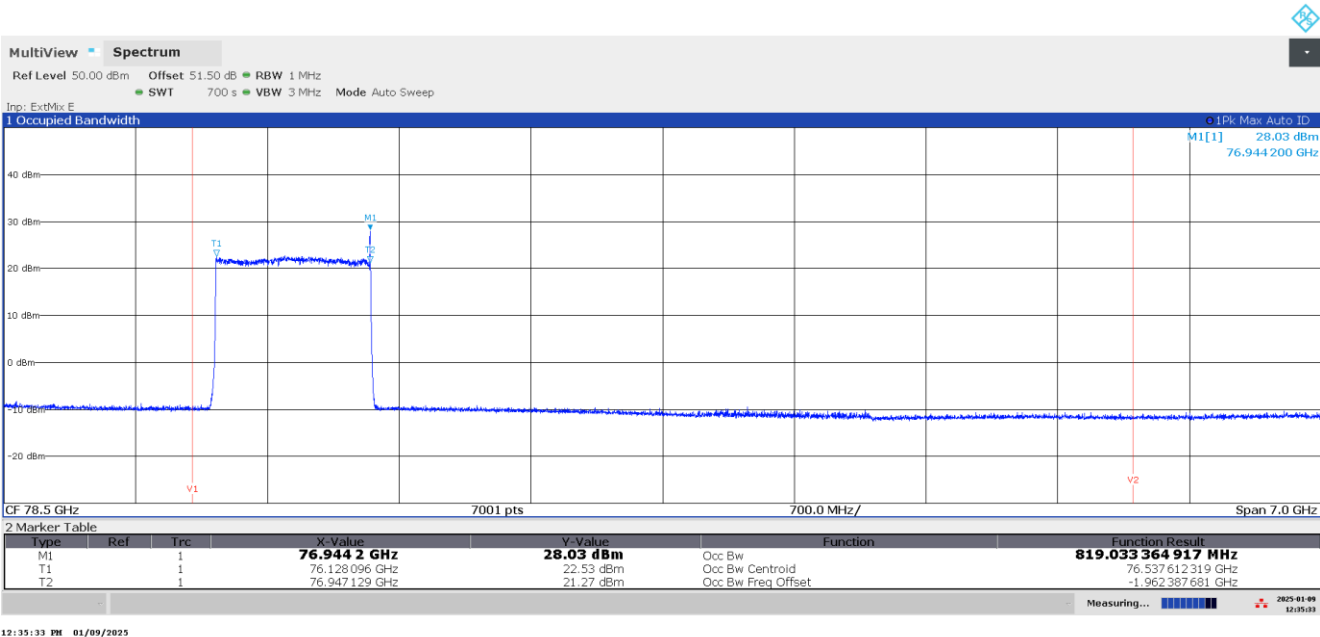
Plot 16: Occupied Bandwidth (99%), T_{nom} / V_{nom} , EUT 7, Mode 25, SW Version 176.030.105



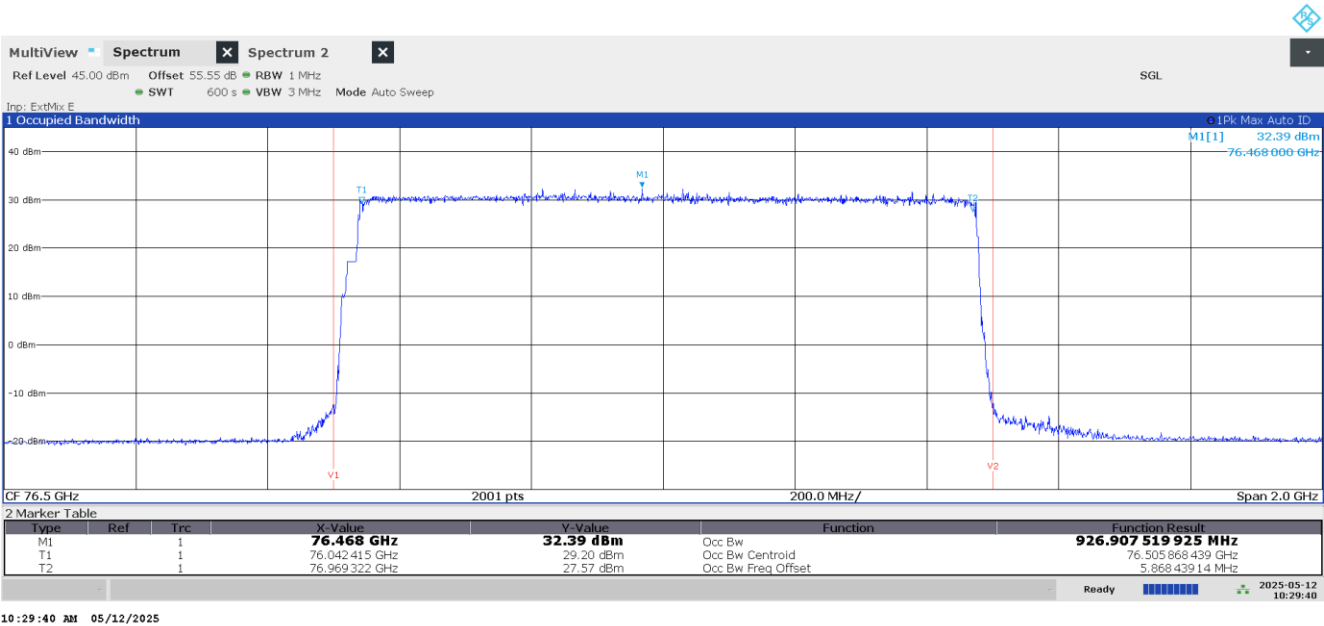
Plot 17: Occupied Bandwidth (99%), T_{nom} / V_{nom} , EUT 7, Mode 37, SW Version 176.030.105



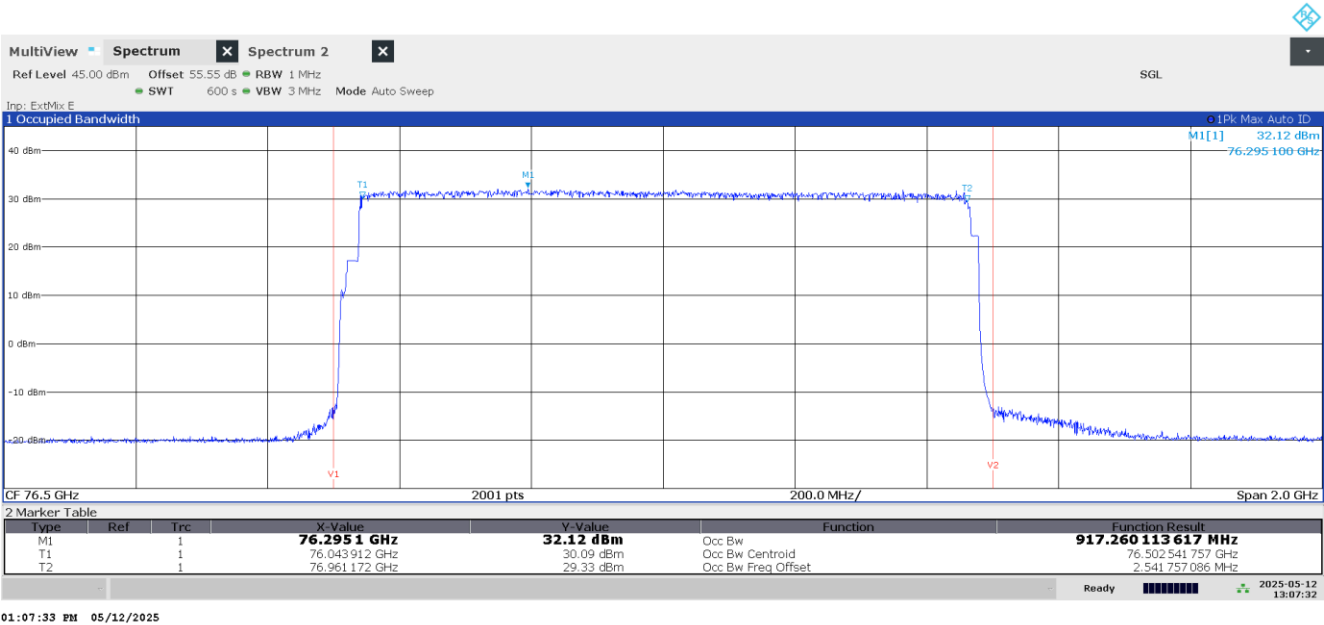
Plot 18: Occupied Bandwidth (99%), T_{nom} / V_{nom} , EUT 7, Mode 62, SW Version 176.030.105



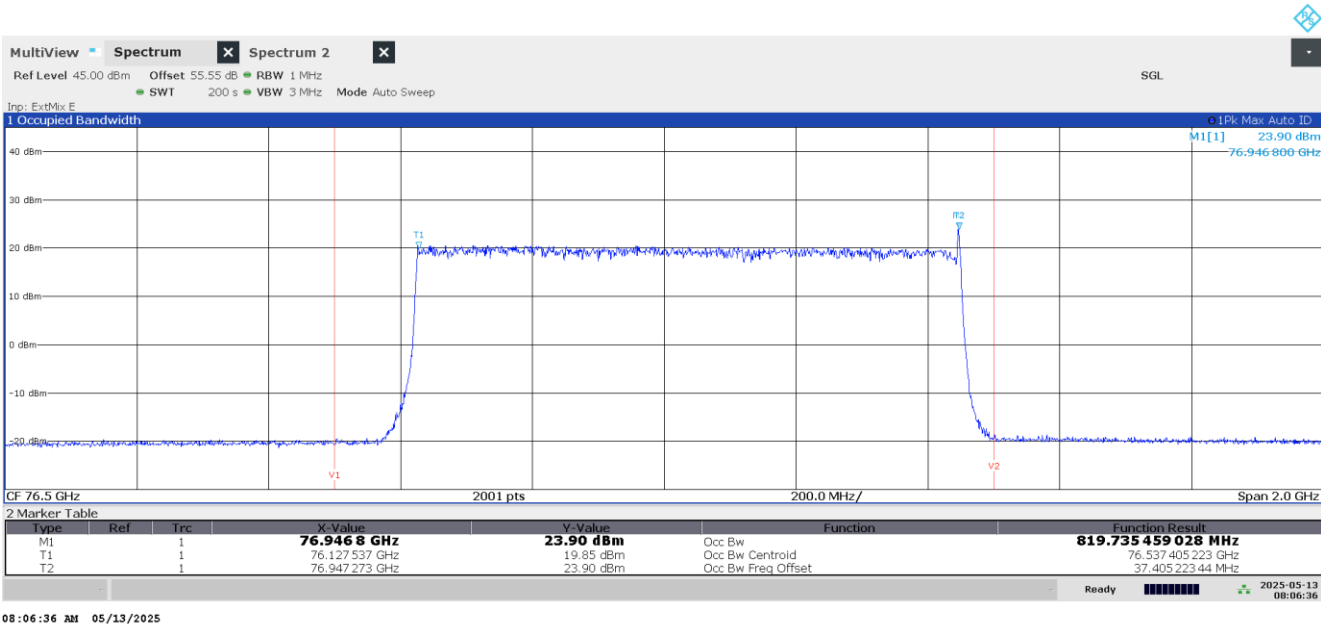
Plot 19: Occupied Bandwidth (99%), T_{nom} / V_{nom} , EUT 11, Mode 1, SW Version 186.030.107



Plot 20: Occupied Bandwidth (99%), T_{nom} / V_{nom} , EUT 11, Mode 17, SW Version 186.030.107



Plot 21: Occupied Bandwidth (99%), T_{nom} / V_{nom} , EUT 11, Mode 44, SW Version 186.030.107



11.3.4 Unwanted emissions (radiated spurious)

Description:

Measurement of the radiated unwanted emissions.

Limits:

FCC §95.3379

(a) The power density of any emissions outside the 76-81 GHz band shall consist solely of spurious emissions and shall not exceed the following:

(1) Radiated emissions below 40 GHz shall not exceed the field strength as shown in the following emissions table.

FCC		
CFR Part 95.3379 (a) (1) / CFR Part 95.3379 (a) (3)		
Radiated unwanted emissions		
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 – 30.0	30	30
30 - 88	100	3
88 – 216	150	3
216 – 960	200	3
960 – 40 000	500	3

- (i) In the emissions table in paragraph (a)(1) of this section, the tighter limit applies at the band edges.
 - (ii) The limits in the table in paragraph (a)(1) of this section are based on the frequency of the unwanted emissions and not the fundamental frequency. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.
 - (iii) The emissions limits shown in the table in paragraph (a)(1) of this section are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9.0-90.0 kHz, 110.0-490.0 kHz, and above 1000 MHz. Radiated emissions limits in these three bands are based on measurements employing an average detector with a 1 MHz RBW
- (2) The power density of radiated emissions outside the 76-81 GHz band above 40.0 GHz shall not exceed the following, based on measurements employing an average detector with a 1 MHz RBW:
- (i) For radiated emissions outside the 76-81 GHz band between 40 GHz and 200 GHz from field disturbance sensors and radar systems operating in the 76-81 GHz band: 600 pW/cm² at a distance of 3 meters from the exterior surface of the radiating structure.

- (ii) For radiated emissions above 200 GHz from field disturbance sensors and radar systems operating in the 76-81 GHz band: 1000 pW/cm² at a distance of 3 meters from the exterior surface of the radiating structure.

Frequency Range (GHz)	Power Density	EIRP
40 – 200	600 pW/cm ² @ 3m	-1.7 dBm
200 – 231	1000 pW/cm ² @ 3m	+0.5 dBm

- (3) For field disturbance sensors and radar systems operating in the 76-81 GHz band, the spectrum shall be investigated up to 231.0 GHz.

Limit conversion (ANSI C63.10-2013 9.6):

$$\text{EIRP[dBm]} = 10 \times \log(4 \times \pi \times d^2 \times 1000 \times \text{PD[W/m}^2])$$

- Power density at the distance specified by the limit: PD [W/m²]
- Equivalent isotropically radiated power: EIRP [dBm]
- Distance at which the power density limit is specified: d [m]

According to this formula, an emission limit of PD = 600 pW/cm² at a distance of d = 3 m corresponds to an equivalent isotropically radiated power of EIRP = -1.7 dBm.

Measurement:

Measurement parameter	
Detector:	Quasi Peak / Pos-Peak / Lin. Average / RMS
Resolution bandwidth:	F < 1 GHz: 100 kHz F > 1 GHz: 1 MHz
Video bandwidth:	F < 1 GHz: 300 kHz F > 1 GHz: 3 MHz
Trace-Mode:	Max Hold

Measurement results:

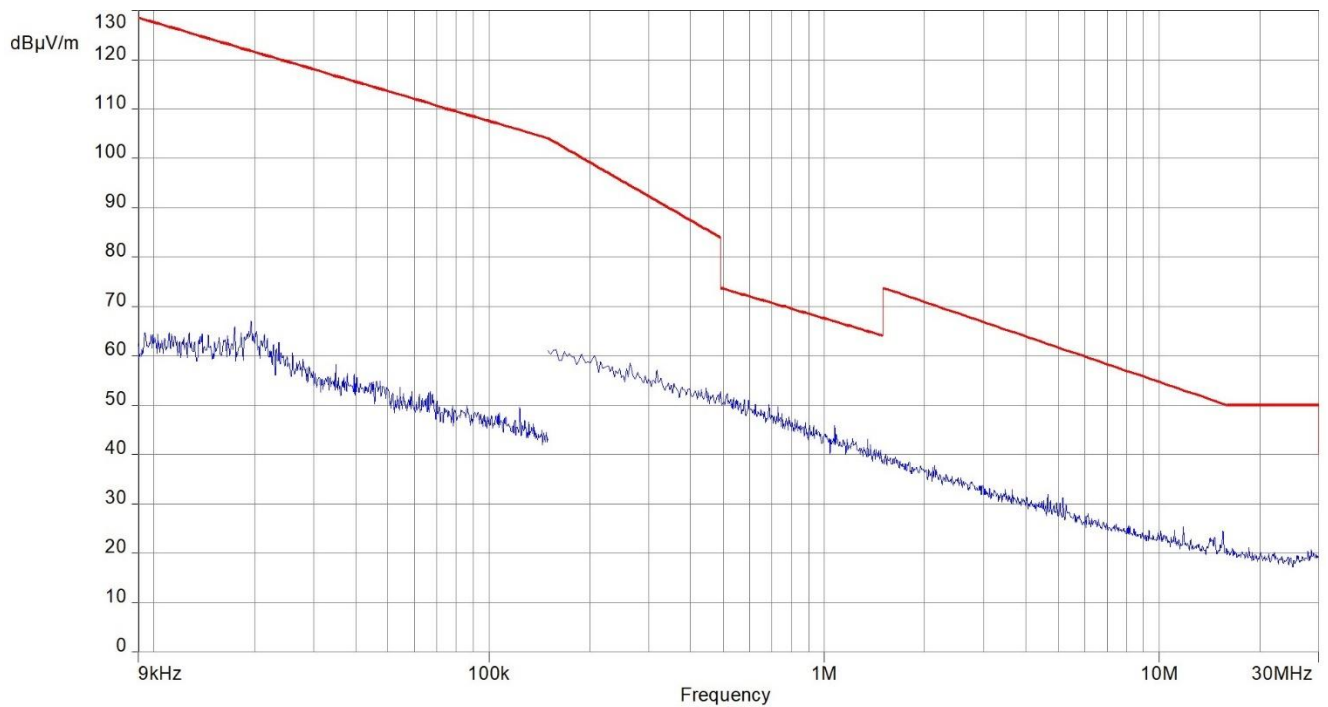
Frequency [GHz]	Detector	Bandwidth [MHz]	Level [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]
0.033	Quasi Peak	0.12	17.45	30.0	12.55
0.039	Quasi Peak	0.12	16.24	30.0	13.76
0.042	Quasi Peak	0.12	17.06	30.0	12.94
0.056	Quasi Peak	0.12	12.69	30.0	17.31
0.730	Quasi Peak	0.12	13.24	36.0	22.76
0.912	Quasi Peak	0.12	15.71	36.0	20.29
8.99	Peak	1.0	52.61	74.0	21.39
8.99	Linear Average	1.0	43.07	54.0	10.93
10.66	Peak	1.0	56.56	74.0	17.44
10.66	Linear Average	1.0	39.86	54.0	14.14
14.40	Peak	1.0	43.59	74.0	30.41
14.40	Linear Average	1.0	39.63	54.0	14.37
19.11	Peak	1.0	47.70	74.0	26.30
28.80	Linear Average	1.0	40.50	54.0	13.50
Please refer to the following plots for more information on the level of spurious emissions					

Note:

- The mode with the highest peak power (Mode 01) is used as a worst-case analysis for unwanted emissions measurements in the spurious domain
- All unwanted spurious emission measurements were performed using software version **176.030.105**

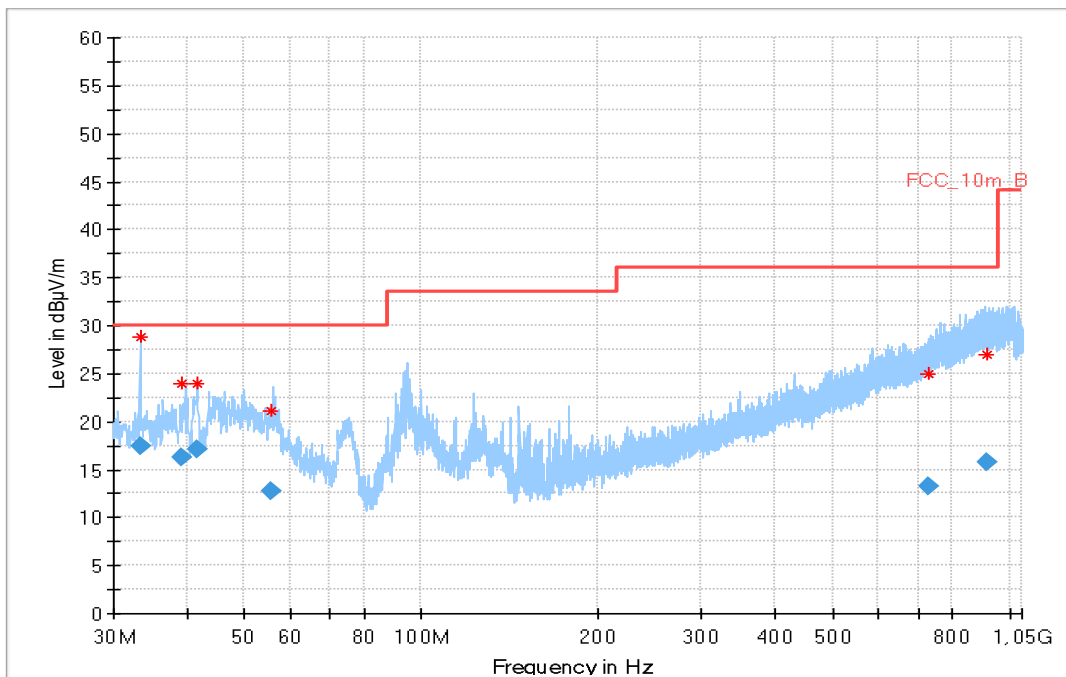
Verdict: Compliant

Plot 22: 9 kHz – 30 MHz, EUT 7, Mode 01



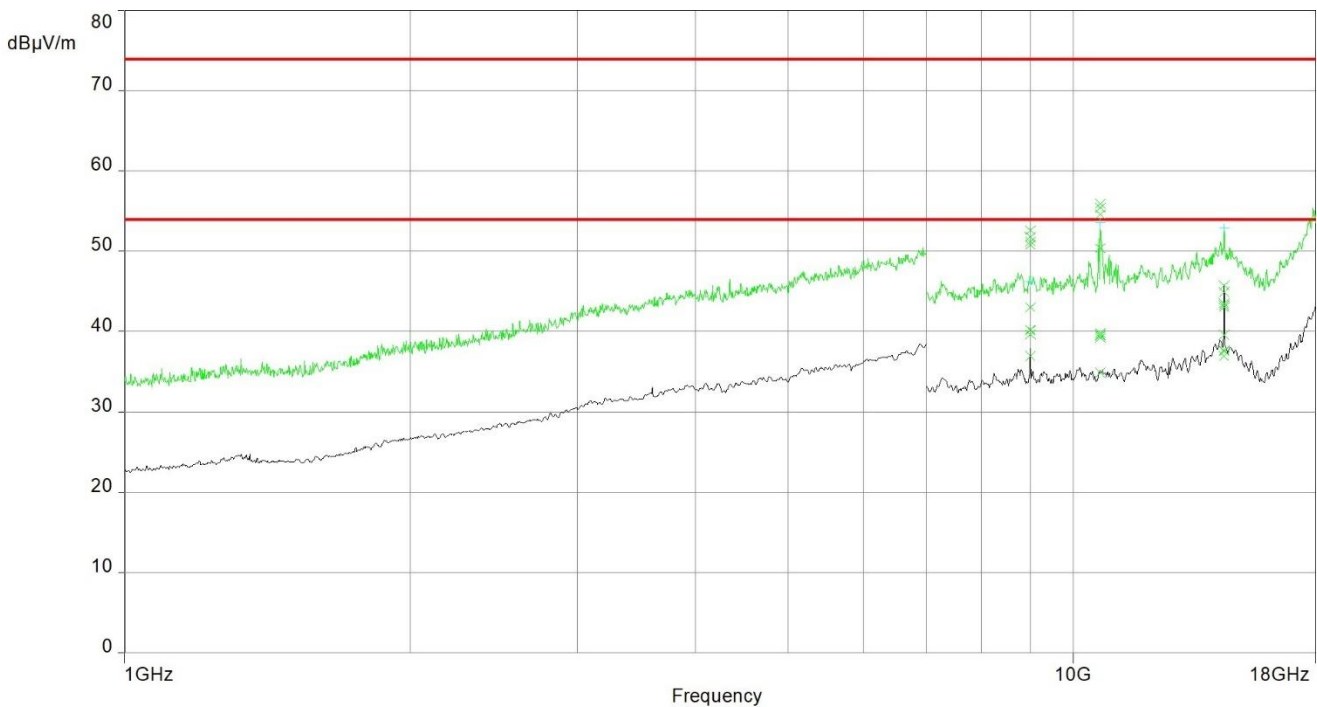
Note: Ferrite beads placed on the cable to the EUT and shielding blankets over the AE (See setup photos).

Plot 23: 30 MHz – 1 GHz, EUT 7, Mode 01



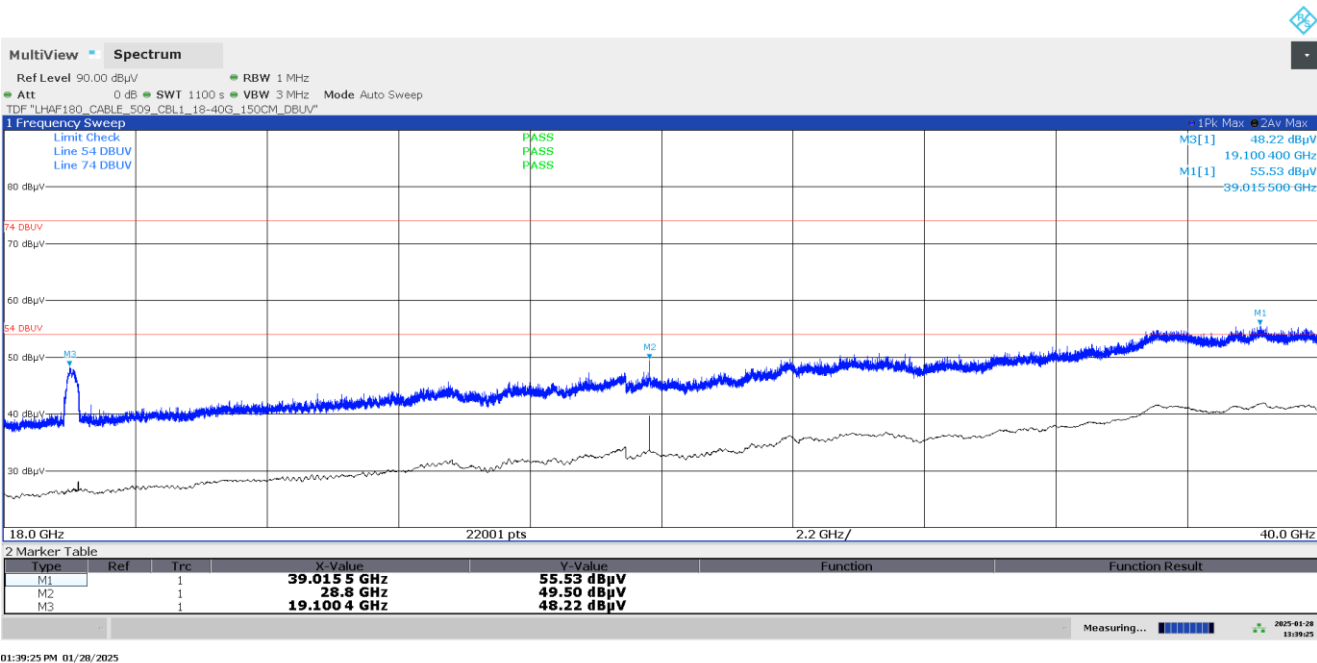
Note: Ferrite beads placed on the cable to the EUT and shielding blankets over the AE (See setup photos).

Plot 24: 1 GHz – 18 GHz, EUT 7

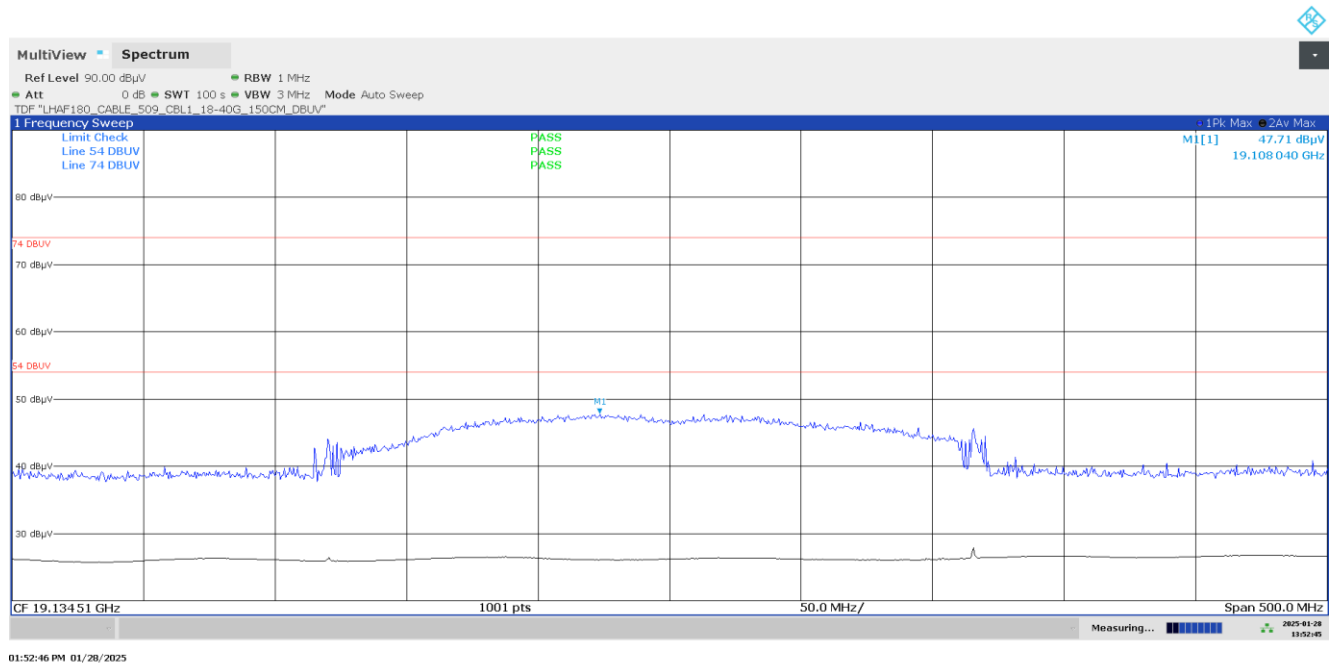


Note: Green trace: Peak detector, Black trace: RMS detector. Ferrite beads placed on the cable to the EUT and shielding blankets over the AE (See setup photos).

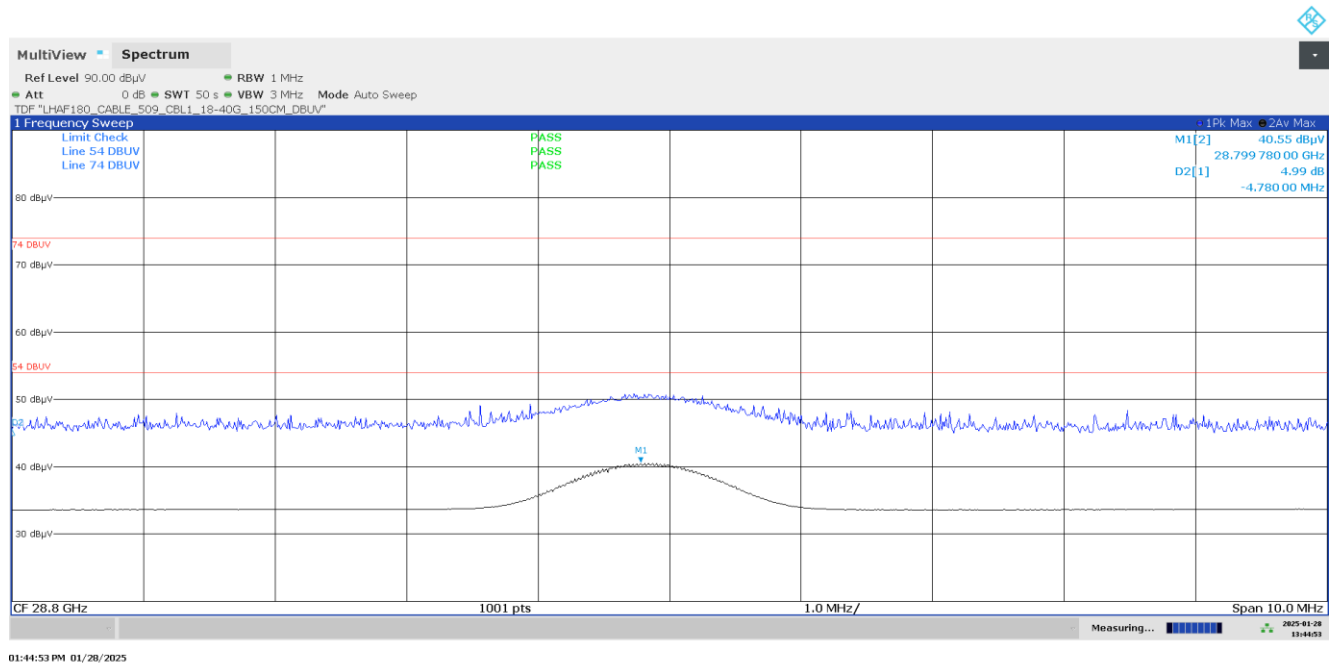
Plot 25: 18 GHz – 40 GHz, EUT 7, Mode 01

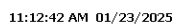
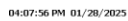


Plot 26: Emission at 19.1 GHz, EUT 7, Mode 01

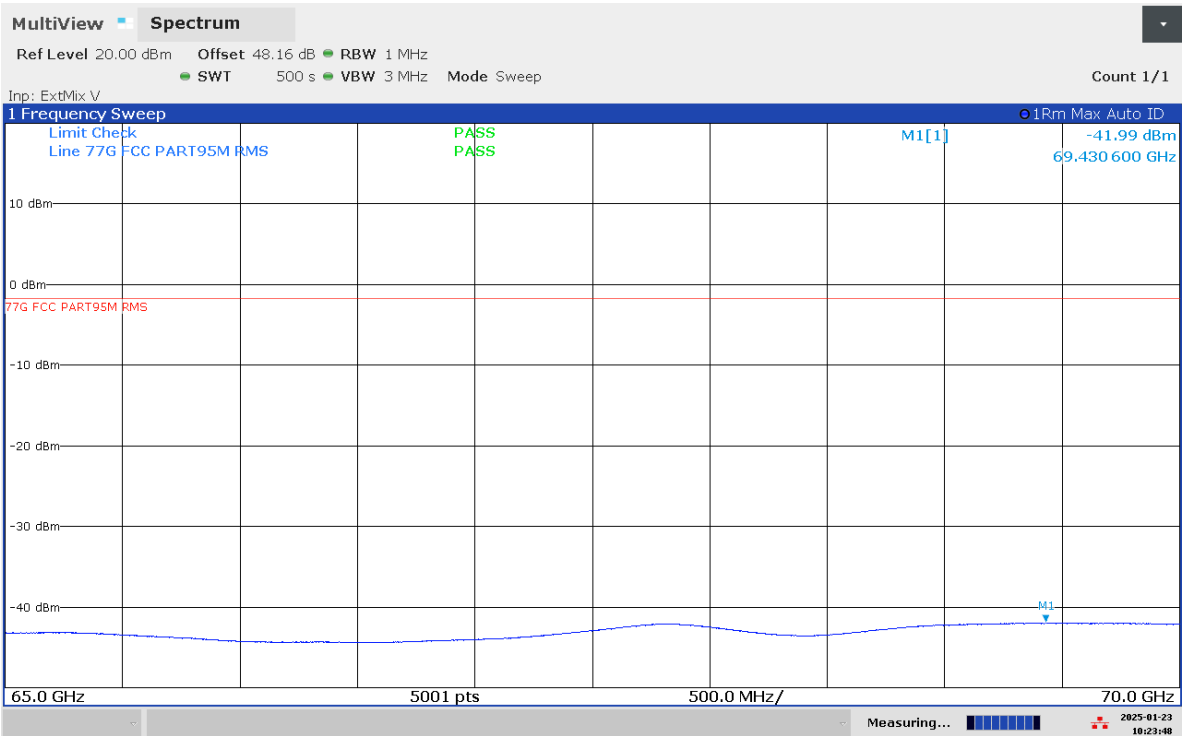


Plot 27: Emission at 28.8 GHz, EUT 7, Mode 01



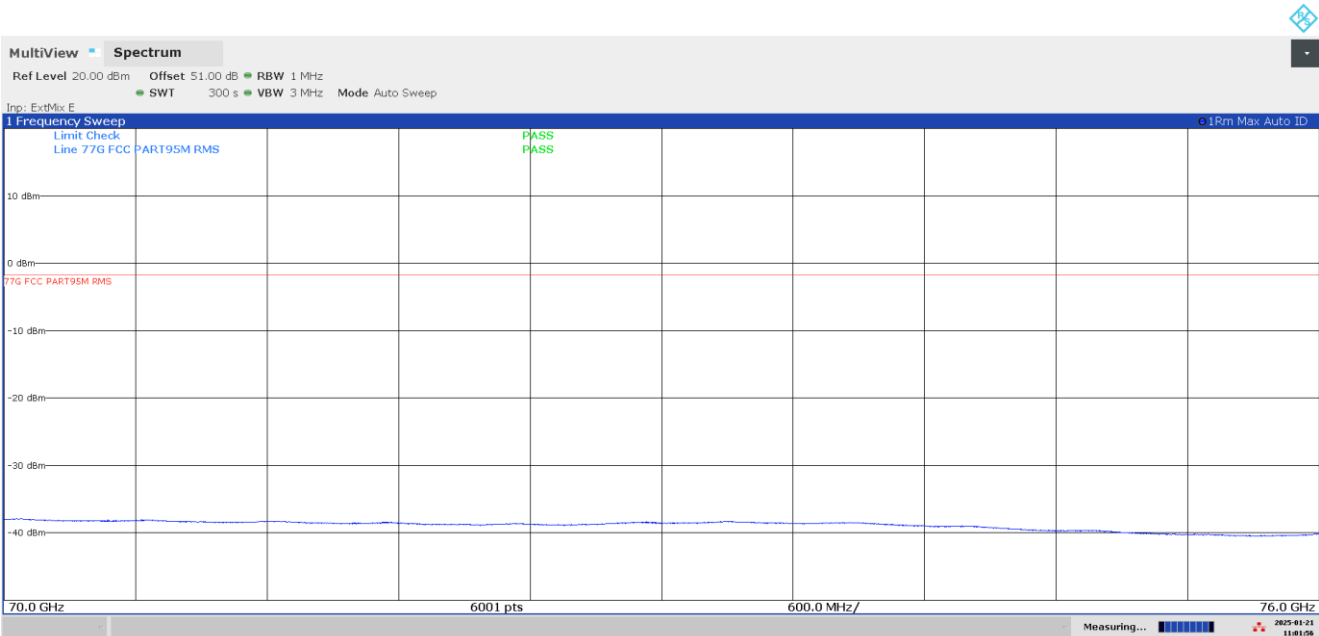


Plot 30: 65 GHz – 70 GHz, EUT 7, Mode 01



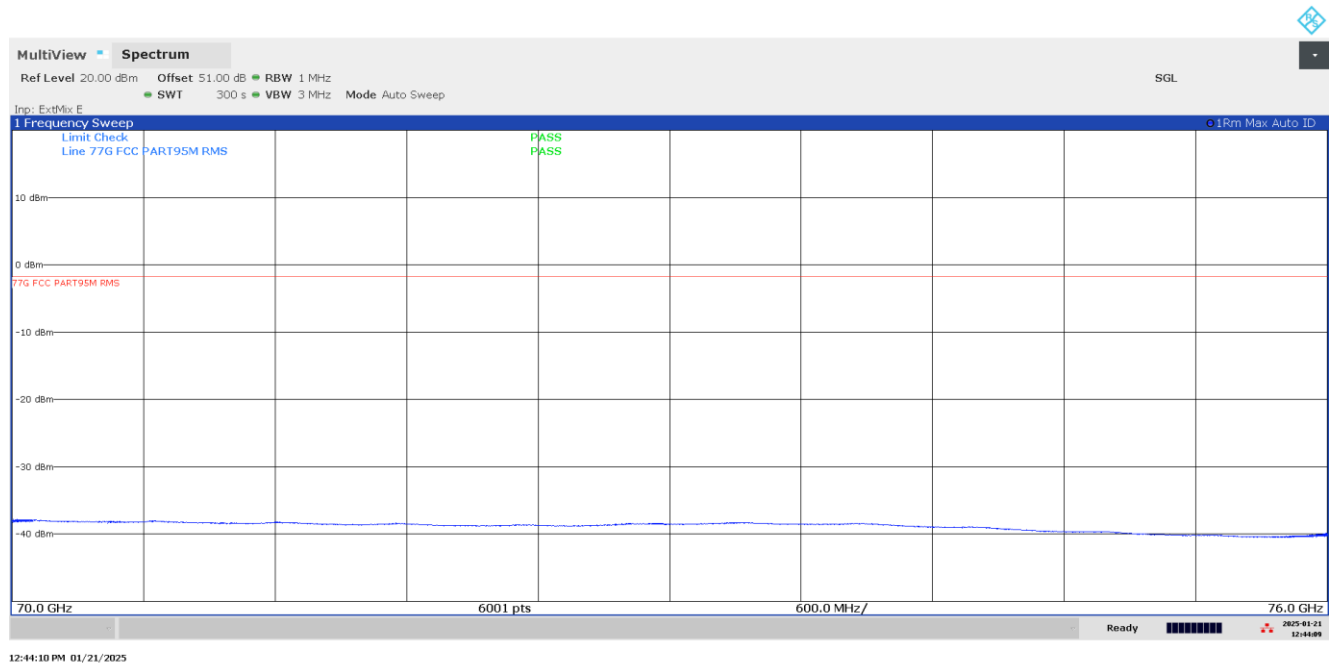
10:23:49 AM 01/23/2025

Plot 31: 70 GHz – 76 GHz, EUT 7, Mode 01

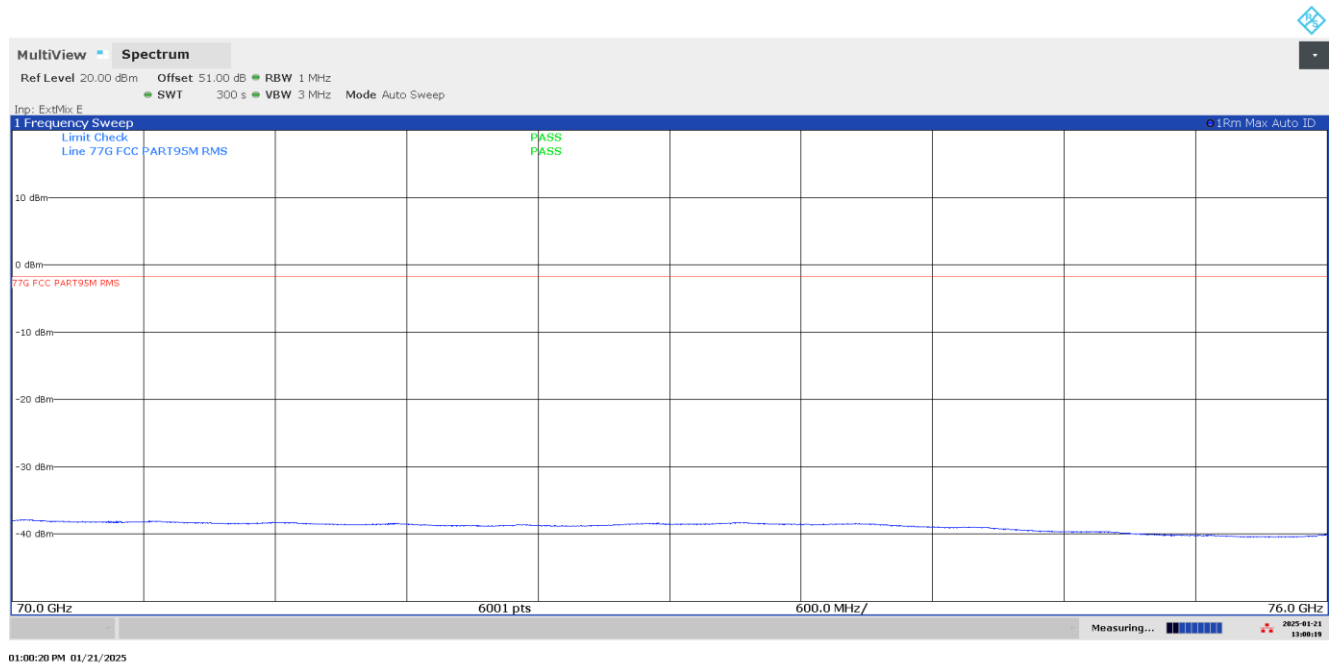


11:01:56 AM 01/23/2025

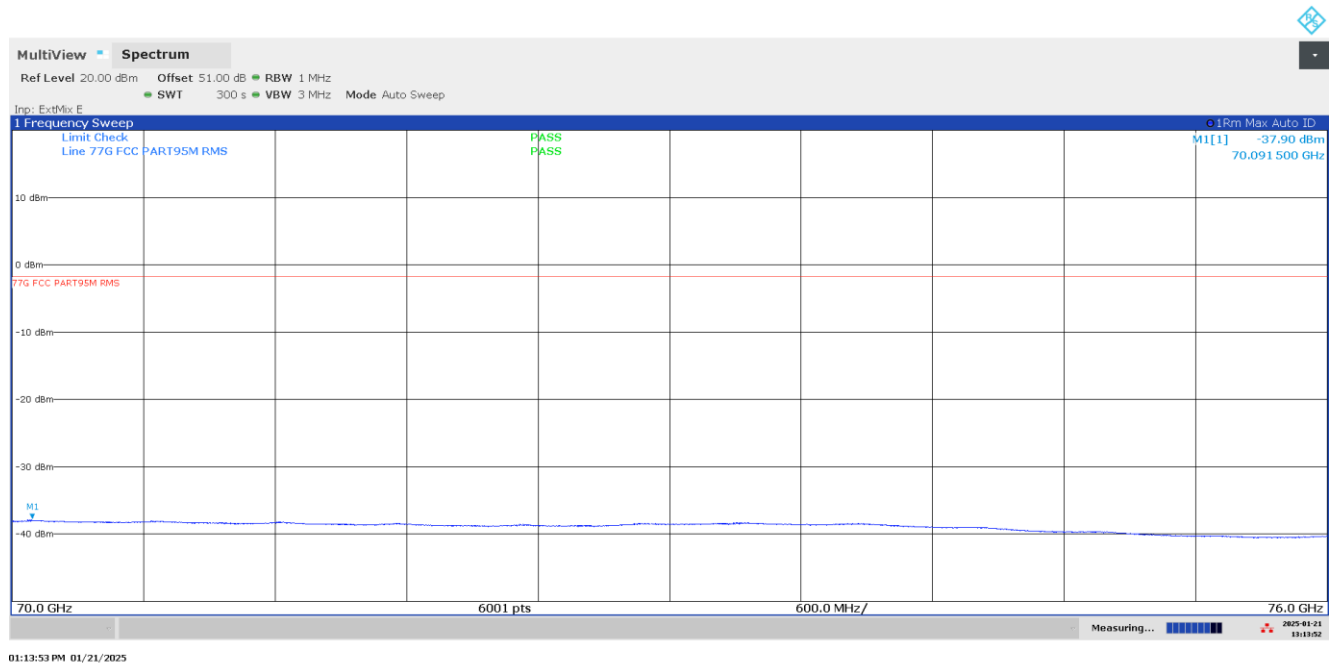
Plot 32: 70 GHz – 76 GHz, EUT 7, Mode 25



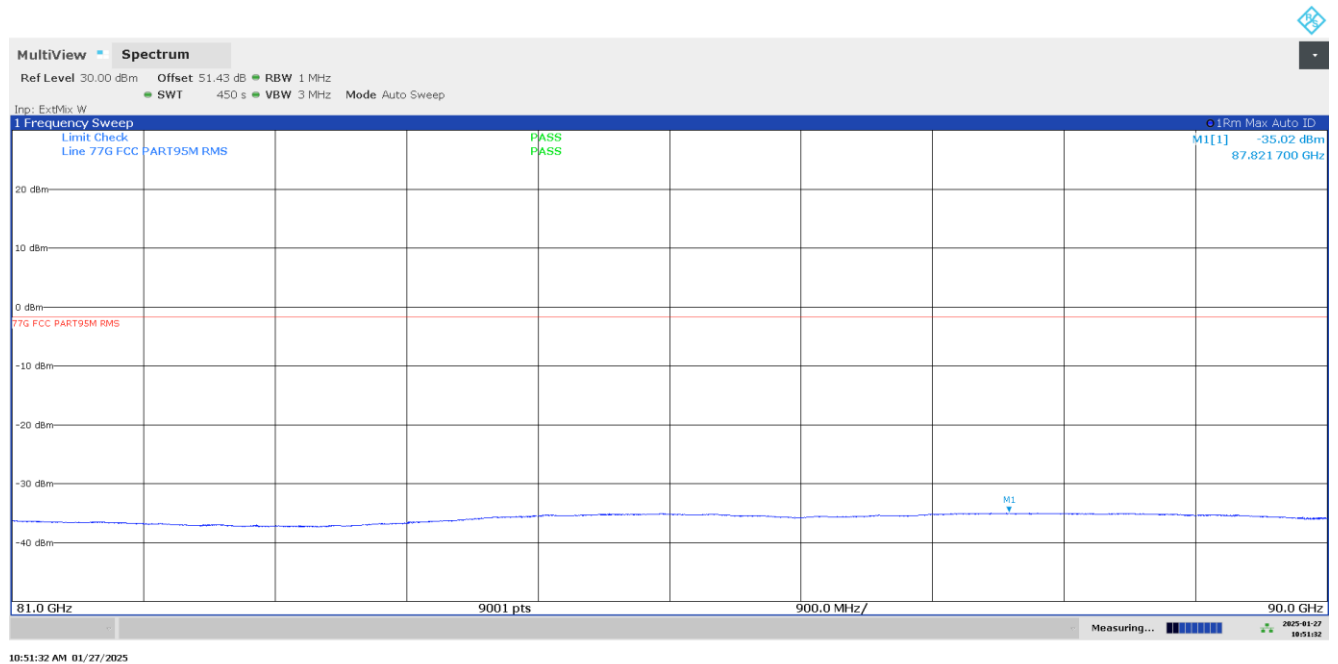
Plot 33: 70 GHz – 76 GHz, EUT 7, Mode 37



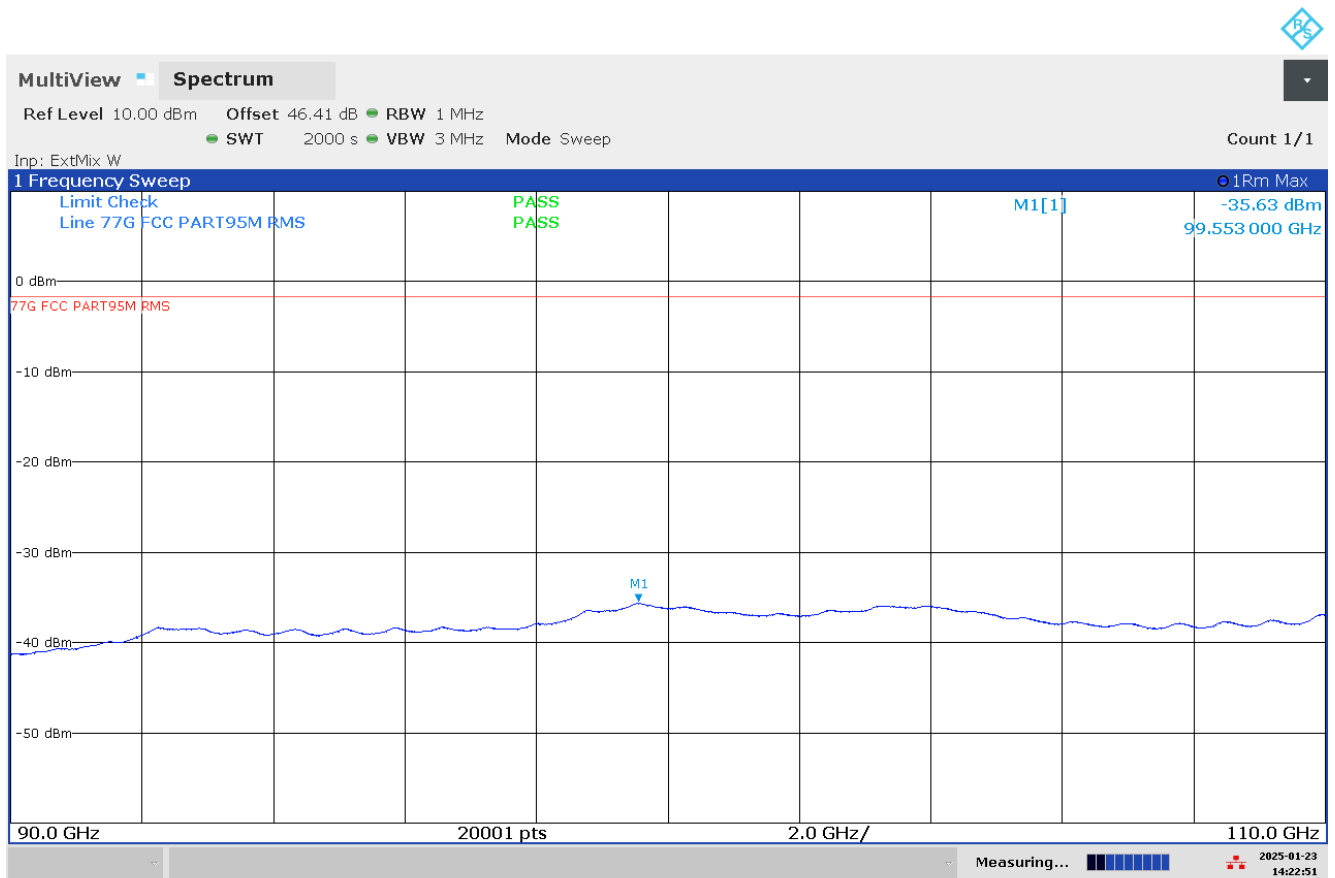
Plot 34: 70 GHz – 76 GHz, EUT 7, Mode 62



Plot 35: 81 GHz – 90 GHz, EUT 7, Mode 01

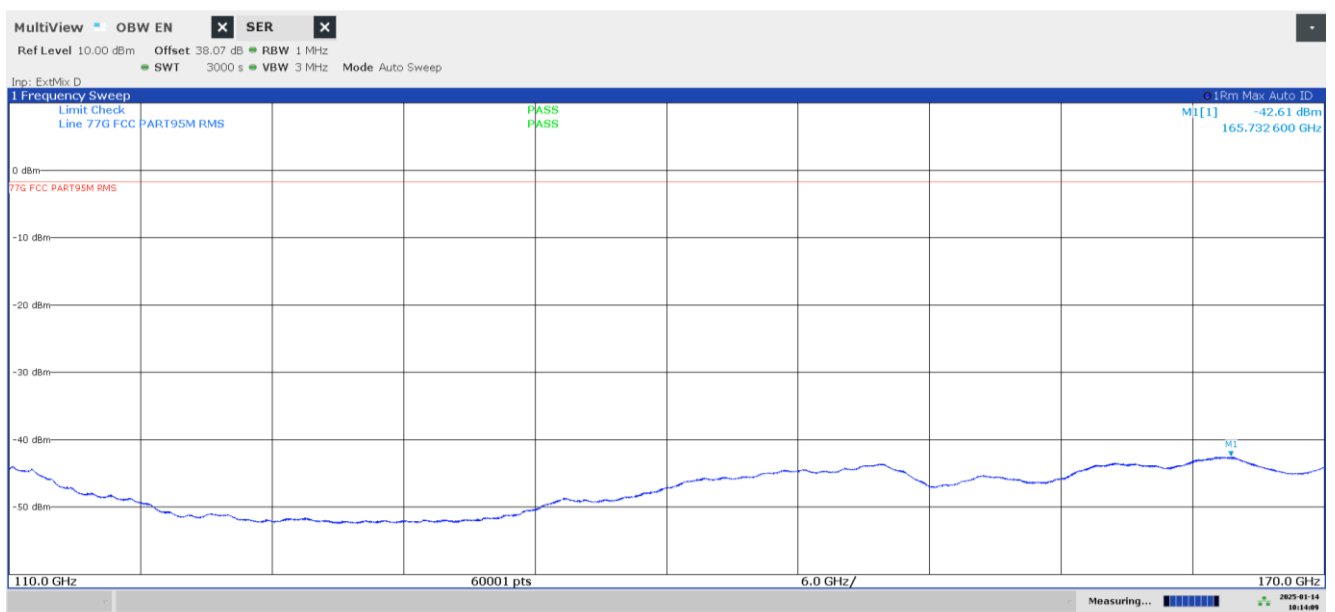


Plot 36: 90 GHz – 110 GHz, EUT 7, Mode 01



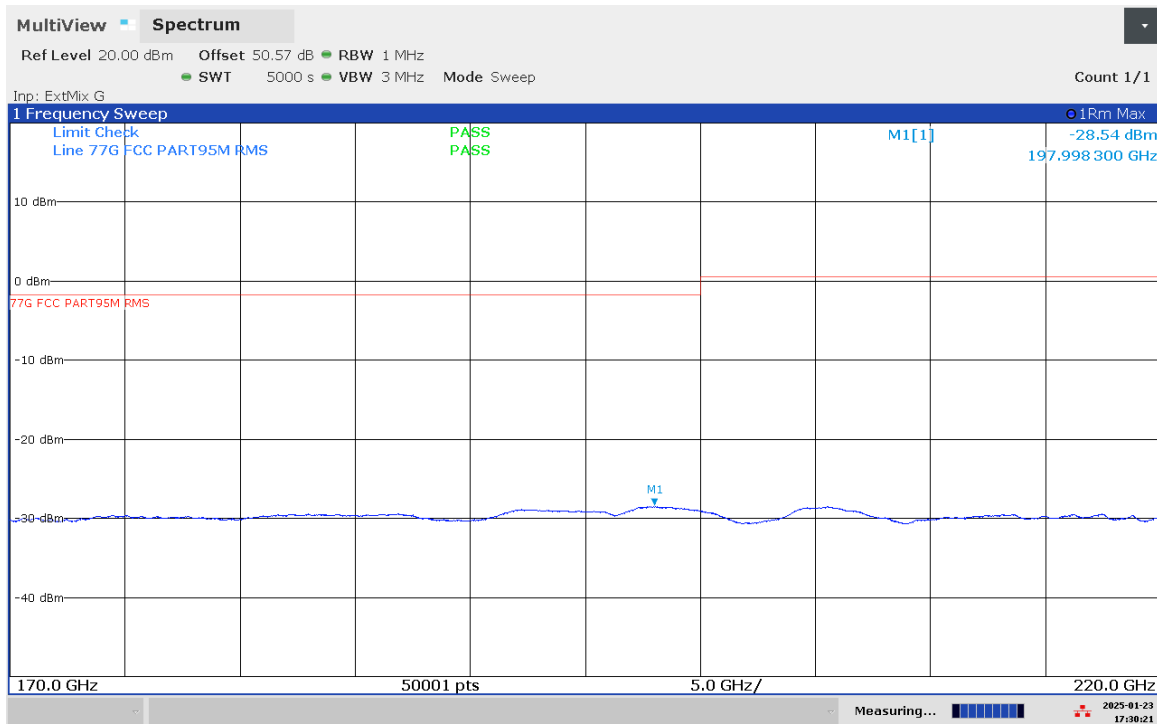
02:22:52 PM 01/23/2025

Plot 37: 110 GHz – 170 GHz, EUT 7, Mode 01



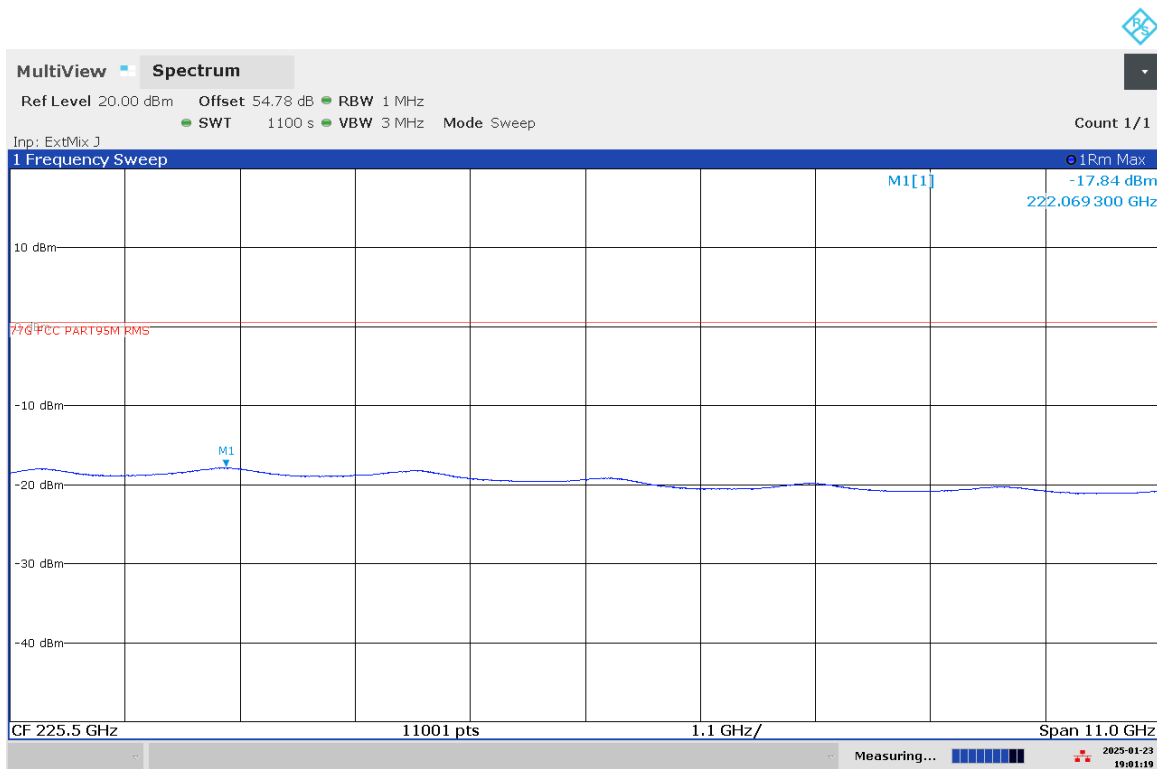
10:14:10 AM 01/14/2025

Plot 38: 170 GHz – 220 GHz, EUT 7, Mode 01



05:30:22 PM 01/23/2025

Plot 39: 220 GHz – 243GHz, EUT 7, Mode 01



07:01:19 PM 01/23/2025

12 79 GHz Band (77 GHz– 81 GHz)

12.1 Summary of measurement results

12.1.1 Summary

☒	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	47 CFR Part 95 Subpart M	see below	2025-09-25	-/-

Test specification clause	Test case	Temperature conditions	Power source voltages	Pass	Fail	NA	NP	Remark
§2.1046 §95.3367	Radiated power	Nominal	Nominal	☒	☐	☐	☐	complies
§2.1047	Modulation characteristics	-/-	-/-	☒	☐	☐	☐	complies
§2.1049 §2.1055 §95.3379 (b)	Occupied bandwidth / Frequency stability (99% bandwidth)	Nominal Extreme	Nominal Extreme	☒	☐	☐	☐	complies
§2.1051	Spurious emissions at antenna terminals	Nominal	Nominal	☐	☐	☒	☐	see note 2, DUT has integral/internal antenna
§2.1053 §95.3379 (a)	Unwanted emissions (radiated spurious)	Nominal	Nominal	☒	☐	☐	☐	complies

Note:

- 3) NA = Not applicable; NP = Not performed
- 4) ANSI C63.26-2015 5.5.1:
 "...many contemporary portable transmitters utilize integral antennas, precluding access to an antenna output port from which to perform conducted compliance measurements. For these types of transmitters, all the data necessary to demonstrate compliance must be measured in a radiated test configuration..."

12.2 Additional comments

Reference documents:

- SRR6-B_RF_Test_Input_Doc_v4.0rev3.pdf

Special test descriptions:

- SRR6-B_RF_Test_Input_Doc_v4.0rev3.pdf

Configuration descriptions:

- SRR6-B_RF_Test_Input_Doc_v4.0rev3.pdf

Test devices (EUT):

- EUT 10: Normal operation modes, used for general purpose testing
- EUT 11: Normal operation modes, used for general purpose testing
- All test devices used for measurements in the 79.5 GHz band (77 GHz – 81 GHz) operated with software version 186.030.107

Associated equipment (AE):

- AE1: Control Input Display (Used to configure set the EUT mode)
- AE2: Vehicular Gateway (VG4)

Normal operation modes, as declared by customer:

Mode ID	Centre frequency [GHz]	Bandwidth [GHz]	Remark
4 (c0)	78.720	3.6	Operation
4 (c1)	78.720	3.6	Operation
7 (c0)	77.893	1.8	Operation
7 (c1)	77.893	1.8	Operation

Details on test mode settings:

According to the customer's instructions, the following steps and commands were used to configure the test modes:

- Connect the EUT and associated equipment to an appropriate power supply
- On the Control Input Display:
 - Enter the mode ID
 - Press the "Set Mode" button
 - Enter a speed value of 0 kph for c0 or 20 kph for c1
 - Press the "Set Speed" button
 - Press the "Start" button

12.3 Measurement results

12.3.1 Radiated power

Description:

§95.3367

The fundamental radiated emission limits within the 76-81 GHz band are expressed in terms of Equivalent Isotropically Radiated Power (EIRP) and are as shown below.

Limits:

FCC §95.3367 (a) (b)

Frequency	Limit (eirp)
76.0 - 81.0 GHz	50 dBm (Average)
76.0 - 81.0 GHz	55 dBm/MHz (PEAK)

Measurement:

Measurement parameter: Average Power	
Detector:	RMS
Resolution bandwidth:	1 MHz
Video bandwidth:	3 MHz
Trace-Mode:	Max Hold

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

Note: KDB 653005 4.(c)(1)

“Peak power measurements of swept frequency radar implementations (e.g., high sweep rate FMCW) may require a desensitization correction factor to be applied to the measurement results.”

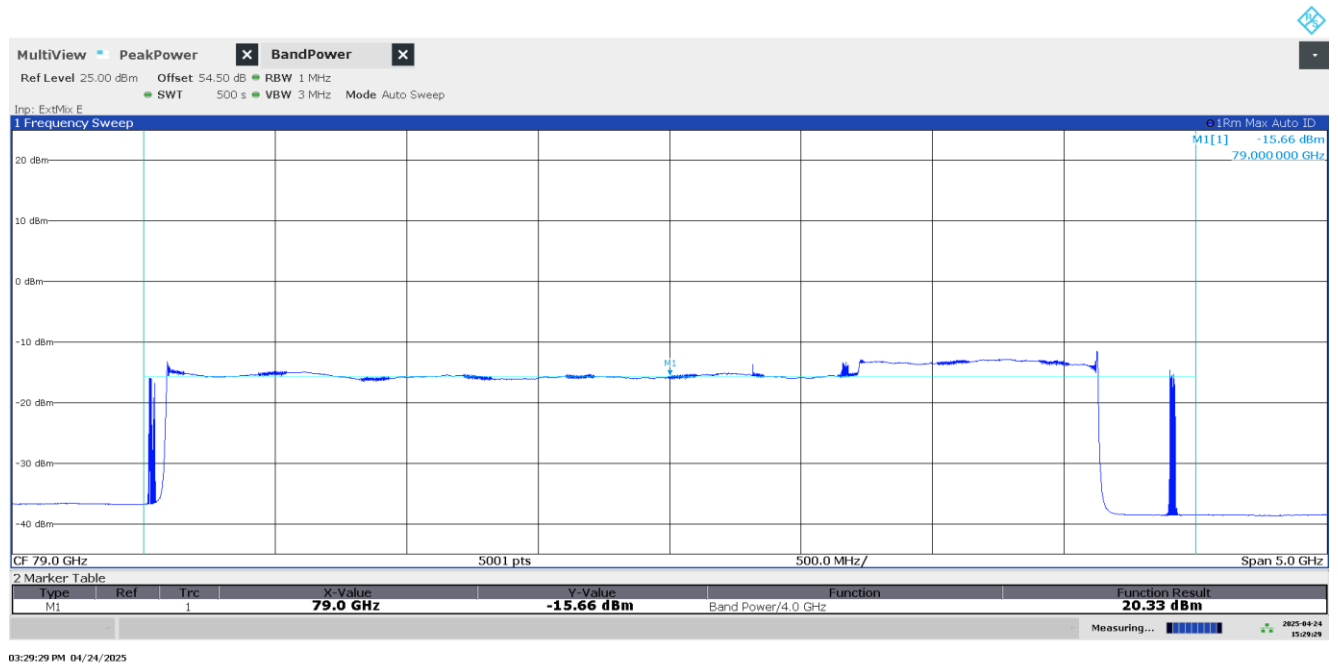
→ Peak power measurements are therefore performed using a larger resolution bandwidth to mitigate issues with desensitization.

Measurement results:

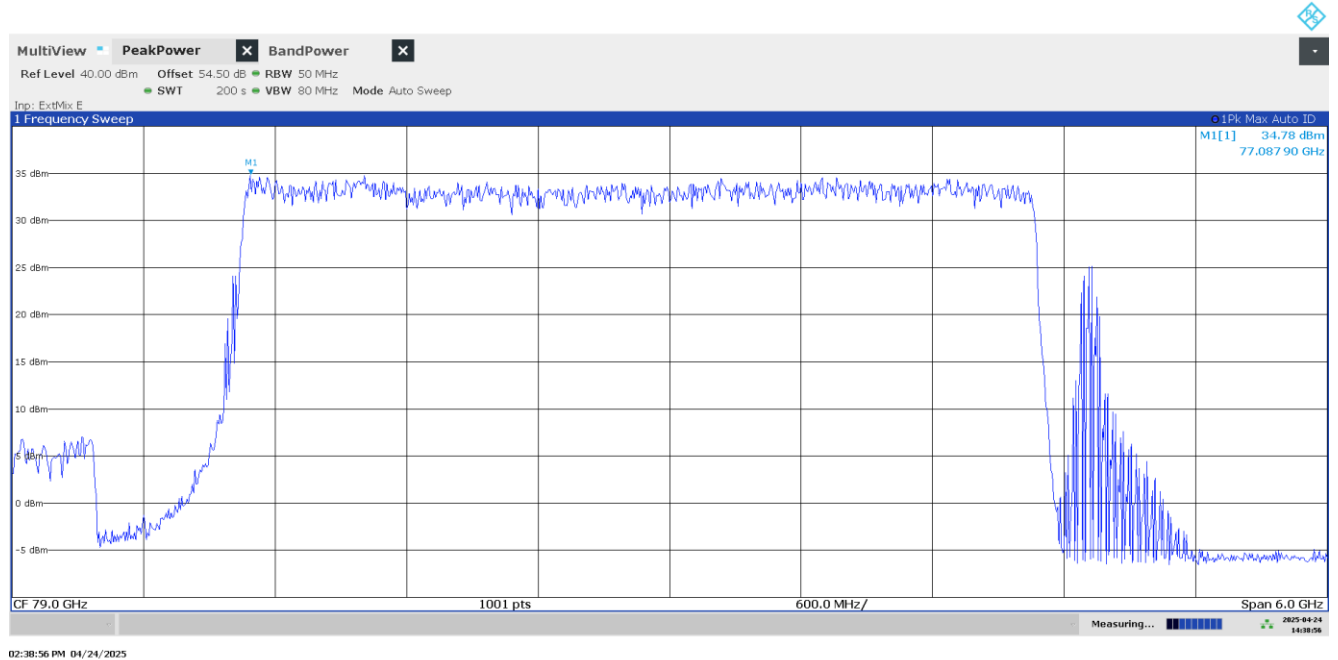
EUT	Mode	Test condition	Radiated Peak Power (EIRP)	Radiated Mean Power (EIRP)
EUT 10	4 (c0)	T_{nom} / V_{nom}	34.78	20.33
EUT 10	4 (c1)	T_{nom} / V_{nom}	34.51	20.33
EUT 10	7 (c0)	T_{nom} / V_{nom}	32.41	17.65
EUT 10	7 (c1)	T_{nom} / V_{nom}	32.09	17.65

Verdict: Compliant

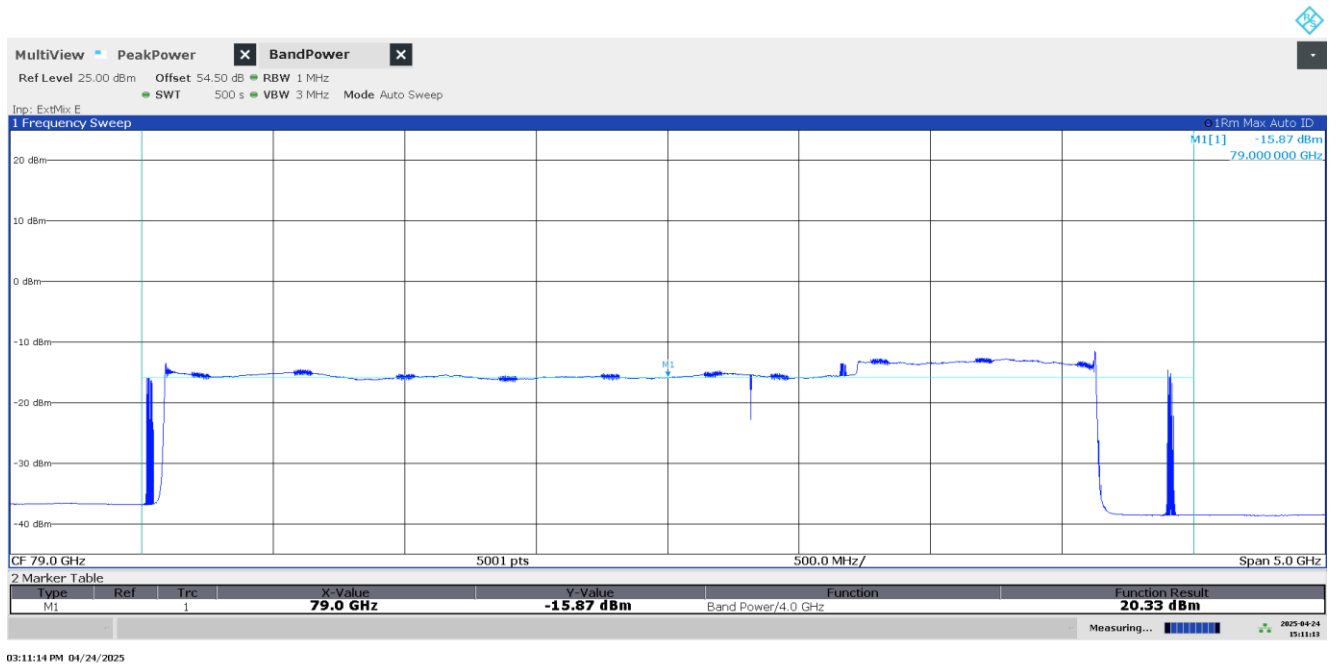
Plot 40: Radiated Mean Power (EIRP), EUT 10, Mode 4 (c0)



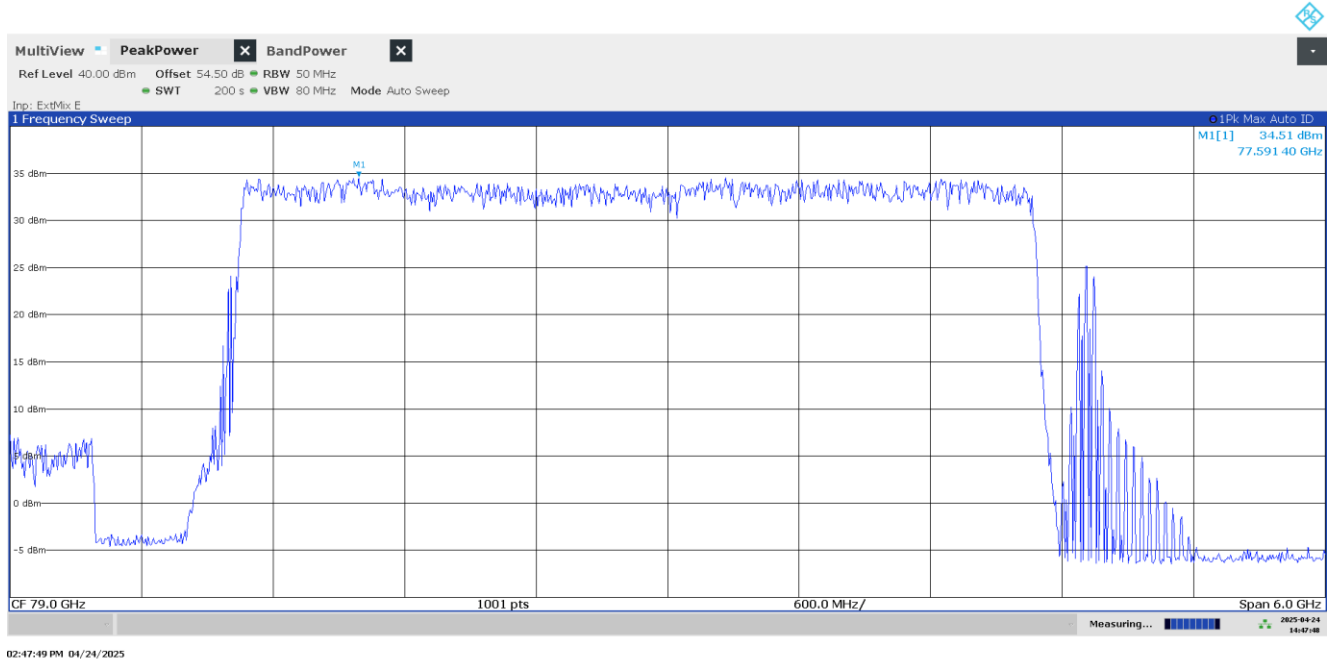
Plot 41: Radiated Peak Power (EIRP), EUT 10, Mode 4 (c0)



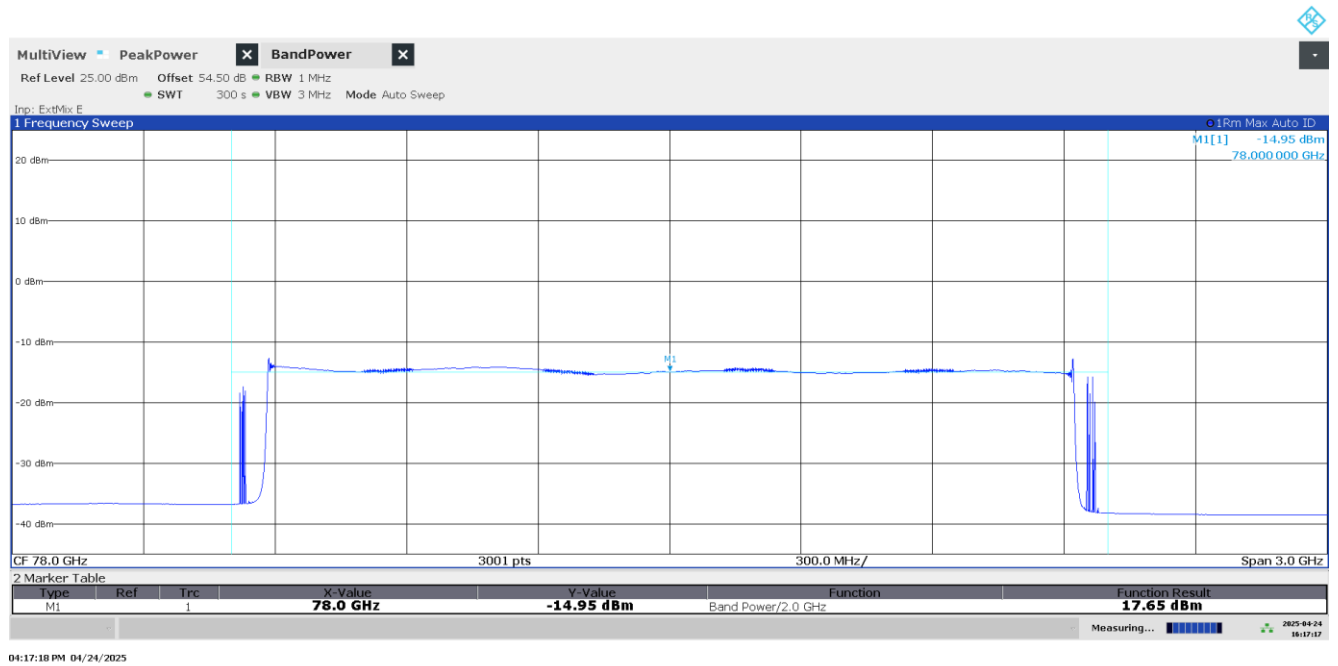
Plot 42: Radiated Mean Power (EIRP), EUT 10, Mode 4 (c1)



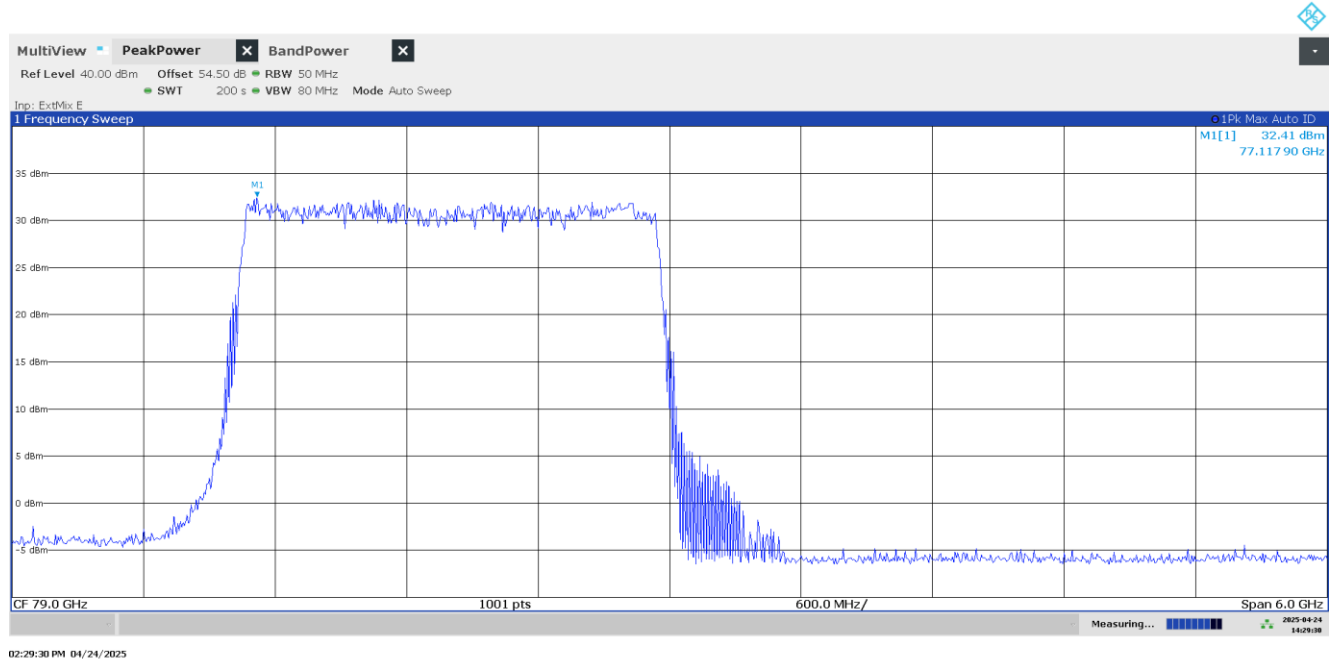
Plot 43: Radiated Peak Power (EIRP), EUT 10, Mode 4 (c1)



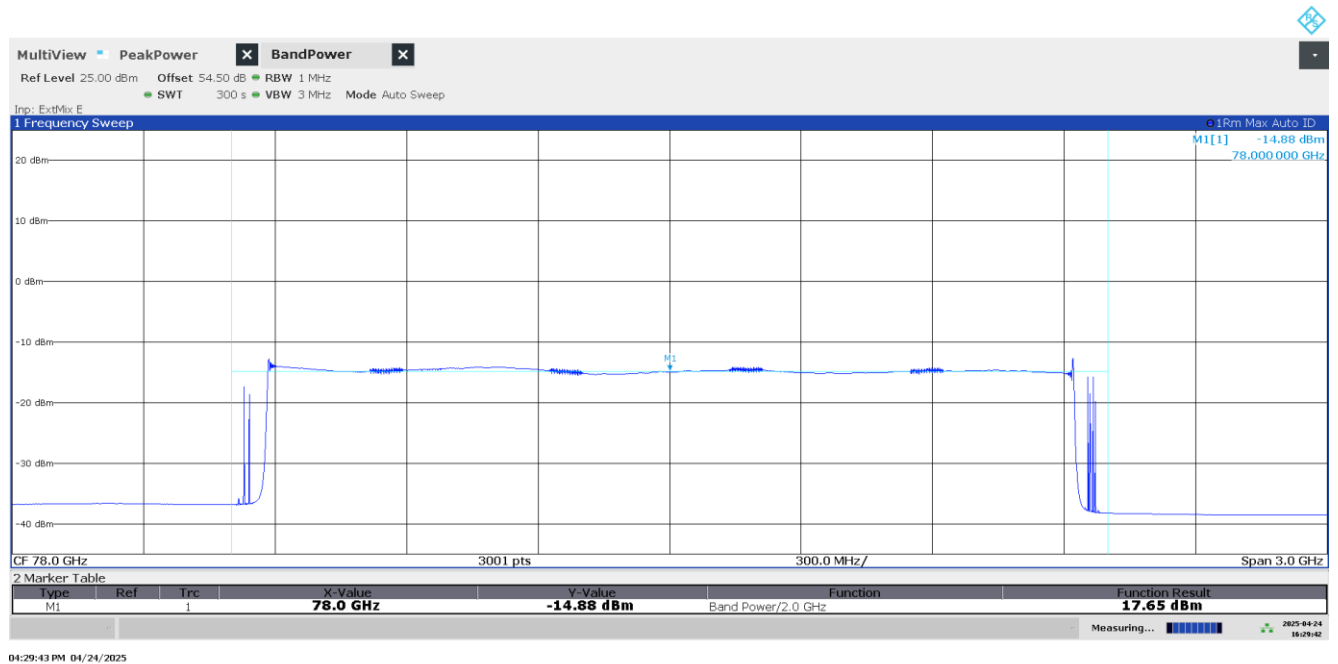
Plot 44: Radiated Mean Power (EIRP), EUT 10, Mode 7 (c0)



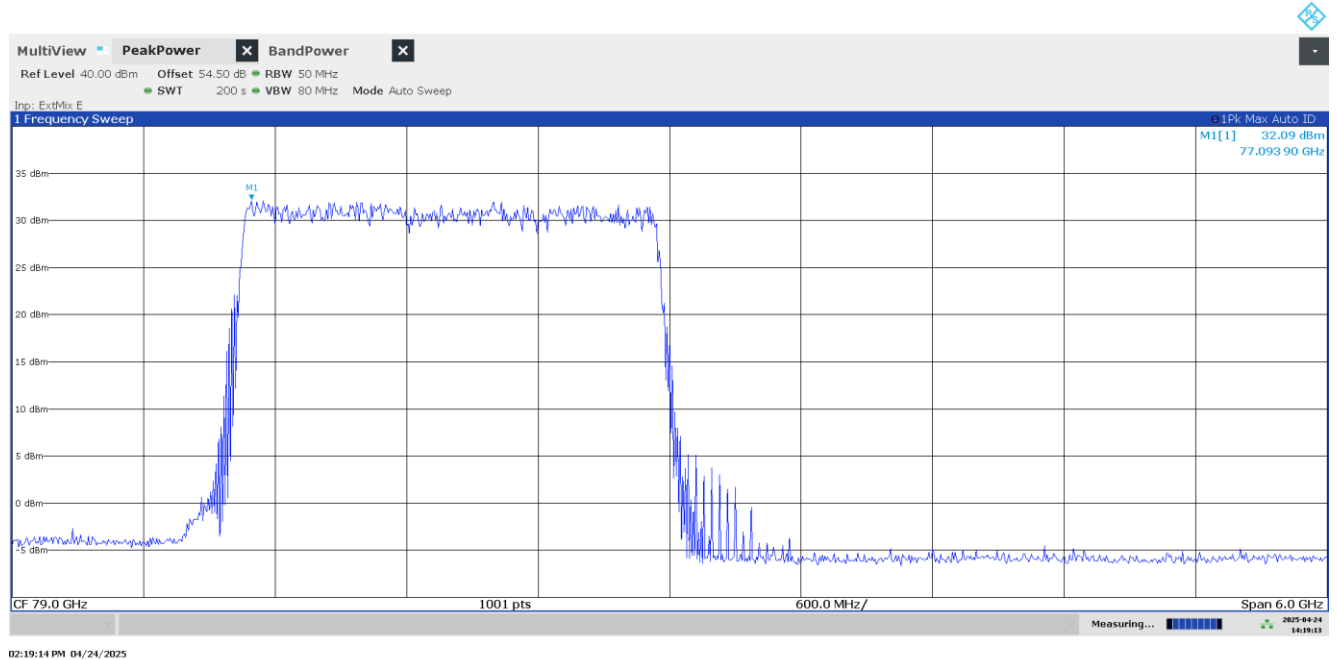
Plot 45: Radiated Peak Power (EIRP), EUT 10, Mode 7 (c0)



Plot 46: Radiated Mean Power (EIRP), EUT 10, Mode 7 (c1)



Plot 47: Radiated Peak Power (EIRP), EUT 10, Mode 7 (c1)



12.3.2 Modulation characteristics

Description:

§2.1047 (d) *Other types of equipment.* A curve or equivalent data which shows that the equipment will meet the modulation requirements of the rules under which the equipment is to be licensed.

KDB 653005 D01 76-81 GHz Radars v01r02, section 3 (g)

Concerning the Section 2.1047 modulation characteristics requirement, the following information should be provided:

- 1) Pulsed radar: pulse width and pulse repetition frequency (if PRF is variable, then report maximum and minimum values).
- 2) Non-pulsed radar (e.g., FMCW): modulation type (i.e., sawtooth, sinusoid, triangle, or square wave) and sweep characteristics (sweep bandwidth, sweep rate, sweep time).

Information from manufacturer on modulation characteristics:

Parameter	SRR6-B
Frequency band	77-81 GHz
Duty Cycle	Max: 28 % Min: 16,8 % [4 GHz BW] / 17,4 % [2 GHz BW]
Timing	Typical Cycle Time: 100ms Max Burst 27.9 ms (256 Ramps+Monitoring). Min Burst 17.5 ms (256 Ramps+Monitoring)
Modulation	FM- chirps, negative Sawtooth over sweep bandwidth
Sweep Bandwidth	Mode dependent: 1,8 GHz / 3,6 GHz
Sweep rate	Max 55 MHz/ μ s
Power	Power constant during RF on
Steepness of Ramps	Steepness varies for scans and monitoring.
Calibration	No calibration routines applied
Antenna Beam Steering (Tx)	No beam steering

- Note: Information provided by customer via additional document "SRR6-B_RF_Test_Input_Doc_v4.0rev3.pdf"

12.3.3 Occupied bandwidth / Frequency stability

Description:

§2.1049 The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission.

§95.3379 (b) 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.

Limits:

FCC
FCC §2.1049/ §95.3379 (b)
The occupied bandwidth from intentional radiators operated within the specified frequency band shall comply during all conditions of operation with the following:
Frequency range
76 GHz – 81 GHz

Measurement:

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

Results:

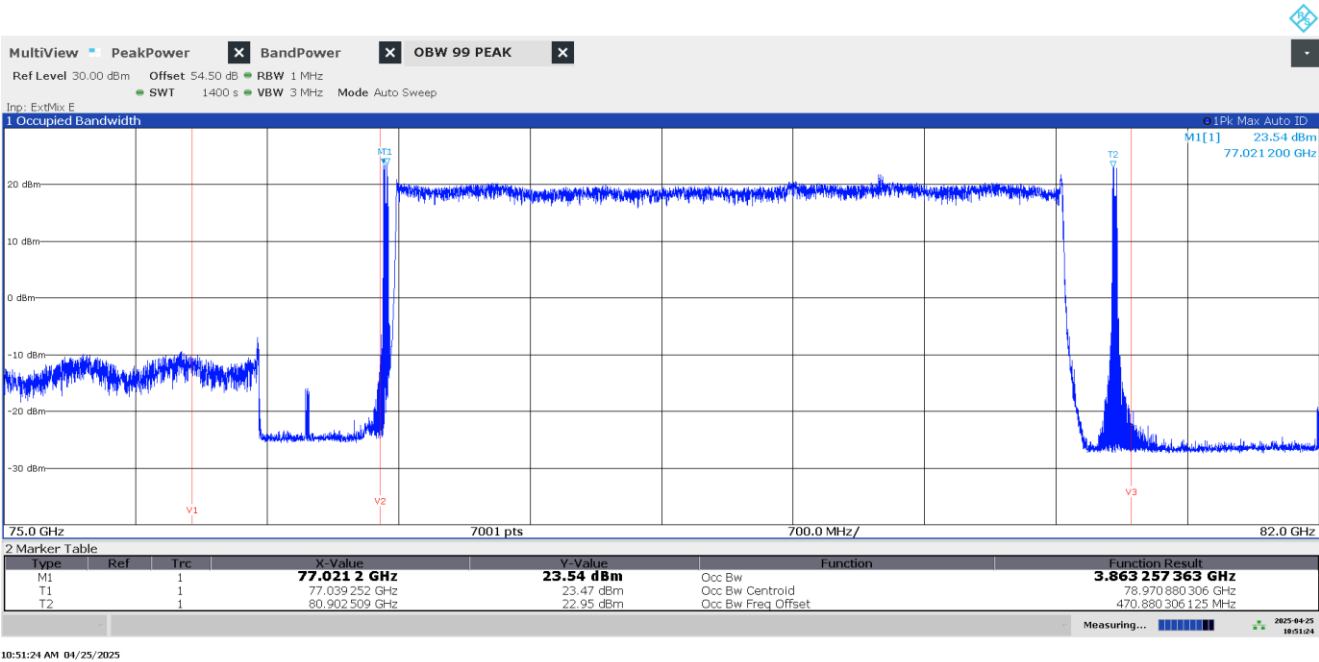
EUT	Mode	TEST CONDITIONS	f_L in GHz	f_H in GHz	Occupied Bandwidth (99%) in GHz
EUT 10	4 (c0)	T_{min} / V_{nom}	77.041	80.910	3.868
EUT 10	4 (c0)	$-30\text{ °C} / V_{nom}$	77.044	80.907	3.863
EUT 10	4 (c0)	$-20\text{ °C} / V_{nom}$	77.043	80.905	3.861
EUT 10	4 (c0)	$-10\text{ °C} / V_{nom}$	77.044	80.906	3.862
EUT 10	4 (c0)	$0\text{ °C} / V_{nom}$	77.042	80.906	3.864
EUT 10	4 (c0)	$10\text{ °C} / V_{nom}$	77.042	80.908	3.867
EUT 10	4 (c0)	$T_{nom} / 10.2\text{ V}$	77.042	80.903	3.861
EUT 10	4 (c0)	T_{nom} / V_{nom}	77.040	80.907	3.867
EUT 10	4 (c0)	$T_{nom} / 13.8\text{ V}$	77.043	80.905	3.862
EUT 10	4 (c0)	$30\text{ °C} / V_{nom}$	77.042	80.905	3.862
EUT 10	4 (c0)	$40\text{ °C} / V_{nom}$	77.039	80.906	3.867
EUT 10	4 (c0)	$50\text{ °C} / V_{nom}$	77.038	80.905	3.867
EUT 10	4 (c0)	T_{max} / V_{nom}	77.043	80.907	3.864
EUT 10	4 (c1)	T_{nom} / V_{nom}	77.039	80.903	3.863
EUT 10	7 (c0)	T_{nom} / V_{nom}	77.040	78.959	1.919
EUT 10	7 (c1)	T_{nom} / V_{nom}	77.031	78.960	1.929

Note:

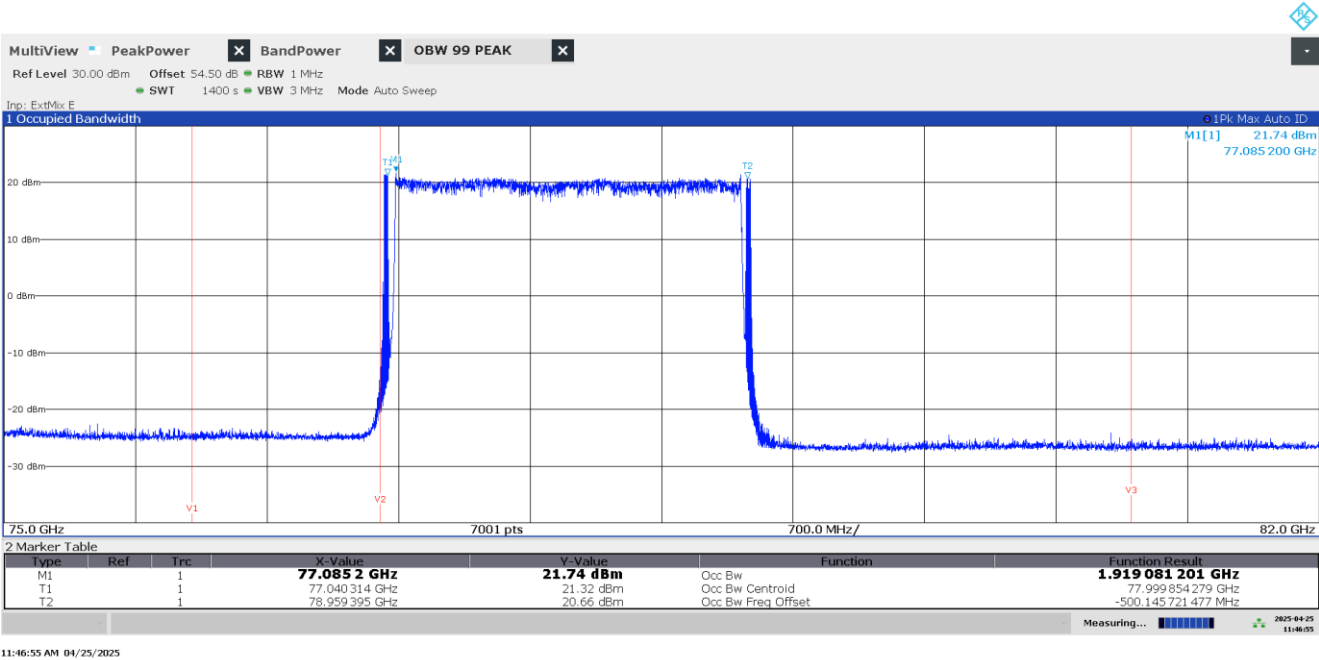
- The EUT is tested in the temperature range from -20 °C to 50 °C specified by §95.3379 (b) and RSS Gen 6.11.
- If the operating temperature range of the device specified by the manufacturer exceeds the test temperature range (-20 °C to $+50\text{ °C}$), the customer is responsible for ensuring the frequency stability and proper functioning of the device within the extended operating temperature range.
- Measurements under extreme test conditions were performed using **Mode 4 (c0)** as a worst-case analysis, as it is the mode with the highest occupied bandwidth under normal test conditions
- The plots of measurements performed using Mode 4 (c0) can be found in the additional document: **1-8315-24-02-04_TR1-A201-R1**, plots of measurements performed using the other normal operation modes are shown below

Verdict: Compliant

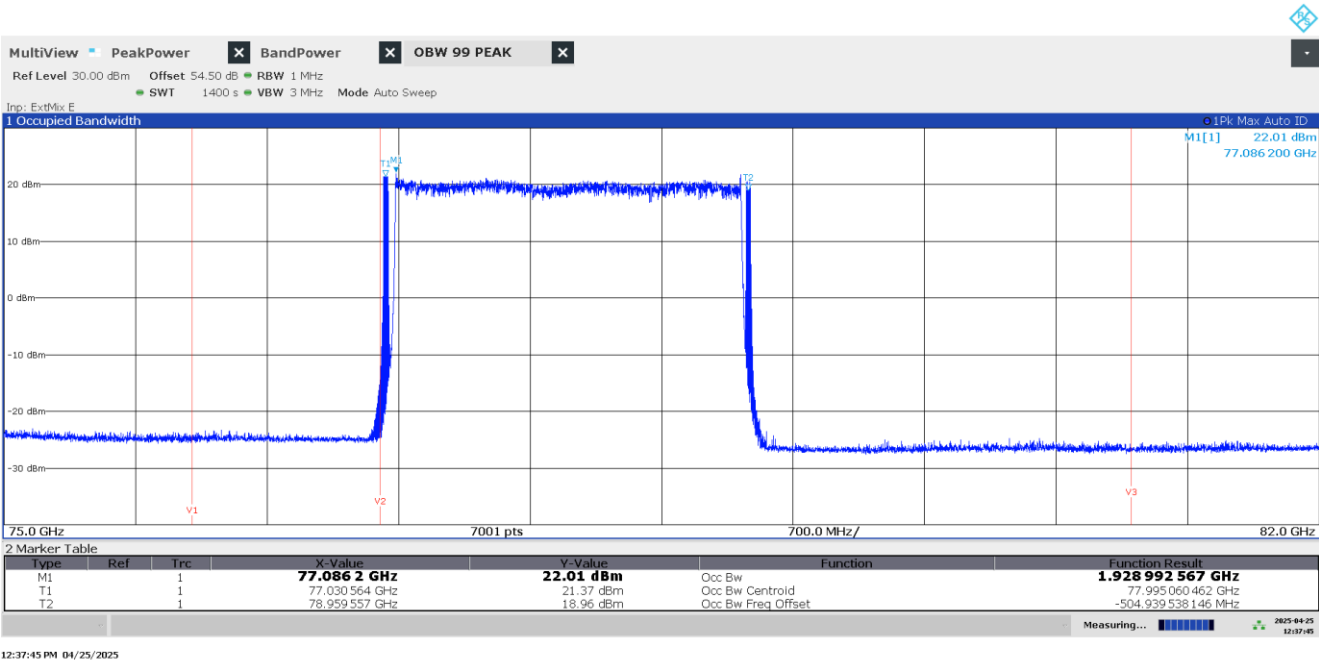
Plot 48: Occupied Bandwidth (99%), T_{nom}/V_{nom} , EUT 10, Mode 4 (c1)



Plot 49: Occupied Bandwidth (99%), T_{nom}/V_{nom} , EUT 10, Mode 7 (c0)



Plot 50: Occupied Bandwidth (99%), T_{nom}/V_{nom} , EUT 10, Mode 7 (c1)



12.3.4 Unwanted emissions (radiated spurious)

Description:

Measurement of the radiated unwanted emissions.

Limits:

FCC §95.3379

(b) The power density of any emissions outside the 76-81 GHz band shall consist solely of spurious emissions and shall not exceed the following:

(1) Radiated emissions below 40 GHz shall not exceed the field strength as shown in the following emissions table.

FCC		
CFR Part 95.3379 (a) (1) / CFR Part 95.3379 (a) (3)		
Radiated unwanted emissions		
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 – 30.0	30	30
30 - 88	100	3
88 – 216	150	3
216 – 960	200	3
960 – 40 000	500	3

- (i) In the emissions table in paragraph (a)(1) of this section, the tighter limit applies at the band edges.
 - (ii) The limits in the table in paragraph (a)(1) of this section are based on the frequency of the unwanted emissions and not the fundamental frequency. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.
 - (iii) The emissions limits shown in the table in paragraph (a)(1) of this section are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9.0-90.0 kHz, 110.0-490.0 kHz, and above 1000 MHz. Radiated emissions limits in these three bands are based on measurements employing an average detector with a 1 MHz RBW
- (2) The power density of radiated emissions outside the 76-81 GHz band above 40.0 GHz shall not exceed the following, based on measurements employing an average detector with a 1 MHz RBW:
- (i) For radiated emissions outside the 76-81 GHz band between 40 GHz and 200 GHz from field disturbance sensors and radar systems operating in the 76-81 GHz band: 600 pW/cm² at a distance of 3 meters from the exterior surface of the radiating structure.

- (ii) For radiated emissions above 200 GHz from field disturbance sensors and radar systems operating in the 76-81 GHz band: 1000 pW/cm² at a distance of 3 meters from the exterior surface of the radiating structure.

Frequency Range (GHz)	Power Density	EIRP
40 – 200	600 pW/cm ² @ 3m	-1.7 dBm
200 – 231	1000 pW/cm ² @ 3m	+0.5 dBm

- (3) For field disturbance sensors and radar systems operating in the 76-81 GHz band, the spectrum shall be investigated up to 231.0 GHz.

Limit conversion (ANSI C63.10-2013 9.6):

$$\text{EIRP[dBm]} = 10 \times \log(4 \times \pi \times d^2 \times 1000 \times \text{PD[W/m}^2])$$

- Power density at the distance specified by the limit: PD [W/m²]
- Equivalent isotropically radiated power: EIRP [dBm]
- Distance at which the power density limit is specified: d [m]

According to this formula, an emission limit of PD = 600 pW/cm² at a distance of d = 3 m corresponds to an equivalent isotropically radiated power of EIRP = -1.7 dBm.

Measurement:

Measurement parameter	
Detector:	Quasi Peak / Pos-Peak / Lin. Average / RMS
Resolution bandwidth:	F < 1 GHz: 100 kHz F > 1 GHz: 1 MHz
Video bandwidth:	F < 1 GHz: 300 kHz F > 1 GHz: 3 MHz
Trace-Mode:	Max Hold

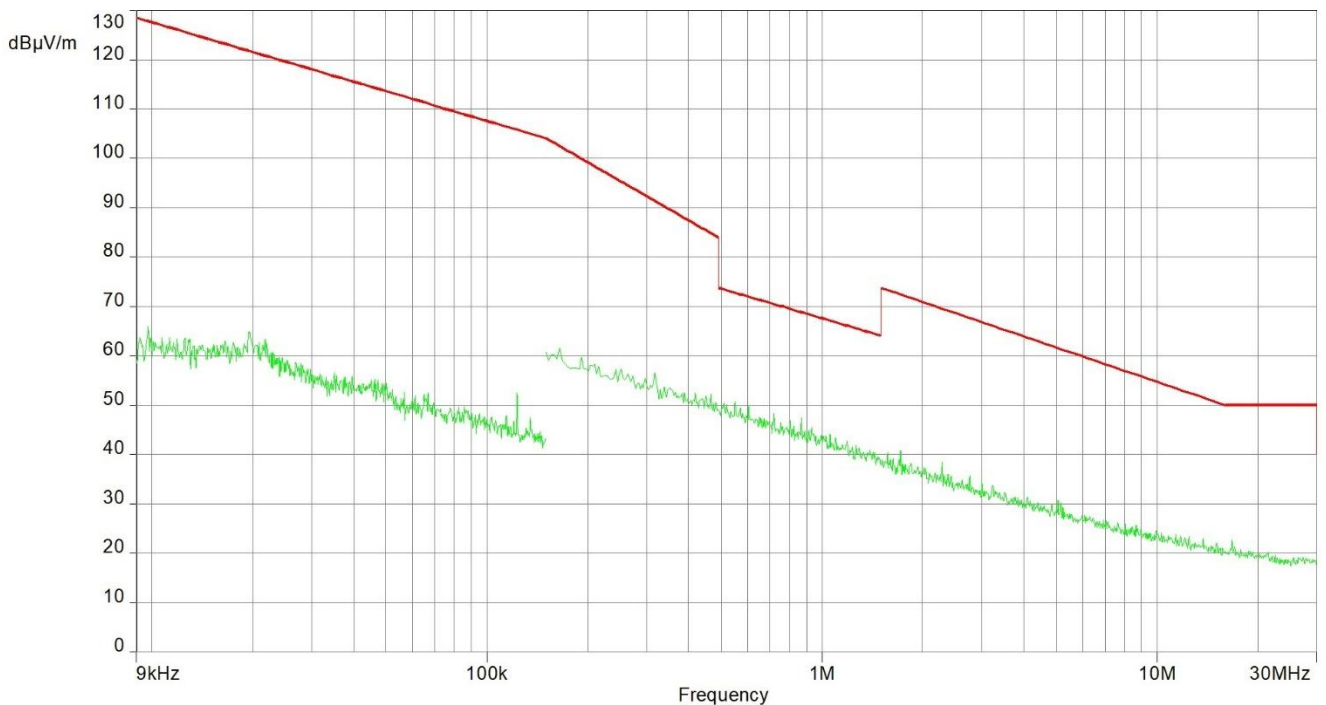
Measurement results:

Frequency [GHz]	Detector	Bandwidth [MHz]	Level	Limit	Margin [dB]
0.054	Quasi Peak	0.12	2.76	30.0	27.24
0.102	Quasi Peak	0.12	19.74	33.5	13.76
0.105	Quasi Peak	0.12	19.61	33.5	13.89
0.720	Quasi Peak	0.12	13.31	36.0	22.69
0.762	Quasi Peak	0.12	13.89	36.0	22.11
0.904	Quasi Peak	0.12	15.70	36.0	20.30
1.347	Peak	1.0	46.93	74.0	27.07
14.400	Peak	1.0	53.84	74.0	20.16
Please refer to the following plots for more information on the level of spurious emissions					

Note: The mode with the highest peak power (Mode 4 (c0)) is used as a worst-case analysis for unwanted emissions measurements in the spurious domain.

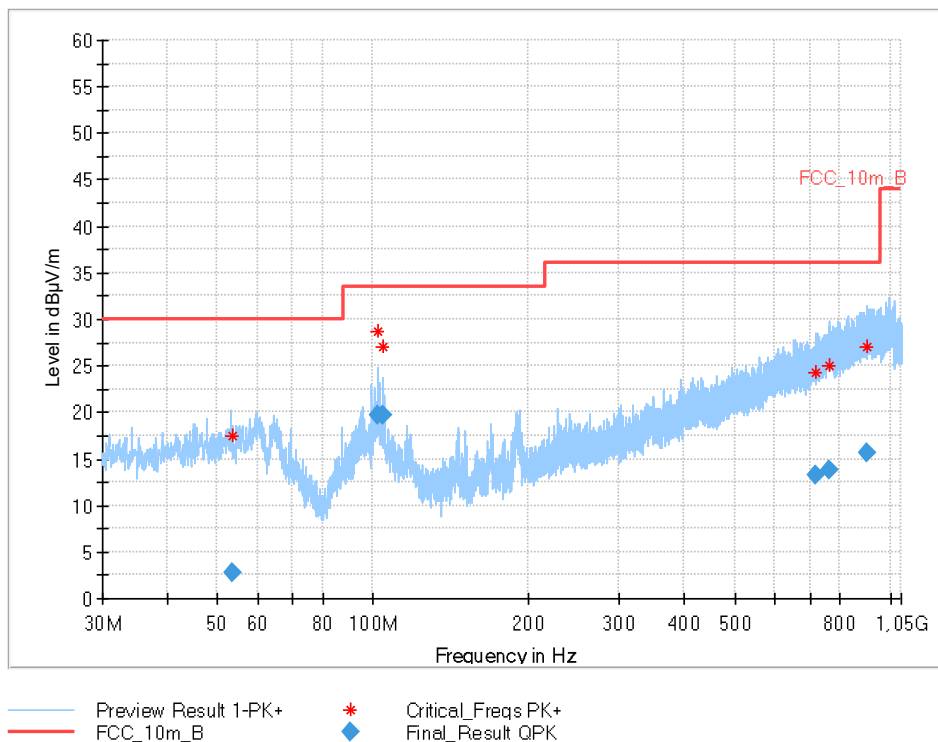
Verdict: Compliant

Plot 51: 9 kHz – 30 MHz, EUT 11, Mode 4 (c0)



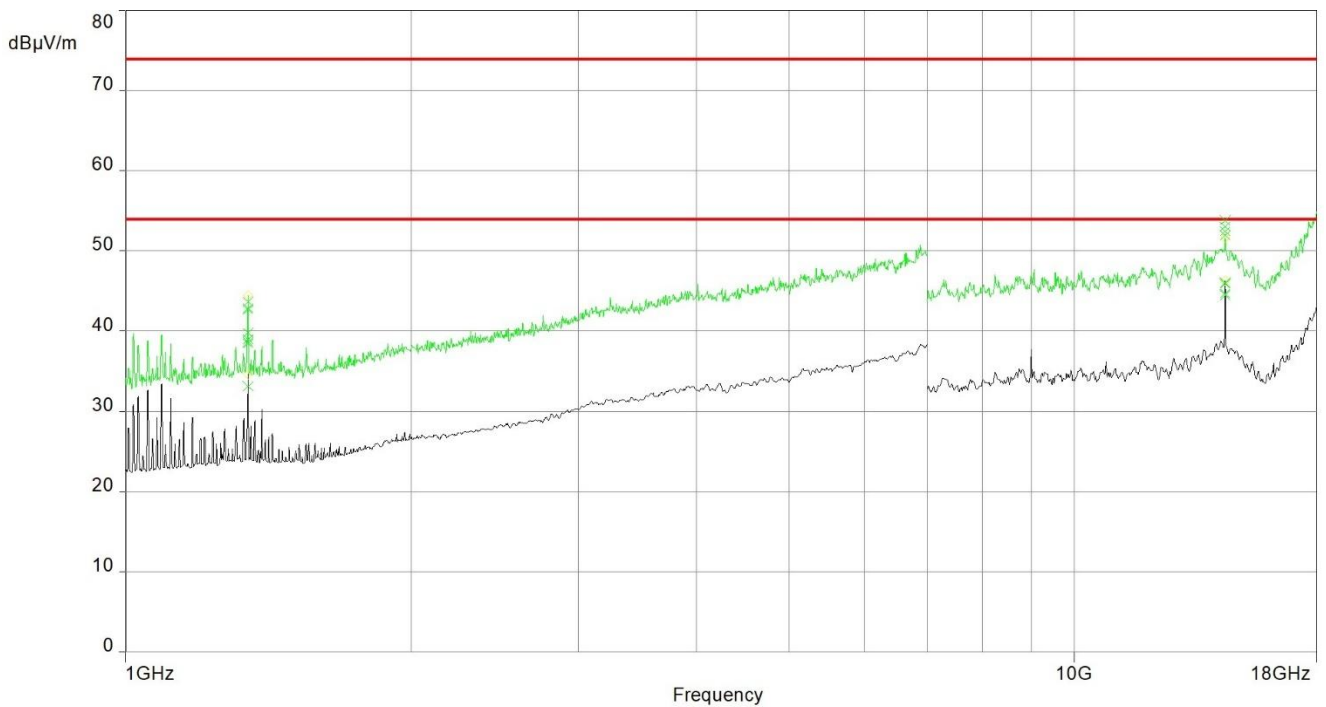
Note: Ferrite beads placed on the cable to the EUT and shielding blankets over the AE (See setup photos).

Plot 52: 30 MHz – 1 GHz, EUT 11, Mode 4 (c0), using EUT cable with ferrites and shielding blankets over the AE



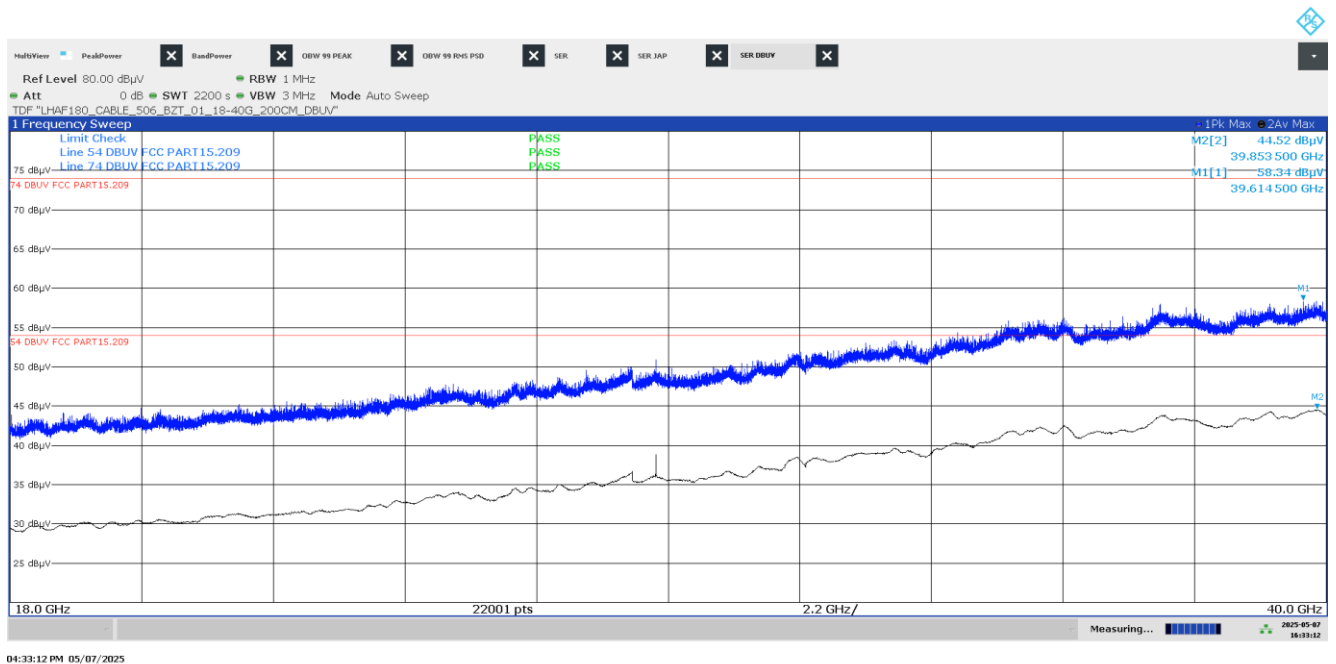
Note: Ferrite beads placed on the cable to the EUT and shielding blankets over the AE (See setup photos).

Plot 53: 1 GHz – 18 GHz, EUT 11, Mode 4 (c0), using EUT cable with ferrites and shielding blankets over the AE

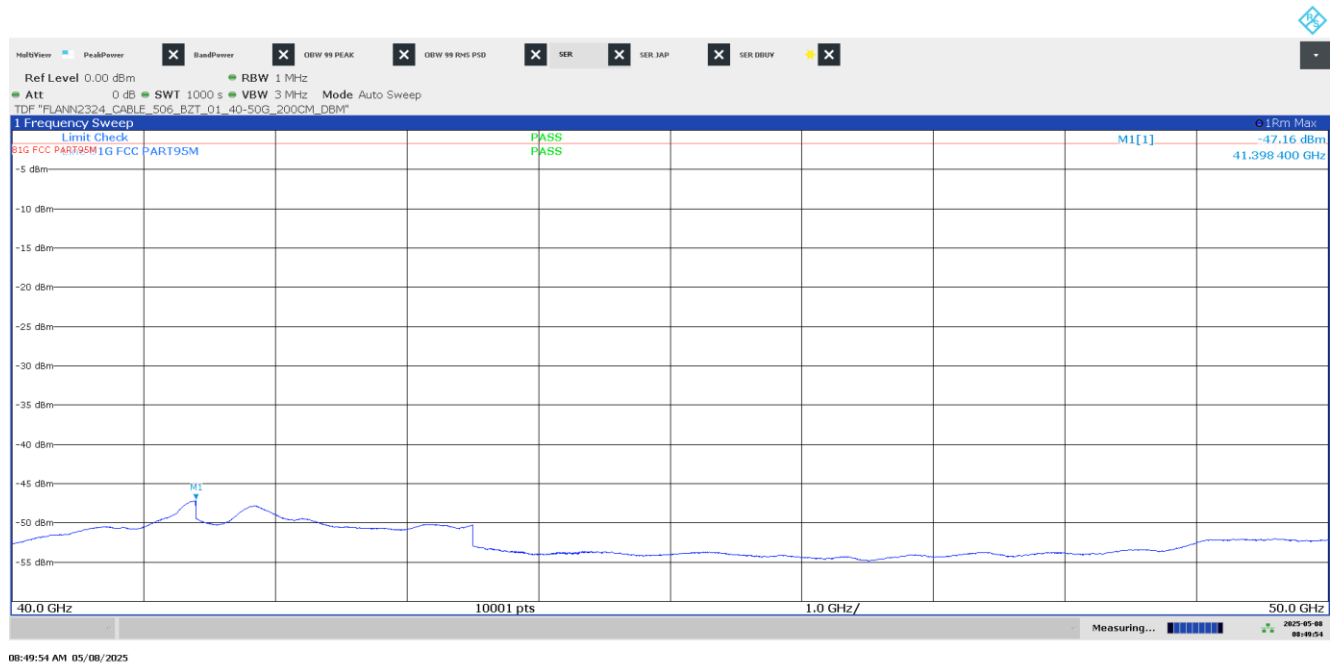


Note: Green trace: Peak detector, Black trace: RMS detector. Ferrite beads placed on the cable to the EUT and shielding blankets over the AE (See setup photos).

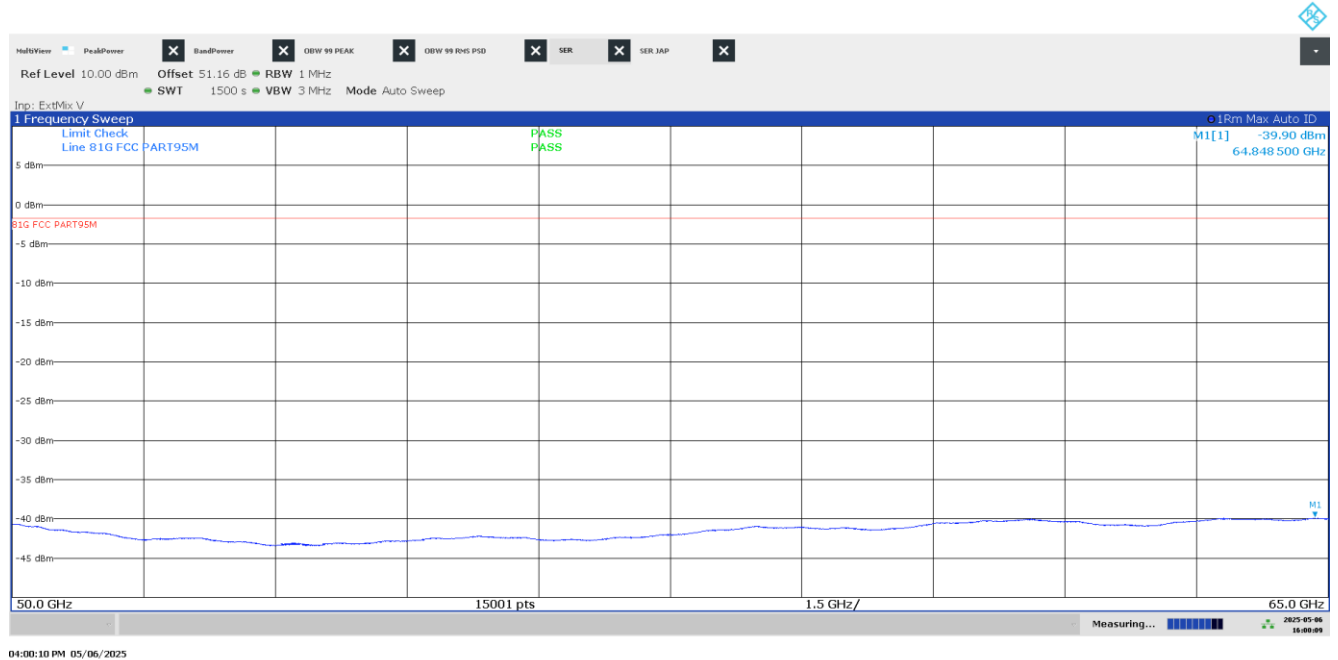
Plot 54: 18 GHz – 40 GHz, EUT 10, Mode 4 (c0)



Plot 55: 40 GHz – 50 GHz, EUT 10, Mode 4 (c0)

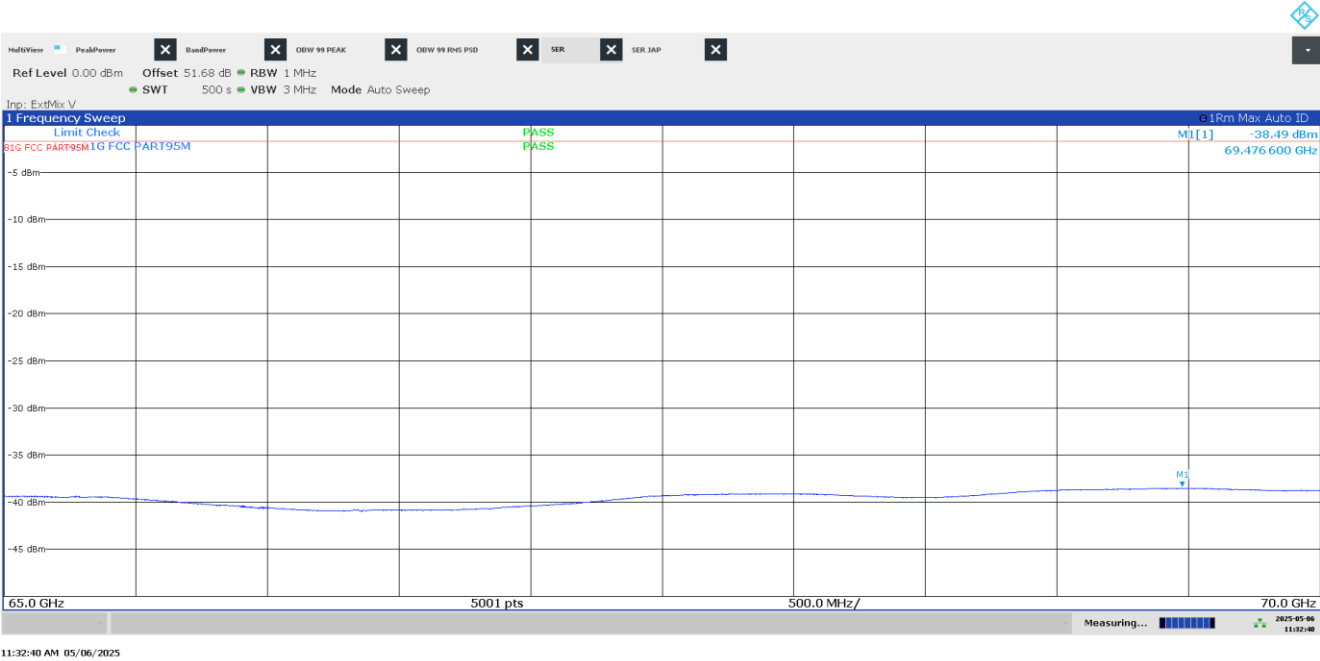


Plot 56: 50 GHz – 65 GHz, EUT 10, Mode 4 (c0)

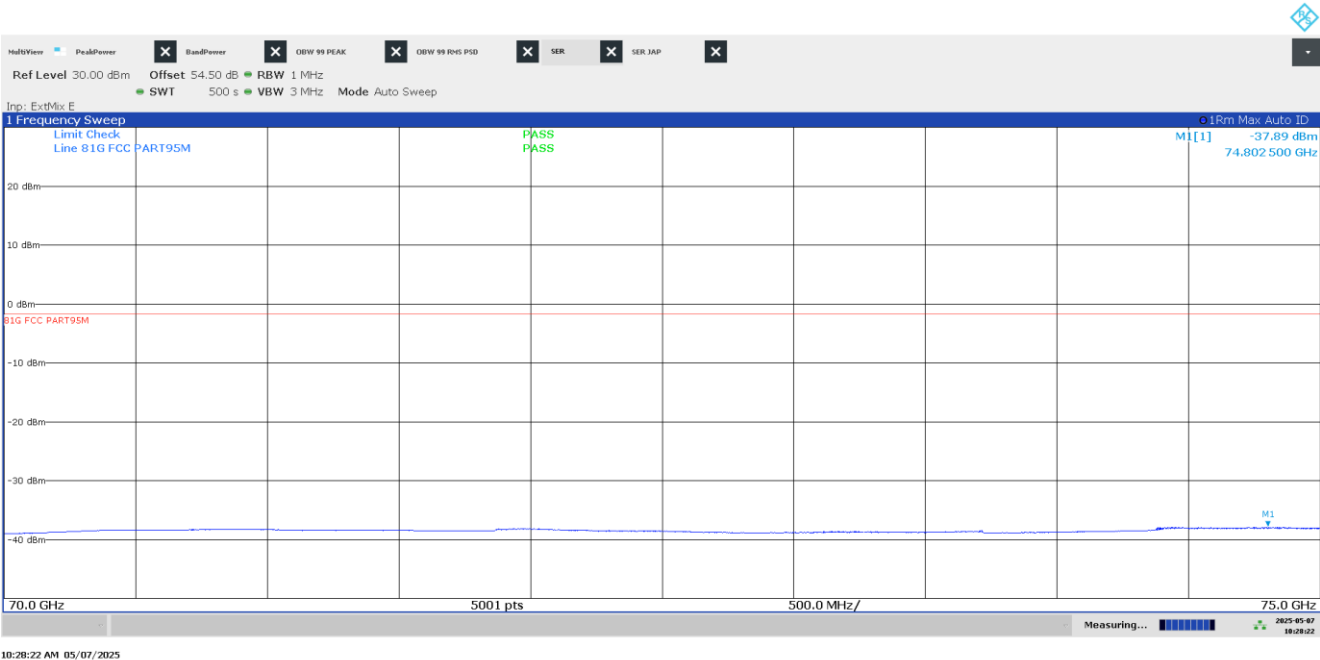


Plot 57: 65 GHz – 70 GHz, EUT 10, Mode 4 (c0)

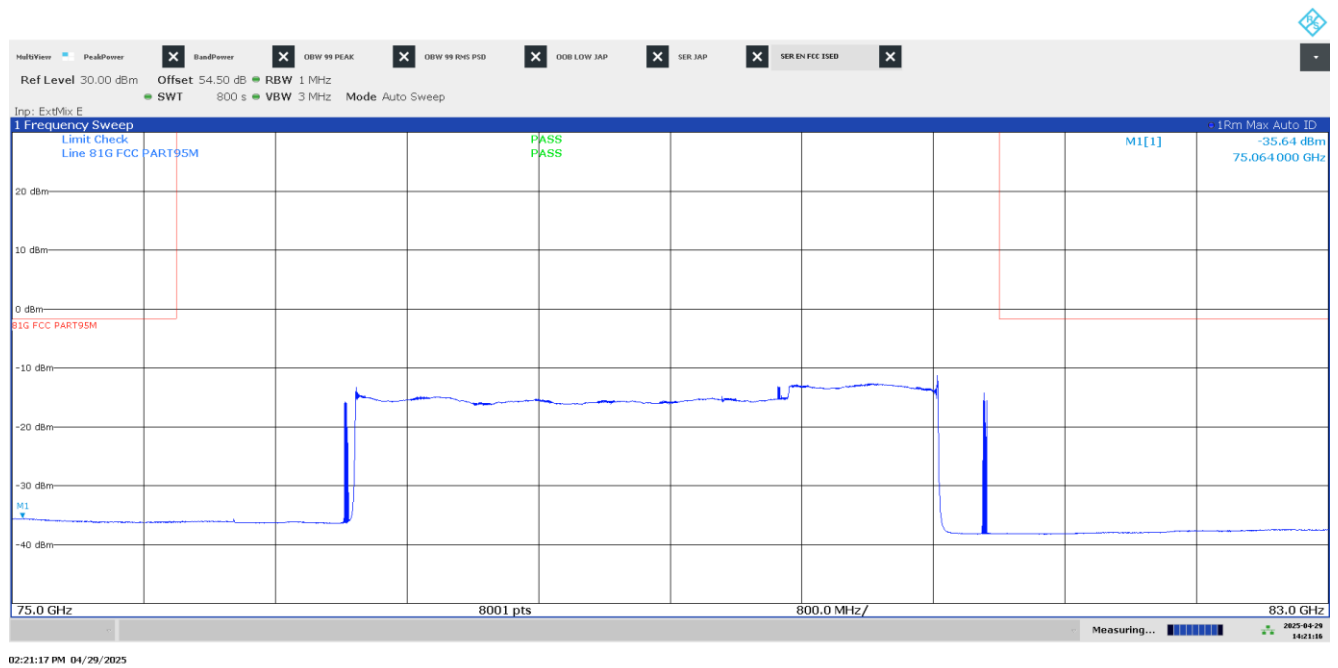
a



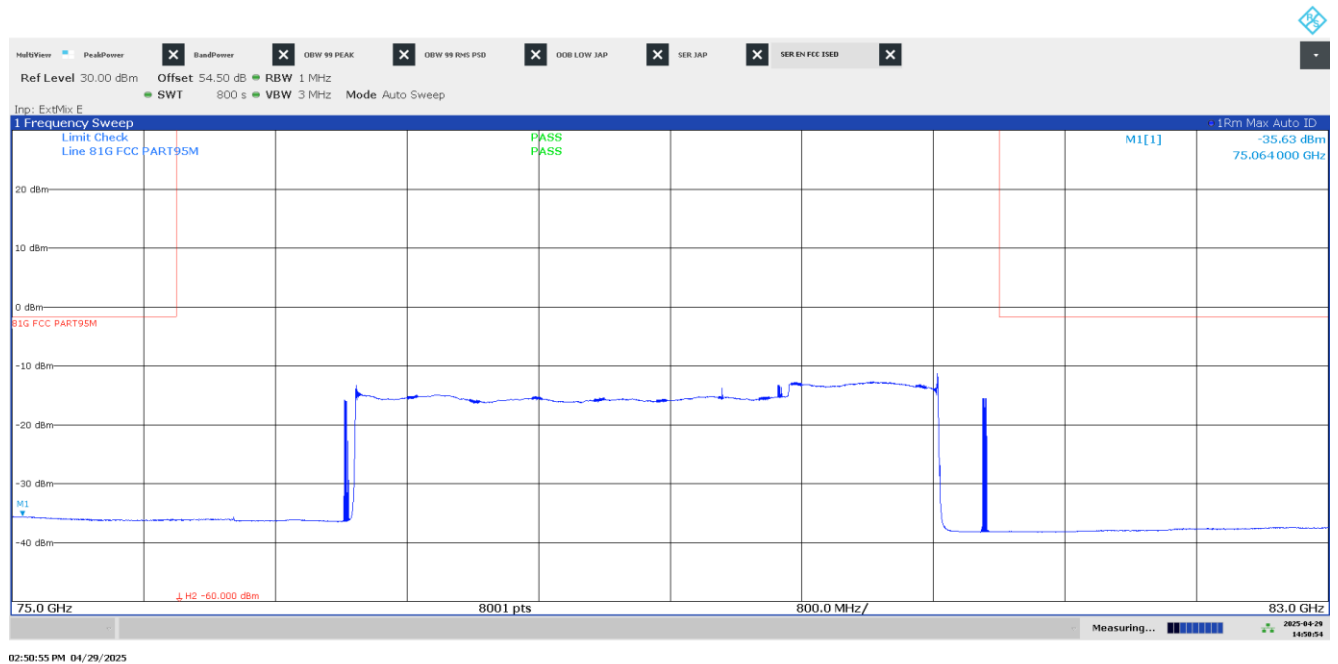
Plot 58: 70 GHz – 75 GHz, EUT 10, Mode 4 (c0)



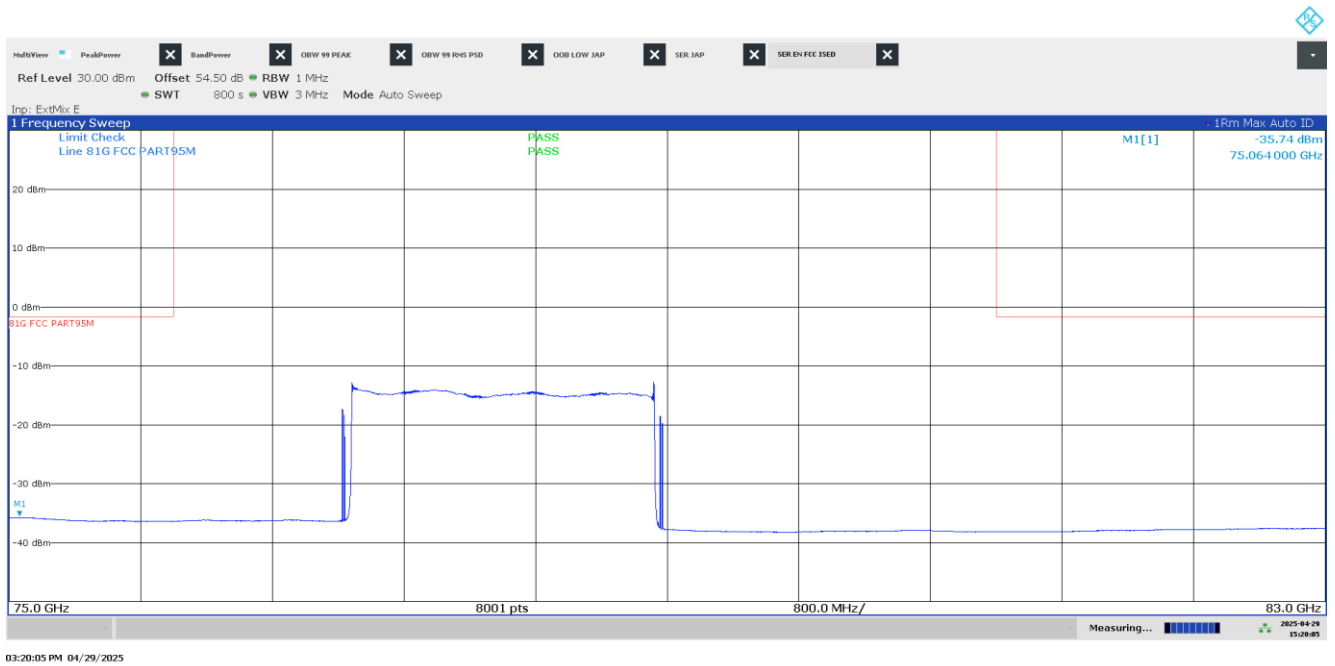
Plot 59: 75 GHz – 83 GHz, EUT 10, Mode 4 (c0)



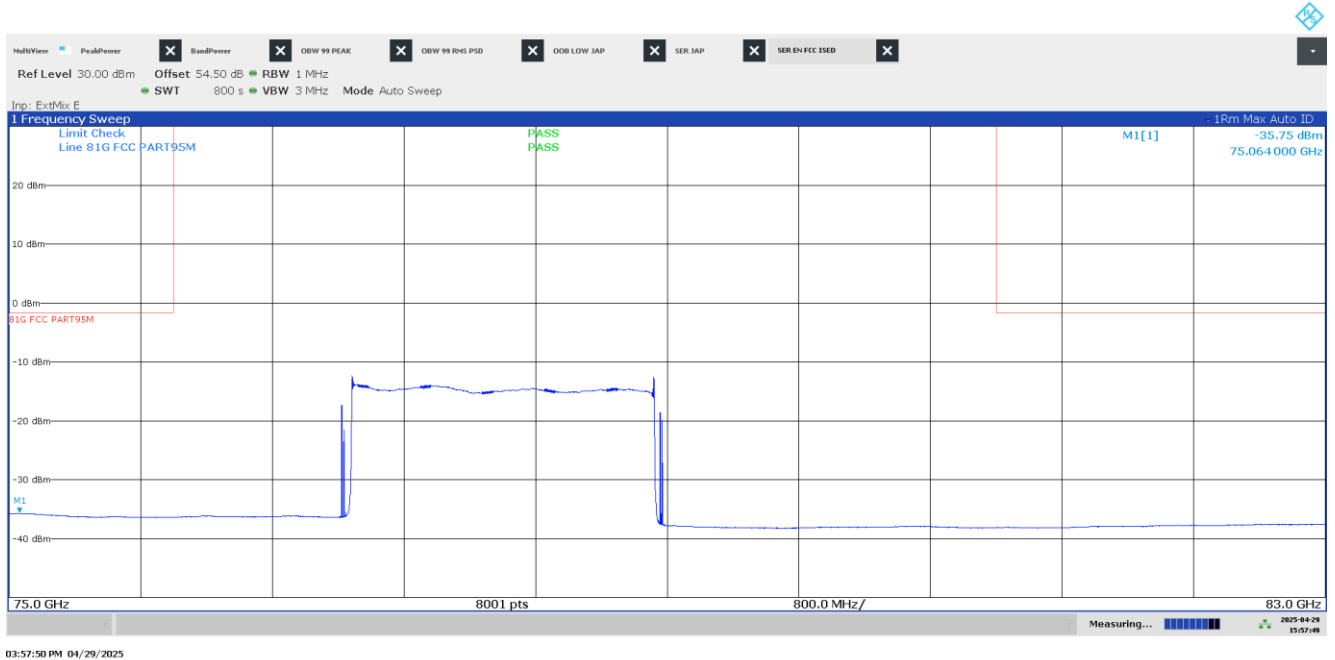
Plot 60: 75 GHz – 83 GHz, EUT 10, Mode 4 (c1)



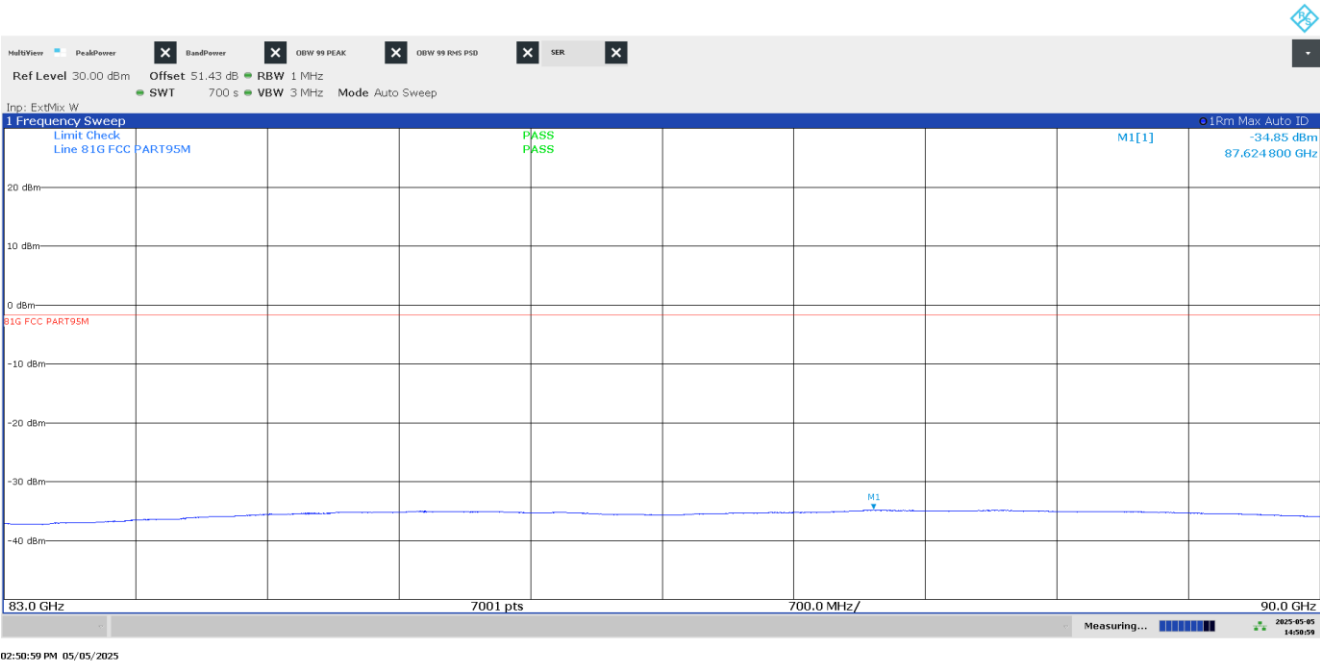
Plot 61: 75 GHz – 83 GHz, EUT 10, Mode 7 (c0)



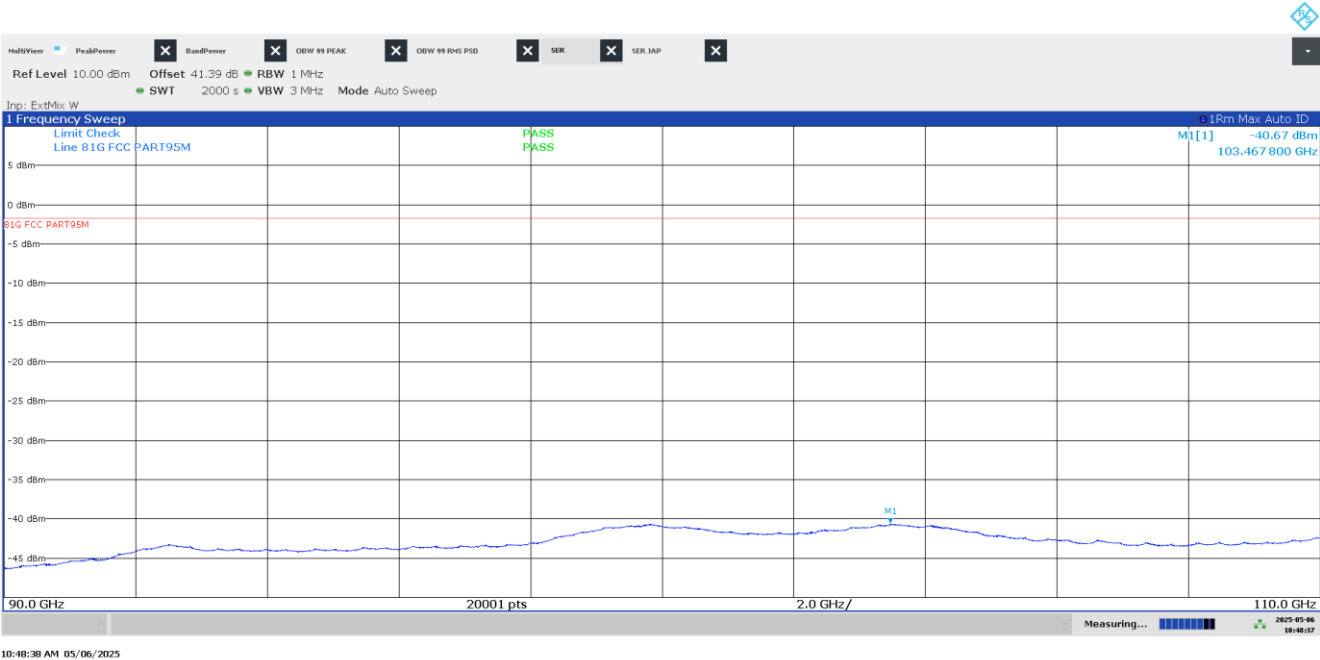
Plot 62: 75 GHz – 83 GHz, EUT 10, Mode 7 (c1)

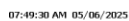
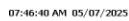


Plot 63: 83 GHz – 90 GHz, EUT 10, Mode 4 (c0)

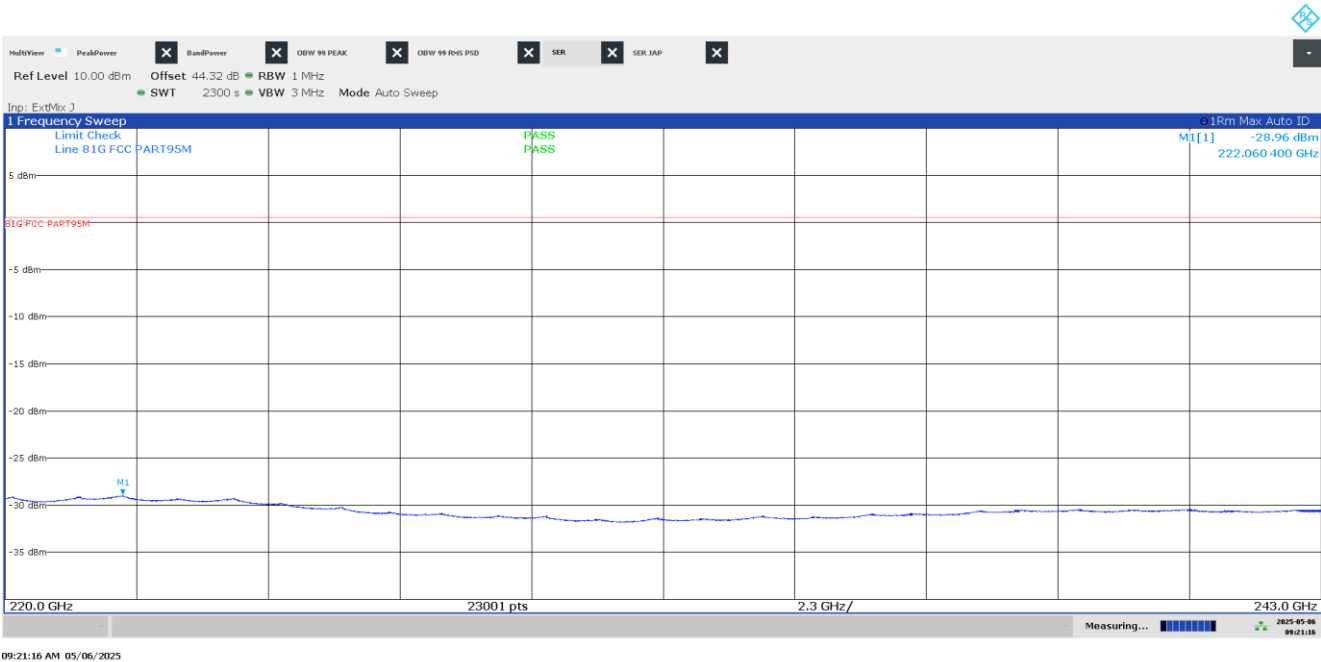


Plot 64: 90 GHz – 110 GHz, EUT 10, Mode 4 (c0)





Plot 67: 220 GHz – 243GHz, EUT 10, Mode 4 (c0)



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	Continuous 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/N₀	Carrier to noise-density ratio, expressed in dB-Hz

14 Document history

Version	Applied changes	Date of release
R01-D1	Initial Draft release	2025-02-24
R01-D2	76.5 GHz band: Measurements under extreme conditions repeated using software version 195.230.107	2025-09-22
R01	Initial release	2025-11-20

END OF TEST REPORT