Test Report

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RF test report

140275-AU01+W04

GYMWATCH GmbH

GYMWATCH Sensor

GW-1000

bluetooth-mode

DAkkS
Deutsche
Akkreditierungsstelle
D-PL-12155-01-01

EMV **TESTHAUS** GmbH

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Accreditation:

DAkkS
Deutsche
Akkreditierungsstelle
D-PL-12155-01-01

Test Laboratory:

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Germany

The technical accuracy is guaranteed through the quality management of the
EMV **TESTHAUS** GmbH

Table of contents

List of pictures

List of tables

1 Test regulations

CFR 47 Part 2: 10-2013	Code of Federal Regulations Part 2 (Frequency allocation and radio treaty matters; General rules and regulations) of the Federal Communication Commission (FCC)
CFR 47 Part 15: 10-2013	Code of Federal Regulations Part 15 (Radio Frequency Devices) of the Federal Communication Commission (FCC)
Public Notice DA 00-705	Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems.
ANSI C63.4: December 2009	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
RSS-Gen Issue 4, November 2014	General Requirements for Compliance of Radio Apparatus, published by Industry Canada
RSS-102 Issue 4, March 2010, updated December 2010	Radio Frequency Exposure Compliance of Radiocommunications Apperatus
RSS-210 Issue 8, December 2010	Low Power Licence-Exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment, published by Industry Canada

1.1 Cross reference of FCC and Industry Canada standards

CFR 47 Part and Section	Test	Equivalent to IC
15.207	AC power line conducted emissions 0.150 MHz to 30 MHz	RSS-Gen Issue 4, section 8.8
15.247(a) Public Notice DA 00-705	Carrier Frequency Separation	RSS-210 Issue 8 A 8.1(b)
15.247(a) Public Notice DA 00-705	Number of Hopping Frequencies	RSS-210 Issue 8 A 8.1(d)
15.247(a) Public Notice DA 00-705	Time of Occupancy (Dwell time)	RSS-210 Issue 8 A 8.1(d)
15.247(a) Public Notice DA 00-705	20 dB bandwidth	RSS-210 Issue 8 A 8.1(a)
2.202(a)	Occupied bandwidth	RSS-Gen Issue 4, section 6.6
15.247(b) Public Notice DA 00-705	Maximum conducted output power	RSS-Gen Issue 4, section 6.12 RSS-210 Issue 8 A 8.4
15.247(d) Public Notice DA 00-705	Band-edge Compliance	RSS-210 Issue 8 A 8.5
15.247(d) Public Notice DA 00-705	Spurious RF Conducted Emission	RSS-210 Issue 8 A 8.5
15.247(d) Public Notice DA 00-705	Radiated emission 9 kHz to 10th Harmonic	RSS-Gen Issue 4, section 6.13 RSS-210 Issue 8 A 8.5
2.1091 Public Notice DA 00-705	Radiofrequency radiation exposure evaluation for mobile devices	RSS-Gen Issue 4, section 3.2 Exempted form SAR and RF evaluation

1.2 Summary of test results

Standard	Test result
FCC CFR 47 Part 15, section 15.247	Passed
RSS-210 Issue 8 Annex 8 and RSS-Gen Issue 4	Passed

2 Equipment under Test (EUT)

Product type:	GYMWATCH Sensor
Model Name:	GW-1000
Manufacturer:	GYMWATCH GmbH
Serial number:	- sample 1 -> radiated measurements - sample 2 -> conducted measurements
FCC ID:	2AC6J-GW1000
IC:	12332A-GW1000
Application freq. band:	2400 MHz – 2483.5 MHz
Frequency range:	2402MHz – 2480 MHz
Operating frequency:	2402MHz – 2480 MHz
Channel spacing:	1 MHz
Number of RF-channels:	79
Type of modulation:	FHSS (GFSK)
Antenna type:	internal smd onboard antenna
Antenna gain:	1.7 dBi
Power supply:	Host powered nominal: 3.7 V
Temperature range:	-20°C to +60°C

2.1 Photo documentation

For photos taken during testing, see annex A.
For photos of the EUT, see annex B.
For internal photos of the EUT, see annex C.

2.2 Short description of the EUT

The EUT is a workout sensor which uses bluetooth or bluetooth low energy to transfer its collected data to a host (e.g. an i-phone)

During the pre-measurements it was investigated which EUT position is the respective worst-case. The EUT positions are documented in annex A.

2.3 Operation mode

For EUT-configuration the terminal programm “Hterm” was used.
The following adjustments were set for testing:

BLUETOOTH

Tx-mode:
- GFSK
- power level 15
- test pattern: “0101 0101 0101 0101”
- hopping were it was requiered
- Channel 0, 39, 78 were it was requiered

2.4 Configuration

The following peripheral devices and interface cables were connected during the tests:

Device	Model:	S/N
GYMWATCH Sensor	GW-1000	sample1/2
FUJITSU Notebook	Lifebook A531	YLDS013094
AC power source	CHROMA 61602	616020002099
Power supply	Input 120V/60Hz /Output 0-30V DC Statron 3252.1	1201211
Multimeter	Gossen METRAhit 29S	E00099

Used cables

Numbers:	Description: (type / lengths / remarks)	Serial No
2	DC cable / 1.5m / unshielded	N/A
1	Antenna cable / 0.3m / shielded	N/A

3 AC power line conducted emissions

according to CFR 47 Part 15, section 15.207

3.1 Test location

Description	Manufacturer	Inventory No.
Shielded chamber	Siemens - Matsushita	E00107

3.2 Test instruments

	Description	Manufacturer	Inventory No.
☐	ESCS 30	Rohde & Schwarz	E00003
☐	ESCI	Rohde & Schwarz	E00001
☐	ESH3 Z2	Rohde & Schwarz	E00028
☐	ESH 2-Z5	Rohde & Schwarz	E00004
☐	ESH 2-Z5	Rohde & Schwarz	E00005

3.3 Limits

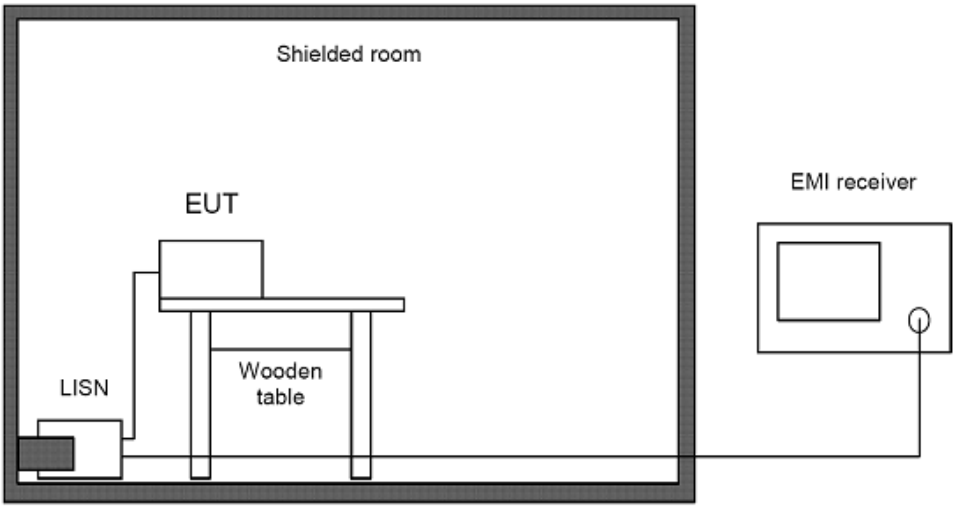
Frequency [MHz]	Quasi-peak [dBµV]	Avarage [dBµV]
0.15 – 0.5	66 - 56	56 – 46
0.5 – 5.0	56	46
5 – 30	60	50

3.4 Test procedure

1. The tests of conducted emission were carried out in a shielded room using a line impedance stabilization network (LISN) 50 µH/50 Ohms and an EMI test receiver.
2. The EMI test receiver was connected to the LISN and set to a measurement bandwidth of 9 kHz in the frequency range form 0.15 MHz to 30 MHz.
3. The EUT was placed on a wooden table and connected to the LISN.
4. To accelerate the measurement the detector of the EMI test receiver was set to peak and the whole frequency range form 0.15 MHz to 30 MHz were scanned.
5. After that all peaks values with fewer margins than 10 dB to quasi-peak limit or exceeding the limit were marked and re-measured with quasi-peak detector.
6. If after that all values are under the average limit no addition measurement is necessary. In case there are still values between quasi-peak and average limit than these values were re-measured again with an average detector.
7. These measurements were done on all current carrying conductors.

According to ANSI C63.4, section 13.1.3.1 testing of intentional radiators with detachable antennas shall be done with a dummy load otherwise the tests should be done with connected antenna and if adjustable fully extended.

3.5 Test setup

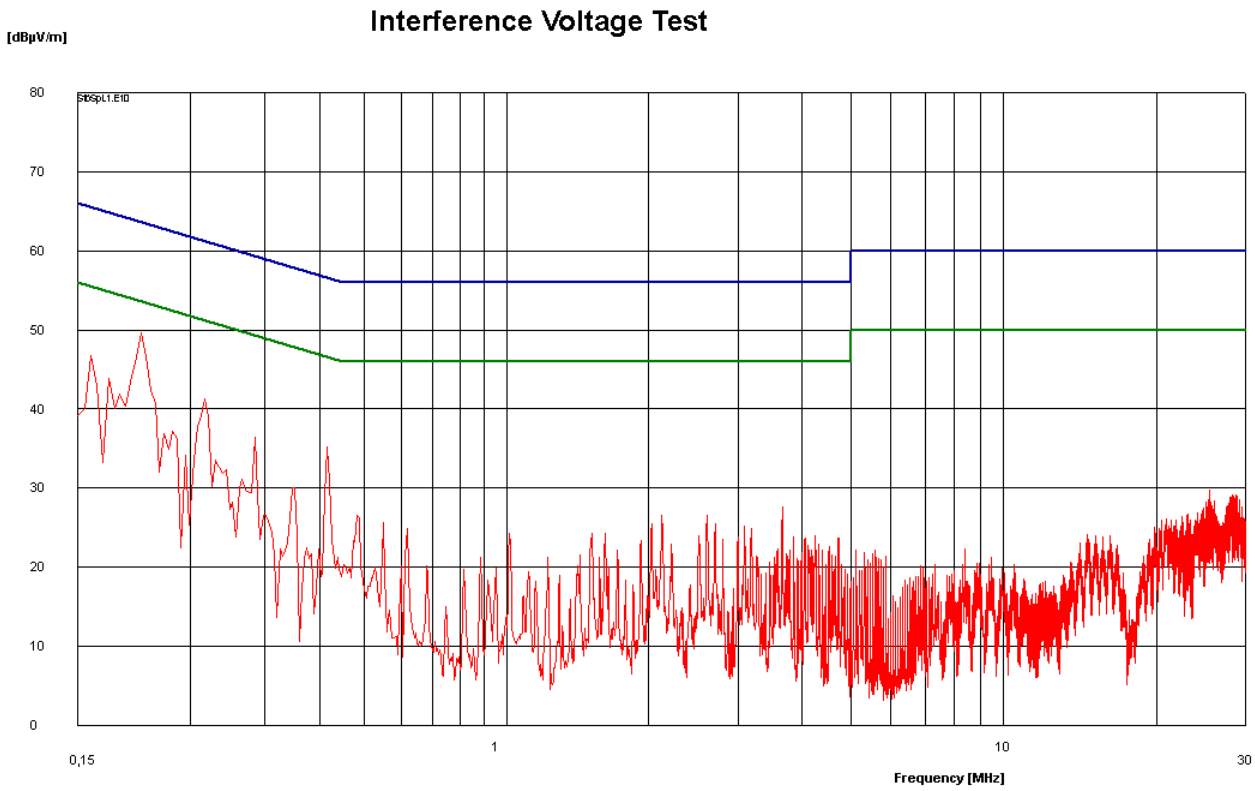


Picture 1: Outline of conducted emission test setup

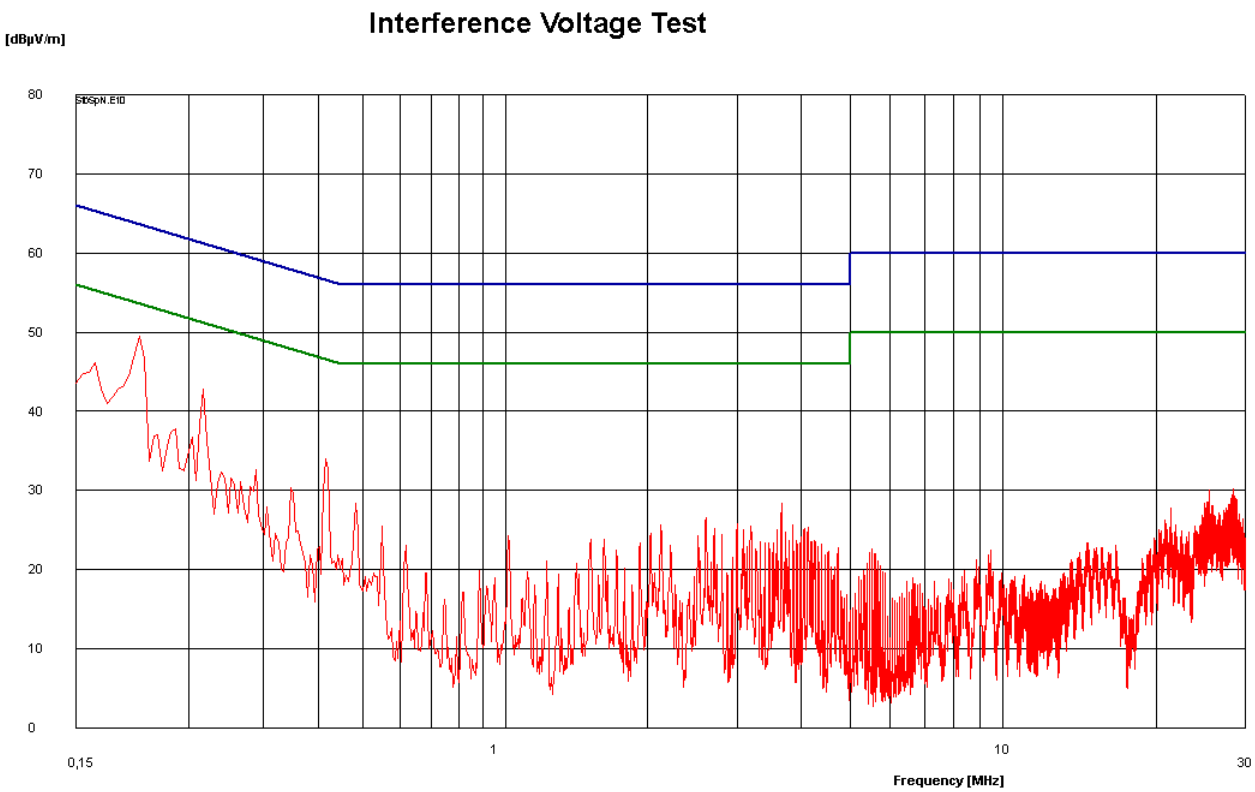
Comments: The EUT needs to be charged via USB. This is the only possibility to get it connected to mains. So this setting was used for this test.

3.6 Test results

Temperature:	21°C	Humidity:	41%
Tested by:	M. Müller	Test date:	2014-09-22



Picture 2: Conducted emission on mains, phase (120V 60Hz)



Picture 3: Conducted emission on mains, neutral (120V 60Hz)

4 Carrier Frequency Separation

according to CFR 47 Part 15, section 15.247(a), and Public Notice DA 00-705

4.1 Test location

☑ Conducted measurement
☐ Scan with peak detector in 3 m CDC
☐ CISPR measurement with quasi peak detector on 10m open area test site.
☐ Measurement with peak detector on 3m open area test site

Description	Manufacturer	Inventory No.
CDC	Albatross Projects	E00026
Open area test site	EMV **TESTHAUS** GmbH	E00354

4.2 Test instruments

	Description	Manufacturer	Inventory No.
☐	ESCS 30 (FF)	Rohde & Schwarz	E00003
☑	ESU 26	Rohde & Schwarz	W00002
☐	ESCI (CDC)	Rohde & Schwarz	E00001
☐	HFH2-Z2	Rohde & Schwarz	E00060
☐	VULB 9163 (FF)	Schwarzbeck	E00013
☐	VULB 9160 (CDC)	Schwarzbeck	E00011

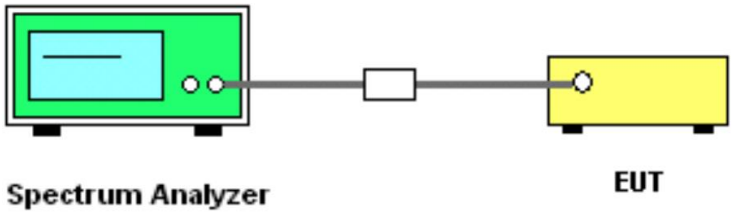
4.3 Limits

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

4.4 Test procedure

1. The EUT was connected to the spectrum analyzer
2. The EUT has its hopping function enabled
3. The unit was operated in continuous transmit mode with modulation.
4. After the trace has stabilized the peak of the adjacent channels was recorded using the delta Marker function.

4.5 Test setup



Picture 4: Test setup for carrier frequency separation measurement

4.6 Test Deviation

There is no deviation with the original standard.

4.7 EUT operation during test

The EUT was programmed to be in continuously transmitting mode with enabled hopping function.

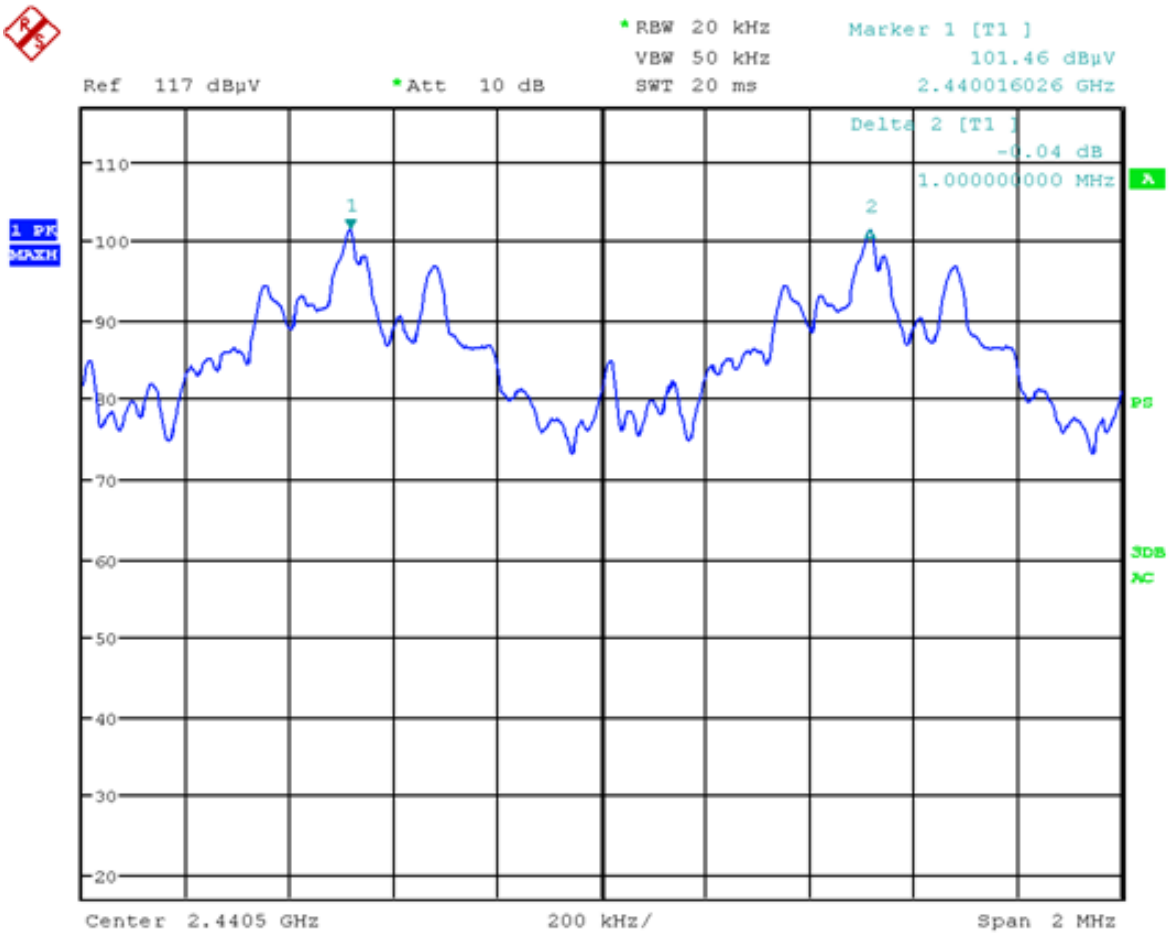
4.8 Test results

Temperature:	23°C	Humidity:	41%
Tested by:	M. Müller	Test date:	2014-09-15

Test Result		
Carrier Frequency Separation (MHz)	**Minimum Separation (MHz)**	**Result**
1.000	0.692	PASS

with

Maximum 20-dB-bandwidth: 1.0385 MHz (>> 25 kHz), see clause 7.8 on page 27
Maximum output power: -4.26 dBm (0.37 mW < 125 mW), see clause 9.8 on page 36
Minimum separation required: 2/3 * 20-dB-Bandwidth = 0.692 MHz



Picture 5: Carrier Frequency Separation

5 Number of Hopping Frequencies

according to CFR 47 Part 15, section 15.247(a), and Public Notice DA 00-705

5.1 Test location

☑ Conducted measurement
☐ Scan with peak detector in 3 m CDC
☐ CISPR measurement with quasi peak detector on 10m open area test site.
☐ Measurement with peak detector on 3m open area test site

Description	Manufacturer	Inventory No.
CDC	Albatross Projects	E00026
Open area test site	EMV **TESTHAUS** GmbH	E00354

5.2 Test instruments

	Description	Manufacturer	Inventory No.
☐	ESCS 30 (FF)	Rohde & Schwarz	E00003
☑	ESU 26	Rohde & Schwarz	W00002
☐	ESCI (CDC)	Rohde & Schwarz	E00001
☐	HFH2-Z2	Rohde & Schwarz	E00060
☐	VULB 9163 (FF)	Schwarzbeck	E00013
☐	VULB 9160 (CDC)	Schwarzbeck	E00011

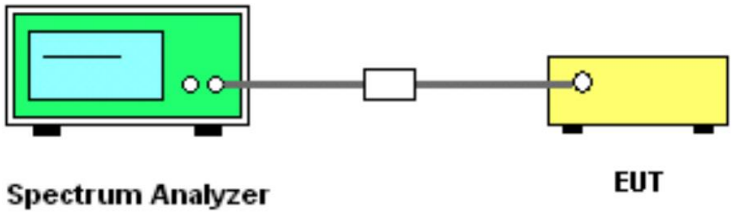
5.3 Limits

Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

5.4 Test procedure

1. The EUT was connected to the spectrum analyzer
2. The EUT has its hopping function enabled
3. The unit was operated in continuous transmit mode with modulation.
4. After the trace has stabilized count the peaks.
5. To get a higher resolution the frequency range was split in two parts.

5.5 Test setup



Picture 6: Test setup for number of hopping channels measurement

5.6 Test Deviation

There is no deviation with the original standard.

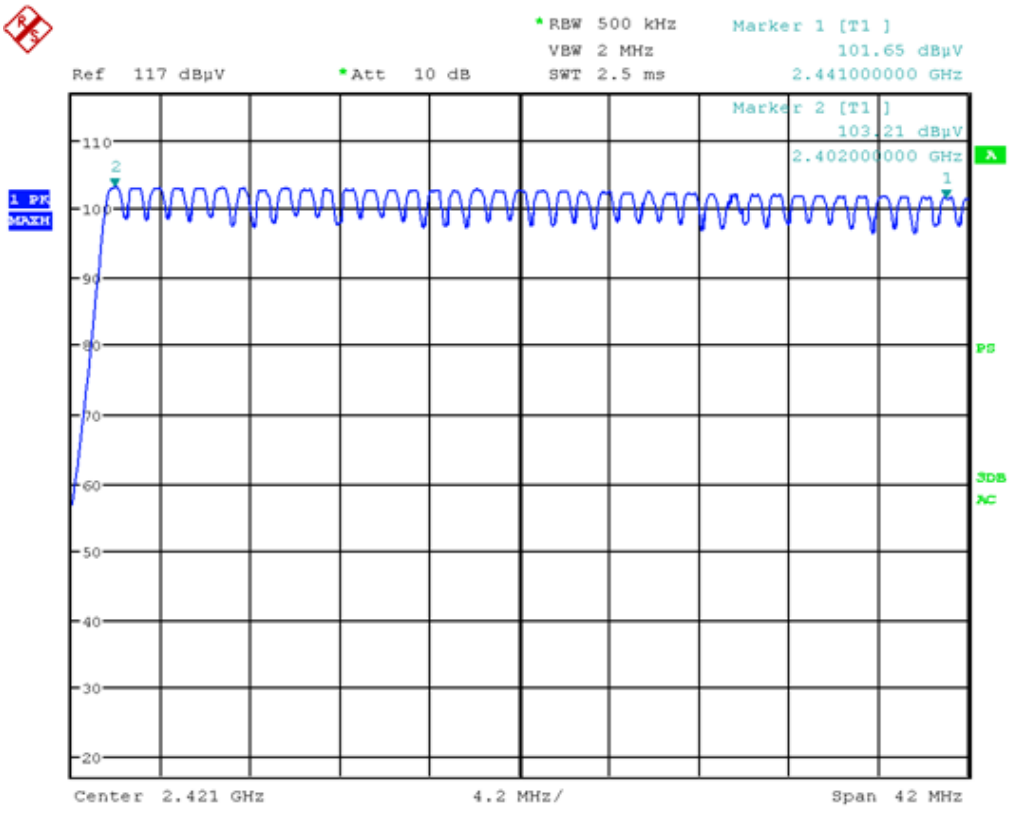
5.7 EUT operation during test

The EUT was programmed to be in continuously transmitting mode with enabled hopping function.

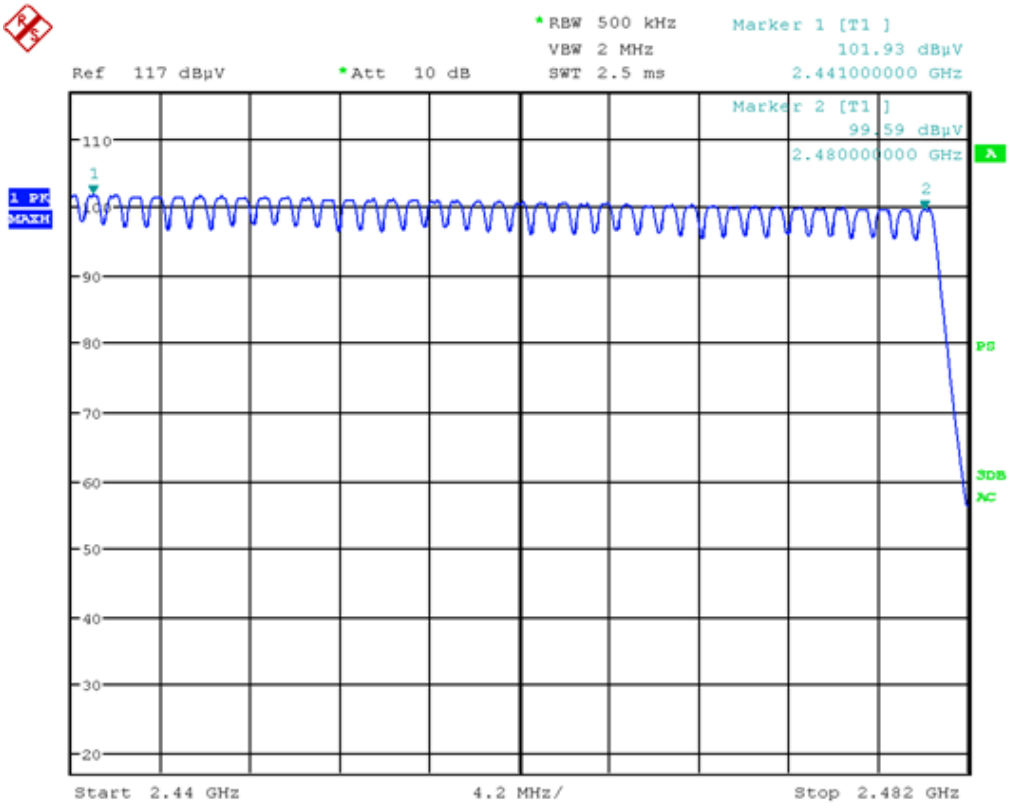
5.8 Test results

Temperature:	23°C	Humidity:	41%
Tested by:	M. Müller	Test date:	2014-09-15

Test Result	
Number of Hopping Channels	**79**



Picture 7: Number of hopping frequencies - lower half



Picture 8: Number of hopping frequencies - upper half

6 Time of Occupancy (Dwell time)

according to CFR 47 Part 15, section 15.247(a), and Public Notice DA 00-705

6.1 Test location

☑ Conducted measurement
☐ Scan with peak detector in 3 m CDC
☐ CISPR measurement with quasi peak detector on 10m open area test site.
☐ Measurement with peak detector on 3m open area test site

Description	Manufacturer	Inventory No.
CDC	Albatross Projects	E00026
Open area test site	EMV **TESTHAUS** GmbH	E00354

6.2 Test instruments

	Description	Manufacturer	Inventory No.
☐	ESCS 30 (FF)	Rohde & Schwarz	E00003
☑	ESU 26	Rohde & Schwarz	W00002
☐	ESCI (CDC)	Rohde & Schwarz	E00001
☐	HFH2-Z2	Rohde & Schwarz	E00060
☐	VULB 9163 (FF)	Schwarzbeck	E00013
☐	VULB 9160 (CDC)	Schwarzbeck	E00011

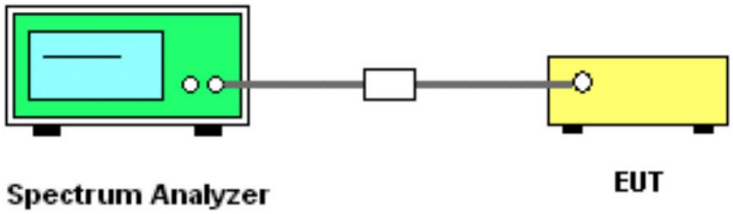
6.3 Limits

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

6.4 Test procedure

1. The EUT was connected to the spectrum analyzer
2. The EUT has its hopping function enabled
3. The unit was operated in continuous transmit mode with modulation.

6.5 Test setup



Picture 9: Test setup for time of occupancy measurement

6.6 Test Deviation

There is no deviation with the original standard.

6.7 EUT operation during test

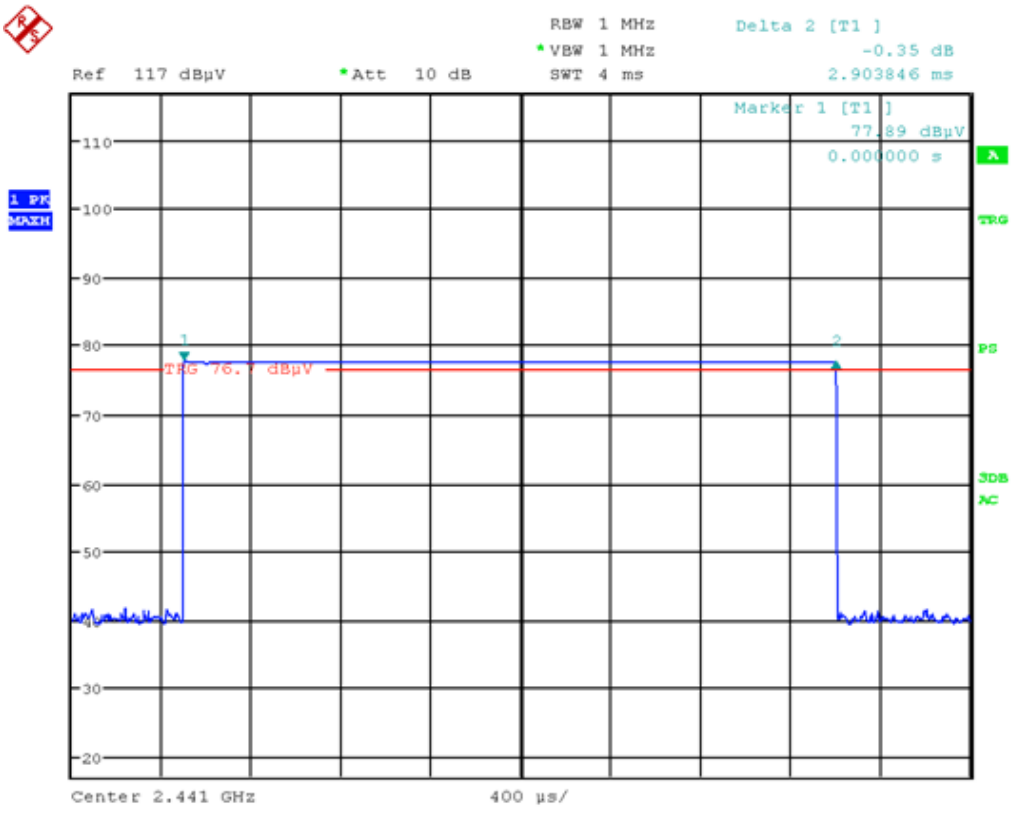
The EUT was programmed to be in continuously transmitting mode with enabled hopping function.

6.8 Test results

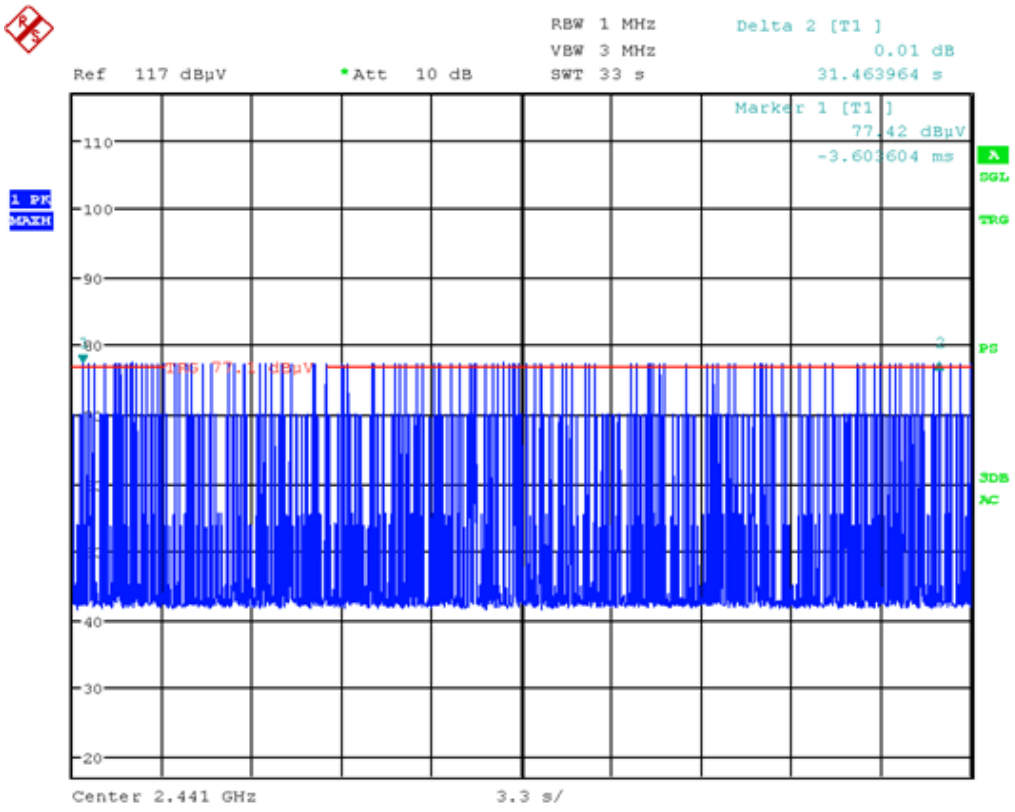
Temperature:	23°C	Humidity:	41%
Tested by:	M. Müller	Test date:	2014-09-15

Time of Transmission (79ch * 0.4s)	Number of hops within time of transmission	Signal On time (msec)	Result (Dwell Time) (msec)	Limit (msec)	Result
31.6s	**110**	**2.903846**	**319.42306**	**400**	**PASS**

Dwell Time = Number of hops within Time of Transmission*Signal On Time

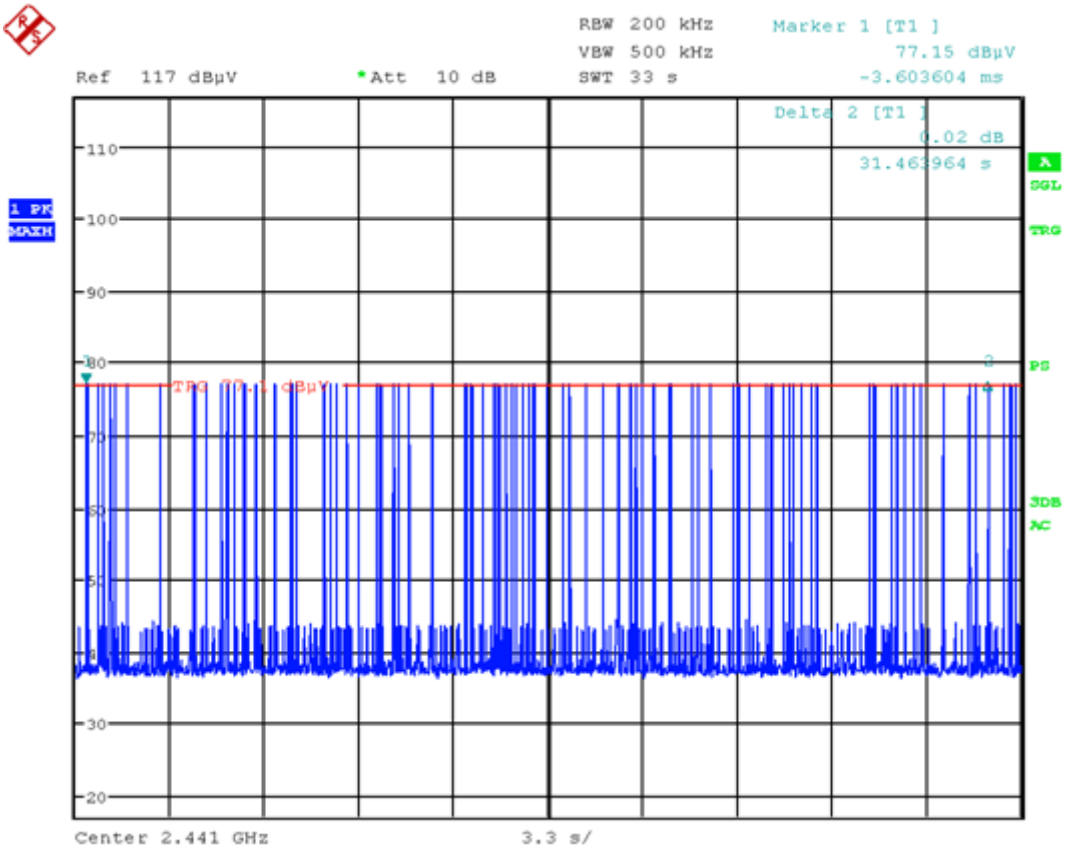


Picture 10: Signal-on-Time



Picture 11: Number of hops within Time of Transmission (RBW = 1MHz)

To prove that the bursts at 70 dBµV are sidebands from allocated channels the Time of Transmission was also measured with RBW = 200kHz.



Picture 12: Number of hops within Time of Transmission (RBW = 200kHz)

7 20 dB bandwidth

according to CFR 47 Part 15, section 15.247(a), and Public Notice DA 00-705

7.1 Test location

☑ Conducted measurement
☐ Scan with peak detector in 3 m CDC
☐ CISPR measurement with quasi peak detector on 10m open area test site.
☐ Measurement with peak detector on 3m open area test site

Description	Manufacturer	Inventory No.
CDC	Albatross Projects	E00026
Open area test site	EMV **TESTHAUS** GmbH	E00354

7.2 Test Instruments

	Description	Manufacturer	Inventory No.
☐	ESCS 30 (FF)	Rohde & Schwarz	E00003
☑	ESU 26	Rohde & Schwarz	W00002
☐	ESCI (CDC)	Rohde & Schwarz	E00001
☐	HFH2-Z2	Rohde & Schwarz	E00060
☐	VULB 9163 (FF)	Schwarzbeck	E00013
☐	VULB 9160 (CDC)	Schwarzbeck	E00011

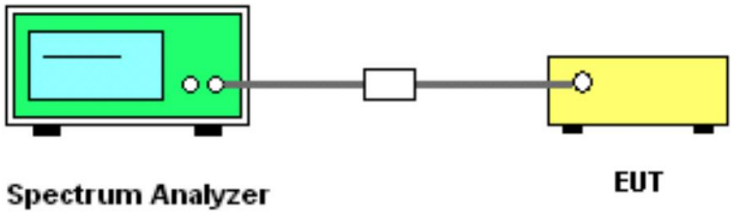
7.3 Limits

N/A

7.4 Test procedure

1. The test is performed in accordance with FCC Public Notice DA00-705
2. The transmitter output (antenna port) was connected to the spectrum analyzer in peak hold mode.
3. The unit was operated in continuous transmit mode with modulation.
4. The resolution bandwidth of 30 kHz and the video bandwidth of 30 kHz were used.
5. Measure the spectrum width with power higher than 20dB below carrier. The transmitter output (antenna port) was connected to the spectrum analyzer.

7.5 Test setup



Picture 13: Test setup for 20dB bandwidth measurement

7.6 Test deviation

There is no deviation with the original standard.

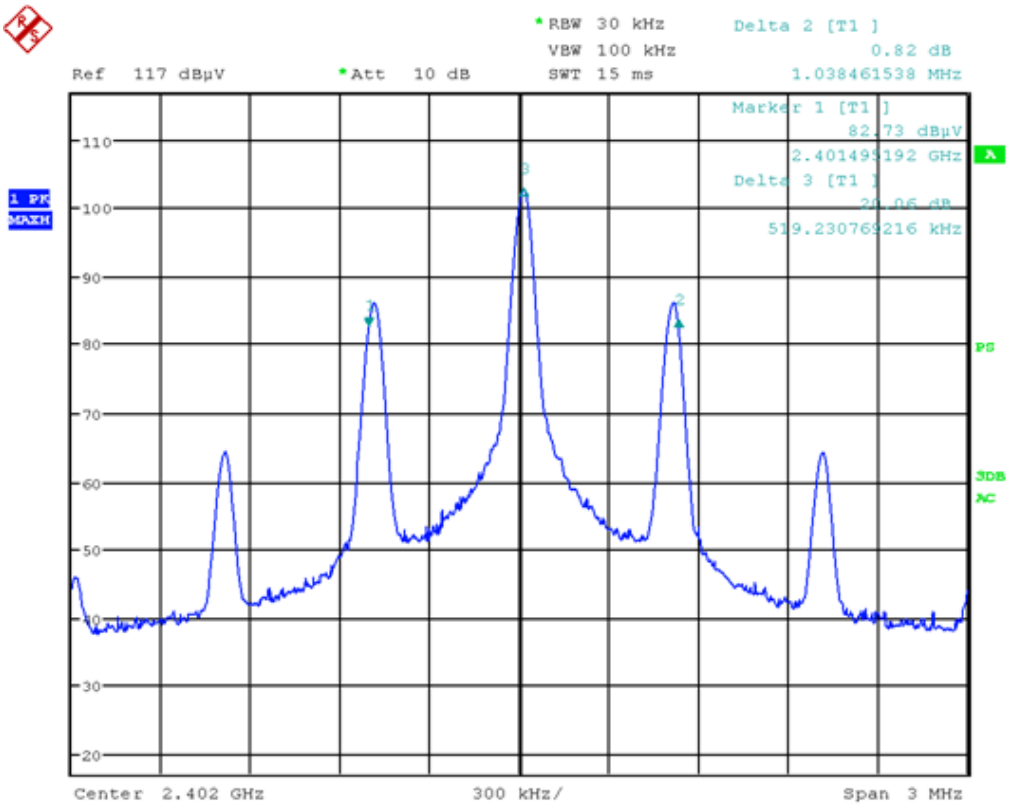
7.7 EUT operation during test

The EUT was programmed to be in continuously transmitting mode.

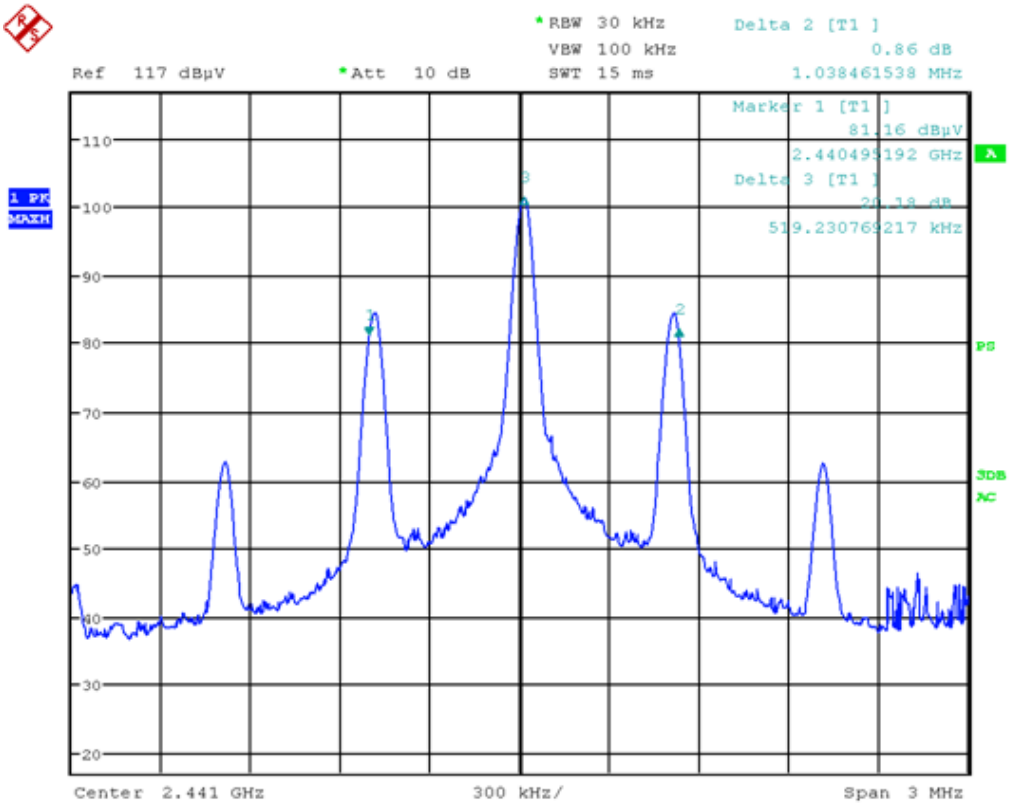
7.8 Test results

Temperature:	22°C	Humidity:	44%
Tested by:	M. Müller	Test date:	2014-09-15

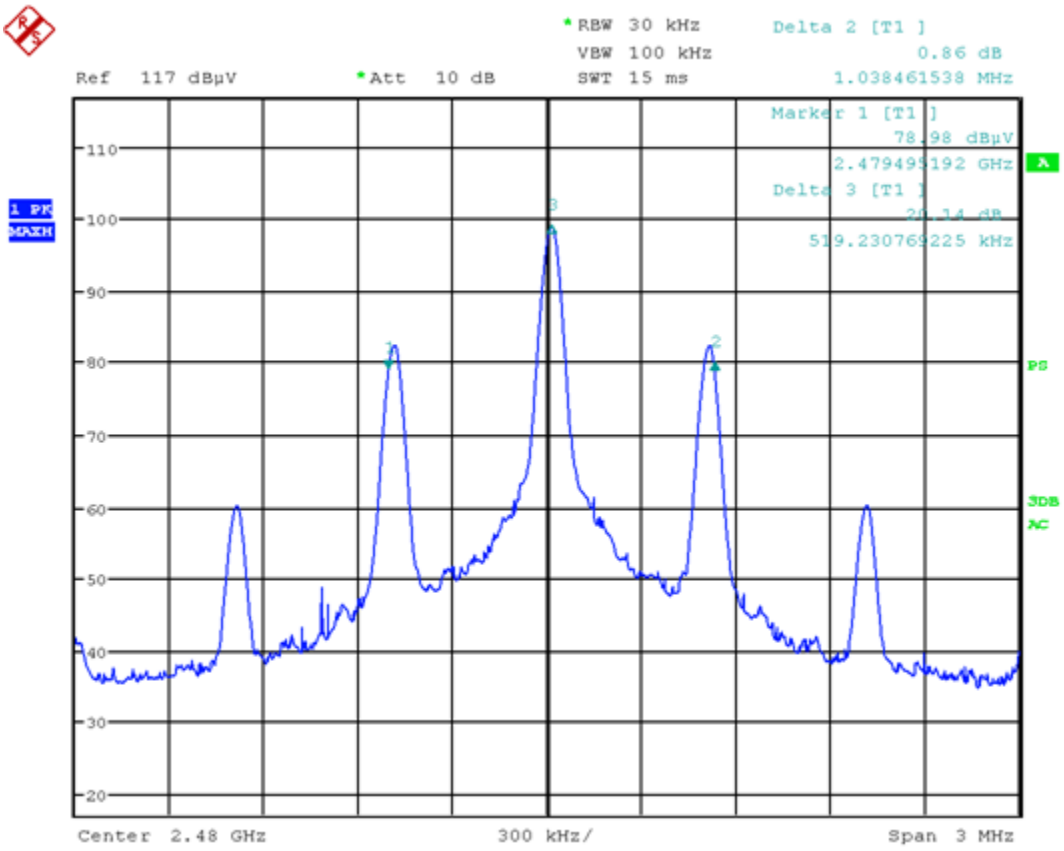
Channel	Frequency (GHz)	20 dB bandwidth (MHz)
0	2.402	1.0385
39	2.441	1.0385
78	2.480	1.0385



Picture 14: 20dB bandwidth channel 0



Picture 15: 20dB bandwidth channel 39



Picture 16: 20dB bandwidth channel 78

8 Occupied bandwidth

according to CFR 47 Part 2, section 2.202(a)

8.1 Test location

☑ Conducted measurement
☐ Scan with peak detector in 3 m CDC
☐ CISPR measurement with quasi peak detector on 10m open area test site.
☐ Measurement with peak detector on 3m open area test site

Description	Manufacturer	Inventory No.
CDC	Albatross Projects	E00026
Open area test site	EMV **TESTHAUS** GmbH	E00354

8.2 Test Instruments

	Description	Manufacturer	Inventory No.
☐	ESCS 30 (FF)	Rohde & Schwarz	E00003
☑	ESU 26	Rohde & Schwarz	W00002
☐	ESCI (CDC)	Rohde & Schwarz	E00001
☐	HFH2-Z2	Rohde & Schwarz	E00060
☐	VULB 9163 (FF)	Schwarzbeck	E00013
☐	VULB 9160 (CDC)	Schwarzbeck	E00011

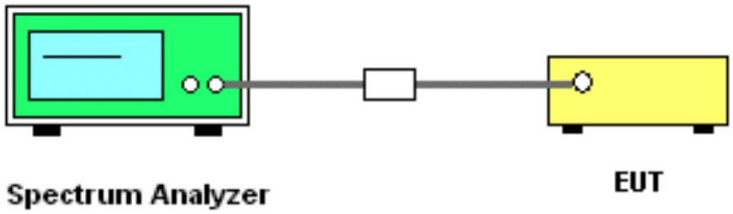
8.3 Limits

N/A

8.4 Test procedure

1. The test is performed in accordance with CFR 47 Part 2, section 2.202(a)
2. The transmitter output (antenna port) was connected to the spectrum analyzer in peak hold mode.
3. The unit was operated in continuous transmit mode with modulation.
4. The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be approximately three times the RBW.
6. The 99 % frequency bandwidth was measured so that, below its lower and above its upper frequency limits, the mean powers radiated were each equal to 0.5 percent of the total mean power radiated by a given emission.

8.5 Test setup



Picture 17: Test setup for occupied bandwidth measurement

8.6 Test deviation

There is no deviation with the original standard.

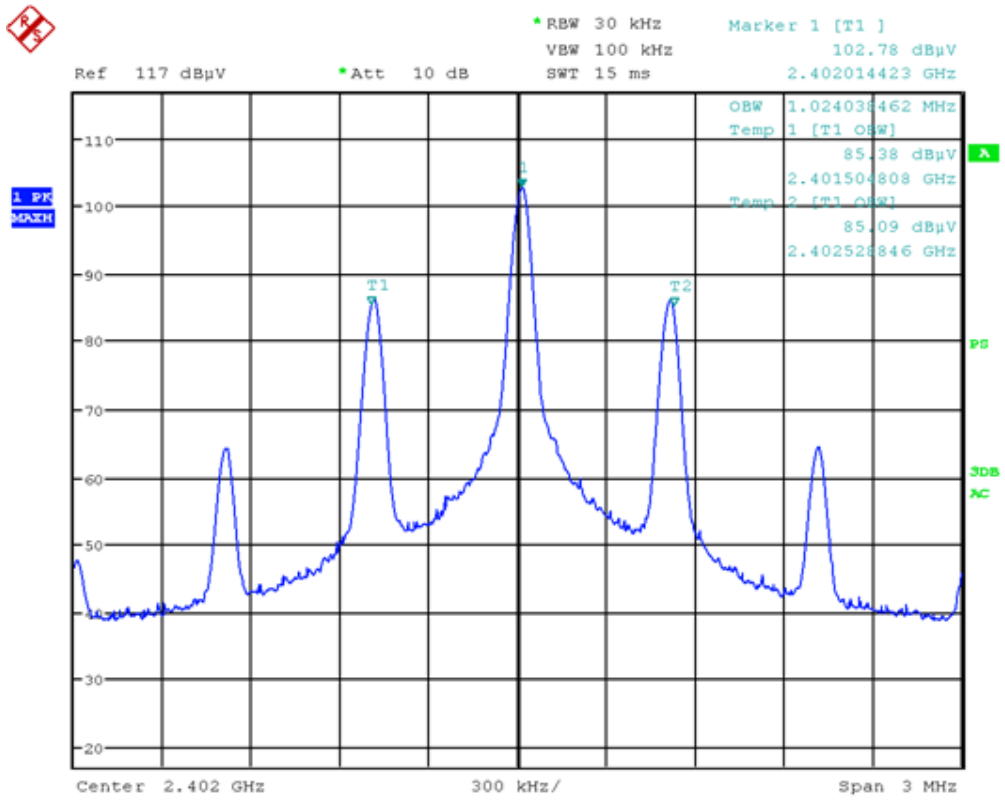
8.7 EUT operation during test

The EUT was programmed to be in continuously transmitting mode.

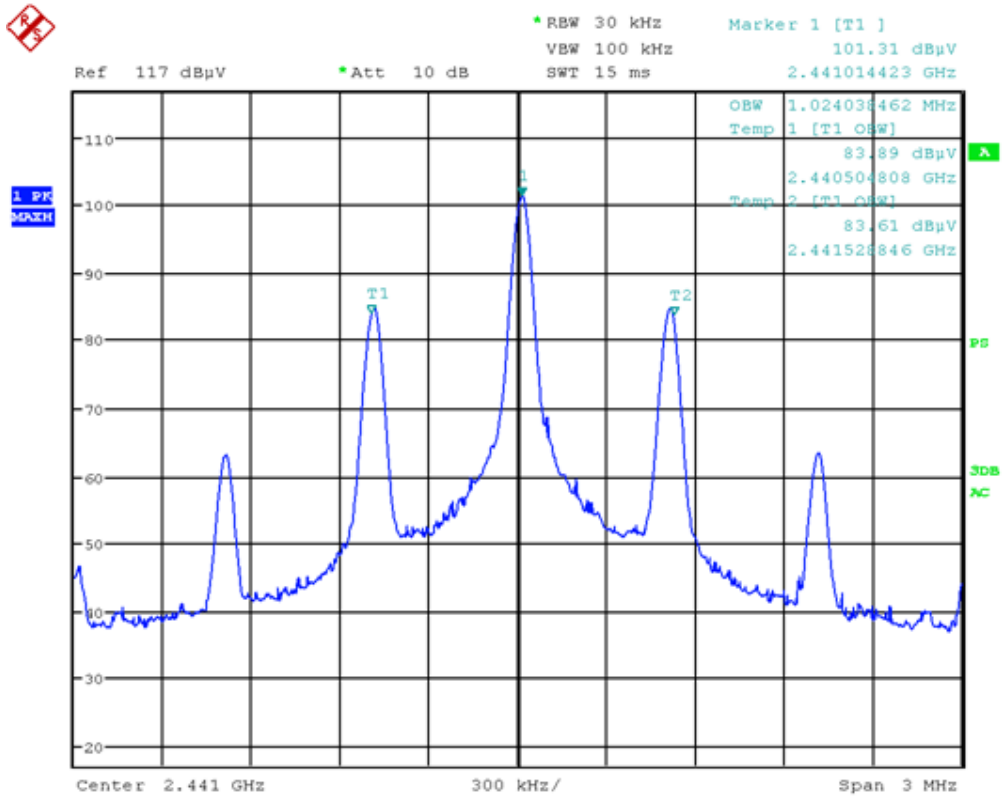
8.8 Test results

Temperature:	22°C	Humidity:	44%
Tested by:	M. Müller	Test date:	2014-09-15

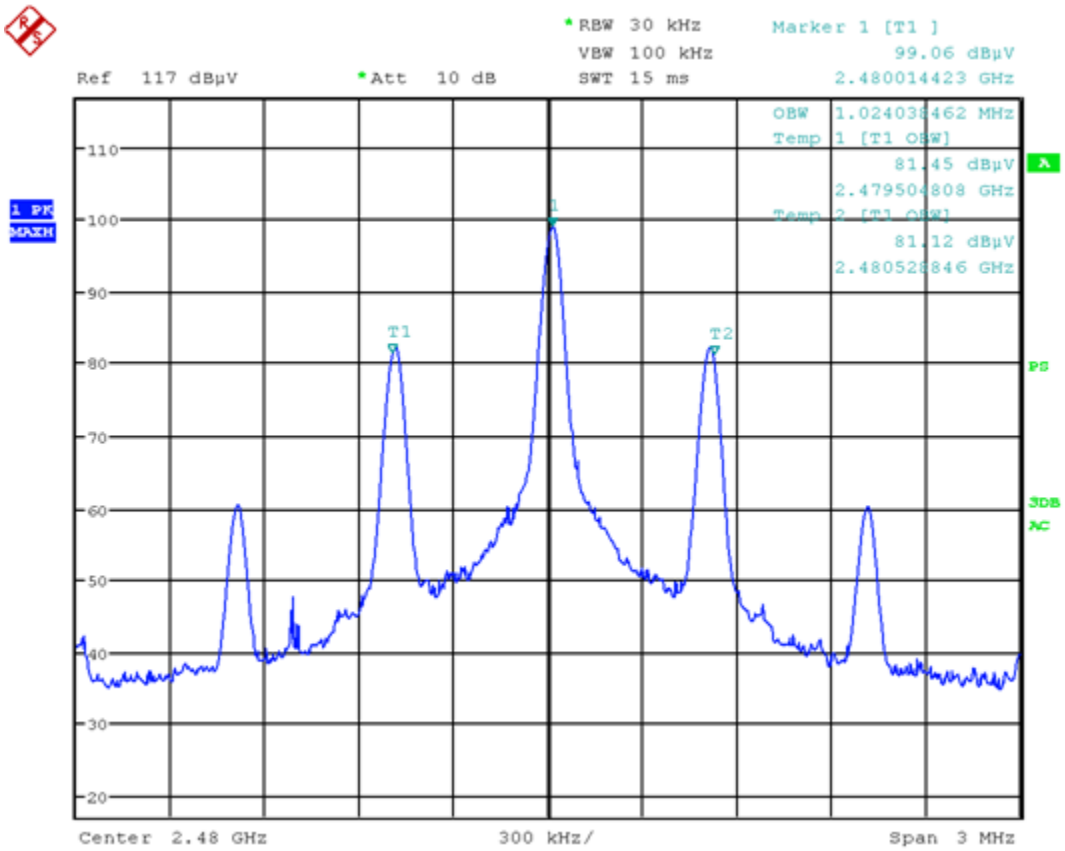
Channel	Frequency (GHz)	Occupied bandwidth (MHz)
0	2.402	1.0240
39	2.441	1.0240
78	2.480	1.0240



Picture 18: Occupied bandwidth channel 0



Picture 19: Occupied bandwidth channel 39



Picture 20: Occupied bandwidth channel 78

9 Maximum conducted output power

according to CFR 47 Part 15, section 15.247(b), and Public Notice DA 00-705

9.1 Test location

☑ Conducted measurement
☐ Scan with peak detector in 3 m CDC
☐ CISPR measurement with quasi peak detector on 10m open area test site.
☐ Measurement with peak detector on 3m open area test site

Description	Manufacturer	Inventory No.
CDC	Albatross Projects	E00026
Open area test site	EMV **TESTHAUS** GmbH	E00354

9.2 Test instruments

	Description	Manufacturer	Inventory No.
☐	ESCS 30 (FF)	Rohde & Schwarz	E00003
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☐	ESCI (CDC)	Rohde & Schwarz	E00001
☐	HFH2-Z2	Rohde & Schwarz	E00060
☐	VULB 9163 (FF)	Schwarzbeck	E00013
☐	VULB 9160 (CDC)	Schwarzbeck	E00011

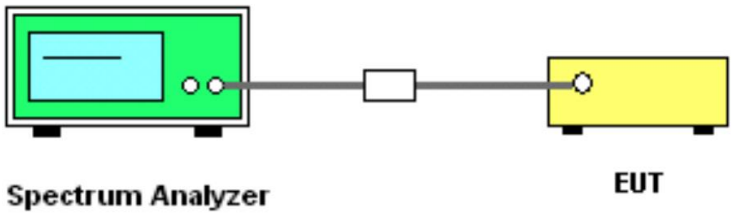
9.3 Limits

For frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725–5850 MHz band: 1 watt (30 dBm). For all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts (21 dBm).
Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level.
The conducted output power limit is based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

9.4 Test procedure

1. The transmitter output (antenna port) was connected to the spectrum analyzer.
2. Test was performed in accordance with Measurement of Digital Transmission Systems Operating under Section 15.247.

9.5 Test setup



Picture 21: Test setup for conducted output power measurement

9.6 Test deviation

There is no deviation with the original standard.

9.7 EUT operation during Test

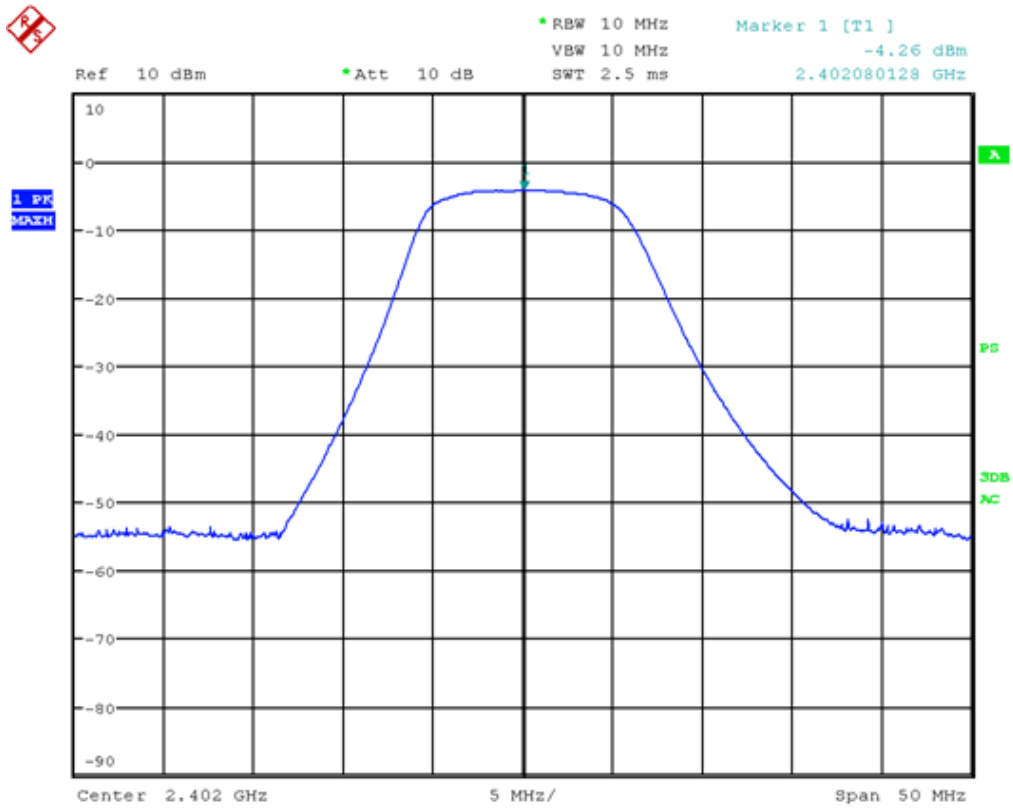
The EUT was programmed to be in continuously transmitting mode.

9.8 Test results

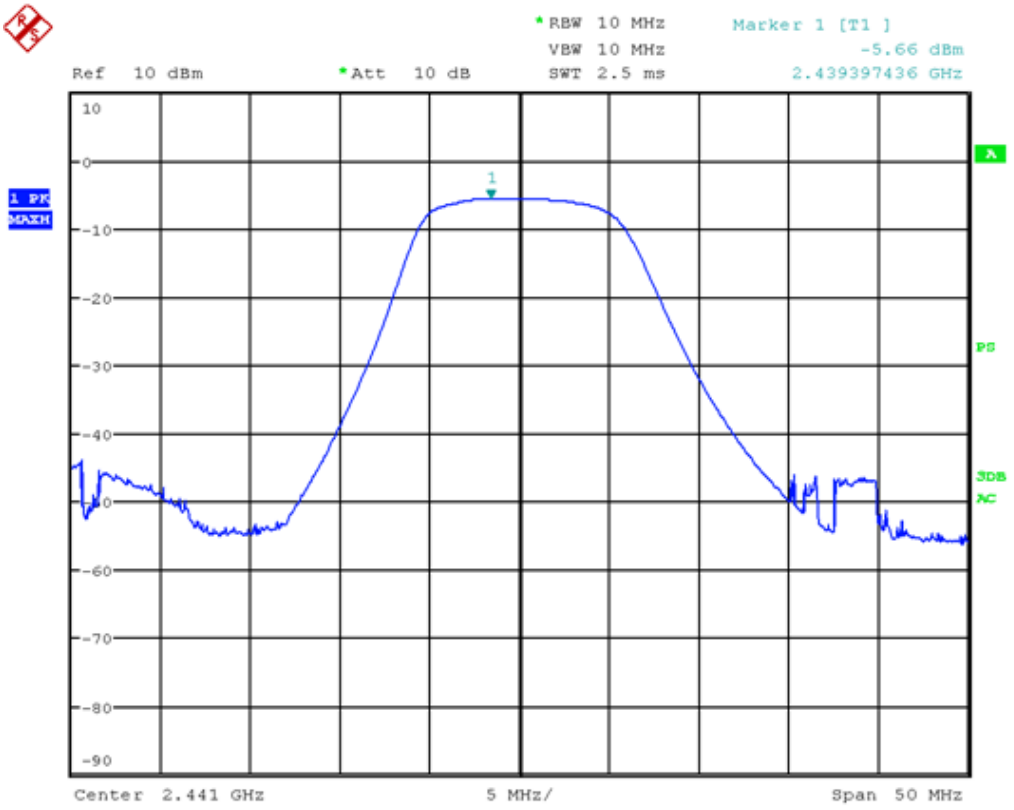
Temperature:	22°C	Humidity:	44%
Tested by:	M. Müller	Test date:	2014-09-15

Channel	Frequency (GHz)	Detector	Conducted power (dBm)	Limit (dBm)	Result
0	2.402	PK	-4.26	21	PASS
39	2.441	PK	-5.66	21	PASS
78	2.480	PK	-7.77	21	PASS

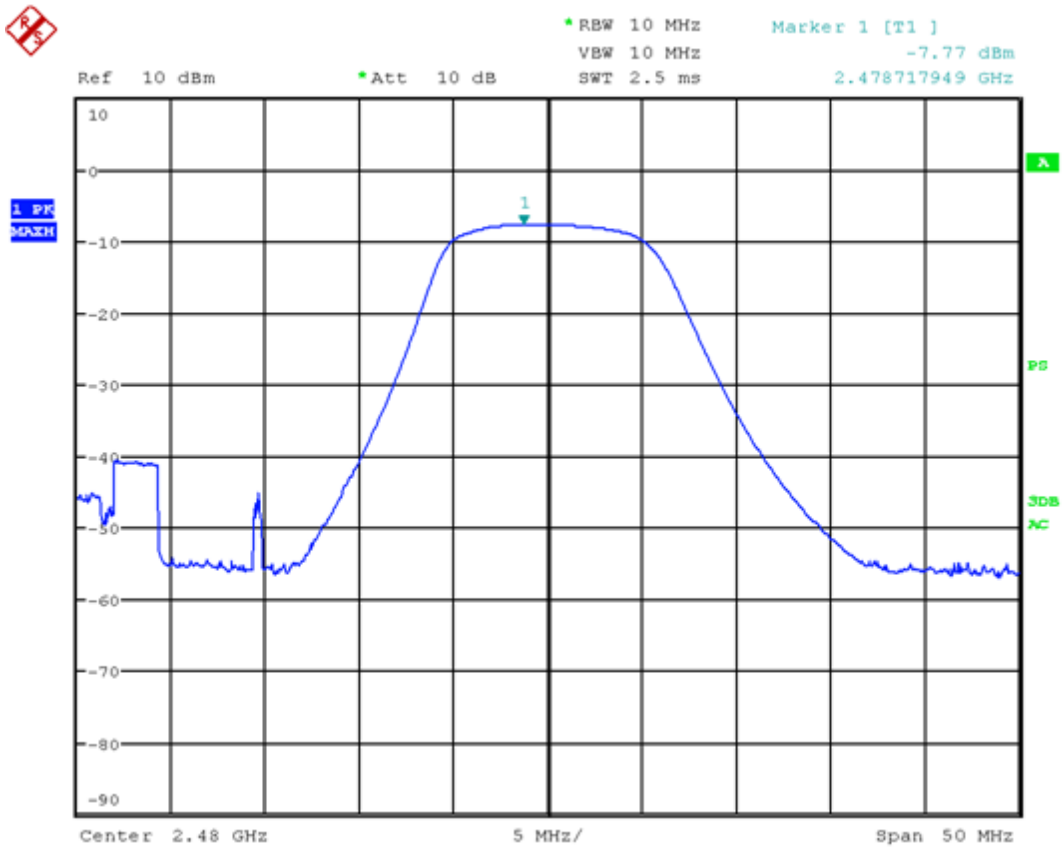
Comments: - none -



Picture 22: Conducted output power channel 0



Picture 23: Conducted output power channel 39



Picture 24: Conducted output power channel 78

10 Band-edge Compliance

according to CFR 47 Part 15, section 15.247(d), and Public Notice DA 00-705

10.1 Test location

☑ conducted measurement

10.2 Test Instruments

	Description	Manufacturer	Inventory No.
☑	ESU26	Rohde & Schwarz	W00002
☑	AMF-5D-00501800-28-13P	Miteq	W00089
☐	AMF-6F-16002650-25-10P	Miteq	W00090
☑	BBHA 9170	Schwarzbeck	W00054
☐	BBHA 9170	Schwarzbeck	W00055
☑	COSB 4-1-26	Conformitas	W00091

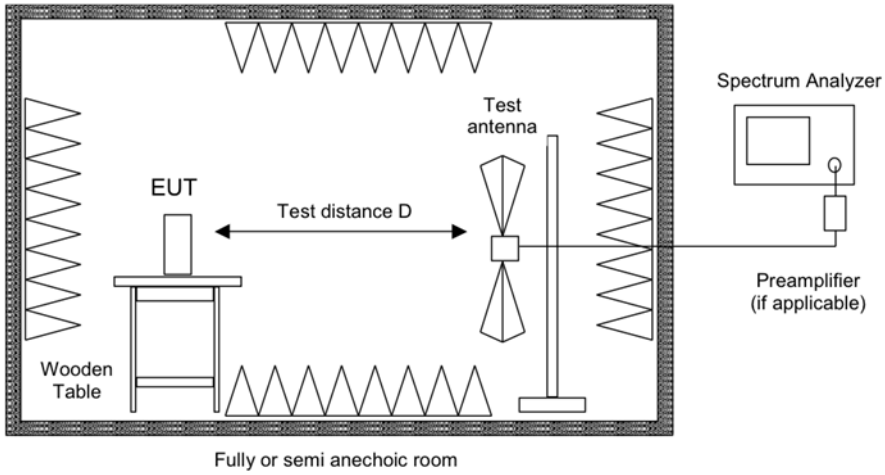
10.3 Limits

< -20dBc outside restricted bands
< 54dBµV (video average) inside restricted bands
< 74dBµV (peak detector) inside restricted bands

10.4 Test procedure

1. Configure the EUT according to ANSI C63.4. The EUT was placed on the top of the turntable 0.8 meter above ground. The receiving antenna was placed 3 meters from the turntable. The test setup was placed inside a fully anechoic chamber.
2. Power on the EUT and all peripherals.
3. Set frequency to lowest channel
4. Set marker 20dB below the peak both sides of the intentional emission.
5. Record this trace
6. Set frequency to highest channel
7. Repeat step 4 and 5.

10.5 Test setup



Picture 25: Test setup for band-edge compliance measurement

10.6 Test deviation

There is no deviation with the original standard.

10.7 EUT operation during test

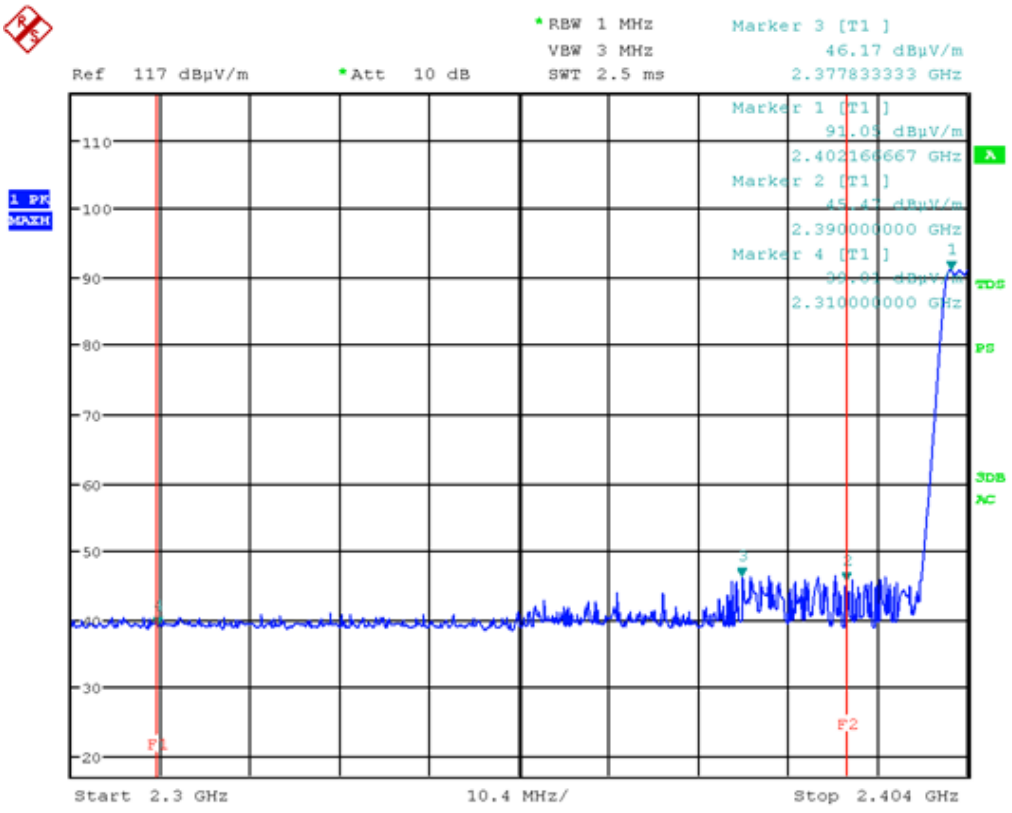
The EUT was programmed to be in continuously transmitting mode.

10.8 Test results

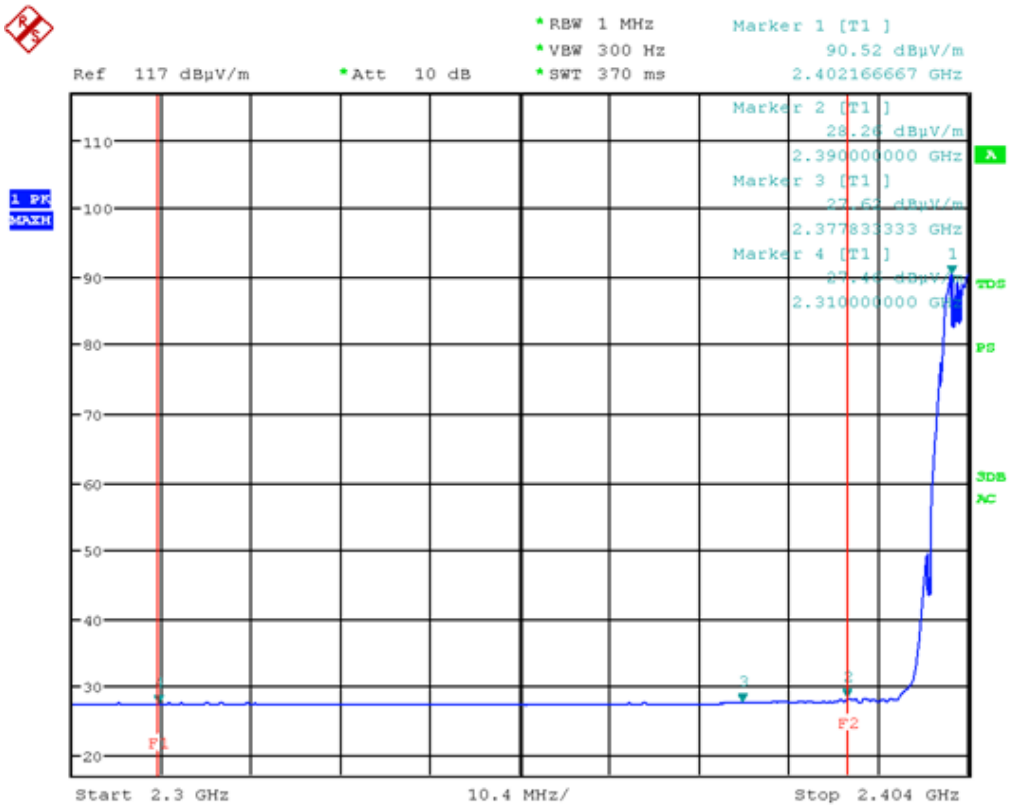
Temperature:	22°C	Humidity:	44%
Tested by:	M. Müller	Test date:	2014-09-15

Frequency (GHz)	Detector	Reading value (dBµV/m)	Restricted Band	Limit (dBµV/m)	Result
2.3100	PK	39.01	Yes	74	Pass
2.3100	AV	27.64	Yes	54	Pass
2.3778	PK	46.17	Yes	74	Pass
2.3778	AV	27.62	Yes	54	Pass
2.3900	PK	45.47	Yes	74	Pass
2.3900	AV	28.26	Yes	54	Pass
2.4020	PK	91.05	No	- - -	Carrier
2.4020	AV	90.52	No	- - -	Carrier

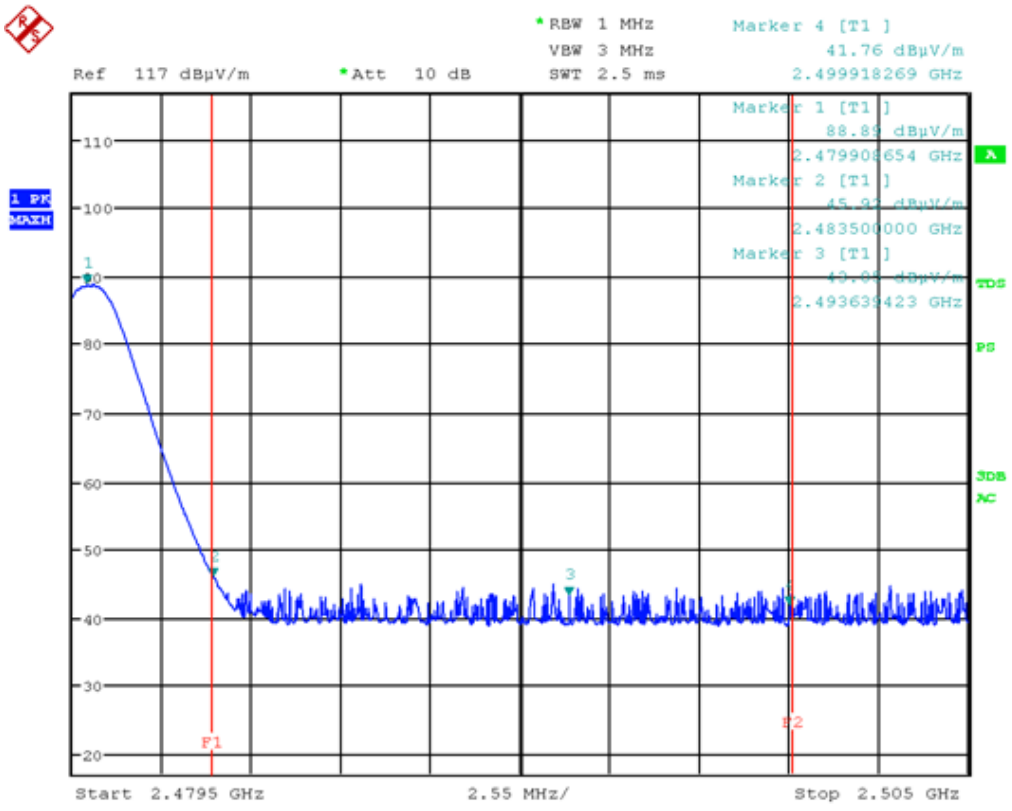
Frequency (GHz)	Detector	Reading value (dBµV/m)	Restricted Band	Limit (dBµV/m)	Result
2.4800	PK	88.89	No	- - -	Carrier
2.4800	AV	88.07	No	- - -	Carrier
2.4835	PK	45.92	Yes	74	Pass
2.4835	AV	42.15	Yes	54	Pass
2.4936	PK	43.05	Yes	74	Pass
2.4930	AV	28.59	Yes	54	Pass
2.4999	PK	41.76	Yes	74	Pass
2.5000	AV	27.69	Yes	54	Pass



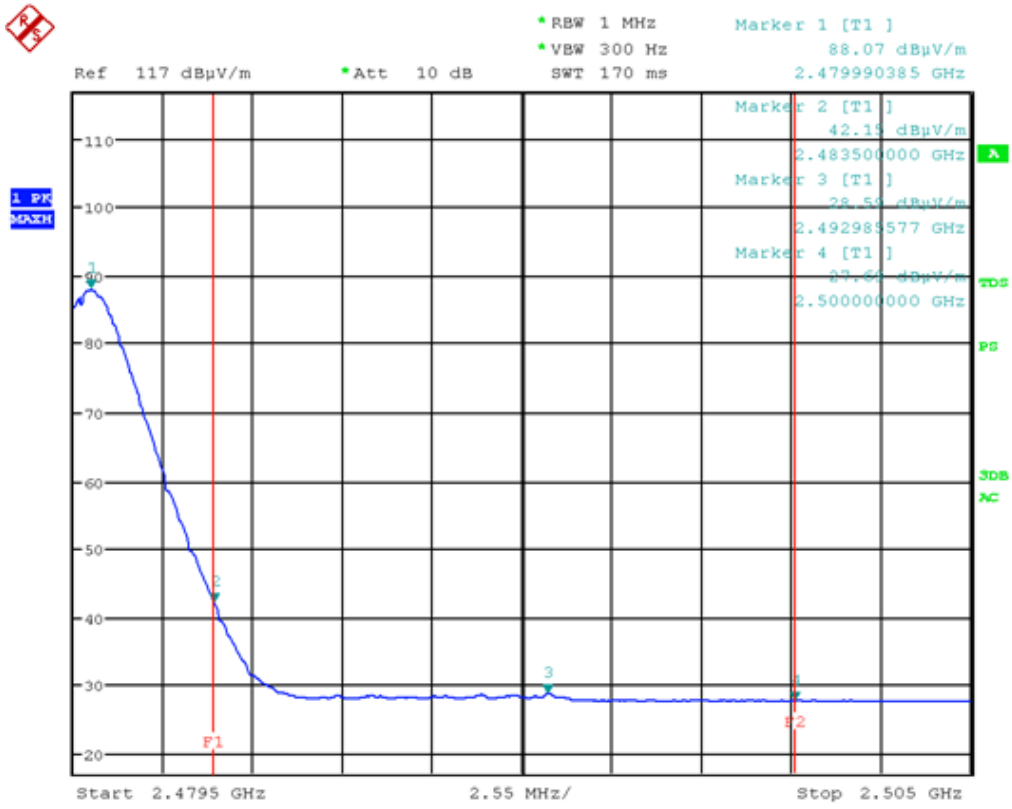
Picture 26: lower edge - PK



Picture 27: lower edge - AV



Picture 28: upper edge - PK



Picture 29: upper edge - AV

11 Spurious RF Conducted Emission

according to CFR 47 Part 15, section 15.247(d), and Public Notice DA 00-705

11.1 Test location

☑ Conducted measurement
☐ Scan with peak detector in 3 m CDC
☐ CISPR measurement with quasi peak detector on 10m open area test site.
☐ Measurement with peak detector on 3m open area test site

Description	Manufacturer	Inventory No.
CDC	Albatross Projects	E00026
Open area test site	EMV **TESTHAUS** GmbH	E00354

11.2 Test Instruments

	Description	Manufacturer	Inventory No.
☐	ESCS 30 (FF)	Rohde & Schwarz	E00003
☑	ESU 26	Rohde & Schwarz	W00002
☐	ESCI (CDC)	Rohde & Schwarz	E00001
☐	HFH2-Z2	Rohde & Schwarz	E00060
☐	VULB 9163 (FF)	Schwarzbeck	E00013
☐	VULB 9160 (CDC)	Schwarzbeck	E00011

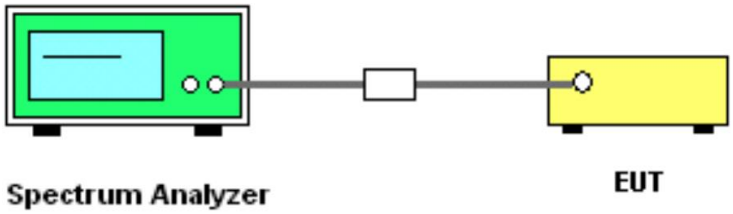
11.3 Limits

< - 20dBc outside restricted bands
< 54dBµV (video average) inside restricted bands
< 74dBµV (peak detector) inside restricted bands

11.4 Test procedure

1. The test is performed in accordance with FCC Public Notice KBD 558074
2. The transmitter output (antenna port) was connected to the spectrum analyzer in peak hold mode.
3. The unit was operated in continuous transmit mode with modulation.
4. The resolution bandwidth of 100 kHz and the video bandwidth of 100 kHz were used.
5. Measure the spectrum from the lowest frequency generated in the EUT up through the 10th harmonic.

11.5 Test setup



Picture 30: Test setup for conducted spurious emission measurement

11.6 Test deviation

There is no deviation with the original standard.

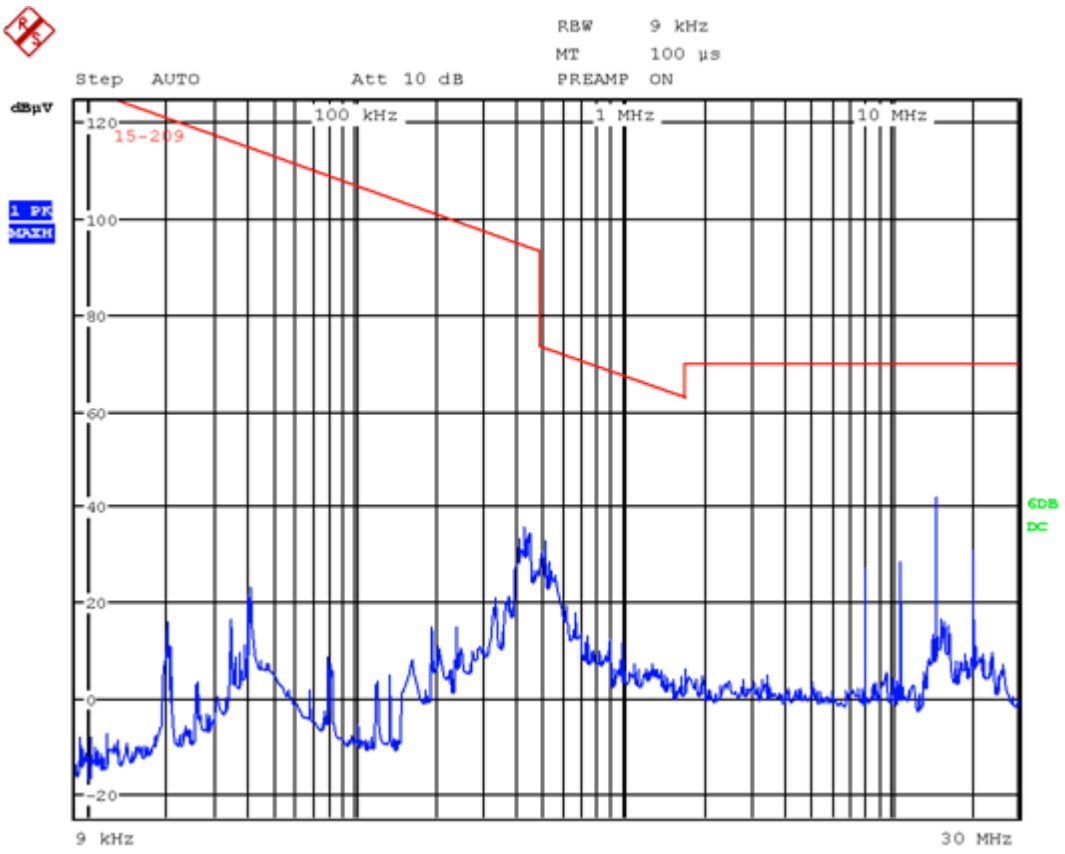
11.7 EUT operation during test

The EUT was programmed to be in continuously transmitting mode.

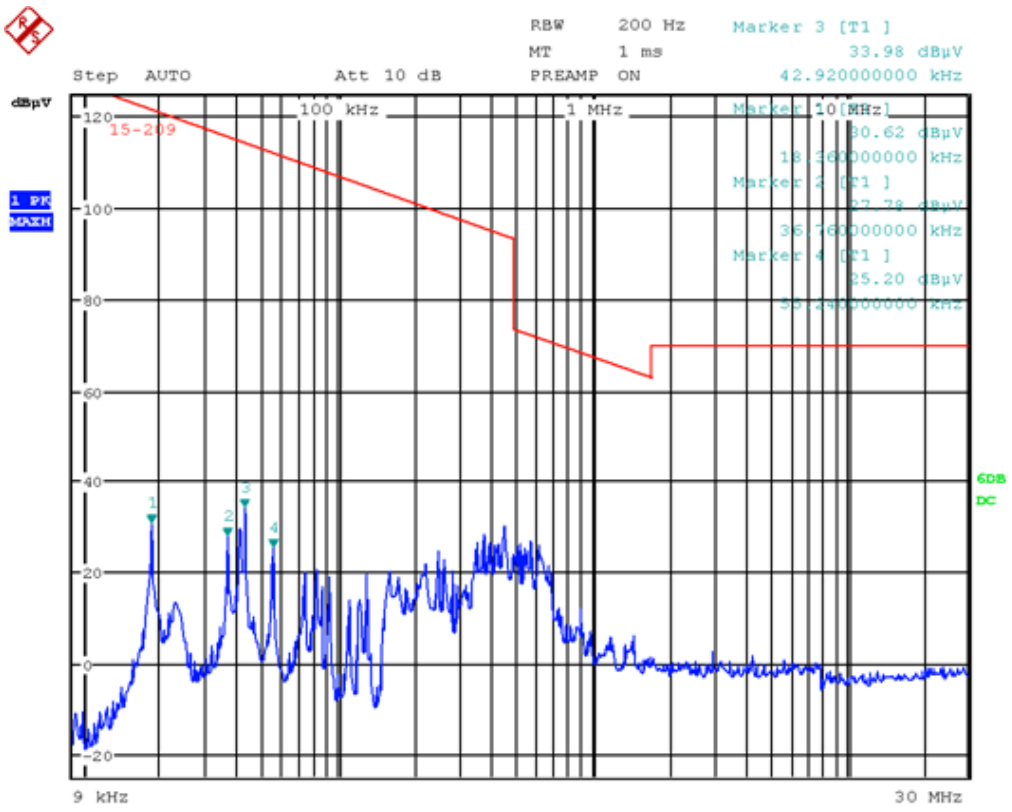
11.8 Test results

Temperature:	22°C	Humidity:	44%
Tested by:	M. Müller	Test date:	2014-09-11

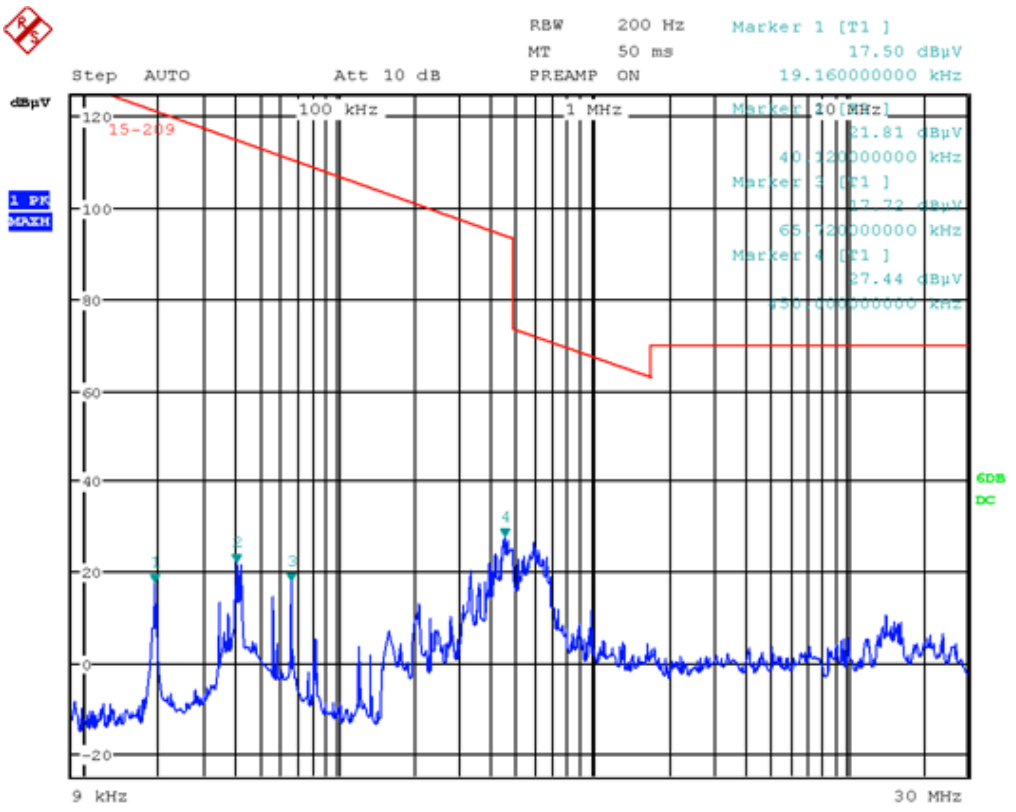
11.9 Test results 9kHz - 30MHz



Picture 31: spurious emission channel 0



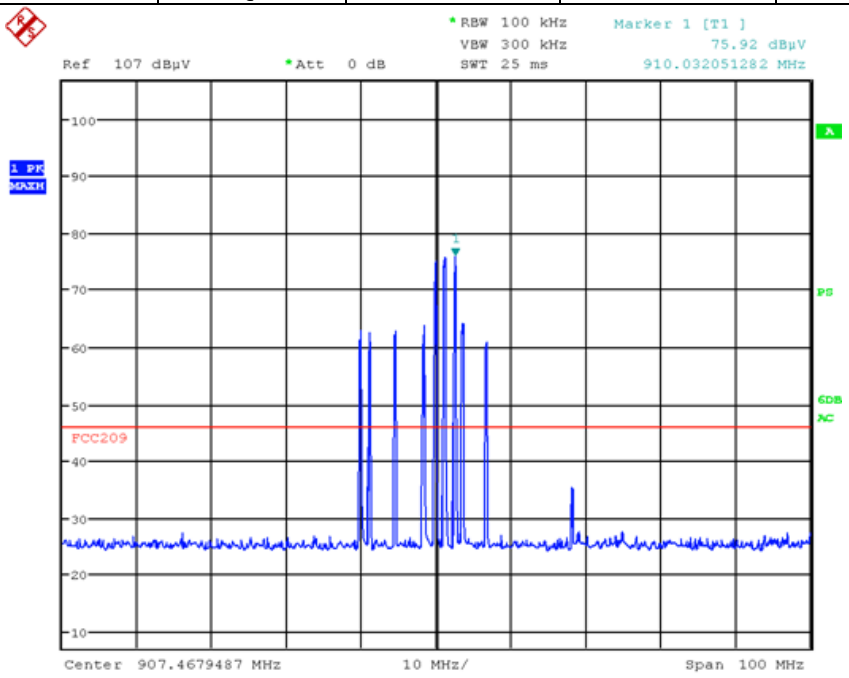
Picture 32: spurious emission channel 39



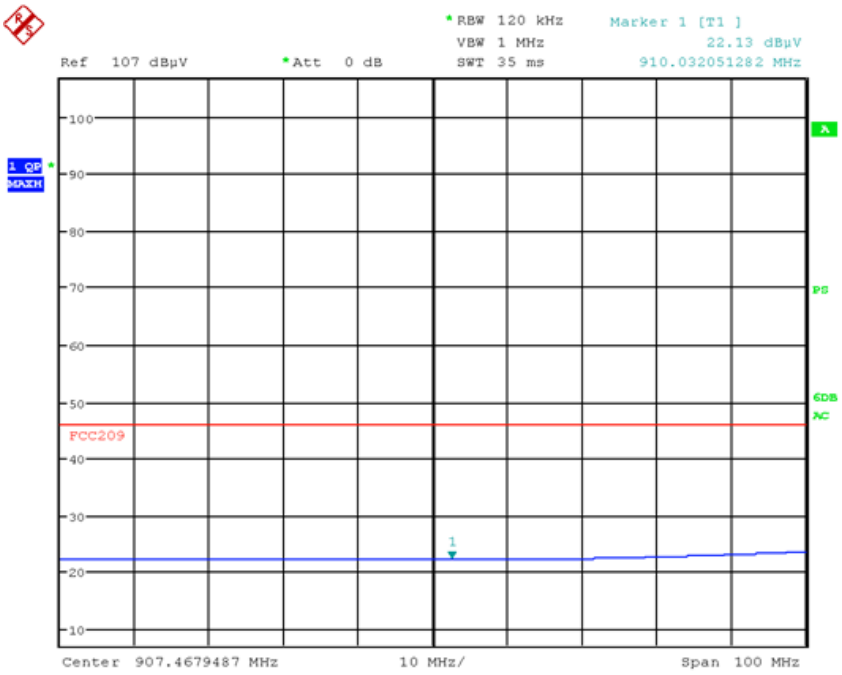
Picture 33: spurious emission channel 78

11.10 Test results 30MHz - 26GHz

Channel0					
f [GHz]	Reading [dBµV]	Detector	Limit [dBµV]	Restricted Band	Result
0.9075	22.13	QP	46	NO	Pass



Picture 34: spurious emission channel 0 - PK (30MHz – 1GHz)

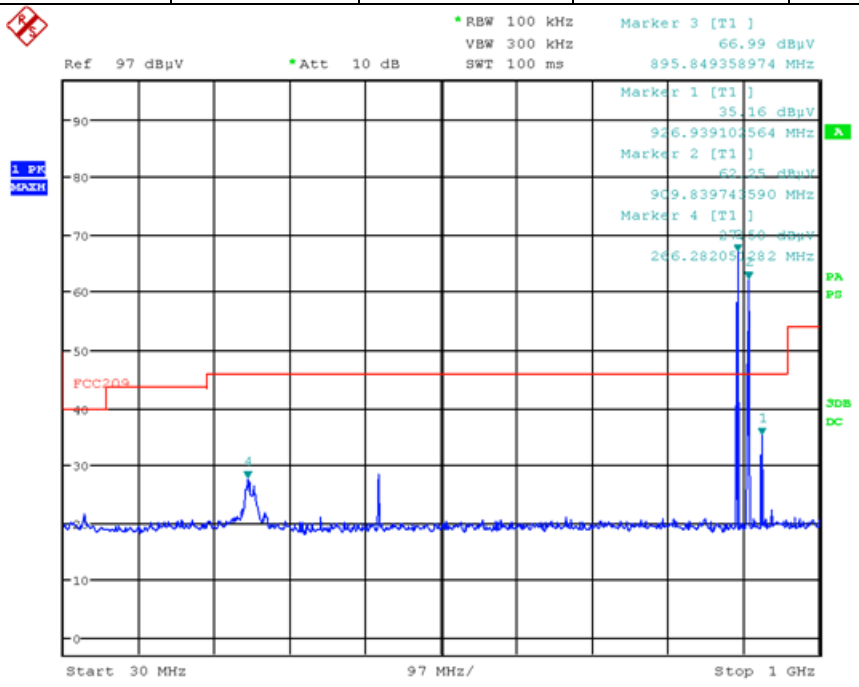


Picture 35: spurious emission channel 0 - QP (30MHz – 1GHz)

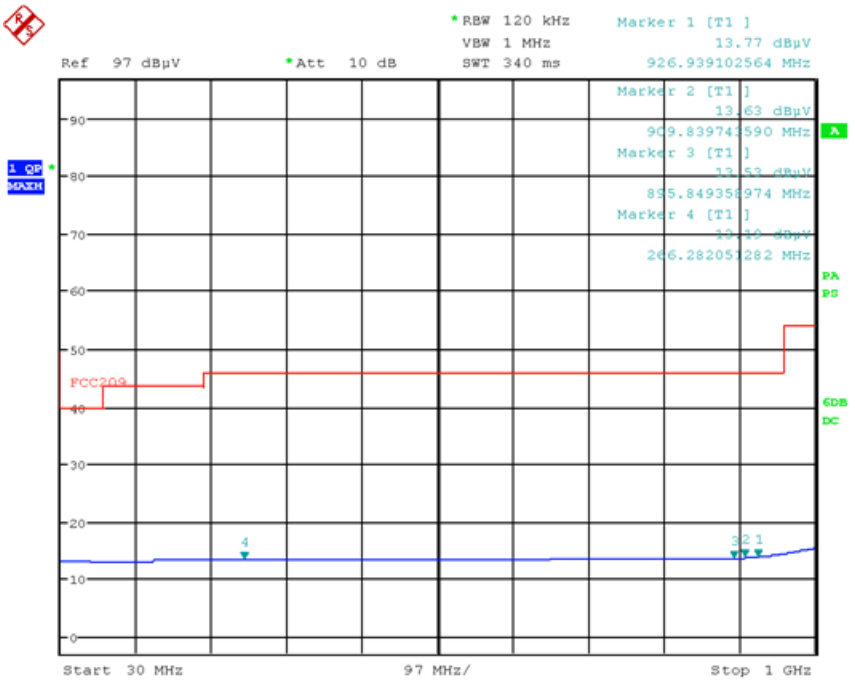
Channel39					
f [GHz]	Reading [dBµV]	Detector	Limit [dBµV]	Restricted Band	Result
No emissions detected					

Picture 36: spurious emission channel 39 (30MHz – 1GHz)

Channel78					
f [GHz]	Reading [dBµV]	Detector	Limit [dbµV]	Restricted Band	Result
0.8559	13.53	QP	46	NO	Pass
0.9269	13.63	QP	46	NO	Pass
0.9075	13.77	QP	46	NO	Pass

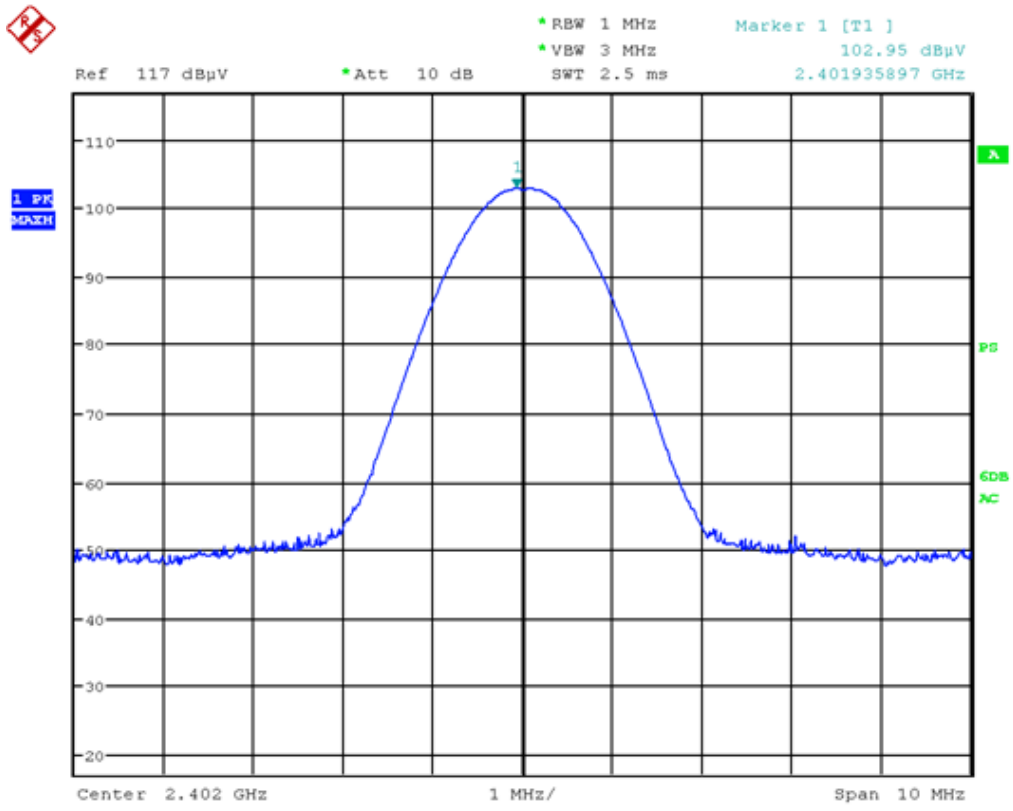


Picture 37: spurious emission channel 78 - PK (30MHz – 1GHz)

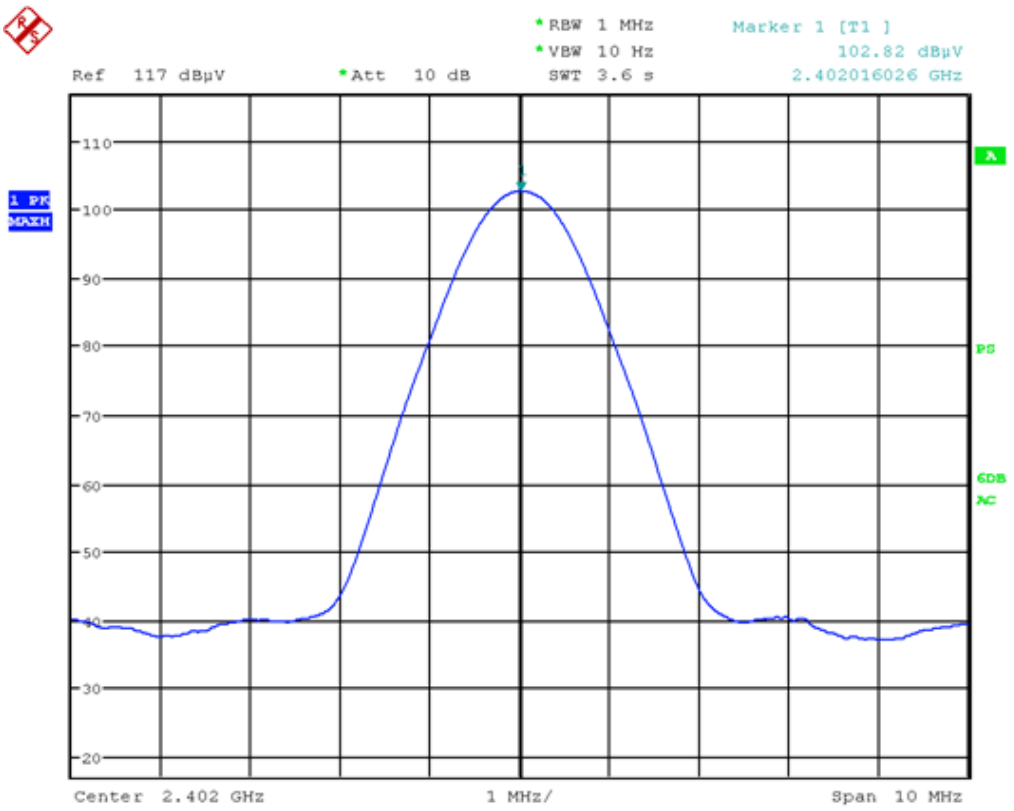


Picture 38: spurious emission channel 78 - PK (30MHz – 1GHz)

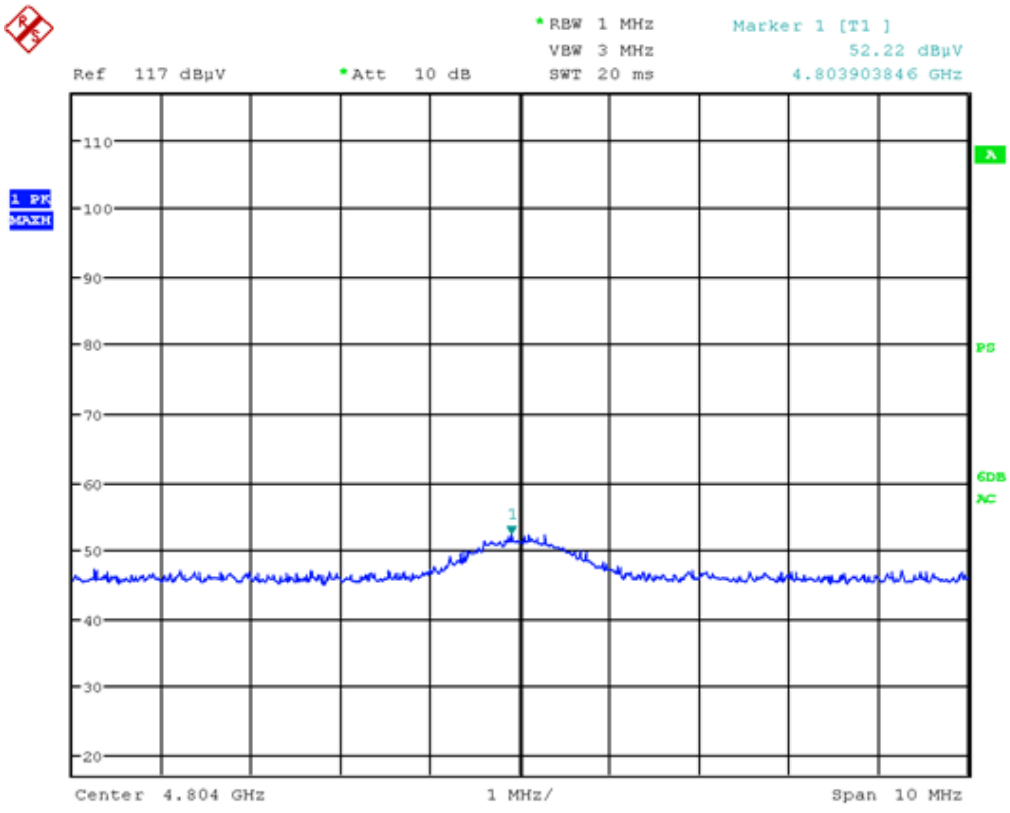
Channel0					
f [GHz]	Reading [dBµV]	Detector	Limit [dbµV]	Restricted Band	Result
2.4020	102.95	PK	- - -	NO	Carrier
2.4020	102.82	AV	- - -		Carrier
4.8040	52.22	PK	74	YES	Pass
4.8040	45.49	AV	54		Pass
7.2060	53.79	PK	-20dBc	NO	Pass
7.2060	48.24	AV	-20dBc		Pass
9.6080	52.72	PK	-20dBc	NO	Pass
9.6080	45.20	AV	-20dBc		Pass



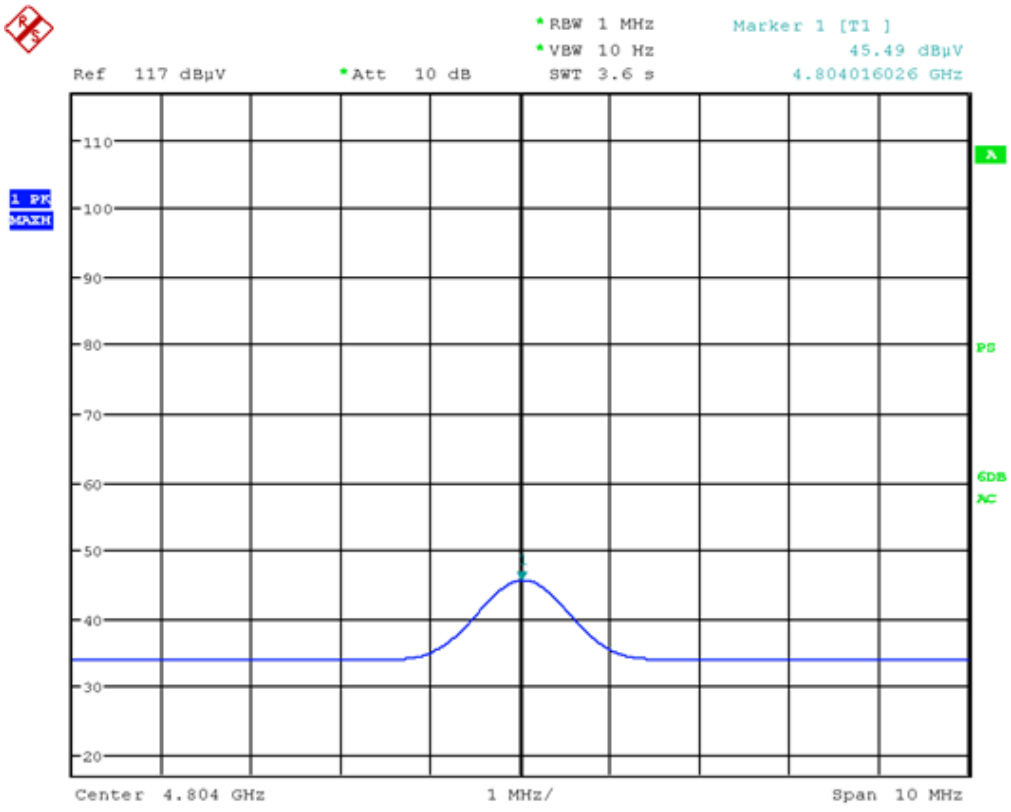
Picture 39: spurious emission channel 0 - PK (1GHz - 26GHz)



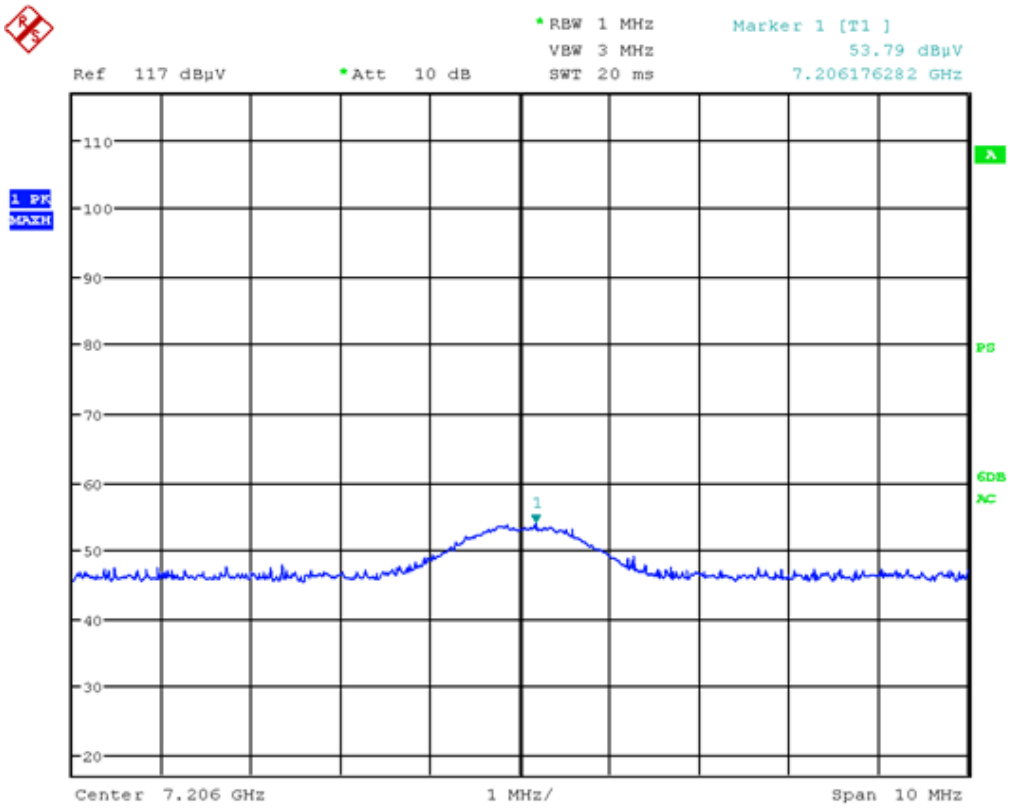
Picture 40: spurious emission channel 0 - AV (1GHz - 26GHz)



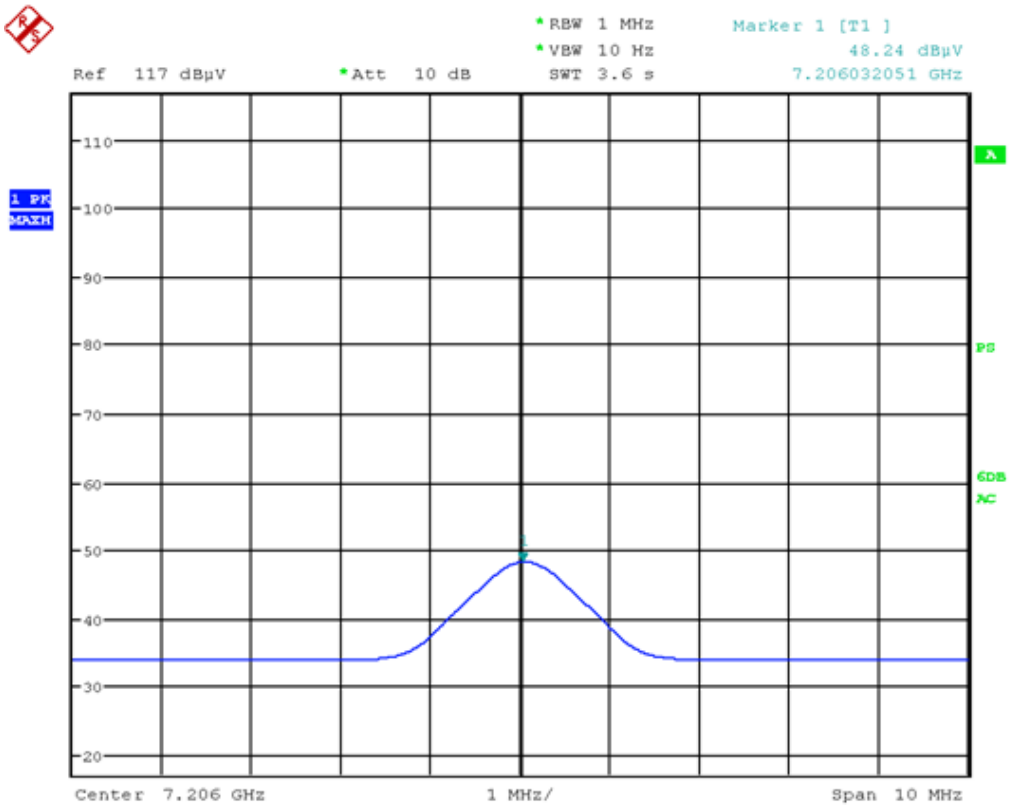
Picture 41: spurious emission channel 0 - PK (1GHz - 26GHz)



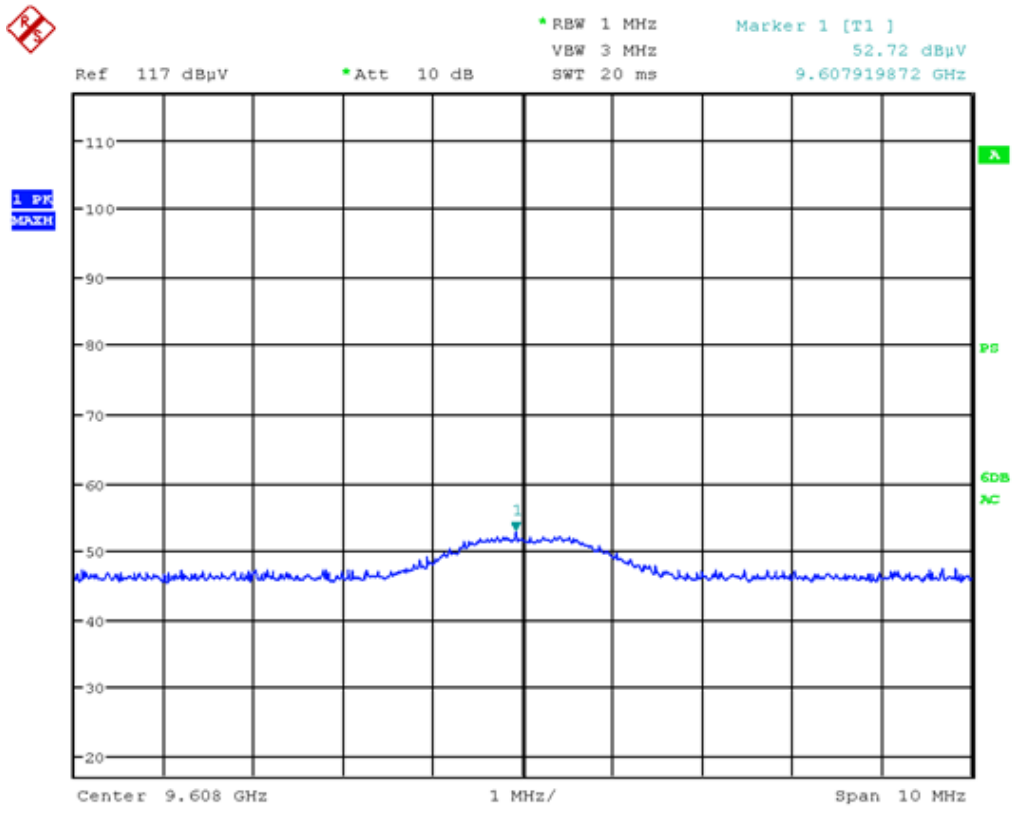
Picture 42: spurious emission channel 0 - AV (1GHz - 26GHz)



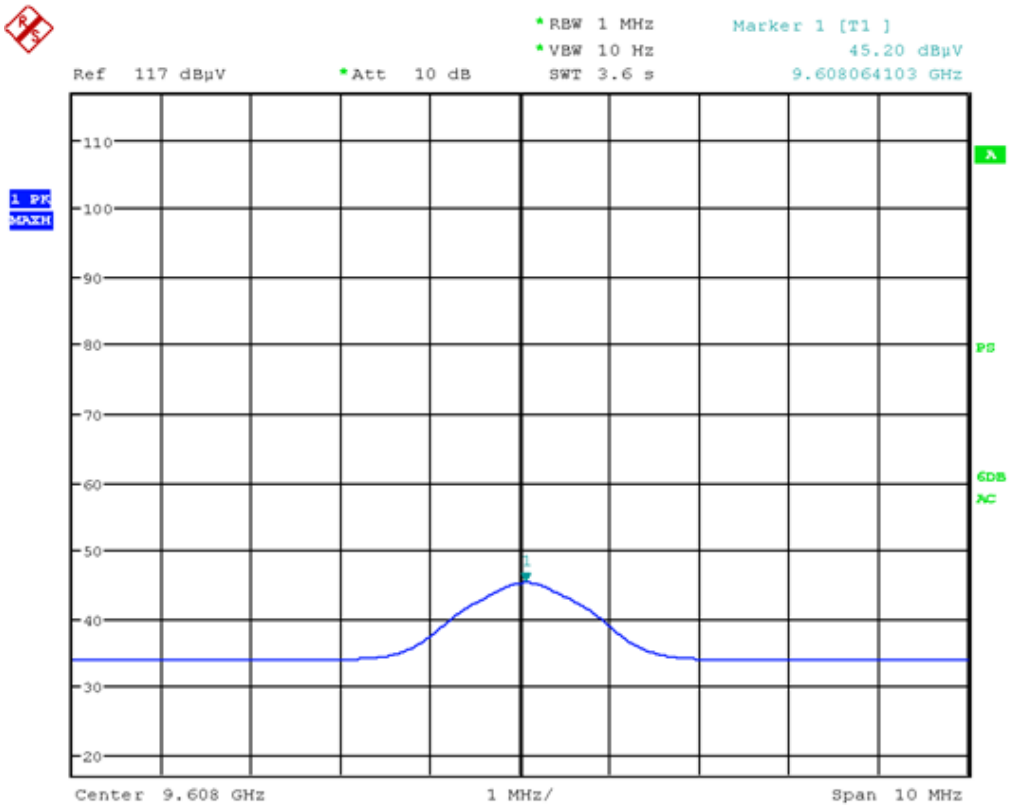
Picture 43: spurious emission channel 0 - PK (1GHz - 26GHz)



Picture 44: spurious emission channel 0 - AV (1GHz - 26GHz)

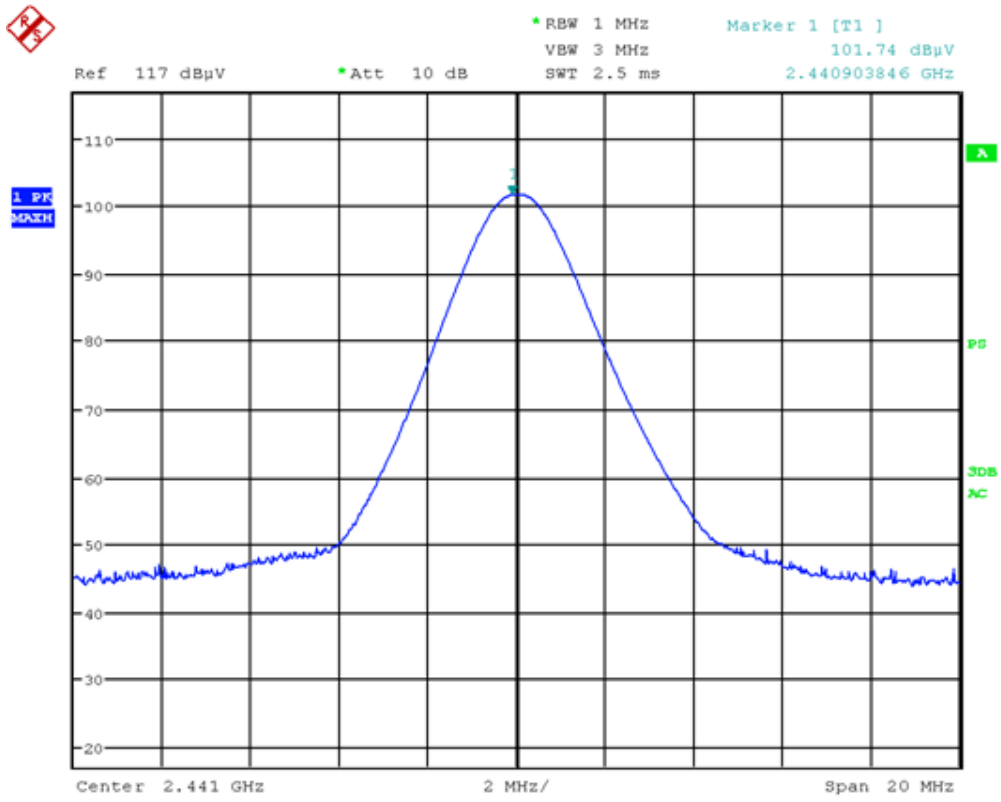


Picture 45: spurious emission channel 0 - PK (1GHz - 26GHz)

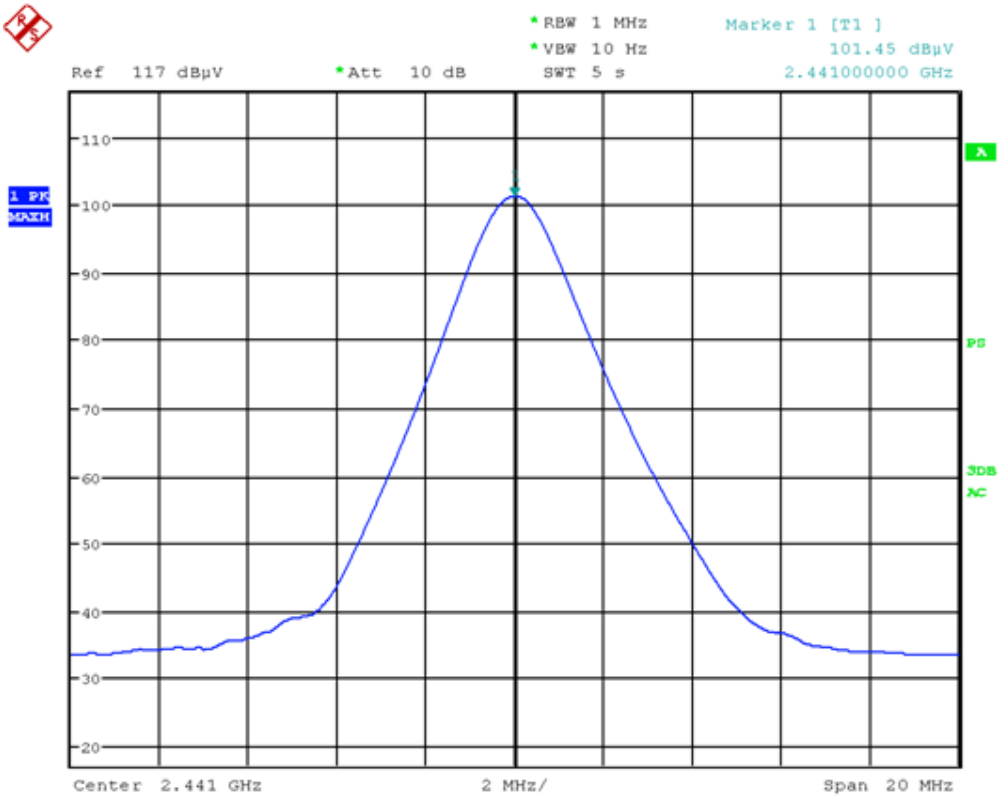


Picture 46: spurious emission channel 0 - AV (1GHz - 26GHz)

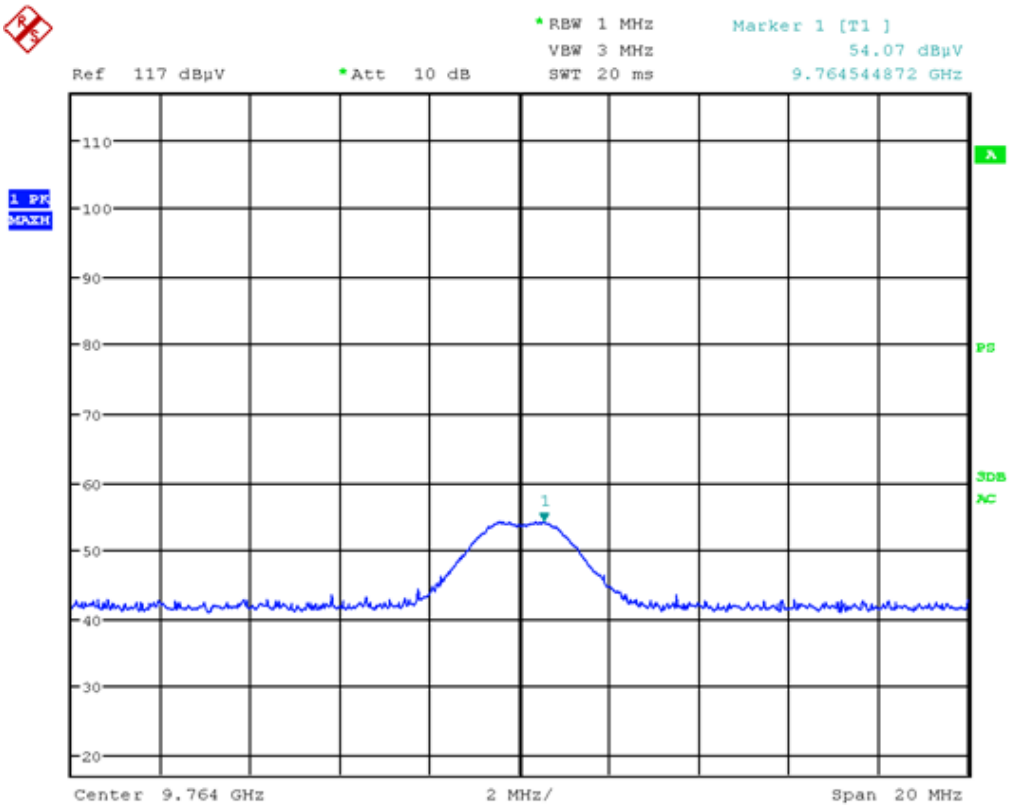
Channel39					
f [GHz]	Reading [dBµV]	Detector	Limit [dbµV]	Restricted Band	Result
2.4410	101.74	PK	- - -	NO	Carrier
2.4410	101.45	AV	- - -		Carrier
9.7640	54.07	PK	-20dBc	NO	Pass
9.7640	50.63	AV	-20dBc		Pass



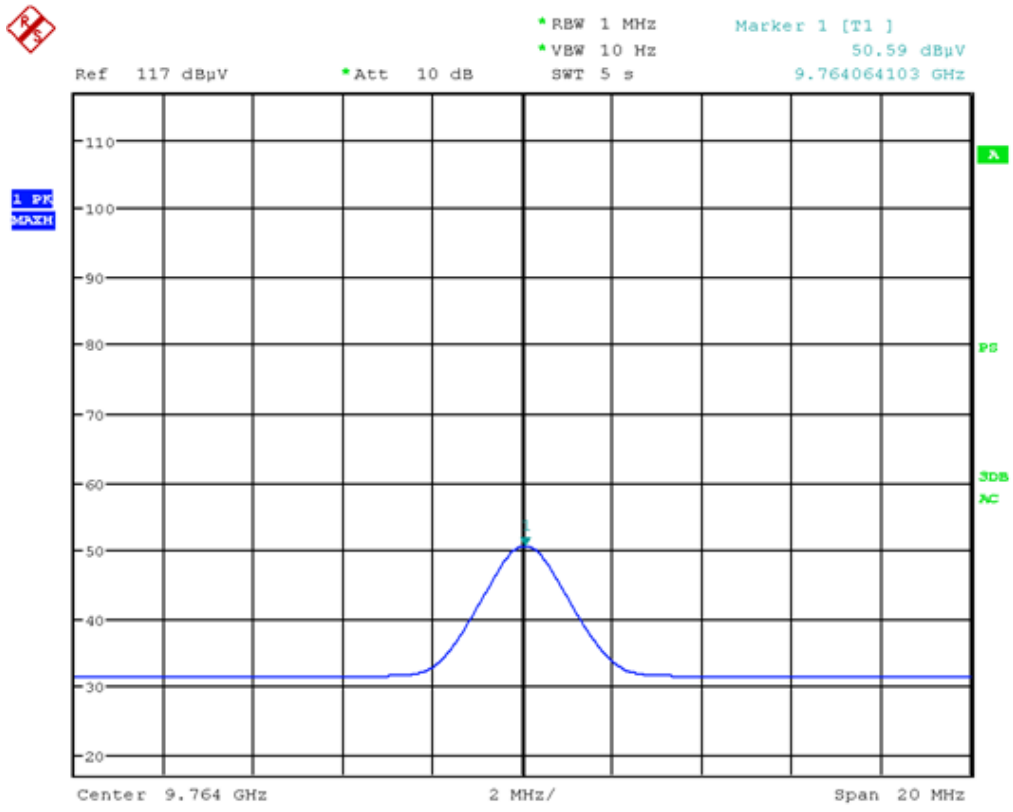
Picture 47: spurious emission channel 39 - PK (1GHz - 26GHz)



Picture 48: spurious emission channel 39 - AV (1GHz - 26GHz)

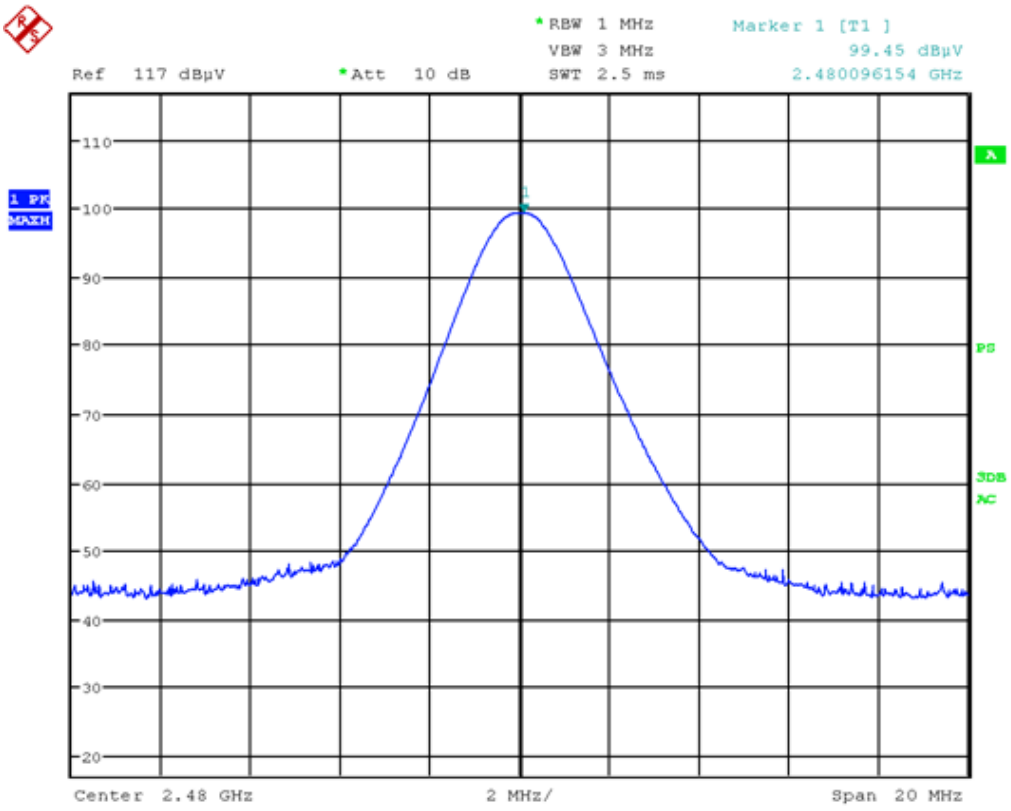


Picture 49: spurious emission channel 39 - PK (1GHz - 26GHz)

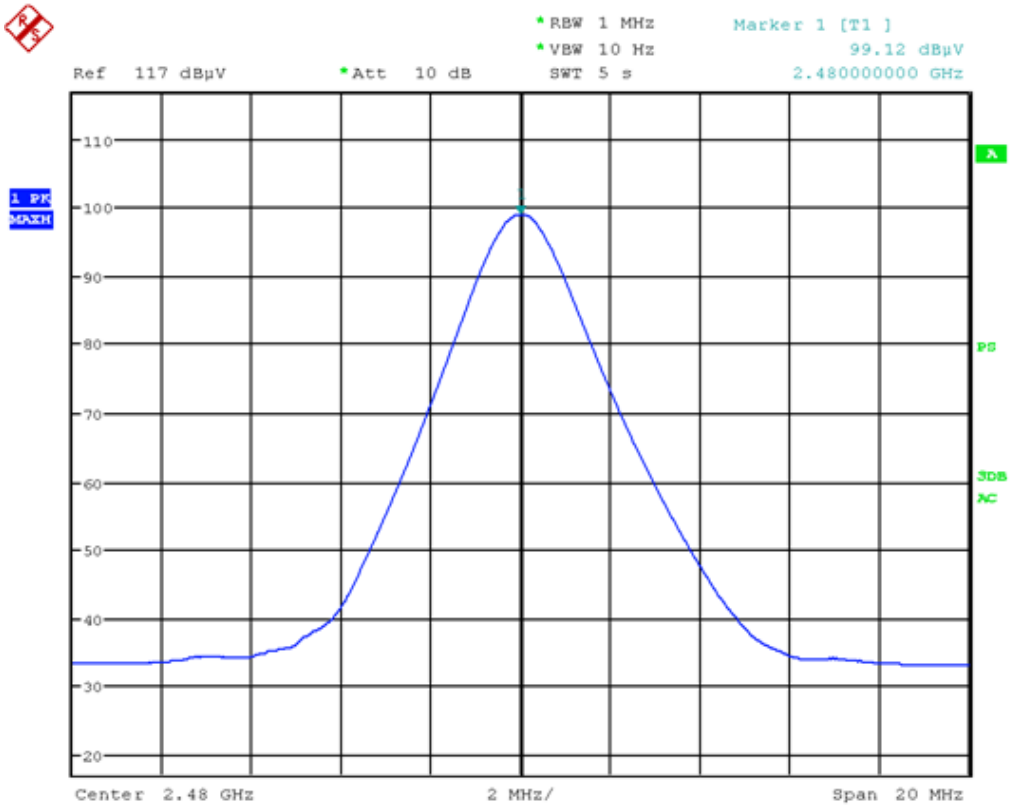


Picture 50: spurious emission channel 39 - AV (1GHz - 26GHz)

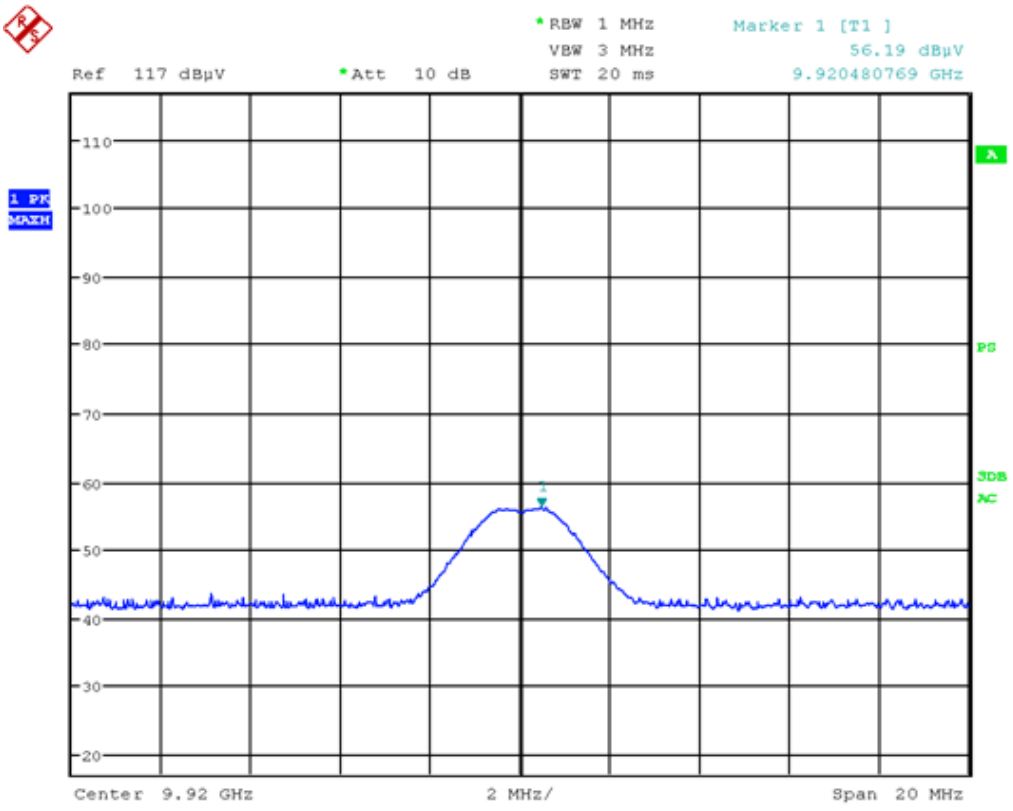
Channel78					
f [GHz]	Reading [dBµV]	Detector	Limit [dbµV]	Restricted Band	Result
2.4800	99.45	PK	- - -	NO	Carrier
2.4800	99.12	AV	- - -		Carrier
9.9200	56.19	PK	-20dBc	NO	Pass
9.9200	53.12	AV	-20dBc		Pass



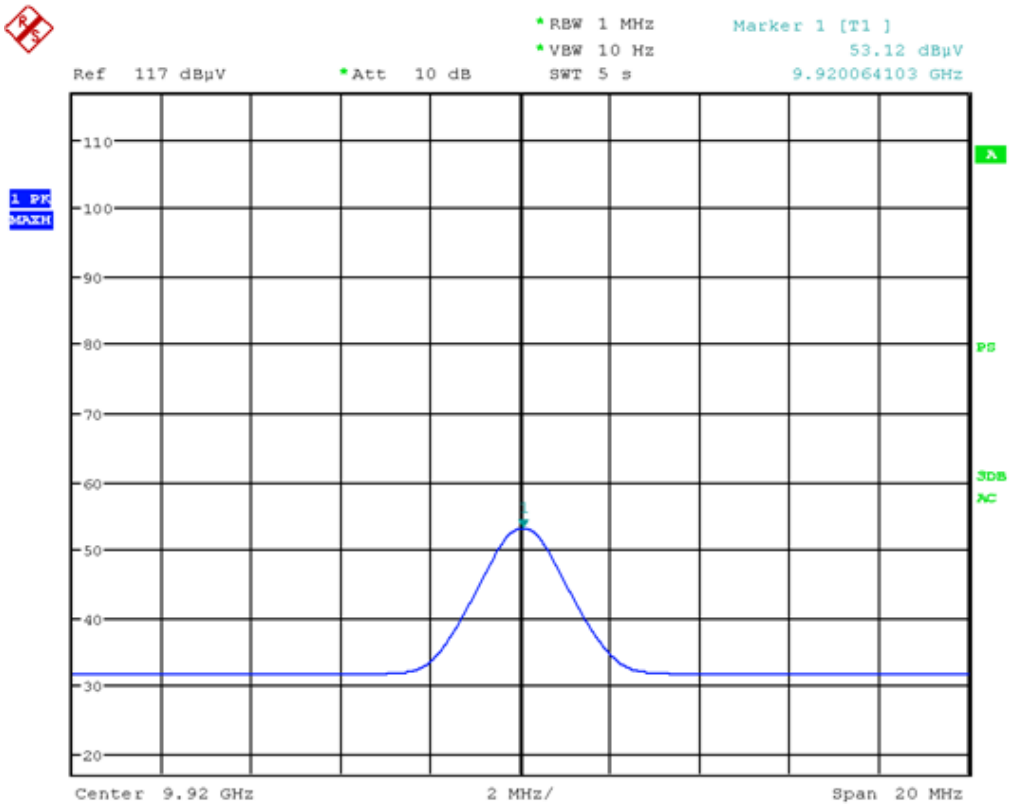
Picture 51: spurious emission channel 78 - PK (1GHz - 26GHz)



Picture 52: spurious emission channel 78 - AV (1GHz - 26GHz)



Picture 53: spurious emission channel 78 - PK (1GHz - 26GHz)



Picture 54: spurious emission channel 78 - AV (1GHz - 26GHz)

12 Radiated emission measurement (<1 GHz)

according to CFR 47 Part 15, sections 15.205(a), 15.209(a), 15.247(d), and Public Notice DA 00-705

12.1 Test Location

☑ Scan with peak detector in 3 m CDC.

☑ Final CISPR measurement with quasi peak detector on 3 m open area test site.

Description	Manufacturer	Inventory No.
CDC	Albatross Projects	E00026
Open site area	EMV **TESTHAUS** GmbH	E00354

12.2 Test instruments

	Description	Manufacturer	Inventory No.
☑	ESCS 30 (FF)	Rohde & Schwarz	E00003
☐	ESU 26	Rohde & Schwarz	W00002
☑	ESCI (CDC)	Rohde & Schwarz	E00001
☑	VULB 9163 (FF)	Schwarzbeck	E00013
☑	VULB 9160 (CDC)	Schwarzbeck	E00011
☑	HFH2-Z2	Rohde & Schwarz	E00060
☑	Feedline OATS	Huber & Suhner	200024

12.3 Limits

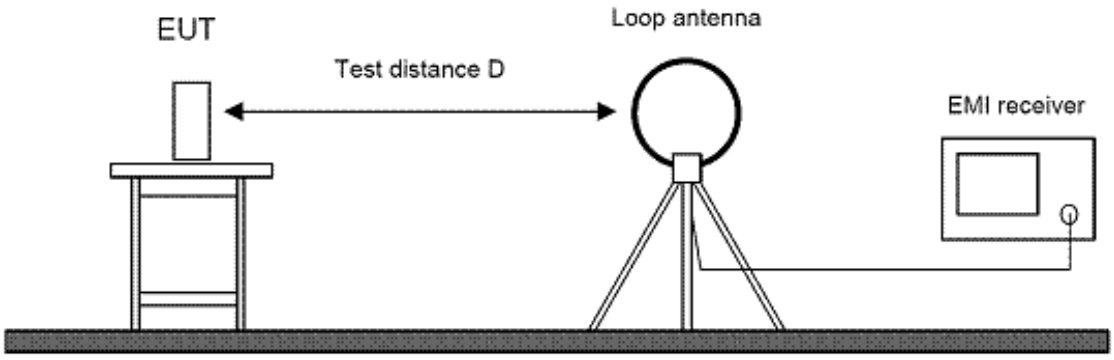
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.
In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

Frequency [MHz]	Field strength Fs [µV/m]	Field strength [dBµV/m]	Measurement distance d [m]
0.009 – 0.490	266.6 – 4.9	48.5 – 13.8	300
0.490 – 1.705	48.98 – 14.08	33.8 – 22.97	30
1.705 – 30.0	30	29.54	30
30 – 88	100	40	3
88 – 216	150	43.5	3
216 - 960	200	46	3
Above 960	500	54	3

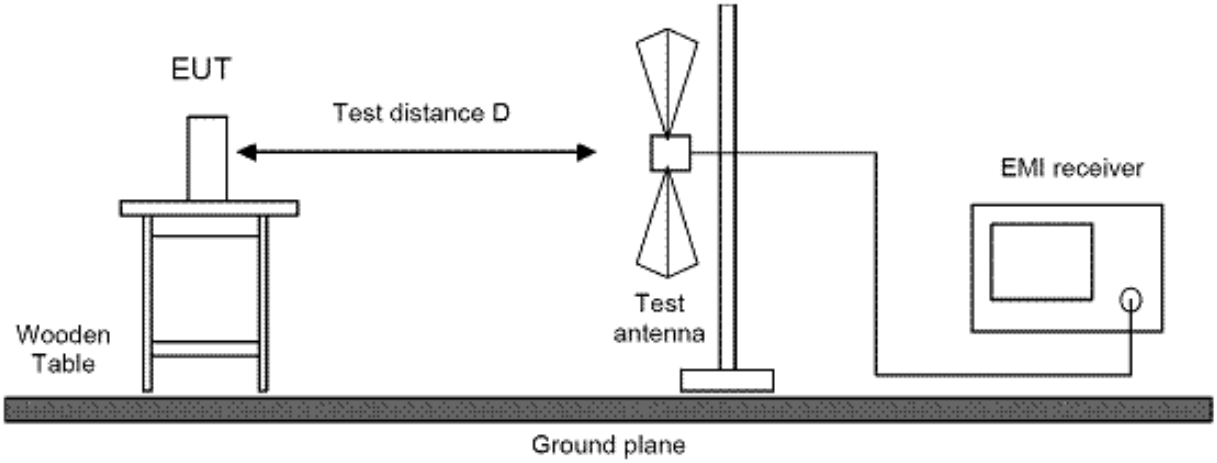
12.4 Test procedure

1. Configure the EUT according to ANSI C63.4. The EUT is placed on the top of the turntable 0.8 meter above ground. The receiving antenna is placed 3 meters from the turntable. For prescan measurements the test setup is placed inside a compact diagnostic chamber.
2. Power on the EUT and all peripherals.
3. The broadband antenna is set to vertical polarization.
4. The EMI receiver performes a scan from 9 kHz to 30 MHz or 30MHz to 1000MHz with the detector set to peak. Appropriate CISPR measurement bandwidths are used, i. e. 200 Hz for the frequency range 9 kHz to 150 kHz, 10 kHz for 150 kHz to 30 MHz and 120 kHz for 30MHz to 1000MHz.
5. The turn table is rotated to 6 different positions (360° / 6) and the antenna polarization is changed to horizontal.
6. Repeat the test procedure at step 4 and 5.
7. Then the test setup is placed in an OATS at 3 m distance and all peak values over or with less than 6dB margin to the limit are re-measured with quasi-peak detector (except for the frequency bands 9–90 kHz and 110–490 kHz where average detector is used). If the margin of all emissions recorded prescan in the compact diagnostic chamber is more than 6 dB no final test in OATS is performed.
8. The turntable is rotated by 360 degrees to determine the position of the highest radiation.
9. The height of the broadband receiving antenna is varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization. The highest value is recorded.
10. For emissions below 30MHz, measurements are performed with a loop antenna. The antenna height is not changed during this test.

12.5 Test setup



Picture 55: Test setup for radiated emission measurement (< 30 MHz)



Picture 56: Test setup for radiated emission measurement (< 1 GHz)

12.6 Test deviation

There is no deviation with the original standard.

12.7 EUT operation during test

The EUT was programmed to be in continuously transmitting mode.
It was also investigated that the EUT-position1 is the respective worst-case for the measurements below 1GHz.
For the measurements below 30MHz the loop-antenna was polarised to “l”.

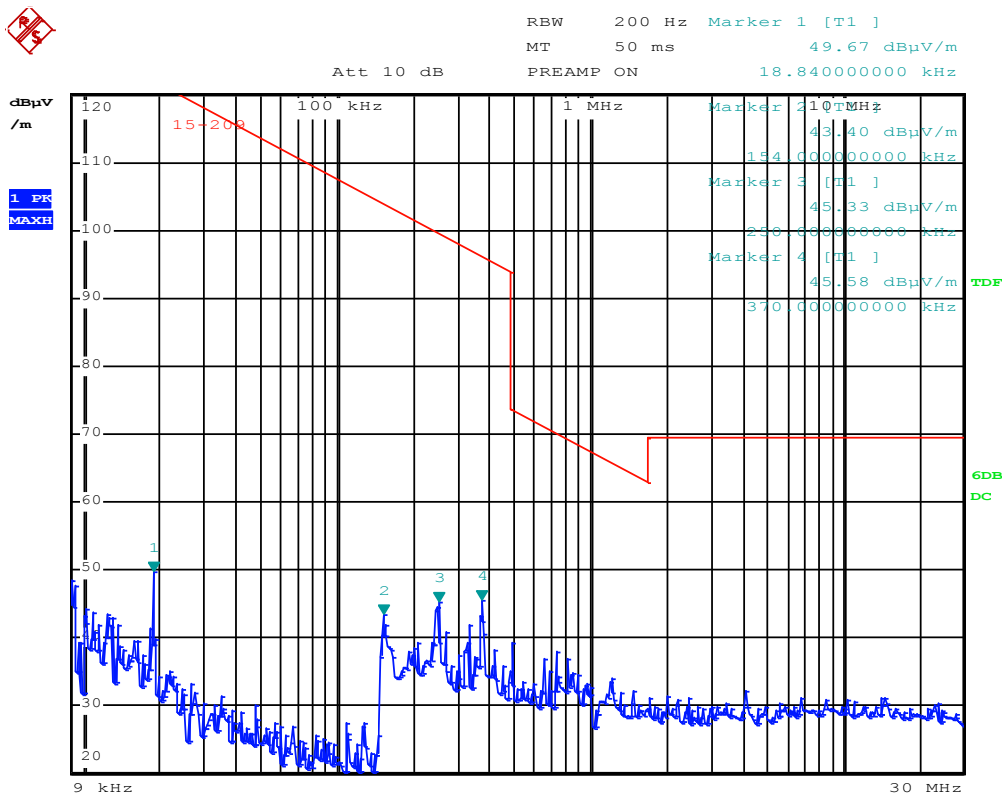
12.8 Test results

Transmit mode

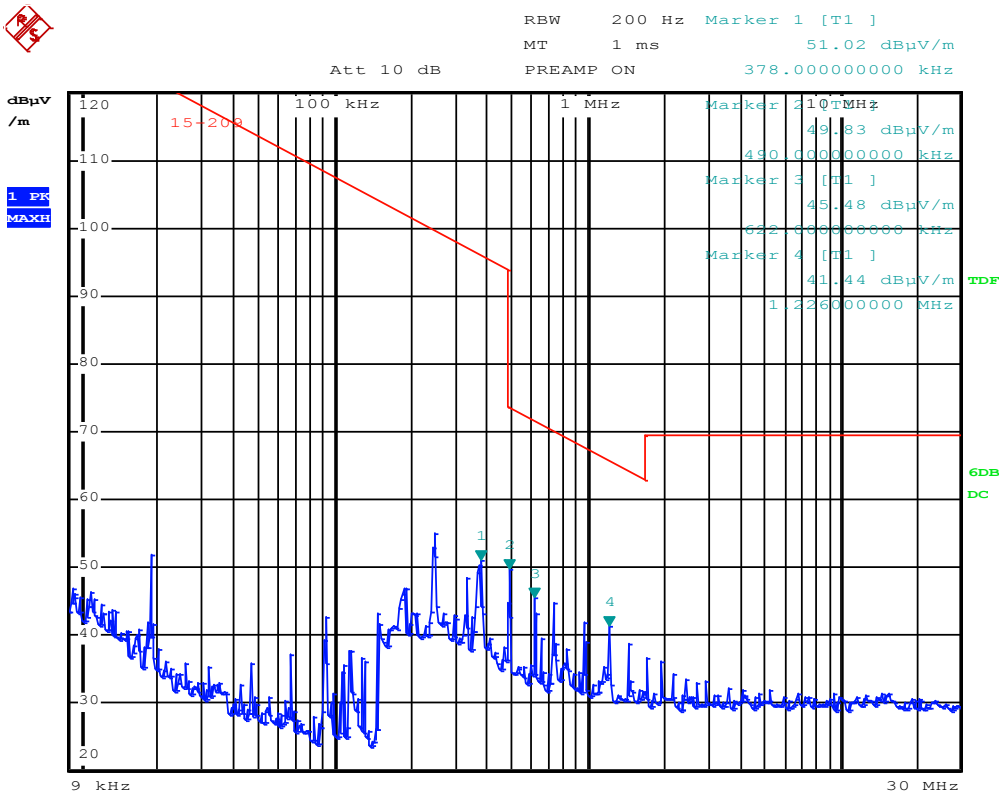
Temperature:	22°C	Humidity:	44%
Tested by:	M. Müller	Test date:	2014-09-24

Radiated Emission Measurement 9 kHz – 30 MHz

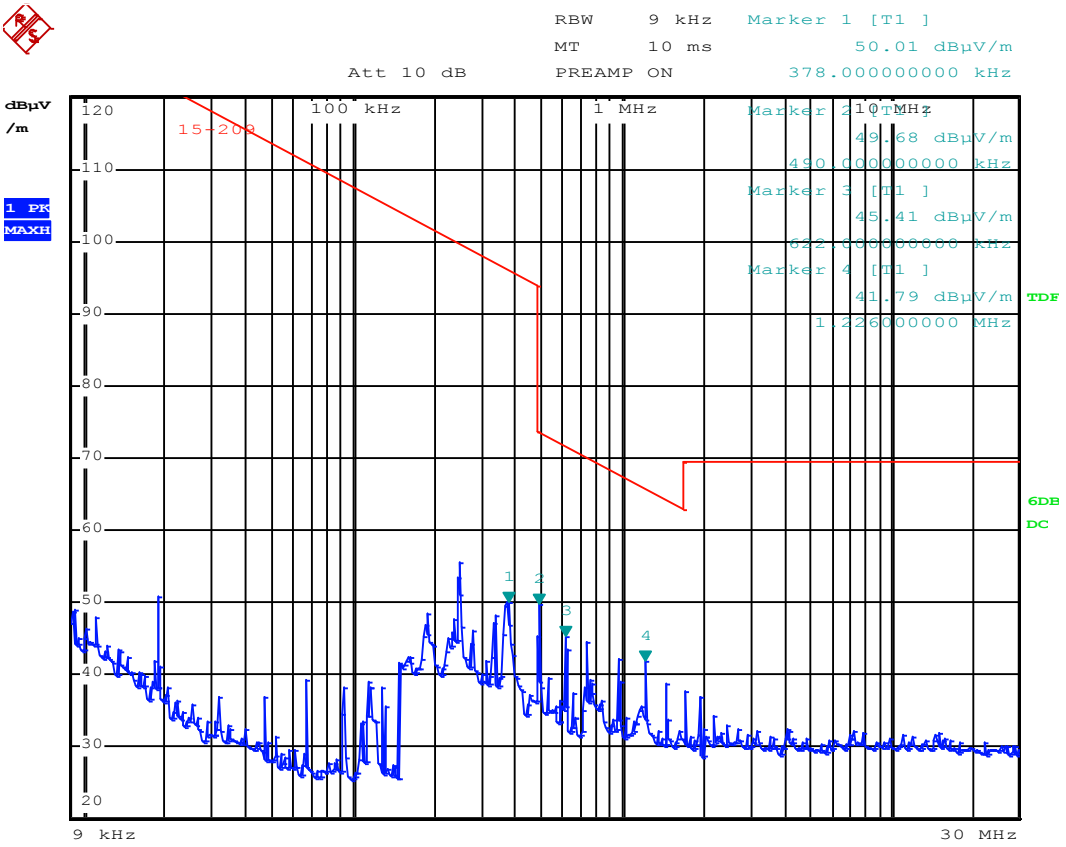
Note:
Measured value = dBµV/m @ 3 m
Recalculation factor = 40 dB / decade
Recalculated value1 = dBµV/m @ 3 m - 40 dB = **dBµV/m @ 30 m**
Recalculated value2 = dBµV/m @ 30 m - 40 dB = **dBµV/m @ 300 m**



Picture 57: Radiated emission 9 kHz – 30MHz (Channel 0)



Picture 58: Radiated emission 9 kHz – 30MHz (Channel 39)



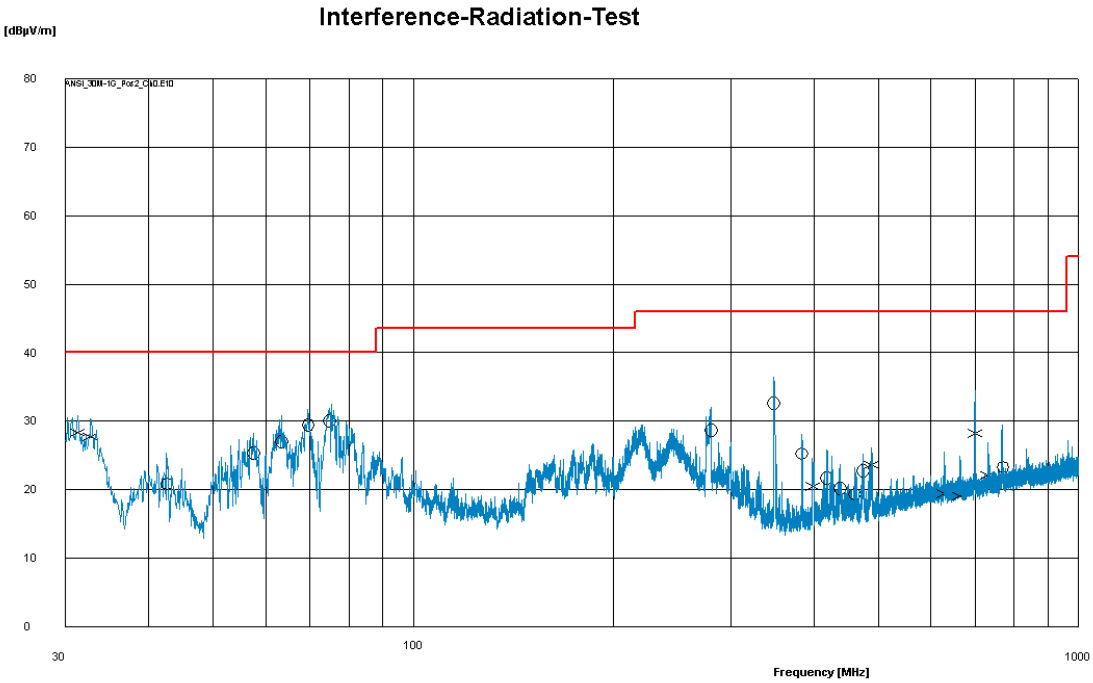
Picture 59: Radiated emission 9 kHz – 30MHz (Channel 78)

Transmit mode

Temperature:	22°C	Humidity:	44%
Tested by:	M. Müller	Test date:	2014-09-16

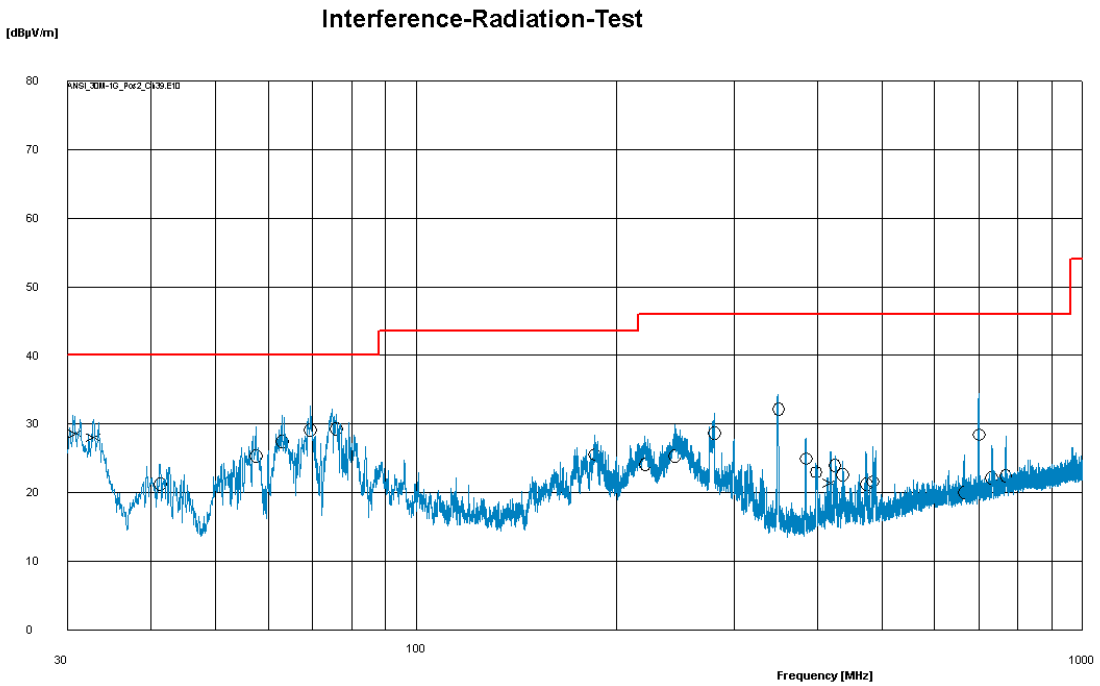
Radiated Emission Measurement 30 MHz - 1 GHz

It was investigated that EUT position 2 is the respective worst-case.



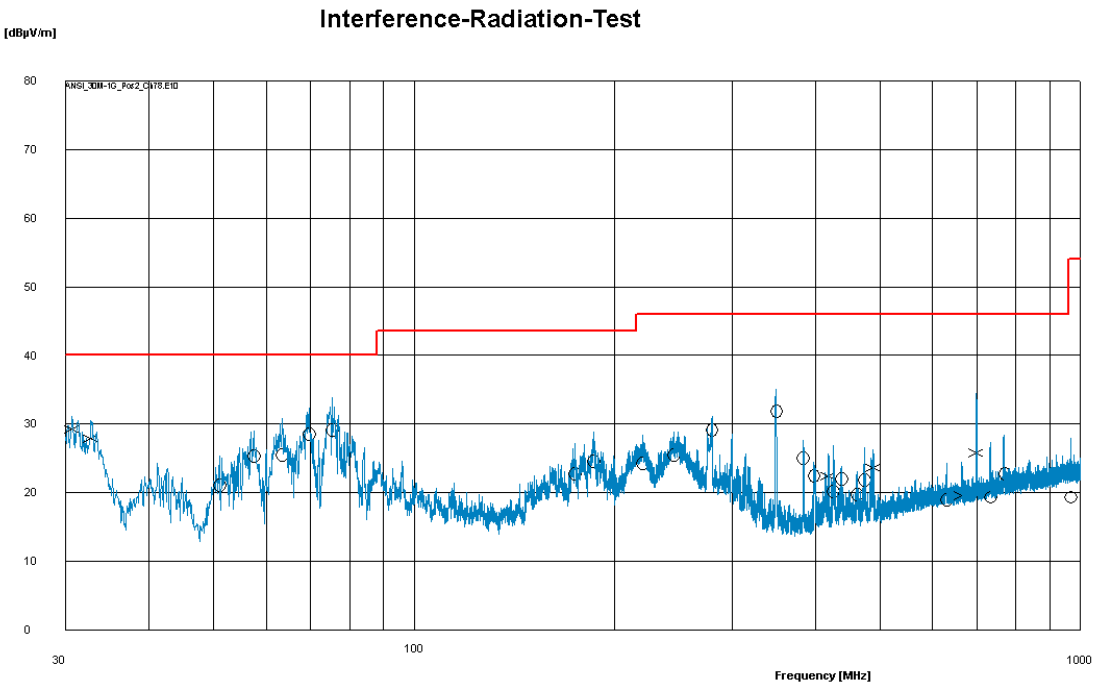
M.	Freq [M...	VMaxC...	Corr...	Limit	dLimit	Pol	Ant	TT	Date	Remarks	VSca...	Corr ...
☑	31,32	28,3	12,1	40,0	- 11,7	V	100	20	2014-09-16 12:23...		30,8	0,0
☑	32,7	27,7	12,1	40,0	- 12,3	V	100	16	2014-09-16 12:24...		30,4	0,0
☑	42,6	20,9	12,8	40,0	- 19,1	H	100	126	2014-09-16 12:31...		25,4	0,0
☑	57,48	25,4	12,5	40,0	- 14,6	H	100	112	2014-09-16 12:32...		28,3	0,0
☑	63,42	27,0	11,6	40,0	- 13,0	H	100	340	2014-09-16 12:33...		30,9	0,0
☑	69,48	29,4	10,4	40,0	- 10,6	H	100	343	2014-09-16 12:34...		31,7	0,0
☑	74,88	30,1	9,5	40,0	- 9,9	H	100	341	2014-09-16 12:35...		32,0	0,0
☑	280,32	28,7	12,3	46,0	- 17,3	H	100	5	2014-09-16 12:36...		32,1	0,0
☑	348,54	32,6	13,7	46,0	- 13,4	H	100	261	2014-09-16 12:37...		36,5	0,0
☑	383,4	25,3	14,4	46,0	- 20,7	H	100	249	2014-09-16 12:38...		28,2	0,0
☑	399,9	20,5	14,7	46,0	- 25,5	V	100	178	2014-09-16 12:25...		24,1	0,0
☑	418,2	21,7	15,1	46,0	- 24,3	H	100	248	2014-09-16 12:38...		25,8	0,0
☑	438,54	20,2	15,6	46,0	- 25,8	H	100	32	2014-09-16 12:39...		23,7	0,0
☑	461,34	19,4	16,0	46,0	- 26,6	H	100	124	2014-09-16 12:40...		23,3	0,0
☑	474,72	22,8	16,2	46,0	- 23,2	H	100	115	2014-09-16 12:41...		25,2	0,0
☑	487,92	23,6	16,3	46,0	- 22,4	V	100	343	2014-09-16 12:26...		26,2	0,0
☑	627,3	19,5	18,8	46,0	- 26,6	V	100	57	2014-09-16 12:27...		25,5	0,0
☑	663,78	19,1	19,3	46,0	- 26,9	V	100	61	2014-09-16 12:28...		24,9	0,0
☑	699,18	28,2	19,6	46,0	- 17,8	V	100	58	2014-09-16 12:29...		34,5	0,0
☑	731,82	22,1	20,1	46,0	- 23,9	V	100	315	2014-09-16 12:30...		26,8	0,0
☑	769,68	23,3	20,7	46,0	- 22,7	H	100	58	2014-09-16 12:42...		29,4	0,0

Picture 60: Radiated emission 30 MHz – 1000MHz (Channel 0)



M.	Freq [M...	VMaxC...	Corr...	Limit	dLimit	Pol	Ant	TT	Date	Remarks	VSca...	Corr ...
☑	30,72	28,6	12,2	40,0	- 11,4	V	100	20	2014-09-16 13:07...		31,1	0,0
☑	32,82	28,0	12,1	40,0	- 12,0	V	100	5	2014-09-16 13:08...		30,6	0,0
☑	41,28	21,2	13,0	40,0	- 18,8	H	100	114	2014-09-16 13:10...		24,2	0,0
☑	57,48	25,4	12,5	40,0	- 14,6	H	100	124	2014-09-16 13:10...		29,7	0,0
☑	63	27,5	11,7	40,0	- 12,5	H	100	343	2014-09-16 13:11...		31,3	0,0
☑	69,42	29,1	10,4	40,0	- 10,9	H	100	347	2014-09-16 13:12...		32,6	0,0
☑	75,96	29,3	9,3	40,0	- 10,7	H	100	331	2014-09-16 13:13...		31,5	0,0
☑	185,64	25,6	11,1	43,5	- 17,9	H	100	83	2014-09-16 13:14...		28,3	0,0
☑	220,74	24,2	10,3	46,0	- 21,8	H	100	58	2014-09-16 13:15...		27,7	0,0
☑	244,32	25,3	11,3	46,0	- 20,7	H	100	57	2014-09-16 13:16...		30,0	0,0
☑	280,38	28,8	12,3	46,0	- 17,3	H	100	8	2014-09-16 13:17...		31,6	0,0
☑	349,86	32,2	13,7	46,0	- 13,9	H	100	261	2014-09-16 13:18...		34,4	0,0
☑	384,84	25,0	14,4	46,0	- 21,0	H	100	249	2014-09-16 13:19...		27,9	0,0
☑	398,34	23,0	14,6	46,0	- 23,0	H	100	245	2014-09-16 13:20...		24,2	0,0
☑	418,14	21,4	15,1	46,0	- 24,6	V	100	178	2014-09-16 13:08...		26,0	0,0
☑	425,28	24,0	15,2	46,0	- 22,0	H	100	45	2014-09-16 13:21...		25,4	0,0
☑	437,28	22,7	15,5	46,0	- 23,4	H	100	45	2014-09-16 13:22...		24,6	0,0
☑	474,18	21,3	16,1	46,0	- 24,7	H	100	116	2014-09-16 13:23...		25,7	0,0
☑	485,28	21,7	16,3	46,0	- 24,4	H	100	124	2014-09-16 13:24...		26,8	0,0
☑	664,74	20,1	19,3	46,0	- 25,9	H	100	45	2014-09-16 13:25...		25,5	0,0
☑	699,78	28,5	19,6	46,0	- 17,6	H	100	248	2014-09-16 13:25...		34,5	0,0
☑	731,82	22,2	20,1	46,0	- 23,8	H	100	7	2014-09-16 13:26...		26,9	0,0
☑	767,28	22,5	20,6	46,0	- 23,5	H	100	57	2014-09-16 13:27...		28,0	0,0

Picture 61: Radiated emission 30 MHz – 1000MHz (Channel 39)



M.	Freq [M...	VMaxC...	Corr...	Limit	dLimit	Pol	Ant	TT	Date	Remarks	VSca...	Corr ...
☑	30,66	29,2	12,2	40,0	- 10,8	V	100	20	2014-09-16 13:42...		31,2	0,0
☑	32,7	27,9	12,1	40,0	- 12,1	V	100	20	2014-09-16 13:43...		30,6	0,0
☑	51,06	21,1	12,7	40,0	- 18,9	H	100	126	2014-09-16 13:48...		25,3	0,0
☑	57,48	25,4	12,5	40,0	- 14,6	H	100	115	2014-09-16 13:49...		29,0	0,0
☑	63,36	25,5	11,7	40,0	- 14,5	H	100	352	2014-09-16 13:50...		30,3	0,0
☑	69,6	28,5	10,4	40,0	- 11,5	H	100	343	2014-09-16 13:51...		32,3	0,0
☑	75,36	29,2	9,4	40,0	- 10,8	H	100	340	2014-09-16 13:52...		33,9	0,0
☑	174,48	22,8	12,6	43,5	- 20,8	H	100	74	2014-09-16 13:53...		27,2	0,0
☑	185,94	24,6	11,1	43,5	- 18,9	H	100	83	2014-09-16 13:54...		28,8	0,0
☑	220,38	24,3	10,3	46,0	- 21,7	H	100	74	2014-09-16 13:55...		28,5	0,0
☑	245,34	25,5	11,3	46,0	- 20,5	H	100	70	2014-09-16 13:55...		28,9	0,0
☑	279,96	29,2	12,3	46,0	- 16,8	H	100	20	2014-09-16 13:56...		30,8	0,0
☑	349,86	31,9	13,7	46,0	- 14,2	H	100	257	2014-09-16 13:57...		35,1	0,0
☑	383,4	25,1	14,4	46,0	- 20,9	H	100	249	2014-09-16 13:58...		27,6	0,0
☑	398,34	22,5	14,6	46,0	- 23,5	H	100	245	2014-09-16 13:59...		24,5	0,0
☑	418,2	22,4	15,1	46,0	- 23,6	V	100	191	2014-09-16 13:44...		25,7	0,0
☑	425,94	20,3	15,3	46,0	- 25,8	H	100	49	2014-09-16 14:00...		26,9	0,0
☑	438,72	22,0	15,6	46,0	- 24,0	H	100	45	2014-09-16 14:01...		23,8	0,0
☑	462,72	19,8	16,0	46,0	- 26,3	H	100	115	2014-09-16 14:02...		23,2	0,0
☑	474,78	21,9	16,2	46,0	- 24,1	H	100	124	2014-09-16 14:03...		26,6	0,0
☑	487,92	23,6	16,3	46,0	- 22,4	V	100	354	2014-09-16 13:45...		26,3	0,0
☑	629,76	19,0	18,8	46,0	- 27,0	H	100	261	2014-09-16 14:04...		24,3	0,0
☑	664,14	19,7	19,3	46,0	- 26,4	V	100	70	2014-09-16 13:46...		24,2	0,0
☑	698,64	25,8	19,6	46,0	- 20,2	V	100	49	2014-09-16 13:47...		34,4	0,0
☑	733,08	19,4	20,1	46,0	- 26,6	H	100	17	2014-09-16 14:05...		27,3	0,0
☑	769,8	22,8	20,7	46,0	- 23,2	H	100	48	2014-09-16 14:06...		28,4	0,0
☑	968,76	19,4	22,7	54,0	- 34,6	H	100	17	2014-09-16 14:07...		27,9	0,0

Picture 62: Radiated emission 30 MHz – 1000MHz (Channel 78)

13 Radiated emission measurement (>1 GHz)

according to CFR 47 Part 15, sections 15.205(a), 15.209(a), 15.247(d), and Public Notice DA 00-705

13.1 Test location

☑ Scan with peak detector in 3 m anechoic chamber

☑ Final measurement with average and max peak detector.

Description	Manufacturer	Inventory No.
Anechoic chamber	EMV **TESTHAUS** GmbH	E00100

13.2 Test instruments

	Description	Manufacturer	Inventory No.
☑	ESU26	Rohde & Schwarz	W00002
☑	AMF-5D-00501800-28-13P	Miteq	W00089
☑	AMF-6F-16002650-25-10P	Miteq	W00090
☑	BBHA 9120D	Schwarzbeck	W00053
☑	BBHA 9170	Schwarzbeck	W00055
☑	COSB 4-1-26	Conformitas	W00091

13.3 Limits

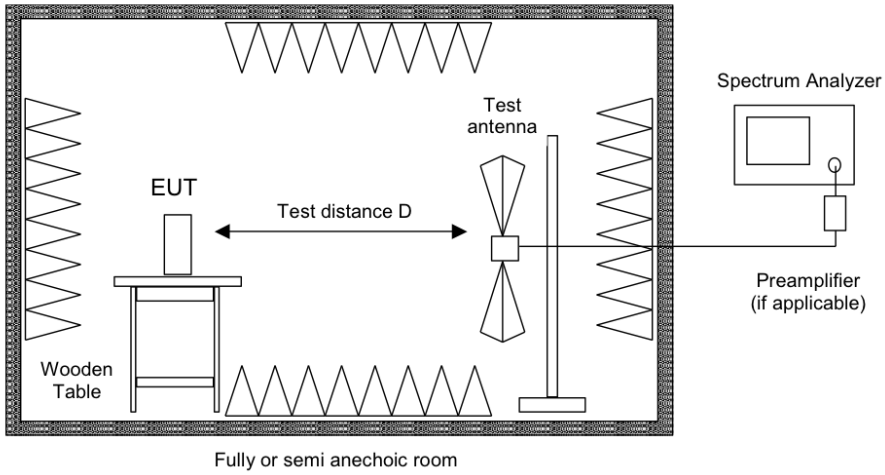
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

Frequency [MHz]	Field strength Fs [µV/m]	Field strength [dBµV/m]	Measurement distance d [m]
30 – 88	100	40	3
88 – 216	150	43.5	3
216 - 960	200	46	3
Above 960	500	54	3

13.4 Test procedure

6. Configure the EUT according to ANSI C63.4. The EUT was placed on the top of the turntable 0.8 meter above ground. The receiving antenna was placed 3 meters from the turntable. The test setup was placed inside a fully anechoic chamber.
7. Power on the EUT and all peripherals.
8. The broadband antenna was set to vertical polarization.
9. The EMI receiver performed a scan from 1000 MHz to 10th harmonic of the fundamental frequency with the detector set to peak and the measurement bandwidth set to 1 MHz (VBW ≥ 3 MHz). The trace data was recorded with the receiver Max Hold function.
10. The turn table was rotated in intervals of 15°.
11. After a full 360°-turn the antenna polarization was changed to horizontal and the test was repeated at step 4 and 5.
12. After the scan suspicious frequencies were selected and the RBW was set to 1 MHz and the VBW was set to 10Hz and the detector was changed to average reading.
13. The receiving antenna was set to vertical polarization.
14. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
15. The receiving antenna was then set to horizontal polarization and the measurement was repeated at step 9.
16. The highest recorded level was noted.

13.5 Test setup



Picture 63: Test setup for radiated emission measurement (> 1 GHz)

13.6 Test deviation

There is no deviation with the original standard.

13.7 EUT operation during test

The EUT was programmed to be in continuously transmitting mode.
For these measurements it was investigated that EUT-position2 in conjunction with antenna polarised to horizontal is the respective worst-case.

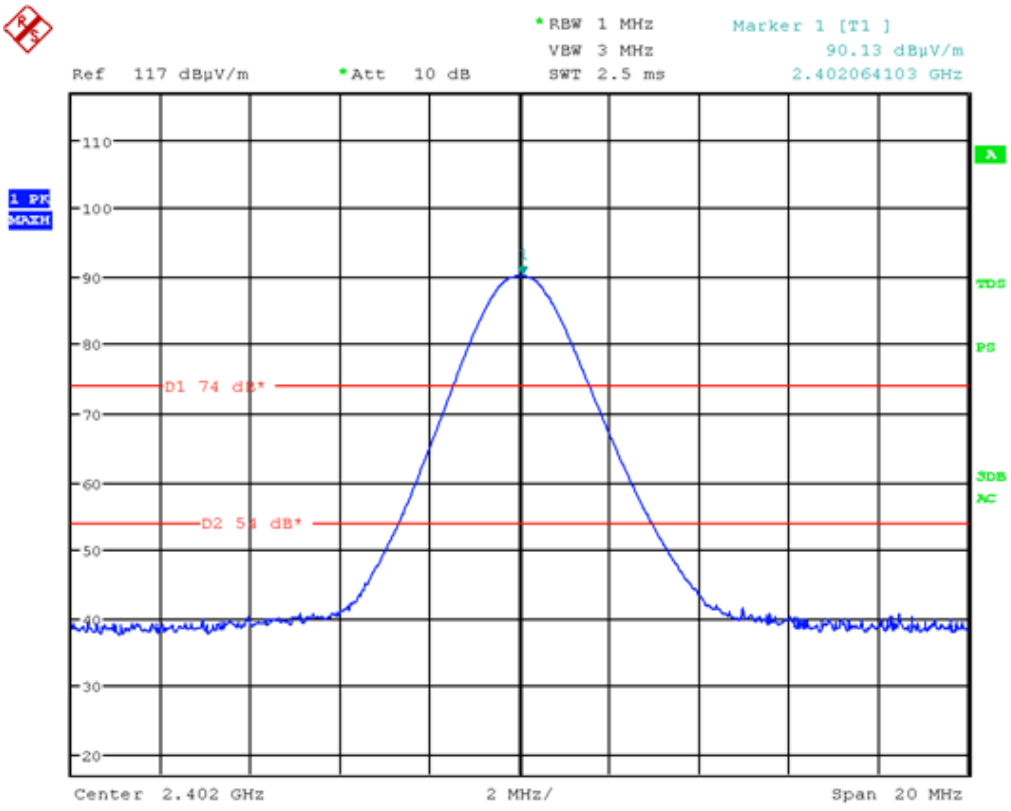
13.8 Test results channel 0

Temperature:	22°C	Humidity:	44%
Tested by:	M. Müller	Test date:	2014-09-17

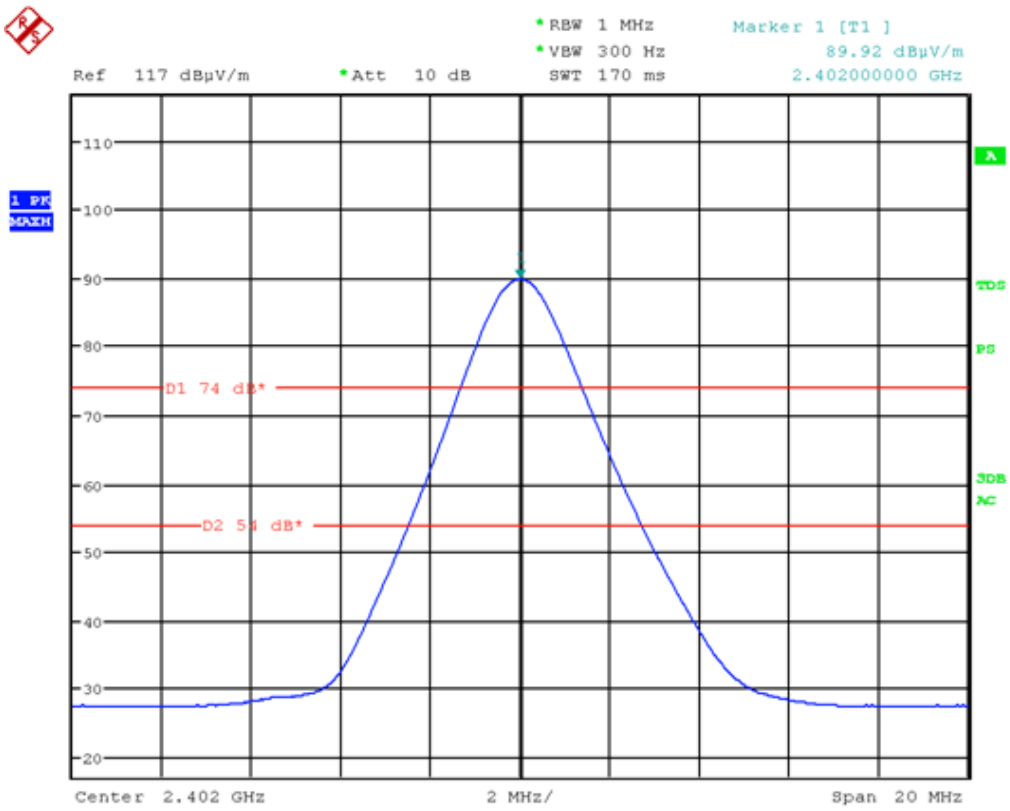
Channel0					
f [GHz]	Reading [dBµV]	Detector	Limit [dbµV]	Restricted Band	Result
2.4020	90.13	PK	- - -	NO	Carrier
2.4020	89.92	AV	- - -		Carrier
4.8040	48.31	PK	74	YES	Pass
4.8040	40.77	AV	54		Pass

Picture 64: Radiated emission 1GHz – 16GHz[1)]

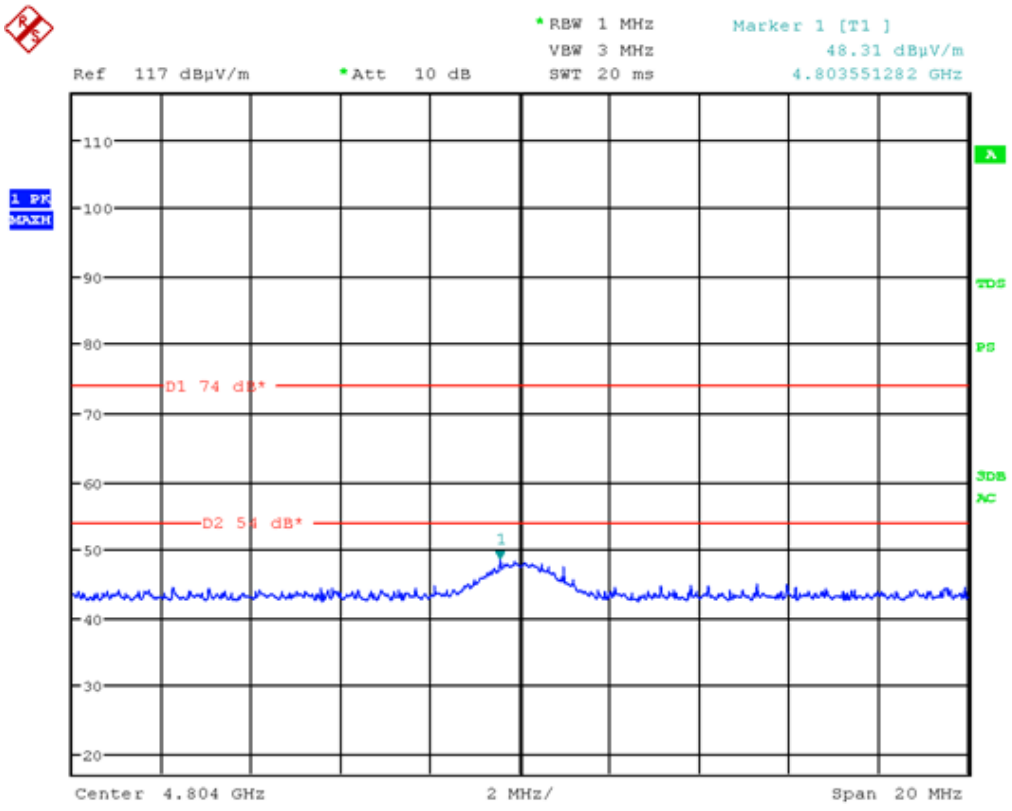
[1)]: above 16GHz no significant emissions were detected



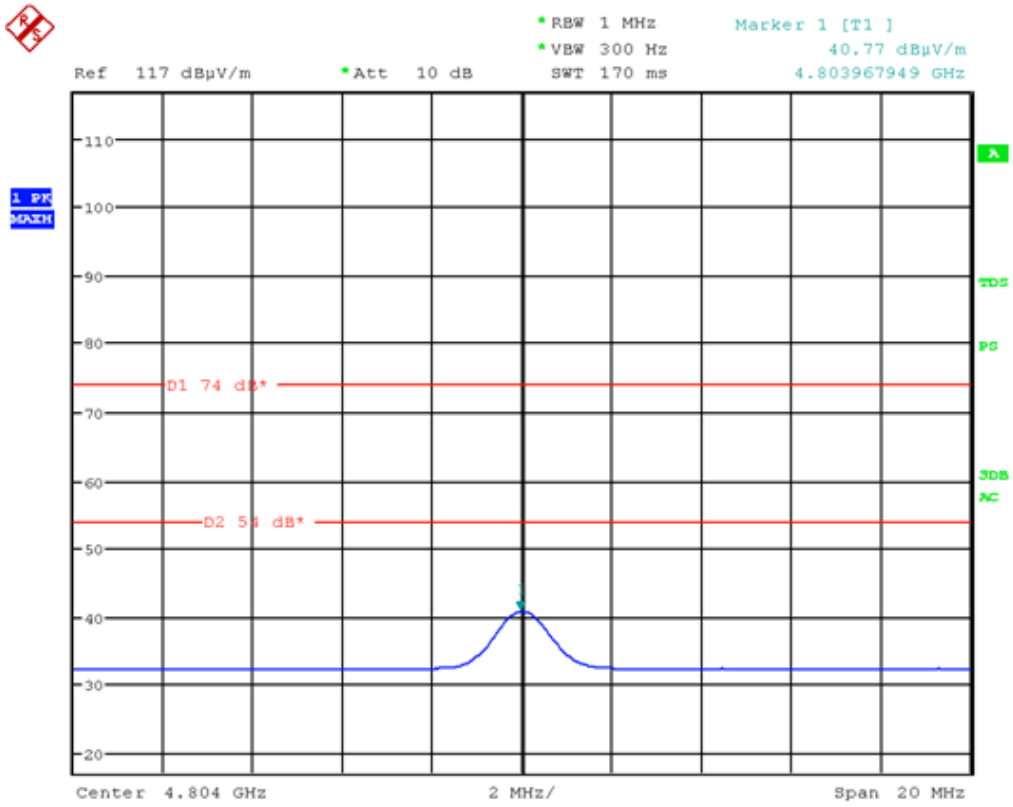
Picture 65: Radiated emission 1GHz – 16GHz - PK



Picture 66: Radiated emission 1GHz – 16GHz - AV



Picture 67: Radiated emission 1GHz – 16GHz - PK



Picture 68: Radiated emission 1GHz – 16GHz - AV

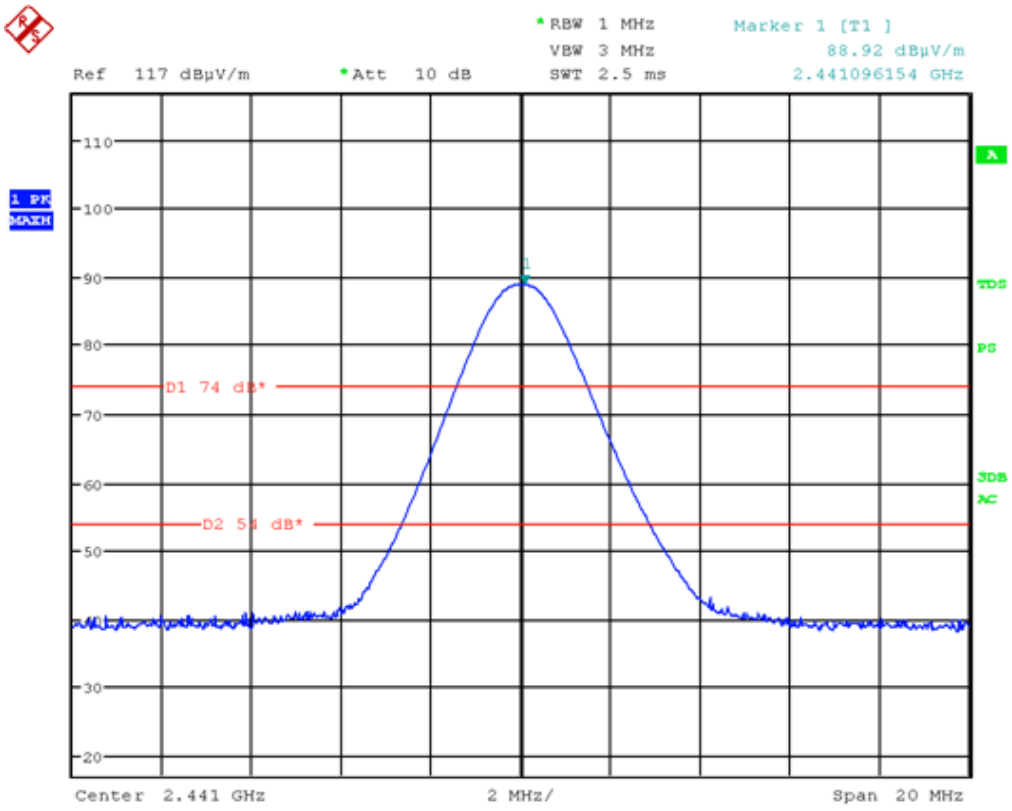
13.9 Test results channel 39

Temperature:	22°C	Humidity:	44%
Tested by:	M. Müller	Test date:	2014-09-17

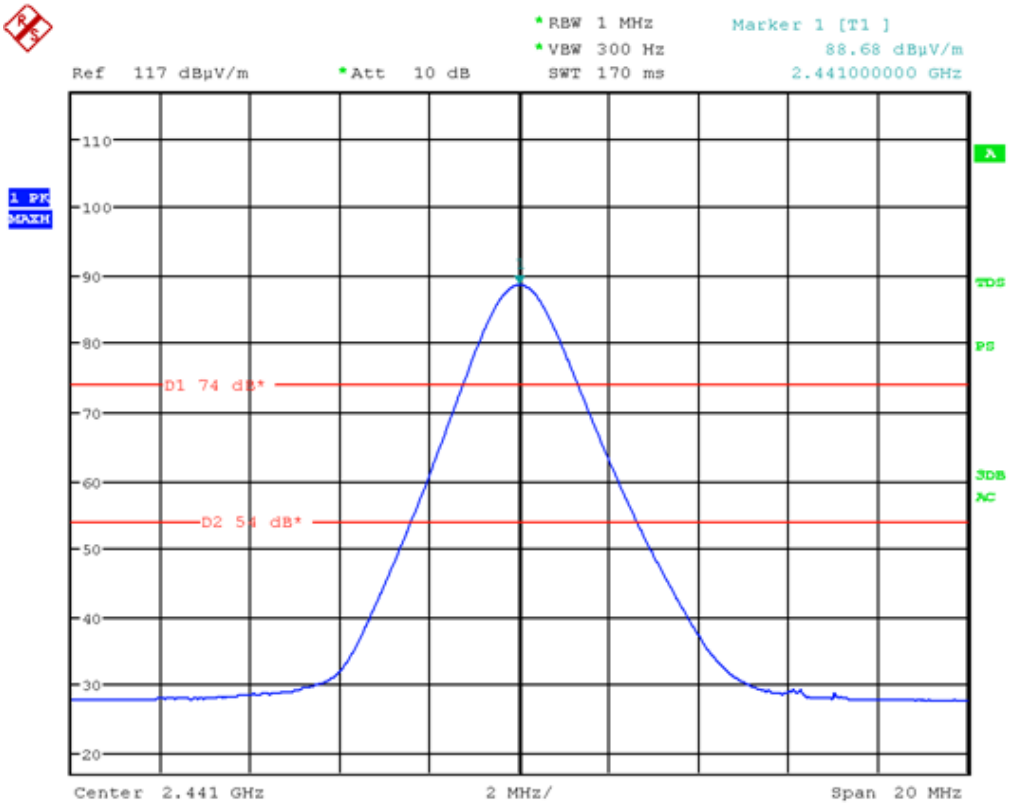
Channel39					
f [GHz]	Reading [dBµV]	Detector	Limit [dbµV]	Restricted Band	Result
2.4410	88.92	PK	- - -	NO	Carrier
2.4410	88.68	AV	- - -		Carrier
4.8820	48.62	PK	74	YES	Pass
4.8820	40.53	AV	54		Pass

Picture 69: Radiated emission 1GHz – 16GHz[1)]

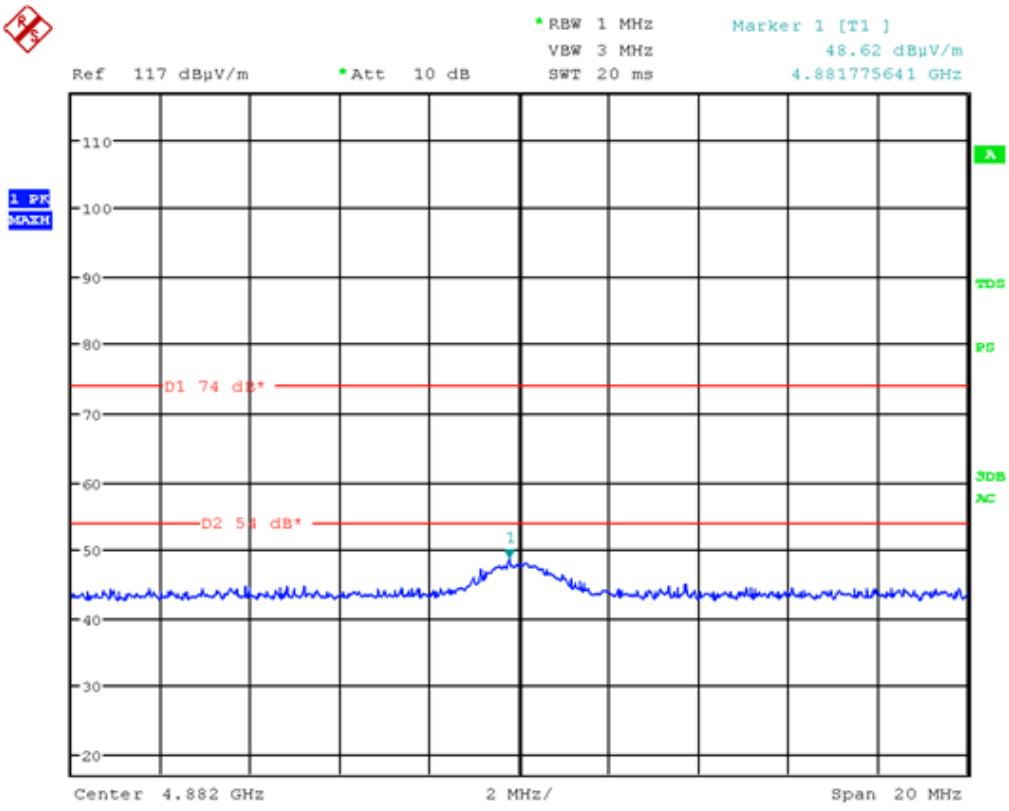
[1)]: above 16GHz no significant emissions were detected



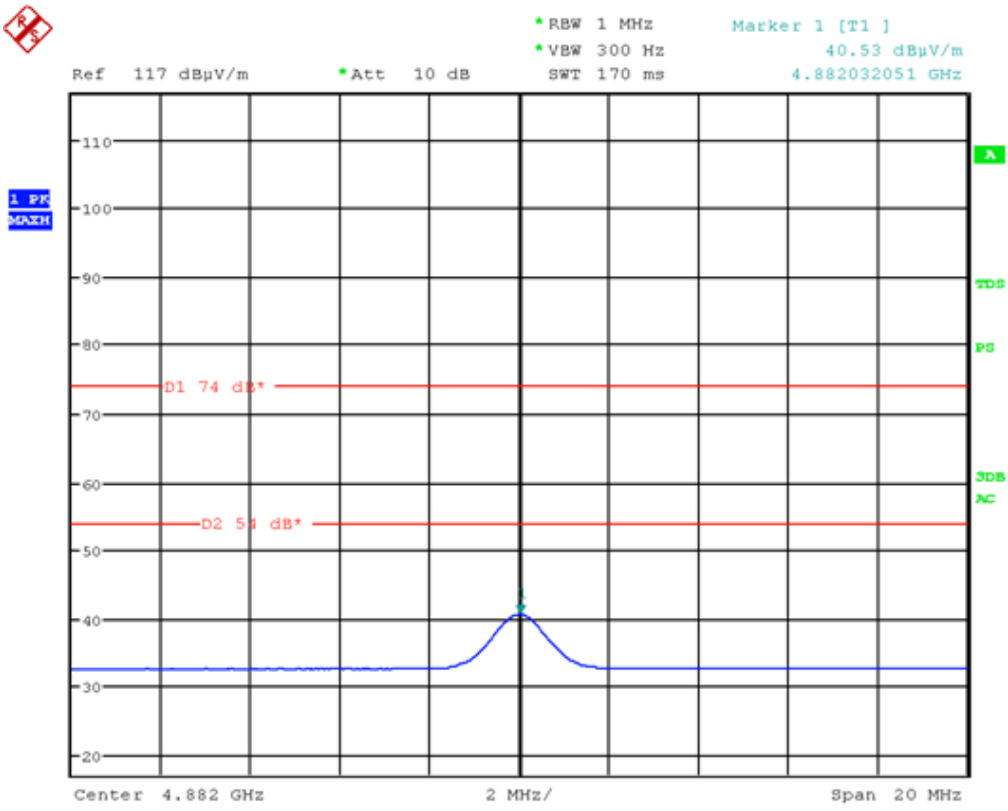
Picture 70: Radiated emission 1GHz – 16GHz - PK



Picture 71: Radiated emission 1GHz – 16GHz - AV



Picture 72: Radiated emission 1GHz – 16GHz - PK



Picture 73: Radiated emission 1GHz – 16GHz - AV

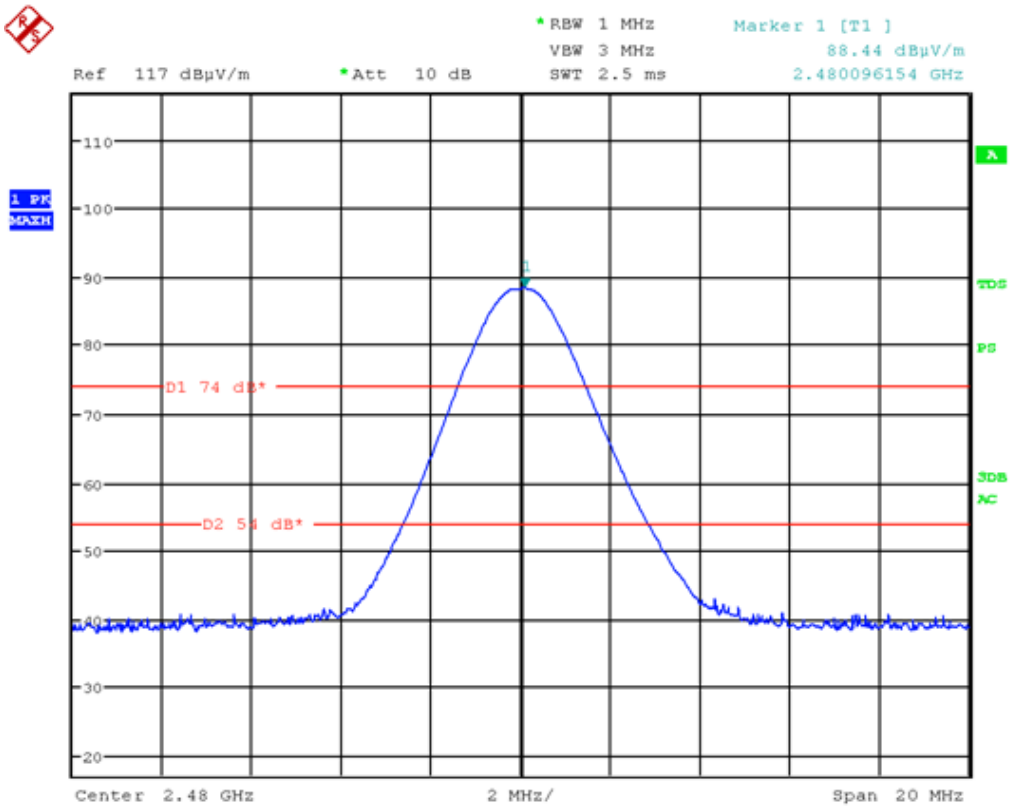
13.10 Test results channel 78

Temperature:	22°C	Humidity:	44%
Tested by:	M. Müller	Test date:	2014-09-17

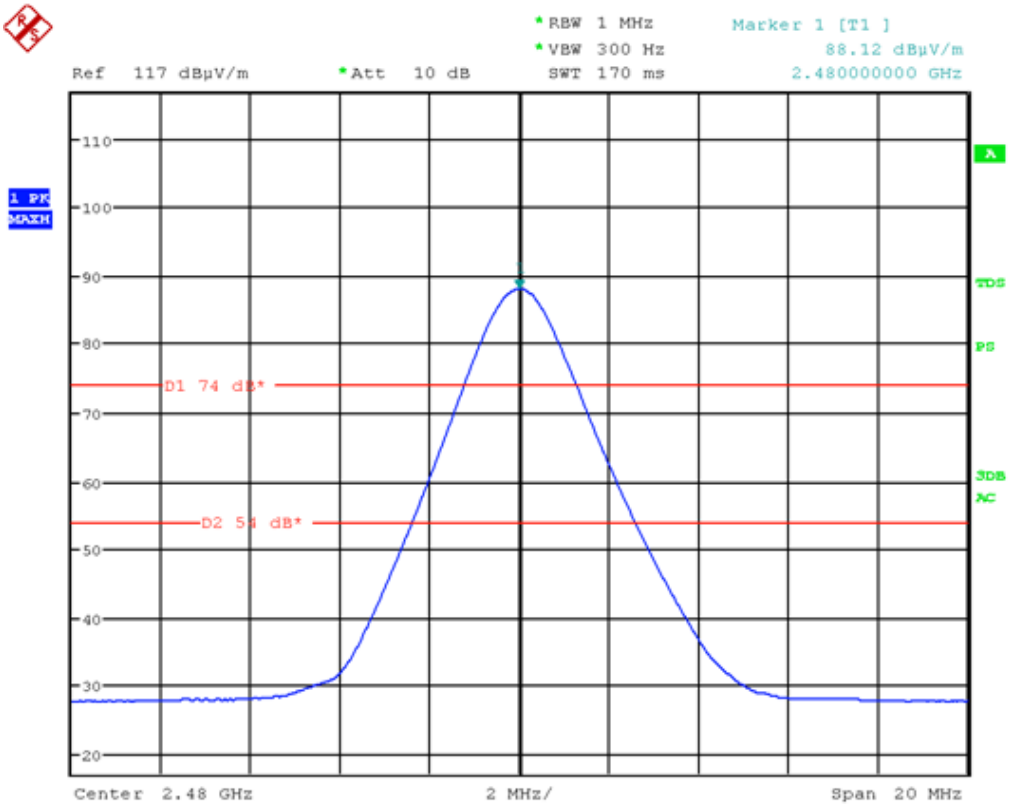
Channel78					
f [GHz]	Reading [dBµV]	Detector	Limit [dbµV]	Restricted Band	Result
2.4800	88.44	PK	- - -	NO	Carrier
2.4800	88.12	AV	- - -		Carrier
4.9600	48.29	PK	74	YES	Pass
4.9600	39.56	AV	54		Pass

Picture 74: Radiated emission 1GHz – 16GHz[1)]

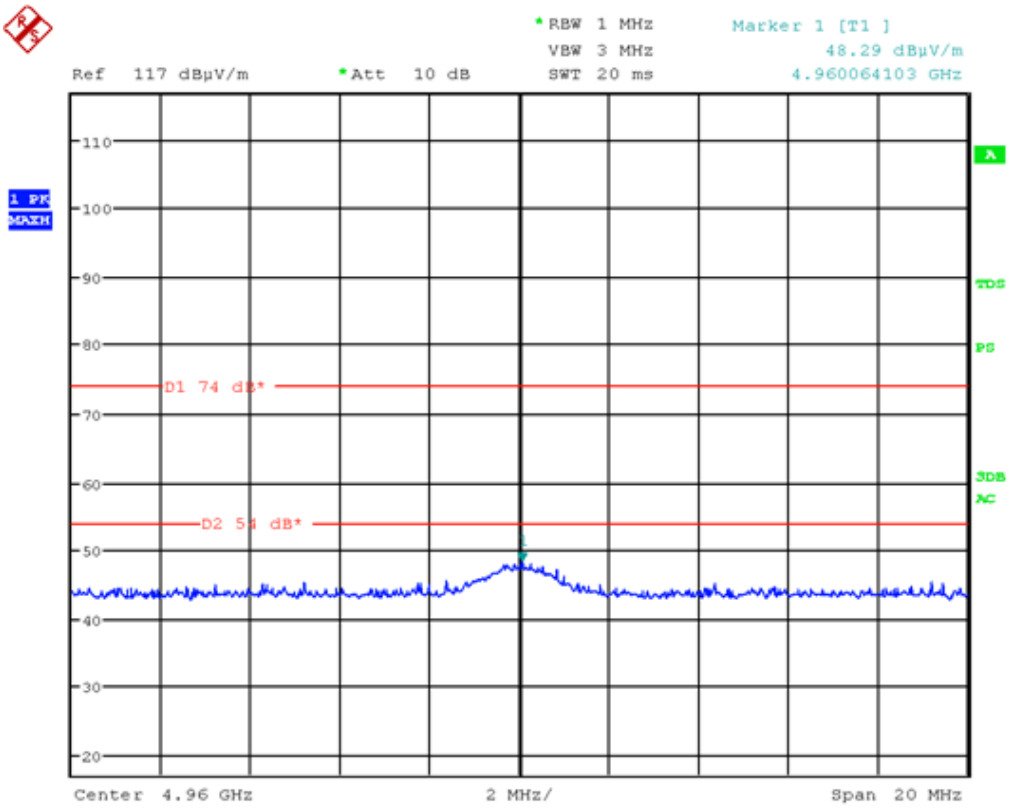
[1)]: above 16GHz no significant emissions were detected



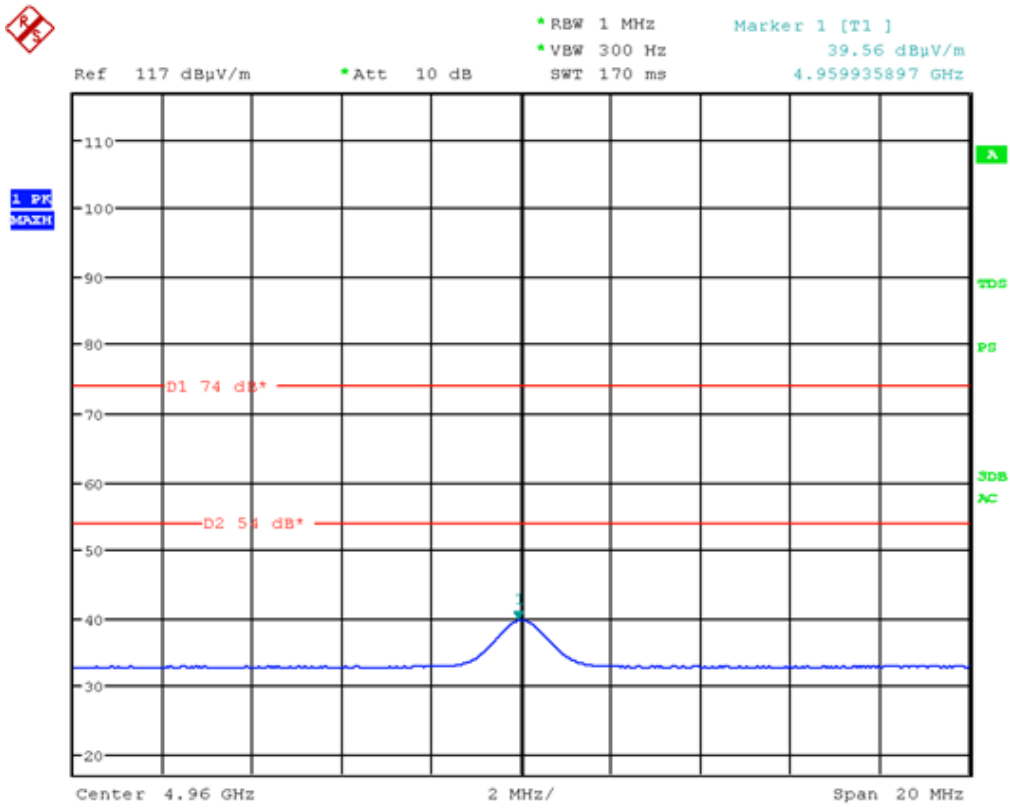
Picture 75: Radiated emission 1GHz – 16GHz - PK



Picture 76: Radiated emission 1GHz – 16GHz - AV



Picture 77: Radiated emission 1GHz – 16GHz - PK



Picture 78: Radiated emission 1GHz – 16GHz - AV

14 Exposure of humans to RF fields

according to CFR 47 Part 2, section 2.1091, Public Notice DA 00-705, RSS-Gen Issue 4, section 3.2, and RSS-102 Issue 4, section 2.5.2

Radiofrequency radiation exposure evaluation for mobile devices

External detachable antenna (see antenna specification)
Gi: 1.7dBi = numeric gain 1.479
Output power conducted: -4.26dBm = 0.375mW
π =3,1416
R=20cm

$$S = \frac{G \cdot CP}{4 * \pi * R^2}$$

G:numerical antenna gain
CP: conducted output power [W]

$$S = \frac{1.479 \cdot 0.375\ mW}{4 * \pi * 400\ cm^2} = 0,000110\ mW / cm^2$$

Limit:
1mW/cm²

15 Equipment calibration status

Description	Modell number	Serial number	Inventory number(s)	Last calibration	Next calibration
Test receiver	ESU 26	100026	W00002	2014-02	2016-02
Test receiver	ESCI 3	100013	E00001	2013-12	2015-12
Test receiver	ESCI 3	100328	E00552	2014-07	2016-07
Test receiver	ESCS 30	825442/0002	E00003	2014-02	2015-02
Test receiver	ESCS 30	845552/0008	E00551	2014-01	2015-01
LISN	ESH2-Z5	881362/037	E00004	2013-03	2015-03
LISN	ESH2-Z5	893406/009	E00005	2014-01	2016-01
Loop antenna	HFH2-Z2	871398/0050	E00004	2014-07	2016-07
Broadband antenna	VULB 9163	9163-114	E00013	2013-09	2015-09
Broadband horn antenna	BBHA 9120D	9120D-593	W00053	2014-03	2016-03
Broadband horn antenna	BBHA 9170	9170-331	W00055	2014-03	2016-03
Shielded room	P92007	B83117C1109T211	E00107	N/A	
Compact Diagnostic Chamber (CDC)	VK041.0174	D62128-A502-A69-2-0006	E00026	N/A	
Open area test site (OATS)	---	---	E00354	2014-10	2015-10
Climatic chamber 340 l	VC³ 4034	58566123250010	C00015	2014-09	2016-09
Cable set shielded room	Cable no. 30	---	E00424	2014-07	2015-07
Cable set CDC	Cables no. 37 and 38	---	E00459 E00460	2014-05	2015-05
Cable set OATS 3 m	Cables no. 19, 34 and 36	---	E00453 E00456 E00458	2014-10	2015-10
Cable set OATS 10 m	Cables no. 19, 33 and 36	---	E00453 E00455 E00458	2014-10	2015-10
Cable set anechoic chamber 01	Cables no. 01, 09, 11 and 13	---	W00095 E00307 E00319 E00436	2014-04	2015-04

Description	Modell number	Serial number	Inventory number(s)	Last calibration	Next calibration
Cable set anechoic chamber 02	Cables no. 01, 09, 12 and 14	---	W00095 E00307 E00320 E00437	2014-04	2015-04

Table 1: Equipment calibration status

Note: Expiration date of measurement facility registration (OATS) by
- FCC (registration number 221458): 2017-04
- Industry Canada (test site number 3472A-1): 2015-10

16 Measurement uncertainty

Description	Max. deviation	k=
Conducted emission AMN (9kHz to 30 MHz)	± 4,0 dB	2
Radiated emission open field (30 MHz to 1 GHz)	± 4,5 dB	2
Radiated emission absorber chamber (> 1000 MHz)	± 5,4 dB	2

Table 2: Measurement uncertainty

Comment: The uncertainty stated is the expanded uncertainty obtained by multiplying the standard uncertainty by the coverage factor k. If k=2 the value of the measurements lies within the assigned range of values with a probability of 95 %.

17 Summary

The EMC Regulations according to the marked specifications are

☑ KEPT

The EUT does fulfill the general approval requirements mentioned.

☐ NOT KEPT

The EUT does not fulfill the general approval requirements mentioned.

Place, Date: Straubing, December 3rd, 2014

Martin Müller	Rainer Heller
Test engineer	Head of EMC / radio department
EMV **TESTHAUS** GmbH	EMV **TESTHAUS** GmbH

18 Revision History

Date	Description	Person	Revision
2014-12-03	First edition	M. Müller	- - - -