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consulting - testing - certification >>>

TEST REPORT

Test report no.: 1-9611/15-01-12



Deutsche
Akkreditierungsstelle
D-PL-12076-01-00

Testing laboratory

CETECOM ICT Services GmbH

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Accredited Testing Laboratory:

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

The accreditation is valid for the scope of testing procedures as stated in the accreditation certificate with the registration number: D-PL-12076-01-00

Applicant

Bowers & Wilkins

Dale Rd, Worthing,
West Sussex BN11 2BH / UNITED KINGDOM

Phone: -/-
Fax: -/-
Contact: -/-
e-mail: -/-
Phone: -/-

Manufacturer

Bowers & Wilkins

Dale Rd, Worthing,
West Sussex BN11 2BH / UNITED KINGDOM

Test standard/s

47 CFR Part 15

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

RSS - 247 Issue 1

Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

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

Test Item

Kind of test item: **Wireless music system**

Model name: **Zeppelin Wireless**

FCC ID: **2ACIX-ZW**

IC: **11946B-ZW**

Frequency: DTS band 2400 MHz to 2483.5 MHz

Technology tested: Bluetooth®, +EDR

Antenna: Integrated antenna

Power supply: 110.0 V AC by internal power supply unit

Temperature range: +5°C to +35°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:

Joerg Warken
Lab Manager
Radio Communications & EMC

Test performed:

Mihail Dorongovskij
Testing Manager
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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2.2 Application details

Date of receipt of order:	2015-04-22
Date of receipt of test item:	2015-05-28
Start of test:	2015-05-28
End of test:	2015-05-29
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 - 247 Issue 1	2015-05	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

3.1 Measurement guidance

DTS : KDB 558074	2014-06	Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247
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4 Test environment

Temperature:	T_{nom}	+22 °C during room temperature tests
	T_{max}	No tests under extreme conditions
	T_{min}	No tests under extreme conditions
Relative humidity content:		54 %
Barometric pressure:		not relevant for this kind of testing
Power supply:	V_{nom}	110.0 V AC by internal power supply unit
	V_{max}	No tests under extreme conditions
	V_{min}	No tests under extreme conditions

5 Test item

Kind of test item	:	Wireless music system
Type identification	:	Zeppelin Wireless
PMN	:	Zeppelin Wireless
HMN	:	-/-
HVIN	:	Zeppelin Wireless
FVIN	:	MCU 1.00, WiFi CP15, BT 1.1
S/N serial number	:	Rad. 1503-TR110095 Cond. 1503-TR110088
HW hardware status	:	TR1
SW software status	:	v1.00
Frequency band	:	DTS band 2400 MHz to 2483.5 MHz (lowest channel 2402 MHz; highest channel 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	:	110.0 V AC by internal power supply unit
Temperature range	:	+5°C to +35°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:
 1-9611/15-01-01_AnnexA
 1-9611/15-01-01_AnnexB
 1-9611/15-01-01_AnnexD

6 Test laboratories sub-contracted

None

7 Description of the test setup

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 analysers are connected to an external high-precision 10 MHz reference (GPS-based or rubidium frequency standard).

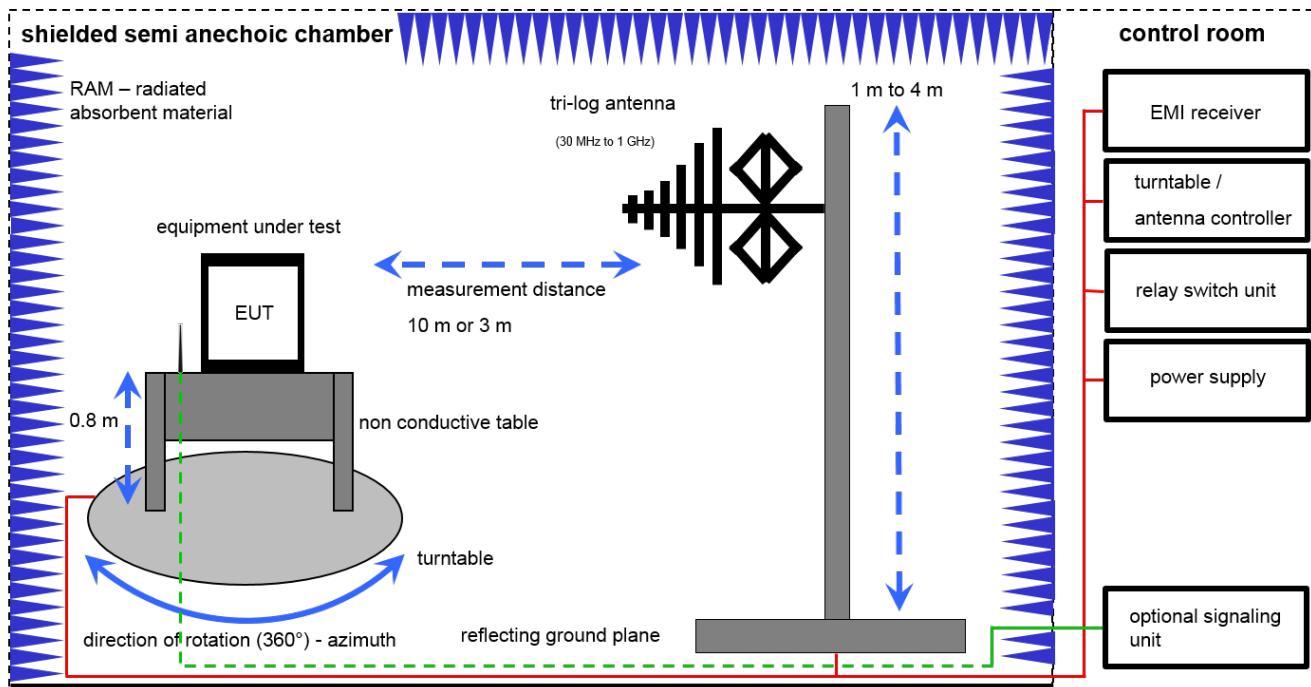
In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

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
vk!l!	Attention: extended calibration interval	*	next calibration ordered / currently in progress
NK!	Attention: not calibrated		

7.1 Shielded semi anechoic chamber

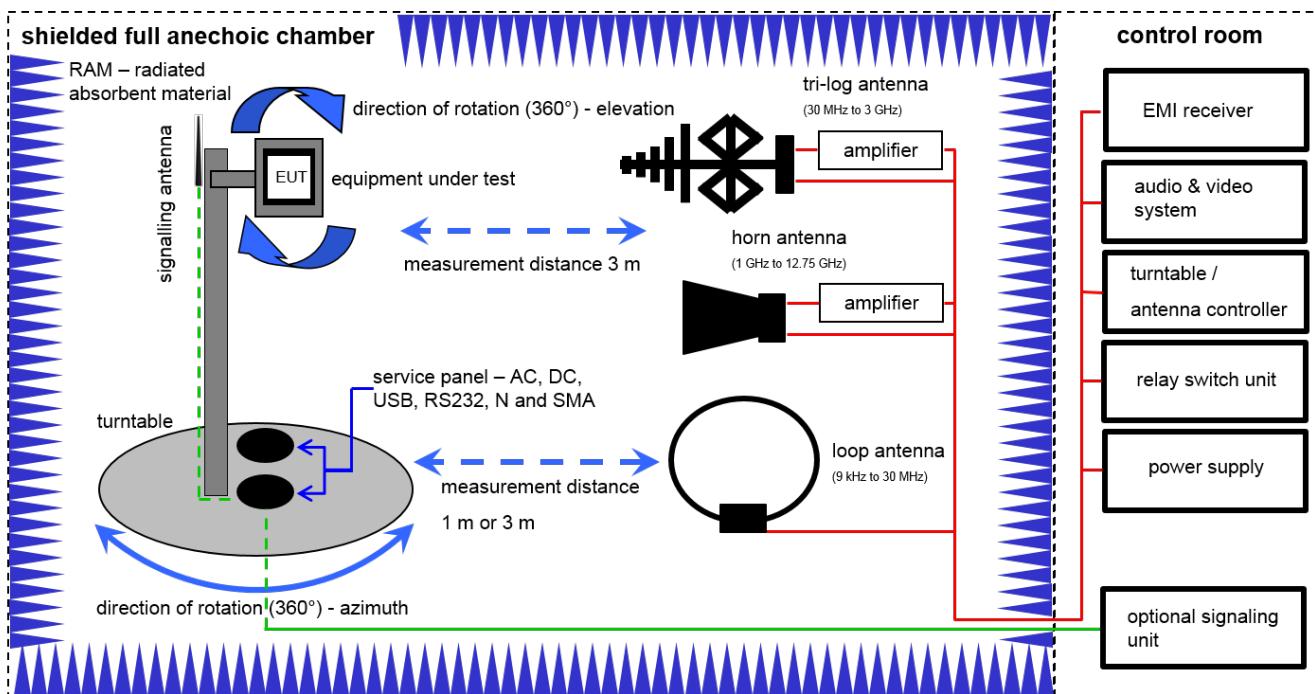
The radiated measurements are performed in vertical and horizontal plane in the frequency range from 9 kHz to 1 GHz in semi-anechoic chambers. The EUT is positioned on a non-conductive support with a height of 0.80 m above a conductive ground plane that covers the whole chamber. The receiving antennas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

No.	Lab / Item	Equipment	Type	Manufact.	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	45	Switch-Unit	3488A	HP	2719A14505	300000368	ev		
2	45	EMI Test Receiver	ESCI 3	R&S	100083	300003312	k	26.01.2015	26.01.2016
3	45	Antenna Tower	Model 2175	ETS-Lindgren	64762	300003745	izw		
4	45	Positioning Controller	Model 2090	ETS-Lindgren	64672	300003746	izw		
5	45	Turntable Interface-Box	Model 105637	ETS-Lindgren	44583	300003747	izw		
6	45	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	295	300003787	k	22.04.2014	22.04.2016
7	n. a.	Bluetooth Tester	CBT35	R&S	100635	300003907	k	28.05.2014	28.05.2016

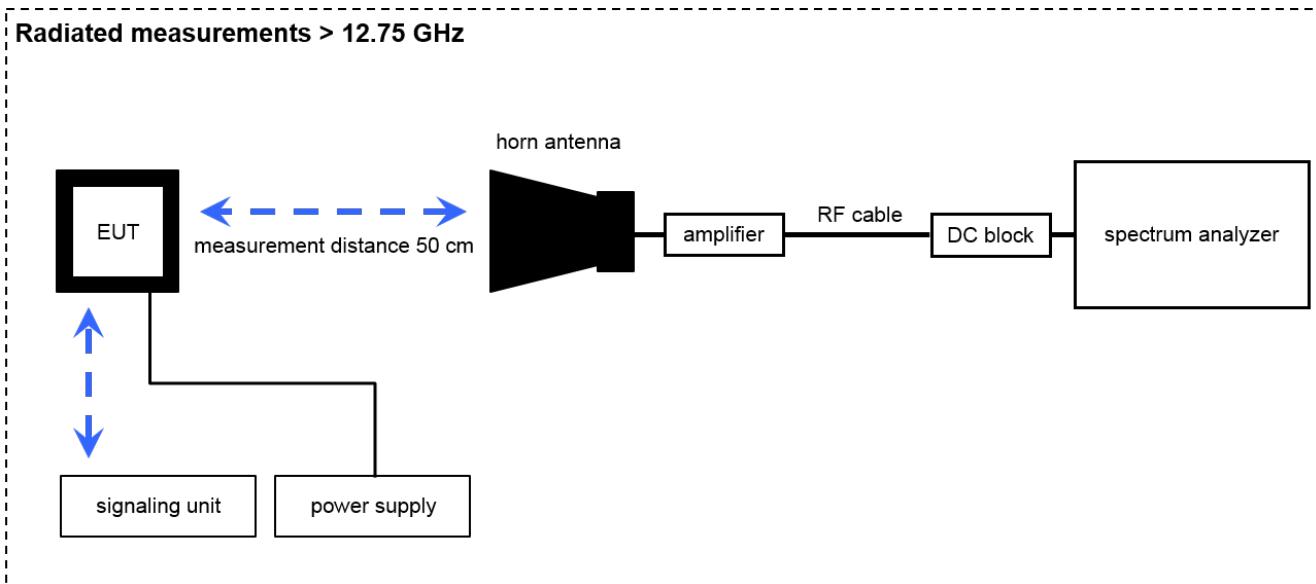
7.2 Shielded fully anechoic chamber



Equipment table:

No.	Lab / Item	Equipment	Type	Manufact.	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	n. a.	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	8812-3088	300001032	vIKI!	20.05.2015	20.05.2017
2	n. a.	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev		
3	n. a.	Switch / Control Unit	3488A	HP	*	300000199	ne		
4	n. a.	Amplifier	js42-00502650-28-5a	Parzich GMBH	928979	300003143	ne		
5	n. a.	Band Reject filter	WRCG2400/2483-2375/2505-50/10SS	Wainwright	11	300003351	ev		
6	n. a.	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	371	300003854	vIKI!	29.10.2014	29.10.2017
7	n. a.	MXE EMI Receiver 20 Hz to 26,5 GHz	N9038A	Agilent Technologies	MY51210197	300004405	k	06.03.2015	06.03.2016
8	n. a.	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000037	300004509	ne		
9	n. a.	Bluetooth Tester	CBT35	R&S	100635	300003907	k	28.05.2014	28.05.2016
10	90	Active Loop Antenna 10 kHz to 30 MHz	6502	Kontron Psychotech	8905-2342	300000256	k	13.06.2013	13.06.2015

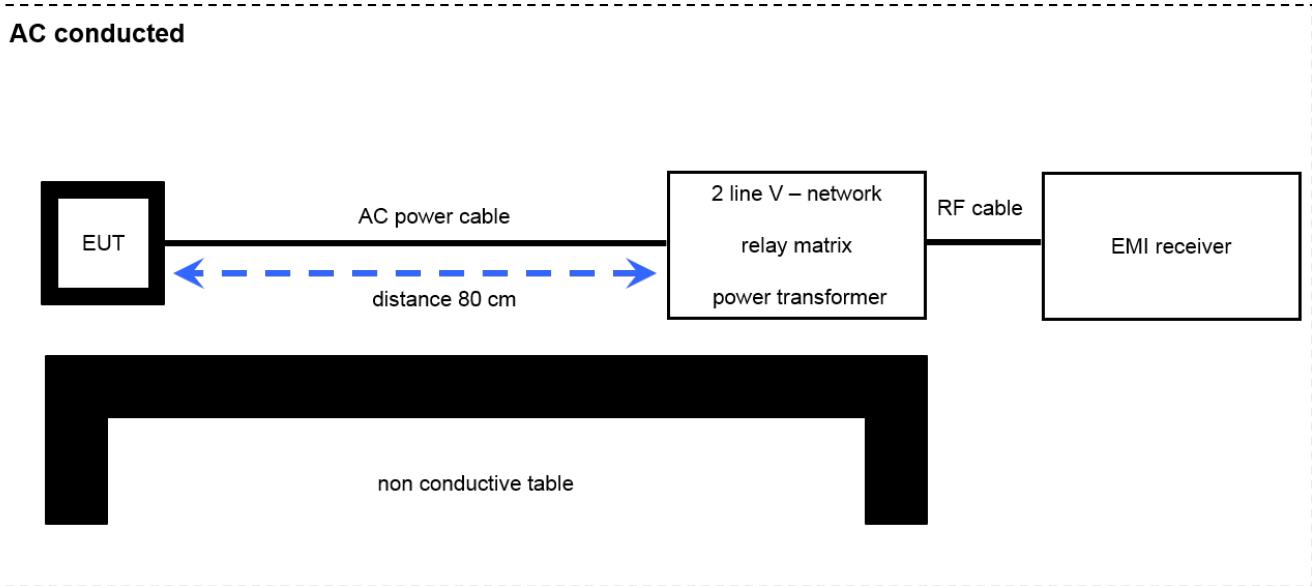
7.3 Radiated measurements > 12.75 GHz



Equipment table:

No.	Lab / Item	Equipment	Type	Manufact.	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	n. a.	Bluetooth Tester	CBT35	R&S	100635	300003907	k	28.05.2014	28.05.2016
2	n. a.	Amplifier 2-40 GHz	JS32-02004000-57-5P	MITEQ	1777200	300004541	ev	20.05.2015	20.05.2017
3	A026	Std. Gain Horn Antenna 12.4 to 18.0 GHz	639	Narda	8402	300000787	k	22.07.2013	22.07.2015
4	A029	Std. Gain Horn Antenna 18.0 to 26.5 GHz	638	Narda	8205	300002442	k	19.07.2013	19.07.2015
5	A029	Signal Analyzer 40 GHz	FSV40	R&S	101042	300004517	k	22.01.2015	22.01.2016

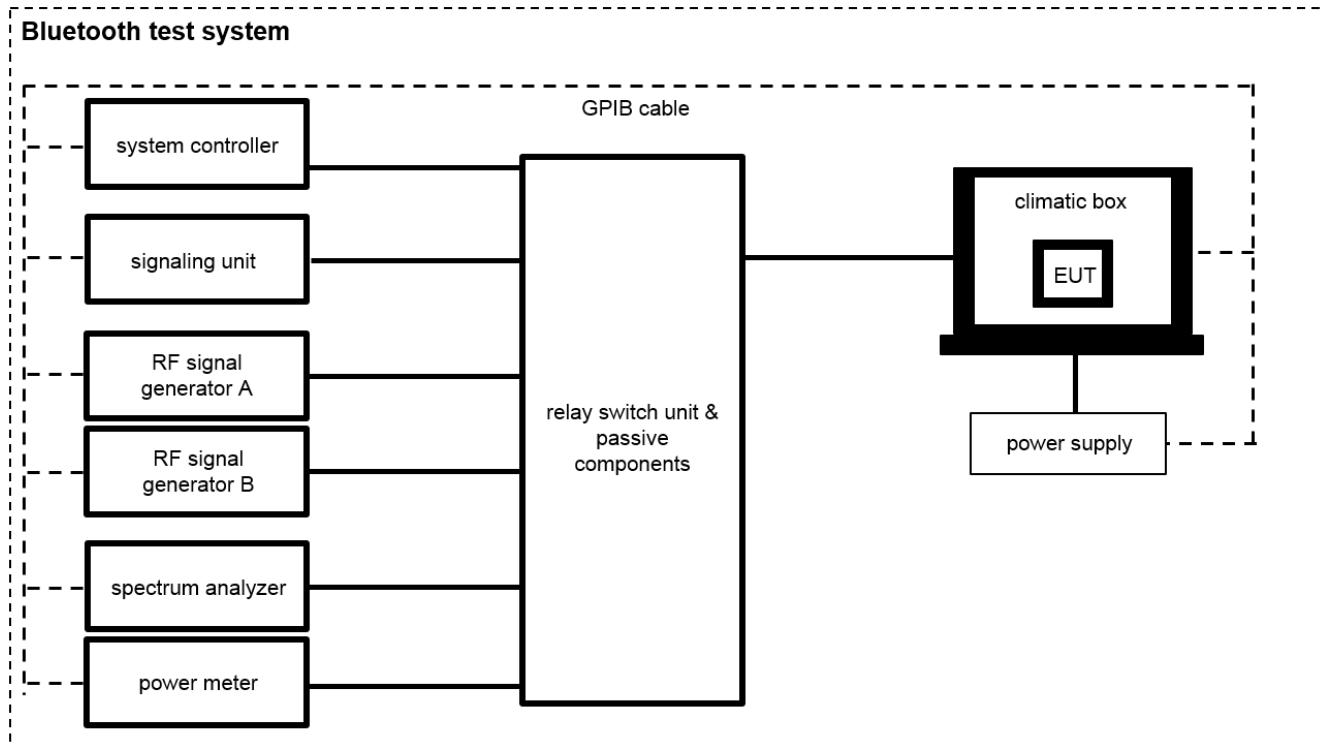
7.4 AC conducted



Equipment table:

No.	Lab / Item	Equipment	Type	Manufact.	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	n. a.	Bluetooth Tester	CBT35	R&S	100635	300003907	k	28.05.2014	28.05.2016
2	n. a.	Isolating Transformer	RT5A	Grundig	8041	300001626	g		
3	9	Artificial Mains 9 kHz to 30 MHz	ESH3-Z5	R&S	828576/020	300001210	Ve	30.01.2014	30.01.2016
4	9	Relais Matrix	PSU	R&S	890167/024	300001168	ne		

7.5 Conducted measurements BT system



Equipment table:

No.	Lab / Item	Equipment	Type	Manufact.	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	n. a.	Switch / Control Unit	3488A	HP		300001691	ne		
2	n. a.	Signal Analyzer 20Hz-26,5GHz-150 to + 30 DBM	FSIQ26	R&S	835540/018	300002681	k	30.01.2014	30.01.2016
3	n. a.	Frequency Standard (Rubidium Frequency Standard)	MFS (Rubidium)	R&S (Datum)	002	300002681	Ve	29.01.2015	29.01.2017
4	n. a.	Temperature Test Chamber	VT 4002	Heraeus Voetsch	58566046820010	300003019	Ve	26.09.2013	26.09.2015
5	n. a.	CBT (Bluetooth Tester + EDR Signalling)	CBT 1153.9000K35, CBT-B55, CBT-K55	R&S	100313	300003516	vIKI!	26.08.2014	26.08.2016
6	n. a.	USB/GPIB interface	82357B	Agilent Technologies	MY52103346	300004390	ne		
7	n. a.	Wideband Power Sensor, 50 MHz to 18 GHz	NRP-Z81	R&S	102585	300004863	k	21.01.2015	21.01.2016
8	n. a.	Messplatzrechner	Tecline	F+W	102585	300003580	ne		

8 Summary of measurement results

<input checked="" type="checkbox"/>	No deviations from the technical specifications were ascertained
<input type="checkbox"/>	There were deviations from the technical specifications ascertained
<input type="checkbox"/>	This test report is only a partial test report. The content and verdict of the performed test cases are listed below.

TC Identifier	Description	Verdict	Date	Remark
RF-Testing	CFR Part 15 RSS - 247, Issue 1	See table!	2015-06-24	-/-

Test specification clause	Test case	Temperature conditions	Power source voltages	Mode	Pass	Fail	NA	NP	Remark
§15.247(b)(4) RSS - 247 / 5.4 (2)	System gain	Nominal	Nominal	GFSK	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§15.247(a)(1) RSS - 247 / 5.1 (2)	Carrier frequency separation	Nominal	Nominal	GFSK	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§15.247(a)(1) RSS - 247 / 5.1 (4)	Number of hopping channels	Nominal	Nominal	GFSK	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§15.247(a)(1) (iii) RSS - 247 / 5.1 (4)	Time of occupancy (dwell time)	Nominal	Nominal	GFSK Pi/4 DQPSK 8 DPSK	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§15.247(a)(1) RSS - 247 / 5.1 (1)	Spectrum bandwidth of a FHSS system 20 dB bandwidth	Nominal	Nominal	GFSK Pi/4 DQPSK 8 DPSK	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	complies
§15.247(b)(1) RSS - 247 / 5.4 (2)	Maximum output power	Nominal	Nominal	GFSK Pi/4 DQPSK 8 DPSK	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	complies
§15.247(d) RSS - 247 / 5.5	Detailed spurious emissions @ the band edge - conducted	Nominal	Nominal	GFSK Pi/4 DQPSK 8 DPSK	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	complies
§15.205 RSS - 247 / 5.5 RSS - Gen	Band edge compliance radiated	Nominal	Nominal	GFSK Pi/4 DQPSK 8 DPSK	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	complies
§15.247(d) RSS - 247 / 5.5	Spurious emissions conducted	Nominal	Nominal	GFSK Pi/4 DQPSK 8 DPSK	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	complies
§15.209(a) RSS - Gen	Spurious emissions radiated below 30 MHz	Nominal	Nominal	GFSK	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§15.247(d) RSS - 247 / 5.5 §15.109 RSS - Gen	Spurious emissions radiated 30 MHz to 1 GHz	Nominal	Nominal	GFSK	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§15.247(d) RSS-247 / 5.5 §15.109 RSS-Gen	Spurious emissions radiated above 1 GHz	Nominal	Nominal	GFSK	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§15.107(a) §15.207	Conducted emissions below 30 MHz (AC conducted)	Nominal	Nominal	GFSK	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies

Note: NA = Not Applicable; NP = Not Performed

9 Additional comments

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

Reference documents: 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 System 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
Resolution bandwidth:	3 MHz
Video 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		3.0	2.5	2.2
Radiated power [dBm] Measured with GFSK modulation		3.7	4.1	3.7
Gain [dBi] Calculated		0.7	1.6	1.5

Verdict: **complies**

10.2 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

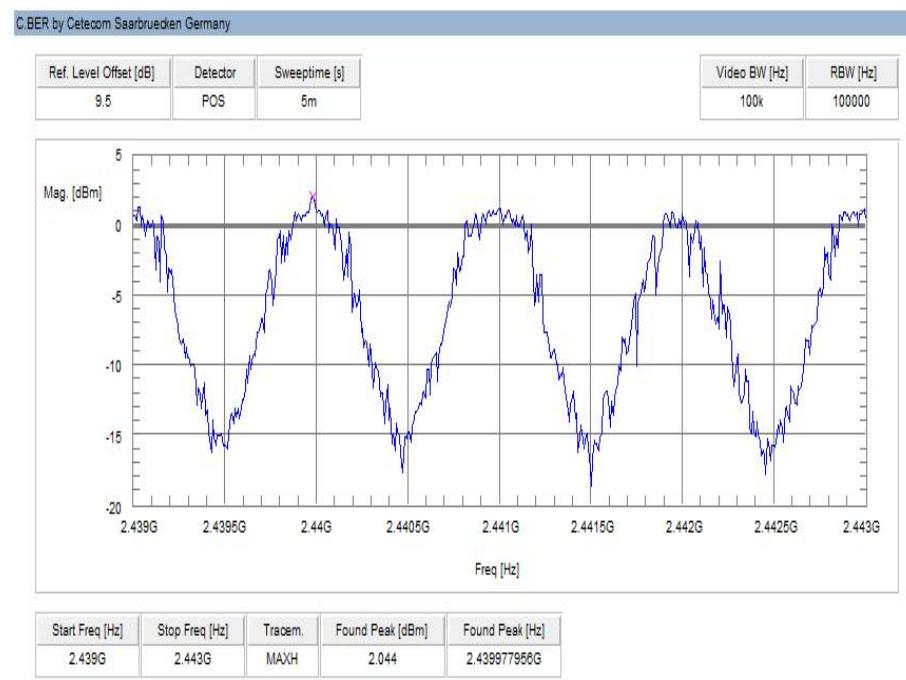
Limits:

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: **complies**

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

10.3 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

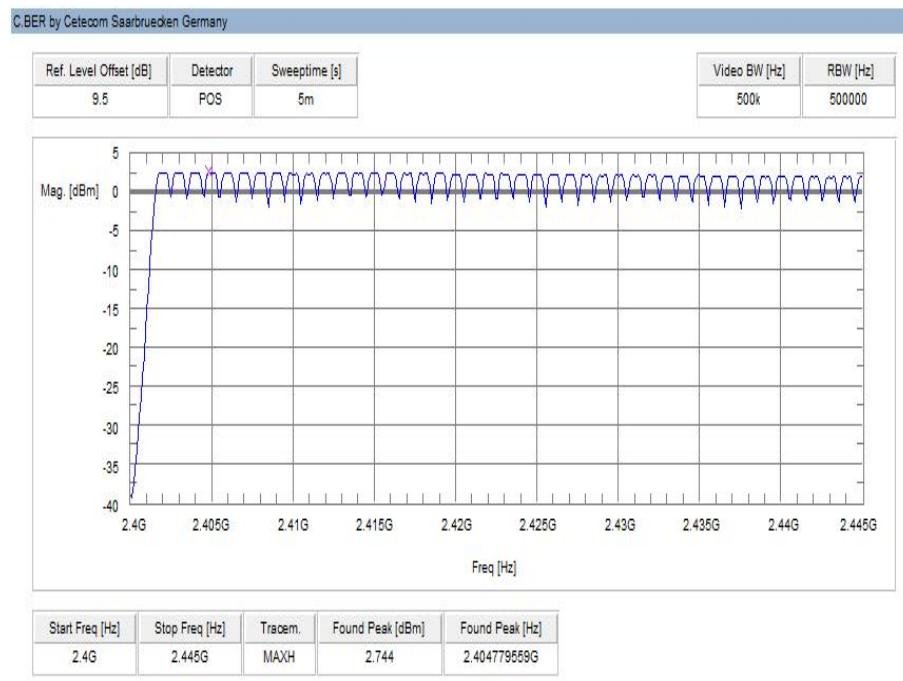
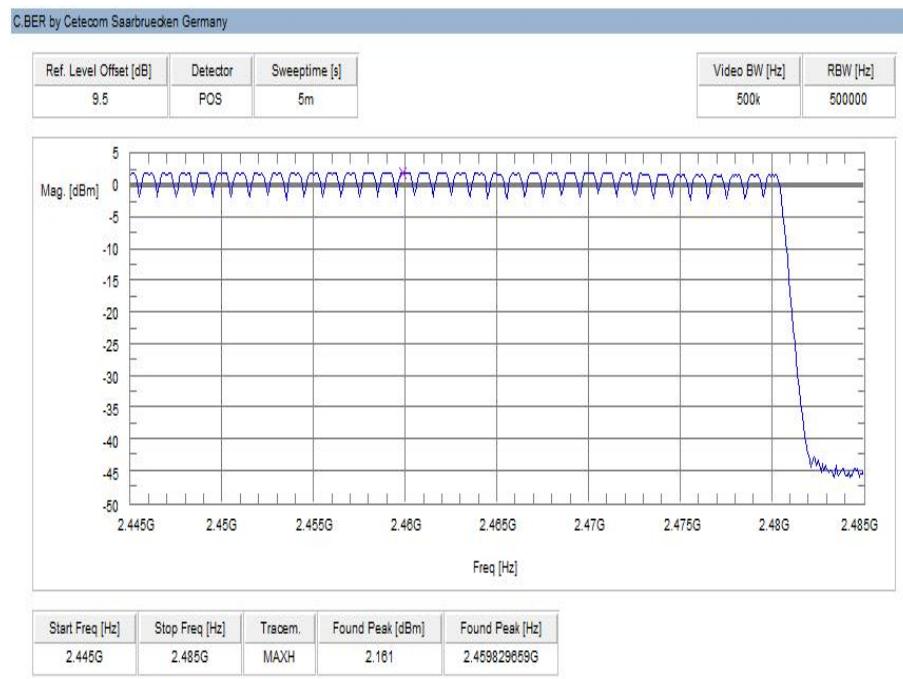
Limits:

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

Result:

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

Verdict: **complies**

Plots:**Plot 1:** Number of hopping channels (GFSK modulation)**Plot 2:** Number of hopping channels (GFSK modulation)

10.4 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:

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

Example for a DH1 packet (with a maximum length of one time slot)

$$\text{Channel staying time} = 625 \mu\text{s} * 1600 * 1/\text{s} / 79 * 31.6 \text{ s} = 0.4 \text{ s} (\text{in a } 31.6 \text{ s period})$$

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)

$$\text{Channel staying time} = 3 * 625 \mu\text{s} * 1600 / 3 * 1/\text{s} / 79 * 31.6 \text{ s} = 0.4 \text{ s} (\text{in a } 31.6 \text{ s period})$$

Example for a DH5 packet (with a maximum length of five time slots)

$$\text{Channel staying time} = 5 * 625 \mu\text{s} * 1600 / 5 * 1/\text{s} / 79 * 31.6 \text{ s} = 0.4 \text{ s} (\text{in a } 31.6 \text{ s period})$$

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.	

Verdict: **complies**

10.5 Spectrum bandwidth of a FHSS system – 20 dB bandwidth

Description:

Measurement of the 20 dB 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

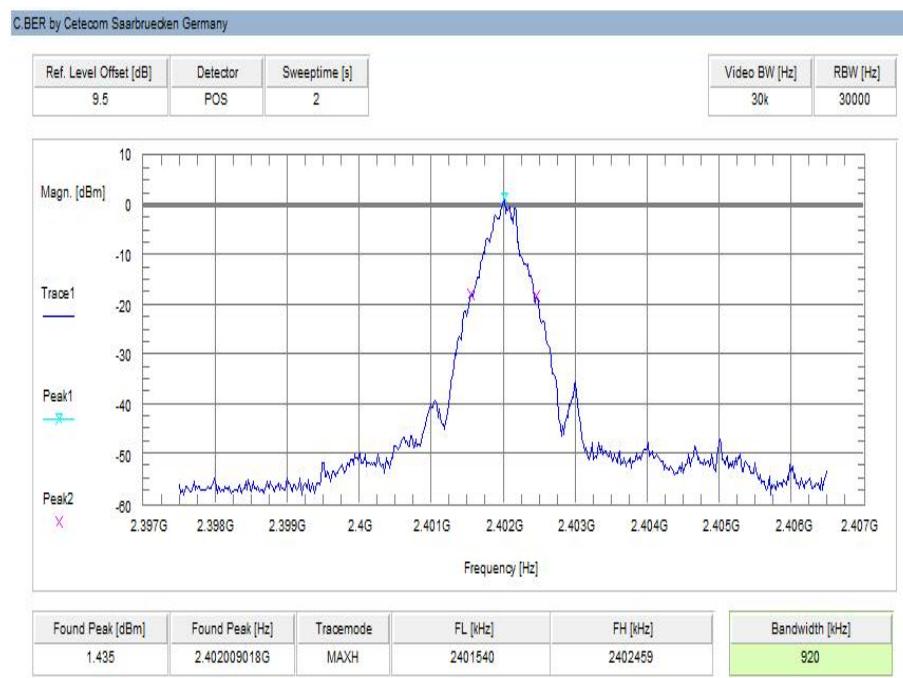
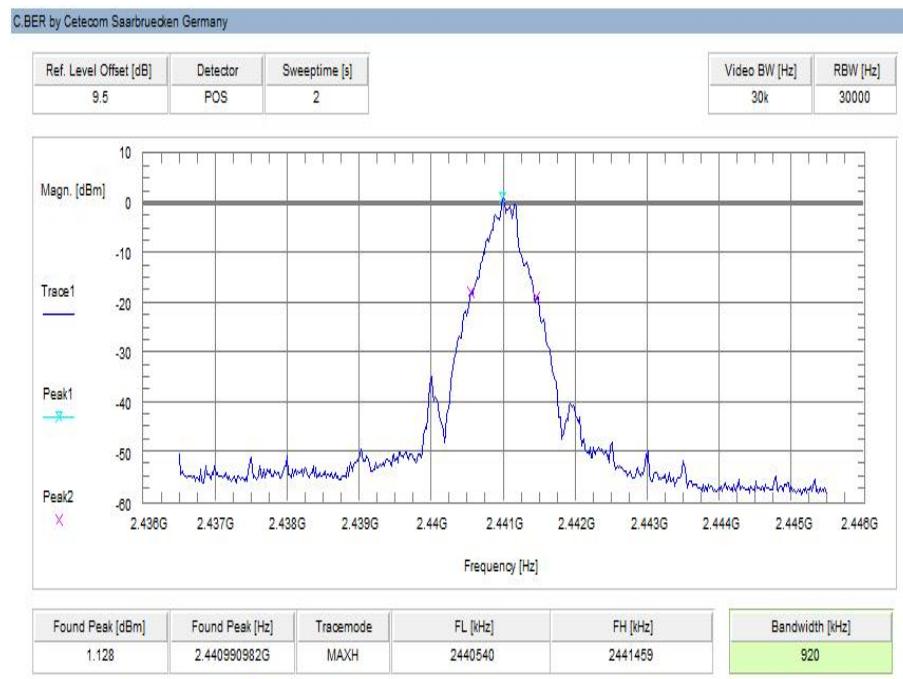
Limits:

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

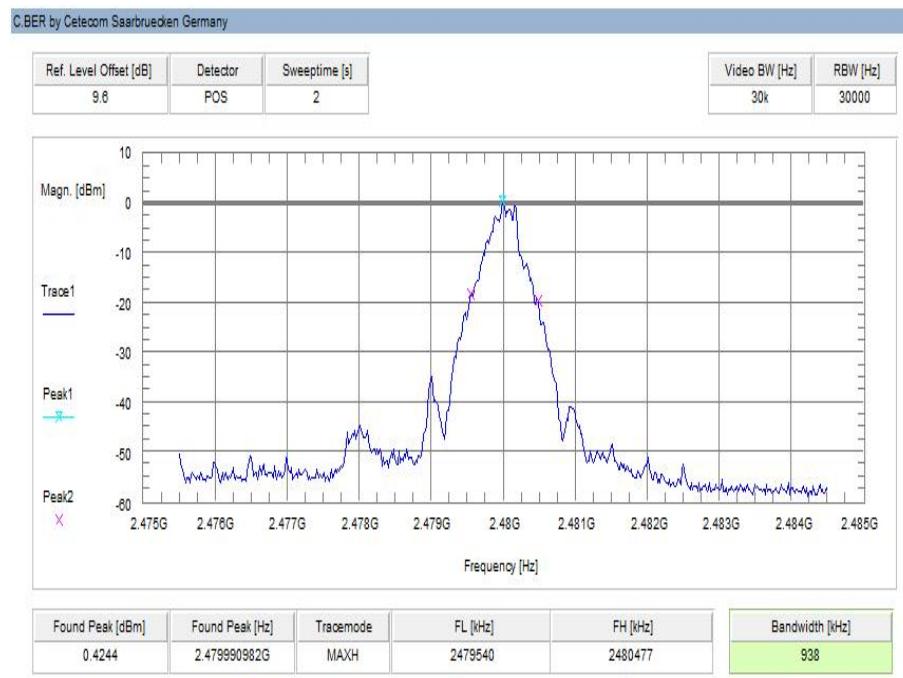
Results:

Modulation	20 dB bandwidth [kHz]		
	2402 MHz	2441 MHz	2480 MHz
GFSK	920	920	938
Pi/4 DQPSK	1263	1244	1263
8DPSK	1263	1263	1263
Measurement uncertainty	± 10 kHz		

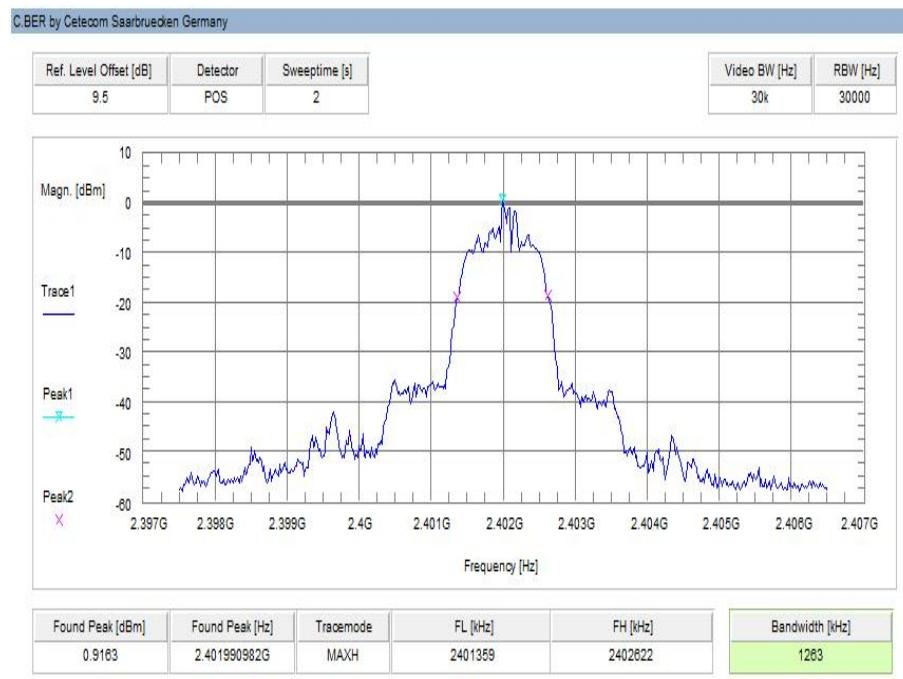
Verdict: **complies**

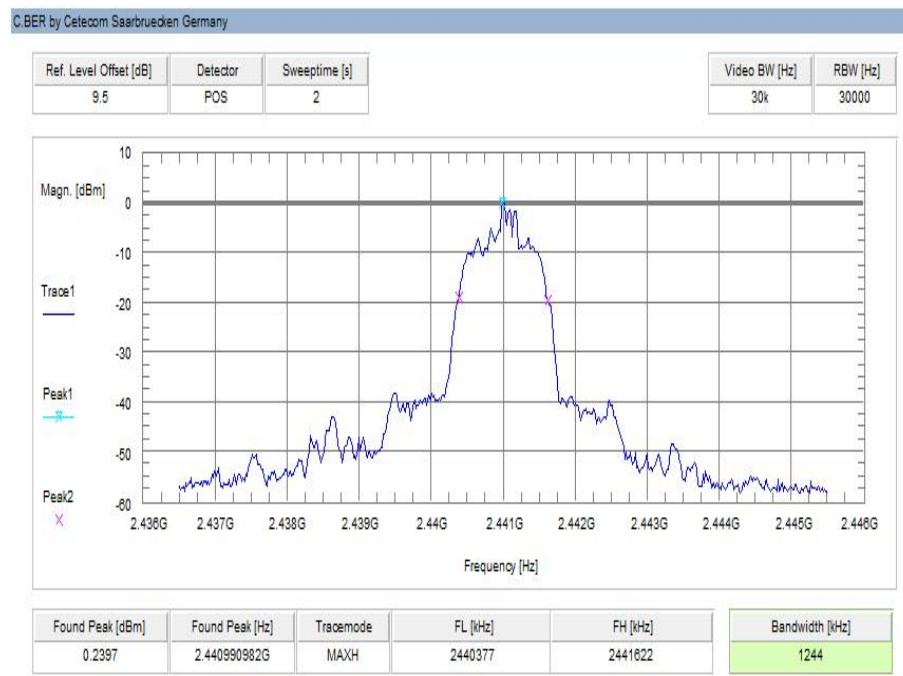
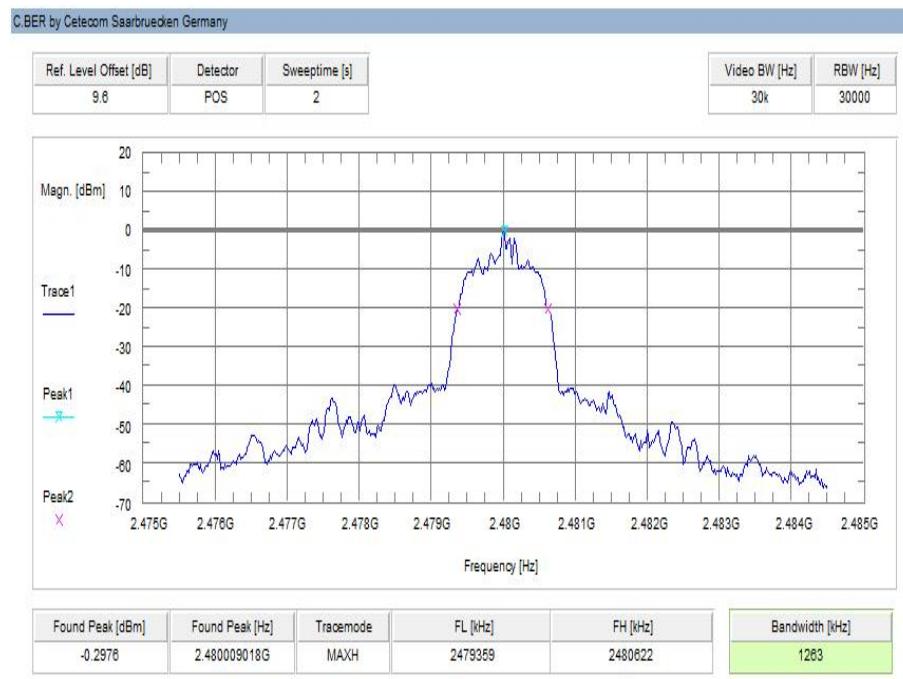
Plots:**Plot 1: lowest channel – 2402 MHz, GFSK modulation****Plot 2: middle channel – 2441 MHz, GFSK modulation**

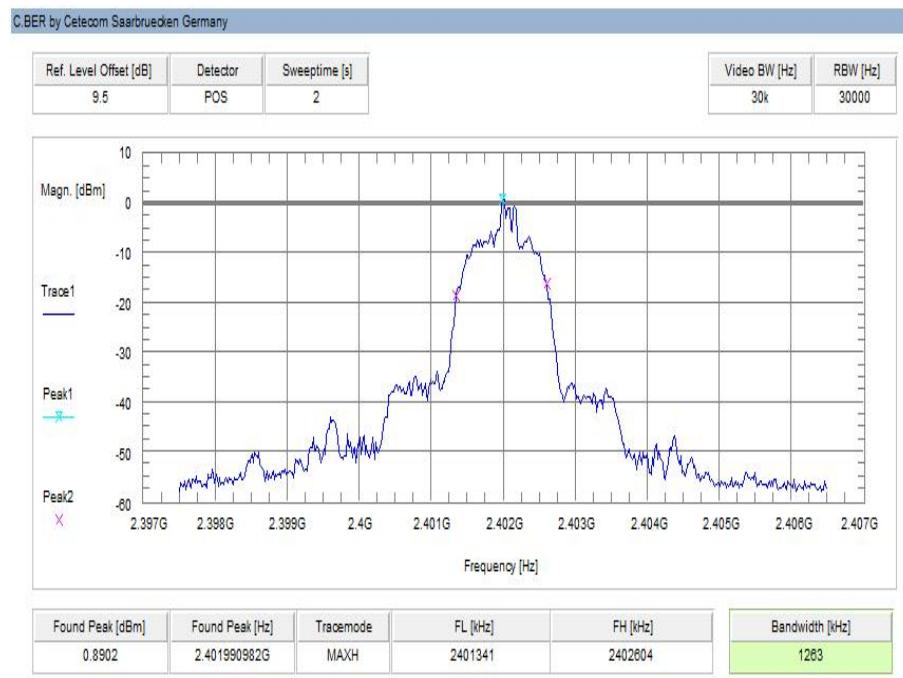
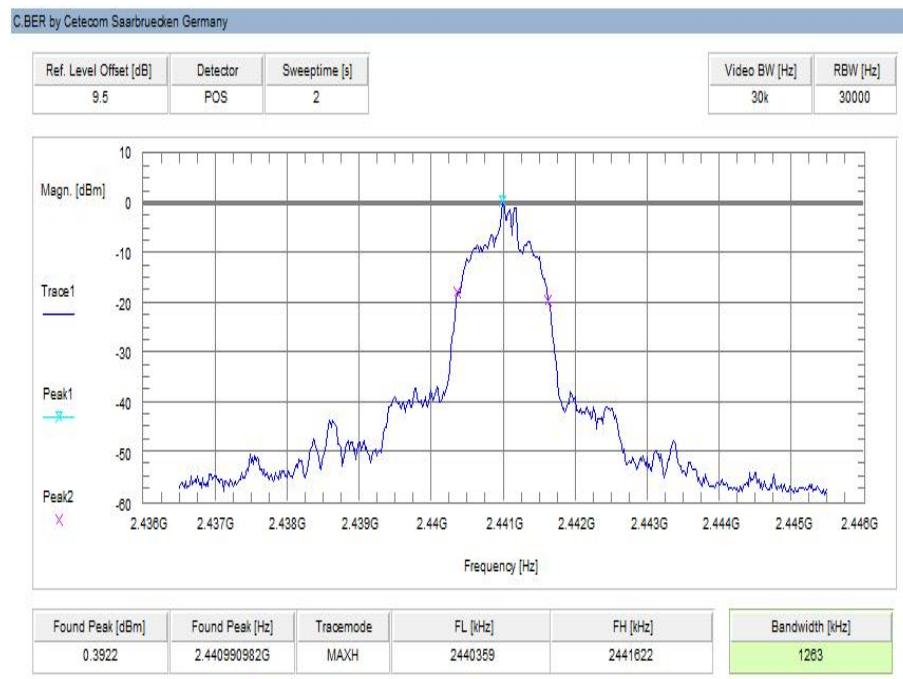
Plot 3: highest channel – 2480 MHz, GFSK modulation

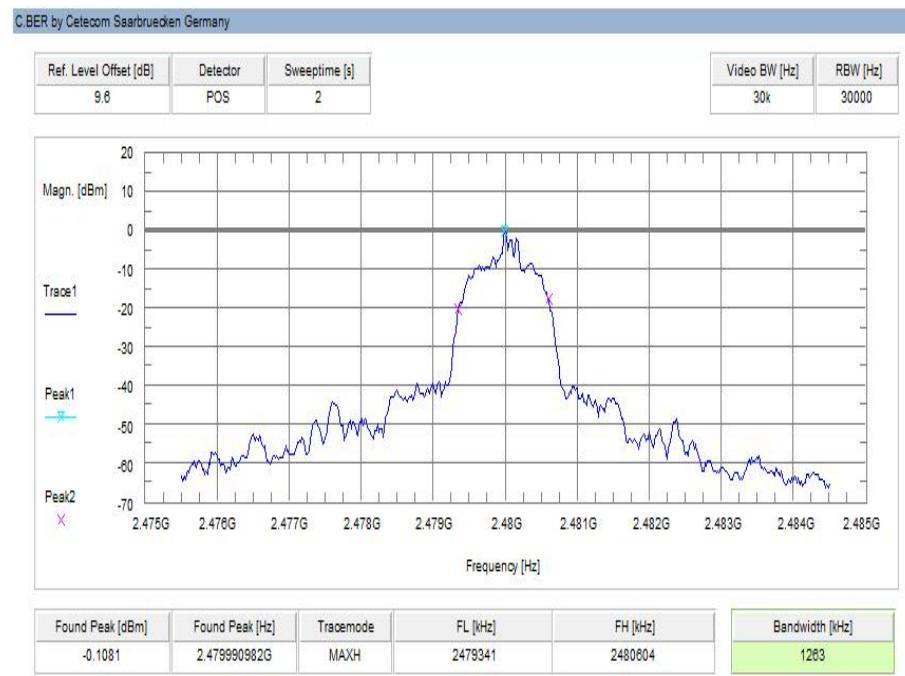


Plot 4: lowest channel – 2402 MHz, Pi / DQPSK modulation



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

10.6 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:

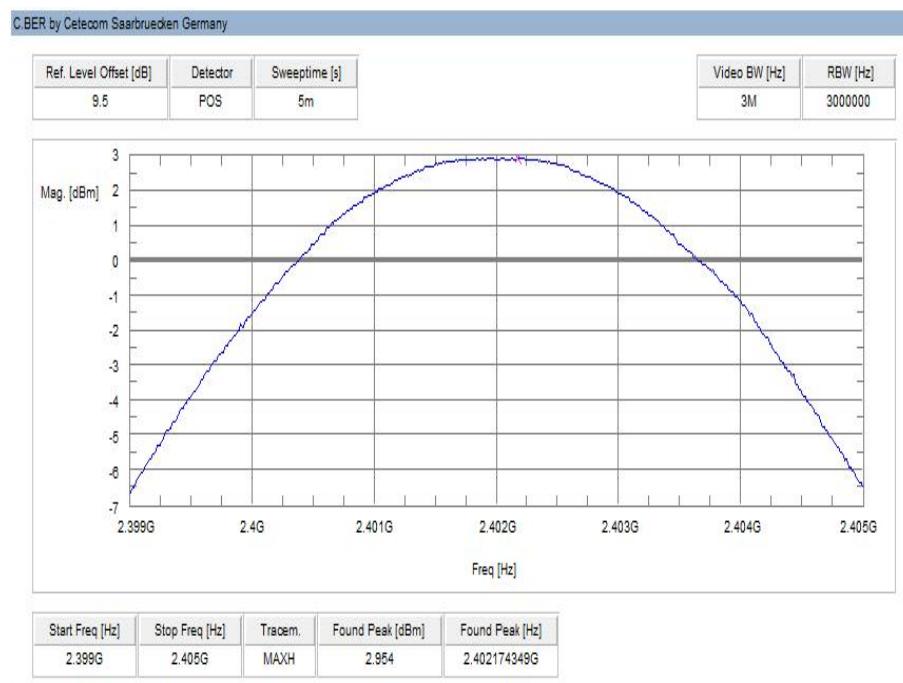
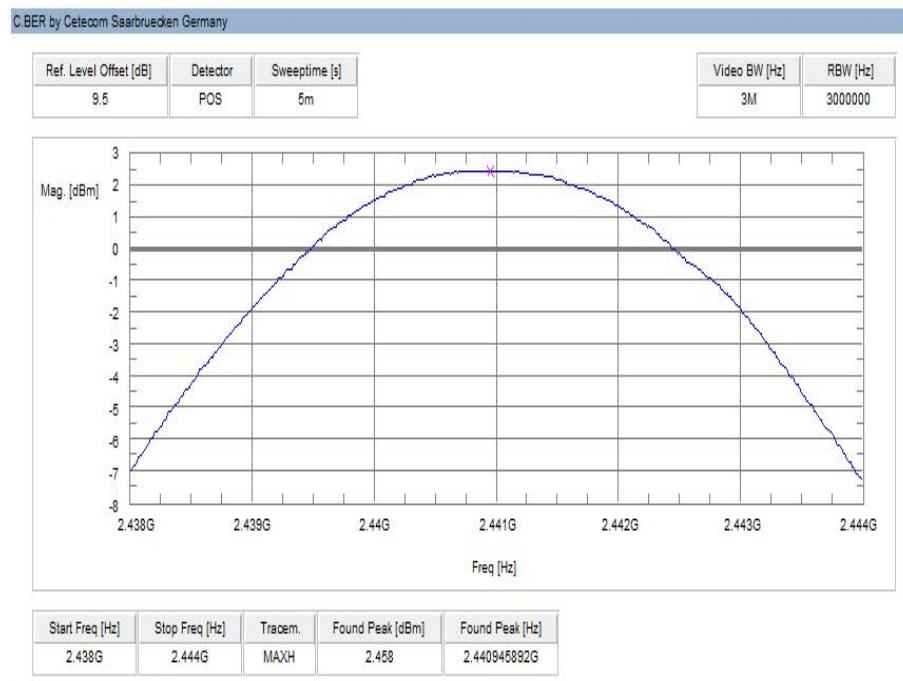
Modulation	Maximum output power conducted [dBm]		
	2402 MHz	2441 MHz	2480 MHz
GFSK	3.0	2.5	2.2
Pi/4 DQPSK	2.9	2.3	1.8
8 DPSK	3.1	2.5	2.1
Measurement uncertainty	± 1 dB		

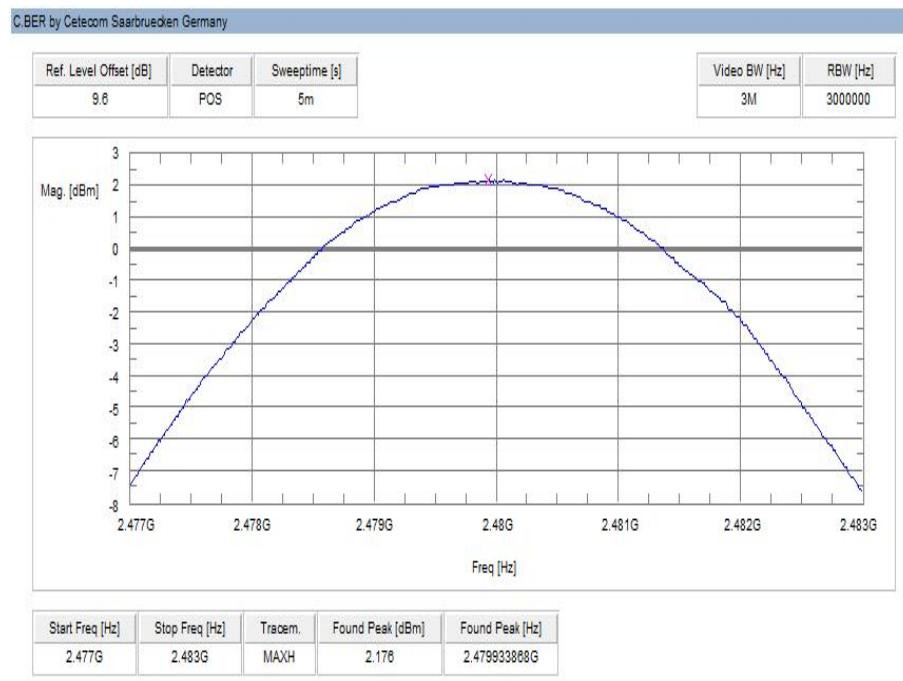
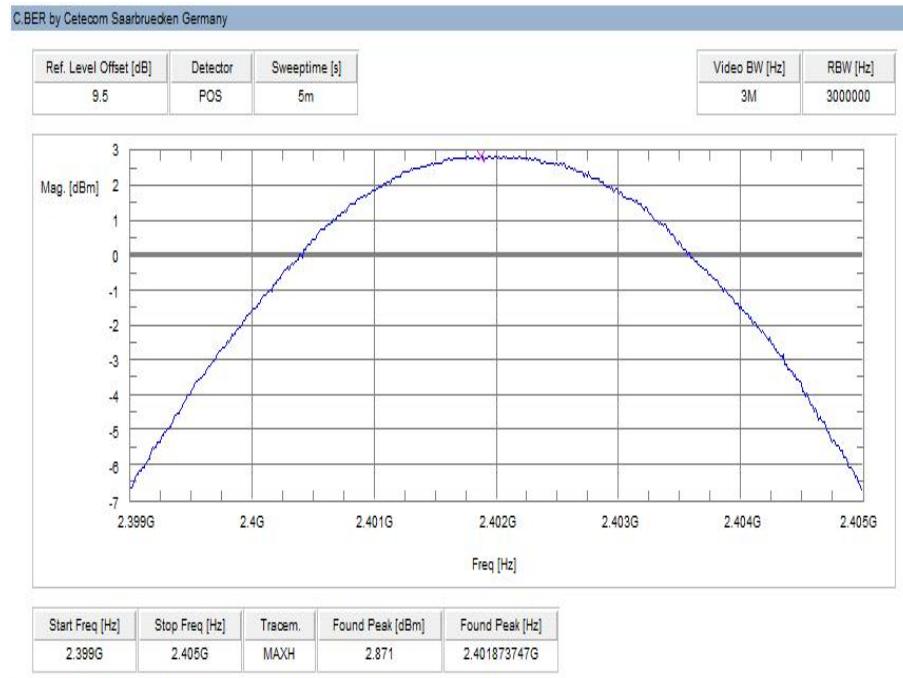
Verdict: **complies****Results:**

Modulation	Maximum output power radiated - EIRP [dBm]		
	2402 MHz	2441 MHz	2480 MHz
GFSK	3.7	4.1	3.7
Pi/4 DQPSK *)	3.6	3.9	3.3
8 DPSK *)	3.8	4.1	3.6
Measurement uncertainty	± 3 dB		

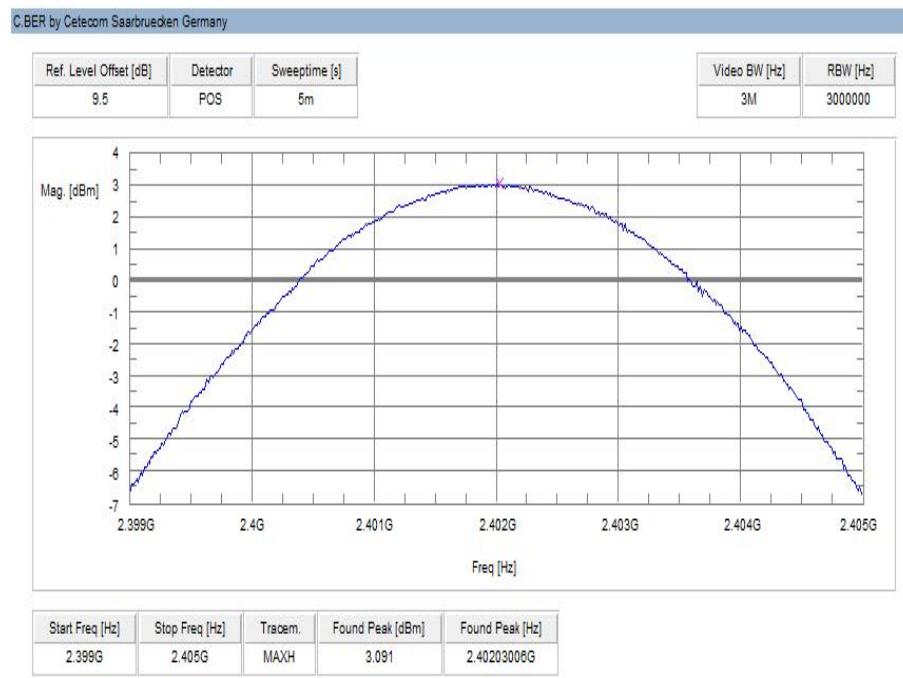
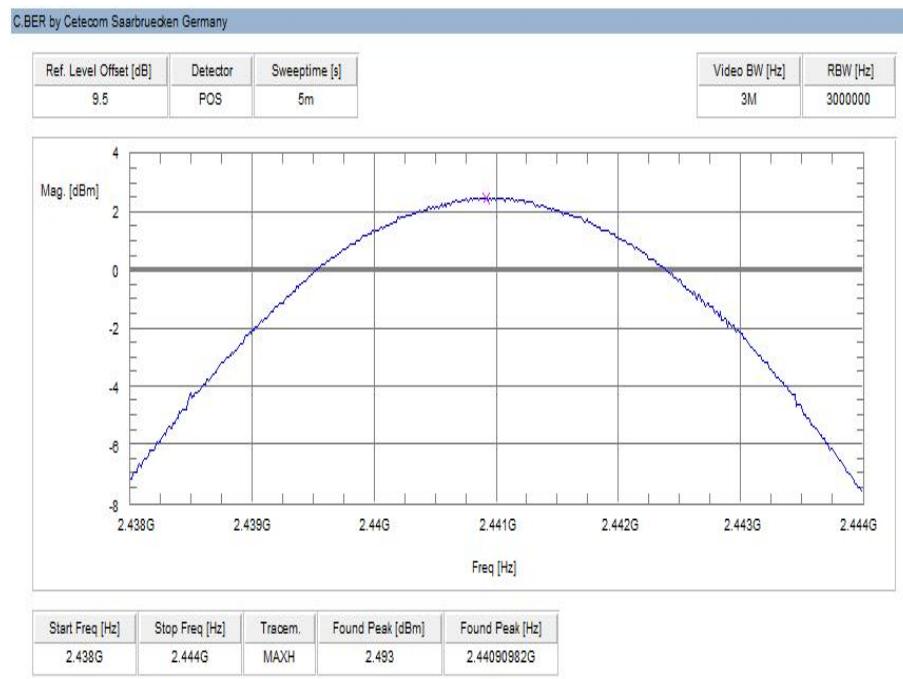
*) - Values calculated with antenna gain

Verdict: **complies**

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 Detailed spurious emissions @ the band edge - 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:	300 kHz / 500 kHz
Resolution bandwidth:	100 kHz
Span:	Lower Band Edge: 2395 – 2405 MHz higher Band Edge: 2478 – 2489 MHz
Trace-Mode:	Max Hold

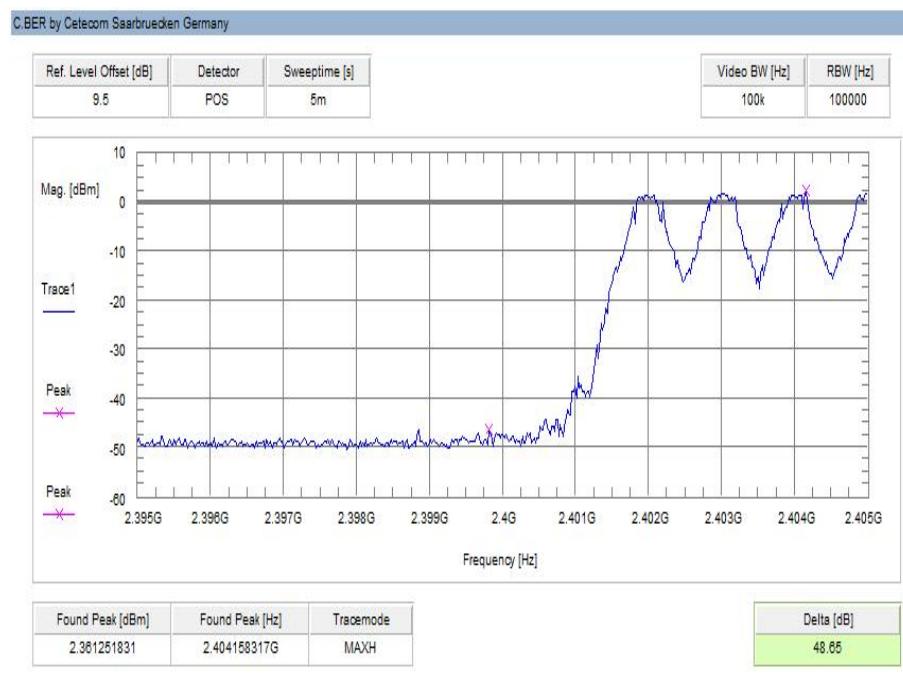
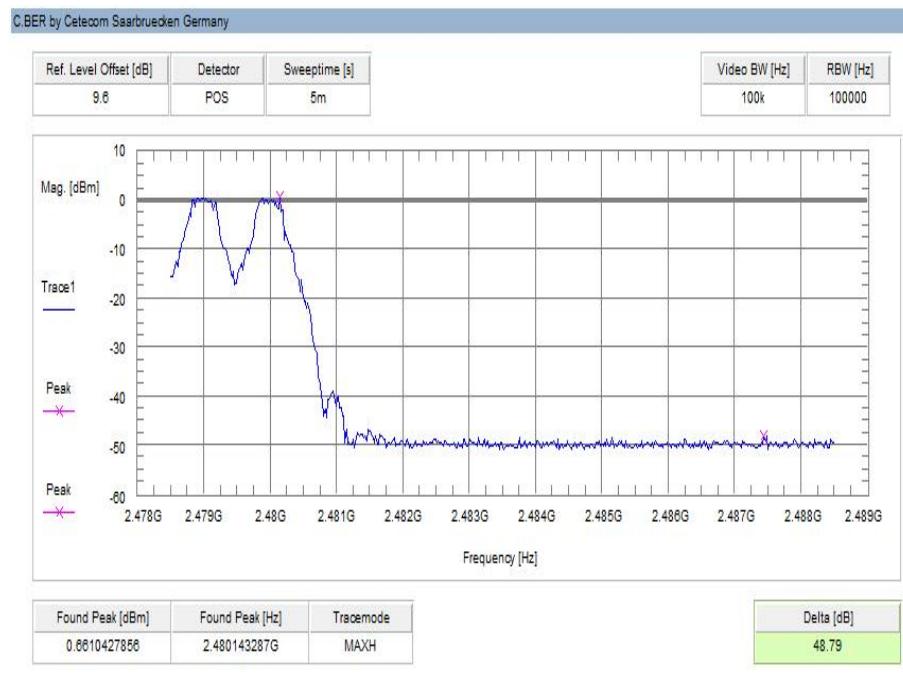
Limits:

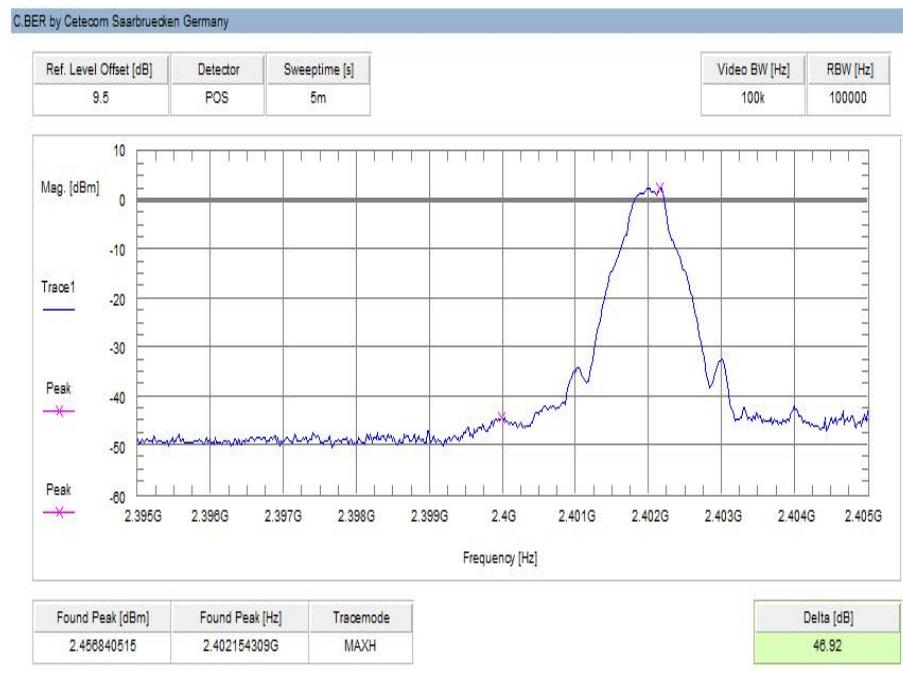
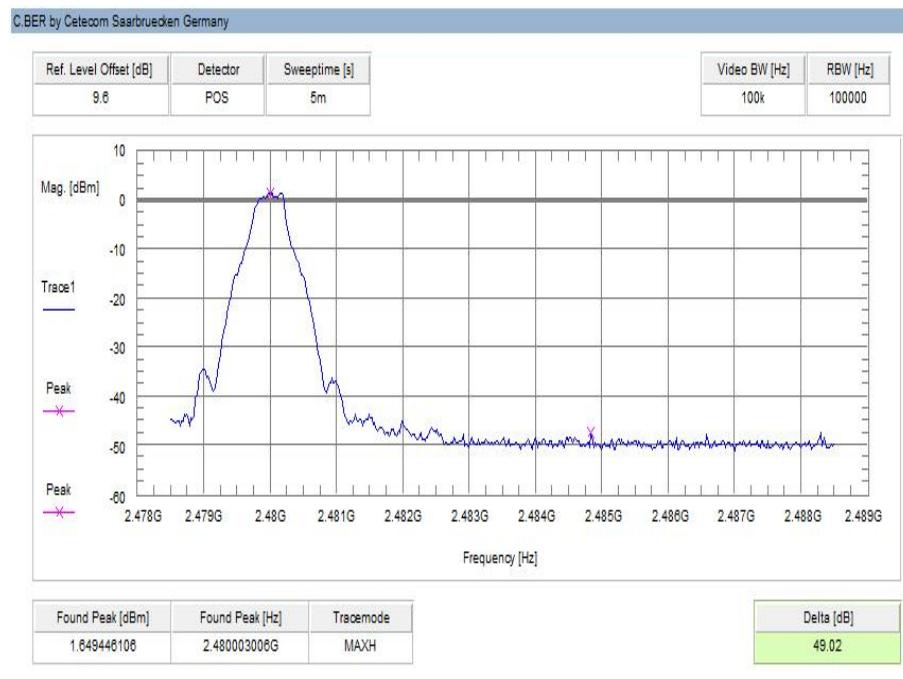
FCC	IC
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains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

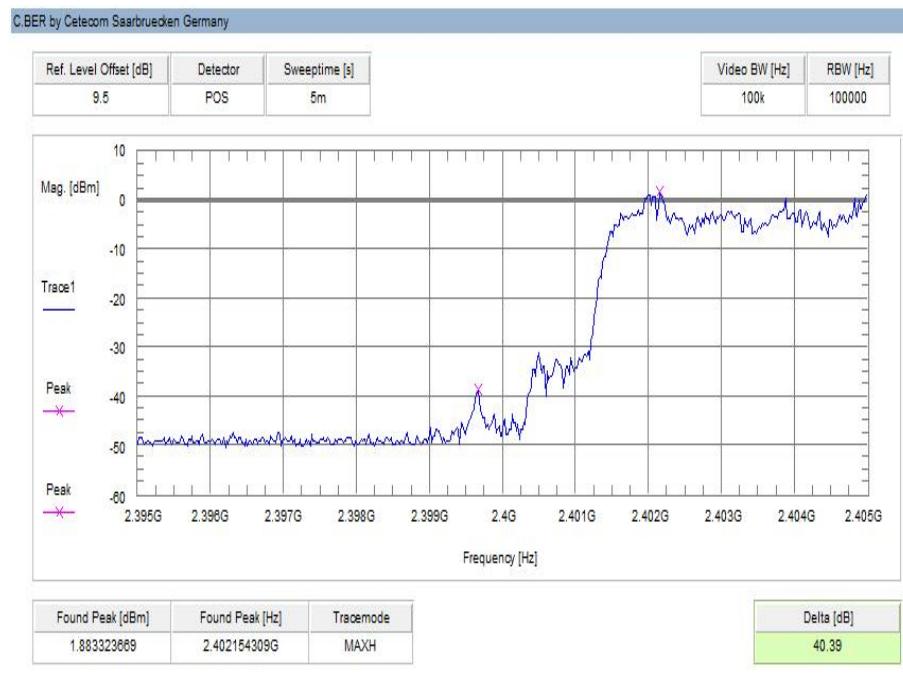
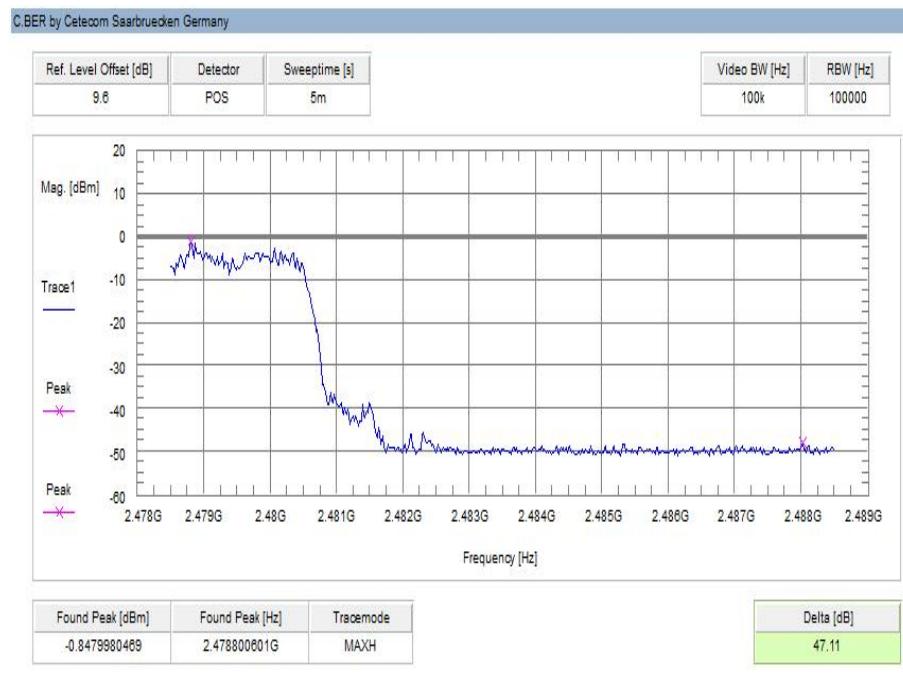
Results:

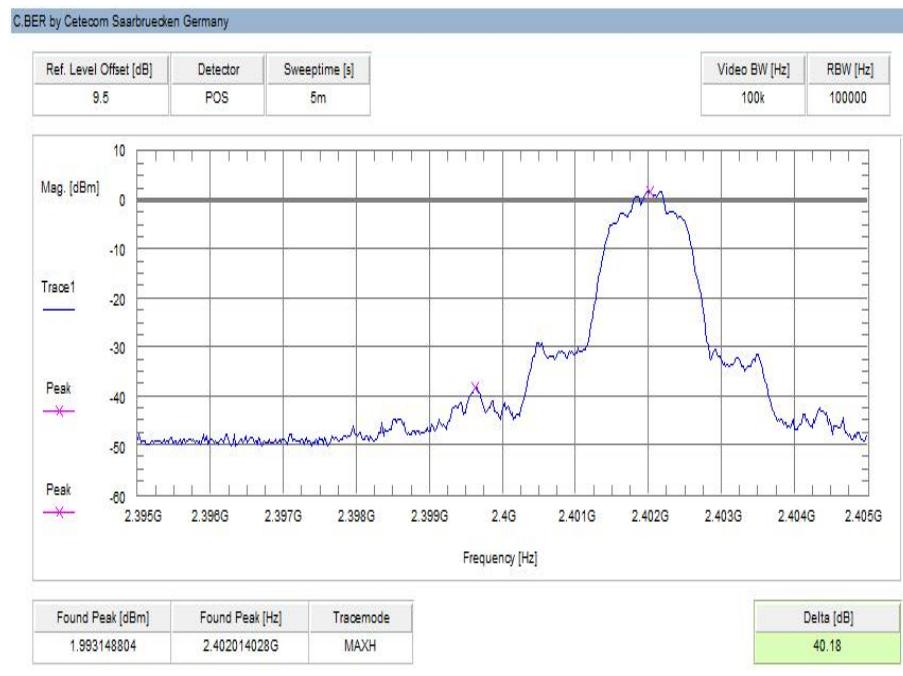
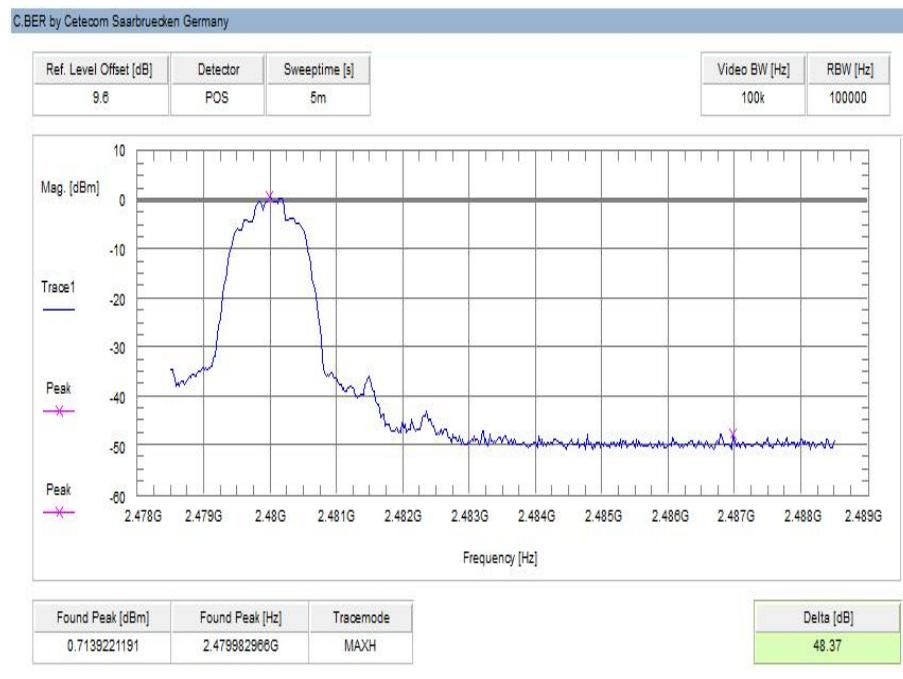
Scenario Modulation	Band edge compliance conducted [dB]		
	GFSK	Pi/4 DQPSK	8DPSK
Lower band edge – hopping off	> 20 dB	> 20 dB	> 20 dB
Lower band edge – hopping on	> 20 dB	> 20 dB	> 20 dB
Upper band edge – hopping off	> 20 dB	> 20 dB	> 20 dB
Upper band edge – hopping on	> 20 dB	> 20 dB	> 20 dB
Measurement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

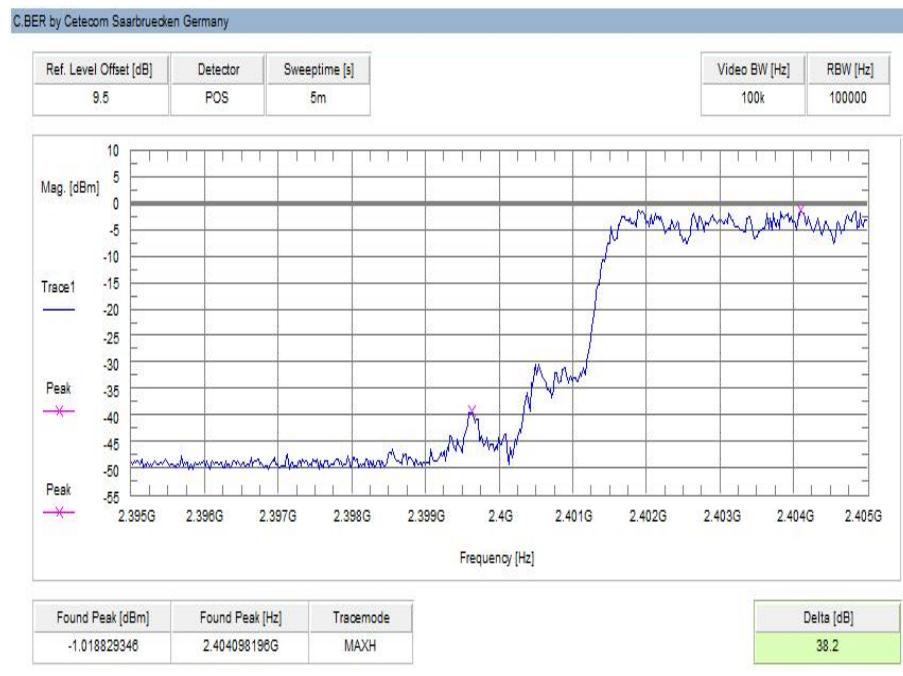
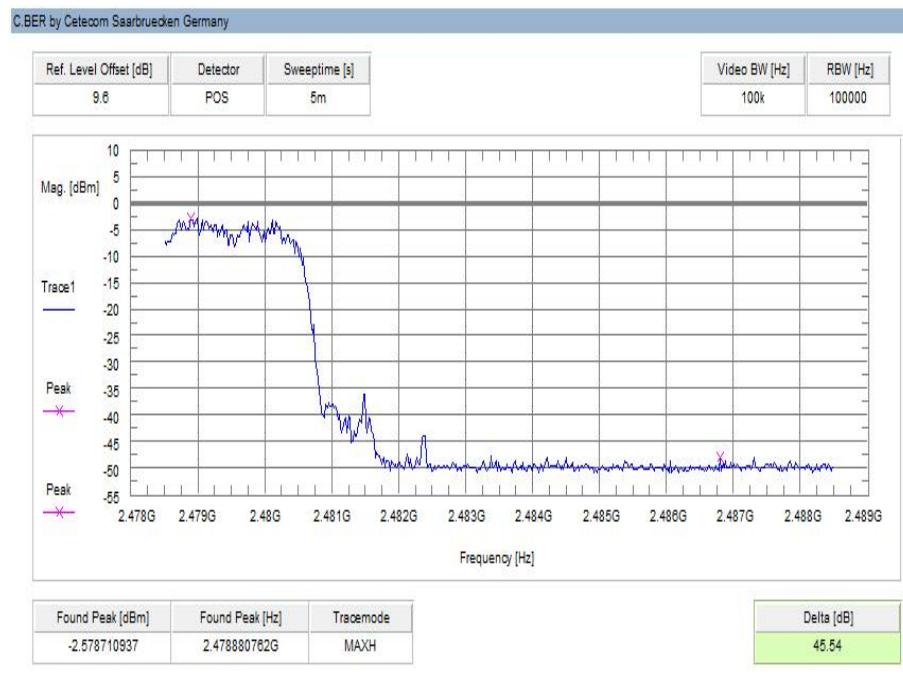
Verdict: **complies**

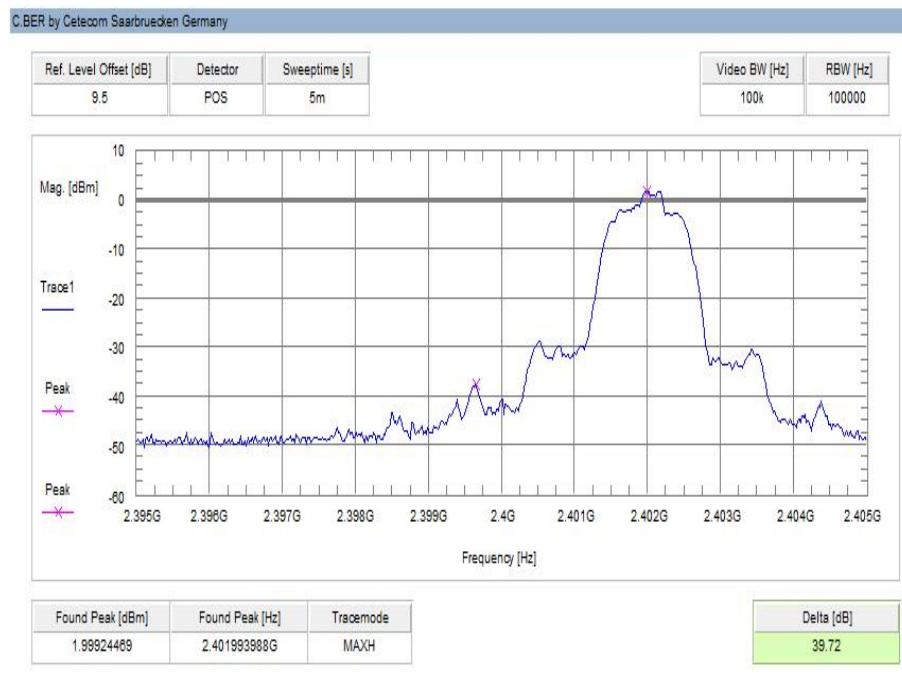
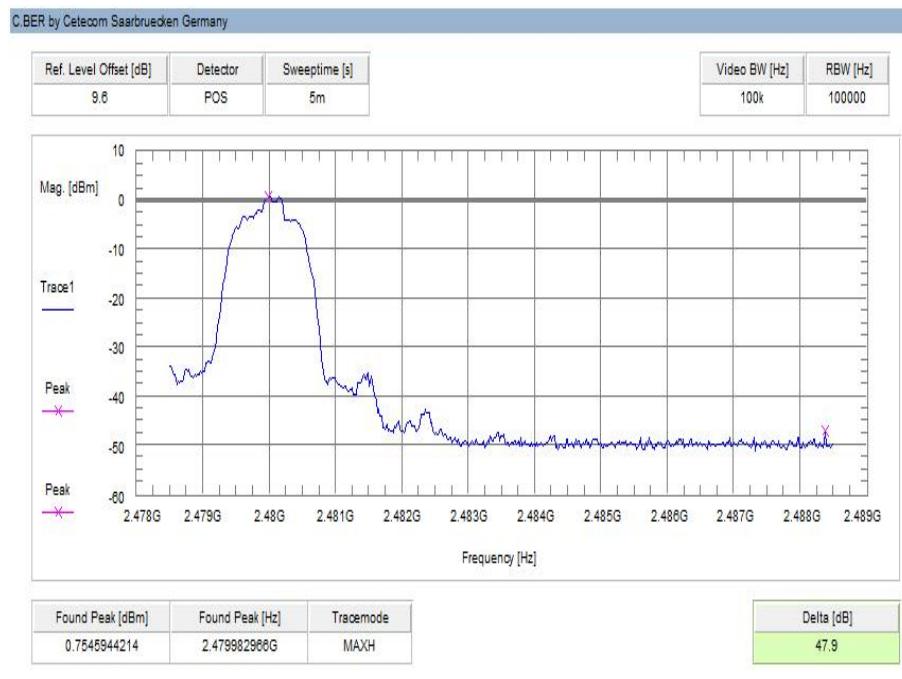
Plots:**Plot 1: Lower band edge – hopping on, GFSK modulation****Plot 2: Upper band edge – hopping on, GFSK modulation**

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

10.8 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 / RMS
Sweep time:	Auto
Video bandwidth:	1 MHz
Resolution bandwidth:	1 MHz
Span:	Lower Band: 2370 – 2400 MHz Upper Band: 2480 – 2500 MHz
Trace-Mode:	Max Hold

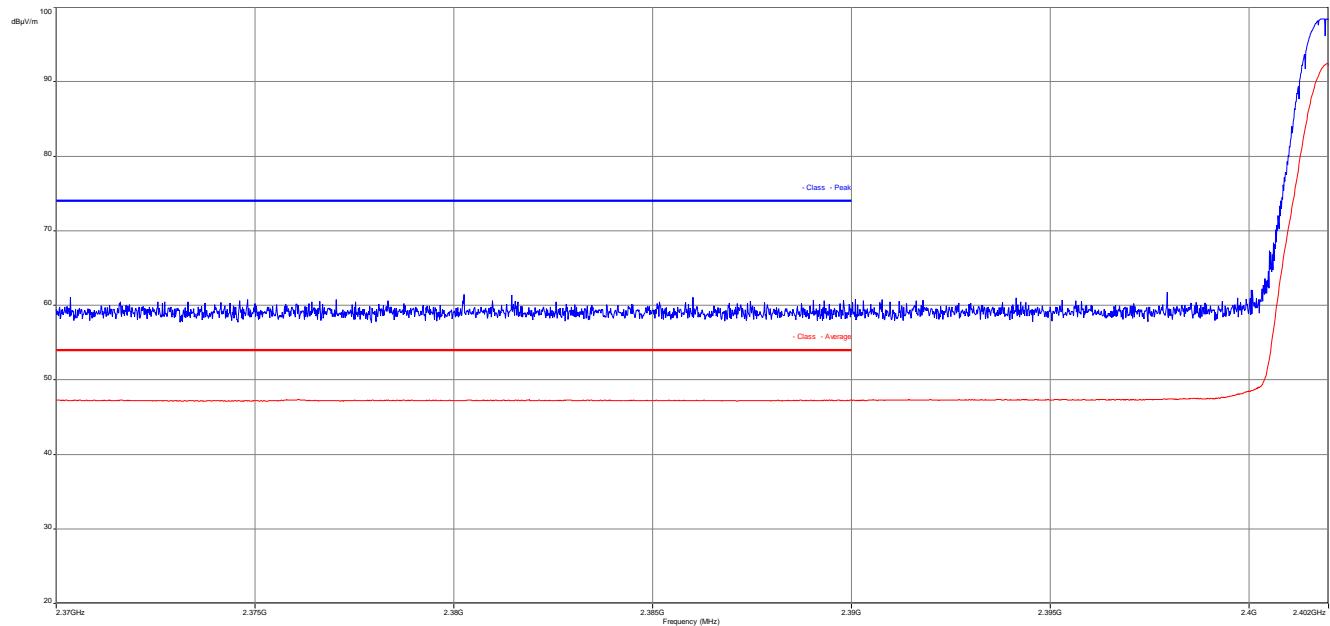
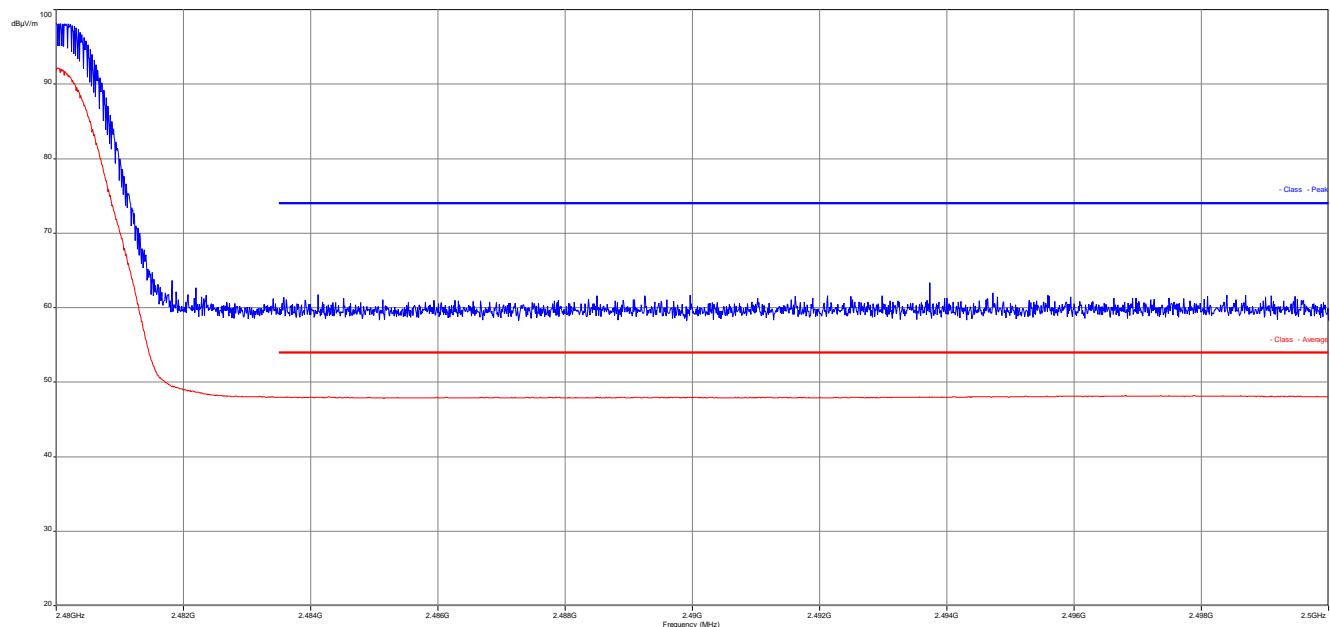
Limits:

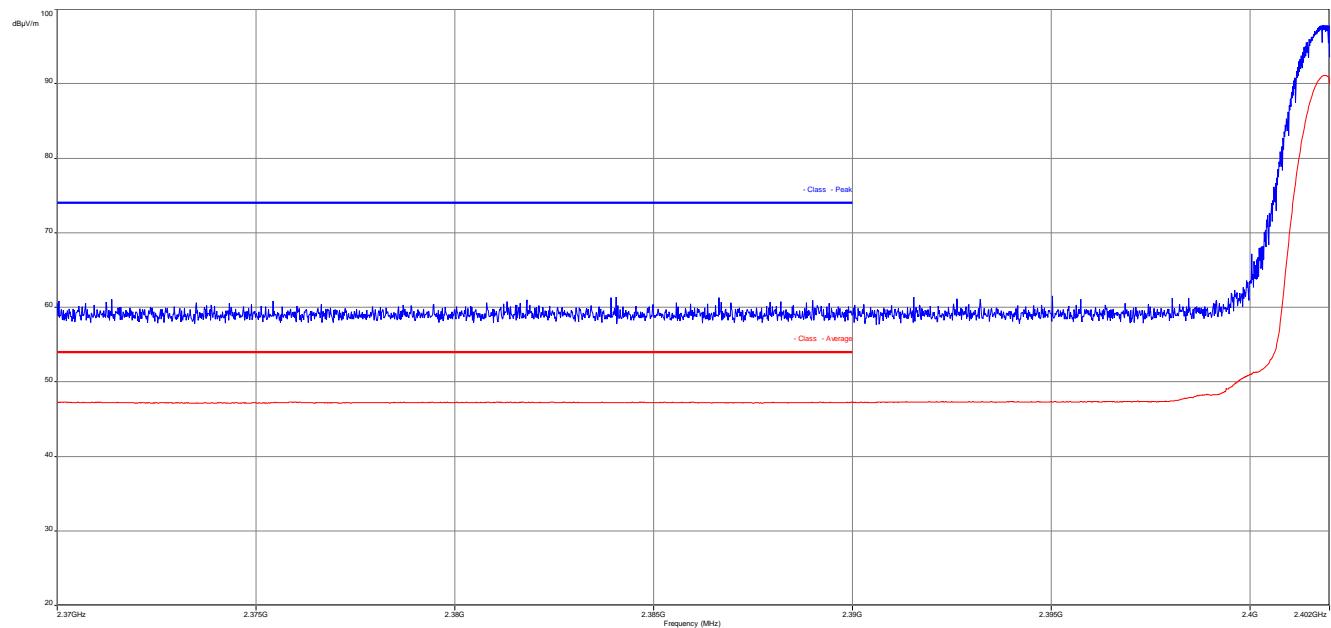
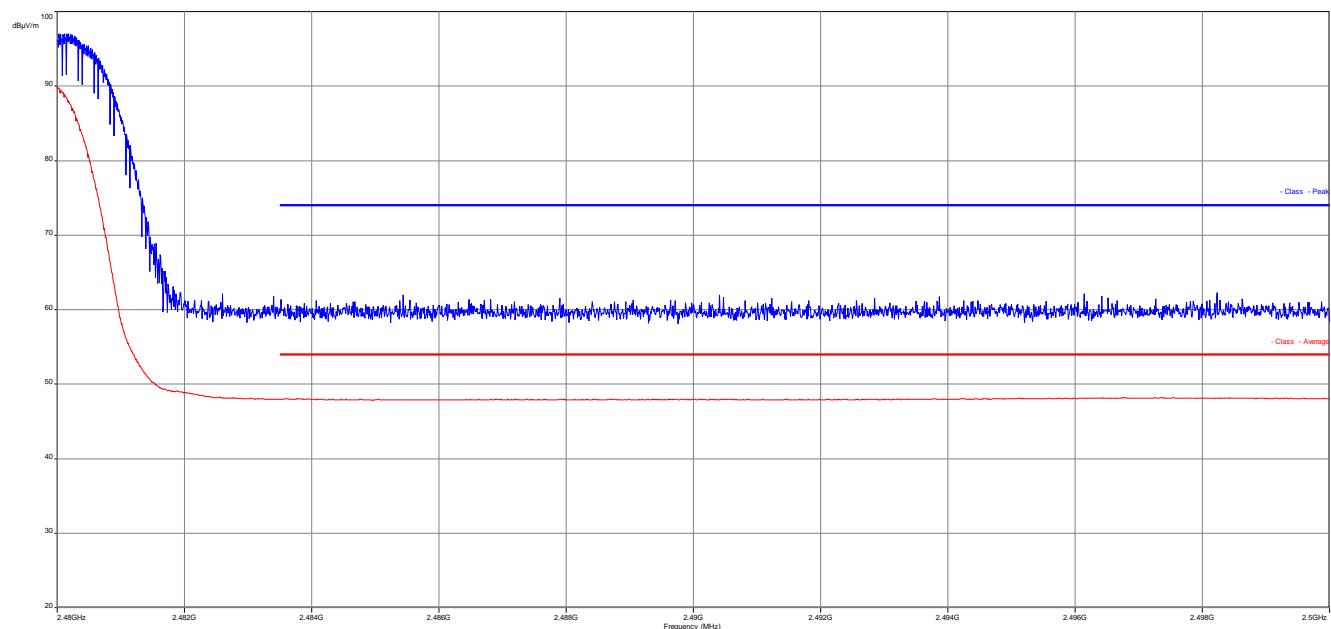
FCC	IC
Band edge compliance radiated	
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth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

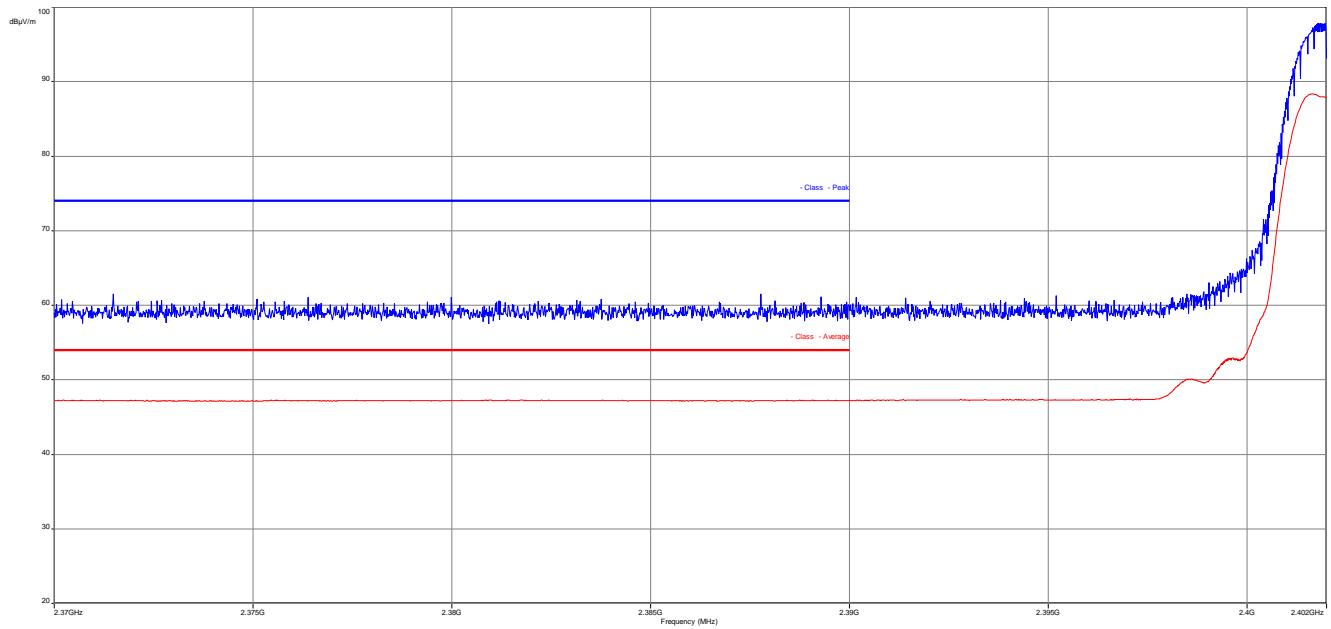
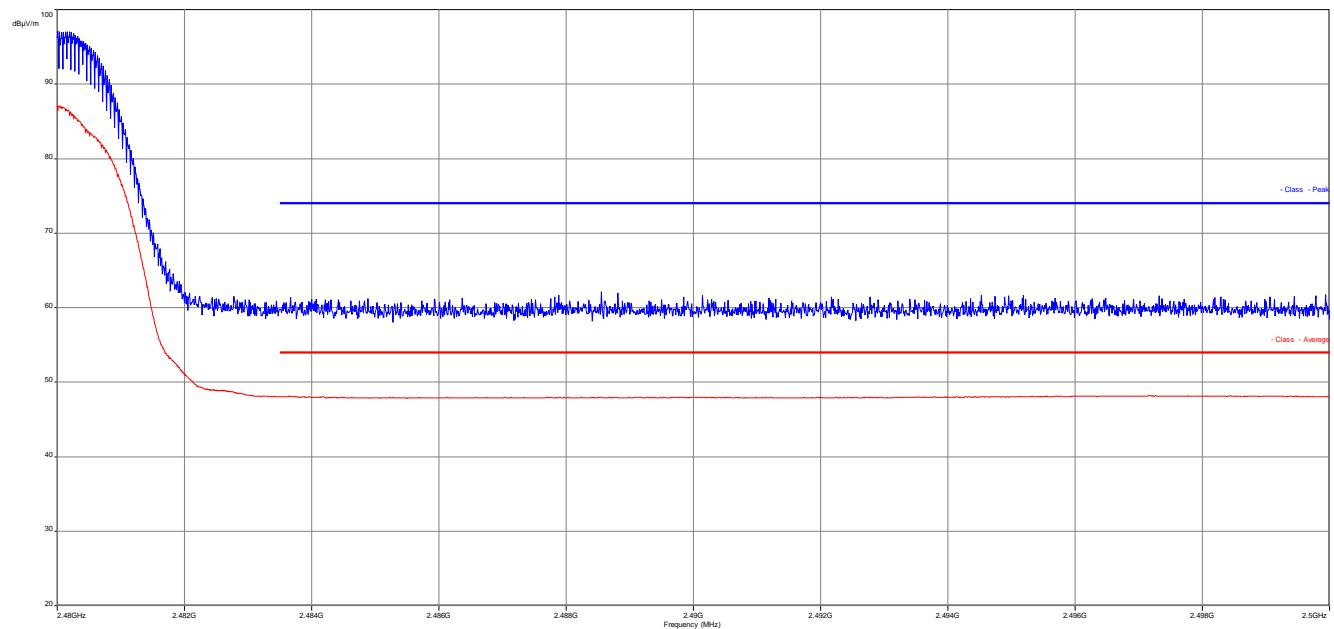
Results:

Scenario	Band edge compliance radiated [dB μ V/m]		
	GFSK	Pi/4 DQPSK	8DPSK
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: complies

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

10.9 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		2.5	30 dBm		Operating frequency
All detected emissions are below the -20 dBc criteria. Please take a look at the plot!			-20 dBc		complies
2441		2.0	30 dBm		Operating frequency
All detected emissions are below the -20 dBc criteria. Please take a look at the plot!			-20 dBc		complies
2480		1.1	30 dBm		Operating frequency
All detected emissions are below the -20 dBc criteria. Please take a look at the plot!			-20 dBc		complies
Measurement uncertainty		± 3 dB			

Verdict: **complies****Results:**

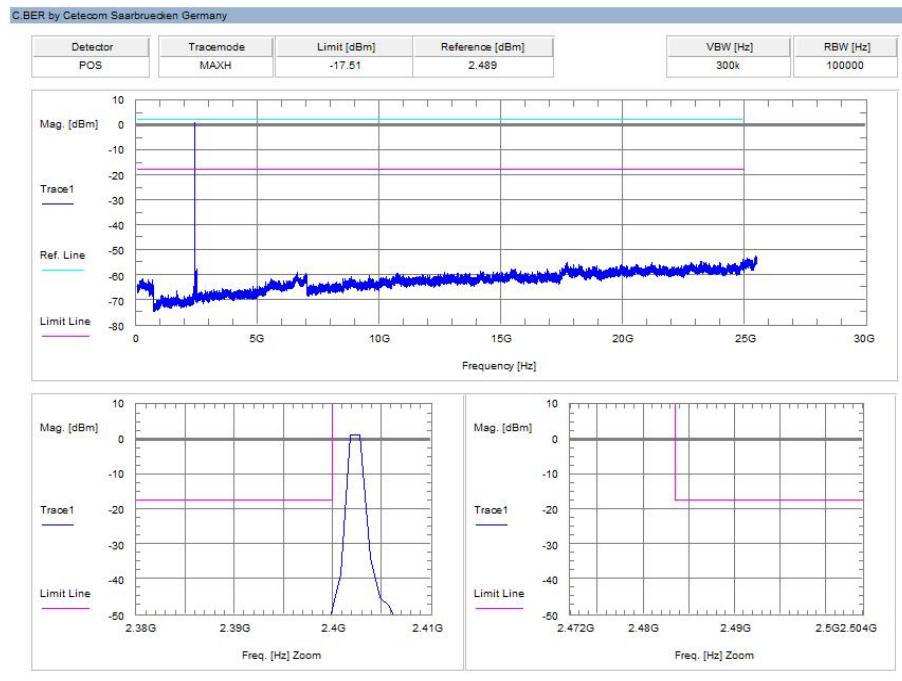
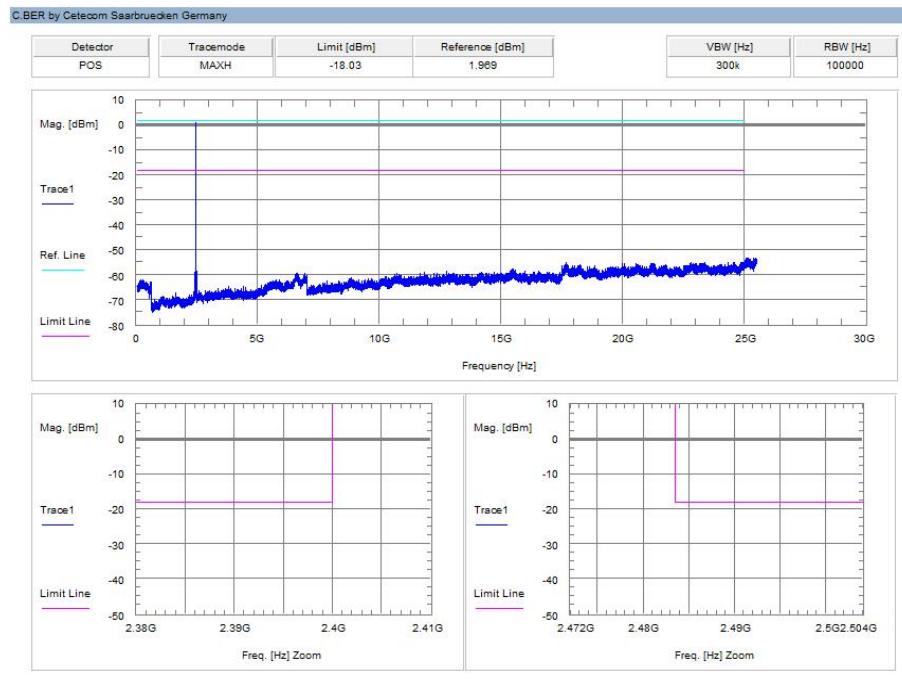
TX spurious emissions conducted					
Pi/4-DQPSK - mode					
f [MHz]		amplitude of emission [dBm]	limit max. allowed emission power	actual attenuation below frequency of operation [dB]	results
2402		2.0	30 dBm		Operating frequency
All detected emissions are below the -20 dBc criteria. Please take a look at the plot!			-20 dBc		complies
2441		0.6	30 dBm		Operating frequency
All detected emissions are below the -20 dBc criteria. Please take a look at the plot!			-20 dBc		complies
2480		0.1	30 dBm		Operating frequency
All detected emissions are below the -20 dBc criteria. Please take a look at the plot!			-20 dBc		complies
Measurement uncertainty		± 3dB			

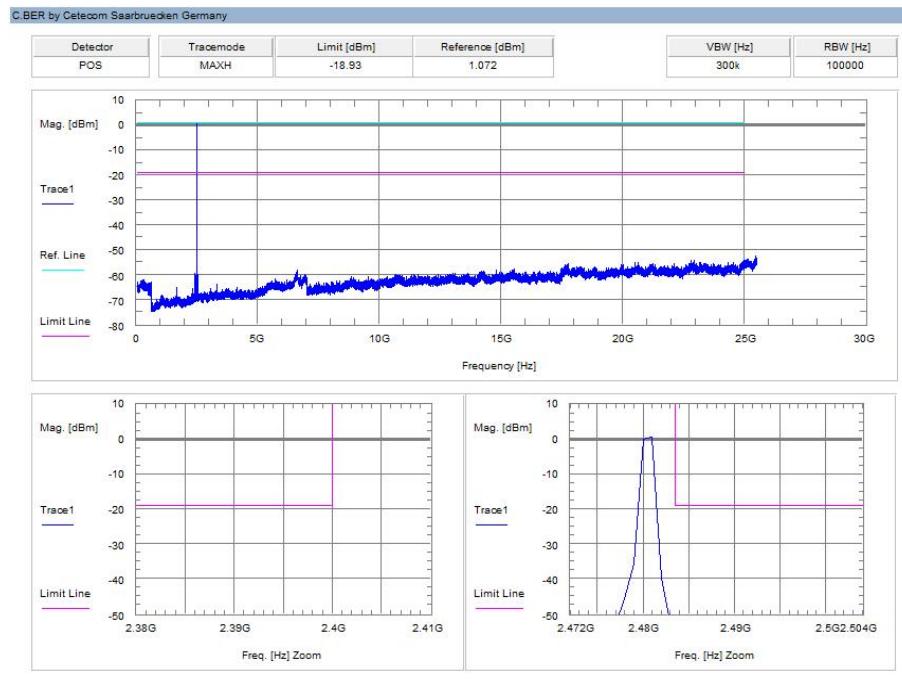
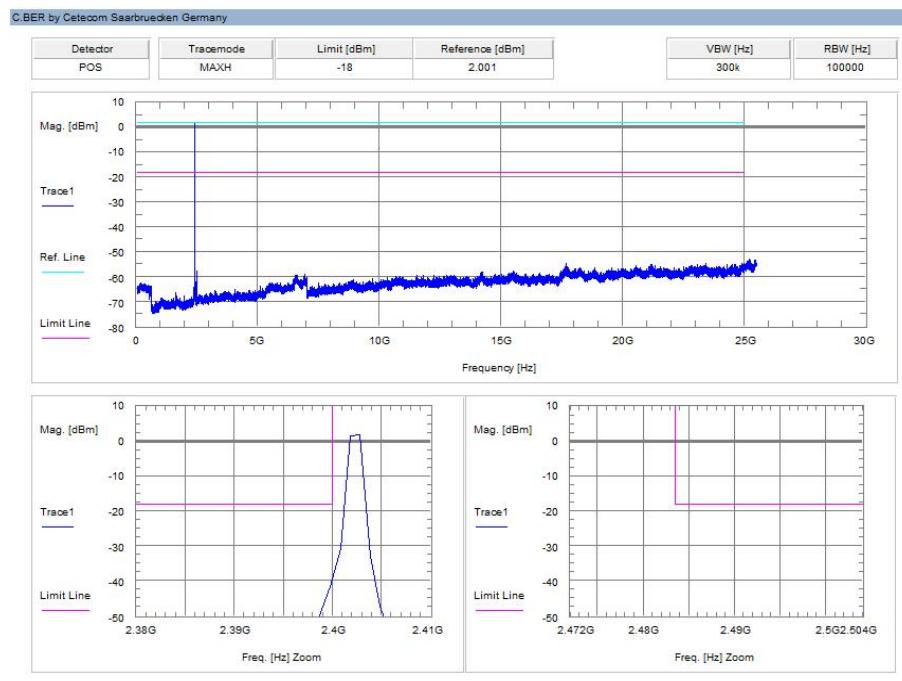
Verdict: **complies**

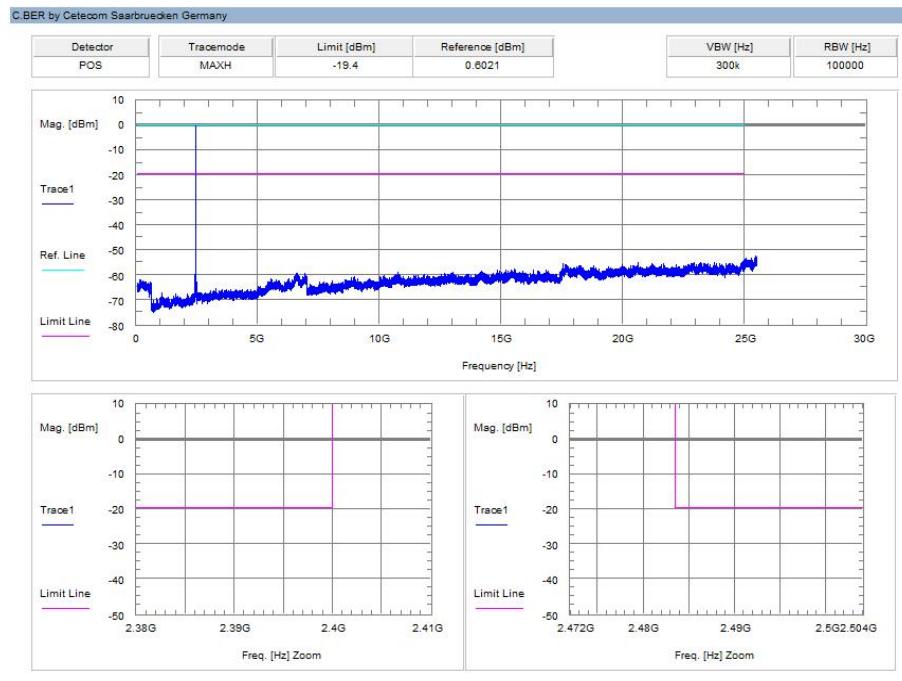
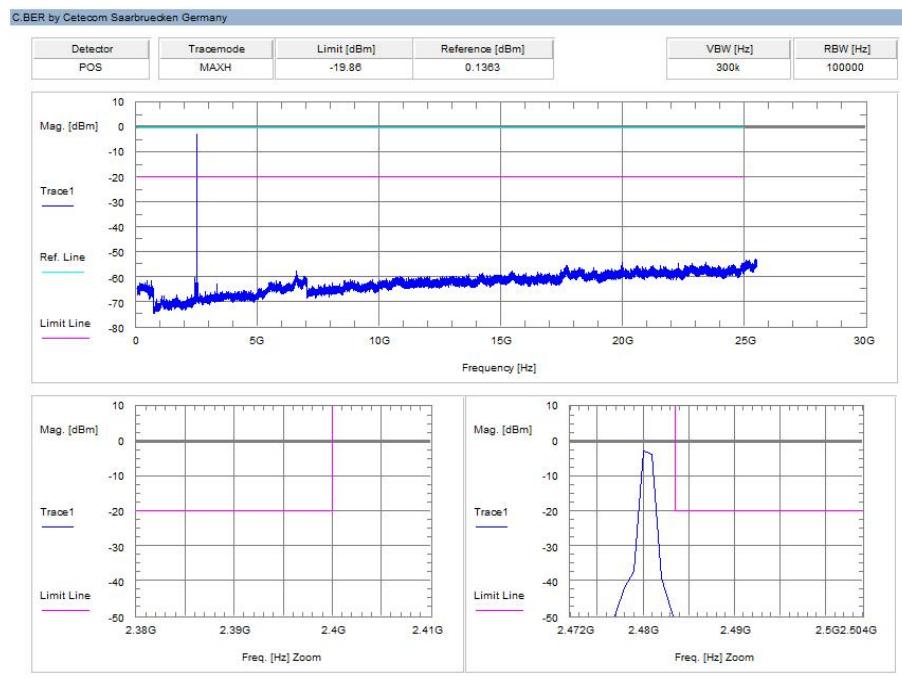
Results:

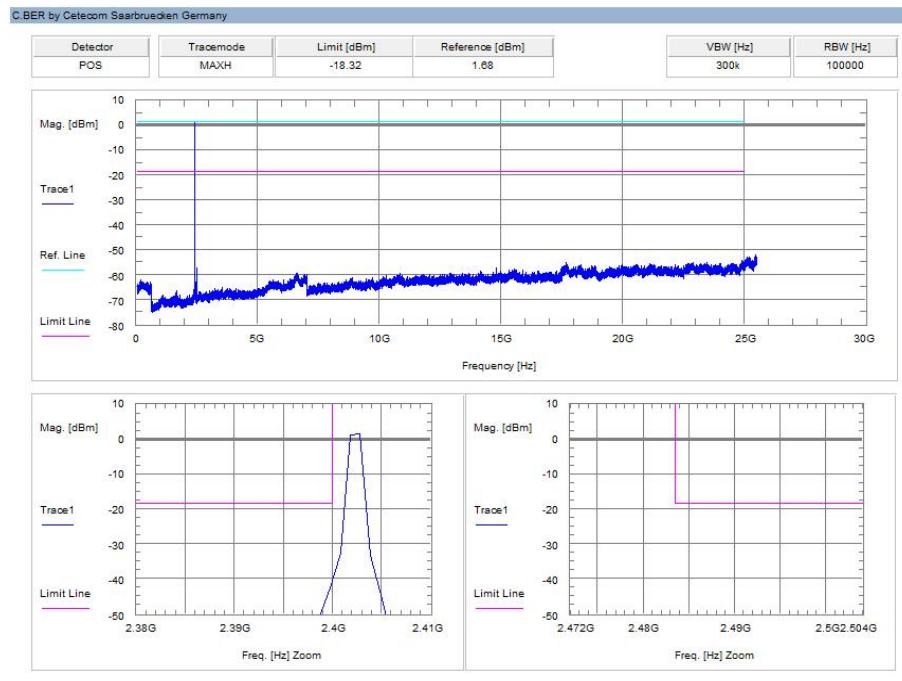
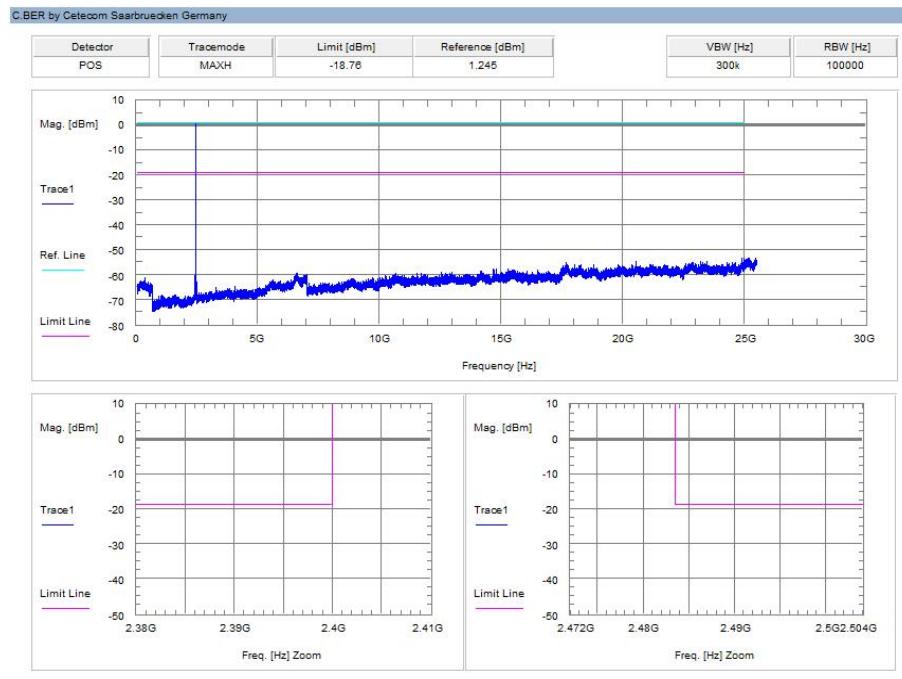
TX spurious emissions conducted 8DPSK - mode					
f [MHz]		amplitude of emission [dBm]	limit max. allowed emission power	actual attenuation below frequency of operation [dB]	results
2402		1.7	30 dBm		Operating frequency
All detected emissions are below the -20 dBc criteria. Please take a look at the plot!			-20 dBc		complies
2441		1.2	30 dBm		Operating frequency
All detected emissions are below the -20 dBc criteria. Please take a look at the plot!			-20 dBc		complies
2480		0.1	30 dBm		Operating frequency
All detected emissions are below the -20 dBc criteria. Please take a look at the plot!			-20 dBc		complies
Measurement uncertainty		± 3dB			

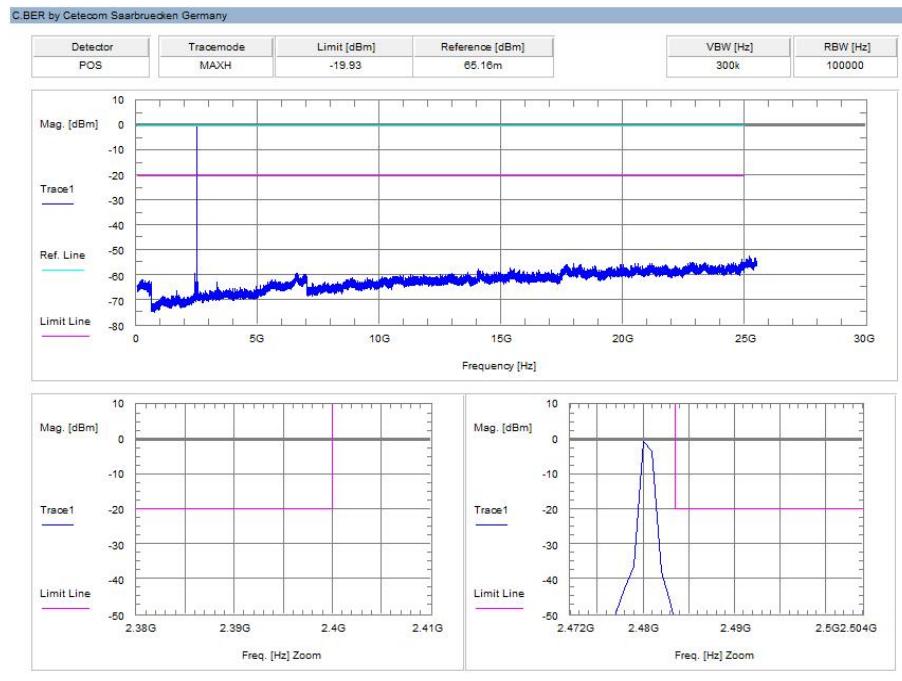
Verdict: **complies**

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

10.10 Spurious emissions radiated below 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 channels are 00; 39 and 78. The measurement is performed in the mode with the highest output power. The limits are recalculated to a measurement distance of 3 m according the ANSI C63.10.

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

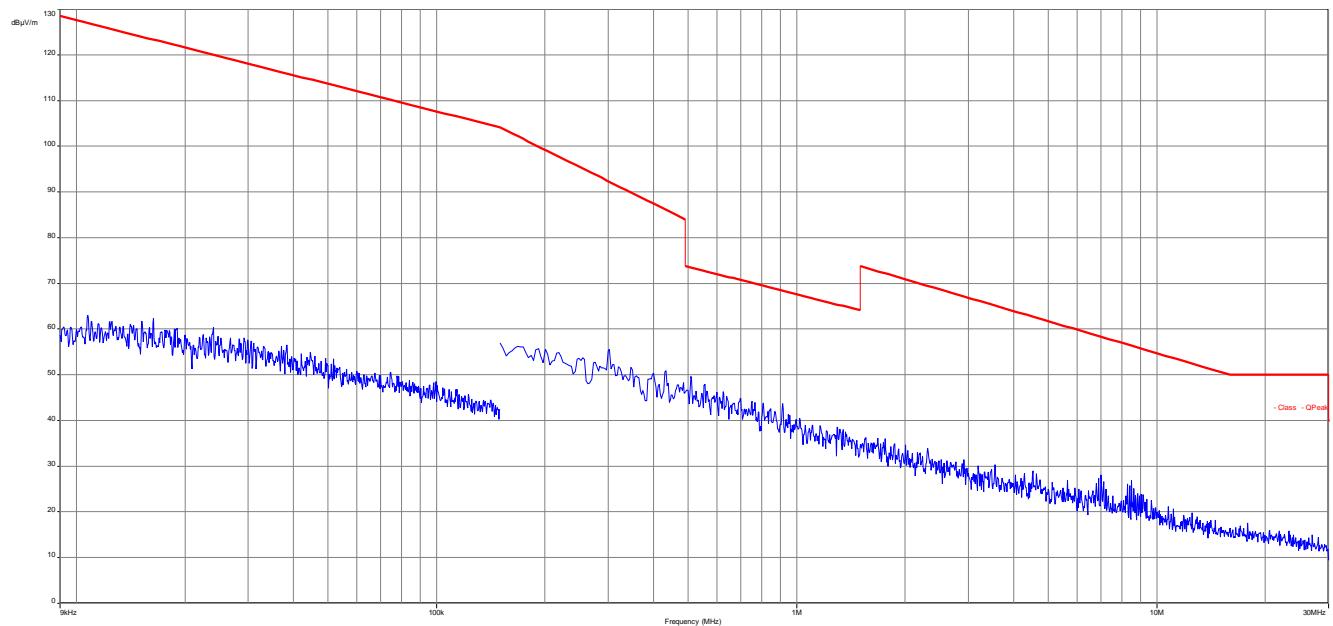
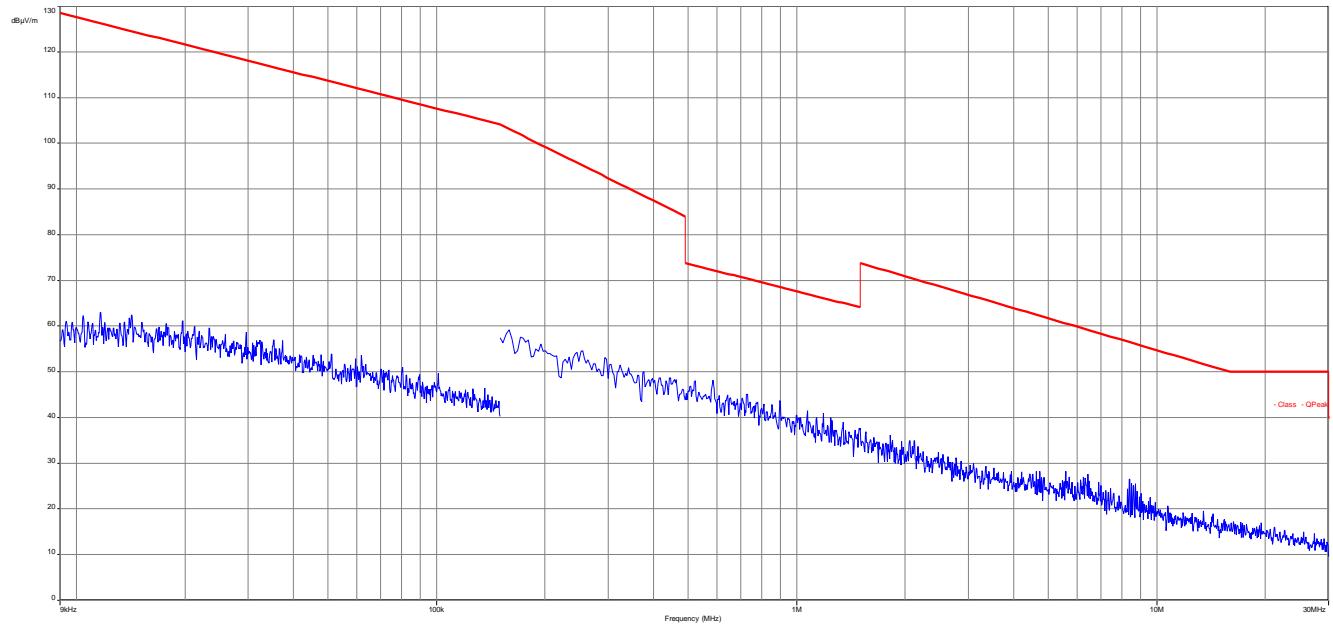
Limits:

FCC	IC	
TX spurious emissions radiated below 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:

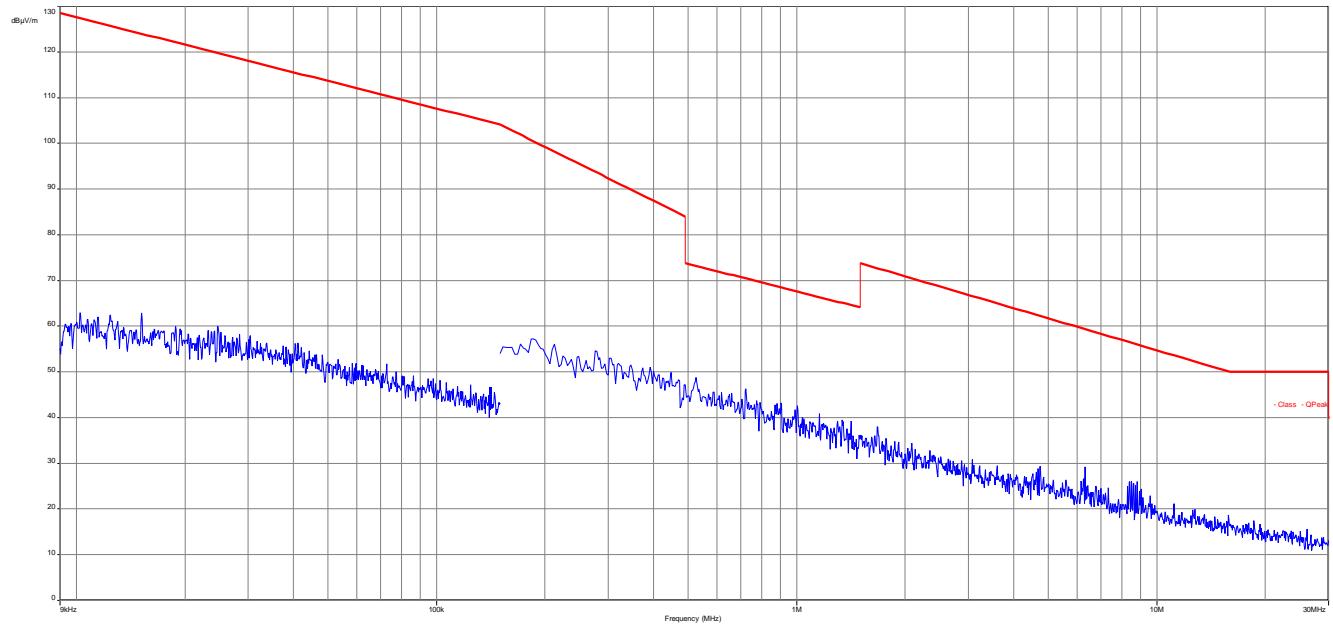
TX spurious emissions radiated below 30 MHz [dB μ V/m]		
F [MHz]	Detector	Level [dB μ V/m]
All detected emissions are more than 20 dB below the limit.		
Measurement uncertainty		± 3 dB

Verdict: complies

Plots:**Plot 1:** 9 kHz to 30 MHz, channel 00, transmit mode**Plot 2:** 9 kHz to 30 MHz, channel 39, transmit mode

0.1

Plot 2: 9 kHz to 30 MHz, channel 78, transmit mode



10.11 Spurious emissions radiated 30 MHz to 1 GHz

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
Resolution bandwidth:	120 kHz
Span:	30 MHz to 1 GHz
Trace-Mode:	Max Hold
Measured Modulation:	<input checked="" type="checkbox"/> GFSK <input type="checkbox"/> Pi/4 DQPSK <input type="checkbox"/> 8DPSK

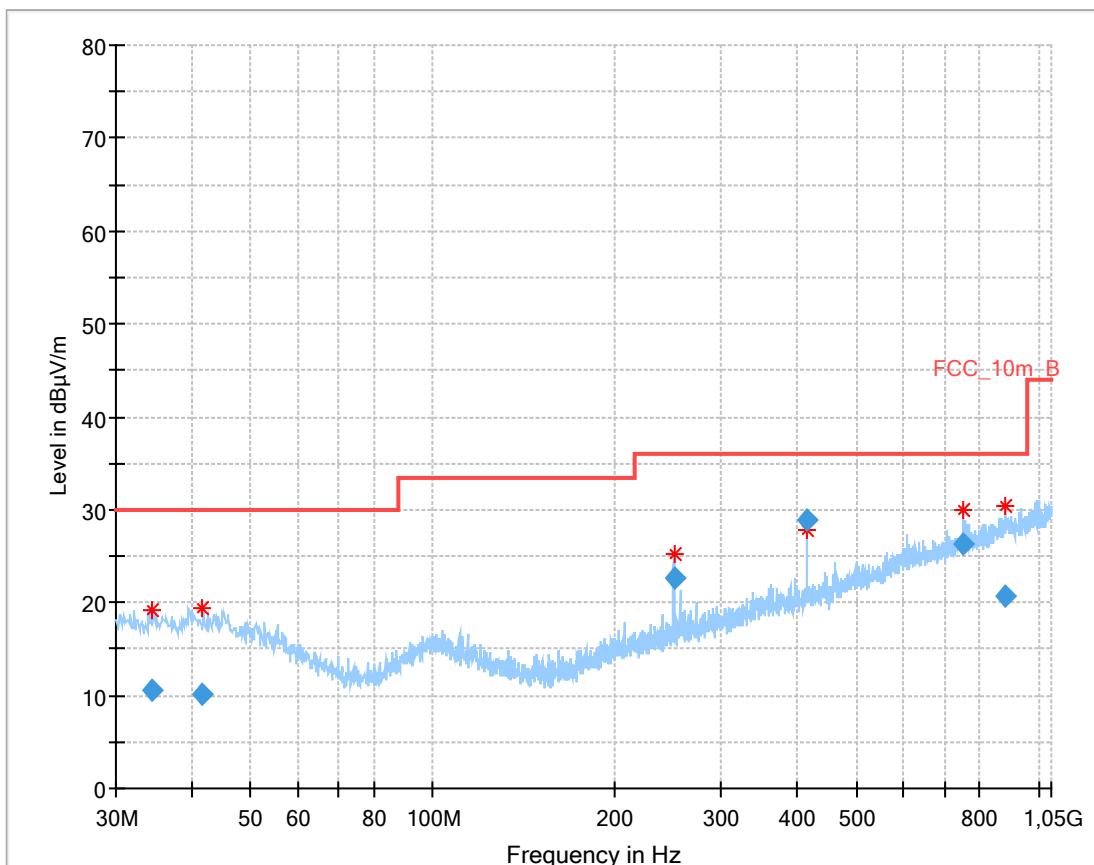
The modulation with the highest output power was used to perform the transmitter spurious emissions. If spurious were detected a re-measurement was performed on the detected frequency with each modulation.

Limits:

FCC	IC															
TX spurious emissions radiated																
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																
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center; padding: 5px;">Frequency (MHz)</th> <th style="text-align: center; padding: 5px;">Field strength (dBμV/m)</th> <th style="text-align: center; padding: 5px;">Measurement distance</th> </tr> </thead> <tbody> <tr> <td style="text-align: center; padding: 5px;">30 - 88</td><td style="text-align: center; padding: 5px;">30.0</td><td style="text-align: center; padding: 5px;">10</td></tr> <tr> <td style="text-align: center; padding: 5px;">88 - 216</td><td style="text-align: center; padding: 5px;">33.5</td><td style="text-align: center; padding: 5px;">10</td></tr> <tr> <td style="text-align: center; padding: 5px;">216 - 960</td><td style="text-align: center; padding: 5px;">36.0</td><td style="text-align: center; padding: 5px;">10</td></tr> <tr> <td style="text-align: center; padding: 5px;">Above 960</td><td style="text-align: center; padding: 5px;">54.0</td><td style="text-align: center; padding: 5px;">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														

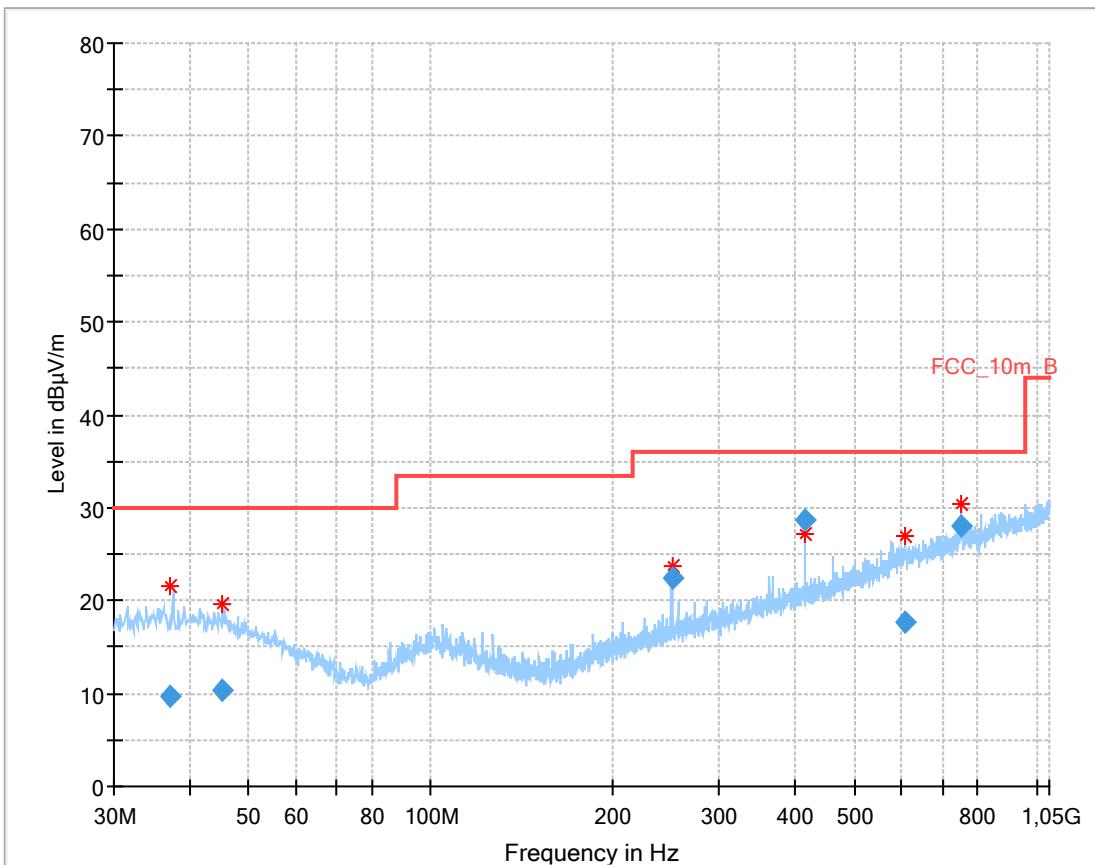
Plots: Transmit mode

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

**Final_Result**

Frequency (MHz)	QuasiPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
34.499250	10.66	30.00	19.34	1000.0	120.000	101.0	V	314	13.7
41.551800	10.24	30.00	19.76	1000.0	120.000	100.0	V	356	14.0
250.017450	22.63	36.00	13.37	1000.0	120.000	98.0	V	0	13.4
414.854250	28.81	36.00	7.19	1000.0	120.000	170.0	H	61	17.1
750.070650	26.30	36.00	9.70	1000.0	120.000	98.0	H	255	22.7
880.804350	20.79	36.00	15.21	1000.0	120.000	98.0	H	236	23.9

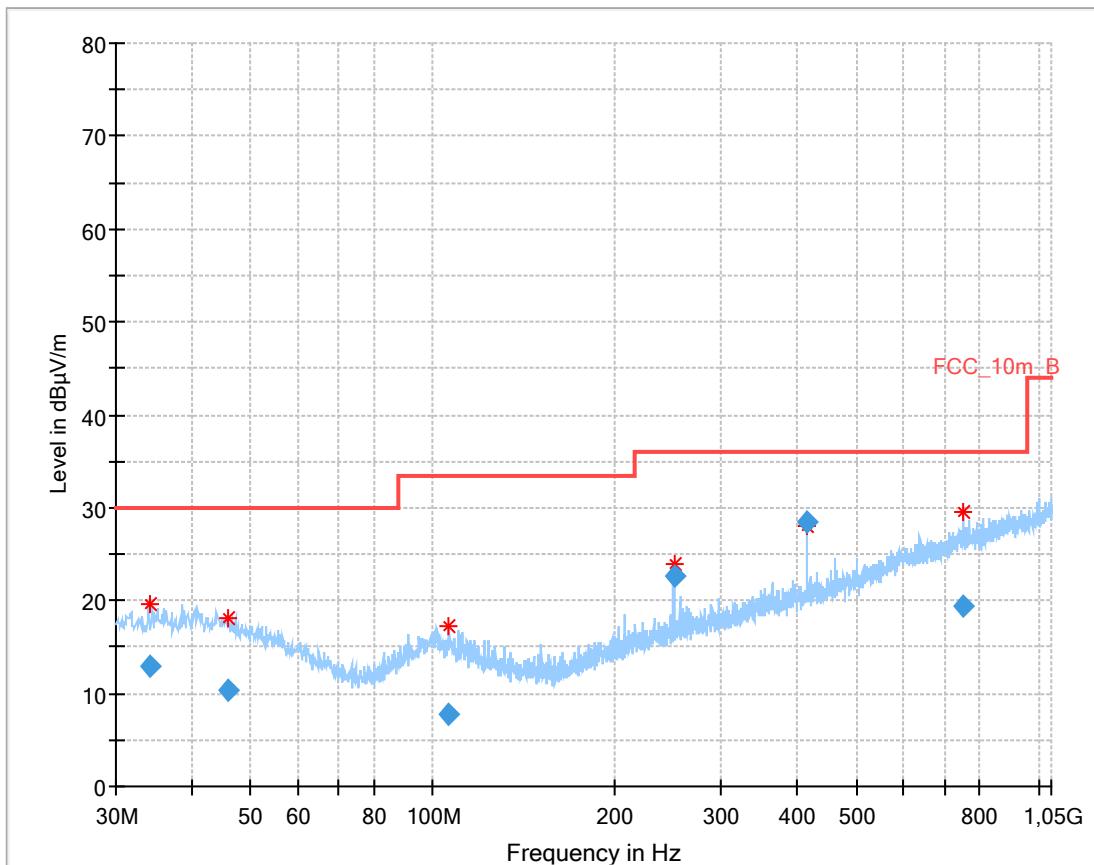
Plot 2: 30 MHz to 1 GHz, TX mode, channel 39, vertical & horizontal polarization



Final_Result

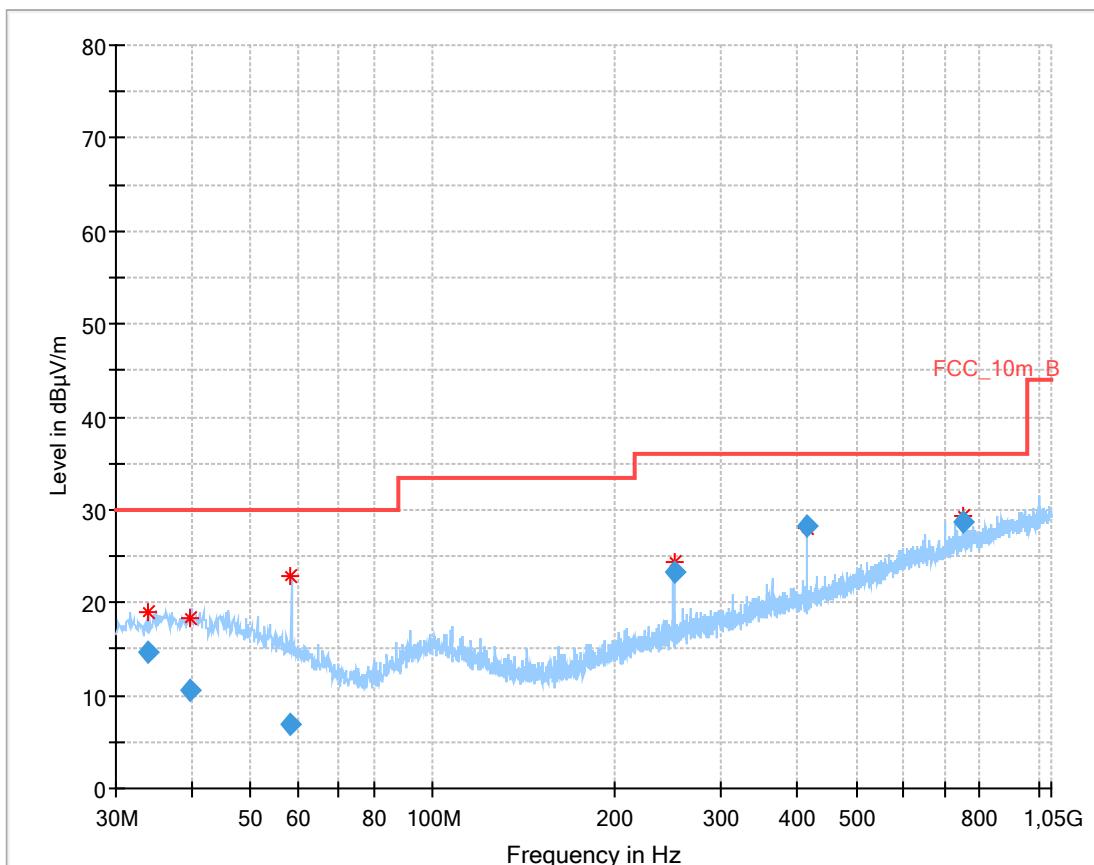
Frequency (MHz)	QuasiPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
37.256250	9.80	30.00	20.20	1000.0	120.000	170.0	V	154	13.9
45.355350	10.41	30.00	19.59	1000.0	120.000	170.0	H	116	13.8
250.017750	22.41	36.00	13.59	1000.0	120.000	98.0	V	359	13.4
414.897300	28.73	36.00	7.27	1000.0	120.000	170.0	H	61	17.1
608.045250	17.64	36.00	18.36	1000.0	120.000	170.0	H	194	20.8
750.031800	28.11	36.00	7.89	1000.0	120.000	98.0	H	273	22.7

Plot 3: 30 MHz to 1 GHz, TX mode, channel 78, vertical & horizontal polarization



Final_Result

Frequency (MHz)	QuasiPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
34.039500	12.89	30.00	17.11	1000.0	120.000	101.0	V	314	13.7
45.873150	10.33	30.00	19.67	1000.0	120.000	101.0	V	141	13.6
106.268400	7.67	33.50	25.83	1000.0	120.000	101.0	H	103	11.5
250.023450	22.69	36.00	13.31	1000.0	120.000	98.0	V	141	13.4
415.149450	28.37	36.00	7.63	1000.0	120.000	170.0	H	54	17.1
751.691700	19.42	36.00	16.58	1000.0	120.000	98.0	H	300	22.7

Plots: Receiver mode**Plot 1:** 30 MHz to 1 GHz, RX / idle – mode, vertical & horizontal polarization**Final_Result**

Frequency (MHz)	QuasiPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
34.006950	14.59	30.00	15.41	1000.0	120.000	101.0	V	7	13.7
39.648750	10.61	30.00	19.39	1000.0	120.000	101.0	V	25	14.0
58.230900	6.89	30.00	23.11	1000.0	120.000	101.0	V	56	11.0
250.007700	23.22	36.00	12.78	1000.0	120.000	98.0	V	164	13.4
415.008600	28.19	36.00	7.81	1000.0	120.000	170.0	H	49	17.1
750.042900	28.68	36.00	7.32	1000.0	120.000	98.0	H	270	22.7

10.12 Spurious emissions radiated above 1 GHz

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 / RMS
Sweep time:	Auto
Video bandwidth:	3 x RBW
Resolution bandwidth:	1MHz
Span:	1 GHz to 26 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		
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 (dB μ V/m)	Measurement distance
Above 960	54.0	3

Results: Transmitter mode

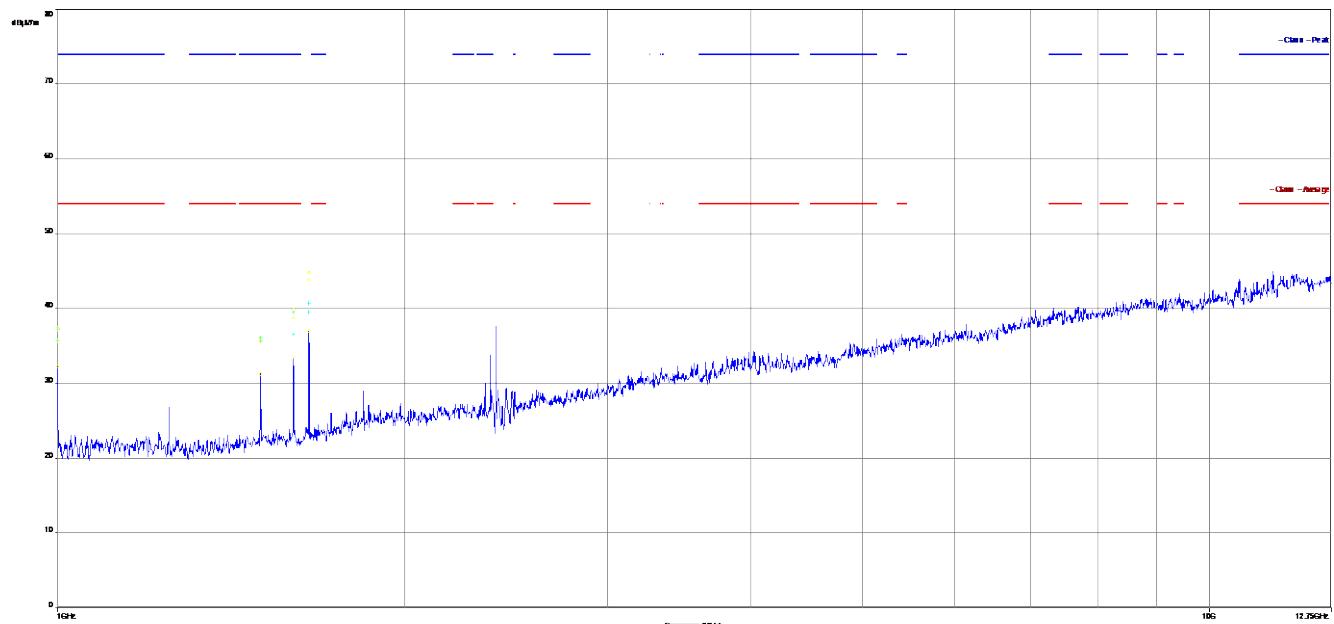
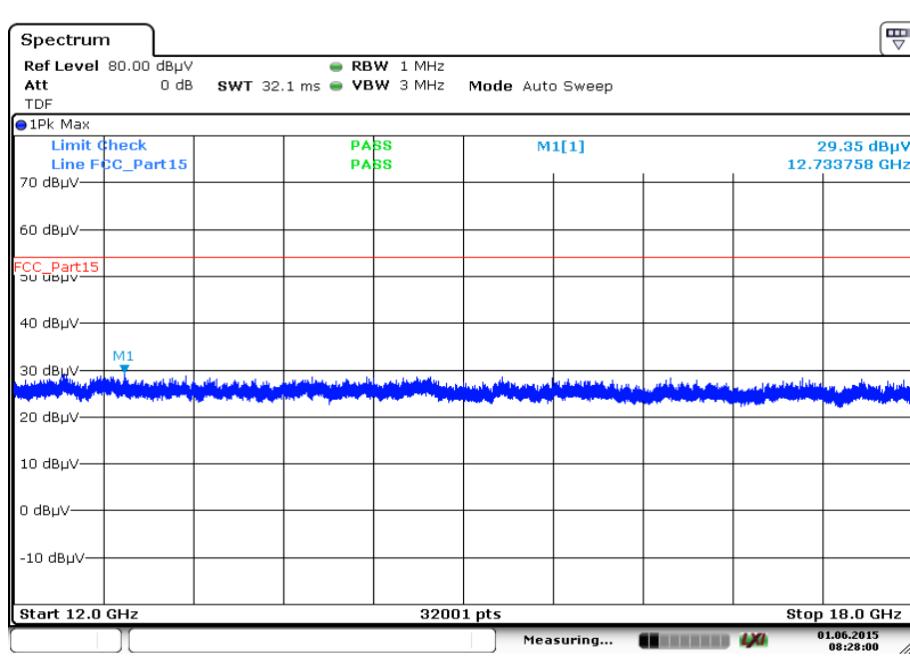
TX spurious emissions radiated [dB μ V/m]								
2402 MHz			2441 MHz			2480 MHz		
F [MHz]	Detector	Level [dB μ V/m]	F [MHz]	Detector	Level [dB μ V/m]	F [MHz]	Detector	Level [dB μ V/m]
1000	Peak	37.3	1627	Peak	42.0			
1500	Peak	36.1						
1602	Peak	39.8						
1652	Peak	44.8						
Measurement uncertainty			± 3 dB					

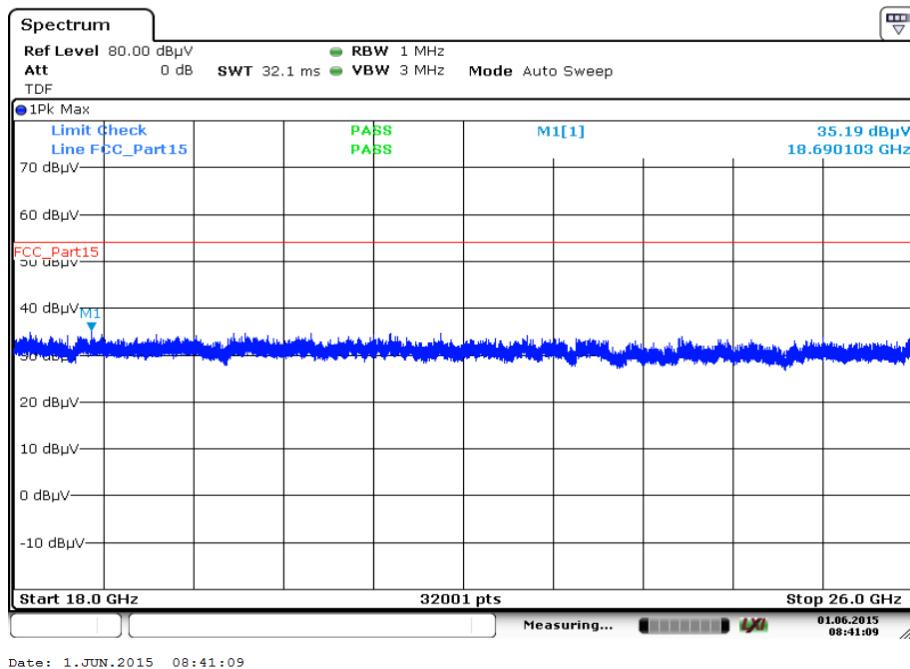
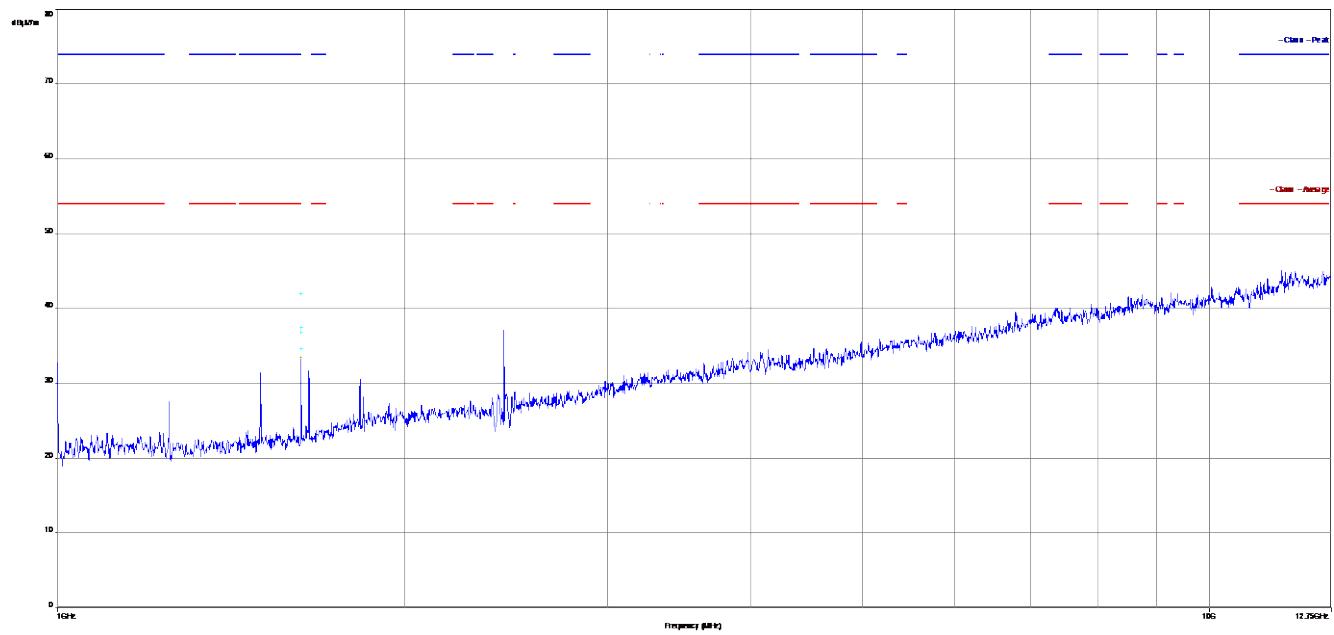
Verdict: complies**Results:** Receiver mode

RX spurious emissions radiated [dB μ V/m]		
F [MHz]	Detector	Level [dB μ V/m]
1000	Peak	38.6
1250	Peak	33.8
1501	Peak	37.1
1831	Peak	35.3
Measurement uncertainty	± 3 dB	

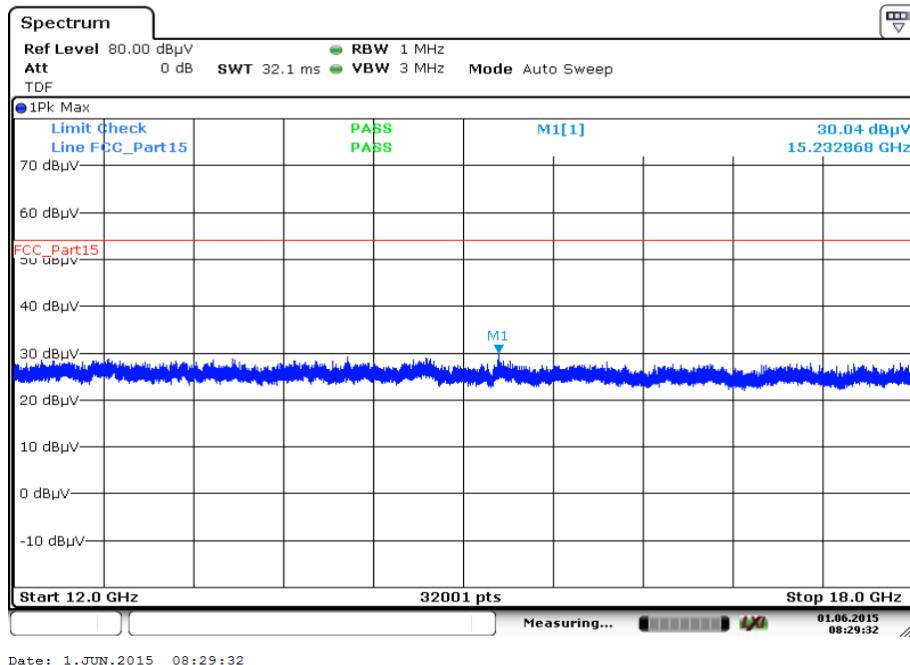
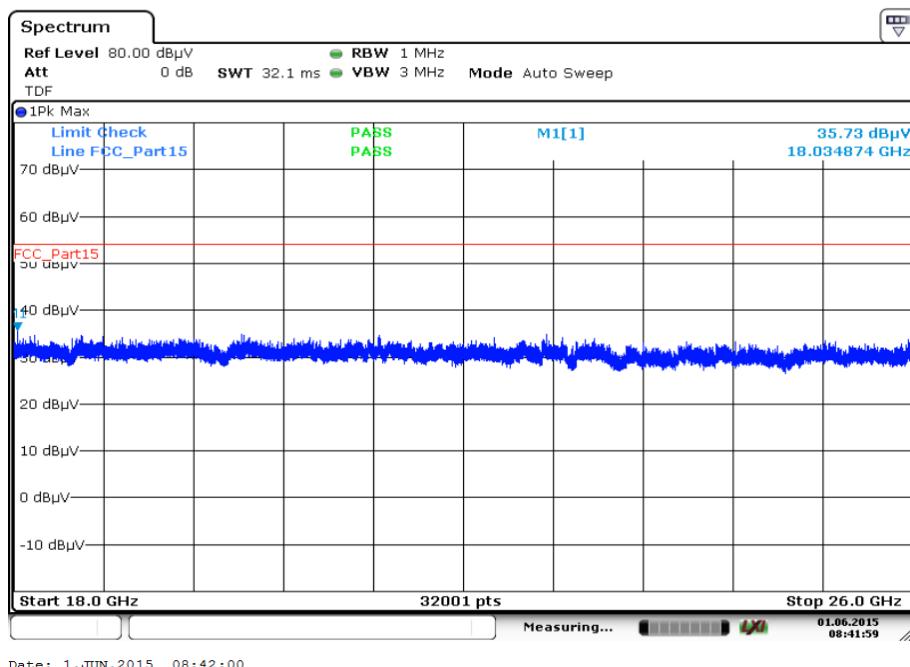
Verdict: complies

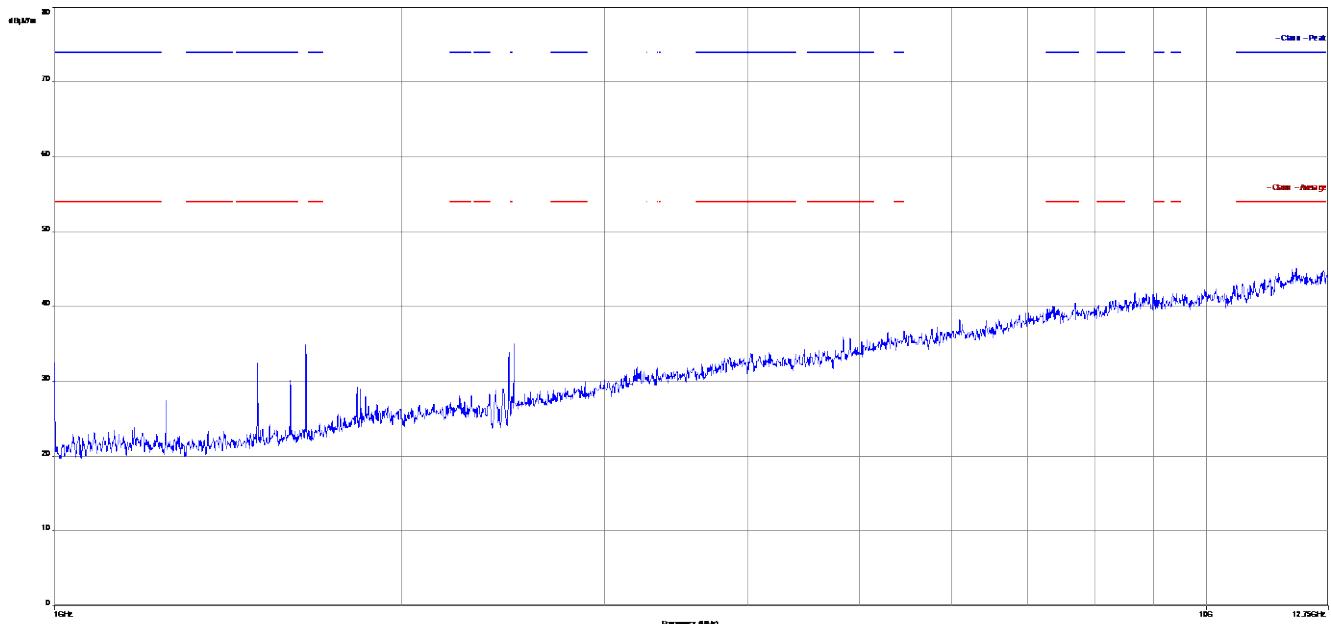
Note: The limit was recalculated with 20 dB / decade (Part 15.31) for all radiated spurious emissions 30 MHz to 1 GHz from 3 meter limit to a 10 meter distance. (40dB/decade for emissions < 30MHz)

Plots: Transmitter mode**Plot 1:** 1 GHz to 12.75 GHz, TX mode, channel 00, vertical & horizontal polarization**Plot 2:** 12.75 GHz to 18 GHz, TX mode, channel 00, vertical & horizontal polarization

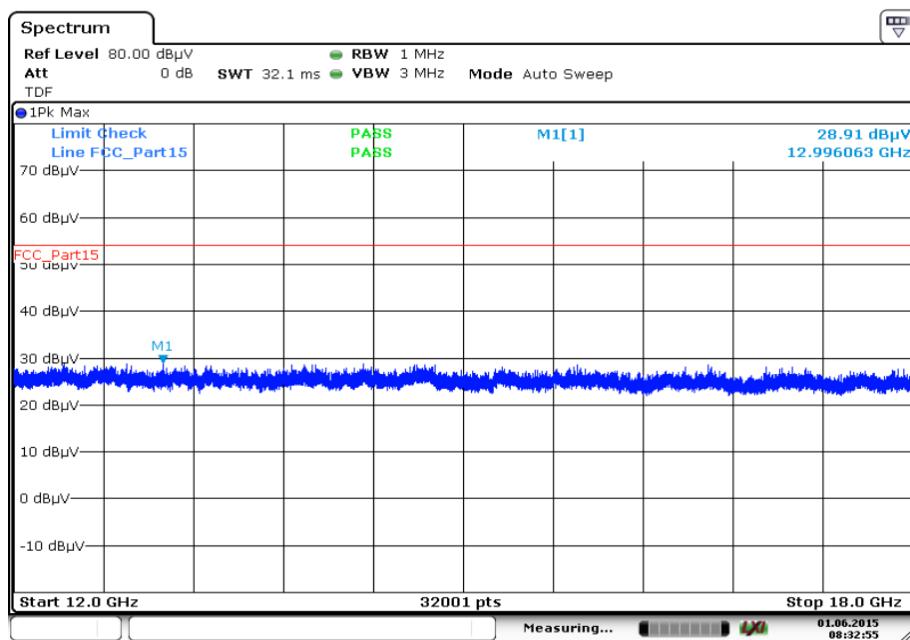
Plot 3: 18 GHz to 26 GHz, TX mode, channel 00, vertical & horizontal polarization**Plot 4:** 1 GHz to 12.75 GHz, TX mode, channel 39, vertical & horizontal polarization

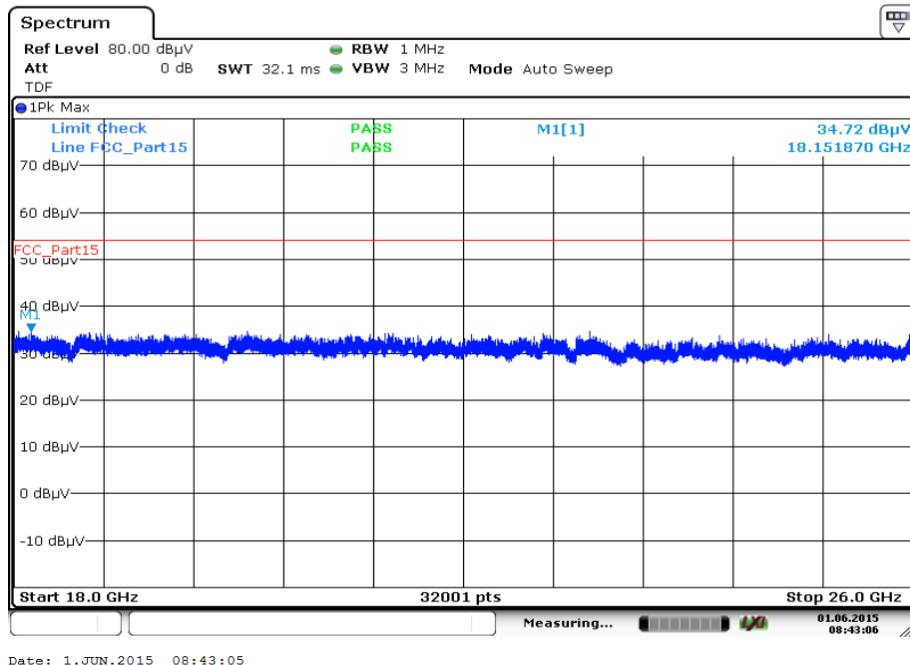
The carrier signal is notched with a 2.4 GHz band rejection filter.

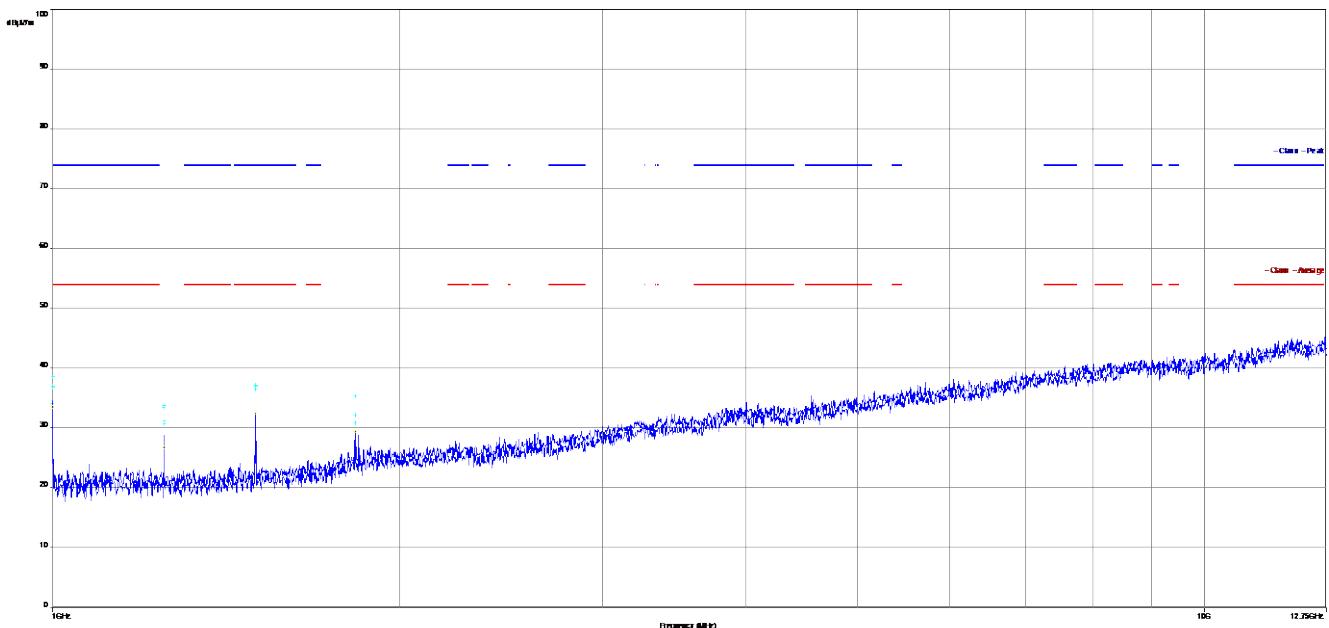
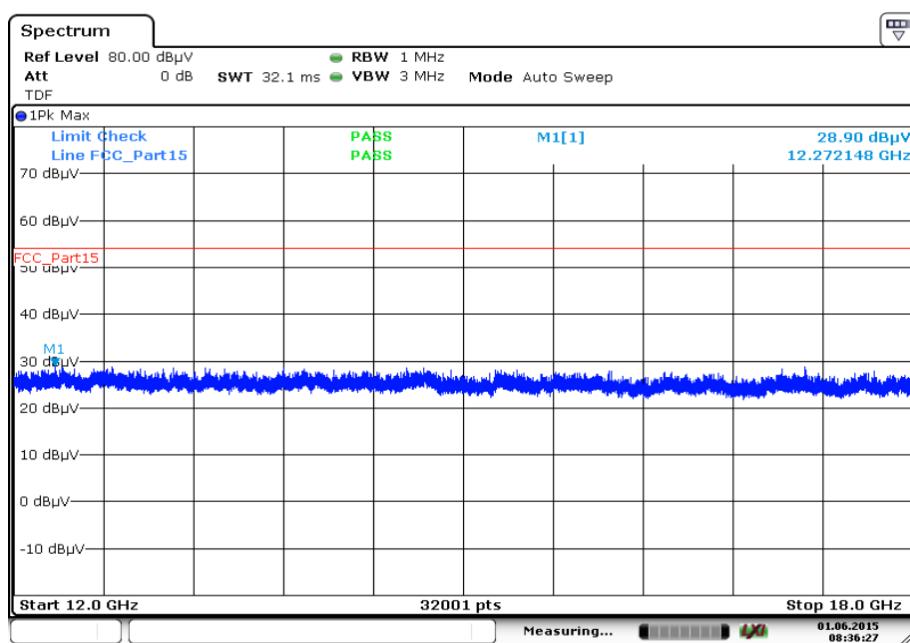
Plot 5: 12.75 GHz to 18 GHz, TX mode, channel 39, vertical & horizontal polarization**Plot 6:** 18 GHz to 26 GHz, TX mode, channel 39, vertical & horizontal polarization

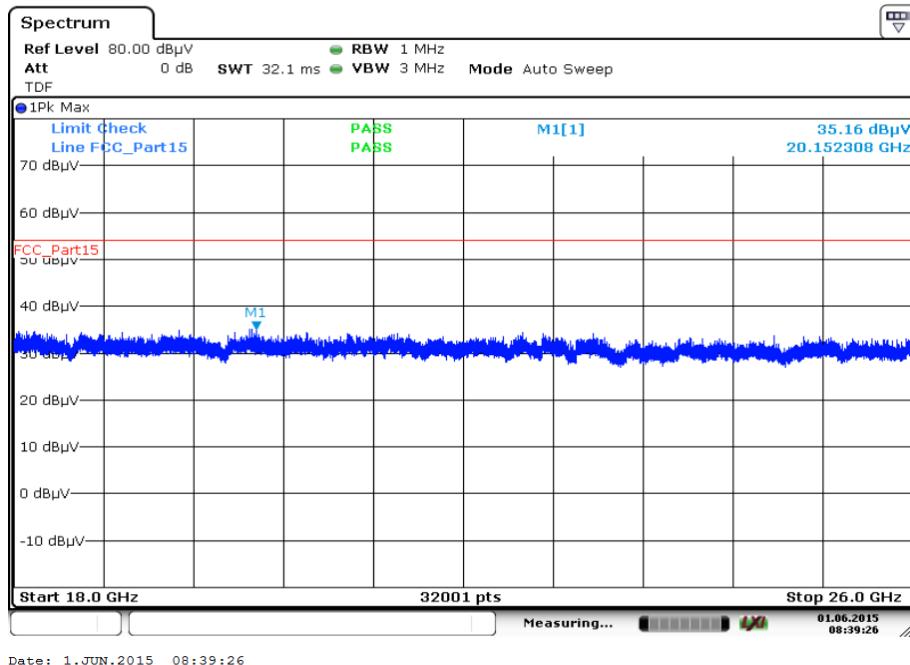
Plot 7: 1 GHz to 12.75 GHz, TX mode, channel 78, vertical & horizontal polarization

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

Plot 8: 12.75 GHz to 18 GHz, TX mode, channel 78, vertical & horizontal polarization

Plot 9: 18 GHz to 26 GHz, TX mode, channel 78, vertical & horizontal polarization

Plots: Receiver mode**Plot 1:** 1 GHz to 12.75 GHz, RX / idle – mode, vertical & horizontal polarization**Plot 2:** 12.75 GHz to 18 GHz, RX / idle – mode, vertical & horizontal polarization

Plot 3: 18 GHz to 26 GHz, RX / idle – mode, vertical & horizontal polarization

10.13 Spurious emissions conducted below 30 MHz (AC conducted)

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:

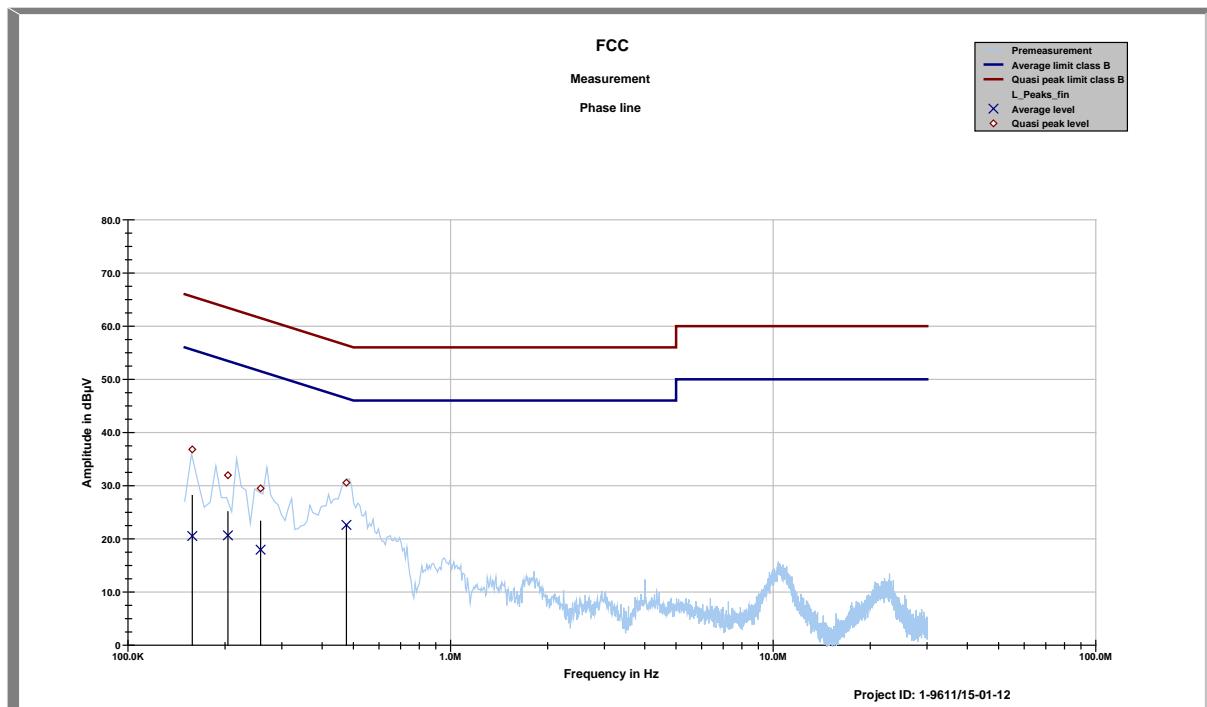
FCC	IC	
TX spurious emissions conducted < 30 MHz		
Frequency (MHz)	Quasi-peak (dB μ V/m)	Average (dB μ V/m)
0.15 – 0.5	66 to 56*	56 to 46*
0.5 – 5	56	46
5 – 30.0	60	50

*Decreases with the logarithm of the frequency

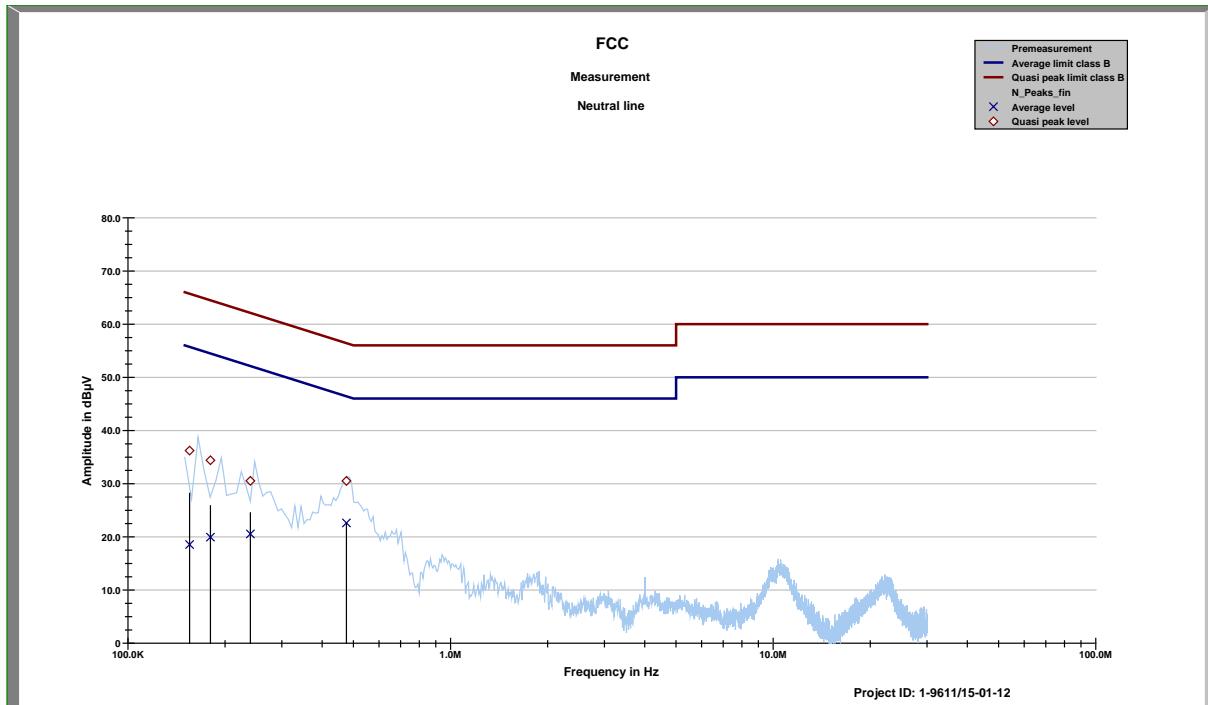
Results:

Spurious emissions conducted < 30 MHz [dB μ V/m]		
F [MHz]	Detector	Level [dB μ V/m]
No emissions detected		
Measurement uncertainty		± 3 dB

Verdict: **complies**

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

Frequency	Quasi peak level	Margin quasi peak	Average level	Margin average
MHz	dB μ V	dB μ V	dB μ V	dB μ V
0.15834	36.81	28.74	20.53	35.23
0.20414	31.97	31.47	20.66	33.80
0.25777	29.50	32.00	17.95	34.97
0.47553	30.56	25.85	22.62	24.08

Plot 2: 150 kHz to 30 MHz, neutral line

Frequency	Quasi peak level	Margin quasi peak	Average level	Margin average
MHz	dB μ V	dB μ V	dB μ V	dB μ V
0.15532	36.22	29.49	18.55	37.30
0.18018	34.39	30.09	19.93	35.21
0.23959	30.52	31.59	20.54	32.90
0.47546	30.51	25.90	22.61	24.09

Annex A Document history

Version	Applied changes	Date of release
	Initial release	2015-06-24

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
PMN	Product marketing name
HMN	Host marketing name
HVIN	Hardware version identification number
FVIN	Firmware version identification number

Annex C Accreditation Certificate

Front side of certificate

Back side of certificate



Deutsche Akkreditierungsstelle GmbH

Befähigt 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
Unterkirheimer 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
Alarmsysteme
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 and 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 Dokument, der
Rückseite des Deckblatts und der folgenden Anlage mit insgesamt 77 Seiten.

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

Deutsche Akkreditierungsstelle GmbH

Standort Berlin
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10117 Berlin

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Gartenstraße 6
60594 Frankfurt am Main

Standort Braunschweig
Bündesallee 100
38116 Braunschweig

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und des Rates vom 9. Juli 2008 über die Vorschriften für die Akkreditierung und Marktüberwachung
im Zusammenhang mit der Vermarktung von Produkten (Abl. L 218 vom 9. Juli 2008, S. 30).

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Europäischen Organisation für Akkreditierung (EA), des International Accreditation Forum (IAF) und
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ILAC: www.ilac.org
IAF: www.iaf.nu

Frankfurt am Main, 07.03.2014

Ihre Auftragserfüllung ist Ralfigner
Abteilungsleiter

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>