DAkkS Deutsche Akkreditierungsstelle D-PL-21375-01-03

INGENIEURBÜRO LENHARDT

Bundesnetzagentur
BNetzA-CAB-21/21-21

Test Report

Test report no.: 21055521-20703-1
Date of issue: 2022-01-24

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

Applicant
Robert Bosch GmbH

Manufacturer
Robert Bosch GmbH

Test Item
C5CP12

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* *Lab Manager RF*	signature
Approved by (name, function, signature)	*Andreas Bender* *Deputy Managing Director*	signature

Applicant and Test item details	
Applicant	Robert Bosch GmbH Daimlerstrasse 6 71229, Leonberg, Germany Phone: +49 711 400 40990 Fax: +49 711 400 40999
Manufacturer	Robert Bosch GmbH Daimlerstrasse 6 71229, Leonberg, Germany
Test item description	Radar sensor
Model/Type reference	C5CP12
FCC ID	NF3-C5CP12
Frequency	76.0 GHz to 77.0 GHz
Antenna	integrated patch antenna
Power supply	7.0 to 16.0 V DC
Temperature range	-40 °C to +85 °C

Disclaimer and Notes

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

IBL-Lab GmbH does not take samples. The samples used for testing are provided by the applicant.

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 Sankt Ingbert / Germany Fon: +49 6894 38938-0 Fax: +49 6894 38938-99 URL: www.ib-lenhardt.de E-Mail: info@ib-lenhardt.de
Accreditation	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: • Electronics D-PL-21375-01-01 • Electromagnetic Compatibility D-PL-21375-01-02 • Electromagnetic Compatibility and Telecommunication (FCC requirements) D-PL-21375-01-03 • Telecommunication (TC) and Electromagnetic Compatibility (EMC) for Canadian Standards D-PL-21375-01-04 • ISED Company Number 27156 • Testing Laboratory CAB Identifier DE0020 • Telecommunication (TC) D-PL-21375-01-05 Website DAkkS: https://www.dakks.de/ The Deutsche Akkreditierungsstelle GmbH (DAkkS) is also a signatory to the ILAC Mutual Recognition Arrangement
Testing location	**IBL-Lab GmbH** Heinrich-Hertz-Allee 7 66386 St. Ingbert / Germany
Date of receipt of test samples	2022-01-11
Start – End of tests	2022-01-11 – 2022-01-21

2.2 Possible test case verdicts

Test sample meets the requirements	P (PASS)
Test sample does not meet the requirements	F (FAIL)
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

-1 Revision: declaration of similarity actualized

This test report 21055521-20703-1 **replaces the previous test report 21055521-20703-0.**
Utilisation, publication and control of previous report editions is under responsibility of the applicant.

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

Temperature	20°C ± 5°C
Relative humidity	25-75% r.H.
Barometric Pressure	940-1060 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	7.0 V DC	12.0 V DC	16.0 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
KDB653005 D01, V01, R01	Equipment Authorization Guidance for 76-81 GHz Radar Devices

5 EQUIPMENT UNDER TEST (EUT)

5.1 Product description

Radar sensor

5.2 Description of test item

Model name*	C5CP12
Serial number*	1100010692800409332206010321147324011969
PCB identifier*	0265.B62.862-01
Hardware status*	C35.3; 0265.B62.862-01 (back connector) 0265.B62.863-01 (side connector)
Software status*	1037608832

*: 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*	1
Channel bandwidth*	< 1 GHz
Channel spacing*	N/A
Receiver category*	N/A
Receiver bandwidth*	N/A
Duty cycle*	DMP 6: 26.7 % DMP 8: 25.5 % DMP 12: 26.0 %
Antenna*	integrated patch antenna
Rated RF output power*	< 50 dBm
Power supply*	7.0 to 16.0 V DC
Temperature range*	-40 °C to +85 °C

*: as declared by applicant

5.4 Additional information

Model differences	*Several EUT's were made available for testing purposes. The first EUT (eg. labelled no.1) was used for testing.* *The EUT's differ considering the connector, 2 versions are made available:* *As stated in the Declaration of similarity:* *"The model C5CP12 has two connector variants:* *1. variant 0265.B62.862-01; with housing P/N: 1275.101.969 (connector on the back of the sensor)* *2. variant 0265.B62.863-01; with housing P/N: 1275.101.968 (connector on the side of the sensor)* *Difference between the 0265.B62.862-01 and 0265.B62.863-01 is only mechanical direction of the connector. All other components are identical."*

Ancillaries tested with	*-/-*
Additional equipment used for testing	*A notebook, 2 CAN converters and special test software was used, to change the running mode of the EUT*

5.5 Operating conditions

The following information is derived from the provided document “Technical Documentation C5CP12”

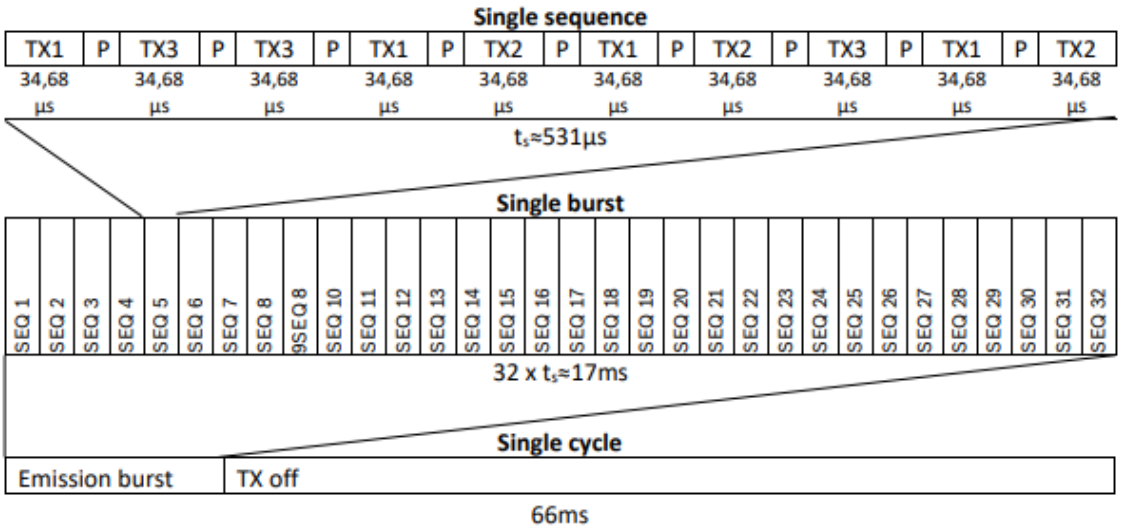
4.3 Modulation description

The sensor emits a series of fast FMCW chirps. The chirps are grouped in sequence and sequences are grouped in bursts. Parameters of the chirps and sequences vary between different modulation schemes (DMP – Detection and Measurement Program).
The CR5TPCC sensor modulation mode depends on vehicle speed.

Vehicle speed	Modulation mode	Active TX channels
up to 3km/h	DMP12	TX1, TX2, TX3
3km/h – 30 km/h	DMP8	TX1, TX2, TX3 (normal); TX2, TX3 (boost)
above 30 km/h	DMP6	TX1, TX2, TX3

4.3.1 DMP12 modulation

A single sequence takes 531µs and consists of 10 chirps around constant centre frequency. Each chirp is emitted on different TX channel and takes 34,68µs. In between chirps transmitter is turned off. In every sequence, 4 chirps are emitted on TX1 antenna, 3 chirps on TX2 and 3 chirps on TX3.
A burst takes 17ms and consists of 32 sequences (320 chirps). Centre frequency of each sequence is shifted slightly. Once burst emission is completed, transmitter is turned off until end of cycle.
A single cycle takes 66ms.



Chirp frequency span: 274MHz
Burst frequency span: 572MHz
Occupied bandwidth: 846 MHz

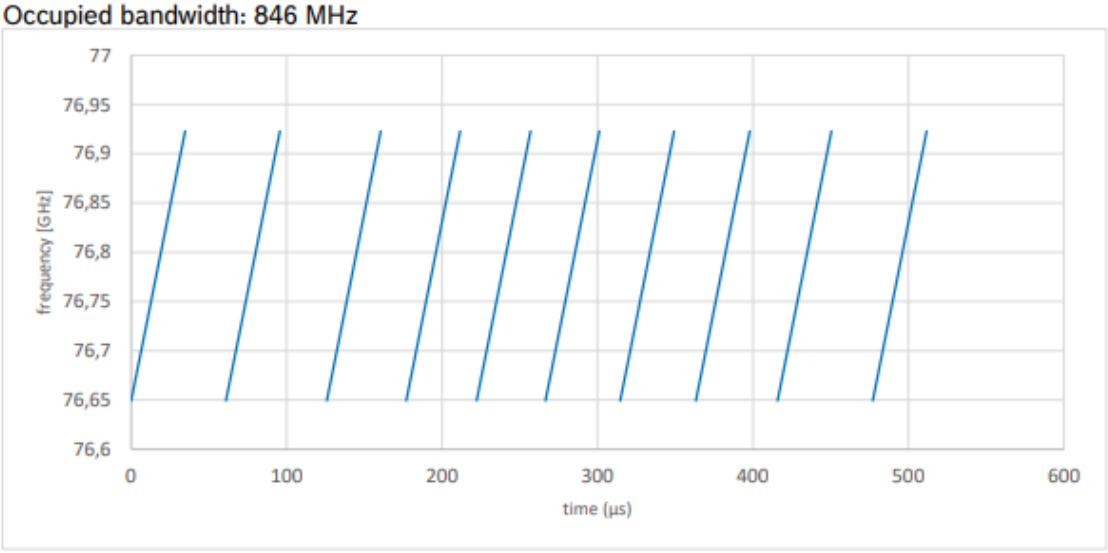


Figure 6: DMP12 single sequence

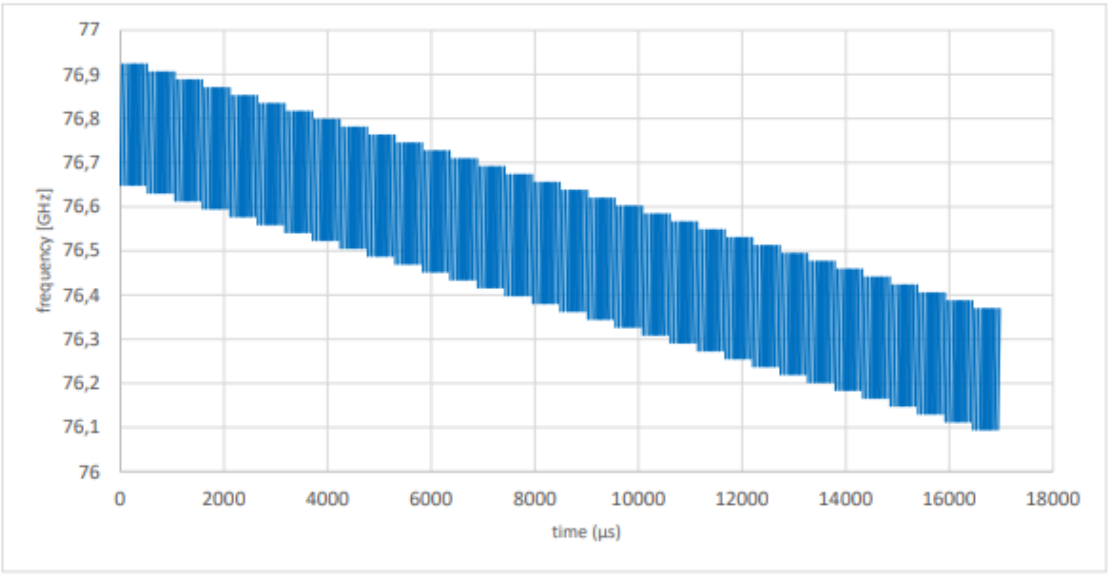


Figure 7: DMP12 single burst

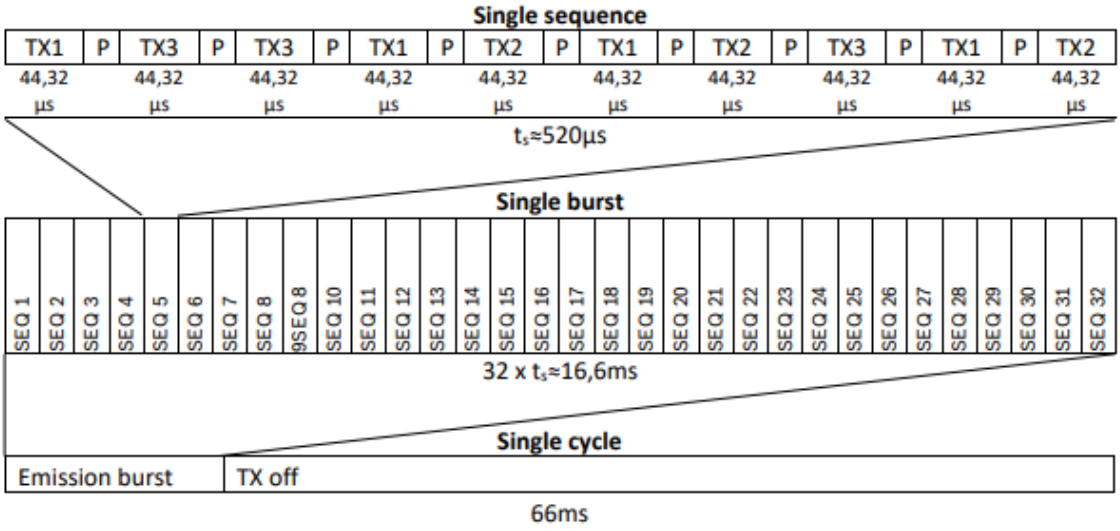
4.3.2 DMP8 modulation

DMP8 uses two different sequences: “normal” and “boost”. The sequences are emitted alternately:

Normal 66ms cycle	Boost 66ms cycle	Normal 66ms cycle	Boost 66ms cycle	Normal 66ms cycle	Boost 66ms cycle

4.3.2.1 DMP8 modulation normal

A single sequence takes 520µs and consists of 10 chirps around constant centre frequency. Each chirp is emitted on different TX channel and takes 44,32µs. In between chirps transmitter is turned off. In every sequence, 4 chirps are emitted on TX1 antenna, 3 chirps on TX2 and 3 chirps on TX3.
A burst takes 16,6ms and consists of 32 sequences (320 chirps). Centre frequency of each sequence is shifted slightly. Once burst emission is completed, transmitter is turned off until end of cycle.
A single cycle takes 66ms.



Chirp frequency span: 215 MHz
Burst frequency span: 634 MHz
Occupied bandwidth: 849 MHz

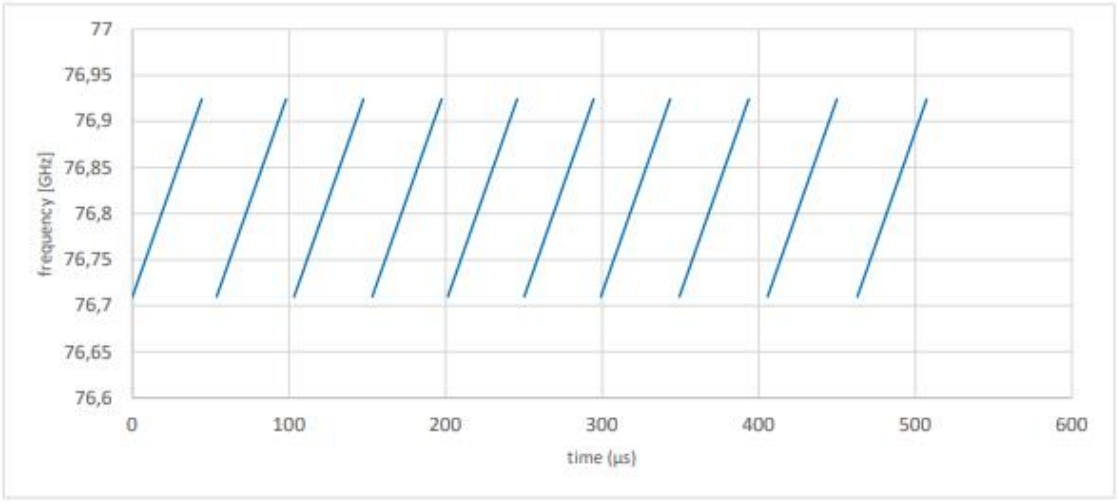


Figure 8: DMP8 normal single sequence

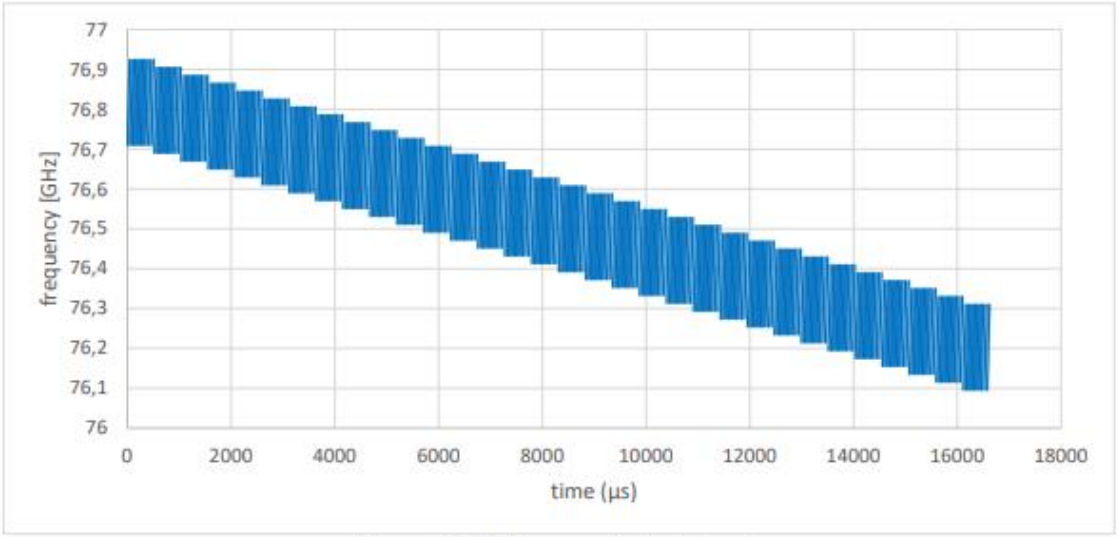
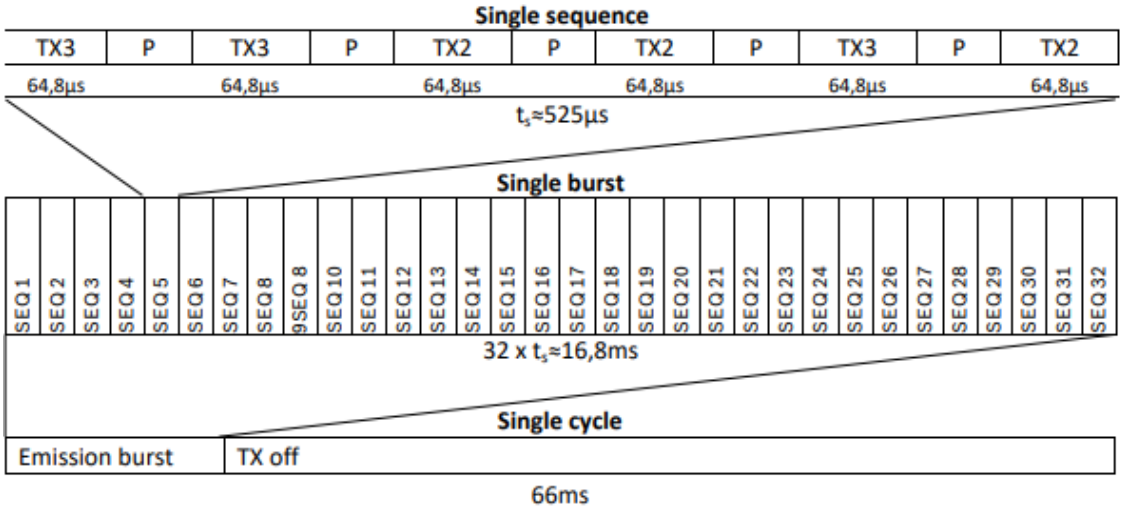


Figure 9: DMP8 normal single burst

4.3.2.2 DMP8 modulation boost

A single sequence takes 525µs and consists of 6 chirps around constant centre frequency. Each chirp is emitted on different TX channel and takes 64,8µs. In between chirps transmitter is turned off. In every sequence, 3 chirps on TX2 and 3 chirps on TX3.
A burst takes 16,8ms and consists of 32 sequences (192 chirps). Centre frequency of each sequence is shifted slightly. Once burst emission is completed, transmitter is turned off until end of cycle.
A single cycle takes 66ms.



Chirp frequency span: 213 MHz
Burst frequency span: 630 MHz
Occupied bandwidth: 843 MHz

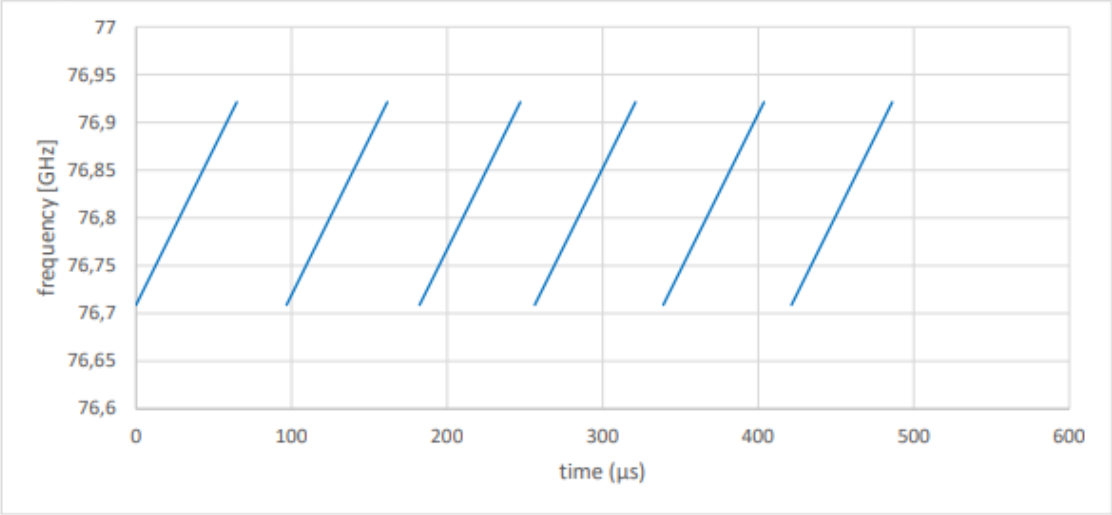


Figure 10: DMP8 boost single sequence

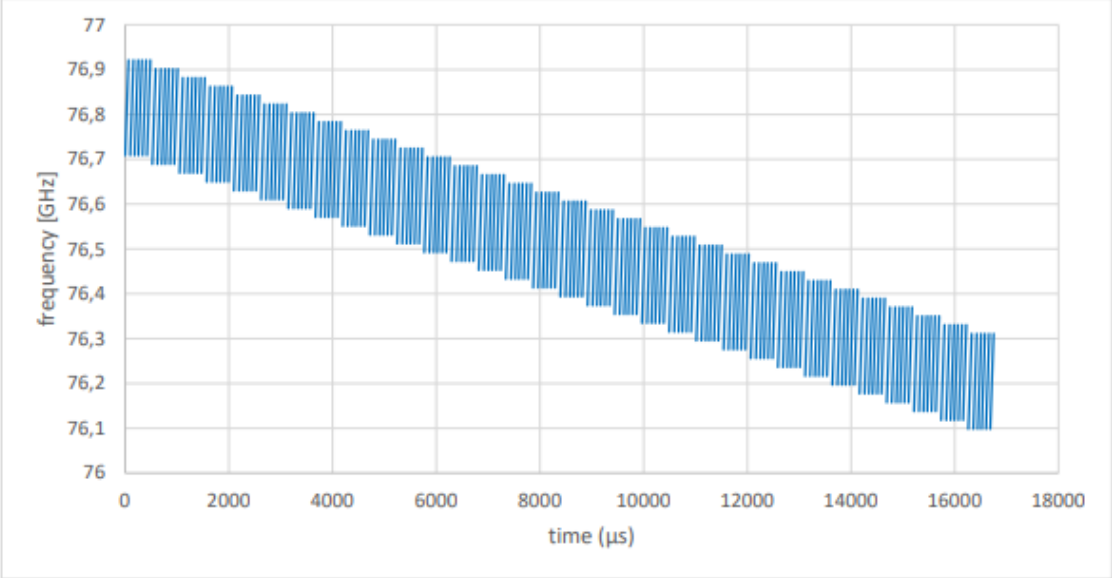
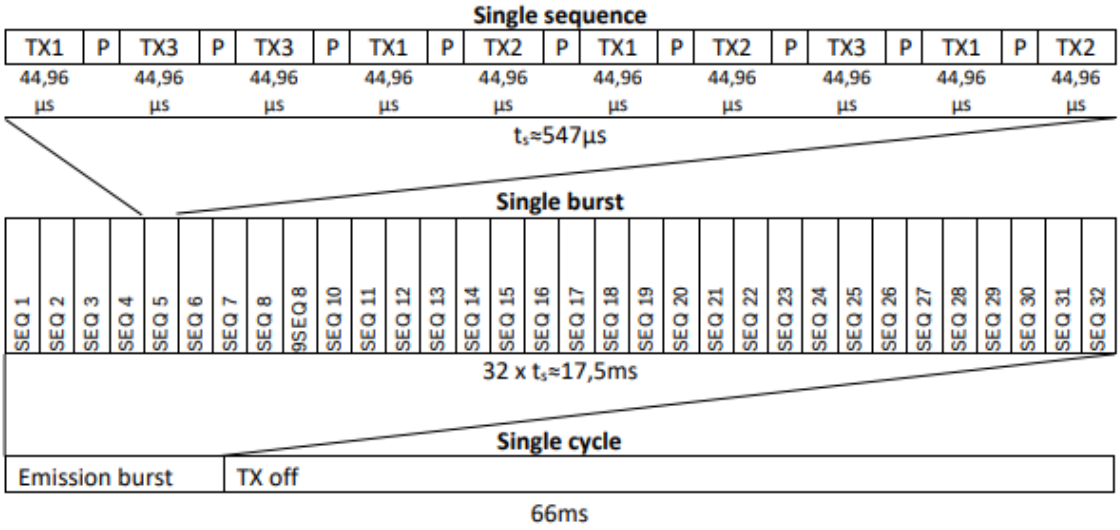


Figure 11: DMP8 boost single burst

4.3.3 DMP6 modulation

A single sequence takes 547µs and consists of 10 chirps around constant centre frequency. Each chirp is emitted on different TX channel and takes 44,96µs. In between chirps transmitter is turned off. In every sequence, 4 chirps are emitted on TX1 antenna, 3 chirps on TX2 and 3 chirps on TX3.
A burst takes 17,5ms and consists of 32 sequences (320 chirps). Centre frequency of each sequence is shifted slightly. Once burst emission is completed, transmitter is turned off until end of cycle.
A single cycle takes 66ms.



Chirp frequency span: 274 MHz
Burst frequency span: 572 MHz
Occupied bandwidth: 846 MHz

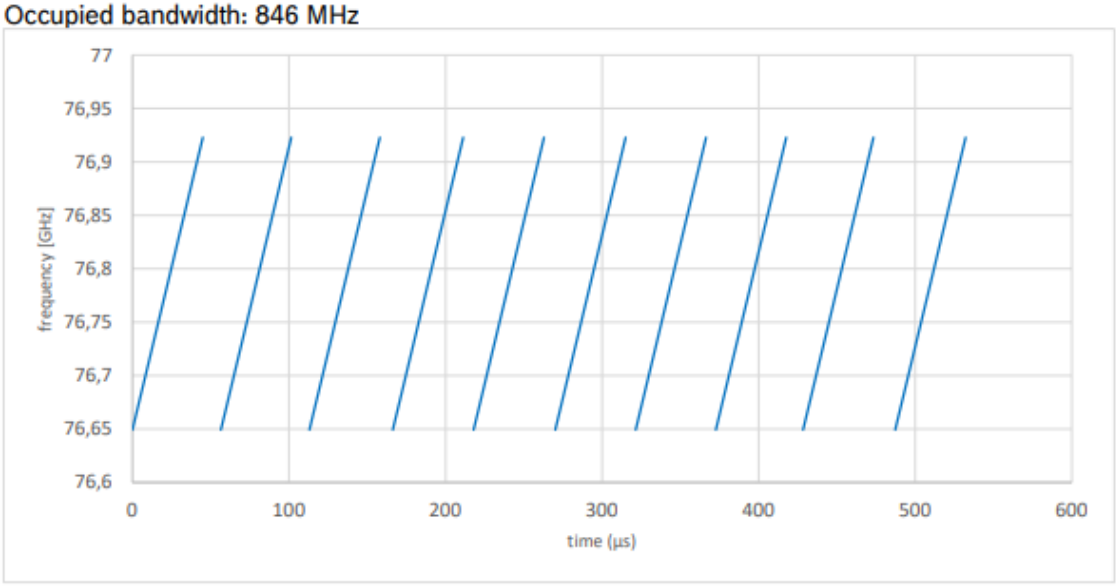


Figure 12: DMP6 single sequence

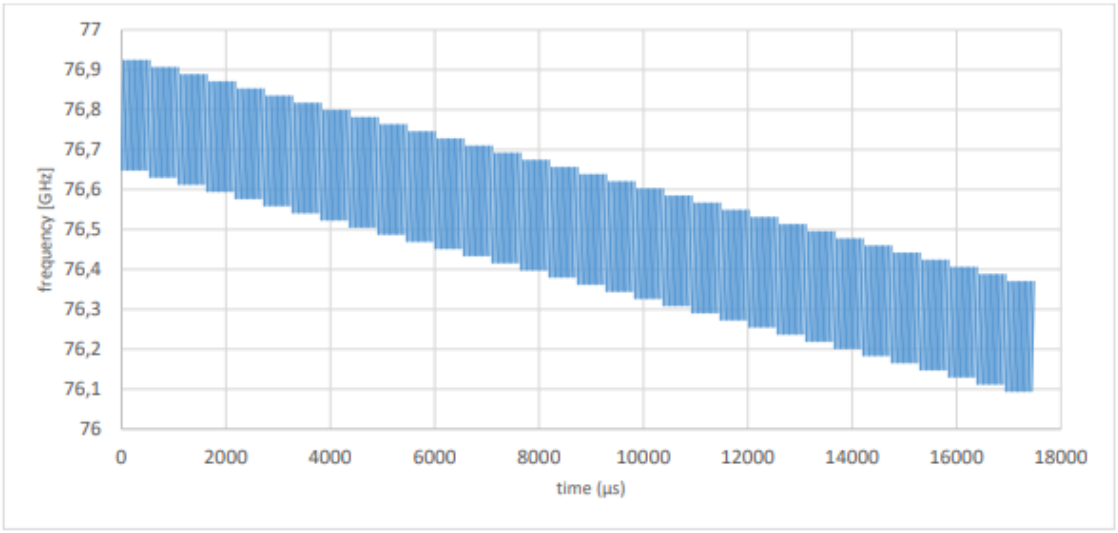
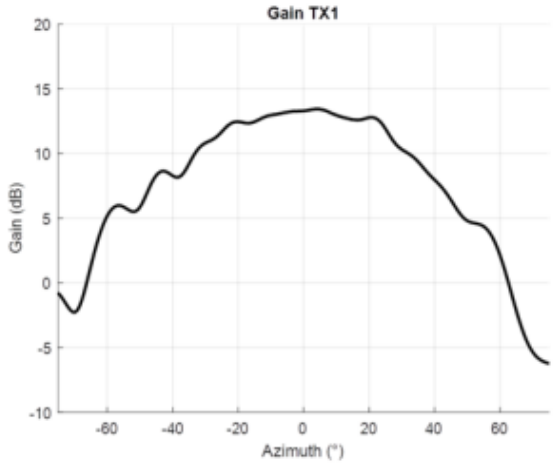


Figure 13: DMP6 single burst

5.6 Antenna characteristics

4.2.1 TX1 antenna characteristic

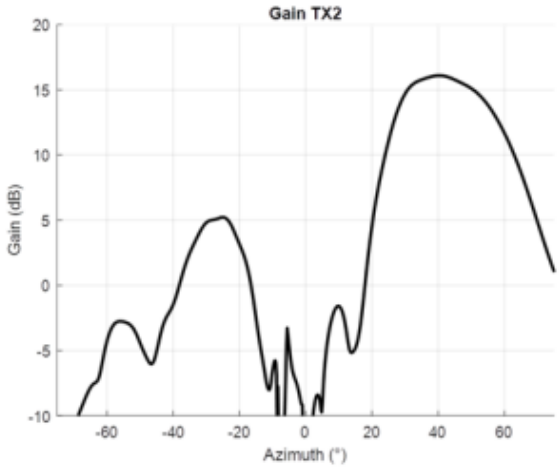
Simulation result of TX1 azimuth antenna characteristic is presented below:



Maximum gain is: 13,3dBi at 0deg and 9,07dBi at 36deg

4.2.2 TX2 antenna characteristics

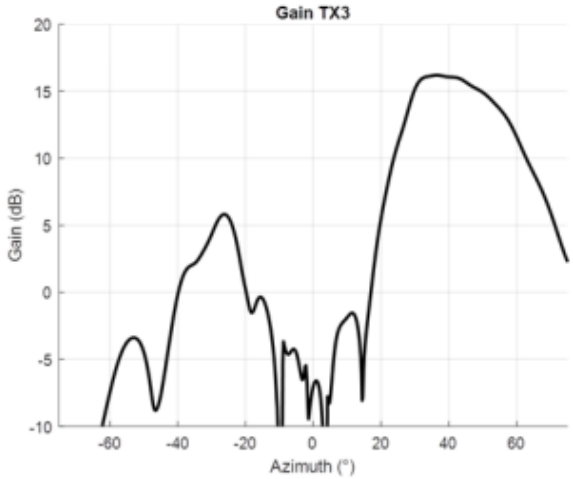
Simulation result of TX2 azimuth antenna characteristic is presented below:



Maximum gain is 15,87dBi at 36deg.

4.2.3 TX3 antenna characteristics

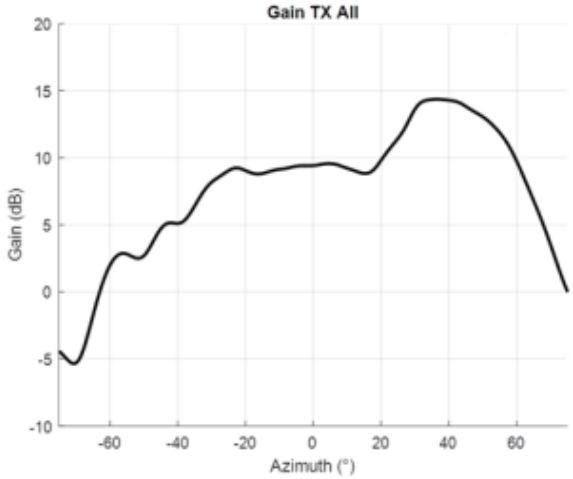
Simulation result of TX3 azimuth antenna characteristic is presented below:



Maximum gain is 16,2dBi at 36deg.

4.2.4 TXall antenna characteristics

Simulation result of all channels (TX1, TX2, TX3) combined azimuth antenna characteristic is presented below:



Maximum gain is 14,37dBi at 36deg.

4.2.5 Calculation of effective sensor antenna gain

Every chirp is sent though single TX channel and antenna. Details about number of chirps and TX channels are provided in Chapter 4.3. With these details effective antenna gain of the sensor can be calculated:

4.2.5.1 Antenna gain of sensor in DMP12 and DMP6 modes

In these modes sensor emits 4 chirps on TX1, 3 chirps on TX2 and 3 chirps on TX3, total 10 chirps. Therefore effective antenna gain:

$$G = 10log\left(\frac{4 * 10^{\frac{9,07}{10}} + 3 * 10^{\frac{15,87}{10}} + 3 * 10^{\frac{16,2}{10}}}{10}\right) = 14,37dBi$$

See also Chapter 4.2.4

4.2.5.2 Antenna gain of sensor in DMP8 mode

DMP8 modes uses two sequences, normal and boost (as described in Chapter 4.3.2). In normal sequence sensor emits 4 chirps on TX1, 3 chirps on TX2 and 3 chirps on TX3, total 10 chirps. In boost sequence sensor emits 3 chirps on TX2 and 3 chirps on TX3, total 6 chirps (TX1 is not used).
Combined sequence contains 4 chirps on TX1, 6 chirps on TX2 and 6 chirps on TX3, total 16 chirps. Therefore effective antenna gain:

$$G = 10log\left(\frac{4 * 10^{\frac{9,07}{10}} + 6 * 10^{\frac{15,87}{10}} + 6 * 10^{\frac{16,2}{10}}}{16}\right) = 15,07dBi$$

4.4 Duty Cycle

Total duration of a single CR5TPCC cycle is always 66ms. Within this time, the sensor transmits a single burst of length depending on DMP mode. Additionally, every 2nd cycle, sensor emits a monitoring signal, which takes 0,29ms.
Therefore, sensor duty cycle:

$$Duty\_cycle = \frac{burst\_length + \frac{monitoring\_length}{2}}{cycle\_length} * 100$$

Modulation mode	Burst length	Duty cycle
DMP12	17ms	26%
DMP8 (average of normal and boost)	16,7ms	25,5%
DMP6	17,5ms	26,7%

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	18.97 dBm mean 28.23 dBm peak	P
§2.1047	Modulation characteristics	Nominal		N/P
§2.1049	Occupied bandwidth	Nominal	886.185 MHz	P
§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	P
§2.1055 §95.3379 (b)	Frequency stability	Nominal Extreme	Within band	P

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

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.

Method with power meter

The power meter shall be connected to the measurement antenna. The frequency correction factor shall be taken into account. The power meter shall be a true RMS power meter. The measurement time shall be equal or longer than the EUT cycle time.

Test procedure

Peak Power

Method with a spectrum analyser

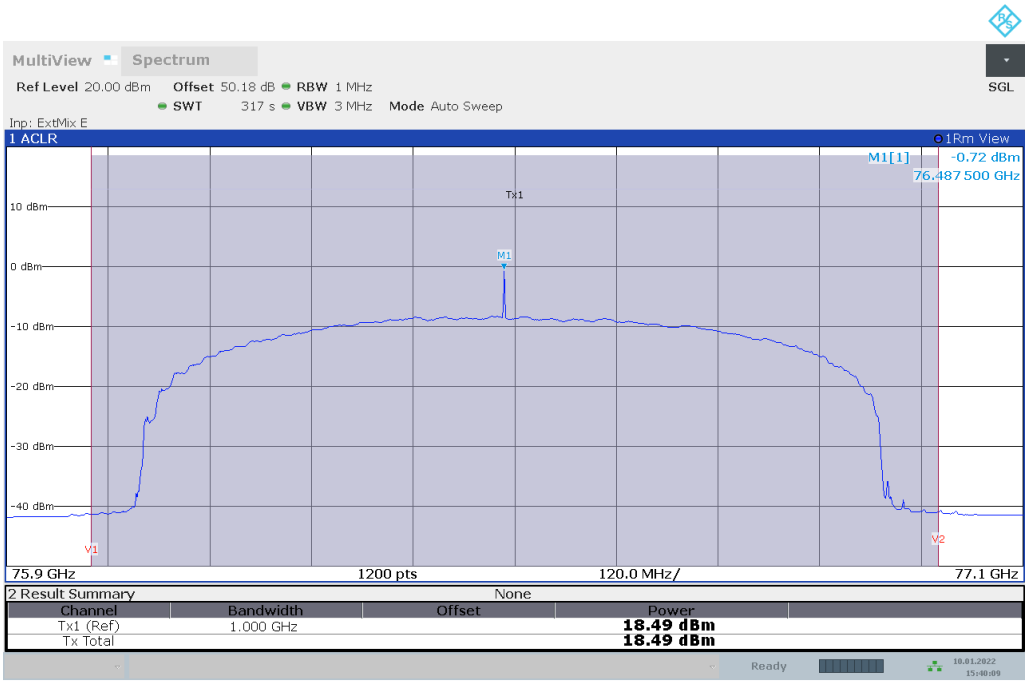
A spectrum analyser with the following settings is used as measuring receiver in the test set-up:

- 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.
- Averaging time: none, due to peak detector
- Sweep time: Pulse repetition time x number of sweep points
- Measurement is done until trace is stabilised

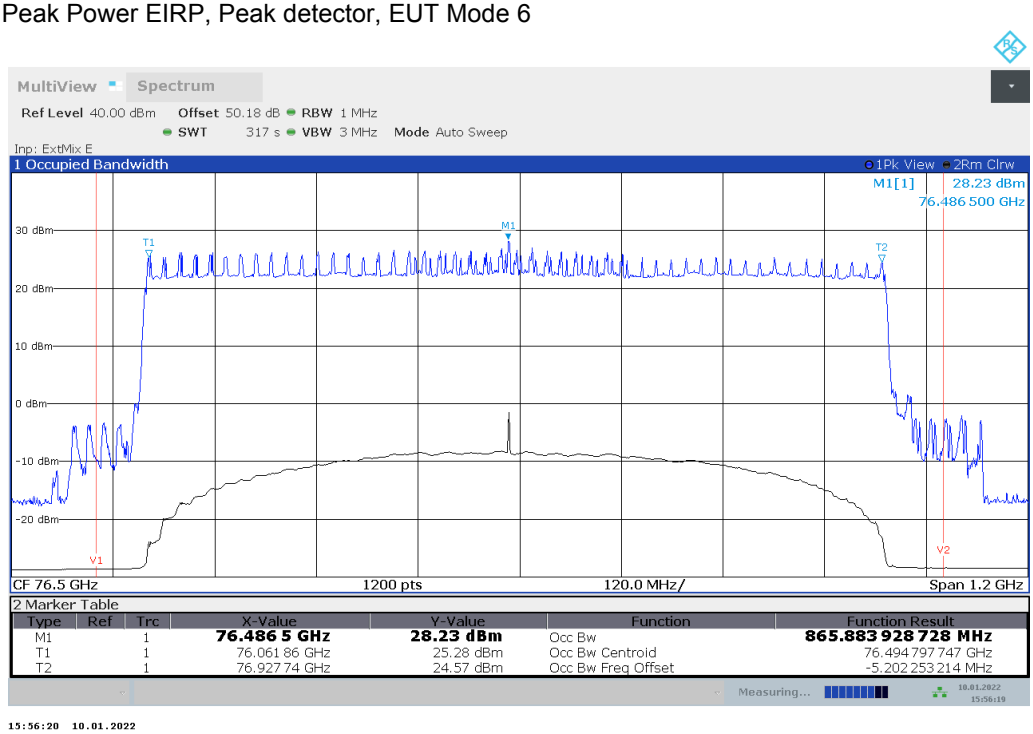
The peak power to be considered is the maximum value recorded.

Test setup: 8.3			
Test results:			
EUT mode	**Test distance**	**Radiated Mean Power (EIRP) [dBm]**	**Radiated Peak Power (EIRP) [dBm]**
6	1 m	18.49	**28.23**
8	1 m	**18.97**	28.09
12	1 m	17.16	27.98

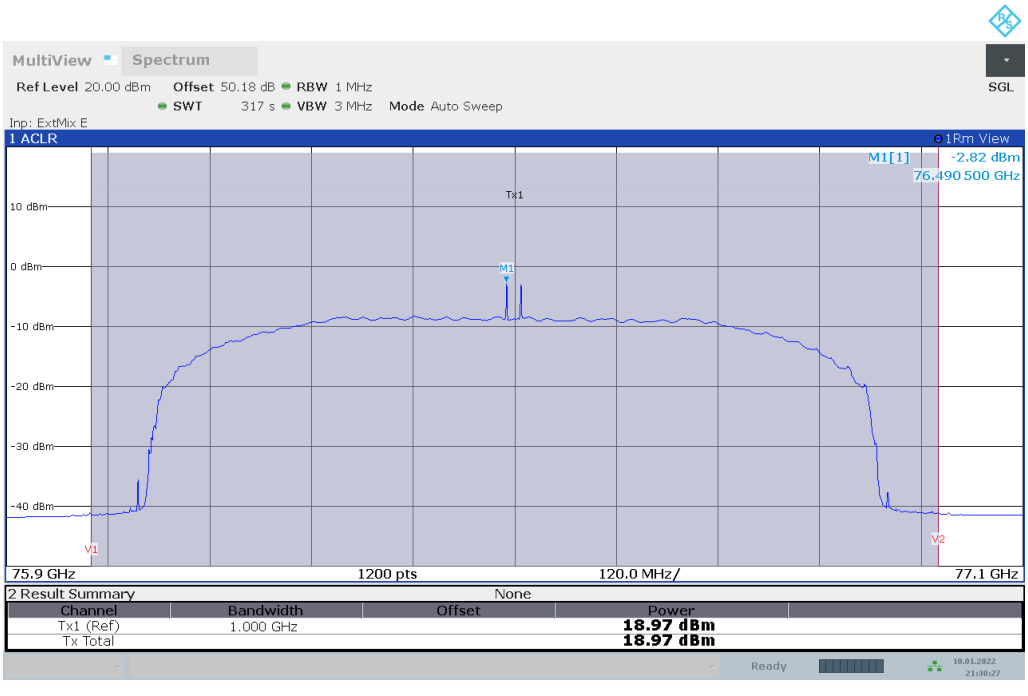
Plot no. 1: Mean Power EIRP, RMS detector / Channel Power, EUT Mode 6



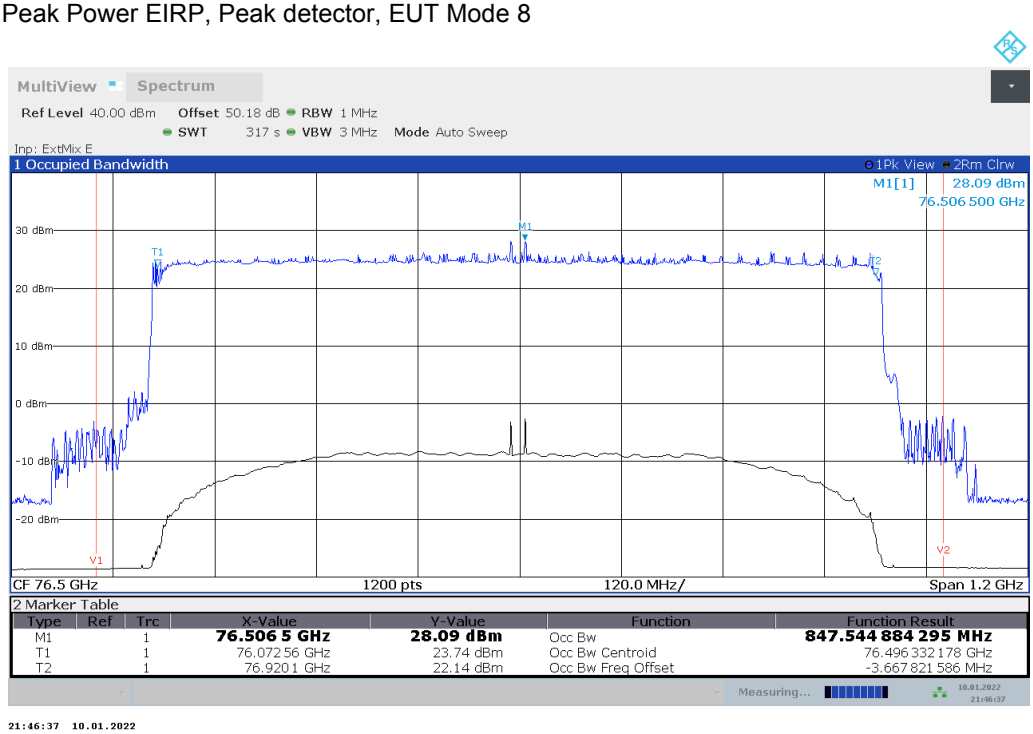
Plot no. 2: Peak Power EIRP, Peak detector, EUT Mode 6



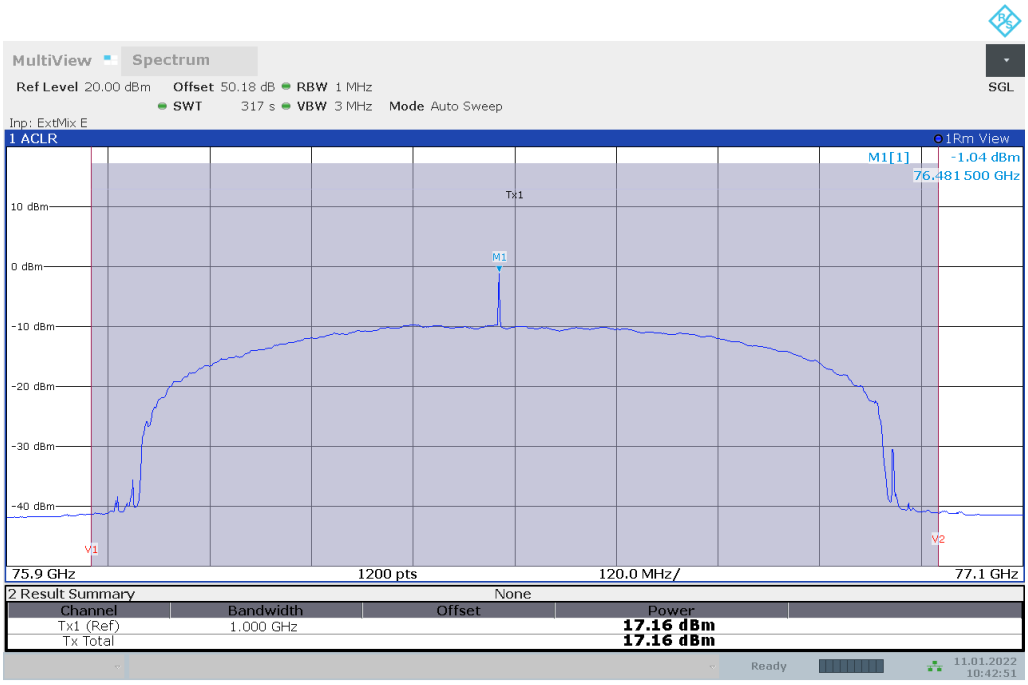
Plot no. 3: Mean Power EIRP, RMS detector / Channel Power, EUT Mode 8



Plot no. 4: Peak Power EIRP, Peak detector, EUT Mode 8



Plot no. 5: Mean Power EIRP, RMS detector / Channel Power, EUT Mode 12



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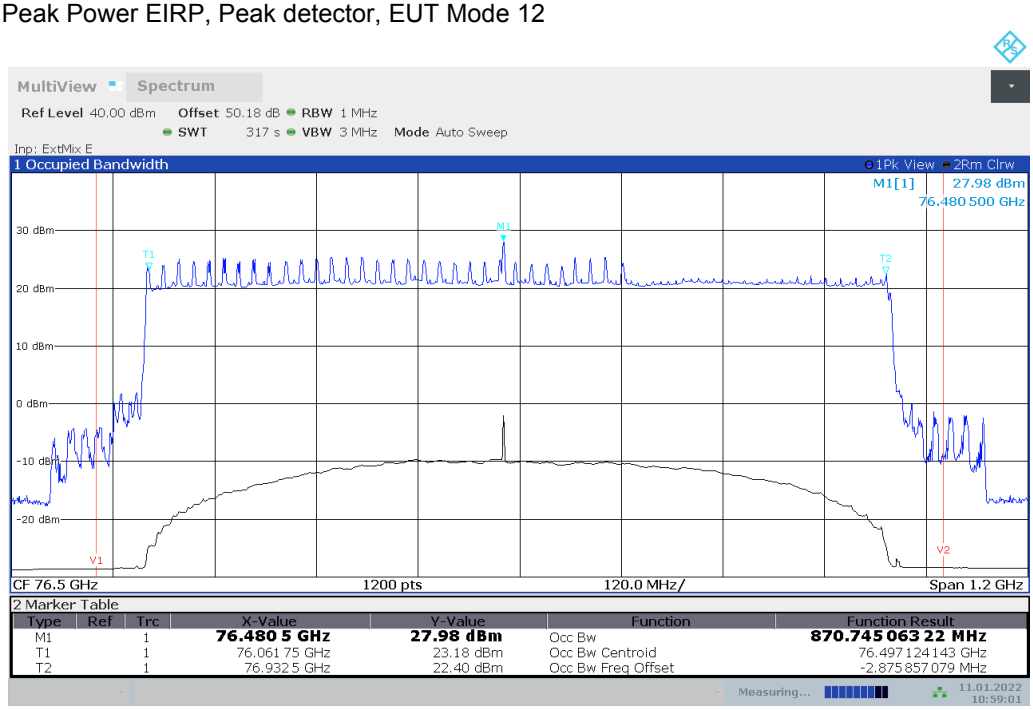
Plot no. 6: Peak Power EIRP, Peak detector, EUT Mode 12



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7.2 Modulation characteristics (§2.1047 & KDB 653005 D01 76-81 GHz Radars v01r01)

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 V01r01:

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

Please refer to chapter 5.5

7.3 Occupied bandwidth (§2.1049)

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

The radar device's occupied bandwidth (i.e. 99% emission bandwidth) shall be contained in the 76-81GHz frequency band.

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) ay 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)

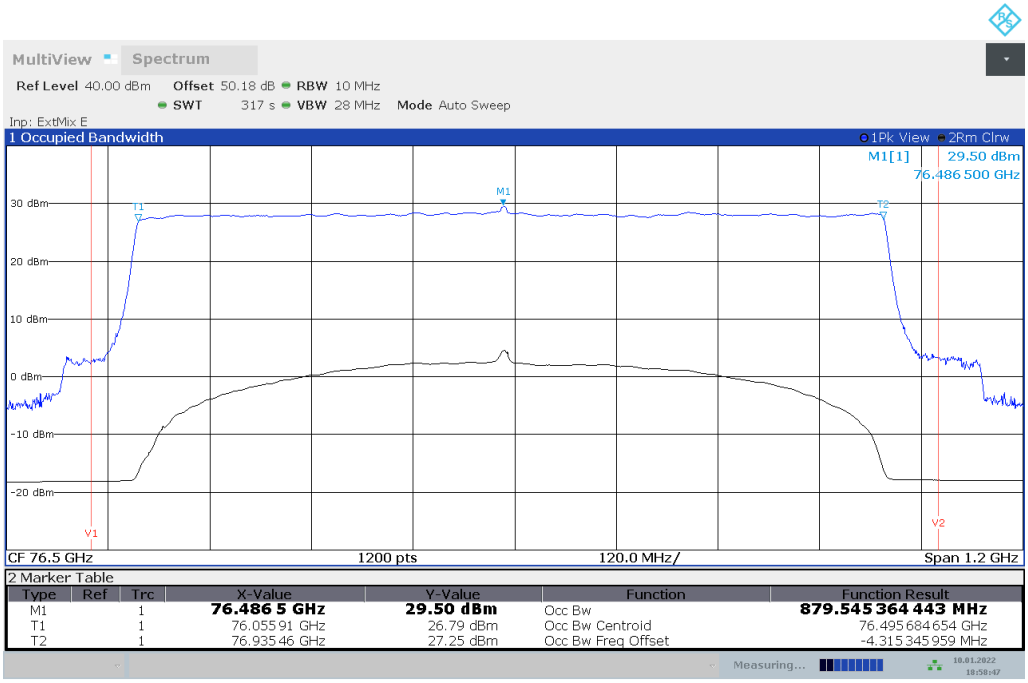
Note

Measurements with the peak detector are 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 general considerations).

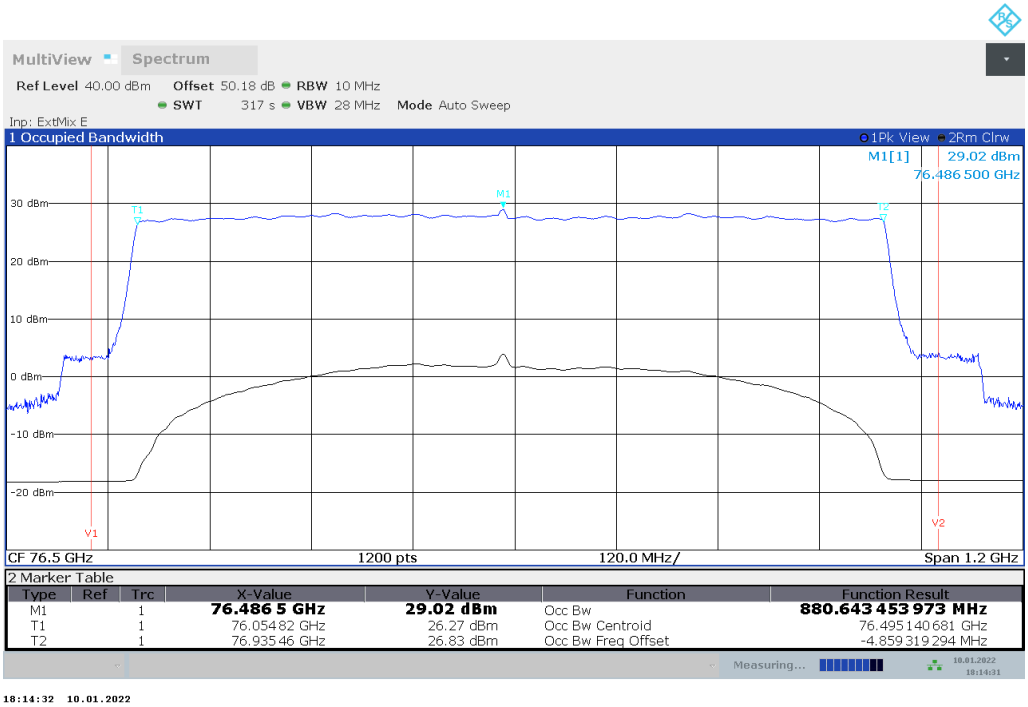
Test setup: 8.3, 8.4

Test results under normal and extreme test conditions:				
EUT mode	**Test conditions**	**f_L [GHz]**	**f_H [GHz]**	**99% OBW [MHz]**
6	85 °C	76.056	76.935	879.545
6	50 °C	76.055	76.935	880.643
6	40 °C	76.056	76.935	879.524
6	30 °C	76.055	76.936	880.126
6	20 °C / V_{min}	76.056	76.936	880.013
6	20 °C / V_{nom}	76.055	76.936	880.190
6	20 °C / V_{max}	76.055	76.936	880.907
6	10 °C	76.056	76.936	880.296
6	0 °C	76.056	76.937	880.994
6	-10 °C	76.056	76.937	880.495
6	-20 °C	76.057	76.937	880.403
6	-30 °C	76.058	76.938	880.008
6	-40 °C	76.058	76.938	880.510
8	85 °C	76.064	76.937	872.811
8	50 °C	76.064	76.930	865.840
8	40 °C	76.065	76.931	866.577
8	30 °C	76.066	76.931	865.407
8	20 °C / V_{min}	76.066	76.932	866.733
8	20 °C / V_{nom}	76.066	76.931	865.905
8	20 °C / V_{max}	76.064	76.932	867.257
8	10 °C	76.066	76.933	866.503
8	0 °C	76.066	76.932	866.081
8	-10 °C	76.067	76.933	865.684
8	-20 °C	76.068	76.933	865.655
8	-30 °C	76.068	76.934	865.946
8	-40 °C	76.069	76.934	865.885
12	85 °C	76.055	76.942	**886.185**
12	50 °C	76.055	76.940	885.323
12	40 °C	76.056	76.941	884.734
12	30 °C	76.057	76.941	884.433
12	20 °C / V_{min}	76.057	76.941	883.680
12	20 °C / V_{nom}	76.057	76.941	883.640
12	20 °C / V_{max}	76.057	76.941	883.691
12	10 °C	76.058	76.942	883.253
12	0 °C	76.059	76.942	883.116
12	-10 °C	76.060	76.942	882.619
12	-20 °C	76.060	76.943	882.685
12	-30 °C	76.059	76.942	882.986
12	-40 °C	76.060	76.943	882.669
With voltage variation				
Input voltage variation does not affect the transmitted signal (see plots for ambient/normal temperature).				

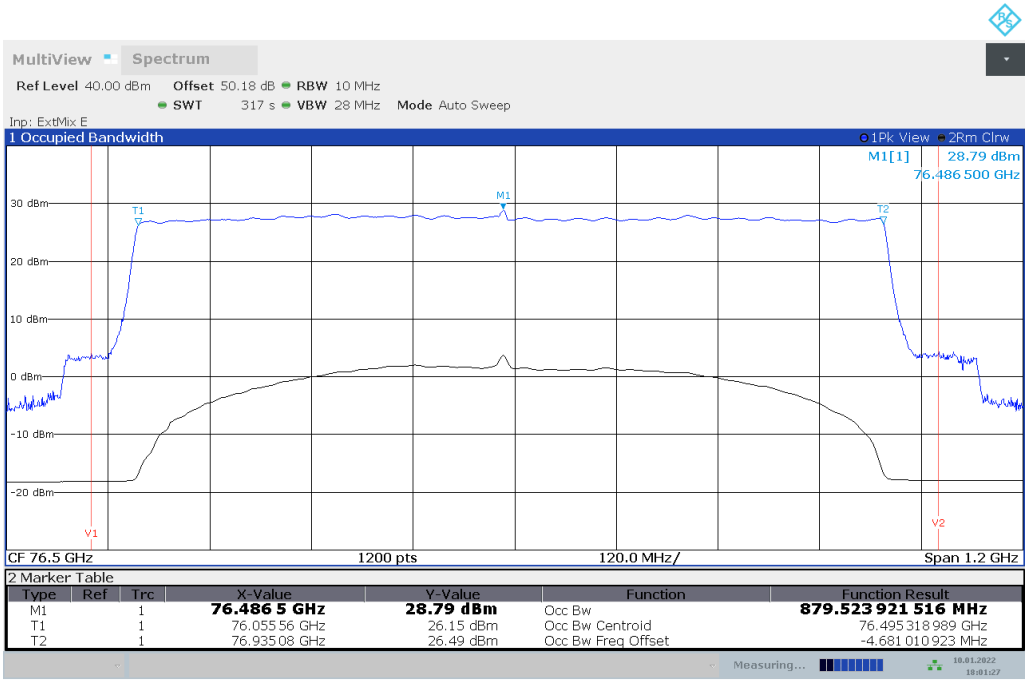
Plot no. 7: 99% OBW, Peak detector, 85 °C, Test mode 6



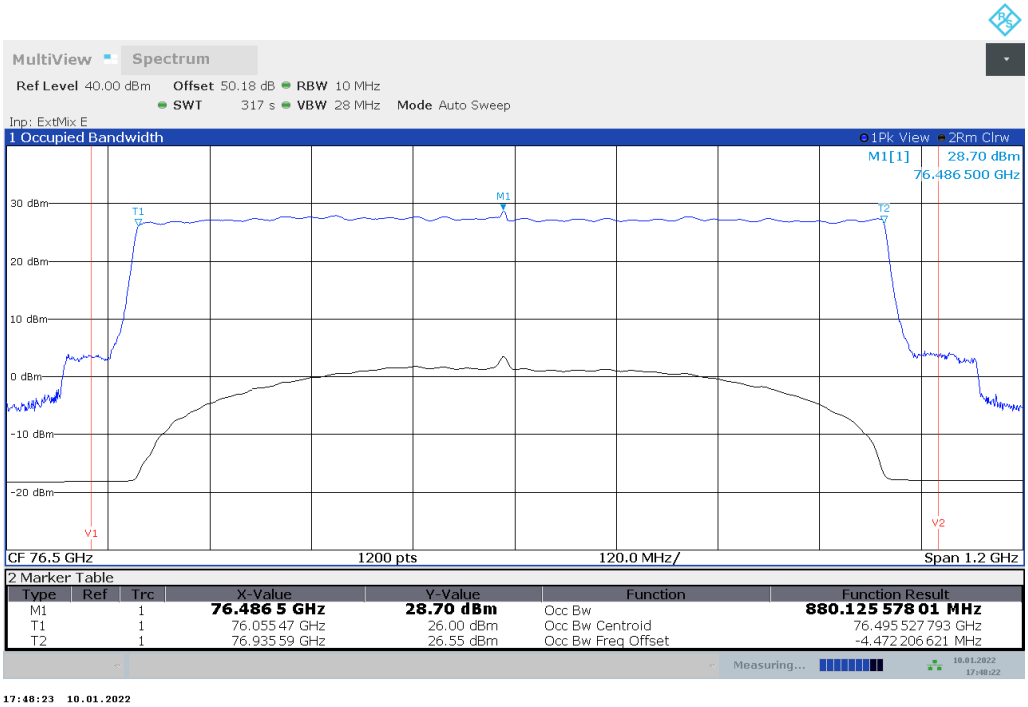
Plot no. 8: 99% OBW, Peak detector, 50 °C, Test mode 6



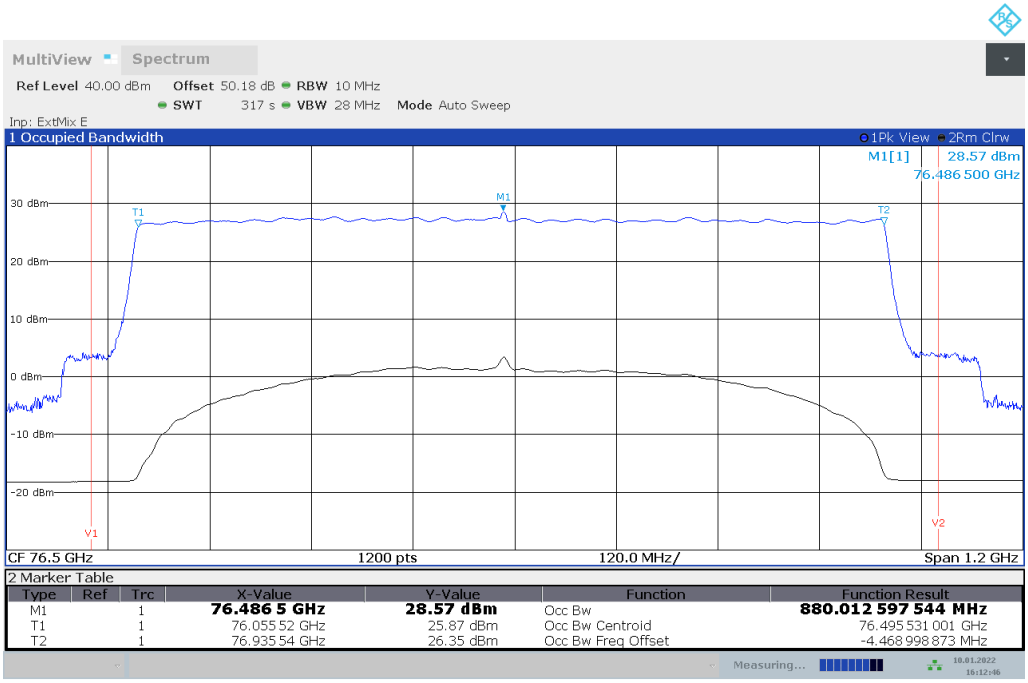
Plot no. 9: 99% OBW, Peak detector, 40 °C, Test mode 6



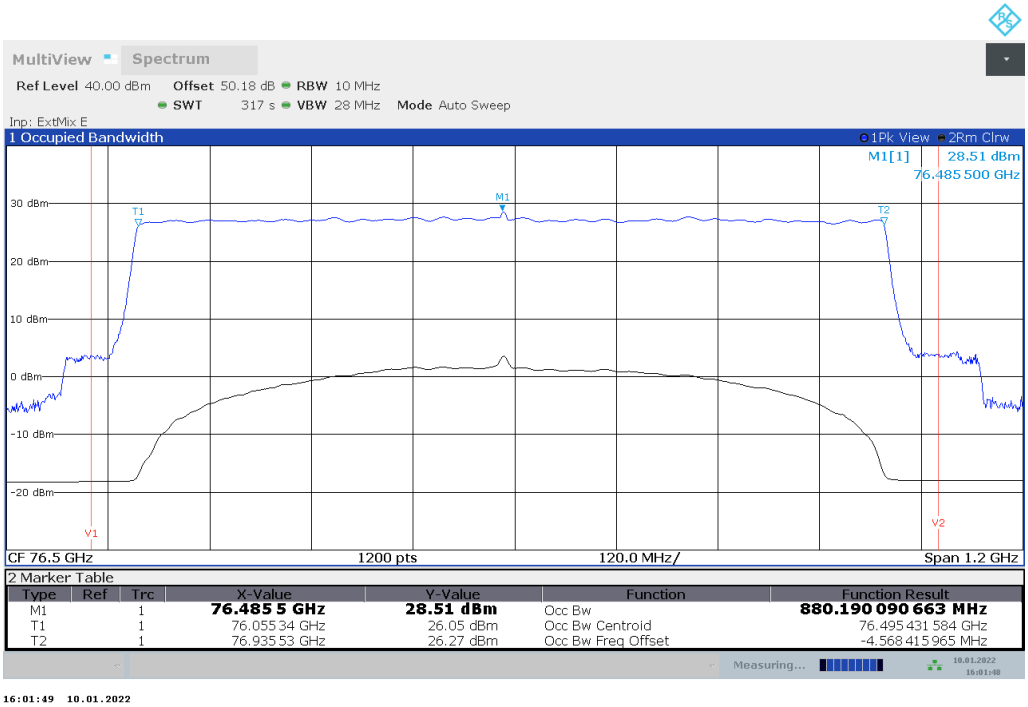
Plot no. 10: 99% OBW, Peak detector, 30 °C, Test mode 6



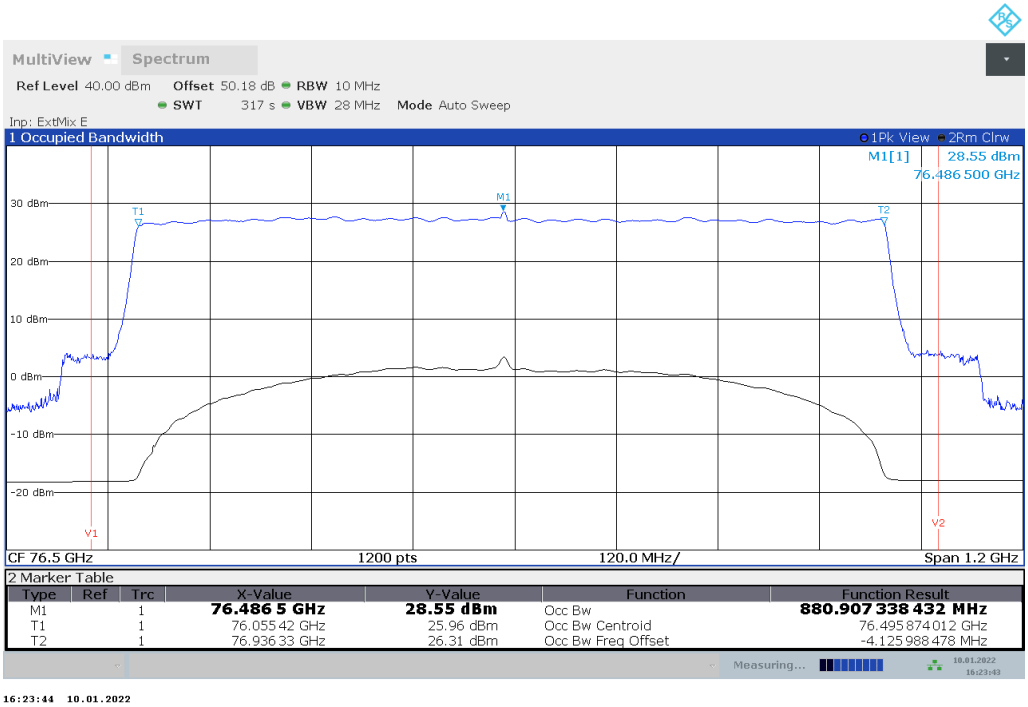
Plot no. 11: 99% OBW, Peak detector, 20 °C, V_{min}, Test mode 6



Plot no. 12: 99% OBW, Peak detector, 20 °C, V_{nom}, Test mode 6

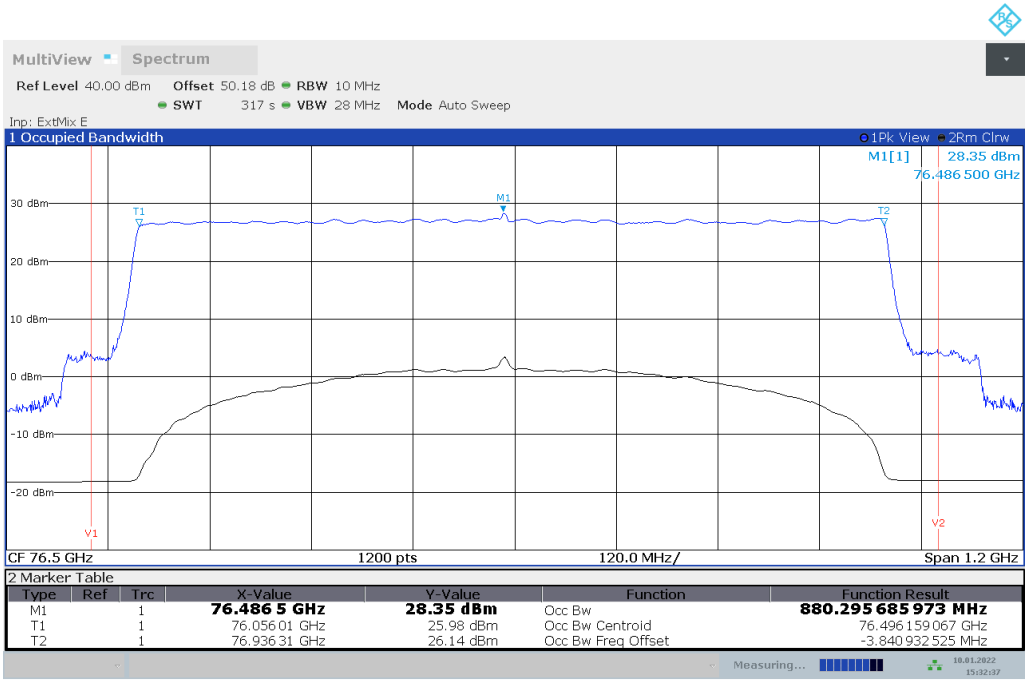


Plot no. 13: 99% OBW, Peak detector, 20 °C, V_{max}, Test mode 6



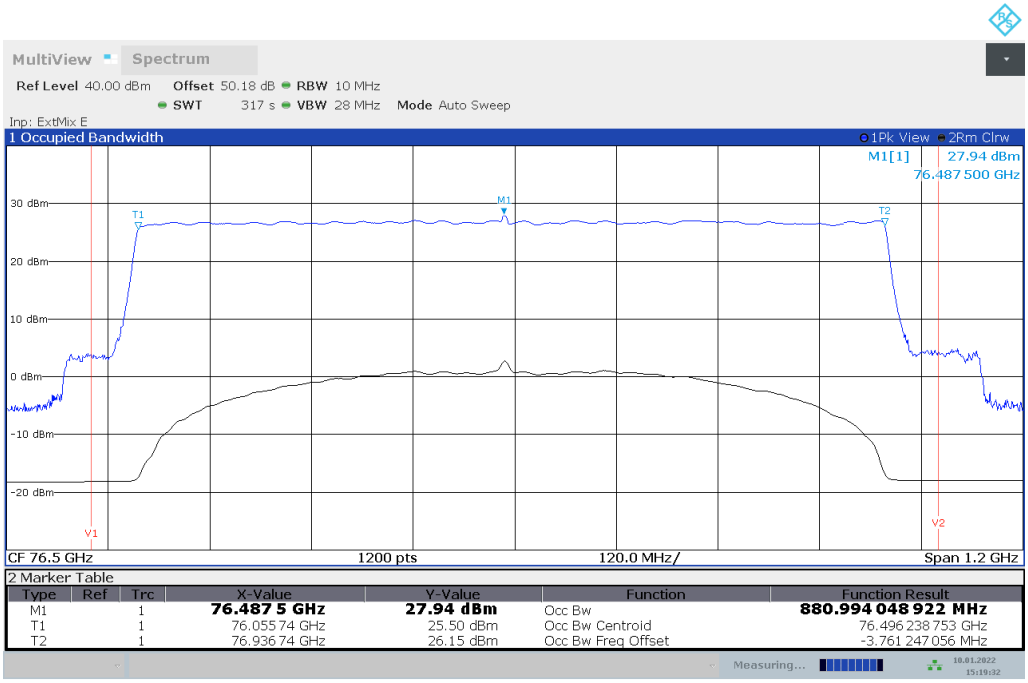
16:23:44 10.01.2022

Plot no. 14: 99% OBW, Peak detector, 10 °C, Test mode 6



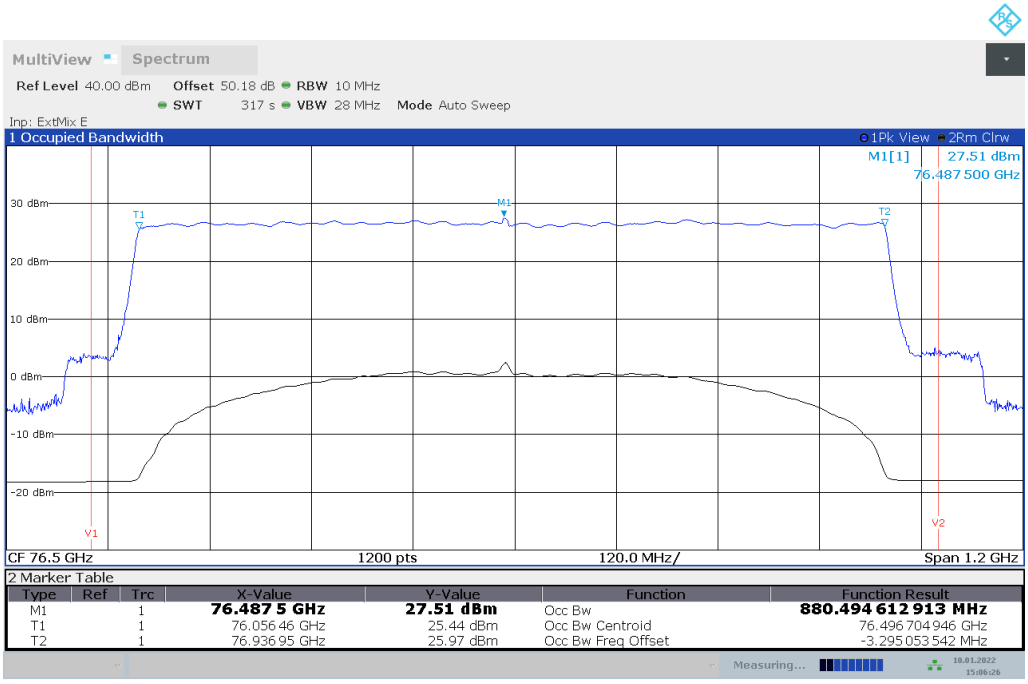
15:32:37 10.01.2022

Plot no. 15: 99% OBW, Peak detector, 0 °C, Test mode 6



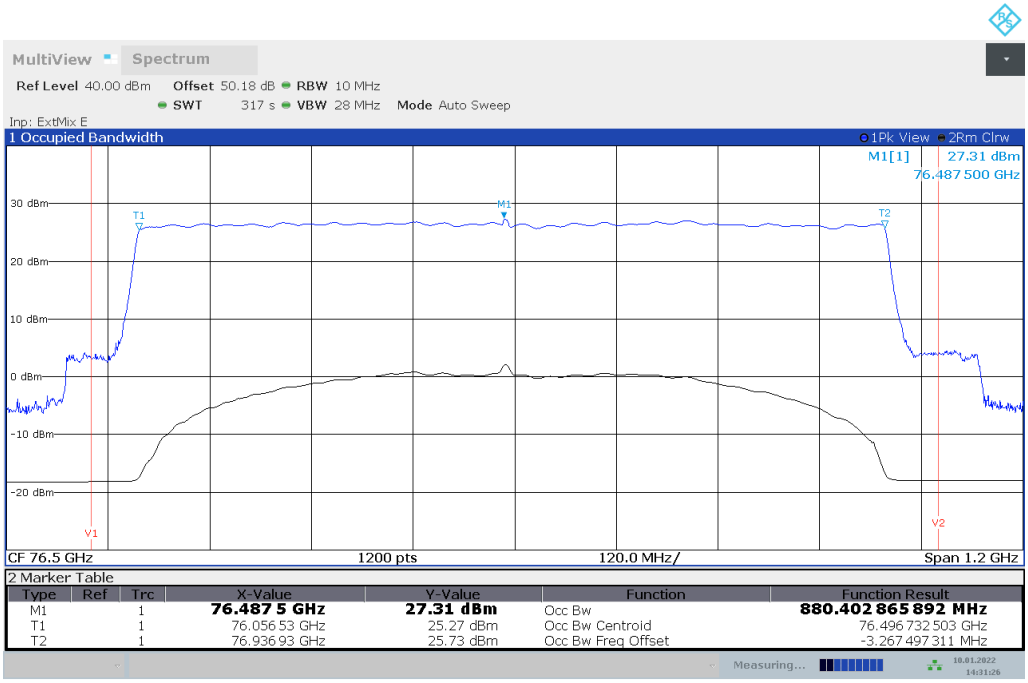
15:19:32 10.01.2022

Plot no. 16: 99% OBW, Peak detector, -10 °C, Test mode 6



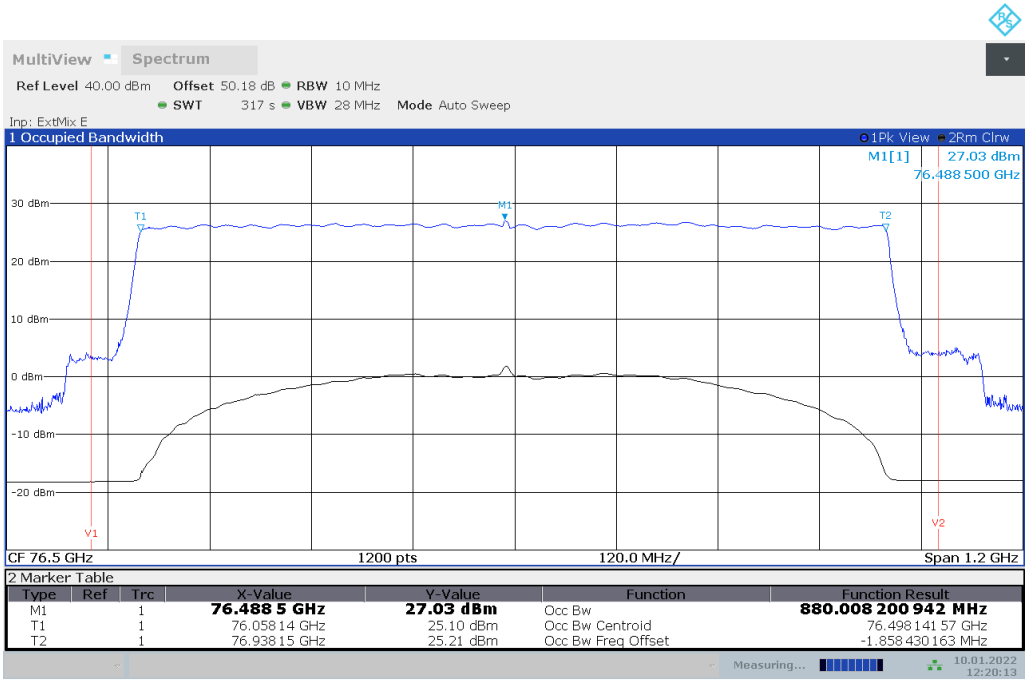
15:06:27 10.01.2022

Plot no. 17: 99% OBW, Peak detector, -20 °C, Test mode 6



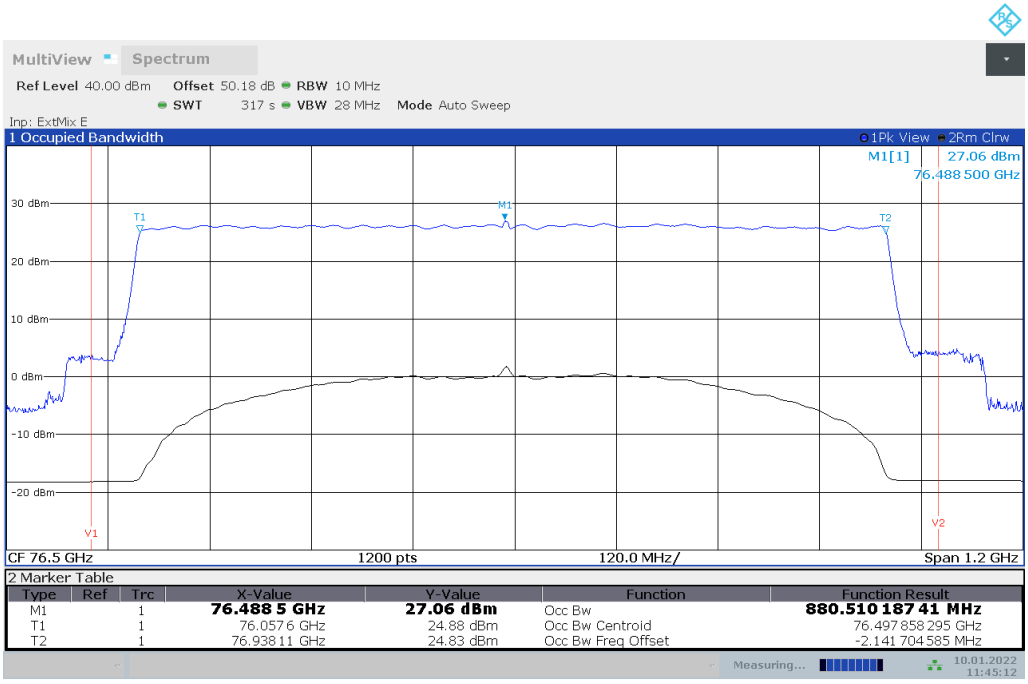
14:31:26 10.01.2022

Plot no. 18: 99% OBW, Peak detector, -30 °C, Test mode 6



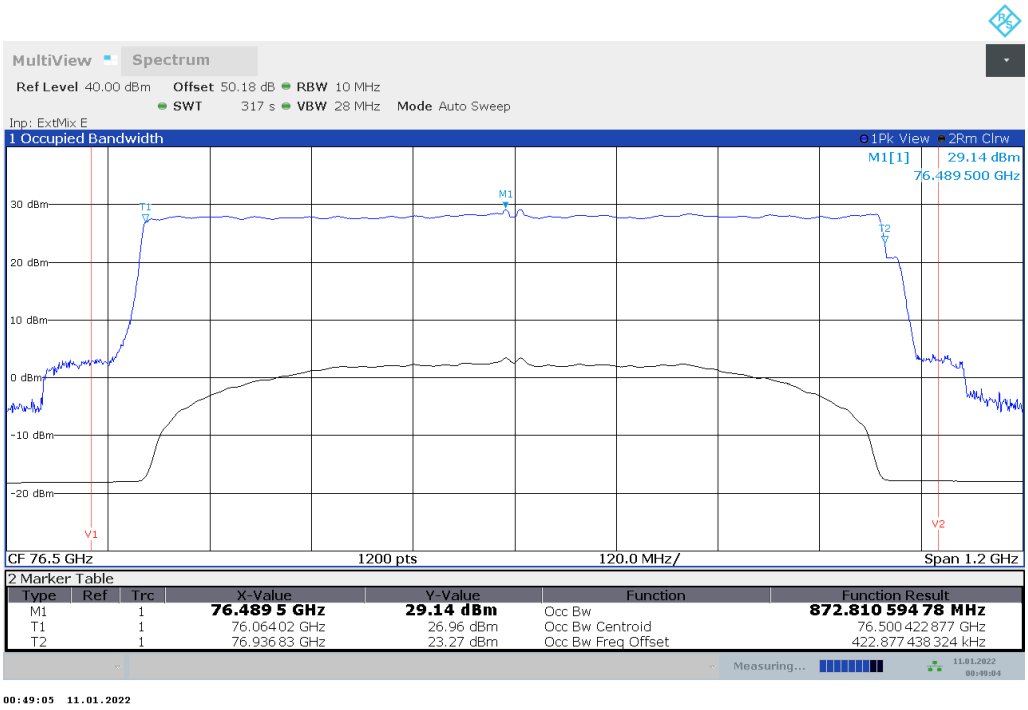
12:20:14 10.01.2022

Plot no. 19: 99% OBW, Peak detector, -40 °C, Test mode 6

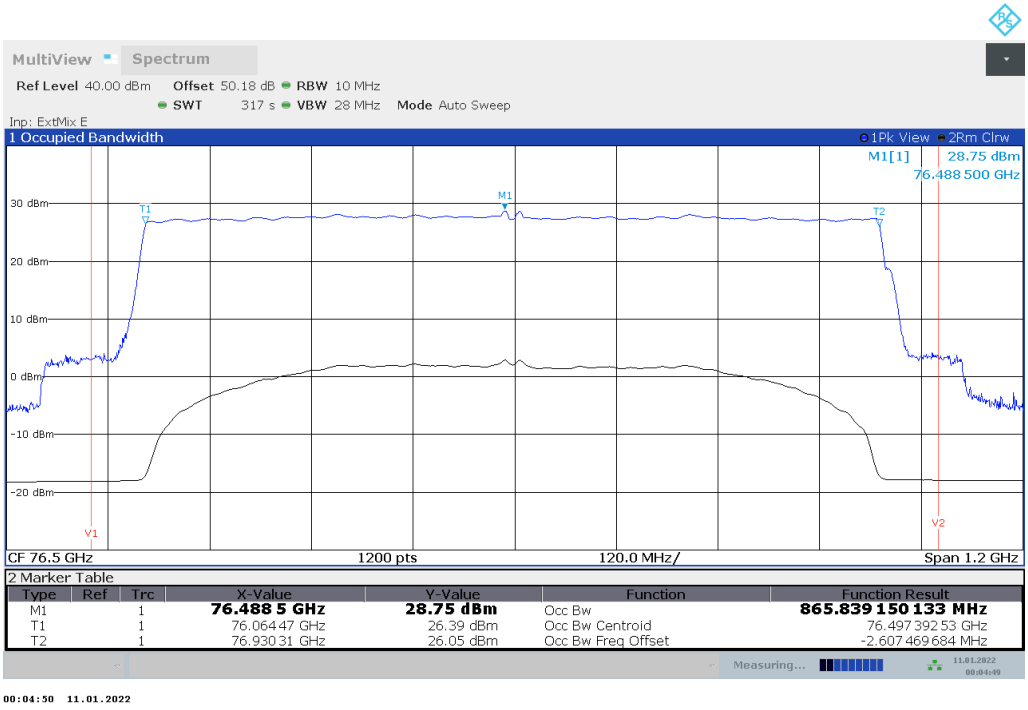


11:45:13 10.01.2022

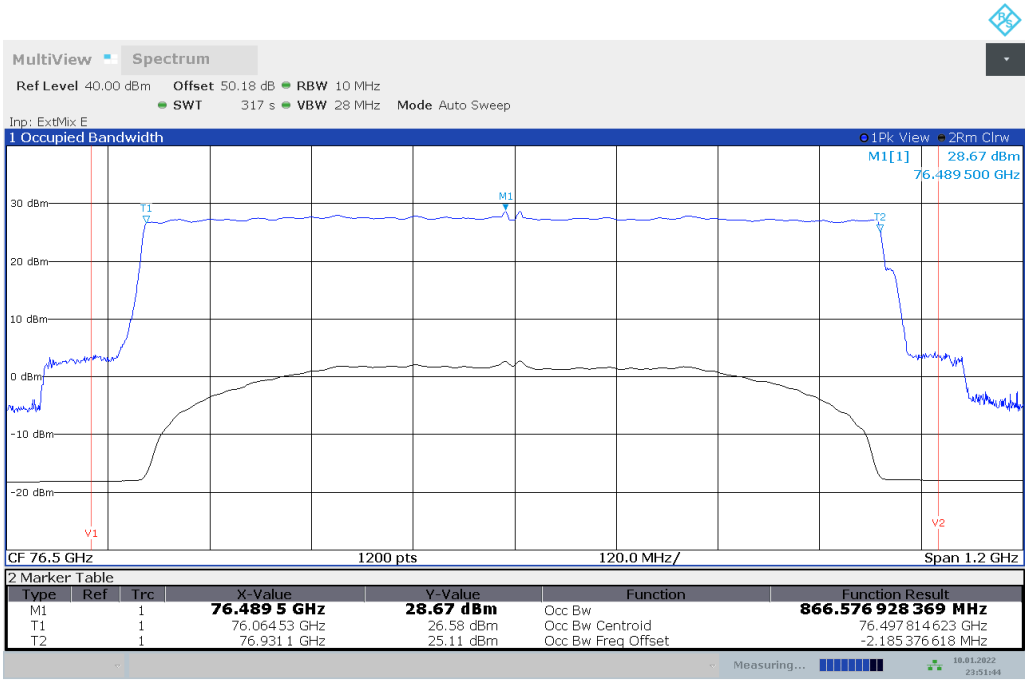
Plot no. 20: 99% OBW, Peak detector, 85 °C, Test mode 8



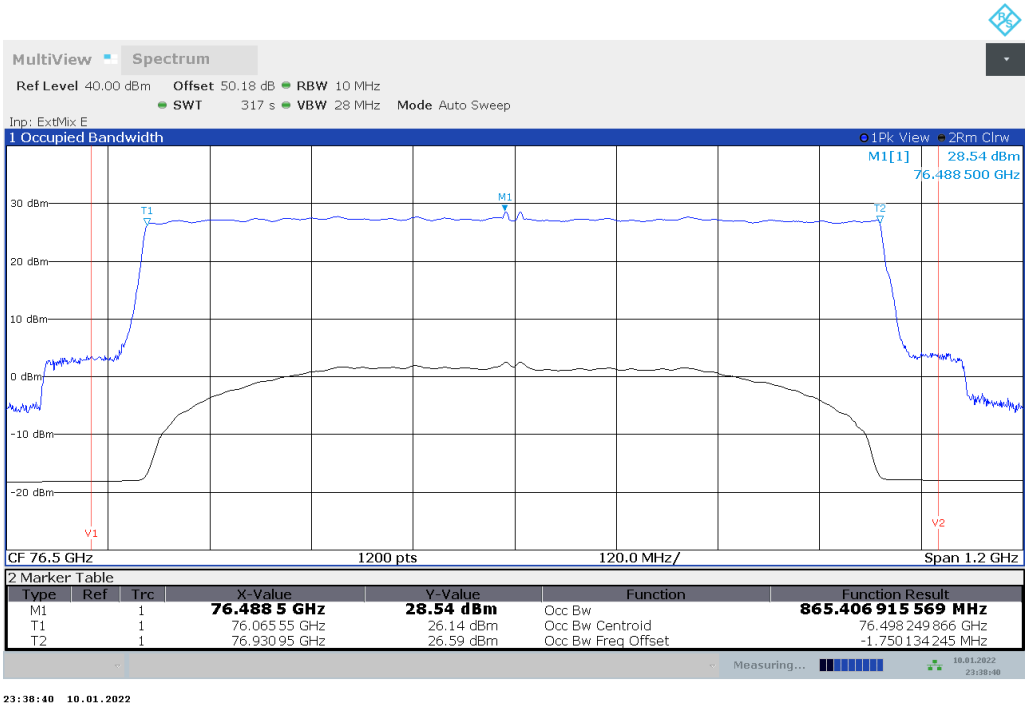
Plot no. 21: 99% OBW, Peak detector, 50 °C, Test mode 8



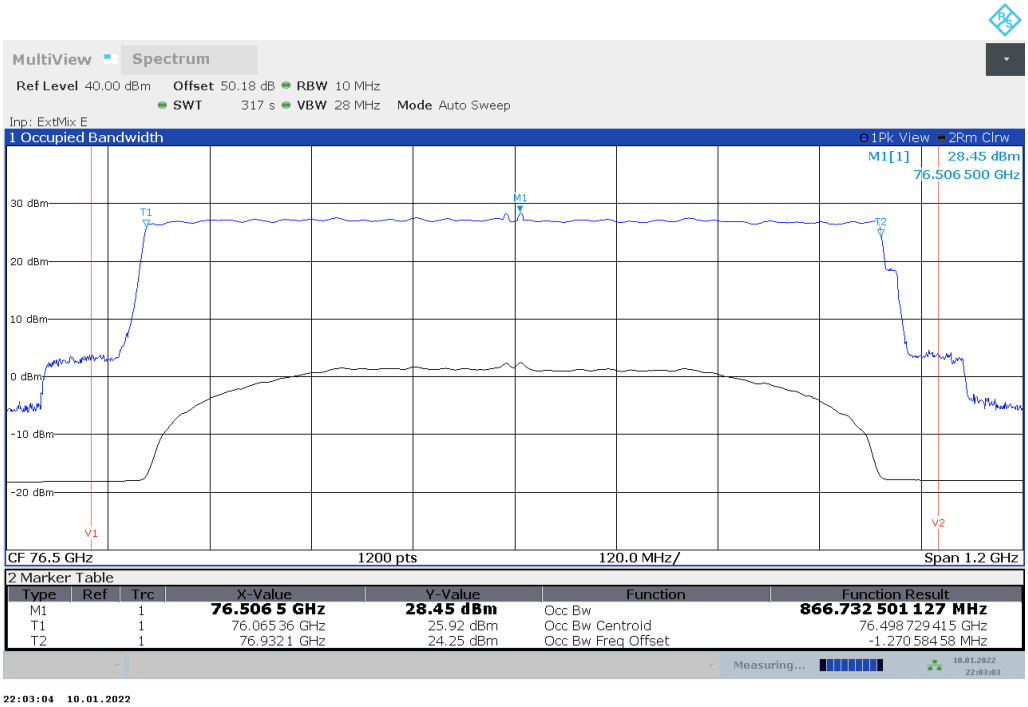
Plot no. 22: 99% OBW, Peak detector, 40 °C, Test mode 8



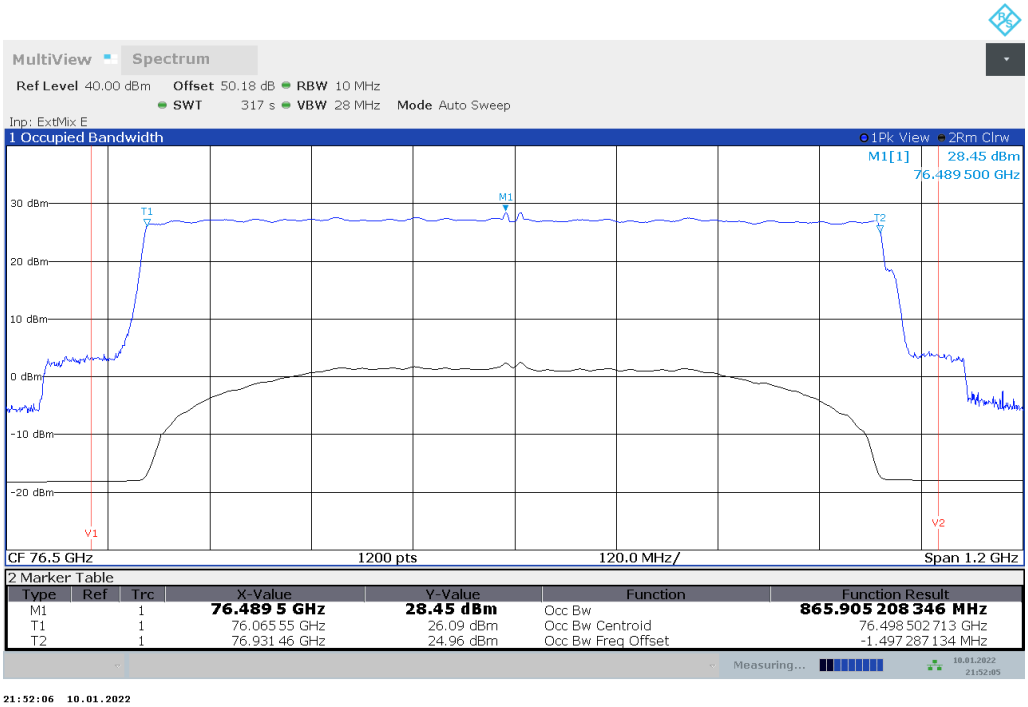
Plot no. 23: 99% OBW, Peak detector, 30 °C, Test mode 8



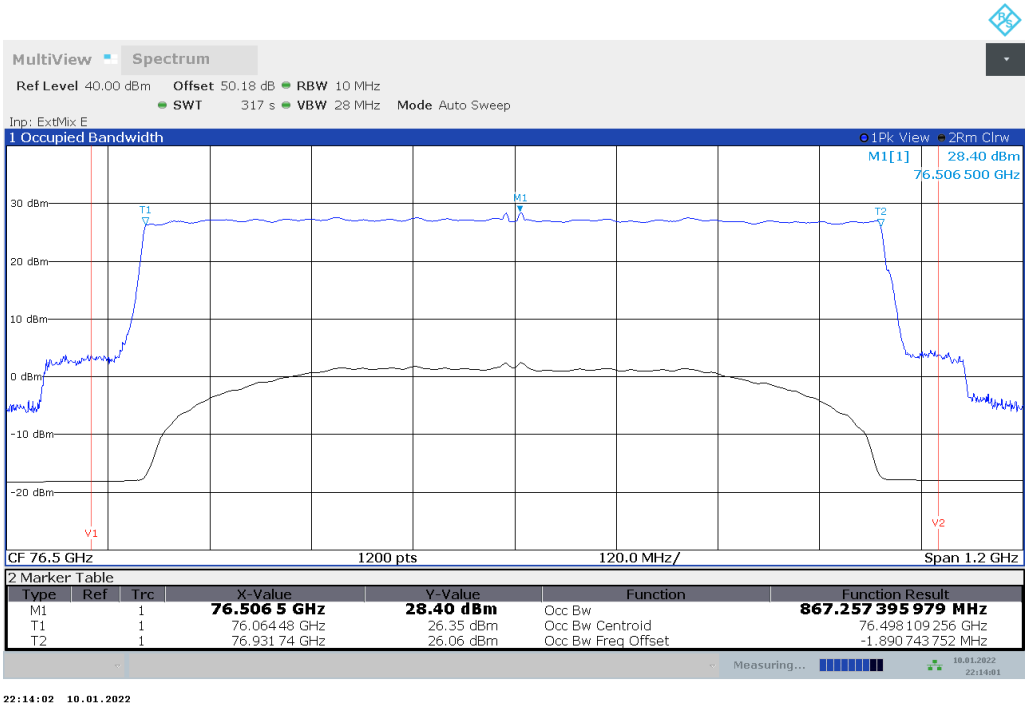
Plot no. 24: 99% OBW, Peak detector, 20 °C, V_{min}, Test mode 8



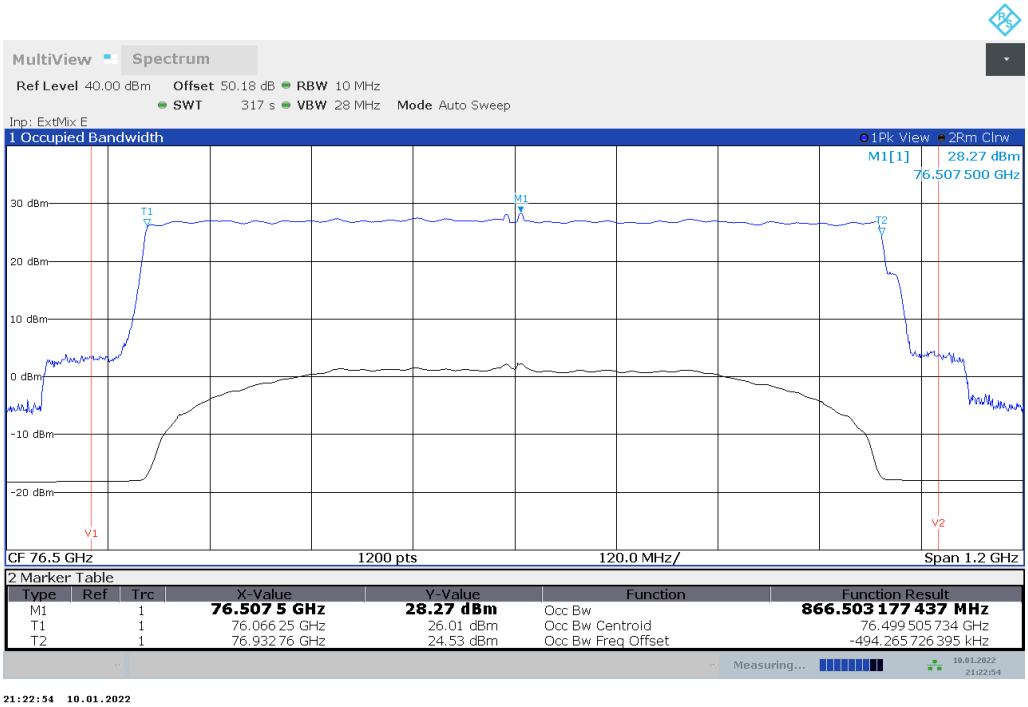
Plot no. 25: 99% OBW, Peak detector, 20 °C, V_{nom}, Test mode 8



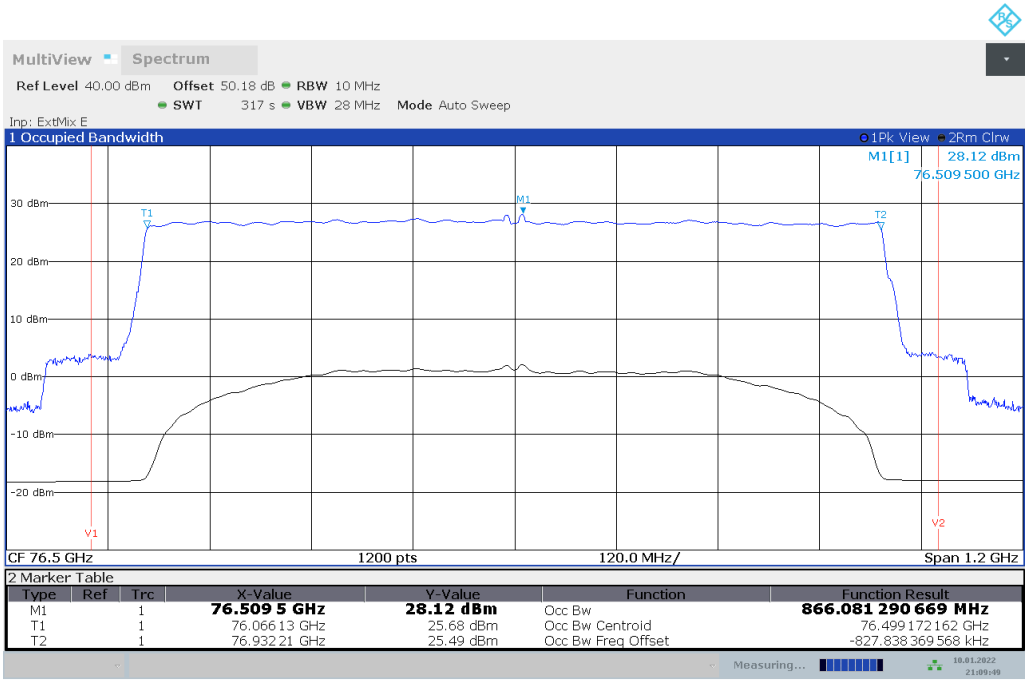
Plot no. 26: 99% OBW, Peak detector, 20 °C, V_{max}, Test mode 8



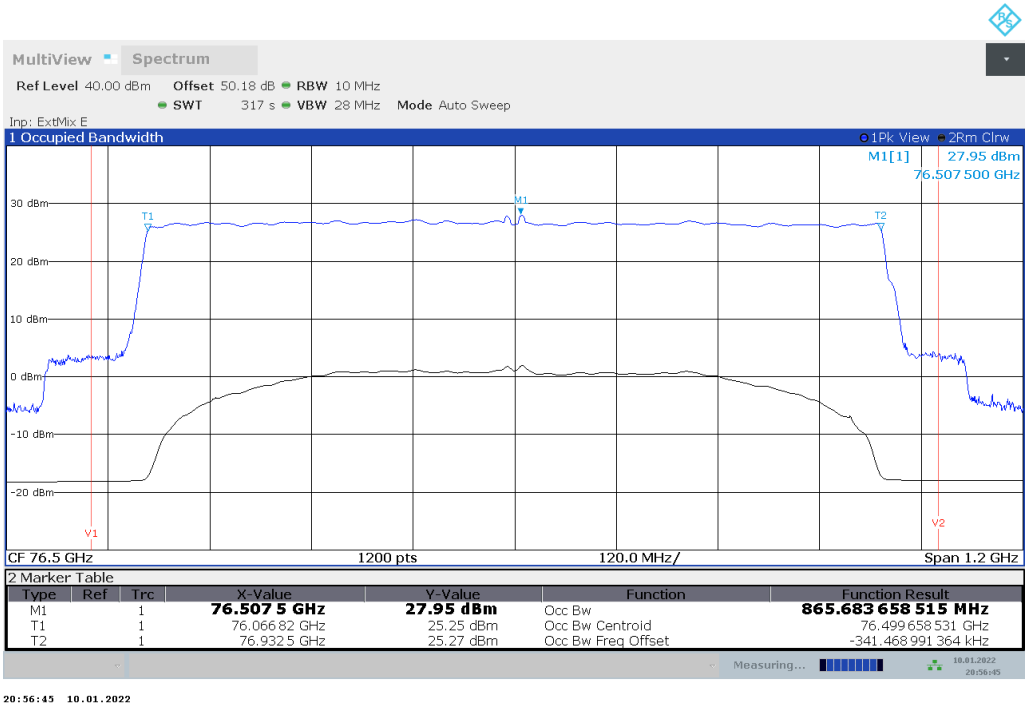
Plot no. 27: 99% OBW, Peak detector, 10 °C, Test mode 8



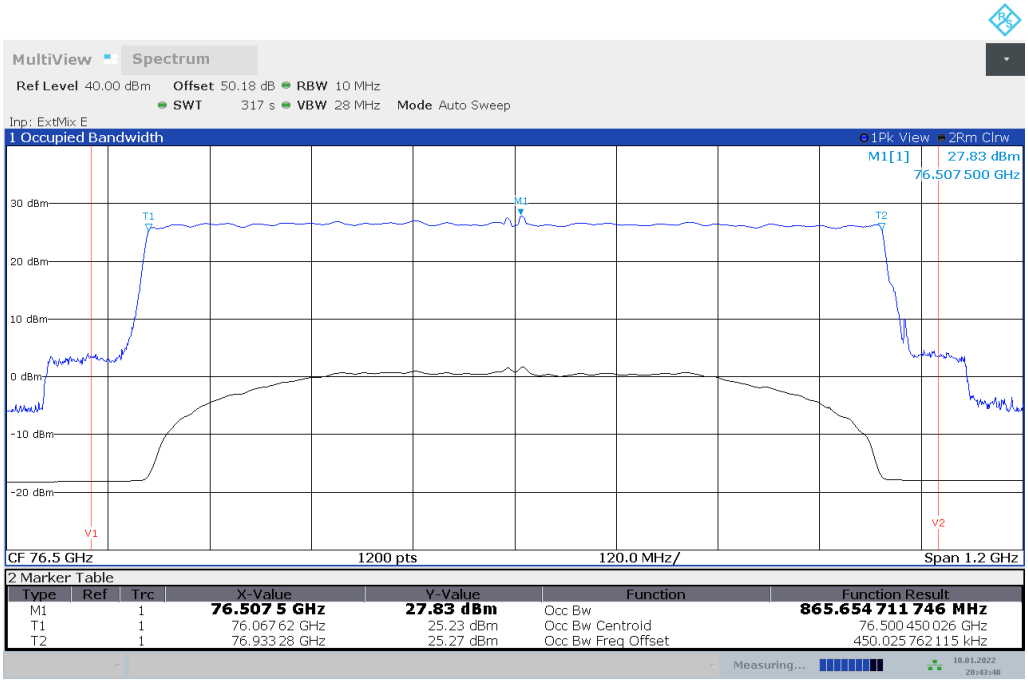
Plot no. 28: 99% OBW, Peak detector, 0 °C, Test mode 8



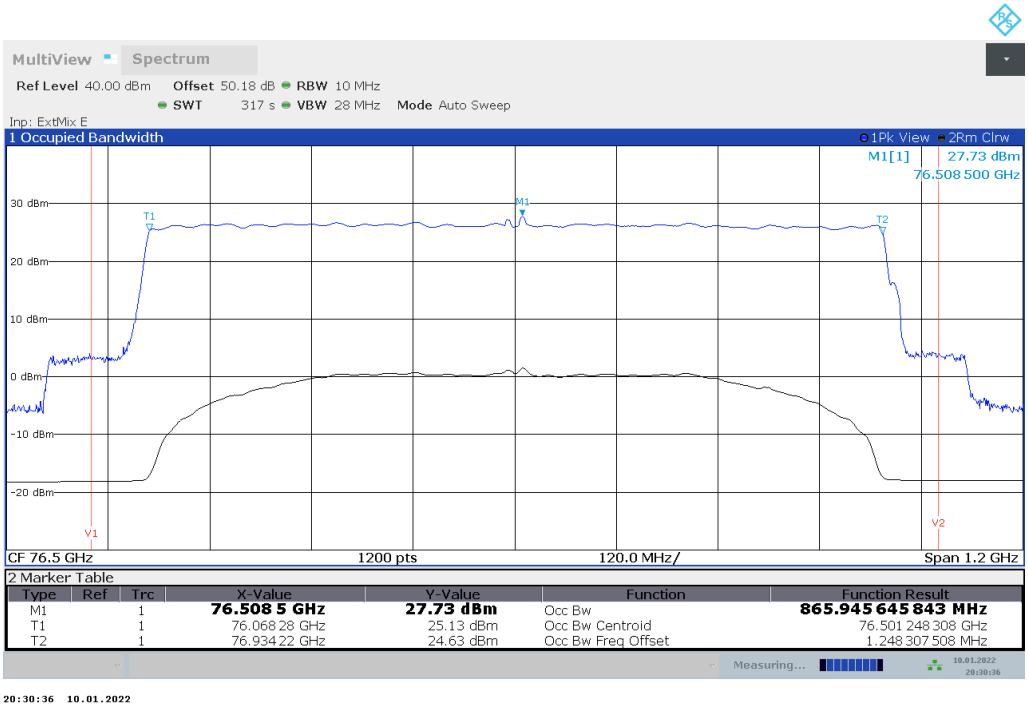
Plot no. 29: 99% OBW, Peak detector, -10 °C, Test mode 8



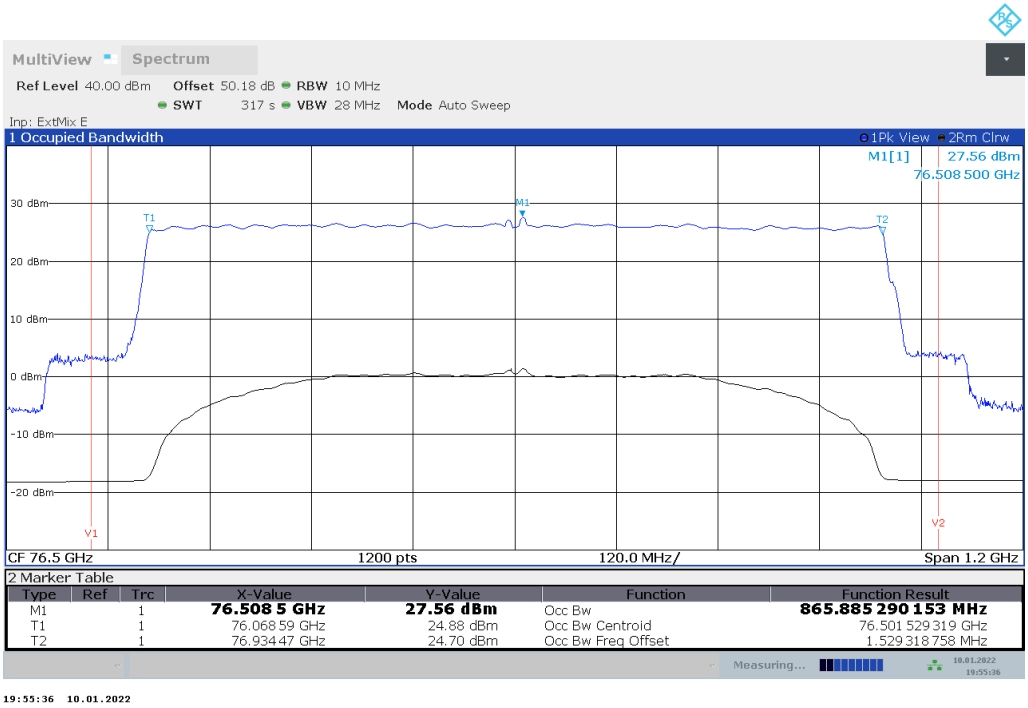
Plot no. 30: 99% OBW, Peak detector, -20 °C, Test mode 8



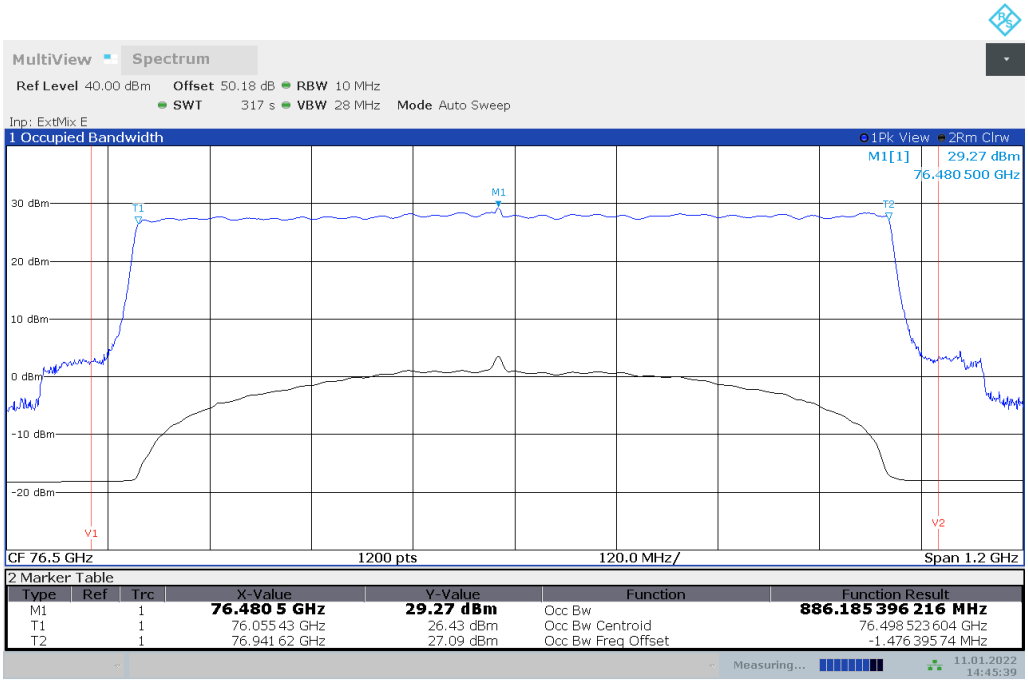
Plot no. 31: 99% OBW, Peak detector, -30 °C, Test mode 8



Plot no. 32: 99% OBW, Peak detector, -40 °C, Test mode 8

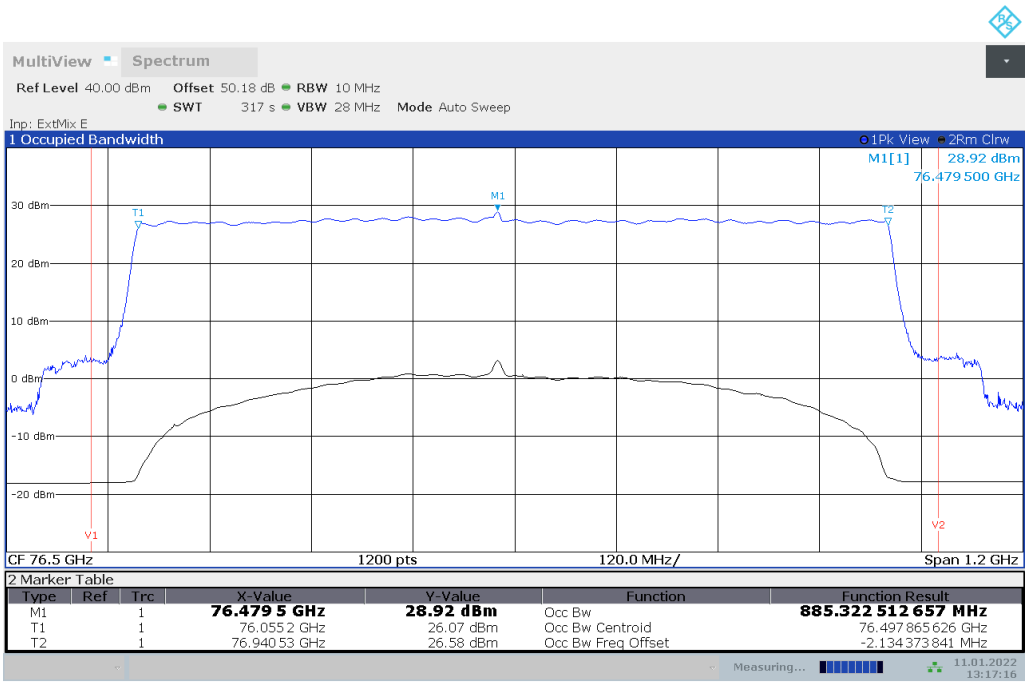


Plot no. 33: 99% OBW, Peak detector, 85 °C, Test mode 12



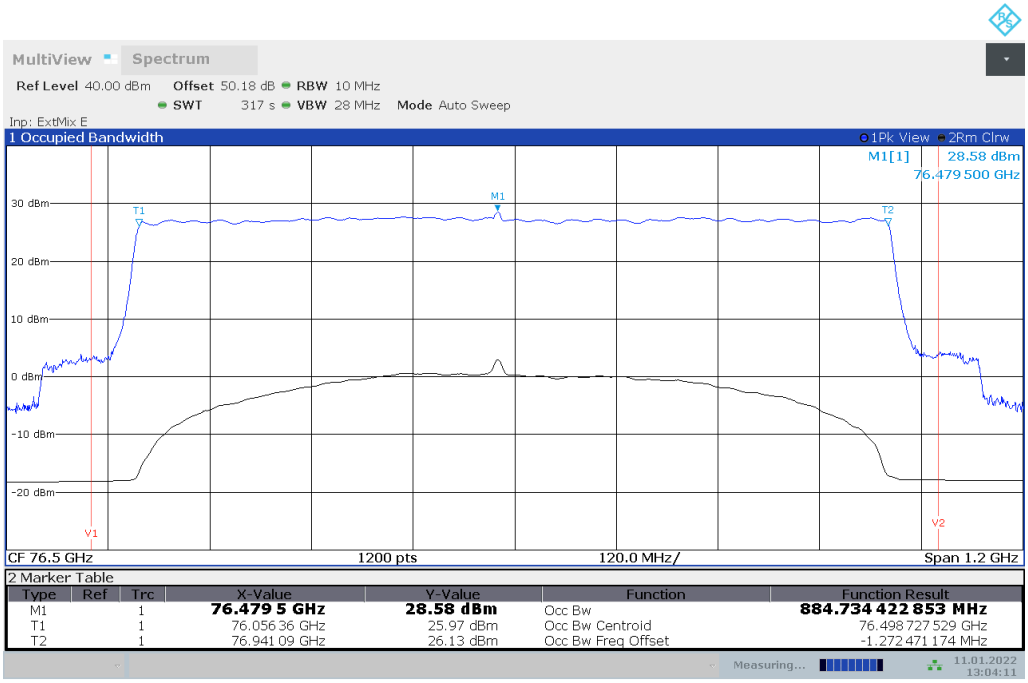
14:45:39 11.01.2022

Plot no. 34: 99% OBW, Peak detector, 50 °C, Test mode 12



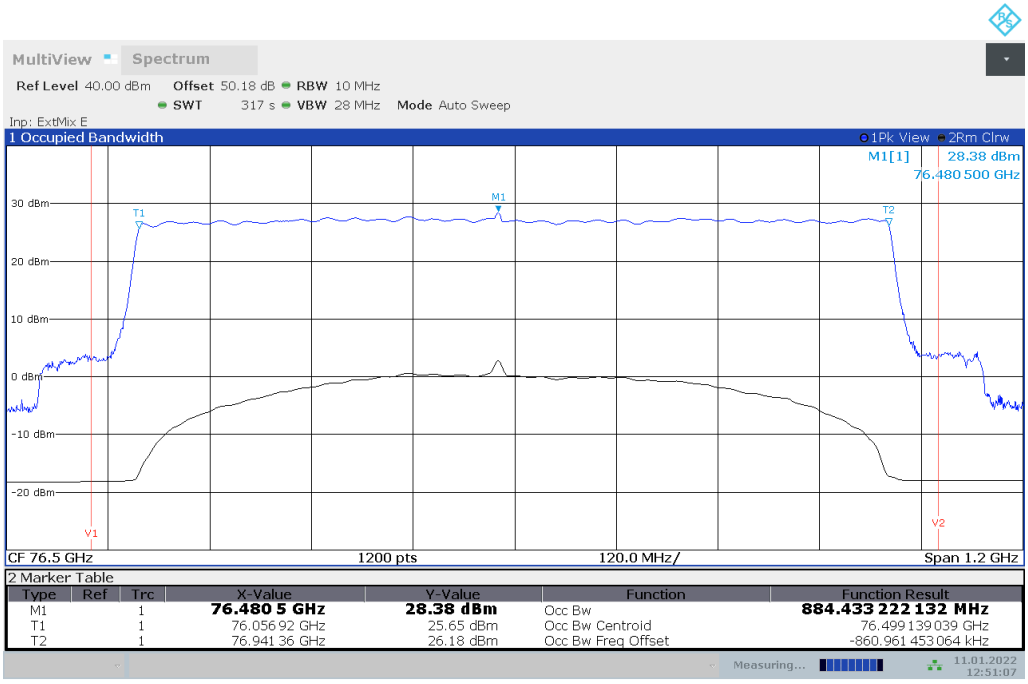
13:17:16 11.01.2022

Plot no. 35: 99% OBW, Peak detector, 40 °C, Test mode 12



13:04:12 11.01.2022

Plot no. 36: 99% OBW, Peak detector, 30 °C, Test mode 12



12:51:07 11.01.2022