REPORT

issued by an Accredited Testing Laboratory

SP Testing

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Date
2019-10-17
Rev1
2022-10-20

Reference
9P06454-Rev1

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Anders Karlsson
BURA DURA RP QRM
Torshamnsgatan 21
164 80 Stockholm

Radio measurements on SM 6701 B261 with FCC ID: TA8AKRK10101

Rev1 2022-10-20: Frequency stability added

Product name: SM 6701 B261
Product number: KRK 101 01/1

RISE Research Institutes of Sweden AB
Electronics - EMC

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Accred. No. 1002
Testing
ISO/IEC 17025

Summary

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

Description of the test object

Equipment:	Street Macro radio, SM 6701 B261 Product number: KRK 101 01/1 FCC ID: TA8AKRK10101
Hardware revision state:	R1C
Tested configuration:	3GPP NR TDD
Frequency band:	TX/ RX: 27500 – 28350 MHz
IBW:	400 MHz
Nominal Output power (EIRP):	53 dBm/ Polarization
RF configurations:	TX Diversity, SU and MU MIMO up to 2 layers 1x(2x2), Contiguous Spectrum (CS) and Non-Contiguous spectrum (NCS), Carrier Aggregation (CA) intra-band supported
Antenna beam steering:	Azimuth ±60 deg, elevation ±15 deg
Channel bandwidth(s)/ Sub Carrier Spacing:	100 MHz/ 120 kHz
Modulations:	QPSK, 16QAM and 64QAM
Emission designators:	95M9W7D
Emission designators Carrier Aggregation:	195MW7D (2x 100 MHz), 308MW7D (3x 100 MHz) 396MW7D (4x 100 MHz)
RF power Tolerance:	+1.5/ -2.0 dB

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 1.33 dB was added to the test results.

Measurements

The test object was powered with 120 VAC 60 Hz by an external power supply. Additional connections are documented in the setup drawings for radiated measurements.

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 range :

Frequency range [GHz]	Far field distance [m]	Measured distance [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:

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

References

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

CFR 47 part 30, October 2018
ANSI C63.26-2015
KDB 842590 D01 Upper Microwave Flexible Use Service V01
3GPP TS 38.141-2 V15.2.0 (2019-06)
3GPP TR 37.842 V13.2.0 (2017-03)

RISE Measurement equipment

	Calibration Due	RISE number
Anechoic chamber, Hertz	2020-11	BX50194
R&S FSW 43	2020-09	902 073
R&S ESU	2020-07	901 553
R&S ZNB 40	2020-07	BX50051
RF Cable VNA-calibration	2020-01	BX50189
RF Cable VNA-calibration	2020-01	BX50190
RF Cable	2020-04	BX50236
RF Cable	2020-09	BX50192
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	2020-12	BX90566
Mixer FS-Z90	2021-01	BX90567
Mixer FS-Z110	2020-07	BX81425
Miteq, Low Noise Amplifier	2020-01	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	2020-01	901 544
RF Cable	2020-01	BX81431
RF Cable	2020-04	BX81423
RF Cable	2020-09	503 681
RF Cable FSW-B21	2020-10	BX62069
RF Cable FSW-B21	2020-10	BX62073
Temperature and humidity meter, Testo 615	2020-06	503 498

Frequency stability 2022-07

	Calibration Due	RISE number
R&S FSW 43	2023-01	902 073
RF Cable	2023-04	BX50236
EMCO Horn Antenna 3116	2024-06	503 279
Temperature Chamber	-	503 360
Testo 635, temperature and humidity meter	2023-07	504 203
Multimeter Fluke 87	2023-05	502 190

EAB Measurement equipment

Calibrated at RISE before testing.

	Calibration Due	S/N
SWH010 HPF 30-40 GHz	2020-09	ST010619225
SSL036 LPF 26.5 GHz	2020-09	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: 2019-09-24.

Manufacturer’s representative

Mikael Jansson, Ericsson AB.

Test engineers

Tomas Lennhager and Karl Flysjö, RISE

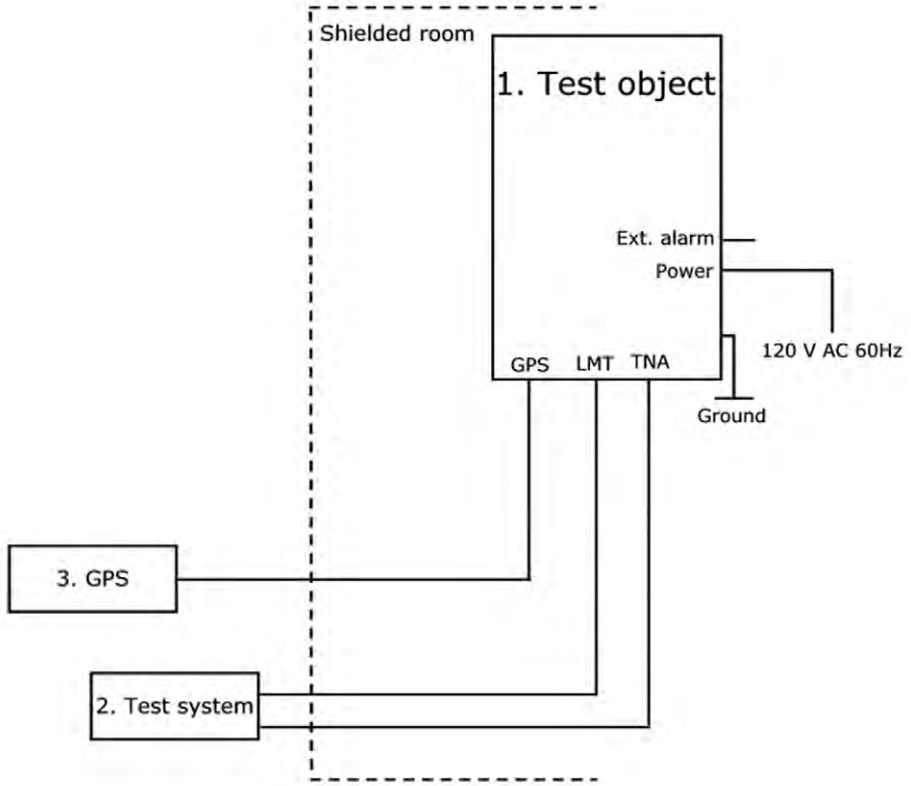
Test participant(-s)

Mikael Jansson, Henry Liu, Xiang Yue and Allen Hu. Ericsson AB.

Test frequencies used for radiated measurements

Frequency Hor/ Ver [MHz]	Symbolic name	Comment
27550.08	BL_{100}	100 MHz BW, TX bottom Lower band
27874.92	TL_{100}	100 MHz BW, TX Top Lower band
27975.00	BH_{100}	100 MHz BW, TX Bottom High band
28299.96	TH_{100}	100 MHz BW, TX Top High band
27550.08 27650.04	$BL2_{100}$	100 MHz BW, TX 2 carrier Bottom Lower band
28200.00 28299.96	$TH2_{100}$	100 MHz BW, TX 2 carrier Top High band
27550.08 27650.04 27849.96	$BL3_{100}$	100 MHz BW, TX 3 carrier Bottom Lower band
27550.08 27650.04 27849.96	$BCA3_{100}$	100 MHz BW, TX 3 carrier Bottom Lower band for CA
27999.96 28200.00 28299.96	$TH3_{100}$	100 MHz BW, TX 3 carrier Top High band
27550.08 27650.04 27750.00 27849.96	$BL4_{100}$	100 MHz BW, TX 4 carrier Bottom Lower band
27999.96 28099.92 28200.00 28299.96	$TH4_{100}$	100 MHz BW, TX 4 carrier Top High band

Test setup: radiated measurements



Test object:

1.	AC: SM 6701, KRK 101 01/1, rev. R1C, s/n: E23A768788 With Radio Software: CXP2030055/1, rev. R2B206, RBS Software: CXP9024418/6, rev. R77A152F1 FCC ID: TA8AKRK10101 For Frequency stability test 2022-07 AC: SM 6701, KRK 101 01/11, rev. R1C, s/n: E23A806920 With Radio Software: CXP9024418, rev. R58A89 FCC ID: TA8AKRK10101

Functional test equipment:

2.	Computer, Apple Mac mini, BAMS - 100196432
3.	GPS Active Antenna, KRE 101 2082/1 GPS 02 01, NCD 901 41/1, rev. R1D, s/n: A401804384

Interfaces:

Power input configuration AC: 120 VAC 60Hz	Power
LMT, shielded multi-wire	Signal
TN A, shielded multi-wire	Signal
GPS, shielded multi-wire	Signal
EXT Alarm, shielded multi-wire	Signal
TN B, Optical Interface Link, single mode opto fibre	Signal
TN C, Optical Interface Link, single mode opto fibre	Signal
Ground wire	Ground

RF power output measurements according to CFR 47 §30.202

Date	Temperature	Humidity
2019-09-30	24 °C ± 3 °C	28 % ± 5 %
2019-10-01	23 °C ± 3 °C	30 % ± 5 %

Test set-up and procedure

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

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

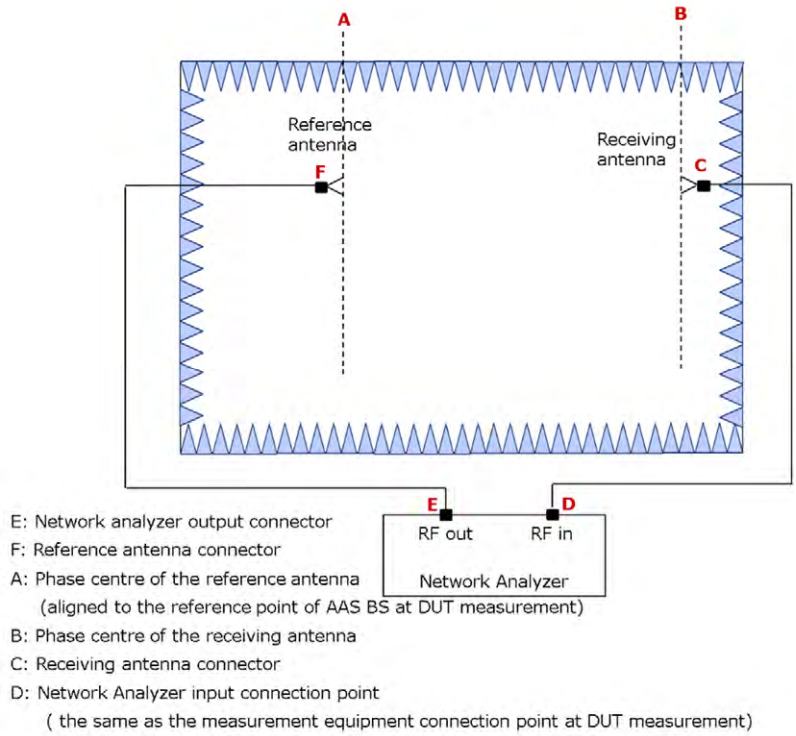


Figure 1: Indoor Anechoic Chamber calibration system setup for EIRP

Stage 1 - Calibration:

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

$LF_{EIRP, E→F}$: Cable loss between E and F in figure 1.

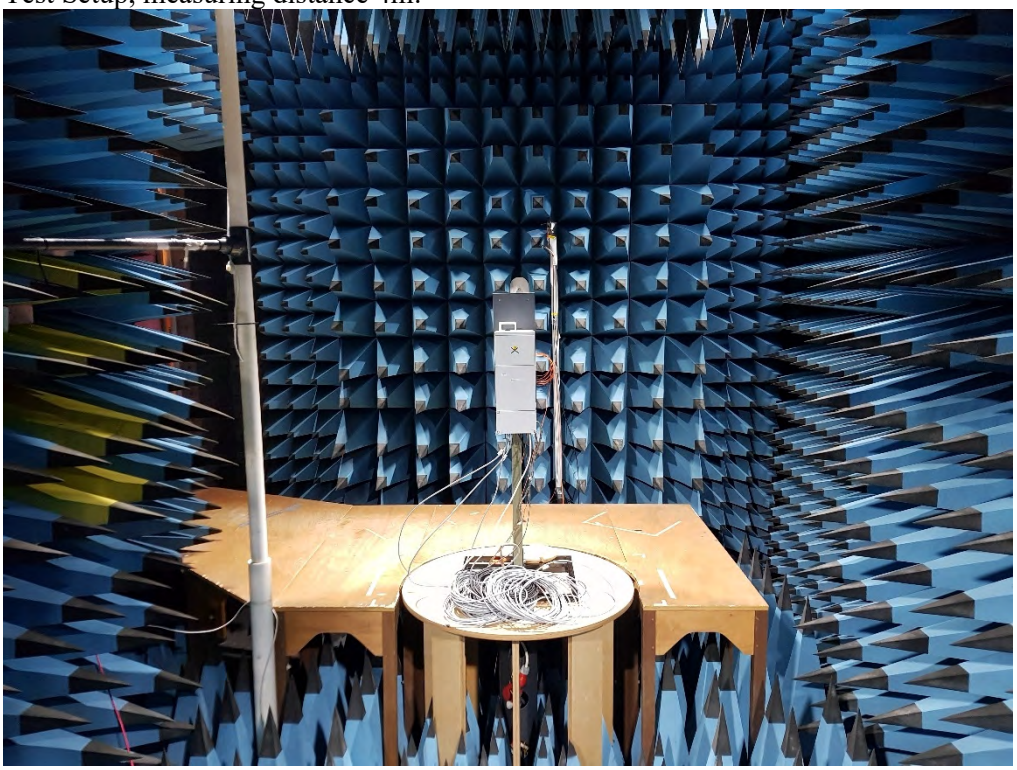
5) Calculate the calibration value between A and D with the following formula:
$L_{EIRP\_cal, A→D} = LF_{EIRP, E→D} + G_{REF\_ANT\_EIRP, A→F} - LF_{EIRP, E→F}$.
$L_{EIRP\_cal, A→D}$: Calibration value between A and D in figure 1. Was implemented in the spectrum analyzer as a transducer.
$G_{REF\_ANT\_EIRP,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

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

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

Beam index 0 Boresight, Bandwidth 100MHz
Rated output power per 100 MHz EIRP, 1x 53 dBm/ Polarization.

		Output power per 100 MHz, EIRP [RMS dBm] Vertical/ Horizontal
Modulation	Symbolic name	PAAM 0
QPSK	BL_{100}	53.25/ 52.90
QPSK	TL_{100}	52.57/ 52.42
QPSK	BH_{100}	52.79/ 52.80
QPSK	TH_{100}	52.38 / 52.37

2-Carrier

Beam index 0 Boresight, Bandwidth 100MHz
Rated output power per 100 MHz EIRP, 2x 50.0 dBm/ Polarization.

		Output power per 100 MHz, EIRP [RMS dBm] Vertical/ Horizontal	
Modulation	Symbolic name	Carrier 1	Carrier 2
QPSK	$BL2_{100}$	50.47/ 49.97	51.05/ 50.22
QPSK	$TH2_{100}$	49.81/ 49.78	49.66/ 49.19

3-Carrier

Beam index 0 Boresight, Bandwidth 100MHz
Rated output power per 100 MHz EIRP, 3x 48.2 dBm/ Polarization.

		Output power per 100 MHz, EIRP [RMS dBm] Vertical/ Horizontal		
Modulation	Symbolic name	Carrier 1	Carrier 2	Carrier 3
QPSK	$BL3_{100}$	48.70/ 47.80	49.02/ 48.86	49.66/ 49.31
QPSK	$TH3_{100}$	48.11/ 47.48	48.09/ 47.76	48.23/ 47.97

4-Carrier

Beam index 0 Boresight, Bandwidth 100MHz
Rated output power per 100 MHz EIRP, at 4x 47.0 dBm/ Polarization.

		Output power per 100 MHz, EIRP [RMS dBm] Vertical/ Horizontal			
Modulation	Symbolic name	Carrier 1	Carrier 2	Carrier 3	Carrier 4
QPSK	$BL4_{100}$	47.70/ 46.85	48.09/ 48.00	48.35/ 48.05	48.55/ 48.45
QPSK	$TH4_{100}$	47.30/ 46.50	47.29/ 47.42	47.25/ 46.84	47.12/ 47.06

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

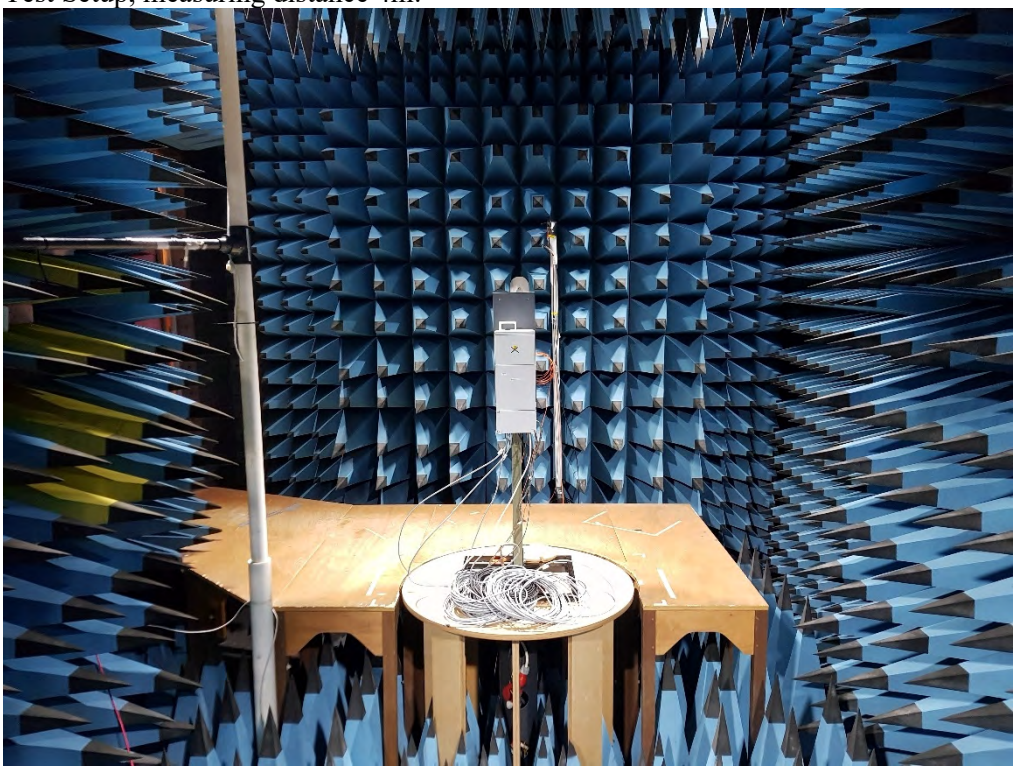
Occupied bandwidth measurements according to CFR47 §2.1049

Date	Temperature	Humidity
2019-09-30	24 °C ± 3 °C	28 % ± 5 %
2019-10-01	23 °C ± 3 °C	30 % ± 5 %
2019-10-03	23 °C ± 3 °C	21 % ± 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

Bandwidth: 100MHz

Modulation: QPSK

Diagram	Symbolic name	Polarization	Occupied BW (99%) [MHz]
1	BL_{100}	Hor	95.856
2	BL_{100}	Ver	95.613
3	TL_{100}	Hor	95.529
4	TL_{100}	Ver	95.451
5	BH_{100}	Hor	94.968
6	BH_{100}	Ver	94.938
7	TH_{100}	Hor	95.564
8	TH_{100}	Ver	95.497

Carrier Aggregation, Bandwidth: 100MHz, Modulation: QPSK

Diagram	Symbolic name	Polarization	Occupied BW (99%) [MHz]
9	CA_{2x100}	Hor	194.946
10	CA_{2x100}	Ver	195.029
11	CA_{3x100}	Hor	296.946
12	CA_{3x100}	Ver	307.580
13	CA_{4x100}	Hor	394.798
14	CA_{4x100}	Ver	395.763

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:

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

Date	Temperature	Humidity
2019-10-01	23 °C ± 3 °C	30 % ± 5 %
2019-10-02	23 °C ± 3 °C	23 % ± 5 %
2019-10-03	23 °C ± 3 °C	21 % ± 5 %
2019-10-04	23 °C ± 3 °C	20 % ± 5 %
2019-10-07	23 °C ± 3 °C	18 % ± 5 %
2019-10-08	23 °C ± 3 °C	21 % ± 5 %

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

In the test range from 40 – 100 GHz
A propagation loss in free space was calculated. The used formula was
$\gamma = 20\log\left(\frac{4\pi D}{\lambda}\right)$, γ is the propagation loss and D is the antenna distance.
For 40 – 60 GHz *D* was 3.0 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).

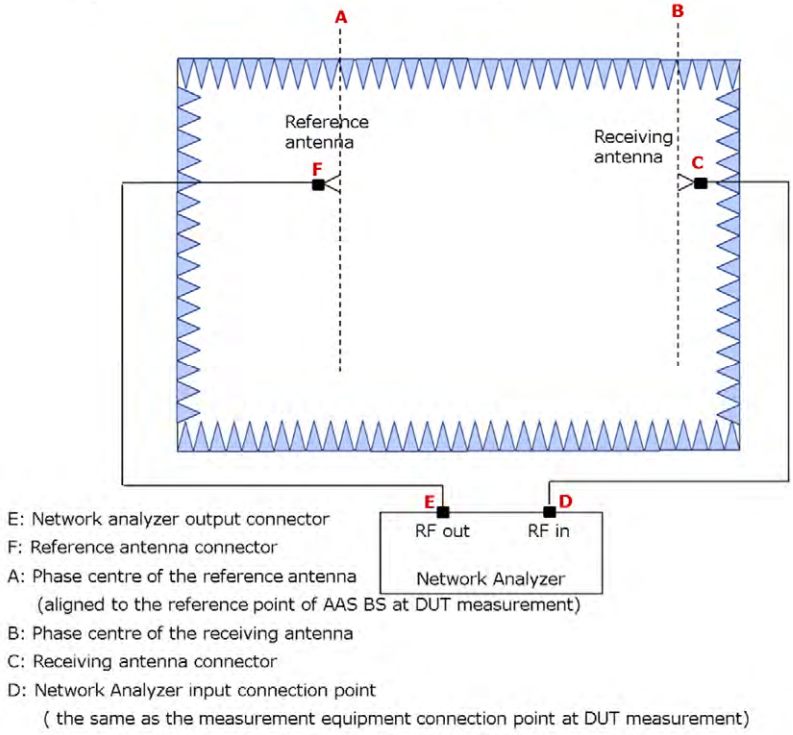


Figure 1: Indoor Anechoic Chamber calibration system setup for EIRP

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 20log|S21| (dB) obtained by the network analyzer:
$LF_{EIRP, E\rightarrow D}$: Pathloss between E and D in figure 1.
4) Measure the cable loss, $LF_{EIRP, E\rightarrow F}$ between the reference antenna connector and the network analyzer connector:
$LF_{EIRP, E\rightarrow F}$: Cable loss between E and F in figure 1.
5) Calculate the calibration value between A and D with the following formula:
$L_{EIRP\_cal, A\rightarrow D} = LF_{EIRP, E\rightarrow D} + G_{REF\_ANT\_EIRP, A\rightarrow F} - LF_{EIRP, E\rightarrow F}$.
$L_{EIRP\_cal, A\rightarrow D}$: Calibration value between A and D in figure 1. Was implemented in the spectrum analyzer as a transducer.
$G_{REF\_ANT\_EIRP, A\rightarrow F}$: Antenna gain of the reference antenna.

Stage 2 - Measurement:

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

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

The measurement procedure was as the following:

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

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

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

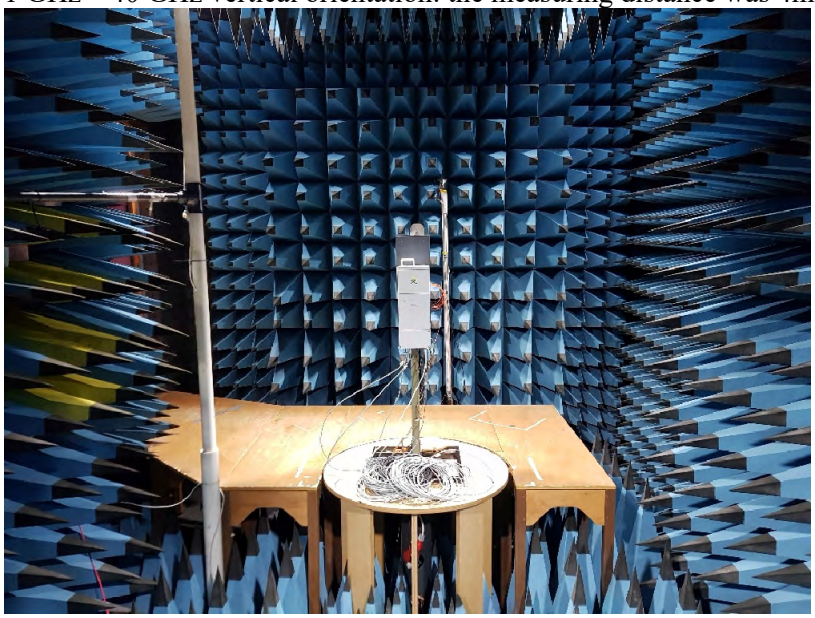
    a. Two Cut method according to KDB 842590 D01 chapter 4.4.2.2
        i. EUT set in vertical orientation
        ii. EIRP measurement samples with horizontal and vertical polarization of the measurement antenna. Angular step size based on frequency and dimension of the EUT
        iii. EUT set in horizontal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

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

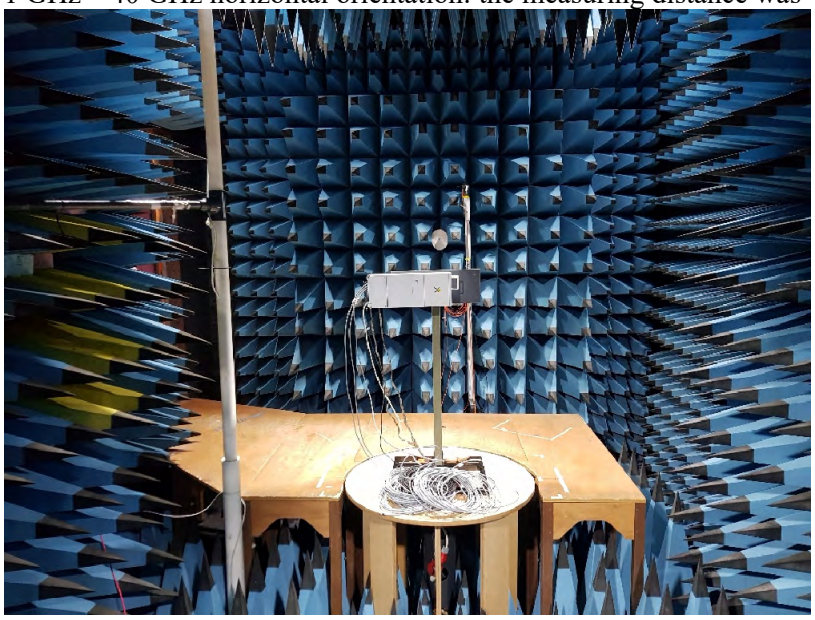
The test set-up during the spurious radiation measurements is shown in the pictures below:

30 MHz – 1 GHz vertical orientation: the measuring distance was 3m

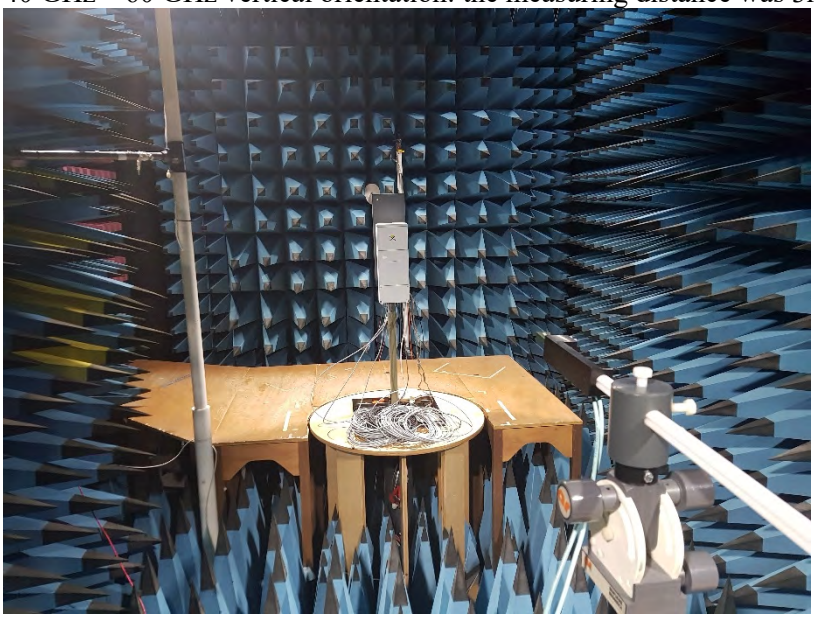
1 GHz – 40 GHz vertical orientation: the measuring distance was 4m



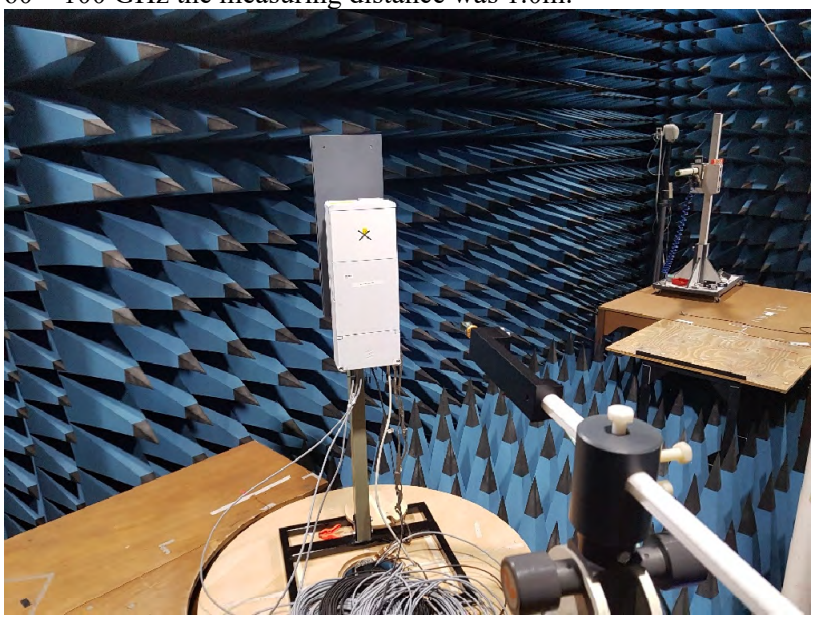
1 GHz – 40 GHz horizontal orientation: the measuring distance was 4m



40 GHz – 60 GHz vertical orientation: the measuring distance was 3m



60 – 100 GHz the measuring distance was 1.0m:



Rise Measurement equipment

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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	501 548
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	Pol	Frequency range	Measurement method	"Early exit?"
15a	BL_{100}	Hor	30-1000 MHz	Pre scan EIRP	Yes
15b	BL_{100}	Ver	30-1000 MHz	Pre scan EIRP	Yes
16a	BL_{100}	Hor	1-18 GHz	Pre scan EIRP	Yes
16b	BL_{100}	Ver	1-18 GHz	Pre scan EIRP	Yes
17a	BL_{100}	Hor	18-26.5 GHz	Pre scan EIRP	No
17b	BL_{100}	Ver	18-26.5 GHz	Pre scan EIRP	No
17c	BL_{100}	Hor/Ver	25.47-25.57 GHz	Two cut TRP	Compliant to TRP limit
18a	BL_{100}	Hor	26.5-30 GHz	Pre scan EIRP	No
18b	BL_{100}	Ver	26.5-30 GHz	Pre scan EIRP	No
18c	BL_{100}	Hor	27-27.51 GHz	Pre scan EIRP	No*
18d	BL_{100}	Ver	27-27.51 GHz	Pre scan EIRP	No*
18e	BL_{100}	Hor/Ver	27.3-27.5 GHz	Pattern multiplication TRP	Compliant to TRP limit
19a	$BL3_{100}$	Hor	27-27.51 GHz	Pre scan EIRP	No*
19b	$BL3_{100}$	Ver	27-27.51 GHz	Pre scan EIRP	No*
19c	$BL3_{100}$	Hor/Ver	27.3-27.5 GHz	Pattern multiplication TRP	Compliant to TRP limit
20a	TL_{100}	Hor	27.625-28.225 GHz	Pre scan EIRP	Yes*
20b	TL_{100}	Ver	27.625-28.225 GHz	Pre scan EIRP	Yes*
21a	BH_{100}	Hor	27.625-28.225 GHz	Pre scan EIRP	Yes*
21b	BH_{100}	Ver	27.625-28.225 GHz	Pre scan EIRP	Yes*
22a	TH_{100}	Hor	26.5-30 GHz	Pre scan EIRP	No
22b	TH_{100}	Ver	26.5-30 GHz	Pre scan EIRP	No
22c	TH_{100}	Hor	28.34-28.85 GHz	Pre scan EIRP	No*
22d	TH_{100}	Ver	28.34-28.85 GHz	Pre scan EIRP	No*
22e	TH_{100}	Hor/Ver	28.35-28.55 GHz	Pattern multiplication TRP	Compliant to TRP limit
23a	$TH3_{100}$	Hor	28.34-28.85 GHz	Pre scan EIRP	No*
23b	$TH3_{100}$	Ver	28.34-28.85 GHz	Pre scan EIRP	No*
23c	$TH3_{100}$	Hor/Ver	28.35-28.85 GHz	Pattern multiplication TRP	Compliant to TRP limit
24a	BL_{100}	Hor	30-40 GHz	Pre scan EIRP	No
24b	BL_{100}	Ver	30-40 GHz	Pre scan EIRP	No
25c	BL_{100}	Hor/Ver	30.57-30.67 GHz	Two cut TRP	Compliant to TRP limit
26a	BL_{100}	Hor	40-60 GHz	Pre scan EIRP	Yes
26b	BL_{100}	Ver	40-60 GHz	Pre scan EIRP	Yes
27a	BL_{100}	Hor	60-80 GHz	Pre scan EIRP	Yes
27b	BL_{100}	Ver	60-80 GHz	Pre scan EIRP	Yes
28a	BL_{100}	Hor	80-100 GHz	Pre scan EIRP	Yes
28b	BL_{100}	Ver	80-100 GHz	Pre scan EIRP	Yes

* Conducted power calculated using antenna gain.

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.

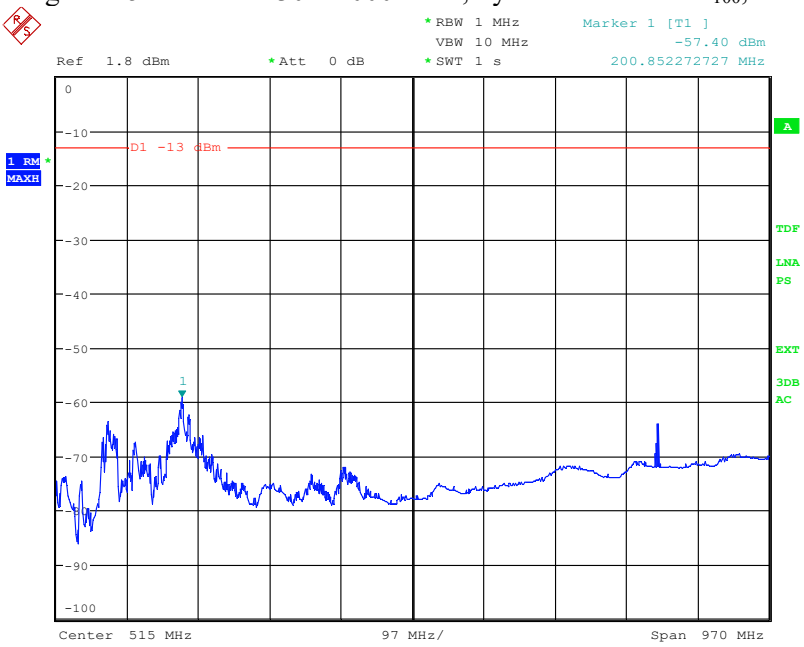
(b)(1) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater.

(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.

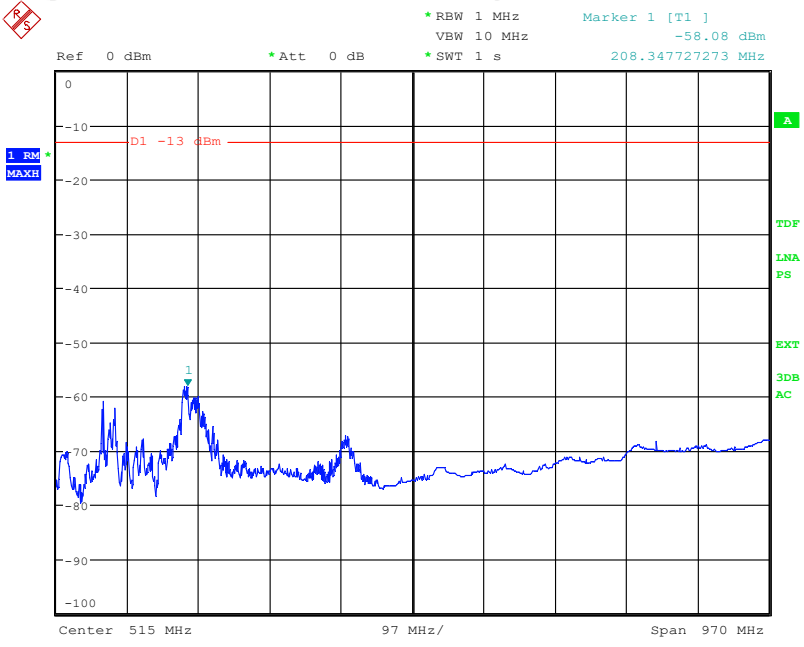
Complies?	Yes

Diagram 15a: Pre scan 30 – 1000 MHz, Symbolic name: BL_{100}, EIRP Horizontal polarization



Date: 2.OCT.2019 16:19:52

Diagram 15b: Pre scan 30 – 1000 MHz, Symbolic name: BL_{100}, EIRP Vertical polarization



Date: 2.OCT.2019 16:15:43

Diagram 16a: Pre scan 1 – 18 GHz, Symbolic name: BL_{100}, EIRP Horizontal polarization

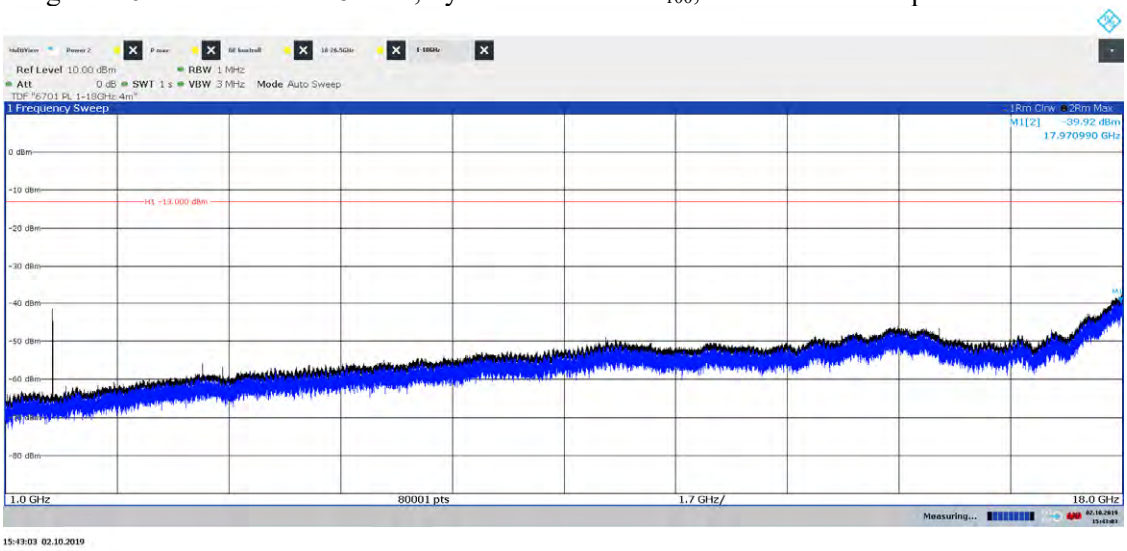


Diagram 16b: Pre scan 1 – 18 GHz, Symbolic name: BL_{100}, EIRP Vertical polarization

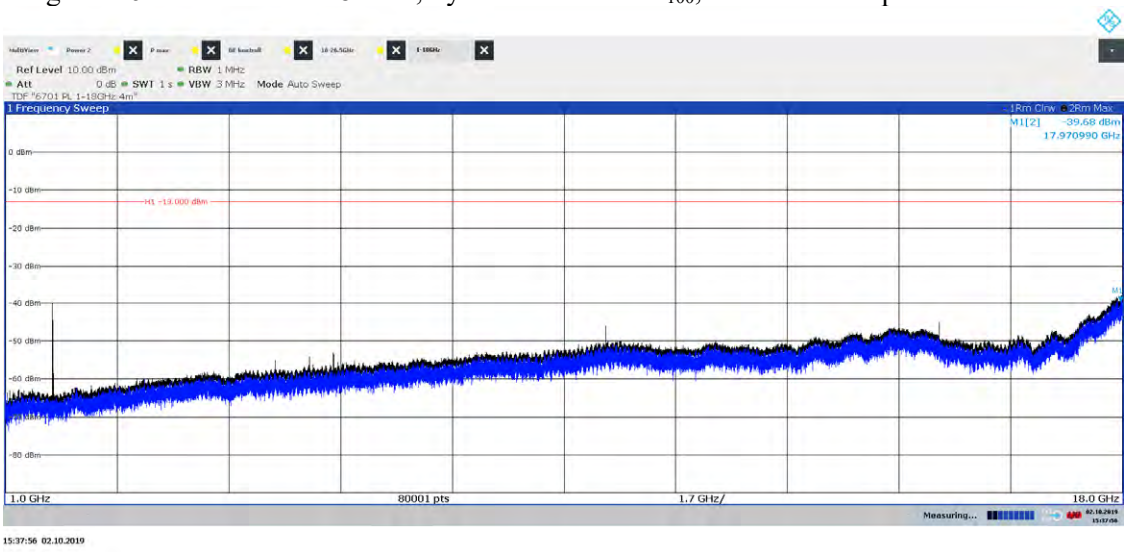


Diagram 17a: Pre scan 18 – 26.5 GHz, Symbolic name: BL_{100}, EIRP Horizontal polarization
See diagram 17c for TRP result

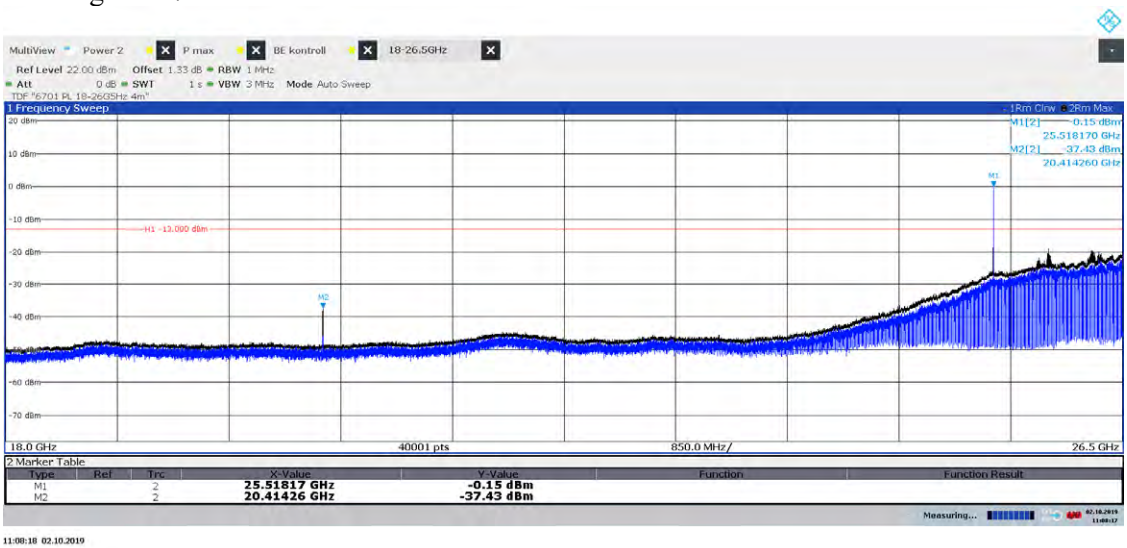


Diagram 17b: Pre scan 18 – 26.5 GHz, Symbolic name: BL_{100}, EIRP Vertical polarization
See diagram 17c for TRP result

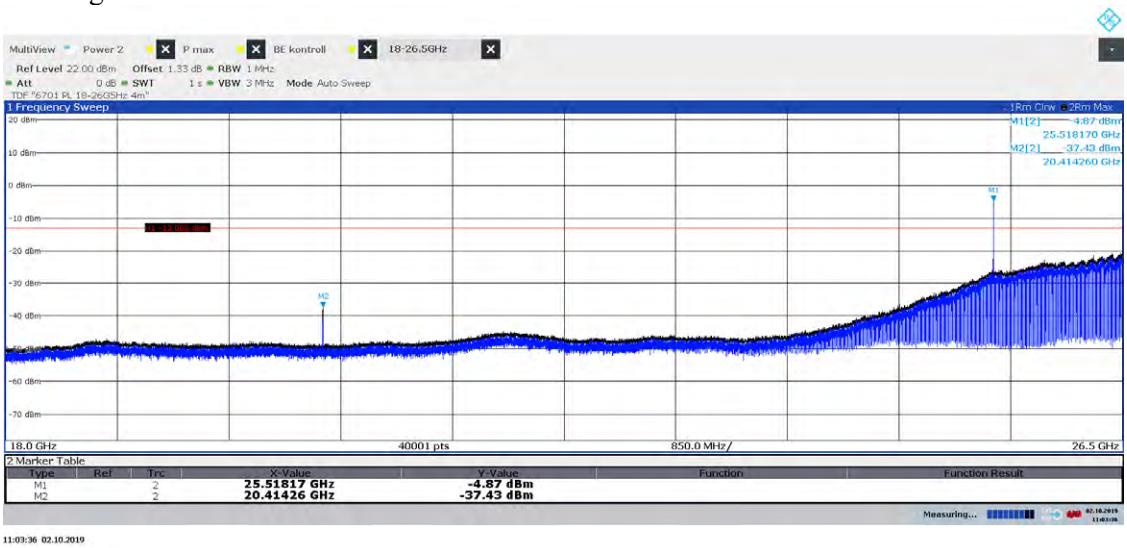


Diagram 17c: Two cut TRP 25.47 – 25.57 GHz 5x LO, Symbolic name: BL_{100}

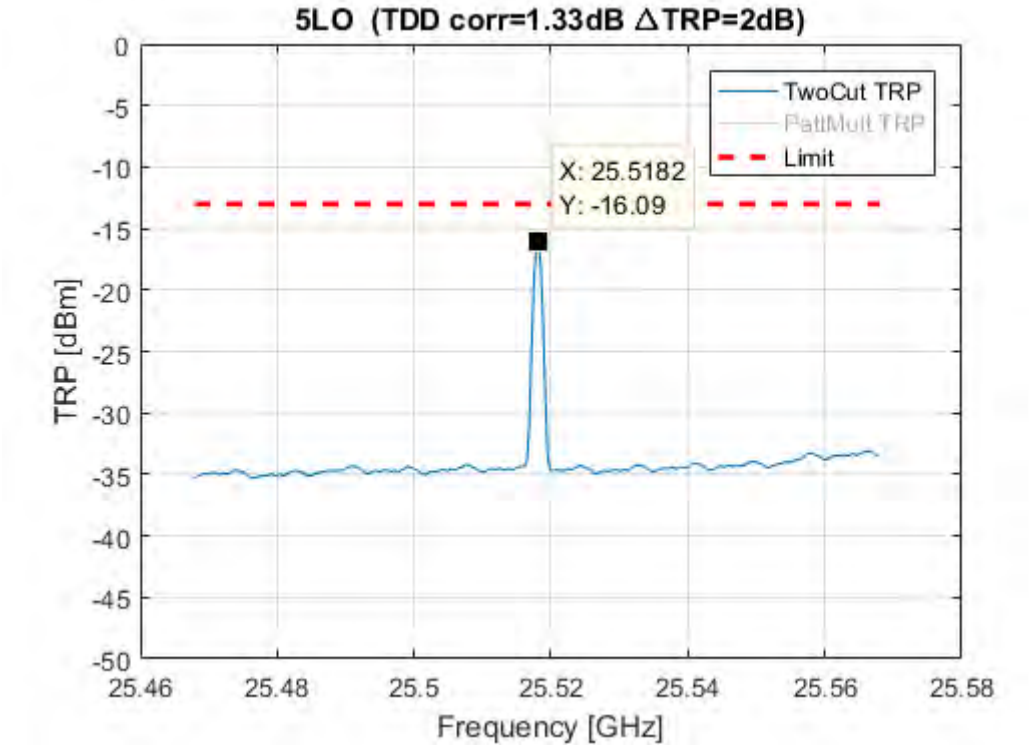


Diagram 18a: Pre scan 26.5 – 30.0 GHz, Symbolic name: BL_{100}, EIRP Horizontal polarization
See diagram 18e for TRP result

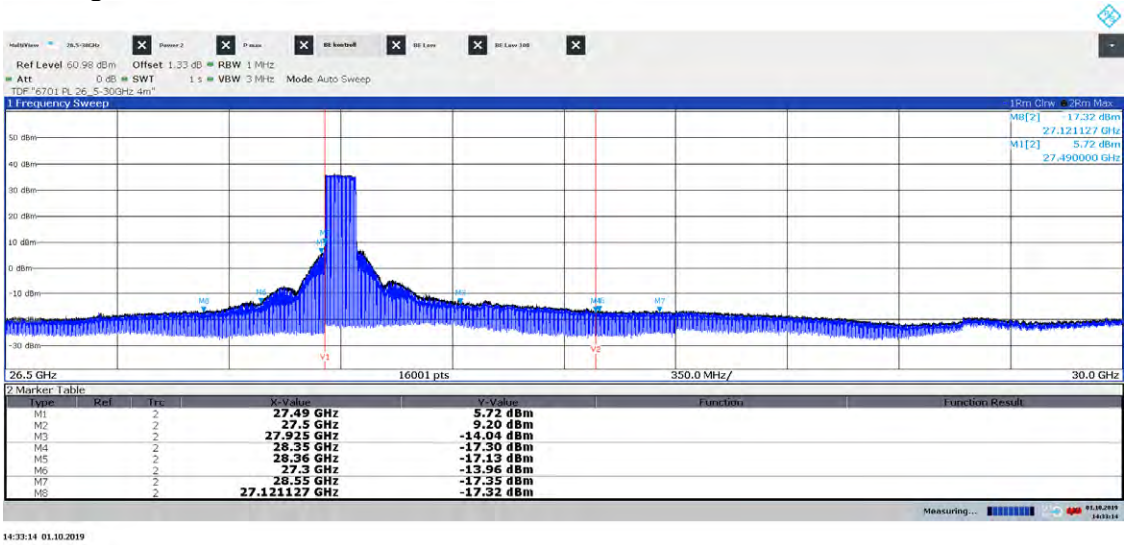


Diagram 18b: Pre scan 26.5 – 30.0 GHz, Symbolic name: BL_{100}, EIRP Vertical polarization
See diagram 18e for TRP result

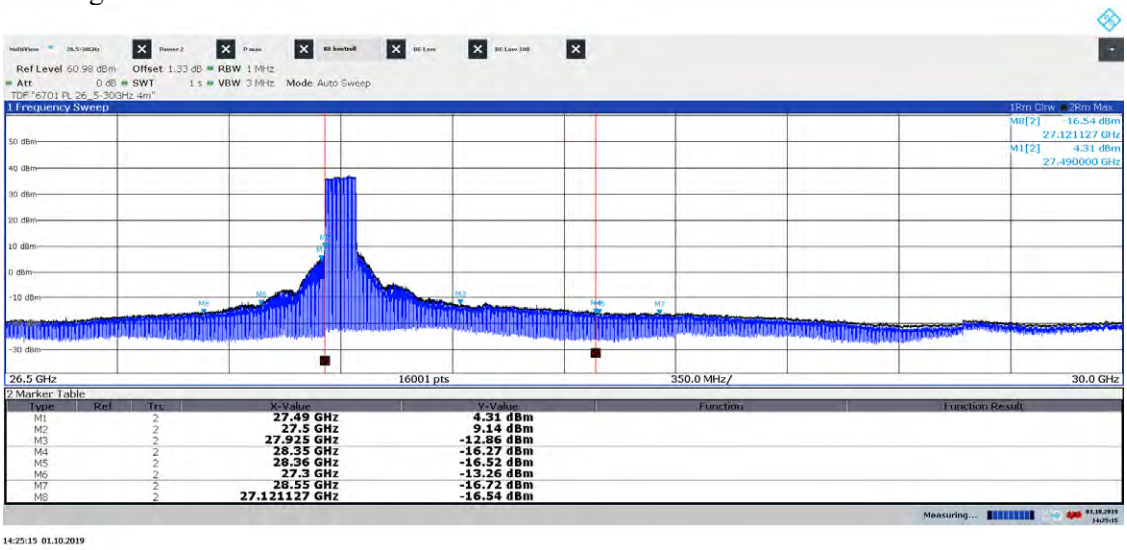


Diagram 18c: Pre scan 27.00 – 27.51 GHz, Symbolic name: BL_{100}, EIRP Horizontal polarization
See diagram 18e for TRP result

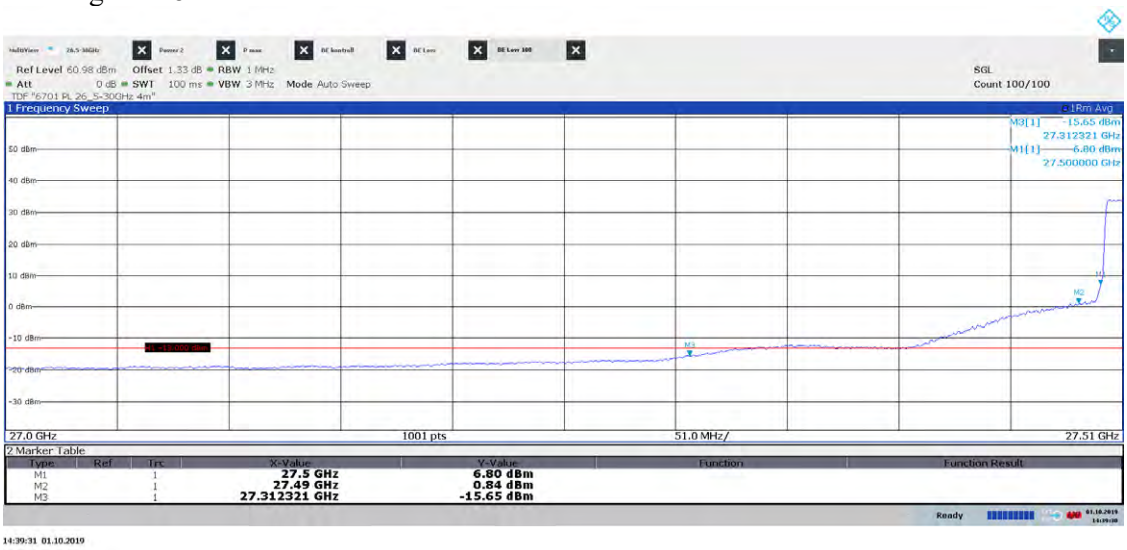
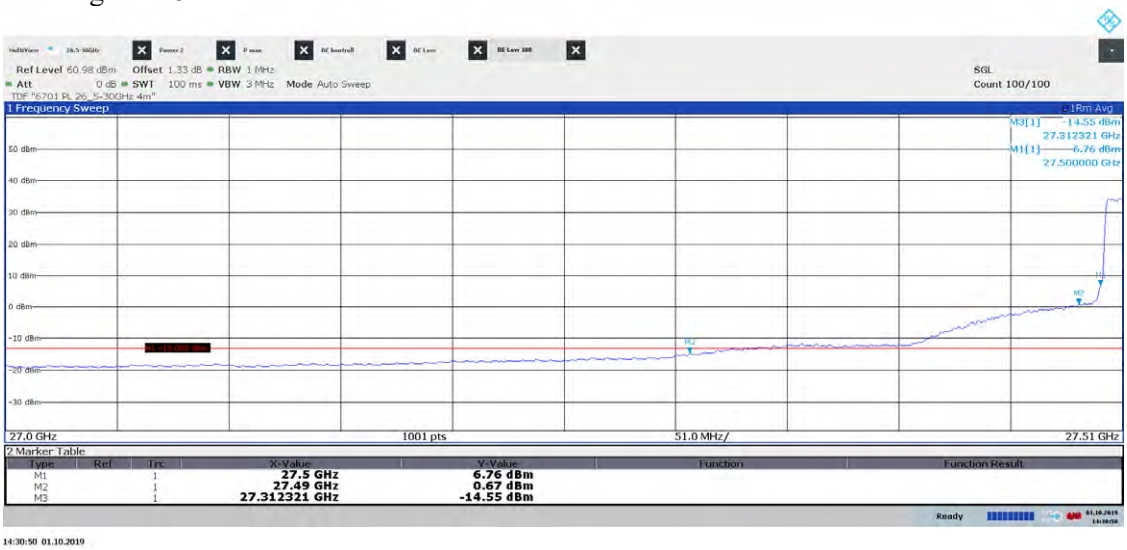


Diagram 18d: Pre scan 27.00 – 27.51 GHz, Symbolic name: BL_{100}, EIRP Vertical polarization
See diagram 18e for TRP result



Power EIRP for 27.5GHz Hor/ Ver [dBm]	Power EIRP for 27.49 GHz Hor/ Ver [dBm]	Antenna Gain Hor/ Ver [dBi]	Total conducted power/BW for 27.5 GHz (Limit -5 dBm) [dBm]/ Verdict	Total conducted power/BW for 27.49 GHz (Limit -13 dBm) [dBm]/ Verdict
6.80/ 6.76	0.84/ 0.67	28.17/ 28.30	-18.44/ Pass	-24.47/ Pass

Diagram 18e: Pattern multiplication TRP 27.3 – 27.5 GHz, Symbolic name: BL_{100}

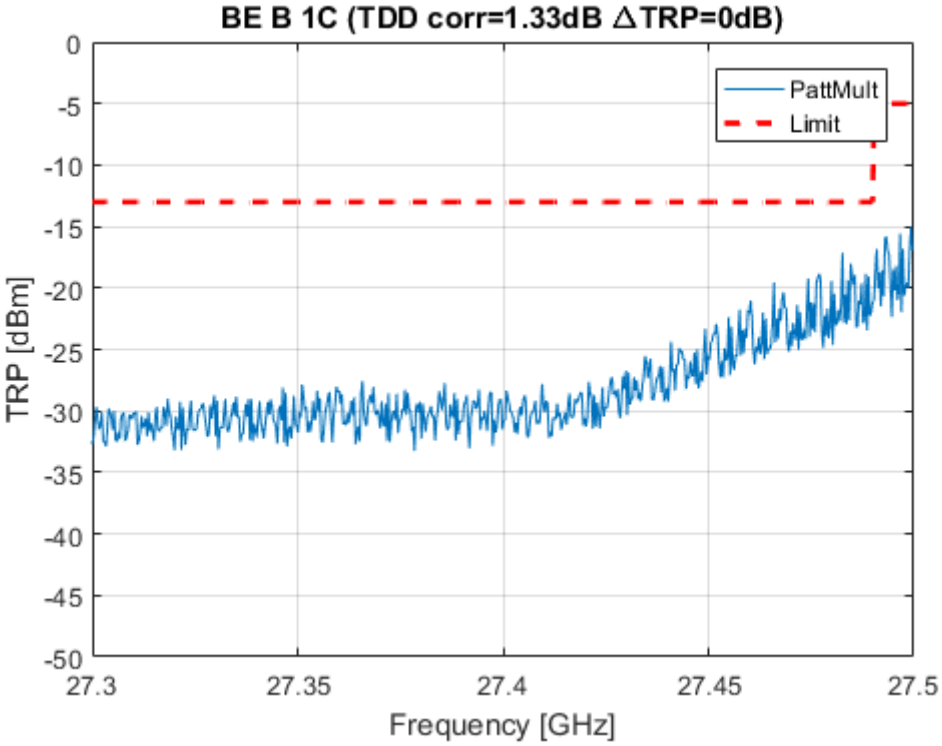


Diagram 19a: Pre scan 27 – 27.5 GHz, Symbolic name: $BL3_{100}$, EIRP Horizontal polarization
See diagram 19c for TRP result

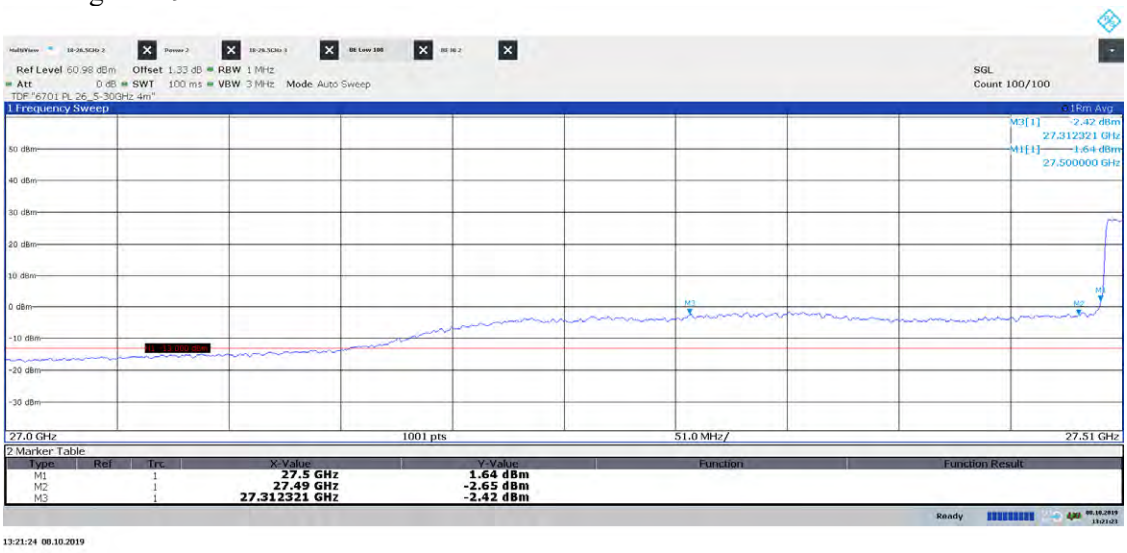


Diagram 19b: Pre scan 27 – 27.5 GHz, Symbolic name: $BL3_{100}$, EIRP Vertical polarization
See diagram 19c for TRP result

Power EIRP for 27.5 GHz Hor/ Ver [dBm]	Power EIRP for 27.49 GHz Hor/ Ver [dBm]	Antenna Gain Hor/ Ver [dBi]	Total conducted power/BW for 27.5 GHz (Limit -5 dBm) [dBm]/ Verdict	Total conducted power/BW for 27.49 GHz (Limit -13 dBm) [dBm]/ Verdict
1.64/ 1.98	-2.65/ -2.22	28.17/ 28.3	-23.41/ Pass	-27.66/ Pass

Diagram 19c: Pattern multiplication TRP 27.0 – 27.5 GHz, Symbolic name: $BL3_{100}$

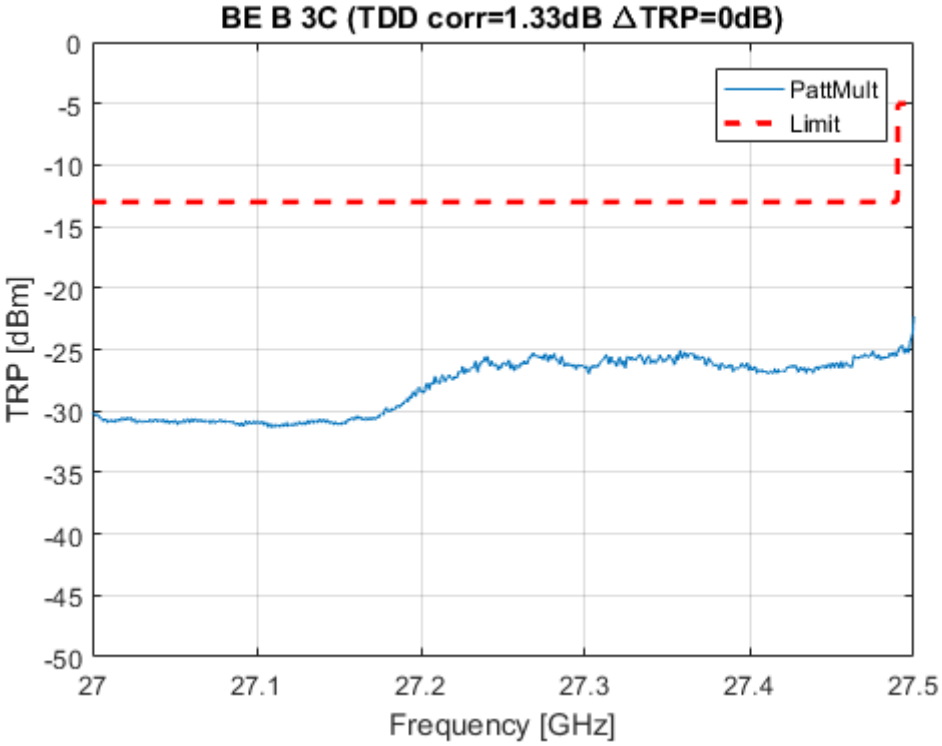


Diagram 20a: Pre scan 27.625 – 28.225 GHz, Symbolic name: TL_{100}, EIRP Horizontal polarization

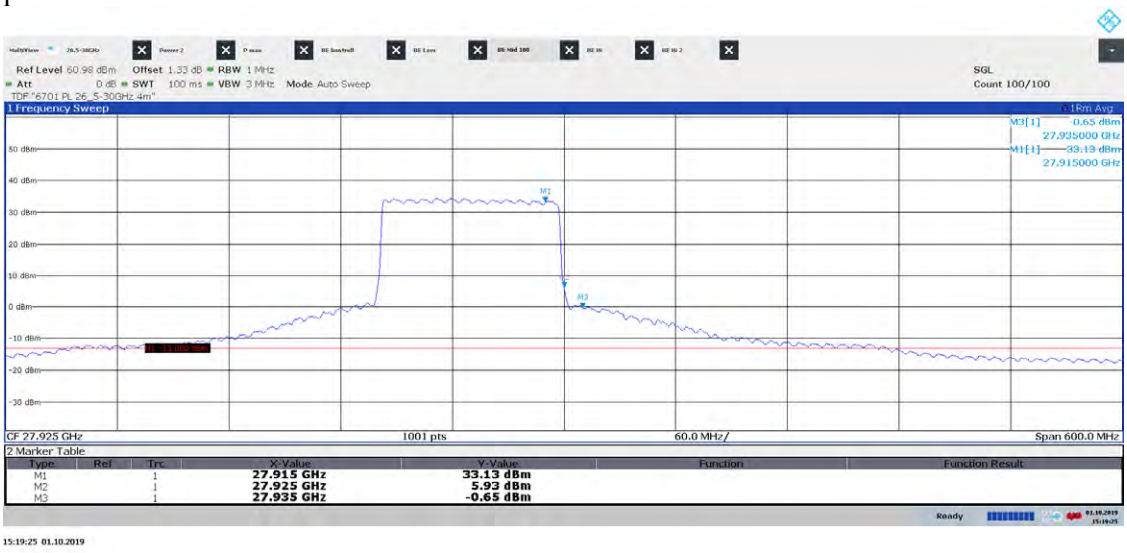
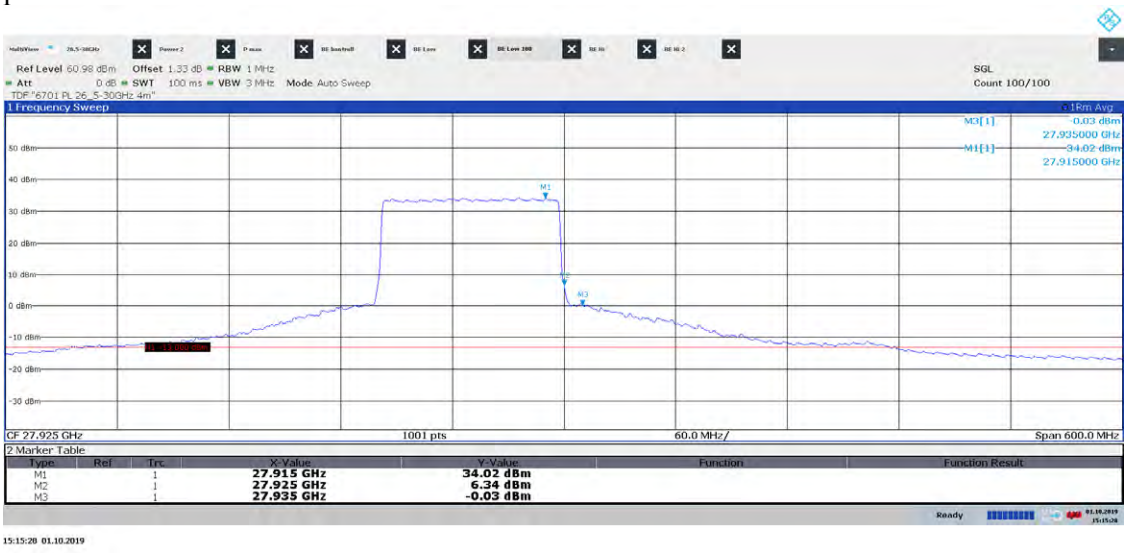


Diagram 20b: Pre scan 27.625 – 28.225 GHz, Symbolic name: TL_{100}, EIRP Vertical polarization



Power EIRP for 27.925 GHz Hor/ Ver [dBm]	Power EIRP for 27.935 GHz Hor/ Ver [dBm]	Antenna Gain Hor/ Ver [dBi]	Total conducted power/BW for 27.925 GHz (Limit -5 dBm) [dBm]/ Verdict	Total conducted power/BW for 27.935 GHz (Limit -13 dBm) [dBm]/ Verdict
5.93/ 6.34	-0.65/ -0.03	28.9/ 29	-19.80/ Pass	-26.27/ Pass

Diagram 21a: Pre scan 27.625 – 28.225 GHz, Symbolic name: BH_{100}, EIRP Horizontal polarization

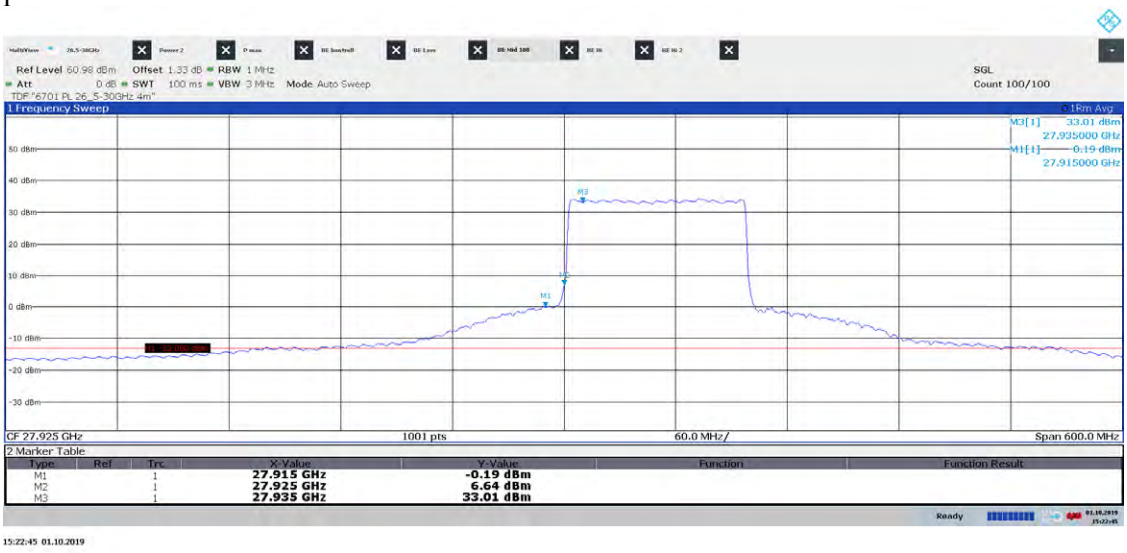


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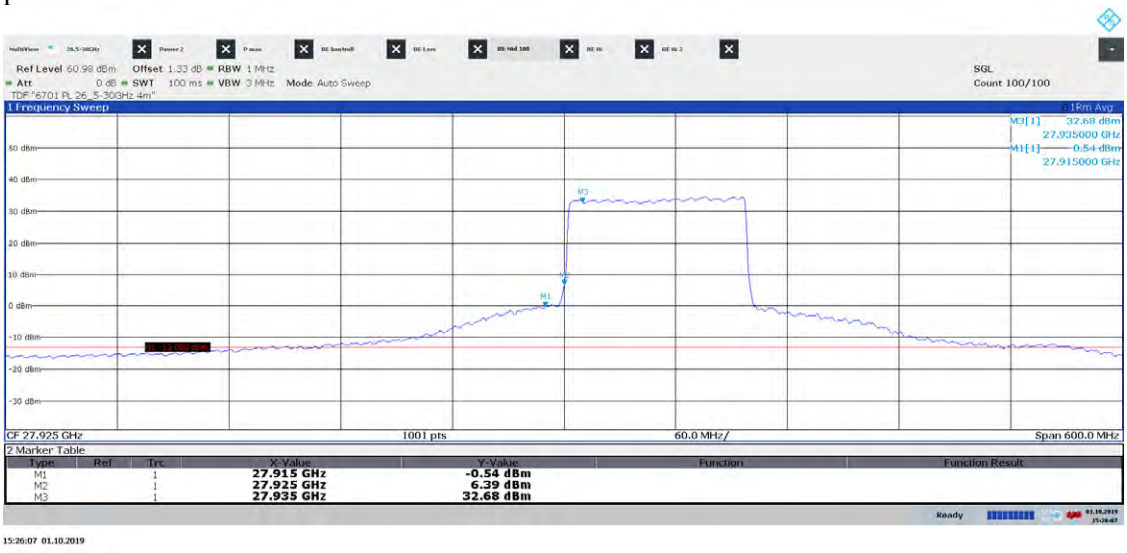
Diagram 21b: Pre scan 27.625 – 28.225 GHz, Symbolic name: BH_{100}, EIRP Vertical polarization



15:26:07 01.10.2019

Power EIRP for 27.925 GHz Hor/ Ver [dBm]	Power EIRP for 27.915 GHz Hor/ Ver [dBm]	Antenna Gain Hor/ Ver [dBi]	Total conducted power/BW for 27.925 GHz (Limit -5 dBm) [dBm]/ Verdict	Total conducted power/BW for 27.915 GHz (Limit -13 dBm) [dBm]/ Verdict
6.64/ 6.39	-0.19/ -0.54	28.9/ 29	-19.42/ Pass	-26.30/ Pass

Diagram 22a: Pre scan 26.5 – 30.0 GHz, Symbolic name: TH_{100}, EIRP Horizontal polarization
See diagram 22e for TRP result

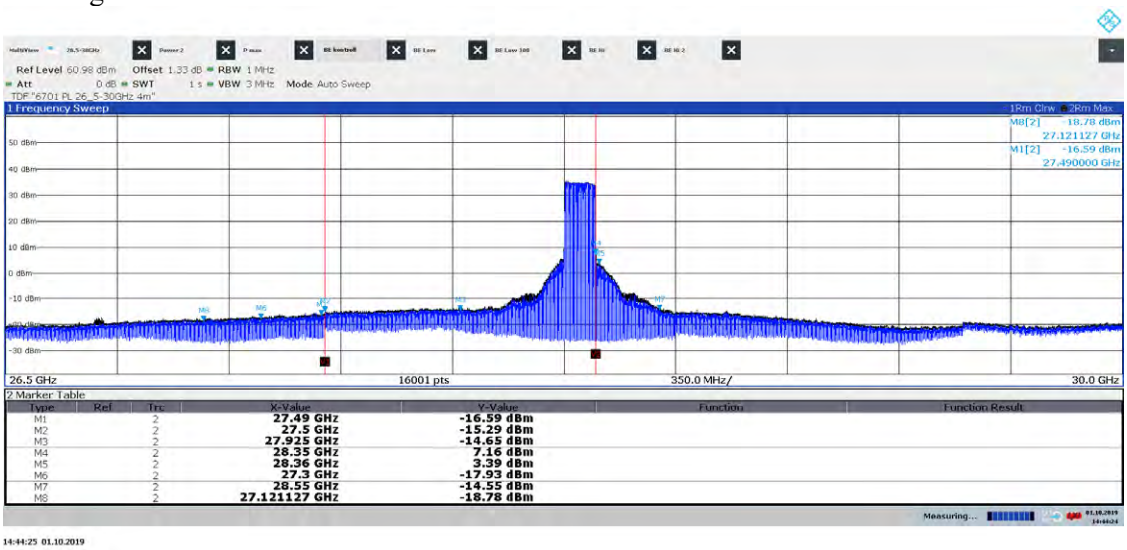


Diagram 22b: Pre scan 26.5 – 30.0 GHz, Symbolic name: TH_{100}, EIRP Vertical polarization
See diagram 22e for TRP result

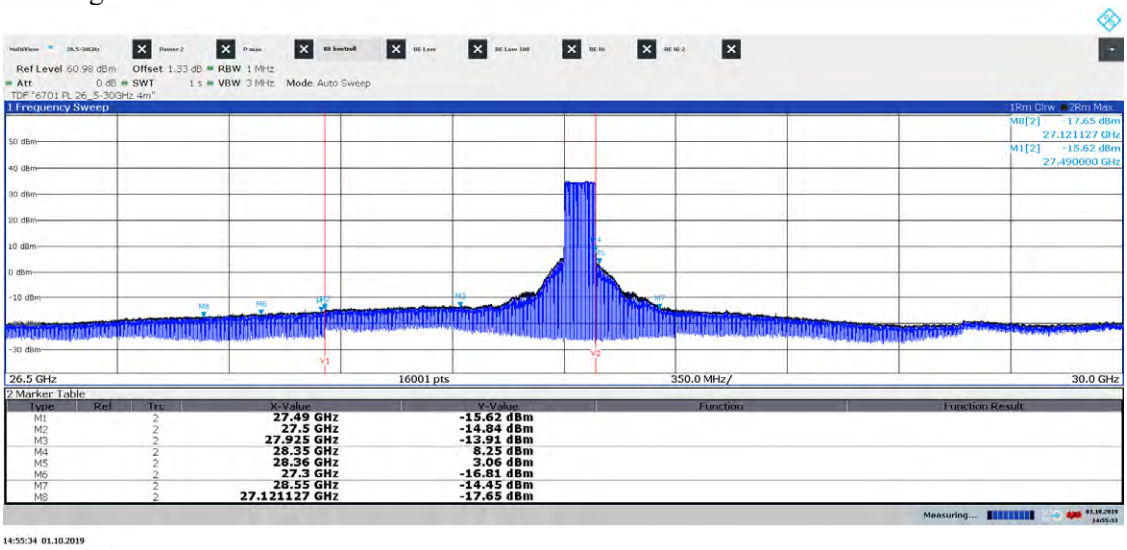


Diagram 22c: Pre scan 28.34 – 28.85 GHz, Symbolic name: TH_{100}, EIRP Horizontal polarization
See diagram 22e for TRP result

Diagram 22d: Pre scan 28.34 – 28.85 GHz, Symbolic name: TH_{100}, EIRP Vertical polarization
See diagram 22e for TRP result

Power EIRP for 28.35 GHz Hor/ Ver [dBm]	Power EIRP for 28.36 GHz Hor/ Ver [dBm]	Antenna Gain Hor/ Ver [dBi]	Total conducted power/BW for 28.35 GHz (Limit -5 dBm) [dBm]/ Verdict	Total conducted power/BW for 28.36 GHz (Limit -13 dBm) [dBm]/ Verdict
4.87/ 5.01	-0.85/ -1.77	28.91/ 29.11	-21.06/ Pass	-27.26/ Pass

Diagram 22e: Pattern multiplication TRP 28.35 – 28.55 GHz, Symbolic name: TH_{100}

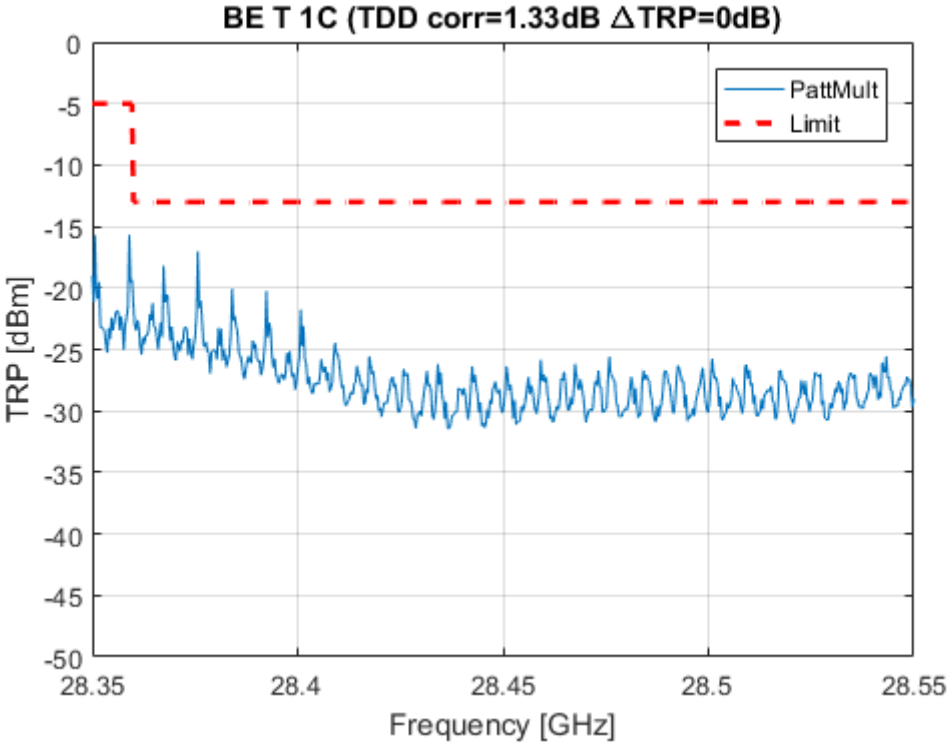


Diagram 23a: Pre scan 28.34 – 28.85 GHz, Symbolic name: $TH3_{100}$, EIRP Horizontal polarization
See diagram 23c for TRP result

Diagram 23b: Pre scan 28.34 – 28.85 GHz, Symbolic name: $TH3_{100}$, EIRP Vertical polarization
See diagram 23c for TRP result

Power EIRP for 28.35 GHz Hor/ Ver [dBm]	Power EIRP for 28.36 GHz Hor/ Ver [dBm]	Antenna Gain Hor/ Ver [dBi]	Total conducted power/BW for 28.35 GHz (Limit -5 dBm) [dBm]/ Verdict	Total conducted power/BW for 28.36 GHz (Limit -13 dBm) [dBm]/ Verdict
1.82/ 1.24	-4.51/ -3.17	28.91/ 29.11	-24.45/ Pass	-29.80/ Pass

Diagram 23c: Pattern multiplication TRP 28.35 – 28.85 GHz, Symbolic name: $TH3_{100}$

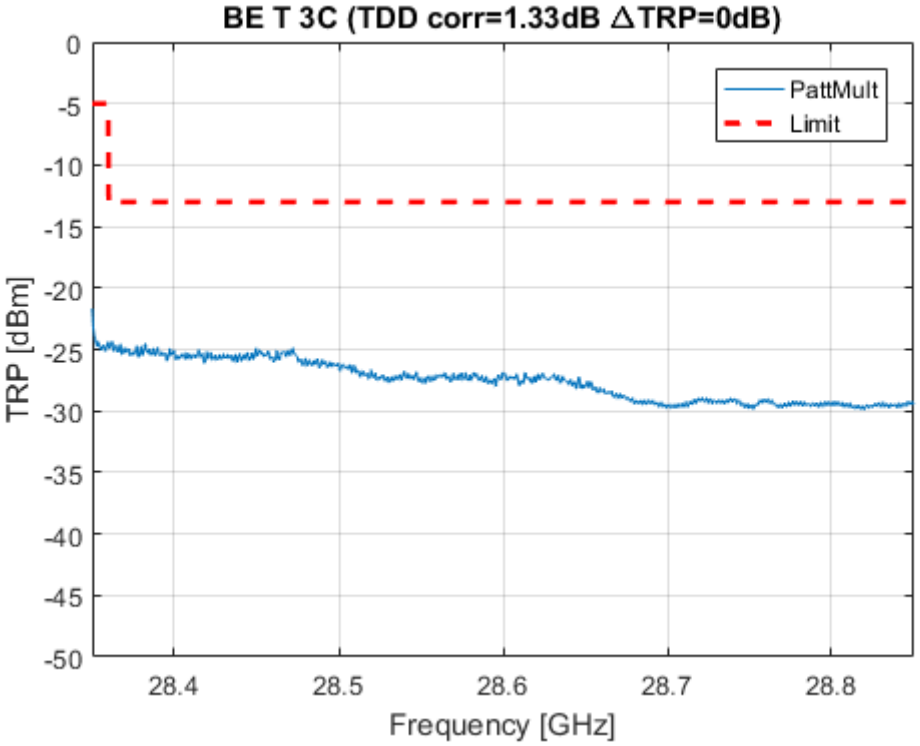


Diagram 24a: Pre scan 30 – 40 GHz, Symbolic name: BL_{100}, EIRP Horizontal polarization
See diagram 24c for TRP result

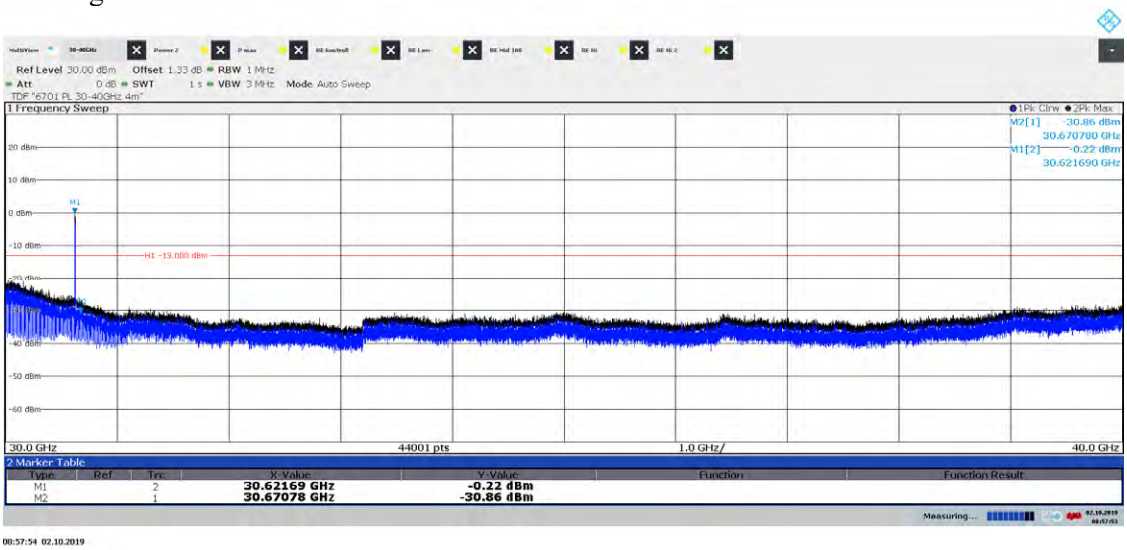


Diagram 24b: Pre scan 30 – 40 GHz, Symbolic name: BL_{100}, EIRP Vertical polarization
See diagram 10c for TRP result

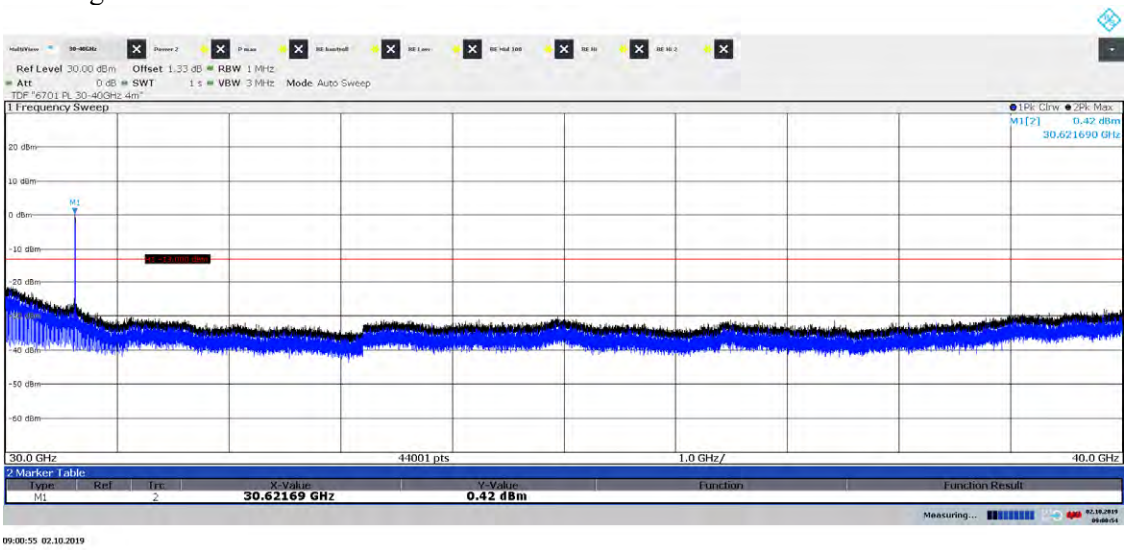


Diagram 24c: Two cut TRP 30.57 – 30.67 GHz 6x LO, Symbolic name: BL_{100}

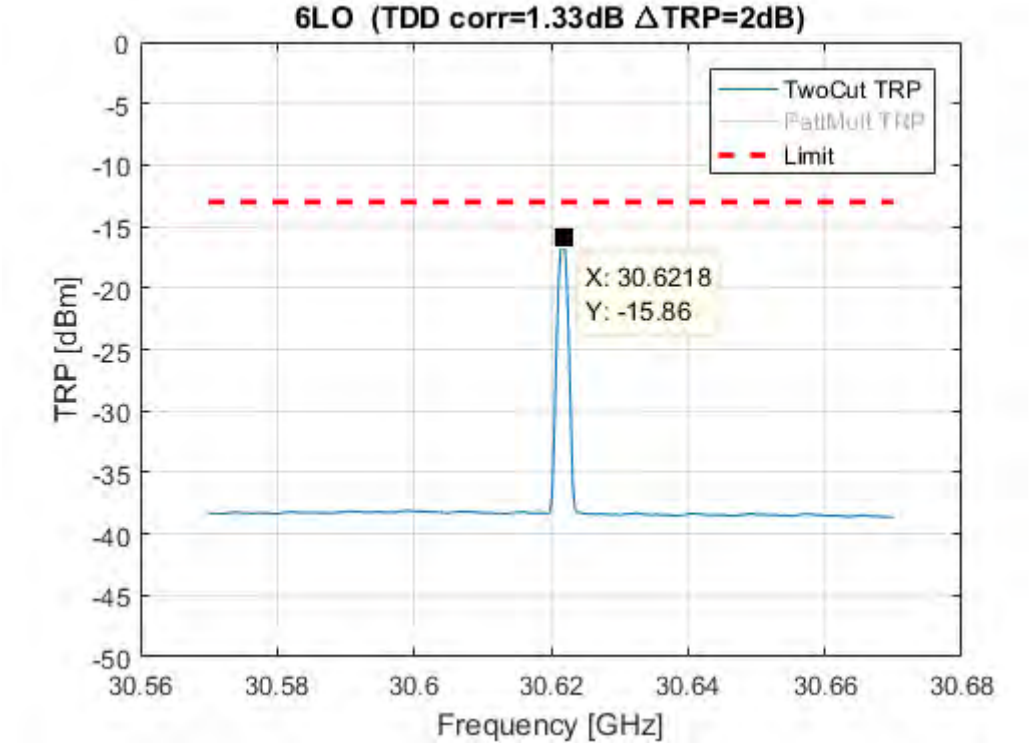


Diagram 25a: Pre scan 40 – 60 GHz, Symbolic name: BL_{100}, EIRP Horizontal polarization

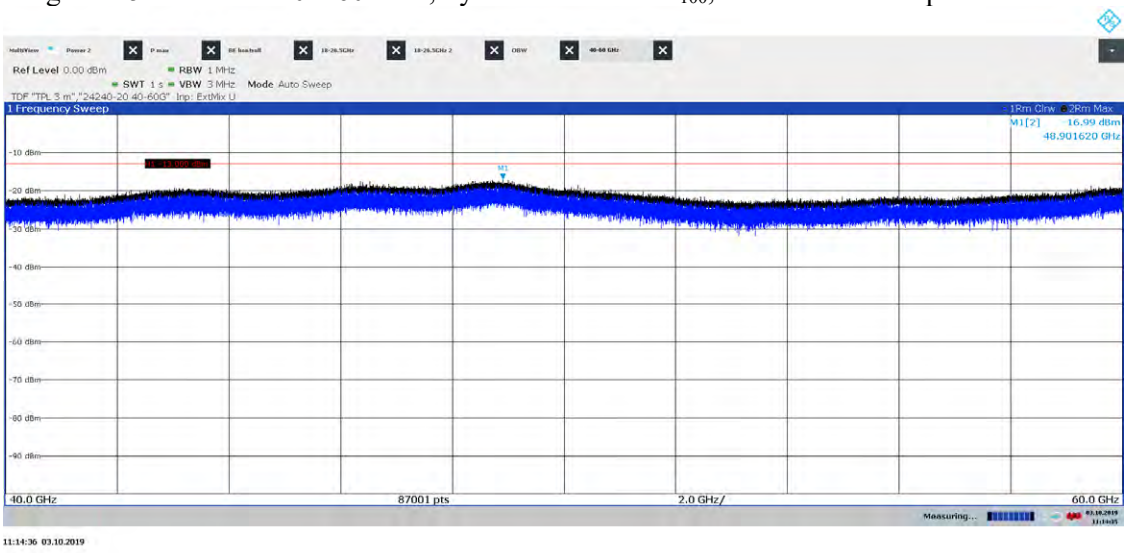


Diagram 25b: Pre scan 40 – 60 GHz, Symbolic name: BL_{100}, EIRP Vertical polarization

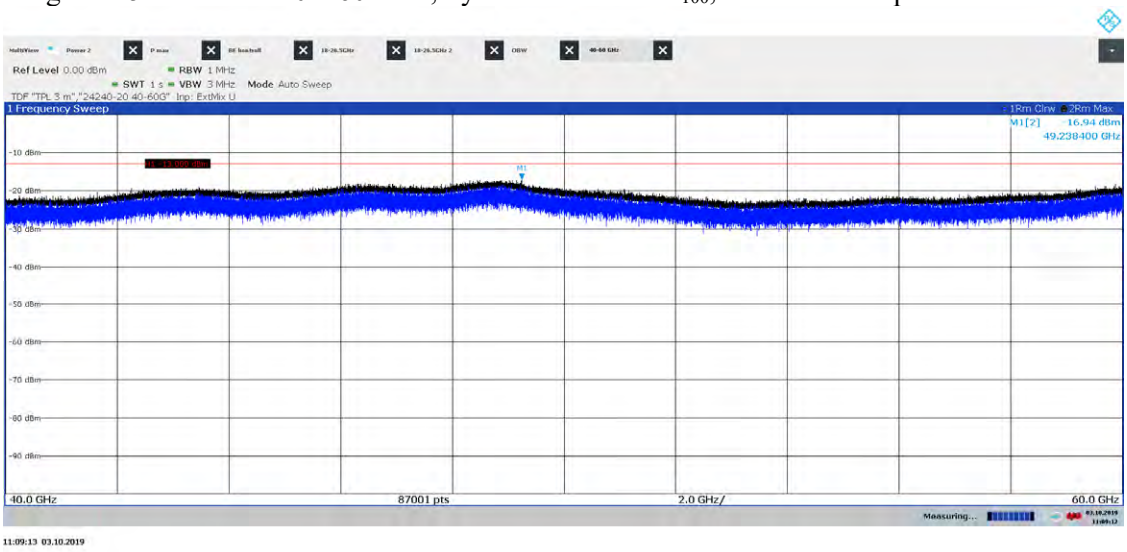


Diagram 26a: Pre scan 60 – 80 GHz, Symbolic name: BL_{100}, EIRP Horizontal polarization

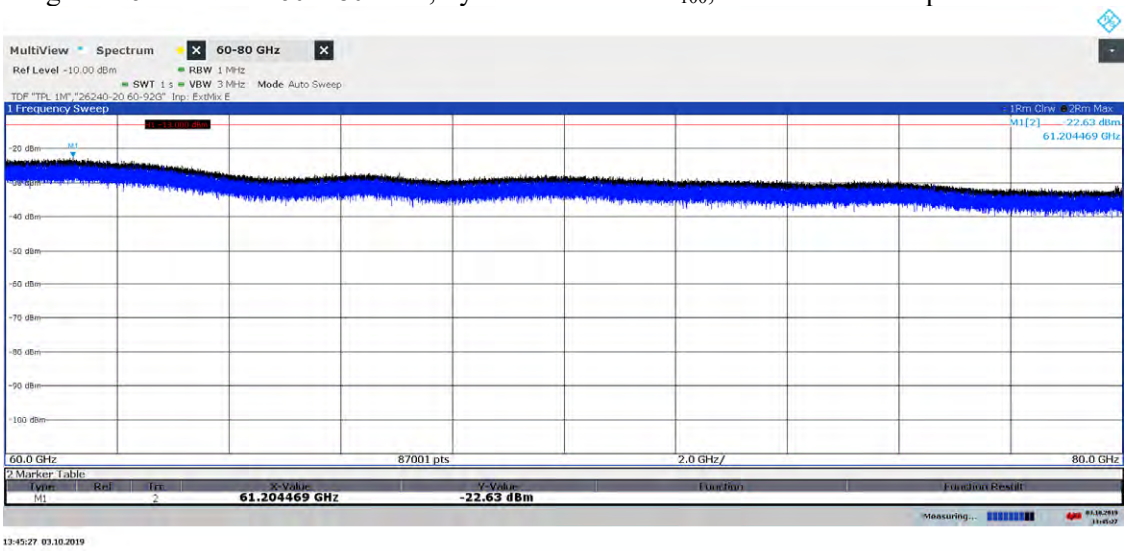


Diagram 27b: Pre scan 60 – 80 GHz, Symbolic name: BL_{100}, EIRP Vertical polarization

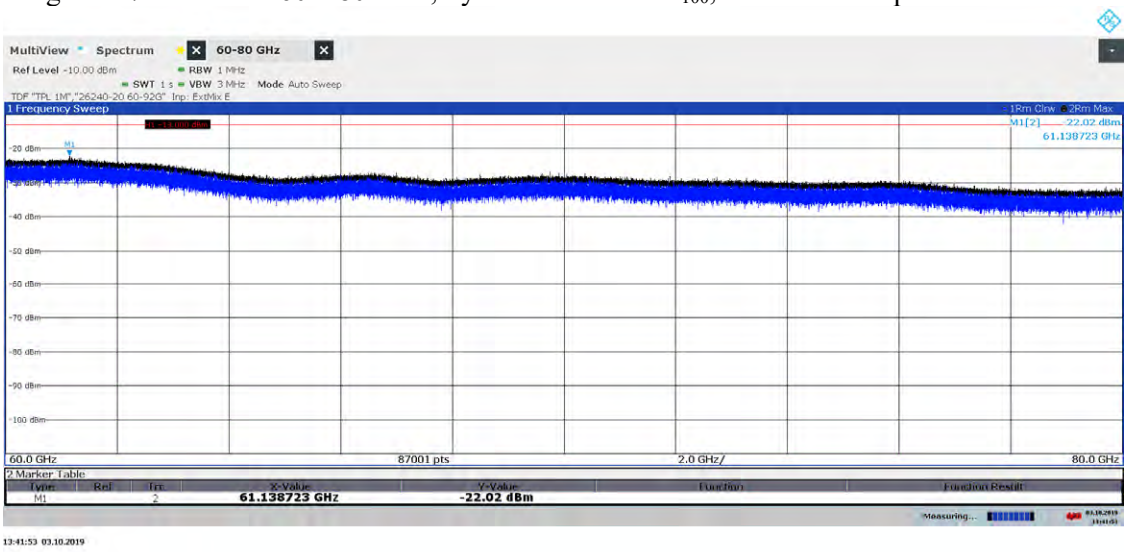


Diagram 28a: Pre scan 80 – 100 GHz, Symbolic name: BL_{100}, EIRP Horizontal polarization

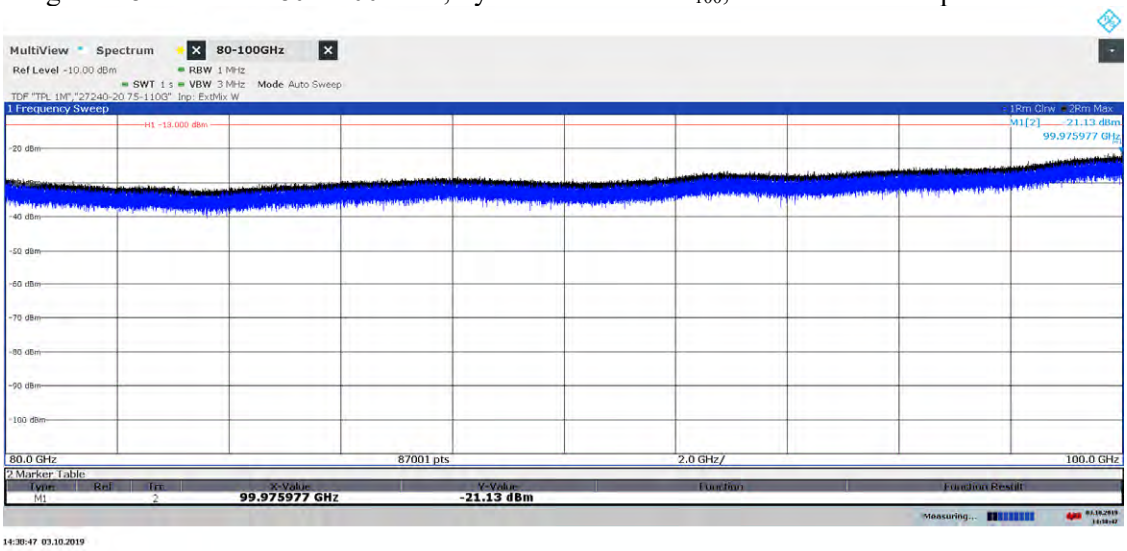
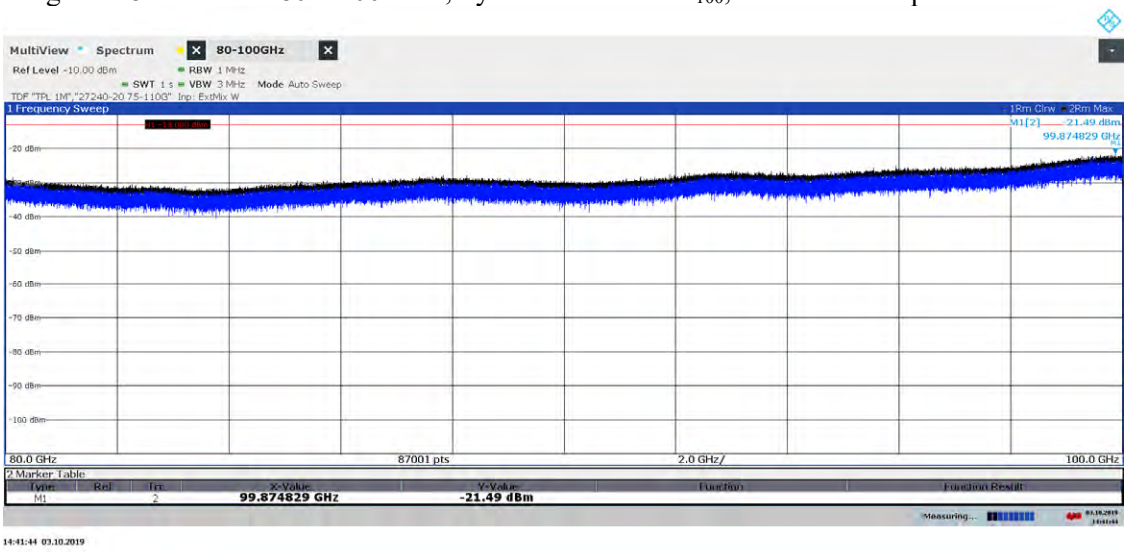


Diagram 28b: Pre scan 80 – 100 GHz, Symbolic name: BL_{100}, EIRP Vertical polarization



Frequency stability measurements according to 47 CFR §2.1055

Date	Temperature (test equipment)	Humidity (test equipment)
2022-07-11	23 °C ± 3 °C	46 % ± 5 %
2022-07-12	22 °C ± 3 °C	49 % ± 5 %
2022-07-13	23 °C ± 3 °C	48 % ± 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_{100}) with a bandwidth of 100 MHz.

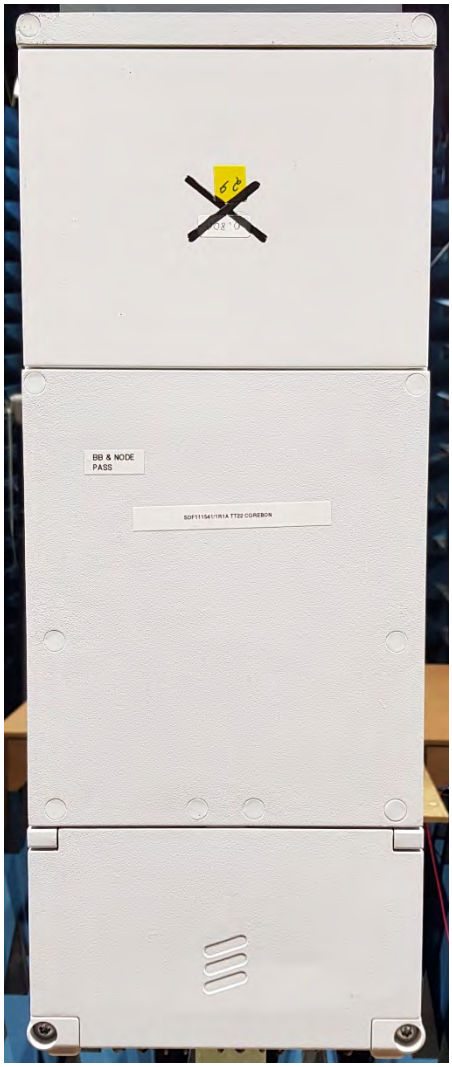
Test conditions		Frequency error (Hz)
Supply voltage AC (V)	Temp. (°C)	
102	+20	+80
138	+20	+78
120	+20	+89
120	+30	-77
120	+40	+68
120	+50	-59
120	+10	+88
120	0	+55
120	-10	-66
120	-20	-77
120	-30	+46
Maximum freq. error (Hz)		89
Measurement uncertainty		$< \pm 1 \times 10^{-7}$

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 KRK 101 01/1:

Bottom side:

Top side

Left side

Right side