

TEST REPORT

Test report no.: 1-9081-24-01-05_TR1-R03



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

Amazonen Werke H. Dreyer GmbH & Co.KG

Am Amazonenwerk 9-13

49205 Hasbergen / GERMANY

Phone:

Contact: Felix Book

e-mail: felix.book@amazone.de

Manufacturer

Pulsotronic GmbH & Co. KG

Neue Schichtstraße 14b

09366 Niederdorf / 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

RSS - 210 Issue 11 Licence-Exempt Radio Apparatus: Category I Equipment

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

Test Item

Kind of test item: **24 GHz Radar Sensor**

Model name: **NH243**

FCC ID: **2BQOS-NH243**

IC: **34252-NH243**

Frequency: 24.075 GHz – 24.175 GHz

Technology tested: CW Radar

Antenna: Integrated patch antenna

Power supply: 09 V to 16 V DC by external power supply

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.

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Meheza Walla
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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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2.2 Application details

Date of receipt of order:	2025-02-19
Date of receipt of test item:	2025-04-04
Start of test:*	2025-04-09
End of test:*	2025-04-15
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 15		FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices
RSS - 210 Issue 11	06-2024	Licence-Exempt Radio Apparatus: Category I Equipment

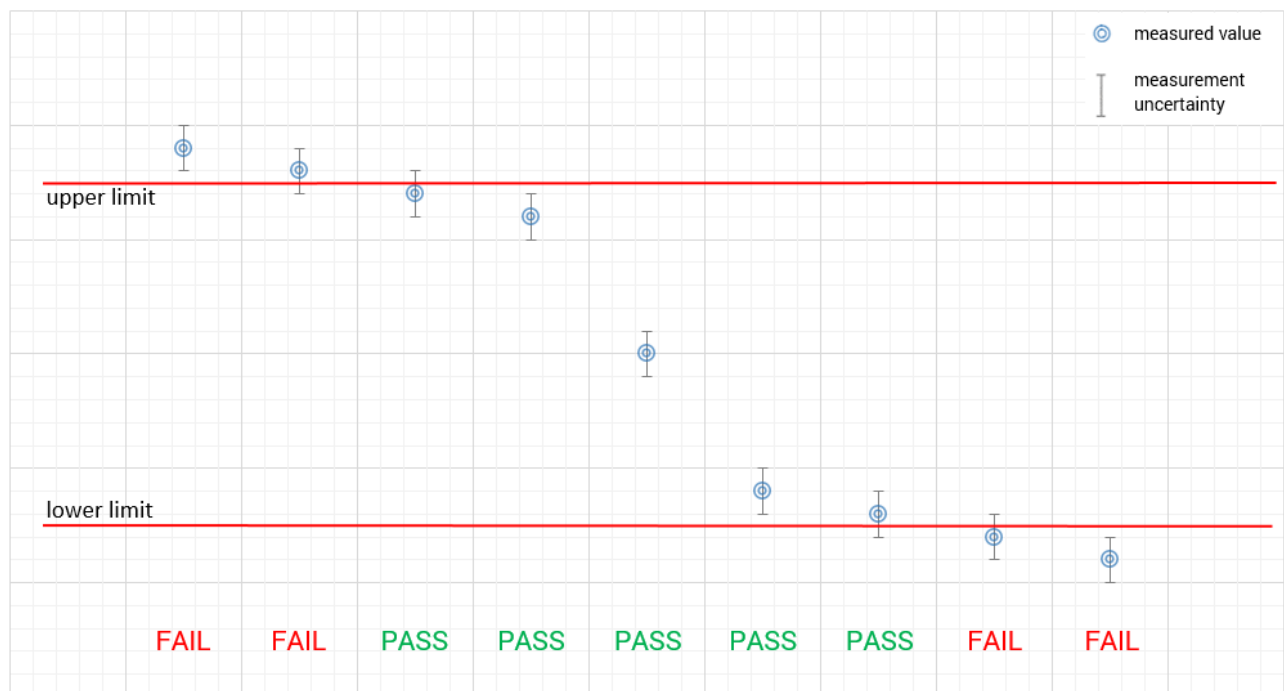
Guidance	Version	Description
ANSI C63.4-2014	-/-	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI C63.10-2020	-/-	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless 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}	+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}	12 V DC by external power supply 16 V 09 V

6 Test item

6.1 General description

Kind of test item	:	24 GHz Radar Sensor
Model name	:	NH243
HMN	:	N/A
PMN	:	NH243
HVIN	:	D
FVIN	:	1.1.29
S/N serial number	:	-/-
Hardware status	:	D
Software status	:	1.1.29.
Frequency band	:	24.075 GHz – 24.175 GHz
Type of modulation	:	CW
Number of modes	:	1
Antenna	:	Integrated patch antenna
Power supply	:	09 V to 12 V DC by external power supply
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:

- 1-9081-24-01-01_TR1-A101-R01 (External photographs of EUT)
- 1-9081-24-01-01_TR1-A102-R01 (Internal photographs of EUT)
- 1-9081-24-01-01_TR1-A103-R01 (Test set-up photographs)
- 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.

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).

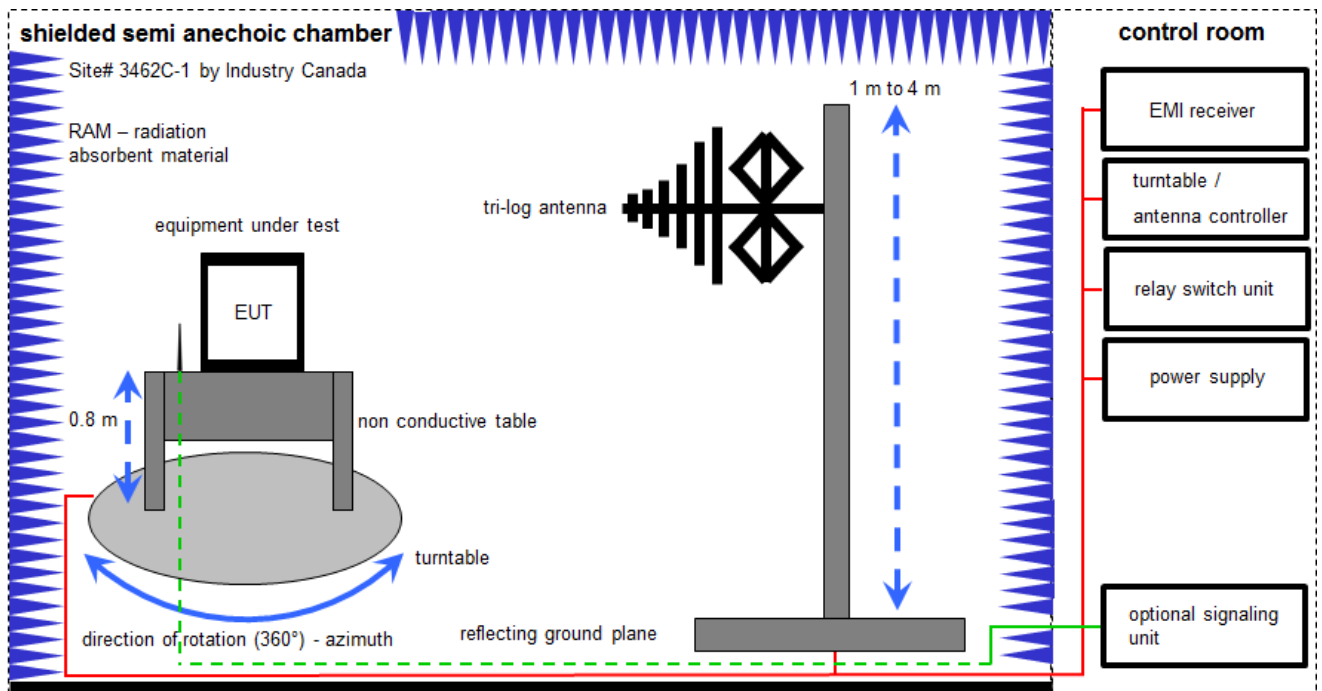
In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

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)

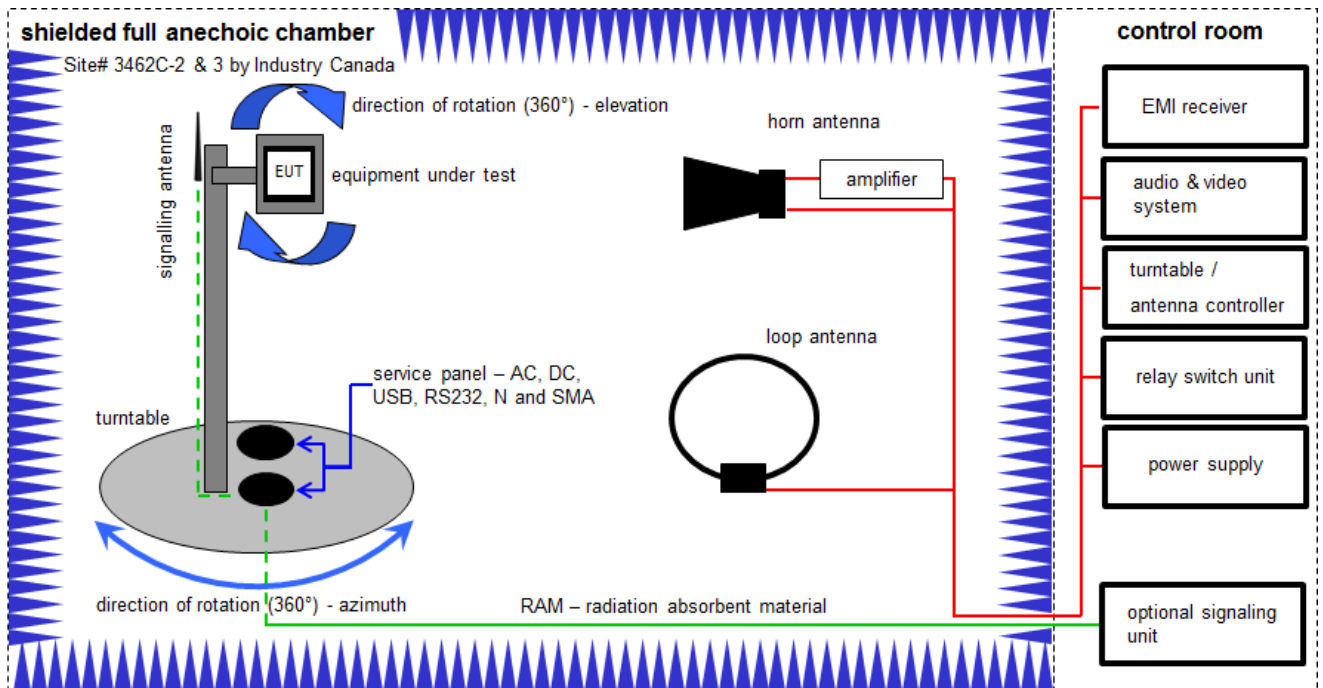
Example calculation:

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

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	n.a.	Semi anechoic chamber	3000023	MWB AG		300000551	cnn	-/-	-/-
2	n.a.	TRILOG Broadband Antenna	VULB9163	Schwarzbeck Mess-Elektronik OHG / Schönau	371	300003854	cal	11.07.2024	11.07.2026
3	n.a.	Turntable	2089-4.0	EMCO Elektronik GmbH / Gilching		300004394	cnn	-/-	-/-
4	n.a.	Power Supply	6032A	Hewlett Packard	2920A04466	300000580	cnn	-/-	-/-
5	n.a.	Antenna Tower	2175	ETS-Lindgren GmbH / Taufkirchen	64762	300003745	cnn	-/-	-/-
6	n.a.	Positioning Controller	2090	ETS-Lindgren GmbH / Taufkirchen	64672	300003746	cnn	-/-	-/-
7	n.a.	EMI Test Receiver	ESR3	Rohde & Schwarz Messgerätebau GmbH / Memmingen	102587	300005771	cal	05.12.2024	05.12.2025

7.2 Shielded fully anechoic chamber



Measurement distance: horn antenna 3 meter / 1 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:

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

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

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

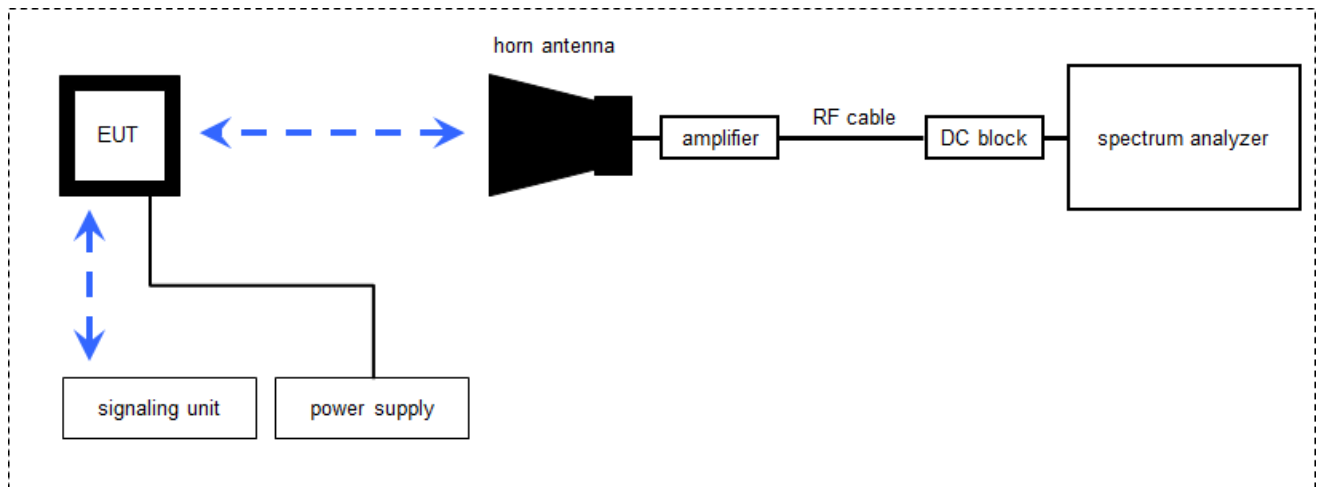
Example calculation:

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

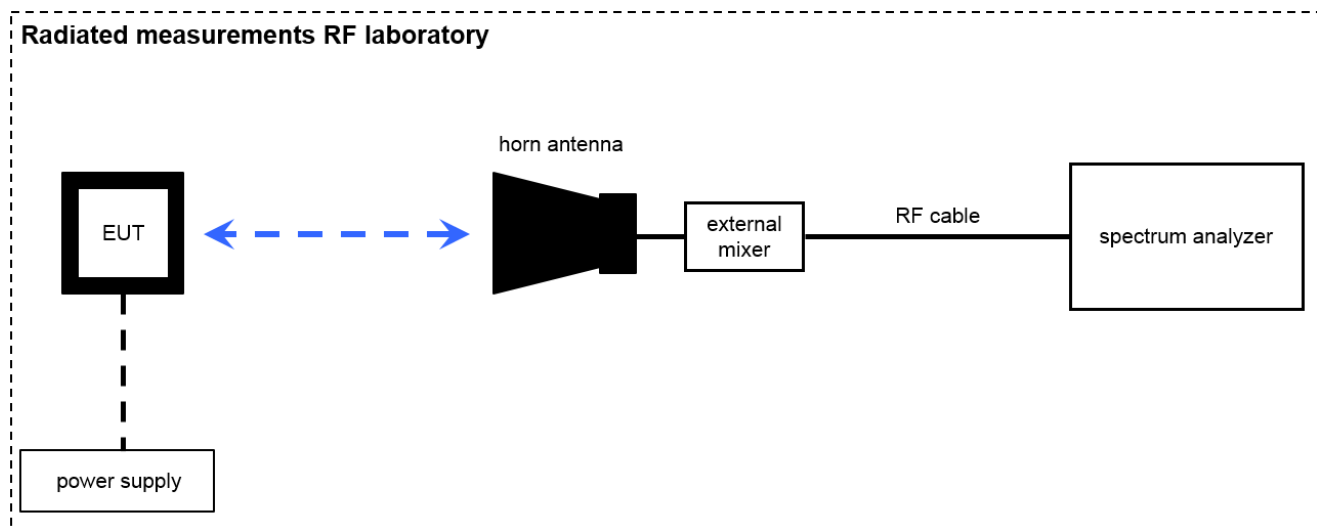
Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	n.a.	DC power supply, 60Vdc, 50A, 1200 W	6032A	Hewlett Packard	2818A03450	300001040	cal	05.12.2023	05.12.2026
2	n.a.	Double-Ridged Waveguide Horn Antenna	3115	EMCO Elektronik GmbH / Gilching	8812-3088	300001032	cal	10.10.2023	31.10.2025
3	n.a.	Anechoic chamber	FAC 3/5m	MEC Import: MWB / TDK	87400/02	300000996	cpu	-/-	-/-
4	n.a.	Switch / Control Unit	3488A	Hewlett Packard	*	300000199	cnn	-/-	-/-
5	n.a.	Highpass Filter	WHKX7.0/18G-8SS	Wainwright Instruments GmbH / Andechs	19	300003790	cnn	-/-	-/-
6	n.a.	Broadband Amplifier 0.5-18 GHz	CBLU5184540	MEC Import: CERNEX	22049	300004481	cpu	-/-	-/-
7	n.a.	4U RF Switch Platform	L4491A	Agilent Technologies Deutschland GmbH / Böblingen	MY50000037	300004509	cnn	-/-	-/-
8	n.a.	NEXIO EMV-Software	BAT EMC V2022.0.32.0	MEC Import: Nexio		300004682	cnn	-/-	-/-
9	n.a.	Active Loop Antenna	6502	EMCO Elektronik GmbH / Gilching	2210	300001015	cal	02.08.2023	02.08.2025
10	n.a.	EMI Test Receiver	ESU26	Rohde & Schwarz Messgerätebau GmbH / Memmingen	100037	300003555	cal	10.12.2024	10.12.2025
11	n.a.	TRILOG Broadband Antenna	VULB9163	Schwarzbeck Mess-Elektronik OHG / Schönau	318	300003696	cal	31.01.2024	31.01.2026

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:

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

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

(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:

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

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

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	n.a.	Temperature Test Chamber	VT4002	Heraeus Voetsch	521/84193	300003889	calchk	18.09.2024	30.09.2026
2	n.a.	Broadband LNA 18-50 GHz	CBL18503070PN	CERNEX	25240	300004948	chk	22.04.2024	22.04.2026
3	n.a.	Std. Gain Horn Antenna 49.9-75.8 GHz	2524-20	Flann	*	300001983	cnn	-/-	-/-
4	n.a.	Std. Gain Horn Antenna 60-90 GHz	COR 60_90	Thomson CSF		300000814	cpu	-/-	-/-
5	n.a.	Std. Gain Horn Antenna 33.0-50.1 GHz	2324-20	Flann	57	400000683	cnn	-/-	-/-
6	n.a.	Harmonic Mixer 3-Port, 60-90 GHz	FS-Z90	Rohde & Schwarz Messgerätebau GmbH / Memmingen	101555	300004691	cal	25.07.2024	25.07.2025
7	n.a.	Harmonic Mixer 3-Port, 75-110 GHz	FS-Z110	Rohde & Schwarz Messgerätebau GmbH / Memmingen	101411	300004959	cal	30.08.2024	30.08.2025
8	n.a.	Harmonic Mixer 3-port, 90-140 GHz	FS-Z140	Rohde & Schwarz Messgerätebau GmbH / Memmingen	101119	300005581	cal	01.08.2024	01.08.2025
9	n.a.	Harmonic Mixer 3-Port, 50-75 GHz	FS-Z75	Rohde & Schwarz Messgerätebau GmbH / Memmingen	101578	300005788	cal	10.07.2024	10.07.2025
10	n.a.	Std. Gain Horn Antenna 73.8-112 GHz	2724-20	Flann	*	300001988	cnn	-/-	-/-
11	n.a.	Std. Gain Horn Antenna 92.3-140 GHz	2824-20	Flann	*	300001993	cnn	-/-	-/-
12	n.a.	Horn Antenna 18,0-40,0 GHz	Horn Antenna 18,0-40,0 GHz LHAF180	Microw.Devel	39180-103-021	300001747	cal	24.01.2024	31.01.2026
13	n.a.	Power supply	N5767A	Agilent Technologies Deutschland GmbH / Böblingen	US14J1569P	300004851	cal	06.12.2023	31.12.2026
14	n.a.	Signal- and Spectrum analyzer	FSW85	Rohde & Schwarz Messgerätebau GmbH / Memmingen	101333	300005568	cal	01.10.2024	30.09.2025

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 63.10.
- 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 63.10) – 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 63.10).
- 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 63.10.
- 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 63.10) – 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 63.10).
- 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 63.10.
- 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 63.10) – 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 63.10).
- 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 63.10.
- 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 63.10).
- 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 63.10.
- 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 63.10).
- 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 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	FCC 47 CFR Part 15 RSS-210 Issue 11	see table	2026-05-11	-/-

Test specification clause	Test case	Temperature conditions	Power supply	Pass	Fail	NA	NP	Remark
§15.215(c) / RSS-210 F.2e / RSS-Gen 6.7	Bandwidth and frequency stability of the wanted signal	Nominal Extreme	Nominal Extreme	☒	☐	☐	☐	complies
§15.245(b) / RSS-210, F.1(a) / RSS-210, F.2(a) /	Field strength of fundamental emission	Nominal	Nominal	☒	☐	☐	☐	complies
§15.209(a) / §15.245(b) / RSS-210, F.1 RSS-210, F.2 RSS-Gen 8.9	Field strength of emissions (radiated spurious)	Nominal	Nominal	☒	☐	☐	☐	complies
§15.245(b)(1)(iii) / RSS-210 F.1(d)	Prevention of continuous operation	Nominal	Nominal	☒	☐	☐	☐	see note 2

Note:

- 1) NA = Not Applicable; NP = Not Performed
- 2) Only required for field disturbance sensors

11 Additional comments

Reference documents:

- Manual Testsetup.pdf

Special test descriptions:

- Manual Testsetup.pdf

Configuration descriptions:

- Manual Testsetup.pdf

- Kind of device:**
- ☒ Field disturbance sensor (not for use in motor vehicles or aircraft)
- ☐ Field disturbance sensors designed to be used in motor vehicles or aircraft
- ☐ Speed radar meter

Note:

- §15.245(a): Operation under the provisions of this section is limited to intentional radiators used as field disturbance sensors, excluding perimeter protection systems.
- RSS-210 F.1: Perimeter protection systems, which employ a leaky transmission line as the radiating source, are excluded from the requirements of this annex.

Test devices (EUT):

- EUT1: The normal operation mode (intended use) is used.
- EUT2: for Fotos.

Associated equipment (AE):

- AE1: IDS-208 RF-Simulator
- AE2: Target Simulator
- AE3: ISG-207 Driver-Generator
- AE4: PCAN Can-Dongle

Normal operation modes (NM):

Abbreviation	Name	Features
NM	Normal mode	Intended use

- Additional test modes:**
- ☒ No test modes available
- ☐ Special test modes/special software (see description below)
- ☐ Stop-Modes (see description below)

Software provided by the manufacturer:

- No software provided by the manufacturer

Additional comment:

- None

12 Measurement results

12.1 Bandwidth and frequency stability of the wanted signal

Description:

Measurement of the bandwidth and the frequency stability of the wanted signal (fundamental emission) under temperature and supply voltage variations.

Limits and provisions:

§15.215(c):

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. In the case of intentional radiators operating under the provisions of subpart E, the emission bandwidth may span across multiple contiguous frequency bands identified in that subpart. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

Designated frequency bands of §15.245			
Fundamental frequency [GHz]	f_L [GHz]	f_H [GHz]	Bandwidth [MHz]
0.902 – 0.928	> 0.902	< 0.928	< 26 MHz
2.435 – 2.465	> 2.435	< 2.465	< 30 MHz
5.785 – 5.815	> 5.785	< 5.815	< 30 MHz
10.500 – 10.550	> 10.500	< 10.550	< 50 MHz
24.075 – 24.175	> 24.075	< 24.175	<100 MHz

RSS-210 F.2 e: The carrier frequency stability shall be sufficient to ensure that the 40 dB bandwidth stays within the operating frequency band when tested at the temperature and supply voltage variations specified for the frequency stability measurement in RSS-Gen.

RSS-Gen 6.7: Occupied bandwidth (or 99% emission bandwidth) and x dB bandwidth

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

Designated frequency bands of RSS-210 Annex F for field disturbance sensors			
Fundamental frequency [GHz]	f_L [GHz]	f_H [GHz]	Bandwidth [MHz]
0.902 – 0.928	> 0.902	< 0.928	< 26 MHz
2.435 – 2.465	> 2.435	< 2.465	< 30 MHz
5.785 – 5.815	> 5.785	< 5.815	< 30 MHz
10.500 – 10.550	> 10.500	< 10.550	< 50 MHz
24.075 – 24.175	> 24.075	< 24.175	<100 MHz

Designated frequency bands of RSS-210 Annex F for speed radar meters			
Fundamental frequency [GHz]	f_L [GHz]	f_H [GHz]	Bandwidth [MHz]
10.500 – 10.550	> 10.500	< 10.550	< 50 MHz
24.075 – 24.175	> 24.075	< 24.175	<100 MHz
33.400 – 36.000	> 33.400	< 36.000	< 2600 MHz

Measurement:

Measurement parameter	
Detector:	Pos-Peak
Resolution bandwidth:	10 kHz
Video bandwidth:	30 kHz
Trace-Mode:	Max Hold

Measurement procedures:

- Bandwidth: ANSI C63.10-2013 6.9
- Frequency stability: ANSI C63.10-2013 6.8

Measurement results:**20 dB bandwidth at normal conditions:**

EUT	Mode	Test condition	f_L [GHz]	f_H [GHz]	Bandwidth [kHz]
1	NM	T_{nom} / V_{nom}	24.144 780	24.145 080	300

99% bandwidth at normal conditions:

EUT	Mode	Test condition	f_L [GHz]	f_H [GHz]	Bandwidth [kHz]
1	NM	T_{nom} / V_{nom}	24.144 831 000	24.145 029 800	199

Frequency stability:

Mode for frequency stability tests: NM (Mode with the widest bandwidth, ANSI C63.10-2013 5.6.2.2)

Bandwidth measurement for frequency stability tests: 20 dB bandwidth

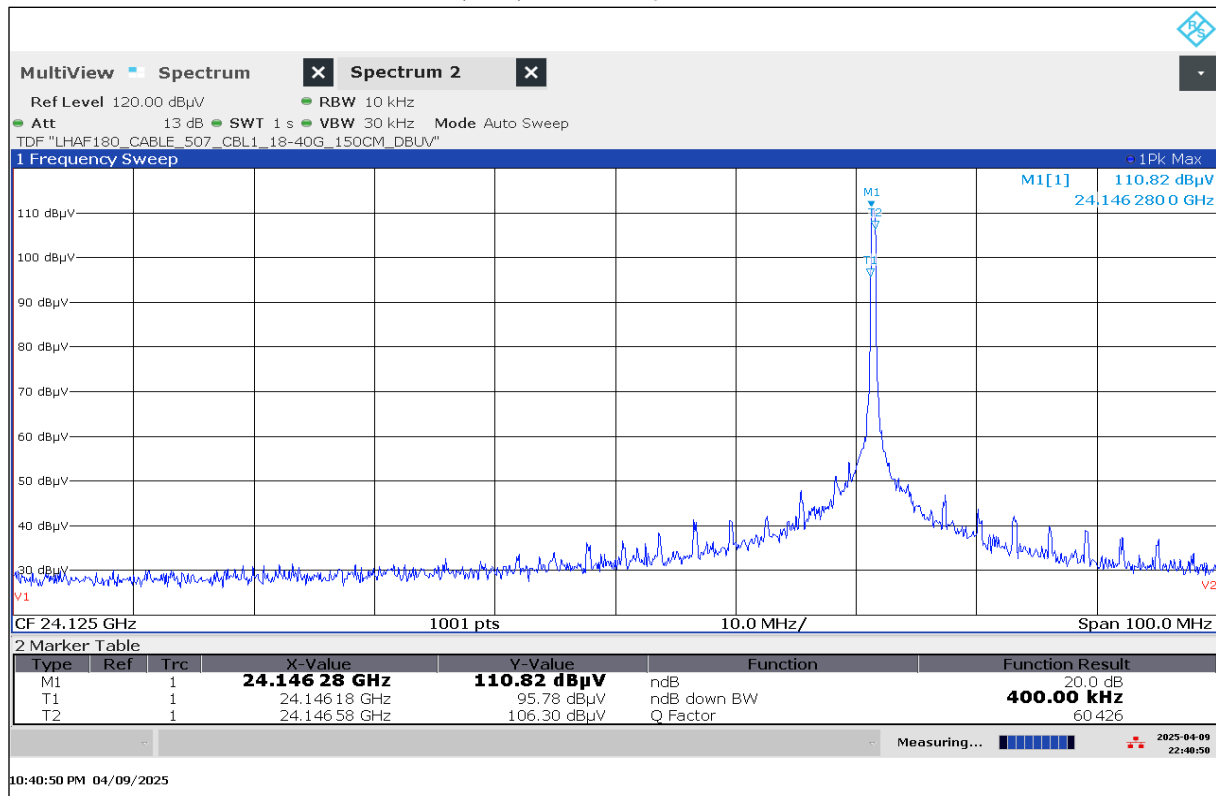
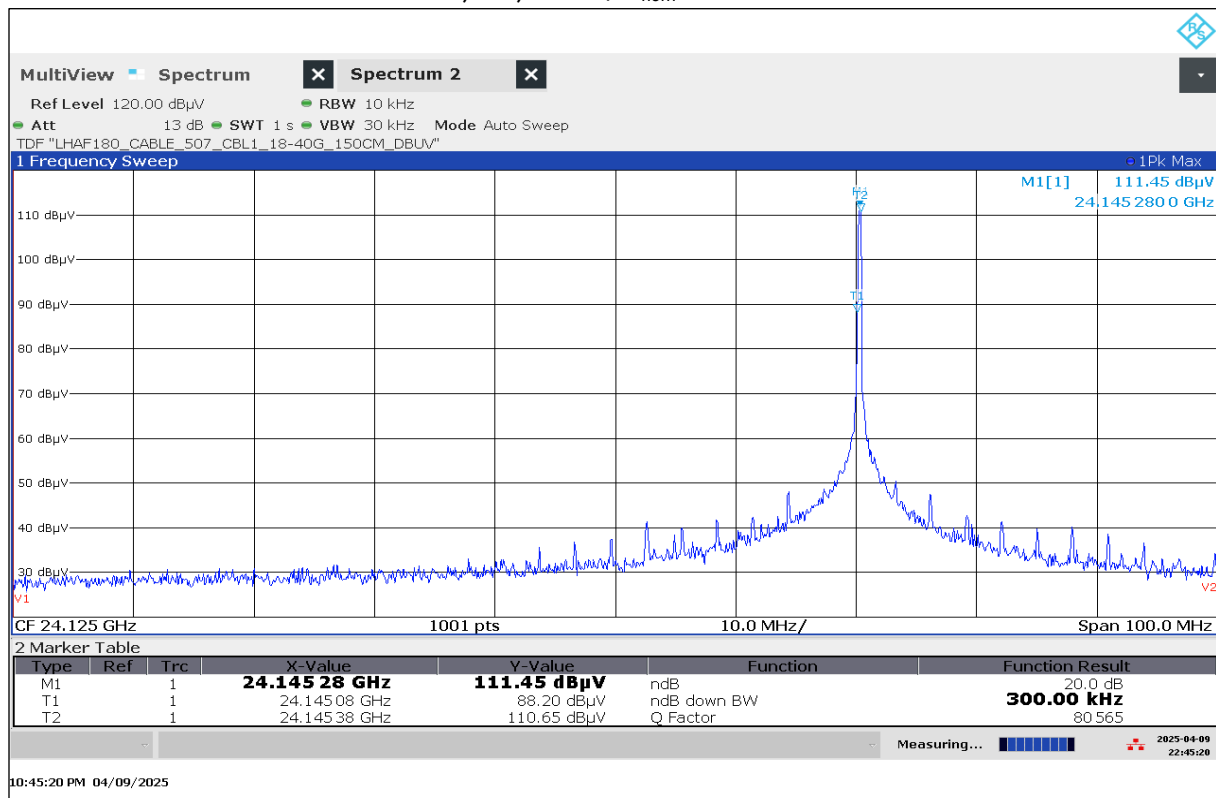
Test condition	Frequency f_L [GHz]	Frequency f_H [GHz]	N20dB Bandwidth [kHz]
-20 °C / V_{nom}	24.146 180	24.146 580	400
-10 °C / V_{nom}	24.145 080	24.145 380	300
0 °C / V_{nom}	24.145 380	24.145 780	400
10 °C / V_{nom}	24.143 880	24.144 280	400
20 °C / V_{nom}	24.144 780	24.145 080	300
20 °C / V_{min}	24.144 780	24.145 080	300
20 °C / V_{max}	24.144 580	24.144 880	300
30 °C / V_{nom}	24.144 480	24.144 880	400
40 °C / V_{nom}	24.143 880	24.144 280	400
50 °C / V_{nom}	24.144 480	24.144 780	300
T_{max} / V_{nom}	24.143 480	24.143 880	400

Verdict: Compliant

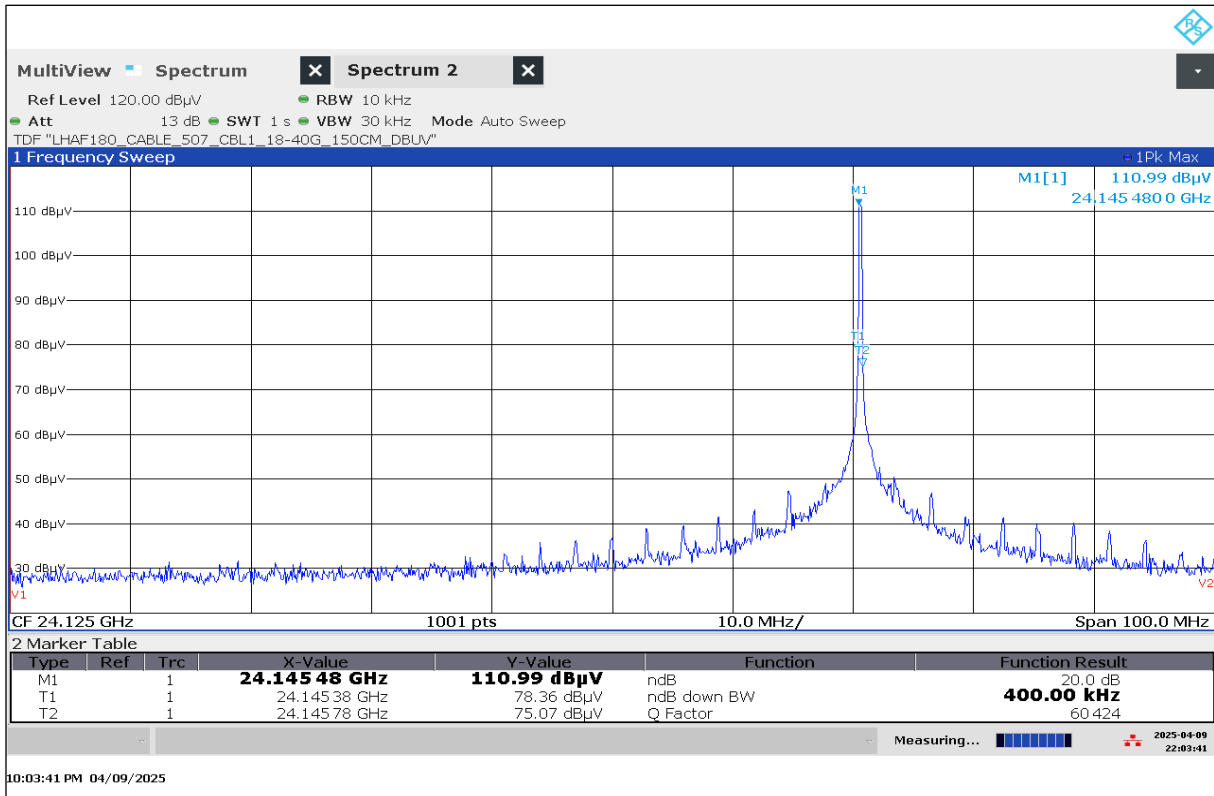
Bandwidth measurement for frequency stability tests: 99% bandwidth

Test condition	Frequency f_L [GHz]	Frequency f_H [GHz]	99% Bandwidth [kHz]
-20 °C / V_{nom}	24.144 931 500	24.145 228 400	297
-10 °C / V_{nom}	24.144 731 900	24.145 028 500	297
0 °C / V_{nom}	24.146 230 300	24.146 527 100	297
10 °C / V_{nom}	24.144 331 700	24.144 627 800	296
20 °C / V_{nom}	24.144 831 000	24.145 029 800	199
20 °C / V_{min}	24.144 831 300	24.145 029 900	199
20 °C / V_{max}	24.144 631 400	24.144 829 400	198
30 °C / V_{nom}	24.143 333 000	24.143 630 200	297
40 °C / V_{nom}	24.143 233 300	24.143 530 100	297
50 °C / V_{nom}	24.144 131 700	24.144 329 800	198
T_{max} / V_{nom}	24.144 423 300	24.144 827 700	395

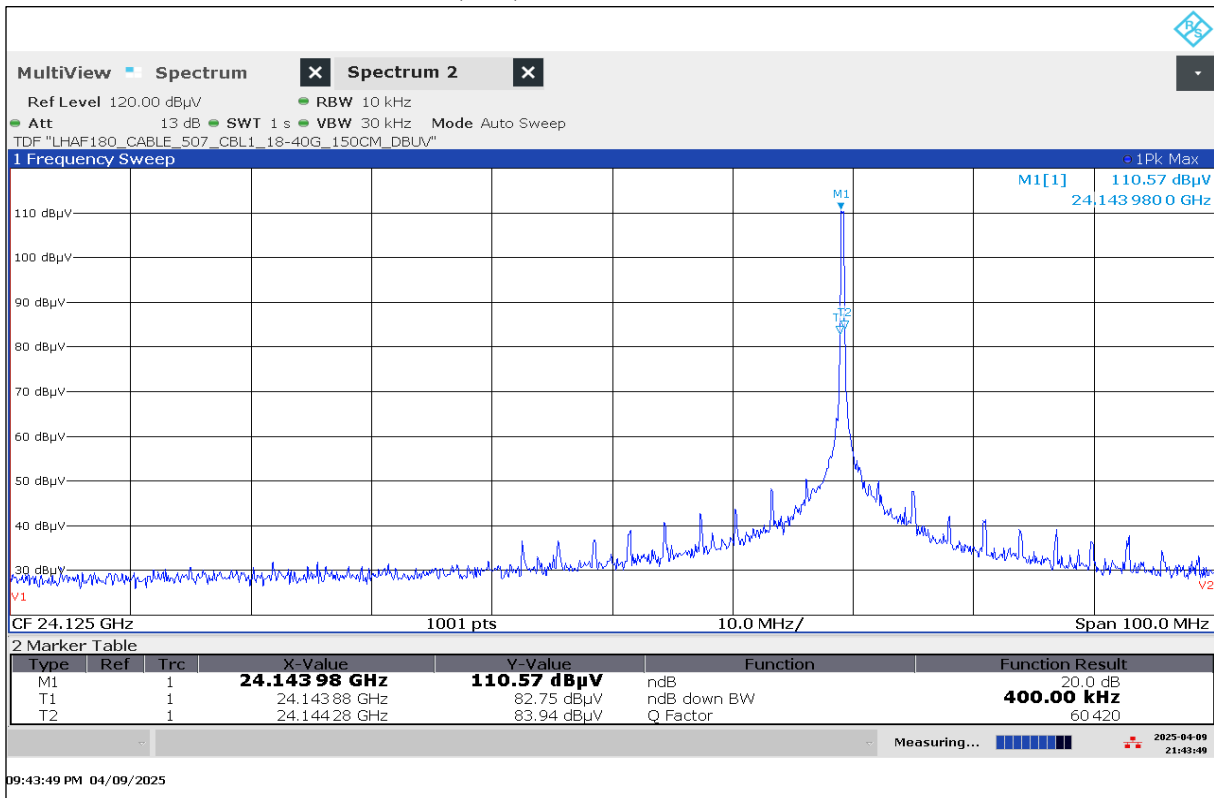
Verdict: Compliant

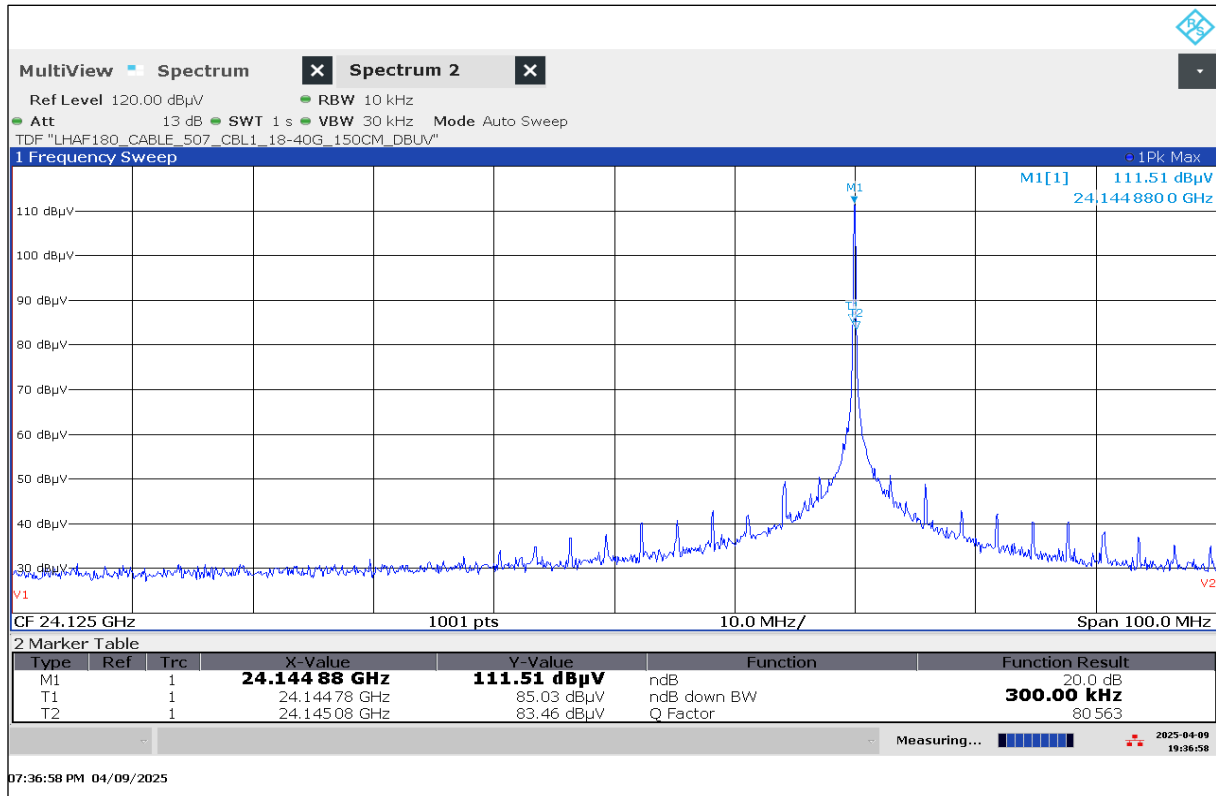
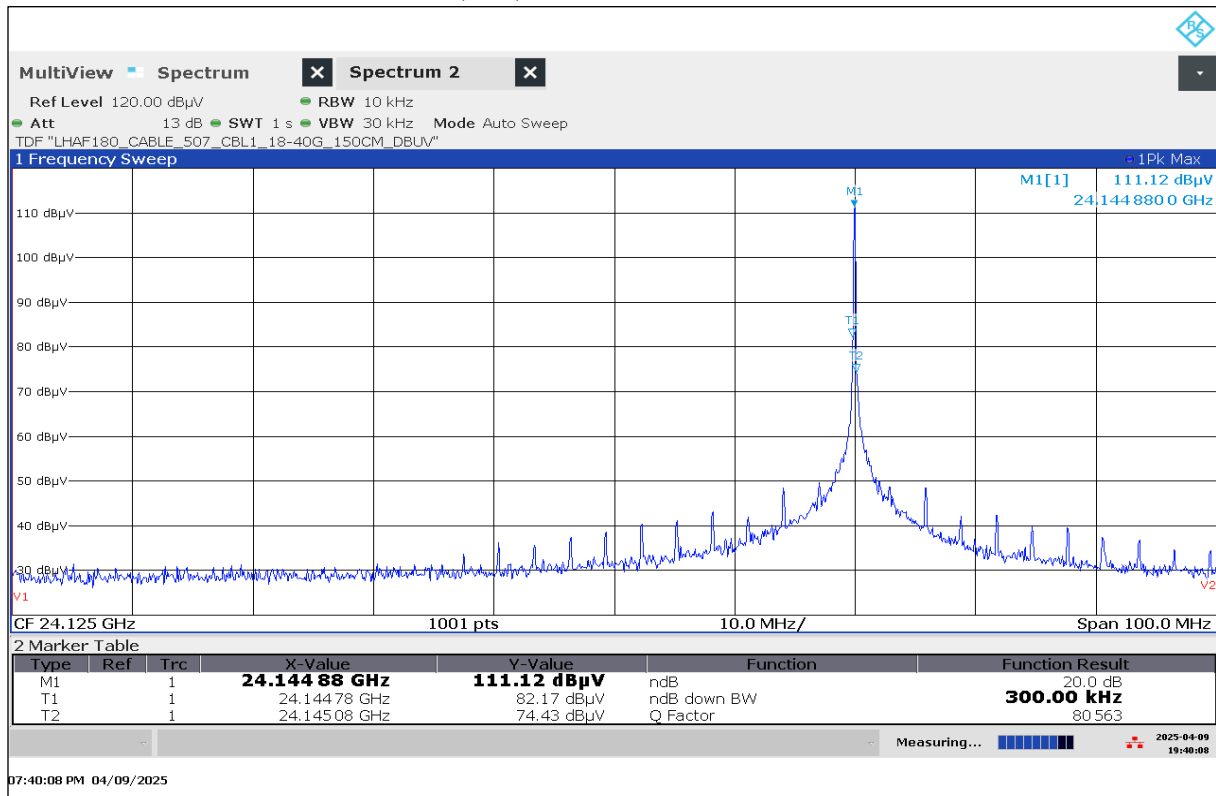
Plot 1: 20dB bandwidth at normal condition, NM, -20 °C / V_{nom} Plot 2: 20dB bandwidth at normal condition, NM, -10 °C / V_{nom} 

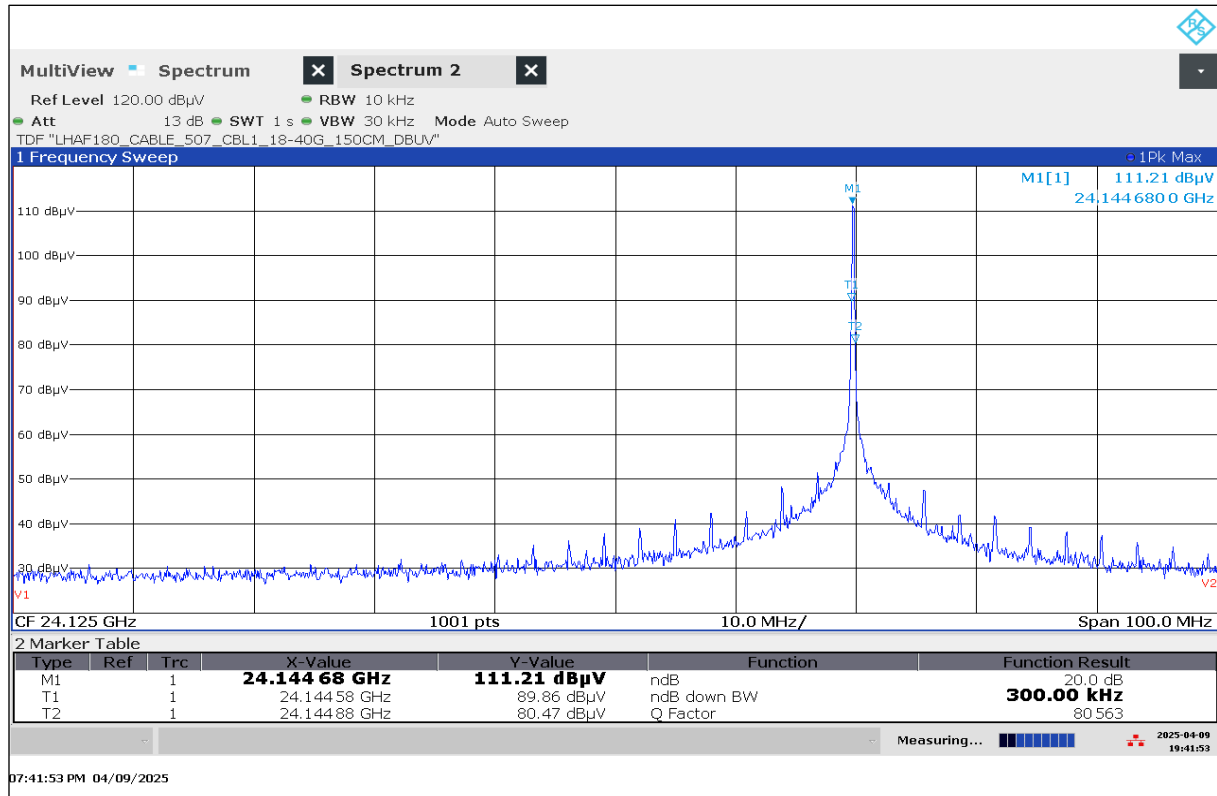
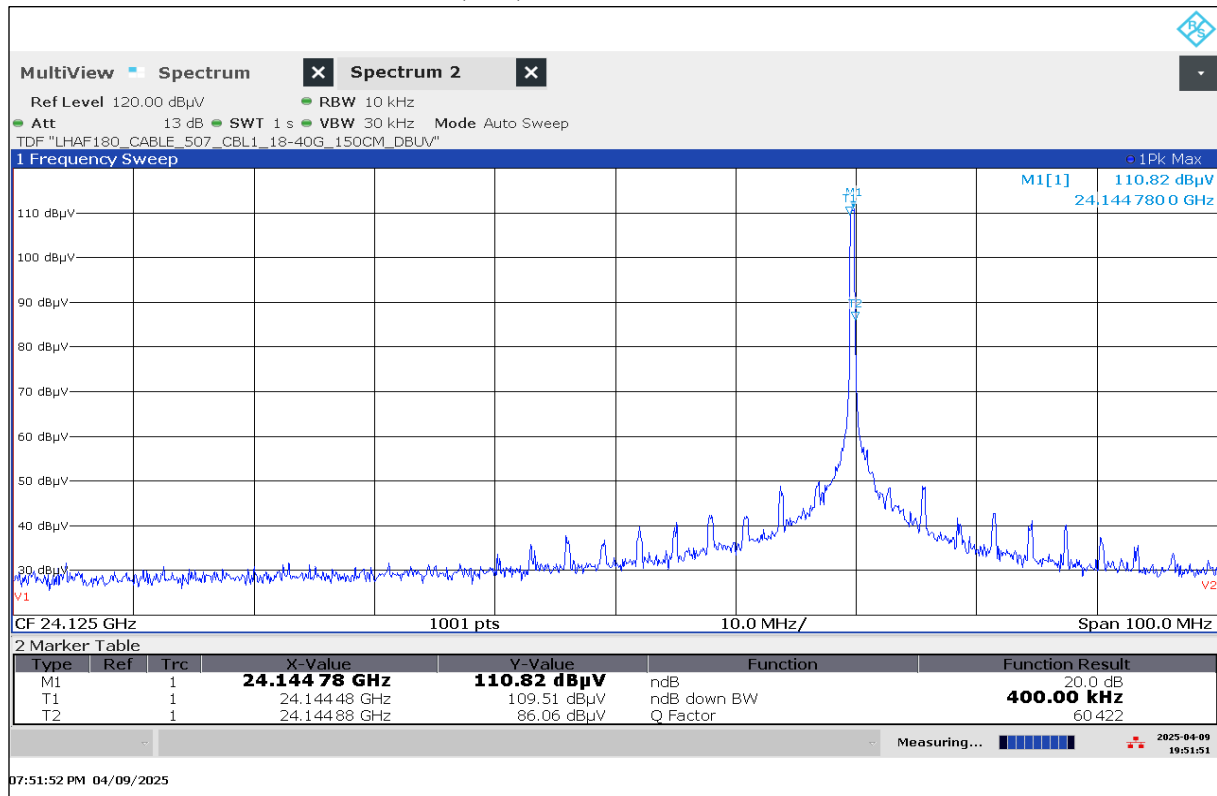
Plot 3: 20dB bandwidth at normal condition, NM, 0 °C / V_{nom}



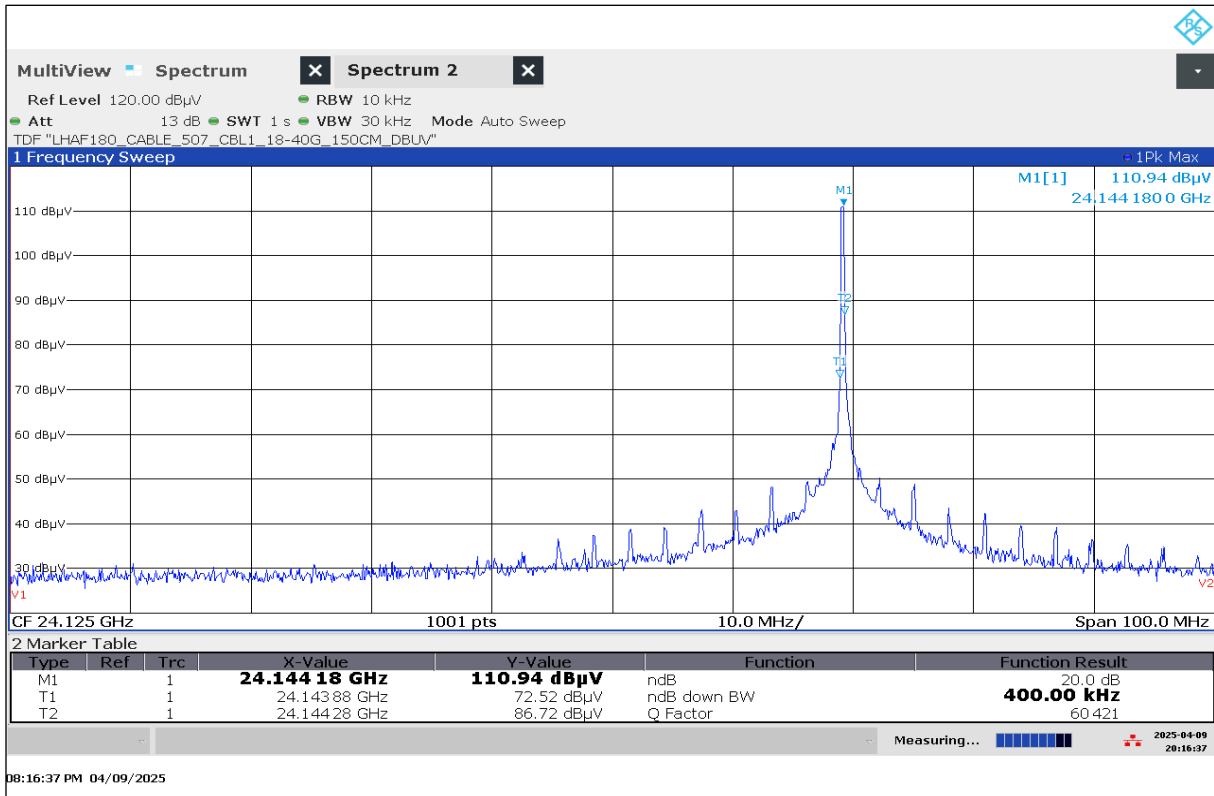
Plot 4: 20dB bandwidth at normal condition, NM, 10 °C / V_{nom}



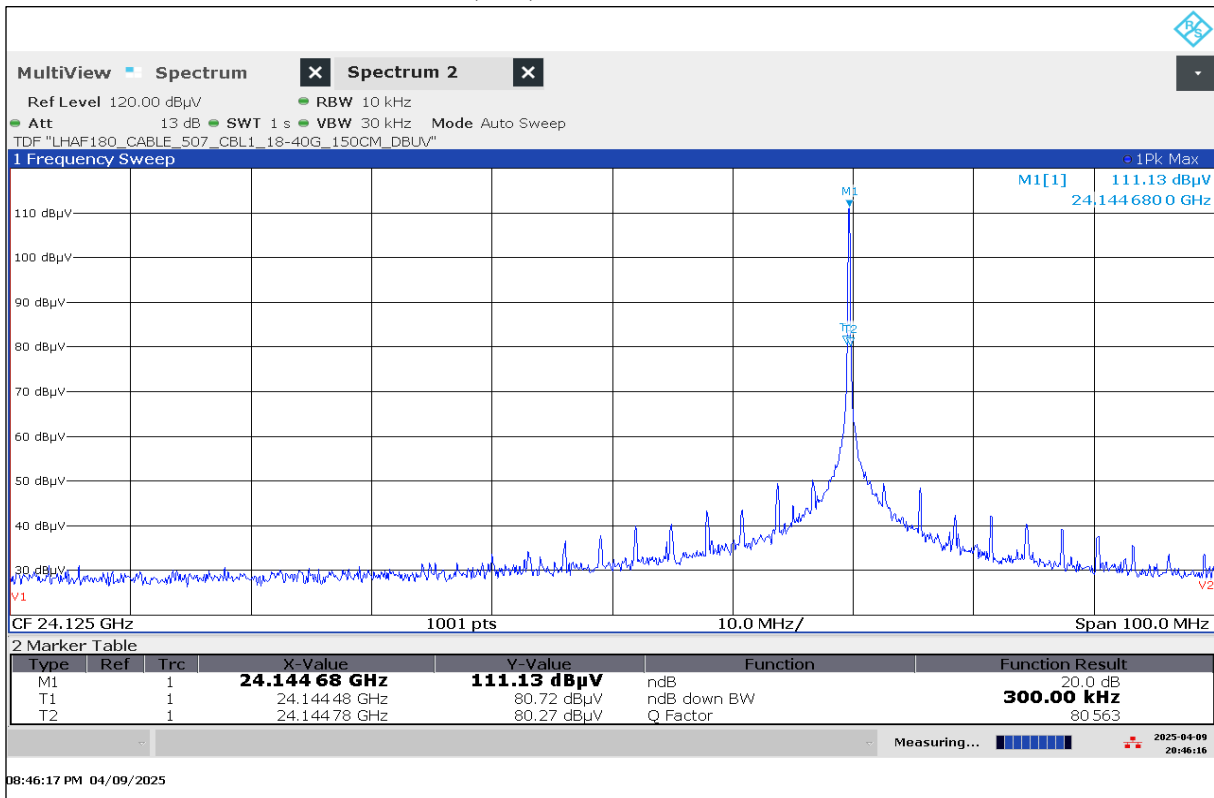
Plot 5: 20dB bandwidth at normal condition, NM, 20 °C / V_{nom} Plot 6: 20dB bandwidth at normal condition, NM, 20 °C / V_{min} 

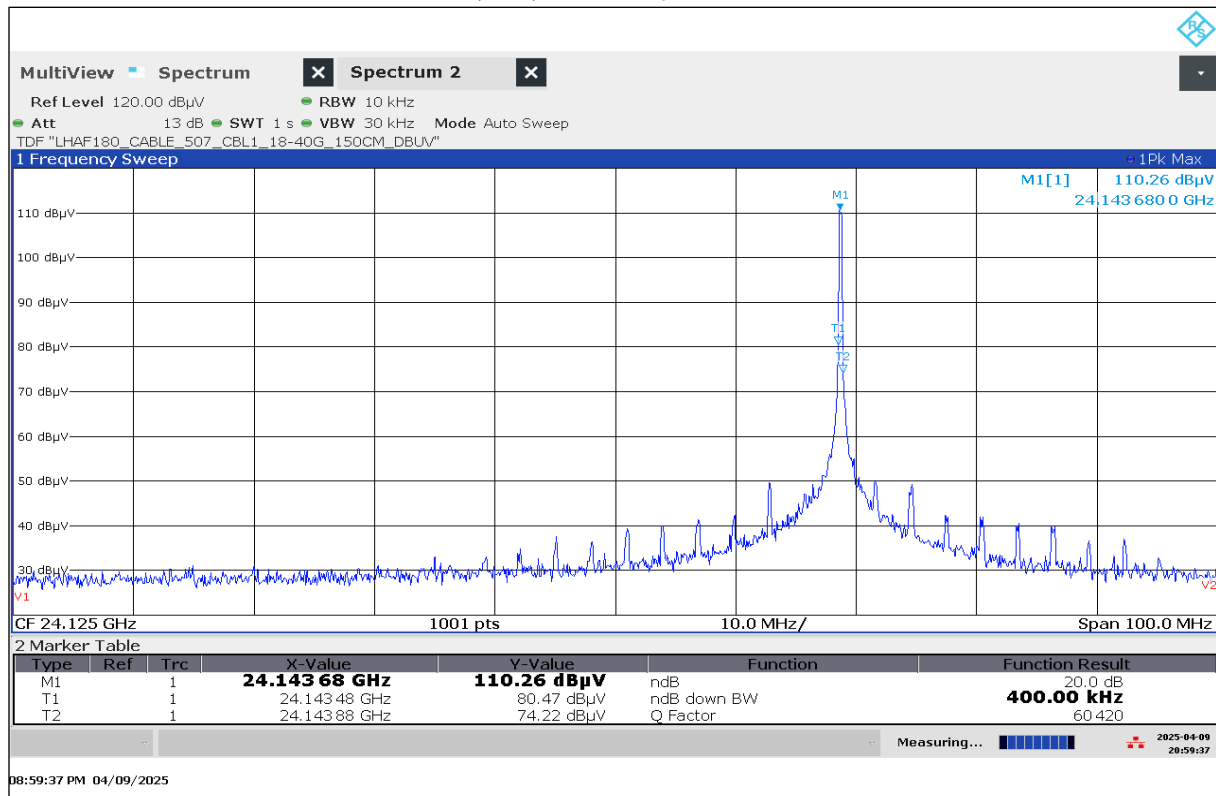
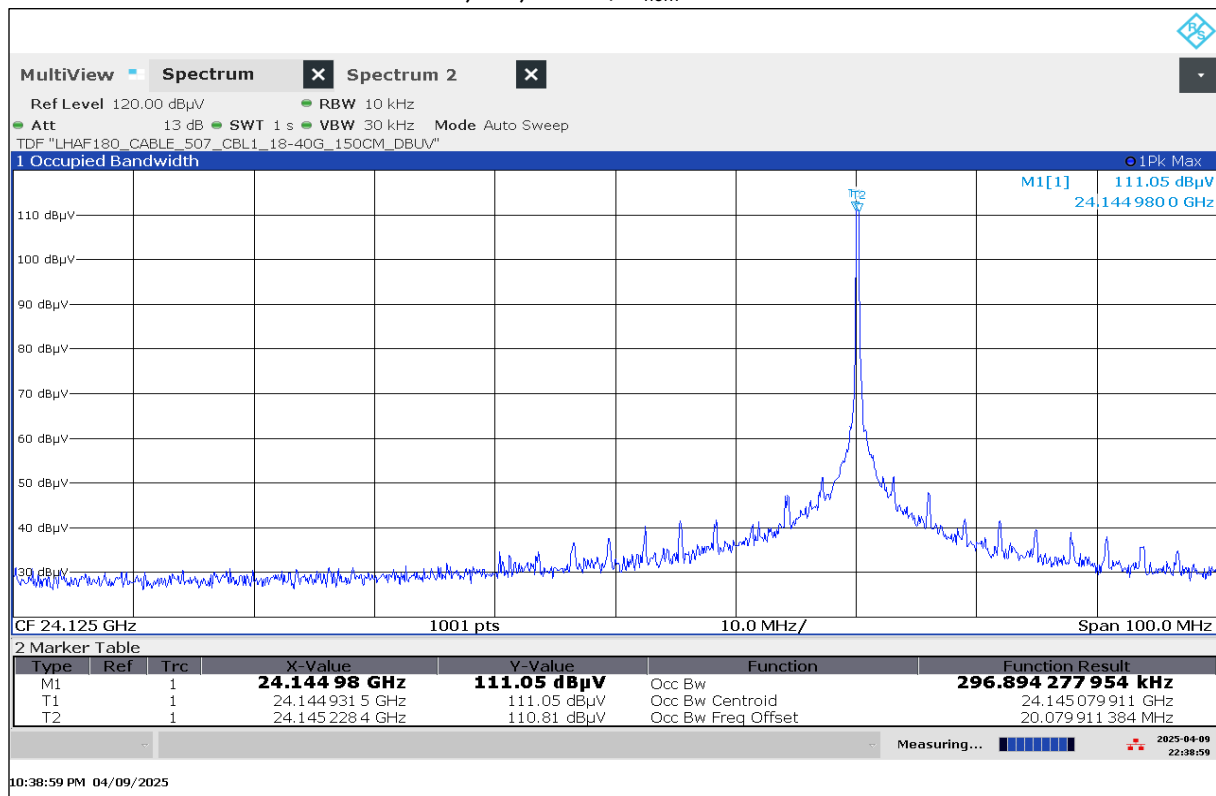
Plot 7: 20dB bandwidth at normal condition, NM, 20 °C / $V_{\max}$ Plot 8: 20dB bandwidth at normal condition, NM, 30 °C / V_{nom} 

Plot 9: 20dB bandwidth at normal condition, NM, 40 °C / V_{nom}

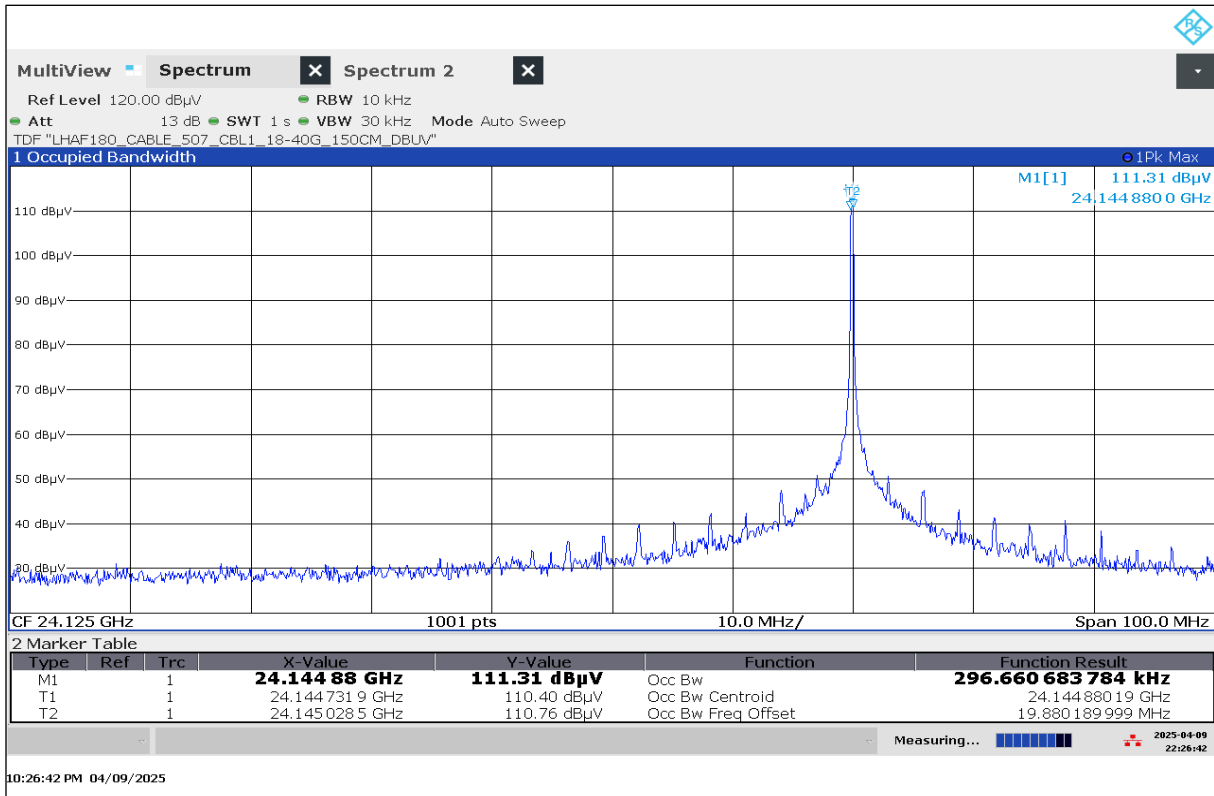


Plot 10: 20dB bandwidth at normal condition, NM, 50 °C / V_{nom}

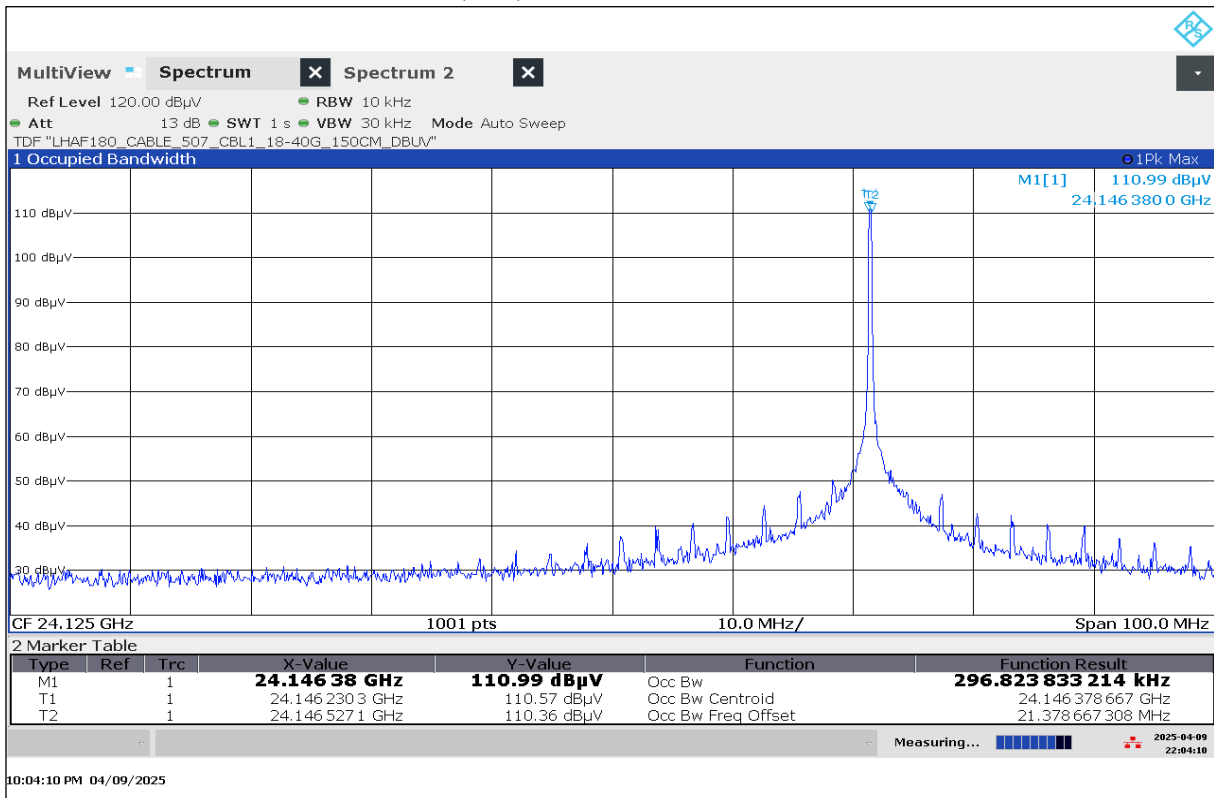


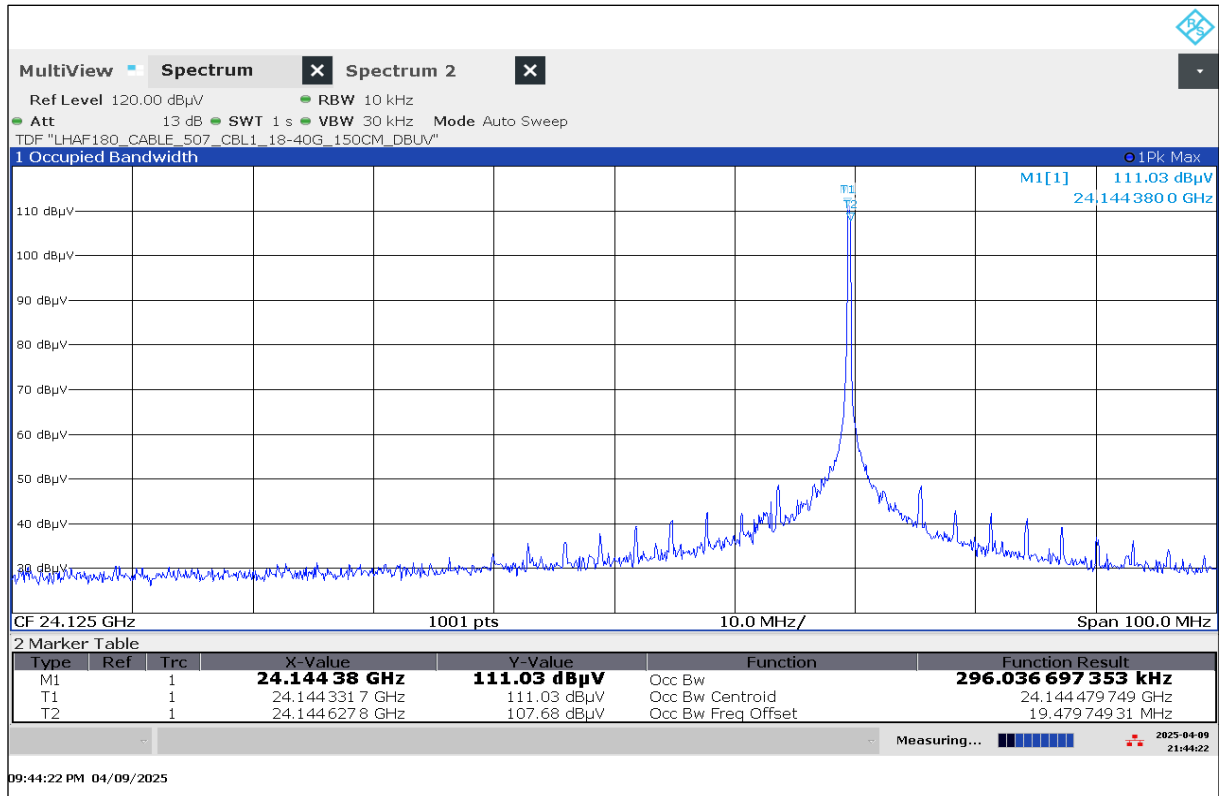
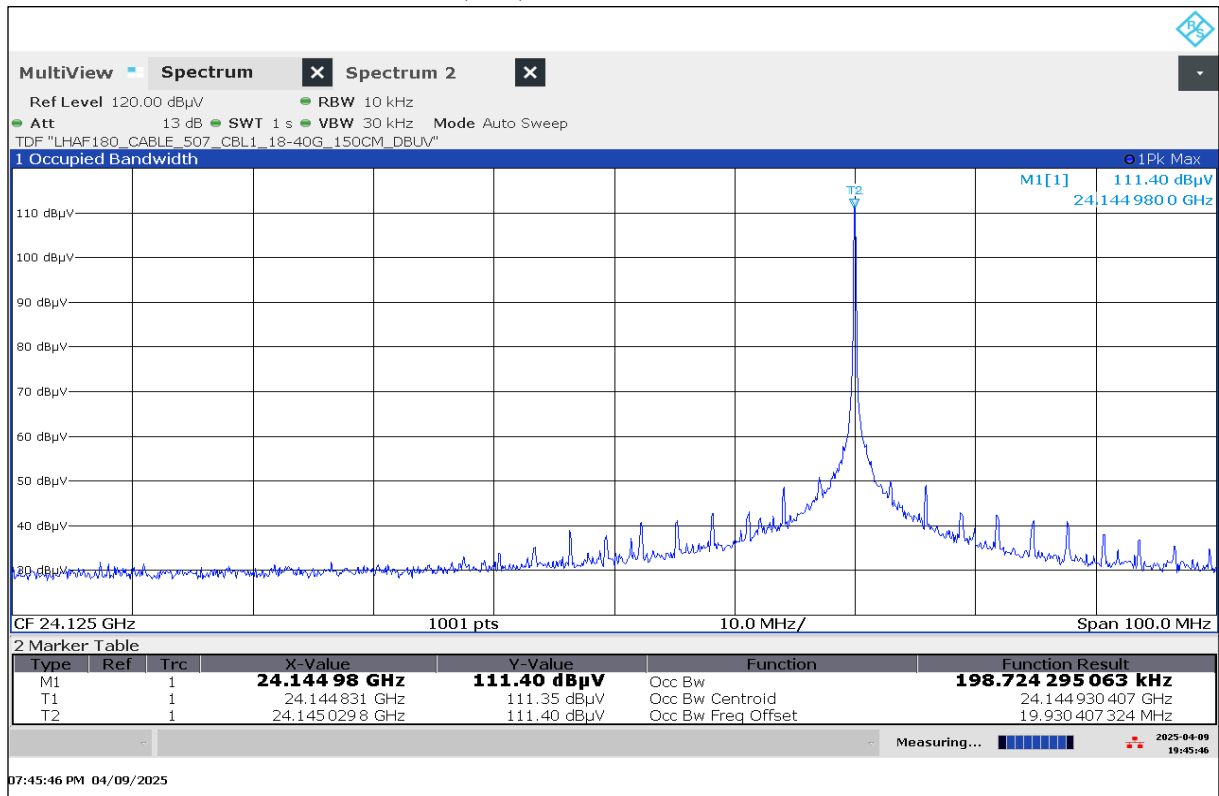
Plot 11: 20dB bandwidth at normal condition, NM, 60 °C / V_{nom} Plot 12: 99% bandwidth at normal condition, NM, -20 °C / V_{nom} 

Plot 13: 99% bandwidth at normal condition, NM, -10 °C / V_{nom}

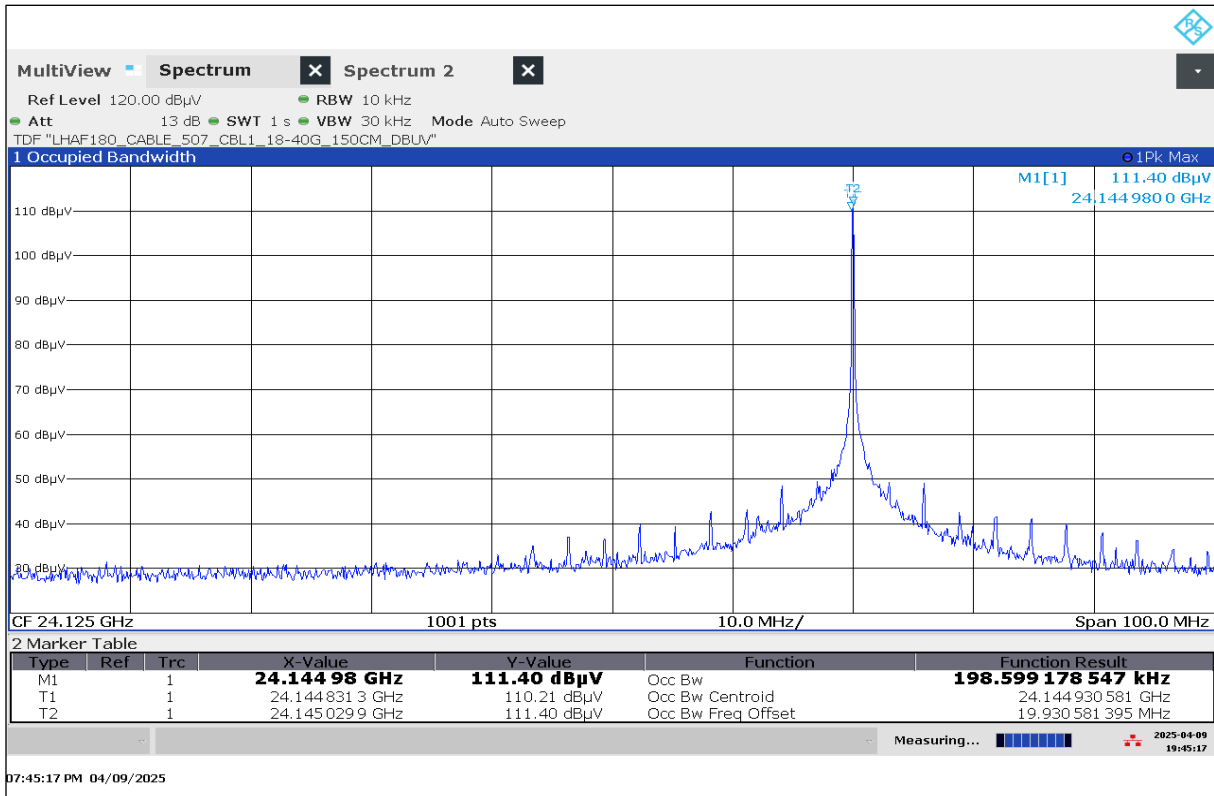


Plot 14: 99% bandwidth at normal condition, NM, 0 °C / V_{nom}

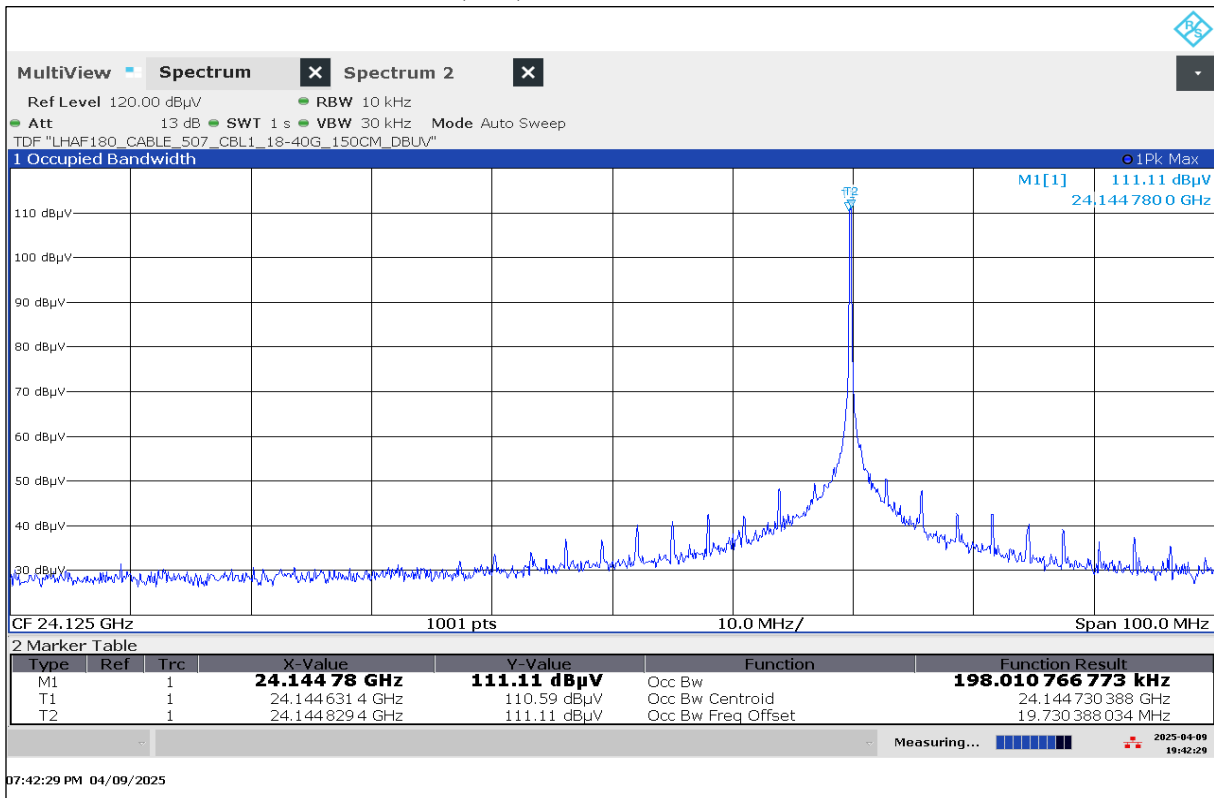


Plot 15: 99% bandwidth at normal condition, NM, 10 °C / V_{nom} Plot 16: 99% bandwidth at normal condition, NM, 20 °C / V_{nom} 

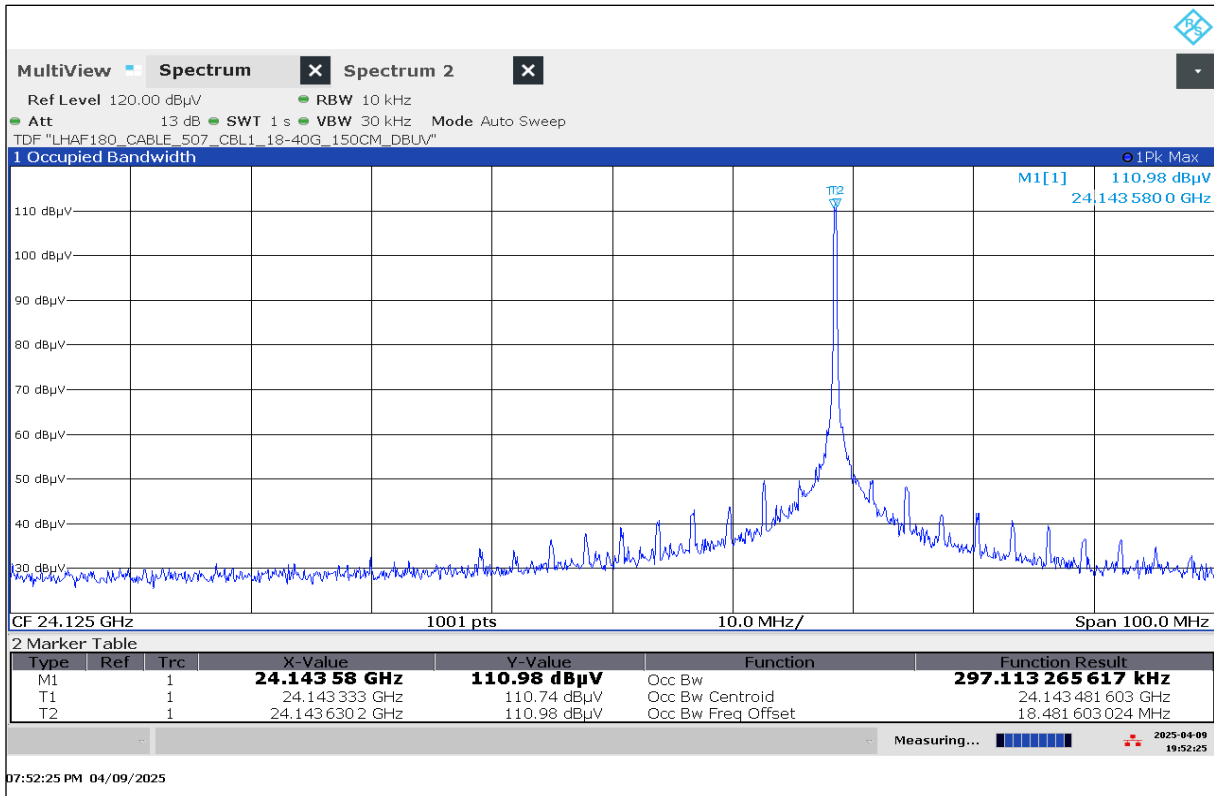
Plot 17: 99% bandwidth at normal condition, NM, 20 °C / $V_{\min}$



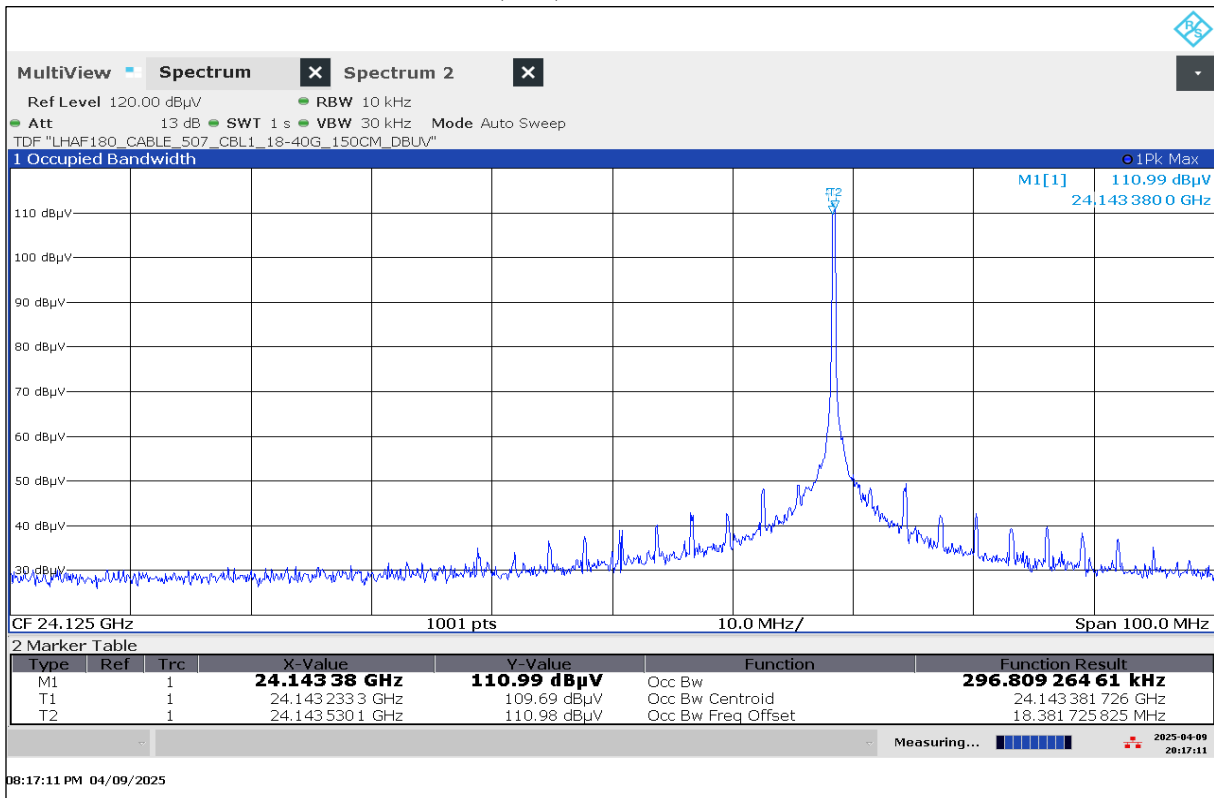
Plot 18: 99% bandwidth at normal condition, NM, 20 °C / $V_{\max}$

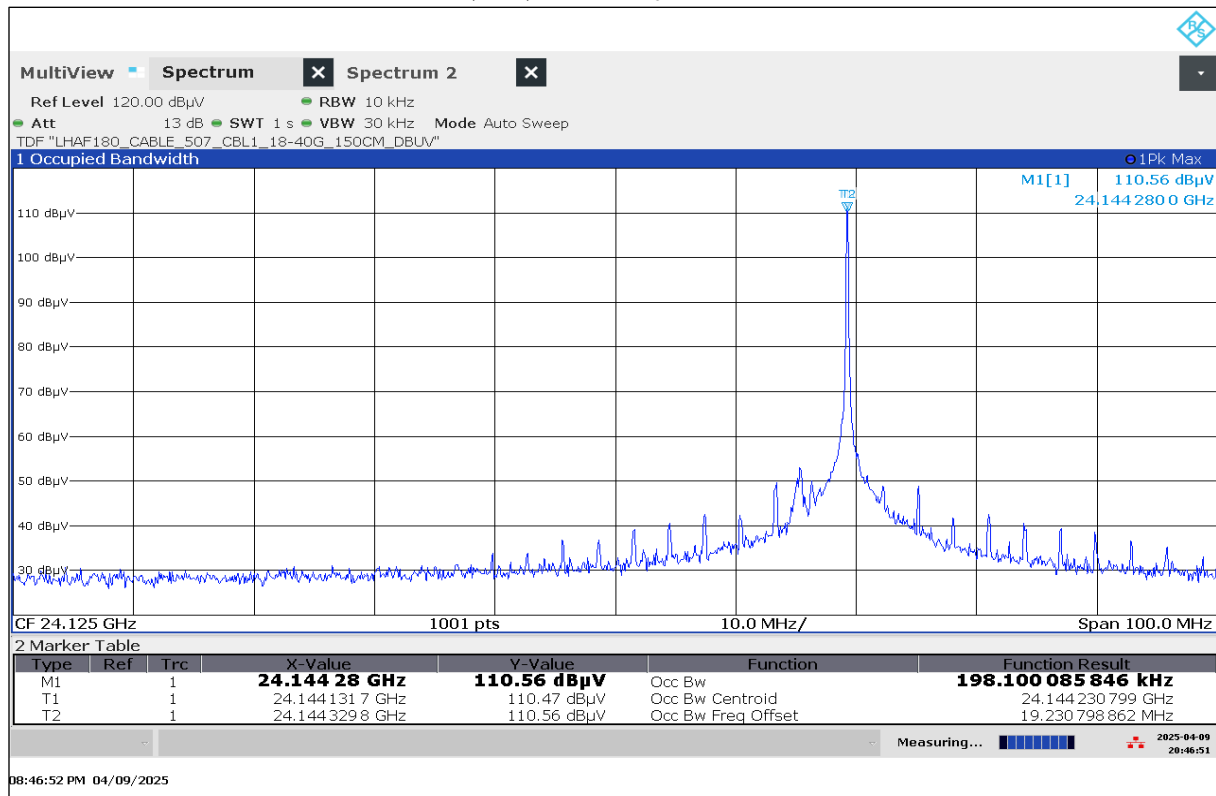
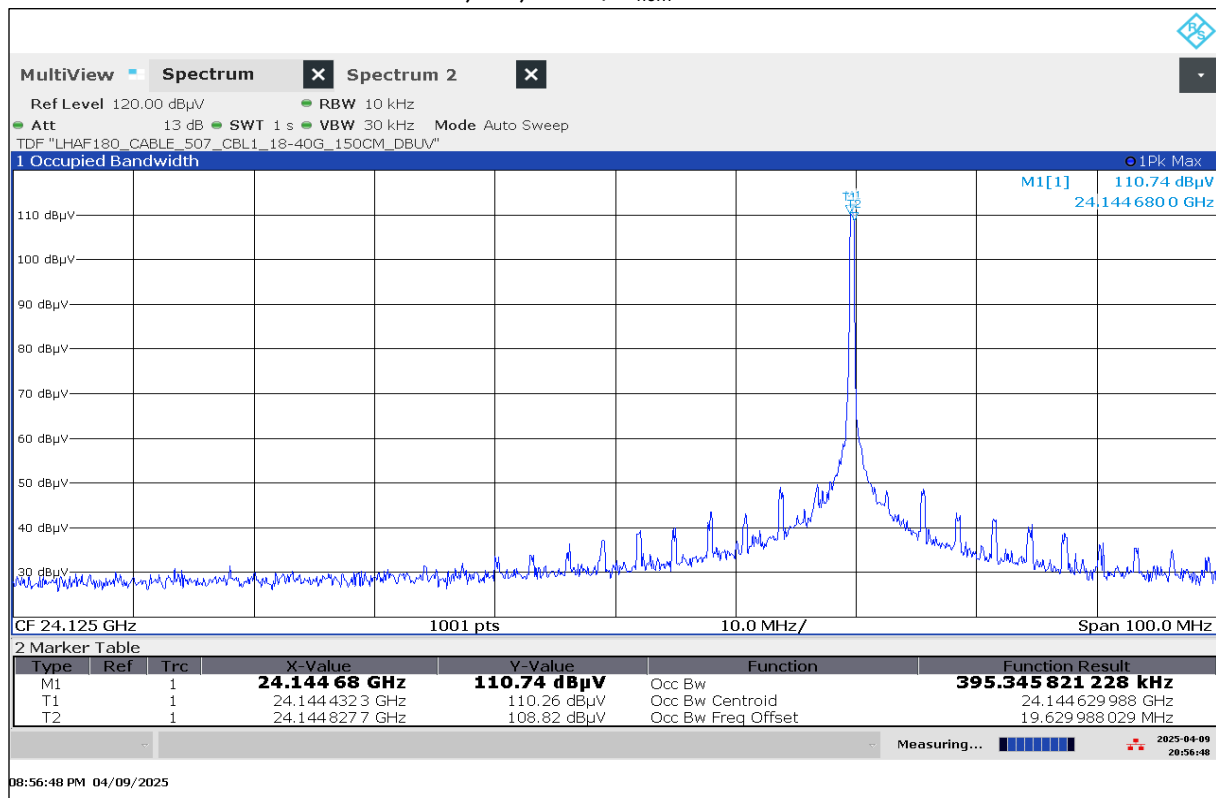


Plot 19: 99% bandwidth at normal condition, NM, 30 °C / V_{nom}



Plot 20: 99% dB bandwidth at normal condition, NM, 40 °C / V_{nom}



Plot 21: 99% bandwidth at normal condition, NM, 50 °C / V_{nom} Plot 22: 99% bandwidth at normal condition, NM, 60 °C / V_{nom} 

12.2 Field strength of fundamental emission

Description:

Measurement of the maximum radiated field strength of the wanted signal (fundamental emission).

Limits and provisions:

§15.245 (b):

The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental frequency (MHz)	Field strength of fundamental (mV/m)
902-928	500
2435-2465	500
5785-5815	500
10500-10550	2500
24075-24175	2500

§15.245 (b)(2):

Field strength limits are specified at a distance of 3 meters.

§15.245 (b)(4):

The emission limits shown above are based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply.

§15.35(b):

Unless otherwise specified, on any frequency or frequencies above 1000 MHz, the radiated emission limits are based on the use of measurement instrumentation employing an average detector function. Unless otherwise specified, measurements above 1000 MHz shall be performed using a minimum resolution bandwidth of 1 MHz. When average radiated emission measurements are specified in this part, including average emission measurements below 1000 MHz, there also is a limit on the peak level of the radio frequency emissions. Unless otherwise specified, e.g., see §§ 15.250, 15.252, 15.253(d), 15.255, 15.256, and 15.509 through 15.519, the limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device, e.g., the total peak power level. Note that the use of a pulse desensitization correction factor may be needed to determine the total peak emission level. The instruction manual or application note for the measurement instrument should be consulted for determining pulse desensitization factors, as necessary.

§15.31 (c):

Except as otherwise indicated in §15.256, for swept frequency equipment, measurements shall be made with the frequency sweep stopped at those frequencies chosen for the measurements to be reported.

RSS-210 F.1 Field disturbance sensors

This section sets out the requirements for field disturbance sensors operating in the frequency bands shown in the table below. [...]

Devices shall comply with the following requirements:

- a. The average field strength of fundamental [...] emissions measured at 3 m shall not exceed the limits shown in the table below

Field strength limits for field disturbance sensors operating at various frequencies	
Fundamental frequency (MHz)	Field strength of fundamental emissions (mV/m)
902-928	500
2435-2465	500
5785-5815	500
10500-10550	2500
24075-24175	2500

RSS-210 F.2 Speed radar meters

This section sets out the requirements for speed radar meters operating in the frequency bands 10.5-10.55 GHz, 24.075-24.175 GHz and 33.4-36 GHz.

Devices shall comply with the following requirements:

- a. The average field strength of emissions measured at 3m shall not exceed:
 - i. 2500 mV/m for fundamental emissions for devices operating in all frequency bands

RSS-GEN 8.1:

[...] If an average limit is specified for the EUT, then the peak emission shall also be measured with instrumentation properly adjusted for factors such as pulse desensitization to ensure that the peak emission is less than 20 dB above the average limit. [...]

Applicable limits according to §15.245 (b) / RSS-210 F.1 / RSS-210 F.2:

Fundamental frequency (MHz)	Field strength of fundamental		Distance
	average value	peak value	
24075-24175	2500 mV/m (128 dBµV/m)	25000 mV/m (148 dBµV/m)	3 m

Measurement:

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

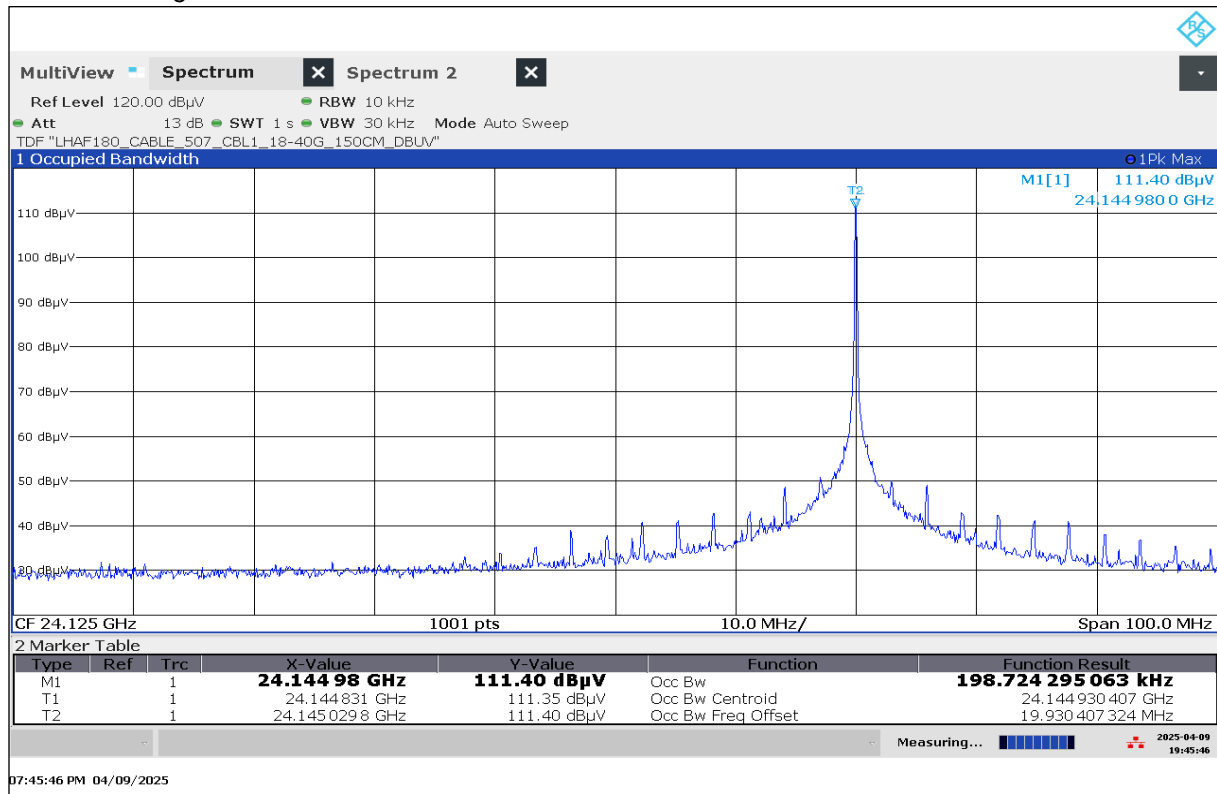
Measurement results:

EUT	Frequency [GHz]	Field strength of fundamental @ 3m [dB μ V/m]	Applicable limit	Margin [dB]	Plot
		Average value			
1	24.145	110.91	2500 mV/m (128 dB μ V/m)	17.09	25

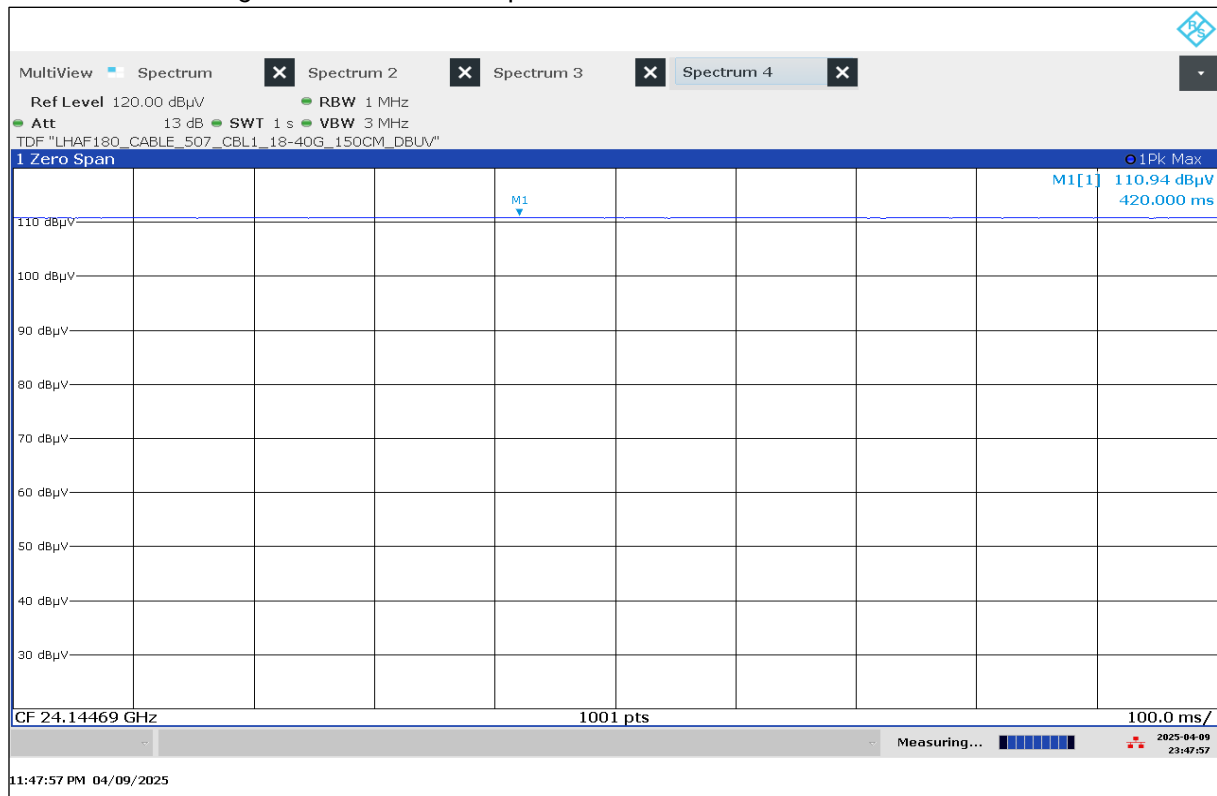
EUT	Frequency [GHz]	Field strength of fundamental @ 3m [dB μ V/m]	Applicable limit	Margin [dB]	Plot
		Peak value			
1	24.145	110.94	25000 mV/m (148 dB μ V/m)	37.06	24

Verdict: Compliant

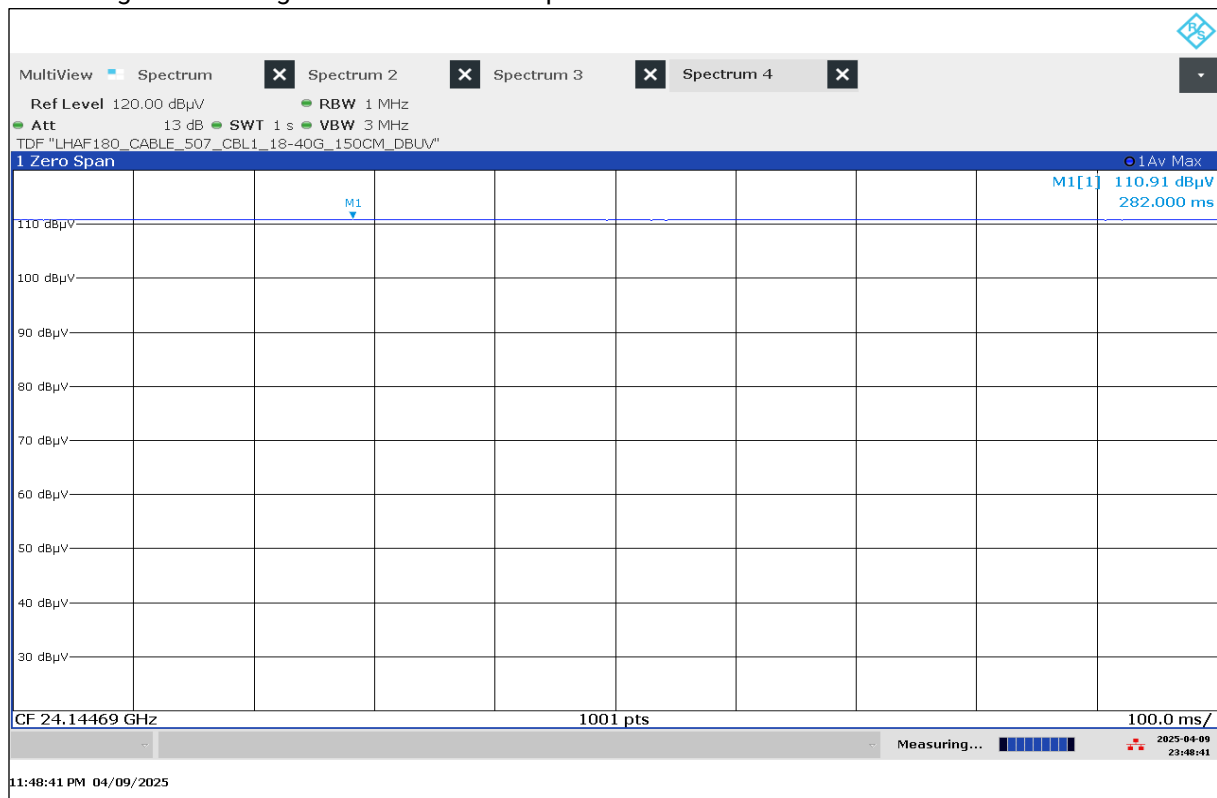
Plot 23: Field strength of fundamental emission



Plot 24: Peak Field strength measured in zero span



Plot 25: Average Field strength measured in zero span



12.3 Field strength of emissions (radiated outside of the specified frequency bands)

Description:

Measurement of the field strength of emissions radiated outside of the specified frequency bands (in transmit mode).

Limits and provisions:

§15.245 (b):

The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental frequency (MHz)	Field strength of fundamental (mV/m)	Field strength of harmonics (mV/m)
902-928	500	1.6
2435-2465	500	1.6
5785-5815	500	1.6
10500-10550	2500	25.0
24075-24175	2500	25.0

- (1) Regardless of the limits shown in the table of §15.245 (b), harmonic emissions in the restricted bands below 17.7 GHz, as specified in §15.205, shall not exceed the field strength limits shown in §15.209. Harmonic emissions in the restricted bands at and above 17.7 GHz shall not exceed the following field strength limits:
 - (i) For the second and third harmonics of field disturbance sensors operating in the 24075-24175 MHz band and for other field disturbance sensors designed for use only within a building or to open building doors, 25.0 mV/m.
 - (ii) For all other field disturbance sensors, 7.5 mV/m.
 - (iii) Field disturbance sensors designed to be used in motor vehicles or aircraft must include features to prevent continuous operation unless their emissions in the restricted bands, other than the second and third harmonics from devices operating in the 24075-24175 MHz band, fully comply with the limits given in § 15.209. Continuous operation of field disturbance sensors designed to be used in farm equipment, vehicles such as fork lifts that are intended primarily for use indoors or for very specialized operations, or railroad locomotives, railroad cars and other equipment which travels on fixed tracks is permitted. A field disturbance sensor will be considered not to be operating in a continuous mode if its operation is limited to specific activities of limited duration (e.g., putting a vehicle into reverse gear, activating a turn signal, etc.).
- (2) Field strength limits are specified at a distance of 3 meters.
- (3) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.
- (4) The emission limits shown in §15.245 (b) are based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply.

§15.205(d)(8):

Devices operated in the 24.075–24.175 GHz band under § 15.245 are exempt from complying with the requirements of this section for the 48.15–48.35 GHz and 72.225–72.525 GHz bands only, and shall not exceed the limits specified in § 15.245(b).

§15.205(e):

Harmonic emissions appearing in the restricted bands above 17.7 GHz from field disturbance sensors operating under the provisions of § 15.245 shall not exceed the limits specified in § 15.245(b).

§15.209 (a):

Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table

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
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54–72 MHz, 76–88 MHz, 174–216 MHz or 470–806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§ 15.231 and 15.241

§15.209(b):

In the emission table above, the tighter limit applies at the band edges.

§15.209(c):

The level of any unwanted emissions from an intentional radiator operating under these general provisions shall not exceed the level of the fundamental emission. For intentional radiators which operate under the provisions of other sections within this part and which are required to reduce their unwanted emissions to the limits specified in this table, the limits in this table are based on the frequency of the unwanted emission and not the fundamental frequency. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.

§15.209(d):

The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

§15.31 (c):

Except as otherwise indicated in §15.256, for swept frequency equipment, measurements shall be made with the frequency sweep stopped at those frequencies chosen for the measurements to be reported.

§15.33(a):

For an intentional radiator, the spectrum shall be investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to at least the frequency shown in this paragraph: [...]

(2) If the intentional radiator operates at or above 10 GHz and below 30 GHz: to the fifth harmonic of the highest fundamental frequency or to 100 GHz, whichever is lower.

RSS-210 F.1 Field disturbance sensors

Devices shall comply with the following requirements:

- a. The average field strength of fundamental and harmonic emissions measured at 3 m shall not exceed the limits shown in table below

Field strength limits for field disturbance sensors operating at various frequencies		
Fundamental frequency (MHz)	Field strength of fundamental emissions (mV/m)	Field strength of harmonic emissions (mV/m)
902-928	500	1.6
2435-2465	500	1.6
5785-5815	500	1.6
10500-10550	2500	25
24075-24175	2500	25

- b. Additionally, harmonic emissions falling into restricted frequency bands listed in RSS-Gen and that are below 17.7 GHz shall meet the general field strength limits specified in RSS-Gen, regardless of the limits given in the table above.
- c. Harmonic emissions falling into restricted frequency bands listed in RSS-Gen and that are at or above 17.7 GHz shall not exceed the following field strength limits measured at a distance of 3 m:
- 25 mV/m for the second and third harmonic emissions of field disturbance sensors operating in the band 24075-24175 MHz and for devices designed for use only within buildings or for intermittent use, such as to open building doors
 - 7.5 mV/m for all other devices
- e. Emissions radiated outside of the specified frequency bands, except for harmonic emissions, shall be attenuated by at least 50 dB below the level of the fundamental emissions or to the general field strength limits specified in RSS-Gen, whichever is less stringent.

RSS-210 F.2 Speed radar meters

This section sets out the requirements for speed radar meters operating in the frequency bands 10.5-10.55 GHz, 24.075-24.175 GHz and 33.4-36 GHz.

Devices shall comply with the following requirements:

- a. The average field strength of emissions measured at 3m shall not exceed:
- 2500 mV/m for fundamental emissions for devices operating in all frequency bands
 - 25 mV/m for harmonic emissions for devices operating in the bands 10.5-10.55 GHz, 24.075-24.175 GHz and 80 mV/m for harmonic emissions for devices operating in the band 33.4-36 GHz
- b. Harmonic emissions falling into restricted frequency bands listed in RSS-Gen and that are below 17.7 GHz shall meet the general field strength limits specified in RSS-Gen.
- c. Harmonic emissions falling into restricted frequency bands listed in RSS-Gen and that are at or above 17.7 GHz shall not exceed the following field strength limits measured at a distance of 3 m:
- 25 mV/m for the second and third harmonic emissions of devices operating in the band 24.075-24.175 GHz and for the second harmonic emission of devices operating in the band 33.4-36.0 GHz
 - 7.5 mV/m for all other devices

- d. Emissions radiated outside of these specified operating frequency bands, except for harmonic emissions, shall be attenuated by at least 50 dB below the level of the fundamental emissions or to the general field strength limits specified in RSS-Gen, whichever is less stringent.

RSS Gen 6.13.2 Frequency range for measuring unwanted emission

In measuring unwanted emissions, the spectrum shall be investigated from 30 MHz or the lowest radio frequency signal generated or used in the equipment, whichever is lower, without going below 9 kHz, up to at least the applicable frequency given below: [...]

- b. If the equipment operates at or above 10 GHz and below 30 GHz: to the fifth harmonic of the highest fundamental frequency or to 100 GHz, whichever is lower.

RSS-Gen 8.9 Transmitter emission limits

Except where otherwise indicated in the applicable RSS, radiated emissions shall comply with the field strength limits shown in table 5 and table 6. Additionally, the level of any transmitter unwanted emission shall not exceed the level of the transmitter's fundamental emission.

General field strength limits at frequencies below 30 MHz		
Frequency (MHz)	Magnetic field strength (H-Field) ($\mu\text{A/m}$)	Measurement distance (m)
0.009 – 0.490 ^{Note1}	6.37/F (F in kHz)	300
0.490 – 1.705	63.7/F (F in kHz)	30
1.705 – 30.0	0.08	30
Note 1: The emission limits for the ranges 9-90 kHz and 110-490 kHz are based on measurements employing a linear average detector.		

General field strength limits at frequencies above 30 MHz		
Frequency (MHz)	Field Strength ($\mu\text{V/m}$)	Measurement distance (m)
30 – 88	100	3
88 – 216	150	3
216 – 960	200	3
Above 960	500	3

Calculation of limits according to §15.245 (b)(3) / RSS-210 F.1e / RSS-210 F.2d:

$$E_{\text{pot}} = E_{\text{fund}} - 50 \text{ dB}$$

- E_{pot} : Potential limit according to §15.245 (b)(3) / RSS-210 F.1e / RSS-210 F.2d
- E_{fund} : Measured field strength of fundamental emission @ 3m (see chapter 12.2)

EUT	Measured field strength of fundamental emission @ 3m [dBμV/m]	Potential limit according to §15.245 (b)(3) / RSS-210 F.1e / RSS-210 F.2d (field strength @ 3m) [dBμV/m]	Limit according to §15.209 / RSS-Gen (field strength @ 3m) [dBμV/m]
	average value	average value	average value
1	110.91	60.91	54 (f > 1GHz)

Note:

- The limit value with the lesser attenuation compared to the fundamental field strength applies.
- The level of any unwanted emissions shall not exceed the level of the fundamental frequency.

Applicable limits according to §15.245 (b)(1)(ii) / RSS-210 F.1:

For all other field disturbance sensors, 7.5 mV/m

EUT	Harmonics (field strength @ 3m) [dBμV/m]		Emissions radiated outside of the specified frequency bands (except for harmonics) (field strength @ 3m) [dBμV/m]	
	average value	peak value	average value	peak value
1	60.91	80.91	77.5	97.5

Measurement:

Measurement parameter	
Detector:	Quasi Peak / Peak / Linear average
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:

Emissions radiated outside of the specified frequency bands:

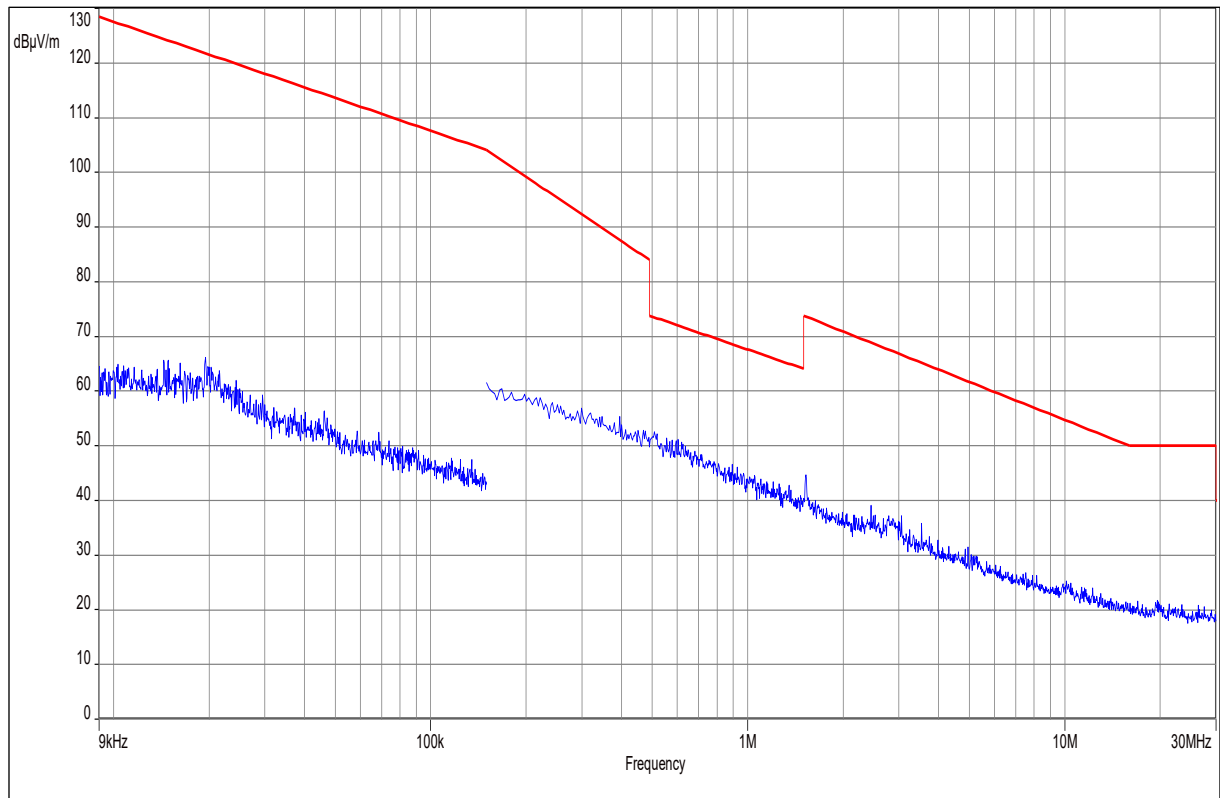
Frequency f [MHz]	Detector	Measured level [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]
Please refer to the following plots for more information on the level of spurious emissions				
-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-

Note:

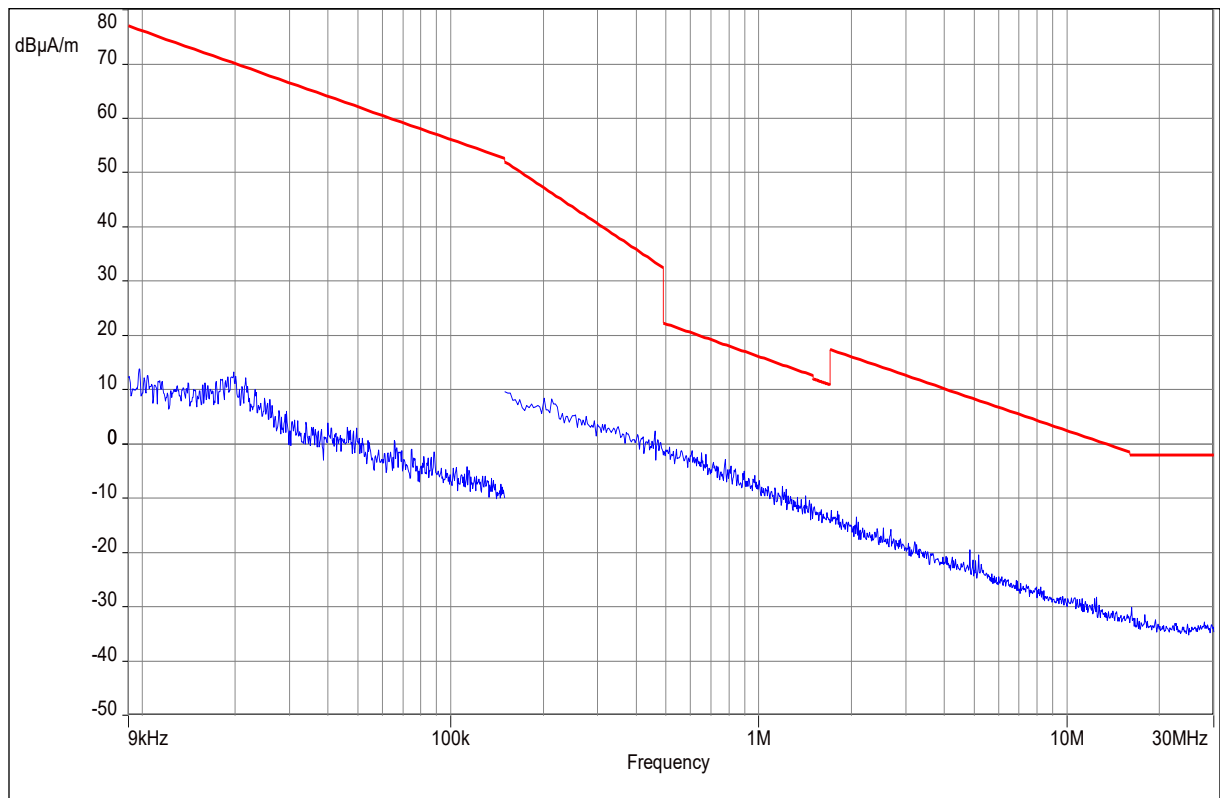
- The measured level and the limit value correspond to a field strength at the distance specified in the provisions (see section "limits and provisions" above).

Verdict: Compliant

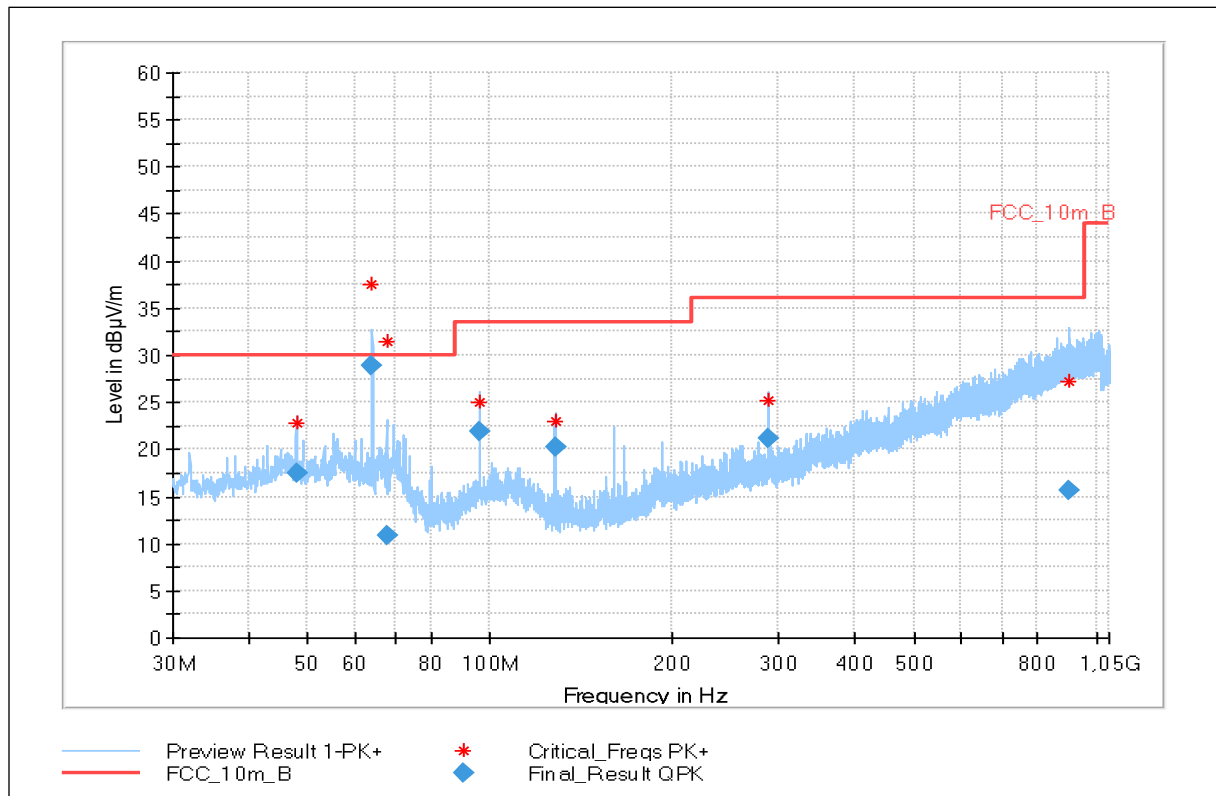
Plot 26: 9 kHz to 30 MHz for FCC limits



Plot 27: 9 kHz to 30 MHz for RSS limits

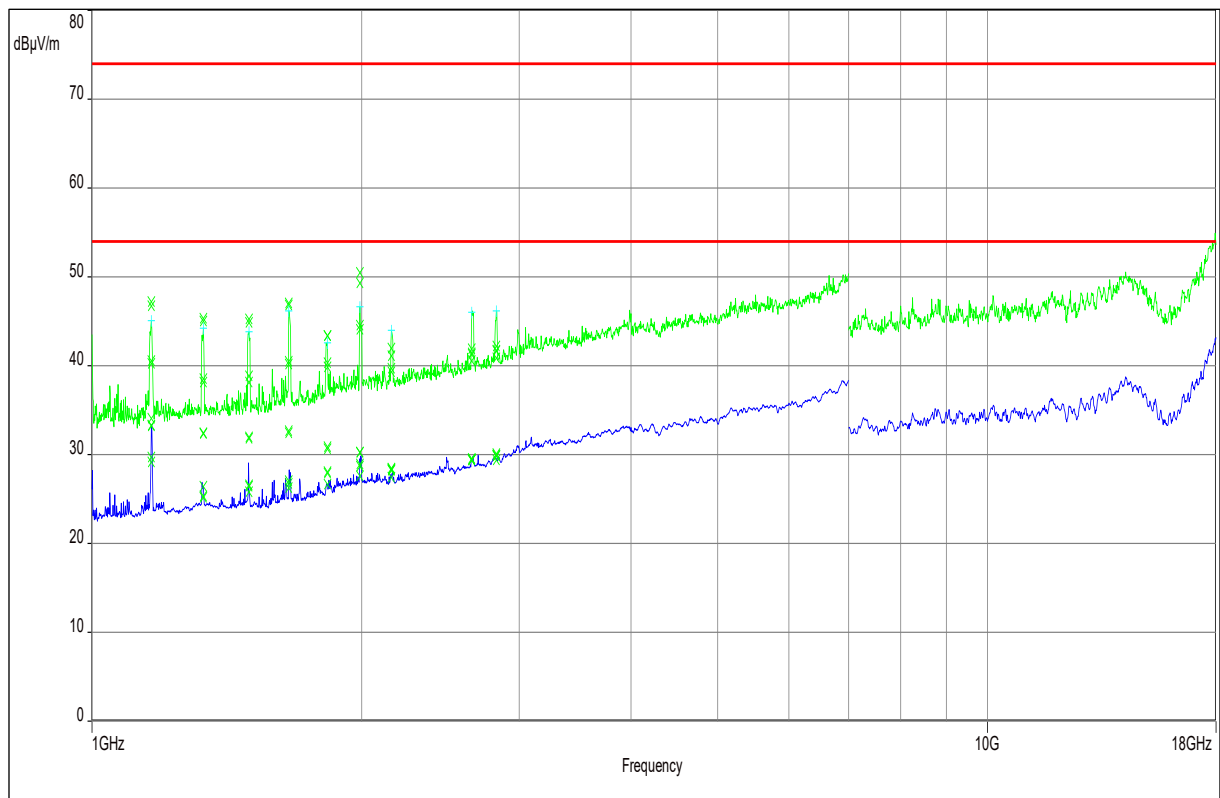


Plot 28: 30 MHz to 1 GHz



Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
48.013	17.44	30.0	12.6	1000	120.0	141.0	V	179	15
63.982	28.82	30.0	1.2	1000	120.0	400.0	V	270	12
67.849	10.81	30.0	19.2	1000	120.0	400.0	V	342	11
96.003	21.90	33.5	11.6	1000	120.0	106.0	V	270	13
127.983	20.19	33.5	13.3	1000	120.0	157.0	V	45	10
287.979	21.14	36.0	14.9	1000	120.0	127.0	V	135	15
902.925	15.70	36.0	20.3	1000	120.0	196.0	V	93	25

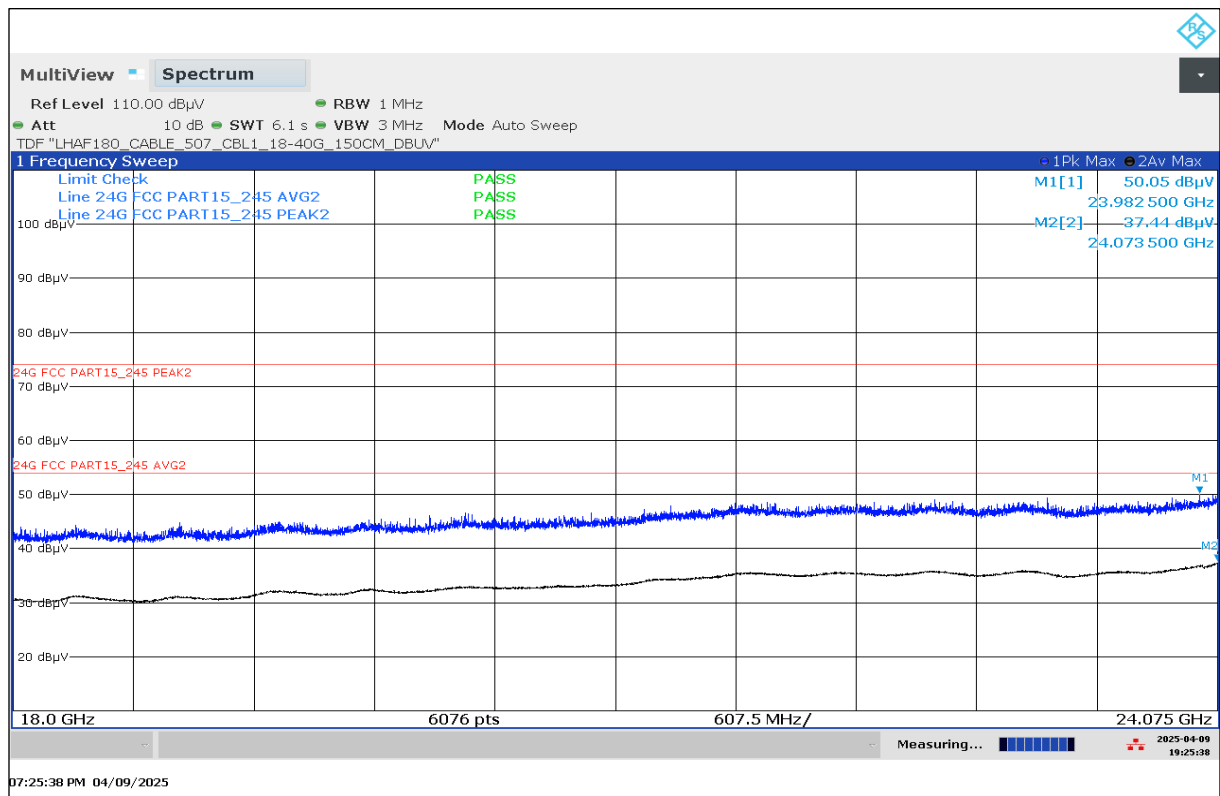
Plot 29: 1 GHz to 18 GHz



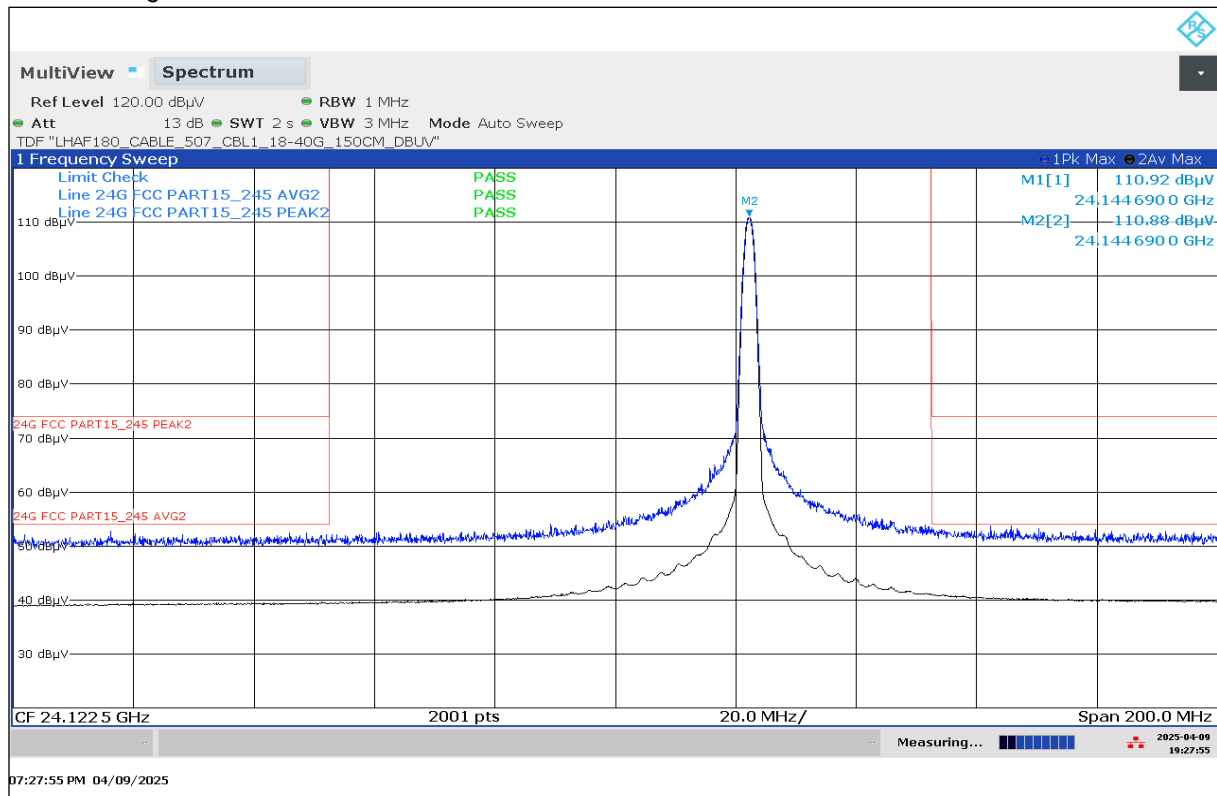
Note:

- Blue Trace: AV detector (Limit 54 dB μ V/m)
- Green Trace: PK detector (Limit 74 dB μ V/m)

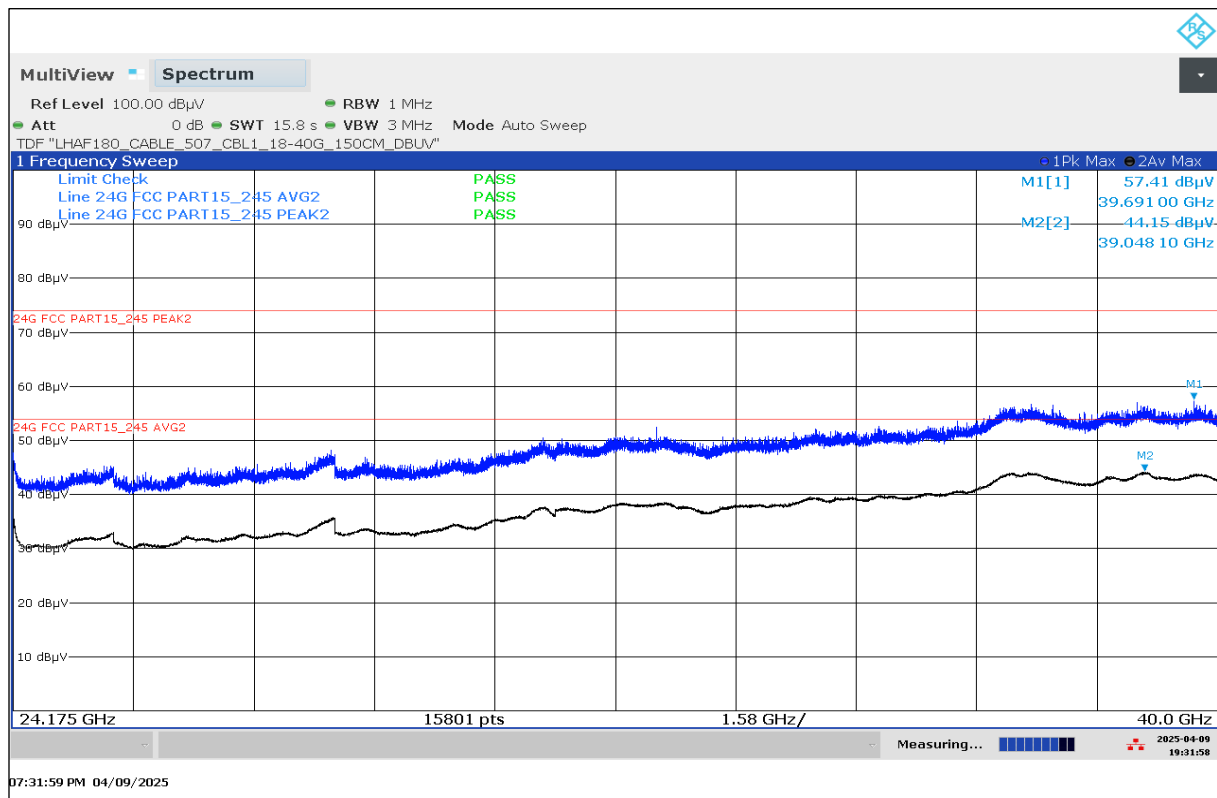
Plot 30: 18 GHz to 24.075 GHz:



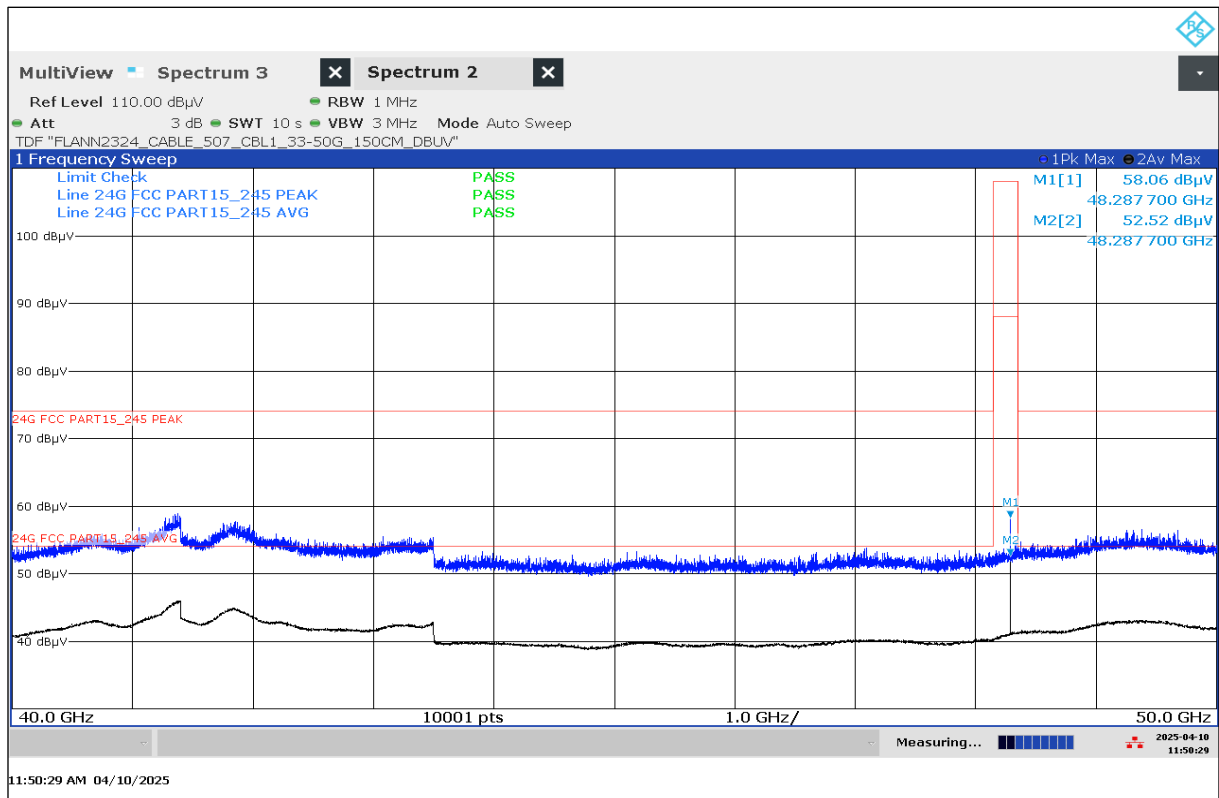
Plot 31: Band edges



Plot 32: 24.175 GHz to 40 GHz

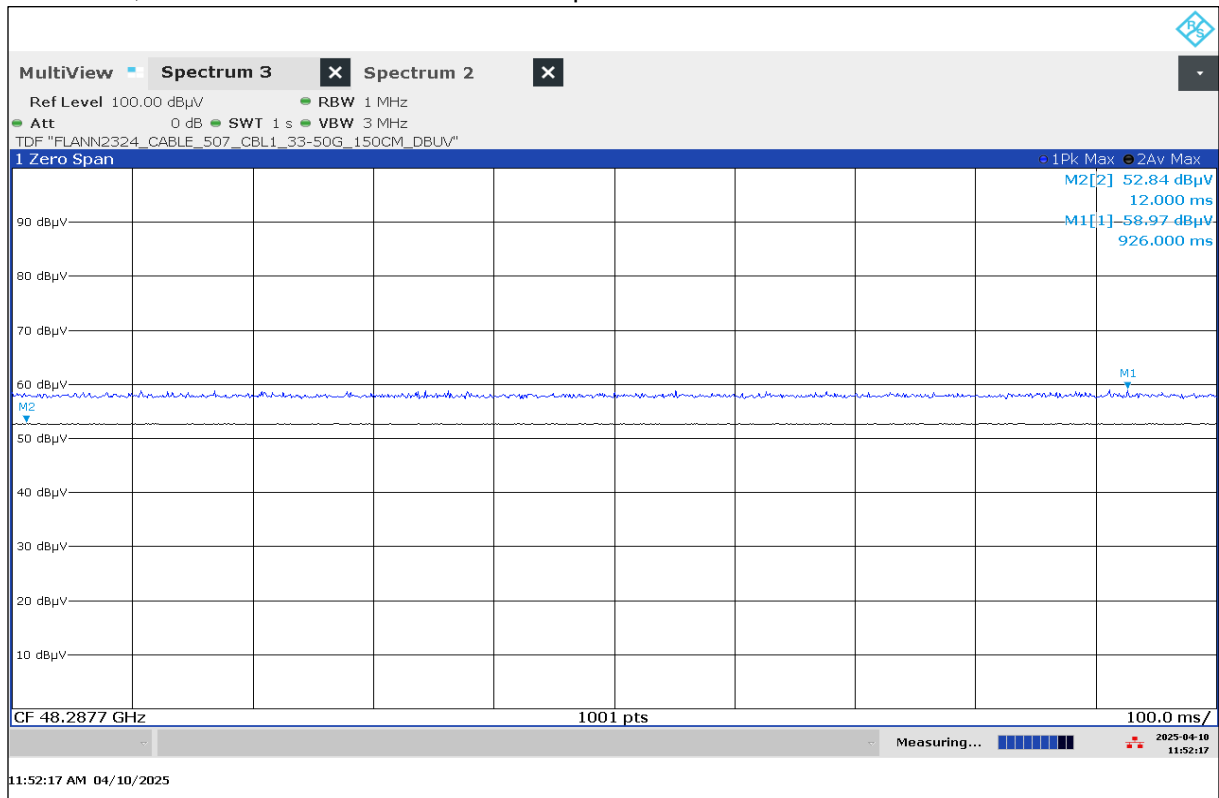


Plot 33: 40 GHz to 50 GHz



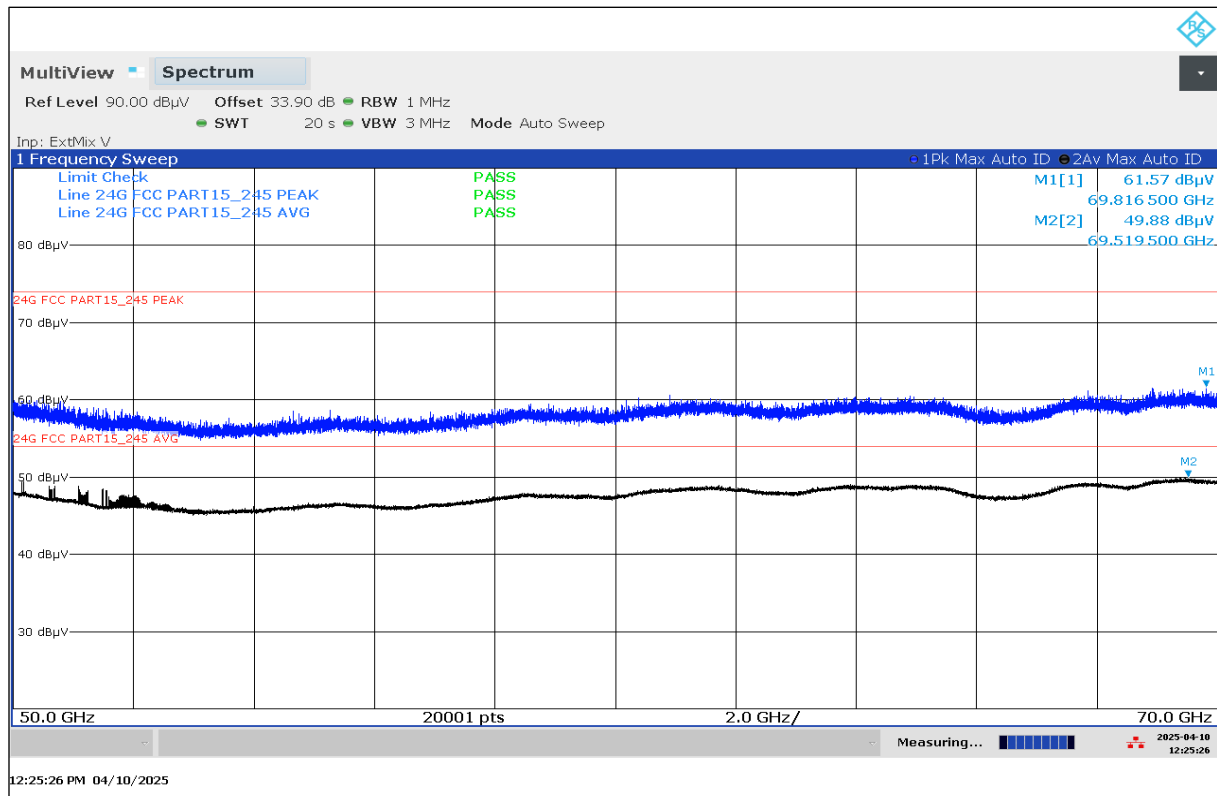
Harmonics limit is 97.5 dBμV/m Peak and 77.5 dBμV/m Average, therefore, the measurement is passed

Plot 34: 48 GHz, PK and AV value measured in zero span

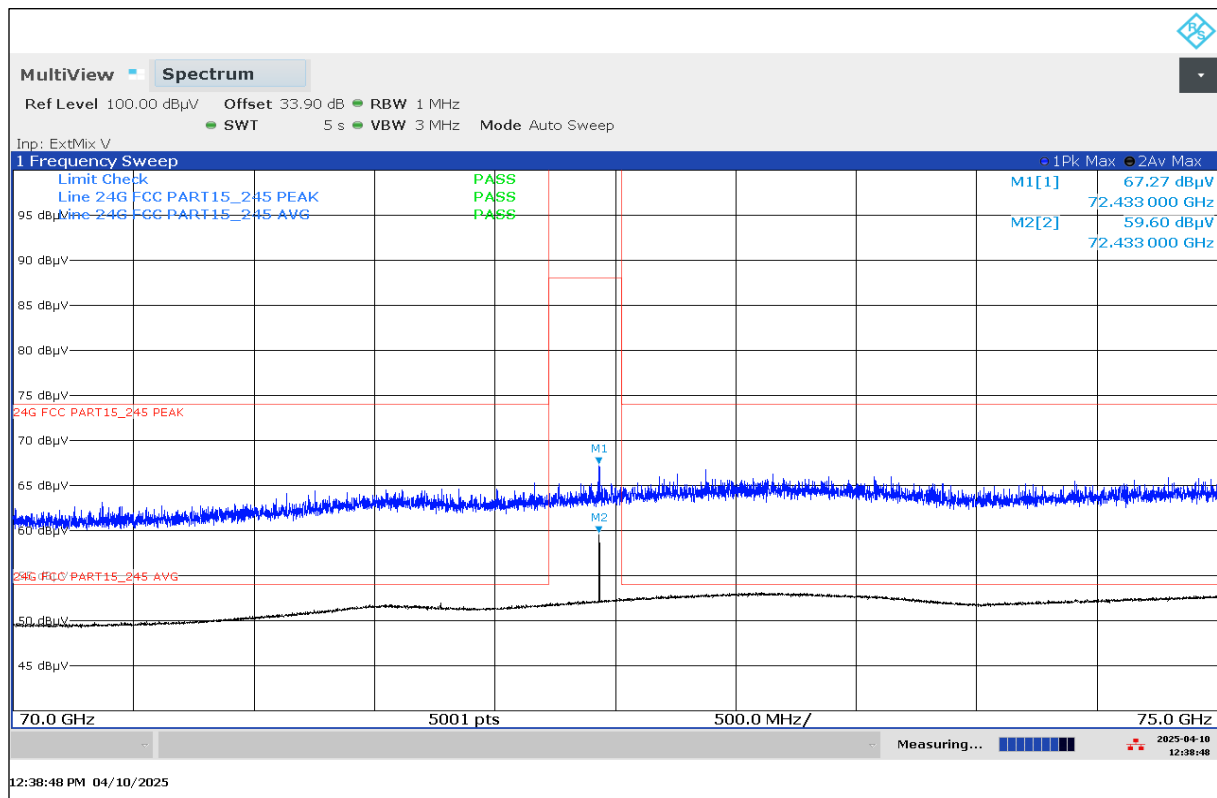


Harmonics limit is 97.5 dBμV/m Peak and 77.5 dBμV/m Average, therefore, the measurement is passed

Plot 35: 50 GHz to 70 GHz

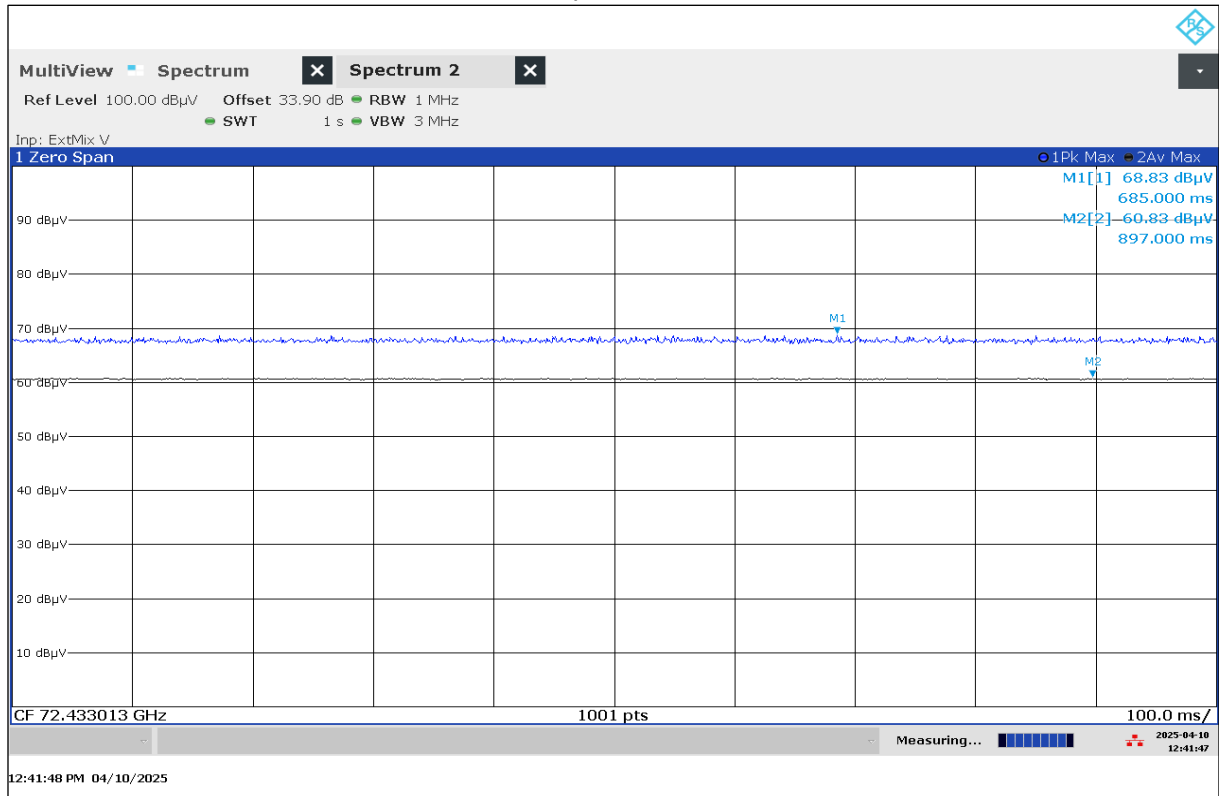


Plot 36: 70 GHz to 75 GHz



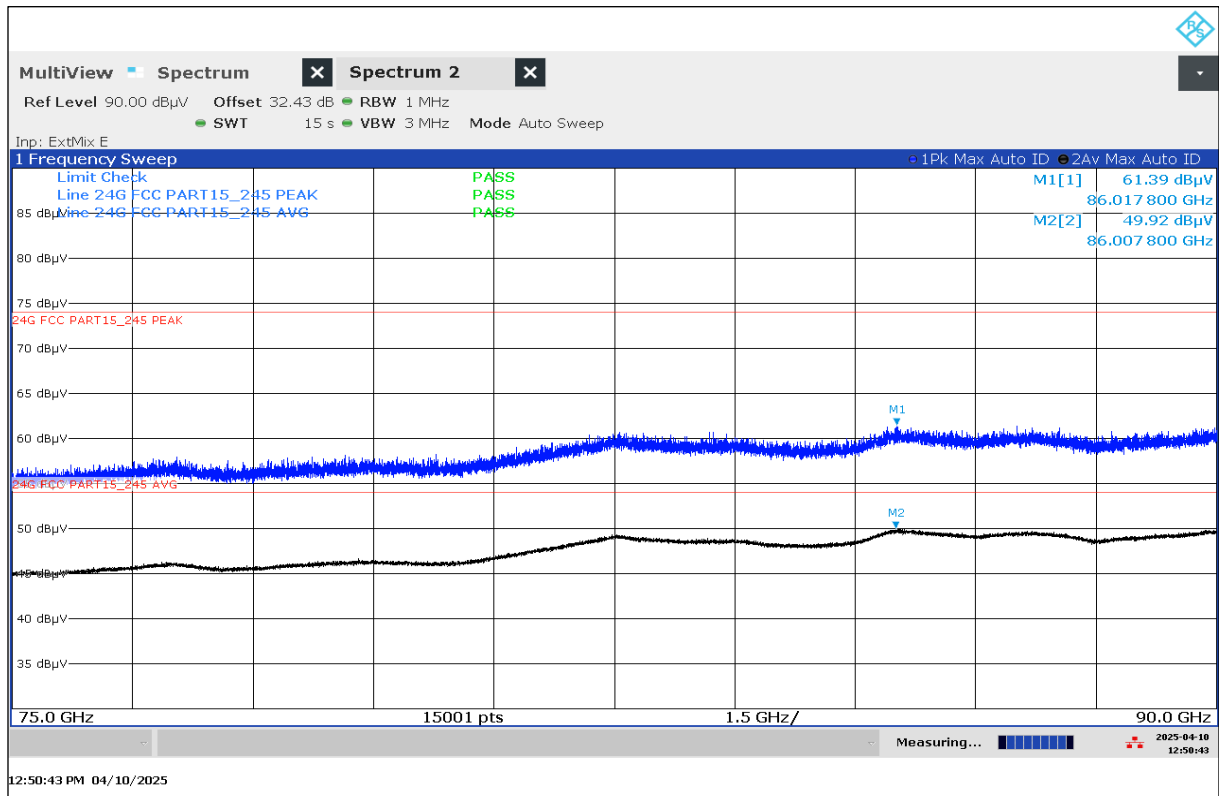
Harmonics limit is 97.5 dBμV/m Peak and 77.5 dBμV/m Average, therefore, the measurement is passed

Plot 37: 72 GHz, PK and AV value measured in zero span

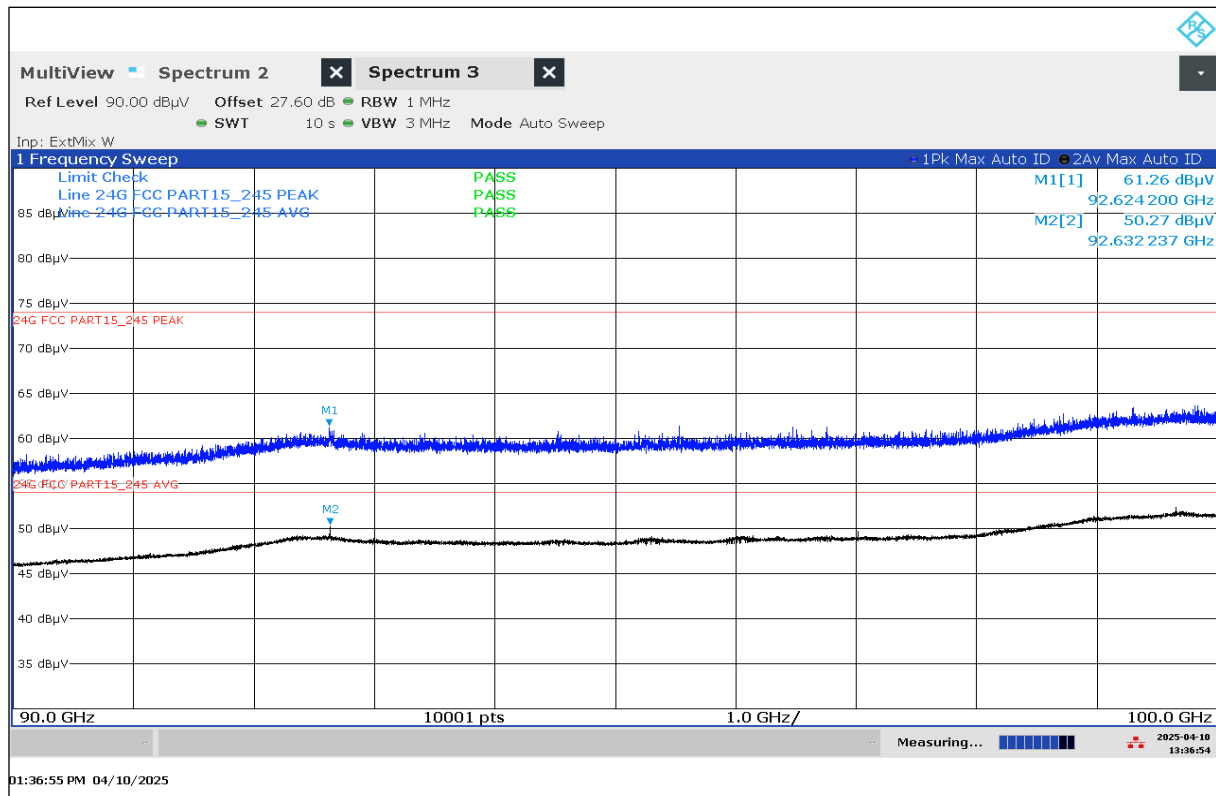


Harmonics limit is 97.5 dBμV/m Peak and 77.5 dBμV/m Average, therefore, the measurement is passed

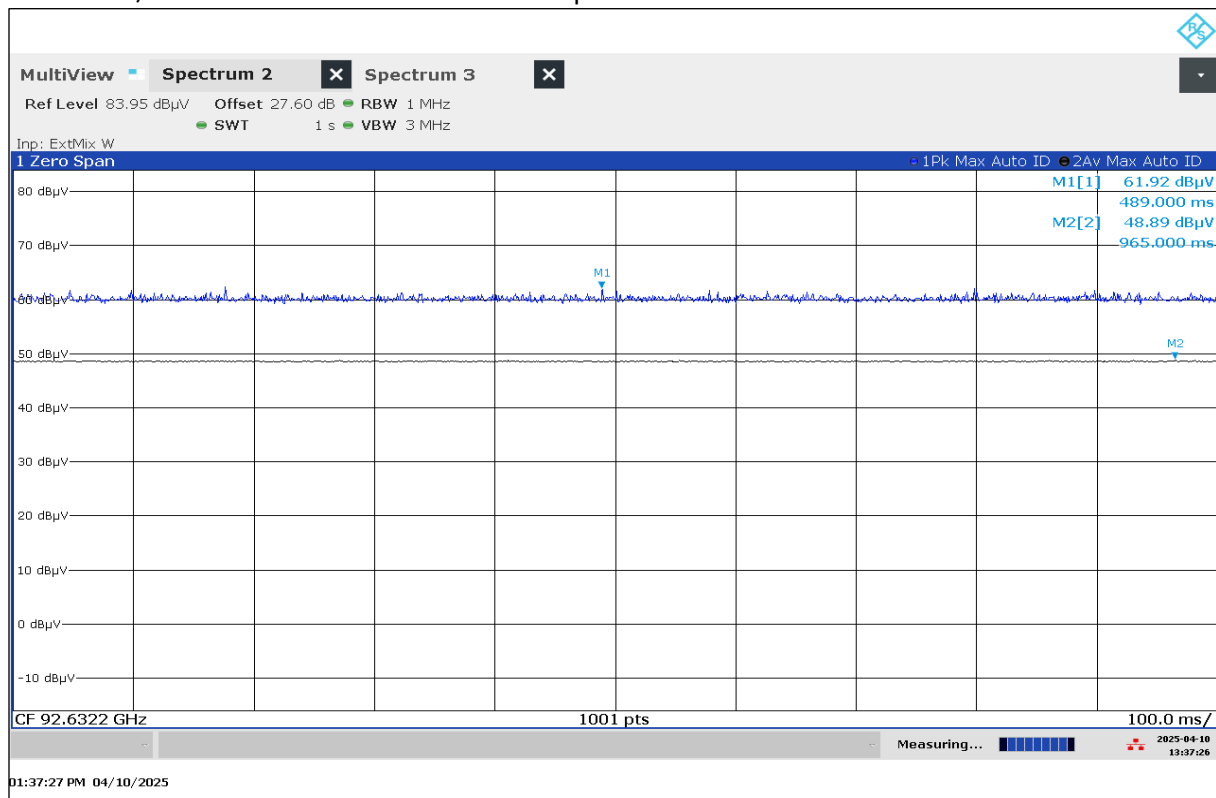
Plot 38: 75 GHz to 90 G



Plot 39: 90 GHz to 100 GHz



Plot 40: 92 GHz, PK and AV value measured in zero span



12.4 Prevention of continuous operation

Description:

Field disturbance sensors must include features to prevent continuous operation under certain conditions.

Limits and provisions:

§15.245(b)(1)(iii):

Field disturbance sensors designed to be used in motor vehicles or aircraft must include features to prevent continuous operation unless their emissions in the restricted bands, other than the second and third harmonics from devices operating in the 24075–24175 MHz band, fully comply with the limits given in § 15.209.

Continuous operation of field disturbance sensors designed to be used in farm equipment, vehicles such as fork lifts that are intended primarily for use indoors or for very specialized operations, or railroad locomotives, railroad cars and other equipment which travels on fixed tracks is permitted.

A field disturbance sensor will be considered not to be operating in a continuous mode if its operation is limited to specific activities of limited duration (e.g., putting a vehicle into reverse gear, activating a turn signal, etc.).

RSS-210 F.1 Field disturbance sensors

- d. Field disturbance sensors designed to be used in motor vehicles or aircraft must include features to prevent continuous operation, unless their emissions in the restricted frequency bands as listed in RSS-Gen, other than the second and third harmonic emissions from devices operating in the band 24075–24175 MHz, comply with the general field strength limits specified in RSS-Gen.

Continuous operation of field disturbance sensors designed to be used in farm equipment (i.e. forklifts that are intended primarily for use indoors or for very specialized operations), or railroad locomotives, railroad cars, and other equipment that travel on fixed tracks, is permitted.

A field disturbance sensor is considered not to be operating in a continuous mode if its operation is limited to specific activities of limited duration (e.g. putting a vehicle into reverse gear, activating a turn signal).

RSS-210 F.2 Speed radar meters

None

Results:

The emissions in the restricted bands, other than the second and third harmonics from devices operating in the 24075–24175 MHz band, fully comply with the limits given in § 15.209/RSS-Gen.

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

14 Document history

Version	Applied changes	Date of release
R01-D1	Initial release - DRAFT	2025-07-04
R01	Initial release	2026-01-13
R02	Harmonics limit, RSS 210 Issue 11	2026-05-08
R03	PMN, FVIN, SW updated	2026-05-11

END OF TEST REPORT