REPORT

issued by an Accredited Testing Laboratory

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Radio measurements on AIR 1281 B260 V2

Rev1 2022-02-08: Frequency stability added.

Product name: AIR 1281 B260 V2
Product number: KRD 901 166/2

RISE Research Institutes of Sweden AB
Vehicles and Automation – EMC-IKT

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Accred. No. 1002
Testing
ISO/IEC 17025

Summary

Standard Listed part of	Compliant
FCC CFR 47 part 30 Subpart C	
2.1046/ 30.202 RF power output	Yes
2.1049 Occupied bandwidth	Yes
2.1053/ 30.203 Field strength of spurious radiation	Yes
2.1055 Frequency stability	Yes

Description of the test object

Equipment:	Radio equipment AIR 1281 B260 V2 Product number: KRD 901 166/2 including KRX 101 07/1 Rev. R1C with FCC ID: TA8AKRX10107
Hardware revision state:	R1B
Tested configuration:	3GPP NR TDD
Frequency range:	TX/ RX: 37000 – 40000 MHz
No of supported beams:	Config mode 1: 2 beams in 2 orthogonal polarizations each, 4 beams in total. Config mode 2: 1 beam in 2 orthogonal polarizations each, 2 beams in total.
Operating bandwidth:	Config mode 1: Two segments of 400 MHz Config mode 2: One segment of 400 MHz
Nominal Output power (EIRP):	53 dBm/ beam and polarization config mode 2 47 dBm/ beam and polarization config mode 1
RF configurations:	TX Diversity, SU and MU MIMO up to 2 layers 1x(2x2), Contiguous Spectrum (CS) and Non-Contiguous spectrum (NCS), Carrier Aggregation (CA) intra-band supported
Antenna beam steering:	Azimuth ±60 deg, elevation ±15 deg
Channel bandwidth(s)/ Sub Carrier Spacing:	50 MHz and 100 MHz/ 120 kHz
Modulations:	QPSK, 16QAM and 64QAM
Emission designators:	46M6W7D and 96M0W7D
Emission designators Carrier Aggregation:	397MW7D (4x 100 MHz) and 796MW7D (8x 100 MHz)
RF power Tolerance:	+2.4/ -2.0 dB
CPRI Speed	25 Gbps

The information above is supplied by the manufacturer.

Purpose of test

The purpose of the tests is to verify compliance to the performance characteristics specified in applicable items of FCC CFR 47 Part 30.

Operation modes during measurements

The measurements were performed with the test object transmitting test models as defined in 3GPP TS 38.141-2. Test model NR-FR2 TM 1.1 is used to represent QPSK, test model NR-FR2 TM 3.2 to represent 16QAM, test model NR-FR2 TM 3.1 to represent 64QAM modulation

The settings below were deemed representative for worst case settings, for all traffic scenarios when settings with different modulations and RF configurations was found to represent worst case settings.

MIMO mode, NR-FR2 TM1.1, QPSK with the beams locked in boresight. All measurements were performed with the test object configured for maximum transmit power.

The measurement shall be done during active part of transmission, or if the measurement is performed with constant duty cycle <98%, the result shall be adjusted for the duty cycle according to ANSI C63.26 5.2.4.3.4. The duty cycle was measured to 74% and to compensate for this 1.30 dB was added to the test results.

Measurements

The test object was powered with -48 VDC by an external power supply. Additional connections are documented in the setup drawings for radiated measurements.

RISE 10 MHz reference was connected to the signal analyser as external reference, during all measurements.

Far field distance for power, OBW and Band edge measurements is 2.68 m, based on the EUT antenna dimensions and the highest transmitter frequency (40 GHz).

Far field distances for OOB emissions is based on the measurement antenna dimension and highest frequency in the measurement range :

Frequency range [GHz]	Far field distance R [m]	Measurement distance [m]
18 – 26.5	0.73	3
26.5 – 40	0.48	3
40 – 60	0.34	3
60 – 90	0.22	1
90 – 110	0.17	1
110 – 150	0.13	1
150 – 170	0.13	0.5
170 – 200	0.10	0.5

Formula for far field distance calculation, with R being far field distance and D meaning antenna aperture size:

R = 2x D^2/ λ

References

Measurements were done according to relevant parts of the following standards:

CFR 47 part 30, May 2020
ANSI C63.26-2015
KDB 842590 D01 Upper Microwave Flexible Use Service v01r01
KDB 971168 D01 Power Meas License Digital Systems v03r01
KDB 971168 D03 IM Emission Repeater Amp v01
3GPP TS 38.141-2 V15.5.0 (2020-03)
3GPP TR 37.842 V13.3.0 (2020-01)

Measurement equipment

	Calibration Due	RISE number
Anechoic chamber, Hertz	2021-09	BX50194
R&S FSW 43	2021-07	902 073
R&S ESU 40	2021-07	901 385
R&S ZNB 40	2021-07	BX50051
RF Cable VNA-calibration	2022-01	BX50189
RF Cable VNA-calibration	2022-01	BX50190
RF Cable	2021-05	BX50236
RF Cable	2021-09	BX50192
RF Cable	2022-01	BX81431
RF Cable	2021-05	BX81423
RF Cable	2021-09	503 681
RF Cable FSW-B21	2021-09	BX62069
RF Cable FSW-B21	2021-09	BX62073
Bilog antenna Schaffner 6143A	2021-08	504079
EMCO Horn Antenna 3115	2021-07	502 175
EMCO Horn Antenna 3115	2021-12	902 212
EMCO Horn Antenna 3116	2021-07	503 279
Flann STD Gain Horn Antenna 20240-20	-	KWP02600
Flann STD Gain Horn Antenna 22240-20	-	KWP02601
Flann STD Gain Horn Antenna 24240-20	-	BX92414
Flann STD Gain Horn Antenna 26240-20	-	BX92416
Flann STD Gain Horn Antenna 27240-20	-	BX92417
Flann STD Gain Horn Antenna 29240-20	-	BX92419
Flann STD Gain Horn Antenna 30240-20	-	BX92420
Mixer FS-Z60	2023-09	BX90566
Mixer FS-Z90	2022-01	BX90567
Mixer FS-Z110	2024-01	BX81425
Mizer FS-Z170	2024-01	BX81426
Mixer FS-Z220	2024-01	BX81427
µComp Nordic, Low Noise Amplifier	2022-01	901 544
Miteq, Low Noise Amplifier	2022-01	503 278
Temperature and humidity meter, Testo 615	2021-06	503 498

Frequency stability 2021-12

	Calibration Due	RISE number
R&S FSW 43	2022-07	902 073
RF Cable	2022-04	BX50236
EMCO Horn Antenna 3116	2024-06	503 279
Temperature Chamber	-	503 360
Testo 635, temperature and humidity meter	2022-07	504 203
Multimeter Fluke 87	2022-05	502 190

EAB Measurement equipment

Calibrated at RISE before testing.

	Calibration Due	S/N
Marki Microwave FLP2650 Low pass filter	2021-10	1827
Qualwave QBF-26400-33000-60 Band pass filter	2021-10	182704

Uncertainties

Measurement and test instrument uncertainties are described in the quality assurance documentation ”SP-QD 10885”. The uncertainties are calculated with a coverage factor k=2 (95% level of confidence).
Compliance evaluation is based on a shared risk principle with respect to the measurement uncertainty.

Reservation

The test results in this report apply only to the particular test object as declared in the report.

Delivery of test object

The test object was delivered: 2021-01-13.

Manufacturer’s representative

Mikael Jansson, Ericsson AB.

Test engineers

Tomas Lennhager and Björn Skönvall, RISE

Test participant(-s)

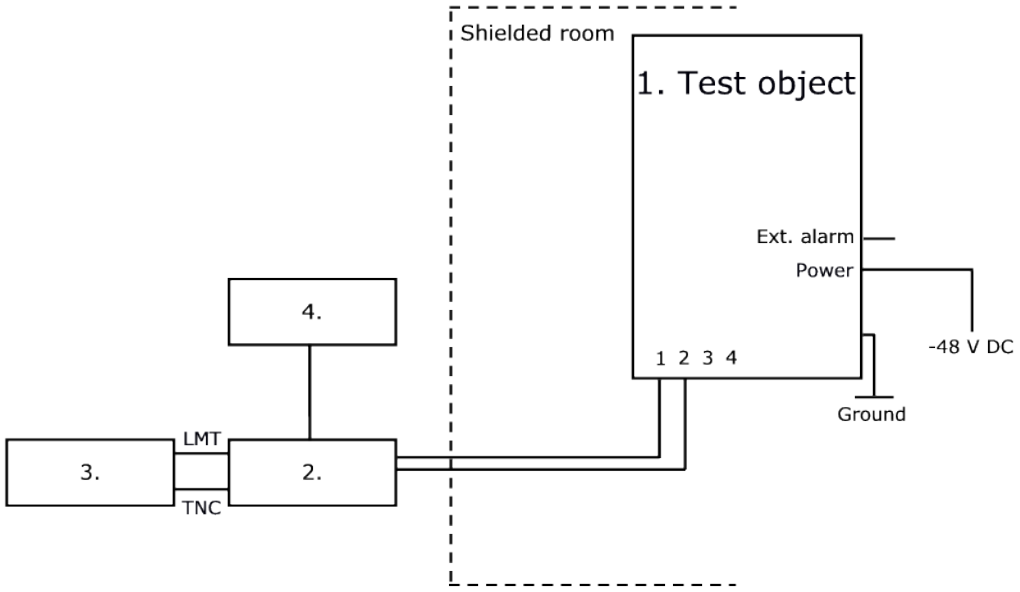
None

Test frequencies used for radiated measurements

Frequency Hor/ Ver [MHz]	Symbolic name	Comment
37025.04	BL_{50}	50 MHz BW, TX bottom frequency configuration lower band
37800.00	ML_{50}	50 MHz BW, TX middle frequency configuration lower band
38574.96	TL_{50}	50 MHz BW, TX top frequency configuration lower band
38625.00	BH_{50}	50 MHz BW, TX bottom frequency configuration higher band
39300.00	MH_{50}	50 MHz BW, TX middle frequency configuration higher band
39975.00	TH_{50}	50 MHz BW, TX top frequency configuration higher band
37050.00	BL_{100}	100 MHz BW, TX bottom frequency configuration lower band
37800.00	ML_{100}	100 MHz BW, TX middle frequency configuration lower band
38550.00	TL_{100}	100 MHz BW, TX top frequency configuration lower band
38649.96	BH_{100}	100 MHz BW, TX bottom frequency configuration lower band
39300.00	MH_{100}	100 MHz BW, TX middle frequency configuration higher band
39949.92	TH_{100}	100 MHz BW, TX top frequency configuration higher band
37050.00 37149.96	$BL2_{100}$	100 MHz BW, 2 carrier, TX bottom frequencies configuration lower band
38449.92 38550.00	$TL2_{100}$	100 MHz BW, 2 carrier, TX top frequencies configuration lower band
39849.96 39949.92	$TH2_{100}$	100 MHz BW, 2 carrier, TX top frequencies configuration higher band
37025.00 37074.96 37374.96	Bim_{50}	50 MHz BW, 3 carrier, TX bottom frequencies configuration lower band
39625.08 39924.96 39975.00	Tim_{50}	50 MHz BW, 3 carrier, TX top frequencies configuration higher band
37050.00 37149.96 37249.92 37350.00	$BL4_{100}$	100 MHz BW, 4 carrier, TX bottom frequencies configuration lower band
38250.00 38349.96 38449.92 38550.00	$TL4_{100}$	100 MHz BW, 4 carrier, TX top frequencies configuration lower band
39649.92 39750.00 39849.96 39949.92	$TH4_{100}$	100 MHz BW, 4 carrier, TX top frequencies configuration higher band

Frequency Hor/ Ver [MHz]	Symbolic name	Comment
37050.00 37149.96 37249.92 37350.00 37449.96 37549.92 37650.00 37749.96	$BL8_{100}$	100 MHz BW, 8 carrier, TX Bottom frequencies configuration lower band
38250.00 38349.96 38449.92 38550.00 38649.96 38749.92 38850.00 38949.96	$M8_{100}$	100 MHz BW, 8 carrier, TX top frequencies configuration lower band and bottom frequencies configuration higher band
39249.96 39349.92 39450.00 39549.96 39649.92 39750.00 39849.96 39949.92	$TH8_{100}$	100 MHz BW, 8 carrier, TX top frequencies configuration higher band

Test setup: radiated measurements



Test object:

1.	AIR 1281 B260 V2, KRD 901 166/2, rev. R1B, s/n: C82A593646 Radio Software: CXP 203 0045/1, rev. R7A496 including KRX 101 07/1, Rev. R1C with FCC ID: TA8AKRX10107

Associated equipment:

2.	Testing Equipment: Baseband 6630, KDU 137 0015/1, rev. R3A, s/n: E23B947567 with software: CXP2020683/1, rev. R19A257 For frequency stability test Baseband 6648, KDU 137 0015/1, rev. R3A, s/n: E23B849332 with software: CXP2010174/1_R38A130 was used

Functional test equipment:

3.	Computer, HP ZBook, BAMS - 1001530471
4.	GPS Active Antenna, KRE 101 2082/1 GPS 02 01, NCD 901 41/1, rev. R1D, s/n: A401804384

Interfaces:

1, Optical Interface Link, single mode opto fibre	Signal
2, Optical Interface Link, single mode opto fibre	Signal
3, Optical Interface Link, single mode opto fibre	Signal
4, Optical Interface Link, single mode opto fibre	Signal
Power input configuration Dc: -48 V DC	Power
EXT Alarm, shielded multi-wire	Signal
Ground wire	Ground

RF power output measurements according to CFR 47 §30.202

Date	Temperature	Humidity
2021-01-13	23 °C ± 3 °C	13 % ± 5 %
2021-01-14	24 °C ± 3 °C	11 % ± 5 %

Test set-up and procedure

The test object was located in a anechoic chamber. The measuring antenna was aligned to the centre of the PAAM. A turn table was used to find the highest output power. A signal analyzer with the channel power function activated was used to measure the output power with the RMS detector activated. The bandwidth setting of the channel power function was set to 100 MHz.

A substitution measurement defined in 3GPP TR 37.842 chapter 10.3.1.1.2 was used to get the actual correction factor (Transducer factor A-D in the figure 1 below) with a Network analyzer (ZNB 40).

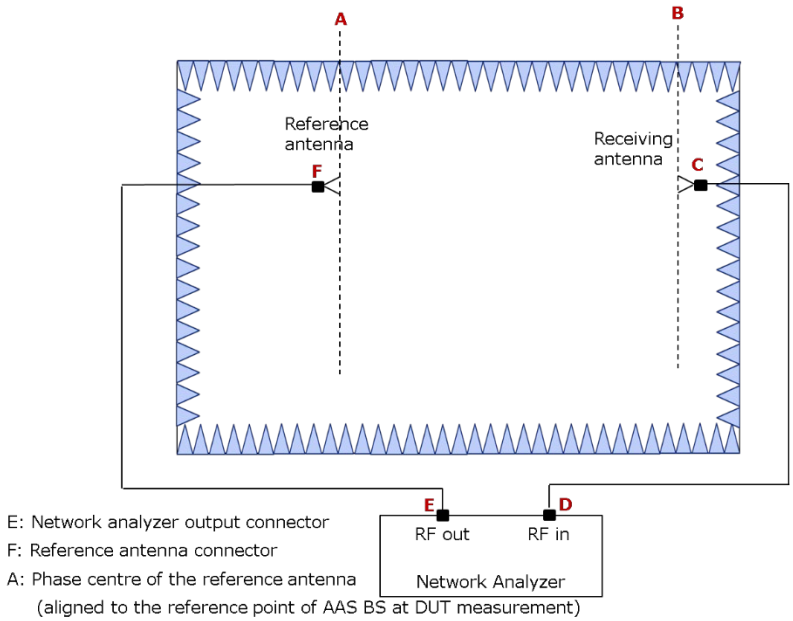


Figure 1: Indoor Anechoic Chamber calibration system setup for EIRP

Stage 1 - Calibration:

1) Connect the reference antenna and the receiving antenna to the measurement RF out port and RF in port of the network analyzer, respectively, as shown in figure 1.
2) Install the reference antenna with its *beam peak direction* and the height of its phase centre aligned with the receiving antenna.
3) Set the centre frequency of the network analyzer to the carrier centre frequency of the tested signal for EIRP measurement of the EUT and measure $LF_{EIRP,\ E\rightarrow D}$, which is equivalent to 20log|S21| (dB) obtained by the network analyzer:
   $LF_{EIRP,\ E\rightarrow D}$: Pathloss between E and D in figure 1.
4) Measure the cable loss, $LF_{EIRP,\ E\rightarrow F}$ between the reference antenna connector and the network analyzer connector:
   $LF_{EIRP,\ E\rightarrow F}$: Cable loss between E and F in figure 1.

5) Calculate the calibration value between A and D with the following formula:
$L_{EIRP\_cal,\ A\rightarrow D} = LF_{EIRP,\ E\rightarrow D} + G_{REF\_ANT\_EIRP,\ A\rightarrow F} - LF_{EIRP,\ E\rightarrow F}$.
$L_{EIRP\_cal,\ A\rightarrow D}$: Calibration value between A and D in figure 1. Was implemented in the spectrum analyzer as a transducer.
$G_{REF\_ANT\_EIRP,\ A\rightarrow F}$: Antenna gain of the reference antenna.

Stage 2 - Measurement:

6) Uninstall the reference antenna and install the EUT with the manufacturer declared coordinate system reference point in the same place as the phase centre of the reference antenna. The manufacturer declared coordinate system orientation of the EUT is set to be aligned with the testing system.
7) Measure the mean power, $P_{R\_EUT\_EIRP,\ D}$, D in figure 1.
8) Calculate the EIRP with the following formula:

$$EIRP = P_{R\_EUT\_EIRP,\ D} + L_{EIRP\_cal,\ A\rightarrow D}$$

Test Setup, measuring distance 3m:

Measurement equipment	RISE number
Anechoic chamber, Hertz	BX50194
R&S FSW 43	902 073
R&S ZNB 40	BX50051
EMCO Horn Antenna 3116	503 279
FLANN Std gain 22240-20	KWP02601
RF Cable	BX81423
Testo 615, temperature and humidity meter	503 498

Measurement uncertainty: 3.3 dB

Results

Single carrier Config mode 2

Beam index 0 Bore site, Bandwidth 50MHz, QPSK
Nominal rated output power (EIRP) per Beam: 53 dBm/ Polarization.

	Output power per 100 MHz, EIRP [RMS dBm] Vertical/ Horizontal
Symbolic name	Carrier 1
BL_{50}	53.78/ 54.04
ML_{50}	53.33/ 53.65
TL_{50}	53.72/ 53.38
BH_{50}	53.51/ 53.20
MH_{50}	53.51/ 53.18
TH_{50}	53.09/ 53.22

Beam index 0 Bore site, Bandwidth 100MHz, QPSK
Nominal rated output power (EIRP) per Beam: 53 dBm/ Polarization.

	Output power per 100 MHz, EIRP [RMS dBm] Vertical/ Horizontal
Symbolic name	Carrier 1
BL_{100}	53.40/ 53.89
ML_{100}	53.07/ 53.51
TL_{100}	53.57/ 53.53
BH_{100}	53.22/ 53.00
MH_{100}	53.55/ 52.99
TH_{100}	53.01/ 53.01

Multi carrier

2-Carrier Config mode 2

Beam index 0 Bore site, Bandwidth 100MHz, QPSK
Nominal rated output power (EIRP) per Beam: 53 dBm/ Polarization.

	Output power per 100 MHz, EIRP [RMS dBm] Vertical/ Horizontal		
Symbolic name	Carrier 1	Carrier 2	Total (per 200 MHz)
$BL2_{100}$	49.83/ 50.51	50.28/ 50.81	53.7/ 53.67
$TL2_{100}$	49.94/ 50.03	50.60/ 50.49	53.29/ 53.28
$TH2_{100}$	49.61/ 49.96	49.68/ 49.68	52.66/ 52.83

4-Carrier Config mode 2

Beam index 0 Bore site, Bandwidth 100MHz, QPSK
Nominal rated output power (EIRP) per Beam: 53 dBm/ Polarization.

	Output power per 100 MHz, EIRP [RMS dBm] Vertical/ Horizontal				
Symbolic name	Carrier 1	Carrier 2	Carrier 3	Carrier 4	Total (per 400 MHz)
$BL4_{100}$	46.82/ 47.64	46.55/ 47.39	47.60/ 48.25	46.96/ 48.10	53.02/ 53.88
$TL4_{100}$	46.36/ 46.60	46.56/ 46.70	47.46/ 47.41	47.07/ 47.68	52.90/ 53.14
$TH4_{100}$	47.84/ 48.19	46.72/ 46.92	46.59/ 46.51	45.66/ 46.07	52.79/ 53.02

8-Carrier Config mode 1

Beam index 0 Boresight, Carrier Bandwidth 100 MHz, QPSK
Nominal rated output power (EIRP) per Beam: 47.0 dBm/ Polarization.

	Output power per 100 MHz, EIRP [RMS dBm] Vertical/ Horizontal									
	Beam 1					Beam 2				
Symbolic name	A	B	C	D	Total Power Beam 1 (per 400 MHz)	E	F	G	H	Total power Beam 2 (per 400 MHz)
$BL8_{100}$	40.38/ 41.51	40.35/ 41.43	41.59/ 42.45	41.26/ 42.59	46.95/ 48.05	40.99/ 41.15	41.10/ 41.27	41.71/ 41.78	41.78/ 41.94	47.43/ 47.57
$M8_{100}$	40.60/ 41.04	40.89/ 41.16	42.03/ 41.98	41.94/ 42.24	47.43/ 47.66	40.26/ 40.24	40.12/ 40.01	40.93/ 40.55	40.97/ 40.60	46.61/ 46.38
$TH8_{100}$	41.79/ 41.77	41.26/ 41.22	41.91/ 41.59	41.38/ 41.38	47.61/ 47.52	41.62/ 41.55	40.61/ 40.40	40.63/ 40.01	40.08/ 39.37	46.79/ 46.43

Limits

CFR47 §30.202 Power limits.

(a) For fixed and base stations operating in connection with mobile systems, the average power of the sum of all antenna elements is limited to an equivalent isotopically radiated power (EIRP) density of +75dBm/100 MHz. For channel bandwidths less than 100 MHz the EIRP must be reduced proportionally and linearly based on the bandwidth relative to 100 MHz.

Complies?	Yes

Occupied bandwidth measurements according to CFR47 2.1049

Date	Temperature	Humidity
2021-01-13	23 °C ± 3 °C	13 % ± 5 %
2021-01-14	24 °C ± 3 °C	11 % ± 5 %

Test set-up and procedure

The test object was located in a anechoic chamber. The measuring antenna was aligned to the centre of the of the PAAM. A turn table was used to find the highest output power. A signal analyzer with Peak detector and max hold was used to measure the OBW.

Test Setup, measuring distance 3m:

Measurement equipment	RISE number
Anechoic chamber, Hertz	BX50194
R&S FSW 43	902 073
R&S ZNB 40	BX50051
EMCO Horn Antenna 3116	503 279
FLANN Std gain 22240-20	KWP02601
RF Cable	BX81423
Testo 615, temperature and humidity meter	503 498

Measurement uncertainty: 3.3 dB

Results

Single carrier, Config mode 2, Bandwidth: 50MHz Modulation: QPSK

Diagram	Symbolic name	Polarization	Occupied BW (99%) [MHz]
1.1	TL_{50}	Hor	46.579
1.2	TL_{50}	Ver	46.594

Single carrier, Config mode 2, Bandwidth: 100MHz Modulation: QPSK

Diagram	Symbolic name	Polarization	Occupied BW (99%) [MHz]
1.3	TL_{100}	Hor	96.018
1.4	TL_{100}	Ver	95.956

Carrier Aggregation, Config mode 2, Bandwidth: 4x 100MHz, Modulation: QPSK

Diagram	Symbolic name	Polarization	Occupied BW (99%) [MHz]
1.5	$TL4_{100}$	Hor	396.751
1.6	$TL4_{100}$	Ver	396.795

Carrier Aggregation, Config mode 1, Bandwidth: 8x 100MHz, Modulation: QPSK

Diagram	Symbolic name	Polarization	Occupied BW (99%) [MHz]
1.7	$M8_{100}$	Hor	796.410
1.8	$M8_{100}$	Ver	795.625

Diagram 1.1, TL_{50}, QPSK, Horizontal:

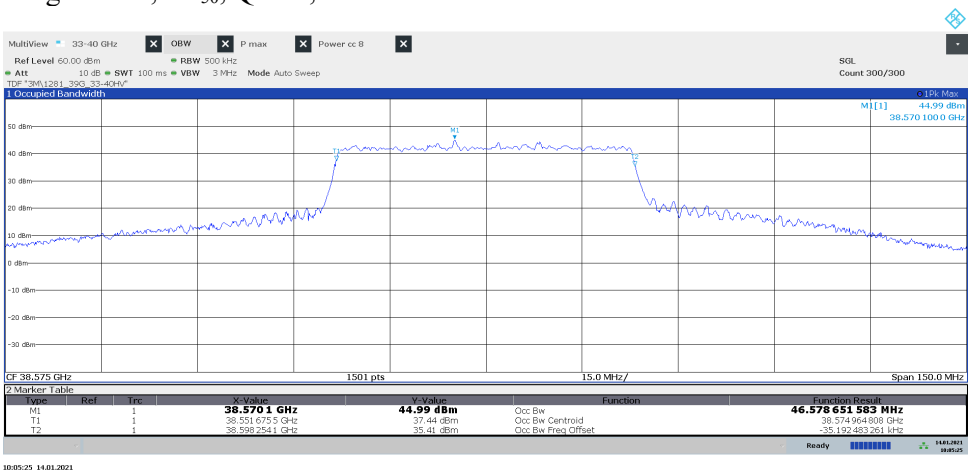


Diagram 1.2, TL_{50}, QPSK, Vertical::

Diagram 1.3, TL_{100}, QPSK, Horizontal:

Diagram 1.4, TL_{100}, QPSK, Vertical::

Diagram 1.5, $TL4_{100}$, QPSK, Horizontal:

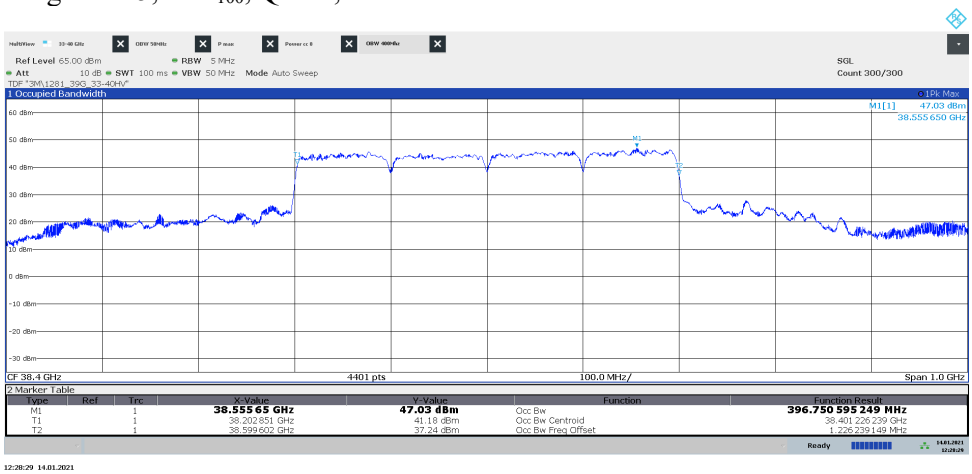


Diagram 1.6, $TL4_{100}$, QPSK, Vertical::

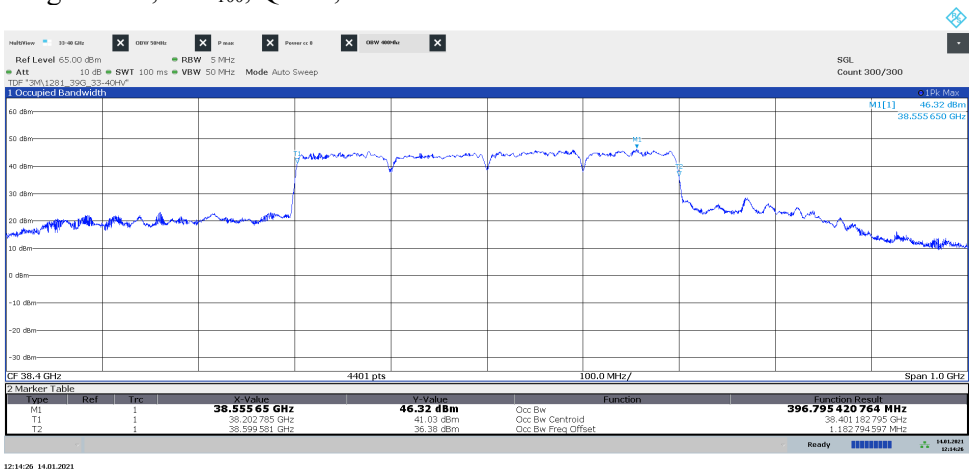


Diagram 1.7, $M8_{100}$, QPSK, Horizontal:

Diagram 1.8, $M8_{100}$, QPSK, Vertical::

Field strength of spurious radiation measurements according to CFR 47 §30.203

Date	Temperature	Humidity
2021-01-14	24 °C ± 3 °C	11 % ± 5 %
2021-01-15	23 °C ± 3 °C	9 % ± 5 %
2021-01-18	23 °C ± 3 °C	12 % ± 5 %
2021-01-19	23 °C ± 3 °C	18 % ± 5 %
2021-01-20	23 °C ± 3 °C	18 % ± 5 %
2021-01-21	23 °C ± 3 °C	17 % ± 5 %
2021-01-22	23 °C ± 3 °C	12 % ± 5 %
2021-01-25	23 °C ± 3 °C	15 % ± 5 %
2021-01-26	23 °C ± 3 °C	15 % ± 5 %
2021-01-27	23 °C ± 3 °C	10 % ± 5 %
2021-01-28	23 °C ± 3 °C	11 % ± 5 %

The measurements were performed with both horizontal and vertical polarization of the antenna. The measurement was performed with a RBW of 1 MHz. The antenna distance and test object height in the different frequency ranges is descried below.

In the test range from 40 – 200 GHz
A propagation loss in free space was calculated. The used formula was
$\gamma = 20\log\left(\frac{4\pi D}{\lambda}\right)$, γ is the propagation loss and D is the antenna distance.
For 40 – 60 GHz *D* was 3.0m, for 60 – 150 GHz *D* was 1.0m and for 150 – 200 GHz *D* was 0.5m.

In the test range from 30MHz – 40 GHz a substitution measurement defined in 3GPP TR 37.842 chapter 10.3.1.1.2 was used to get the actual correction factor (Transducer factor A-D in the figure 1 below) with a Network analyzer (ZNB 40).

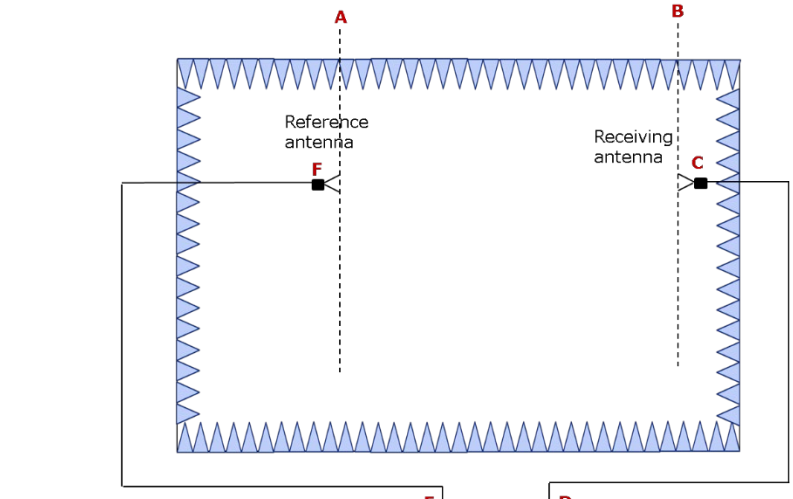


Figure 1: Indoor Anechoic Chamber calibration system setup for EIRP

Stage 1 - Calibration:

1) Connect the reference antenna and the receiving antenna to the measurement RF out port and RF in port of the network analyzer, respectively, as shown in figure 1.
2) Install the reference antenna with its *beam peak direction* and the height of its phase centre aligned with the receiving antenna.
3) Set the centre frequency of the network analyzer to the carrier centre frequency of the tested signal for EIRP measurement of the EUT and measure $LF_{EIRP,\ E\rightarrow D}$, which is equivalent to 20log|S21| (dB) obtained by the network analyzer:
   $LF_{EIRP,\ E\rightarrow D}$: Pathloss between E and D in figure 1.
4) Measure the cable loss, $LF_{EIRP,\ E\rightarrow F}$ between the reference antenna connector and the network analyzer connector:
   $LF_{EIRP,\ E\rightarrow F}$: Cable loss between E and F in figure 1.
5) Calculate the calibration value between A and D with the following formula:
   $L_{EIRP\_cal,\ A\rightarrow D} = LF_{EIRP,\ E\rightarrow D} + G_{REF\_ANT\_EIRP,\ A\rightarrow F} - LF_{EIRP,\ E\rightarrow F}$.
   $L_{EIRP\_cal,\ A\rightarrow D}$: Calibration value between A and D in figure 1. Was implemented in the spectrum analyzer as a transducer.
   $G_{REF\_ANT\_EIRP,\ A\rightarrow F}$: Antenna gain of the reference antenna.

Stage 2 - Measurement:

6) Uninstall the reference antenna and install the EUT with the manufacturer declared coordinate system reference point in the same place as the phase centre of the reference antenna. The manufacturer declared coordinate system orientation of the EUT is set to be aligned with the testing system.
7) Measure the mean power, $P_{R\_EUT\_EIRP,\ D}$, D in figure 1.
8) Calculate the EIRP with the following formula:

$$EIRP = P_{R\_EUT\_EIRP,\ D} + L_{EIRP\_cal,\ A \rightarrow D}$$

The measurement procedure was as the following:

1. An EIRP pre-scan with the measurement antenna in horizontal and vertical polarization is performed with RMS detector and Max Hold on the spectrum analyzer. The turn table was slowly rotating form 0-360 degrees.

2. EIRP spurious radiation on frequencies closer than 10 dB to the TRP limit in the pre-scan a manual search for maximum response was done.

3. If the recorded EIRP value was above the TRP limit, a TRP measurement was done according to KDB 842590 D01 chapter 4.4. Overview of the methods.

    a. Two Cut method according to KDB 842590 D01 chapter 4.4.2.2
        i. EUT set in vertical orientation
        ii. EIRP measurement samples with horizontal and vertical polarization of the measurement antenna. Angular step size based on frequency and dimension of the EUT
        iii. EUT set in horizontal orientation
        iv. EIRP measurement samples with horizontal and vertical polarization of the measurement antenna. Angular step size based on frequency and dimension of the EUT.
        v. TRP = EIRP measurement samples averaged+ΔTRP.
        (ΔTRP = Margin factor based on grid selection).

b. Two Cut method when pattern multiplication is applicable and used according to KDB 842590 D01 chapter 4.4.2.3
    i. EUT set in vertical orientation
    ii. EIRP measurement samples with horizontal and vertical polarization of the measurement antenna. Angular step size based on frequency and dimension of the EUT
    iii. EUT set in horizontal orientation
    iv. EIRP measurement samples with horizontal and vertical polarization of the measurement antenna. Angular step size based on frequency and dimension of the EUT.
    v. TRP is calculated using the formula in Appendix E of KDB 842590 D01
c. EIRP to Conducted Power Conversion in Band Edge Using Antenna Gain according to KDB 842590 D01 chapter 4.4.2.5
    i. Convert each radiated measurement to conducted power/BW using the equations:
    Conducted Power level (dBm) at any frequency/BW = Measured EIRP level (dBm)/BW – EUT antenna Gain (dBi)
    ii. Sum the radiated power Horizontal and Vertical polarisations for total conducted power level/BW.
    iii. Evaluate the pass/fail decision by comparing total conducted power level/BW against the applicable TRP limit.

d. Spherical Grid Method, according to KDB 842590 D01 chapter 4.4.2.4
    i. EUT set in horizontal orientation bottom of the EUT to the right.
    ii. EIRP measurement samples with horizontal and vertical polarization of the measurement antenna. Angular step size of the turn table was 15 degrees from 0 – 165 degrees and 195 – 360 degrees. In cone of radiation 165 – 195 degrees the step size of the turn table was 1 degree.
    iii. EUT was changed in 15 degrees step from horizontal bottom right to horizontal bottom to the left (twelve steps). Step ii. was repeated for all twelve steps.
    iv. TRP was calculated according to Appendix B in KDB 842590.

Measurement equipment

	RISE number
Anechoic chamber, Hertz	BX50194
R&S FSW 43	902 073
R&S ESU	901 385
R&S ZNB 40	BX50051
RF Cable VNA-calibration	BX50189
RF Cable VNA-calibration	BX50190
RF Cable	BX50236
RF Cable	BX50192
RF Cable	BX81431
RF Cable	BX81423
RF Cable	503 681
RF Cable FSW-B21	BX62069
RF Cable FSW-B21	BX62073
Bilog antenna Schaffner 6143A	504079
EMCO Horn Antenna 3115	502 175
EMCO Horn Antenna 3115	902 212
EMCO Horn Antenna 3116	503 279
Flann STD Gain Horn Antenna 20240-20	KWP02600
Flann STD Gain Horn Antenna 22240-20	KWP02601
Flann STD Gain Horn Antenna 24240-20	BX92414
Flann STD Gain Horn Antenna 26240-20	BX92416
Flann STD Gain Horn Antenna 27240-20	BX92417
Flann STD Gain Horn Antenna 29240-20	BX92419
Flann STD Gain Horn Antenna 30240-20	BX92420
Mixer FS-Z60	BX90566
Mixer FS-Z90	BX90567
Mixer FS-Z110	BX81427
Mizer FS-Z170	BX81428
Mixer FS-Z220	BX81429
µComp Nordic, Low Noise Amplifier	901 544
Miteq, Low Noise Amplifier	503 278
Temperature and humidity meter, Testo 615	503 498

EAB Measurement equipment

Calibrated at RISE before testing.

	S/N
Marki Microwave FLP2650 Low pass filter	1827
Qualwave QBF-26400-33000-60 Band pass filter	182704

Results

The diagrams represents worst case configurations for each frequency range.

Diagram	Symbolic name	Config mode	Pol	Frequency range	Measurement method	"Early exit?"
2.1a	TL_{100}	2	Hor	30-1000 MHz	Pre scan Max hold EIRP	Yes
2.1b	TL_{100}	2	Ver	30-1000 MHz	Pre scan Max hold EIRP	Yes
2.2a	$BL8_{100}$	1	Hor	30-1000 MHz	Pre scan Max hold EIRP	Yes
2.2b	$BL8_{100}$	1	Ver	30-1000 MHz	Pre scan Max hold EIRP	Yes
2.3a	TL_{100}	2	Hor	1-18 GHz	Pre scan Max hold EIRP	Yes
2.3b	TL_{100}	2	Ver	1-18 GHz	Pre scan Max hold EIRP	Yes
2.4a	$BL8_{100}$	1	Hor	1-18 GHz	Pre scan Max hold EIRP	Yes
2.4b	$BL8_{100}$	1	Ver	1-18 GHz	Pre scan Max hold EIRP	Yes
2.5a	TL_{100}	2	Hor	18-26.5 GHz	Pre scan Max hold EIRP	Yes
2.5b	TL_{100}	2	Ver	18-26.5 GHz	Pre scan Max hold EIRP	Yes
2.6a	$BL8_{100}$	1	Hor	18-26.5 GHz	Pre scan Max hold EIRP	Yes
2.6b	$BL8_{100}$	1	Ver	18-26.5 GHz	Pre scan Max hold EIRP	Yes
2.7a	TH_{100}	2	Hor	26.5-33 GHz	Pre scan Max hold EIRP	Yes
2.7b	TH_{100}	2	Ver	26.5-33 GHz	Pre scan Max hold EIRP	Yes
2.8a	$TH8_{100}$	1	Hor	26.5-33 GHz	Pre scan Max hold EIRP	Yes
2.8b	$TH8_{100}$	1	Ver	26.5-33 GHz	Pre scan Max hold EIRP	Yes
2.9a	BL_{50}	2	Hor	33-40 GHz 33-36.5 GHz 38.6-40 GHz	Pre scan Max hold EIRP	No Yes[2] Yes[1]
2.9b	BL_{50}	2	Ver	33-40 GHz 33-36.5 GHz 38.6-40 GHz	Pre scan Max hold EIRP	No Yes[2] Yes[1]
2.9c	BL_{50}	2	Hor	36-37 GHz	Pre scan Max average EIRP	Yes[1]
2.9d	BL_{50}	2	Ver	36-37 GHz	Pre scan Max average EIRP	Yes[1]
2.10a	$BL8_{100}$	1	Hor	33-40 GHz 38.6-40 GHz	Pre scan Max hold EIRP	No Yes[1]
2.10b	$BL8_{100}$	1	Ver	33-40 GHz 38.6-40 GHz	Pre scan Max hold EIRP	No Yes[1]
2.10c	$BL8_{100}$	1	Hor	36-37 GHz	Pre scan Max average EIRP	Yes[1]
2.10d	$BL8_{100}$	1	Ver	36-37 GHz	Pre scan Max average EIRP	Yes[1]
2.11a	Bim_{50}	2	Hor	33-40 GHz 38.6-40 GHz	Pre scan Max hold EIRP	No Yes[1]
2.11b	Bim_{50}	2	Ver	33-40 GHz 38.6-40 GHz	Pre scan Max hold EIRP	No Yes[1]
2.11c	Bim_{50}	2	Hor	36-37 GHz	Pre scan Max average EIRP	Yes[1]
2.11d	Bim_{50}	2	Ver	36-37 GHz	Pre scan Max average EIRP	Yes[1]
2.11e	Bim_{50}	2	Hor/ Ver	36.3-37 GHz	Pattern multiplication TRP	Compliant to TRP limit

[1)] Calculated conducted power based on antenna gain below limit
[2)] Compliant to TRP limit based on Lower EIRP compared to $BL4_{100}$ (Diagram 2.12)

Diagram	Symbolic name	Config mode	Pol	Frequency range	Measurement method	"Early exit?"
2.12a	$BL4_{100}$	2	Hor	33-40 GHz 38.6-40 GHz	Pre scan Max hold EIRP	No Yes[1]
2.12b	$BL4_{100}$	2	Ver	33-40 GHz 38.6-40 GHz	Pre scan Max hold EIRP	No Yes[1]
2.12c	$BL4_{100}$	2	Hor	36-37 GHz	Pre scan Max hold EIRP	Yes[1]
2.12d	$BL4_{100}$	2	Ver	36-37 GHz	Pre scan Max hold EIRP	Yes[1]
2.12e	$BL4_{100}$	2	Hor/ Ver	36.29-36.39 GHz	Two cut TRP	Compliant to TRP limit
2.13a	$TH4_{100}$	2	Hor	33-40 GHz	Pre scan Max hold EIRP	No
2.13b	$TH4_{100}$	2	Ver	33-40 GHz	Pre scan Max hold EIRP	No
2.13c	$TH4_{100}$	2	Hor/ Ver	35.67-35.77 GHz	Spherical grid Method TRP	Compliant to TRP limit
2.14a	TL_{50}	2	Hor	38.35-38.85 GHz	Pre scan Max average EIRP	Yes[1]
2.14b	TL_{50}	2	Ver	38.35-38.85 GHz	Pre scan Max average EIRP	Yes[1]
2.15a	BH_{50}	2	Hor	38.35-38.85 GHz	Pre scan Max average EIRP	Yes[1]
2.15b	BH_{50}	2	Ver	38.35-38.85 GHz	Pre scan Max average EIRP	Yes[1]
2.16a	TH_{50}	2	Hor	40-43 GHz	Pre scan Max hold EIRP	No
2.16b	TH_{50}	2	Ver	40-43 GHz	Pre scan Max hold EIRP	No
2.16c	TH_{50}	2	Hor	40-43 GHz	Pre scan Max average EIRP	Yes[1]
2.16d	TH_{50}	2	Ver	40-43 GHz	Pre scan Max average EIRP	Yes[1]
2.17a	$TH8_{100}$	1	Hor	40-43 GHz	Pre scan Max hold EIRP	No
2.17b	$TH8_{100}$	1	Ver	40-43 GHz	Pre scan Max hold EIRP	No
2.17c	$TH8_{100}$	1	Hor	40-43 GHz	Pre scan Max average EIRP	Yes[1]
2.17d	$TH8_{100}$	1	Ver	40-43 GHz	Pre scan Max average EIRP	Yes[1]
2.18a	Tim_{50}	2	Hor	40-43 GHz 40.4-43 GHz	Pre scan Max hold EIRP	No Yes[3]
2.18b	Tim_{50}	2	Ver	40-43 GHz 40.4-43 GHz	Pre scan Max hold EIRP	No Yes[3]
2.18c	Tim_{50}	2	Hor	40-43 GHz	Pre scan Max average EIRP	No
2.18d	Tim_{50}	2	Ver	40-43 GHz	Pre scan Max average EIRP	No
2.18e	Tim_{50}	2	Hor/ Ver	40-40.4 GHz	Two cut TRP	Compliant to TRP limit
2.19a	BL_{50}	2	Hor	40-43 GHz	Pre scan Max hold EIRP	No
2.19b	BL_{50}	2	Ver	40-43 GHz	Pre scan Max hold EIRP	No
2.19c	BL_{50}	2	Hor/ Ver	40.05-40.15 GHz	Spherical grid Method TRP	Compliant to TRP limit

[1)] Calculated conducted power based on antenna gain below limit
[2)] Compliant to TRP limit based on Lower EIRP compared to $BL4_{100}$ (Diagram 2.12)

Diagram	Symbolic name	Config mode	Pol	Frequency range	Measurement method	"Early exit?"
2.20a	BL_{50}	2	Hor	43-60 GHz	Pre scan Max hold EIRP	Yes
2.20b	BL_{50}	2	Ver	43-60 GHz	Pre scan Max hold EIRP	Yes
2.20c	BL_{50}	2	Hor/ Ver	43.1-43.25 GHz	Two cut TRP	Compliant to TRP limit
2.21a	$BL8_{100}$	1	Hor	43-60 GHz	Pre scan Max hold EIRP	Yes
2.21b	$BL8_{100}$	1	Ver	43-60 GHz	Pre scan Max hold EIRP	Yes
2.22a	TL_{100}	2	Hor	60-75 GHz	Pre scan Max hold EIRP	Yes
2.22b	TL_{100}	2	Ver	60-75 GHz	Pre scan Max hold EIRP	Yes
2.23a	$BL8_{100}$	1	Hor	60-75 GHz	Pre scan Max hold EIRP	Yes
2.23b	$BL8_{100}$	1	Ver	60-75 GHz	Pre scan Max hold EIRP	Yes
2.24a	BL_{100}	2	Hor	75-90 GHz	Pre scan Max hold EIRP	Yes
2.24b	BL_{100}	2	Ver	75-90 GHz	Pre scan Max hold EIRP	Yes
2.25a	$BL8_{100}$	1	Hor	75-90 GHz	Pre scan Max hold EIRP	Yes
2.25b	$BL8_{100}$	1	Ver	75-90 GHz	Pre scan Max hold EIRP	Yes
2.26a	BL_{100}	2	Hor	90-110 GHz	Pre scan Max hold EIRP	Yes
2.26b	BL_{100}	2	Ver	90-110 GHz	Pre scan Max hold EIRP	Yes
2.27a	$BL8_{100}$	1	Hor	90-110 GHz	Pre scan Max hold EIRP	Yes
2.27b	$BL8_{100}$	1	Ver	90-110 GHz	Pre scan Max hold EIRP	Yes
2.28a	BL_{100}	2	Hor	110-130 GHz	Pre scan Max hold EIRP	Yes
2.28b	BL_{100}	2	Ver	110-130 GHz	Pre scan Max hold EIRP	Yes
2.29a	$BL8_{100}$	1	Hor	110-130 GHz	Pre scan Max hold EIRP	Yes
2.29b	$BL8_{100}$	1	Ver	110-130 GHz	Pre scan Max hold EIRP	Yes
2.30a	BL_{100}	2	Hor	130-150 GHz	Pre scan Max hold EIRP	Yes
2.30b	BL_{100}	2	Ver	130-150 GHz	Pre scan Max hold EIRP	Yes
2.31a	$BL8_{100}$	1	Hor	130-150 GHz	Pre scan Max hold EIRP	Yes
2.31b	$BL8_{100}$	1	Ver	130-150 GHz	Pre scan Max hold EIRP	Yes
2.32a	BL_{100}	2	Hor	150-170 GHz	Pre scan Max hold EIRP	Yes
2.32b	BL_{100}	2	Ver	150-170 GHz	Pre scan Max hold EIRP	Yes
2.33a	$BL8_{100}$	1	Hor	150-170 GHz	Pre scan Max hold EIRP	Yes
2.33b	$BL8_{100}$	1	Ver	150-170 GHz	Pre scan Max hold EIRP	Yes
2.34a	BL_{100}	2	Hor	170-185 GHz	Pre scan Max hold EIRP	Yes
2.34b	BL_{100}	2	Ver	170-185 GHz	Pre scan Max hold EIRP	Yes
2.35a	$BL8_{100}$	1	Hor	170-185 GHz	Pre scan Max hold EIRP	Yes
2.35b	$BL8_{100}$	1	Ver	170-185 GHz	Pre scan Max hold EIRP	Yes
2.36a	BL_{100}	2	Hor	185-200 GHz	Pre scan Max hold EIRP	Yes
2.36b	BL_{100}	2	Ver	185-200 GHz	Pre scan Max hold EIRP	Yes
2.37a	$BL8_{100}$	1	Hor	185-200 GHz	Pre scan Max hold EIRP	Yes
2.37b	$BL8_{100}$	1	Ver	185-200 GHz	Pre scan Max hold EIRP	Yes

Measurement uncertainty: 30 – 1000 MHz 3.1 dB
1 – 18 GHz, 3.0 dB
18 – 40 GHz, 3.1 dB
40 – 60 GHz, 2.27 dB
60 – 75 GHz, 2.70 dB
75 – 110 GHz, 4.24 dB
110 – 150 GHz, 3.61 dB
150 – 170 GHz, 4.67 dB
170 – 200 GHz, 5.10 dB

Limits

CFR 47 §30.203 Emission limits.

(a) The conductive power or the total radiated power of any emission outside a licensee's frequency block shall be −13 dBm/MHz or lower. However, in the bands immediately outside and adjacent to the licensee's frequency block, having a bandwidth equal to 10 percent of the channel bandwidth, the conductive power or the total radiated power of any emission shall be −5 dBm/MHz or lower.

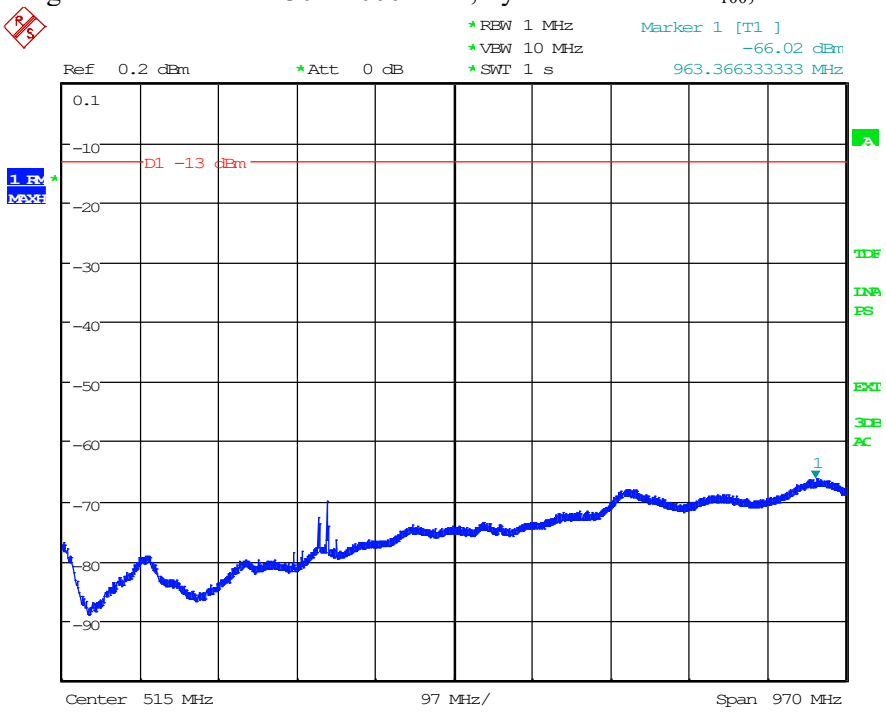
(b)(1) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater.

(2) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the licensee's frequency block edges as the design permits.

(3) The measurements of emission power can be expressed in peak or average values.

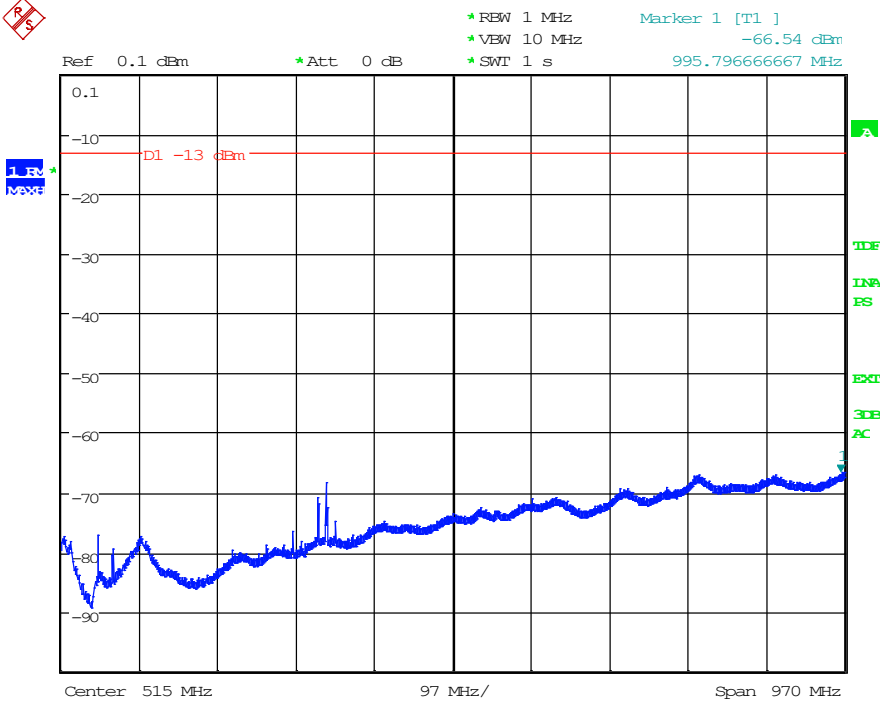
Complies?	Yes

Diagram 2.1a: Pre scan 30 – 1000 MHz, Symbolic name: TL_{100}, EIRP Horizontal polarization



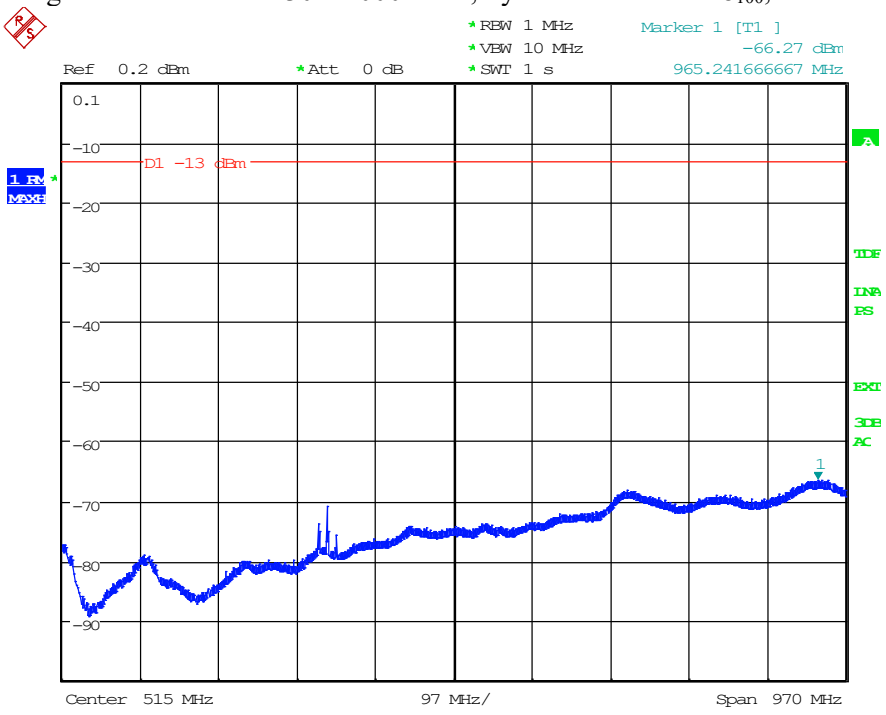
Date: 28.JAN.2021 11:17:55

Diagram 2.1b: Pre scan 30 – 1000 MHz, Symbolic name: TL_{100}, EIRP Vertical polarization



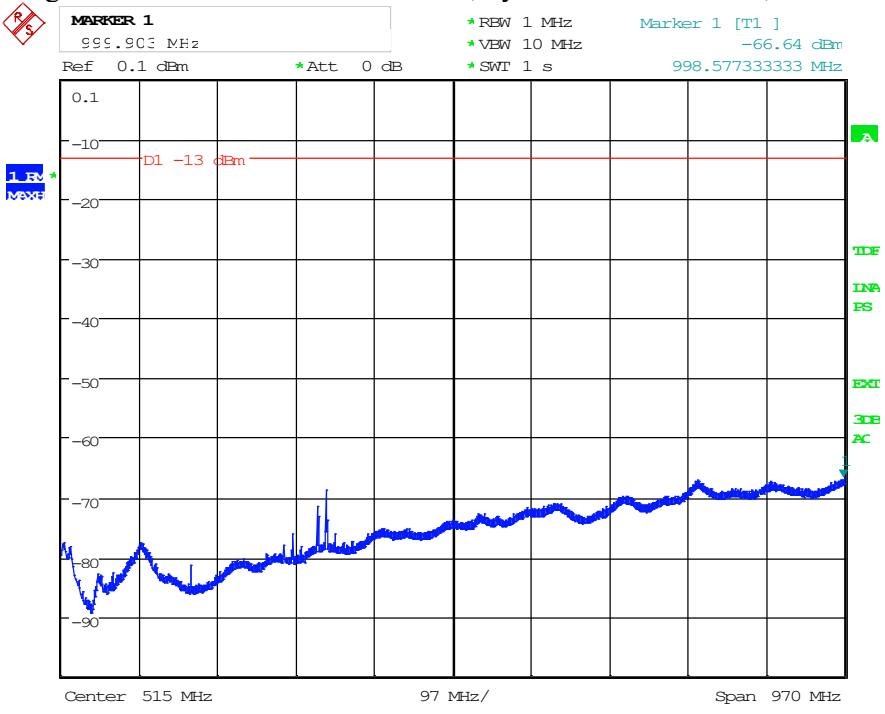
Date: 28.JAN.2021 11:22:15

Diagram 2.2a: Pre scan 30 – 1000 MHz, Symbolic name: $BL8_{100}$, EIRP Horizontal polarization



Date: 28.JAN.2021 11:07:39

Diagram 2.2b: Pre scan 30 – 1000 MHz, Symbolic name: $BL8_{100}$, EIRP Vertical polarization



Date: 28.JAN.2021 11:03:29

Diagram 2.3a: Pre scan 1 – 18 GHz, Symbolic name: TL_{100}, EIRP Horizontal polarization

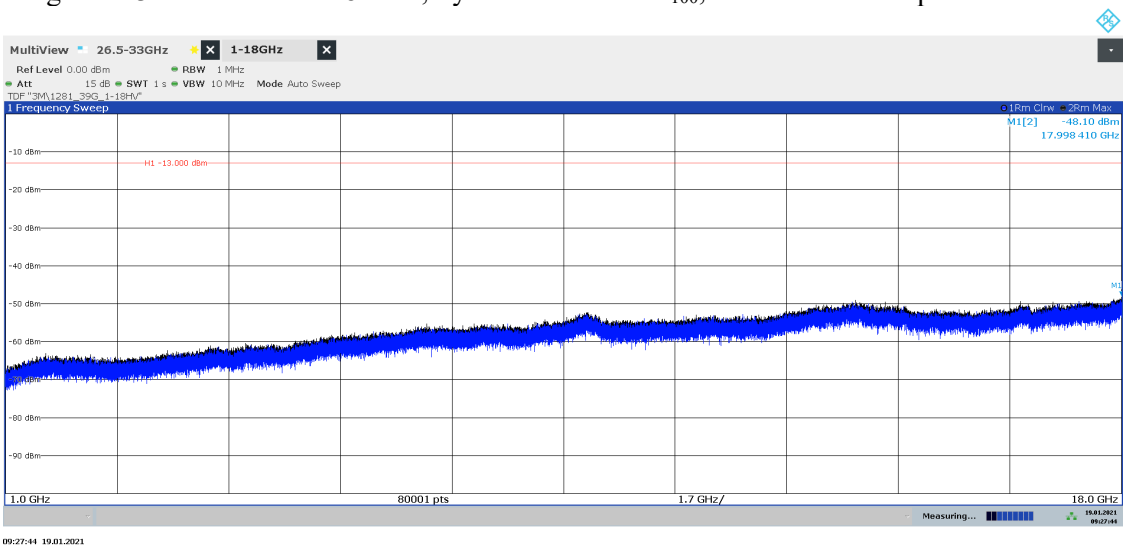


Diagram 2.3b: Pre scan 1 – 18 GHz, Symbolic name: TL_{100}, EIRP Vertical polarization

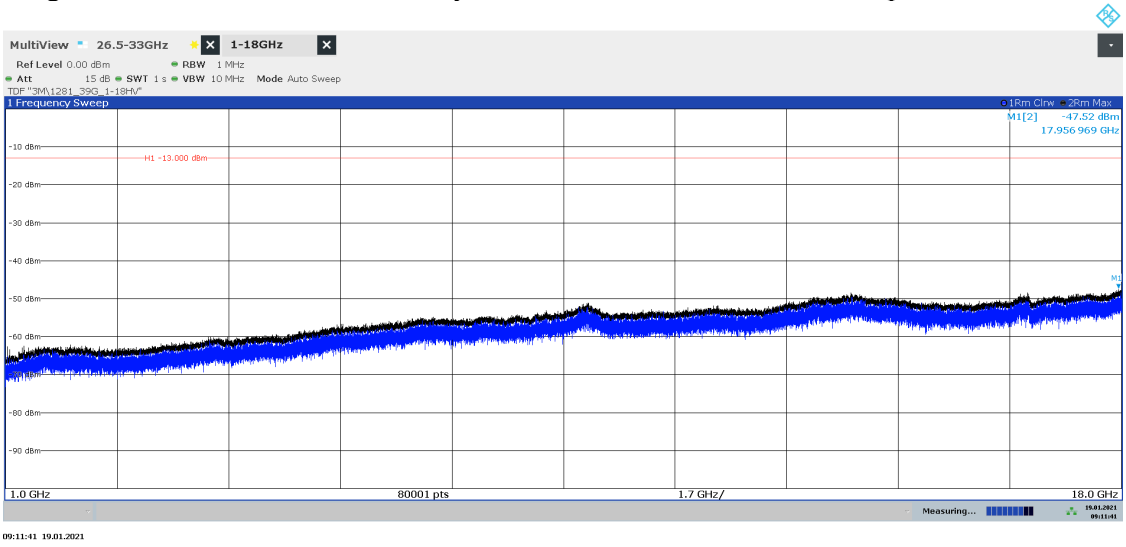


Diagram 2.4a: Pre scan 1 – 18 GHz, Symbolic name: $BL8_{100}$, EIRP Horizontal polarization

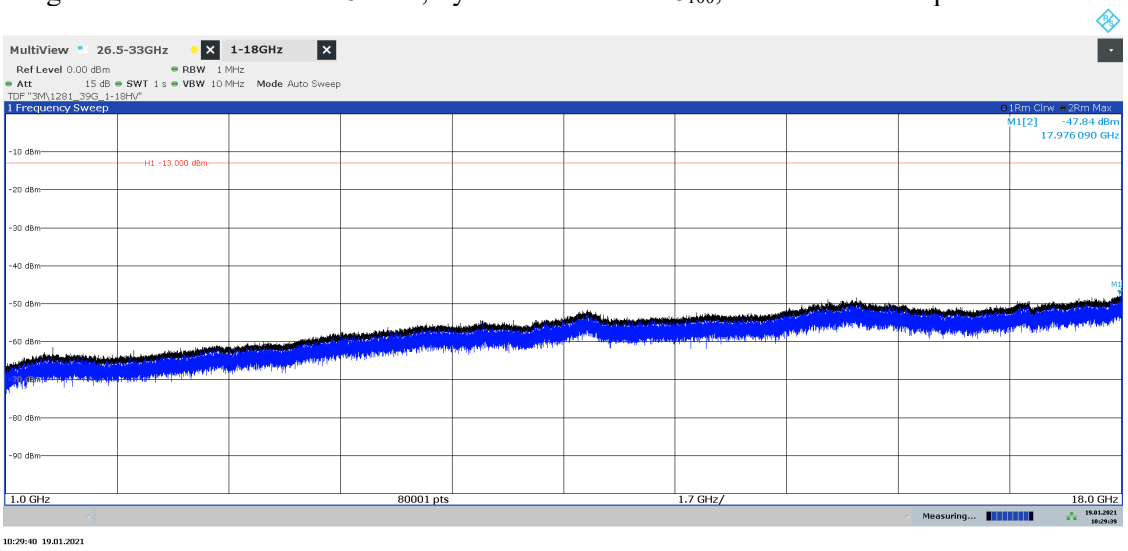


Diagram 2.4b: Pre scan 1 – 18 GHz, Symbolic name: $BL8_{100}$, EIRP Vertical polarization

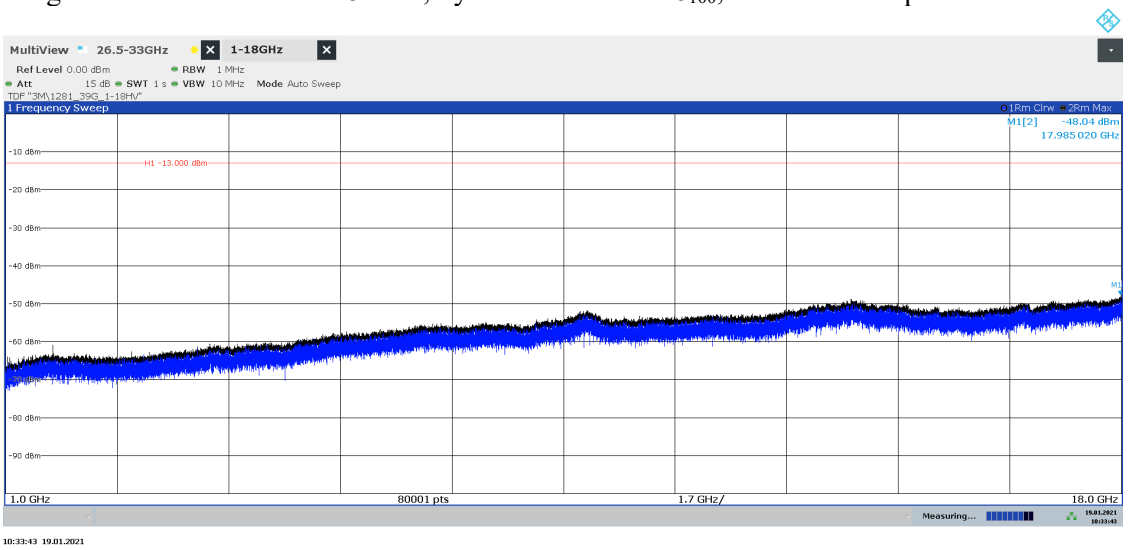


Diagram 2.5a: Pre scan 18 – 26.5 GHz, Symbolic name: TL_{100}, EIRP Horizontal polarization

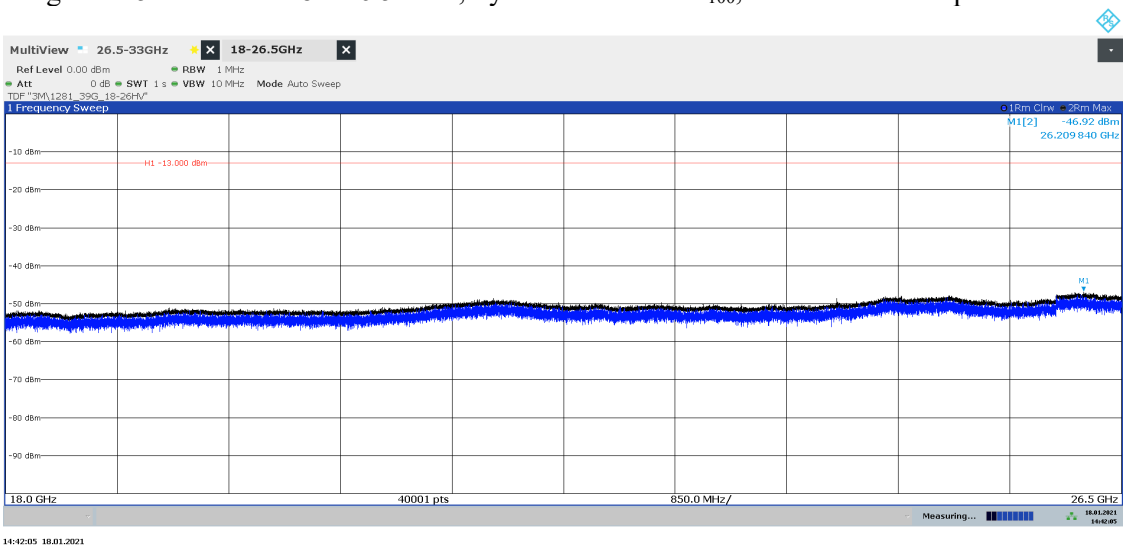


Diagram 2.5b: Pre scan 18 – 26.5 GHz, Symbolic name: TL_{100}, EIRP Vertical polarization

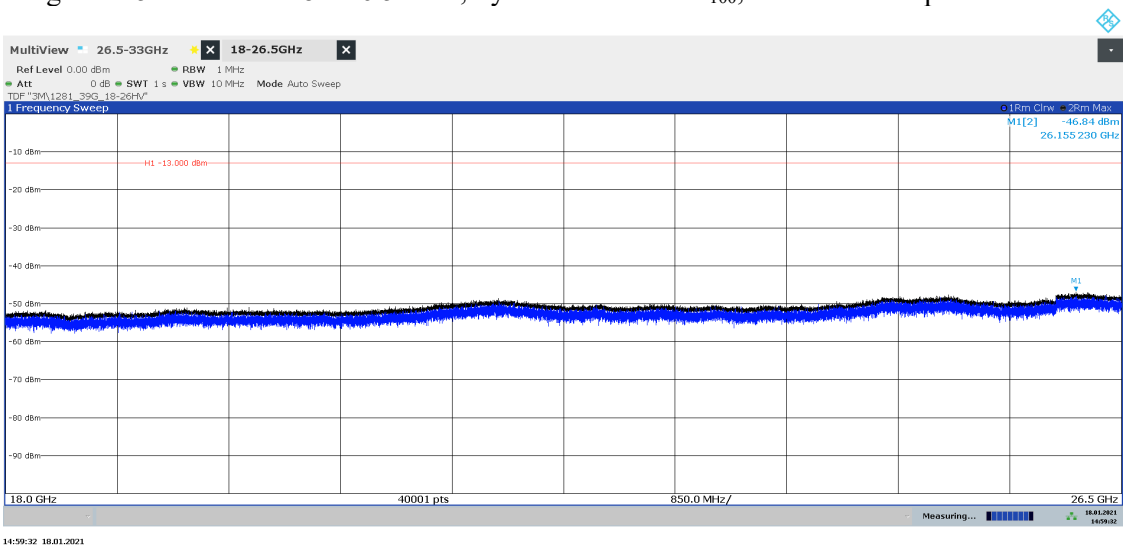


Diagram 2.6a: Pre scan 18 – 26.5 GHz, Symbolic name: $BL8_{100}$, EIRP Horizontal polarization

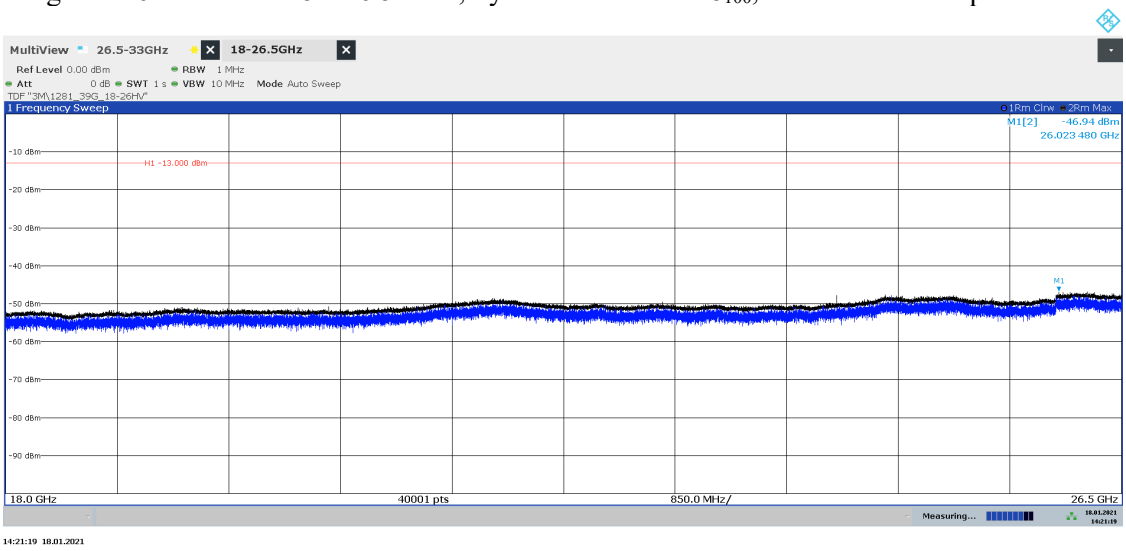


Diagram 2.6b: Pre scan 18 – 26.5 GHz, Symbolic name: $BL8_{100}$, EIRP Vertical polarization

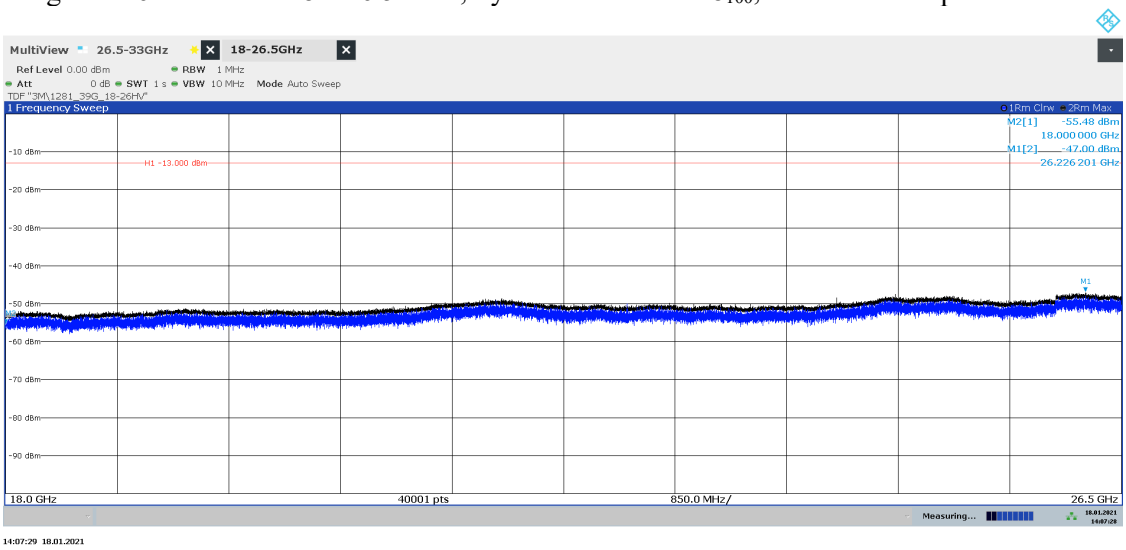


Diagram 2.7a: Pre scan 26.5 – 33 GHz, Symbolic name TH_{100}, EIRP Horizontal polarization

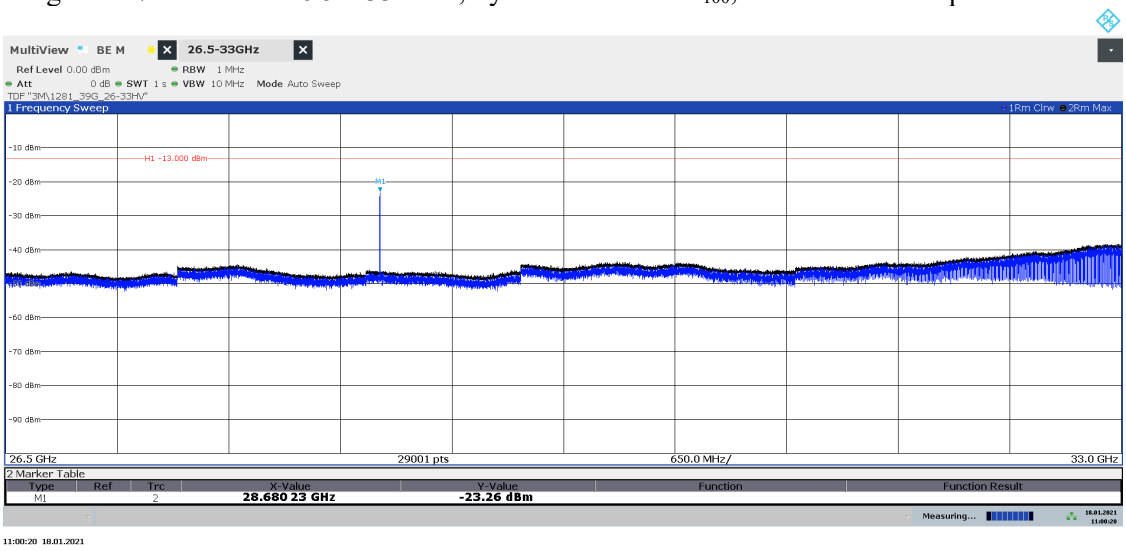


Diagram 2.7b: Pre scan 26.5 – 33 GHz, Symbolic name $TH1_{100}$, EIRP Vertical polarization

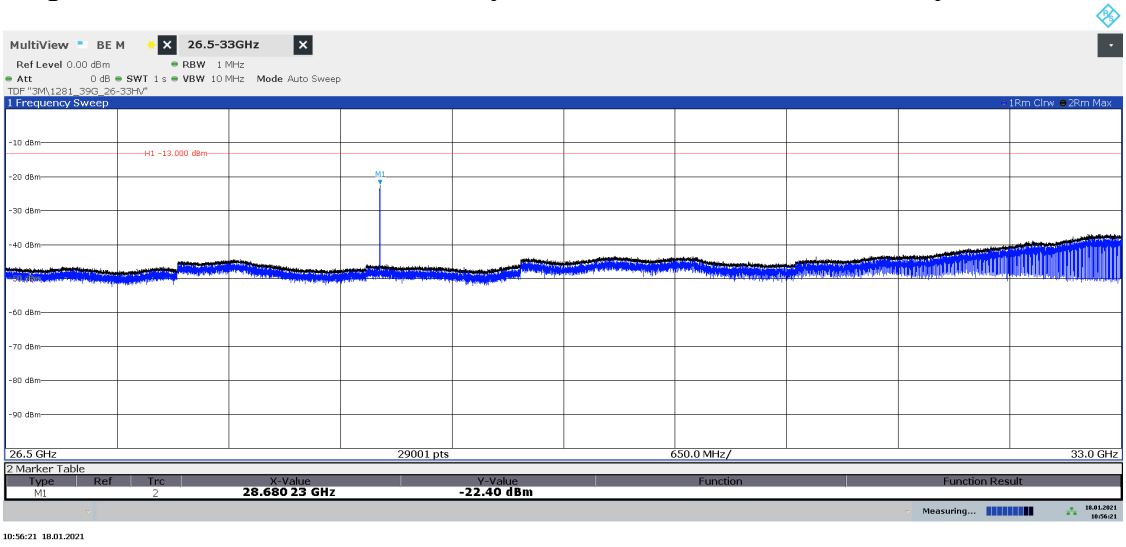


Diagram 2.8a: Pre scan 26.5 – 33 GHz, Symbolic name $TH8_{100}$, EIRP Horizontal polarization

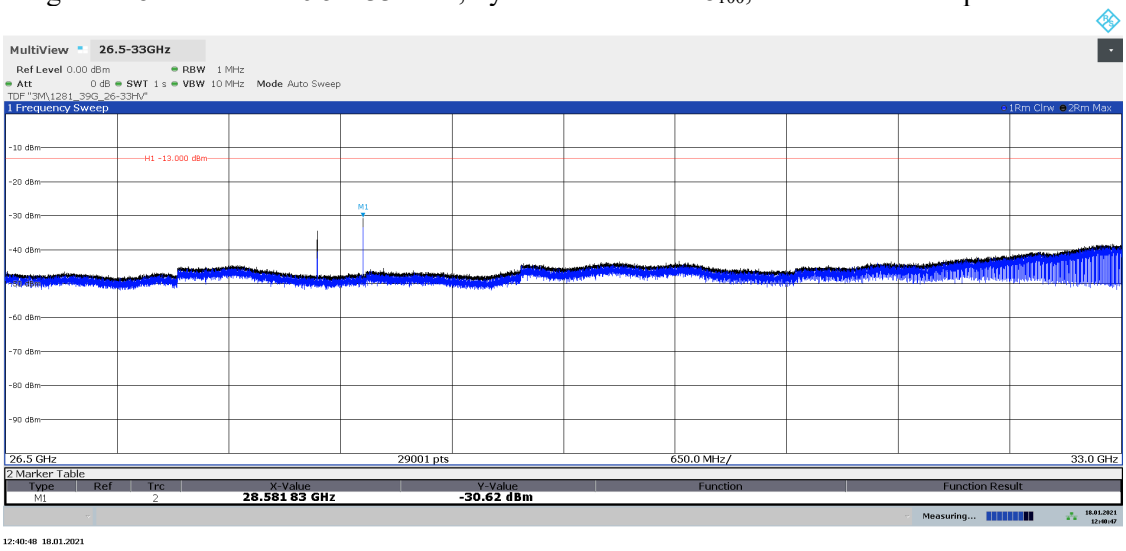


Diagram 2.8a: Pre scan 26.5 – 33 GHz, Symbolic name $TH8_{100}$, EIRP Vertical polarization

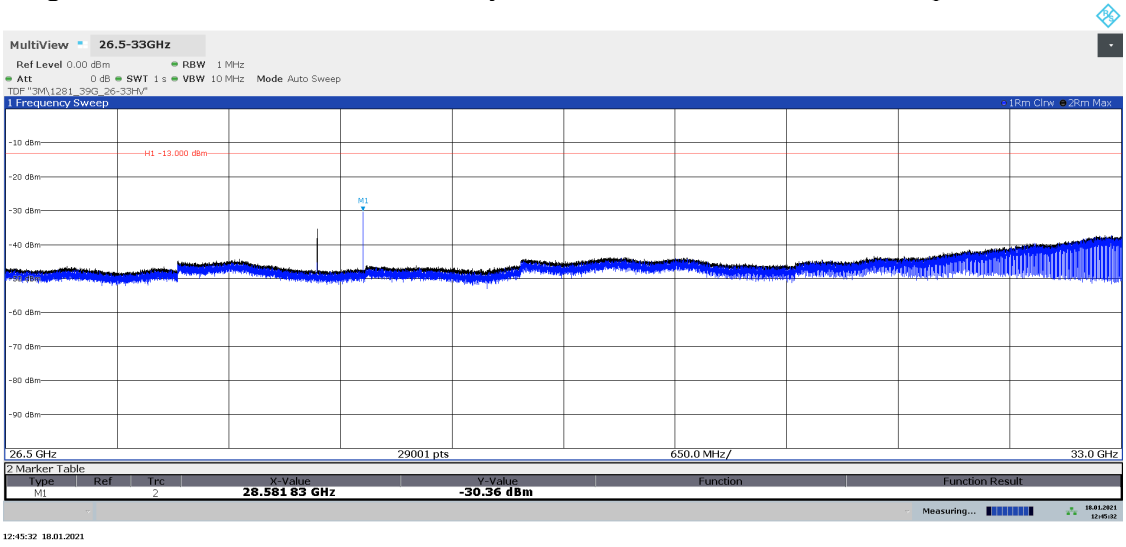


Diagram 2.9a: 33 – 40 GHz, QPSK, BL_{50}, EIRP Horizontal polarization

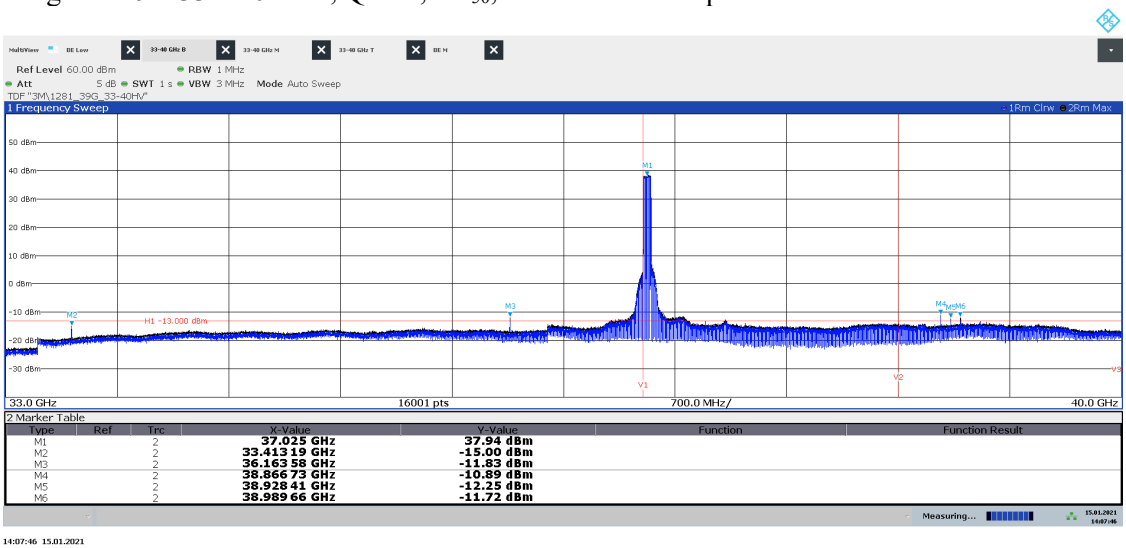
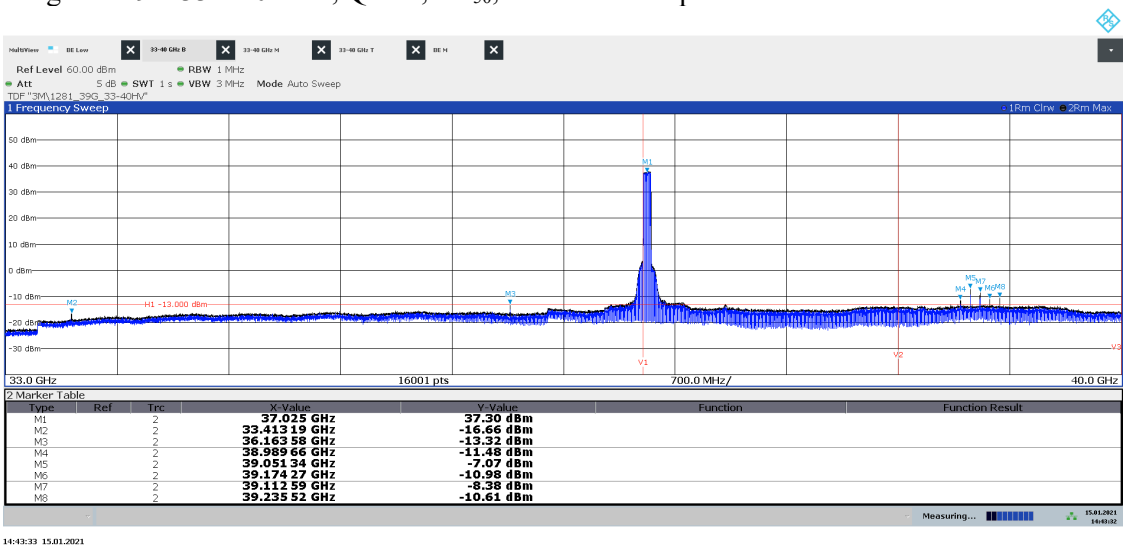


Diagram 2.9b: 33 – 40 GHz, QPSK, BL_{50}, EIRP Vertical polarization



Freq [GHz]	Power Hor/ Ver [dBm]	Antenna Gain Hor/ Ver [dBi]	Total conducted power/BW (Limit -13 dBm) [dBm]/ Verdict
38.866	-10.89/	29.02/29.05	-39.91/ Pass
38.928	-12.25/	29.02/29.05	-41.27/ Pass
38.990	-11.72/ -11.48	29.02/29.05	-37.62/ Pass
39.051	/ -7.07	29.02/29.05	-36.12/ Pass
39.174	/ -10.98	29.02/29.05	-40.03/ Pass
39.113	/ -8.38	29.02/29.05	-37.43/ Pass
39.236	/ -10.61	29.02/29.05	-39.66/ Pass

Diagram 2.9c: 36 – 37 GHz, QPSK, BL_{50}, EIRP Horizontal polarization

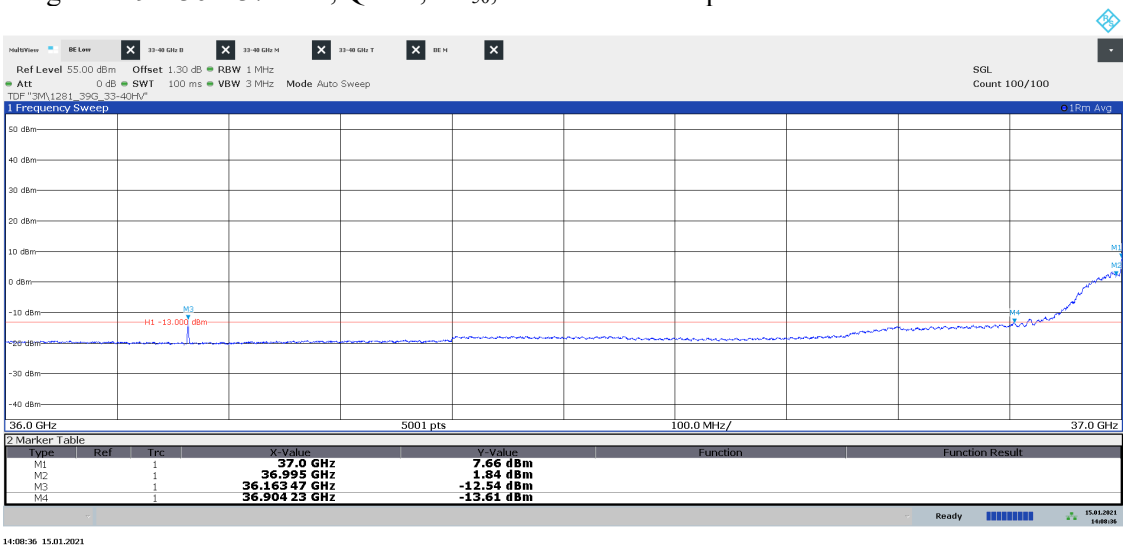
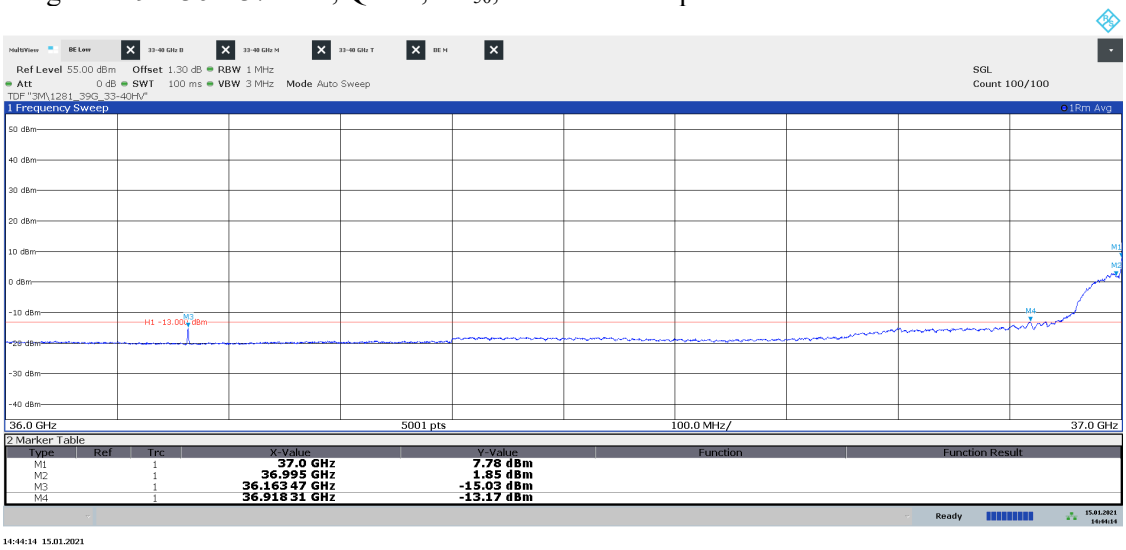


Diagram 2.9d: 36 – 37 GHz, QPSK, BL_{50}, EIRP Vertical polarization



Power EIRP for 37.0 GHz Hor/ Ver [dBm]	Power EIRP for 36.995 GHz Hor/ Ver [dBm]	Antenna Gain Hor/ Ver [dBi]	Total conducted power/BW for 37.0 GHz (Limit -5 dBm) [dBm]/ Verdict	Total conducted power/BW for 36.995 GHz (Limit -13 dBm) [dBm]/ Verdict
7.66/ 7.78	1.84/ 1.85	28.68/ 28.61	-17.91/ Pass	-24.18/ Pass

Diagram 2.10a: 33 – 40 GHz, QPSK, $BL8_{100}$, EIRP Horizontal polarization

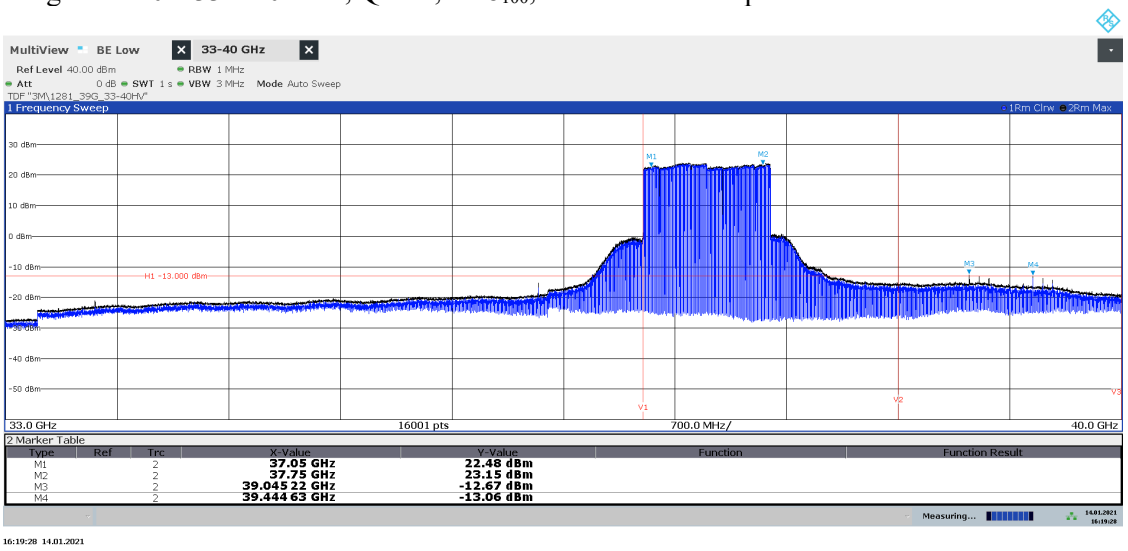
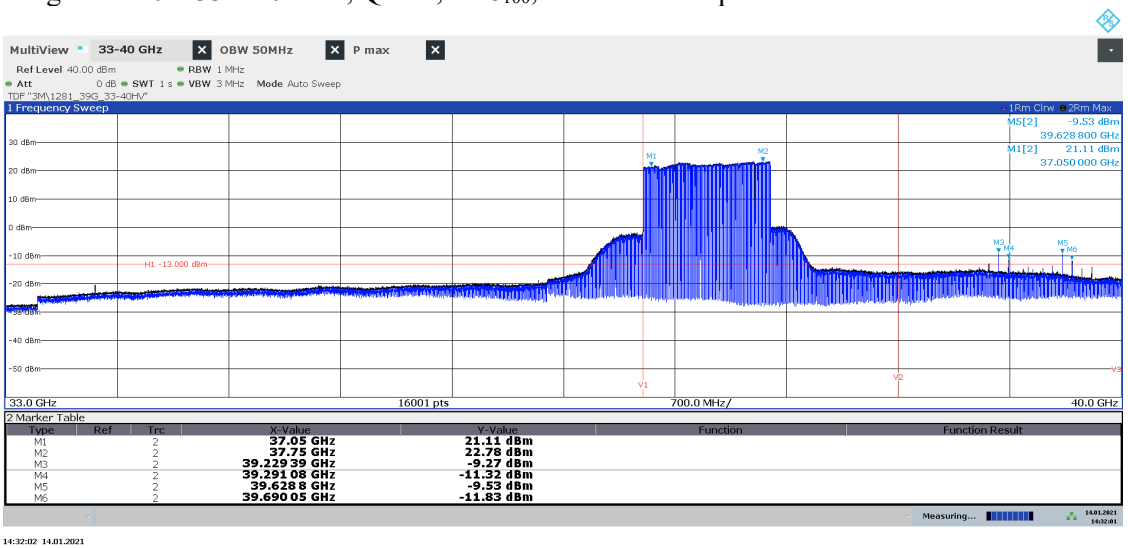


Diagram 2.10b: 33 – 40 GHz, QPSK, $BL8_{100}$, EIRP Vertical polarization



Freq [GHz]	Power Hor/ Ver [dBm]	Antenna Gain Hor/ Ver [dBi]	Total conducted power/BW (Limit -13 dBm) [dBm]/ Verdict
39.045	-12.67/	26.26/ 26.71	-38.93/ Pass
39.445	-13.06/	26.26/ 26.71	-39.32/ Pass
39.229	/ -9.27	26.26/ 26.71	-35.95/ Pass
39.291	/ -11.32	26.26/ 26.71	-38.03/ Pass
39.629	/ -9.53	26.40/26.52	-36.05/ Pass
39.690	/ -11.83	26.40/26.52	-38.35/ Pass

Diagram 2.10c: 36 – 37 GHz, QPSK, $BL8_{100}$, EIRP Horizontal polarization

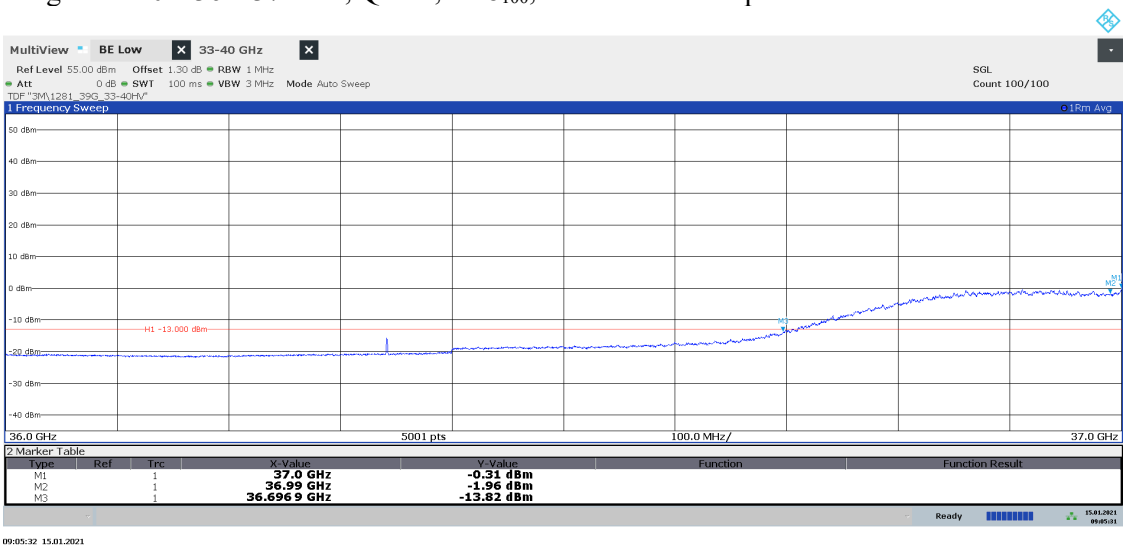
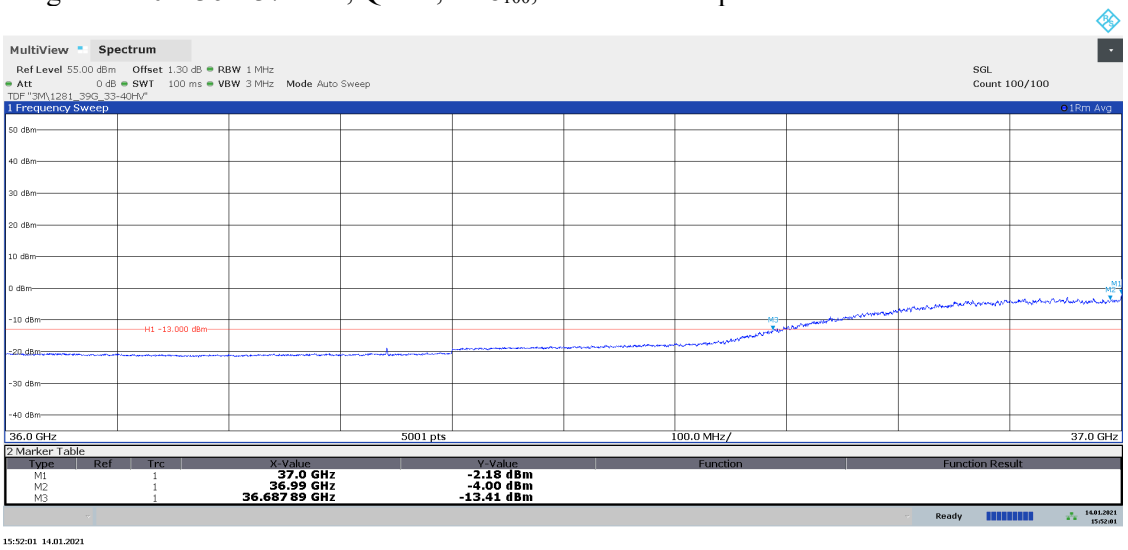


Diagram 2.10d: 36 – 37 GHz, QPSK, $BL8_{100}$, EIRP Vertical polarization



Power EIRP for 37.0 GHz Hor/ Ver [dBm]	Power EIRP for 36.990GHz Hor/ Ver [dBm]	Antenna Gain Hor/ Ver [dBi]	Total conducted power/BW for 37.0 GHz (Limit -5 dBm) [dBm]/ Verdict	Total conducted power/BW for 36.990 GHz (Limit -13 dBm) [dBm]/ Verdict
-0.31/ -2.18	-1.96/ -4.00	25.98/ 26.15	-24.18/ Pass	-25.90/ Pass

Diagram 2.11a: 33 – 40 GHz, QPSK, Bim_{50}, EIRP Horizontal polarization
See diagram 2.11e for TRP result

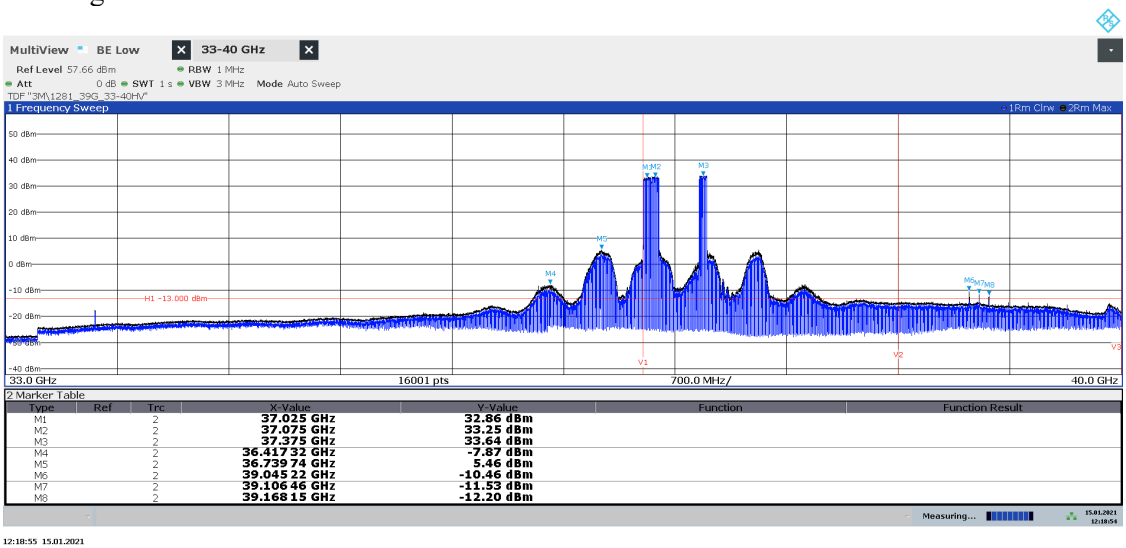
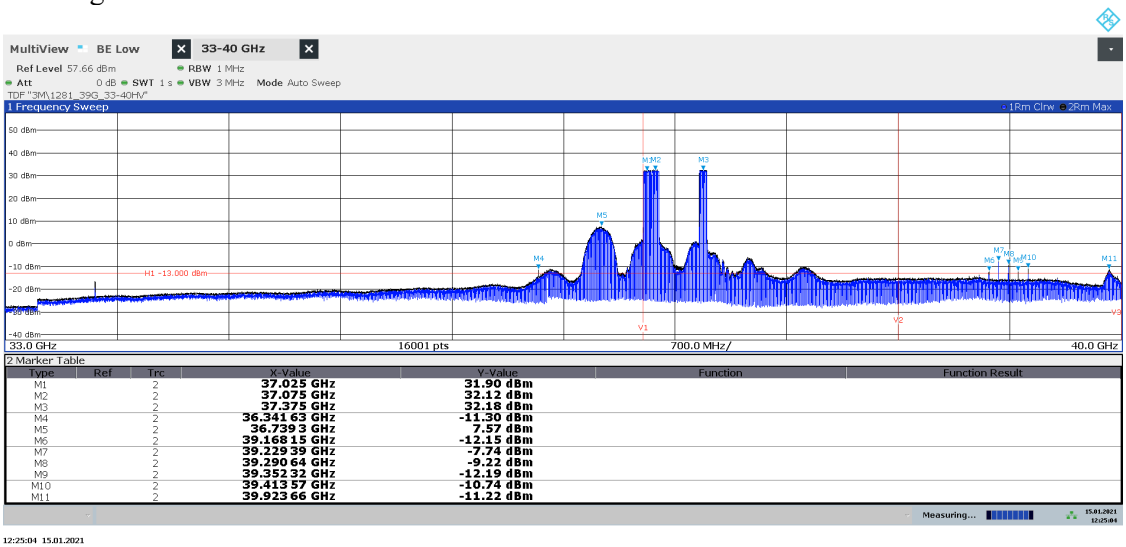
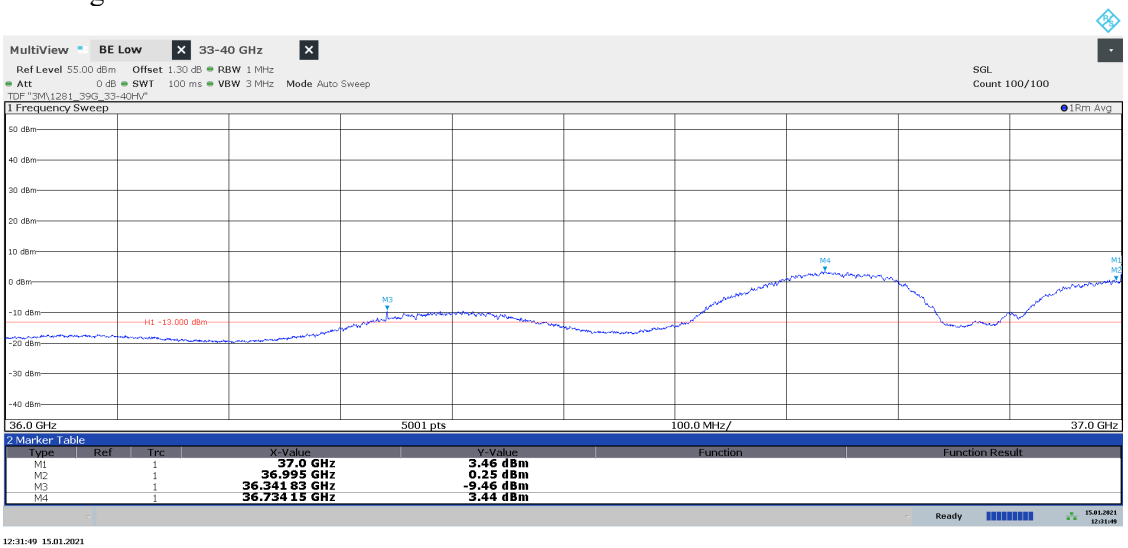


Diagram 2.11b: 33 – 40 GHz, QPSK, Bim_{50}, EIRP Vertical polarization
See diagram 2.11e for TRP result



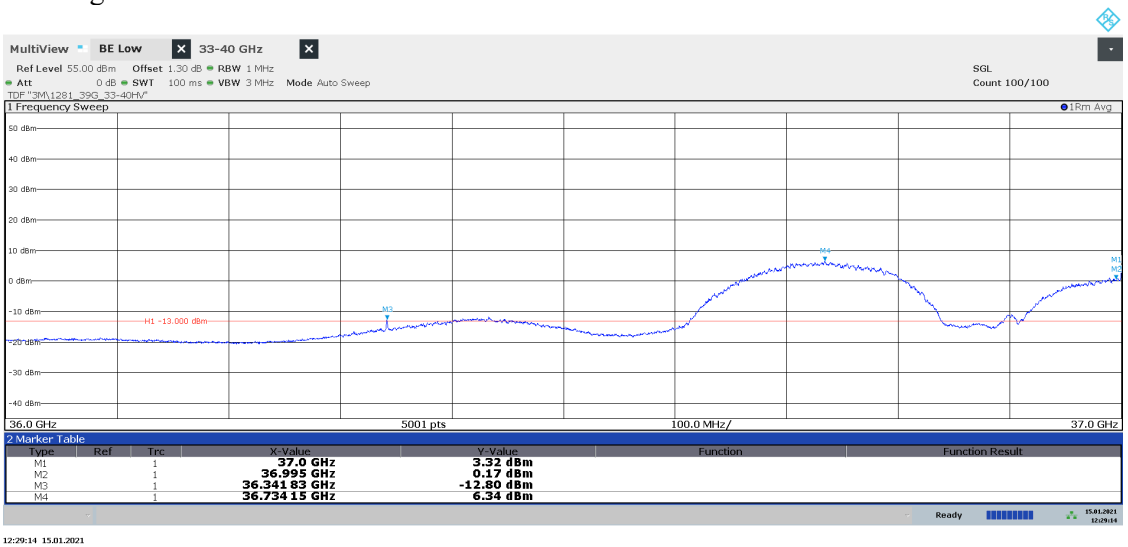
Freq [GHz]	Power Hor/ Ver [dBm]	Antenna Gain Hor/ Ver [dBi]	Total conducted power/BW (Limit -13 dBm) [dBm]/ Verdict
39.045	-10.46/	29.02/29.05	-39.48/ Pass
39.106	-11.53/	29.02/29.05	-40.55/ Pass
39.168	-12.20/ -12.15	29.02/29.05	-38.20/ Pass
39.229	/ -7.74	29.02/29.05	-36.79/ Pass
39.291	/ -9.22	29.02/29.05	-38.27/ Pass
39.352	/ -12.19	29.01/29.00	-41.19/ Pass
39.414	/ -10.74	29.01/29.00	-39.74/ Pass
39.924	/ -11.22	29.01/29.00	-40.22/ Pass

Diagram 2.11c: 36 – 37 GHz, QPSK, Bim_{50}, EIRP Horizontal polarization
See diagram 2.11e for TRP result



12:31:49 15.01.2021

Diagram 2.11d: 36 – 37 GHz, QPSK, Bim_{50}, EIRP Vertical polarization
See diagram 2.11e for TRP result



12:29:14 15.01.2021

Power EIRP for 37.00 GHz Hor/ Ver [dBm]	Power EIRP for 36.995 GHz Hor/ Ver [dBm]	Antenna Gain Hor/ Ver [dBi]	Total conducted power/BW for 37.00 GHz (Limit -5 dBm) [dBm]/ Verdict	Total conducted power/BW for 36.995 GHz (Limit -13 dBm) [dBm]/ Verdict
3.46/ 3.32	0.25/ 0.17	28.68/ 28.61	-22.24/ Pass	-25.42/ Pass

Diagram 2.11e: 36.3 – 37 GHz, QPSK, Bim_{50}, Pattern multiplication TRP

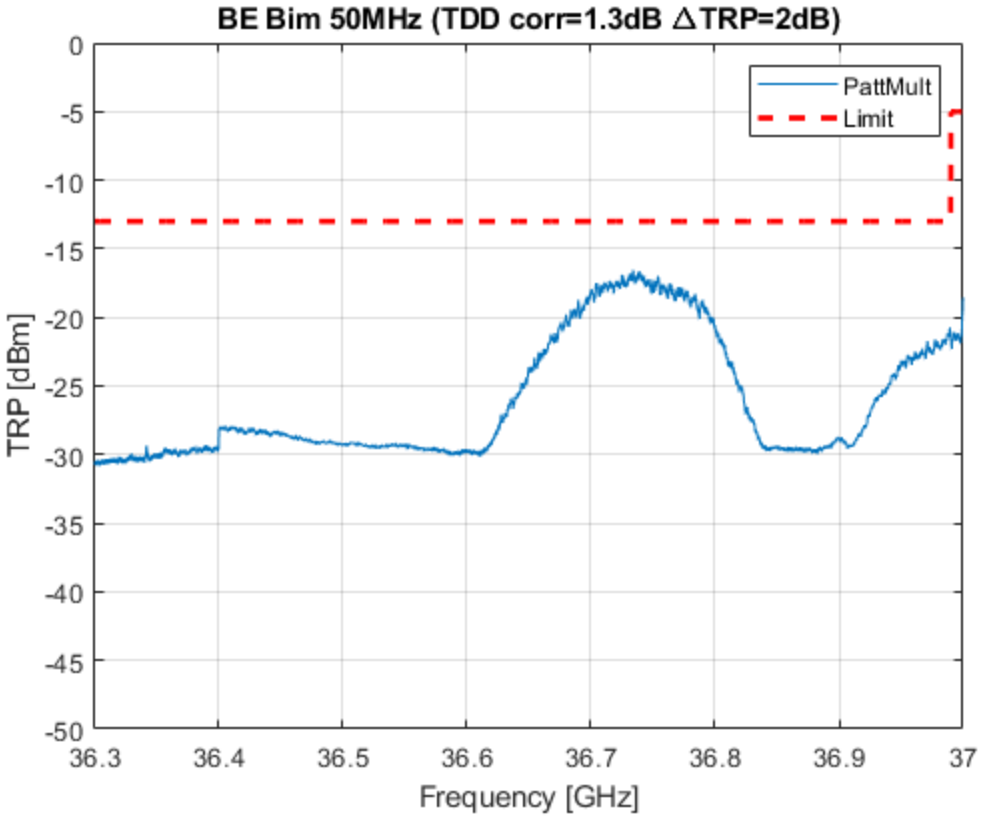


Diagram 2.12a: 33 – 40 GHz, QPSK, $BL4_{100}$, EIRP Horizontal polarization
See diagram 2.12e for TRP result

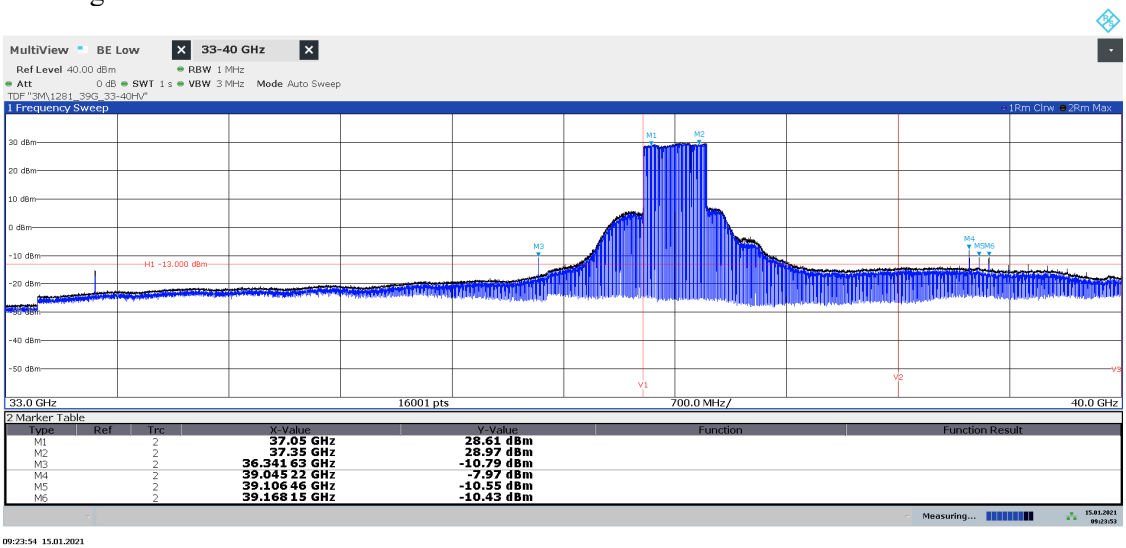
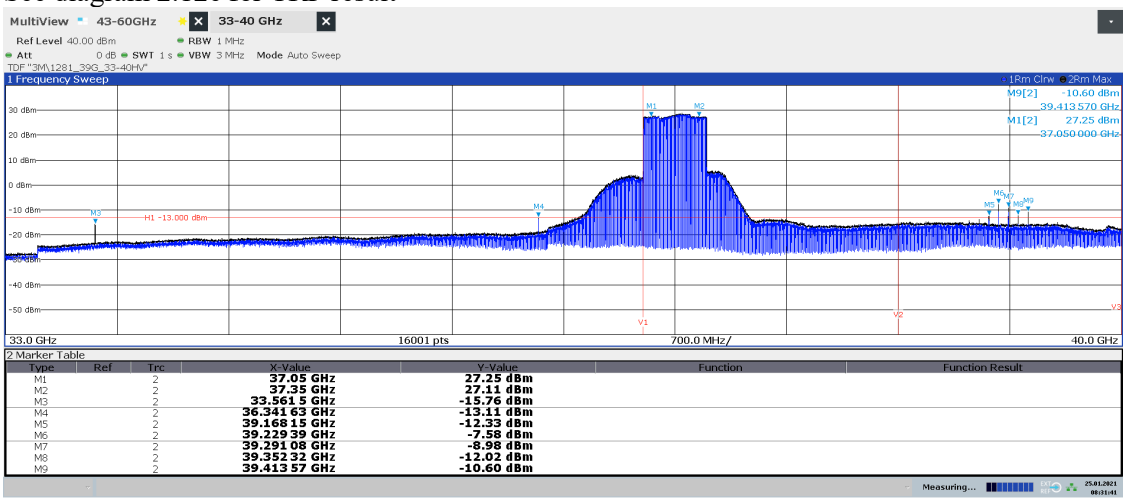


Diagram 2.12b: 33 – 40 GHz, QPSK, $BL4_{100}$, EIRP Vertical polarization
See diagram 2.12e for TRP result



Freq [GHz]	Power Hor/ Ver [dBm]	Antenna Gain Hor/ Ver [dBi]	Total conducted power/BW (Limit -13 dBm) [dBm]/ Verdict
39.045	-7.97/	29.02/29.05	-36.99/ Pass
39.106	-10.55/	29.02/29.05	-39.57/ Pass
39.168	-10.43/ -12.33	29.02/29.05	-37.30/ Pass
39.229	/ -7.58	29.02/29.05	-36.63/ Pass
39.291	/ -8.95	29.02/29.05	-38.00/ Pass
39.352	/ -12.02	29.01/29.00	-41.02/ Pass
39.414	/ -10.60	29.01/29.00	-39.06/ Pass

Diagram 2.12c: 37.4 – 38.4 GHz, QPSK, $BL4_{100}$, EIRP Horizontal polarization
See diagram 2.12e for TRP result

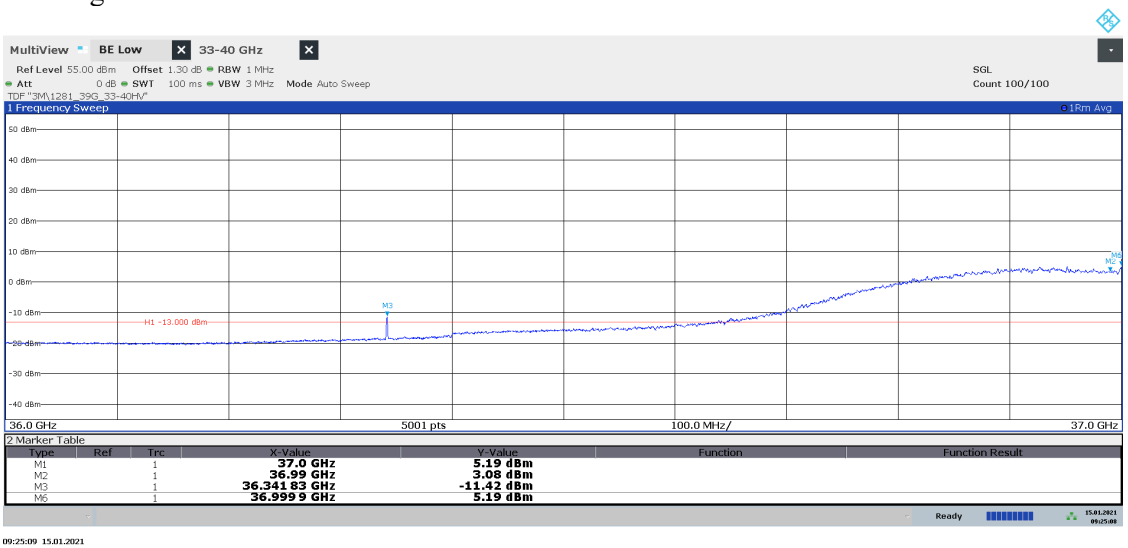
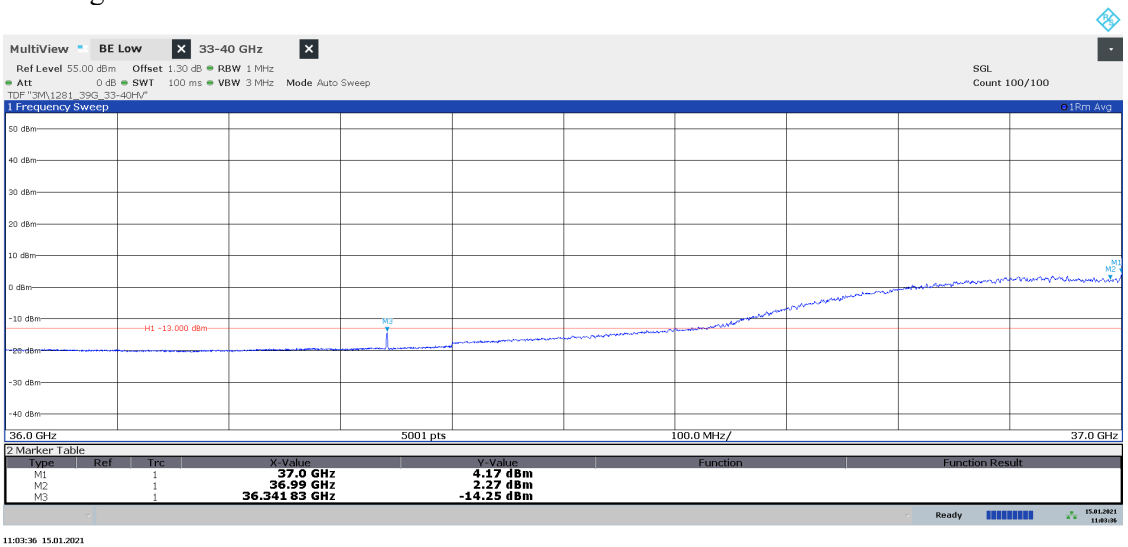


Diagram 2.12d: 37.4 – 38.4 GHz, QPSK, $BL4_{100}$, EIRP Vertical polarization
See diagram 2.12e for TRP result



Power EIRP for 37.0 GHz Hor/ Ver [dBm]	Power EIRP for 36.990GHz Hor/ Ver [dBm]	Antenna Gain Hor/ Ver [dBi]	Total conducted power/BW for 37.0 GHz (Limit -5 dBm) [dBm]/ Verdict	Total conducted power/BW for 36.990 GHz (Limit -13 dBm) [dBm]/ Verdict
5.19/ 4.17	3.08/ 2.27	28.68/ 28.61	-20.93/ Pass	-22.94/ Pass

Diagram 2.12e: 36.29 – 36.39 GHz, QPSK, $BL4_{100}$,Two cut TRP

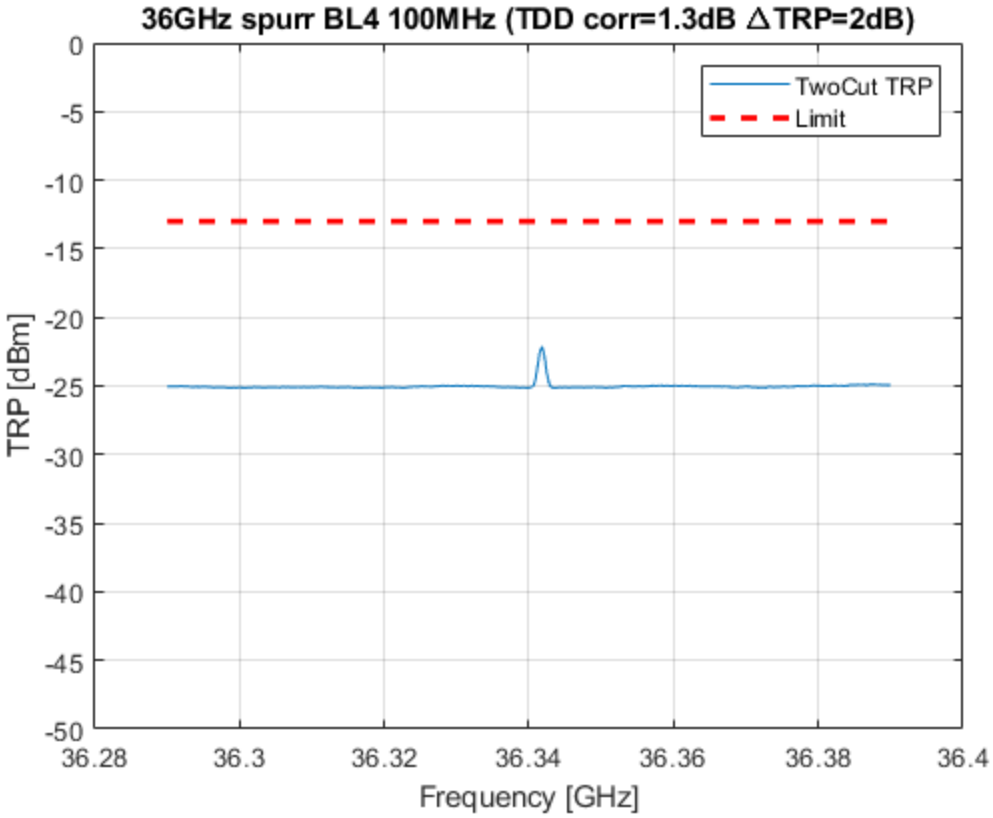


Diagram 2.13a: 33 – 40 GHz, QPSK, $TH4_{100}$, EIRP Horizontal polarization
See diagram 2.13c for TRP result

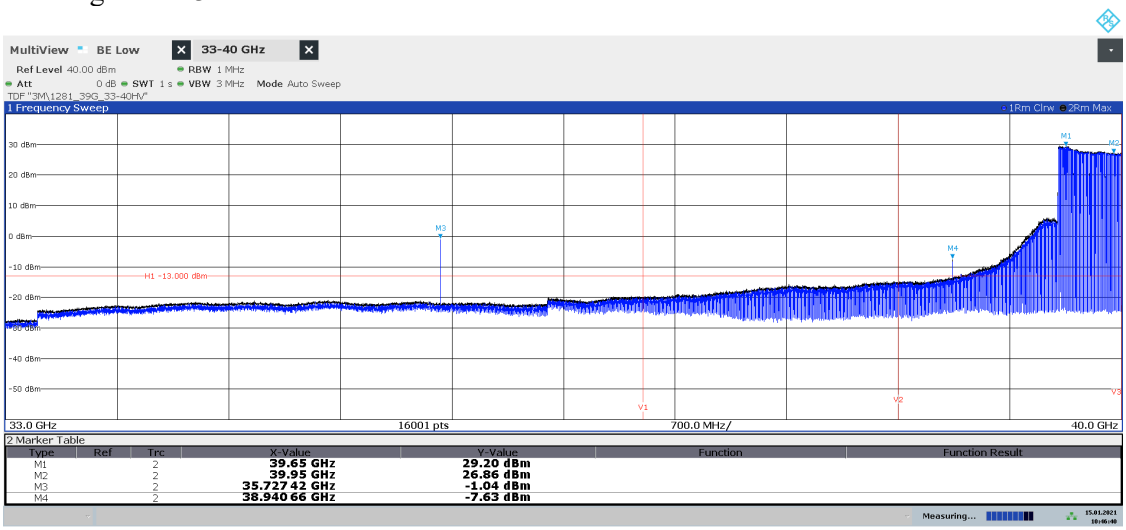


Diagram 2.13b: 33 – 40 GHz, QPSK, $TH4_{100}$, EIRP Vertical polarization
See diagram 2.13c for TRP result

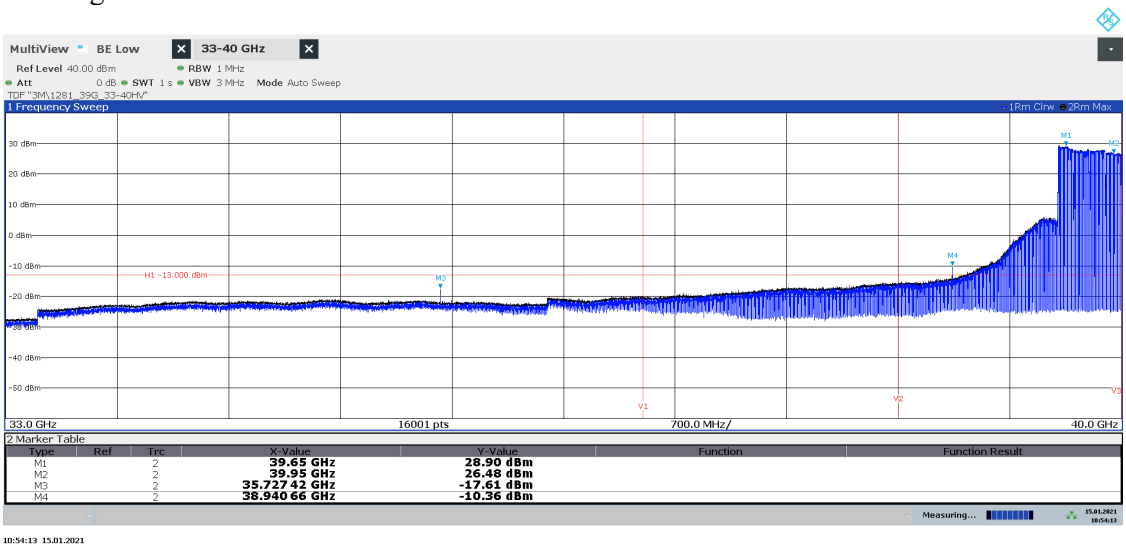


Diagram 2.13c: 35.67 – 35.77 GHz, QPSK, $TH4_{100}$, Spherical grid

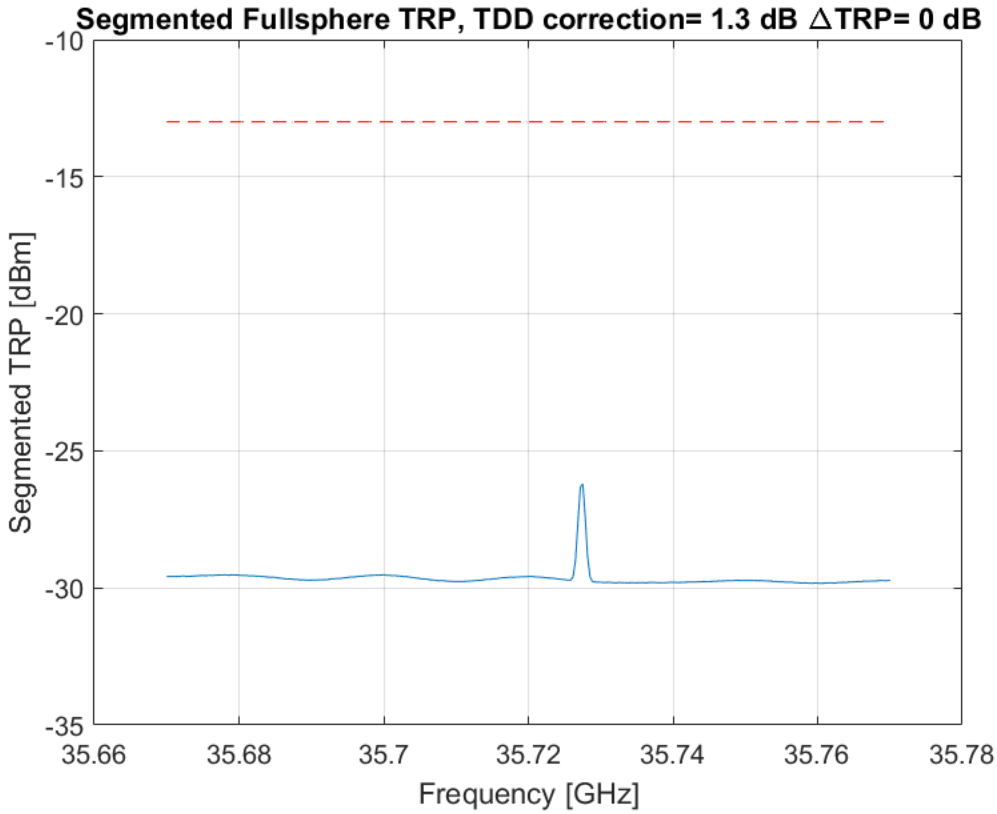


Diagram 2.14a: 38.35 – 38.85 GHz, QPSK, TL_{50}, EIRP Horizontal polarization

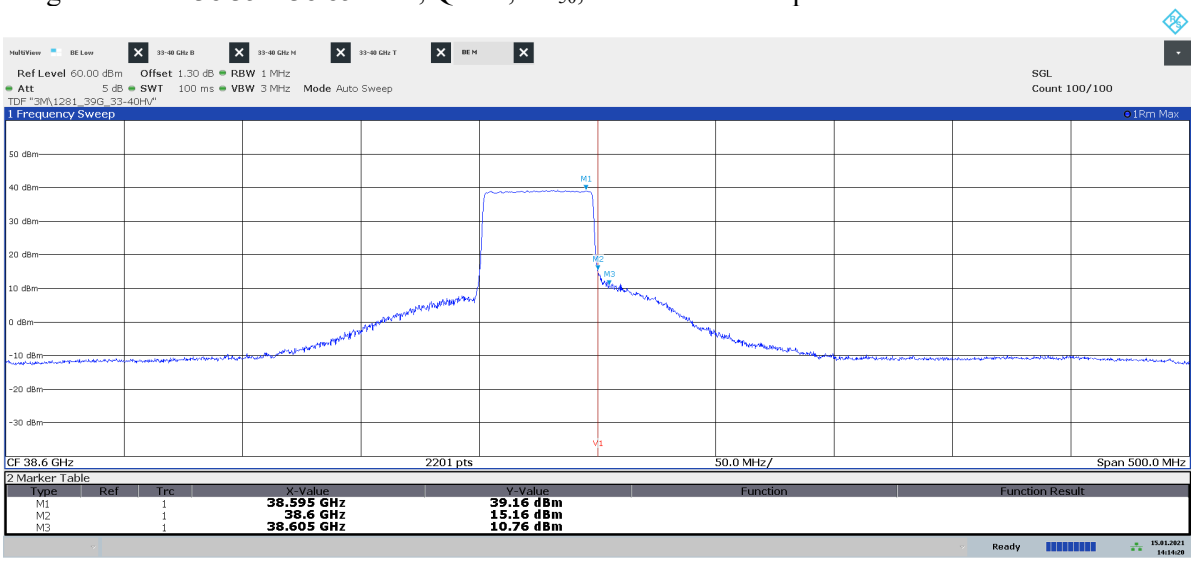
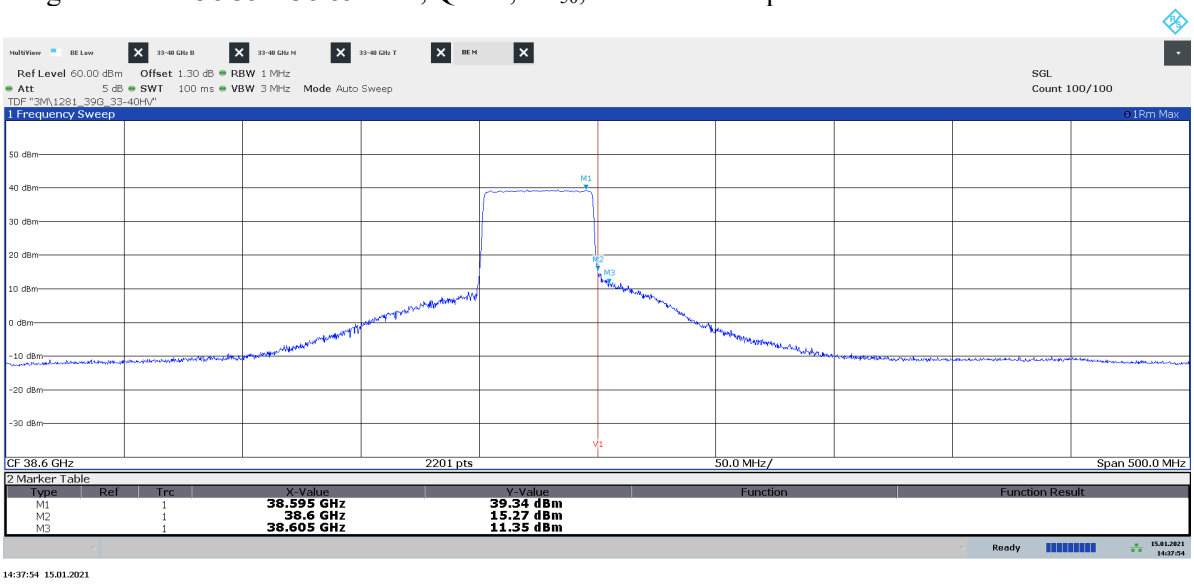


Diagram 2.14b: 38.35 – 38.85 GHz, QPSK, TL_{50}, EIRP Vertical polarization



Power EIRP for 38.6 GHz Hor/ Ver [dBm]	Power EIRP for 38.605 GHz Hor/ Ver [dBm]	Antenna Gain Hor/ Ver [dBi]	Total conducted power/BW for 38.6 GHz (Limit -5 dBm) [dBm]/ Verdict	Total conducted power/BW for 38.605 GHz (Limit -13 dBm) [dBm]/ Verdict
15.16/ 15.27	10.76/ 11.35	29.02/ 29.05	-10.81/ Pass	-14.96/ Pass

Diagram 2.15a: 38.35 – 38.85 GHz, QPSK, BH_{50}, EIRP Horizontal polarization

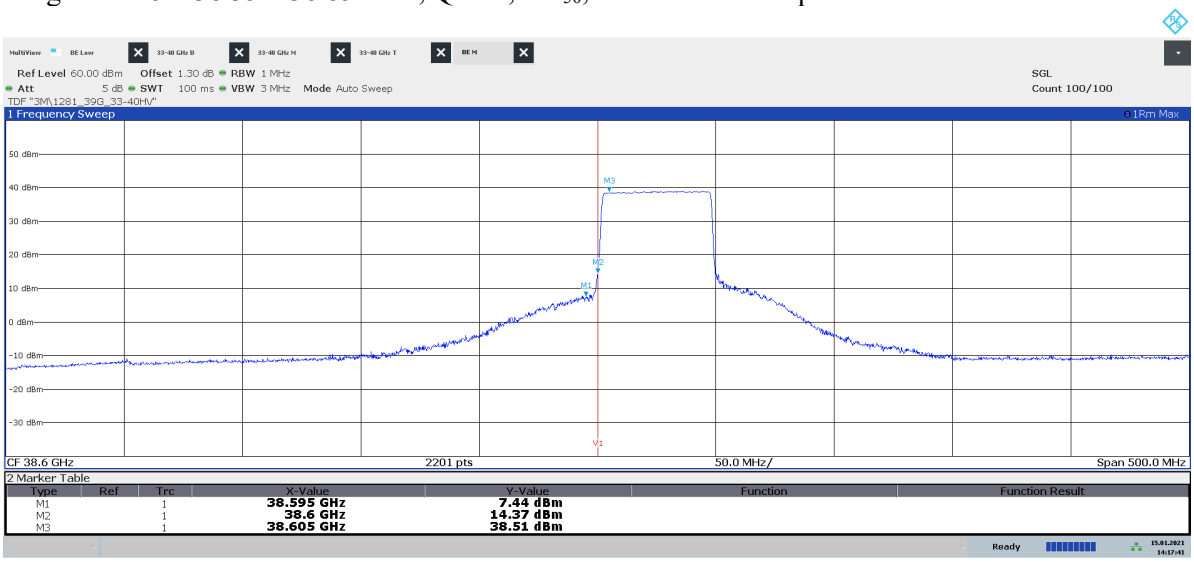
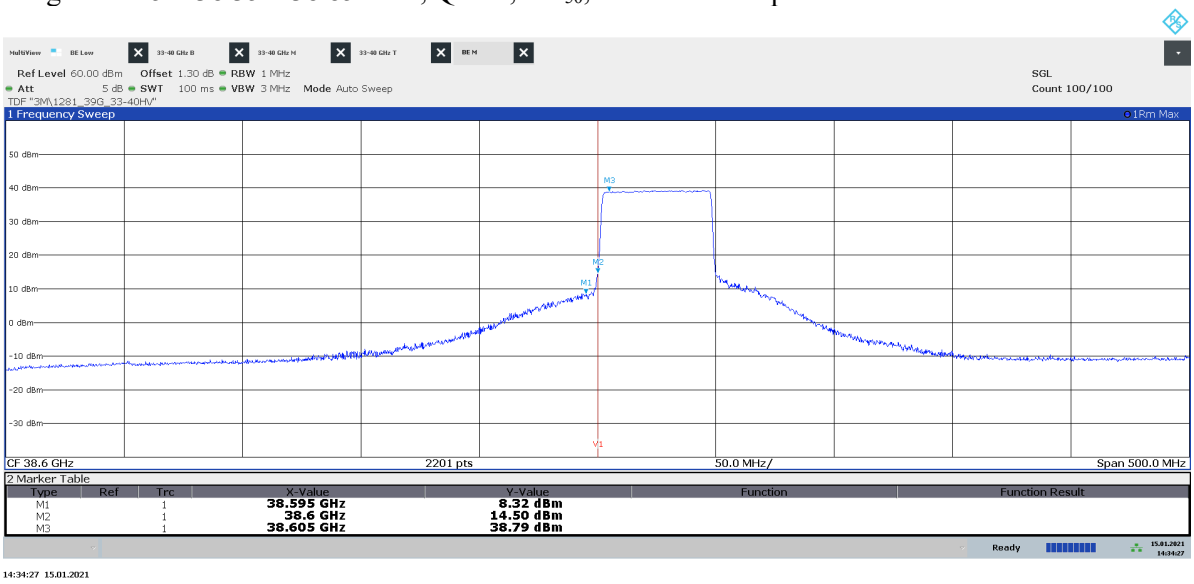


Diagram 2.15b: 38.35 – 38.85 GHz, QPSK, BH_{50}, EIRP Vertical polarization



Power EIRP for 38.6 GHz Hor/ Ver [dBm]	Power EIRP for 38.595 GHz Hor/ Ver [dBm]	Antenna Gain Hor/ Ver [dBi]	Total conducted power/BW for 38.6 GHz (Limit -5 dBm) [dBm]/ Verdict	Total conducted power/BW for 38.595 GHz (Limit -13 dBm) [dBm]/ Verdict
14.37/ 14.50	7.44/ 8.32	29.02/ 29.05	-11.59/ Pass	-18.12/ Pass

Diagram 2.16a: 40 – 43 GHz, QPSK, TH_{50}, EIRP Horizontal polarization

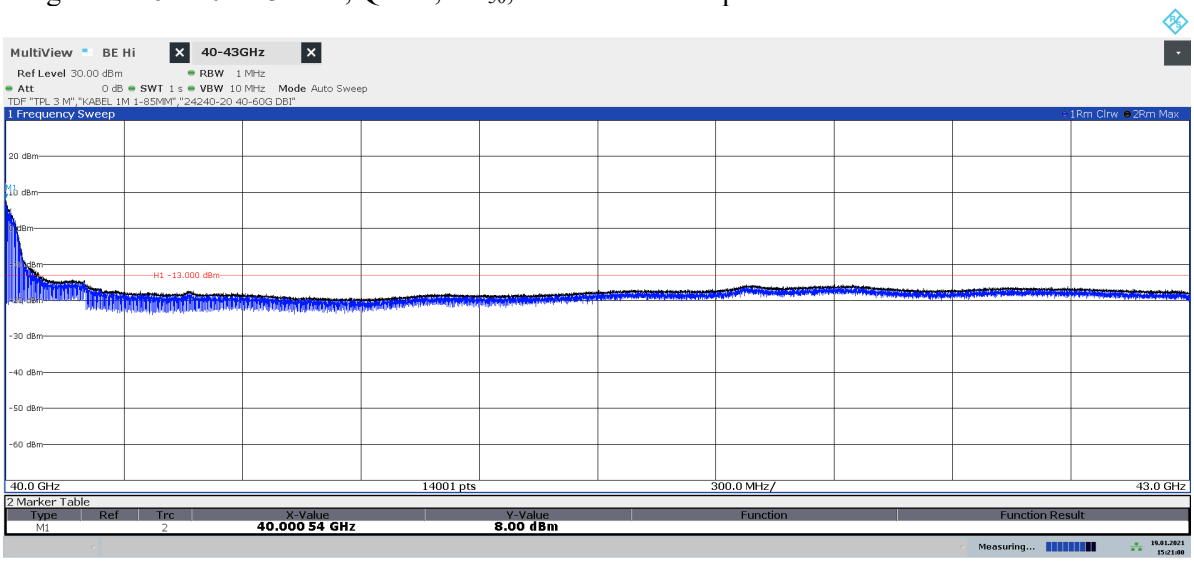


Diagram 2.16b: 40 – 43 GHz, QPSK, TH_{50}, EIRP Vertical polarization

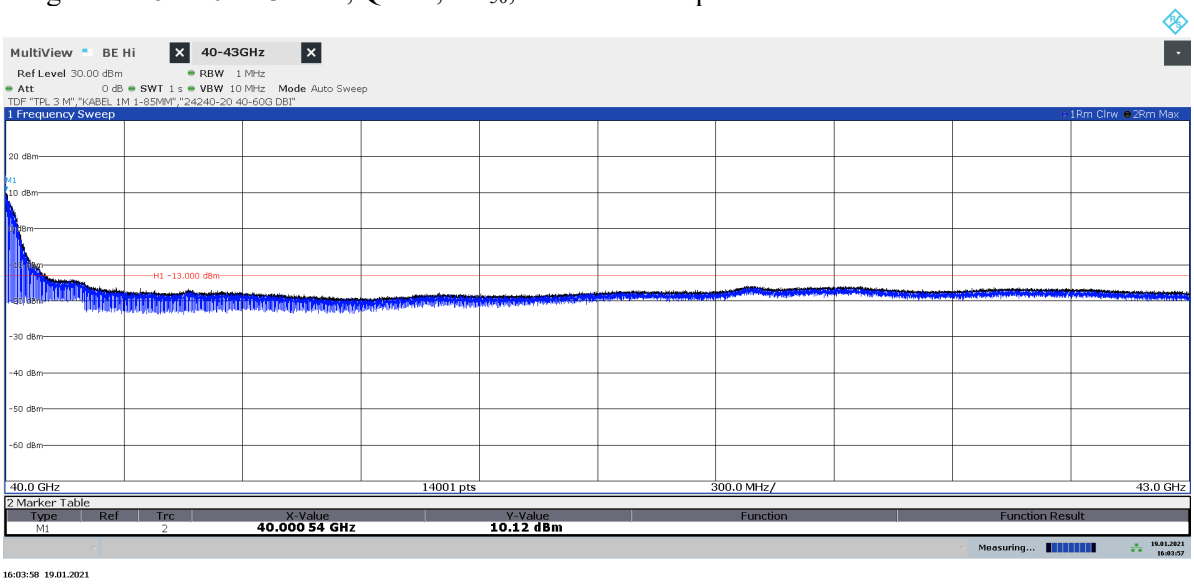


Diagram 2.16c: 40 – 43 GHz, QPSK, TH_{50}, EIRP Horizontal polarization

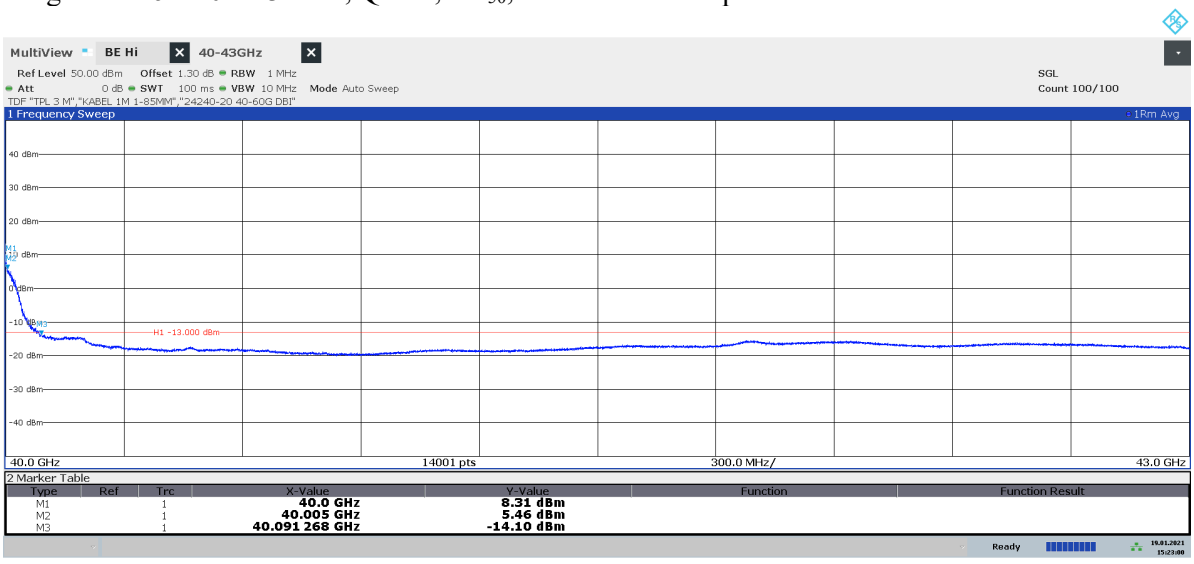
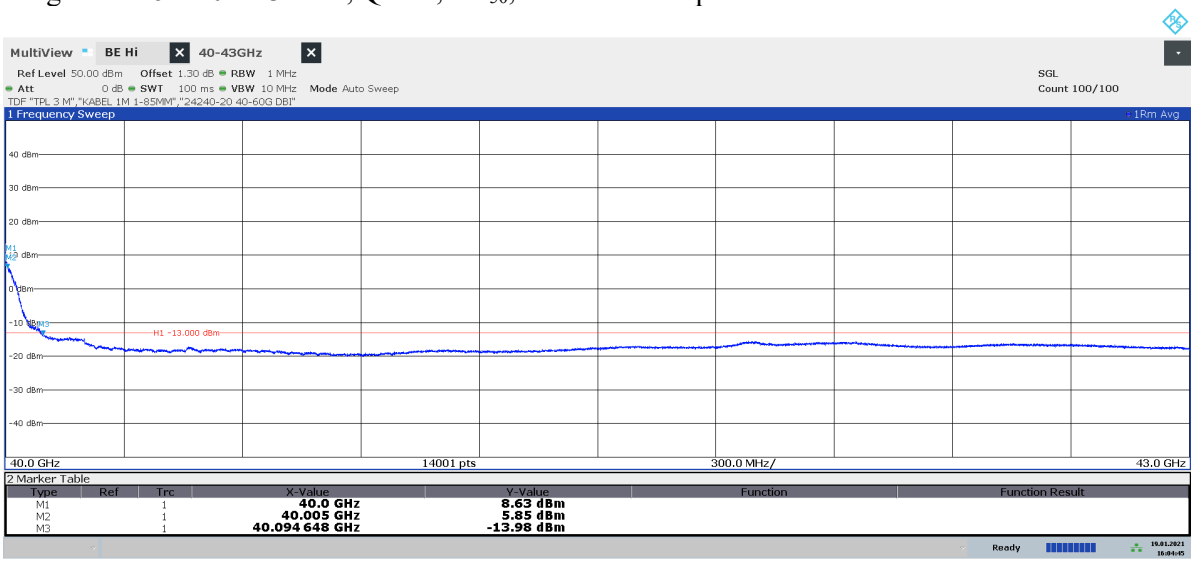


Diagram 2.16d: 40 – 43 GHz, QPSK, TH_{50}, EIRP Vertical polarization



Power EIRP for 40.0 GHz Hor/ Ver [dBm]	Power EIRP for 40.005 GHz Hor/ Ver [dBm]	Antenna Gain Hor/ Ver [dBi]	Total conducted power/BW for 40.0 GHz (Limit -5 dBm) [dBm]/ Verdict	Total conducted power/BW for 40.005 GHz (Limit -13 dBm) [dBm]/ Verdict
8.31/ 8.63	5.46/ 5.85	29.01/ 29.00	-17.52/ Pass	-20.34/ Pass

Diagram 2.17a: 40 – 43 GHz, QPSK, TH8$_{100}$, EIRP Horizontal polarization

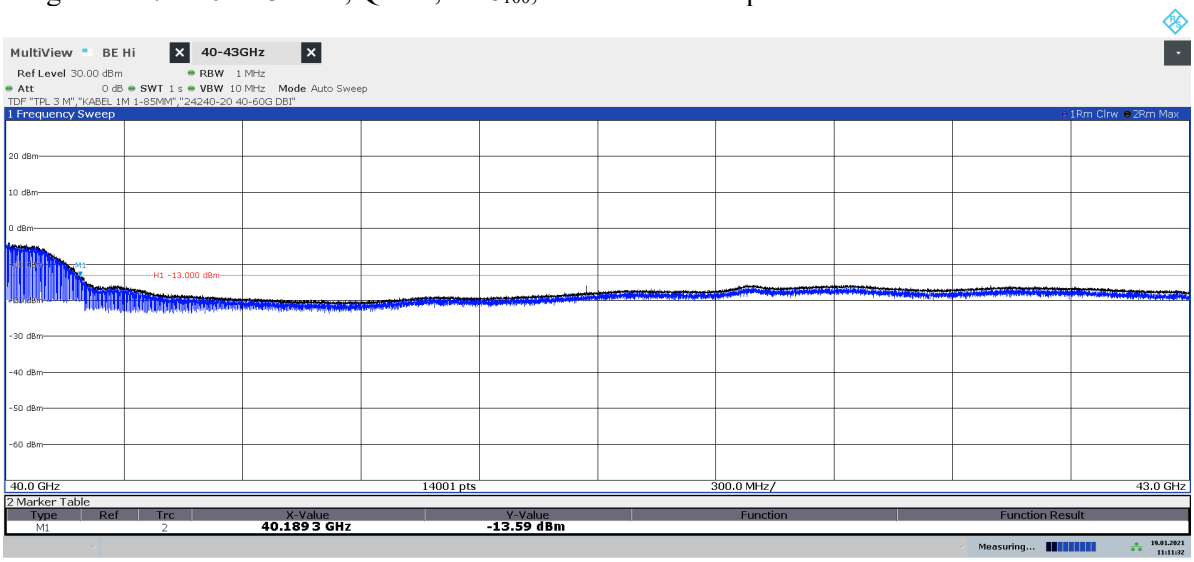


Diagram 2.17b: 40 – 43 GHz, QPSK, TH8$_{100}$, EIRP Vertical polarization

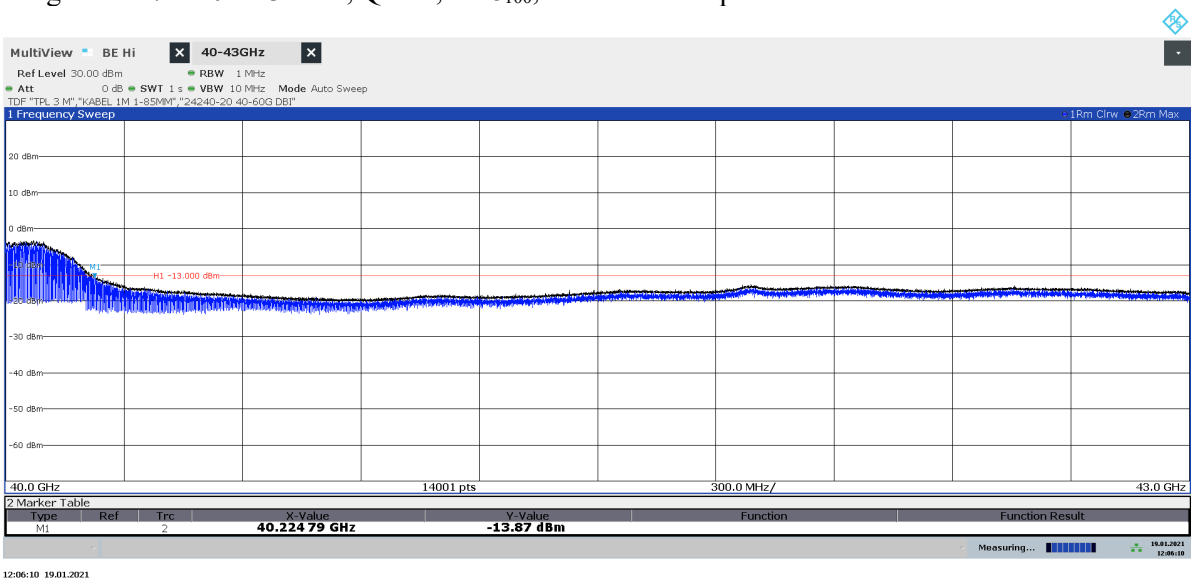


Diagram 2.17c: 40 – 43 GHz, QPSK, TH8$_{100}$, EIRP Horizontal polarization

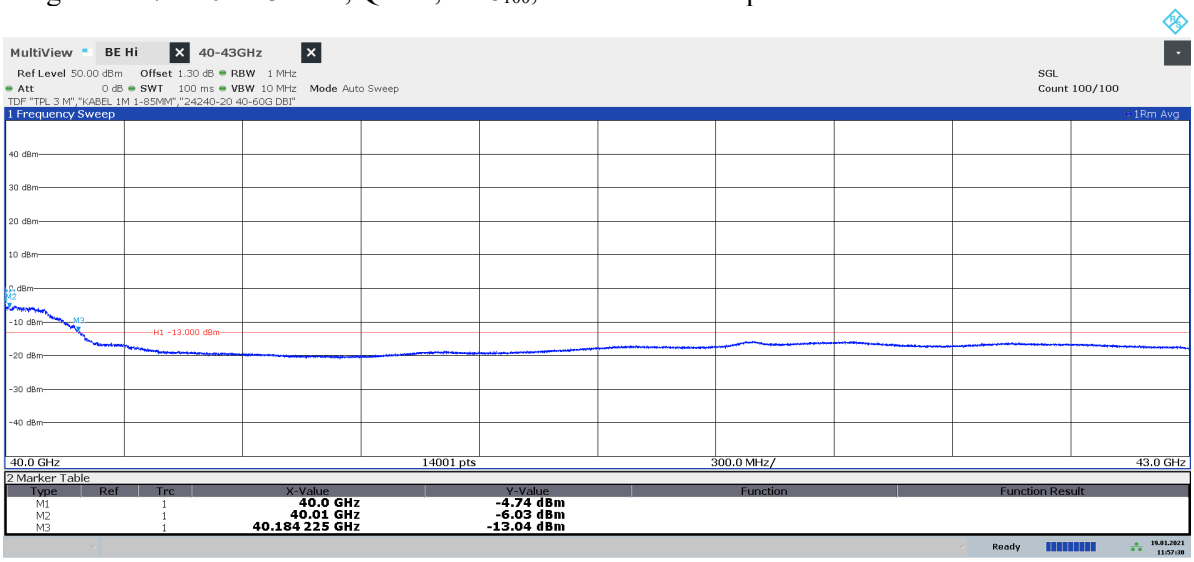
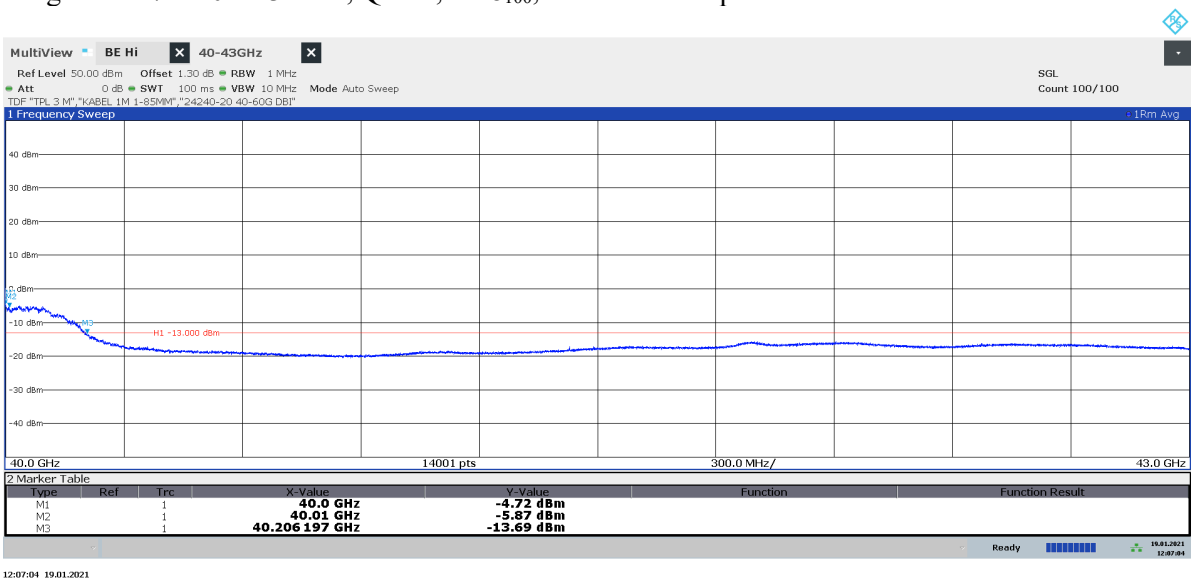


Diagram 2.17d: 40 – 43 GHz, QPSK, TH8$_{100}$, EIRP Vertical polarization



Power EIRP for 40.0 GHz Hor/ Ver [dBm]	Power EIRP for 40.01 GHz Hor/ Ver [dBm]	Antenna Gain Hor/ Ver [dBi]	Total conducted power/BW for 40.0 GHz (Limit -5 dBm) [dBm]/ Verdict	Total conducted power/BW for 40.01 GHz (Limit -13 dBm) [dBm]/ Verdict
-4.74/ -4.72	-6.03/ -5.87	26.40/ 26.52	-28.18/ Pass	-29.40/ Pass

Diagram 2.18a: 40 – 43 GHz, QPSK, Tim_{50}, EIRP Horizontal polarization
See diagram 2.18e for TRP result

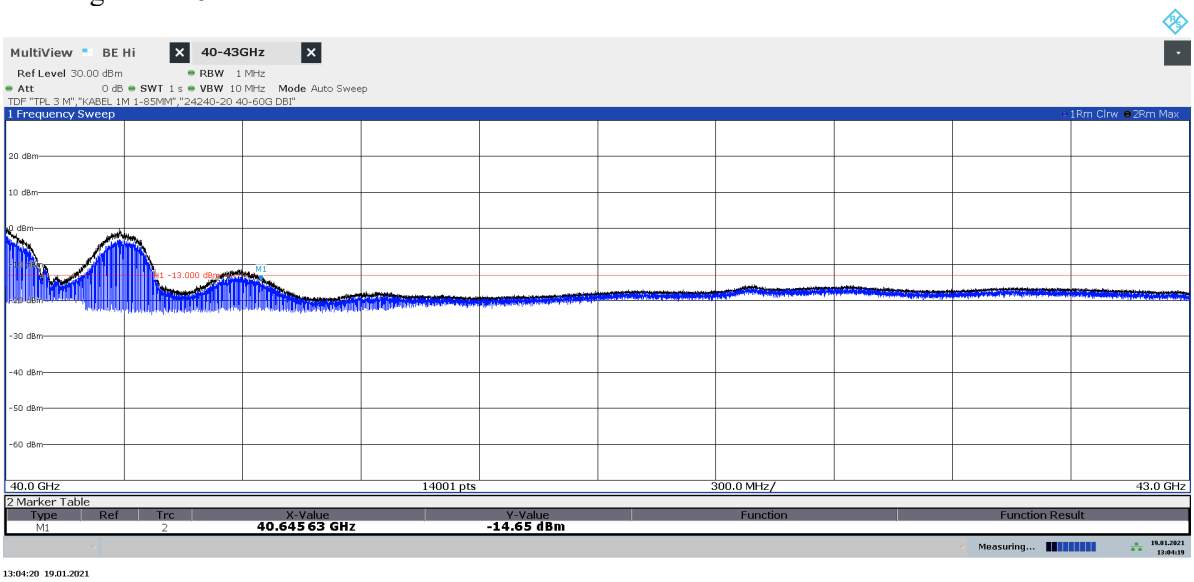


Diagram 2.18b: 40 – 43 GHz, QPSK, Tim_{50}, EIRP Vertical polarization
See diagram 2.18e for TRP result

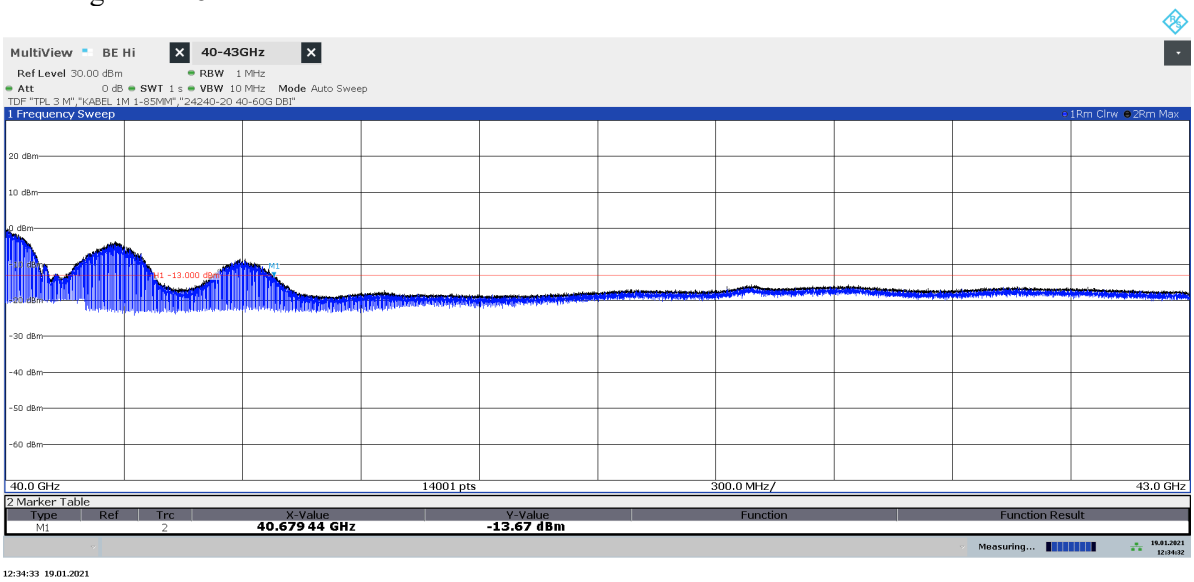


Diagram 2.18c: 40 – 43 GHz, QPSK, Tim_{50}, EIRP Horizontal polarization
See diagram 2.18e for TRP result

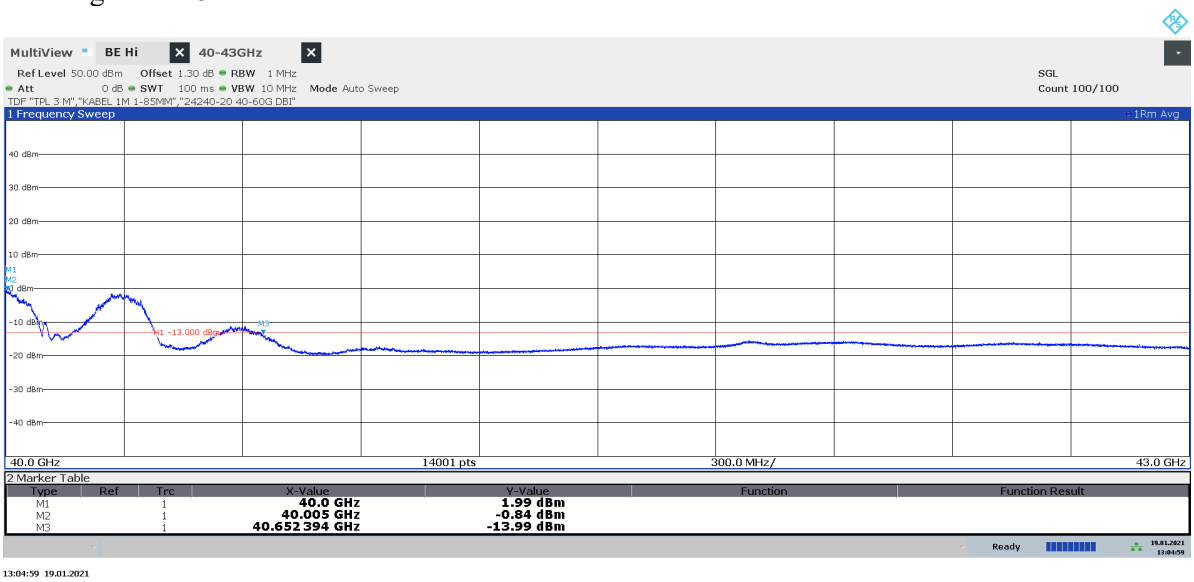
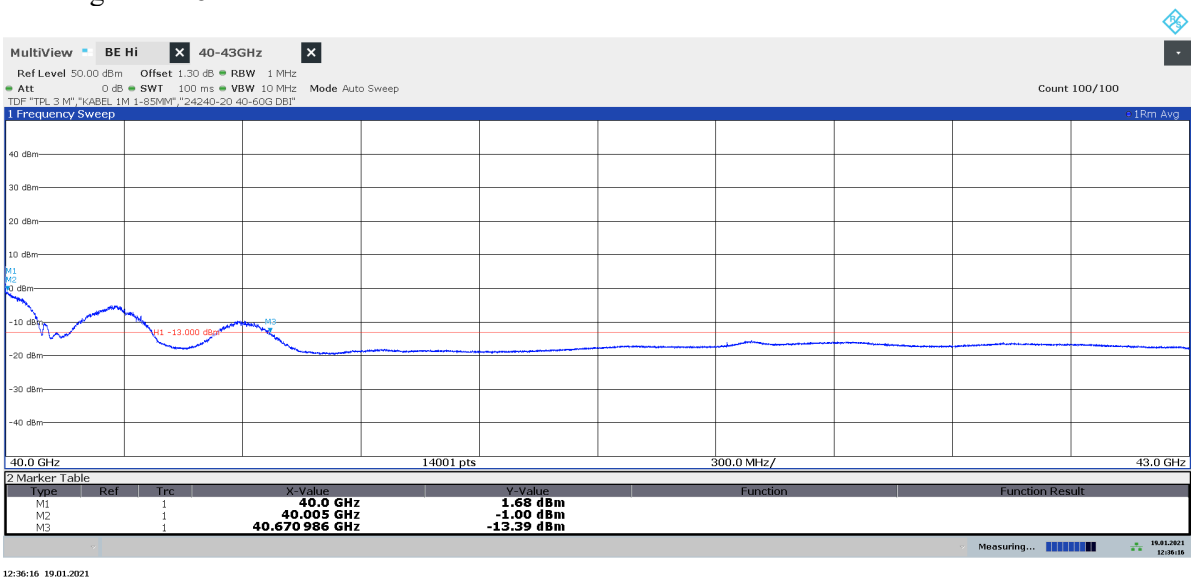


Diagram 2.18d: 40 – 43 GHz, QPSK, Tim_{50}, EIRP Vertical polarization
See diagram 2.18e for TRP result



Power EIRP for 40.0 GHz Hor/ Ver [dBm]	Power EIRP for 40.005 GHz Hor/ Ver [dBm]	Antenna Gain Hor/ Ver [dBi]	Total conducted power/BW for 40.0 GHz (Limit -5 dBm) [dBm]/ Verdict	Total conducted power/BW for 40.005 GHz (Limit -13 dBm) [dBm]/ Verdict
1.99/ 1.68	-0.84/ -1.00	29.01/ 29.00	-24.16/ Pass	-26.91/ Pass

Diagram 2.18e: 40 – 40.4 GHz, QPSK, Tim_{50}, Two cut TRP

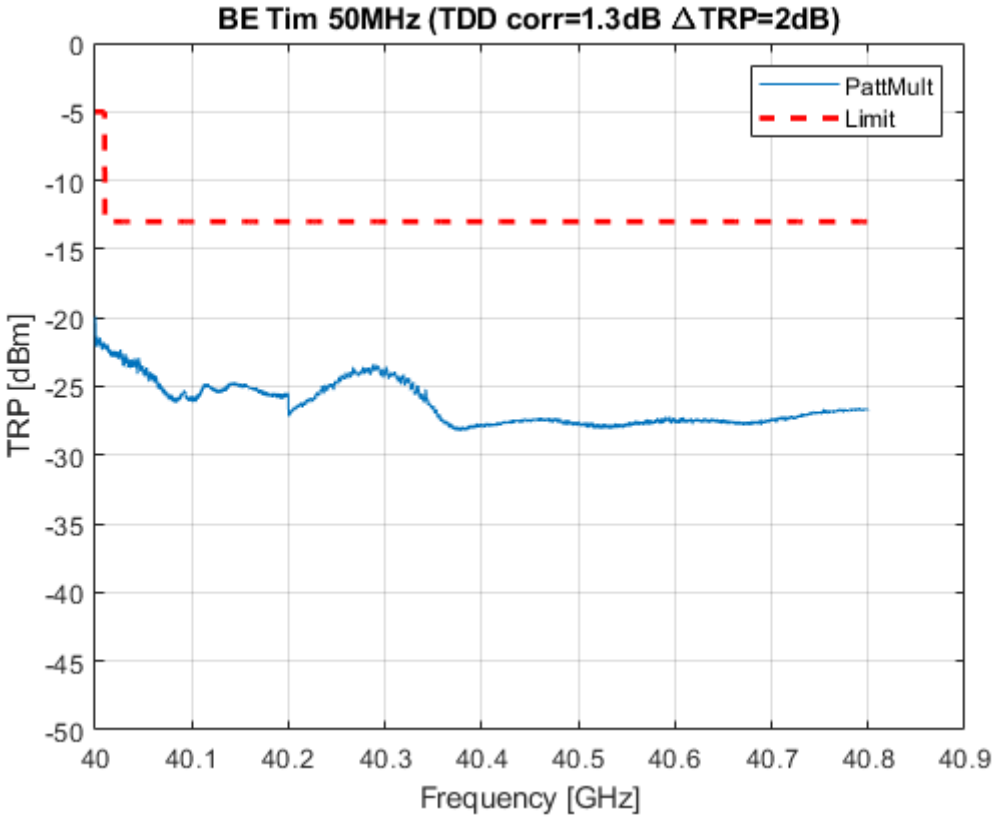


Diagram 2.19a: 40 – 43 GHz, QPSK, BL_{50}, EIRP Horizontal polarization
See diagram 2.19c for TRP result

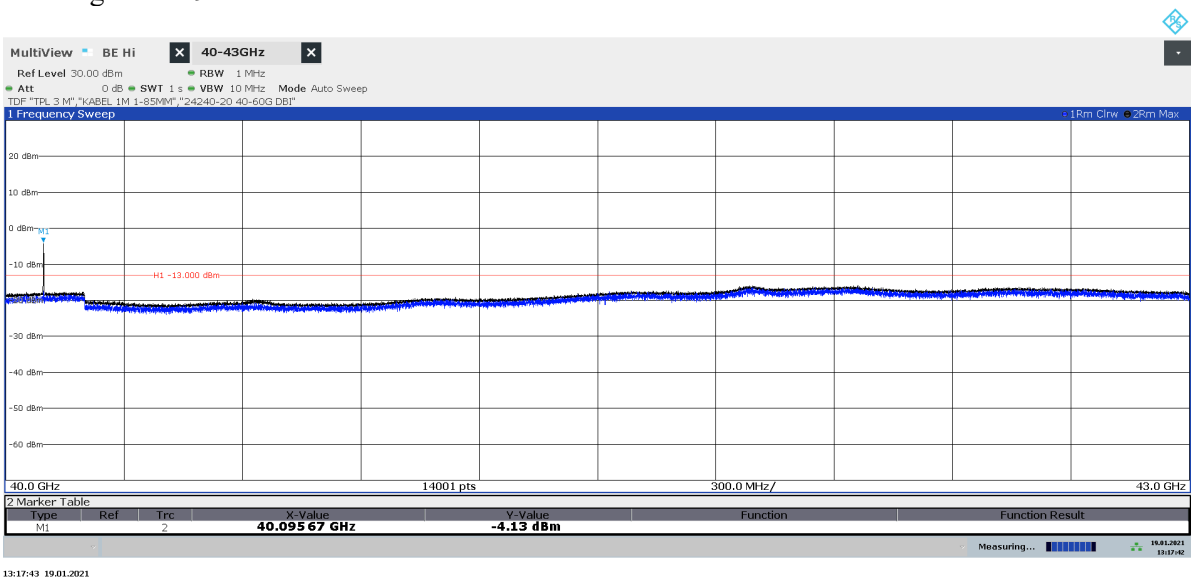


Diagram 2.19b: 40 – 43 GHz, QPSK, BL_{50}, EIRP Vertical polarization
See diagram 2.19c for TRP result

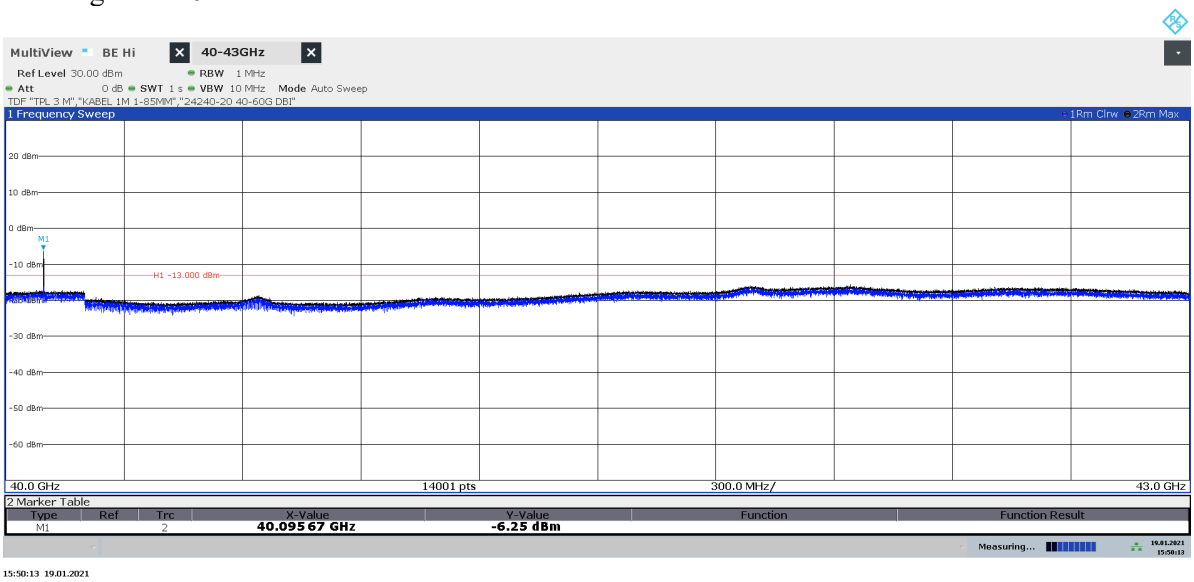


Diagram 2.19c: 40.05 – 40.15 GHz, QPSK, BL_{50}, Spherical grid Method TRP

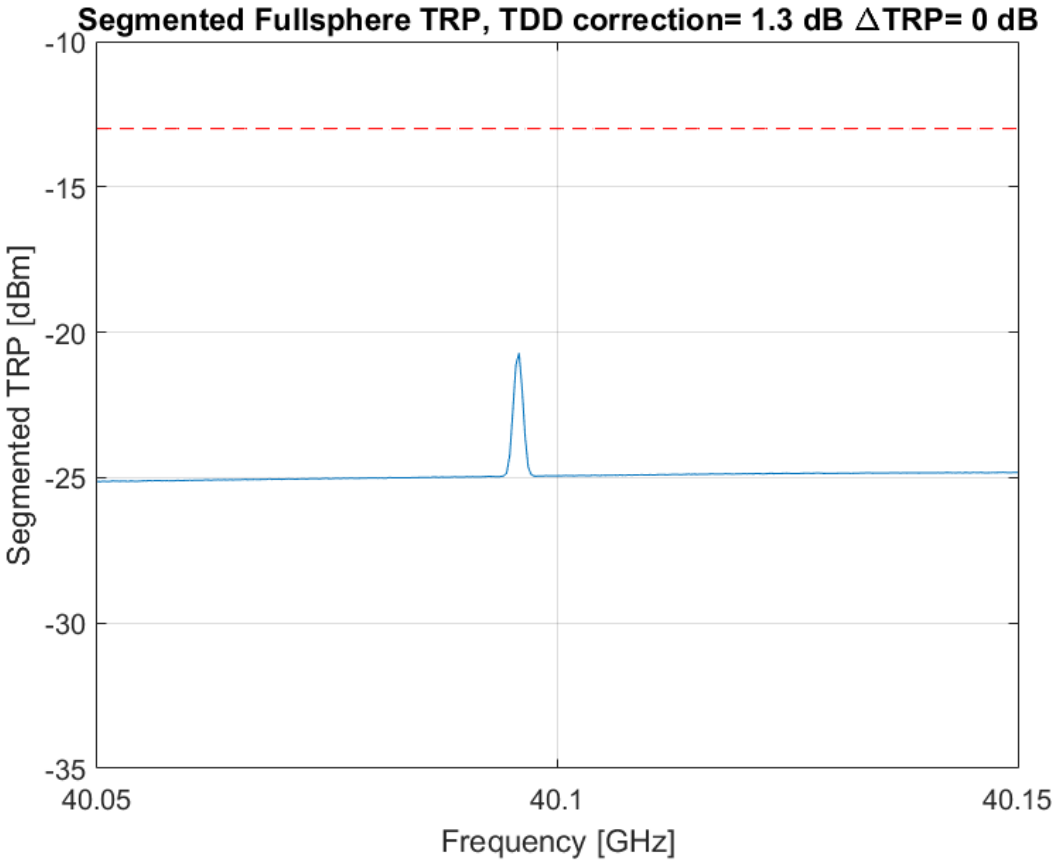


Diagram 2.20a: 43 – 60 GHz, QPSK, BL_{50}, EIRP Horizontal polarization

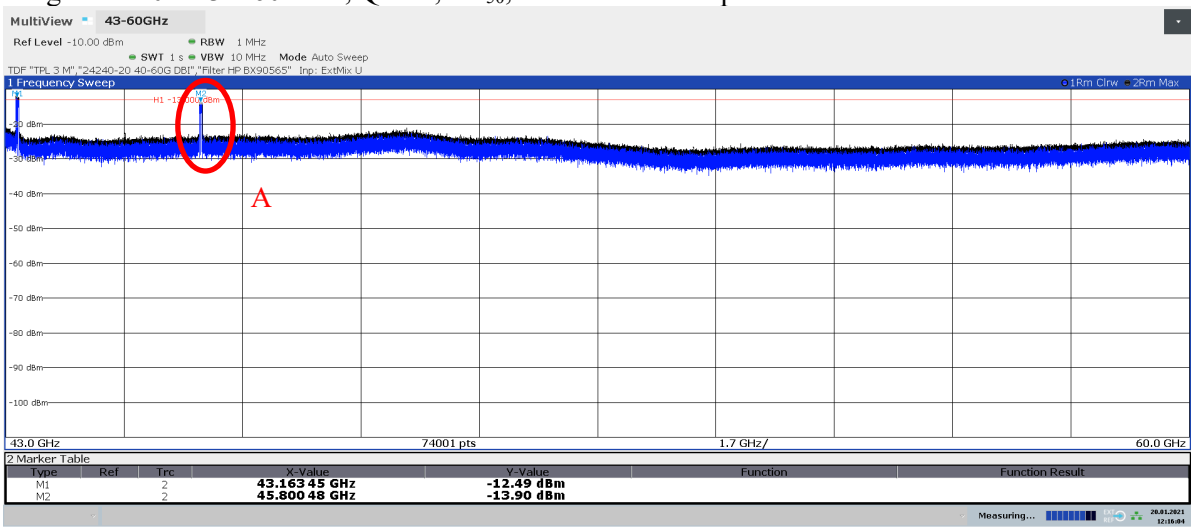
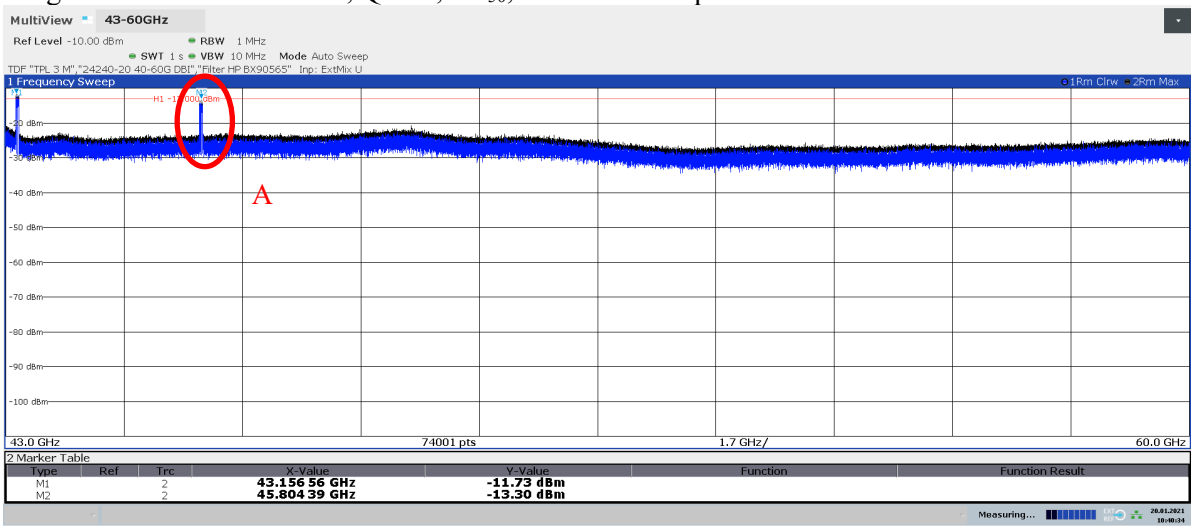


Diagram 2.20b: 43 – 60 GHz, QPSK, BL_{50}, EIRP Vertical polarization



"False signals" originating from unwanted mixer products between LO signal generated by the spectrum analyzer and the strong out of measurement band RF-signal (EUT carrier frequencies) are marked with red circles. The frequency of the "false signals" can be calculated and are show in the table below.

Plot label	F EUT [GHz]	Mixing indicies n [-]	m [-]	"False F" [GHz]
A	37.025	4	1	45.8

Diagram 2.20c: 43.1 – 43.25 GHz, QPSK, BL_{50}, Two cut TRP

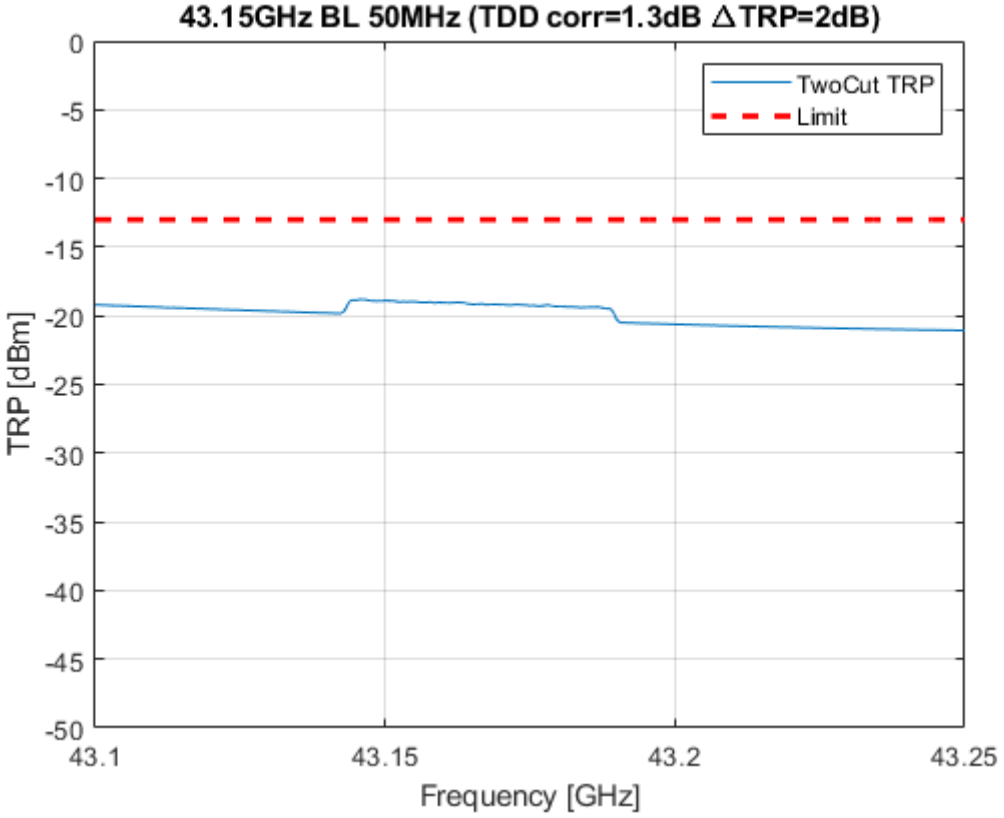


Diagram 2.21a: 43 – 60 GHz, QPSK, $BL8_{100}$, EIRP Horizontal polarization

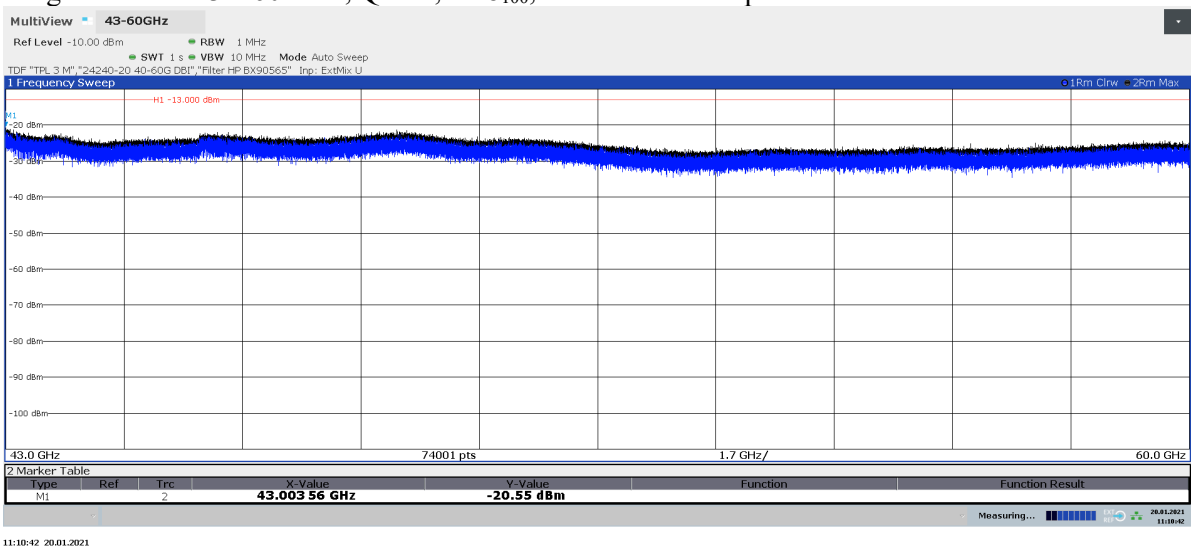


Diagram 2.21b: 43 – 60 GHz, QPSK, $BL8_{100}$, EIRP Vertical polarization

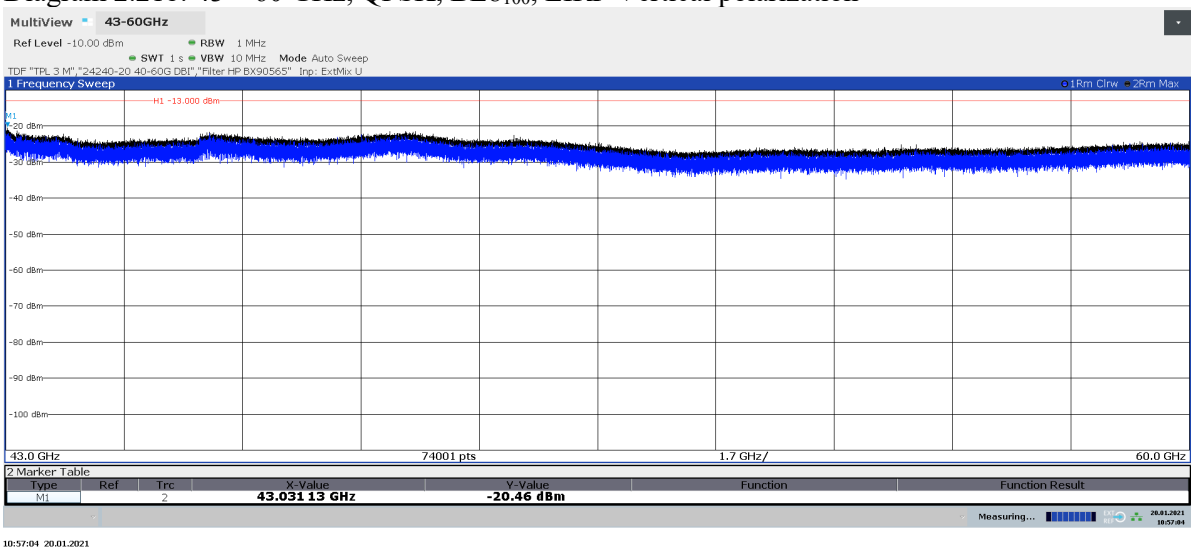


Diagram 2.22a: 60 – 75 GHz, QPSK, TL_{100}, EIRP Horizontal polarization

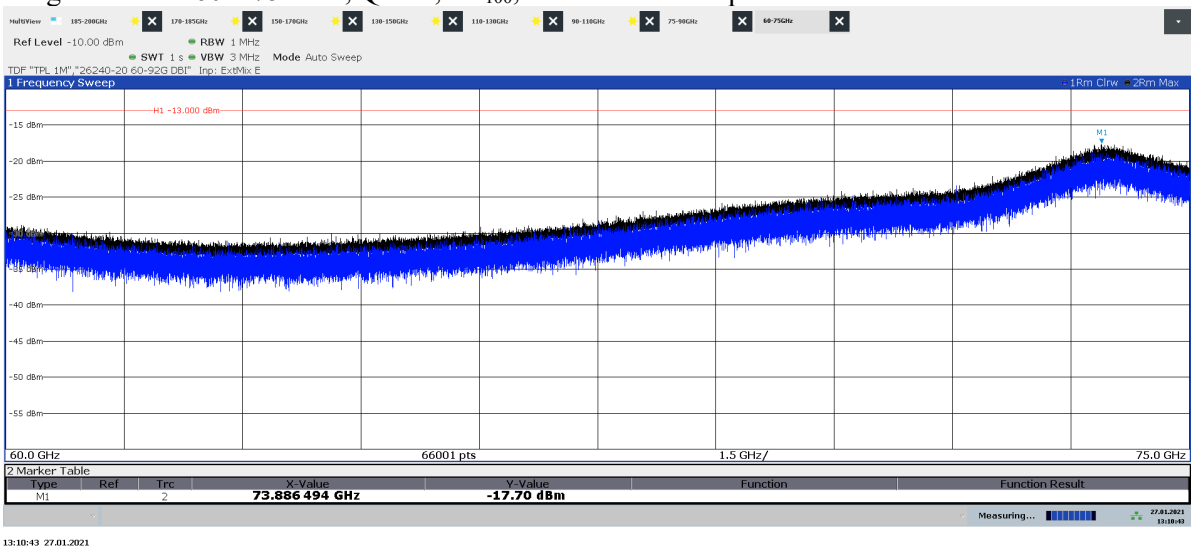


Diagram 2.22b: 60 – 75 GHz, QPSK, TL_{100}, EIRP Vertical polarization

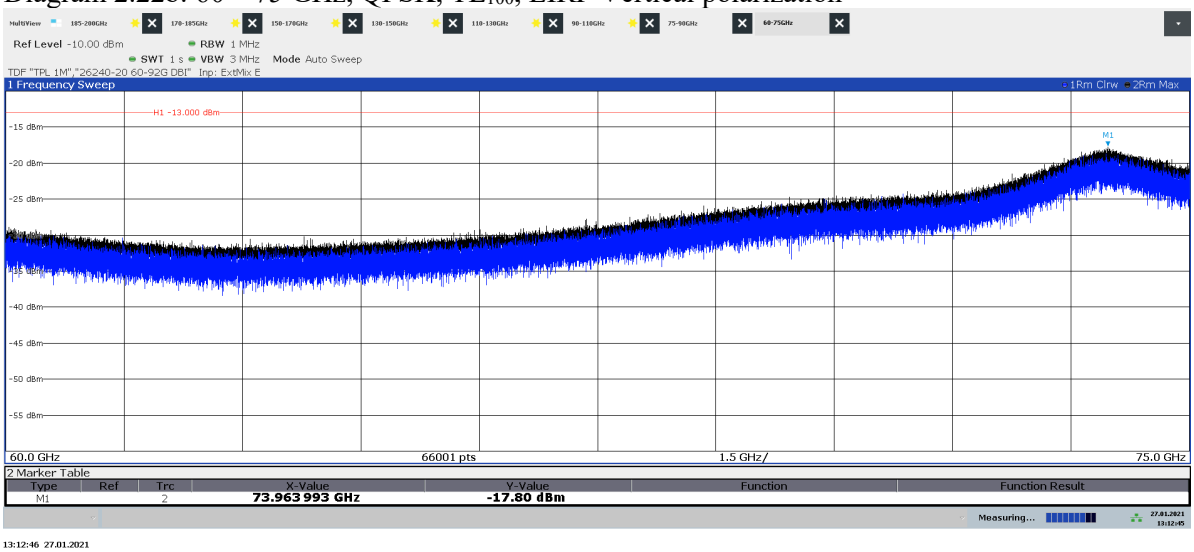


Diagram 2.23a: 60 – 75 GHz, QPSK, $BL8_{100}$, EIRP Horizontal polarization

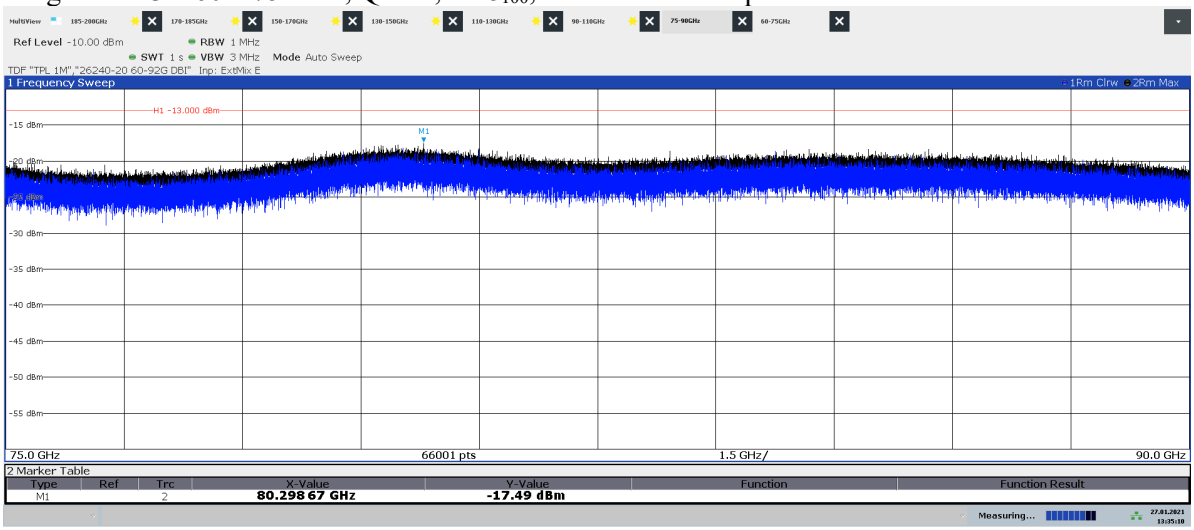


Diagram 2.23b: 60 – 75 GHz, QPSK, $BL8_{100}$, EIRP Vertical polarization

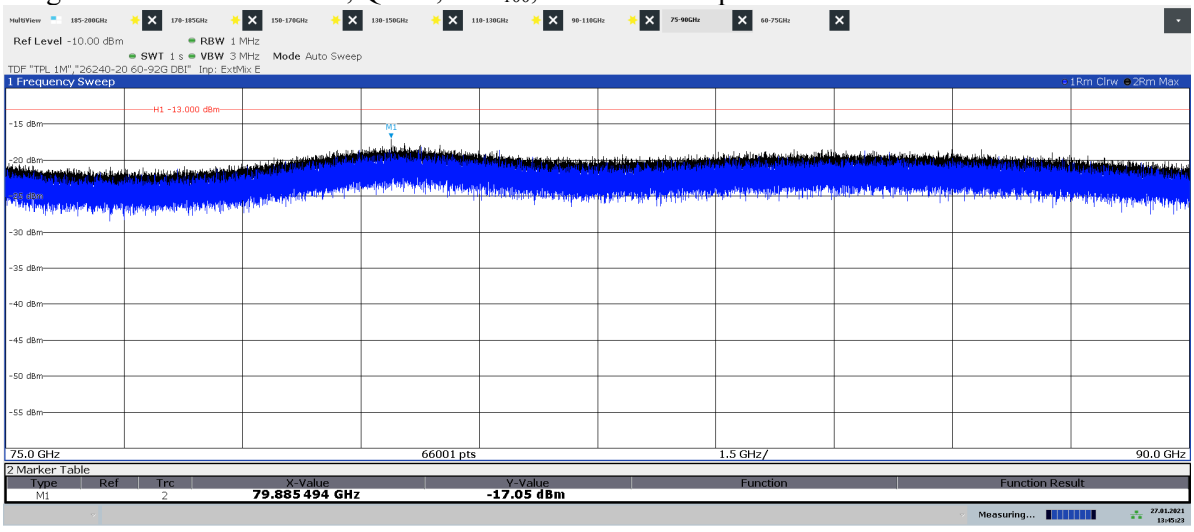


Diagram 2.24a: 75 – 90 GHz, QPSK, TL_{100}, EIRP Horizontal polarization

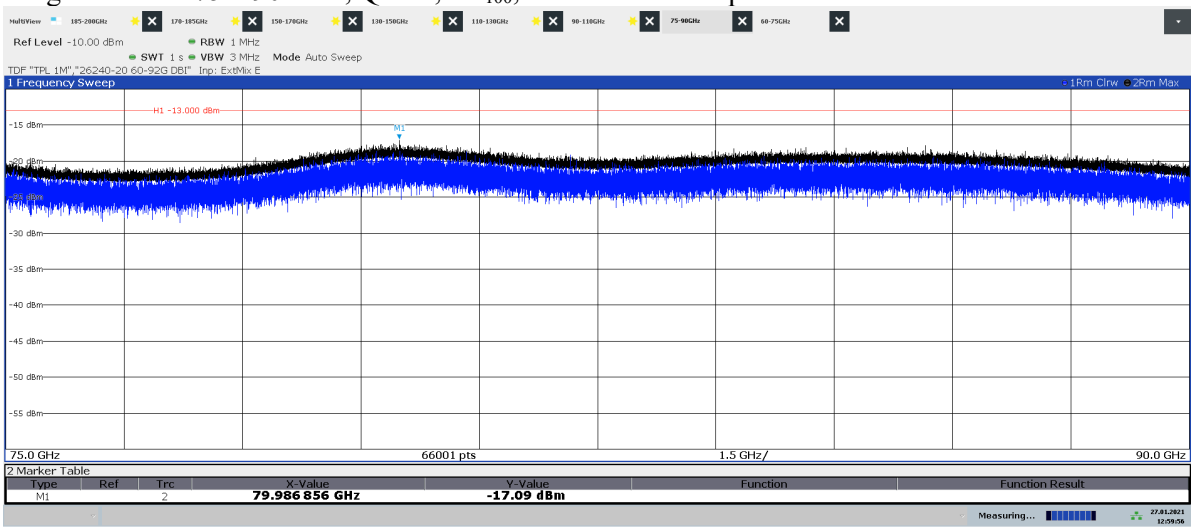


Diagram 2.24b: 75 – 90 GHz, QPSK, TL_{100}, EIRP Vertical polarization

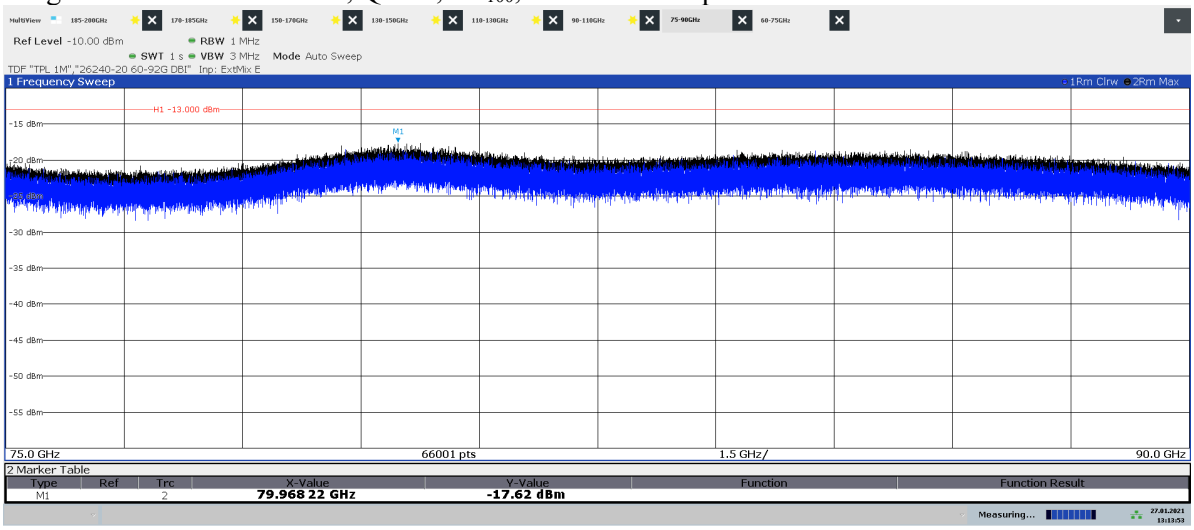


Diagram 2.25a: 75 – 90 GHz, QPSK, $BL8_{100}$, EIRP Horizontal polarization

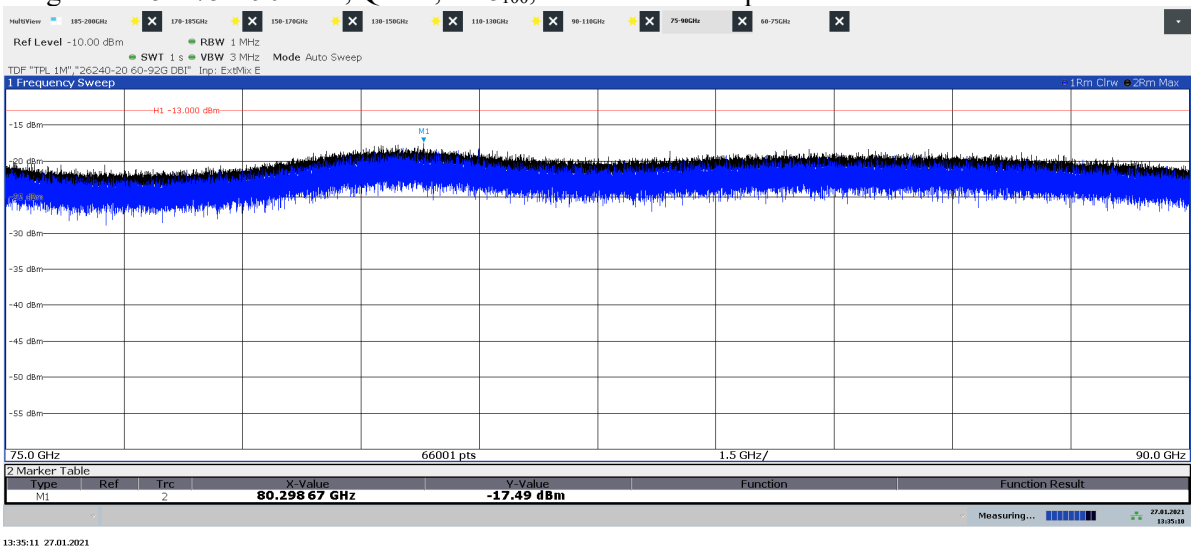


Diagram 2.25b: 75 – 90 GHz, QPSK, $BL8_{100}$, EIRP Vertical polarization

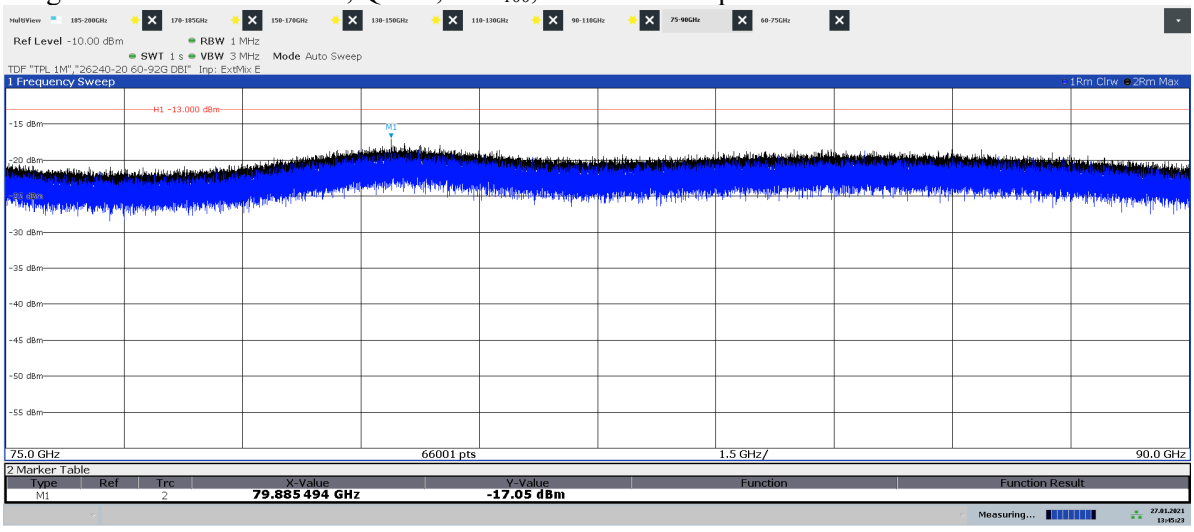


Diagram 2.26a: 90 – 110 GHz, QPSK, TL_{100}, EIRP Horizontal polarization

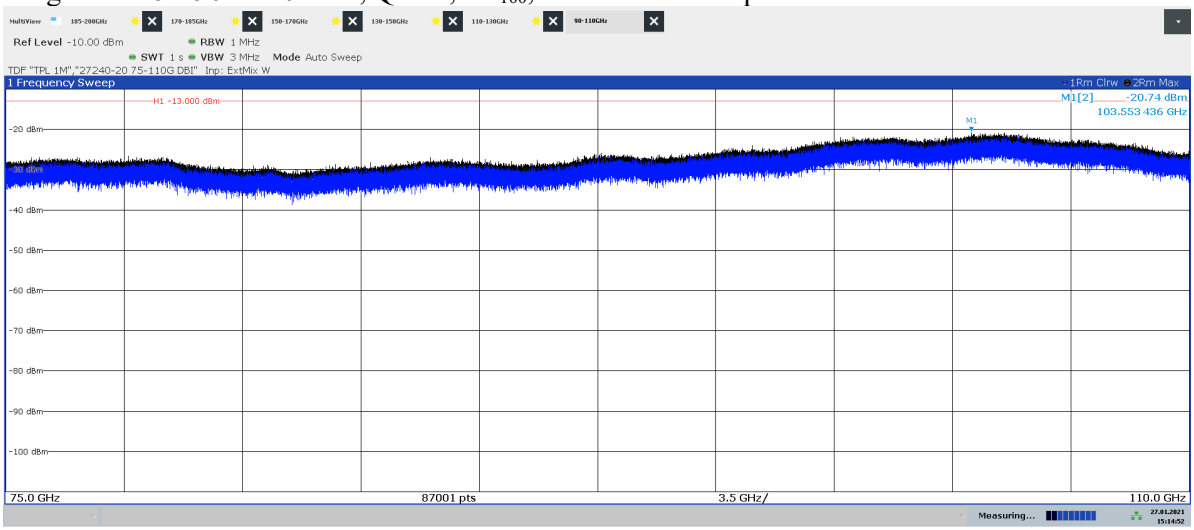


Diagram 2.26b: 90 – 110 GHz, QPSK, TL_{100}, EIRP Vertical polarization

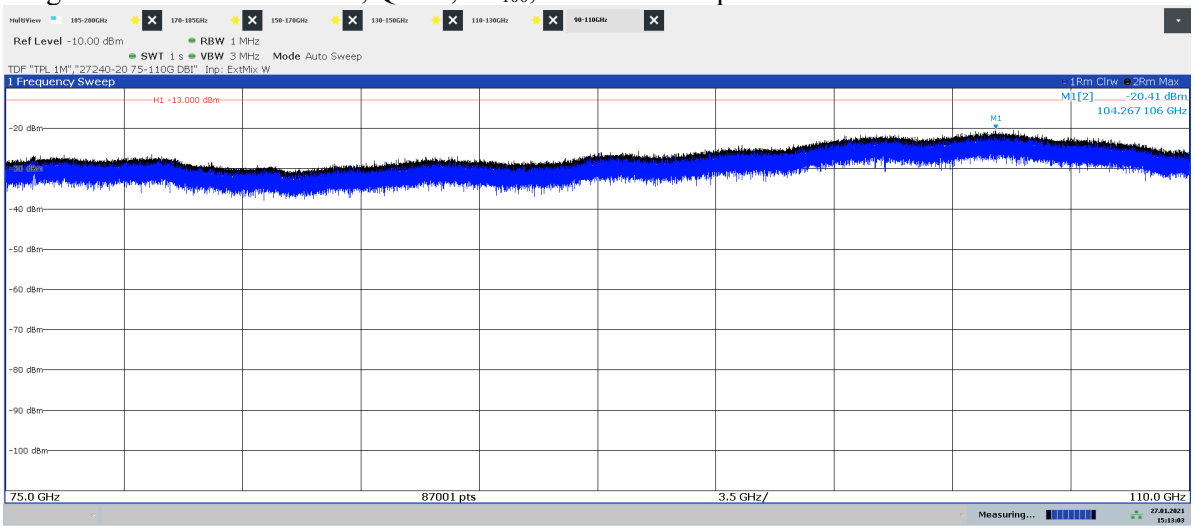


Diagram 2.27a: 90 – 110 GHz, QPSK, BL8$_{100}$, EIRP Horizontal polarization

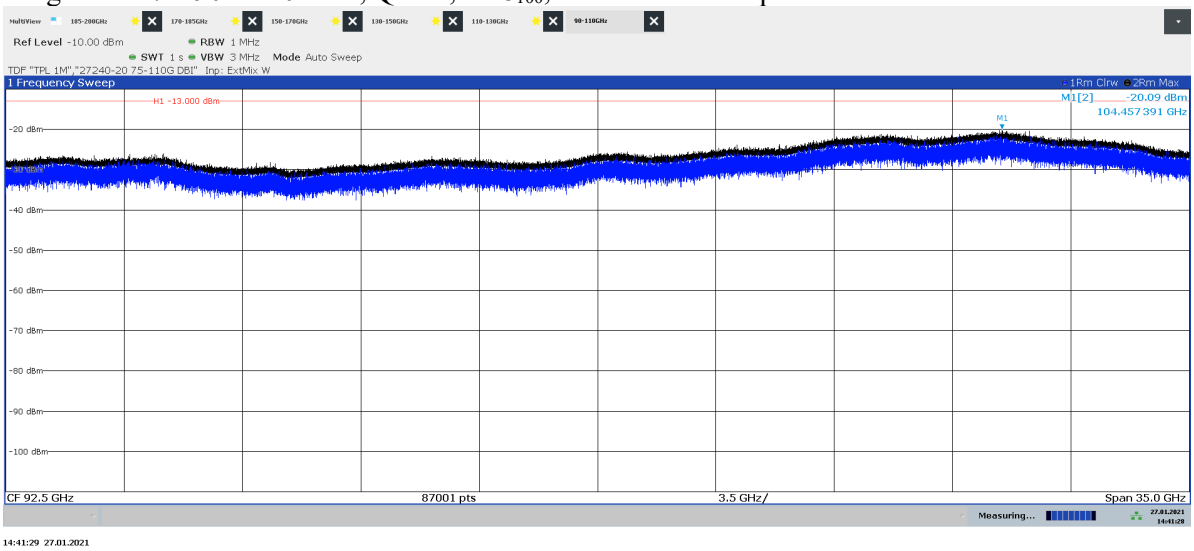


Diagram 2.27b: 90 – 110 GHz, QPSK, BL8$_{100}$, EIRP Vertical polarization

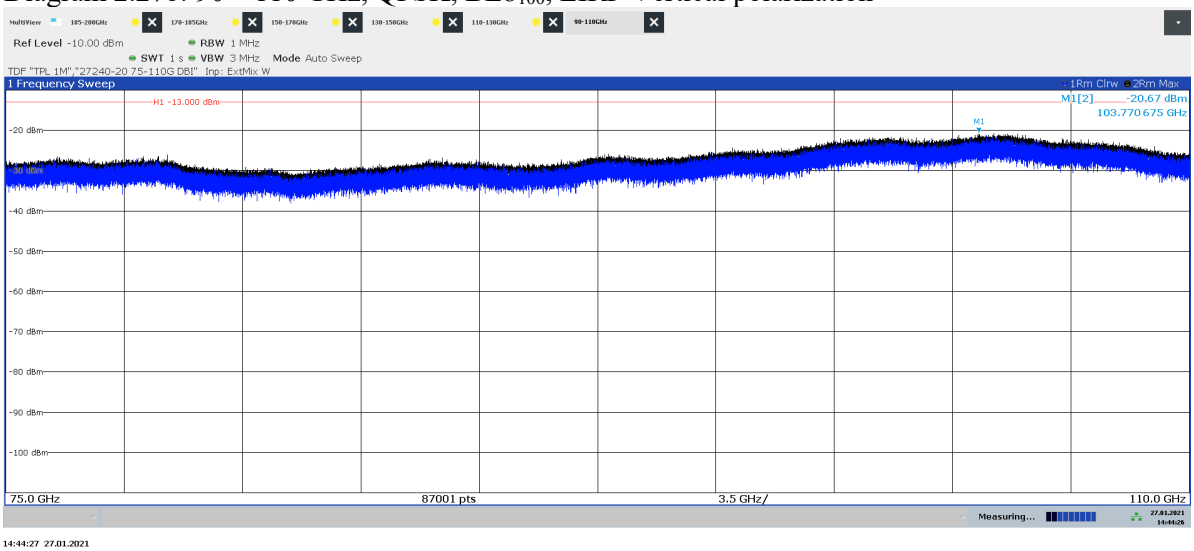


Diagram 2.28a: 110 – 130 GHz, QPSK, TL_{100}, EIRP Horizontal polarization

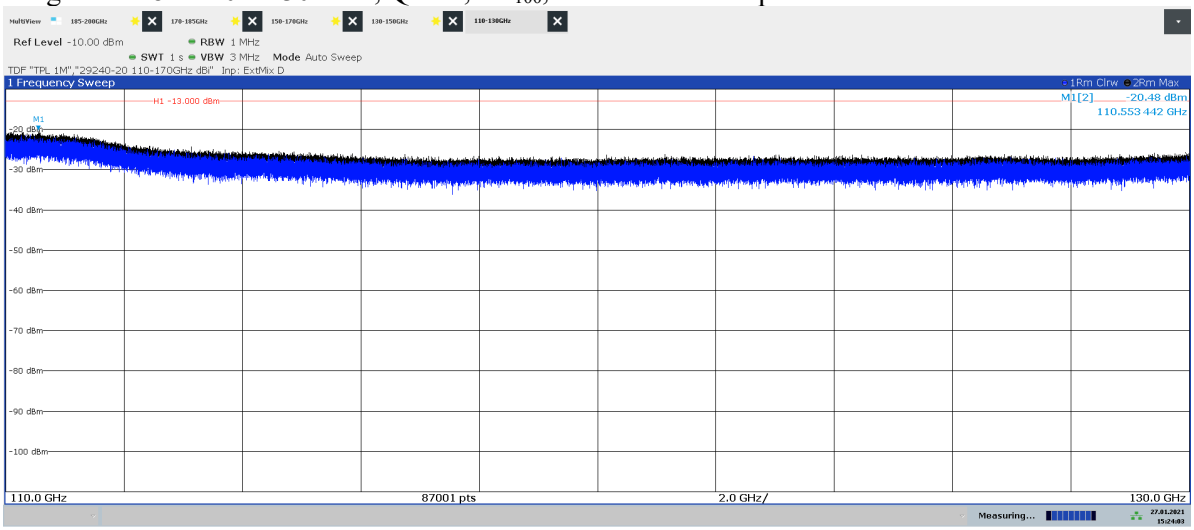


Diagram 2.28b: 110 – 130 GHz, QPSK, TL_{100}, EIRP Vertical polarization

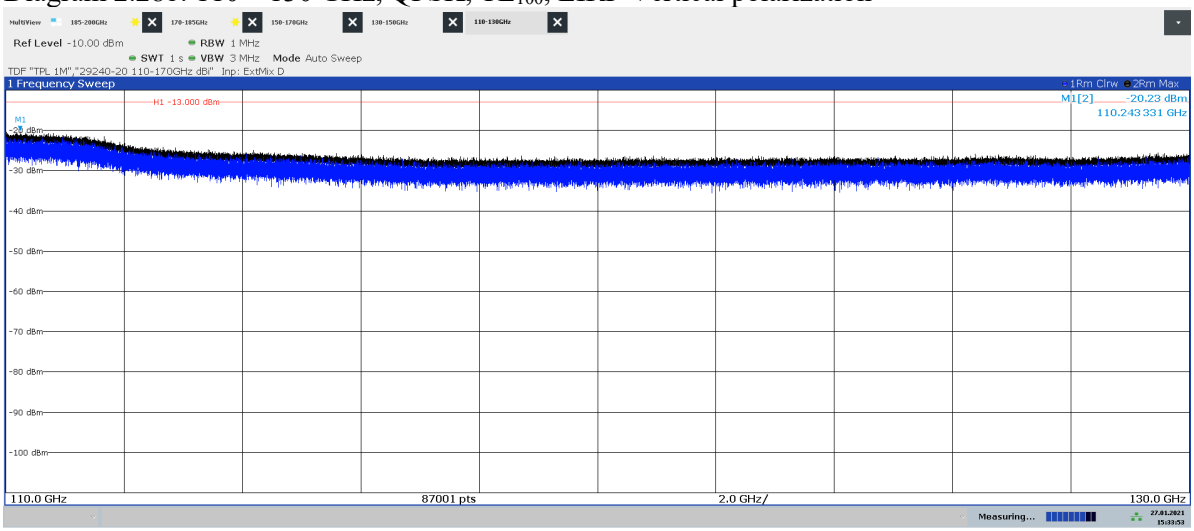


Diagram 2.29a: 110 – 130 GHz, QPSK, $BL8_{100}$, EIRP Horizontal polarization

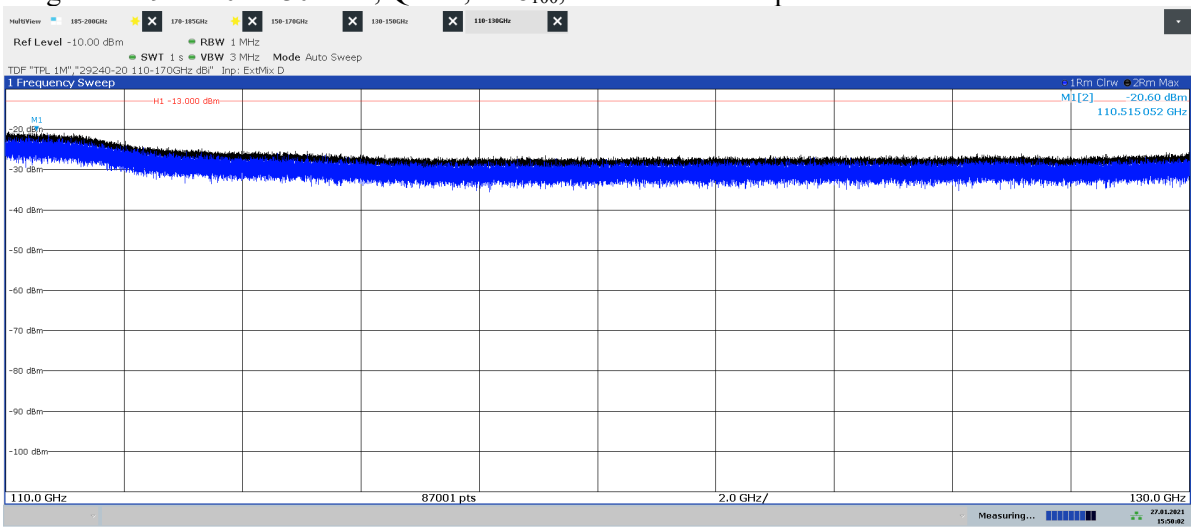


Diagram 2.29b: 110 – 130 GHz, QPSK, $BL8_{100}$, EIRP Vertical polarization

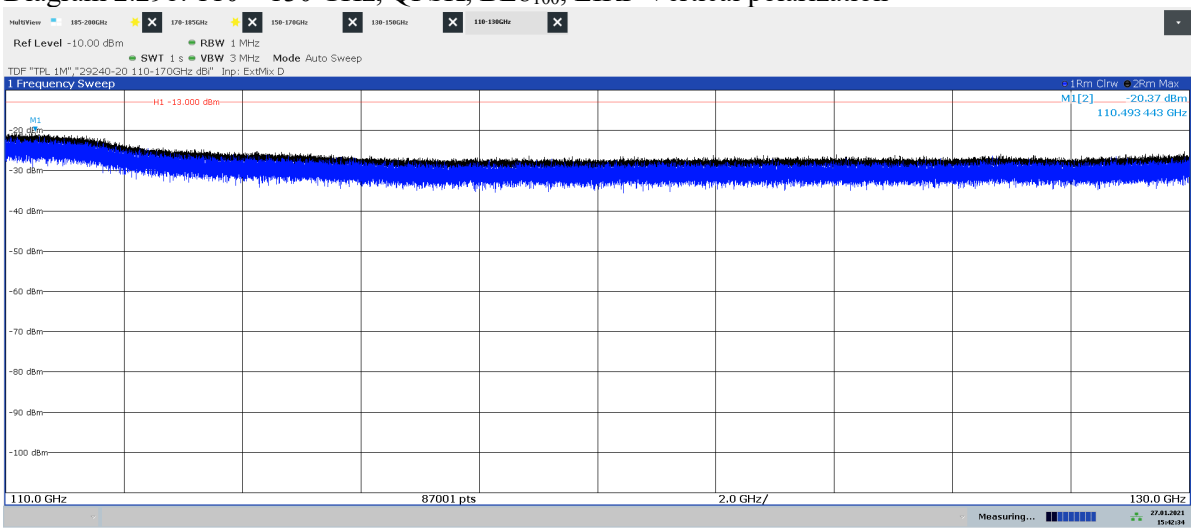


Diagram 2.30a: 130 – 150 GHz, QPSK, TL_{100}, EIRP Horizontal polarization

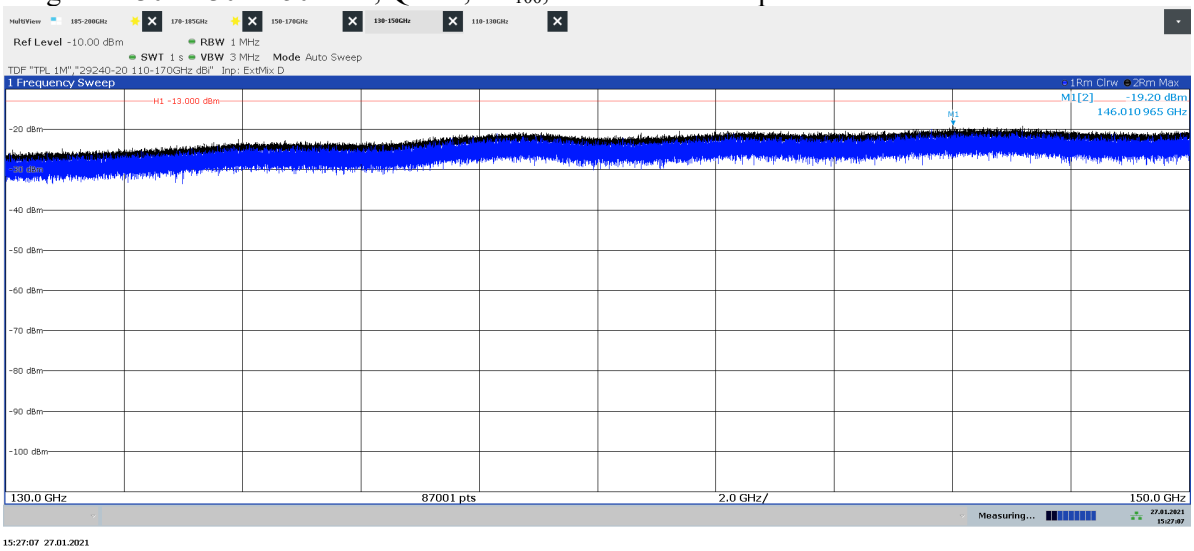


Diagram 2.30b: 130 – 150 GHz, QPSK, TL_{100}, EIRP Vertical polarization

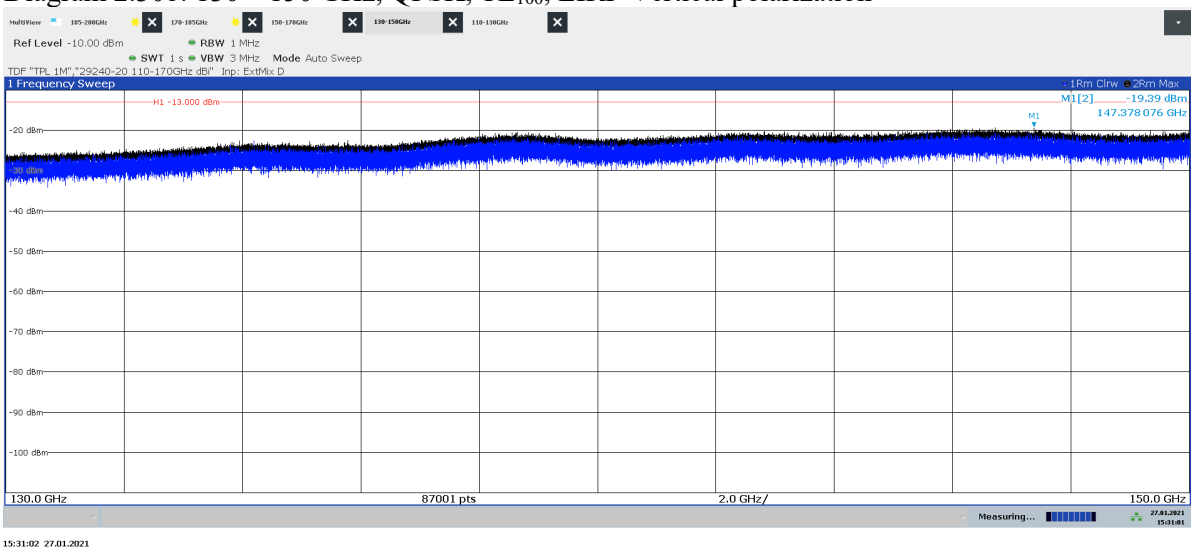


Diagram 2.31a: 130 – 150 GHz, QPSK, $BL8_{100}$, EIRP Horizontal polarization

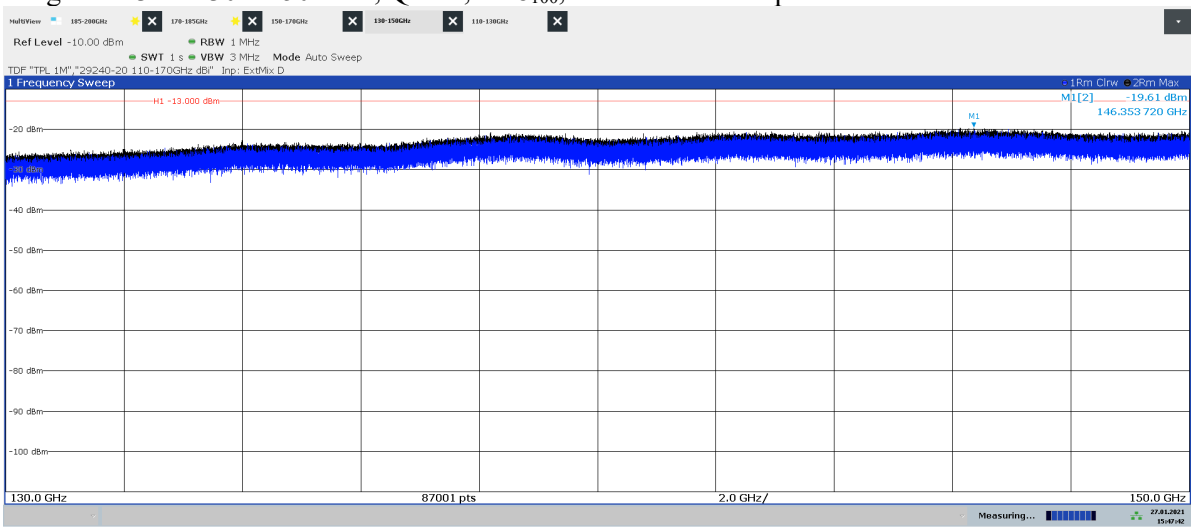


Diagram 2.31b: 130 – 150 GHz, QPSK, $BL8_{100}$, EIRP Vertical polarization

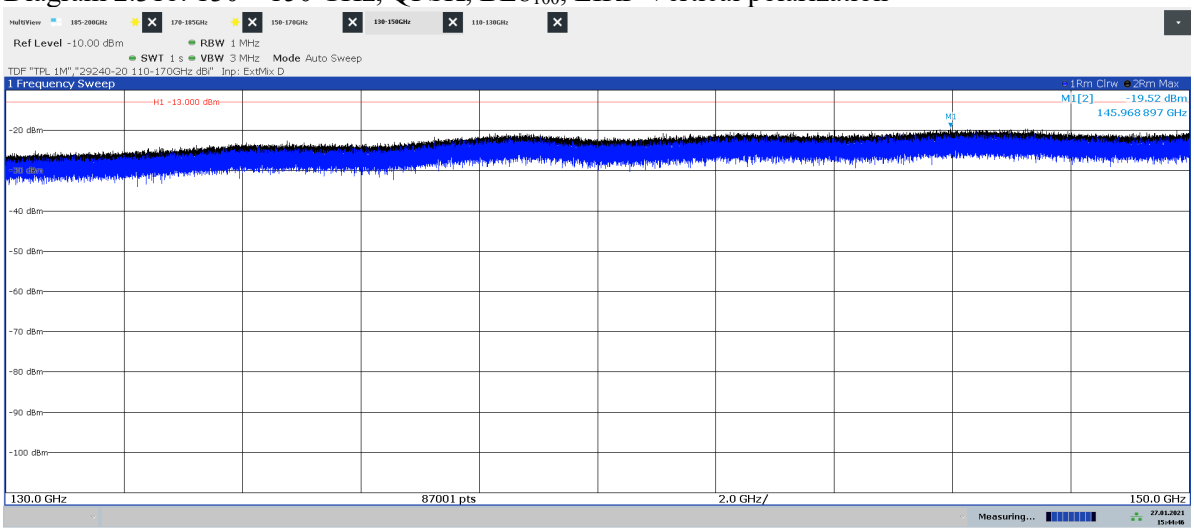


Diagram 2.32a: 150 – 170 GHz, QPSK, TL_{100}, EIRP Horizontal polarization

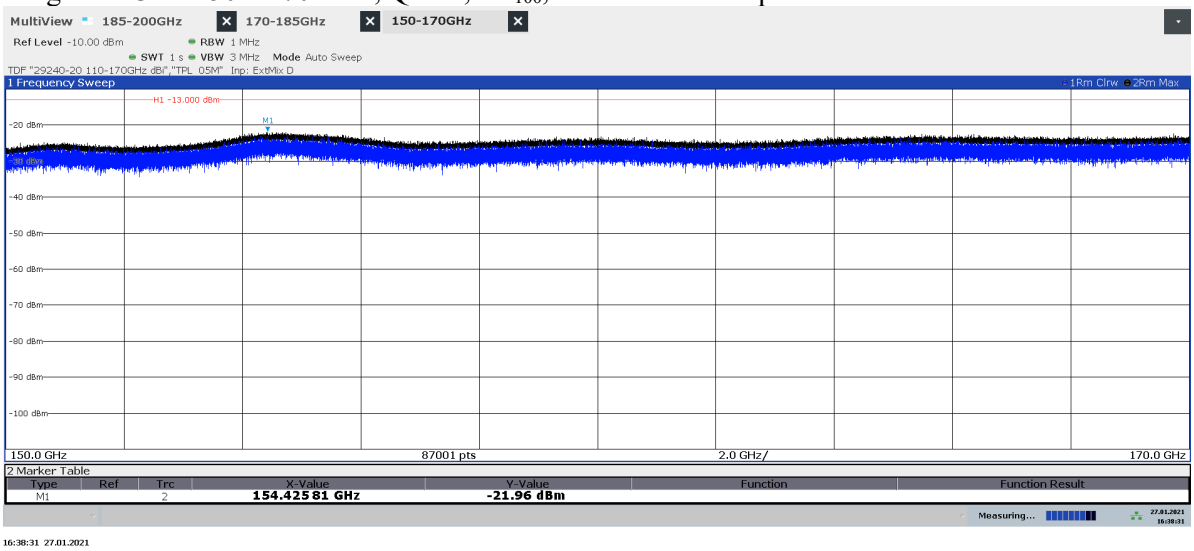


Diagram 2.32b: 150 – 170 GHz, QPSK, TL_{100}, EIRP Vertical polarization

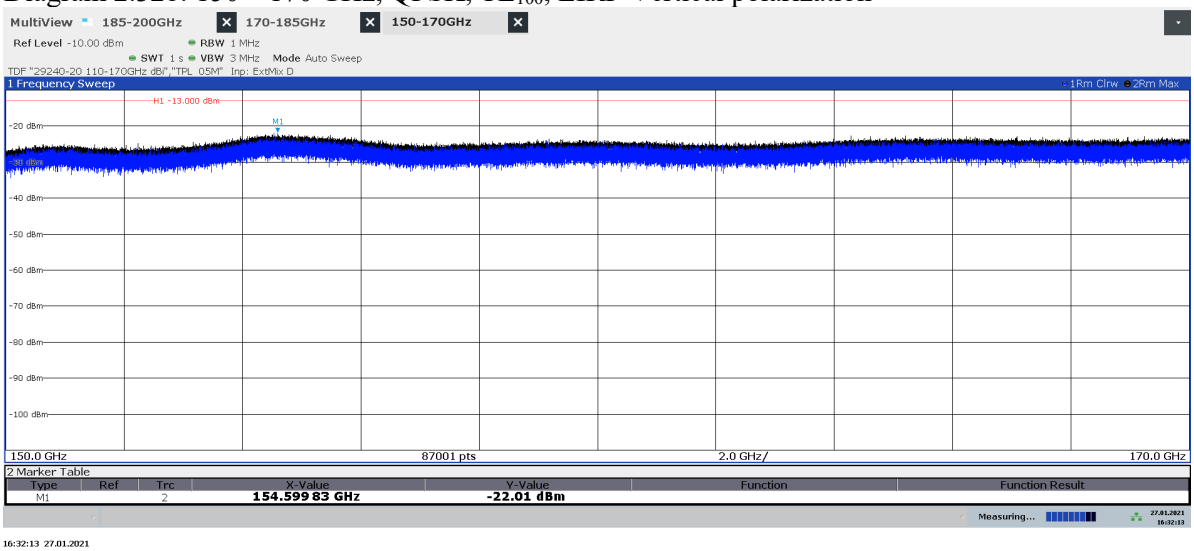


Diagram 2.33a: 150 – 170 GHz, QPSK, $BL8_{100}$, EIRP Horizontal polarization

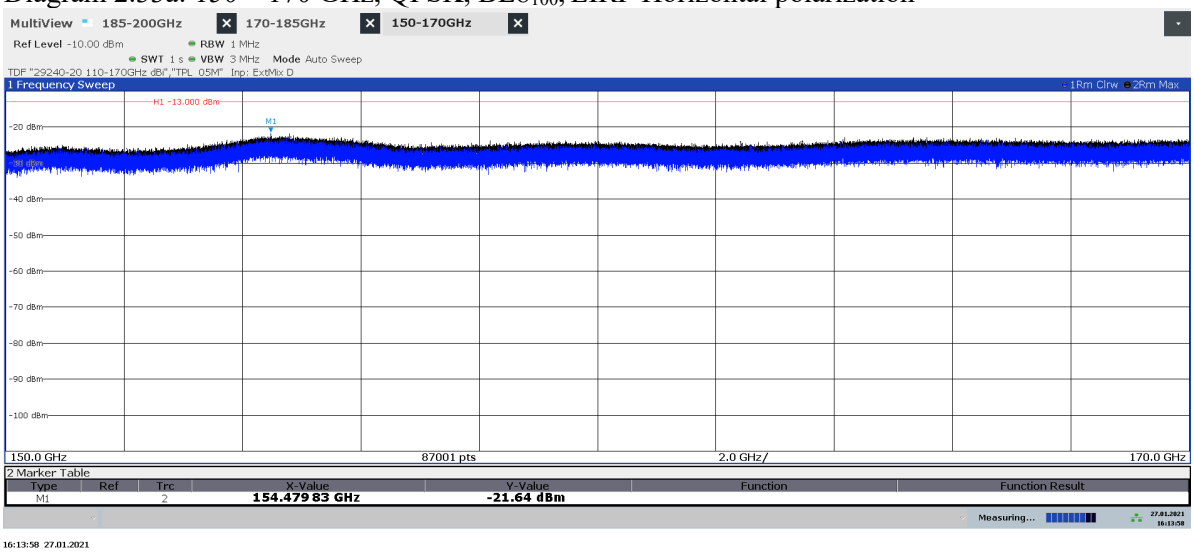


Diagram 2.33b: 150 – 170 GHz, QPSK, $BL8_{100}$, EIRP Vertical polarization

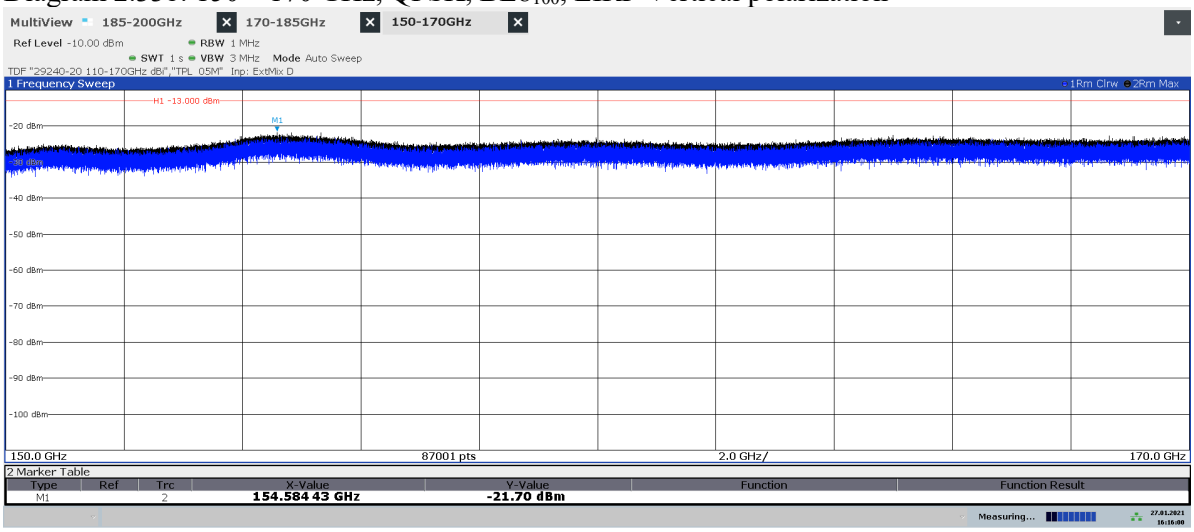


Diagram 2.34a: 170 – 185 GHz, QPSK, TL_{100}, EIRP Horizontal polarization

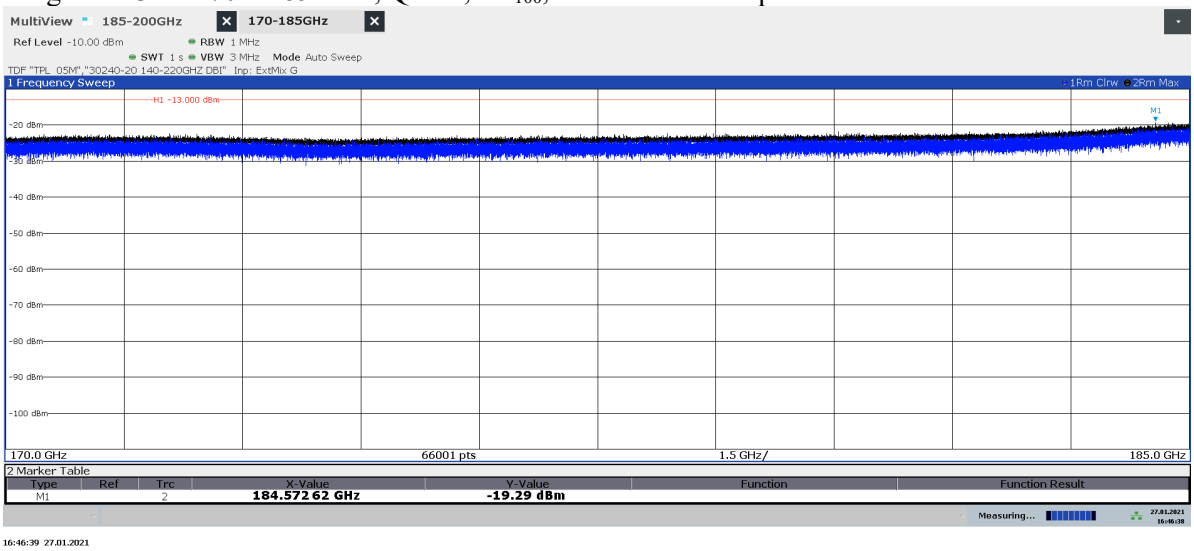


Diagram 2.34b: 170 – 185 GHz, QPSK, TL_{100}, EIRP Vertical polarization

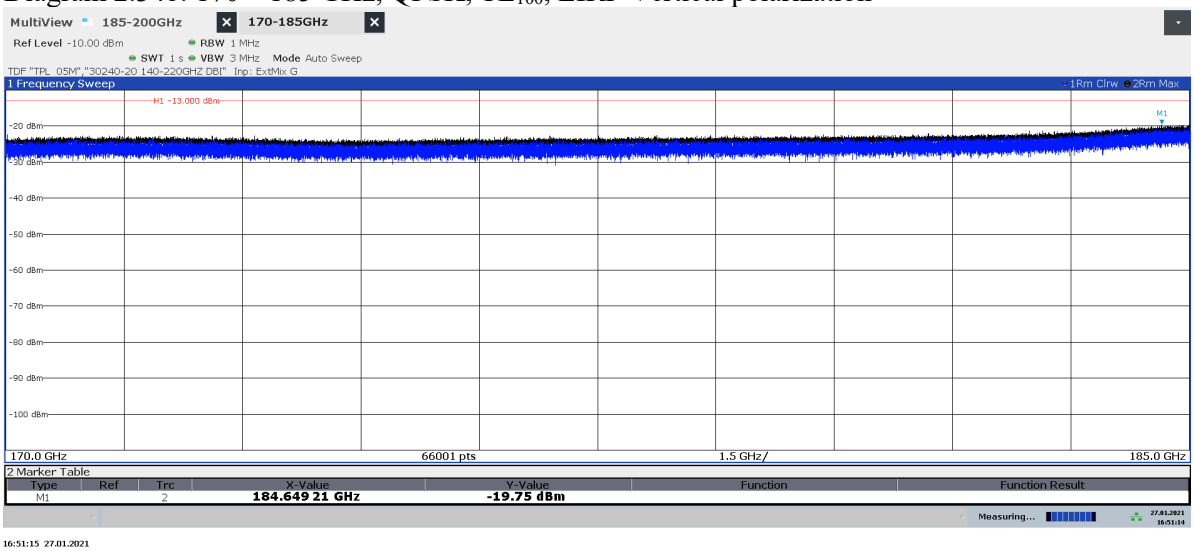


Diagram 2.35a: 170 – 185 GHz, QPSK, $BL8_{100}$, EIRP Horizontal polarization

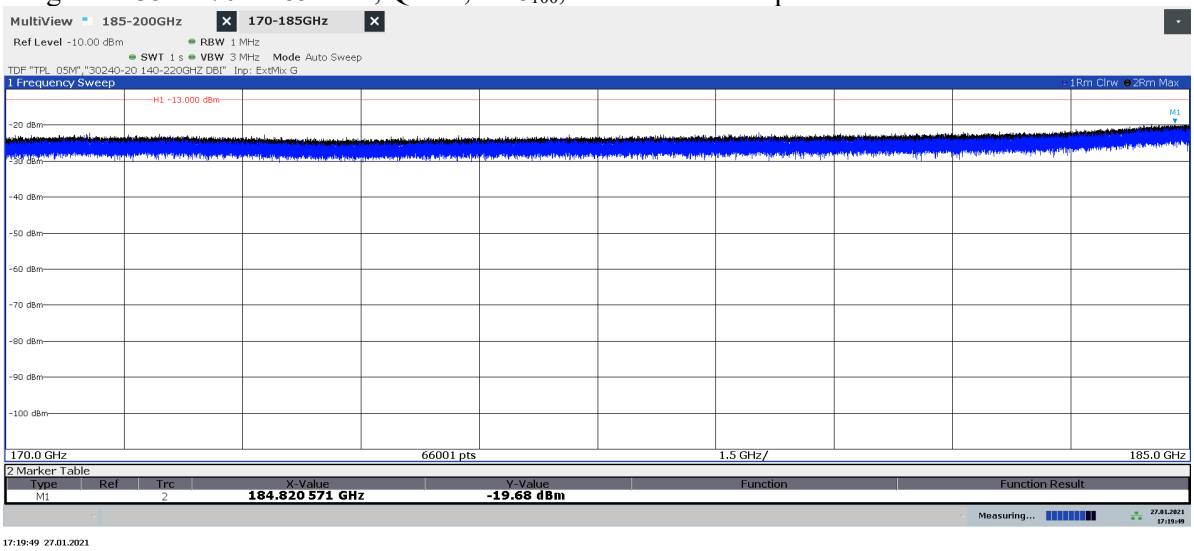


Diagram 2.35b: 170 – 185 GHz, QPSK, $BL8_{100}$, EIRP Vertical polarization

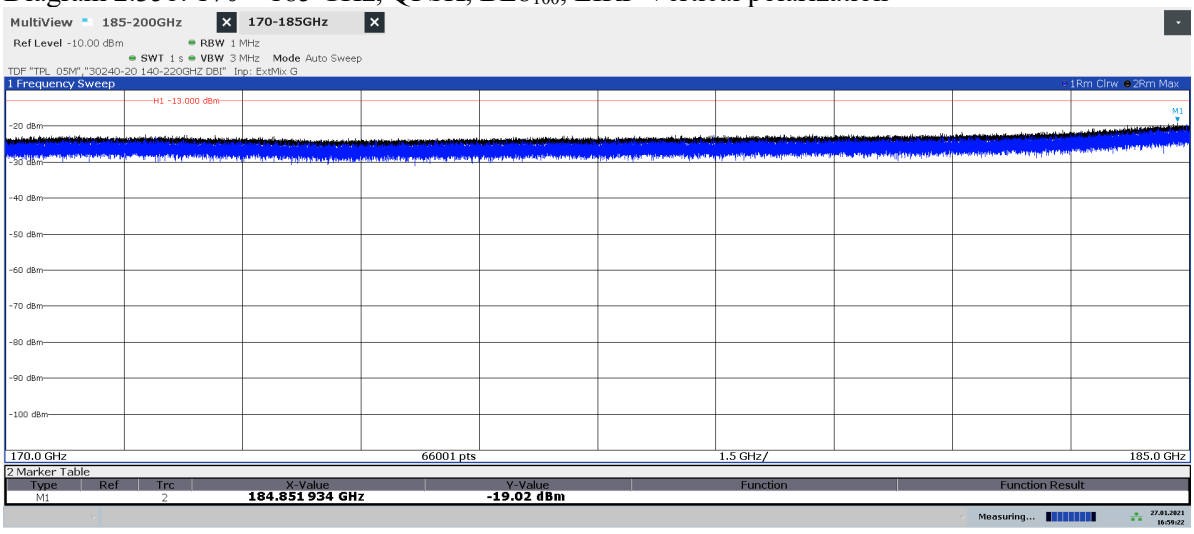


Diagram 2.36a: 185 – 200 GHz, QPSK, TL_{100}, EIRP Horizontal polarization

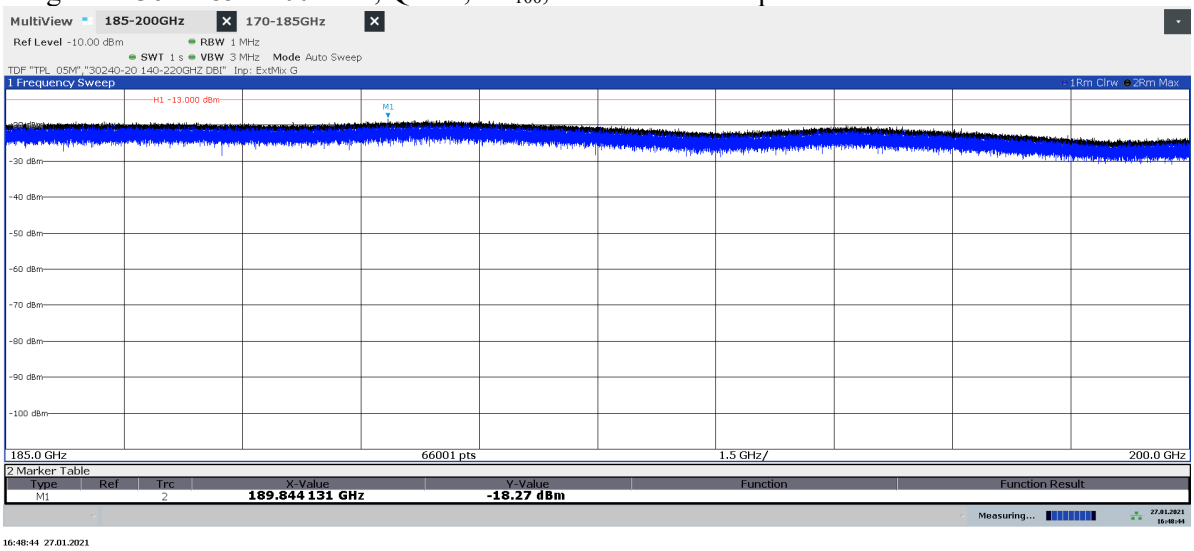


Diagram 2.36b: 185 – 200 GHz, QPSK, TL_{100}, EIRP Vertical polarization

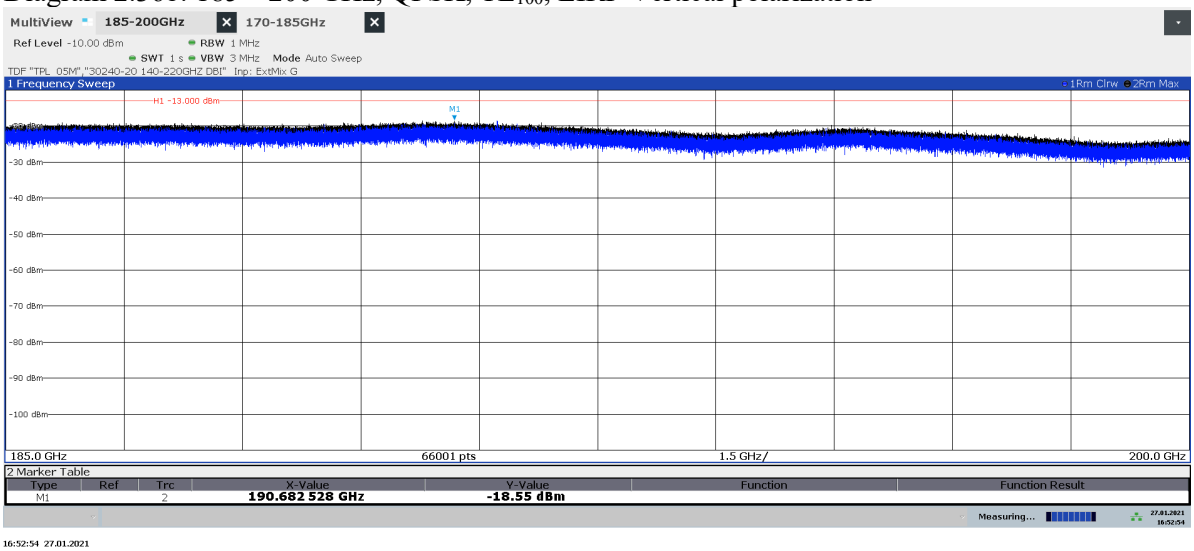


Diagram 2.37a: 185 – 200 GHz, QPSK, $BL8_{100}$, EIRP Horizontal polarization

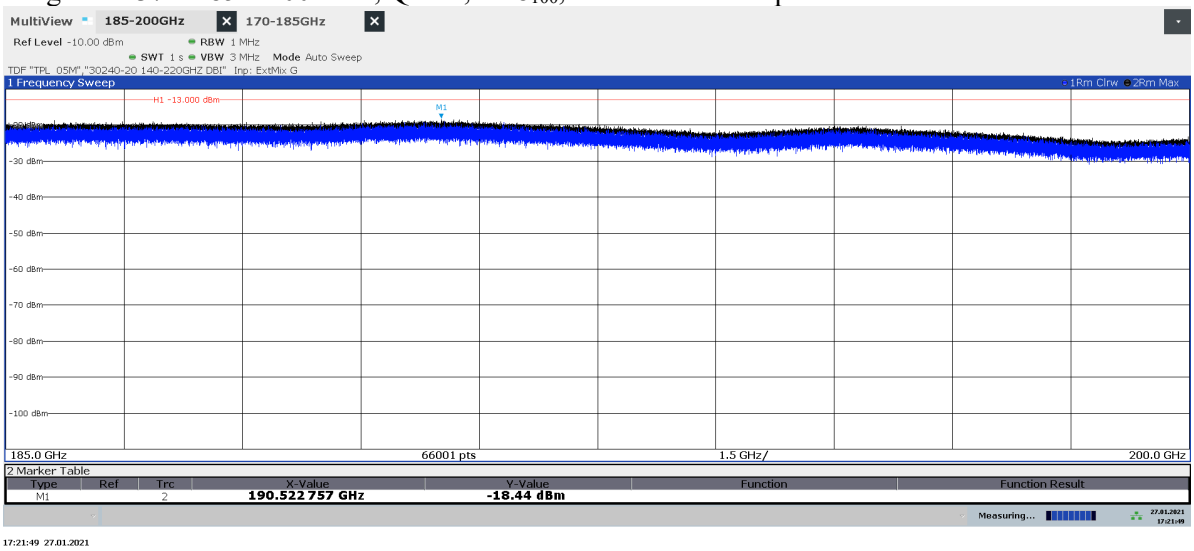
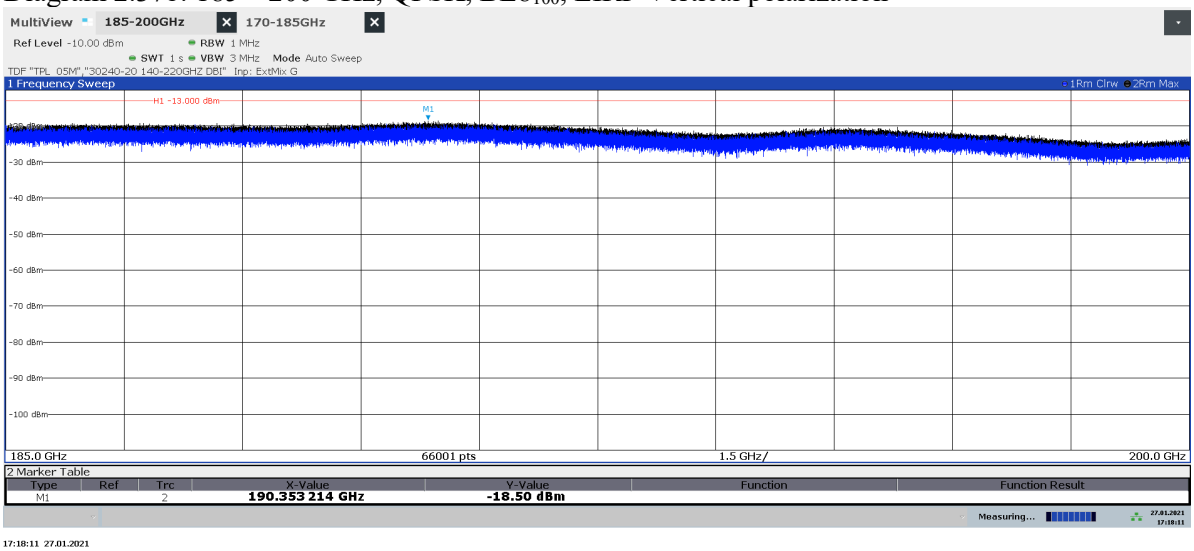


Diagram 2.37b: 185 – 200 GHz, QPSK, $BL8_{100}$, EIRP Vertical polarization



Frequency stability measurements according to 47 CFR §2.1055

Date	Temperature (test equipment)	Humidity (test equipment)
2021-12-16	23 °C ± 3 °C	37 % ± 5 %
2021-12-17	23 °C ± 3 °C	35 % ± 5 %
2021-12-20	23 °C ± 3 °C	30 % ± 5 %

Test set-up and procedure

The measurements were made per definition in ANSI C63.26, 5.6.

A temperature chamber with a RF transparent door was used and a measurement antenna was aligned outside the temperature chamber. The option NR 5G downlink measurements K144 in the spectrum analyser was used to demodulate the signal and report the frequency error.

Measurement equipment	RISE number
R&S FSW 43	902 073
RF Cable	BX50236
EMCO Horn Antenna 3116	503 279
Temperature Chamber	503 360
Testo 635, temperature and humidity meter	504 203
Multimeter Fluke 87	502 190

Results

Nominal transmitter frequency was 37025.04 MHz (BL) with a carrier bandwidth of 50 MHz.

Test conditions		Frequency error (Hz)
Supply voltage DC (V)	Temp. (°C)	
40.8	+20	-56
55.2	+20	-57
48.0	+20	-63
48.0	+30	-55
48.0	+40	-51
48.0	+50	-55
48.0	+10	-60
48.0	0	-53
48.0	-10	-49
48.0	-20	-56
48.0	-30	-53
Maximum freq. error (Hz)		63
Measurement uncertainty		$< \pm 1 \times 10^{-7}$

Remark

The frequency stability performance is sufficient to ensure that the fundamental emission stays within the authorized frequency band.

End of report.