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CETECOM ICT Services
consulting - testing - certification ➤➤➤

TEST REPORT

Test report no.: 1-7443/14-04-07-B



DAkkS
Deutsche
Akkreditierungsstelle
D-PL-12076-01-00

Testing laboratory

CETECOM ICT Services GmbH

Untertuerkheimer Strasse 6 – 10
66117 Saarbruecken / Germany

Phone: + 49 681 5 98 - 0
Fax: + 49 681 5 98 - 9075
Internet: <http://www.cetecom.com>
e-mail: ict@cetecom.com

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-12076-01-00

Applicant

Sony Mobile Communications AB

Nya Vattentornet
22188 Lund / SWEDEN
Phone: +46 46 19 30 00
Fax: -/-
Contact: Mikael Nilsson
e-mail: Micke.nilsson@sonymobile.com
Phone: +46 7 03 22 75 03

Manufacturer

Sony Mobile Communications Inc.
1-8-15 Kohnan, Minato-ku, Tokyo, 108-0075 Japan

Test standard/s

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

RSS - 210 Issue 8 Spectrum Management and Telecommunications Radio Standards Specification - Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment

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

Test Item

Kind of test item: BT Smart Watch

Model name: SWR50

Commercial name: SWR50

Type number: RD-0090

FCC ID: PY7-RD0090

IC: 4170B-RD0090

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: 3.7 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
Professional
Radio Communications & EMC

Test performed:

Marco Bertolino
Specialist
Radio Communications & EMC

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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: | 2014-07-08 |
| Date of receipt of test item: | 2014-07-10 |
| Start of test: | 2014-07-10 |
| End of test: | 2014-07-18 |
| 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 |
| RSS - 210 Issue 8 | 01.12.2010 | Spectrum Management and Telecommunications Radio Standards Specification - Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment |

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: | | 54 % |
| Barometric pressure: | | not relevant for this kind of testing |
| Power supply: | V_{nom} | 3.7 V DC by Li - polymer battery |
| | V_{max} | 4.2 V |
| | V_{min} | 3.3 V |

5 Test item

| | | |
|----------------------------|---|--|
| Kind of test item | : | BT Smart Watch |
| Model name | : | SWR50 |
| Commercial name | : | SWR50 |
| Type number | : | RD-0090 |
| S/N serial number | : | 14271D1EA3728B8 14271D1BA371ED0 |
| HW hardware status | : | AP |
| SW software status | : | Cond.: RF test software java_sony_brooks.020-eng ANDROID-201410704.154857KOT49H 20test-keys |
| Frequency band [MHz] | : | DTS band 2400 MHz to 2483.5 MHz (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 DQPSK and 8 DPSK |
| Number of channels | : | 79 |
| Antenna | : | Integrated antenna |
| Power supply | : | 3.7 V DC by Li - polymer battery |
| Temperature range | : | -30°C to +50 °C |

5.1 Additional information

The content of the following annexes is defined in the QA. It may be that not all of the listed annexes are necessary for this report, thus some values in between may be missing.

Test setup- and EUT-photos are included in test report: 1-7443/14-04-01_AnnexA
1-7443/14-04-01_AnnexB
1-7443/14-04-01_AnnexD

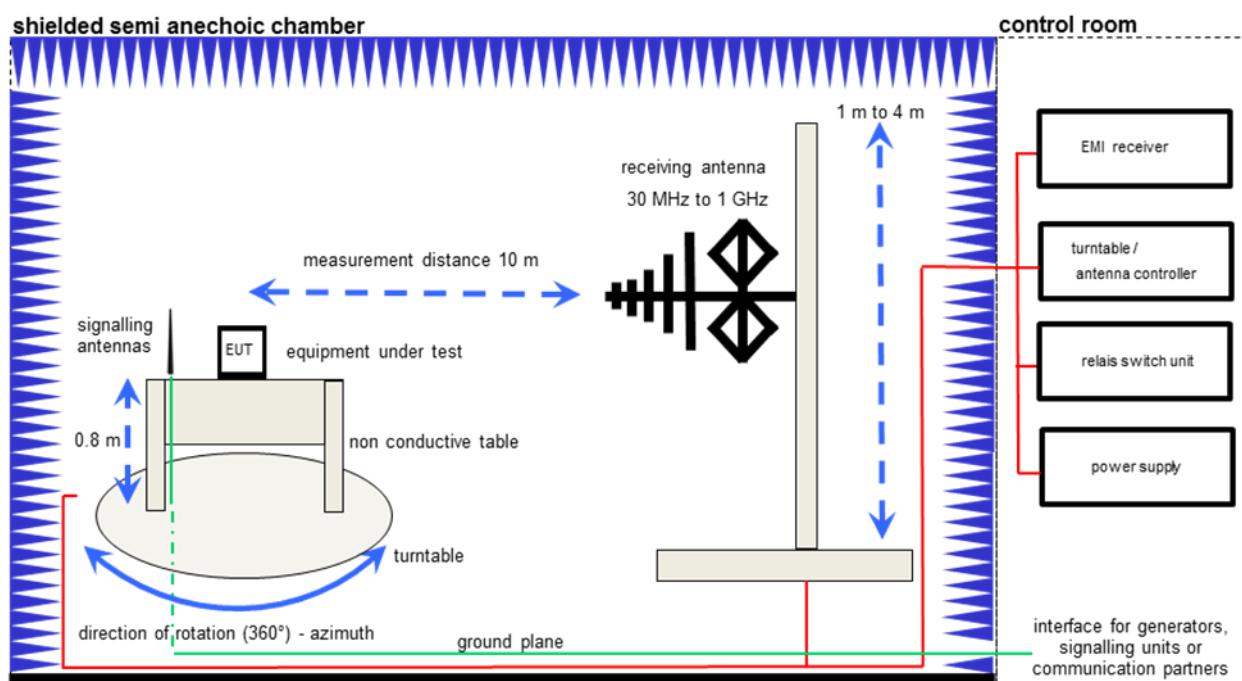
6 Test laboratories sub-contracted

None

7 Description of the test setup

7.1 Radiated measurements chamber F

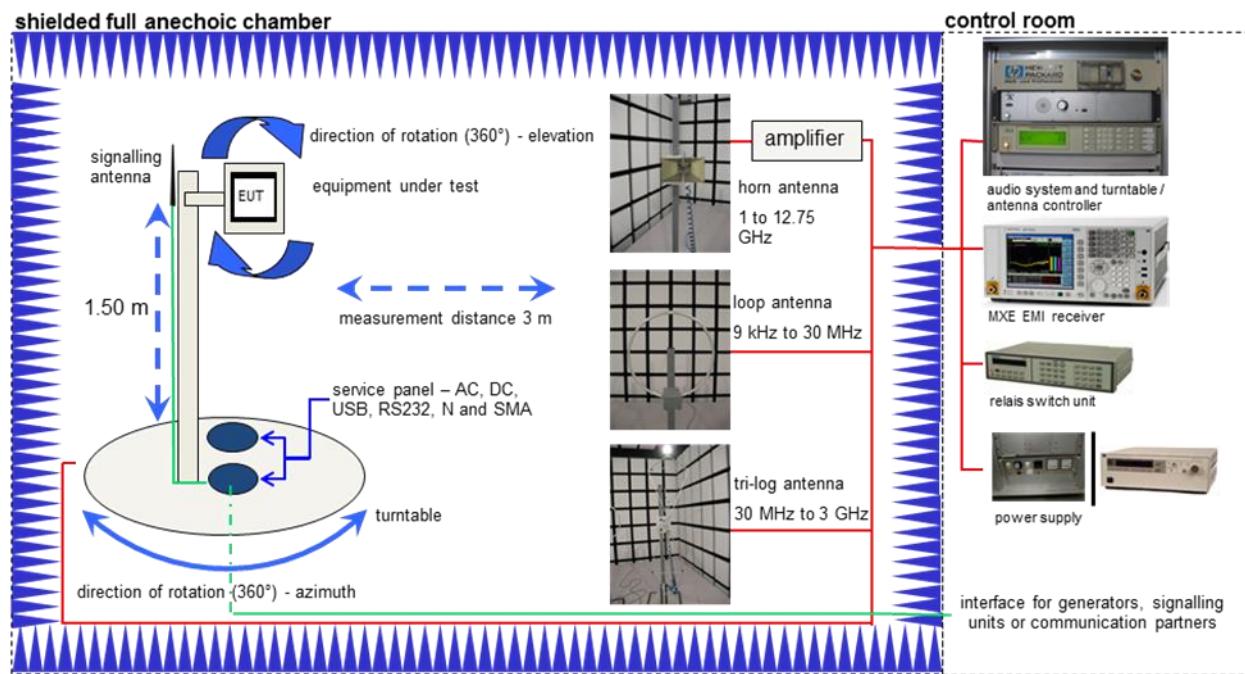
The radiated measurements are performed in vertical and horizontal plane in the frequency range from 9 kHz to 1 GHz in semi-anechoic chambers. The EUT is positioned on a non-conductive support with a height of 0.80 m above a conductive ground plane that covers the whole chamber. The receiving antennas 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 |
|--|------------------------------------|---------------|------------|-----------------|
| Software | EMC32 V.1 9.12.05 | R&S | -/- | -/- |
| 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 Regeltranntravo | 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 |

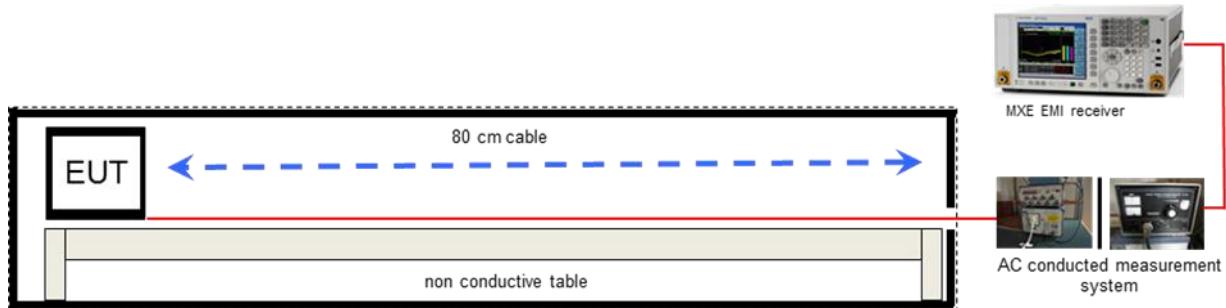
7.3 Radiated measurements 12.75 GHz to 26 GHz



Equipment table:

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

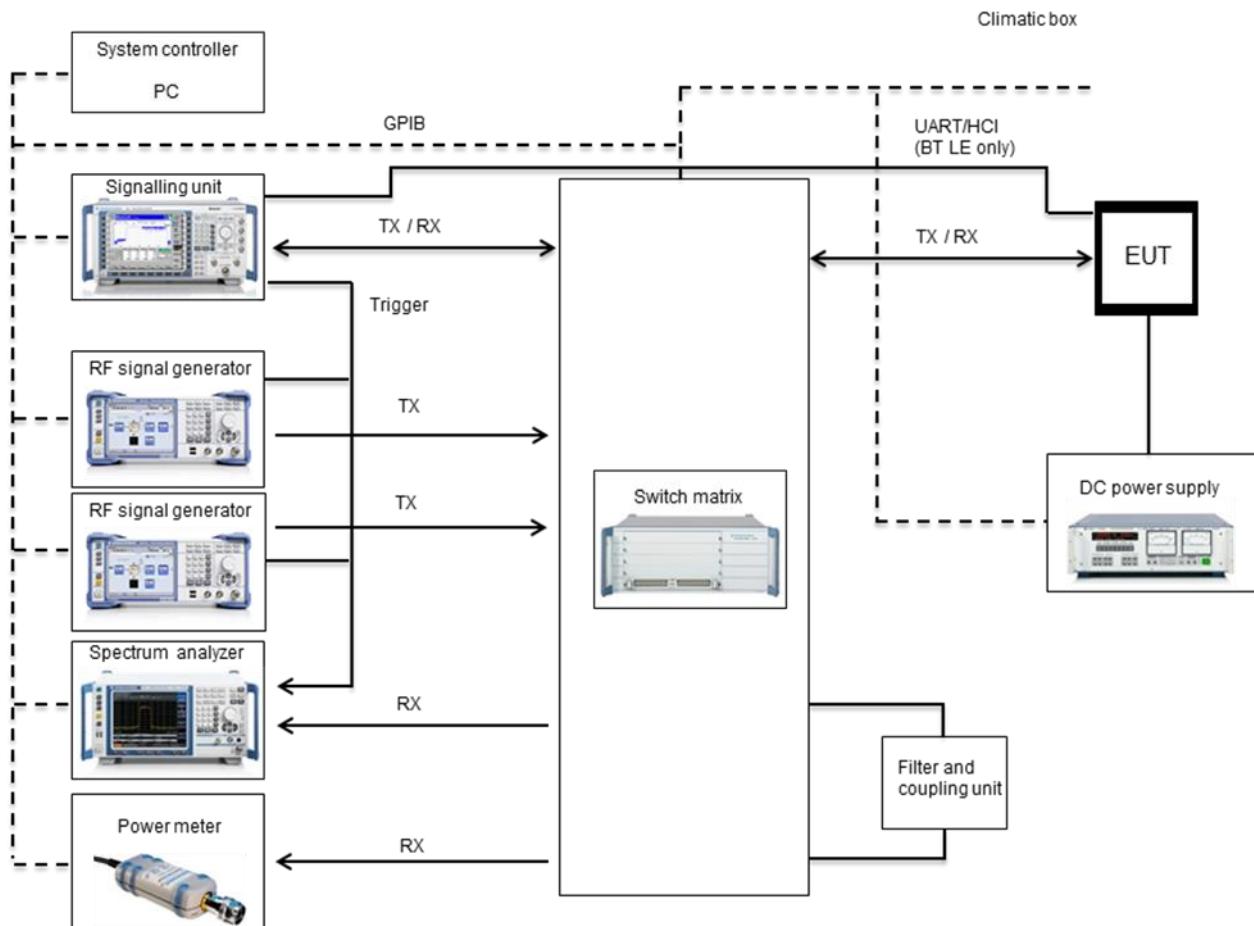
7.4 AC conducted



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 signalling test system



Equipment table:

| Equipment | Type | Manufacturer | Serial No. | INV. No Cetecom |
|---|------------------|---------------|------------|-----------------|
| Switch / Control Unit | 3488A | HP Meßtechnik | | 300001691 |
| Power Supply DC | NGPE 40/40 | R&S | 388 | 400000078 |
| Frequency Standard (Rubidium Frequency Standard) | MFS (Rubidium) | R&S (Datum) | 002 | 300002681-0009 |
| Power Sensor 50 Ohms, 10 MHz – 18 GHz, 1 nW – 20 mW | NRV-Z1 | R&S | 833894/012 | 300002681-0013 |
| 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 |
| Spectrum Analyzer 9kHz to 30GHz -140..+30dBm | FSP30 | R&S | 100886 | 300003575 |
| Microwave System Amplifier, 0.5-26.5 GHz | 83017A | HP Meßtechnik | 00419 | 300002268 |

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 RSS 210, Issue 8, Annex 8 | Passed | 2014-09-09 | -/- |

| Test specification clause | Test case | Temperature conditions | Power source voltages | Mode | Pass | Fail | NA | NP | Remark |
|---|--|------------------------|-----------------------|------------------------------|-------------|-------------|-------------|-------------|--------------------------|
| §15.247(b)(4) RSS 210 / A8.4(2) | Antenna gain | Nominal | Nominal | GFSK | ☒ | ☐ | ☐ | ☐ | complies |
| §15.247© RSS 210 / A8.2(b) | Power spectral density | Nominal | Nominal | GFSK Pi/4 DQPSK 8 DPSK | ☐ | ☐ | ☒ | ☐ | Not applicable for FHSS! |
| §15.247(a)(1) RSS 210 / A8.1(b) | Carrier frequency separation | Nominal | Nominal | GFSK | ☒ | ☐ | ☐ | ☐ | complies |
| §15.247(a)(1) RSS 210 / A8.1(d) | Number of hopping channels | Nominal | Nominal | GFSK | ☒ | ☐ | ☐ | ☐ | complies |
| §15.247(a)(1) (iii) RSS 210 / A8.3(1) | Time of occupancy (dwell time) | Nominal | Nominal | GFSK Pi/4 DQPSK 8 DPSK | ☒ | ☐ | ☐ | ☐ | complies |
| §15.247(a)(1) RSS 210 / A8.2(a) | Spectrum bandwidth of a FHSS system 20 dB bandwidth | Nominal | Nominal | GFSK Pi/4 DQPSK 8 DPSK | ☒ ☒ ☒ | ☐ ☐ ☐ | ☐ ☐ ☐ | ☐ ☐ ☐ | complies |
| §15.247(b)(1) RSS-210 / A8.4(2) | Maximum output power | Nominal | Nominal | GFSK Pi/4 DQPSK 8 DPSK | ☒ ☒ ☒ | ☐ ☐ ☐ | ☐ ☐ ☐ | ☐ ☐ ☐ | complies |
| §15.247(d) RSS-210 / A8.5 | Band edge compliance conducted | Nominal | Nominal | GFSK Pi/4 DQPSK 8 DPSK | ☒ ☒ ☒ | ☐ ☐ ☐ | ☐ ☐ ☐ | ☐ ☐ ☐ | complies |
| §15.205 RSS-210 / A8.5 | Band edge compliance radiated | Nominal | Nominal | GFSK Pi/4 DQPSK 8 DPSK | ☒ ☒ ☒ | ☐ ☐ ☐ | ☐ ☐ ☐ | ☐ ☐ ☐ | complies |
| §15.247(d) RSS-210 / A8.5 | TX spurious emissions conducted | Nominal | Nominal | GFSK Pi/4 DQPSK 8 DPSK | ☒ ☒ ☒ | ☐ ☐ ☐ | ☐ ☐ ☐ | ☐ ☐ ☐ | complies |
| §15.247(d) RSS-210 / A8.5 | TX spurious emissions radiated | Nominal | Nominal | GFSK | ☒ | ☐ | ☐ | ☐ | complies |
| §15.109 RSS-Gen | RX spurious emissions radiated | Nominal | Nominal | -/- | ☒ | ☐ | ☐ | ☐ | complies |
| §15.209(a) RSS-Gen | TX spurious emissions radiated < 30 MHz | Nominal | Nominal | GFSK | ☒ | ☐ | ☐ | ☐ | complies |
| §15.107(a) §15.207 | Conducted emissions < 30 MHz | Nominal | Nominal | GFSK | ☒ | ☐ | ☐ | ☐ | 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: None

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

Measurement:

The antenna gain of the complete system is calculated by the difference of radiated power in EIRP and the conducted power of the module. For normal Bluetooth® devices, the GFSK modulation is used.

Measurement parameters:

| Measurement parameter | |
|-----------------------|----------|
| Detector: | Peak |
| Sweep time: | Auto |
| Video bandwidth: | 3 MHz |
| Resolution bandwidth: | 3 MHz |
| Span: | 6 MHz |
| Trace-Mode: | Max hold |

Limits:

| FCC | IC |
|--------------|----|
| Antenna Gain | |
| 6 dBi | |

Results:

| T_{nom} | V_{nom} | lowest channel 2402 MHz | middle channel 2441 MHz | highest channel 2480 MHz |
|--|-----------|-------------------------|-------------------------|--------------------------|
| Conducted power [dBm] Measured with GFSK modulation | | 7.66 | 8.52 | 9.08 |
| Radiated power [dBm] Measured with GFSK modulation | | 6.09 | 7.48 | 7.78 |
| Gain [dBi] Calculated | | -1.57 | -1.04 | -1.30 |

Result: **Passed**

10.2 Power spectral density

Description:

Measurement of the power spectral density of a digital modulated system. This requirement is only valid for digitally modulated systems without hopping functionality.

Measurement:

| Measurement parameter | |
|-----------------------|----------|
| Detector: | Peak |
| Sweep time: | 500 s |
| Video bandwidth: | 3 kHz |
| Resolution bandwidth: | 3 kHz |
| Span: | 150 kHz |
| Trace-Mode: | Max Hold |

Limits:

| FCC | IC |
|--|----|
| Power Spectral Density | |
| For digitally modulated systems the transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission or over 1.0 second if the transmission exceeds 1.0-second duration. | |

Results:

| Modulation | Power spectral density [dBm/3kHz] | | |
|-------------------------|-----------------------------------|----------|----------|
| | 2412 MHz | 2437 MHz | 2462 MHz |
| GFSK | | | |
| Pi/4 DQPSK | Not required for hopping systems! | | |
| 8DPSK | | | |
| Measurement uncertainty | ± 1.5 dB | | |

10.3 Carrier frequency separation

Description:

Measurement of the carrier frequency separation of a hopping system. The carrier frequency separation is constant for all modulation-modes. We use GFSK-modulation to show compliance. EUT in hopping mode.

Measurement:

| Measurement parameter | |
|-----------------------|----------|
| Detector: | Peak |
| Sweep time: | Auto |
| Video bandwidth: | 100 kHz |
| Resolution bandwidth: | 100 kHz |
| Span: | 4 MHz |
| Trace-Mode: | Max Hold |

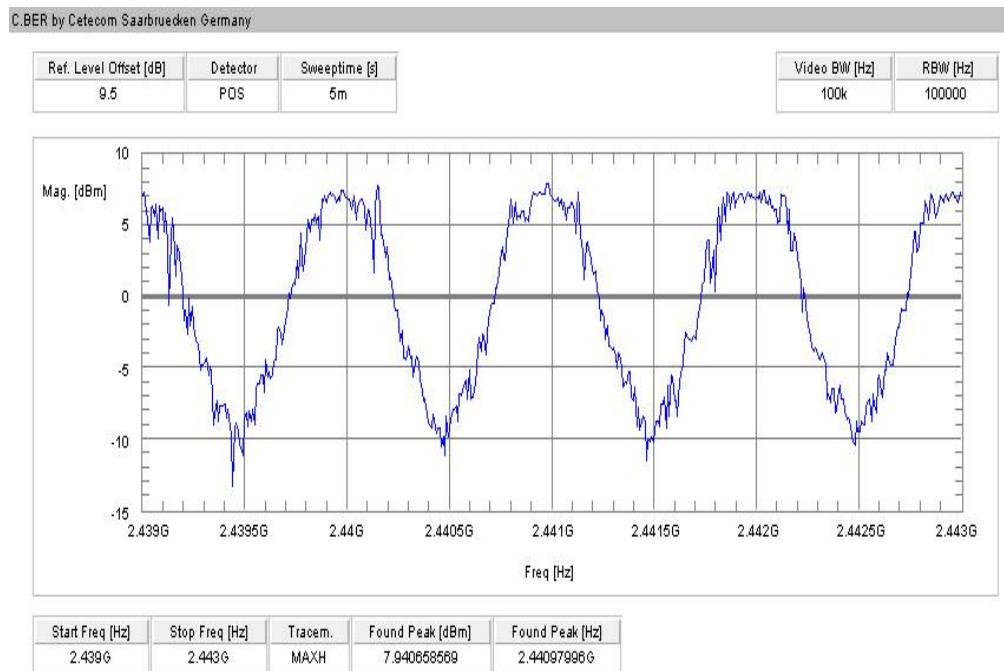
Limits:

| FCC | IC |
|---|----|
| Carrier Frequency Separation | |
| Minimum 25 kHz or two-thirds of the 20 dB bandwidth of the hopping system whichever is greater. | |

Result:

| | |
|------------------------------|---------|
| Carrier frequency separation | ~ 1 MHz |
|------------------------------|---------|

Result: Passed

Plot:**Plot 1: Carrier frequency separation (GFSK modulation)**

10.4 Number of hopping channels

Description:

Measurement of the total number of used hopping channels. The number of hopping channels is constant for all modulation-modes. We use GFSK-modulation to show compliance. EUT in hopping mode.

Measurement:

| Measurement parameter | |
|-----------------------|--|
| Detector: | Peak |
| Sweep time: | Auto |
| Video bandwidth: | 500 kHz |
| Resolution bandwidth: | 500 kHz |
| Span: | Plot 1: 2400 – 2445 MHz Plot 2: 2445 – 2485 MHz |
| Trace-Mode: | Max Hold |

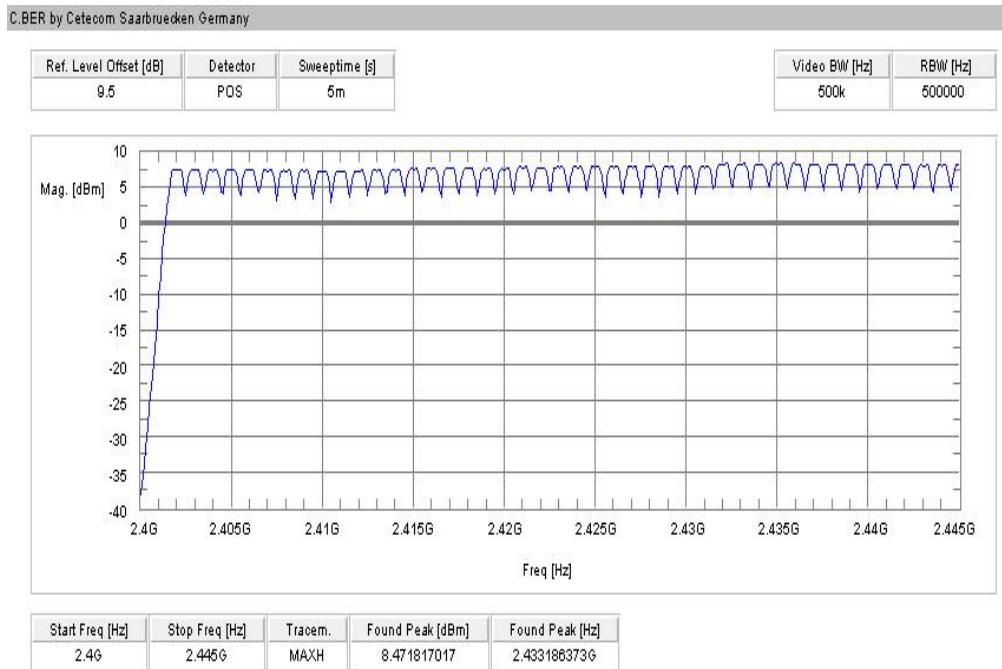
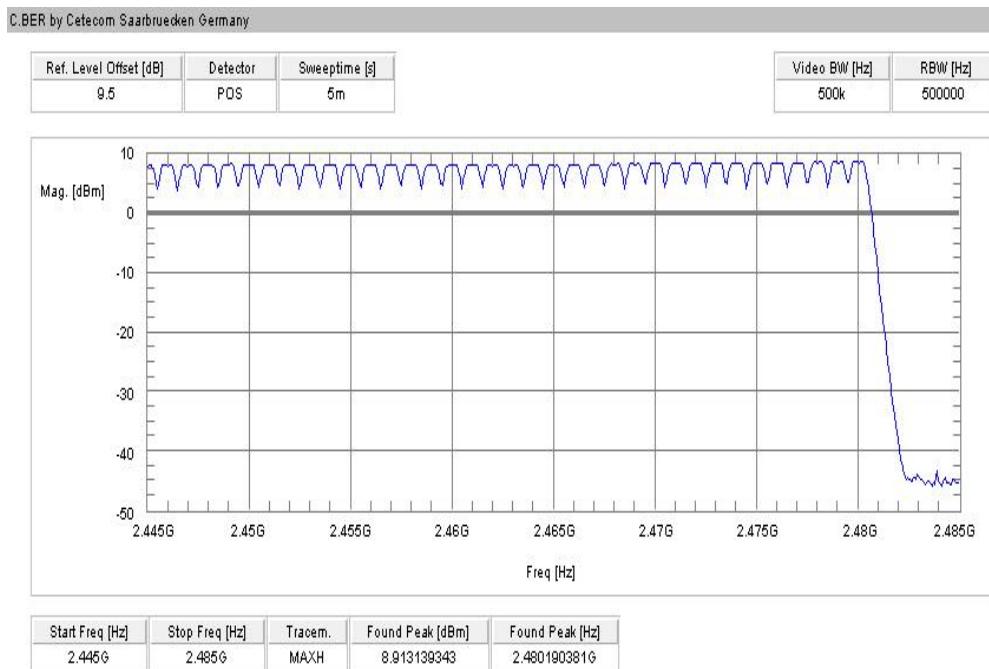
Limits:

| FCC | IC |
|--|----|
| Number of hopping channels | |
| At least 15 non overlapping hopping channels | |

Result:

| | |
|----------------------------|----|
| Number of hopping channels | 79 |
|----------------------------|----|

Result: Passed

Plots:
Plot 1: Number of hopping channels (GFSK modulation)

Plot 2: Number of hopping channels (GFSK modulation)


10.5 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 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 | IC |
|---|----|
| 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 a duration in seconds equal to the number of hopping frequencies multiplied by 0.4. | |

Result: Passed

10.6 Spectrum bandwidth of a FHSS system – 20 dB bandwidth

Description:

Measurement of the 20dB bandwidth of the modulated signal. The measurement is performed according to the "Measurement Guidelines" (DA 00-705, March 30, 2000). EUT in single channel mode.

Measurement:

| Measurement parameter | |
|-----------------------|----------|
| Detector: | Peak |
| Sweep time: | Auto |
| Video bandwidth: | 30 kHz |
| Resolution bandwidth: | 30 kHz |
| Span: | 6 MHz |
| Trace-Mode: | Max Hold |

Limits:

| FCC | IC |
|--|----|
| Spectrum bandwidth of a FHSS system – 20 dB bandwidth | |
| GFSK < 1500 kHz Pi/4 DQPSK < 1500 kHz 8DPSK < 1500 kHz | |

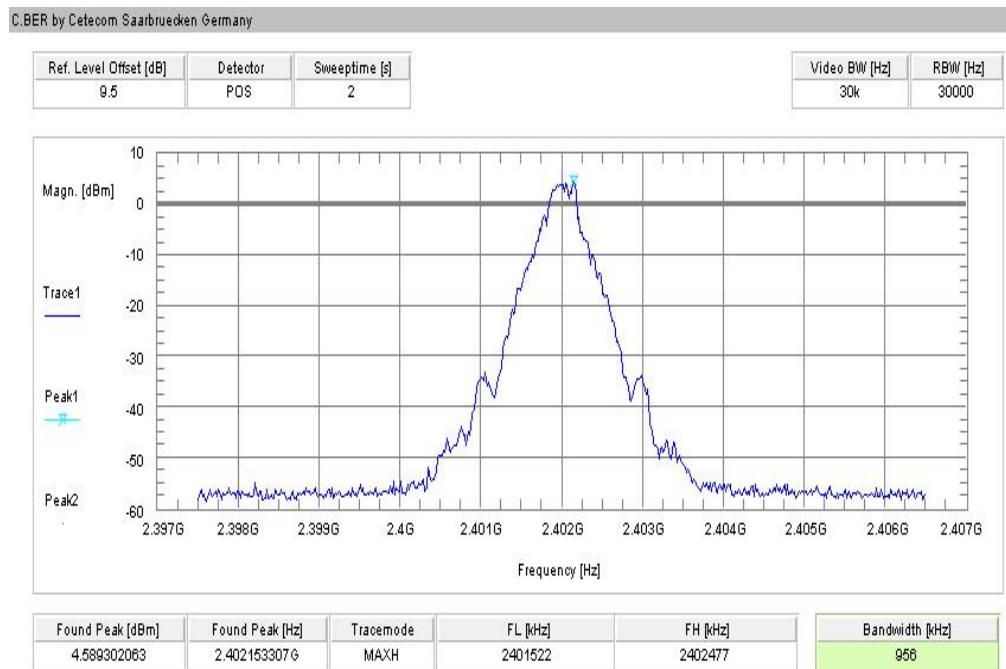
Results:

| Modulation | 20 dB bandwidth [kHz] | | |
|-------------------------|-----------------------|----------|----------|
| | 2402 MHz | 2441 MHz | 2480 MHz |
| GFSK | 956 | 956 | 938 |
| Pi/4 DQPSK | 1335 | 1335 | 1335 |
| 8DPSK | 1335 | 1317 | 1335 |
| Measurement uncertainty | ± 30 kHz | | |

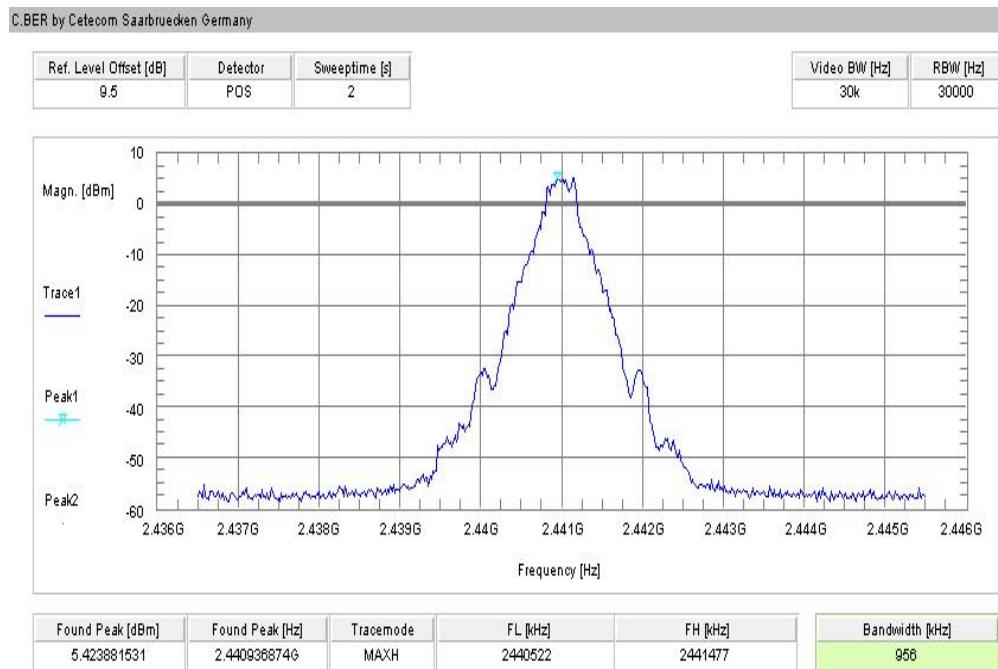
Result: Passed

Plots:

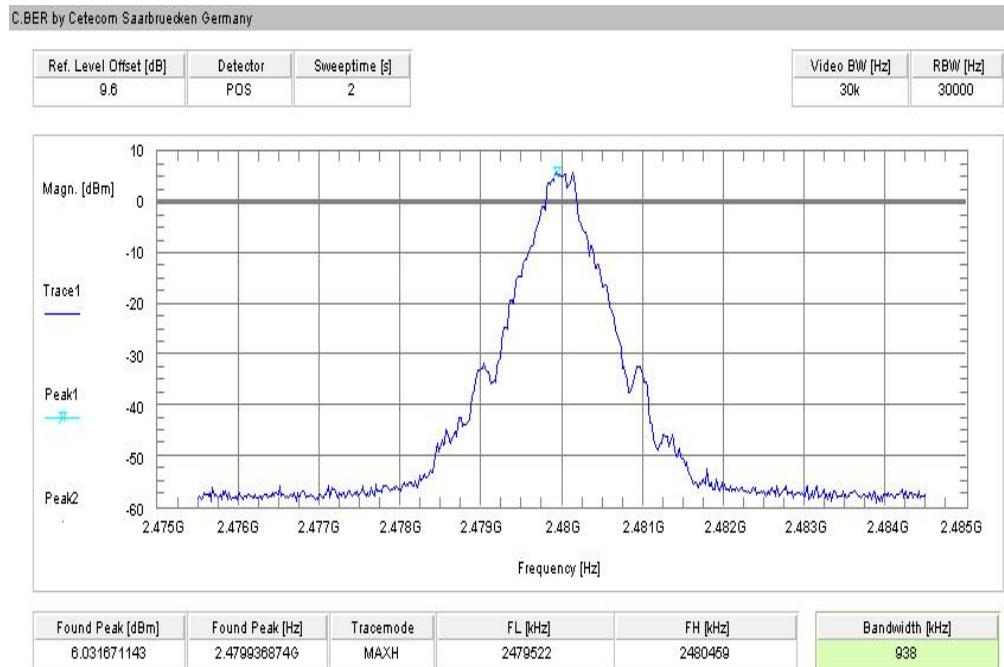
Plot 1: lowest channel – 2402 MHz, GFSK modulation



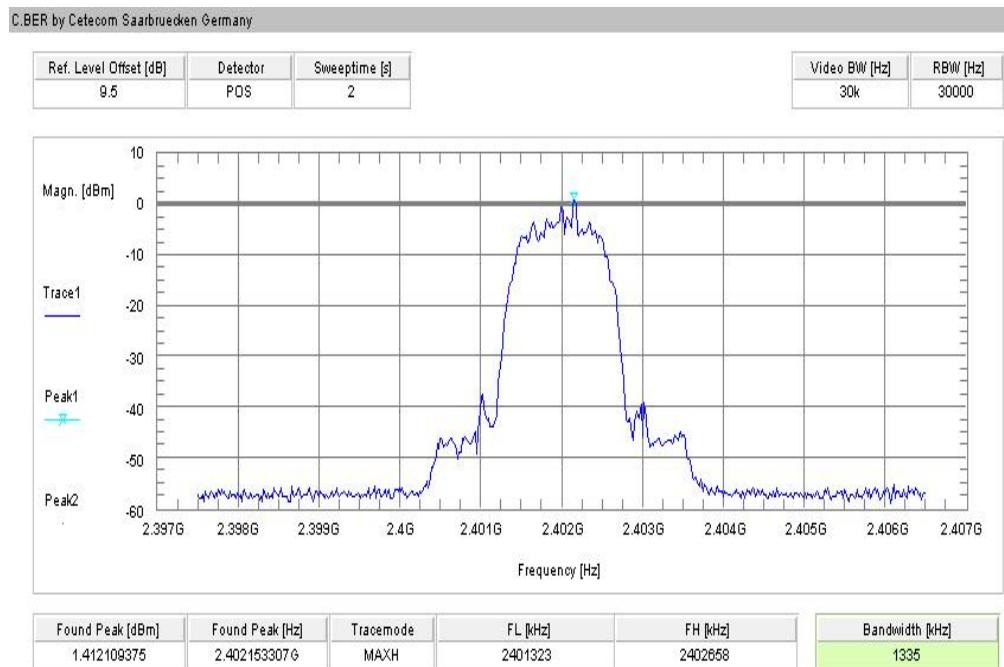
Plot 2: middle channel – 2441 MHz, GFSK modulation



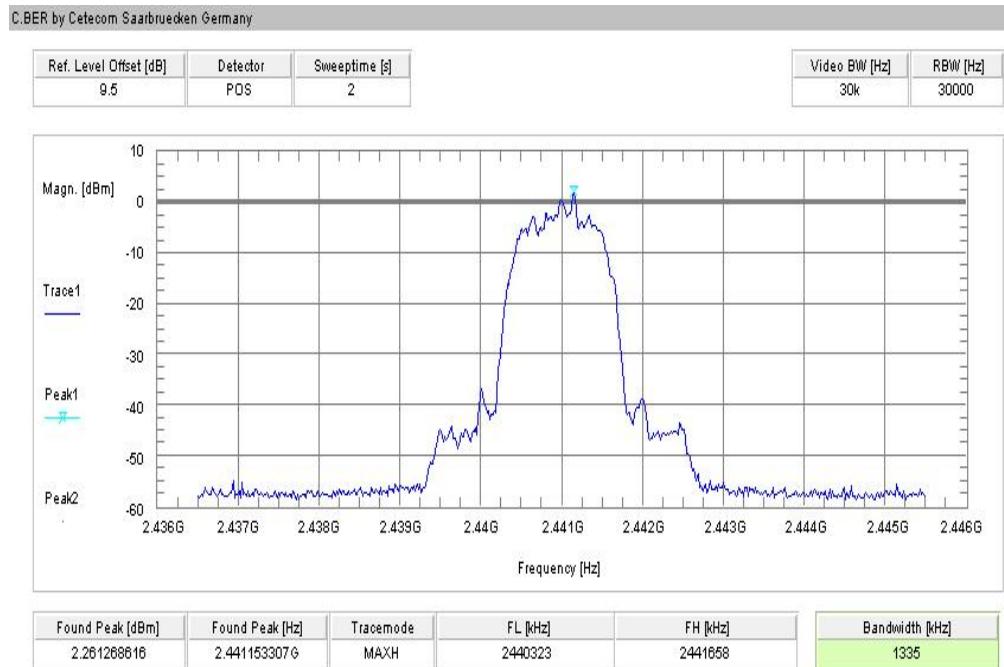
Plot 3: highest channel – 2480 MHz, GFSK modulation



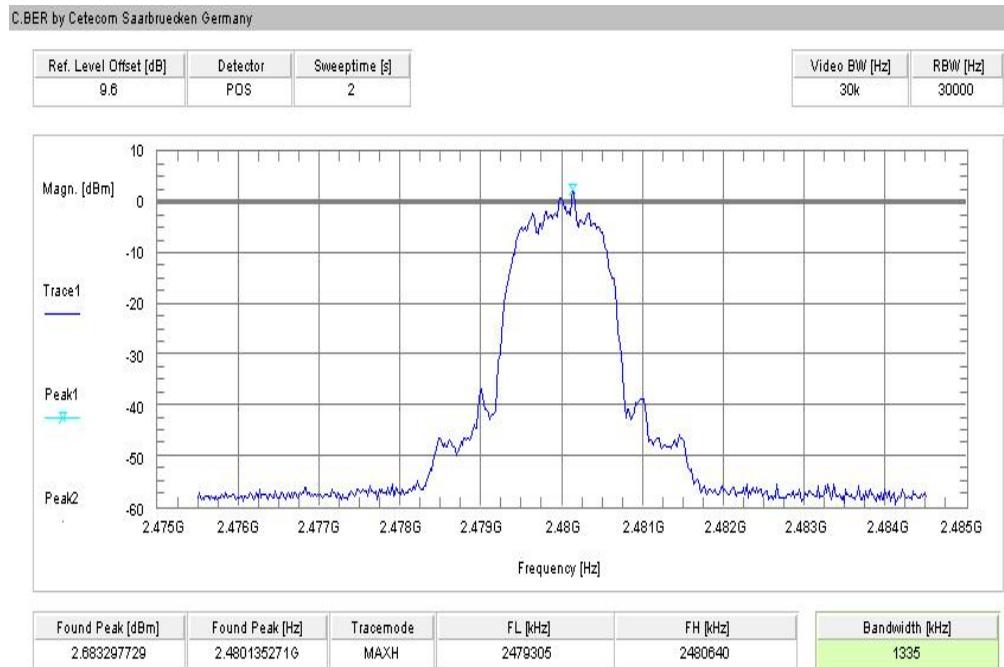
Plot 4: lowest channel – 2402 MHz, Pi / DQPSK modulation

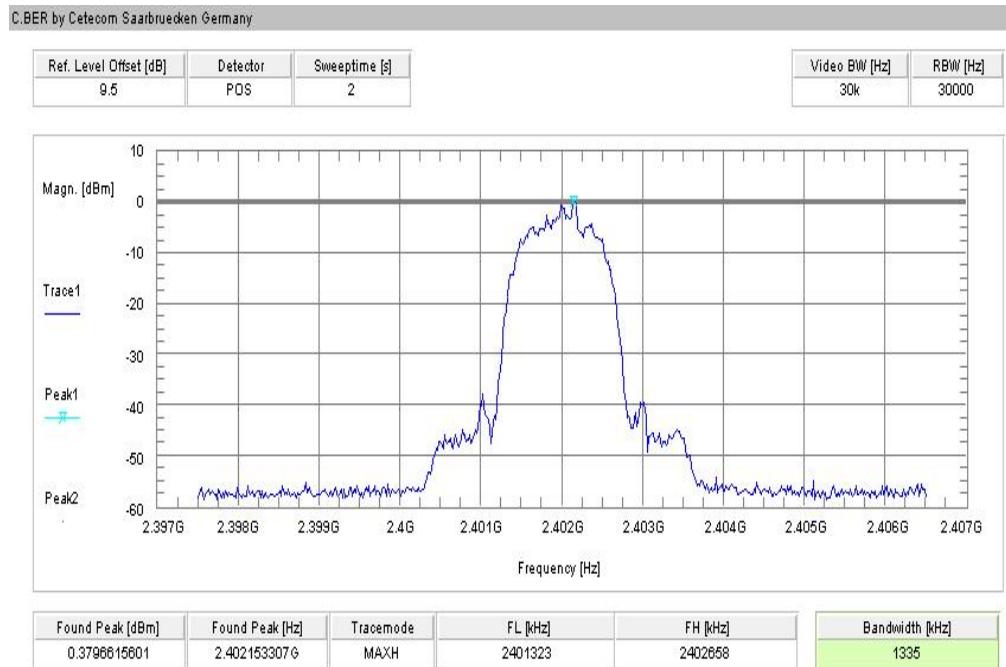
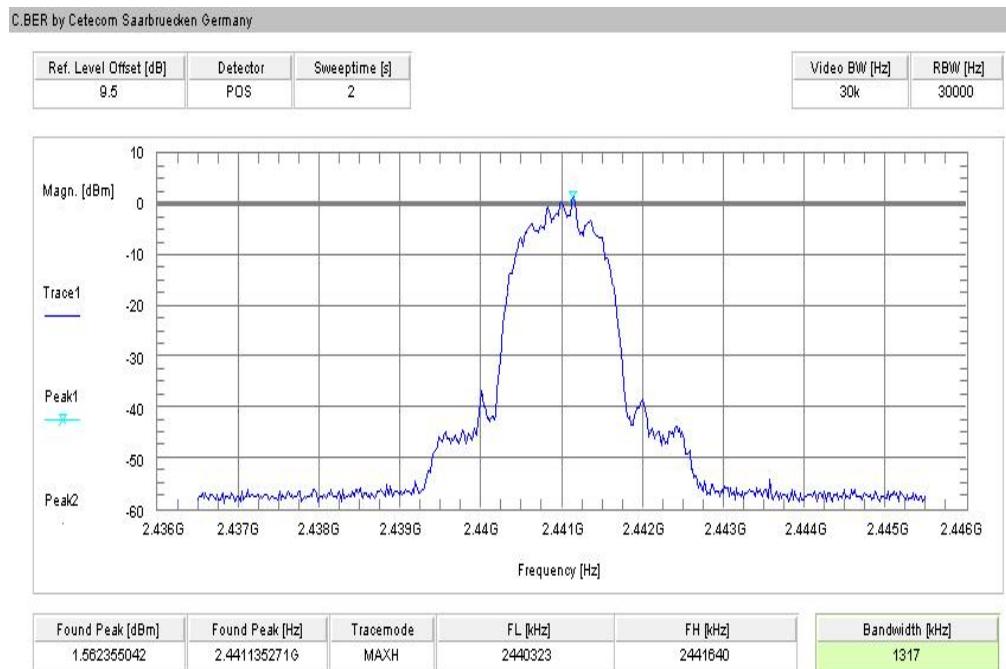


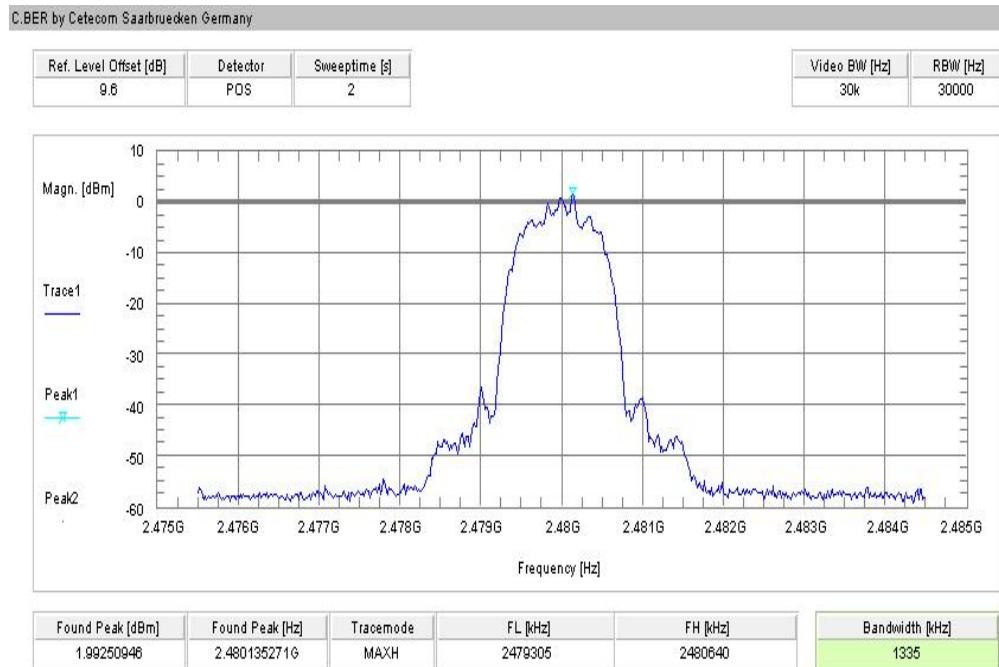
Plot 5: middle channel – 2441 MHz, Pi / DQPSK modulation



Plot 6: highest channel – 2480 MHz, Pi / DQPSK modulation



Plot 7: lowest channel – 2402 MHz, 8 DPSK modulation**Plot 8: middle channel – 2441 MHz, 8 DPSK modulation**

Plot 9: highest channel – 2480 MHz, 8 DPSK modulation


10.7 Maximum output power

Description:

Measurement of the maximum output power conducted and radiated. EUT in single channel mode.

Measurement:

| Measurement parameter | |
|-----------------------|----------|
| Detector: | Peak |
| Sweep time: | Auto |
| Video bandwidth: | 3 MHz |
| Resolution bandwidth: | 3 MHz |
| Span: | 5 MHz |
| Trace-Mode: | Max Hold |

Limits:

| FCC | IC |
|--|----|
| Maximum output power | |
| [Conducted: 0.125 W – antenna gain max. 6 dBi] Systems using more than 75 hopping channels: Conducted: 1.0 W – antenna gain max. 6 dBi | |

Results:

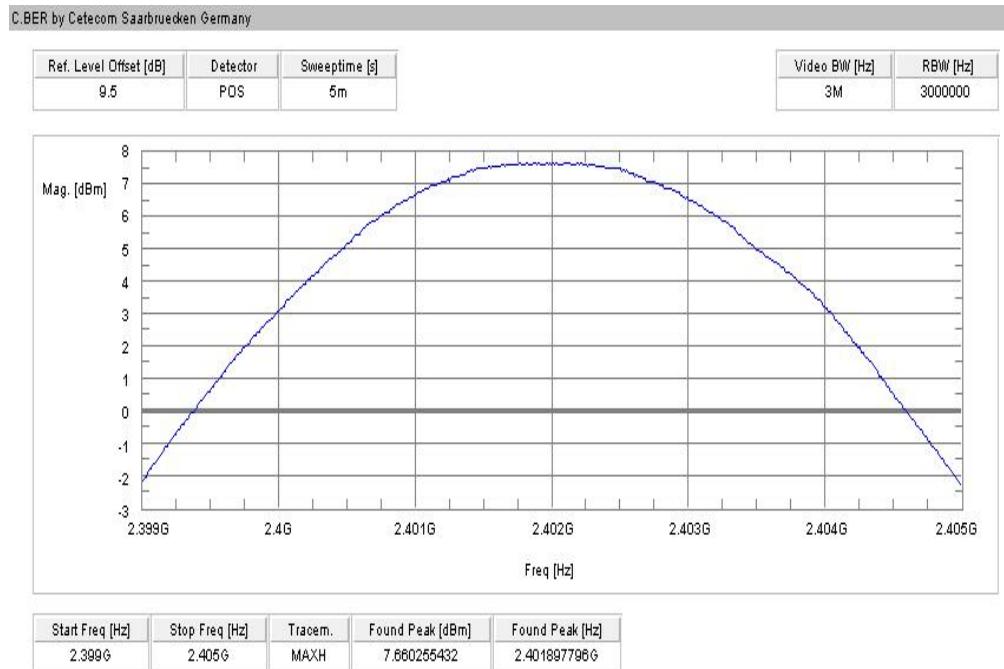
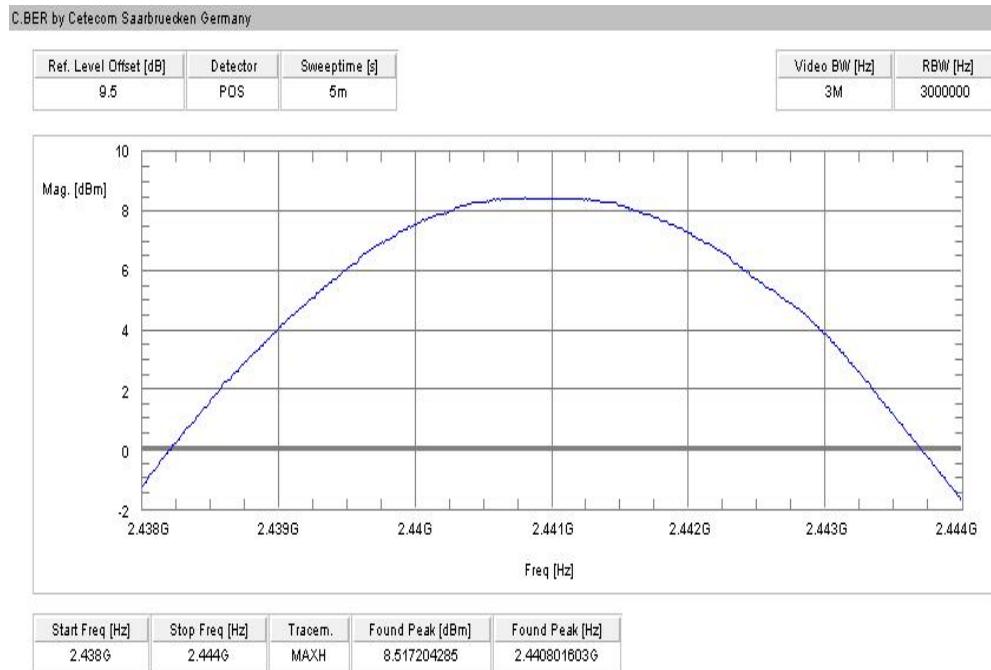
| Modulation | Maximum output power conducted [dBm] | | |
|-------------------------|---|----------|----------|
| | 2402 MHz | 2441 MHz | 2480 MHz |
| GFSK | 7.66 | 8.52 | 9.08 |
| Pi/4 DQPSK | 6.19 | 7.01 | 7.49 |
| 8DPSK | 6.86 | 7.61 | 8.23 |
| Measurement uncertainty | ± 1 dB | | |

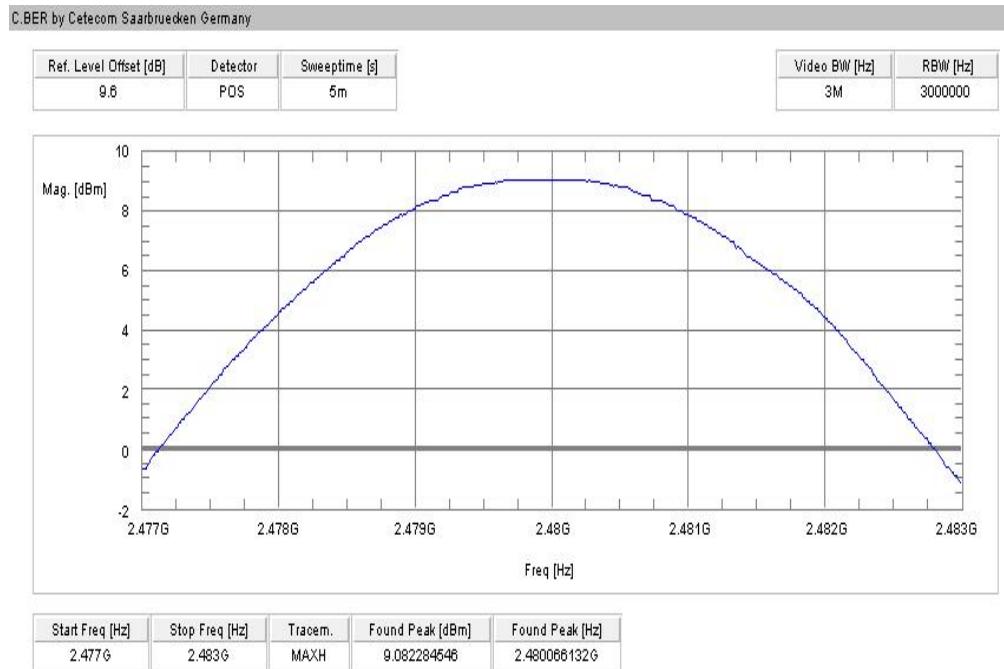
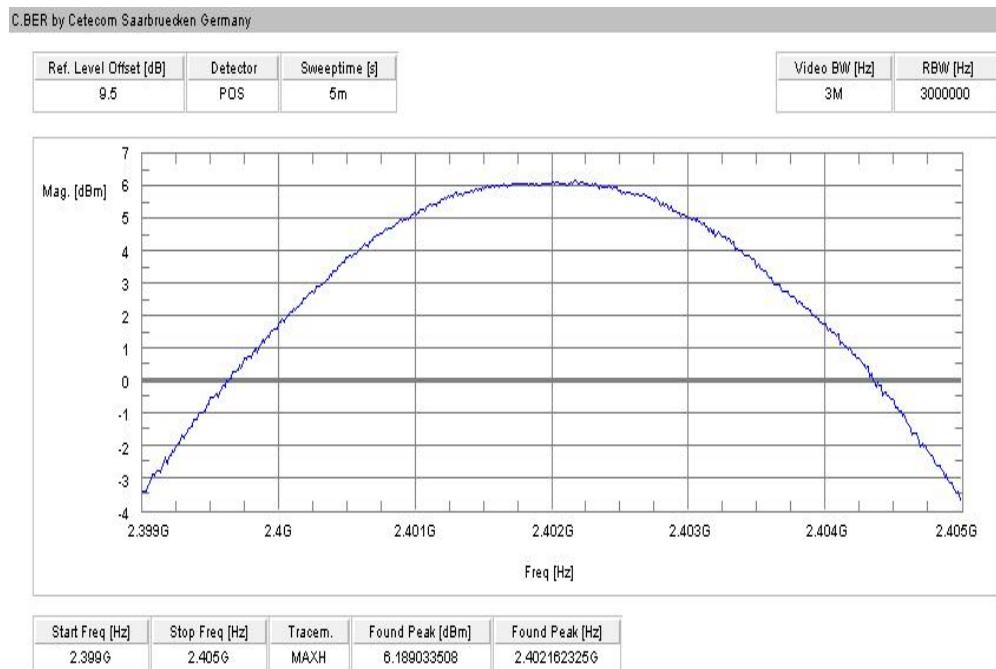
Result: Passed**Results:**

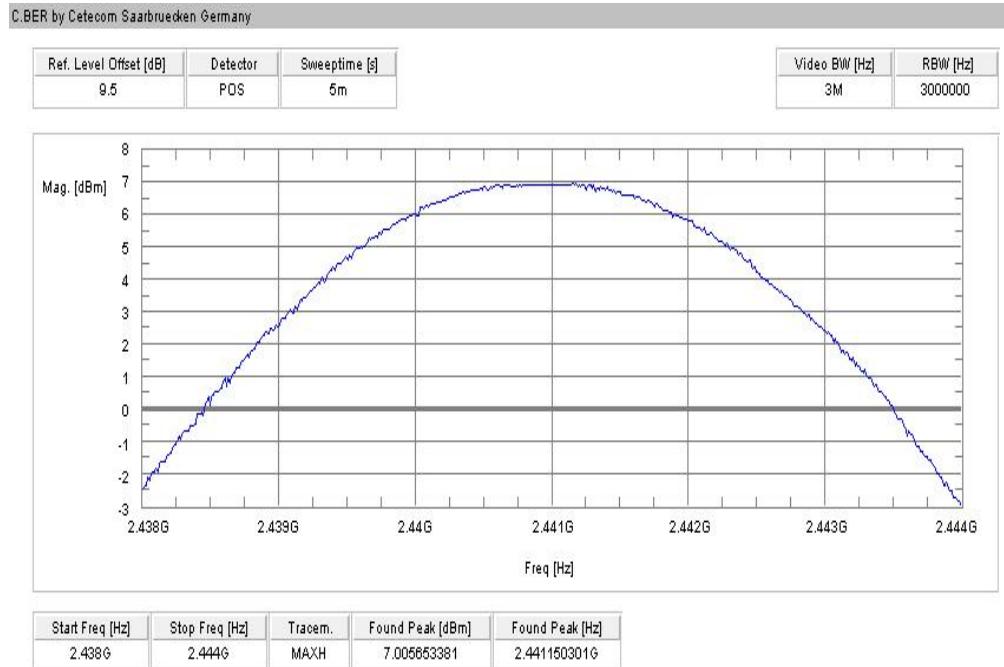
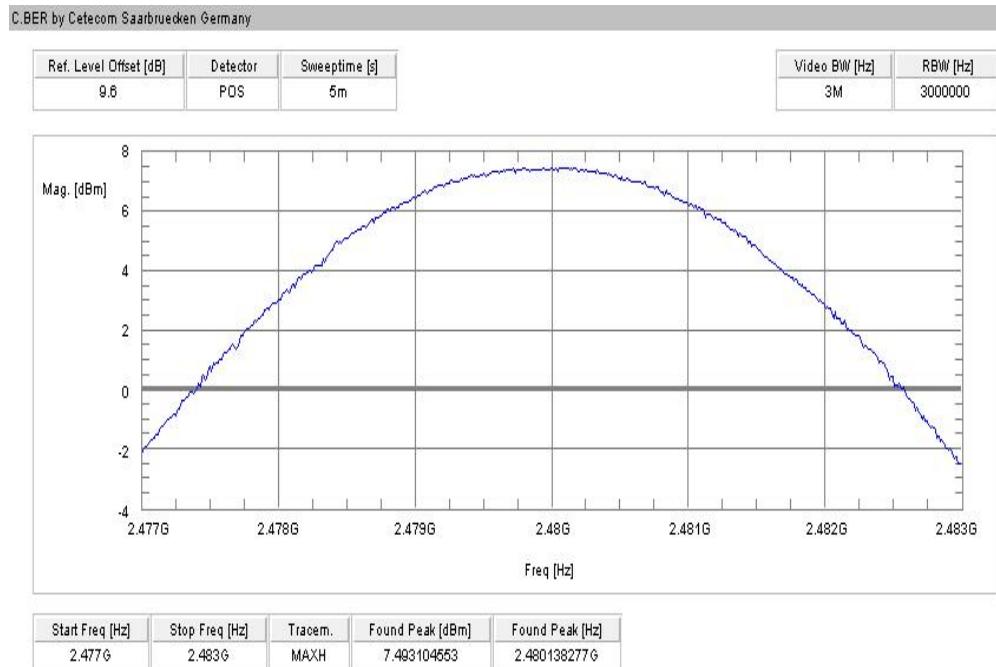
| Modulation | Maximum output power radiated – EIRP [dBm] | | |
|-------------------------|---|----------|----------|
| | 2402 MHz | 2441 MHz | 2480 MHz |
| GFSK | 6.09 | 7.48 | 7.78 |
| Pi/4 DQPSK *) | 4.62 | 5.97 | 6.19 |
| 8DPSK *) | 5.29 | 6.57 | 6.93 |
| Measurement uncertainty | ± 3 dB | | |

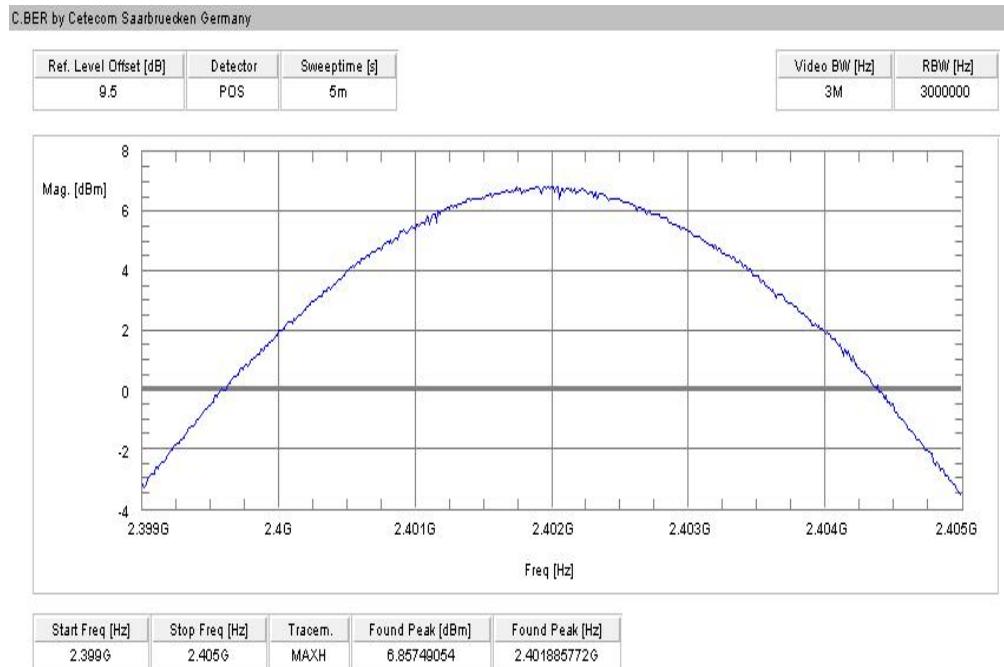
*) – Values calculated with antenna gain

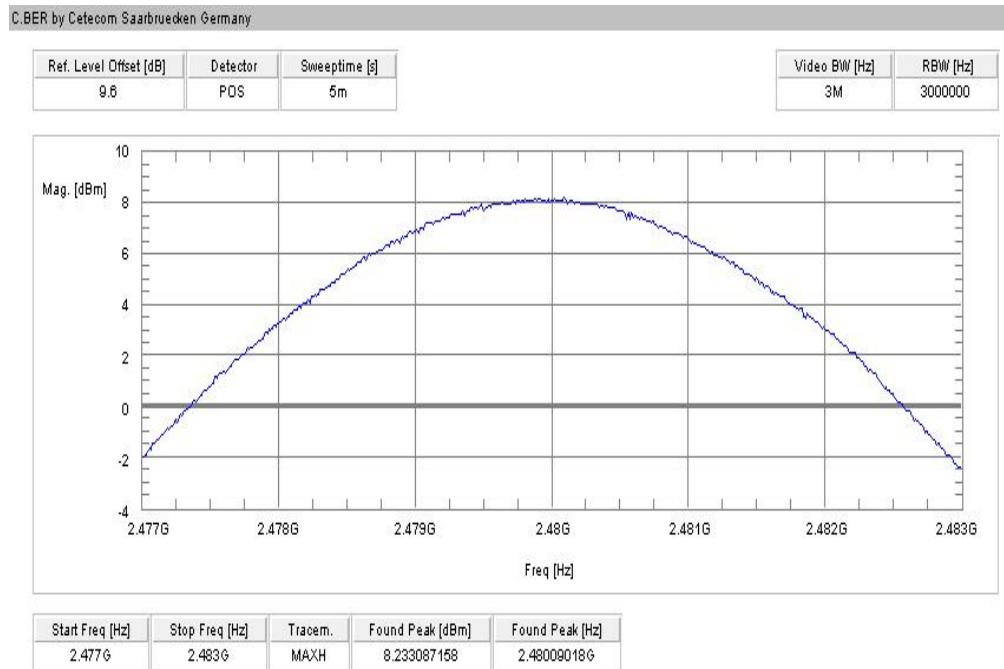
Result: Passed

Plots:
Plot 1: lowest channel – 2402 MHz, GFSK modulation

Plot 2: middle channel – 2441 MHz, GFSK modulation


Plot 3: highest channel – 2480 MHz, GFSK modulation

Plot 4: lowest channel – 2402 MHz, Pi / DQPSK modulation


Plot 5: middle channel – 2441 MHz, Pi / DQPSK modulation**Plot 6:** highest channel – 2480 MHz, Pi / DQPSK modulation

Plot 7: lowest channel – 2402 MHz, 8 DPSK modulation**Plot 8:** middle channel – 2441 MHz, 8 DPSK modulation

Plot 9: highest channel – 2480 MHz, 8 DPSK modulation

10.8 Band edge compliance conducted

Description:

Measurement of the conducted band edge compliance. EUT is measured at the lower and upper band edge in single channel and hopping mode. The measurement is repeated for all modulations.

Measurement:

| Measurement parameter | |
|-----------------------|--|
| Detector: | Peak |
| Sweep time: | Auto |
| Video bandwidth: | 100 kHz |
| Resolution bandwidth: | 100 kHz |
| Span: | Lower Band Edge: 2395 – 2405 MHz Upper Band Edge: 2478 – 2489 MHz |
| Trace-Mode: | Max Hold |

Limits:

| FCC | IC |
|---|----|
| Band edge compliance conducted | |
| 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. | |

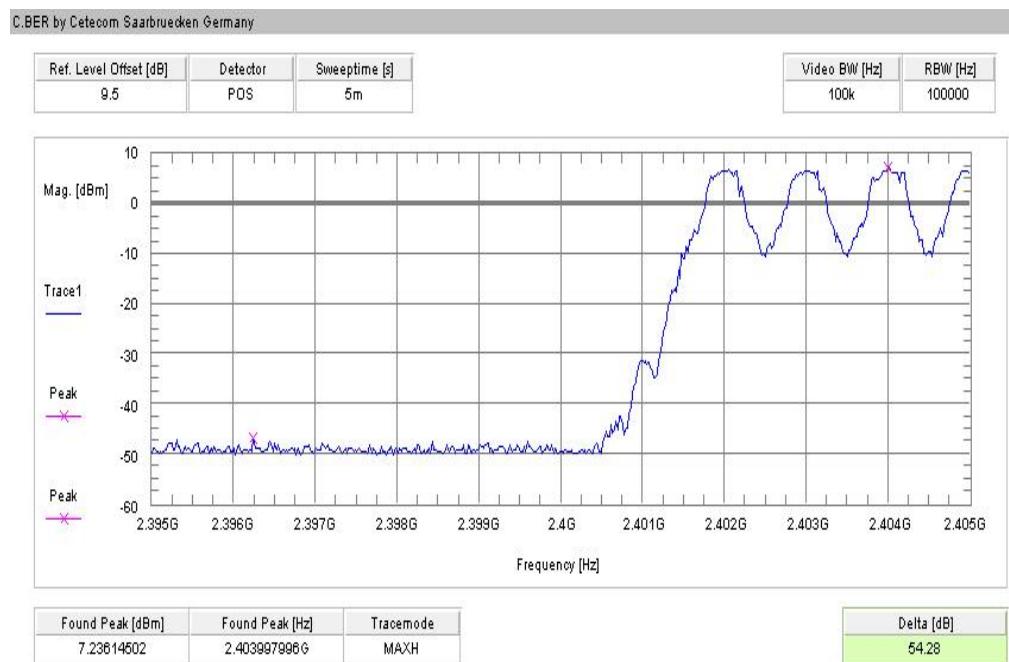
Results:

| Scenario | Band edge compliance conducted [dB] | | |
|-------------------------------|-------------------------------------|------------|---------|
| | GFSK | Pi/4 DQPSK | 8DPSK |
| Lower band edge – hopping off | > 20 dB | > 20 dB | > 20 dB |
| Lower band edge – hopping on | > 20 dB | > 20 dB | > 20 dB |
| Upper band edge – hopping off | > 20 dB | > 20 dB | > 20 dB |
| Upper band edge – hopping on | > 20 dB | > 20 dB | > 20 dB |
| Measurement uncertainty | ± 1.5 dB | | |

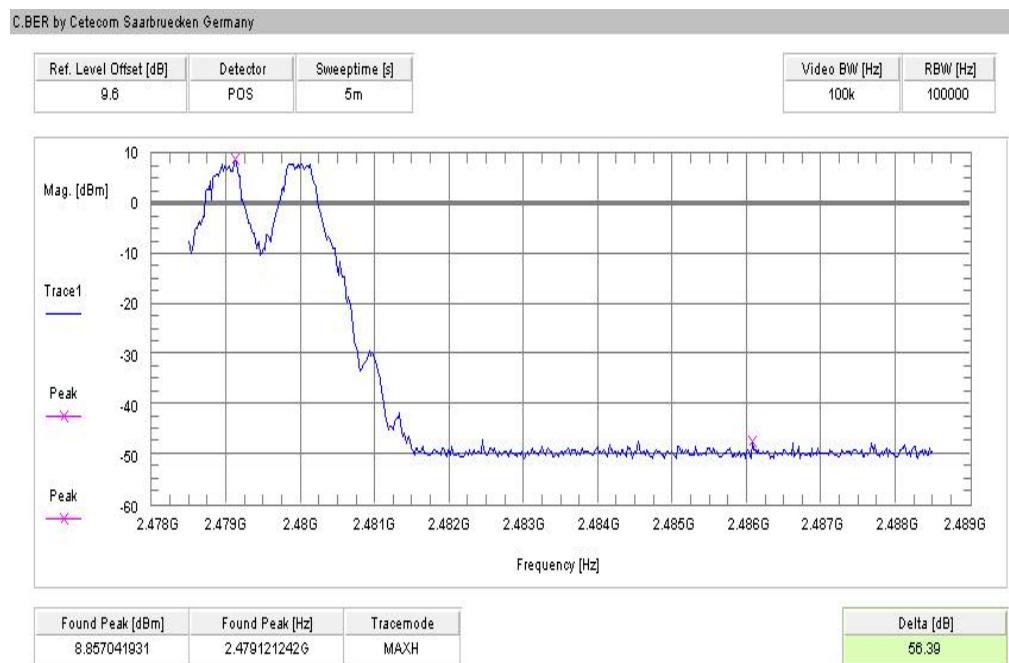
Result: Passed

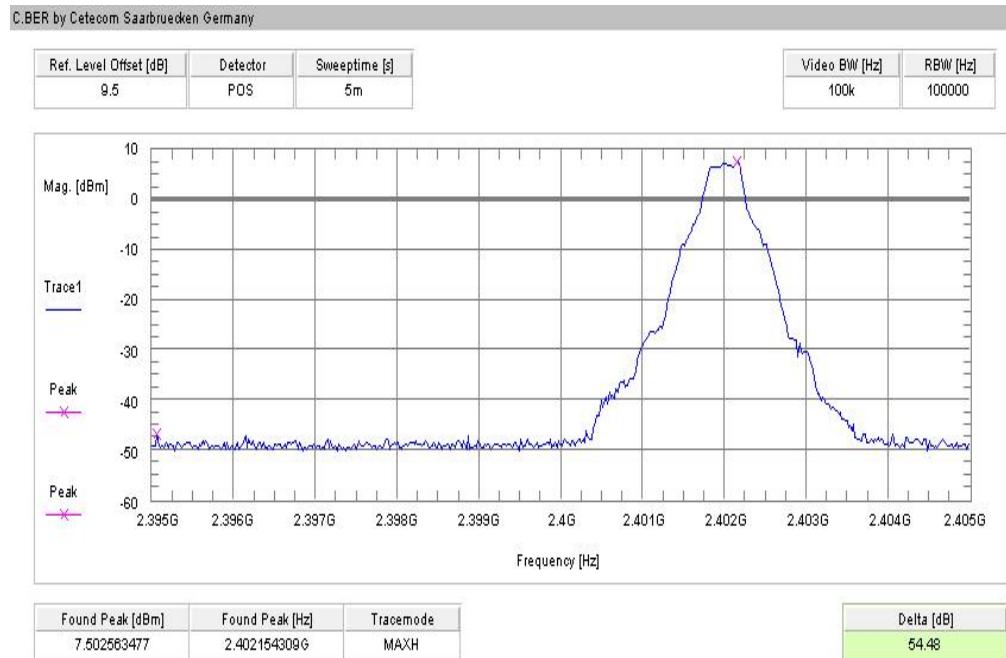
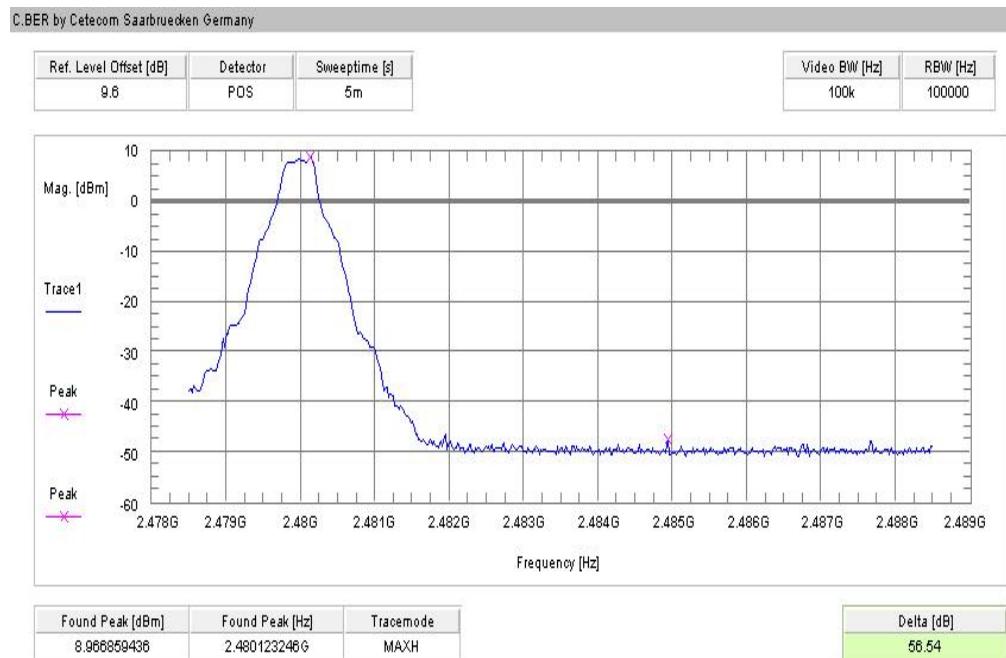
Plots:

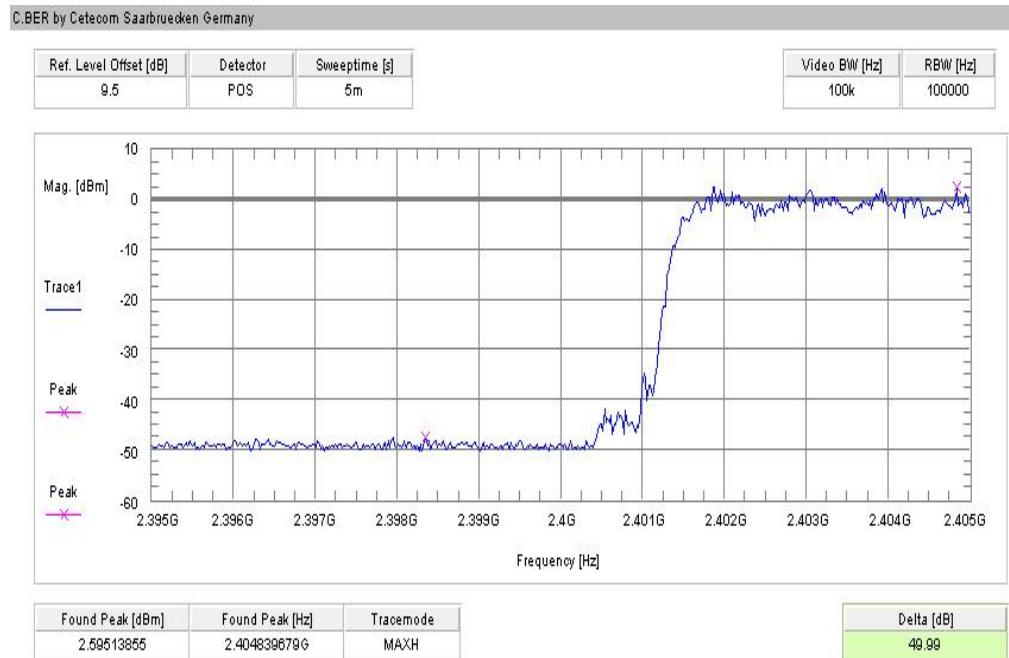
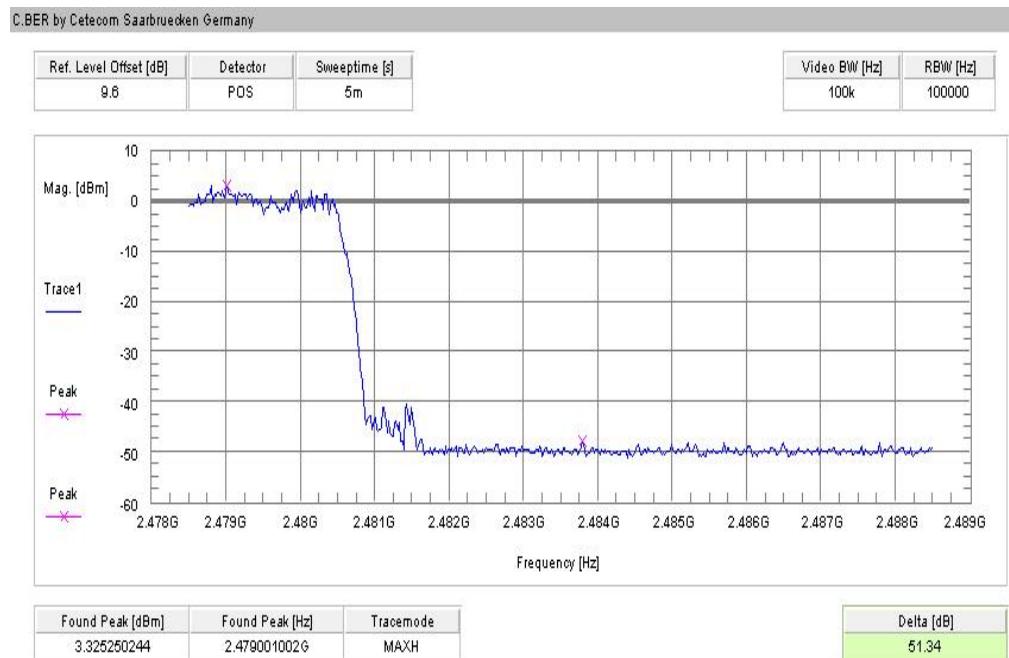
Plot 1: Lower band edge – hopping on, GFSK modulation

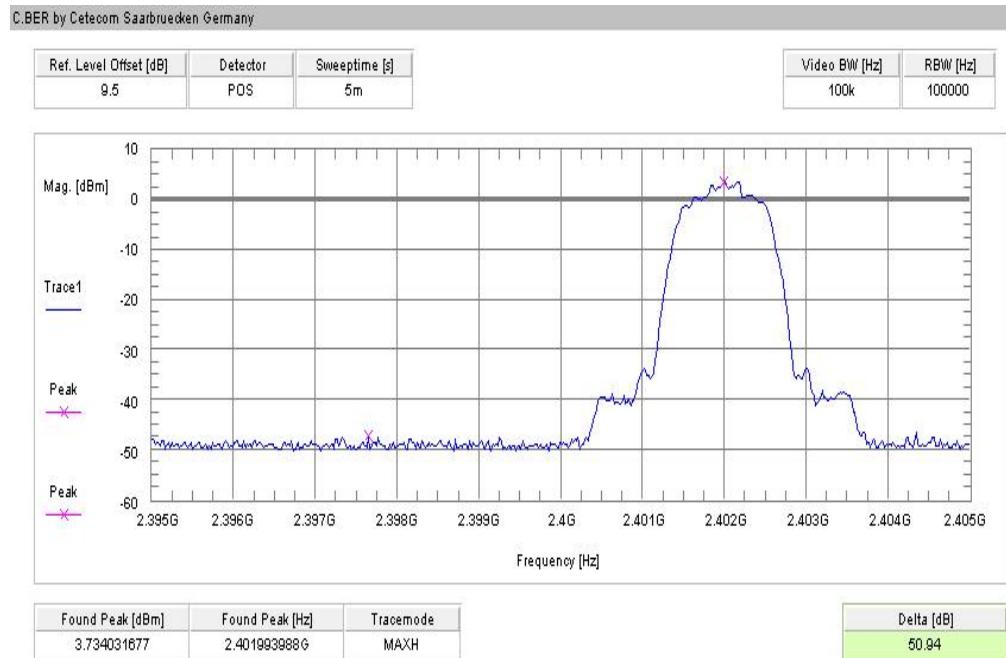
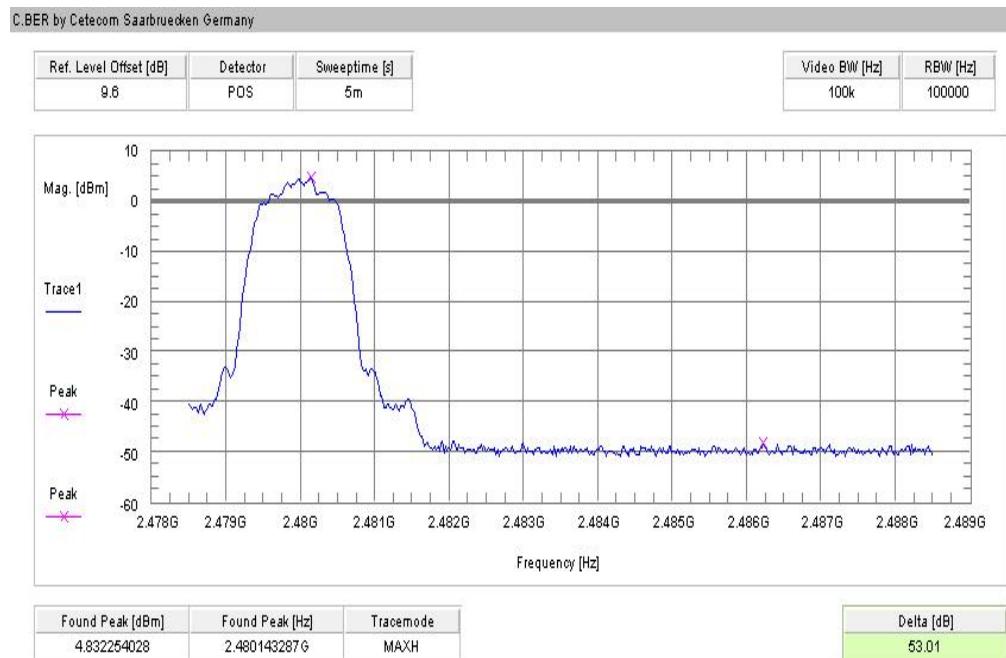


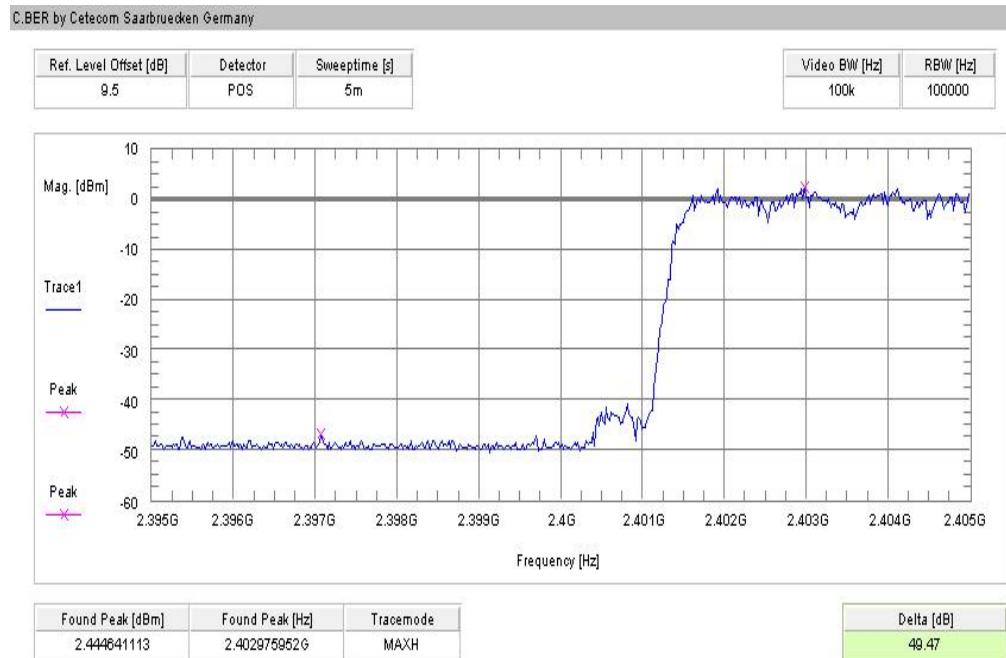
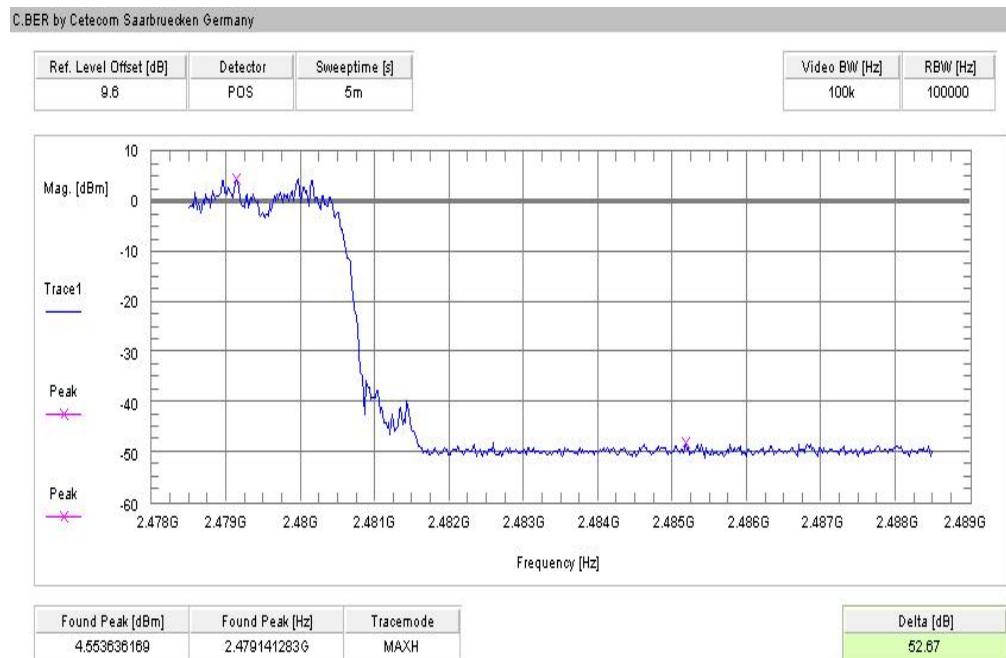
Plot 2: Upper band edge – hopping on, GFSK modulation



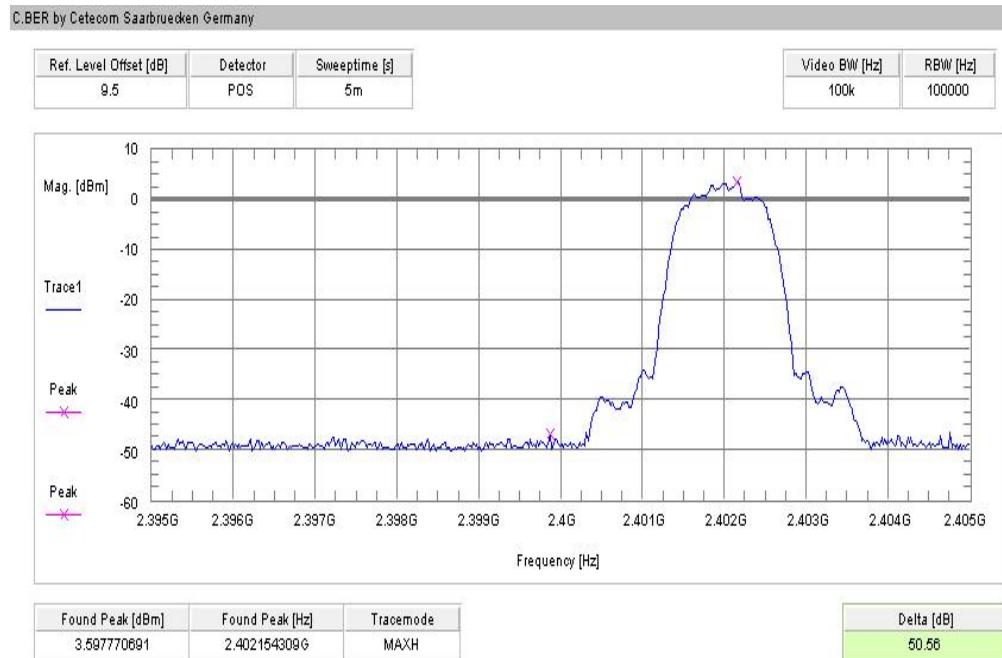
Plot 3: Lower band edge – hopping off, GFSK modulation**Plot 4: Upper band edge – hopping off, GFSK modulation**

Plot 5: Lower band edge – hopping on, Pi/4 DQPSK modulation**Plot 6: Upper band edge – hopping on, Pi/4 DQPSK modulation**

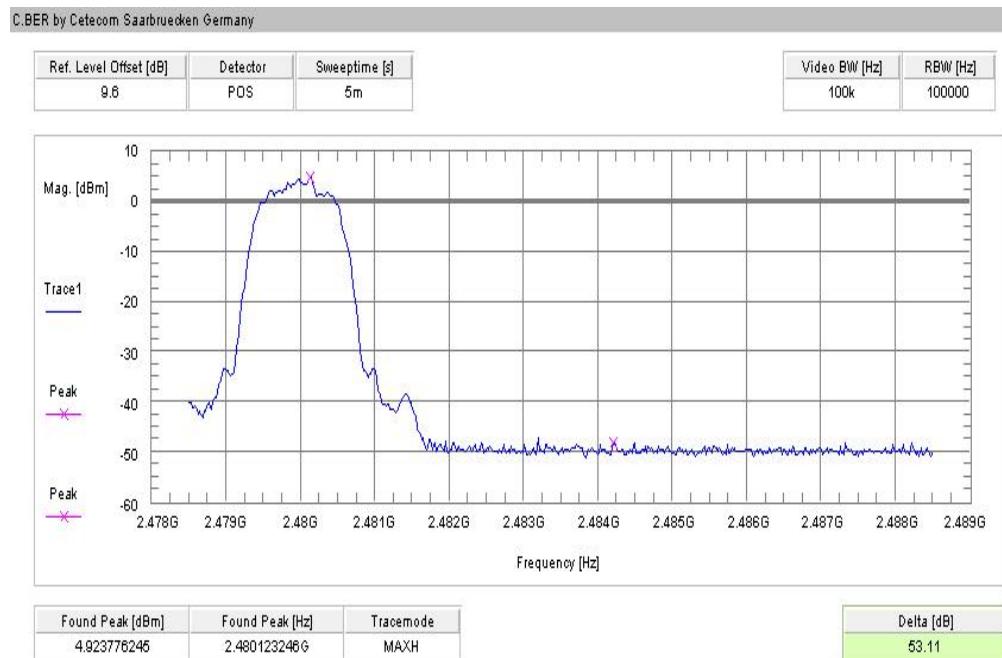
Plot 7: Lower band edge – hopping off, Pi/4 DQPSK modulation**Plot 8: Upper band edge – hopping off, Pi/4 DQPSK modulation**

Plot 9: Lower band edge – hopping on, 8DPSK modulation**Plot 10: Upper band edge – hopping on, 8DPSK modulation**

Plot 11: Lower band edge – hopping off, 8DPSK modulation



Plot 12: Upper band edge – hopping off, 8DPSK modulation



10.9 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 Upper Band: 2480 – 2500 MHz |
| Trace-Mode: | Max Hold |

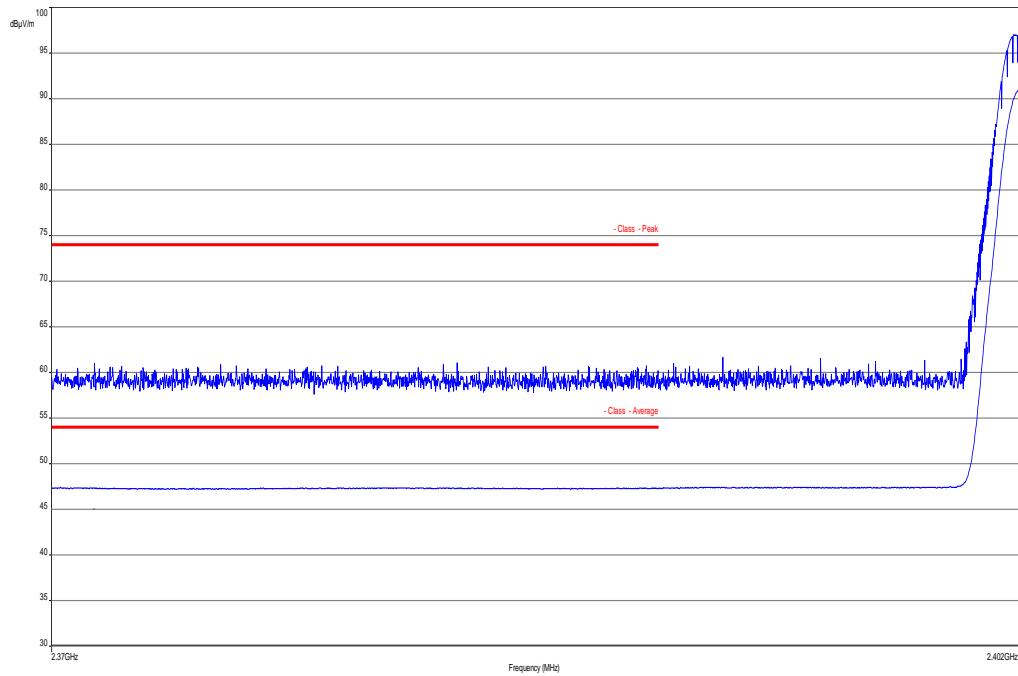
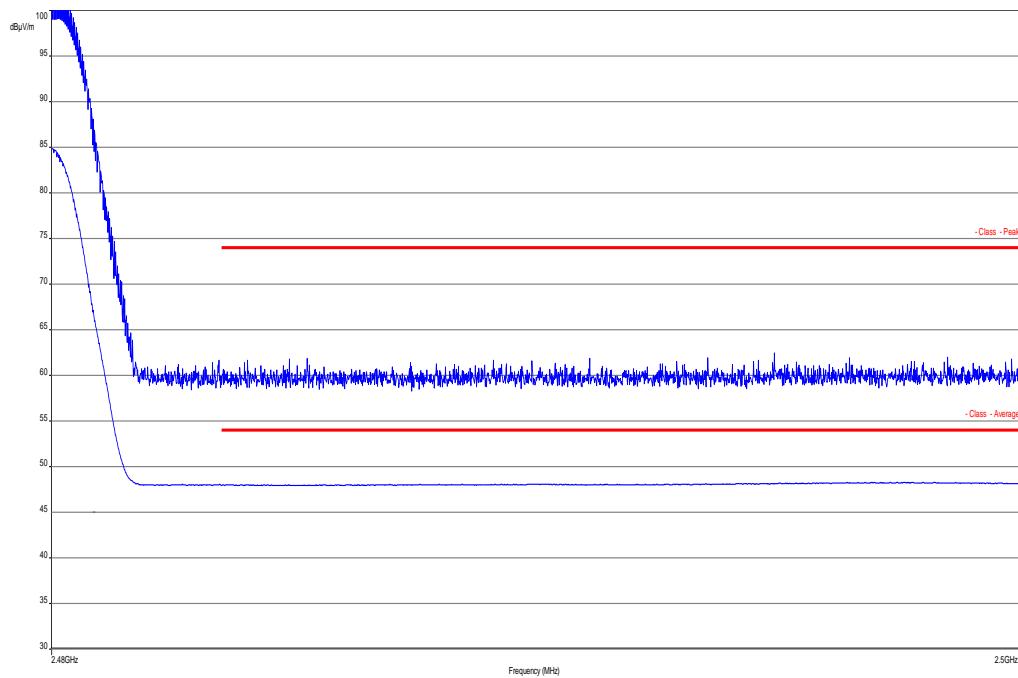
Limits:

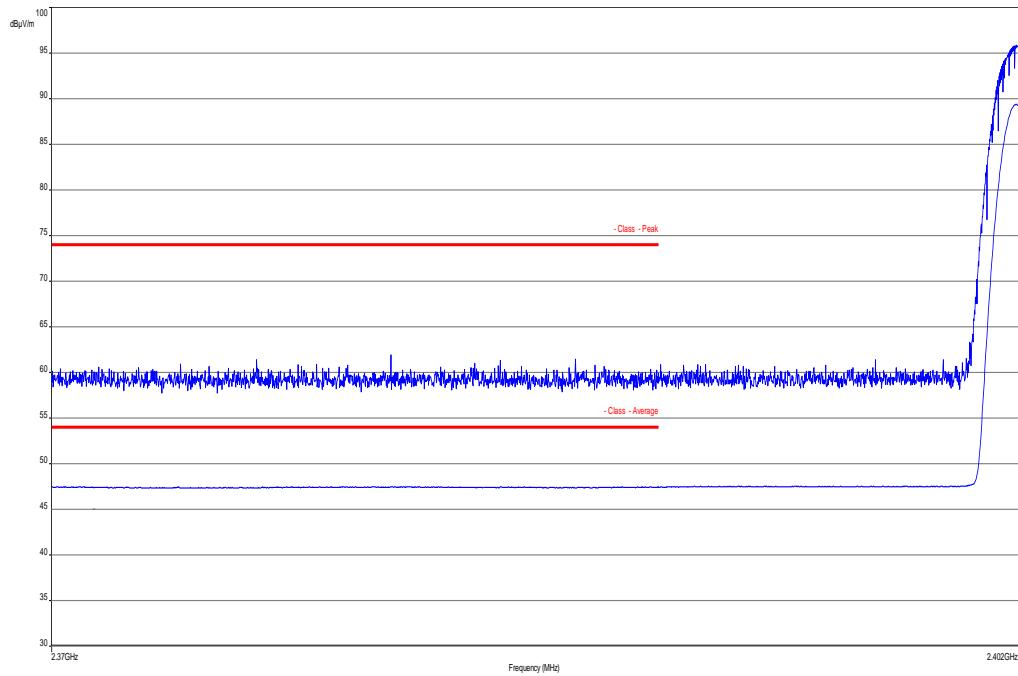
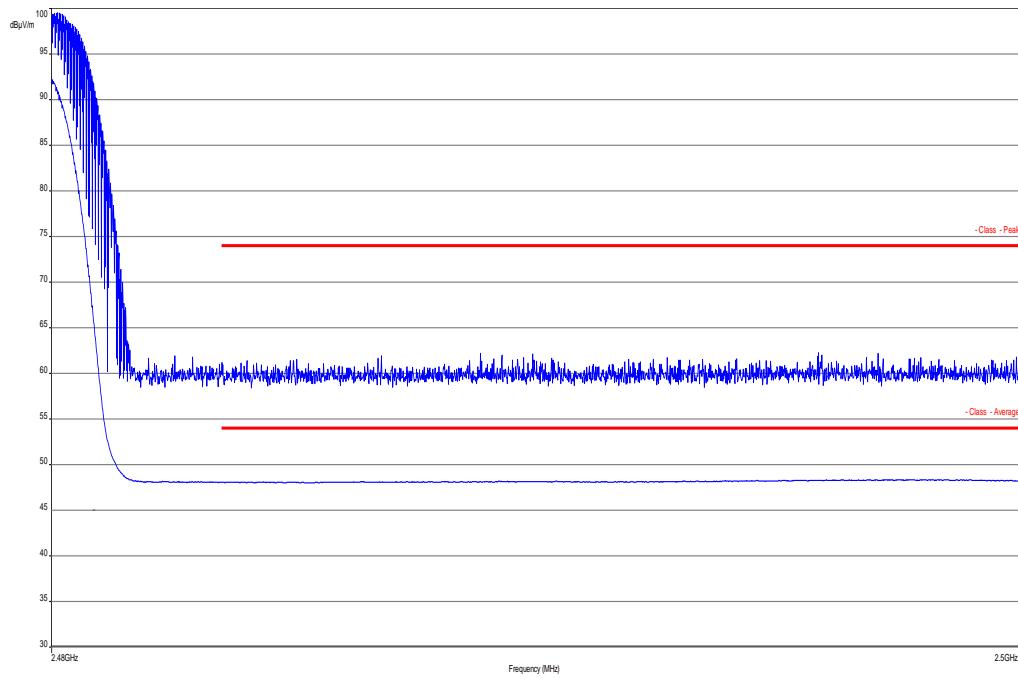
| FCC | IC |
|--|----|
| Band edge compliance radiated | |
| In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below 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 dB μ V/m AVG 74 dB μ V/m Peak | |

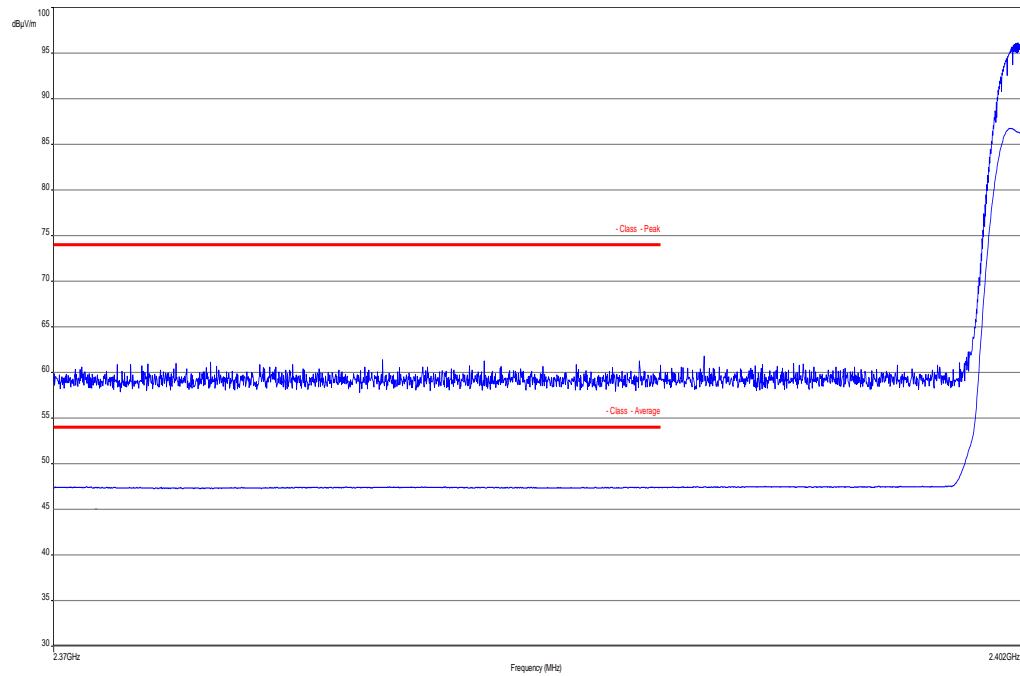
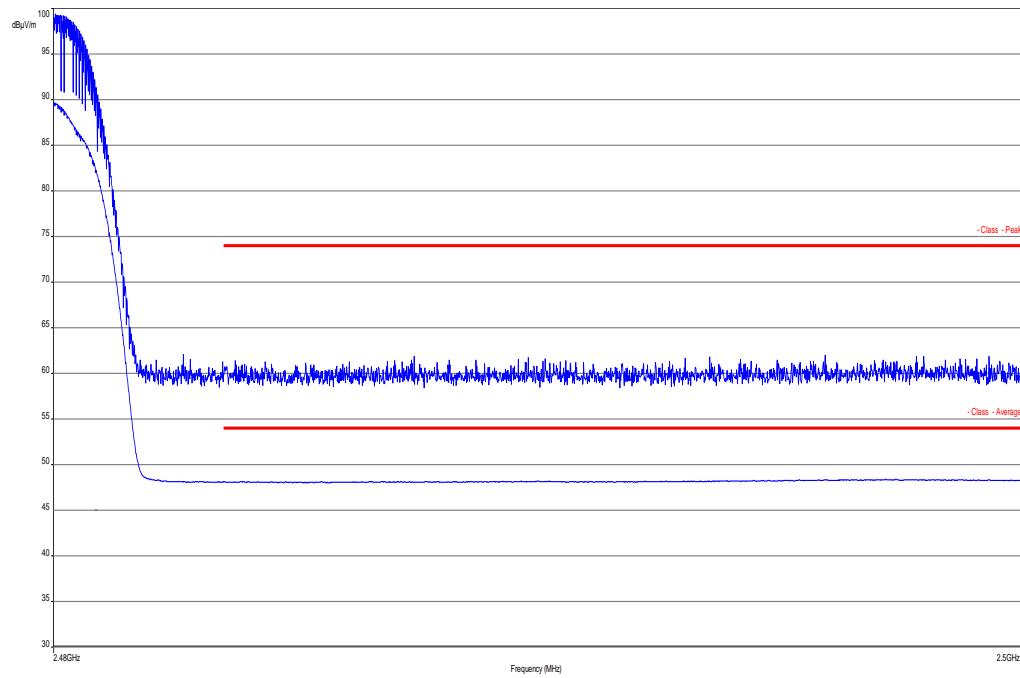
Results:

| Scenario | Band edge compliance radiated [dB μ V/m] | | |
|-------------------------|--|--------------------|--------------------|
| | GFSK | Pi/4 DQPSK | 8DPSK |
| Modulation | | | |
| 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

10.10 TX spurious emissions conducted

Description:

Measurement of the conducted 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 repeated for all modulations.

Measurement:

| Measurement parameter | |
|-----------------------|--|
| Detector: | Peak |
| Sweep time: | Auto |
| Video bandwidth: | $F < 1 \text{ GHz}$: 500 kHz $F > 1 \text{ GHz}$: 500 kHz |
| Resolution bandwidth: | $F < 1 \text{ GHz}$: 100 kHz $F > 1 \text{ GHz}$: 100 kHz |
| Span: | 9 kHz to 25 GHz |
| Trace-Mode: | Max Hold |

Limits:

| FCC | IC |
|--|----|
| TX spurious emissions conducted | |
| 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 | |

Results:

| TX spurious emissions conducted | | | | | |
|--|--|-----------------------------|-----------------------------------|--|---------------------|
| GFSK – mode | | | | | |
| f [MHz] | | amplitude of emission [dBm] | limit max. allowed emission power | actual attenuation below frequency of operation [dB] | results |
| 2402 | | 7.73 | 30 dBm | | Operating frequency |
| All detected emissions are below the -20 dBc criteria. | | | -20 dBc | | complies |
| | | | | | |
| | | | | | |
| | | | | | |
| 2441 | | 8.49 | 30 dBm | | Operating frequency |
| All detected emissions are below the -20 dBc criteria. | | | -20 dBc | | complies |
| | | | | | |
| | | | | | |
| | | | | | |
| 2480 | | 9.14 | 30 dBm | | Operating frequency |
| All detected emissions are below the -20 dBc criteria. | | | -20 dBc | | complies |
| | | | | | |
| | | | | | |
| | | | | | |
| Measurement uncertainty | | ± 3 dB | | | |

Result: Passed**Results:**

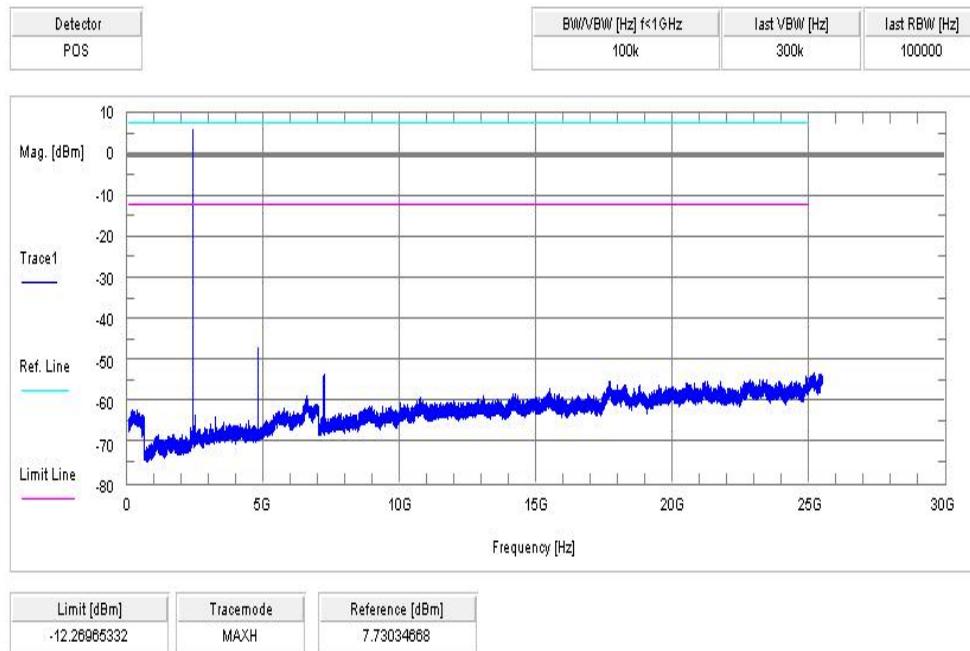
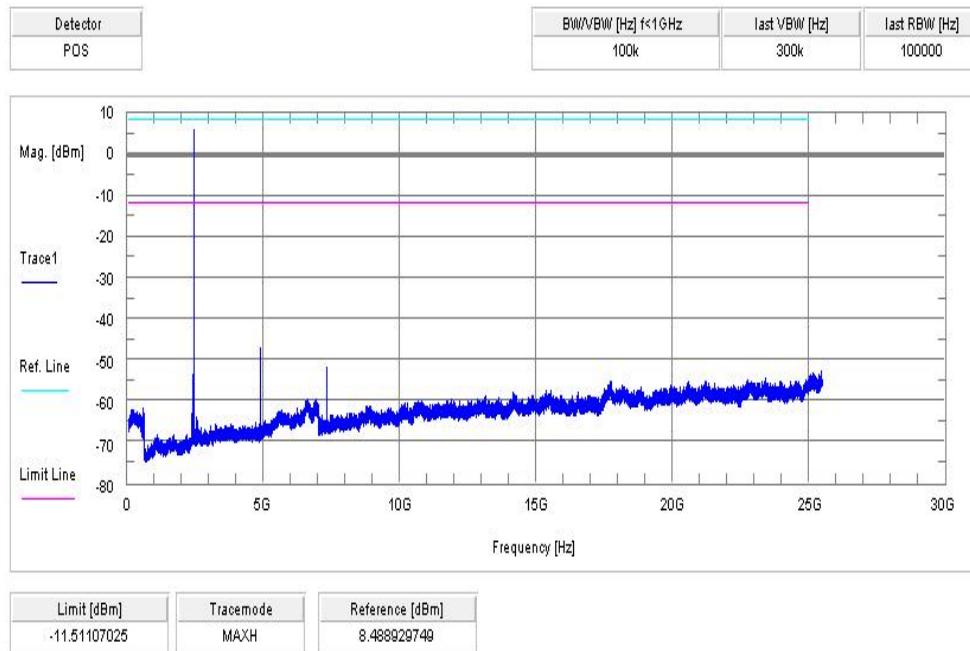
| TX spurious emissions conducted | | | | | |
|--|--|-----------------------------|-----------------------------------|--|---------------------|
| Pi/4-DQPSK – mode | | | | | |
| f [MHz] | | amplitude of emission [dBm] | limit max. allowed emission power | actual attenuation below frequency of operation [dB] | results |
| 2402 | | 5.87 | 30 dBm | | Operating frequency |
| All detected emissions are below the -20 dBc criteria. | | | -20 dBc | | complies |
| | | | | | |
| | | | | | |
| | | | | | |
| 2441 | | 6.67 | 30 dBm | | Operating frequency |
| All detected emissions are below the -20 dBc criteria. | | | -20 dBc | | complies |
| | | | | | |
| | | | | | |
| | | | | | |
| 2480 | | 7.06 | 30 dBm | | Operating frequency |
| All detected emissions are below the -20 dBc criteria. | | | -20 dBc | | complies |
| | | | | | |
| | | | | | |
| | | | | | |
| Measurement uncertainty | | ± 3dB | | | |

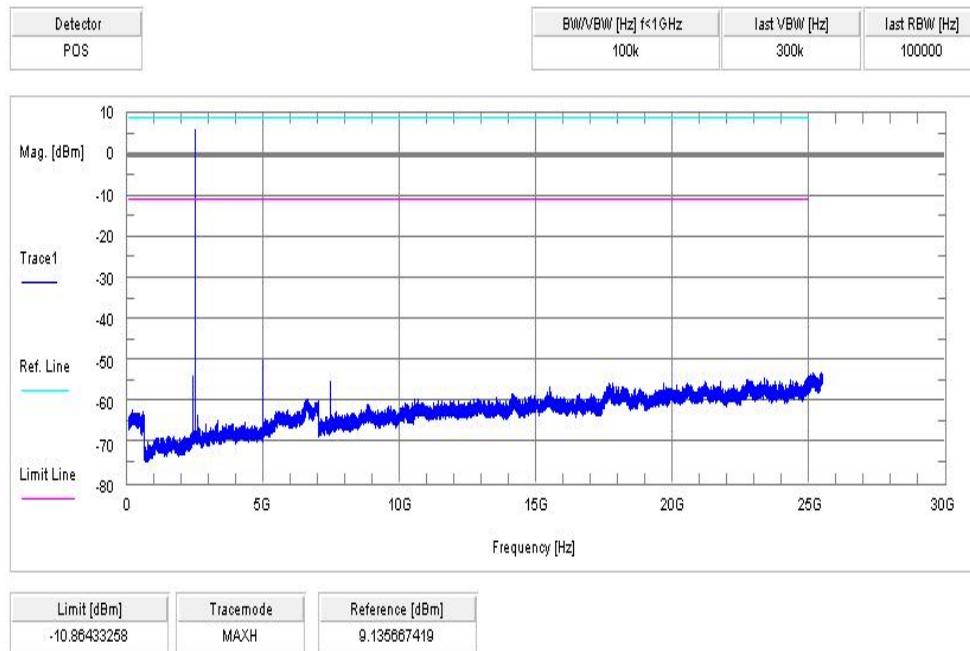
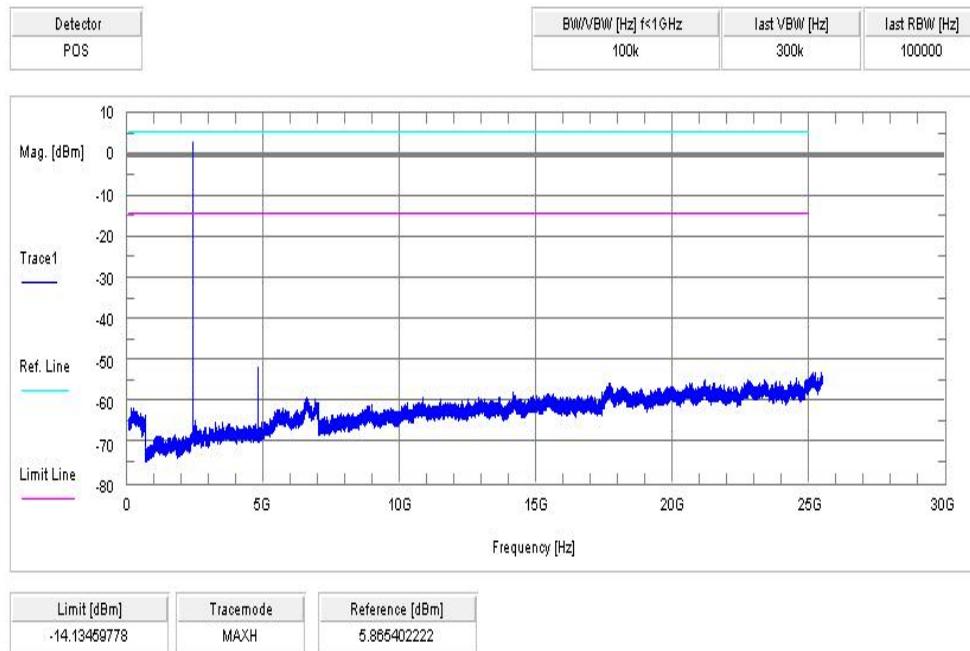
Result: Passed

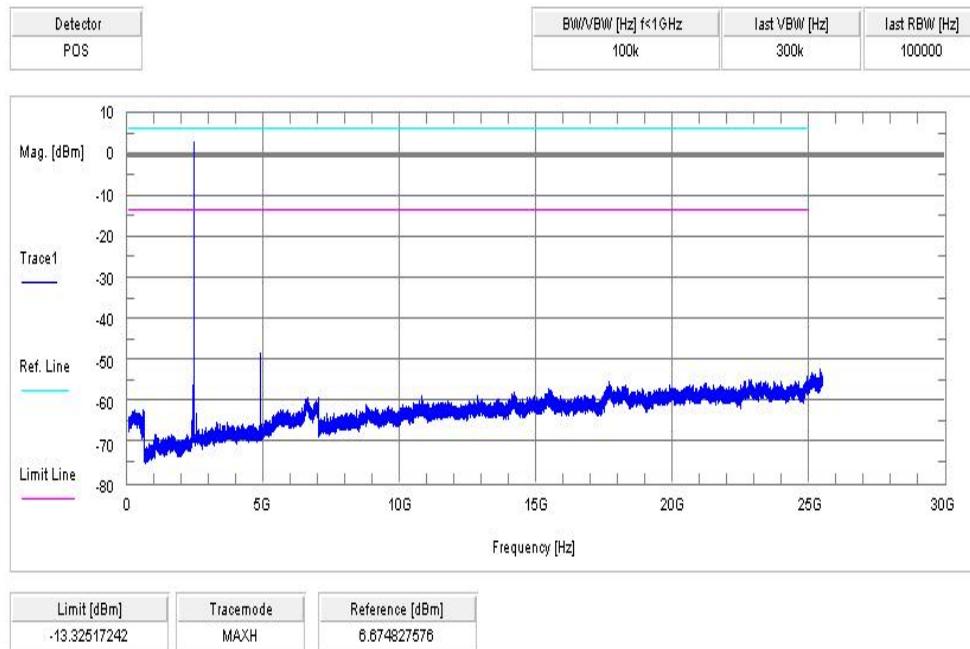
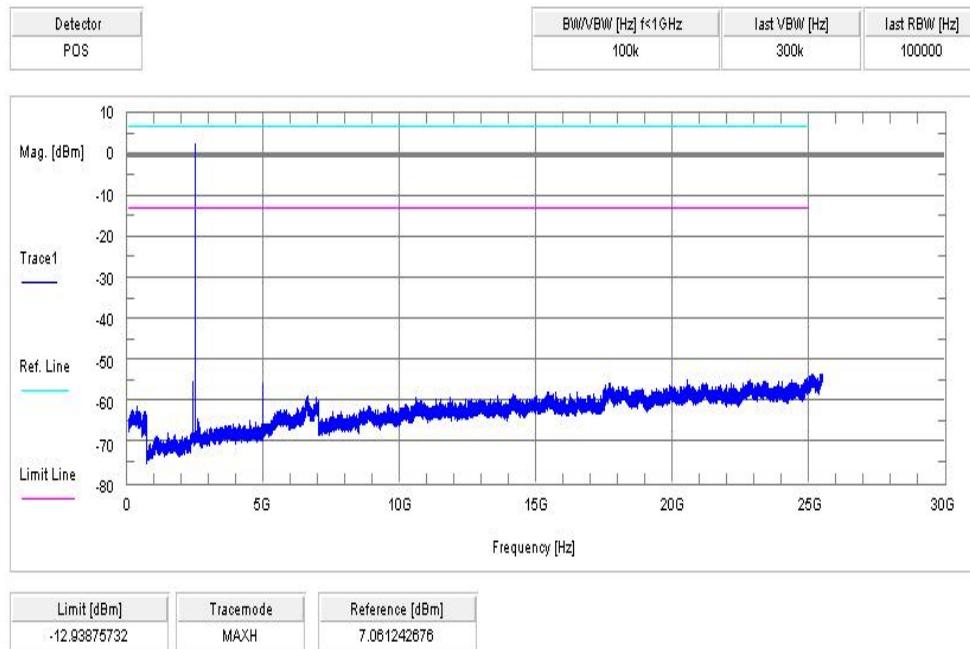
Results:

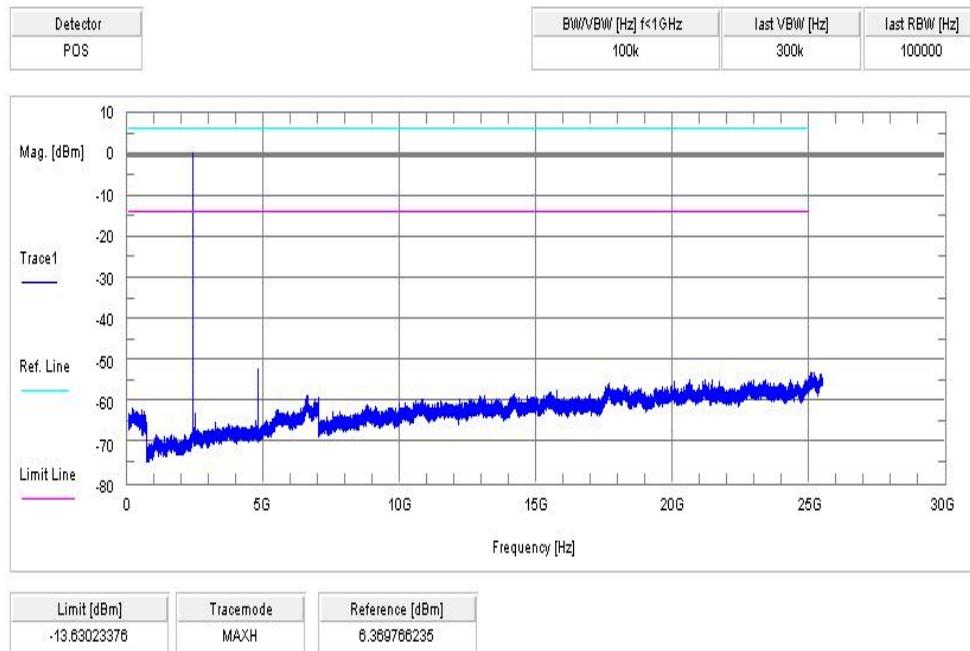
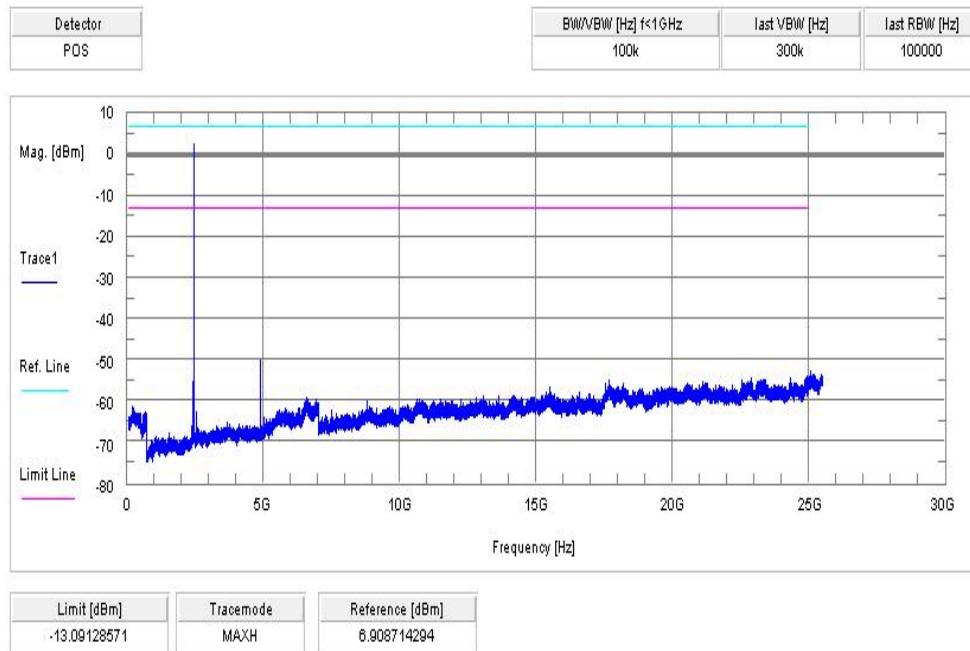
| TX spurious emissions conducted 8DPSK – mode | | | | | |
|---|--|-----------------------------------|---|--|---------------------|
| f [MHz] | | amplitude of emission [dBm] | limit max. allowed emission power | actual attenuation below frequency of operation [dB] | results |
| 2402 | | 6.37 | 30 dBm | | Operating frequency |
| All detected emissions are below the -20 dBc criteria. | | | -20 dBc | | complies |
| | | | | | |
| | | | | | |
| 2441 | | 6.91 | 30 dBm | | Operating frequency |
| All detected emissions are below the -20 dBc criteria. | | | -20 dBc | | complies |
| | | | | | |
| | | | | | |
| 2480 | | 7.39 | 30 dBm | | Operating frequency |
| All detected emissions are below the -20 dBc criteria. | | | -20 dBc | | complies |
| | | | | | |
| | | | | | |
| Measurement uncertainty | | ± 3dB | | | |

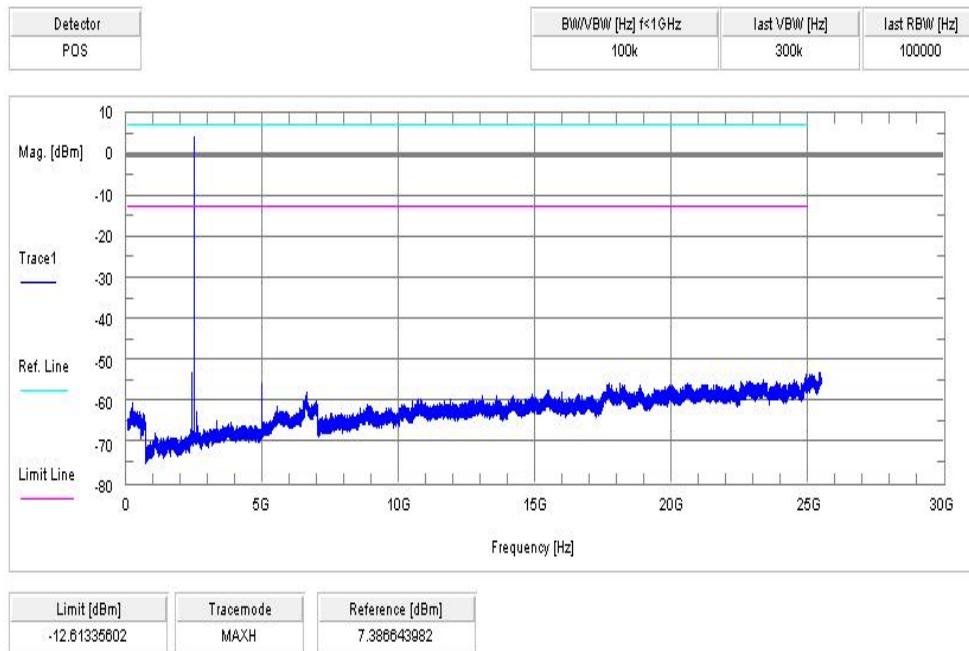
Result: **Passed**

Plots:
Plot 1: lowest channel – 2402 MHz, GFSK modulation

Plot 2: middle channel – 2441 MHz, GFSK modulation


Plot 3: highest channel – 2480 MHz, GFSK modulation**Plot 4:** lowest channel – 2402 MHz, Pi / DQPSK modulation

Plot 5: middle channel – 2441 MHz, Pi / DQPSK modulation**Plot 6:** highest channel – 2480 MHz, Pi / DQPSK modulation

Plot 7: lowest channel – 2402 MHz, 8 DPSK modulation**Plot 8:** middle channel – 2441 MHz, 8 DPSK modulation

Plot 9: highest channel – 2480 MHz, 8 DPSK modulation

10.11 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 Remeasurement: 10 Hz |
| Resolution bandwidth: | F < 1 GHz: 100 kHz 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 | IC | | | | | | | | | | | | | | | |
|--|-------------------------------|----------------------|-------------------------------|----------------------|---------|------|----|----------|------|----|-----------|------|----|-----------|------|---|
| TX spurious emissions radiated | | | | | | | | | | | | | | | | |
| <p>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)).</p> | | | | | | | | | | | | | | | | |
| §15.209 | | | | | | | | | | | | | | | | |
| <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Frequency (MHz)</th><th style="text-align: center;">Field strength (dBμV/m)</th><th style="text-align: center;">Measurement distance</th></tr> </thead> <tbody> <tr> <td style="text-align: center;">30 – 88</td><td style="text-align: center;">30.0</td><td style="text-align: center;">10</td></tr> <tr> <td style="text-align: center;">88 – 216</td><td style="text-align: center;">33.5</td><td style="text-align: center;">10</td></tr> <tr> <td style="text-align: center;">216 – 960</td><td style="text-align: center;">36.0</td><td style="text-align: center;">10</td></tr> <tr> <td style="text-align: center;">Above 960</td><td style="text-align: center;">54.0</td><td style="text-align: center;">3</td></tr> </tbody> </table> | | Frequency (MHz) | Field strength (dB μ V/m) | Measurement distance | 30 – 88 | 30.0 | 10 | 88 – 216 | 33.5 | 10 | 216 – 960 | 36.0 | 10 | Above 960 | 54.0 | 3 |
| Frequency (MHz) | Field strength (dB μ 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:

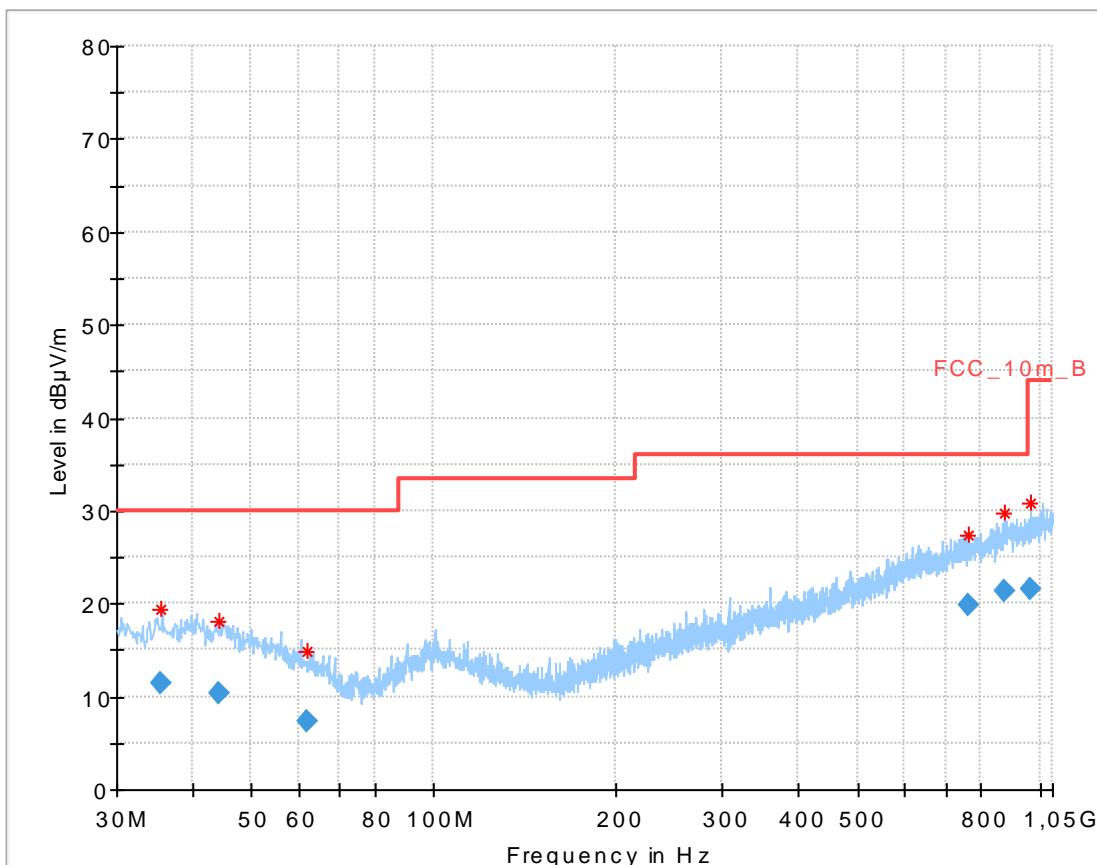
| TX spurious emissions radiated [dB μ V/m] | | | | | | | | |
|--|----------|----------------------|--|----------|----------------------|--|----------|----------------------|
| 2402 MHz | | | 2441 MHz | | | 2480 MHz | | |
| F [MHz] | Detector | Level [dB μ V/m] | F [MHz] | Detector | Level [dB μ V/m] | F [MHz] | Detector | Level [dB μ 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. | | |
| All detected peak emissions are below the average limit. | | | All detected peak emissions are below the average limit. | | | All detected peak emissions are below the average limit. | | |
| | | | | | | | | |
| | | | | | | | | |
| 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)

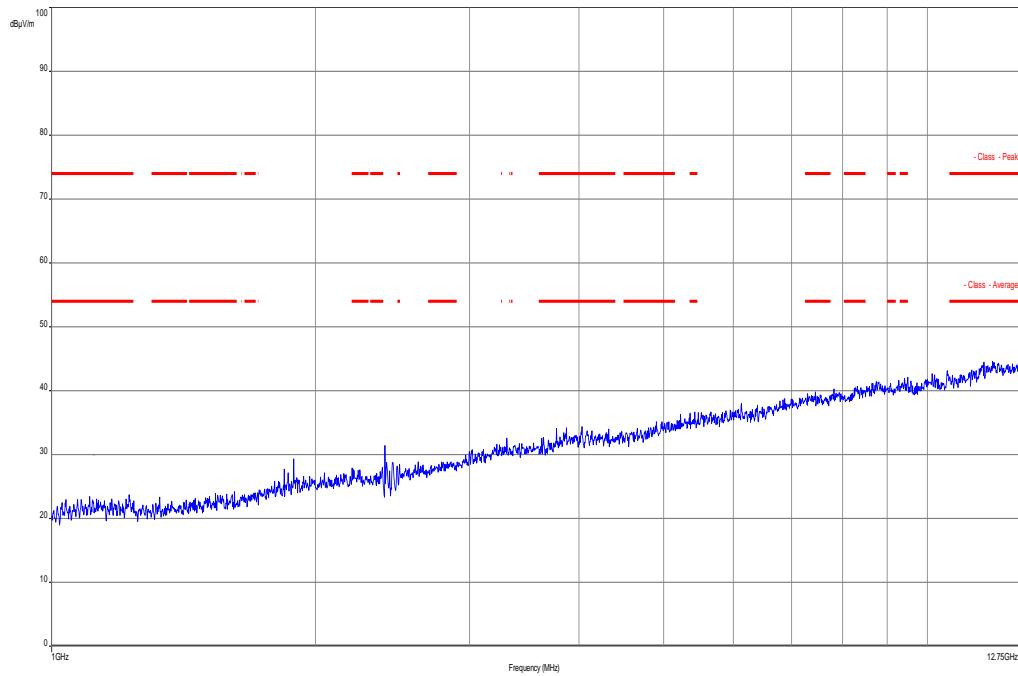
Plots:

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

**Final_Result:**

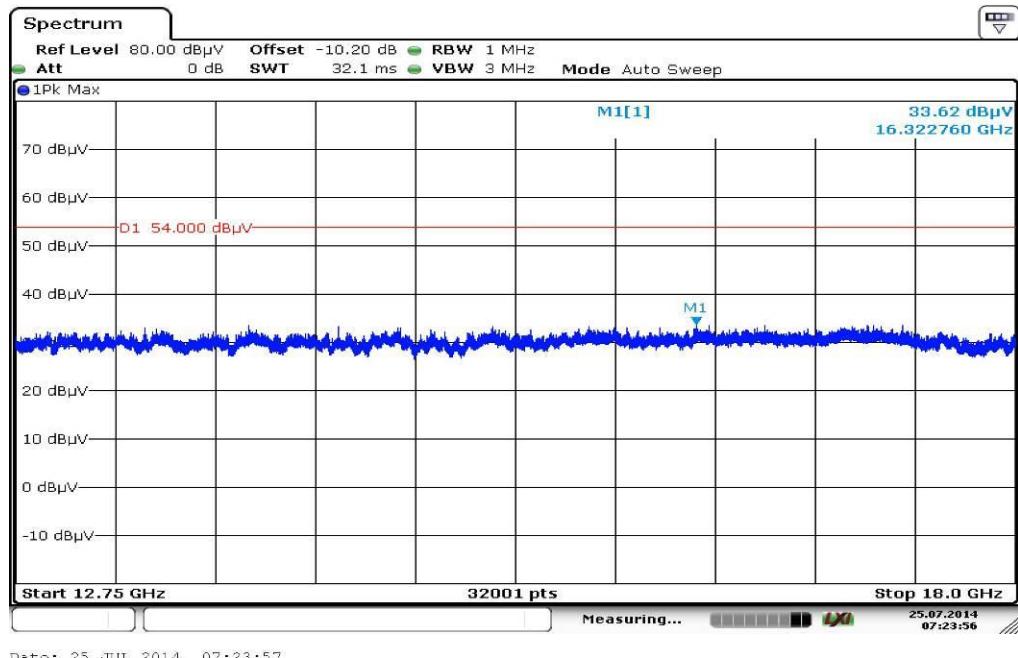
| Frequency (MHz) | QuasiPeak (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|-----------------|--------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|------------|
| 35.467500 | 11.47 | 30.00 | 18.53 | 1000.0 | 120.000 | 170.0 | V | 205 | 13.8 |
| 44.134200 | 10.33 | 30.00 | 19.67 | 1000.0 | 120.000 | 170.0 | V | 179 | 13.9 |
| 61.998450 | 7.23 | 30.00 | 22.77 | 1000.0 | 120.000 | 101.0 | V | -1 | 10.1 |
| 763.185150 | 19.93 | 36.00 | 16.07 | 1000.0 | 120.000 | 170.0 | H | 65 | 22.7 |
| 873.432300 | 21.24 | 36.00 | 14.76 | 1000.0 | 120.000 | 170.0 | H | 25 | 23.8 |
| 967.013250 | 21.57 | 44.00 | 22.43 | 1000.0 | 120.000 | 101.0 | H | 295 | 24.4 |

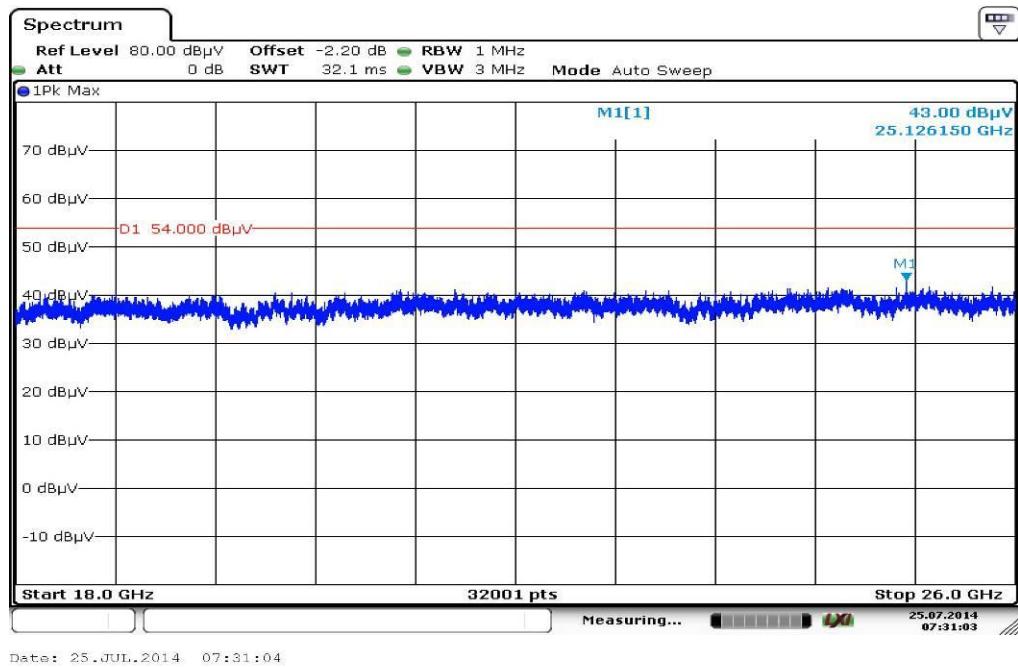
Plot 2: 1 GHz to 12.75 GHz, TX mode, channel 00, vertical & horizontal polarization

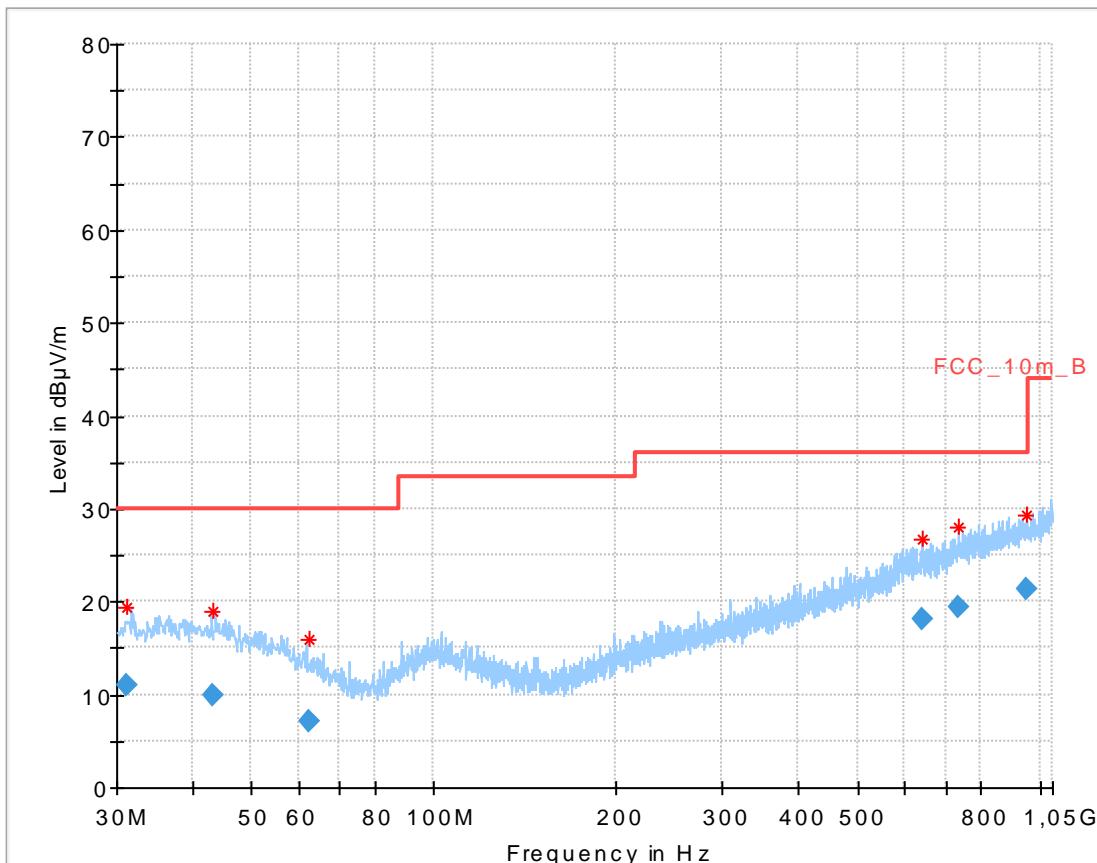


The carrier signal is notched with a 2.4 GHz band rejection filter.

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

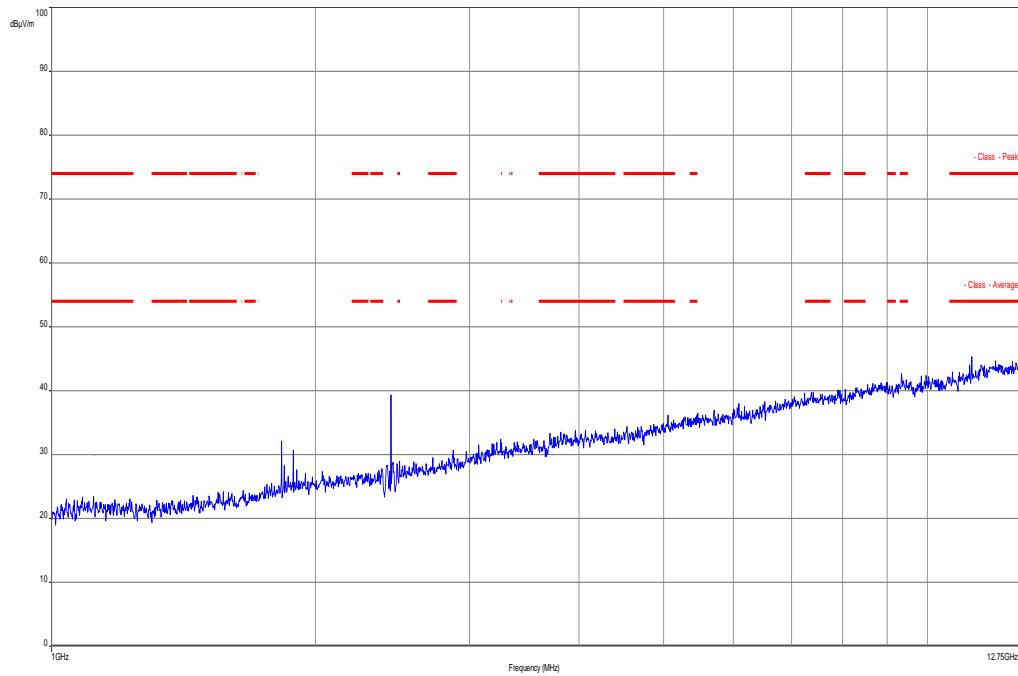


Plot 4: 18 GHz to 26 GHz, TX mode, channel 00, vertical & horizontal polarization

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

Final_Result:

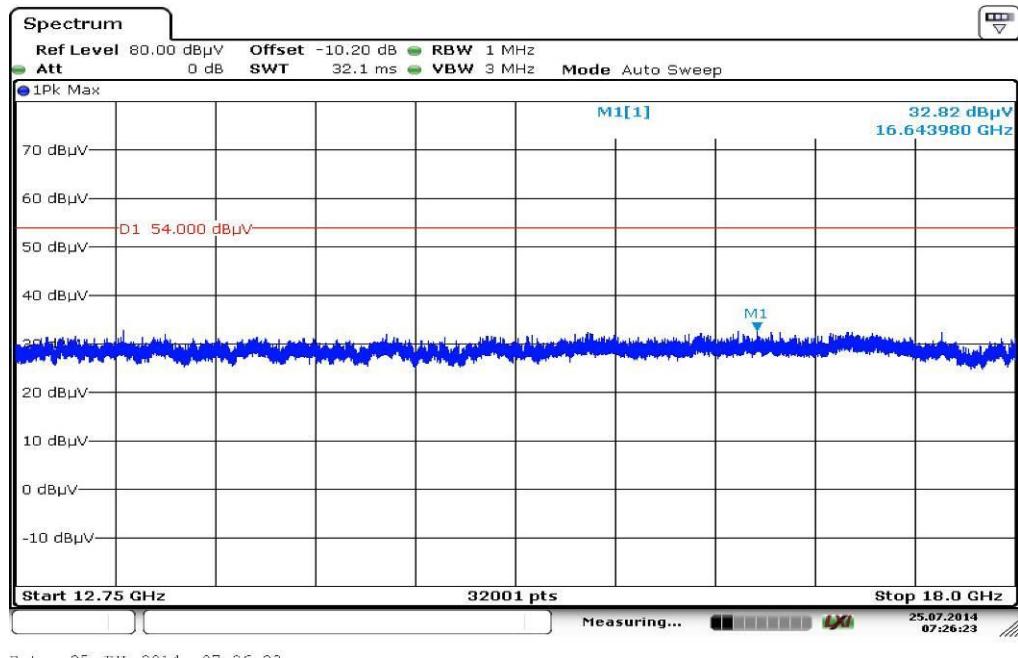
| Frequency (MHz) | QuasiPeak (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|-----------------|--------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|------------|
| 31.133100 | 10.91 | 30.00 | 19.09 | 1000.0 | 120.000 | 101.0 | H | 90 | 13.4 |
| 43.372050 | 9.86 | 30.00 | 20.14 | 1000.0 | 120.000 | 101.0 | V | 25 | 13.9 |
| 62.146200 | 7.08 | 30.00 | 22.92 | 1000.0 | 120.000 | 100.0 | V | 245 | 10.1 |
| 639.511500 | 18.01 | 36.00 | 17.99 | 1000.0 | 120.000 | 98.0 | V | 269 | 21.0 |
| 732.397350 | 19.42 | 36.00 | 16.58 | 1000.0 | 120.000 | 170.0 | V | 89 | 22.3 |
| 953.573250 | 21.42 | 36.00 | 14.58 | 1000.0 | 120.000 | 170.0 | H | 179 | 24.3 |

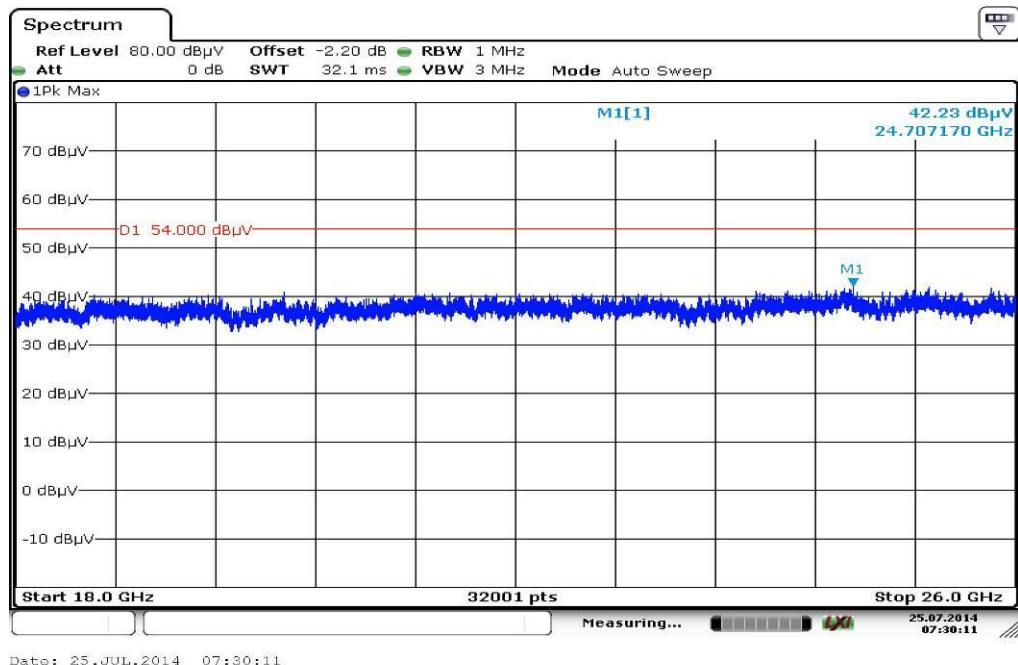
Plot 6: 1 GHz to 12.75 GHz, TX mode, channel 39, vertical & horizontal polarization

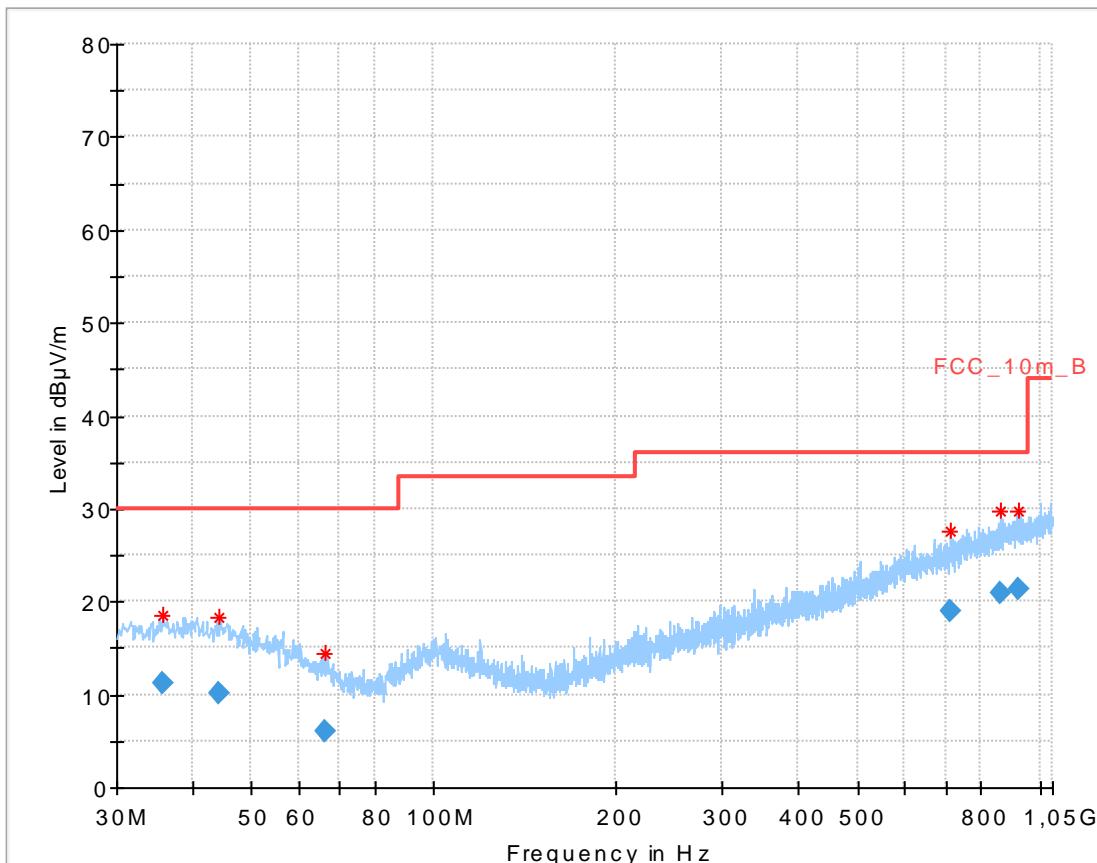


The carrier signal is notched with a 2.4 GHz band rejection filter.

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

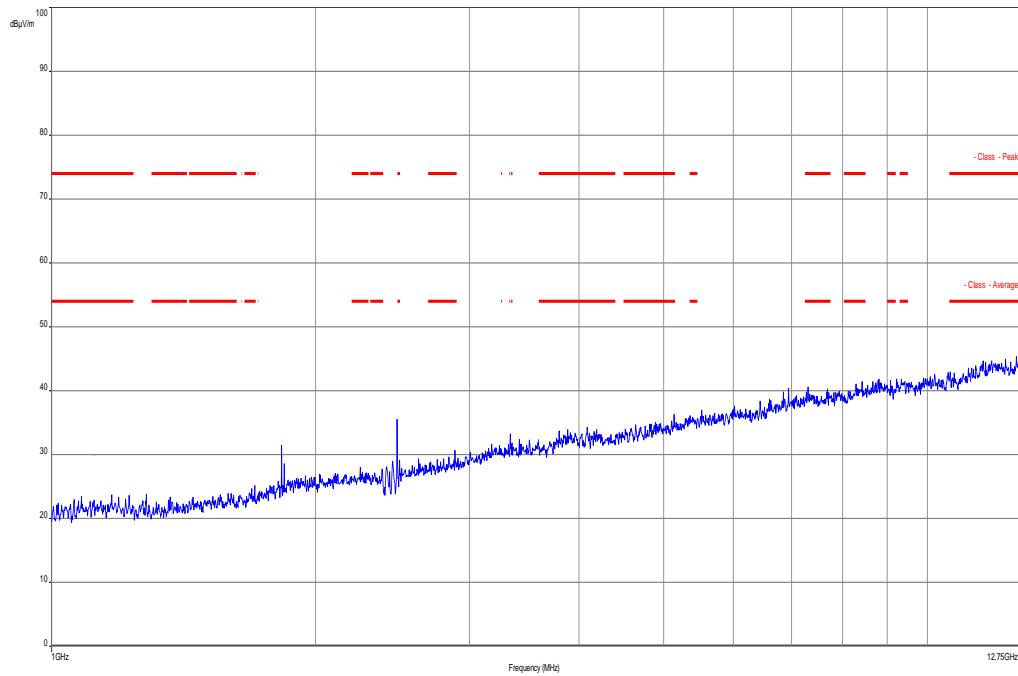


Plot 8: 18 GHz to 26 GHz, TX mode, channel 39, vertical & horizontal polarization

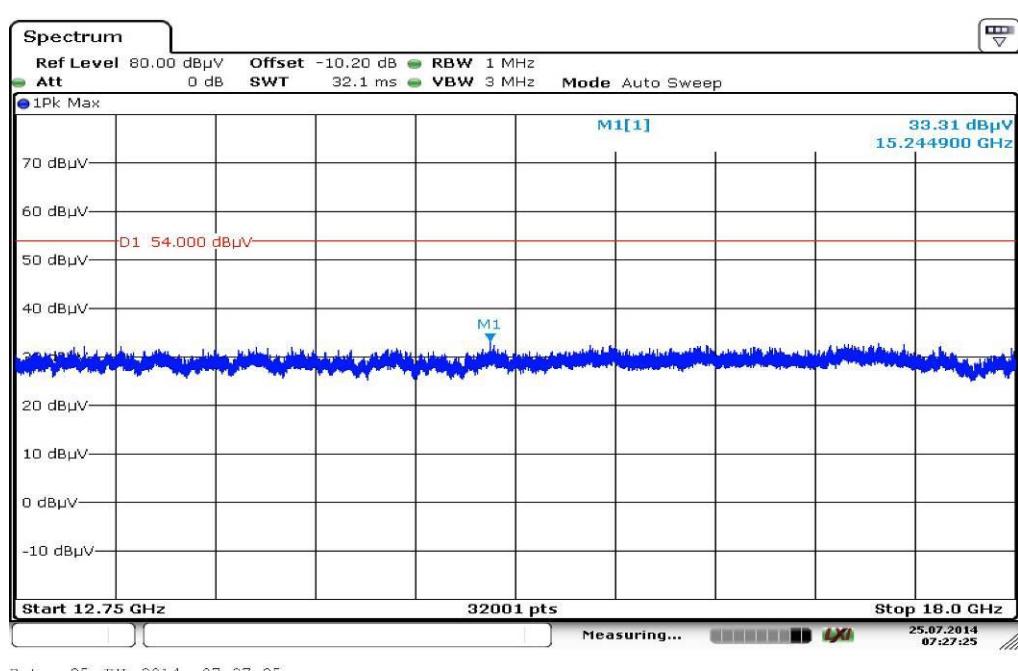
Plot 9: 30 MHz to 1 GHz, TX mode, channel 78, vertical & horizontal polarization

Final_Result:

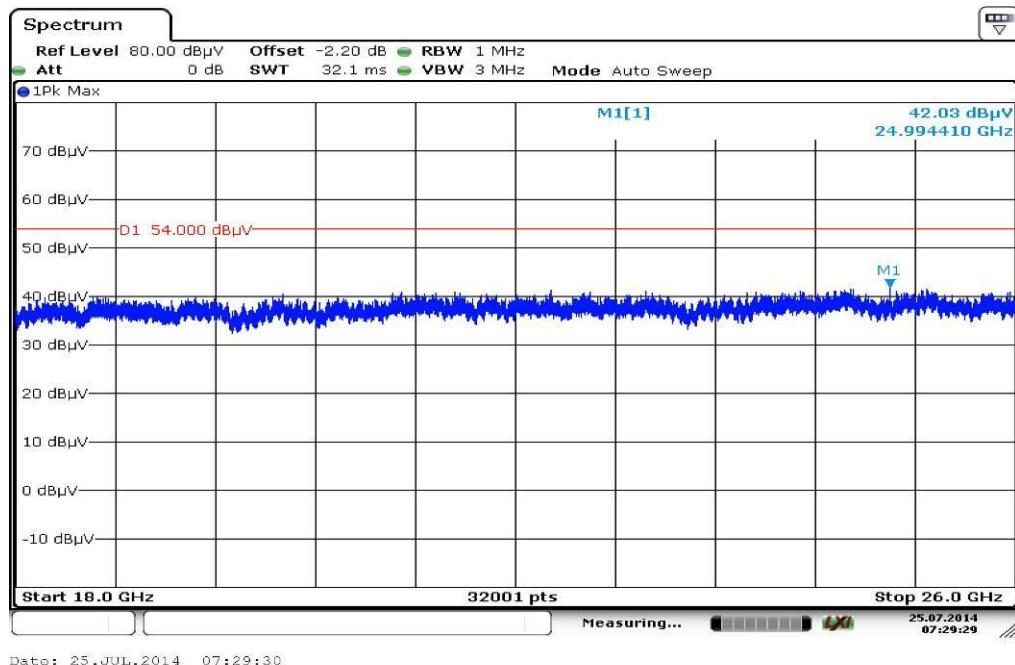
| Frequency (MHz) | QuasiPeak (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|-----------------|--------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|------------|
| 35.710050 | 11.13 | 30.00 | 18.87 | 1000.0 | 120.000 | 101.0 | V | 269 | 13.8 |
| 44.307450 | 10.21 | 30.00 | 19.79 | 1000.0 | 120.000 | 100.0 | H | 205 | 13.9 |
| 66.249300 | 6.08 | 30.00 | 23.92 | 1000.0 | 120.000 | 170.0 | H | 25 | 9.2 |
| 711.507150 | 18.94 | 36.00 | 17.06 | 1000.0 | 120.000 | 170.0 | H | 25 | 21.8 |
| 861.088350 | 20.83 | 36.00 | 15.17 | 1000.0 | 120.000 | 170.0 | H | 295 | 23.6 |
| 920.036850 | 21.26 | 36.00 | 14.74 | 1000.0 | 120.000 | 170.0 | V | 245 | 24.2 |

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



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

10.12 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 Remeasurement: 10 Hz |
| Resolution bandwidth: | F < 1 GHz: 100 kHz F > 1 GHz: 1 MHz |
| Span: | 30 MHz to 25 GHz |
| Trace-Mode: | Max Hold |

Limits:

| FCC | IC | |
|--------------------------------|-------------------------------|----------------------|
| RX Spurious Emissions Radiated | | |
| Frequency (MHz) | Field strength (dB μ 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:

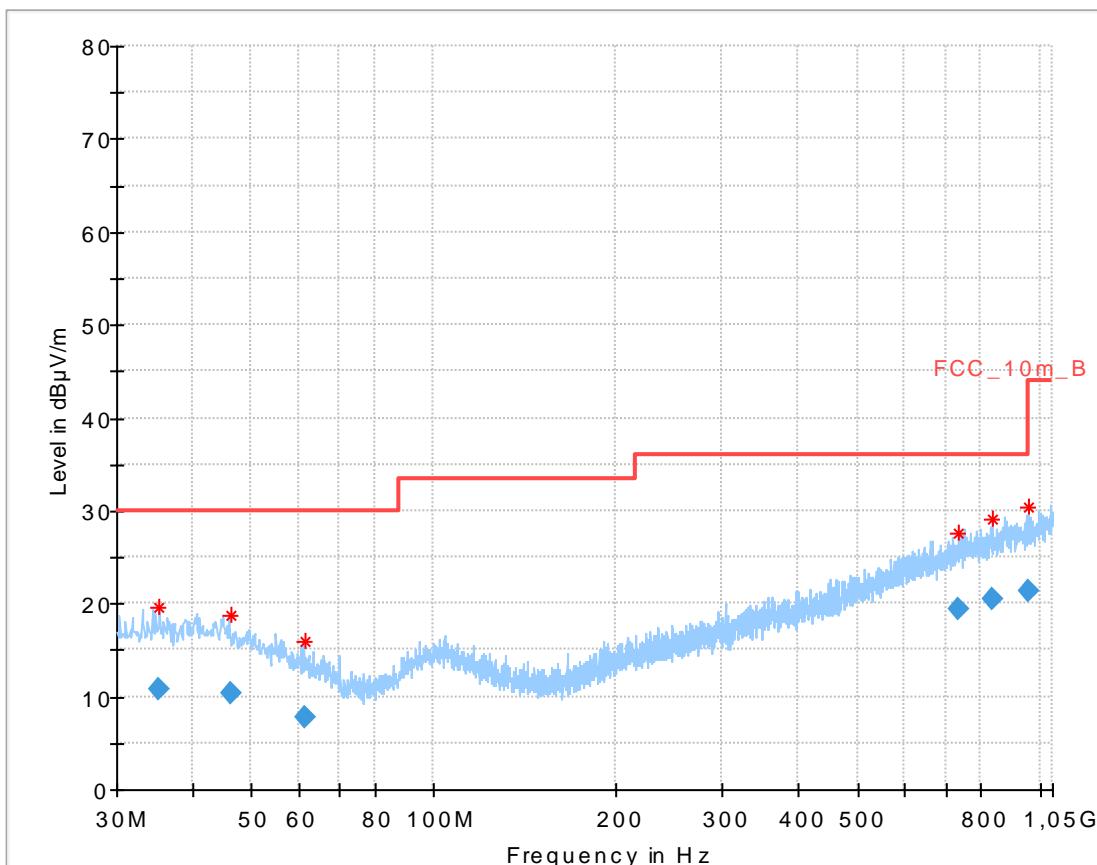
| RX spurious emissions radiated [dB μ V/m] | | |
|--|----------|----------------------|
| F [MHz] | Detector | Level [dB μ V/m] |
| For emissions below 1 GHz, please take a look at the table below the 1 GHz plot. | | |
| All detected peak emissions are below the average limit. | | |
| Measurement uncertainty | | ±3 dB |

Result: Passed

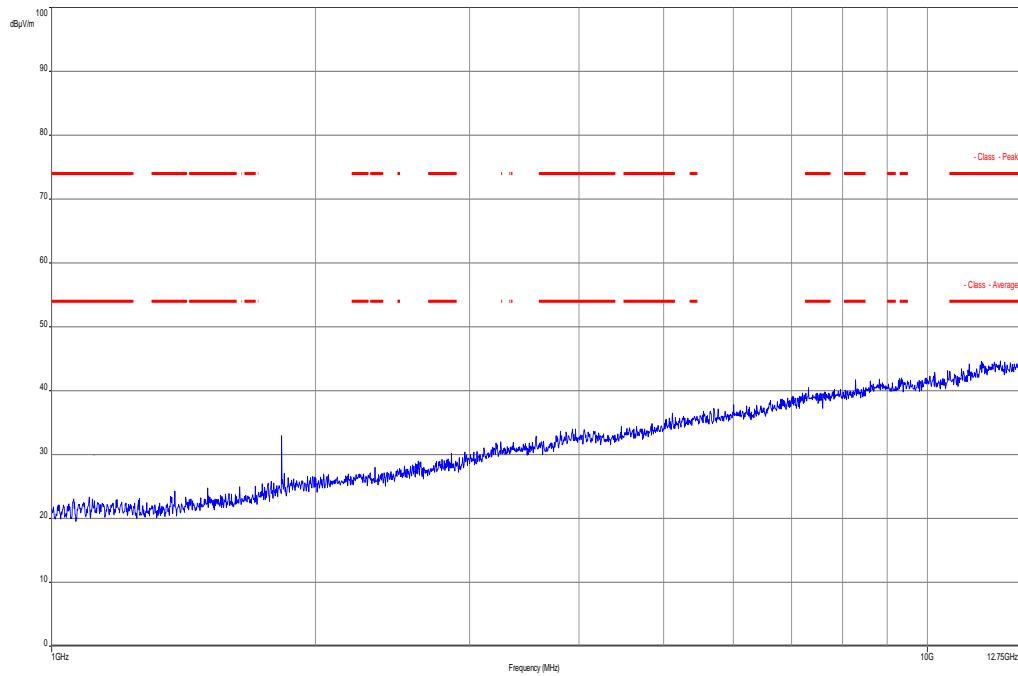
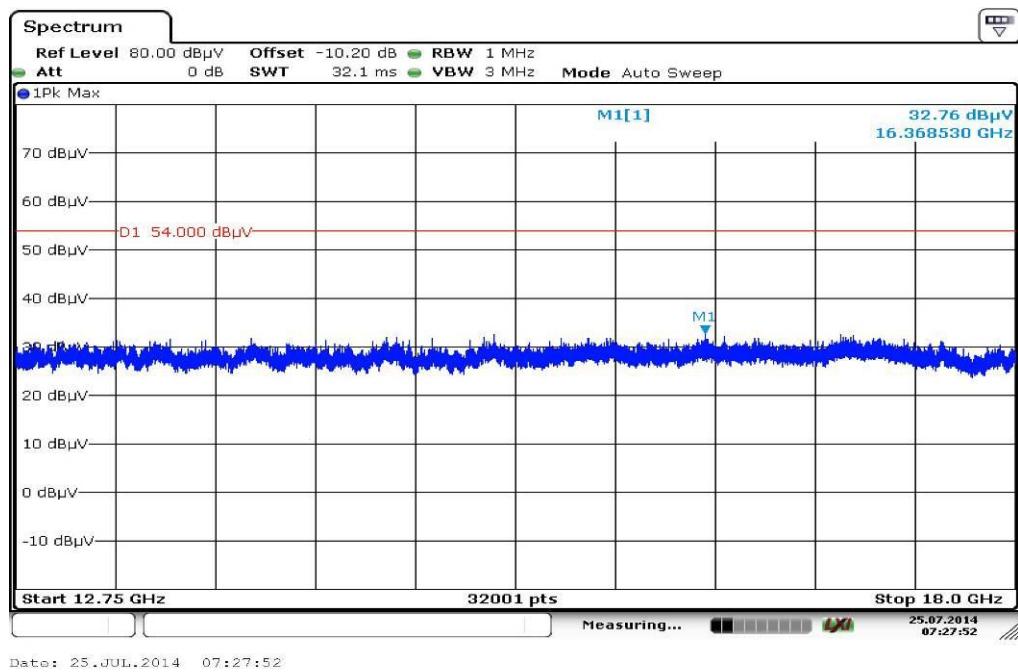
Note: The limit was recalculated with 20 dB / decade (Part 15.31) for all radiated spurious emissions 30 MHz to 1 GHz from 3 meter limit to a 10 meter distance. (40dB/decade for emissions < 30MHz)

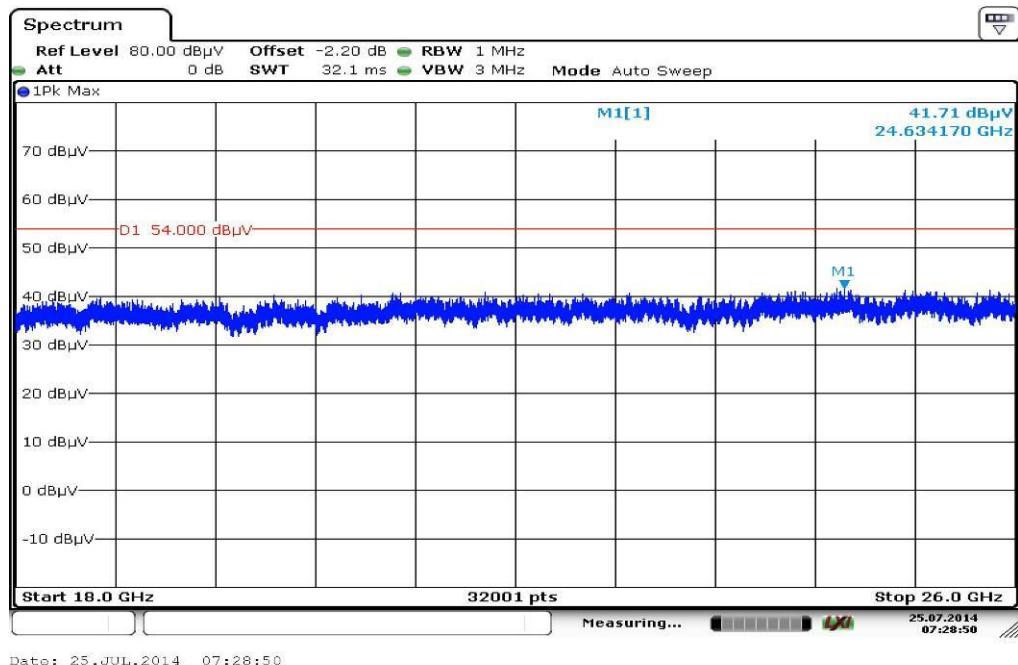
Plots:

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

**Final_Result:**

| Frequency (MHz) | QuasiPeak (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|-----------------|--------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|------------|
| 35.098650 | 10.80 | 30.00 | 19.20 | 1000.0 | 120.000 | 101.0 | H | 89 | 13.8 |
| 46.164150 | 10.31 | 30.00 | 19.69 | 1000.0 | 120.000 | 98.0 | H | 179 | 13.6 |
| 61.217250 | 7.69 | 30.00 | 22.31 | 1000.0 | 120.000 | 100.0 | V | 155 | 10.3 |
| 733.605900 | 19.39 | 36.00 | 16.61 | 1000.0 | 120.000 | 170.0 | V | 205 | 22.3 |
| 834.522900 | 20.39 | 36.00 | 15.61 | 1000.0 | 120.000 | 170.0 | H | 115 | 23.2 |
| 958.040100 | 21.38 | 36.00 | 14.62 | 1000.0 | 120.000 | 170.0 | V | -1 | 24.3 |

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

10.13 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 F > 150 kHz: 9 kHz |
| Resolution bandwidth: | F < 150 kHz: 1 kHz F > 150 kHz: 100 kHz |
| Span: | 9 kHz to 30 MHz |
| Trace-Mode: | Max Hold |

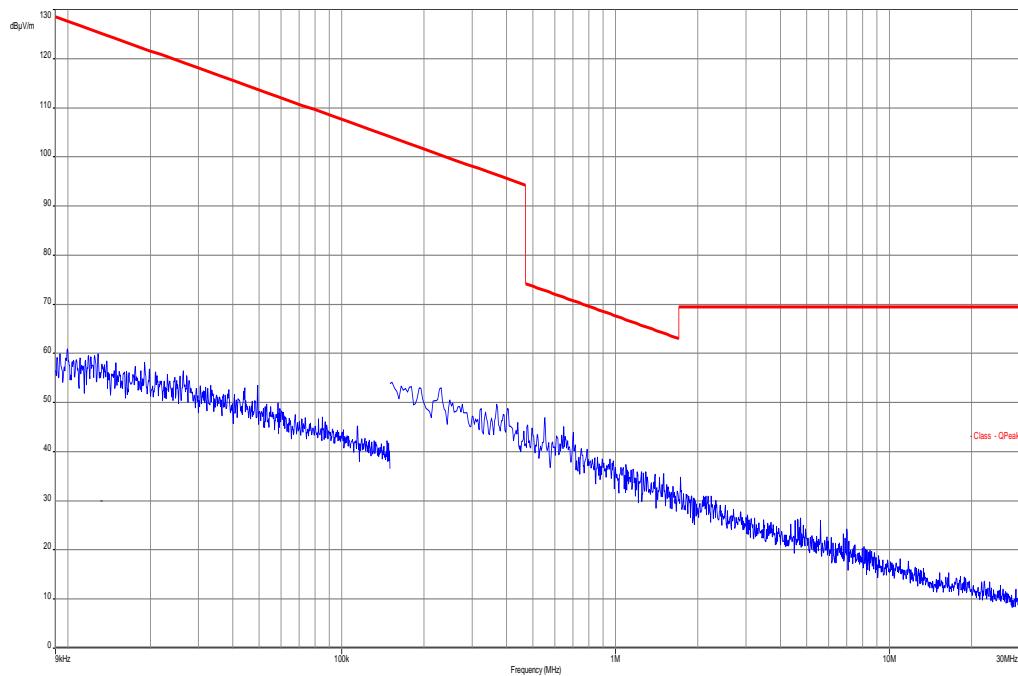
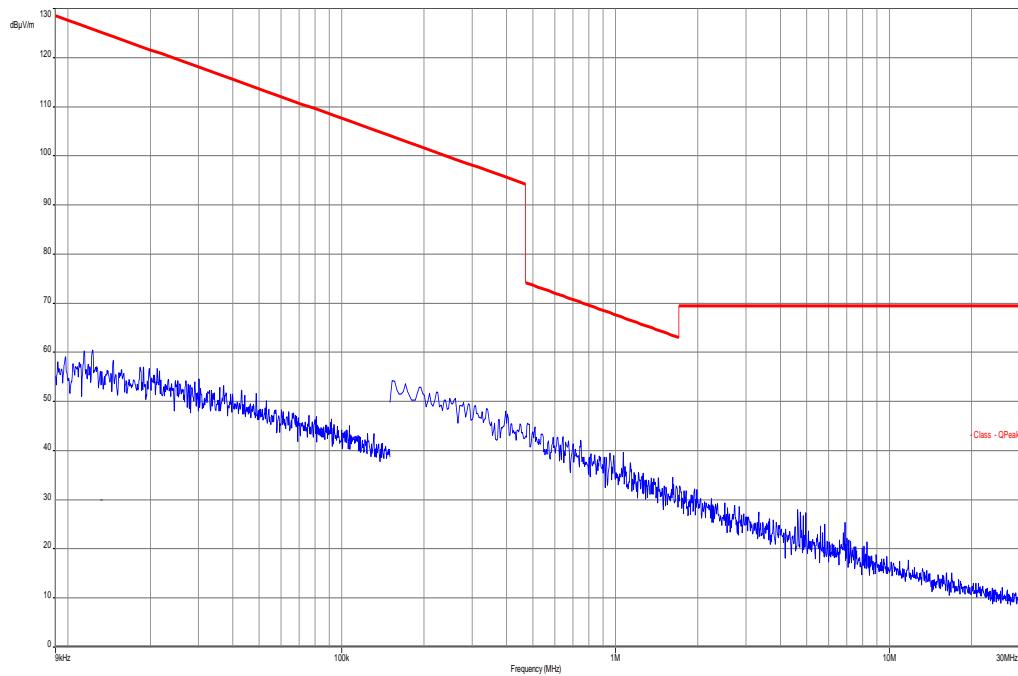
Limits:

| FCC | IC | |
|---|-------------------------------|----------------------|
| TX spurious emissions radiated < 30 MHz | | |
| Frequency (MHz) | Field strength (dB μ V/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 [dB μ V/m] | | |
|--|----------|----------------------|
| F [MHz] | Detector | Level [dB μ V/m] |
| No emissions detected. | | |
| | | |
| | | |
| Measurement uncertainty | | ± 3 dB |

Result: Passed

Plots:**Plot 1: 9 kHz to 30 MHz, TX mode****Plot 4: 9 kHz to 30 MHz, RX mode**

10.14 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 F > 150 kHz: 9 kHz |
| Resolution bandwidth: | F < 150 kHz: 1 kHz F > 150 kHz: 100 kHz |
| Span: | 9 kHz to 30 MHz |
| Trace-Mode: | Max Hold |

Limits:

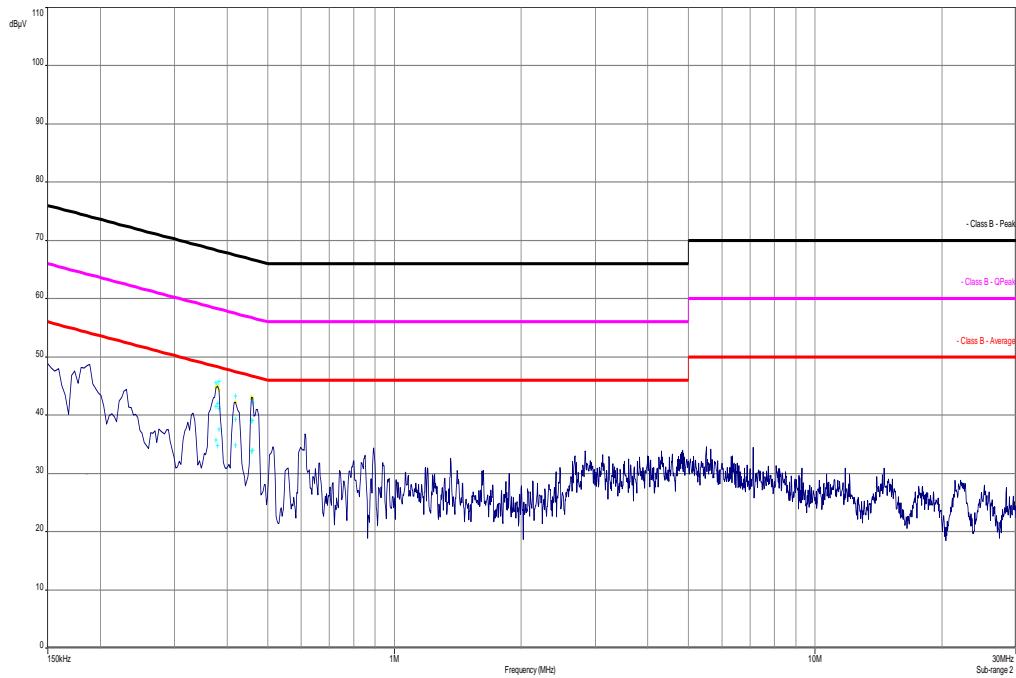
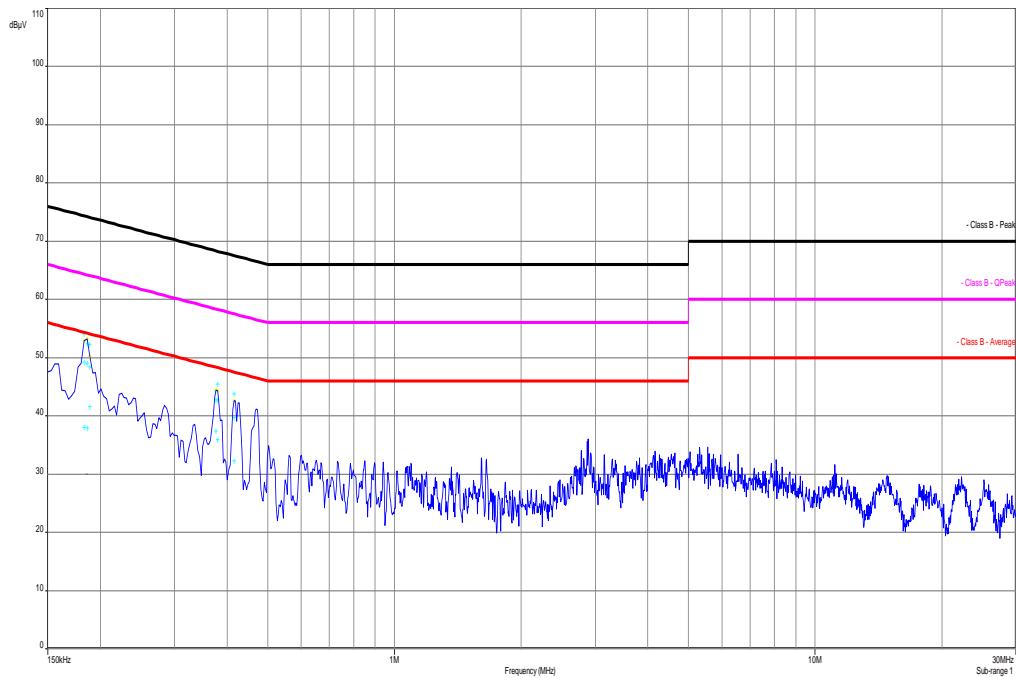
| FCC | IC | |
|--|---------------------------|------------------------|
| TX spurious emissions conducted < 30 MHz | | |
| Frequency (MHz) | Quasi-peak (dB μ V/m) | Average (dB μ V/m) |
| 0.15 – 0.5 | 66 to 56* | 56 to 46* |
| 0.5 – 5 | 56 | 46 |
| 5 – 30.0 | 60 | 50 |

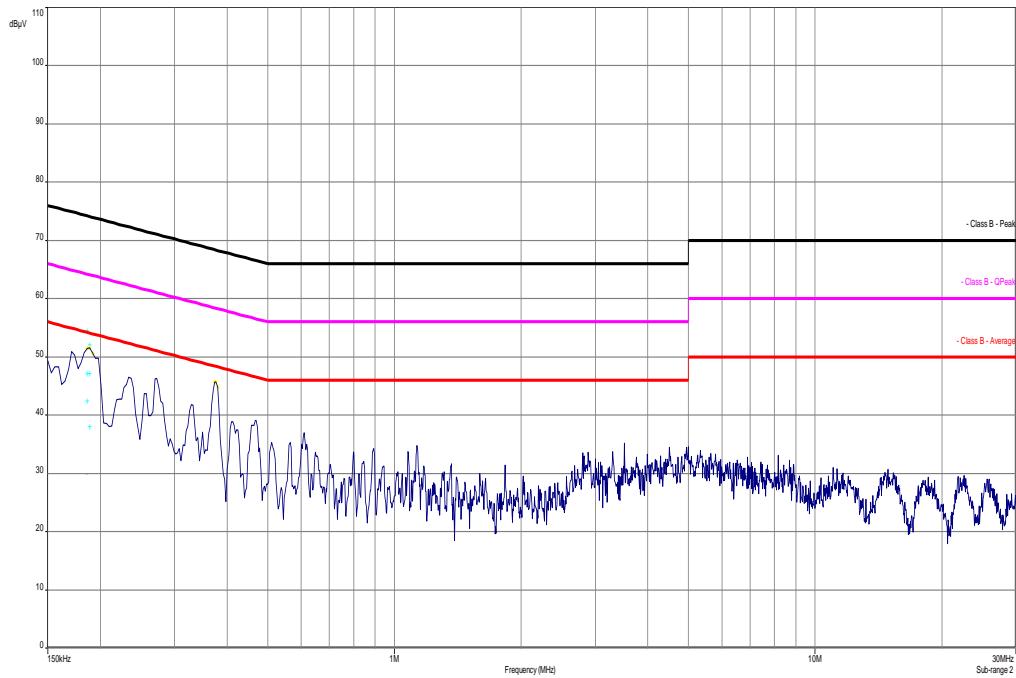
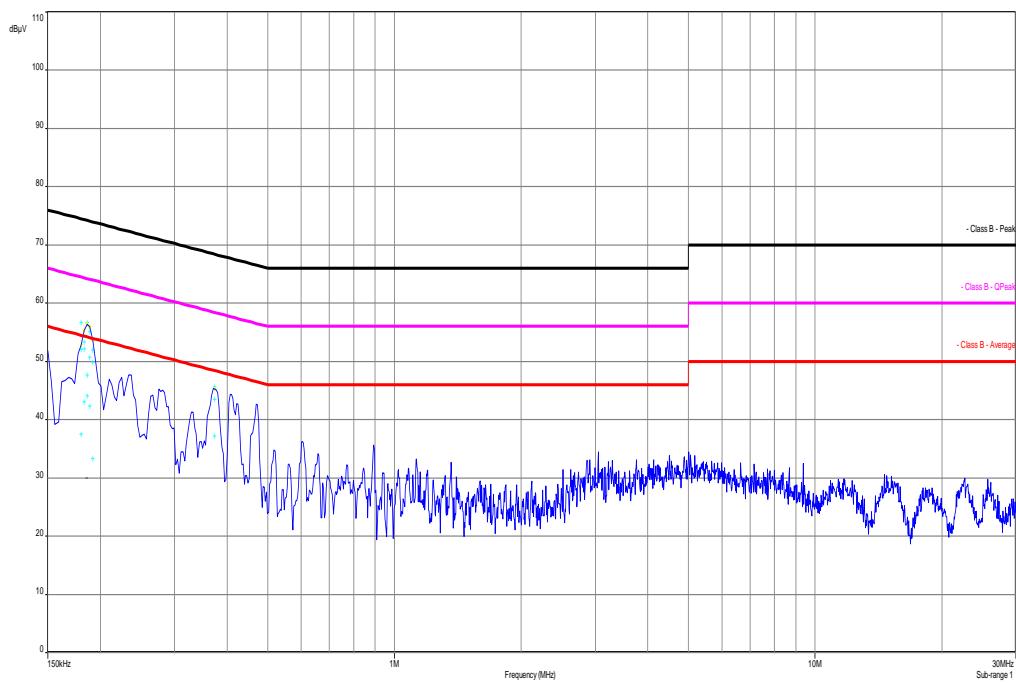
*Decreases with the logarithm of the frequency

Results:

| TX spurious emissions conducted < 30 MHz [dB μ V/m] | | |
|--|----------|----------------------|
| F [MHz] | Detector | Level [dB μ V/m] |
| All detected spurious emissions are below the limit – see plots. | | |
| 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 signaling 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 Cetecom | Kind of Calibration | Last Calibration | Next Calibration |
|-----|------------|---|---------------------------------|----------------------|------------|-----------------|---------------------|------------------|------------------|
| 1 | 45 | Switch-Unit | 3488A | HP Meßtechnik | 2719A14505 | 300000368 | g | | |
| 2 | 50 | DC power supply, 60Vdc, 50A, 1200 W | 6032A | HP 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. | Funkstörmessemfpänger 20Hz- 26,5GHz | ESU26 | R&S | 100037 | 300003555 | k | 28.02.2014 | 28.02.2015 |
| 5 | n. a. | Antenna Tower | Model 2175 | ETS-LINDGREN | 64762 | 300003745 | izw | | |
| 6 | n. a. | Positioning Controller | Model 2090 | ETS-LINDGREN | 64672 | 300003746 | izw | | |
| 7 | n. a. | Turntable Interface-Box | Model 105637 | ETS-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. | Double-Ridged Waveguide Horn Antenna 1-18.0GHz | 3115 | EMCO | 8812-3088 | 300001032 | vlKI! | 08.05.2013 | 08.05.2015 |
| 10 | n. a. | Anechoic chamber | FAC 3/5m | MWB / TDK | 87400/02 | 300000996 | ev | | |
| 11 | n. a. | Switch / Control Unit | 3488A | HP Meßtechnik | * | 300000199 | ne | | |
| 12 | 9 | Artificial Mains 9 kHz to 30 MHz | ESH3-Z5 | R&S | 828576/020 | 300001210 | Ve | 30.01.2014 | 30.01.2016 |
| 13 | 90 | Active Loop Antenna 10 kHz to 30 MHz | 6502 | Kontron Psychotech | 8905-2342 | 300000256 | k | 13.06.2013 | 13.06.2015 |
| 14 | n. a. | Amplifier | js42-00502650-28-5a | Parzich GMBH | 928979 | 300003143 | ne | | |
| 15 | n. a. | Band Reject filter | WRCG2400/2483-2375/2505-50/10SS | Wainwright | 11 | 300003351 | ev | | |
| 16 | n. a. | TRILOG Broadband Test-Antenna 30 MHz – 3 GHz | VULB9163 | Schwarzbeck | 371 | 300003854 | vlKI! | 14.10.2011 | 14.10.2014 |
| 17 | n. a. | MXE EMI Receiver 20 Hz bis 26,5 GHz | N9038A | Agilent Technologies | MY51210197 | 300004405 | k | 13.03.2014 | 13.03.2015 |
| 18 | n. a. | Switch / Control Unit | 3488A | HP Meßtechnik | | 300001691 | ne | | |
| 19 | n. a. | Power Supply DC | NGPE 40/40 | R&S | 388 | 400000078 | vlKI! | 21.08.2012 | 21.08.2014 |
| 20 | n. a. | Frequency Standard (Rubidium Frequency Standard) | MFS (Rubidium) | R&S (Datum) | 002 | 300002681-0009 | Ve | 21.08.2012 | 21.08.2014 |
| 21 | n. a. | Power Sensor 50 Ohms, 10 MHz – 18 GHz, 1 nW – 20 mW | NRV-Z1 | R&S | 833894/012 | 300002681-0013 | NK! | 26.08.2008 | |
| 22 | n. a. | Directional Coupler | 101020010 | Krytar | 70215 | 300002840 | ev | | |
| 23 | n. a. | DC-Blocker | 8143 | Inmet Corp. | none | 300002842 | ne | | |
| 24 | n. a. | Powersplitter | 6005-3 | Inmet Corp. | | 300002841 | ev | | |
| 25 | n. a. | CBT (Bluetooth Tester + EDR Signalling) | CBT 1153.9000K35 | R&S | 100185 | 300003416 | vlKI! | 21.08.2012 | 21.08.2014 |
| 26 | n. a. | Spectrum Analyzer 9kHz to 30GHz - 140..+30dBm | FSP30 | R&S | 100886 | 300003575 | k | 22.08.2012 | 22.08.2014 |
| 27 | 11b | Microwave System Amplifier, 0.5-26.5 GHz | 83017A | HP Meßtechnik | 00419 | 300002268 | ev | | |
| 28 | A026 | Std. Gain Horn Antenna 12.4 to 18.0 GHz | 639 | Narda | 8402 | 300000787 | k | 22.07.2013 | 22.07.2015 |
| 29 | A029 | Std. Gain Horn Antenna 18.0 to 26.5 GHz | 638 | Narda | 8205 | 300002442 | k | 19.07.2013 | 19.07.2015 |
| 30 | n. a. | Signal Analyzer 40 GHz | FSV40 | R&S | 101042 | 300004517 | k | 21.01.2014 | 21.01.2015 |

Agenda: Kind of Calibration

| | | | |
|-------|--|-----|--|
| k | calibration / calibrated | EK | limited calibration |
| ne | not required (k, ev, izw, zw not required) | zw | cyclical maintenance (external cyclical maintenance) |
| ev | periodic self verification | izw | internal cyclical maintenance |
| Ve | long-term stability recognized | g | blocked for accredited testing |
| vlkl! | Attention: extended calibration interval | | |
| NK! | Attention: not calibrated | *) | next calibration ordered / currently in progress |

12 Observations

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

Annex A Document history

| Version | Applied changes | Date of release |
|---------|-------------------|-----------------|
| | Initial release | 2014-07-29 |
| A | Editorial changes | 2014-08-07 |
| B | Editorial changes | 2014-09-09 |

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 |

Annex C Accreditation Certificate

Front side of certificate

Back side of certificate



Deutsche Akkreditierungsstelle GmbH

Beilehene gemäß § 8 Absatz 1 AkkStelleG i.V.m. § 1 Absatz 1 AkkStelleGBV
Unterzeichner der Multilateralen Abkommen
von EA, ILAC und IAF zur gegenseitigen Anerkennung

Akkreditierung



Die Deutsche Akkreditierungsstelle GmbH bestätigt hiermit, dass das Prüflaboratorium

CETECOM ICT Services GmbH
Untertürkheimer Straße 6-10, 66117 Saarbrücken

die Kompetenz nach DIN EN ISO/IEC 17025:2005 besitzt, Prüfungen in folgenden Bereichen
durchzuführen:

Drahtgebundene Kommunikation einschließlich xDSL
VoIP und DECT
Akustik
Funk einschließlich WLAN
Short Range Devices (SRD)
RFID
WiMax und Richtfunk
Mobilfunk (GSM / DCS, Over the Air (OTA) Performance)
Elektromagnetische Verträglichkeit (EMV) einschließlich Automotive
Produktsicherheit
SAR und Hearing Aid Compatibility (HAC)
Umweltsimulation
Smart Card Terminals
Bluetooth®
Wi-Fi-Services

Die Akkreditierungsurkunde gilt nur in Verbindung mit dem Bescheid vom 07.03.2014 mit der
Akkreditierungsnr. D-PL-12076-01 und ist gültig 17.01.2018. Sie besteht aus diesem Deckblatt, der
Rückseite des Deckblatts und der folgenden Anlage mit insgesamt 77 Seiten.

Registrierungsnummer der Urkunde: D-PL-12076-01-00

Frankfurt am Main, 07.03.2014



W. Auftrag D-PL-12076-01 Ralf Kigner
Akkreditierer

Deutsche Akkreditierungsstelle GmbH

Standort Berlin
Spittelmarkt 10
10117 Berlin

Standort Frankfurt am Main
Gartenstraße 6
60591 Frankfurt am Main

Standort Braunschweig
Bundesallee 100
38115 Braunschweig

Die ausgewiesene Veröffentlichung des Akkreditierungsnachweises bedarf einer vorherigen schriftlichen Zustimmung der Deutsche Akkreditierungsstelle GmbH (DAkkS). Angenommen davon ist die separate Weiterverbreitung des Deckblattes durch die umseitig genannte Konformitätsbewertungsstelle in unveränderter Form.

Es darf nicht der Anschein erweckt werden, dass sich die Akkreditierung auch auf Bereiche erstreckt, die über den durch die DAkkS bestätigten Akkreditierungsbereich hinausgehen.

Die Akkreditierung erfolgte gemäß des Gesetzes über die Akkreditierungsstelle (AkkStelleG) vom 31. Juli 2009 (BGBl. I S. 2625) sowie der Verordnung (EG) Nr. 765/2008 des Europäischen Parlaments und des Rates vom 9. Juli 2008 über die Verordnung für die Akkreditierung und Marktbereitstellung von Prüf- und Überwachungsanstalten der Produktion (Offizielle Veröffentlichung am 12.8.2008, Amtsblatt S. 3-50).

Die DAkkS ist Unterzeichnerin der Multilateralen Abkommen zur gegenseitigen Anerkennung der Europäischen Organisation für Akkreditierung (EA), des Internationalen Akkreditierungsrats (IAF) und der International Laboratory Accreditation Cooperation (ILAC). Die unterzeichner dieser Abkommen erkennen Ihre Akkreditierungen gegenseitig an.

Der aktuelle Stand der Mitgliedschaft kann folgenden Webseiten entnommen werden:
EA: www.european-accreditation.org
ILAC: www.ilac.org
IAF: www.iaf.org

Note:

The current certificate including annex is published on our website (see link below) or may be received from CETECOM ICT Services on request.

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