Test Report

Customer:

Arnold & Richter Cine Technik GmbH & Co
Betriebs KG.

Türkenstrasse 89
80799 München

Tel.: +49 89 3809-0
Fax +49 89 3809-1244

RF test report

140719-AU02+W02

Arnold & Richter Cine Technik GmbH & Co Betriebs KG.

RF module 2.4 GHz

EMIP300

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

EMV **TESTHAUS** GmbH

Gustav-Hertz-Straße 35
94315 Straubing
Tel.: +49 9421 56868-0
Fax: +49 9421 56868-100
Email: info@emv-testhaus.com

Accreditation:

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

FCC facility registration number: 221458
Test Firm Type “2.948 listed”: Valid until 2017-04-22
Test Firm Type “accredited”: Valid until 2015-06-11
MRA US-EU, FCC designation number: DE0010
BnetzA-CAB-02/21-02/04 Valid until 2018-11-27

Industry Canada test site number: 3472A-1
Registration expiry date: 2015-10-02

Test Laboratory:

EMV **TESTHAUS** GmbH
Gustav-Hertz-Straße 35
94315 Straubing
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

47 CFR Part 2 October 2014	Code of Federal Regulations Part 2 (Frequency allocation and radio treaty matters; General rules and regulations) of the Federal Communication Commission (FCC)
47 CFR Part 15 October 2014	Code of Federal Regulations Part 15 (Radio Frequency Devices) of the Federal Communication Commission (FCC)
KDB Publication no. 558074 June 5, 2014	Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247
OET Bulletin 65 August 1997	Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields
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
ANSI C63.10 June 2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
RSS-Gen Issue 4, November 2014	General Requirements for Compliance of Radio Apparatus
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

1.1 Cross reference of FCC and Industry Canada standards

47 CFR Part and Section	Test	Equivalent to IC
15.207	AC power line conducted emissions 150 kHz to 30 MHz	RSS-Gen Issue 4 section 8.8
15.247(a)(2) KDB 558074, section 8	6 dB bandwidth	RSS-210 Issue 8, section A 8.2
15.247(a)(1)	20 dB bandwidth[1]	RSS-210 Issue 8, section A 8.1(a)
2.202(a)	Occupied bandwidth	RSS-Gen Issue 4, section 6.6
15.247(b) KDB 558074, section 9	Maximum peak conducted output power	RSS-Gen Issue 4, section 6.12 RSS-210 Issue 8, A 8.4
15.247(d)	Band-edge compliance	RSS-210 Issue 8, section A 8.5
15.247(e) KDB 558074, section 10	Power spectral density	RSS-210 Issue 8, section A 8.2
15.247(d)	Spurious RF Conducted Emission	RSS-210 Issue 8, section A 8.5
15.247(d)	Radiated emission 9 kHz to 10th harmonic	RSS-Gen Issue 4, section 6.13 RSS-210 Issue 8, section A 8.5
2.1091	Radio frequency radiation exposure evaluation for mobile devices	RSS-Gen Issue 4, section 3.2 Exempted from SAR and RF evaluation

[1] For DTS equipment recorded for information only.

1.2 Summary of test results

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

2 Equipment under Test (EUT)

Product type:	RF module 2.4 GHz
Model Name:	EMIP300
Manufacturer:	Arnold & Richter Cine Technik GmbH & Co Betriebs KG.
Serial number(s):	006
FCC ID:	Y7N-EMIP300
IC:	9482A-EMIP300
Application freq. band:	2400 MHz to 2483.5 MHz
Frequency range:	2405MHz to 2480 MHz
Operating frequency:	2405MHz to 2480 MHz
Channel spacing:	5 MHz
Number of RF-channels:	16
Type of modulation:	DSSS
Antenna type:	detachable antenna, for more detailed information see table below
Antenna connectors:	2
Antenna diversity:	☒ yes ☐ no
Power supply:	Powered by battery supplied remote control Nominal voltage: 3.3 V DC
Temperature range:	-20°C to +60°C

Specified antennas for EMIP300

No.	*Type*	*Manufacturer*	*Model*	*Gain[1)] [dBi]*	*Frequency range [GHz]*	*Radiation*
1	Swivel antenna, half wave dipole	Nearson	131	2.0	2.4 - 2.5	Omni-directional
2	Half wave dipole	Radiall/Larsen	R380.500.125	2.0	2.4 - 2.5	Omni-directional
3	Customized antenna	ARRI Austria (HFB Elektronik)	WCU	-2.6	2.405 - 2.480	---

Antenna no. 1 with maximum gain was selected for testing (see annex B).

[1)] specifications without antenna cable

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 RF module which uses the 2.4-GHz-band and which is integrated in movie cameras and remote controls for movie cameras.

During pre-measurements it was investigated which EUT and antenna position is the respective worst-case. Additionally as specified by manufacturer intended antenna polarization is vertical. For the module no such position is specified. Therefore final tests were performed with module in worst-case position of 3 orthogonal directions and antenna in vertical polarization.
The EUT positions including antenna direction are documented in annex A.

2.3 Operation mode

The EUT was set to the measured channels. Further the following adjustments were set:

Tx-mode:
- Modulated continuous wave for bandwidth measurements
- PRBS-mode for all other measurements
- Channel settings: see table 1
- Antenna settings: Ant00, Ant01

Channel	Power level	Selected for testing
11	8	**yes**
12	11	no
13	15	**yes**
14 to 17	15	no
18	15	**yes**
19 to 23	15	no
24	15	**yes**
25	11	no
26	8	**yes**

Table 1: Channel settings for TX mode

Reference point for all conducted measurements is connector plug of module. Therefore all reading values were corrected by the attenuation of the test cable and the antenna cable (see Table 2).

2.4 Configuration

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

Device	Model:	S/N
RF module 2.4 GHz	EMIP300	006
FUJITSU Notebook	Lifebook A531	YLDS013094
Adapter RS232	- - - -	- - - -
Power supply	Input 120V/60Hz /Output 0-30V DC Statron 3252.1	1201211
Multimeter	Gossen METRAhit 29S	E00099

Used cables

Count:	Description: (type / lengths / remarks)	Serial No
2	DC cable / 1.5m / unshielded	N/A
1	Adapter antenna cable (MMCX / SMA-connector) / 0.1m / coax / attenuation see Table 2	N/A

Channel	Frequency [GHz]	test cable attenuation [dB]	antenna cable attenuation [dB]	cable correction [dB]
11	2.405	0.55	0.47	**1.02**
13	2.415	0.55	0.51	**1.06**
18	2.440	0.55	0.52	**1.07**
24	2.470	0.56	0.46	**1.02**
26	2.480	0.56	0.44	**1.00**

Table 2: Cable corrections

3 AC power line conducted emissions

according to 47 CFR 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]	Average [dBµV]
0.15 – 0.5	66 - 56	56 – 46
0.5 – 5.0	56	46
5 – 30	60	50

3.4 Test results

This test was not applied because the EUT is powered by battery supplied remote control having no port to be connected to AC mains.
The belonging battery can only be charged by a separate station.

4 6 dB bandwidth

according to 47 CFR Part 15, section 15.247(a), and KDB Publication no. 558074, section 8

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

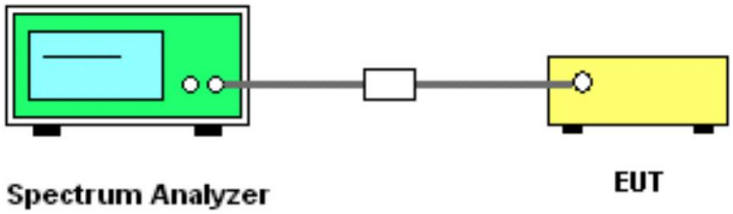
4.3 Limits

The minimum 6 dB bandwidth shall be at least 500kHz

4.4 Test procedure

1. The test is performed in accordance with FCC KDB publication no. 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 was set to 100 kHz with video bandwidth at least equal to three times the resolution bandwidth.
5. The maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission were recorded.

4.5 Test setup



Picture 1: Test setup for 6 dB bandwidth measurement

4.6 Test deviation

There is no deviation with the original standard.

4.7 EUT operation during test

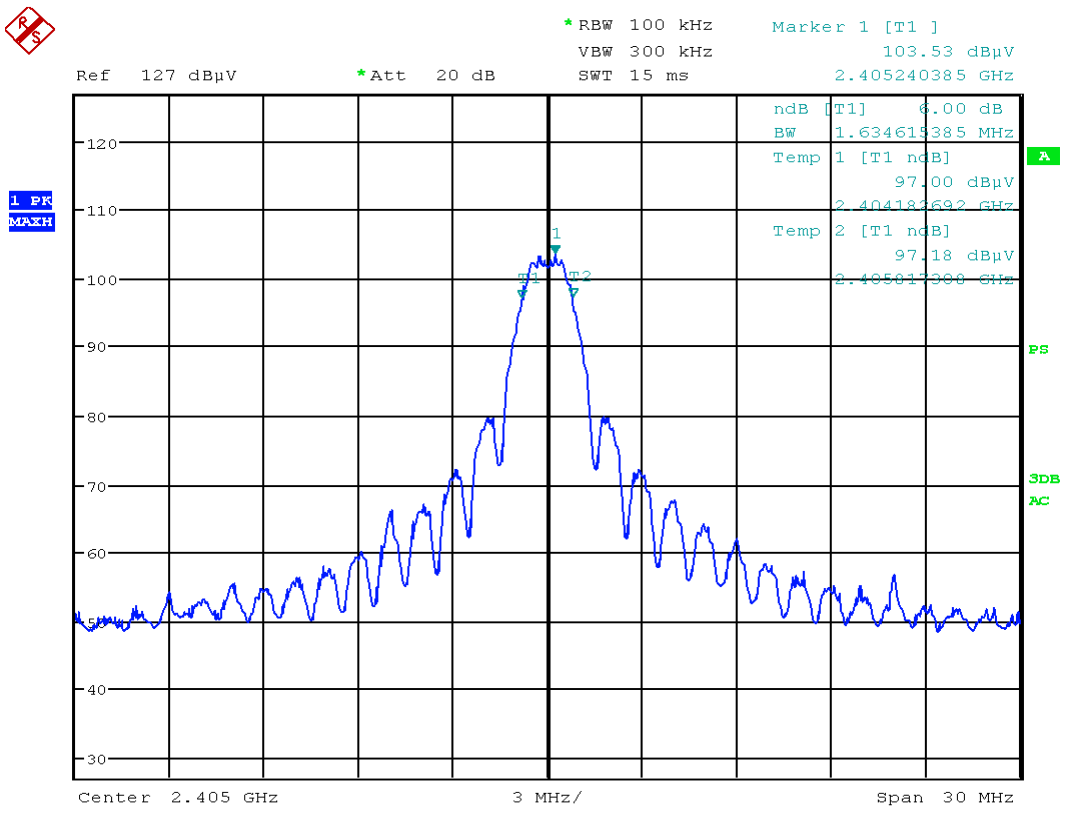
The EUT was programmed to be in continuously transmitting mode.

4.8 Test results

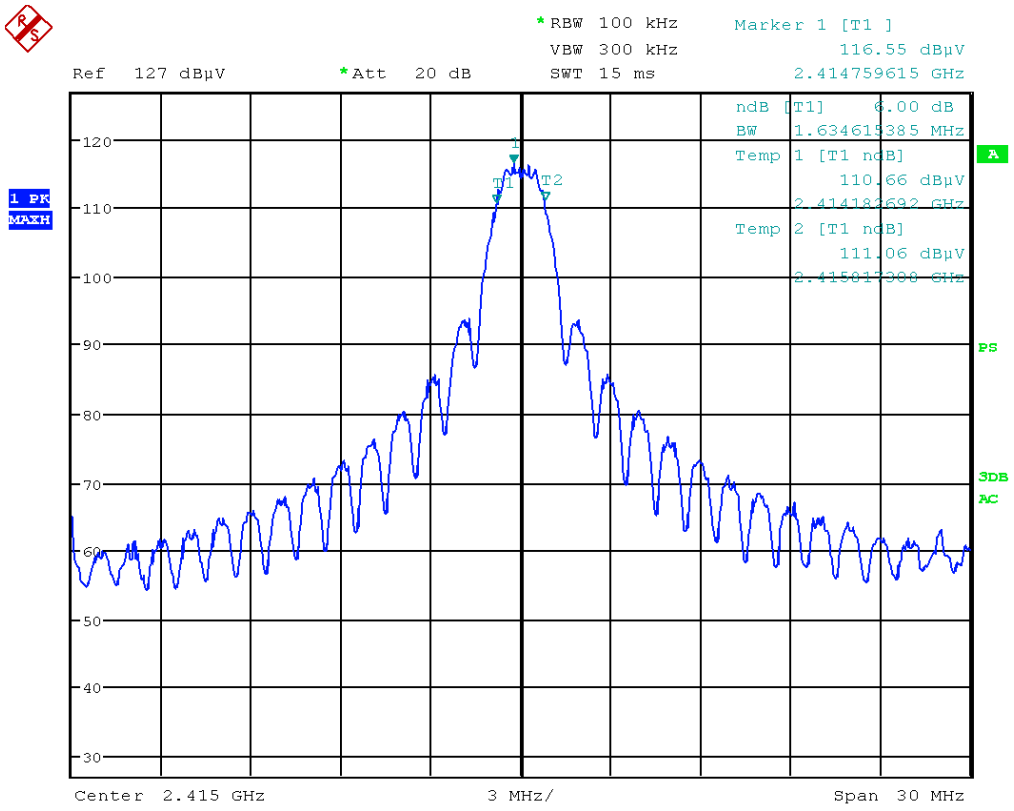
Temperature:	19°C	Humidity:	44%
Tested by:	M. Müller	Test date:	2015-01-12

Antenna	Channel	Frequency (GHz)	6 dB bandwidth (MHz)
00	11	2.4052	1.6346
00	13	2.4148	1.6346
00	18	2.4398	1.6346
00	24	2.4698	1.5385
00	26	2.4798	1.6346

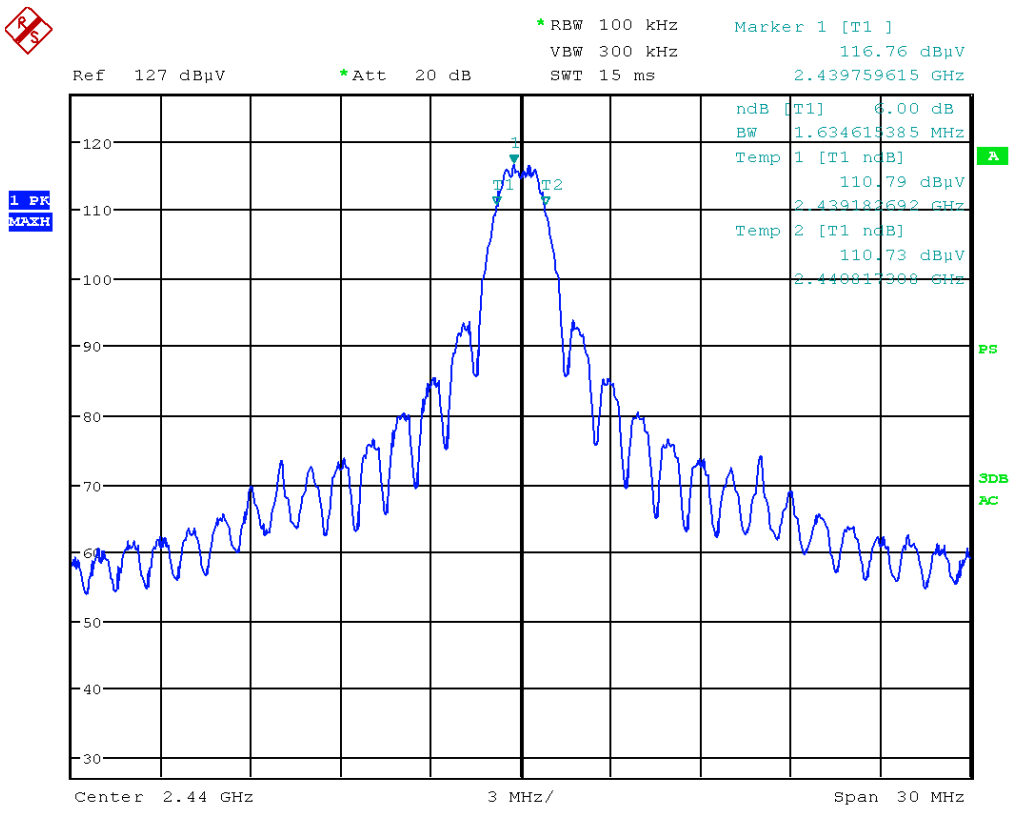
Antenna	Channel	Frequency (GHz)	6 dB bandwidth (MHz)
01	11	2.4047	1.6346
01	13	2.4148	1.6346
01	18	2.4398	1.6346
01	24	2.4702	1.6346
01	26	2.4798	1.6346



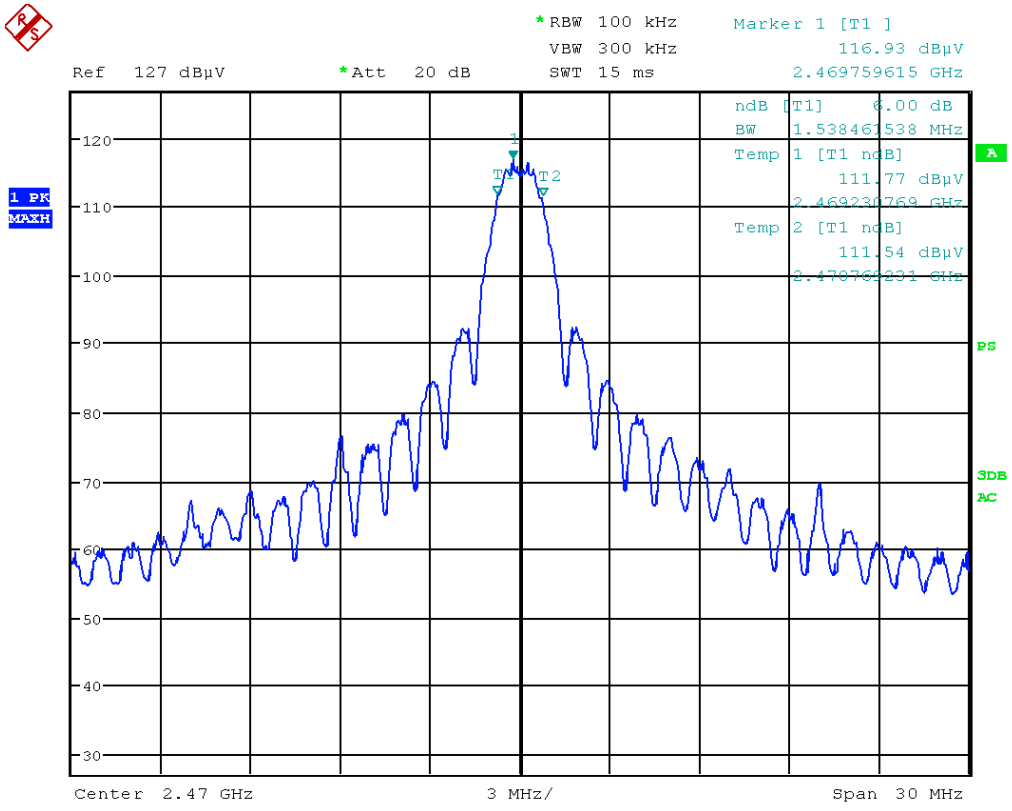
Picture 2: 6dB bandwidth ant00, channel 11



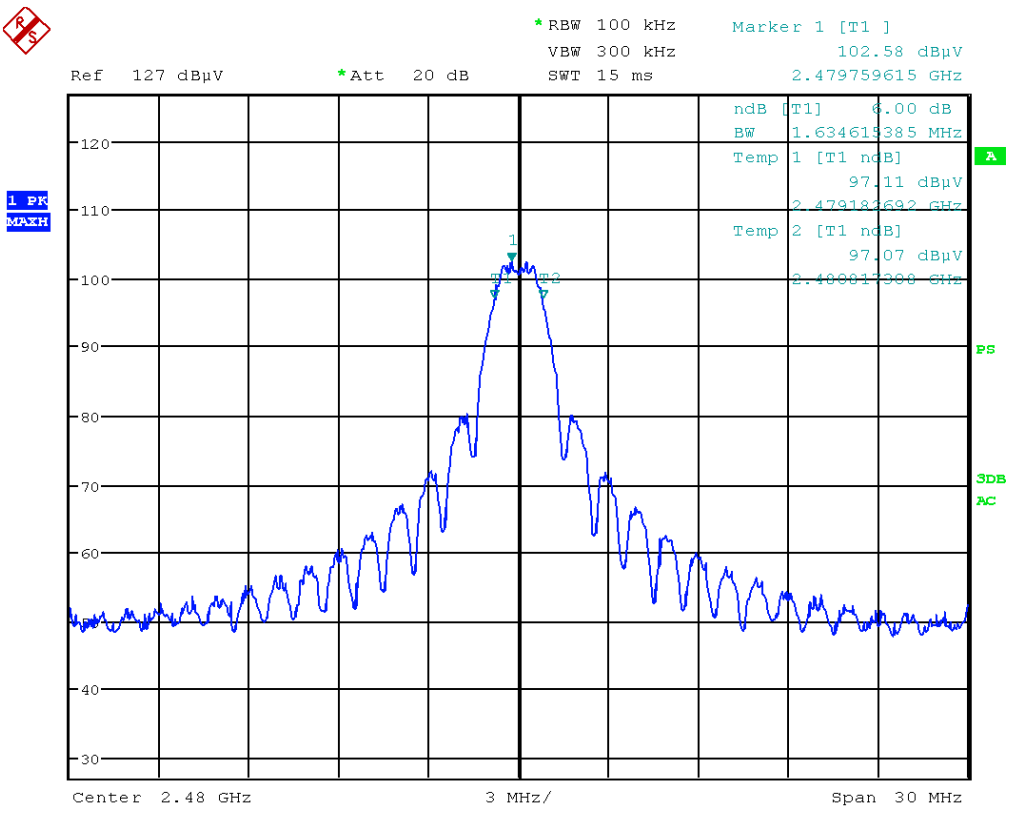
Picture 3: 6dB bandwidth ant00, channel 13



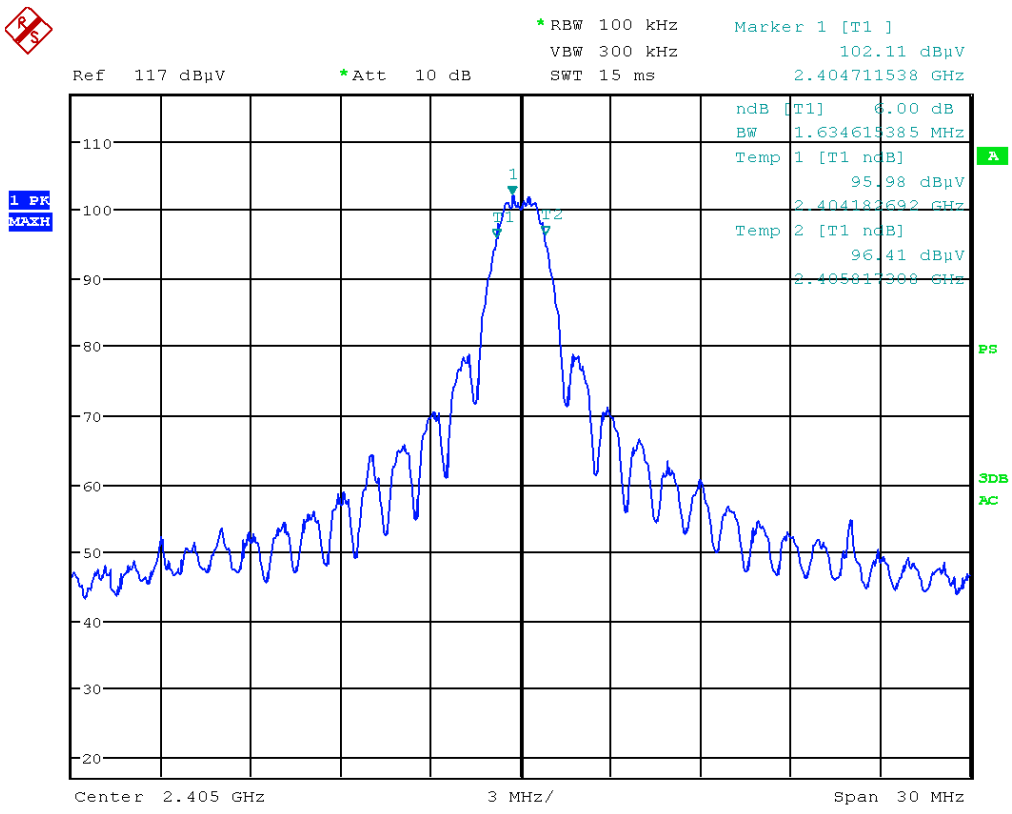
Picture 4: 6dB bandwidth ant00, channel 18



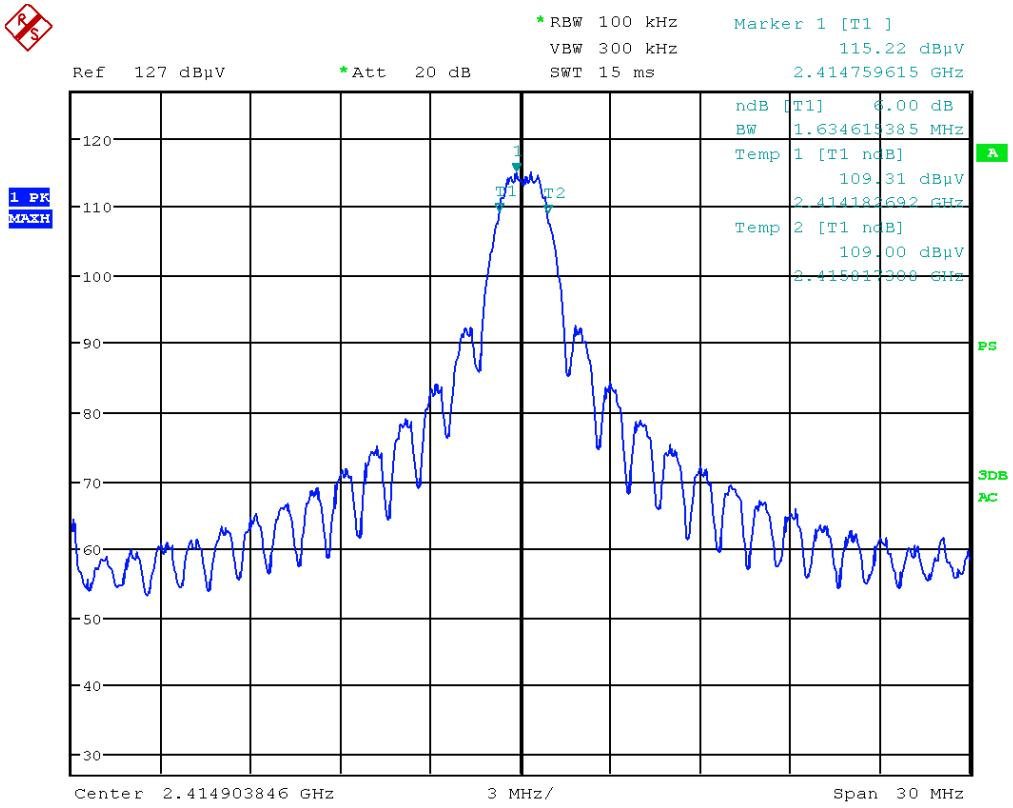
Picture 5: 6dB bandwidth ant00, channel 24



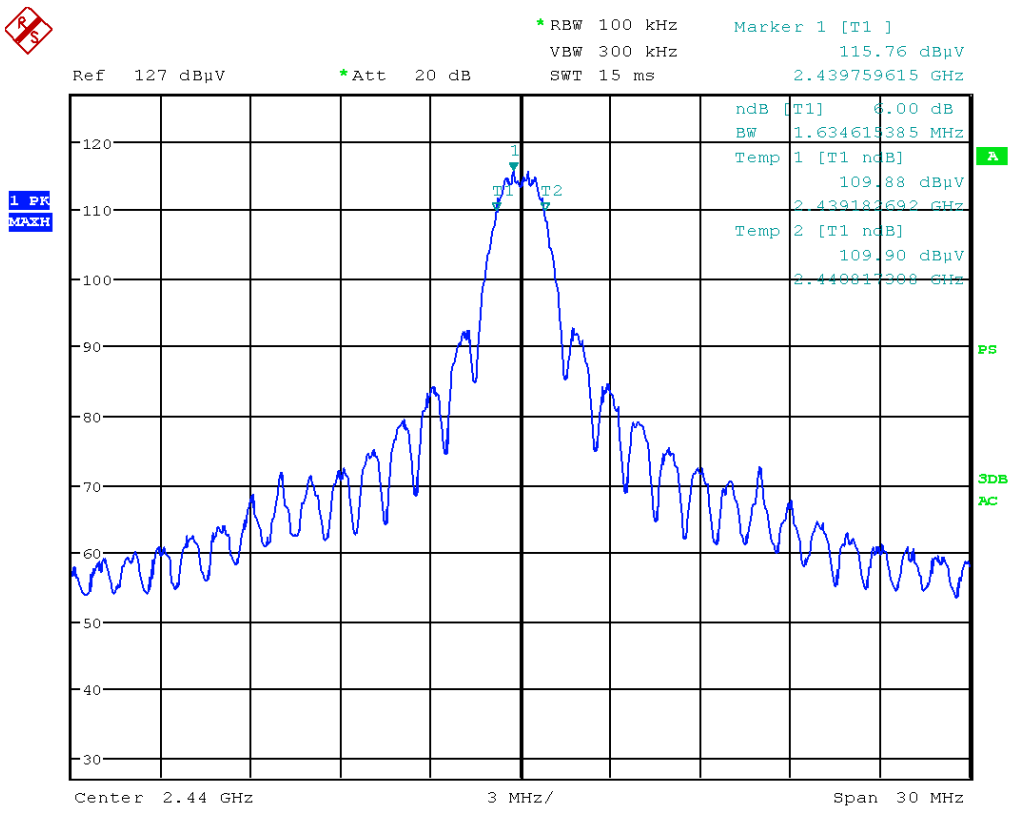
Picture 6: 6dB bandwidth ant00, channel 26



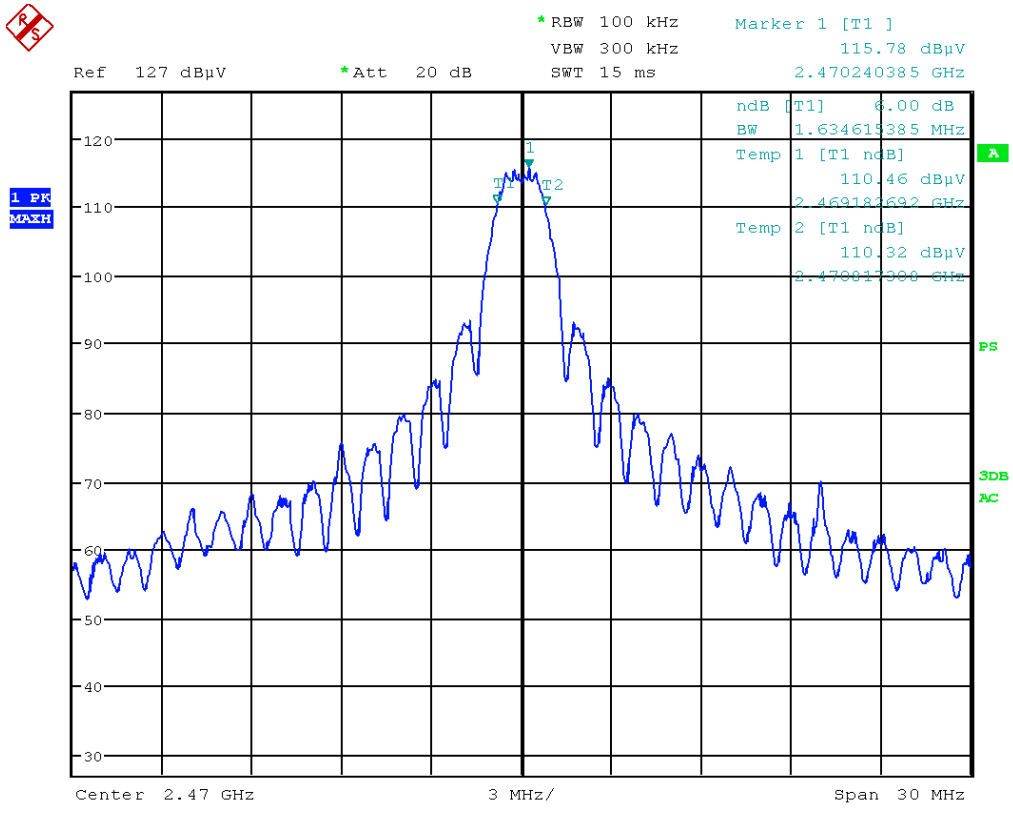
Picture 7: 6dB bandwidth ant01, channel 11



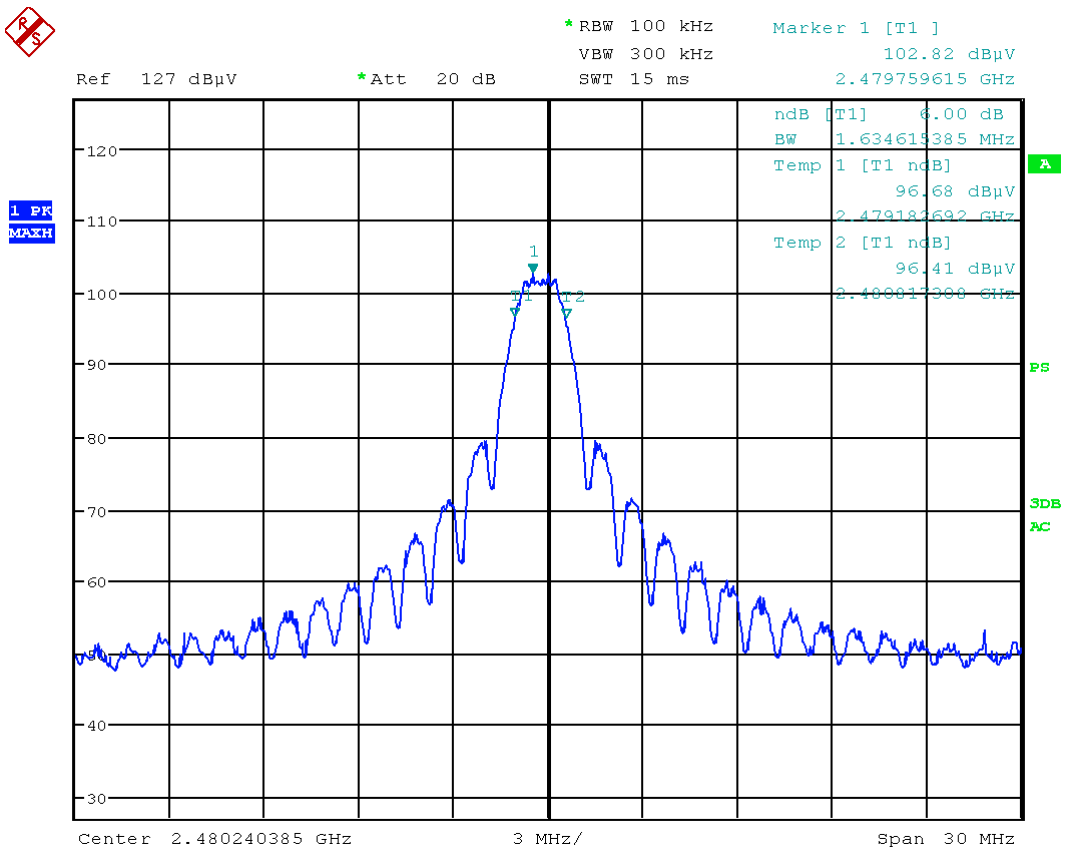
Picture 8: 6dB bandwidth ant01, channel 13



Picture 9: 6dB bandwidth ant01, channel 18



Picture 10: 6dB bandwidth ant01, channel 24



Picture 11: 6dB bandwidth ant01, channel 26

5 20 dB bandwidth

according to 47 CFR Part 15, section 15.247(a)

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

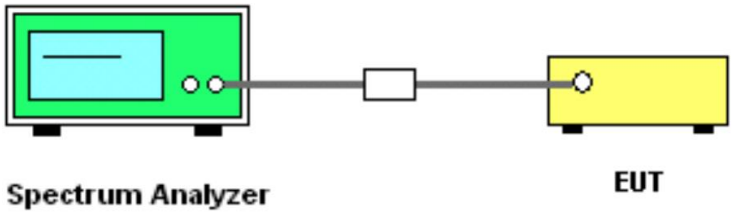
5.3 Limits

N/A

5.4 Test procedure

1. The transmitter output (antenna port) was connected to the spectrum analyzer in peak hold mode.
2. The unit was operated in continuous transmit mode with modulation.
3. The resolution bandwidth was set to equal or greater than 1.0% of the emission bandwidth with video bandwidth at least equal to resolution bandwidth.
4. The maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 20 dB relative to the maximum level measured in the fundamental emission were recorded.

5.5 Test setup



Picture 12: Test setup for 20 dB bandwidth measurement

5.6 Test deviation

There is no deviation with the original standard.

5.7 EUT operation during test

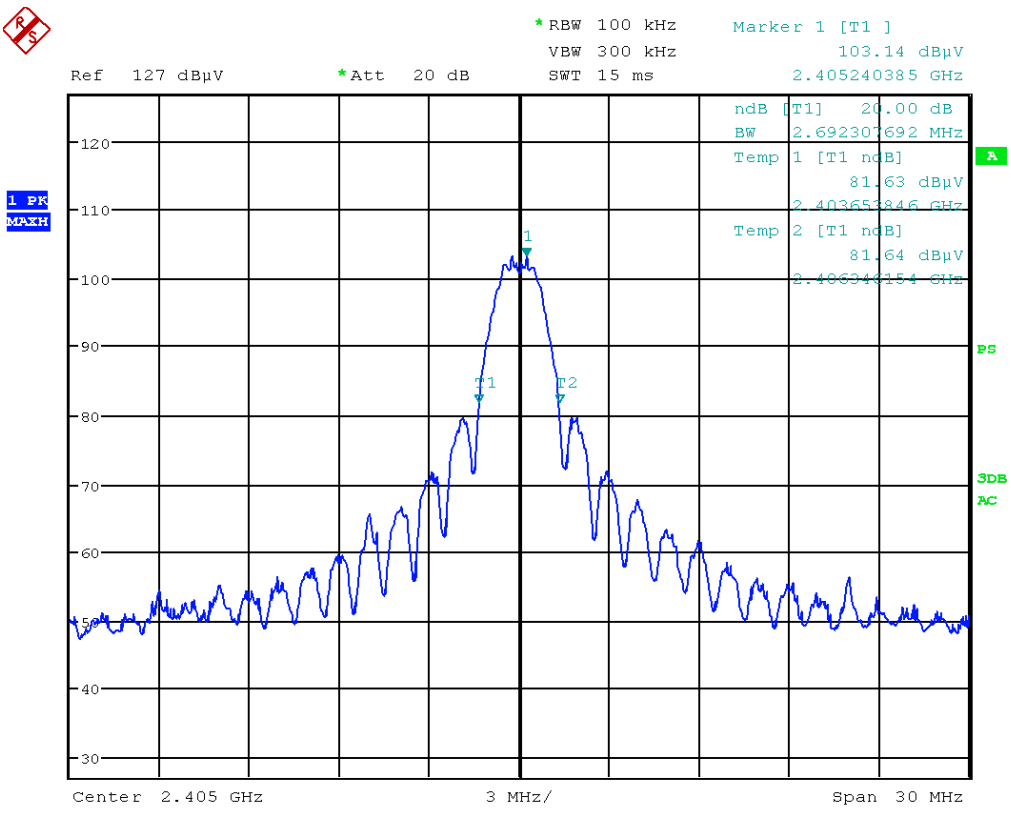
The EUT was programmed to be in continuously transmitting mode.

5.8 Test results

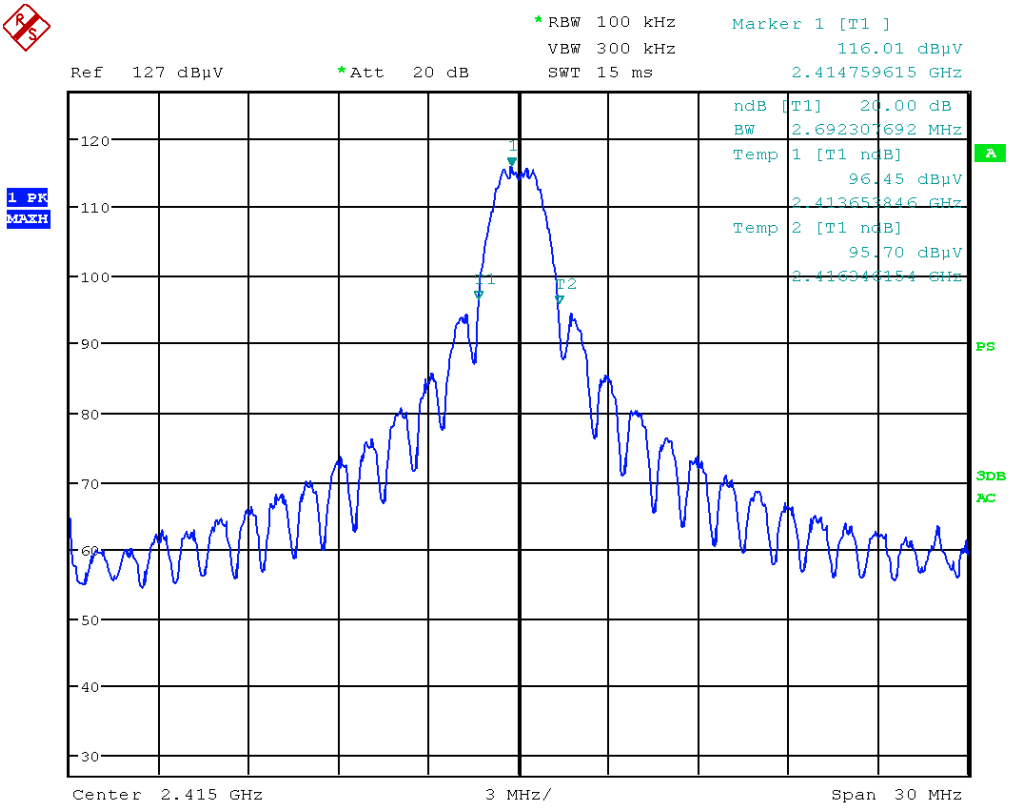
Temperature:	19°C	Humidity:	44%
Tested by:	M. Müller	Test date:	2015-01-12

Antenna	Channel	Frequency (GHz)	20 dB bandwidth (MHz)
00	11	2.4052	2.6923
00	13	2.4148	2.6923
00	18	2.4402	2.6923
00	24	2.4697	2.6923
00	26	2.4802	2.6923

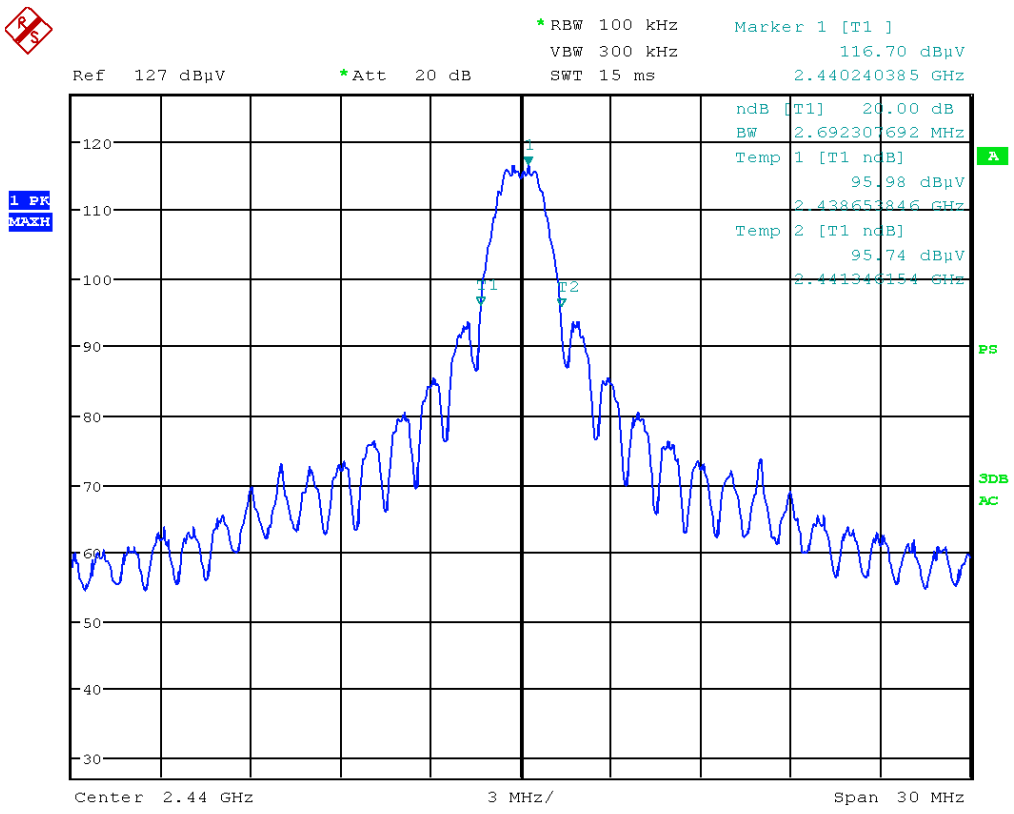
Antenna	Channel	Frequency (GHz)	20 dB bandwidth (MHz)
01	11	2.4048	2.6923
01	13	2.4148	2.6923
01	18	2.4397	2.6923
01	24	2.4698	2.6923
01	26	2.4797	2.6923



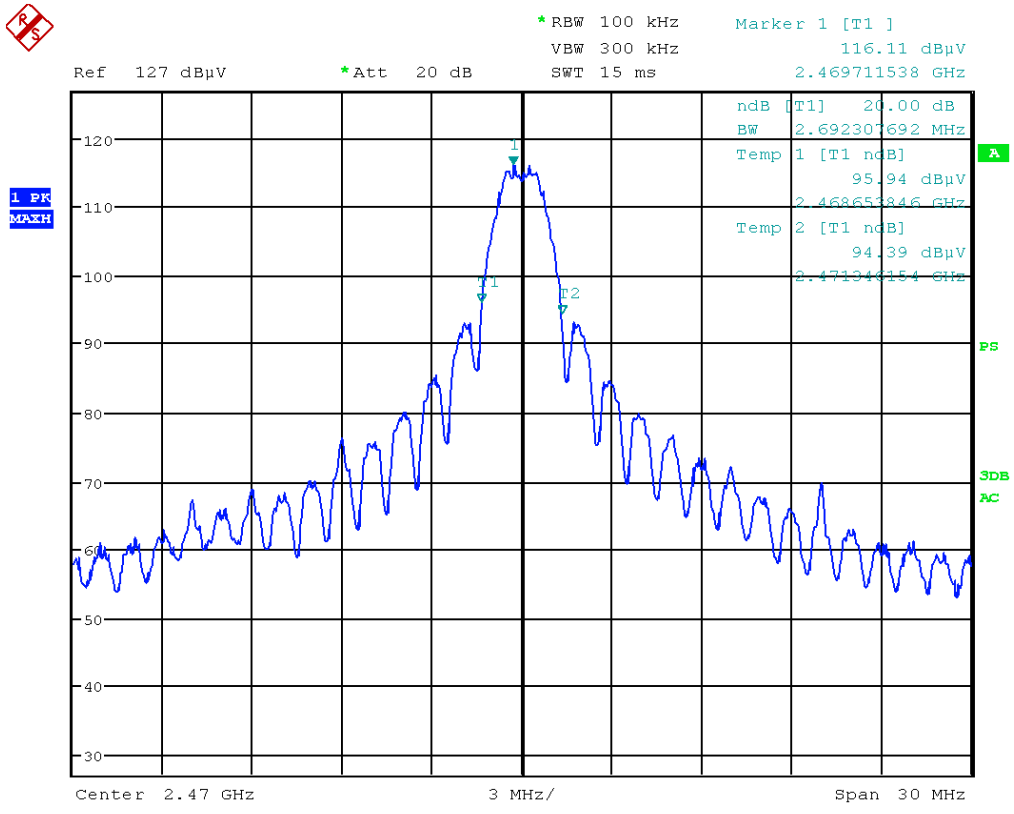
Picture 13: 20dB bandwidth ant00, channel 11



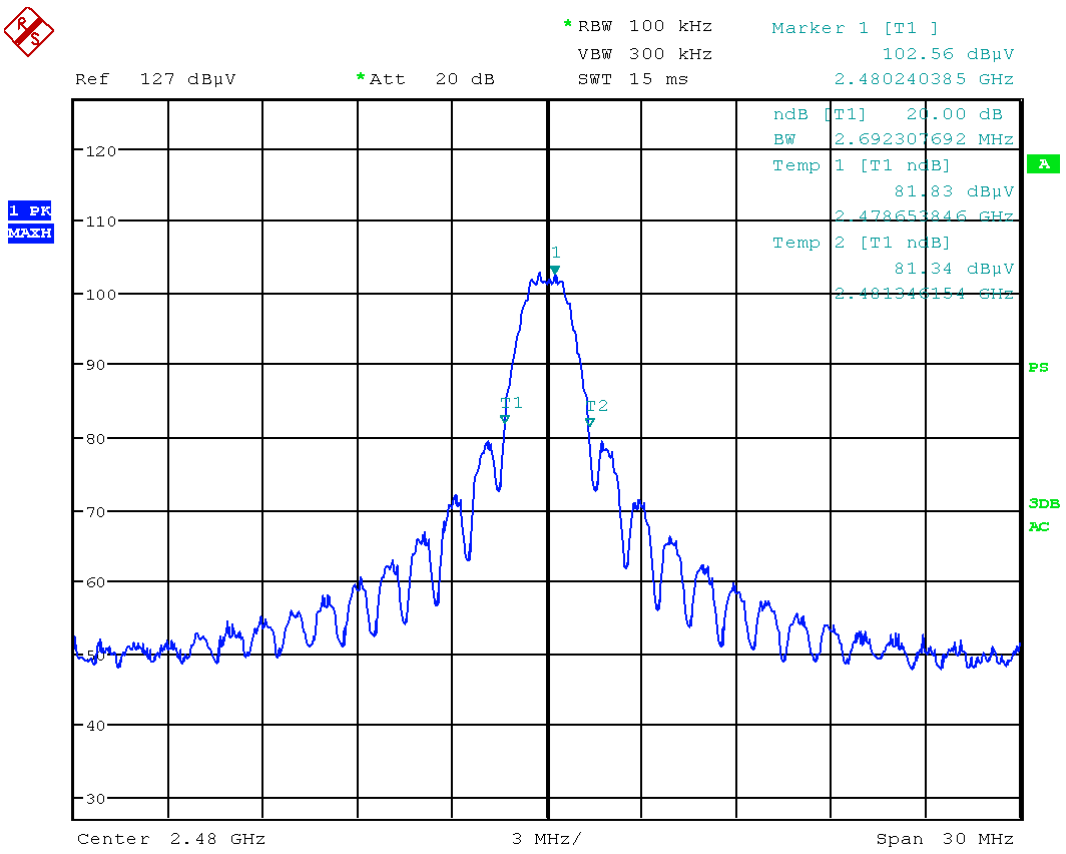
Picture 14: 20dB bandwidth ant00, channel 13



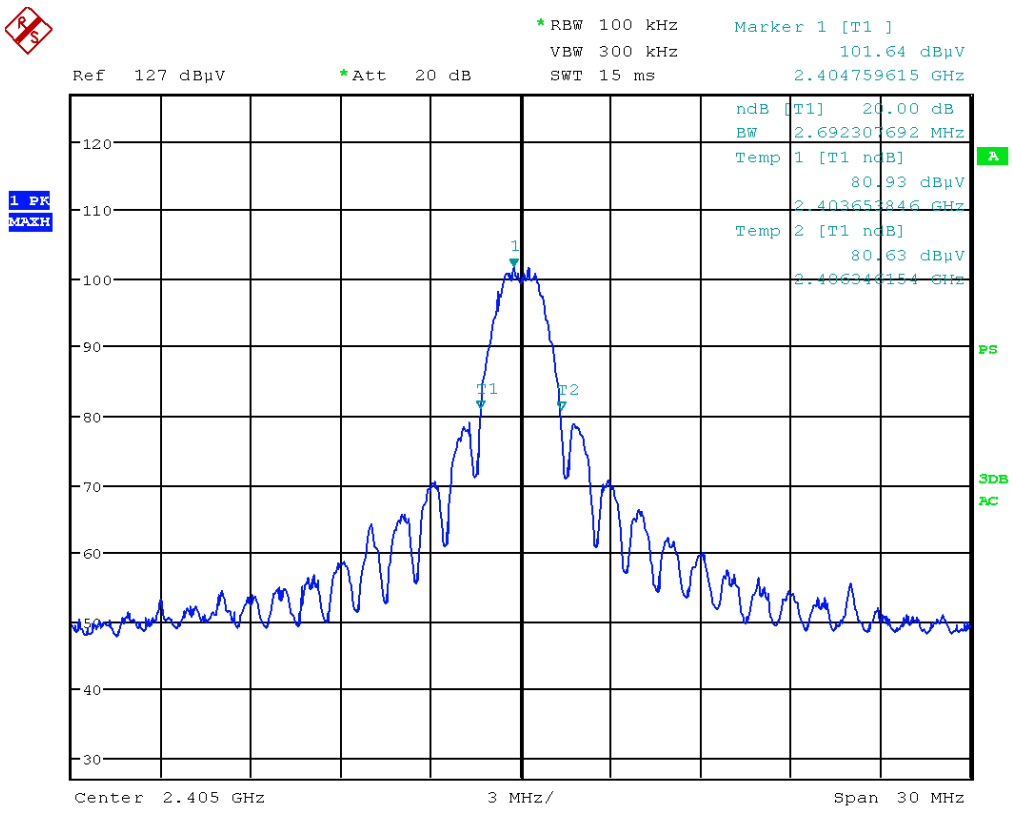
Picture 15: 20dB bandwidth ant00, channel 18



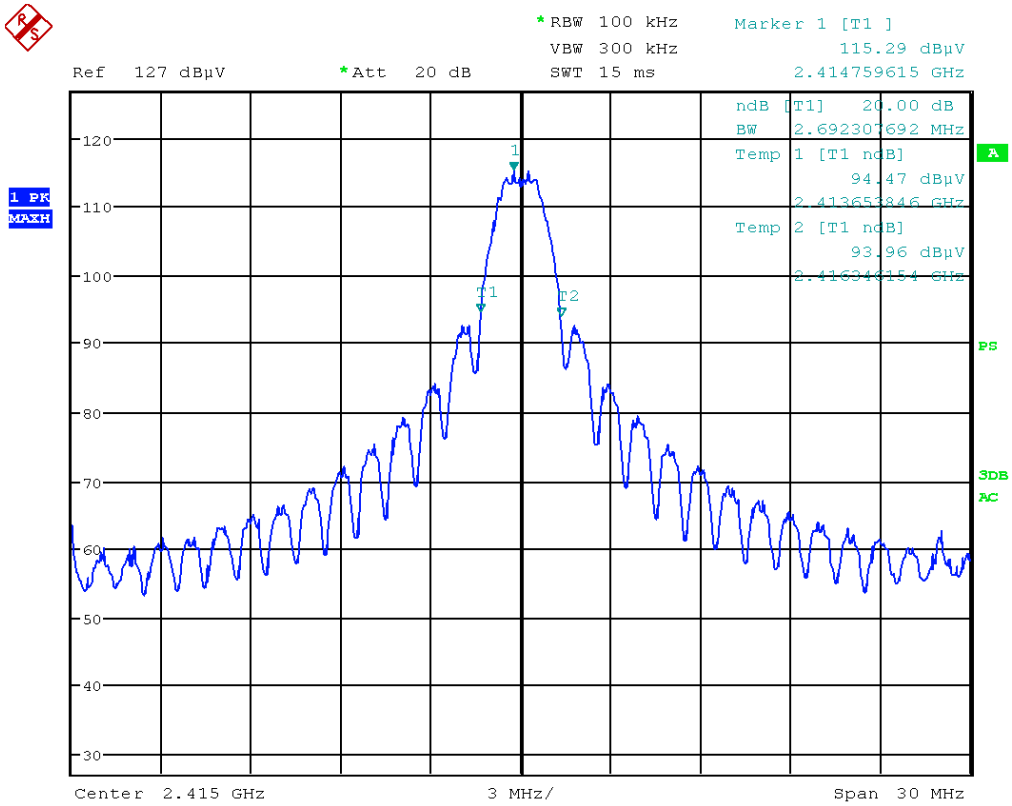
Picture 16: 20dB bandwidth ant00, channel 24



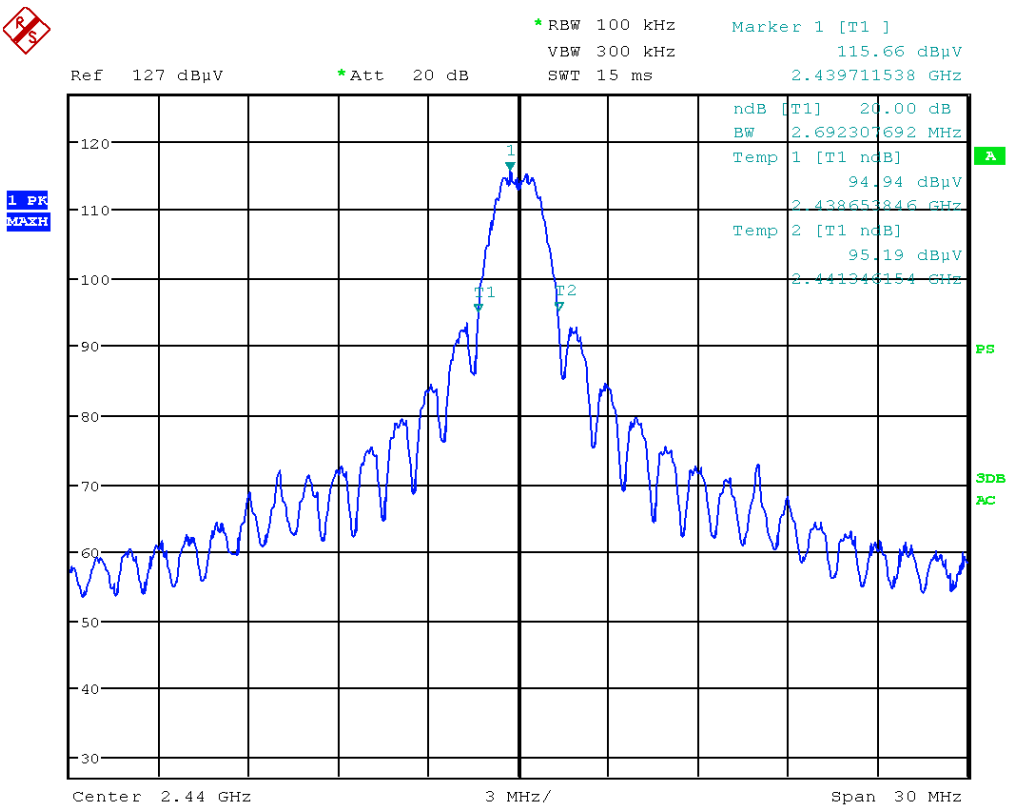
Picture 17: 20dB bandwidth ant00, channel 26



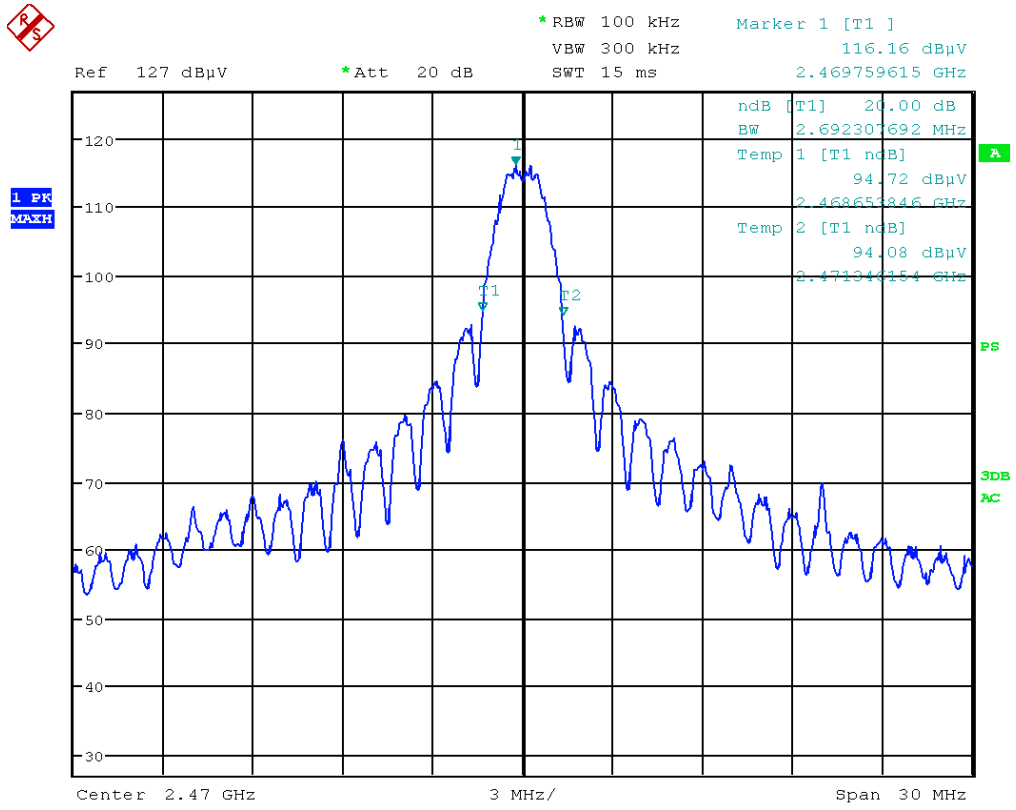
Picture 18: 20dB bandwidth ant01, channel 11



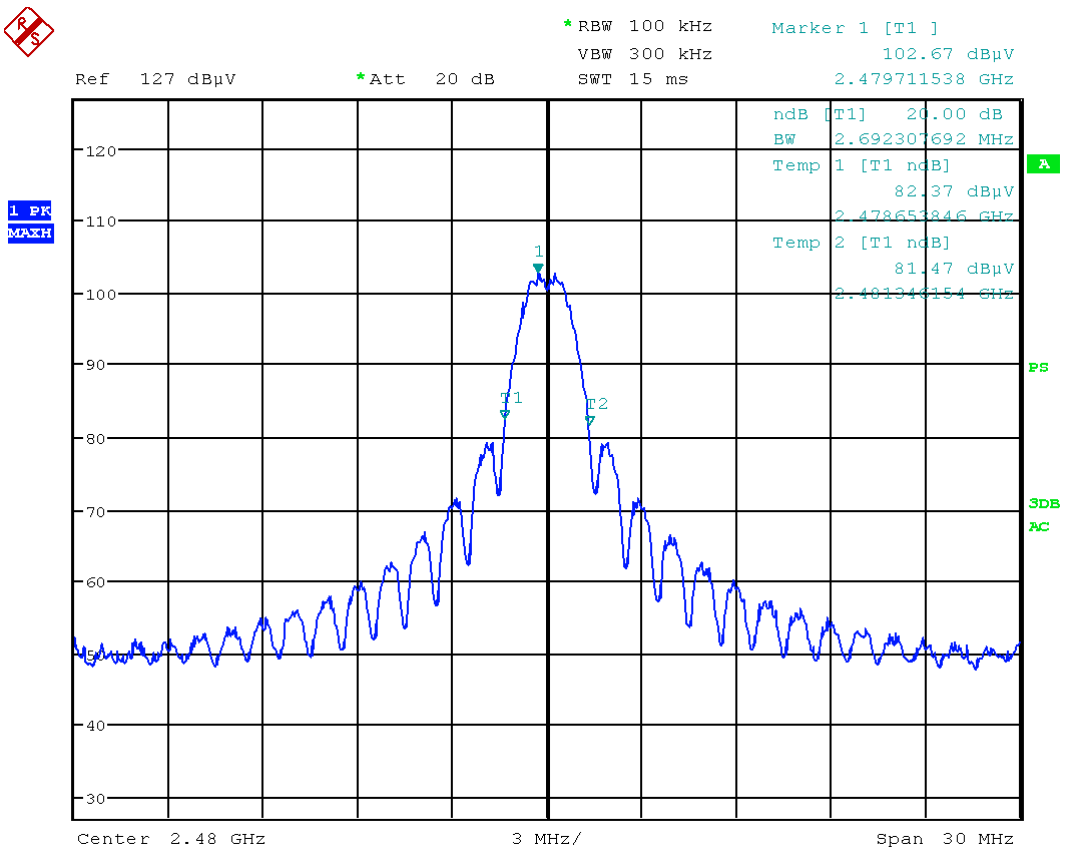
Picture 19: 20dB bandwidth ant01, channel 13



Picture 20: 20dB bandwidth ant01, channel 18



Picture 21: 20dB bandwidth ant01, channel 24



Picture 22: 20dB bandwidth ant01, channel 26

6 Occupied bandwidth

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

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

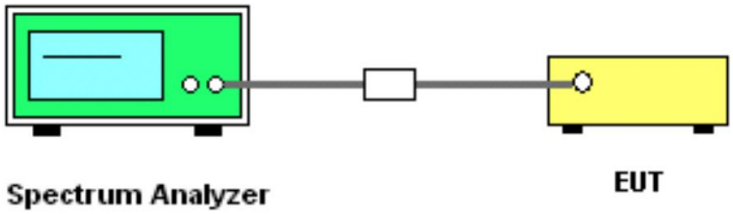
6.3 Limits

N/A

6.4 Test procedure

1. The test is performed in accordance with 47 CFR 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.
5. 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.

6.5 Test setup



Picture 23: Test setup for occupied bandwidth measurement

6.6 Test deviation

There is no deviation with the original standard.

6.7 EUT operation during test

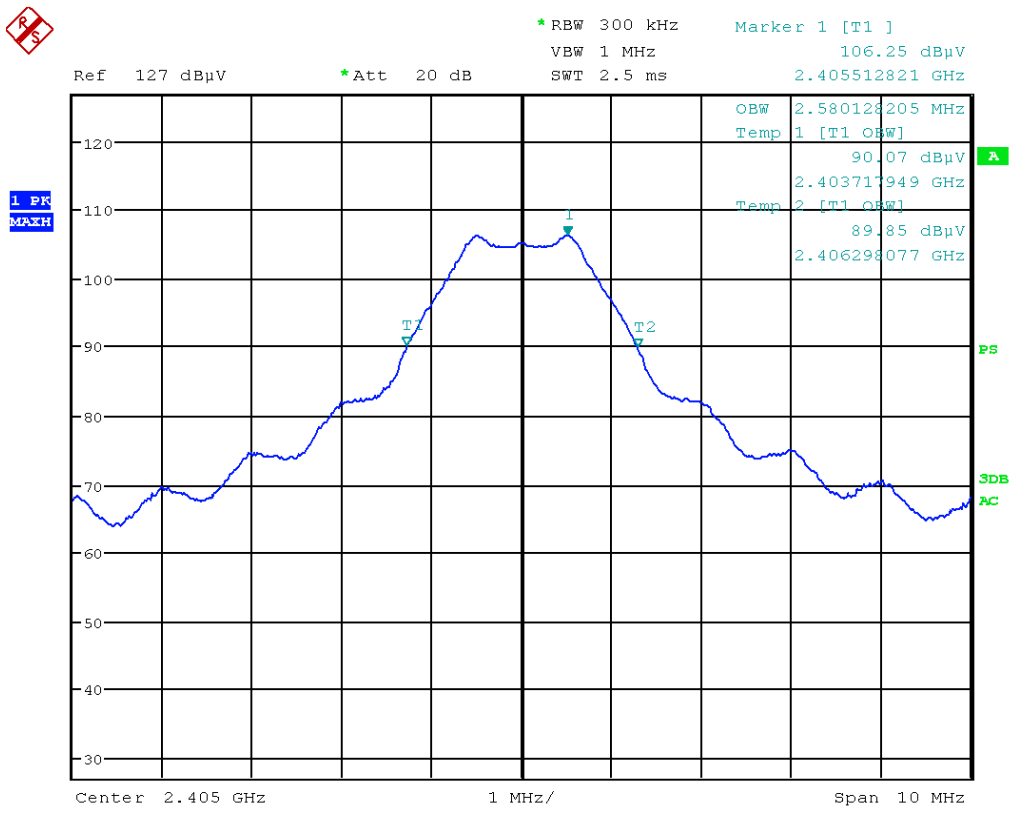
The EUT was programmed to be in continuously transmitting mode.

6.8 Test results

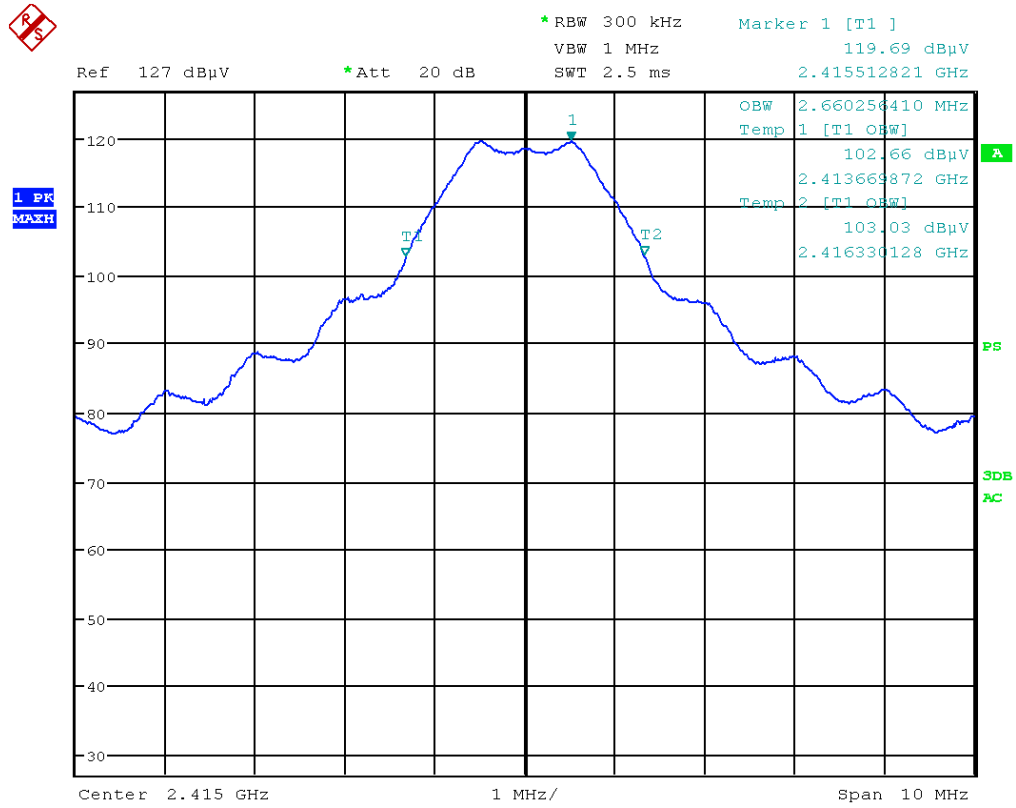
Temperature:	19°C	Humidity:	44%
Tested by:	M. Müller	Test date:	2015-01-12

Antenna	Channel	Frequency (GHz)	Occupied bandwidth (MHz)
00	11	2.4055	2.5801
00	13	2.4155	2.6603
00	18	2.4405	2.6442
00	24	2.4695	2.5801
00	26	2.4795	2.5641

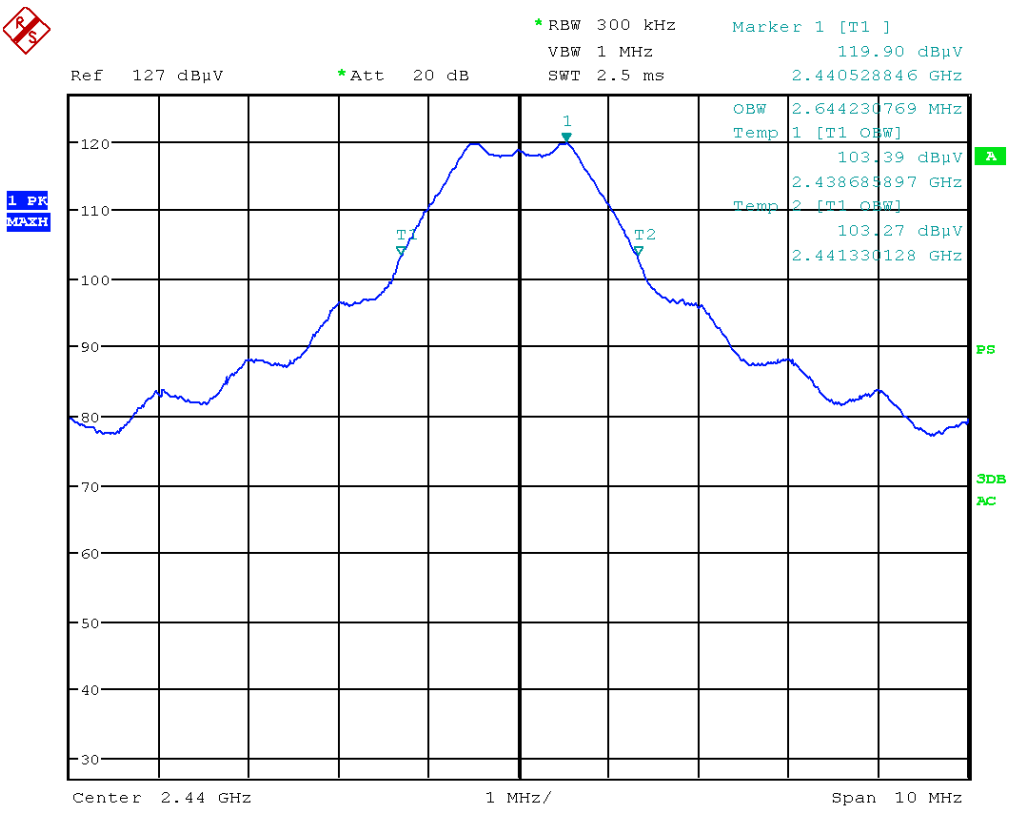
Antenna	Channel	Frequency (GHz)	Occupied bandwidth (MHz)
01	11	2.4055	2.6442
01	13	2.4155	2.6603
01	18	2.4405	2.6442
01	24	2.4705	2.7404
01	26	2.4805	2.6923



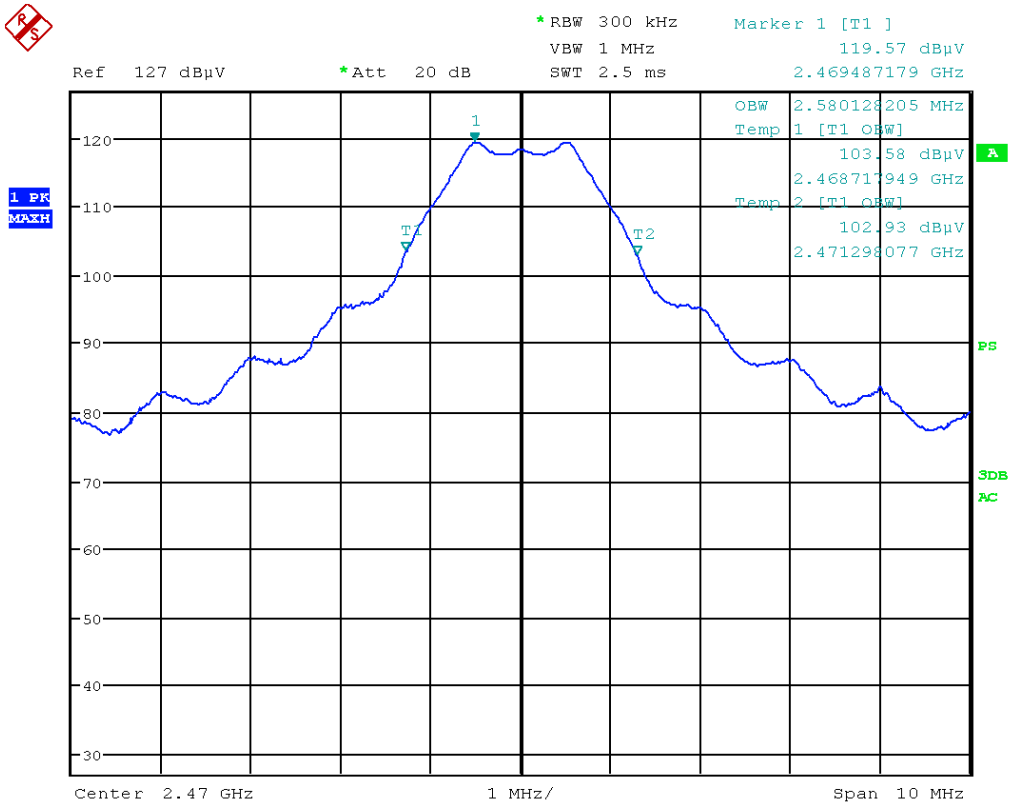
Picture 24: Occupied bandwidth ant00, channel 11



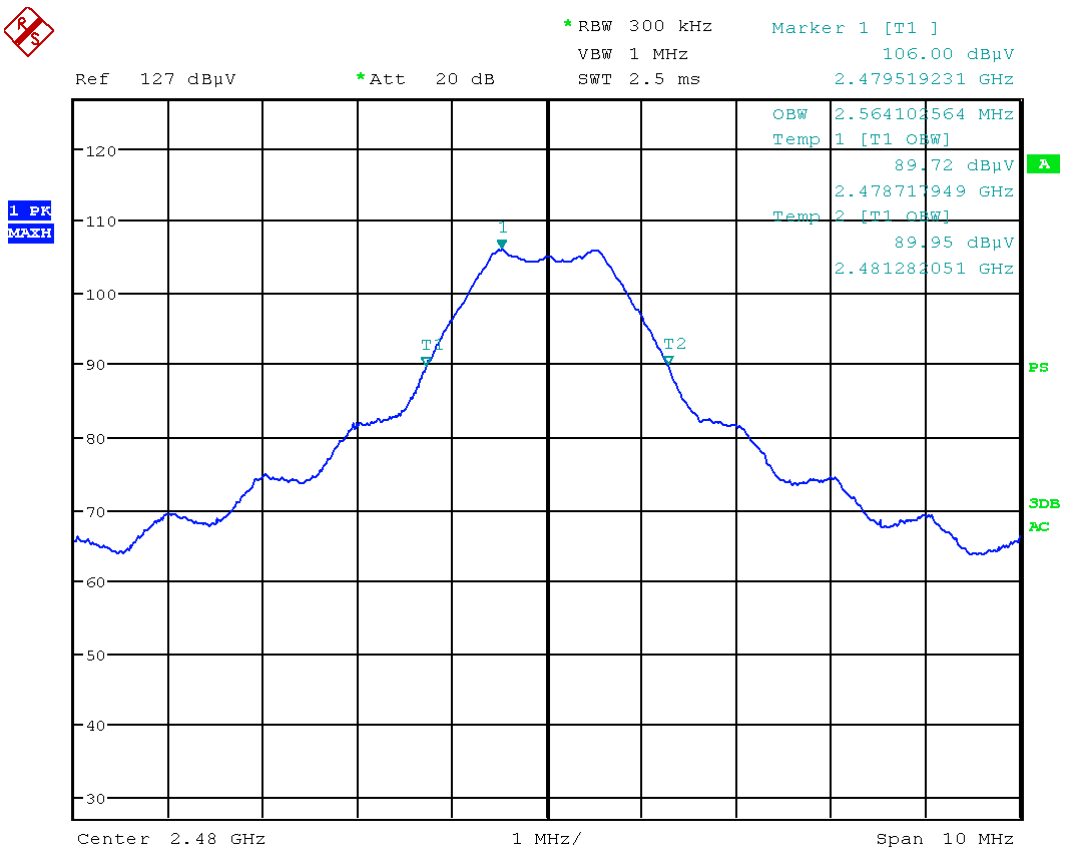
Picture 25: Occupied bandwidth ant00, channel 13



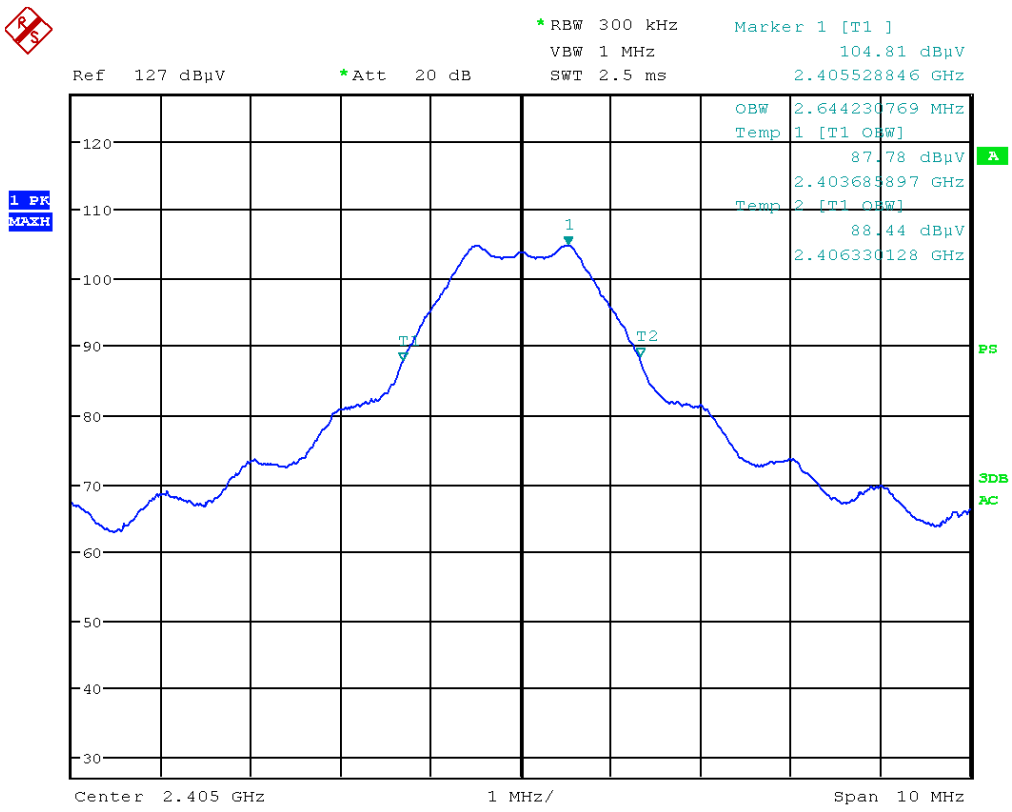
Picture 26: Occupied bandwidth ant00, channel 18



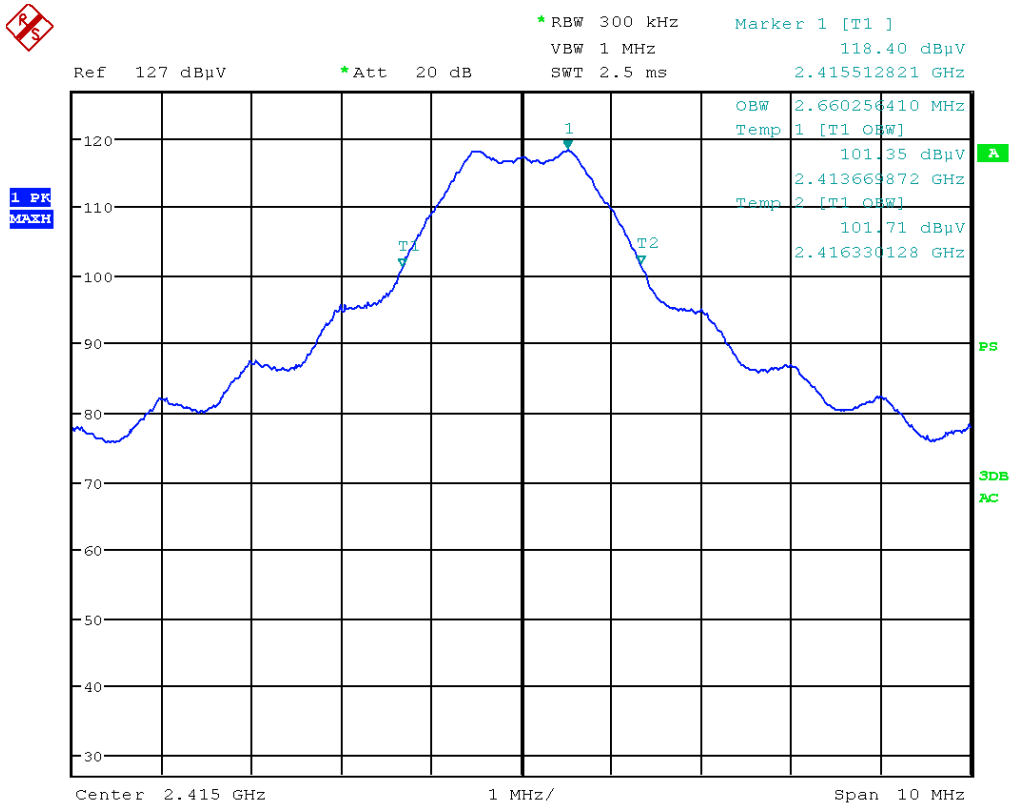
Picture 27: Occupied bandwidth ant00, channel 24



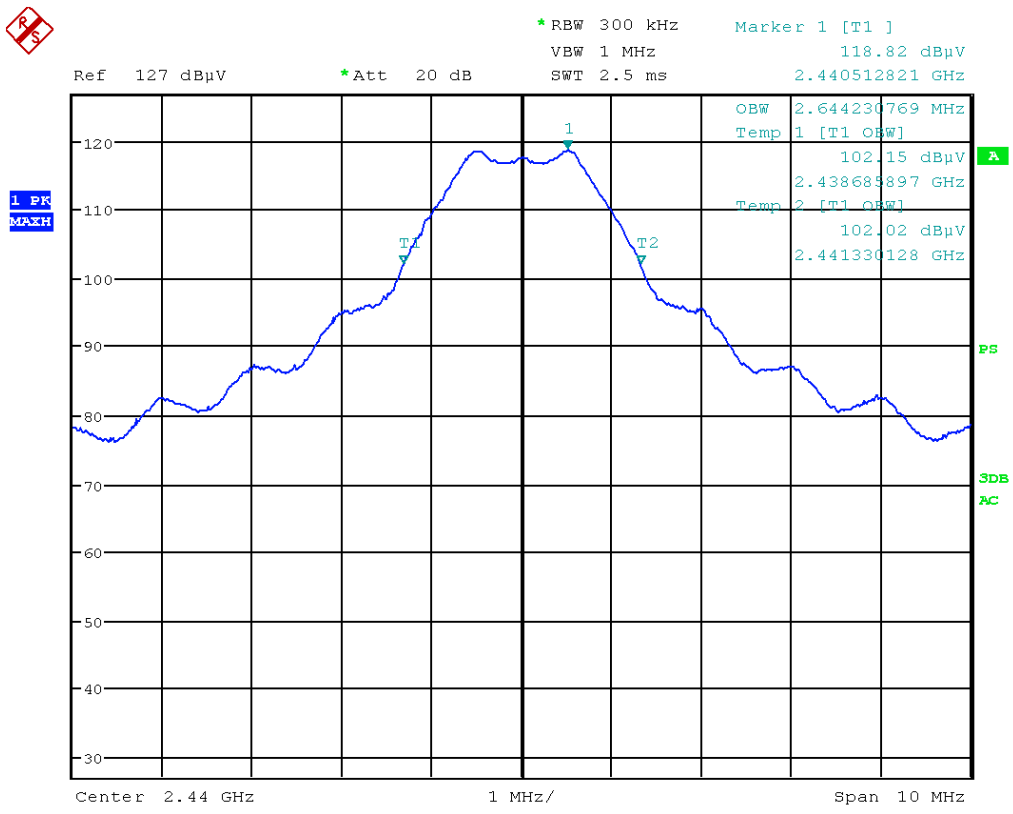
Picture 28: Occupied bandwidth ant00, channel 26



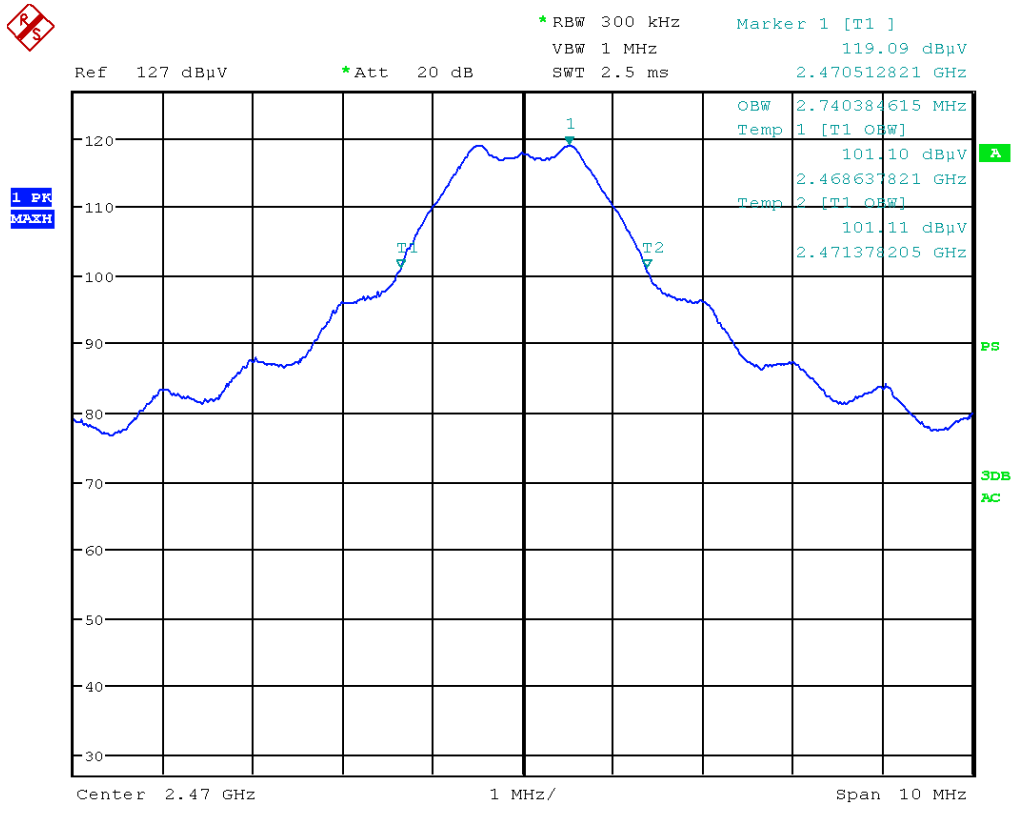
Picture 29: Occupied bandwidth ant01, channel 11



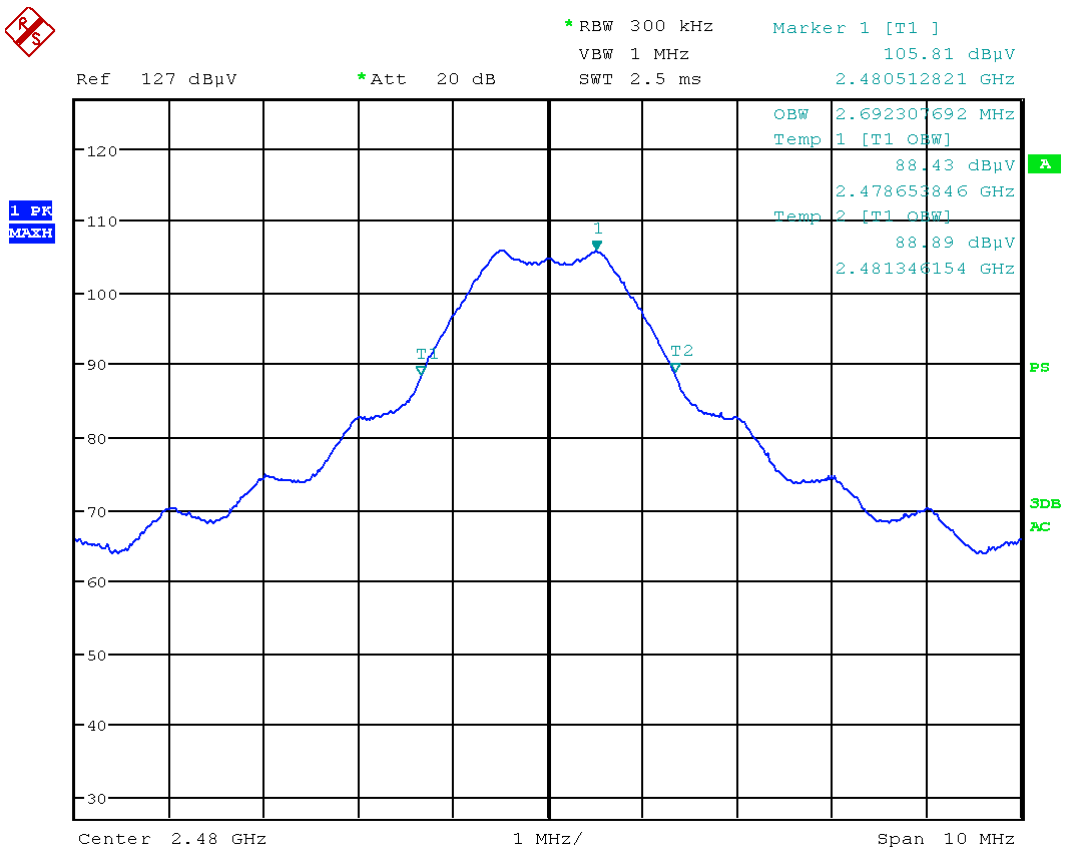
Picture 30: Occupied bandwidth ant01, channel 13



Picture 31: Occupied bandwidth ant01, channel 18



Picture 32: Occupied bandwidth ant01, channel 24



Picture 33: Occupied bandwidth ant01, channel 26

7 Maximum peak conducted output power

according to 47 CFR Part 15, section 15.247(b), and KDB 558074, section 9

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

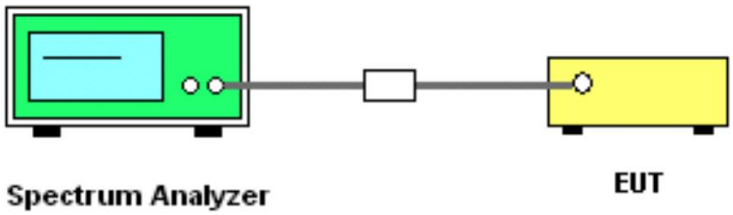
For systems using digital modulation: 1 Watt (30 dBm).

As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power.
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.

7.4 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 and FCC KDB publication no. 558074, section 9.1.1 with detector set to peak (max hold) and the following settings:
   a) RBW ≥ DTS bandwidth (6 dB bandwidth)
   b) VBW ≥ 3 × RBW.
   c) span ≥ 3 x RBW
   d) Sweep time = auto couple.

7.5 Test setup



Picture 34: Test setup for conducted output power 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.

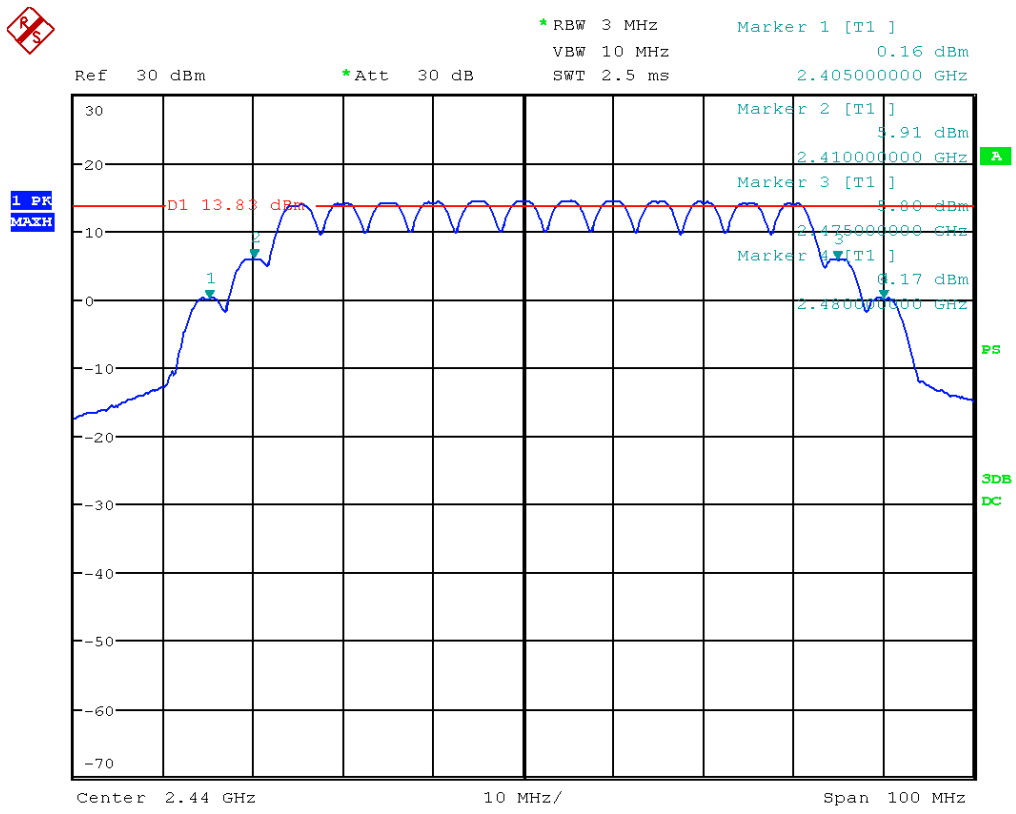
7.8 Test results

Temperature:	20°C	Humidity:	43%
Tested by:	M. Müller	Test date:	2015-01-12

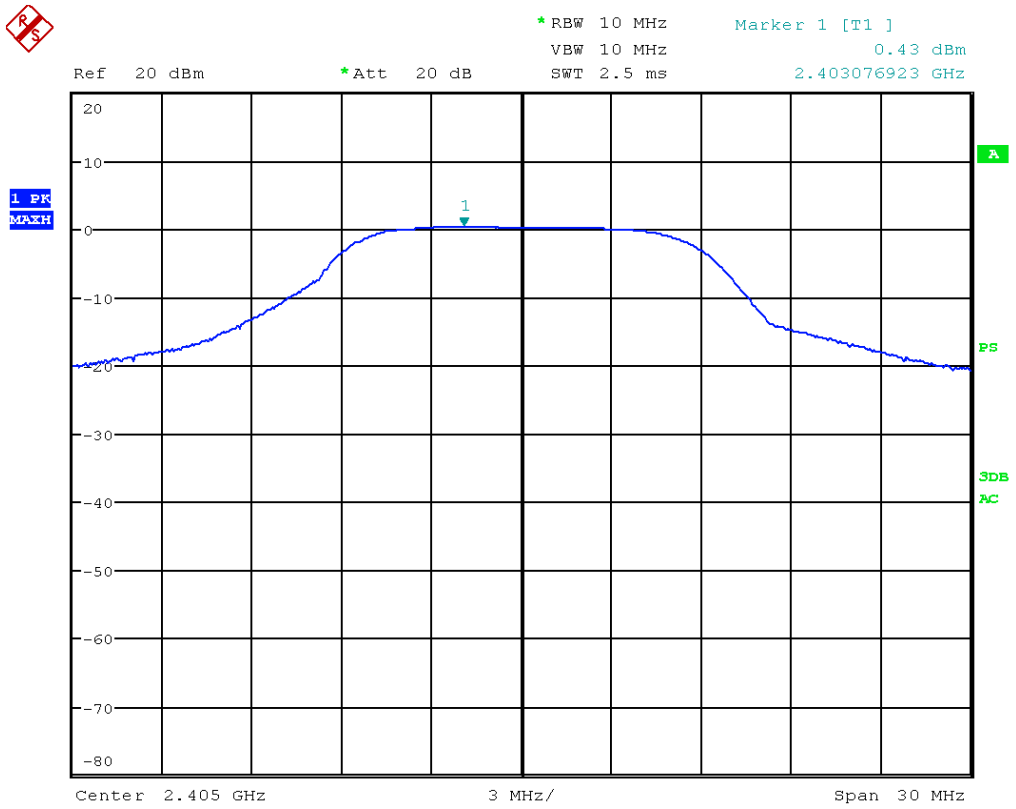
Antenna	Channel	Frequency (GHz)	Detector	Conducted power		Limit (dBm)	Result
				reading (dBm)	final (dBm)		
00	11	2.4031	PK	0.43	1.45	30	Passed
00	13	2.4129	PK	13.90	14.96	30	Passed
00	18	2.4378	PK	14.47	15.54	30	Passed
00	24	2.4679	PK	14.27	15.29	30	Passed
00	26	2.4779	PK	0.51	1.51	30	Passed

Antenna	Channel	Frequency (GHz)	Detector	Conducted power		Limit (dBm)	Result
				reading (dBm)	final (dBm)		
01	11	2.4031	PK	-1.33	-0.31	30	Passed
01	13	2.4131	PK	12.39	13.45	30	Passed
01	18	2.4381	PK	13.03	14.10	30	Passed
01	24	2.4679	PK	13.51	14.53	30	Passed
01	26	2.4781	PK	0.09	1.09	30	Passed

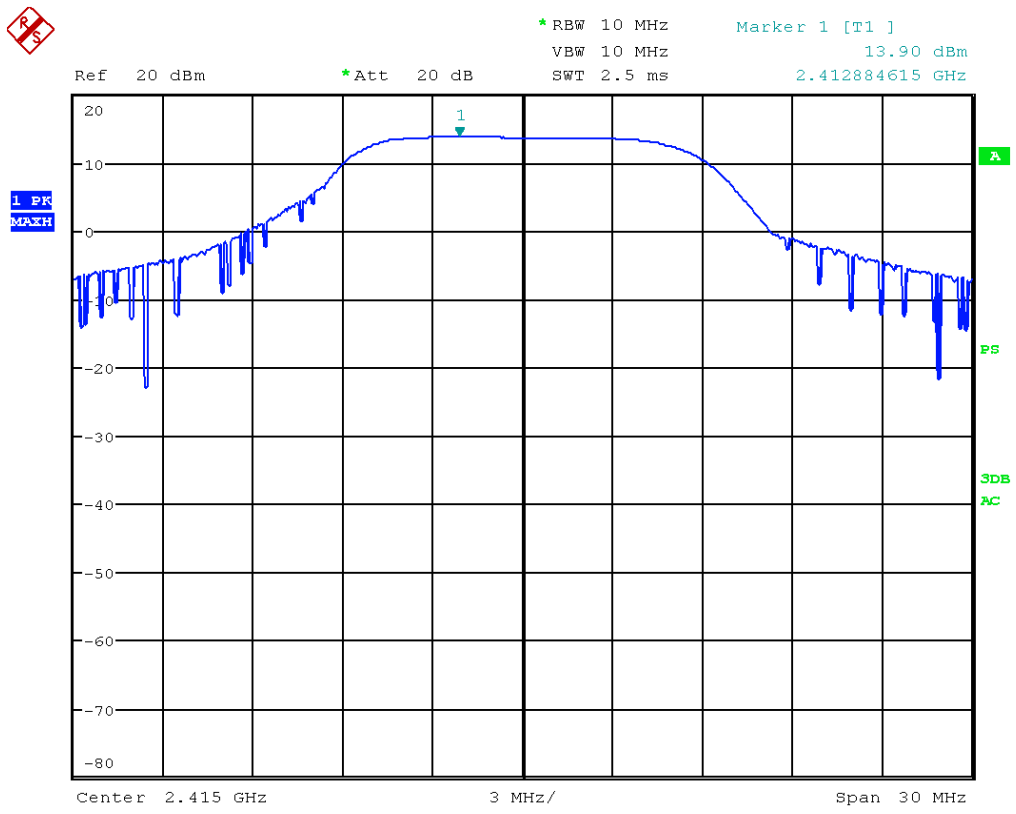
Comments: Final conducted power value is reading value + cable correction according to Table 2.



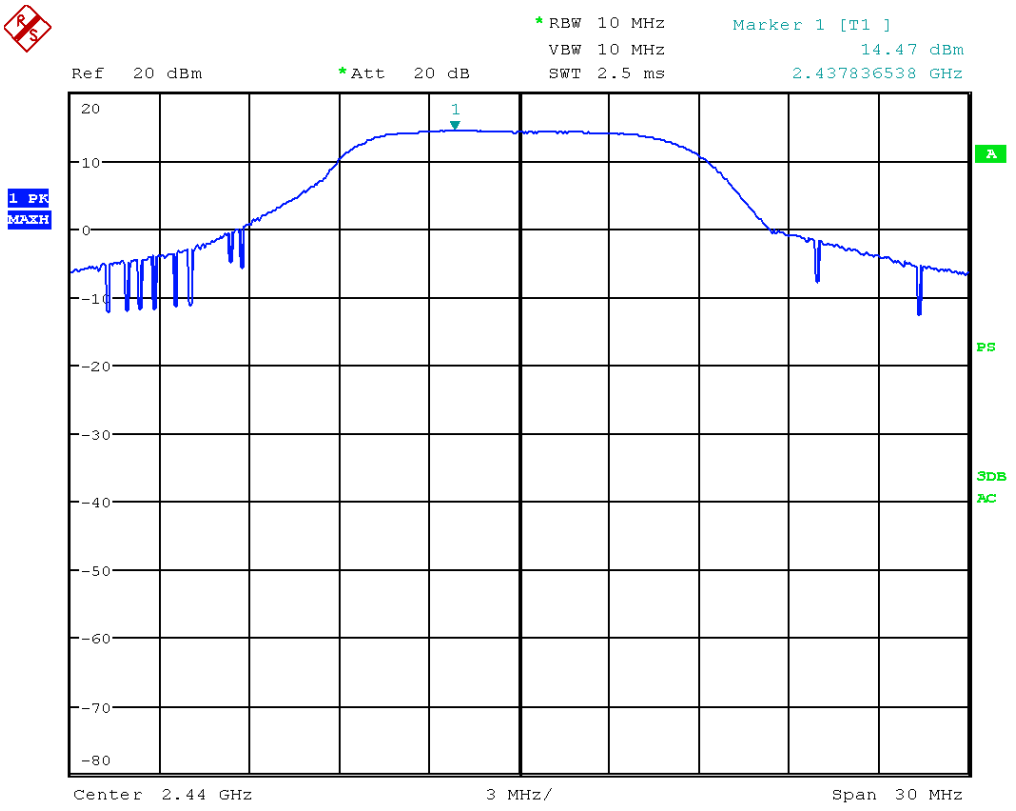
Picture 35: Channel spectrum ant00



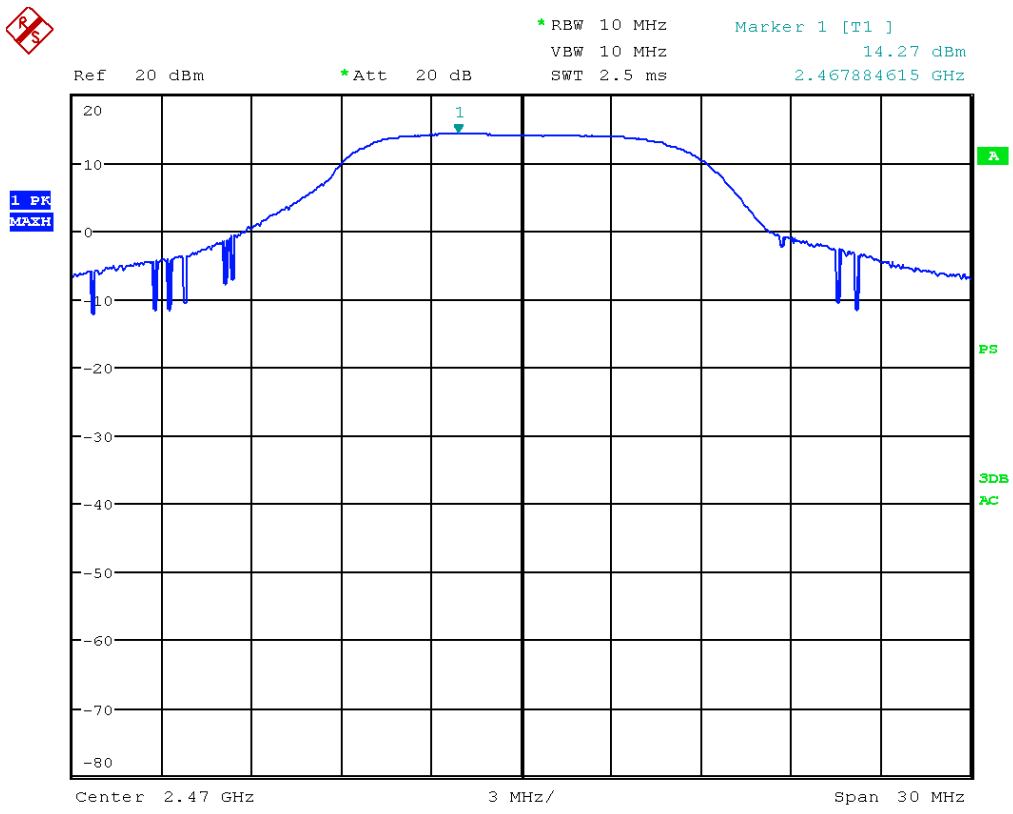
Picture 36: Conducted output power ant00, channel 11



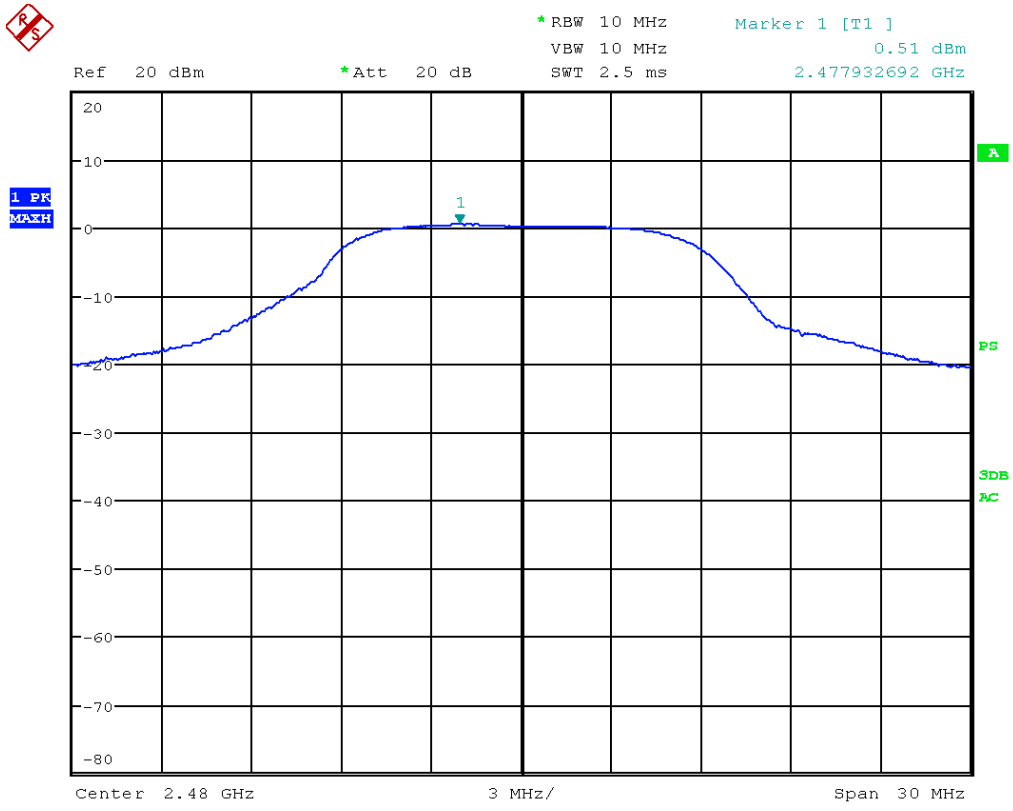
Picture 37: Conducted output power ant00, channel 13



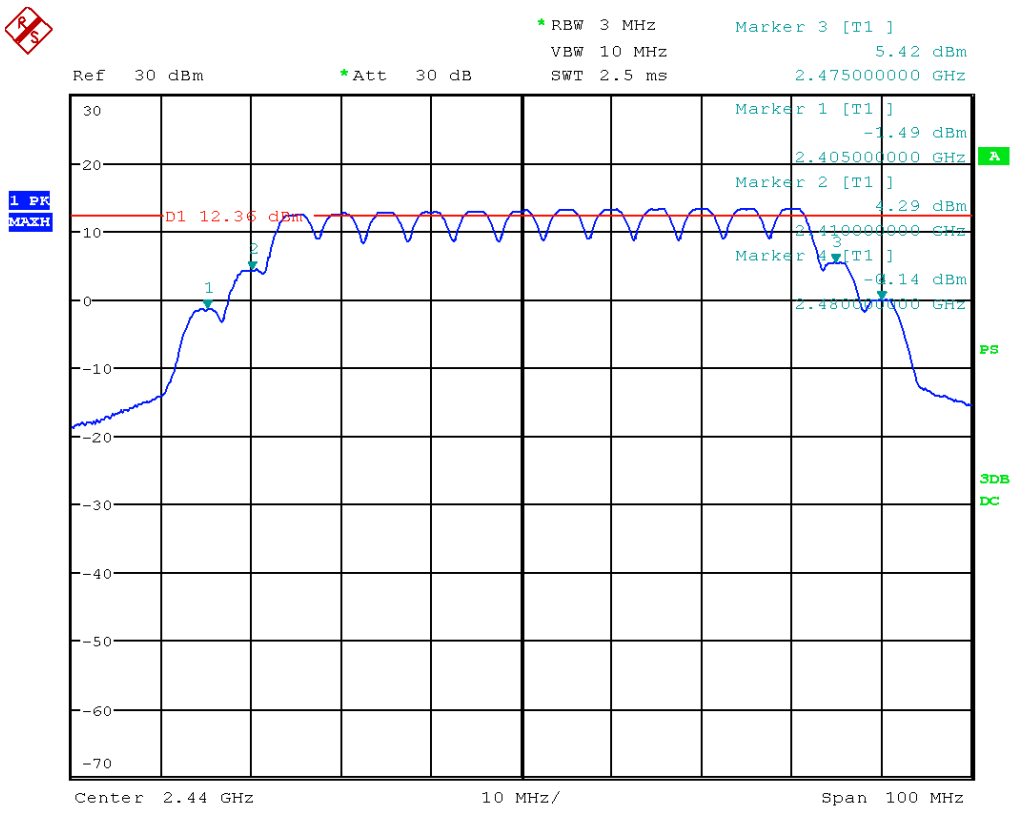
Picture 38: Conducted output power ant00, channel 18



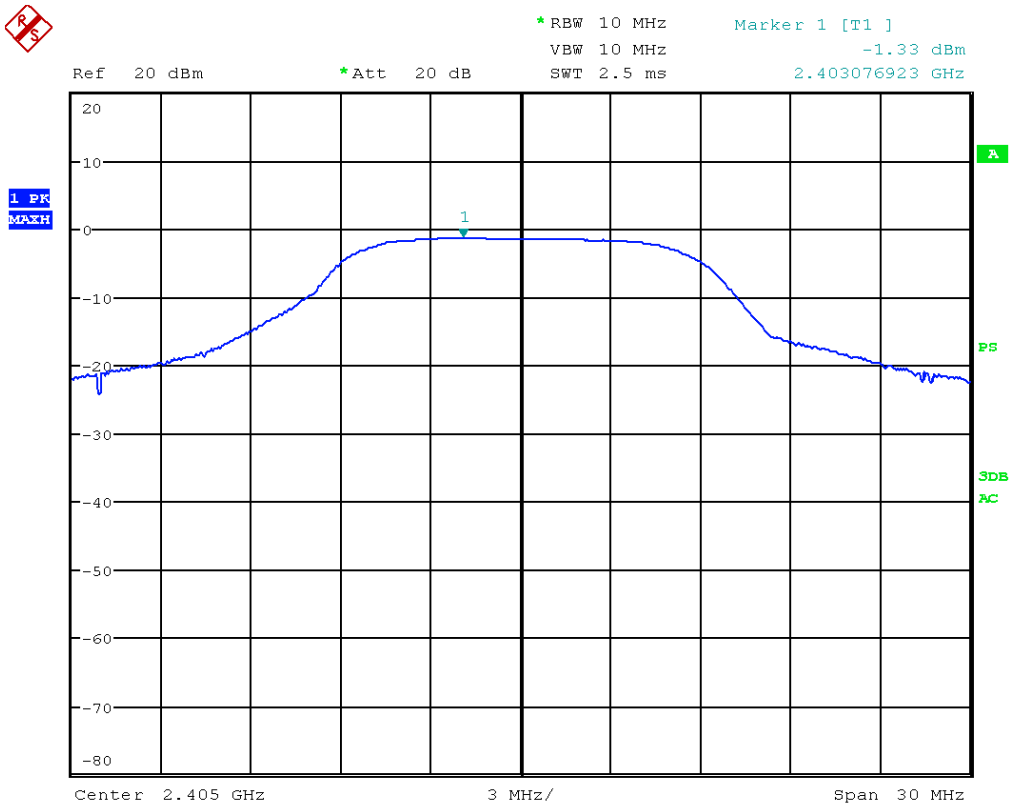
Picture 39: Conducted output power ant00, channel 24



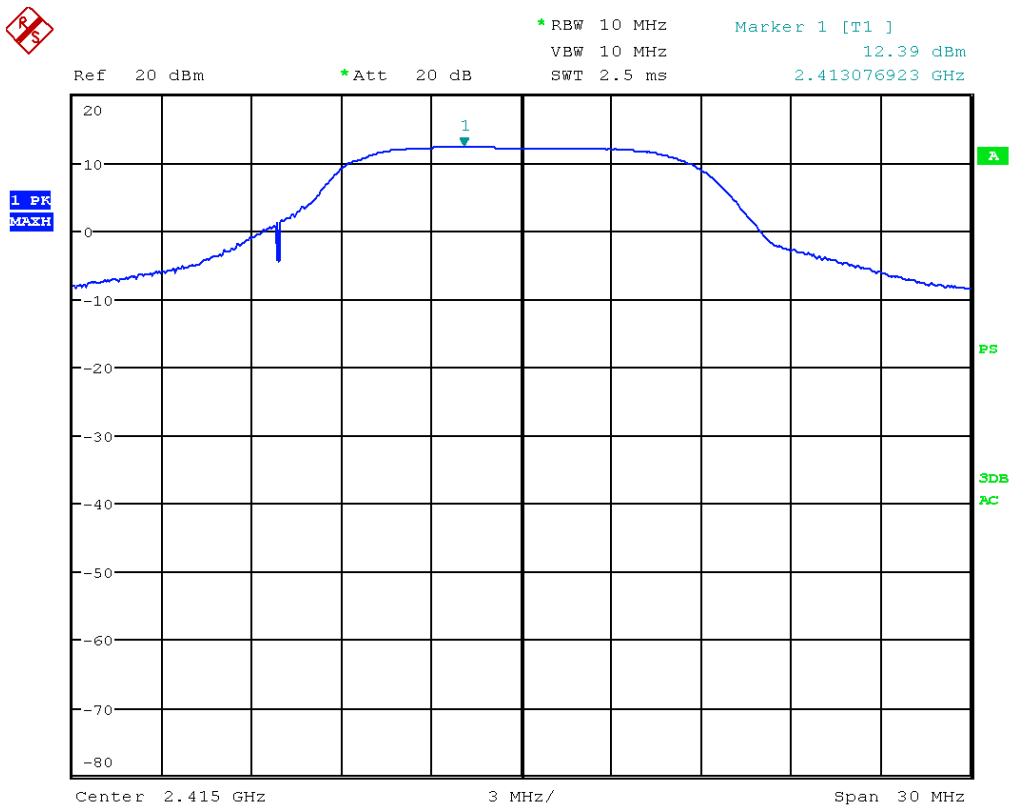
Picture 40: Conducted output power ant00, channel 26



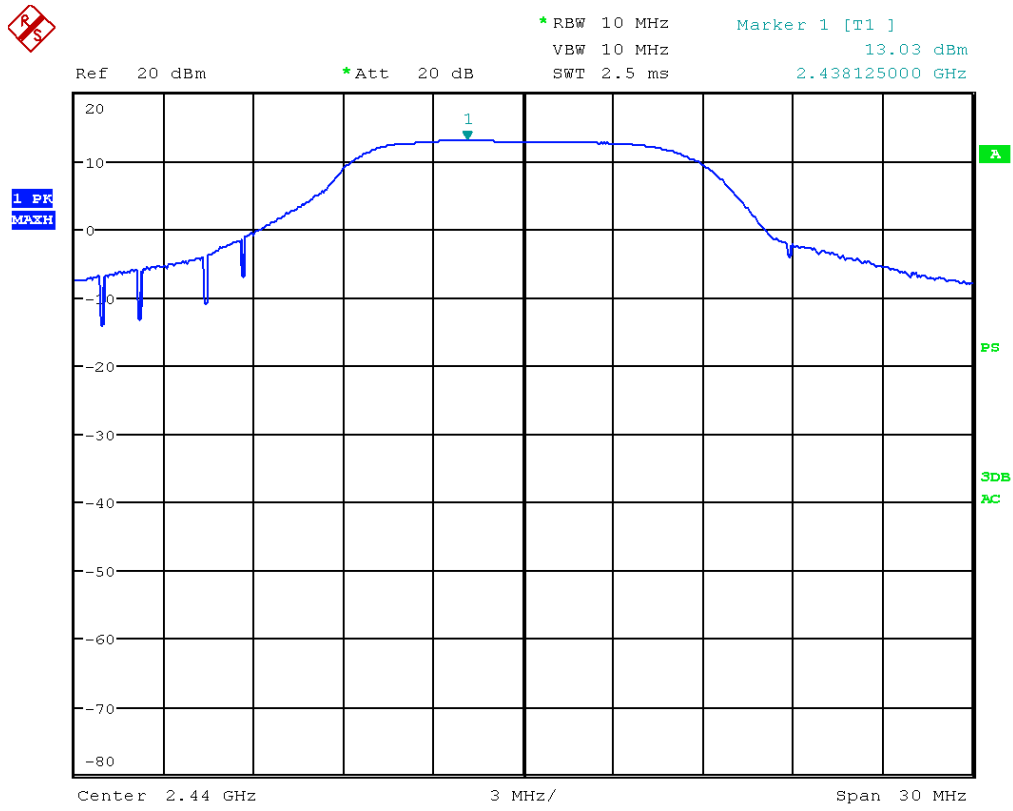
Picture 41: Channel spectrum ant01



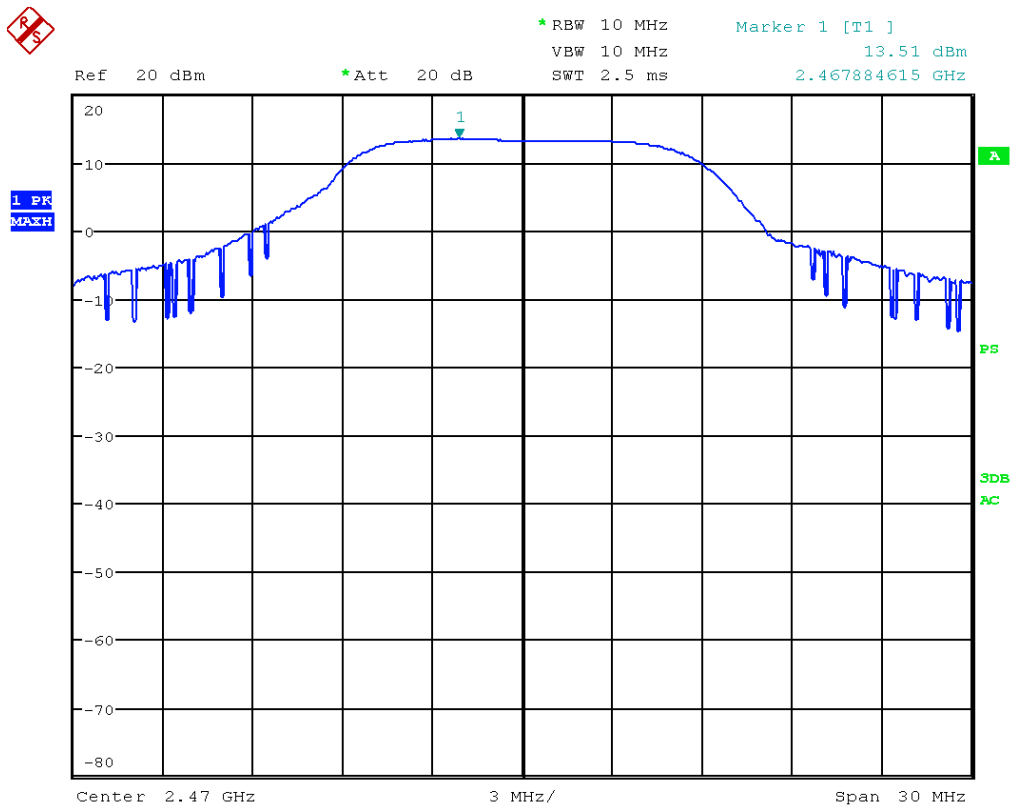
Picture 42: Conducted output power ant01, channel 11



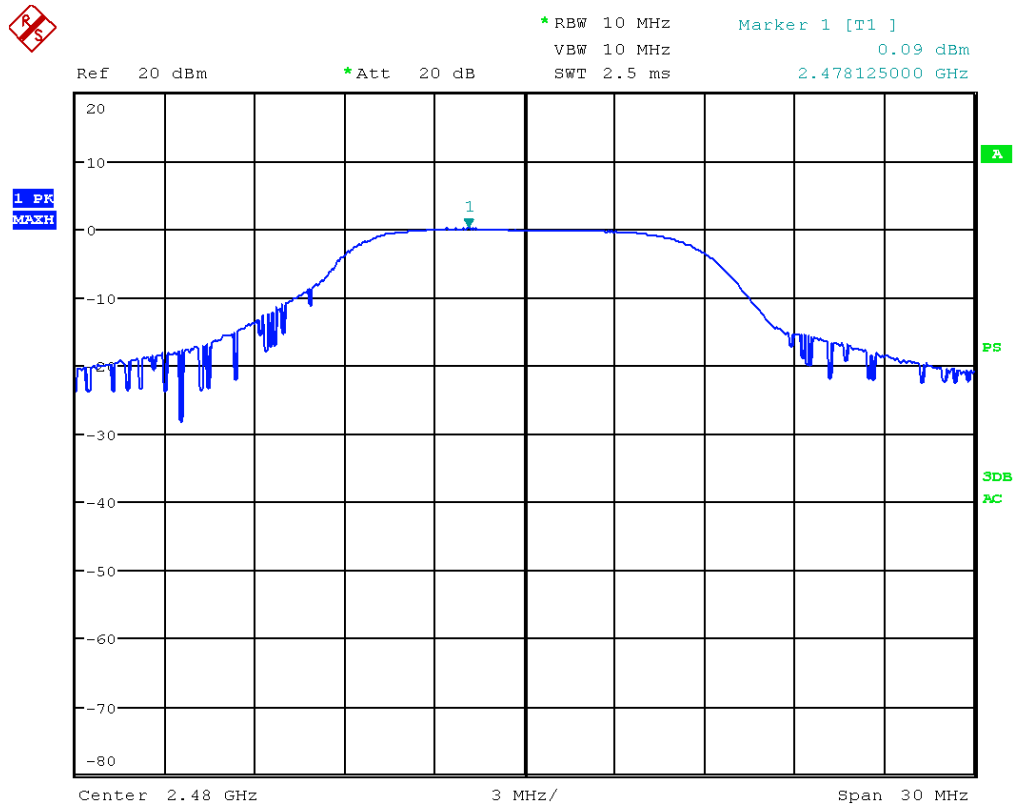
Picture 43: Conducted output power ant01, channel 13



Picture 44: Conducted output power ant01, channel 18



Picture 45: Conducted output power ant01, channel 24



Picture 46: Conducted output power ant01, channel 26

8 Power spectral density

according to 47 CFR Part 15, section 15.247(e), and KDB 558074, section 10

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

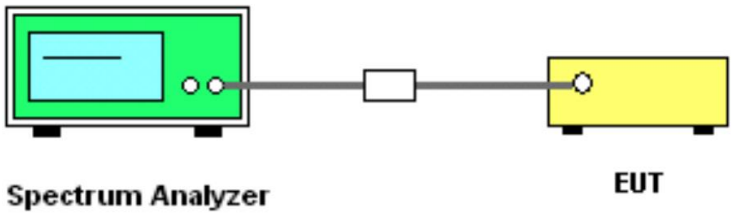
8.3 Limits

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of section 15.247.
The same method of determining the conducted output power shall be used to determine the power spectral density.

8.4 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 and FCC KDB publication no. 558074, section 10 with detector set to peak (max hold) and the following settings:
   a) span = 1.5 x DTS bandwidth (6 dB bandwidth)
   b) 3 kHz ≤ RBW ≤ 100 kHz
   c) VBW ≥ 3 × RBW.
   d) Sweep time = auto couple for prescans, ≥ span / RBW for final scan

8.5 Test setup



Picture 47: Test setup for power spectral density 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.

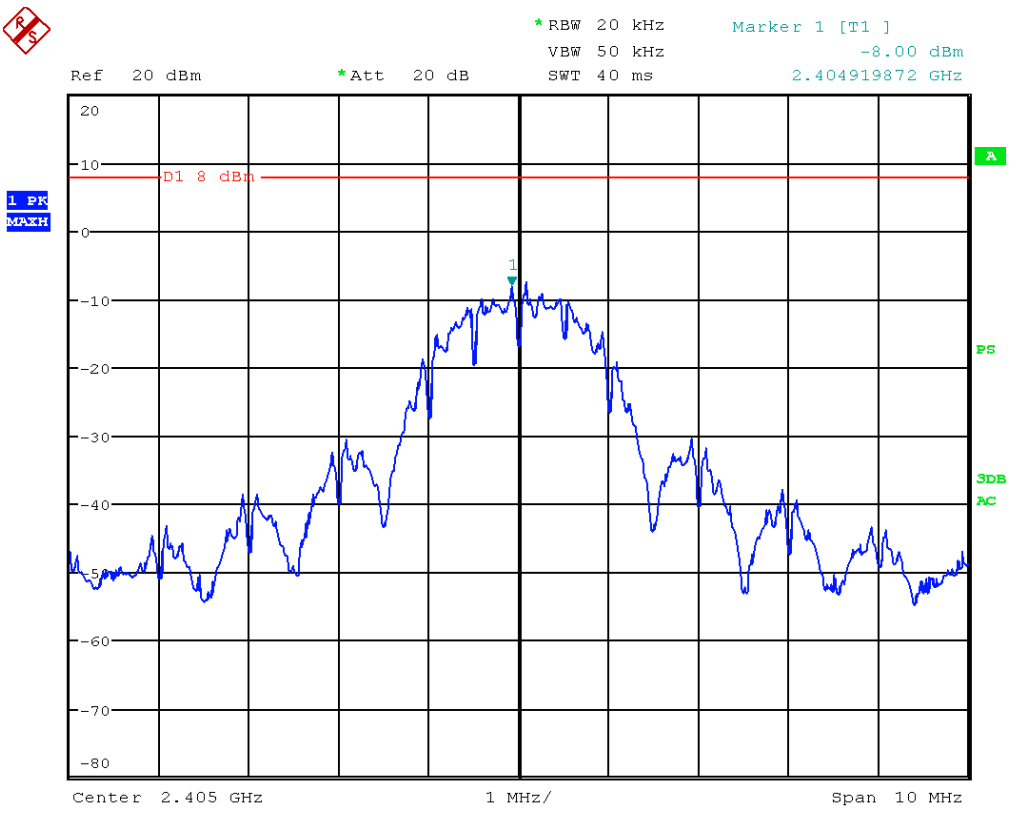
8.8 Test results

Temperature:	21°C	Humidity:	46%
Tested by:	M. Müller	Test date:	2015-01-13

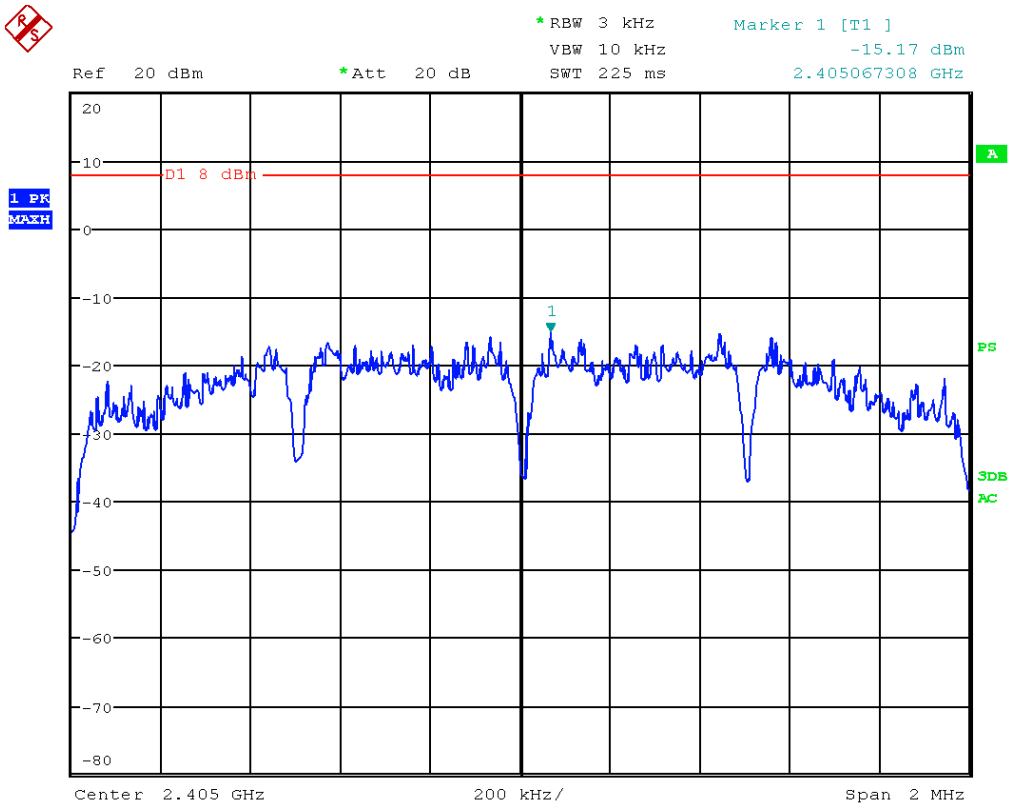
Antenna 00								
Channel	**Detector**	**Frequency (GHz)**	**PSD @ 20kHz RBW reading (dBm)**	**Frequency (GHz)**	**PSD @ 3kHz RBW**		**Limit (dBm)**	**Result**
					reading (dBm)	**final (dBm)**		
11	PK	2.4049	-8.00	2.4051	-14.40	-13.38	8	Passed
13	PK	2.4151	5.63	2.4151	-1.21	-0.15	8	Passed
18	PK	2.4399	5.82	2.4401	0.05	1.12	8	Passed
24	PK	2.4701	5.87	2.4701	-0.22	0.80	8	Passed
26	PK	2.4801	-7.81	2.4801	-13.65	-12.65	8	Passed

Antenna 01								
Channel	**Detector**	**Frequency (GHz)**	**PSD @ 20kHz RBW reading (dBm)**	**Frequency (GHz)**	**PSD @ 3kHz RBW**		**Limit (dBm)**	**Result**
					reading (dBm)	**final (dBm)**		
11	PK	2.4051	-9.26	2.4051	-15.90	-14.88	8	Passed
13	PK	2.4151	4.17	2.4151	-2.06	-1.00	8	Passed
18	PK	2.4401	4.61	2.4401	-1.25	-0.18	8	Passed
24	PK	2.4701	4.83	2.4701	-1.39	-0.37	8	Passed
26	PK	2.4801	-8.38	2.4801	-14.10	-13.10	8	Passed

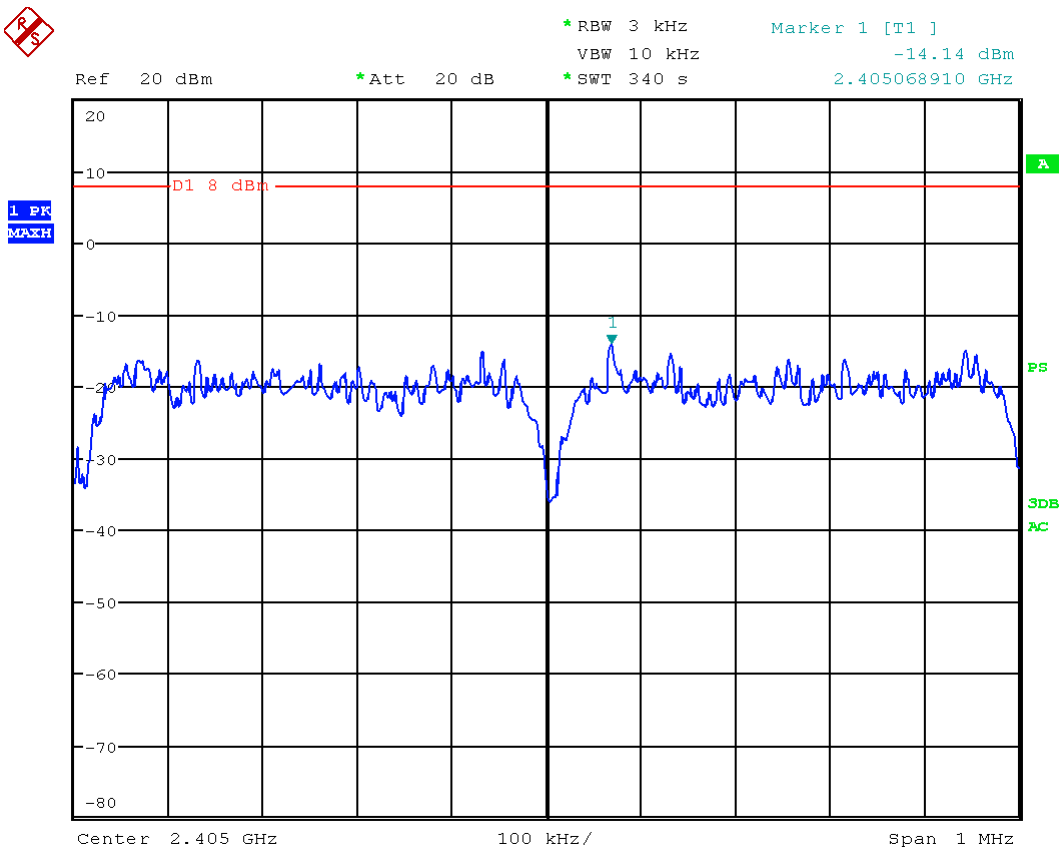
Comments: Final PSD value is reading value + cable correction according to Table 2.



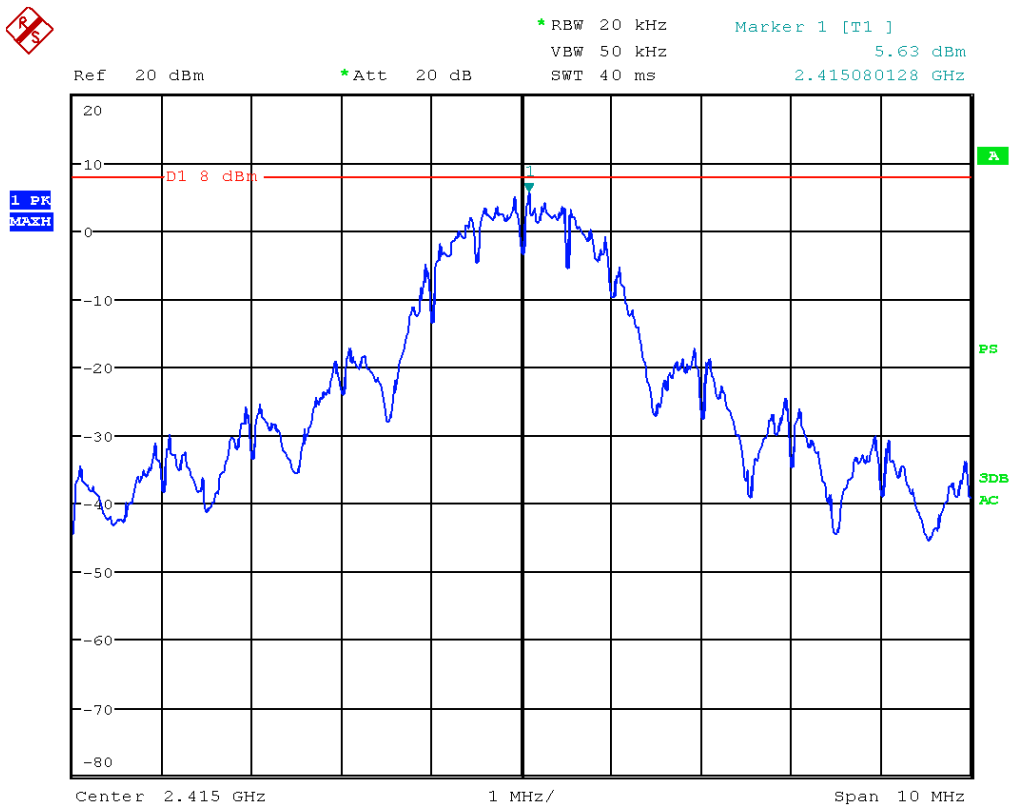
Picture 48: Power spectral density ant00, channel 11 - complete carrier



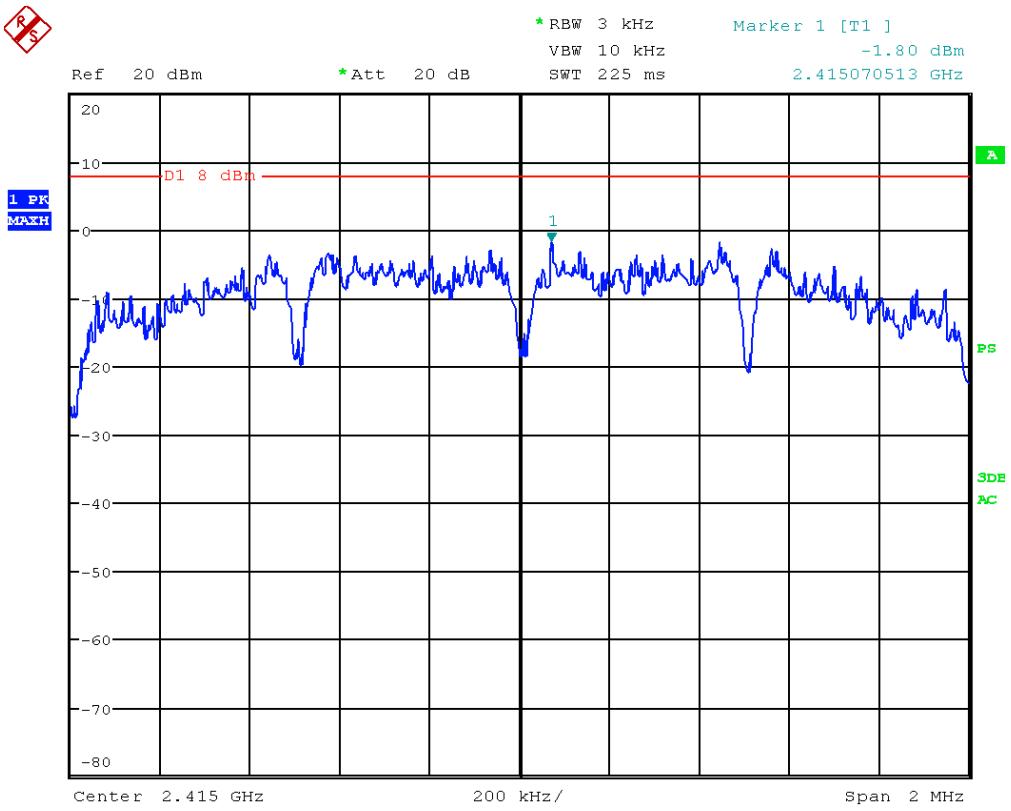
Picture 49: Power spectral density ant00, channel 11 - zoom1 to maximum



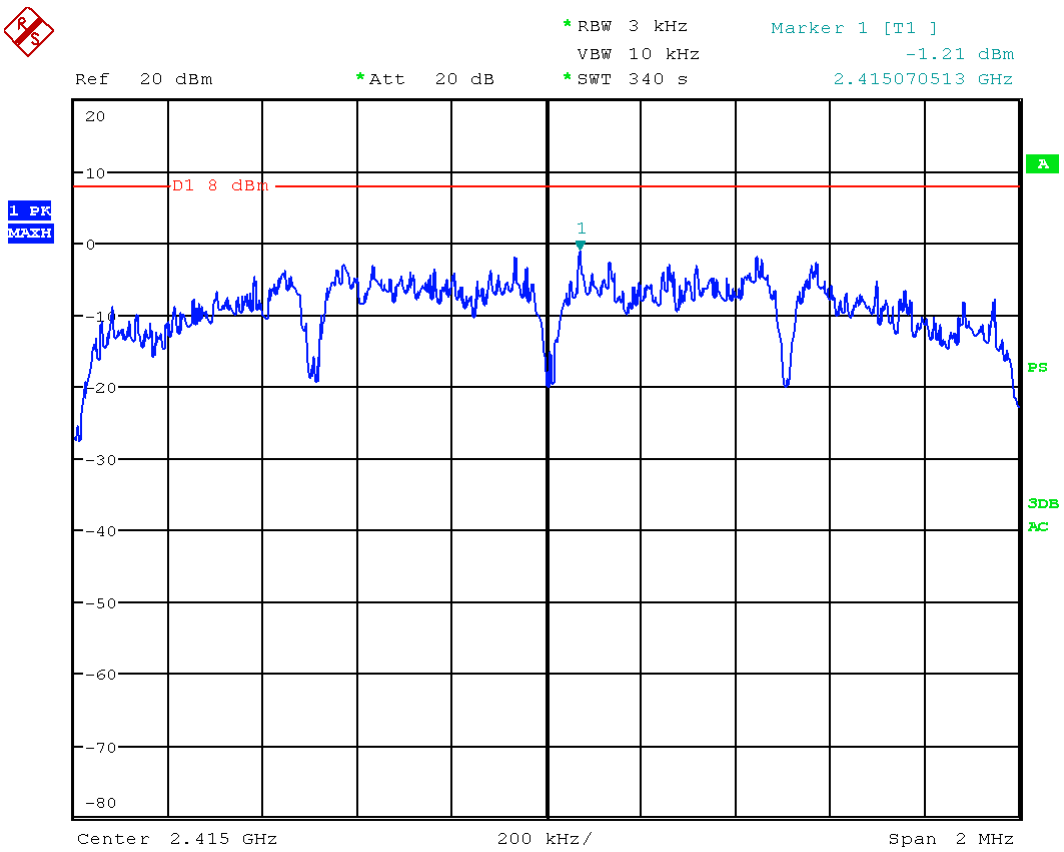
Picture 50: Power spectral density ant00, channel 11 - zoom2 to maximum



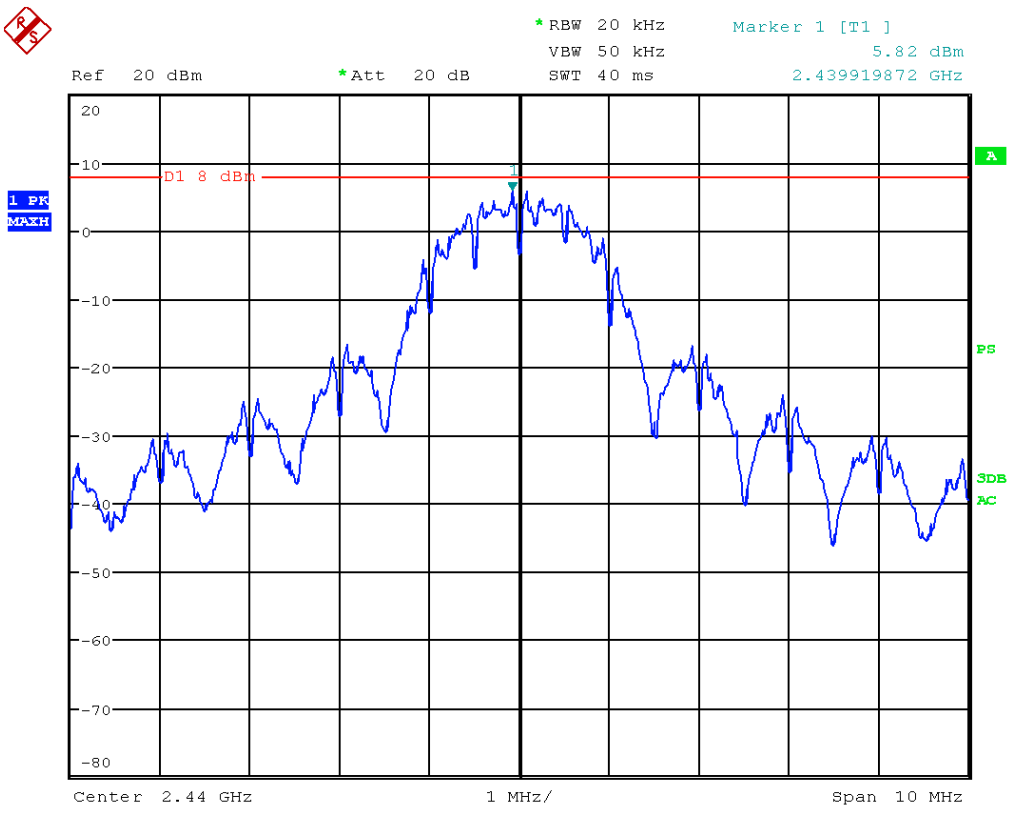
Picture 51: Power spectral density ant00, channel 13 - complete carrier



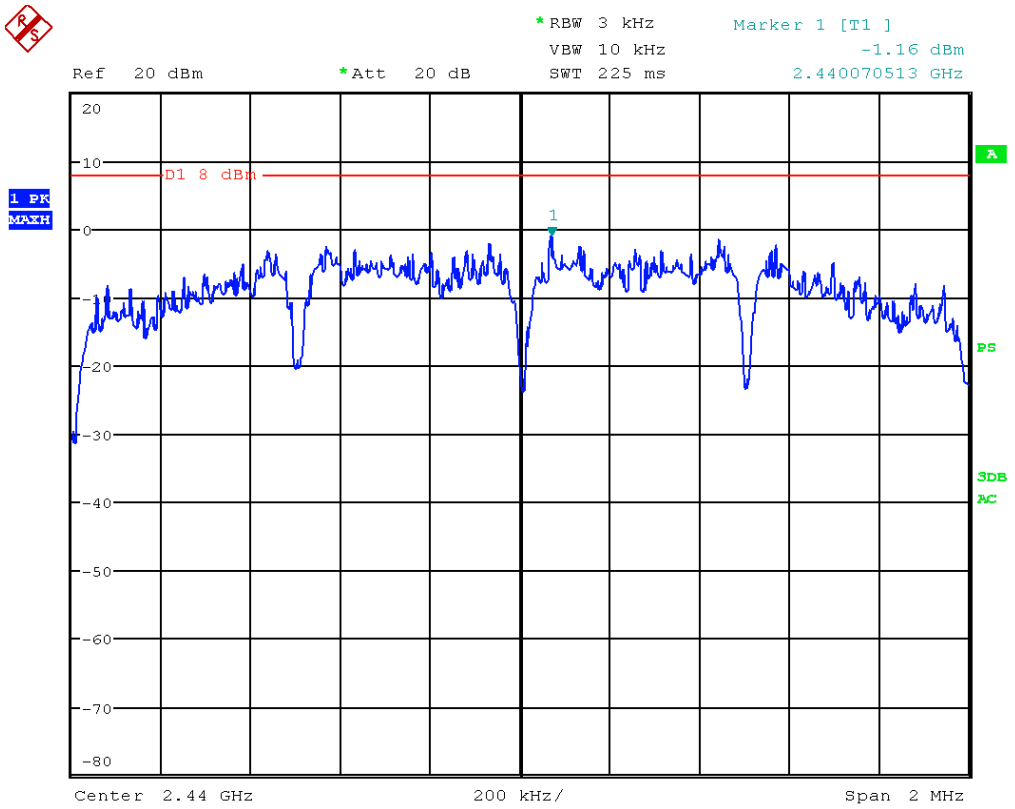
Picture 52: Power spectral density ant00, channel 13 - zoom1 to maximum



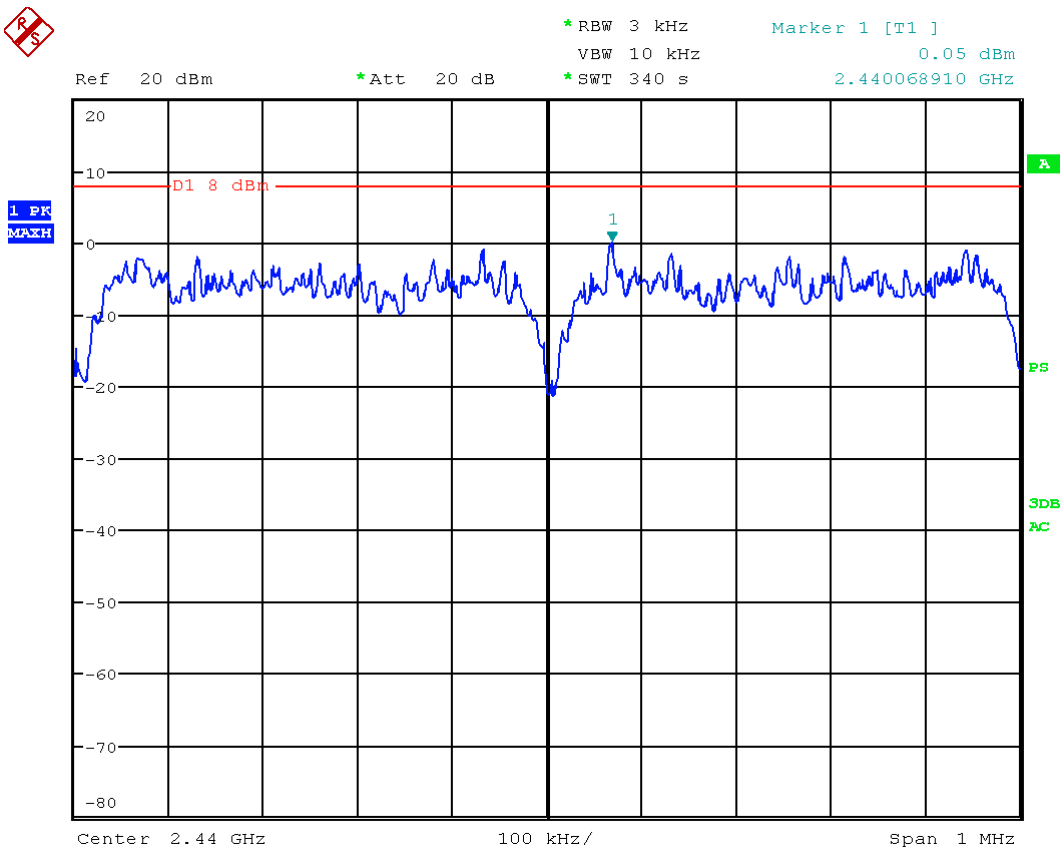
Picture 53: Power spectral density ant00, channel 13 - zoom2 to maximum



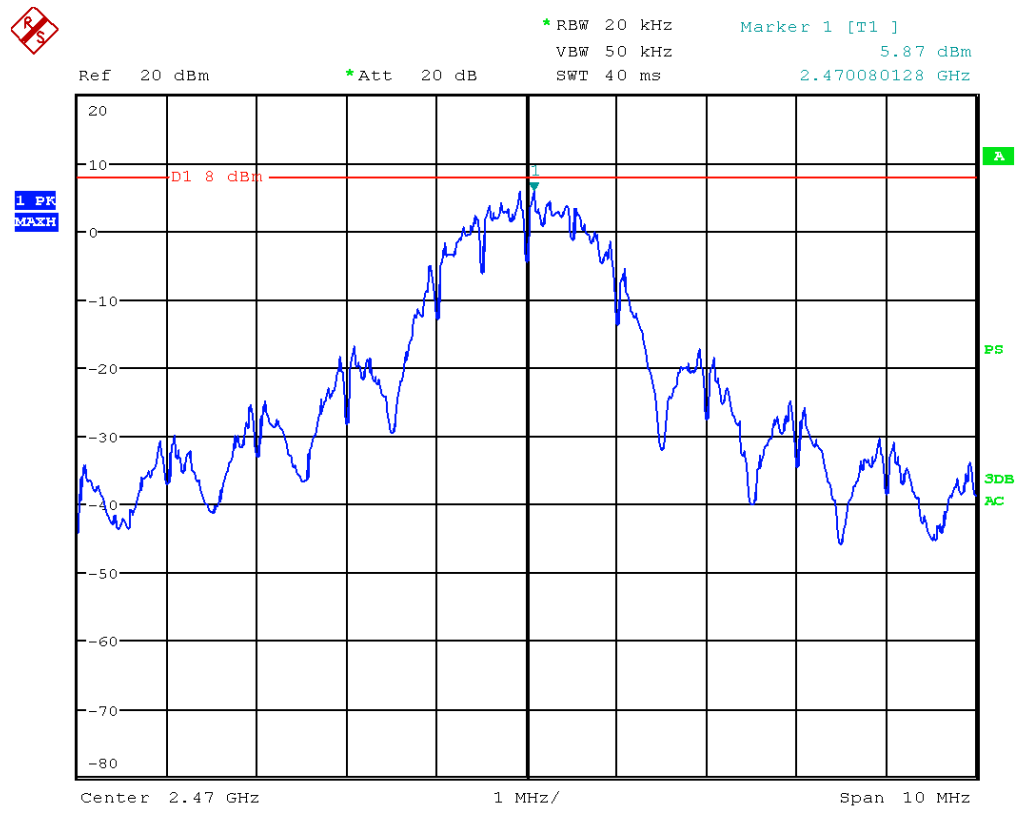
Picture 54: Power spectral density ant00, channel 18 - complete carrier



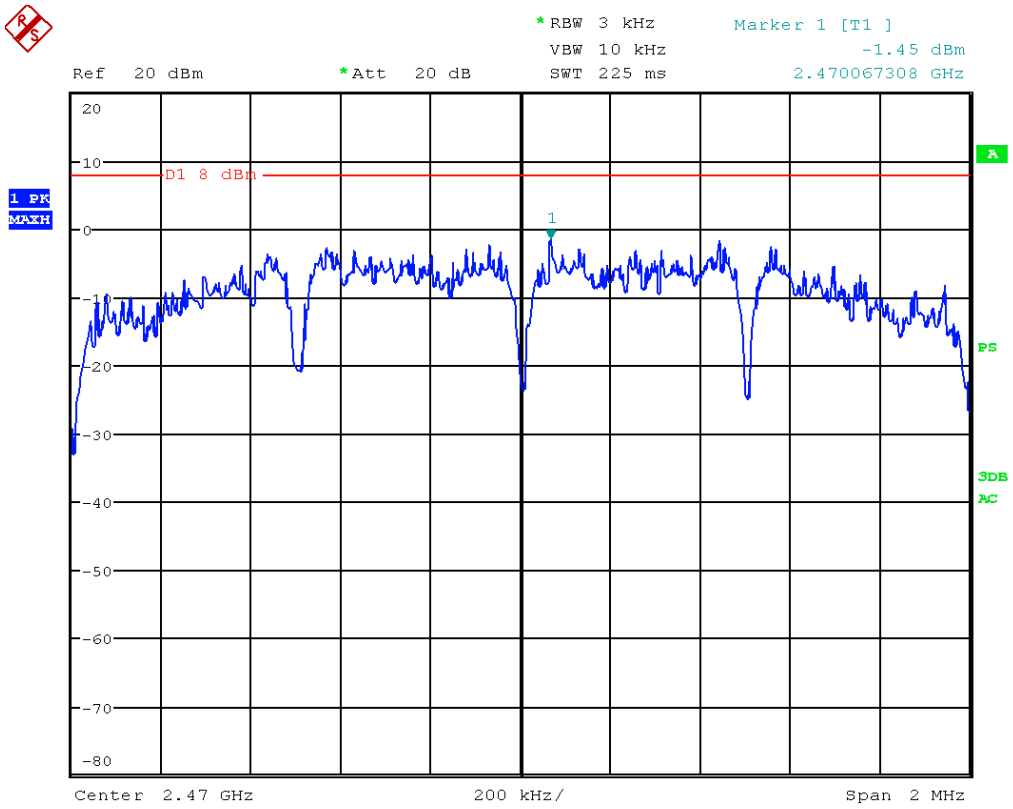
Picture 55: Power spectral density ant00, channel 18 - zoom1 to maximum



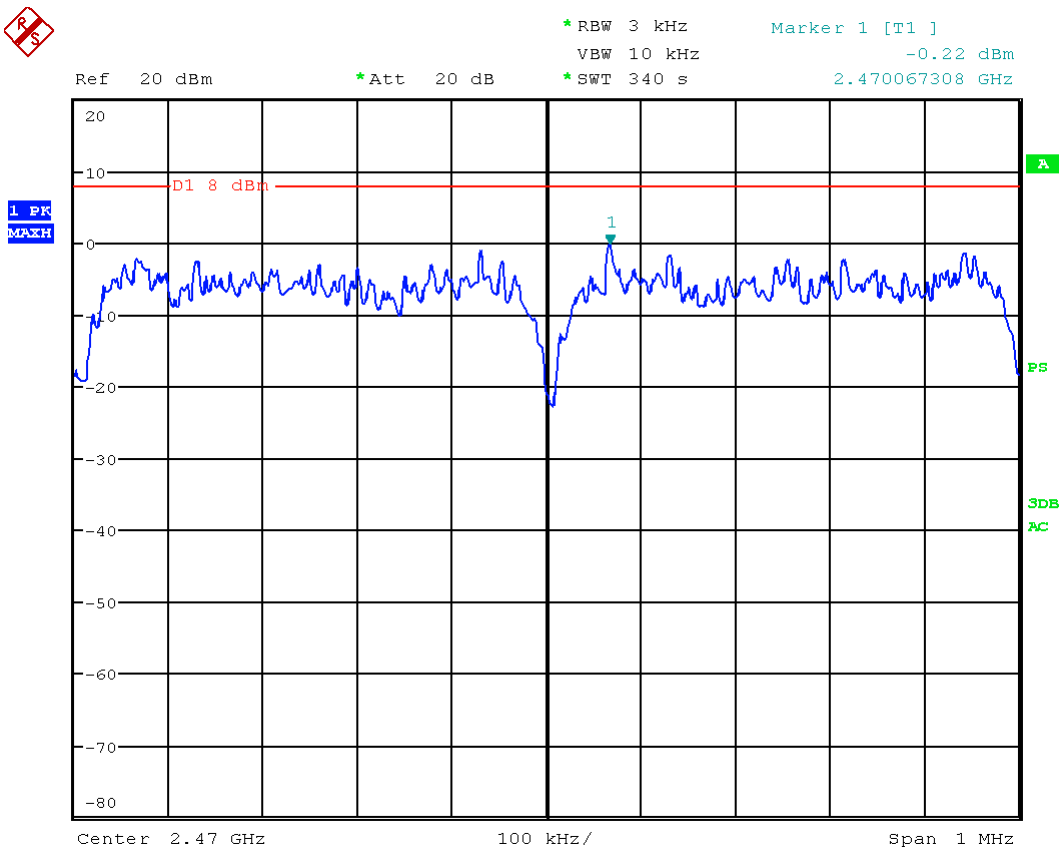
Picture 56: Power spectral density ant00, channel 18 - zoom2 to maximum



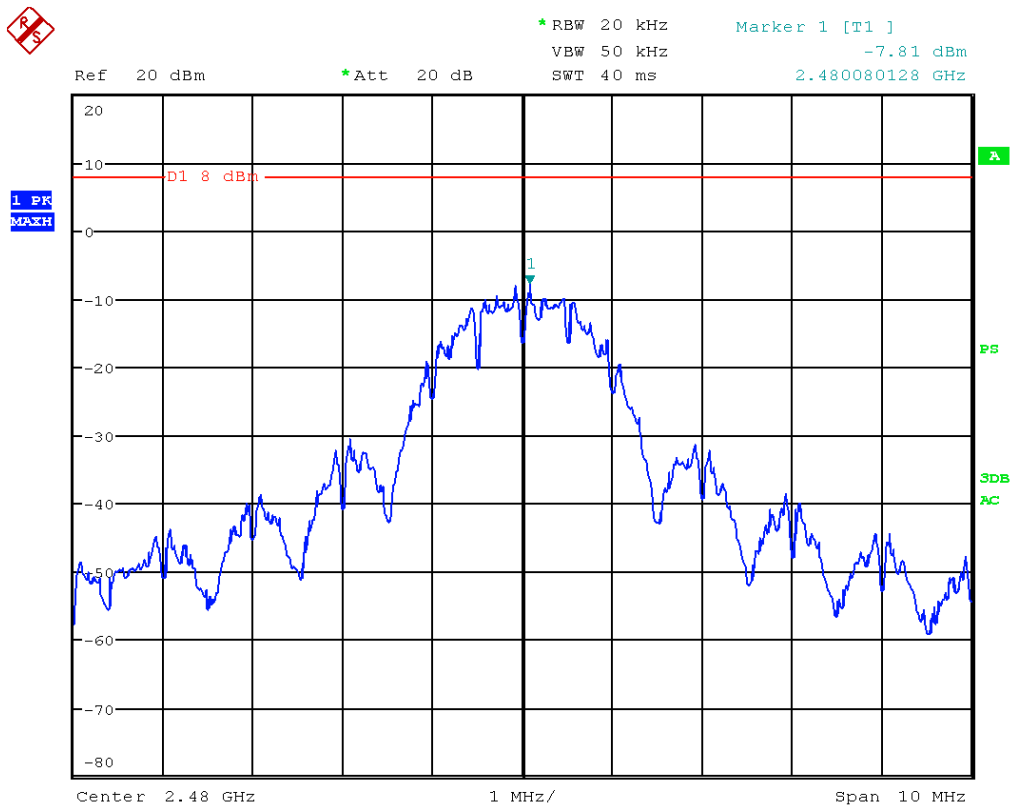
Picture 57: Power spectral density ant00, channel 24 - complete carrier



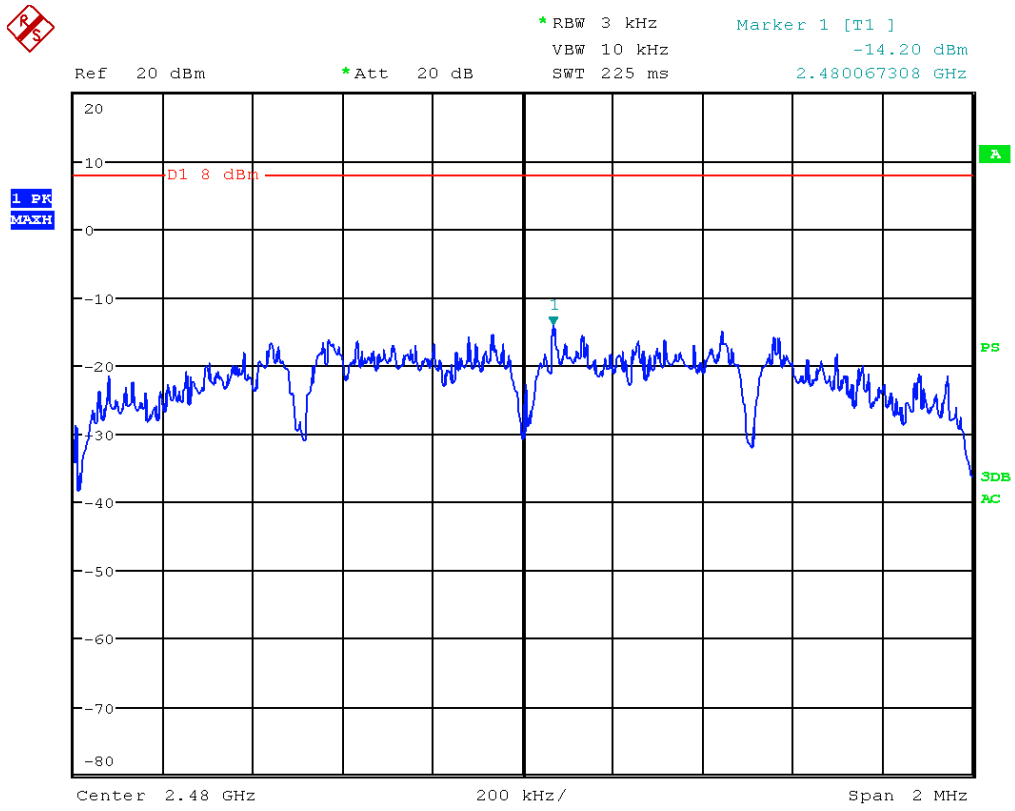
Picture 58: Power spectral density ant00, channel 24 - zoom1 to maximum



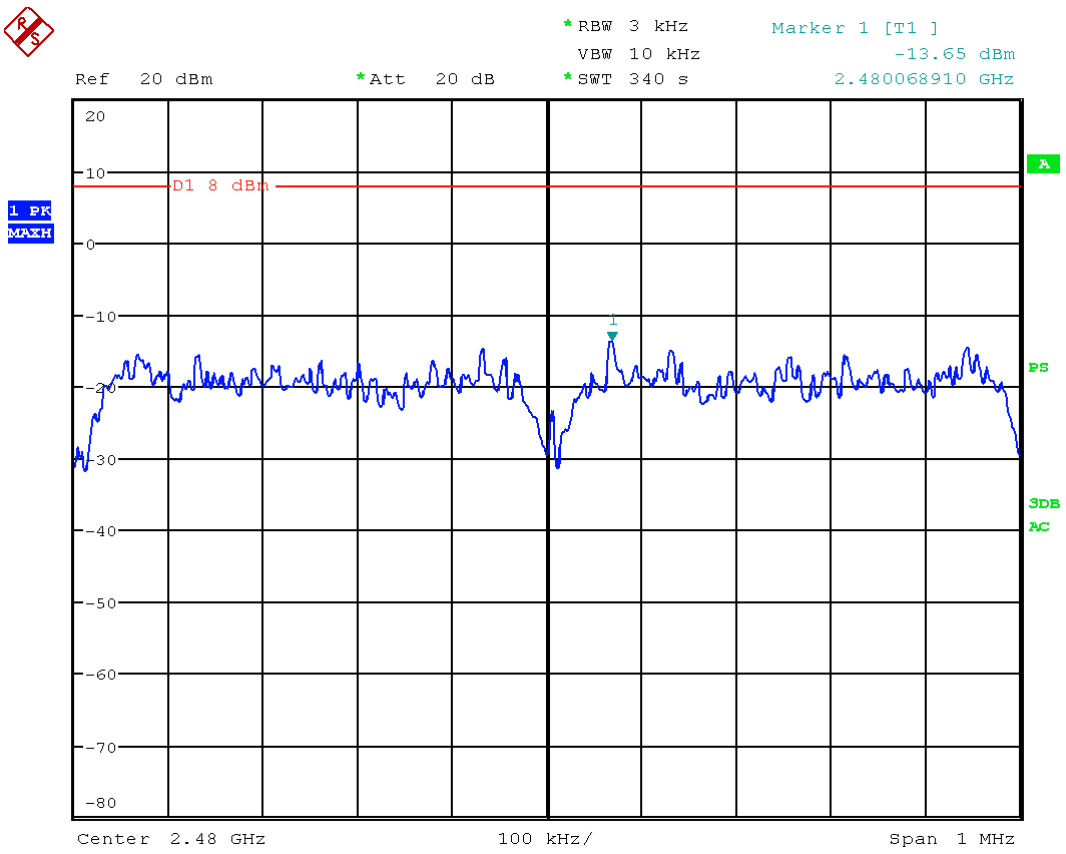
Picture 59: Power spectral density ant00, channel 24 - zoom2 to maximum



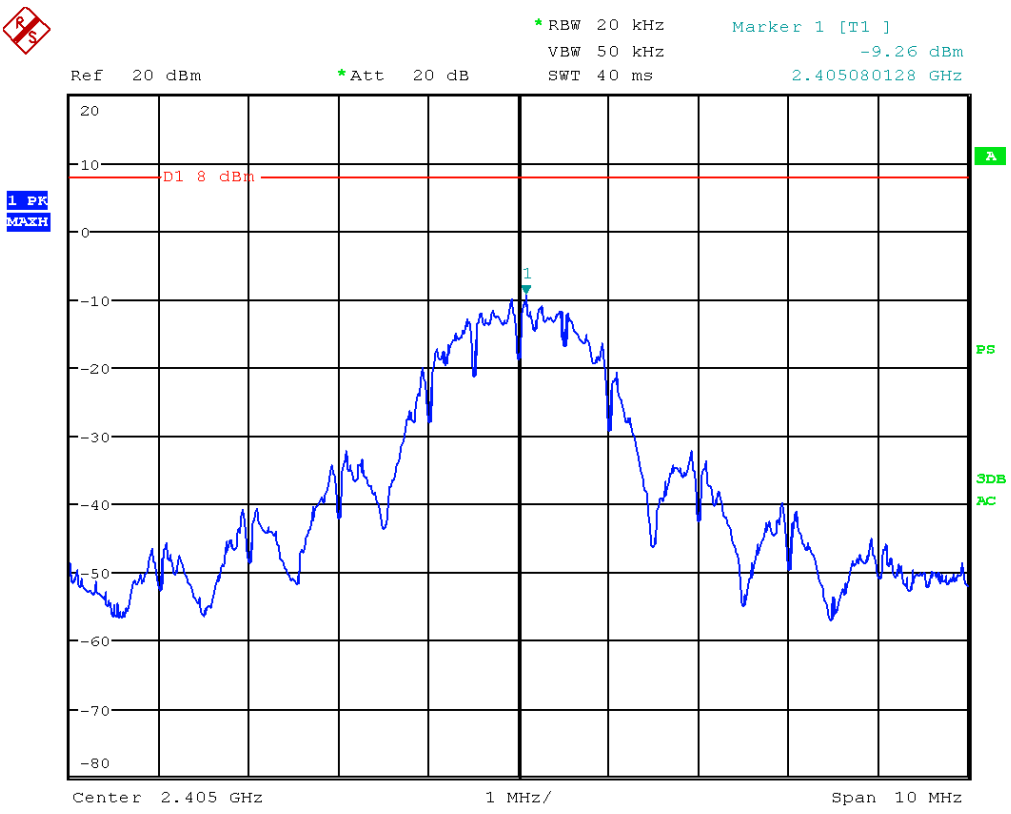
Picture 60: Power spectral density ant00, channel 26 - complete carrier



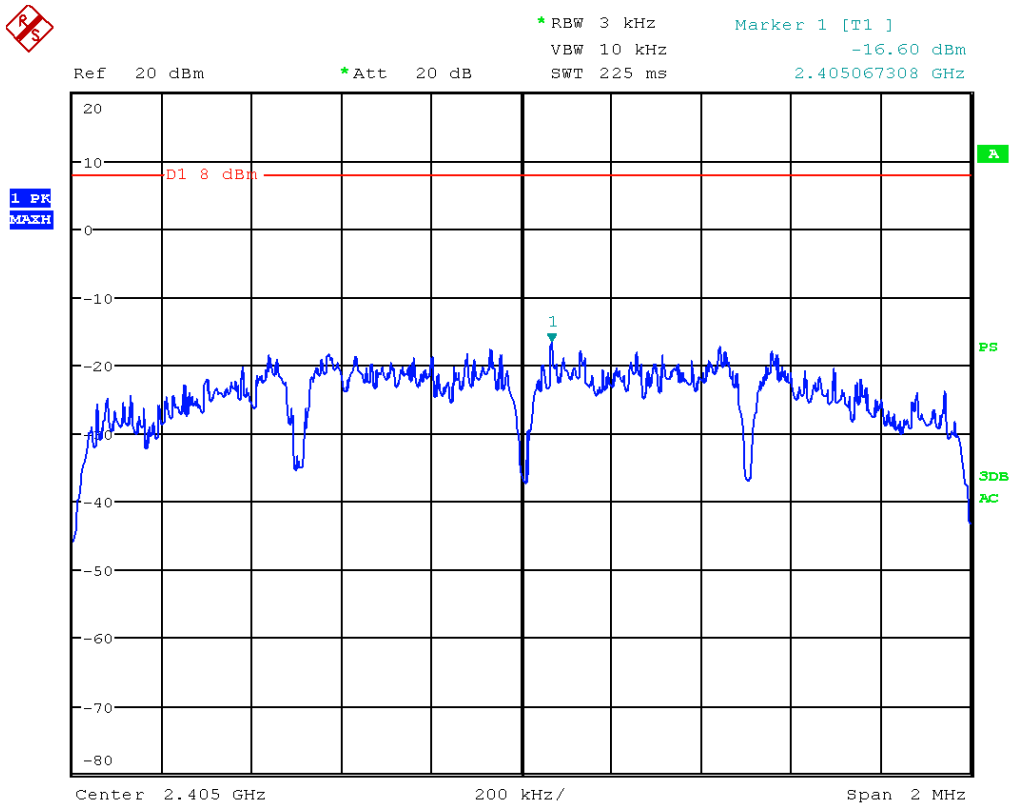
Picture 61: Power spectral density ant00, channel 26 - zoom1 to maximum



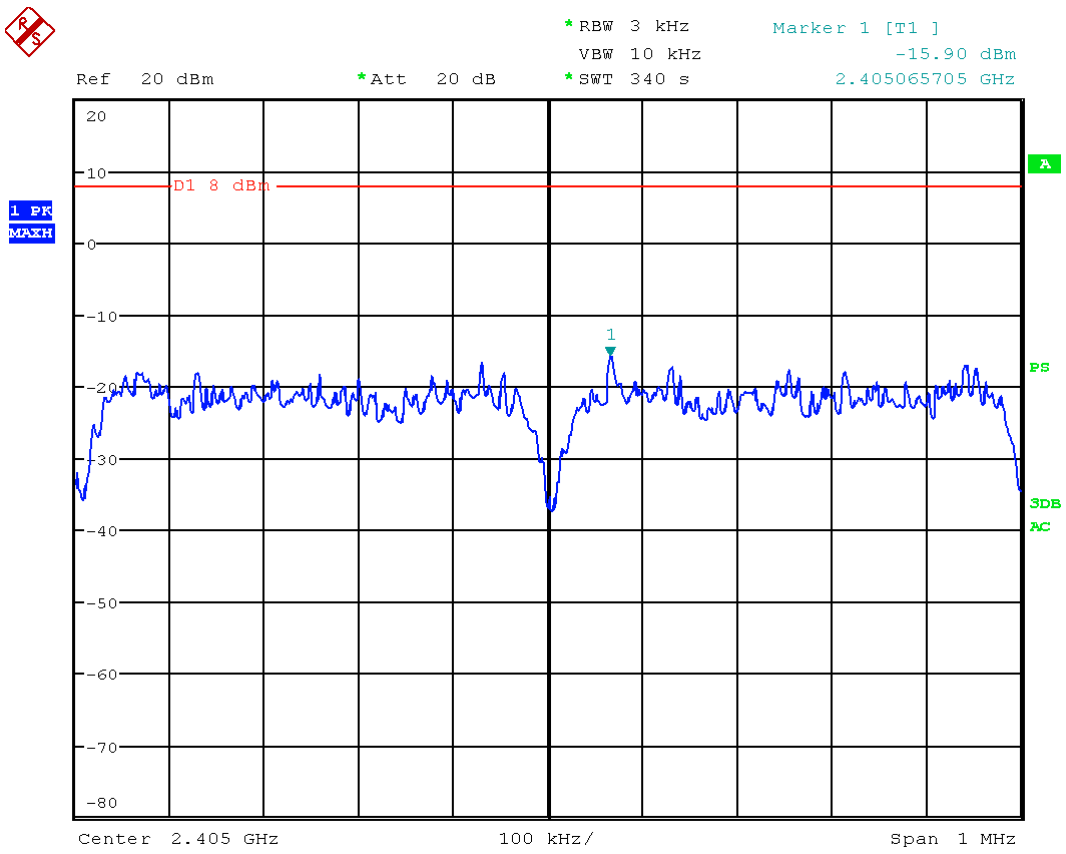
Picture 62: Power spectral density ant00, channel 26 - zoom2 to maximum



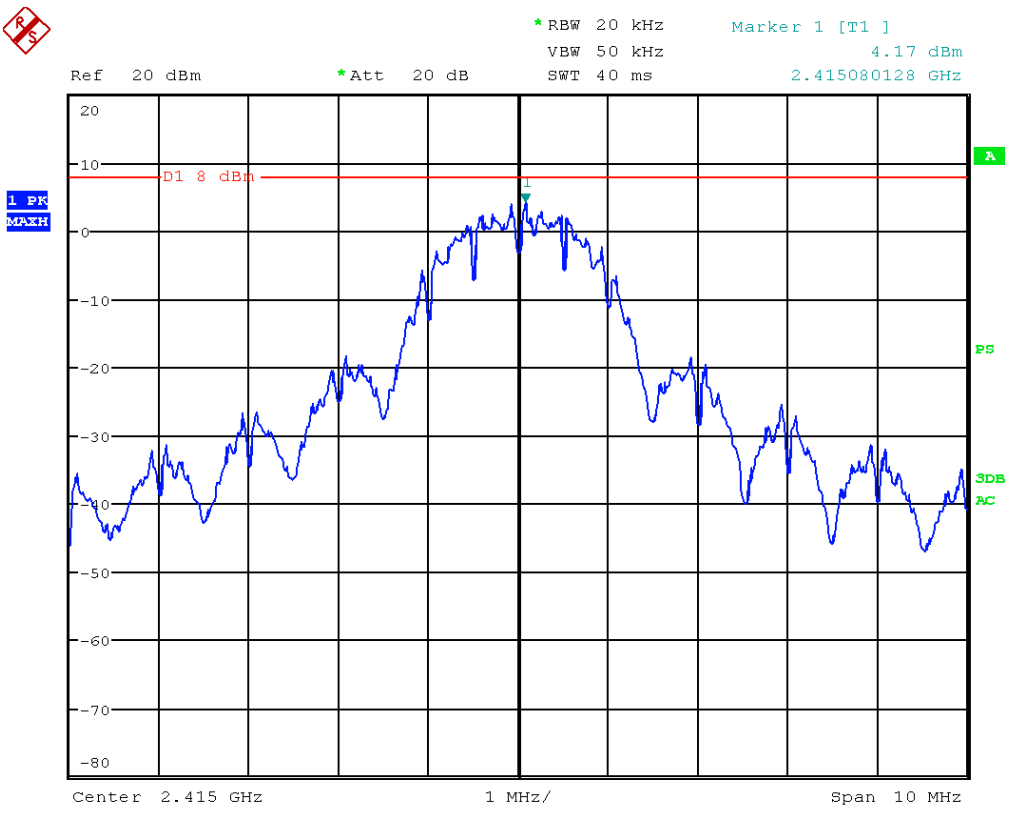
Picture 63: Power spectral density ant01, channel 11 - complete carrier



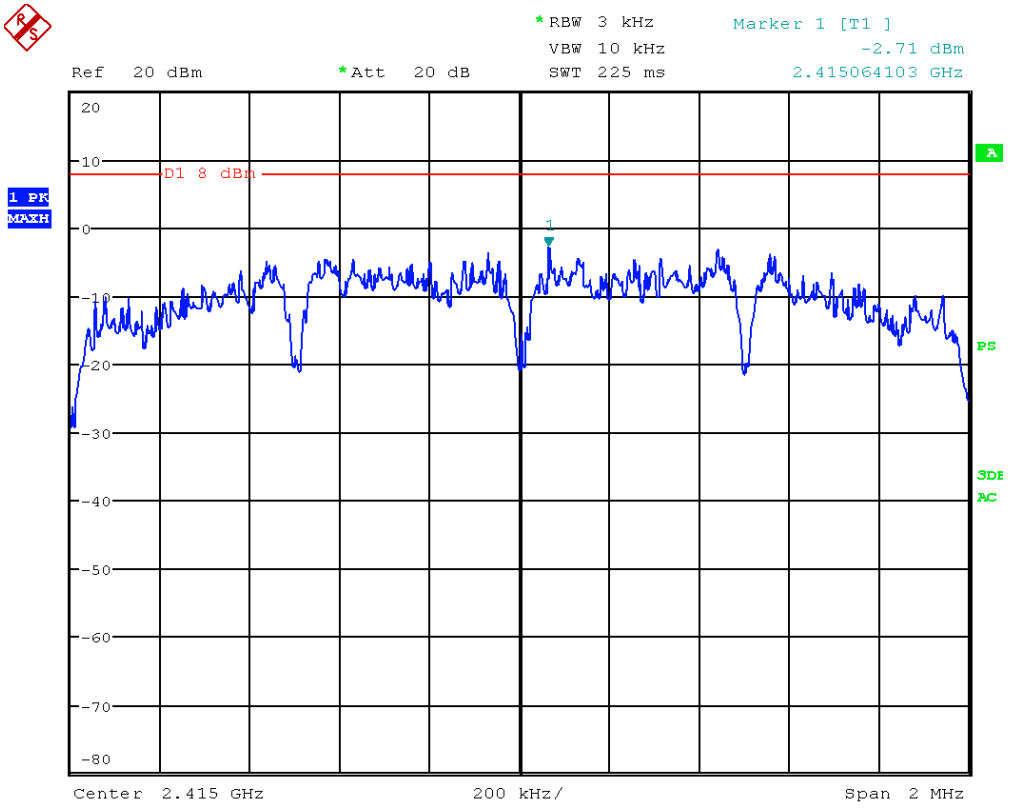
Picture 64: Power spectral density ant01, channel 11 - zoom1 to maximum



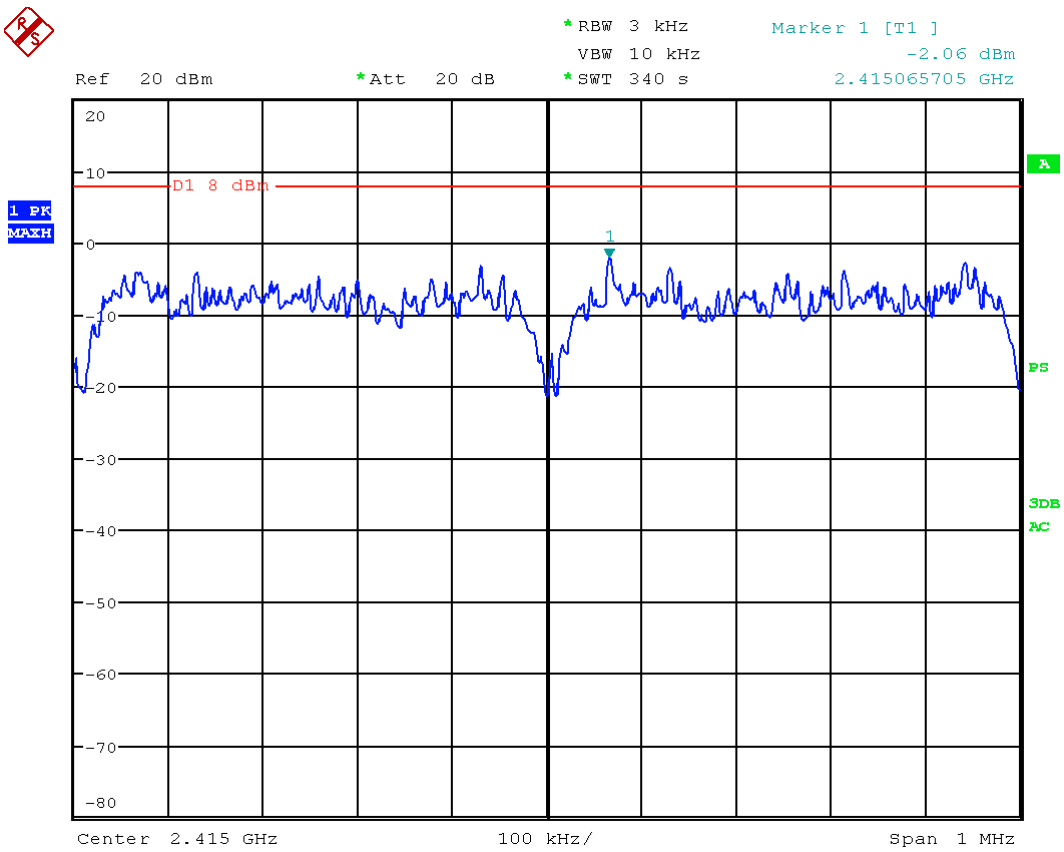
Picture 65: Power spectral density ant01, channel 11 - zoom2 to maximum



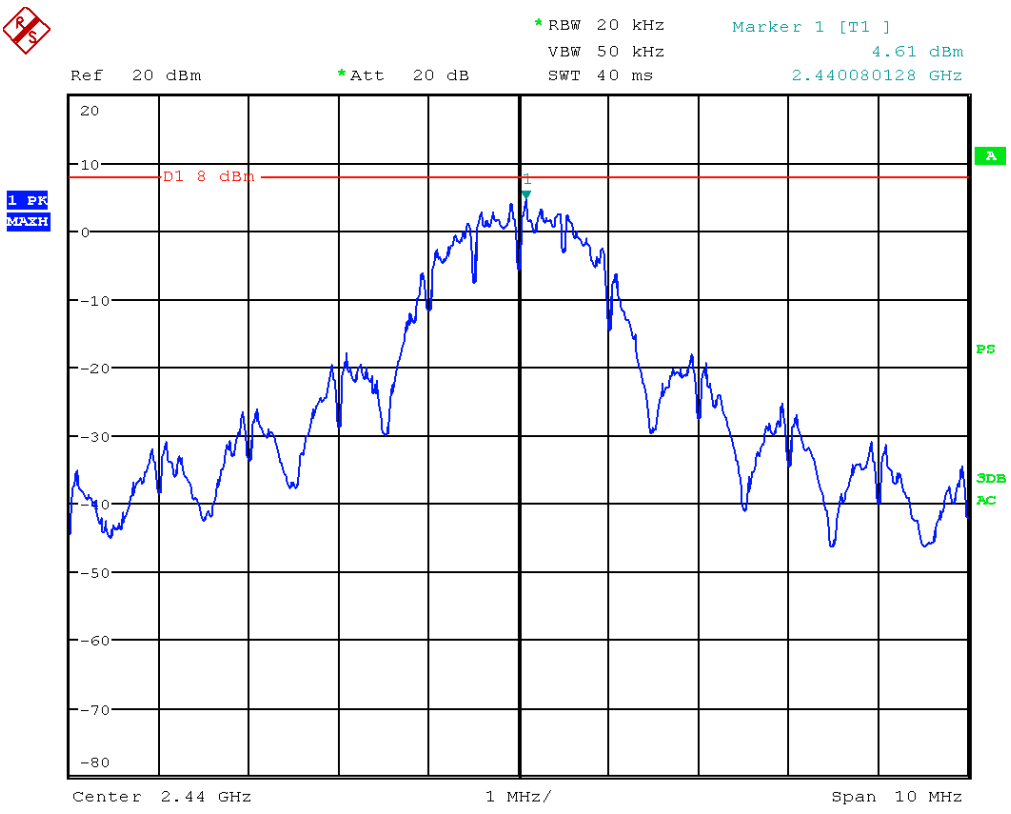
Picture 66: Power spectral density ant01, channel 13 - complete carrier



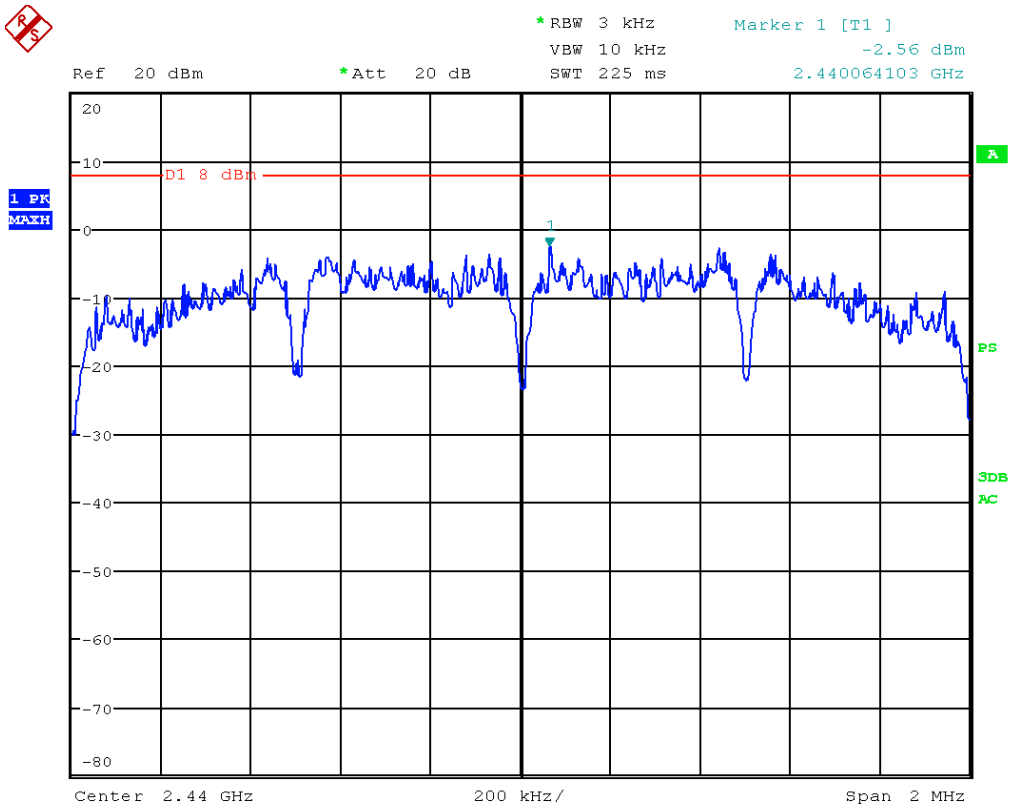
Picture 67: Power spectral density ant01, channel 13 - zoom1 to maximum



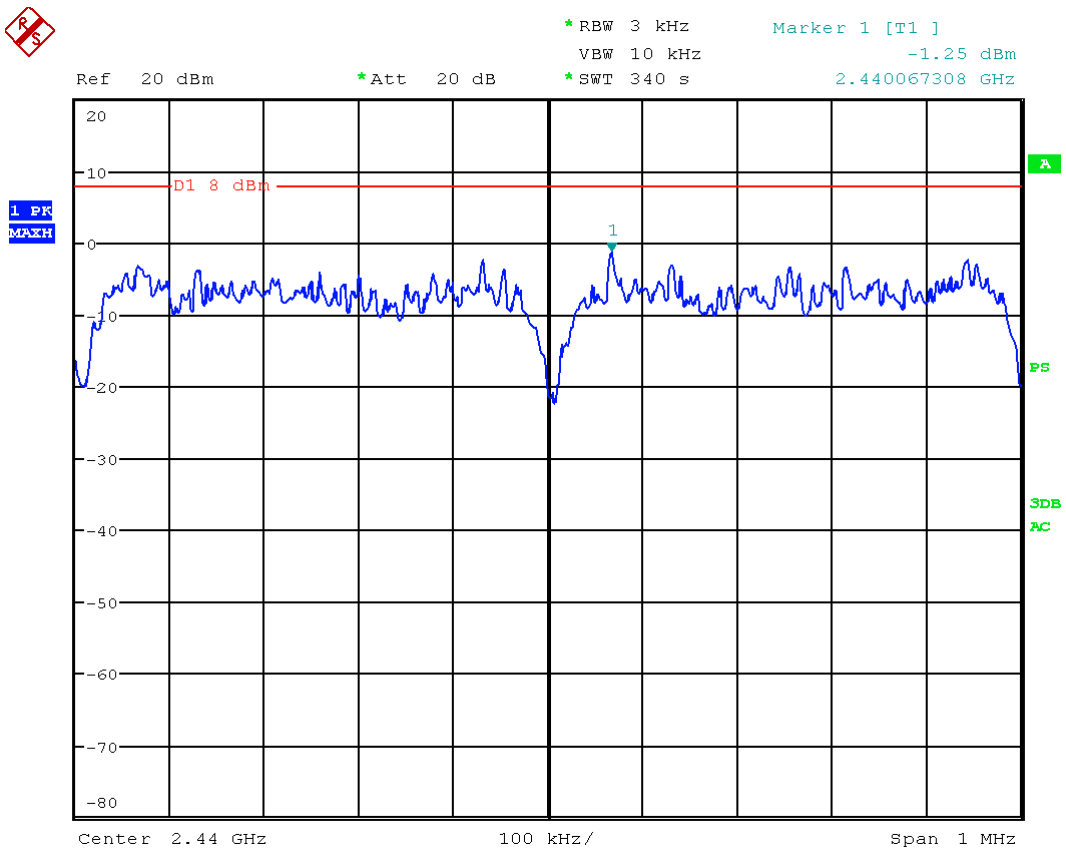
Picture 68: Power spectral density ant01, channel 13 - zoom2 to maximum



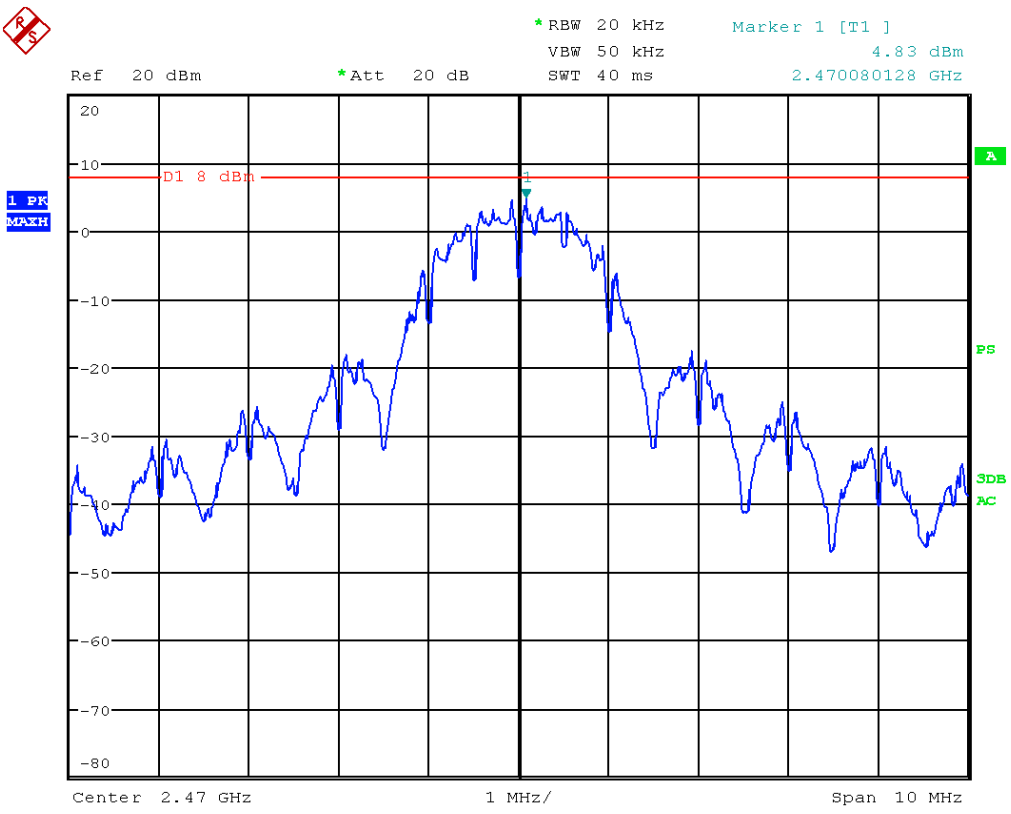
Picture 69: Power spectral density ant01, channel 18 - complete carrier



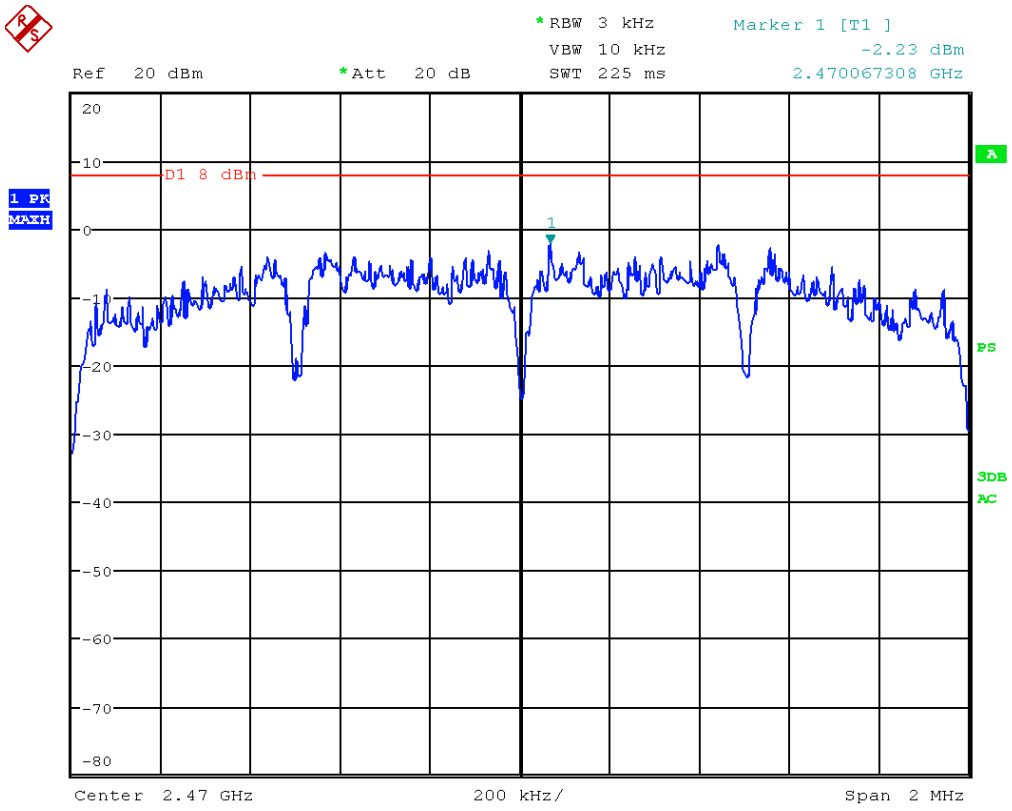
Picture 70: Power spectral density ant01, channel 18 - zoom1 to maximum



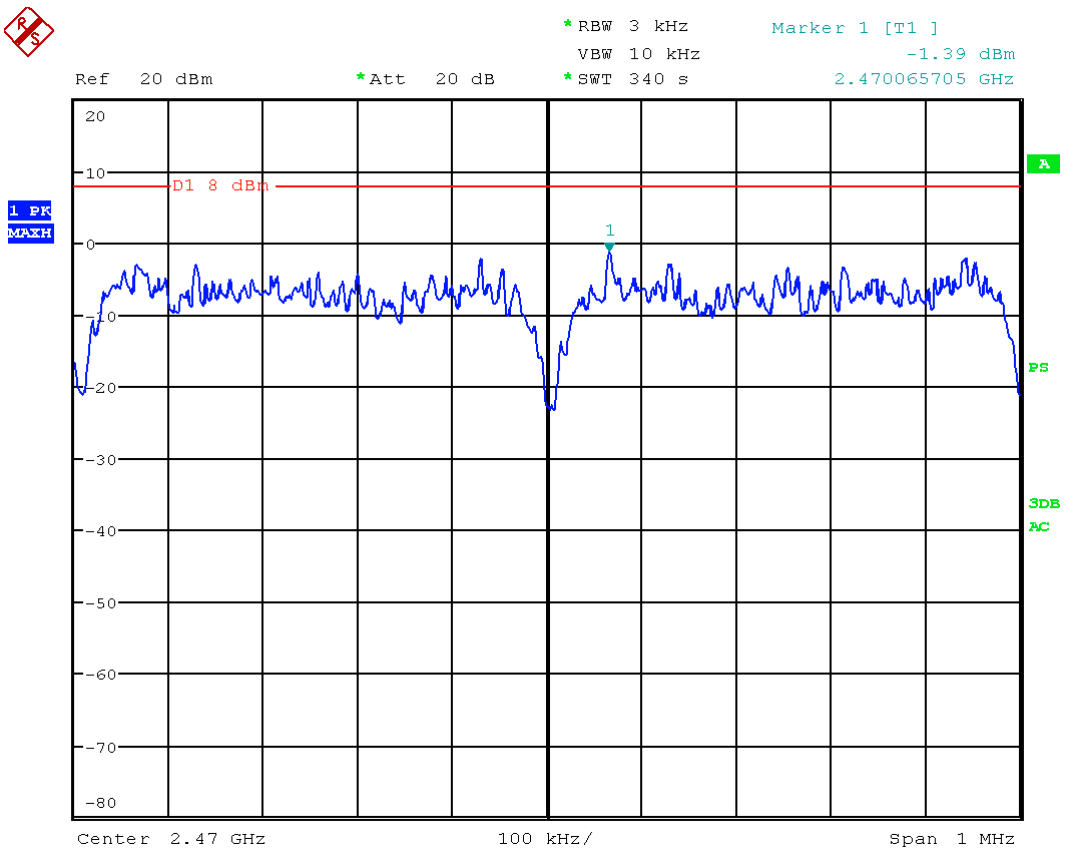
Picture 71: Power spectral density ant01, channel 18 - zoom2 to maximum



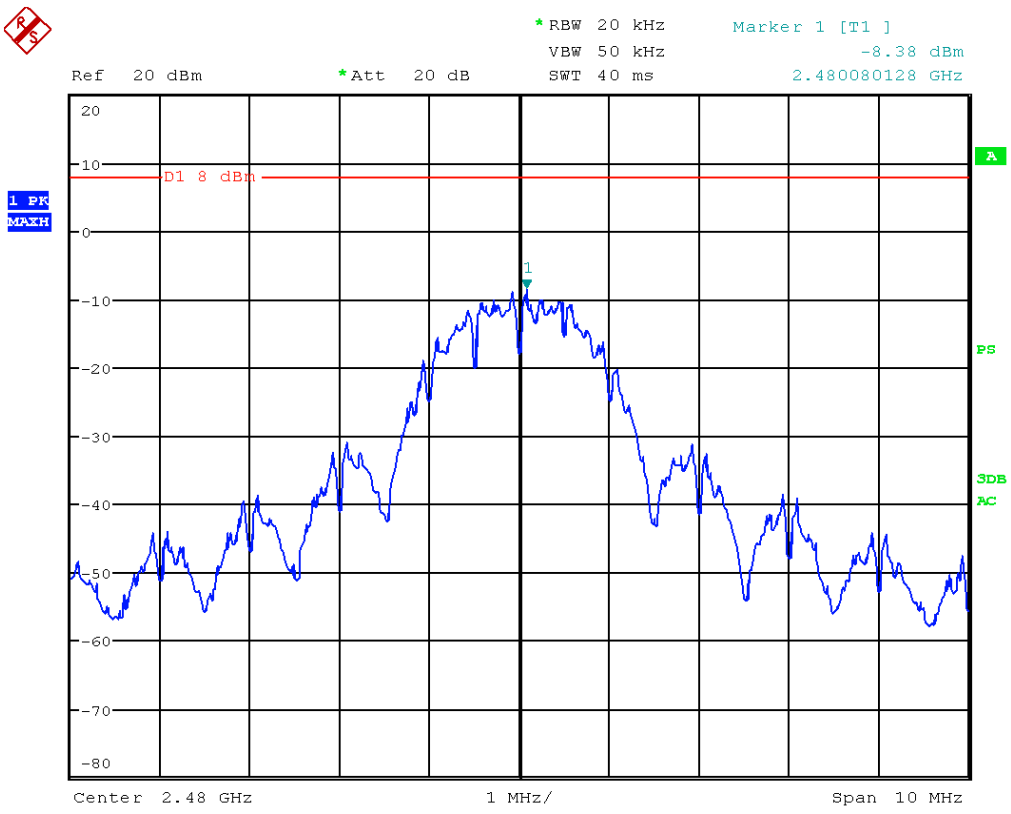
Picture 72: Power spectral density ant01, channel 24 - complete carrier



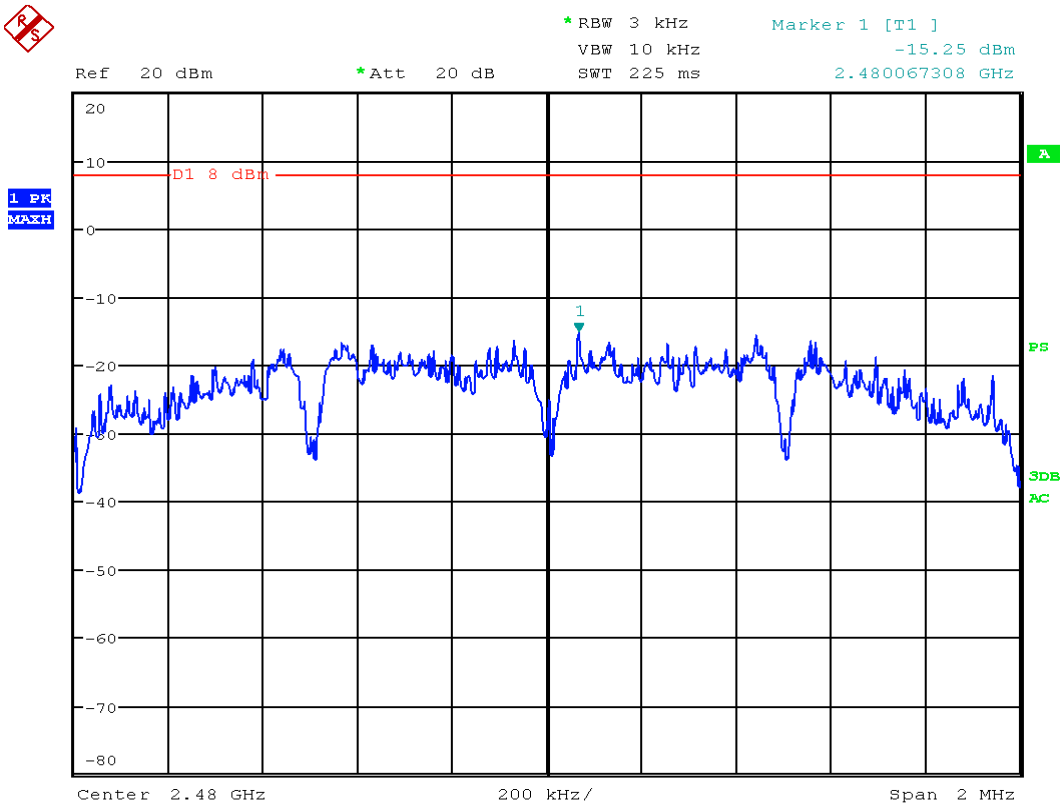
Picture 73: Power spectral density ant01, channel 24 - zoom1 to maximum



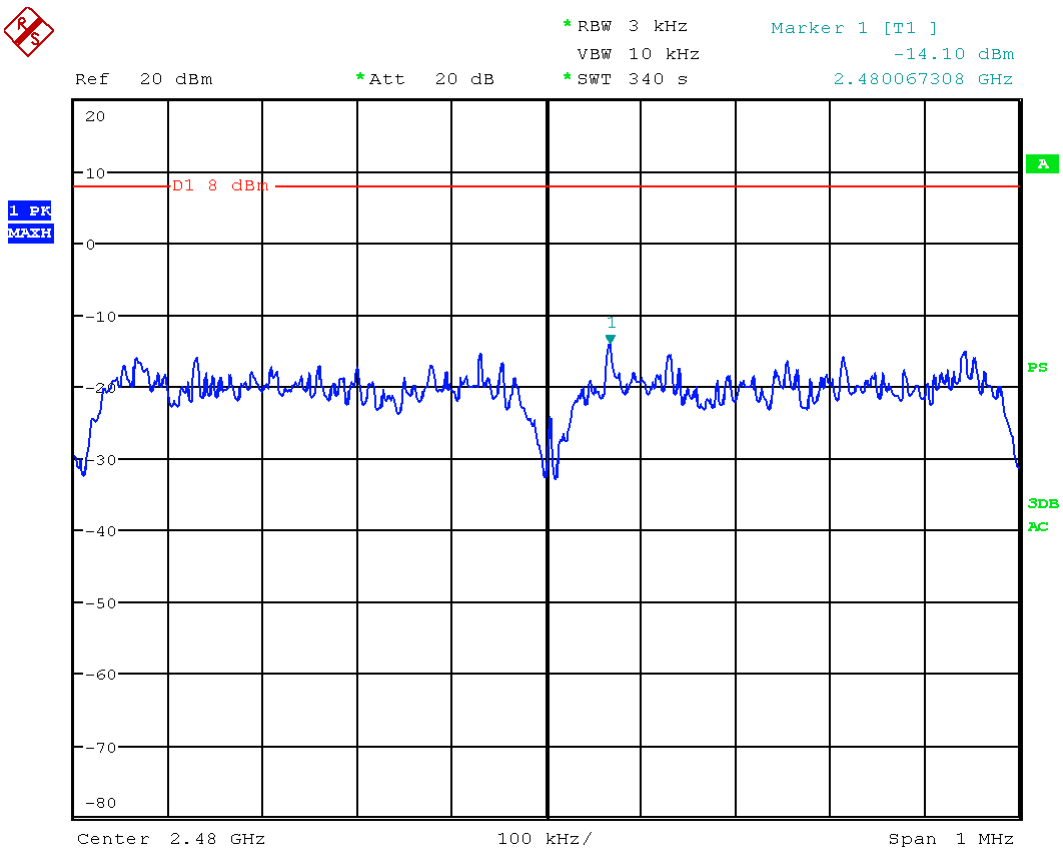
Picture 74: Power spectral density ant01, channel 24 - zoom2 to maximum



Picture 75: Power spectral density ant01, channel 26 - complete carrier



Picture 76: Power spectral density ant01, channel 26 - zoom1 to maximum



Picture 77: Power spectral density ant01, channel 26 - zoom2 to maximum

9 Band-edge compliance

according to 47 CFR Part 15, section 15.247(d)

9.1 Test location

☑ Scan with peak detector in 3 m CDC.

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

9.2 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

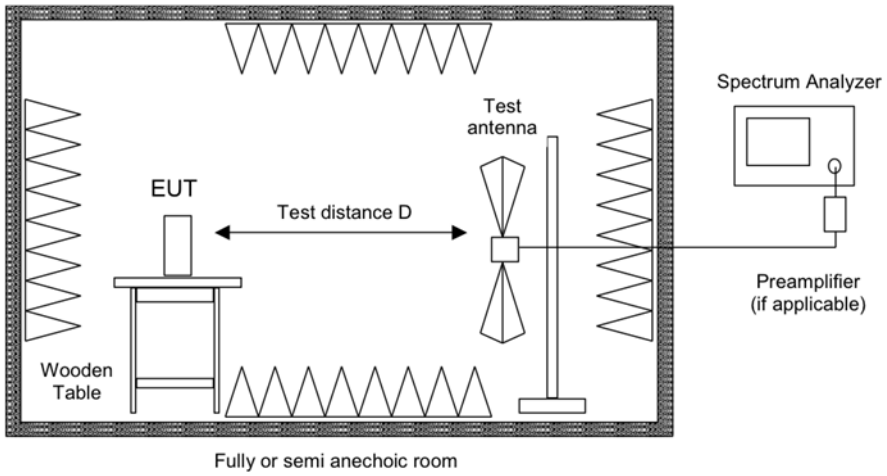
9.3 Limits

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

9.4 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. Maximize radiated emission at band edges by moving turntable and antenna height with horizontal and vertical antenna polarization.
5. Record this trace(s) and set appropriate markers
6. Set frequency to highest channel
7. Repeat steps 4 and 5

9.5 Test setup



Picture 78: Test setup for band-edge compliance 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.
It was investigated that for this test EUT-position1 in combination with measurement-antenna polarised to vertical is the respective worst-case.

9.8 Test results

Temperature:	22°C	Humidity:	44%
Tested by:	M. Müller	Test date:	2015-01-27

Test results antenna 00

Channel11					
f[GHz]	E_{meas} [dBµV/m]	Detector	Restr. Band	Limit [dBµV/m]	Result
2.4061	97.54	PK	No	----	Carrier
2.4054	62.77	AV (50Hz)	No	----	Carrier
2.3900	61.93	PK	Yes	74	Pass
2.3841	33.95	AV (50Hz)	Yes	54	Pass
2.3725	72.51	PK	Yes	74	Pass
2.3732	38.18	AV (50Hz)	Yes	54	Pass
2.3100	45.50	PK	Yes	74	Pass
2.3088	31.05	AV (50Hz)	No	-20dBc	Pass

Picture 79: Band edge compliance - ant00, channel 11

Channel13					
f[GHz]	E_{meas} [dBµV/m]	Detector	Restr. Band	Limit [dBµV/m]	Result
2.4160	111.16	PK	No	----	Carrier
2.4153	69.62	AV (50Hz)	No	----	Carrier
2.3834	70.56	PK	Yes	74	Pass
2.3830	43.17	AV (50Hz)	Yes	54	Pass
2.3722	72.39	PK	Yes	74	Pass
2.3513	39.11	AV (50Hz)	Yes	54	Pass
2.3190	35.08	AV (50Hz)	Yes	54	Pass
2.2881	53.47	PK	Yes	74	Pass
2.2874	35.14	AV (50Hz)	Yes	54	Pass
2.1366	59.00	PK	No	-20dBc	Pass
2.1360	36.17	AV (50Hz)	No	-20dBc	Pass

Picture 80: Band edge compliance - ant00, channel 13

Note: Frequency lines in charts are set to the edges of the restricted band closest to the carrier:
F1 = 2.3100 GHz
F2 = 2.3900 GHz

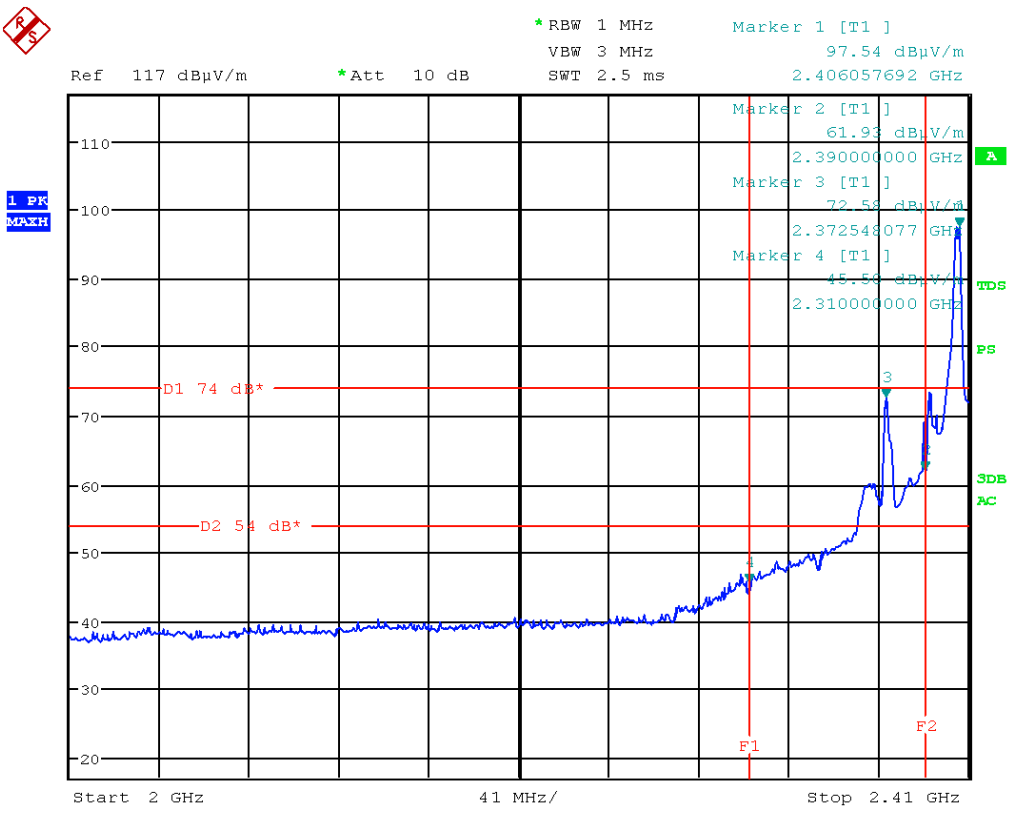
Channel24					
f[GHz]	E_{meas} [dBµV/m]	Detector	Restr. Band	Limit [dBµV/m]	Result
2.4695	67.57	AV (50Hz)	No	----	Carrier
2.4704	106.98	PK	No	----	Carrier
2.4868	73.68	PK	Yes	74	Pass
2.4955	72.55	PK	Yes	74	Pass
2.4998	72.47	PK	Yes	74	Pass
2.5015	40.47	AV (50Hz)	No	-20dBc	Pass
2.5336	37.58	AV (50Hz)	No	-20dBc	Pass
2.5448	71.13	PK	No	-20dBc	Pass
2.5656	32.89	AV (50Hz)	No	-20dBc	Pass
2.5976	33.61	AV (50Hz)	No	-20dBc	Pass

Picture 81: Band edge compliance - ant00, channel 24

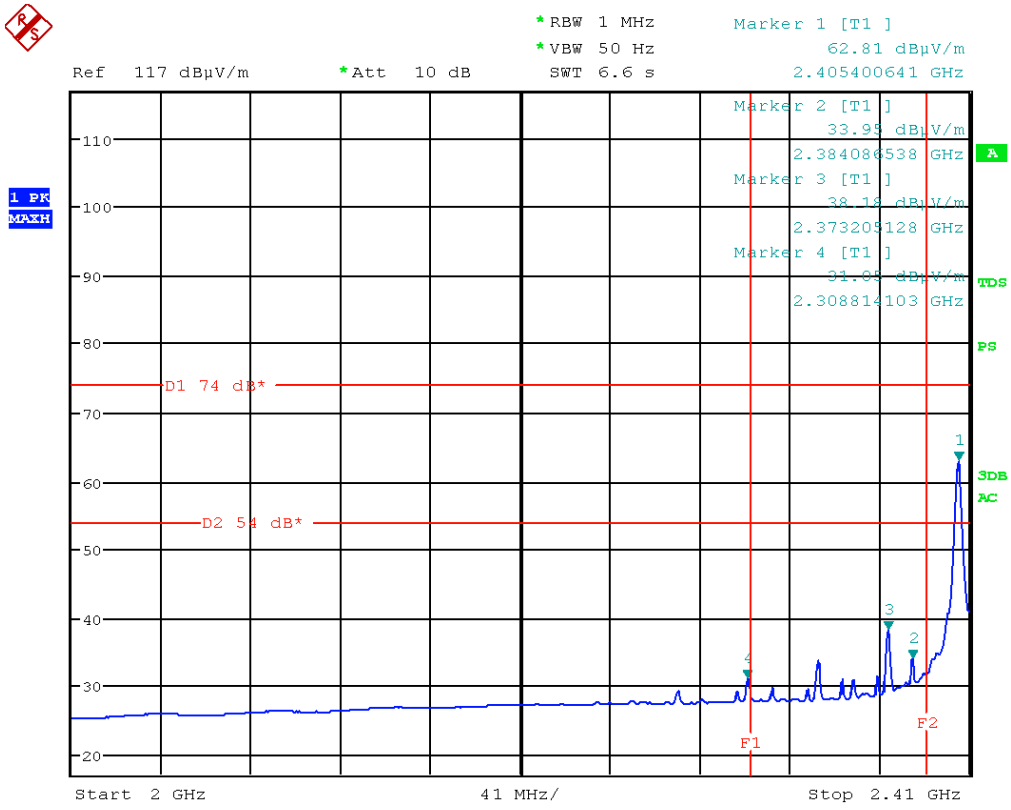
Channel26					
f[GHz]	E_{meas} [dBµV/m]	Detector	Restr. Band	Limit [dBµV/m]	Result
2.4793	97.16	PK	No	----	Carrier
2.4793	62.67	AV (50Hz)	No	----	Carrier
2.4837	73.57	PK	Yes	74	Pass
2.3837	42.41	AV (50Hz)	Yes	54	Pass
2.4925	73.07	PK	Yes	74	Pass
2.4955	33.08	AV (50Hz)	Yes	54	Pass
2.4982	73.01	PK	Yes	74	Pass
2.5074	72.71	PK	No	-20dBc	Pass
2.5116	37.30	AV (50Hz)	No	-20dBc	Pass
2.5439	33.57	AV (50Hz)	No	-20dBc	Pass
2.5447	71.21	PK	No	-20dBc	Pass

Picture 82: Band edge compliance - ant00, channel 26

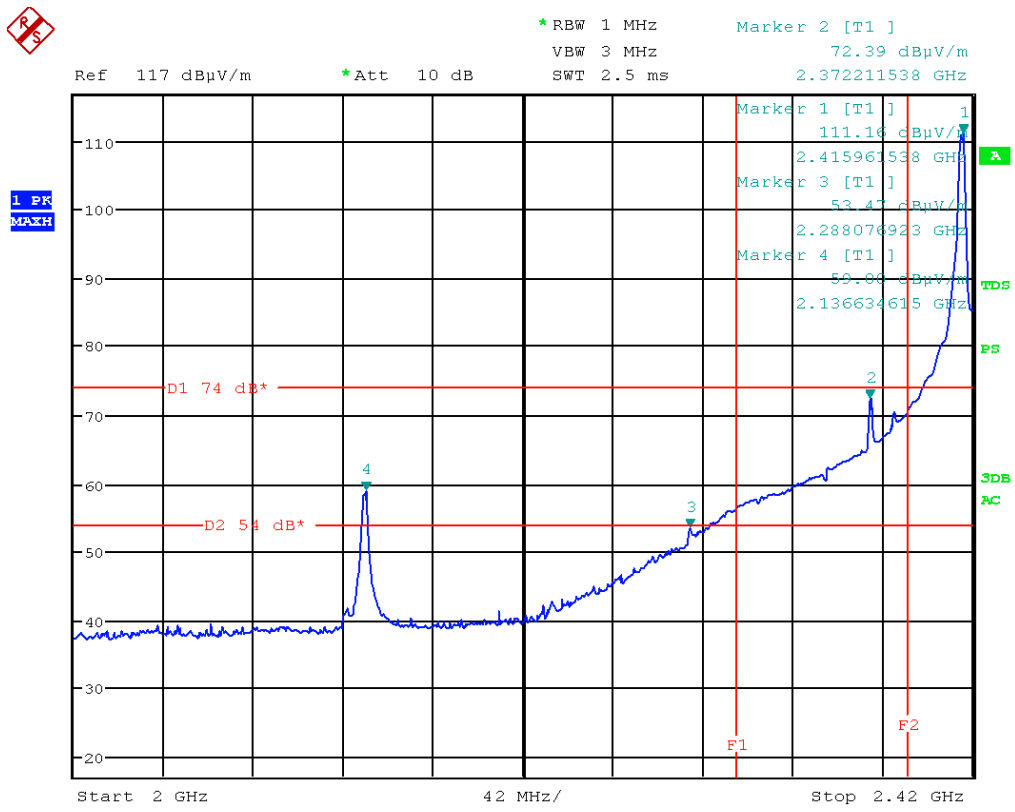
Note: Frequency lines in charts are set to the edges of the restricted band closest to the carrier:
F1 = 2.4835 GHz
F2 = 2.5000 GHz



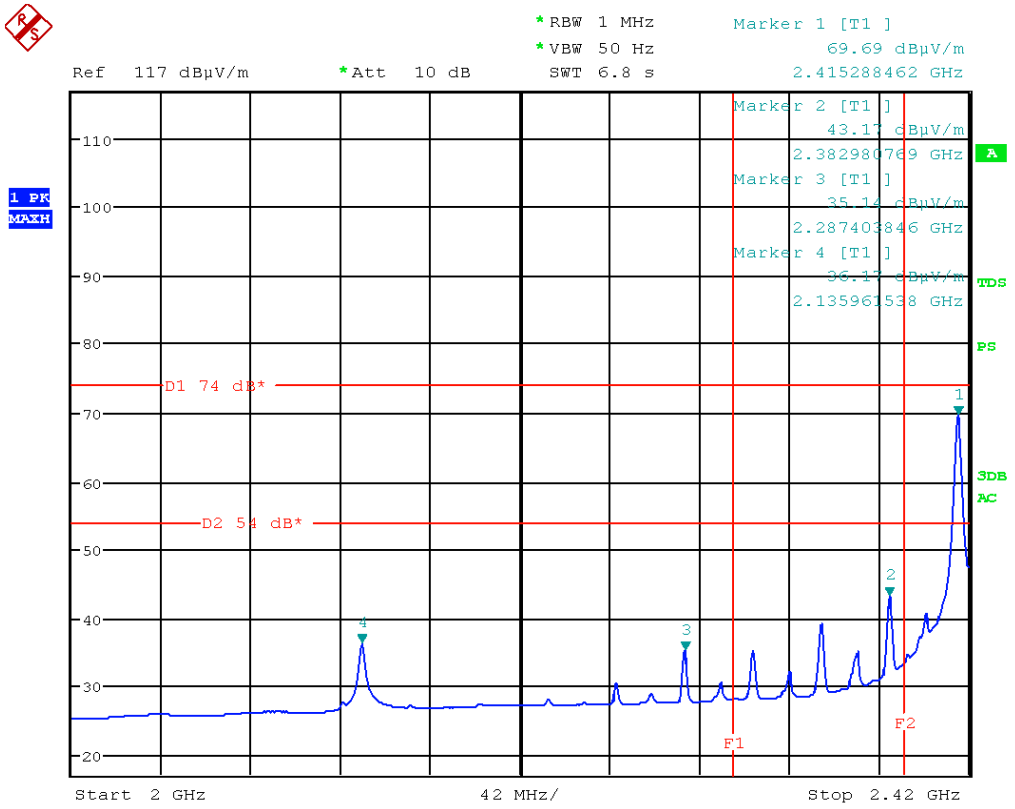
Picture 83: lower edge (PK) - ant00, channel 11



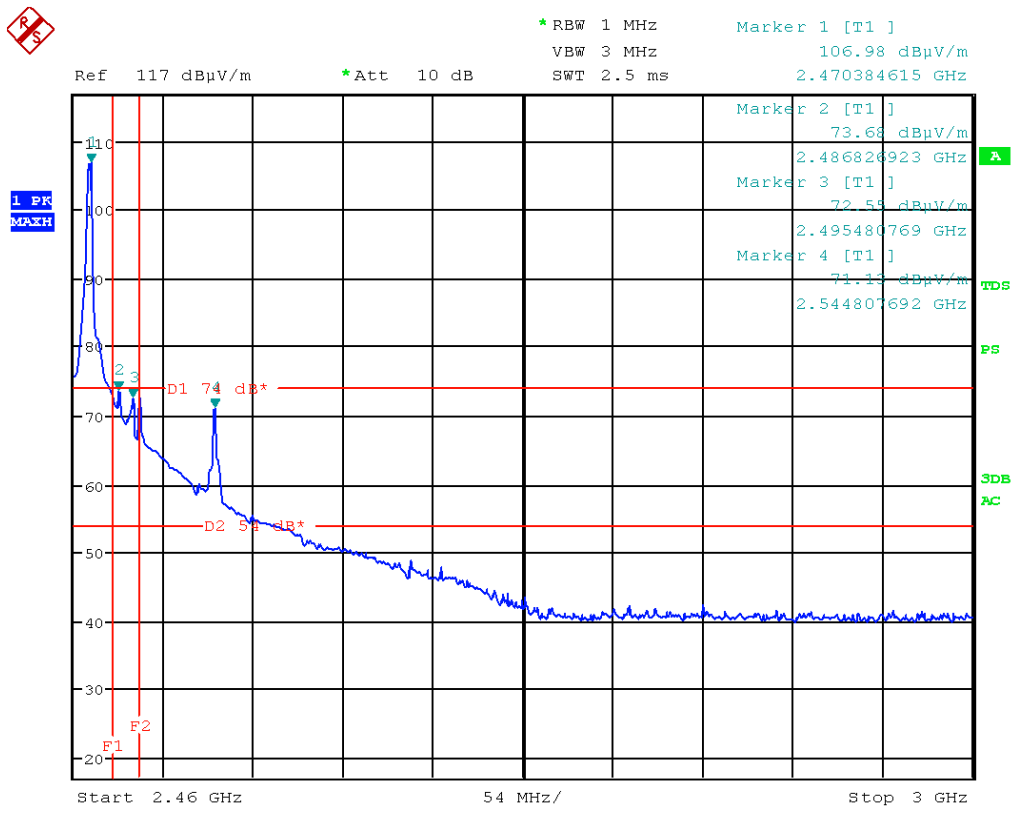
Picture 84: lower edge (AV) - ant00, channel 11



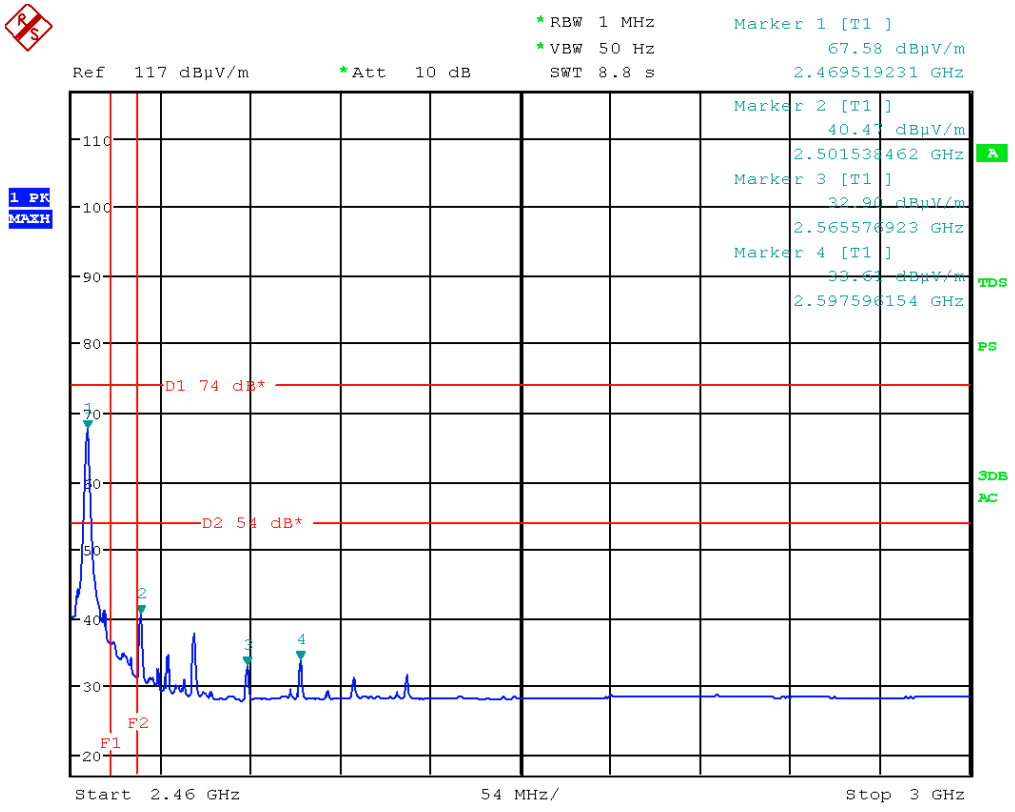
Picture 85: lower edge (PK) - ant00, channel 13



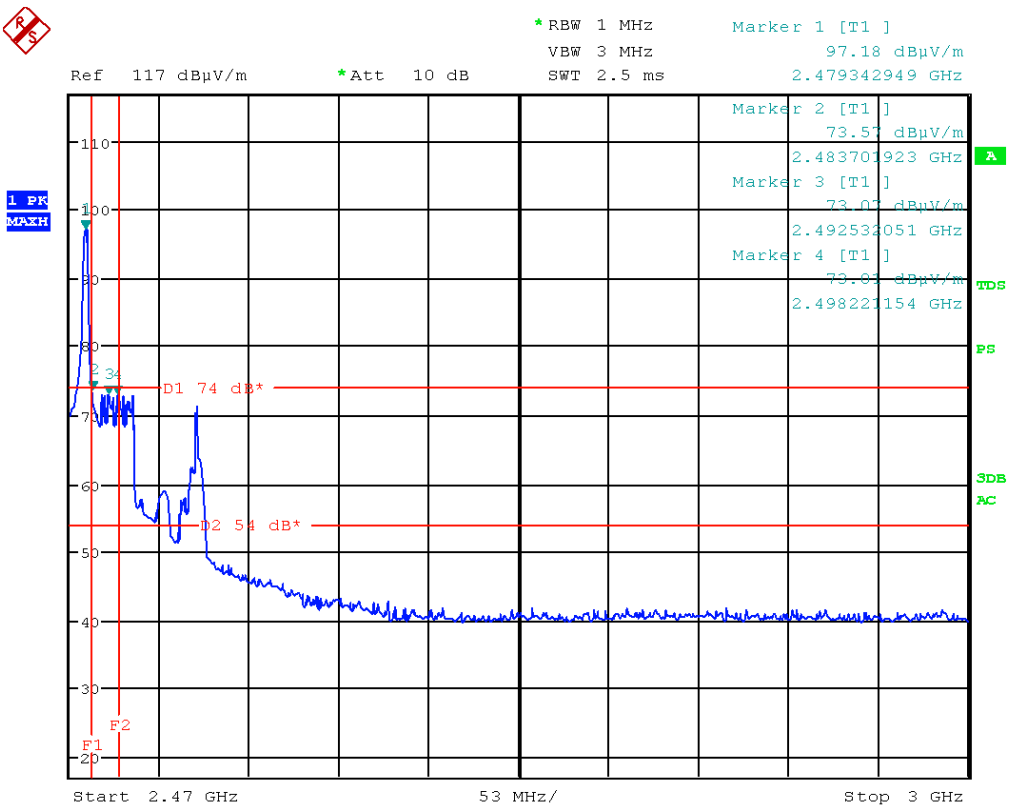
Picture 86: lower edge (AV) - ant00, channel 13



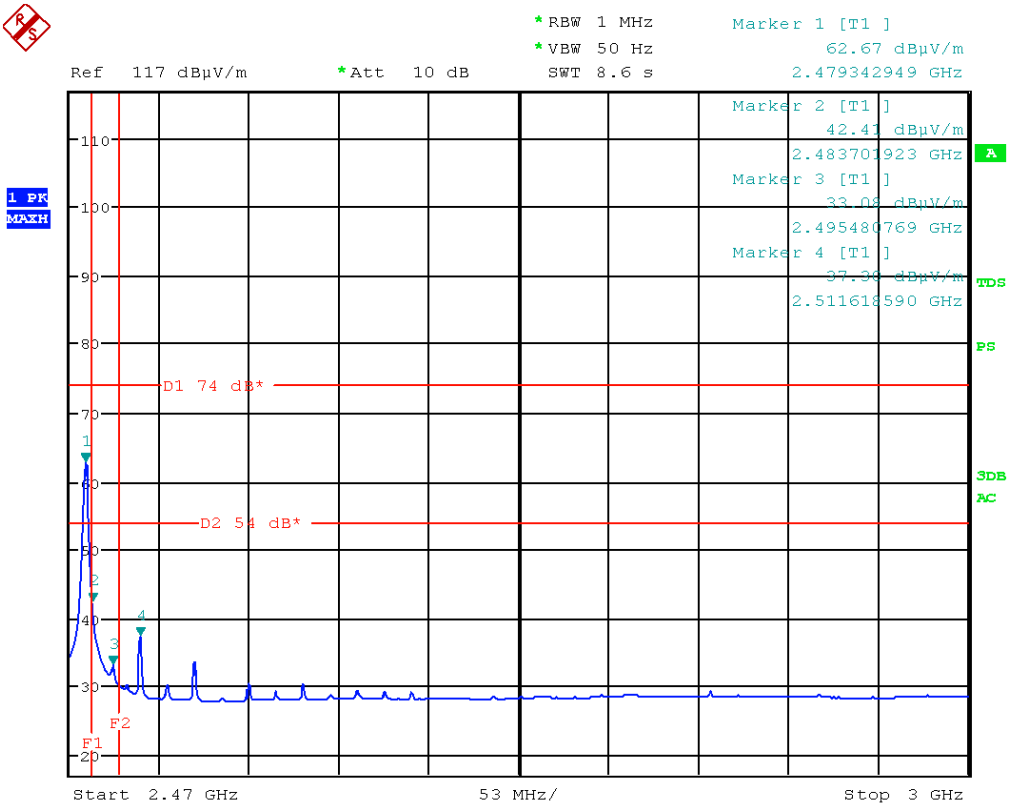
Picture 87: upper edge (PK) - ant00, channel 24



Picture 88: upper edge (AV) - ant00, channel 24



Picture 89: upper edge (PK) - ant00, channel 26



Picture 90: upper edge (AV) - ant00, channel 26

Test results antenna 01

Channel11					
f[GHz]	E_{meas} [dBµV/m]	Detector	Restr. Band	Limit [dBµV/m]	Result
2.4060	94.96	PK	No	----	Carrier
2.4054	61.39	AV (50Hz)	No	----	Carrier
2.3923	71.46	PK	No	-20dBc	Pass
2.3884	70.64	PK	Yes	74	Pass
2.3845	33.25	AV (50Hz)	Yes	54	Pass
2.3733	37.55	AV (50Hz)	Yes	54	Pass
2.3724	71.66	PK	Yes	74	Pass
2.3410	32.78	AV (50Hz)	No	-20dBc	Pass

Picture 91: Band edge compliance - ant01, channel 11

Channel13					
f[GHz]	E_{meas} [dBµV/m]	Detector	Restr. Band	Limit [dBµV/m]	Result
2.4160	108.94	PK	No	----	Carrier
2.4153	68.55	AV (50Hz)	No	----	Carrier
2.3838	69.54	PK	Yes	74	Pass
2.3831	42.91	AV (50Hz)	Yes	54	Pass
2.3720	71.60	PK	Yes	74	Pass
2.3511	38.90	AV (50Hz)	Yes	54	Pass
2.3100	52.90	PK	Yes	74	Pass
2.2864	34.95	AV (50Hz)	Yes	54	Pass

Picture 92: Band edge compliance - ant01, channel 13

Note: Frequency lines in charts are set to the edges of the restricted band closest to the carrier:
F1 = 2.3100 GHz
F2 = 2.3900 GHz

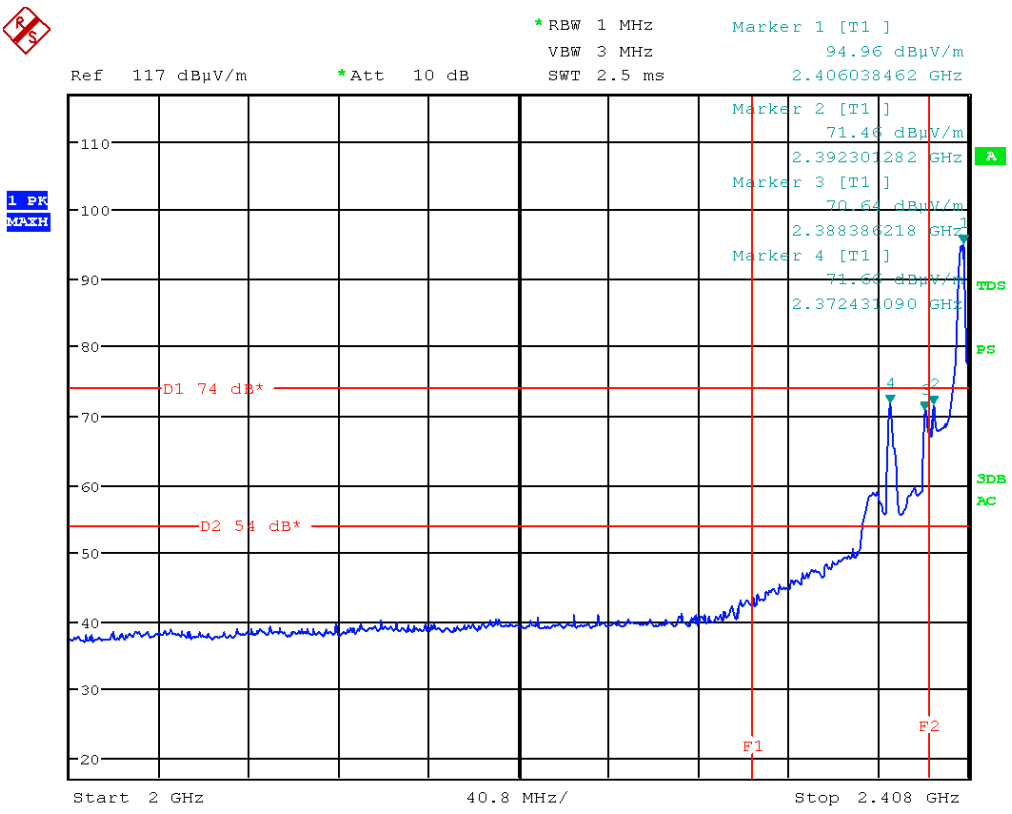
Channel24					
f[GHz]	E_{meas} [dBµV/m]	Detector	Restr. Band	Limit [dBµV/m]	Result
2.4693	66.95	AV (50Hz)	No	----	Carrier
2.4701	106.00	PK	No	----	Carrier
2.4871	72.60	PK	Yes	74	Pass
2.4957	71.92	PK	Yes	74	Pass
2.5000	72.03	PK	Yes	74	Pass
2.5019	40.39	AV (50Hz)	No	-20dBc	Pass
2.5336	38.36	AV (50Hz)	No	-20dBc	Pass
2.5447	71.76	PK	No	-20dBc	Pass
2.5979	34.37	AV (50Hz)	No	-20dBc	Pass

Picture 93: Band edge compliance - ant01, channel 24

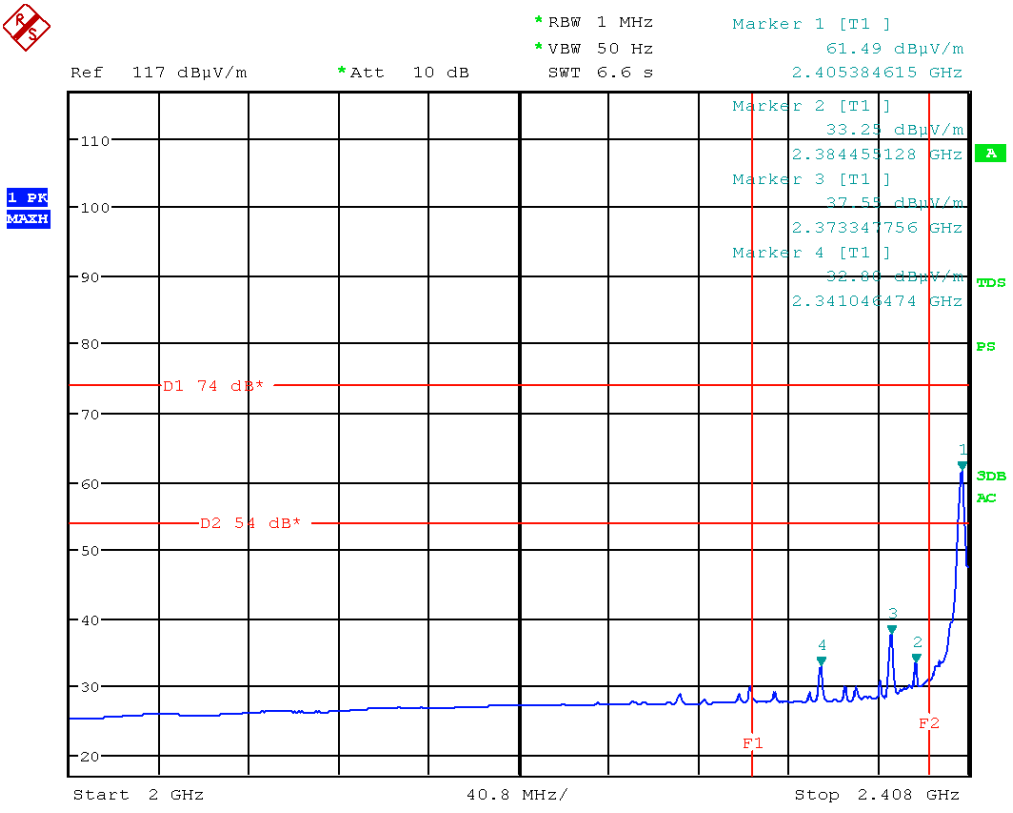
Channel26					
f[GHz]	E_{meas} [dBµV/m]	Detector	Restr. Band	Limit [dBµV/m]	Result
2.4792	96.33	PK	No	----	Carrier
2.4792	62.14	AV (50Hz)	No	----	Carrier
2.4825	76.57	PK	No	----	Carrier
2.4831	76.58	PK	No	-20dBc	Pass
2.4951	32.78	AV (50Hz)	Yes	54	Pass
2.4877	72.89	PK	Yes	74	Pass
2.4986	72.45	PK	Yes	74	Pass
2.5069	72.46	PK	No	-20dBc	Pass
2.5255	59.21	PK	No	-20dBc	Pass
2.5448	71.82	PK	No	-20dBc	Pass
2.5112	37.33	AV (50Hz)	No	-20dBc	Pass
2.5440	34.22	AV (50Hz)	No	-20dBc	Pass

Picture 94: Band edge compliance - ant01, channel 26

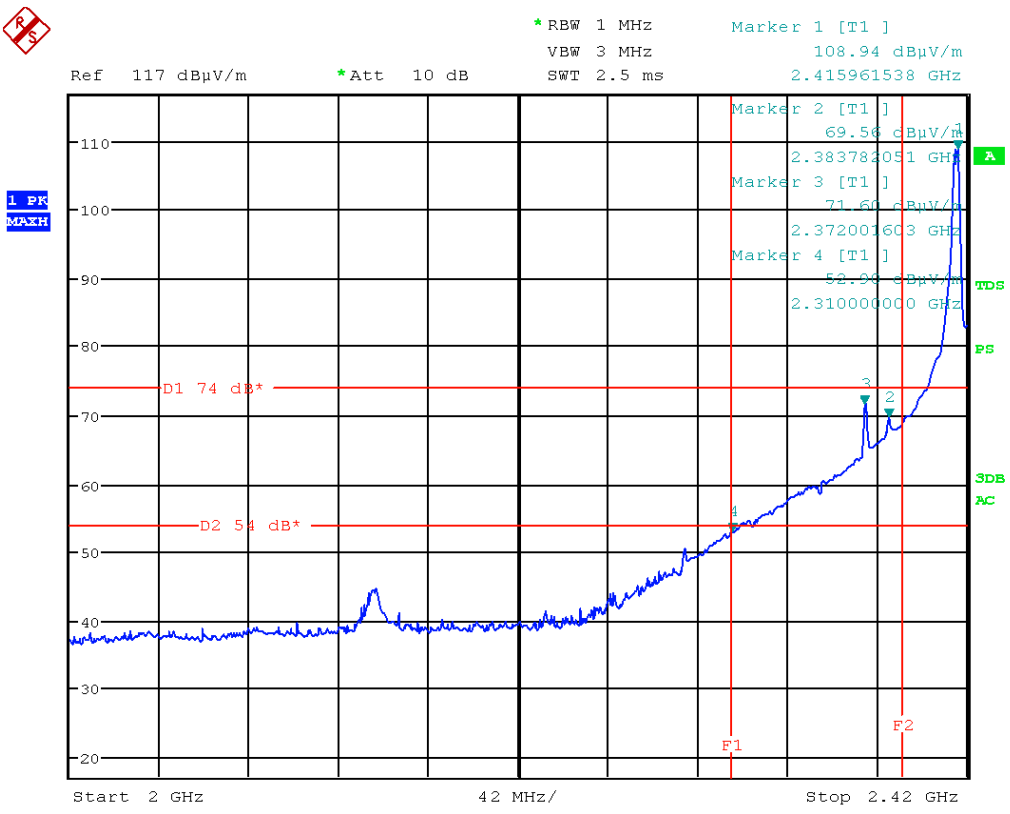
Note: Frequency lines in charts are set to the edges of the restricted band closest to the carrier:
F1 = 2.4835 GHz
F2 = 2.5000 GHz



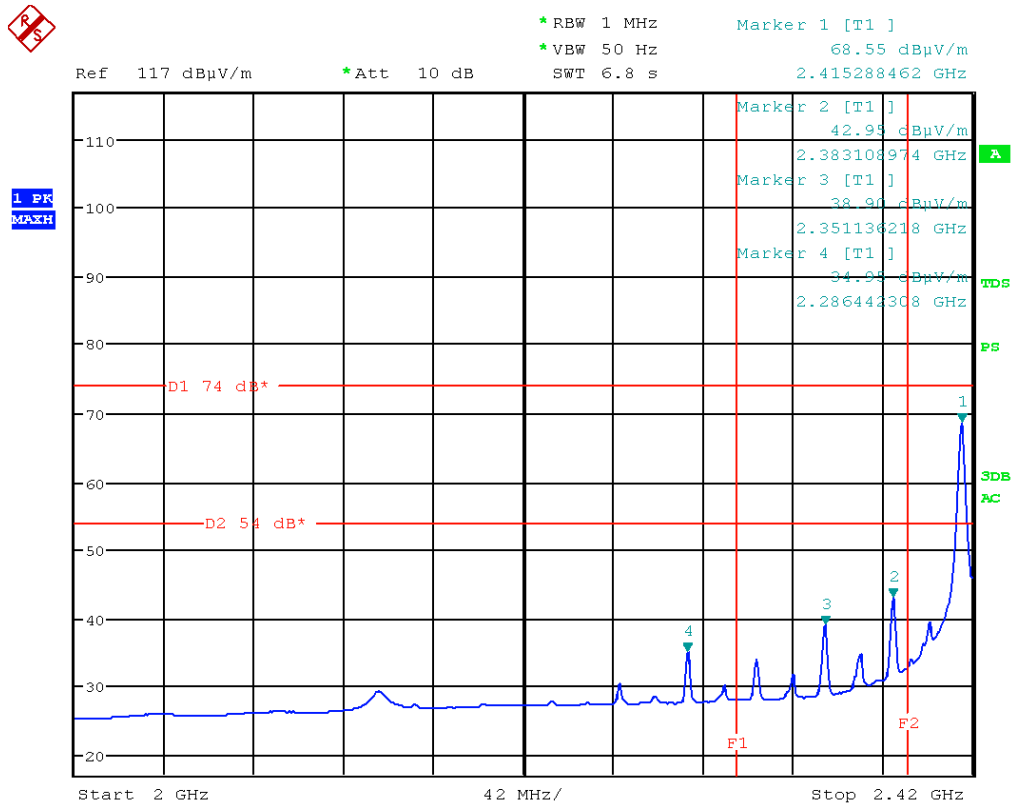
Picture 95: lower edge (PK) - ant01, channel 11



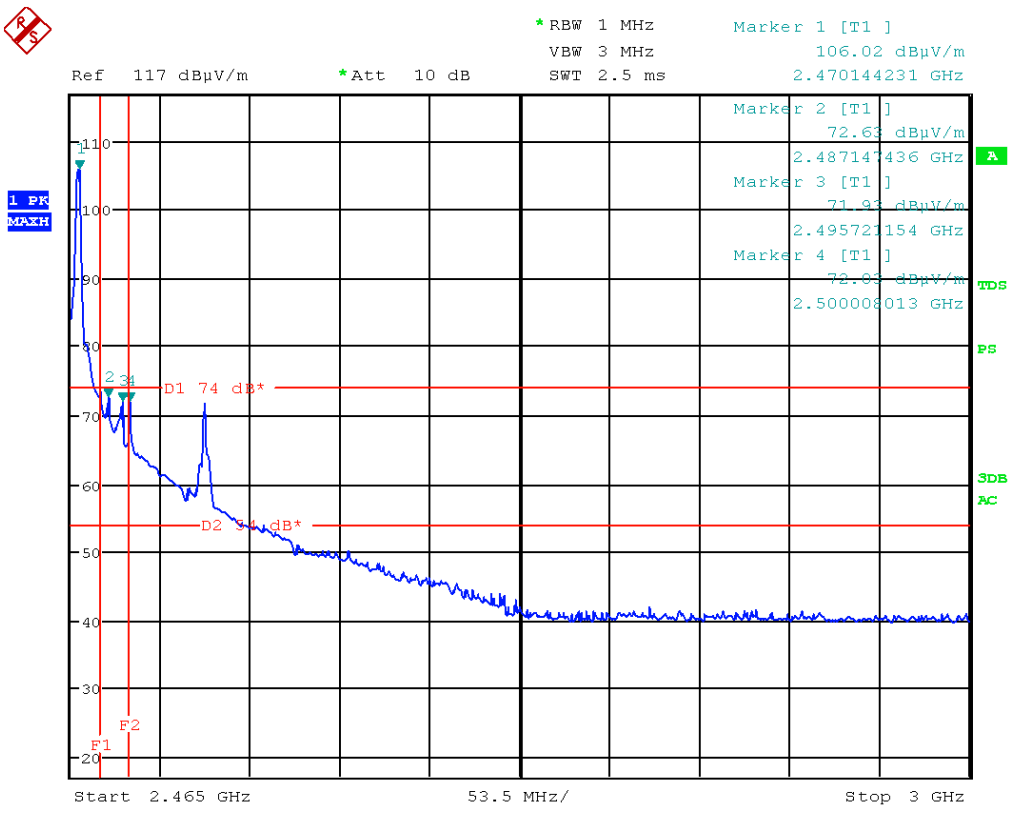
Picture 96: lower edge (AV) - ant01, channel 11



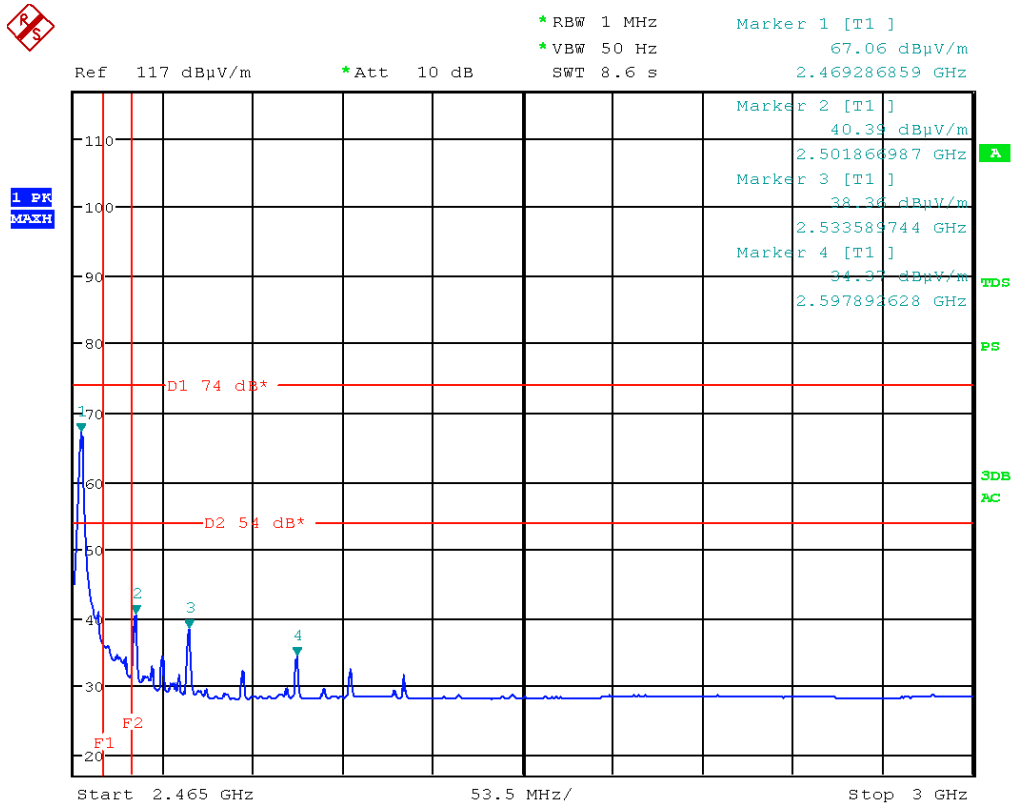
Picture 97: lower edge (PK) - ant01, channel 13



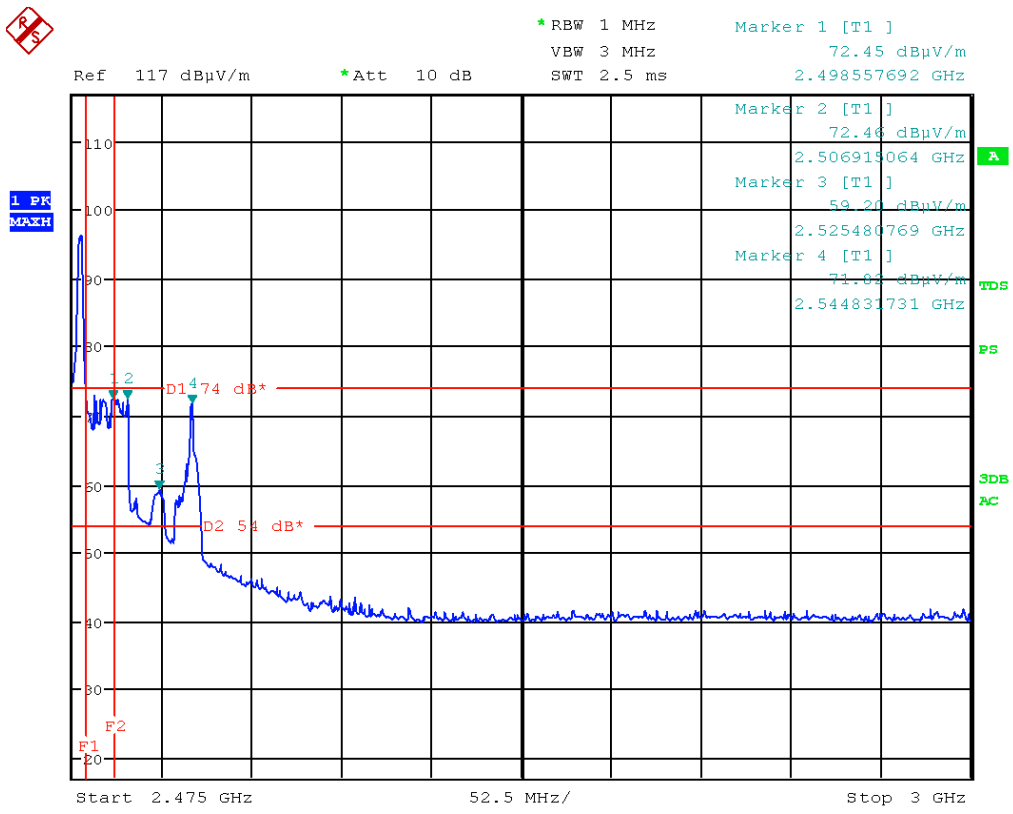
Picture 98: lower edge (AV) - ant01, channel 13



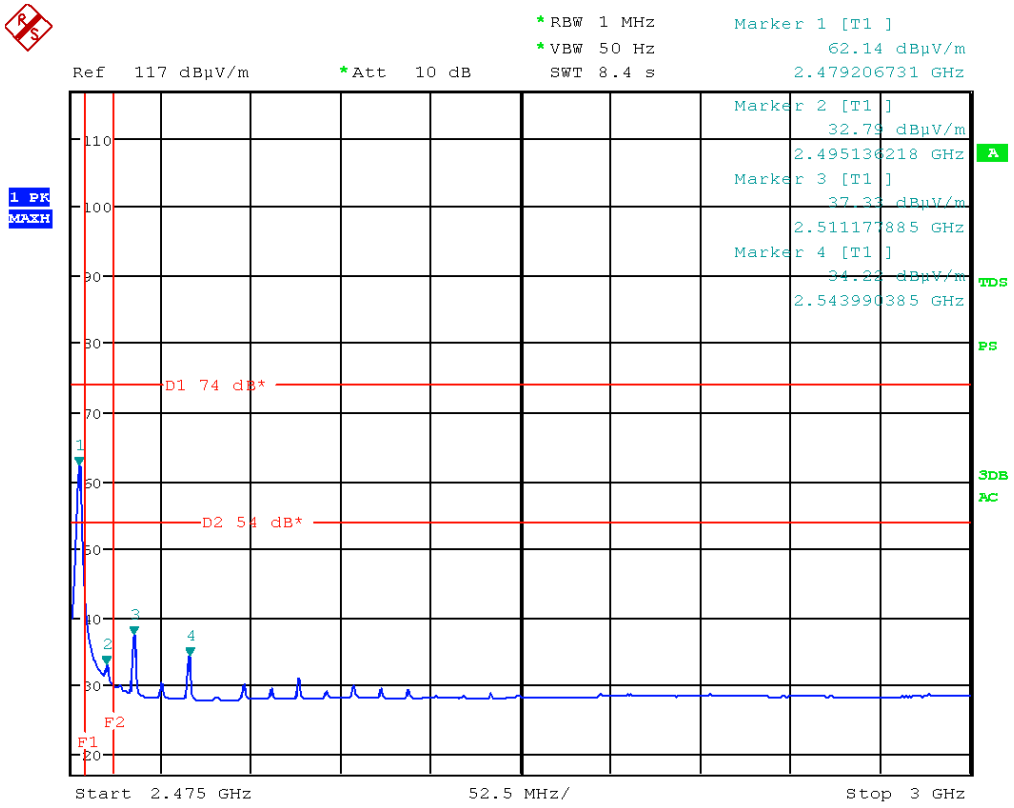
Picture 99: upper edge (PK) - ant01, channel 24



Picture 100: upper edge (AV) - ant01, channel 24



Picture 101: upper edge (PK) - ant01, channel 26



Picture 102: upper edge (AV) - ant01, channel 26

10 Spurious RF Conducted Emission

according to 47 CFR Part 15, section 15.247(d)

10.1 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

10.2 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

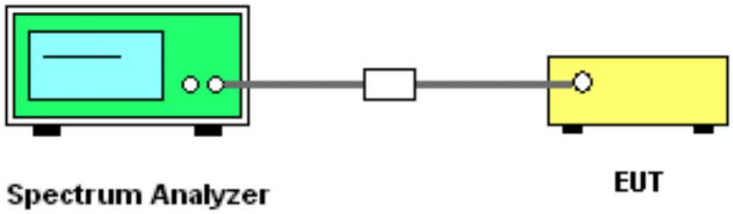
10.3 Limits

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

10.4 Test procedure

1. The test is performed in accordance with FCC KDB publication no. 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. Minimum resolution bandwidths of 200 Hz for measurement frequencies below 150 kHz, 10 kHz between 150 kHz and 30 MHz, 100 kHz between 30 MHz and 1 GHz and 1 MHz above 1 GHz were used.
5. Measure the spectrum from the lowest frequency generated in the EUT up through the 10th harmonic.

10.5 Test setup



Picture 103: Test setup for conducted spurious emission measurement

10.6 Test deviation

There is no deviation with the original standard.

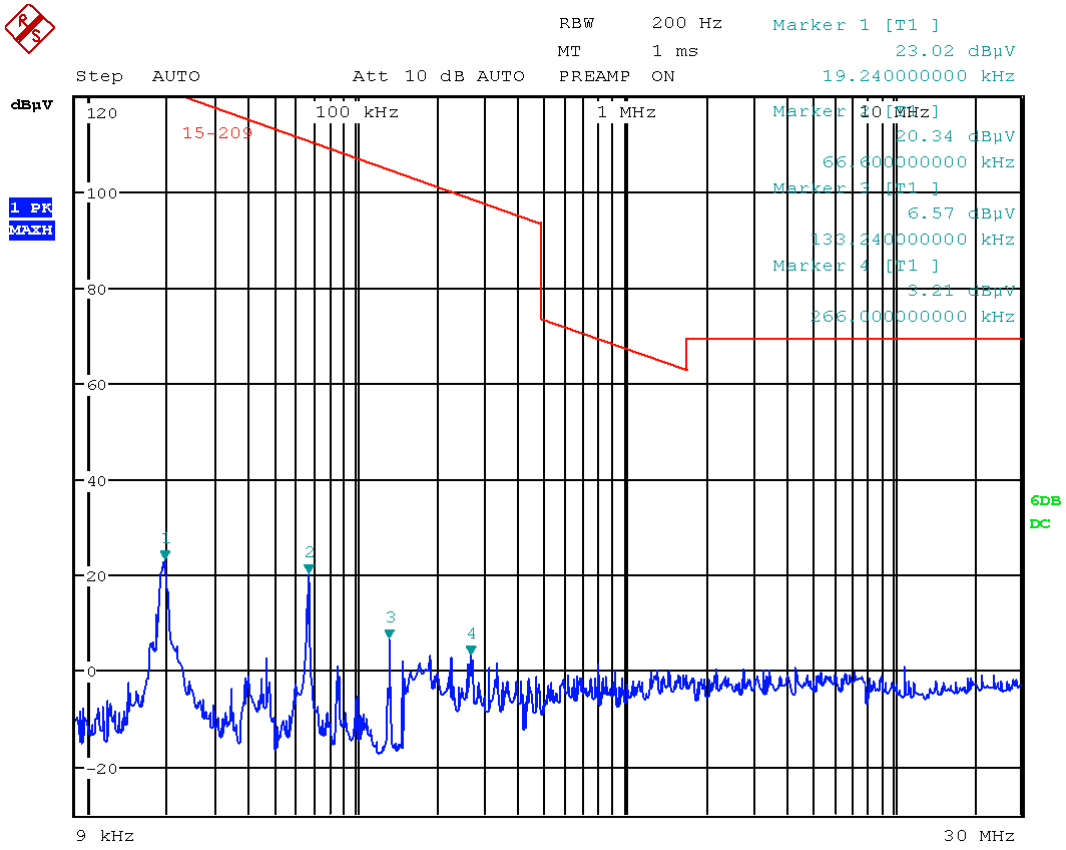
10.7 EUT operation during test

The EUT was programmed to be in continuously transmitting mode.

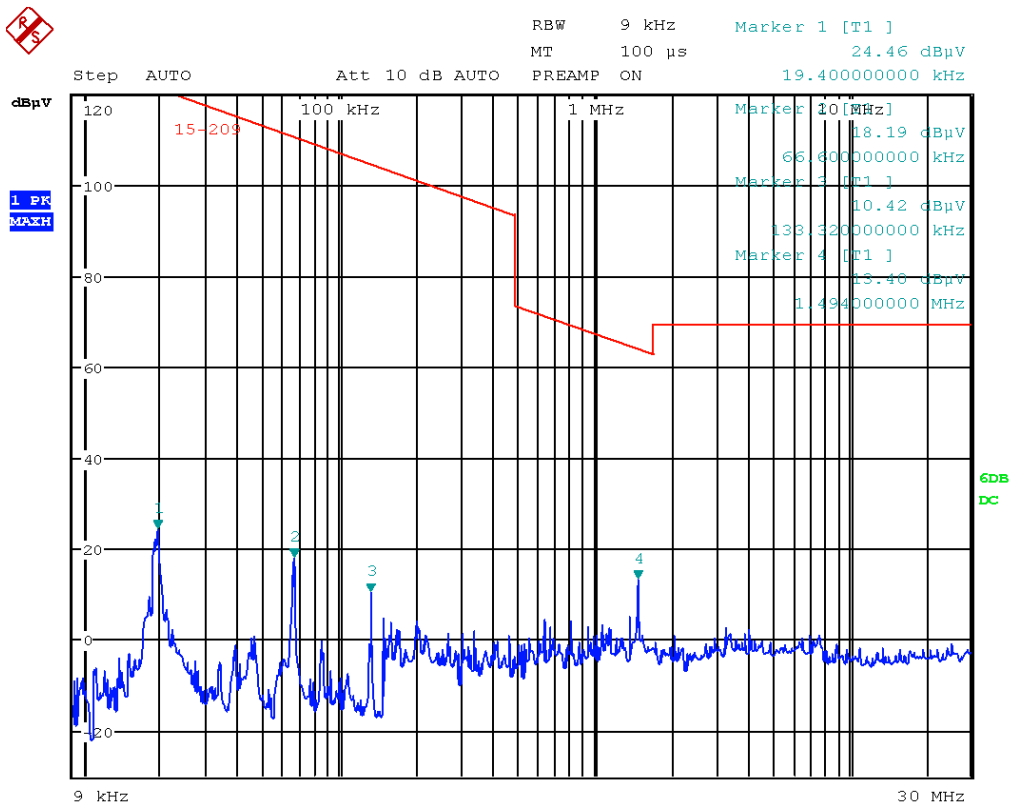
10.8 Test results

Temperature:	21°C	Humidity:	46%
Tested by:	M. Müller	Test date:	2015-01-14

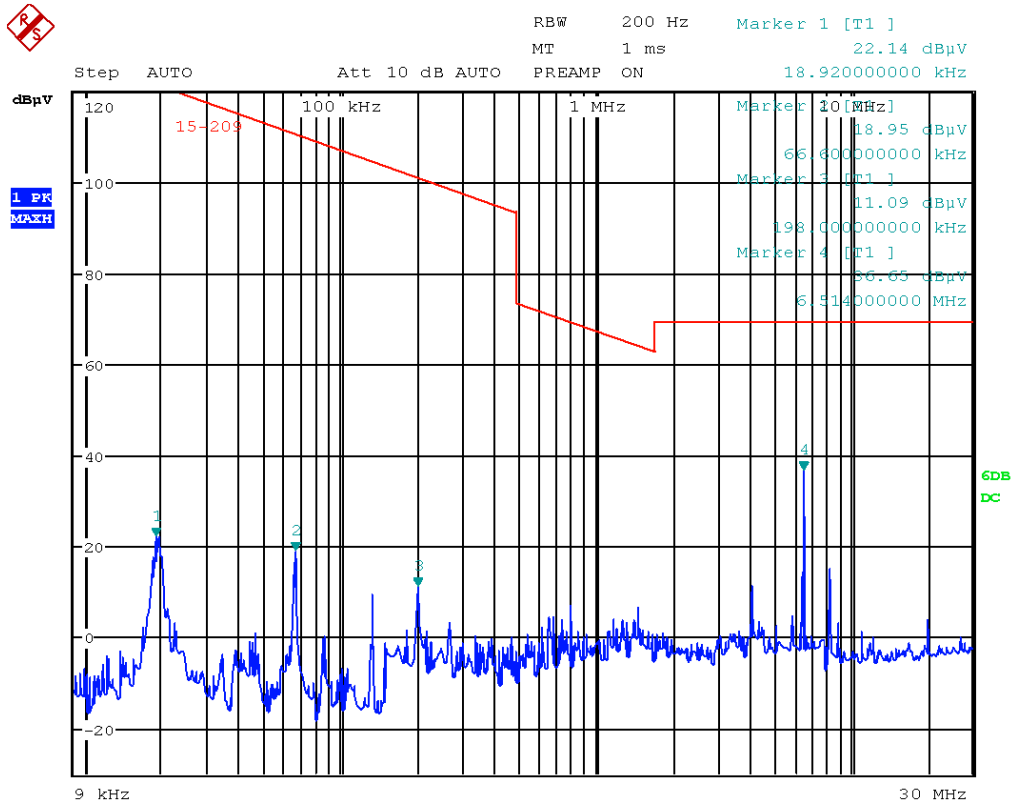
10.9 Test results 9 kHz – 30 MHz



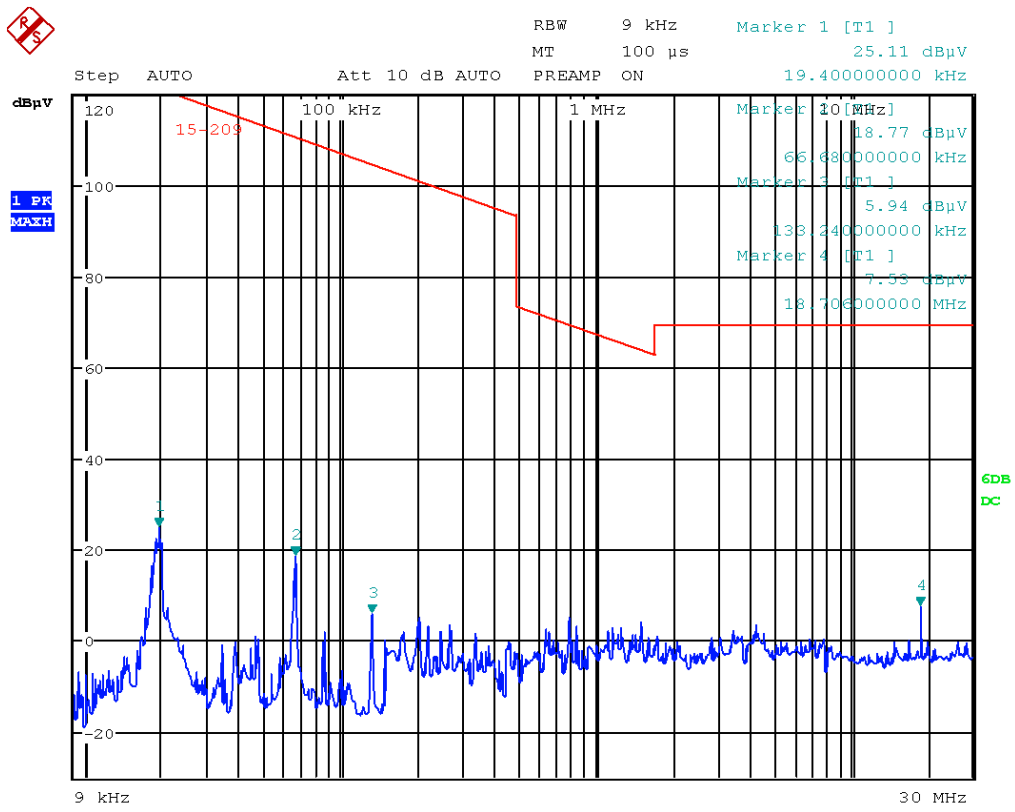
Picture 104: spurious emission ant00, channel 11 (9kHz - 30MHz)



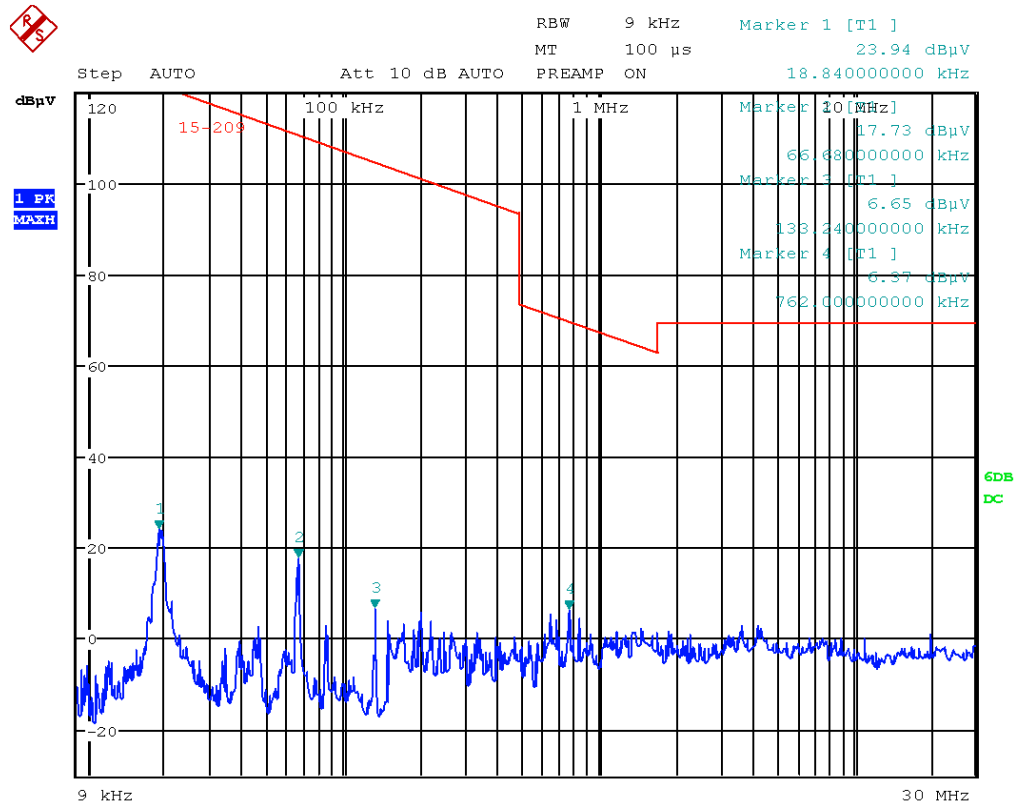
Picture 105: spurious emission ant00, channel 13 (9kHz - 30MHz)



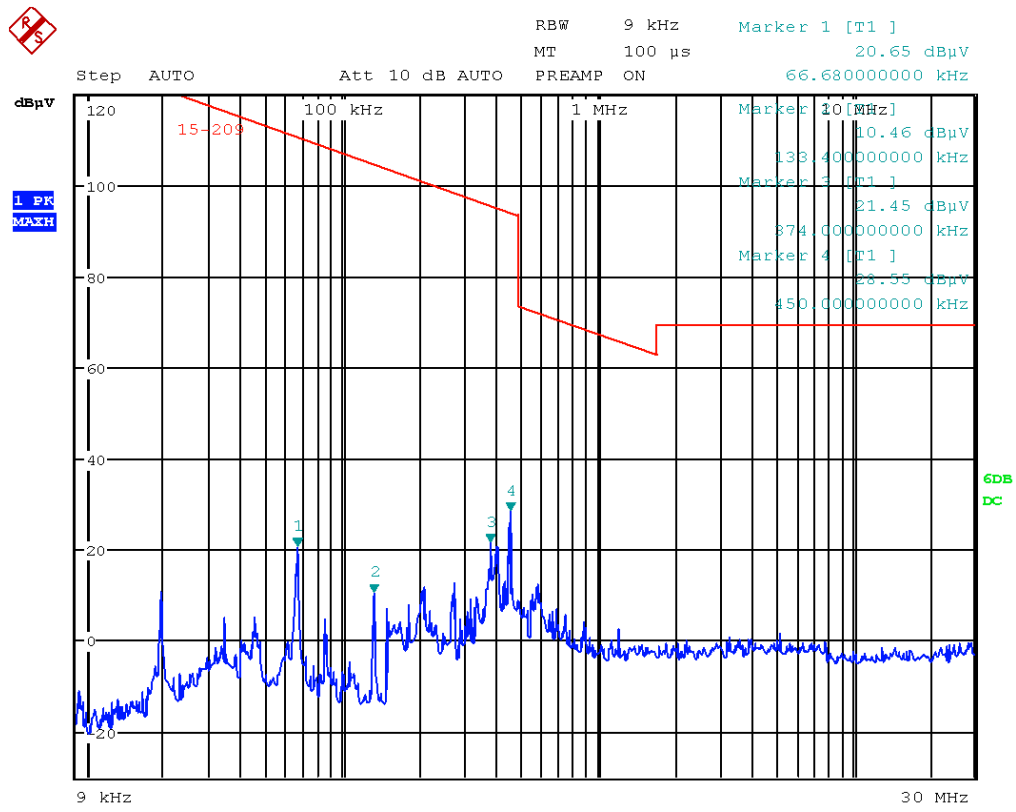
Picture 106: spurious emission ant00, channel 18 (9kHz - 30MHz)



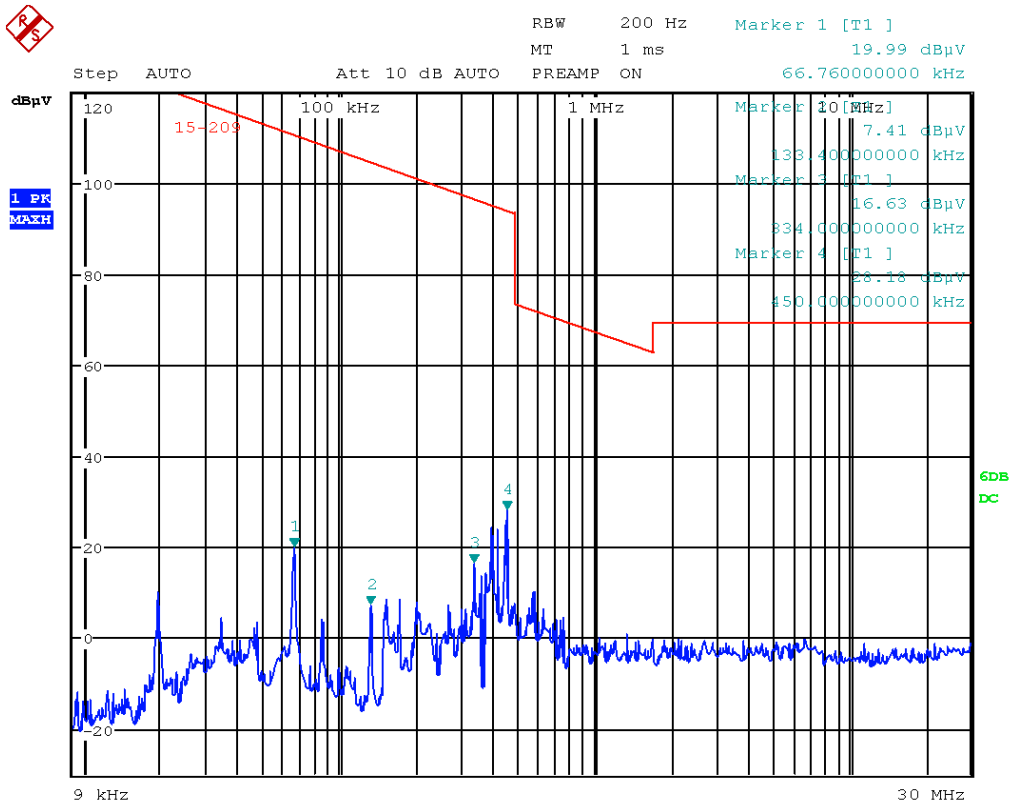
Picture 107: spurious emission ant00, channel 24 (9kHz - 30MHz)



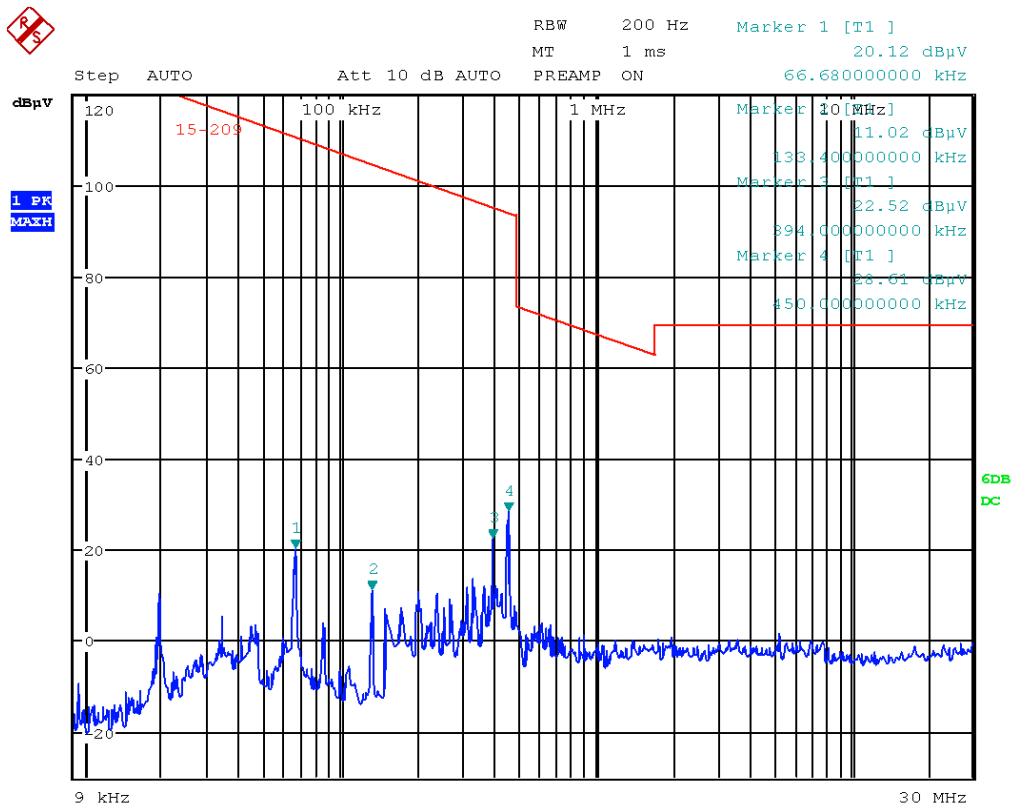
Picture 108: spurious emission ant00, channel 26 (9kHz - 30MHz)



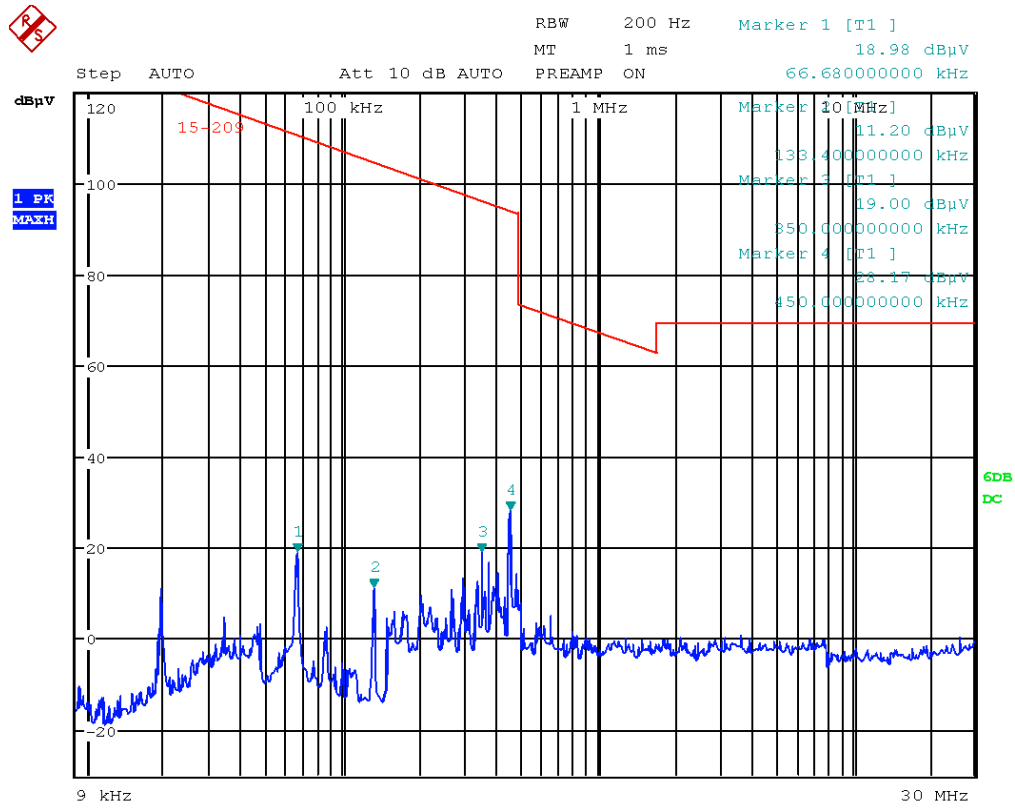
Picture 109: spurious emission ant01, channel 11 (9kHz - 30MHz)



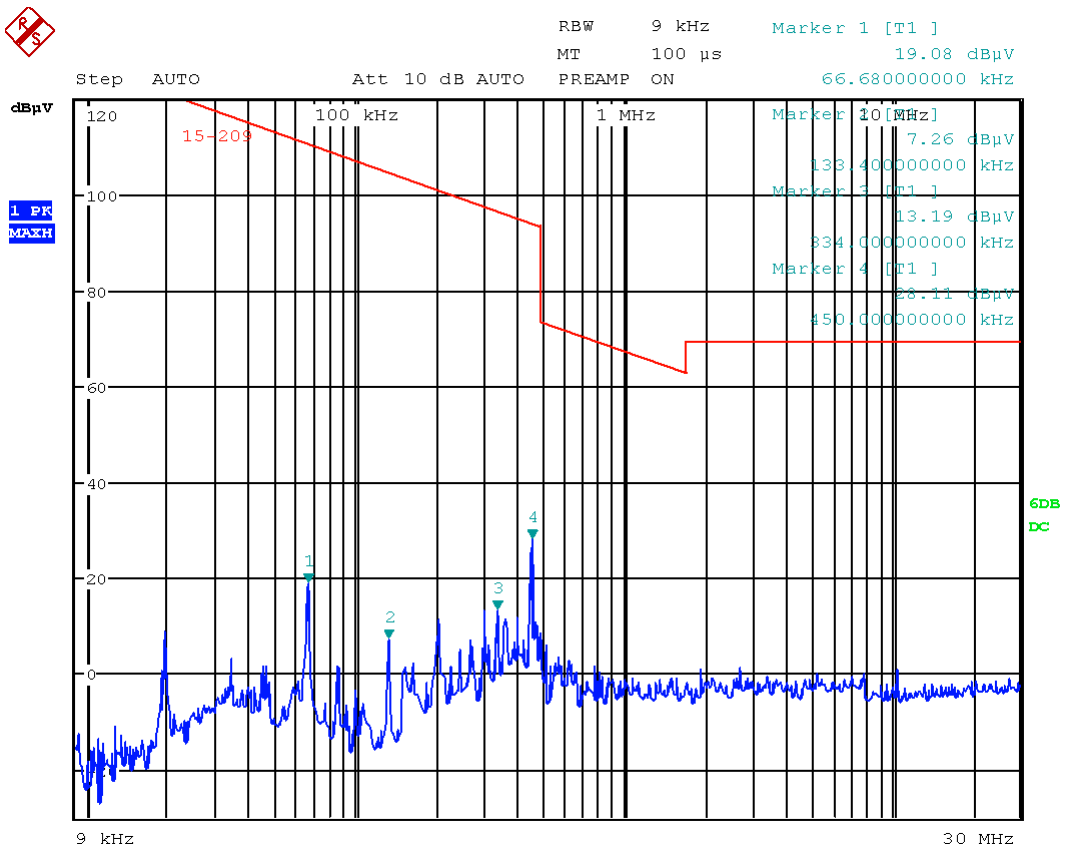
Picture 110: spurious emission ant01, channel 13 (9kHz - 30MHz)



Picture 111: spurious emission ant01, channel 18 (9kHz - 30MHz)

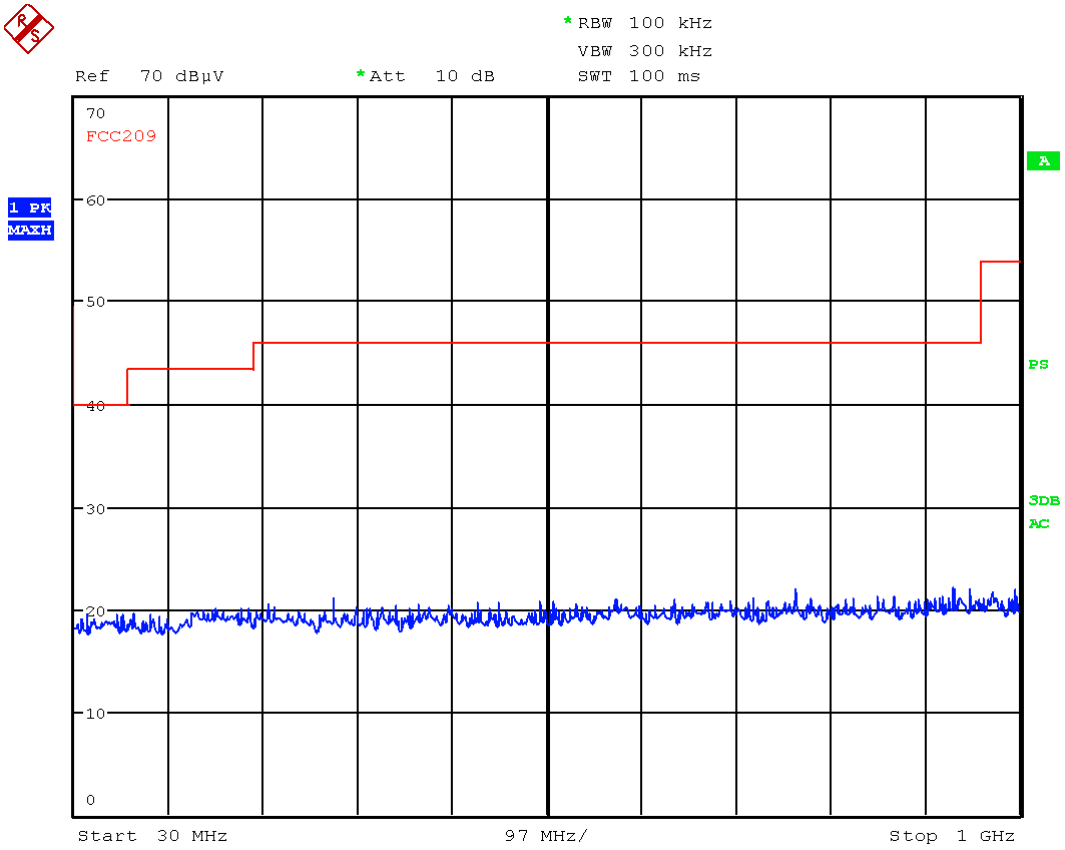


Picture 112: spurious emission ant01, channel 24 (9kHz - 30MHz)

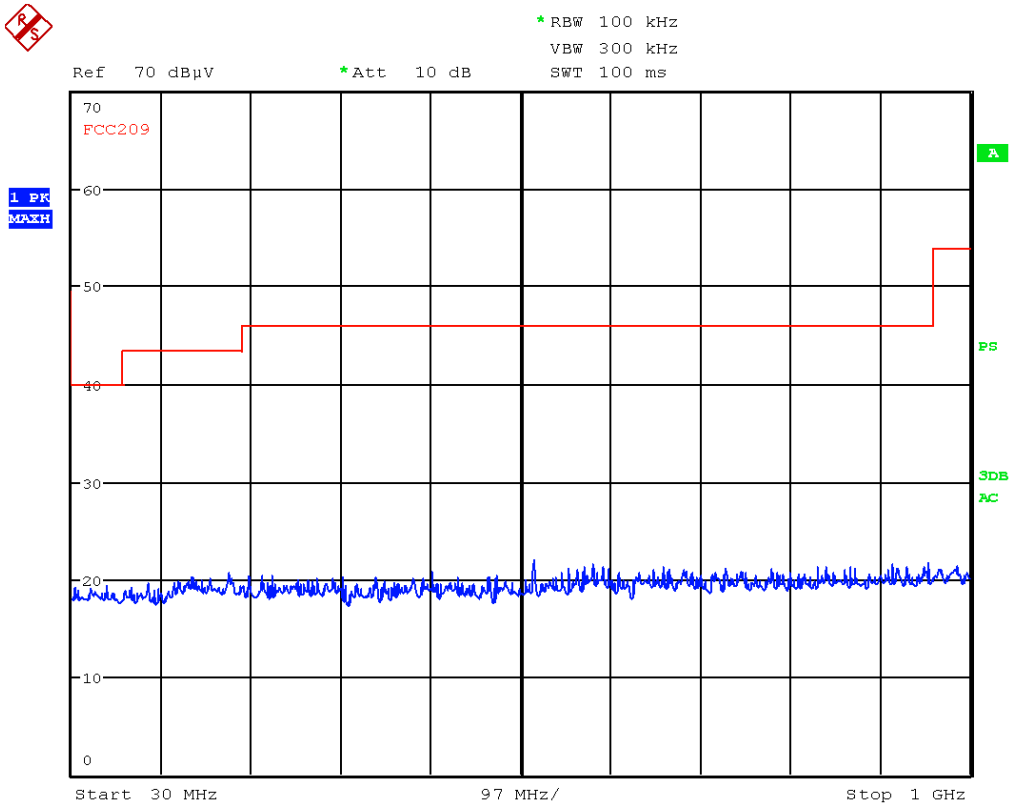


Picture 113: spurious emission ant01, channel 26 (9kHz - 30MHz)

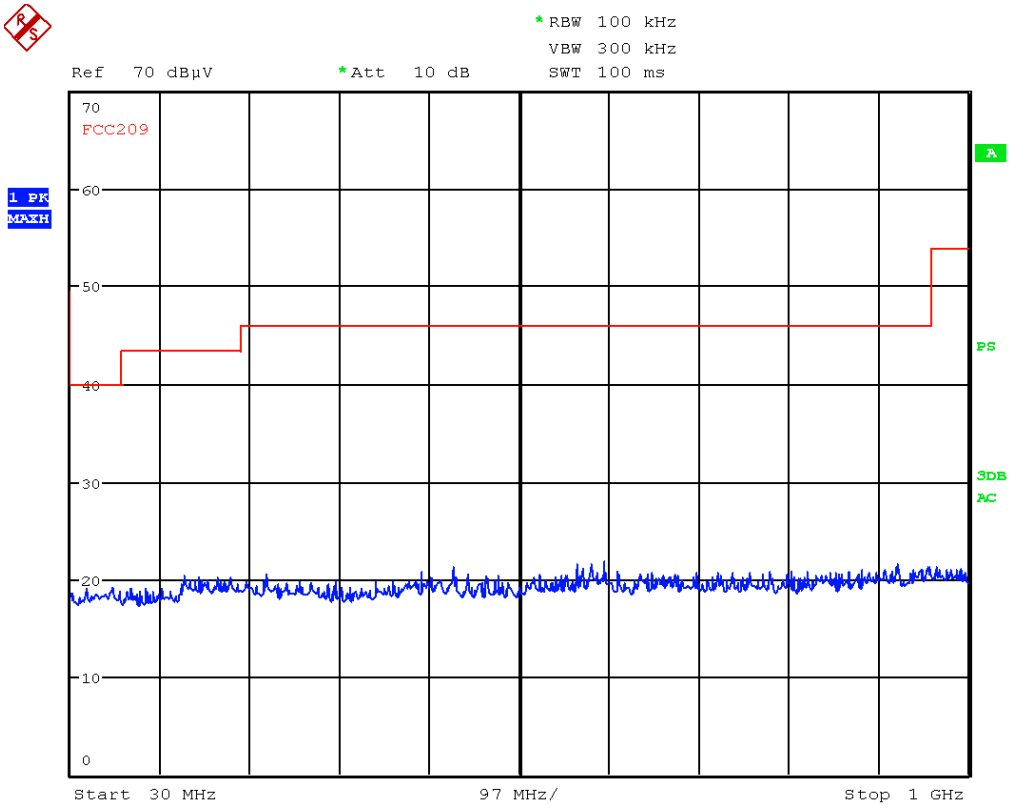
10.10 Test results 30 MHz – 1 GHz



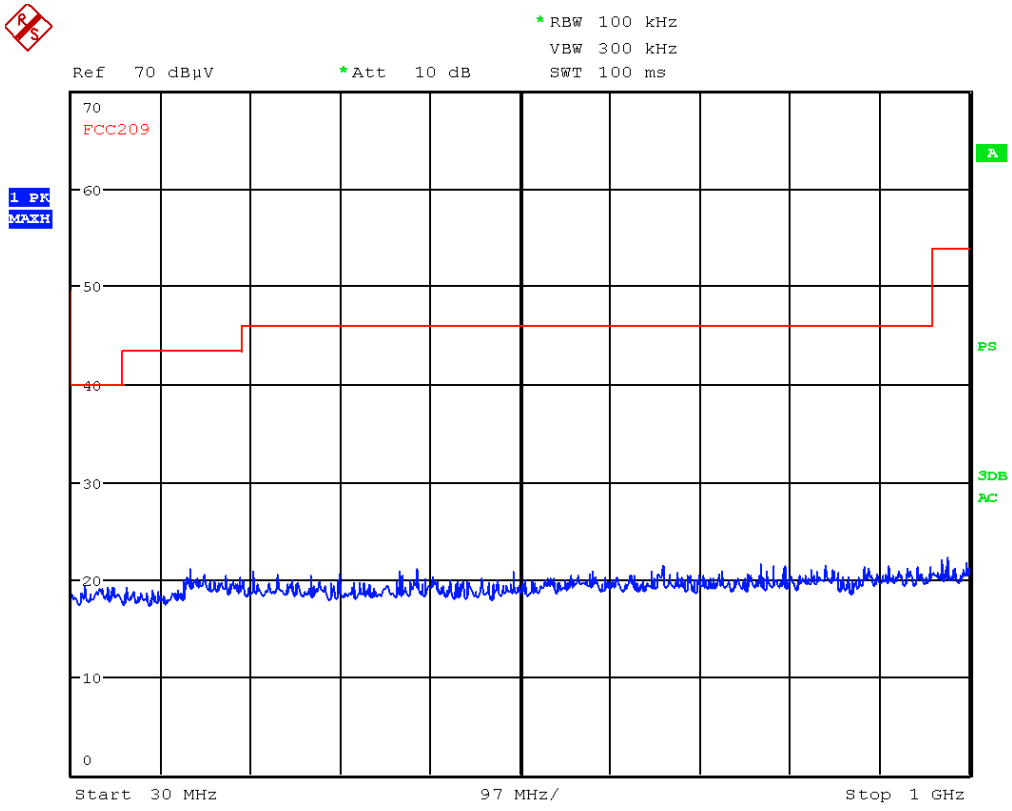
Picture 114: spurious emission ant00, channel 11 (30MHz - 1GHz)



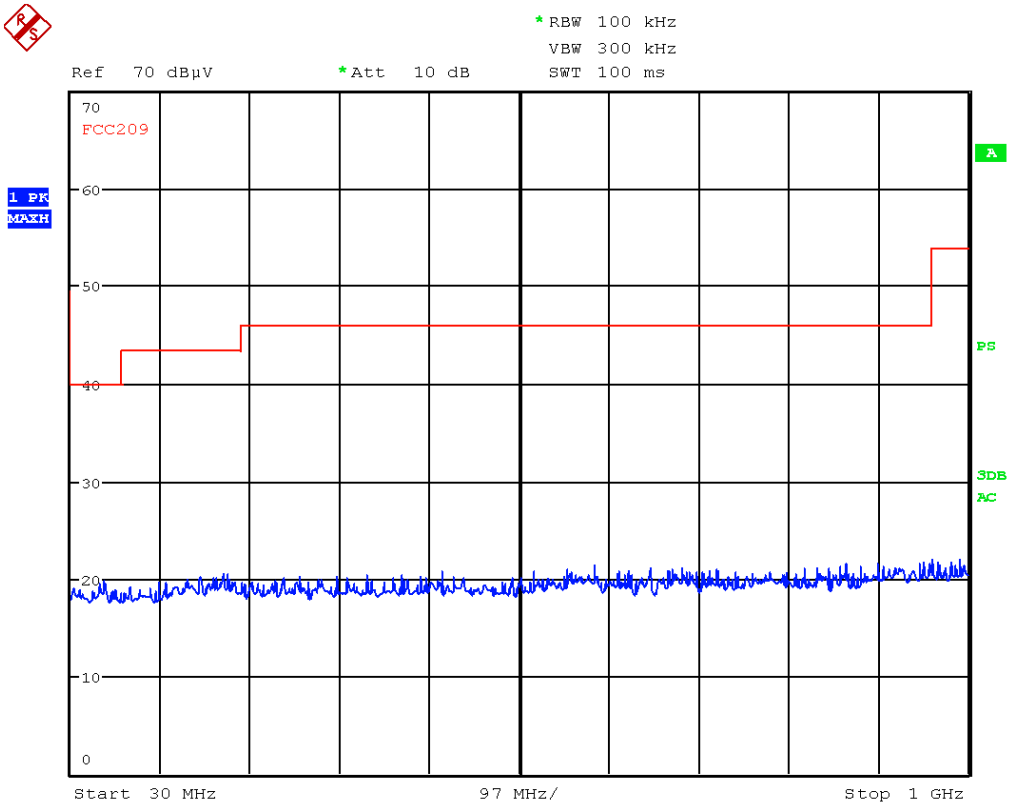
Picture 115: spurious emission ant00, channel 13 (30MHz - 1GHz)



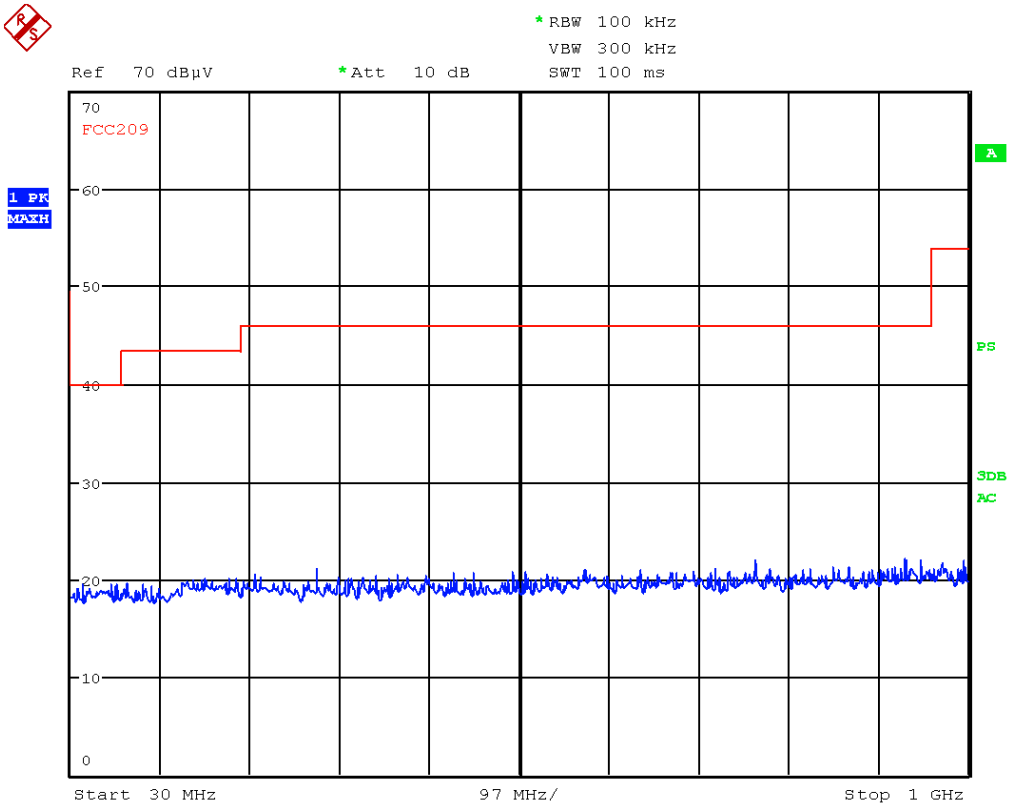
Picture 116: spurious emission ant00, channel 18 (30MHz - 1GHz)



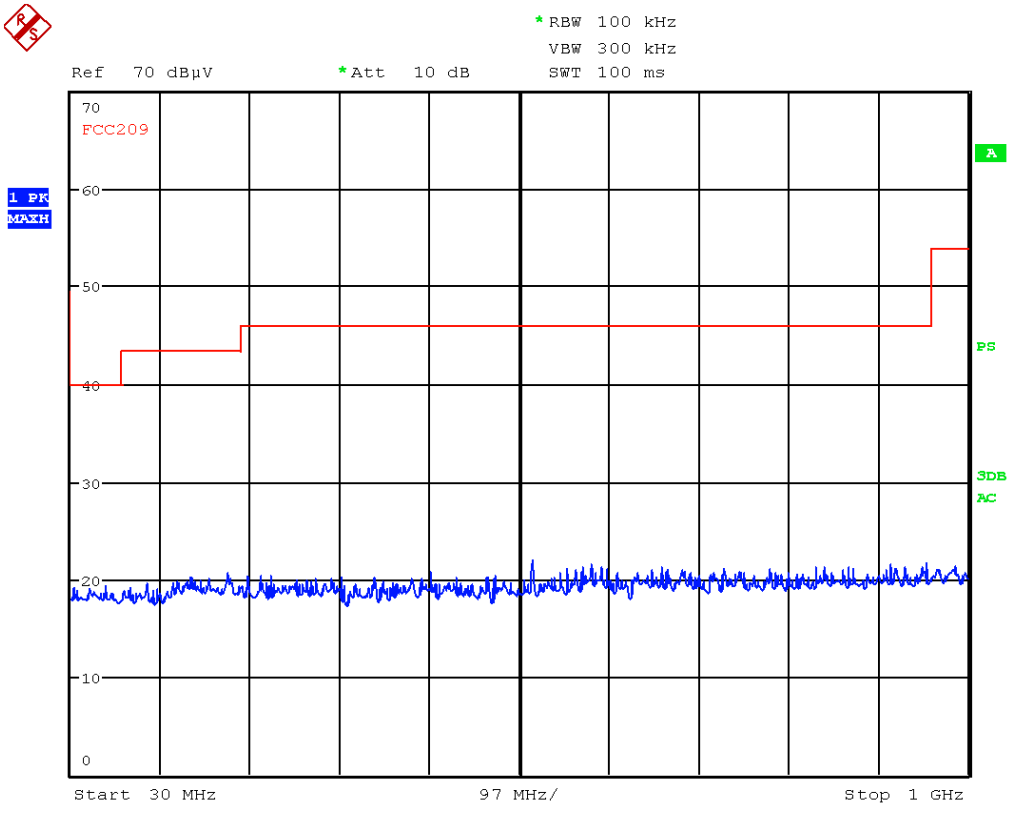
Picture 117: spurious emission ant00, channel 24 (30MHz - 1GHz)



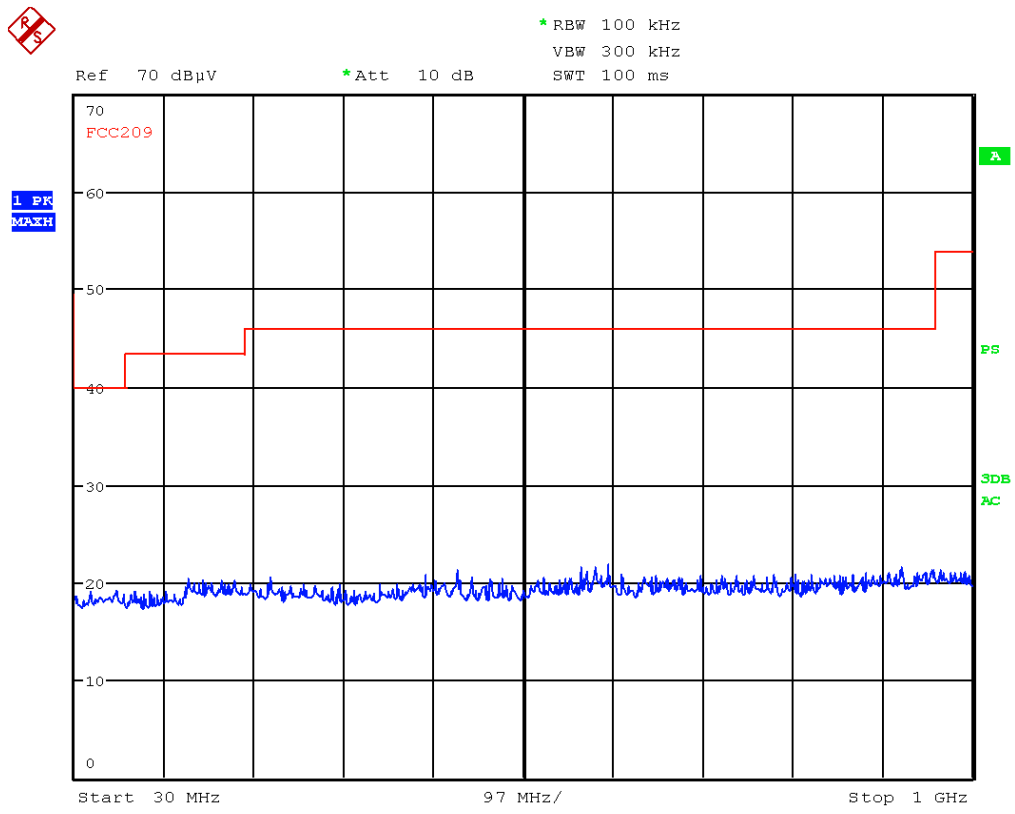
Picture 118: spurious emission ant00, channel 26 (30MHz - 1GHz)



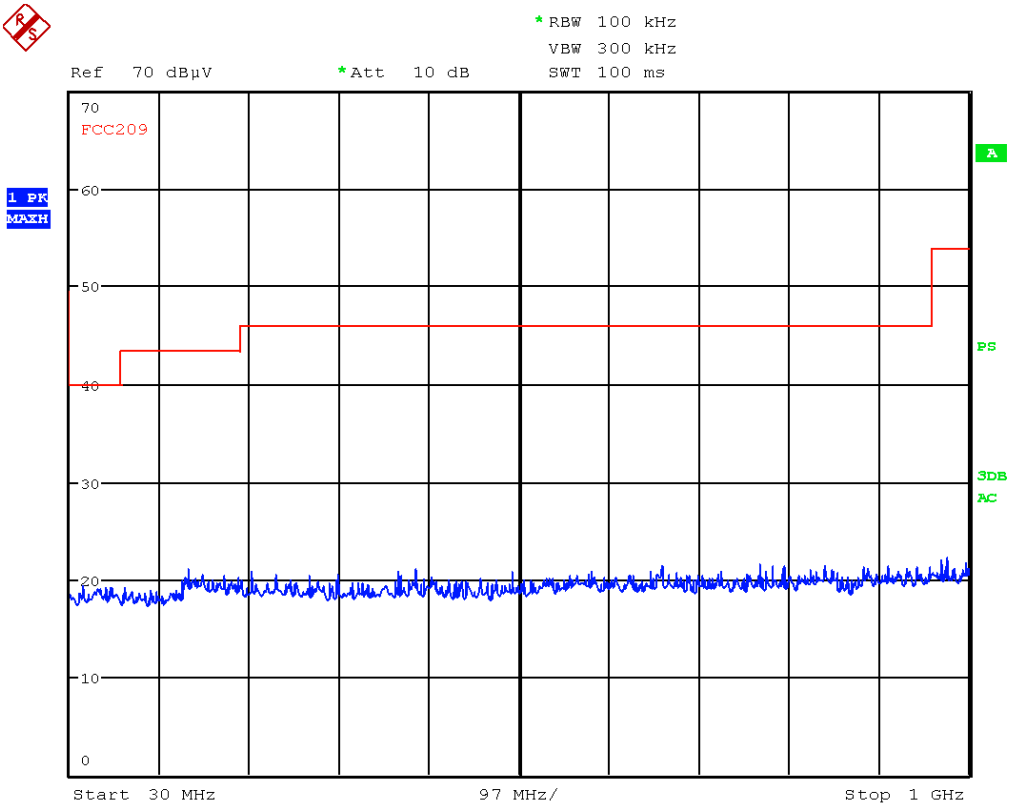
Picture 119: spurious emission ant01, channel 11 (30MHz - 1GHz)



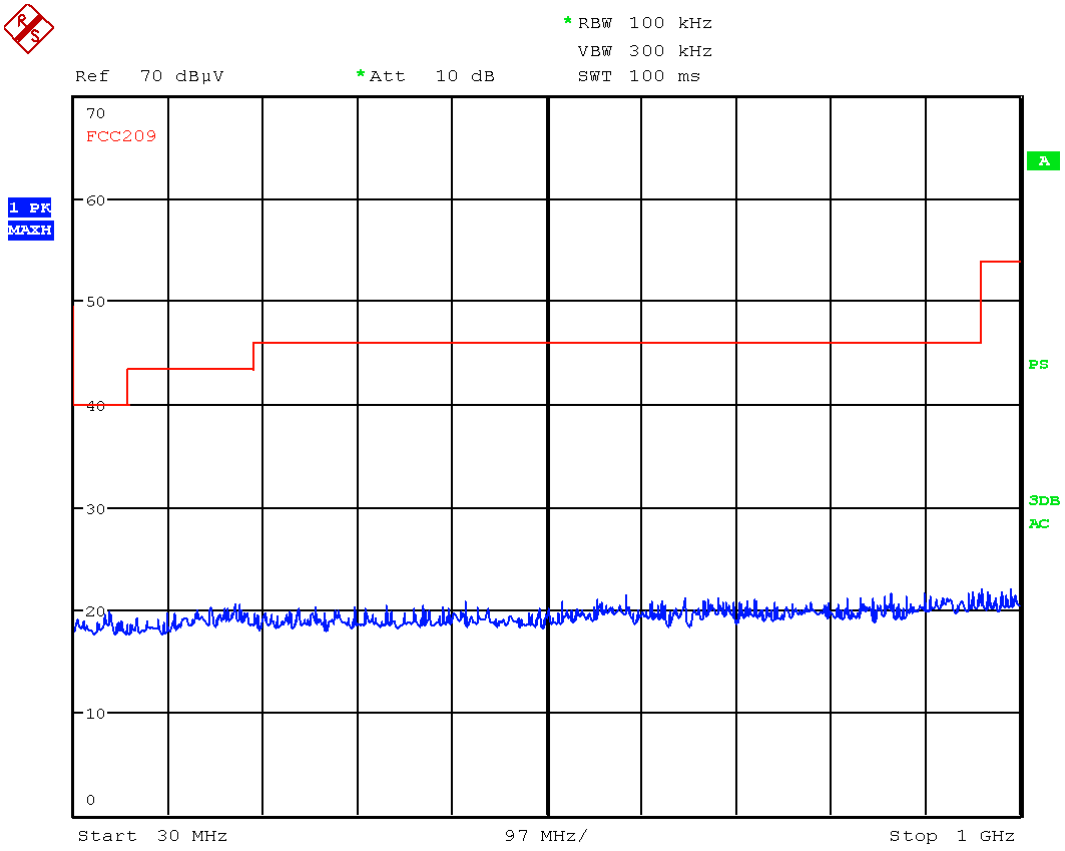
Picture 120: spurious emission ant01, channel 13 (30MHz - 1GHz)



Picture 121: spurious emission ant01, channel 18 (30MHz - 1GHz)



Picture 122: spurious emission ant01, channel 24 (30MHz - 1GHz)



Picture 123: spurious emission ant01, channel 26 (30MHz - 1GHz)

10.11 Test results 1 GHz – 26 GHz

Channel 11, PWR8					
f [GHz]	Reading [dBµV]	Detector	Limit [dBµV]	Restricted Band	Result
2.4055	106.93	PK	----	No	Carrier
2.4051	69.47	AV	----		Carrier

Picture 124: spurious emission ant00, channel 11 (1GHz - 26 GHz)

Channel 13, PWR15					
f [GHz]	Reading [dBµV]	Detector	Limit [dBµV]	Restricted Band	Result
2.4156	120.45	PK	----	No	Carrier
2.4150	81.61	AV	----		Carrier
4.8310	59.09	PK	74	Yes	Pass
4.8298	41.27	AV	54		Pass
7.2434	63.51	PK	-20dBc	No	Pass
7.2463	42.11	AV	-20dBc		Pass

Picture 125: spurious emission ant00, channel 13 (1GHz - 26 GHz)

Channel 18, PWR15					
f [GHz]	Reading [dBµV]	Detector	Limit [dBµV]	Restricted Band	Result
2.4395	120.84	PK	----	No	Carrier
2.4399	81.85	AV	----		Carrier
4.8789	60.67	PK	74	Yes	Pass
4.8799	42.26	AV	54		Pass
7.3216	66.32	PK	74	Yes	Pass
7.3212	43.44	AV	54		Pass

Picture 126: spurious emission ant00, channel 18 (1GHz - 26 GHz)

Channel 24, PWR15					
f [GHz]	Reading [dBµV]	Detector	Limit [dBµV]	Restricted Band	Result
2.4705	120.95	PK	----	No	Carrier
2.4700	81.78	AV	----		Carrier
4.9390	59.83	PK	74	Yes	Pass
4.9400	41.68	AV	54		Pass
7.4115	65.17	PK	74	Yes	Pass
7.4112	42.84	AV	54		Pass

Picture 127: spurious emission ant00, channel 24 (1GHz - 26 GHz)

Channel 26, PWR8					
f [GHz]	Reading [dBµV]	Detector	Limit [dBµV]	Restricted Band	Result
2.4806	107.08	PK	----	No	Carrier
2.4800	69.91	AV	----		Carrier

Picture 128: spurious emission ant00, channel 26 (1GHz - 26 GHz)

Channel 11, PWR8					
f [GHz]	Reading [dBµV]	Detector	Limit [dBµV]	Restricted Band	Result
2.4055	105.43	PK	----	No	Carrier
2.4049	69.05	AV	----		Carrier

Picture 129: spurious emission ant01, channel 11 (1GHz - 26 GHz)

Channel 13, PWR15					
f [GHz]	Reading [dBµV]	Detector	Limit [dBµV]	Restricted Band	Result
2.4155	119.17	PK	----	No	Carrier
2.4150	80.82	AV	----		Carrier
7.2466	59.68	PK	-20dBc	No	Pass
7.2463	40.26	AV	-20dBc		Pass

Picture 130: spurious emission ant01, channel 13 (1GHz - 26 GHz)

Channel 18, PWR15					
f [GHz]	Reading [dBµV]	Detector	Limit [dBµV]	Restricted Band	Result
2.4405	119.72	PK	----	No	Carrier
2.4399	81.20	AV	----		Carrier
4.8810	52.06	PK	74	Yes	Pass
4.8801	37.09	AV	54		Pass
7.3184	63.36	PK	74	Yes	Pass
7.3212	41.95	AV	54		Pass

Picture 131: spurious emission ant01, channel 18 (1GHz - 26 GHz)

Channel 24, PWR15					
f [GHz]	Reading [dBµV]	Detector	Limit [dBµV]	Restricted Band	Result
2.4706	120.14	PK	----	No	Carrier
2.4699	81.38	AV	----		Carrier
4.9411	53.92	PK	74	Yes	Pass
4.9400	38.10	AV	54		Pass
7.4084	64.34	PK	74	Yes	Pass
7.4113	42.40	AV	54		Pass

Picture 132: spurious emission ant01, channel 24 (1GHz - 26 GHz)

Channel 26, PWR8					
f [GHz]	Reading [dBµV]	Detector	Limit [dBµV]	Restricted Band	Result
2.4795	106.65	PK	----	No	Carrier
2.4800	69.76	AV	----		Carrier

Picture 133: spurious emission ant01, channel 26 (1GHz - 26 GHz)

11 Radiated emission measurement (<1 GHz)

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

11.1 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

11.2 Test instruments

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

11.3 Limits

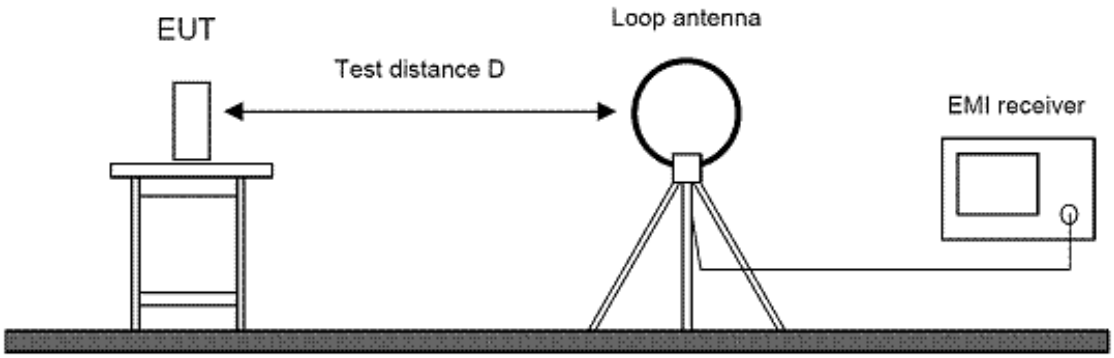
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the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

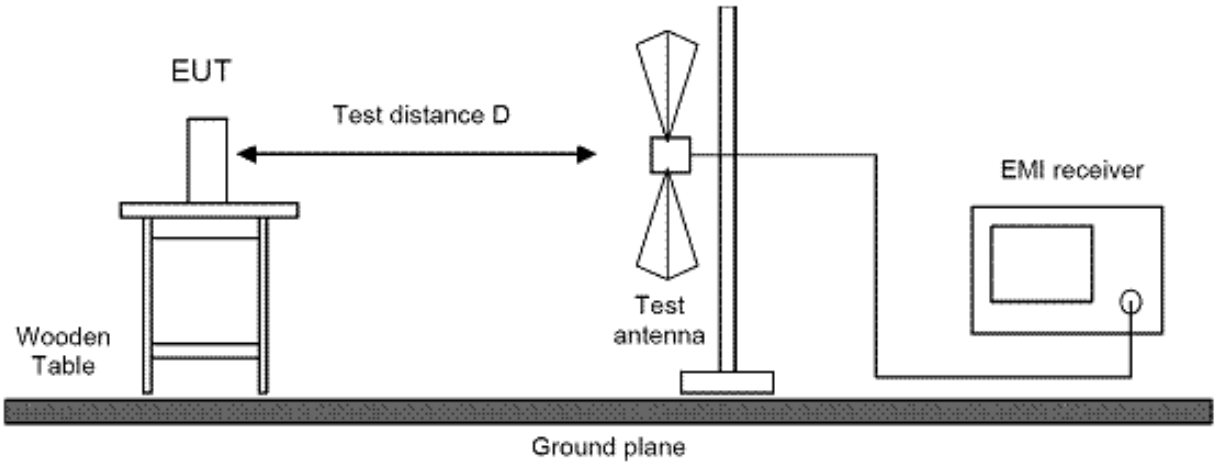
11.4 Test procedure

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.

11.5 Test setup



Picture 134: Test setup for radiated emission measurement (< 30 MHz)



Picture 135: Test setup for radiated emission measurement (< 1 GHz)

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

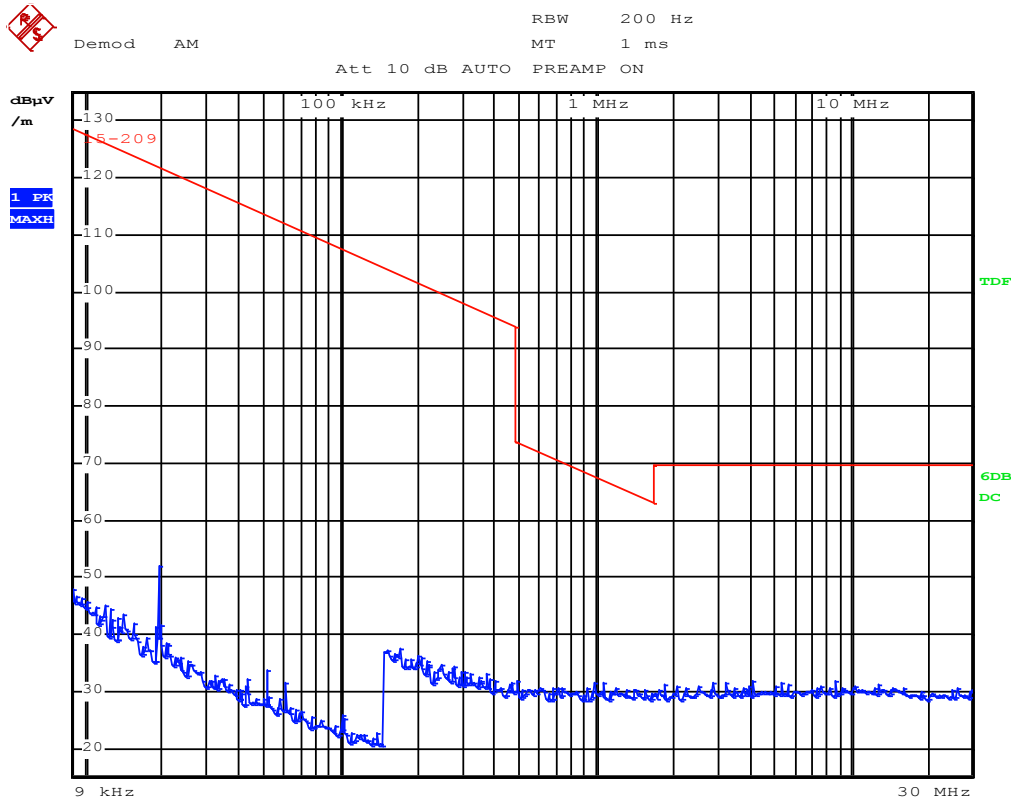
Transmit mode

Temperature:	22°C	Humidity:	46%
Tested by:	M. Müller	Test date:	2015-01-22

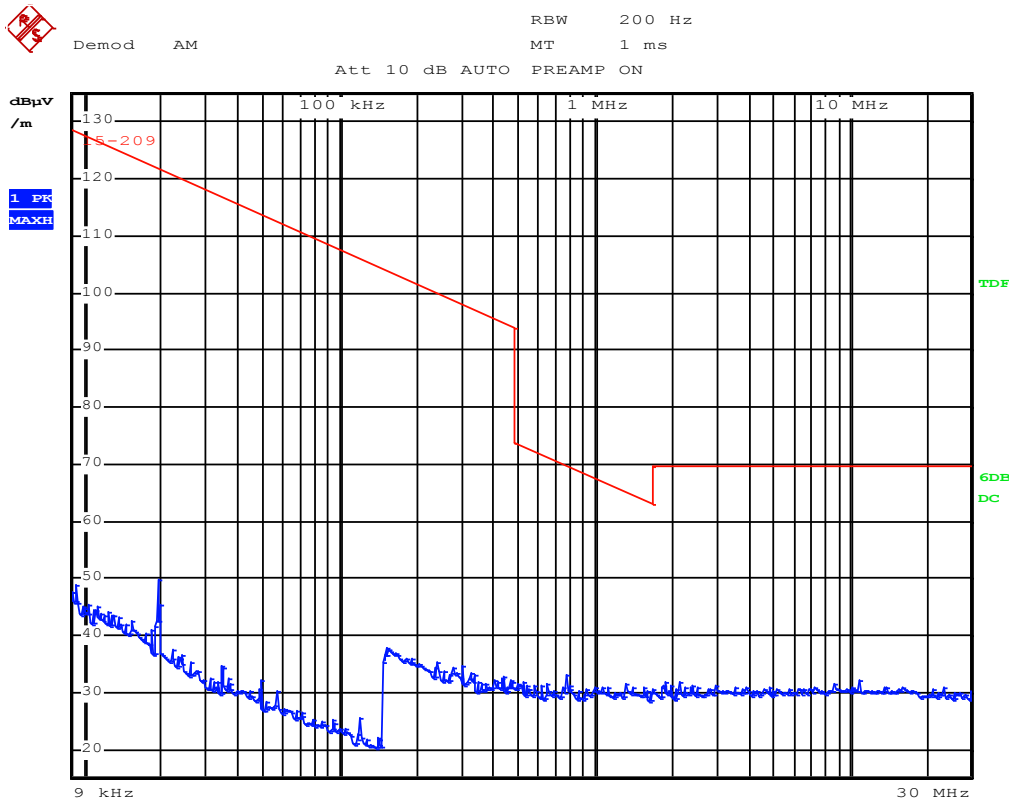
Radiated Emission Measurement 9 kHz – 30 MHz

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**

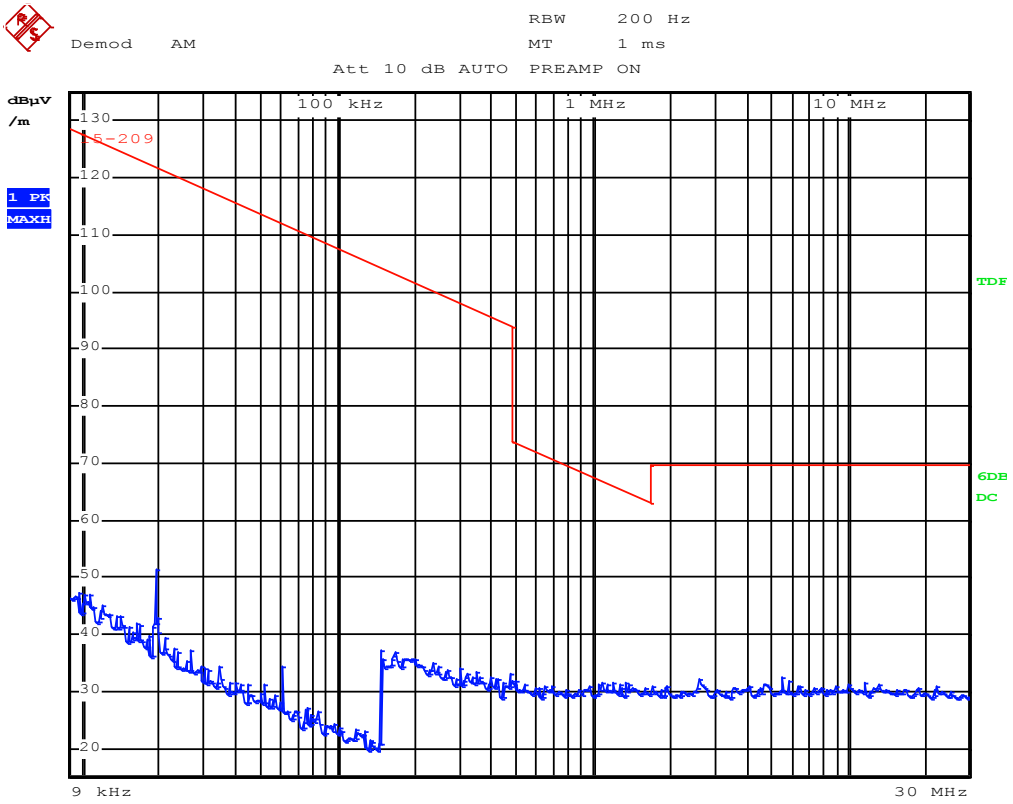
During pre-measurements it was investigated that for the radiated emission measurement from 9kHz to 30MHz the worst-case-position is EUT-position 3 in combination with the loop-antenna polarised to “O”.



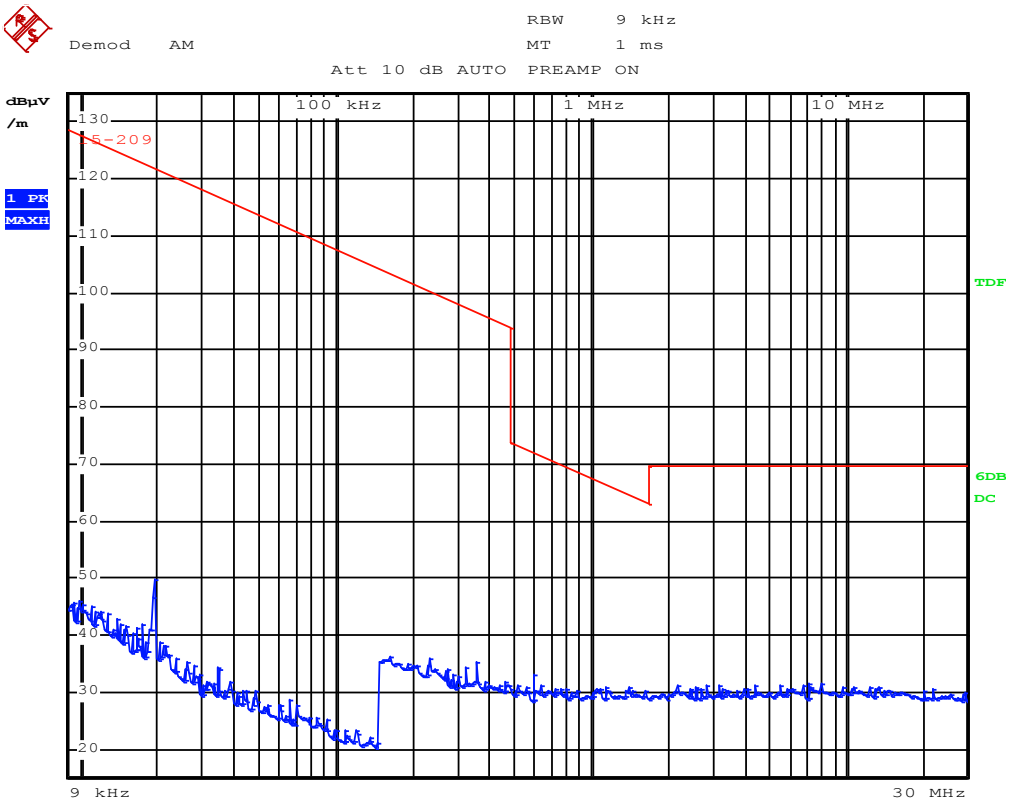
Picture 136: Radiated emission 9 kHz – 30MHz (Ant00, Channel 11)



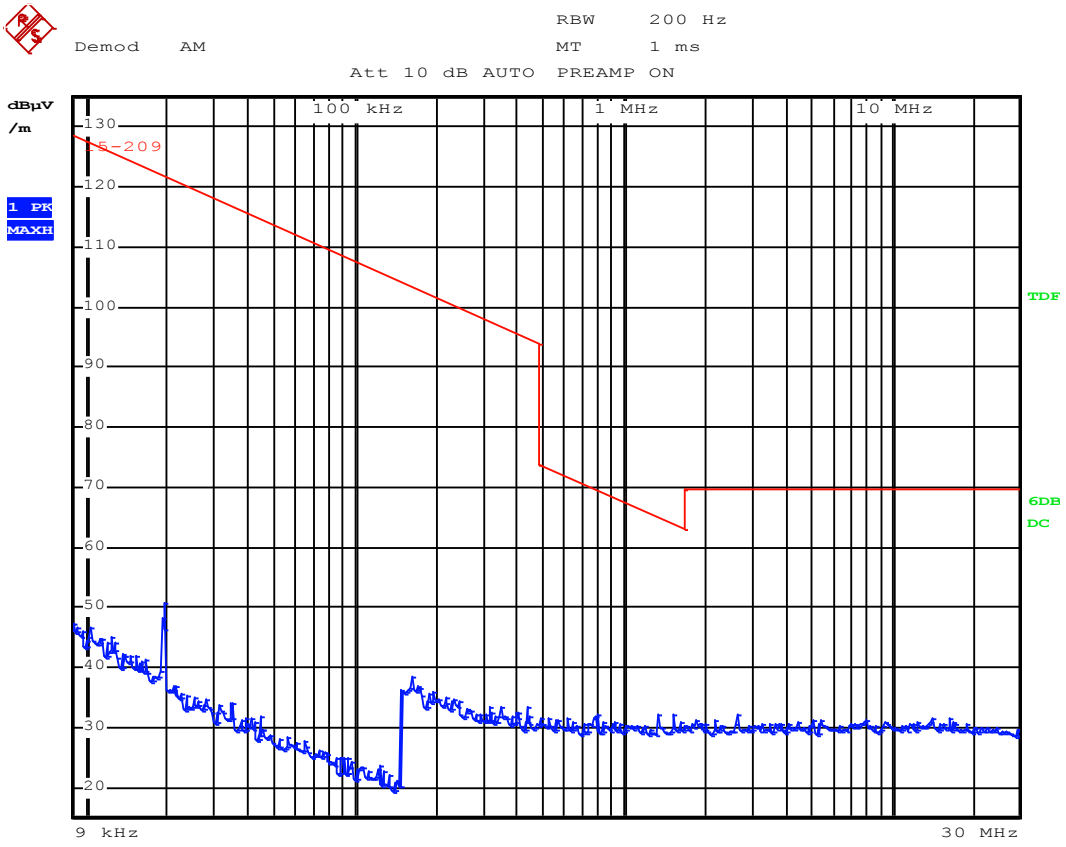
Picture 137: Radiated emission 9 kHz – 30MHz (Ant00, Channel 13)



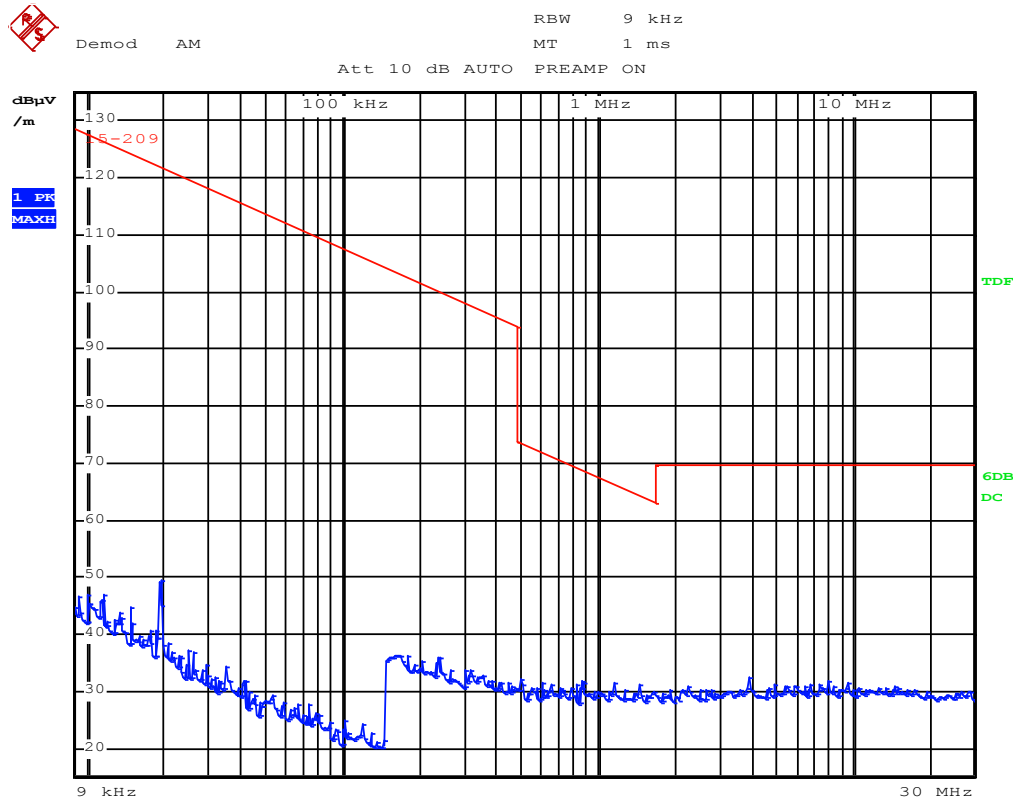
Picture 138: Radiated emission 9 kHz – 30MHz (Ant00, Channel 18)



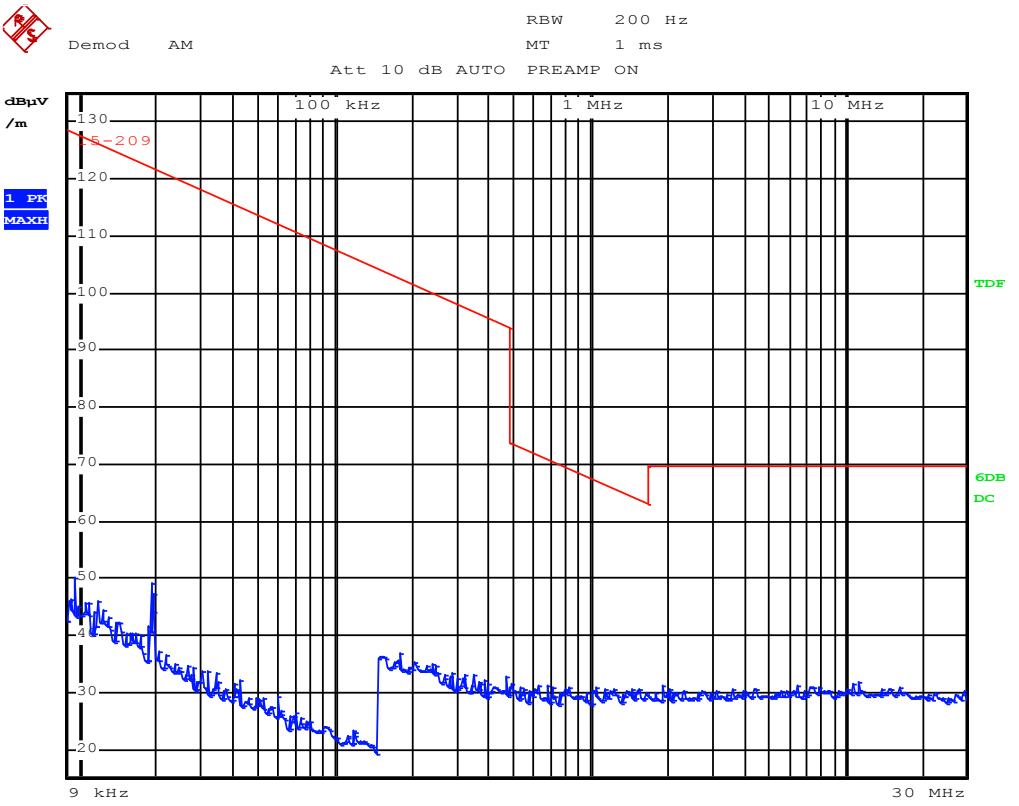
Picture 139: Radiated emission 9 kHz – 30MHz (Ant00, Channel 24)



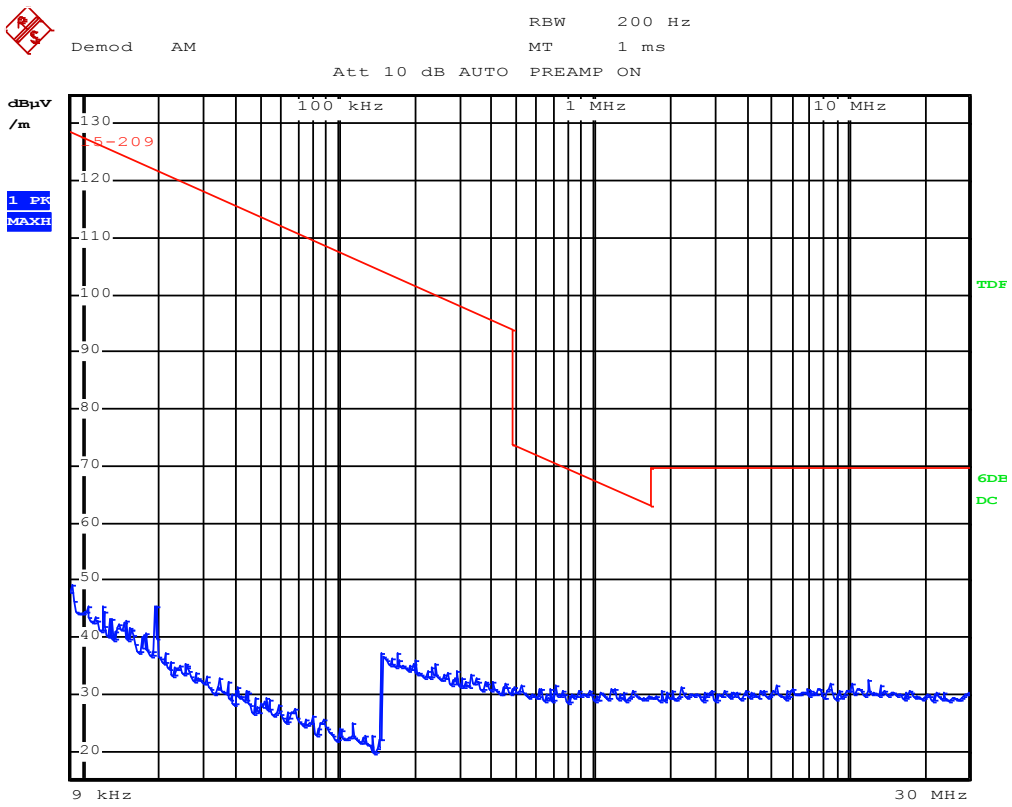
Picture 140: Radiated emission 9 kHz – 30MHz (Ant00, Channel 26)



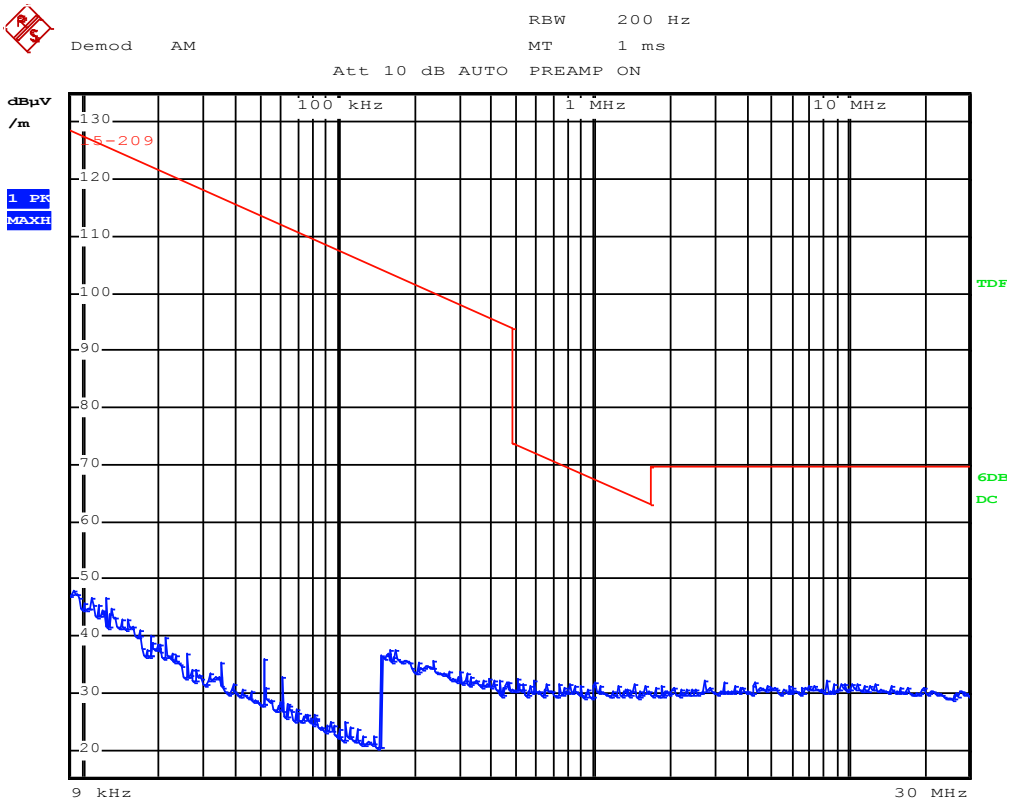
Picture 141: Radiated emission 9 kHz – 30MHz (Ant01, Channel 11)



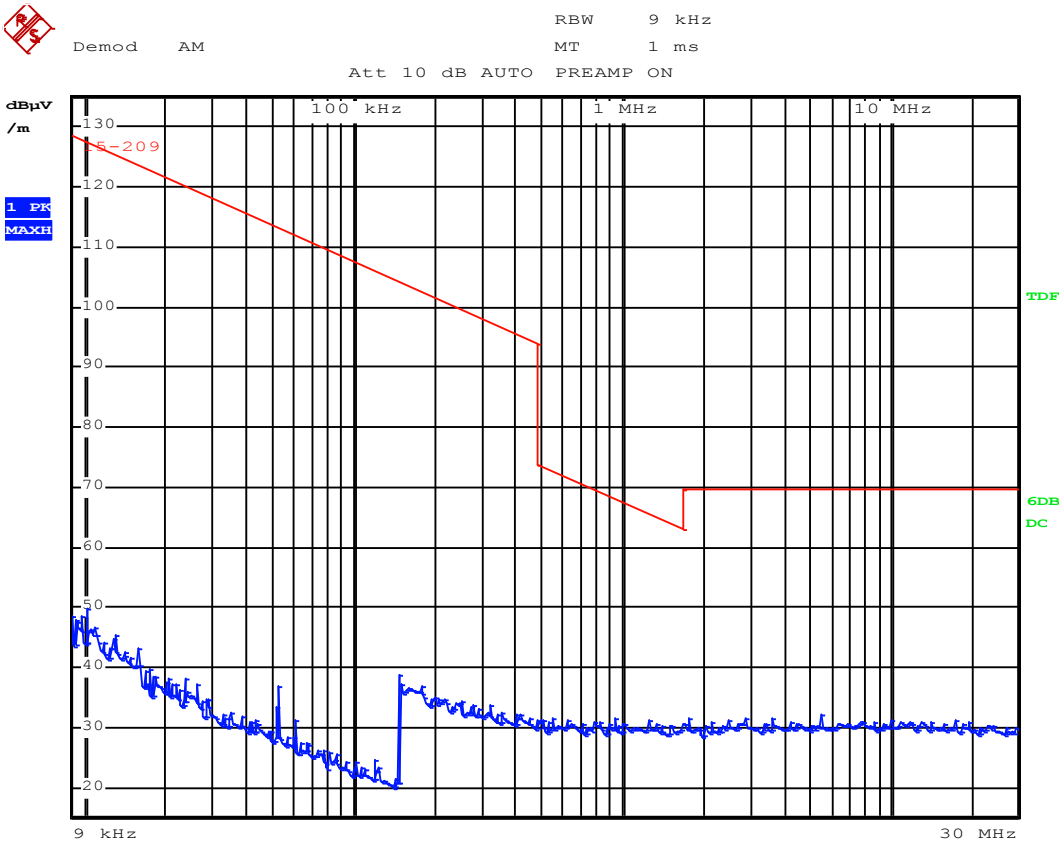
Picture 142: Radiated emission 9 kHz – 30MHz (Ant01, Channel 13)



Picture 143: Radiated emission 9 kHz – 30MHz (Ant01, Channel 18)



Picture 144: Radiated emission 9 kHz – 30MHz (Ant01, Channel 24)



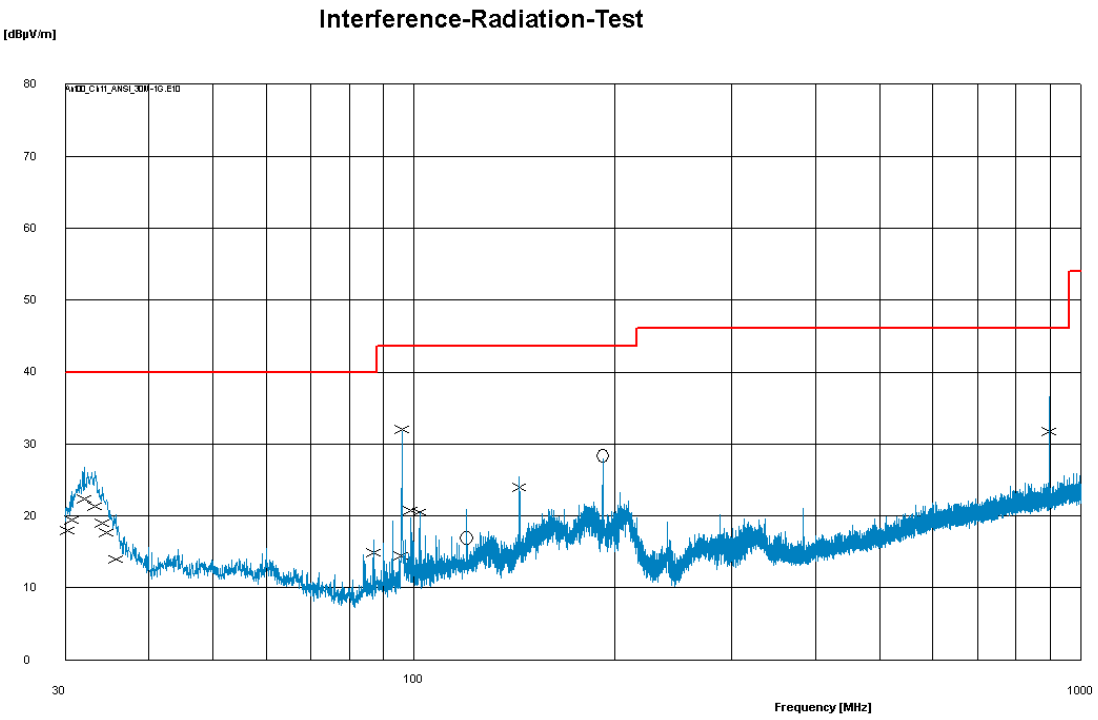
Picture 145: Radiated emission 9 kHz – 30MHz (Ant01, Channel 26)

Transmit mode

Temperature:	21°C	Humidity:	48%
Tested by:	M. Müller	Test date:	2015-01-15

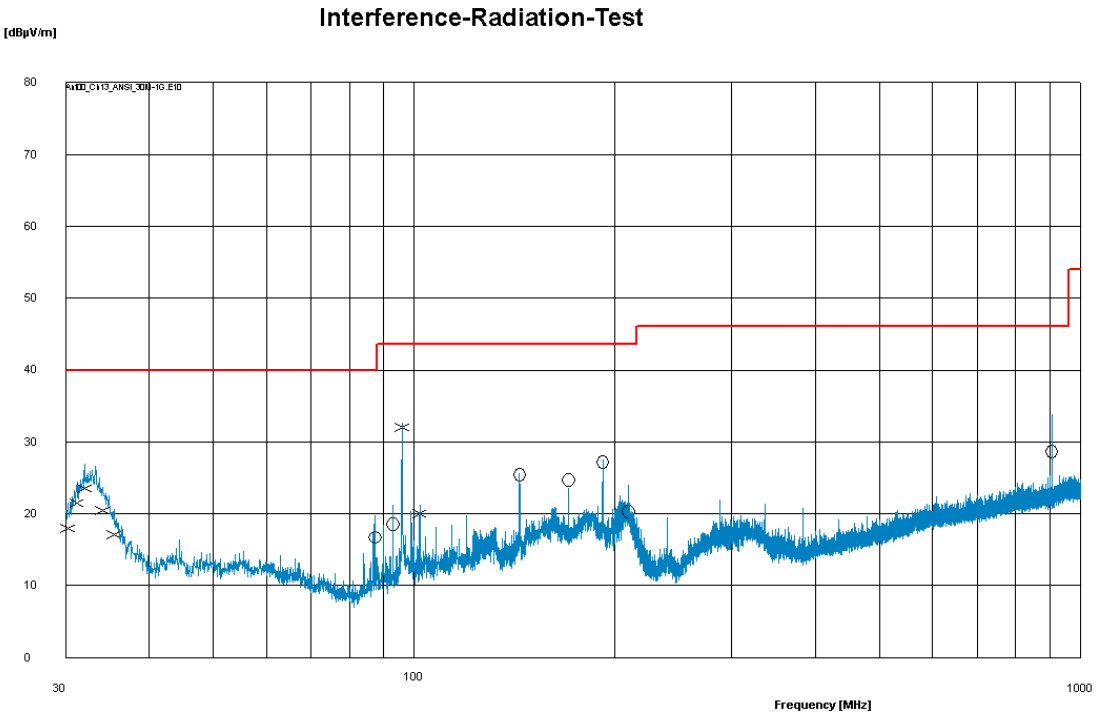
Radiated Emission Measurement 30 MHz - 1 GHz

It was investigated that EUT position 3 is the respective worst-case.



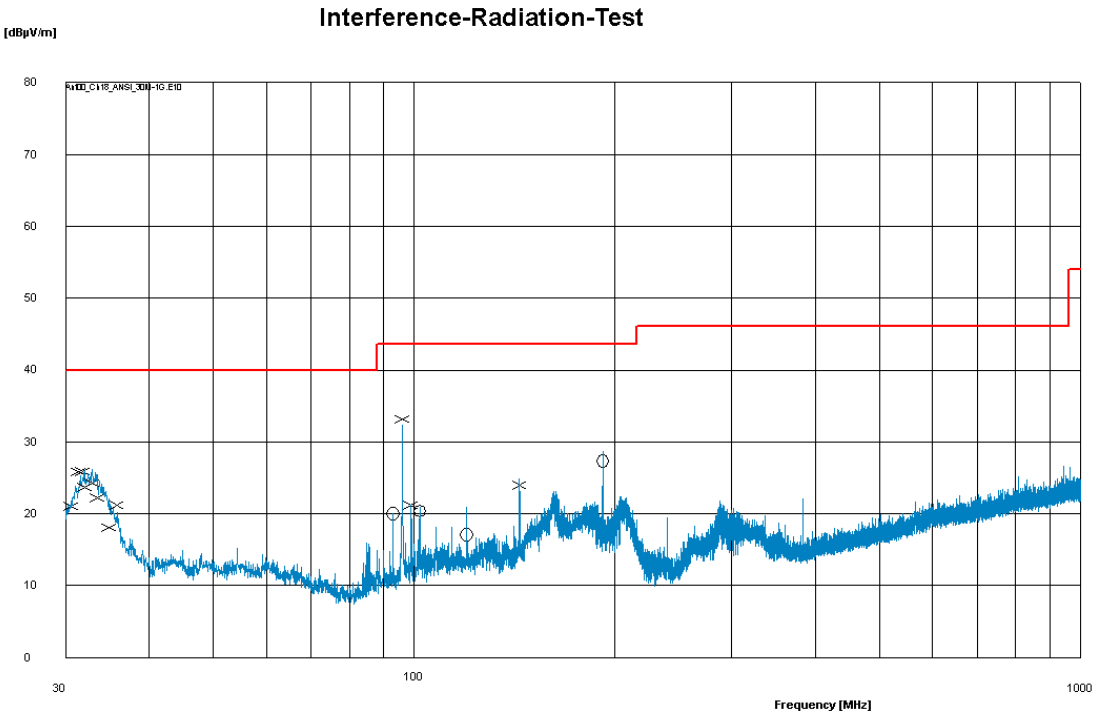
M.	Freq [M...	VMaxC...	Corr...	Limit	dLimit	Pol	Ant	TT	Date	Remarks	VSca...	Corr ...
☑	30,24	18,0	12,2	40,0	- 22,0	V	100	140	2015-01-15 12:33...		21,1	0,0
☑	30,72	19,5	12,2	40,0	- 20,5	V	100	195	2015-01-15 12:34...		23,3	0,0
☑	32,04	22,3	12,1	40,0	- 17,7	V	100	191	2015-01-15 12:35...		26,7	0,0
☑	33,24	21,4	12,1	40,0	- 18,6	V	100	128	2015-01-15 12:36...		26,1	0,0
☑	34,14	19,0	12,1	40,0	- 21,0	V	100	178	2015-01-15 12:36...		24,0	0,0
☑	34,56	17,7	12,1	40,0	- 22,3	V	100	102	2015-01-15 12:37...		22,1	0,0
☑	35,7	13,9	12,2	40,0	- 26,1	V	100	112	2015-01-15 12:38...		20,2	0,0
☑	87,06	14,9	9,5	40,0	- 25,1	V	100	140	2015-01-15 12:39...		16,6	0,0
☑	95,76	14,4	10,2	43,5	- 29,1	V	100	137	2015-01-15 12:40...		23,9	0,0
☑	96	32,0	10,2	43,5	- 11,5	V	100	128	2015-01-15 12:41...		31,8	0,0
☑	99	20,8	10,4	43,5	- 22,7	V	100	137	2015-01-15 12:42...		19,7	0,0
☑	102	20,5	10,7	43,5	- 23,0	V	100	140	2015-01-15 12:43...		20,5	0,0
☑	120	17,0	12,5	43,5	- 26,6	H	100	247	2015-01-15 12:46...		20,9	0,0
☑	144	24,0	13,5	43,5	- 19,6	V	100	6	2015-01-15 12:44...		25,4	0,0
☑	192	28,4	10,5	43,5	- 15,1	H	100	290	2015-01-15 12:47...		27,9	0,0
☑	897	31,8	21,8	46,0	- 14,3	V	100	223	2015-01-15 12:45...		36,5	0,0

Picture 146: Radiated emission 30 MHz – 1000MHz (Ant00, Channel 11)



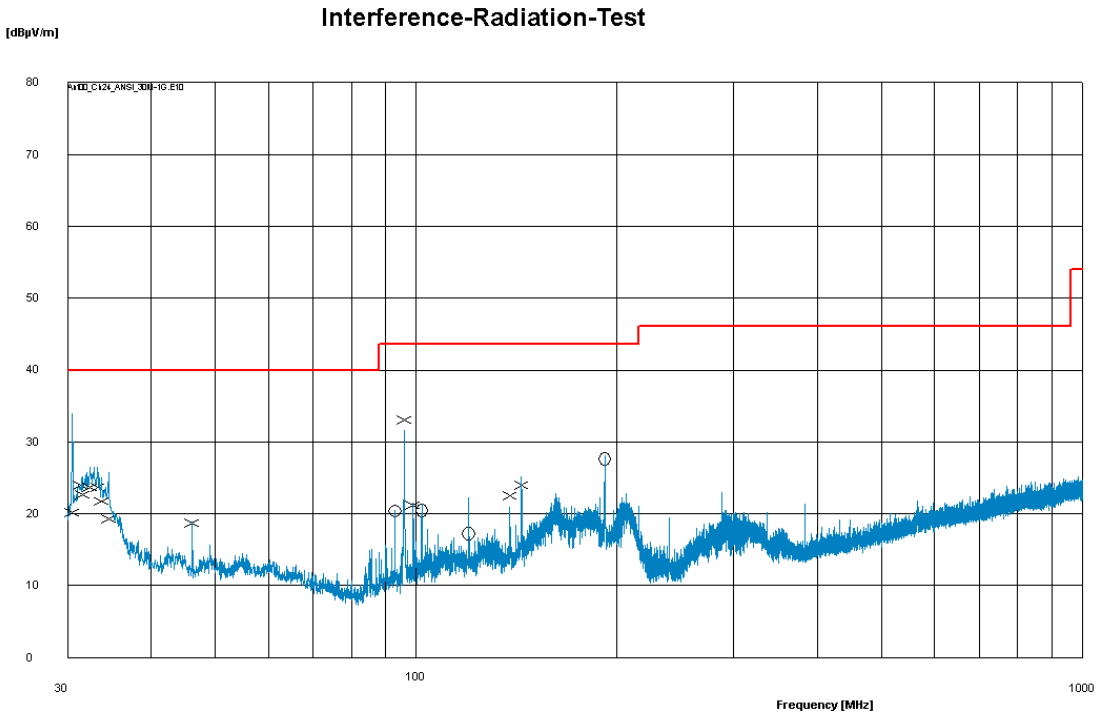
M.	Freq [M...	VMaxC...	Corr...	Limit	dLimit	Pol	Ant	TT	Date	Remarks	VSca...	Corr ...
☑	30,24	18,0	12,2	40,0	- 22,0	V	100	99	2015-01-15 11:41...		21,4	0,0
☑	31,2	21,5	12,1	40,0	- 18,5	V	100	99	2015-01-15 11:42...		24,4	0,0
☑	32,04	23,5	12,1	40,0	- 16,5	V	100	178	2015-01-15 11:43...		26,9	0,0
☑	34,08	20,4	12,1	40,0	- 19,6	V	100	361	2015-01-15 11:43...		23,7	0,0
☑	35,46	17,1	12,2	40,0	- 22,9	V	100	299	2015-01-15 11:44...		20,6	0,0
☑	87,48	16,7	9,6	40,0	- 23,3	H	100	249	2015-01-15 11:47...		19,7	0,0
☑	93	18,5	10,0	43,5	- 25,0	H	100	274	2015-01-15 11:48...		21,1	0,0
☑	96	32,0	10,2	43,5	- 11,5	V	100	153	2015-01-15 11:45...		32,7	0,0
☑	102	20,0	10,7	43,5	- 23,5	V	100	166	2015-01-15 11:46...		21,3	0,0
☑	144	25,4	13,5	43,5	- 18,1	H	100	73	2015-01-15 11:49...		25,5	0,0
☑	170,4	24,7	13,2	43,5	- 18,9	H	100	45	2015-01-15 11:50...		23,6	0,0
☑	192	27,2	10,5	43,5	- 16,4	H	100	290	2015-01-15 11:51...		27,4	0,0
☑	210	20,3	10,0	43,5	- 23,2	H	100	191	2015-01-15 11:52...		24,0	0,0
☑	905,88	28,6	21,9	46,0	- 17,4	H	100	331	2015-01-15 11:53...		33,8	0,0

Picture 147: Radiated emission 30 MHz – 1000MHz (Ant00, Channel 13)



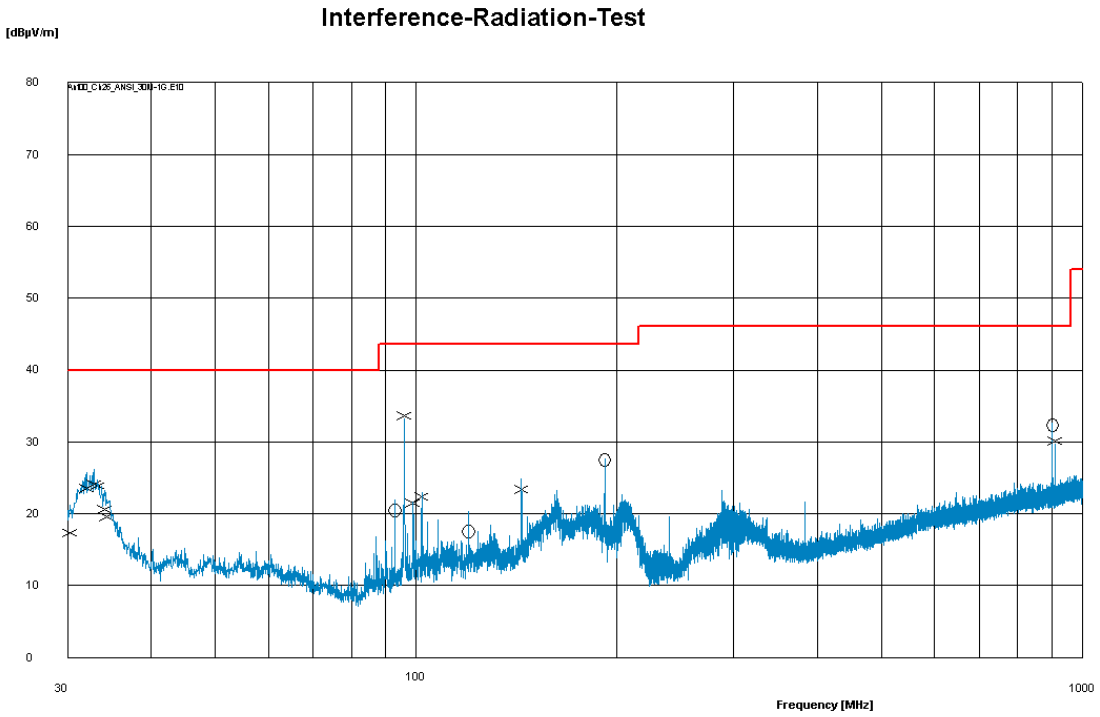
M.	Freq [M...	VMaxC...	Corr...	Limit	dLimit	Pol	Ant	TT	Date	Remarks	VSca...	Corr ...
☑	30,54	21,0	12,2	40,0	- 19,0	V	100	73	2015-01-15 13:28...		21,7	0,0
☑	31,38	25,8	12,1	40,0	- 14,2	V	100	354	2015-01-15 13:29...		23,7	0,0
☑	31,8	25,9	12,1	40,0	- 14,1	V	100	99	2015-01-15 13:29...		25,0	0,0
☑	32,04	23,7	12,1	40,0	- 16,3	V	100	182	2015-01-15 13:30...		26,0	0,0
☑	32,88	24,3	12,1	40,0	- 15,7	V	100	165	2015-01-15 13:31...		26,2	0,0
☑	33,48	22,2	12,1	40,0	- 17,8	V	100	194	2015-01-15 13:32...		25,5	0,0
☑	34,86	18,0	12,1	40,0	- 22,0	V	100	213	2015-01-15 13:33...		22,1	0,0
☑	35,82	21,2	12,2	40,0	- 18,8	V	100	45	2015-01-15 13:34...		20,2	0,0
☑	93	20,0	10,0	43,5	- 23,5	H	100	262	2015-01-15 13:38...		20,1	0,0
☑	96	33,1	10,2	43,5	- 10,4	V	100	137	2015-01-15 13:35...		32,3	0,0
☑	99	21,1	10,4	43,5	- 22,4	V	100	153	2015-01-15 13:36...		21,2	0,0
☑	102	20,4	10,7	43,5	- 23,2	H	100	70	2015-01-15 13:39...		20,9	0,0
☑	120	17,1	12,5	43,5	- 26,4	H	100	261	2015-01-15 13:40...		21,0	0,0
☑	144	24,0	13,5	43,5	- 19,5	V	100	6	2015-01-15 13:37...		24,8	0,0
☑	192	27,3	10,5	43,5	- 16,2	H	100	299	2015-01-15 13:41...		28,6	0,0

Picture 148: Radiated emission 30 MHz – 1000MHz (Ant00, Channel 18)



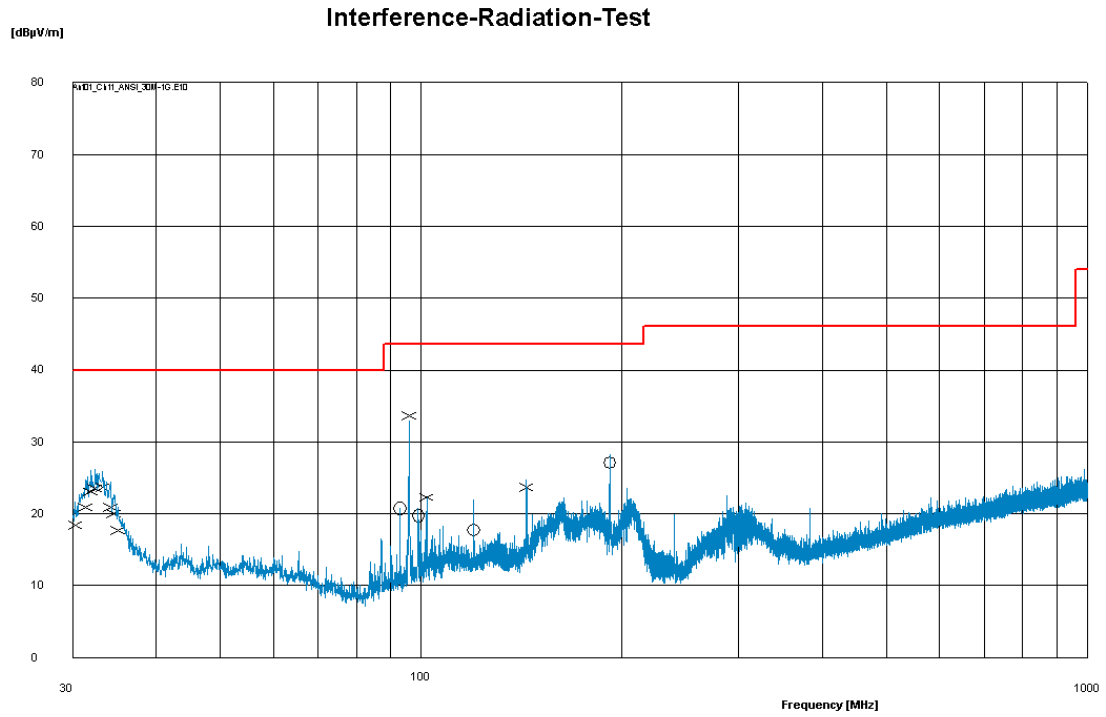
M.	Freq [M...	VMaxC...	Corr...	Limit	dLimit	Pol	Ant	TT	Date	Remarks	VSca...	Corr ...
☑	30,48	20,1	12,2	40,0	- 19,9	V	100	182	2015-01-15 13:56...		33,9	0,0
☑	31,32	24,0	12,1	40,0	- 16,0	V	100	140	2015-01-15 13:57...		23,7	0,0
☑	31,56	22,6	12,1	40,0	- 17,4	V	100	178	2015-01-15 13:58...		25,1	0,0
☑	32,46	23,7	12,1	40,0	- 16,3	V	100	182	2015-01-15 13:59...		26,4	0,0
☑	33,3	23,7	12,1	40,0	- 16,3	V	100	220	2015-01-15 14:00...		26,4	0,0
☑	33,72	21,7	12,1	40,0	- 18,3	V	100	128	2015-01-15 14:01...		25,0	0,0
☑	34,56	19,2	12,1	40,0	- 20,8	V	100	137	2015-01-15 14:02...		25,7	0,0
☑	46,08	18,7	12,7	40,0	- 21,3	V	100	32	2015-01-15 14:03...		18,8	0,0
☑	93	20,4	10,0	43,5	- 23,1	H	100	273	2015-01-15 14:07...		20,4	0,0
☑	96	33,1	10,2	43,5	- 10,4	V	100	153	2015-01-15 14:04...		31,5	0,0
☑	99	21,2	10,4	43,5	- 22,3	V	100	153	2015-01-15 14:04...		21,5	0,0
☑	102	20,5	10,7	43,5	- 23,0	H	100	61	2015-01-15 14:08...		21,4	0,0
☑	120	17,2	12,5	43,5	- 26,3	H	100	273	2015-01-15 14:09...		22,2	0,0
☑	138,36	22,6	13,2	43,5	- 21,0	V	100	6	2015-01-15 14:05...		20,9	0,0
☑	144	23,9	13,5	43,5	- 19,6	V	100	7	2015-01-15 14:06...		25,2	0,0
☑	192	27,6	10,5	43,5	- 15,9	H	100	303	2015-01-15 14:10...		28,0	0,0

Picture 149: Radiated emission 30 MHz – 1000MHz (Ant00, Channel 24)



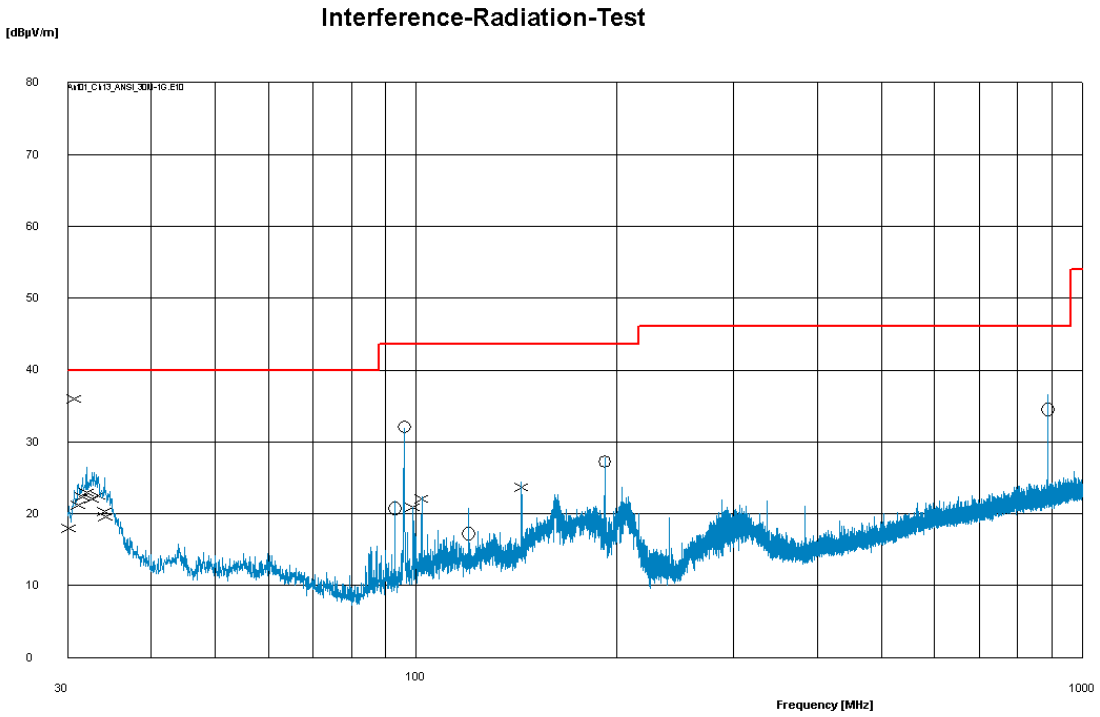
M.	Freq [M...	VMaxC...	Corr...	Limit	dLimit	Pol	Ant	TT	Date	Remarks	VSca...	Corr ...
☑	30,24	17,3	12,2	40,0	- 22,7	V	100	200	2015-01-15 14:27...		21,3	0,0
☑	32,04	23,5	12,1	40,0	- 16,5	V	100	153	2015-01-15 14:27...		25,7	0,0
☑	32,88	24,1	12,1	40,0	- 15,9	V	100	165	2015-01-15 14:28...		26,2	0,0
☑	33,3	23,9	12,1	40,0	- 16,1	V	100	128	2015-01-15 14:29...		24,7	0,0
☑	34,08	20,6	12,1	40,0	- 19,4	V	100	124	2015-01-15 14:30...		23,3	0,0
☑	34,38	19,5	12,1	40,0	- 20,5	V	100	115	2015-01-15 14:31...		21,9	0,0
☑	93	20,4	10,0	43,5	- 23,1	H	100	262	2015-01-15 14:37...		22,0	0,0
☑	96	33,7	10,2	43,5	- 9,8	V	100	137	2015-01-15 14:32...		33,1	0,0
☑	99	21,5	10,4	43,5	- 22,0	V	100	153	2015-01-15 14:33...		21,6	0,0
☑	102	22,4	10,7	43,5	- 21,1	V	100	150	2015-01-15 14:34...		22,9	0,0
☑	120	17,6	12,5	43,5	- 26,0	H	100	274	2015-01-15 14:38...		20,2	0,0
☑	144	23,3	13,5	43,5	- 20,2	V	100	7	2015-01-15 14:35...		24,9	0,0
☑	192	27,5	10,5	43,5	- 16,0	H	100	290	2015-01-15 14:39...		27,7	0,0
☑	901,92	32,3	21,9	46,0	- 13,7	H	100	17	2015-01-15 14:40...		32,6	0,0
☑	910,98	30,2	22,0	46,0	- 15,9	V	100	219	2015-01-15 14:36...		29,7	0,0

Picture 150: Radiated emission 30 MHz – 1000MHz (Ant00, Channel 26)



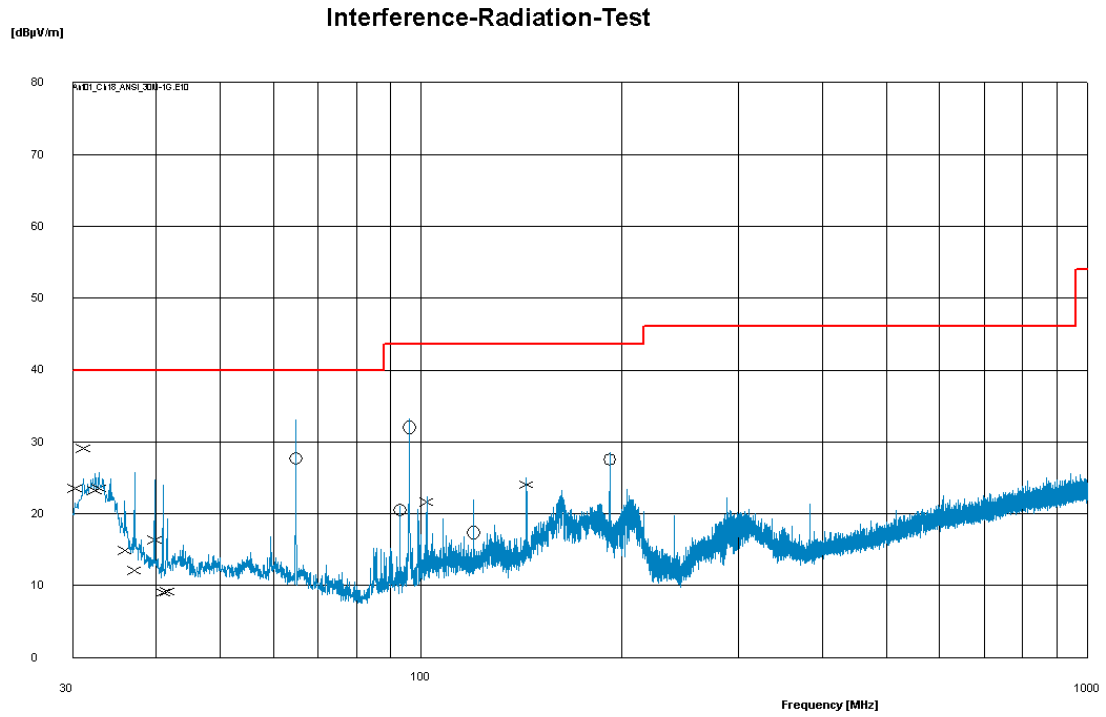
M.	Freq [M...	VMaxC...	Corr...	Limit	dLimit	Pol	Ant	TT	Date	Remarks	VSca...	Corr ...
☑	30,3	18,4	12,2	40,0	- 21,6	V	100	207	2015-01-15 15:01...		21,6	0,0
☑	31,32	20,9	12,1	40,0	- 19,1	V	100	182	2015-01-15 15:02...		24,6	0,0
☑	31,98	23,0	12,1	40,0	- 17,0	V	100	153	2015-01-15 15:03...		26,1	0,0
☑	32,46	23,6	12,1	40,0	- 16,4	V	100	182	2015-01-15 15:04...		26,2	0,0
☑	33,3	23,6	12,1	40,0	- 16,4	V	100	112	2015-01-15 15:05...		25,9	0,0
☑	34,2	20,9	12,1	40,0	- 19,1	V	100	103	2015-01-15 15:06...		24,4	0,0
☑	34,56	20,0	12,1	40,0	- 20,0	V	100	42	2015-01-15 15:07...		22,7	0,0
☑	35,1	17,7	12,1	40,0	- 22,3	V	100	128	2015-01-15 15:08...		20,9	0,0
☑	93	20,8	10,0	43,5	- 22,7	H	100	262	2015-01-15 15:12...		20,8	0,0
☑	96	33,6	10,2	43,5	- 9,9	V	100	137	2015-01-15 15:09...		32,9	0,0
☑	99	19,8	10,4	43,5	- 23,8	H	100	70	2015-01-15 15:13...		20,8	0,0
☑	102	22,3	10,7	43,5	- 21,2	V	100	141	2015-01-15 15:10...		22,1	0,0
☑	120	17,8	12,5	43,5	- 25,8	H	100	261	2015-01-15 15:14...		21,9	0,0
☑	144	23,6	13,5	43,5	- 19,9	V	100	6	2015-01-15 15:11...		24,8	0,0
☑	192	27,1	10,5	43,5	- 16,4	H	100	299	2015-01-15 15:15...		28,2	0,0

Picture 151: Radiated emission 30 MHz – 1000MHz (Ant01, Channel 11)



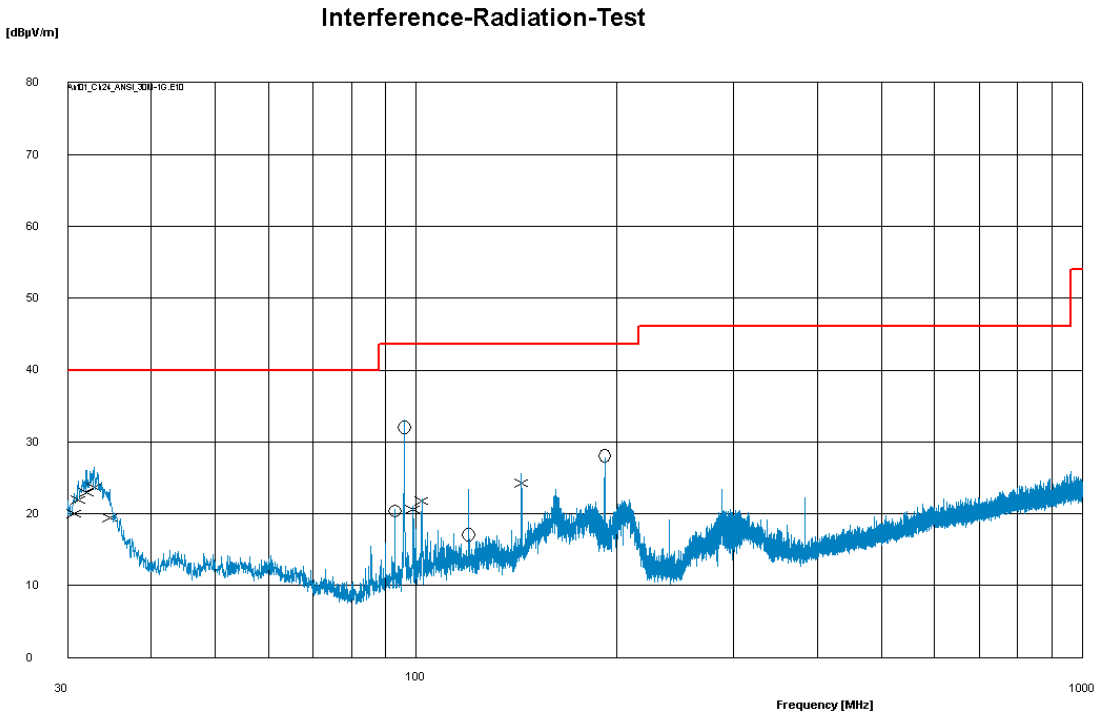
M.	Freq [M...	VMaxC...	Corr...	Limit	dLimit	Pol	Ant	TT	Date	Remarks	VSca...	Corr ...
☑	30,18	18,0	12,2	40,0	- 22,0	V	100	184	2015-01-15 15:33...		21,0	0,0
☑	30,72	36,0	12,2	40,0	- 4,0	V	100	290	2015-01-15 15:34...		23,2	0,0
☑	31,14	21,2	12,1	40,0	- 18,8	V	100	191	2015-01-15 15:35...		24,1	0,0
☑	31,56	22,4	12,1	40,0	- 17,6	V	100	182	2015-01-15 15:36...		25,0	0,0
☑	32,04	23,0	12,1	40,0	- 17,0	V	100	178	2015-01-15 15:37...		26,4	0,0
☑	32,64	22,1	12,1	40,0	- 17,9	V	100	153	2015-01-15 15:38...		25,7	0,0
☑	33,36	22,5	12,1	40,0	- 17,5	V	100	166	2015-01-15 15:39...		25,2	0,0
☑	34,08	20,3	12,1	40,0	- 19,7	V	100	115	2015-01-15 15:39...		24,9	0,0
☑	34,26	19,5	12,1	40,0	- 20,5	V	100	219	2015-01-15 15:40...		23,2	0,0
☑	93	20,7	10,0	43,5	- 22,8	H	100	273	2015-01-15 15:44...		21,7	0,0
☑	96	32,1	10,2	43,5	- 11,4	H	100	249	2015-01-15 15:45...		31,8	0,0
☑	99	20,8	10,4	43,5	- 22,7	V	100	153	2015-01-15 15:41...		20,9	0,0
☑	102	22,1	10,7	43,5	- 21,4	V	100	150	2015-01-15 15:42...		22,3	0,0
☑	120	17,2	12,5	43,5	- 26,3	H	100	273	2015-01-15 15:46...		20,8	0,0
☑	144	23,7	13,5	43,5	- 19,8	V	100	7	2015-01-15 15:43...		24,3	0,0
☑	192	27,3	10,5	43,5	- 16,3	H	100	290	2015-01-15 15:47...		27,7	0,0
☑	886,86	34,6	21,7	46,0	- 11,5	H	100	29	2015-01-15 15:48...		36,5	0,0

Picture 152: Radiated emission 30 MHz – 1000MHz (Ant01, Channel 13)



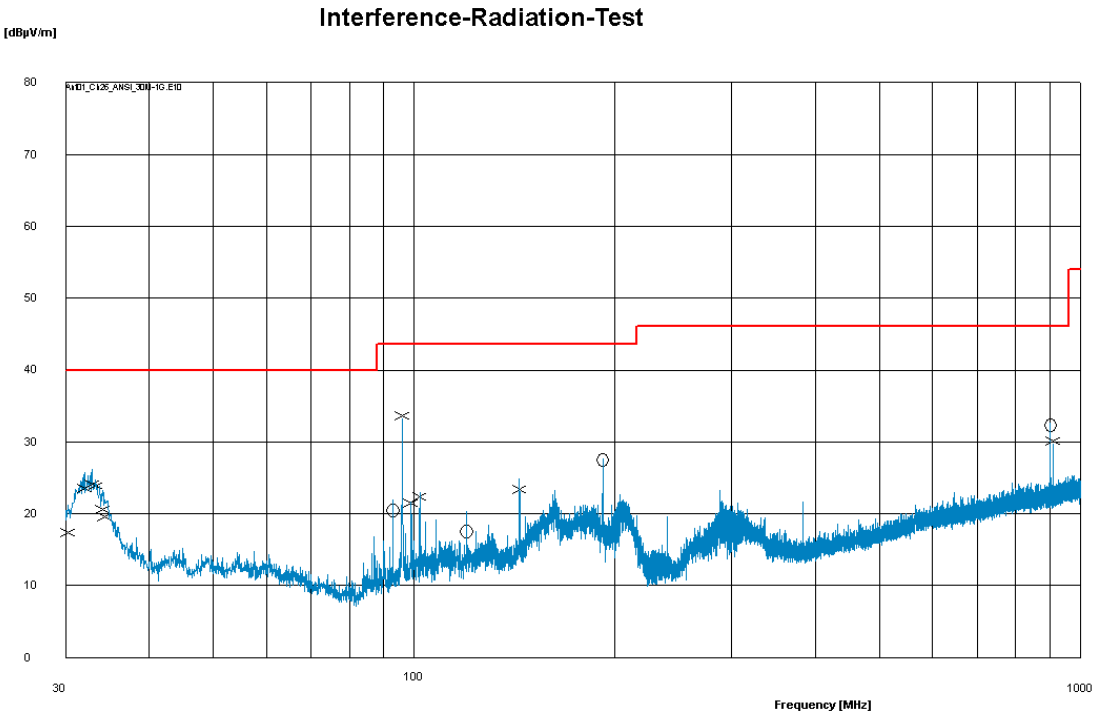
M.	Freq [M...	VMaxC...	Corr...	Limit	dLimit	Pol	Ant	TT	Date	Remarks	VSca...	Corr ...
☑	30,24	23,5	12,2	40,0	- 16,5	V	100	276	2015-01-15 16:08...		21,5	0,0
☑	31,14	29,1	12,1	40,0	- 10,9	V	100	261	2015-01-15 16:09...		24,8	0,0
☑	32,46	23,2	12,1	40,0	- 16,8	V	100	137	2015-01-15 16:10...		25,6	0,0
☑	32,88	23,5	12,1	40,0	- 16,5	V	100	153	2015-01-15 16:11...		25,7	0,0
☑	35,94	14,9	12,2	40,0	- 25,1	V	100	166	2015-01-15 16:11...		21,7	0,0
☑	37,14	12,1	12,5	40,0	- 27,9	V	100	128	2015-01-15 16:12...		25,8	0,0
☑	39,84	16,3	13,0	40,0	- 23,7	V	100	219	2015-01-15 16:13...		24,6	0,0
☑	40,98	9,1	13,0	40,0	- 30,9	V	100	61	2015-01-15 16:14...		24,0	0,0
☑	41,58	9,2	12,9	40,0	- 30,8	V	100	245	2015-01-15 16:15...		19,2	0,0
☑	64,86	27,7	11,3	40,0	- 12,3	H	100	304	2015-01-15 16:18...		33,1	0,0
☑	93	20,5	10,0	43,5	- 23,0	H	100	273	2015-01-15 16:19...		21,0	0,0
☑	96	32,0	10,2	43,5	- 11,5	H	100	249	2015-01-15 16:20...		33,2	0,0
☑	102	21,6	10,7	43,5	- 21,9	V	100	141	2015-01-15 16:16...		22,3	0,0
☑	120	17,3	12,5	43,5	- 26,2	H	100	273	2015-01-15 16:21...		21,9	0,0
☑	144	24,0	13,5	43,5	- 19,5	V	100	6	2015-01-15 16:17...		25,0	0,0
☑	192	27,5	10,5	43,5	- 16,0	H	100	290	2015-01-15 16:22...		28,5	0,0

Picture 153: Radiated emission 30 MHz – 1000MHz (Ant01, Channel 18)



M.	Freq [M...	VMaxC...	Corr...	Limit	dLimit	Pol	Ant	TT	Date	Remarks	VSca...	Corr ...
☑	30,66	20,0	12,2	40,0	- 20,0	V	100	188	2015-01-15 16:37...		22,8	0,0
☑	31,14	21,9	12,1	40,0	- 18,1	V	100	169	2015-01-15 16:38...		24,6	0,0
☑	32,04	23,0	12,1	40,0	- 17,0	V	100	261	2015-01-15 16:39...		26,1	0,0
☑	32,88	23,7	12,1	40,0	- 16,3	V	100	169	2015-01-15 16:40...		26,4	0,0
☑	34,68	19,4	12,1	40,0	- 20,6	V	100	353	2015-01-15 16:41...		23,4	0,0
☑	93	20,4	10,0	43,5	- 23,1	H	100	273	2015-01-15 16:45...		20,5	0,0
☑	96	32,0	10,2	43,5	- 11,5	H	100	249	2015-01-15 16:46...		33,1	0,0
☑	99	20,6	10,4	43,5	- 22,9	V	100	141	2015-01-15 16:42...		21,0	0,0
☑	102	21,8	10,7	43,5	- 21,7	V	100	150	2015-01-15 16:43...		22,0	0,0
☑	120	17,1	12,5	43,5	- 26,5	H	100	273	2015-01-15 16:47...		23,3	0,0
☑	144	24,3	13,5	43,5	- 19,2	V	100	7	2015-01-15 16:44...		25,5	0,0
☑	192	28,0	10,5	43,5	- 15,5	H	100	290	2015-01-15 16:48...		27,7	0,0

Picture 154: Radiated emission 30 MHz – 1000MHz (Ant01, Channel 24)



M.	Freq [M...	VMaxC...	Corr...	Limit	dLimit	Pol	Ant	TT	Date	Remarks	VSca...	Corr ...
☑	30,24	17,4	12,2	40,0	- 22,6	V	100	200	2015-01-15 16:27...		21,3	0,0
☑	32,04	23,5	12,1	40,0	- 16,5	V	100	153	2015-01-15 16:27...		25,7	0,0
☑	32,88	24,1	12,1	40,0	- 15,9	V	100	165	2015-01-15 16:28...		26,2	0,0
☑	33,3	23,9	12,1	40,0	- 16,1	V	100	128	2015-01-15 16:29...		24,7	0,0
☑	34,08	20,6	12,1	40,0	- 19,4	V	100	124	2015-01-15 16:30...		23,3	0,0
☑	34,38	19,5	12,1	40,0	- 20,5	V	100	115	2015-01-15 16:31...		21,9	0,0
☑	93	20,4	10,0	43,5	- 23,1	H	100	262	2015-01-15 16:37...		22,0	0,0
☑	96	33,7	10,2	43,5	- 9,8	V	100	137	2015-01-15 16:32...		33,1	0,0
☑	99	21,5	10,4	43,5	- 22,0	V	100	153	2015-01-15 16:33...		21,6	0,0
☑	102	22,4	10,7	43,5	- 21,1	V	100	150	2015-01-15 16:34...		22,9	0,0
☑	120	17,6	12,5	43,5	- 26,0	H	100	274	2015-01-15 16:38...		20,2	0,0
☑	144	23,3	13,5	43,5	- 20,2	V	100	7	2015-01-15 16:35...		24,9	0,0
☑	192	27,5	10,5	43,5	- 16,0	H	100	290	2015-01-15 16:39...		27,7	0,0
☑	901,92	32,3	21,9	46,0	- 13,7	H	100	17	2015-01-15 16:40...		32,6	0,0
☑	910,98	30,2	22,0	46,0	- 15,9	V	100	219	2015-01-15 16:36...		29,7	0,0

Picture 155: Radiated emission 30 MHz – 1000MHz (Ant01, Channel 26)

12 Radiated emission measurement (>1 GHz)

according to 47 CFR 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 anechoic chamber

☑ Final measurement with average and max peak detector.

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

12.2 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

12.3 Limits

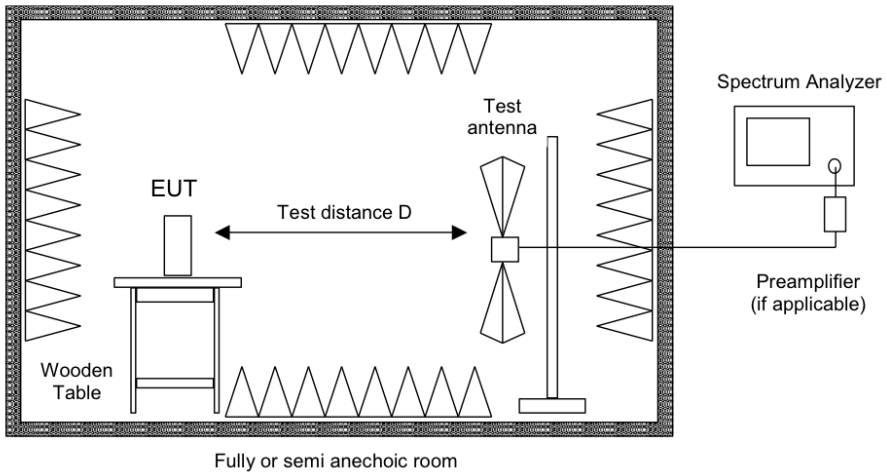
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the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

12.4 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 reduced to a minimum of 10 Hz (300 Hz by default) to get average values determined by video averaging.
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.

12.5 Test setup



Picture 156: 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.
For these measurements it was investigated that EUT-position1 is the respective worst-case.

12.8 Test results antenna00, channel 11

Temperature:	19°C	Humidity:	47%
Tested by:	M. Müller	Test date:	2015-01-27

Final Results:

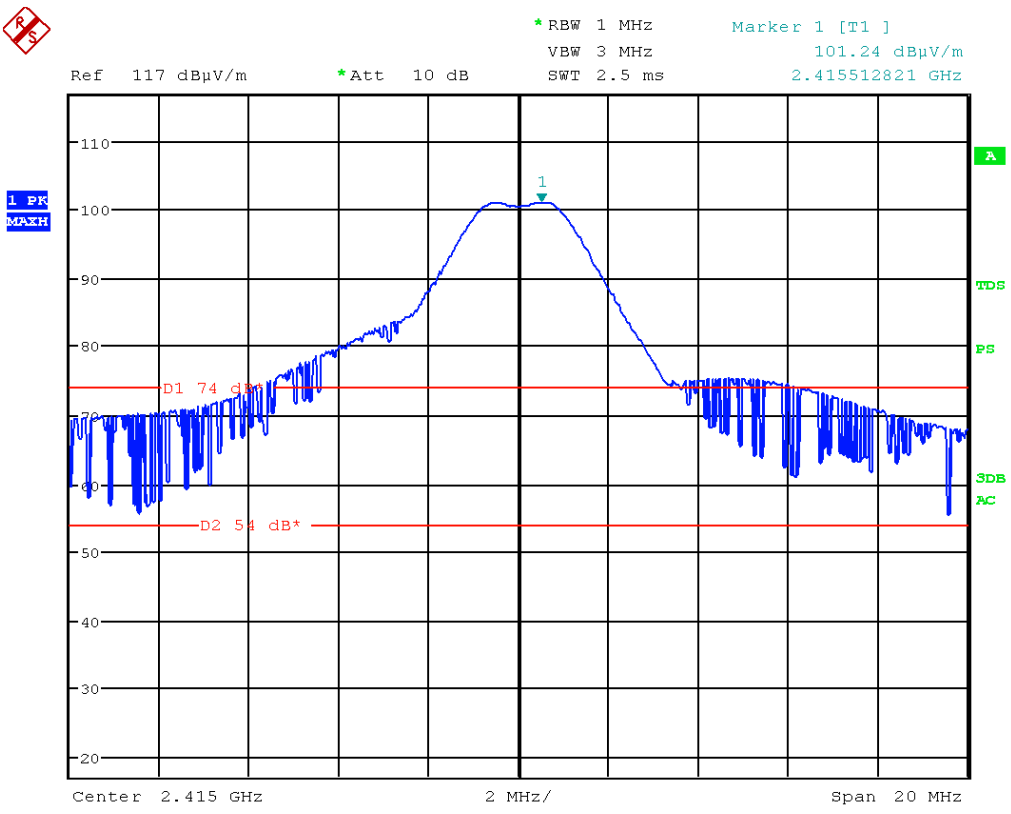
Channel11
- no significant emissions detected -

12.9 Test results antenna00, channel 13

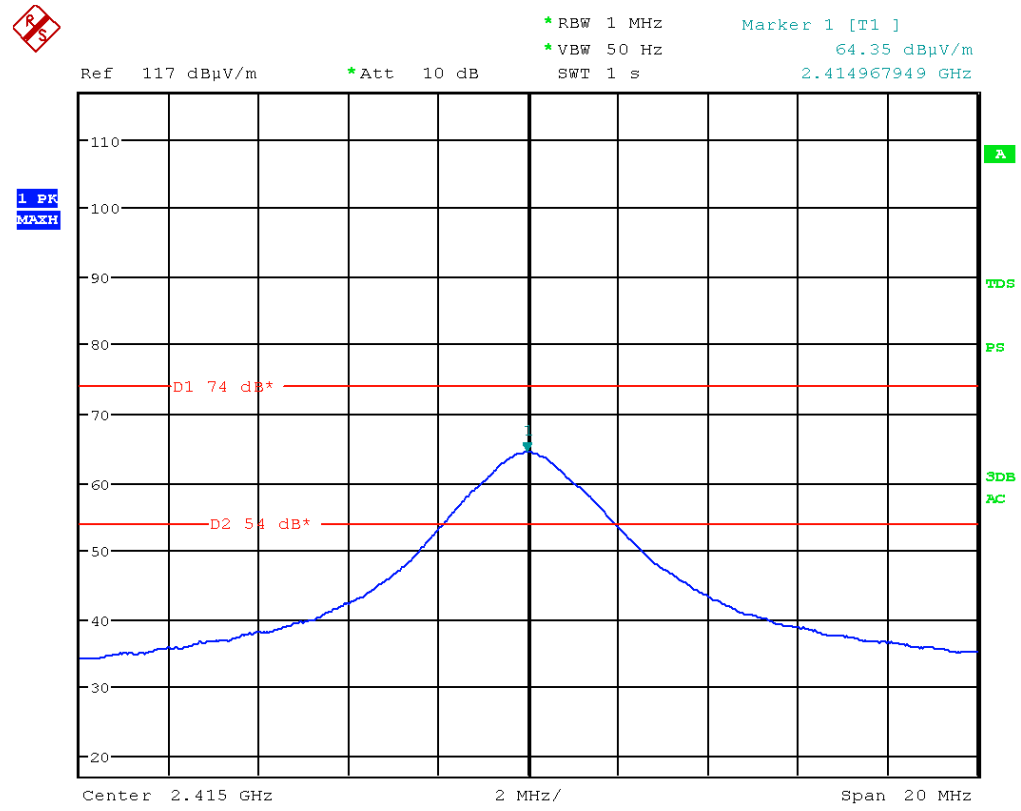
Temperature:	19°C	Humidity:	47%
Tested by:	M. Müller	Test date:	2015-01-27

Final Results:

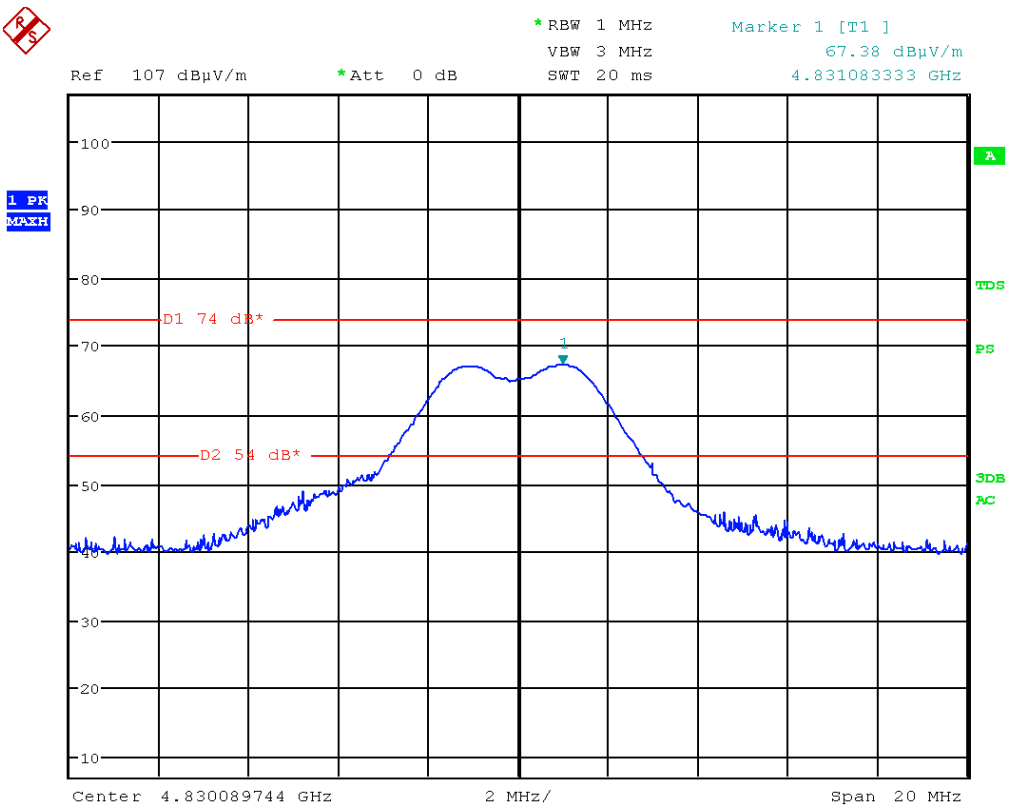
Channel13							
f[GHz]	E_{meas} [dBµV/m]	Ant	Turntable [°]	Detector	Restr. Band	Limit [dBµV/m]	Result
2.4155	101.24	H	189.7	PK	No	----	Carrier
2.4150	64.35			AV (50Hz)		----	Carrier
4.8311	67.38	H	96.7	PK	Yes	74	Pass
4.8300	43.60			AV (50Hz)		54	Pass
7.2435	61.33	H	39.1	PK	No	-20dBc	Pass
7.2463	41.09			AV (50Hz)		-20dBc	Pass



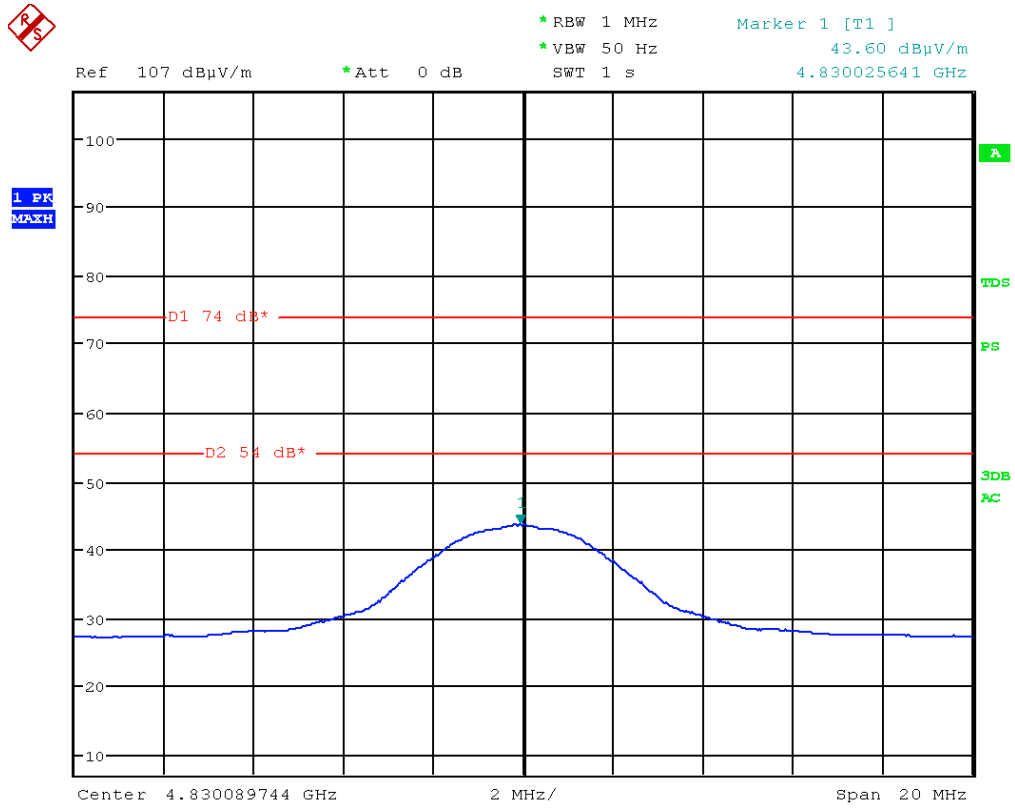
Picture 157: spurious emission ant00, ch13 - PK



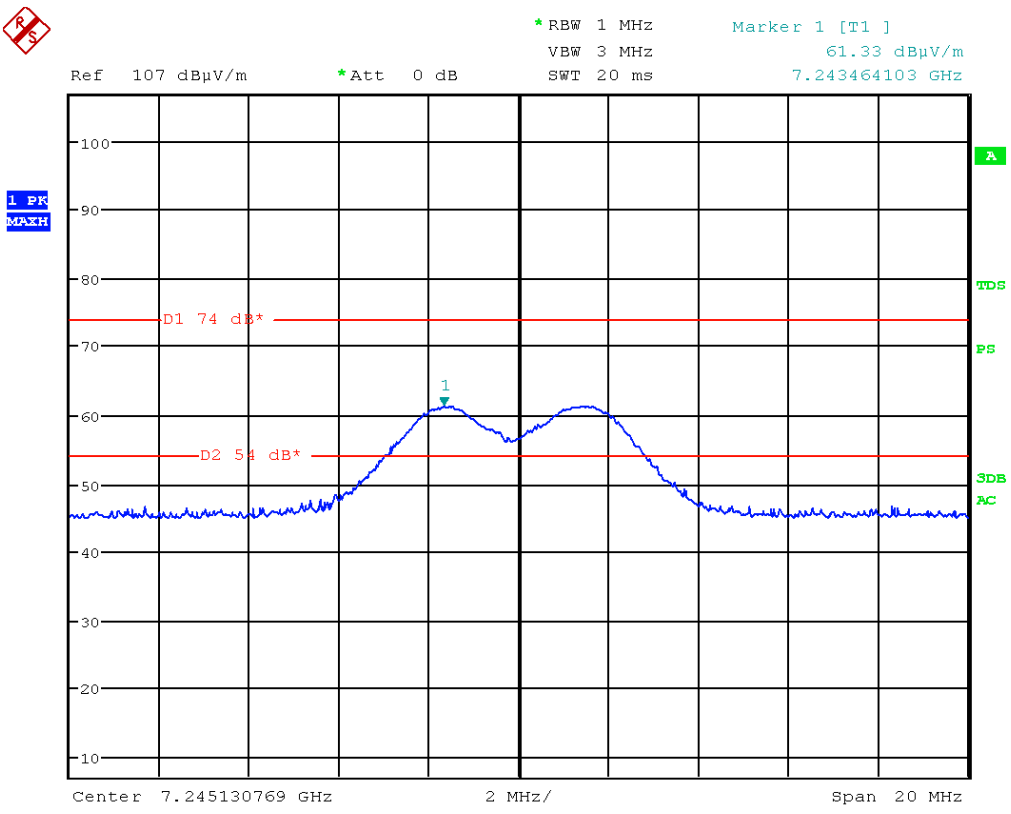
Picture 158: spurious emission ant00, ch13 - AV



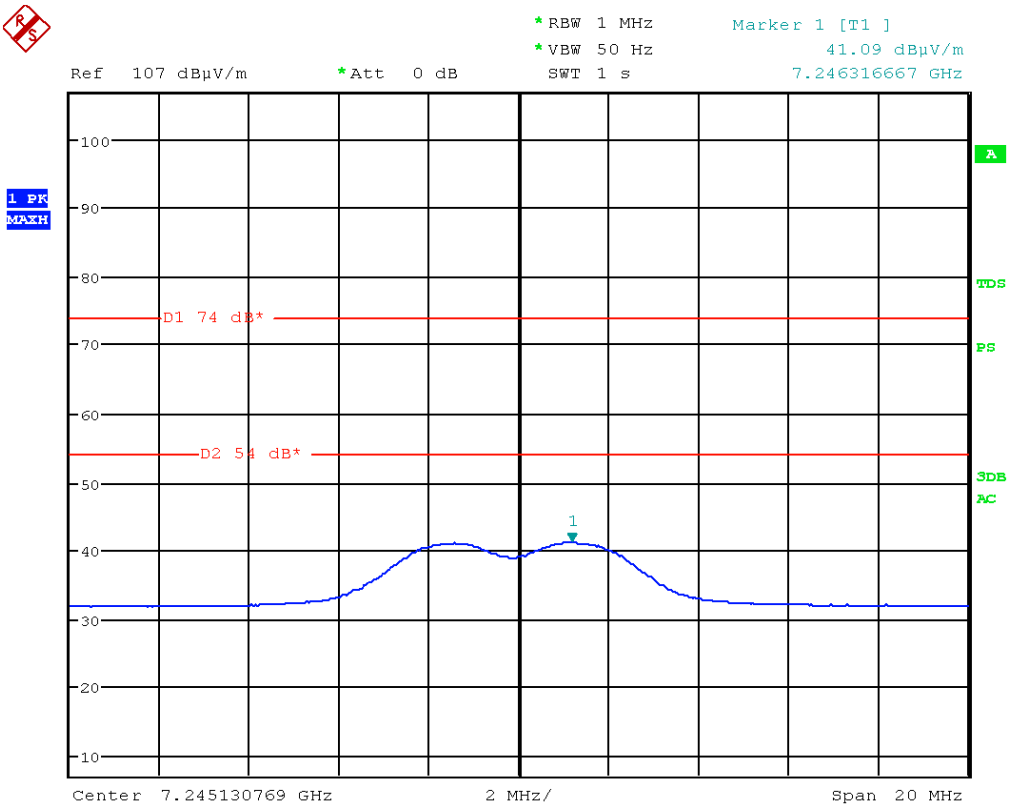
Picture 159: spurious emission ant00, ch13 - PK



Picture 160: spurious emission ant00, ch13 - AV



Picture 161: spurious emission ant00, ch13 - PK



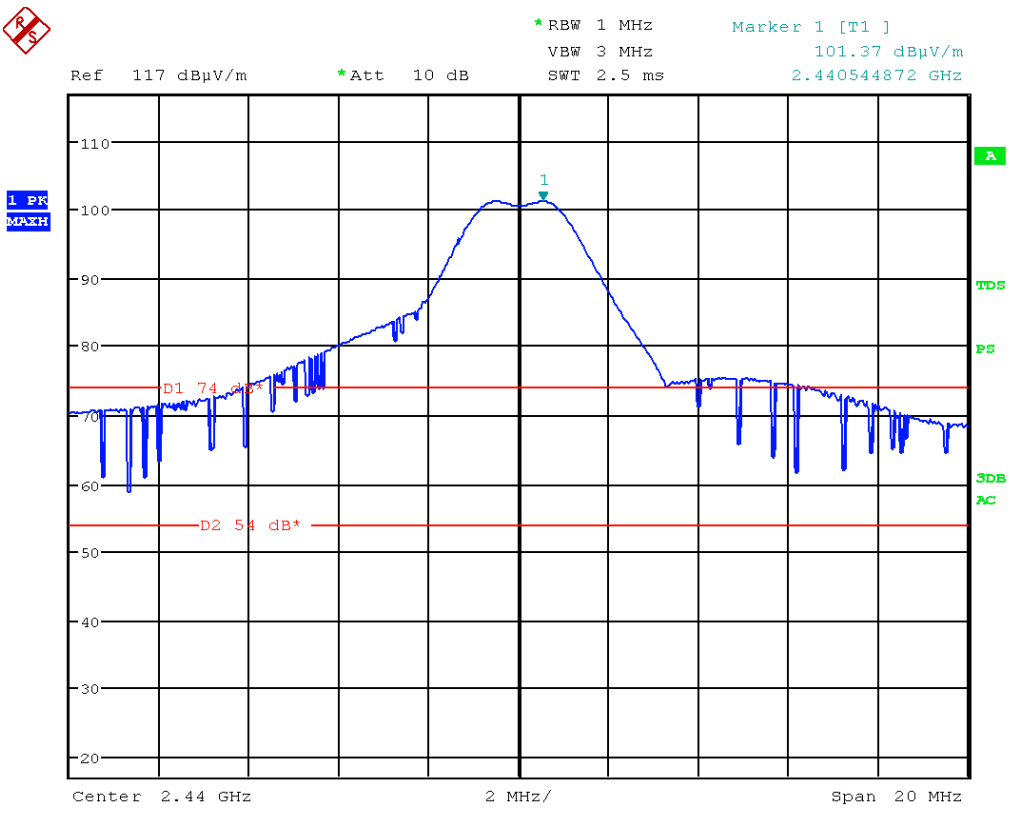
Picture 162: spurious emission ant00, ch13 - AV

12.10 Test results antenna00, channel 18

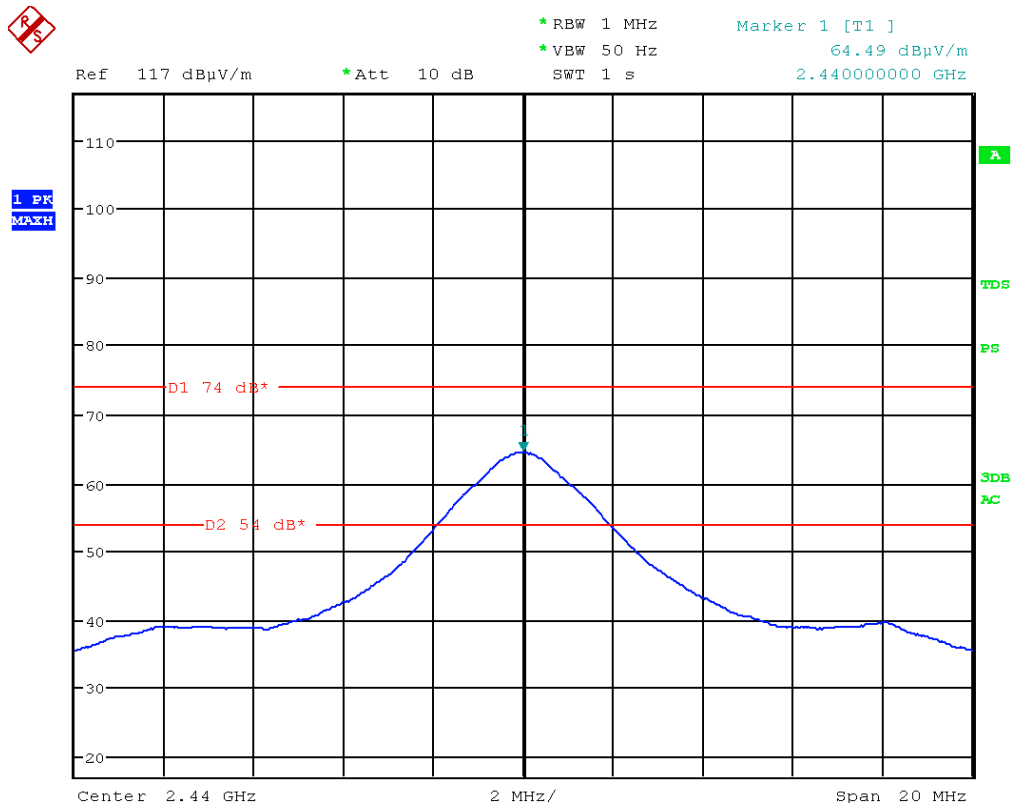
Temperature:	19°C	Humidity:	47%
Tested by:	M. Müller	Test date:	2015-01-27

Final Results:

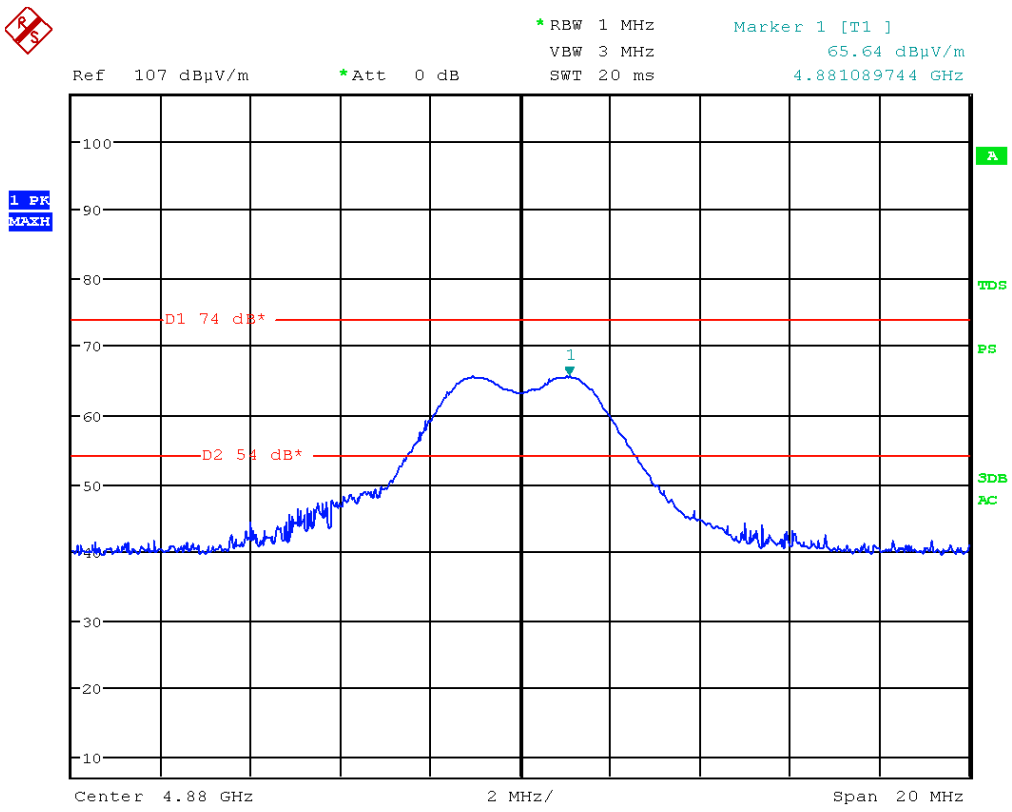
Channel18							
f[GHz]	E_{meas} [dBµV/m]	Ant	Turntable [°]	Detector	Restr. Band	Limit [dBµV/m]	Result
2.4405	101.37	H	192.1	PK	No	----	Carrier
2.4400	64.49			AV (50Hz)		----	Carrier
4.8790	65.64	H	65.2	PK	Yes	74	Pass
4.8801	42.88			AV (50Hz)		54	Pass
7.3215	52.95	H	24.0	PK	Yes	74	Pass
7.3212	36.88			AV (50Hz)		54	Pass



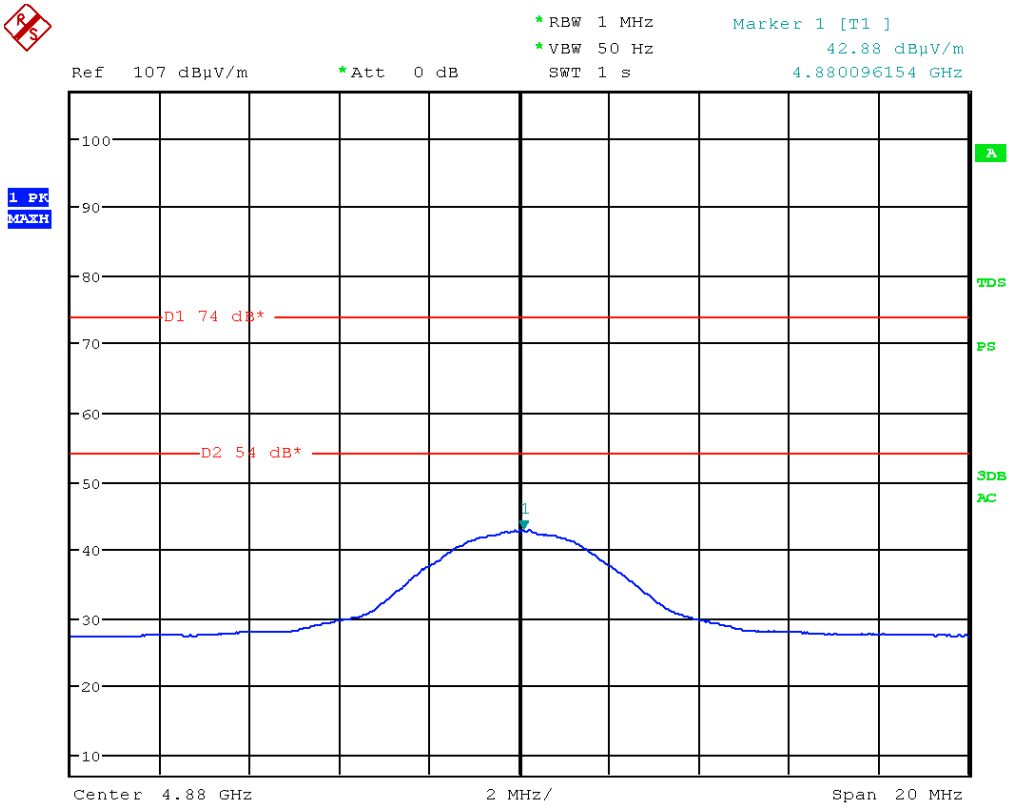
Picture 163: spurious emission ant00, ch18 - PK



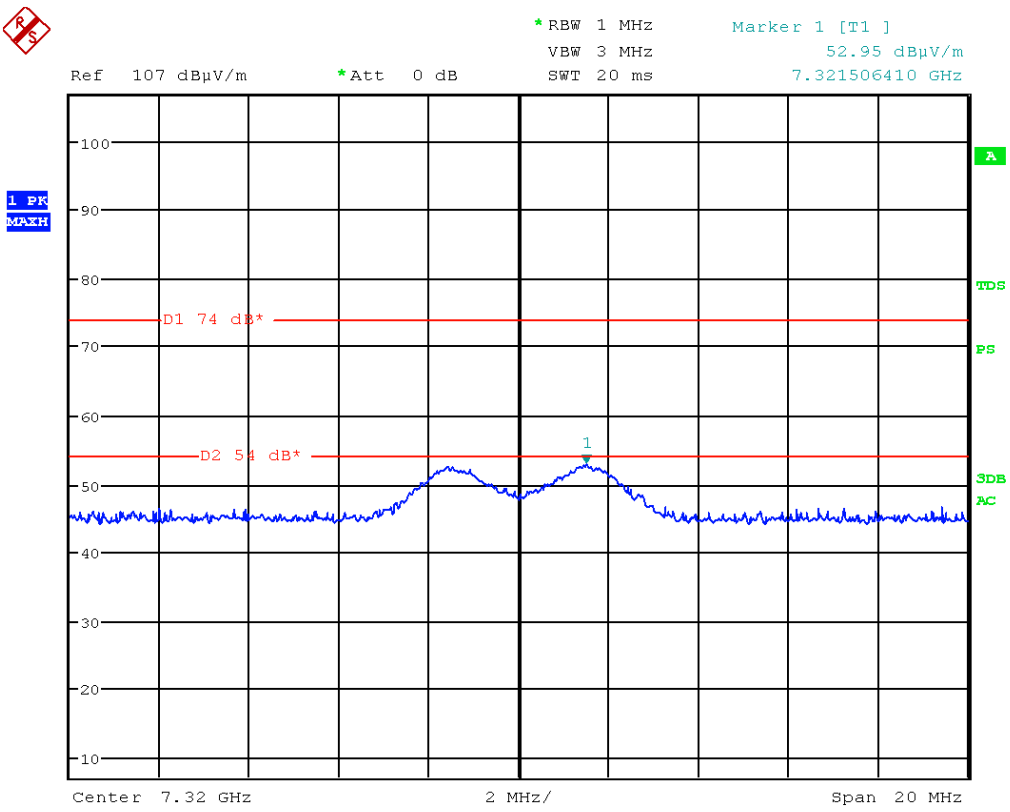
Picture 164: spurious emission ant00, ch18 - AV



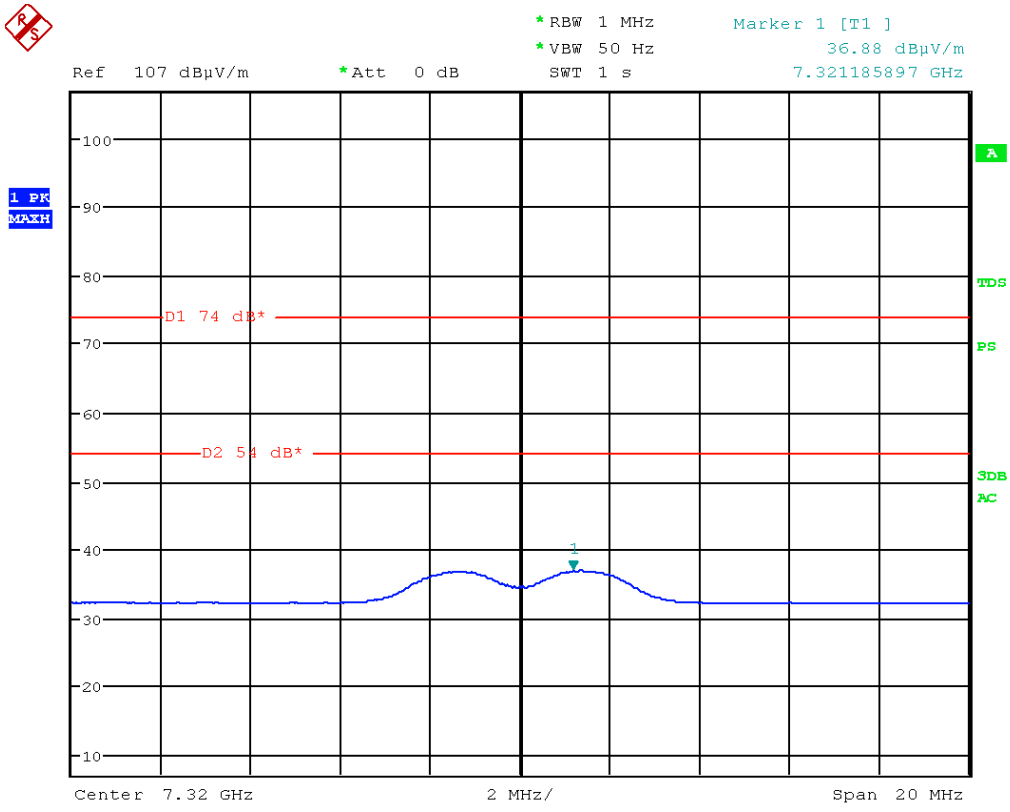
Picture 165: spurious emission ant00, ch18 - PK



Picture 166: spurious emission ant00, ch18 - AV



Picture 167: spurious emission ant00, ch18 - PK



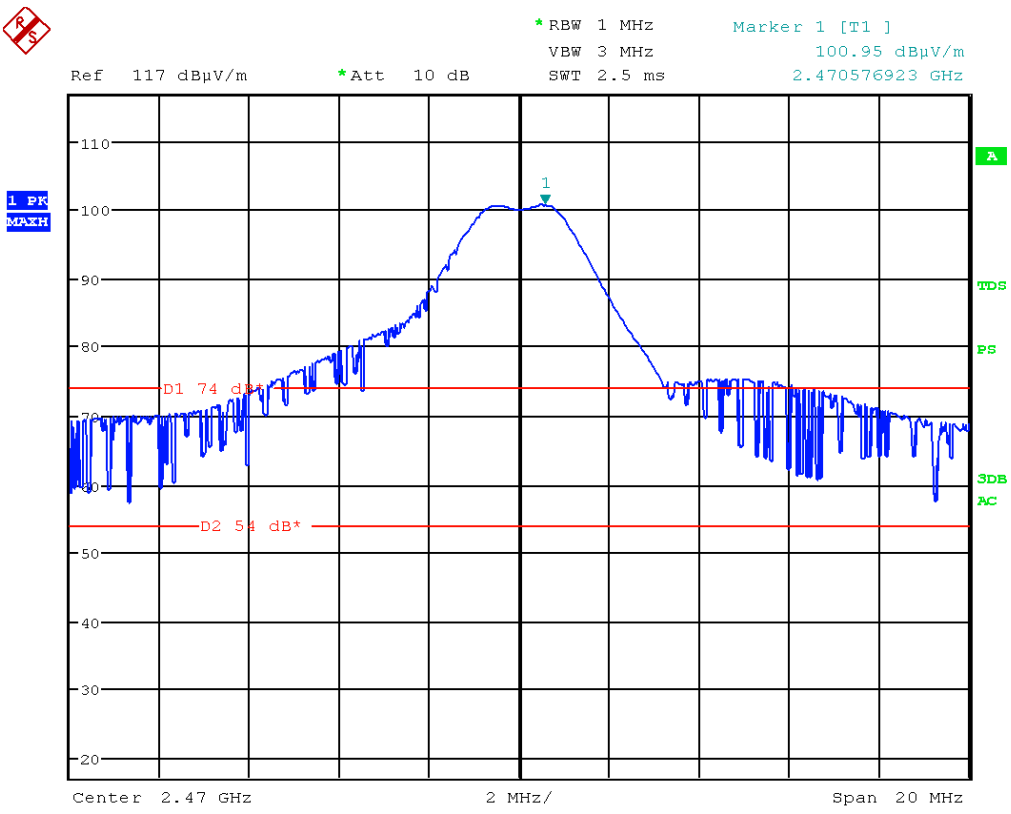
Picture 168: spurious emission ant00, ch18 - AV

12.11 Test results antenna00, channel 24

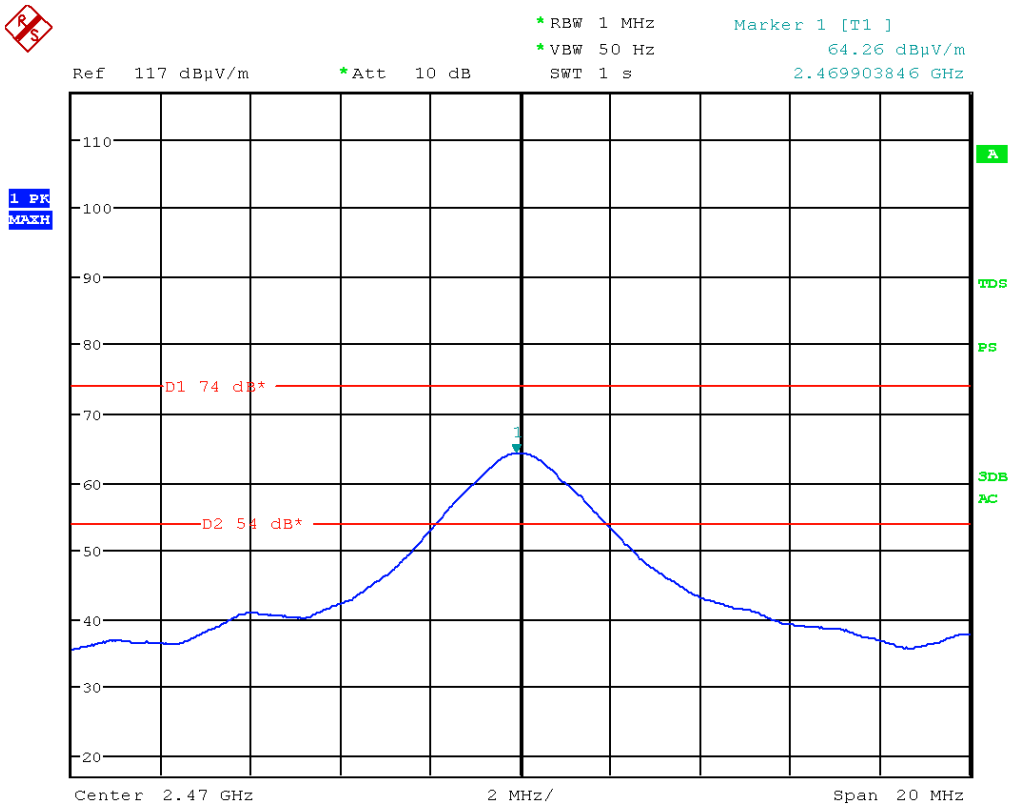
Temperature:	19°C	Humidity:	47%
Tested by:	M. Müller	Test date:	2015-01-27

Final Results:

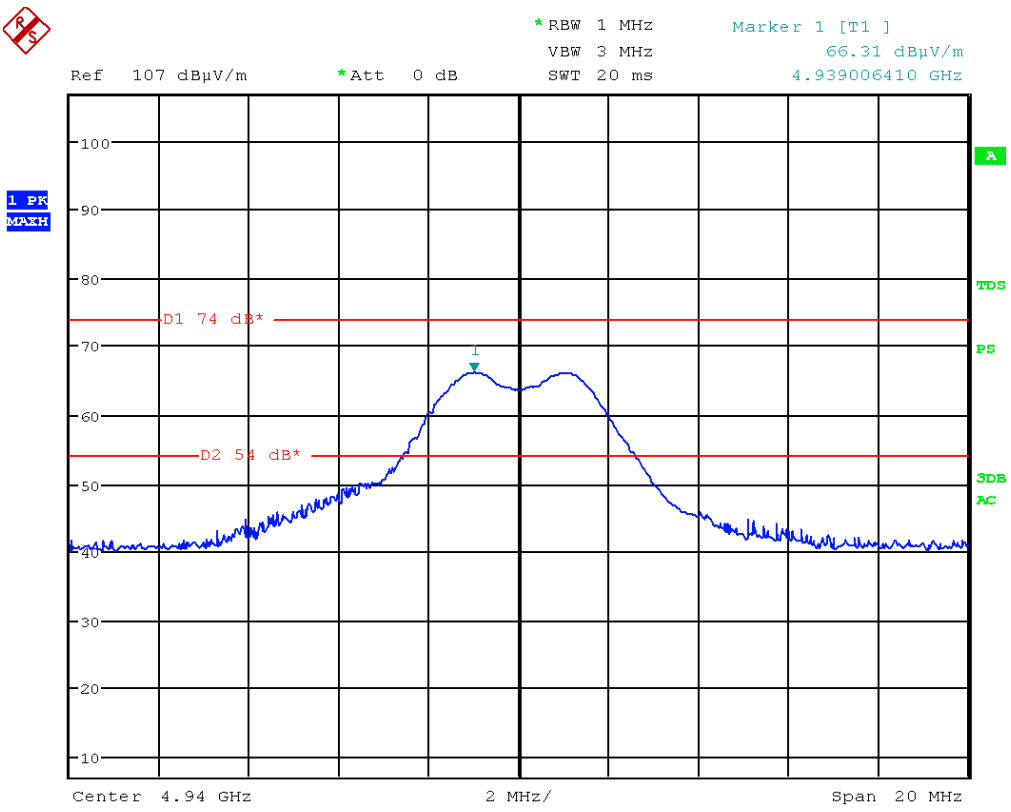
Channel24							
f[GHz]	E_{meas} [dBµV/m]	Ant	Turntable [°]	Detector	Restr. Band	Limit [dBµV/m]	Result
2.4706	100.95	H	181.4	PK	No	----	Carrier
2.4699	64.26			AV (50Hz)		----	Carrier
4.9390	66.31	H	170.1	PK	Yes	74	Pass
4.9400	43.39			AV (50Hz)		54	Pass
7.4085	49.68	H	20.1	PK	Yes	74	Pass
7.4086	34.70			AV (50Hz)		54	Pass



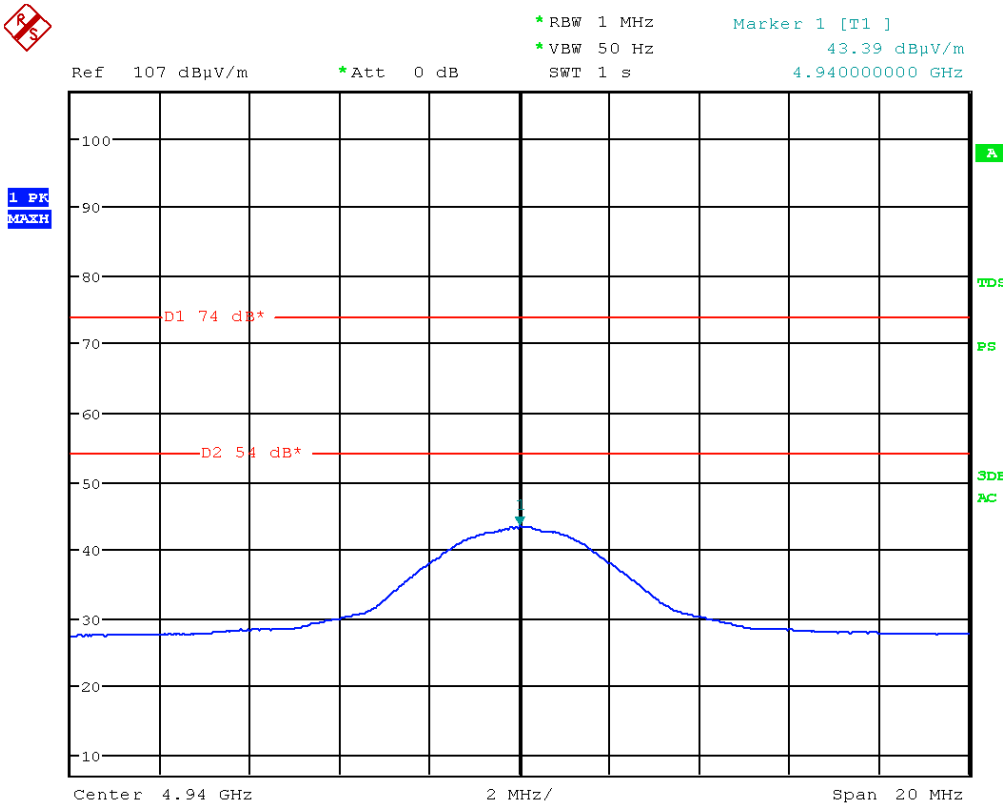
Picture 169: spurious emission ant00, ch24 - PK



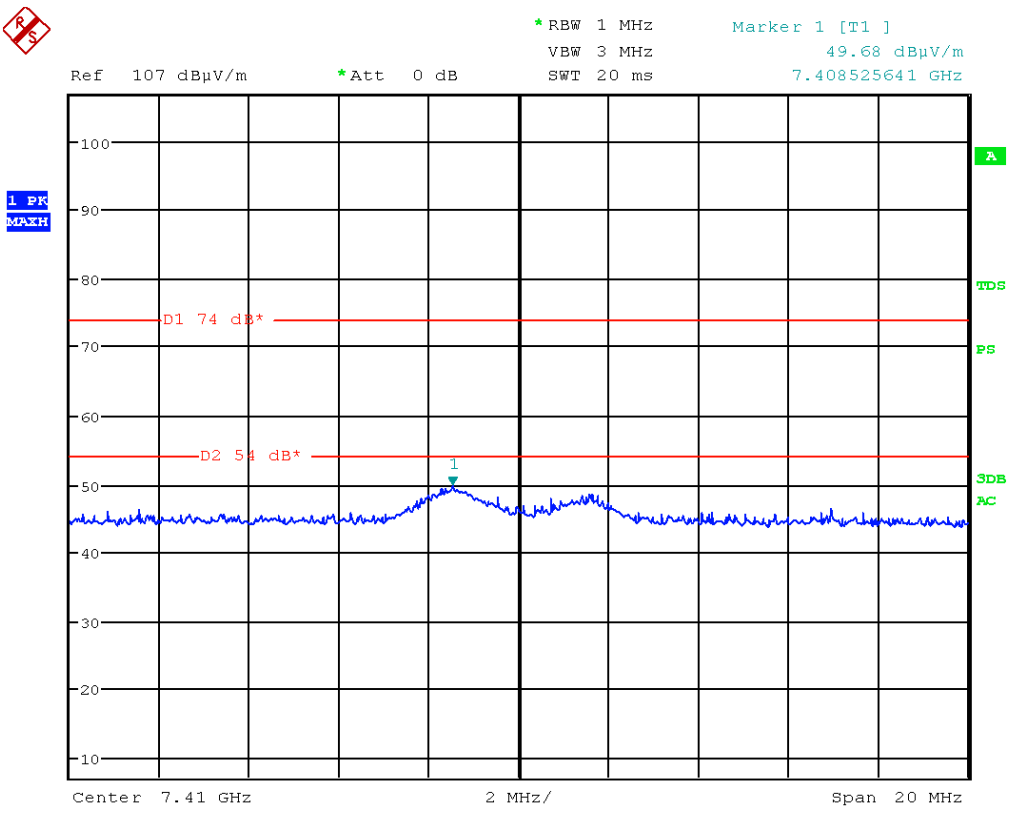
Picture 170: spurious emission ant00, ch24 - AV



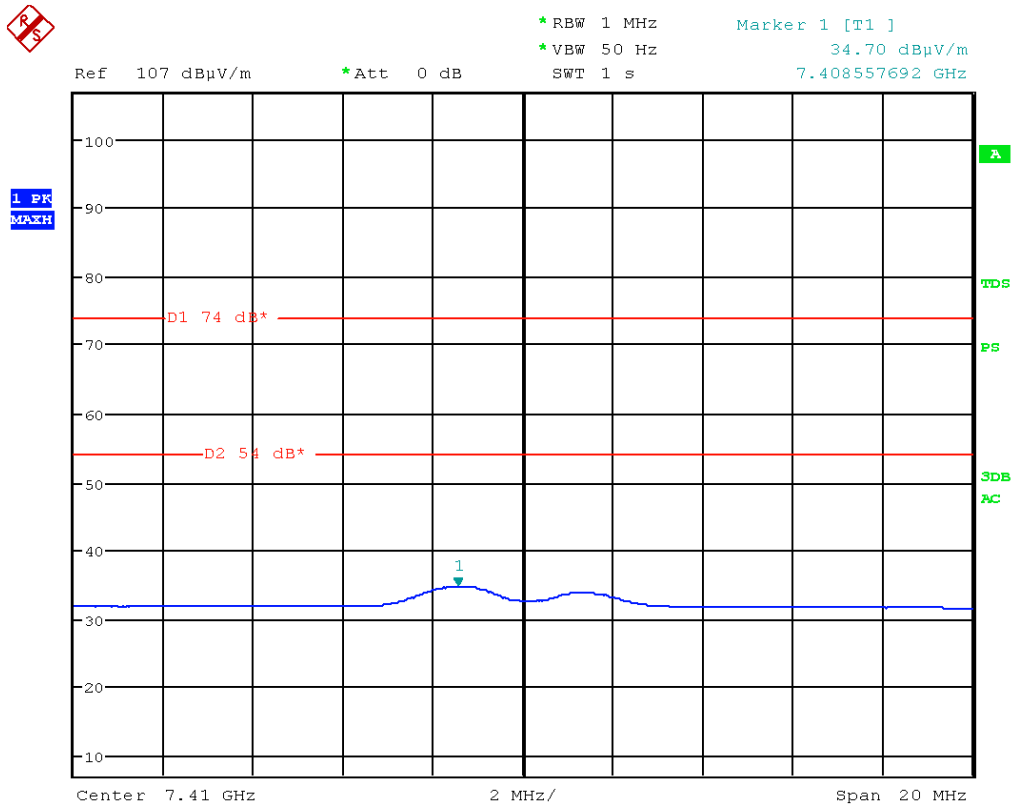
Picture 171: spurious emission ant00, ch24 - PK



Picture 172: spurious emission ant00, ch24 - AV



Picture 173: spurious emission ant00, ch24 - PK



Picture 174: spurious emission ant00, ch24 - AV

12.12 Test results antenna00, channel 26

Temperature:	19°C	Humidity:	47%
Tested by:	M. Müller	Test date:	2015-01-27

Final Results:

Channel26
- no significant emissions detected -

12.13 Test results antenna01, channel 11

Temperature:	19°C	Humidity:	47%
Tested by:	M. Müller	Test date:	2015-01-27

Final Results:

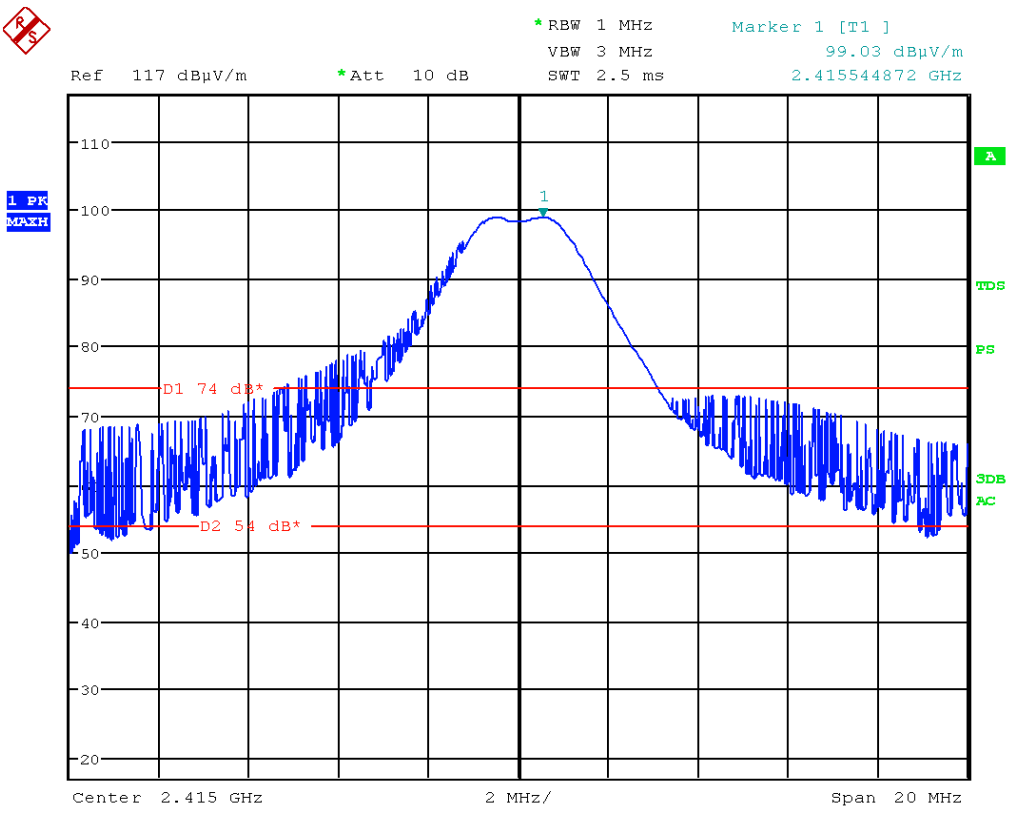
Channel11
- no significant emissions detected -

12.14 Test results antenna01, channel 13

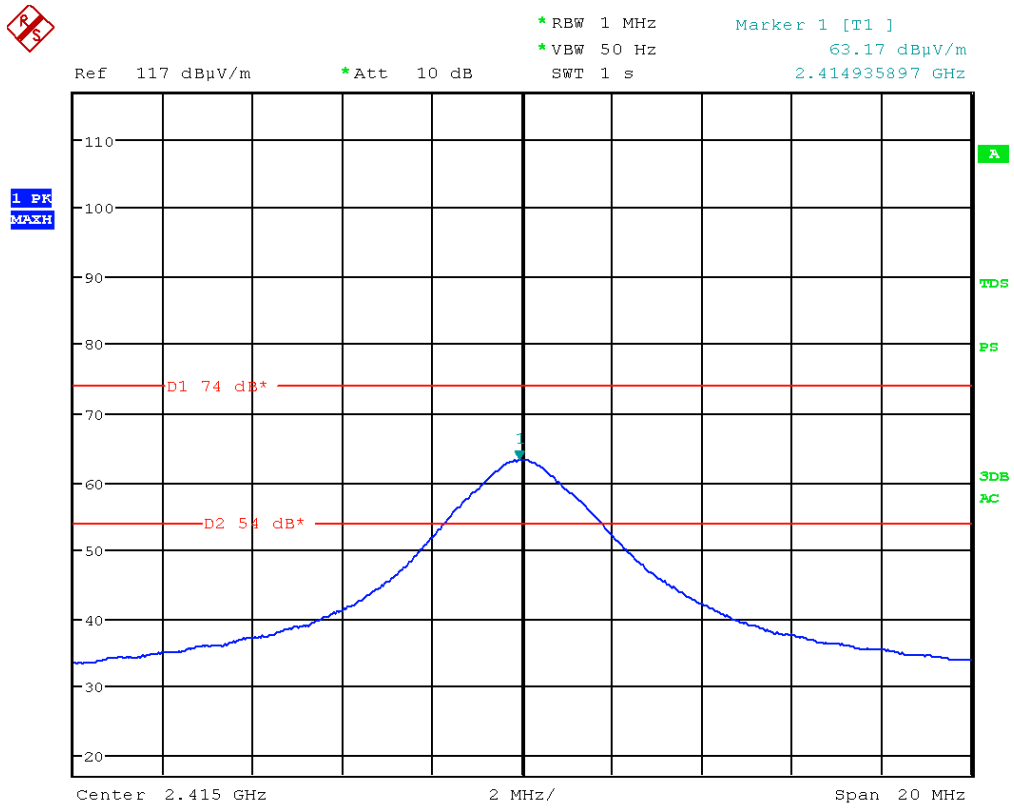
Temperature:	19°C	Humidity:	47%
Tested by:	M. Müller	Test date:	2015-01-27

Final Results:

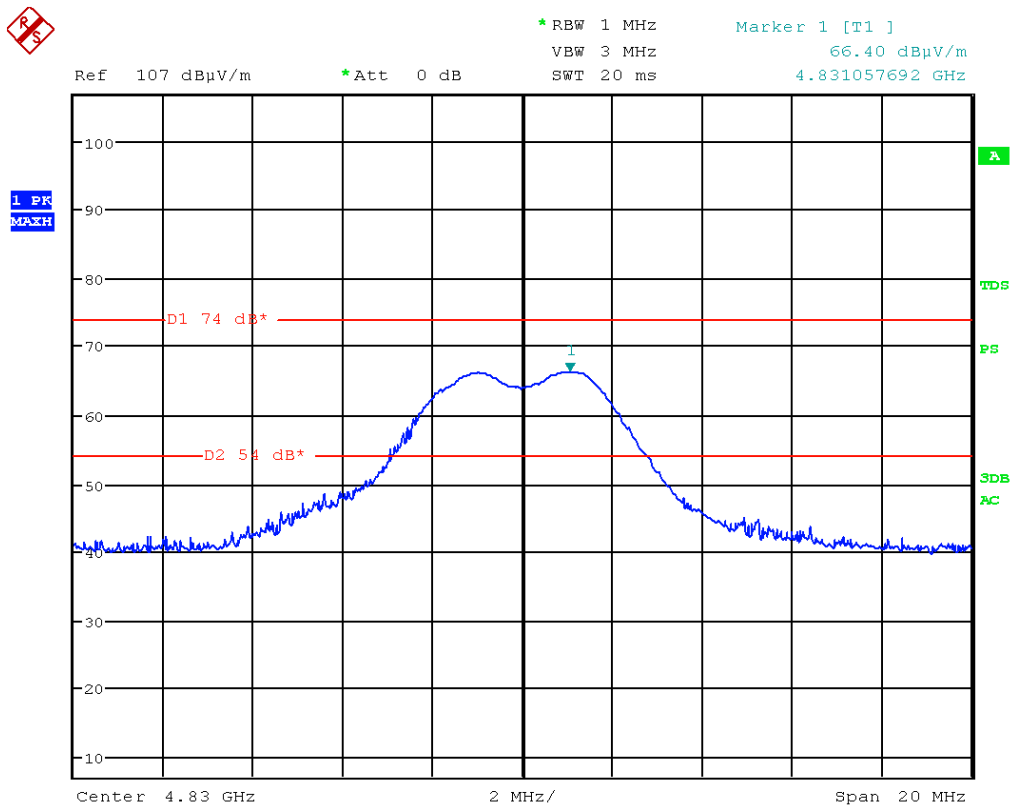
Channel13							
f[GHz]	E_{meas} [dBµV/m]	Ant	Turntable [°]	Detector	Restr. Band	Limit [dBµV/m]	Result
2.4155	99.03	H	188.9	PK	No	----	Carrier
2.4149	63.17			AV (50Hz)		----	Carrier
4.8311	66.40	H	56.2	PK	Yes	74	Pass
4.8300	43.14			AV (50Hz)		54	Pass
7.2465	56.45	H	198.9	PK	No	-20dBc	Pass
7.2462	38.67			AV (50Hz)		-20dBc	Pass



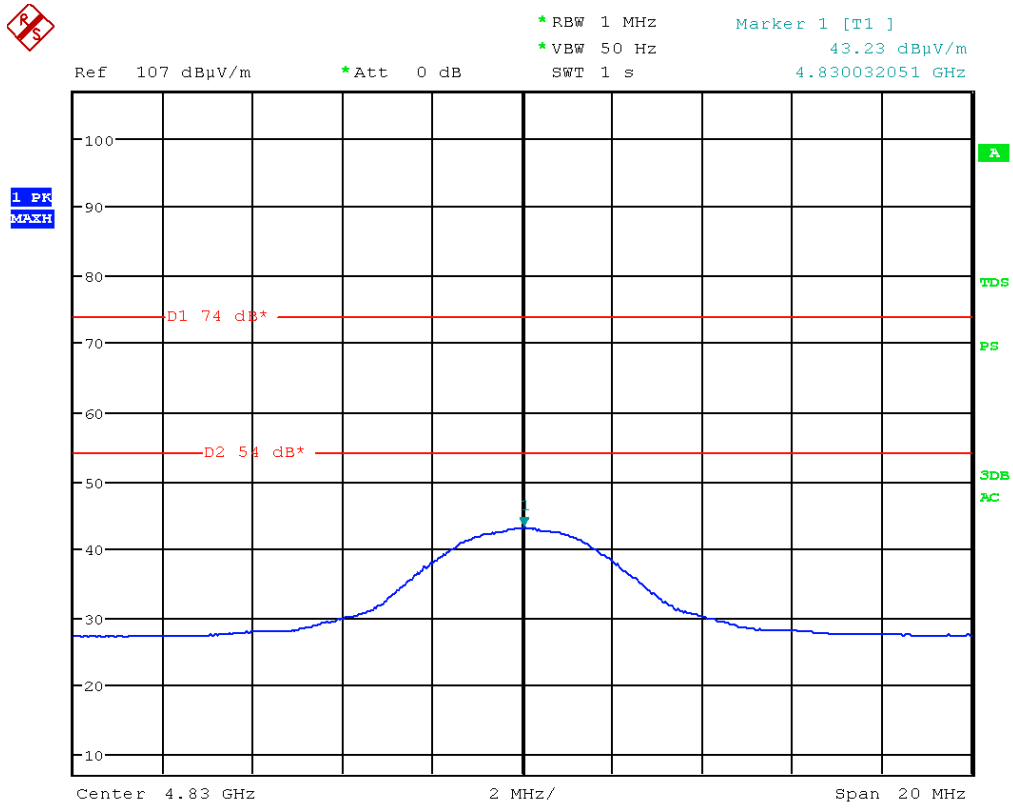
Picture 175: spurious emission ant01, ch13 - PK



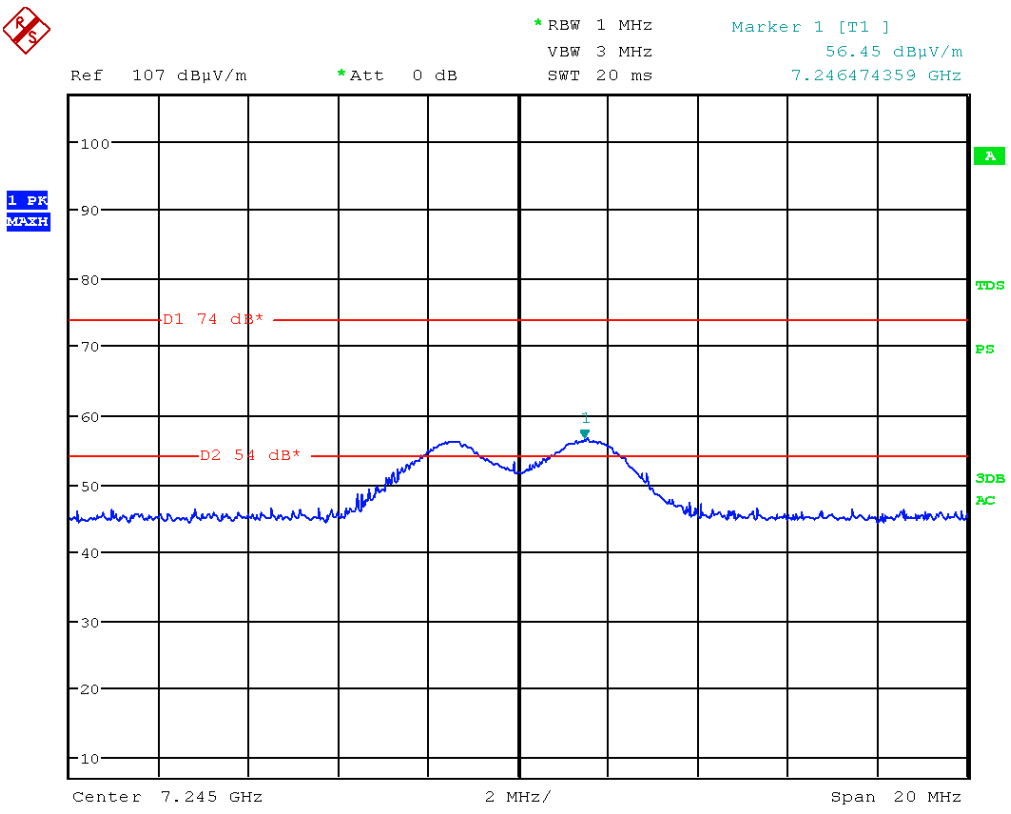
Picture 176: spurious emission ant01, ch13 - AV



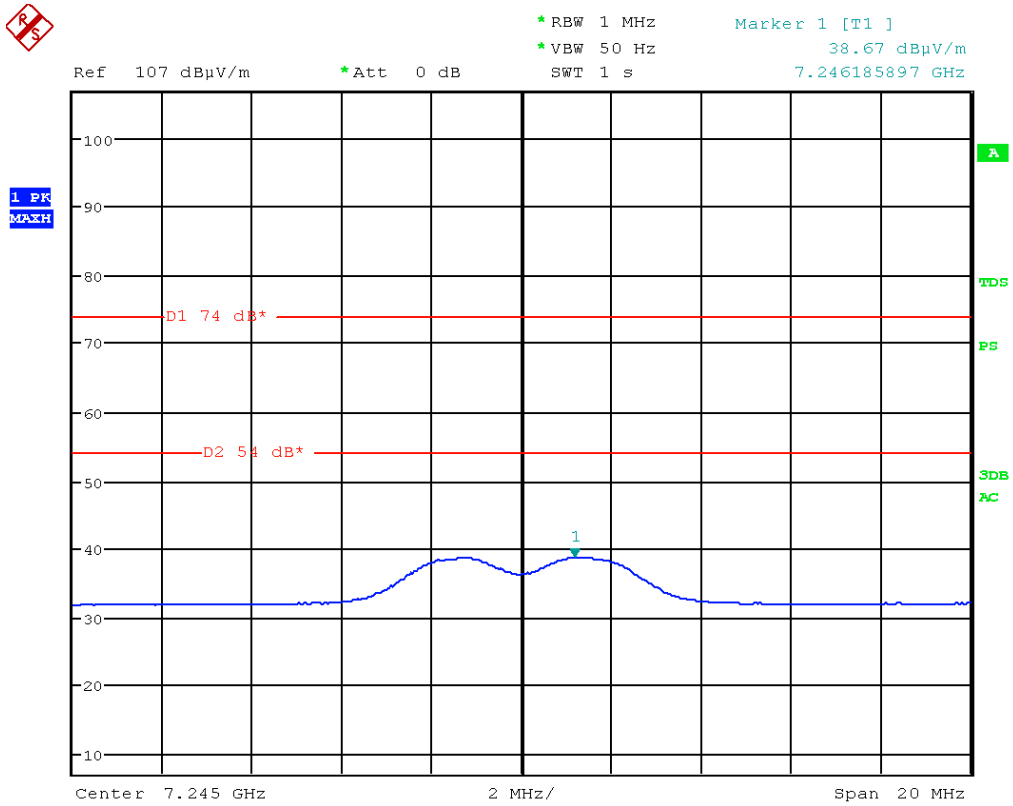
Picture 177: spurious emission ant01, ch13 - PK



Picture 178: spurious emission ant01, ch13 - AV



Picture 179: spurious emission ant01, ch13 - PK



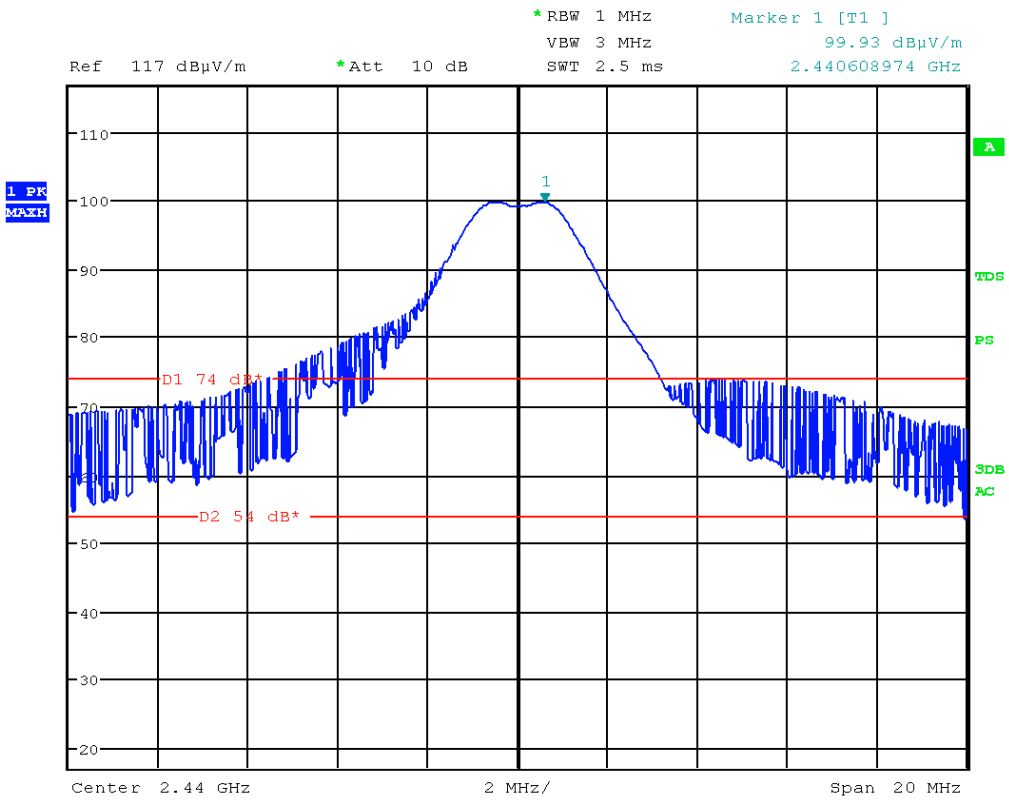
Picture 180: spurious emission ant01, ch13 - AV

12.15 Test results antenna01, channel 18

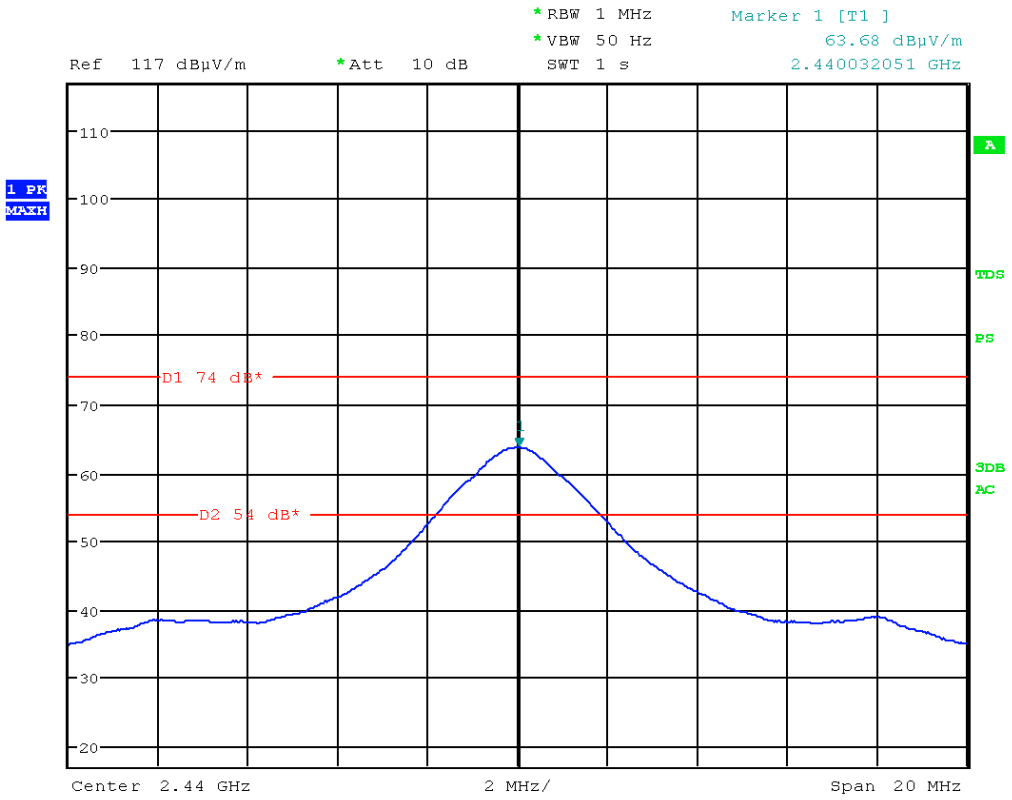
Temperature:	19°C	Humidity:	47%
Tested by:	M. Müller	Test date:	2015-01-27

Final Results:

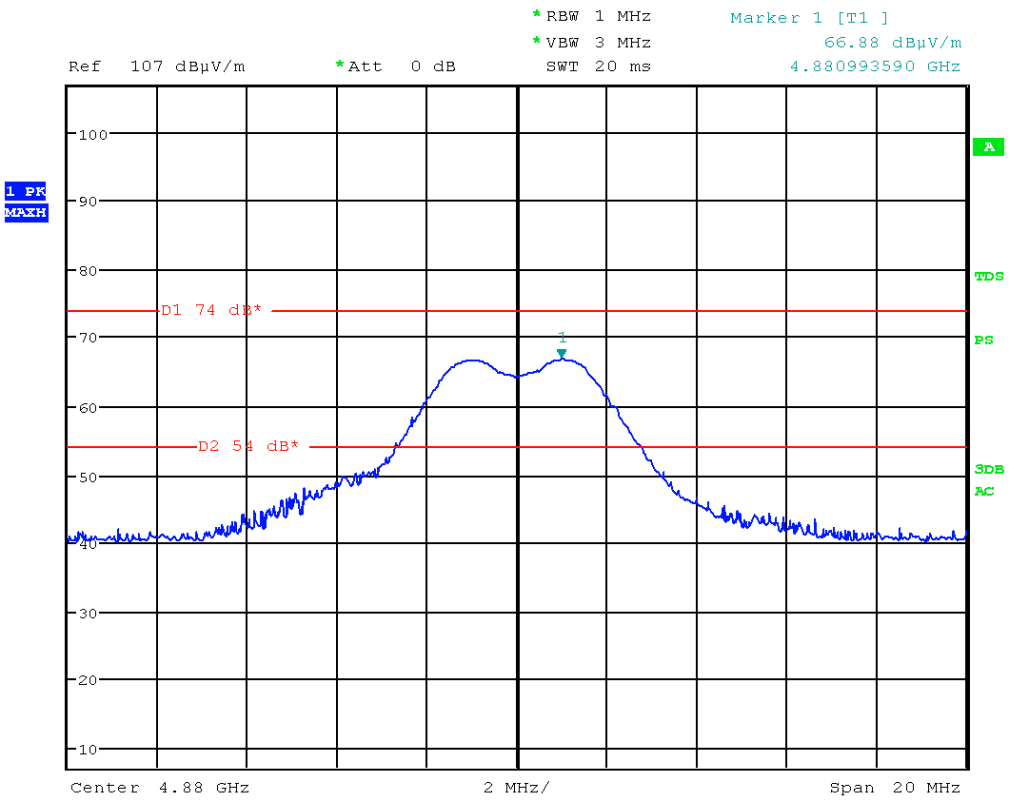
Channel18							
f[GHz]	E_{meas} [dBµV/m]	Ant	Turntable [°]	Detector	Restr. Band	Limit [dBµV/m]	Result
2.4406	99.93	H	172.9	PK	No	----	Carrier
2.4400	63.68			AV (50Hz)		----	Carrier
4.8810	66.88	H	58.1	PK	Yes	74	Pass
4.8800	43.62			AV (50Hz)		54	Pass
7.3184	52.34	H	162.6	PK	Yes	74	Pass
7.3186	36.41			AV (50Hz)		54	Pass



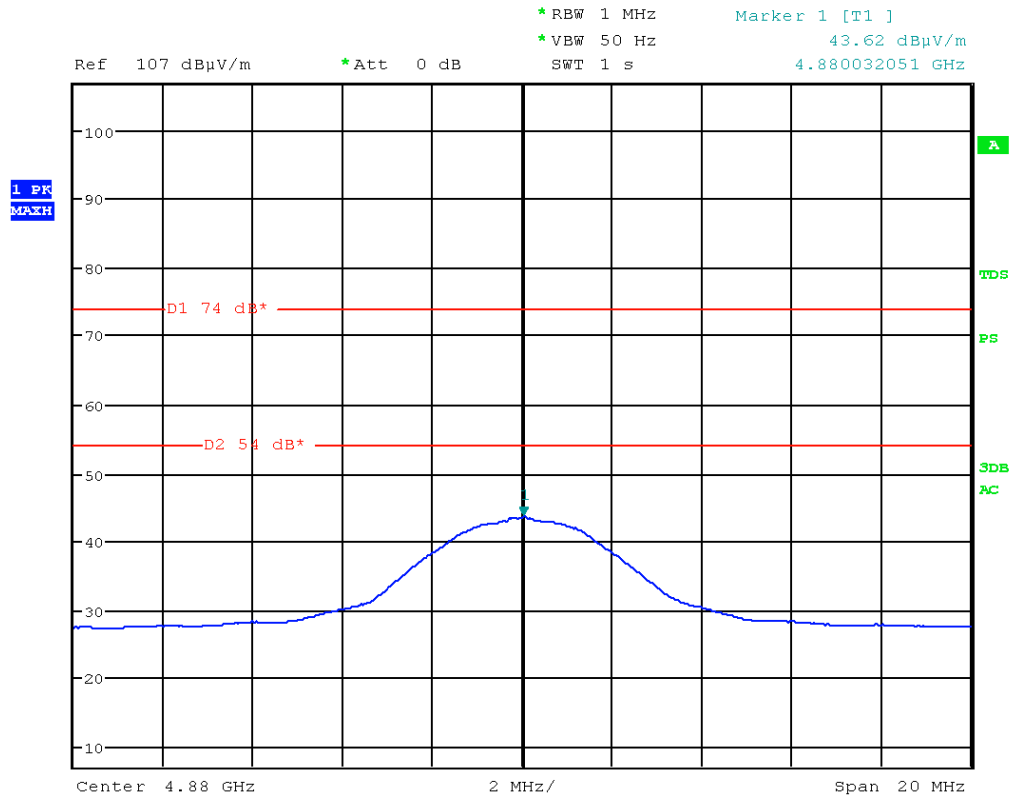
Picture 181: spurious emission ant01, ch18 - PK



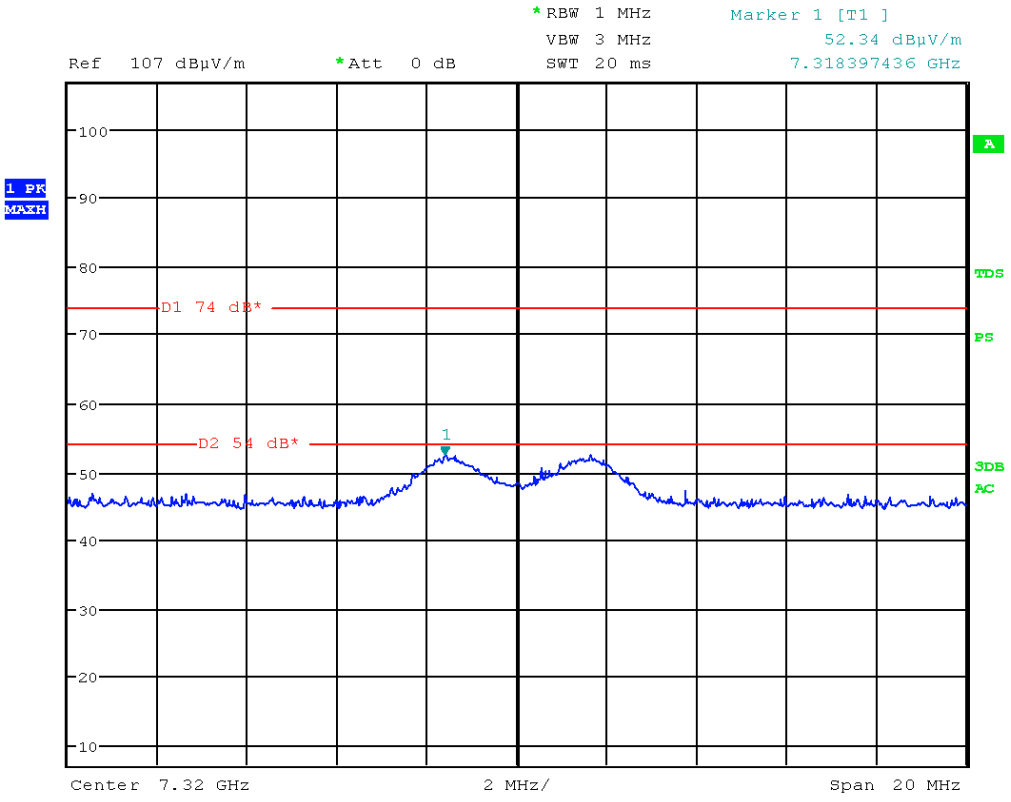
Picture 182: spurious emission ant01, ch18 - AV



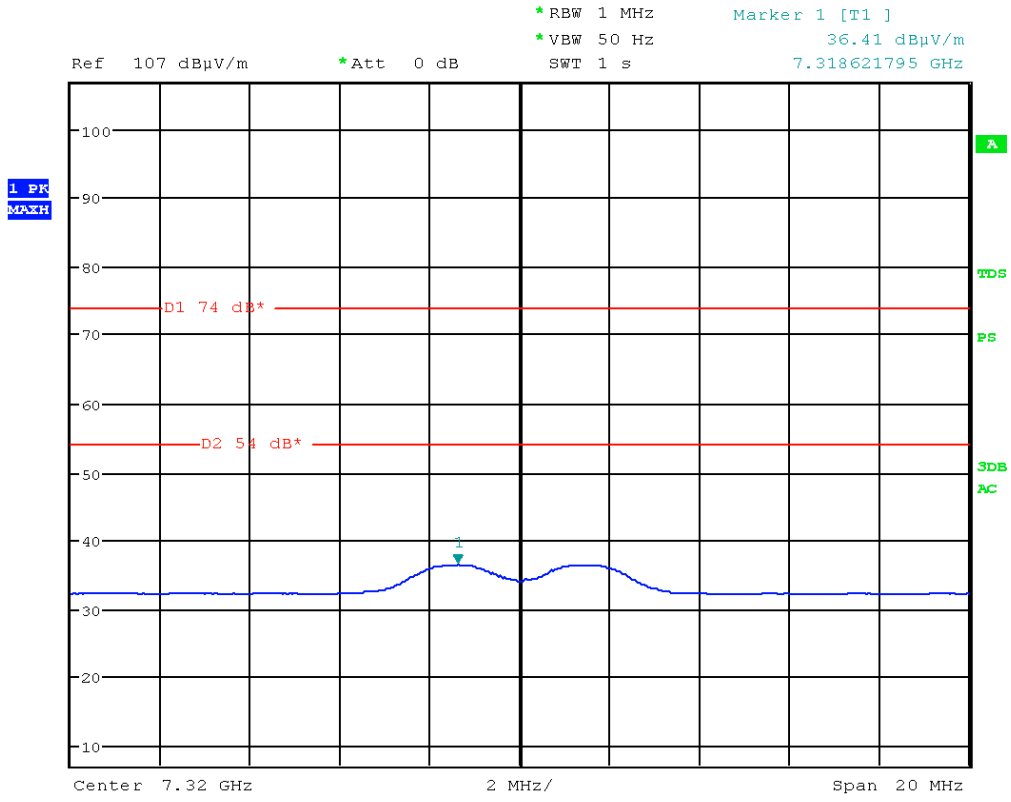
Picture 183: spurious emission ant01, ch18 - PK



Picture 184: spurious emission ant01, ch18 - AV



Picture 185: spurious emission ant01, ch18 - PK



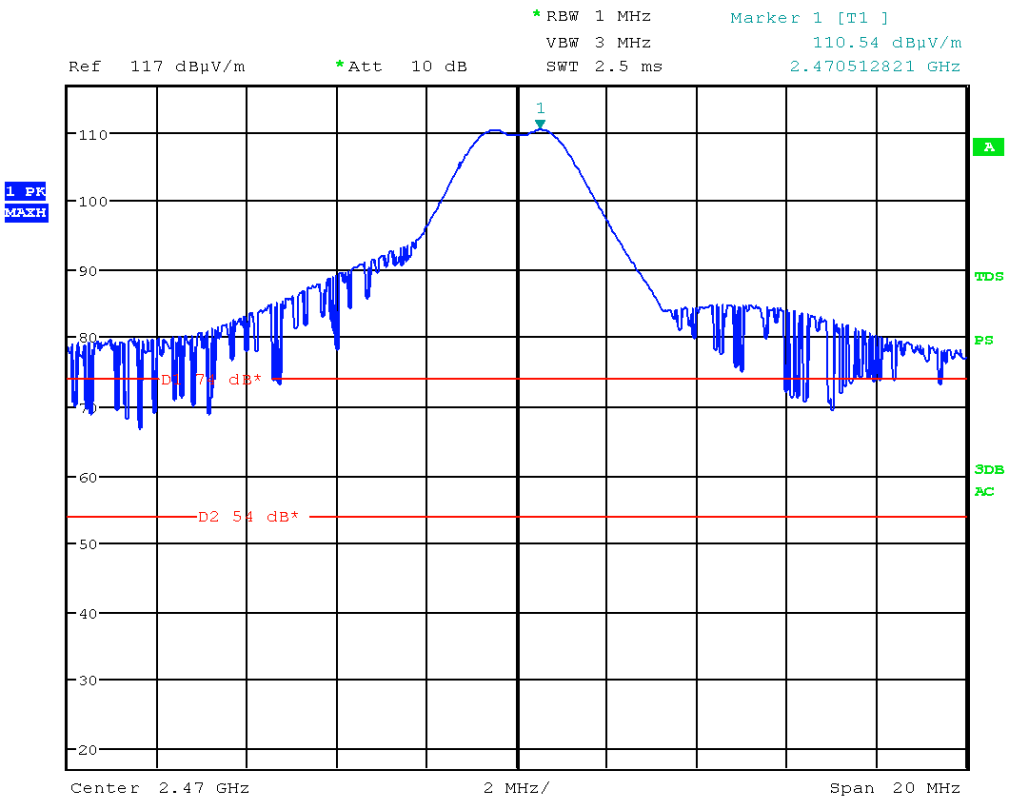
Picture 186: spurious emission ant01, ch18 - AV

12.16 Test results antenna01, channel 24

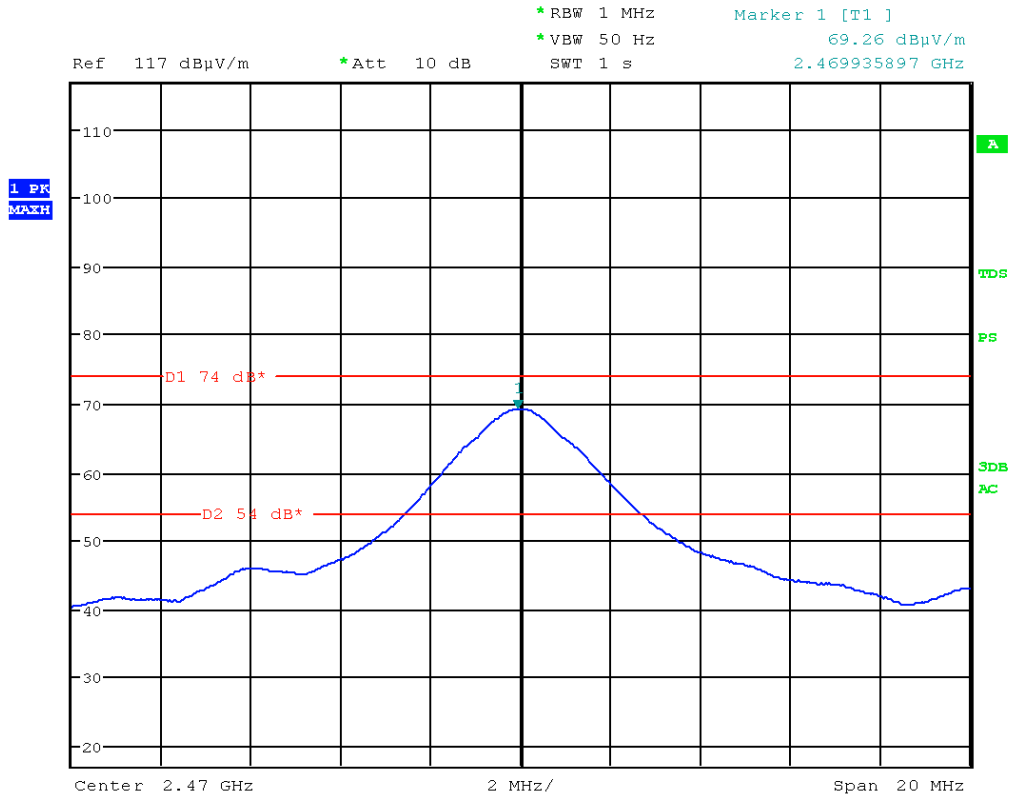
Temperature:	19°C	Humidity:	47%
Tested by:	M. Müller	Test date:	2015-01-27

Final Results:

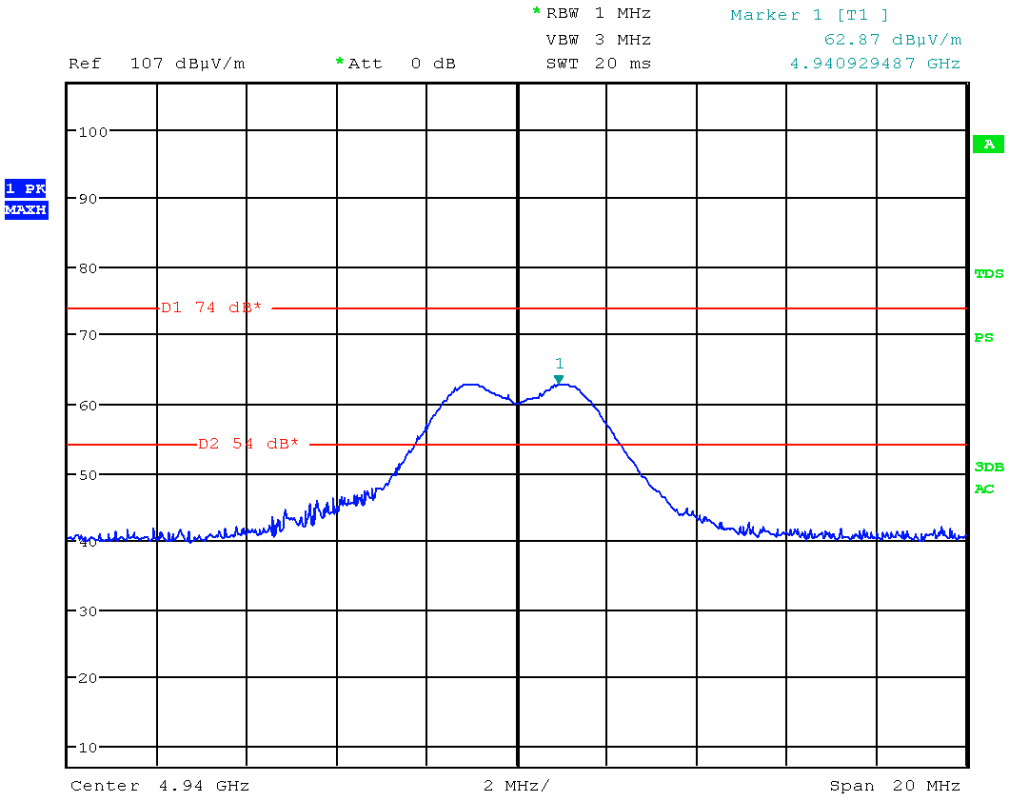
Channel24							
f[GHz]	E_{meas} [dBµV/m]	Ant	Turntable [°]	Detector	Restr. Band	Limit [dBµV/m]	Result
2.4705	110.54	V	159.9	PK	No	----	Carrier
2.4699	69.26			AV (50Hz)		----	Carrier
4.9409	62.87	V	18.7	PK	Yes	74	Pass
4.9401	41.32			AV (50Hz)		54	Pass



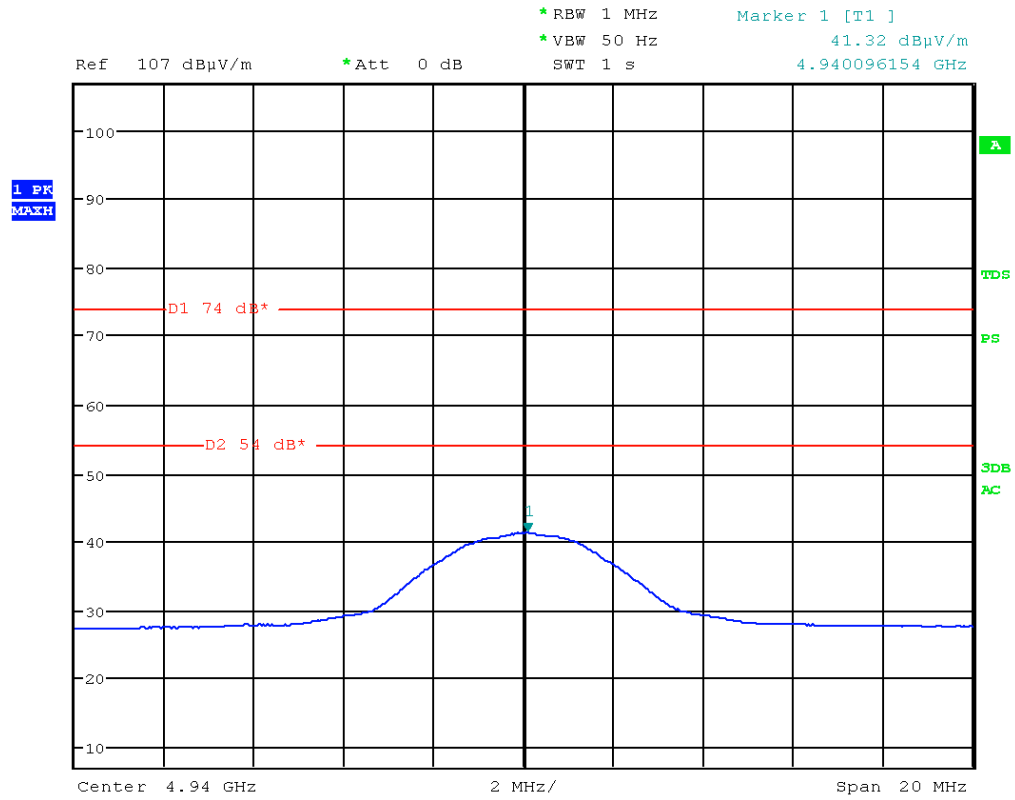
Picture 187: spurious emission ant01, ch24 - PK



Picture 188: spurious emission ant01, ch24 - AV



Picture 189: spurious emission ant01, ch24 - PK



Picture 190: spurious emission ant01, ch24 - AV

12.17 Test results antenna01, channel 26

Temperature:	19°C	Humidity:	47%
Tested by:	M. Müller	Test date:	2015-01-27

Final Results:

Channel26
- no significant emissions detected -

13 Radio frequency radiation exposure evaluation for mobile devices

according to 47 CFR Part 2, section 2.1091, OET Bulletin 65, RSS-Gen Issue 4, section 3.2, and RSS-102 Issue 4, section 2.5.2

13.1 Equipment data

Antenna detachable (see antenna specifications):	☒ yes	☐ no
Antenna gain G referring to isotropic radiator:	2.0 dBi	
	Numeric gain:	1.58
Conducted output power CP (maximum):	15.54 dBm	
	Numeric power:	35.81 mW
Separation distance between user and transmitting device:	☐ R ≤ 20 cm	☒ R > 20 cm

13.2 RF exposure evaluation calculating EIRP

The device operates at or above 1.5 GHz and the maximum equivalent isotropically radiated power (e.i.r.p.) of the device is equal to or less than 5 W: ☒ yes ☐ no

$$EIRP = G \cdot CP = 1.58 \cdot 35.81 \cdot 10^{-3} W = 0.057 W$$

13.3 RF exposure evaluation calculating power density

The device operates at or above 1.5 GHz and the maximum permissible exposure (MPE) of the device is equal to or less than the power density limit specified for general population / uncontrolled exposure of 1 mW / cm²: ☒ yes ☐ no

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

S: power density
π: pi ≈ 3.1416
R: minimum distance

$$S = \frac{1.58 \cdot 35.81\ mW}{4 * \pi * 400\ cm^2} = 0,011\ mW / cm^2$$

14 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	2016-02
Test receiver	ESCS 30	845552/0008	E00551	2014-01	2016-01
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 3: 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

15 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 4: 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 %.

16 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, April 8th, 2015

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

17 Revision History

Date	Description	Person	Revision
2015-04-08	First edition	M. Müller	- - - -