REPORT

issued by an Accredited Testing Laboratory

Contact person RISE
Tomas Lennhager
Division Safety and Transport
+46 10 516 54 09
tomas.lennhager@ri.se

Date
2018-11-12
Rev1
2022-06-14

Reference
8P07821-P30-rev1

Testing

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

Radio measurements on AIR 5121 B257A equipment with FCC ID TA8AKRD901059-1

Rev1 2022-06-14: Frequency stability added.

Product name: AIR 5121 B257A
Product number: KRD 901 059/1 and KRD 901 059/4

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

Performed by

Signed by: Tomas Lennhager
Reason: I am the author of this document
Date & Time: 2022-06-14 09:58:23 +02:00

Tomas Lennhager

Examined by

Signed by: Daniel Lundgren
Reason: I have reviewed this document
Date & Time: 2022-06-14 11:22:36 +02:00

Daniel Lundgren

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 5121 B257A Product number AC: KRD 901 059/1 and DC: KRD 901 059/4 FCC ID: TA8AKRD901059-1
Hardware revision state:	R2A. Two different versions of power supply were tested,
Tested configuration:	Single RAT NR TDD
Frequency band:	TX/ RX: 27500 – 28350 MHz
Total BW:	850 MHz
Output power:	Maximum output power / PAAM per Polarization: 40 W
RF configurations:	2 beams/ PAAM 2x2 MIMO, Contiguous Spectrum (CS) and Non-Contiguous spectrum (NCS), Carrier Aggregation (CA) intra-band supported
Antenna beam steering:	Azimuth ±60 deg, elevation ±15 deg
Channel bandwidths:	50 MHz and 100 MHz
Modulations:	QPSK, 16QAM and 64QAM
RF power Tolerance:	+1.5/ -2.5 dB
CPRI Speed	Up to 10.1 Gbit/s

The information above is supplied by the manufacturer.

Purpose of test

The purpose of this test is to justify a Class two Permissive change to add the Radio Access Technology "New Radio" (NR) and also include a DC powered version of the same radio.

Operation modes during measurements

The measurements were performed with the test object transmitting test models as defined in NEW-18:012192 PA1. Test model NR FR2 TM 1.1 was 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

Different beam index locked and scan mode was tested. Locked mode in bore site was found to represent worst case.
All measurements were performed with the test object configured for maximum transmit power at bore site. The measured configurations is representative for worst case settings.

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 55% and to compensate for this 2.57 dB was added to the test results.

Measurements

The AC powered version was used for all measurements. In addition, out of band emission was performed on the DC powered version in a limited frequency range.

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

References

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

CFR 47 part 30, October 2018
ANSI C63.26-2015
ANSI C63.26 mmWave JTG v1.0
3GPP TS 38.141-2 v1.1.0
662911 D01 Multiple Transmitter Output v02r01 (2013-10-31)
662911 D02 MIMO with Cross Polarized Antenna v01 (2011-10-25)
971168 D01 Power Meas License Digital Systems v03 (2017-10-27)

Measurement equipment

	Calibration Due	RISE number
Anechoic chamber, Hertz	2020-11	BX50194
R&S FSW 43	2019-08	902 073
R&S ESU	2019-08	901 553
R&S ZNB 40	2019-08	BX50051
Bilog antenna Schaffner 6143	2021-07	504079
Flann STD Gain Horn Antenna 20240-20	-	503 674
Flann STD Gain Horn Antenna 22240-20	-	503 674
Flann STD Gain Horn Antenna 24240-20	-	503 674
Flann STD Gain Horn Antenna 26240-20	-	503 674
Flann STD Gain Horn Antenna 27240-20	-	503 674
Mixer FS-Z60	2019-11	100147
Mixer FS-Z90	2020-08	503 569
Mixer FS-Z110	2019-01	BX81427
Miteq, Low Noise Amplifier	2018-12	503 278
EMCO Horn Antenna 3115	2021-07	502 175
EMCO Horn Antenna 3115	2019-03	501 548
EMCO Horn Antenna 3116	2021-07	503 279
µComp Nordic, Low Noise Amplifier	2019-01	901 544
Temperature and humidity meter, Testo 615	2019-06	503 498

Frequency stability 2022-04

	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

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: 2018-10-20.

Manufacturer’s representative

Mikael Jansson, Ericsson AB.

Test engineers

Tomas Lennhager Tomas Isbring and Hyder Khalaf, RISE

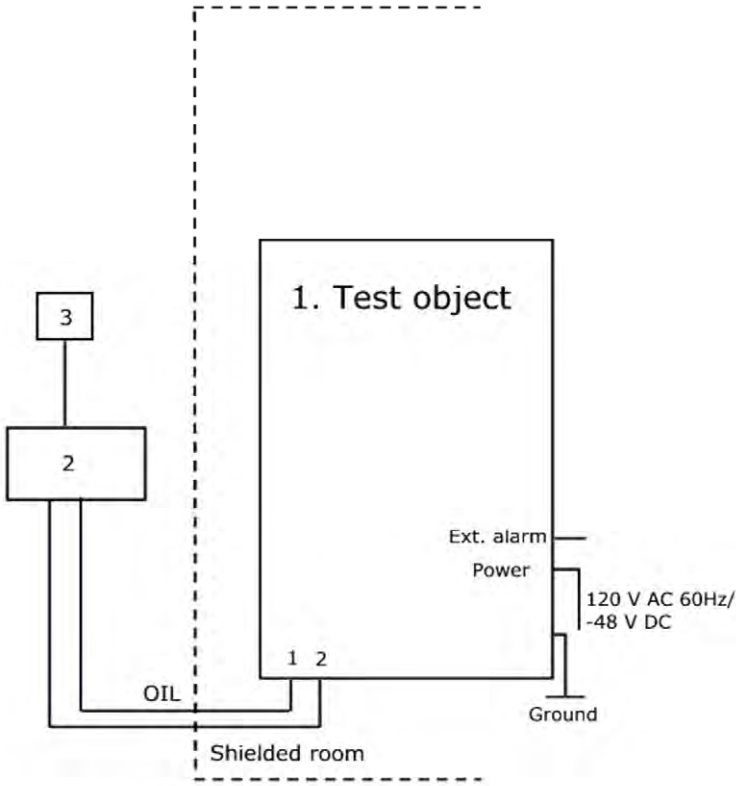
Test participant(-s)

Mikael Jansson and Gunnar Svensson, Ericsson AB.

Test frequencies used for radiated measurements

Frequency PAAM 0 Hor/ Ver [MHz]	Frequency PAAM 1 Hor/ Ver [MHz]	Frequency PAAM 2 Hor/ Ver [MHz]	Frequency PAAM 3 Hor/ Ver [MHz]	Symbolic name	Comment
27525	27900	27950	28325	BMT_{50}	50 MHz BW, TX bottom middle and top frequency configuration
27550	27875	27975	28300	BMT_{100}	100 MHz BW, TX bottom middle and top frequency configuration
27525	27900	27525	27900	$2EL_{50}$	50MHz BW, 2x2 MIMO, TX edge low configuration
27550	27875	27550	27875	$2EL_{100}$	100MHz BW, 2x2 MIMO, TX edge low configuration
27950	28325	27950	28325	$2EH_{50}$	50 MHz BW, 2x2 MIMO, TX edge high configuration
27975	28300	27975	28300	$2EH_{100}$	100 MHz BW, 2x2 MIMO, TX edge high configuration
27550	27650	27550	27650	$2B_{100}$	100 MHz BW, 2x2 MIMO, TX bottom configuration
28200	28300	28200	28300	$2T_{100}$	100 MHz BW, 2x2 MIMO, TX top configuration
28200	28300	28200	28300	CA_{200}	2x100 MHz BW, 2x2 MIMO, 200 MHz Aggregation configuration
28000	28100	28200	28300	CA_{400}	4x100 MHz BW, 400 MHz Aggregation configuration

Test setup: radiated measurements



Test object:

1.	AC: AIR 5121 B257A, KRD 901 059/1, rev. R2A, s/n: D16Y014828 and DC: AIR 5121 B257A, KRD 901 059/4, rev. R2A, s/n: D16Y060590 With Radio Software: CXP 9013268/16, rev. R74GM. FCC ID: TA8AKRD901059-1 For Frequency stability test 2022-04 AC: AIR 1281 B261, KRD 901 059/1, rev. R2A, s/n: D16Y014830 DC: AIR 1281 B261, KRD 901 059/4, rev. R2A, s/n: D16Y060590 Radio Software: CXP 9013268/16, rev. R89DK

Associated equipment:

2.	Testing Equipment: CT10, LPC 102 487/1, rev. R1C, s/n: T01F289490, BAMS – 1000724377 with software CXC1726763/1, rev. P7A26.58, TCA software R12B04 For Frequency stability test 2022-04 Baseband 6630, KDU 137 848/1, rev. R3C, s/n: E23B720982 with software: CXP9024418/15, rev. R47A306

Functional test equipment:

3.	Computer, HP EliteBook 8770w, BAMS - 1001450166

Interfaces:

Power input configuration AC: 120 VAC 60Hz	Power
Power input configuration DC: -48 V DC	Power
1, Optical Interface Link, single mode opto fibre	Signal
2, Optical Interface Link, single mode opto fibre	Signal
EXT Alarm, shielded multi-wire	Signal
Ground wire	Ground

RF power output measurements according to CFR 47 §30.202

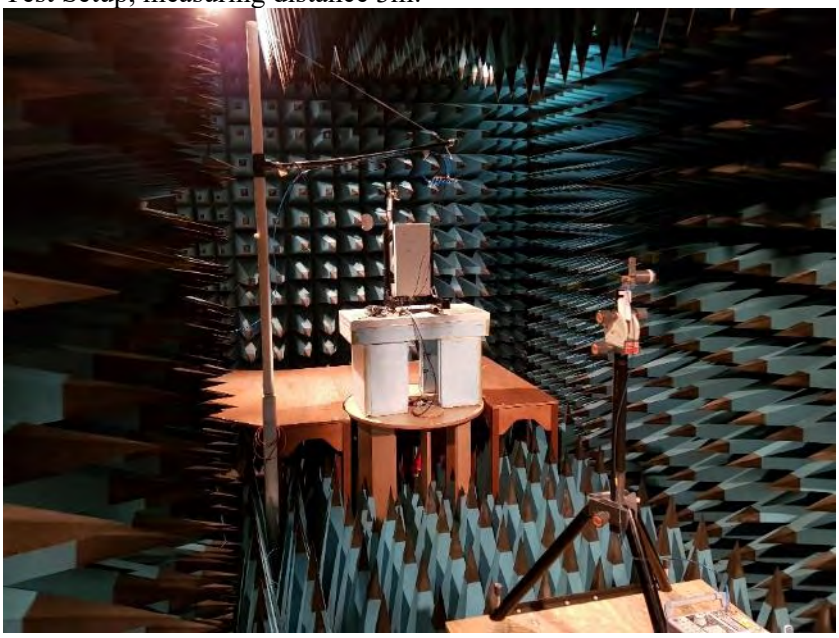
Date	Temperature	Humidity
2018-10-23	23 °C ± 3 °C	31 % ± 5 %
2018-10-24	23 °C ± 3 °C	15 % ± 5 %
2018-10-25	23 °C ± 3 °C	25 % ± 5 %

Test set-up and procedure

The test object was located in a anechoic chamber. The measuring antenna was aligned to the centre of the test object antennas. A turn table was used to find the highest output power. A signal analyser 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 Network analyzer (ZNB 40) was used to measure the total correction factor for the measurement chain, including the receiver antenna gain, cable loss, and the pathloss for the measurement distance using a reference antenna(EMCO 3116) replacing the EUT. The reference antenna was located in the center of the EUT PAAMs. The antenna gain of the reference antenna was subtracted from the S21 measurement and the result was entered into the spectrum analyzer as a transducer factor.

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	503 674
Testo 615, temperature and humidity meter	503 498

Measurement uncertainty: 3.3 dB

Results

KRD 901 059/1

Beam index 0 Bore site, Bandwidth 50MHz
Rated output power level at each PAAM 1x 43 dBm/ Polarization.

		Output power per 100 MHz [RMS dBm] Vertical/ Horizontal			
Modulation	Symbolic name	PAAM 0	PAAM 1	PAAM 2	PAAM 3
QPSK	BMT_{50}	40.73/ 40.78	41.93/ 41.75	42.25/ 41.70	41.95/ 41.91
16 QAM	BMT_{50}	40.77/ 40.91	41.96/ 41.86	41.98/ 41.83	41.84/ 41.89
64 QAM	BMT_{50}	40.89/ 40.76	41.93/ 41.95	42.03/ 41.76	41.88/ 41.95

Beam index 0 Bore site, Bandwidth 100MHz
Rated output power level at each PAAM 1x 46 dBm/ Polarization.

		Output power per 100 MHz [RMS dBm] Vertical/ Horizontal			
Modulation	Symbolic name	PAAM 0	PAAM 1	PAAM 2	PAAM 3
QPSK	BMT_{100}	43.94/ 43.86	44.72/ 44.41	44.58/ 44.29	44.92/ 44.82
16 QAM	BMT_{100}	43.88/ 43.97	44.89/ 44.46	44.71/ 44.26	44.87/ 45.02
64 QAM	BMT_{100}	41.54/ 41.79	42.44/ 42.25	42.53/ 42.07	42.39/ 42.54

Beam index 0 Bore site, Bandwidth 50MHz

Rated output power level with two PAAM transmitting on the same frequency, 2x 43 dBm/ Polarization.

		Output power per 100 MHz [RMS dBm] Vertical/ Horizontal	
Modulation	Symbolic name	PAAM 0+2	PAAM 1+3
QPSK	$2EL_{50}$	44.13/ 44.01	44.77/ 44.59
QPSK	$2EH_{50}$	45.03/ 44.26	44.61/ 45.08
16 QAM	$2EL_{50}$	44.19/ 43.98	44.74/ 44.55
16 QAM	$2EH_{50}$	44.97/ 44.43	44.53/ 44.98
64 QAM	$2EL_{50}$	44.18/ 43.88	44.66/ 44.66
64 QAM	$2EH_{50}$	44.96/ 44.49	44.75/ 45.04

Beam index 0 Bore site, Bandwidth 100MHz

Rated output power level with two PAAM transmitting on the same frequency, 2x 46 dBm/ Polarization.

		Output power per 100 MHz [RMS dBm] Vertical/ Horizontal	
Modulation	Symbolic name	PAAM 0+2	PAAM 1+3
QPSK	$2EL_{100}$	47.26/ 46.74	47.35/ 47.18
QPSK	$2EH_{100}$	47.31/ 47.04	47.69/ 47.68
16 QAM	$2EL_{100}$	47.55/ 46.93	47.22/ 47.31
16 QAM	$2EH_{100}$	47.55/ 46.94	47.86/ 47.86
64 QAM	$2EL_{100}$	45.28/ 44.56	44.90/ 45.16
64 QAM	$2EH_{100}$	45.29/ 44.52	45.32/ 45.57

Carrier Aggregation Beam index 0 Bore site

Rated output power level with two PAAM transmitting on the same frequency, 2x 46 dBm/ Polarization

		Output power per 100 MHz [RMS dBm] Vertical/ Horizontal	
Modulation	Symbolic name	PAAM 0+2	PAAM 1+3
16 QAM	CA_{200}	48.22/ 47.70	47.50/ 48.03

Rated output power level at each PAAM 1x 46 dBm/ Polarization.

		Output power per 100 MHz [RMS dBm] Vertical/ Horizontal			
Modulation	Symbolic name	PAAM 0	PAAM 1	PAAM 2	PAAM 3
16 QAM	CA_{400}	44.33/ 43.80	44.47/ 44.85	45.73/ 45.20	44.80/ 44.90

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

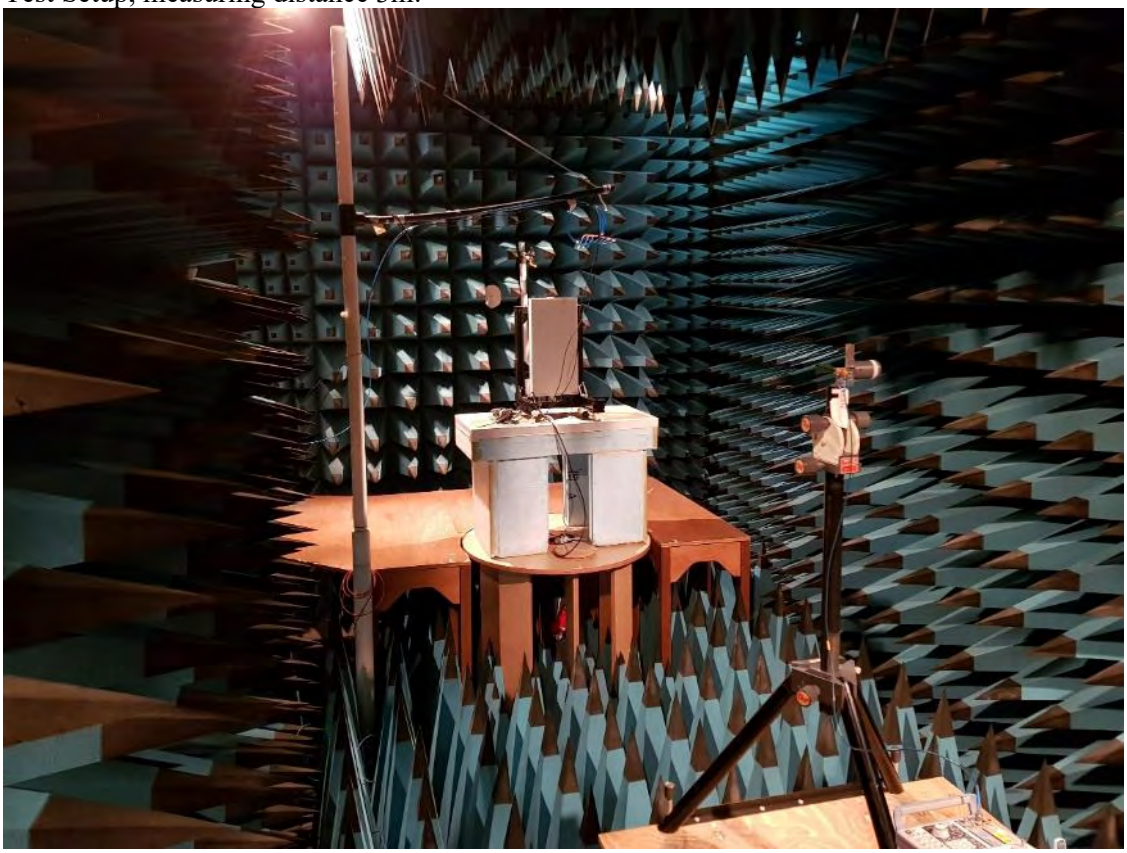
Occupied bandwidth measurements according to CFR47 2.1049

Date	Temperature	Humidity
2018-10-23	23 °C ± 3 °C	31 % ± 5 %
2018-10-24	23 °C ± 3 °C	15 % ± 5 %
2018-10-25	23 °C ± 3 °C	25 % ± 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 test object antennas. A turn table was used to find the highest output power. A signal analyser 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	503 674
Testo 615, temperature and humidity meter	503 498

Measurement uncertainty: 3.3 dB

Results

KRD 901 059/1, Bandwidth: 50 MHz

Modulation: QPSK

Diagram	Carrier Frequency [MHz]	PAAM	Polarization	Occupied BW (99%) [MHz]
1	27525	0	Hor	45.503
2	27525	0	Ver	45.326
3	27900	1	Hor	45.475
4	27900	1	Ver	45.413
5	27950	2	Hor	45.428
6	27950	2	Ver	45.370
7	28325	3	Hor	45.522
8	28325	3	Ver	45.317

Modulation: 16 QAM

Diagram	Symbolic name	PAAM	Polarization	Occupied BW (99%) [MHz]
9	27525	0	Hor	45.411
10	27525	0	Ver	45.221
11	27900	1	Hor	45.340
12	27900	1	Ver	45.381
13	27950	2	Hor	45.341
14	27950	2	Ver	45.334
15	28325	3	Hor	45.478
16	28325	3	Ver	45.344

Modulation: 64 QAM

Diagram	Symbolic name	PAAM	Polarization	Occupied BW (99%) [MHz]
17	27525	0	Hor	45.359
18	27525	0	Ver	45.292
19	27900	1	Hor	45.427
20	27900	1	Ver	45.397
21	27950	2	Hor	45.270
22	27950	2	Ver	45.271
23	28325	3	Hor	45.327
24	28325	3	Ver	45.293

Bandwidth: 100MHz

Modulation: QPSK

Diagram	Symbolic name	PAAM	Polarization	Occupied BW (99%) [MHz]
25	B	0	Hor	94.593
26	B	0	Ver	94.564
27	M	1	Hor	94.558
28	M	1	Ver	94.531
29	M	2	Hor	94.494
30	M	2	Ver	94.601
31	T	3	Hor	95.005
32	T	3	Ver	94.756

Modulation: 16 QAM

Diagram	Symbolic name	PAAM	Polarization	Occupied BW (99%) [MHz]
33	B	0	Hor	94.589
34	B	0	Ver	94.480
35	M	1	Hor	94.369
36	M	1	Ver	94.561
37	M	2	Hor	94.399
38	M	2	Ver	94.587
39	T	3	Hor	95.066
40	T	3	Ver	94.654

Modulation: 64 QAM

Diagram	Symbolic name	PAAM	Polarization	Occupied BW (99%) [MHz]
41	B	0	Hor	94.433
42	B	0	Ver	94.246
43	M	1	Hor	94.322
44	M	1	Ver	94.380
45	M	2	Hor	94.387
46	M	2	Ver	94.423
47	T	3	Hor	94.462
48	T	3	Ver	94.368

Carrier Aggregation, Modulation: 16 QAM

Diagram	Symbolic name	PAAM	Polarization	Occupied BW (99%) [MHz]
49	CA_{200}	0+2, 1+3	Hor	193.422
50	CA_{200}	0+2, 1+3	Ver	193.556
51	CA_{400}	0, 1, 2, 3	Hor	391.768
52	CA_{400}	0, 1, 2, 3	Ver	392.200

Diagram 1:

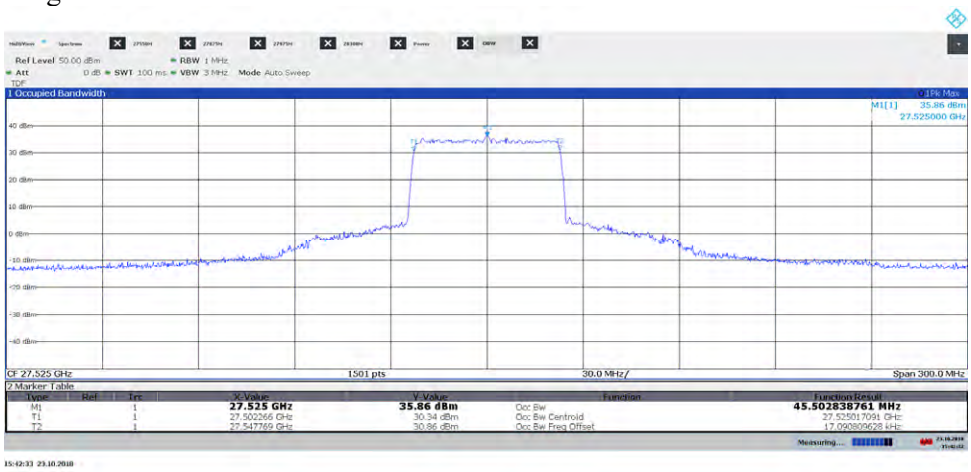


Diagram 2:

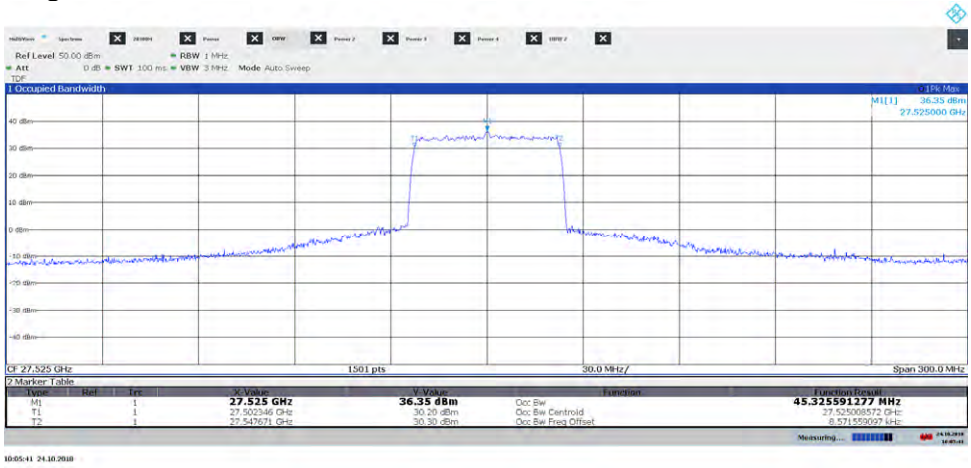


Diagram 3:

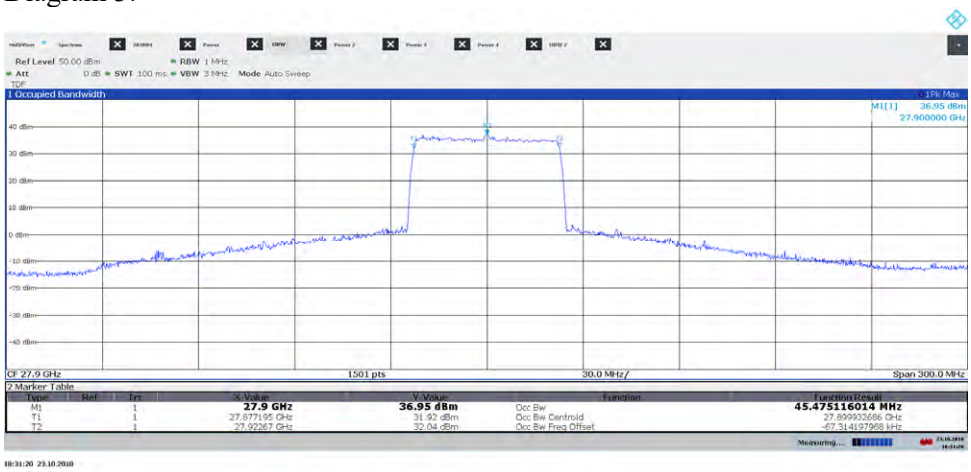


Diagram 4:

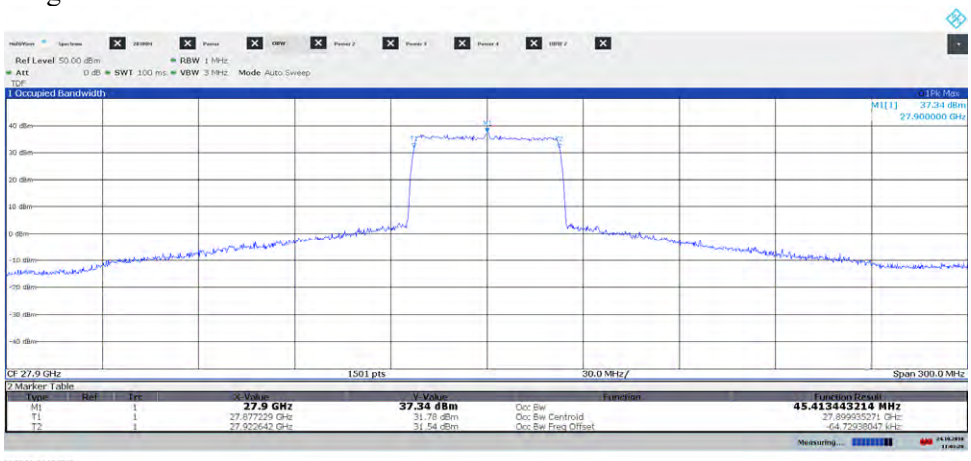


Diagram 5:

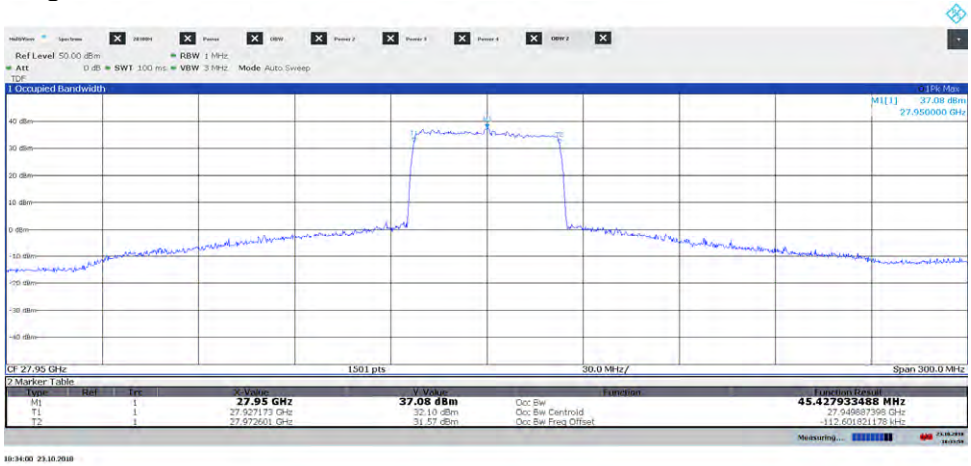


Diagram 6:

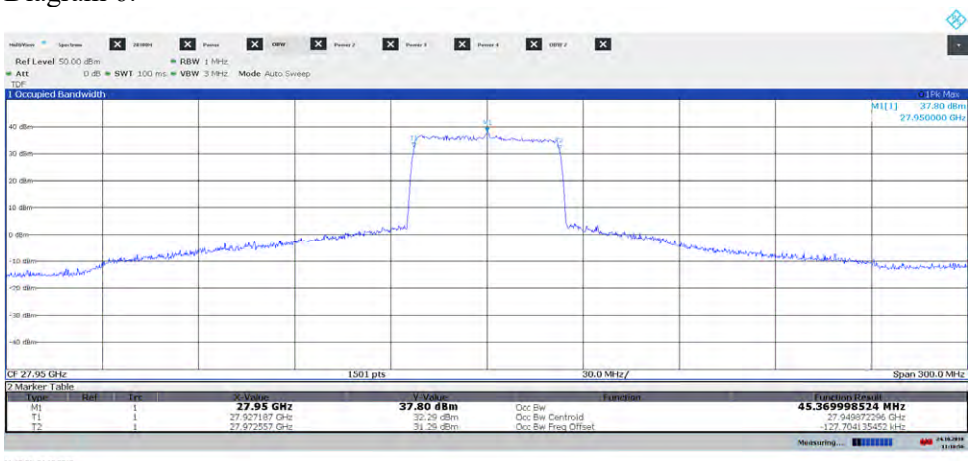


Diagram 7:

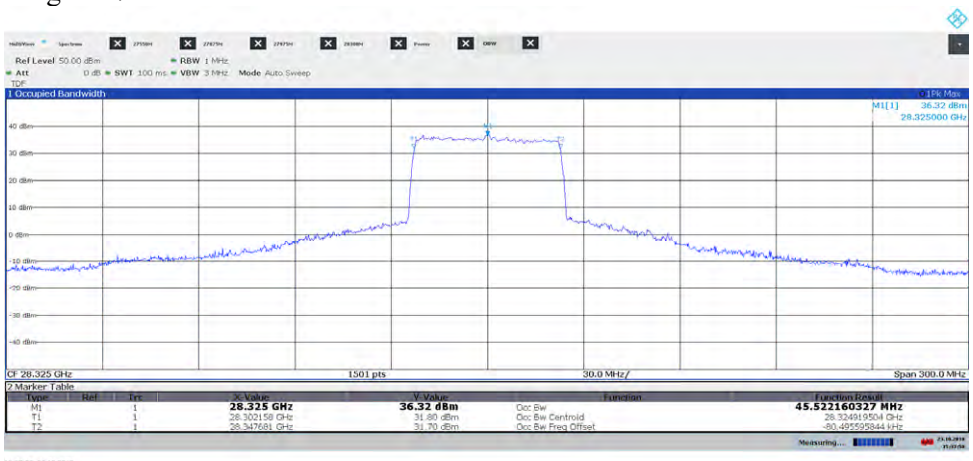


Diagram 8:

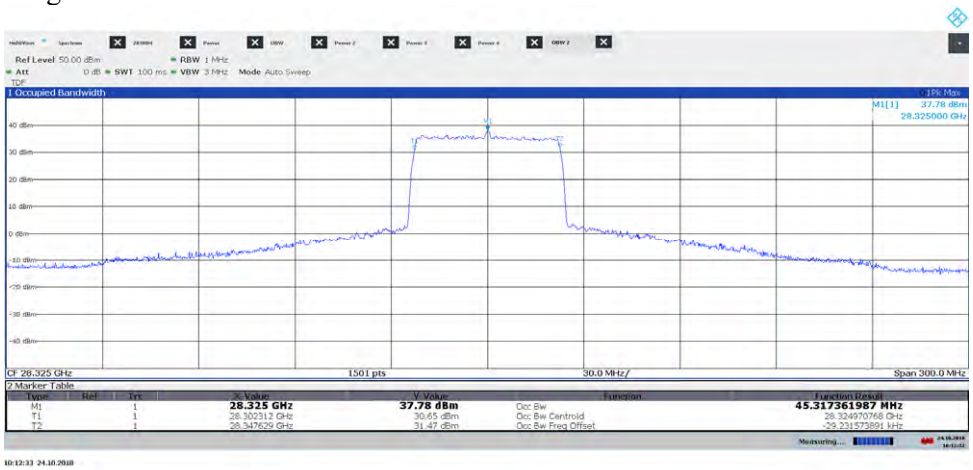


Diagram 9:

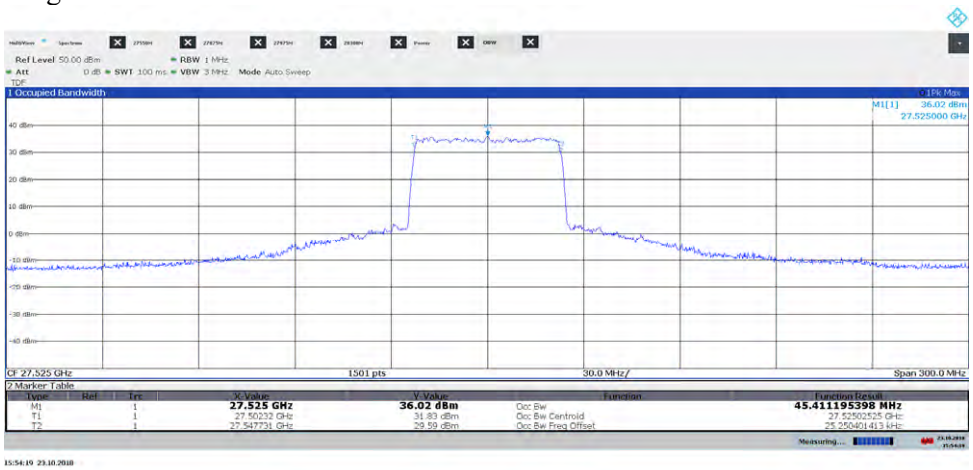


Diagram 10:

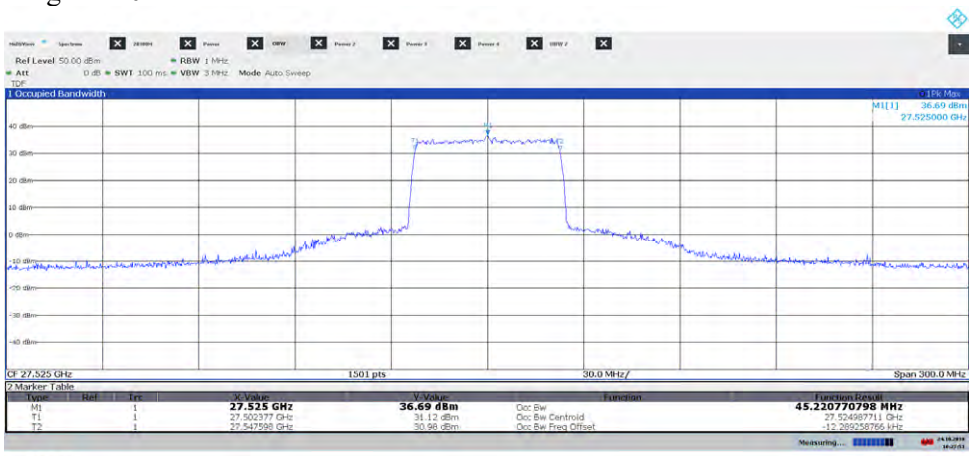


Diagram 11:

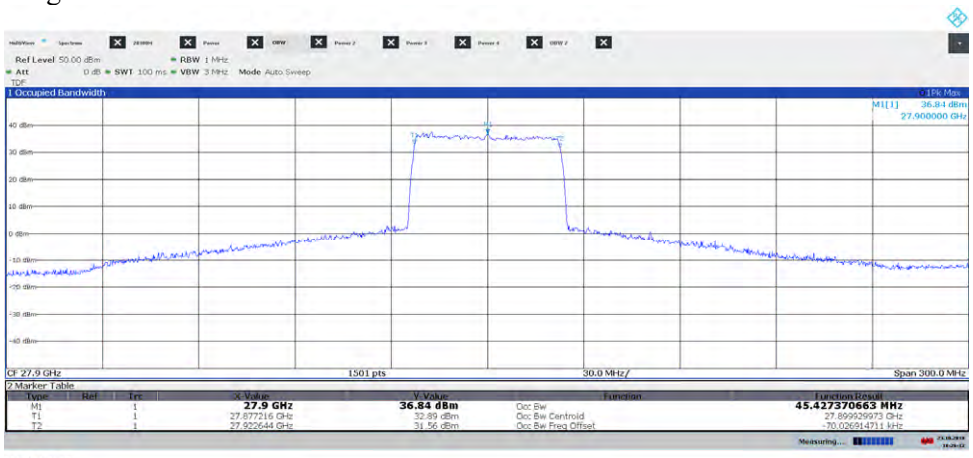


Diagram 12:

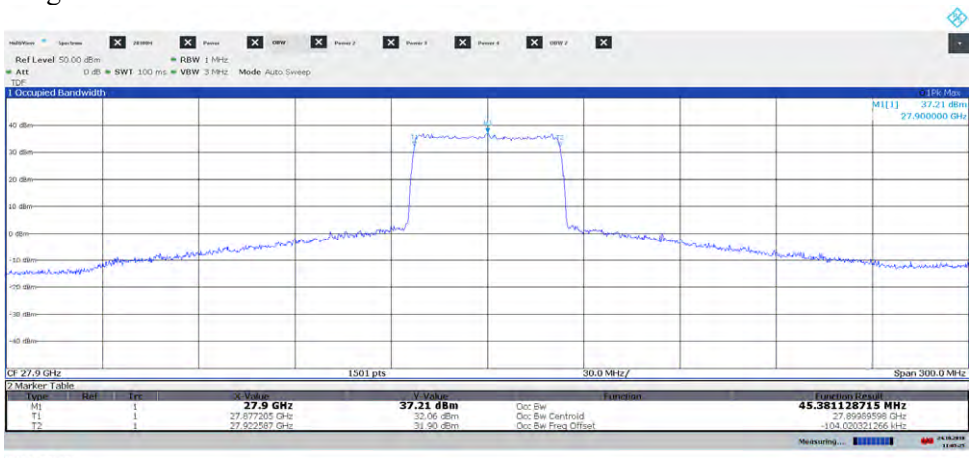


Diagram 13:

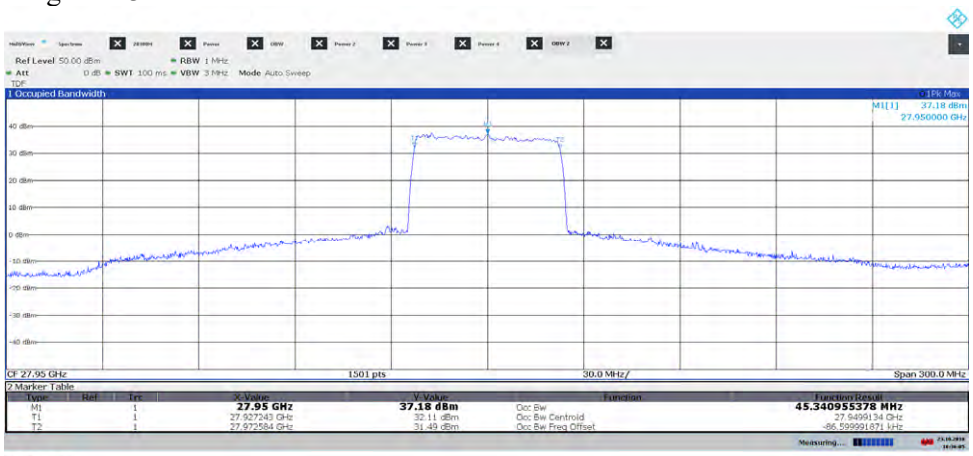


Diagram 14:

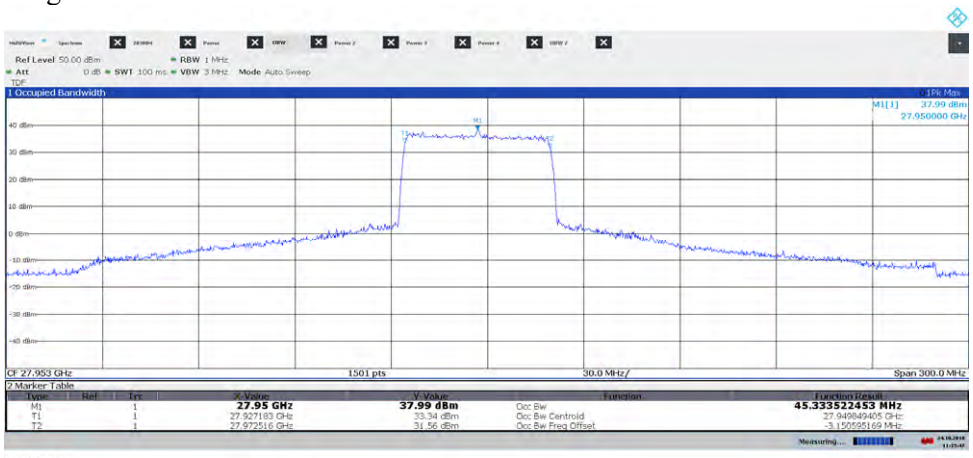


Diagram 15:

Diagram 16:

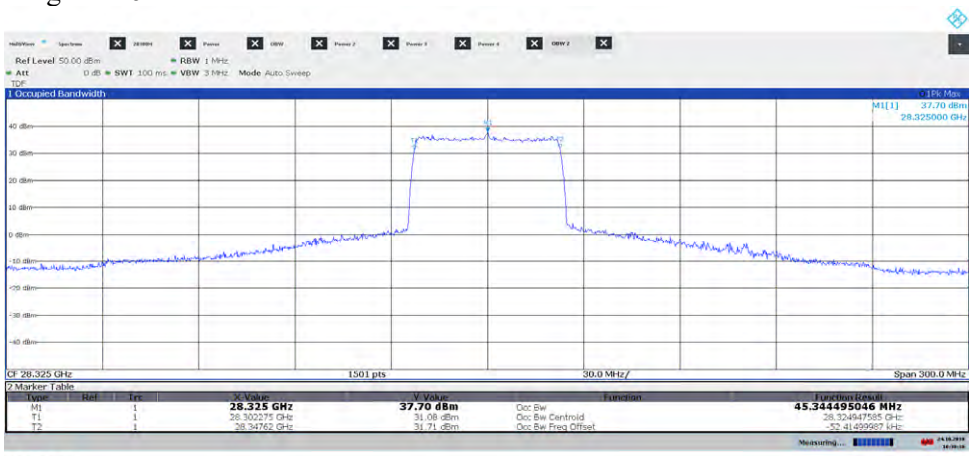


Diagram 17:

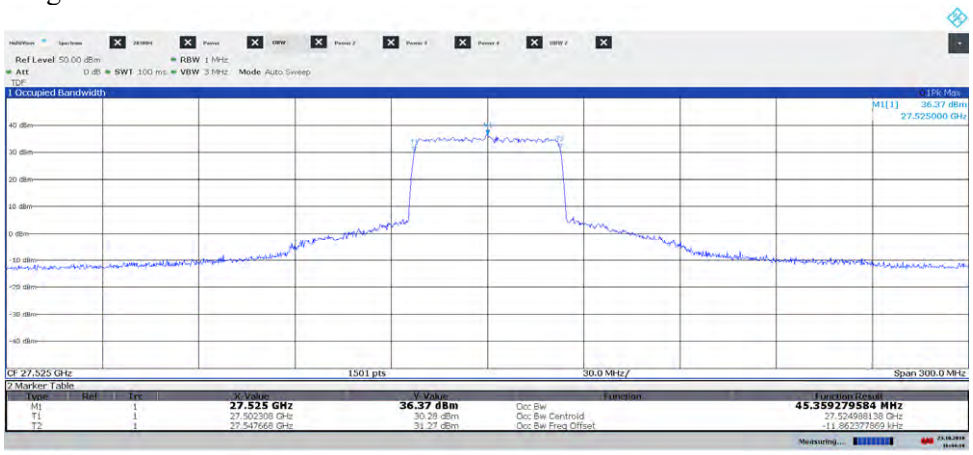


Diagram 18:

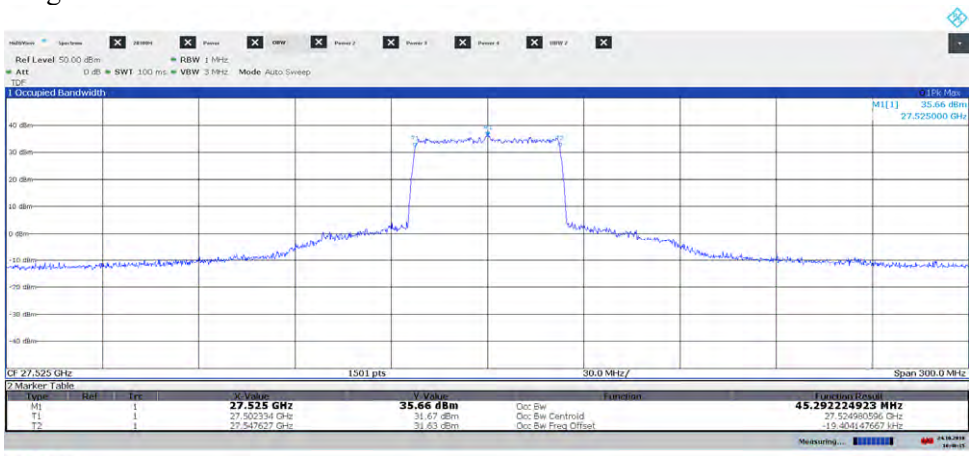


Diagram 19:

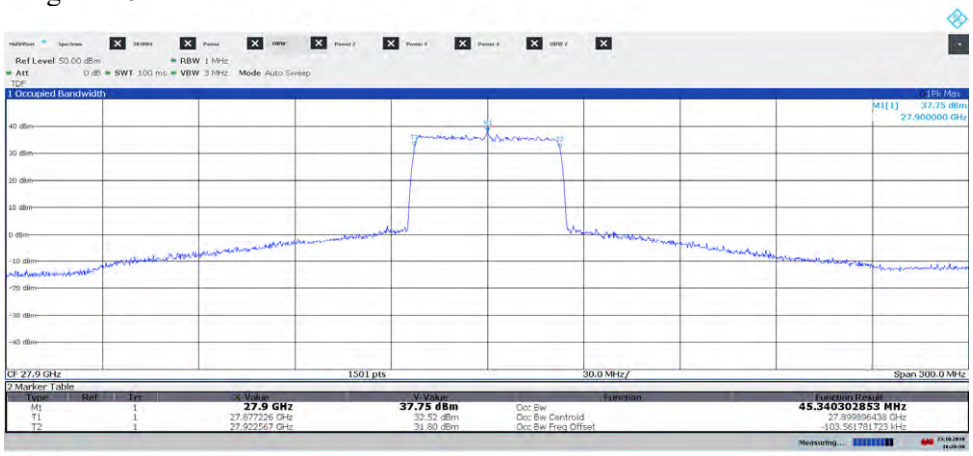


Diagram 20:

Diagram 21:

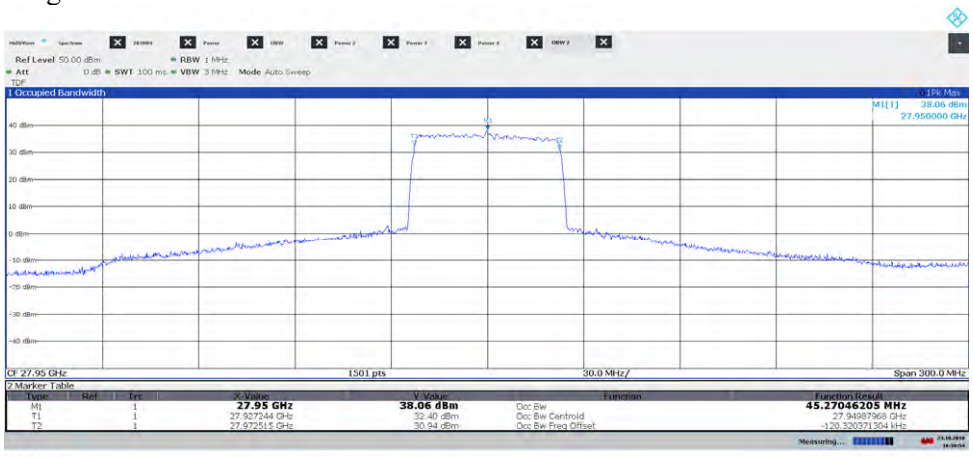


Diagram 22:

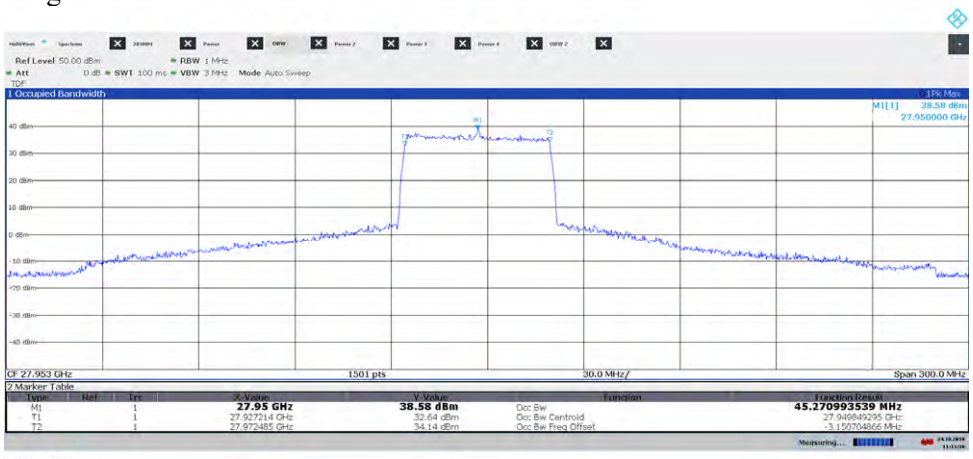


Diagram 23:

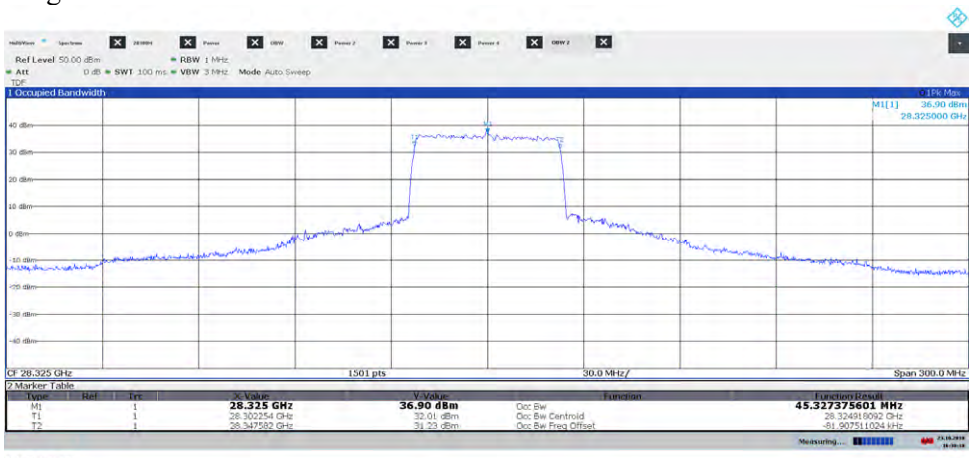


Diagram 24:

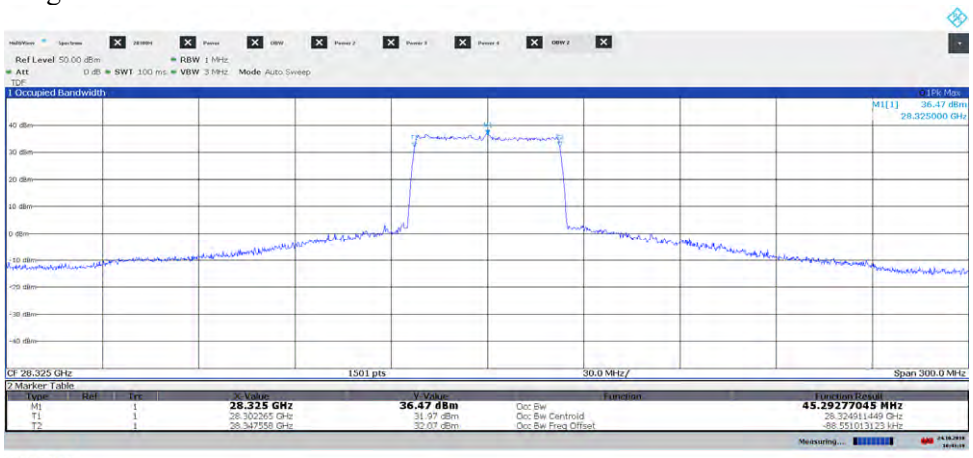
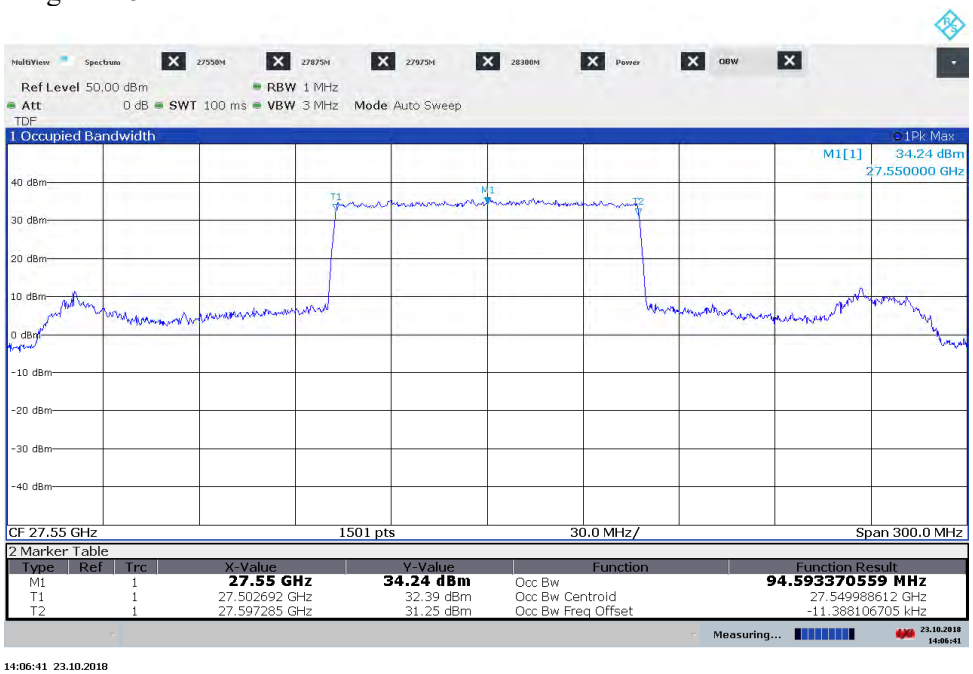
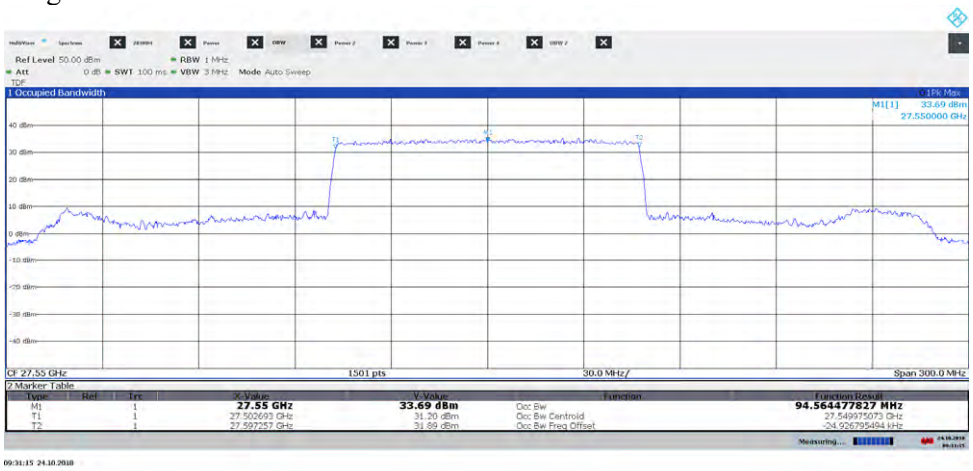


Diagram 25:



14:06:41 23.10.2018

Diagram 26:



09:31:15 24.10.2018

Diagram 27:

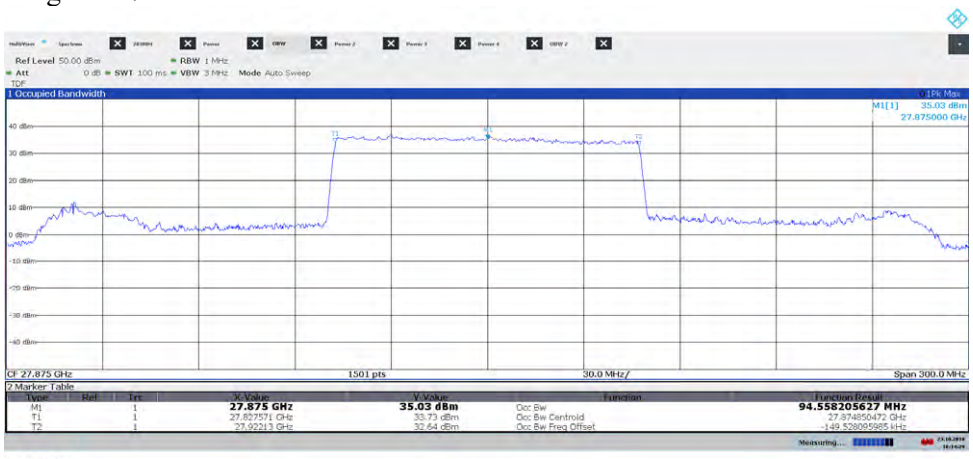


Diagram 28:

Diagram 29:

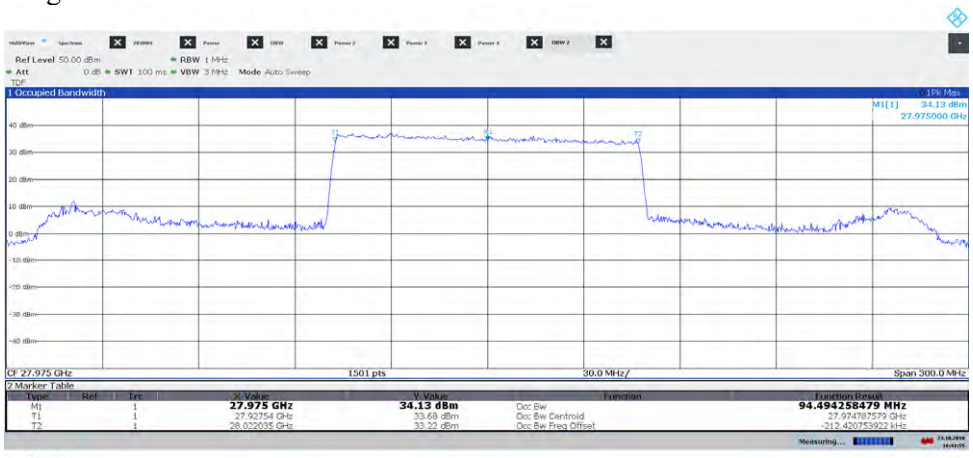


Diagram 30:

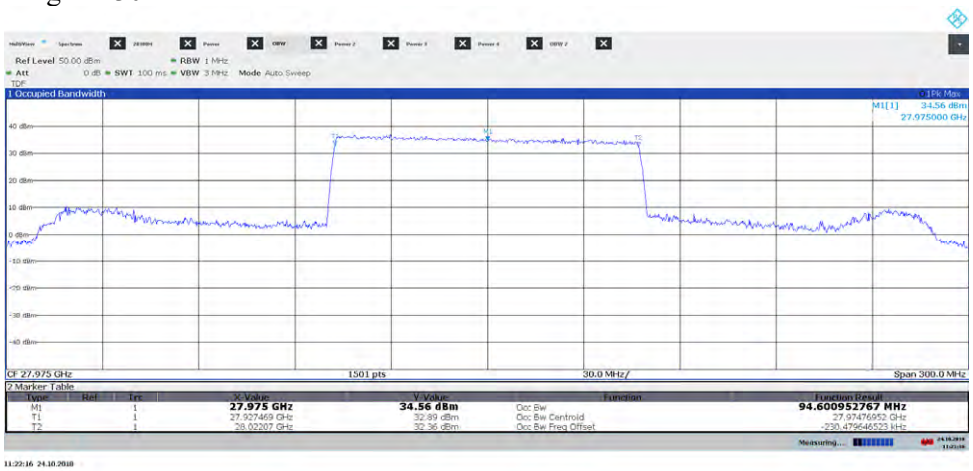
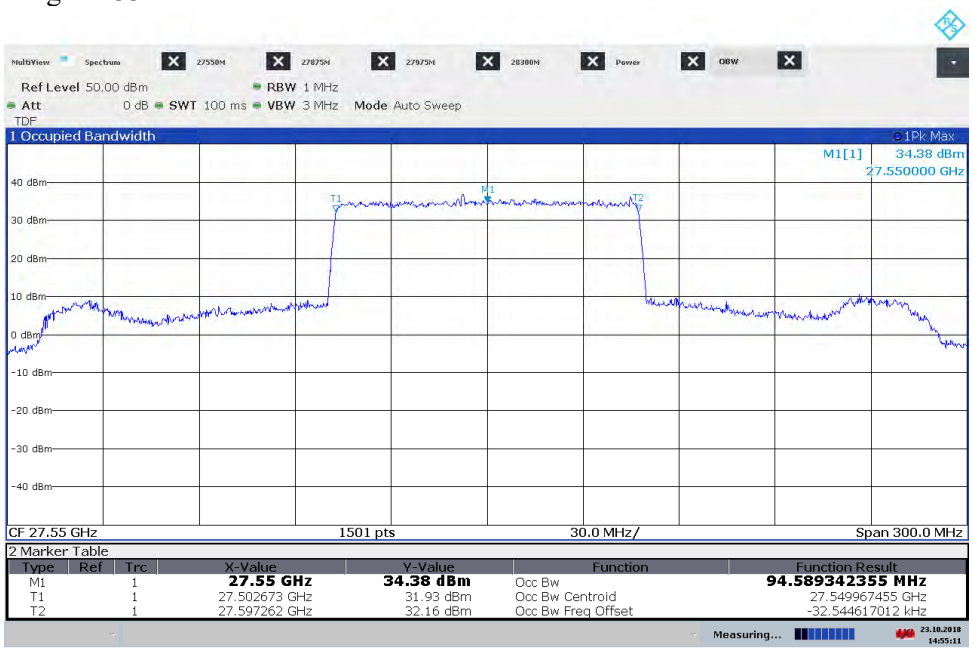


Diagram 31:

Diagram 32:

Diagram 33:



14:55:12 23.10.2018

Diagram 34:

09:44:34 24.10.2018

Diagram 35:

10:17:17 23.10.2018

Diagram 36:

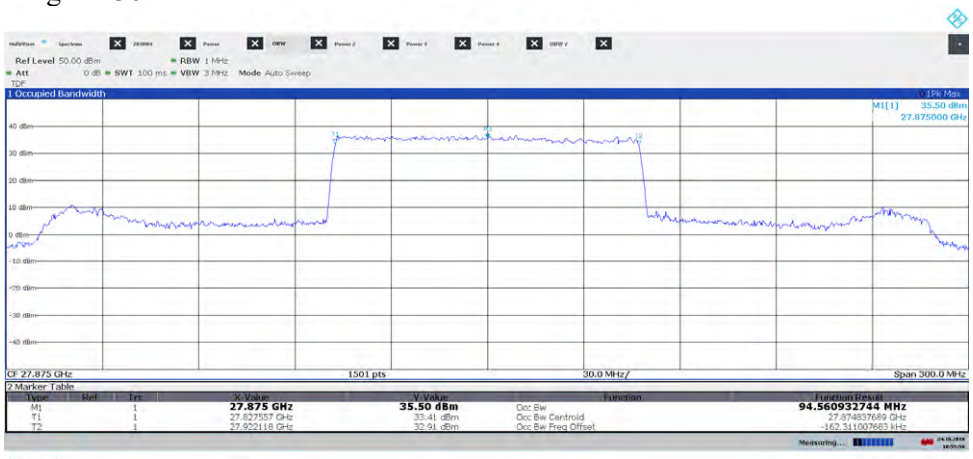


Diagram 37:

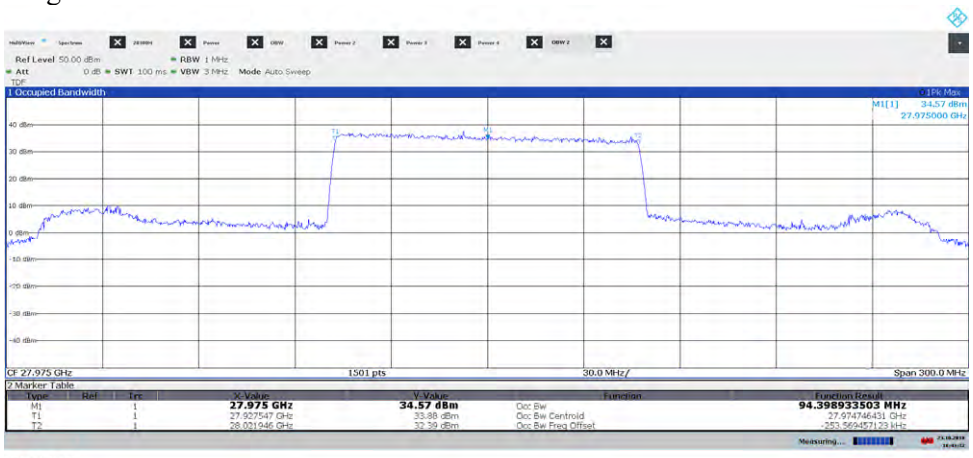


Diagram 38:

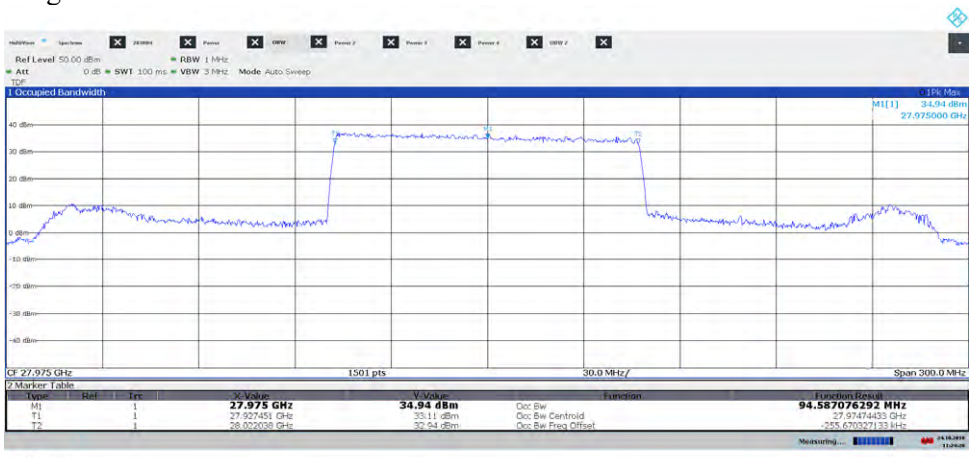


Diagram 39:

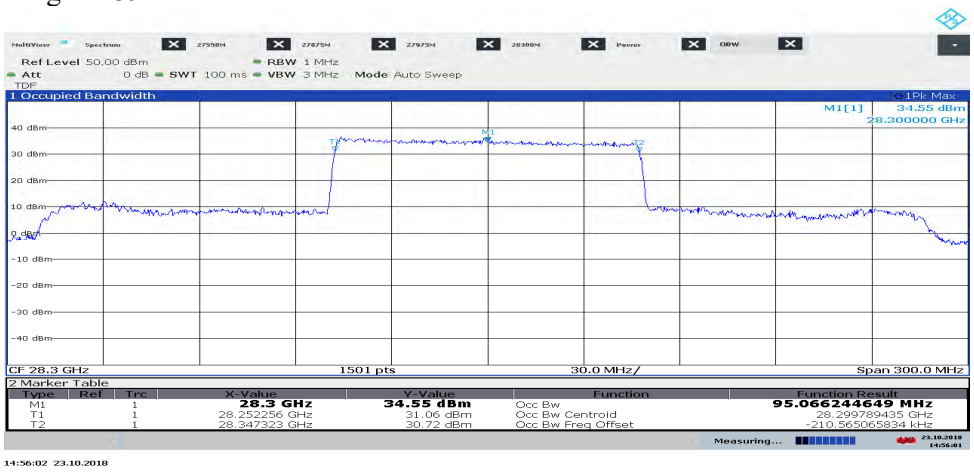


Diagram 40:

Diagram 41:

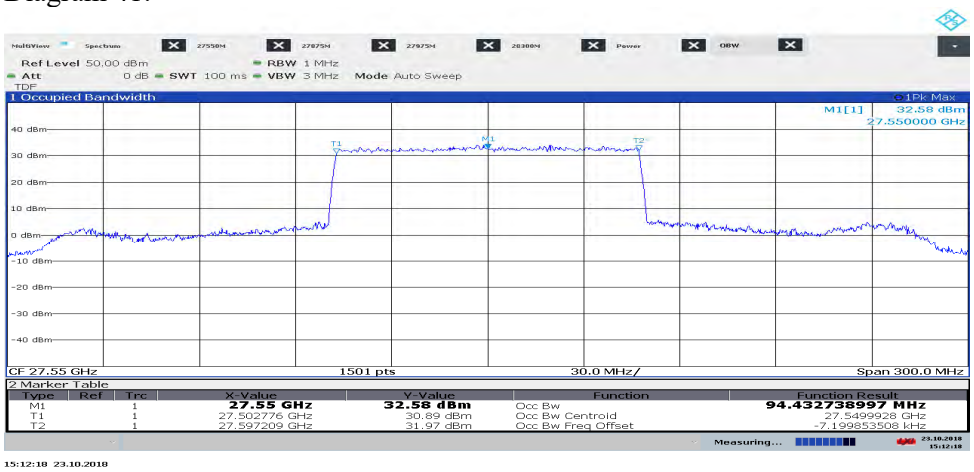


Diagram 42:

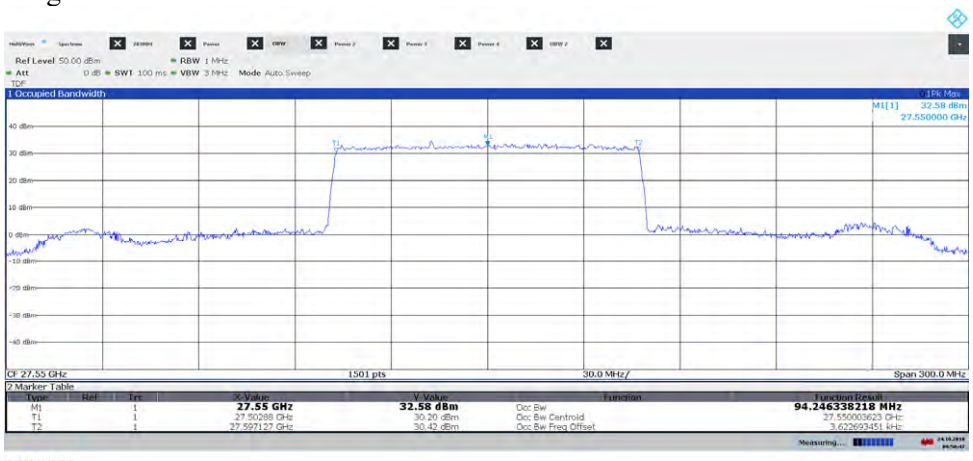


Diagram 43:

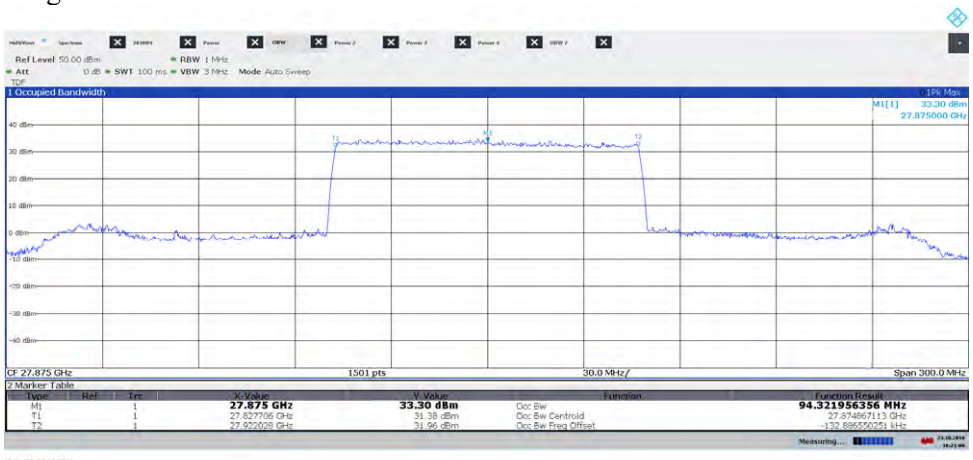


Diagram 44:

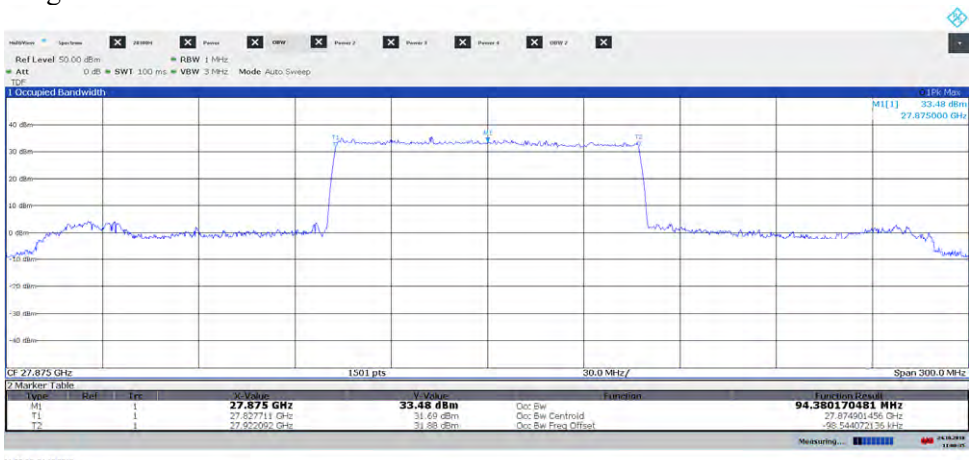


Diagram 45:

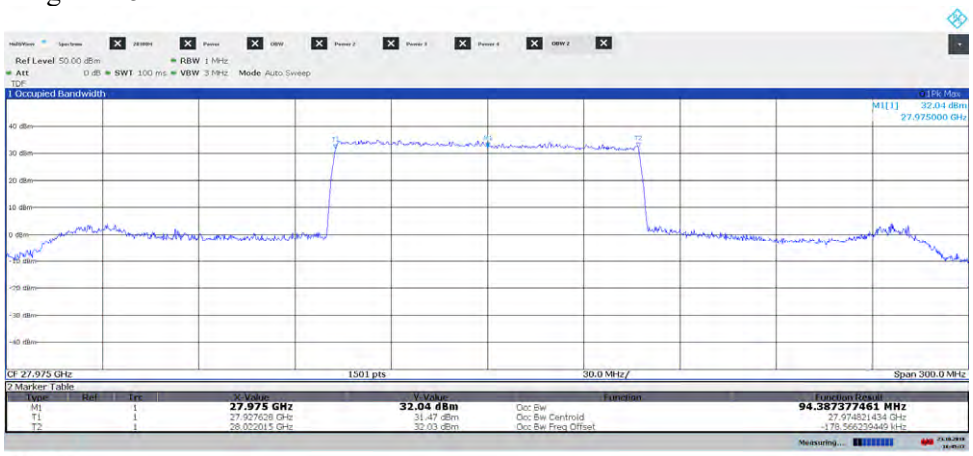


Diagram 46:

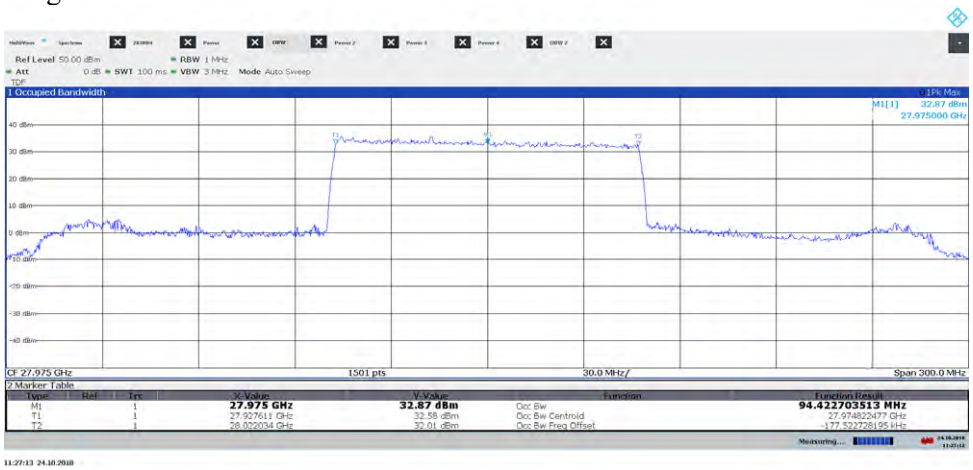


Diagram 47:

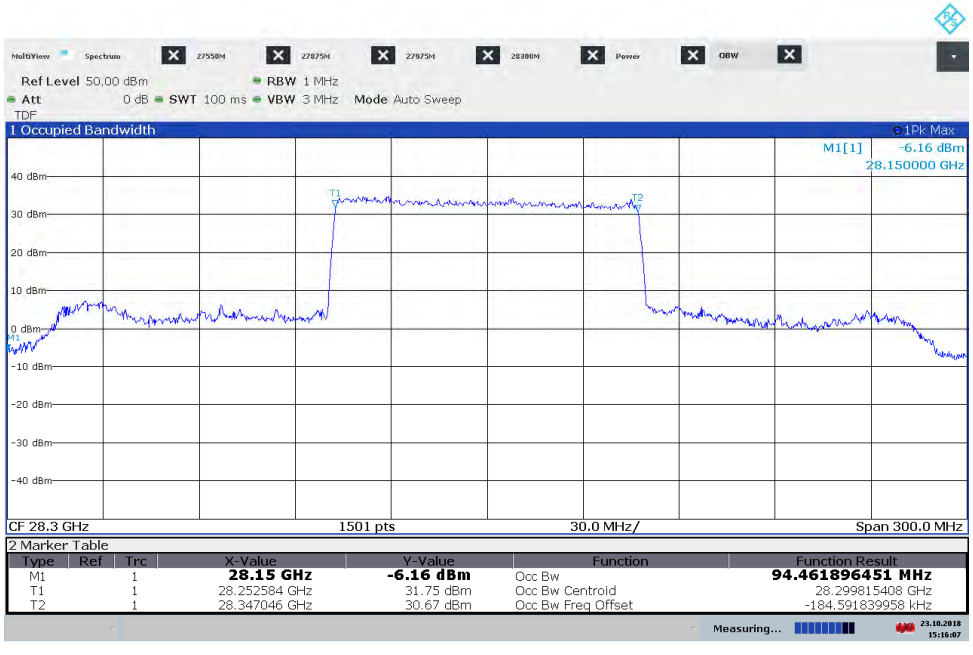


Diagram 48:

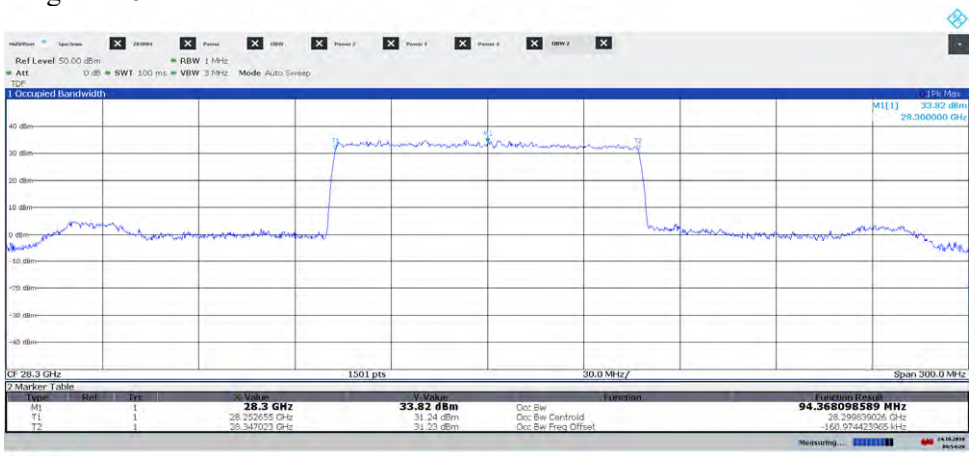


Diagram 49:

Diagram 50:

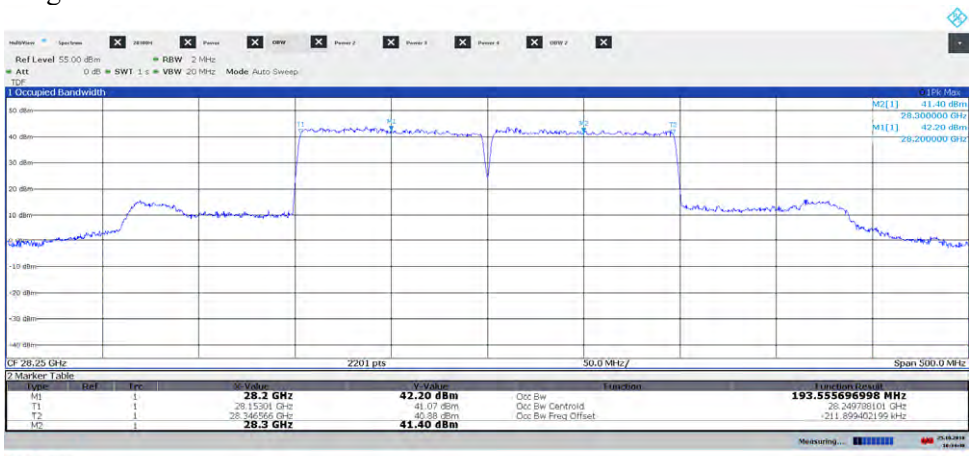
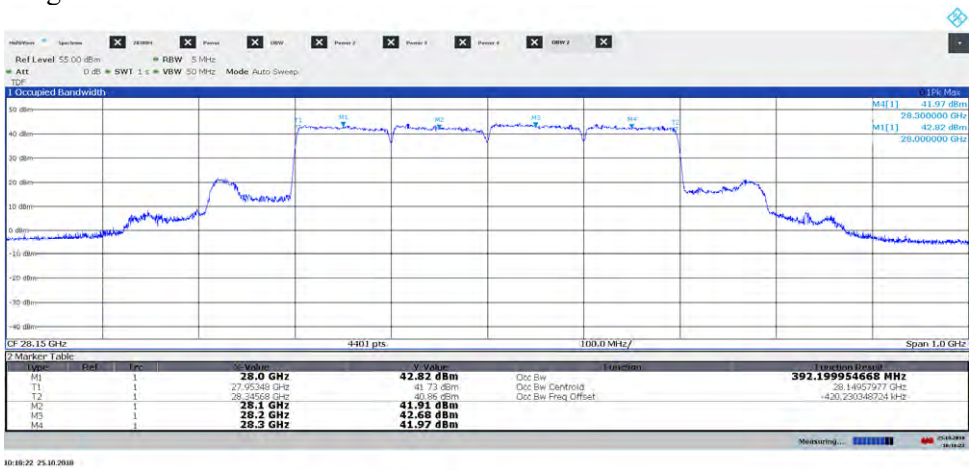


Diagram 51:

Diagram 52:



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

Date	Temperature	Humidity
2018-10-26	23 °C ± 3 °C	24 % ± 5 %
2018-10-29	23 °C ± 3 °C	18 % ± 5 %
2018-10-30	23 °C ± 3 °C	24 % ± 5 %
2018-10-31	23 °C ± 3 °C	25 % ± 5 %
2018-11-01	23 °C ± 3 °C	25 % ± 5 %
2018-11-05	23 °C ± 3 °C	33 % ± 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 30 – 1000 MHz and 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 30 Mhz – 60 GHz D was 3m and for 60 – 100 GHz D was 1.0m.

In the test range from 1 – 40 GHz A Network analyzer (ZNB 40) was used to measure the total correction factor for the measurement chain, including the receiver antenna gain, cable loss, and the pathloss for the measurement distance using a reference antenna(EMCO 3115 and EMCO 3116) replacing the EUT. The reference antenna was located in the center of the EUT PAAMs. The antenna gain of the reference antennas was subtracted from the S21 measurement and the result was entered into the spectrum analyzer as a transducer factor.

The measurement procedure was as the following:

1. A pre-measurement is performed with RMS detector and Max Hold on the spectrum analyser. The turn table was slowly rotating form 0-360 degrees.

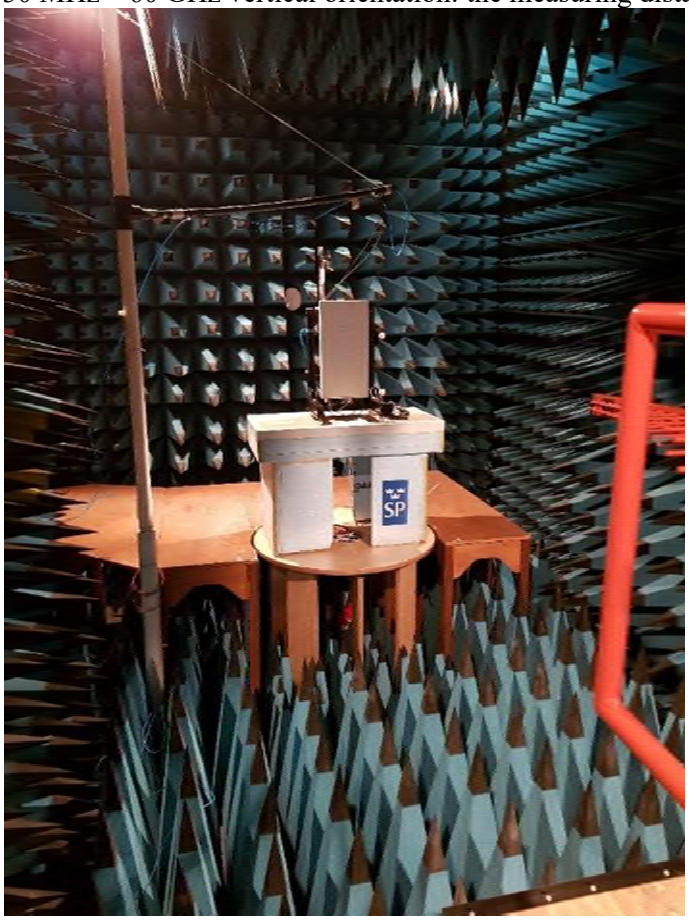
2. Spurious radiation on frequencies closer than 10 dB to the limit in the pre-measurement a manual search for maximum response was done.

3. If the recorded EIRP value was close or above the TRP limit, a Two Cut TRP measurement was done according to C63.26 mmWave JTG V1.0 chapter 6.6.5. This method is not included in our scope of accreditation. Overview of the method.

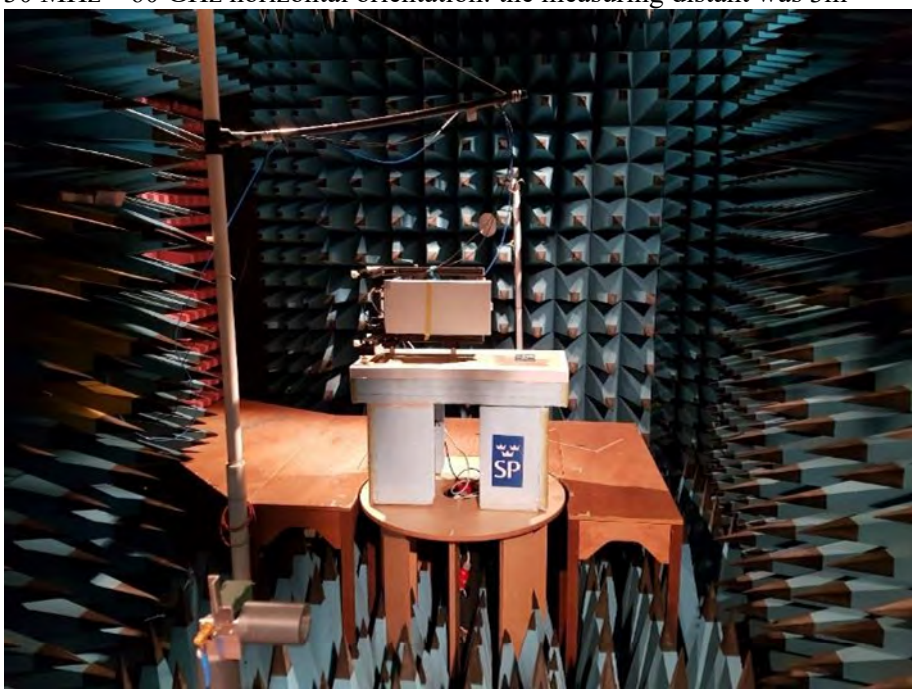
    a. EUT set in vertical orientation
    b. EIRP measurement samples with horizontal and vertical polarization of the measurement antenna. Angular step size based on frequency and dimension of the EUT
    c. EUT set in horizontal orientation
    d. EIRP measurement samples with horizontal and vertical polarization of the measurement antenna. Angular step size based on frequency and dimension of the EUT.
    e. TRP = EIRP measurement samples averaged+ΔTRP.
    (ΔTRP= Margin factor based on grid selection).

The test set-up during the spurious radiation measurements is shown in the pictures below:

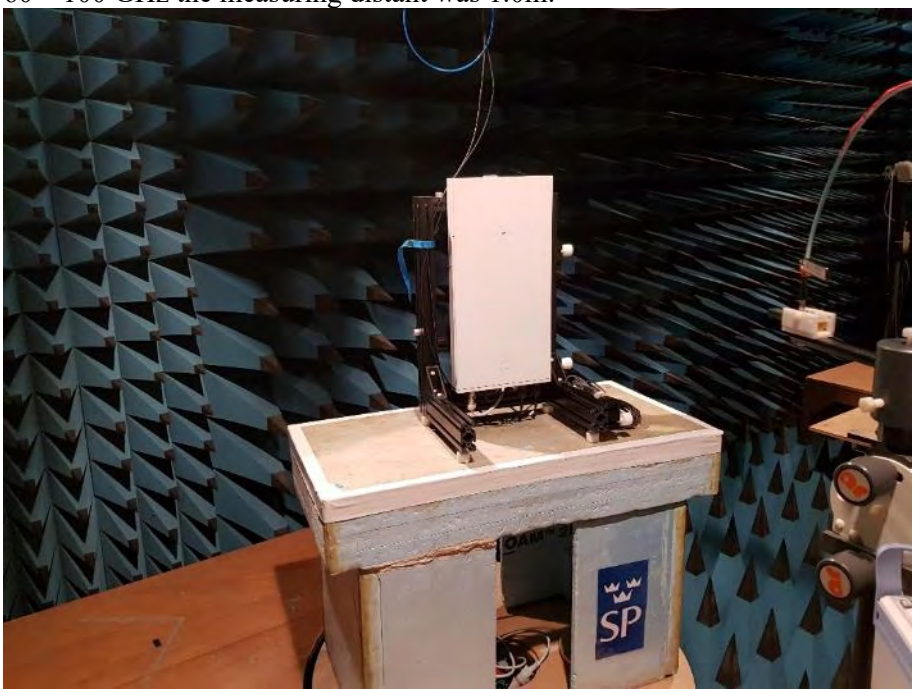
30 MHz – 60 GHz vertical orientation: the measuring distant was 3m



30 MHz – 60 GHz horizontal orientation: the measuring distant was 3m



60 – 100 GHz the measuring distant was 1.0m:



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	503 674
Flann STD Gain Horn Antenna 22240-20	503 674
Flann STD Gain Horn Antenna 24240-20	503 674
Flann STD Gain Horn Antenna 26240-20	503 674
Flann STD Gain Horn Antenna 27240-20	503 674
Mixer FS-Z60	100147
Mixer FS-Z90	503 569
Mixer FS-Z110	BX81427
Miteq, Low Noise Amplifier	503 278
EMCO Horn Antenna 3115	502 175
EMCO Horn Antenna 3115	501 548
µComp Nordic, Low Noise Amplifier	901 544
Temperature and humidity meter, Testo 615	503 498

Results

Representing worst case:

Symbolic name 2T with test model 16 QAM shown in Diagram 1 – 9, 13 – 21 and 24 – 29.
Symbolic name 2B with test model 16 QAM shown in Diagram 10 – 12 and 22 – 23.

Measurement uncertainty: 30 – 1000 MHz 3.1 dB
1 – 18 GHz, 3.1 dB
18 – 40 GHz, 3.3 dB
40 – 60 GHz, 3.95 dB
60 – 100 GHz, 4.6 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.

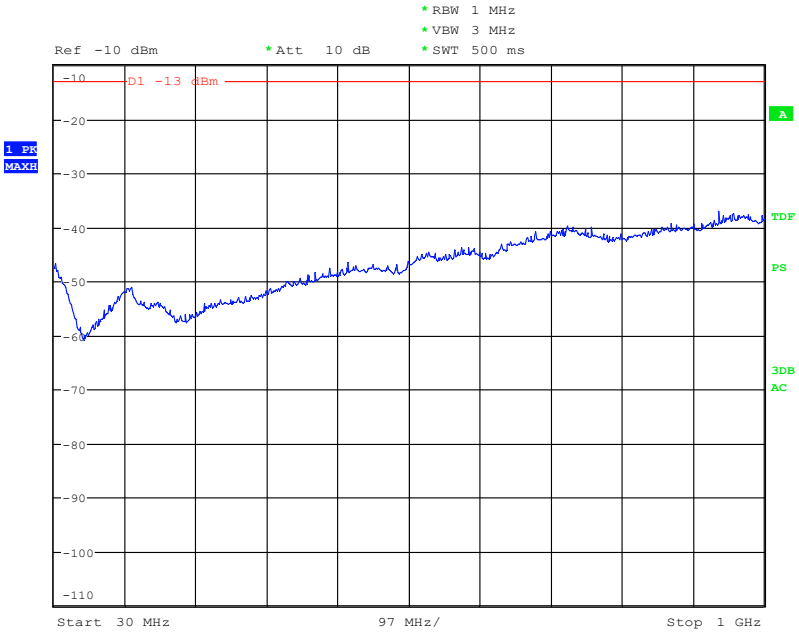
(2) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the licensee's frequency block edges as the design permits.

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

Complies?	Yes

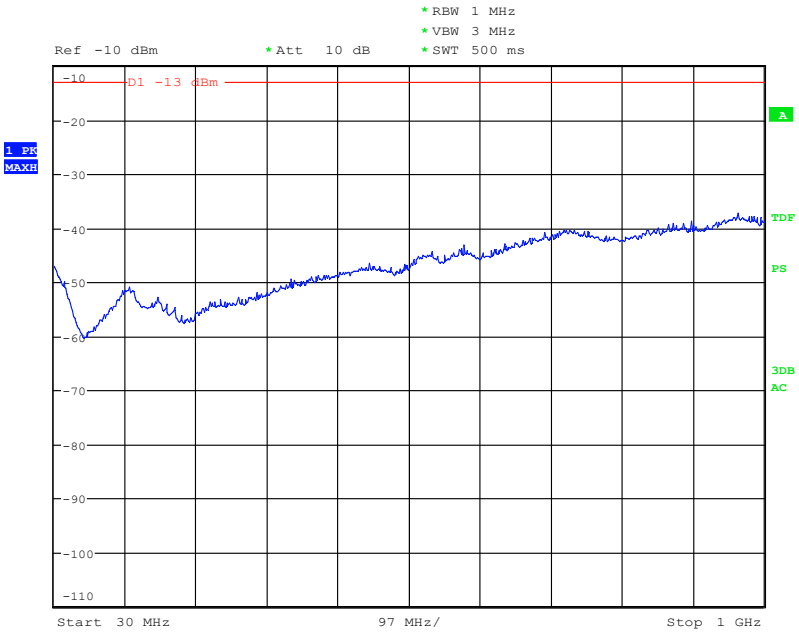
AC KRD 901 059/1

Diagram 1: 30 – 1000 MHz, EIRP Horizontal polarization



Date: 1.NOV.2018 15:36:19

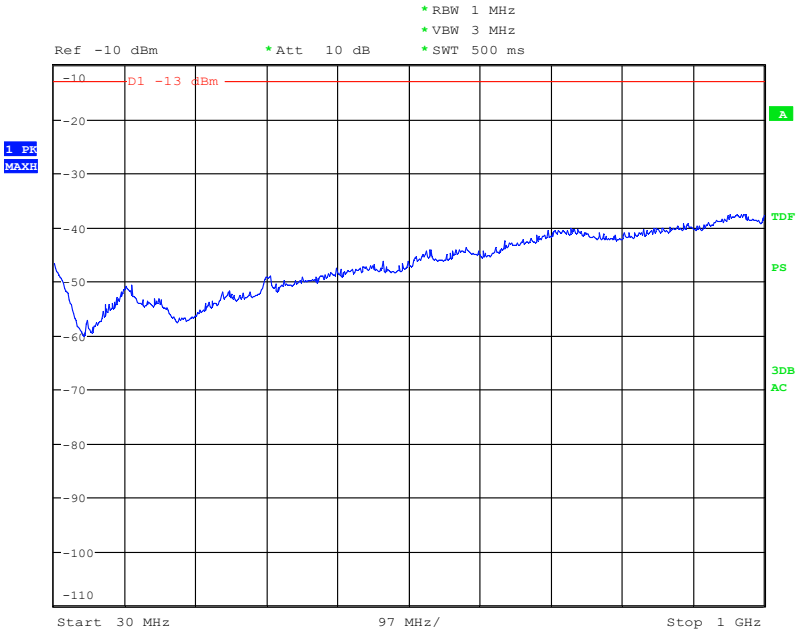
Diagram 2: 30 – 1000 MHz, EIRP Vertical polarization



Date: 1.NOV.2018 15:38:53

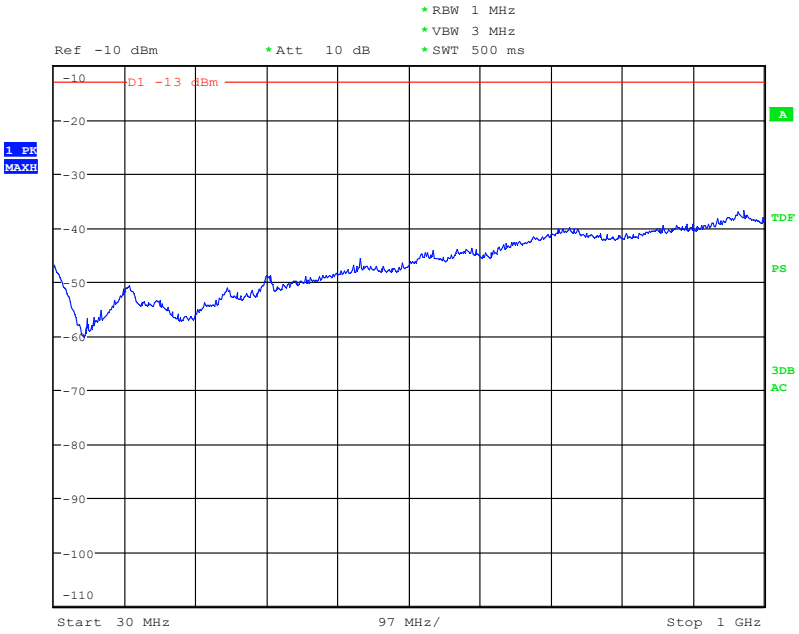
DC KRD 901 059/4

Diagram 3: 30 – 1000 MHz, EIRP Horizontal polarization



Date: 1.NOV.2018 16:40:30

Diagram 4: 30 – 1000 MHz, EIRP Vertical polarization



Date: 1.NOV.2018 16:37:39

AC KRD 901 059/1

Diagram 5: 1 – 18 GHz, EIRP Horizontal polarization

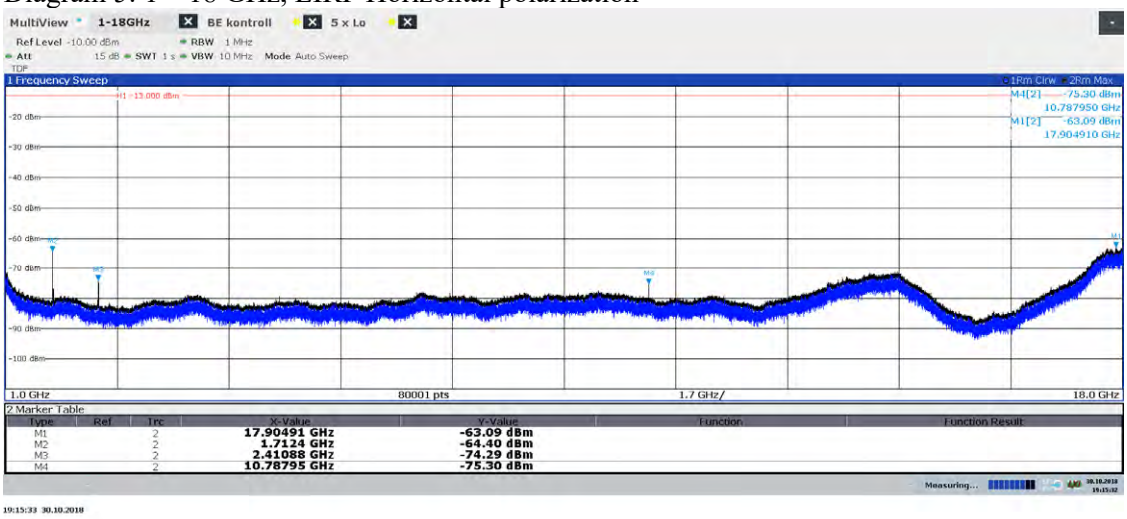


Diagram 6: 1 – 18 GHz, EIRP Vertical polarization

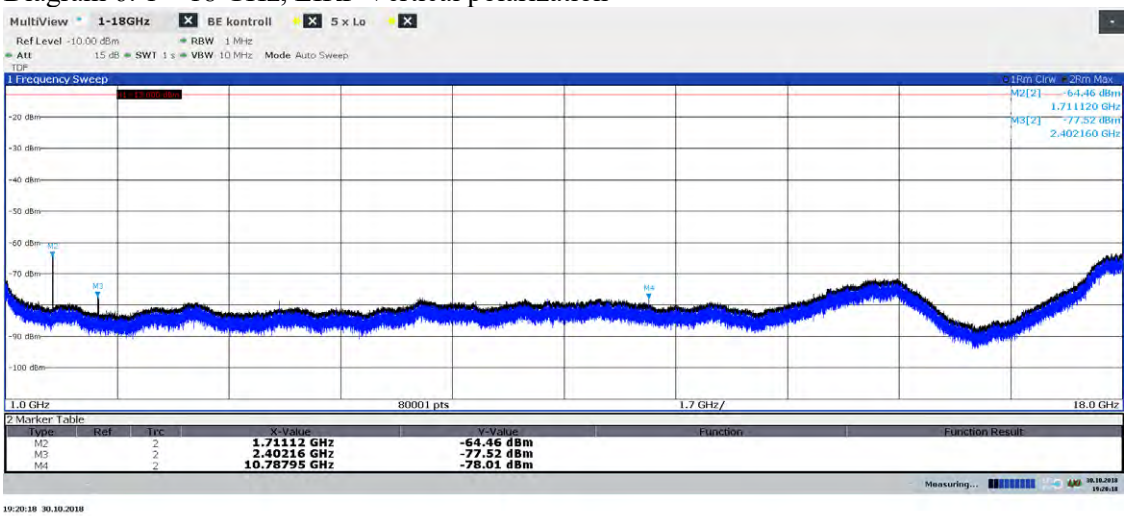


Diagram 7: 18 – 26.5 GHz, EIRP Horizontal polarization

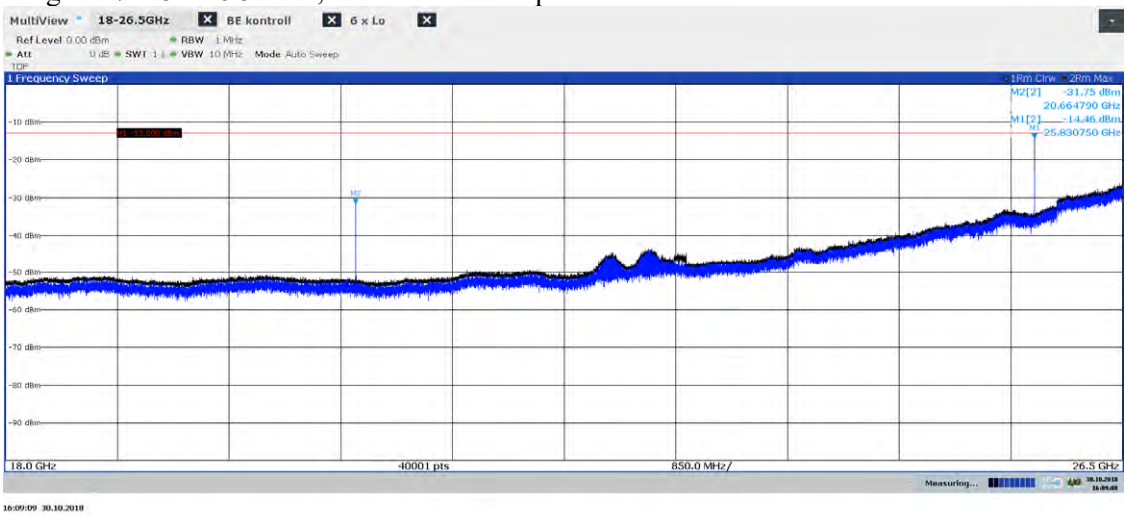


Diagram 8: 18 – 26.5 GHz, EIRP Vertical polarization

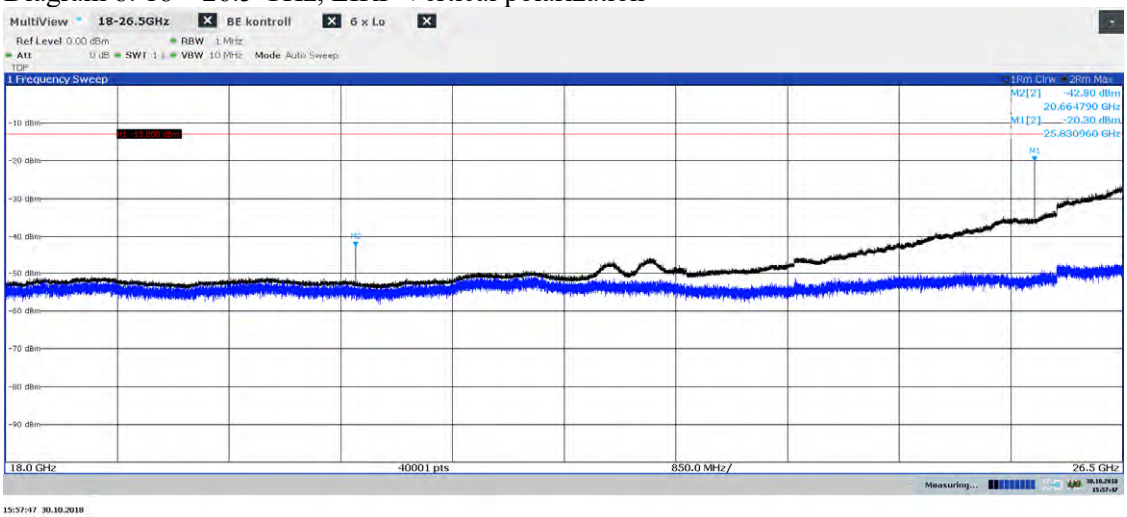


Diagram 9: 25.74 – 25.92 GHz, Two Cut TRP

According to ANSI C63.26 mmWave JTG V1.0 chapter 6.6.5.2.1

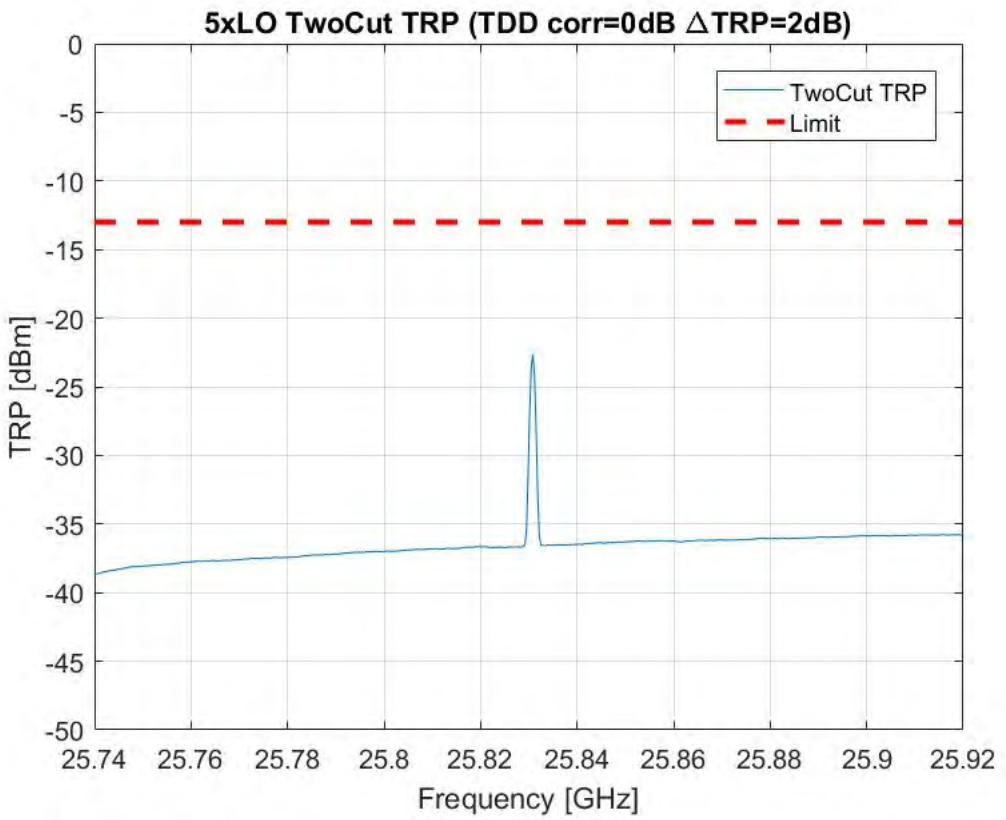
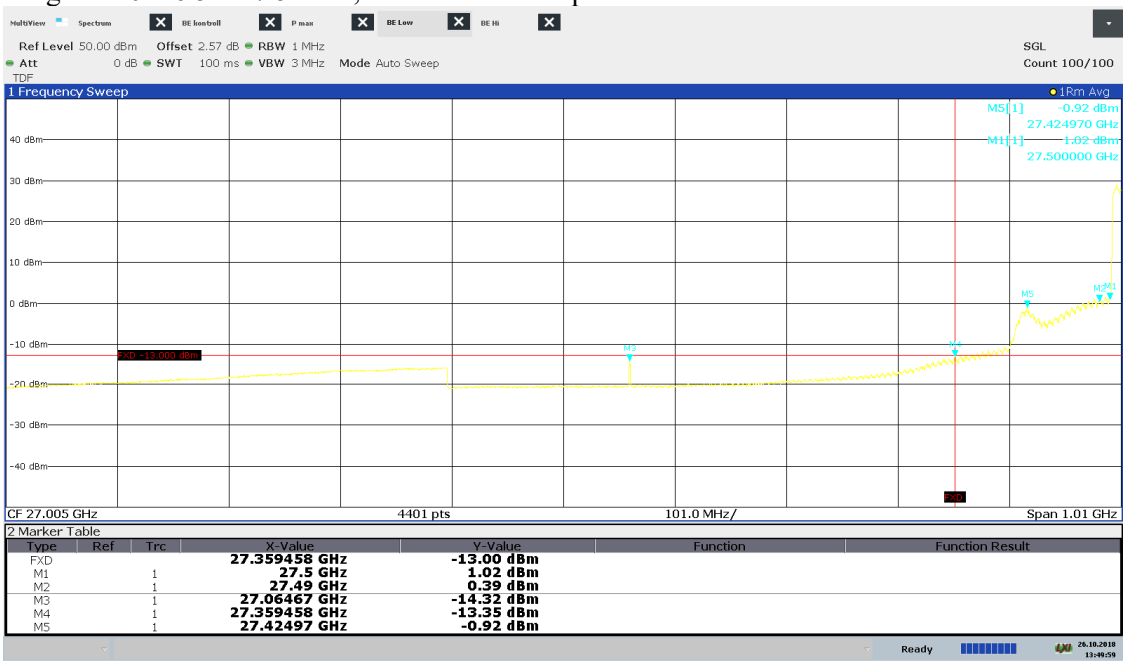
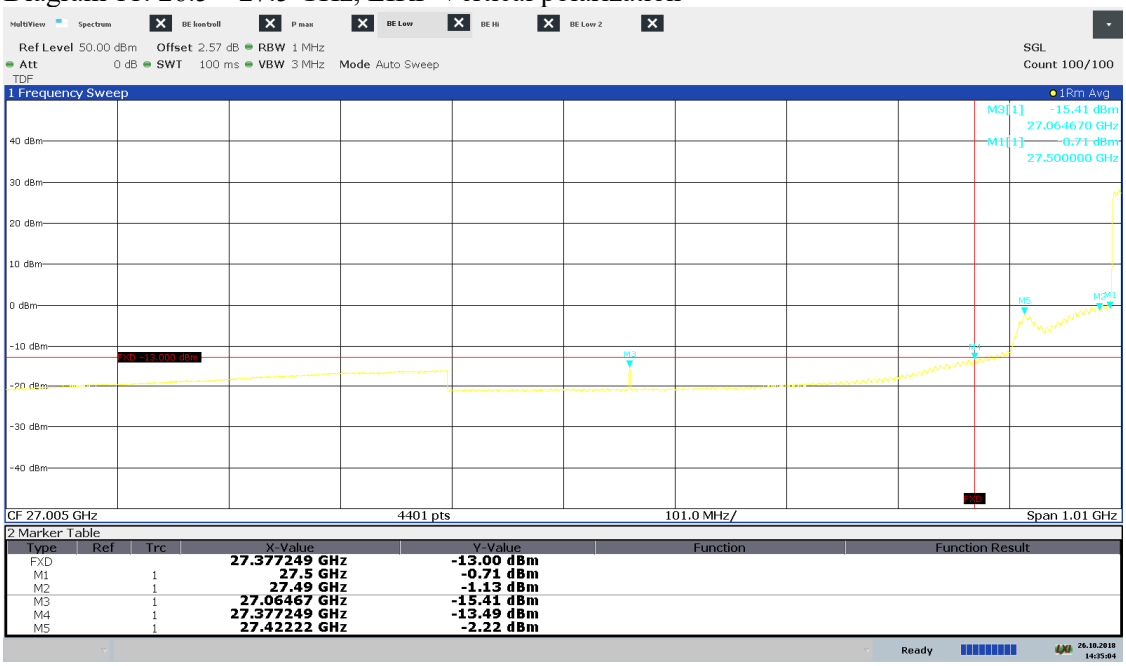


Diagram 10: 26.5 – 27.5 GHz, EIRP Horizontal polarization



13:50:00 26.10.2018

Diagram 11: 26.5 – 27.5 GHz, EIRP Vertical polarization



14:35:05 26.10.2018

Diagram 12: 27 – 27.5 GHz, Pattern multiplication

According to ANSI C63.26 mmWave JTG V1.0 chapter 6.6.5.2.2

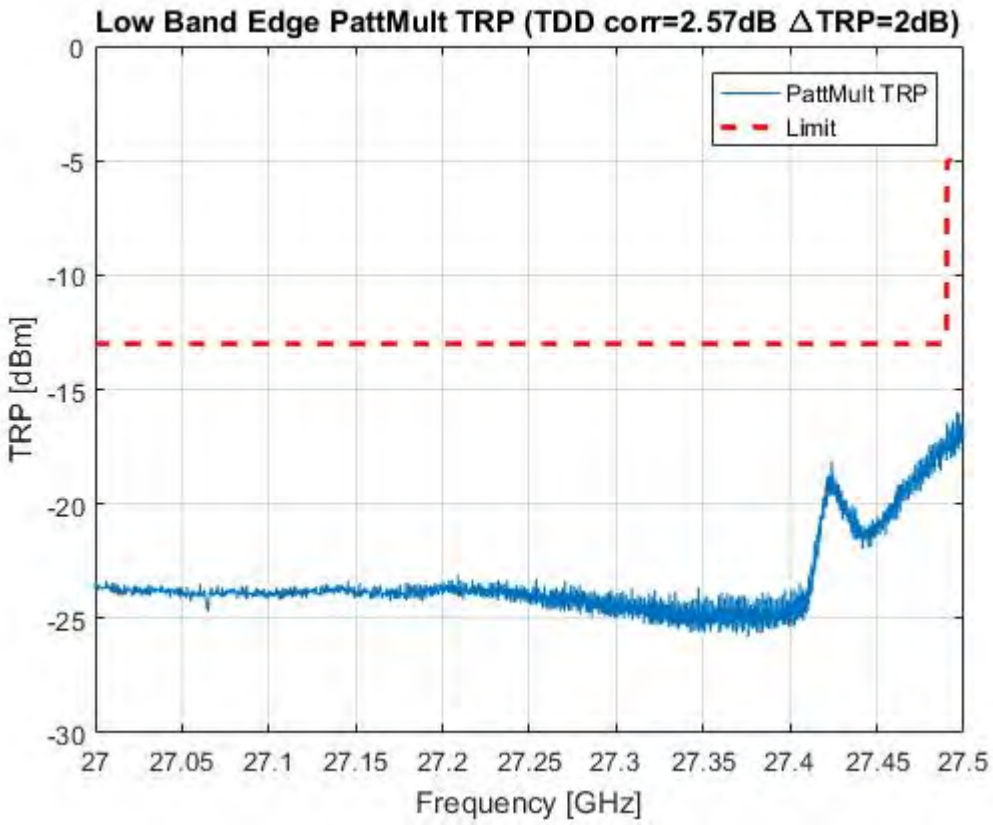


Diagram 13: 28.35 – 30 GHz, Horizontal polarization

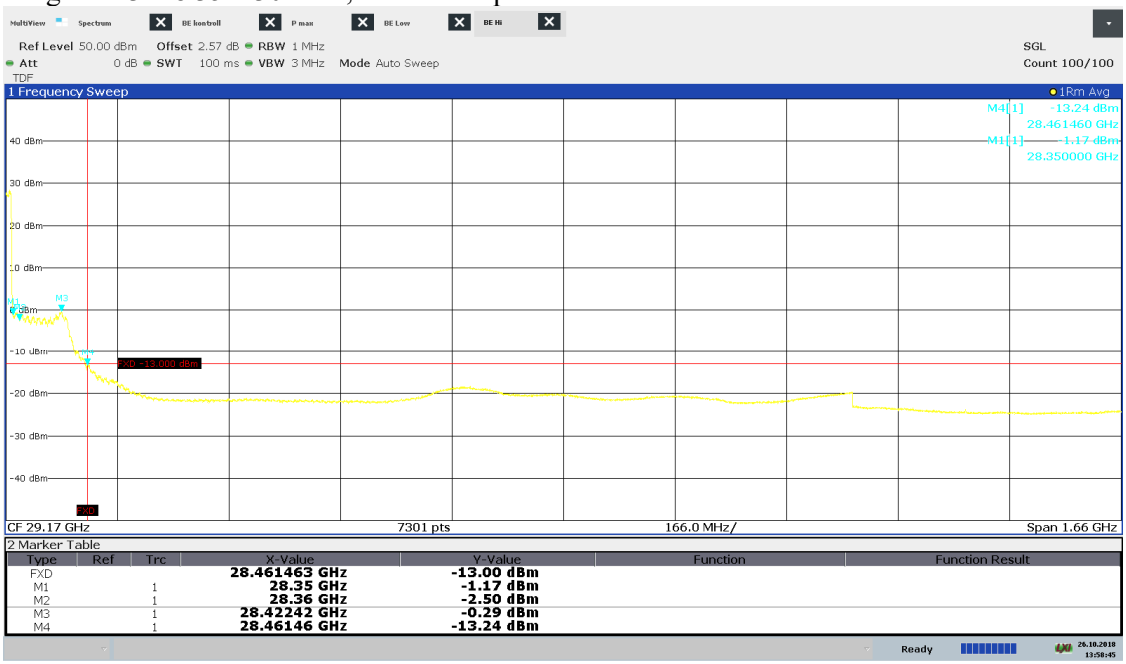


Diagram 14: 28.35 – 30 GHz Vertical polarization

Diagram 15: 28.35 – 28.7 GHz, Pattern multiplication

According to ANSI C63.26 mmWave JTG V1.0 chapter 6.6.5.2.12

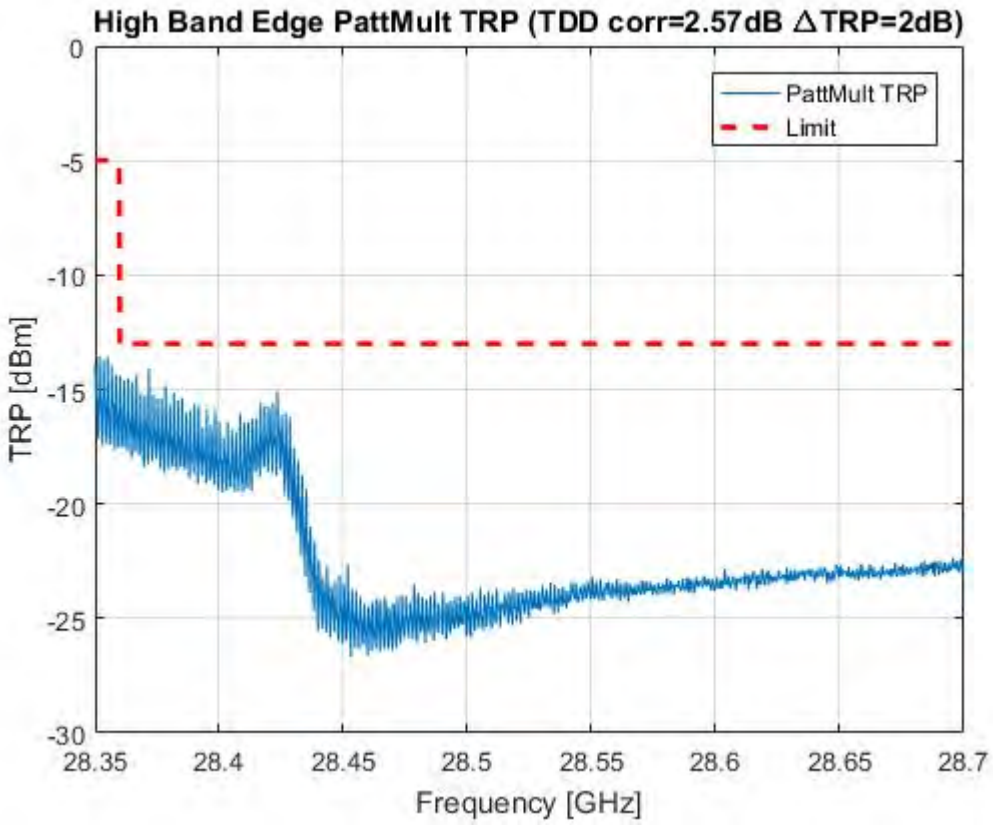


Diagram 16: 30 – 40 GHz, EIRP Horizontal polarization

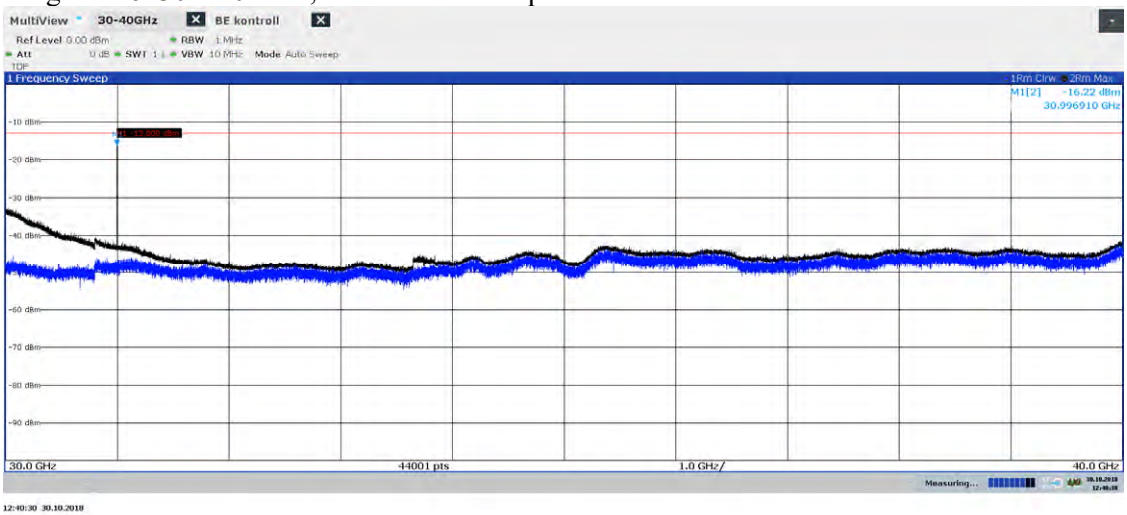


Diagram 17: 30 – 40 GHz, EIRP Vertical polarization

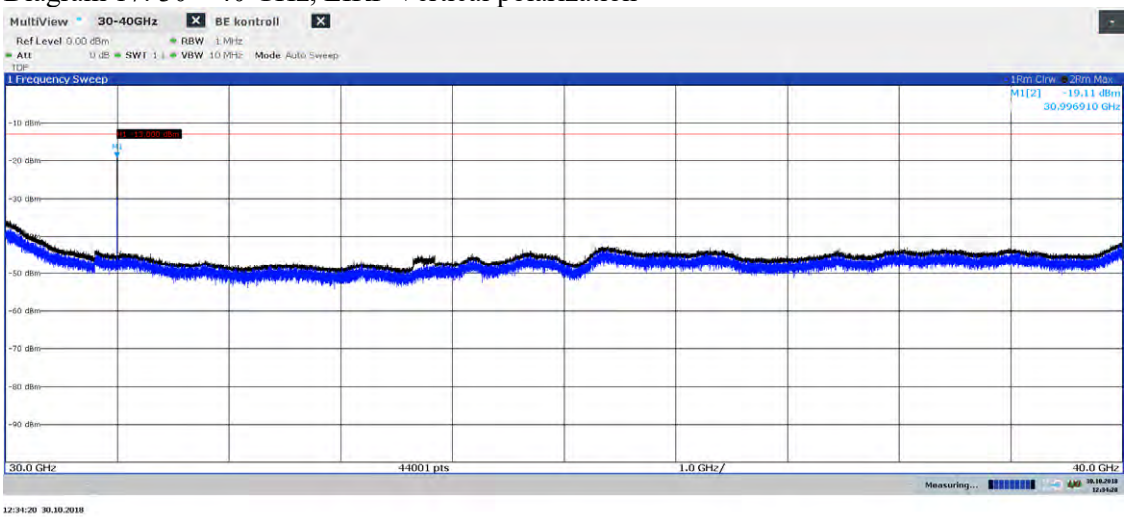


Diagram 18: 30.9 – 31.1 GHz, Two Cut TRP

According to ANSI C63.26 mmWave JTG V1.0 chapter 6.6.5.2.1

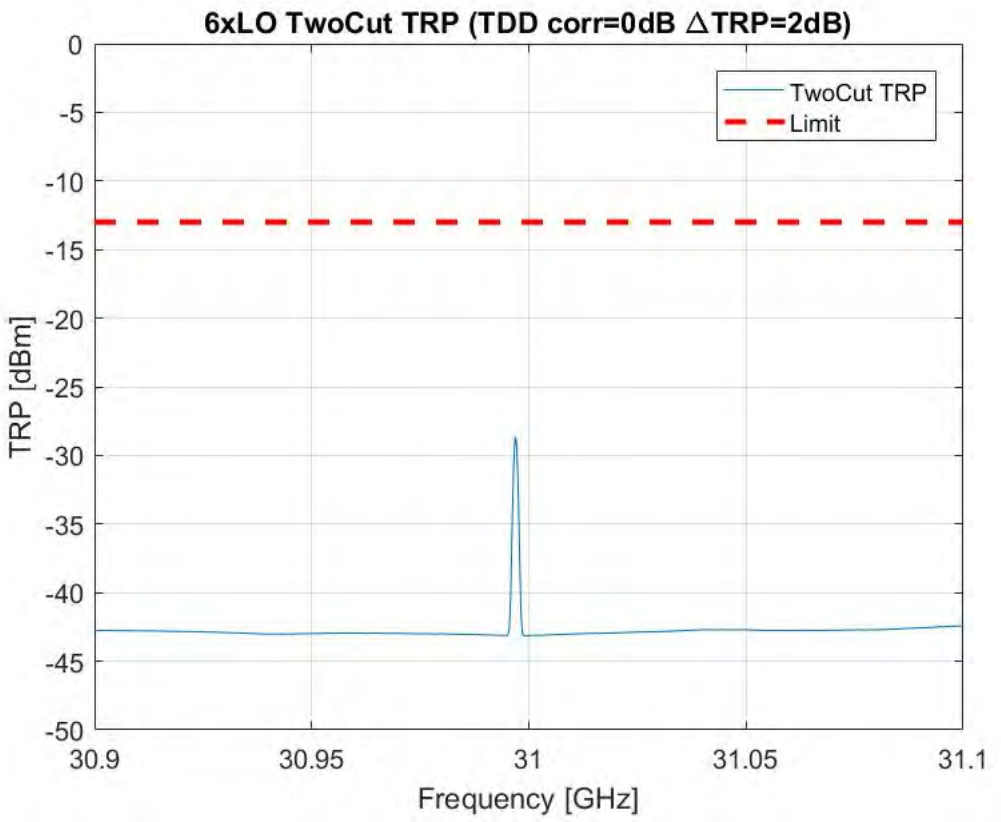


Diagram 19: 40 – 60 GHz, EIRP Horizontal polarization

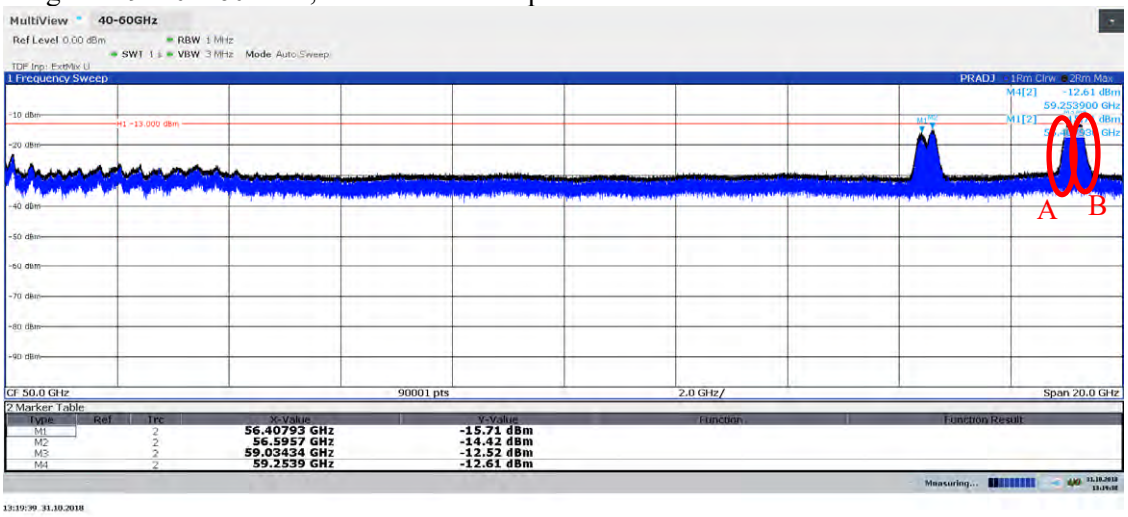
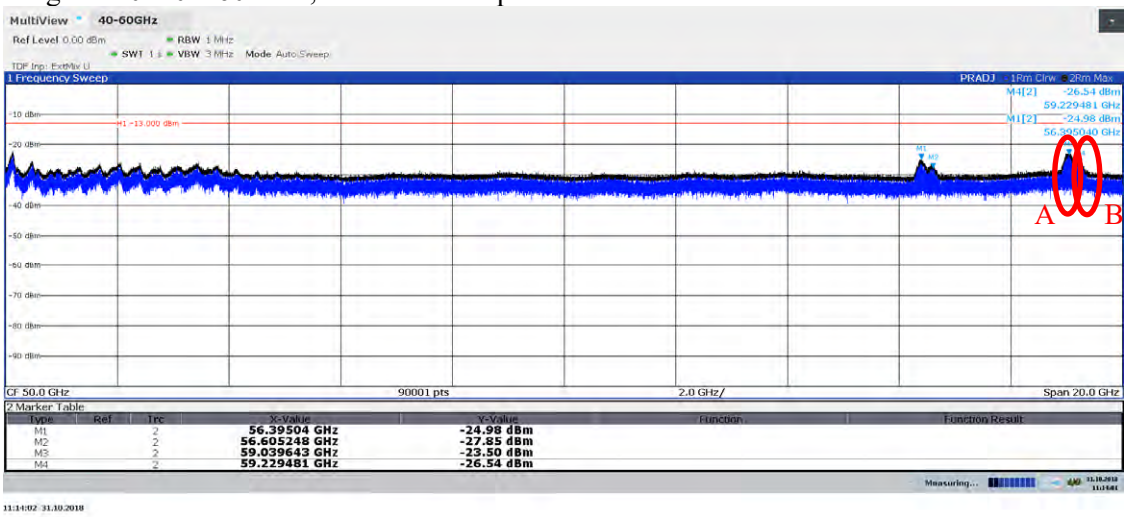


Diagram 20: 40 – 60 GHz, EIRP Vertical polarization



"False signals" originating from unwanted mixer products between LO signal generated by the spectrum analyser 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	Mixing indicies n	m	"False F"
	[GHz]	[-]	[-]	[GHz]
A	28.2	-2	4	59.03
B	28.3	-2	4	59.25

Diagram 21: 56 – 57 GHz, Two Cut TRP

According to ANSI C63.26 mmWave JTG V1.0 chapter 6.6.5.2.1

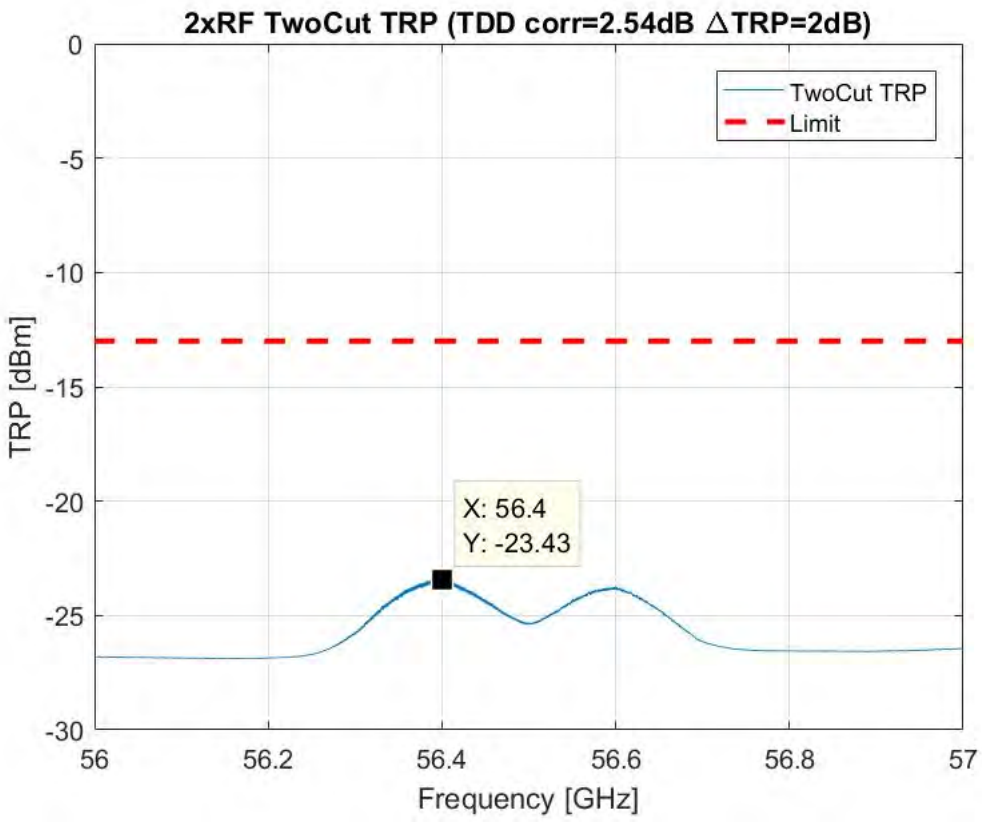


Diagram 22: 40 – 60 GHz, EIRP Horizontal polarization

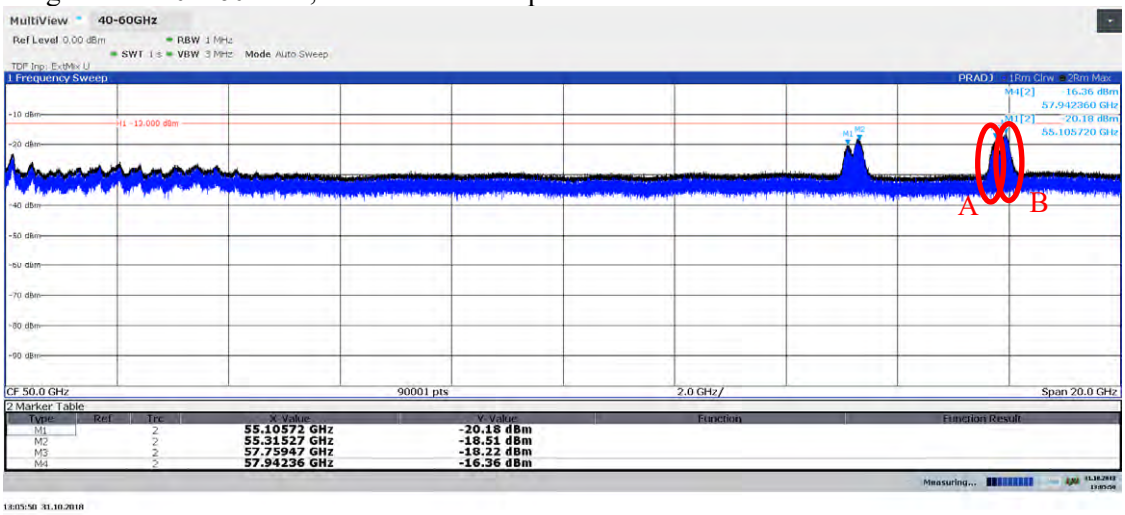
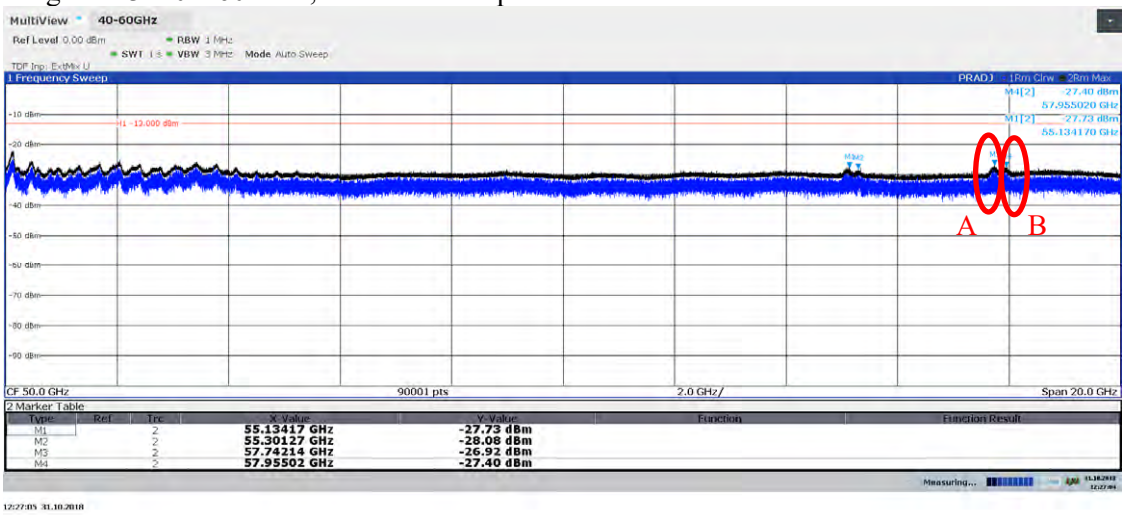


Diagram 23: 40 – 60 GHz, EIRP Vertical polarization



"False signals" originating from unwanted mixer products between LO signal generated by the spectrum analyser 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	Mixing indicies n	m	"False F"
	[GHz]	[-]	[-]	[GHz]
A	27.55	-2	4	57.74
B	27.65	-2	4	57.95

Diagram 24: 60 – 75 GHz, EIRP Horizontal polarization

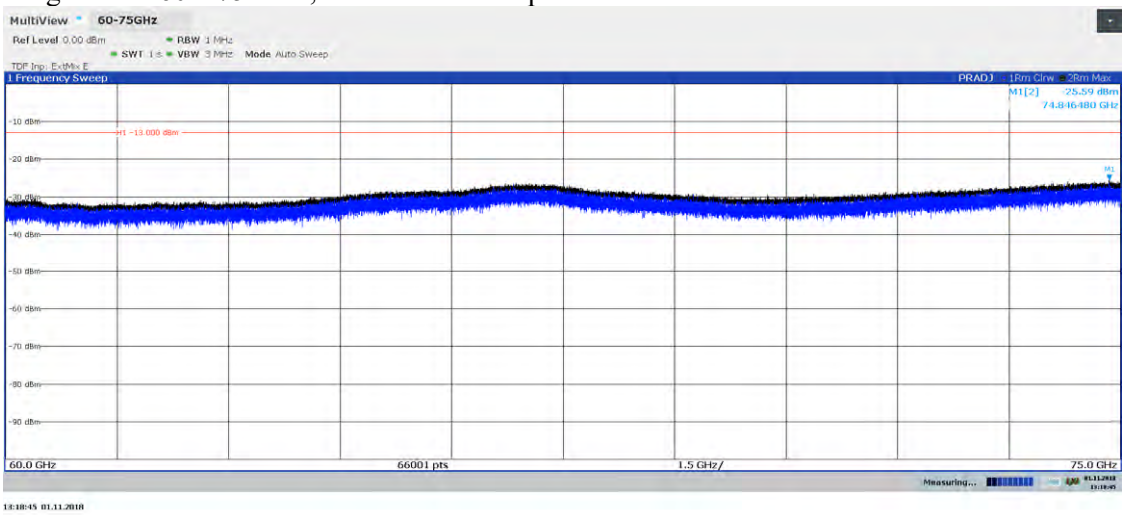


Diagram 25: 60 – 75 GHz, EIRP Vertical polarization

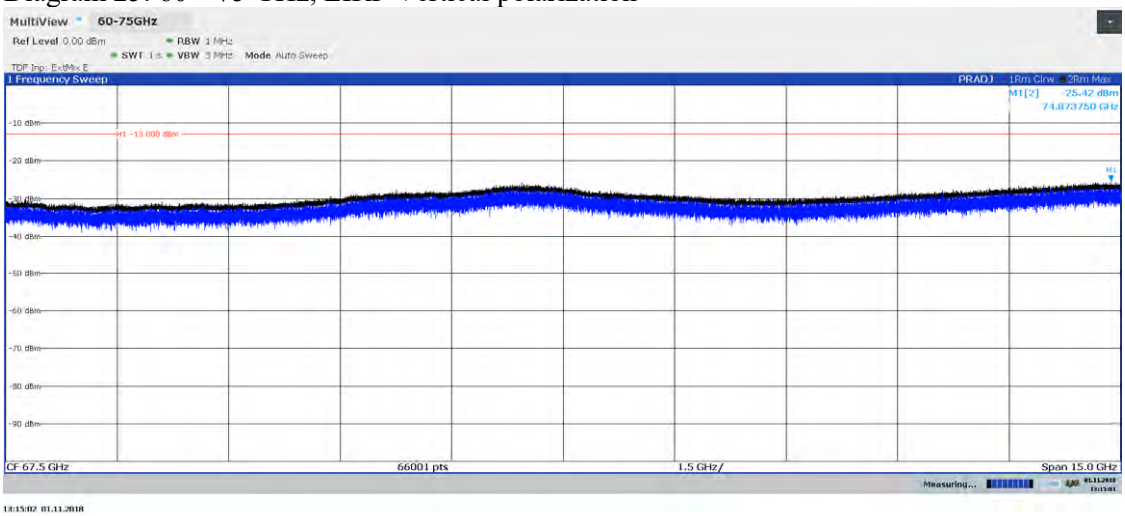


Diagram 26: 75 – 90 GHz, EIRP Horizontal polarization

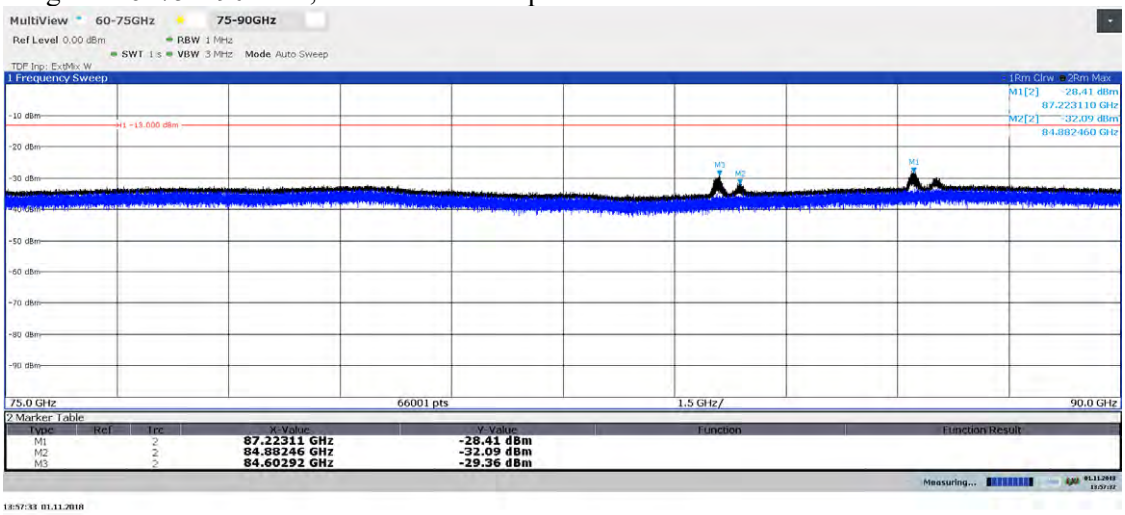


Diagram 27: 75 – 90 GHz, EIRP Vertical polarization

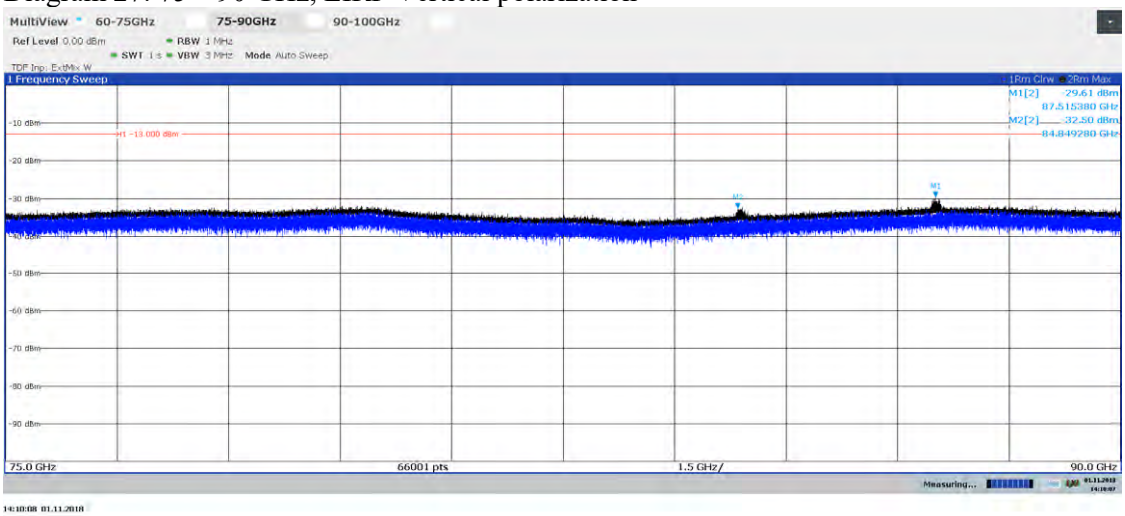


Diagram 28: 90 – 100 GHz, EIRP Horizontal polarization

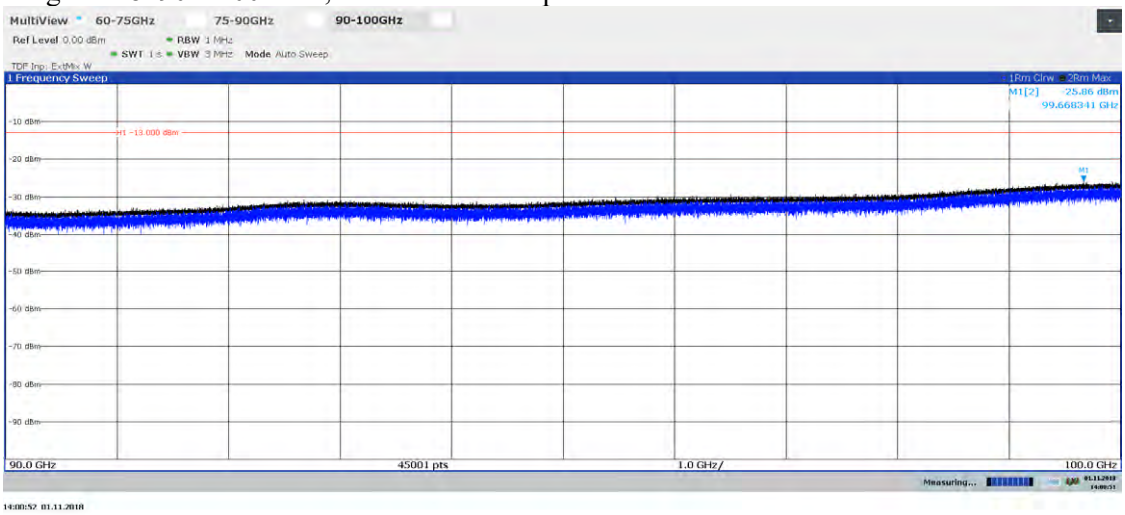
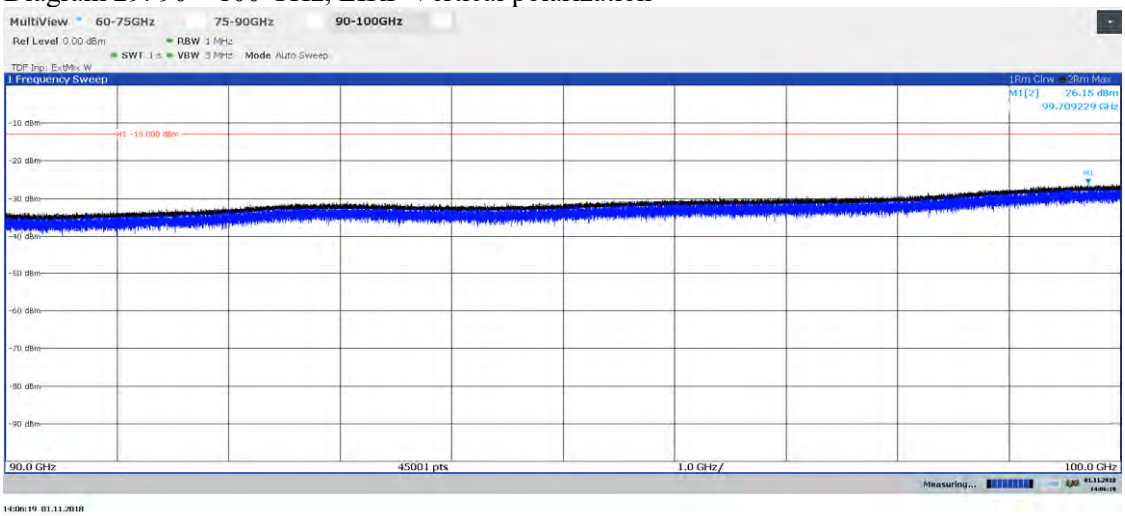


Diagram 29: 90 – 100 GHz, EIRP Vertical polarization



Frequency stability measurements according to 47 CFR §2.1055

Date	Temperature (test equipment)	Humidity (test equipment)
2022-04-06	23 °C ± 3 °C	20 % ± 5 %
2022-04-07	23 °C ± 3 °C	22 % ± 5 %
2022-04-08	23 °C ± 3 °C	25 % ± 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 27550.08 MHz (BL) with a bandwidth of 100 MHz.

Test conditions		Frequency error (Hz)
Supply voltage AC (V)	Temp. (°C)	
102	+20	-53
138	+20	+52
120	+20	+50
120	+30	+50
120	+40	+73
120	+50	+56
120	+10	+50
120	0	+55
120	-10	+50
120	-20	-52
120	-30	-51
Maximum freq. error (Hz)		73
Measurement uncertainty		$< \pm 1 \times 10^{-7}$

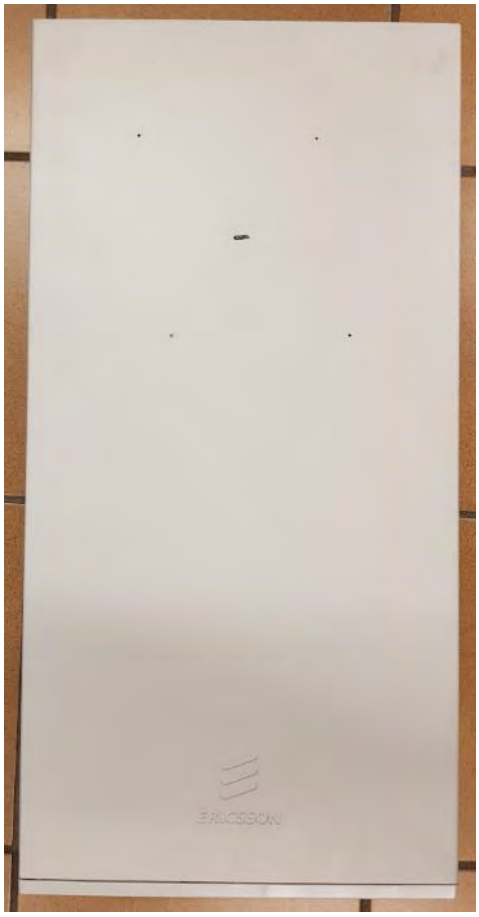
Test conditions		Frequency error (Hz)
Supply voltage DC (V)	Temp. (°C)	
40.8	+20	+88
55.2	+20	-116
48	+20	+101
Maximum freq. error (Hz)		116
Measurement uncertainty		$< \pm 1 \times 10^{-7}$

Remark

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

Photos of test object

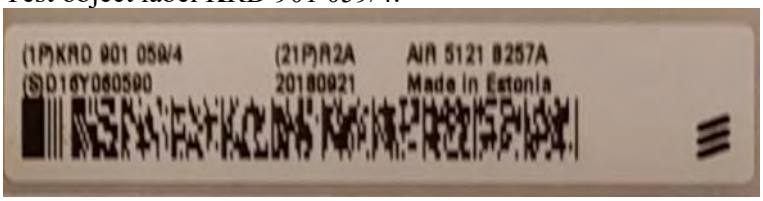
Front side



Rear side

Test object label KRD 901 059/1:

Test object label KRD 901 059/4:



Bottom side KRD 901 059/1

Bottom side KRD 901 059/4

Top side

Left side

Right side

SFP module Data 1:

SFP module Data 2:

End of report.