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## Radio measurements on Air 1281 B261

Rev1 2022-02-08: Frequency stability added.

Product name: Air 1281 B261  
Product number: KRD 901 165/2**RISE Research Institutes of Sweden AB**  
**Vehicles and Automation - EMC-IKT**

Performed by

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## Summary

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

## Description of the test object

|                                               |                                                                                                                                                                      |
|-----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Equipment:                                    | Radio equipment:, Air 1281 B261<br>Product number: KRD 901 165/2 including KRX 101 01/1,<br>Rev. R1A with FCC ID: TA8AKRX10101                                       |
| Hardware revision state:                      | R1A                                                                                                                                                                  |
| Tested configuration:                         | 3GPP NR TDD                                                                                                                                                          |
| Frequency range:                              | TX/ RX: 27500 – 28350 MHz                                                                                                                                            |
| No of supported beams:                        | Config mode 1: 2 beams in 2 orthogonal polarizations each, 4<br>beams in total.<br>Config mode 2: 1 beam in 2 orthogonal polarizations each, 2<br>beams in total.    |
| Operating bandwidth:                          | Config mode 1: Two segments of 400 MHz<br>Config mode 2: One segment of 400 MHz                                                                                      |
| Nominal Output power<br>(EIRP):               | 53 dBm/ beam and polarization config mode 2<br>47 dBm/ beam and polarization config mode 1                                                                           |
| RF configurations:                            | TX Diversity, SU and MU MIMO up to 2 layers 1x(2x2),<br>Contiguous Spectrum (CS) and Non-Contiguous spectrum (NCS),<br>Carrier Aggregation (CA) intra-band supported |
| Antenna beam steering:                        | Azimuth $\pm 60$ deg, elevation $\pm 15$ deg                                                                                                                         |
| Channel bandwidth(s)/<br>Sub Carrier Spacing: | 50MHz and 100 MHz/ 120 kHz                                                                                                                                           |
| Modulations:                                  | QPSK, 16QAM and 64QAM                                                                                                                                                |
| Emission designators:                         | 46M1W7D and 95M0W7D                                                                                                                                                  |
| Emission designators<br>Carrier Aggregation:  | 793MW7D (8x 100 MHz)                                                                                                                                                 |
| RF power Tolerance:                           | +1.5/ -2.0 dB                                                                                                                                                        |
| CPRI Speed                                    | Up to 10.1 Gbit/s                                                                                                                                                    |

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 1.31 dB was added to the test results.

## Measurements

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

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

Far field distance for power, OBW and Band edge measurements is 3.5 m, based on the EUT antenna dimensions and the highest transmitter frequency (28.35 GHz).

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

| Frequency range<br>[GHz] | Far field distance<br>[m] | Measured distance<br>[m] |
|--------------------------|---------------------------|--------------------------|
| 18 – 26.5                | 0.73                      | 4                        |
| 26.5 – 40                | 0.49                      | 4                        |
| 40 – 60                  | 0.34                      | 3                        |
| 60 – 80                  | 0.18                      | 1                        |
| 80 – 100                 | 0.16                      | 1                        |

Formula for far field distance calculation:

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

## References

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

CFR 47 part 30, May 2020

ANSI C63.26-2015

KDB 842590 D01 Upper Microwave Flexible Use Service v01r01

3GPP TS 38.141-2 V15.5.0 (2020-03)

3GPP TR 37.842 V13.3.0 (2020-01)

## RISE Measurement equipment

|                                           | Calibration Due | RISE number |
|-------------------------------------------|-----------------|-------------|
| Anechoic chamber, Hertz                   | 2020-11         | BX50194     |
| R&S FSW 43                                | 2021-07         | 902 073     |
| R&S ESU 40                                | 2021-07         | 901 385     |
| R&S ZNB 40                                | 2021-07         | BX50051     |
| RF Cable VNA-calibration                  | 2021-01         | BX50189     |
| RF Cable VNA-calibration                  | 2021-01         | BX50190     |
| RF Cable                                  | 2021-05         | BX50236     |
| RF Cable                                  | 2020-09         | BX50192     |
| RF Cable                                  | 2021-01         | BX81431     |
| RF Cable                                  | 2021-05         | BX81423     |
| RF Cable                                  | 2020-09         | 503 681     |
| RF Cable FSW-B21                          | 2020-10         | BX62069     |
| RF Cable FSW-B21                          | 2020-10         | BX62073     |
| Bilog antenna Schaffner 6143A             | 2021-08         | 504 079     |
| Flann STD Gain Horn Antenna 20240-20      | -               | BX92412     |
| Flann STD Gain Horn Antenna 22240-20      | -               | BX92413     |
| Flann STD Gain Horn Antenna 24240-20      | -               | BX92414     |
| Flann STD Gain Horn Antenna 26240-20      | -               | BX92415     |
| Flann STD Gain Horn Antenna 27240-20      | -               | BX92416     |
| Mixer FS-Z60                              | 2023-08         | BX90566     |
| Mixer FS-Z90                              | 2021-01         | BX90567     |
| Mixer FS-Z110                             | 2021-07         | BX81425     |
| Miteq, Low Noise Amplifier                | 2021-01         | 503 278     |
| EMCO Horn Antenna 3115                    | 2021-07         | 502 175     |
| EMCO Horn Antenna 3115                    | 2022-02         | 902 212     |
| EMCO Horn Antenna 3116                    | 2021-07         | 503 279     |
| µComp Nordic, Low Noise Amplifier         | 2021-01         | 901 544     |
| Temperature and humidity meter, Testo 615 | 2021-06         | 503 498     |

### Frequency stability 2021-12

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

## EAB Measurement equipment

Calibrated at RISE before testing.

|                      | Calibration Due | S/N         |
|----------------------|-----------------|-------------|
| SWH010 HPF 30-40 GHz | 2021-06         | ST010619225 |
| SSL036 LPF 26.5 GHz  | 2021-06         | ST012717003 |

## 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: 2020-06-22

## Manufacturer's representative

Mikael Jansson, Ericsson AB.

## Test engineers

Tomas Lennhager and Karl Flysjö, RISE

## Test participant(-s)

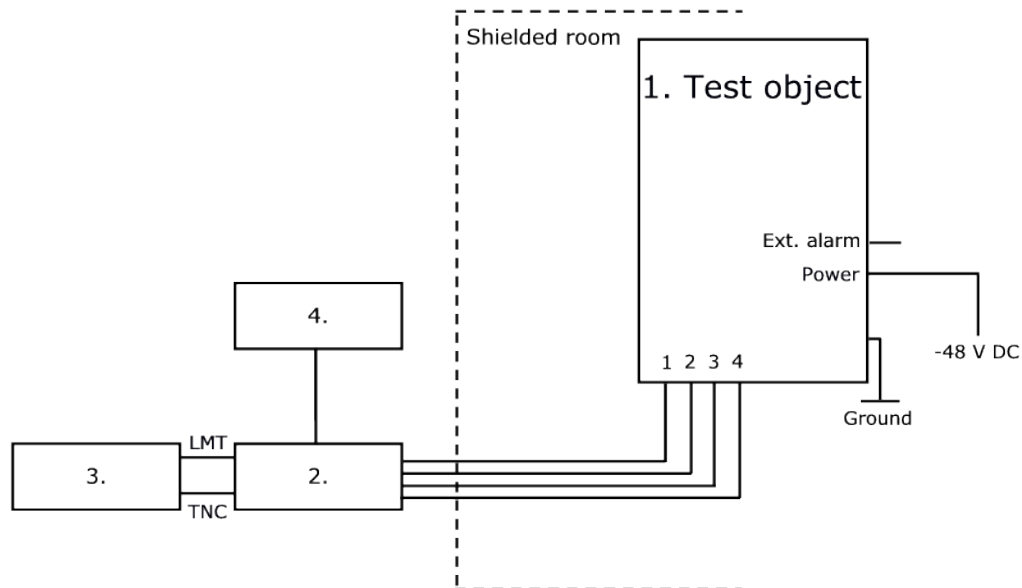
None

### Test frequencies used for radiated measurements

| nr-arfcn:                                                                            | Frequency<br>Hor/ Ver<br>[MHz]                                                               | Symbolic<br>name    | Config<br>mode | Comment                                      |
|--------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|---------------------|----------------|----------------------------------------------|
| 2071249                                                                              | 27525.00                                                                                     | BL <sub>50</sub>    | 2              | 50 MHz BW, TX bottom Lower block             |
| 2077499                                                                              | 27900.00                                                                                     | TL <sub>50</sub>    | 2              | 50 MHz BW, TX Top Lower block                |
| 2078339                                                                              | 27950.04                                                                                     | BH <sub>50</sub>    | 2              | 50 MHz BW, TX Bottom High block              |
| 2084581                                                                              | 28324.92                                                                                     | TH <sub>50</sub>    | 2              | 50 MHz BW, TX Top High block                 |
| 2071679                                                                              | 27550.08                                                                                     | BL <sub>100</sub>   | 2              | 100 MHz BW, TX bottom Lower block            |
| 2077081                                                                              | 27874.92                                                                                     | TL <sub>100</sub>   | 2              | 100 MHz BW, TX Top Lower block               |
| 2078749                                                                              | 27975.00                                                                                     | BH <sub>100</sub>   | 2              | 100 MHz BW, TX Bottom High block             |
| 2084165                                                                              | 28299.96                                                                                     | TH <sub>100</sub>   | 2              | 100 MHz BW, TX Top High block                |
| 2071667<br>2073333                                                                   | 27550.08<br>27650.04                                                                         | BL <sub>2100</sub>  | 2              | 100 MHz BW, TX 2 carrier Bottom Lower band   |
| 2082499<br>2084165                                                                   | 28200.00<br>28299.96                                                                         | TH <sub>2100</sub>  | 2              | 100 MHz BW, TX 2 carrier Top High band       |
| 2071249<br>2072083<br>2077081                                                        | 27525.00<br>27575.04<br>27874.92                                                             | BIM <sub>350</sub>  | 2              | 50 MHz BW, TX 3 carrier Bottom Lower block   |
| 2078749<br>2083749<br>2084581                                                        | 27975.00<br>28275.00<br>28324.92                                                             | TIM <sub>350</sub>  | 2              | 50 MHz BW, TX 3 carrier Top High block       |
| 2071667<br>2073333<br>2076665                                                        | 27550.08<br>27650.04<br>27849.96                                                             | BIM <sub>3100</sub> | 2              | 100 MHz BW, TX 3 carrier Bottom Lower block  |
| 2079165<br>2082499<br>2084165                                                        | 27999.96<br>28200.00<br>28299.96                                                             | TIM <sub>3100</sub> | 2              | 100 MHz BW, TX 3 carrier Top High block      |
| 2071667<br>2073333<br>2074999<br>2076665                                             | 27550.08<br>27650.04<br>27750.00<br>27849.96                                                 | BL <sub>4100</sub>  | 2              | 100 MHz BW, TX 4 carrier Bottom Lower block  |
| 2079165<br>2080831<br>2082499<br>2084165                                             | 27999.96<br>28099.92<br>28200.00<br>28299.96                                                 | TH <sub>4100</sub>  | 2              | 100 MHz BW, TX 4 carrier Top High block      |
| 2071249<br>2072083<br>2076249<br>2077081<br>2078749<br>2079581<br>2083749<br>2084581 | 27525.00<br>27575.04<br>27825.00<br>27874.92<br>27975.00<br>28024.92<br>28275.00<br>28324.92 | BT <sub>850</sub>   | 1              | 50 MHz BW, TX 8 carrier Bottom and Top block |
| 2074999<br>2075831<br>2076665<br>2077499<br>2078333<br>2079165<br>2079999<br>2080831 | 27750.00<br>27799.92<br>27849.96<br>27900.00<br>27950.04<br>27999.96<br>28050.00<br>28099.92 | M <sub>850</sub>    | 1              | 50 MHz BW, TX 8 carrier Middle               |

| nr-arfcn:                                                                            | Frequency<br>Hor/ Ver<br>[MHz]                                                               | Symbolic<br>name   | Config<br>mode | Comment                                       |
|--------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|--------------------|----------------|-----------------------------------------------|
| 2071667<br>2073333<br>2074999<br>2076665<br>2079165<br>2080831<br>2082499<br>2084165 | 27550.08<br>27650.04<br>27750.00<br>27849.96<br>27999.96<br>28099.92<br>28200.00<br>28299.96 | BT8 <sub>100</sub> | 1              | 100 MHz BW, TX 8 carrier Bottom and Top block |
| 2072083<br>2073749<br>2075415<br>2077083<br>2078749<br>2080415<br>2082083<br>2083749 | 27575.04<br>27675.00<br>27774.96<br>27875.04<br>27975.00<br>28074.96<br>28175.04<br>28275.00 | M8 <sub>100</sub>  | 1              | 100 MHz BW, TX 8 carrier Middle               |

## Test setup: radiated measurements



### Test object:

- |    |                                                                                                                                                                    |
|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | AIR 1281 B261, KRD 901 165/2, rev. R1A, s/n: E23B497412<br>including KRX 101 01/1 rev R1A with FCC ID: TA8AKRX10101<br>Radio Software: CXP 203 0045/1, rev. R5A400 |
|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|

### Associated equipment:

- |    |                                                                                                                                                                                                                                                                        |
|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2. | Testing Equipment:<br>Baseband 6630, KDU 137 848/1, rev. R3B, s/n: E23B220402<br>with software: CXP904418/15, rev. R11A67<br><br>For frequency stability test Baseband 6648, KDU 137 0015/1, rev. R3A, s/n: E23B849332<br>with software: CXP2010174/1 R38A130 was used |
|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

### Functional test equipment:

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

### Interfaces:

|                                                       |        |
|-------------------------------------------------------|--------|
| Power input configuration DC (KRD 901 165/2): -48 VDC | 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     | Signal |
| 4, Optical Interface Link, single mode opto fibre     | Signal |
| Ground wire                                           | Ground |

## RF power output measurements according to CFR 47 §30.202

| Date       | Temperature  | Humidity   |
|------------|--------------|------------|
| 2020-08-11 | 24 °C ± 3 °C | 42 % ± 5 % |
| 2020-08-12 | 23 °C ± 3 °C | 46 % ± 5 % |
| 2020-08-13 | 23 °C ± 3 °C | 49 % ± 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).

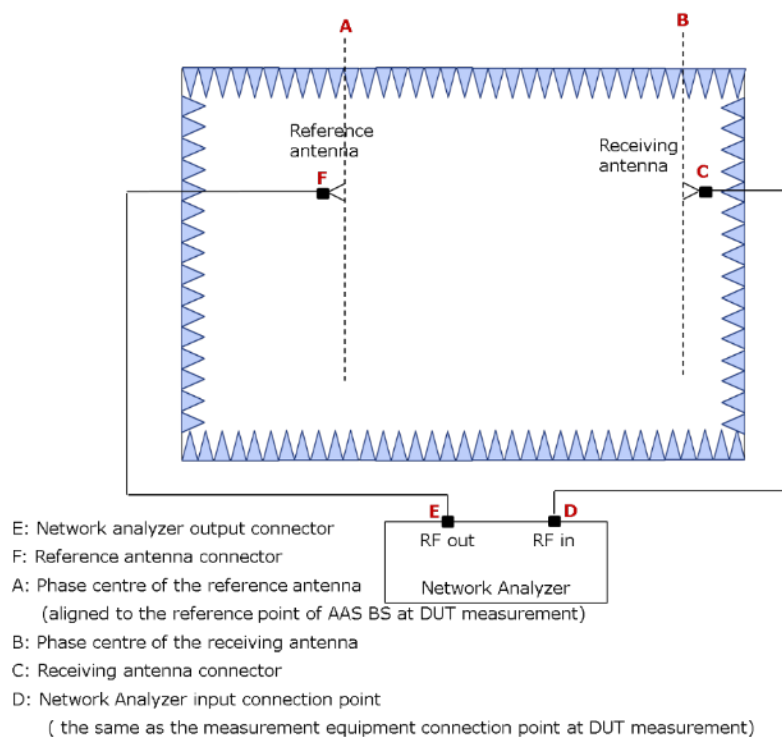


Figure 1: Indoor Anechoic Chamber calibration system setup for EIRP

### 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  $20\log|S_{21}|$  (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:  
 $LEIRP_{cal, A \rightarrow D} = LF_{EIRP, E \rightarrow D} + G_{REF\_ANT\_EIRP, A \rightarrow F} - LF_{EIRP, E \rightarrow F}$ .  
 $LEIRP_{cal, A \rightarrow D}$ : 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:

$$EIRP = P_{R\_EUT\_EIRP, D} + LEIRP_{cal, A \rightarrow D}$$

Test Setup, measuring distance 4m:

| 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                                  | BX81423     |
| Testo 615, temperature and humidity meter | 503 498     |

Measurement uncertainty: 3.3 dB

## Results

Single carrier Config mode 2

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

|                  | Output power per 100 MHz, EIRP [RMS dBm]<br>Vertical/ Horizontal |
|------------------|------------------------------------------------------------------|
| Symbolic<br>name | Carrier 1                                                        |
| BL <sub>50</sub> | 53.90/ 53.69                                                     |
| TL <sub>50</sub> | 53.44/ 53.25                                                     |
| BH <sub>50</sub> | 53.60/ 53.13                                                     |
| TH <sub>50</sub> | 53. 69/ 53.18                                                    |

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

|                   | Output power per 100 MHz, EIRP [RMS dBm]<br>Vertical/ Horizontal |
|-------------------|------------------------------------------------------------------|
| Symbolic<br>name  | Carrier 1                                                        |
| BL <sub>100</sub> | 54.04/ 53.89                                                     |
| TL <sub>100</sub> | 53.57/ 53.34                                                     |
| BH <sub>100</sub> | 53.69/ 53.12                                                     |
| TH <sub>100</sub> | 53.71/ 52.93                                                     |

## 2-Carrier Config mode 2

Beam index 0 Boresight, Carrier Bandwidth 100 MHz, QPSK

Nominal rated output power (EIRP) per Beam: 53 dBm/ Polarization.

|                    | Output power per 100 MHz, EIRP [RMS dBm]<br>Vertical/ Horizontal |              |                     |
|--------------------|------------------------------------------------------------------|--------------|---------------------|
| Symbolic name      | Carrier 1                                                        | Carrier 2    | Total (per 200 MHz) |
| BL2 <sub>100</sub> | 50.74/ 50.50                                                     | 51.08/ 50.59 | 53.92/ 53.56        |
| TH2 <sub>100</sub> | 50.75/ 50.26                                                     | 50.70/ 50.01 | 53.74/ 53.15        |

## 4-Carrier Config mode 2

Beam index 0 Boresight, Bandwidth 100MHz, QPSK

Nominal rated output power (EIRP) per Beam: 53 dBm/ Polarization

|                    | Output power per 100 MHz, EIRP [RMS dBm]<br>Vertical/ Horizontal |              |              |              |                        |
|--------------------|------------------------------------------------------------------|--------------|--------------|--------------|------------------------|
| Symbolic name      | Carrier 1                                                        | Carrier 2    | Carrier 3    | Carrier 4    | Total<br>(per 400 MHz) |
| BL4 <sub>100</sub> | 47.36/ 47.62                                                     | 47.65/ 47.53 | 48.03/ 47.49 | 48.04/ 47.84 | 53.80/ 53.64           |
| TH4 <sub>100</sub> | 47.39/ 47.31                                                     | 47.56/ 47.27 | 47.97/ 47.36 | 47.54/ 47.38 | 53.64/ 53.35           |

8-Carrier Config mode 1

Beam index 0 Boresight, Carrier Bandwidth 50 MHz

Nominal rated output power (EIRP) per Beam: 47.0 dBm/ Polarization.

|            |                   | Output power per 50 MHz, EIRP [RMS dBm]<br>Vertical/ Horizontal |                 |                 |                 |                    |                 |                 |                 |                 |                    |
|------------|-------------------|-----------------------------------------------------------------|-----------------|-----------------|-----------------|--------------------|-----------------|-----------------|-----------------|-----------------|--------------------|
|            |                   | Beam 1                                                          |                 |                 |                 |                    | Beam 2          |                 |                 |                 |                    |
| Modulation | Symbolic name     | A                                                               | B               | C               | D               | Total Power Beam 1 | E               | F               | G               | H               | Total power Beam 2 |
| QPSK       | BT8 <sub>50</sub> | 41.95/<br>41.26                                                 | 42.11/<br>41.83 | 42.13/<br>41.63 | 42.20/<br>41.99 | 48.12/<br>47.7     | 41.04/<br>41.28 | 41.50/<br>41.53 | 41.70/<br>41.15 | 41.23/<br>41.54 | 47.40/<br>47.40    |
| QPSK       | M8 <sub>50</sub>  | 41.52/<br>41.40                                                 | 41.93/<br>41.30 | 41.91/<br>41.16 | 42.25/<br>41.41 | 47.93/<br>47.34    | 41.31/<br>40.92 | 41.18/<br>41.42 | 41.21/<br>41.46 | 42.02/<br>41.47 | 47.46/<br>47.34    |

Beam index 0 Boresight, Carrier Bandwidth 100 MHz

Nominal rated output power (EIRP) per Beam: 47.0 dBm/ Polarization.

|            |                    | Output power per 100 MHz, EIRP [RMS dBm]<br>Vertical/ Horizontal |                 |                 |                 |                    |                 |                 |                 |                 |                    |
|------------|--------------------|------------------------------------------------------------------|-----------------|-----------------|-----------------|--------------------|-----------------|-----------------|-----------------|-----------------|--------------------|
|            |                    | Beam 1                                                           |                 |                 |                 |                    | Beam 2          |                 |                 |                 |                    |
| Modulation | Symbolic name      | A                                                                | B               | C               | D               | Total Power Beam 1 | E               | F               | G               | H               | Total power Beam 2 |
| QPSK       | BT8 <sub>100</sub> | 41.93/<br>41.43                                                  | 41.87/<br>41.47 | 42.15/<br>41.40 | 42.30/<br>41.75 | 48.09/<br>47.54    | 41.25/<br>41.28 | 41.55/<br>41.19 | 41.80/<br>41.45 | 41.65/<br>41.31 | 47.59/<br>47.33    |
| QPSK       | M8 <sub>100</sub>  | 41.88/<br>41.28                                                  | 41.83/<br>41.33 | 42.07/<br>41.33 | 42.24/<br>41.65 | 48.03/<br>47.42    | 41.22/<br>41.24 | 41.55/<br>41.11 | 41.83/<br>41.47 | 41.73/<br>41.38 | 47.61/<br>47.32    |

## 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   |
|------------|--------------|------------|
| 2020-08-12 | 23 °C ± 3 °C | 46 % ± 5 % |
| 2020-08-13 | 23 °C ± 3 °C | 49 % ± 5 % |

### Test set-up and procedure

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

Test Setup, measuring distance 4m:

| 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                                  | BX81423     |
| Testo 615, temperature and humidity meter | 503 498     |

Measurement uncertainty: 3.3 dB

## Results

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

| Diagram | Symbolic name    | Polarization | Occupied BW (99%) [MHz] |
|---------|------------------|--------------|-------------------------|
| 1.1     | TL <sub>50</sub> | Hor          | 46.138                  |
| 1.2     | TL <sub>50</sub> | Ver          | 46.115                  |

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

| Diagram | Symbolic name     | Polarization | Occupied BW (99%) [MHz] |
|---------|-------------------|--------------|-------------------------|
| 1.3     | TL <sub>100</sub> | Hor          | 95.006                  |
| 1.4     | TL <sub>100</sub> | Ver          | 95.008                  |

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

| Diagram | Symbolic name     | Polarization | Occupied BW (99%) [MHz] |
|---------|-------------------|--------------|-------------------------|
| 1.5     | M8 <sub>100</sub> | Hor          | 791.357                 |
| 1.6     | M8 <sub>100</sub> | Ver          | 793.120                 |

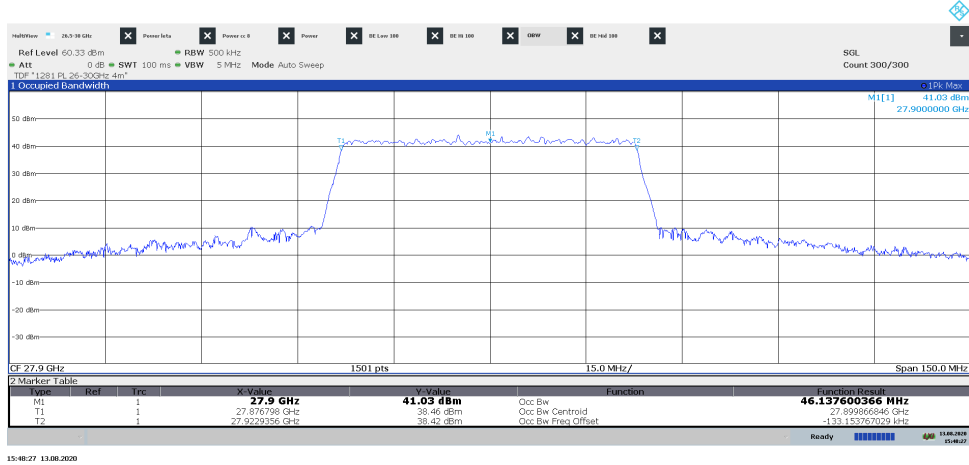
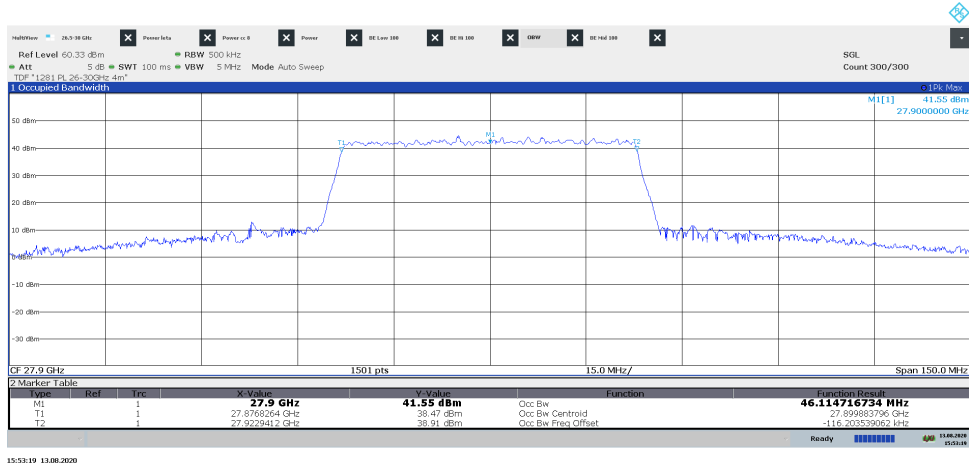
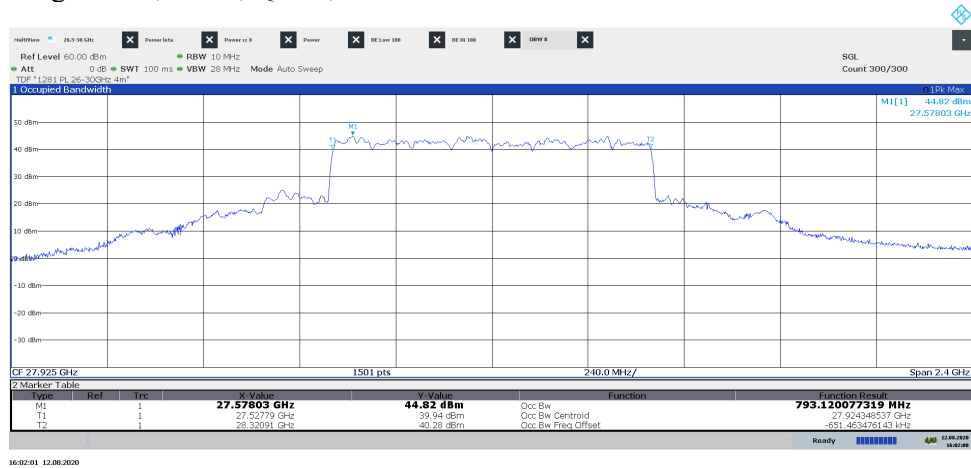
Diagram 1.1, TL<sub>50</sub>, QPSK, Horizontal:Diagram 1.2, TL<sub>50</sub>, QPSK, Vertical:



Diagram 1.5, M8<sub>100</sub>, QPSK, Horizontal:Diagram 1.6, M8<sub>100</sub>, QPSK, Vertical::

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

| Date       | Temperature  | Humidity   |
|------------|--------------|------------|
| 2020-08-11 | 24 °C ± 3 °C | 42 % ± 5 % |
| 2020-08-12 | 23 °C ± 3 °C | 46 % ± 5 % |
| 2020-08-13 | 23 °C ± 3 °C | 49 % ± 5 % |
| 2020-08-04 | 23 °C ± 3 °C | 48 % ± 5 % |
| 2020-08-25 | 23 °C ± 3 °C | 26 % ± 5 % |
| 2020-08-26 | 22 °C ± 3 °C | 37 % ± 5 % |
| 2020-08-27 | 23 °C ± 3 °C | 27 % ± 5 % |
| 2020-08-28 | 23 °C ± 3 °C | 30 % ± 5 % |
| 2020-08-31 | 23 °C ± 3 °C | 23 % ± 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 described below.

In the test range from 40 – 100 GHz

A propagation loss in free space was calculated. The used formula was

$$\gamma = 20 \log \left( \frac{4\pi D}{\lambda} \right), \quad \gamma \text{ is the propagation loss and } D \text{ is the antenna distance.}$$

For 40 – 60 GHz  $D$  was 3.0 m and for 60 – 100 GHz  $D$  was 1.0 m.

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).

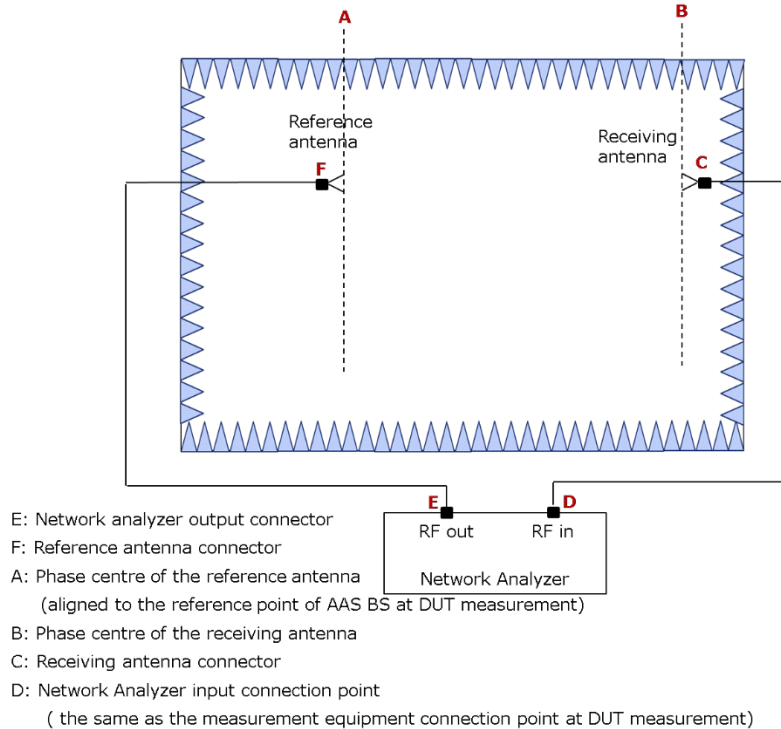


Figure 1: Indoor Anechoic Chamber calibration system setup for EIRP

**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  $20\log|S_{21}|$  (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 from 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  $\pm \Delta TRP$ .  
( $\Delta TRP$  = 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.

**Rise Measurement equipment**

| Measurement equipment                     | RISE number |
|-------------------------------------------|-------------|
| Anechoic chamber, Hertz                   | BX50194     |
| R&S FSW 43                                | 902 073     |
| R&S ESU 40                                | 901 385     |
| R&S ZNB 40                                | BX50051     |
| EMCO Horn Antenna 3116                    | 503 279     |
| Bilog antenna Schaffner 6143              | 504 079     |
| Flann STD Gain Horn Antenna 20240-20      | BX92412     |
| Flann STD Gain Horn Antenna 22240-20      | BX92413     |
| Flann STD Gain Horn Antenna 24240-20      | BX92414     |
| Flann STD Gain Horn Antenna 26240-20      | BX92415     |
| Flann STD Gain Horn Antenna 27240-20      | BX92416     |
| 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                                  | BX81423     |
| 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         |
|----------------------|-------------|
| SWH010 HPF 30-40 GHz | ST010619225 |
| SSL036 LPF 26,5 GHz  | ST012717003 |

## Results

The diagrams represents worst case configurations for each frequency range.

| Diagram | Symbolic name      | Config mode | Pol     | Frequency range   | Measurement method         | “Early exit?”          |
|---------|--------------------|-------------|---------|-------------------|----------------------------|------------------------|
| 2.1a    | TH <sub>50</sub>   | 2           | Hor     | 30-1000 MHz       | Pre scan EIRP              | Yes                    |
| 2.1b    | TH <sub>50</sub>   | 2           | Ver     | 30-1000 MHz       | Pre scan EIRP              | Yes                    |
| 2.2a    | BT8 <sub>100</sub> | 1           | Hor     | 30-1000 MHz       | Pre scan EIRP              | Yes                    |
| 2.2b    | BT8 <sub>100</sub> | 1           | Ver     | 30-1000 MHz       | Pre scan EIRP              | Yes                    |
| 2.3a    | TH <sub>50</sub>   | 2           | Hor     | 1-18 GHz          | Pre scan EIRP              | Yes                    |
| 2.3b    | TH <sub>50</sub>   | 2           | Ver     | 1-18 GHz          | Pre scan EIRP              | Yes                    |
| 2.4a    | BT8 <sub>100</sub> | 1           | Hor     | 1-18 GHz          | Pre scan EIRP              | Yes                    |
| 2.4b    | BT8 <sub>100</sub> | 1           | Ver     | 1-18 GHz          | Pre scan EIRP              | Yes                    |
| 2.5a    | TH <sub>50</sub>   | 2           | Hor     | 18-26.5 GHz       | Pre scan EIRP              | No                     |
| 2.5b    | TH <sub>50</sub>   | 2           | Ver     | 18-26.5 GHz       | Pre scan EIRP              | No                     |
| 2.5c    | TH <sub>50</sub>   | 2           | Hor/Ver | 26.113-26.213 GHz | Two cut TRP                | Compliant to TRP limit |
| 2.6a    | BT8 <sub>100</sub> | 1           | Hor     | 18-26.5 GHz       | Pre scan EIRP              | Yes                    |
| 2.6b    | BT8 <sub>100</sub> | 1           | Ver     | 18-26.5 GHz       | Pre scan EIRP              | Yes                    |
| 2.7a    | BL <sub>50</sub>   | 2           | Hor     | 26.5-30 GHz       | Pre scan EIRP              | No                     |
| 2.7b    | BL <sub>50</sub>   | 2           | Ver     | 26.5-30 GHz       | Pre scan EIRP              | No                     |
| 2.7c    | BL <sub>50</sub>   | 2           | Hor     | 27-27.51 GHz      | Pre scan EIRP              | Yes <sup>1</sup>       |
| 2.7d    | BL <sub>50</sub>   | 2           | Ver     | 27-27.51 GHz      | Pre scan EIRP              | Yes <sup>1</sup>       |
| 2.8a    | TH <sub>100</sub>  | 2           | Hor     | 26.5-30 GHz       | Pre scan EIRP              | No                     |
| 2.8b    | TH <sub>100</sub>  | 2           | Ver     | 26.5-30 GHz       | Pre scan EIRP              | No                     |
| 2.8c    | TH <sub>100</sub>  | 2           | Ver     | 28.34-28.85 GHz   | Pre scan EIRP              | Yes <sup>1</sup>       |
| 2.8d    | TH <sub>100</sub>  | 2           | Ver     | 28.34-28.85 GHz   | Pre scan EIRP              | Yes <sup>1</sup>       |
| 2.8c    | TH <sub>100</sub>  | 2           | Hor/Ver | 27.39-27.49 GHz   | Two cut TRP                | Compliant to TRP limit |
| 2.9a    | Bim3 <sub>50</sub> | 2           | Hor     | 26.5-30 GHz       | Pre scan EIRP              | No                     |
| 2.9b    | Bim3 <sub>50</sub> | 2           | Ver     | 26.5-30 GHz       | Pre scan EIRP              | No                     |
| 2.9c    | Bim3 <sub>50</sub> | 2           | Hor     | 26.8-27.51 GHz    | Pre scan EIRP              | No                     |
| 2.9d    | Bim3 <sub>50</sub> | 2           | Ver     | 26.8-27.51 GHz    | Pre scan EIRP              | No                     |
| 2.9e    | Bim3 <sub>50</sub> | 2           | Hor/Ver | 26.8-27.5 GHz     | Pattern multiplication TRP | Compliant to TRP limit |
| 2.10a   | TL <sub>50</sub>   | 2           | Hor     | 27.625-28.225 GHz | Pre scan EIRP              | Yes <sup>1</sup>       |
| 2.10b   | TL <sub>50</sub>   | 2           | Ver     | 27.625-28.225 GHz | Pre scan EIRP              | Yes <sup>1</sup>       |
| 2.11a   | BH <sub>50</sub>   | 2           | Hor     | 27.625-28.225 GHz | Pre scan EIRP              | Yes <sup>1</sup>       |
| 2.11b   | BH <sub>50</sub>   | 2           | Ver     | 27.625-28.225 GHz | Pre scan EIRP              | Yes <sup>1</sup>       |
| 2.12a   | TH <sub>50</sub>   | 2           | Hor     | 26.5-30 GHz       | Pre scan EIRP              | No <sup>2</sup>        |
| 2.12b   | TH <sub>50</sub>   | 2           | Ver     | 26.5-30 GHz       | Pre scan EIRP              | No <sup>2</sup>        |
| 2.12c   | TH <sub>50</sub>   | 2           | Hor     | 28.34-28.85 GHz   | Pre scan EIRP              | Yes <sup>1</sup>       |
| 2.12d   | TH <sub>50</sub>   | 2           | Ver     | 28.34-28.85 GHz   | Pre scan EIRP              | Yes <sup>1</sup>       |

<sup>1)</sup> Calculated conducted power based on antenna gain below limit

<sup>2)</sup> Early Exit based on Lower EIRP compared to TH<sub>100</sub> (Diagram 2.8) for the spurious at 27.44GHz .

| Diagram | Symbolic name      | Config mode | Pol     | Frequency range | Measurement method         | “Early exit?”          |
|---------|--------------------|-------------|---------|-----------------|----------------------------|------------------------|
| 2.13a   | Tim <sub>350</sub> | 2           | Hor     | 26.5-30 GHz     | Pre scan EIRP              | No <sup>2</sup>        |
| 2.13b   | Tim <sub>350</sub> | 2           | Ver     | 26.5-30 GHz     | Pre scan EIRP              | No <sup>2</sup>        |
| 2.13c   | Tim <sub>350</sub> | 2           | Hor     | 28.34-28.85 GHz | Pre scan EIRP              | No                     |
| 2.13d   | Tim <sub>350</sub> | 2           | Ver     | 28.34-28.85 GHz | Pre scan EIRP              | No                     |
| 2.13e   | Tim <sub>350</sub> | 2           | Hor/Ver | 28.35-28.85 GHz | Pattern multiplication TRP | Compliant to TRP limit |
| 2.14a   | BT <sub>8100</sub> | 1           | Hor     | 26.5-30 GHz     | Pre scan EIRP              | No                     |
| 2.14b   | BT <sub>8100</sub> | 1           | Ver     | 26.5-30 GHz     | Pre scan EIRP              | No                     |
| 2.14c   | BT <sub>8100</sub> | 1           | Hor     | 27-27.51 GHz    | Pre scan EIRP              | Yes <sup>1</sup>       |
| 2.14d   | BT <sub>8100</sub> | 1           | Ver     | 27-27.51 GHz    | Pre scan EIRP              | Yes <sup>1</sup>       |
| 2.14e   | BT <sub>8100</sub> | 1           | Hor     | 28.34-28.85 GHz | Pre scan EIRP              | Yes <sup>1</sup>       |
| 2.14f   | BT <sub>8100</sub> | 1           | Ver     | 28.34-28.85 GHz | Pre scan EIRP              | Yes <sup>1</sup>       |
| 2.15a   | BL <sub>50</sub>   | 2           | Hor     | 30-40 GHz       | Pre scan EIRP              | No                     |
| 2.15b   | BL <sub>50</sub>   | 2           | Ver     | 30-40 GHz       | Pre scan EIRP              | No                     |
| 2.15c   | BL <sub>50</sub>   | 2           | Hor/Ver | 30.55-30.65 GHz | Two cut TRP                | Compliant to TRP limit |
| 2.16a   | BT <sub>8100</sub> | 1           | Hor     | 30-40 GHz       | Pre scan EIRP              | Yes <sup>3</sup>       |
| 2.16b   | BT <sub>8100</sub> | 1           | Ver     | 30-40 GHz       | Pre scan EIRP              | Yes <sup>3</sup>       |
| 2.17a   | TH <sub>50</sub>   | 2           | Hor     | 40-60 GHz       | Pre scan EIRP              | Yes                    |
| 2.17b   | TH <sub>50</sub>   | 2           | Ver     | 40-60 GHz       | Pre scan EIRP              | Yes                    |
| 2.18a   | BT <sub>8100</sub> | 1           | Hor     | 40-60 GHz       | Pre scan EIRP              | Yes                    |
| 2.18b   | BT <sub>8100</sub> | 1           | Ver     | 40-60 GHz       | Pre scan EIRP              | Yes                    |
| 2.19a   | TH <sub>50</sub>   | 2           | Hor     | 60-80 GHz       | Pre scan EIRP              | Yes                    |
| 2.19b   | TH <sub>50</sub>   | 2           | Ver     | 60-80 GHz       | Pre scan EIRP              | Yes                    |
| 2.20a   | BT <sub>8100</sub> | 1           | Hor     | 60-80 GHz       | Pre scan EIRP              | Yes                    |
| 2.20b   | BT <sub>8100</sub> | 1           | Ver     | 60-80 GHz       | Pre scan EIRP              | Yes                    |
| 2.21a   | TH <sub>50</sub>   | 2           | Hor     | 80-100 GHz      | Pre scan EIRP              | Yes                    |
| 2.21b   | TH <sub>50</sub>   | 2           | Ver     | 80-100 GHz      | Pre scan EIRP              | Yes                    |
| 2.22a   | BT <sub>8100</sub> | 1           | Hor     | 80-100 GHz      | Pre scan EIRP              | Yes                    |
| 2.22b   | BT <sub>8100</sub> | 1           | Ver     | 80-100 GHz      | Pre scan EIRP              | Yes                    |

<sup>1)</sup> Calculated conducted power based on antenna gain below limit

<sup>2)</sup> Early Exit based on Lower EIRP compared to TH<sub>100</sub> (Diagram 2.8) for the spurious at 27.44GHz .

<sup>3)</sup> Early Exit based on Lower EIRP compared to BL<sub>50</sub> (Diagram 2.15)

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 – 100 GHz, 4.24 dB

## Limits

CFR 47 §30.203 Emission limits.

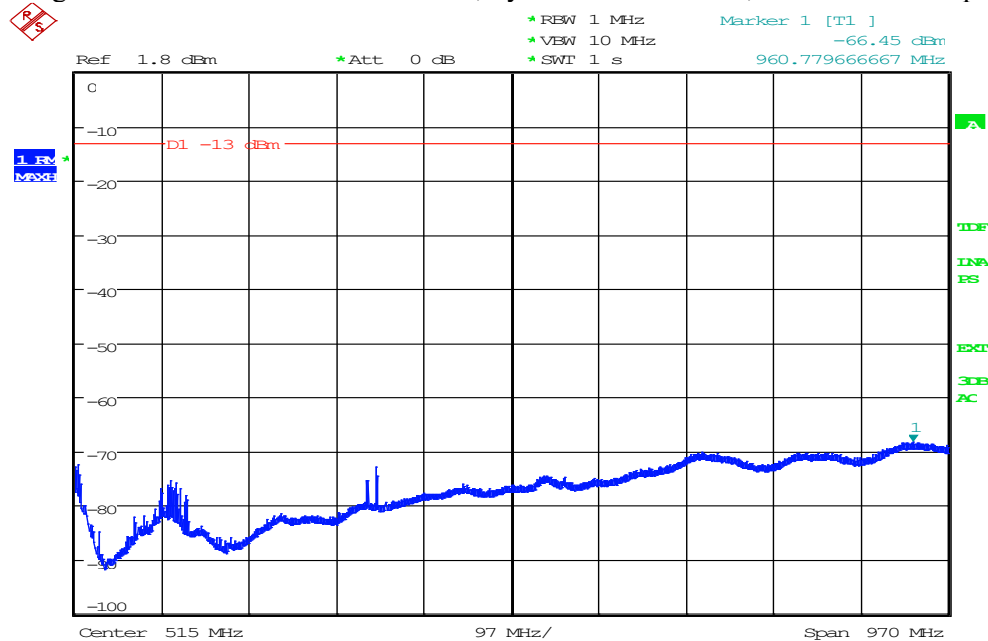
(a) The conductive power or the total radiated power of any emission outside a licensee's frequency block shall be  $-13$  dBm/MHz or lower. However, in the bands immediately outside and adjacent to the licensee's frequency block, having a bandwidth equal to 10 percent of the channel bandwidth, the conductive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

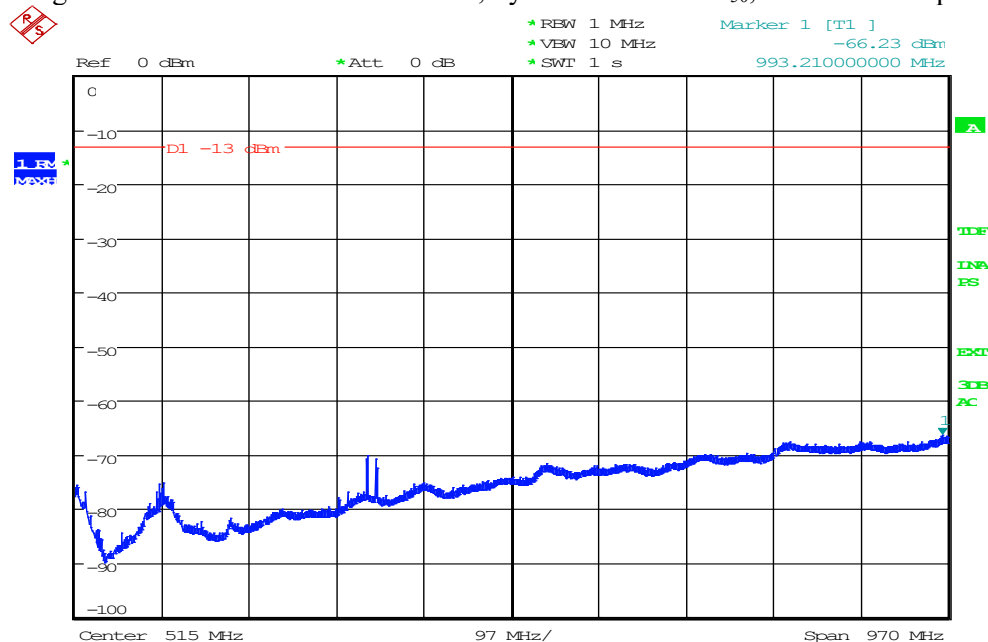
(2) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the licensee's frequency block edges as the design permits.

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

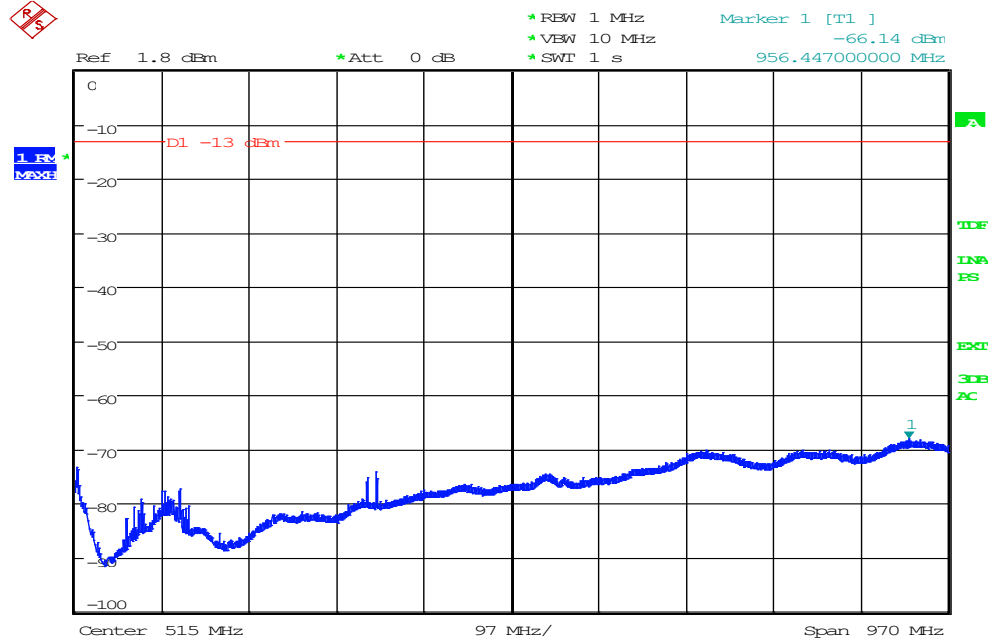
|           |     |
|-----------|-----|
| Complies? | Yes |
|-----------|-----|

Diagram 2.1a: Pre scan 30 – 1000 MHz, Symbolic name: TH<sub>50</sub>, EIRP Horizontal polarization

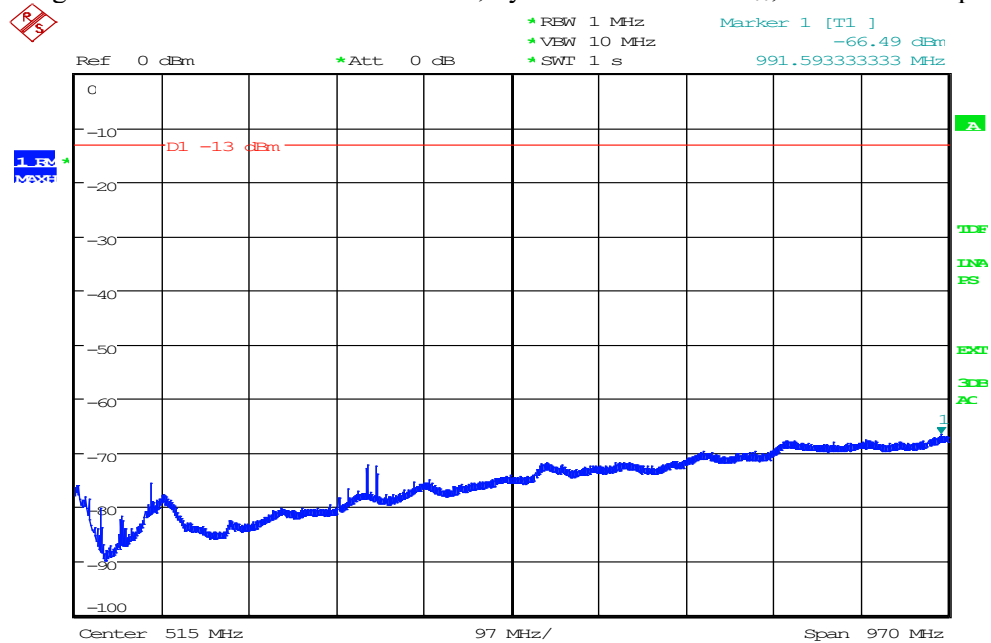
Date: 14.AUG.2020 15:30:27

Diagram 2.1b: Pre scan 30 – 1000 MHz, Symbolic name: TH<sub>50</sub>, EIRP Vertical polarization

Date: 14.AUG.2020 15:34:11

Diagram 2.2a: Pre scan 30 – 1000 MHz, Symbolic name: BT8<sub>100</sub>, EIRP Horizontal polarization

Date: 14.AUG.2020 15:18:48

Diagram 2.2b: Pre scan 30 – 1000 MHz, Symbolic name: BT8<sub>100</sub>, EIRP Vertical polarization

Date: 14.AUG.2020 15:13:29

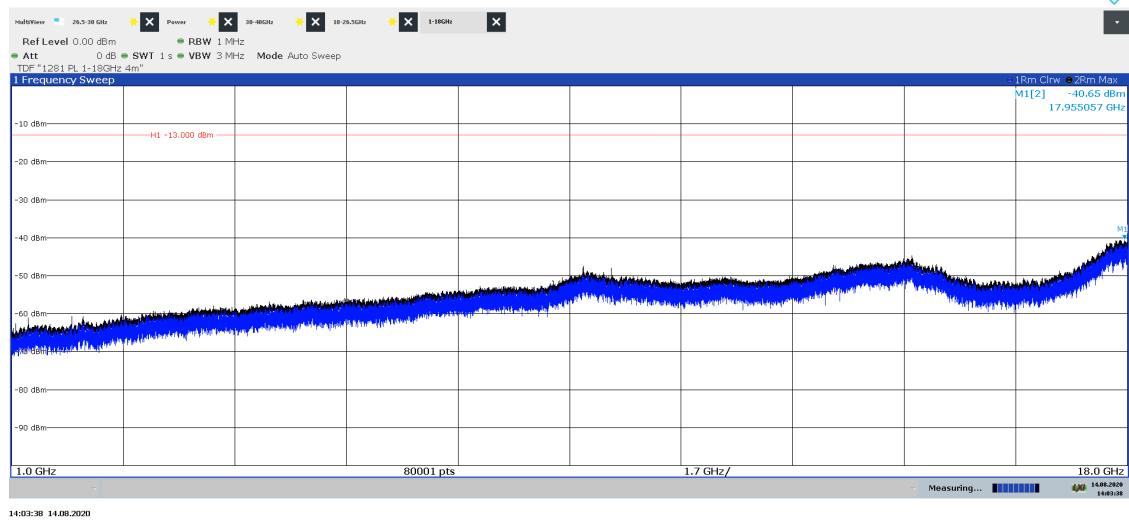
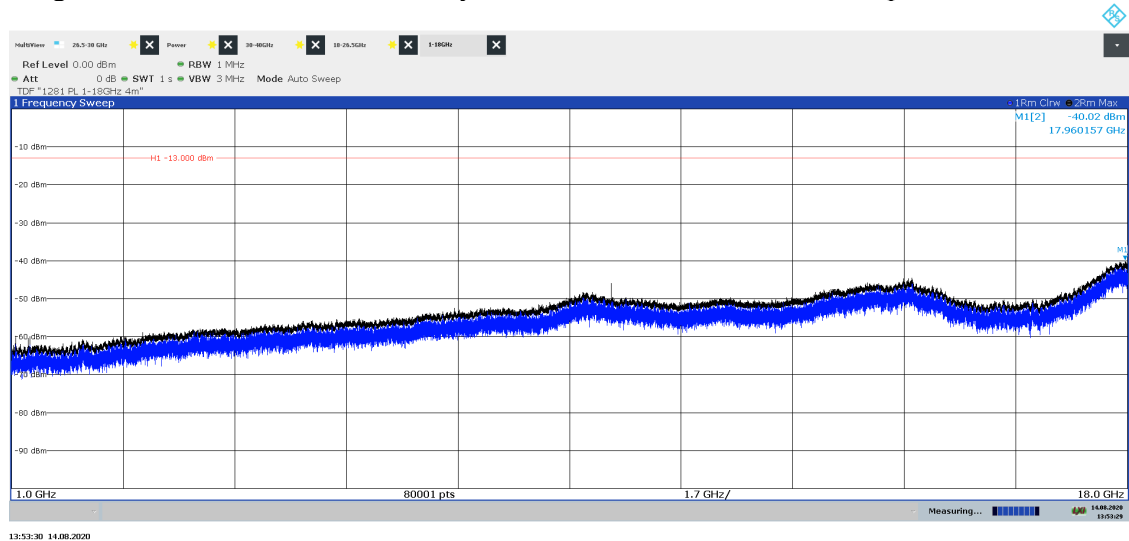
Diagram 2.3a: Pre scan 1 – 18 GHz, Symbolic name: TH<sub>50</sub>, EIRP Horizontal polarizationDiagram 2.3b: Pre scan 1 – 18 GHz, Symbolic name: TH<sub>50</sub>, EIRP Vertical polarization

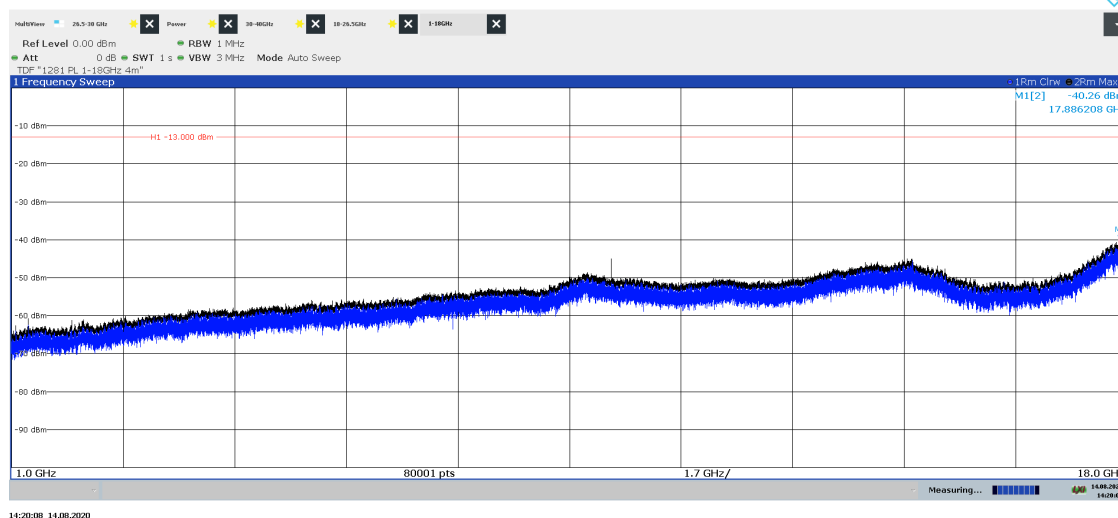
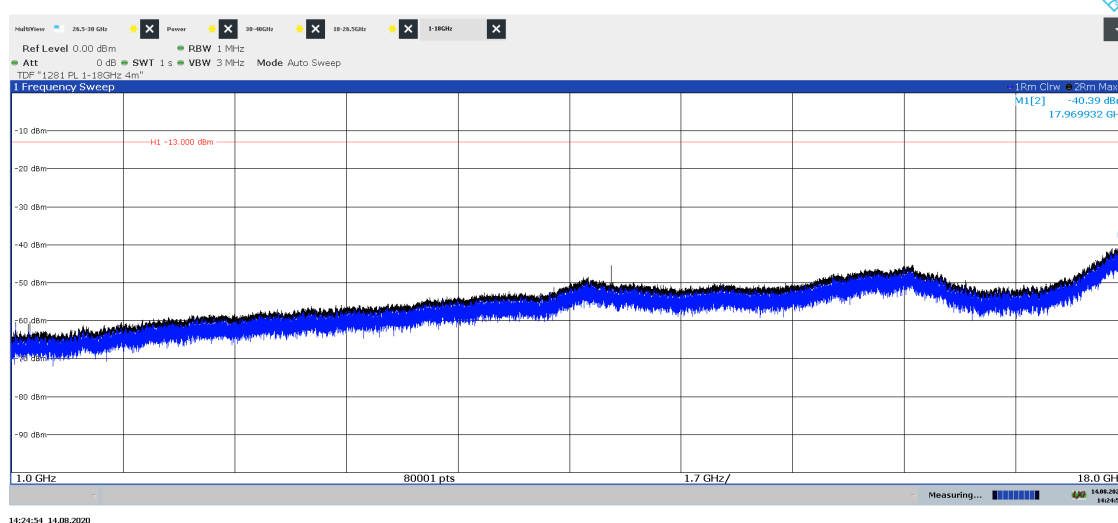
Diagram 2.4a: Pre scan 1 – 18 GHz, Symbolic name: BT8<sub>100</sub>, EIRP Horizontal polarizationDiagram 2.4b: Pre scan 1 – 18 GHz, Symbolic name: BT8<sub>100</sub>, EIRP Vertical polarization

Diagram 2.5a: Pre scan 18 – 26.5 GHz, Symbolic name: TH<sub>50</sub>, EIRP Horizontal polarization  
See diagram 2.5c for TRP result

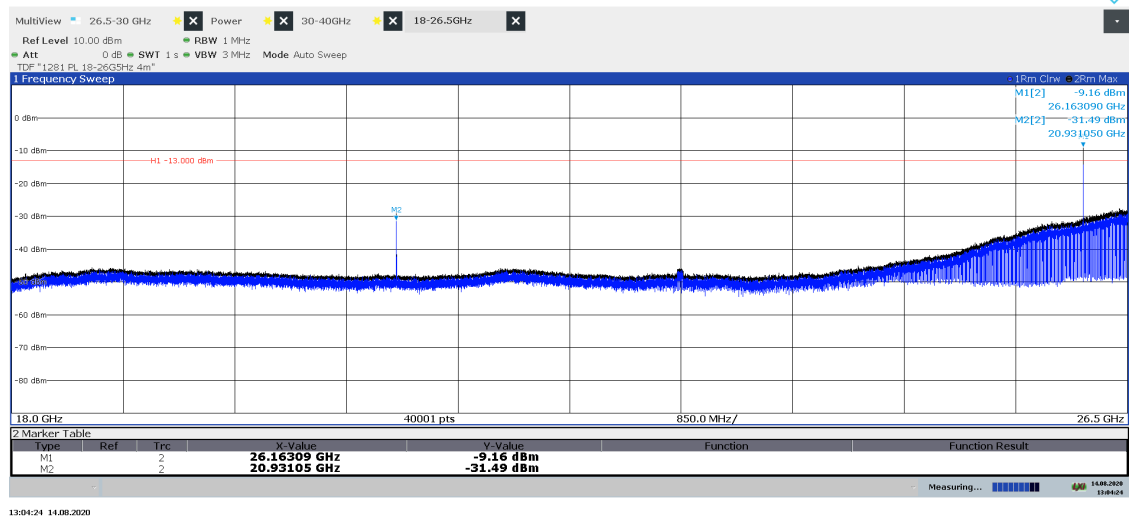


Diagram 2.5b: Pre scan 18 – 26.5 GHz, Symbolic name: TH<sub>50</sub>, EIRP Vertical polarization  
See diagram 2.5c for TRP result

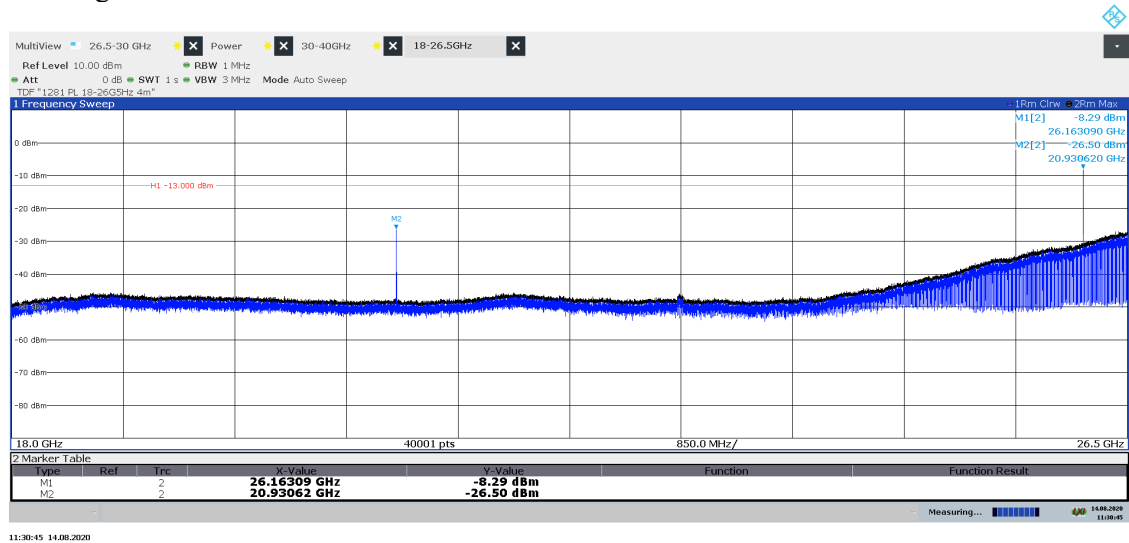


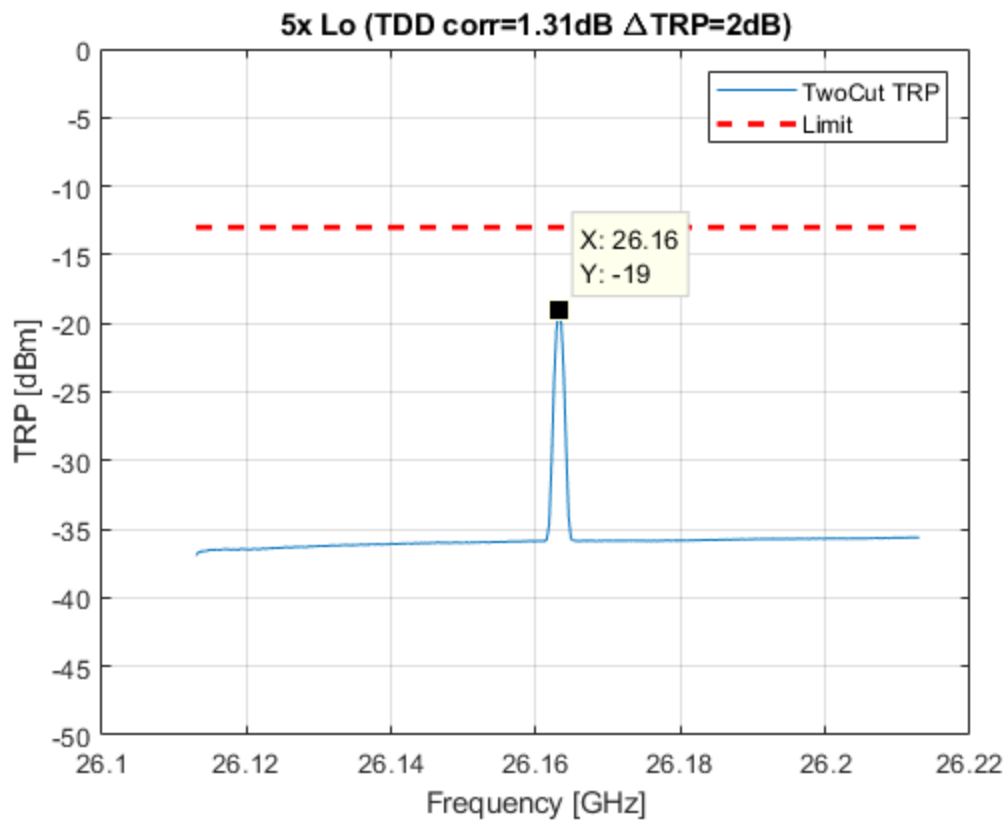
Diagram 2.5c: Two cut TRP 26.113 – 26.213 GHz 5x LO, Symbolic name: TH<sub>50</sub>

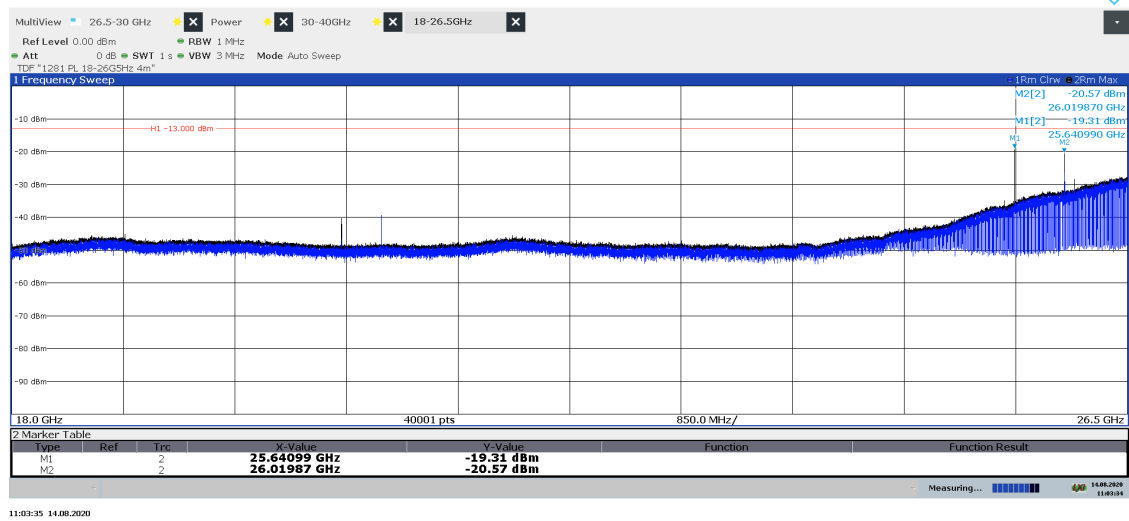
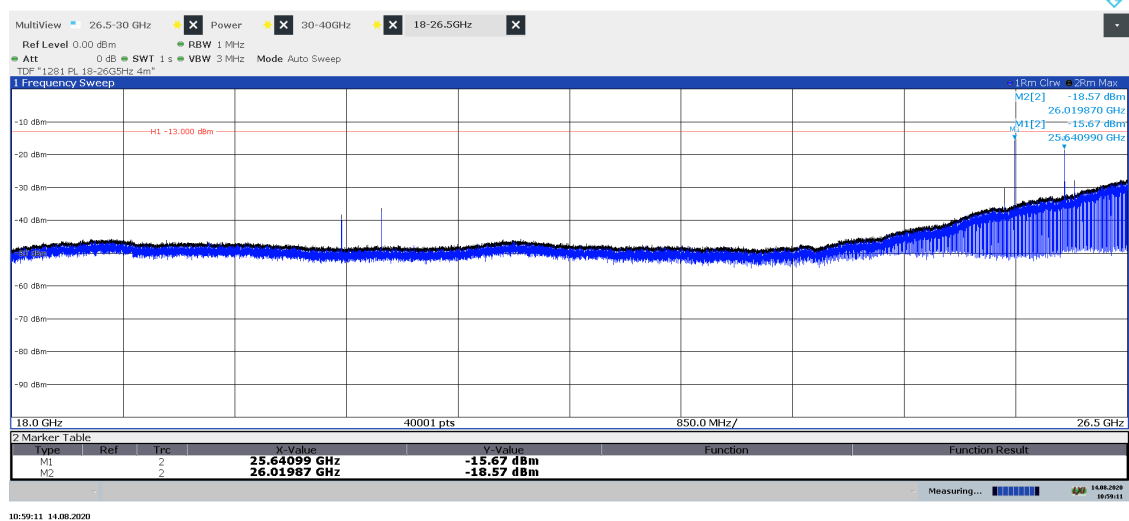
Diagram 2.6a: Pre scan 18 – 26.5 GHz, Symbolic name: BT8<sub>100</sub>, EIRP Horizontal polarizationDiagram 2.6b: Pre scan 18 – 26.5 GHz, Symbolic name: BT8<sub>100</sub>, EIRP Vertical polarization

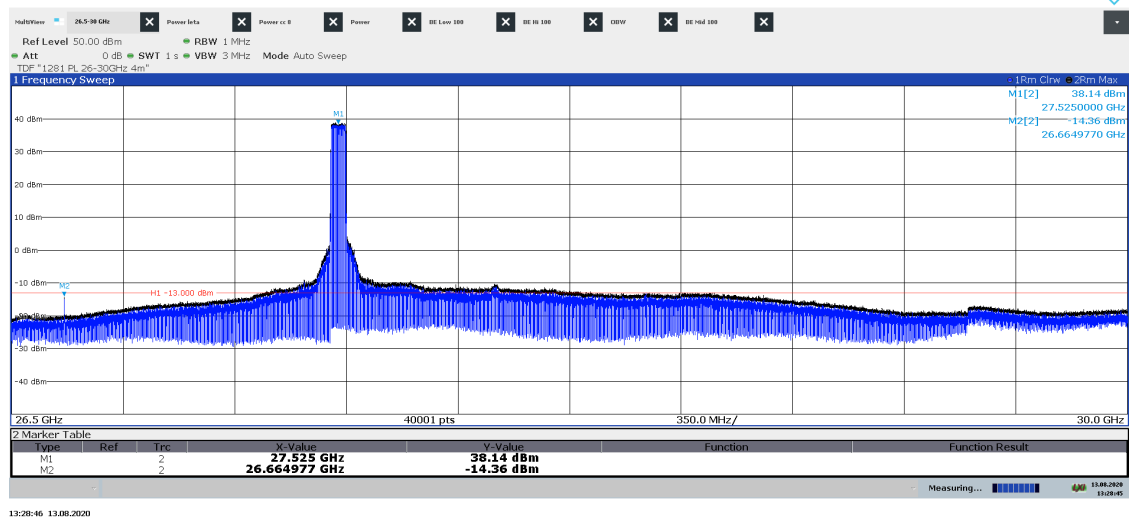
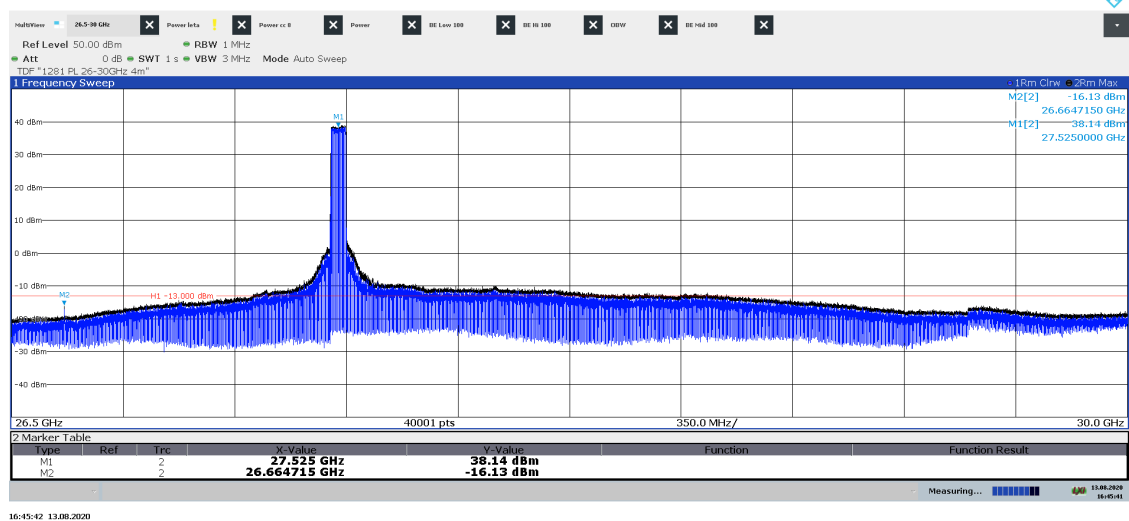
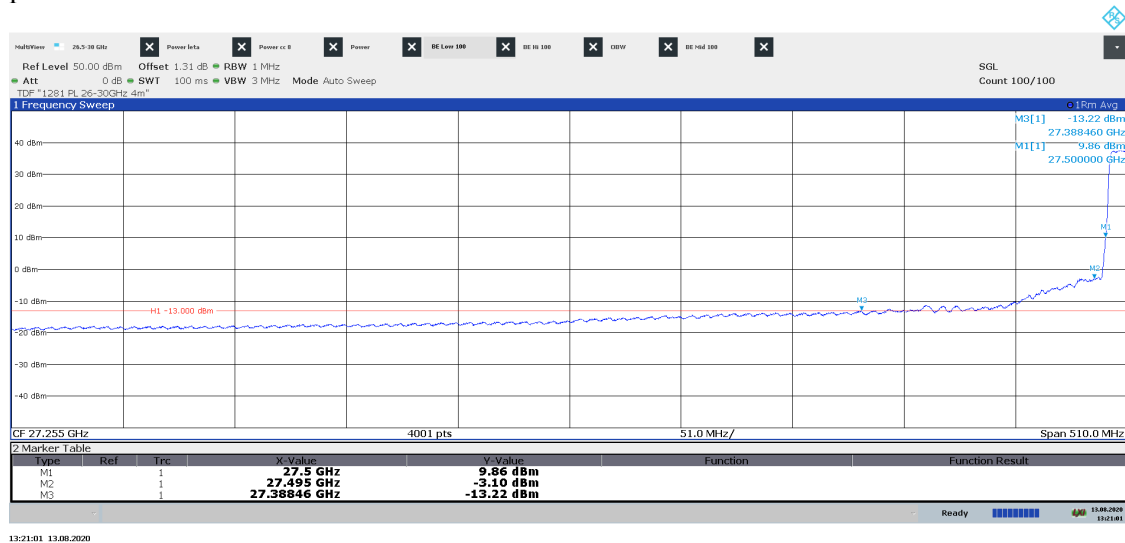
Diagram 2.7a: Pre scan 26.5 – 30.0 GHz, Symbolic name: BL<sub>50</sub>, EIRP Horizontal polarizationDiagram 2.7b: Pre scan 26.5 – 30.0 GHz, Symbolic name: BL<sub>50</sub>, EIRP Vertical polarization

Diagram 2.7c: Pre scan 27.00 – 27.51 GHz, Symbolic name: BL<sub>50</sub>, EIRP Horizontal polarizationDiagram 2.7d: Pre scan 27.00 – 27.51 GHz, Symbolic name: BL<sub>50</sub>, EIRP Vertical polarization

|                                                |                                                  |                                   |                                                                                 |                                                                                   |
|------------------------------------------------|--------------------------------------------------|-----------------------------------|---------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|
| Power EIRP for<br>27.5GHz<br>Hor/ Ver<br>[dBm] | Power EIRP for<br>27.49 GHz<br>Hor/ Ver<br>[dBm] | Antenna Gain<br>Hor/ Ver<br>[dBi] | Total conducted<br>power/BW for<br>27.5 GHz<br>(Limit -5 dBm)<br>[dBm]/ Verdict | Total conducted<br>power/BW for<br>27.49 GHz<br>(Limit -13 dBm)<br>[dBm]/ Verdict |
| 9.86/ 10.57                                    | -3.10/ -2.43                                     | 28.66/ 28.74                      | -15.46/ Pass                                                                    | -28.44/ Pass                                                                      |

Diagram 2.8a: Pre scan 26.5 – 30.0 GHz, Symbolic name: TH<sub>100</sub>, EIRP Horizontal polarization  
See diagram 2.8e for TRP result

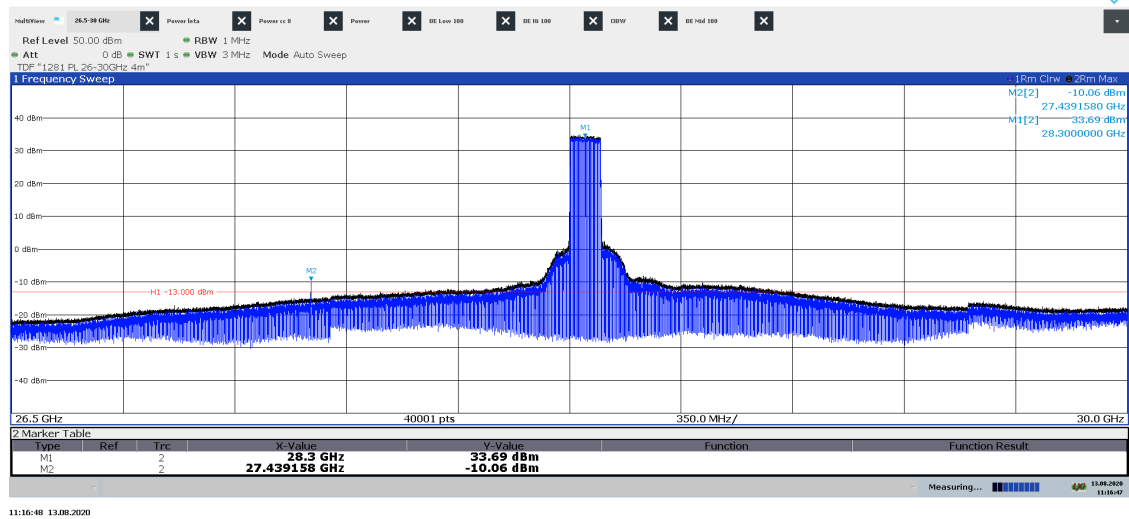


Diagram 2.8b: Pre scan 26.5 – 30.0 GHz, Symbolic name: TH<sub>100</sub>, EIRP Vertical polarization  
See diagram 2.8e for TRP result

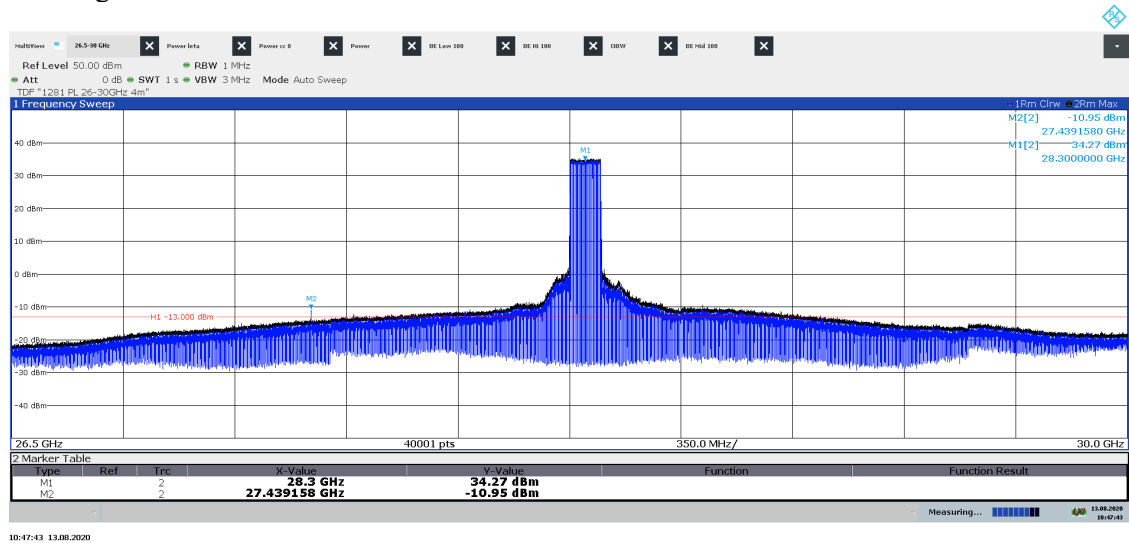


Diagram 2.8c: Pre scan 28.34 – 28.85GHz, Symbolic name: TH<sub>100</sub>, EIRP Horizontal polarization

See diagram 2.8e for TRP result

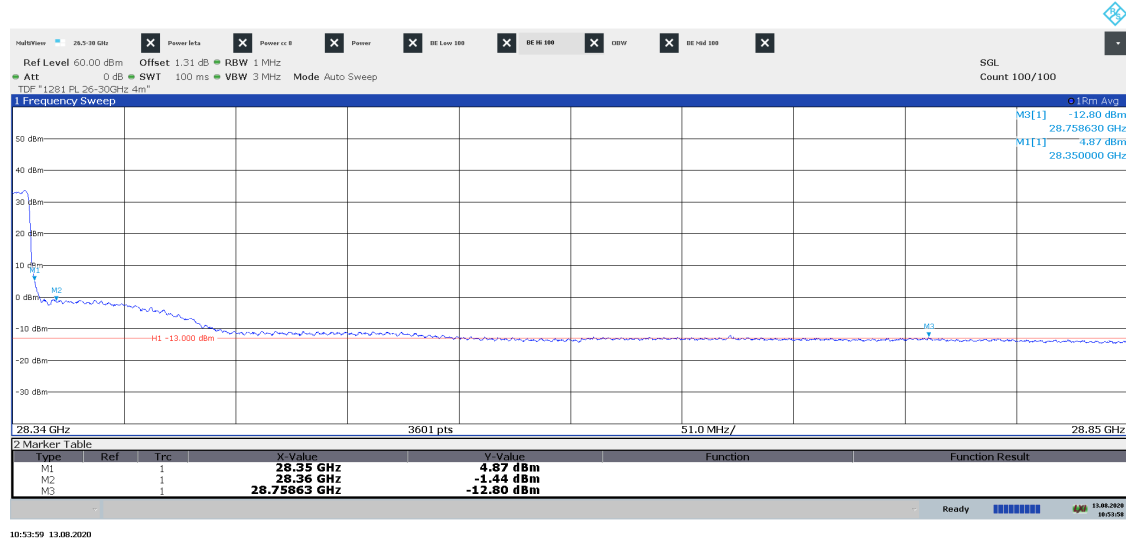
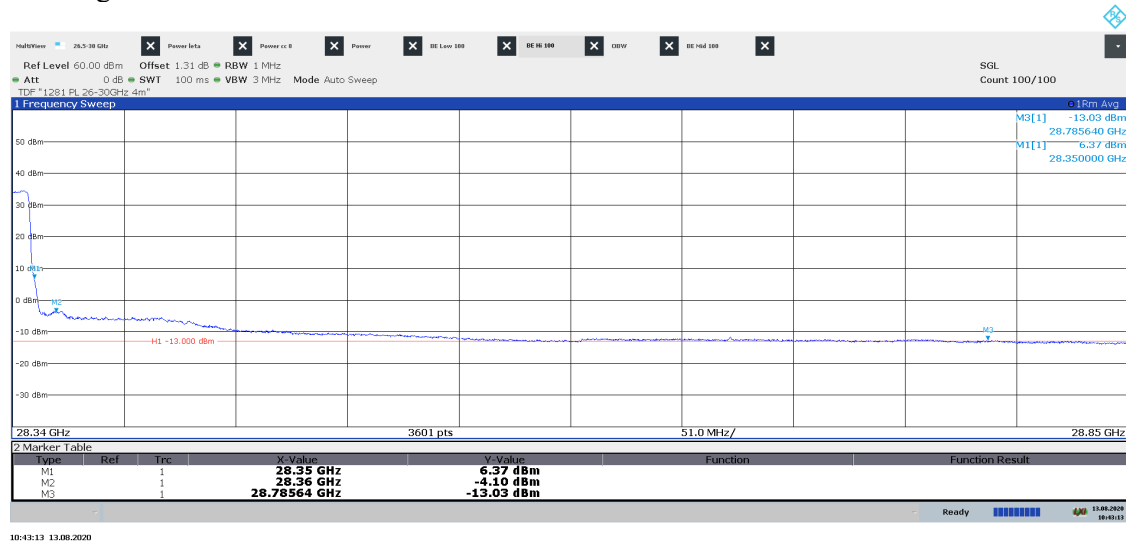


Diagram 2.8d: Pre scan 28.34 – 28.85 GHz, Symbolic name: TH<sub>100</sub>, EIRP Vertical polarization

See diagram 2.8e for TRP result



|                                                  |                                                  |                                   |                                                                                  |                                                                                   |
|--------------------------------------------------|--------------------------------------------------|-----------------------------------|----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|
| Power EIRP for<br>28.35 GHz<br>Hor/ Ver<br>[dBm] | Power EIRP for<br>28.36 GHz<br>Hor/ Ver<br>[dBm] | Antenna Gain<br>Hor/ Ver<br>[dBi] | Total conducted<br>power/BW for<br>28.35 GHz<br>(Limit -5 dBm)<br>[dBm]/ Verdict | Total conducted<br>power/BW for<br>28.36 GHz<br>(Limit -13 dBm)<br>[dBm]/ Verdict |
| 4.87/ 6.37                                       | -1.44/ -4.10                                     | 28.9/ 28.92                       | -20.22/ Pass                                                                     | -28.47/ Pass                                                                      |

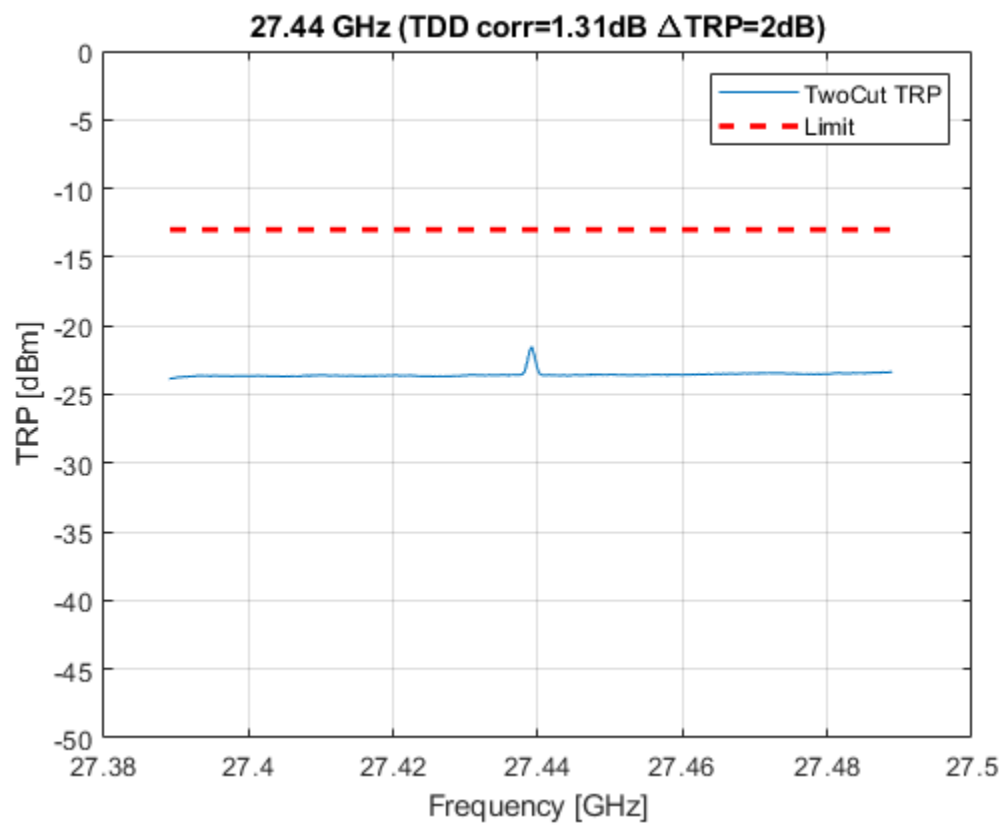
Diagram 2.8c: Two cut TRP 27.39 – 27.49 GHz, Symbolic name: TH<sub>100</sub>

Diagram 2.9a: Pre scan 26.5 – 30.0 GHz, Symbolic name: Bim3<sub>50</sub>, EIRP Horizontal polarization  
See diagram 2.9e for TRP result

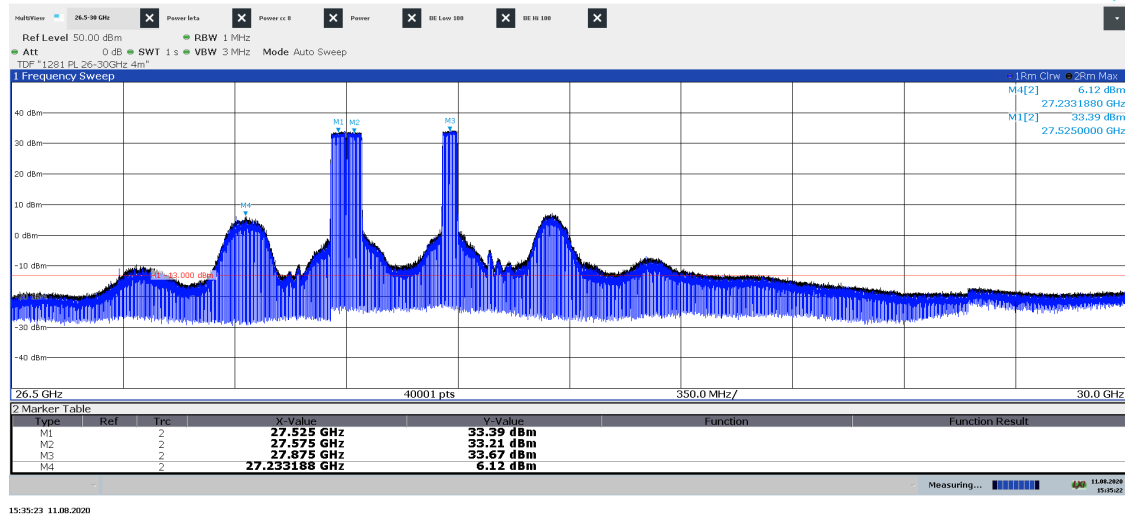


Diagram 2.9b: Pre scan 26.5 – 30.0 GHz, Symbolic name: Bim3<sub>50</sub>, EIRP Vertical polarization  
See diagram 2.9e for TRP result

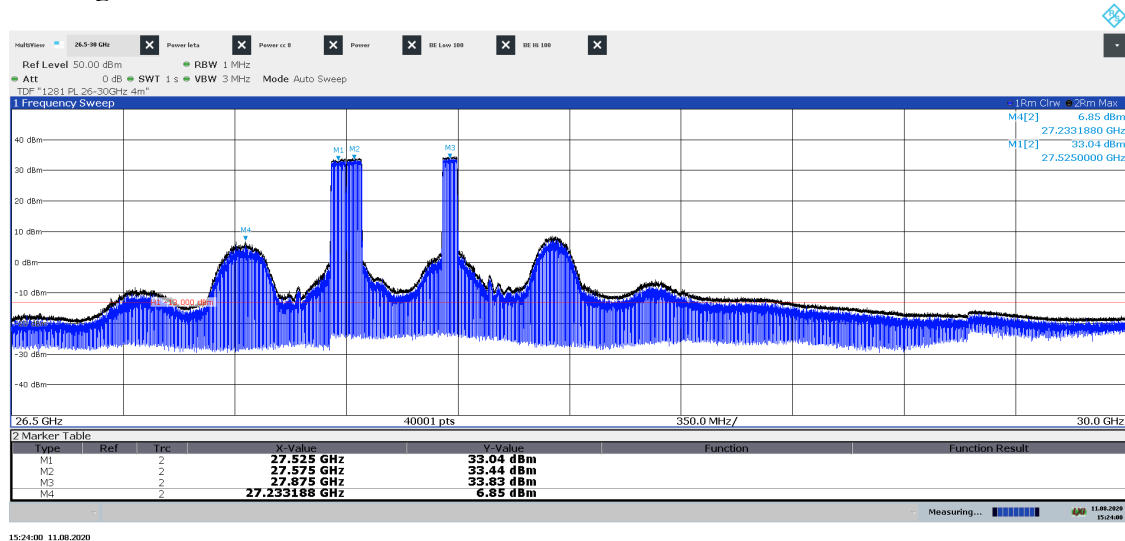


Diagram 2.9c: Pre scan 27.00 – 27.51 GHz, Symbolic name: Bim3<sub>50</sub>, EIRP Horizontal polarization  
See diagram 2.9e for TRP result

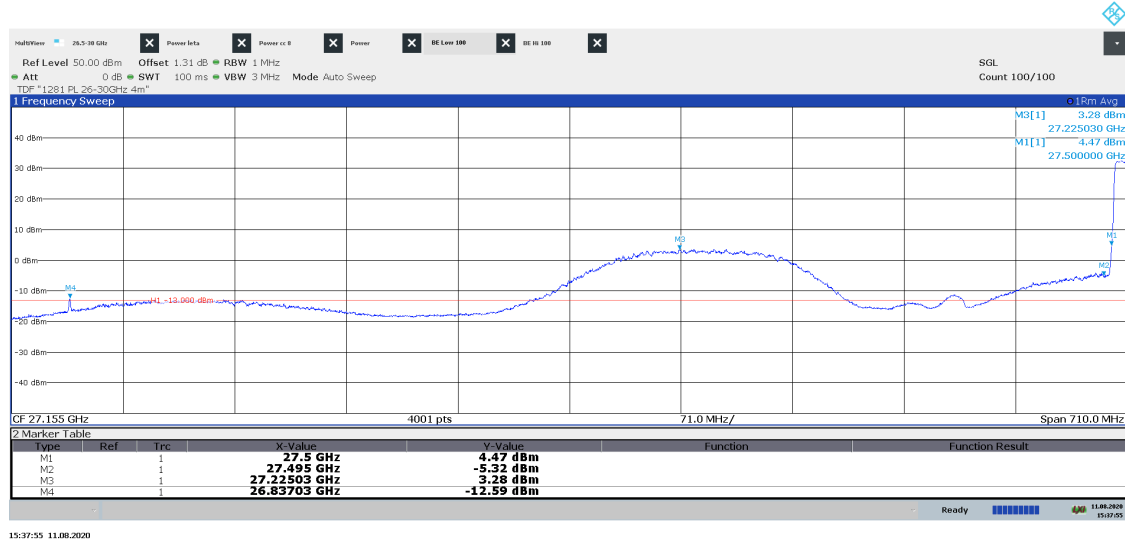
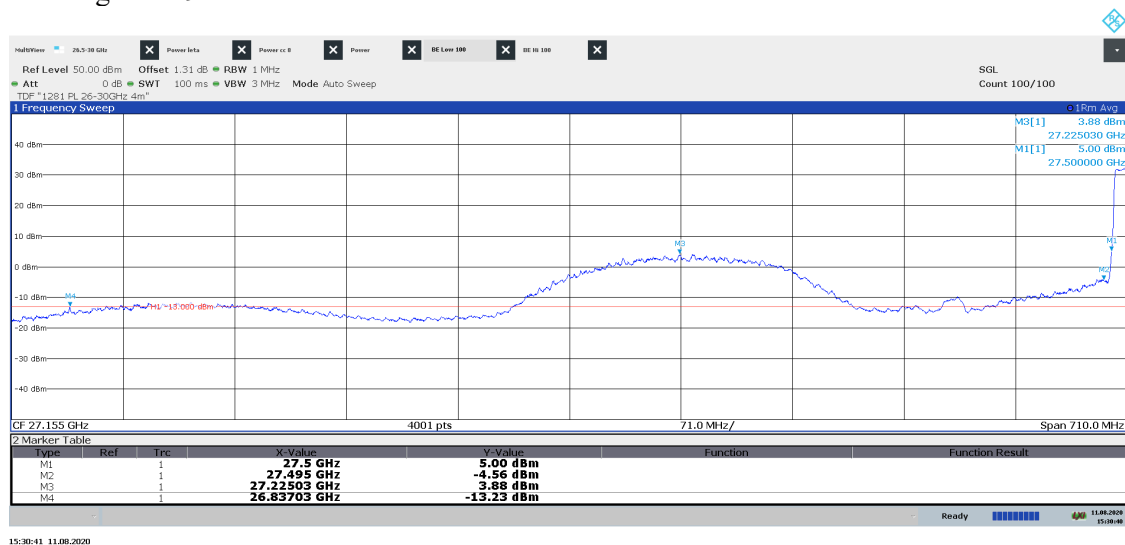


Diagram 2.9d: Pre scan 27.00 – 27.51 GHz, Symbolic name: Bim3<sub>50</sub>, EIRP Vertical polarization  
See diagram 2.9e for TRP result



| Power EIRP for<br>27.5GHz<br>Hor/ Ver<br>[dBm] | Power EIRP for<br>27.49 GHz<br>Hor/ Ver<br>[dBm] | Antenna Gain<br>Hor/ Ver<br>[dBi] | Total conducted<br>power/BW for<br>27.5 GHz<br>(Limit -5 dBm)<br>[dBm]/ Verdict | Total conducted<br>power/BW for<br>27.49 GHz<br>(Limit -13 dBm)<br>[dBm]/ Verdict |
|------------------------------------------------|--------------------------------------------------|-----------------------------------|---------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|
| 4.47/ 5.00                                     | -5.32/ -4.56                                     | 28.66/ 28.74                      | -20.95/ Pass                                                                    | -30.62/ Pass                                                                      |

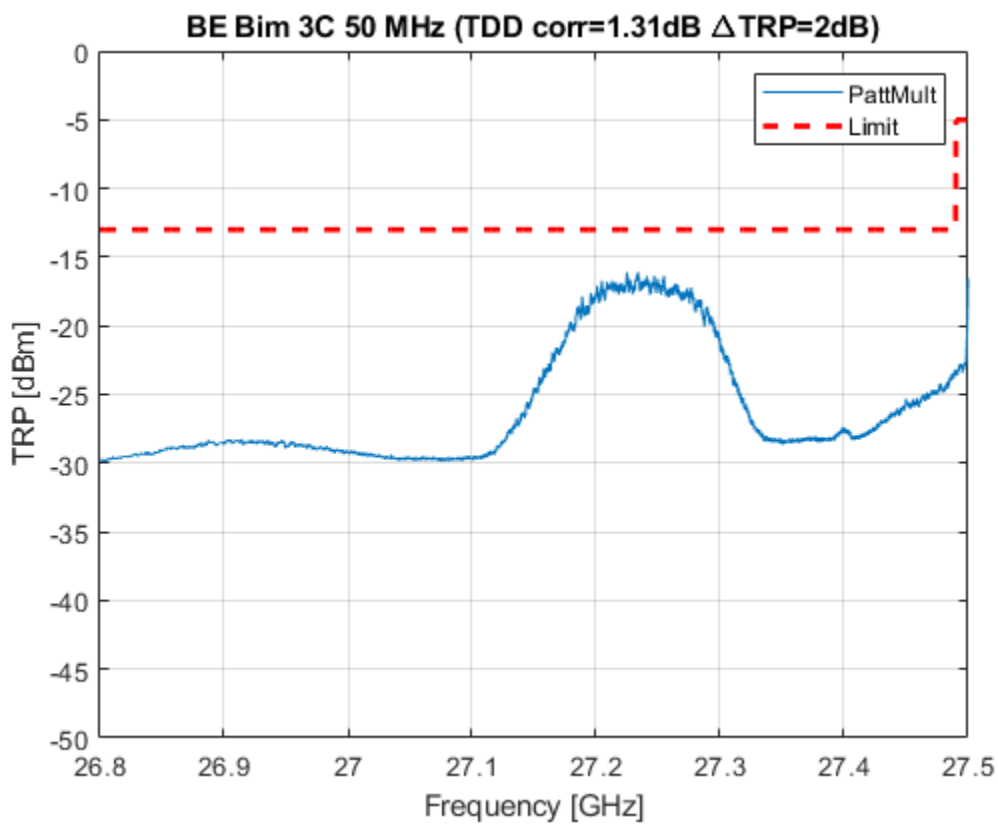
Diagram 2.9e: Pattern multiplication TRP 26.8 – 27.5 GHz, Symbolic name: Bim3<sub>50</sub>

Diagram 2.10a: Pre scan 27.625 – 28.225 GHz, Symbolic name: TL<sub>50</sub>, EIRP Horizontal polarization

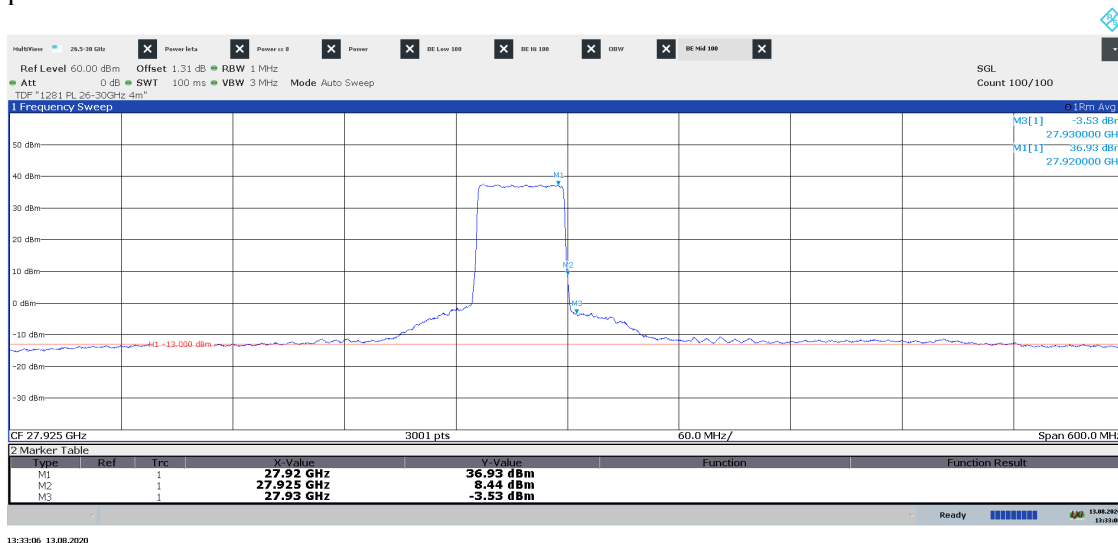
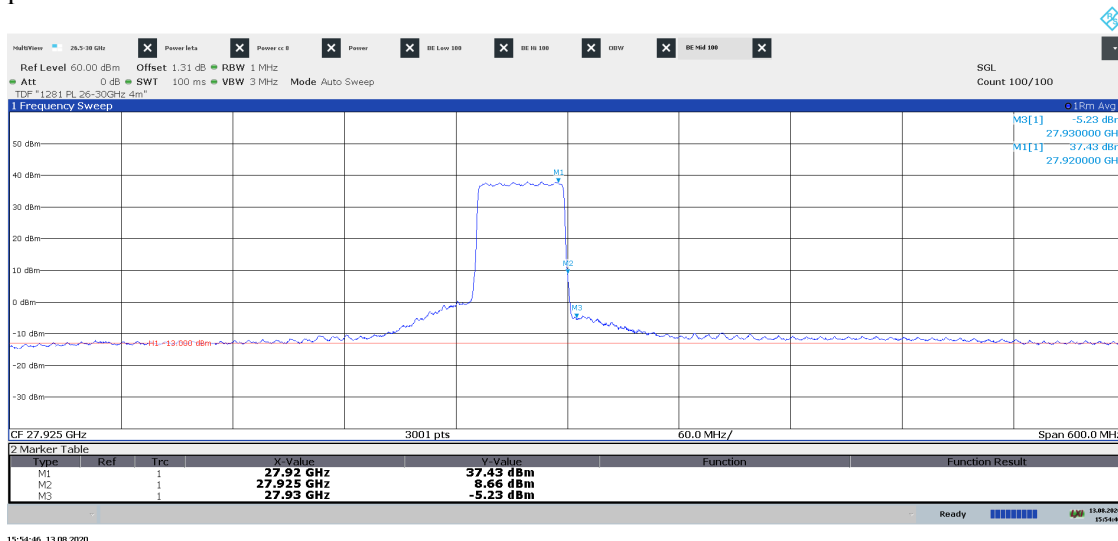


Diagram 2.10b: Pre scan 27.625 – 28.225 GHz, Symbolic name: TL<sub>50</sub>, EIRP Vertical polarization



|                                                   |                                                   |                                   |                                                                                   |                                                                                    |
|---------------------------------------------------|---------------------------------------------------|-----------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
| Power EIRP for<br>27.925 GHz<br>Hor/ Ver<br>[dBm] | Power EIRP for<br>27.935 GHz<br>Hor/ Ver<br>[dBm] | Antenna Gain<br>Hor/ Ver<br>[dBi] | Total conducted<br>power/BW for<br>27.925 GHz<br>(Limit -5 dBm)<br>[dBm]/ Verdict | Total conducted<br>power/BW for<br>27.935 GHz<br>(Limit -13 dBm)<br>[dBm]/ Verdict |
| 8.44/ 8.66                                        | -3.53/ -5.23                                      | 28.8/ 28.83                       | -17.25/ Pass                                                                      | -30.10/ Pass                                                                       |

Diagram 2.11a: Pre scan 27.625 – 28.225 GHz, Symbolic name: BH<sub>50</sub>, EIRP Horizontal polarization

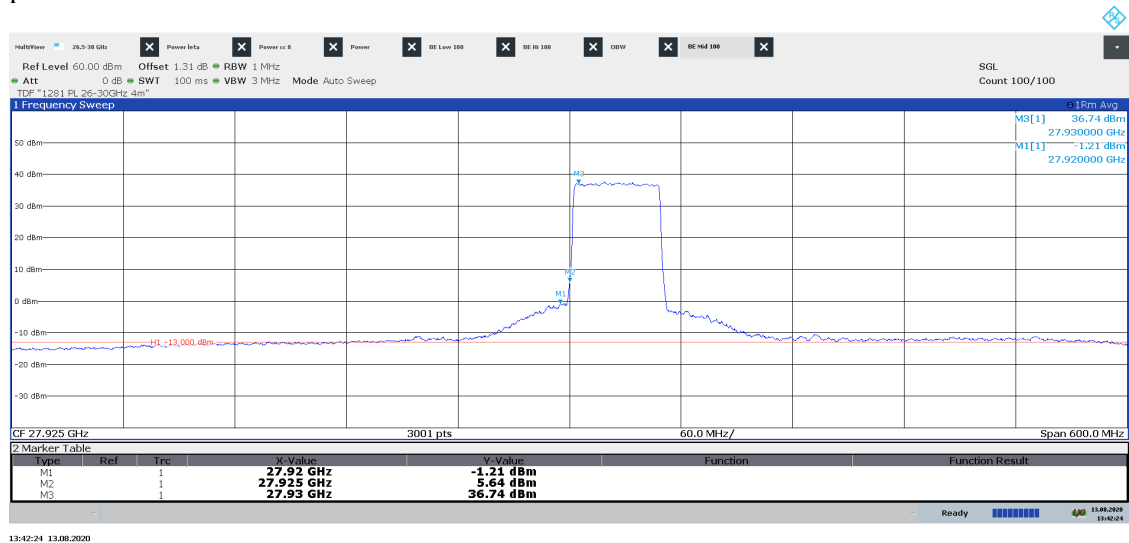
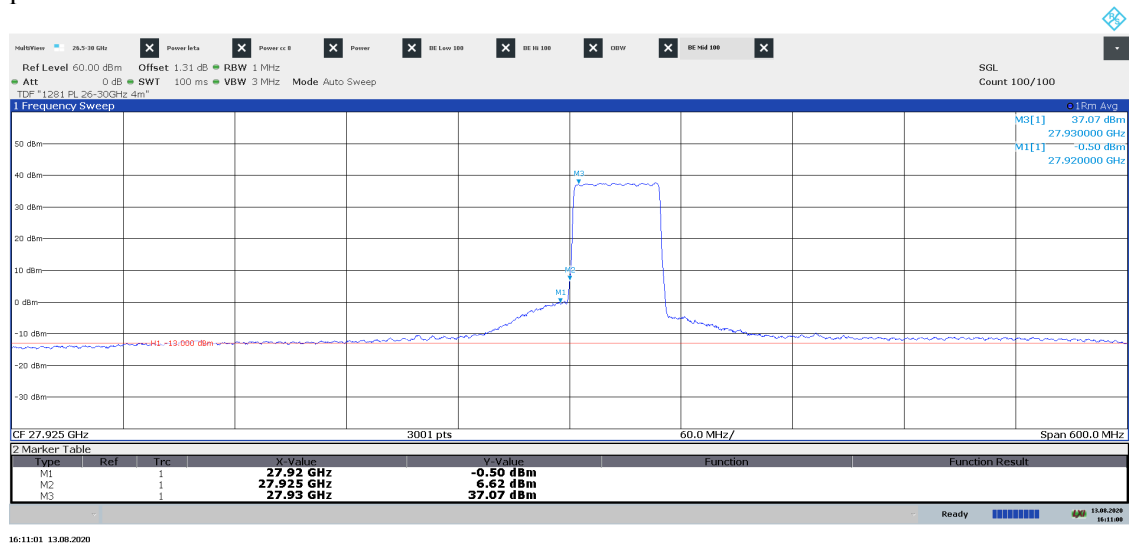


Diagram 2.11b: Pre scan 27.625 – 28.225 GHz, Symbolic name: BH<sub>50</sub>, EIRP Vertical polarization



|                                                   |                                                   |                                   |                                                                                   |                                                                                    |
|---------------------------------------------------|---------------------------------------------------|-----------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
| Power EIRP for<br>27.925 GHz<br>Hor/ Ver<br>[dBm] | Power EIRP for<br>27.915 GHz<br>Hor/ Ver<br>[dBm] | Antenna Gain<br>Hor/ Ver<br>[dBi] | Total conducted<br>power/BW for<br>27.925 GHz<br>(Limit -5 dBm)<br>[dBm]/ Verdict | Total conducted<br>power/BW for<br>27.915 GHz<br>(Limit -13 dBm)<br>[dBm]/ Verdict |
| 5.64/ 6.62                                        | -1.21/ -0.50                                      | 28.8/ 28.83                       | -19.65/ Pass                                                                      | -26.65/ Pass                                                                       |

Diagram 2.12a: Pre scan 26.5 – 30.0 GHz, Symbolic name: TH<sub>50</sub>, EIRP Horizontal polarization

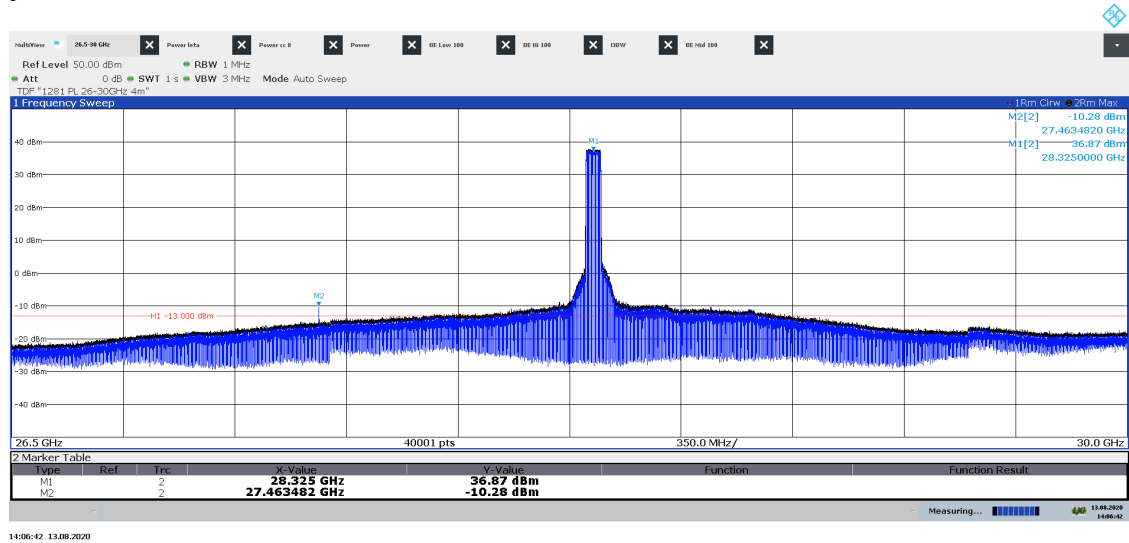


Diagram 2.12b: Pre scan 26.5 – 30.0 GHz, Symbolic name: TH<sub>50</sub>, EIRP Vertical polarization

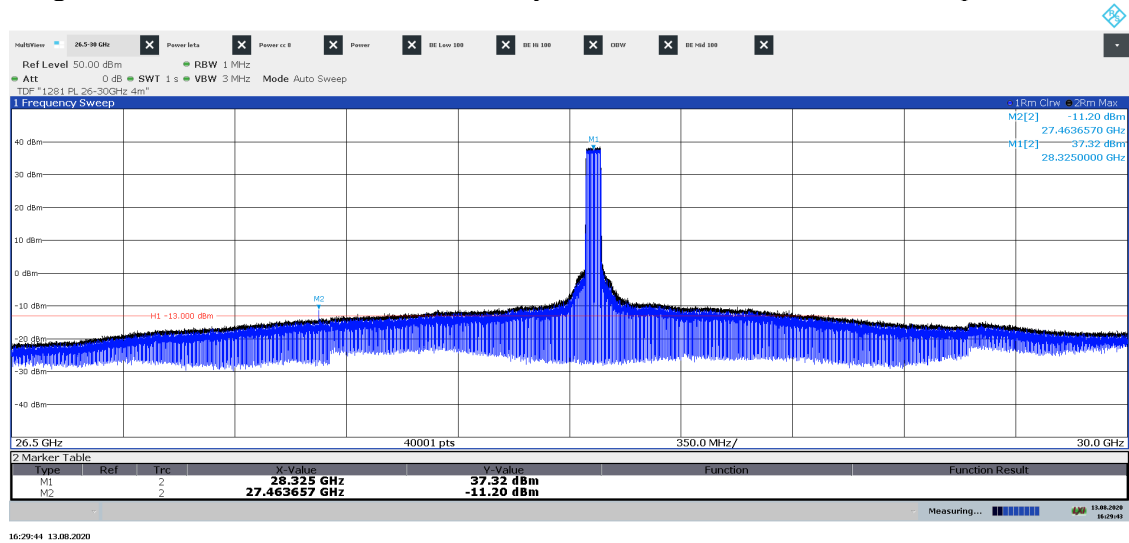


Diagram 2.12c: Pre scan 28.34 – 28.85 GHz, Symbolic name: TH<sub>50</sub>, EIRP Horizontal polarization



Diagram 2.12d: Pre scan 28.34 – 28.85 GHz, Symbolic name: TH<sub>50</sub>, EIRP Vertical polarization



|                                                  |                                                   |                                   |                                                                                  |                                                                                    |
|--------------------------------------------------|---------------------------------------------------|-----------------------------------|----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
| Power EIRP for<br>28.35 GHz<br>Hor/ Ver<br>[dBm] | Power EIRP for<br>28.355 GHz<br>Hor/ Ver<br>[dBm] | Antenna Gain<br>Hor/ Ver<br>[dBi] | Total conducted<br>power/BW for<br>28.35 GHz<br>(Limit -5 dBm)<br>[dBm]/ Verdict | Total conducted<br>power/BW for<br>28.355 GHz<br>(Limit -13 dBm)<br>[dBm]/ Verdict |
| 8.07/ 8.78                                       | 0.20/ -1.95                                       | 28.9/ 28.92                       | -17.46/ Pass                                                                     | -26.64/ Pass                                                                       |

Diagram 2.13a: Pre scan 26.5 – 30 GHz, Symbolic name: Tim3<sub>50</sub>, EIRP Horizontal polarization  
See diagram 2.13e for TRP result

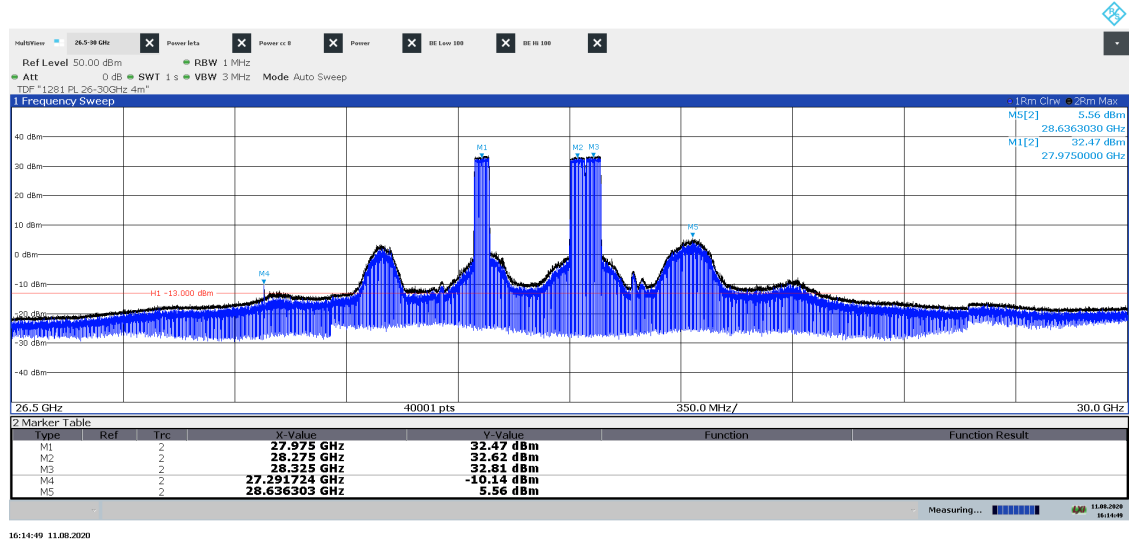


Diagram 2.13b: Pre scan 26.5 – 30 GHz, Symbolic name: Tim3<sub>50</sub>, EIRP Vertical polarization  
See diagram 2.13e for TRP result

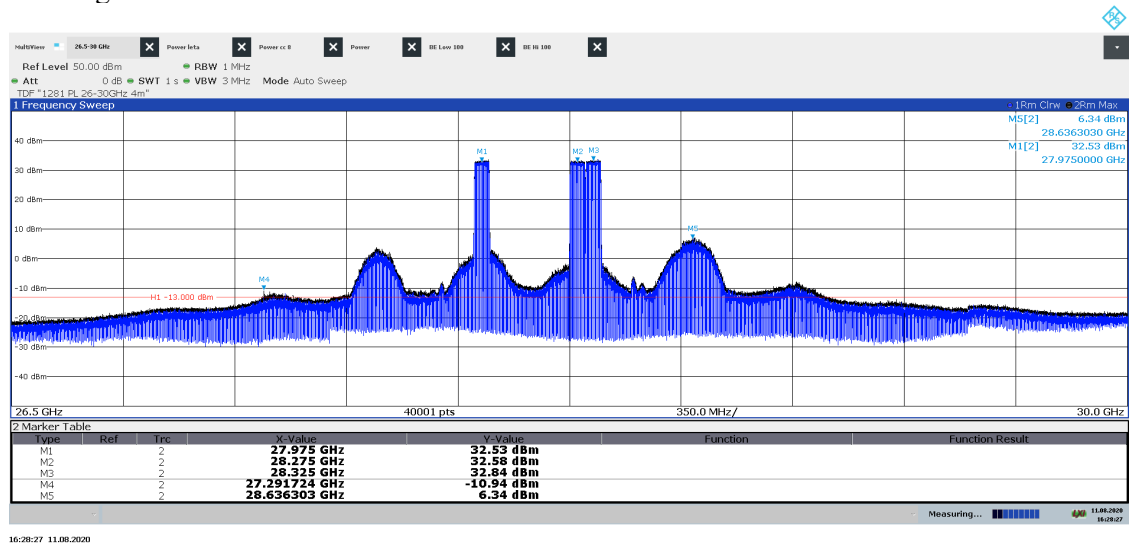


Diagram 2.13c: Pre scan 28.34 – 28.85 GHz, Symbolic name: Tim3<sub>50</sub>, EIRP Horizontal polarization

See diagram 2.13e for TRP result

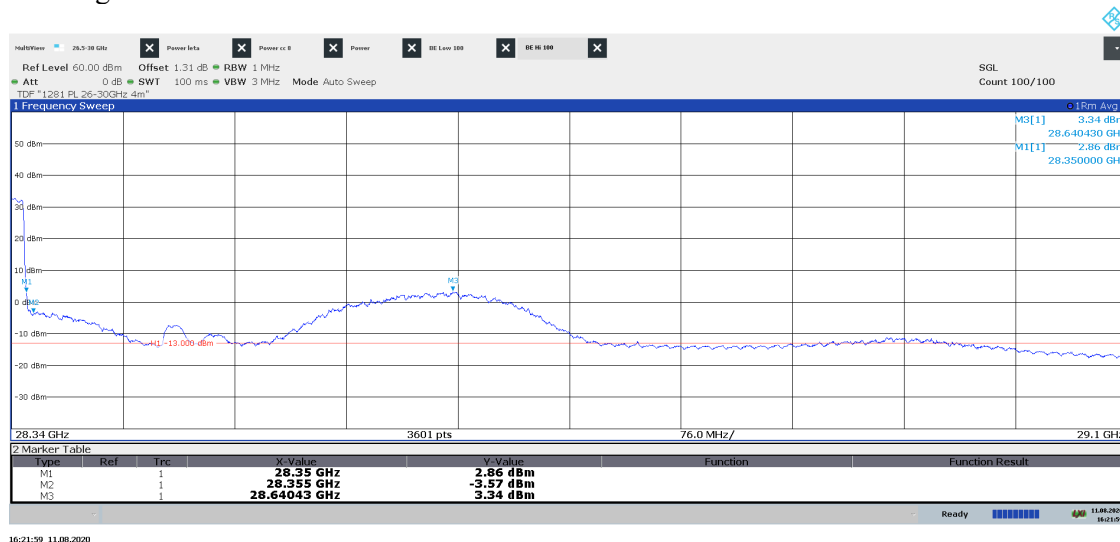
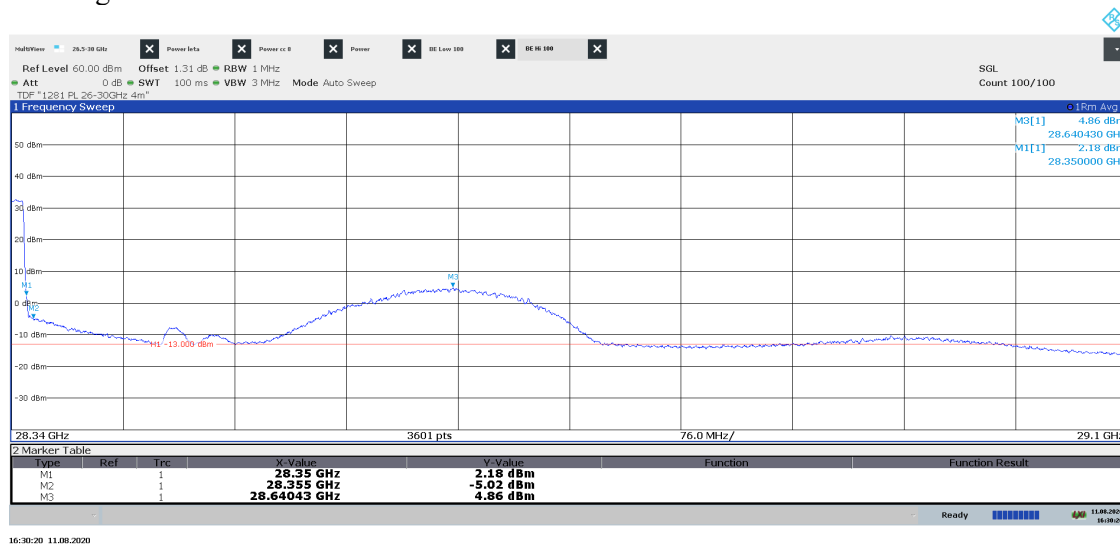


Diagram 2.13d: Pre scan 28.34 – 28.85 GHz, Symbolic name: Tim3<sub>50</sub>, EIRP Vertical polarization

See diagram 2.13e for TRP result



| Power EIRP for<br>28.35 GHz<br>Hor/ Ver<br>[dBm] | Power EIRP for<br>28.355 GHz<br>Hor/ Ver<br>[dBm] | Antenna Gain<br>Hor/ Ver<br>[dBi] | Total conducted<br>power/BW for<br>28.35 GHz<br>(Limit -5 dBm)<br>[dBm]/ Verdict | Total conducted<br>power/BW for<br>28.355 GHz<br>(Limit -13 dBm)<br>[dBm]/ Verdict |
|--------------------------------------------------|---------------------------------------------------|-----------------------------------|----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
| 2.86/ 2.18                                       | -3.57/ -5.02                                      | 28.9/ 28.92                       | -23.37/ Pass                                                                     | -30.13/ Pass                                                                       |

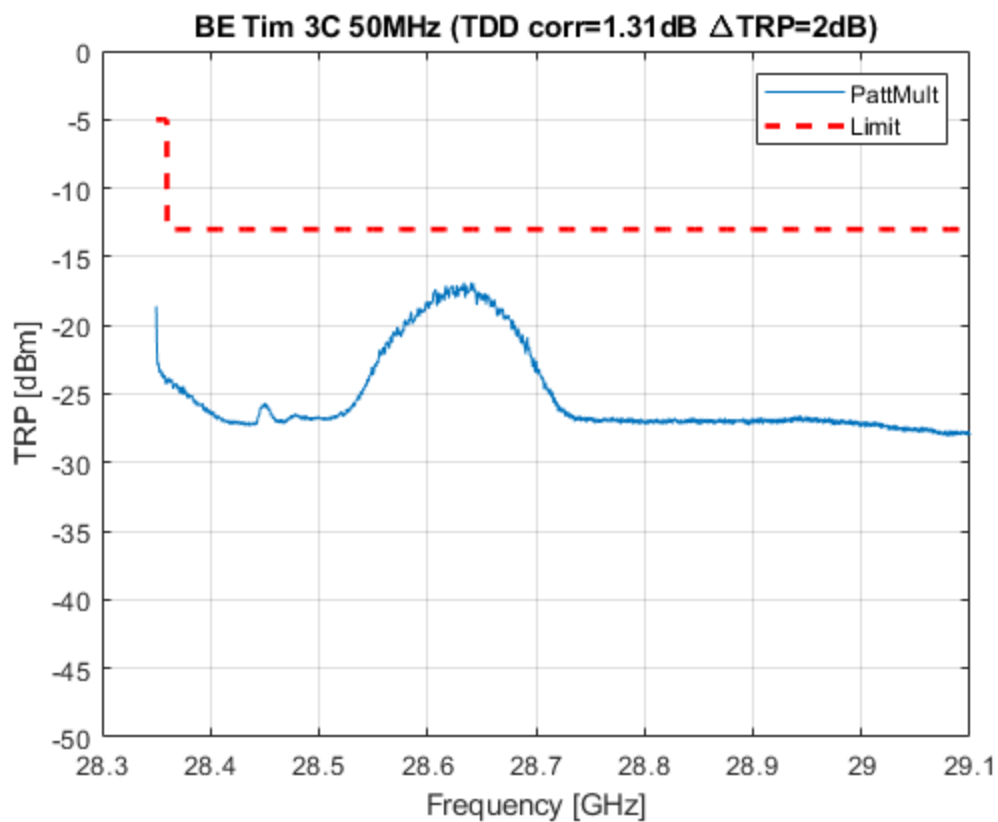
Diagram 2.13e: Pattern multiplication TRP 28.35 – 28.85 GHz, Symbolic name: Tim3<sub>50</sub>

Diagram 2.14a: Pre scan 26.5 – 30 GHz, Symbolic name: BT8<sub>100</sub>, EIRP Horizontal polarization

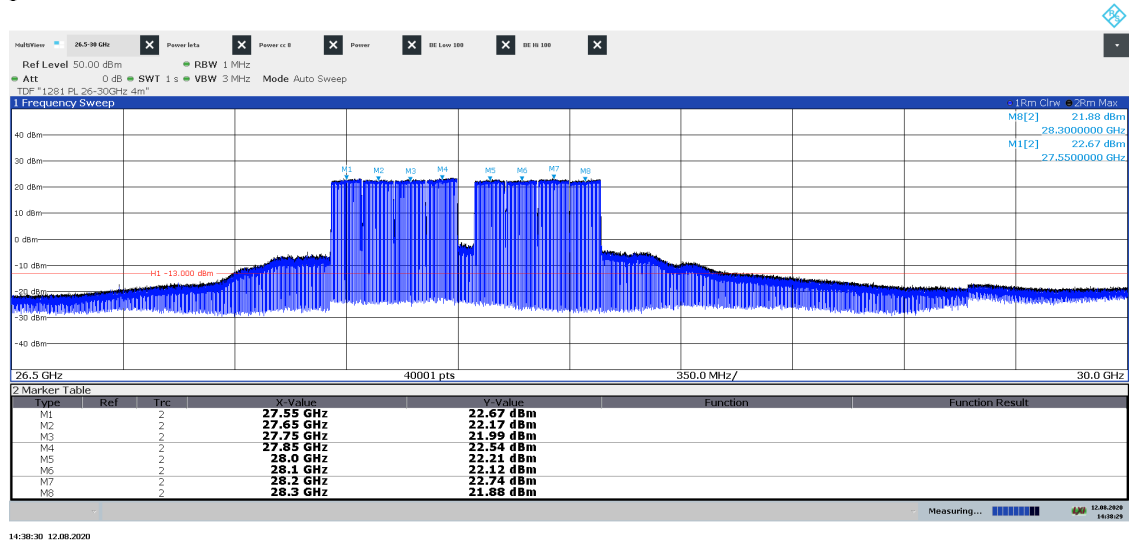


Diagram 2.14b: Pre scan 26.5 – 30 GHz, Symbolic name: BT8<sub>100</sub>, EIRP Vertical polarization

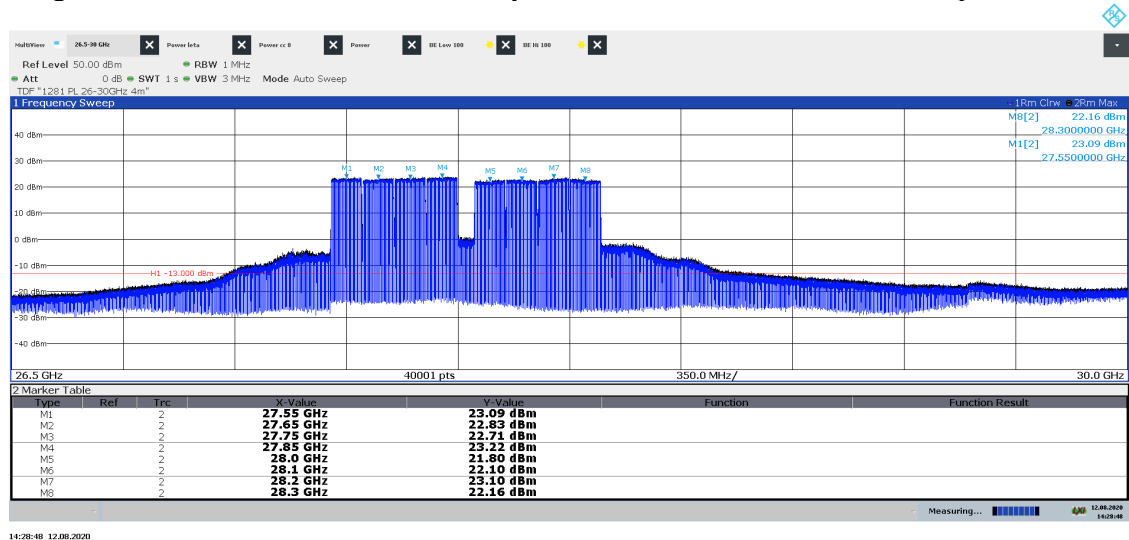
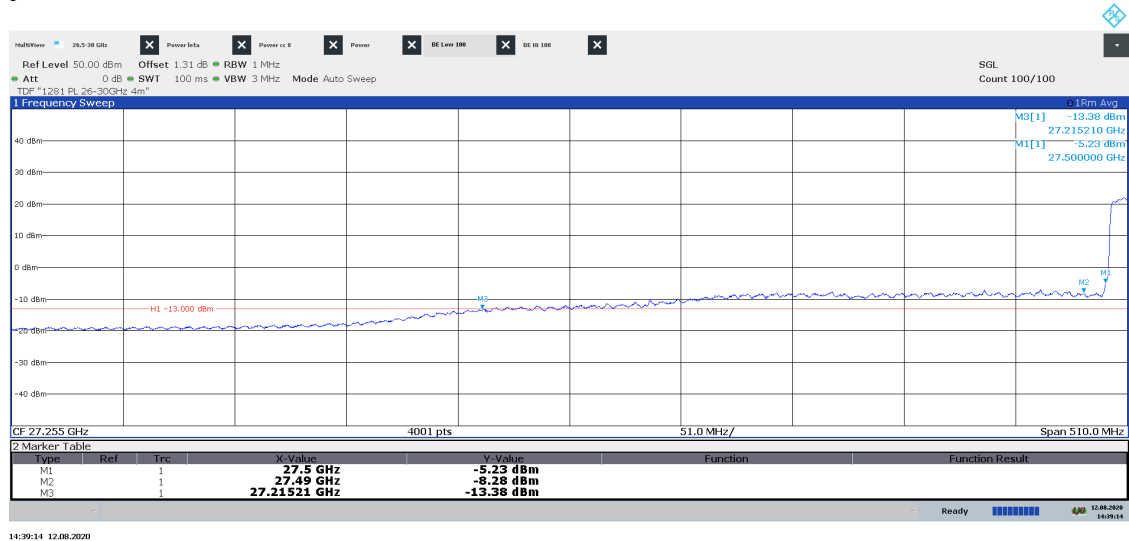
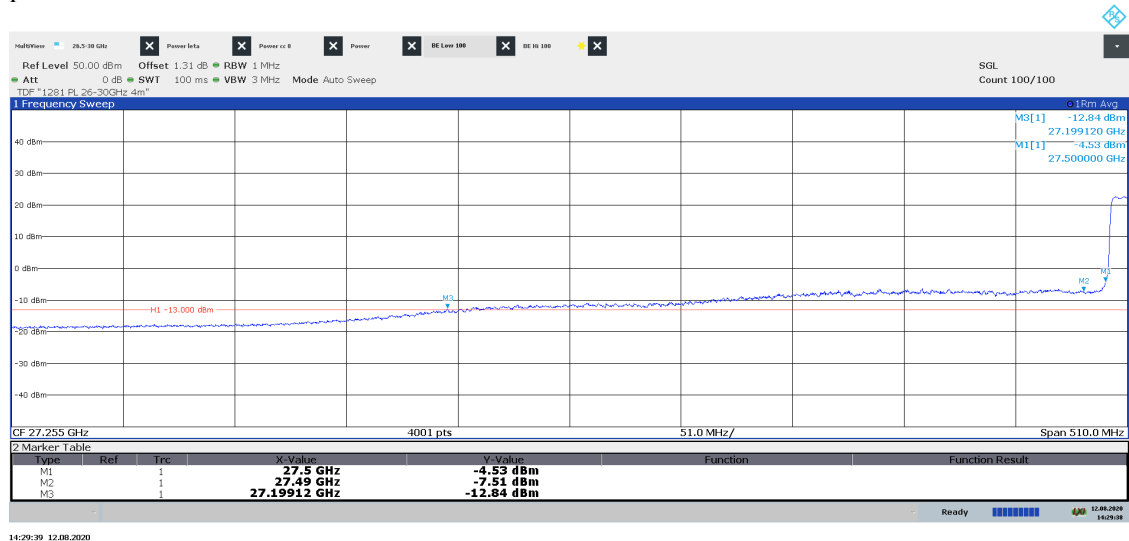


Diagram 2.14c: Pre scan 27.00 – 27.51 GHz, Symbolic name: BT8<sub>100</sub>, EIRP Horizontal polarizationDiagram 2.14d: Pre scan 27.00 – 27.51 GHz, Symbolic name: BT8<sub>100</sub>, EIRP Vertical polarization

|                                                |                                                  |                                   |                                                                                 |                                                                                   |
|------------------------------------------------|--------------------------------------------------|-----------------------------------|---------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|
| Power EIRP for<br>27.5GHz<br>Hor/ Ver<br>[dBm] | Power EIRP for<br>27.49 GHz<br>Hor/ Ver<br>[dBm] | Antenna Gain<br>Hor/ Ver<br>[dBi] | Total conducted<br>power/BW for<br>27.5 GHz<br>(Limit -5 dBm)<br>[dBm]/ Verdict | Total conducted<br>power/BW for<br>27.49 GHz<br>(Limit -13 dBm)<br>[dBm]/ Verdict |
| -5.23/ -4.53                                   | -8.28/ -7.51                                     | 25.79/ 25.83                      | -27.67/ Pass                                                                    | -30.68/ Pass                                                                      |

Diagram 2.14e: Pre scan 28.34 – 28.85 GHz, Symbolic name: BT8<sub>100</sub>, EIRP Horizontal polarization

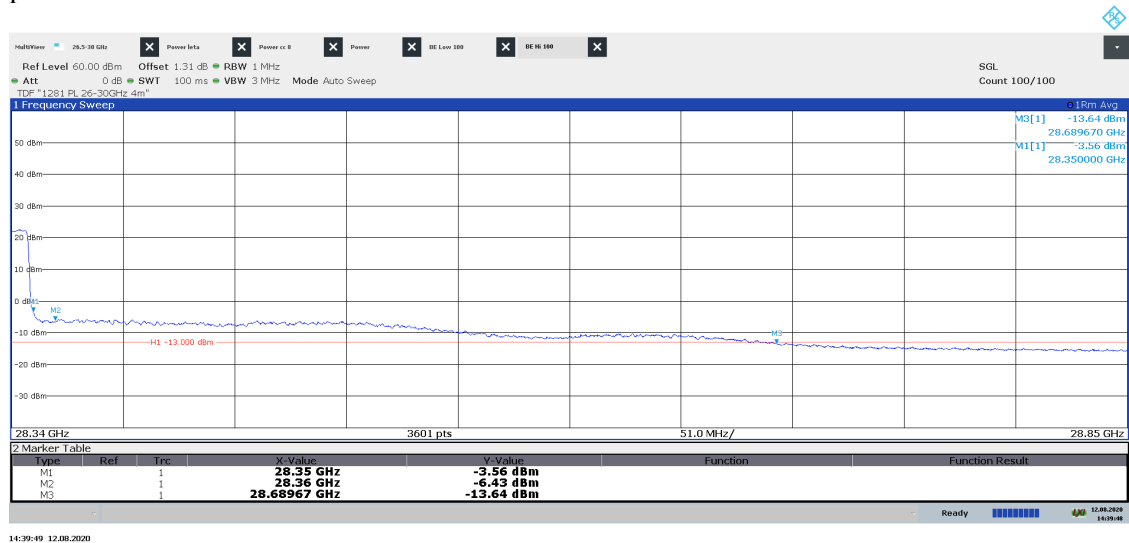
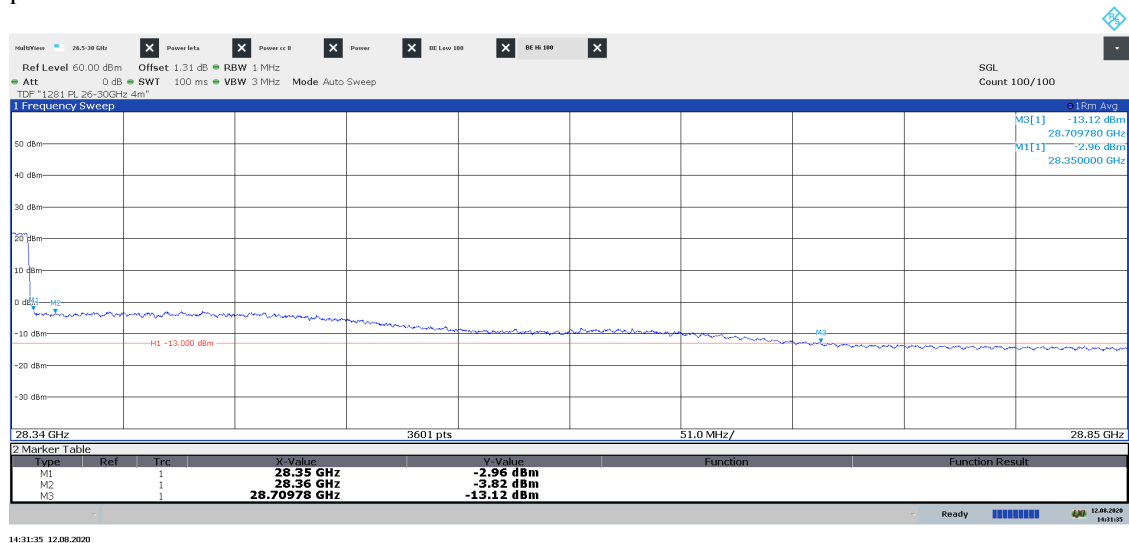


Diagram 2.14f: Pre scan 28.34 – 28.85 GHz, Symbolic name: BT8<sub>100</sub>, EIRP Vertical polarization



|                                                  |                                                  |                                   |                                                                                  |                                                                                   |
|--------------------------------------------------|--------------------------------------------------|-----------------------------------|----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|
| Power EIRP for<br>28.35 GHz<br>Hor/ Ver<br>[dBm] | Power EIRP for<br>28.36 GHz<br>Hor/ Ver<br>[dBm] | Antenna Gain<br>Hor/ Ver<br>[dBi] | Total conducted<br>power/BW for<br>28.35 GHz<br>(Limit -5 dBm)<br>[dBm]/ Verdict | Total conducted<br>power/BW for<br>28.36 GHz<br>(Limit -13 dBm)<br>[dBm]/ Verdict |
| -3.56/ -2.96                                     | -6.43/ -3.82                                     | 25.9/ 26.04                       | -26.21/ Pass                                                                     | -27.91/ Pass                                                                      |

Diagram 2.15a: Pre scan 30 – 40 GHz, Symbolic name: BL<sub>50</sub>, EIRP Horizontal polarization  
See diagram 2.15c for TRP result

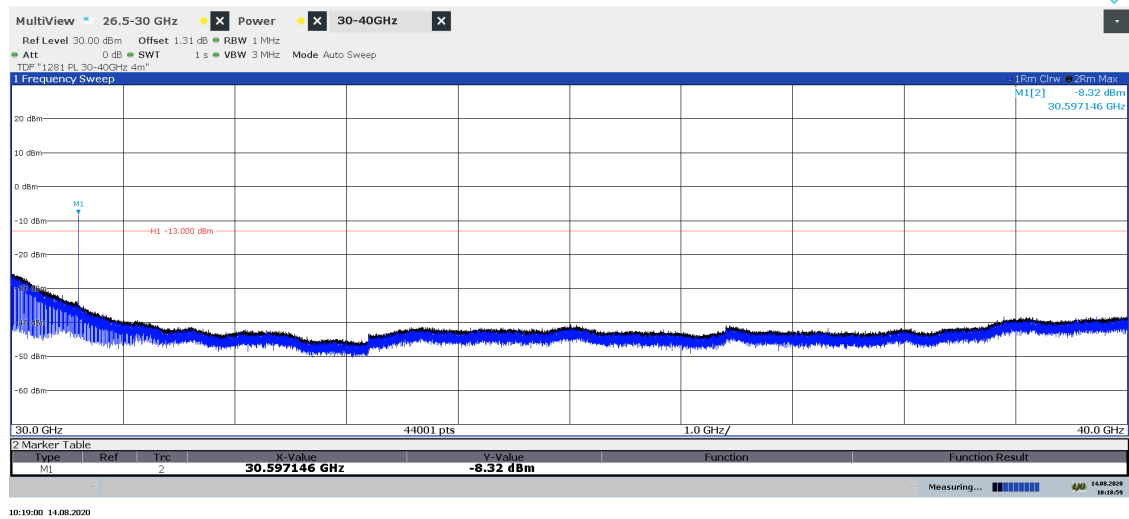


Diagram 2.15b: Pre scan 30 – 40 GHz, Symbolic name: BL<sub>50</sub>, EIRP Vertical polarization  
See diagram 2.15c for TRP result

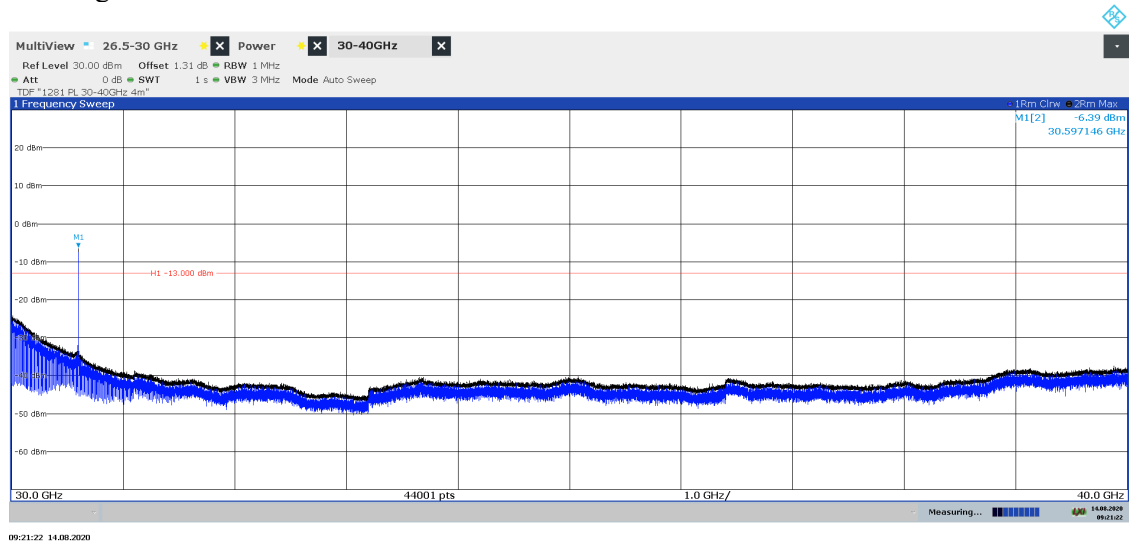


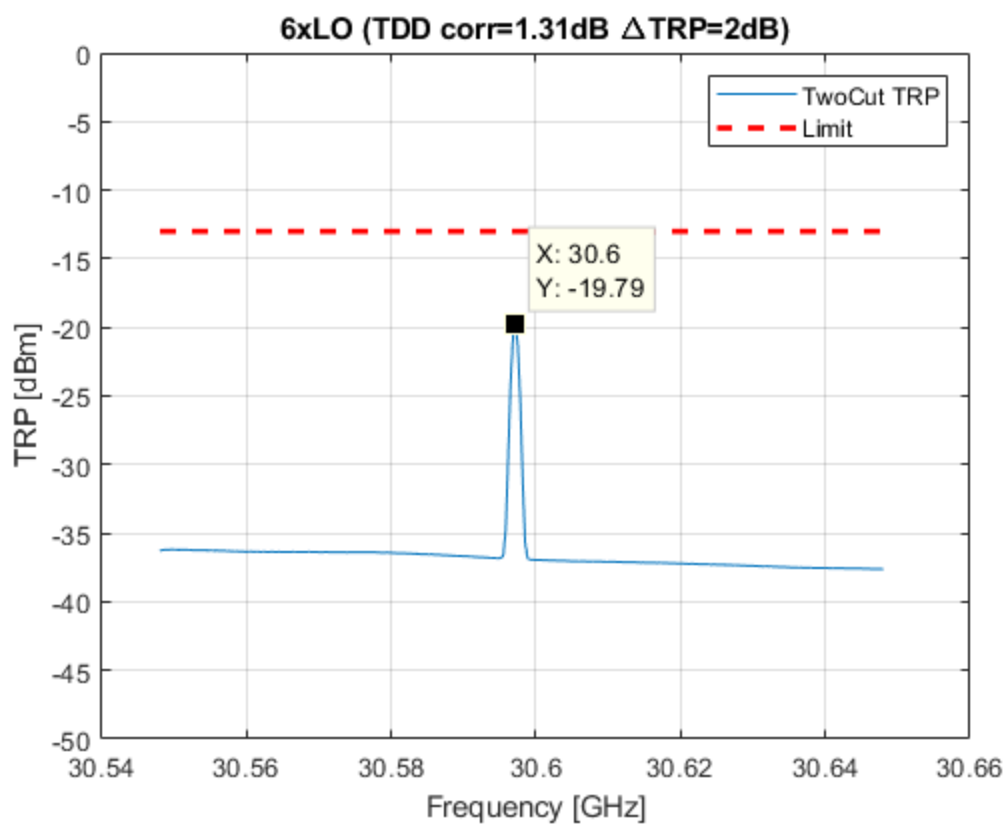
Diagram 2.15c: Two cut TRP 30.55 – 30.65 GHz 6x LO, Symbolic name: BL<sub>50</sub>

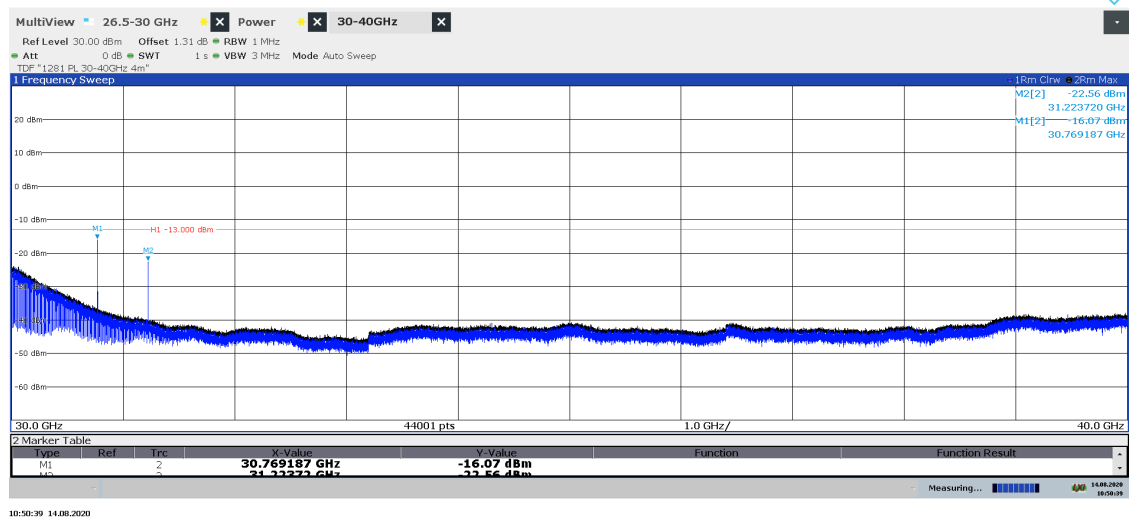
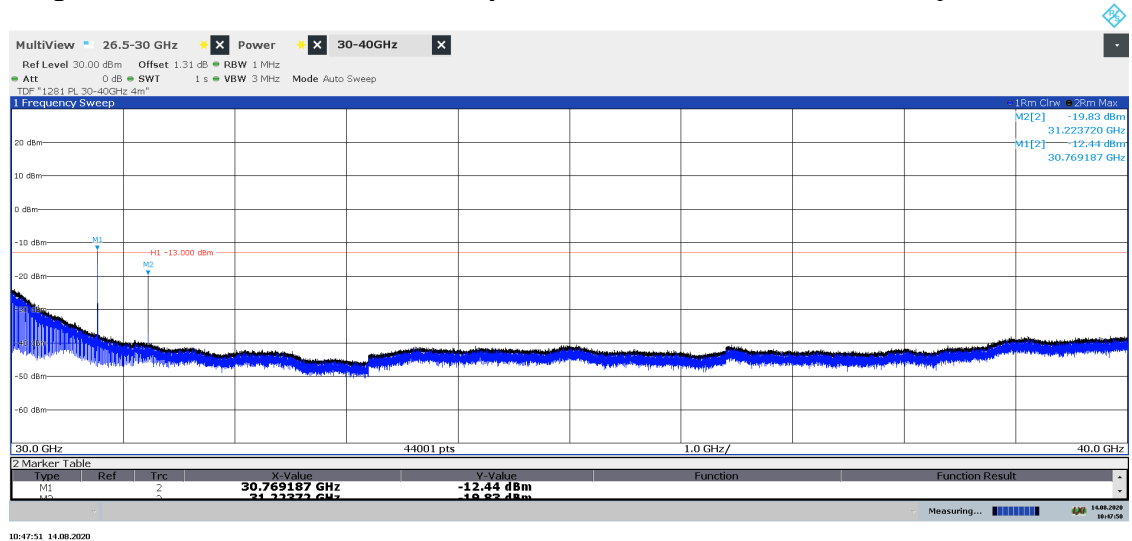
Diagram 2.16a: Pre scan 30 – 40 GHz, Symbolic name: BT8<sub>100</sub>, EIRP Horizontal polarizationDiagram 2.16b: Pre scan 30 – 40 GHz, Symbolic name: BT8<sub>100</sub>, EIRP Vertical polarization

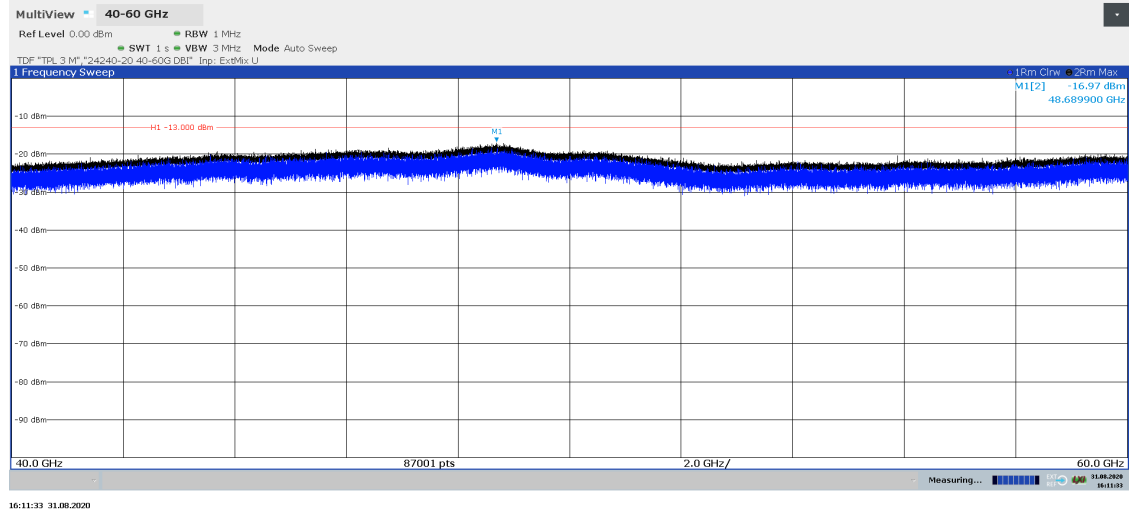
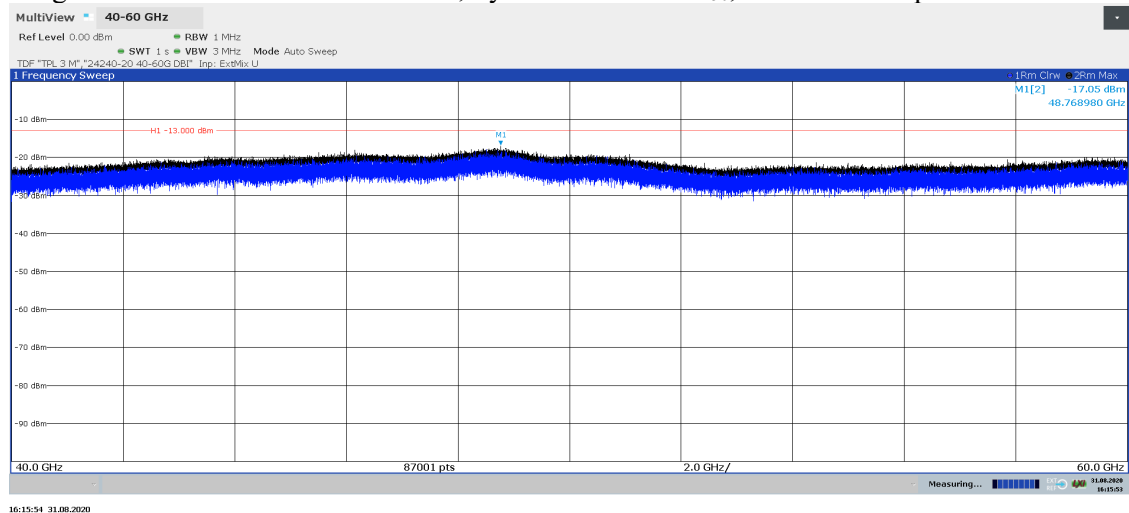
Diagram 2.17a: Pre scan 40 – 60 GHz, Symbolic name: TH<sub>50</sub>, EIRP Horizontal polarizationDiagram 2.17b: Pre scan 40 – 60 GHz, Symbolic name: TH<sub>50</sub>, EIRP Vertical polarization

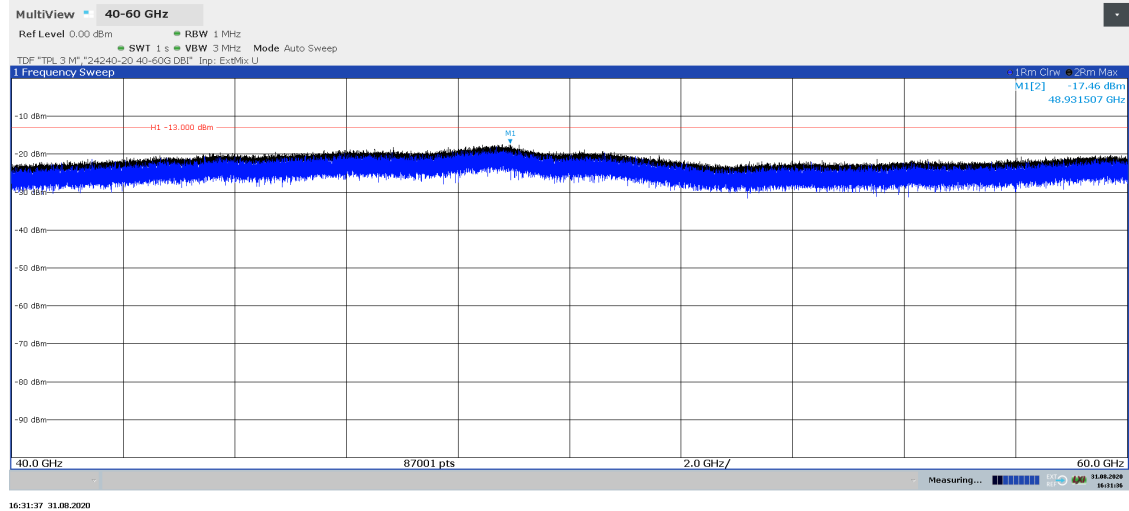
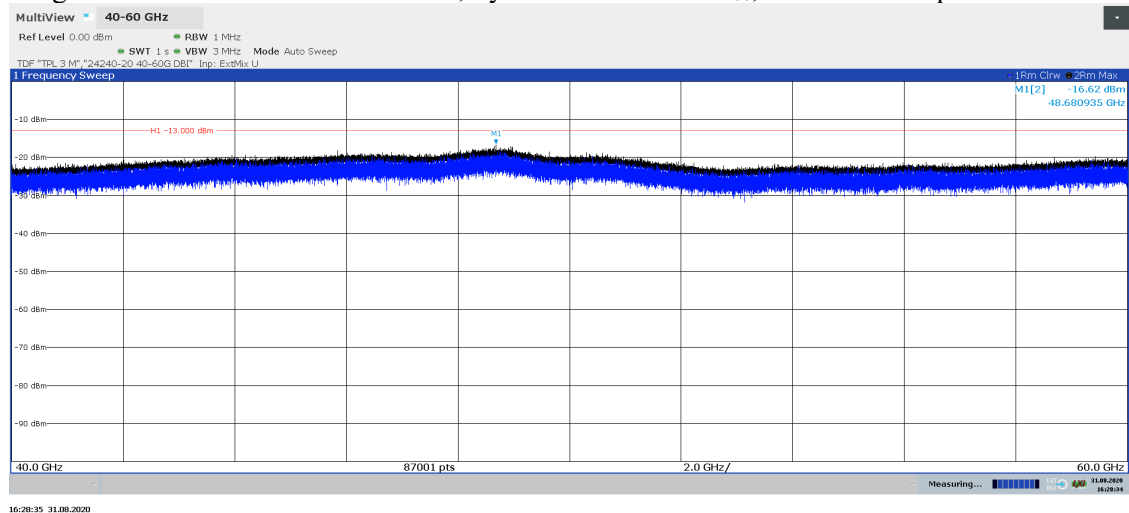
Diagram 2.18a: Pre scan 40 – 60 GHz, Symbolic name: BT8<sub>100</sub>, EIRP Horizontal polarizationDiagram 2.18b: Pre scan 40 – 60 GHz, Symbolic name: BT8<sub>100</sub>, EIRP Vertical polarization

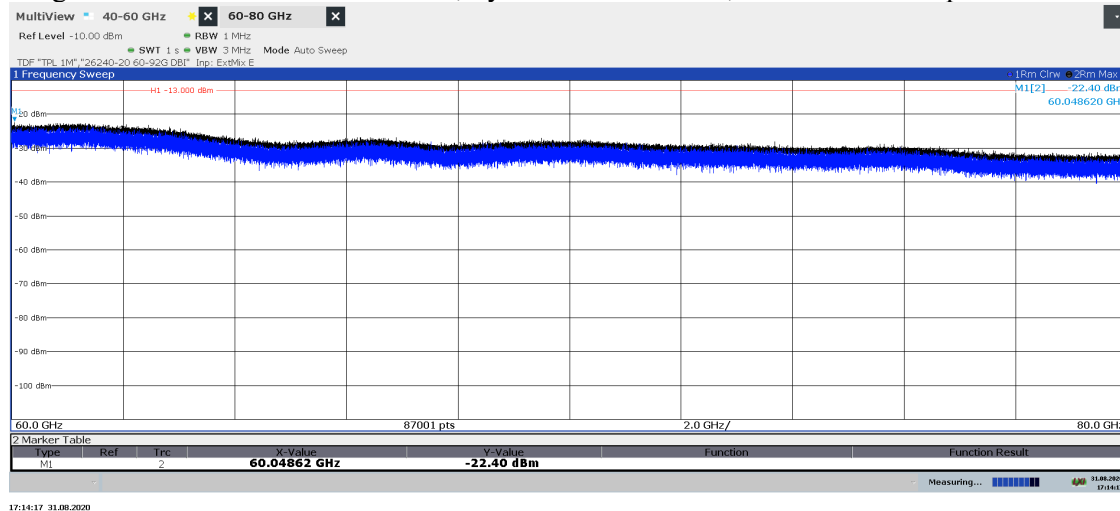
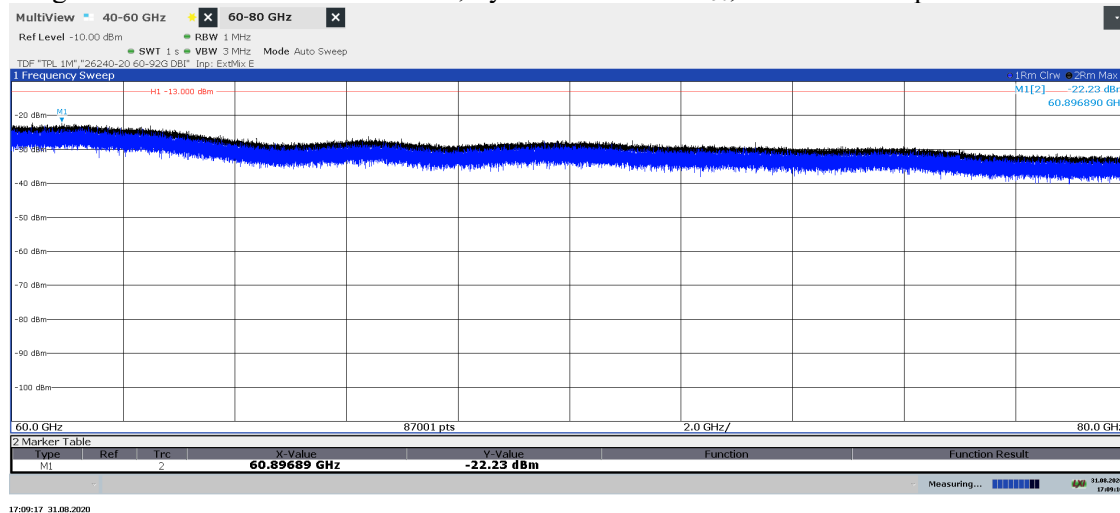
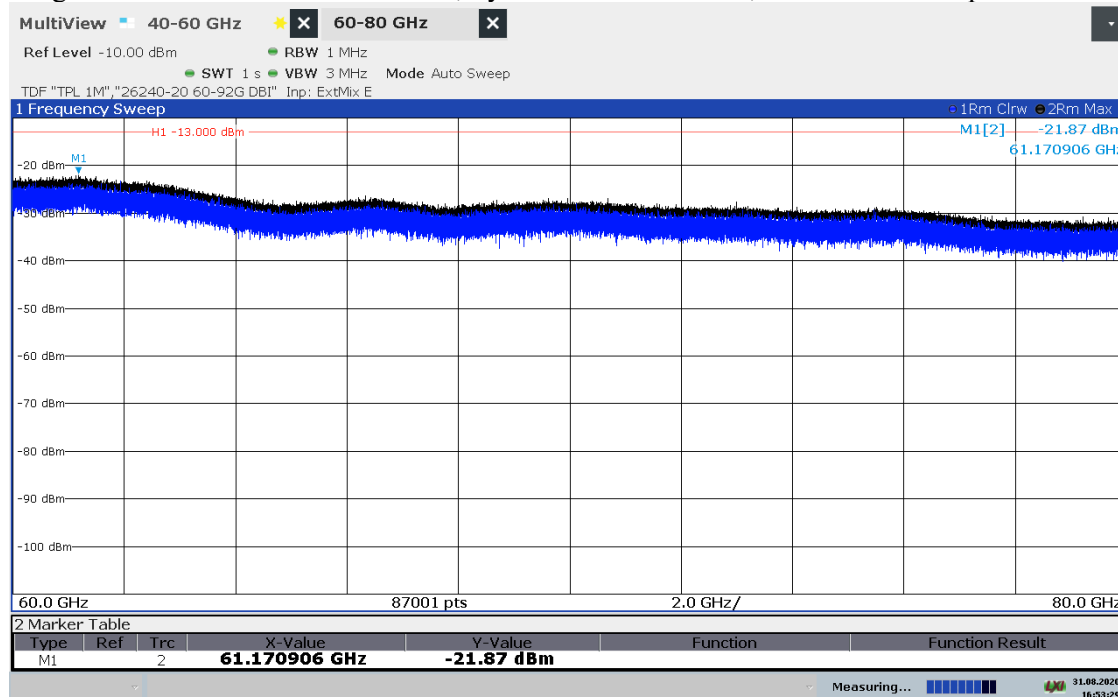
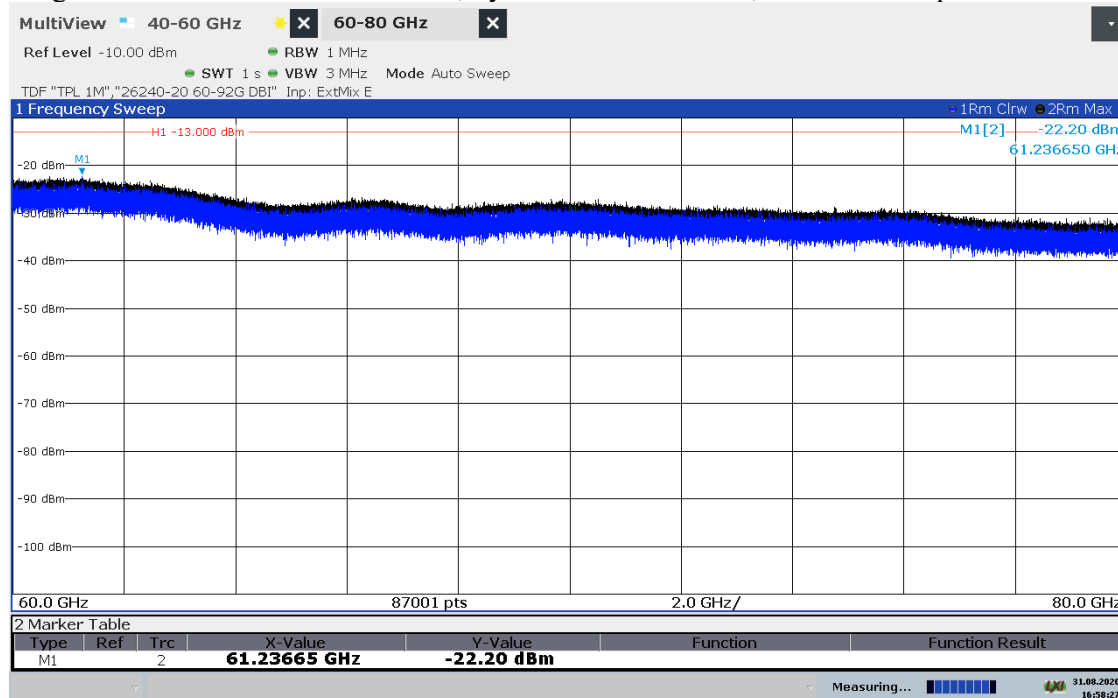
Diagram 2.19a: Pre scan 60 – 80 GHz, Symbolic name: TH<sub>50</sub>, EIRP Horizontal polarizationDiagram 2.19b: Pre scan 60 – 80 GHz, Symbolic name: TH<sub>50</sub>, EIRP Vertical polarization

Diagram 2.20a: Pre scan 60 – 80 GHz, Symbolic name: BT8<sub>100</sub>, EIRP Horizontal polarization

16:53:29 31.08.2020

Diagram 2.20b: Pre scan 60 – 80 GHz, Symbolic name: BT8<sub>100</sub>, EIRP Vertical polarization

16:58:28 31.08.2020

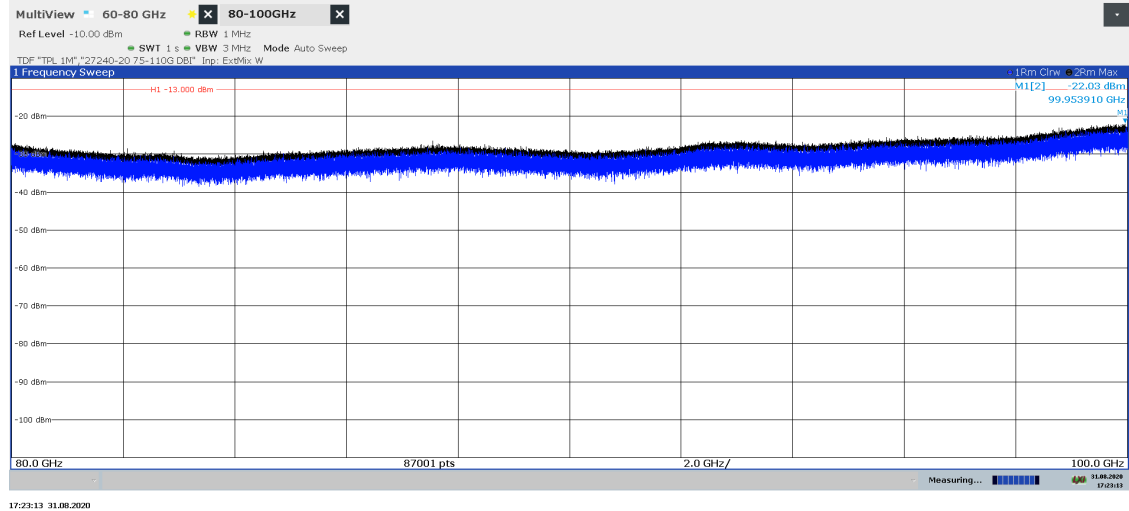
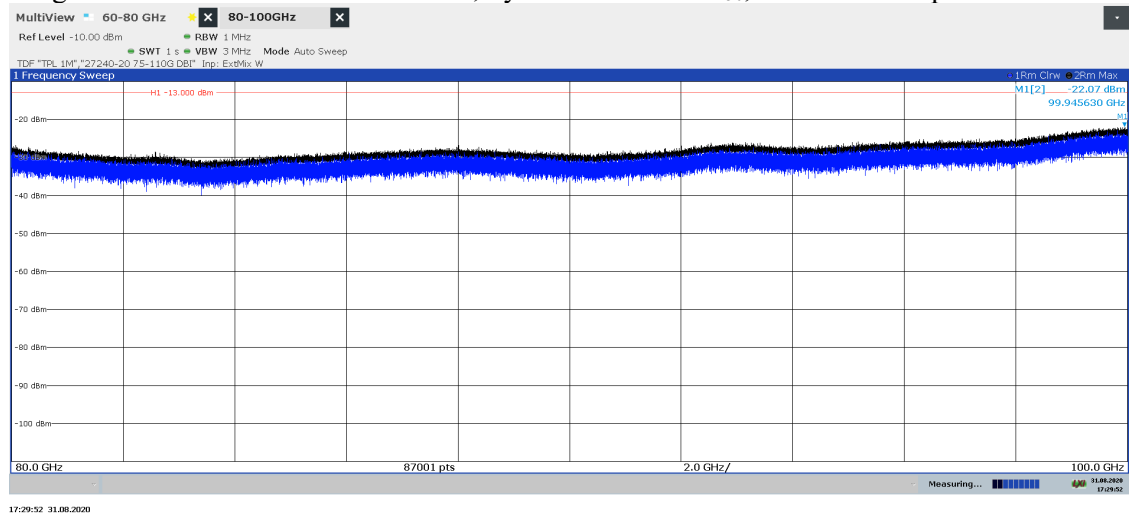
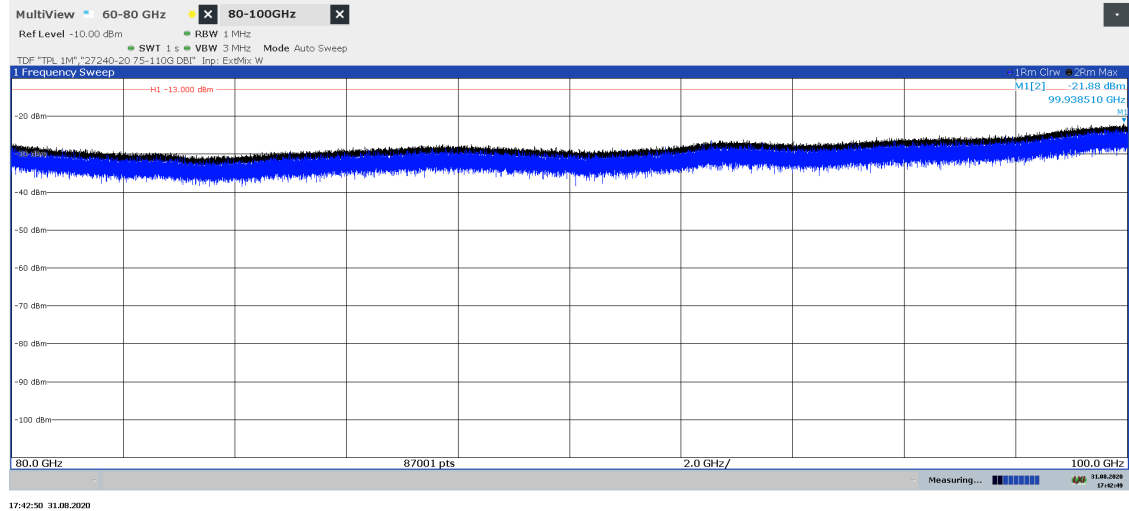
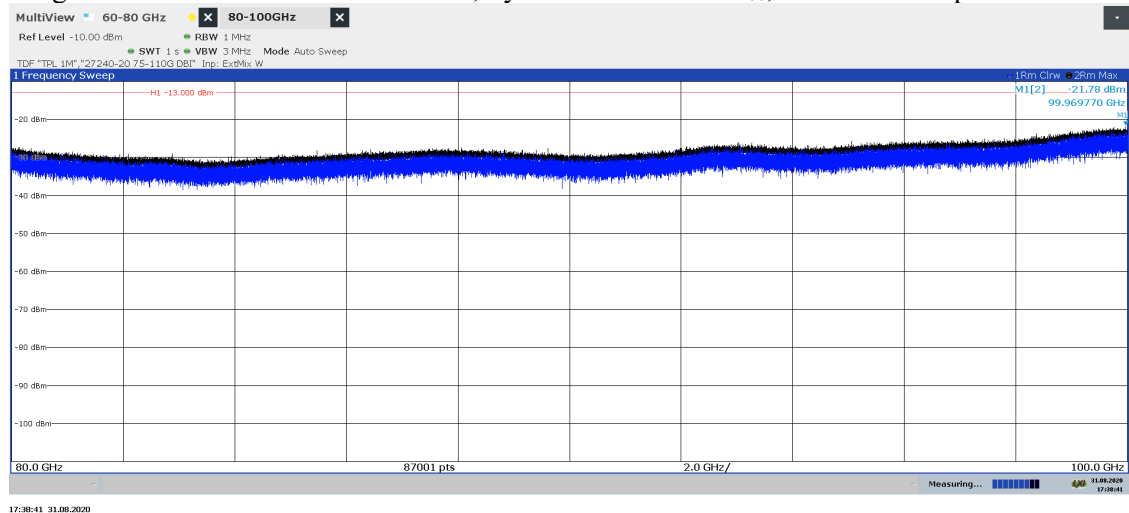
Diagram 2.21a: Pre scan 80 – 100 GHz, Symbolic name: TH<sub>50</sub>, EIRP Horizontal polarizationDiagram 2.21b: Pre scan 80 – 100 GHz, Symbolic name: TH<sub>50</sub>, EIRP Vertical polarization

Diagram 2.22a: Pre scan 80 – 100 GHz, Symbolic name: BT8<sub>100</sub>, EIRP Horizontal polarizationDiagram 2.22b: Pre scan 80 – 100 GHz, Symbolic name: BT8<sub>100</sub>, EIRP Vertical polarization

## Frequency stability measurements according to 47 CFR §2.1055

| Date       | Temperature (test equipment) | Humidity (test equipment) |
|------------|------------------------------|---------------------------|
| 2021-12-14 | 23 °C ± 3 °C                 | 35 % ± 5 %                |
| 2021-12-15 | 23 °C ± 3 °C                 | 38 % ± 5 %                |
| 2021-12-16 | 23 °C ± 3 °C                 | 37 % ± 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 27525 MHz (BL) with a carrier bandwidth of 50 MHz.

| Test conditions          |               | Frequency error (Hz)     |
|--------------------------|---------------|--------------------------|
| Supply voltage<br>DC (V) | Temp.<br>(°C) |                          |
| 40.8                     | +20           | -46                      |
| 55.2                     | +20           | -42                      |
| 48.0                     | +20           | -45                      |
| 48.0                     | +30           | -47                      |
| 48.0                     | +40           | -47                      |
| 48.0                     | +50           | -42                      |
| 48.0                     | +10           | -45                      |
| 48.0                     | 0             | -42                      |
| 48.0                     | -10           | -45                      |
| 48.0                     | -20           | -44                      |
| 48.0                     | -30           | -45                      |
| Maximum freq. error (Hz) |               | 47                       |
| 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.