DAkkS Deutsche Akkreditierungsstelle D-PL-21375-01-00

LENHARDT WORLDWIDE | TESTING | CERTIFICATION

Bundesnetzagentur BNetzA-CAB-21/21-21

Test Report

Test report no.: 23109360-40973-0
Date of issue: 2025-05-20

Test result: The test item **- passed - and complies** with below listed standards.

Applicant
Robert Bosch GmbH

Manufacturer
Robert Bosch GmbH

Test Item
C6AB0

RF-Spectrum Testing according to:

FCC 47 CFR Part 95
Personal radio services – Subpart M
The 76-81 GHz Band Radar Service

Tested by (name, function, signature)	*Sebastian Janoschka* *Head of Department RF*	signature
Approved by (name, function, signature)	*Karsten Geraldy* *Lab Manager RF*	signature

Applicant and Test item details	
Applicant	Robert Bosch GmbH Renningen 70465, Stuttgart, Germany
Manufacturer	Robert Bosch GmbH Renningen 70465, Stuttgart, Germany
Test item description	Automotive radar sensor
Model/Type reference	C6AB0
Standard specific information	
FCC ID	NF3-C6AB0
Technology	Automotive radar device
Frequency	76.0 GHz to 77.0 GHz
Antenna	3D-waveguide antenna
Power supply	6.7 to 19.0 V DC
Temperature range	-40 °C to +85 °C

Disclaimer and Notes

The content of this report relates to the mentioned test sample(s) only.
IBL-Lab GmbH does not take samples. The samples used for testing are provided by the applicant.
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The last valid version is available at TAMSys®.
Signatures are done electronically, if signer does not match stated signer, it is signed per order.
Information supplied by the applicant can affect the validity of results. The data is marked accordingly.

Within this test report, a ☒ point / ☐ comma is used as a decimal separator.
If otherwise, a detailed note is added adjected to its use.

Decision rule:
Decision rule based on simple acceptance without guard bands, binary statement, based on mutually agreed uncertainty tolerances with expansion factor k=2 according to ILAC-G8:09/2019

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2 GENERAL INFORMATION

2.1 Administrative details

Testing laboratory	**IBL-Lab GmbH** Heinrich-Hertz-Allee 7 66386 St. Ingbert / Germany Fon: +49 6894 38938-0 Fax: +49 6894 38938-99 URL: https://ib-lenhardt.com/ E-Mail: info@ib-lenhardt.com
Accreditation / Designation	The testing laboratory is accredited by Deutsche Akkreditierungsstelle GmbH (DAkkS) in compliance with DIN EN ISO/IEC 17025:2018. Scope of testing and registration number: • Attachment to the accreditation certificate D-PL-21375-01-00 ○ Electronics ○ Electromagnetic Compatibility ○ Radio ○ Electromagnetic Compatibility and Telecommunication (FCC requirements) ○ Telecommunication (TC) and Electromagnetic Compatibility (EMC) for Canadian Standards ○ Automotive EMC Website DAkkS: https://www.dakks.de/ The Deutsche Akkreditierungsstelle GmbH (DAkkS) is also a signatory to the ILAC Mutual Recognition Arrangement. • Designations ○ FCC Testing Laboratory Designation Number DE0024 ○ ISED ISED Company Number 27156 Testing Laboratory CAB Identifier DE0020 ○ Kraftfahrt-Bundesamt KBA-P 00120-23
Testing location	**IBL-Lab GmbH** Heinrich-Hertz-Allee 7 66386 St. Ingbert / Germany
Date of receipt of test samples	2025-03-18
Start – End of tests	2025-03-19 – 2025-05-07

2.2 Possible test case verdicts

Test sample meets the requirements	P (PASS) – the measured value is below the acceptance limit, AL = TL
Test sample does not meet the requirements	F (FAIL) – the measured value is above the acceptance limit, AL = TL
Test case does not apply to the test sample	N/A (Not applicable)
Test case not performed	N/P (Not performed)

2.3 Observations

No additional observations other than the reported observations within this test report have been made.

2.4 Opinions and interpretations

No appropriate opinions or interpretations according ISO/IEC 17025:2017 clause 7.8.7 are within this test report.

2.5 Revision history

-0 Initial Version

2.6 Further documents

List of further applicable documents belonging to the present test report:
– no additional documents –

3 ENVIRONMENTAL & TEST CONDITIONS

3.1 Environmental conditions of test laboratory

Temperature	20°C ± 5°C
Relative humidity	25-75% r.H.
Barometric Pressure	860-1060 mbar
Power supply	230 V AC ± 5%

3.2 Normal and extreme test conditions

	minimum	normal	maximum
Temperature	-40 °C	20 °C	+85 °C
Relative humidity	-/-	45 % r.h.	-/-
Power supply	6.7 V DC	13.2 V DC	19.0 V DC

4 TEST STANDARDS AND REFERENCES

Test standard (accredited)	Description
FCC 47 CFR Part 95	Personal radio services – Subpart M The 76-81 GHz Band Radar Service

Reference	Description
ANSI C63.4-2014	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI C63.10-2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
ANSI C63.26-2015	American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services
KDB 653005 D01, V01, R02	Equipment Authorization Guidance for 76-81 GHz Radar Devices

5 EQUIPMENT UNDER TEST (EUT)

5.1 Product description

Automotive radar sensor

5.2 Description of test item

Model name*	C6AB0
Serial number*	Molex – side: 1049104910494741111110150224278374971037 AK2 – back: 03220312031015001010001001243600851510 44
Hardware status*	Molex – side: 0203.3BB.06N-80 AK2 – back: 0203.3BB.0F7-01
Software status*	02033B8124

*: as declared by applicant

5.3 Technical data of test item

Operational frequency band*	76.0 GHz to 77.0 GHz
Type of radio transmission*	modulated carrier
Modulation type*	FMCW
Number of channels*	N/A
Channel bandwidth*	< 1 GHz
Channel spacing*	N/A
Receiver category*	N/A
Receiver bandwidth*	N/A
Duty cycle*	28.7%
Antenna Gain*	17.90 dBi
Antenna*	3D-waveguide antenna
Power supply*	6.7 to 19.0 V DC
Temperature range*	-40 °C to +85 °C

*: as declared by applicant

5.4 Additional information

Model differences	In general, the EUT has two connector orientations: connector on the back of the sensor and connector on the side of the sensor. Difference is the mechanical direction of the connector. All other components are identical. (as declared by the manufacturer) Two different devices are tested: one device with the AK2-connector on EUT's back side and another one with the Molex-connector directed straight to the side. Full testing is performed for EUT with Molex-connector and test modes DMP01, DMP02 and DMP03. Additional radiated spurious test are performed for EUT with AK2-connector on its backside and DMP01-Mode only.
Ancillaries tested with	N/A
Additional equipment used for testing	A laptop with specialized software as well as a CAN converter were used to change the running mode of the EUT and to monitor the in-band and out-of-band signals handling

5.5 Operating conditions

Following information is derived from document "*Technical Documentation C6AB0*", dated 2025-02-20, provided by applicant.

4.3 Modulation description

The C6AB0 sensor modulation mode depends on vehicle speed.

Vehicle speed	Modulation mode	Occupied Bandwidth	Active TX channels
up to 7km/h	DMP01	850 MHz	TX1, TX2, TX3, TX4
7km/h – 65 km/h	DMP02	850 MHz	TX1, TX2, TX3, TX4
above 65 km/h	DMP03	850 MHz	TX1, TX2, TX3, TX4

Basic modulation principle:

The sensor emits a series of fast FMCW chirps. The chirps are grouped in sequence and sequences are grouped in bursts.

Each chirp takes on average 19 µs. 4 chirps are emitted within a sequence on a single transmit frequency. A burst consists of 128 sequences, each sequency transmitted on a different frequency. The sequences are transmitted time shifted on different TX channels, resulting in a burst length of 14,38 ms. Once burst emission is completed, transmitter is turned off until end of cycle. A single cycle takes 50ms.

4.4 Duty Cycle

Total duration of a single C6AB0 cycle is 50ms. Within this time, the sensor transmits a single burst of 14,38 ms. Therefore, the sensor duty cycle is 14,38ms/50ms = 0,287.

$$Duty\_cycle = \frac{burst\_length}{cycle\_length} * 100$$

Modulation mode	Burst length	Duty cycle	Factor
DMP01; DMP02; DMP03	14,38 ms	28,7 %	5,41 dB

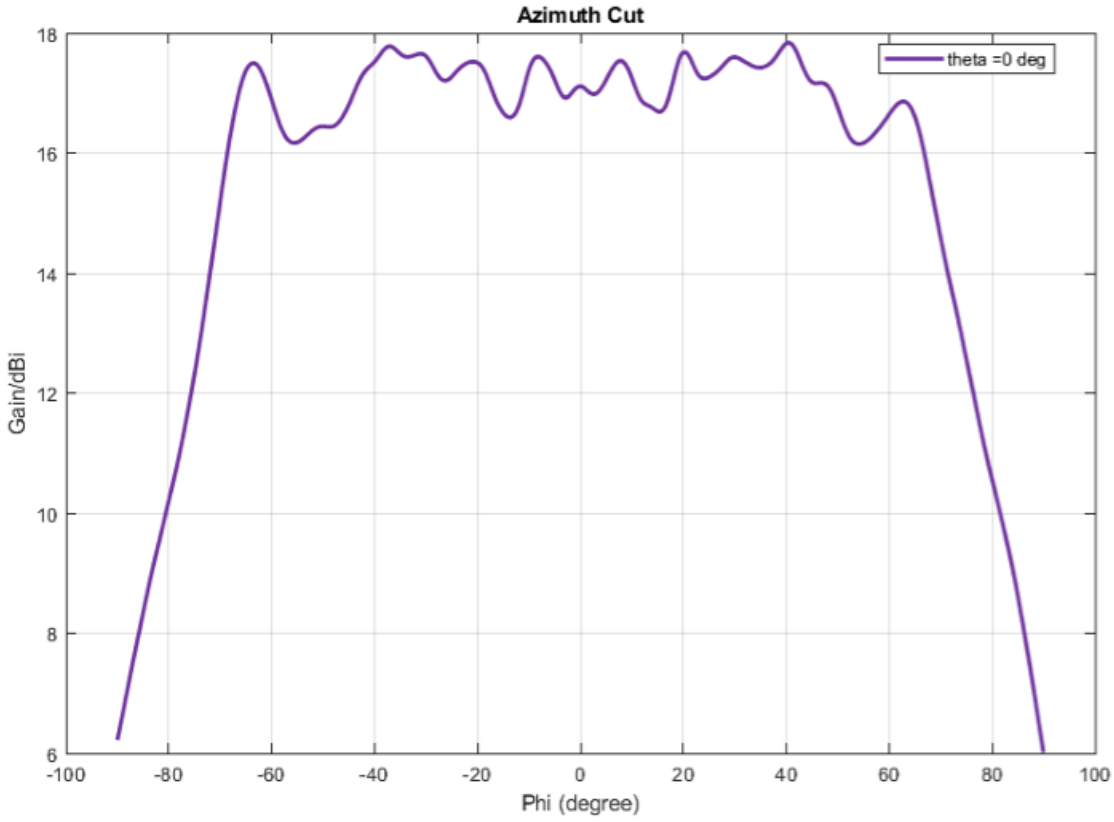
5.6 Antenna characteristics

Following information is derived from document "*Technical Documentation C6AB0*", dated 2025-02-20, provided by applicant.

4.2 Antenna characteristics

4.2.1 TX all antenna characteristics

Simulation result of all channels combined azimuth antenna characteristic:



Maximum gain is 17,90 dBi.

6 SUMMARY OF TEST RESULTS

Test specification
FCC 47 CFR Part 95 – Subpart M

Clause	Requirement / Test case	Test Conditions	Result / Remark	Verdict
§2.1046 §95.3367 (a) (b)	RF power output	Nominal	23.5 dBm mean 34.6 dBm peak	**- PASS -**
§2.1047	Modulation characteristics	Nominal		**- PASS -**
§2.1049 §95.3379 (b)	Occupied bandwidth	Nominal	835.0 MHz	**- PASS -**
§2.1051	Spurious emissions at antenna terminals	Nominal	see note	**- N/A -**
§2.1053 §95.3379 (a)(1) §95.3379 (a)(2) §95.3379 (a)(3)	Field strength of spurious radiation	Nominal	< limit	**- PASS -**
§2.1055 §95.3379 (b)	Frequency stability	Nominal Extreme	within band	**- PASS -**

Notes
FCC's Millimeter Wave Test Procedures: I. A radiated method of measurements in order to demonstrate compliance with the various regulatory requirements has been chosen in consideration of test equipment availability and the limitations of many external harmonic mixers. A conducted method of measurement could be employed if EUT and mixer waveguides both are accessible and of the same type (WG number) and if waveguide sections and transitions can be found. Another potential problem is that the peak power output may exceed the +20 dBm input power limit of many commercially available mixers. For these reasons a radiated method is preferred.

Comments and observations
– none –

7 TEST RESULTS

7.1 RF power output (§2.1046 & §95.3367)

Description

§2.1046 Measurements required: RF power output.

(a) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in §2.1033(c)(8). The electrical characteristics of the radio frequency load attached to the output terminals when this test is made shall be stated.

Limits

§95.3367 76-81 GHz Band Radar Service radiated power limits

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

(a) The maximum power (EIRP) within the 76-81 GHz band shall not exceed 50 dBm based on measurements employing a power averaging detector with a 1 MHz Resolution Bandwidth (RBW).

(b) The maximum peak power (EIRP) within the 76-81 GHz band shall not exceed 55 dBm based on measurements employing a peak detector with a 1 MHz RBW.

Test procedure

Mean Power

Method with spectrum analyser

A spectrum analyser with the following settings is used as measuring receiver in the test set-up:

- Start frequency: lower than the lower edge of the operating frequency range.
- Stop frequency: higher than the upper edge of the operating frequency range.
- Resolution bandwidth: 1 MHz.
- Video bandwidth: 3 MHz.
- Detector mode: RMS.
- Display mode: clear write.
- Averaging time: larger than one EUT cycle time.
- Sweep time: averaging time × number of sweep points.

Channel Power function needs to be used to calculate the average power. Boundaries for the calculation needs to be defined. This is typically the operating frequency range.

KDB 653005 D01 76-81 GHz Radars v01r02, 4. b)

The maximum fundamental emission power (EIRP) shall be measured using a power averaging (rms) detector with a 1 MHz resolution bandwidth (RBW) and integrated over the full 99% occupied bandwidth (OBW) to obtain the data necessary to demonstrate compliance to the 50 dBm limit.

Test procedure

Peak Power

Method with a spectrum analyser

A spectrum analyser with the following settings is used as measuring receiver in the test set-up:
• Start frequency: lower than the lower edge of the operating frequency range.
• Stop frequency: higher than the upper edge of the operating frequency range.
• Resolution bandwidth: 1 MHz.
• Video bandwidth: 3 MHz.
• Detector mode: Peak detector.
• Display mode: Maxhold.
• Sweep time: EUT cycle time × number of sweep points.
• Measurement is done until trace is stabilised.
The peak power to be considered is the maximum value recorded.

KDB 653005 D01 76-81 GHz Radars v01r02, 4. c)
The maximum peak fundamental emission power (EIRP) measurement shall be performed by sweeping over the transmitted occupied bandwidth using a positive peak power detector with peak hold activated, and a 1 MHz RBW. Power integration is not to be used in performing this measurement. The resultant peak power spectral density (maximum in any 1 MHz) data shall be used to demonstrate compliance to the 55 dBm/MHz limit.
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. See relevant Application Note(s) from the measurement instrumentation vendor for details.

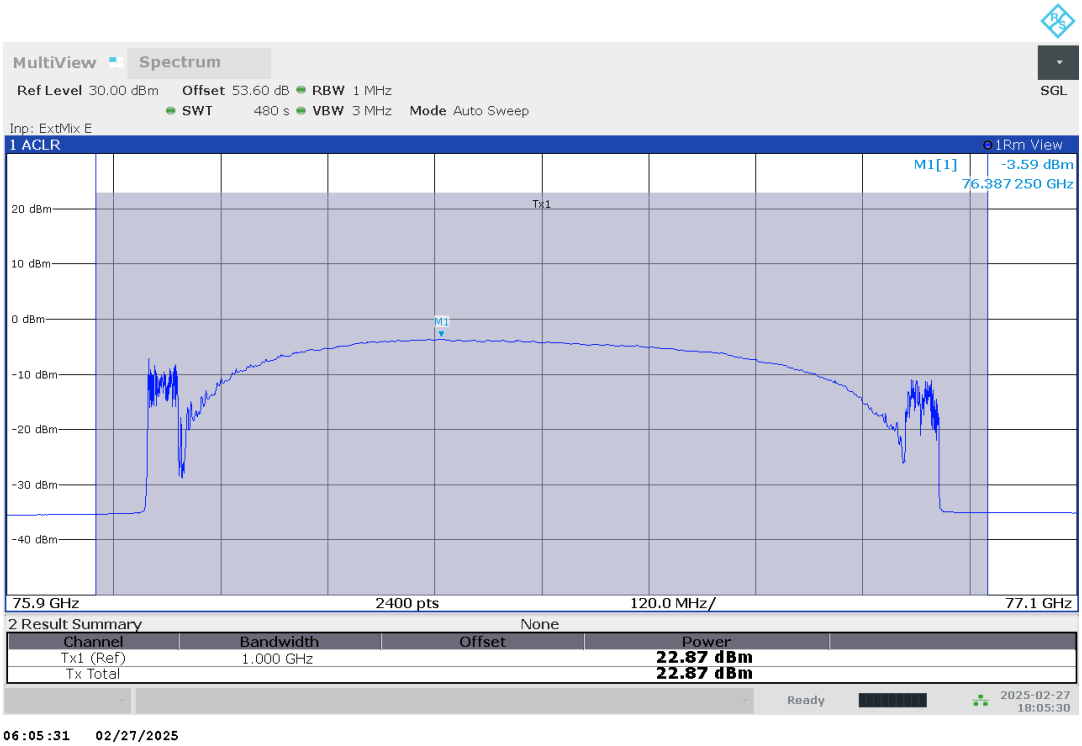
Test procedure used: Method with Spectrum Analyzer

Test setup: 8.3

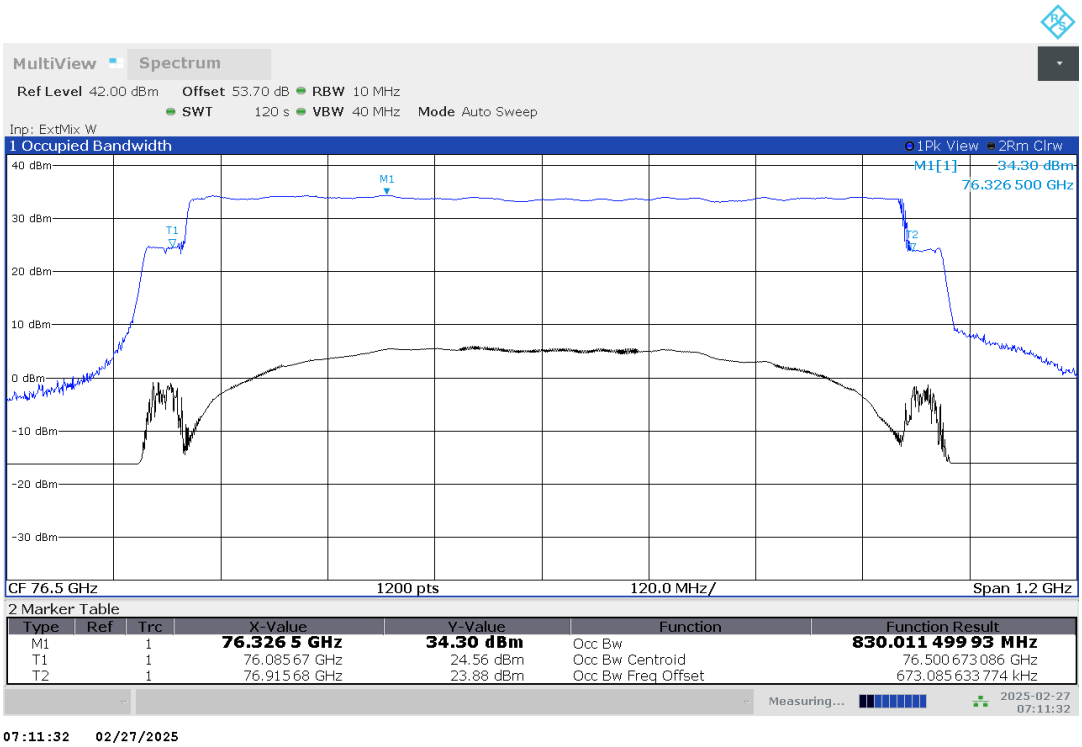
Test results

EUT mode	Test distance [m]	Radiated Mean Power (EIRP) [dBm]	Radiated Peak Power (EIRP) [dBm]
DMP01	1.5	22.87	34.30
DMP02	1.5	22.50	34.49
DMP03	1.5	**23.46**	**34.62**

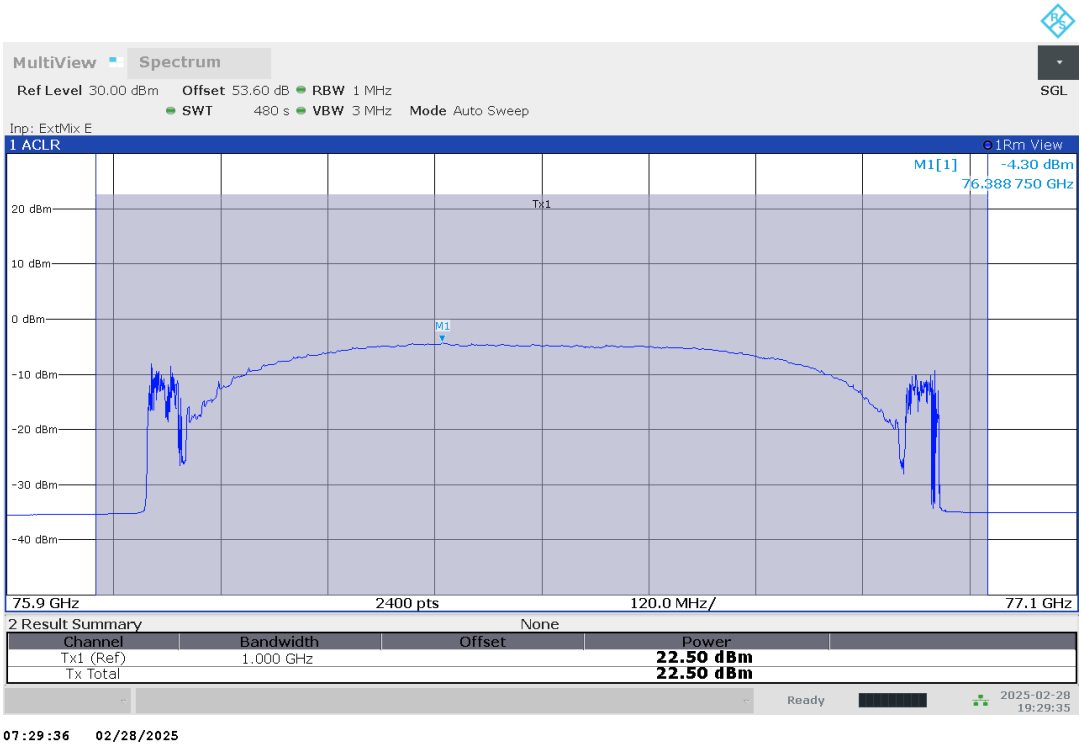
Plot no. 1: Mean Power EIRP, RMS detector / Channel Power, EUT DMP01



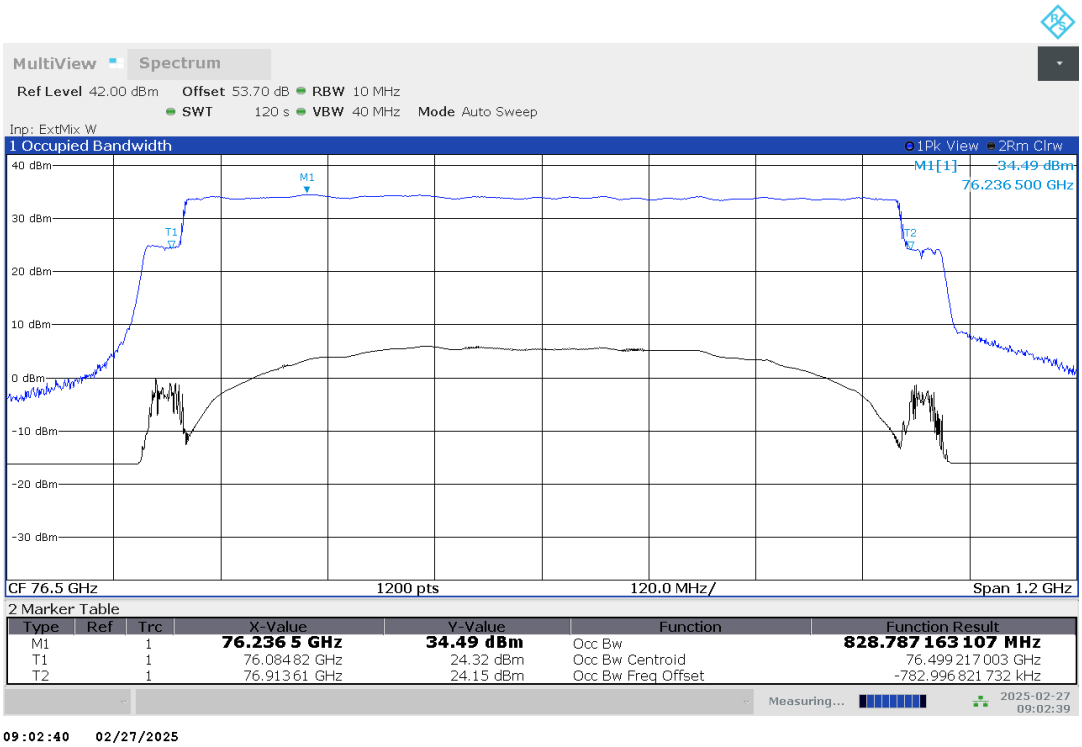
Plot no. 2: Peak Power EIRP, Peak detector, EUT DMP01



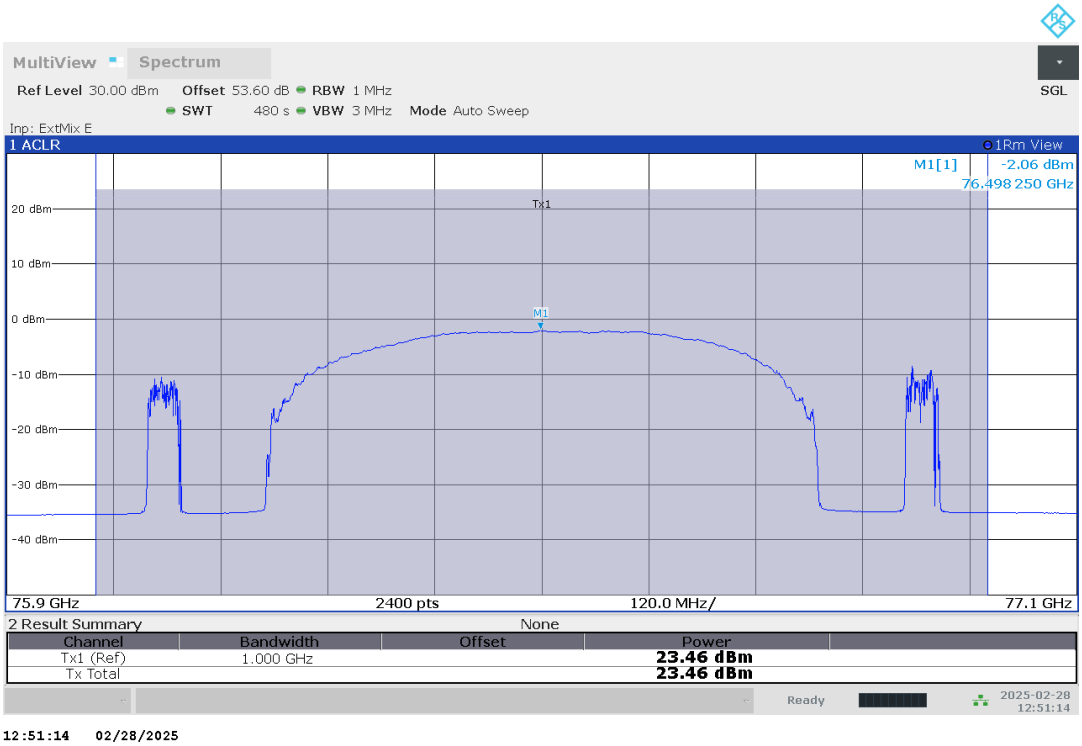
Plot no. 3: Mean Power EIRP, RMS detector / Channel Power, EUT DMP02



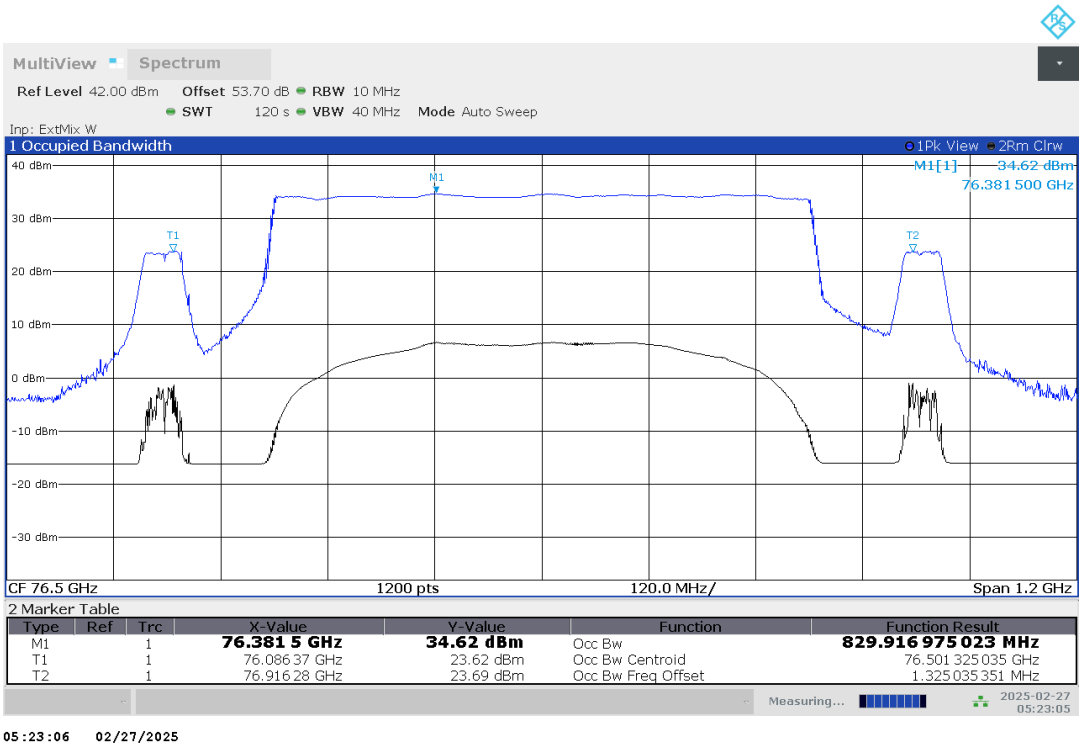
Plot no. 4: Peak Power EIRP, Peak detector, EUT DMP02



Plot no. 5: Mean Power EIRP, RMS detector / Channel Power, EUT DMP03



Plot no. 6: Peak Power EIRP, Peak detector, EUT DMP03



7.2 Modulation characteristics (§2.1047 & KDB 653005 D01 76-81 GHz Radars)

Description

§2.1047 Modulation characteristics

(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, 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).

Statement of applicant / manufacturer concerning modulation characteristics of EUT

Modulation characteristics described in technical documentation by applicant. Please refer to chapter 5.5

7.3 Occupied bandwidth (§2.1049 & §95.3379)

Description

§2.1049 Measurements required: Occupied bandwidth.

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 shall be measured.

Limits

§95.3379 (b)

Fundamental emissions (i.e. 99% emission bandwidth) must be contained within the frequency bands specified in this section during all conditions of operation.

Test procedure

ANSI C63.26, 5.4.4

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

The following procedure shall be used for measuring 99% power bandwidth:

a) The instrument center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be between 1.5 times and 5.0 times the OBW.

b) The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW, and VBW shall be approximately three times the RBW, unless otherwise specified by the applicable requirement.

c) Set the reference level of the instrument as required, keeping the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than [10 log (OBW/RBW)] below the reference level. Specific guidance is given in 4.1.5.2.
Note: Step a) through step c) may require iteration to adjust within the specified tolerances.

d) Set the detection mode to peak, and the trace mode to max-hold.

e) If the instrument does not have a 99% OBW function, recover the trace data points and sum directly in linear power terms. Place the recovered amplitude data points, beginning at the lowest frequency, in a running sum until 0.5% of the total is reached. Record that frequency as the lower OBW frequency. Repeat the process until 99.5% of the total is reached and record that frequency as the upper OBW frequency. The 99% power OBW can be determined by computing the difference these two frequencies.

f) The OBW shall be reported and plot(s) of the measuring instrument display shall be provided with the test report. The frequency and amplitude axis and scale shall be clearly labeled. Tabular data can be reported in addition to the plot(s)

KDB 653005 D01 76-81 GHz Radars v01r02, 4. d)

The occupied bandwidth of the radar device shall be measured, reported, and shown to be fully contained within the designated 76-81 GHz frequency band under normal operating conditions as well as under those extreme ambient temperature and input voltage conditions as described in Section 2.1057.

The OBW measurement of an FMCW radar shall be performed with the transmitter operating in normal mode (i.e., with frequency sweep or step active).

Note

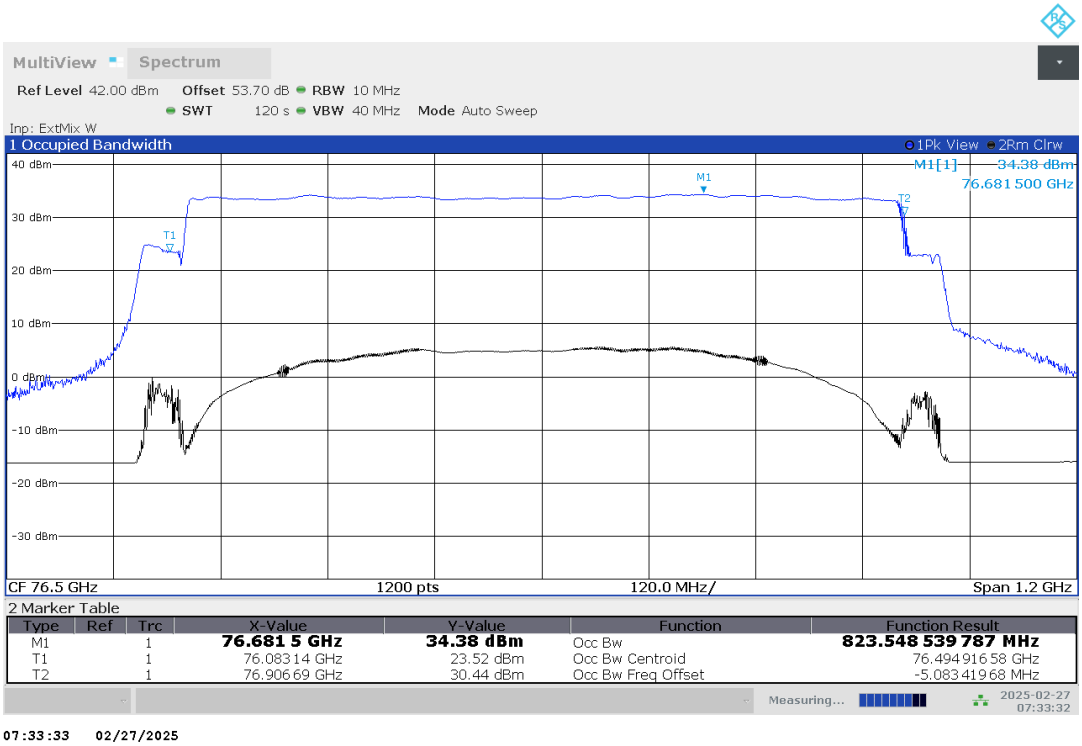
Measurements with the peak detector are also suitable to demonstrate compliance of an EUT, as long as the required resolution bandwidth is used, because peak detection will yield amplitudes equal to or greater than amplitudes measured with RMS detector. The measurement data from a spectrum analyser peak detector will represent the worst-case results (see ANSI C63.26, chapter D2: general considerations).

Test setup: 8.3, 8.4

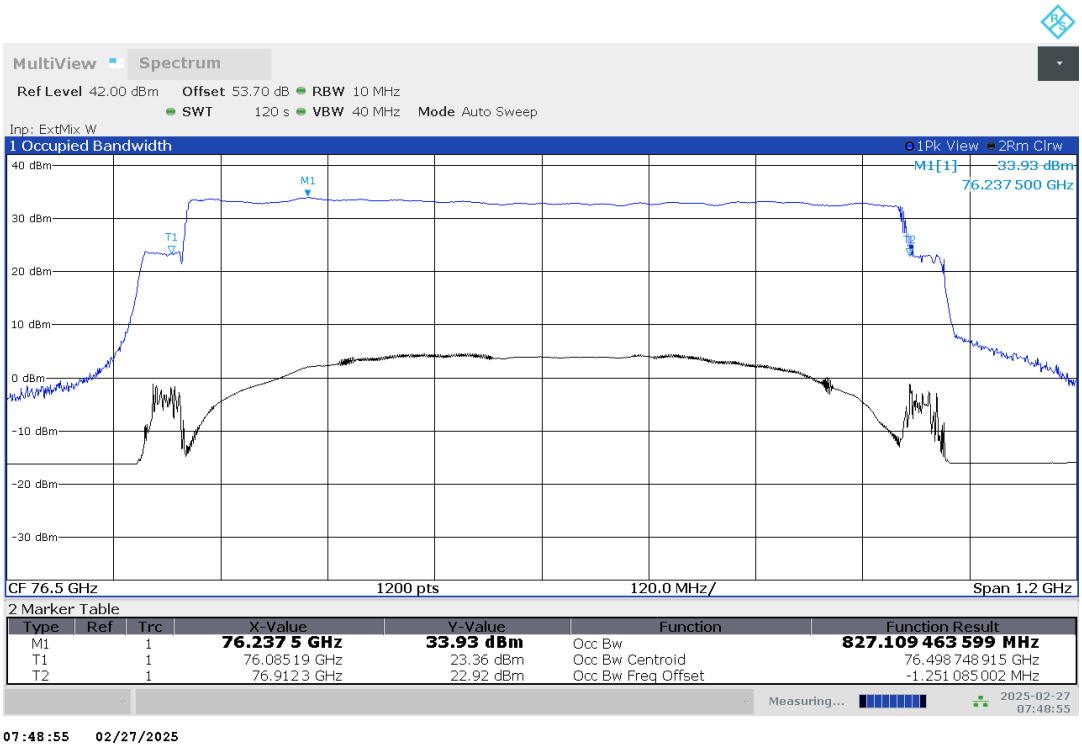
Test results				
EUT mode	**Test conditions**	**f_L [GHz]**	**f_H [GHz]**	**99% OBW [MHz]**
DMP01	85 °C	76.083	76.907	823.549
DMP01	60 °C	76. 085	76.912	827.109
DMP01	50 °C	76.088	76.908	820.324
DMP01	40 °C	76.084	76.911	826.777
DMP01	30 °C	76.085	76.913	828.546
DMP01	20 °C / V_{max}	76.085	76.916	830.816
DMP01	20 °C / V_{nom}	76.086	76.916	830.011
DMP01	20 °C / V_{min}	76.084	76.916	832.432
DMP01	10 °C	76.086	76.916	830.565
DMP01	0 °C	76.086	76.917	831.552
DMP01	-10 °C	76.087	76.916	829.070
DMP01	-20 °C	76.091	76.916	824.915
DMP01	-30 °C	76.091	76.916	824.915
DMP01	-40 °C	76.092	76.917	824.740
DMP02	85 °C	76.094	76.917	822.634
DMP02	60 °C	76.084	76.912	827.710
DMP02	50 °C	76.083	76.909	826.144
DMP02	40 °C	76.090	76.909	818.579
DMP02	30 °C	76.087	76.908	821.005
DMP02	20 °C / V_{max}	76.085	76.909	823.860
DMP02	20 °C / V_{nom}	76.085	76.913	827.381
DMP02	20 °C / V_{min}	76.085	76.914	828.787
DMP02	10 °C	76.082	76.915	832.939
DMP02	0 °C	76.084	76.913	828.878
DMP02	-10 °C	76.085	76.913	828.568
DMP02	-20 °C	76.087	76.916	828.484
DMP02	-30 °C	76.089	76.916	827.009
DMP02	-40 °C	76.087	76.917	830.415
DMP03	85 °C	76.082	76.916	834.039
DMP03	60 °C	76.082	76.917	**835.017**
DMP03	50 °C	76.085	76.916	**835.017**
DMP03	40 °C	76.086	76.918	831.877
DMP03	30 °C	76.087	76.919	831.822
DMP03	20 °C / V_{max}	76.086	76.916	829.917
DMP03	20 °C / V_{nom}	76.088	76.919	830.844
DMP03	20 °C / V_{min}	76.086	76.918	832.059
DMP03	10 °C	76.088	76.918	830.541
DMP03	0 °C	76.087	76.918	830.565
DMP03	-10 °C	76.088	76.916	828.151
DMP03	-20 °C	76.090	76.917	827.373
DMP03	-30 °C	76.089	76.917	828.467
DMP03	-40 °C	76.091	76.916	825.715

With voltage variation
Input voltage variation does not affect the transmitted signal (see plots for ambient/normal temperature).

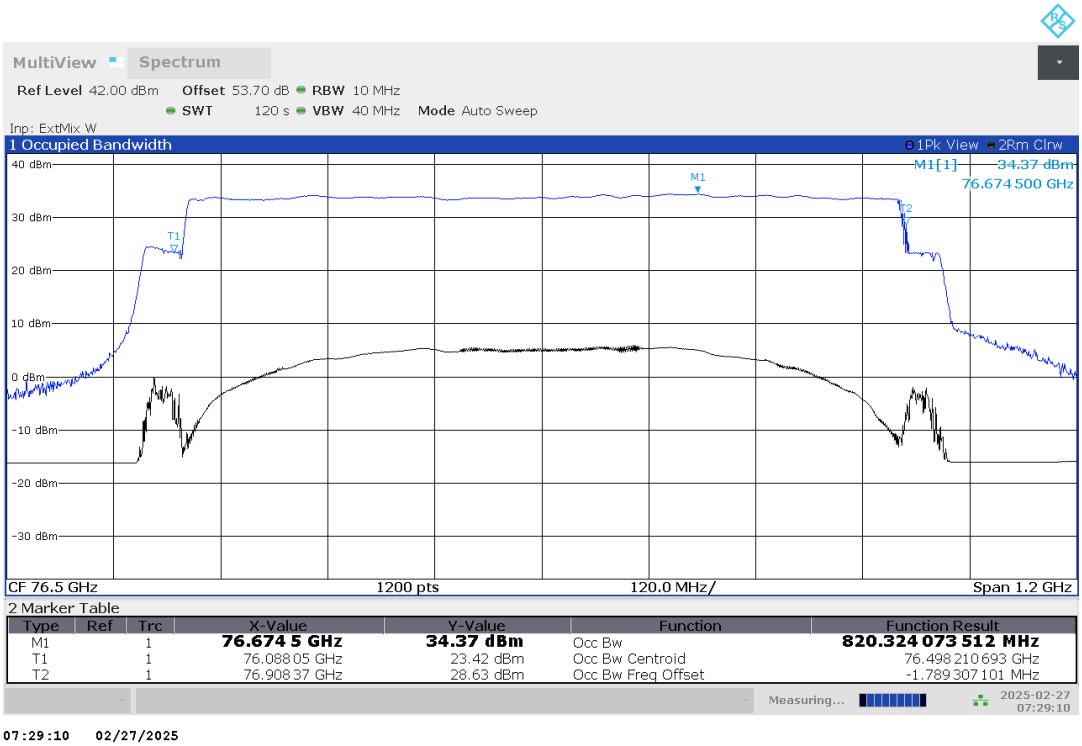
Plot no. 7: 99% OBW, Peak detector, 85 °C, DMP01



Plot no. 8: 99% OBW, Peak detector, 60 °C, DMP01



Plot no. 9: 99% OBW, Peak detector, 50 °C, DMP01



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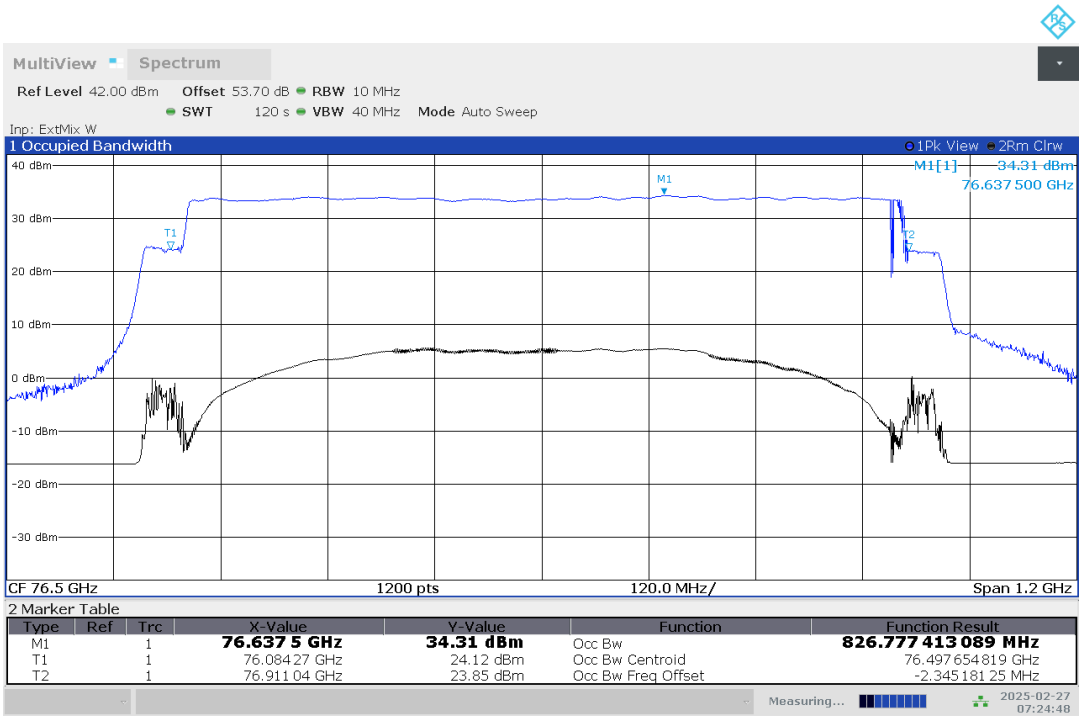
Plot no. 10: 99% OBW, Peak detector, 40 °C, DMP01



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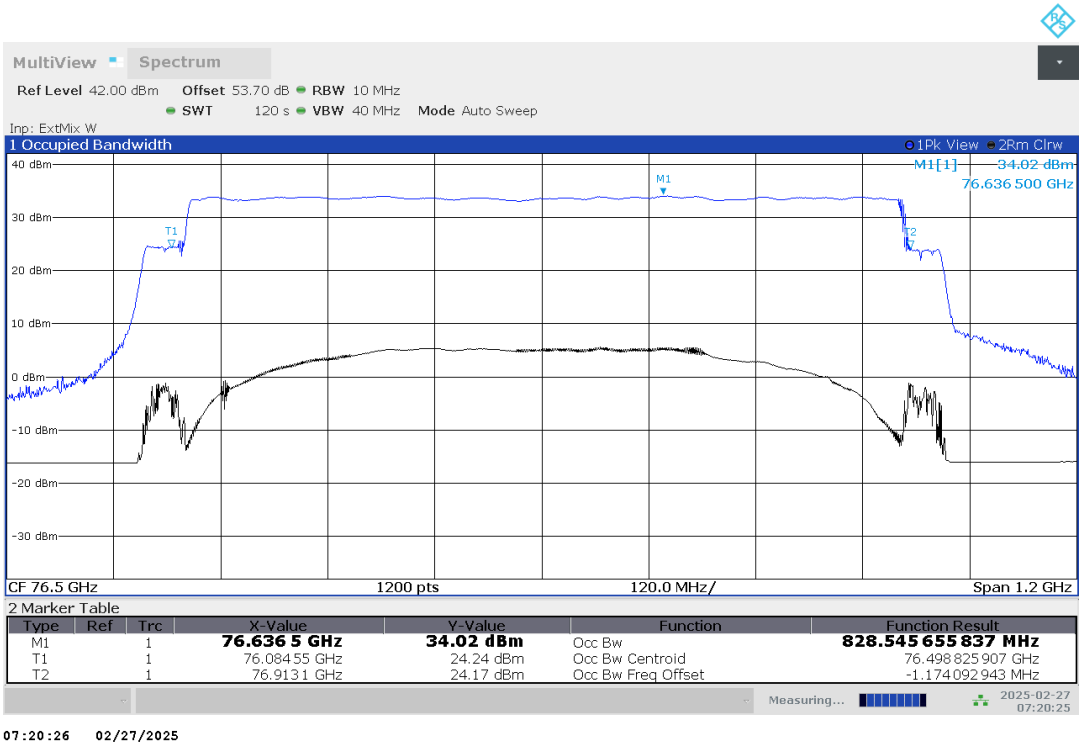
Plot no. 11: 99% OBW, Peak detector, 30 °C, DMP01



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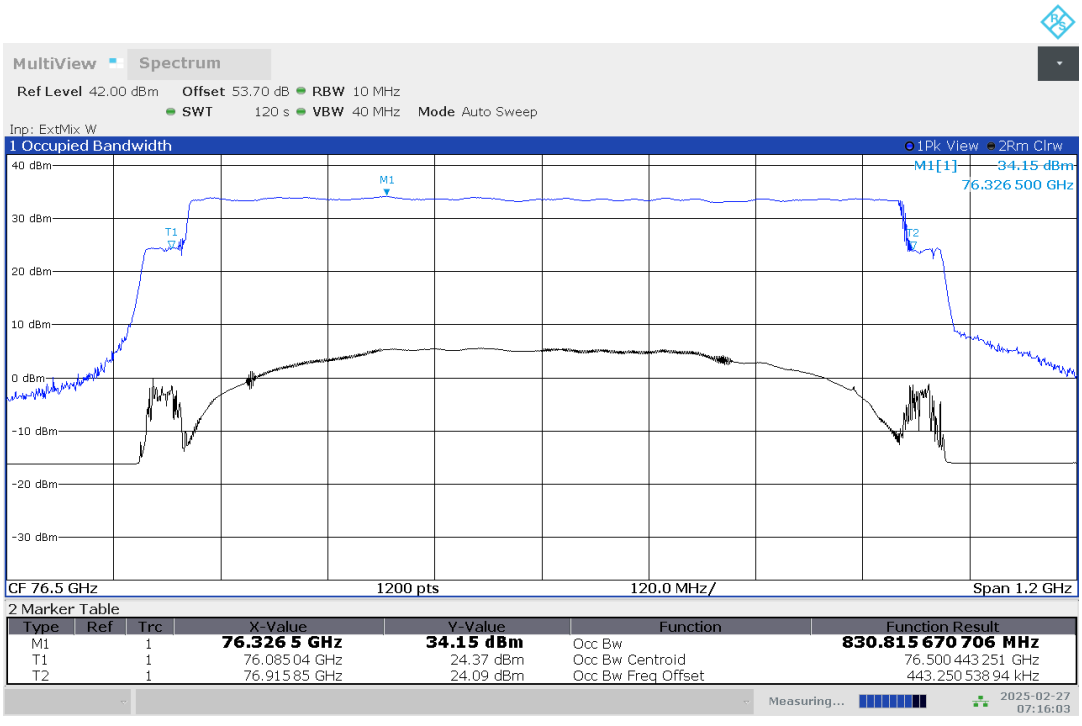
Plot no. 12: 99% OBW, Peak detector, 20 °C, V_{max}, DMP01



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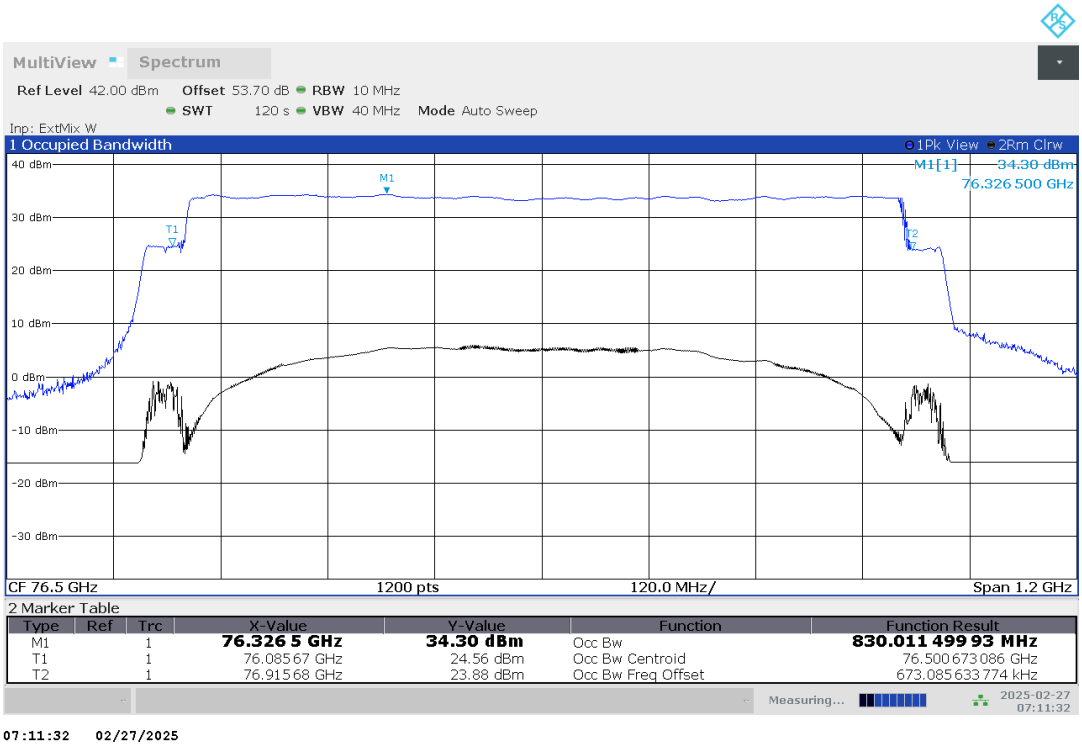
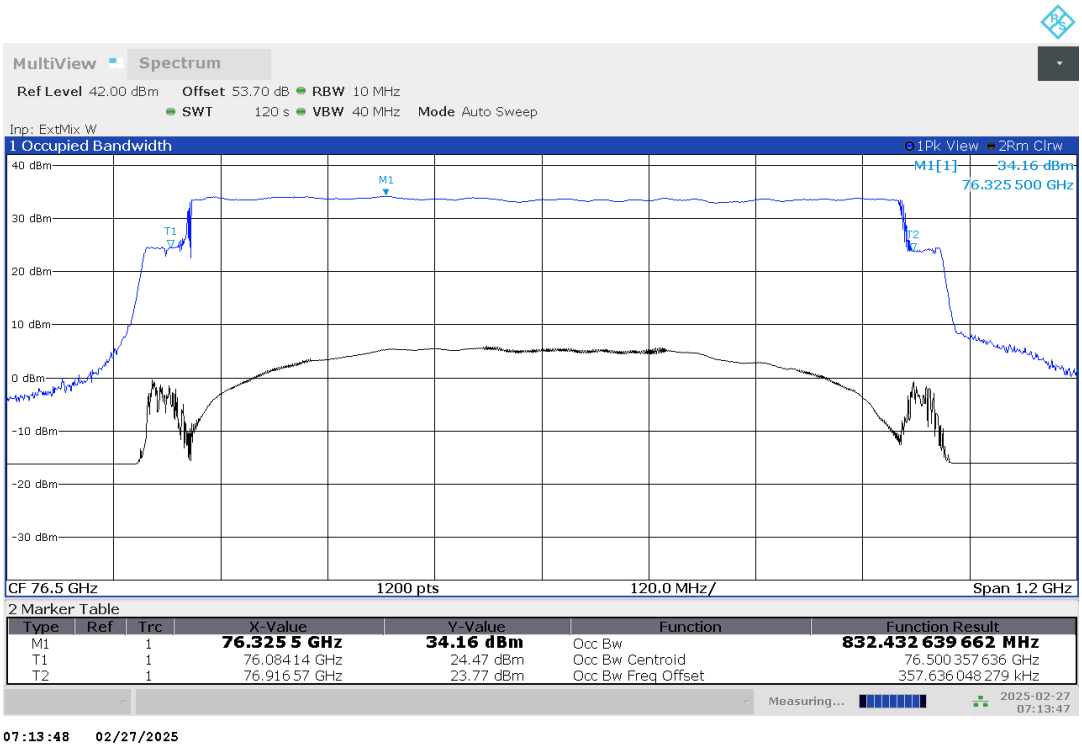
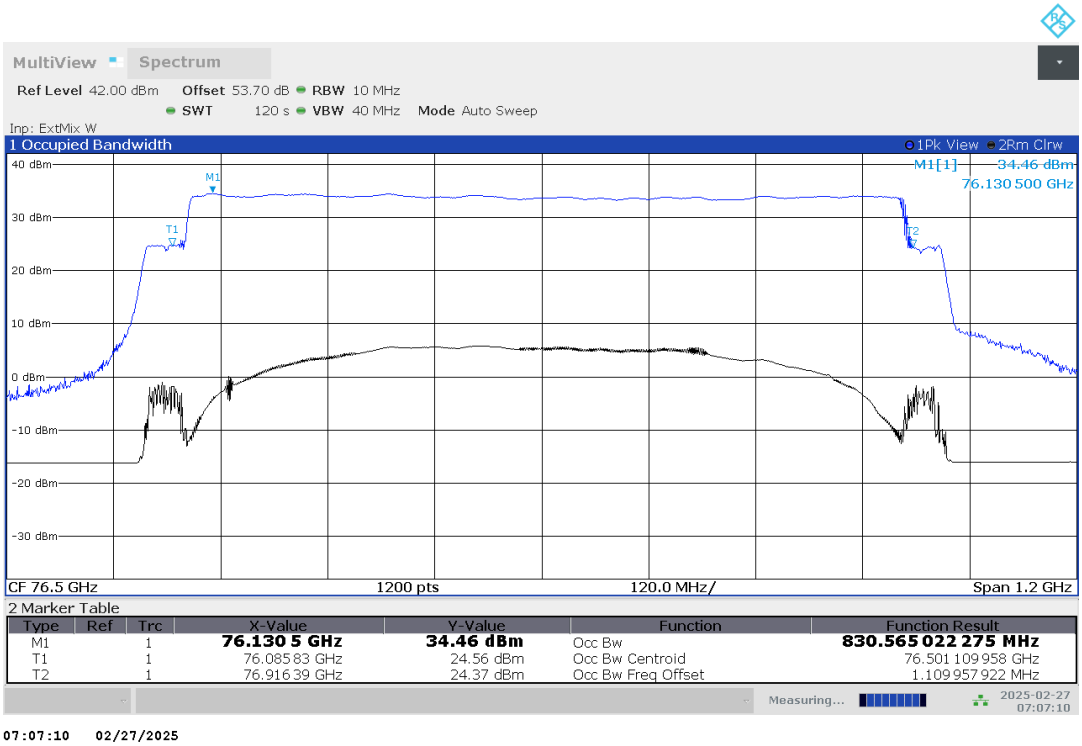
Plot no. 13: 99% OBW, Peak detector, 20 °C, V_{nom}, DMP01



Plot no. 14: 99% OBW, Peak detector, 20 °C, V_{min}, DMP01

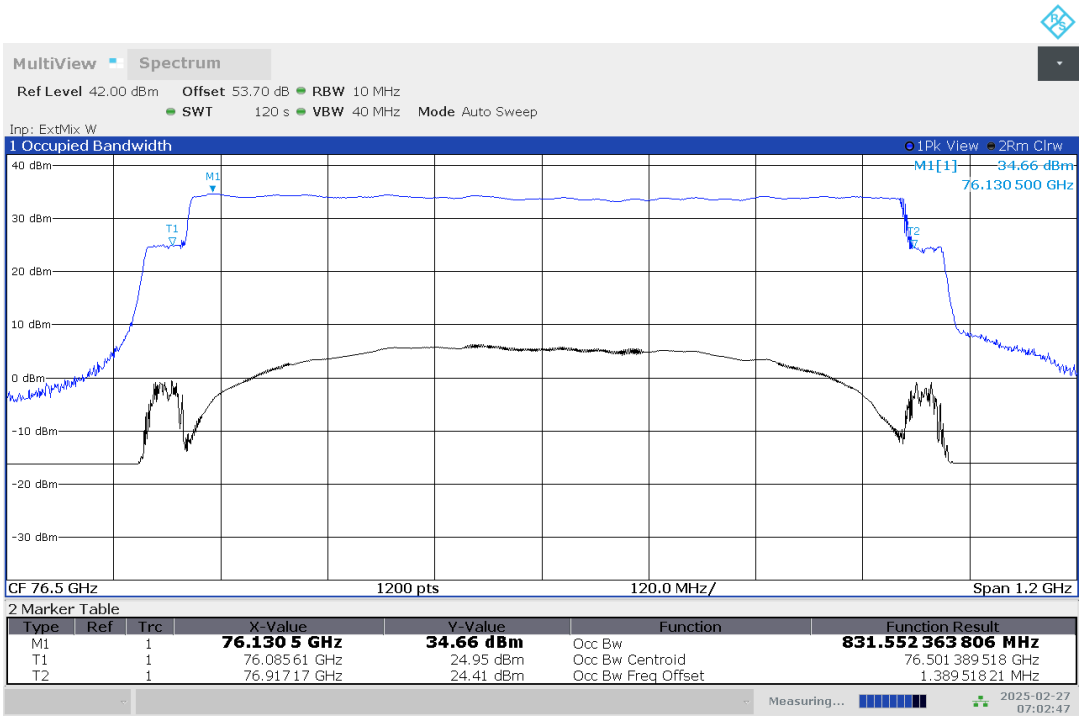


Plot no. 15: 99% OBW, Peak detector, 10 °C, DMP01



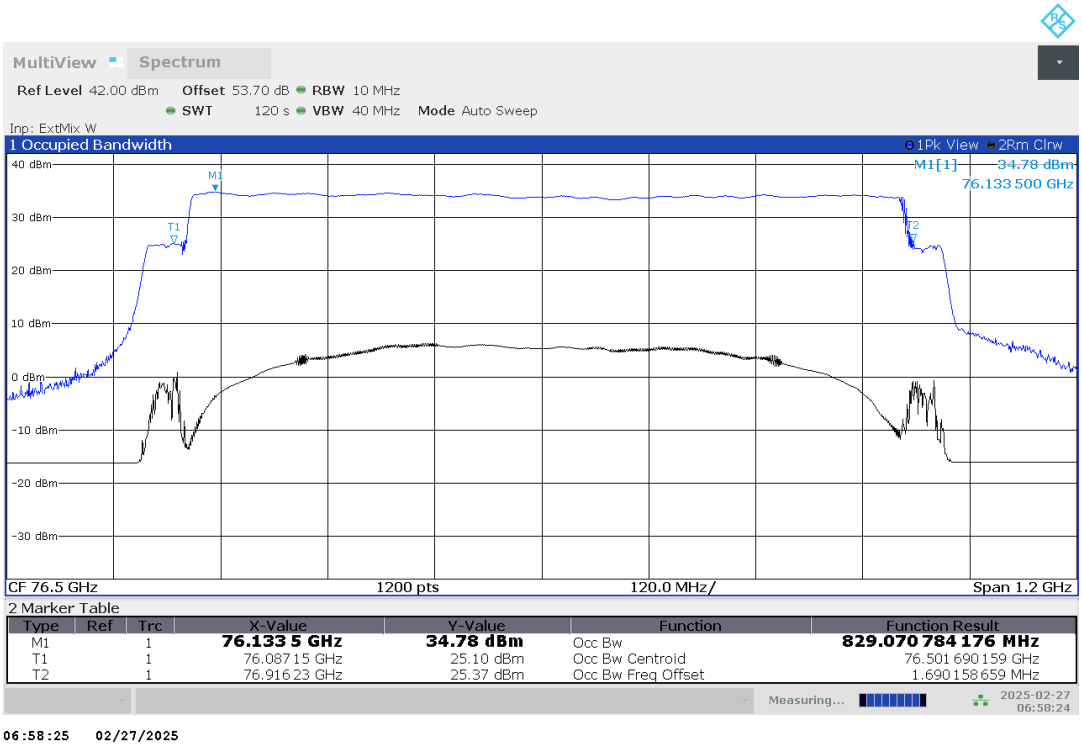
07:07:10 02/27/2025

Plot no. 16: 99% OBW, Peak detector, 0 °C, DMP01



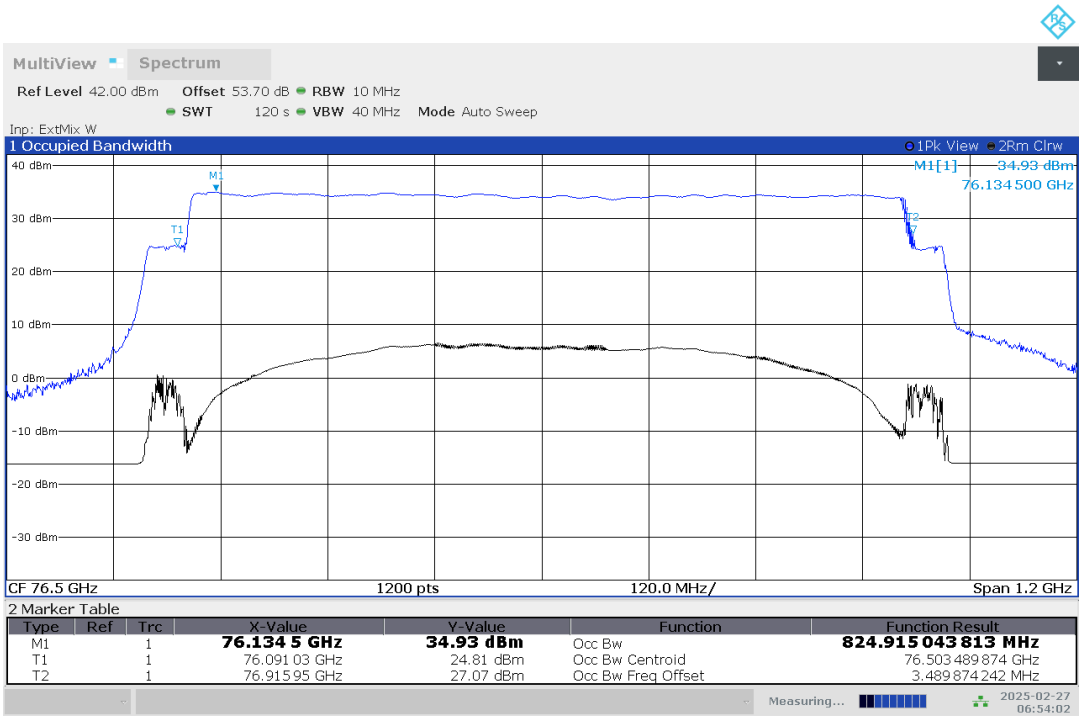
07:02:47 02/27/2025

Plot no. 17: 99% OBW, Peak detector, -10 °C, DMP01



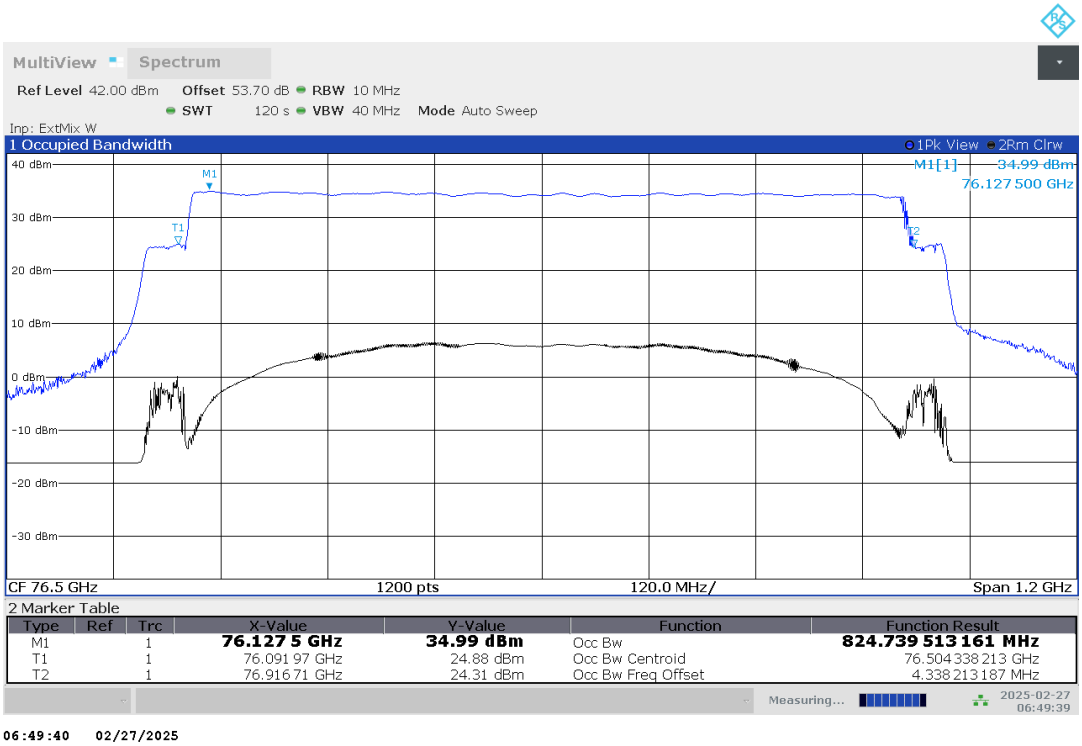
06:58:25 02/27/2025

Plot no. 18: 99% OBW, Peak detector, -20 °C, DMP01

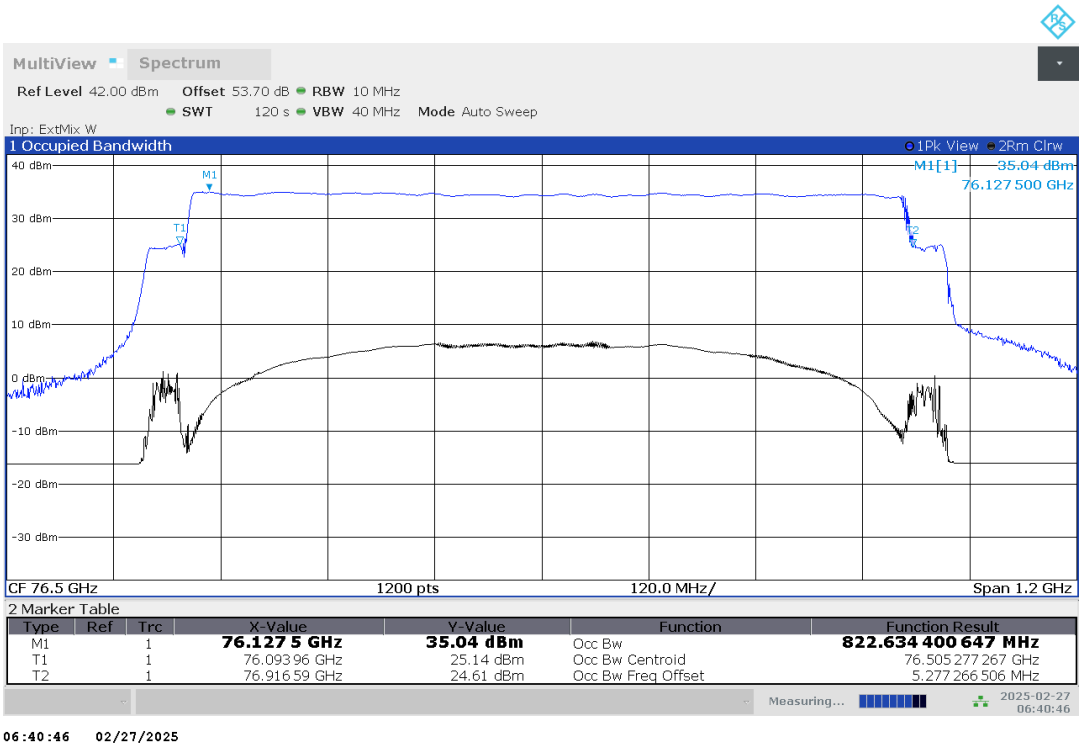


06:54:03 02/27/2025

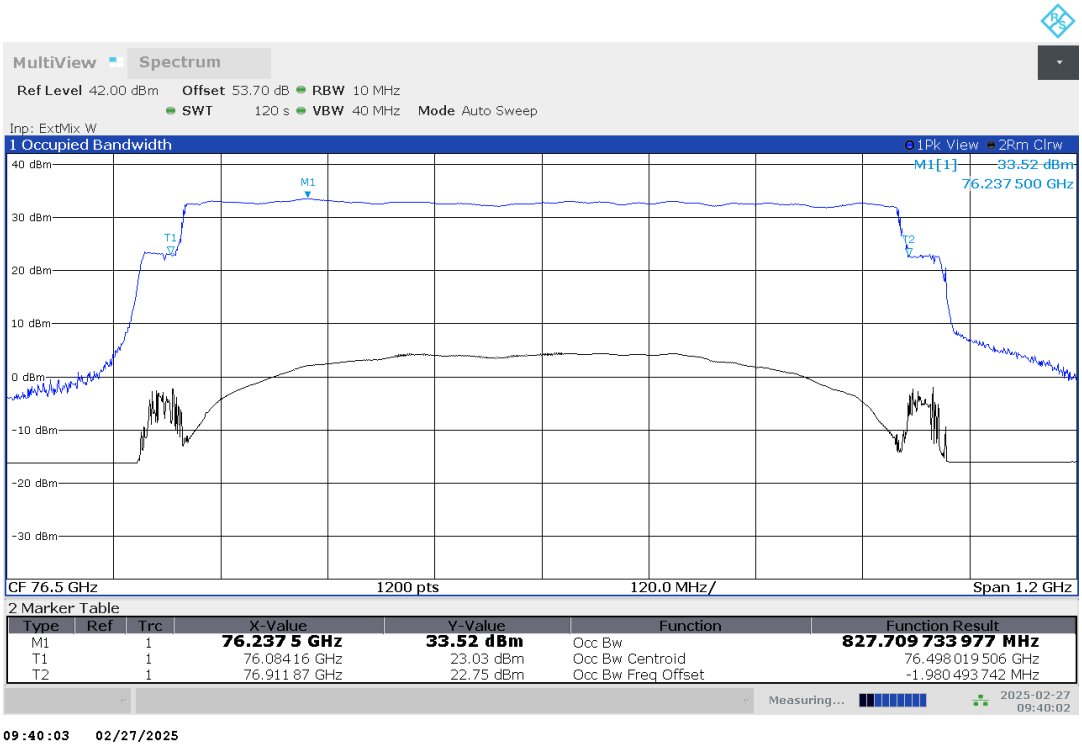
Plot no. 19: 99% OBW, Peak detector, -30 °C, DMP01



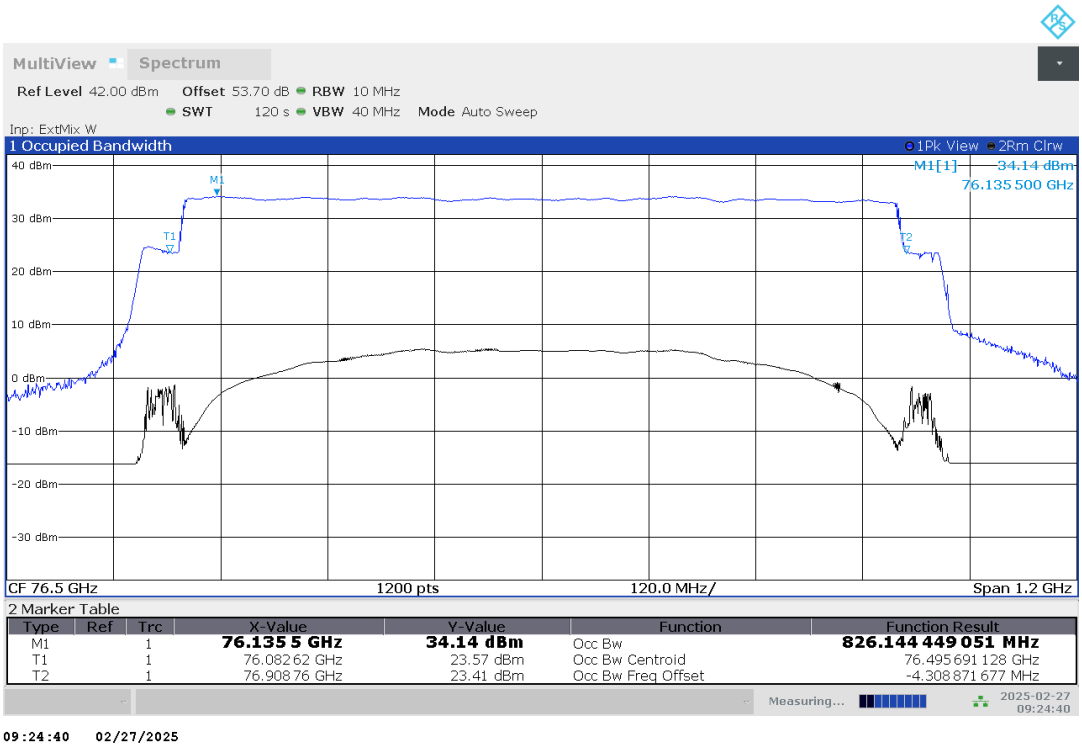
Plot no. 20: 99% OBW, Peak detector, -40 °C, DMP01



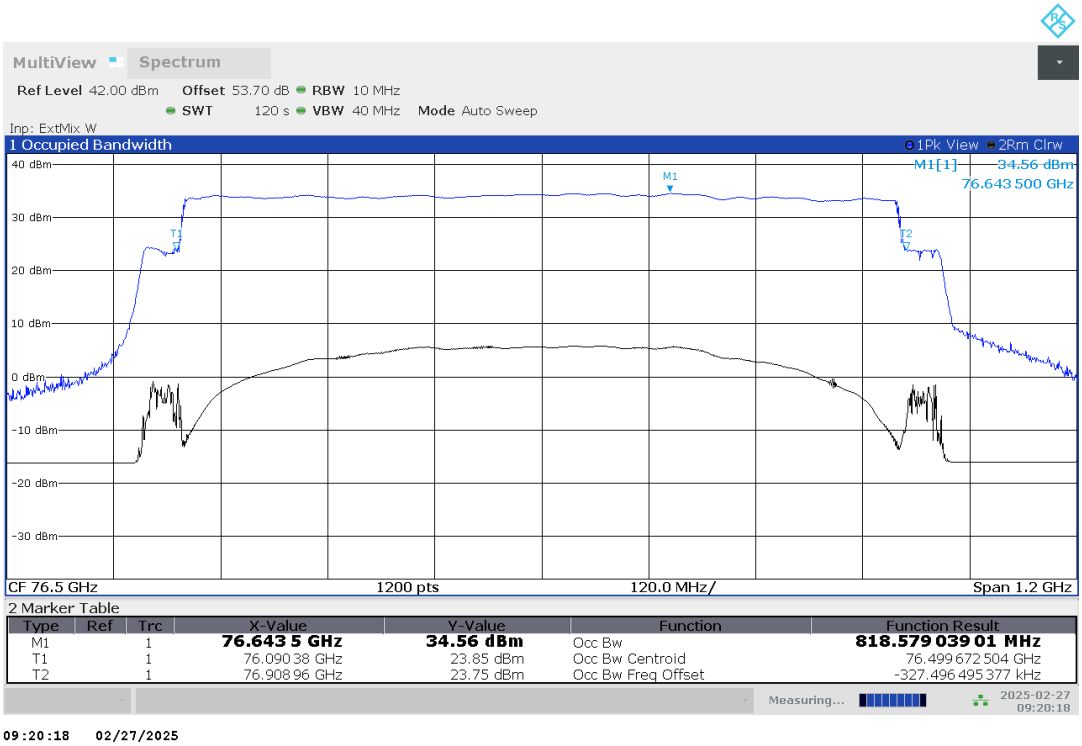
Plot no. 21: 99% OBW, Peak detector, 85 °C, DMP02



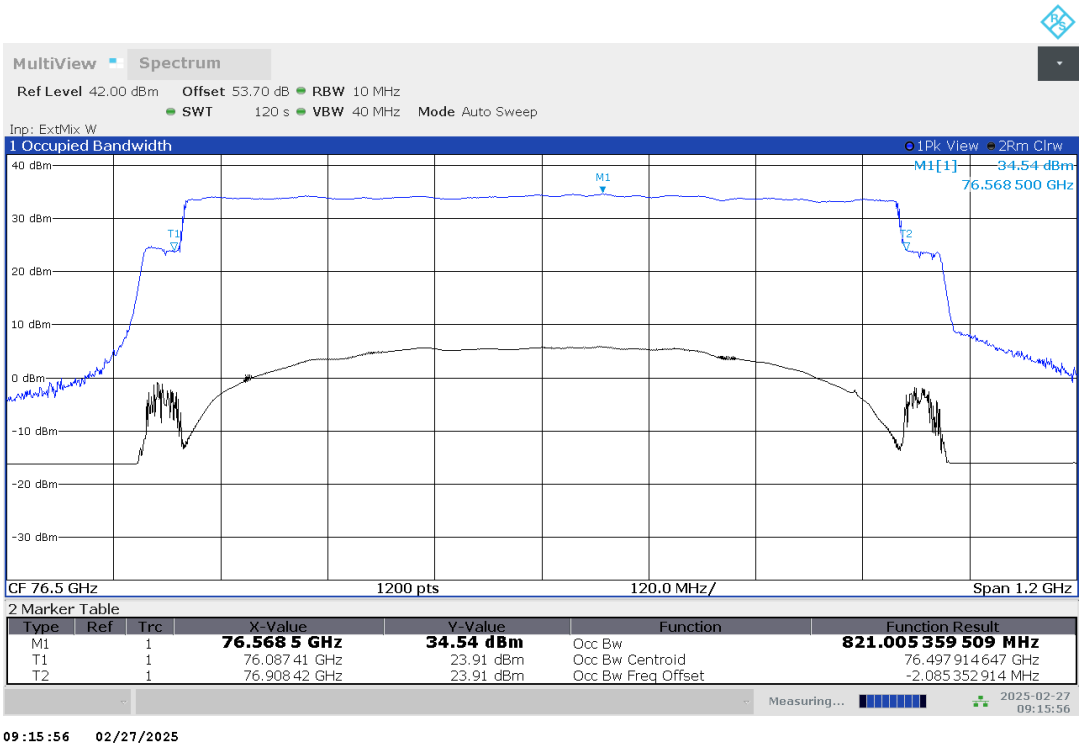
Plot no. 22: 99% OBW, Peak detector, 60 °C, DMP02



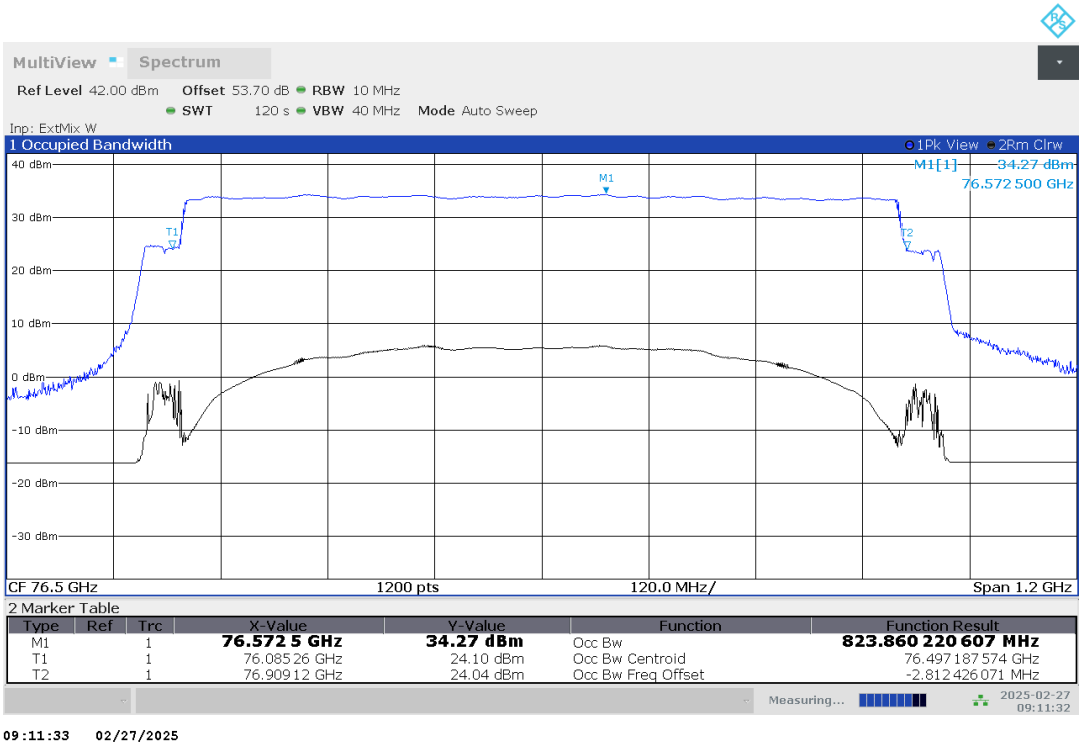
Plot no. 23: 99% OBW, Peak detector, 50 °C, DMP02



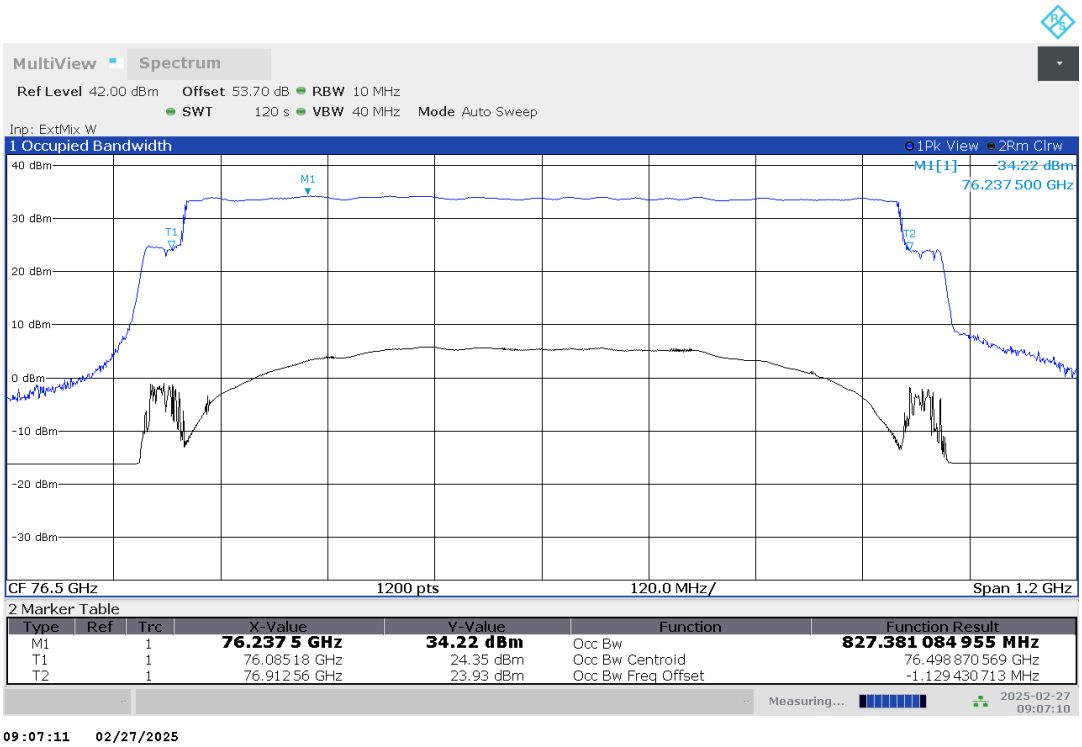
Plot no. 24: 99% OBW, Peak detector, 40 °C, DMP02



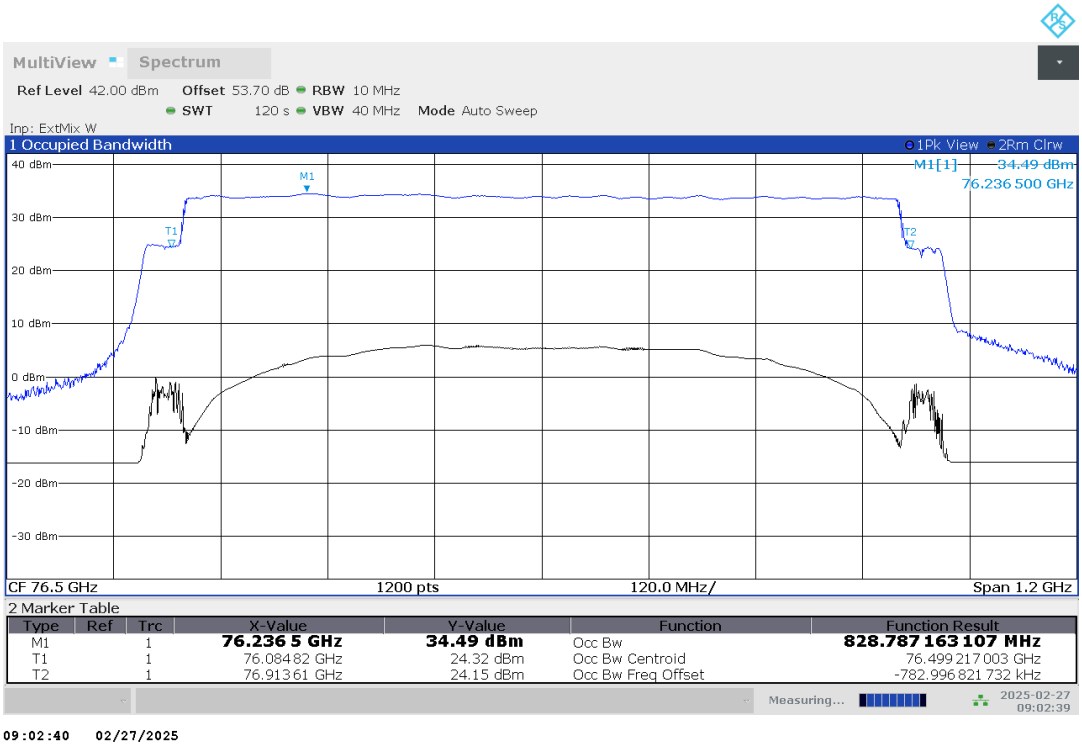
Plot no. 25: 99% OBW, Peak detector, 30 °C, DMP02



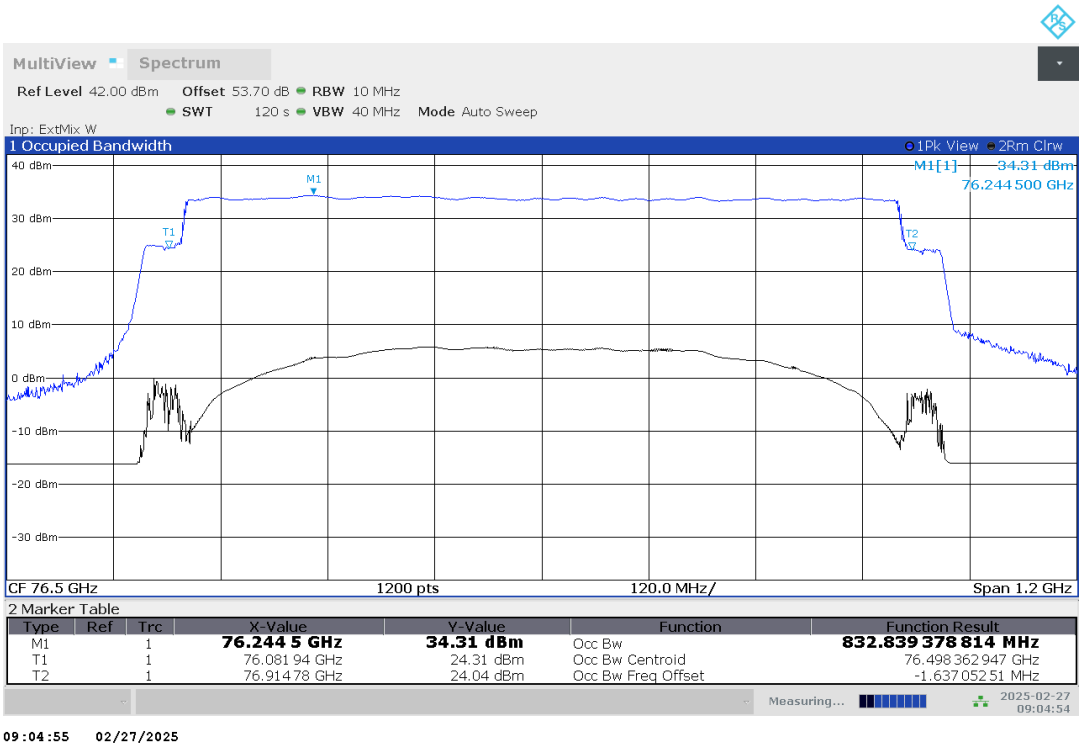
Plot no. 26: 99% OBW, Peak detector, 20 °C, V_{max}, DMP02



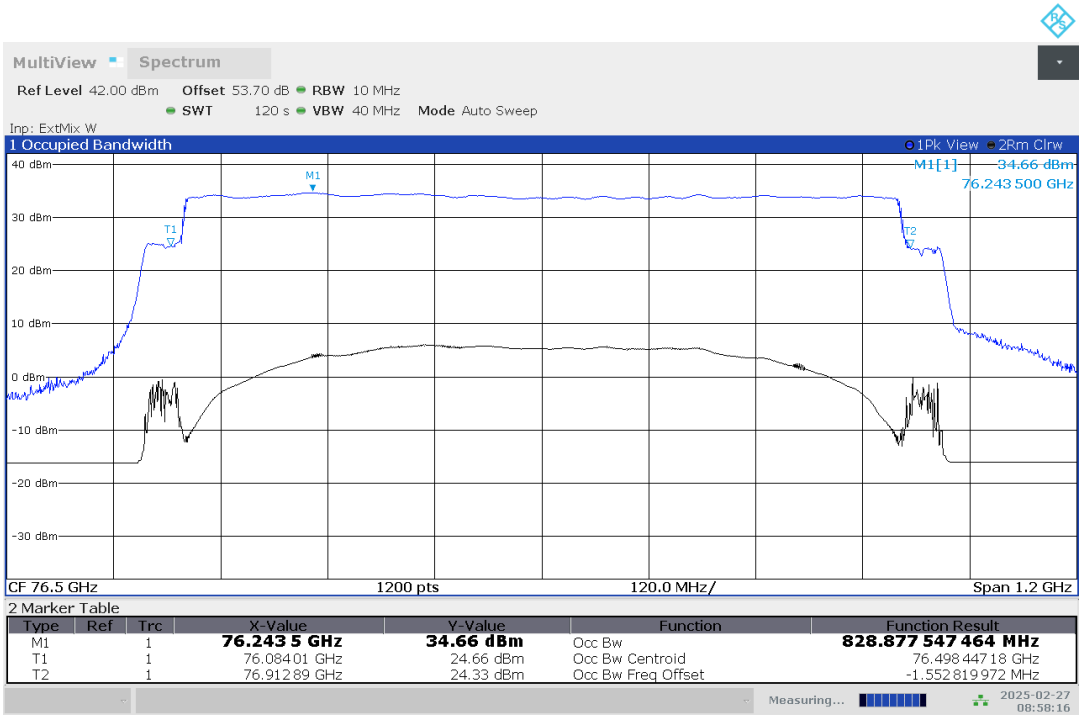
Plot no. 27: 99% OBW, Peak detector, 20 °C, V_{nom}, DMP02



Plot no. 28: 99% OBW, Peak detector, 20 °C, V_{min}, DMP02



Plot no. 29: 99% OBW, Peak detector, 10 °C, DMP02

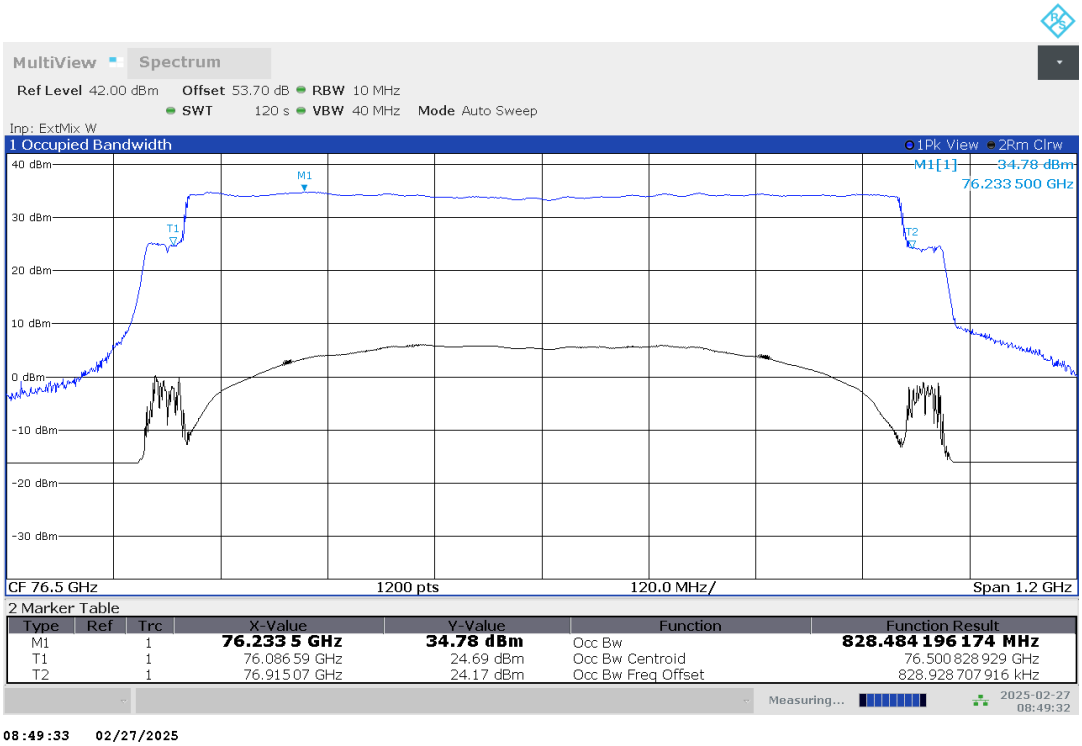


08:58:17 02/27/2025

Plot no. 30: 99% OBW, Peak detector, 0 °C, DMP02

08:53:55 02/27/2025

Plot no. 31: 99% OBW, Peak detector, -10 °C, DMP02



08:49:33 02/27/2025

Plot no. 32: 99% OBW, Peak detector, -20 °C, DMP02

08:45:11 02/27/2025

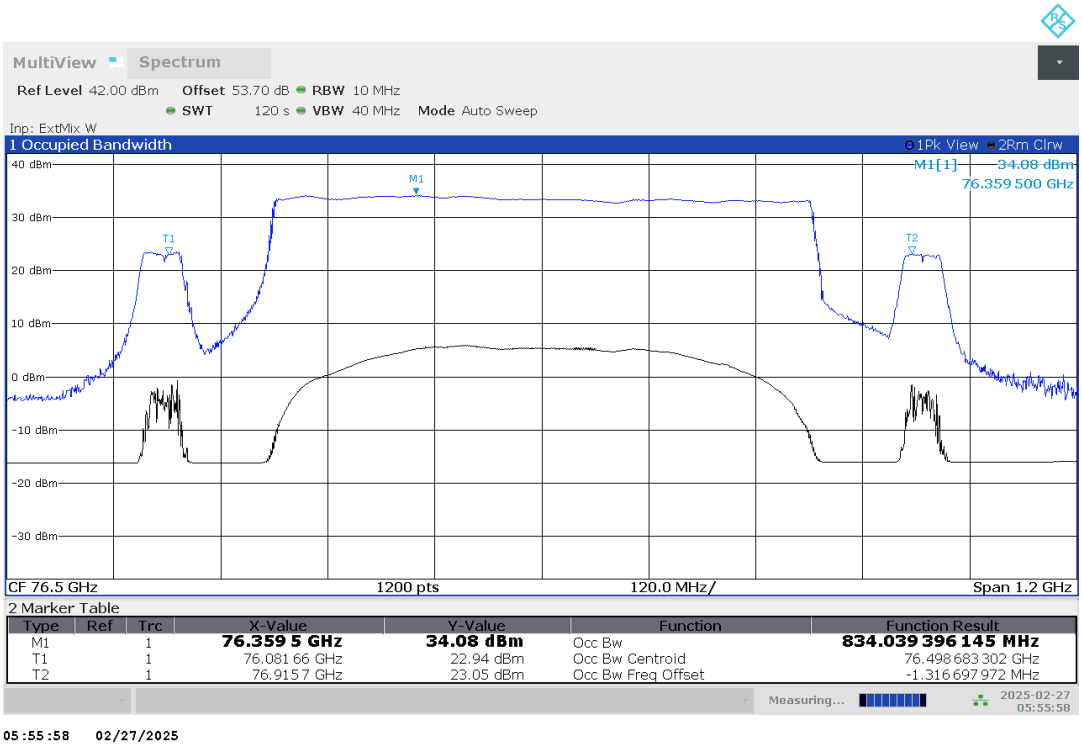
Plot no. 33: 99% OBW, Peak detector, -30 °C, DMP02

08:40:48 02/27/2025

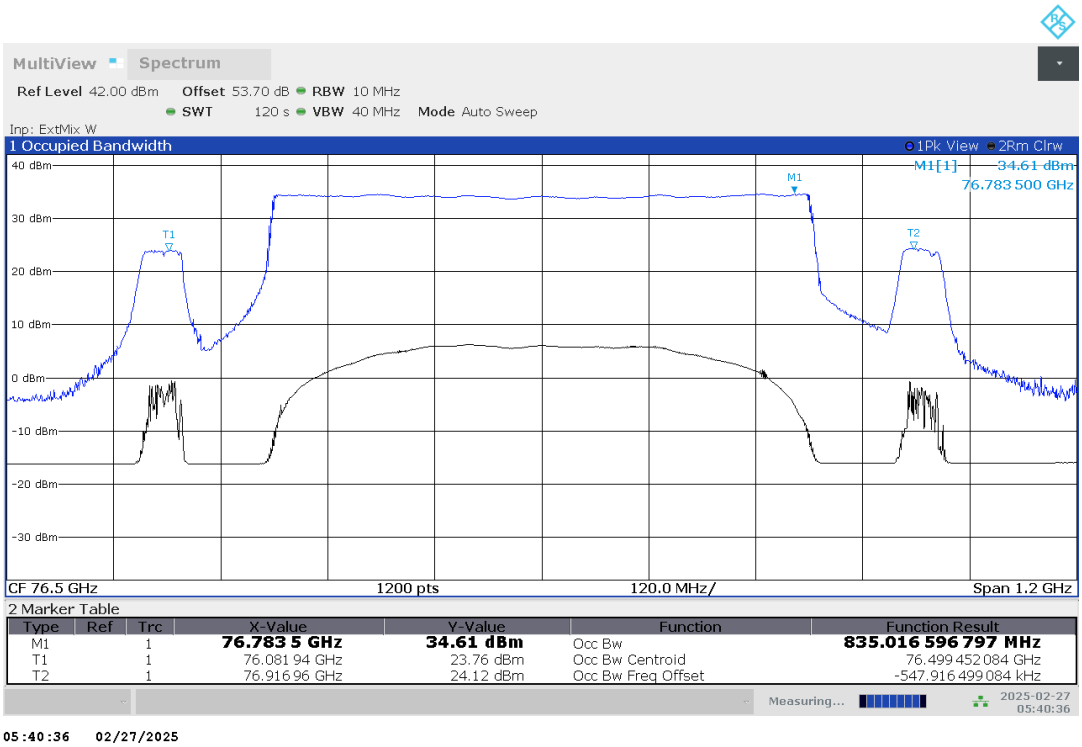
Plot no. 34: 99% OBW, Peak detector, -40 °C, DMP02

08:31:55 02/27/2025

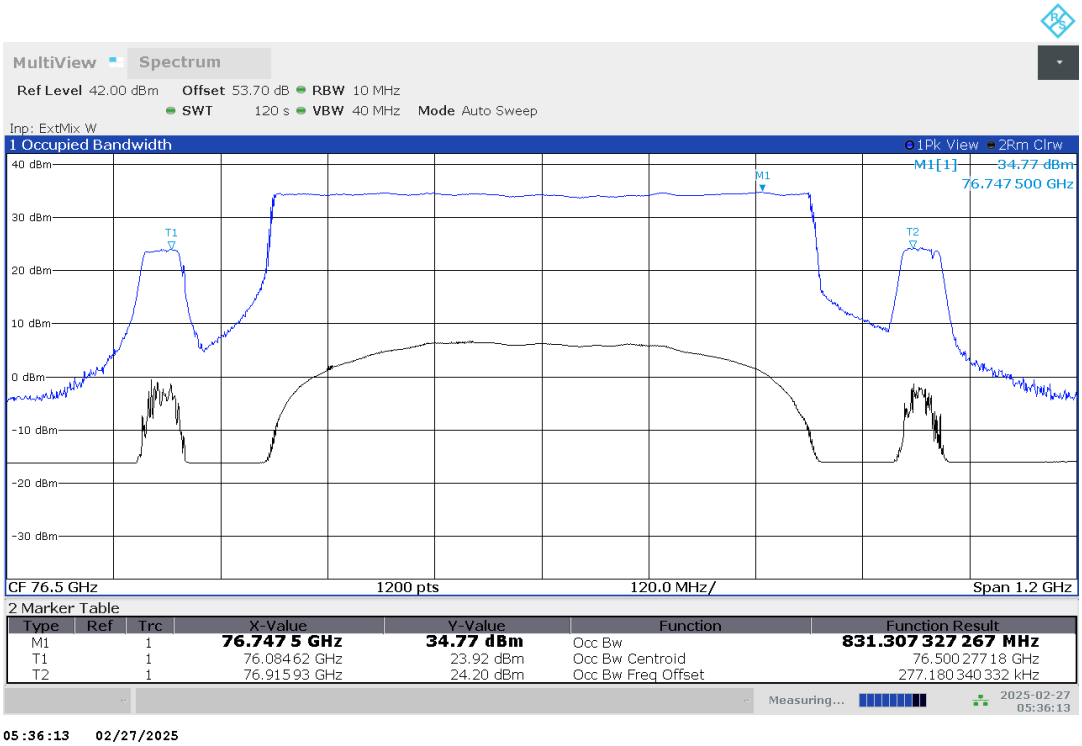
Plot no. 35: 99% OBW, Peak detector, 85 °C, DMP03



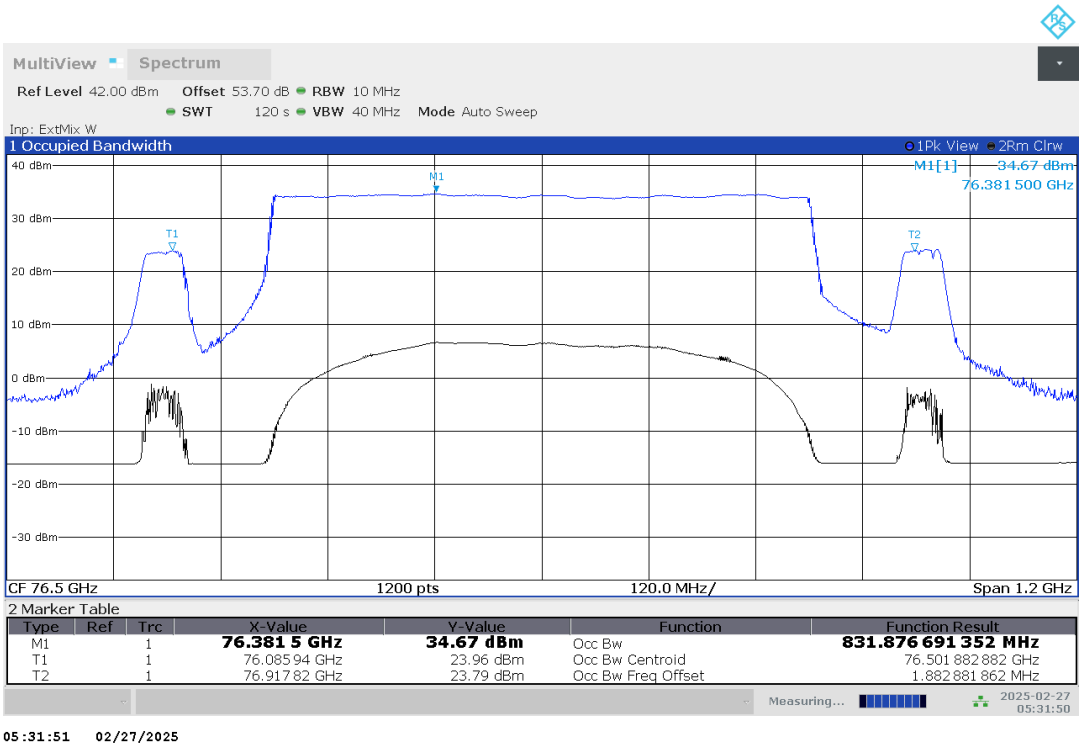
Plot no. 36: 99% OBW, Peak detector, 60 °C, DMP03



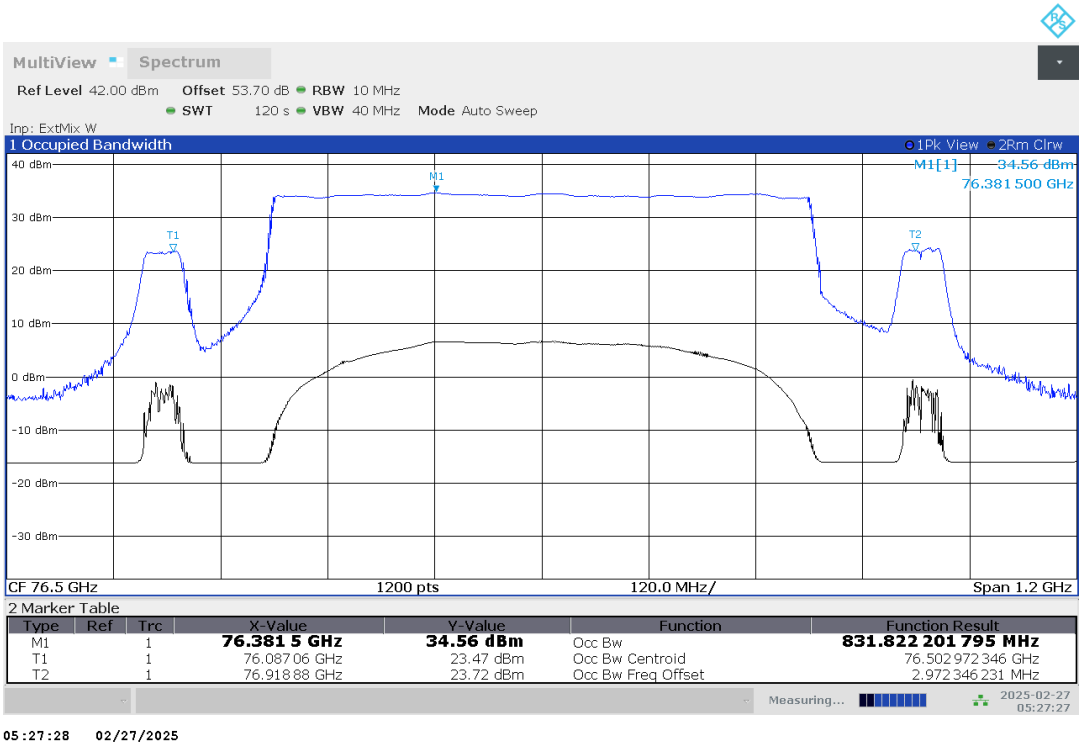
Plot no. 37: 99% OBW, Peak detector, 50 °C, DMP03



Plot no. 38: 99% OBW, Peak detector, 40 °C, DMP03

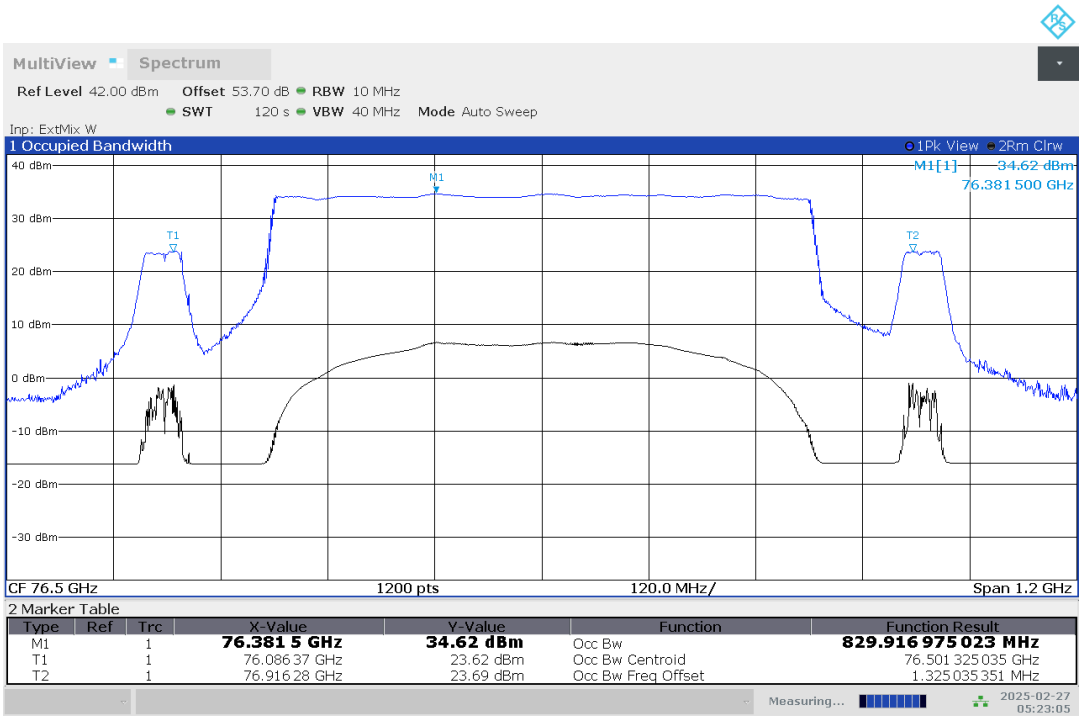


Plot no. 39: 99% OBW, Peak detector, 30 °C, DMP03



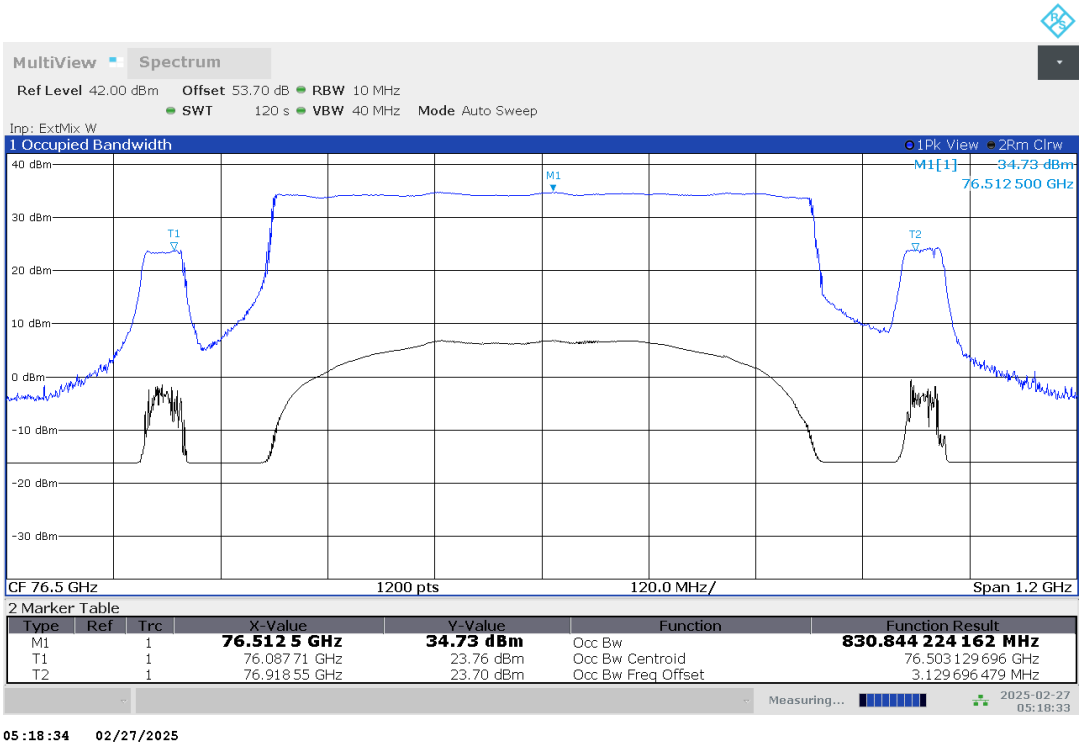
05:27:28 02/27/2025

Plot no. 40: 99% OBW, Peak detector, 20 °C, V_{max}, DMP03

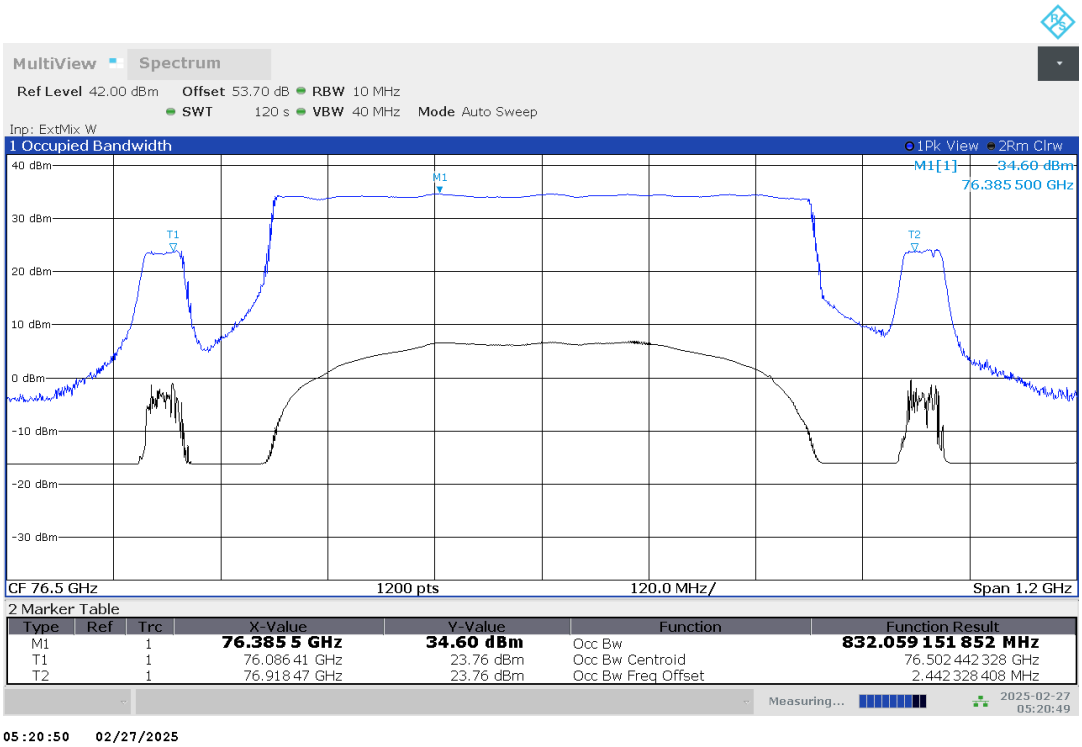


05:23:06 02/27/2025

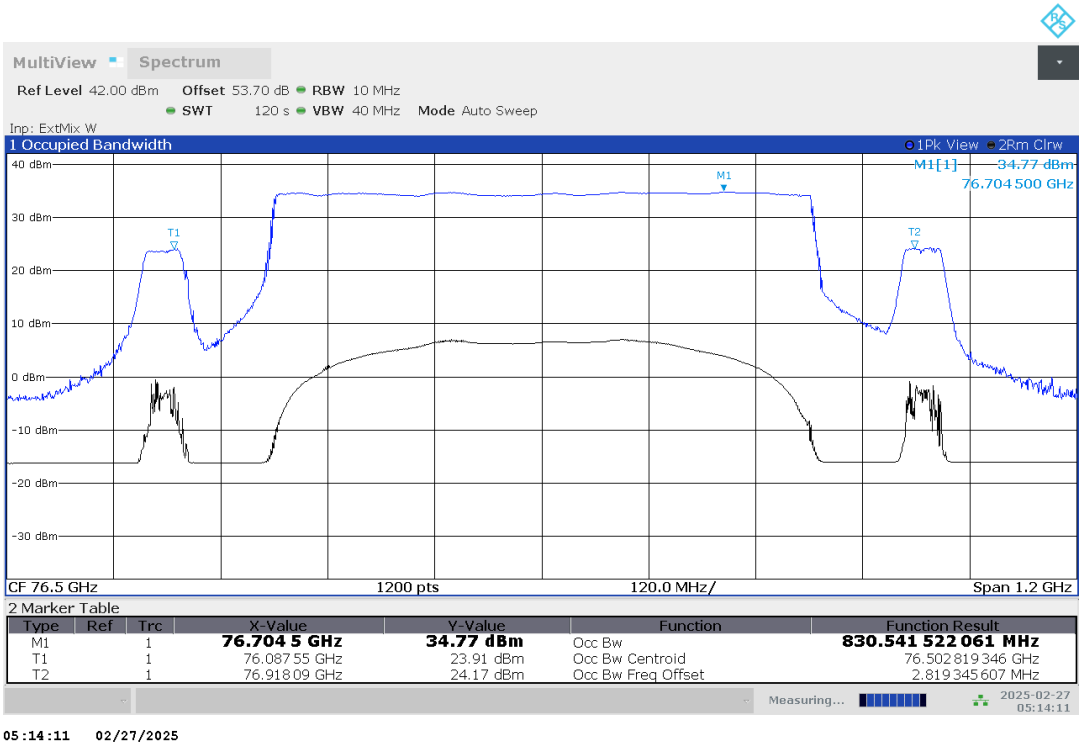
Plot no. 41: 99% OBW, Peak detector, 20 °C, V_{nom}, DMP03



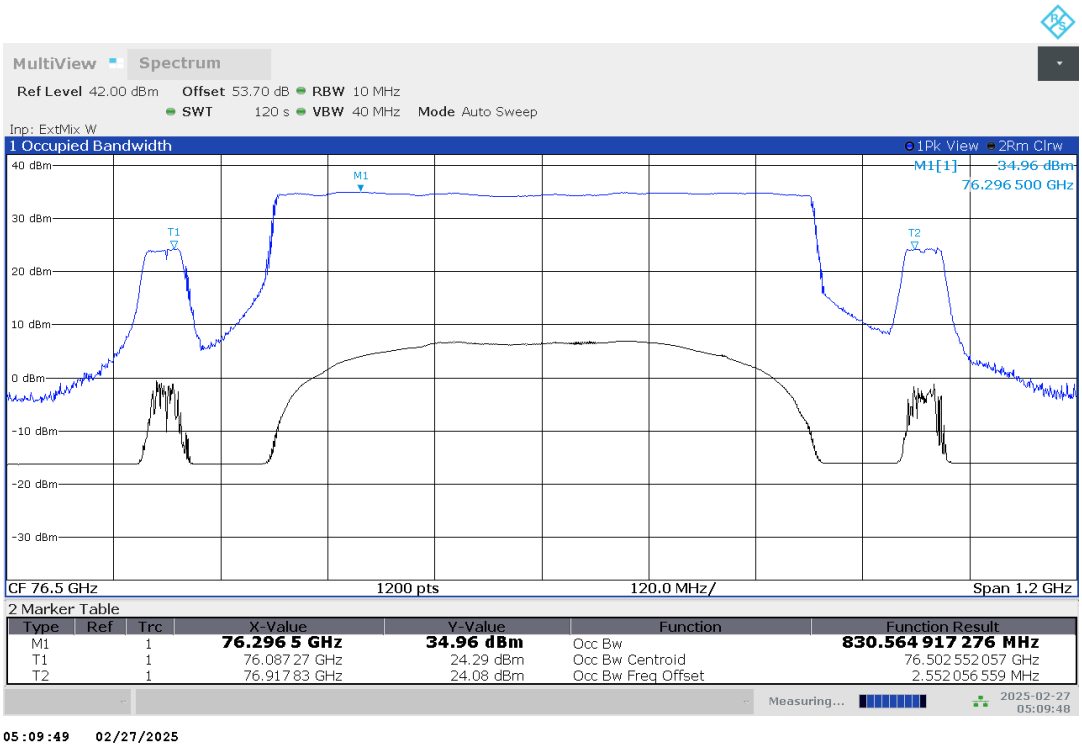
Plot no. 42: 99% OBW, Peak detector, 20 °C, V_{min}, DMP03



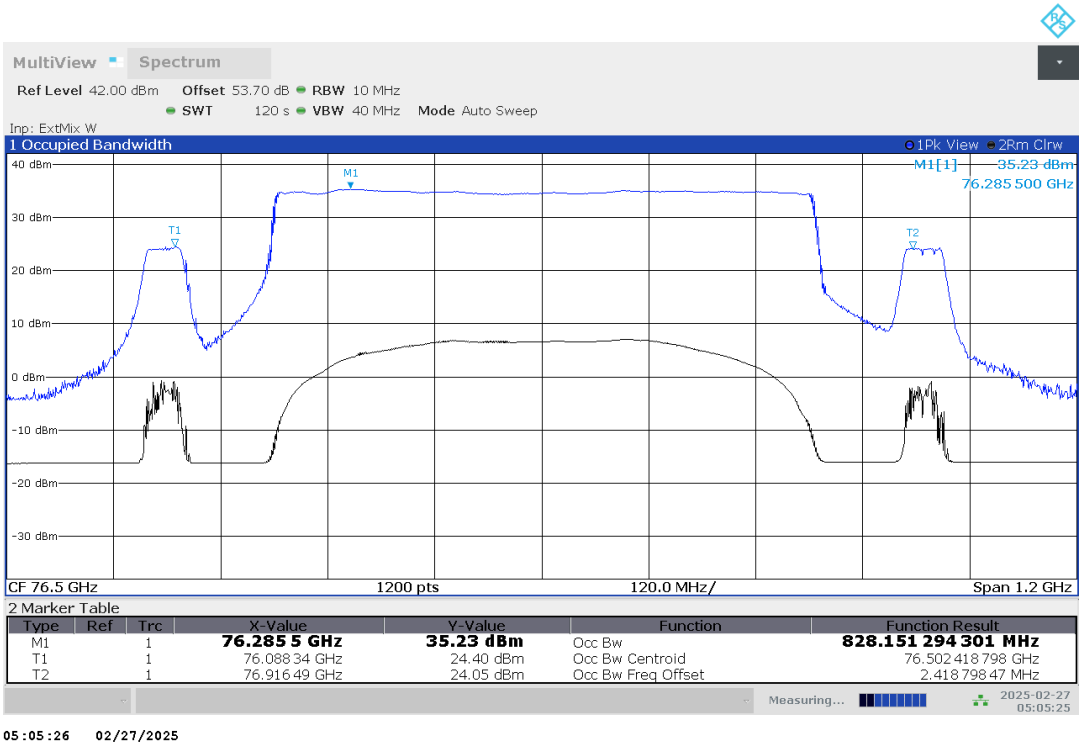
Plot no. 43: 99% OBW, Peak detector, 10 °C, DMP03



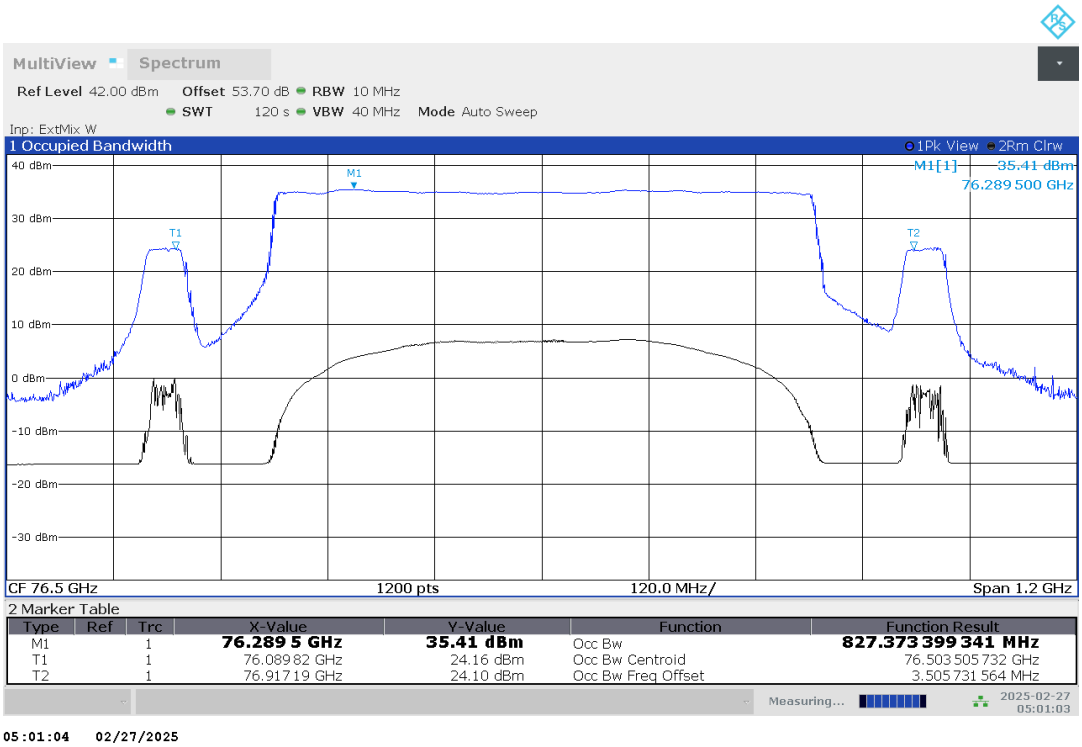
Plot no. 44: 99% OBW, Peak detector, 0 °C, DMP03



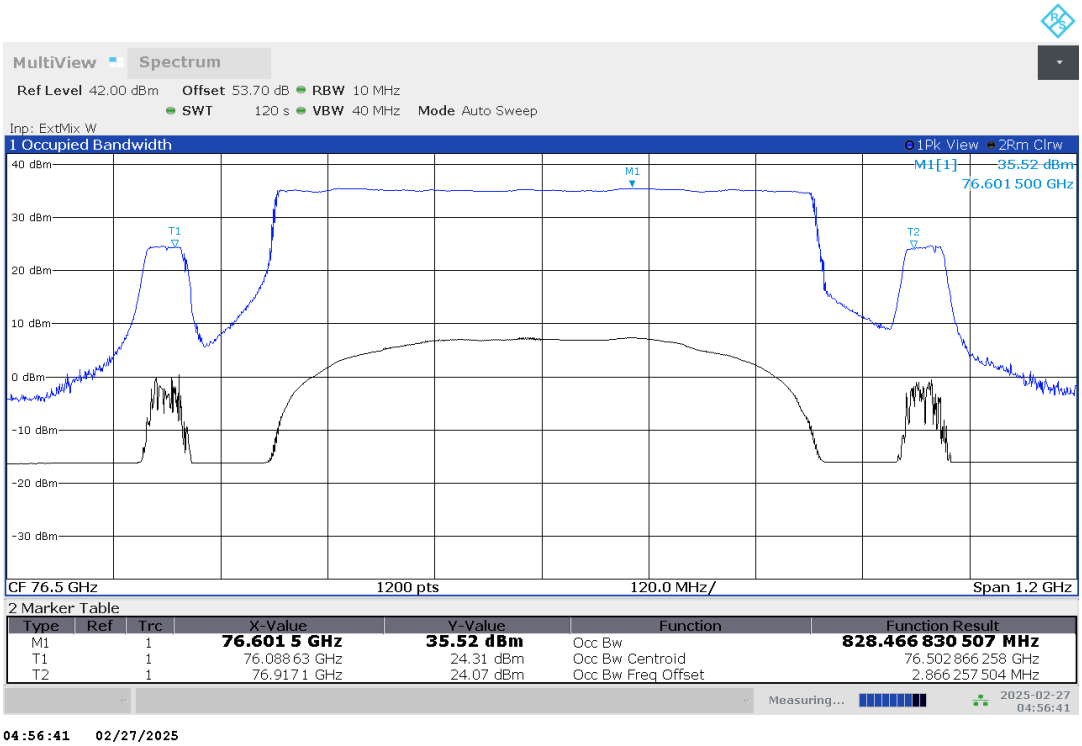
Plot no. 45: 99% OBW, Peak detector, -10 °C, DMP03



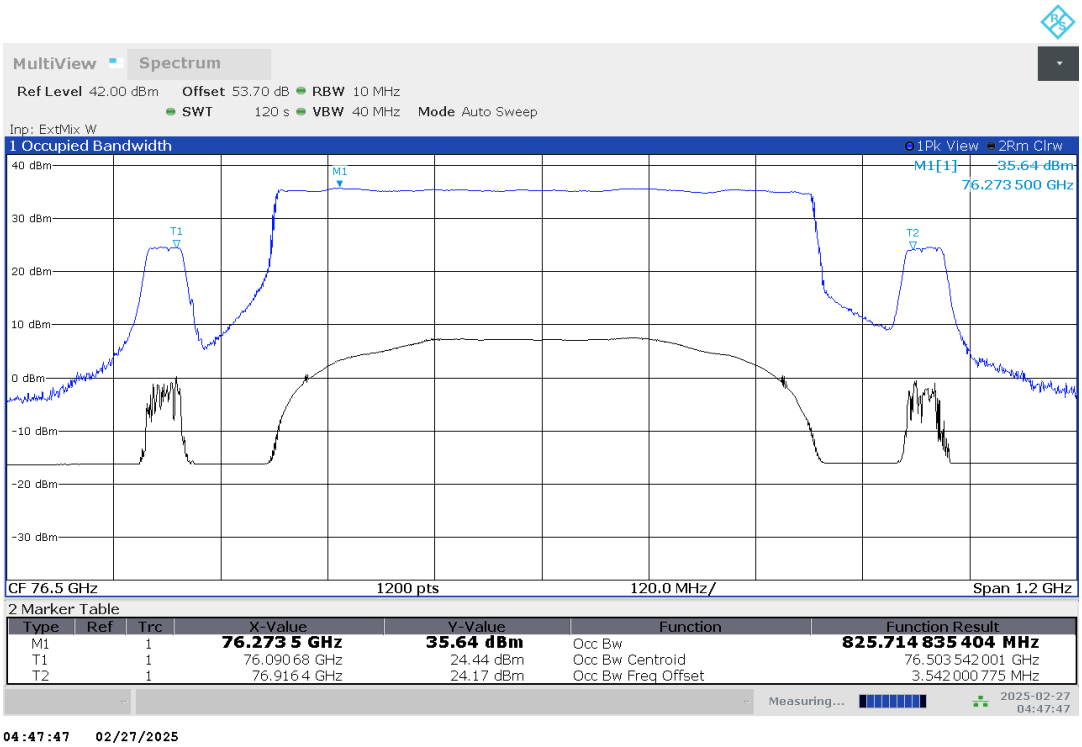
Plot no. 46: 99% OBW, Peak detector, -20 °C, DMP03



Plot no. 47: 99% OBW, Peak detector, -30 °C, DMP03



Plot no. 48: 99% OBW, Peak detector, -40 °C, DMP03



7.4 Field strength of spurious radiation (§2.1053 & §95.3379)

Description

§2.1053 Measurements required: Field strength of spurious radiation.

(a) Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of §2.1049, as appropriate. For equipment operating on frequencies below 890 MHz, an open field test is normally required, with the measuring instrument antenna located in the far-field at all test frequencies. In the event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from halfwave dipole antennas.

Limits

§95.3379 76-81 GHz Band Radar Service unwanted emissions limits.

(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.

Frequency [MHz]	Field Strength [µV/m] / [dBµV/m]	Measurement distance [m]
0.009 – 0.490	2400/F[kHz]	300
0.490 – 1.705	24000/F[kHz]	30
1.705 – 30.0	30.0 / 29.5	30
30 – 88	100 / 40.0	3
88 – 216	150 / 43.5	3
216 – 960	200 / 46.0	3
960 – 40 000	500 / 54.0	3

(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:

Frequency [GHz]	Power Density / EIRP	Measurement distance [m]
40 – 200	600 pW/cm^2 → -1.7 dBm	3
200 – 243	1000 pW/cm^2 → +0.5 dBm	3

Note

Measurements with the peak detector are also suitable to demonstrate compliance of an EUT, as long as the required resolution bandwidth is used, because peak detection will yield amplitudes equal to or greater than amplitudes measured with RMS detector. The measurement data from a spectrum analyser peak detector will represent the worst-case results (see ANSI C63.26, chapter D2: general considerations).

Calculation of the far field distance (Rayleigh distance):
The aperture dimensions of these horn antennas shall be small enough so that the measurement distance in meters is equal to or greater than the Rayleigh distance (i.e. $R_m = 2D^2 / \lambda$), where D is the largest linear dimension (i.e. width or height) of the antenna aperture in m and λ is the free-space wavelength in meters at the frequency of measurement.

Antenna type	Frequency range [GHz]	D [m]	Highest frequency in use [GHz]	Far field distance R_m [m]
20240-20	18.0 – 26.5	0.0520	26.5	0.478
22240-20	26.5 – 40.0	0.0342	40	0.312
23240-20	33.0 – 50.0	0.0280	50	0.261
24240-20	40.0 – 60.0	0.0230	60	0.212
25240-20	50.0 – 75.0	0.0185	75	0.171
26240-20	60.0 – 90.0	0.0150	90	0.135
27240-20	75.0 – 110	0.0124	110	0.113
28240-20	90.0 – 140	0.0100	140	0.093
29240-20	110 – 170	0.0085	170	0.082
30240-20	140 – 220	0.0068	220	0.068
32240-20	220 – 325	0.00446	243	0.032

Used test distances

Up to 18 GHz:	3.00 m
18 – 60 GHz:	1.00 m
60 – 84 GHz:	1.50 m
84 – 110 GHz:	0.50 m
110 – 170 GHz:	0.25 m
170 – 325 GHz:	1.00 m
In-band / OOB:	1.50 m

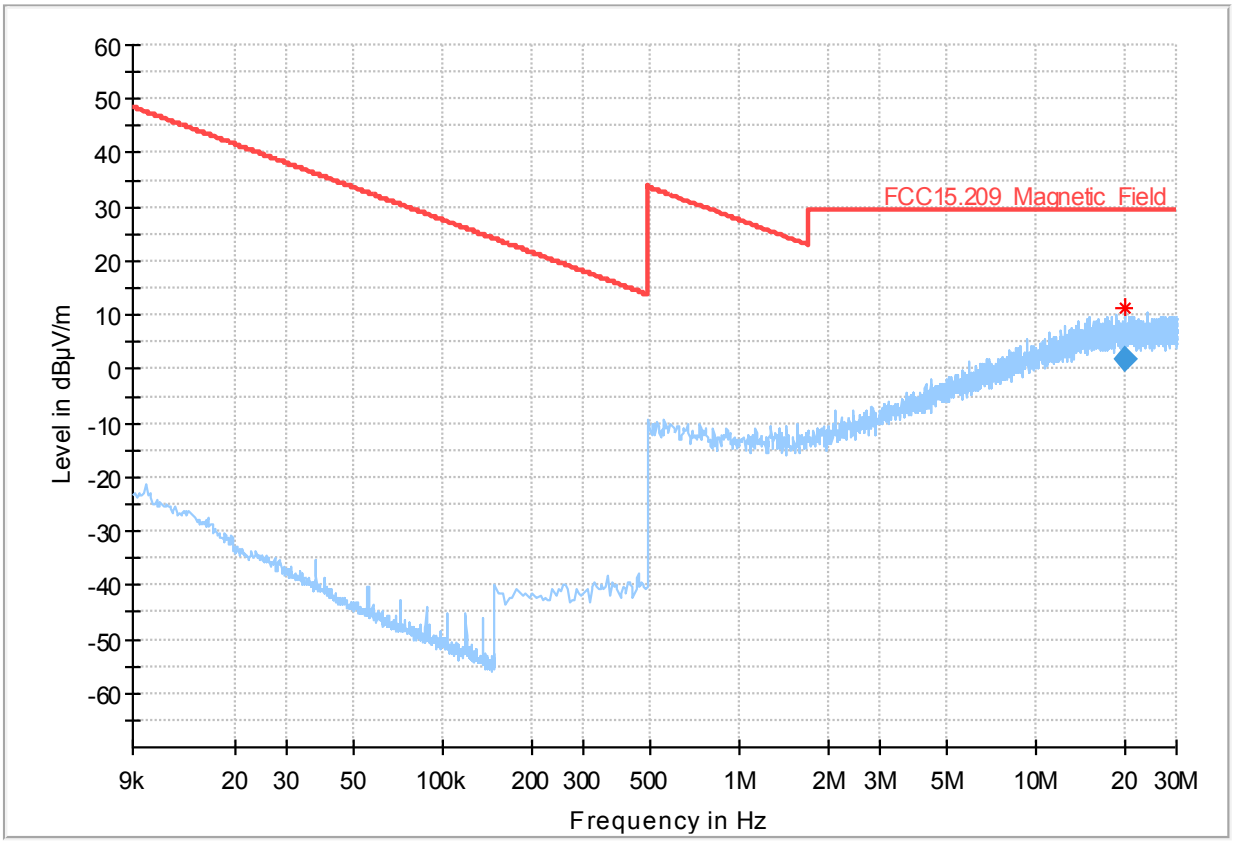
Test setup: 8.1 – 8.4 (in case of field strength measurements below 40 GHz: test distance correction factor of 20dB/decade is already considered in the plots / test result table)

Test results

Channel / Mode	Frequency [GHz]	Detector	Test distance [m]	Level [dBµV/dBm @LD]	Limit [dBµV/dBm @LD]	Margin [dB]
No critical peaks found. Please refer to plots.						

Note:
LD = Limit Distance of 300m / 30m / 3m depending on frequency range, see limit table

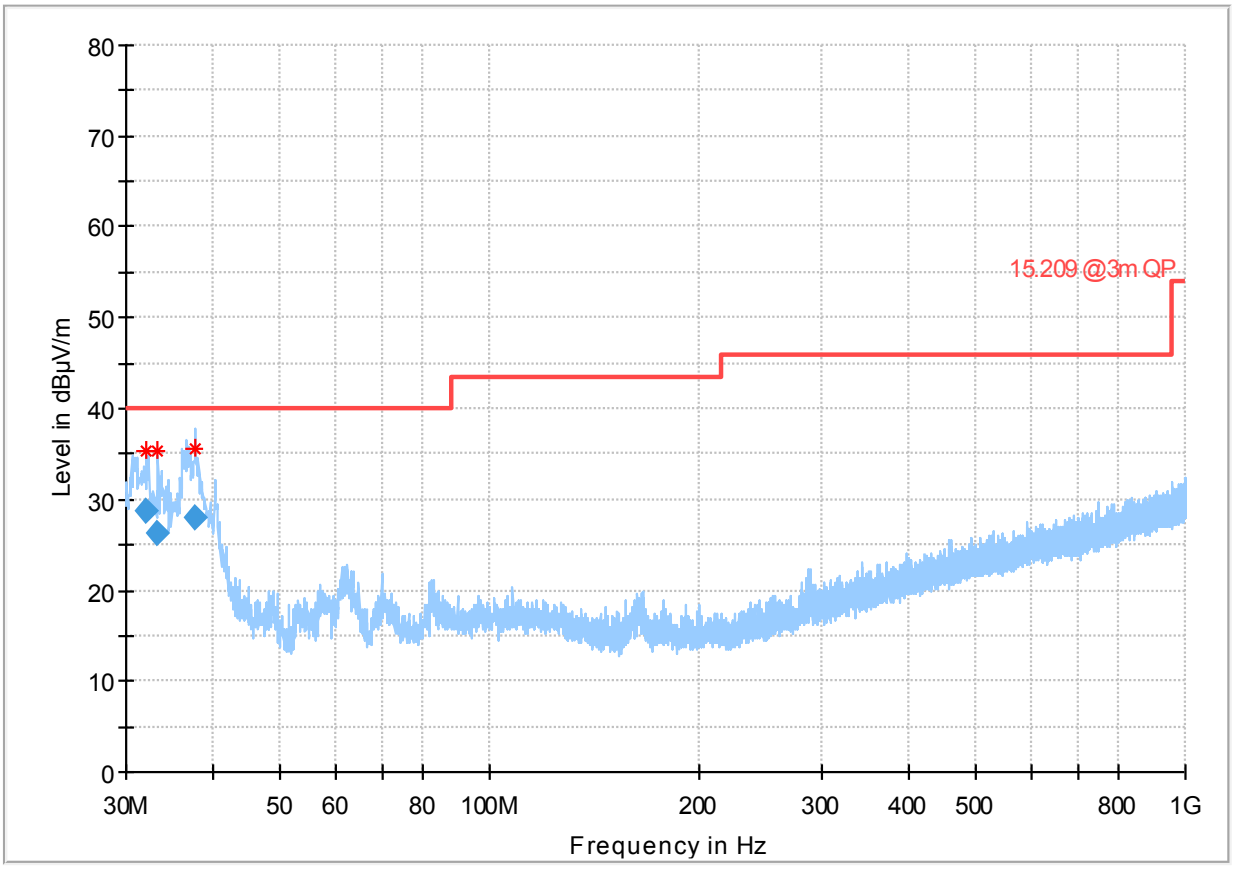
Plot no. 49: radiated emissions 9 kHz – 30 MHz, loop antenna polarization vertical / horizontal, DMP01



Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Pol	Azimuth (deg)	Corr. (dB/m)
20.210114	1.65	29.54	27.89	100.0	9.000	V	219.0	0.5

Plot no. 50: radiated emissions 30 MHz – 1 GHz, polarization vertical / horizontal, DMP01

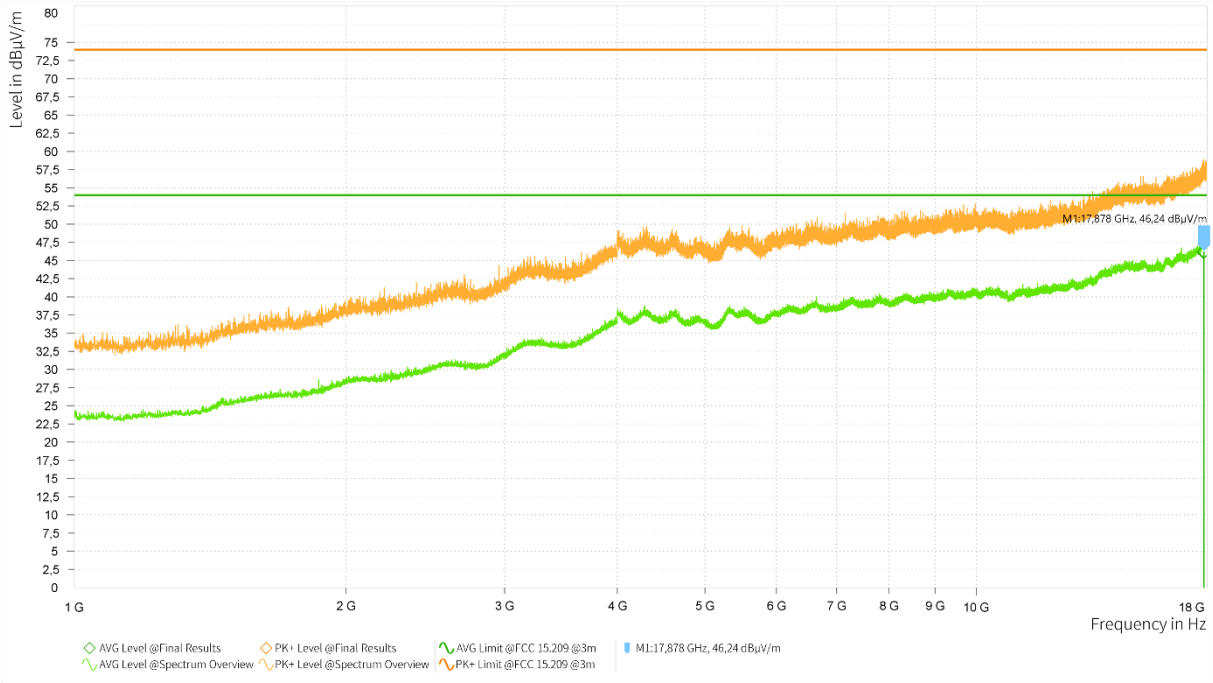


Preview Result 1-PK+
Final_Result QPK
Critical_Freqs PK+
MaxPeak-PK+ (Single)
15.209 @3m QP
QuasiPeak-QPK (Single)

Final_Result

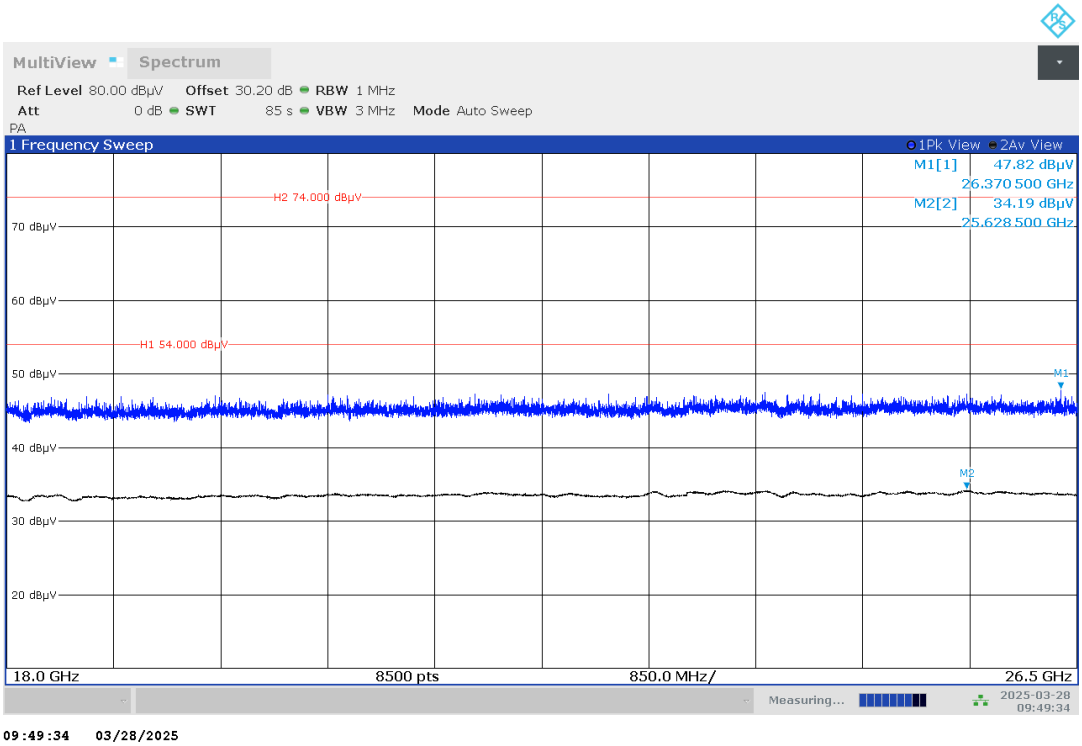
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
32.044000	28.67	40.00	11.33	100.0	120.000	100.0	V	177.0
33.316500	26.25	40.00	13.75	100.0	120.000	100.0	V	262.0
37.771500	28.09	40.00	11.91	100.0	120.000	100.0	V	266.0

Plot no. 51: radiated emissions 1 GHz – 18 GHz, polarization vertical / horizontal, DMP01

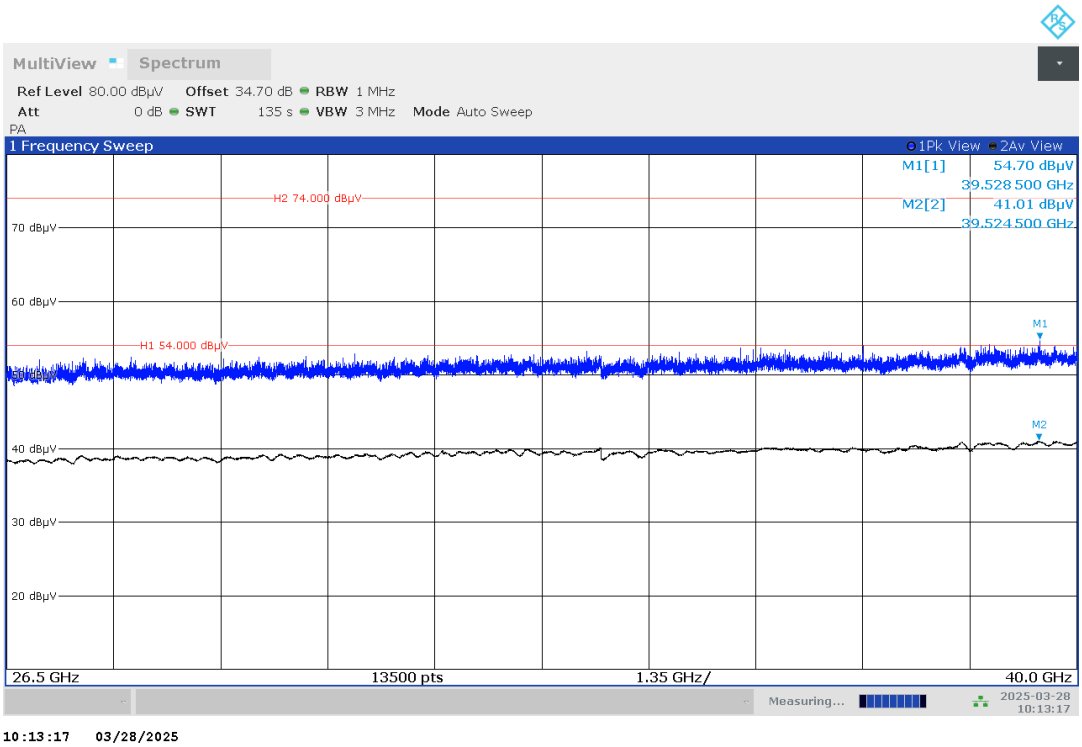


Rg	Frequency [MHz]	PK+ Level [dBµV/m]	PK+ Limit [dBµV/m]	PK+ Margin [dB]	AVG Level [dBµV/m]	AVG Limit [dBµV/m]	AVG Margin [dB]	Correction [dB]	Elevation [deg]	Azimuth [deg]	Antenna Height [m]	Time of Meas.
1	17.851,000				46,14	54,00	7,86	44,07	105	174,3	1,50	09:52:42
1	17.877,650				46,24	54,00	7,76	44,14	79,7	51,3	1,50	09:51:33

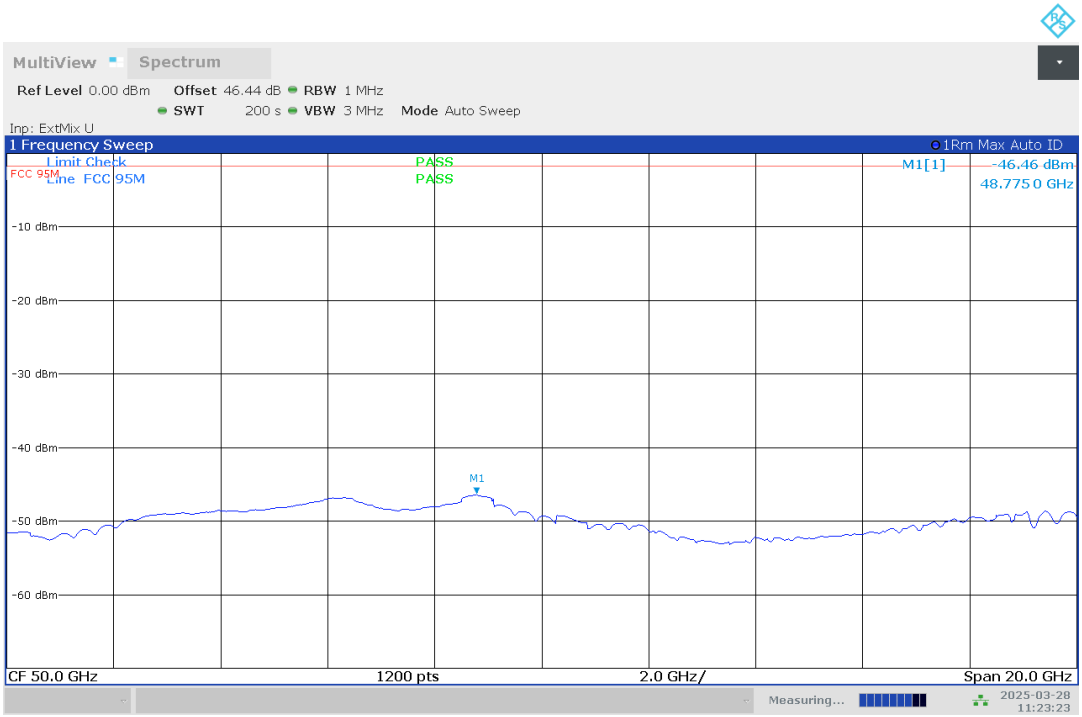
Plot no. 52: radiated emissions 18 GHz – 26.5 GHz, polarization vertical / horizontal, DMP01



Plot no. 53: radiated emissions 26.5 GHz – 40 GHz, polarization vertical / horizontal, DMP01

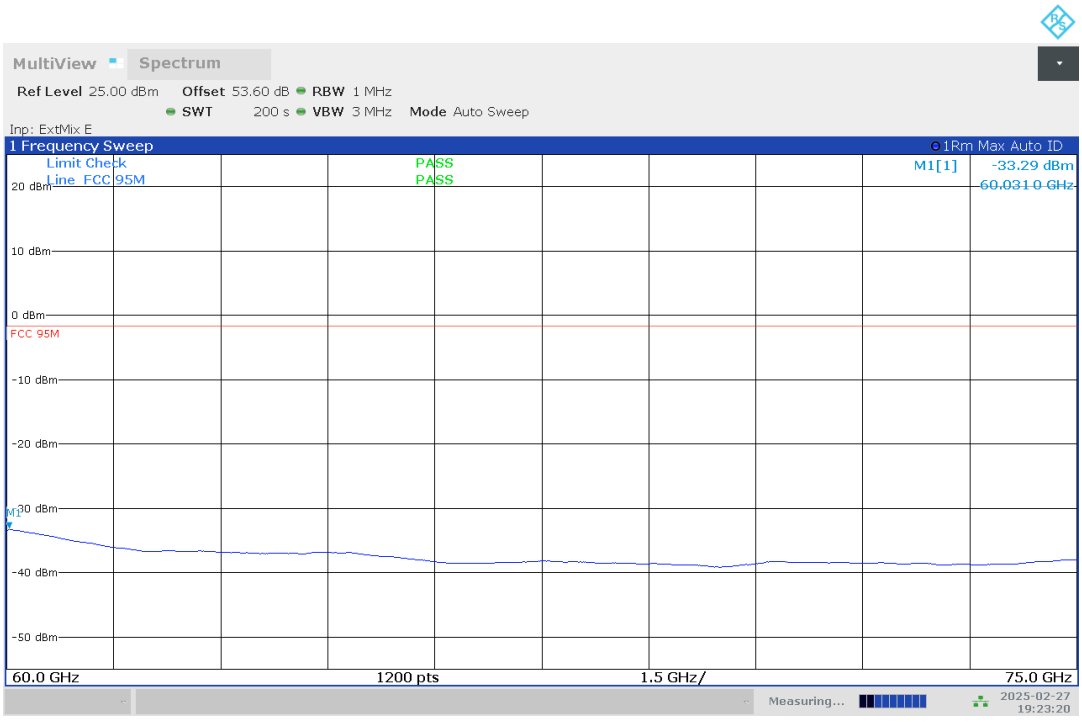


Plot no. 54: radiated emissions 40 GHz – 60 GHz, polarization vertical / horizontal, DMP01



11:23:23 03/28/2025

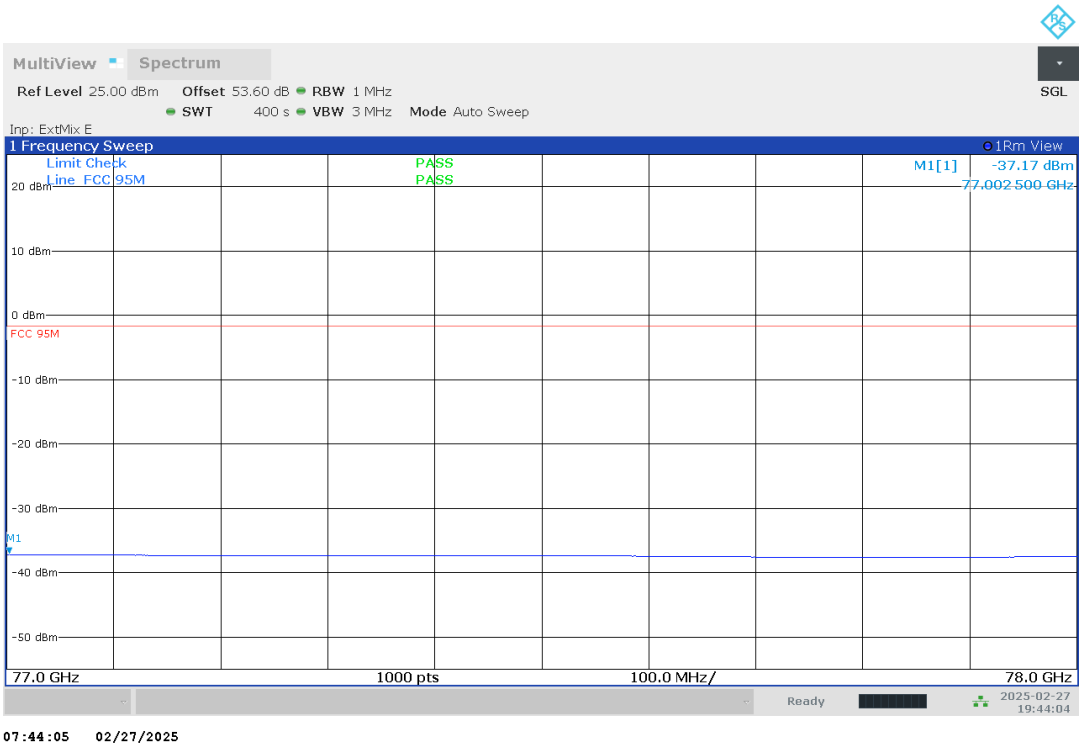
Plot no. 55: radiated emissions 60 GHz – 75 GHz, polarization vertical / horizontal, DMP01



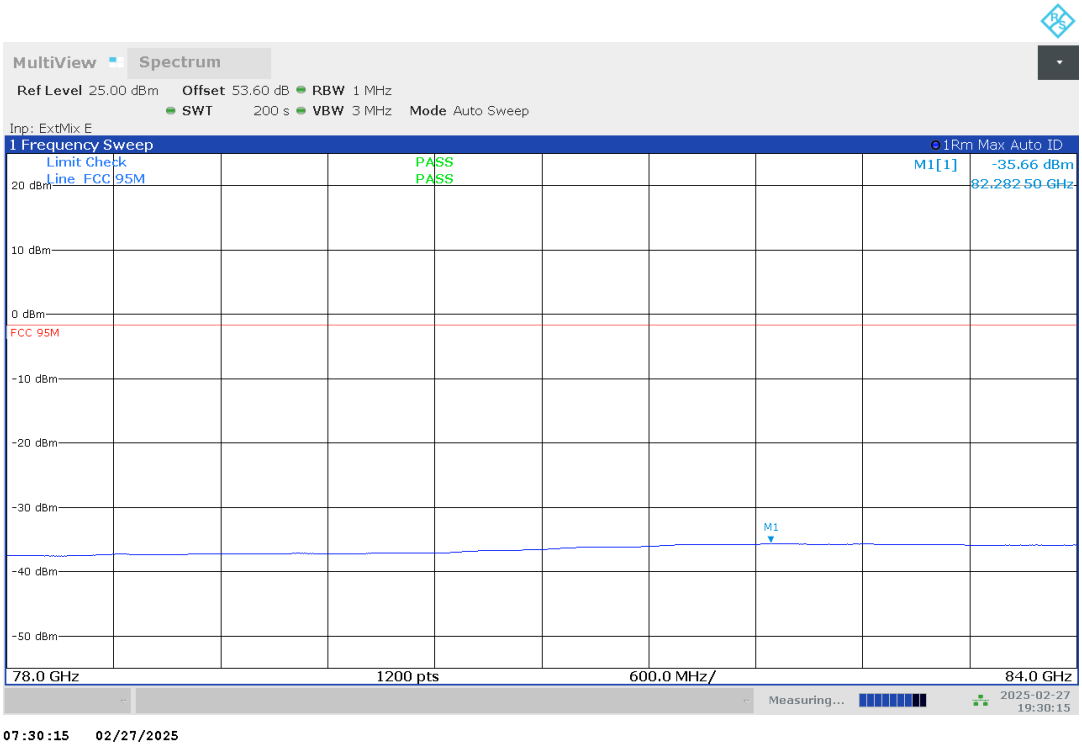
07:23:20 02/27/2025

Plot no. 56: radiated emissions 75.0 GHz – 76.0 GHz, band edge, DMP01

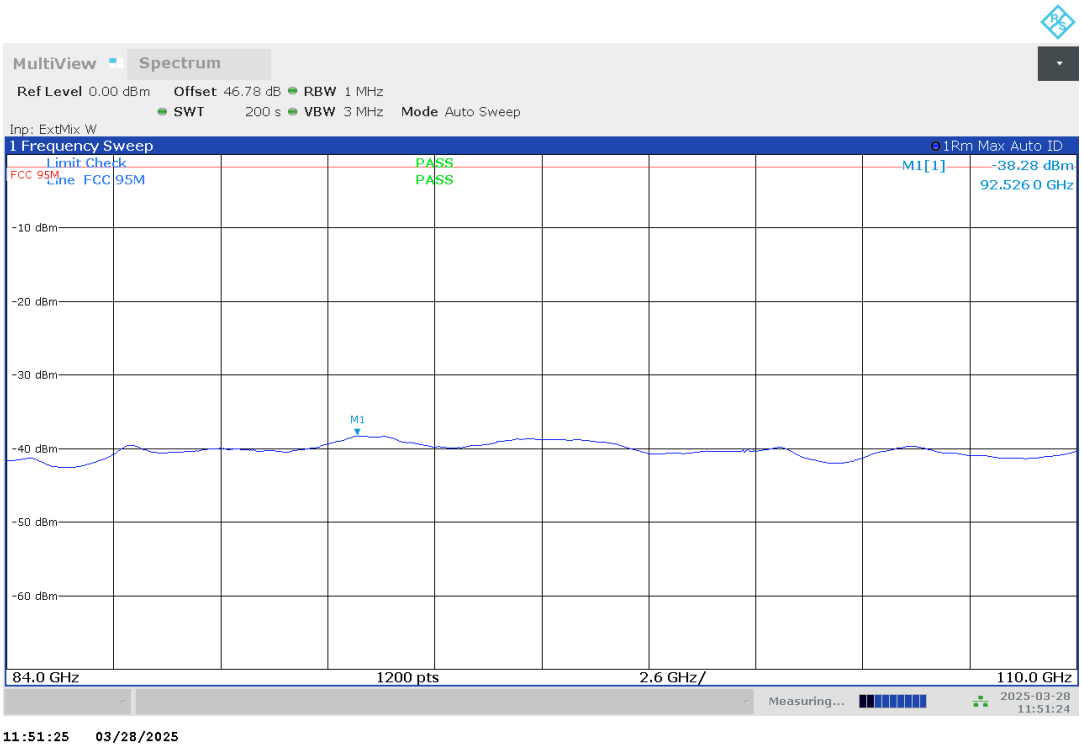
Plot no. 57: radiated emissions 77 GHz – 78 GHz, polarization vertical / horizontal, DMP01



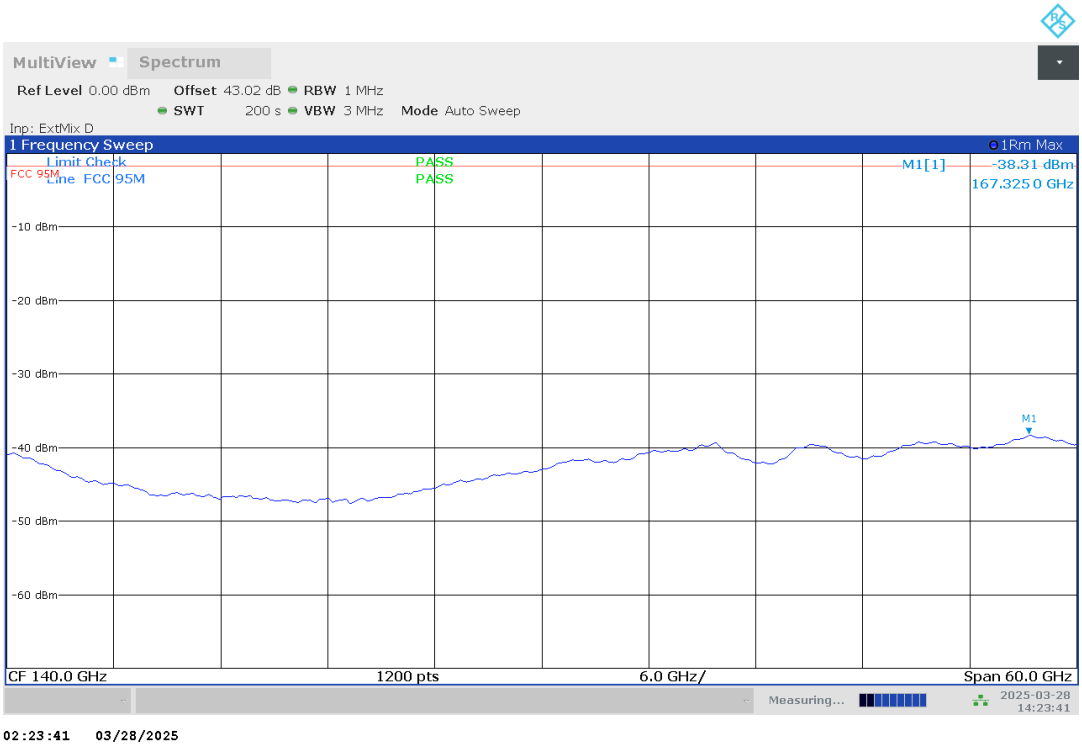
Plot no. 58: radiated emissions 78 GHz – 84 GHz, polarization vertical / horizontal, DMP01



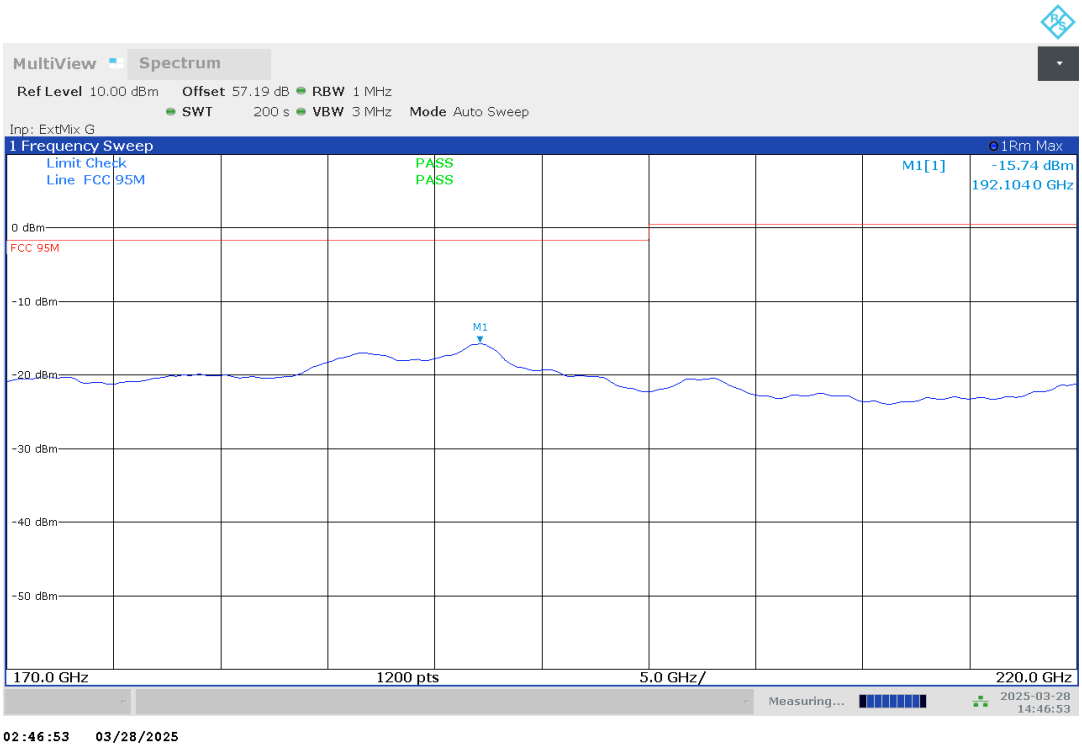
Plot no. 59: radiated emissions 84 GHz – 110 GHz, polarization vertical / horizontal, DMP01



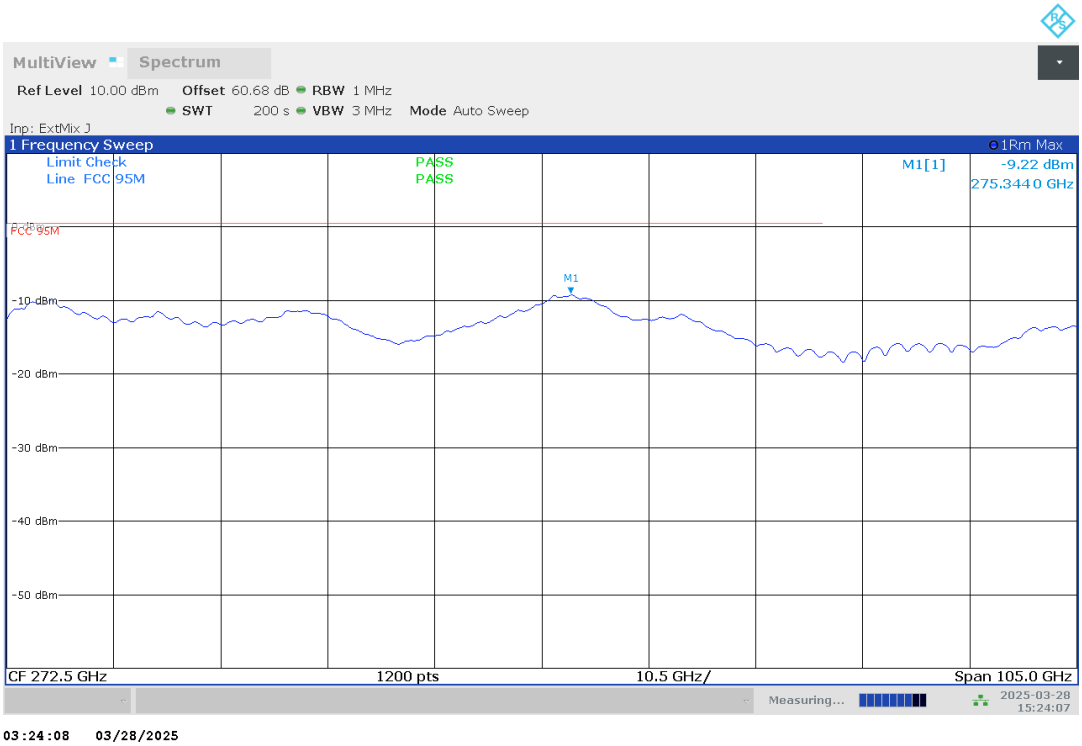
Plot no. 60: radiated emissions 110 GHz – 170 GHz, polarization vertical / horizontal, DMP01



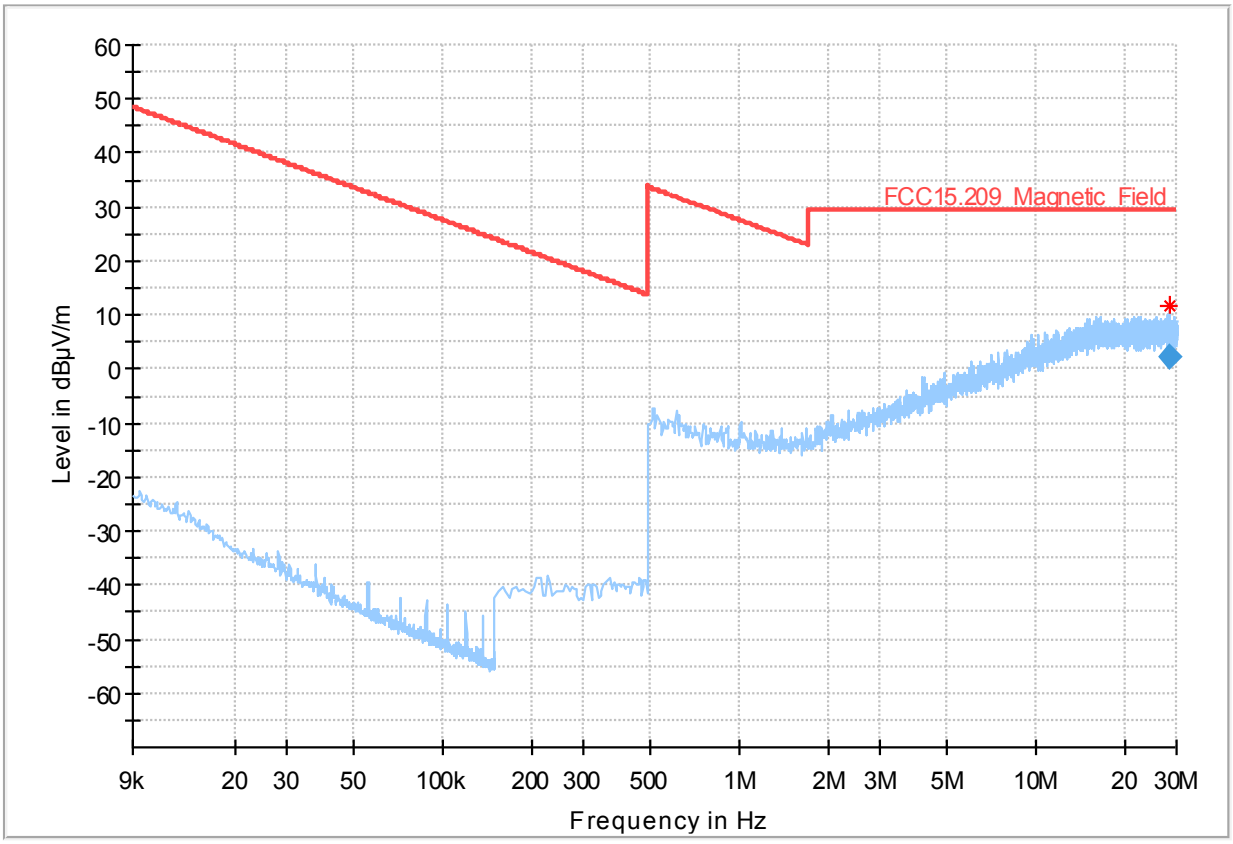
Plot no. 61: radiated emissions 170 GHz – 220 GHz, polarization vertical / horizontal, DMP01



Plot no. 62: radiated emissions 220 GHz – 325 GHz, polarization vertical / horizontal, DMP01



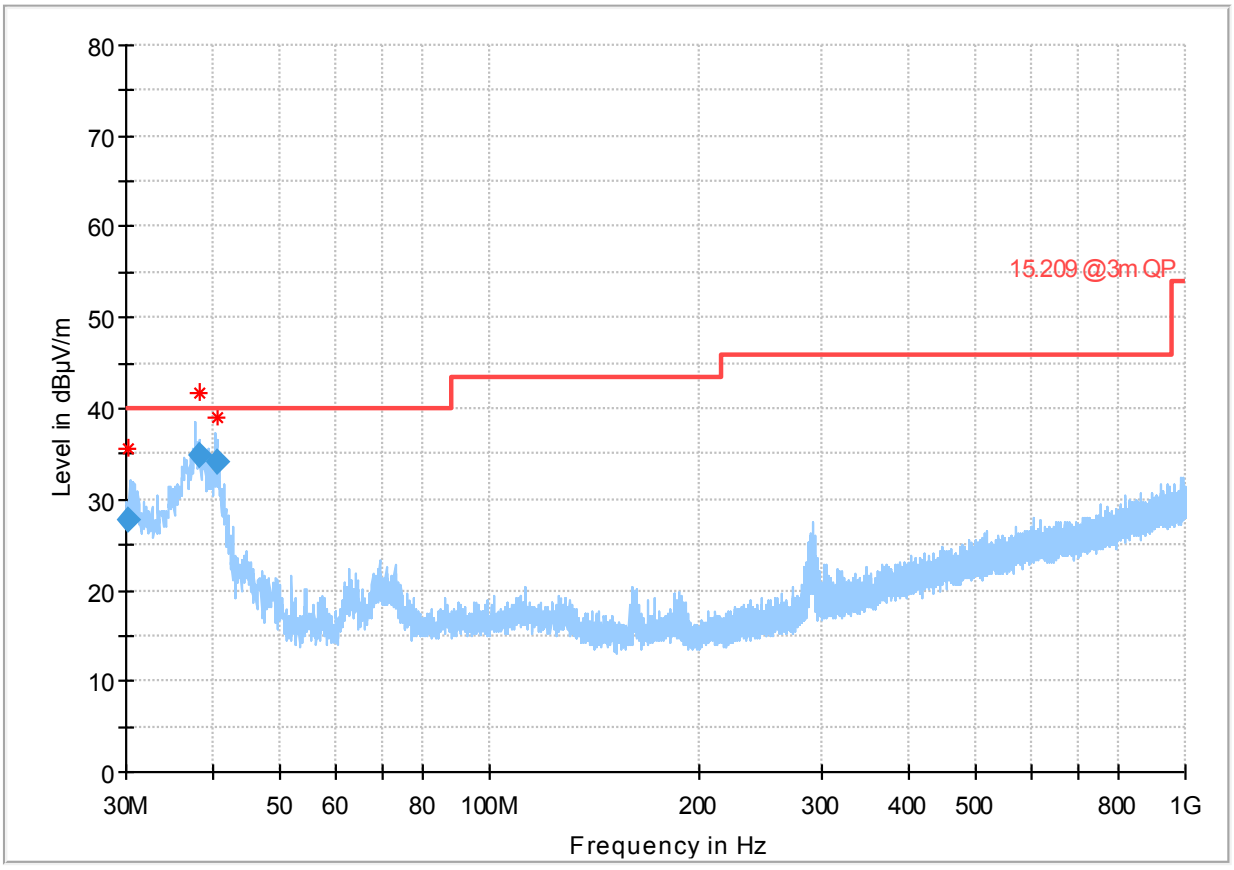
Plot no. 63: radiated emissions 9 kHz – 30 MHz, loop antenna polarization vertical / horizontal, DMP02



Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Pol	Azimuth (deg)	Corr. (dB/m)
28.310568	2.21	29.54	27.33	100.0	9.000	V	183.0	0.8

Plot no. 64: radiated emissions 30 MHz – 1 GHz, polarization vertical / horizontal, DMP02



Preview Result 1-PK+
Final_Result QPK
Critical_Freqs PK+
MaxPeak-PK+ (Single)
15.209 @3m QP
QuasiPeak-QPK (Single)

Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
30.150000	27.69	40.00	12.31	100.0	120.000	100.0	V	54.0
38.360000	34.87	40.00	5.13	100.0	120.000	353.0	V	294.0
40.582000	34.01	40.00	5.99	100.0	120.000	100.0	V	24.0