

## TEST REPORT

Test report no.: 1-7524/14-01-04-A



Deutsche  
Akkreditierungsstelle  
D-PL-12076-01-01

### Testing laboratory

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**Accredited Testing Laboratory:**

The testing laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025 (2005) by the Deutsche Akkreditierungsstelle GmbH (DAkkS)

The accreditation is valid for the scope of testing procedures as stated in the accreditation certificate with the registration number: D-PL-12076-01-01

Area of Testing:

Radio Communications & EMC (RCE)

### Applicant

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### Manufacturer

**pragmaSol GmbH**

Schulhausgasse 12

3113 Rubigen / SWITZERLAND

### Test standard/s

47 CFR Part 90

Subpart F - Radiolocation Service

RSS – 210 Issue 8

Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment

RSS – Gen Issue 3

General Requirements and Information for the Certification of Radio Apparatus

For further applied test standards please refer to section 3 of this test report.

### Test Item

**Kind of test item:** Radar System 17.1 GHz – 17.3 GHz  
**Model name:** Gamma GPRI-II-2 Radar 17.1 – 17.3 GHz  
**FCC ID:** Y3Z-GRPIII2  
**IC:** 9410A-GPRIII2  
**Frequency:** 17.1 – 17.3 GHz  
**Antenna:** End fed slotted array antenna  
**Power supply:** 100 – 240 V AC, 50 / 60 Hz  
**Temperature range:** -30 °C to +50 °C



This test report is electronically signed and valid without handwriting signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

### Test performed:

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## 2 General information

### 2.1 Notes

The test results of this test report relate exclusively to the test item specified in this test report. CETECOM ICT Services GmbH does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of CETECOM ICT Services GmbH.

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In no case this test report can be considered as a Letter of Approval.

This test report is electronically signed and valid without handwritten signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

### 2.2 Application details

|                                    |                  |
|------------------------------------|------------------|
| Date of receipt of order:          | 2014-01-24       |
| Date of receipt of test item:      | 2014-02-10       |
| Start of test:                     | 2014-02-10       |
| End of test:                       | 2014-02-20       |
| Person(s) present during the test: | Mr. Andreas Kurz |

## 3 Test standard/s

| Test standard     | Version | Test standard description                                                        |
|-------------------|---------|----------------------------------------------------------------------------------|
| 47 CFR Part 90    | 2013-10 | Subpart F - Radiolocation Service                                                |
| RSS – 210 Issue 8 | 2010-12 | Licence-exempt Radio Apparatus (All Frequency Bands):<br>Category I Equipment    |
| RSS – Gen Issue 3 | 2010-12 | General Requirements and Information for the Certification of<br>Radio Apparatus |

#### 4 Test environment

|                    |           |                                       |
|--------------------|-----------|---------------------------------------|
| Temperature:       | $T_{nom}$ | +22 °C during room temperature tests  |
|                    | $T_{max}$ | +50 °C during high temperature test   |
|                    | $T_{min}$ | -30 °C during low temperature test    |
| Relative humidity: |           | 45 %                                  |
| Air pressure:      |           | not relevant for this kind of testing |
| Power supply:      | $V_{nom}$ | 100-240 V AC                          |
|                    | $V_{max}$ | 97 V AC                               |
|                    | $V_{min}$ | 127 V AC                              |

## 5 Test item

### 5.1 General Description

|                       |                                       |
|-----------------------|---------------------------------------|
| Kind of test item:    | Radar System 17.1 GHz – 17.3 GHz      |
| Type identification:  | Gamma GPRI-II-2 Radar 17.1 – 17.3 GHz |
| S/N serial number:    | see table below                       |
| HW hardware status:   | -/-                                   |
| SW software status:   | -/-                                   |
| Frequency band [MHz]: | 17.1 - 17.3 GHz                       |
| Type of modulation:   | FMCW                                  |
| Number of channels:   | -/-                                   |
| Emission designator   | 199M5F0N                              |
| Antenna:              | end fed slotted array antenna         |
| Power supply:         | 100 – 240 V AC, 50 / 60 Hz            |
| Temperature range:    | -30 °C to +50 °C                      |

### 5.2 List of components

| No. | Component             | Manufacturer              | Type                     | S/No    |
|-----|-----------------------|---------------------------|--------------------------|---------|
| 1   | control unit          | Gamma Remote Sensing      | GPRI-II-2 (control unit) | 001     |
| 2   | RF-unit / transceiver | Gamma Remote Sensing      | GPRI-II-2 (RF-unit)      | 002     |
| 3   | antenna               | Cobham Technical Services | ANT0235-0100-ICD:        | 9516/12 |
| 4   | antenna               | Cobham Technical Services | ANT0235-0100-ICD:        | 9517/12 |
| 5   | antenna               | Cobham Technical Services | ANT0235-0100-ICD:        | 9518/12 |

### 5.3 Additional information

Test setup- and EUT-photos are included in test report:

1-7524/14-01-04\_AnnexA  
 1-7524/14-01-04\_AnnexB  
 1-7524/14-01-04\_AnnexD

## 6 Test laboratories sub-contracted

None

## 7 Summary of measurement results



No deviations from the technical specifications were ascertained



There were deviations from the technical specifications ascertained

| TC Identifier | Description                                    | Verdict | Date       | Remark |
|---------------|------------------------------------------------|---------|------------|--------|
| RF-Testing    | 47 CFR Part 2<br>47 CFR Part 90 – F<br>RSS-210 | Passed  | 2014-09-11 | -/-    |

| Test Specification Clause                                | Test Case                                                                                       | Temperature / Voltage                  | Pass                                | Fail                     | NA                       | NP                       | Results (max.)          |
|----------------------------------------------------------|-------------------------------------------------------------------------------------------------|----------------------------------------|-------------------------------------|--------------------------|--------------------------|--------------------------|-------------------------|
| FCC 47 CFR § 2.1046<br>§ 90.205 (r)<br>RSS-210<br>A.2.10 | Measurements required: RF power output / Power limits (conducted/radiated)                      | nominal / nominal                      | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | 22 dBm / 55 dBm (chirp) |
| FCC 47 CFR § 2.1049<br>RSS-Gen<br>§ 4.6.1                | Measurements required: Occupied bandwidth                                                       | nominal / nominal                      | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | 199.5 MHz               |
| § 1.1310                                                 | MPE Calculation                                                                                 | nominal / nominal                      | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | complies                |
| FCC 47 CFR § 2.1051<br>§ 90.210                          | Measurements required: Spurious emissions at antenna terminals / Emission mask                  | nominal / nominal                      | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | complies                |
| FCC 47 CFR § 2.1051<br>§ 90.210<br>RSS-Gen<br>§ 4.9      | Measurements required: Spurious emissions at antenna terminals / Spurious emissions (conducted) | nominal / nominal                      | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | complies                |
| FCC 47 CFR § 2.1053<br>§ 90.210<br>RSS-Gen<br>§ 4.9      | Measurements required: Field strength of spurious radiation / Spurious emissions (radiated)     | nominal / nominal                      | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | complies                |
| RSS-Gen<br>§ 4.10                                        | Receiver Spurious Emissions                                                                     | nominal / nominal                      | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | complies                |
| FCC 47 CFR § 2.1055<br>§ 90.213<br>RSS-Gen<br>§ 4.7      | Measurements required: Frequency stability                                                      | extreme / nominal<br>nominal / extreme | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | -60 Hz                  |

**Note:** NA = Not Applicable; NP = Not Performed

## 8 RF measurement testing

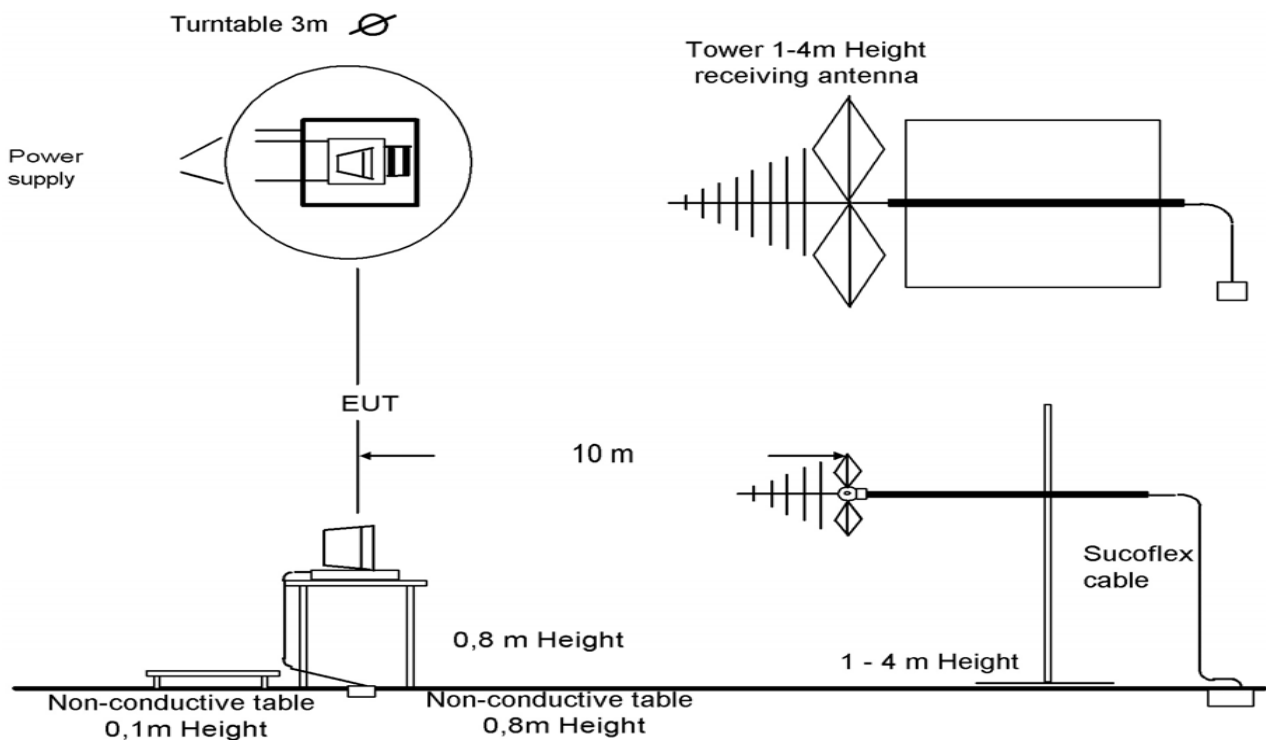
### 8.1 Description of test setup

#### 8.1.1 Radiated measurements

The radiated measurements are performed in vertical and horizontal plane in the frequency range from 9 kHz to 25 GHz in semi-anechoic chambers. The EUT is positioned on a non-conductive support with a height of 0.80 m above a conductive ground plane that covers the whole chamber. The receiving antennas are confirmed with specifications ANSI C63.2-1996 clause 15 and ANSI C63.4-2009 clause 4.1.5. These antennas can be moved over the height range between 1.0 m and 4.0 m in order to search for maximum field strength emitted from EUT. The measurement distances between EUT and receiving antennas are indicated in the test setups for the various frequency ranges. For each measurement, the EUT is rotated in all three axes until the maximum field strength is received. The wanted and unwanted emissions are received by spectrum analyzers where the detector modes and resolution bandwidths over various frequency ranges are set according to requirement ANSI C63-4-2009 clause 4.2.

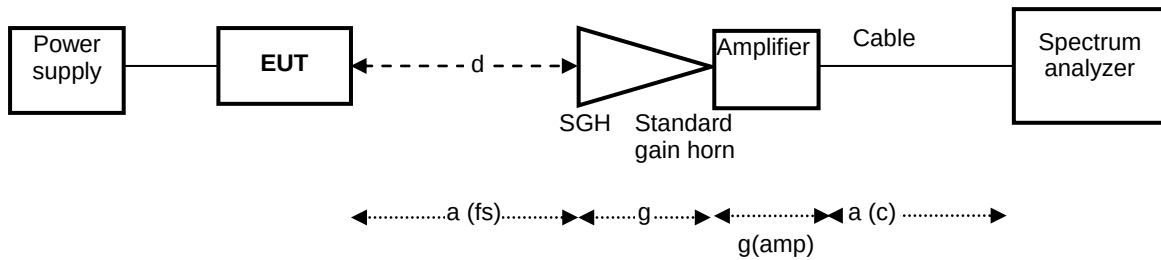
Antennas are confirmed with ANSI C63.2-1996 item 15.

Semi anechoic chamber



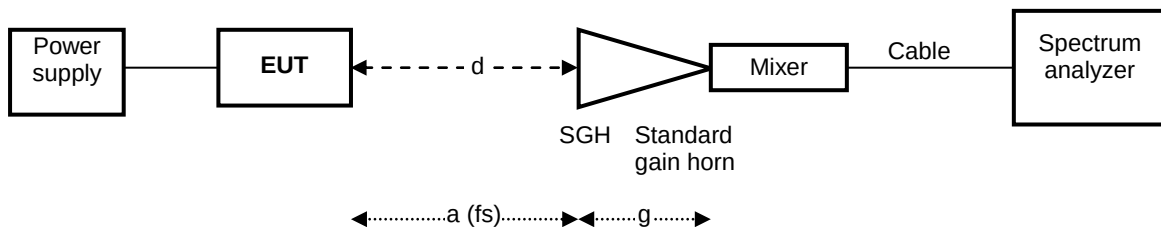
Picture 1: Diagram radiated measurements (Up to 12 GHz)

Test set-up for the measurement of spurious radiation in the frequency range 12 GHz to 50 GHz:



Picture 2: Diagram radiated measurements (12 GHz – 50 GHz)

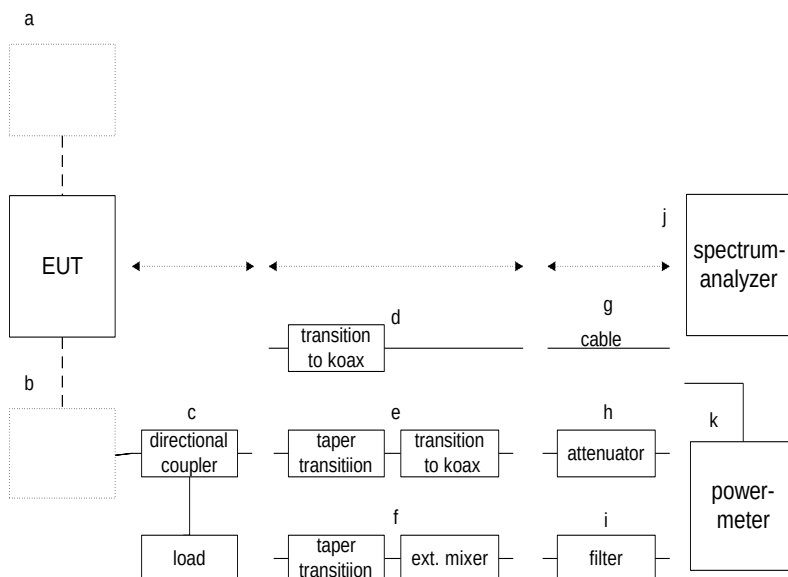
Test set-up for the measurement of spurious radiation and EIRP in the frequency range above 50 GHz:



Picture 3: Diagram radiated measurements (Above 50 GHz)

### 8.1.2 Conducted measurements

The EUT's RF signal is coupled out by the antenna connector which is supplied by the manufacturer. The signal is first 10dB attenuated before it is fed to the spectrum analyzer. The specific loss is first checked within a calibration. The measurement readings on the spectrum analyzer are corrected by the specific test set-up loss. The attenuator, cables and the spectrum analyzer are impedance matched on 50 Ohm.



Picture 4: Diagram conducted measurements

## 8.2 Additional comments

Reference documents:       None

Special test descriptions:   None

Configuration descriptions:   None

## 9 Measurement results

### 9.1 Conducted / radiated peak output power (EIRP)

#### Conducted measurements:

The EUT was set for low, mid, high channel and normal operation (chirp) and highest RF output power. The spectrum analyzer was connected to the EUT's antenna terminal.

| Measurement parameters |                  |
|------------------------|------------------|
| Detector:              | Peak             |
| Sweep time:            | Auto             |
| Resolution bandwidth:  | 1 MHz            |
| Video bandwidth:       | 1 MHz            |
| Span:                  | 20 MHz / 250 MHz |
| Trace-Mode:            | Max. hold        |

#### Limits:

| IC                                                                                                                          |
|-----------------------------------------------------------------------------------------------------------------------------|
| 300 mW / 24.8 dBm EIRP (Average)                                                                                            |
| FCC                                                                                                                         |
| 47 CFR § 2.1046 / § 90.205 (r)                                                                                              |
| Measurements required: RF output power / Power limits                                                                       |
| <i>All other frequency bands.</i><br>Requested transmitter power will be considered and authorized on a case by case basis. |

#### Result:

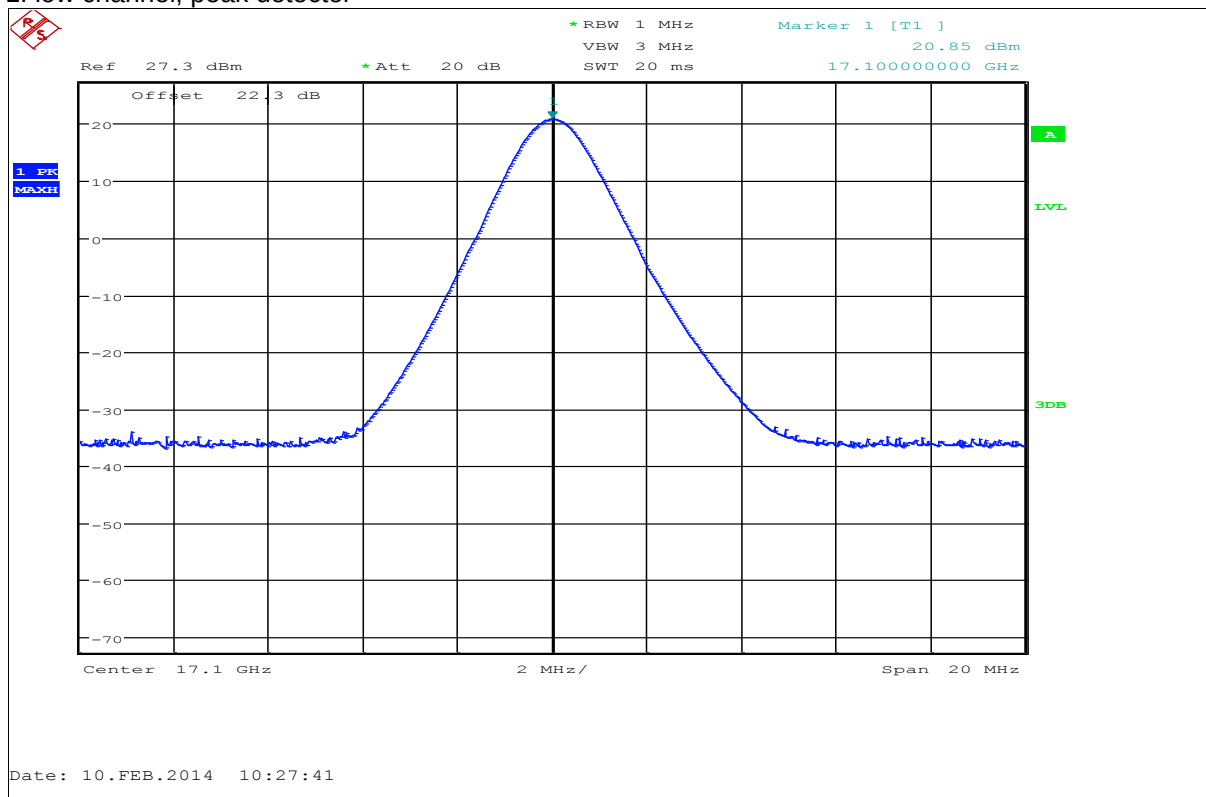
| Frequency (channel)     | Conducted output power | Radiated output power (EIRP) |
|-------------------------|------------------------|------------------------------|
| 17.1 GHz (low)          | 20.85 dBm (Peak)       | 53.85 dBm (Peak)             |
| 17.2 GHz (mid)          | 22.43 dBm (Peak)       | 55.43 dBm (Peak)             |
| 17.3 GHz (high)         | 21.55 dBm (Peak)       | 54.55 dBm (Peak)             |
| 17.1 - 17.3 GHz (chirp) | 22.00 dBm (Peak)       | 55.00 dBm (Peak)             |
| 17.1 - 17.3 GHz (chirp) | -18.43 dBm (Average)   | 14.57 dBm (Average)          |

Note: Radiated output power (EIRP) values are calculated, based on the conducted output power values plus an antenna gain of 33 dBi.

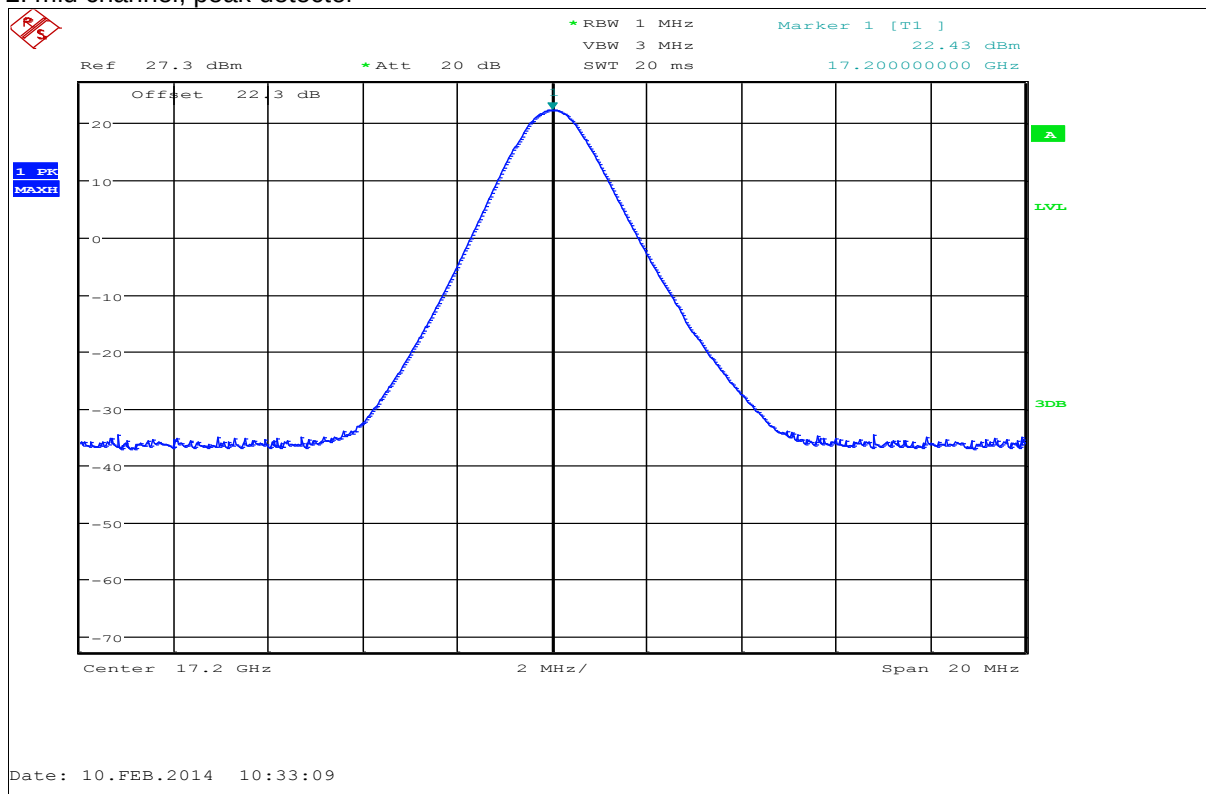
**Result: The measurement is passed.**

**Plots of the measurement:**

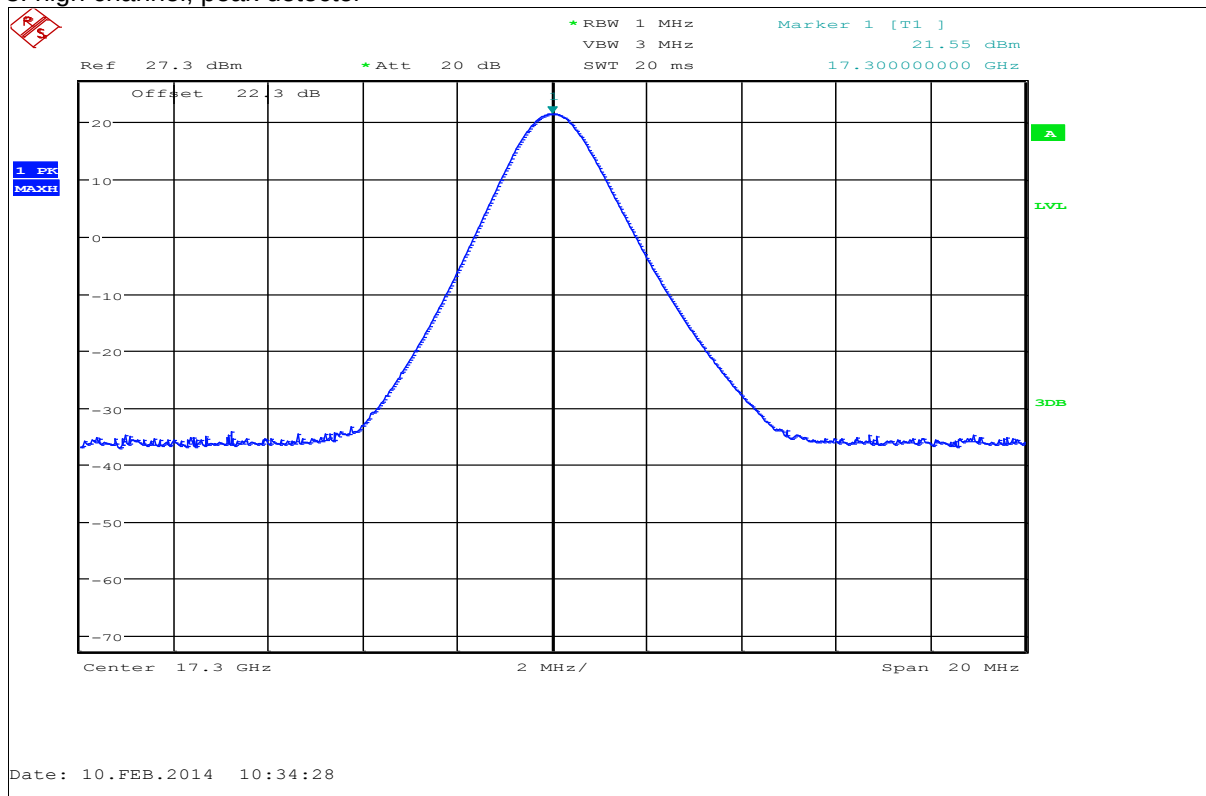
Plot 1: low channel, peak detector



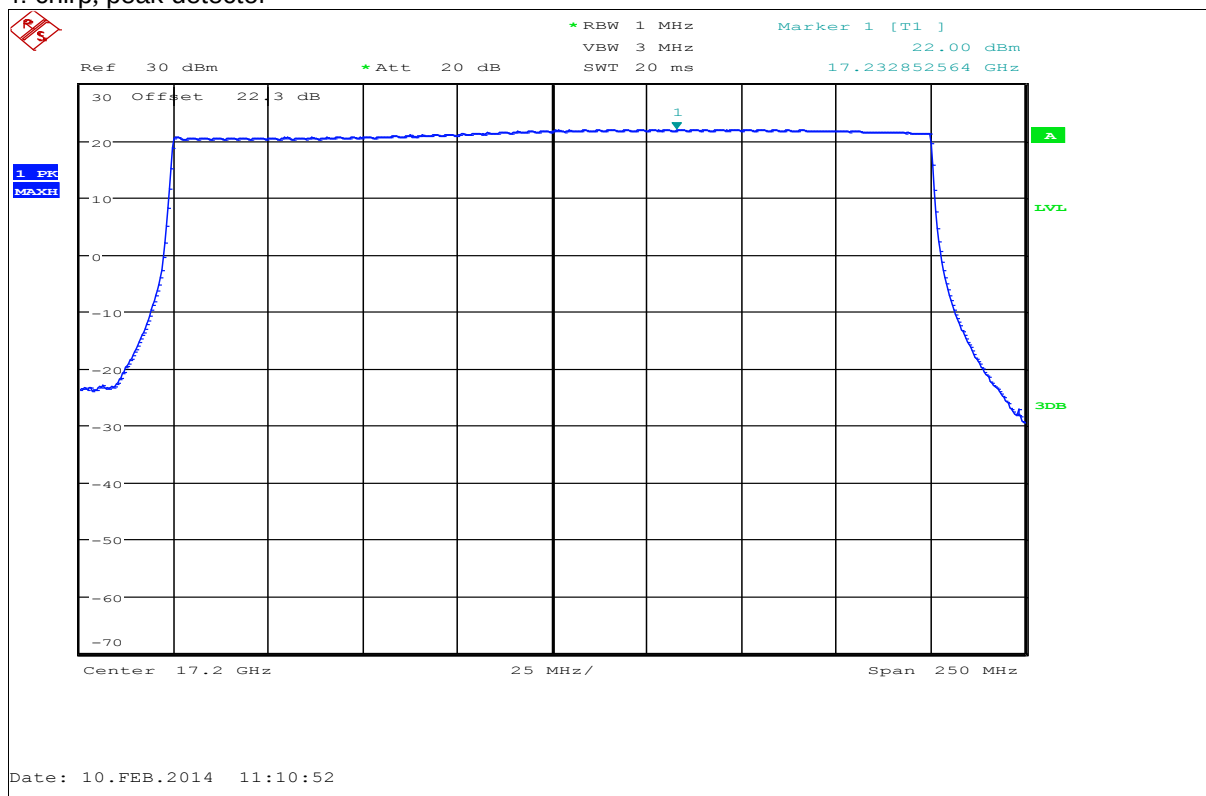
Plot 2: mid channel, peak detector



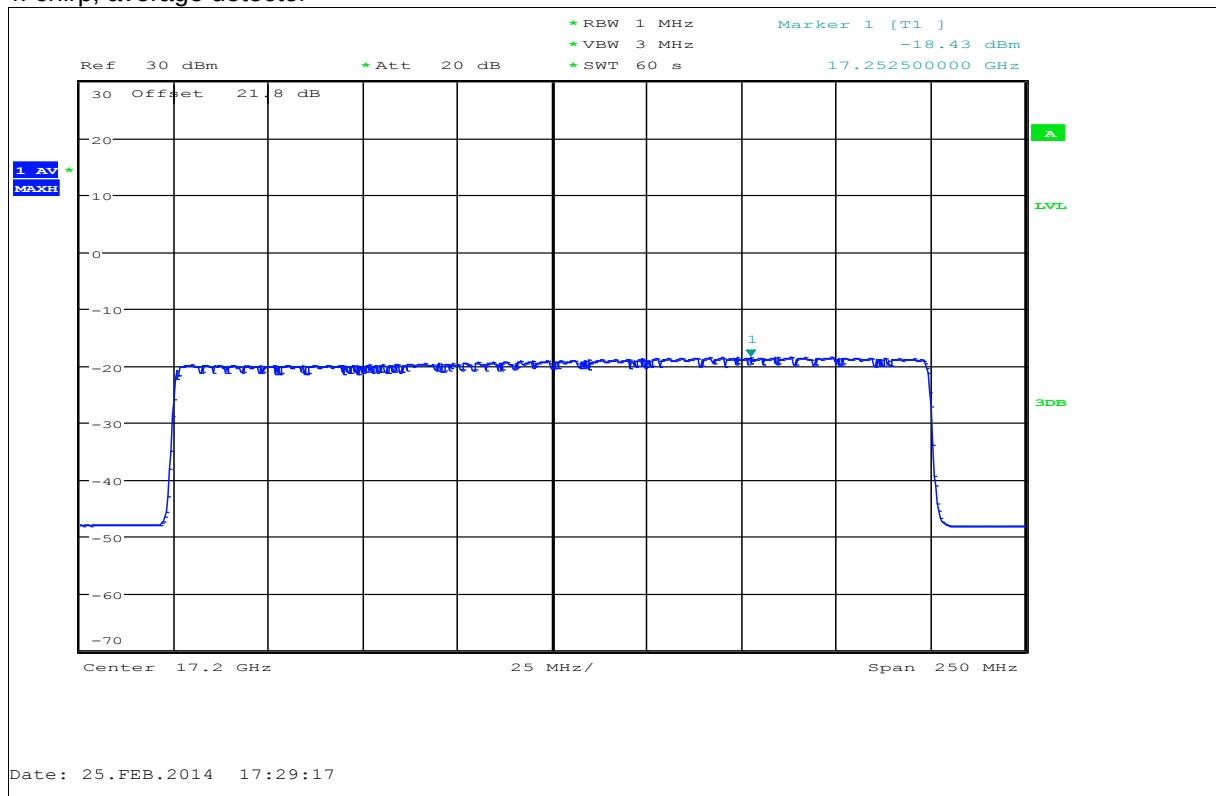
Plot 3: high channel, peak detector



Plot 4: chirp, peak detector



Plot 4: chirp, average detector



## 9.2 MPE calculation

These equations are generally accurate in the far field of an antenna but will over predict power density in the near field, where they could be used for making a “worst case” prediction.

$$S = PG/4\pi R^2$$

where S = power density ( in appropriate units, e.g. mW/cm<sup>2</sup>)  
P = power input to the antenna (in appropriate units e.g. mW)  
G = power gain of the antenna in the direction of interest relative to the isotropic radiator  
R = distance to the centre of radiation of the antenna (appropriate units e.g. cm)

Or

$$S = \text{EIRP}/4\pi R^2$$

where EIRP = equivalent isotropically radiated power

### Calculation:

(Calculated for mean EIRP)

EIRP: 14.6 dBm (28.8 mW)

calculated power density for 20cm distance:

$$S = 28.8 \text{ mW} / (4\pi * 20^2) = 0.0057 \text{ mW/cm}^2$$

Limit:

1mW/cm<sup>2</sup> is the reference level for general public exposure according to the OET Bulletin 65, Edition 97-01 Table 1.

### 9.3 Occupied bandwidth

#### Conducted measurements:

The EUT was set for low, mid, high channel and normal operation (chirp) and highest RF output power. The spectrum analyzer was connected to the EUT's antenna terminal.

| Measurement parameter |                  |
|-----------------------|------------------|
| Detector:             | Peak             |
| Sweep time:           | Auto             |
| Resolution bandwidth: | 1 MHz            |
| Video bandwidth:      | 1 MHz            |
| Span:                 | 20 MHz / 250 MHz |
| Trace-Mode:           | Max. hold        |

#### Limits:

| RSS-Gen                                                                                                                                                                                                                                                 |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Clause 4.6.1                                                                                                                                                                                                                                            |
| FCC                                                                                                                                                                                                                                                     |
| 47 CFR § 2.1049 (1)                                                                                                                                                                                                                                     |
| Measurements required: Occupied bandwidth                                                                                                                                                                                                               |
| The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured. |

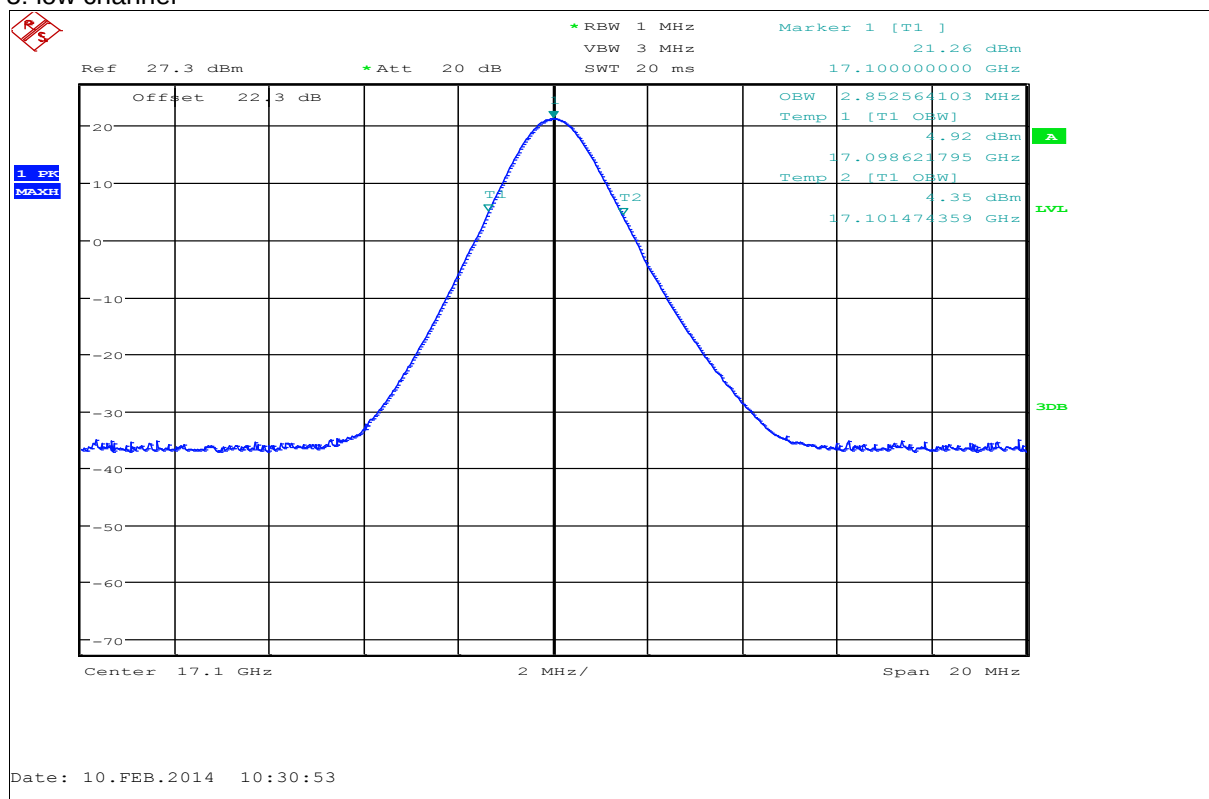
#### Result:

| Frequency (channel)     | Bandwidth |
|-------------------------|-----------|
| 17.1 GHz (low)          | 2.85 MHz  |
| 17.2 GHz (mid)          | 2.85 MHz  |
| 17.3 GHz (high)         | 2.82 MHz  |
| 17.1 - 17.3 GHz (chirp) | 199.5 MHz |

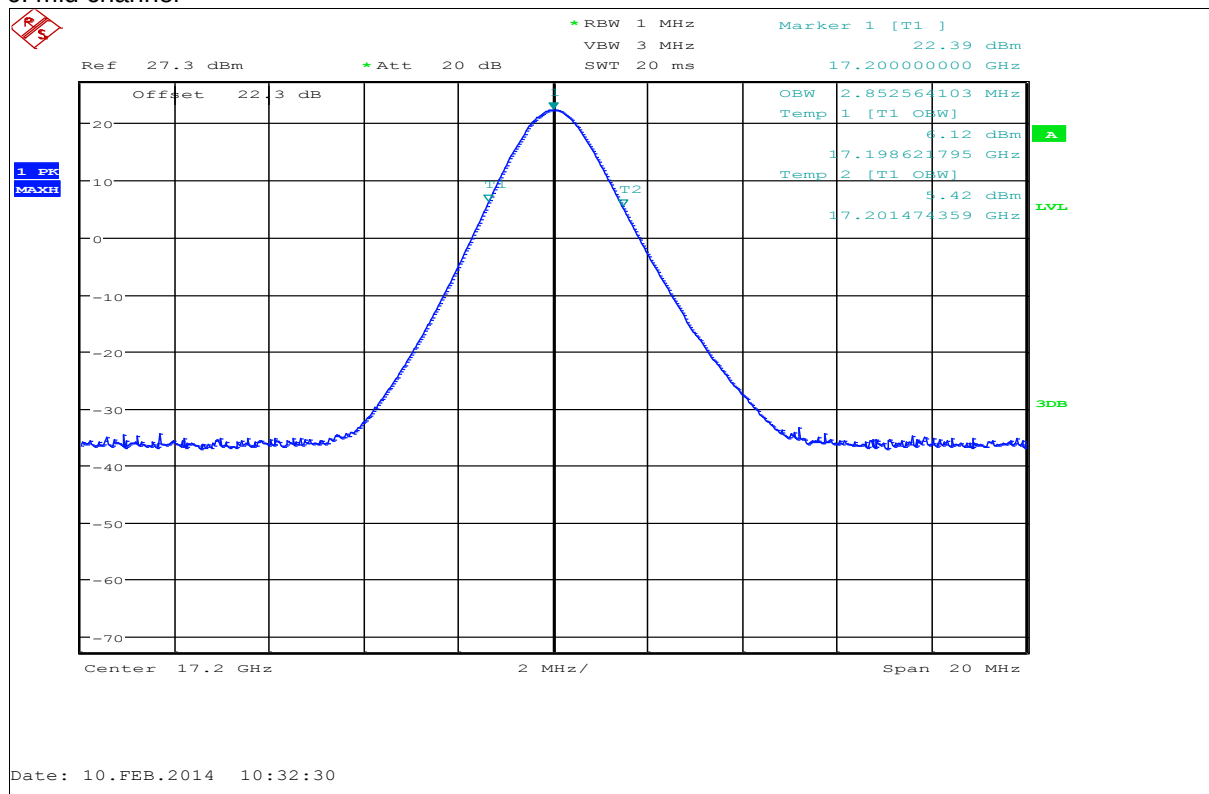
**Result:** The measurement is passed.

**Plots of the measurements**

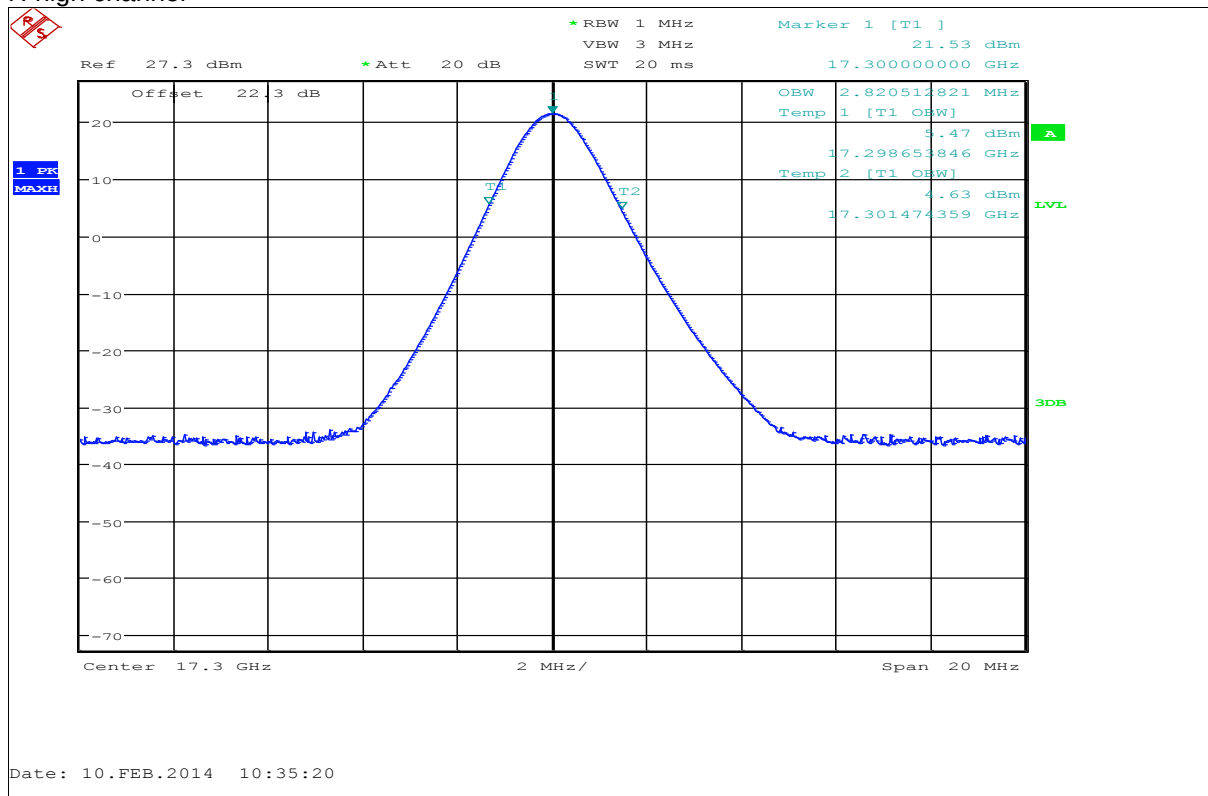
Plot 5: low channel



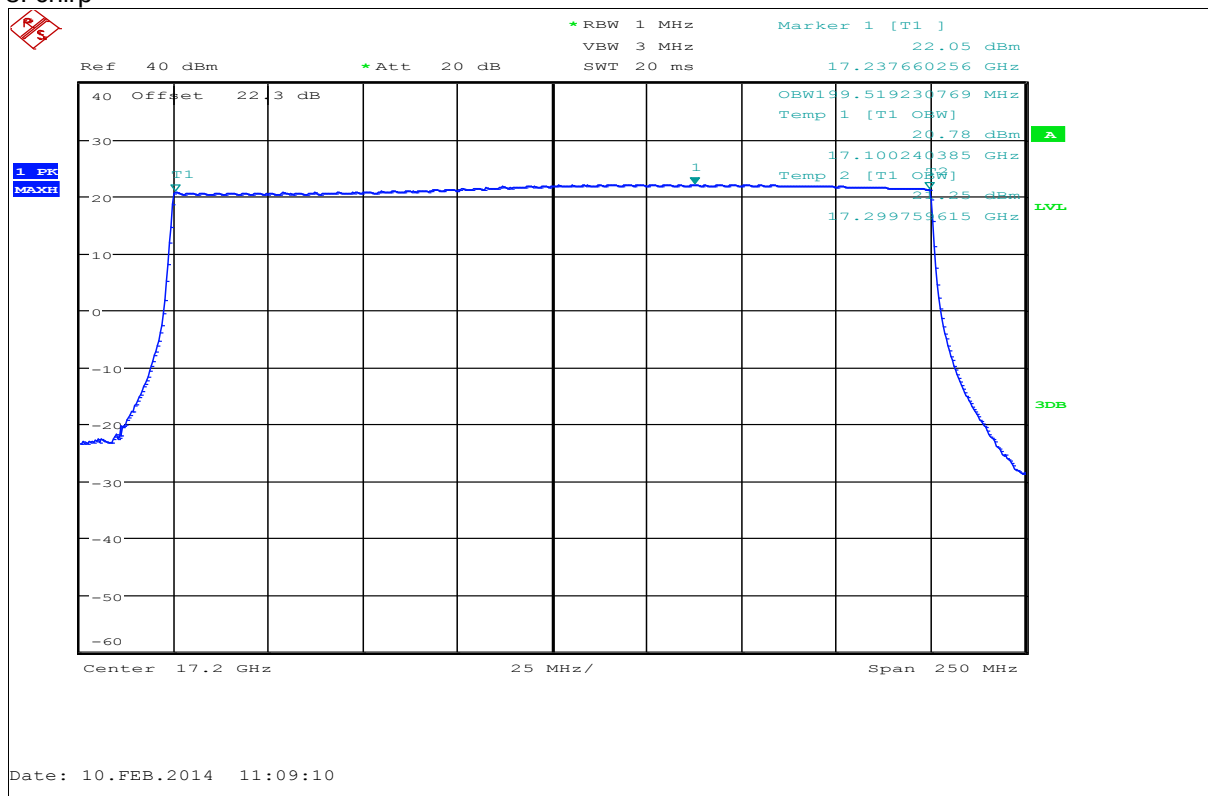
Plot 6: mid channel



Plot 7: high channel



Plot 8: chirp



## 9.4 Spurious emissions (emission mask)

### Conducted measurements:

The EUT was set for low, mid, high channel and highest RF output power. The spectrum analyzer was connected to the EUT's antenna terminal.

| Measurement parameter |           |
|-----------------------|-----------|
| Detector:             | Peak      |
| Sweep time:           | Auto      |
| Resolution bandwidth: | 100 kHz   |
| Video bandwidth:      | 1 MHz     |
| Span:                 | 14 MHz    |
| Trace-Mode:           | Max. hold |

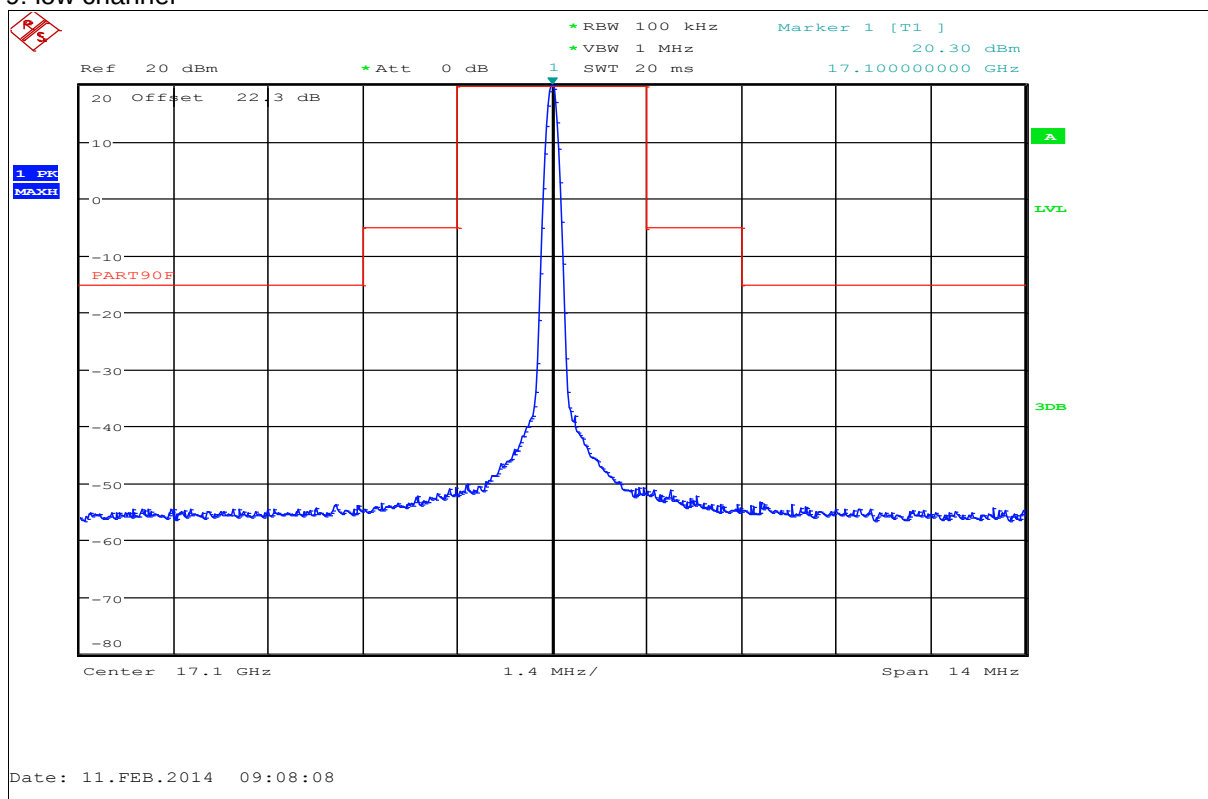
### Limits:

| FCC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 47 CFR §2.1051 / § 90.210 (b) (n)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Measurements required: Spurious emissions at antenna terminals / Emission mask                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <p>(b) <i>Emission Mask B.</i><br/> For transmitters that are equipped with an audio lowpass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as follows:</p> <p>(1) On any frequency removed from the assigned frequency by more than 50 percent, but not more than 100 percent of the authorized bandwidth: At least 25 dB.</p> <p>(2) On any frequency removed from the assigned frequency by more than 100 percent, but not more than 250 percent of the authorized bandwidth: At least 35 dB.</p> <p>(3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least <math>43 + 10 \log (P)</math> dB.</p> <p>(n) <i>Other frequency bands.</i> Transmitters designed for operation under this part on frequencies other than listed in this section must meet the emission mask requirements of Emission Mask B.</p> |

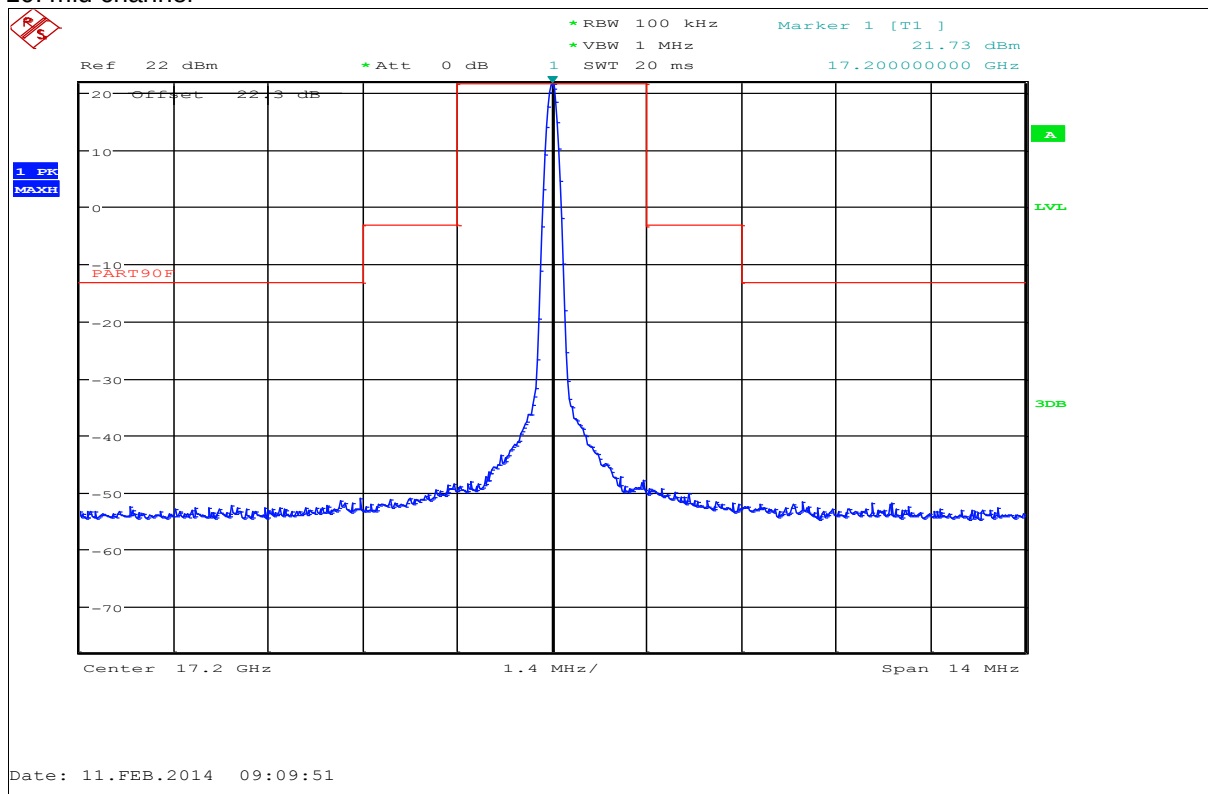
**Result:** The measurement is passed.

## Plots of the measurements

Plot 9: low channel



Plot 10: mid channel



Ref 21.2 dBm      \* Att 0 dB      1      \* RBW 100 kHz      Marker 1 [T1]      21.20 dBm  
 \* VBW 1 MHz      17.300000000 GHz  
 \* SWT 20 ms

Offset 22.3 dB

1 PK  
MAXH

PART90F

3dB

Center 17.3 GHz      1.4 MHz/      Span 14 MHz

Date: 11.FEB.2014 09:10:38

## 9.5 Spurious emissions (conducted)

### Conducted measurements:

The EUT was set for low, mid, high channel and highest RF output power. The spectrum analyzer was connected to the EUT's antenna terminal.

| Measurement parameter |                                         |
|-----------------------|-----------------------------------------|
| Detector:             | Peak                                    |
| Sweep time:           | Auto                                    |
| Resolution bandwidth: | f < 1 GHz : 100 kHz<br>f ≥ 1GHz : 1 MHz |
| Video bandwidth:      | f < 1 GHz : 100 kHz<br>f ≥ 1GHz : 1 MHz |
| Span:                 | -/-                                     |
| Trace-Mode:           | Max. hold                               |

### Limits:

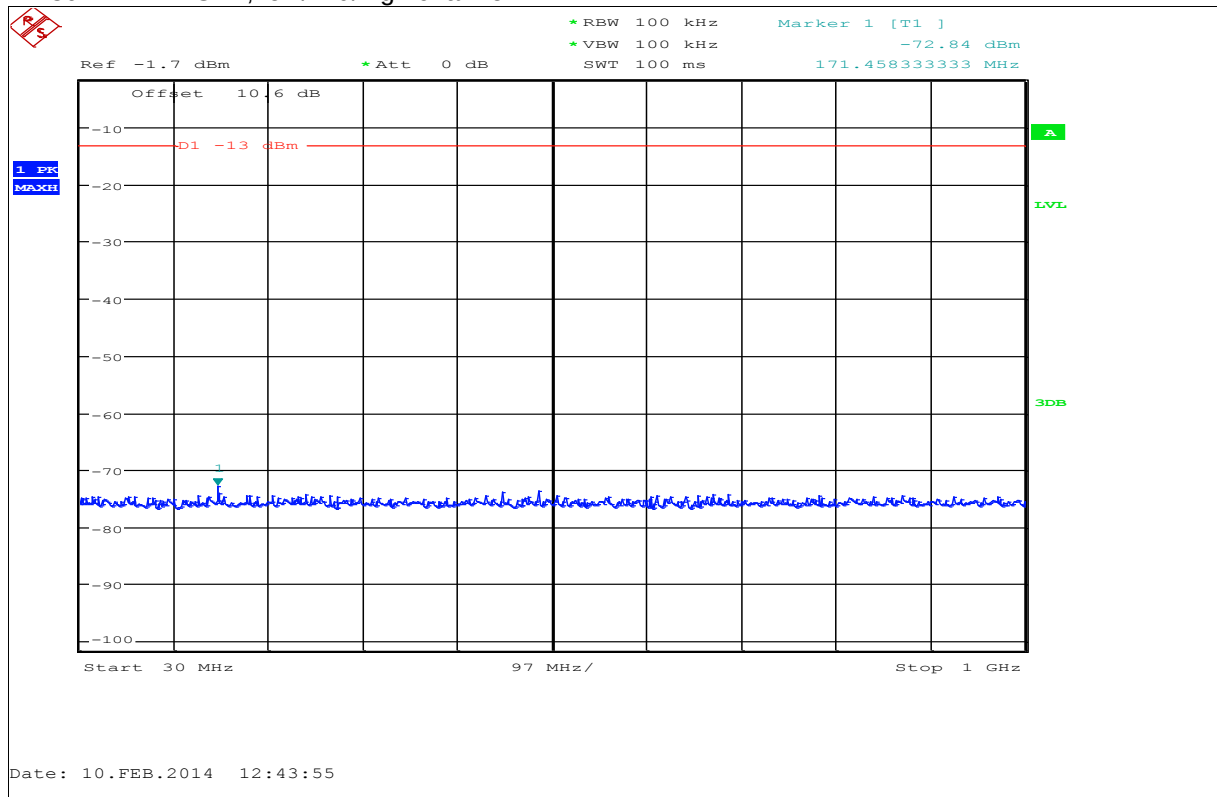
| FCC                                                                                                                                                                                                                                                                                                                                                                                                         |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 47 CFR §2.1051 / § 90.210 (b) (n)                                                                                                                                                                                                                                                                                                                                                                           |
| Measurements required: Spurious emissions at antenna terminals / Emission mask                                                                                                                                                                                                                                                                                                                              |
| <p>(b) <i>Emission Mask B.</i></p> <p>...</p> <p>(3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least 43 + 10 log (P) dB.</p> <p>(n) <i>Other frequency bands.</i> Transmitters designed for operation under this part on frequencies other than listed in this section must meet the emission mask requirements of Emission Mask B.</p> |

| SPURIOUS EMISSIONS LEVEL (dBm) |          |       |             |          |       |              |          |       |
|--------------------------------|----------|-------|-------------|----------|-------|--------------|----------|-------|
| low channel                    |          |       | mid channel |          |       | high channel |          |       |
| Frequency                      | Detector | Level | Frequency   | Detector | Level | Frequency    | Detector | Level |
| See plots!                     |          |       |             |          |       |              |          |       |
| Measurement uncertainty ± 3 dB |          |       |             |          |       |              |          |       |

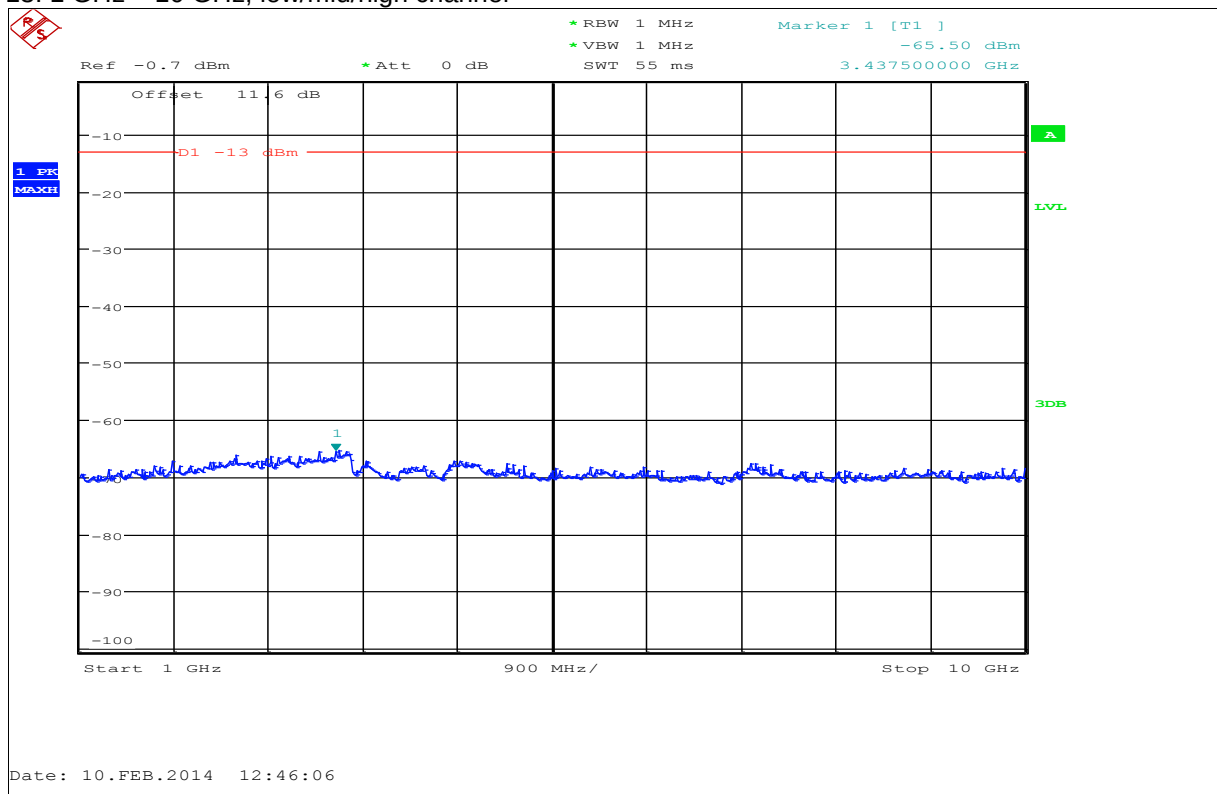
**Result:** The measurement is passed.

**Plots of the measurements**

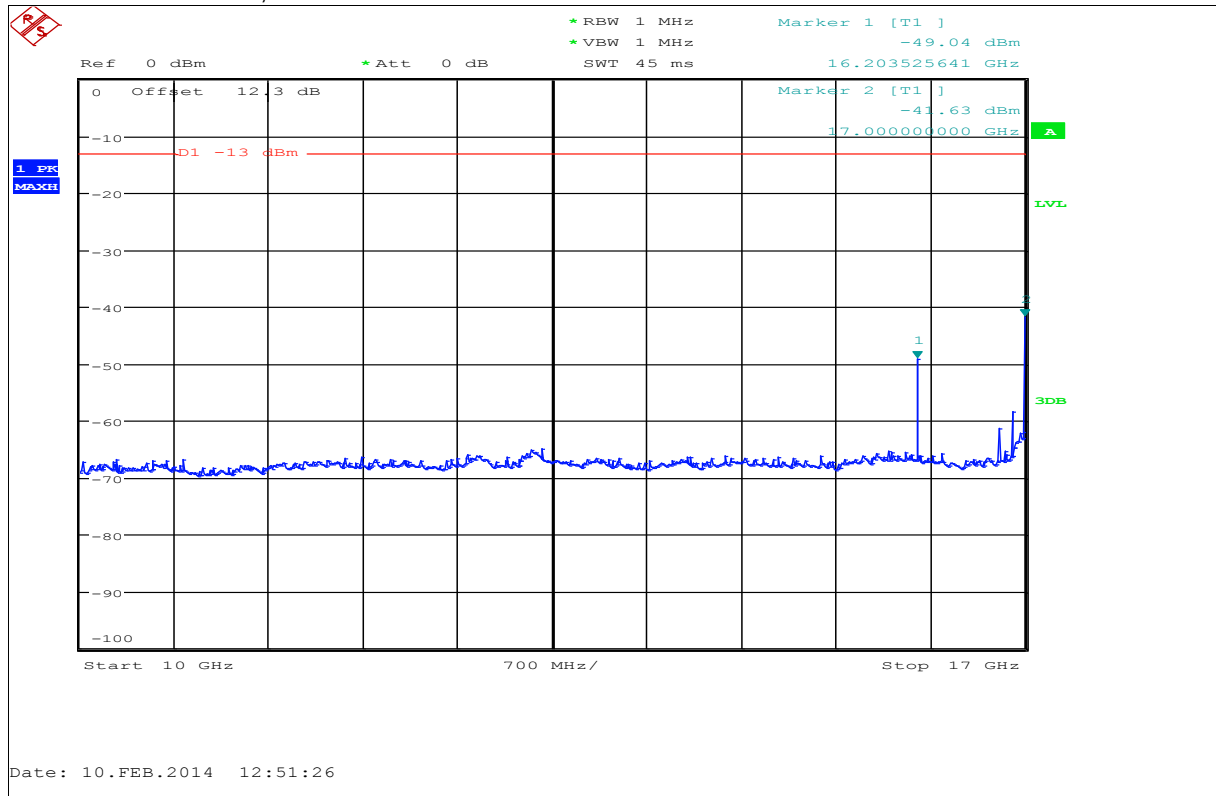
Plot 12: 30 MHz – 1 GHz, low/mid/high channel



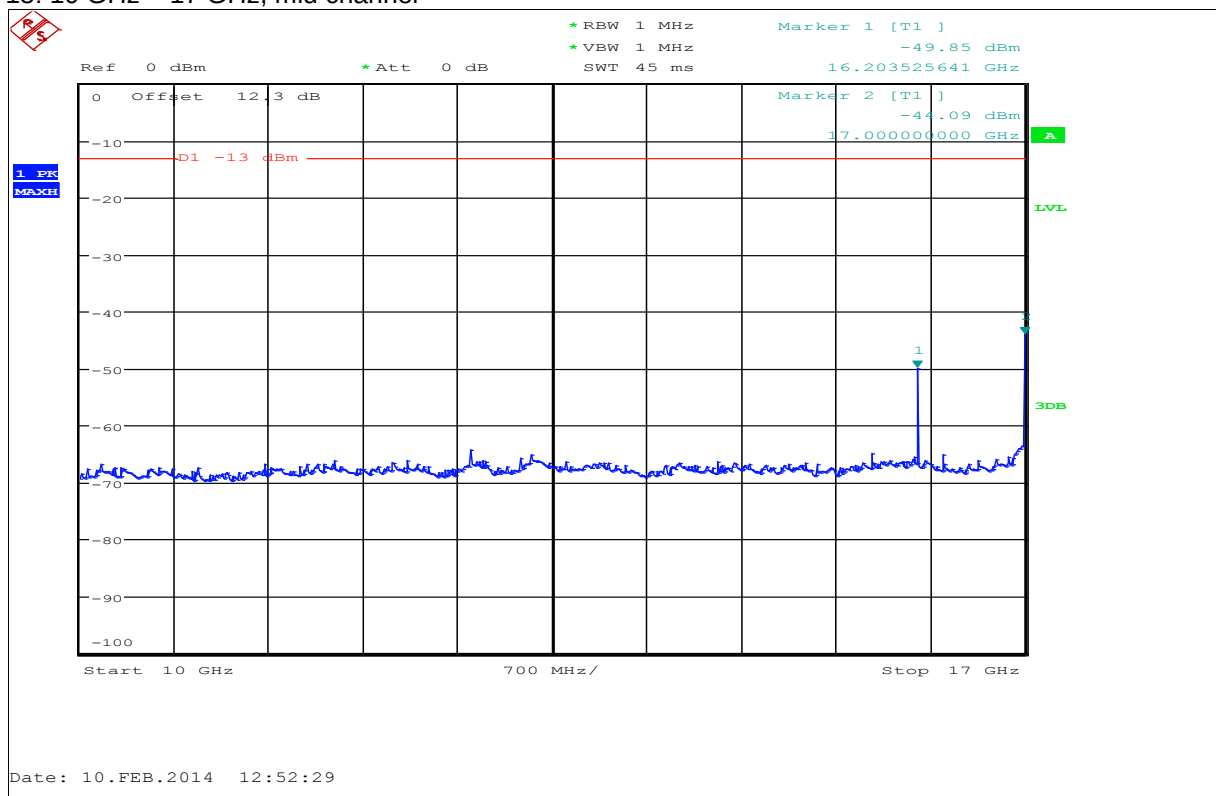
Plot 13: 1 GHz – 10 GHz, low/mid/high channel



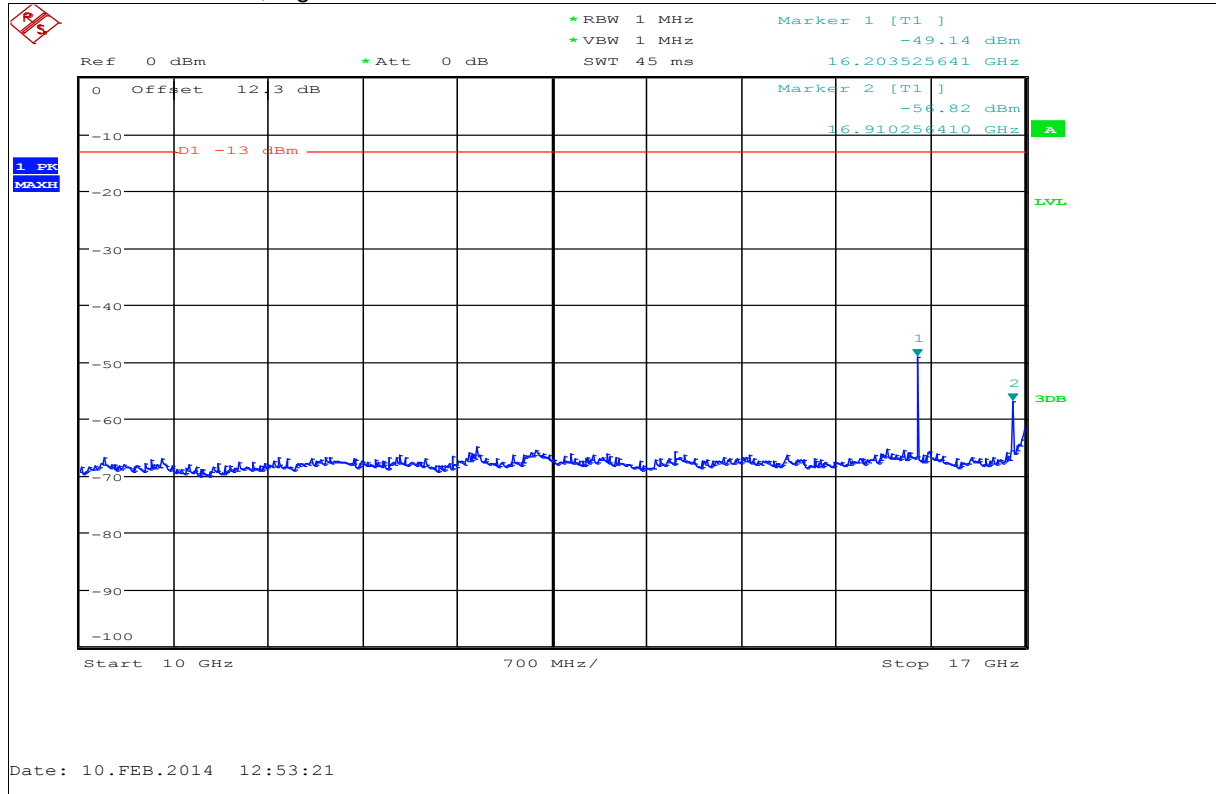
Plot 14: 10 GHz – 17 GHz, low channel



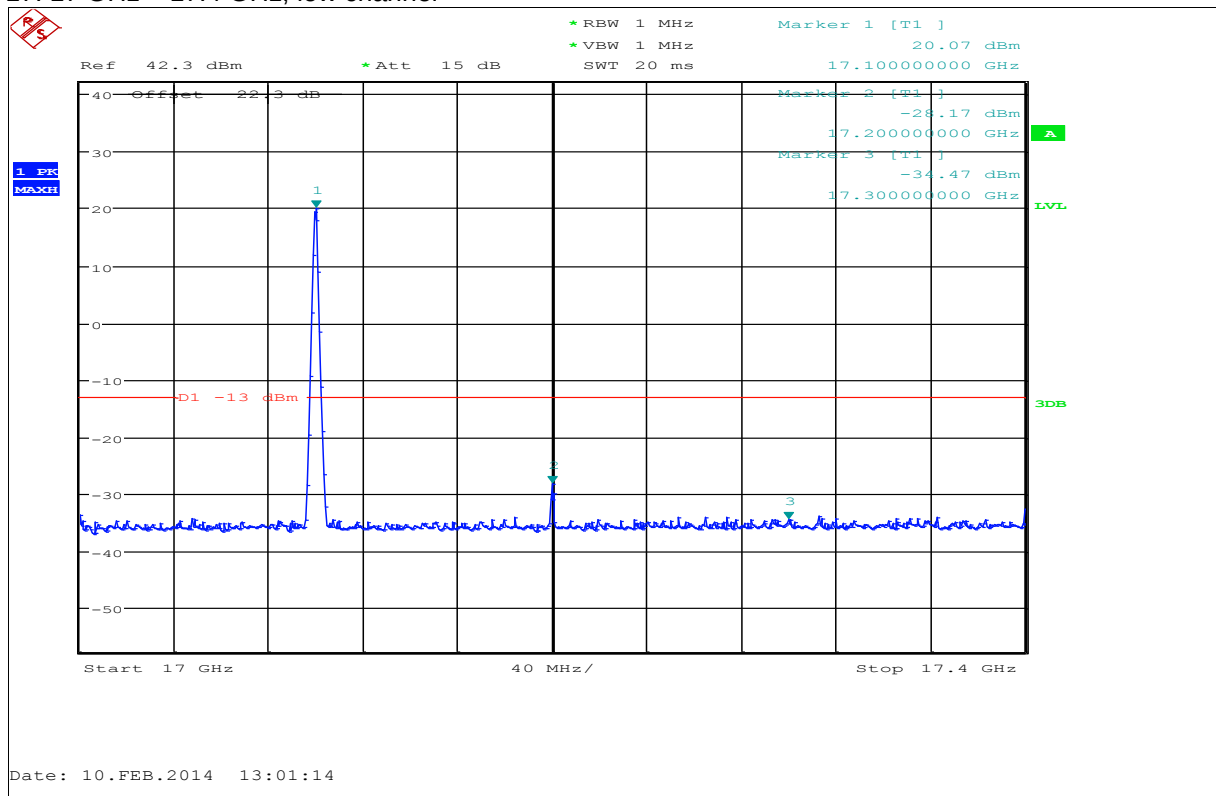
Plot 15: 10 GHz – 17 GHz, mid channel



Plot 16: 10 GHz – 17 GHz, high channel

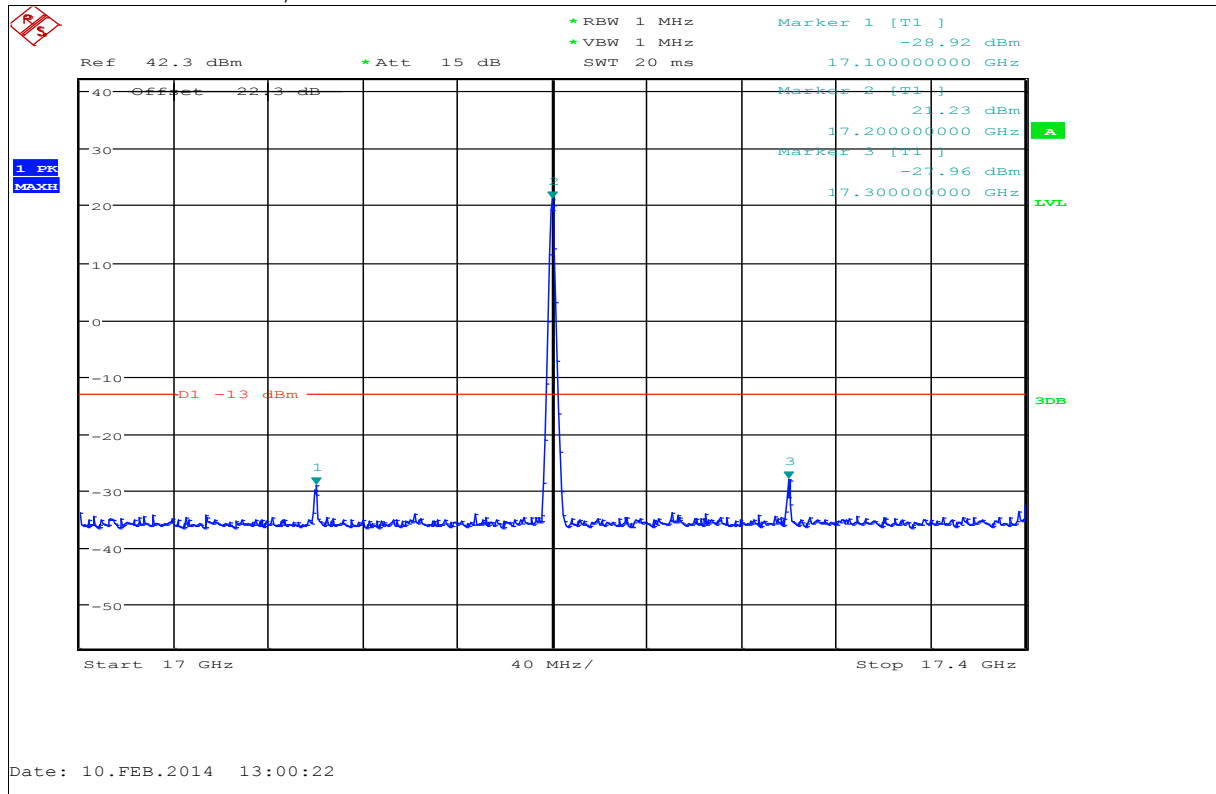


Plot 17: 17 GHz – 17.4 GHz, low channel



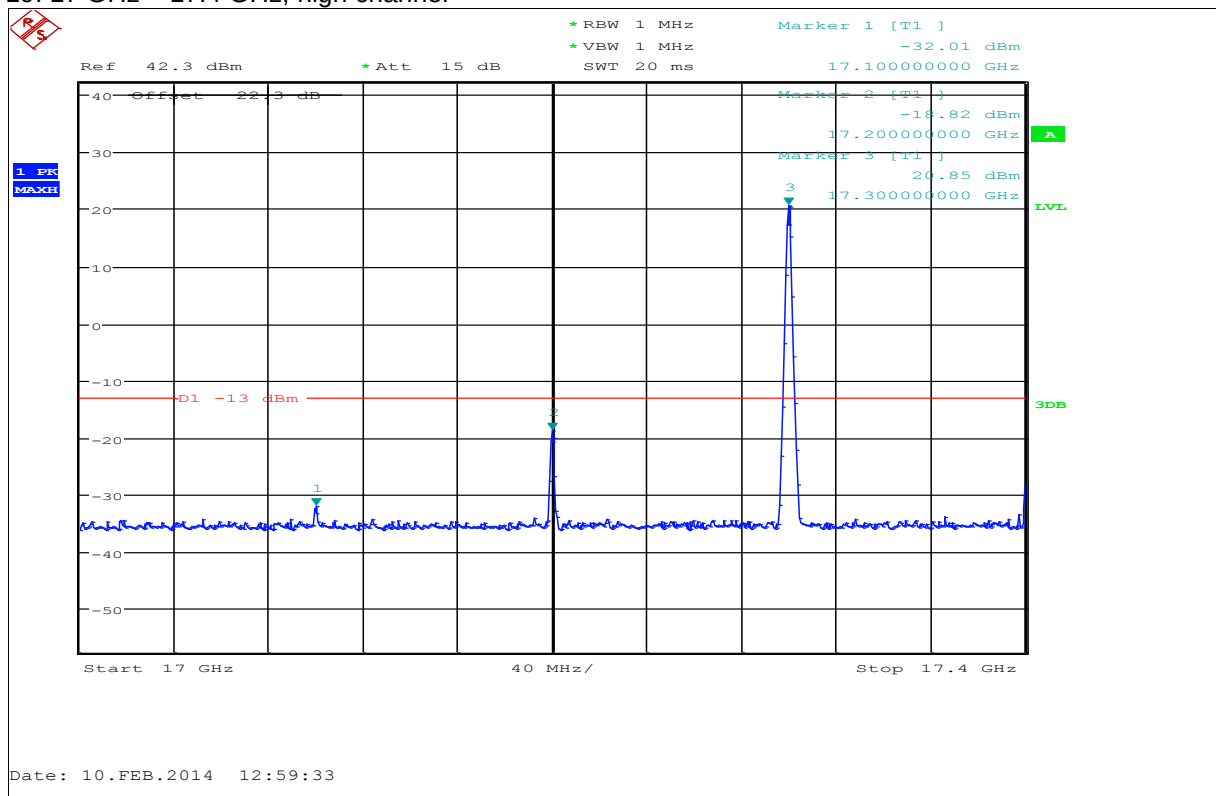
Marker 1 shows the wanted signals

Plot 18: 17 GHz – 17.4 GHz, mid channel



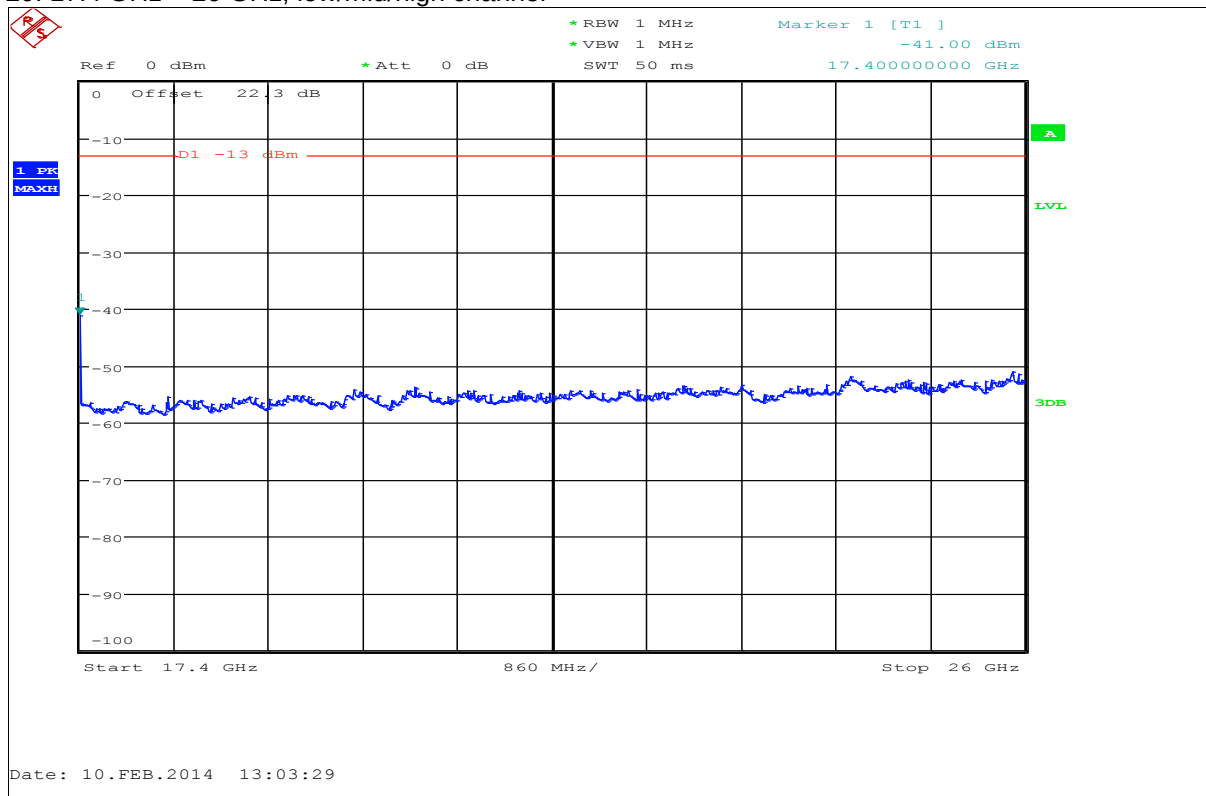
Marker 2 shows the wanted signals

Plot 19: 17 GHz – 17.4 GHz, high channel

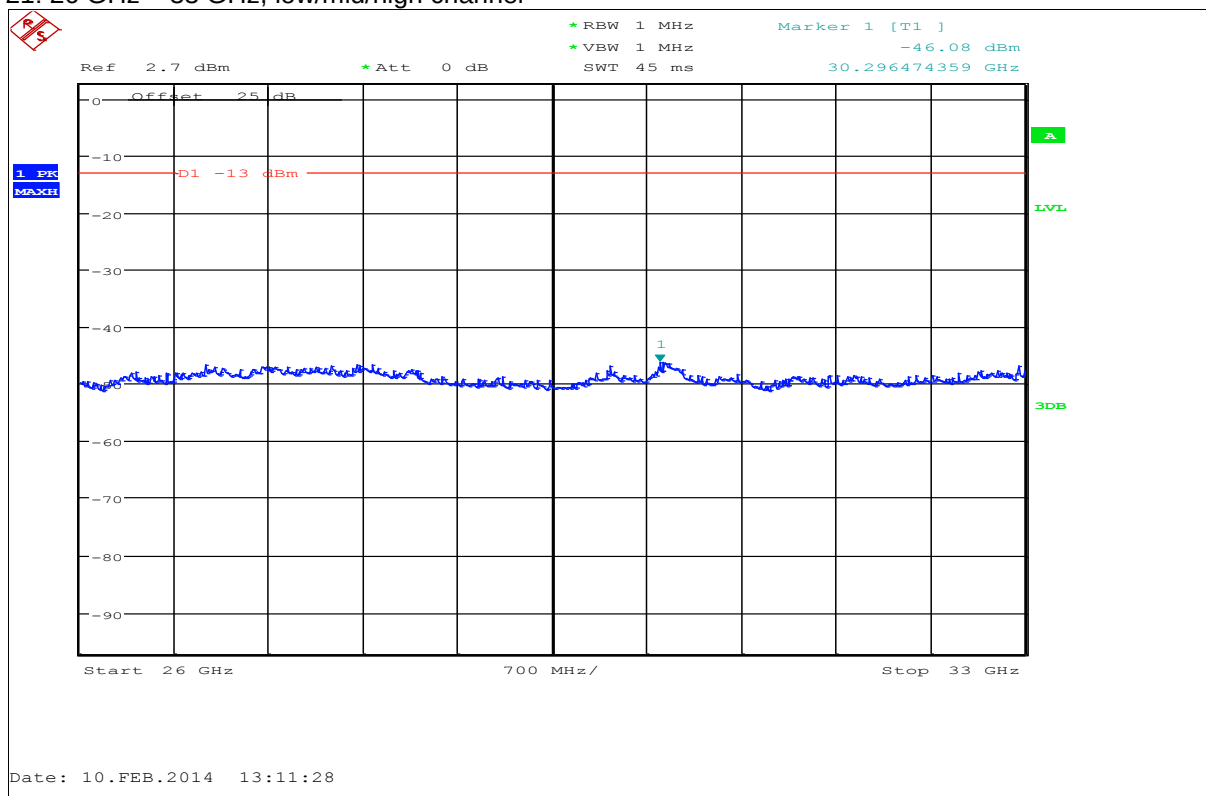


Marker 3 shows the wanted signals

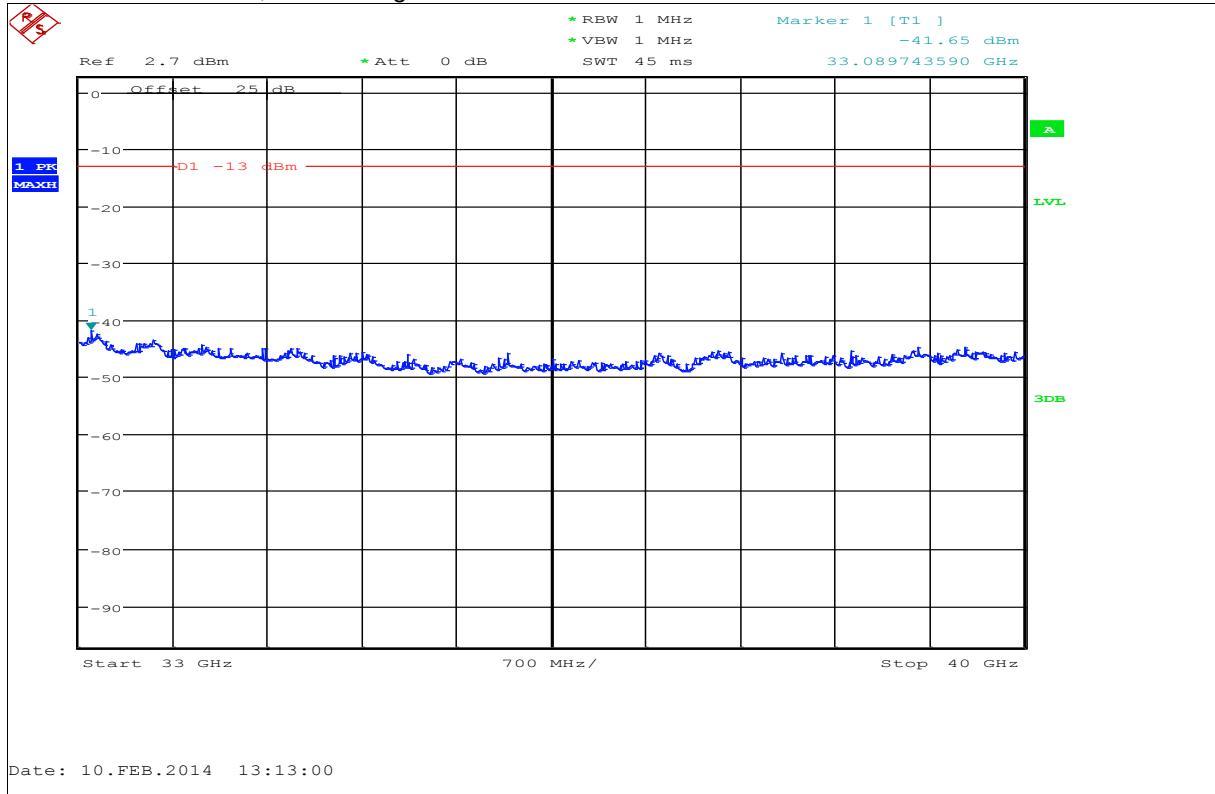
Plot 20: 17.4 GHz – 26 GHz, low/mid/high channel



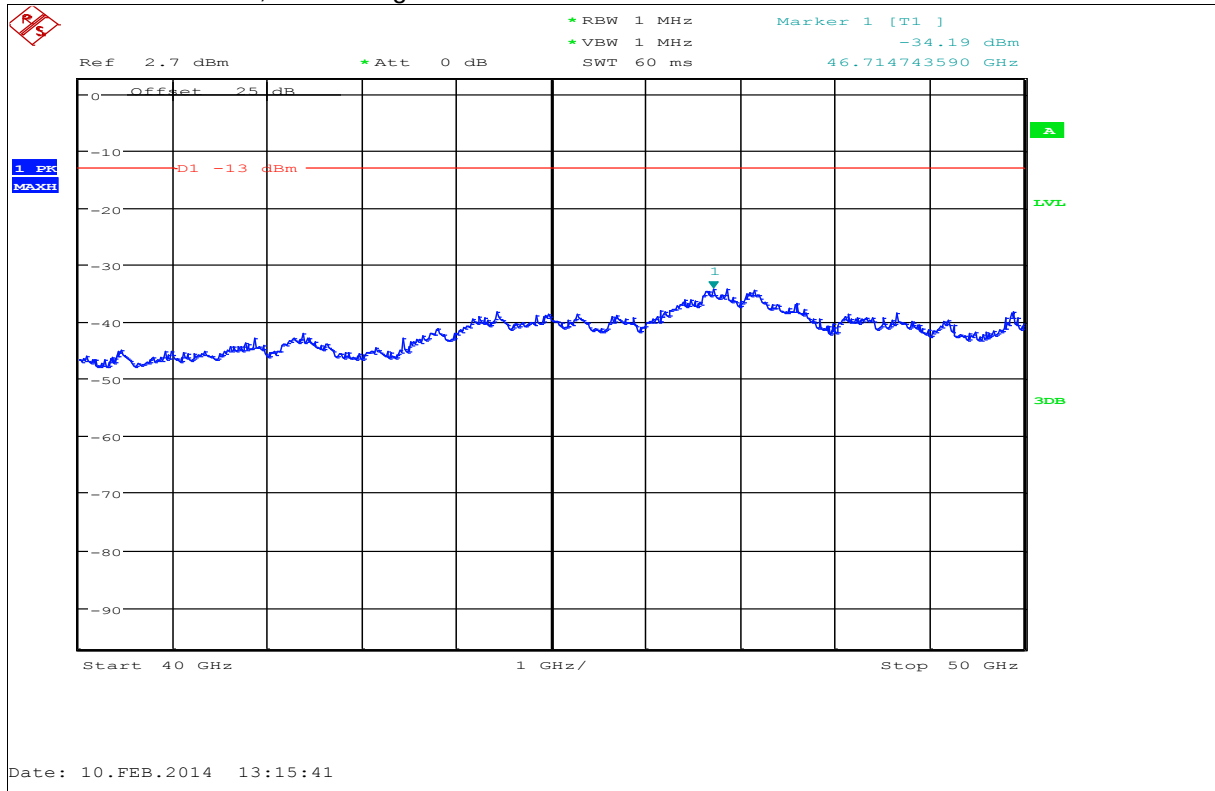
Plot 21: 26 GHz – 33 GHz, low/mid/high channel



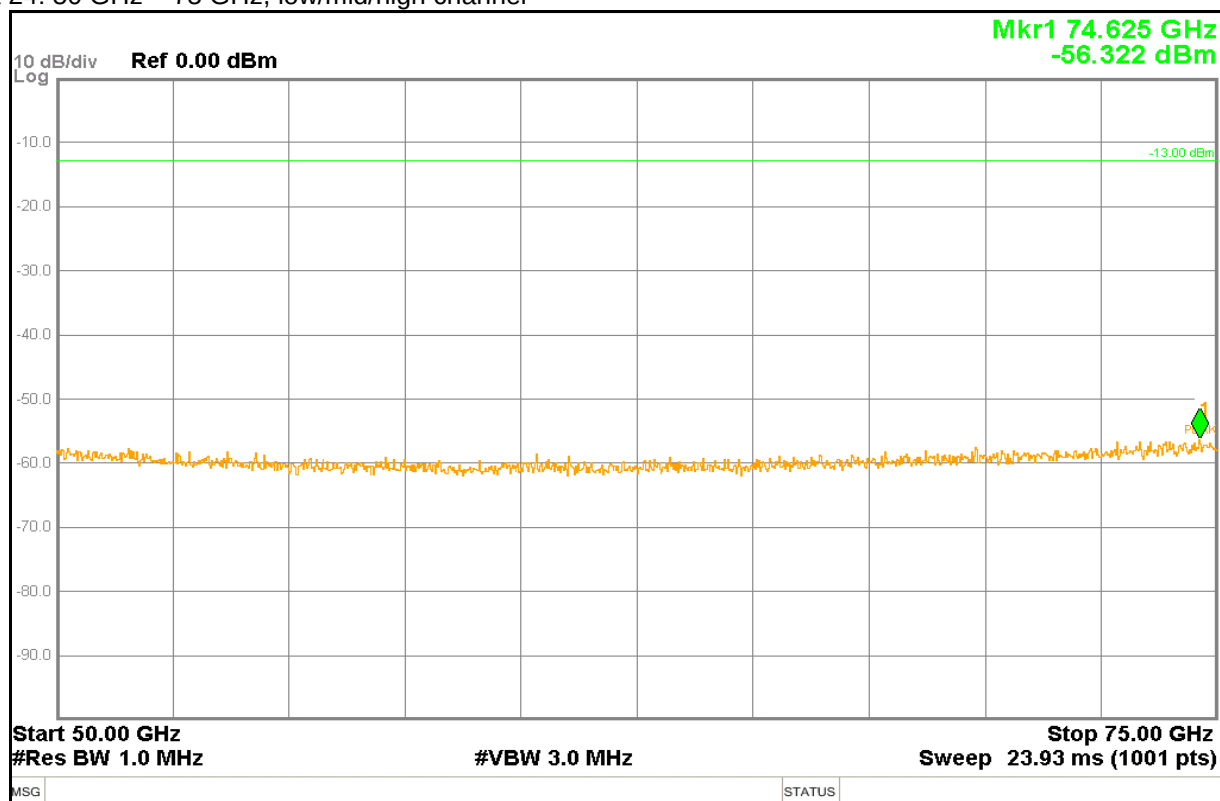
Plot 22: 33 GHz – 40 GHz, low/mid/high channel



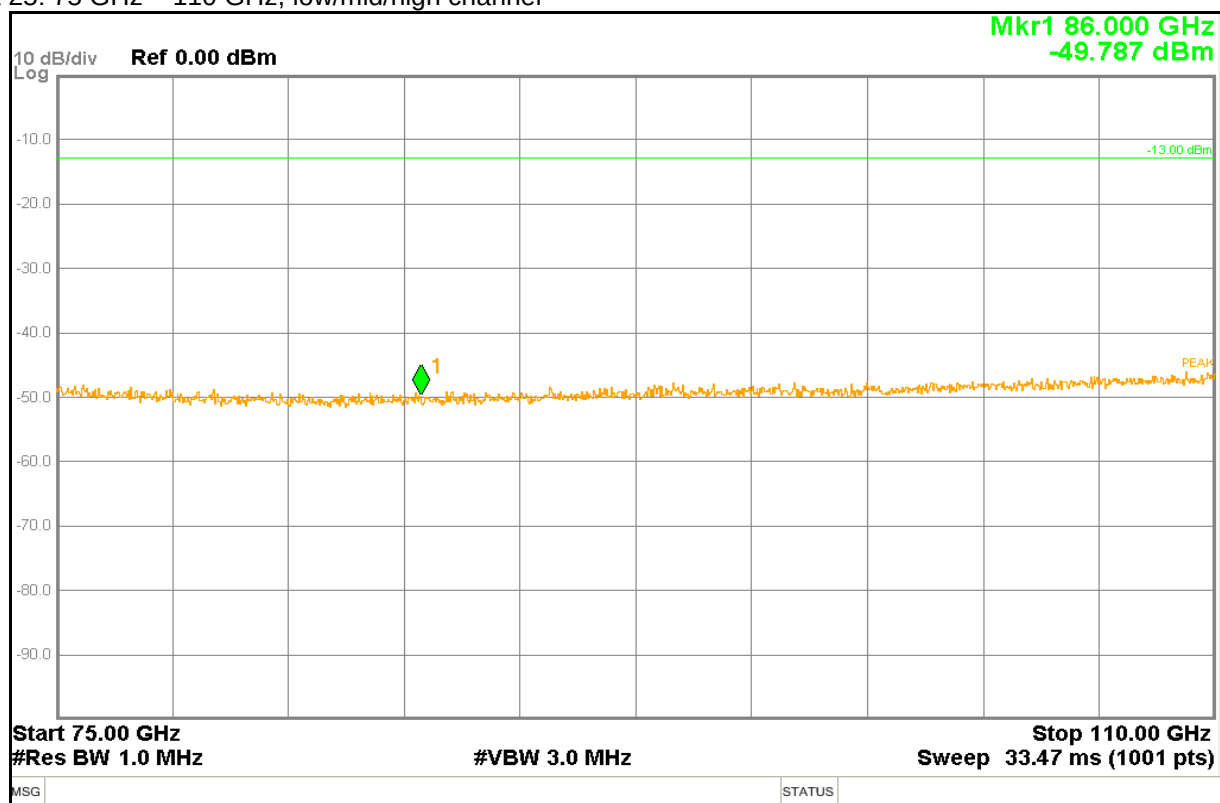
Plot 23: 40 GHz – 50 GHz, low/mid/high channel



Plot 24: 50 GHz – 75 GHz, low/mid/high channel



Plot 25: 75 GHz – 110 GHz, low/mid/high channel



## 9.6 Spurious emissions (radiated)

### Radiated measurements:

The EUT was set for low, mid, high channel and highest RF output power.

| Measurement parameter |                                         |
|-----------------------|-----------------------------------------|
| Detector:             | Peak                                    |
| Sweep time:           | Auto                                    |
| Resolution bandwidth: | f < 1 GHz : 100 kHz<br>f ≥ 1GHz : 1 MHz |
| Video bandwidth:      | f < 1 GHz : 100 kHz<br>f ≥ 1GHz : 1 MHz |
| Span:                 | -/-                                     |
| Trace-Mode:           | Max. hold                               |

### Limits:

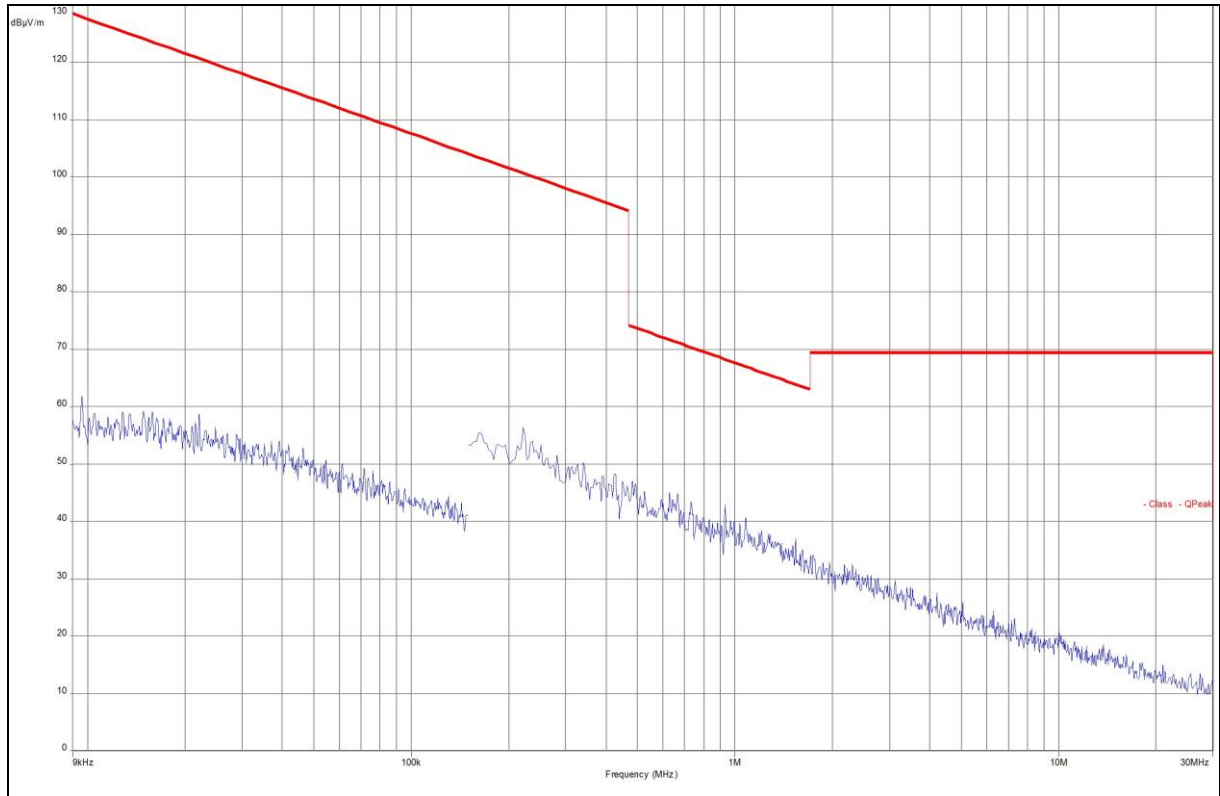
| FCC                                                                                                                                                                                                                                                                                                                                                                                                         |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 47 CFR §2.1051 / § 90.210 (b) (n)                                                                                                                                                                                                                                                                                                                                                                           |
| Measurements required: Spurious emissions at antenna terminals / Emission mask                                                                                                                                                                                                                                                                                                                              |
| <p>(b) <i>Emission Mask B.</i></p> <p>...</p> <p>(3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least 43 + 10 log (P) dB.</p> <p>(n) <i>Other frequency bands.</i> Transmitters designed for operation under this part on frequencies other than listed in this section must meet the emission mask requirements of Emission Mask B.</p> |

| SPURIOUS EMISSIONS LEVEL (dBm) |          |       |             |          |       |              |          |       |
|--------------------------------|----------|-------|-------------|----------|-------|--------------|----------|-------|
| low channel                    |          |       | mid channel |          |       | high channel |          |       |
| Frequency                      | Detector | Level | Frequency   | Detector | Level | Frequency    | Detector | Level |
| See plots!                     |          |       |             |          |       |              |          |       |
| Measurement uncertainty ± 3 dB |          |       |             |          |       |              |          |       |

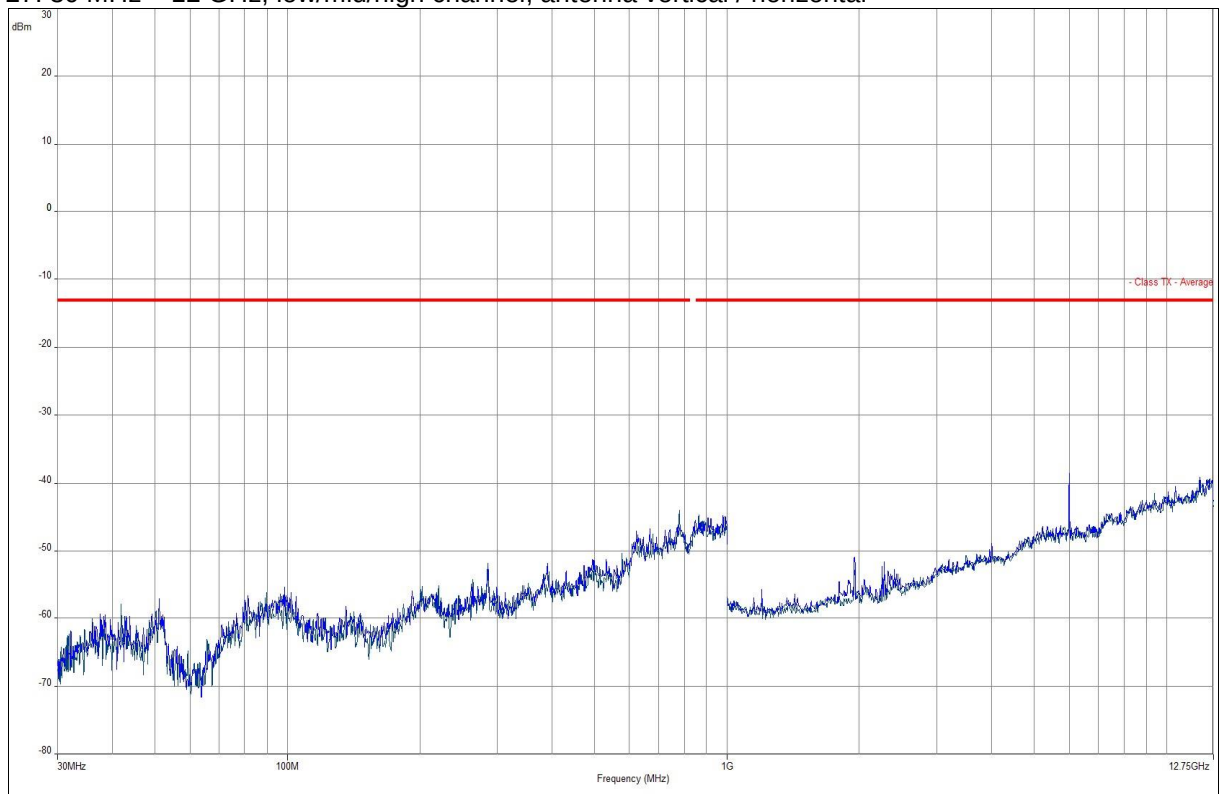
**Result:** The measurement is passed.

**Plots of the measurements**

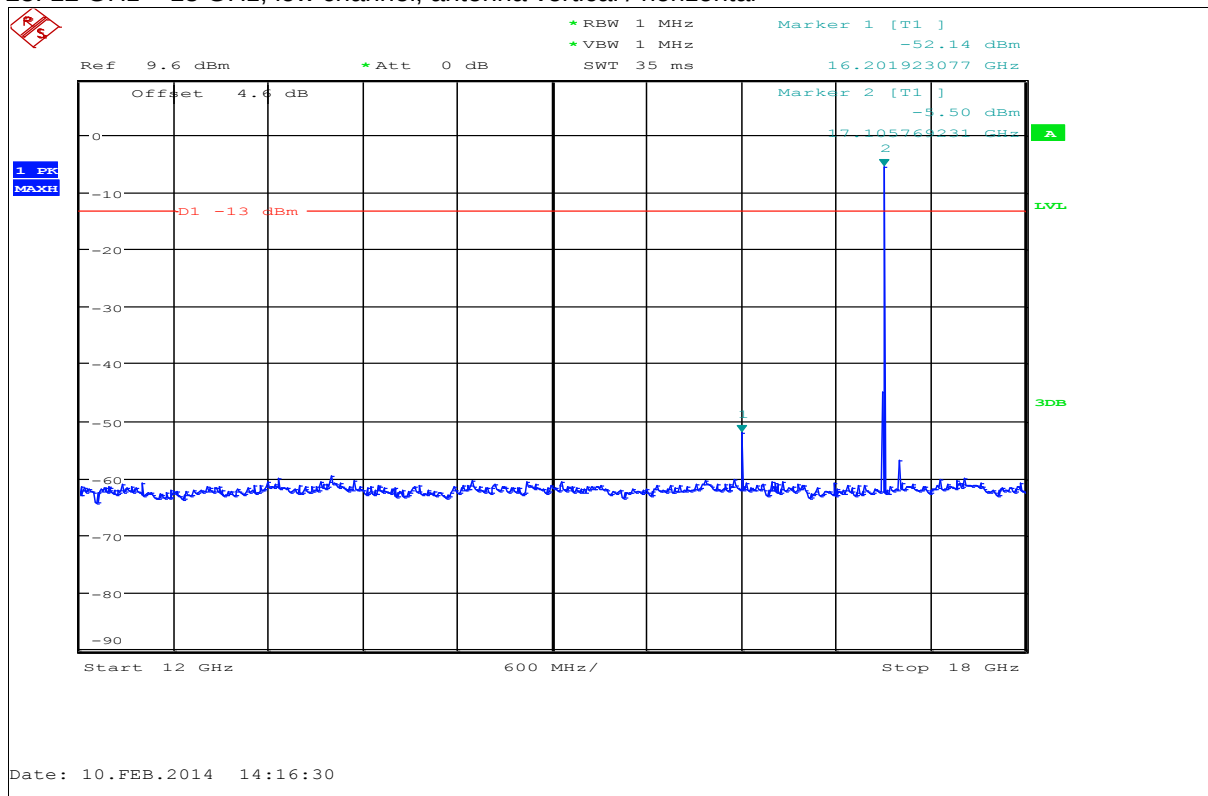
Plot 26: 9 kHz – 30 MHz, low/mid/high channel, loop antenna



Plot 27: 30 MHz – 12 GHz, low/mid/high channel, antenna vertical / horizontal

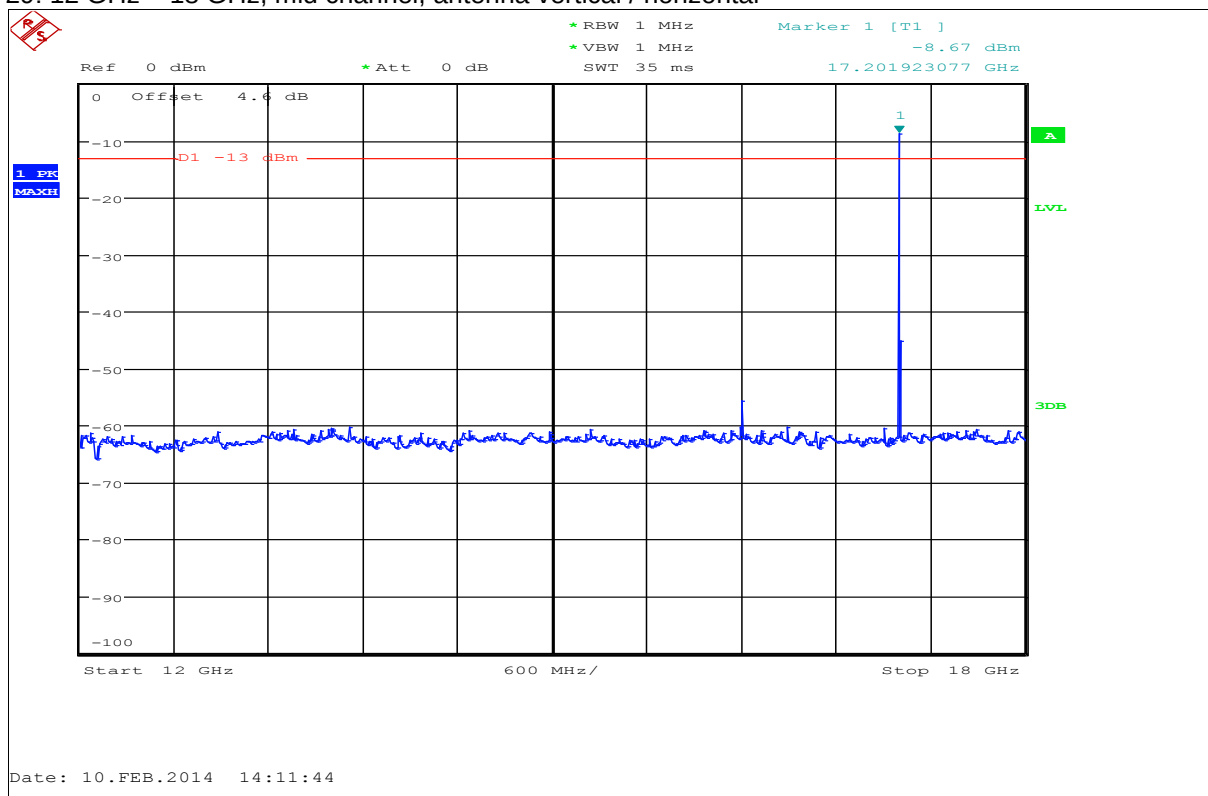


Plot 28: 12 GHz – 18 GHz, low channel, antenna vertical / horizontal



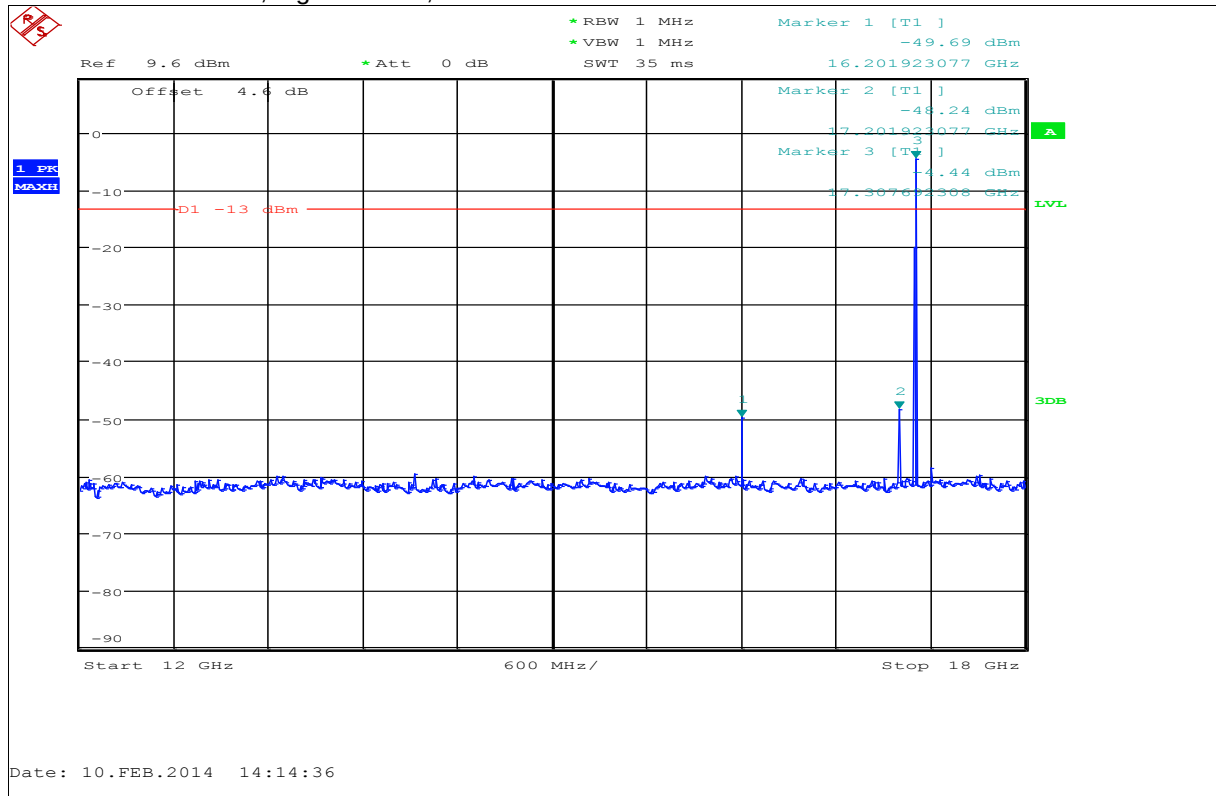
Marker 2 shows the wanted signals

Plot 29: 12 GHz – 18 GHz, mid channel, antenna vertical / horizontal



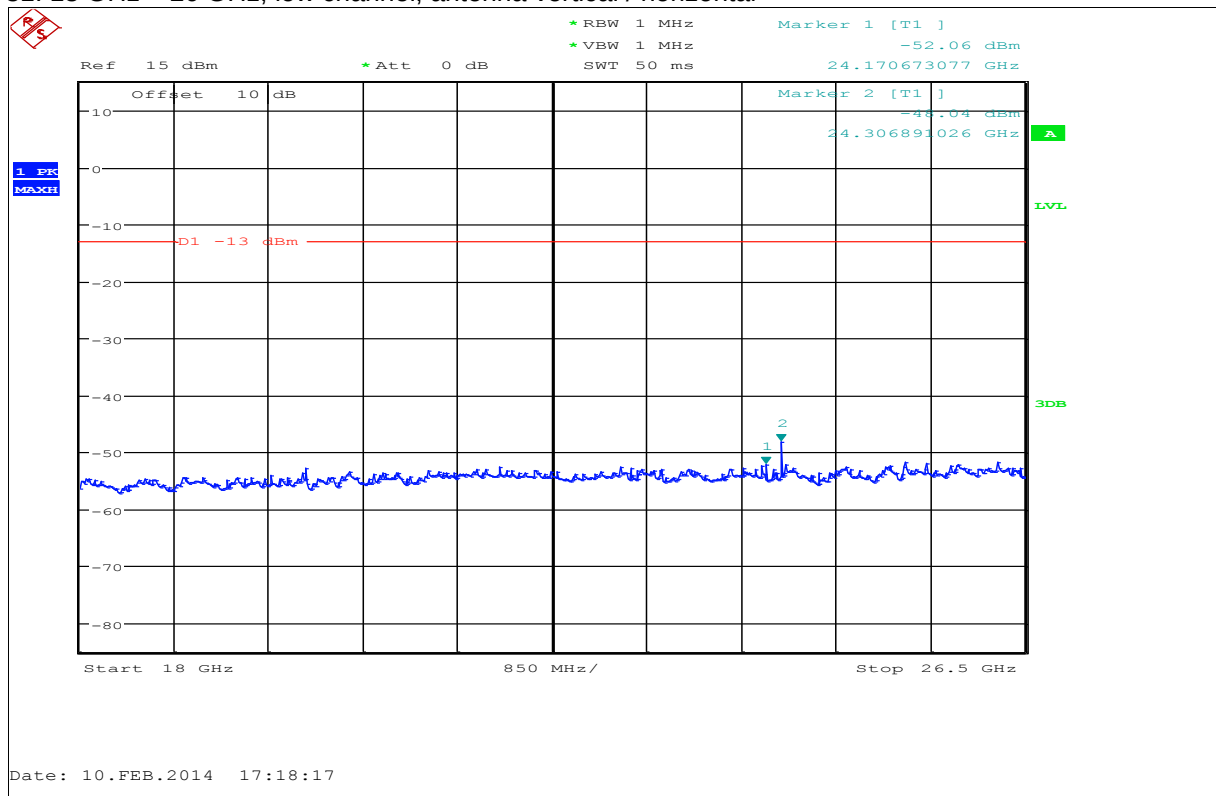
Marker 1 shows the wanted signals

Plot 30: 12 GHz – 18 GHz, high channel, antenna vertical / horizontal

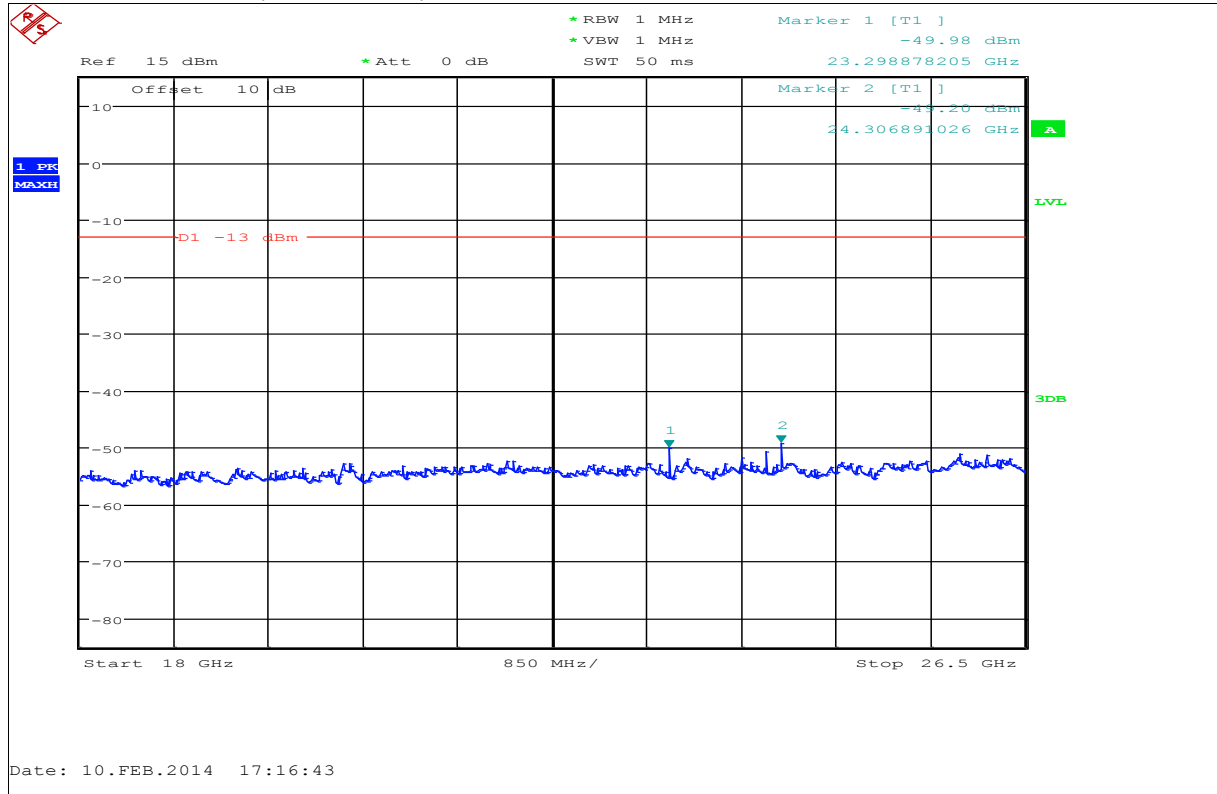


Marker 3 shows the wanted signals

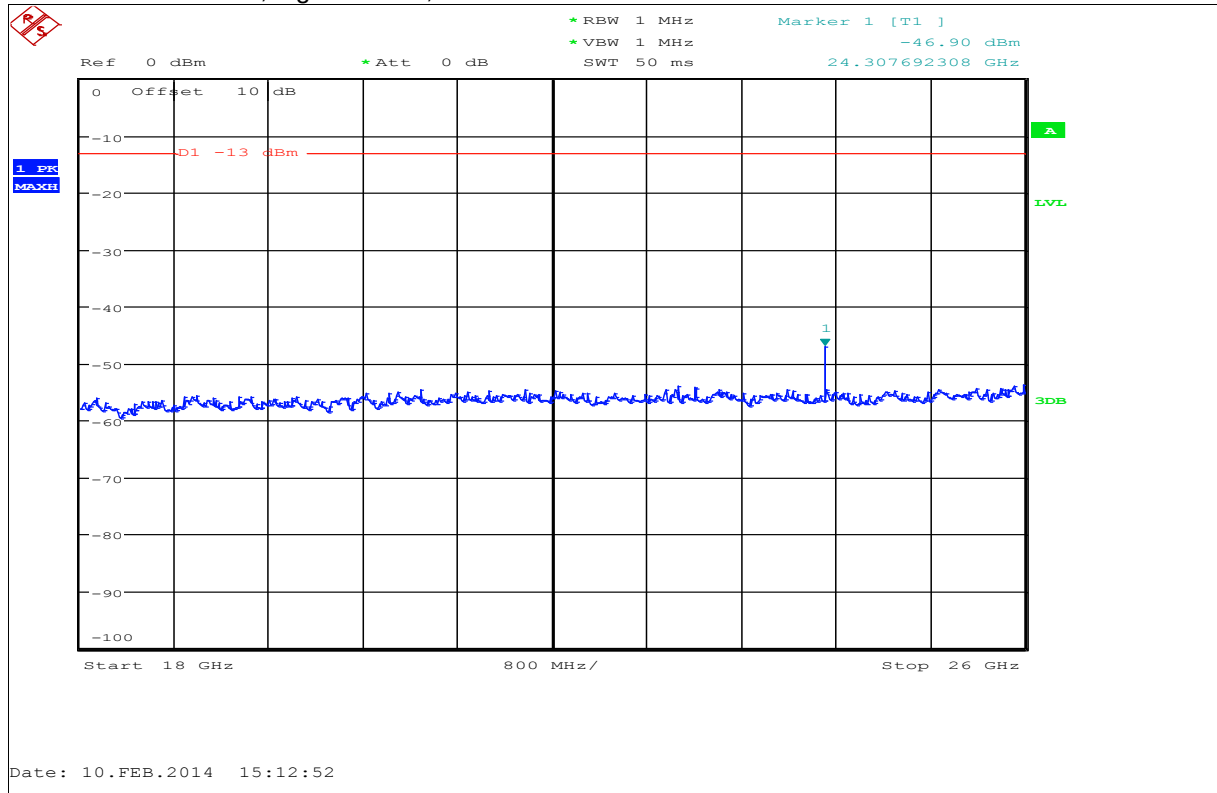
Plot 31: 18 GHz – 26 GHz, low channel, antenna vertical / horizontal



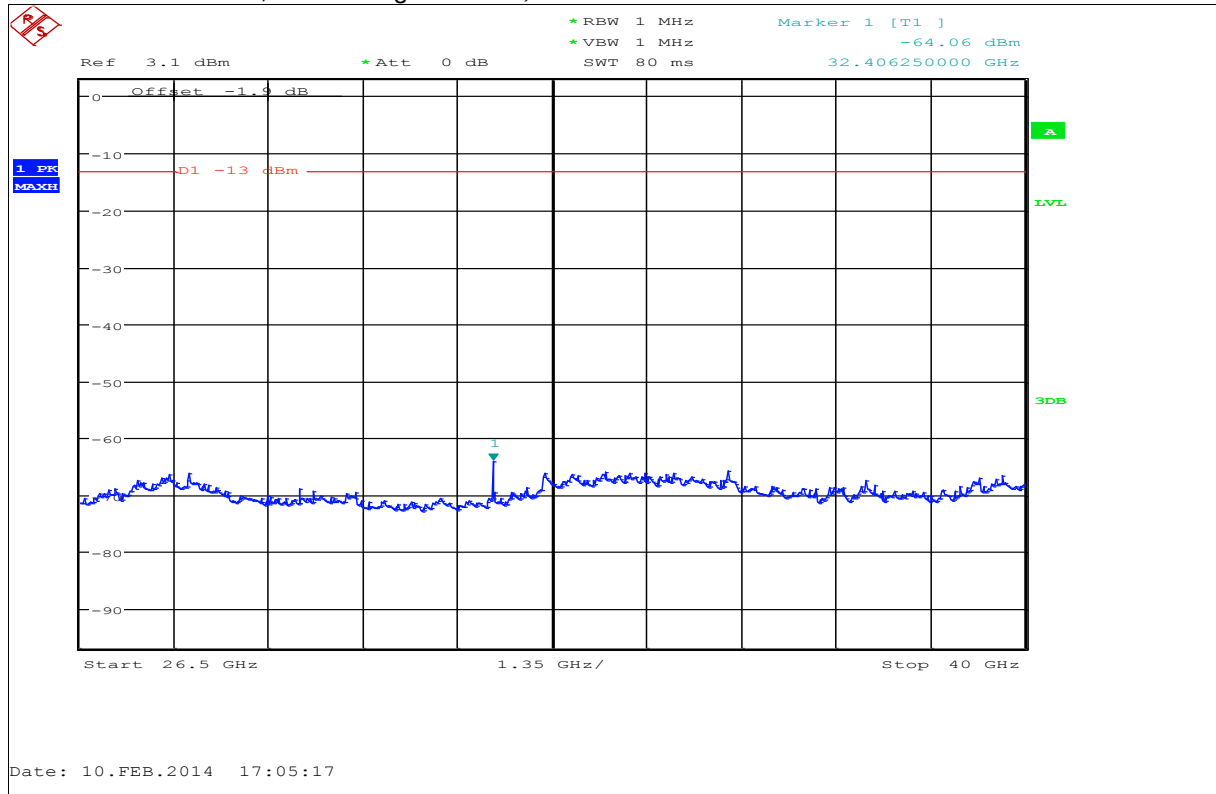
Plot 32: 18 GHz – 26 GHz, mid channel, antenna vertical / horizontal



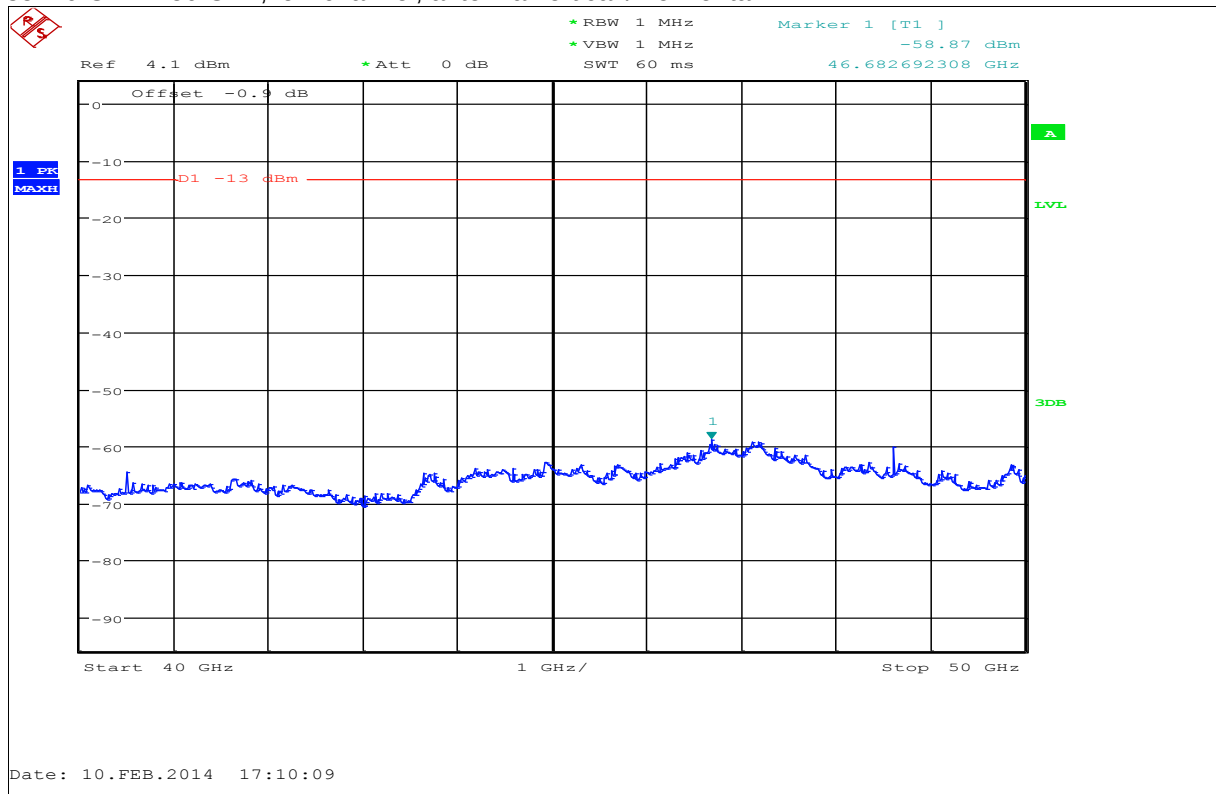
Plot 33: 18 GHz – 26 GHz, high channel, antenna vertical / horizontal



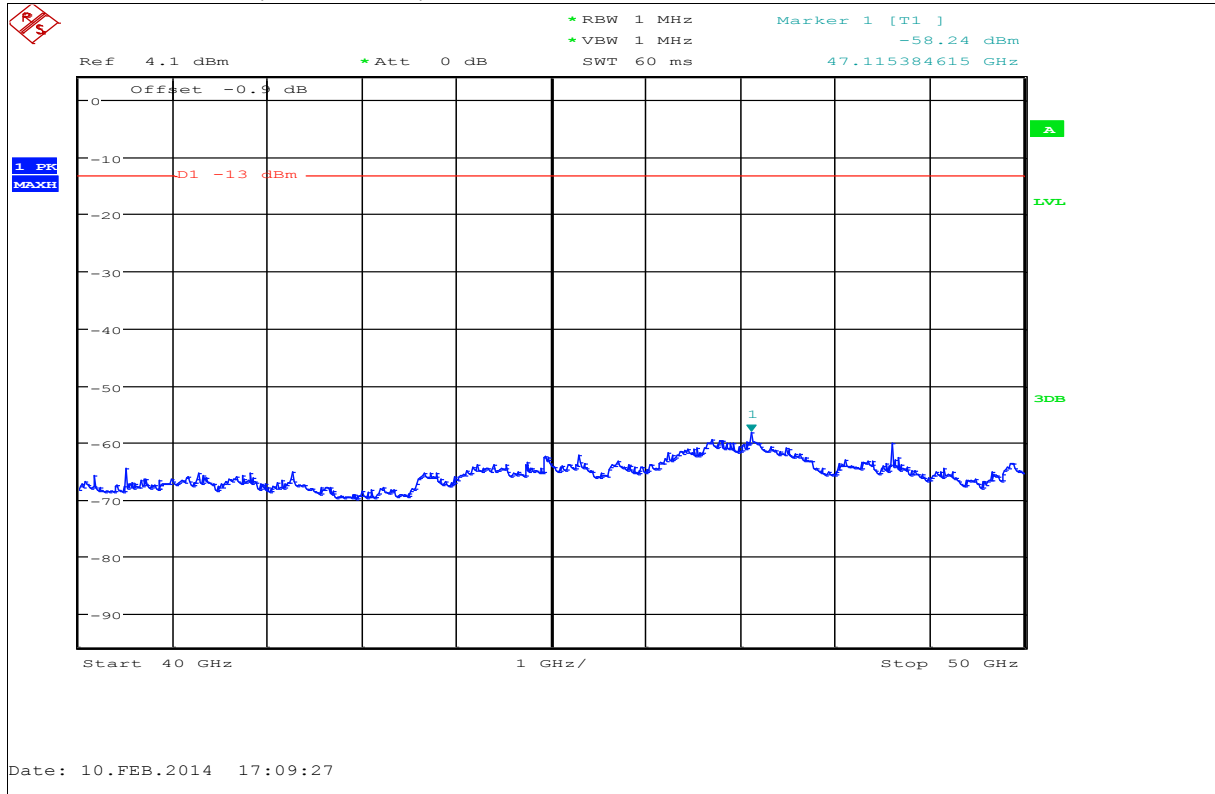
Plot 34: 26 GHz – 40 GHz, low/mid/high channel, antenna vertical / horizontal



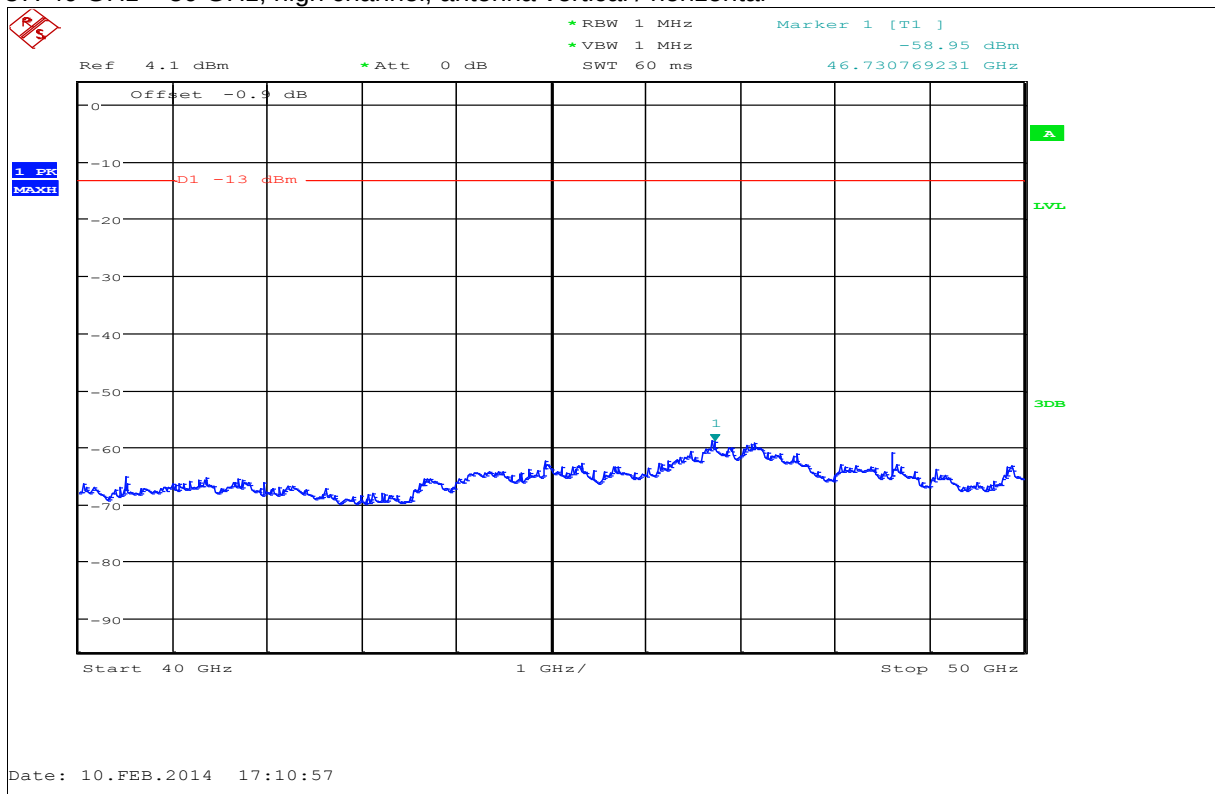
Plot 35: 40 GHz – 50 GHz, low channel, antenna vertical / horizontal



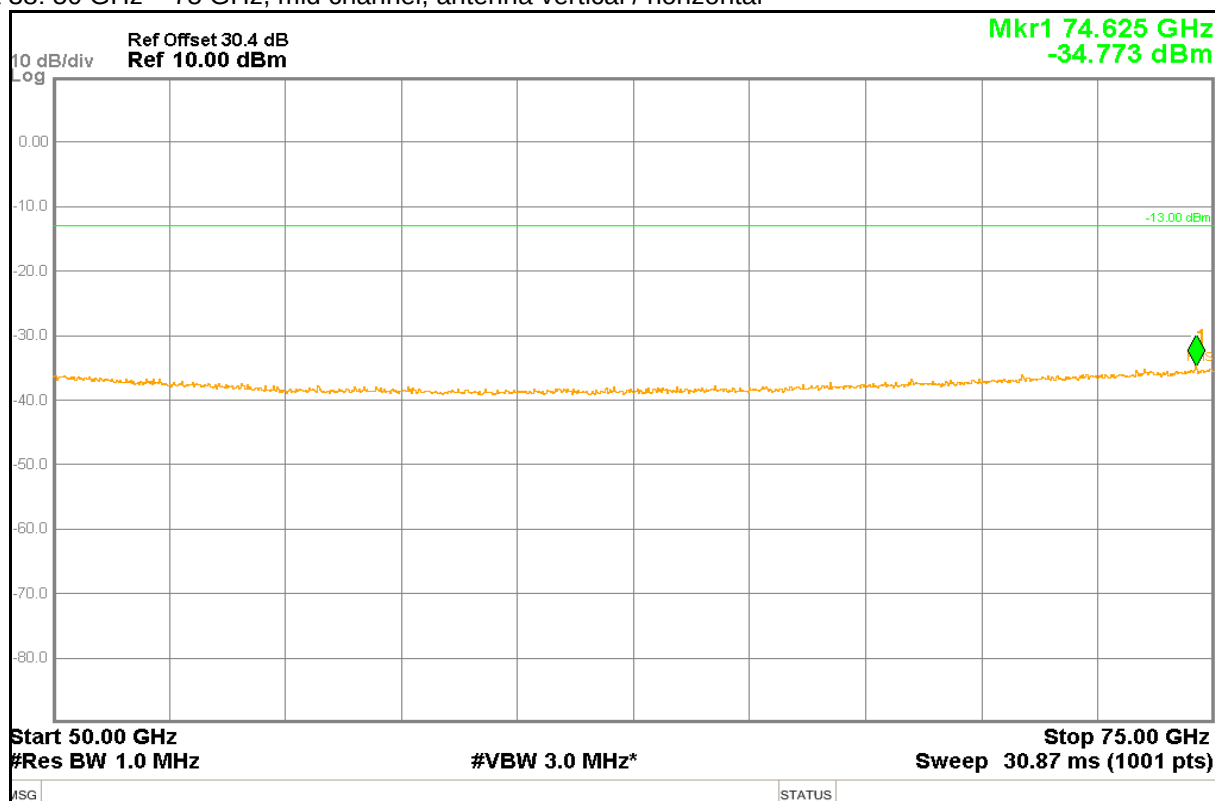
Plot 36: 40 GHz – 50 GHz, mid channel, antenna vertical / horizontal



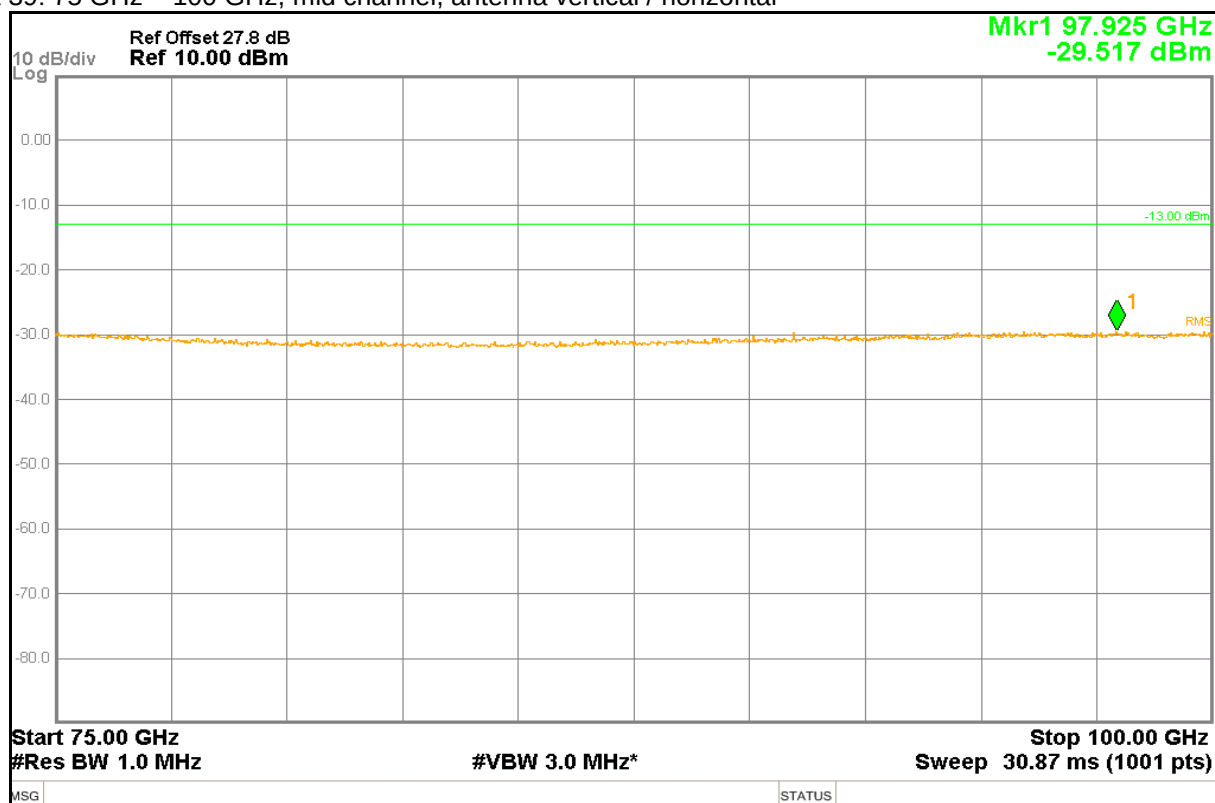
Plot 37: 40 GHz – 50 GHz, high channel, antenna vertical / horizontal



Plot 38: 50 GHz – 75 GHz, mid channel, antenna vertical / horizontal



Plot 39: 75 GHz – 100 GHz, mid channel, antenna vertical / horizontal



## 9.7 Receiver Spurious emissions (conducted)

### Conducted measurements:

| Measurement parameter |                                         |
|-----------------------|-----------------------------------------|
| Detector:             | Peak                                    |
| Sweep time:           | Auto                                    |
| Resolution bandwidth: | f < 1 GHz : 100 kHz<br>f ≥ 1GHz : 1 MHz |
| Video bandwidth:      | f < 1 GHz : 100 kHz<br>f ≥ 1GHz : 1 MHz |
| Span:                 | -/-                                     |
| Trace-Mode:           | Max. hold                               |

The antenna conducted test shall be performed with the antenna disconnected and the receiver antenna terminals connected to a measuring instrument having equal impedance to that specified for the antenna. The receiver spurious emissions measured at the antenna terminals by the antenna conducted method shall then comply with the following limits:

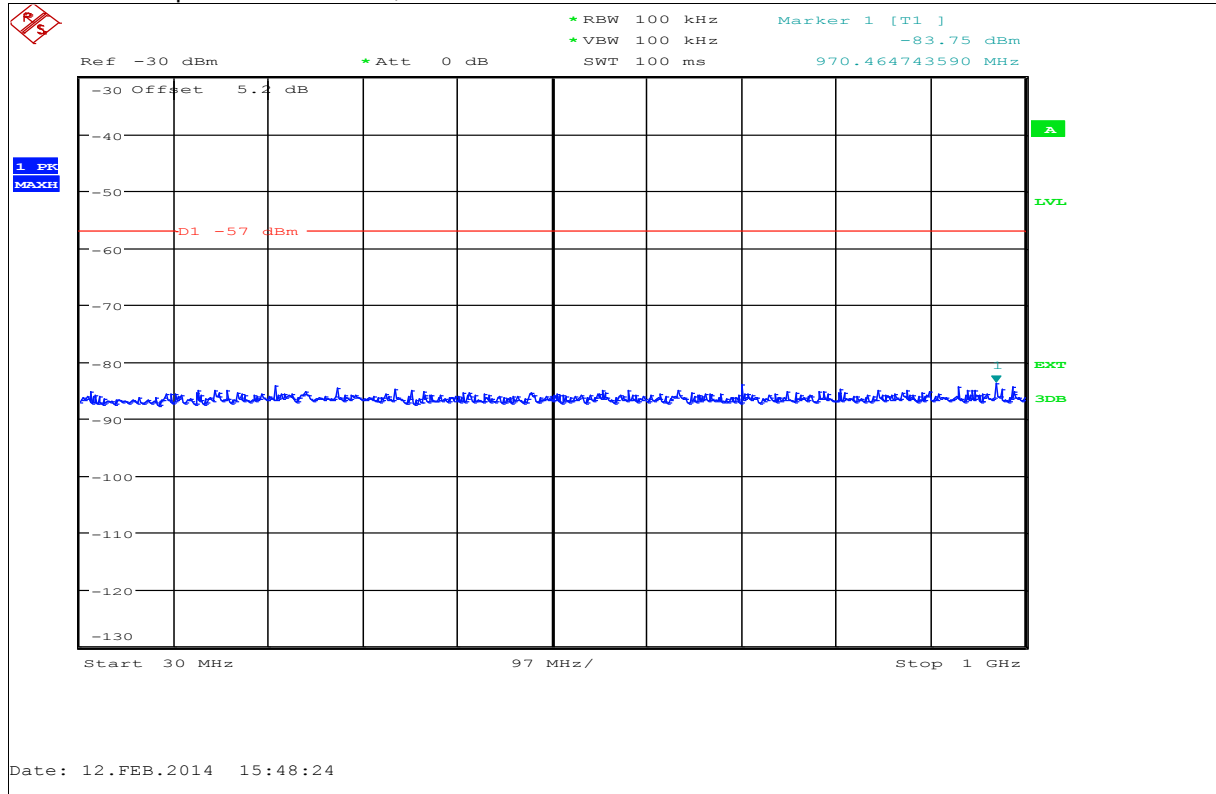
### Limit:

RSS-Gen, clause 6.2

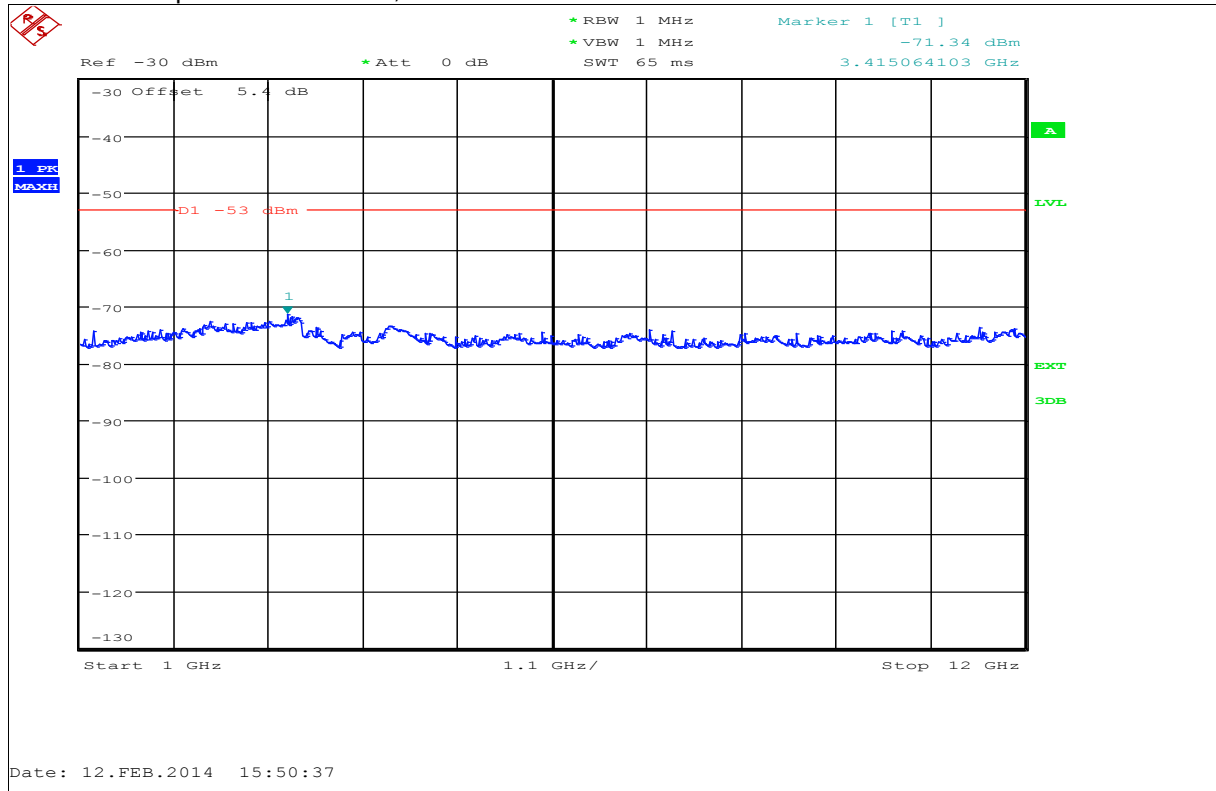
| Frequency (MHz) | Receiver Spurious Conducted Level |
|-----------------|-----------------------------------|
| 30 – 1000       | -57 dBm (2 nanowatts)             |
| > 1000          | -53 dBm (5 nanowatts)             |

**Result:** The measurement is passed.

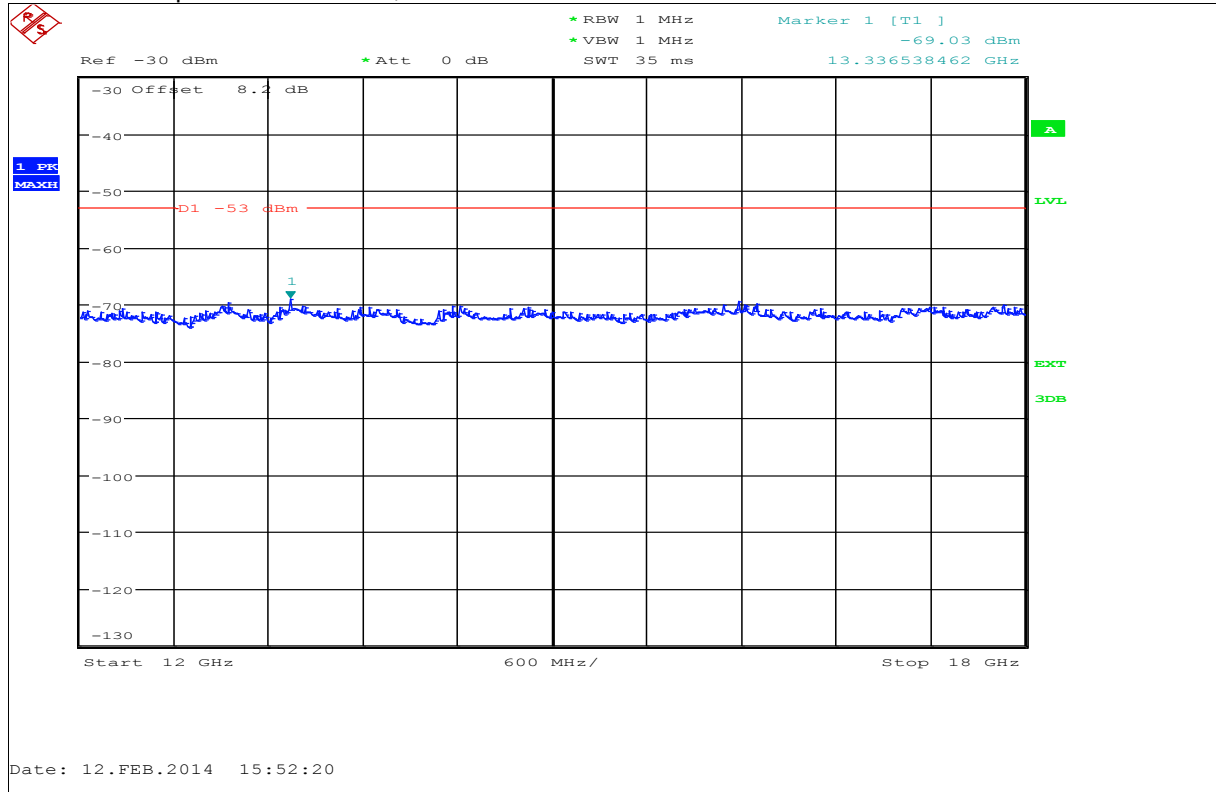
Plot 40: Receiver spurious conducted, 30 MHz – 1 GHz



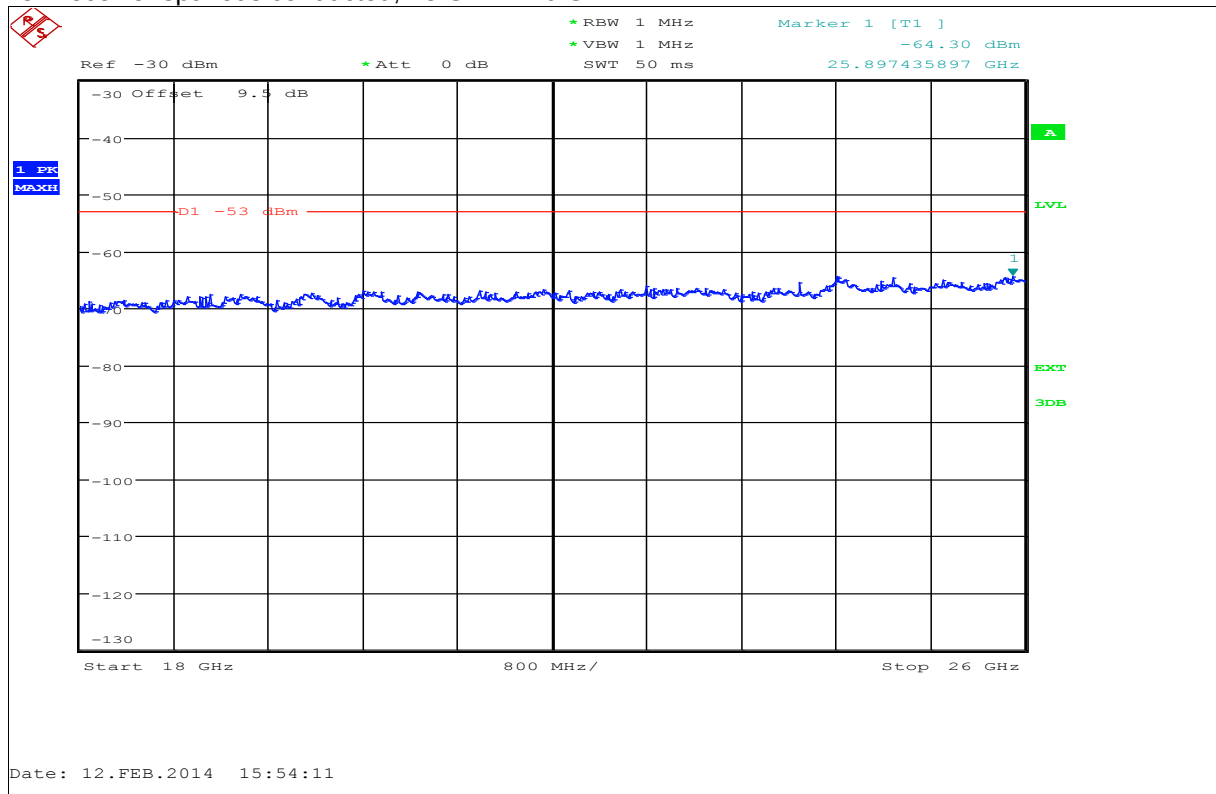
Plot 41: Receiver spurious conducted, 1 GHz – 12 GHz



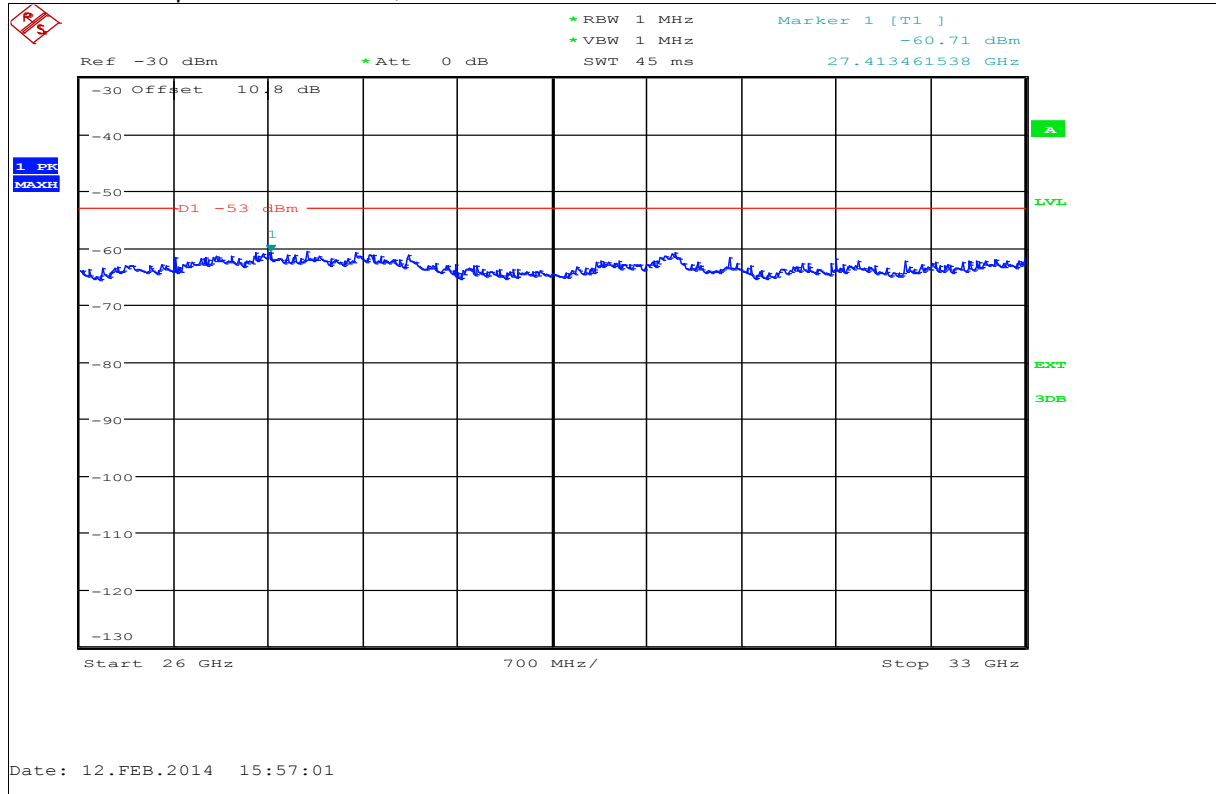
Plot 42: Receiver spurious conducted, 12 GHz – 18 GHz



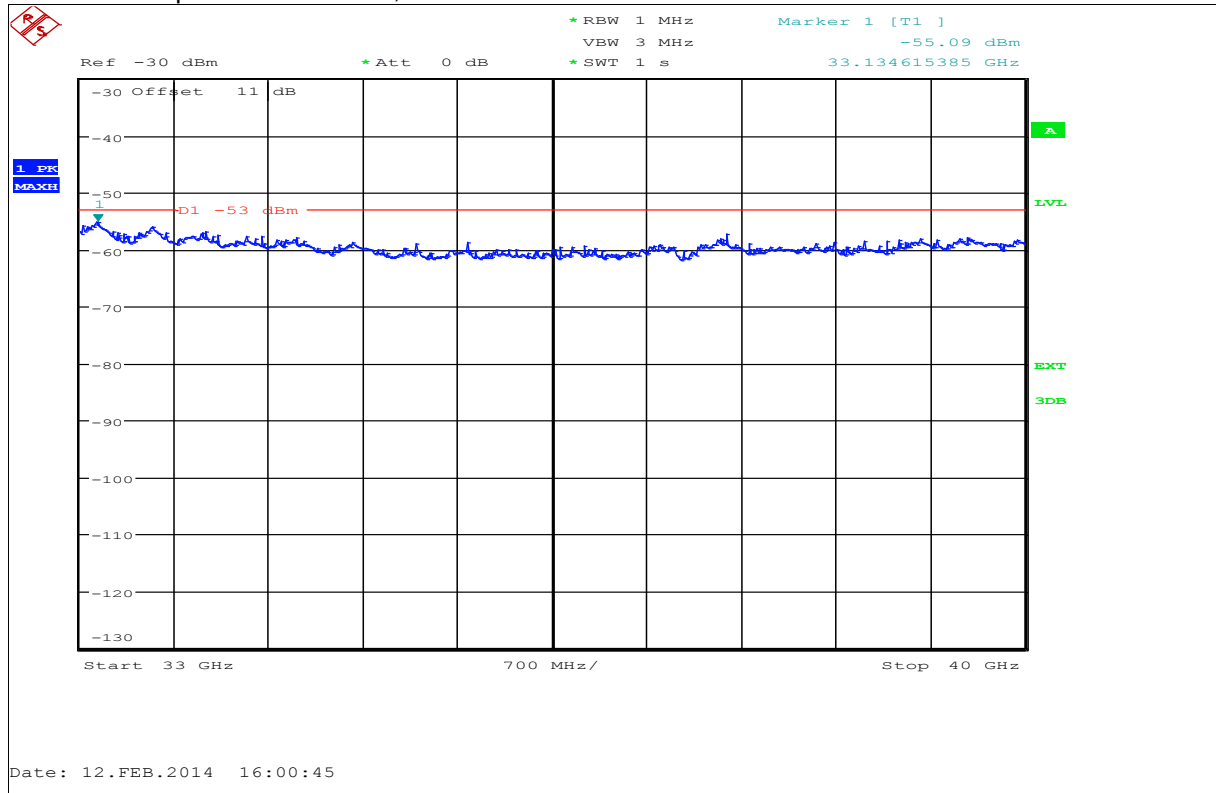
Plot 43: Receiver spurious conducted, 18 GHz – 26 GHz



Plot 44: Receiver spurious conducted, 26 GHz – 33 GHz



Plot 45: Receiver spurious conducted, 33 GHz – 40 GHz



## 9.8 Receiver Spurious emissions (radiated)

### Radiated measurements:

| Measurement parameter |                                         |
|-----------------------|-----------------------------------------|
| Detector:             | Peak                                    |
| Sweep time:           | Auto                                    |
| Resolution bandwidth: | f < 1 GHz : 100 kHz<br>f ≥ 1GHz : 1 MHz |
| Video bandwidth:      | f < 1 GHz : 100 kHz<br>f ≥ 1GHz : 1 MHz |
| Span:                 | -/-                                     |
| Trace-Mode:           | Max. hold                               |

Radiated spurious emission measurements shall be performed with the receiver antenna connected to the receiver antenna terminals. Spurious emissions from receivers shall not exceed the radiated limits shown in the table below:

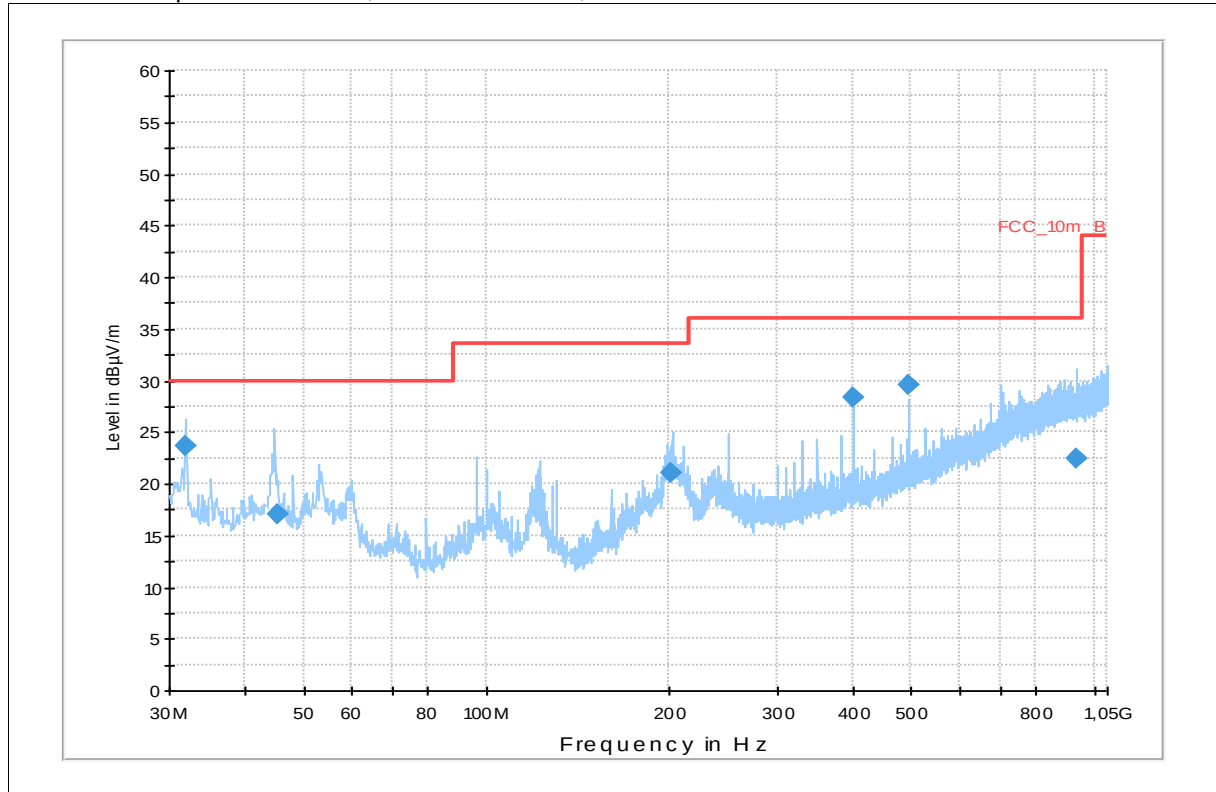
### Limit:

RSS-Gen, clause 6.1

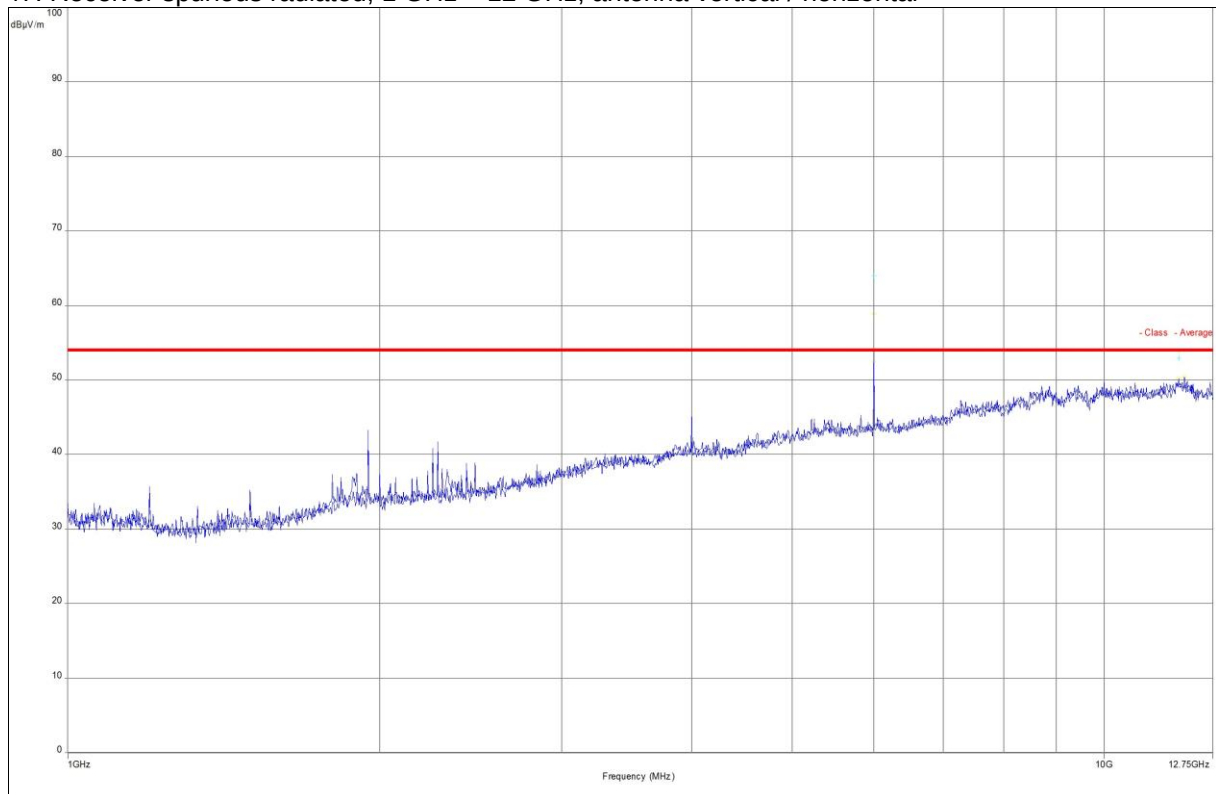
| Frequency (MHz) | Field Strength (dBμV/m) @ 3m Quasi-peak |
|-----------------|-----------------------------------------|
| 30 – 88         | 40                                      |
| 88 – 216        | 43.5                                    |
| 216 – 960       | 46                                      |
| Above 960       | 54                                      |

**Result:** The measurement is passed.

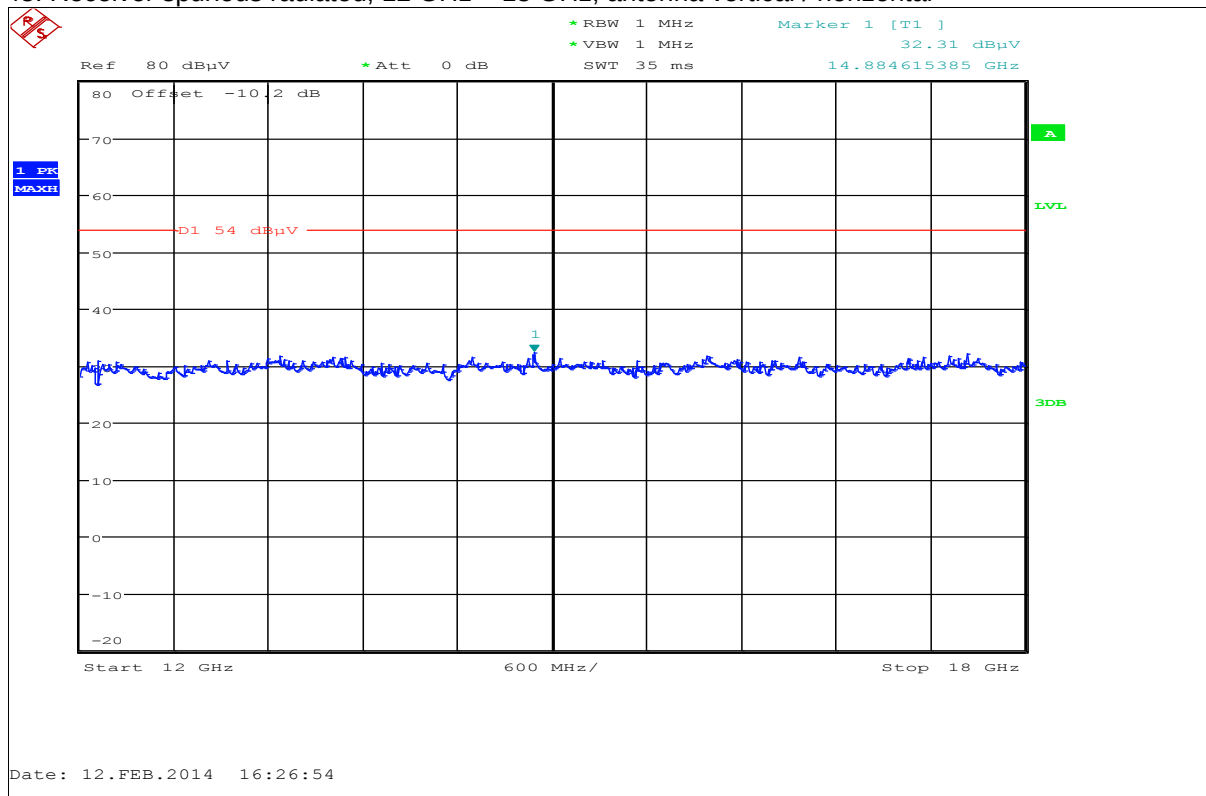
Plot 46: Receiver spurious radiated, 30 MHz – 1 GHz, antenna vertical / horizontal



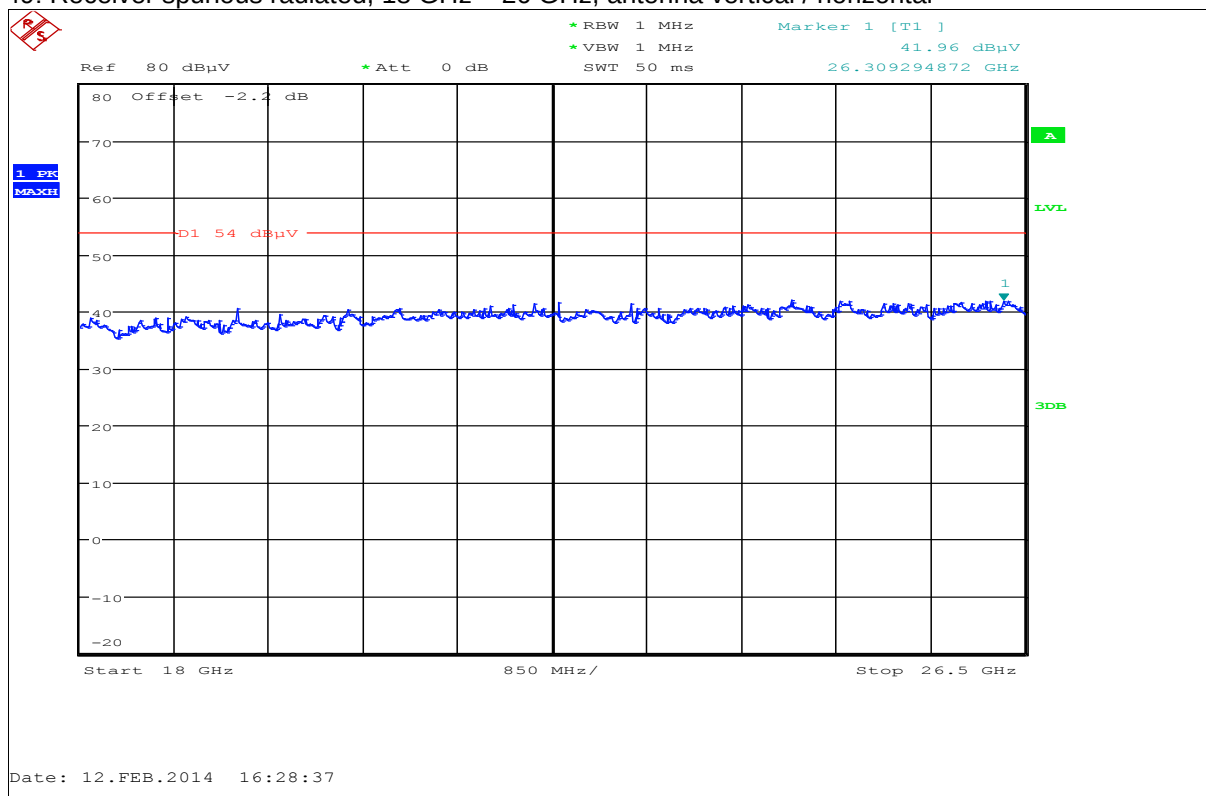
Plot 47: Receiver spurious radiated, 1 GHz – 12 GHz, antenna vertical / horizontal



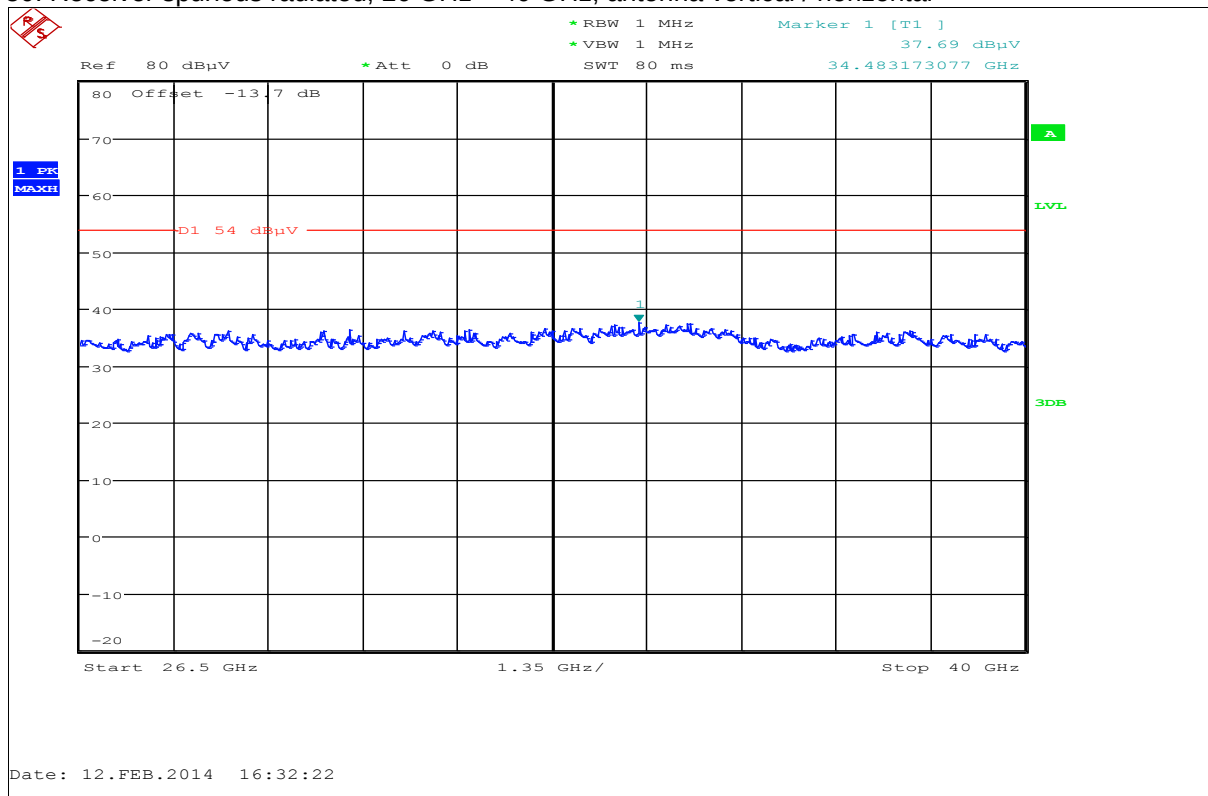
Plot 48: Receiver spurious radiated, 12 GHz – 18 GHz, antenna vertical / horizontal



Plot 49: Receiver spurious radiated, 18 GHz – 26 GHz, antenna vertical / horizontal



Plot 50: Receiver spurious radiated, 26 GHz – 40 GHz, antenna vertical / horizontal



## 9.9 Frequency stability

### Measurement:

Frequency stability was measured with a frequency counter. To improve the quality of measurement the frequency counter was connected to an external GPS based 10 MHz reference signal.

### Limits:

| RSS-Gen                                                                                                            |
|--------------------------------------------------------------------------------------------------------------------|
| Clause 4.7 / Clause 7.2.6                                                                                          |
| FCC                                                                                                                |
| 47 CFR § 2.1055 / § 90.213                                                                                         |
| There are no limits specified<br>Note 10: ... frequency stability is to be specified in the station authorization. |

### Results: nominal frequency at 17.2 GHz

| Temperature   | Frequency (GHz) | Deviation (Hz) |
|---------------|-----------------|----------------|
| -30 °C        | 17.199 999 940  | -60            |
| -20 °C        | 17.199 999 950  | -50            |
| -10 °C        | 17.199 999 955  | -45            |
| 0 °C          | 17.199 999 960  | -40            |
| 10 °C         | 17.199 999 960  | -40            |
| 20 °C (V nom) | 17.199 999 978  | -28            |
| 30 °C         | 17.199 999 955  | -45            |
| 40 °C         | 17.199 999 960  | -40            |
| 50 °C         | 17.199 999 960  | -40            |
| Voltage       |                 |                |
| 85 %          | 17.199 999 970  | -30            |
| 115 %         | 17.199 999 970  | -30            |

Result: The measurement is passed.

## 10 Test equipment and ancillaries used for tests

Typically, the calibrations of the test apparatus are commissioned to and performed by an accredited calibration laboratory. The calibration intervals are determined in accordance with the DIN EN ISO/IEC 17025. In addition to the external calibrations, the laboratory executes comparison measurements with other calibrated test systems or effective verifications. Weekly chamber inspections and range calibrations are performed. Where possible, rf-generating and signalling equipment as well as measuring receivers and analyzers are connected to an external high-precision 10 MHz reference (GPS-based or rubidium frequency standard).

In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

| No. | Lab / Item | Equipment                                      | Type                             | Manufact.            | Serial No. | INV. No<br>Cetecom | Kind of<br>Calibration | Last<br>Calibration | Next<br>Calibration |
|-----|------------|------------------------------------------------|----------------------------------|----------------------|------------|--------------------|------------------------|---------------------|---------------------|
| 1   | n. a.      | DC power supply, 60Vdc, 50A, 1200 W            | 6032A                            | HP Meßtechnik        | 2818A03450 | 300001040          | Ve                     | 12.01.2012          | 12.01.2015          |
| 2   | n. a.      | Double-Ridged Waveguide Horn Antenna 1-18.0GHz | 3115                             | EMCO                 | 8812-3088  | 300001032          | vIKI!                  | 08.05.2013          | 08.05.2015          |
| 3   | n. a.      | Anechoic chamber                               | FAC 3/5m                         | MWB / TDK            | 87400/02   | 300000996          | ev                     |                     |                     |
| 4   | n. a.      | Switch / Control Unit                          | 3488A                            | HP Meßtechnik        | *          | 300000199          | ne                     |                     |                     |
| 5   | 9          | Artificial Mains 9 kHz to 30 MHz               | ESH3-Z5                          | R&S                  | 828576/020 | 300001210          | Ve                     | 30.01.2014          | 30.01.2016          |
| 6   | 9          | Isolating Transformer                          | MPL IEC625 Bus Regeltrennt ravo  | Erfi                 | 91350      | 300001155          | ne                     |                     |                     |
| 7   | 90         | Active Loop Antenna 10 kHz to 30 MHz           | 6502                             | Kontron Psychotech   | 8905-2342  | 300000256          | k                      | 13.06.2013          | 13.06.2015          |
| 8   | n. a.      | Amplifier                                      | js42-00502650-28-5a              | Parzich GMBH         | 928979     | 300003143          | ne                     |                     |                     |
| 9   | n. a.      | Band Reject filter                             | WRCG185 5/1910-1835/1925-40/8SS  | Wainwright           | 7          | 300003350          | ev                     |                     |                     |
| 10  | n. a.      | Band Reject filter                             | WRCG240 0/2483-2375/2505-50/10SS | Wainwright           | 11         | 300003351          | ev                     |                     |                     |
| 11  | n. a.      | Highpass Filter                                | WHKX7.0/18G-8SS                  | Wainwright           | 18         | 300003789          | ne                     |                     |                     |
| 12  | n. a.      | TRILOG Broadband Test-Antenna 30 MHz - 3 GHz   | VULB9163                         | Schwarzbeck          | 371        | 300003854          | vIKI!                  | 14.10.2011          | 14.10.2014          |
| 13  | n. a.      | MXE EMI Receiver 20 Hz bis 26,5 GHz            | N9038A                           | Agilent Technologies | MY51210197 | 300004405          | k                      | 13.03.2014          | 13.03.2015          |
| 14  | n. a.      | 4U RF Switch Platform                          | L4491A                           | Agilent Technologies | MY50000037 | 300004509          | ne                     |                     |                     |
| 15  | CR 79      | Std. Gain Horn Antenna 26.5-40.0 GHz           | V637                             | Narda                | 7911       | 300001751          | ne                     |                     |                     |
| 16  | A025       | Std. Gain Horn Antenna 49.9-75.8 GHz           | 2524-20                          | Flann                | *          | 300001983          | ne                     |                     |                     |
| 17  | A028       | Std. Gain Horn Antenna 73.8-112 GHz            | 2724-20                          | Flann                | *          | 300001991          | ne                     |                     |                     |
| 18  | A026       | Std. Gain Horn Antenna 12.4 to 18.0 GHz        | 639                              | Narda                | 8402       | 300000787          | k                      | 22.07.2013          | 22.07.2015          |
| 19  | A029       | Std. Gain Horn Antenna 18.0 to 26.5 GHz        | 638                              | Narda                | 8205       | 300002442          | k                      | 19.07.2013          | 19.07.2015          |
| 20  | n. a.      | DC power supply, 60Vdc, 50A, 1200 W            | 6032A                            | HP Meßtechnik        | 2920A04590 | 300001041          | Ve                     | 12.01.2012          | 12.01.2015          |

|    |       |                                      |                            |                      |            |           |    |            |            |
|----|-------|--------------------------------------|----------------------------|----------------------|------------|-----------|----|------------|------------|
| 21 | n. a. | PXA Spectrum Analyzer 3Hz to 50GHz   | N9030A PXA Signal Analyzer | Agilent Technologies | US51350267 | 300004338 | k  | 09.01.2014 | 09.01.2015 |
| 22 | n. a. | Std. Gain Horn Antenna 33.0-50.1 GHz | 2324-20                    | Flann                | 57         | 400000683 | ne |            |            |
| 23 |       | Waveguide Harmonic Mixer to 110 GHz  | 11970 (U, W, V, Q, A, K)   | HP Meßtechnik        |            | 300000781 | k  | 20.04.2013 | 20.04.2016 |

## Agenda: Kind of Calibration

k calibration / calibrated  
 ne not required (k, ev, izw, zw not required)  
 ev periodic self verification  
 Ve long-term stability recognized  
 vlk! Attention: extended calibration interval  
 NK! Attention: not calibrated

EK limited calibration  
 zw cyclical maintenance (external cyclical maintenance)  
 izw internal cyclical maintenance  
 g blocked for accredited testing  
 \*) next calibration ordered / currently in progress

**Annex A Document history**

| Version | Applied changes           | Date of release |
|---------|---------------------------|-----------------|
| 1.0     | Initial release           | 2014-06-16      |
| -A      | MPE calculation corrected | 2014-09-11      |

**Annex B Further information****Glossary**

|          |   |                                  |
|----------|---|----------------------------------|
| DUT      | - | Device under Test                |
| EMC      | - | Electromagnetic Compatibility    |
| EUT      | - | Equipment under Test             |
| FCC      | - | Federal Communication Commission |
| FCC ID   | - | Company Identifier at FCC        |
| HW       | - | Hardware                         |
| IC       | - | Industry Canada                  |
| Inv. No. | - | Inventory number                 |
| N/A      | - | not applicable                   |
| S/N      | - | Serial Number                    |
| SW       | - | Software                         |