



## TEST REPORT

Test report no.: 1-6965/13-19-11



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

**Sony Mobile Communications AB**

Nya Vattentorget

22188 Lund / SWEDEN

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Fax: -/-

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### Manufacturer

**Sony Mobile Communications AB**

Nya Vattentorget

22188 Lund / SWEDEN

### Test standard/s

47 CFR Part 15

Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices

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

### Test Item

**Kind of test item:** Smart Phone GPRS/EGPRS 850/900/1800/1900; UMTS HSPA FDDI/II/V/VIII; LTE FDD1/2/3/5/7/8/28; WLAN b/g/n/a/ac; BT 4.0; RFID; A-GPS

**FCC ID:** PY7PM-0751

**IC:** -/-

**Frequency:** DTS band 2400 MHz to 2483.5 MHz  
(lowest channel 00 – 2402 MHz, highest channel 78 – 2480 MHz)

**Technology tested:** Bluetooth®, +EDR

**Antenna:** Integrated antenna

**Power supply:** 4.2 V DC by Li - polymer battery

**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 report authorised:

Stefan Bös  
Senior Testing Manager

### Test performed:

Marco Bertolino  
Testing Manager

**1 Table of contents**

1 Table of contents .....2

2 General information .....3

    2.1 Notes and disclaimer .....3

    2.2 Application details.....3

3 Test standard/s .....3

4 Test environment.....4

5 Test item .....4

    5.1 Additional information .....4

6 Test laboratories sub-contracted .....4

7 Description of the test setup .....5

    7.1 Radiated measurements chamber F.....5

    7.2 Radiated measurements chamber C .....6

    7.3 Radiated measurements 12.75 GHz to 25 GHz .....7

    7.4 AC conducted .....8

    7.5 Conducted bluetooth test system.....9

8 Summary of measurement results .....10

9 Additional comments .....11

10 Measurement results .....12

    10.1 Antenna gain .....12

    10.2 Time of occupancy (dwell time).....13

    10.3 Band edge compliance radiated.....14

    10.4 TX spurious emissions radiated.....18

    10.5 RX spurious emissions radiated .....29

    10.6 Spurious emissions radiated < 30 MHz .....33

    10.7 Spurious emissions conducted < 30 MHz .....35

11 Test equipment and ancillaries used for tests .....38

12 Observations .....39

Annex A Document history .....40

Annex B Further information.....40

Annex C Accreditation Certificate .....41

## 2 General information

### 2.1 Notes and disclaimer

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.

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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:          | 2014-04-14 |
| Date of receipt of test item:      | 2014-05-05 |
| Start of test:                     | 2014-05-05 |
| End of test:                       | 2014-05-15 |
| Person(s) present during the test: | -/-        |

## 3 Test standard/s

| Test standard  | Date | Test standard description   |
|----------------|------|---|
| 47 CFR Part 15 | -/-  | Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices |

#### 4 Test environment

|                            |           |                                       |
|----------------------------|-----------|---------------------------------------|
| Temperature:               | $T_{nom}$ | +22 °C during room temperature tests  |
|                            | $T_{max}$ | +50 °C during high temperature tests  |
|                            | $T_{min}$ | -30 °C during low temperature tests   |
| Relative humidity content: |           | 41 %                                  |
| Barometric pressure:       |           | not relevant for this kind of testing |
| Power supply:              | $V_{nom}$ | 4.2 V DC by Li - polymer battery      |
|                            | $V_{max}$ | 4.2 V                                 |
|                            | $V_{min}$ | 3.3 V                                 |

#### 5 Test item

|                            |   |   |
|----------------------------|---|---|
| Kind of test item          | : | Smart Phone GPRS/EGPRS 850/900/1800/1900; UMTS HSPA FDDI/II/V/VIII; LTE FDD1/2/3/5/7/8/28; WLAN b/g/n/a/ac; BT 4.0; RFID; A-GPS |
| S/N serial number          | : | Conducted units: CB5126Z74E; CB5126Z756<br>Radiated units: CB5126Z4RH; CB5126Z4R1   |
| HW hardware status         | : | No information available!   |
| SW software status         | : | RF test software  |
| Frequency band [MHz]       | : | DTS band 2400 MHz to 2483.5 MHz<br>(lowest channel 00 – 2402 MHz; highest channel 78 – 2480 MHz)                                |
| Type of radio transmission | : | FHSS  |
| Use of frequency spectrum  | : |   |
| Type of modulation         | : | GFSK, Pi/4 QPSK and 8 DPSK  |
| Number of channels         | : | 79  |
| Antenna                    | : | Integrated antenna  |
| Power supply               | : | 4.2 V DC by Li - polymer battery  |
| Temperature range          | : | -30°C to +50 °C   |

#### 5.1 Additional information

Test setup- and EUT-photos are included in test report: 1-6965/13-19-01\_AnnexA  
1-6965/13-19-01\_AnnexB  
1-6965/13-19-01\_AnnexD

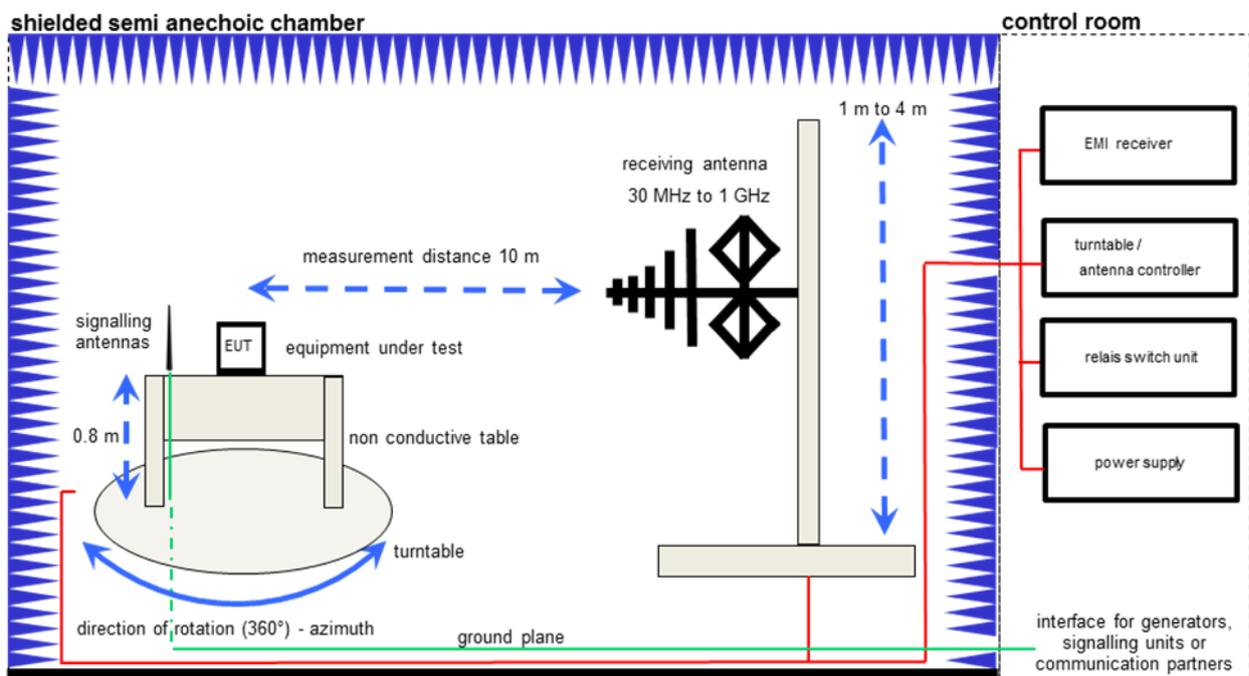
#### 6 Test laboratories sub-contracted

None

## 7 Description of the test setup

### 7.1 Radiated measurements chamber F

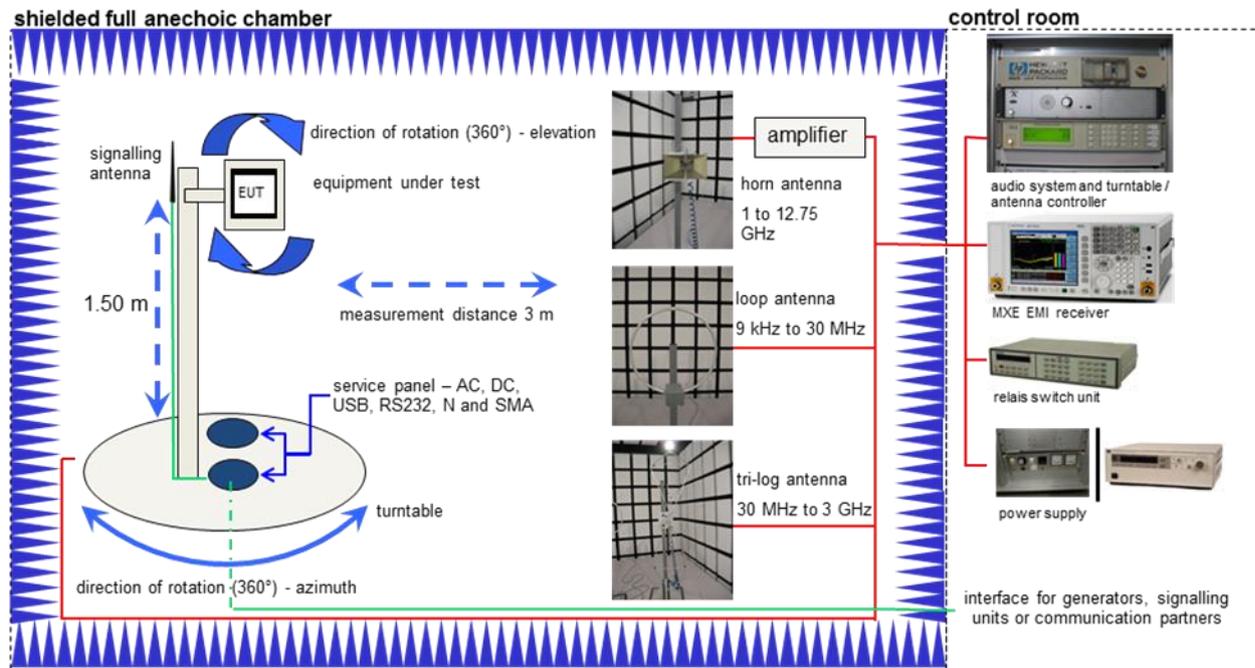
The radiated measurements are performed in vertical and horizontal plane in the frequency range from 9 kHz to 1 GHz in semi-anechoic chambers. The EUT is positioned on a non-conductive support with a height of 0.80 m above a conductive ground plane that covers the whole chamber. The receiving antennas are confirmed with specifications ANSI C63. 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 analysers where the detector modes and resolution bandwidths over various frequency ranges are set according to requirement ANSI C63.



#### Equipment table:

| Equipment                                    | Type                               | Manufacturer  | Serial No. | INV. No Cetecom |
|--|------------------------------------|---------------|------------|-----------------|
| Switch-Unit                                  | 3488A                              | HP Meßtechnik | 2719A14505 | 300000368       |
| DC power supply, 60Vdc, 50A, 1200 W          | 6032A                              | HP Meßtechnik | 2920A04466 | 300000580       |
| EMI Test Receiver                            | ESCI 3                             | R&S           | 100083     | 300003312       |
| Amplifier                                    | JS42-00502650-28-5A                | MITEQ         | 1084532    | 300003379       |
| Antenna Tower                                | Model 2175                         | ETS-LINDGREN  | 64762      | 300003745       |
| Positioning Controller                       | Model 2090                         | ETS-LINDGREN  | 64672      | 300003746       |
| Turntable Interface-Box                      | Model 105637                       | ETS-LINDGREN  | 44583      | 300003747       |
| TRILOG Broadband Test-Antenna 30 MHz - 3 GHz | VULB9163                           | Schwarzbeck   | 295        | 300003787       |
| CBT (Bluetooth Tester + EDR Signalling)      | CBT 1153.9000K35, CBT-B55, CBT-K55 | R&S           | 100313     | 300003516       |

## 7.2 Radiated measurements chamber C



### Equipment table:

| Equipment                                      | Type                               | Manufacturer         | Serial No. | INV. No Cetecom |
|--|------------------------------------|----------------------|------------|-----------------|
| MXE EMI Receiver 20 Hz bis 26,5 GHz            | N9038A                             | Agilent Technologies | MY51210197 | 300004405       |
| TRILOG Broadband Test-Antenna 30 MHz - 3 GHz   | VULB9163                           | Schwarzbeck          | 371        | 300003854       |
| Band Reject filter                             | WRCG2400/2483-2375/2505-50/10SS    | Wainwright           | 11         | 300003351       |
| Highpass Filter                                | WHKX7.0/18G-8SS                    | Wainwright           | 18         | 300003789       |
| Double-Ridged Waveguide Horn Antenna 1-18.0GHz | 3115                               | EMCO                 | 8812-3088  | 300001032       |
| Active Loop Antenna                            | 6502                               | EMCO                 | 8905-2342  | 300000256       |
| Anechoic chamber                               | FAC 3/5m                           | MWB / TDK            | 87400/02   | 300000996       |
| Switch / Control Unit                          | 3488A                              | HP Meßtechnik        | *          | 300000199       |
| Switch / Control Unit                          | 3488A                              | HP Meßtechnik        | 2719A15013 | 300001156       |
| Isolating Transformer                          | MPL IEC625 Bus Regeltrenntravo     | Erfi                 | 91350      | 300001155       |
| Three-Way Power Splitter, 50 Ohm               | 11850C                             | HP Meßtechnik        |            | 300000997       |
| Amplifier                                      | js42-00502650-28-5a                | Parzich GMBH         | 928979     | 300003143       |
| CBT (Bluetooth Tester + EDR Signalling)        | CBT 1153.9000K35, CBT-B55, CBT-K55 | R&S                  | 100313     | 300003516       |

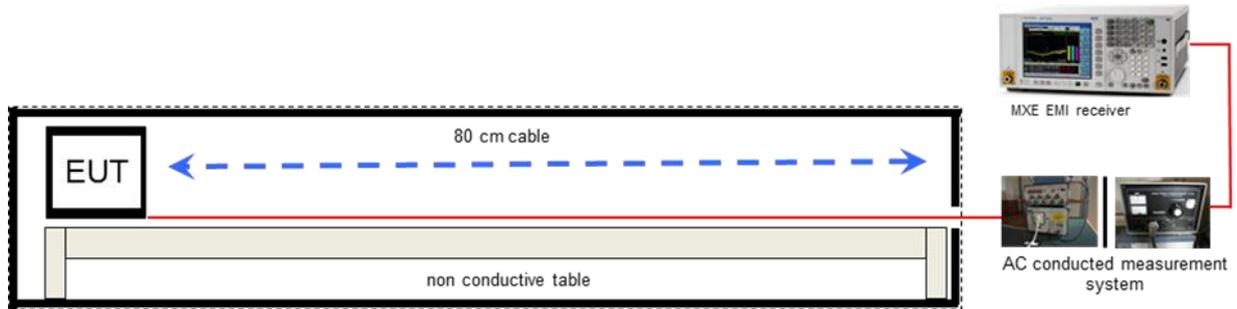
### 7.3 Radiated measurements 12.75 GHz to 25 GHz



#### Equipment table:

| Equipment                                   | Type                                   | Manufacturer  | Serial No. | INV. No Cetecom |
|---|--|---------------|------------|-----------------|
| Std. Gain Horn Antenna<br>12.4 to 18.0 GHz  | 639                                    | Narda         | 8402       | 300000787       |
| Std. Gain Horn Antenna<br>18.0 to 26.5 GHz  | 638                                    | Narda         | 8205       | 300002442       |
| Microwave System<br>Amplifier, 0.5-26.5 GHz | 83017A                                 | HP Meßtechnik | 00419      | 300002268       |
| Spectrum Analyzer 20 Hz -<br>50 GHz         | FSU50                                  | R&S           | 200012     | 300003443       |
| Signal Analyzer 40 GHz                      | FSV40                                  | R&S           | 101042     | 300004517       |
| CBT (Bluetooth Tester +<br>EDR Signalling)  | CBT 1153.9000K35, CBT-<br>B55, CBT-K55 | R&S           | 100313     | 300003516       |

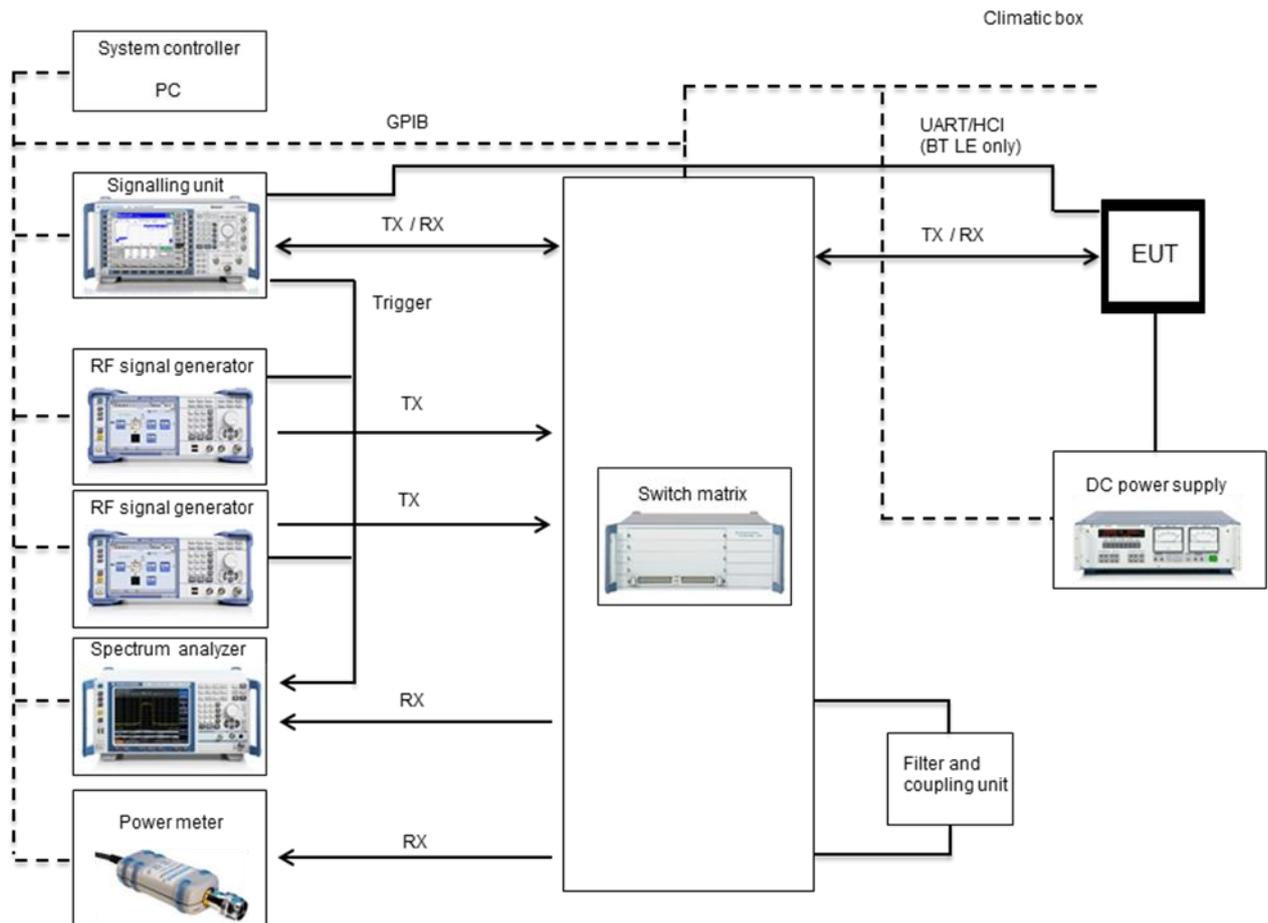
**7.4 AC conducted**



**Equipment table:**

| Equipment                               | Type                               | Manufacturer         | Serial No. | INV. No Cetecom |
|---|------------------------------------|----------------------|------------|-----------------|
| MXE EMI Receiver 20 Hz bis 26,5 GHz     | N9038A                             | Agilent Technologies | MY51210197 | 300004405       |
| Isolating Transformer                   | MPL IEC625 Bus Regeltrenntravo     | Erfi                 | 91350      | 300001155       |
| Switch / Control Unit                   | 3488A                              | HP Meßtechnik        | *          | 300000199       |
| Switch / Control Unit                   | 3488A                              | HP Meßtechnik        | 2719A15013 | 300001168       |
| Artificial Mains 9 kHz to 30 MHz        | ESH3-Z5                            | R&S                  | 828576/020 | 300001210       |
| CBT (Bluetooth Tester + EDR Signalling) | CBT 1153.9000K35, CBT-B55, CBT-K55 | R&S                  | 100313     | 300003516       |

## 7.5 Conducted bluetooth test system



### Equipment table:

| Equipment  | Type             | Manufacturer | Serial No. | INV. No Cetecom |
|--|------------------|--------------|------------|-----------------|
| Power Supply DC                                  | NGPE 40/40       | R&S          | 388        | 40000078        |
| Signal Analyzer 20Hz-26,5GHz-150 to + 30 DBM     | FSIQ26           | R&S          | 835540/018 | 300002681-0005  |
| Frequency Standard (Rubidium Frequency Standard) | MFS (Rubidium)   | R&S (Datum)  | 002        | 300002681-0009  |
| Directional Coupler                              | 101020010        | Krytar       | 70215      | 300002840       |
| DC-Blocker                                       | 8143             | Inmet Corp.  | none       | 300002842       |
| Powersplitter                                    | 6005-3           | Inmet Corp.  |            | 300002841       |
| CBT (Bluetooth Tester + EDR Signalling)          | CBT 1153.9000K35 | R&S          | 100185     | 300003416       |

## 8 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    | CFR Part 15 | Passed  | 2014-05-15 | Delta tests according to manufacturer test plan. |

| Test specification clause | Test case  | Temperature conditions | Power source voltages | Mode                         | Pass  | Fail   | NA   | NP  | Remark                   |
|---------------------------|--|------------------------|-----------------------|------------------------------|---|--|--|---|--------------------------|
| §15.247(b)(4)             | Antenna gain                                       | Nominal                | Nominal               | GFSK                         | <input type="checkbox"/>  | <input type="checkbox"/>   | <input type="checkbox"/>   | <input type="checkbox"/>  | Declared                 |
| §15.247(e)                | Power spectral density                             | Nominal                | Nominal               | GFSK<br>Pi/4 DQPSK<br>8 DPSK | <input type="checkbox"/>  | <input type="checkbox"/>   | <input checked="" type="checkbox"/>  | <input type="checkbox"/>  | Not applicable for FHSS! |
| §15.247(a)(1)             | Carrier frequency separation                       | Nominal                | Nominal               | GFSK                         | <input type="checkbox"/>  | <input type="checkbox"/>   | <input type="checkbox"/>   | <input checked="" type="checkbox"/>   | -/-                      |
| §15.247(a)(1)             | Number of hopping channels                         | Nominal                | Nominal               | GFSK                         | <input type="checkbox"/>  | <input type="checkbox"/>   | <input type="checkbox"/>   | <input checked="" type="checkbox"/>   | -/-                      |
| §15.247(a)(1) (iii)       | Time of occupancy (dwell time)                     | Nominal                | Nominal               | GFSK<br>Pi/4 DQPSK<br>8 DPSK | <input checked="" type="checkbox"/>   | <input type="checkbox"/>   | <input type="checkbox"/>   | <input type="checkbox"/>  | complies                 |
| §15.247(a)(1)             | Spectrum bandwidth of a FHSS system 20dB bandwidth | Nominal                | Nominal               | GFSK<br>Pi/4 DQPSK<br>8 DPSK | <input type="checkbox"/><br><input type="checkbox"/><br><input type="checkbox"/>                                  | <input type="checkbox"/><br><input type="checkbox"/><br><input type="checkbox"/> | <input type="checkbox"/><br><input type="checkbox"/><br><input type="checkbox"/> | <input checked="" type="checkbox"/><br><input checked="" type="checkbox"/><br><input checked="" type="checkbox"/> | -/-                      |
| §15.247(b)(1)             | Maximum output power                               | Nominal                | Nominal               | GFSK<br>Pi/4 DQPSK<br>8 DPSK | <input type="checkbox"/><br><input type="checkbox"/><br><input type="checkbox"/>                                  | <input type="checkbox"/><br><input type="checkbox"/><br><input type="checkbox"/> | <input type="checkbox"/><br><input type="checkbox"/><br><input type="checkbox"/> | <input checked="" type="checkbox"/><br><input checked="" type="checkbox"/><br><input checked="" type="checkbox"/> | -/-                      |
| §15.247(d)                | Band edge compliance conducted                     | Nominal                | Nominal               | GFSK<br>Pi/4 DQPSK<br>8 DPSK | <input type="checkbox"/><br><input type="checkbox"/><br><input type="checkbox"/>                                  | <input type="checkbox"/><br><input type="checkbox"/><br><input type="checkbox"/> | <input type="checkbox"/><br><input type="checkbox"/><br><input type="checkbox"/> | <input checked="" type="checkbox"/><br><input checked="" type="checkbox"/><br><input checked="" type="checkbox"/> | -/-                      |
| §15.205                   | Band edge compliance radiated                      | Nominal                | Nominal               | GFSK<br>Pi/4 DQPSK<br>8 DPSK | <input checked="" type="checkbox"/><br><input checked="" type="checkbox"/><br><input checked="" type="checkbox"/> | <input type="checkbox"/><br><input type="checkbox"/><br><input type="checkbox"/> | <input type="checkbox"/><br><input type="checkbox"/><br><input type="checkbox"/> | <input type="checkbox"/><br><input type="checkbox"/><br><input type="checkbox"/>                                  | complies                 |
| §15.247(d)                | TX spurious emissions conducted                    | Nominal                | Nominal               | GFSK<br>Pi/4 DQPSK<br>8 DPSK | <input type="checkbox"/><br><input type="checkbox"/><br><input type="checkbox"/>                                  | <input type="checkbox"/><br><input type="checkbox"/><br><input type="checkbox"/> | <input type="checkbox"/><br><input type="checkbox"/><br><input type="checkbox"/> | <input checked="" type="checkbox"/><br><input checked="" type="checkbox"/><br><input checked="" type="checkbox"/> | -/-                      |
| §15.247(d)                | TX spurious emissions radiated                     | Nominal                | Nominal               | GFSK                         | <input checked="" type="checkbox"/>   | <input type="checkbox"/>   | <input type="checkbox"/>   | <input type="checkbox"/>  | complies                 |
| §15.109                   | RX spurious emissions radiated                     | Nominal                | Nominal               | -/-                          | <input checked="" type="checkbox"/>   | <input type="checkbox"/>   | <input type="checkbox"/>   | <input type="checkbox"/>  | complies                 |
| §15.209(a)                | TX spurious emissions radiated < 30 MHz            | Nominal                | Nominal               | GFSK                         | <input checked="" type="checkbox"/>   | <input type="checkbox"/>   | <input type="checkbox"/>   | <input type="checkbox"/>  | complies                 |
| §15.107(a) §15.207        | Conducted emissions < 30 MHz                       | Nominal                | Nominal               | GFSK                         | <input checked="" type="checkbox"/>   | <input type="checkbox"/>   | <input type="checkbox"/>   | <input type="checkbox"/>  | complies                 |

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

## 9 Additional comments

The Bluetooth® word mark and logos are owned by the Bluetooth SIG Inc. and any use of such marks by Cetecom ICT Services GmbH is under license.

Reference documents: Main test report: 1-6965/13-16-12-A (FCC ID: PY7PM-0750)

Special test descriptions: None

Configuration descriptions: TX tests: were performed with x-DH5 packets and static PRBS pattern payload.  
RX/Standby tests: BT test mode enabled, scan enabled, TX Idle

Test mode:

- Bluetooth Test mode loop back enabled (EUT is controlled over CBT/CMU)
- Special software is used. EUT is transmitting pseudo random data by itself

## 10 Measurement results

### 10.1 Antenna gain

**Limits:**

| FCC          | -/- |
|--------------|-----|
| Antenna Gain |     |
| 6 dBi        |     |

**Results:**

| T <sub>nom</sub>                            | V <sub>nom</sub> | lowest channel<br>2402 MHz | middle channel<br>2441 MHz | highest channel<br>2480 MHz |
|---|------------------|----------------------------|----------------------------|-----------------------------|
| Gain [dBi]<br>Declared by the manufacturer! |                  | -0.4                       | -3.1                       | -4.4                        |

**Result:** -/-

## 10.2 Time of occupancy (dwell time)

### Measurement:

For Bluetooth® devices no measurements mandatory depending on the fixed requirements according to the Bluetooth® Core Specifications!

### For Bluetooth® devices:

The channel staying time of 0.4 s within a 31.6 second period in data mode is constant for Bluetooth® devices and independent from the packet type (packet length). The calculation for a 31.6 second period is as follows:

Channel staying time = time slot length \* hop rate / number of hopping channels \* 31.6 s

Example for a DH1 packet (with a maximum length of one time slot)  
 Channel staying time =  $625 \mu\text{s} * 1600 * 1/\text{s} / 79 * 31.6 \text{ s} = 0.4 \text{ s}$  (in a 31.6 s period)

For multi-slot packets the hopping is reduced according to the length of the packet.

Example for a DH3 packet (with a maximum length of three time slots)  
 Channel staying time =  $3 * 625 \mu\text{s} * 1600/3 * 1/\text{s} / 79 * 31.6 \text{ s} = 0.4 \text{ s}$  (in a 31.6 s period)

Example for a DH5 packet (with a maximum length of five time slots)  
 Channel staying time =  $5 * 625 \mu\text{s} * 1600/5 * 1/\text{s} / 79 * 31.6 \text{ s} = 0.4 \text{ s}$  (in a 31.6 s period)

This is according to the Bluetooth® Core Specification V2.0 & V2.1 & V3.0 & V4.0 (+ critical errata) for all Bluetooth® devices and all modulations.

### The following table shows the relations:

| Packet Size | Pulse Width [ms] * | Max. number of transmissions per channel in 31.6 sec |
|-------------|--------------------|--|
| DH1         | 0.366              | 640  |
| DH3         | 1.622              | 214  |
| DH5         | 2.870              | 128  |

\* according Bluetooth® specification

### Results:

| Packet Size | Pulse Width [ms]* | Max. number of transmissions in 31.6 sec | Dwell time [Pulse width * Number of transmissions] |
|-------------|-------------------|--|--|
| DH1         | 0.366             | 640                                      | 234.2 ms   |
| DH3         | 1.622             | 214                                      | 347.1 ms   |
| DH5         | 2.870             | 128                                      | 367.4 ms   |

### Limits:

| FCC   | -/- |
|---|-----|
| Time of occupancy (dwell time)  |     |
| The frequency hopping operation shall have an average time of occupancy on any frequency not exceeding 0.4 seconds within duration in seconds equal to the number of hopping frequencies multiplied by 0.4. |     |

**Result: Passed**

### 10.3 Band edge compliance radiated

**Description:**

Measurement of the radiated band edge compliance. The EUT is turned in the position that results in the maximum level at the band edge. Then a sweep over the corresponding restricted band is performed. The EUT is set to single channel mode and the transmit channel is channel 00 for the lower restricted band and channel 78 for the upper restricted band. The measurement is repeated for all modulations. Measurement distance is 3m.

**Measurement:**

| Measurement parameter |  |
|-----------------------|--|
| Detector:             | Peak   |
| Sweep time:           | Auto   |
| Video bandwidth:      | 1 MHz Peak / 10 Hz AVG                                     |
| Resolution bandwidth: | 1 MHz  |
| Span:                 | Lower Band: 2370 – 2400 MHz<br>Upper Band: 2480 – 2500 MHz |
| Trace-Mode:           | Max Hold   |

**Limits:**

| FCC  | -/- |
|--|-----|
| Band edge compliance radiated  |     |
| In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 5.205(c)). |     |
| 54 dBµV/m AVG<br>74 dBµV/m Peak  |     |

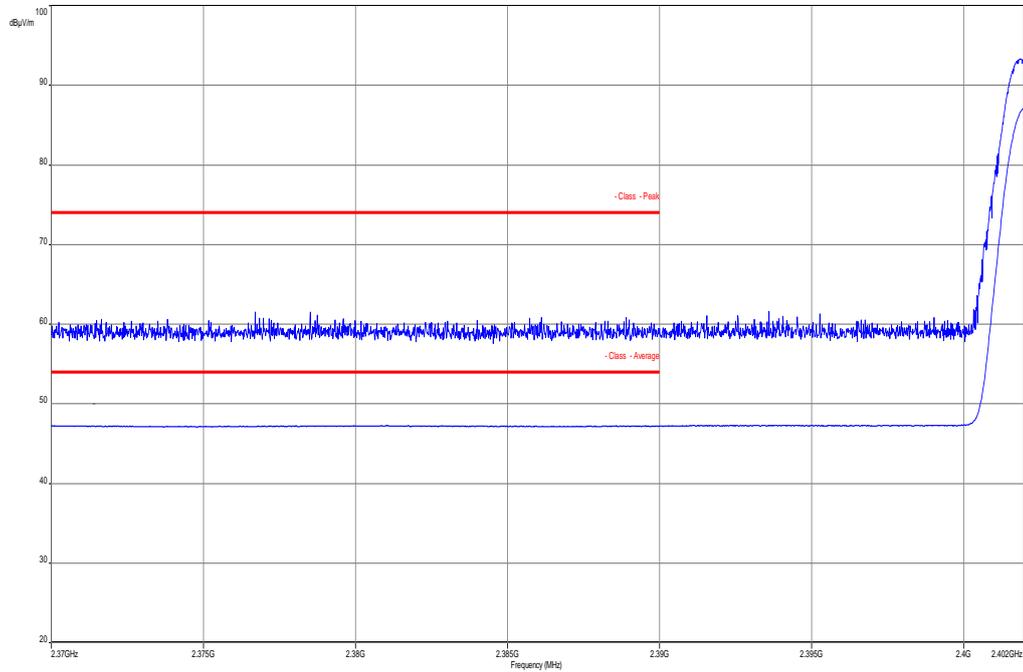
**Results:**

| Scenario<br>Modulation  | Band edge compliance radiated [dBµV/m] |                    |                    |
|-------------------------|--|--------------------|--------------------|
|                         | GFSK                                   | Pi/4 DQPSK         | 8DPSK              |
| Lower restricted band   | < 54 AVG / < 74 PP                     | < 54 AVG / < 74 PP | < 54 AVG / < 74 PP |
| Upper restricted band   | < 54 AVG / < 74 PP                     | < 54 AVG / < 74 PP | < 54 AVG / < 74 PP |
| Measurement uncertainty | ± 3 dB                                 |                    |                    |

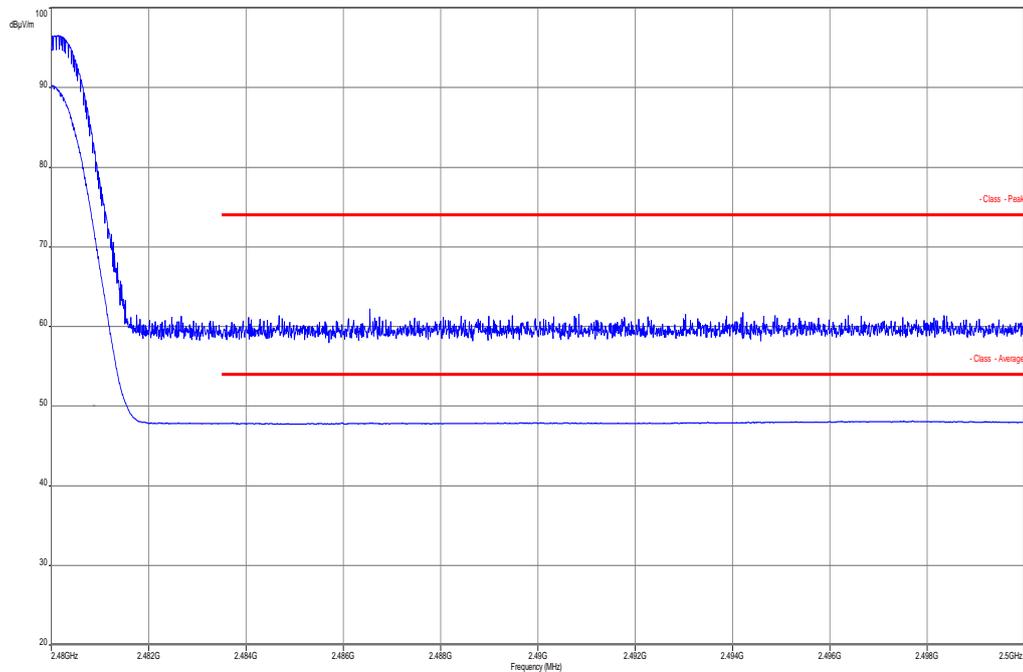
**Result:** Passed

**Plots:**

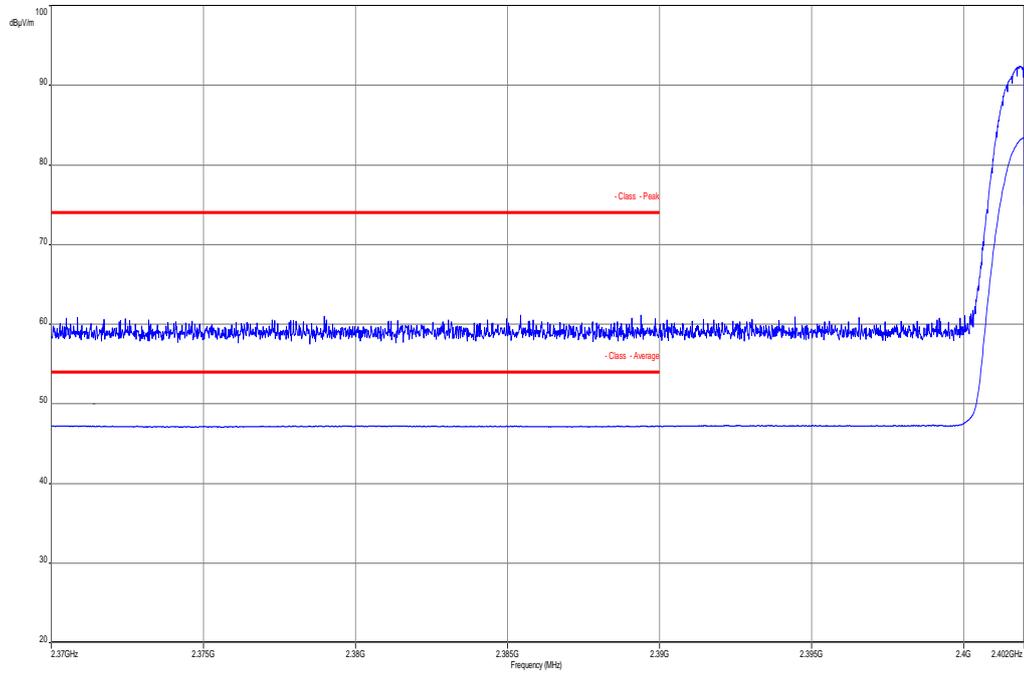
**Plot 1:** Lower band edge, GFSK modulation, vertical & horizontal polarization



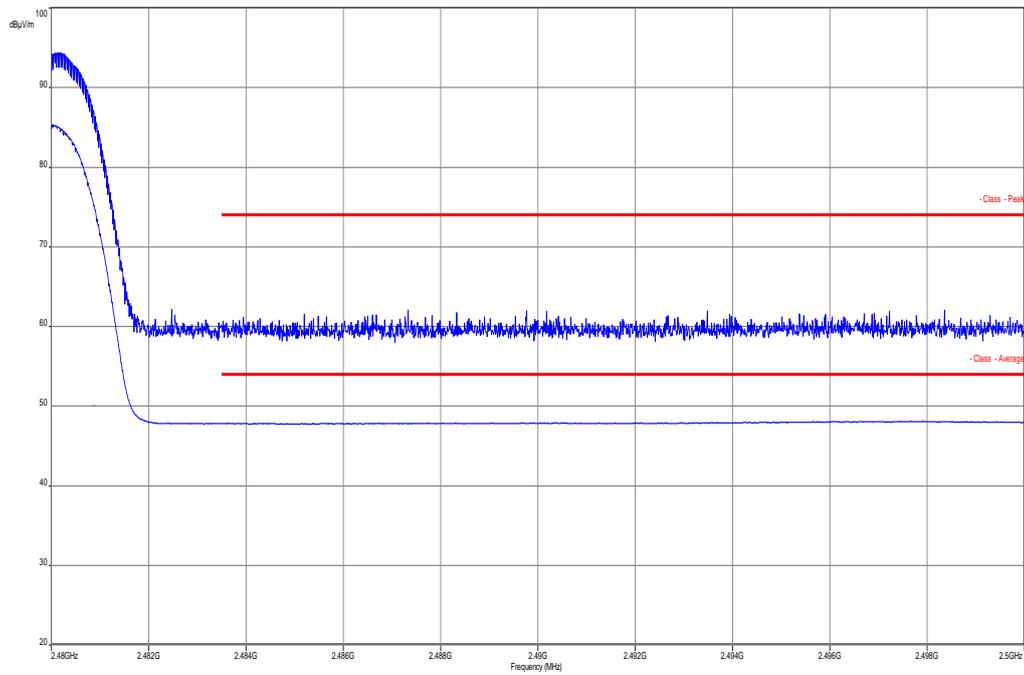
**Plot 2:** Upper band edge, GFSK modulation, vertical & horizontal polarization



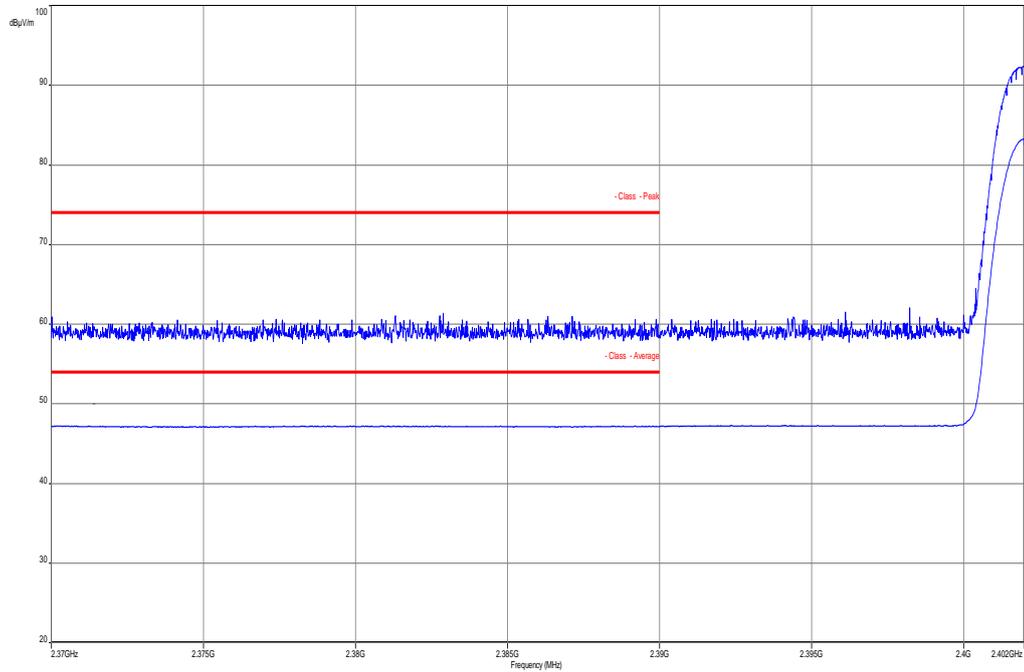
**Plot 3:** Lower band edge, Pi/4 DQPSK modulation, vertical & horizontal polarization



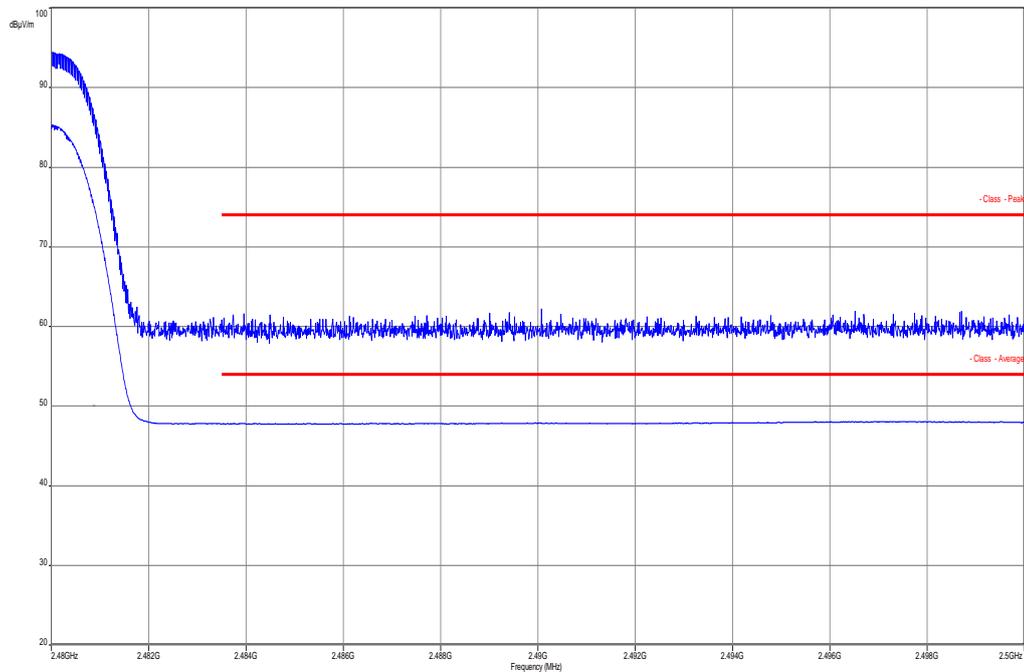
**Plot 4:** Upper band edge, Pi/4 DQPSK modulation, vertical & horizontal polarization



**Plot 5:** Lower band edge, 8 DPSK modulation, vertical & horizontal polarization



**Plot 6:** Upper band edge, 8 DPSK modulation, vertical & horizontal polarization



### 10.4 TX spurious emissions radiated

**Description:**

Measurement of the radiated spurious emissions in transmit mode. The EUT is set to single channel mode and the transmit channel is channel 00, channel 39 and channel 78. The measurement is performed in the mode with the highest output power.

**Measurement:**

| Measurement parameter |   |
|-----------------------|---|
| Detector:             | Peak / Quasi Peak   |
| Sweep time:           | Auto  |
| Video bandwidth:      | 3 x RBW<br>Remeasurement: 10 Hz   |
| Resolution bandwidth: | F < 1 GHz: 100 kHz<br>F > 1 GHz: 1 MHz  |
| Span:                 | 30 MHz to 25 GHz  |
| Trace-Mode:           | Max Hold  |
| Measured Modulation:  | <input checked="" type="checkbox"/> GFSK <input type="checkbox"/> Pi/4 DQPSK <input type="checkbox"/> 8DPSK |

The modulation with the highest output power was used to perform the transmitter spurious emissions. If spurious were detected a re-measurement was performed on the detected frequency with each modulation.

**Limits:**

| FCC  | -/-                     |                      |
|--|-------------------------|----------------------|
| TX spurious emissions radiated   |                         |                      |
| In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)). |                         |                      |
| §15.209  |                         |                      |
| Frequency (MHz)  | Field strength (dBµV/m) | Measurement distance |
| 30 - 88  | 30.0                    | 10                   |
| 88 – 216   | 33.5                    | 10                   |
| 216 – 960  | 36.0                    | 10                   |
| Above 960  | 54.0                    | 3                    |

**Results:**

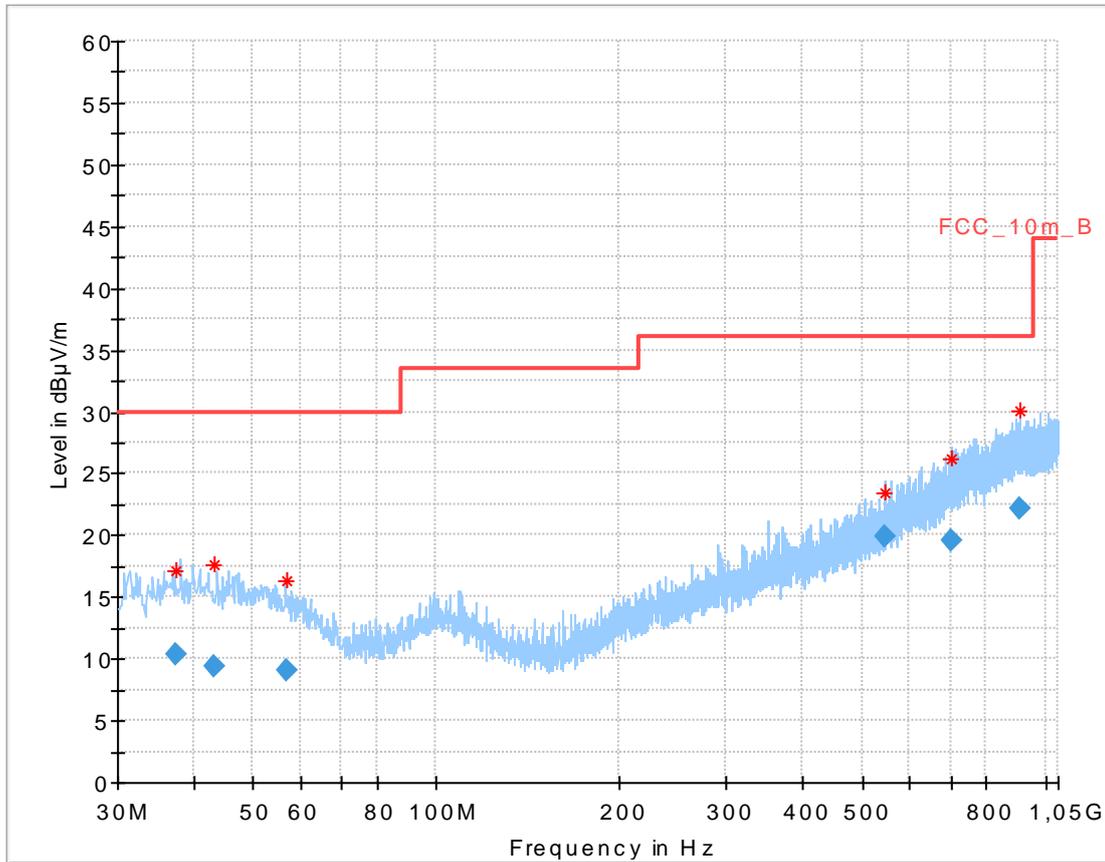
| TX spurious emissions radiated [dB $\mu$ V/m]                                    |          |                      |  |          |                      |  |          |                      |
|--|----------|----------------------|--|----------|----------------------|--|----------|----------------------|
| 2402 MHz   |          |                      | 2441 MHz   |          |                      | 2480 MHz   |          |                      |
| F [MHz]  | Detector | Level [dB $\mu$ V/m] | F [MHz]  | Detector | Level [dB $\mu$ V/m] | F [MHz]  | Detector | Level [dB $\mu$ V/m] |
| For emissions below 1 GHz, please take a look at the table below the 1 GHz plot. |          |                      | For emissions below 1 GHz, please take a look at the table below the 1 GHz plot. |          |                      | For emissions below 1 GHz, please take a look at the table below the 1 GHz plot. |          |                      |
| No emissions detected above 1 GHz.   |          |                      | No emissions detected above 1 GHz.   |          |                      | No emissions detected above 1 GHz.   |          |                      |
|  |          |                      |  |          |                      |  |          |                      |
| Measurement uncertainty  |          |                      | ± 3 dB   |          |                      |  |          |                      |

**Result:** Passed

**Note:** The limit was recalculated with 20 dB / decade (Part 15.31) for all radiated spurious emissions 30 MHz to 1 GHz from 3 meter limit to a 10 meter distance. (40dB/decade for emissions < 30MHz)

**Plots:**

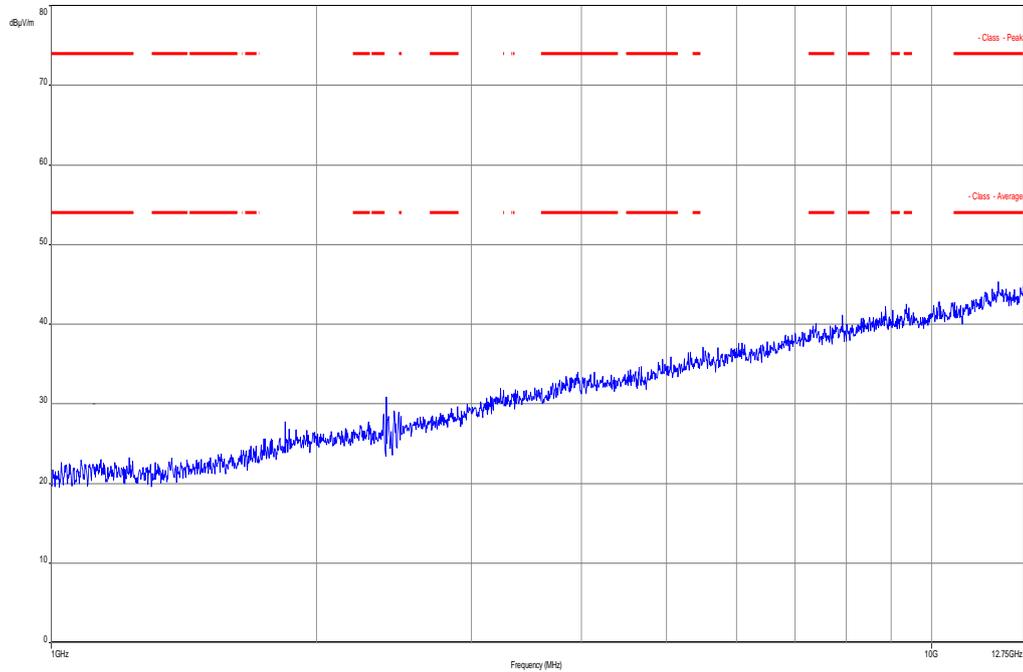
**Plot 1:** 30 MHz to 1 GHz, TX mode, channel 00, vertical & horizontal polarization



**Final result:**

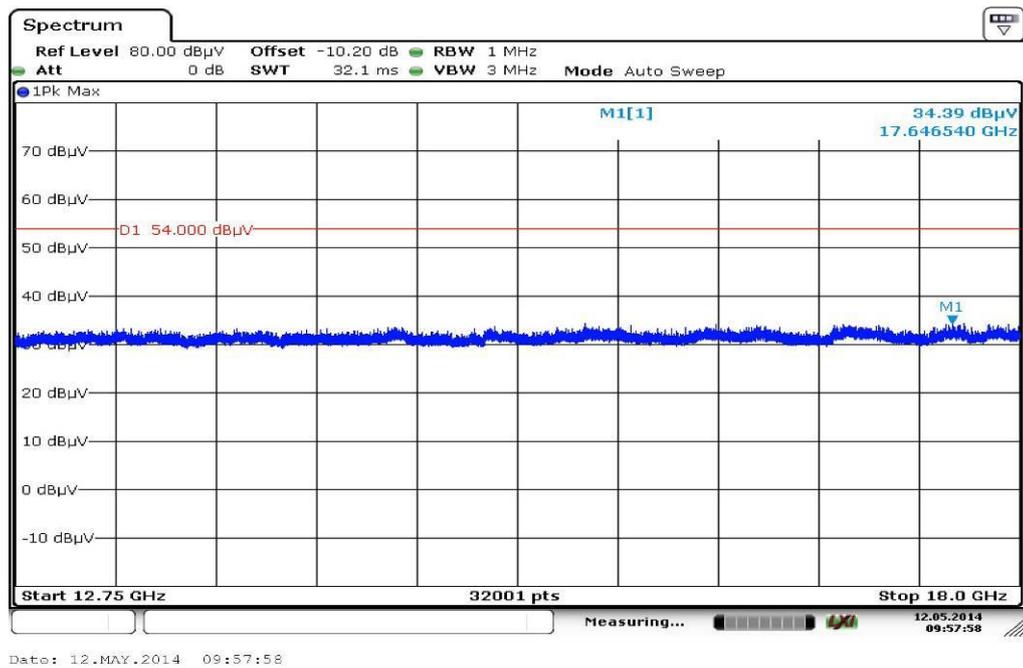
| Frequency (MHz) | Quasi Peak (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|-----------------|---------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|------------|
| 37.491150       | 10.29               | 30.00          | 19.71       | 1000.0          | 120.000         | 170.0       | V   | 86.0          | 13.2       |
| 43.078650       | 9.44                | 30.00          | 20.56       | 1000.0          | 120.000         | 170.0       | V   | -10.0         | 13.3       |
| 56.972250       | 9.10                | 30.00          | 20.90       | 1000.0          | 120.000         | 170.0       | V   | 93.0          | 12.4       |
| 544.026450      | 19.83               | 36.00          | 16.17       | 1000.0          | 120.000         | 170.0       | H   | 190.0         | 19.3       |
| 702.564450      | 19.64               | 36.00          | 16.36       | 1000.0          | 120.000         | 170.0       | V   | 10.0          | 22.6       |
| 908.616150      | 22.23               | 36.00          | 13.77       | 1000.0          | 120.000         | 170.0       | V   | 184.0         | 25.2       |

**Plot 2:** 1 GHz to 12.75 GHz, TX mode, channel 00, vertical & horizontal polarization

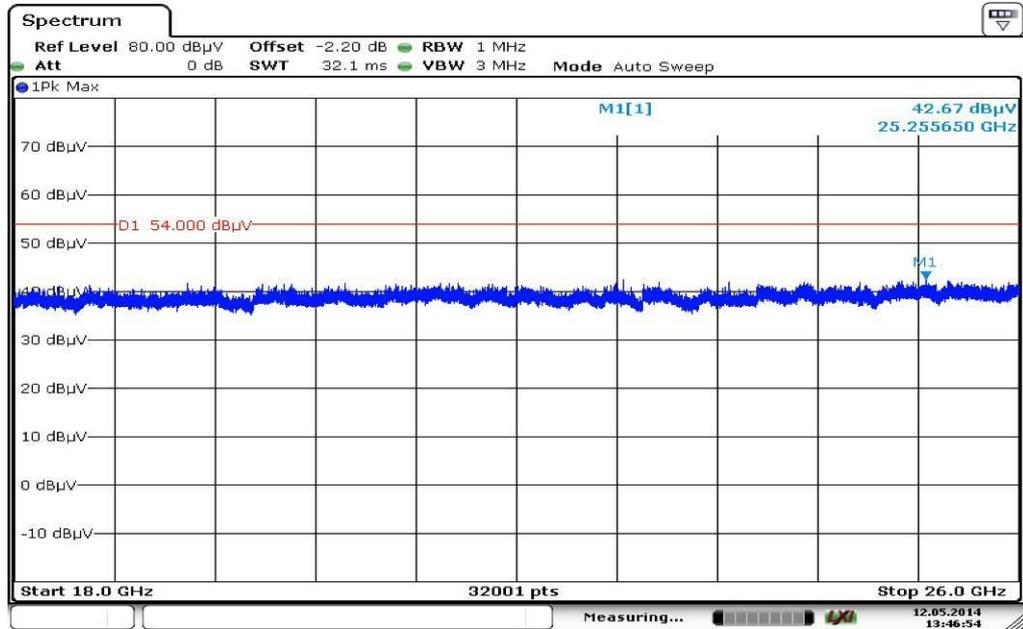


The carrier signal is notched with a 2.4 GHz band rejection filter.

**Plot 3:** 12.75 GHz to 18 GHz, TX mode, channel 00, vertical & horizontal polarization

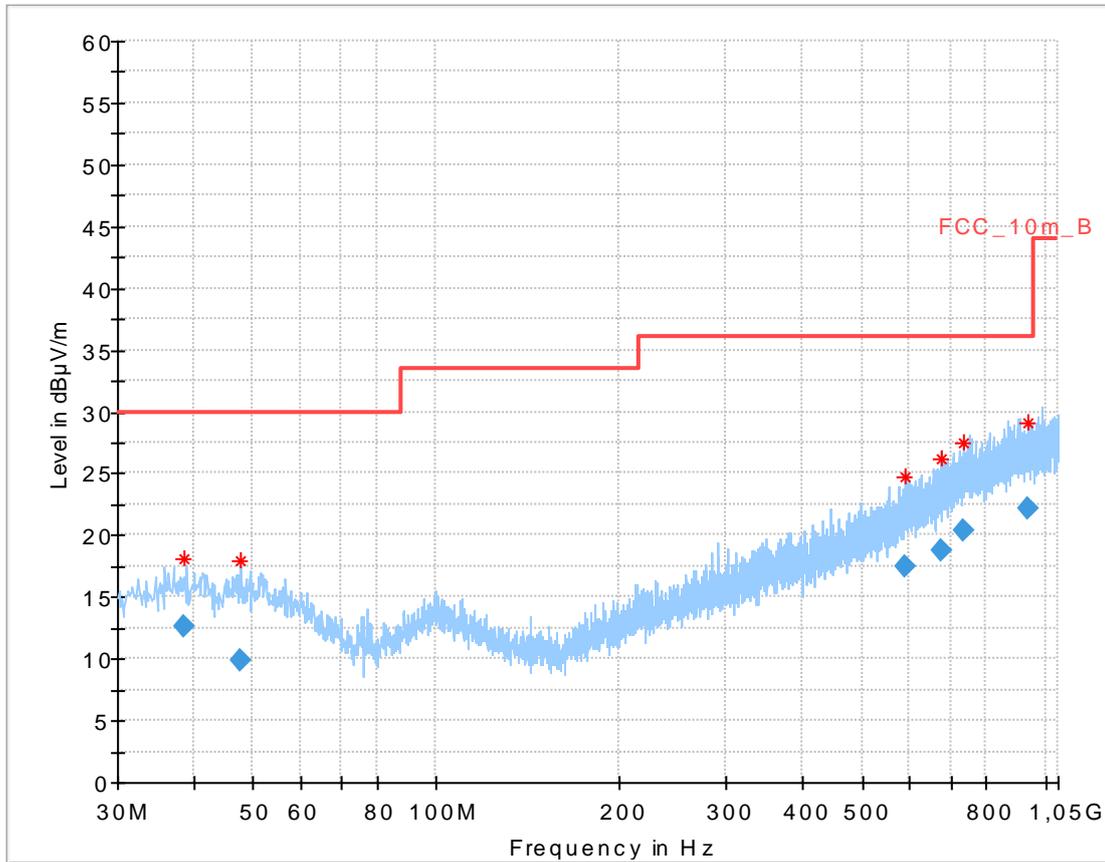


Plot 4: 18 GHz to 26 GHz, TX mode, channel 00, vertical & horizontal polarization



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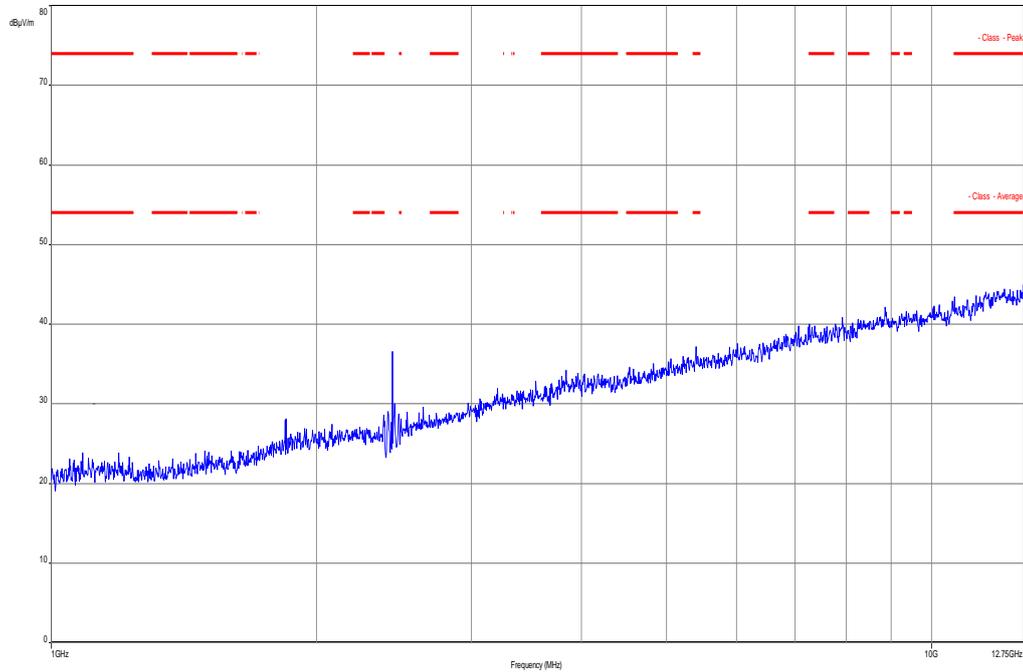
**Plot 5:** 30 MHz to 1 GHz, TX mode, channel 39, vertical & horizontal polarization



**Final result:**

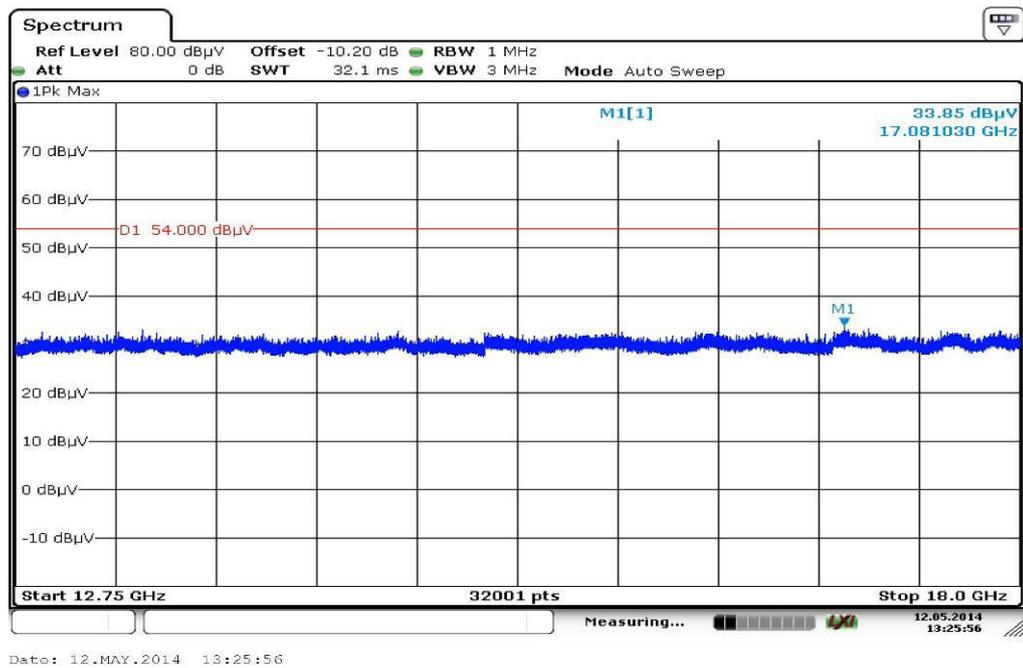
| Frequency (MHz) | Quasi Peak (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|-----------------|---------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|------------|
| 38.698200       | 12.58               | 30.00          | 17.42       | 1000.0          | 120.000         | 105.0       | V   | 85.0          | 13.3       |
| 47.828550       | 9.82                | 30.00          | 20.18       | 1000.0          | 120.000         | 170.0       | V   | 190.0         | 13.3       |
| 588.474600      | 17.54               | 36.00          | 18.46       | 1000.0          | 120.000         | 170.0       | H   | 181.0         | 20.5       |
| 676.425000      | 18.82               | 36.00          | 17.18       | 1000.0          | 120.000         | 170.0       | H   | 100.0         | 21.9       |
| 733.442100      | 20.33               | 36.00          | 15.67       | 1000.0          | 120.000         | 113.0       | H   | 181.0         | 23.3       |
| 935.337000      | 22.22               | 36.00          | 13.78       | 1000.0          | 120.000         | 170.0       | V   | 183.0         | 25.3       |

**Plot 6:** 1 GHz to 12.75 GHz, TX mode, channel 39, vertical & horizontal polarization

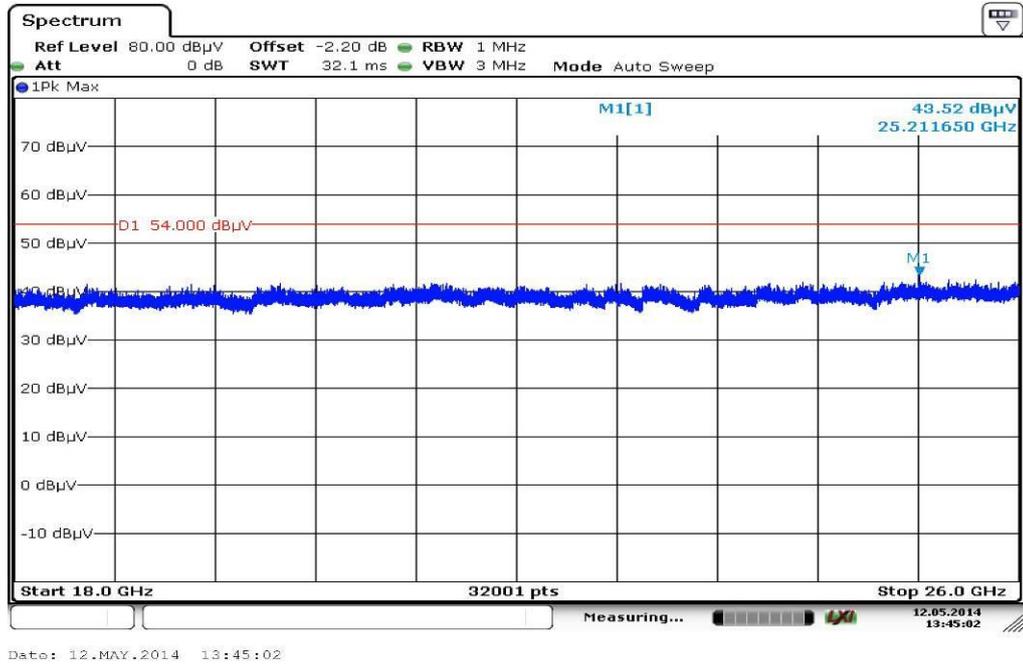


The carrier signal is notched with a 2.4 GHz band rejection filter.

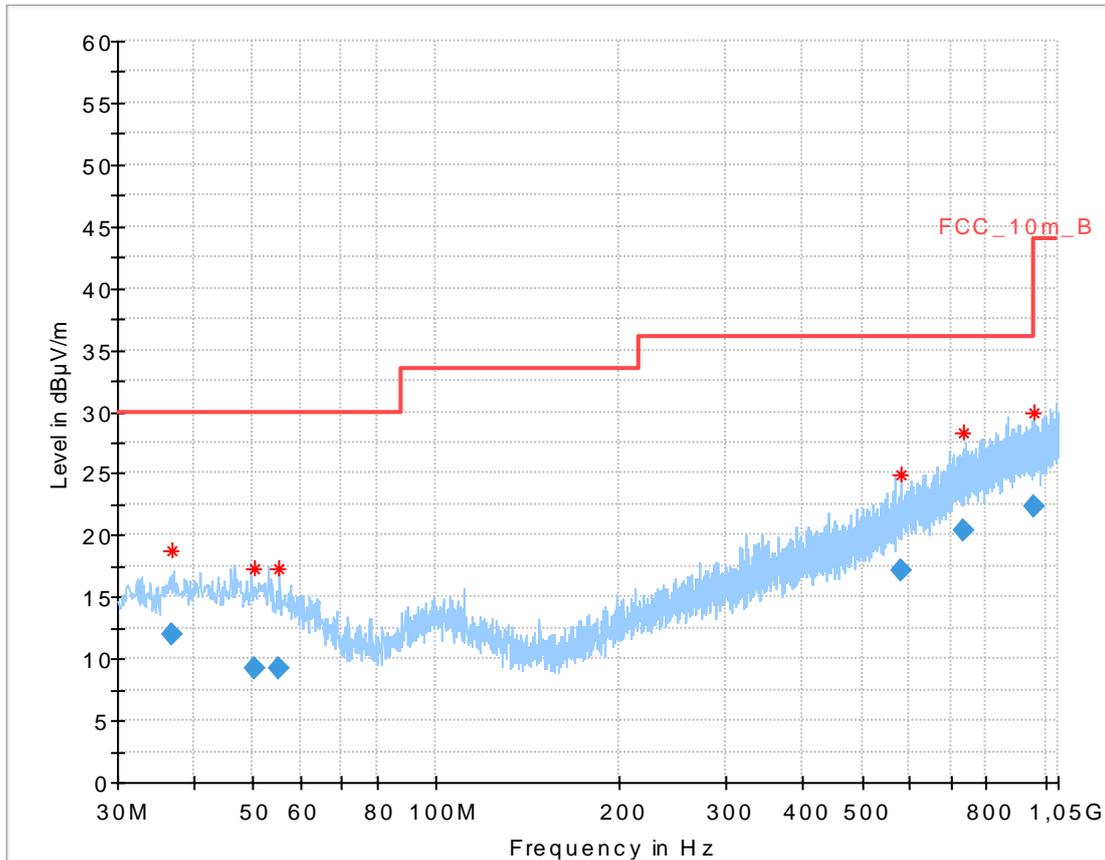
**Plot 7:** 12.75 GHz to 18 GHz, TX mode, channel 39, vertical & horizontal polarization



Plot 8: 18 GHz to 26 GHz, TX mode, channel 39, vertical & horizontal polarization



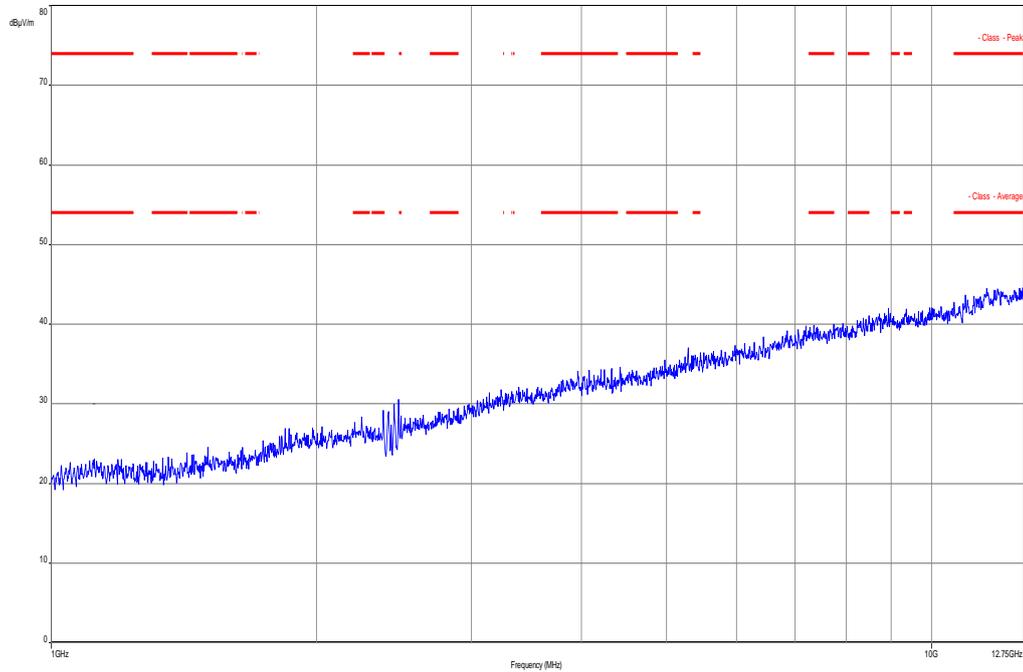
**Plot 9:** 30 MHz to 1 GHz, TX mode, channel 78, vertical & horizontal polarization



**Final result:**

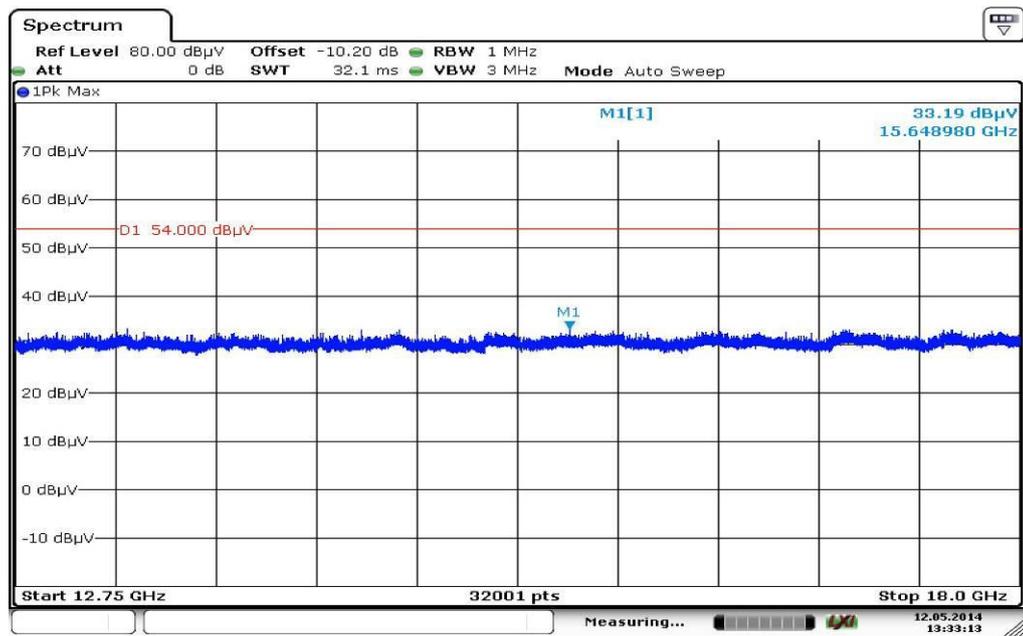
| Frequency (MHz) | Quasi Peak (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|-----------------|---------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|------------|
| 36.963600       | 11.96               | 30.00          | 18.04       | 1000.0          | 120.000         | 170.0       | V   | 266.0         | 13.2       |
| 50.234400       | 9.22                | 30.00          | 20.78       | 1000.0          | 120.000         | 170.0       | H   | 10.0          | 13.3       |
| 55.006050       | 9.20                | 30.00          | 20.80       | 1000.0          | 120.000         | 147.0       | V   | 91.0          | 12.9       |
| 578.863650      | 17.21               | 36.00          | 18.79       | 1000.0          | 120.000         | 170.0       | V   | 261.0         | 20.2       |
| 734.953800      | 20.36               | 36.00          | 15.64       | 1000.0          | 120.000         | 101.0       | V   | -7.0          | 23.3       |
| 959.168100      | 22.37               | 36.00          | 13.63       | 1000.0          | 120.000         | 170.0       | V   | 81.0          | 25.4       |

**Plot 10:** 1 GHz to 12.75 GHz, TX mode, channel 78, vertical & horizontal polarization

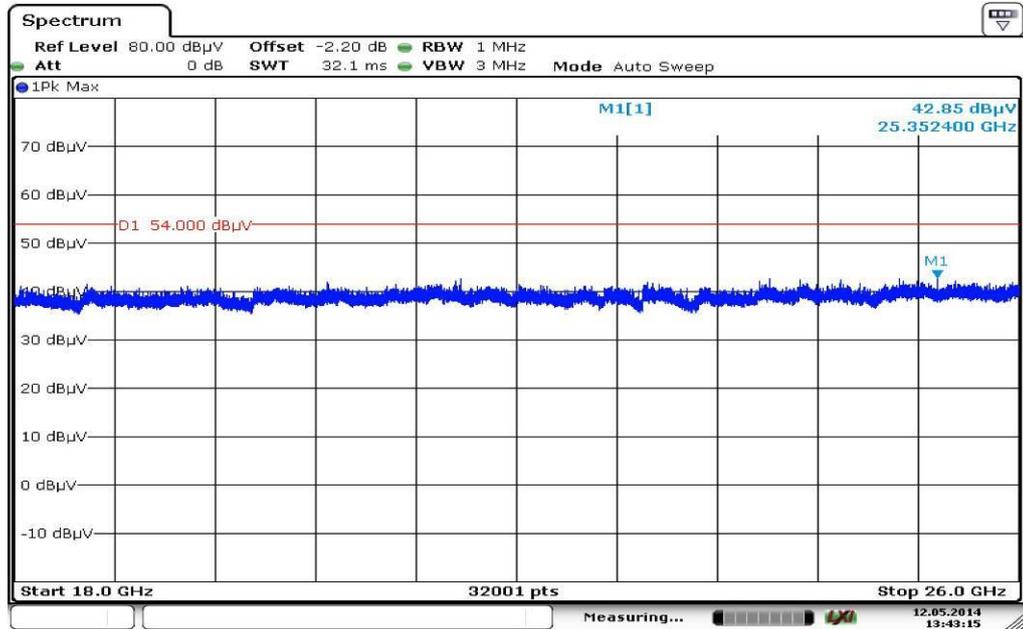


The carrier signal is notched with a 2.4 GHz band rejection filter.

**Plot 11:** 12.75 GHz to 18 GHz, TX mode, channel 78, vertical & horizontal polarization



Plot 12: 18 GHz to 26 GHz, TX mode, channel 78, vertical & horizontal polarization



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## 10.5 RX spurious emissions radiated

### Description:

Measurement of the radiated spurious emissions in idle/receive mode. The EUT is detached so all oscillators are active.

### Measurement:

| Measurement parameter |  |
|-----------------------|--|
| Detector:             | Peak / Quasi peak                      |
| Sweep time:           | Auto                                   |
| Video bandwidth:      | 3 x RBW<br>Remeasurement: 10 Hz        |
| Resolution bandwidth: | F < 1 GHz: 100 kHz<br>F > 1 GHz: 1 MHz |
| Span:                 | 30 MHz to 25 GHz                       |
| Trace-Mode:           | Max Hold                               |

### Limits:

| FCC                            | -/-                           |                      |
|--------------------------------|-------------------------------|----------------------|
| RX Spurious Emissions Radiated |                               |                      |
| Frequency (MHz)                | Field strength (dB $\mu$ V/m) | Measurement distance |
| 30 - 88                        | 30.0                          | 10                   |
| 88 – 216                       | 33.5                          | 10                   |
| 216 – 960                      | 36.0                          | 10                   |
| Above 960                      | 54.0                          | 3                    |

### Results:

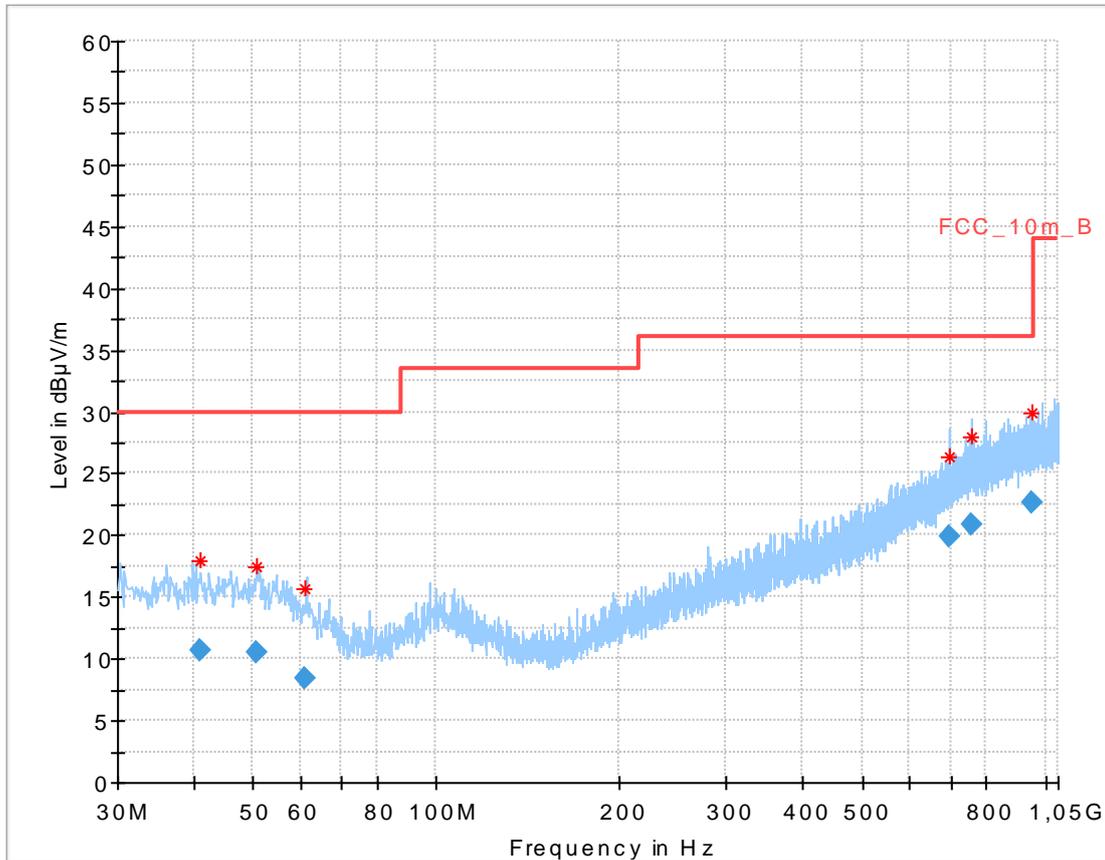
| RX spurious emissions radiated [dB $\mu$ V/m]                                    |          |                      |
|--|----------|----------------------|
| F [MHz]  | Detector | Level [dB $\mu$ V/m] |
| For emissions below 1 GHz, please take a look at the table below the 1 GHz plot. |          |                      |
| No emissions detected above 1 GHz.   |          |                      |
| Measurement uncertainty  | ±3 dB    |                      |

**Result:** Passed

**Note:** The limit was recalculated with 20 dB / decade (Part 15.31) for all radiated spurious emissions 30 MHz to 1 GHz from 3 meter limit to a 10 meter distance. (40dB/decade for emissions < 30MHz)

**Plots:**

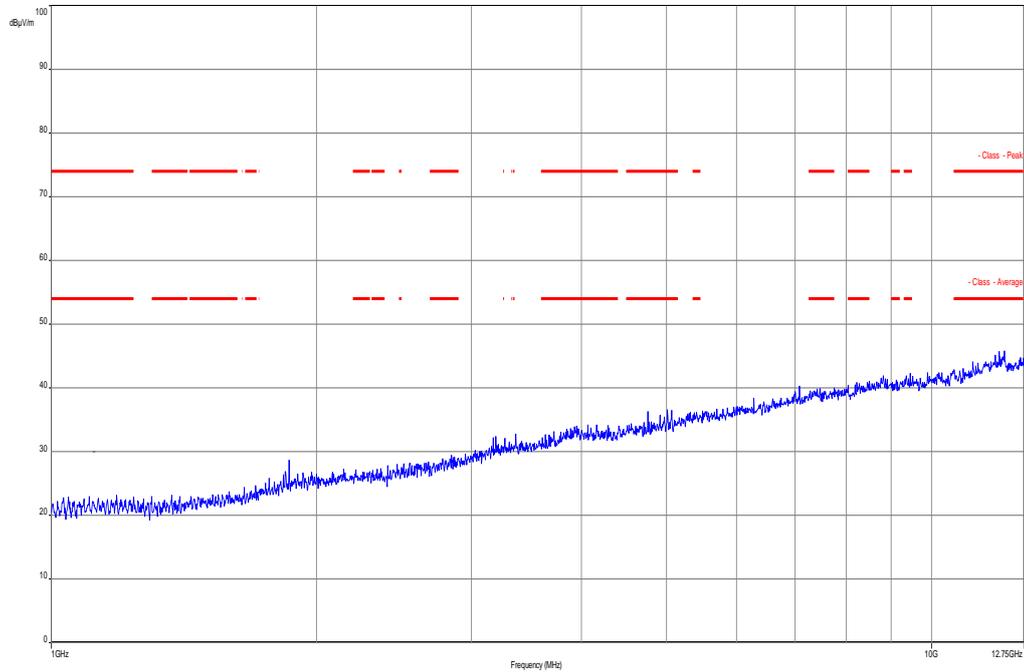
**Plot 1:** 30 MHz to 1 GHz, RX mode, vertical & horizontal polarization



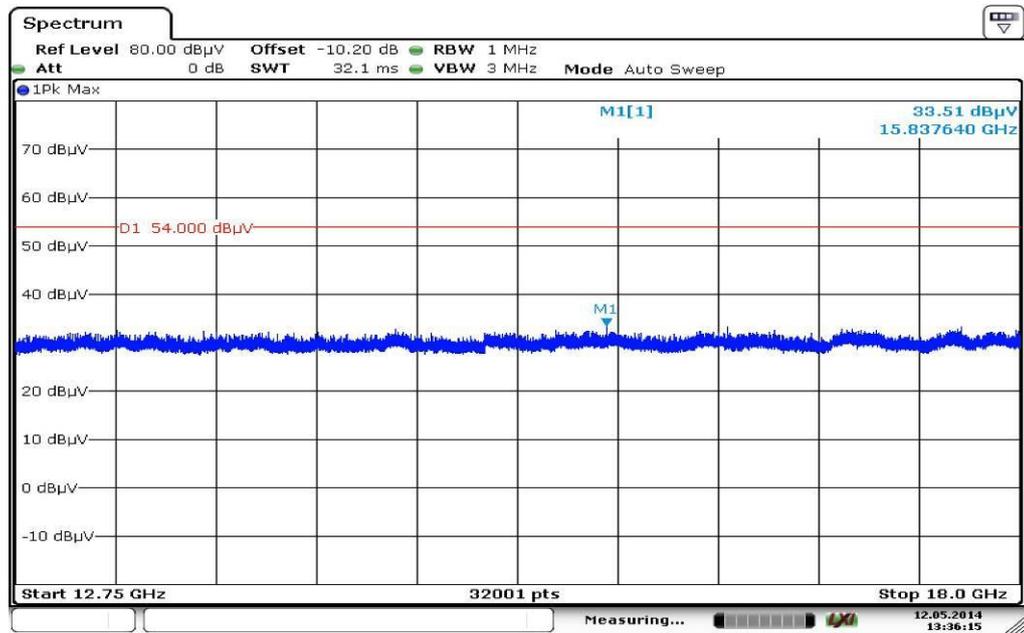
**Final result:**

| Frequency (MHz) | Quasi Peak (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|-----------------|---------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|------------|
| 40.917600       | 10.74               | 30.00          | 19.26       | 1000.0          | 120.000         | 101.0       | V   | 280.0         | 13.4       |
| 50.706450       | 10.47               | 30.00          | 19.53       | 1000.0          | 120.000         | 170.0       | V   | 100.0         | 13.3       |
| 60.728400       | 8.36                | 30.00          | 21.64       | 1000.0          | 120.000         | 105.0       | H   | 84.0          | 11.4       |
| 697.575750      | 19.85               | 36.00          | 16.15       | 1000.0          | 120.000         | 170.0       | H   | -4.0          | 22.4       |
| 757.144800      | 20.93               | 36.00          | 15.07       | 1000.0          | 120.000         | 170.0       | V   | 10.0          | 23.7       |
| 954.128250      | 22.72               | 36.00          | 13.28       | 1000.0          | 120.000         | 116.0       | V   | 190.0         | 25.4       |

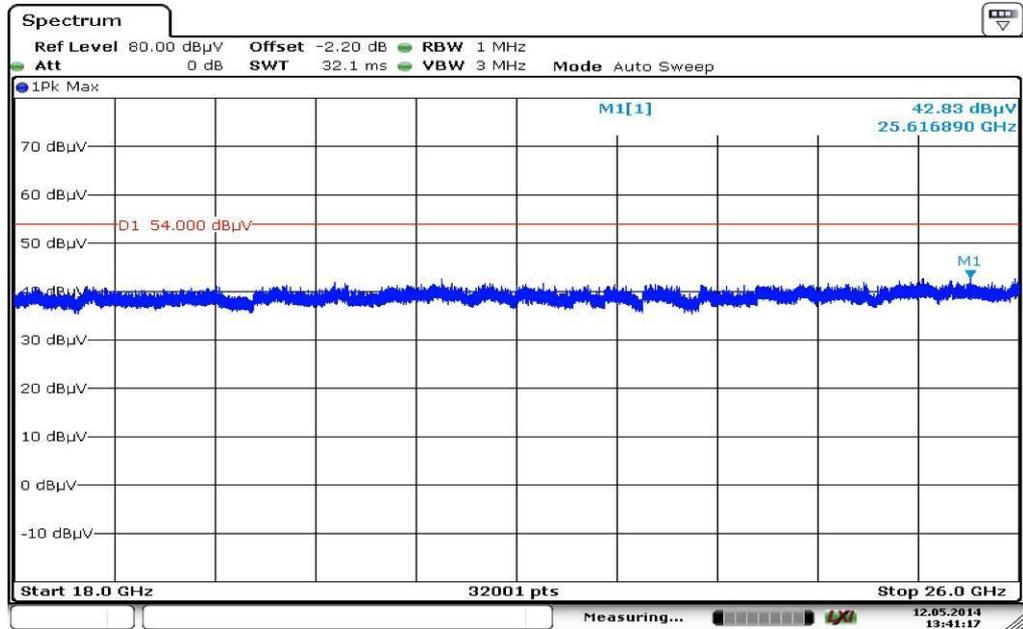
**Plot 2:** 1 GHz to 12.75 GHz, RX mode, vertical & horizontal polarization



**Plot 3:** 12.75 GHz to 18 GHz, RX mode, vertical & horizontal polarization



Plot 4: 18 GHz to 26 GHz, RX mode, vertical & horizontal polarization



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## 10.6 Spurious emissions radiated < 30 MHz

### Description:

Measurement of the radiated spurious emissions in transmit mode below 30 MHz. The EUT is set to single channel mode and the transmit channel is channel 39. This measurement is representative for all channels and modes. If peaks are found channel 00 and channel 78 will be measured too. The measurement is performed in the mode with the highest output power. The limits are recalculated to a measurement distance of 3 m with 40 dB/decade according CFR Part 2.

### Measurement:

| Measurement parameter |  |
|-----------------------|--|
| Detector:             | Peak / Quasi peak                          |
| Sweep time:           | Auto                                       |
| Video bandwidth:      | F < 150 kHz: 200 Hz<br>F > 150 kHz: 9 kHz  |
| Resolution bandwidth: | F < 150 kHz: 1 kHz<br>F > 150 kHz: 100 kHz |
| Span:                 | 9 kHz to 30 MHz                            |
| Trace-Mode:           | Max Hold                                   |

### Limits:

| FCC                                     |                         | -/-                  |
|---|-------------------------|----------------------|
| TX spurious emissions radiated < 30 MHz |                         |                      |
| Frequency (MHz)                         | Field strength (dBµV/m) | Measurement distance |
| 0.009 – 0.490                           | 2400/F(kHz)             | 300                  |
| 0.490 – 1.705                           | 24000/F(kHz)            | 30                   |
| 1.705 – 30.0                            | 30                      | 30                   |

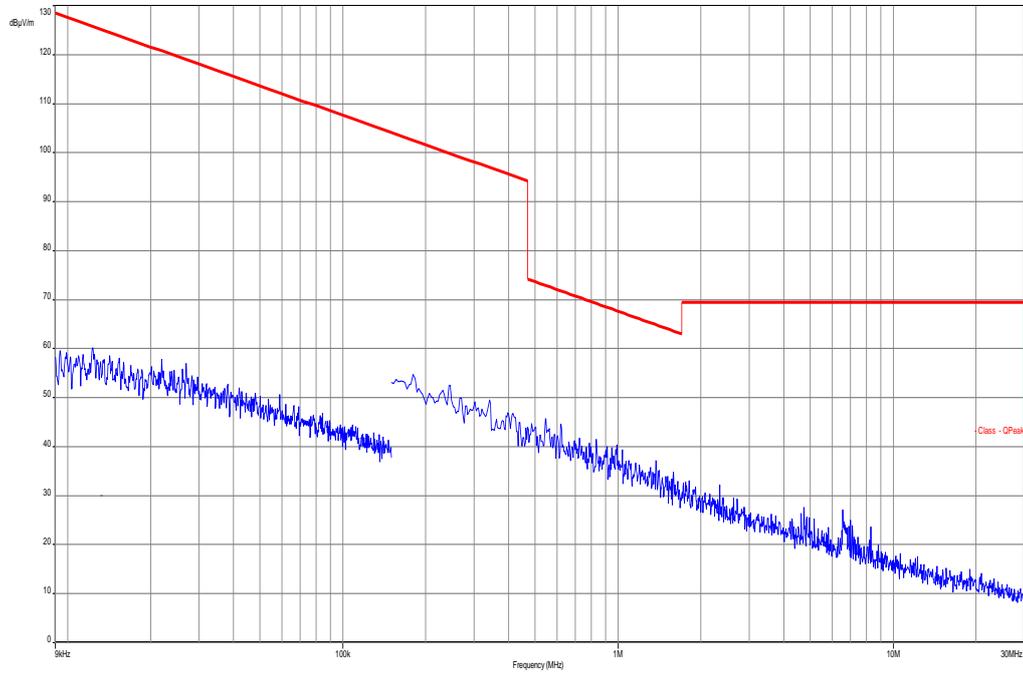
### Results:

| TX spurious emissions radiated < 30 MHz [dBµV/m] |          |                |
|--|----------|----------------|
| F [MHz]  | Detector | Level [dBµV/m] |
| No peaks detected.                               |          |                |
| Measurement uncertainty                          | ± 3 dB   |                |

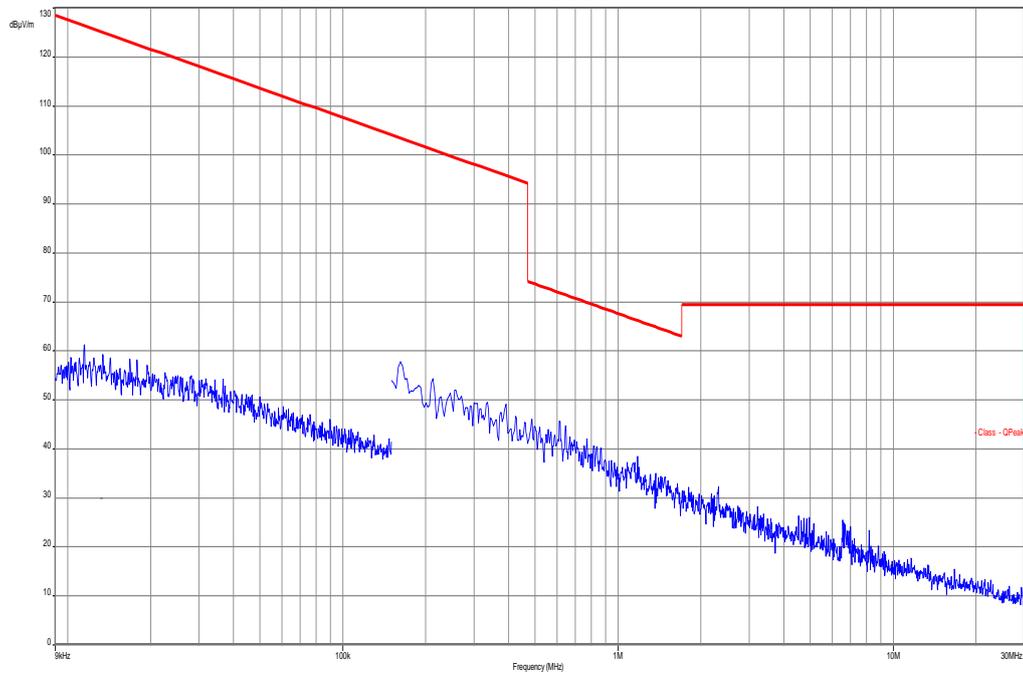
**Result: Passed**

**Plots:**

**Plot 1: 9 kHz to 30 MHz, TX mode**



**Plot 2: 9 kHz to 30 MHz, RX mode**



**10.7 Spurious emissions conducted < 30 MHz**

**Description:**

Measurement of the conducted spurious emissions in transmit mode below 30 MHz. The EUT is set to single channel mode and the transmit channel is channel 39. This measurement is representative for all channels and modes. If peaks are found channel 00 and channel 78 will be measured too. The measurement is performed in the mode with the highest output power. Both power lines, phase and neutral line, are measured. Found peaks are remeasured with average and quasi peak detection to show compliance to the limits.

**Measurement:**

| Measurement parameter |  |
|-----------------------|--|
| Detector:             | Peak - Quasi peak / average                |
| Sweep time:           | Auto                                       |
| Video bandwidth:      | F < 150 kHz: 200 Hz<br>F > 150 kHz: 9 kHz  |
| Resolution bandwidth: | F < 150 kHz: 1 kHz<br>F > 150 kHz: 100 kHz |
| Span:                 | 9 kHz to 30 MHz                            |
| Trace-Mode:           | Max Hold                                   |

**Limits:**

| FCC                                      |                     | -/-              |
|--|---------------------|------------------|
| TX spurious emissions conducted < 30 MHz |                     |                  |
| Frequency (MHz)                          | Quasi-peak (dBµV/m) | Average (dBµV/m) |
| 0.15 – 0.5                               | 66 to 56*           | 56 to 46*        |
| 0.5 – 5                                  | 56                  | 46               |
| 5 – 30.0                                 | 60                  | 50               |

\*Decreases with the logarithm of the frequency

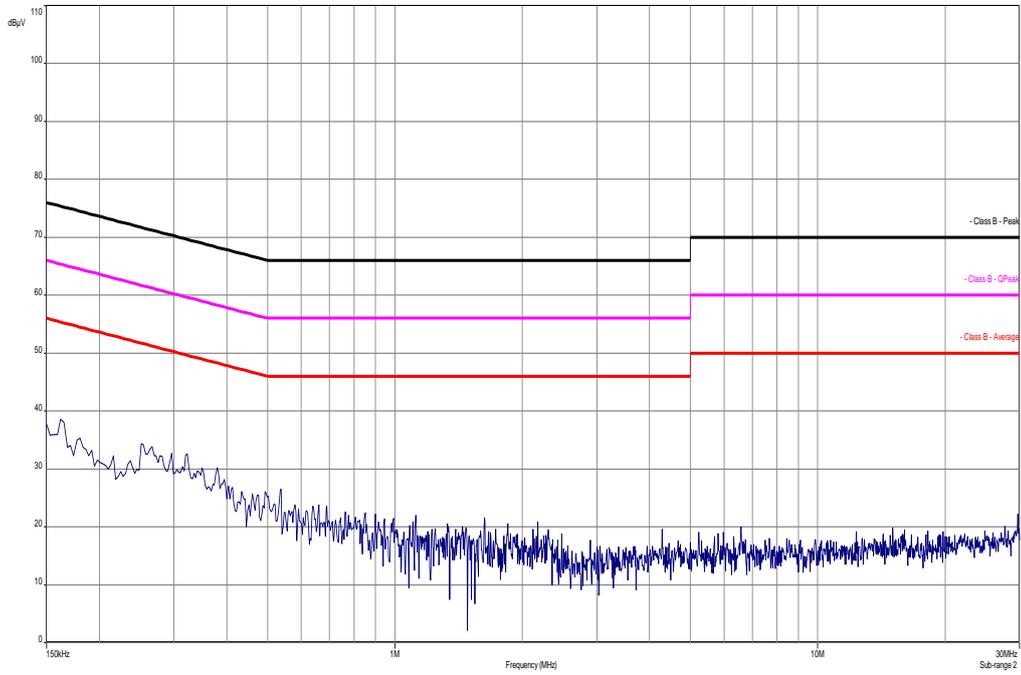
**Results:**

| TX spurious emissions conducted < 30 MHz [dBµV/m] |          |                |
|---|----------|----------------|
| F [MHz]   | Detector | Level [dBµV/m] |
| No peaks detected.                                |          |                |
| Measurement uncertainty                           | ± 3 dB   |                |

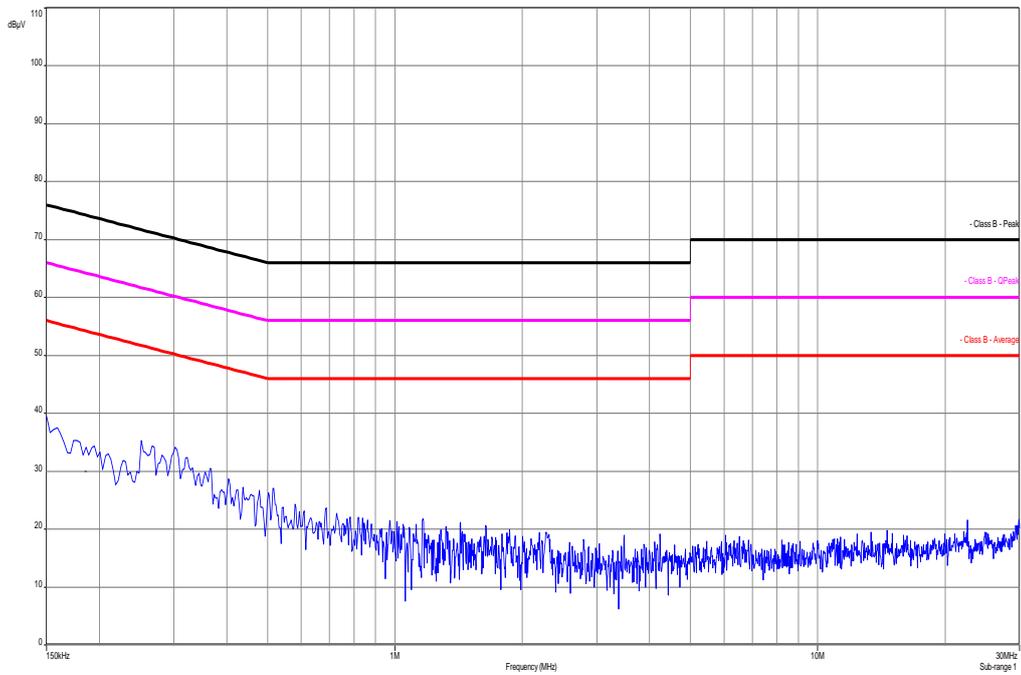
**Result: Passed**

**Plots:**

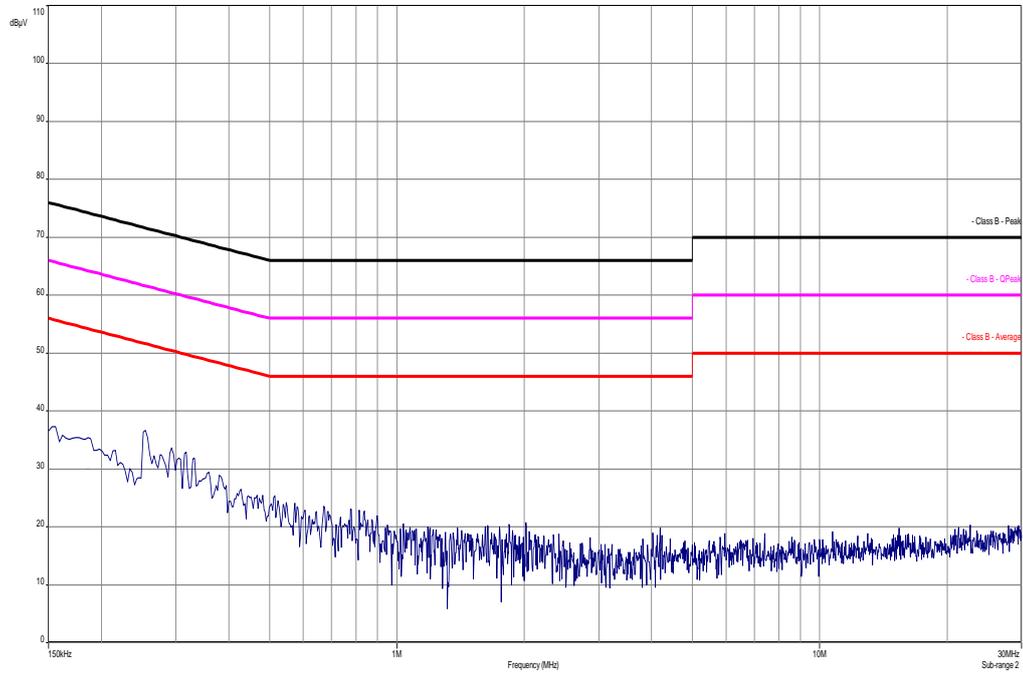
**Plot 1: 150 kHz to 30 MHz, TX mode, phase line**



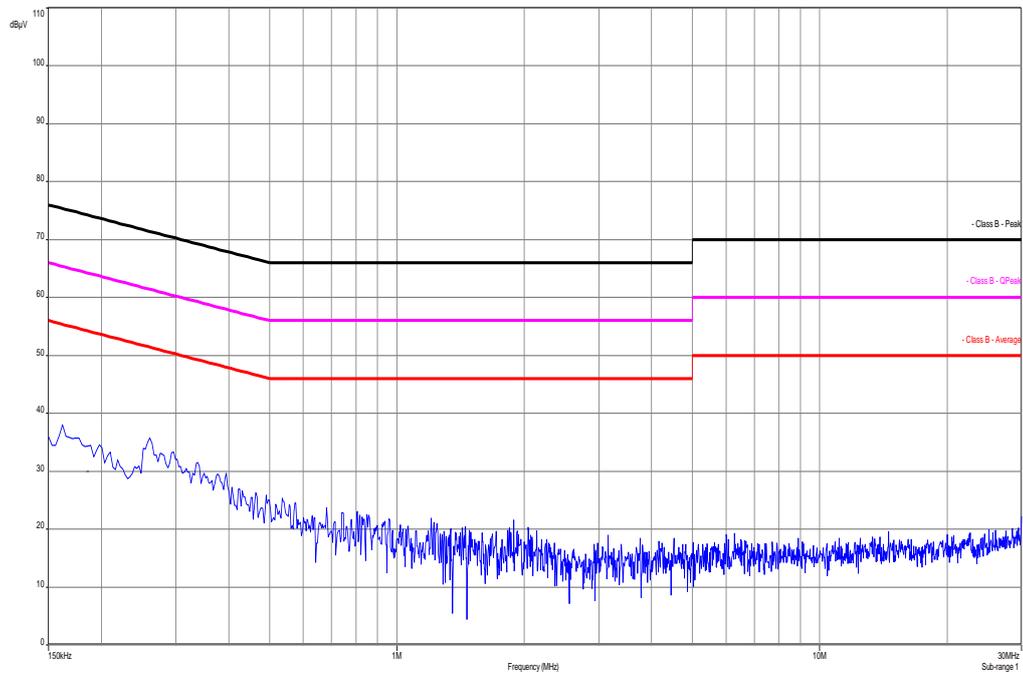
**Plot 2: 150 kHz to 30 MHz, TX mode, neutral line**



Plot 3: 150 kHz to 30 MHz, RX mode, phase line



Plot 4: 150 kHz to 30 MHz, RX mode, neutral line



## 11 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   | 45         | Switch-Unit                                    | 3488A                            | HP<br>Meßtechnik     | 2719A14505 | 300000368          | g                      |                     |                     |
| 2   | 50         | DC power supply, 60Vdc, 50A, 1200 W            | 6032A                            | HP<br>Meßtechnik     | 2920A04466 | 300000580          | ne                     |                     |                     |
| 3   | n. a.      | EMI Test Receiver                              | ESCI 3                           | R&S                  | 100083     | 300003312          | k                      | 27.01.2014          | 27.01.2015          |
| 4   | n. a.      | Funkstörmesse mpfänger 20Hz-26,5GHz            | ESU26                            | R&S                  | 100037     | 300003555          | k                      | 28.02.2014          | 28.02.2015          |
| 5   | n. a.      | Antenna Tower                                  | Model 2175                       | ETS-<br>LINDGREN     | 64762      | 300003745          | izw                    |                     |                     |
| 6   | n. a.      | Positioning Controller                         | Model 2090                       | ETS-<br>LINDGREN     | 64672      | 300003746          | izw                    |                     |                     |
| 7   | n. a.      | Turntable Interface-Box                        | Model 105637                     | ETS-<br>LINDGREN     | 44583      | 300003747          | izw                    |                     |                     |
| 8   | n. a.      | TRILOG Broadband Test-Antenna 30 MHz - 3 GHz   | VULB9163                         | Schwarzbeck          | 295        | 300003787          | k                      | 22.04.2014          | 22.04.2016          |
| 9   | n. a.      | DC power supply, 60Vdc, 50A, 1200 W            | 6032A                            | HP<br>Meßtechnik     | 2818A03450 | 300001040          | Ve                     | 12.01.2012          | 12.01.2015          |
| 10  | n. a.      | Double-Ridged Waveguide Horn Antenna 1-18,0GHz | 3115                             | EMCO                 | 8812-3088  | 300001032          | vKI!                   | 08.05.2013          | 08.05.2015          |
| 11  | n. a.      | Anechoic chamber                               | FAC 3/5m                         | MWB / TDK            | 87400/02   | 300000996          | ev                     |                     |                     |
| 12  | n. a.      | Switch / Control Unit                          | 3488A                            | HP<br>Meßtechnik     | *          | 300000199          | ne                     |                     |                     |
| 13  | n. a.      | Switch / Control Unit                          | 3488A                            | HP<br>Meßtechnik     | 2719A15013 | 300001156          | ne                     |                     |                     |
| 14  | 9          | Isolating Transformer                          | MPL IEC625 Bus Regeltrenntravo   | Erfi                 | 91350      | 300001155          | ne                     |                     |                     |
| 15  | n. a.      | Three-Way Power Splitter, 50 Ohm               | 11850C                           | HP<br>Meßtechnik     |            | 300000997          | ne                     |                     |                     |
| 16  | 90         | Active Loop Antenna 10 kHz to 30 MHz           | 6502                             | Kontron Psychotech   | 8905-2342  | 300000256          | k                      | 13.06.2013          | 13.06.2015          |
| 17  | n. a.      | Amplifier                                      | js42-00502650-28-5a              | Parzich GMBH         | 928979     | 300003143          | ne                     |                     |                     |
| 18  | n. a.      | Band Reject filter                             | WRCG240 0/2483-2375/2505-50/10SS | Wainwright           | 11         | 300003351          | ev                     |                     |                     |
| 19  | n. a.      | TRILOG Broadband Test-Antenna 30 MHz - 3 GHz   | VULB9163                         | Schwarzbeck          | 371        | 300003854          | vKI!                   | 14.10.2011          | 14.10.2014          |
| 20  | n. a.      | MXE EMI Receiver 20 Hz bis 26,5 GHz            | N9038A                           | Agilent Technologies | MY51210197 | 300004405          | k                      | 13.03.2014          | 13.03.2015          |
| 21  | 11b        | Microwave System Amplifier, 0.5-26.5 GHz       | 83017A                           | HP<br>Meßtechnik     | 00419      | 300002268          | ev                     |                     |                     |
| 22  | A026       | Std. Gain Horn                                 | 639                              | Narda                | 8402       | 300000787          | k                      | 22.07.2013          | 22.07.2015          |

|    |       |  |                                     |             |            |                |       |            |            |
|----|-------|--|-------------------------------------|-------------|------------|----------------|-------|------------|------------|
|    |       | Antenna 12.4 to 18.0 GHz                         |                                     |             |            |                |       |            |            |
| 23 | A029  | Std. Gain Horn Antenna 18.0 to 26.5 GHz          | 638                                 | Narda       | 8205       | 300002442      | k     | 19.07.2013 | 19.07.2015 |
| 24 | n. a. | CBT (Bluetooth Tester + EDR Signalling)          | CBT 1153.9000 K35, CBT-B55, CBT-K55 | R&S         | 100313     | 300003516      | vIKI! | 21.08.2012 | 21.08.2014 |
| 25 | n. a. | Power Supply DC                                  | NGPE 40/40                          | R&S         | 388        | 400000078      | vIKI! | 21.08.2012 | 21.08.2014 |
| 26 | n. a. | Signal Analyzer 20Hz-26,5GHz-150 to + 30 DBM     | FSIQ26                              | R&S         | 835540/018 | 300002681-0005 | k     | 30.01.2014 | 30.01.2016 |
| 27 | n. a. | Frequency Standard (Rubidium Frequency Standard) | MFS (Rubidium)                      | R&S (Datum) | 002        | 300002681-0009 | Ve    | 21.08.2012 | 21.08.2014 |
| 28 | n. a. | Directional Coupler                              | 101020010                           | Krytar      | 70215      | 300002840      | ev    |            |            |
| 29 | n. a. | DC-Blocker                                       | 8143                                | Inmet Corp. | none       | 300002842      | ne    |            |            |
| 30 | n. a. | Powersplitter                                    | 6005-3                              | Inmet Corp. |            | 300002841      | ev    |            |            |
| 31 | n. a. | CBT (Bluetooth Tester + EDR Signalling)          | CBT 1153.9000 K35                   | R&S         | 100185     | 300003416      | vIKI! | 21.08.2012 | 21.08.2014 |

**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  
 vIKI! 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

## 12 Observations

No observations exceeding those reported with the single test cases have been made.

**Annex A Document history**

| Version | Applied changes | Date of release |
|---------|-----------------|-----------------|
|         | Initial release | 2014-05-15      |

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

|          |   |  |
|----------|---|--|
| AVG      | - | Average  |
| DUT      | - | Device under test                              |
| EMC      | - | Electromagnetic Compatibility                  |
| EN       | - | European Standard                              |
| EUT      | - | Equipment under test                           |
| ETSI     | - | European Telecommunications Standard Institute |
| FCC      | - | Federal Communication Commission               |
| FCC ID   | - | Company Identifier at FCC                      |
| HW       | - | Hardware                                       |
| IC       | - | Industry Canada                                |
| Inv. No. | - | Inventory number                               |
| N/A      | - | Not applicable                                 |
| PP       | - | Positive peak                                  |
| QP       | - | Quasi peak                                     |
| S/N      | - | Serial number                                  |
| SW       | - | Software                                       |

