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TEST REPORT

Test report no.: 1-7443/14-04-08-A



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

Testing laboratory

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Accredited Testing Laboratory:

The testing laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025 (2005) by the Deutsche Akkreditierungsstelle GmbH (DAkkS). The accreditation is valid for the scope of testing procedures as stated in the accreditation certificate with the registration number: D-PL-12076-01-00

Applicant

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Manufacturer

Sony Mobile Communications Inc.
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Test standard/s

47 CFR Part 15 Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices
RSS - 210 Issue 8 Spectrum Management and Telecommunications Radio Standards Specification - Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment
For further applied test standards please refer to section 3 of this test report.

Test Item

Kind of test item: **BT Smart Watch**
Model name: **SWR50**
Commercial name: **SWR50**
Type number: **RD-0090**
FCC ID: **PY7-RD0090**
IC: **4170B-RD0090**
Frequency: DTS band 2400 MHz to 2483.5 MHz
(lowest channel 00 – 2402 MHz; highest channel 39 – 2480 MHz)
Technology tested: Bluetooth®, LE
Antenna: Integrated antenna
Power supply: 3.7V DC by Li - polymer battery
Temperature range: -30°C to +50°C

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

Test report authorised:

p. o.

Stefan Bös
Professional
Radio Communications & EMC

Test performed:

Marco Bertolino
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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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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:	2014-07-08
Date of receipt of test item:	2014-07-21
Start of test:	2014-07-21
End of test:	2014-07-29
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 - 210 Issue 8	01.12.2010	Spectrum Management and Telecommunications Radio Standards Specification - Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment

4 Test environment

Temperature:	T_{nom}	+22 °C during room temperature tests
	T_{max}	+50 °C during high temperature tests
	T_{min}	-30 °C during low temperature tests
Relative humidity content:		54 %
Barometric pressure:		not relevant for this kind of testing
Power supply:	V_{nom}	3.7 V DC by Li - polymer battery
	V_{max}	4.2 V
	V_{min}	3.3 V

5 Test item

Kind of test item	:	BT Smart Watch
Model name	:	SWR50
Commercial name	:	SWR50
Type number	:	RD-0090
S/N serial number	:	14271D1AA37269C 14271D1BA371D4A
HW hardware status	:	AP
SW software status	:	Cond.: RF test software java_sony_brooks.020-eng ANDROID-201410704.154857KOT49H 20test-keys
Frequency band [MHz]	:	DTS band 2400 MHz to 2483.5 MHz (lowest channel 00 – 2402 MHz; highest channel 39 – 2480 MHz)
Type of radio transmission	:	FHSS
Use of frequency spectrum	:	
Type of modulation	:	GFSK
Number of channels	:	40
Antenna	:	Integrated antenna
Power supply	:	3.7 V DC by Li - polymer battery
Temperature range	:	-30°C to +50 °C

5.1 Additional information

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

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

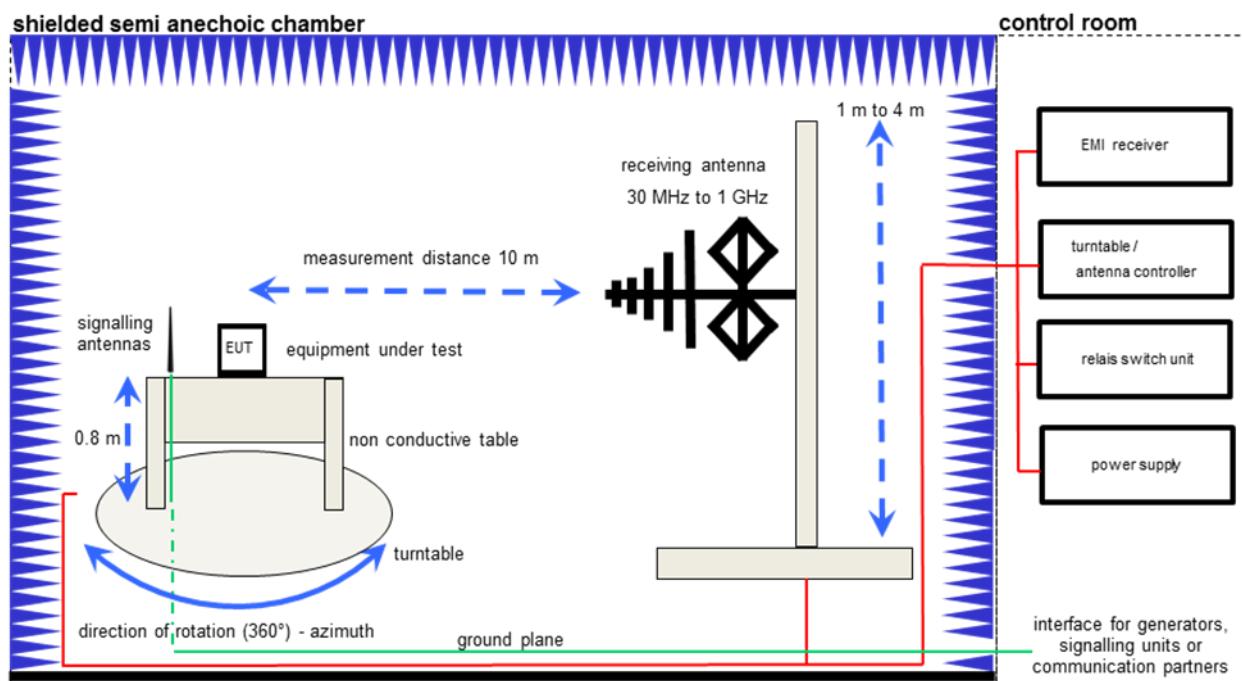
6 Test laboratories sub-contracted

None

7 Description of the test setup

7.1 Radiated measurements chamber F

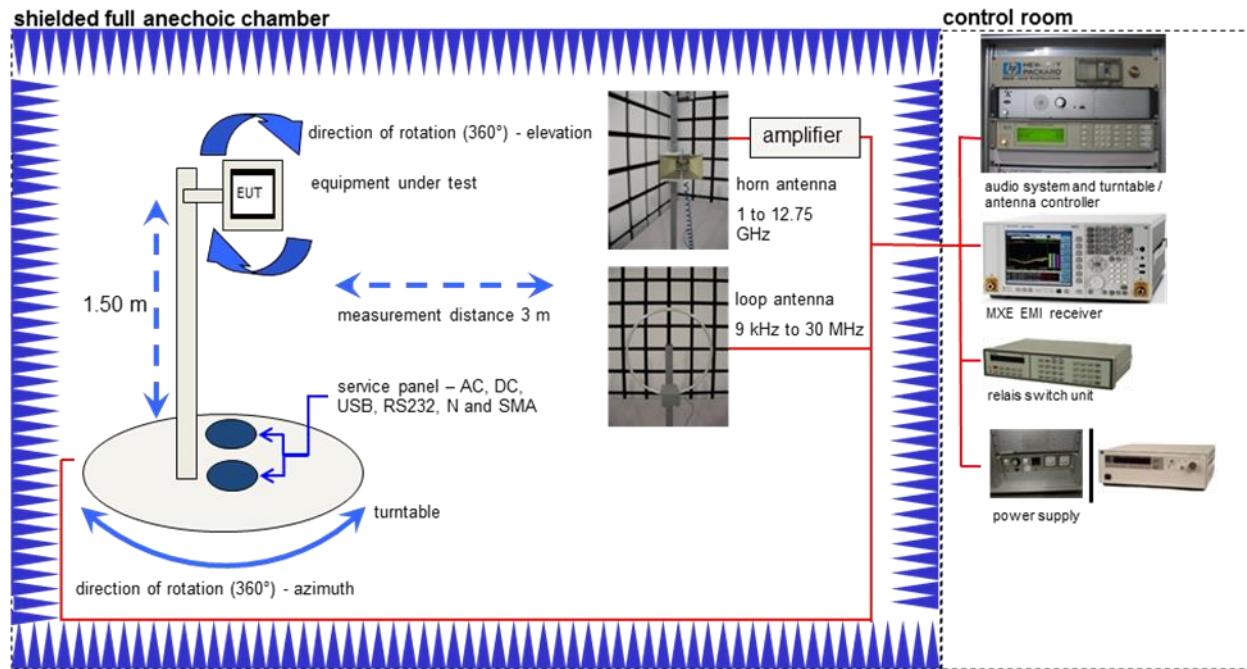
The radiated measurements are performed in vertical and horizontal plane in the frequency range from 9 kHz to 1 GHz in semi-anechoic chambers. The EUT is positioned on a non-conductive support with a height of 0.80 m above a conductive ground plane that covers the whole chamber. The receiving antennas are confirmed with specifications ANSI C63. These antennas can be moved over the height range between 1.0 m and 4.0 m in order to search for maximum field strength emitted from EUT. The measurement distances between EUT and receiving antennas are indicated in the test setups for the various frequency ranges. For each measurement, the EUT is rotated in all three axes until the maximum field strength is received. The wanted and unwanted emissions are received by spectrum analysers where the detector modes and resolution bandwidths over various frequency ranges are set according to requirement ANSI C63.



Equipment table:

Equipment	Type	Manufacturer	Serial No.	INV. No Cetecom
Software	EMC32 V.1 9.12.05	R&S	-/-	-/-
Switch-Unit	3488A	HP Meßtechnik	2719A14505	300000368
DC power supply, 60Vdc, 50A, 1200 W	6032A	HP Meßtechnik	2920A04466	300000580
EMI Test Receiver	ESCI 3	R&S	100083	300003312
Amplifier	JS42-00502650-28-5A	MITEQ	1084532	300003379
Antenna Tower	Model 2175	ETS-LINDGREN	64762	300003745
Positioning Controller	Model 2090	ETS-LINDGREN	64672	300003746
Turntable Interface-Box	Model 105637	ETS-LINDGREN	44583	300003747
TRILOG Broadband Test-Antenna 30 MHz – 3 GHz	VULB9163	Schwarzbeck	295	300003787
CBT (Bluetooth Tester + EDR Signalling)	CBT 1153.9000K35, CBT-B55, CBT-K55	R&S	100313	300003516

7.2 Radiated measurements chamber C



Equipment table:

Equipment	Type	Manufacturer	Serial No.	INV. No Cetecon
MXE EMI Receiver 20 Hz bis 26,5 GHz	N9038A	Agilent Technologies	MY51210197	300004405
Highpass Filter	WHKX7.0/18G-8SS	Wainwright	18	300003789
Double-Ridged Waveguide Horn Antenna 1-18.GHz	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 Regeltranco	Erfi	91350	300001155
Three-Way Power Splitter, 50 Ohm	11850C	HP Meßtechnik		300000997
Amplifier	js42-00502650-28-5a	Parzich GMBH	928979	300003143

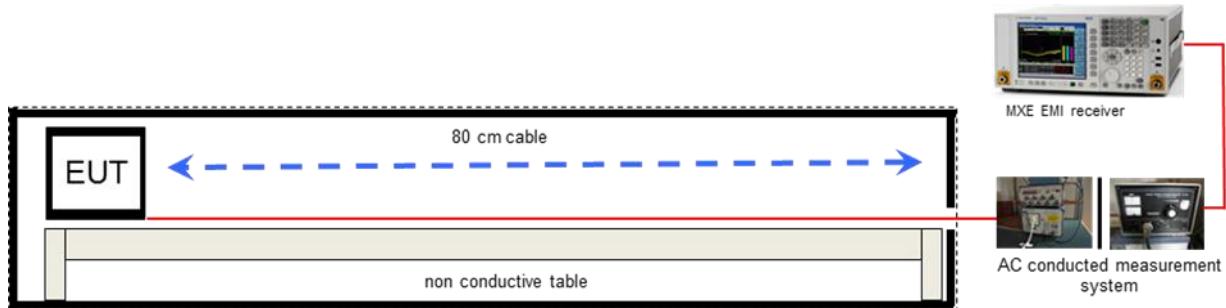
7.3 Radiated measurements 12.75 GHz to 26 GHz



Equipment table:

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

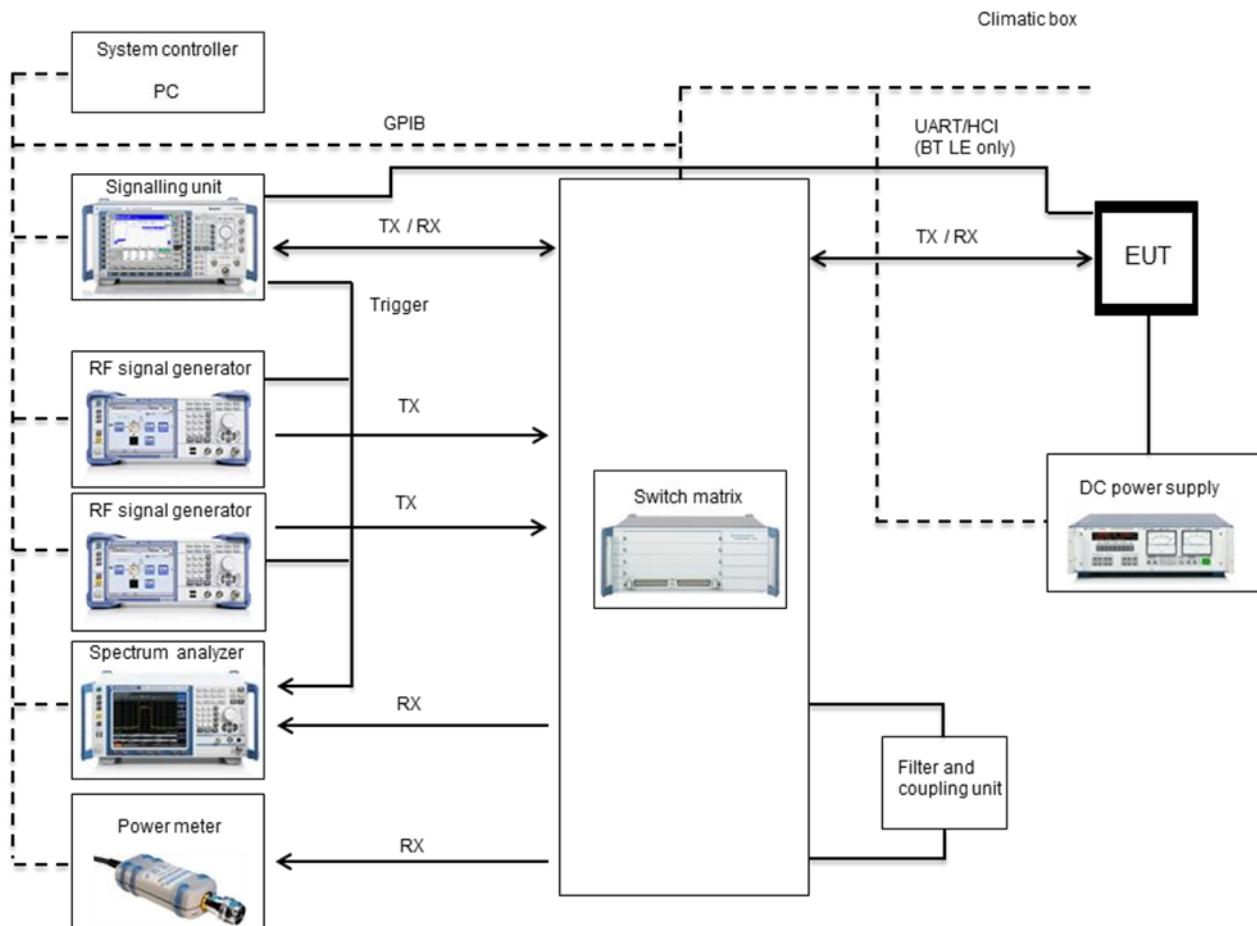
7.4 AC conducted



Equipment table:

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

7.5 Conducted signalling test system



Equipment table:

Equipment	Type	Manufacturer	Serial No.	INV. No Cetecom
Switch / Control Unit	3488A	HP Meßtechnik		300001691
Power Supply DC	NGPE 40/40	R&S	388	400000078
Frequency Standard (Rubidium Frequency Standard)	MFS (Rubidium)	R&S (Datum)	002	300002681-0009
Power Sensor 50 Ohms, 10 MHz – 18 GHz, 1 nW – 20 mW	NRV-Z1	R&S	833894/012	300002681-0013
Directional Coupler	101020010	Krytar	70215	300002840
DC-Blocker	8143	Inmet Corp.	none	300002842
Powersplitter	6005-3	Inmet Corp.		300002841
CBT (Bluetooth Tester + EDR Signalling)	CBT 1153.9000K35	R&S	100185	300003416
Spectrum Analyzer 9kHz to 30GHz -140..+30dBm	FSP30	R&S	100886	300003575
Microwave System Amplifier, 0.5-26.5 GHz	83017A	HP Meßtechnik	00419	300002268

8 Summary of measurement results



No deviations from the technical specifications were ascertained



There were deviations from the technical specifications ascertained

TC Identifier	Description	Verdict	Date	Remark
RF-Testing	CFR Part 15 RSS 210, Issue 8, Annex 8	Passed	2014-08-07	-/-

Test specification clause	Test case	Temperature conditions	Power source voltages	Mode	Pass	Fail	NA	NP	Remark
§15.247(b)(4) RSS 210 / A8.4(2)	Antenna gain	Nominal	Nominal	GFSK	☒	☐	☐	☐	complies
§15.247© RSS 210 / A8.2(b)	Power spectral density	Nominal	Nominal	GFSK	☒	☐	☐	☐	complies
§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	☒	☐	☐	☐	complies
§15.247(a)(2) RSS 210 / A8.2(a)	Spectrum bandwidth of a FHSS system 6 dB bandwidth	Nominal	Nominal	GFSK	☒	☐	☐	☐	complies
§15.247(a)(1) RSS 210	Spectrum bandwidth of a FHSS system 20 dB bandwidth	Nominal	Nominal	GFSK	☒	☐	☐	☐	complies
§15.247(b)(1) RSS-210 / A8.4(2)	Maximum output power	Nominal	Nominal	GFSK	☒	☐	☐	☐	complies
§15.247(d) RSS-210 / A8.5	Band edge compliance conducted	Nominal	Nominal	GFSK	☒	☐	☐	☐	complies
§15.205 RSS-210 / A8.5	Band edge compliance radiated	Nominal	Nominal	GFSK	☒	☐	☐	☐	complies
§15.247(d) RSS-210 / A8.5	TX spurious emissions conducted	Nominal	Nominal	GFSK	☒	☐	☐	☐	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 LE packets (37 byte payload) and static PRBS pattern.
RX/Standby tests: BT enabled, TX Idle

Test mode: Bluetooth LE Test mode enabled
(EUT is controlled over CBT)
 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
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 2440 MHz	highest channel 2480 MHz
Conducted power [dBm] Measured with GFSK modulation		6.36	6.76	7.48
Radiated power [dBm] Measured with GFSK modulation		4.79	5.72	6.18
Gain [dBi] Calculated		-1.57	-1.04	-1.30

Result: **Passed**

10.2 Power spectral density

Description:

Measurement of the power spectral density of a digital modulated system.

Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	3 kHz
Video bandwidth:	10 kHz
Span:	≥ EBW
Trace-Mode:	Max Hold

Limits:

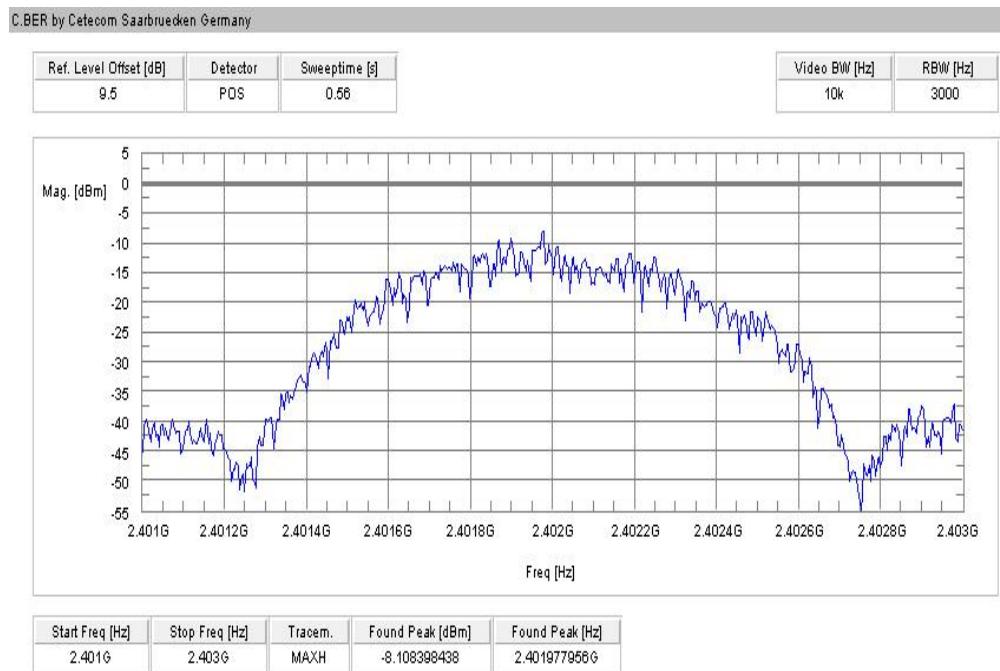
FCC	IC
Power Spectral Density	
For digitally modulated systems the transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission or over 1.0 second if the transmission exceeds 1.0-second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

Results:

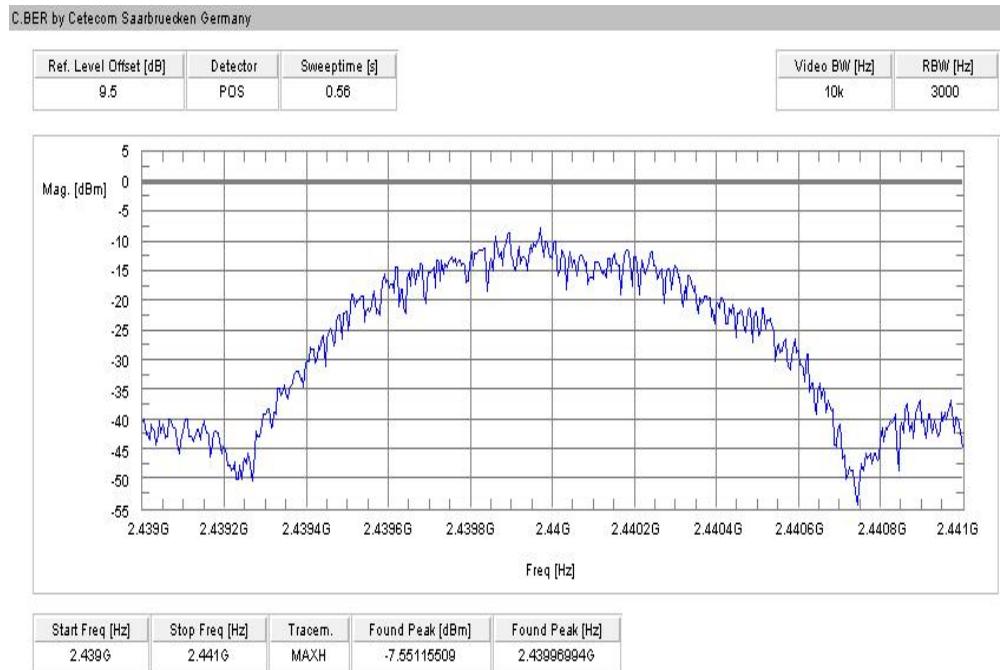
Modulation	Power spectral density		
	2402 MHz	2440 MHz	2480 MHz
[dBm / 3kHz]	-8.11	-7.55	-6.86
Measurement uncertainty	± 1.5 dB		

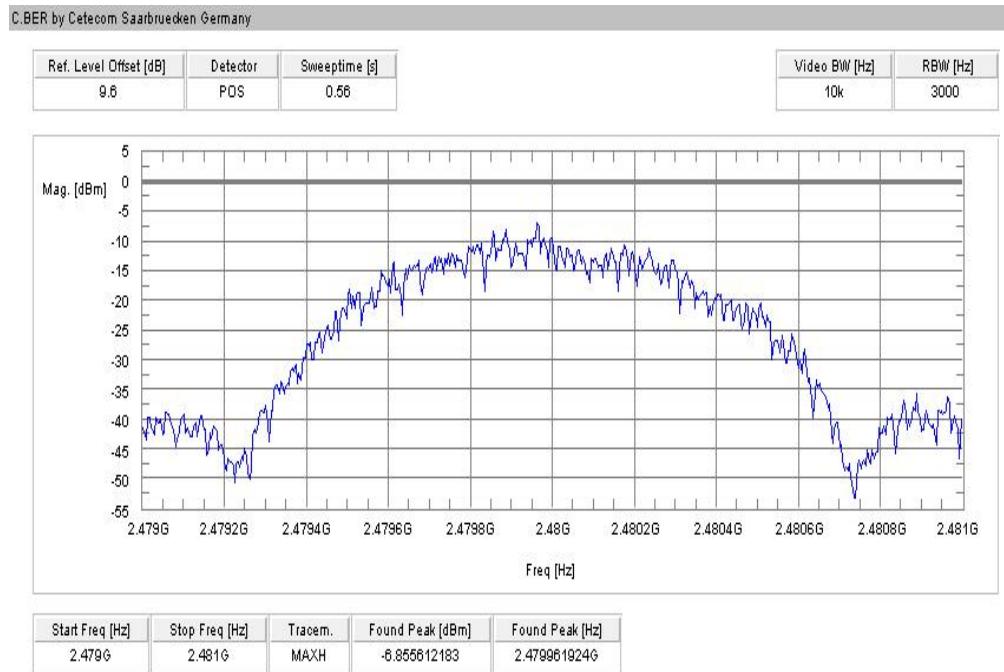
Plots:

Plot 1: lowest channel



Plot 2: mid channel



Plot 3: highest channel

10.3 Carrier frequency separation

Description:

Measurement of the carrier frequency separation of a hopping system. We use GFSK modulation to show compliance. EUT in hopping mode.

Measurement:

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

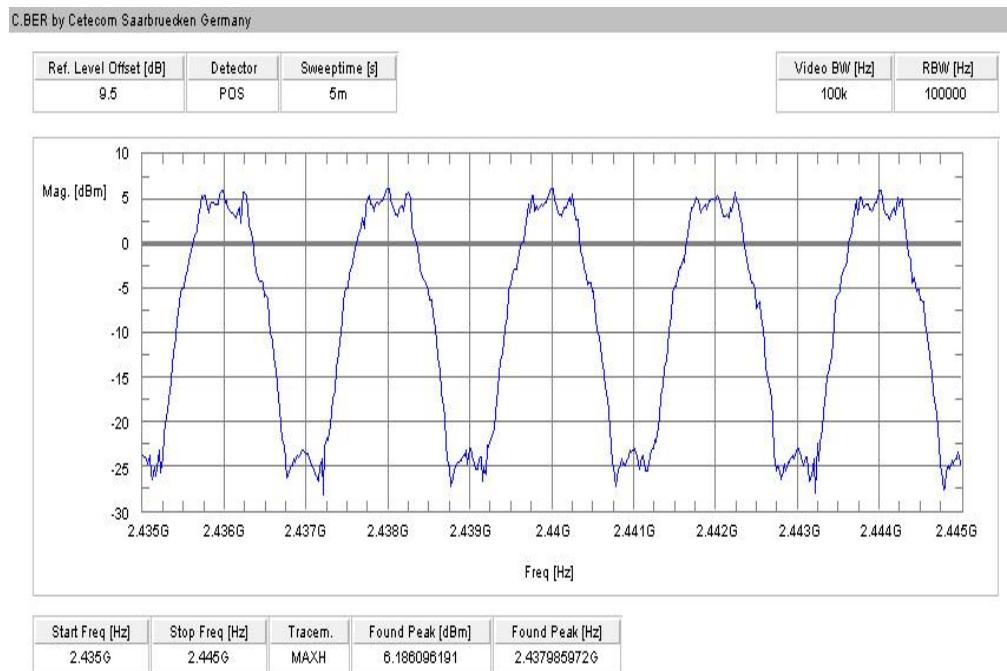
Limits:

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	~ 2 MHz
------------------------------	---------

Result: Passed

Plot:**Plot 1: Carrier Frequency Separation**

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
Resolution bandwidth:	500 kHz
Video bandwidth:	500 kHz
Span:	Plot 1: 2400 – 2445 MHz Plot 2: 2445 – 2485 MHz
Trace-Mode:	Max Hold

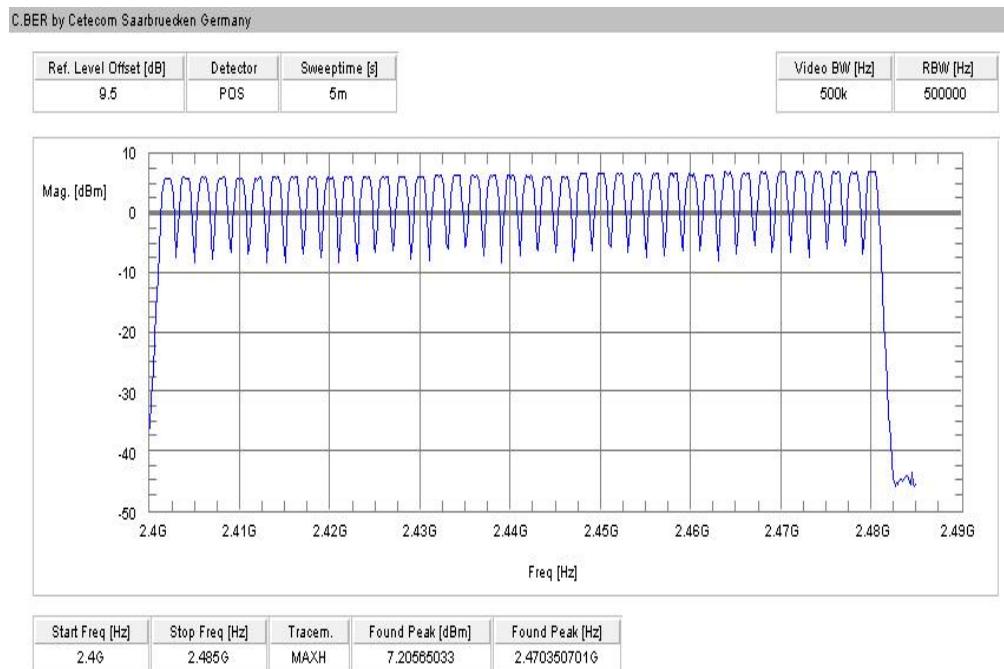
Limits:

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

Result:

Number of hopping channels	40
----------------------------	----

Result: Passed

Plots:**Plot 1: Number of hopping channels**

10.5 Time of occupancy (dwell time)

Measurement:

Measuring/calculation of the pulse width in data transmit mode on one hopping channel for a Bluetooth® LE device.

Measurement parameters:

Detector: Peak
 Video bandwidth: 1 MHz
 Resolution bandwidth: 1 MHz
 Span: Zero Span
 Trace: Video triggered

For Bluetooth® LE devices:

Time slot length:	625μs
Number of channels:	40
Number of time slots per second:	1600/s
Max. number of transmissions per channel in 1 s:	1600/s / 40 = 40
Max. number of transmissions per channel in 16 s:	40 × 16 = 640
Period:	Number of channels × 0.4s = 16s

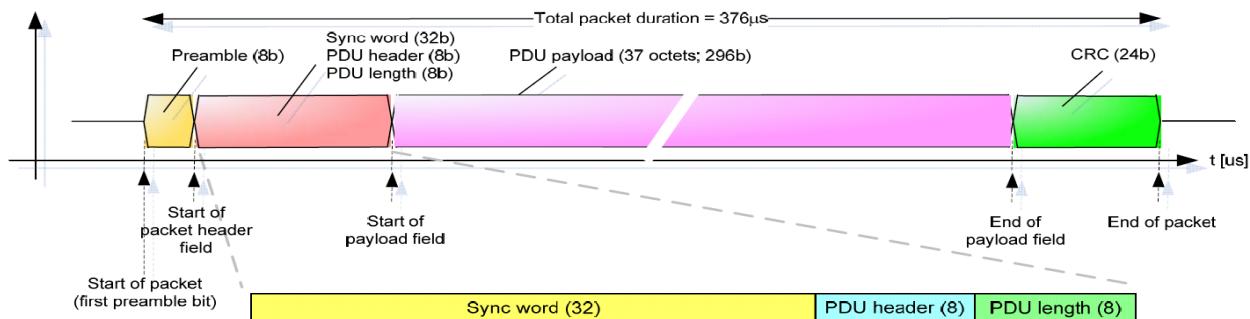
Under normal test conditions only	400 ms within in a period
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Results:

Dwell time = standard test packet pulse width*) × number of transmission per channel in 15.6 seconds

Packet type	standard test packet pulse width [ms]	number of hops in 16 sec	calculated dwell time [ms]
Data Transmit mode	0.376	640	241

*) For Bluetooth® LE devices no measurements are mandatory due to the fixed requirements of the Bluetooth® Core Specification. The standard test packet is defined as:



Result: Passed

10.6 Spectrum bandwidth of a FHSS system – 6 dB bandwidth

Description:

Measurement of the 6 dB bandwidth of the modulated signal.

Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	100 kHz
Video bandwidth:	100 kHz
Span:	3 MHz
Trace-Mode:	Max Hold

Limits:

FCC	IC
Spectrum bandwidth of a FHSS system – 6 dB bandwidth	
> 500 kHz	

Results:

Modulation	6 dB BANDWIDTH [kHz]		
	2402 MHz	2440 MHz	2480 MHz
GFSK	721	721	727
Measurement uncertainty	± 100 kHz		

Result: Passed

Plots:
Plot 1: lowest channel

Plot 2: mid channel


Plot 3: highest channel

10.7 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:	2 s
Resolution bandwidth:	30 kHz
Video bandwidth:	100 kHz
Span:	4 MHz
Trace-Mode:	Max Hold

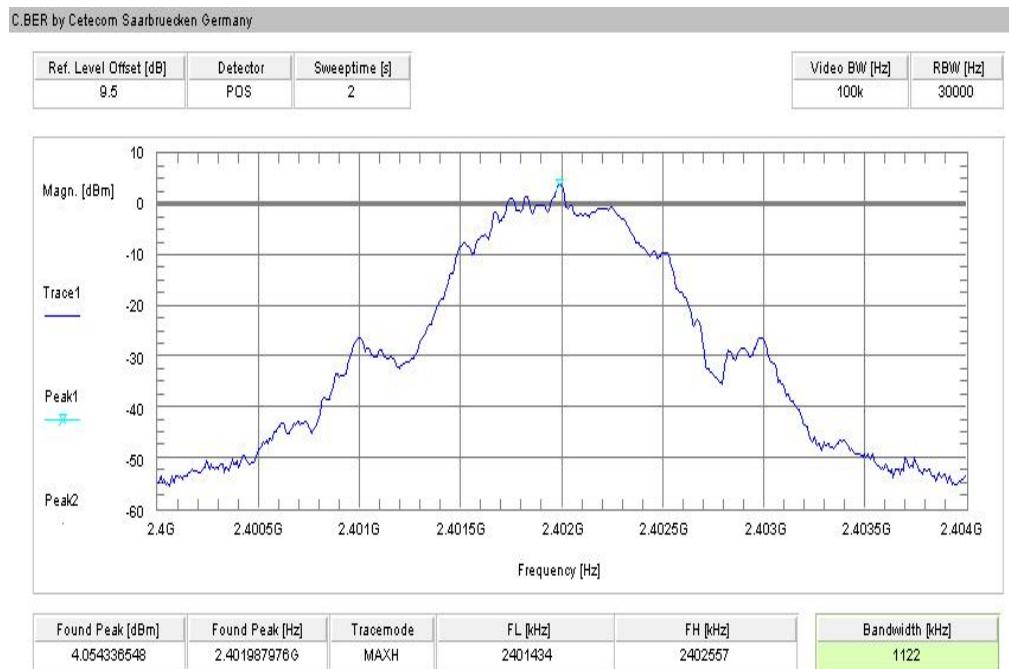
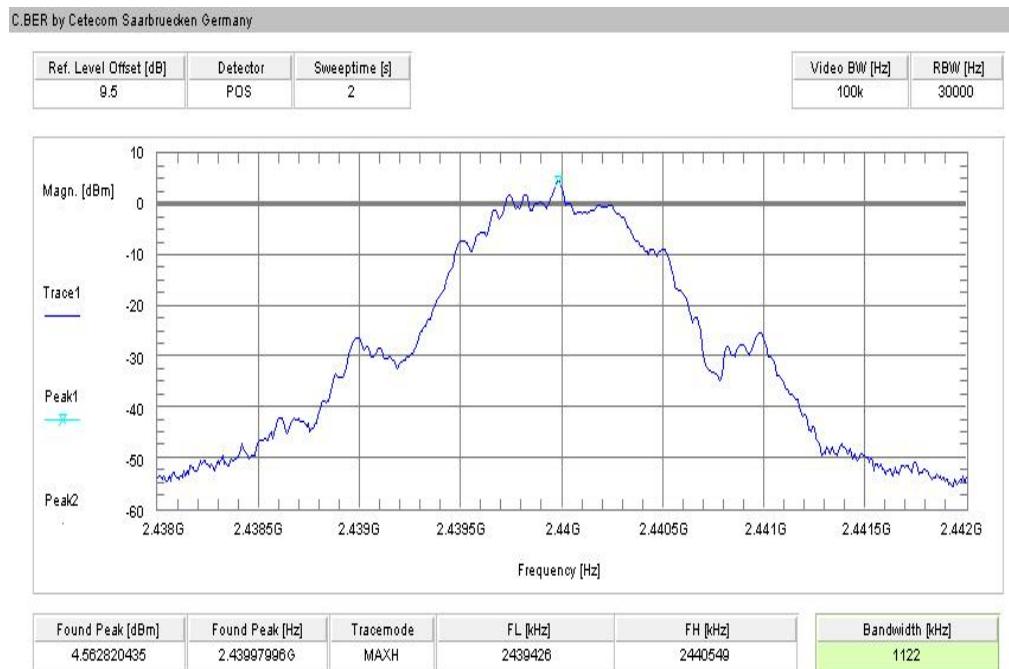
Limits:

FCC	IC
Spectrum bandwidth of a FHSS system – 20 dB bandwidth	
Bandwidth < 3/2 * Channel spacing	

Results:

Modulation	20 dB BANDWIDTH [kHz]		
	2402 MHz	2440 MHz	2480 MHz
GFSK	1122	1122	1114
Measurement uncertainty	± 30 kHz		

Result: Passed

Plots:
Plot 1: lowest channel

Plot 2: mid channel


Plot 3: highest channel

10.8 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
Resolution bandwidth:	3 MHz
Video bandwidth:	10 MHz
Span:	6 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	

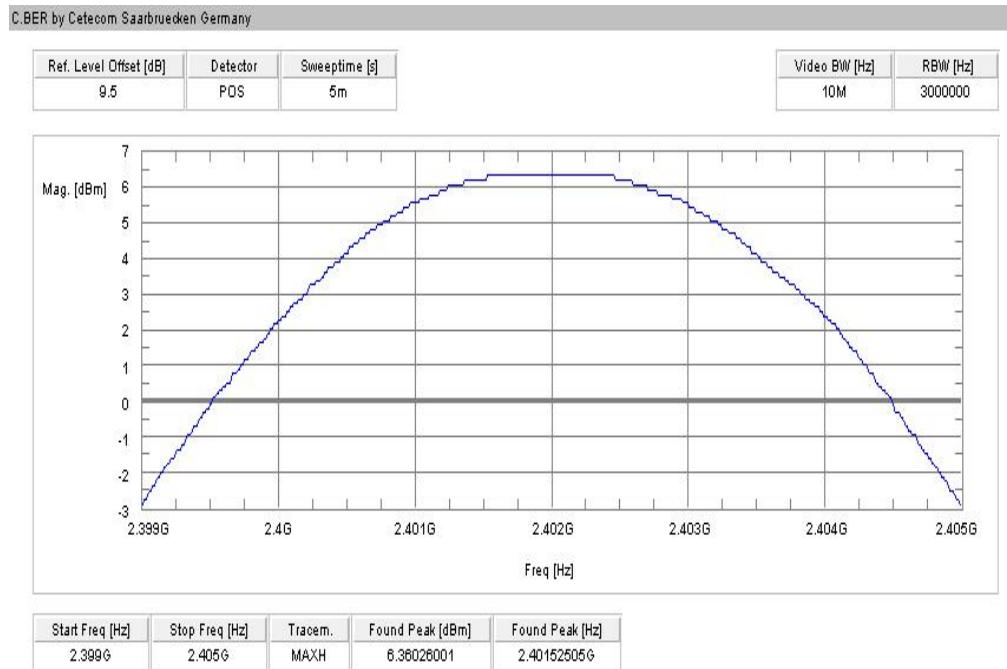
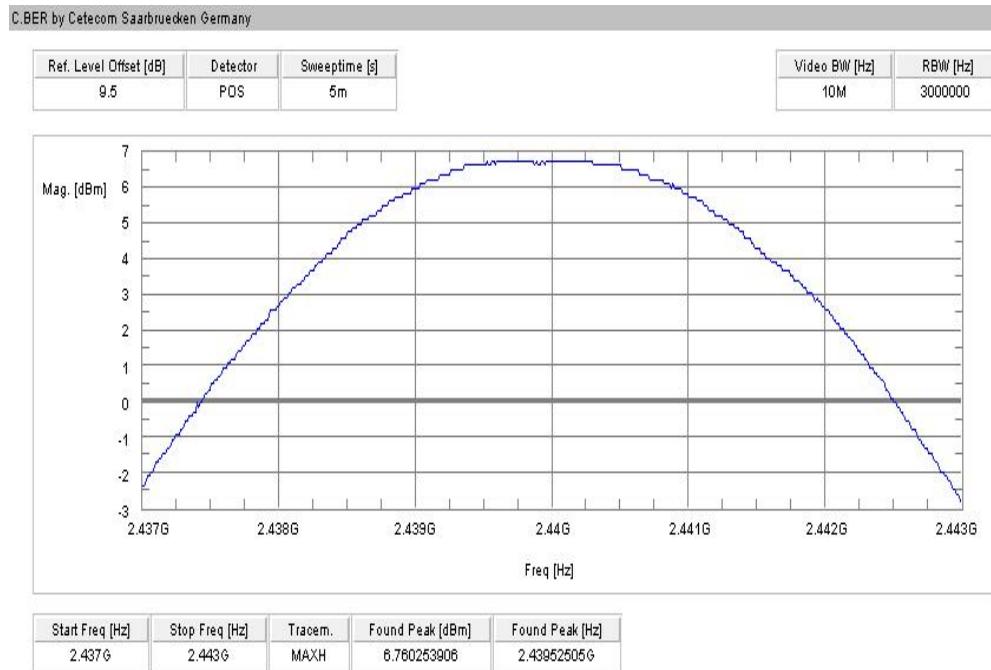
Results:

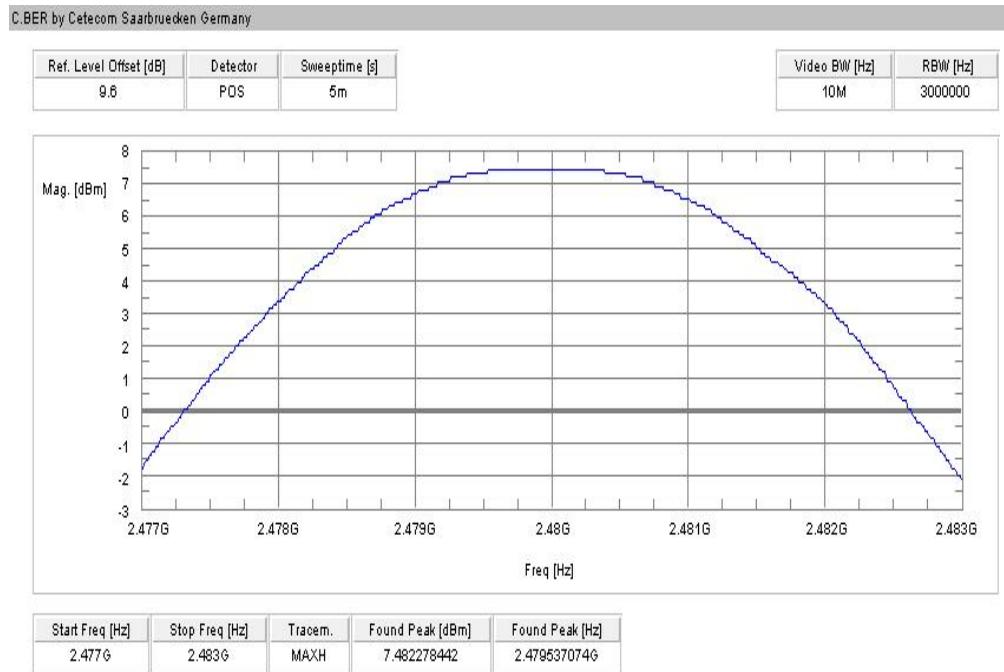
Modulation	Maximum output power conducted [dBm]		
	2402 MHz	2440 MHz	2480 MHz
GFSK	6.36	6.76	7.48
Measurement uncertainty	± 1.5 dB		

Modulation	Maximum output power radiated – EIRP [dBm]		
	2402 MHz	2440 MHz	2480 MHz
GFSK	4.79	5.72	6.18
Measurement uncertainty	± 3 dB		

*) – Values calculated with antenna gain

Result: Passed

Plots:
Plot 1: lowest channel

Plot 2: mid channel


Plot 3: highest channel

10.9 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
Resolution bandwidth:	100 kHz
Video bandwidth:	100 kHz
Span:	Lower Band Edge: 2395 – 2405 MHz Upper Band Edge: 2478 – 2489 MHz
Trace-Mode:	Max Hold

Limits:

FCC	IC
Band edge compliance conducted	
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required.	

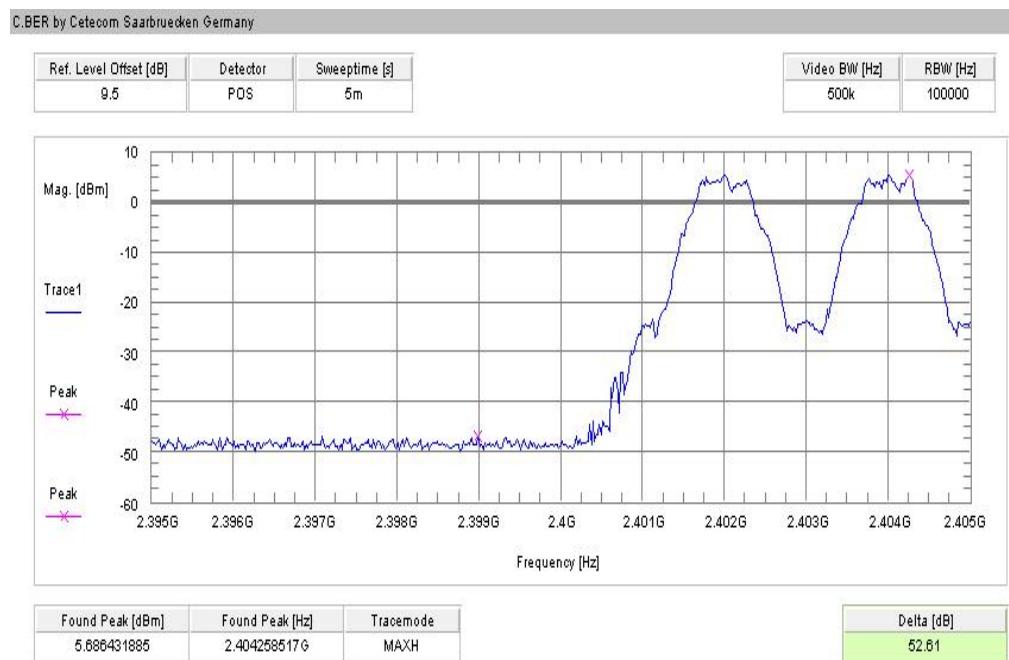
Result:

Scenario	Band edge compliance conducted [dB]
	GFSK
Modulation	
Lower band edge – hopping off	> 20 dB
Lower band edge – hopping on	> 20 dB
Upper band edge – hopping off	> 20 dB
Upper band edge – hopping on	> 20 dB
Measurement uncertainty	± 1.5 dB

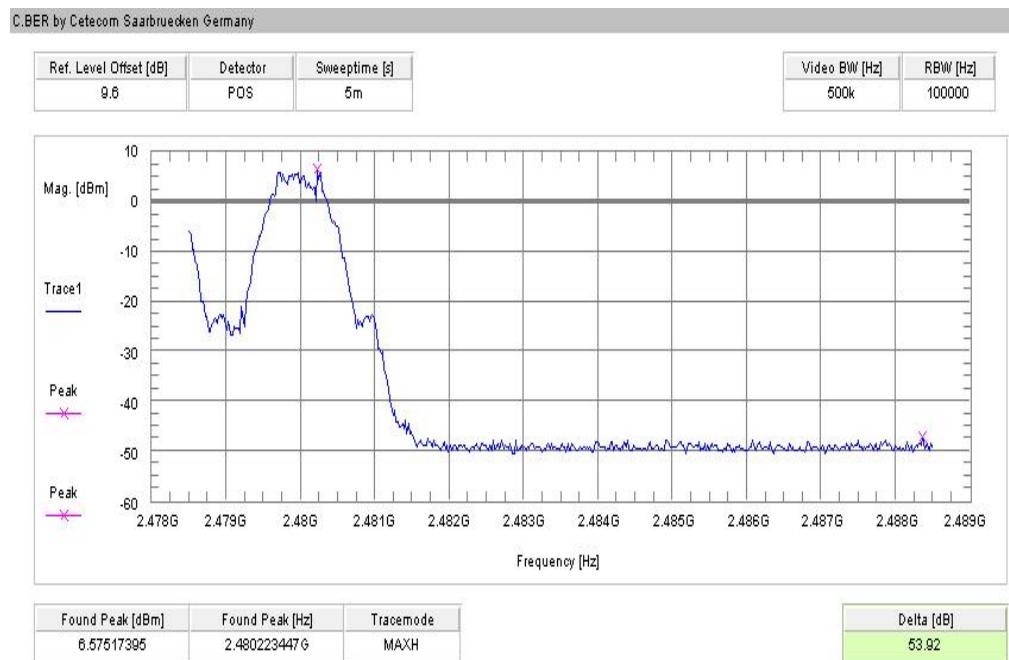
Result: Passed

Plots:

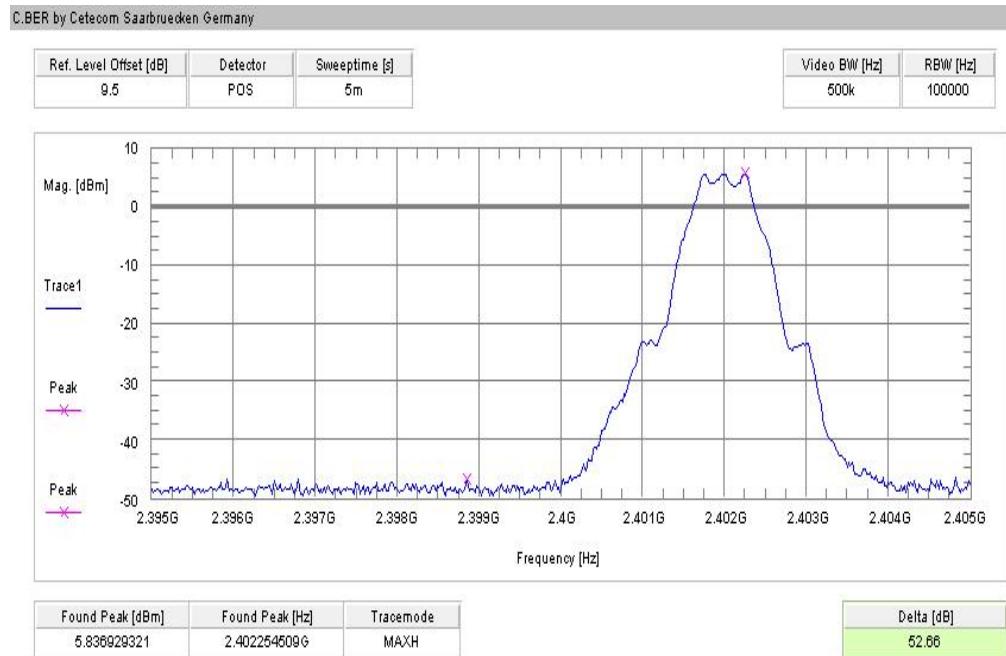
Plot 1: Lower band edge – hopping on



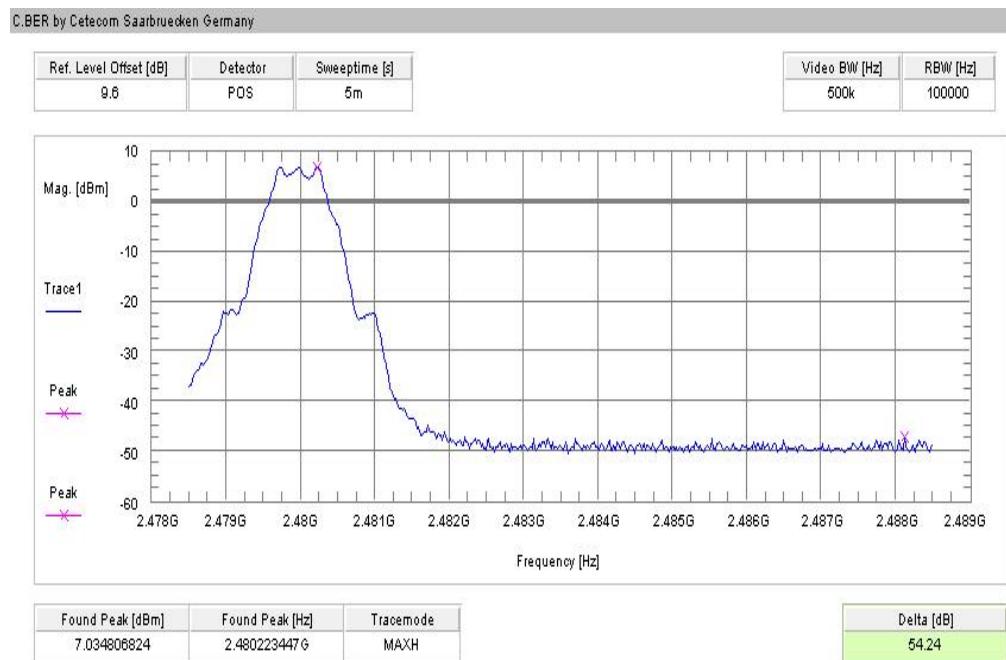
Plot 2: Upper band edge – hopping on



Plot 3: Lower band edge – hopping off



Plot 4: Upper band edge – hopping off



10.10 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 39 for the upper restricted band. The measurement is repeated for all modulations. Measurement distance is 3m.

Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	1 MHz
Video bandwidth:	10 Hz
Span:	Lower Band: 2300 – 2400 MHz Upper Band: 2480 – 2500 MHz
Trace-Mode:	Max Hold

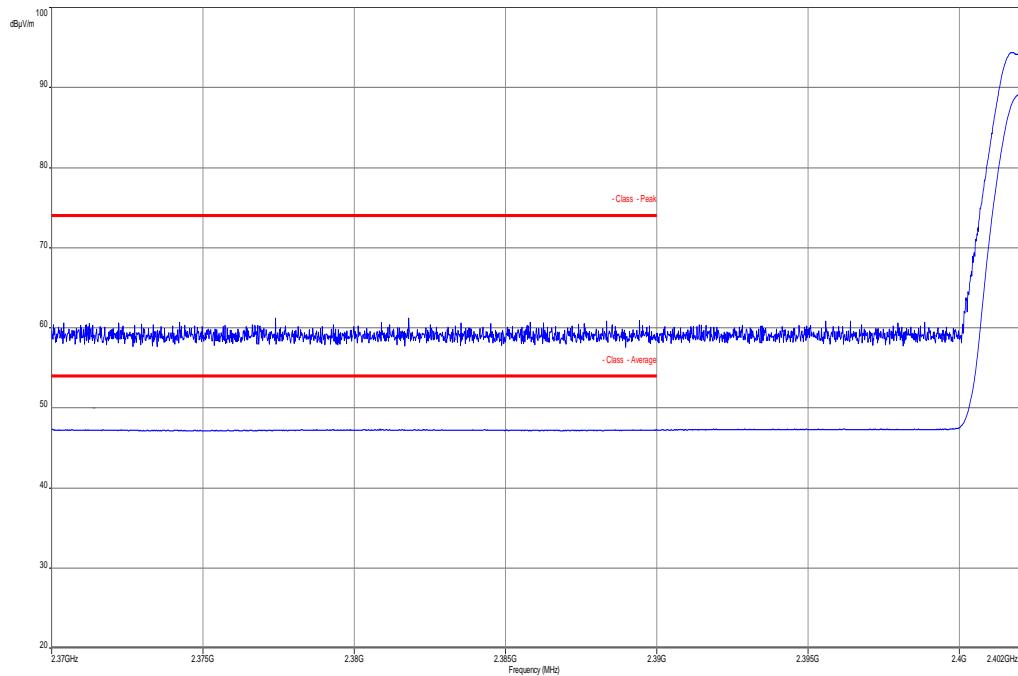
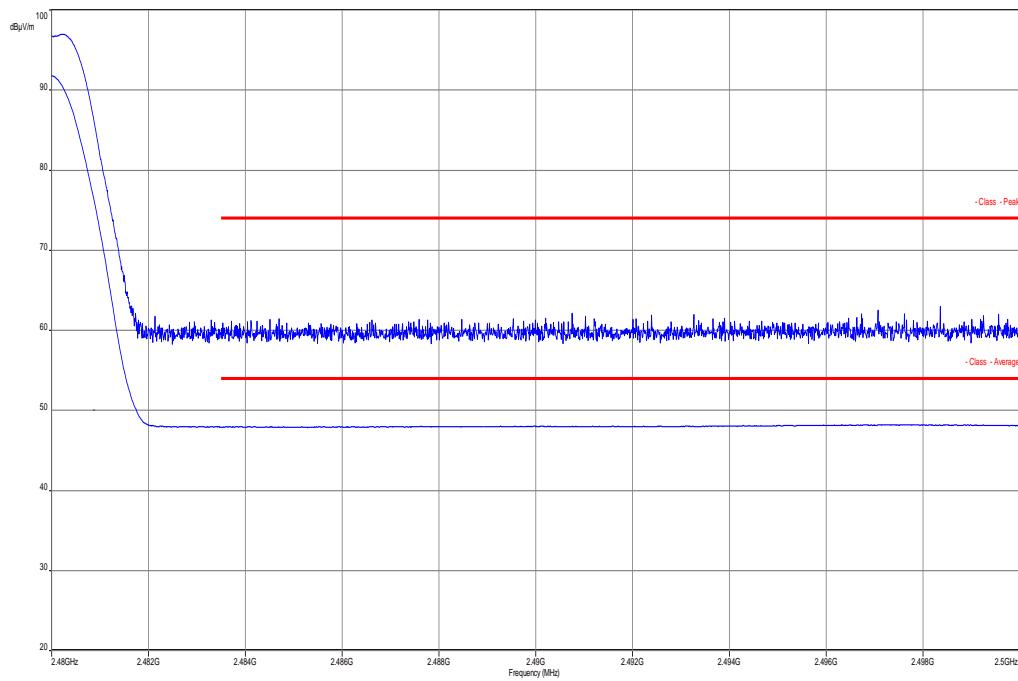
Limits:

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	

Result:

Scenario	Band edge compliance radiated [dB μ V/m]
	GFSK
Modulation	
Lower restricted band	< 54 AVG < 74 Peak
Upper restricted band	< 54 AVG < 74 Peak
Measurement uncertainty	± 3 dB

Result: Passed

Plots:**Plot 1: Lower restricted band****Plot 2: Upper restricted band**

10.11 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 19 and channel 39.

Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	100 kHz
Video bandwidth:	300 kHz or 500 kHz
Span:	9 kHz to 26 GHz
Trace-Mode:	Max Hold

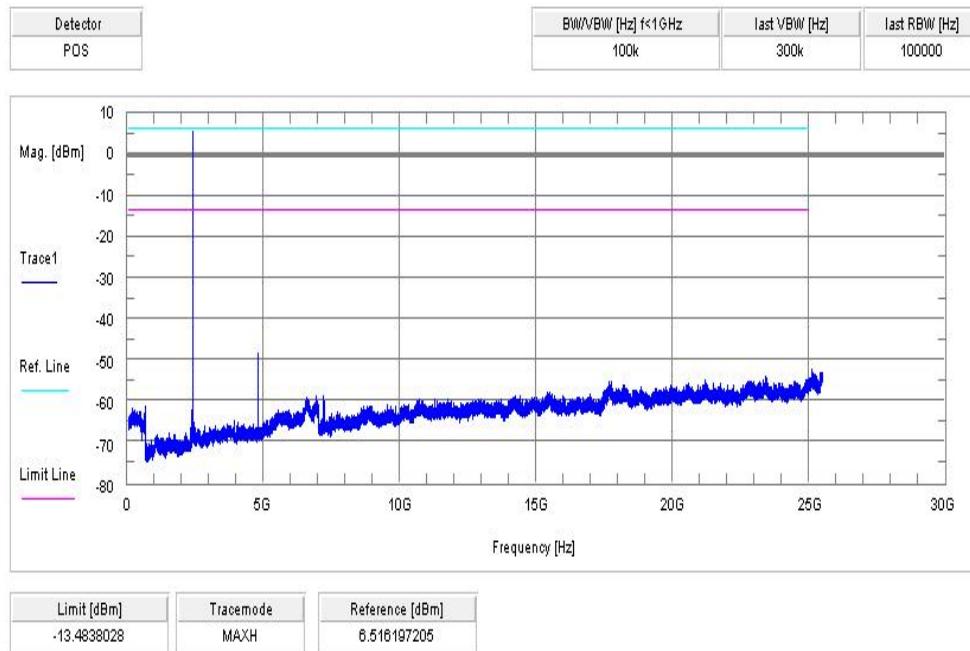
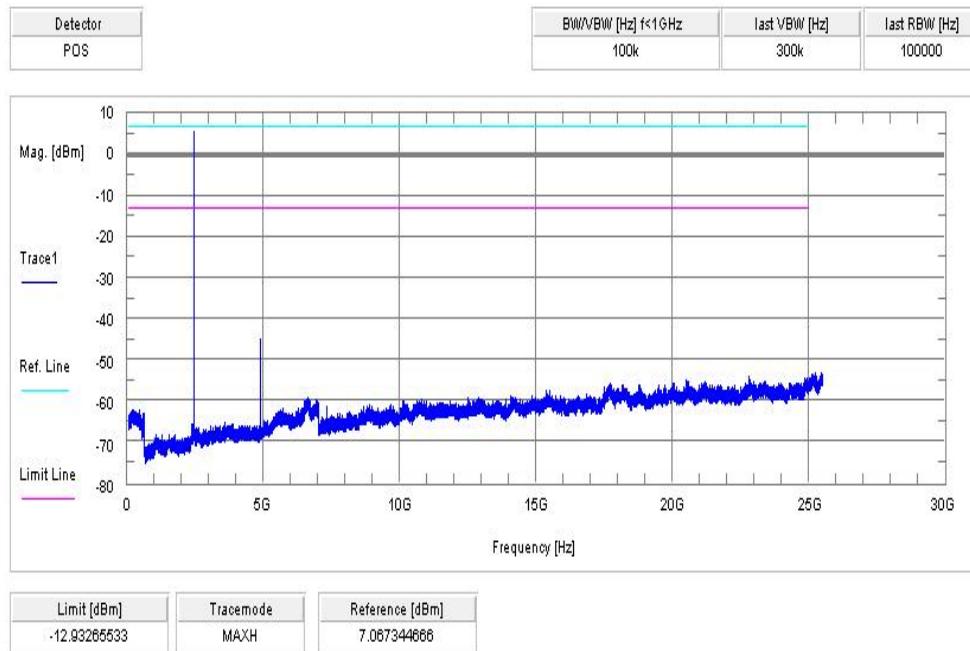
Limits:

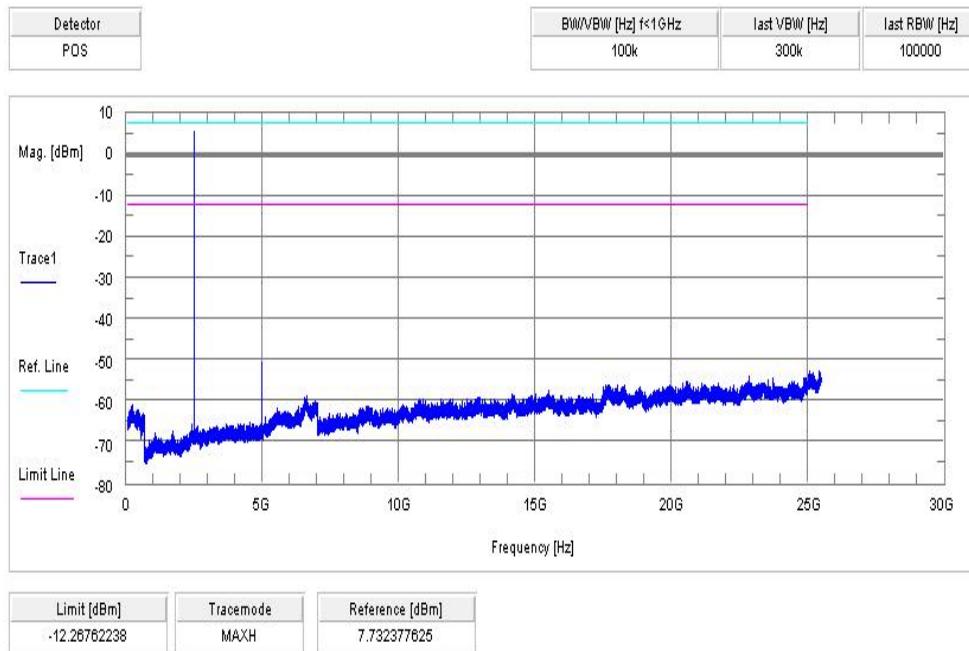
FCC	IC
TX spurious emissions conducted	
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth 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					
f [MHz]		amplitude of emission [dBm]	limit max. allowed emission power	actual attenuation below frequency of operation [dB]	results
2402		6.52	30 dBm		Operating frequency
All detected emissions are more than 6 dB below the limit!			-20 dBc		complies
2440		7.07	30 dBm		Operating frequency
All detected emissions are more than 6 dB below the limit!			-20 dBc		complies
2480		7.73	30 dBm		Operating frequency
All detected emissions are more than 6 dB below the limit!			-20 dBc		complies
Measurement uncertainty			± 3 dB		

Result: Passed

Plots:
Plot 1: lowest channel

Plot 2: mid channel


Plot 3: highest channel

10.12 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 19 and channel 39.

Measurement:

Measurement parameter	
Detector:	Peak / Quasi Peak
Sweep time:	Auto
Resolution bandwidth:	F < 1 GHz: 100 kHz F > 1 GHz: 1 MHz
Video bandwidth:	3 x RBW Remeasurement: 10 Hz
Span:	30 MHz to 26 GHz
Trace-Mode:	Max Hold
Measured Modulation:	GFSK

Limits:

FCC	IC															
TX spurious emissions radiated																
<p>In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).</p>																
§15.209																
<table border="1"> <thead> <tr> <th>Frequency (MHz)</th> <th>Field strength (dBμV/m)</th> <th>Measurement distance</th> </tr> </thead> <tbody> <tr> <td>30 – 88</td> <td>30.0</td> <td>10</td> </tr> <tr> <td>88 – 216</td> <td>33.5</td> <td>10</td> </tr> <tr> <td>216 – 960</td> <td>36.0</td> <td>10</td> </tr> <tr> <td>Above 960</td> <td>54.0</td> <td>3</td> </tr> </tbody> </table>		Frequency (MHz)	Field strength (dB μ V/m)	Measurement distance	30 – 88	30.0	10	88 – 216	33.5	10	216 – 960	36.0	10	Above 960	54.0	3
Frequency (MHz)	Field strength (dB μ V/m)	Measurement distance														
30 – 88	30.0	10														
88 – 216	33.5	10														
216 – 960	36.0	10														
Above 960	54.0	3														

Results:

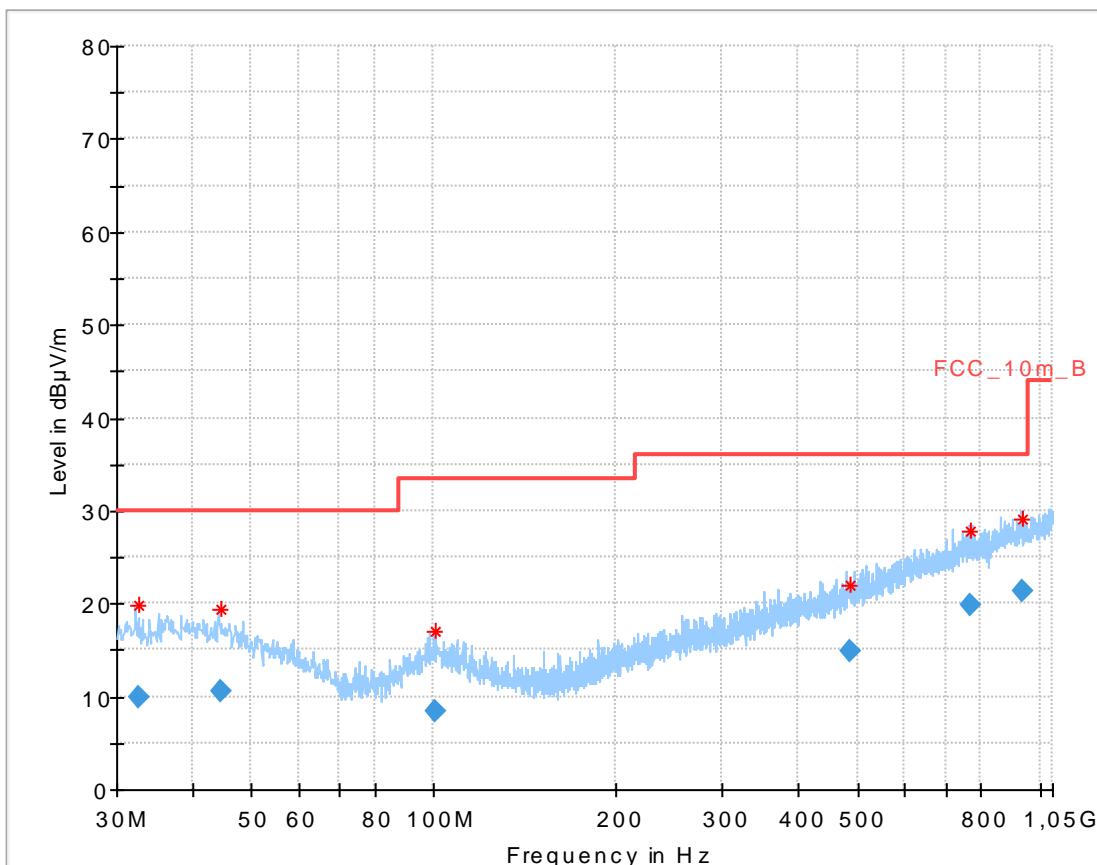
TX spurious emissions radiated [dB μ V/m]								
2402 MHz			2440 MHz			2480 MHz		
F [MHz]	Detector	Level [dB μ V/m]	F [MHz]	Detector	Level [dB μ V/m]	F [MHz]	Detector	Level [dB μ V/m]
For emissions below 1 GHz, please take a look at table below the 1 GHz plot.			For emissions below 1 GHz, please take a look at table below the 1 GHz plot.			For emissions below 1 GHz, please take a look at table below the 1 GHz plot.		
All detected peak emissions are below the average limit – see plots.			All detected peak emissions are below the average limit – see plots.			All detected peak emissions are below the average limit – see plots.		
Measurement uncertainty						± 3 dB		

Result: **Passed**

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

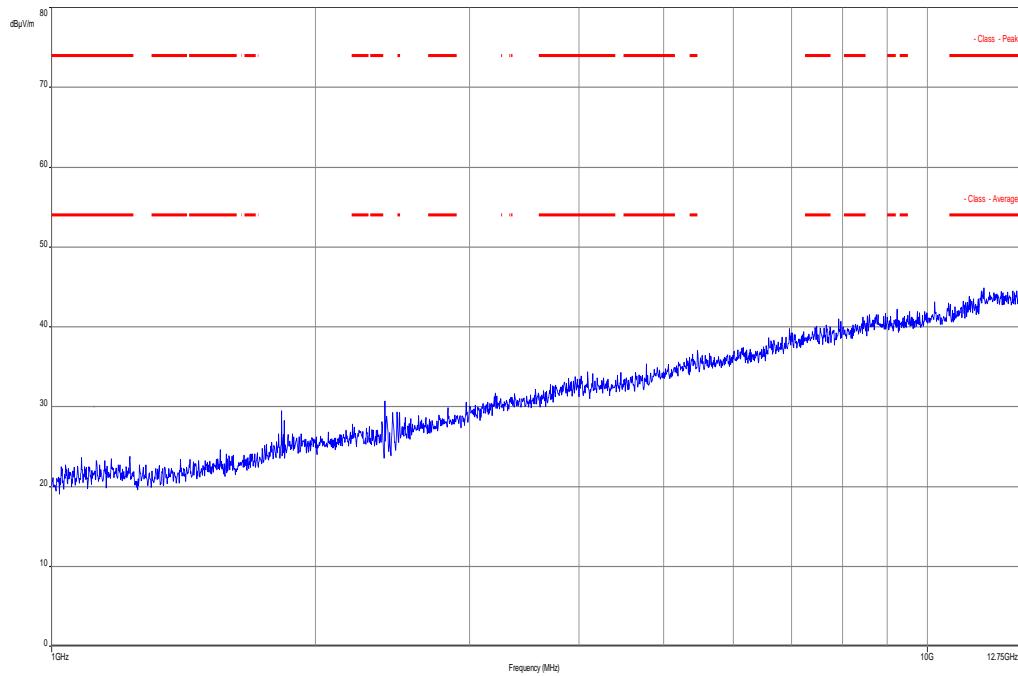
Plots:

Plot 1: 30 MHz to 1 GHz, lowest channel, vertical & horizontal polarization

**Final_Result:**

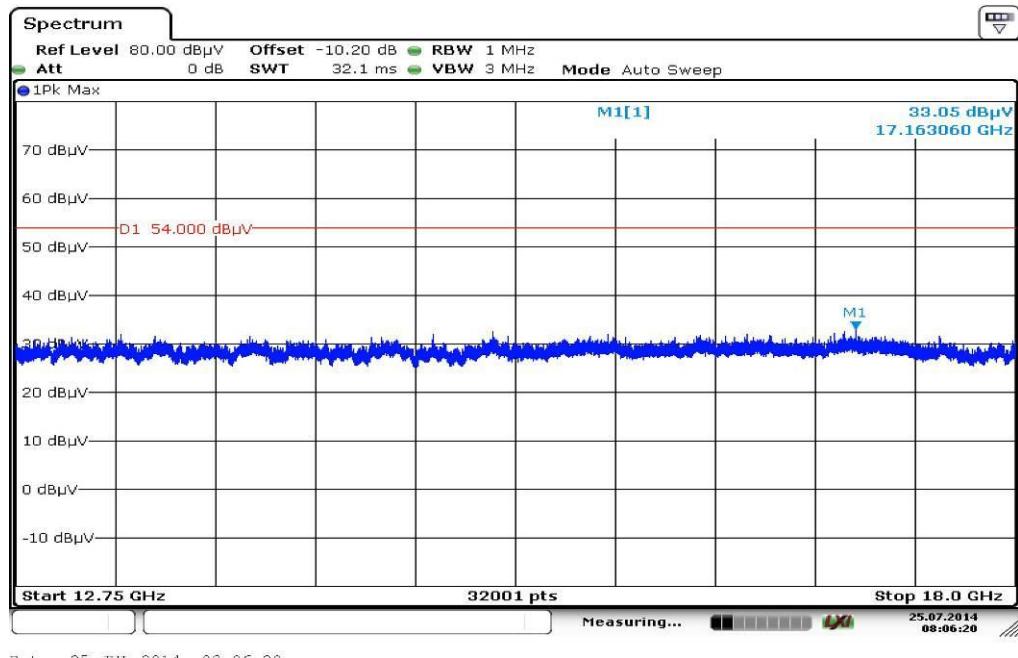
Frequency (MHz)	QuasiPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
32.666700	10.01	30.00	19.99	1000.0	120.000	101.0	H	268	13.6
44.542050	10.46	30.00	19.54	1000.0	120.000	100.0	V	0	13.9
100.290450	8.35	33.50	25.15	1000.0	120.000	100.0	V	115	12.1
485.161350	14.93	36.00	21.07	1000.0	120.000	170.0	V	269	18.4
768.564300	19.76	36.00	16.24	1000.0	120.000	170.0	V	89	22.7
939.226200	21.26	36.00	14.74	1000.0	120.000	170.0	H	-25	24.2

Plot 2: 1 GHz to 12.75 GHz, lowest channel, vertical & horizontal polarization

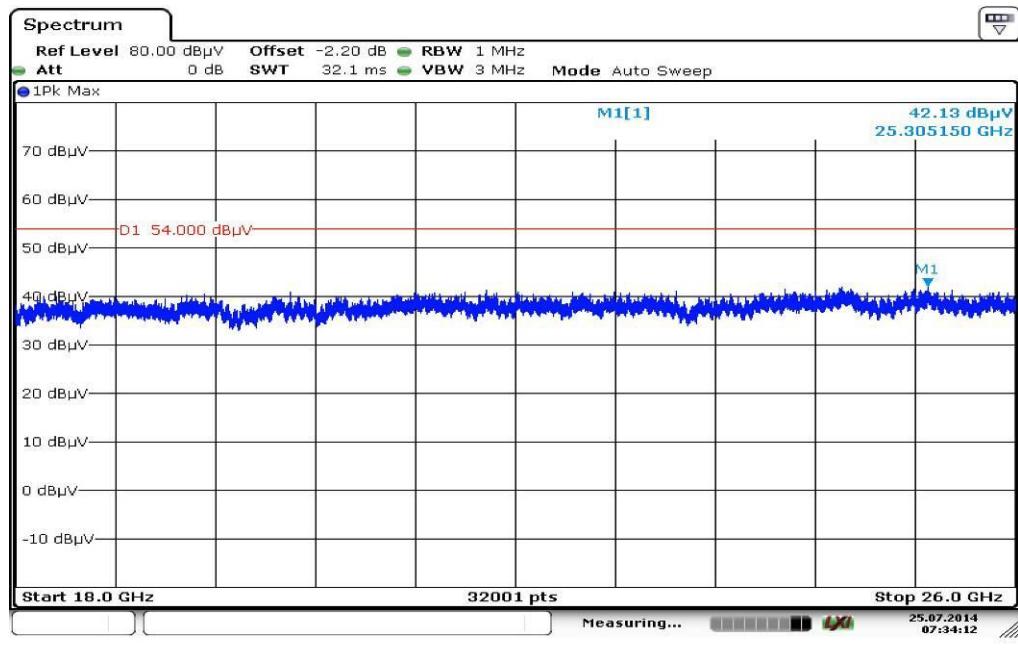


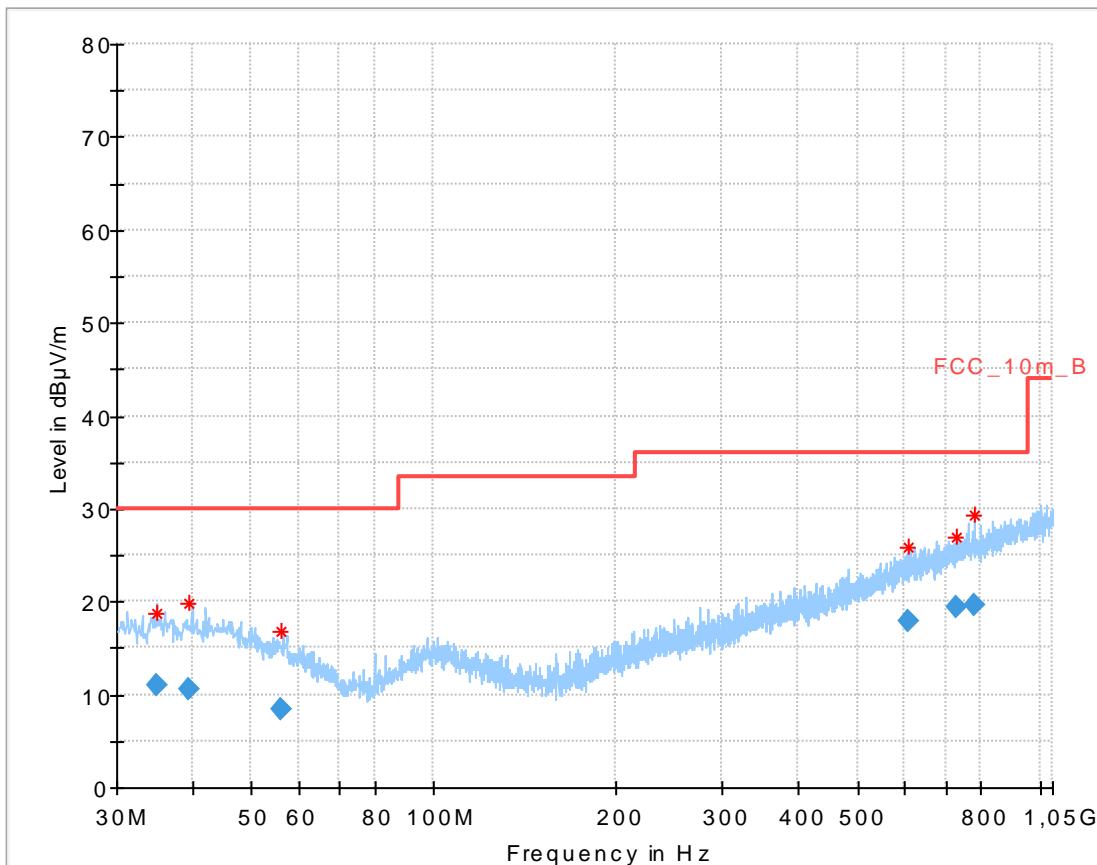
Carrier suppressed with a 2.4 GHz-band rejection filter.

Plot 3: 12 GHz to 18 GHz, lowest channel, vertical & horizontal polarization – valid for all channels



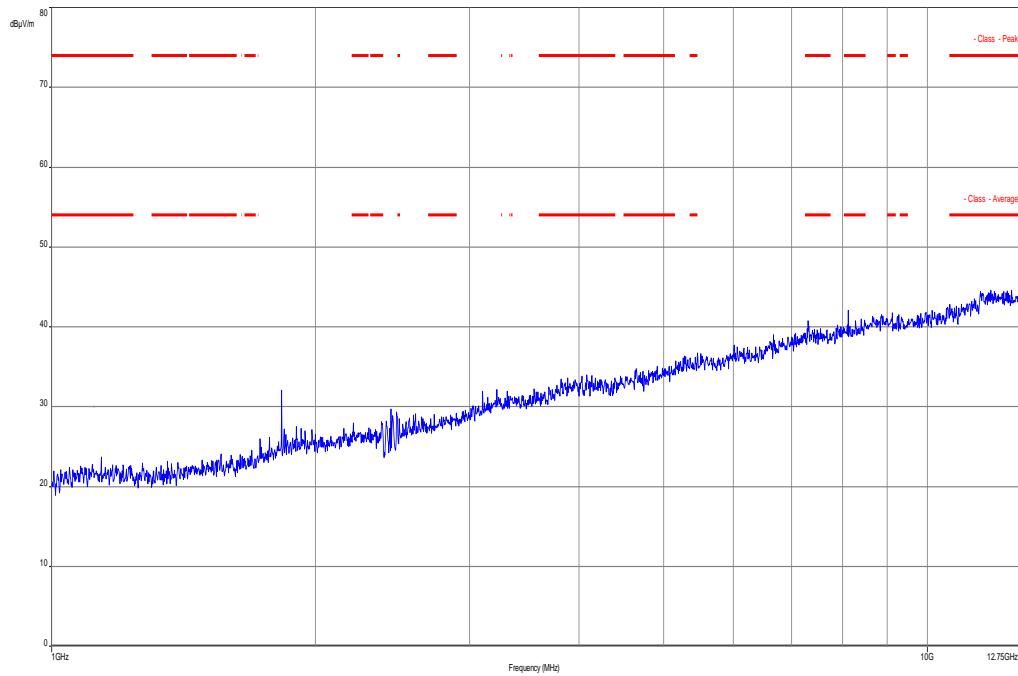
Plot 4: 18 GHz to 26 GHz, lowest channel, vertical & horizontal polarization – valid for all channels



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

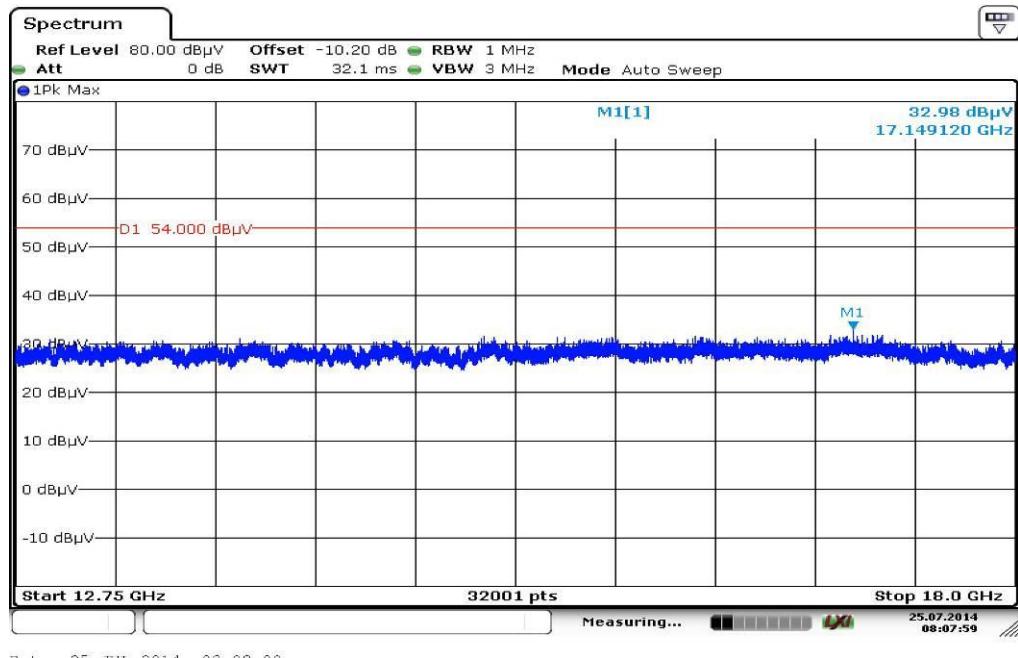
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
34.916100	11.05	30.00	18.95	1000.0	120.000	101.0	V	269	13.8
39.355800	10.51	30.00	19.49	1000.0	120.000	170.0	H	25	14.0
55.942950	8.50	30.00	21.50	1000.0	120.000	101.0	V	115	11.6
608.454450	17.92	36.00	18.08	1000.0	120.000	170.0	V	65	20.8
730.634250	19.39	36.00	16.61	1000.0	120.000	98.0	V	269	22.2
782.896650	19.68	36.00	16.32	1000.0	120.000	101.0	H	179	22.7

Plot 6: 1 GHz to 12.75 GHz, mid channel, vertical & horizontal polarization



Carrier suppressed with a 2.4 GHz-band rejection filter.

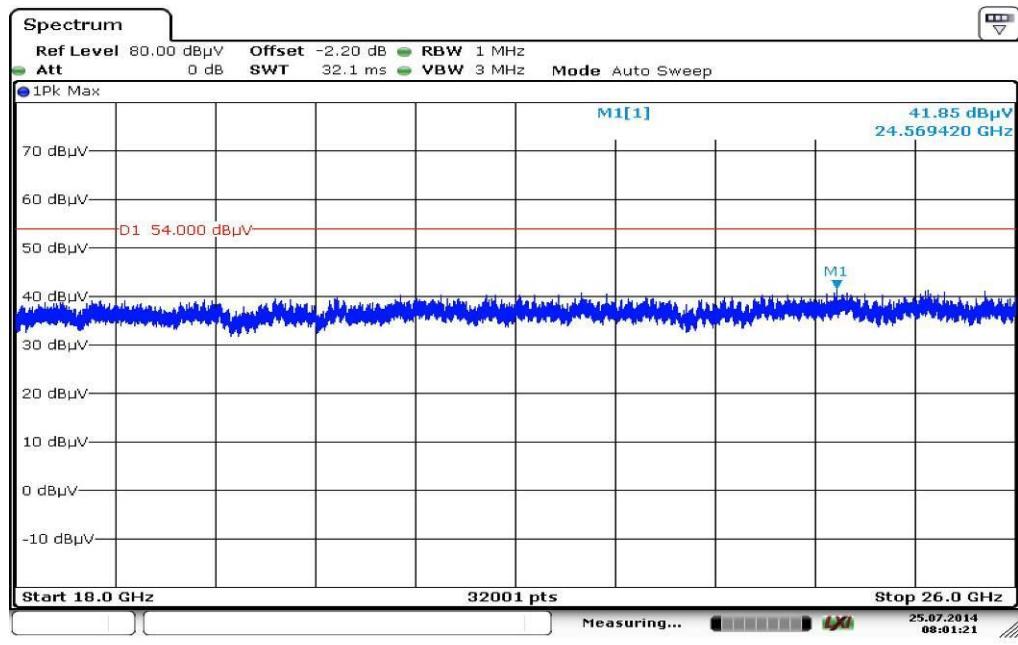
Plot 7: 12 GHz to 18 GHz, mid channel, vertical & horizontal polarization – valid for all channels

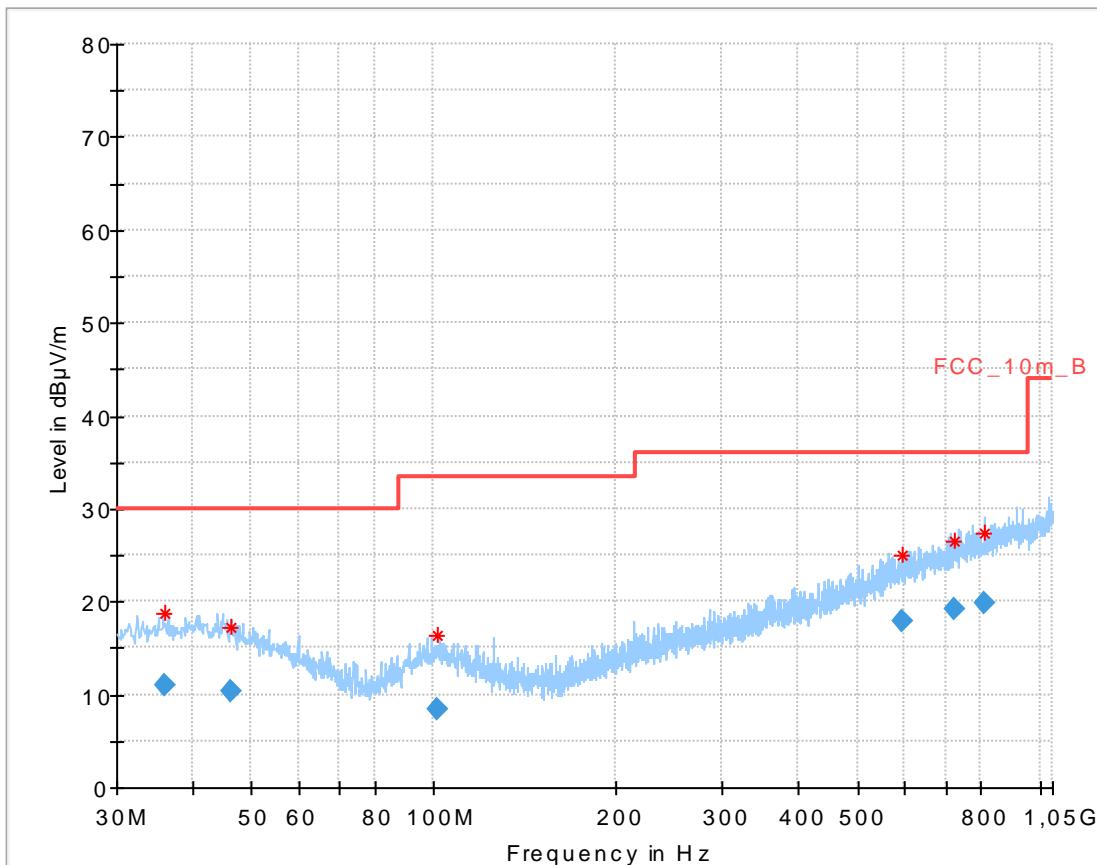


Date: 25.JUL.2014 08:08:00

25.07.2014
08:07:59

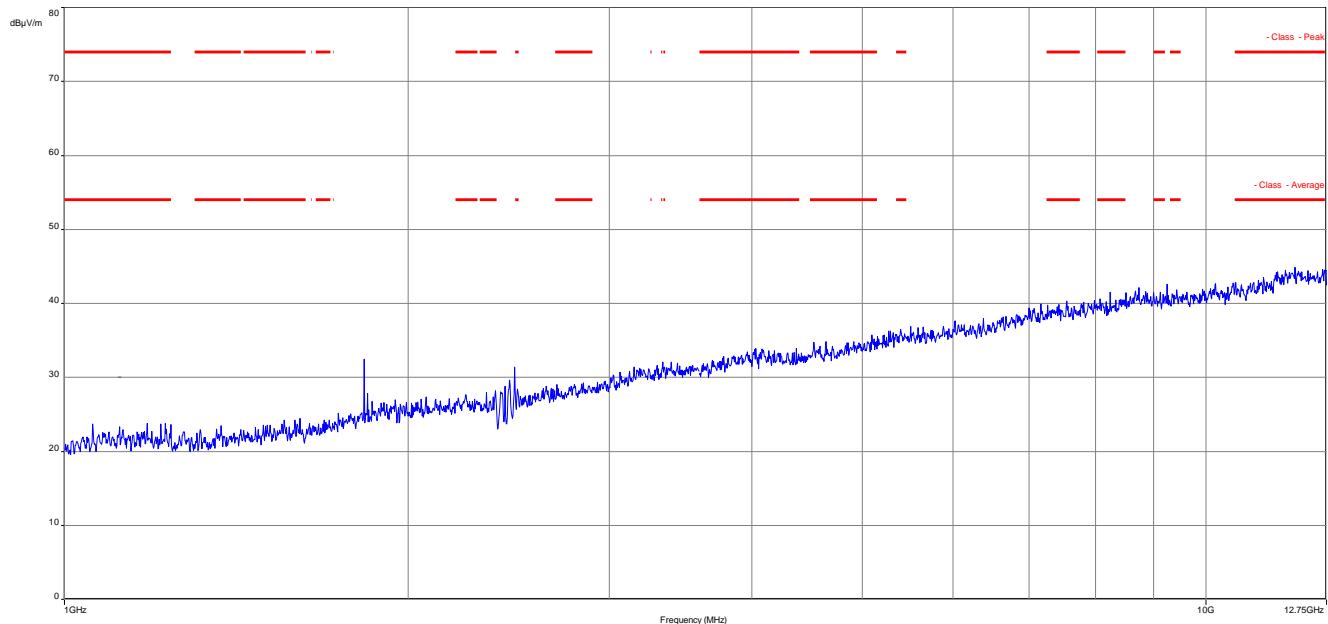
Plot 8: 18 GHz to 26 GHz, mid channel, vertical & horizontal polarization – valid for all channels



Plot 9: 30 MHz to 1 GHz, highest channel, vertical & horizontal polarization

Final_Result:

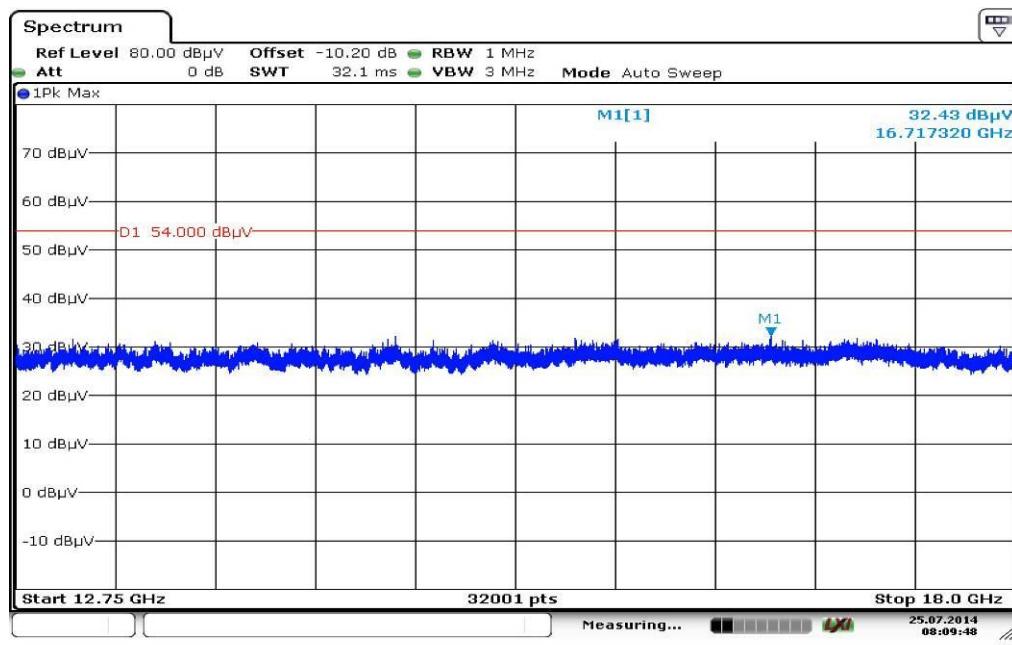
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
36.128250	10.90	30.00	19.10	1000.0	120.000	101.0	V	25	13.9
46.209900	10.29	30.00	19.71	1000.0	120.000	98.0	H	-25	13.6
101.710500	8.47	33.50	25.03	1000.0	120.000	101.0	H	155	12.0
595.263600	17.80	36.00	18.20	1000.0	120.000	170.0	V	0	20.6
723.379650	19.16	36.00	16.84	1000.0	120.000	98.0	H	89	22.1
813.371250	19.94	36.00	16.06	1000.0	120.000	170.0	H	205	22.9

Plot 10: 1 GHz to 12.75 GHz, highest channel, vertical & horizontal polarization



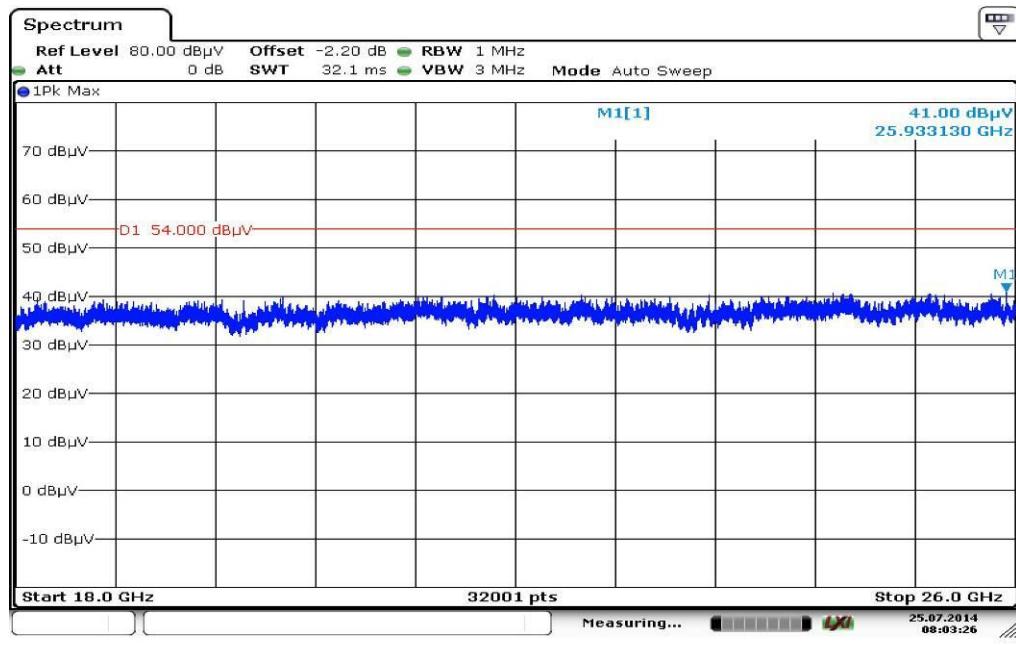
Carrier suppressed with a 2.4 GHz-band rejection filter.

Plot 11: 12 GHz to 18 GHz, highest channel, vertical & horizontal polarization – valid for all channels



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Plot 12: 18 GHz to 26 GHz, highest channel, vertical & horizontal polarization – valid for all channels



10.13 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
Resolution bandwidth:	F < 1 GHz: 100 kHz F > 1 GHz: 1 MHz
Video bandwidth:	3 x RBW Remeasurement: 10 Hz
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:

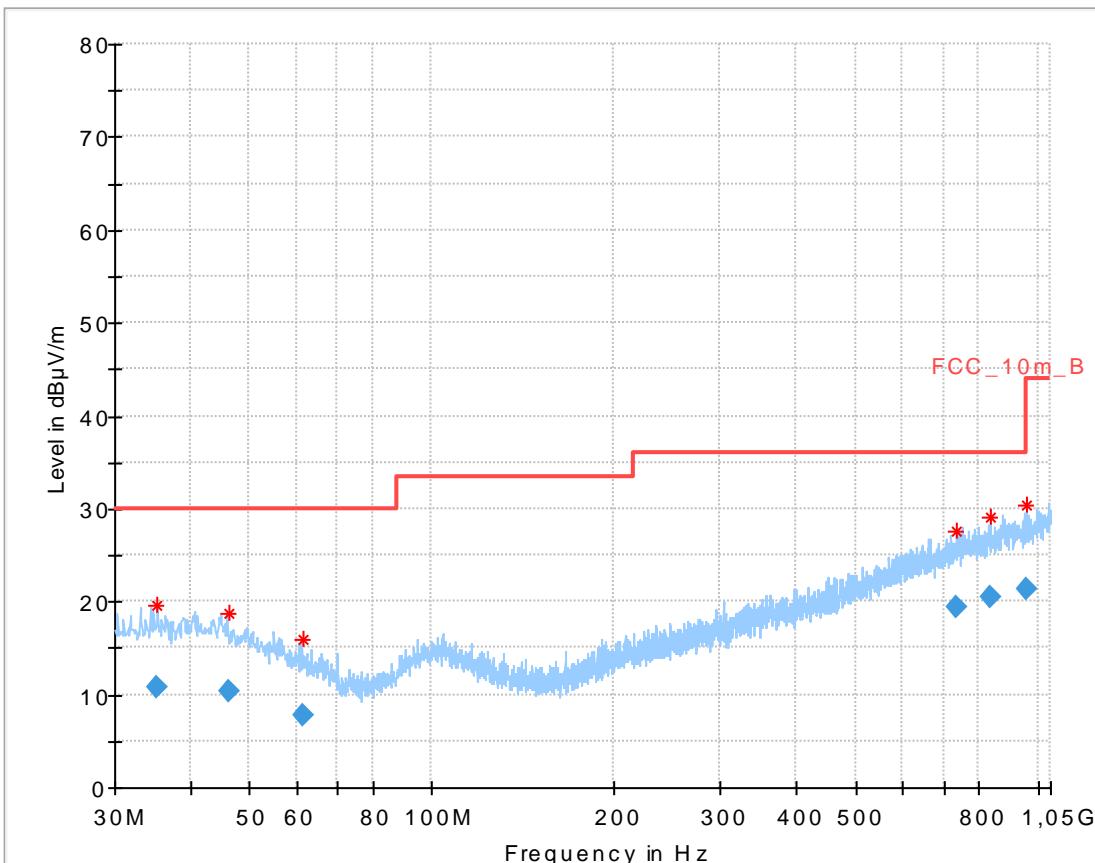
RX spurious emissions radiated [dB μ V/m]		
F [MHz]	Detector	Level [dB μ V/m]
For emissions below 1 GHz, please take a look at table below the 1 GHz plot.		
All detected peak emissions are below the average limit – see plots.		
Measurement uncertainty		±3 dB

Result: **Passed**

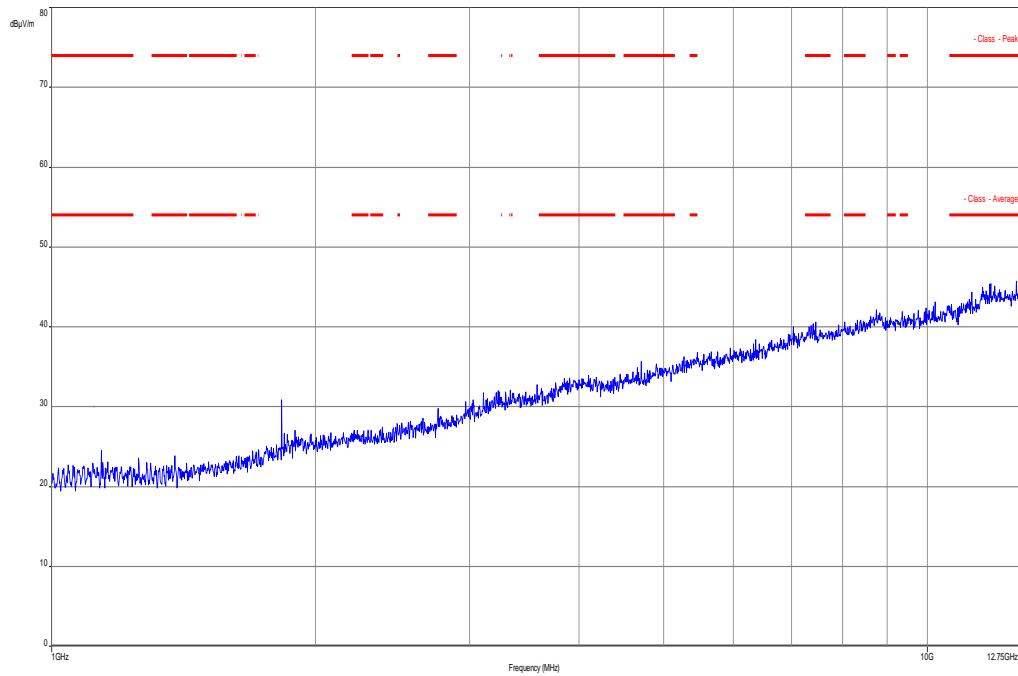
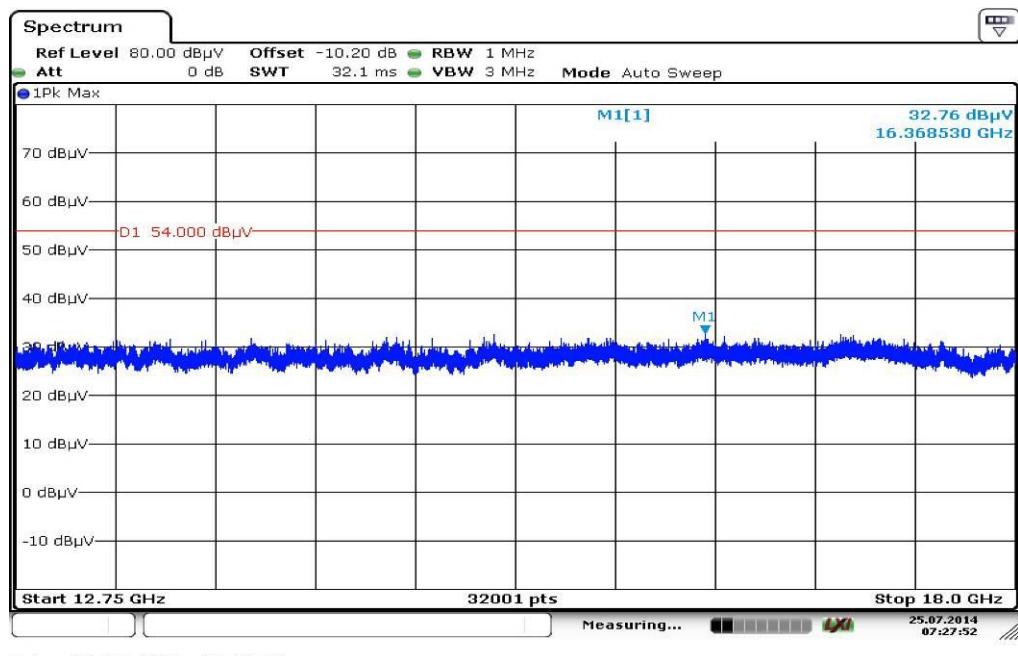
Note: The limit was recalculated with 20 dB / decade (Part 15.31) for all radiated spurious emissions 30 MHz to 1 GHz from 3 meter limit to a 10 meter distance. (40dB/decade for emissions < 30MHz)

Plots:

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

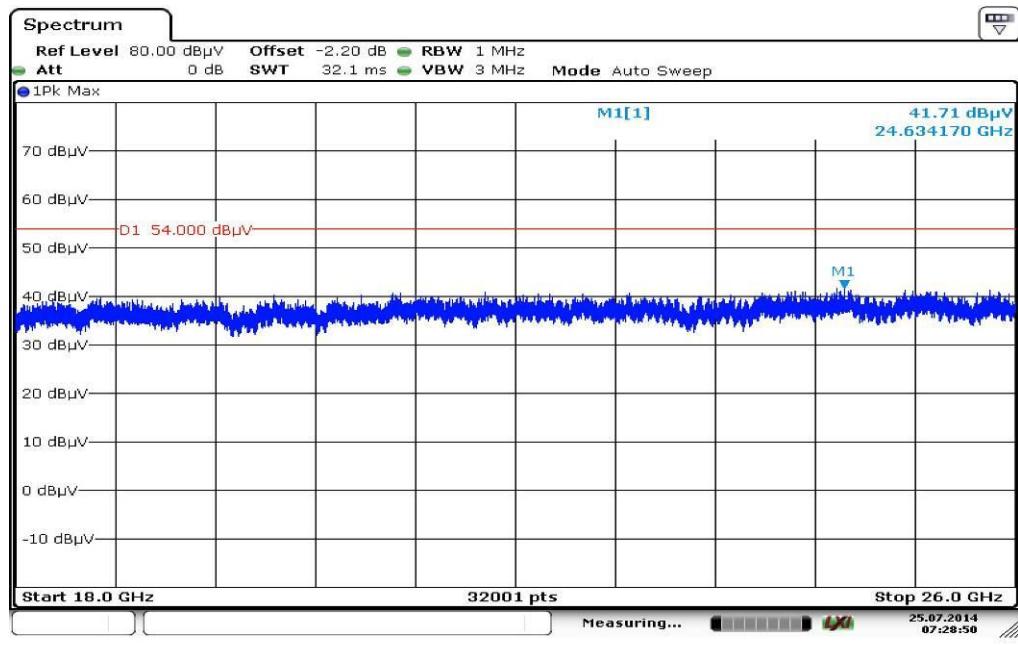
**Final_Result:**

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

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

Plot 3: 12 GHz to 18 GHz, RX / idle – mode, vertical & horizontal polarization


Date: 25.JUL.2014 07:27:52

25.07.2014
07:27:52

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

10.14 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 19. This measurement is representative for all channels and modes. If critical peaks are found channel 00 and channel 39 will be measured too. 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
Resolution bandwidth:	F < 150 kHz: 1 kHz F > 150 kHz: 100 kHz
Video bandwidth:	F < 150 kHz: 200 Hz F > 150 kHz: 9 kHz
Span:	9 kHz to 30 MHz
Trace-Mode:	Max Hold

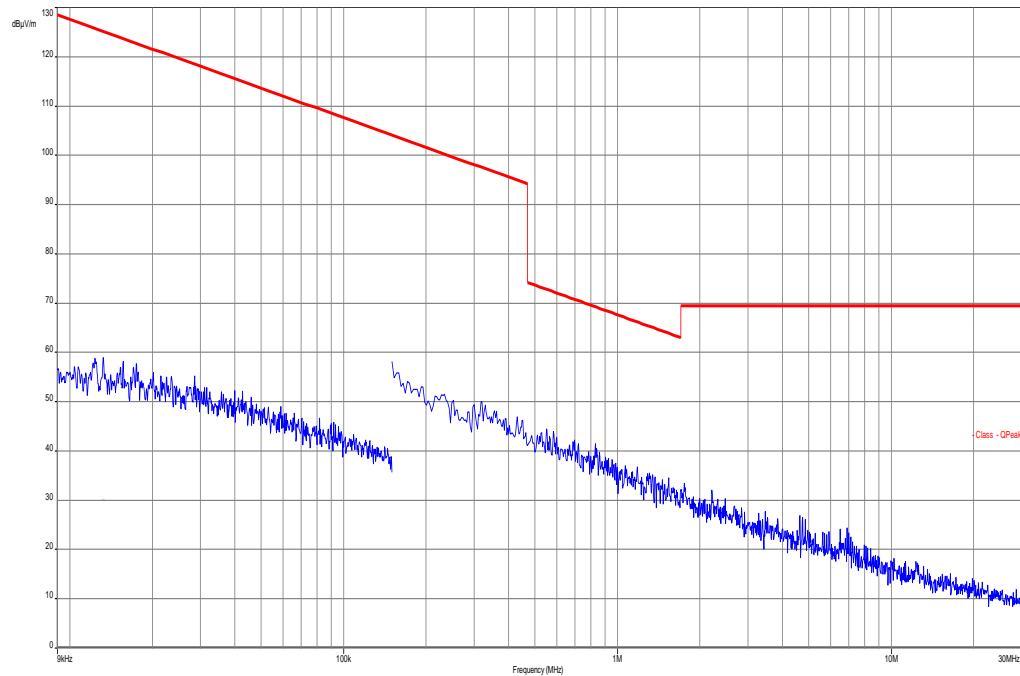
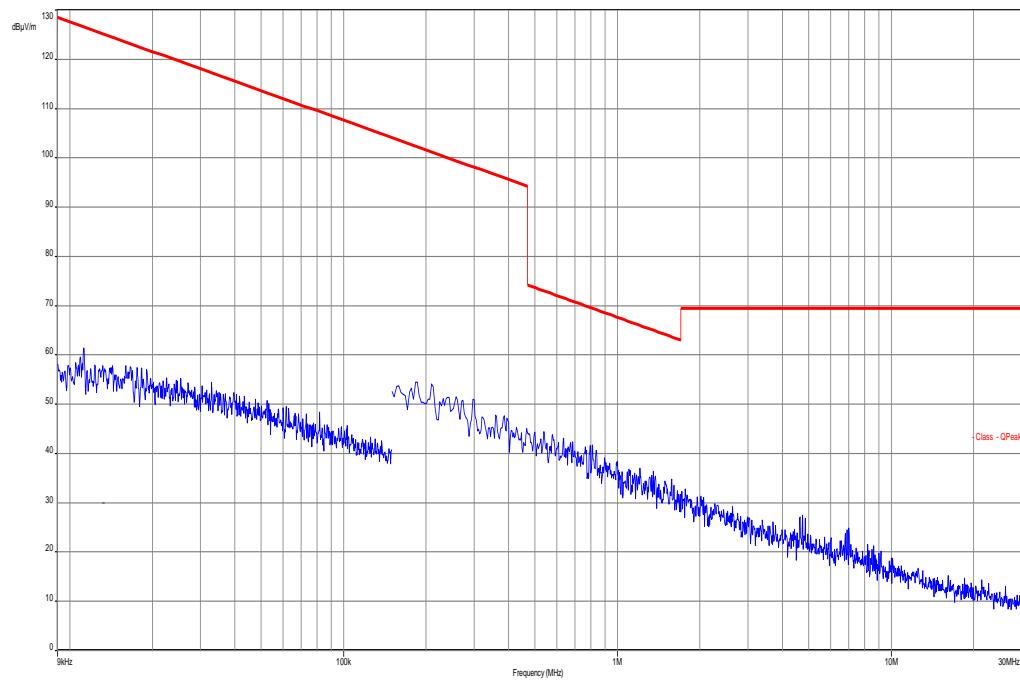
Limits:

FCC	IC	
TX spurious emissions radiated < 30 MHz		
Frequency (MHz)	Field strength (dB μ V/m)	Measurement distance
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30

Results:

TX spurious emissions radiated < 30 MHz [dB μ V/m]		
F [MHz]	Detector	Level [dB μ V/m]
No spurious emissions detected.		
Measurement uncertainty		± 3 dB

Result: Passed

Plot:**Plot 1: 9 kHz to 30 MHz, TX mode****Plot 2: 9 kHz to 30 MHz, RX mode**

10.15 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 19. This measurement is representative for all channels and modes. If critical peaks are found channel 00 and channel 39 will be measured too. Both power lines, phase and neutral line, are measured. Found peaks are re-measured with average and quasi peak detection to show compliance to the limits.

Measurement:

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

Limits:

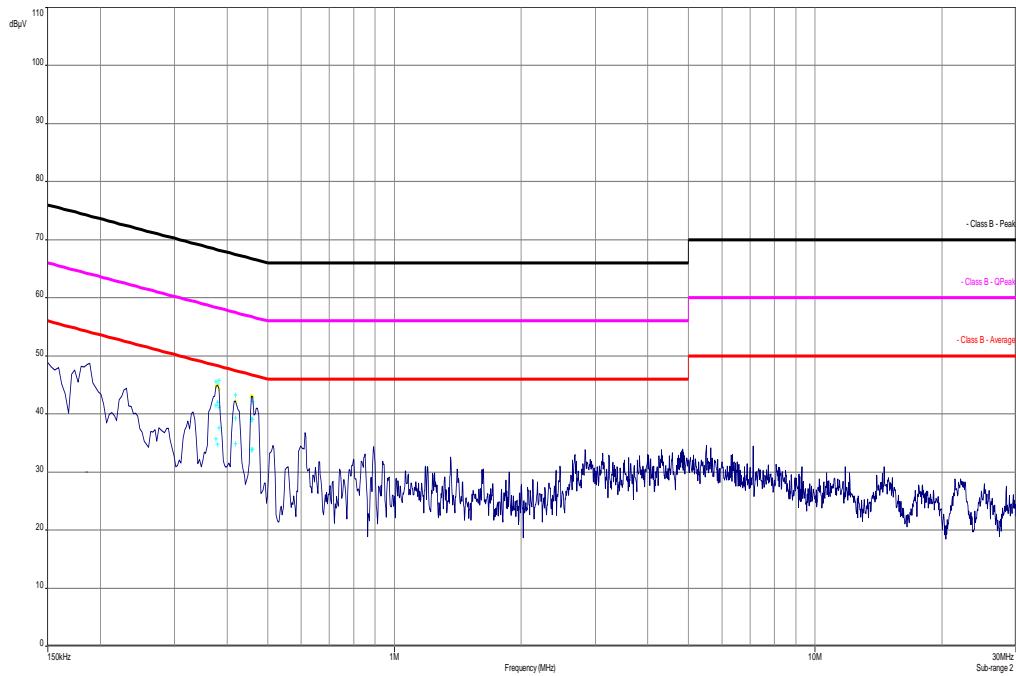
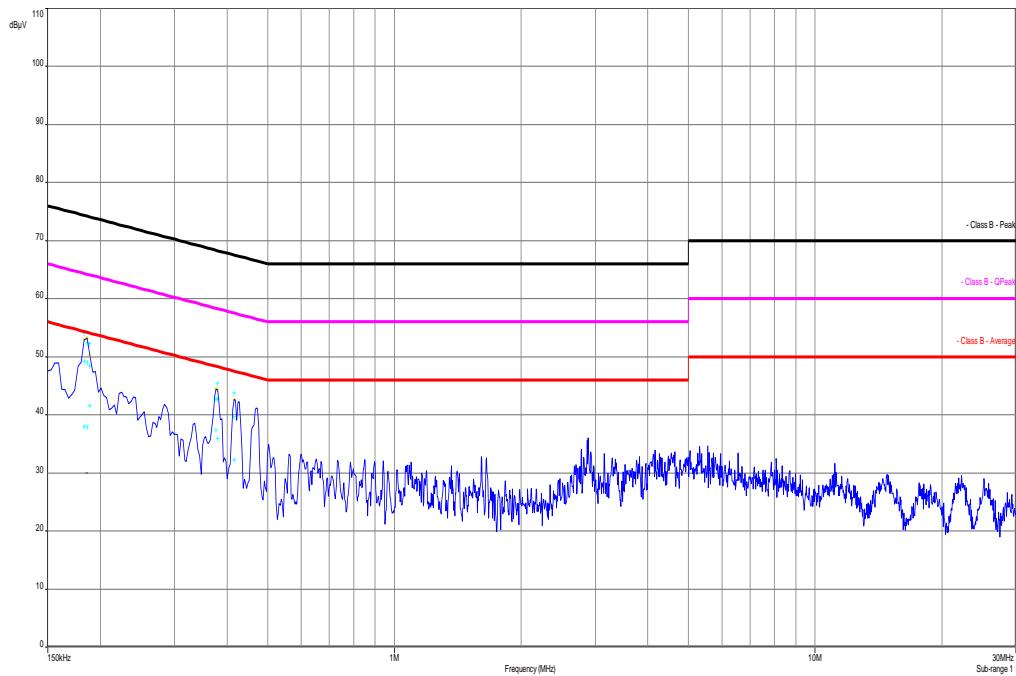
FCC		IC
TX spurious emissions conducted < 30 MHz		
Frequency (MHz)	Quasi-peak (dB μ V/m)	Average (dB μ V/m)
0.15 – 0.5	66 to 56*	56 to 46*
0.5 – 5	56	46
5 – 30.0	60	50

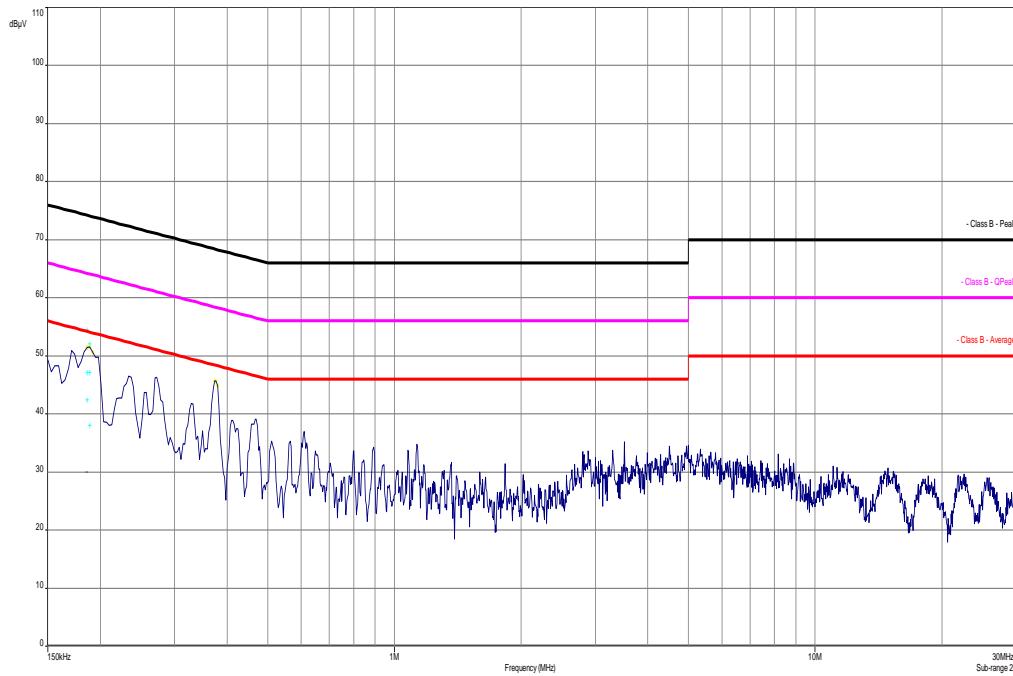
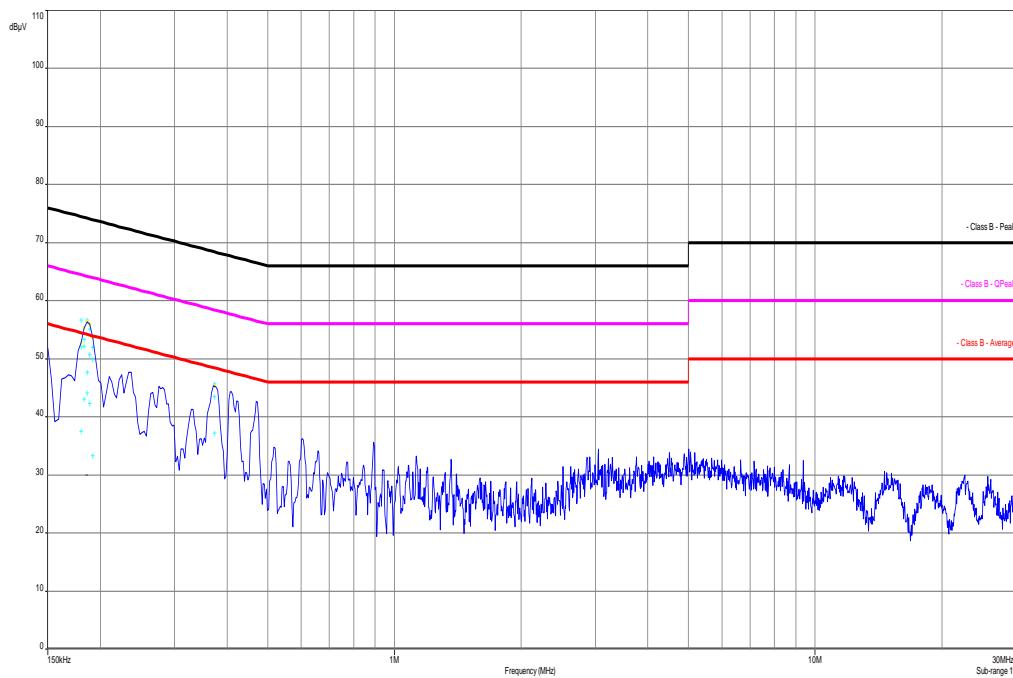
*Decreases with the logarithm of the frequency

Results:

TX spurious emissions conducted < 30 MHz [dB μ V/m]		
F [MHz]	Detector	Level [dB μ V/m]
All detected spurious emissions are below the limit – see plots.		
Measurement uncertainty		± 3 dB

Result: Passed

Plots:**Plot 1:** 150 kHz to 30 MHz, TX mode, phase line**Plot 2:** 150 kHz to 30 MHz, TX mode, neutral line

Plot 3: 150 kHz to 30 MHz, RX mode, phase line**Plot 4: 150 kHz to 30 MHz, RX mode, neutral line**

11 Test equipment and ancillaries used for tests

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

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

No.	Lab / Item	Equipment	Type	Manufact.	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	n. a.	CBT (Bluetooth Tester + EDR Signalling)	CBT 1153.9000K35	R&S	100185	300003416	vlKI!	21.08.2012	21.08.2014
2	n. a.	Spectrum Analyzer 9kHz to 30GHz - 140...+30dBm	FSP30	R&S	100886	300003575	k	22.08.2012	22.08.2014
3	45	Switch-Unit	3488A	HP Meßtechnik	2719A14505	300000368	g		
4	50	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP Meßtechnik	2920A04466	300000580	ne		
5	n. a.	EMI Test Receiver	ESCI 3	R&S	100083	300003312	k	27.01.2014	27.01.2015
6	n. a.	Funktörnmessempfänger 20Hz- 26.5GHz	ESU26	R&S	100037	300003555	k	28.02.2014	28.02.2015
7	n. a.	Antenna Tower	Model 2175	ETS-LINDGREN	64762	300003745	izw		
8	n. a.	Positioning Controller	Model 2090	ETS-LINDGREN	64672	300003746	izw		
9	n. a.	Turntable Interface-Box	Model 105637	ETS-LINDGREN	44583	300003747	izw		
10	n. a.	TRILOG Broadband Test-Antenna 30 MHz – 3 GHz	VULB9163	Schwarzbeck	295	300003787	k	22.04.2014	22.04.2016
11	n. a.	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	8812-3088	300001032	vlKI!	08.05.2013	08.05.2015
12	n. a.	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev		
13	n. a.	Switch / Control Unit	3488A	HP Meßtechnik	*	300000199	ne		
14	9	Artificial Mains 9 kHz to 30 MHz	ESH3-Z5	R&S	828576/020	300001210	Ve	30.01.2014	30.01.2016
15	9	Isolating Transformer	MPL IEC625 Bus Regeltrenntravo	Erfi	91350	300001155	ne		
16	90	Active Loop Antenna 10 kHz to 30 MHz	6502	Kontron Psychotech	8905-2342	300000256	k	13.06.2013	13.06.2015
17	n. a.	Amplifier	js42-00502650-28-5a	Parzich GMBH	928979	300003143	ne		
18	n. a.	Band Reject filter	WRCG2400/2483-2375/2505-50/10SS	Wainwright	11	300003351	ev		
19	n. a.	TRILOG Broadband Test-Antenna 30 MHz – 3 GHz	VULB9163	Schwarzbeck	371	300003854	vlKI!	14.10.2011	14.10.2014
20	n. a.	MXE EMI Receiver 20 Hz bis 26,5 GHz	N9038A	Agilent Technologies	MY51210197	300004405	k	13.03.2014	13.03.2015
21	11b	Microwave System Amplifier, 0.5-26.5 GHz	83017A	HP Meßtechnik	00419	300002268	ev		
22	A026	Std. Gain Horn Antenna 12.4 to 18.0 GHz	639	Narda	8402	300000787	k	22.07.2013	22.07.2015
23	A029	Std. Gain Horn Antenna 18.0 to 26.5 GHz	638	Narda	8205	300002442	k	19.07.2013	19.07.2015
24	n. a.	Signal Analyzer 40 GHz	FSV40	R&S	101042	300004517	k	21.01.2014	21.01.2015
25	n. a.	Switch / Control Unit	3488A	HP Meßtechnik		300001691	ne		
26	n. a.	Power Supply DC	NGPE 40/40	R&S	388	400000078	vlKI!	21.08.2012	21.08.2014
27	n. a.	Frequency Standard (Rubidium Frequency Standard)	MFS (Rubidium)	R&S (Datum)	002	300002681-0009	Ve	21.08.2012	21.08.2014
28	n. a.	Directional Coupler	101020010	Krytar	70215	300002840	ev		
29	n. a.	DC-Blocker	8143	Inmet Corp.	none	300002842	ne		
30	n. a.	Powersplitter	6005-3	Inmet Corp.		300002841	ev		

Agenda: Kind of Calibration

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

12 Observations

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

Annex A Document history

Version	Applied changes	Date of release
	Initial release	2014-07-29
A	Editorial Changes	2014-08-07

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

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

Akkreditierung 

Die Deutsche Akkreditierungsstelle GmbH bestätigt hiermit, dass das Prüflaboratorium

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

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

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

Die Akkreditierungsurkunde gilt nur in Verbindung mit dem Bescheid vom 07.03.2014 mit der
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Rückseite des Deckblatts und der folgenden Anlage mit insgesamt 77 Seiten.

Rekonsolidierungsnr. der Urkunde: D-PL-12076-01-00

Frankfurt am Main, 07.03.2014

In Auftrag DPL-12076-01 Ralf Egner

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ILAC: www.ilac.org
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Note:

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

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