REPORT

issued by an Accredited Testing Laboratory

Contact person RISE
Björn Skönvall
Safety and Transport
+46 10 516 51 23
bjorn.skonvall@ri.se

Date	Reference	Page
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Ericsson AB
Anders Karlsson
BURA DURA RP QRM
Torshamnsgatan 21
164 80 Stockholm

Radio measurements on AIR 1281 B258A

Product name: AIR 1281 B258A
Product number: KRD 901 189/5

RISE Research Institutes of Sweden AB
Department Vehicles and Automation

Performed by

Björn Skönvall

Examined by

Daniel Lundgren

Accred. No. 1002
Testing
ISO/IEC 17025

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Summary

Standard Listed part of	Compliant
FCC CFR 47 part 2/ 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 B258A Product number: KRD 901 189/5 containing KRX 101 05/1 Rev. R1A with FCC-ID TA8AKRX10105
Hardware revision state:	R1A
Tested configuration:	3GPP NR TDD
Frequency range:	TX/ RX: 24.25 – 24.45 and 24.75 – 25.25 GHz
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: up to 600MHz (2 segments of up to 400 MHz) Config mode 2: up to 400MHz (1 segment of up to 400 MHz)
Nominal Output power (EIRP):	Config mode 1: 47 dBm/ beam and polarization Config mode 2: 53 dBm/ beam and polarization
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 Carrier Aggregation (CA) Inter-band supported
Antenna beam steering:	Azimuth ±60 deg, elevation ±15 deg
Channel bandwidth(s)/ Sub Carrier Spacing:	50, 100 and 200 MHz/ 120 kHz
Modulations:	QPSK, 16QAM and 64QAM
Emission designators:	45M9W7D, 94M7W7D and 190MW7D
Emission designators Carrier Aggregation:	Intra-band Maximum 494MW7D (5x100 MHz) Inter-band Maximum 590MW7D (6x100 MHz)
RF power Tolerance:	+2.4/ -2.0 dB
CPRI Speed	24.3 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 120 VAC 60 Hz by an external power supply. Additional connections are documented in the setup drawings for radiated measurements.

Evaluation of spurious emissions have been done in several beam directions, including extreme settings both in azimuth and elevation planes. Results have shown that Beam index 0/Boresight can represent worst case.

Far field distance for power, OBW and Band edge measurements is 3.1 m, based on the EUT antenna dimensions and the highest transmitter frequency (25.25 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	5
26.5 – 40	0.48	5
40 – 60	0.34	3
60 – 80	0.22	1
80 – 100	0.17	1

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

$R = 2x\ D^2/\ \lambda$

References

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

CFR 47 part 30, Apr 2019
Proposed rule change in FR Document number: 2021-10536
ANSI C63.26-2015
KDB 842590 D01 Upper Microwave Flexible Use Service v01r02
KDB 971168 D01 Power Meas License Digital Systems v03r01
KDB 971168 D03 IM Emission Repeater Amp v01
3GPP TR 38.141-2 V15.5.0
3GPP TR 37.842 V13.3.0 (2020-01)

Measurement equipment

	Calibration Due	RISE number
Anechoic chamber, Hertz	2024-07	BX50194
R&S FSW 43	2022-07	902 073
R&S ESU 26	2022-07	901 553
R&S ZNB 40	2022-08	BX50051
RF Cable VNA-calibration	2022-01	BX50189
RF Cable VNA-calibration	2022-01	BX50190
RF Cable	2022-04	BX50236
RF Cable	2022-10	BX50192
RF Cable	2022-04	KWP04236
RF Cable	2022-05	BX81423
RF Cable	2022-09	503 681
RF Cable FSW-B21	2022-09	BX62069
RF Cable FSW-B21	2022-09	BX62073
Bilog antenna Schaffner 6143A	2024-07	504 079
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
Mixer FS-Z60	2023-08	BX90566
Mixer FS-Z90	2022-01	BX90567
Mixer FS-Z110	2024-01	BX81425
Miteq, Low Noise Amplifier	2022-01	503 278
EMCO Horn Antenna 3115	2024-07	502 175
EMCO Horn Antenna 3115	2024-11	902 212
EMCO Horn Antenna 3116	2024-06	503 279
µComp Nordic, Low Noise Amplifier	2022-01	901 544
Temperature and humidity meter, Testo 615	2022-06	503 498
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
Eravant SCF-21306340-SFSF-B3 Bandpass filter	2022-09	04881-01
Eravant SCF-34312340-KFKF-B3 Bandpass filter	2022-09	04876-01

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: 2021-10-28.

Manufacturer’s representative

Patrik Hellström, Ericsson AB.

Test engineers

Tomas Lennhager and Björn Skönvall, RISE

Test participant(-s)

None

Test frequencies used for radiated measurements

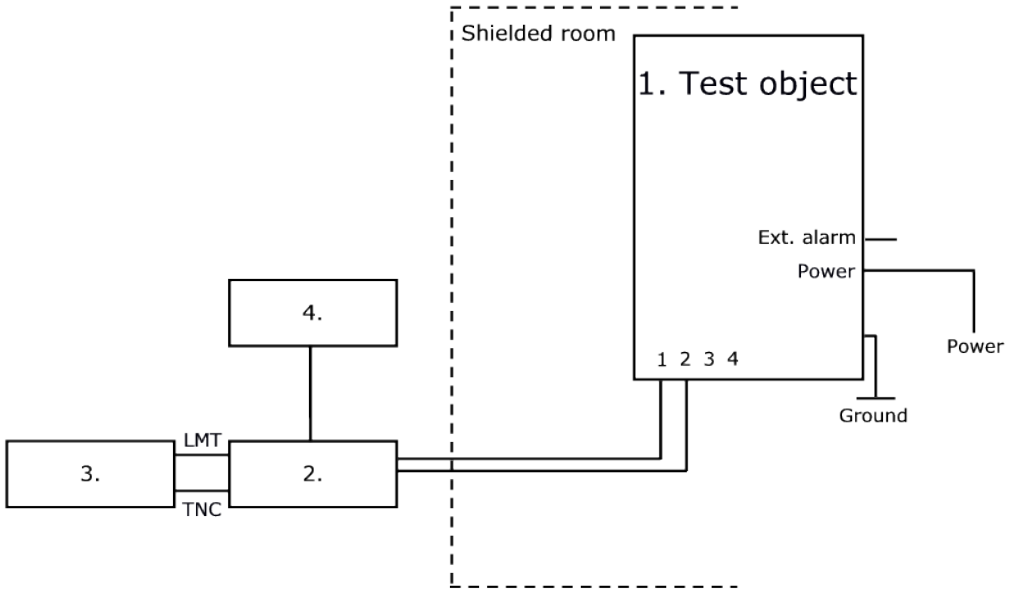
Config mode 2

Symbolic name	Beam/ Carrier	Frequency Hor/ Ver [MHz]	Comment
BL_{50}	B1/C1	24275.04	50 MHz BW, TX bottom frequency configuration lower band
TL_{50}	B1/C1	24425.04	50 MHz BW, TX top frequency configuration lower band
BH_{50}	B1/C1	24775.08	50 MHz BW, TX bottom frequency configuration higher band
MH_{50}	B1/C1	24999.96	50 MHz BW, TX mid frequency configuration higher band
TH_{50}	B1/C1	25225.08	50 MHz BW, TX top frequency configuration higher band
BL_{100}	B1/C1	24300.00	100 MHz BW, TX bottom frequency configuration lower band
TL_{100}	B1/C1	24399.96	100 MHz BW, TX top frequency configuration lower band
BH_{100}	B1/C1	24800.04	100 MHz BW, TX bottom frequency configuration higher band
MH_{100}	B1/C1	24999.96	100 MHz BW, TX mid frequency configuration higher band
TH_{100}	B1/C1	25200.00	100 MHz BW, TX top frequency configuration higher band
ML_{200}	B1/C1	24350.04	200 MHz BW, TX mid frequency configuration lower band
BH_{200}	B1/C1	24850.08	200 MHz BW, TX bottom frequency configuration higher band
MH_{200}	B1/C1	24999.96	200 MHz BW, TX mid frequency configuration higher band
TH_{200}	B1/C1	25150.08	200 MHz BW, TX top frequency configuration higher band
$TH2_{100}$	B1/C1 B1/C2	25050.00 25200.00	100 MHz BW, 2 carrier, TX top frequencies configuration top band 50 MHz separation
$BH4_{100}$	B1/C1 B1/C2 B1/C3 B1/C4	24800.04 24900.00 25000.08 25100.04	100 MHz BW, 4 carrier, TX Bottom frequencies configuration higher band
$BimL_{50}$	B1/C1 B1/C2 B1/C3	24275.04 24325.08 24425.04	50 MHz BW, 3 carrier, TX bottom frequencies configuration lower band
$TimL_{50}$	B1/C1 B1/C2 B1/C3	24275.04 24375.00 24425.04	50 MHz BW, 3 carrier, TX top frequencies configuration lower band
$BimH_{50}$	B1/C1 B1/C2 B1/C3	24775.08 24825.00 25125.00	50 MHz BW, 3 carrier, TX bottom frequencies configuration higher band
$TimH_{50}$	B1/C1 B1/C2 B1/C3	24875.04 25175.04 25225.08	50 MHz BW, 3 carrier, TX top frequencies configuration higher band

Config mode 1

Symbolic name	Beam/ Carrier	Frequency Hor/ Ver [MHz]	Comment
$BT8_{50}$	B1/C1 B1/C2 B1/C3 B1/C4 B2/C1 B2/C2 B2/C3 B2/C4	24275.04 24325.08 24375.00 24425.04 25075.08 25125.00 25175.04 25225.08	50 MHz BW, 8 carrier, bottom and top frequencies configuration
$CA5_{100}$	B1/C1 B1/C2 B1/C3 B1/C4 B2/C1	24800.04 24900.00 25000.08 25100.04 25200.00	100MHz BW, 5 carrier max aggregation Intra-band
$CA6_{100}$	B2/C1 B2/C2 B1/C1 B1/C2 B1/C3 B1/C4	24300.04 24399.96 24800.04 24900.00 24999.96 25100.04	100MHz BW, 6 carrier max aggregation Inter-band

Test setup: radiated measurements



Test object:

1.	AIR 1281 B258A, KRD 901 189/5, rev. R1A, s/n: E23D292470 Radio Software: CXP 203 0045/1, rev. R10C682 including KRX 101 05/1, rev. R1A with FCC ID: TA8AKRX10105

Associated equipment:

2.	Testing Equipment: Baseband 6648, KDU 137 00 15/1, rev. R3C, s/n: E23C586826, With software CXP2010174/1 rev. R38A130

Functional test equipment:

2.	Computer, HP ZBook, BAMS - 1001530471

Interfaces:

Power input configuration AC 120 VAC 60 Hz	Power
EXT Alarm, shielded multi-wire	Signal
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, not used in this configuration	Signal
4, Optical Interface Link, single mode opto fibre, not used in this configuration	Signal
Ground wire	Ground

RF power output measurements according to CFR 47 §30.202

Date	Temperature	Humidity
2021-11-03	24 °C ± 3 °C	41 % ± 5 %
2021-11-04	23 °C ± 3 °C	37 % ± 5 %
2021-11-20	21 °C ± 3 °C	20 % ± 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).

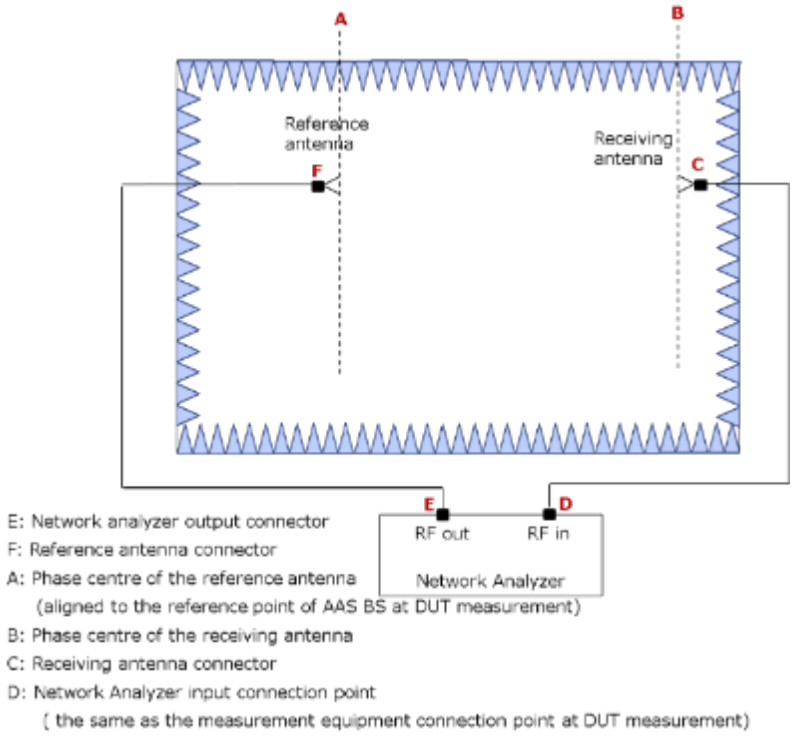


Figure 1: Indoor Anechoic Chamber calibration system setup for EIRP

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:

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

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	BX92413
RF Cable	KWP04236
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	B1/C1
BL50	52.17/ 53.25
TL50	52.06/ 53.71
BH50	51.40/ 53.12
MH50	52.39/ 54.25
TH50	52.07/ 53.54

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	B1/C1
BL_{100}	51.63/ 52.85
TL_{100}	52.16/ 53.52
BH_{100}	51.23/ 52.74
MH_{100}	52.51/ 54.01
TH_{100}	52.02/ 53.45

Beam index 0 Bore site, Bandwidth 200MHz, QPSK
Nominal rated output power (EIRP) per Beam: 53 dBm/ Polarization.

	Output power per 100 MHz, EIRP [RMS dBm] Vertical/ Horizontal		
Symbolic name	B1/C1	B1/C1	Total (per 200 MHz)
ML_{200}	49.22/ 50.95	49.66/ 50.84	52.45/ 53.91
BH_{200}	48.90/ 50.76	49.64/ 51.06	52.30/ 53.92
MH_{200}	49.39/ 51.55	49.94/ 51.61	52.68/ 54.59
TH_{200}	50.97/ 49.28	50.77/ 49.66	53.88/ 52.49

Peak to Average Power Ratio – (PAPR)

Symbolic name	B1/C1 [dB]
BL_{50}	10.05
BL_{100}	9.97
BL_{200}	10.04

Multi carrier

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	B1/C1	B1/C2	B1/C3	B1/C4	Total (per 400 MHz)
$BH4_{100}$	46.23/ 48.29	45.87/ 47.98	47.09/ 48.70	46.48/ 48.19	52.46/ 54.32

8-Carrier Config mode 1

Beam index 0 Boresight, Carrier Bandwidth 50 MHz, QPSK
Nominal rated output power (EIRP) per Beam: 47 dBm/ Polarization.

	Output power per 100 MHz, EIRP [RMS dBm] Vertical/ Horizontal					
Symbolic name	B1/C1 B1/C2	B1/C3 B1/C4	Total Power Beam 1 (per 200 MHz)	B2/C1 B2/C2	B2/C3 B2/C4	Total power Beam 2 (per 200 MHz)
$BT8_{50}$	43.54/ 44.77	44.21/ 44.98	46.90/ 47.88	43.83/ 44.83	44.16/ 44.35	47.00/ 47.60

5-Carrier Config mode 1

Beam index 0 Boresight, Carrier Bandwidth 100 MHz, QPSK
Nominal rated output power (EIRP) per Beam: 47 dBm/ Polarization.

	Output power per 100 MHz, EIRP [RMS dBm] Vertical/ Horizontal					
Symbolic name	B1/C1	B1/C2	B1/C3	B1/C4	Total Power Beam 1 (per 400 MHz)	Total Power Beam 2 B2/C1
$CA5_{100}$	40.68/ 42.05	40.21/ 41.75	41.72/ 42.50	41.18/ 42.42	47.01/ 48.21	46.39/ 47.24

6-Carrier Config mode 1

Beam index 0 Boresight, Carrier Bandwidth 100 MHz, QPSK
Nominal rated output power (EIRP) per Beam: 47 dBm/ Polarization.

	Output power per 100 MHz, EIRP [RMS dBm] Vertical/ Horizontal							
Symbolic name	B1/C1	B1/C2	Total Power Beam 1 (per 200 MHz)	B2/C1	B2/C2	B1/C3	B1/C4	Total Power Beam 2 (per 400 MHz)
$CA6_{100}$	43.93/ 45.07	44.54/ 45.46	47.26/ 48.23	41.22/ 41.99	40.63/ 41.65	41.95/ 42.14	41.14/ 41.30	47.28/ 47.55

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 CFR 47 §2.1049

Date	Temperature	Humidity
2021-11-03	24 °C ± 3 °C	41 % ± 5 %
2021-11-04	23 °C ± 3 °C	37 % ± 5 %
2021-11-20	22 °C ± 3 °C	22 % ± 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, measurement distance 5m:

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	BX92413
RF Cable	KWP04236
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	TH_{50}	Hor	45.881
1.2	TH_{50}	Ver	45.905

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

Diagram	Symbolic name	Polarization	Occupied BW (99%) [MHz]
1.3	BH_{100}	Hor	94.654
1.4	BH_{100}	Ver	94.683

Single carrier, Config mode 2, Bandwidth: 200MHz Modulation: QPSK

Diagram	Symbolic name	Polarization	Occupied BW (99%) [MHz]
1.5	TH_{200}	Hor	189.430
1.6	TH_{200}	Ver	189.697

Carrier Aggregation contiguous spectrum, Intra-band

Config mode 1, Bandwidth: 5x 100MHz, Modulation: QPSK

Diagram	Symbolic name	Polarization	Occupied BW (99%) [MHz]
1.7	$CA5_{100}$	Hor	494.101
1.8	$CA5_{100}$	Ver	494.330

Carrier Aggregation non-contiguous spectrum, Inter-band

Band 24250MHz-24450MHz
Config mode 1, Bandwidth: 2x 100MHz, Modulation: QPSK

Diagram	Symbolic name	Polarization	Occupied BW (99%) [MHz]
1.9	$CA6_{100}$	Hor	194.816
1.10	$CA6_{100}$	Ver	194.404

Band 24750MHz-25250MHz
Config mode 1, Bandwidth: 4x 100MHz, Modulation: QPSK

Diagram	Symbolic name	Polarization	Occupied BW (99%) [MHz]
1.11	$CA6_{100}$	Hor	395.130
1.12	$CA6_{100}$	Ver	394.461

Total aggregated bandwidth, Inter-band: 589,946 MHz

Diagram 1.1, Symbolic name: TH_{50}, QPSK, Horizontal:

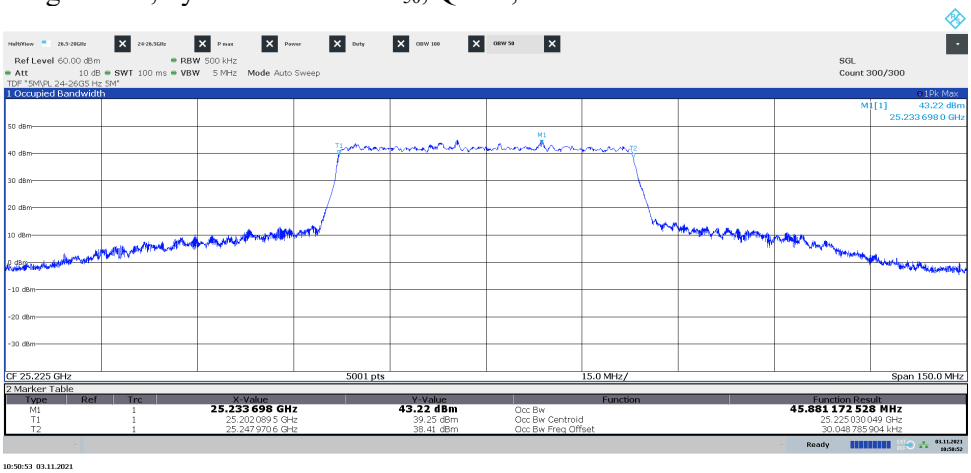


Diagram 1.2, Symbolic name: TH_{50}, QPSK, Vertical:

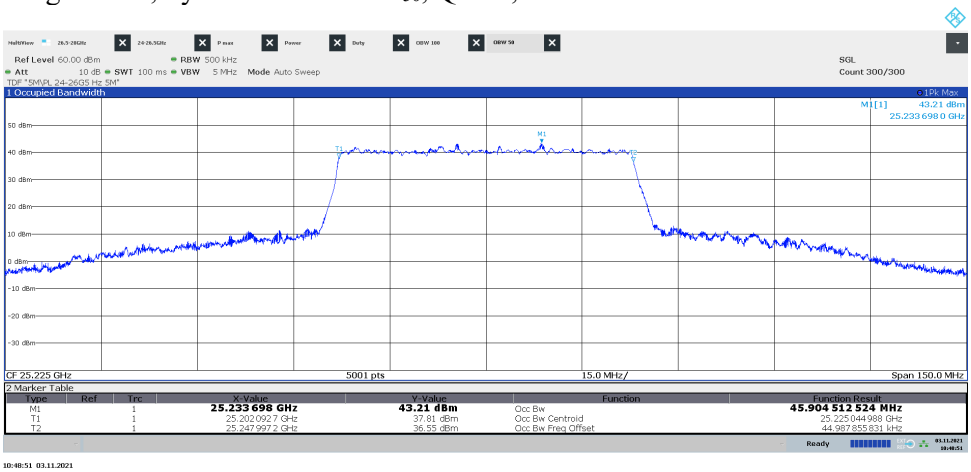


Diagram 1.3, Symbolic name: BH_{100}, QPSK, Horizontal:

Diagram 1.4, Symbolic name: BH_{100}, QPSK, Vertical:

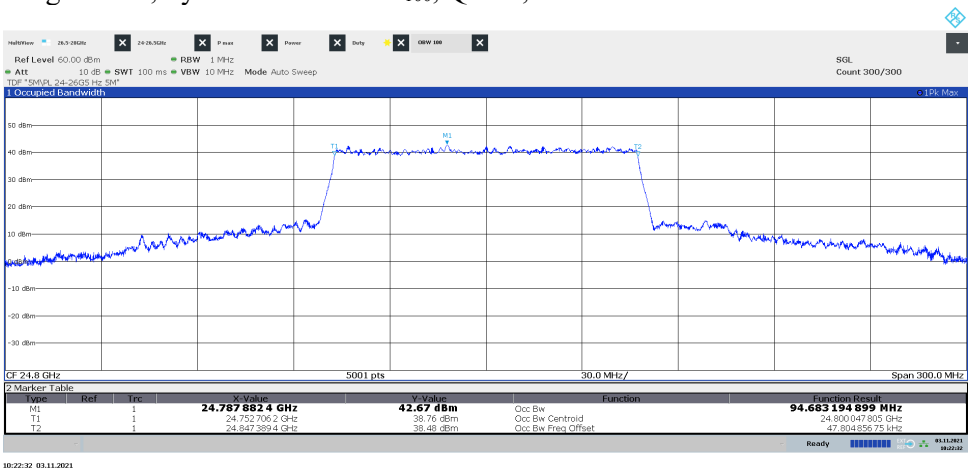


Diagram 1.5, Symbolic name: TH_{200}, QPSK, Horizontal:

Diagram 1.6, Symbolic name: TH_{200}, QPSK, Vertical:

Diagram 1.7, Symbolic name: $CA5_{100}$, QPSC, Horizontal:

Diagram 1.8, Symbolic name: $CA5_{100}$, QPSK, Vertical:

Diagram 1.9, Symbolic name: $CA6_{100}$, QPSK, Horizontal:
Lower 200MHz

Diagram 1.10, Symbolic name: $CA6_{100}$, QPSK, Vertical:
Lower 200MHz

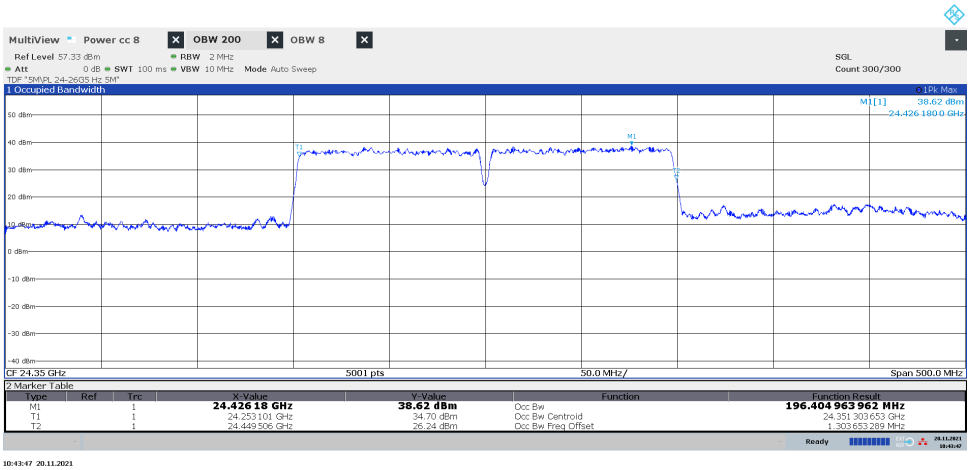


Diagram 1.11, Symbolic name: CA6$_{100}$, QPSK, Horizontal:
Higher 400MHz

Diagram 1.12, Symbolic name: CA6$_{100}$, QPSK, Vertical:
Higher 400MHz

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

Date	Temperature	Humidity
2021-11-05	23 °C ± 3 °C	29 % ± 5 %
2021-11-08	23 °C ± 3 °C	31 % ± 5 %
2021-11-09	23 °C ± 3 °C	33 % ± 5 %
2021-11-10	24 °C ± 3 °C	25 % ± 5 %
2021-11-11	23 °C ± 3 °C	19 % ± 5 %
2021-11-12	24 °C ± 3 °C	22 % ± 5 %
2021-11-20	22 °C ± 3 °C	23 % ± 5 %
2021-11-21	22 °C ± 3 °C	22 % ± 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 – 100 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 and for 60 – 100 GHz D was 1.0m.

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).

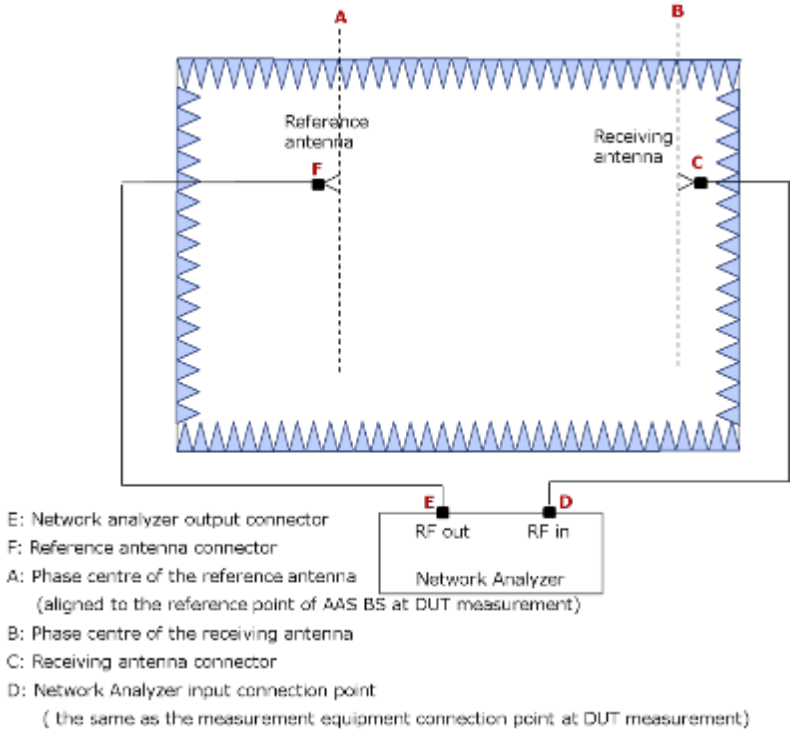


Figure 1: Indoor Anechoic Chamber calibration system setup for EIRP

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 D01.

Measurement equipment

Measurement equipment	RISE number
Anechoic chamber, Hertz	BX50194
R&S FSW 43	902 073
R&S ESU 26	901 553
R&S ZNB 40	BX50051
EMCO Horn Antenna 3116	503 279
Bilog antenna Schaffner 6143	504 079
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
Mixer FS-Z60	BX90566
Mixer FS-Z90	BX90567
Mixer FS-Z110	BX81425
Miteq, Low Noise Amplifier	503 278
EMCO Horn Antenna 3115	502 175
EMCO Horn Antenna 3115	902 212
µComp Nordic, Low Noise Amplifier	901 544
RF Cable	KWP04236
RF Cable	503 681
RF Cable FSW-B21	BX62069
RF Cable FSW-B21	BX62073
Temperature and humidity meter, Testo 615	503 498

EAB Measurement equipment

Calibrated at RISE before testing.

	S/N
Eravant SCF-21306340-SFSF-B3 Bandpass filter	04881-01
Eravant SCF-34312340-KFKF-B3 Bandpass filter	04876-01

Results

Evaluation of spurious emissions have been done in several beam directions, including extreme settings both in azimuth and elevation planes. Results have shown that Beam index 0/Boresight can represent worst case.

The diagrams represents worst case configurations (Beam index 0 /Boresight) for each frequency range.
Config mode 2

Diagram	Symbolic name	Pol	Frequency range	Measurement method	"Early exit?"
2.1a	BH_{50}	Hor	30-1000 MHz	Pre scan Max hold EIRP	Yes
2.1b	BH_{50}	Ver	30-1000 MHz	Pre scan Max hold EIRP	Yes
2.2a	BH_{50}	Hor	1-18 GHz	Pre scan Max hold EIRP	Yes
2.2b	BH_{50}	Ver	1-18 GHz	Pre scan Max hold EIRP	Yes
2.3a	$TimL_{50}$	Hor	18-23 GHz 23-23.6 GHz 23.6-24 GHz	Pre scan Max hold EIRP	No Yes Yes[2]
2.3b	$TimL_{50}$	Ver	18-23 GHz 23-23.6 GHz 23.6-24 GHz	Pre scan Max hold EIRP	No Yes Yes[2]
2.3c	$TimL_{50}$	Hor/ Ver	22.8-22.9 GHz	Two cut TRP	Compliant to TRP limit
2.4a	$BimL_{50}$	Hor	18-23.4 GHz 23.4-24 GHz	Pre scan Max hold EIRP	Yes[1] No
2.4b	$BimL_{50}$	Ver	18-23.4 GHz 23.4-24 GHz	Pre scan Max hold EIRP	Yes[1] No
2.4c	$BimL_{50}$	Hor/Ver	23.6-24 GHz	Two cut TRP	Compliant to TRP limit
2.4d	$BimL_{50}$	Hor	23.6-24 GHz	Pre scan Max hold EIRP	No
2.4e	$BimL_{50}$	Ver	23.6-24 GHz	Pre scan Max hold EIRP	No
2.4f	$BimL_{50}$	Hor/ Ver	23.6-24GHz	Two cut TRP	Compliant to TRP limit[3]
2.5a	BH_{50}	Hor	18-23.4 GHz 23.4-24 GHz	Pre scan Max hold EIRP	Yes[1] No
2.5b	BH_{50}	Ver	18-23.4 GHz 23.4-24 GHz	Pre scan Max hold EIRP	Yes[1] No
2.5c	BH_{50}	Hor/ Ver	23.86-23.96 GHz	Two cut TRP	Compliant to TRP limit

[1)] Compliant (5x LO) to TRP limit based on Lower EIRP compared to $TimL_{50}$ (Diagram 2.3)
[2)] Compliant to TRP limit based on Lower EIRP compared to $BimL_{50}$ (Diagram 2.4)
[3)] Compliant to proposed rule change in FR Document Number: 2021-10536, Table 1—WRC-19 Resolution 750 Unwanted Emissions Permitted Within Any 200 Megahertz in the 23.6-24 GHz Passive Band "Current TRP limit IMT Base Stations: -33dBW"

Diagram	Symbolic name	Pol	Frequency range	Measurement method	"Early exit?"
2.6a	BL_{50}	Hor	24-26.5 GHz	Pre scan Max hold EIRP	No
2.6b	BL_{50}	Ver	24-26.5 GHz	Pre scan Max hold EIRP	No
2.6c	BL_{50}	Hor	24-24.25 GHz	Pre scan average EIRP	Yes[4]
2.6d	BL_{50}	Ver	24-24.25 GHz	Pre scan average EIRP	Yes[4]
2.7a	$BimL_{50}$	Hor	24-24.45 GHz 24.45-26.5 GHz	Pre scan Max hold EIRP	No Yes[4]
2.7b	$BimL_{50}$	Ver	24-24.45 GHz 24.45-26.5 GHz	Pre scan Max hold EIRP	No Yes[4]
2.7c	$BimL_{50}$	Hor	24-24.25 GHz	Pre scan average EIRP	No
2.7d	$BimL_{50}$	Ver	24-24.25 GHz	Pre scan average EIRP	No
2.7e	$BimL_{50}$	Hor/ Ver	24-24.25 GHz	Pattern multiplication TRP	Compliant to TRP limit
2.8a	TL_{50}	Hor	24-26.5 GHz	Pre scan Max hold EIRP	No
2.8b	TL_{50}	Ver	24-26.5 GHz	Pre scan Max hold EIRP	No
2.8c	TL_{50}	Hor	24.45-25.4 GHz	Pre scan average EIRP	Yes[4]
2.8d	TL_{50}	Ver	24.45-25.4 GHz	Pre scan average EIRP	Yes[4]
2.9a	BH_{50}	Hor	24-26.5 GHz	Pre scan Max hold EIRP	No
2.9b	BH_{50}	Ver	24-26.5 GHz	Pre scan Max hold EIRP	No
2.9c	BH_{50}	Hor	24-24.75 GHz	Pre scan average EIRP	Yes[4]
2.9d	BH_{50}	Ver	24-24.75 GHz	Pre scan average EIRP	Yes[4]

[1)] Compliant (5x LO) to TRP limit based on Lower EIRP compared to $TimL_{50}$ (Diagram 2.3)
[4)] Calculated conducted power based on antenna gain below limit
[5)] Compliant to TRP limit based on Lower EIRP compared to BH_{50} (Diagram 2.5)

Diagram	Symbolic name	Pol	Frequency range	Measurement method	"Early exit?"
2.10a	TH_{50}	Hor	24-25.25 GHz 25.25-26.5 GHz	Pre scan Max hold EIRP	Yes[4] No
2.10b	TH_{50}	Ver	24-25.25 GHz 25.25-26.5 GHz	Pre scan Max hold EIRP	Yes[4] No
2.10c	TH_{50}	Hor	25.25-26.5 GHz	Pre scan average EIRP	Yes[4]
2.10d	TH_{50}	Ver	25.25-26.5 GHz	Pre scan average EIRP	Yes[4]
2.11a	$TH2_{100}$	Hor	24-25.25 GHz 25.25-26.5 GHz	Pre scan Max hold EIRP	Yes[4] No
2.11b	$TH2_{100}$	Ver	24-25.25 GHz 25.25-26.5 GHz	Pre scan Max hold EIRP	Yes[4] No
2.11c	$TH2_{100}$	Hor	25.25-26.5 GHz	Pre scan average EIRP	No
2.11d	$TH2_{100}$	Ver	25.25-26.5 GHz	Pre scan average EIRP	No
2.11e	$TH2_{100}$	Hor/ Ver	25.25-25.65 GHz	Pattern multiplication TRP	Compliant to TRP limit
2.12a	BL_{50}	Hor	26.5-28 GHz	Pre scan Max hold EIRP	Yes
2.12b	BL_{50}	Ver	26.5-28 GHz	Pre scan Max hold EIRP	Yes
2.13a	TH_{50}	Hor	28-40 GHz	Pre scan Max hold EIRP	Yes
2.13b	TH_{50}	Ver	28-40 GHz	Pre scan Max hold EIRP	No
2.13c	TH_{50}	Hor/Ver	28.24-28.36GHz	Two cut TRP	Compliant to TRP limit
2.14a	BH_{50}	Hor	40-60 GHz	Pre scan Max hold EIRP	Yes
2.14b	BH_{50}	Ver	40-60 GHz	Pre scan Max hold EIRP	Yes
2.15a	BH_{50}	Hor	60-80 GHz	Pre scan Max hold EIRP	Yes
2.15b	BH_{50}	Ver	60-80 GHz	Pre scan Max hold EIRP	Yes
2.16a	BH_{50}	Hor	80-100 GHz	Pre scan Max hold EIRP	Yes
2.16b	BH_{50}	Ver	80-100 GHz	Pre scan Max hold EIRP	Yes

[4)] Calculated conducted power based on antenna gain below limit

Config mode 1

Diagram	Symbolic name	Pol	Frequency range	Measurement method	"Early exit?"
2.17a	$BT8_{50}$	Hor	30-1000 MHz	Pre scan Max hold EIRP	Yes
2.17b	$BT8_{50}$	Ver	30-1000 MHz	Pre scan Max hold EIRP	Yes
2.18a	$BT8_{50}$	Hor	1-18 GHz	Pre scan Max hold EIRP	Yes
2.18b	$BT8_{50}$	Ver	1-18 GHz	Pre scan Max hold EIRP	Yes
2.19a	$BT8_{50}$	Hor	18-24 GHz	Pre scan Max hold EIRP	Yes[1]
2.19b	$BT8_{50}$	Ver	18-24 GHz	Pre scan Max hold EIRP	Yes[1]
2.20a	$BT8_{50}$	Hor	24-26.5 GHz	Pre scan Max hold EIRP	No
2.20b	$BT8_{50}$	Ver	24-26.5 GHz	Pre scan Max hold EIRP	No
2.20c	$BT8_{50}$	Hor	24-24.25 GHz	Pre scan average EIRP	Yes[4,6]
2.20d	$BT8_{50}$	Ver	24-24.25 GHz	Pre scan average EIRP	Yes[4,6]
2.20e	$BT8_{50}$	Hor	25.25-26.5 GHz	Pre scan average EIRP	Yes[4,7]
2.20f	$BT8_{50}$	Ver	25.25-26.5 GHz	Pre scan average EIRP	Yes[4,7]
2.21a	$BT8_{50}$	Hor	26-28 GHz	Pre scan Max hold EIRP	Yes
2.21b	$BT8_{50}$	Ver	26-28 GHz	Pre scan Max hold EIRP	Yes
2.22a	$BT8_{50}$	Hor	28-40GHz	Pre scan Max hold EIRP	Yes
2.22b	$BT8_{50}$	Ver	28-40GHz	Pre scan Max hold EIRP	Yes
2.23a	$BT8_{50}$	Hor	40-60GHz	Pre scan Max hold EIRP	Yes
2.23b	$BT8_{50}$	Ver	40-60GHz	Pre scan Max hold EIRP	Yes
2.24a	$BT8_{50}$	Hor	60-80GHz	Pre scan Max hold EIRP	Yes
2.24b	$BT8_{50}$	Ver	60-80GHz	Pre scan Max hold EIRP	Yes
2.25a	$BT8_{50}$	Hor	80-100GHz	Pre scan Max hold EIRP	Yes
2.25b	$BT8_{50}$	Ver	80-100GHz	Pre scan Max hold EIRP	Yes

[1)] Compliant (5x LO) to TRP limit based on Lower EIRP compared to $TimL_{50}$ (Diagram 2.3)
[4)] Calculated conducted power based on antenna gain below limit
[6)] Compliant to TRP limit based on Lower EIRP compared to $BimL_{50}$ (Diagram 2.7)
[7)] Compliant to TRP limit based on Lower EIRP compared to $TH2_{100}$ (Diagram 2.11)

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

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, BH_{50}, EIRP Horizontal polarization

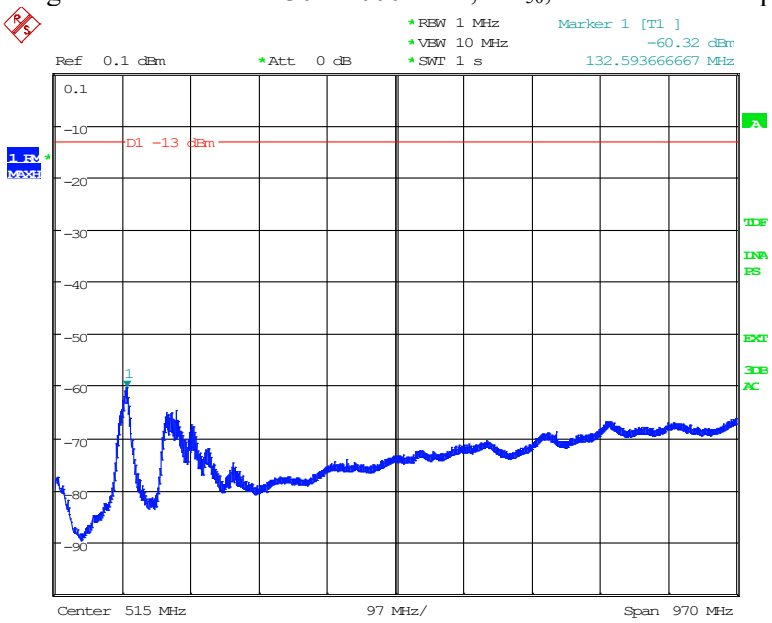


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Diagram 2.1b: Pre scan 30 – 1000 MHz, BH_{50}, EIRP Vertical polarization

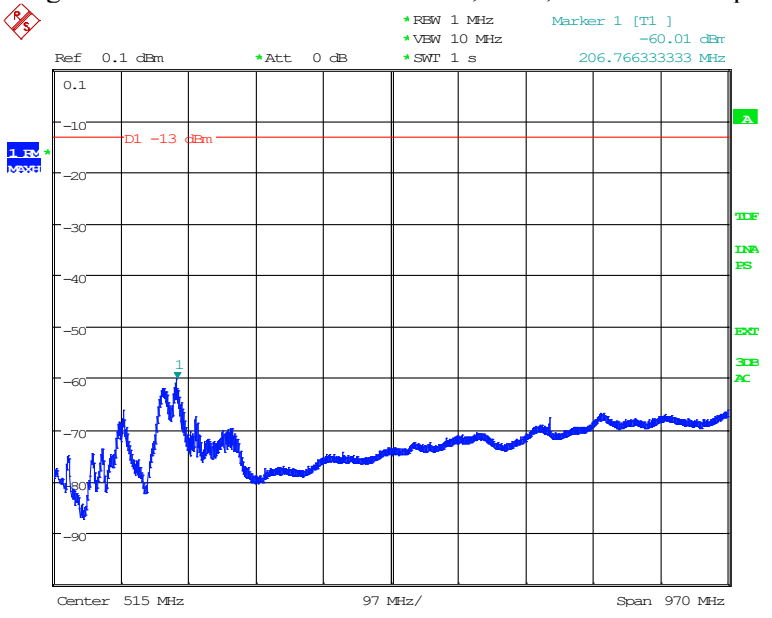

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Diagram 2.2a: Pre scan 1 – 18 GHz, BH_{50}, EIRP Horizontal polarization

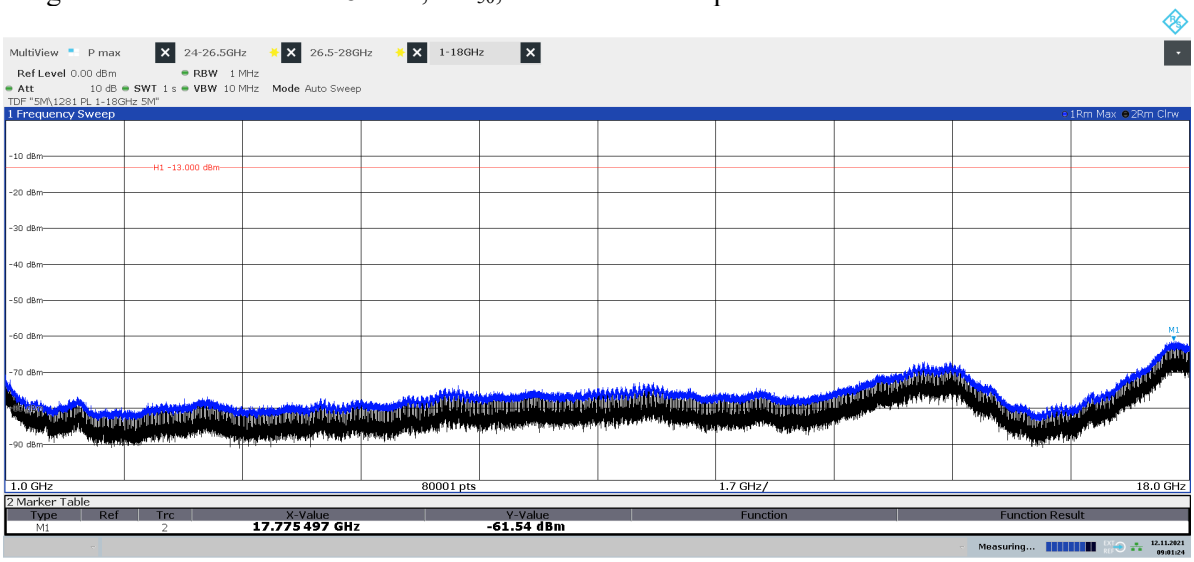


Diagram 2.2b: Pre scan 1 – 18 GHz, BH_{50}, EIRP Vertical polarization

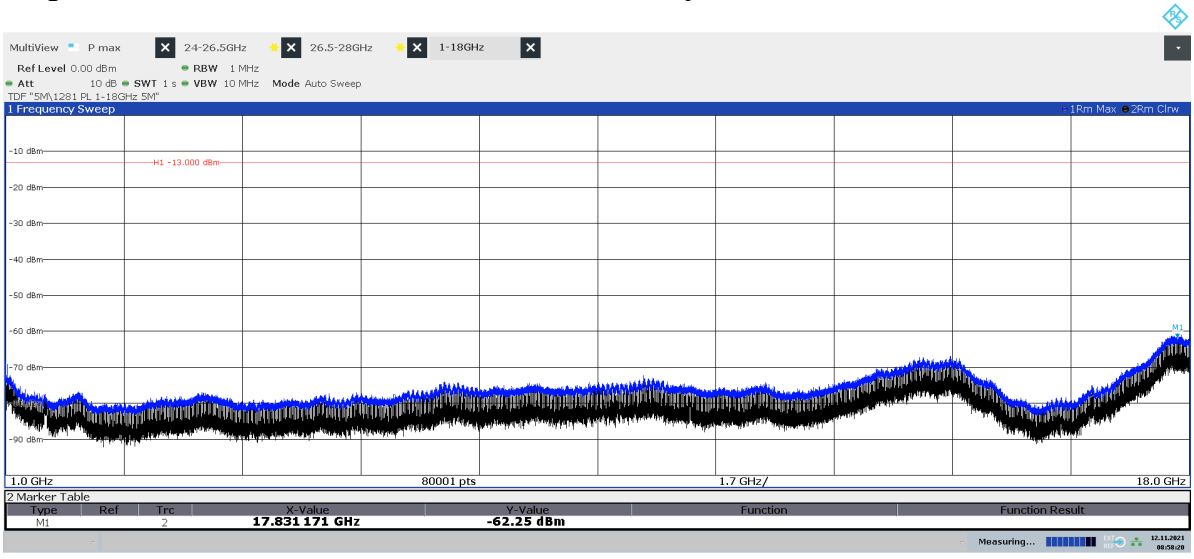


Diagram 2.3a: Pre scan 18 – 24 GHz, $TimL_{50}$, EIRP Horizontal polarization
See diagram 2.3c for TRP result

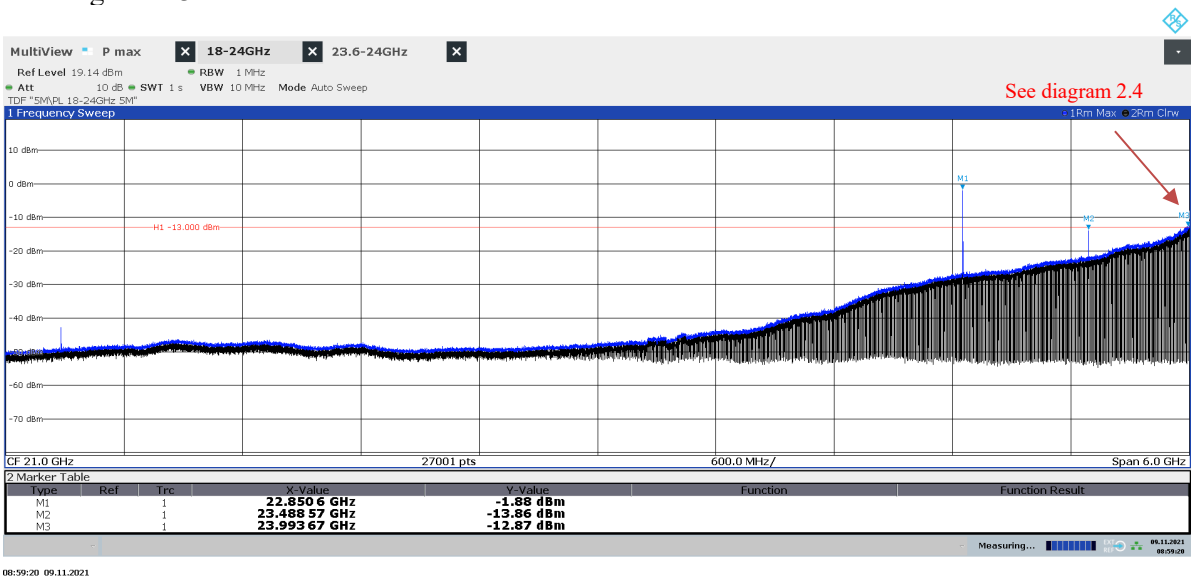


Diagram 2.3b: Pre scan 18 – 24 GHz, $TimL_{50}$, EIRP Vertical polarization
See diagram 2.3c for TRP result

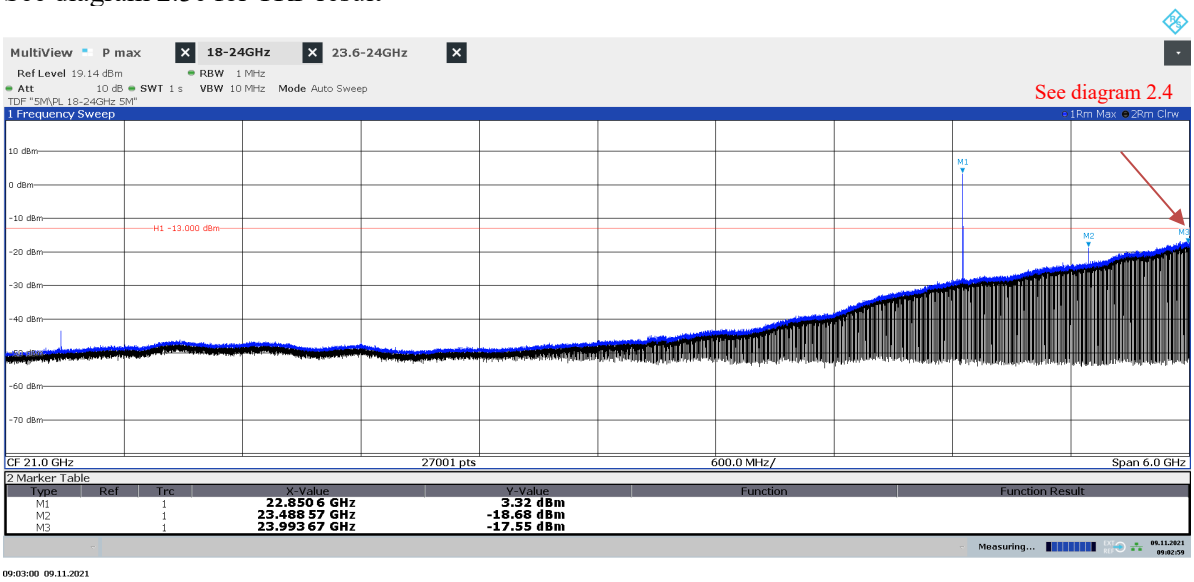


Diagram 2.3c: Two cut TRP 22.8 – 22.9 GHz, $TimL_{50}$

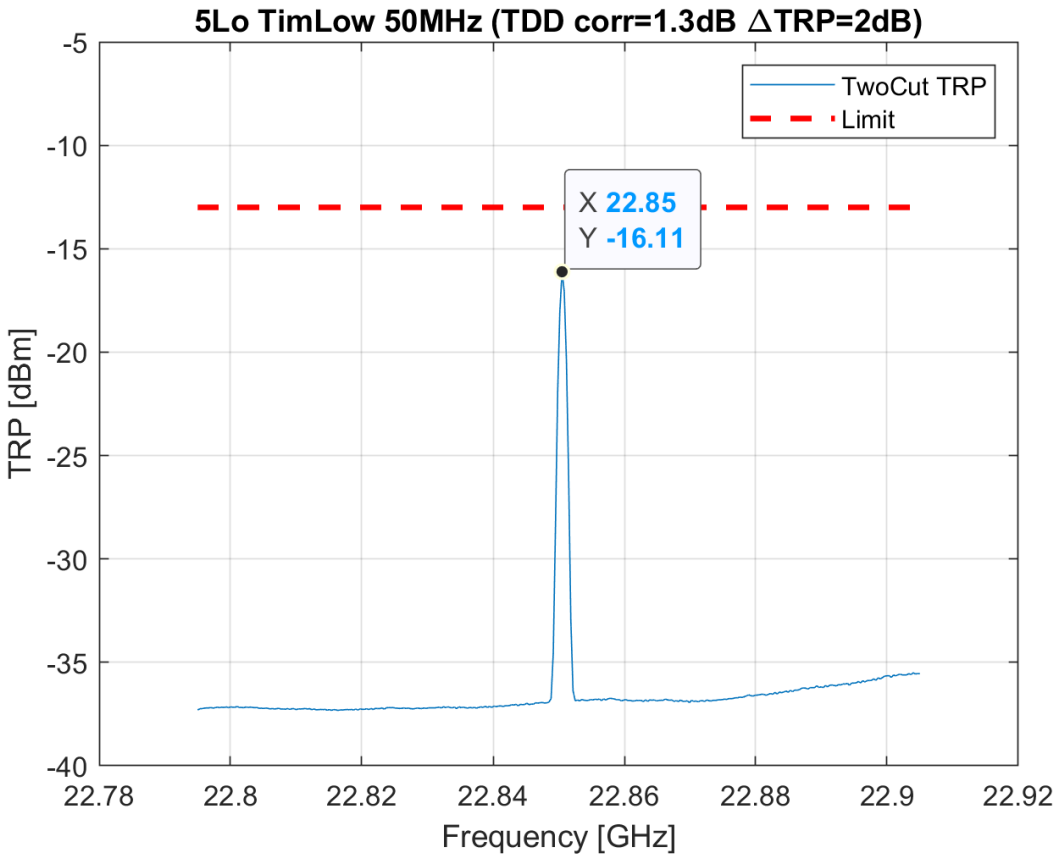


Diagram 2.4a: Pre scan 18 – 24 GHz, $BimL_{50}$, EIRP Horizontal polarization
See diagram 2.4c for TRP result

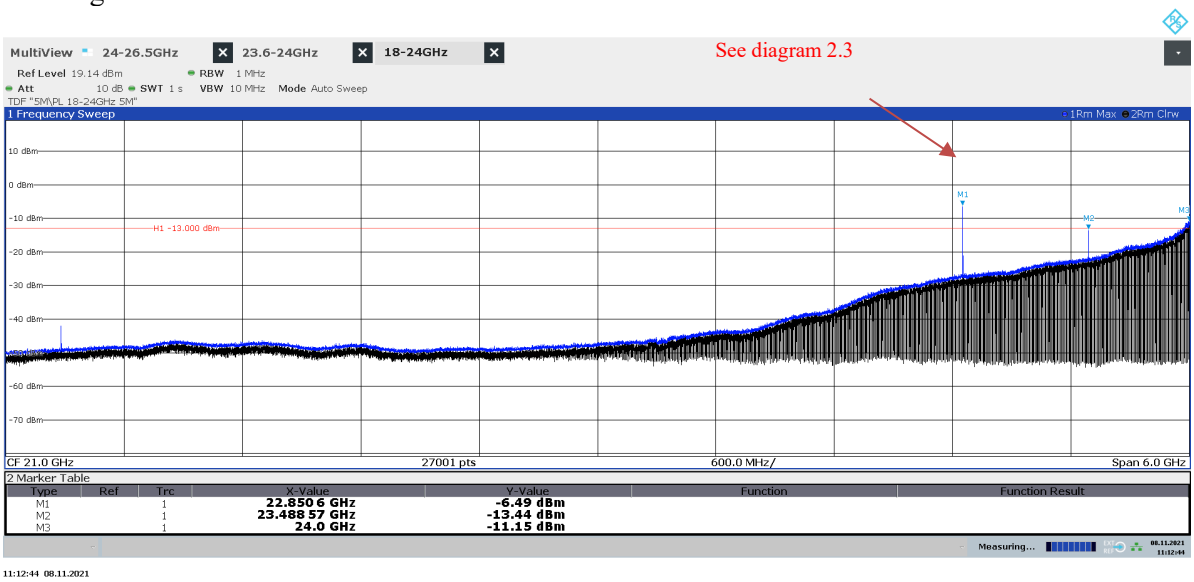


Diagram 2.4b: Pre scan 18 – 24 GHz, $BimL_{50}$, EIRP Vertical polarization
See diagram 2.4c for TRP result

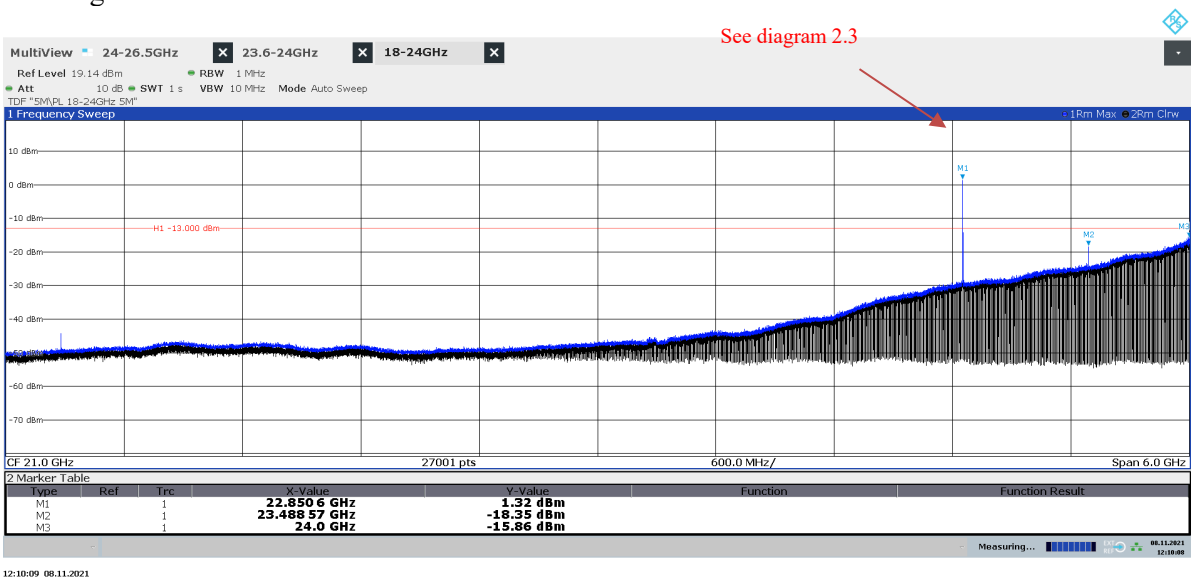


Diagram 2.4c: Two cut TRP 23.6 – 24 GHz, $BimL_{50}$

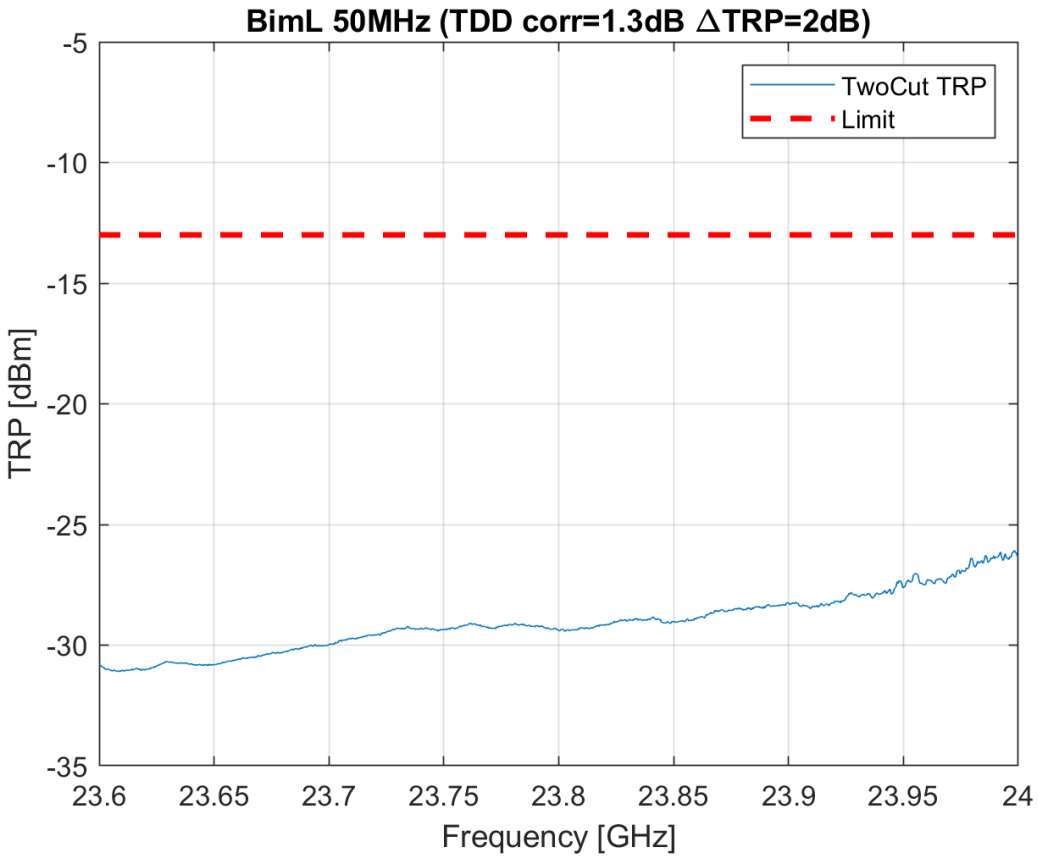


Diagram 2.4d: Pre scan Channel power 200MHz 23.6 – 24 GHz, $BimL_{50}$, EIRP Horizontal polarization
See diagram 2.4f for TRP result

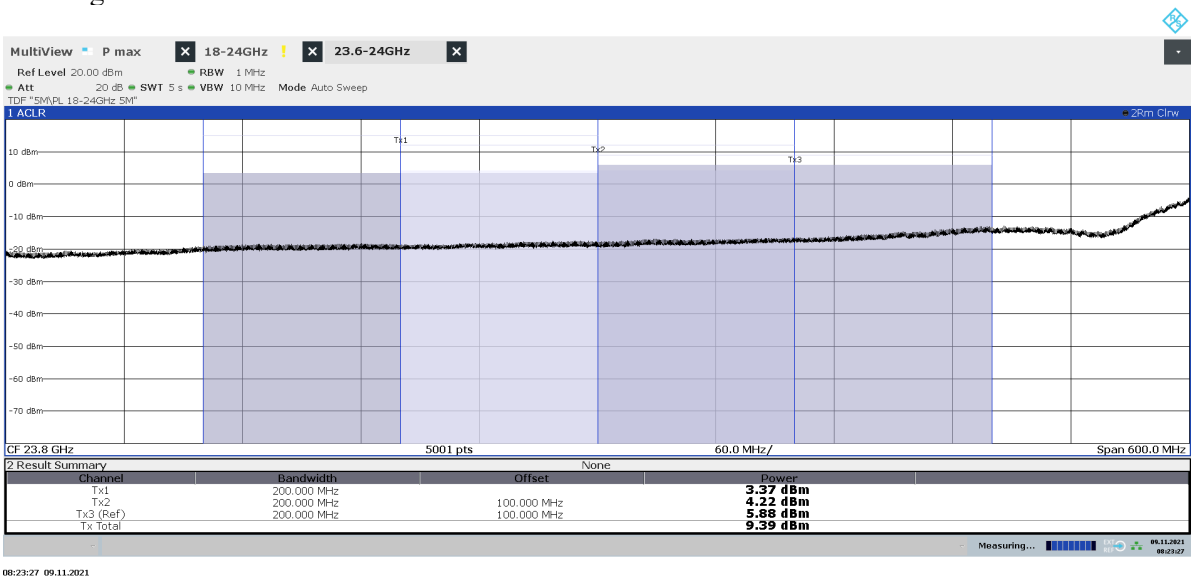


Diagram 2.4e: Pre scan Channel power 200MHz 23.6 – 24 GHz, $BimL_{50}$, EIRP Vertical polarization
See diagram 2.4f for TRP result

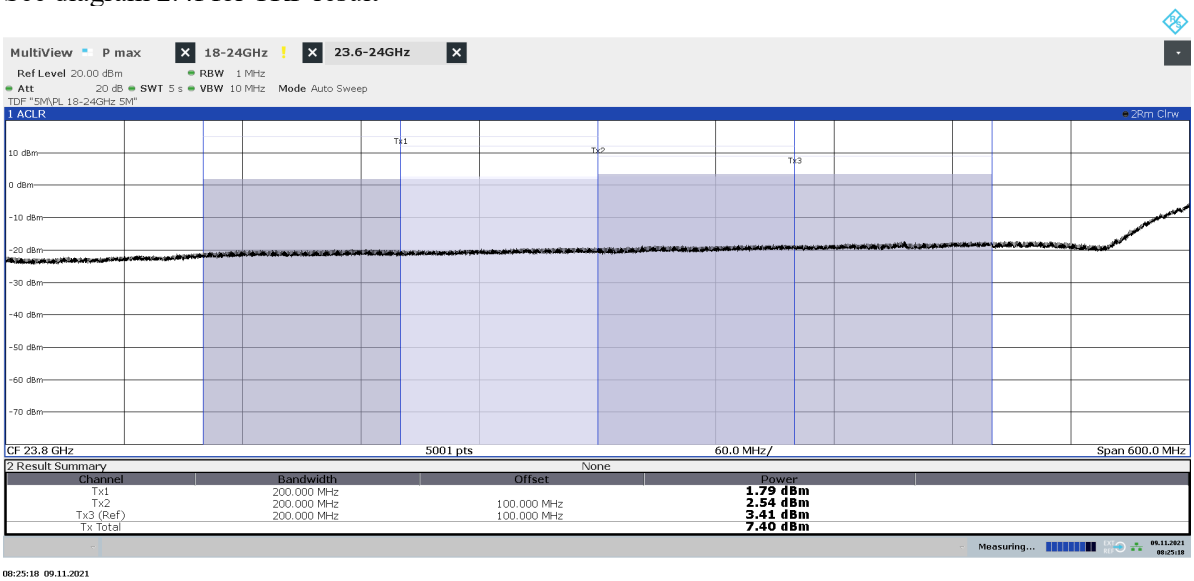
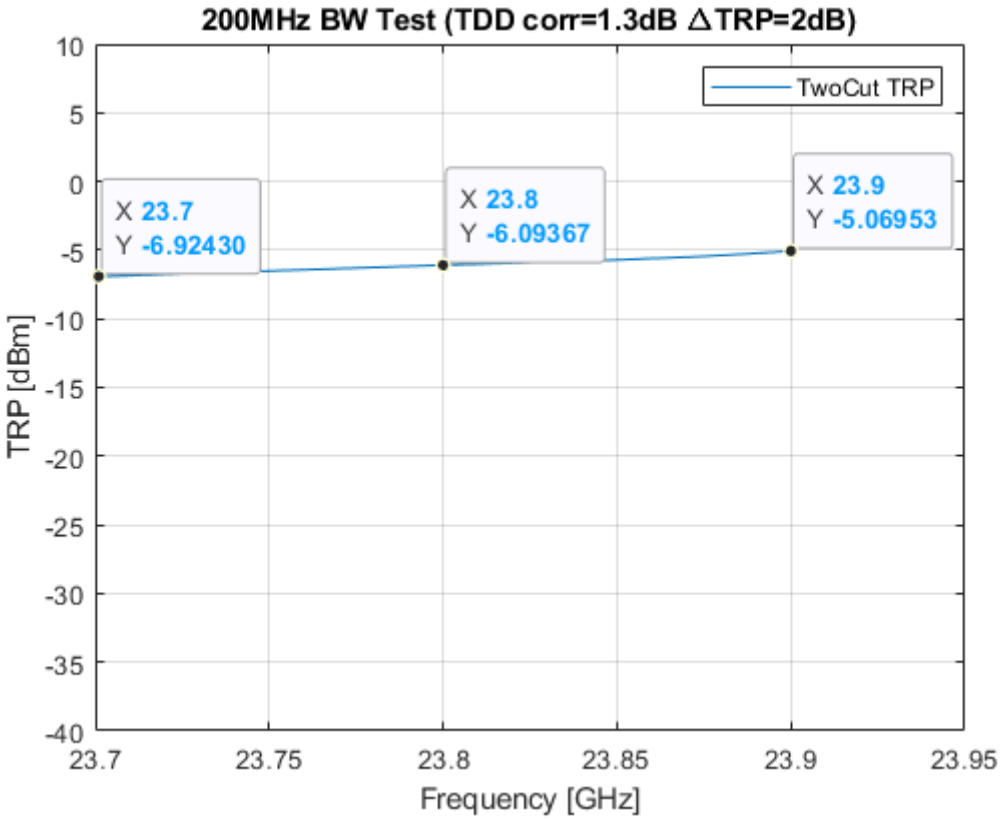


Diagram 2.4f: Two cut TRP Channel power 200MHz 23.6 – 24 GHz, $BimL_{50}$



Proposed rule change in FR Document Number: 2021-10536, Table 1—WRC-19 Resolution 750 Unwanted Emissions Permitted Within Any 200 Megahertz in the 23.6-24 GHz Passive Band

Freq [GHz]	Power TRP [dBW] Channel power 200MHz	Current TRP limit IMT Base Stations [dBW]
23.7	-36.924	-33
23.8	-36.093	-33
23.9	-35.070	-33

Diagram 2.5a: Pre scan 18 – 24 GHz, $BimL_{50}$, EIRP Horizontal polarization
See diagram 2.5c for TRP result

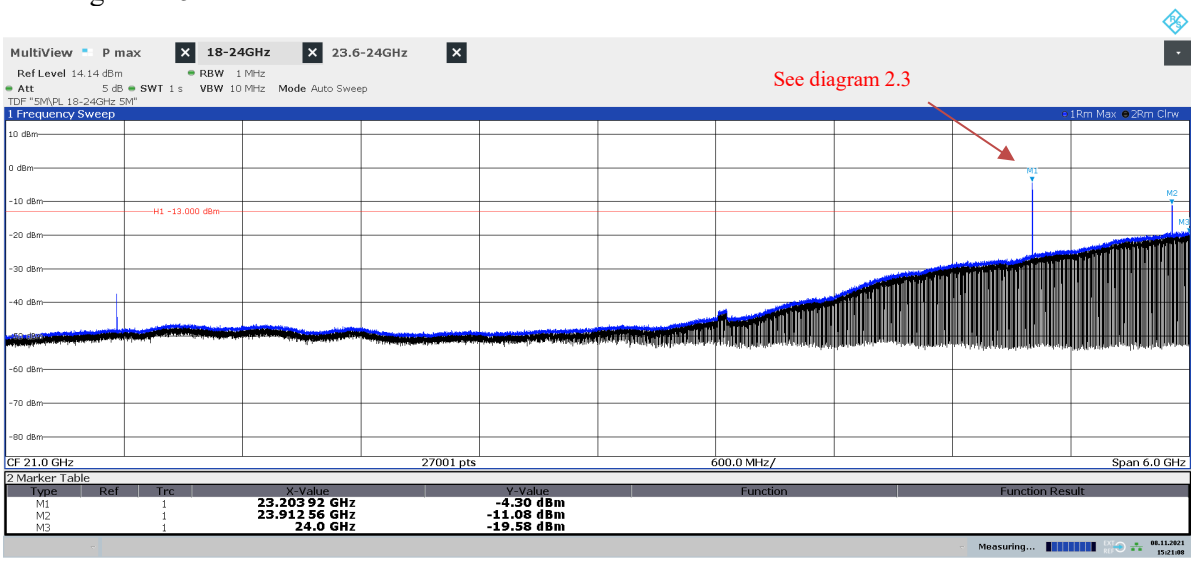


Diagram 2.5b: Pre scan 18 – 24 GHz, $BimL_{50}$, EIRP Vertical polarization
See diagram 2.5c for TRP result

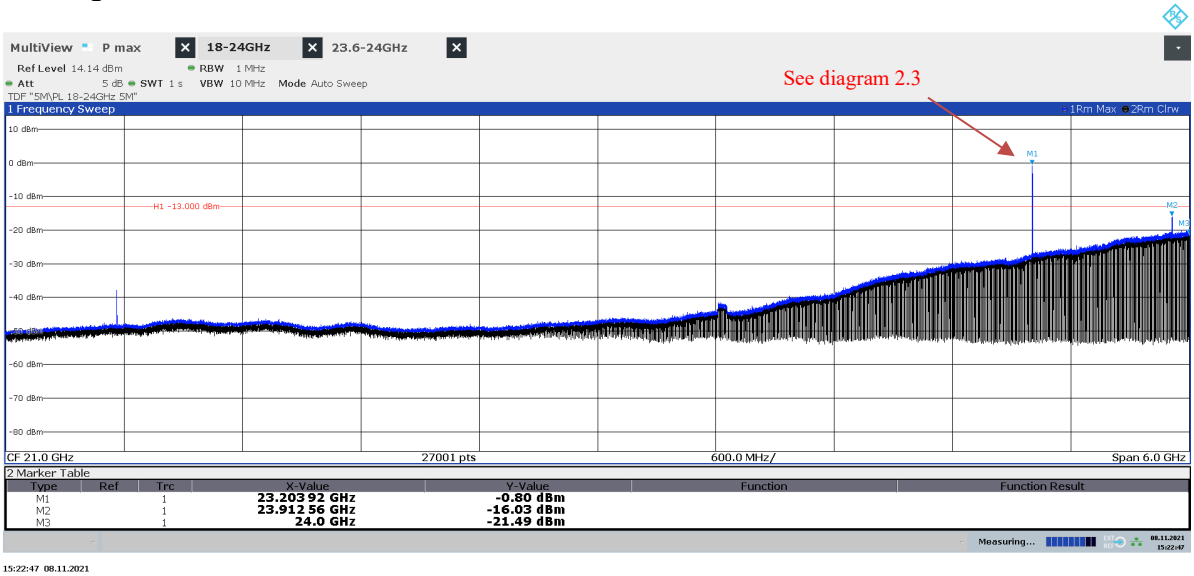


Diagram 2.5c: Two cut TRP 23.86 – 23.96 GHz, BH_{50}

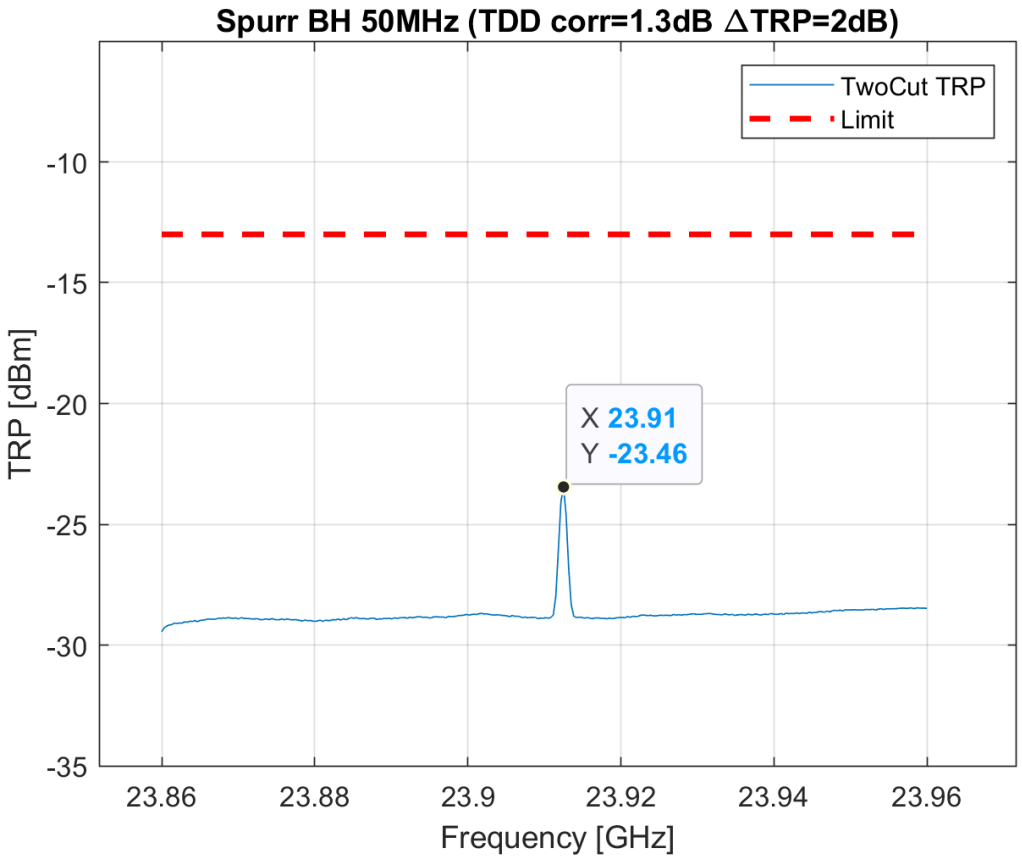


Diagram 2.6a: Pre scan 24 – 26.5 GHz, BL_{50}, EIRP Horizontal polarization

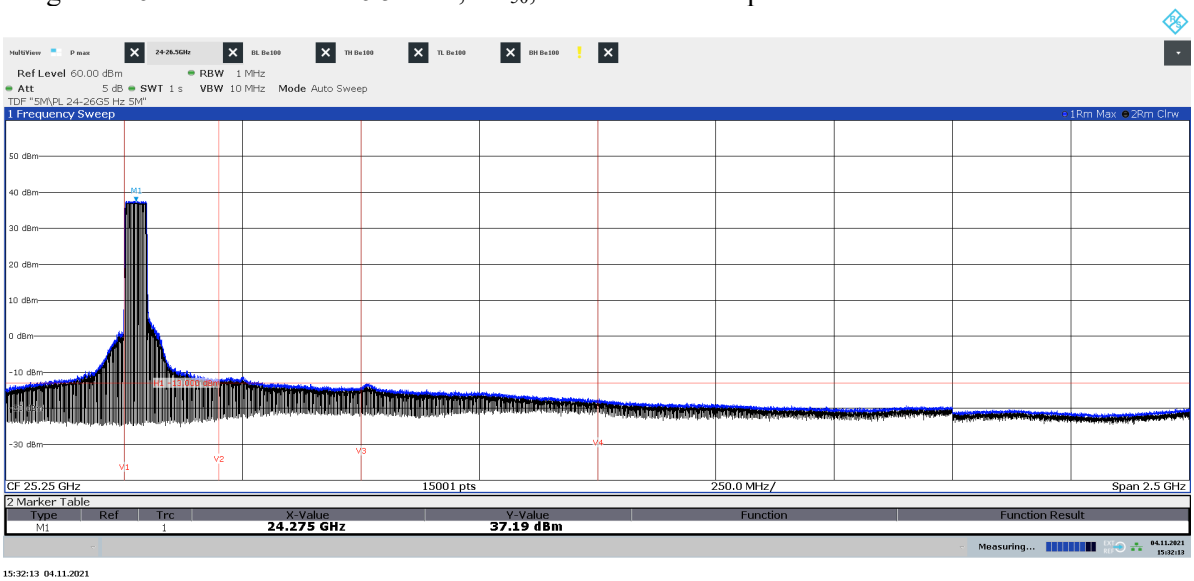


Diagram 2.6b: Pre scan 24 – 26.5 GHz, BL_{50}, EIRP Vertical polarization

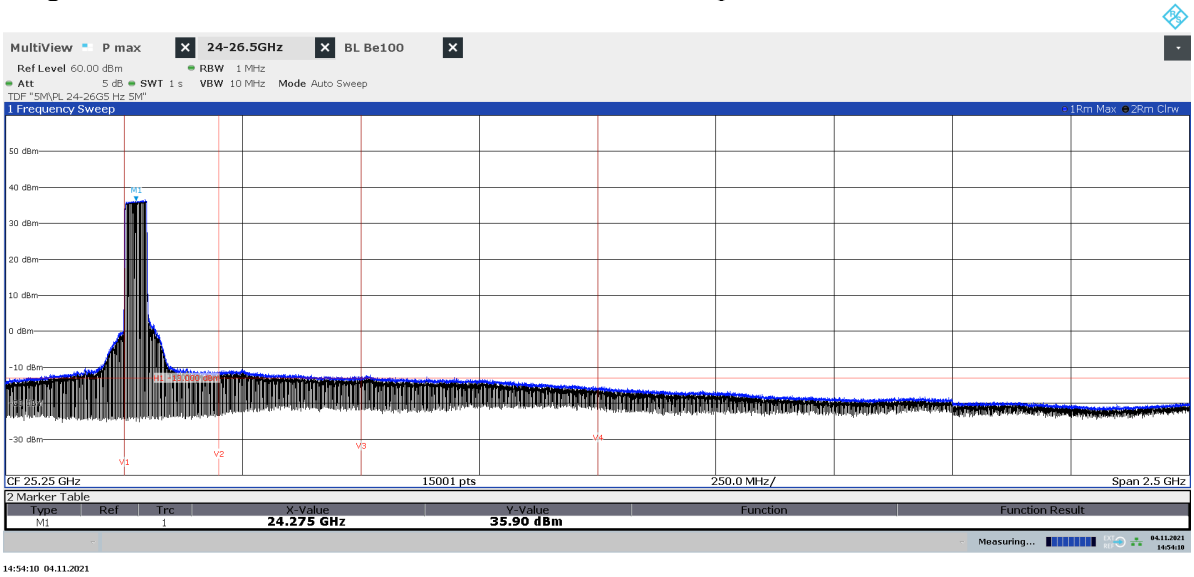


Diagram 2.6c: 24 – 24.25 GHz, QPSK, BL_{50}, EIRP Horizontal polarization

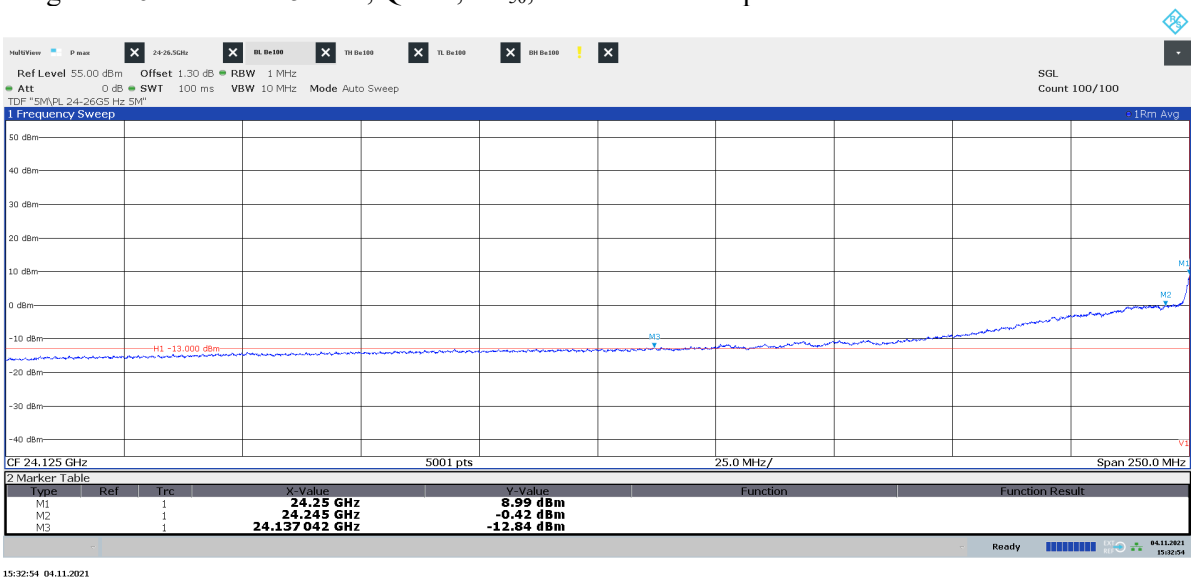
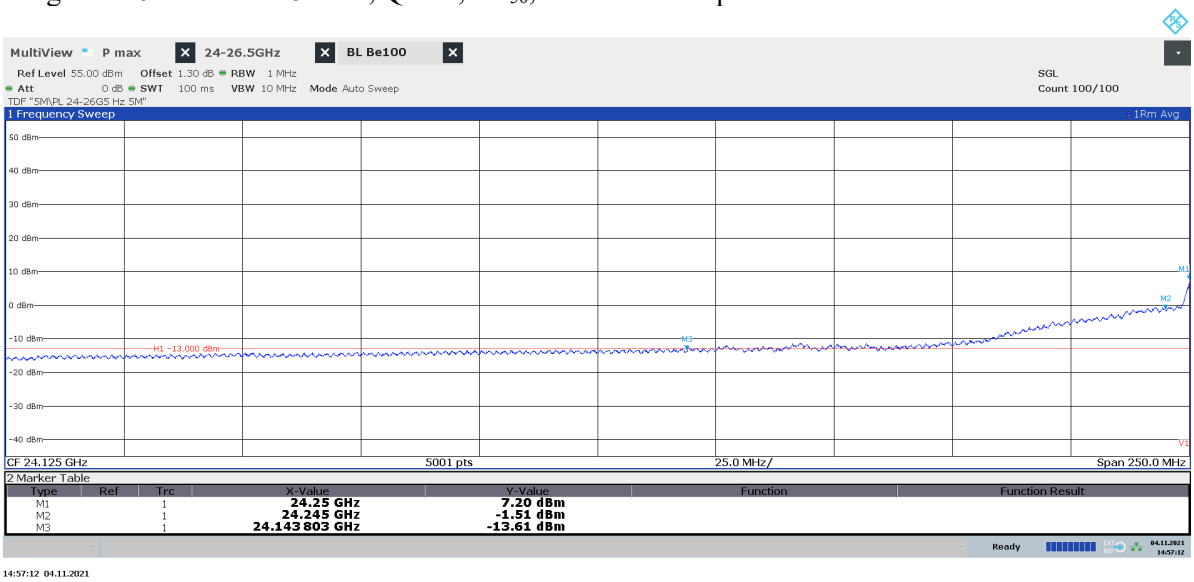


Diagram 2.6d: 24 – 24.25 GHz, QPSK, BL_{50}, EIRP Vertical polarization



Power EIRP for 24.25 GHz Hor/ Ver [dBm]	Power EIRP for 24.245 GHz Hor/ Ver [dBm]	Antenna Gain Hor/ Ver [dBi]	Total conducted power/BW for 24.25 GHz (Limit -5 dBm) [dBm]/ Verdict	Total conducted power/BW for 24.245 GHz (Limit -13 dBm) [dBm]/ Verdict
8.99/ 7.20	-0.42/ -1.51	28.13/ 27.9	-16.84/ Pass	-25.95/ Pass

Diagram 2.7a: Pre scan 24 – 26.5 GHz, $BimL_{50}$, EIRP Horizontal polarization
See diagram 2.7e for TRP result

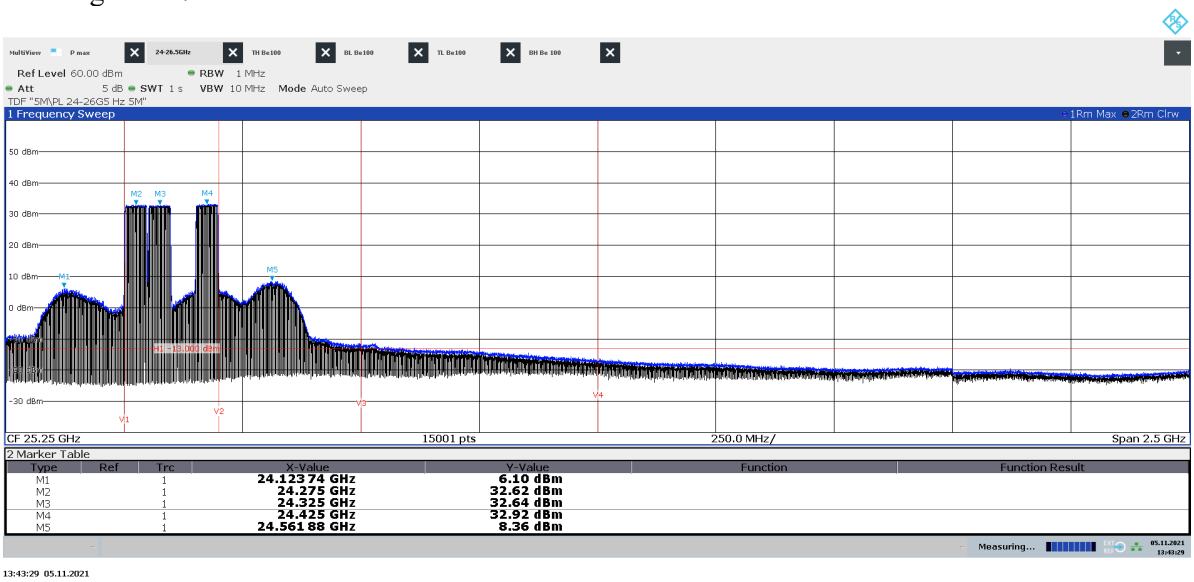
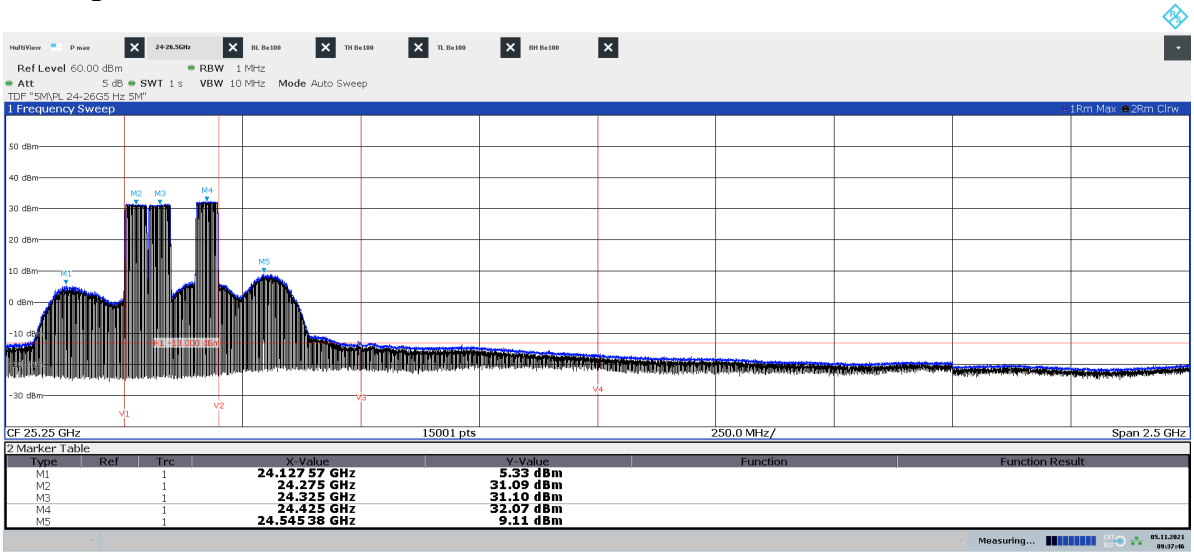
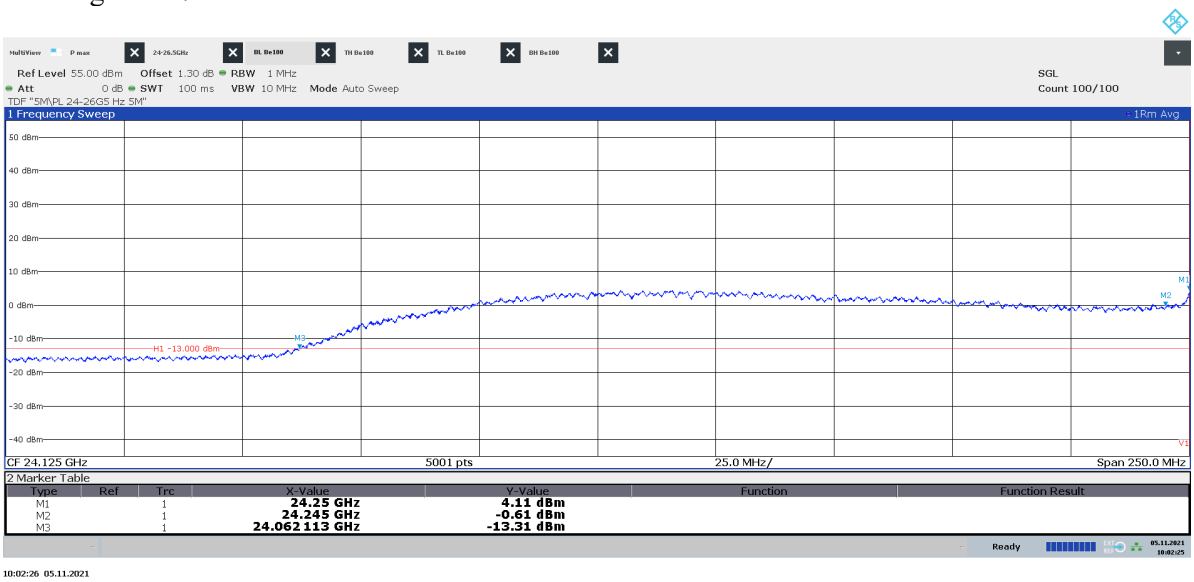


Diagram 2.7b: Pre scan 24 – 26.5 GHz, $BimL_{50}$, EIRP Vertical polarization
See diagram 2.7e for TRP result



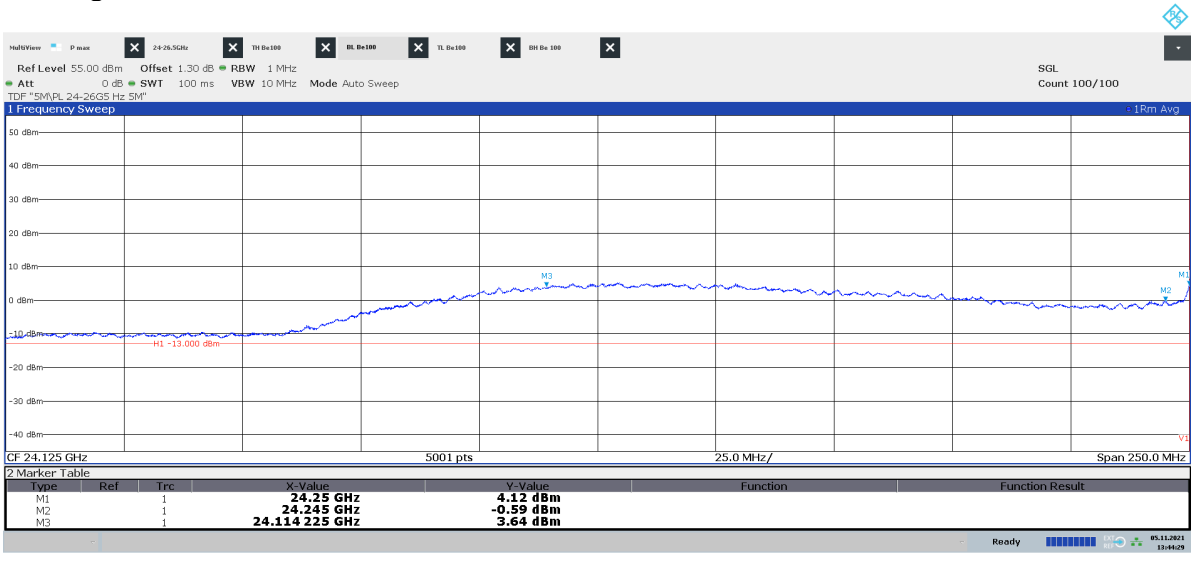
Freq [GHz]	Power Hor/ Ver [dBm]	Antenna Gain Hor/ Ver [dBi]	Total conducted power/BW (Limit -13 dBm) [dBm]/ Verdict
24.545	8.36/ 9.11	28.09/ 27.97	-16.26/ Pass

Diagram 2.7c: 24 – 24.25 GHz, QPSK, $BimL_{50}$, EIRP Horizontal polarization
See diagram 2.7e for TRP result



10:02:26 05.11.2021

Diagram 2.7d: 24 – 24.25 GHz, QPSK, $BimL_{50}$, EIRP Vertical polarization
See diagram 2.7e for TRP result



13:44:29 05.11.2021

Power EIRP for 24.25 GHz Hor/ Ver [dBm]	Power EIRP for 24.245 GHz Hor/ Ver [dBm]	Antenna Gain Hor/ Ver [dBi]	Total conducted power/BW for 24.25 GHz (Limit -5 dBm) [dBm]/ Verdict	Total conducted power/BW for 24.245 GHz (Limit -13 dBm) [dBm]/ Verdict
4.11/ 4.12	-0.61/ -0.59	28.13/ 27.09	-20.45/ Pass	-25.17/ Pass

Diagram 2.7e: Pattern multiplication TRP 24 – 24.25 GHz, $BimL_{50}$

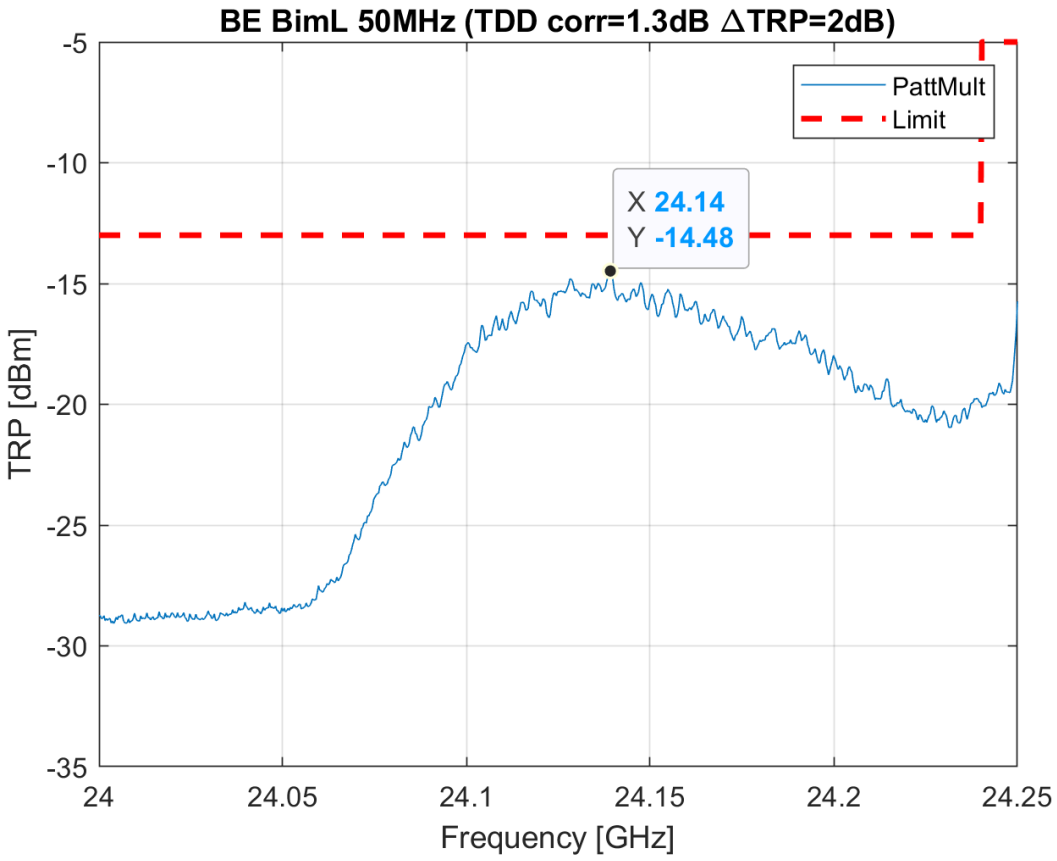


Diagram 2.8a: Pre scan 24 – 26.5 GHz, TL_{50}, EIRP Horizontal polarization

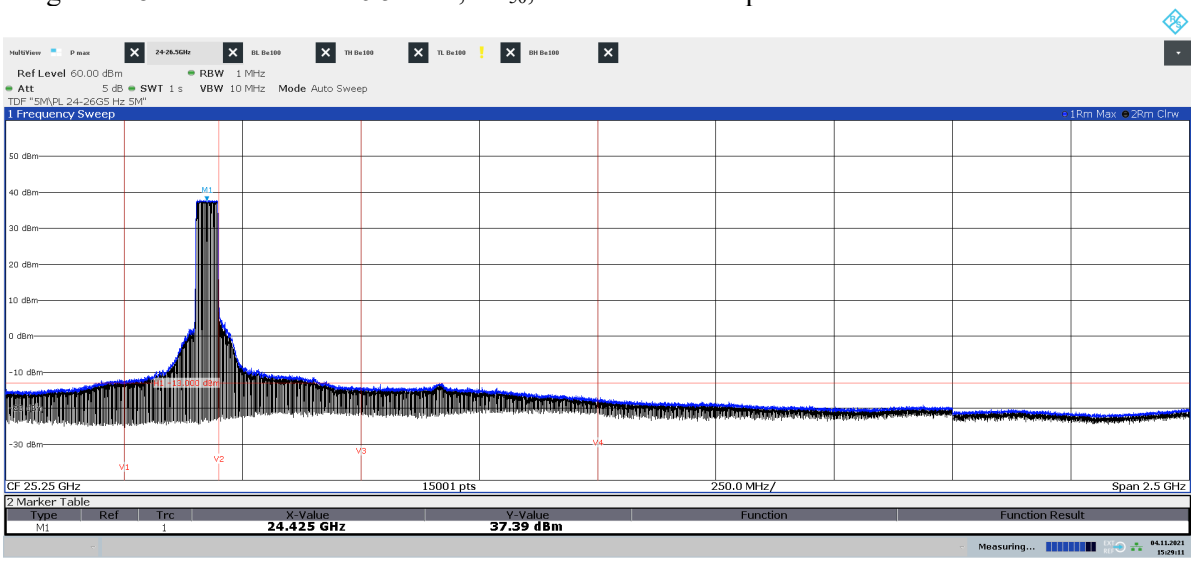


Diagram 2.8b: Pre scan 24 – 26.5 GHz, TL_{50}, EIRP Vertical polarization

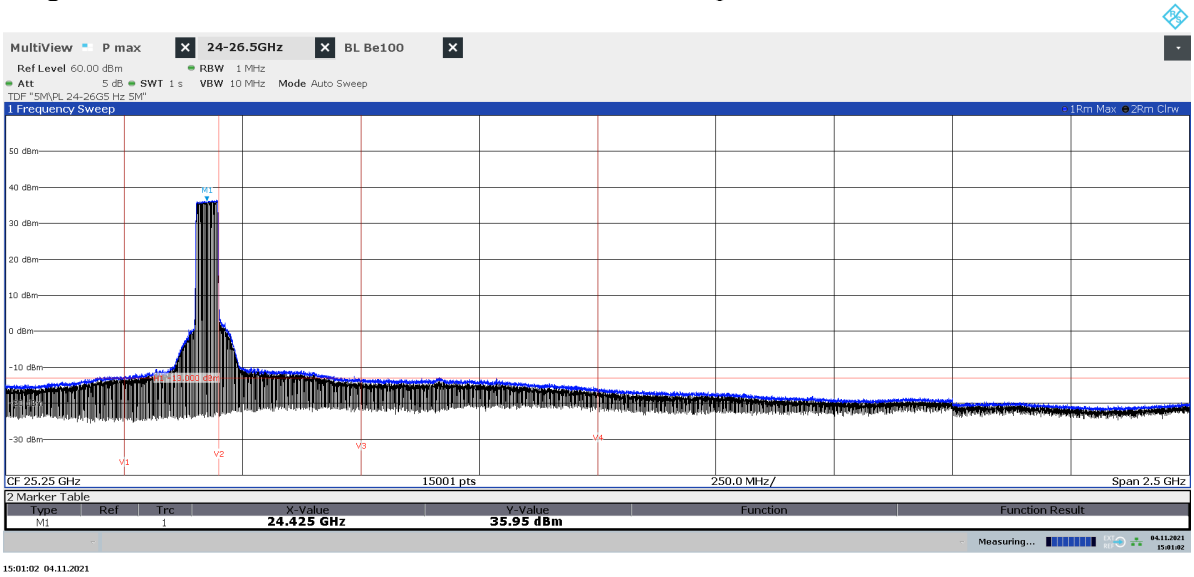


Diagram 2.8c: 24.45 – 25.4 GHz, QPSK, TL_{50}, EIRP Horizontal polarization

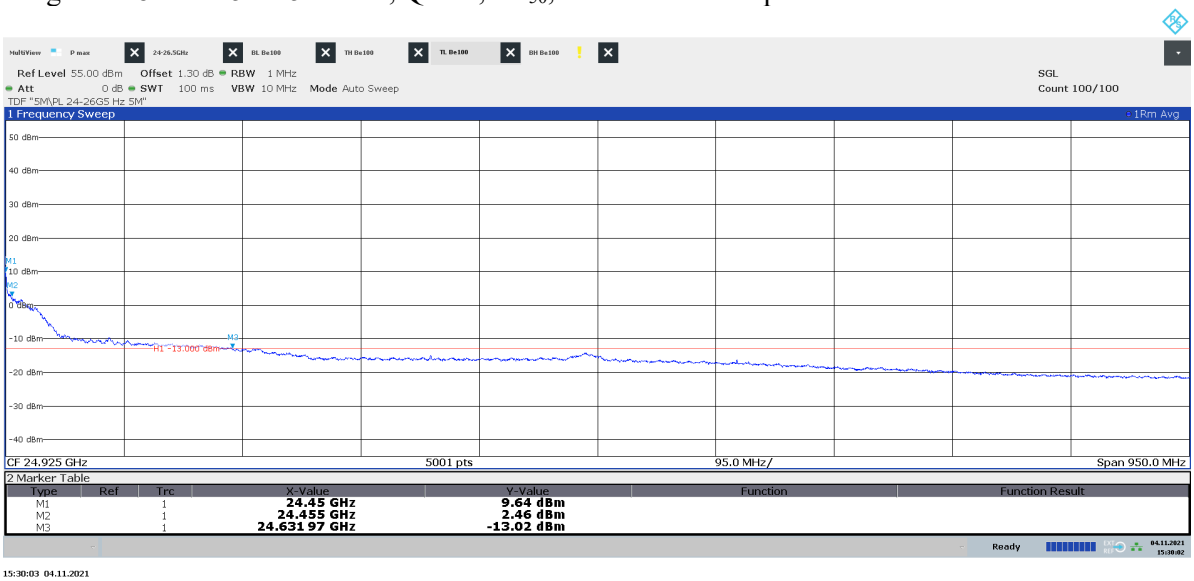
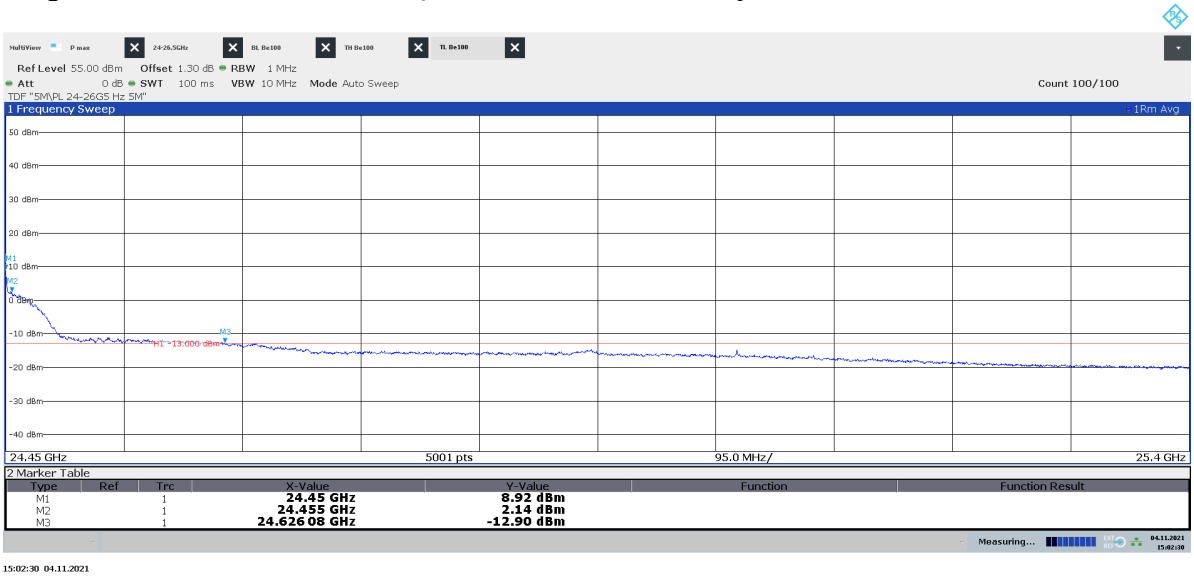


Diagram 2.8d: 24.45 – 25.4 GHz, QPSK, TL_{50}, EIRP Vertical polarization



Power EIRP for 24.45 GHz Hor/ Ver [dBm]	Power EIRP for 24.455 GHz Hor/ Ver [dBm]	Antenna Gain Hor/ Ver [dBi]	Total conducted power/BW for 24.45 GHz (Limit -5 dBm) [dBm]/ Verdict	Total conducted power/BW for 24.455 GHz (Limit -13 dBm) [dBm]/ Verdict
9.64/ 8.92	2.46/ 2.14	28.09/ 27.97	-15.73/ Pass	-22.72/ Pass

Diagram 2.9a: Pre scan 24 – 26.5 GHz, BH_{50}, EIRP Horizontal polarization

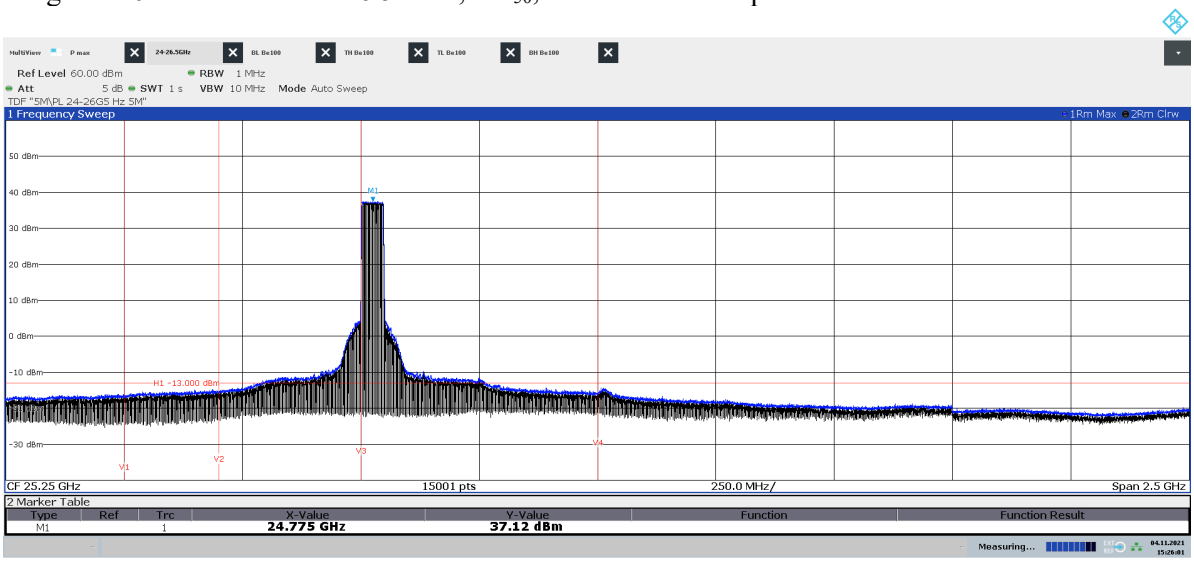


Diagram 2.9b: Pre scan 24 – 26.5 GHz, BH_{50}, EIRP Vertical polarization

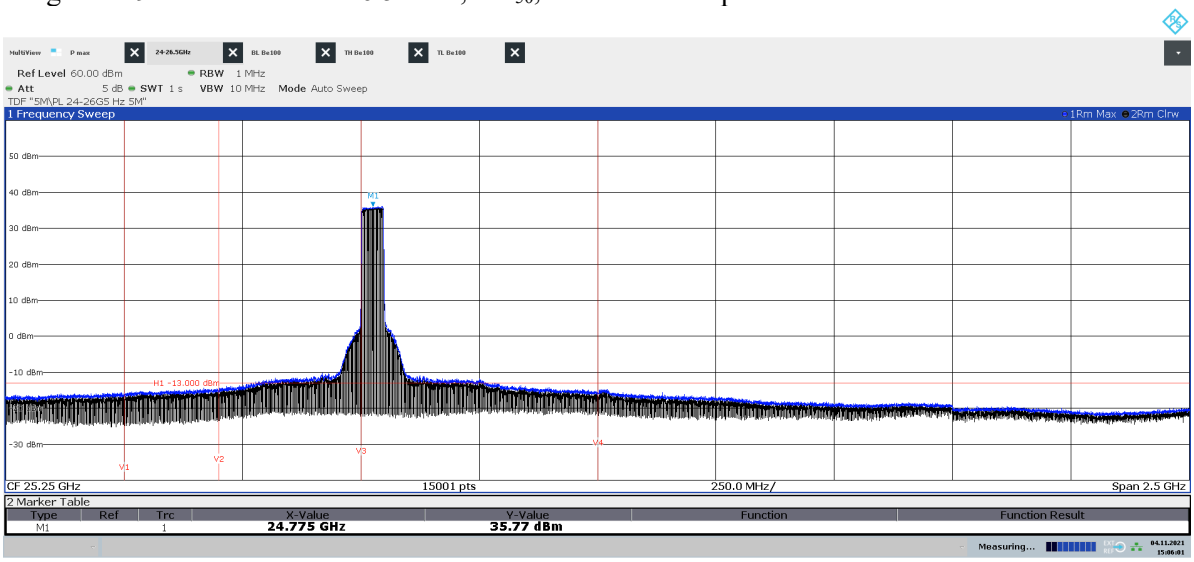


Diagram 2.9c: 24 – 24.75 GHz, QPSK, BH_{50}, EIRP Horizontal polarization

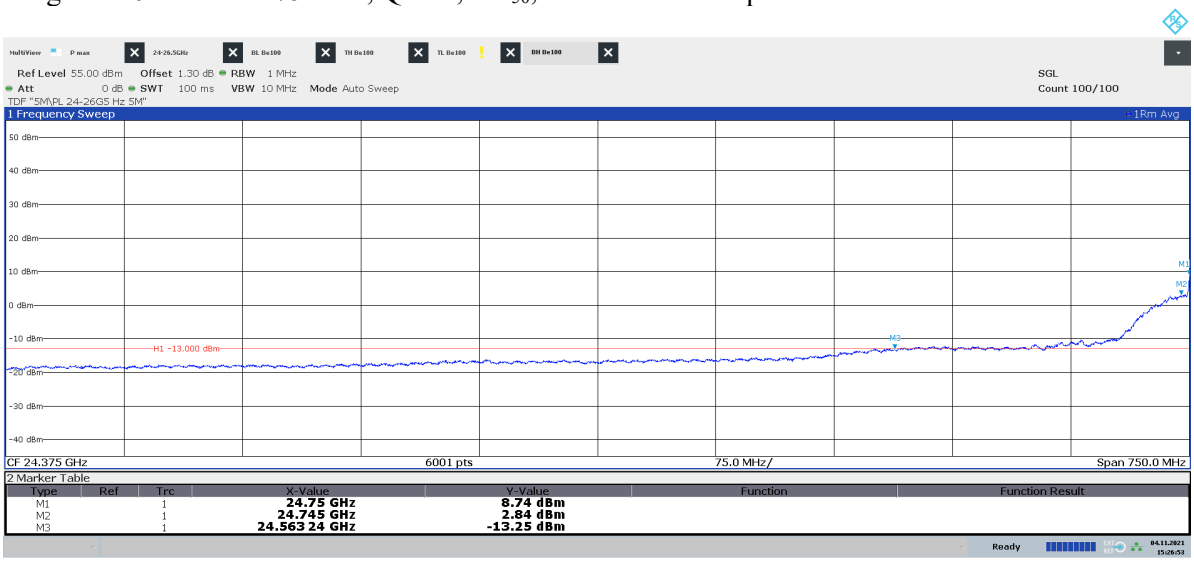
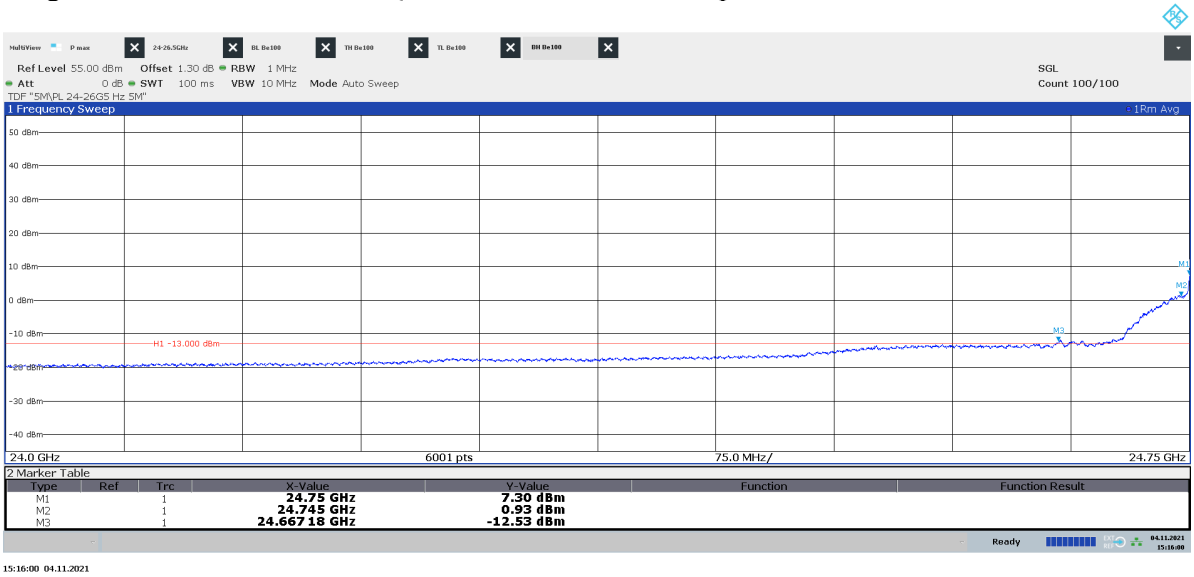


Diagram 2.9d: 24 – 24.75 GHz, QPSK, BH_{50}, EIRP Vertical polarization



Power EIRP for 24.75 GHz Hor/ Ver [dBm]	Power EIRP for 24.745 GHz Hor/ Ver [dBm]	Antenna Gain Hor/ Ver [dBi]	Total conducted power/BW for 24.75 GHz (Limit -5 dBm) [dBm]/ Verdict	Total conducted power/BW for 24.745 GHz (Limit -13 dBm) [dBm]/ Verdict
8.74/ 7.30	2.84/ 0.93	28.21/ 28.10	-17.07 Pass	-23.17/ Pass

Diagram 2.10a: Pre scan 24 – 26.5 GHz, TH_{50}, EIRP Horizontal polarization

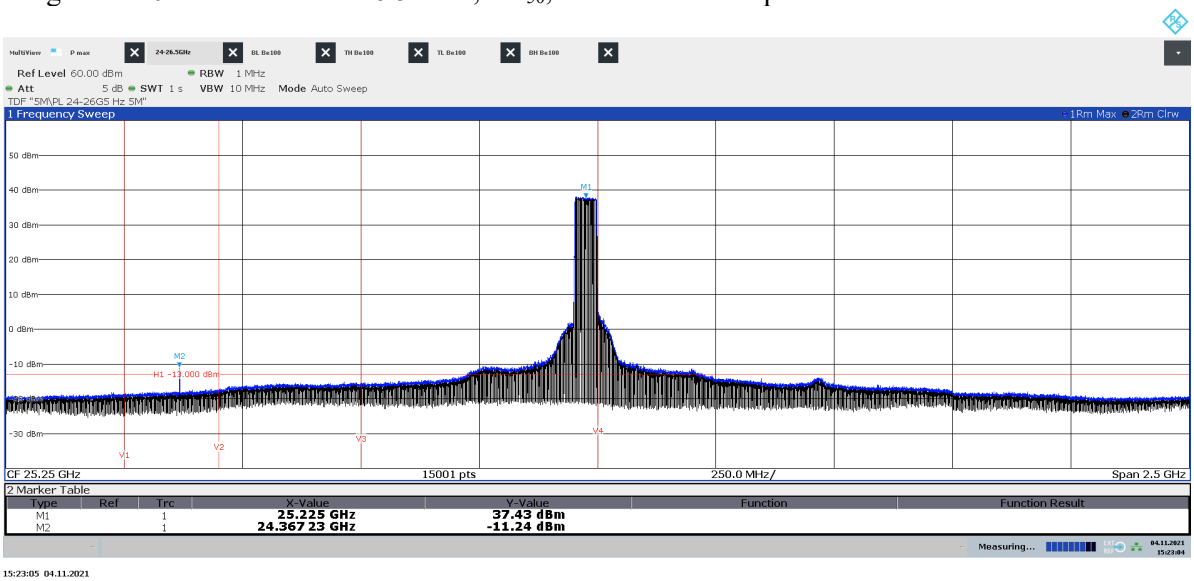
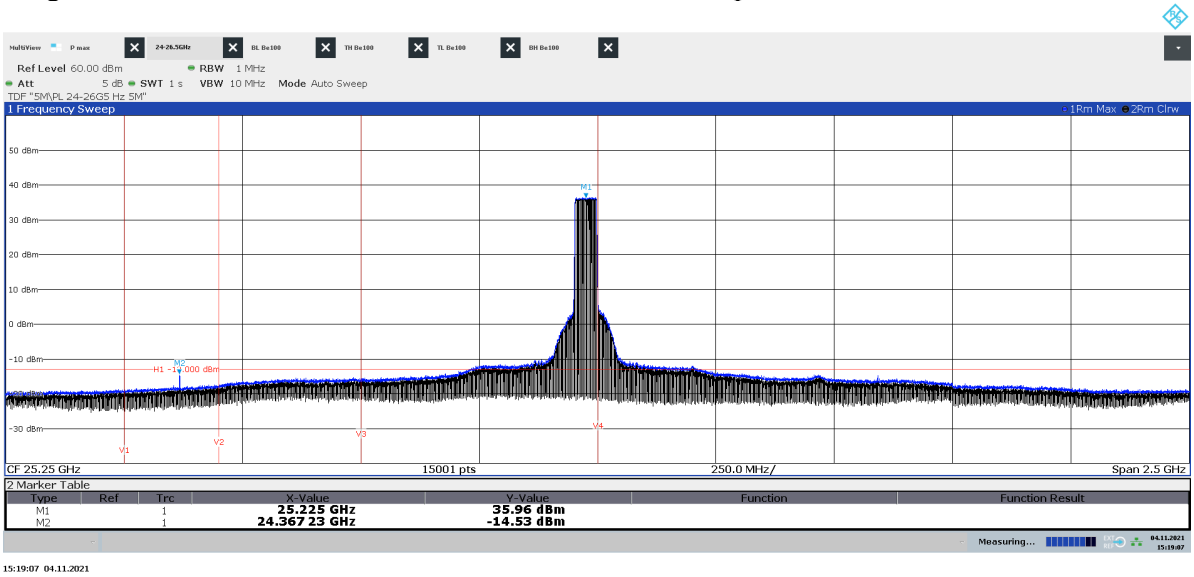


Diagram 2.10b: Pre scan 24 – 26.5 GHz, TH_{50}, EIRP Vertical polarization



Freq [GHz]	Power Hor/ Ver [dBm]	Antenna Gain Hor/ Ver [dBi]	Total conducted power/BW (Limit -13 dBm) [dBm]/ Verdict
24.367	-11.24/ -14.53	28.09/ 27.97	-37.62/ Pass

Diagram 2.10c: 25.25 – 26.5 GHz, QPSK, TH_{50}, EIRP Horizontal polarization

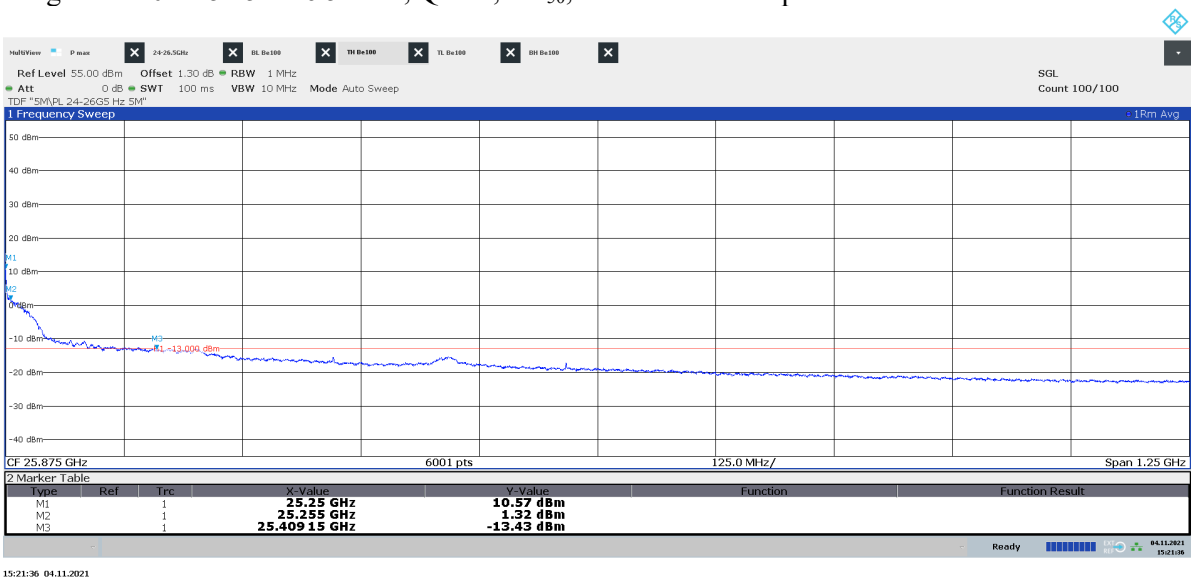
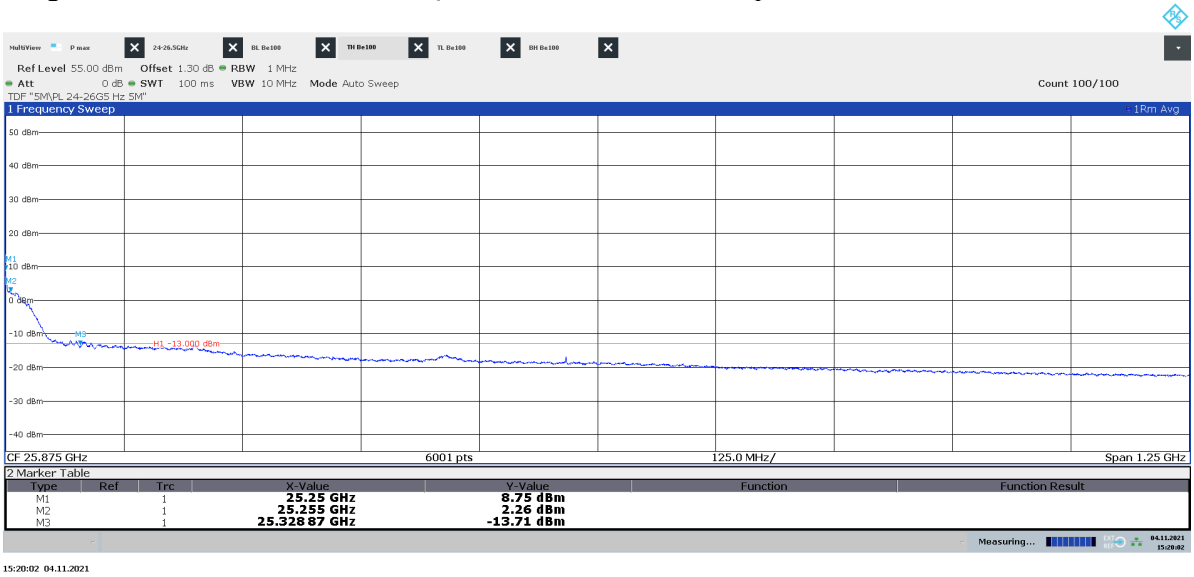
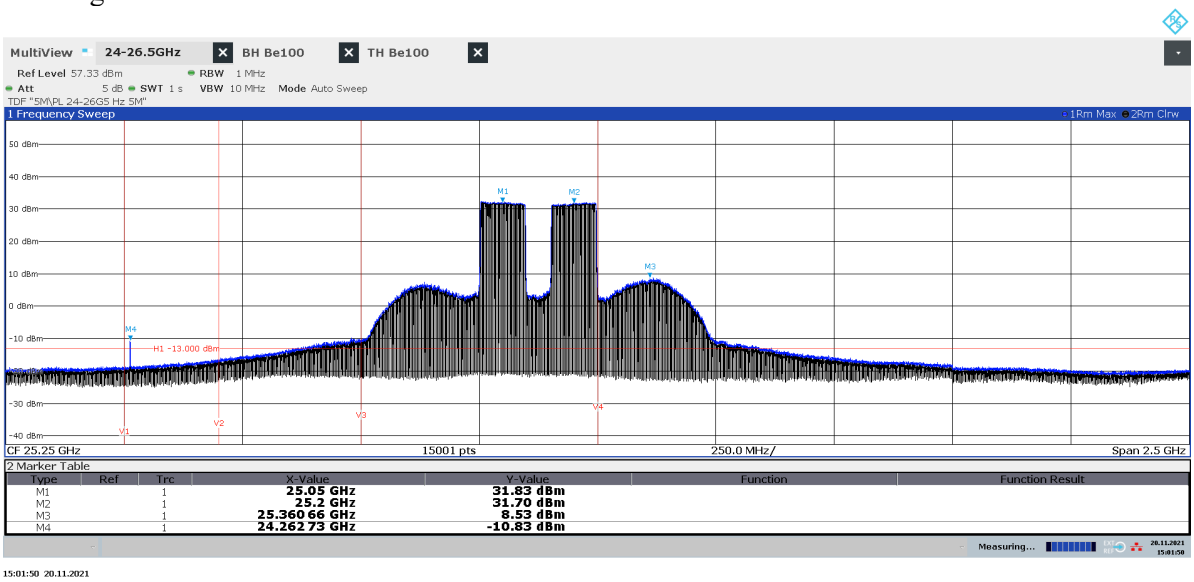


Diagram 2.10d: 25.25 – 26.5 GHz, QPSK, TH_{50}, EIRP Vertical polarization



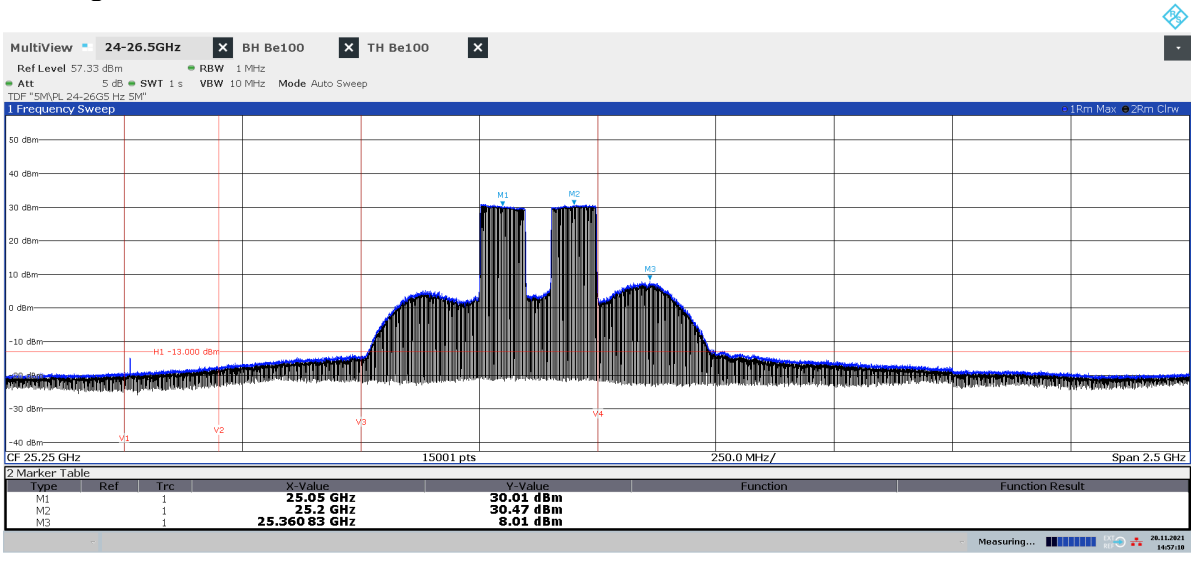
Power EIRP for 25.25 GHz Hor/ Ver [dBm]	Power EIRP for 25.255 GHz Hor/ Ver [dBm]	Antenna Gain Hor/ Ver [dBi]	Total conducted power/BW for 25.25 GHz (Limit -5 dBm) [dBm]/ Verdict	Total conducted power/BW for 25.255 GHz (Limit -13 dBm) [dBm]/ Verdict
10.57/ 8.75	1.32/ 2.26	28.28/ 28.32	-15.53/ Pass	-23.48/ Pass

Diagram 2.11a: Pre scan 24 – 26.5 GHz, $TH2_{100}$, EIRP Horizontal polarization
See diagram 2.11e for TRP result



15:01:50 20.11.2021

Diagram 2.11b: Pre scan 24 – 26.5 GHz, $TH2_{100}$, EIRP Vertical polarization
See diagram 2.11e for TRP result



14:57:11 20.11.2021

Freq [GHz]	Power Hor/ Ver [dBm]	Antenna Gain Hor/ Ver [dBi]	Total conducted power/BW (Limit -13 dBm) [dBm]/ Verdict
24.263	-10.83/ -14.00	28.09/ 27.97	-37.17/ Pass

Diagram 2.11c: 25.25 – 26.5 GHz, QPSK, $TH2_{100}$, EIRP Horizontal polarization
See diagram 2.11e for TRP result

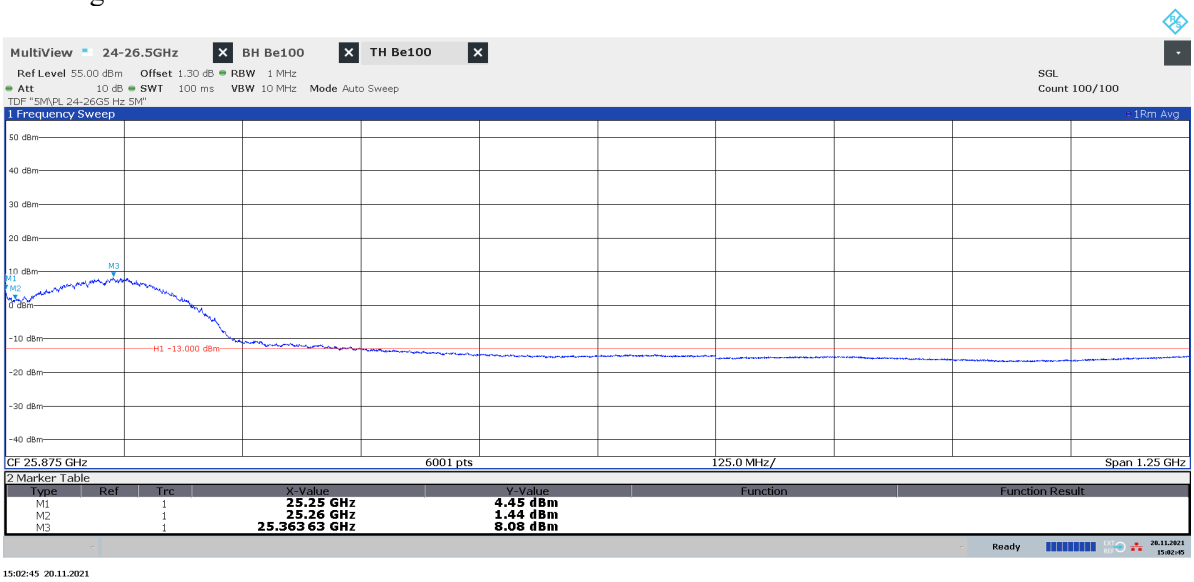
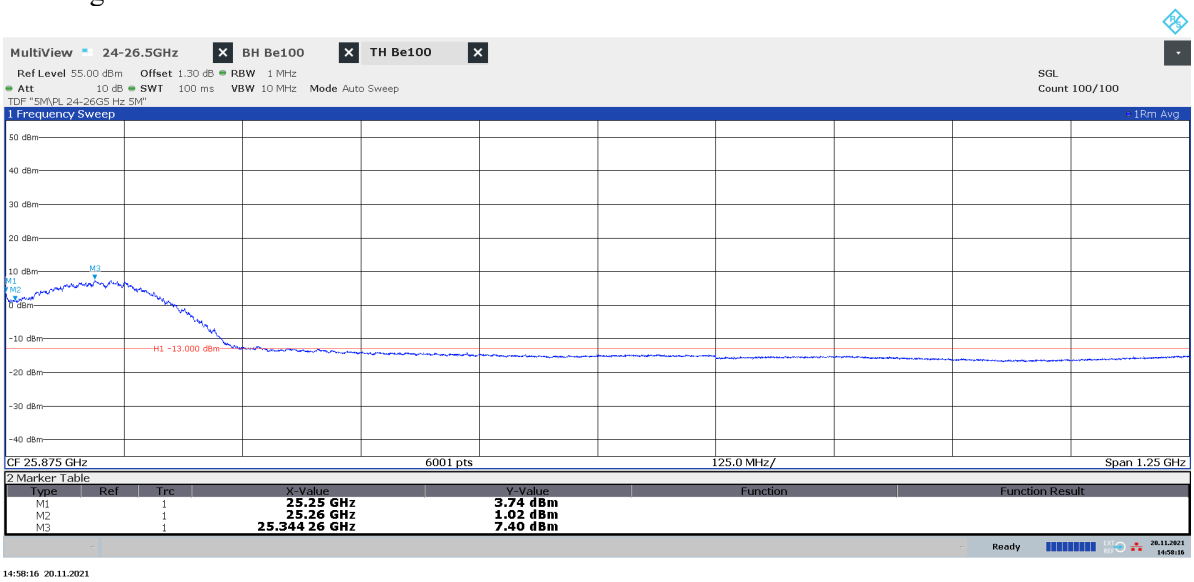


Diagram 2.11d: 25.25 – 26.5 GHz, QPSK, $TH2_{100}$, EIRP Vertical polarization
See diagram 2.11e for TRP result



Power EIRP for 25.25 GHz Hor/ Ver [dBm]	Power EIRP for 25.26 GHz Hor/ Ver [dBm]	Antenna Gain Hor/ Ver [dBi]	Total conducted power/BW for 25.25 GHz (Limit -5 dBm) [dBm]/ Verdict	Total conducted power/BW for 25.26 GHz (Limit -13 dBm) [dBm]/ Verdict
4.45/ 3.74	1.44/ 1.02	28.28/ 28.32	-21.18/ Pass	-24.05/ Pass

Diagram 2.11e: Two cut TRP 25.25 – 25.65 GHz, $TH2_{100}$

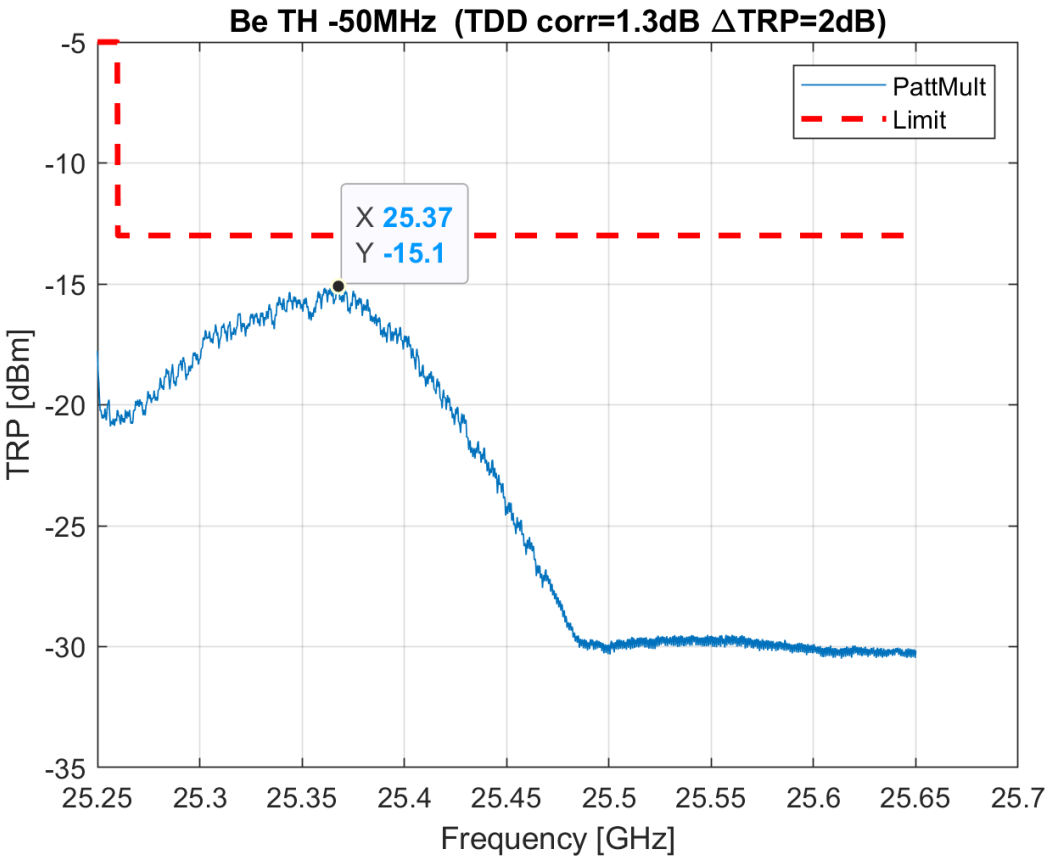
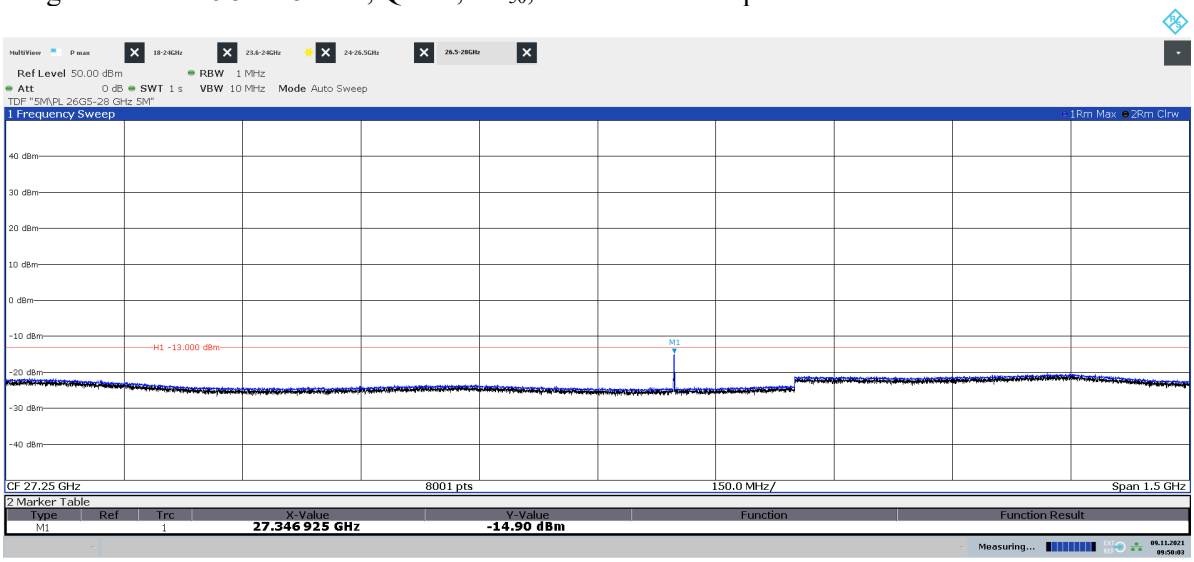
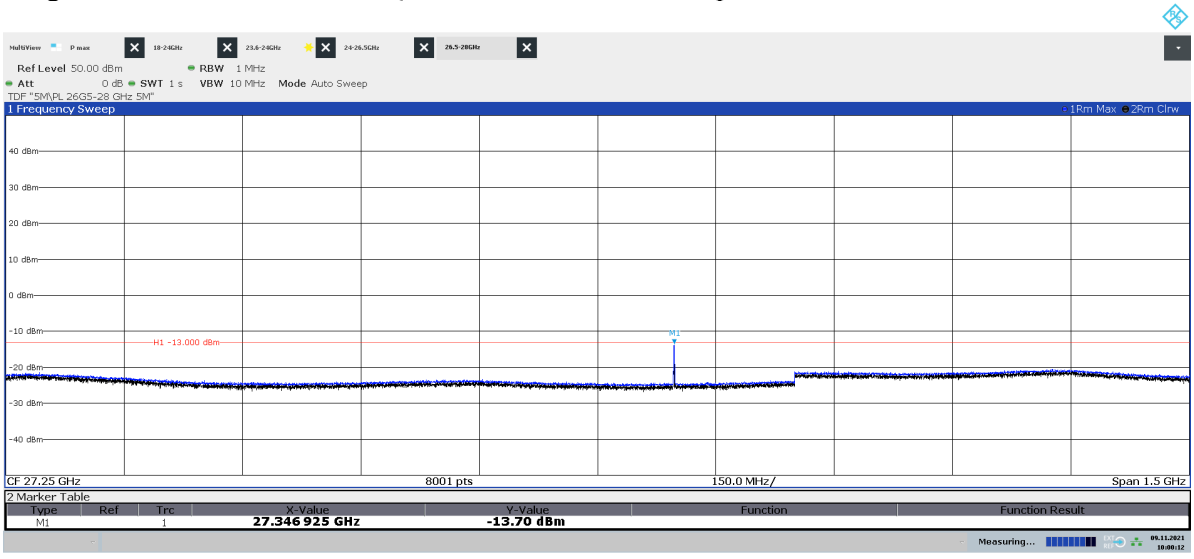


Diagram 2.12a: 26.5 – 28 GHz, QPSK, BL_{50}, EIRP Horizontal polarization



09:50:04 09.11.2021

Diagram 2.12b: 26.5 – 28 GHz, QPSK, BL_{50}, EIRP Vertical polarization



10:00:13 09.11.2021

Diagram 2.13a: 28 – 40 GHz, QPSK, TH_{50}, EIRP Horizontal polarization

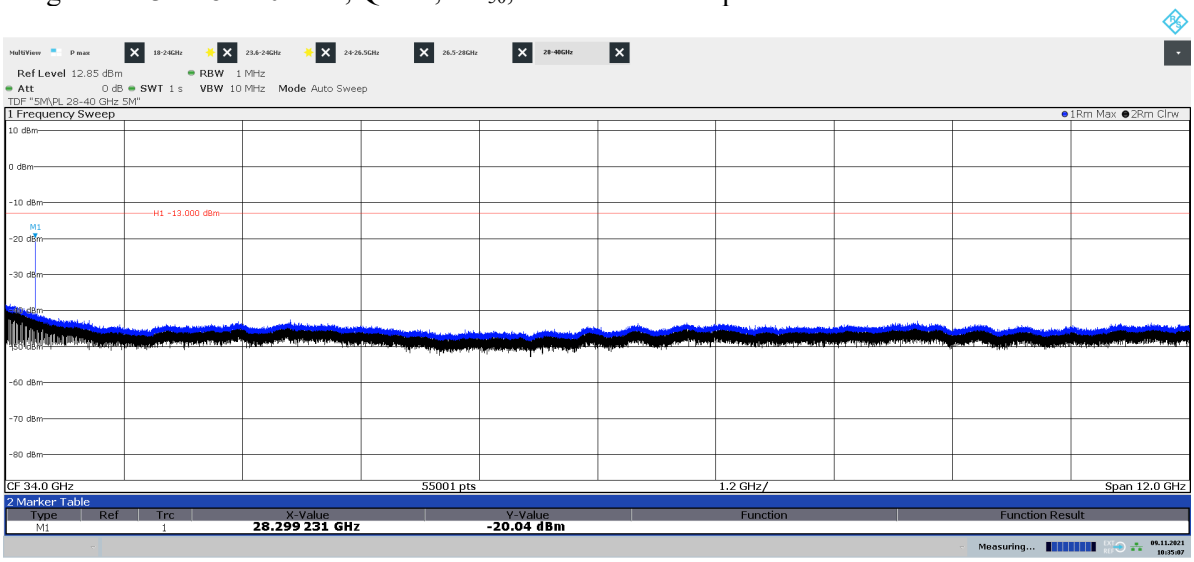


Diagram 2.13b: 28 – 40 GHz, QPSK, TH_{50}, EIRP Vertical polarization
See diagram 2.13c for TRP result

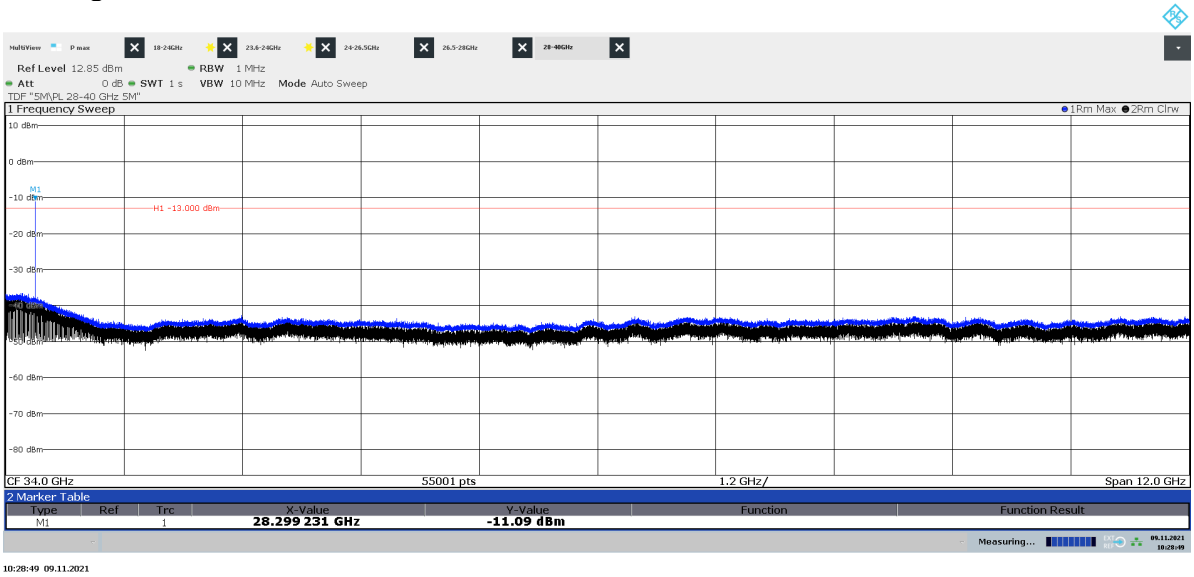


Diagram 2.13c: Two cut TRP 28.24 – 28.36 GHz, TH_{50}

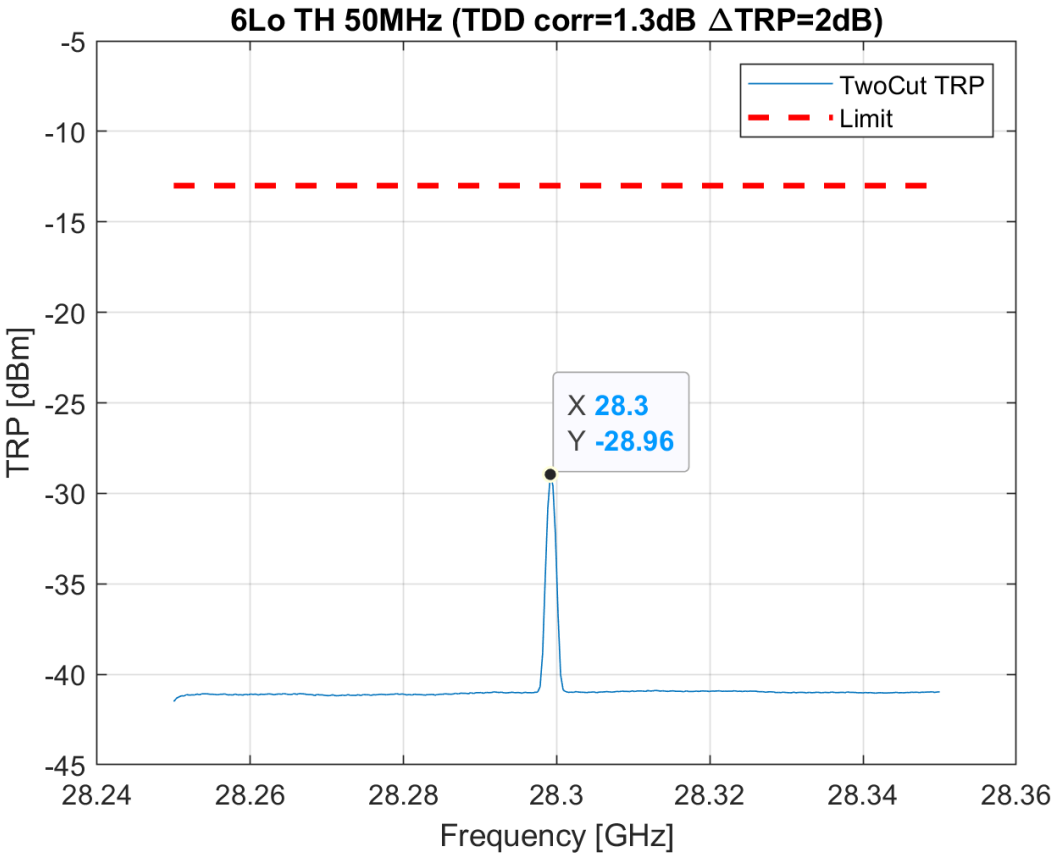
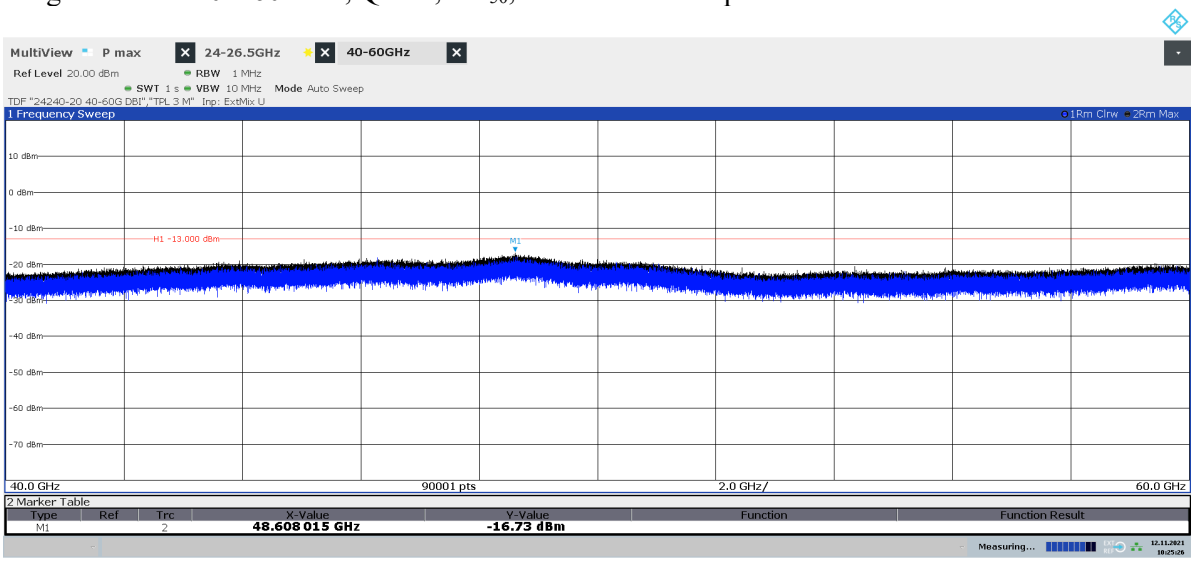
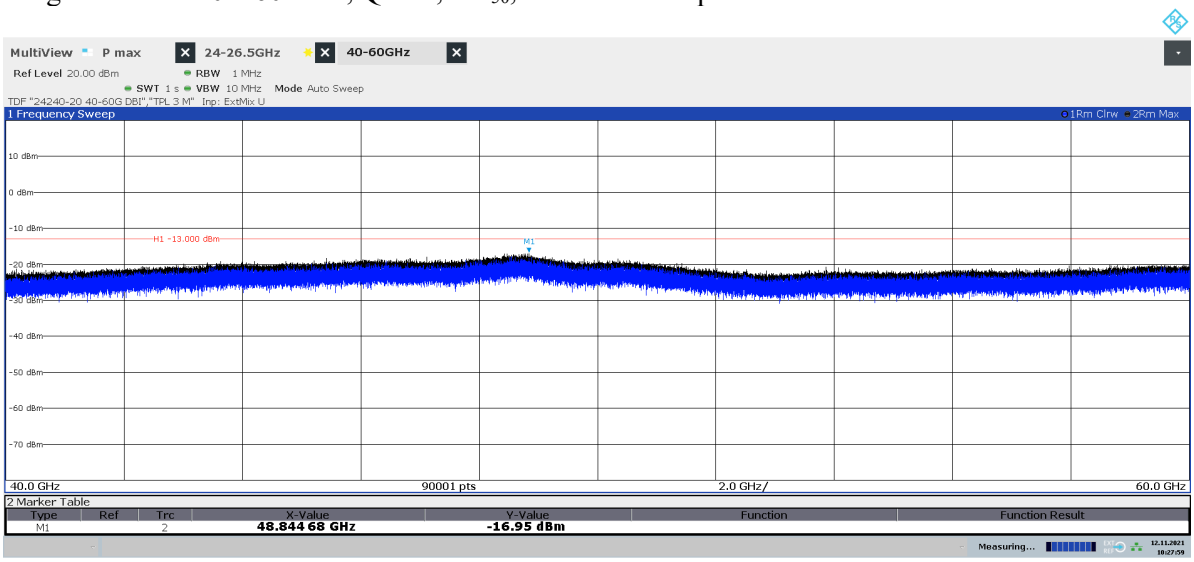


Diagram 2.14a: 40 – 60 GHz, QPSK, BH_{50}, EIRP Horizontal polarization



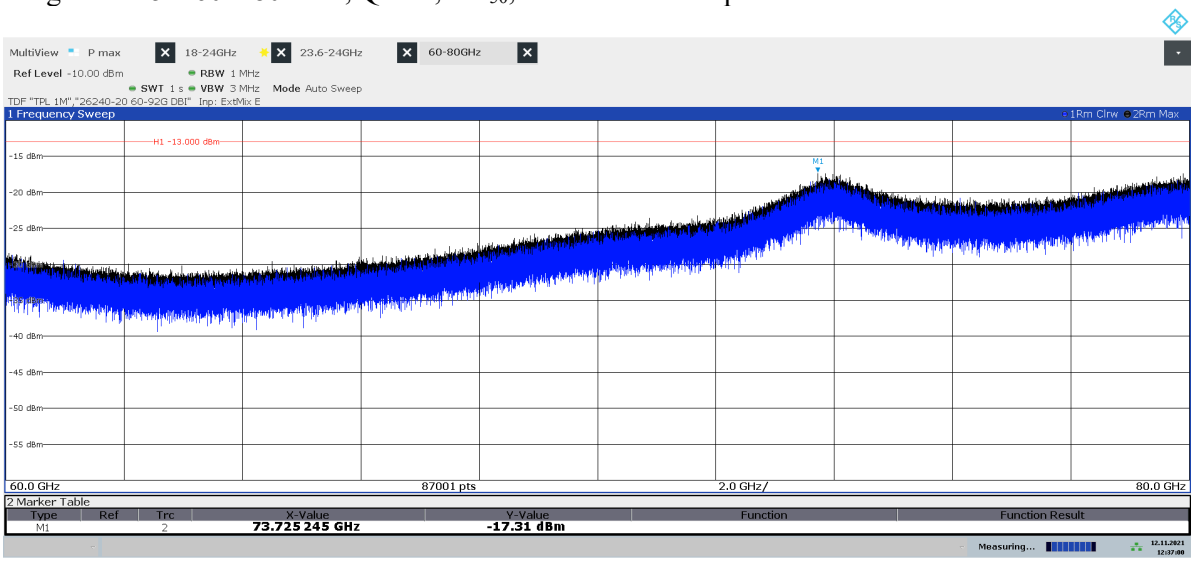
10:25:26 12.11.2021

Diagram 2.14b: 40 – 60 GHz, QPSK, BH_{50}, EIRP Vertical polarization



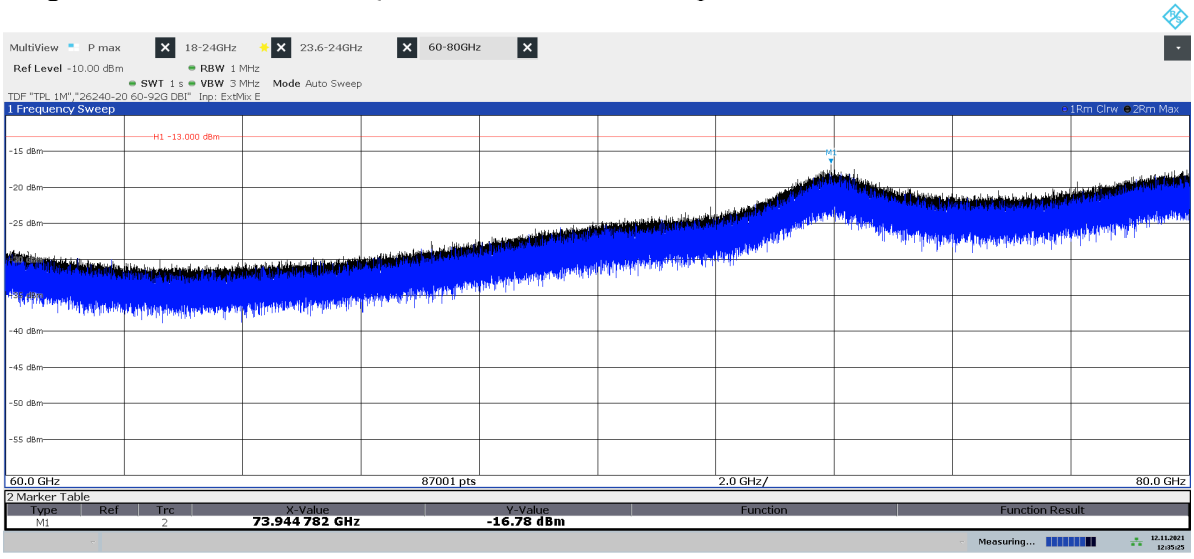
10:27:59 12.11.2021

Diagram 2.15a: 60 – 80 GHz, QPSK, BH_{50}, EIRP Horizontal polarization



12:37:01 12.11.2021

Diagram 2.15b: 60 – 80 GHz, QPSK, BH_{50}, EIRP Vertical polarization



12:35:25 12.11.2021

Diagram 2.16a: 80 – 100 GHz, QPSK, BH_{50}, EIRP Horizontal polarization

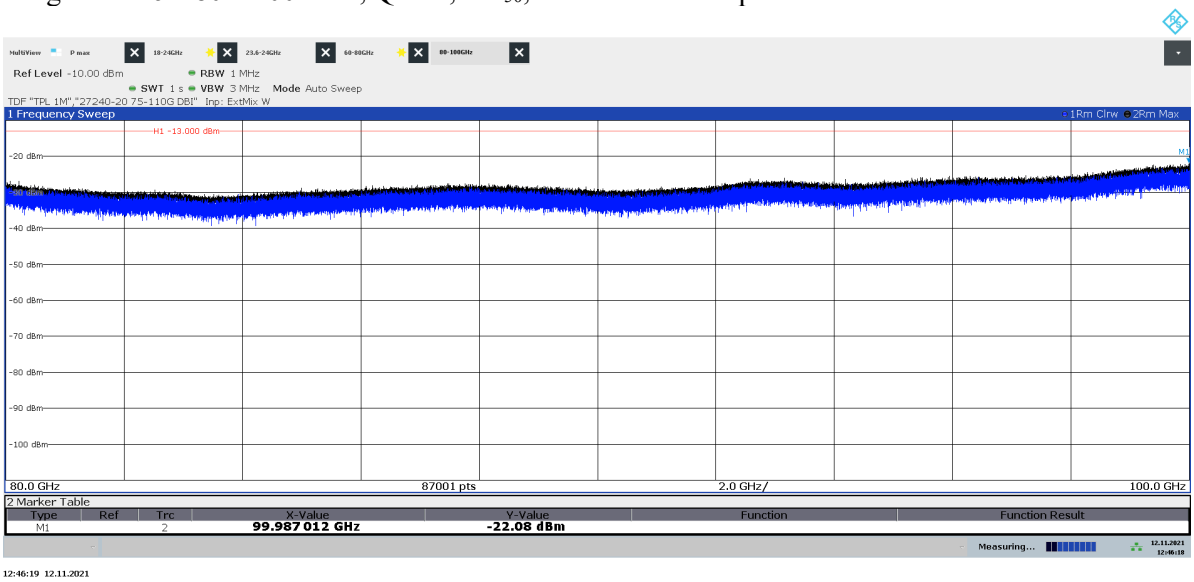


Diagram 2.16b: 80 – 100 GHz, QPSK, BH_{50}, EIRP Vertical polarization

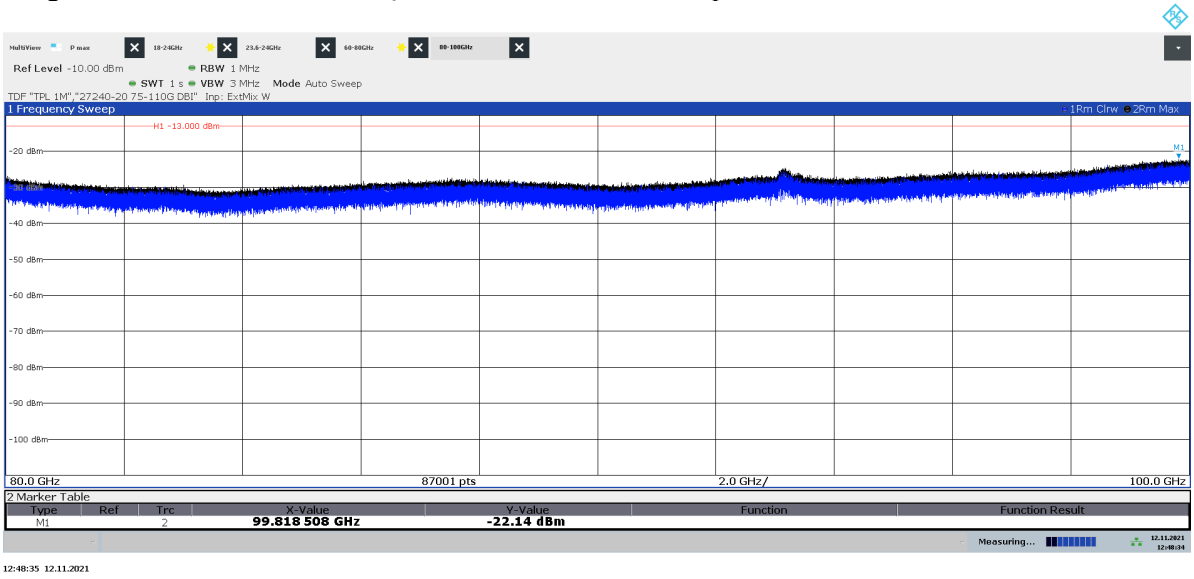


Diagram 2.17a: 30 – 1000 MHz, QPSK, BT8$_{50}$, EIRP Horizontal polarization

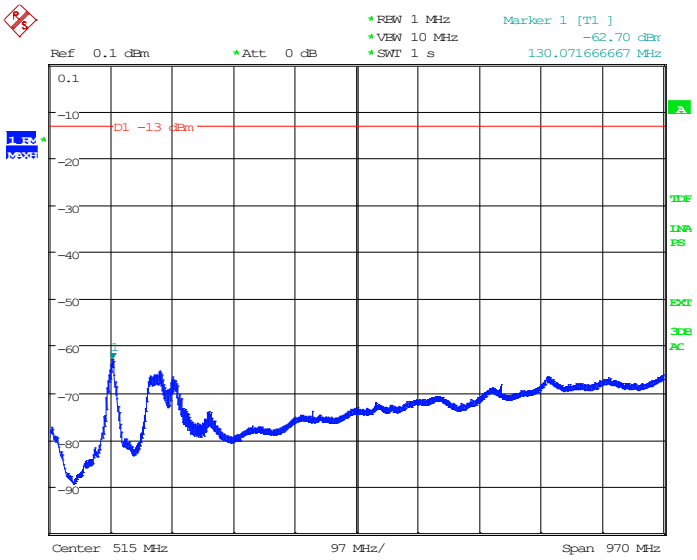


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Diagram 2.17b: 30 – 1000 MHz, QPSK, BT8$_{50}$, EIRP Vertical polarization

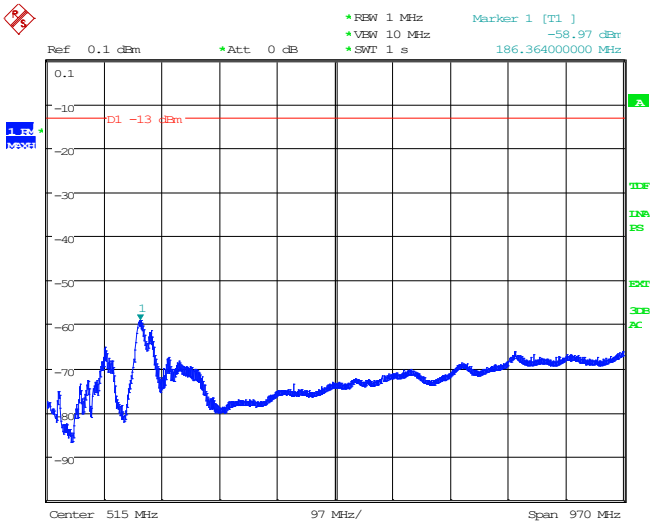

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Diagram 2.18a: 1 – 18 GHz, QPSK, $BT8_{50}$, EIRP Horizontal polarization

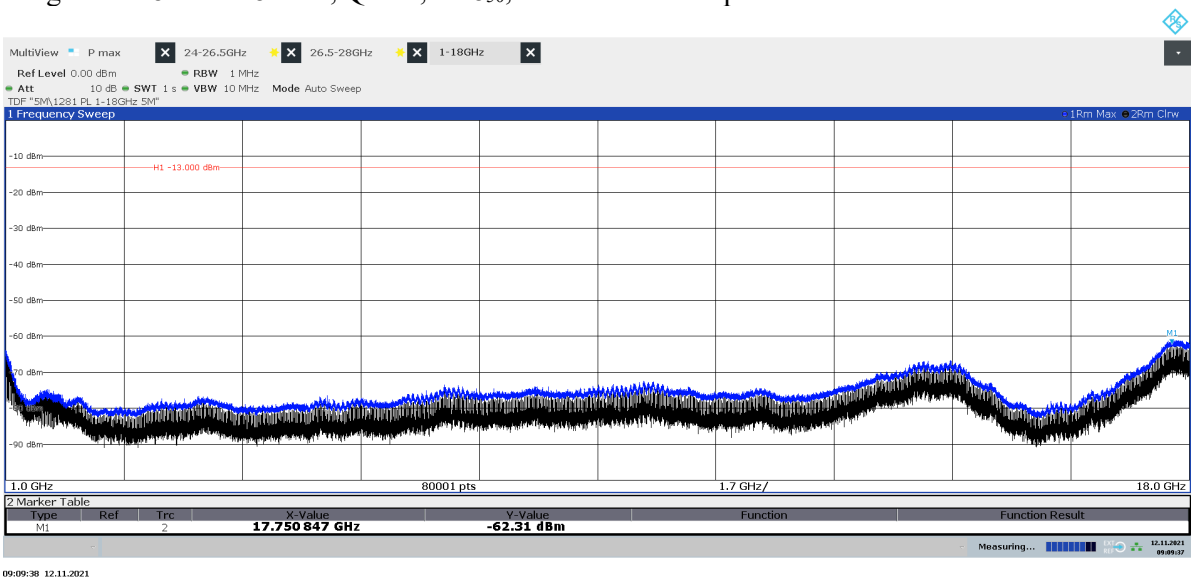


Diagram 2.18b: 1 – 18 GHz, QPSK, $BT8_{50}$, EIRP Vertical polarization

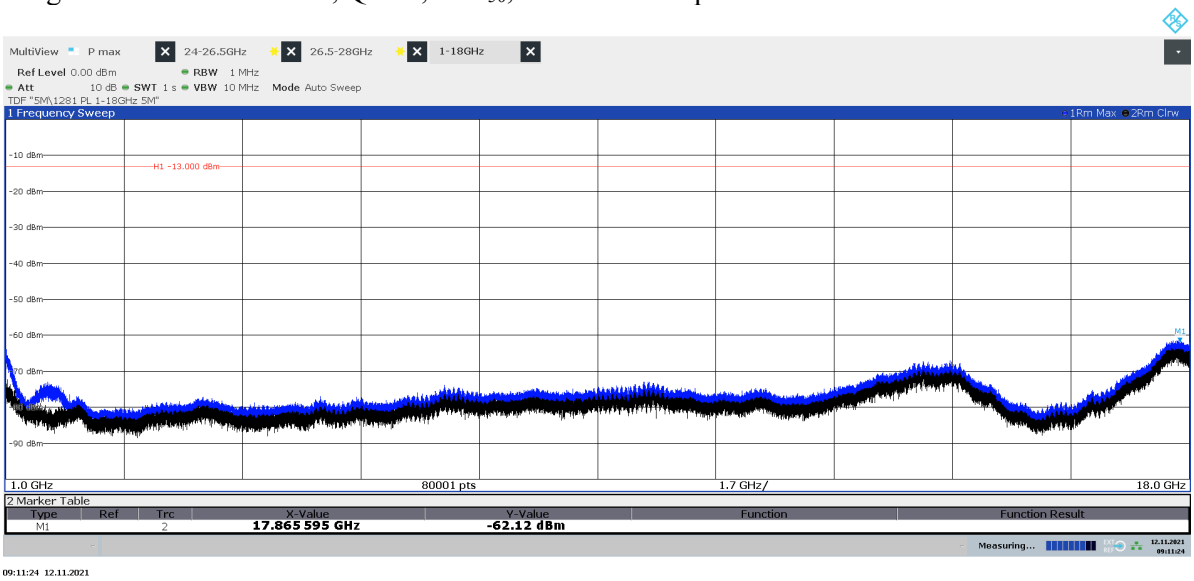


Diagram 2.19a: 18 – 24 GHz, QPSK, $BT8_{50}$, EIRP Horizontal polarization

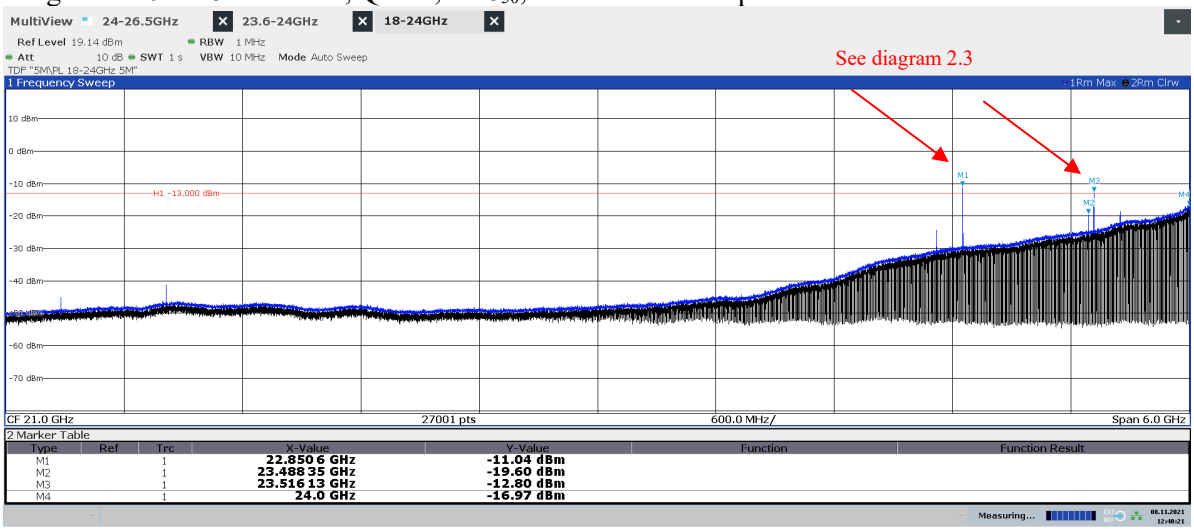


Diagram 2.19b: 18 – 24 GHz, QPSK, $BT8_{50}$, EIRP Vertical polarization

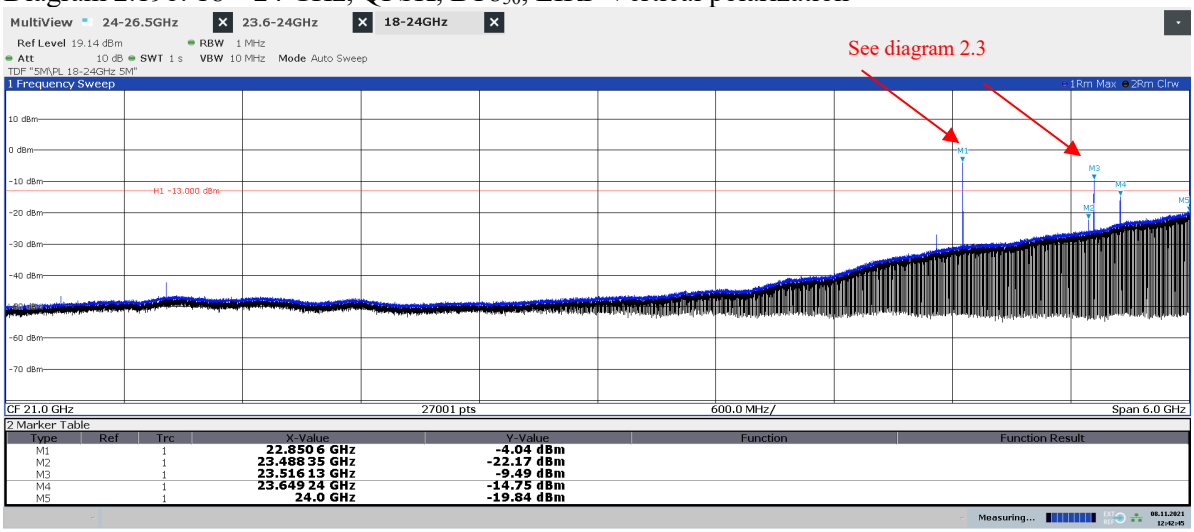


Diagram 2.20a: 24 – 26.5 GHz, QPSK, BT8_{50}, EIRP Horizontal polarization

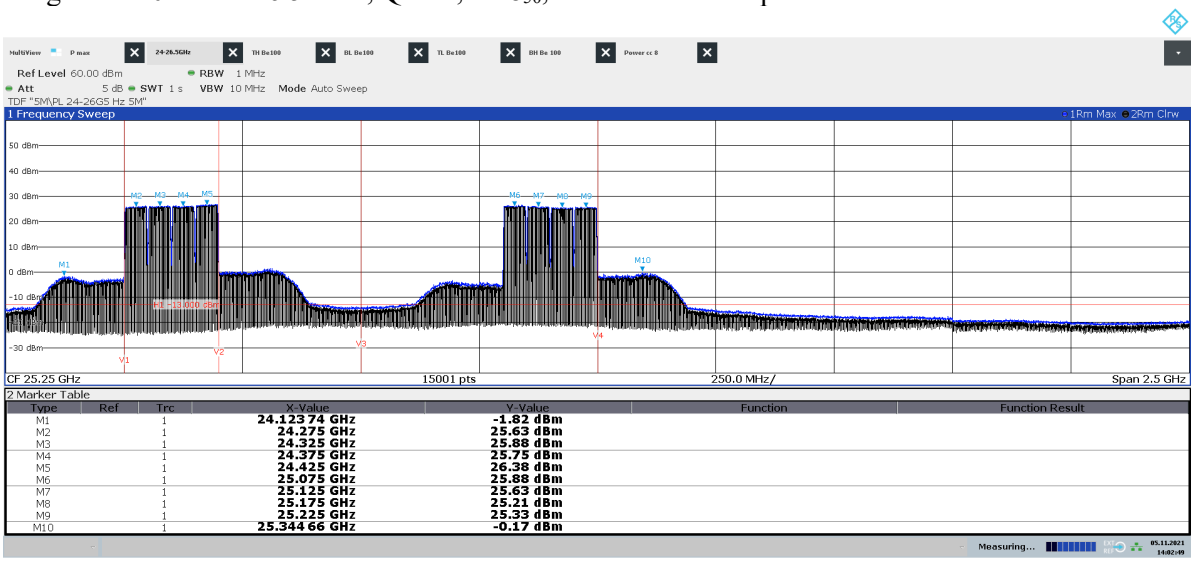


Diagram 2.20b: 24 – 26.5 GHz, QPSK, BT8_{50}, EIRP Vertical polarization

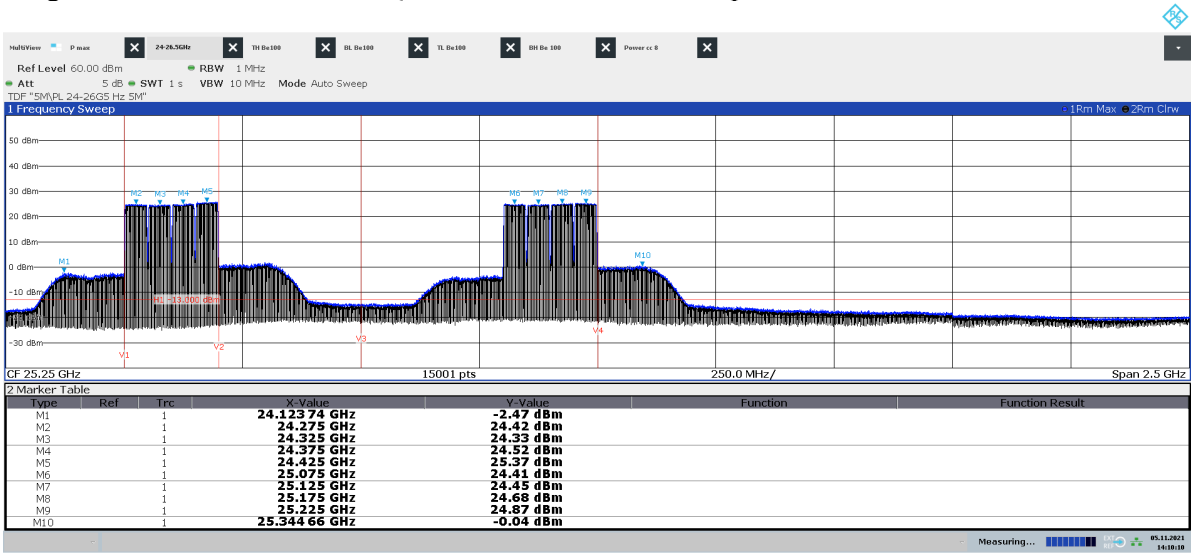


Diagram 2.20c: 24 – 24.25 GHz, QPSK, $BT8_{50}$, EIRP Horizontal polarization

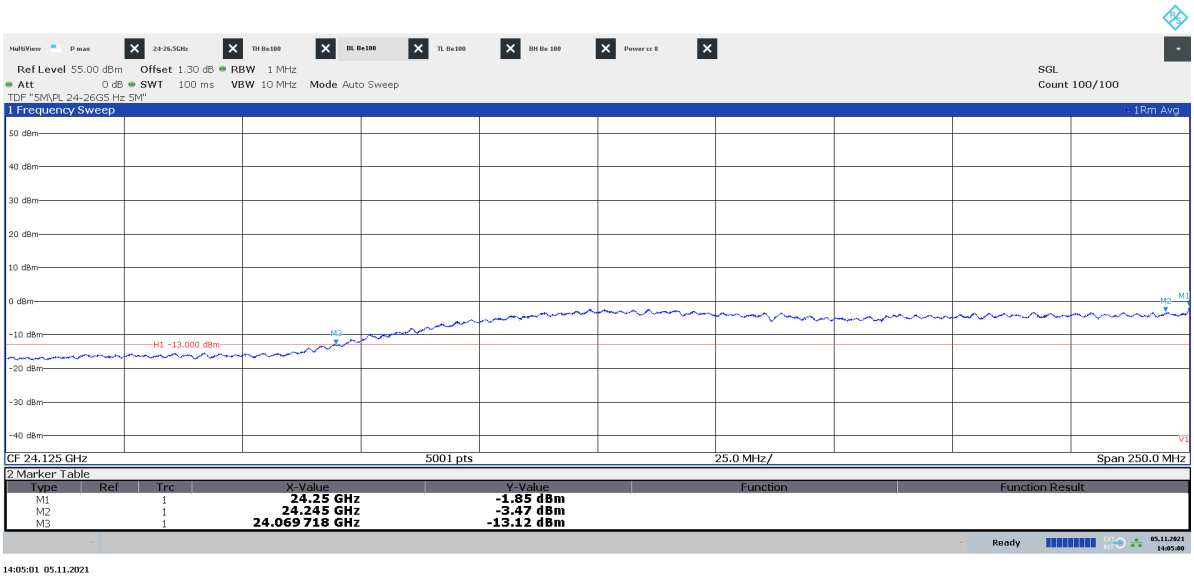
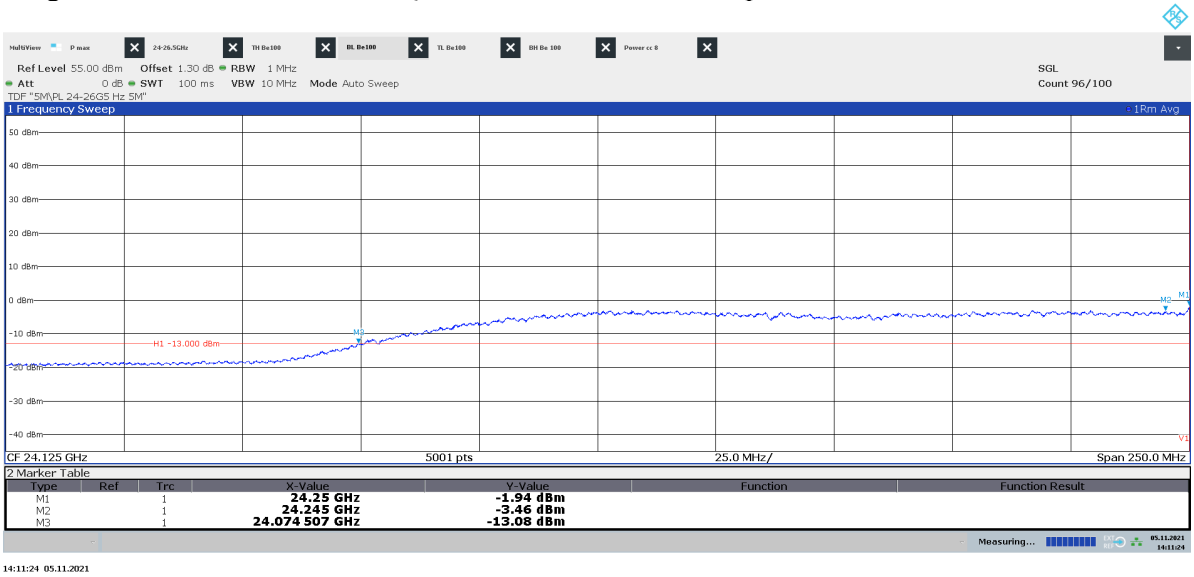


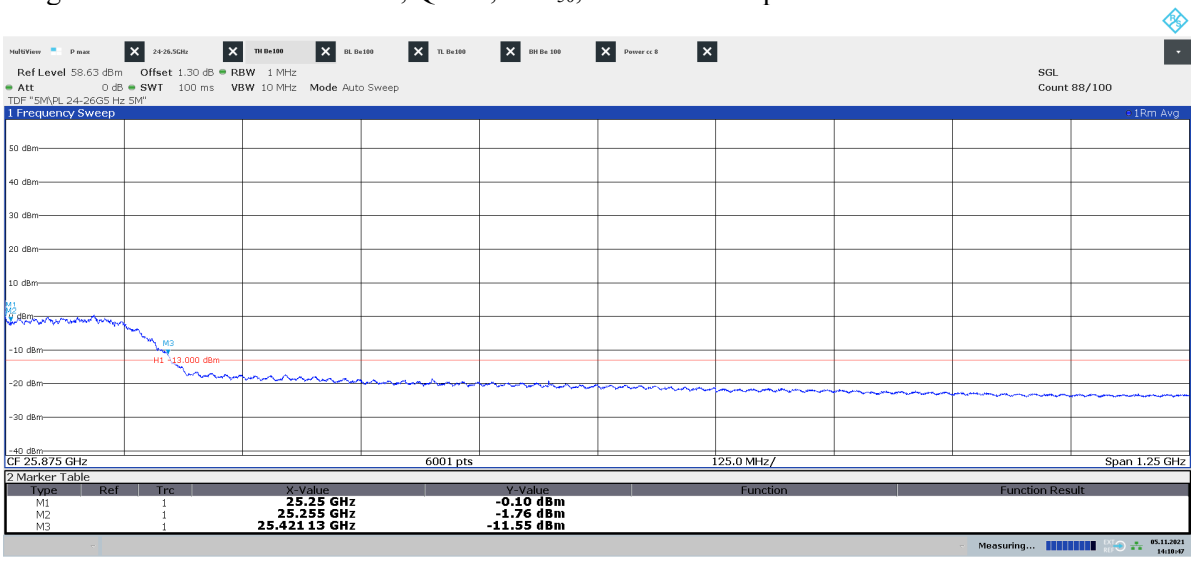
Diagram 2.20d: 24 – 24.25 GHz, QPSK, $BT8_{50}$, EIRP Vertical polarization



Power EIRP for 24.25 GHz Hor/ Ver [dBm]	Power EIRP for 25.245 GHz Hor/ Ver [dBm]	Antenna Gain Hor/ Ver [dBi]	Total conducted power/BW for 24.25 GHz (Limit -5 dBm) [dBm]/ Verdict	Total conducted power/BW for 25.245 GHz (Limit -13 dBm) [dBm]/ Verdict
-1.85/ -1.94	-3.47/ -3.46	25.14/ 25.06	-23.99/ Pass	-25.55/ Pass

Diagram 2.20e: 25.25 – 26.5 GHz, QPSK, $BT8_{50}$, EIRP Horizontal polarization

Diagram 2.20f: 25.25 – 26.5 GHz, QPSK, $BT8_{50}$, EIRP Vertical polarization



Power EIRP for 25.25 GHz Hor/ Ver [dBm]	Power EIRP for 25.255 GHz Hor/ Ver [dBm]	Antenna Gain Hor/ Ver [dBi]	Total conducted power/BW for 24.25 GHz (Limit -5 dBm) [dBm]/ Verdict	Total conducted power/BW for 25.245 GHz (Limit -13 dBm) [dBm]/ Verdict
-1.42/ -0.10	-2.93/ -1.76	25.27/ 25.22	-22.94/ Pass	-24.54/ Pass

Diagram 2.21a: 26 – 28 GHz, QPSK, BT8$_{50}$, EIRP Horizontal polarization

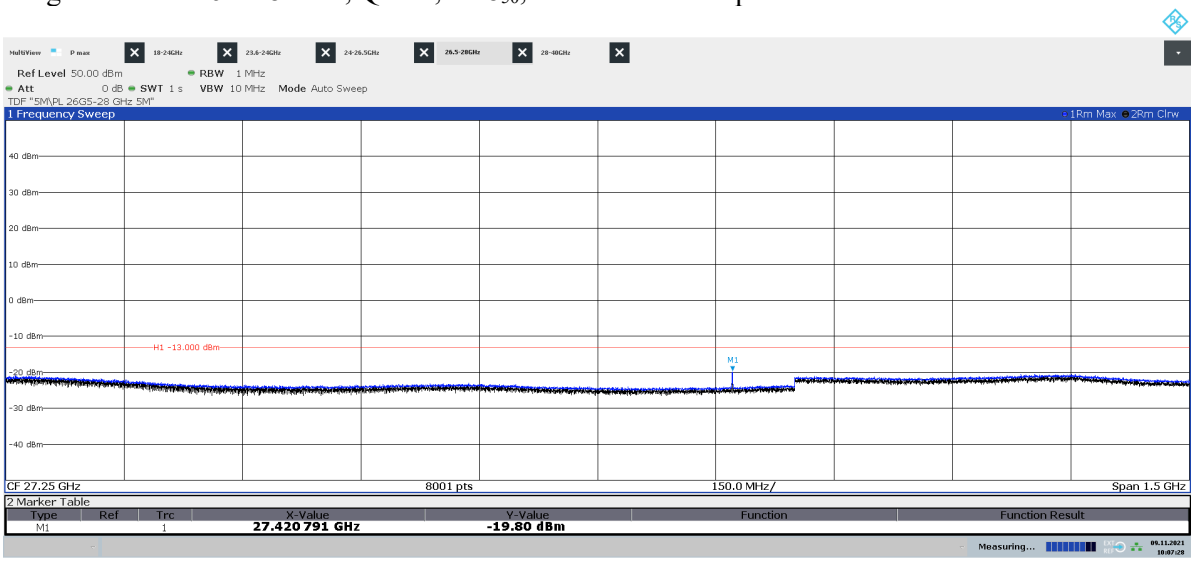


Diagram 2.21a: 26 – 28 GHz, QPSK, BT8$_{50}$, EIRP Vertical polarization

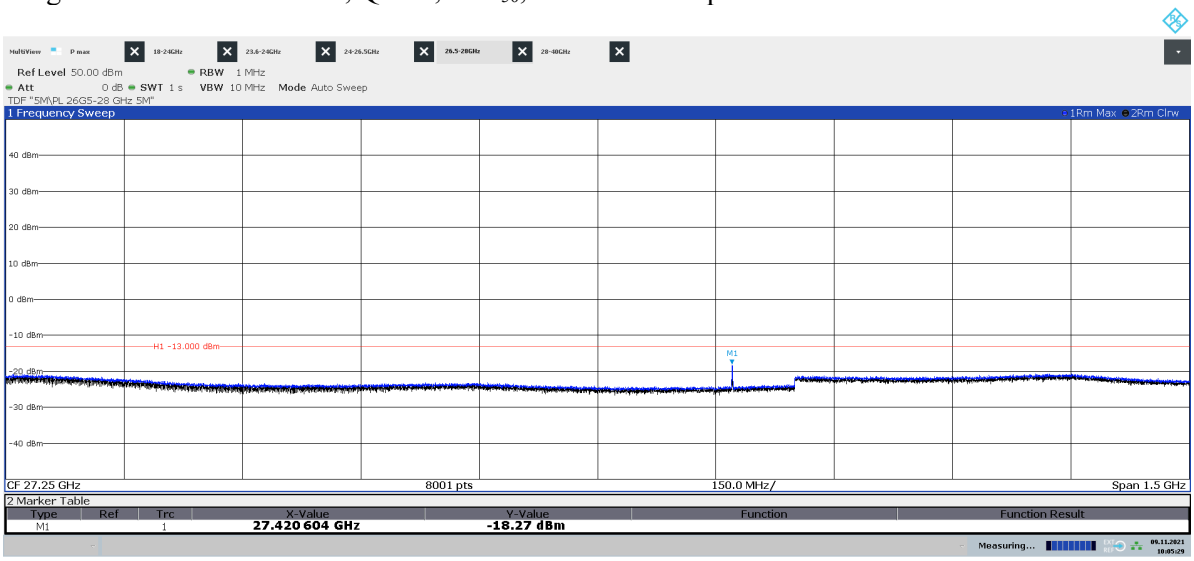


Diagram 2.22a: 28 – 40 GHz, QPSK, $BT8_{50}$, EIRP Horizontal polarization

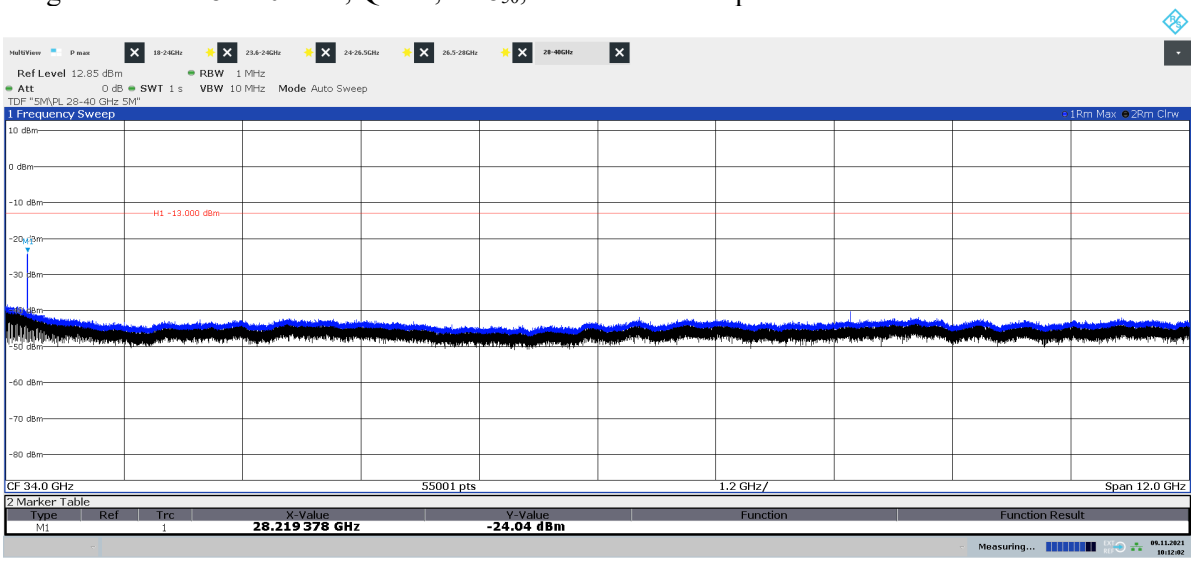


Diagram 2.22b: 28 – 40 GHz, QPSK, $BT8_{50}$, EIRP Vertical polarization

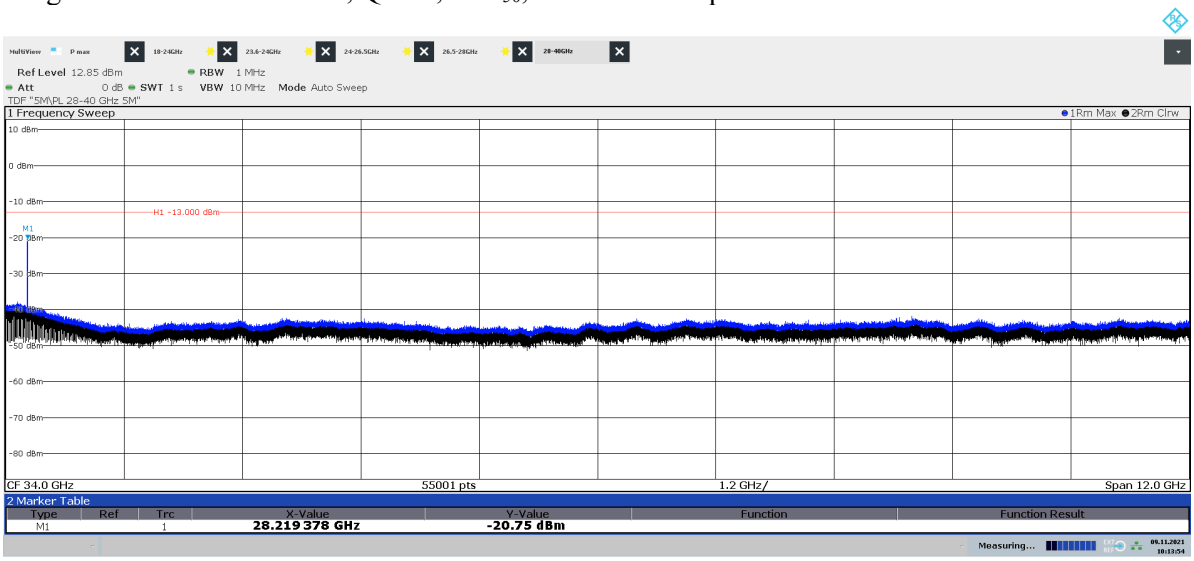
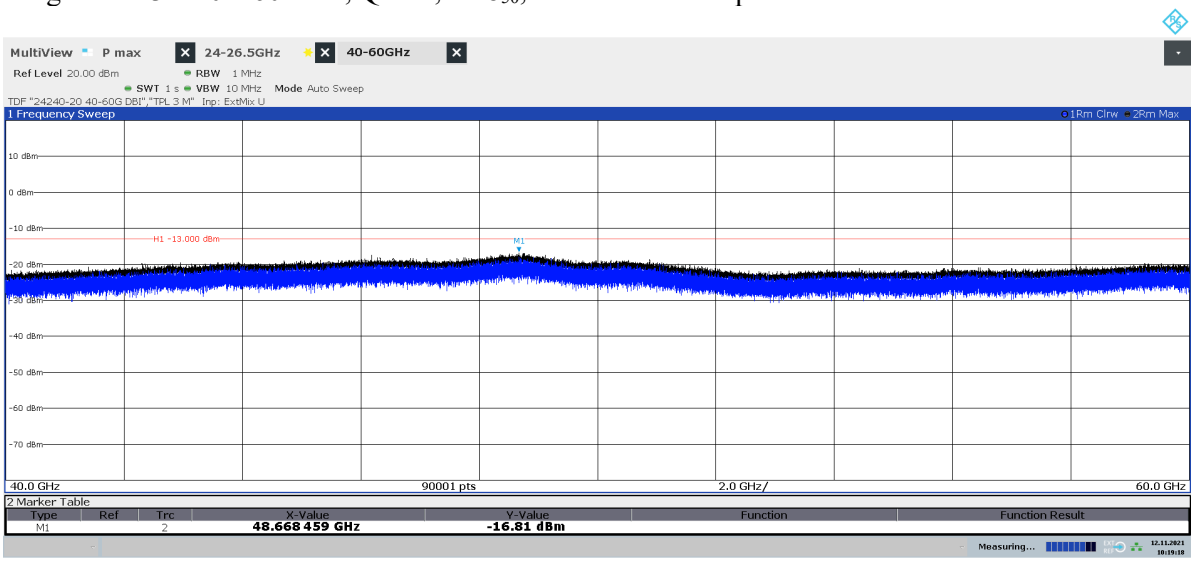
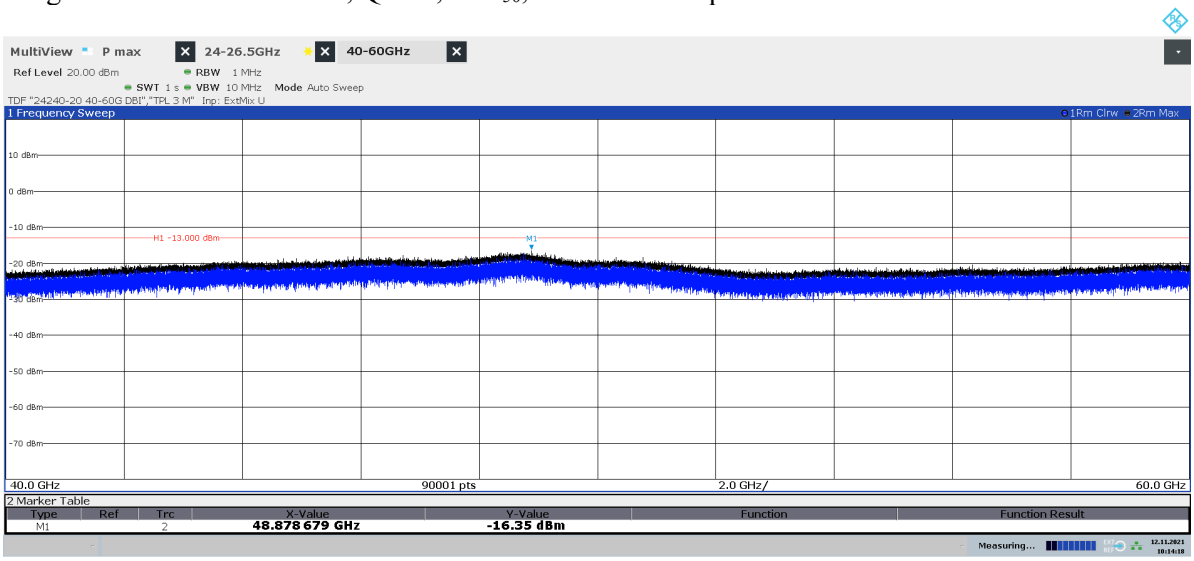


Diagram 2.23a: 40 – 60 GHz, QPSK, BT8$_{50}$, EIRP Horizontal polarization



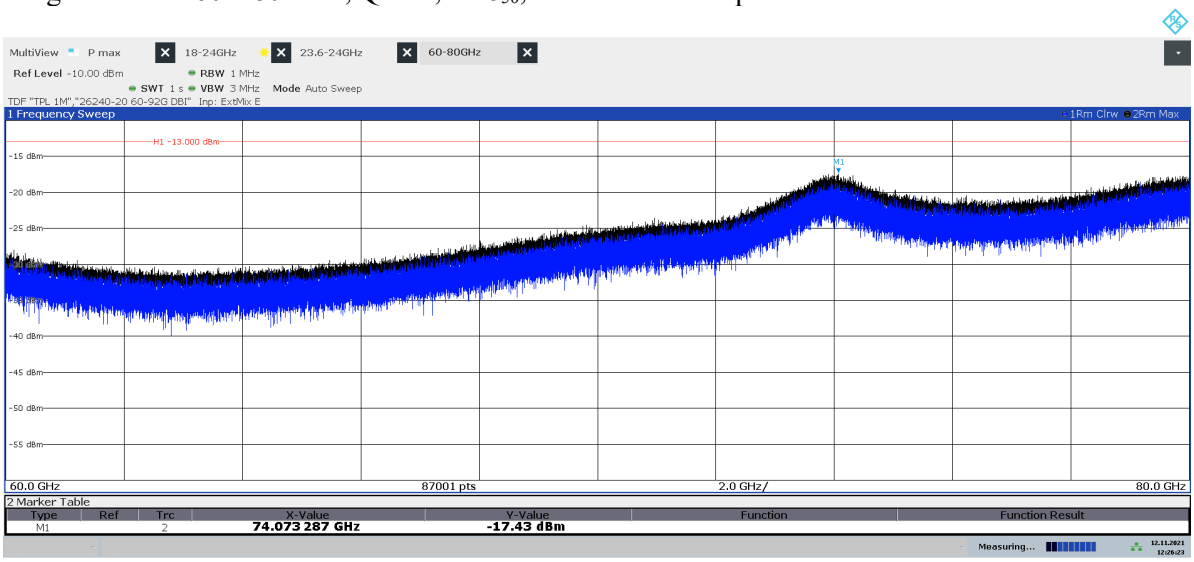
10:19:18 12.11.2021

Diagram 2.23b: 40 – 60 GHz, QPSK, BT8$_{50}$, EIRP Vertical polarization



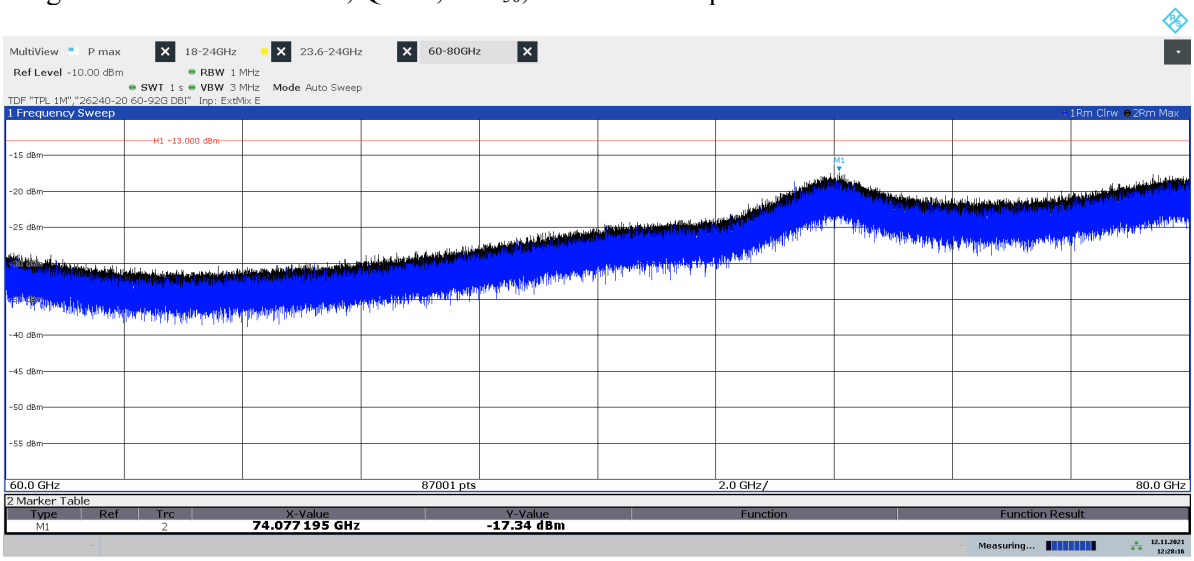
10:14:18 12.11.2021

Diagram 2.24a: 60 – 80 GHz, QPSK, $BT8_{50}$, EIRP Horizontal polarization



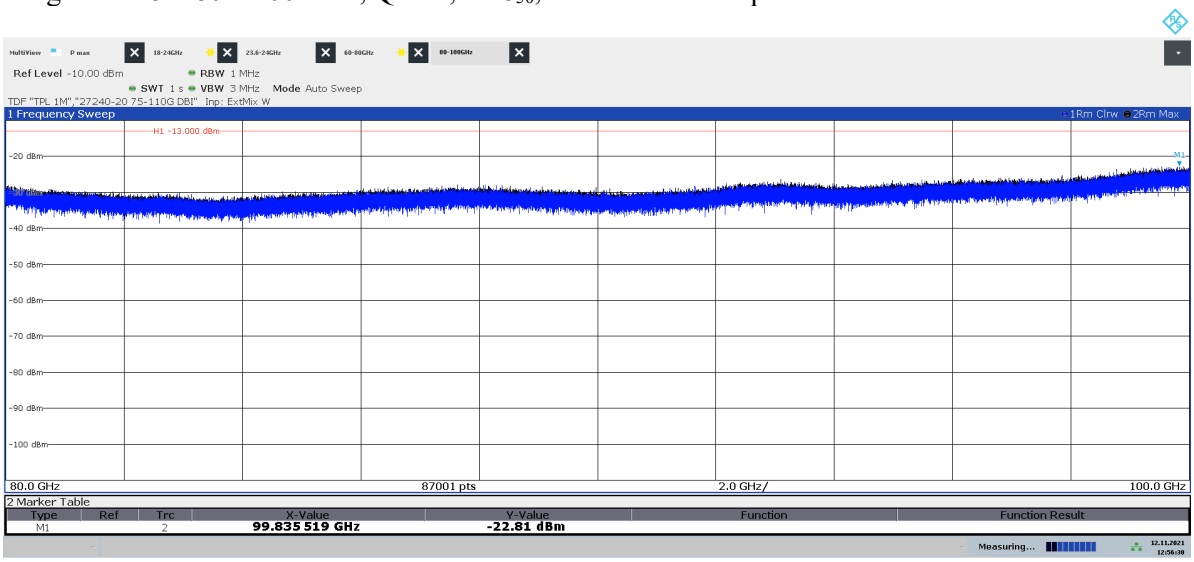
12:26:23 12.11.2021

Diagram 2.24b: 60 – 80 GHz, QPSK, $BT8_{50}$, EIRP Vertical polarization



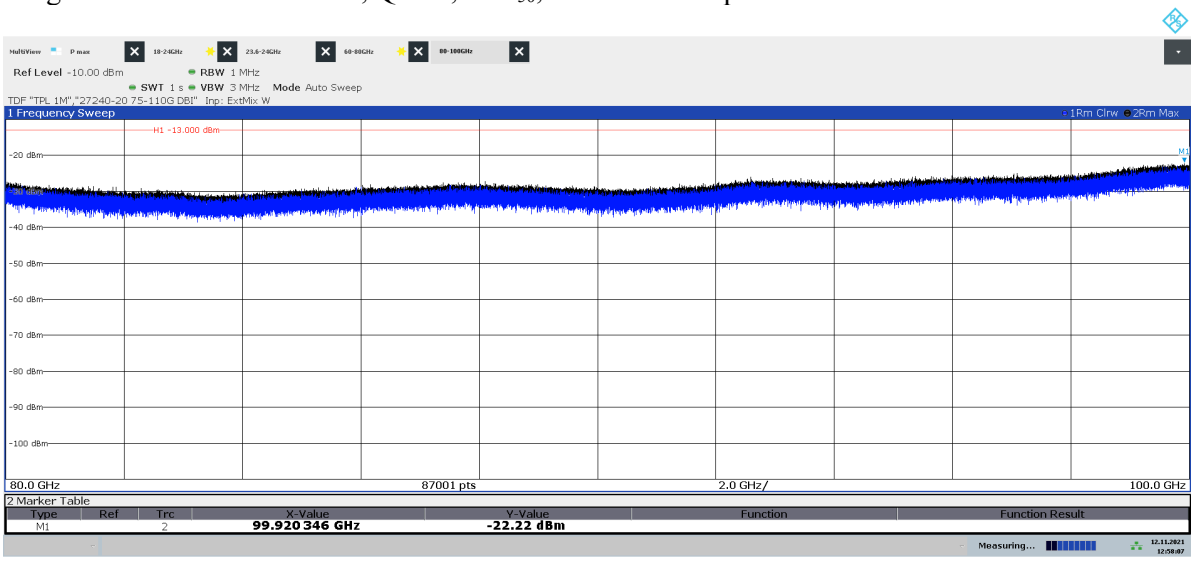
12:28:16 12.11.2021

Diagram 2.25a: 80 – 100 GHz, QPSK, $BT8_{50}$, EIRP Horizontal polarization



12:56:30 12.11.2021

Diagram 2.25b: 80 – 100 GHz, QPSK, $BT8_{50}$, EIRP Vertical polarization



12:58:07 12.11.2021

Frequency stability measurements according to 47 CFR §2.1055

Date	Temperature (test equipment)	Humidity (test equipment)
2021-11-04	23 °C ± 3 °C	40 % ± 5 %
2021-11-05	23 °C ± 3 °C	35 % ± 5 %
2021-11-08	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 and a spectrum analyser with NR software 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 25225.04 MHz (TH) with a bandwidth of 50 MHz.

Test conditions		Frequency error (Hz)
Supply voltage AC (V)	Temp. (°C)	
102	+20	+40
138	+20	+30
120	+20	+34
120	+30	+32
120	+40	-40
120	+50	-49
120	+10	-42
120	0	-37
120	-10	-44
120	-20	-39
120	-30	-40
Maximum freq. error (Hz)		-49
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.