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

TEST REPORT

Test report no.: 1-8532/14-01-05-C

Deutsche
Akkreditierungsstelle
D-PL-12076-01-00

Testing laboratory

CETECOM ICT Services GmbH

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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

Valeo Schalter und Sensoren GmbH

Laiernstrasse 12

74321 Bietigheim-Bissingen / GERMANY

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: Parkman ECU**Model name:** 12PM1H /12PM1E**FCC ID:** VE2-12PM1**IC:** 7173A-12PM1**Frequency:** 2400 MHz to 2483.5 MHz DTS Band
(lowest channel 2402 MHz; highest channel 2480 MHz)**Technology tested:** Bluetooth® LE V.4.0**Antenna:** External monopole antenna**Power supply:** 12V DC by Battery**Temperature range:** -40°C to +85°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:

Andreas Luckenbill
Radio Communications & EMC

Test performed:

David Lang
Radio Communications & EMC

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2 General information

2.1 Notes and disclaimer

The test results of this test report relate exclusively to the test item specified in this test report. CETECOM ICT Services GmbH does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.

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This test report replaces the test report with the number 1-8532/14-01-05-B and dated 2015-02-10

2.2 Application details

Date of receipt of order:	2014-11-05
Date of receipt of test item:	2014-11-10
Start of test:	2014-11-12
End of test:	2014-11-28
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}	+20 °C during room temperature tests
	T_{max}	+85 °C during high temperature tests
	T_{min}	-40 °C during low temperature tests
Relative humidity content:		55 %
Barometric pressure:		not relevant for this kind of testing
Power supply:	V_{nom}	12 V DC by Battery
	V_{max}	16 V
	V_{min}	8 V

5 Test item

Kind of test item	:	Parkman ECU
Type identification	:	12PM1H /12PM1E
S/N serial number	:	Rad. Not available!
	:	Cond. Not available!
HW hardware status	:	D2
SW software status	:	HOMH_084
Frequency band [MHz]	:	2400 MHz to 2483.5 MHz DTS Band (lowest channel 2402 MHz; highest channel 2480 MHz)
Type of radio transmission	:	DSSS, FHSS
Use of frequency spectrum	:	
Type of modulation	:	GFSK
Number of channels	:	40
Antenna	:	External monopole antenna
Power supply	:	12 V DC by Battery
Temperature range	:	-40°C to +85°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: 1-8532/14-01-01_AnnexA
 1-8532/14-01-01_AnnexB
 1-8532/14-01-01_AnnexD

6 Test laboratories sub-contracted

None

7 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	2015-02-19	-/-

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	☒	☐	☐	☐	-/-
§15.247(e) RSS 210 / A8.2(b)	Power spectral density	Nominal	Nominal	GFSK	☒	☐	☐	☐	-/-
§15.247(a)(1) RSS 210 / A8.1(b)	Carrier frequency separation	Nominal	Nominal	GFSK	☒	☐	☐	☐	-/-
§15.247(a)(1) RSS 210 / A8.1(d)	Number of hopping channels	Nominal	Nominal	GFSK	☒	☐	☐	☐	-/-
§15.247(a)(1) (iii) RSS 210 / A8.3(1)	Time of occupancy (dwell time)	Nominal	Nominal	GFSK	☒	☐	☐	☐	-/-
§15.247(a)(2) RSS 210 / A8.2(a)	Spectrum bandwidth of a FHSS system 6 dB bandwidth	Nominal	Nominal	GFSK	☒	☐	☐	☐	-/-
§15.247(a)(1) RSS 210	Spectrum bandwidth of a FHSS system 20 dB bandwidth	Nominal	Nominal	GFSK	☒	☐	☐	☐	-/-
§15.247(b)(1) RSS-210 / A8.4(2)	Maximum output power	Nominal	Nominal	GFSK	☒	☐	☐	☐	-/-
§15.247(d) RSS-210 / A8.5	Band edge compliance conducted	Nominal	Nominal	GFSK	☒	☐	☐	☐	-/-
§15.205 RSS-210 / A8.5	Band edge compliance radiated	Nominal	Nominal	GFSK	☒	☐	☐	☐	-/-
§15.247(d) RSS-210 / A8.5	TX spurious emissions conducted	Nominal	Nominal	GFSK	☒	☐	☐	☐	-/-
§15.247(d) RSS-210 / A8.5	TX spurious emissions radiated	Nominal	Nominal	GFSK	☒	☐	☐	☐	-/-
§15.109 RSS-Gen.	RX spurious emissions radiated	Nominal	Nominal	-/-	☒	☐	☐	☐	-/-
§15.209(a) RSS-Gen	TX spurious emissions radiated < 30 MHz	Nominal	Nominal	GFSK	☒	☐	☐	☐	-/-
§15.107(a) §15.207	Conducted emissions < 30 MHz	Nominal	Nominal	GFSK	☐	☐	☒	☐	-/-

Note: NA = Not Applicable; NP = Not Performed

8 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: Tests have been performed with an external monopole antenna (see document 1-8532/14-01-01 Annex A for pictures).

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

9 Measurement results

9.1 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		-5.2	-5.2	-4.9
Radiated power [dBm] Measured with GFSK modulation		-1.8	-2.9	-2.9
Gain [dBi] Calculated		3.4	2.3	2.0

Verdict: **Passed**

9.2 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

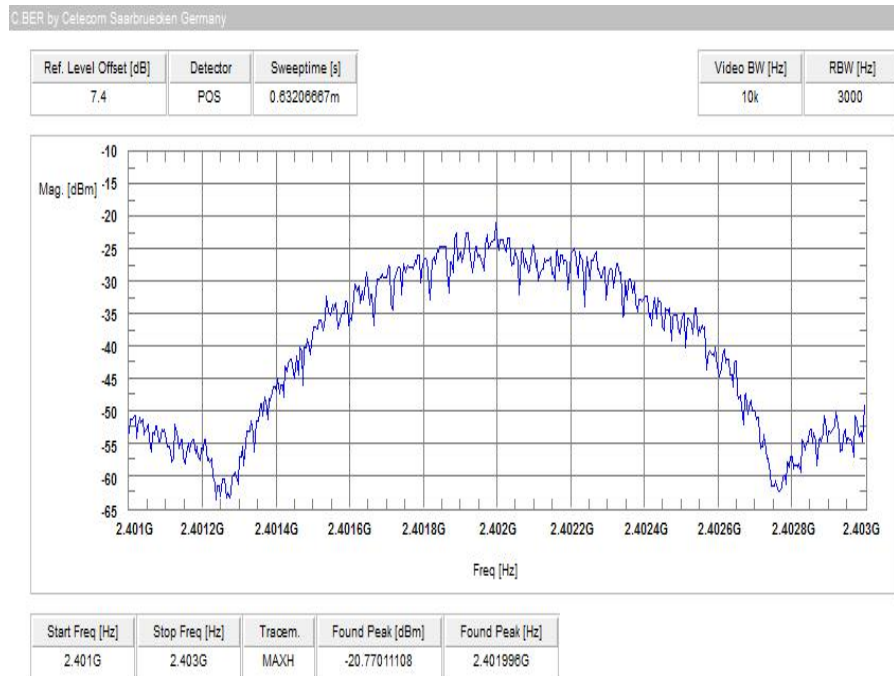
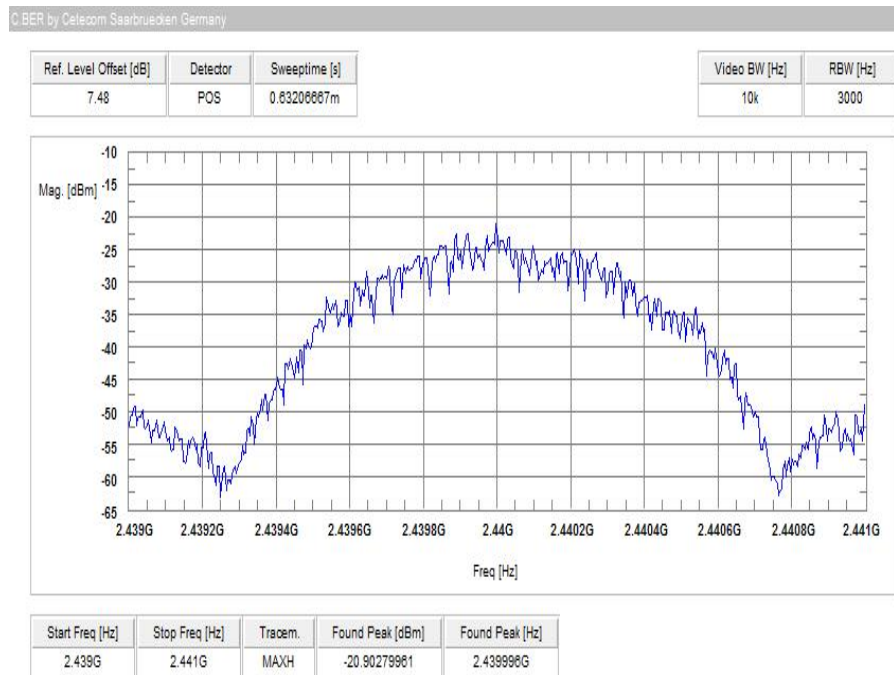
Limits:

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.	

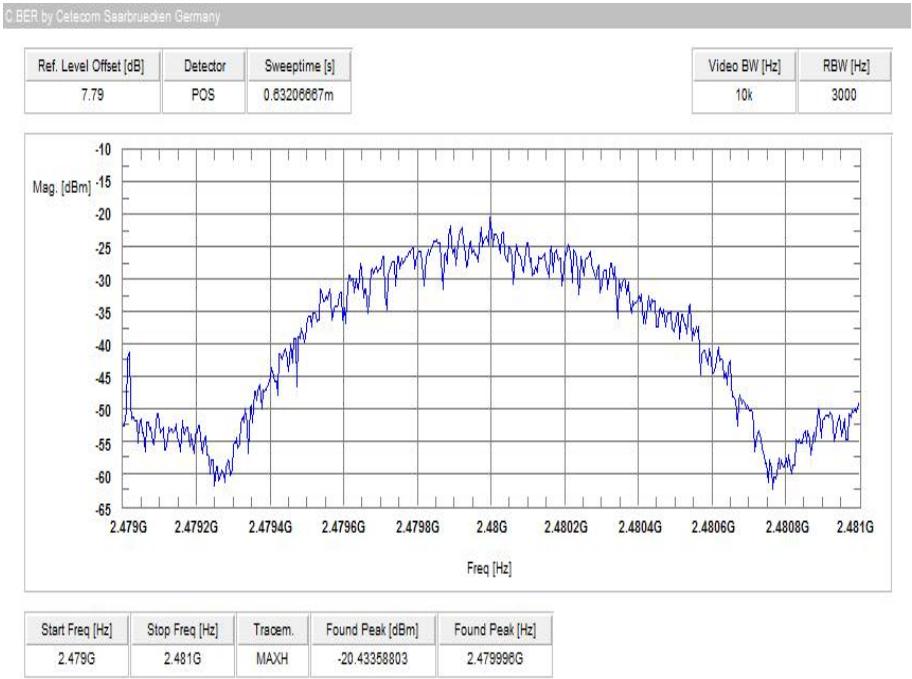
Results:

Modulation	Power spectral density		
Frequency	2402 MHz	2440 MHz	2480 MHz
[dBm / 3kHz]	-20.8	-20.9	-20.4
Measurement uncertainty	± 1.5 dB		

Verdict: **Passed**

Plots:**Plot 1: lowest channel****Plot 2: mid channel**

Plot 3: highest channel



9.3 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.	

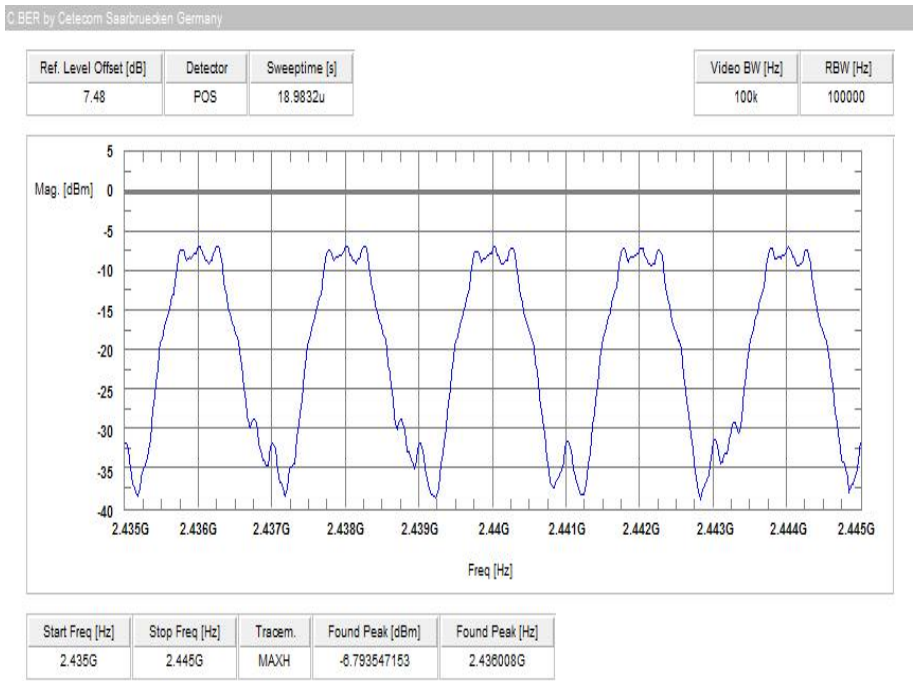
Result:

Carrier frequency separation	~ 2 MHz
------------------------------	---------

Verdict: **Passed**

Plot:

Plot 1: Carrier Frequency Separation



9.4 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	

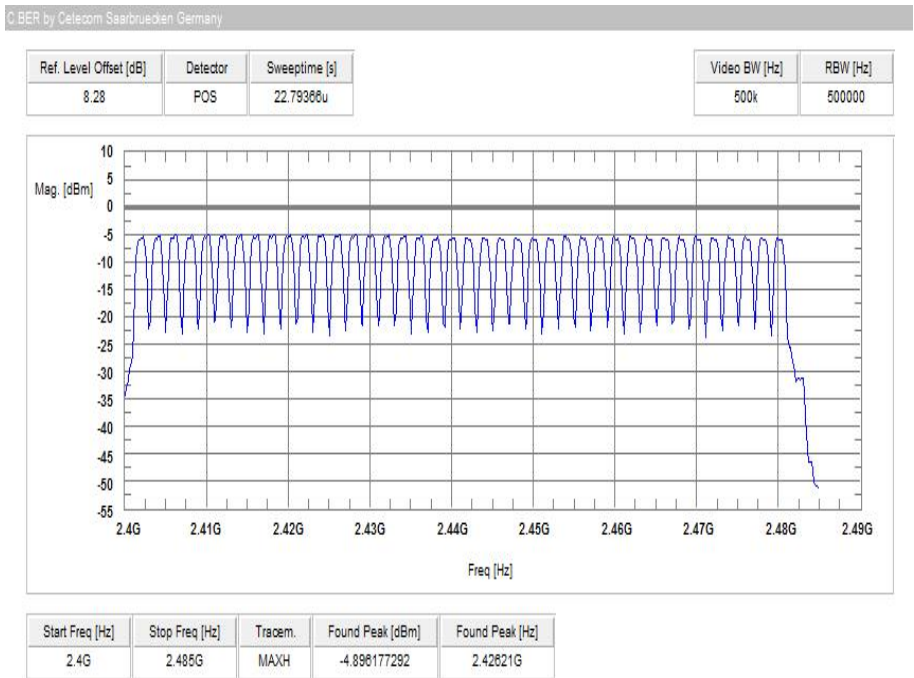
Result:

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

Verdict: **Passed**

Plots:

Plot 1: Number of hopping channels



9.5 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: 625us
 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: $40 \times 16 = 640$
 Period: Number of channels $\times$ 0.4s = 16s

Under normal test conditions only

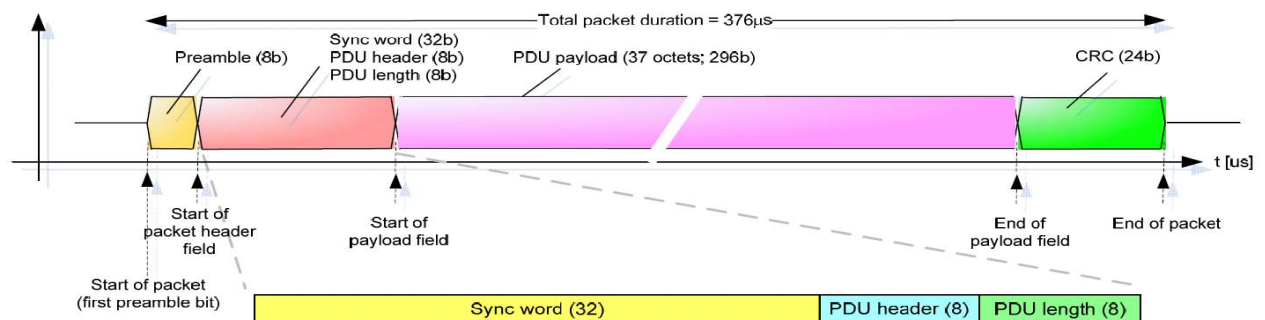
400 ms within in a period

Results:

Dwell time = standard test packet pulse width*) $\times$ 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:



Verdict: Passed

9.6 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:	2 s
Resolution bandwidth:	100 kHz
Video bandwidth:	100 kHz
Span:	3 MHz
Trace-Mode:	Max Hold

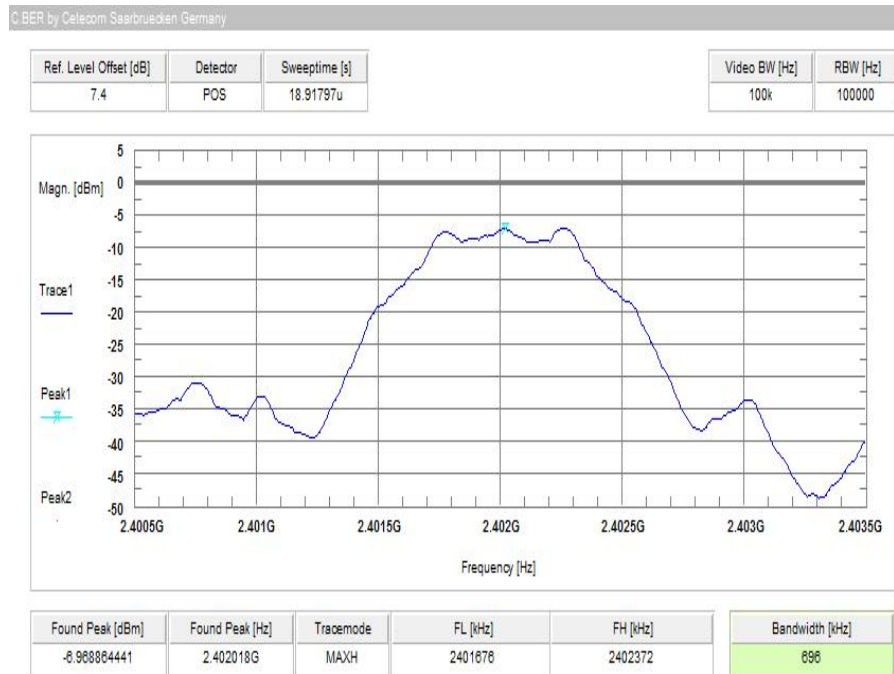
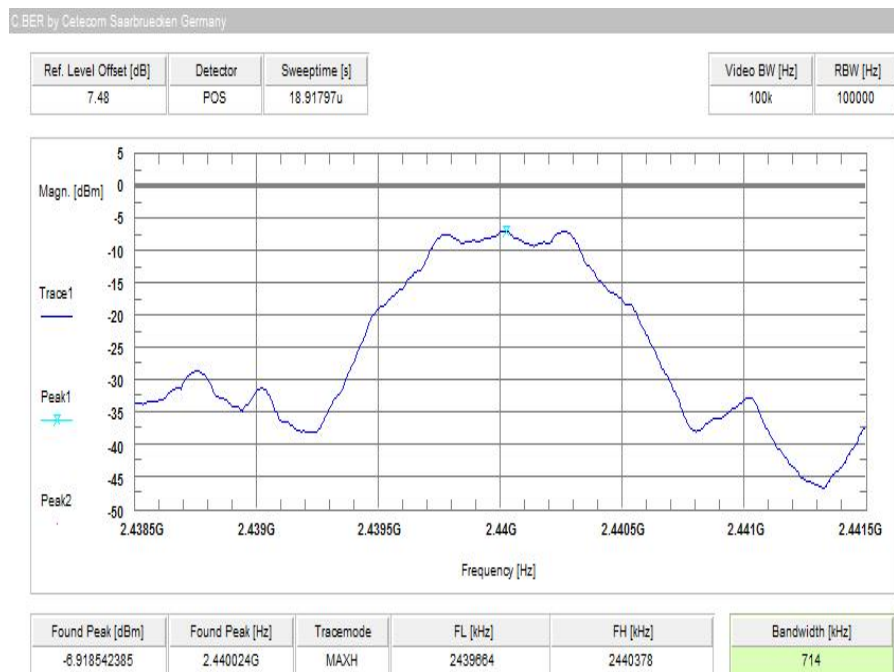
Limits:

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

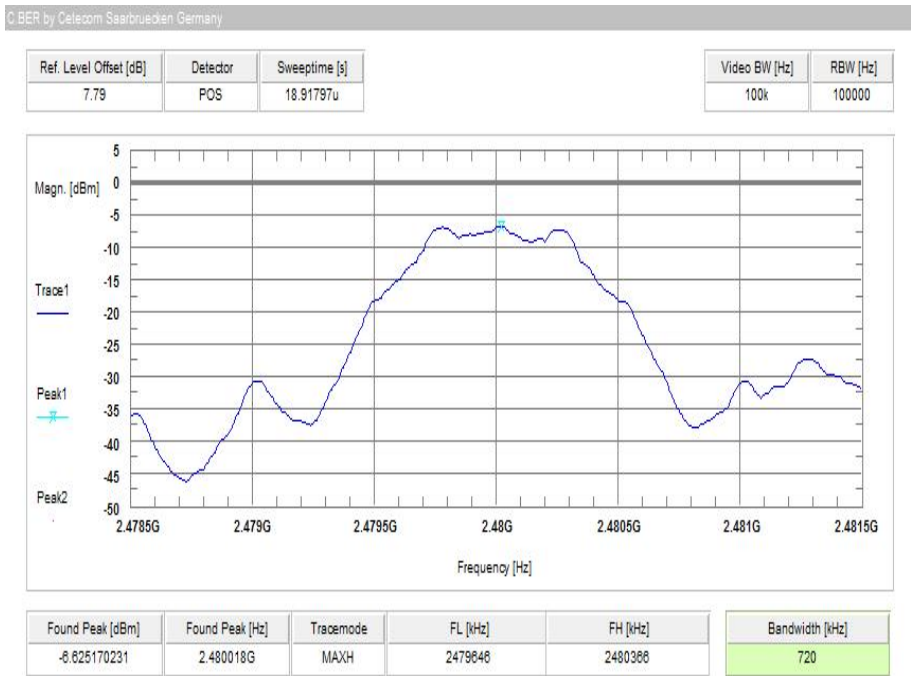
Results:

Modulation Frequency	6 dB BANDWIDTH [kHz]		
	2402 MHz	2440 MHz	2480 MHz
GFSK	696	714	720
Measurement uncertainty	± 10 kHz		

Verdict: **Passed**

Plots:**Plot 1: lowest channel****Plot 2: mid channel**

Plot 3: highest channel



9.7 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:	3 MHz
Trace-Mode:	Max Hold

Limits:

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

Results:

Modulation Frequency	20 dB BANDWIDTH [kHz]		
	2402 MHz	2440 MHz	2480 MHz
GFSK	1104	1112	1112
Measurement uncertainty	± 10 kHz		

Verdict: Passed

Plots:**Plot 1: lowest channel****Plot 2: mid channel**

Plot 3: highest channel



9.8 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:	3 MHz
Span:	3 MHz
Trace-Mode:	Max Hold

Limits:

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

Results:

Modulation Frequency	Maximum output power conducted [dBm]		
	2402 MHz	2440 MHz	2480 MHz
GFSK	-5.2	-5.2	-4.9
Measurement uncertainty	± 1.5 dB		

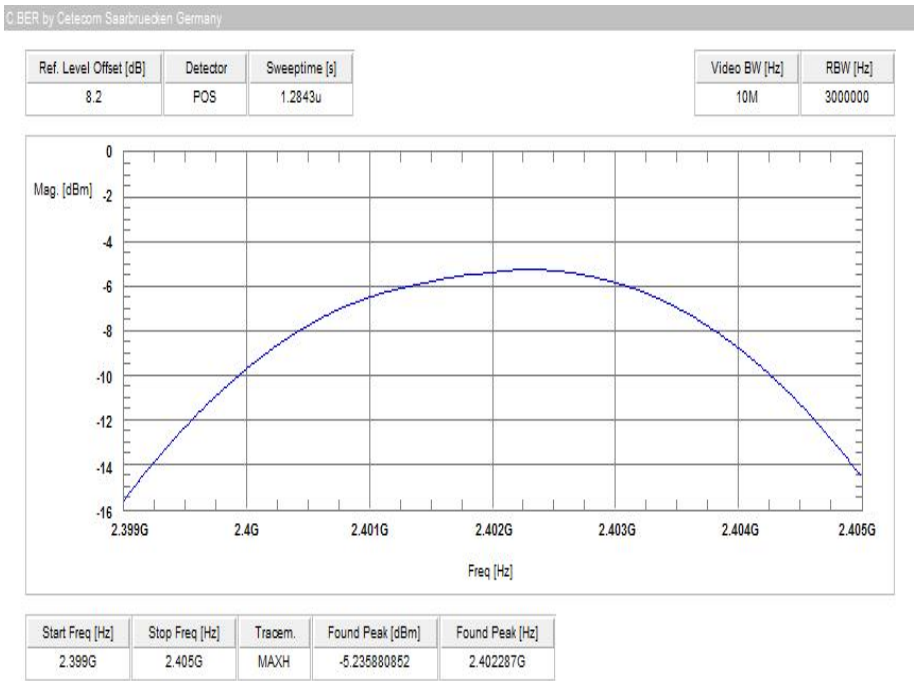
Modulation Frequency	Maximum output power radiated - EIRP [dBm]		
	2402 MHz	2440 MHz	2480 MHz
GFSK	-1.8	-2.9	-2.9
Measurement uncertainty	± 3 dB		

*) - Values calculated with antenna gain

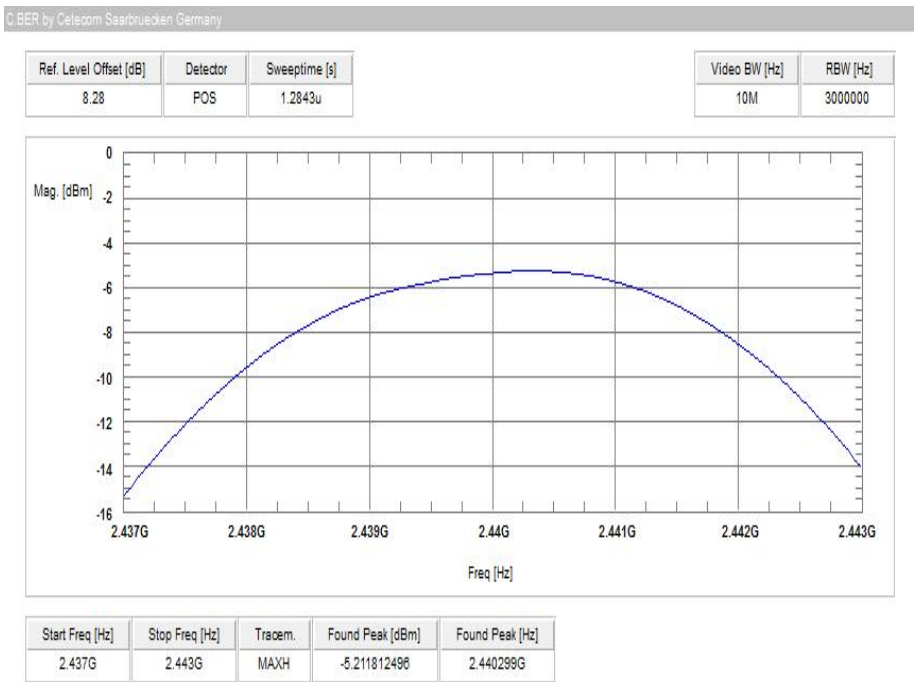
Verdict: Passed

Plots:

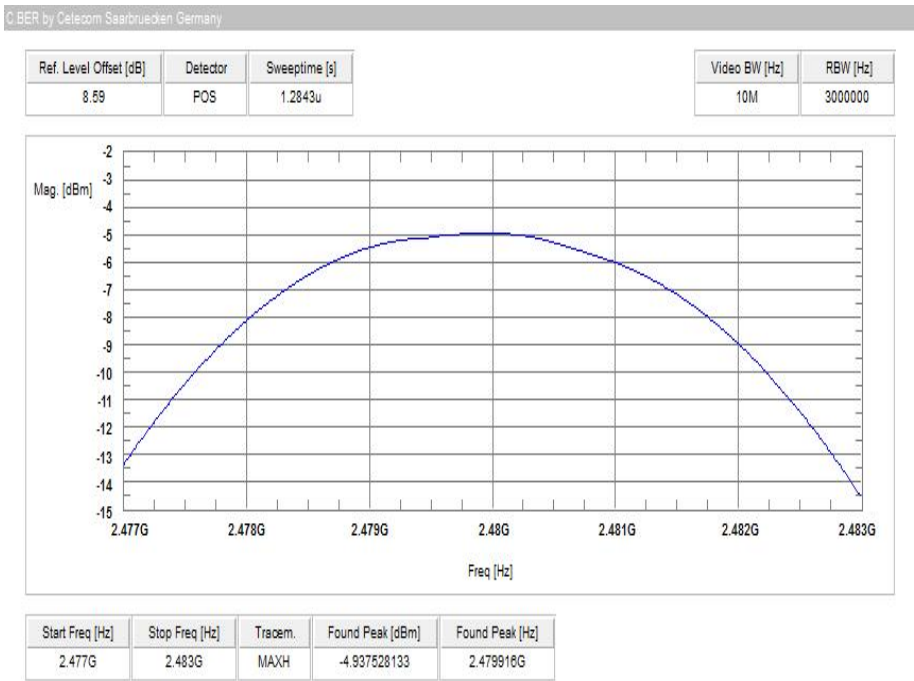
Plot 1: lowest channel



Plot 2: mid channel



Plot 3: highest channel



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

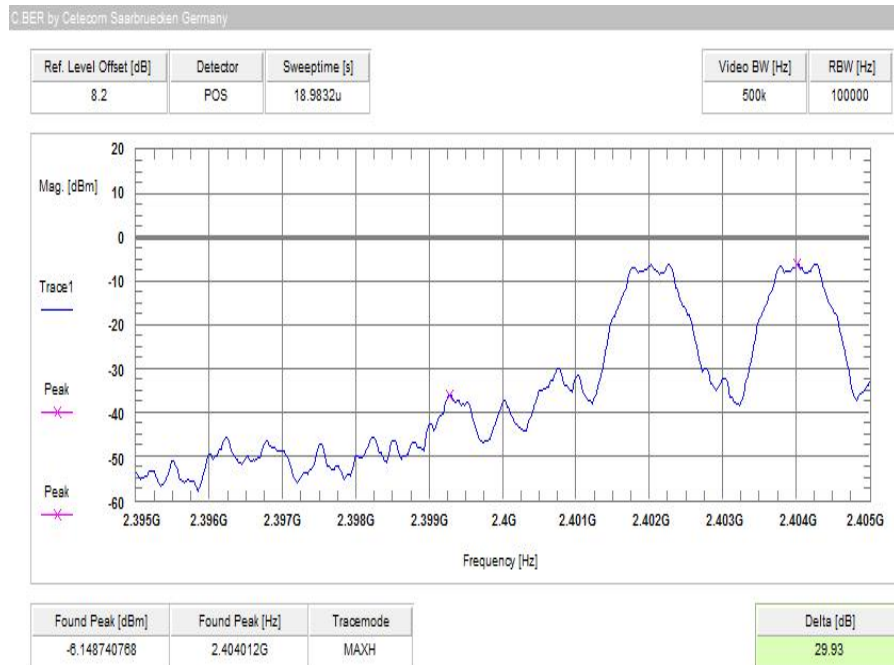
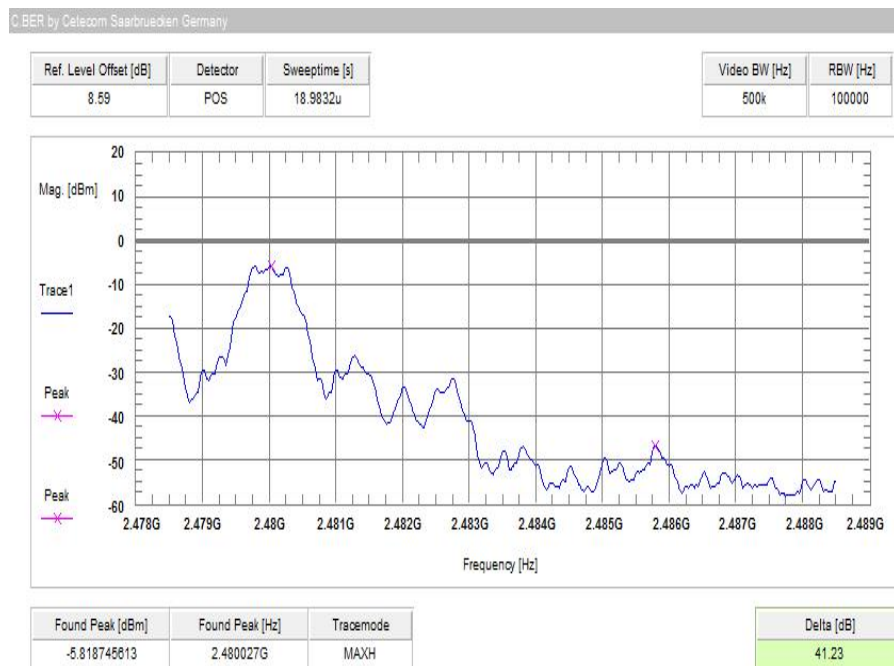
Limits:

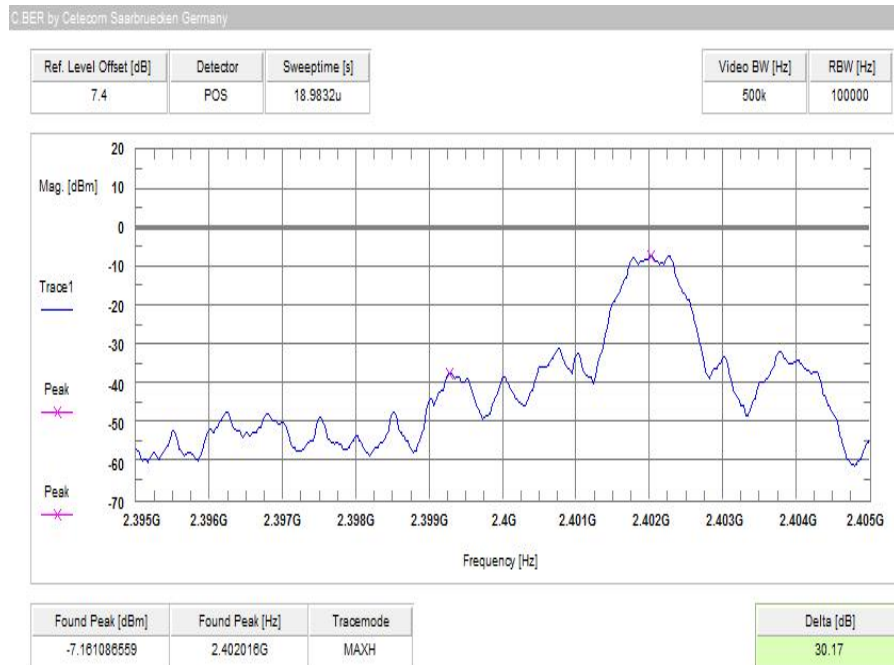
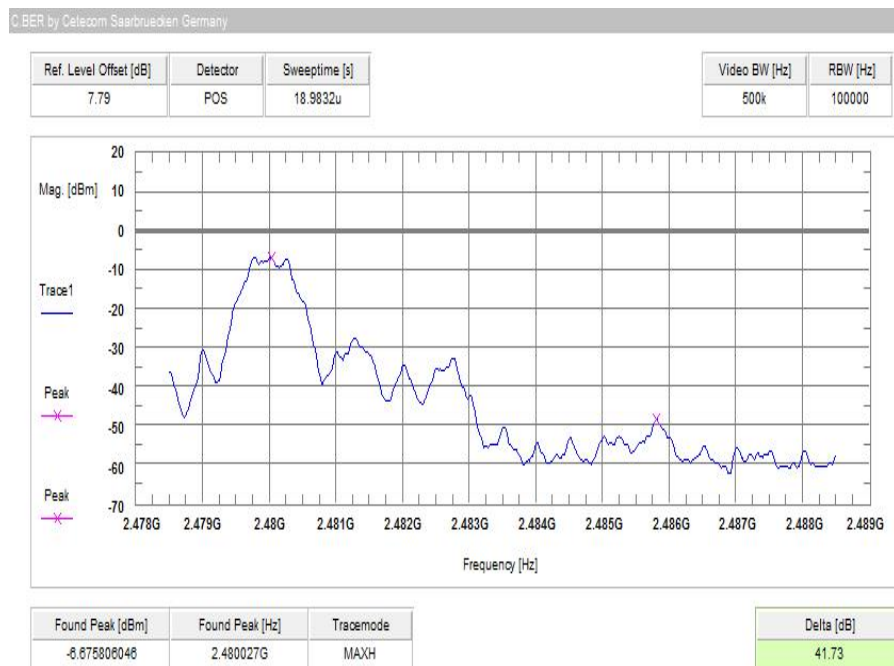
FCC	IC
Band edge compliance conducted	
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth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

Result:

Scenario	Band edge compliance conducted [dB]
Modulation	GFSK
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

Verdict: 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**

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

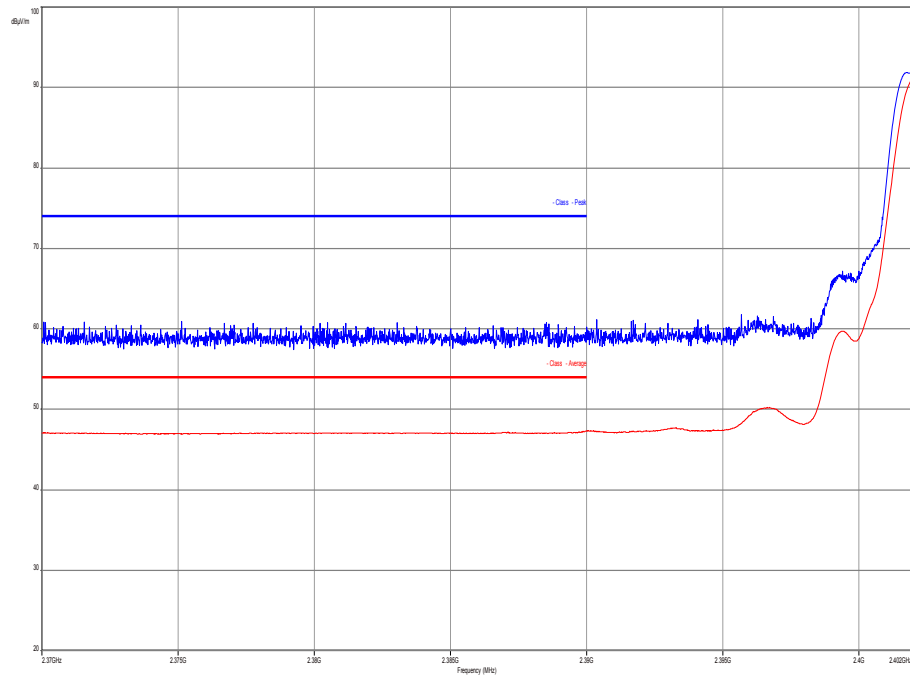
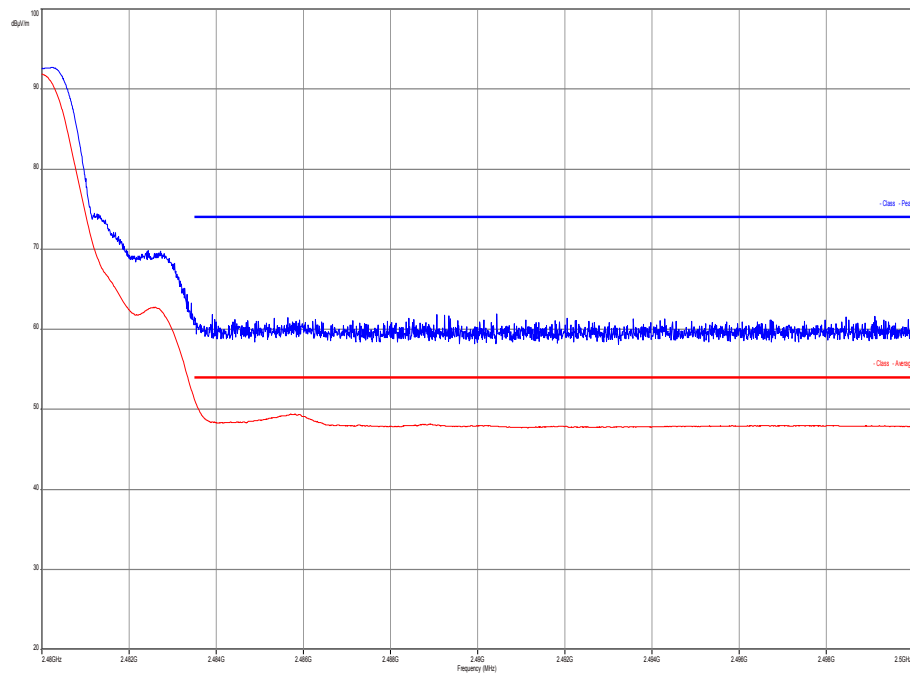
Limits:

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

Result:

Scenario	Band edge compliance radiated [dBµV/m]
Modulation	GFSK
Lower restricted band	< 54 (see plot 1)
Upper restricted band	< 54 (see plot 2)
Measurement uncertainty	± 3 dB

Verdict: Passed

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

9.11 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. The measurement is repeated for all modulations.

Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	100 kHz
Video bandwidth:	300 kHz or 500 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	

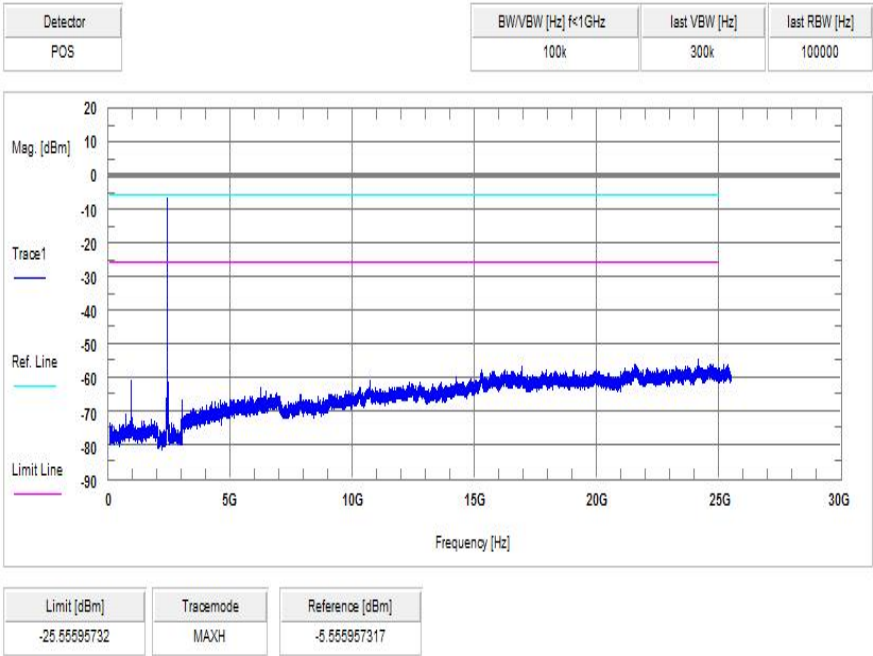
Results:

TX spurious emissions conducted					
f [MHz]		amplitude of emission [dBm]	limit max. allowed emission power	actual attenuation below frequency of operation [dB]	results
2402		-5.5	30 dBm	-/-	Operating frequency
No critical peaks found! All detected emissions are more than 6 dB below the limit!			-20 dBc	>20	complies
2440		-5.5	30 dBm	-/-	Operating frequency
No critical peaks found! All detected emissions are more than 6 dB below the limit!			-20 dBc	>20	complies
2480		-5.1	30 dBm	-/-	Operating frequency
No critical peaks found! All detected emissions are more than 6 dB below the limit!			-20 dBc	>20	complies
Measurement uncertainty		± 3 dB			

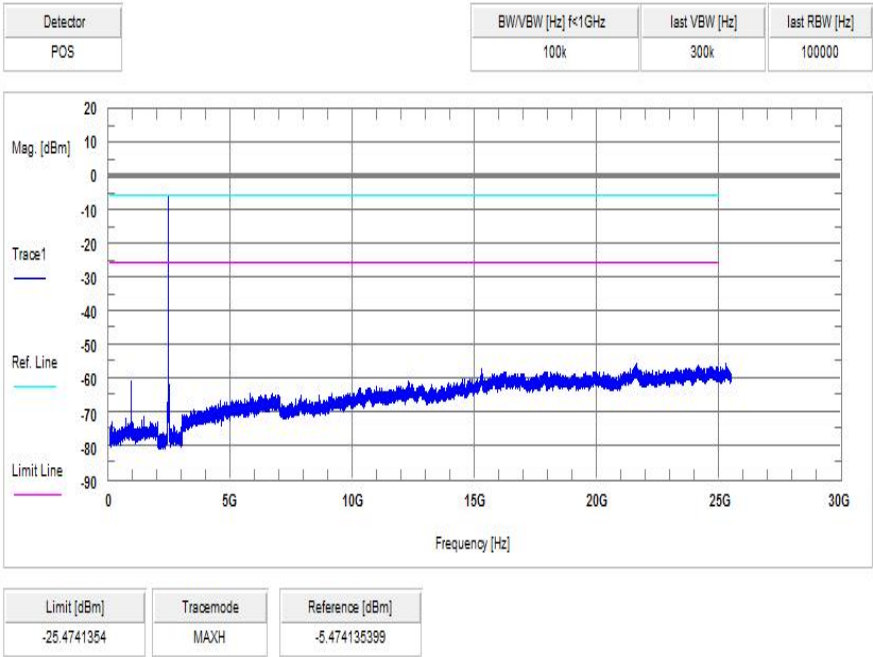
Verdict: Passed

Plots:

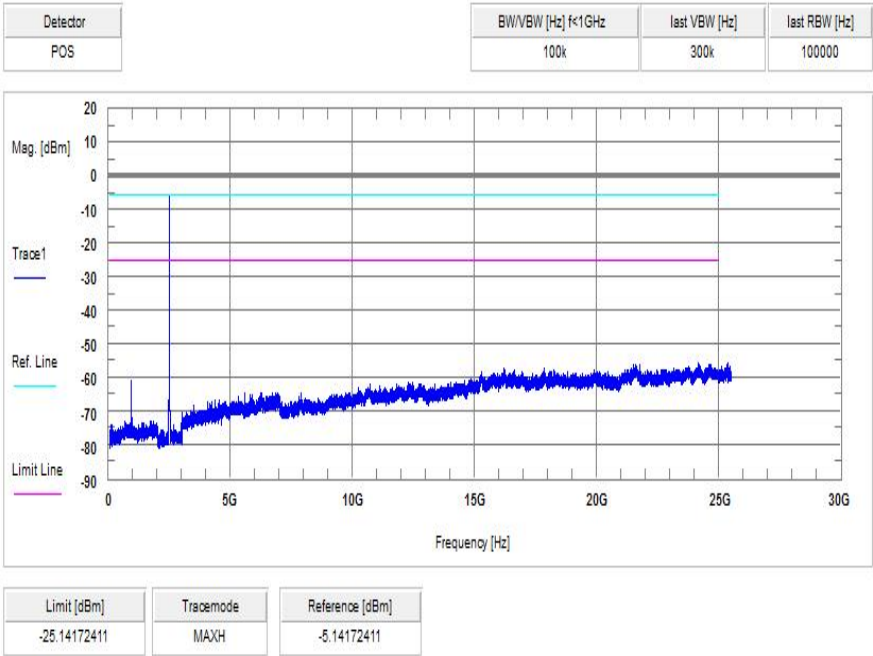
Plot 1: lowest channel



Plot 2: mid channel



Plot 3: highest channel



9.12 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. The measurement is performed in the mode with the highest output power.

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 25 GHz
Trace-Mode:	Max Hold
Measured Modulation:	GFSK

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

Limits:

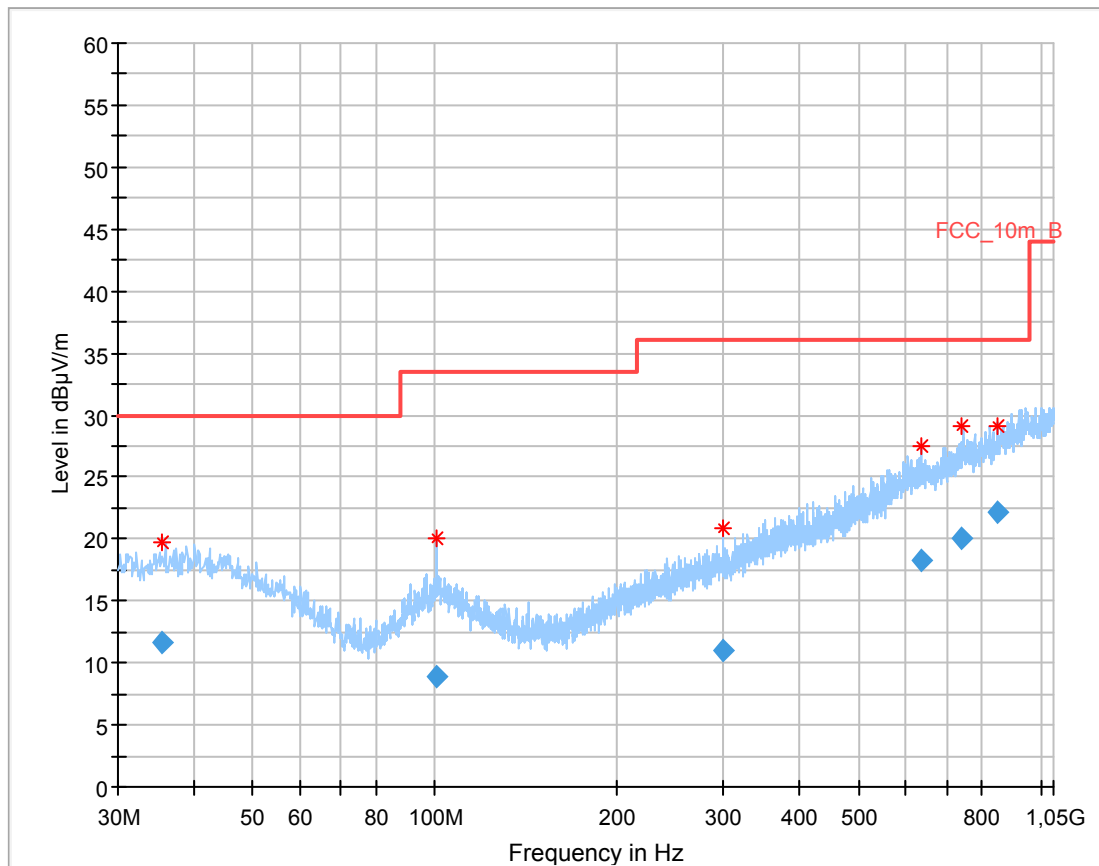
FCC		IC
TX spurious emissions radiated		
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz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

Results:

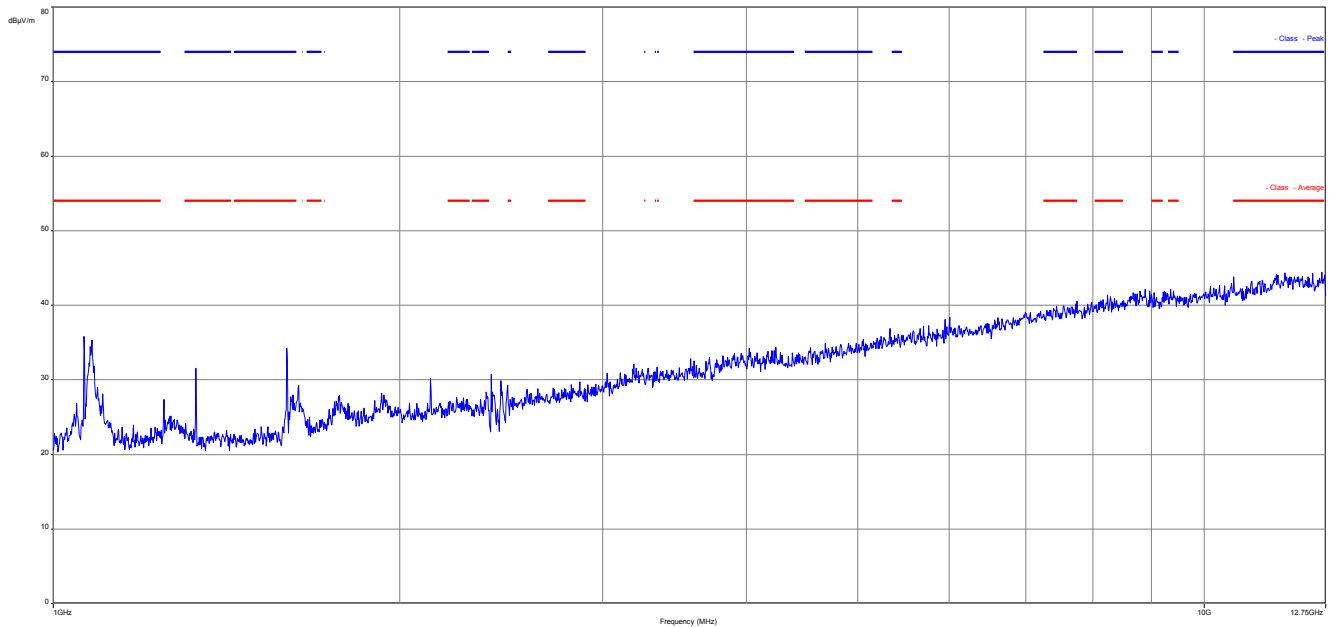
TX spurious emissions radiated [dB μ V/m]								
2402 MHz			2440 MHz			2480 MHz		
F [MHz]	Detector	Level [dB μ V/m]	F [MHz]	Detector	Level [dB μ V/m]	F [MHz]	Detector	Level [dB μ V/m]
No critical peaks found! All detected emissions are more than 6 dB below the limit! (see table below <1GHz plots)			No critical peaks found! All detected emissions are more than 6 dB below the limit! (see table below <1GHz plots)			No critical peaks found! All detected emissions are more than 6 dB below the limit! (see table below <1GHz plots)		
Measurement uncertainty			± 3 dB					

Verdict: Passed

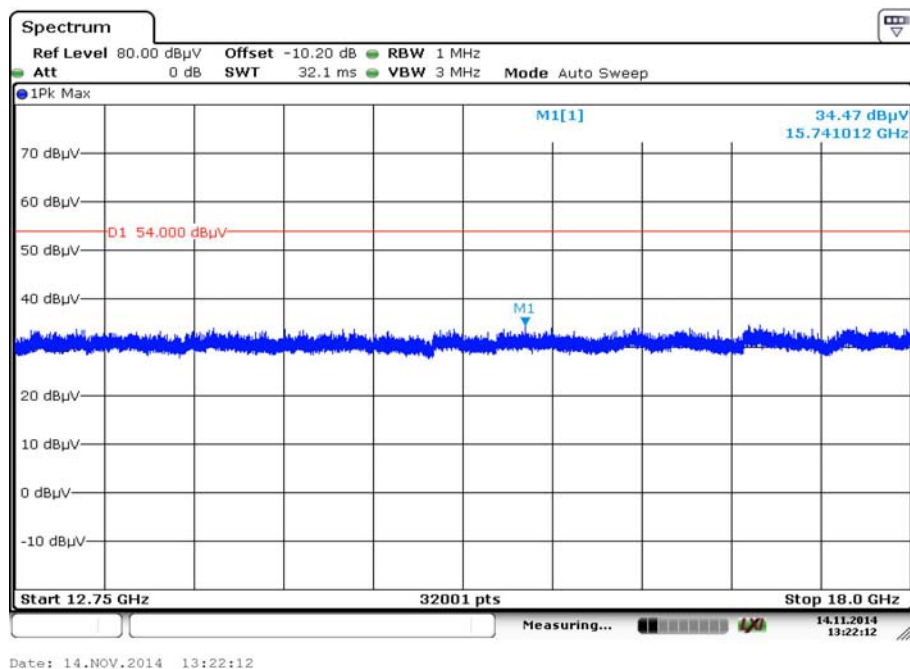
Note: The limit was recalculated with 20 dB / decade (Part 15.31) for all radiated spurious emissions 30 MHz to 1 GHz from 3 meter limit to a 10 meter distance. (40dB/decade for emissions < 30MHz)

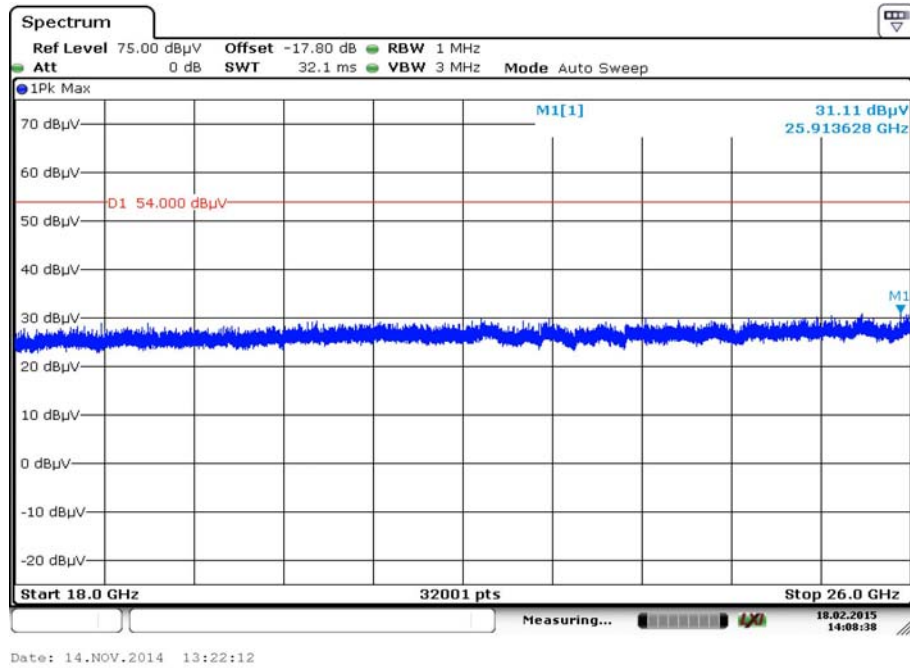
Plots:
Plot 1: 30 MHz to 1 GHz, lowest channel, vertical & horizontal polarization


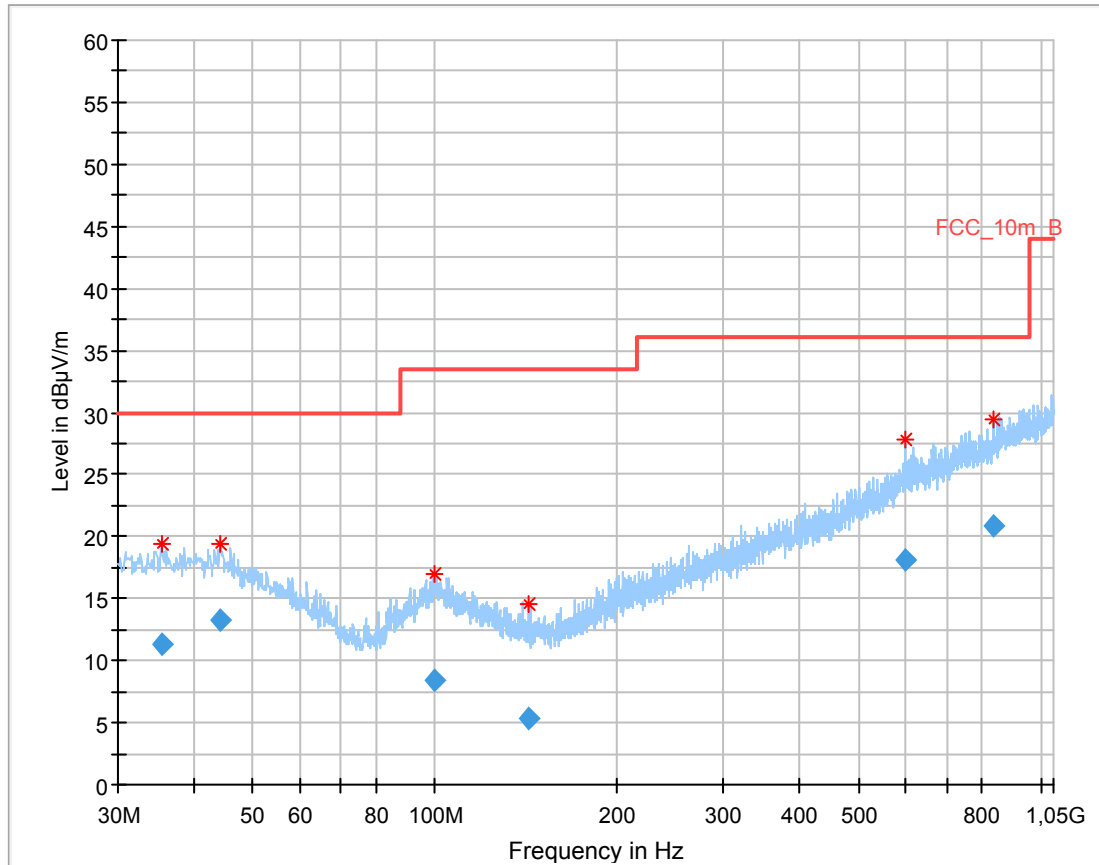
Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
35.497350	11.65	30.00	18.35	1000.0	120.000	171.0	V	265	13.8
101.018550	8.84	33.50	24.66	1000.0	120.000	200.0	H	102	12.1
299.977350	11.04	36.00	24.96	1000.0	120.000	100.0	H	275	14.4
636.281400	18.30	36.00	17.70	1000.0	120.000	200.0	H	56	21.0
742.450350	20.03	36.00	15.97	1000.0	120.000	200.0	V	305	22.5
851.148150	22.10	36.00	13.90	1000.0	120.000	200.0	V	301	23.5

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

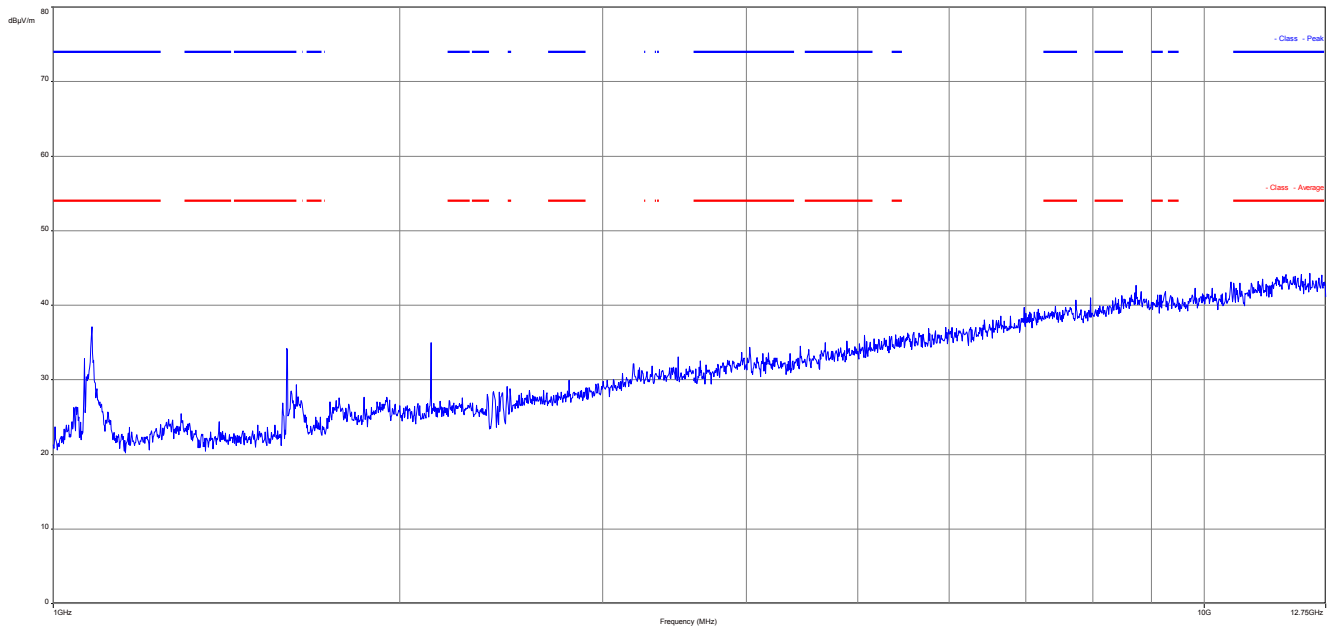
Carrier suppressed with a 2.4 GHz-band rejection filter.

Plot 3: 12 GHz to 18 GHz, lowest channel, vertical & horizontal polarization

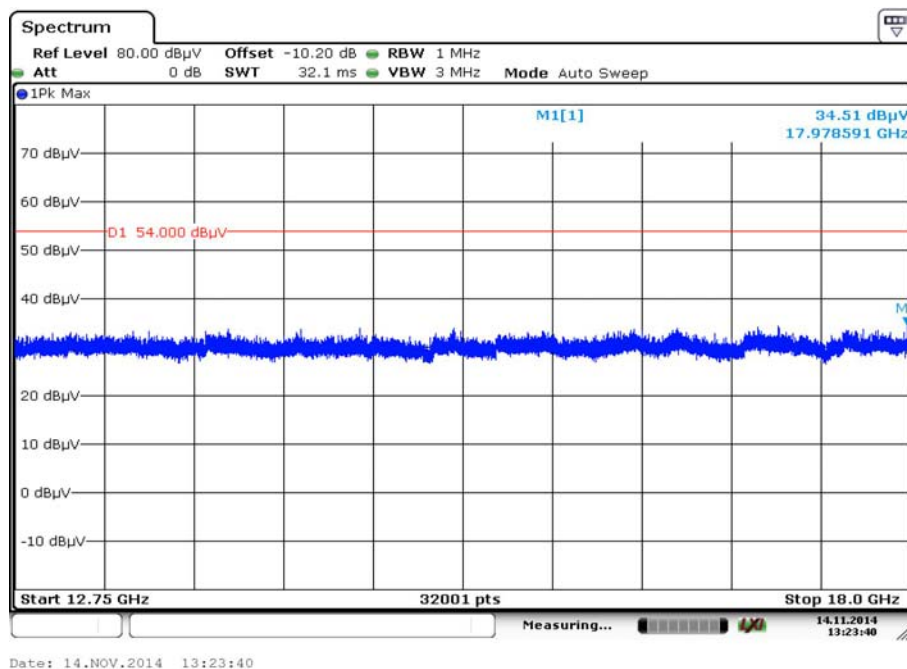
Plot 4: 18 GHz to 25 GHz, lowest channel, vertical & horizontal polarization

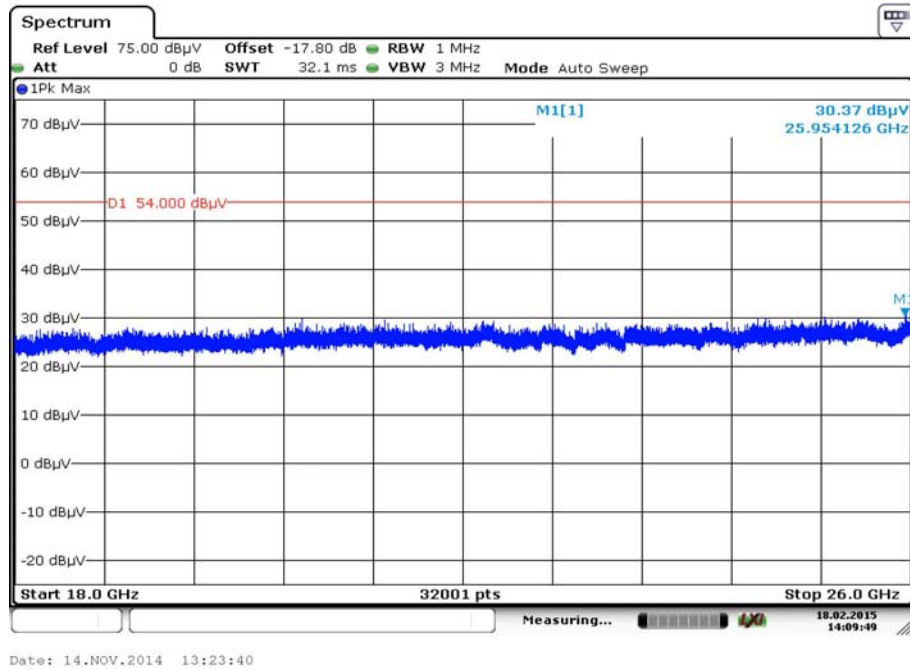
Plot 5: 30 MHz to 1 GHz, mid channel, vertical & horizontal polarization

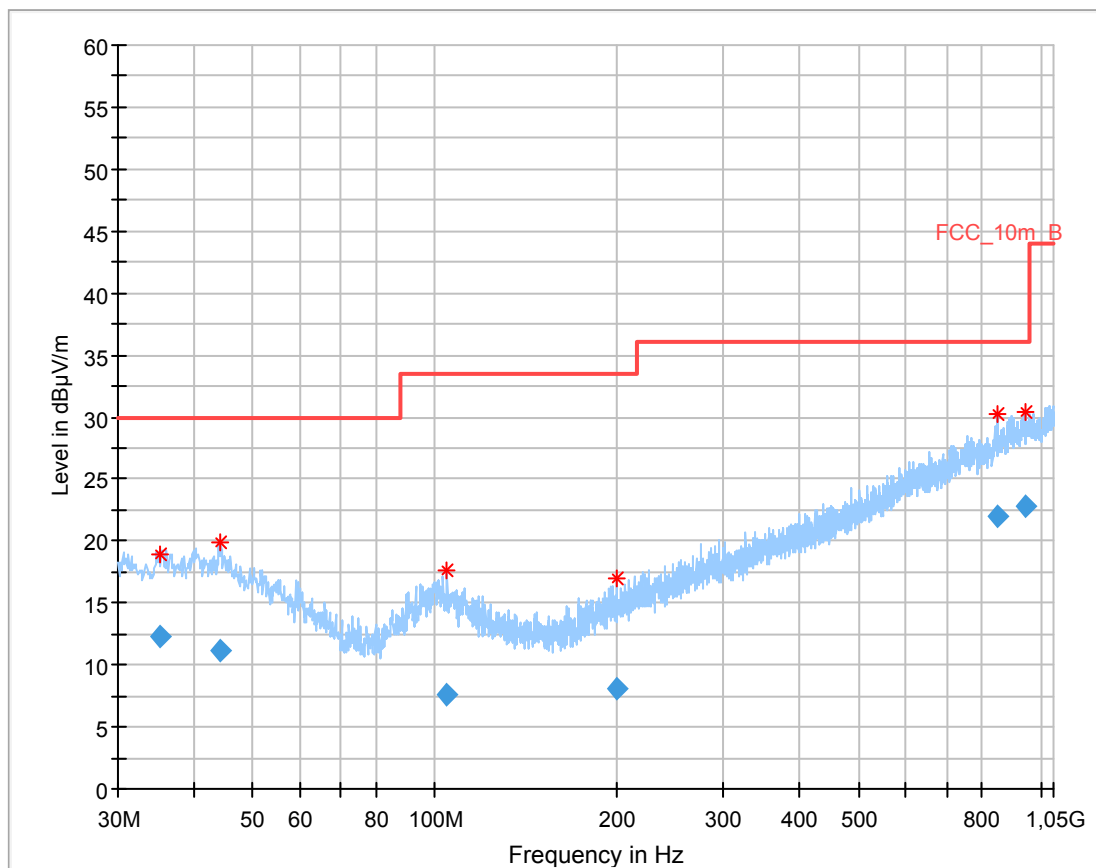
Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
35.592600	11.32	30.00	18.68	1000.0	120.000	103.0	H	306	13.8
44.160150	13.19	30.00	16.81	1000.0	120.000	172.0	V	101	13.9
99.957150	8.47	33.50	25.03	1000.0	120.000	102.0	H	-9	12.2
142.755750	5.31	33.50	28.19	1000.0	120.000	200.0	H	-9	8.8
598.760250	18.13	36.00	17.87	1000.0	120.000	400.0	H	95	20.7
836.308350	20.88	36.00	15.12	1000.0	120.000	200.0	V	302	23.3

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

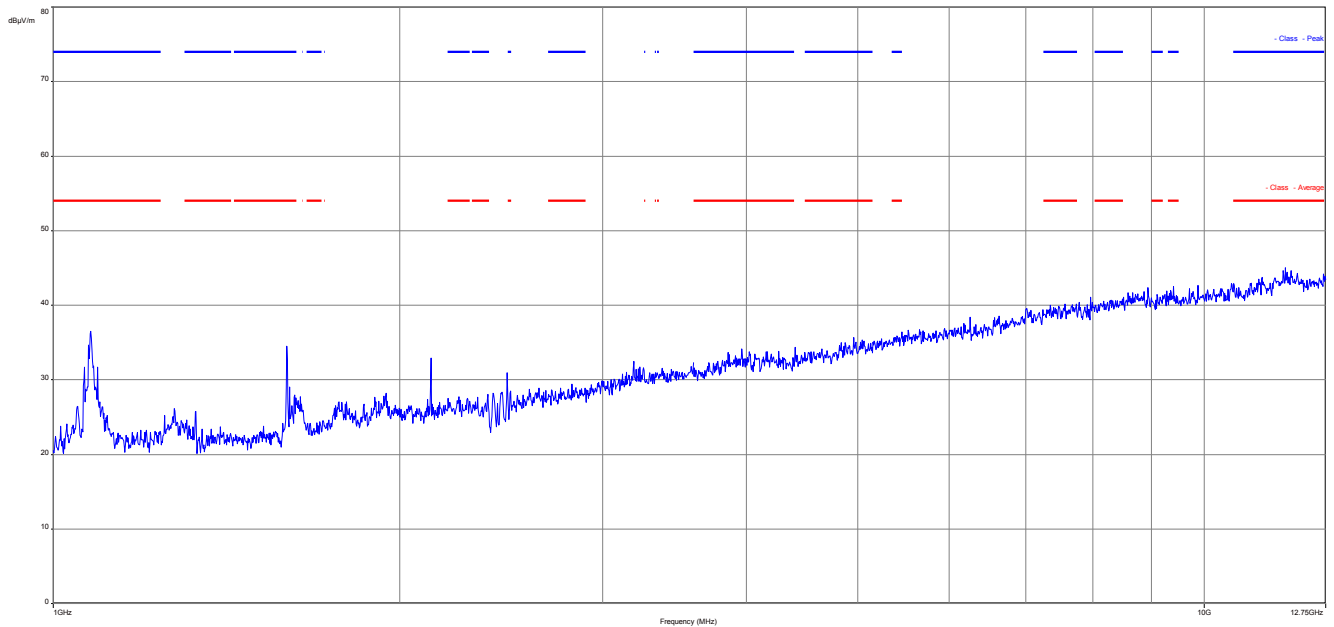
Carrier suppressed with a 2.4 GHz-band rejection filter.

Plot 7: 12 GHz to 18 GHz, mid channel, vertical & horizontal polarization

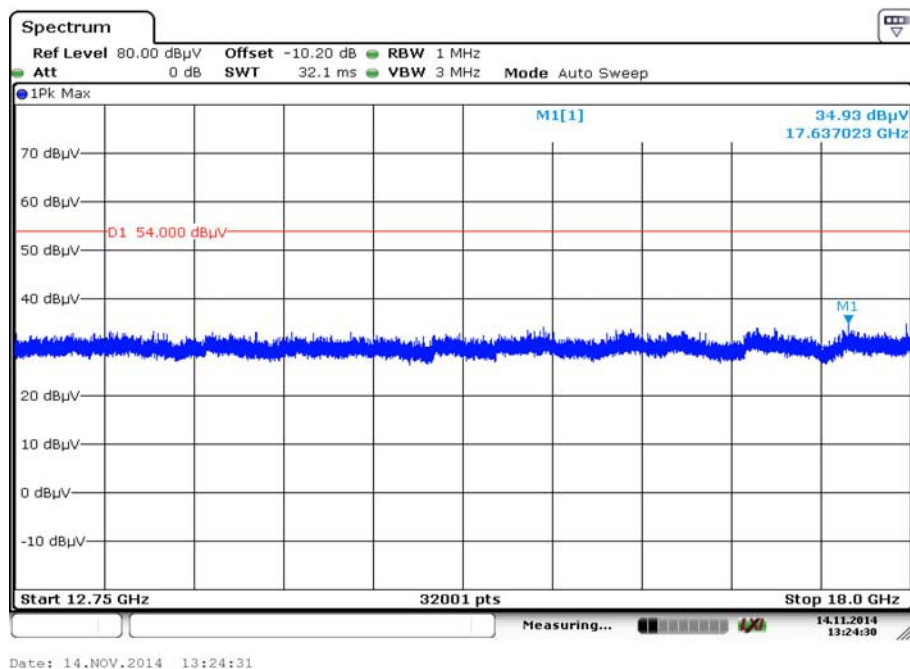
Plot 8: 18 GHz to 25 GHz, mid channel, vertical & horizontal polarization

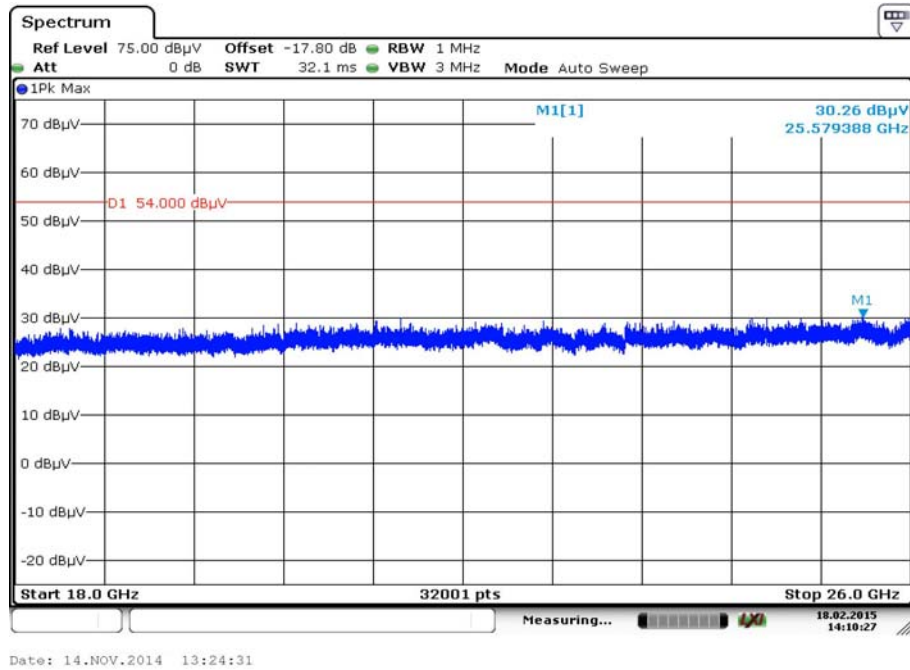
Plot 9: 30 MHz to 1 GHz, highest channel, vertical & horizontal polarization

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
35.140950	12.29	30.00	17.71	1000.0	120.000	200.0	H	261	13.8
44.217000	11.23	30.00	18.77	1000.0	120.000	174.0	V	95	13.9
104.778300	7.64	33.50	25.86	1000.0	120.000	103.0	H	5	11.7
199.942350	8.02	33.50	25.48	1000.0	120.000	273.0	H	31	11.7
846.309000	21.95	36.00	14.05	1000.0	120.000	200.0	V	50	23.4
942.760350	22.75	36.00	13.25	1000.0	120.000	272.0	H	215	24.2

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

Plot 12: 18 GHz to 25 GHz, highest channel, vertical & horizontal polarization

9.13 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 25 GHz
Trace-Mode:	Max Hold

Limits:

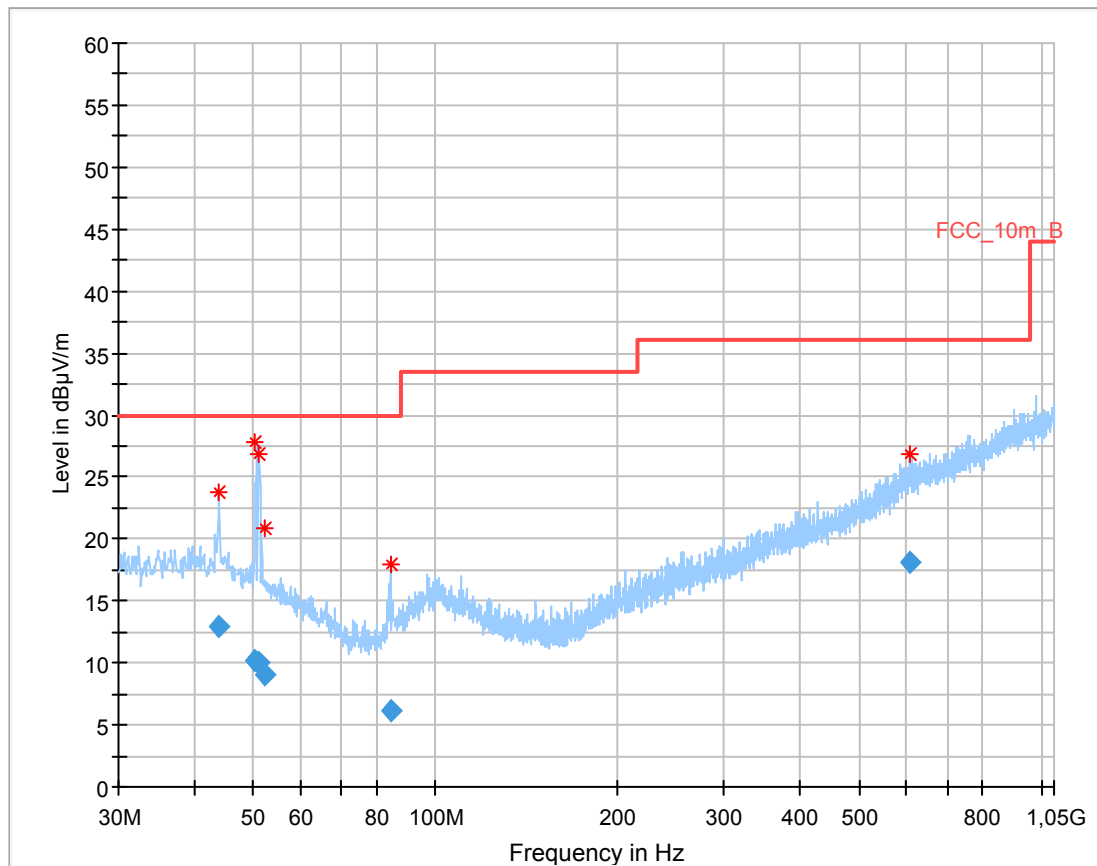
FCC		IC
RX Spurious Emissions Radiated		
Frequency (MHz)	Field strength (dB μ V/m)	Measurement distance
30 - 88	30.0	10
88 - 216	33.5	10
216 - 960	36.0	10
Above 960	54.0	3

Results:

RX spurious emissions radiated [dB μ V/m]		
F [MHz]	Detector	Level [dB μ V/m]
<i>No critical peaks found! All detected emissions are more than 6 dB below the limit!</i>		
Measurement uncertainty	± 3 dB	

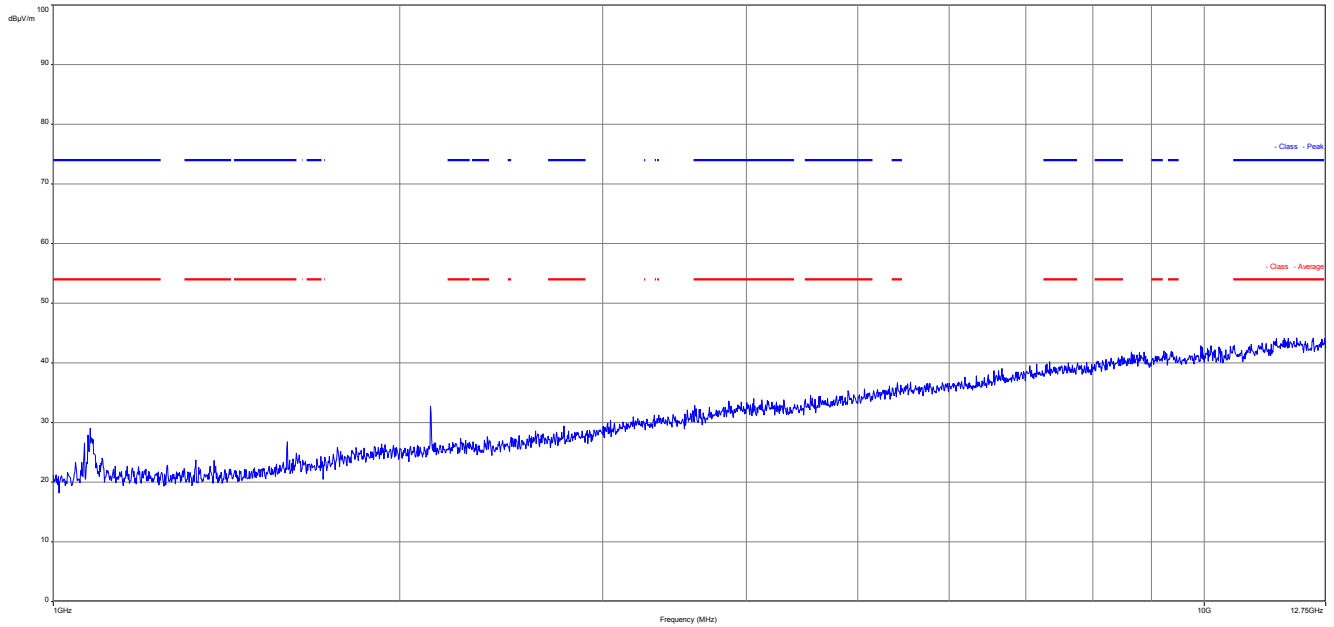
Verdict: **Passed**

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

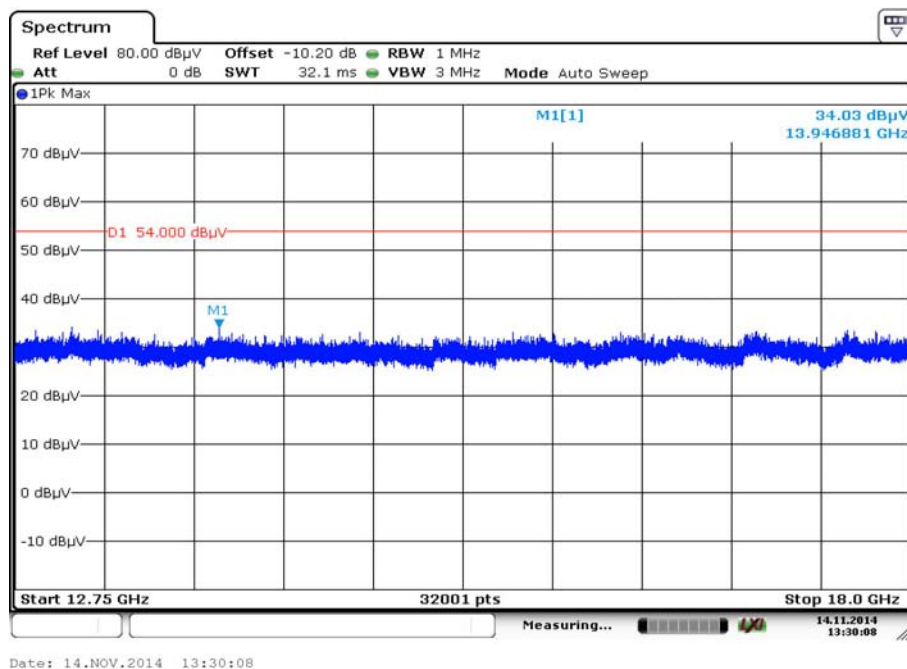
Plots:
Plot 1: 30 MHz to 1 GHz, RX / idle – mode, vertical & horizontal polarization


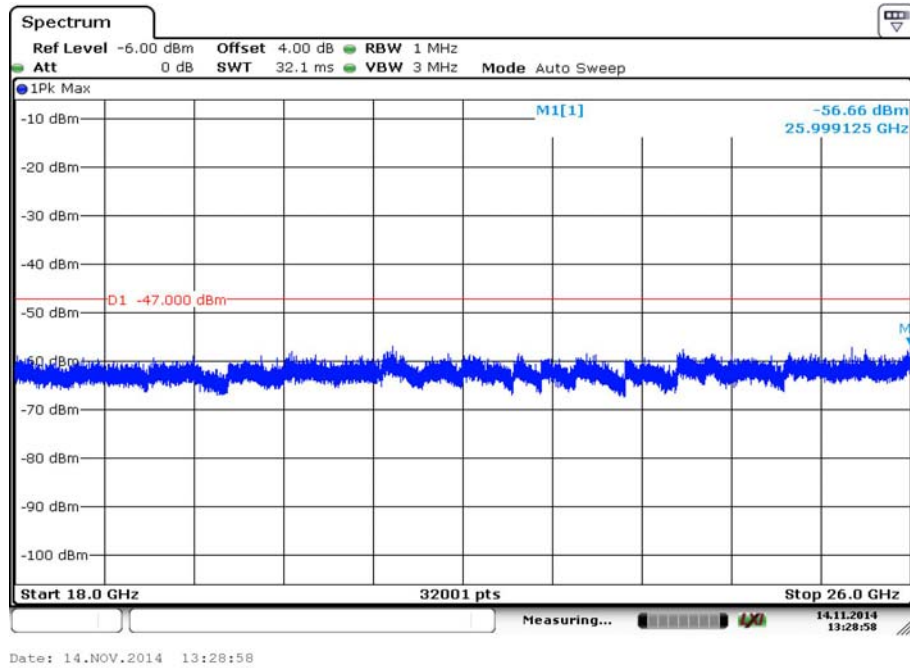
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
43.996650	12.94	30.00	17.06	1000.0	120.000	102.0	V	147	13.9
50.467050	10.17	30.00	19.83	1000.0	120.000	101.0	V	275	12.6
51.014100	10.04	30.00	19.96	1000.0	120.000	104.0	V	237	12.5
52.127100	9.06	30.00	20.94	1000.0	120.000	103.0	V	256	12.3
84.760350	6.17	30.00	23.83	1000.0	120.000	170.0	V	237	9.2
608.934900	18.15	36.00	17.85	1000.0	120.000	200.0	V	220	20.8

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



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

9.14 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 measurement is performed in the mode with the highest output power. The limits are recalculated to a measurement distance of 3 m with 40 dB/decade according CFR Part 2.

Measurement:

Measurement parameter	
Detector:	Peak / Quasi peak
Sweep time:	Auto
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

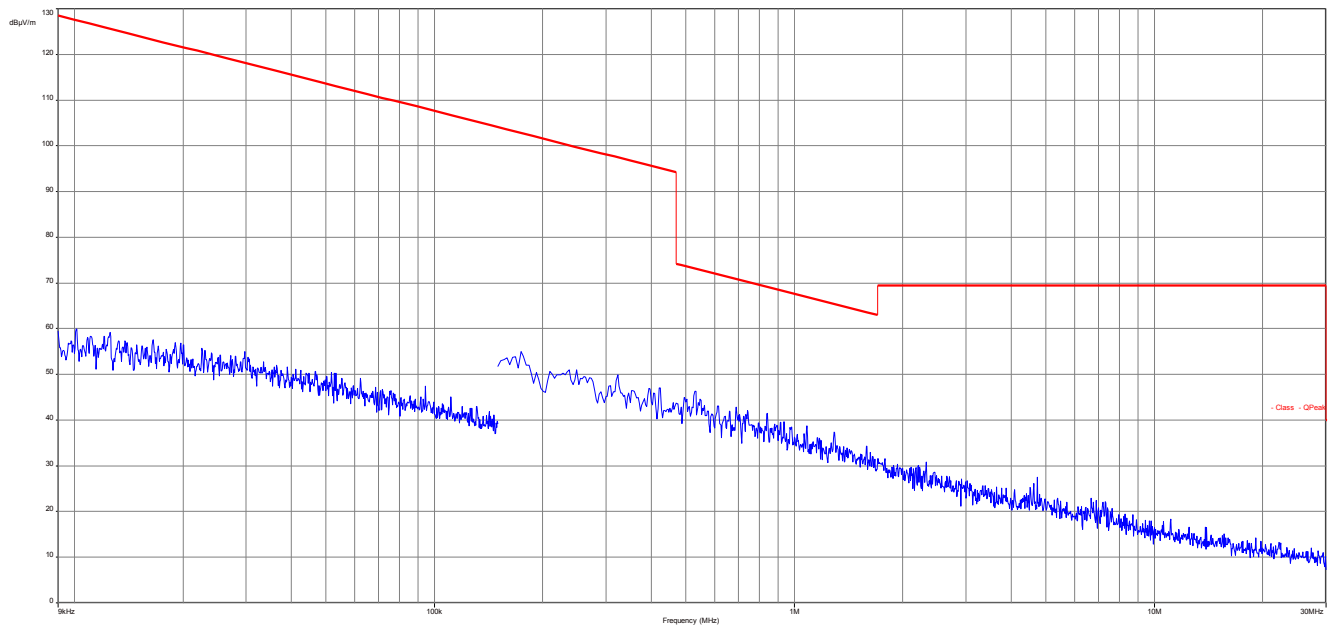
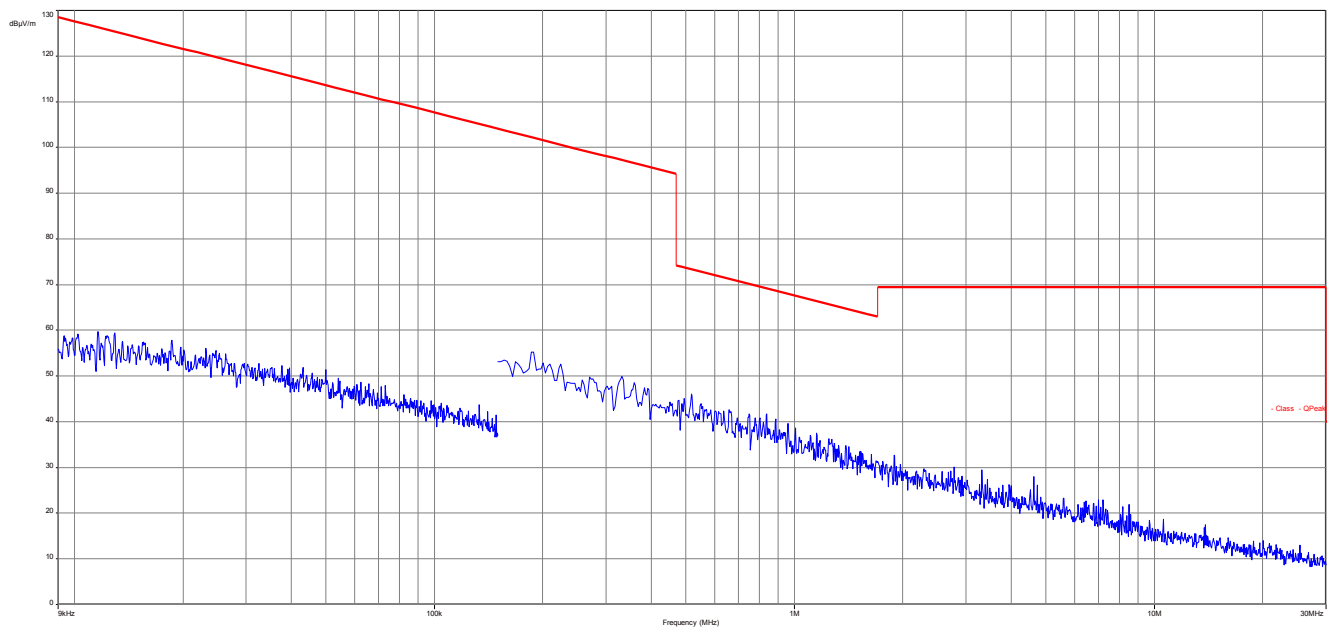
Limits:

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 peaks found!		
Measurement uncertainty	± 3 dB	

Verdict: Passed

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

1 Test equipment and ancillaries used for tests

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

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

No.	Lab / Item	Equipment	Type	Manufact.	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	n. a.	Switch / Control Unit	3488A	HP Meßtechnik		300001691	ne		
2	n. a.	Power Sensor 50 Ohms, 10 MHz - 18 GHz, 1 nW - 20 mW	NRV-Z1	R&S	833894/012	300002681-0013	k	25.08.2014	25.08.2016
3	n. a.	DC-Blocker	8143	Inmet Corp.	none	300002842	ne		
4	n. a.	Powersplitter	6005-3	Inmet Corp.		300002841	ev		
5	n. a.	Signal Analyzer 10 Hz - 40 GHz	FSV40	R&S	101353	300004819	k	20.01.2014	20.01.2015
6	n. a.	System DC Power Supply	N5767A	Agilent Technologies	US14J1569P	300004851	k	04.09.2014	04.09.2016
7	45	Switch-Unit	3488A	HP Meßtechnik	2719A14505	300000368	g		
8	n. a.	EMI Test Receiver	ESCI 3	R&S	100083	300003312	k	27.01.2014	27.01.2015
9	n. a.	Antenna Tower	Model 2175	ETS-LINDGREN	64762	300003745	izw		
10	n. a.	Positioning Controller	Model 2090	ETS-LINDGREN	64672	300003746	izw		
11	n. a.	Turntable Interface-Box	Model 105637	ETS-LINDGREN	44583	300003747	izw		
12	n. a.	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	295	300003787	k	22.04.2014	22.04.2016
13	n. a.	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP Meßtechnik	2818A03450	300001040	Ve	12.01.2012	12.01.2015
14	n. a.	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	8812-3088	300001032	vIKII	08.05.2013	08.05.2015
15	n. a.	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev		
16	n. a.	Switch / Control Unit	3488A	HP Meßtechnik	*	300000199	ne		
17	90	Active Loop Antenna 10 kHz to 30 MHz	6502	Kontron Psychotech	8905-2342	300000256	k	13.06.2013	13.06.2015
18	n. a.	Amplifier	js42-00502650-28-5a	Parzich GMBH	928979	300003143	ne		
19	n. a.	Band Reject filter	WRCG2400/2483-2375/2505-50/10SS	Wainwright	11	300003351	ev		
20	n. a.	Highpass Filter	WHKX7.0/18G-8SS	Wainwright	18	300003789	ne		
21	n. a.	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	371	300003854	vIKII	29.10.2014	29.10.2017
22	n. a.	MXE EMI Receiver 20 Hz bis 26,5 GHz	N9038A	Agilent Technologies	MY51210197	300004405	k	13.03.2014	13.03.2015
23	n. a.	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000037	300004509	ne		
24	11b	Microwave System Amplifier, 0.5-26.5 GHz	83017A	HP Meßtechnik	00419	300002268	ev		
25	A026	Std. Gain Horn Antenna 12.4 to 18.0 GHz	639	Narda	8402	300000787	k	22.07.2013	22.07.2015
26	A029	Std. Gain Horn Antenna 18.0 to 26.5 GHz	638	Narda	8205	300002442	k	19.07.2013	19.07.2015
27	A031	Std. Gain Horn Antenna 26.5 to 40.0 GHz	637	Narda		300000510	k	19.07.2013	19.07.2015
28	n. a.	Broadband Low Noise Amplifier 18-50 GHz	CBL18503070-XX	CERNEX	19338	300004273	ne		

Agenda: Kind of Calibration

k calibration / calibrated
 ne not required (k, ev, izw, zw not required)
 ev periodic self verification

EK limited calibration
 zw cyclical maintenance (external cyclical maintenance)
 izw internal cyclical maintenance

Ve long-term stability recognized

vlk! Attention: extended calibration interval

NK! Attention: not calibrated

g blocked for accredited testing

*) next calibration ordered / currently in progress

2 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	2014-12-02
-A	Kind of test item and model name changed	2015-01-29
-B	Cover page: Applicant and Manufacturer information changed; Typos corrected	2015-02-10
-C	Editorial changes	2015-02-19

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

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

Akkreditierung



Die Deutsche Akkreditierungsstelle GmbH bestätigt hiermit, dass das Prüflaboratorium

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

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

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

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

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

Frankfurt am Main, 07.03.2014

Datei: dkk_001_v01.docx

Dr. Andreas Dörmann
Abteilungsleiter

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

Note:

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

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