**CETECOM™****CETECOM ICT Services**
consulting - testing - certification >>>

TEST REPORT

Test report no.: 1-8241/14-01-08

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

Phonak AG

Laubisruetistrasse 28

8712 Staefa / SWITZERLAND

Phone: +/-

Fax: +41 5 89 28 20 11

Contact: Valentina Shcherba

e-mail: valentina.shcherba@phonak.com

Phone: +41 5 89 28 01 01

Manufacturer

Phonak AG

Laubisruetistrasse 28

8712 Staefa / SWITZERLAND

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: Streamer & remote control device**Model name:** Phonak ComPilot Air II**FCC ID:** KWC-CPAIR2**IC:** 2262A-CPAIR2**Frequency:** ISM 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 LiPo re-chargeable battery**Temperature range:** 0°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:

Tobias Wittenmeier
Experienced
Radio Communications & EMC

Test performed:

Christoph Schneider
Specialist
Radio Communications & EMC

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 26 GHz	7
7.4	AC conducted	8
7.5	Conducted measurements	9
8	Summary of measurement results	10
9	Additional comments	11
10	Measurement results	12
10.1	Antenna gain	12
10.2	Power spectral density	13
10.3	Carrier frequency separation	14
10.4	Number of hopping channels	16
10.5	Time of occupancy (dwell time)	18
10.6	Spectrum bandwidth of a FHSS system – 99 % bandwidth	19
10.7	Maximum output power	25
10.8	Band edge compliance conducted	32
10.9	Band edge compliance radiated	39
10.10	TX spurious emissions conducted	43
10.11	TX spurious emissions radiated	51
10.12	RX spurious emissions radiated	62
10.13	Spurious emissions radiated < 30 MHz	66
10.14	Spurious emissions conducted < 30 MHz	68
11	Test equipment and ancillaries used for tests	72
12	Observations	73
Annex A	Document history	74
Annex B	Further information	74
Annex C	Accreditation Certificate	75

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.

The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of CETECOM ICT Services GmbH.

The testing service provided by CETECOM ICT Services GmbH has been rendered under the current "General Terms and Conditions for CETECOM ICT Services GmbH".

CETECOM ICT Services GmbH will not be liable for any loss or damage resulting from false, inaccurate, inappropriate or incomplete product information provided by the customer.

Under no circumstances does the CETECOM ICT Services GmbH test report include any endorsement or warranty regarding the functionality, quality or performance of any other product or service provided.

Under no circumstances does the CETECOM ICT Services GmbH test report include or imply any product or service warranties from CETECOM ICT Services GmbH, including, without limitation, any implied warranties of merchantability, fitness for purpose, or non-infringement, all of which are expressly disclaimed by CETECOM ICT Services GmbH.

All rights and remedies regarding vendor's products and services for which CETECOM ICT Services GmbH has prepared this test report shall be provided by the party offering such products or services and not by CETECOM ICT Services GmbH.

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

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

2.2 Application details

Date of receipt of order:	2014-07-07
Date of receipt of test item:	2014-07-21
Start of test:	2014-07-21
End of test:	2014-08-22
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}	0 °C during low temperature tests
Relative humidity content:		53 %
Barometric pressure:		not relevant for this kind of testing
Power supply:	V_{nom}	3.7 V DC by LiPo re-chargeable battery
	V_{max}	4.2 V
	V_{min}	3.3 V

5 Test item

Kind of test item	:	Streamer & remote control device
Type identification	:	Phonak ComPilot Air II
S/N serial number	:	No information available!
HW hardware status	:	PT4, 006-0136
SW software status	:	0.4.46.10, full-power HIBAN streaming
Frequency band [MHz]	:	ISM 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/4DQPSK, 8DPSK
Number of channels	:	79
Antenna	:	Integrated antenna
Power supply	:	3.7 V DC by LiPo re-chargeable battery
Temperature range	:	0°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: 1-8241/14-01-01_AnnexA
1-8241/14-01-01_AnnexB
1-8241/14-01-01_AnnexD

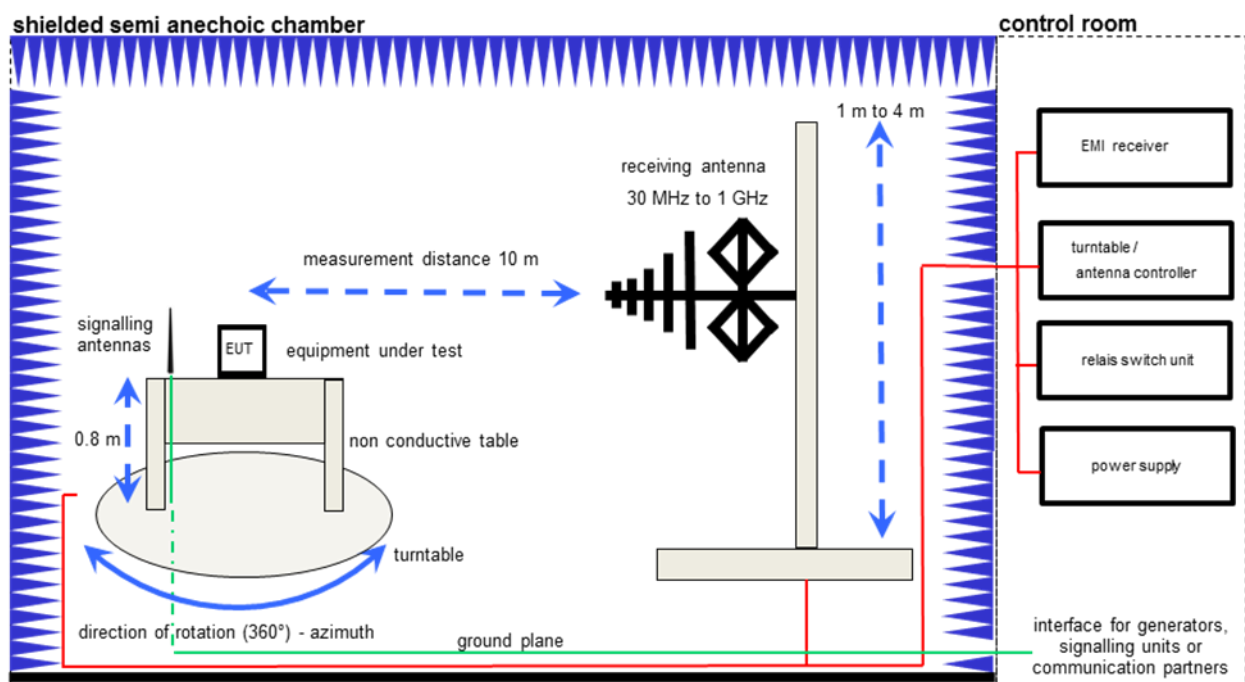
6 Test laboratories sub-contracted

None

7 Description of the test setup

7.1 Radiated measurements chamber F

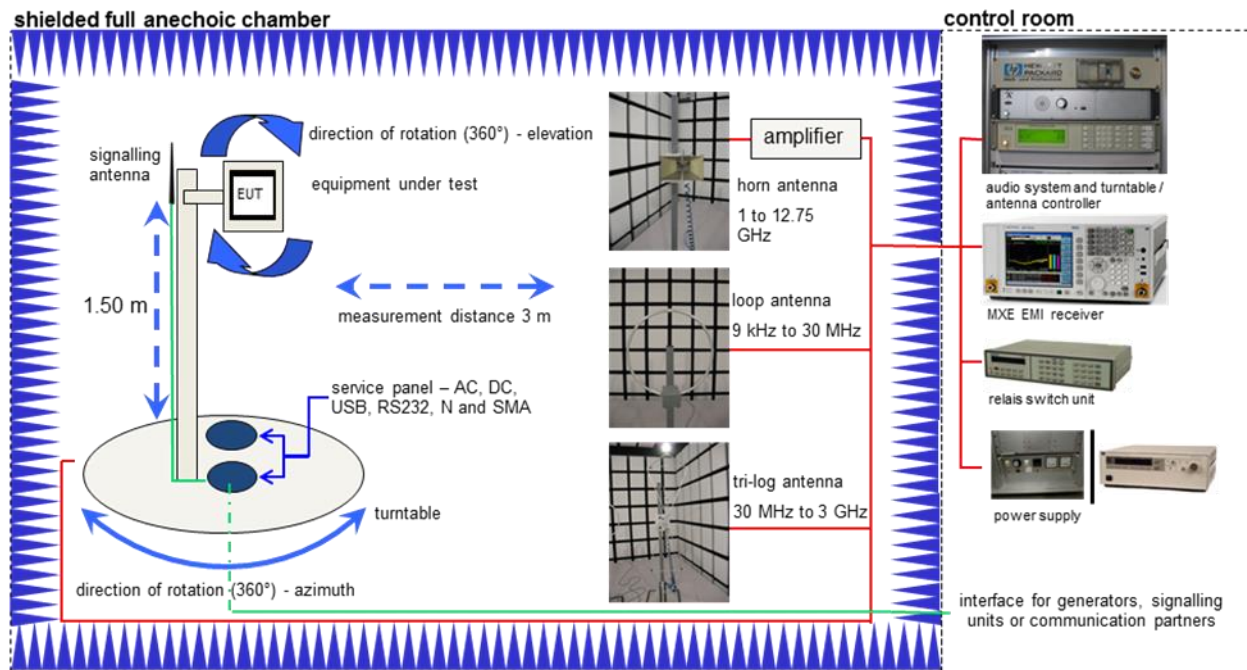
The radiated measurements are performed in vertical and horizontal plane in the frequency range from 9 kHz to 1 GHz in semi-anechoic chambers. The EUT is positioned on a non-conductive support with a height of 0.80 m above a conductive ground plane that covers the whole chamber. The receiving antennas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



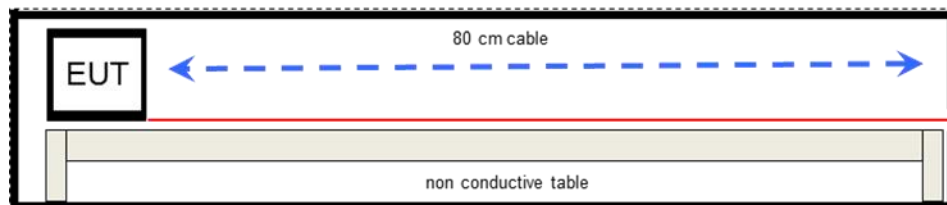
Equipment table:

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 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 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
Spectrum Analyzer 20 Hz - 50 GHz	FSU50	R&S	200012	300003443
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



MXE EMI receiver

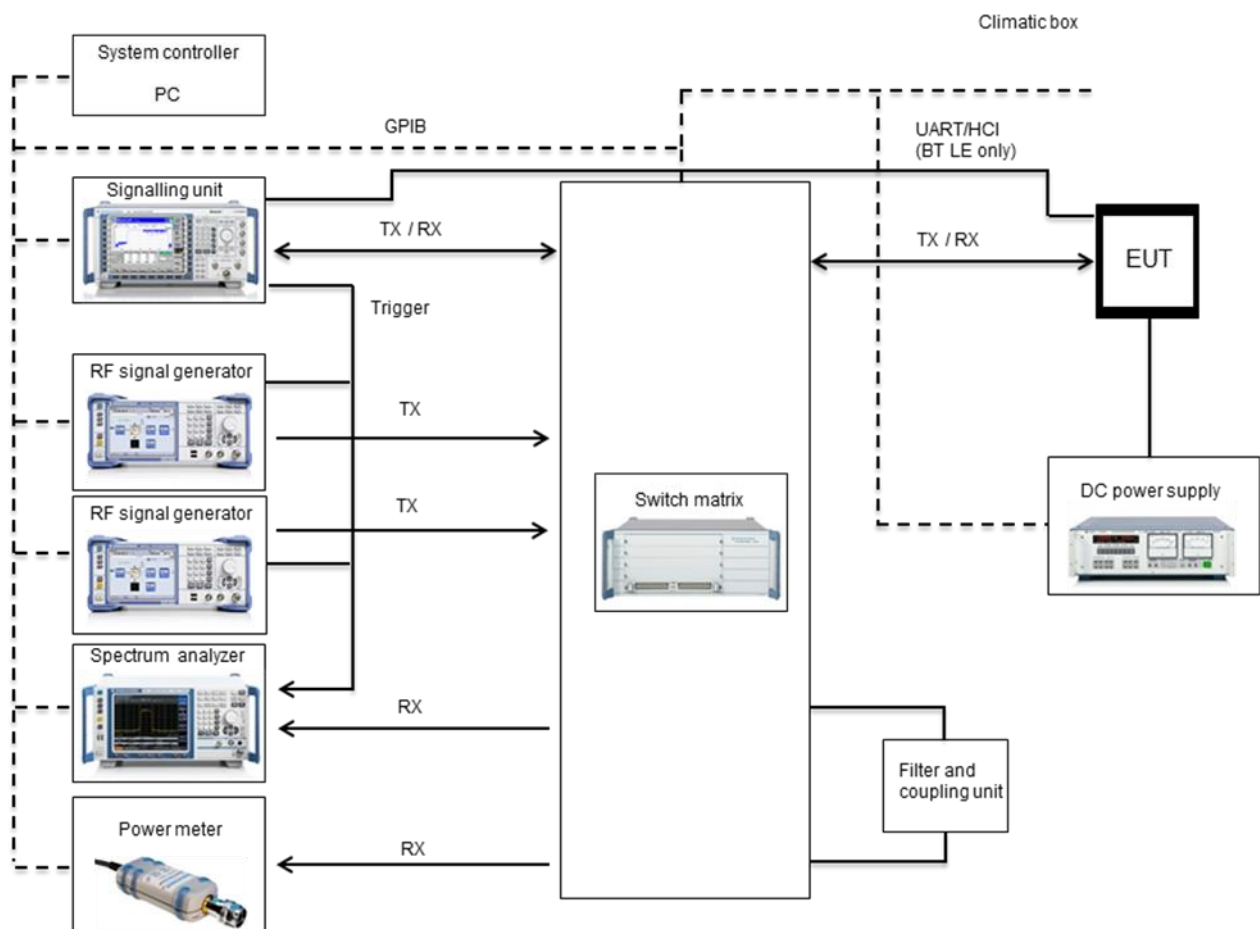


AC conducted measurement system

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	Erft	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 measurements



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
DC-Blocker	8143	Inmet Corp.	none	300002842
CBT (Bluetooth Tester + EDR Signalling)	CBT 1153.9000K35	R&S	100185	300003416
Spectrum Analyzer 9kHz to 30GHz -140..+30dBm	FSP30	R&S	100886	300003575

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	2014-08-22	-/-

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(e) 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 20dB 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:	5 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		4.53	5.68	5.70
Radiated power [dBm] Measured with GFSK modulation		4.28	6.35	6.13
Gain [dBi] Calculated		-0.25	0.67	0.43

Verdict: **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]		
Frequency	2412 MHz	2437 MHz	2462 MHz
GFSK	Not required for hopping systems!		
Pi/4 DQPSK			
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.	

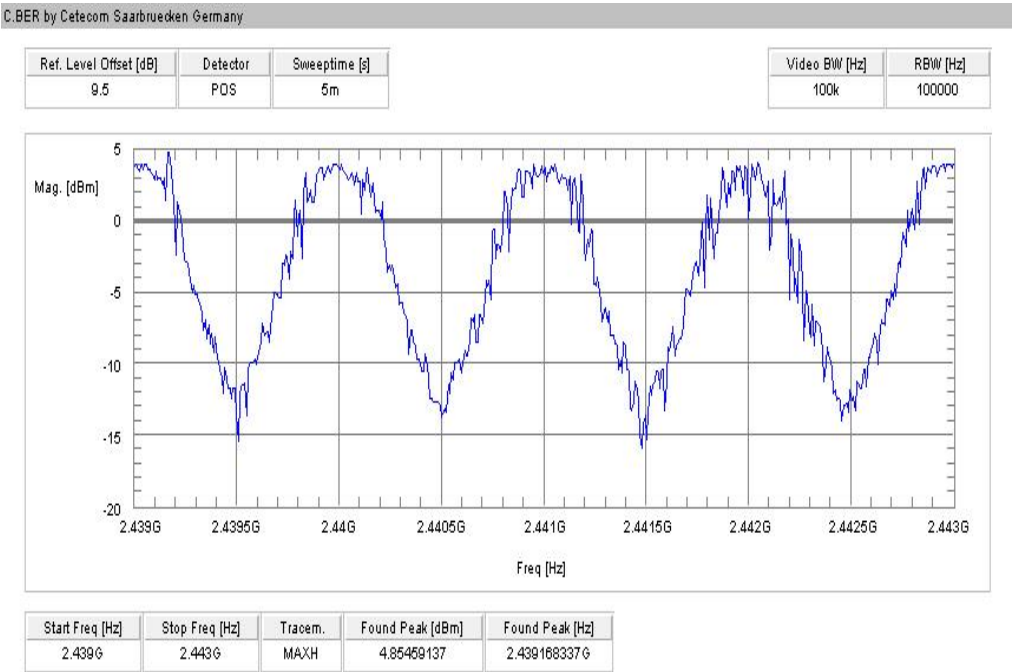
Result:

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

Verdict: **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	

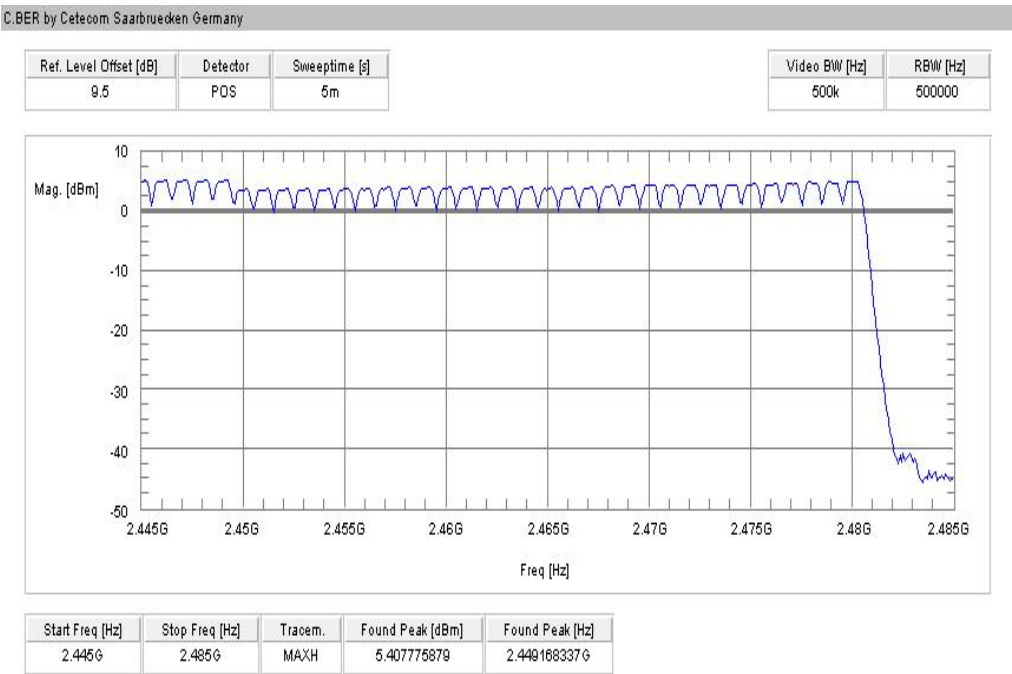
Result:

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

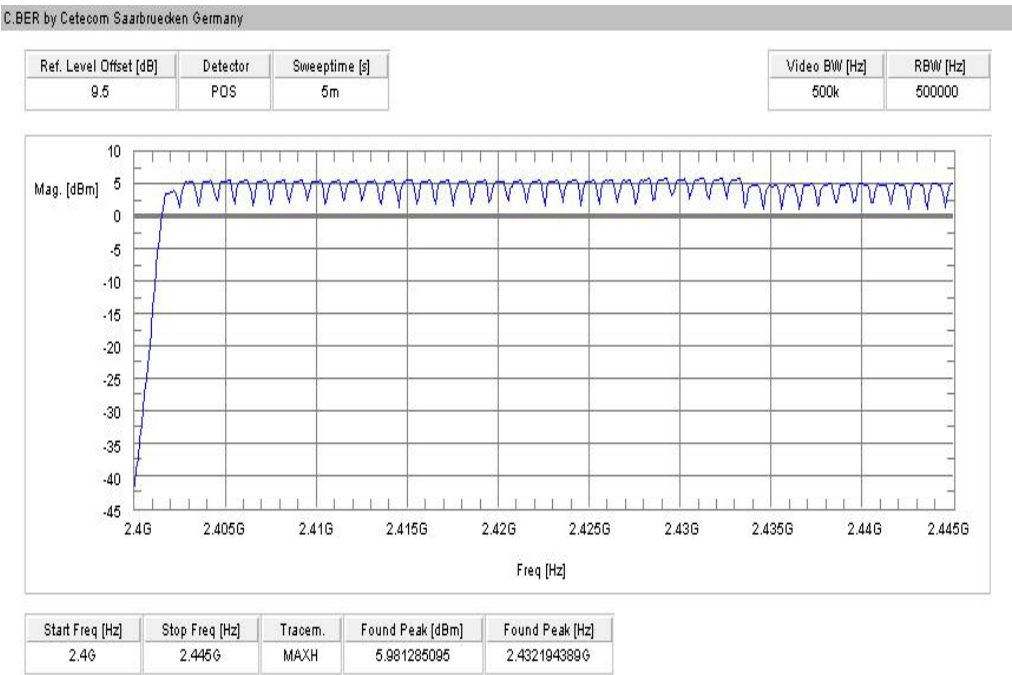
Verdict: **Passed**

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 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	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.	

Verdict: Passed

10.6 Spectrum bandwidth of a FHSS system – 99 % 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:	10 kHz
Span:	6 MHz
Trace-Mode:	Max Hold

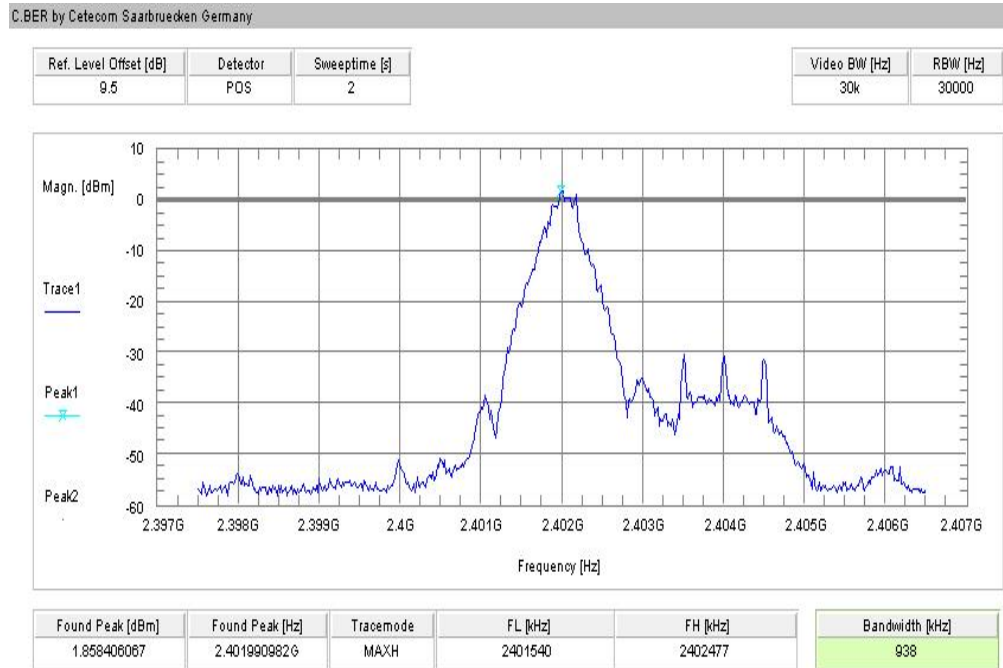
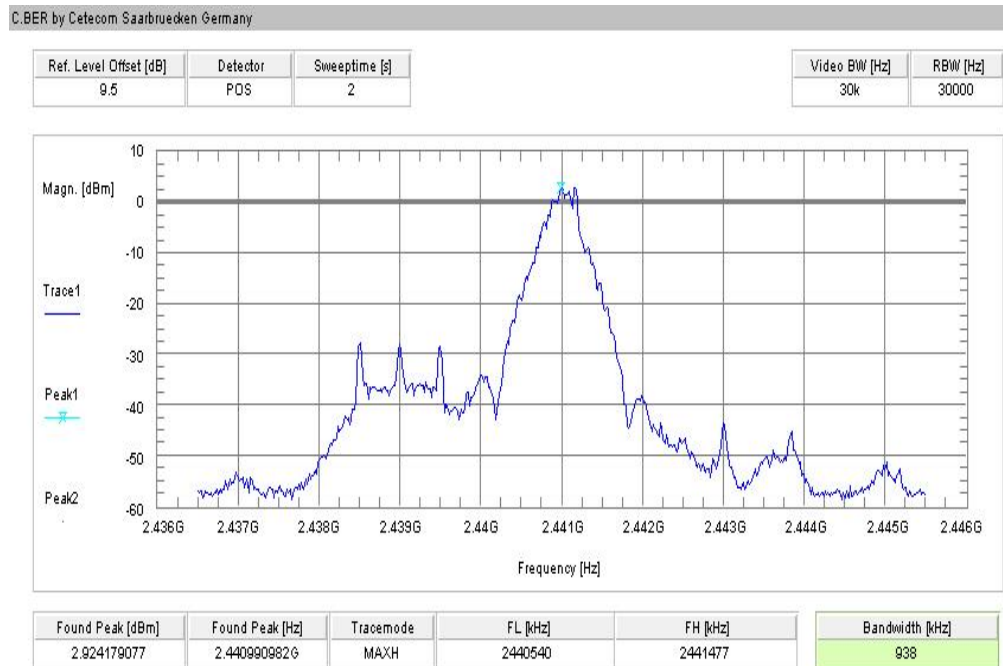
Limits:

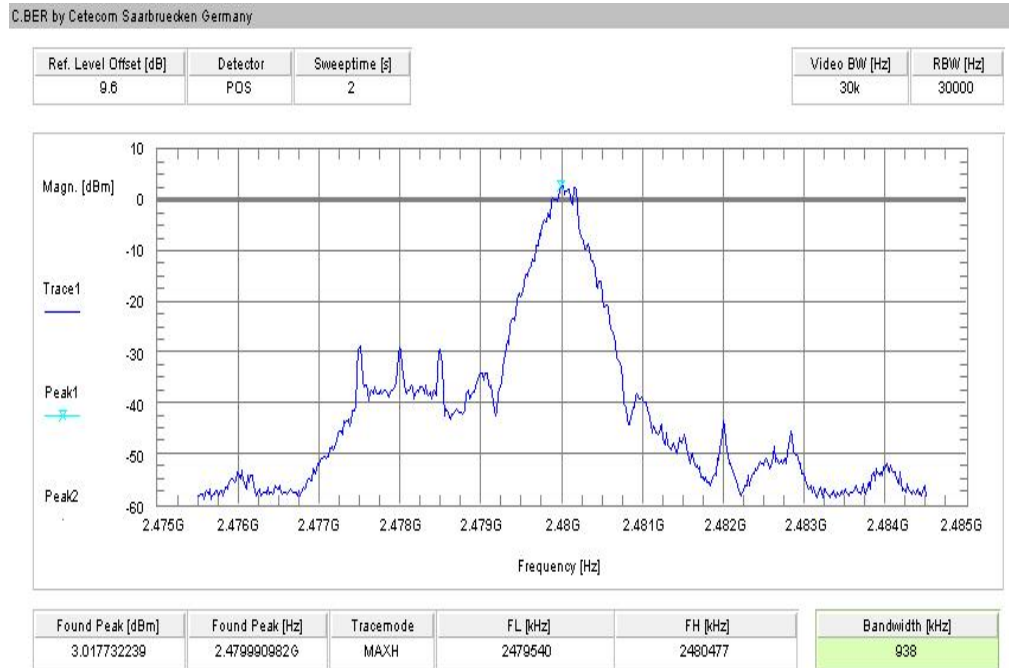
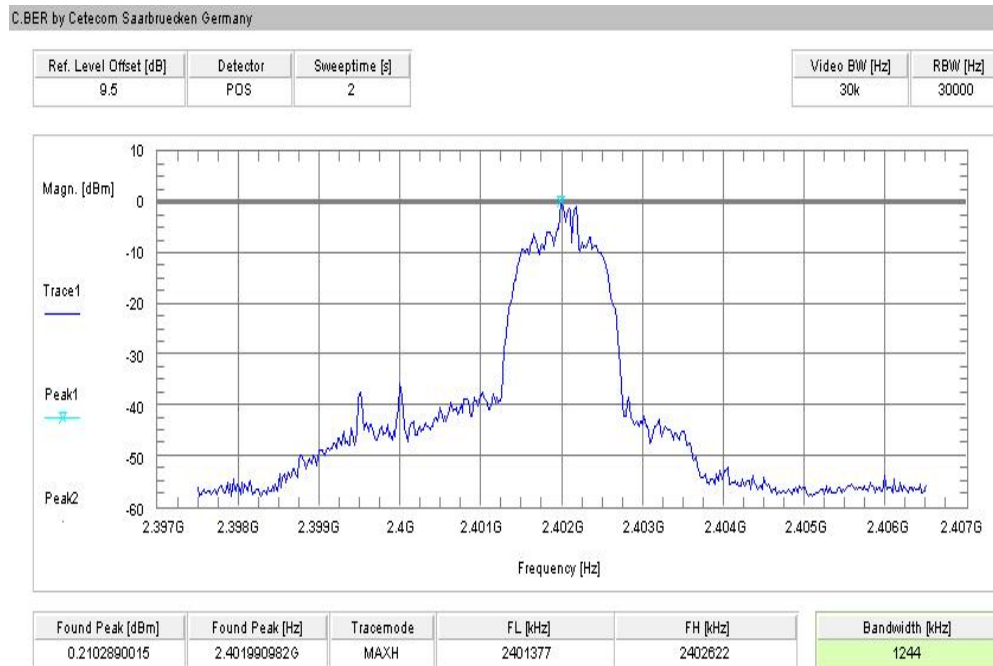
FCC	IC
Spectrum bandwidth of a FHSS system – 99% bandwidth	
GFSK < 1500 kHz Pi/4 DQPSK < 1500 kHz 8DPSK < 1500 kHz	

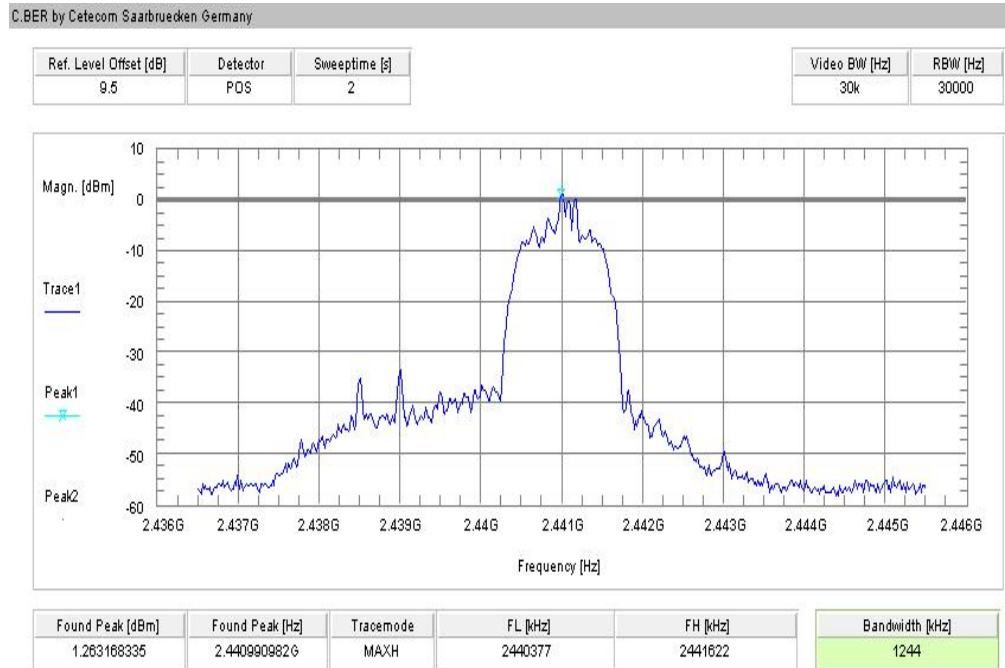
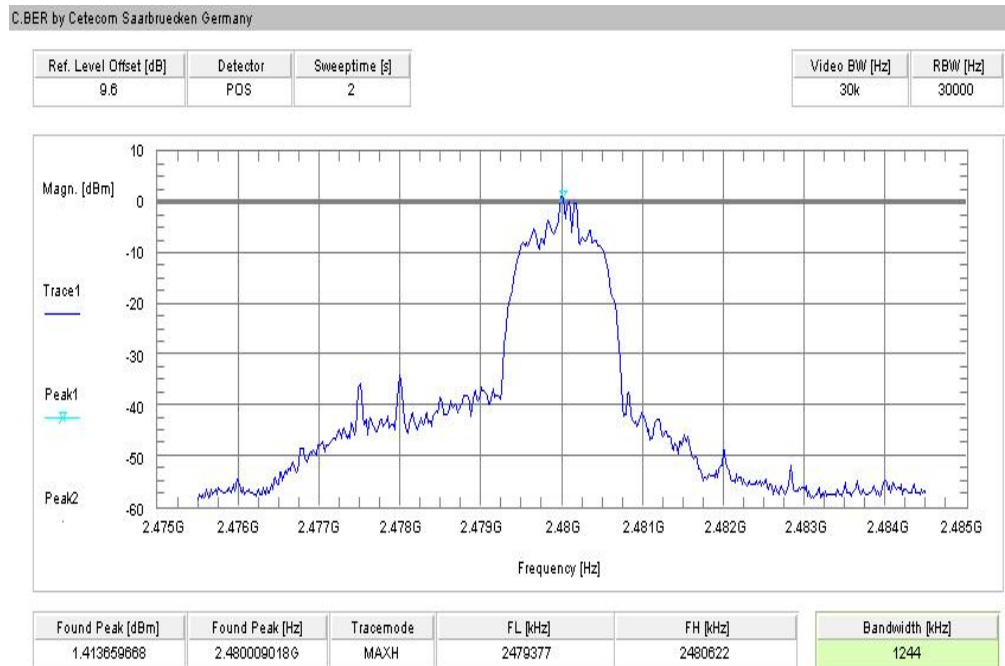
Results:

Modulation Frequency	99 % bandwidth [kHz]		
	2402 MHz	2441 MHz	2480 MHz
GFSK	938	938	938
Pi/4 DQPSK	1244	1244	1244
8DPSK	1263	1263	1263
Measurement uncertainty	± 10 kHz		

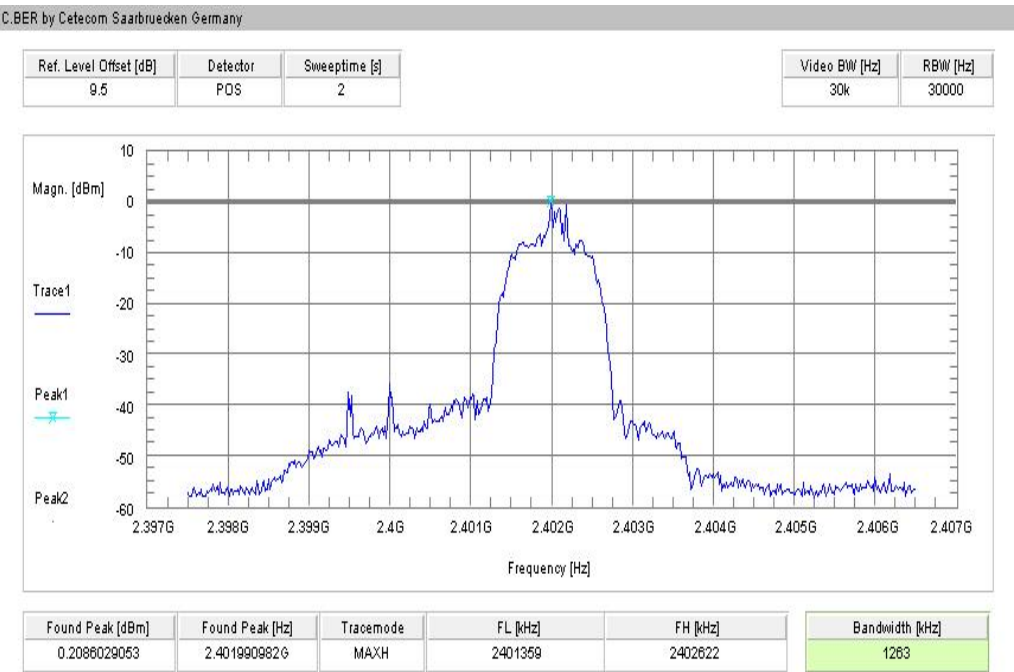
Verdict: **Passed**

Plots:**Plot 1:** lowest channel – 2402 MHz, GFSK modulation**Plot 2:** middle channel – 2441 MHz, GFSK modulation

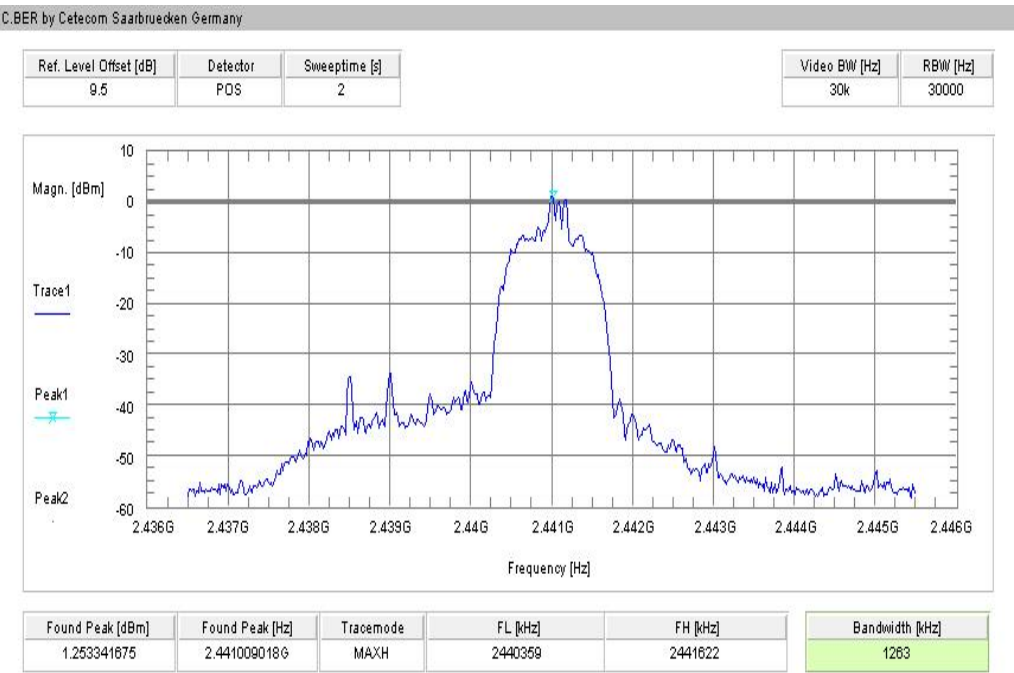
Plot 3: highest channel – 2480 MHz, GFSK modulation**Plot 4: lowest channel – 2402 MHz, Pi / DQPSK modulation**

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

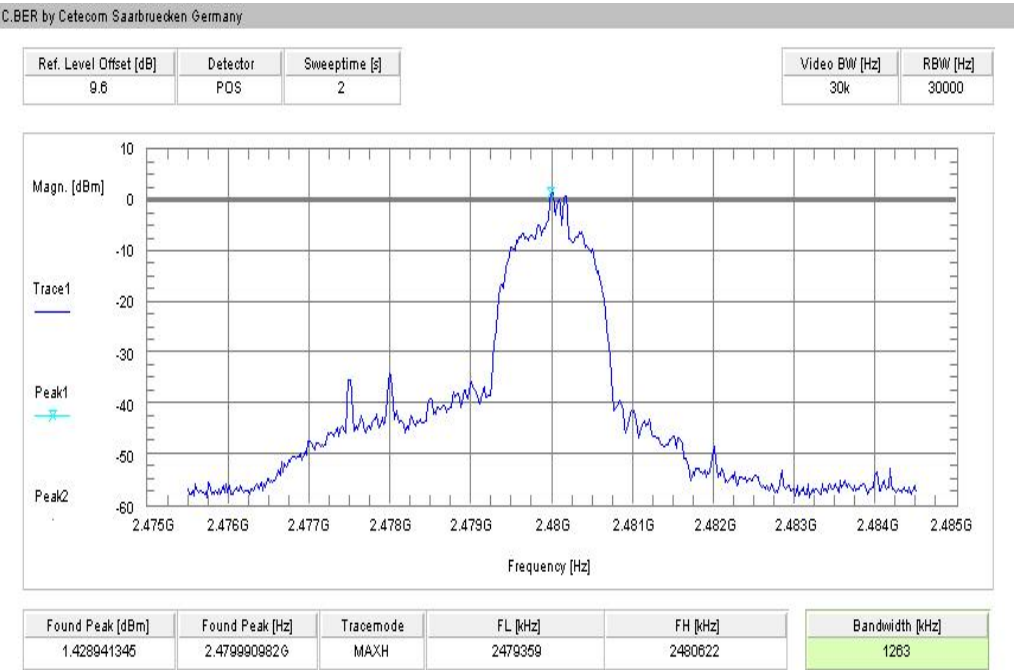
Plot 7: lowest channel – 2402 MHz, 8 DPSK modulation



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 Frequency	Maximum output power conducted [dBm]		
	2402 MHz	2441 MHz	2480 MHz
GFSK	4.53	5.68	5.70
Pi/4 DQPSK	3.58	4.73	4.78
8DPSK	4.12	5.18	5.28
Measurement uncertainty	± 1 dB		

Verdict: Passed**Results:**

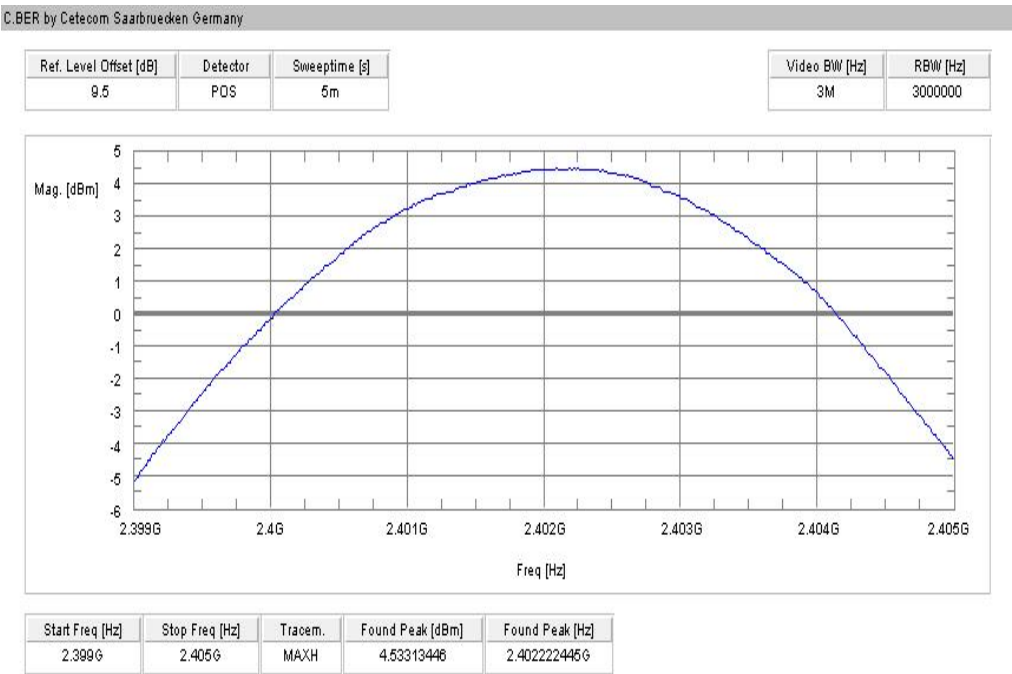
Modulation Frequency	Maximum output power radiated - EIRP [dBm]		
	2402 MHz	2441 MHz	2480 MHz
GFSK	4.28	6.35	6.13
Pi/4 DQPSK *)	3.33	5.40	5.21
8DPSK *)	3.87	5.85	5.71
Measurement uncertainty	± 3 dB		

*) - Values calculated with antenna gain

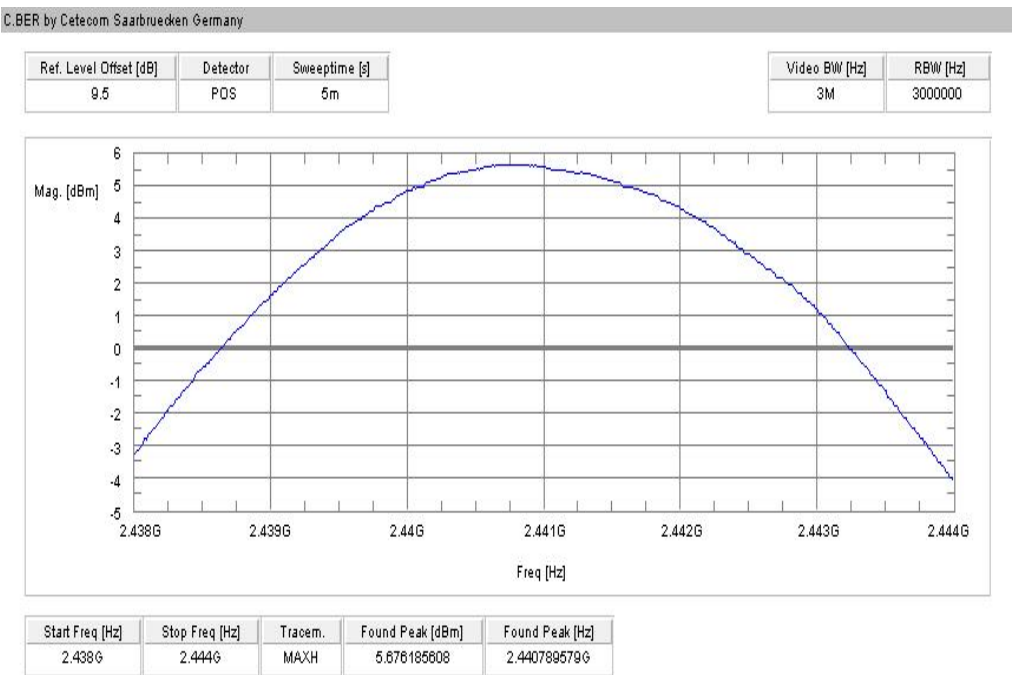
Verdict: Passed

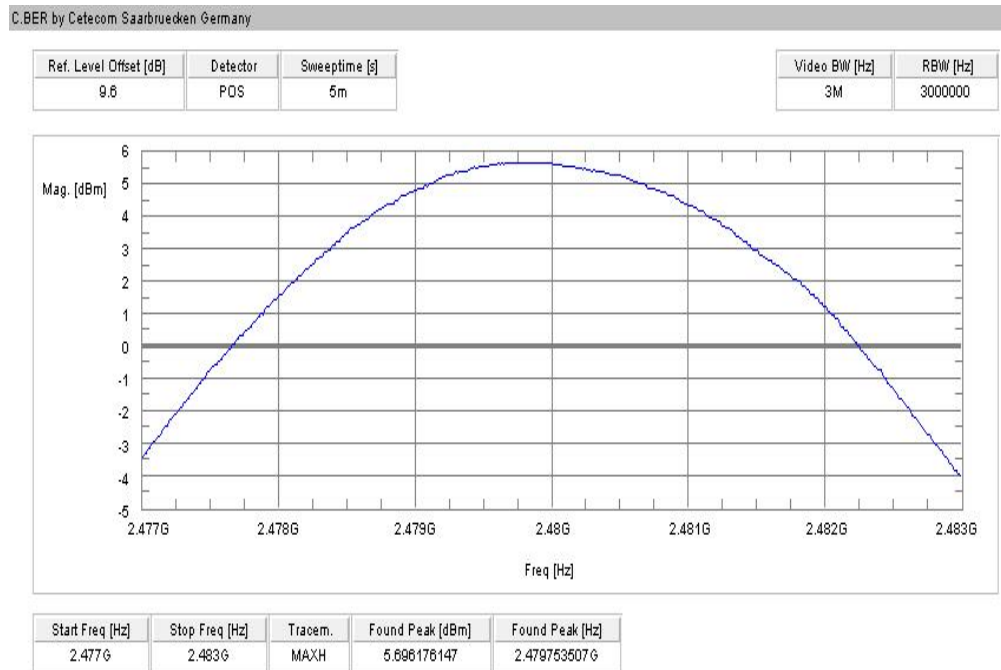
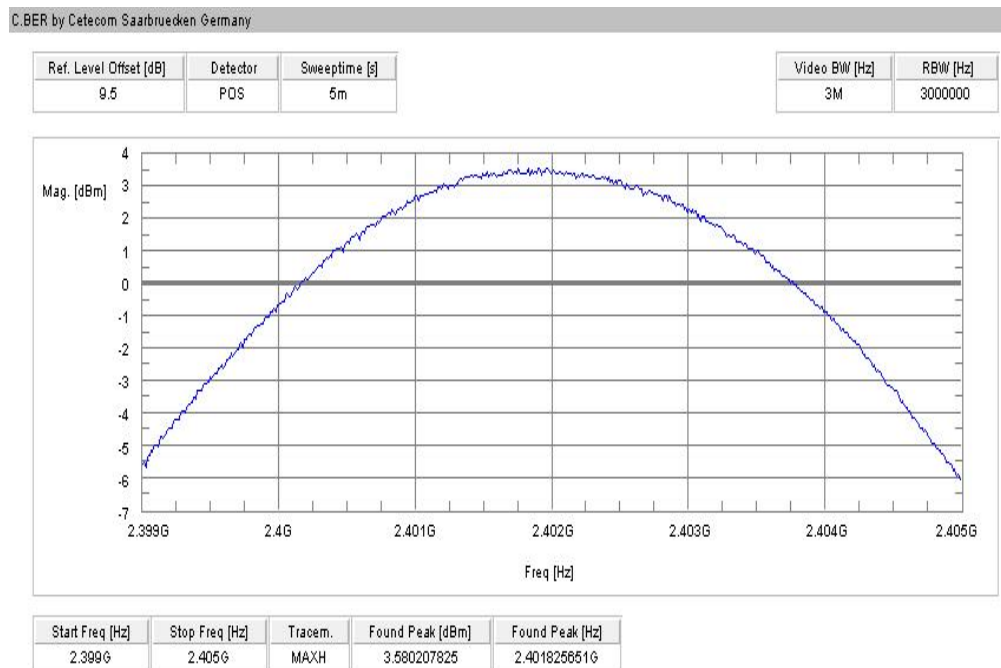
Plots:

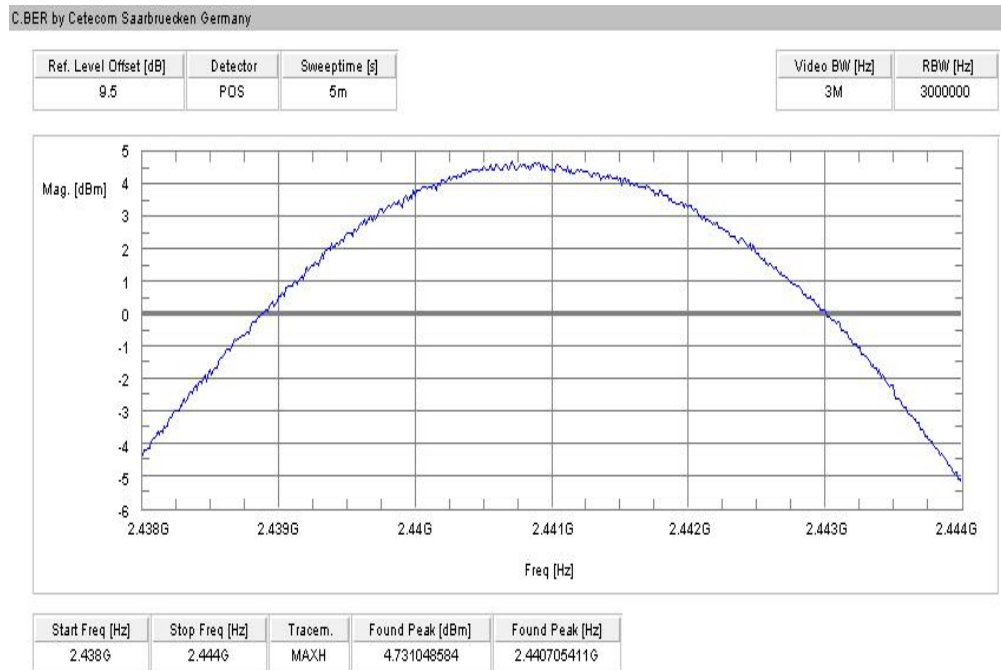
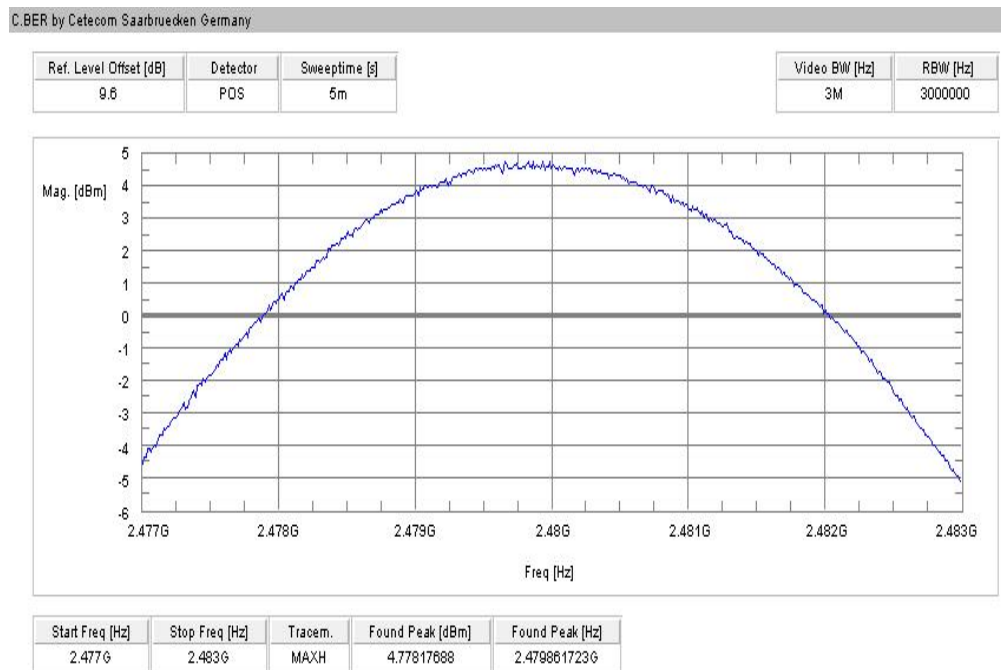
Plot 1: lowest channel – 2402 MHz, GFSK modulation

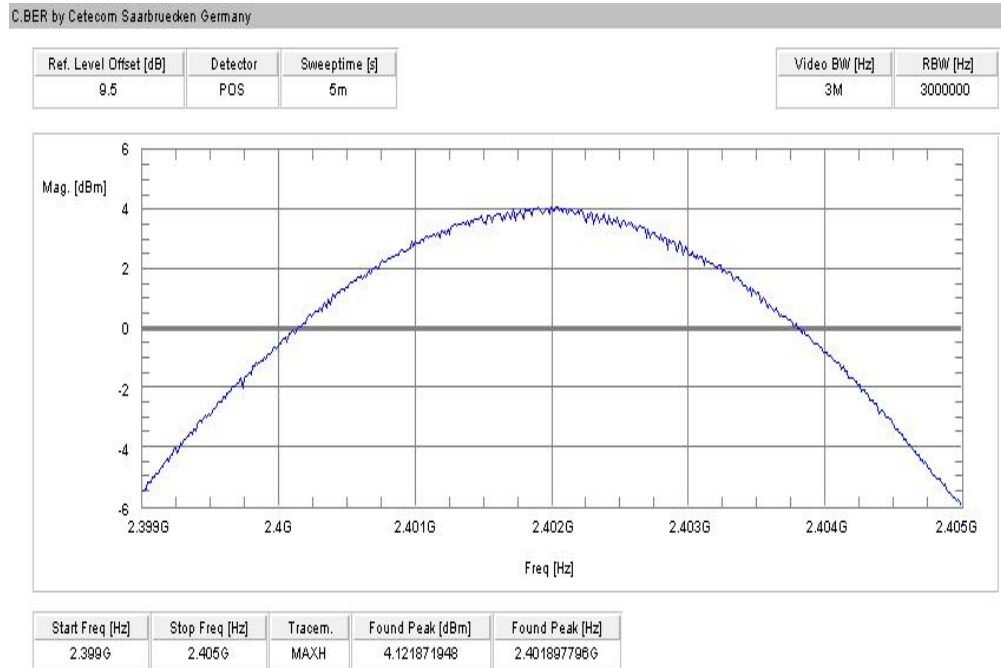
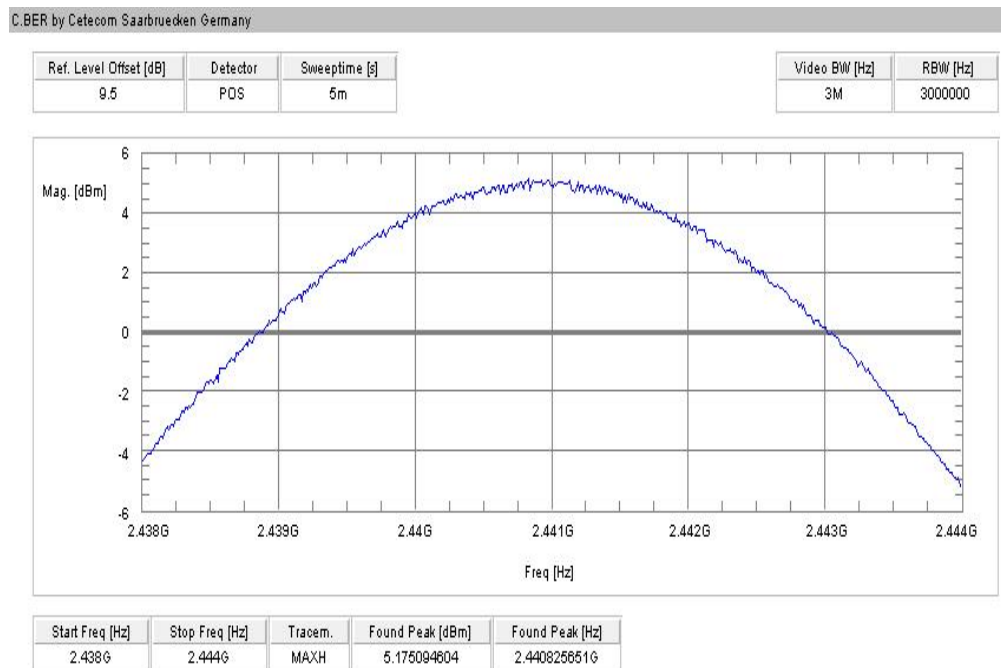


Plot 2: middle channel – 2441 MHz, GFSK modulation

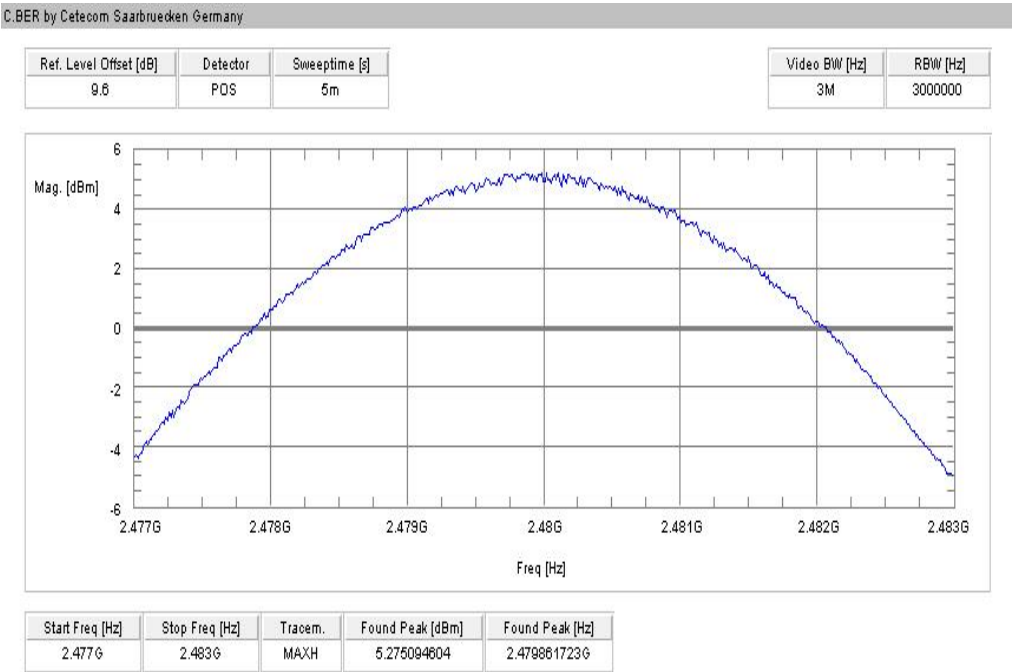


Plot 3: highest channel – 2480 MHz, GFSK modulation**Plot 4: lowest channel – 2402 MHz, Pi / DQPSK modulation**

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 higher Band Edge: 2478 – 2489 MHz
Trace-Mode:	Max Hold

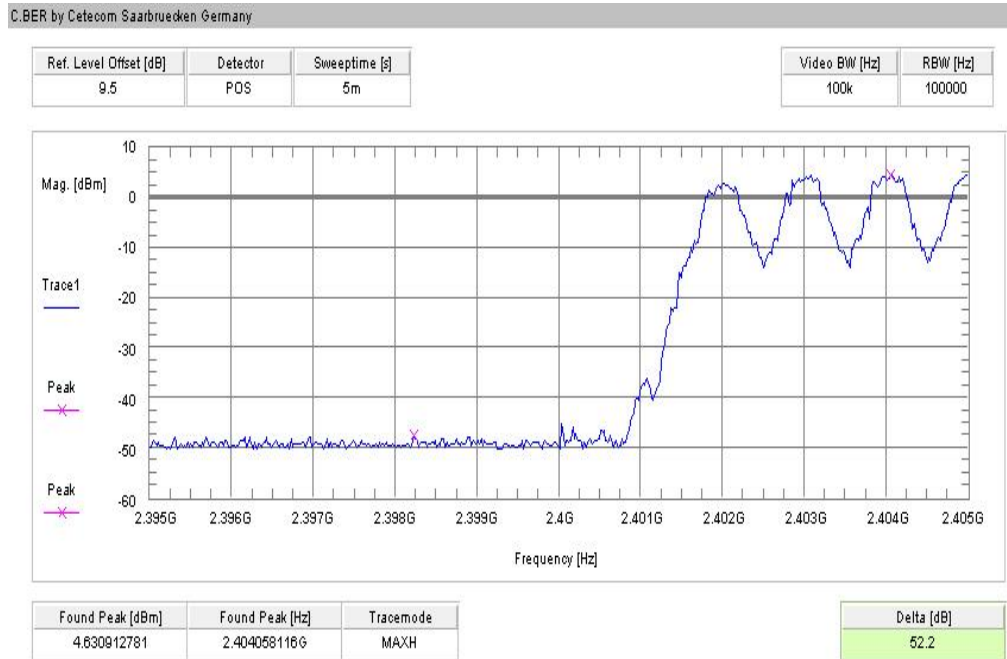
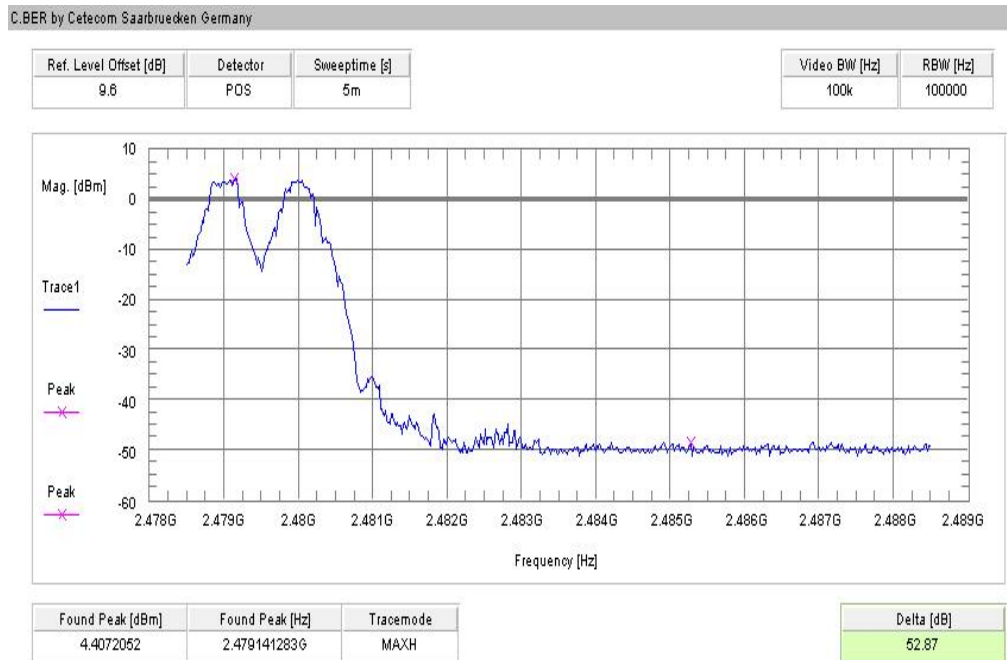
Limits:

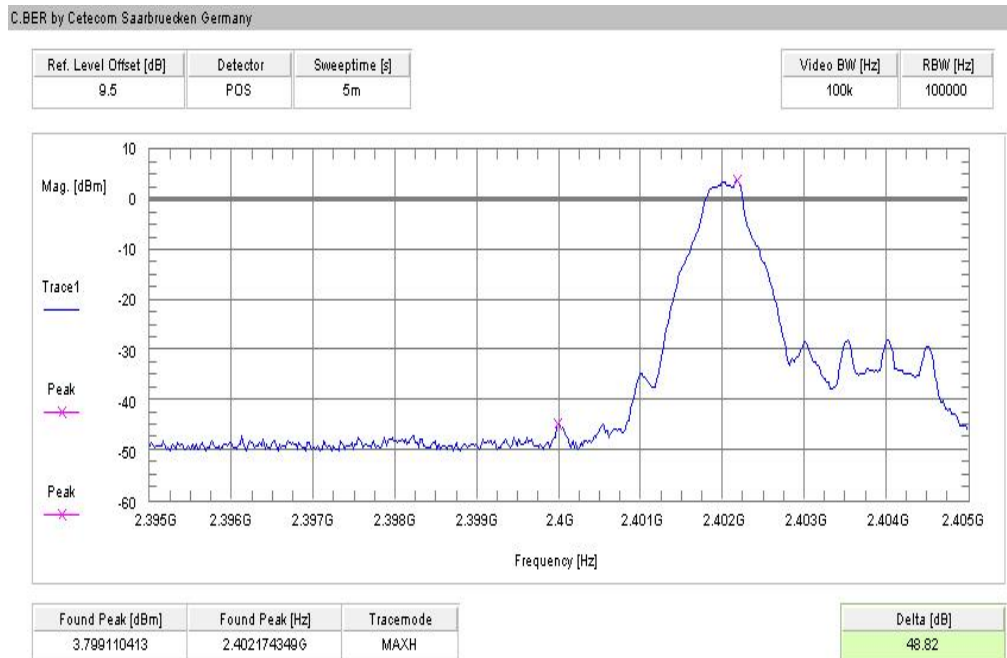
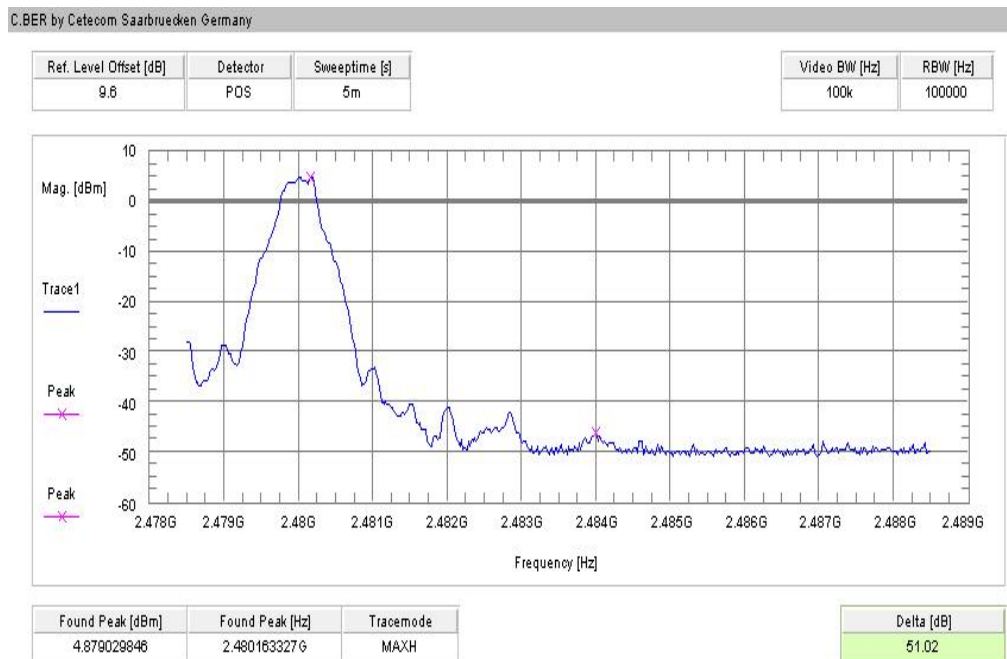
FCC	IC
Band edge compliance conducted	
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth 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:

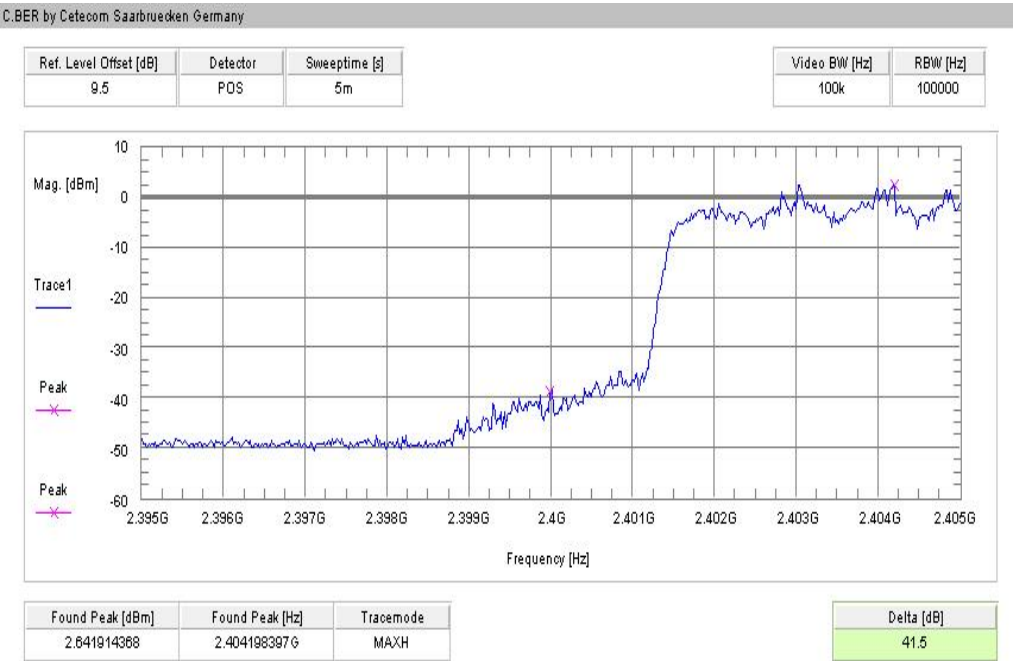
Scenario Modulation	Band edge compliance conducted [dB]		
	GFSK	Pi/4 DQPSK	8 DPSK
Lower band edge – hopping off	> 20 dB	> 20 dB	> 20 dB
Lower band edge – hopping on	> 20 dB	> 20 dB	> 20 dB
Upper band edge – hopping off	> 20 dB	> 20 dB	> 20 dB
Upper band edge – hopping on	> 20 dB	> 20 dB	> 20 dB
Measurement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

Verdict: Passed

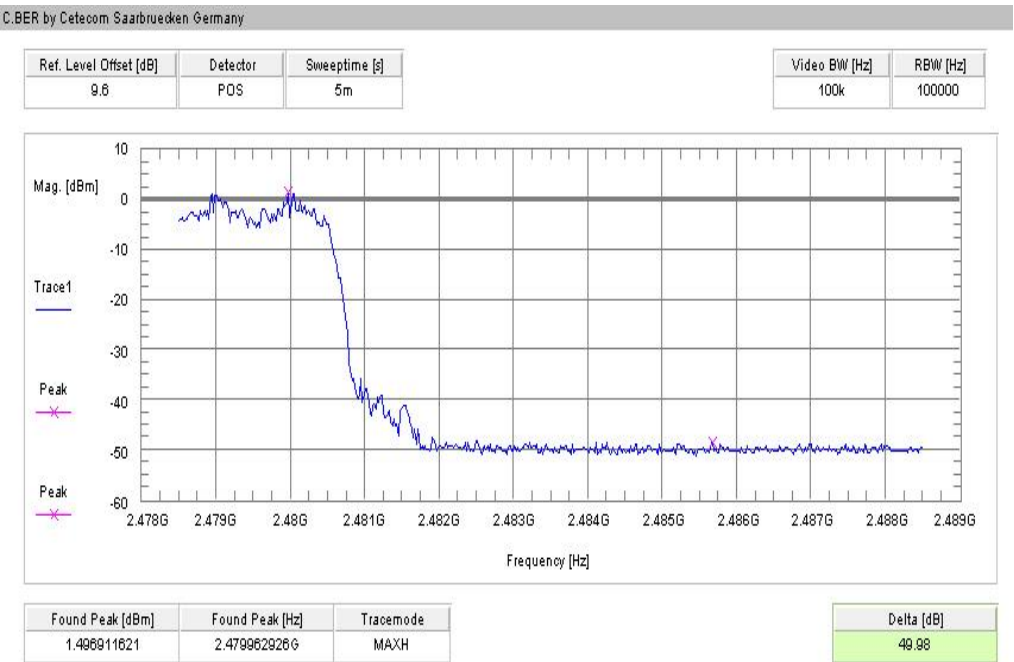
Plots:**Plot 1: Lower band edge – hopping on, GFSK modulation****Plot 2: Upper band edge – hopping on, GFSK modulation**

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

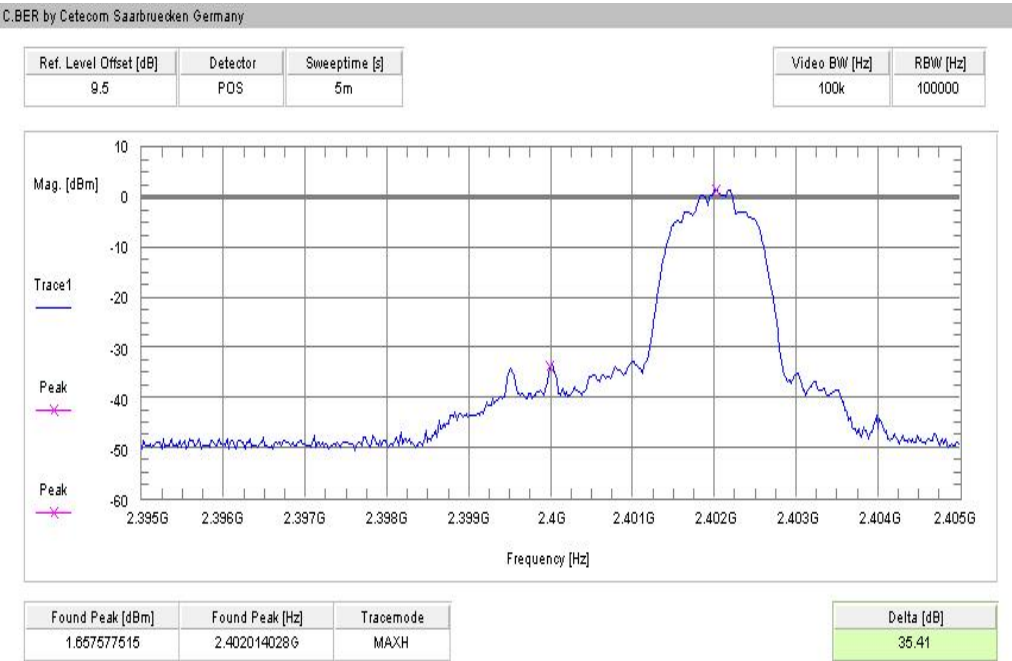
Plot 5: Lower band edge – hopping on, Pi/4 DQPSK modulation



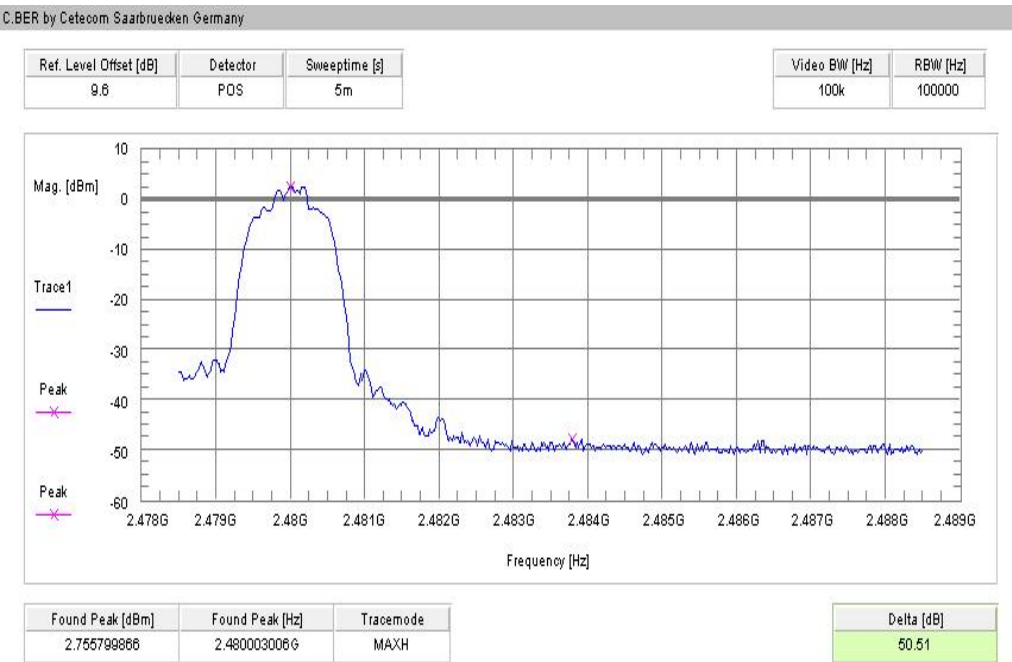
Plot 6: Upper band edge – hopping on, Pi/4 DQPSK modulation

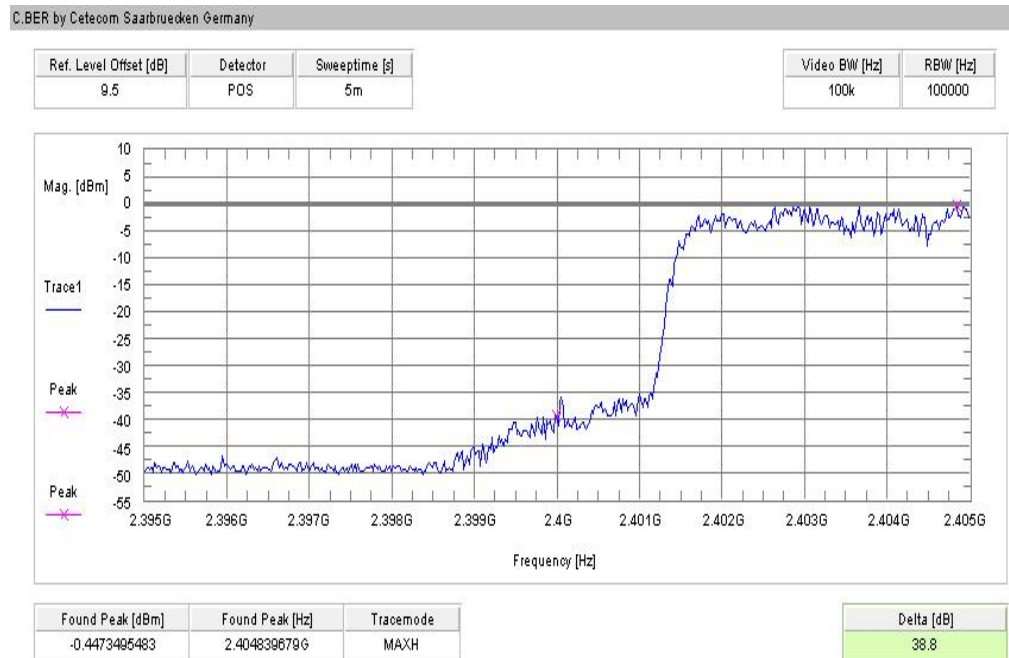
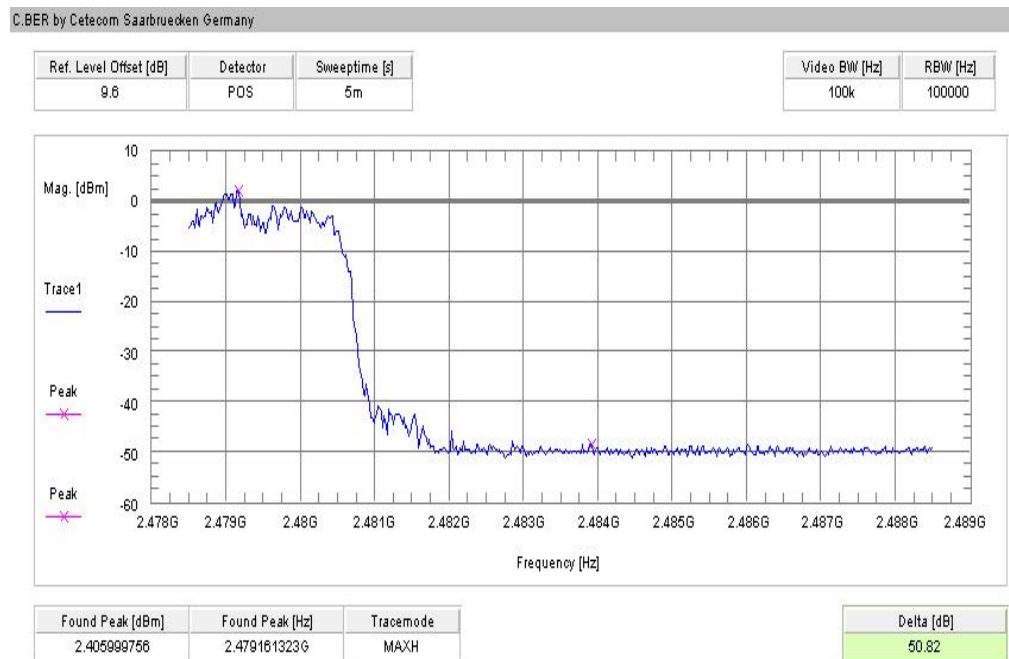


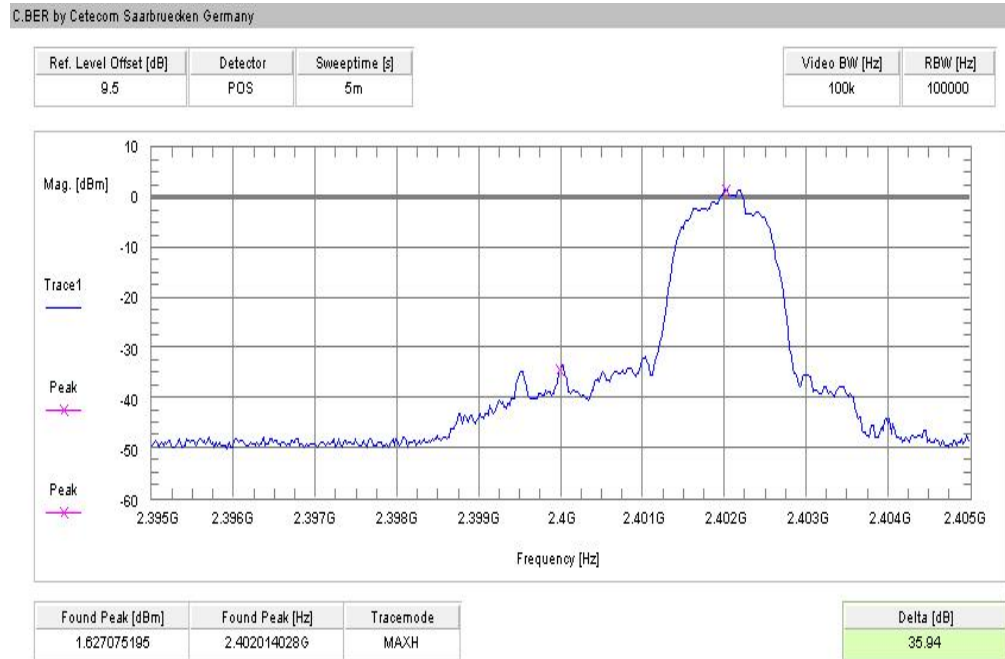
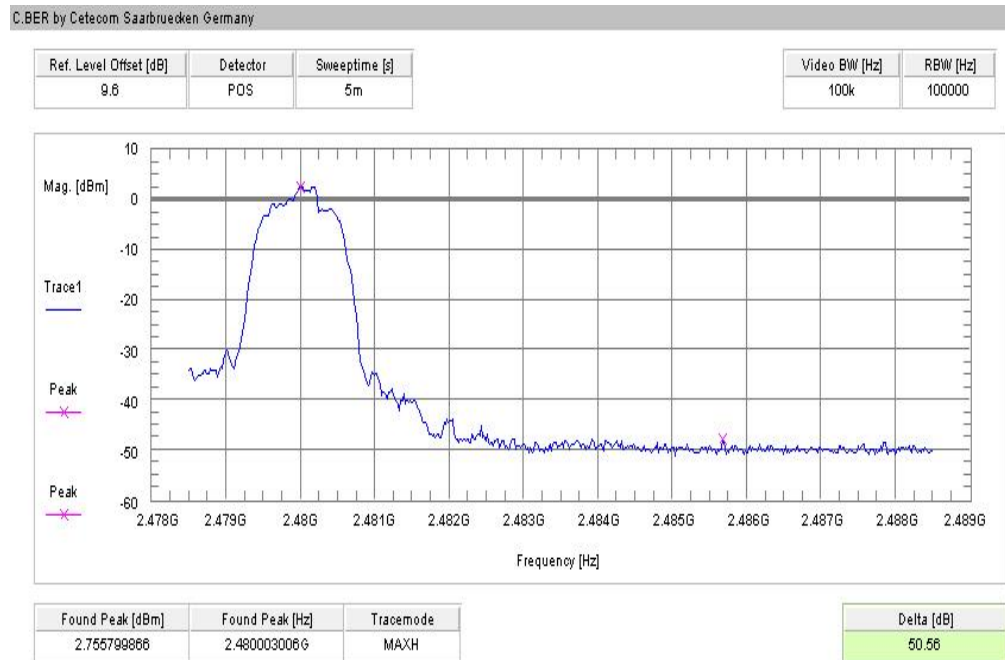
Plot 7: Lower band edge – hopping off, Pi/4 DQPSK modulation



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 higher Band: 2480 – 2500 MHz
Trace-Mode:	Max Hold

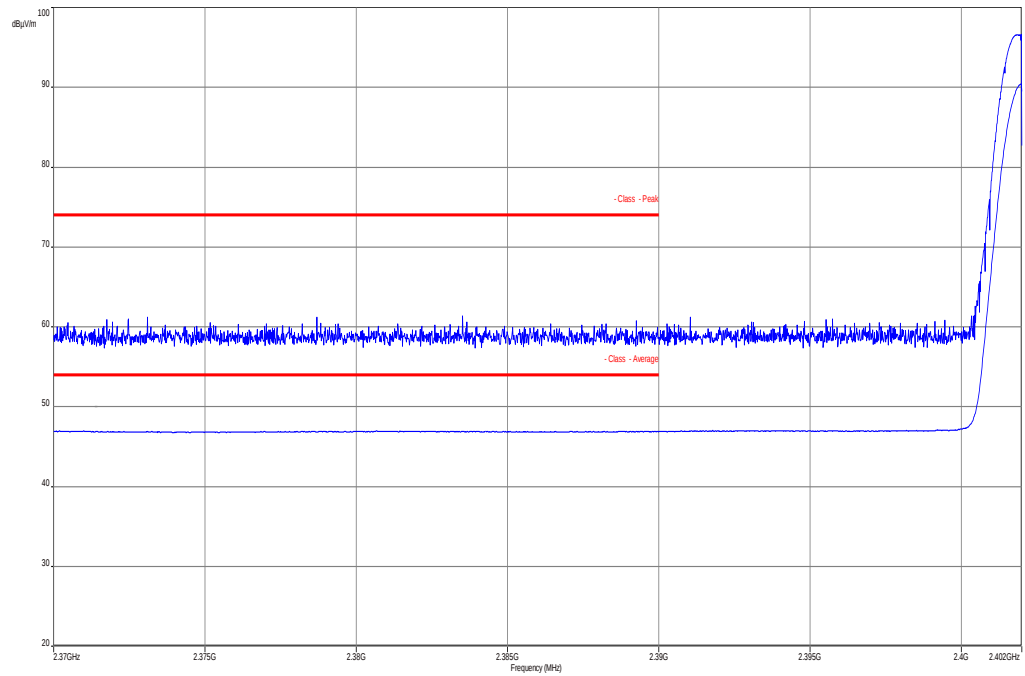
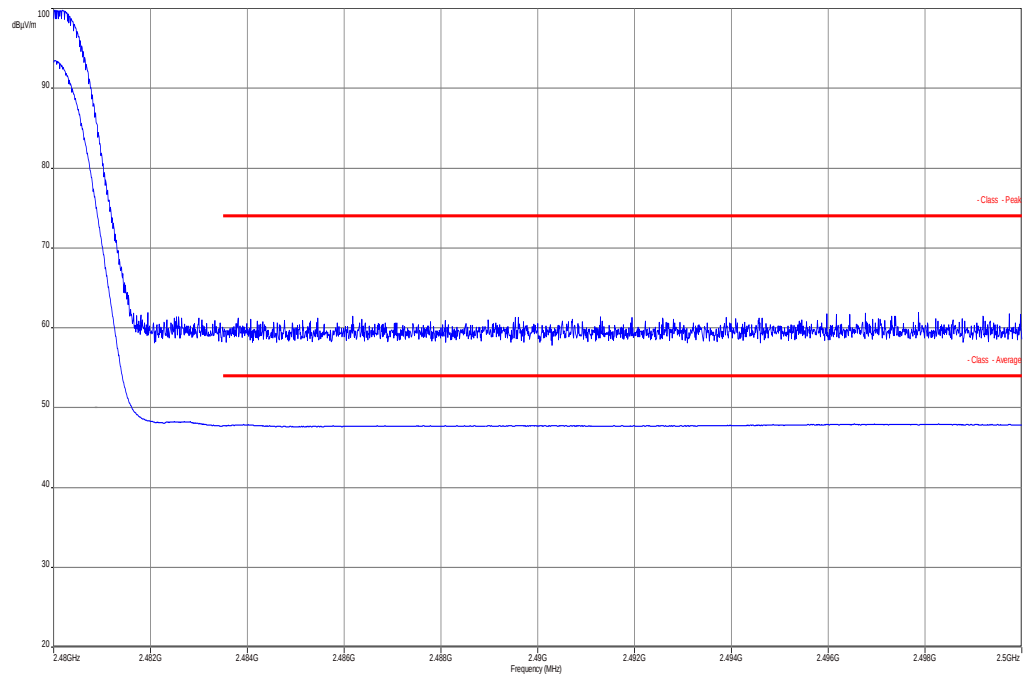
Limits:

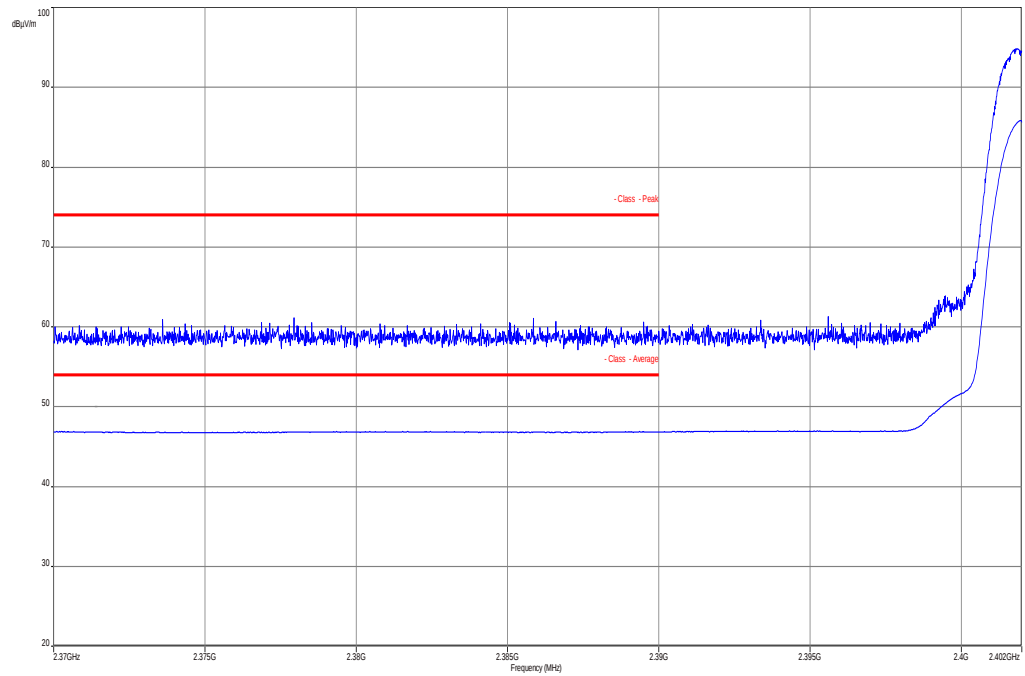
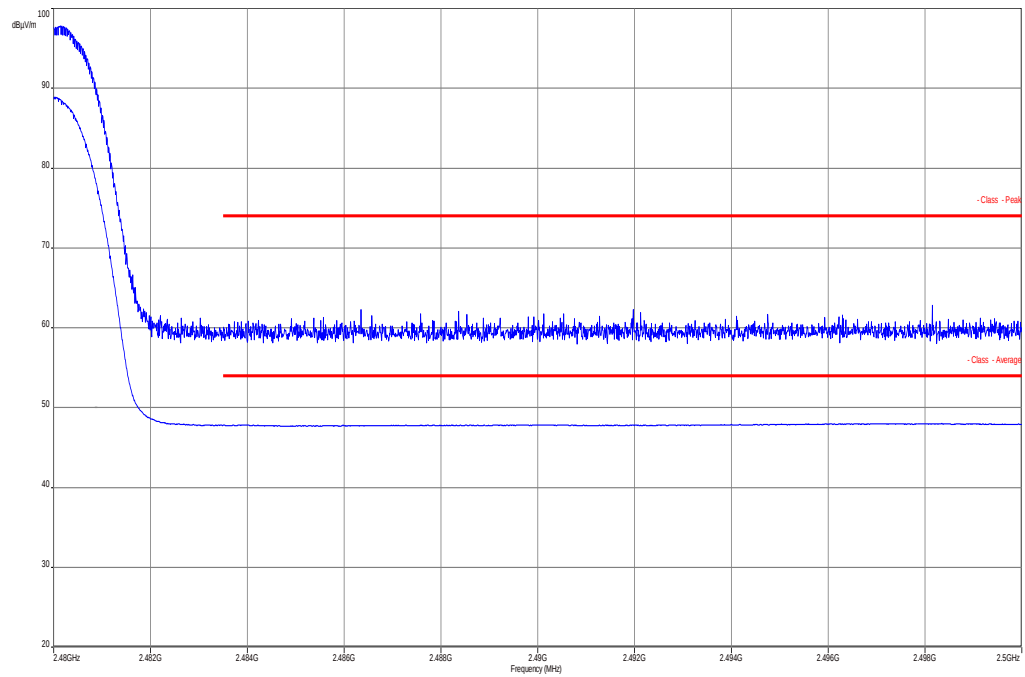
FCC	IC
Band edge compliance radiated	
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth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

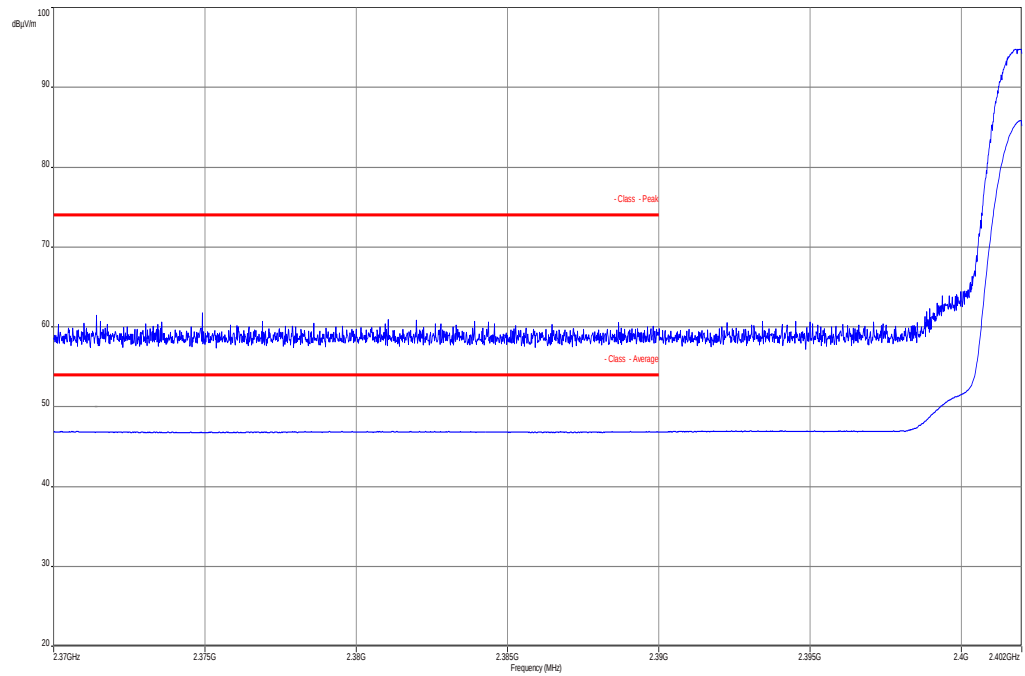
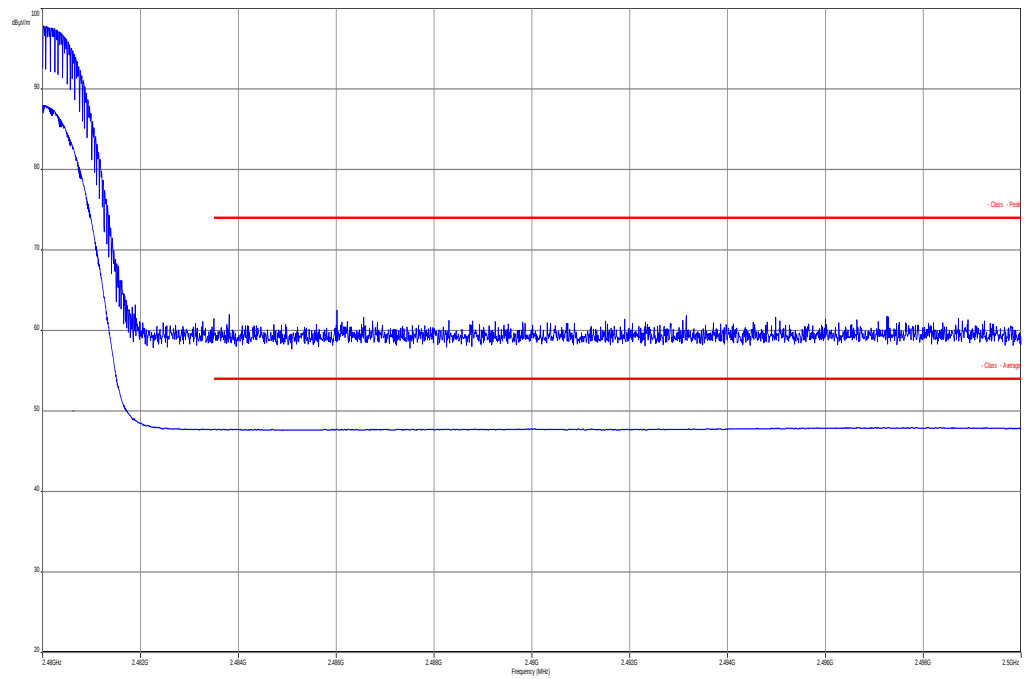
Results:

Scenario 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		

Verdict: 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 GHz: 500 kHz F > 1 GHz: 500 kHz
Resolution bandwidth:	F < 1 GHz: 100 kHz F > 1 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		4.17	30 dBm		Operating frequency
All detected emissions are below the -20 dBc criteria.			-20 dBc		complies
2441		5.37	30 dBm		Operating frequency
All detected emissions are below the -20 dBc criteria.			-20 dBc		complies
2480		5.43	30 dBm		Operating frequency
All detected emissions are below the -20 dBc criteria.			-20 dBc		complies
Measurement uncertainty		± 3 dB			

Verdict: 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		2.78	30 dBm		Operating frequency
All detected emissions are below the -20 dBc criteria.			-20 dBc		complies
2441		3.86	30 dBm		Operating frequency
All detected emissions are below the -20 dBc criteria.			-20 dBc		complies
2480		3.86	30 dBm		Operating frequency
All detected emissions are below the -20 dBc criteria.			-20 dBc		complies
Measurement uncertainty		± 3dB			

Verdict: Passed

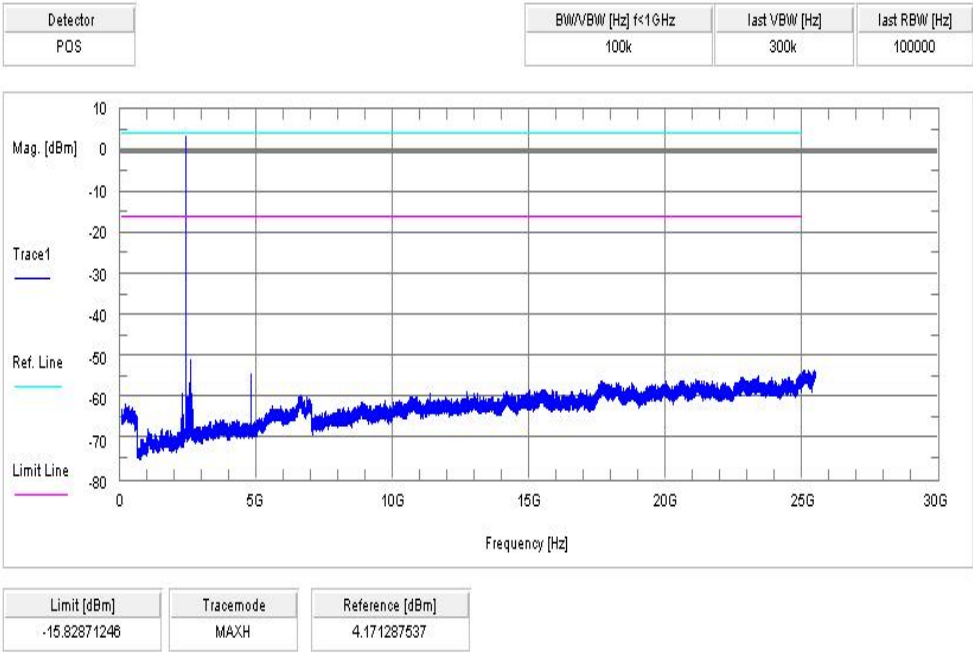
Results:

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		3.02	30 dBm		Operating frequency
All detected emissions are below the -20 dBc criteria.			-20 dBc		complies
2441		3.99	30 dBm		Operating frequency
All detected emissions are below the -20 dBc criteria.			-20 dBc		complies
2480		4.24	30 dBm		Operating frequency
All detected emissions are below the -20 dBc criteria.			-20 dBc		complies
Measurement uncertainty		± 3dB			

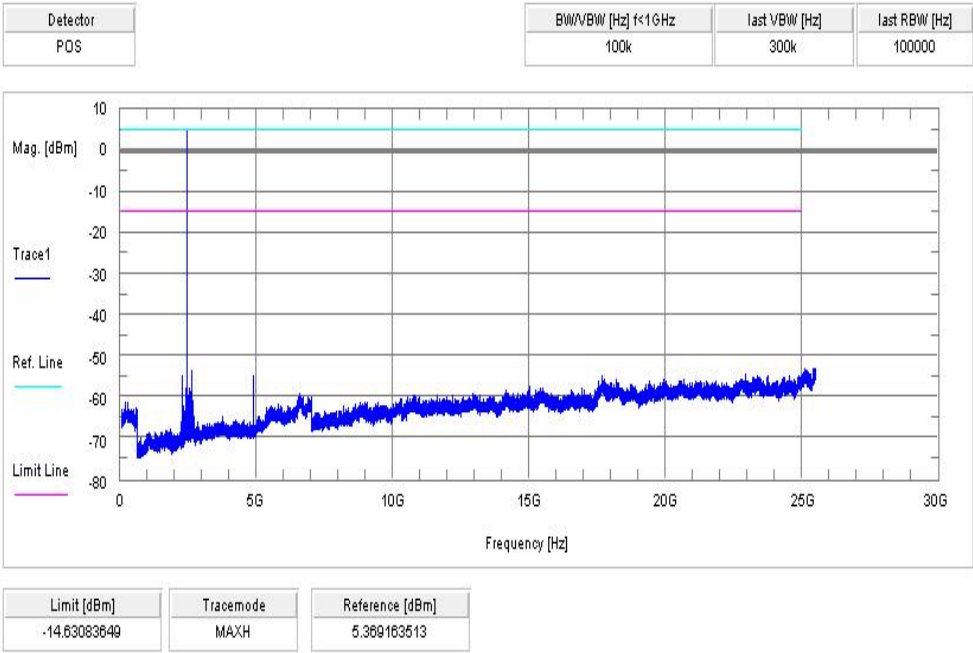
Verdict: Passed

Plots:

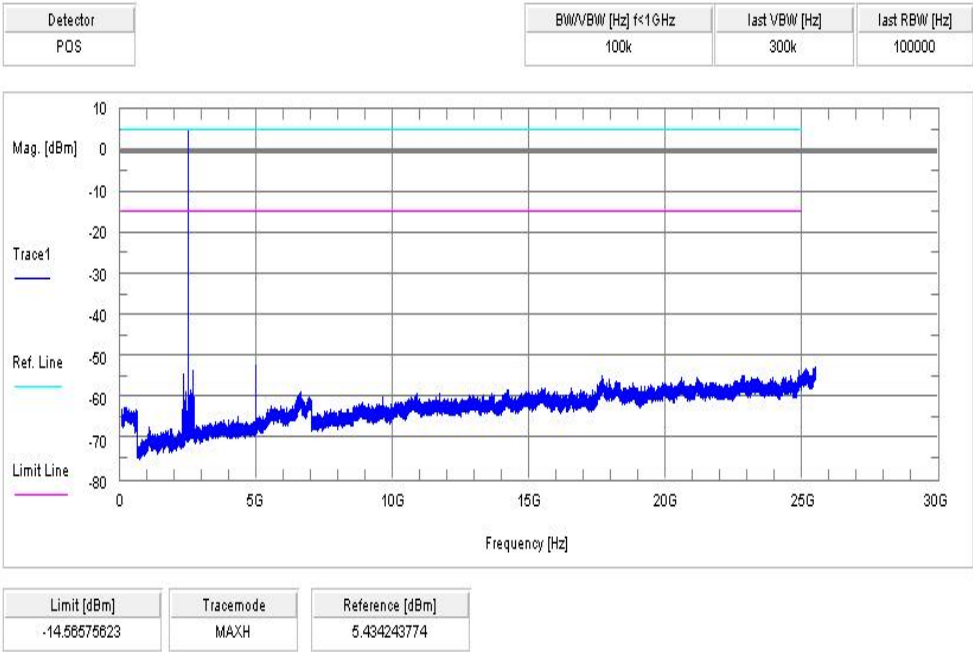
Plot 1: lowest channel – 2402 MHz, GFSK modulation



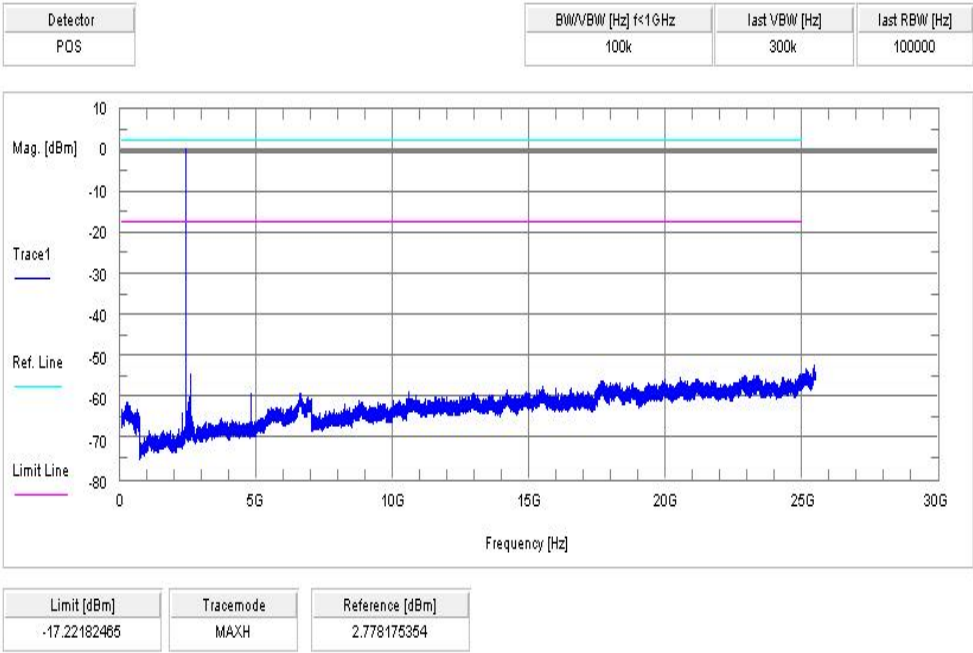
Plot 2: middle channel – 2441 MHz, GFSK modulation



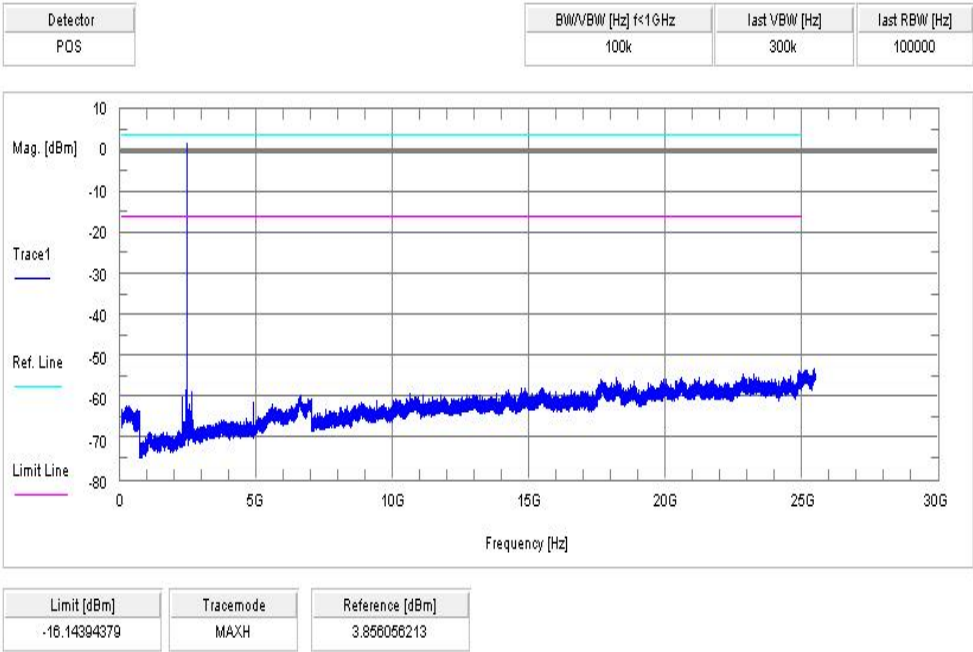
Plot 3: highest channel – 2480 MHz, GFSK modulation



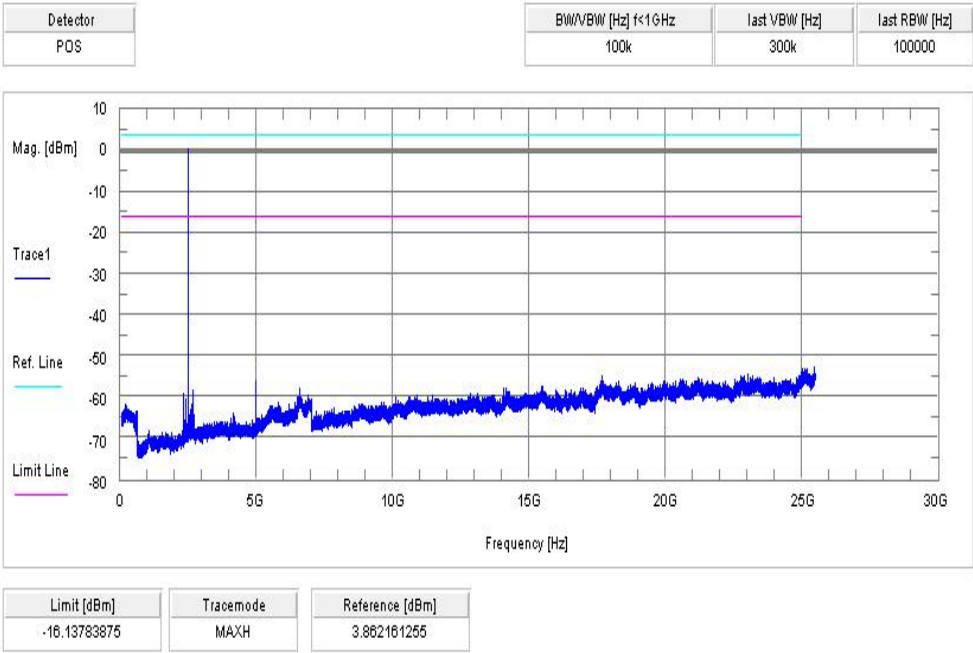
Plot 4: lowest channel – 2402 MHz, Pi / DQPSK modulation



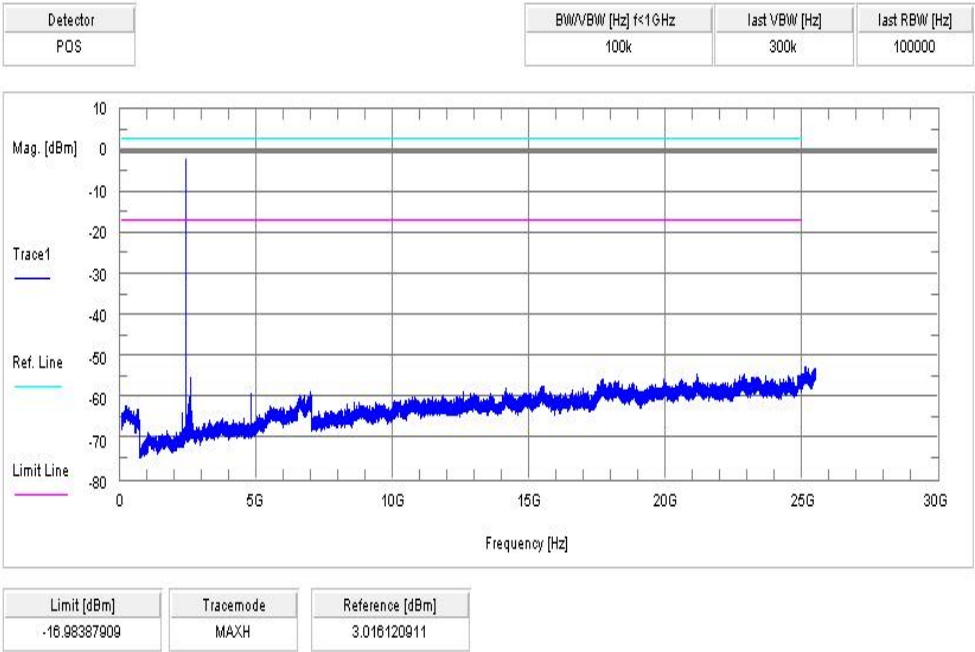
Plot 5: middle channel – 2441 MHz, Pi / DQPSK modulation



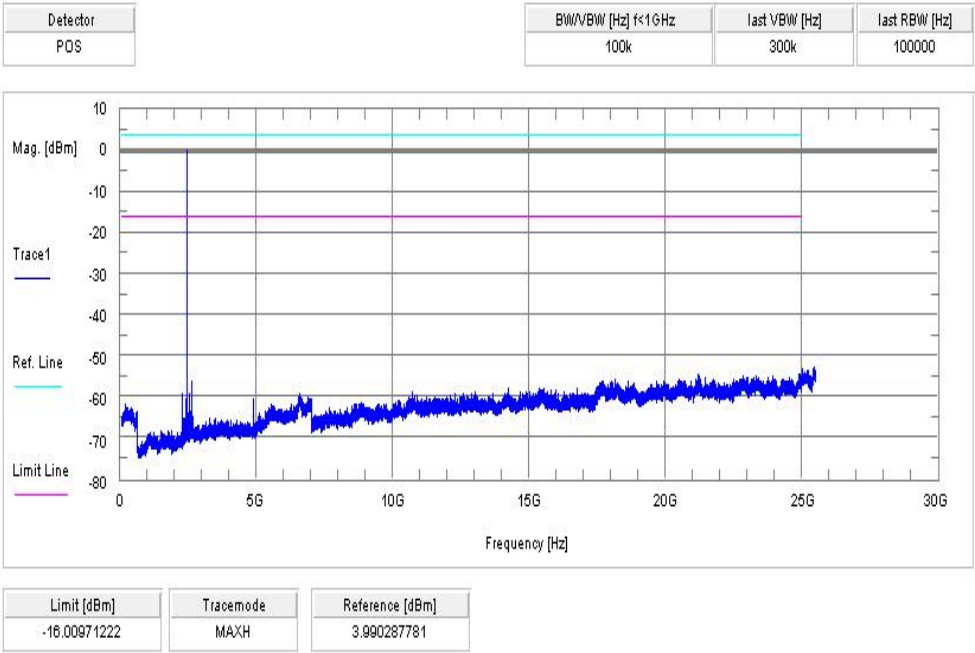
Plot 6: highest channel – 2480 MHz, Pi / DQPSK modulation



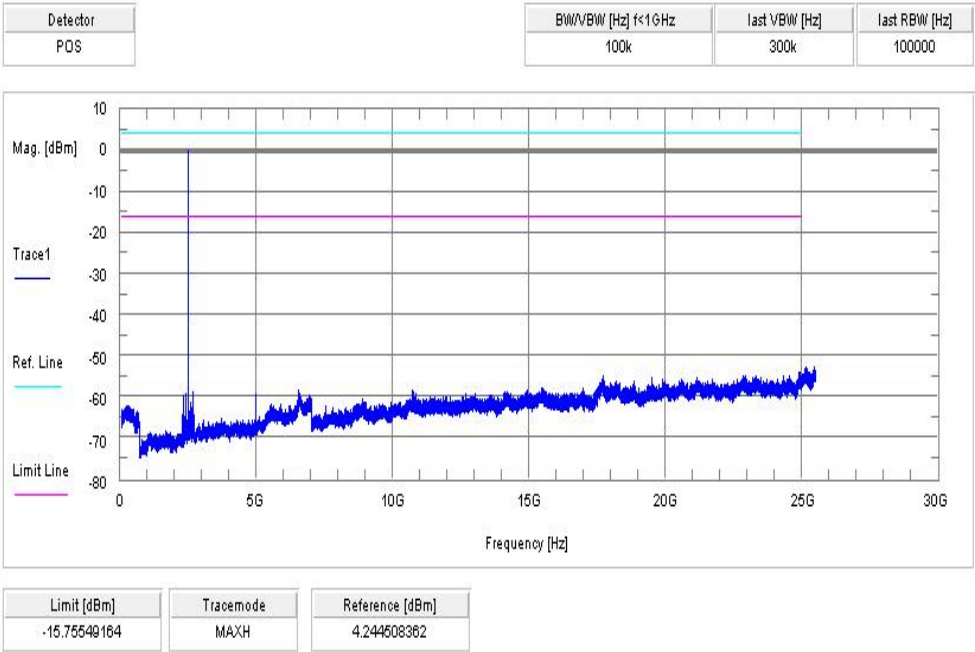
Plot 7: lowest channel – 2402 MHz, 8 DPSK modulation



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 26 GHz
Trace-Mode:	Max Hold
Measured Modulation:	☒ GFSK ☐ Pi/4 DQPSK ☐ 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:

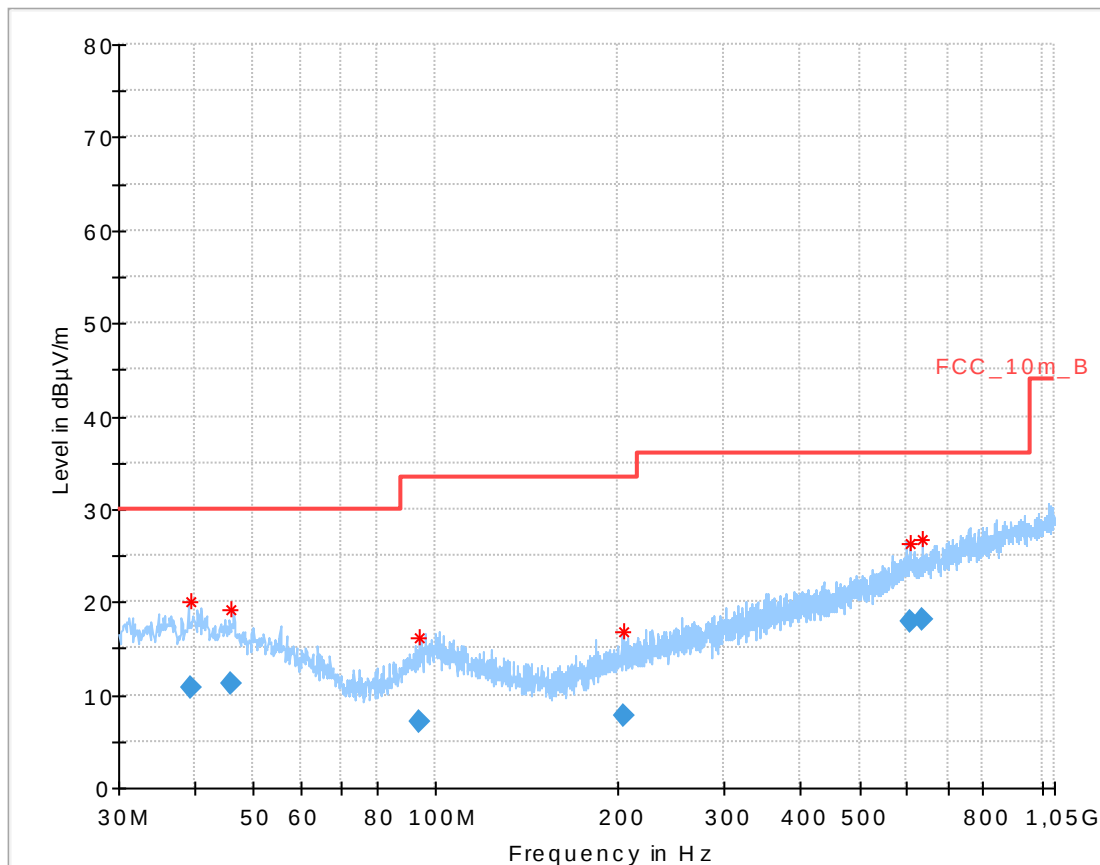
FCC		IC
TX spurious emissions radiated		
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz 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:

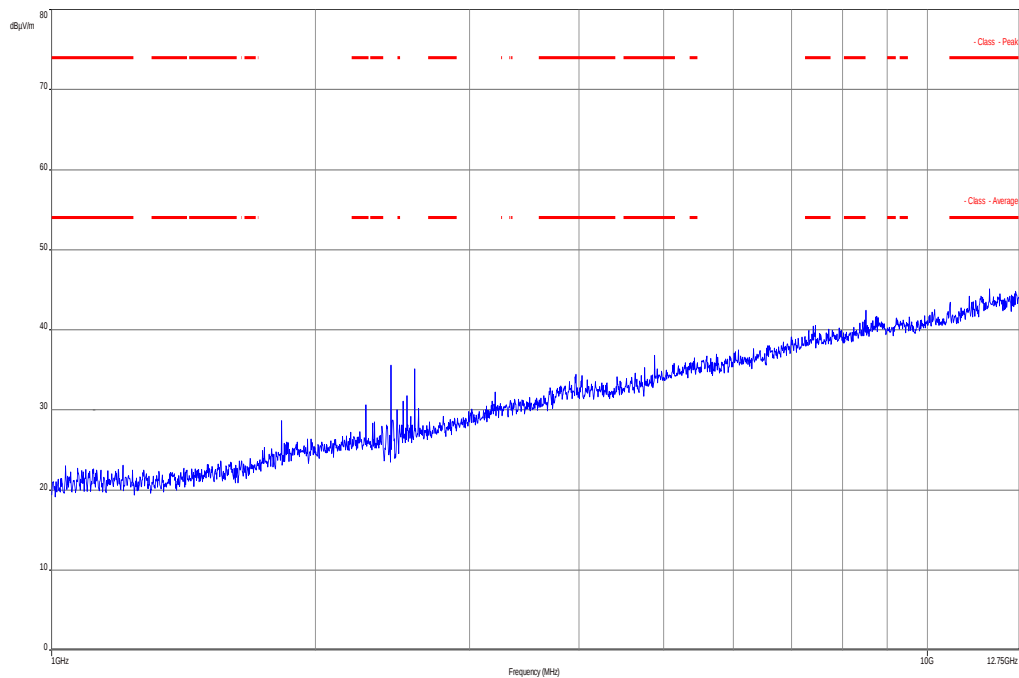
TX spurious emissions radiated [dB μ V/m]								
2402 MHz			2441 MHz			2480 MHz		
F [MHz]	Detector	Level [dB μ V/m]	F [MHz]	Detector	Level [dB μ V/m]	F [MHz]	Detector	Level [dB μ V/m]
For emissions below 1 GHz, please take a look at the table below the 1 GHz plot.			For emissions below 1 GHz, please 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 more than 10 dB below the average limit.			All detected peak emissions are more than 10 dB below the average limit.			All detected peak emissions are more than 10 dB below the average limit.		
Measurement uncertainty			± 3 dB					

Verdict: Passed

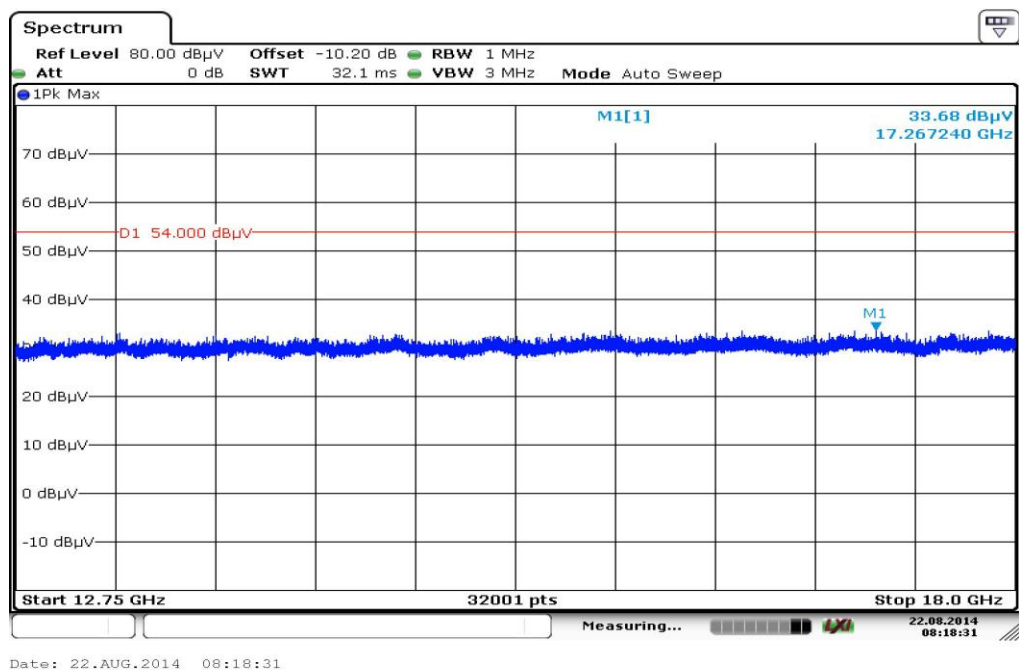
Note: The limit was recalculated with 20 dB / decade (Part 15.31) for all radiated spurious emissions 30 MHz to 1 GHz from 3 meter limit to a 10 meter distance. (40dB/decade for emissions < 30MHz)

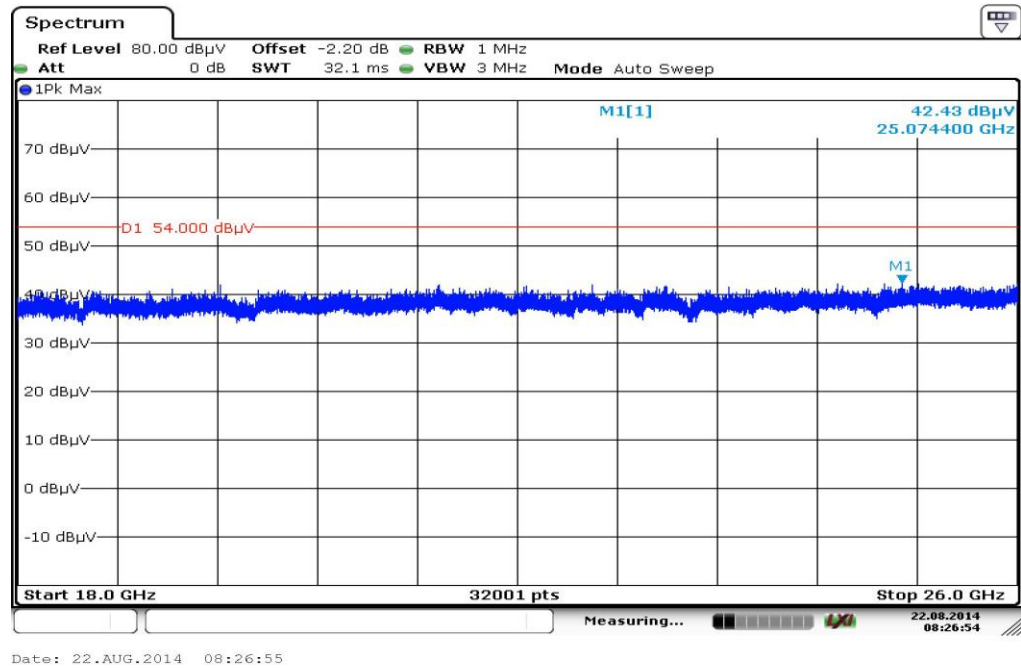
Plots:**Plot 1:** 30 MHz to 1 GHz, TX mode, channel 00, vertical & horizontal polarization**Final_Result:**

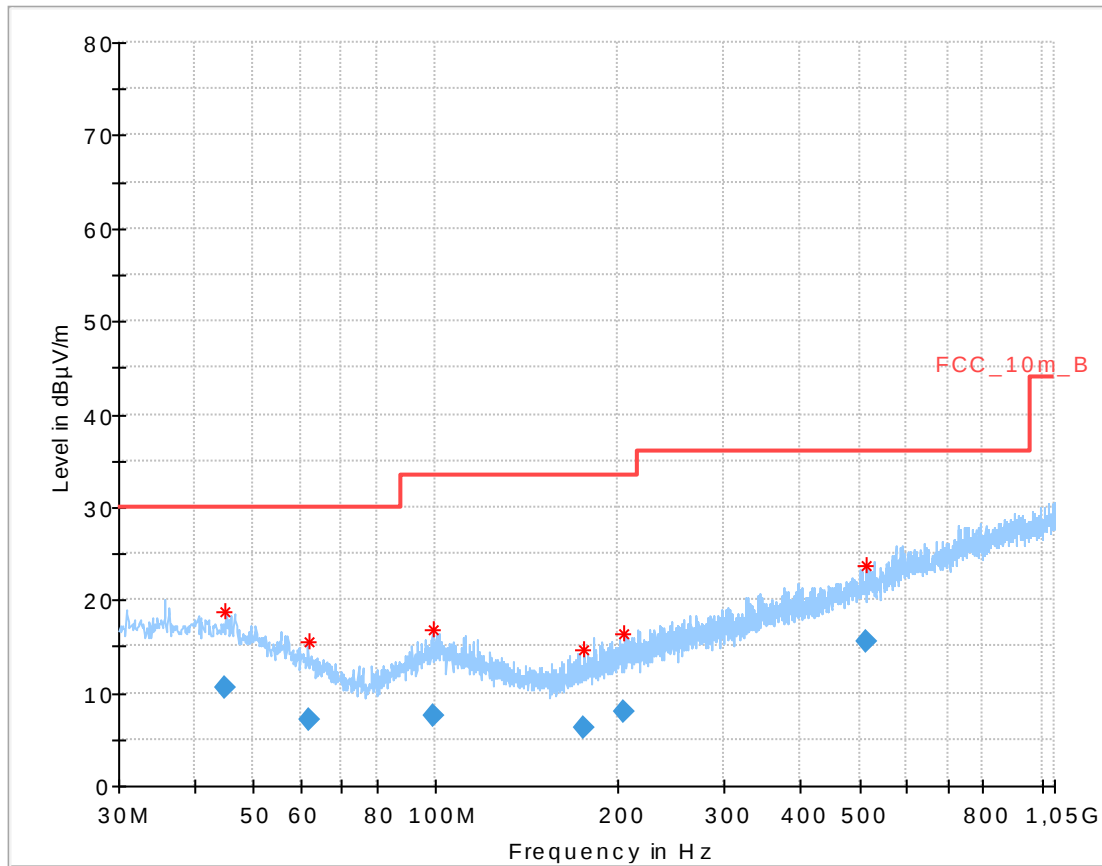
Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
39.525600	10.77	30.00	19.23	1000.0	120.000	101.0	H	25	14.0
46.051500	11.31	30.00	18.69	1000.0	120.000	101.0	V	65	13.6
94.065900	7.14	33.50	26.36	1000.0	120.000	101.0	V	89	11.2
204.100350	7.82	33.50	25.68	1000.0	120.000	170.0	H	115	11.8
607.284150	17.92	36.00	18.08	1000.0	120.000	170.0	V	205	20.8
635.395650	18.10	36.00	17.90	1000.0	120.000	170.0	V	-1	21.0

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

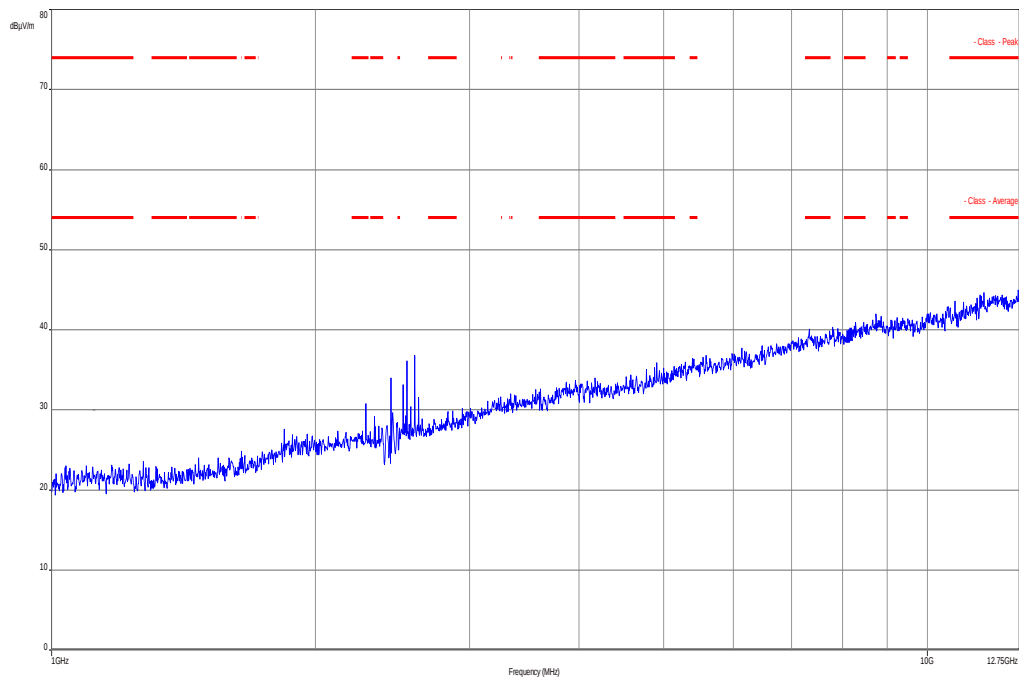
The carrier signal is notched with a 2.4 GHz band rejection filter.

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

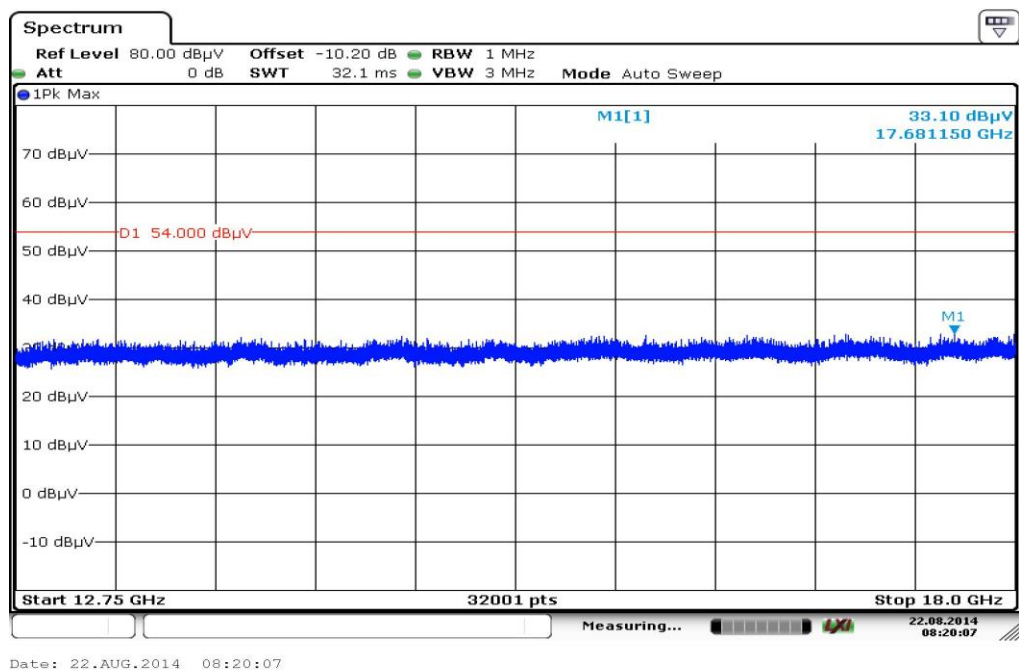
Plot 4: 18 GHz to 26 GHz, TX mode, channel 00, vertical & horizontal polarization

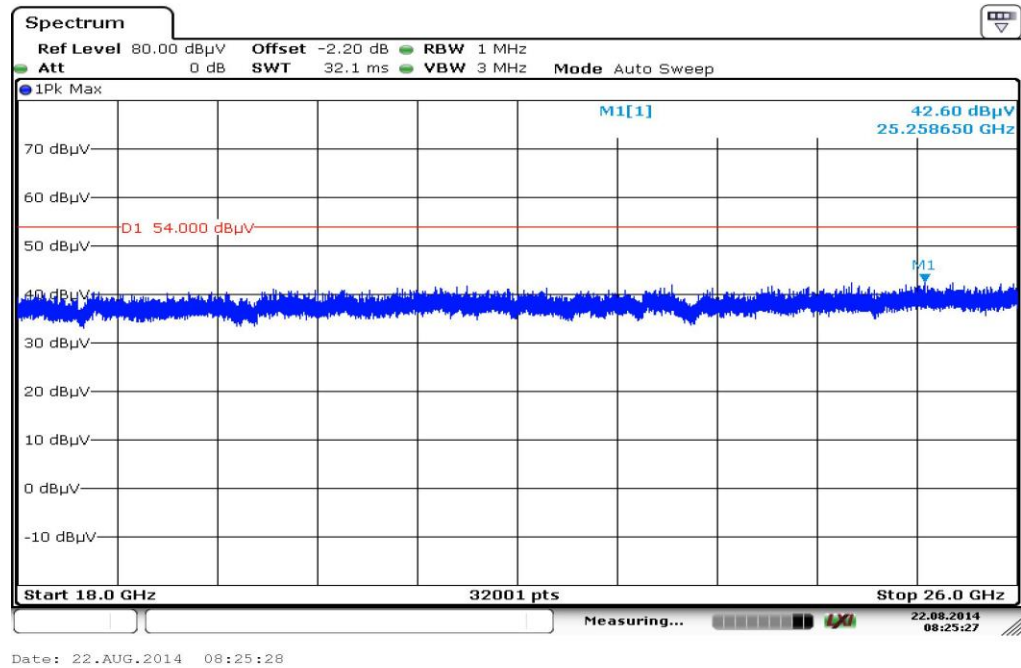
Plot 5: 30 MHz to 1 GHz, TX mode, channel 39, vertical & horizontal polarization**Final_Result:**

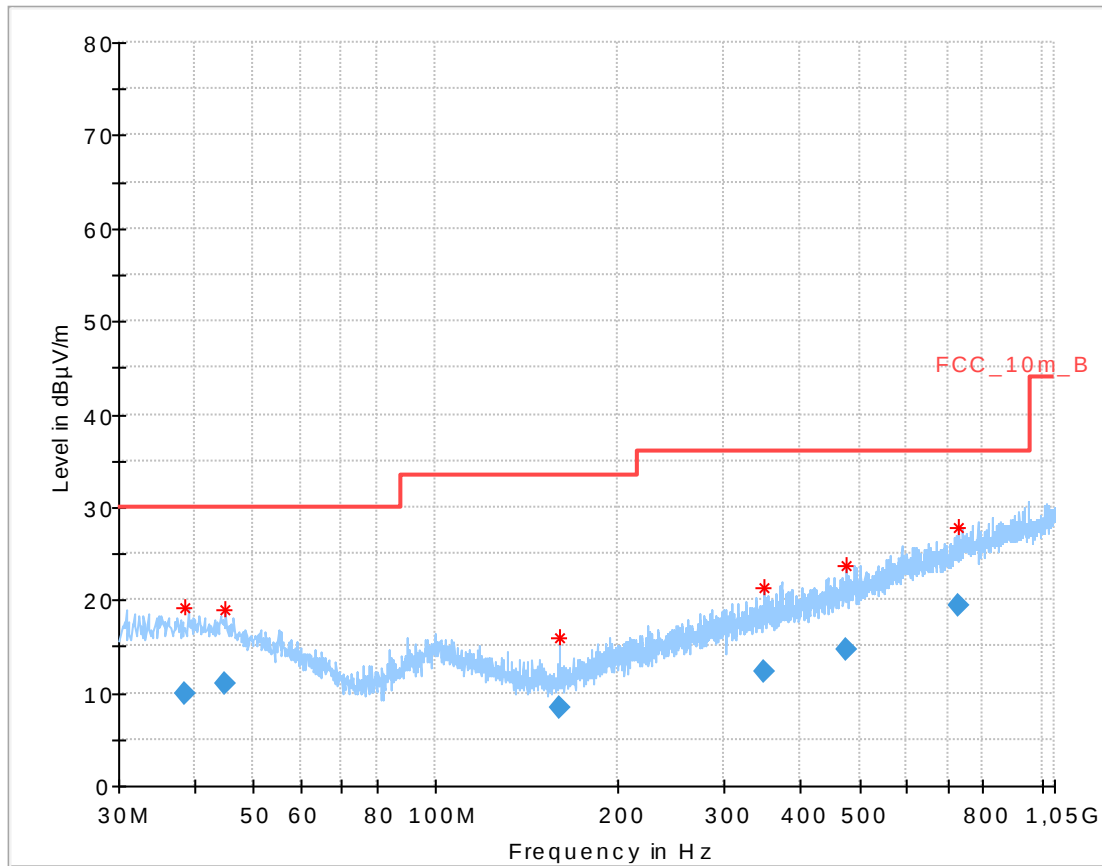
Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
44.750250	10.53	30.00	19.47	1000.0	120.000	101.0	H	295	13.9
61.935150	7.08	30.00	22.92	1000.0	120.000	98.0	V	295	10.1
98.904450	7.57	33.50	25.93	1000.0	120.000	101.0	V	-1	12.0
175.653600	6.18	33.50	27.32	1000.0	120.000	101.0	H	205	10.1
204.759900	7.88	33.50	25.62	1000.0	120.000	170.0	H	155	11.9
513.092550	15.57	36.00	20.43	1000.0	120.000	170.0	H	-25	18.9

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

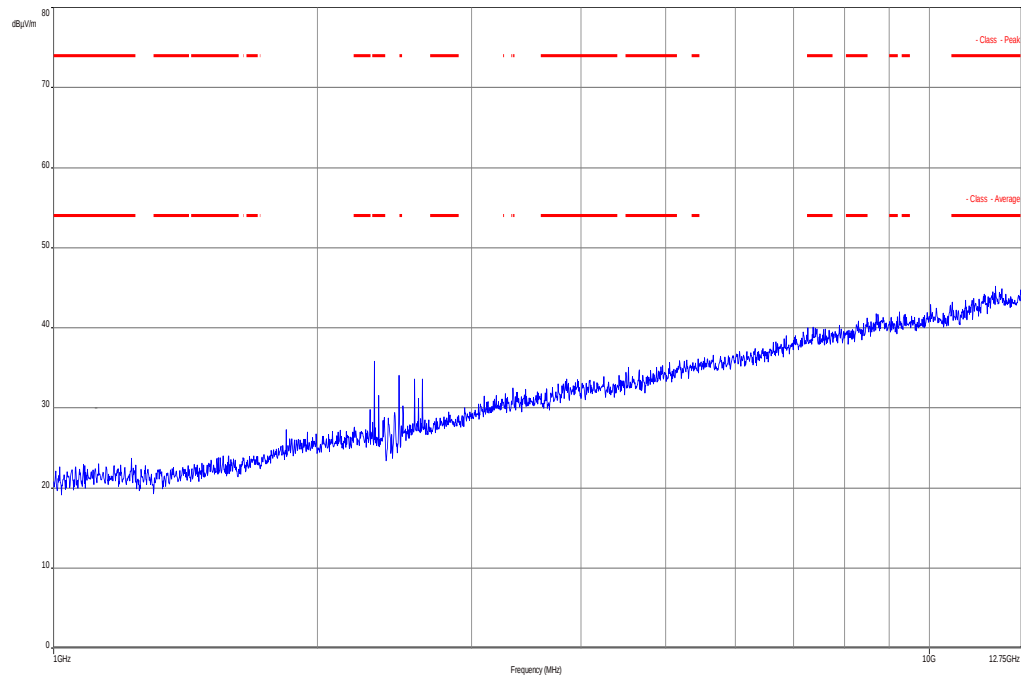
The carrier signal is notched with a 2.4 GHz band rejection filter.

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

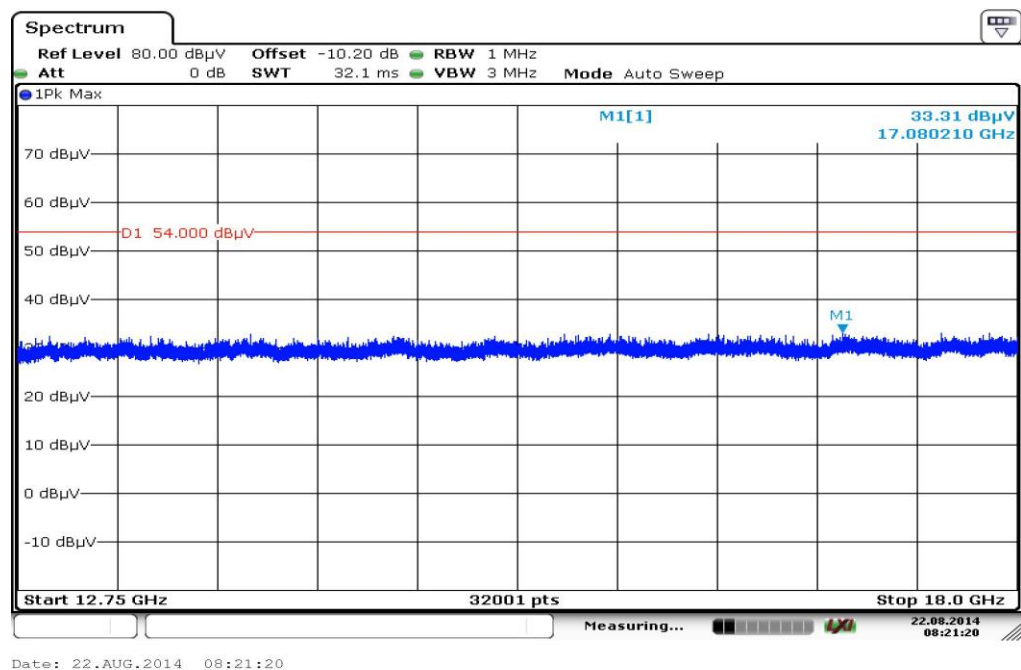
Plot 8: 18 GHz to 26 GHz, TX mode, channel 39, vertical & horizontal polarization

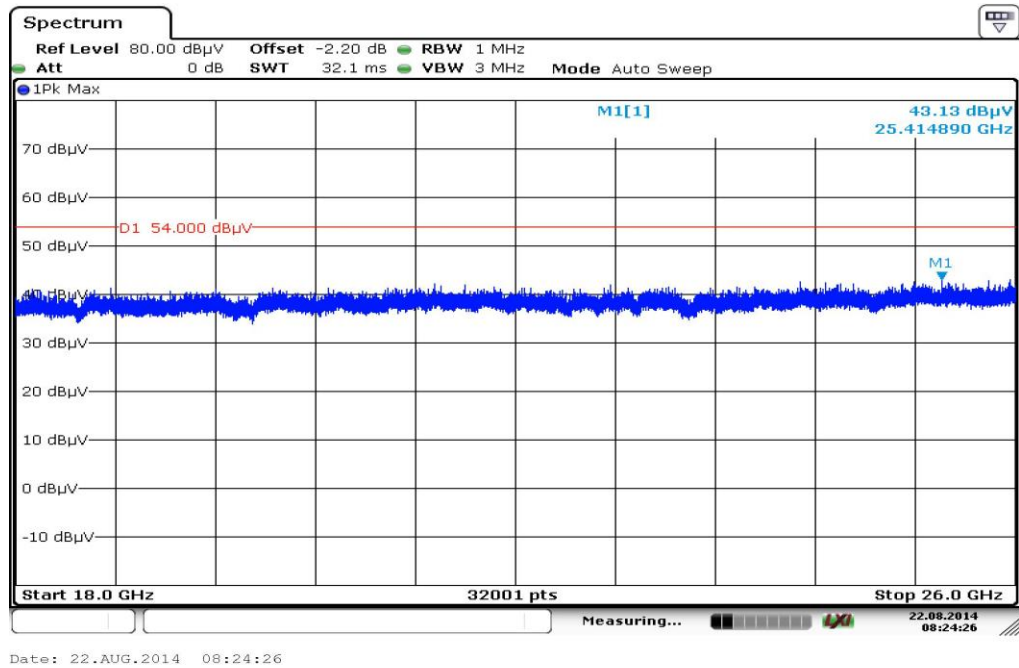
Plot 9: 30 MHz to 1 GHz, TX mode, channel 78, vertical & horizontal polarization**Final_Result:**

Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
38.561100	9.97	30.00	20.03	1000.0	120.000	101.0	V	89	14.0
45.023400	11.06	30.00	18.94	1000.0	120.000	101.0	V	115	13.9
159.947250	8.49	33.50	25.01	1000.0	120.000	170.0	V	25	9.1
349.147050	12.35	36.00	23.65	1000.0	120.000	170.0	V	115	16.0
476.596650	14.63	36.00	21.37	1000.0	120.000	98.0	H	65	18.2
730.621350	19.44	36.00	16.56	1000.0	120.000	170.0	H	205	22.2

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

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 26 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:

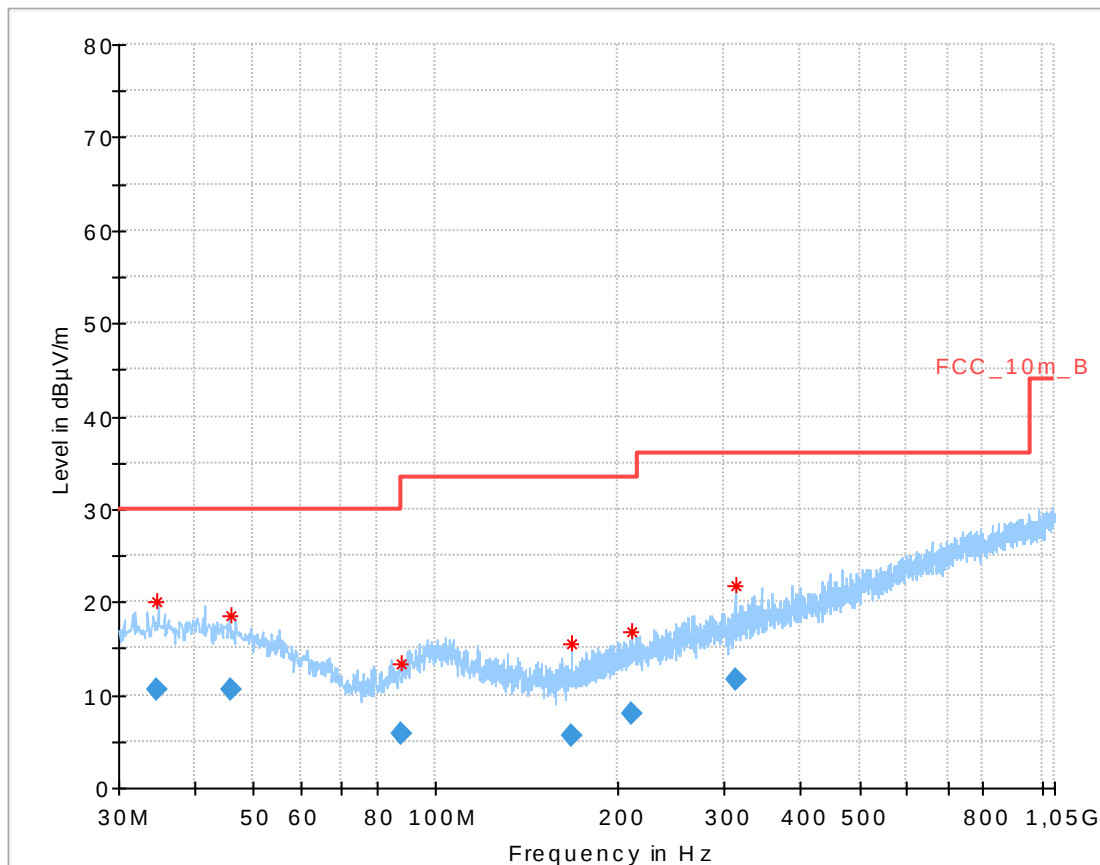
RX spurious emissions radiated [dB μ V/m]		
F [MHz]	Detector	Level [dB μ V/m]
For emissions below 1 GHz, please take a look at the table below the 1 GHz plot.		
All detected peak emissions are more than 10 dB below the average limit.		
Measurement uncertainty	± 3 dB	

Verdict: **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)

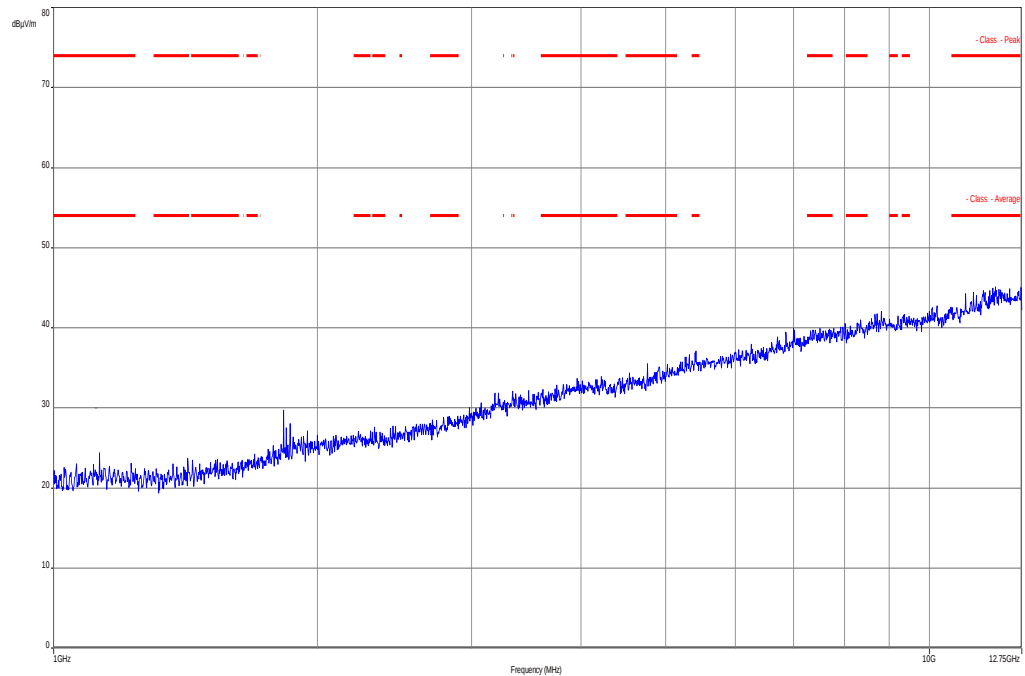
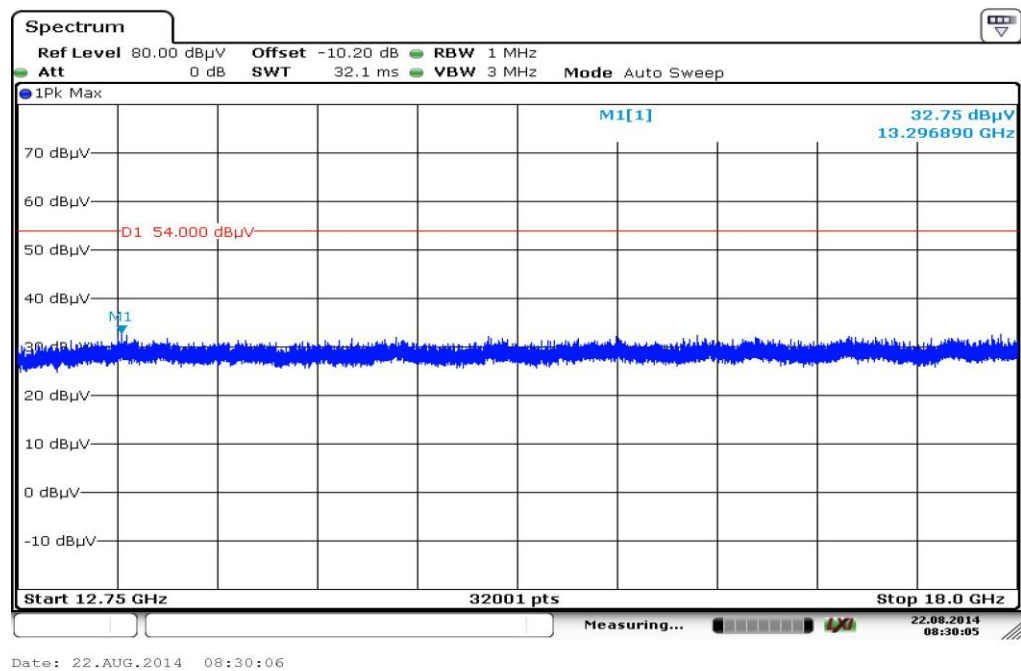
Plots:

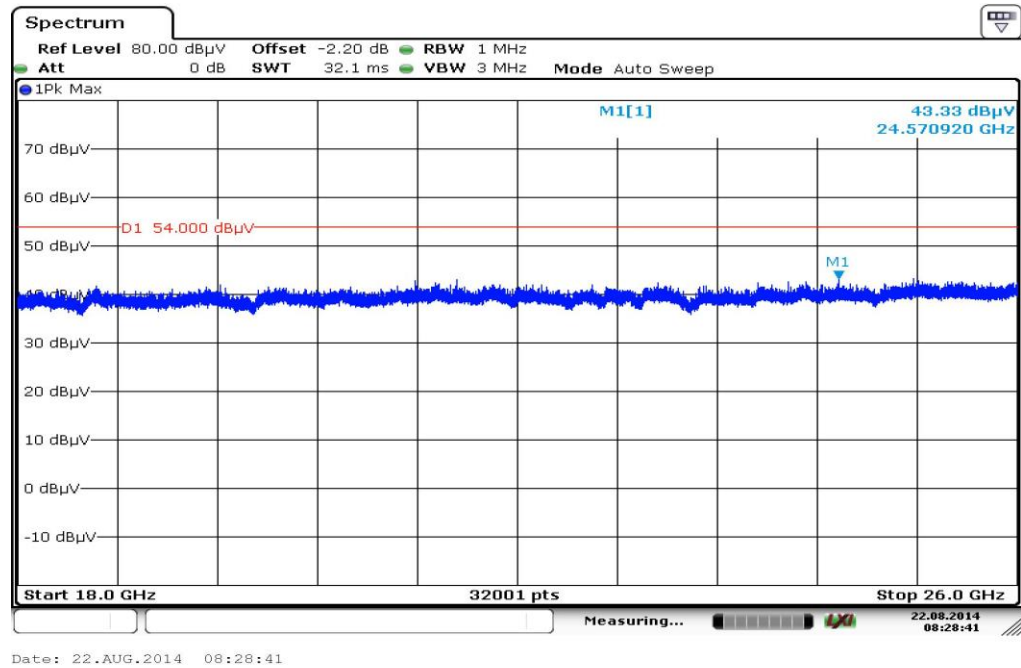
Plot 1: 30 MHz to 1 GHz, RX mode, vertical & horizontal polarization



Final_Result:

Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
34.735950	10.56	30.00	19.44	1000.0	120.000	100.0	V	295	13.8
45.819000	10.60	30.00	19.40	1000.0	120.000	101.0	V	245	13.7
87.688050	5.77	30.00	24.23	1000.0	120.000	101.0	V	25	9.9
167.369100	5.66	33.50	27.84	1000.0	120.000	101.0	V	269	9.6
210.604050	7.98	33.50	25.52	1000.0	120.000	170.0	H	295	12.1
312.091800	11.58	36.00	24.42	1000.0	120.000	170.0	V	90	14.8

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 critical 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

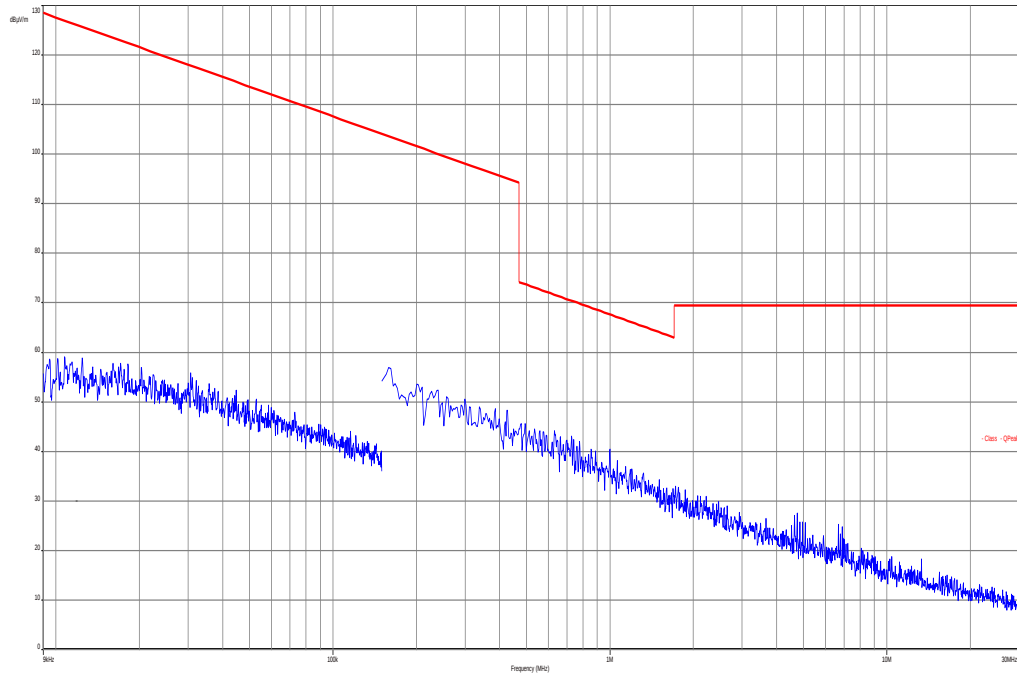
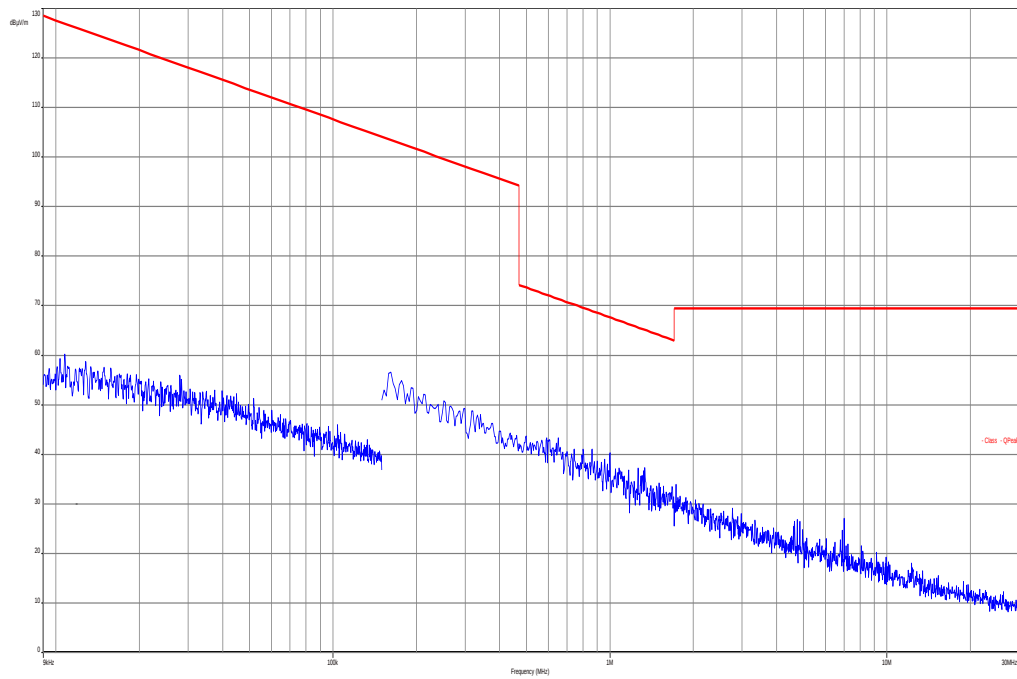
Limits:

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]
All detected peak emissions are below the average limit.		
Measurement uncertainty	± 3 dB	

Verdict: 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 critical 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 (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

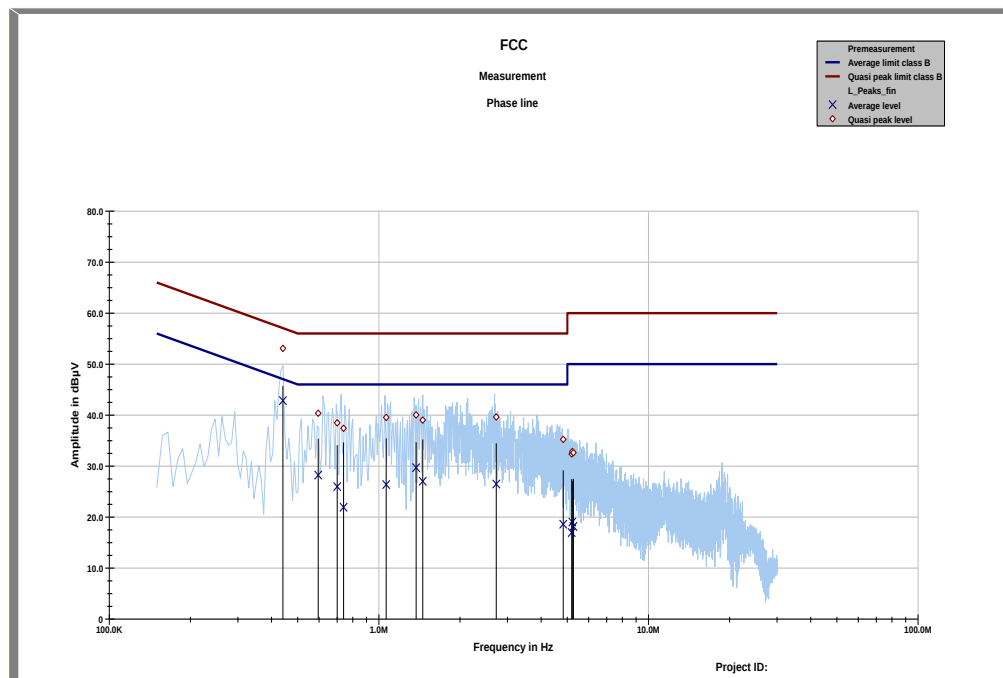
Results:

TX spurious emissions conducted < 30 MHz [dBμV/m]		
F [MHz]	Detector	Level [dBμV/m]
Please take a look at the table below the plots.		
Measurement uncertainty	± 3 dB	

Verdict: Passed

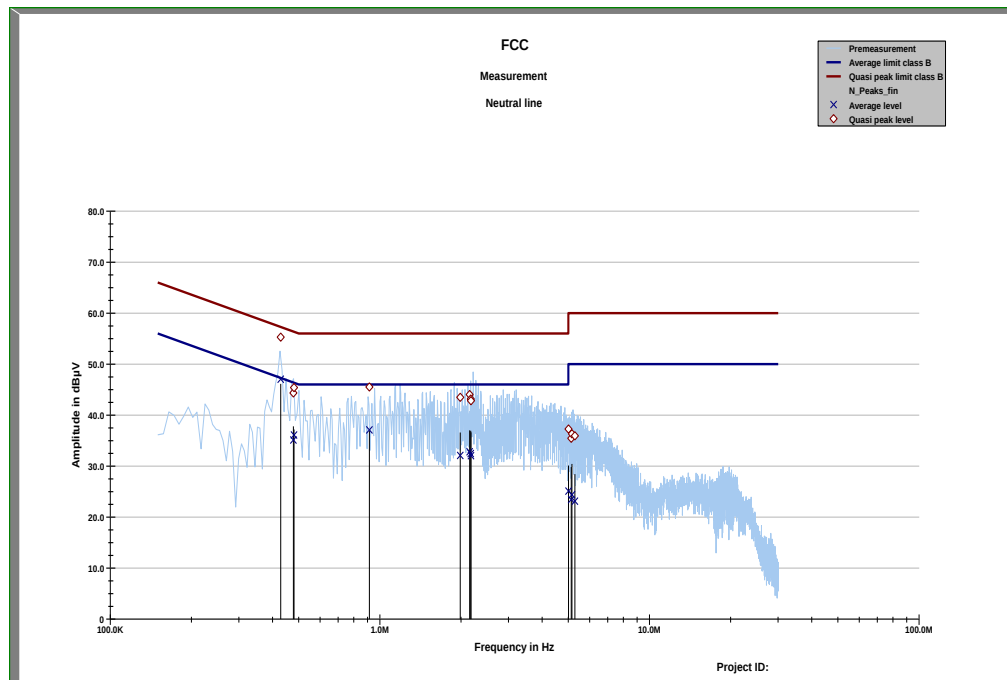
Plots:

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



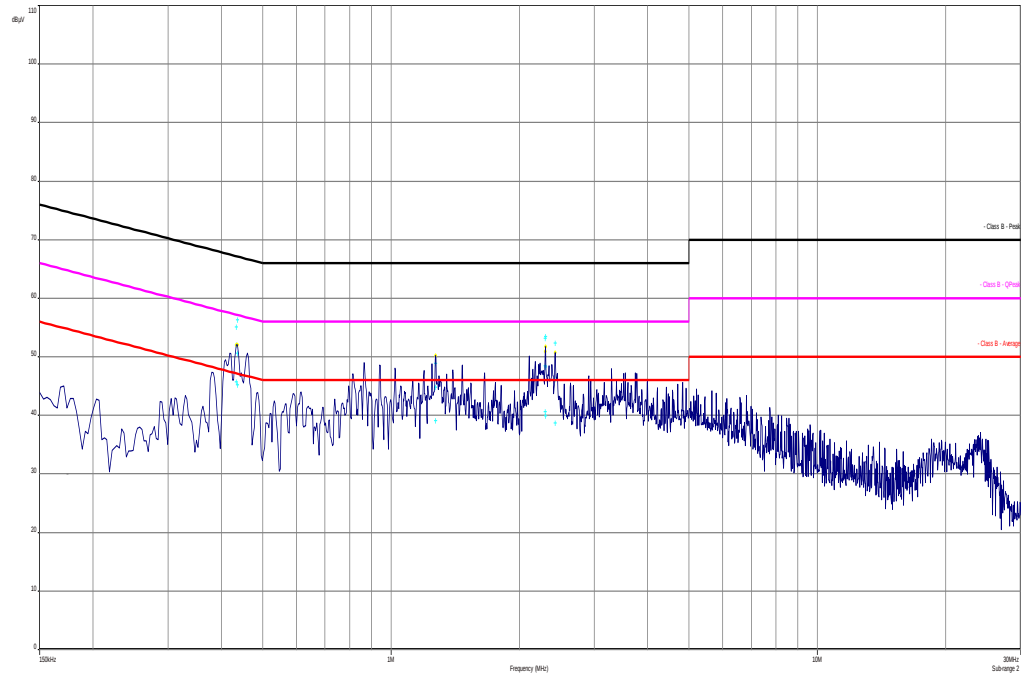
Frequency MHz	Quasi peak level dBμV	Margin quasi peak dBμV	Average level dBμV	Margin average dBμV
0.44051	53.07	3.98	42.84	4.85
0.59565	40.37	15.63	28.23	17.77
0.7006	38.47	17.53	25.98	20.02
0.73955	37.42	18.58	21.93	24.07
1.06433	39.54	16.46	26.37	19.63
1.3742	40.04	15.96	29.69	16.31
1.4541	39.02	16.98	27.03	18.97
2.7239	39.63	16.37	26.48	19.52
4.8248	35.24	20.76	18.61	27.39
5.1883	32.39	27.61	16.97	33.03
5.2175	32.86	27.14	19.03	30.97
5.2662	32.63	27.37	18.17	31.83

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

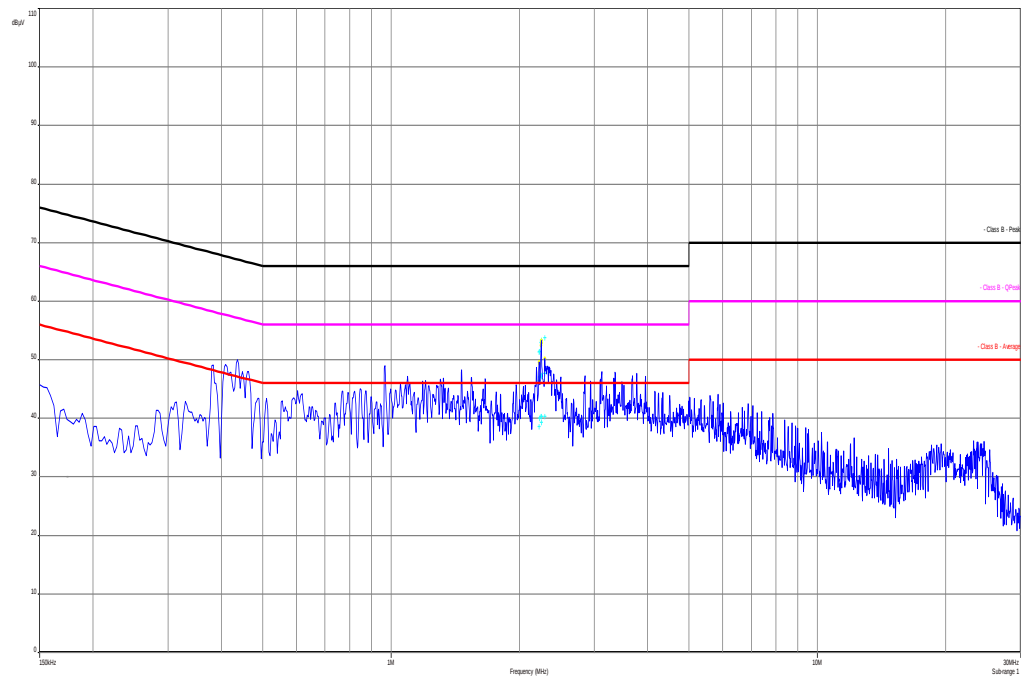


Frequency MHz	Quasi peak level dBμV	Margin quasi peak dBμV	Average level dBμV	Margin average dBμV
0.42859	55.28	2.00	47.03	1.01
0.47777	44.34	12.04	35.12	11.51
0.48014	45.40	10.94	36.09	10.48
0.91412	45.51	10.49	37.08	8.92
1.9863	43.48	12.52	32.08	13.92
2.1515	44.02	11.98	32.81	13.19
2.1724	43.15	12.85	32.45	13.55
2.1765	42.82	13.18	32.04	13.96
5.0051	37.27	22.73	25.09	24.91
5.1243	35.44	24.56	23.43	26.57
5.1529	36.32	23.68	24.38	25.62
5.2866	35.94	24.06	23.12	26.88

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 Cetecom	Kind of Calibration	Last Calibration	Next Calibration
11	45	Switch-Unit	3488A	HP Meßtechnik	2719A14505	300000368	g		
2	50	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP Meßtechnik	2920A04466	300000580	ne	21.08.2012	21.08.2014
3	n. a.	EMI Test Receiver	ESCI 3	R&S	100083	300003312	k	27.01.2014	27.01.2015
4	n. a.	Antenna Tower	Model 2175	ETS-LINDGREN	64762	300003745	izw	29.10.2013	29.10.2015
5	n. a.	Positioning Controller	Model 2090	ETS-LINDGREN	64672	300003746	izw	22.08.2012	22.08.2014
6	n. a.	Turntable Interface-Box	Model 105637	ETS-LINDGREN	44583	300003747	izw	26.08.2008	
7	n. a.	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	295	300003787	k	22.04.2014	22.04.2016
8	n. a.	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	8812-3088	300001032	vIKII	08.05.2013	08.05.2015
9	n. a.	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev		
10	n. a.	Switch / Control Unit	3488A	HP Meßtechnik	*	300000199	ne		
11	9	Artificial Mains 9 kHz to 30 MHz	ESH3-Z5	R&S	828576/020	300001210	Ve	30.01.2014	30.01.2016
12	9	Isolating Transformer	MPL IEC625 Bus Regeltrenntravo	Erfi	91350	300001155	ne	26.09.2013	26.09.2015
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	22.08.2012	22.08.2014
15	n. a.	Band Reject filter	WRCG2400/2483-2375/2505-50/10SS	Wainwright	11	300003351	ev	22.01.2014	22.01.2016
16	n. a.	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	371	300003854	vIKII	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	11b	Microwave System Amplifier, 0.5-26.5 GHz	83017A	HP Meßtechnik	00419	300002268	ev		
19	A026	Std. Gain Horn Antenna 12.4 to 18.0 GHz	639	Narda	8402	300000787	k	22.07.2013	22.07.2015
20	A029	Std. Gain Horn Antenna 18.0 to 26.5 GHz	638	Narda	8205	300002442	k	19.07.2013	19.07.2015
21	n. a.	Signal Analyzer 40 GHz	FSV40	R&S	101042	300004517	k	21.01.2014	21.01.2015
22	n. a.	Switch / Control Unit	3488A	HP Meßtechnik	87400/02	300001691	ne		
23	n. a.	Power Supply DC	NGPE 40/40	R&S	388	400000078	vIKII	21.08.2012	21.08.2014
24	n. a.	Directional Coupler	101020010	Krytar	70215	300002840	ev	30.01.2014	30.01.2016
25	n. a.	DC-Blocker	8143	Inmet Corp.	none	300002842	ne		
26	n. a.	Powersplitter	6005-3	Inmet Corp.	8905-2342	300002841	ev	13.06.2013	13.06.2015
27	n. a.	CBT (Bluetooth Tester + EDR Signalling)	CBT 1153.9000K35	R&S	100185	300003416	vIKII	21.08.2012	21.08.2014
28	n. a.	Spectrum Analyzer 9kHz to 30GHz - 140...+30dBm	FSP30	R&S	100886	300003575	k	22.08.2012	22.08.2014

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
vlk!	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	2014-08-22

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

Befehlens gemäß § 8 Absatz 1 AkkStelleG i.V.m. § 1 Absatz 1 AkkStelleGBV
 Unterzeichnerin 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 / DC, 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 Beschluss vom 07.03.2014 mit der
 Akkreditierungsnummer 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

Datei: 014001-01-01-01

Dr. Andrea Dittmann
 Akkreditierungsleiter

Deutsche Akkreditierungsstelle GmbH

Standort Berlin
 Spittelmarkt 10
 10117 Berlin

Standort Frankfurt am Main
 Gartenstraße 6
 60594 Frankfurt am Main

Standort Braunschweig
 Bundesallee 100
 38115 Braunschweig

Die auszugsweise Veröffentlichung der Akkreditierungsurkunde bedarf der vorherigen schriftlichen
 Zustimmung der Deutschen Akkreditierungsstelle GmbH (DAkkS). Ausgenommen davon ist die separate
 Weiterverbreitung des Deckblatts durch die umseitig genannte Kontaktperson der DAkkS 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 dem Gesetz 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 Vorschriften für die Akkreditierung und Marktüberwachung
 im Zusammenhang mit der Vermarktung von Produkten (Abbl. L 218 vom 9. Juli 2008, S. 30).
 Die DAkkS ist Unterzeichnerin der Multilateralen Abkommen zur gegenseitigen Anerkennung der
 Prüfungen in operation für Akkreditierung (EA), des Internationalen Accreditation Forum (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
 IAF: www.iaf.org
 ILAC: www.ilac.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.

<http://www.cetecom.com/eu/de/cetecom-group/europa/deutschland-saarbruecken/akkreditierungen.html>