
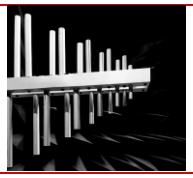
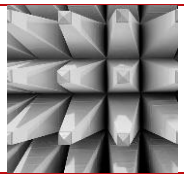

CETECOM™
CETECOM ICT Services
consulting - testing - certification

TEST REPORT

Test report no.: 1-0660/15-01-02-C

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

Testing laboratory

CETECOM ICT Services GmbH
Untertuerkheimer Strasse 6 – 10
66117 Saarbruecken / Germany
Phone: + 49 681 5 98 - 0
Fax: + 49 681 5 98 - 9075
Internet: http://www.cetecom.com
e-mail: ict@cetecom.com

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

Applicant

Verity Studios AG
Sonneggstrasse 3
8006 Zurich / Switzerland
Phone: +41 44 586 5588
Fax: +41 44 632 1139
Contact: Markus Hehn
mailto: mhehn@veritystudios.com
Phone: +41 44 632 9272

Manufacturer

Verity Studios AG
Sonnegstrasse 3
8006 Zurich / Switzerland

Test standard/s

CFR47 Part 15F	Ultra-Wideband Operation
RSS-220	Devices Using Ultra-Wideband (UWB) Technology

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

Test Item

Kind of test item:	**Custom UWB Transceiver**
Model name:	**6 Band UWB Transceiver**
FCC ID:	2AGUC-KDGXVA
IC:	20830-KDGXVA
Frequency:	3.17 GHz – 7.01 GHz (FCC) 5.97 GHz – 7.01 GHz (IC)
Technology tested:	UWB
Antenna:	Integrated antenna
Power supply:	12-24 V DC by power supply
Temperature range:	0°C to +50°C

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

Test report authorized:

M. Walla
cn=Meheza Walla, o=CETECOM ICT Services GmbH, ou=WAL-151005, email=Meheza.Walla@cetecom.com, c=DE
2016.02.10 10:14:16 +01'00'

Meheza Walla
Lab Manager
Radio Communications & EMC

Test performed:

B. Gerber
Benedikt Gerber
cn=Benedikt Gerber, o=CETECOM ICT Services GmbH, ou=Radio Communications & EMC, email=benedikt.gerber@cetecom.com, c=DE
2016.02.09 15:45:42 +01'00'

Benedikt Gerber
Testing Manager
Radio Communications & EMC

1 Table of contents

2 General information

2.1 Notes and disclaimer

The test results of this test report relate exclusively to the test item specified in this test report. CETECOM ICT Services GmbH does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.
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This test report is electronically signed and valid without handwritten signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

This test report replaces the test report with the number 1-0660/15-01-02-B and dated 2016-02-04.

2.2 Application details

Date of receipt of order:	2015-10-30
Date of receipt of test item:	2015-11-11
Start of test:	2015-11-11
End of test:	2016-02-04
Person(s) present during the test:	Markus Hehn Piotr Roszak

3 Test standard/s

Test standard	Date	Test standard description
CFR47 Part 15F	2012/10	Ultra-Wideband Operation
RSS-220	2009/03	Devices Using Ultra-Wideband (UWB) Technology

4 Test environment

Temperature	:	T_{nom} T_{max} T_{min}	+22 °C during room temperature tests -/- °C during high temperature tests -/- °C during low temperature tests
Relative humidity content	:		55 %
Barometric pressure	:		not relevant for this kind of testing
Power supply	:	V_{nom} V_{max} V_{min}	24 V DC by power supply -/- V -/- V

5 Test item

5.1 General description

Kind of test item	:	Custom UWB Transceiver
Type identification	:	6 Band UWB Transceiver
HMN	:	-/-
PMN	:	Kedge XV
HVIN	:	Kedge XV
FVIN	:	-/-
S/N serial number	:	PROTO1, PROTO2, PROTO3, PROTO4
HW hardware status	:	Rev. 1
SW software status	:	V0.5C
Frequency band	:	3.17 GHz to 7.01 GHz for FCC Part 15F 5.97 GHz to 7.01 GHz for RSS-220
Type of radio transmission Use of frequency spectrum	: :	UWB
Type of modulation	:	BPSK/BPM
Number of channels	:	6 channels tested (only two channels applicable for RSS-220, see also 5.2)
Antenna	:	Integrated antenna
Power supply	:	12-24 V DC by power supply
Temperature range	:	0°C to +50°C

5.2 Operating conditions

Condition	Channel no.	Nominal center frequency [MHz]	approx. Nominal bandwidth [MHz]	Pulse Repetition Frequency [MHz]	Transmitter gain in final measurements [dB]	Pulse Generator Delay in final measurements [register value]
1	1	3494,4	500	16	23,0	0xB5
2	1	3494,4	500	64	16,0	0xB5
3	2	3993,6	500	16	19,5	0xC0
4	2	3993,6	500	64	13,5	0xC0
5	3	4492,8	500	16	15,0	0xC5
6	3	4492,8	500	64	9,0	0xC5
7	4	3993,6	1300	16	24,0	0x95
8	4	3993,6	1300	64	19,0	0x95
9*	5	6489,6	500	16	20,0	0xB4
10*	5	6489,6	500	64	15,0	0xB4
11*	7	6489,6	1000	16	18,5	0x93
12*	7	6489,6	1000	64	11,5	0x93

For each Channel, two data rates are available (110kBps, 850kBps)

* only operating conditions 9-12 are applicable for RSS220 other operating conditions **do not** fulfill the requirements of RSS220 (5.2.1) (indoor UWB Device)

5.3 Additional information

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

Test setup- and EUT-photos are included in test report: 1-0660/15-01-02_AnnexE
1-0660/15-01-02_AnnexF

6 Test laboratories sub-contracted

None

7 Description of the test setup

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

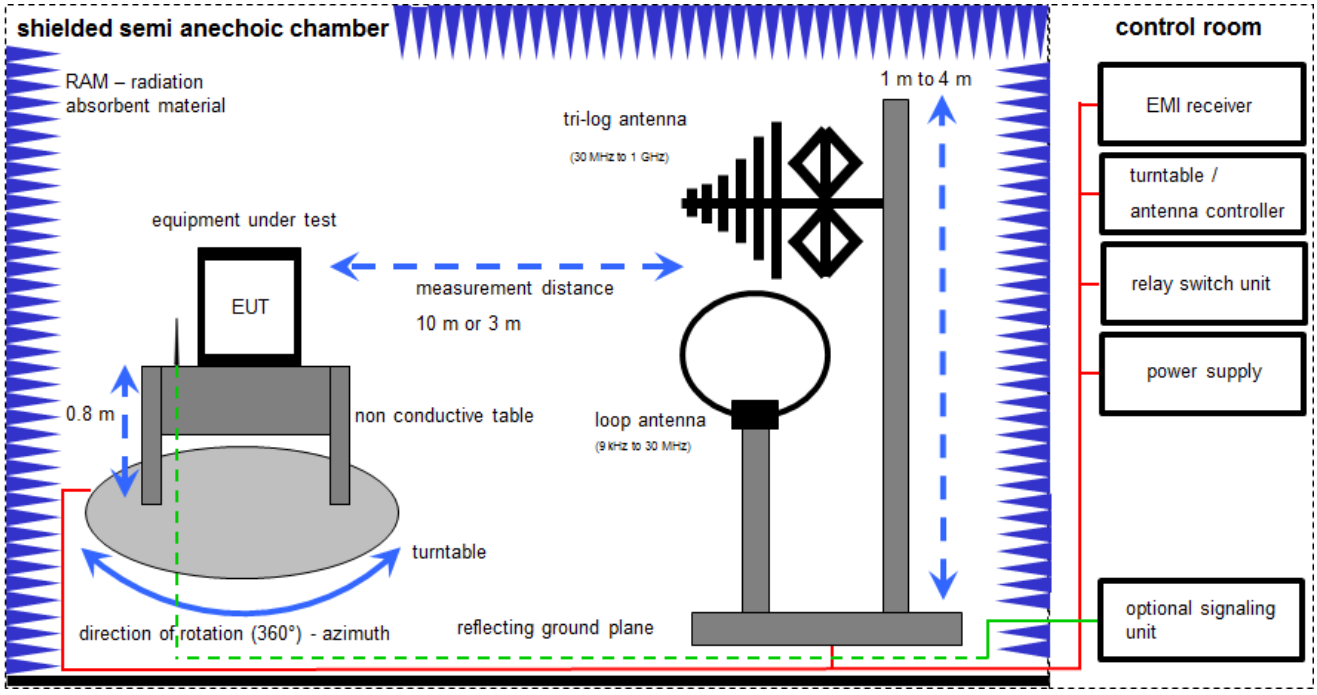
In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

Agenda: Kind of Calibration

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

7.1 Shielded semi anechoic chamber

The radiated measurements are performed in vertical and horizontal plane in the frequency range from 9 kHz to 1 GHz in semi-anechoic chambers. The EUT is positioned on a non-conductive support with a height of 0.80 m above a conductive ground plane that covers the whole chamber. The receiving antennas are confirmed with specifications ANSI C63.10-2013, American National Standard for Testing Unlicensed Wireless Devices. These antennas can be moved over the height range between 1.0 m and 4.0 m in order to search for maximum field strength emitted from EUT. The measurement distances between EUT and receiving antennas are indicated in the test setups for the various frequency ranges. For each measurement, the EUT is rotated in all three axes until the maximum field strength is received. The wanted and unwanted emissions are received by spectrum analyzers where the detector modes and resolution bandwidths over various frequency ranges are set according to requirement ANSI C63.



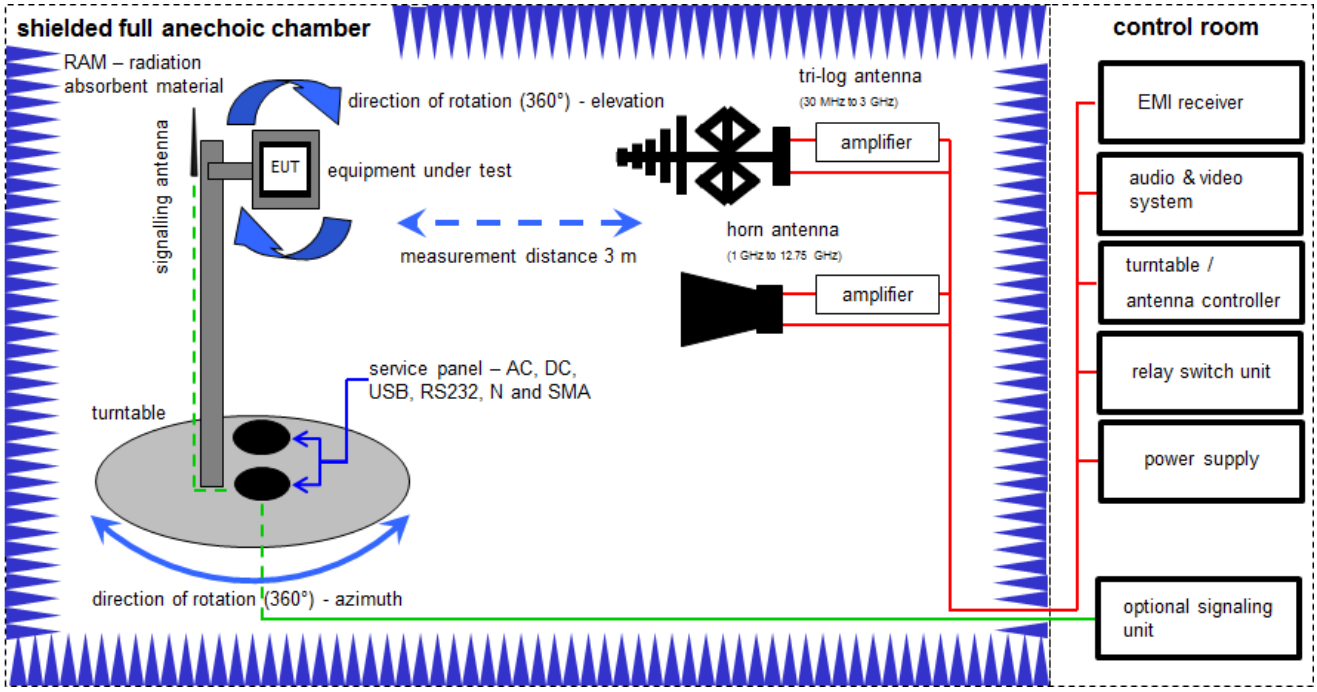
FS = UR + CL + AF
(FS-field strength; UR-voltage at the receiver; CL-loss of the cable; AF-antenna factor)

Example calculation:
FS [dBµV/m] = 12.35 [dBµV/m] + 1.90 [dB] + 16.80 [dB/m] = 31.05 [dBµV/m] (35.69 µV/m)

Equipment table:

No.		Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	1	45	Switch-Unit	3488A	HP	2719A14505	300000368	ev		
2	2	50	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP	2920A04466	300000580	ne		
3	3	n. a.	software	SPS_PHE 1.4f	Spitzenberger & Spiess	B5981; 5D1081;B5979	300000210	ne		
4	4	n. a.	EMI Test Receiver	ESCI 3	R&S	100083	300003312	k	26.01.2015	26.01.2016
5	5	n. a.	Analyzer-Reference-System (Harmonics and Flicker)	ARS 16/1	SPS	A3509 07/0 0205	300003314	Ve	11.02.2014	11.02.2016
6	6	n. a.	Amplifier	JS42-00502650-28-5A	MITEQ	1084532	300003379	ev		
7	7	n. a.	Antenna Tower	Model 2175	ETS-Lindgren	64762	300003745	izw		
8	8	n. a.	Positioning Controller	Model 2090	ETS-Lindgren	64672	300003746	izw		
9	9	n. a.	Turntable Interface-Box	Model 105637	ETS-Lindgren	44583	300003747	izw		
10	10	n. a.	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	295	300003787	k	22.04.2014	22.04.2016
11	11	n. a.	Spectrum-Analyzer	FSU26	R&S	200809	300003874	k	26.01.2015	26.01.2016

7.2 Shielded fully anechoic chamber



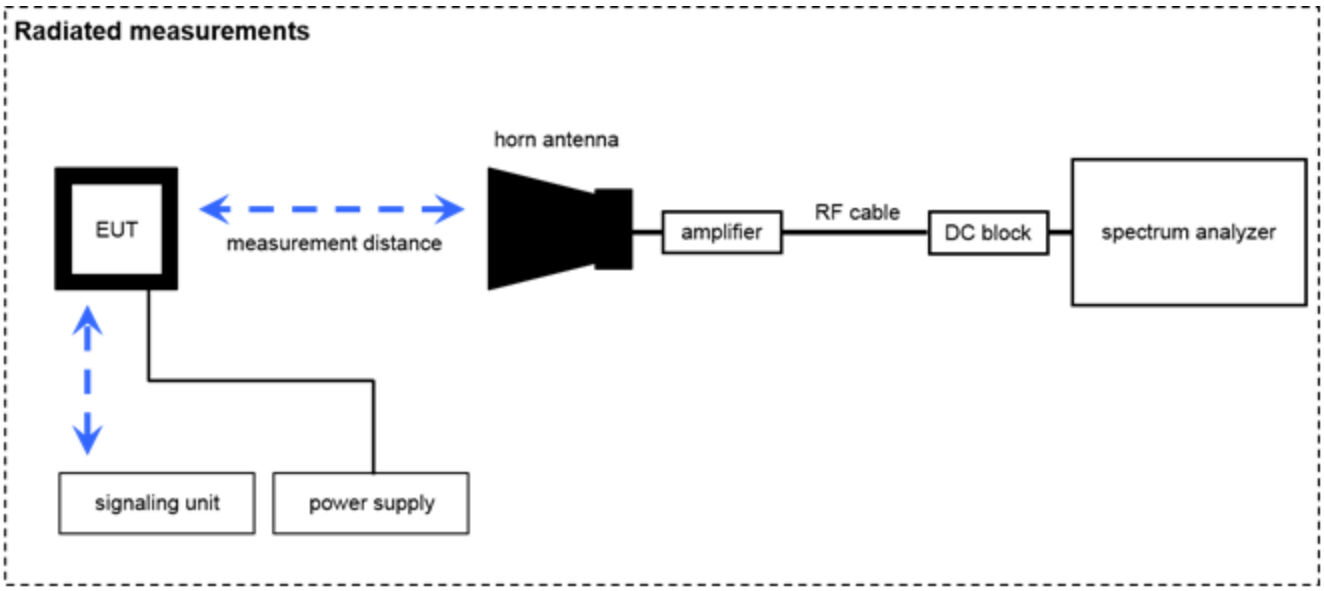
OP = AV + D - G + CA
(OP-radiated output power; AV-analyzer value; D-free field attenuation of measurement distance; G-antenna gain+amplifier gain; CA-loss signal path)

Example calculation:
OP [dBm] = -65.0 [dBm] + 50 [dB] - 20 [dBi] + 5 [dB] = -30 [dBm] (1 µW)

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	n. a.	Ultra Stable Notch Filter	WRCD1887.82/1889 .55-5EE	Wainwright	1	300000115	ne		
2	n. a.	EMI Test Receiver 20Hz- 26,5GHz	ESU26	R&S	100037	300003555	k	22.01.2015	22.01.2016
3	n. a.	Tunable Band Reject (FDD I)	WRCT1850/2170-5/40-10EEK	Wainwright	7	300003386	ne		
4	n. a.	Highpass Filter	WHKX7.0/18G-8SS	Wainwright	18	300003789	ne		
5	n. a.	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	318	300003696	k	22.04.2014	22.04.2017
6	n. a.	Spectrum-Analyzer	FSU26	R&S	200809	300003874	k	26.01.2015	26.01.2016
7	n. a.	Broadband Amplifier 0.5-18 GHz	CBLU5184540	CERNEX	22050	300004482	ev		
8	n. a.	Broadband Amplifier 5-13 GHz	CBLU5135235	CERNEX	22011	300004492	ev		
9	n. a.	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000032	300004510	ne		
10	n. a.	Messrechner und Monitor	Intel Core i3 3220/3,3 GHz, Prozessor	Agilent Technologies	2V2403033A54 21	300004591	ne		
11	n. a.	NEXIO EMV-Software	BAT EMC	EMCO	2V2403033A54 21	300004682	ne		

7.3 Radiated measurements > 12.75 GHz



FS = UR + CA + AF
(FS-field strength; UR-voltage at the receiver; CA-loss signal path & distance correction; AF-antenna factor)

Example calculation:
FS [dBµV/m] = 40.0 [dBµV/m] + (-60.1) [dB] + 36.74 [dB/m] = 16.64 [dBµV/m] (6.79 µV/m)

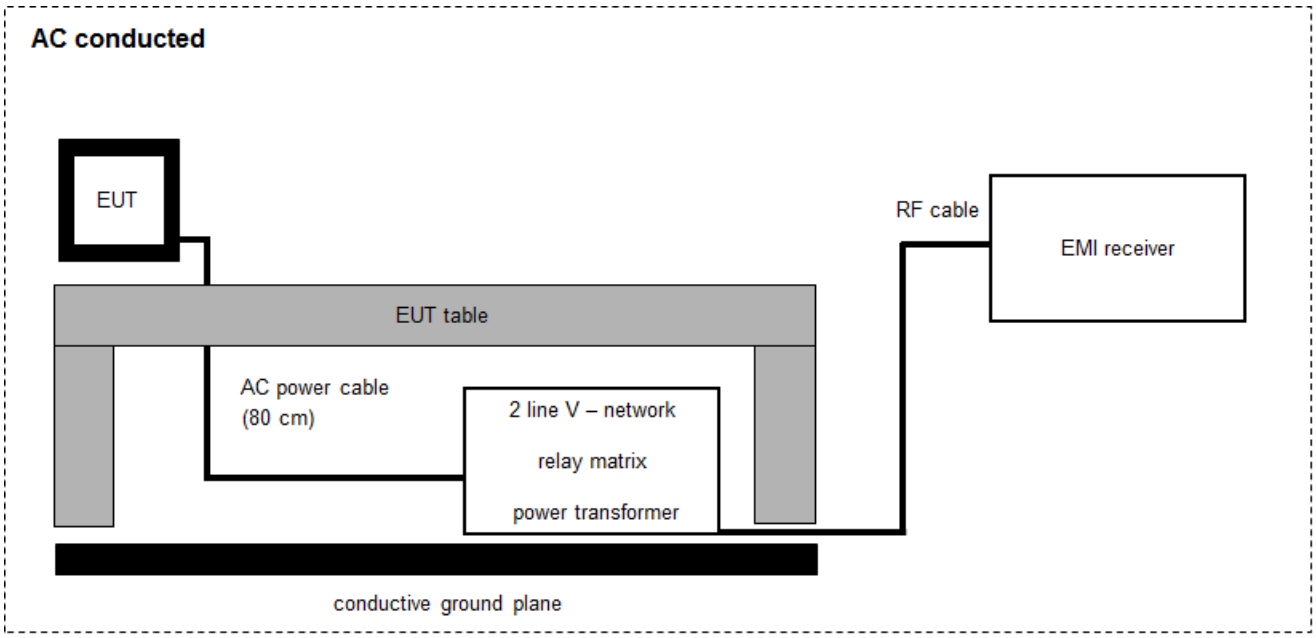
OP = AV + D - G + CA
(OP-radiated output power; AV-analyzer value; D-free field attenuation of measurement distance;
G-antenna gain+amplifier gain; CA-loss signal path)

Example calculation:
OP [dBm] = -59.0 [dBm] + 44.0 [dB] - 20.0 [dBi] + 5.0 [dB] = -30 [dBm] (1 µW)

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	CR 79	Std. Gain Horn Antenna 26.5-40.0 GHz	V637	Narda	7911	300001751	ne		
2	11b	Microwave System Amplifier, 0.5-26.5 GHz	83017A	HP	00419	300002268	ev		
3		Microwave System Amplifier, 0.1-26.5 GHz	83006A	HP	00499	300000211	ev		
4	C101	Cable SMA	ST18/SMAm/SMAm/ 72	Huber&Suhner	Order:84004007 Batch:699714		ev		
5	C2019	Cable K-Type	KPS-1533-390-KPS	Insulated Wire Inc	101995	300002288	ev		
6	A026	Std. Gain Horn Antenna 12.4 to 18.0 GHz	639	Narda	8402	300000787	NK!		
7	A029	Std. Gain Horn Antenna 18.0 to 26.5 GHz	638	Narda	8205	300002442	NK!		
8	A029	Power Supply	LA30/5GA	Zentro	2046	300000711	NK!		
9	A037	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	8812-3089	300000307	Ve	02.10.2014	02.10.2016
10	n. a.	Broadband LNA 18-50 GHz	CBL18503070PN	CERNEX	25240	300004948	ev		
11		Spectrum Analyser (2 Hz – 26.5 GHz)	FSW 26	R&S	101455	300004528	Ve	28.01.2017	
12		Spectrum Analyser (20 Hz – 50 GHz)	FSU 50	R&S	200012	300003443	Ve	02.10.2014	02.10.2016

7.4 AC conducted



FS = UR + CF + VC
(FS-field strength; UR-voltage at the receiver; CR-loss of the cable and filter; VC-correction factor of the ISN)

Example calculation:
FS [dBµV/m] = 37.62 [dBµV/m] + 9.90 [dB] + 0.23 [dB] = 47.75 [dBµV/m] (244.06 µV/m)

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	n. a.	Netznachbildung	ESH3-Z5	R&S	892475/017	300002209	k	17.06.2014	17.06.2016
2	68	EMI-Receiver	8542E	HP	3617A00170	300000568	k	28.01.2015	28.01.2016
3	n. a.	Analyzer-Reference-System (Harmonics and Flicker)	ARS 16/1	SPS	A3509 07/0 0205	300003314	Ve	11.02.2014	11.02.2016

8 Summary of measurement results

☒	No deviations from the technical specifications were ascertained
☐	There were deviations from the technical specifications ascertained
☐	This test report is only a partial test report. The content and verdict of the performed test cases are listed below.

TC Identifier	Description	Verdict	Date	Remark
RF-Testing	CFR47 Part 15 RSS-220, Issue 1	see table	2016-02-09	-/-

Test specification clause	Test case	Temperature conditions	Power source voltages	Pass	Fail	NA	NP	Remark
§15.503(d) / RSS-220(5.1)	UWB Bandwidth (10dB Bandwidth)	Nominal	Nominal	☒	☐	☐	☐	complies
§15.517(c)(e) §15.209 RSS220 (5.2.1)	TX Radiated Emissions	Nominal	Nominal	☒	☐	☐	☐	see Note on page 34 and Annex D
§15.109 / RSS-Gen	RX Radiated Emissions	Nominal	Nominal	☒	☐	☐	☐	complies

Note: NA = Not Applicable; NP = Not Performed

9 Additional comments

Reference documents: None

Special test descriptions: None

Configuration descriptions: None

Test mode: ☐ No test mode available.

☒ Special software is used.
EUT is in a continuous transmission mode

10 Measurement results

10.1 UWB Bandwidth

Description:

§15.503 (a): For the purpose of this subpart, the UWB bandwidth is the frequency band bounded by the points that are 10 dB below the highest radiated emission, as abased on complete transmission system including antenna.

Measurement:

Measurement parameter	
Detector:	Peak
Video bandwidth:	1 MHz
Resolution bandwidth:	3 MHz
Trace-Mode:	Max Hold

Test Setup: 7.3

Limits:

§15.503 (d): *Ultra-wideband (UWB) transmitter.* An intentional radiator that, at any point in time, has a fractional bandwidth equal to or greater than 0.20 or has a UWB bandwidth equal to or greater than 500 MHz, regardless of the fractional bandwidth.

RSS220 (5.1a) The -10 dB bandwidth of the device shall be totally contained in the band 3.1-10.6 GHz.

Results:

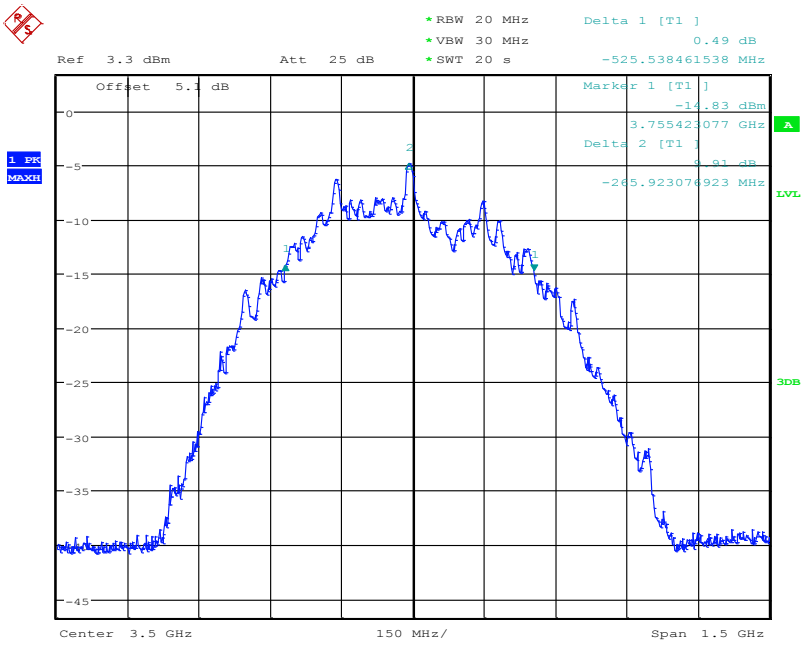
Operating Condition	Data rate [kBps]	Lower -10 dB point [GHz]	Higher -10 dB point [GHz]	UWB bandwidth [MHz]	Plot
1	110 850	3.22988 3.17077	3.75542 3.80800	525.54 637.23	1 2
2	110 850	3.24049 3.23528	3.75272 3.74580	512.23 510.52	3 4
3	110	3.74191	4.27587	533.96	5
4	110	3.74581	4.26744	521.63	6
5	110	4.23709	4.73942	502.33	7
6	110	4.23200	4.74190	503.90	8
7	110	3.48557	4.49519	1009.62	9
8	110	3.48473	4.50396	1019.23	10
9	110	6.23410	6.74550	511.40	11
10	110	6.23890	6.80621	567.31	12
11	110 850	5.98320 5.97838	6.99762 7.01023	1014.42 1031.85	13 14
12	110	5.98320	7.00062	1017.42	15

Time domain measurements:

Operating Condition	Data rate [kBps]	Plot
1	110 850	16 17
2	110 850	18 19
3	110	20
4	110	21
5	110	22
6	110	23
7	110	24
8	110	25
9	110	26
10	110	27
11	110 850	28 29
12	110	30

Verdict: **Compliant**

Plot 1:



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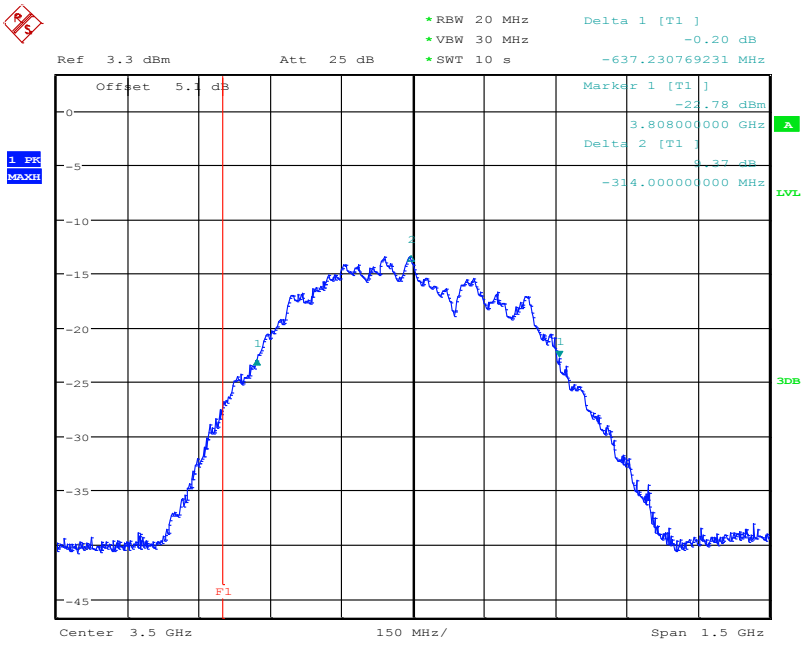

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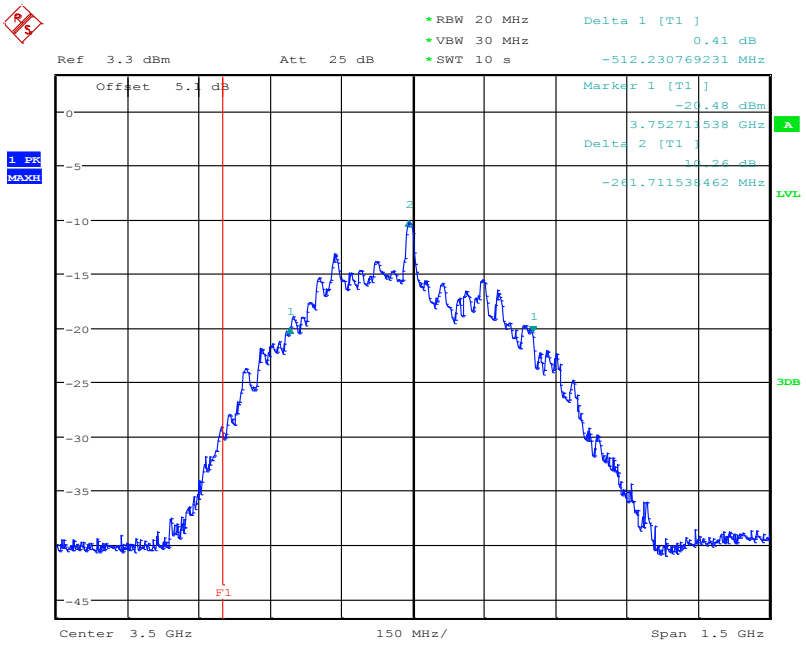

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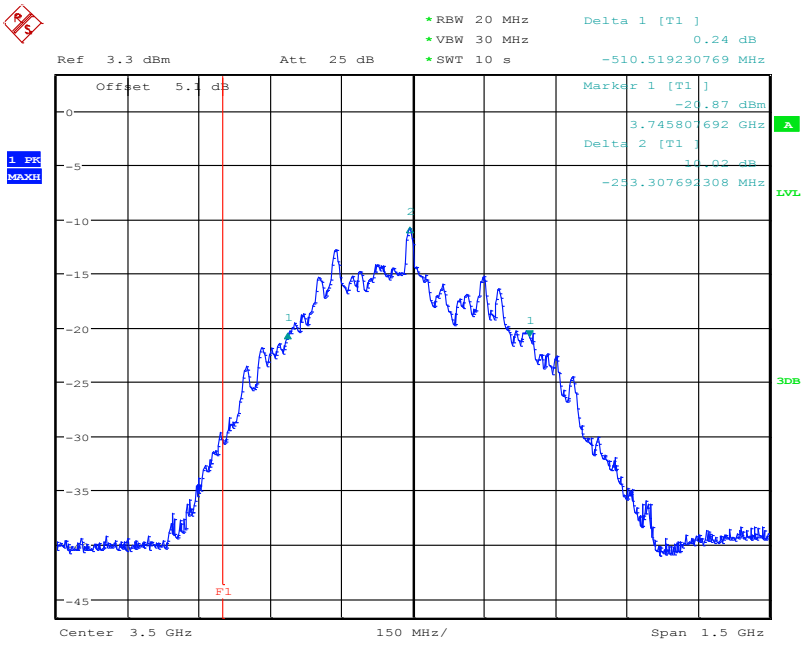

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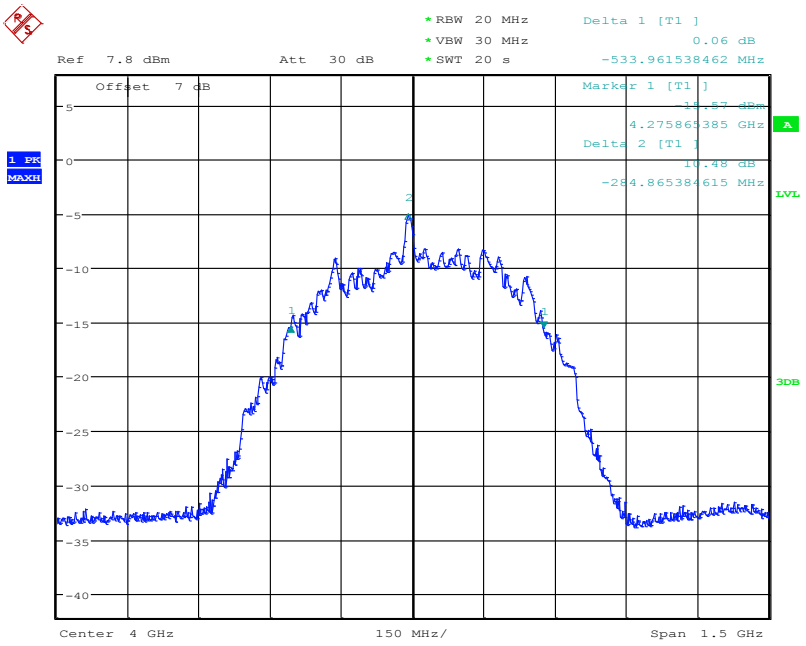

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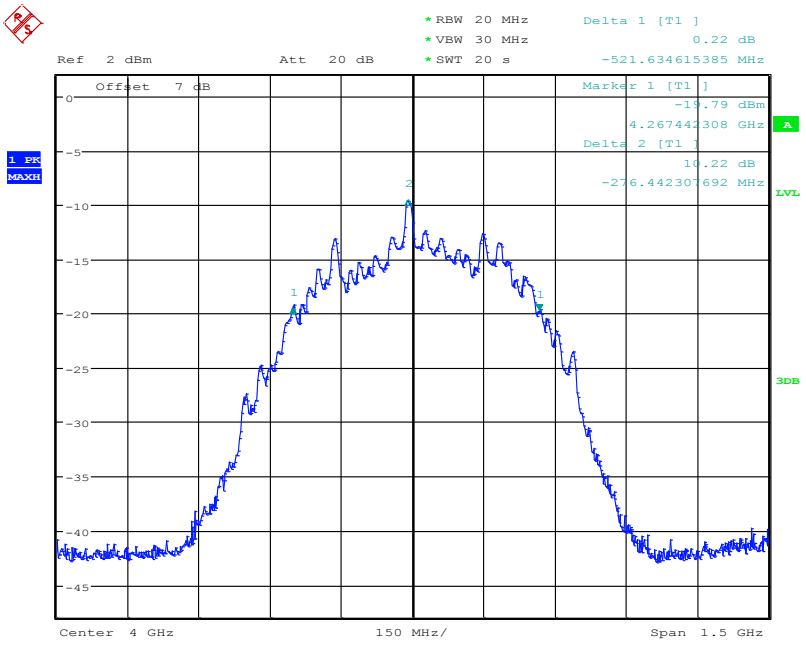

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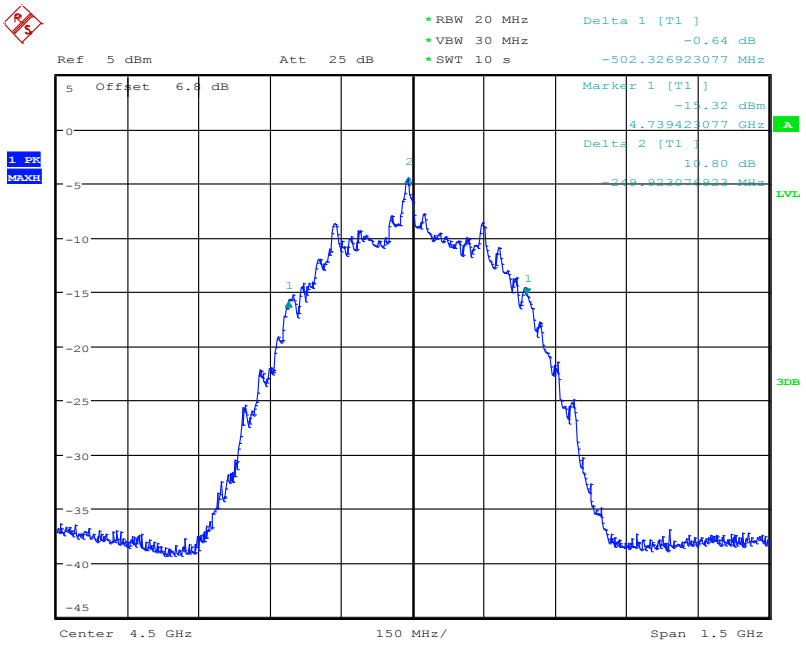

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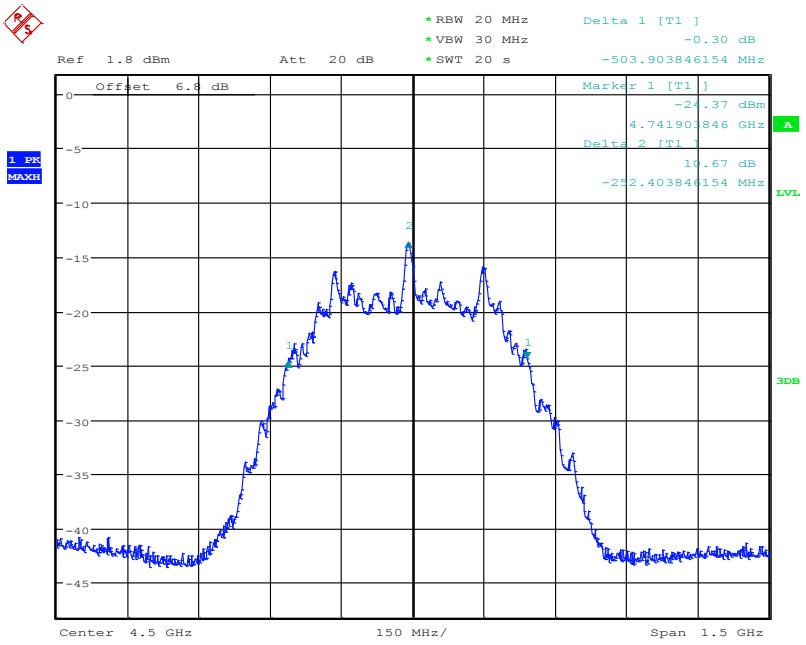
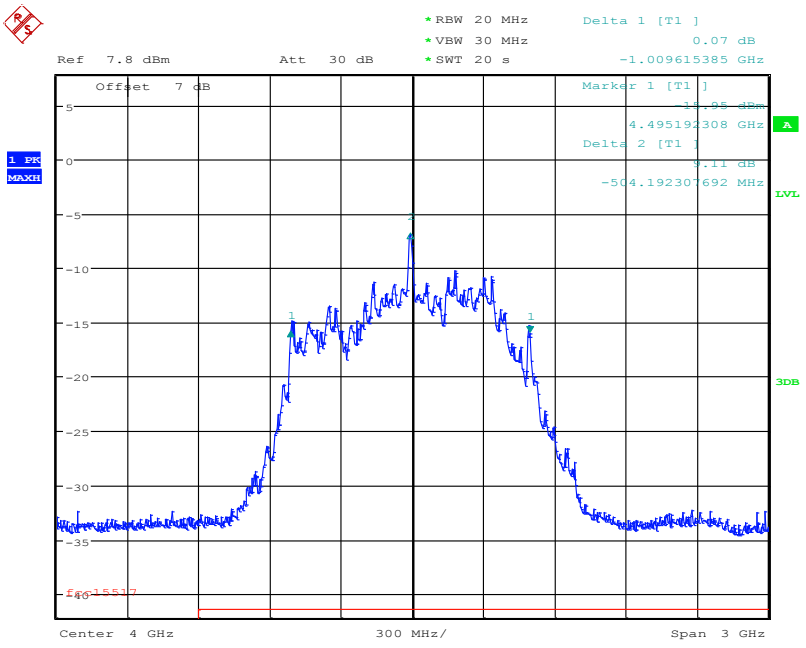


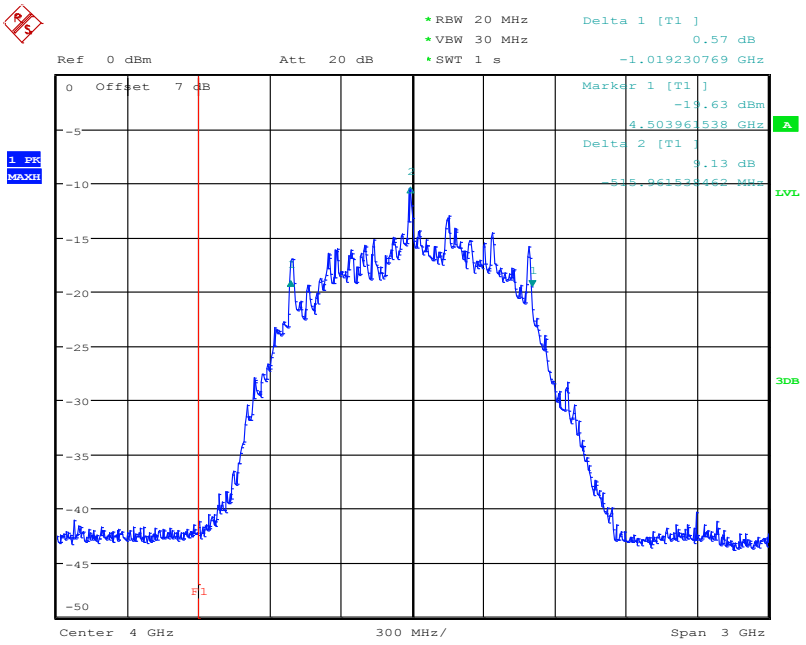
Date: 12.NOV.2015 08:50:58

Plot 9:



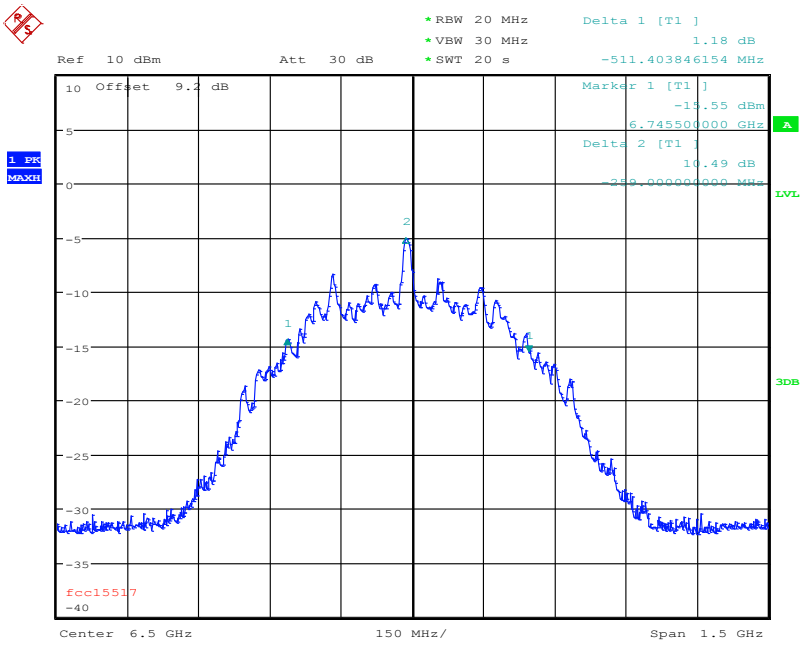
Date: 11.NOV.2015 16:59:50

Plot 10:



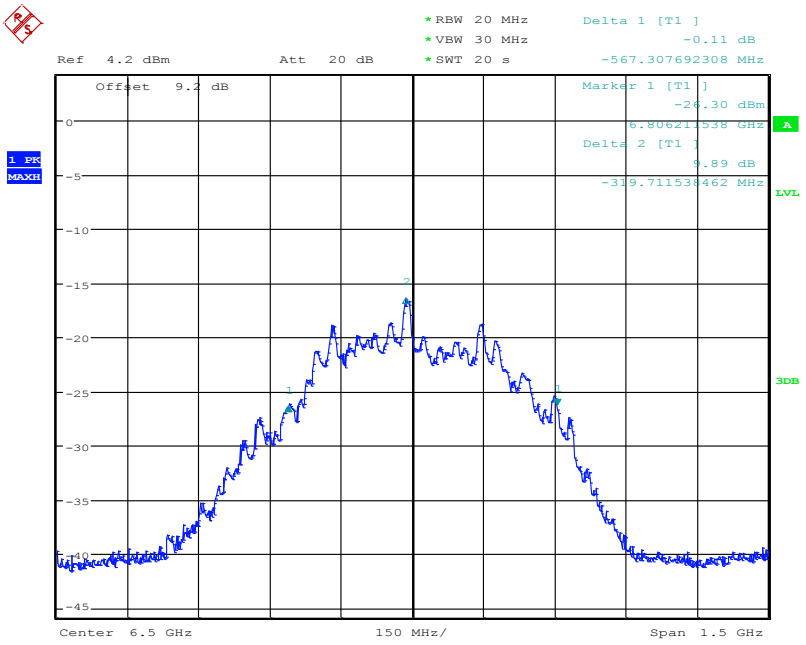
Date: 12.NOV.2015 08:27:23

Plot 11:



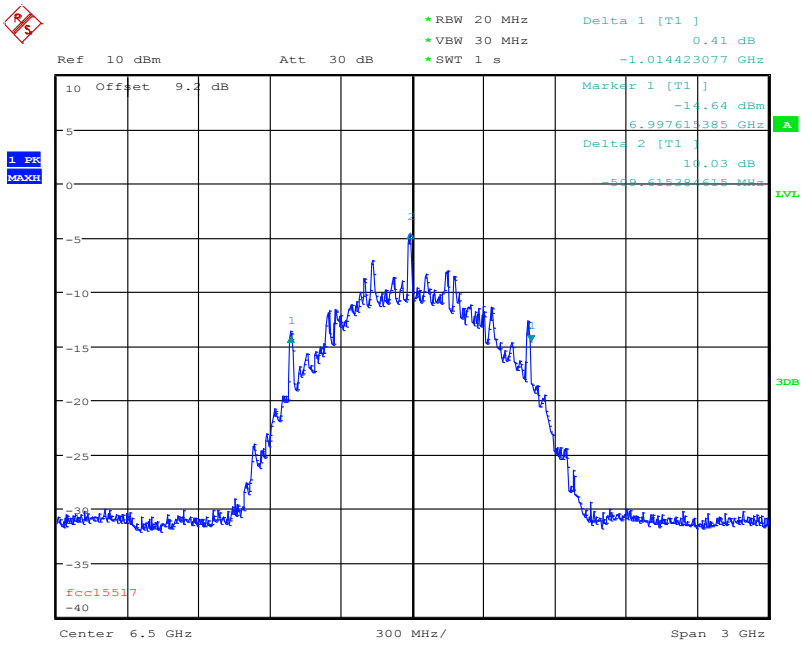
Date: 11.NOV.2015 16:54:45

Plot 12:



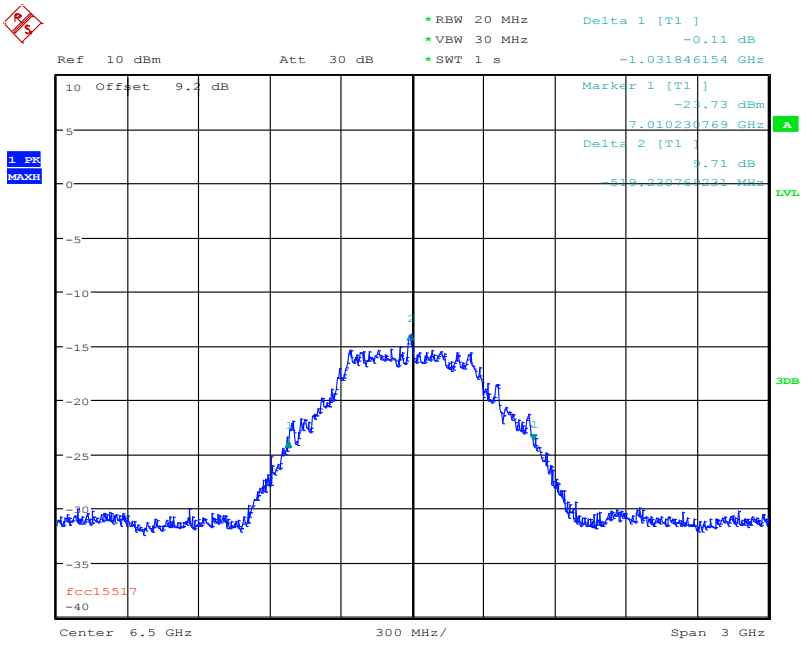
Date: 12.NOV.2015 08:58:51

Plot 13:



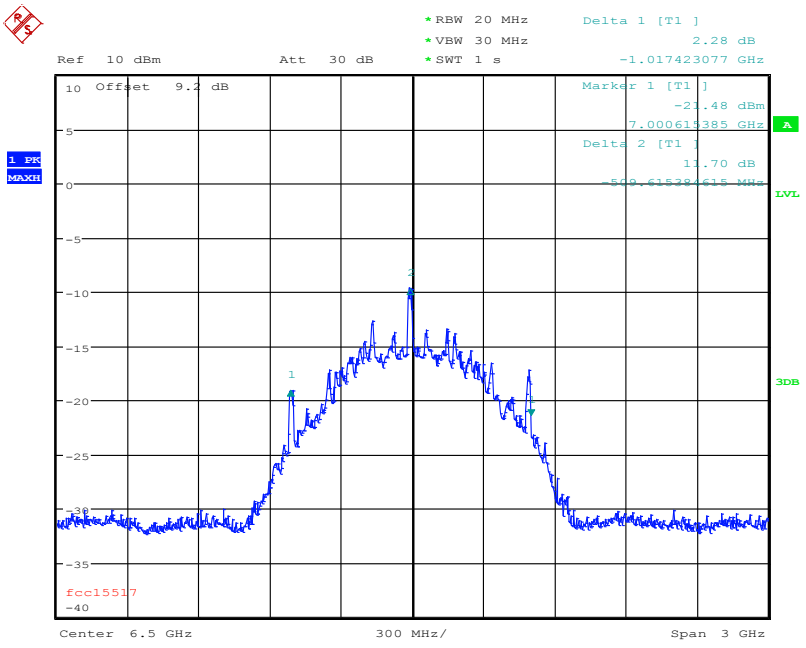
Date: 11.NOV.2015 16:35:36

Plot 14:



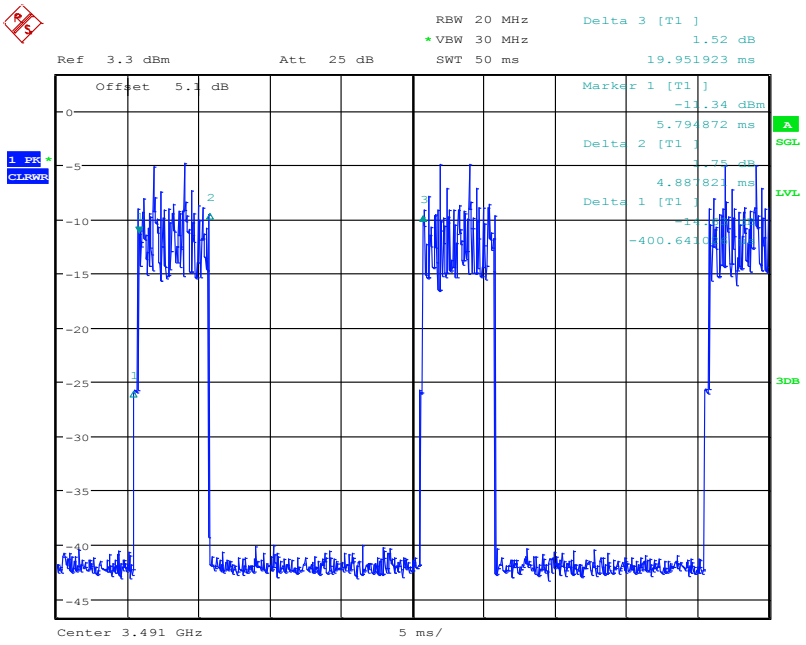
Date: 11.NOV.2015 16:47:19

Plot 15:



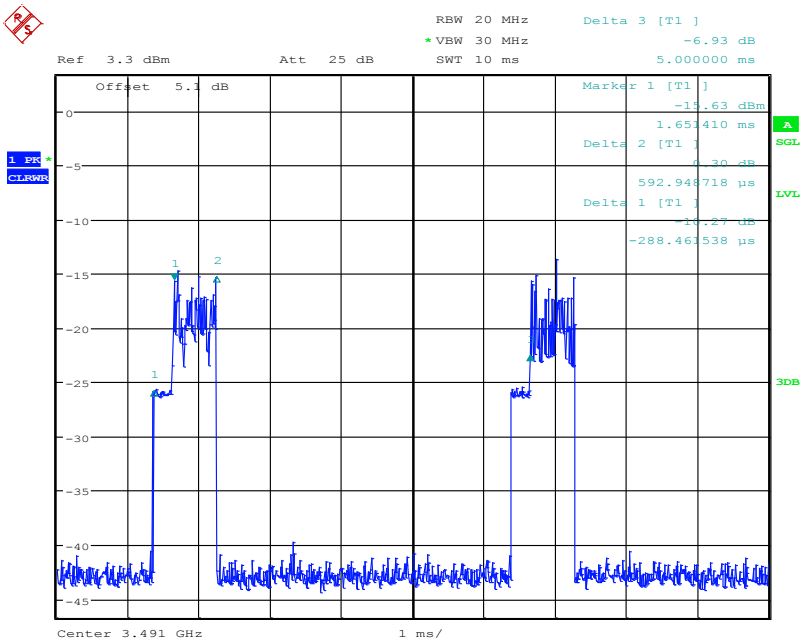
Date: 11.NOV.2015 16:43:24

Plot 16:



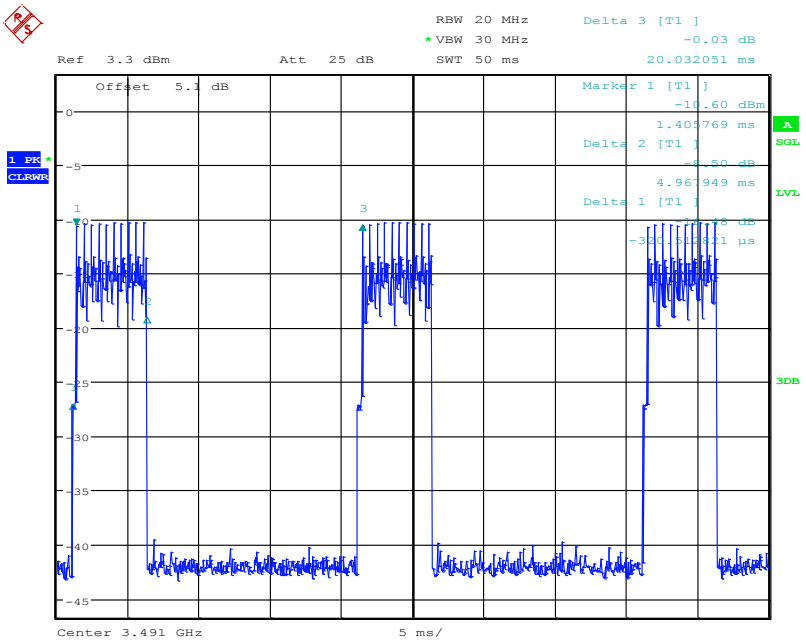
Date: 11.NOV.2015 18:11:02

Plot 17:



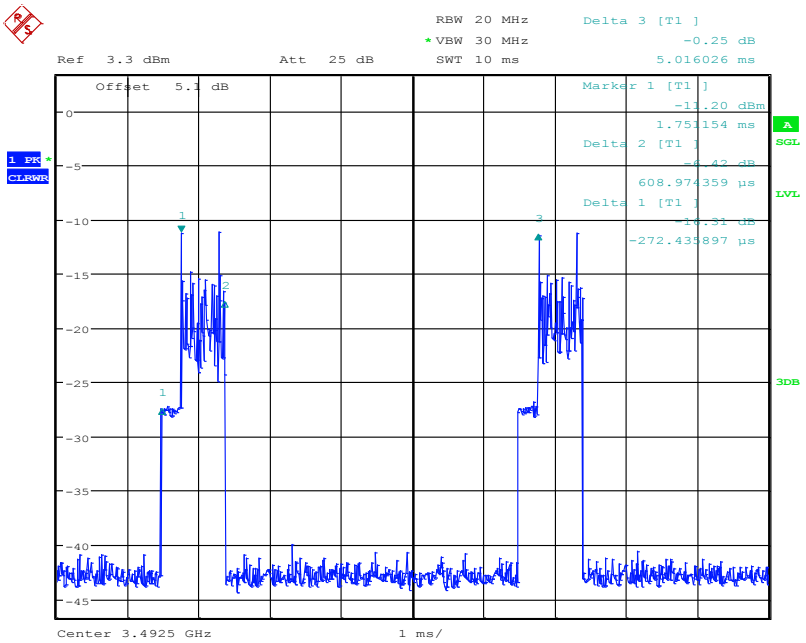
Date: 11.NOV.2015 18:12:41

Plot 18:



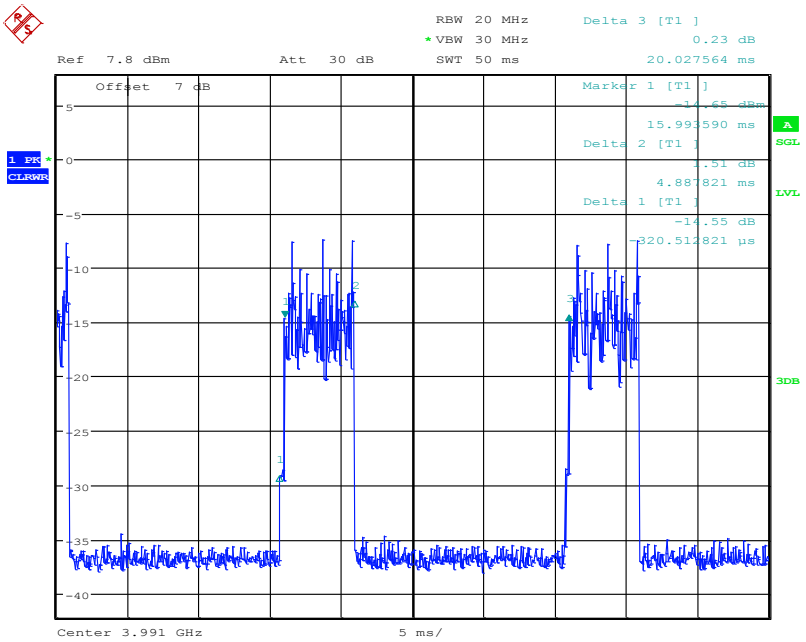
Date: 11.NOV.2015 18:23:21

Plot 19:



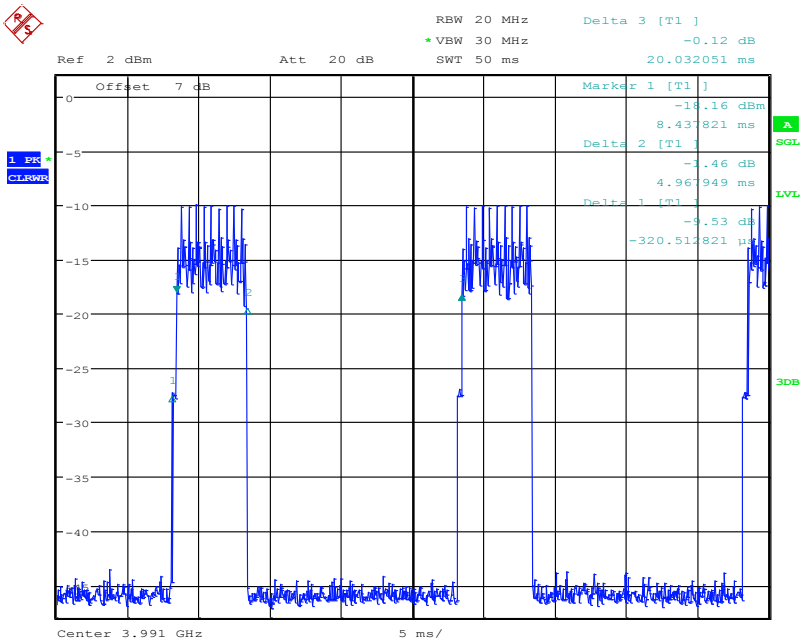
Date: 11.NOV.2015 18:28:04

Plot 20:



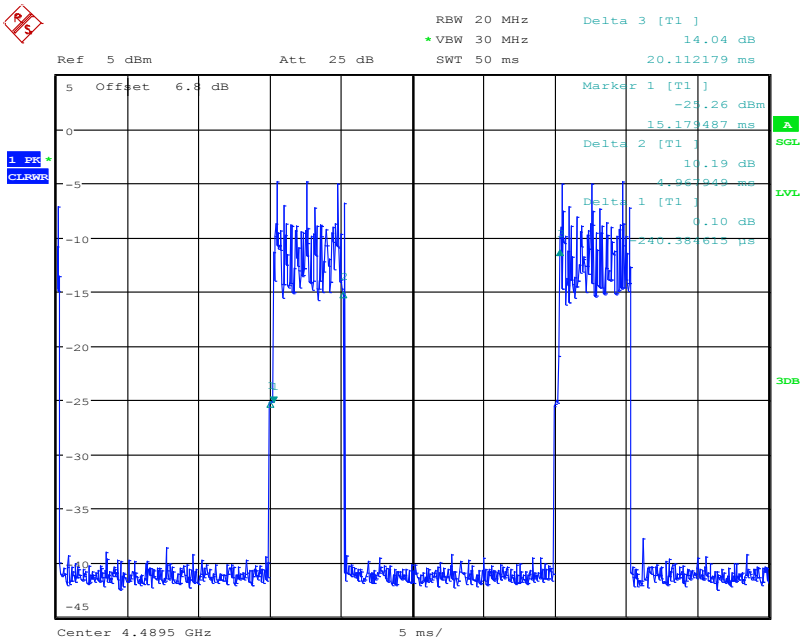
Date: 11.NOV.2015 17:07:36

Plot 21:



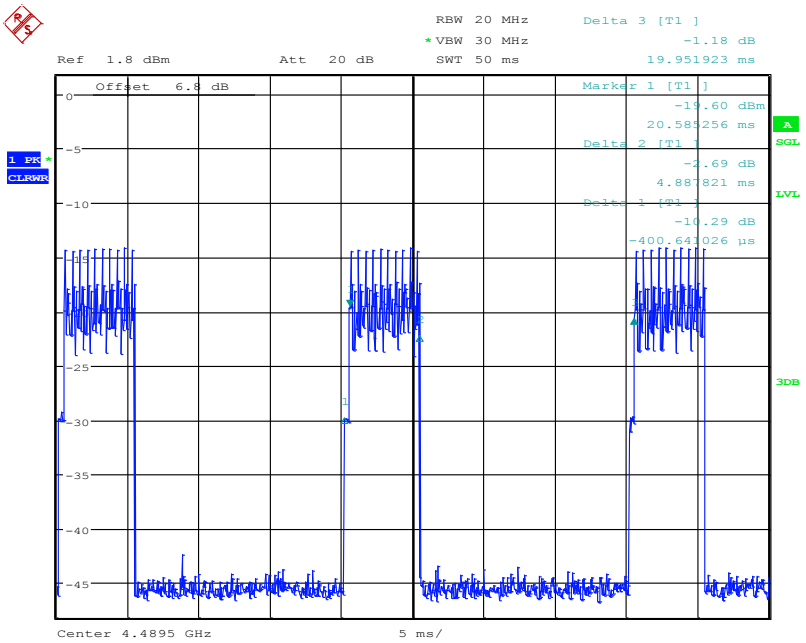
Date: 12.NOV.2015 08:55:52

Plot 22:



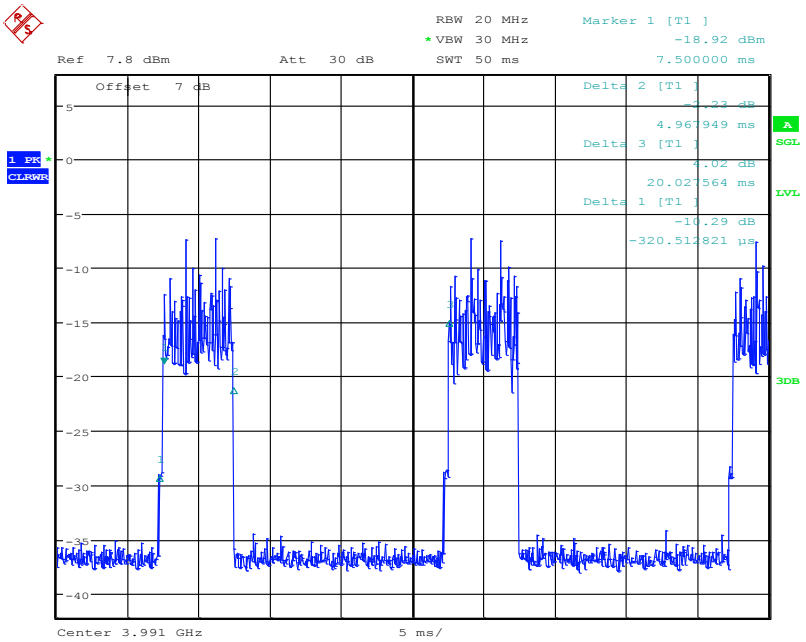
Date: 11.NOV.2015 18:00:50

Plot 23:



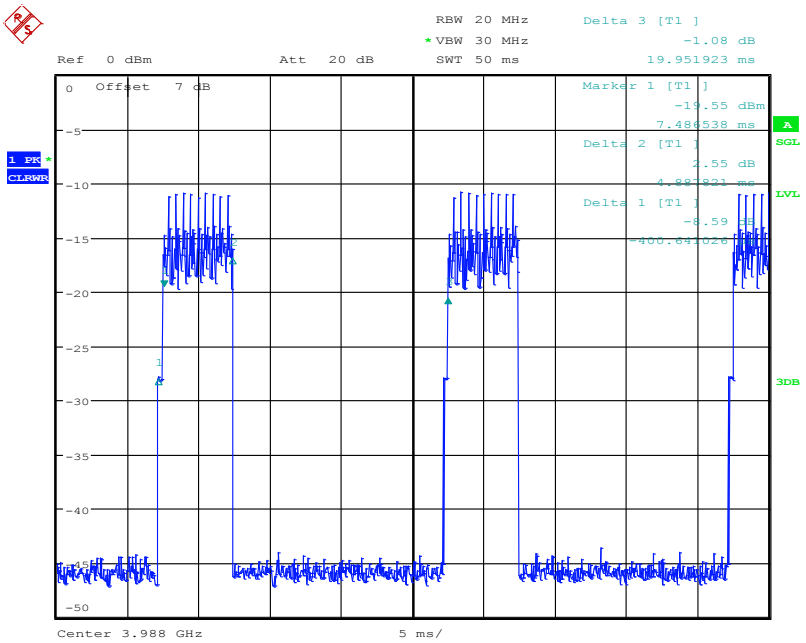
Date: 12.NOV.2015 08:52:32

Plot 24:

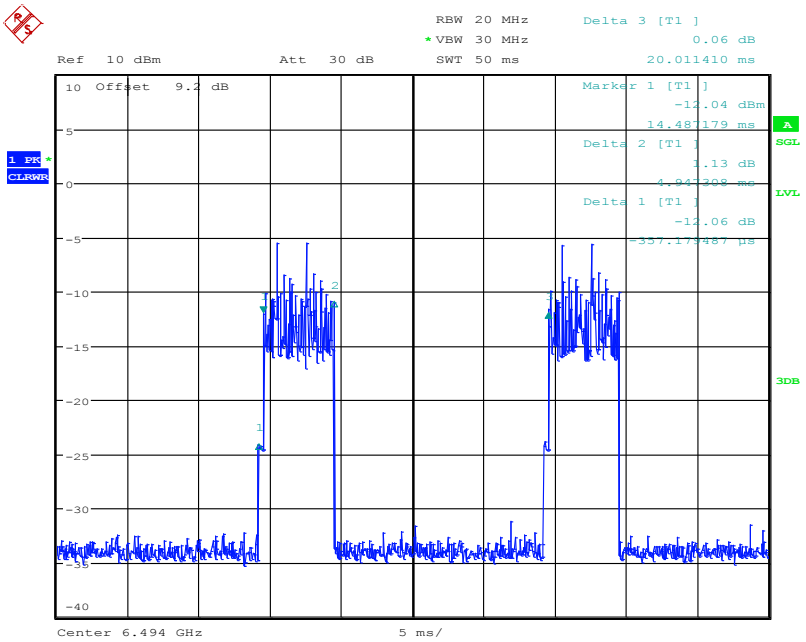


Date: 11.NOV.2015 17:02:35

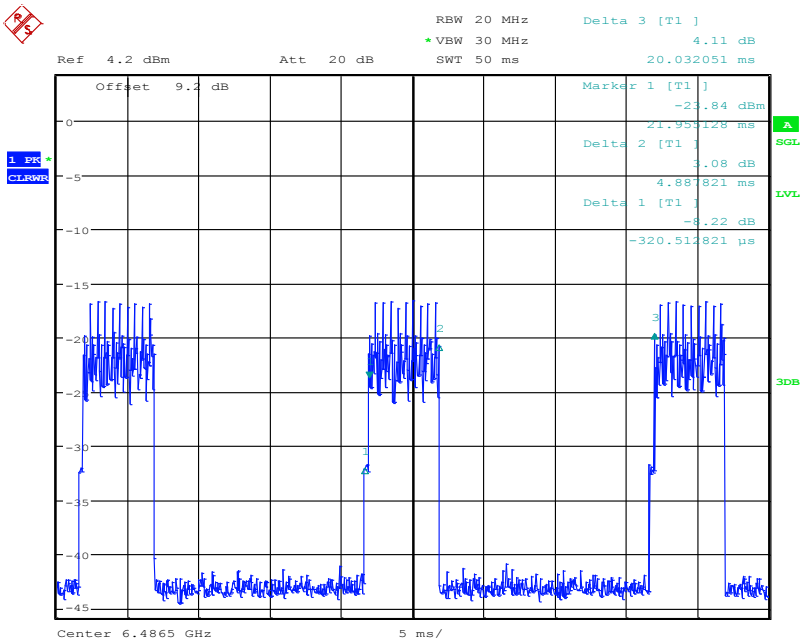
Plot 25:



Plot 26:

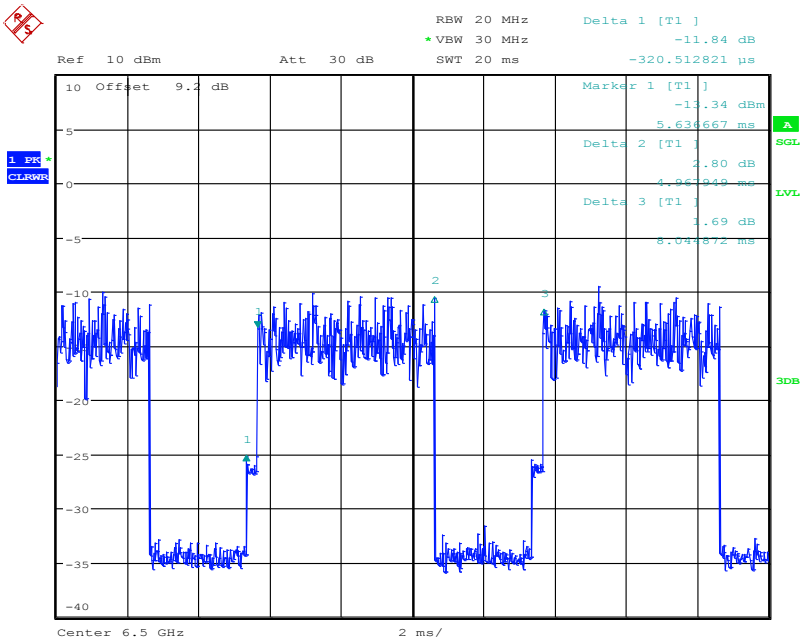


Plot 27:



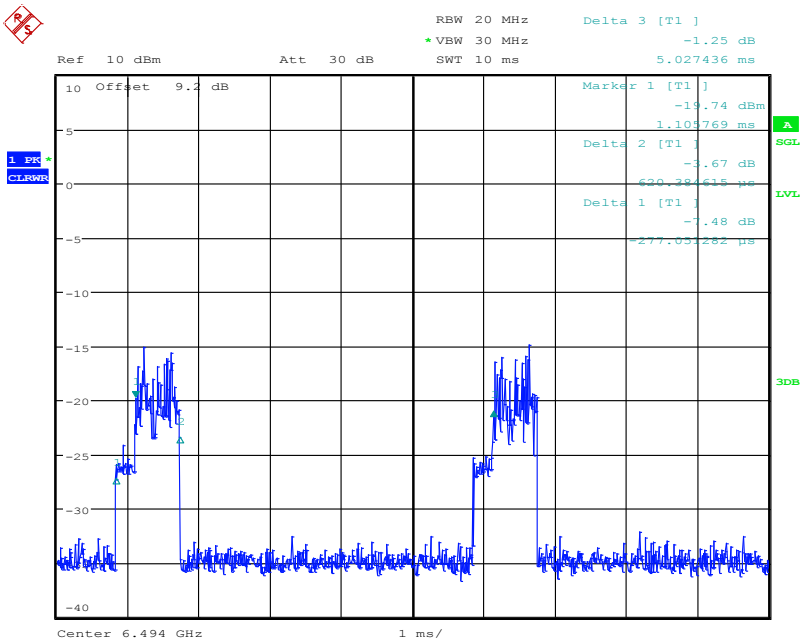
Date: 12.NOV.2015 08:59:45

Plot 28:



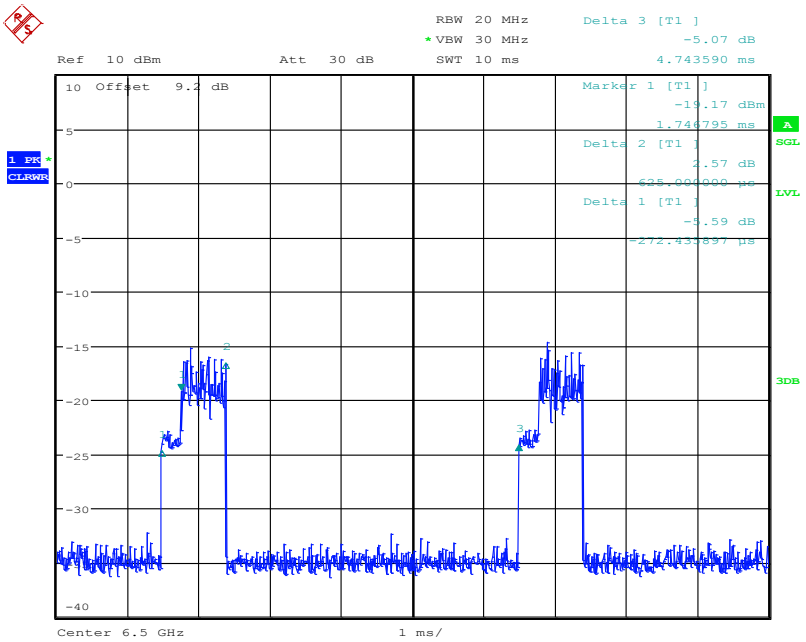
Date: 11.NOV.2015 16:37:21

Plot 29:



Date: 11.NOV.2015 16:48:56

Plot 30:



Date: 11.NOV.2015 16:41:16

10.2 TX Radiated Emissions

Description:

Measurement of the radiated spurious emissions in transmit mode.

For RSS-220, only the channels with a center frequency of 6.5 GHz are applicable.

Measurement:

§15.517 (c) / RSS220 (5.2.1d):

Average Measurement parameter	
Detector:	RMS
Sweep time:	1 ms/pts
Number of points	1001/10001
Video bandwidth:	1 MHz
Resolution bandwidth:	3 MHz
Trace-Mode:	Max Hold

§15.517 (e) / RSS220 (5.2.1g):

Peak Measurement parameter	
Detector:	Max Peak
Sweep time:	1 s
Video bandwidth:	20 MHz / 50 MHz
Resolution bandwidth:	30 MHz / 50 MHz
Span:	Zero span
Trace-Mode:	Max Hold

§15.517 (d) / RSS220 (5.2.1e)::

Average Measurement parameter	
Detector:	RMS
Sweep time:	1 ms/pts
Number of points	10001
Video bandwidth:	1 kHz
Resolution bandwidth:	3 kHz
Trace-Mode:	Max Hold

Limits:

§15.517 (c): The radiated emissions at or below 960 MHz from a device operating under the provisions of this section shall not exceed the emission levels in §15.217. The radiated emissions above 960 MHz from a device operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of 1 MHz:

Frequency in MHz	EIRP in dBm
960 to 1610	-75.3
1610 to 1990	-53.3
1990 to 3100	-51.3
3100 to 10600	-41.3
Above 10600	-51.3

RSS220 (5.2.1d):

Frequency in MHz	EIRP in dBm
960 to 1610	-75.3
1610 to 4750	-70.0
4750 to 10600	-41.3
Above 10600	-51.3

§15.517 (d) / RSS220 (5.2.1e):

In addition to the radiated emission limits specified in the table in paragraph (c) of this section, UWB transmitters operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of no less than 1 kHz:

Frequency in MHz	EIRP in dBm
1164 to 1240	-85.3
1559 to 1610	-85.3

§15.509 (e) / RSS220 (5.2.1g): There is a limit on the peak level of the emissions contained within a 50 MHz bandwidth centered on the frequency at which the highest radiated emission occurs, fM. That limit is 0 dBm EIRP. It is acceptable to employ a different resolution bandwidth, and correspondingly different peak emission limit, following the procedures described in §15.521.

Bandwidth correction factor for peak measurements with 20MHz RBW: $20 \cdot \log(50/20) = -7.96$ dB

Result:

	Operating cond.	Data rate	Frequency /GHz	Max e.i.r.p. / dBm		Plot
				average value	peak value*	
Max E.I.R.P	1	110 kBps 850 kBps	3.5010 3.4980	-41.9 -42.9	-3.6 -13.5*	31, 55 32, 56
	2	110 kBps 850 kBps	3.4950 3.4950	-42.0 -42.6	-10.2* -11.0*	33, 57 34, 58
	3	110 kBps 850 kBps	4.0940 4.0940	-42.0 -43.3	-8.3* -13.5*	35, 59 36, 60
	4	110 kBps 850 kBps	4.0970 4.0980	-41.4 -42.4	-13.7* -13.3*	37, 61 38, 62
	5	110 kBps 850 kBps	4.4820 4.4790	-43.4 -43.2	-2.7 -12.9*	39, 63 40, 64
	6	110 kBps 850 kBps	4.4930 4.4750	-42.2 -43.3	-9.8* -13.3*	41, 65 42, 66
	7	110 kBps 850 kBps	4.1880 4.2640	-41.3 -42.9	-8.0* -13.6*	43, 67 44, 68
	8	110 kBps 850 kBps	4.1800 4.1840	-41.5 -42.2	-13.0* -13.0*	45, 69 46, 70
	9	110 kBps 850 kBps	6.4910 6.4900	-44.0 -44.0	-5.5 -14.4*	47, 71 48, 72
	10	110 kBps 850 kBps	6.4910 6.4900	-41.8 -42.1	-9.3* -10.6*	49, 73 50, 74
	11	110 kBps 850 kBps	6.4900 6.4900	-42.7 -43.9	-2.7 -13.6*	51, 75 52, 76
	12	110 kBps 850 kBps	6.4900 6.4900	-41.9 -42.5	-9.5* -9.4*	53, 77 54, 78
Measurement uncertainty					± 3 dB	

* with BW correction

Emissions outside the bands:

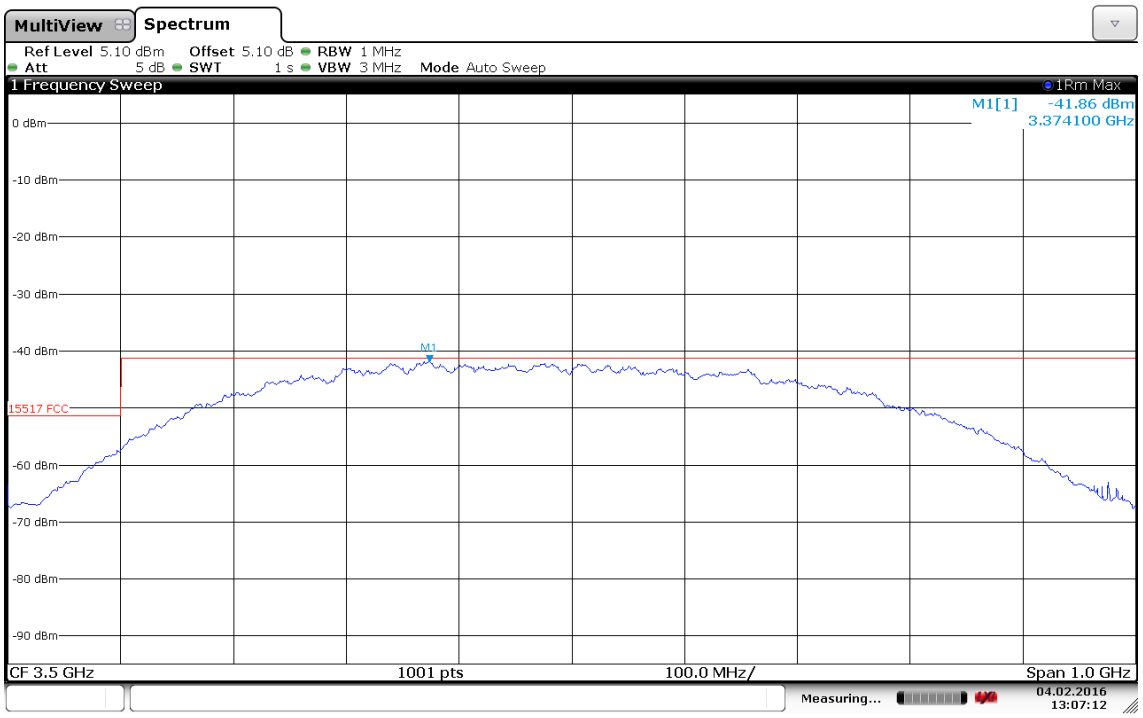
Spurious Emission Level (dBm)			
Frequency (MHz)	**RBW**	**Detector**	**Level (dBm)**
1497.577	1MHz	RMS	-61.4
1075.091	1MHz	RMS	-63.8
1574.397	1 kHz	RMS	-75.9
1036.783	1MHz	RMS	-65.3
1497.699	1MHz	RMS	-58.0
1574.437	1 kHz	RMS	-74.3*
1075.274	1MHz	RMS	-65.486
1459.269	1MHz	RMS	-61.728
1574.437	1 kHz	RMS	-74.023*
	Measurement uncertainty		± 3dB

Note:

The peaks, measured in the 960 MHz to 1610 MHz frequency range exceed the limits for TX spurious (see also plots 89 to 92). The same measurements in RX mode show similar results. The spacing of these peaks is approx. 38.4 MHz, which can also be seen in the RX measurement in, plot 102. The manufacturer declares that these peaks are part of the digital circuitry (see Attestation statement in Annex D), not of the transmitter. In this case the limits in §15.209 apply (§15.521 (c)). Plot 102 shows the RX measurement with §15.209 limits.

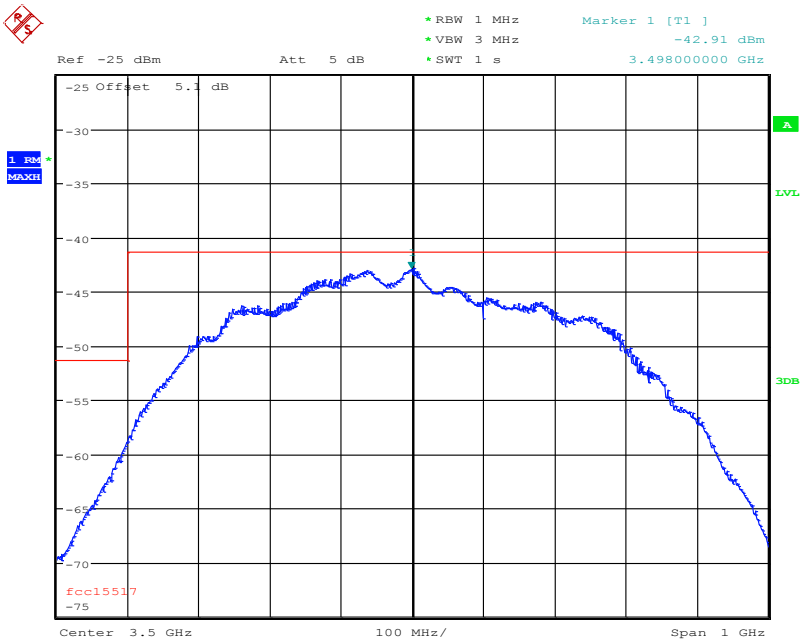
Verdict: **complies**

Plot 31:



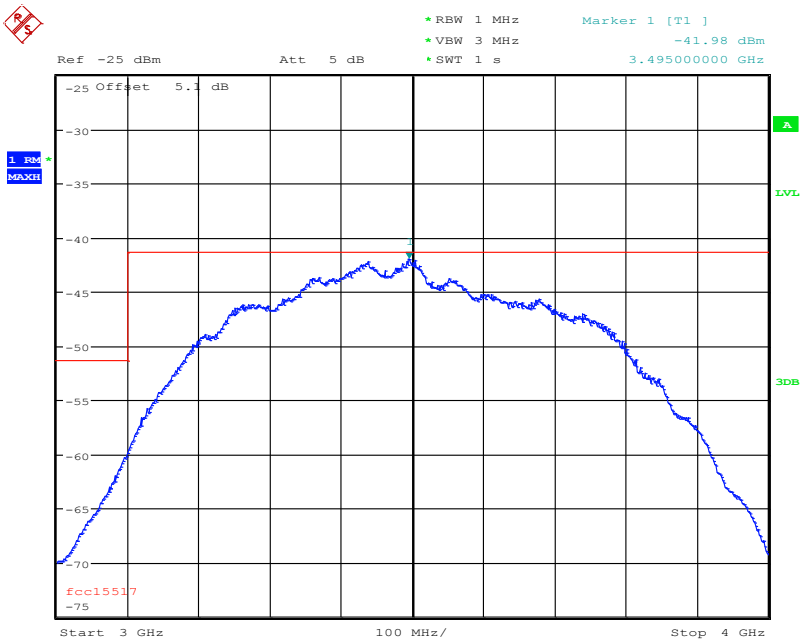
Date: 4.FEB.2016 13:07:12

Plot 32:



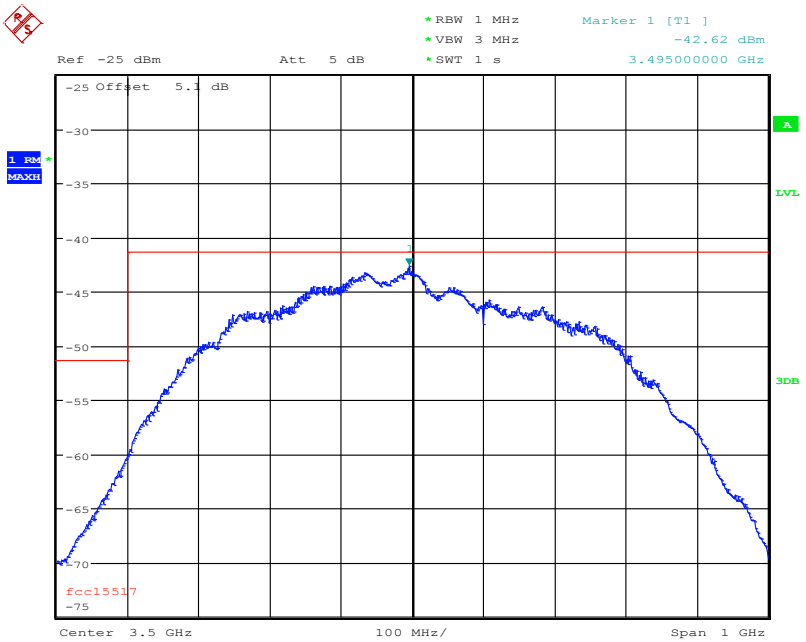
Date: 11.NOV.2015 13:28:37

Plot 33:



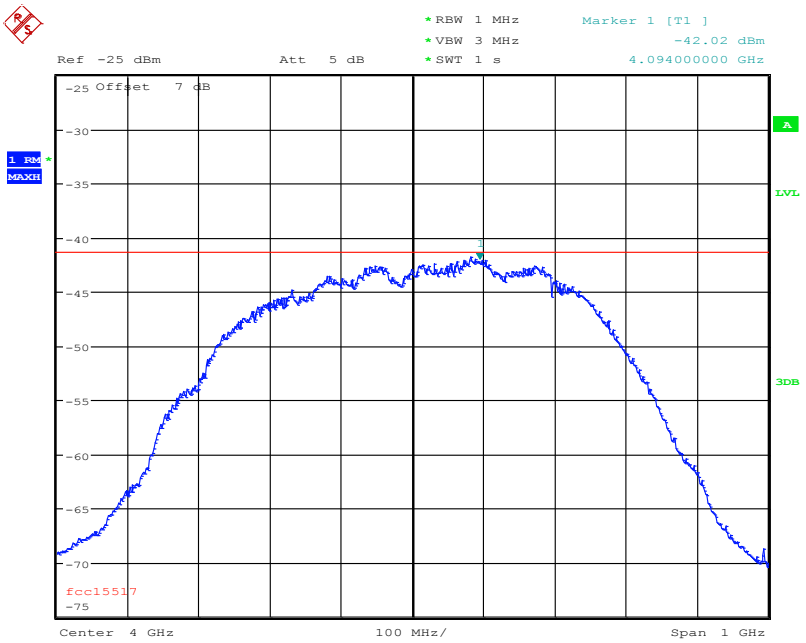
Date: 11.NOV.2015 13:02:43

Plot 34:



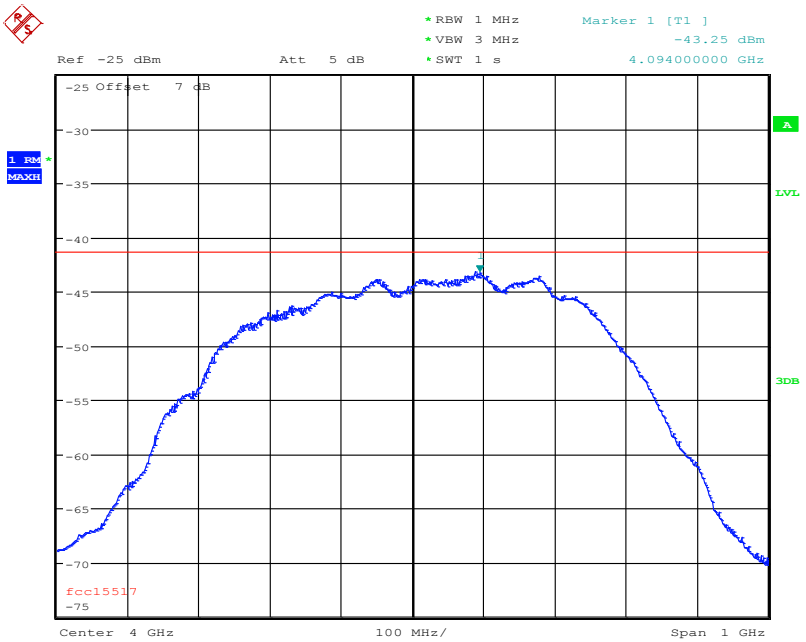
Date: 11.NOV.2015 13:08:33

Plot 35:



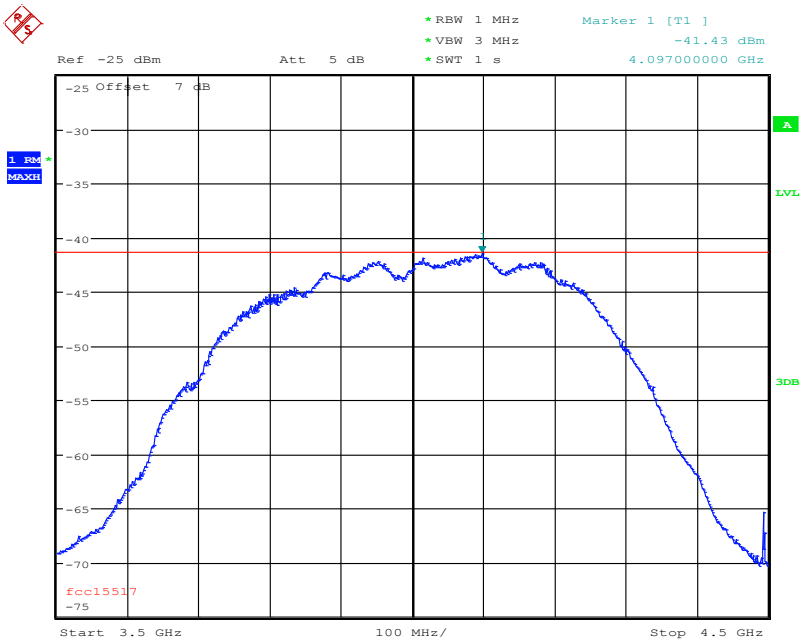
Date: 11.NOV.2015 14:04:01

Plot 36:



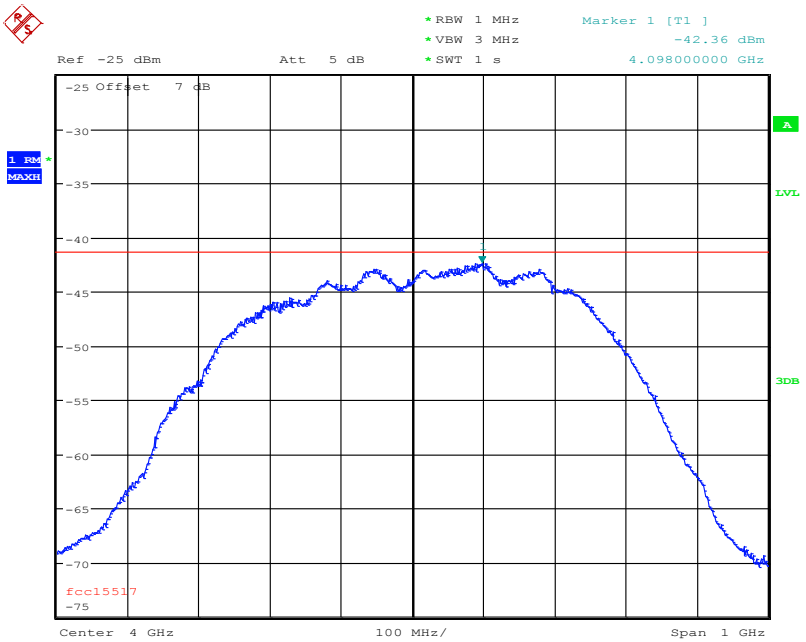
Date: 11.NOV.2015 14:11:48

Plot 37:



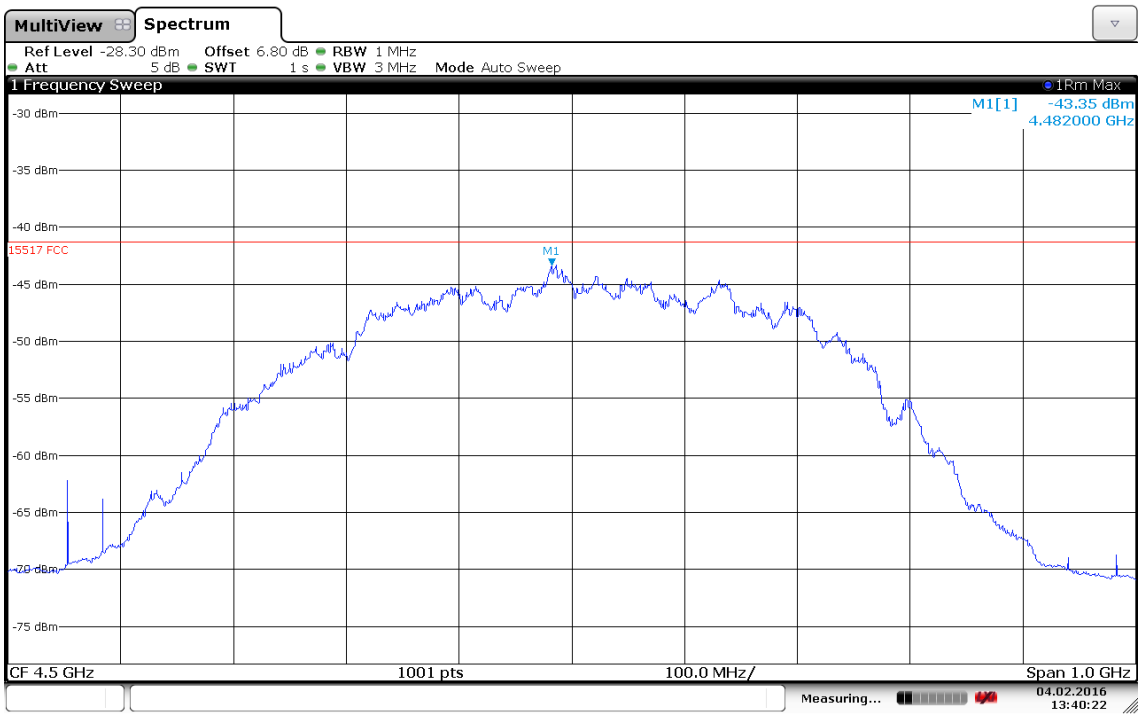
Date: 11.NOV.2015 13:54:03

Plot 38:



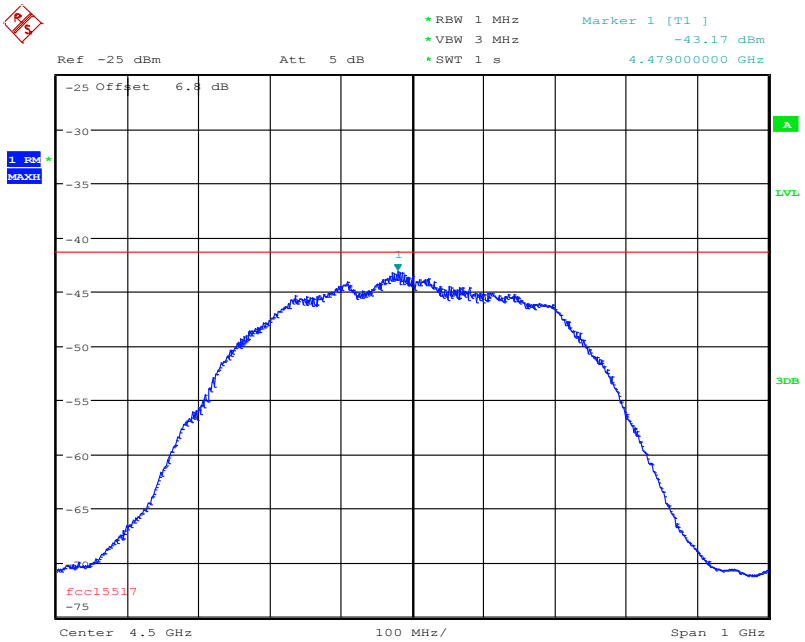
Date: 11.NOV.2015 13:59:18

Plot 39:



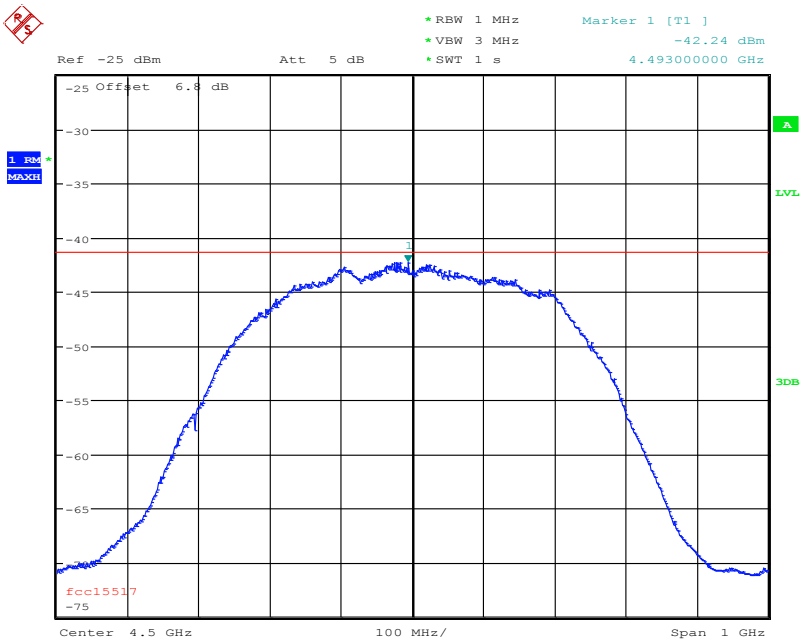
Date: 4.FEB.2016 13:40:22

Plot 40:



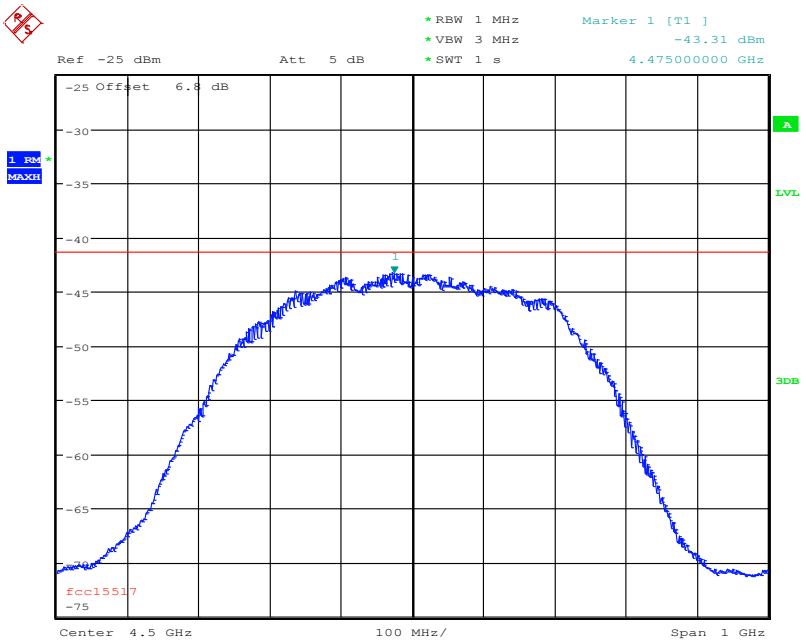
Date: 11.NOV.2015 17:42:27

Plot 41:



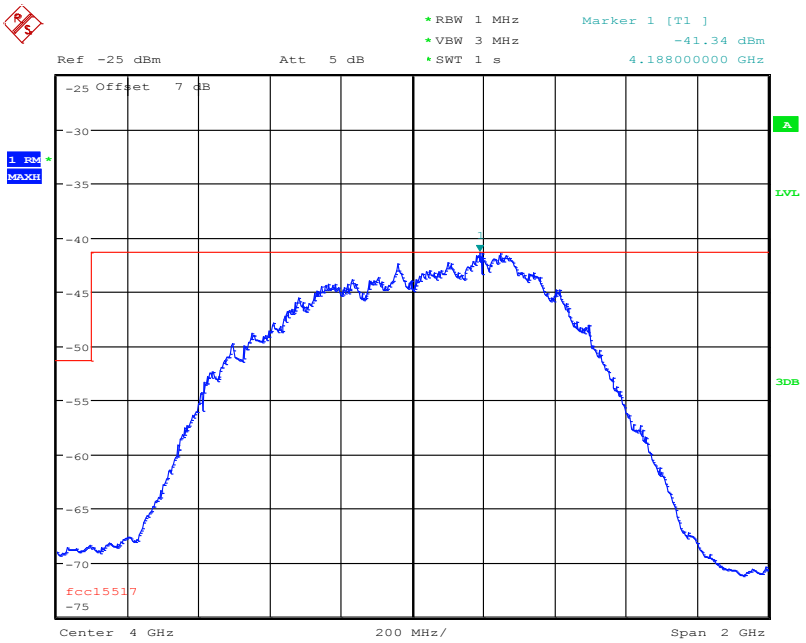
Date: 11.NOV.2015 17:47:41

Plot 42:



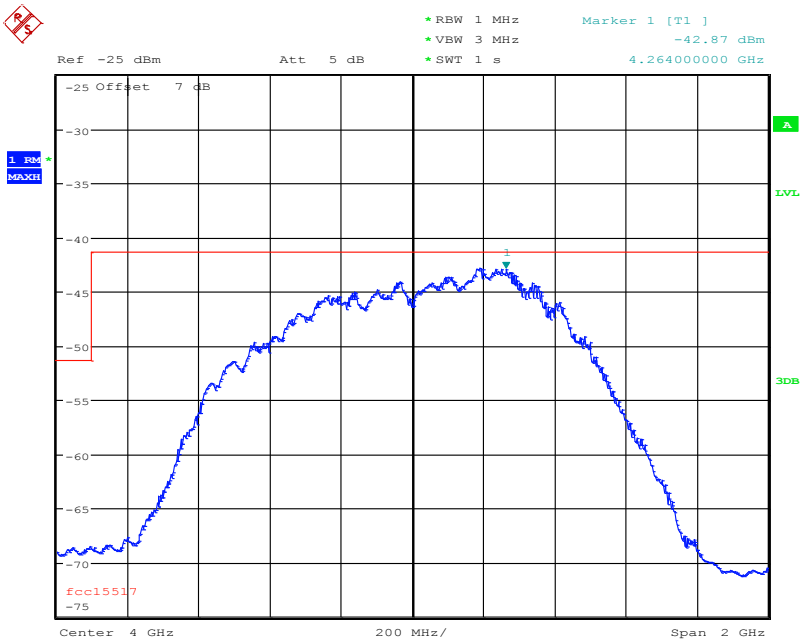
Date: 11.NOV.2015 17:50:11

Plot 43:



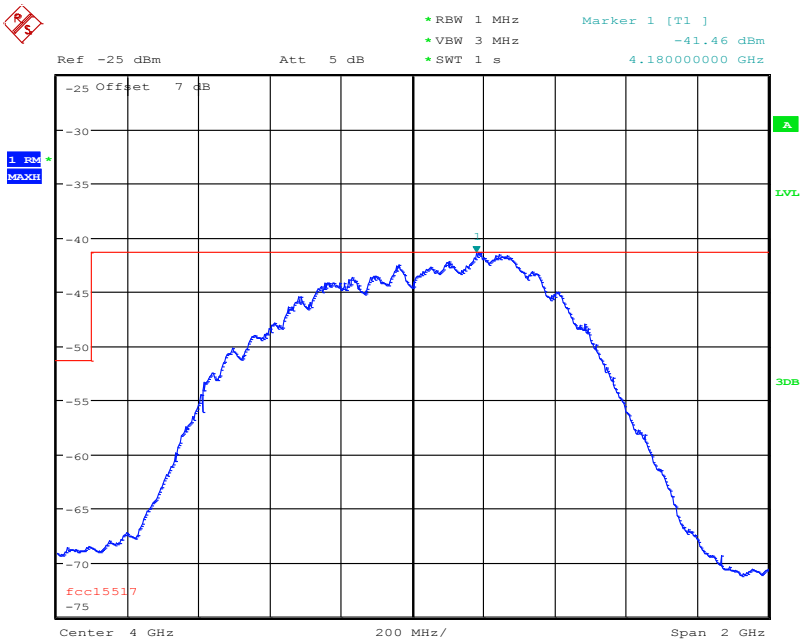
Date: 11.NOV.2015 14:53:19

Plot 44:



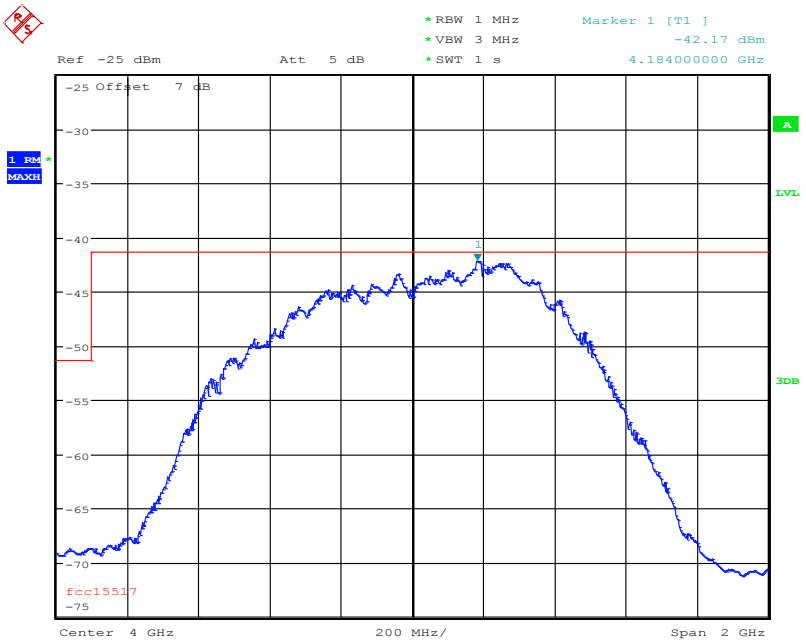
Date: 11.NOV.2015 14:57:08

Plot 45:



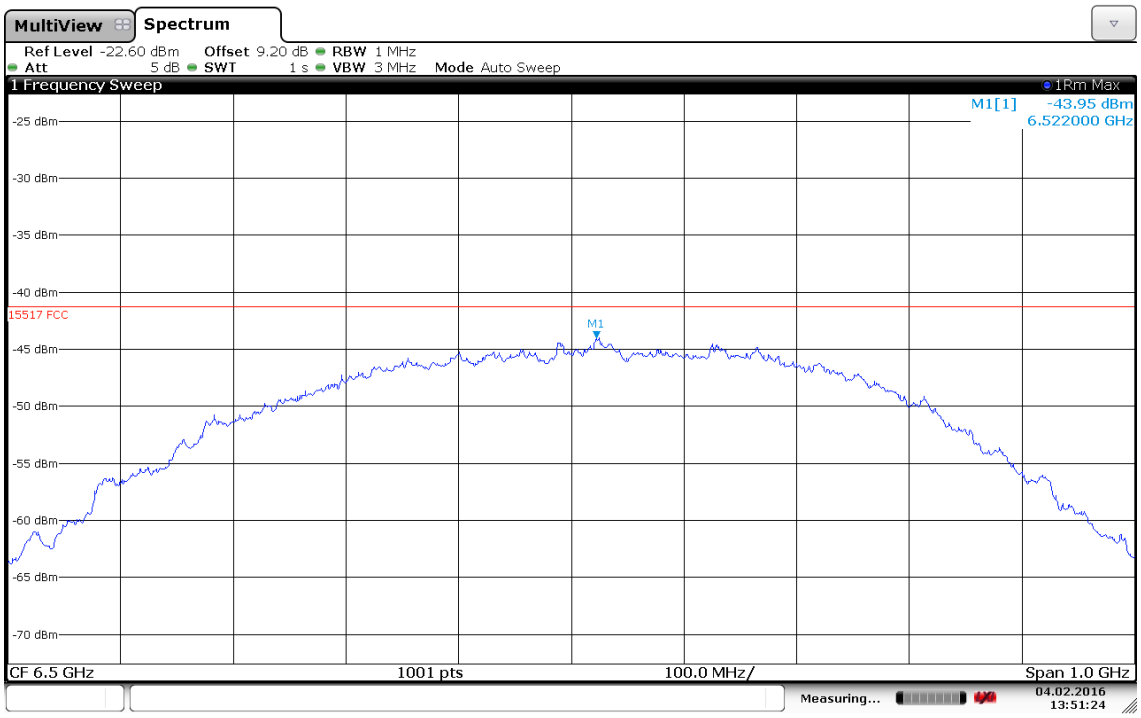
Date: 11.NOV.2015 14:44:52

Plot 46:



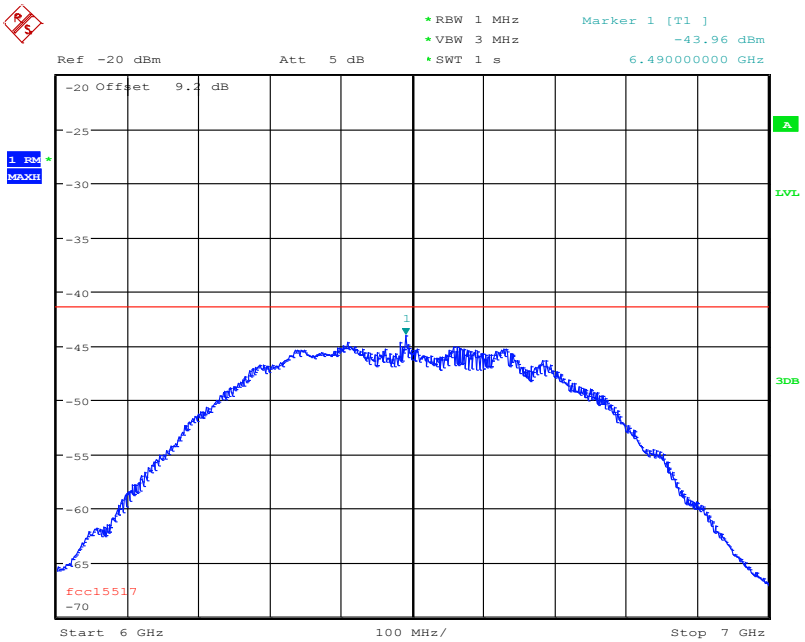
Date: 11.NOV.2015 14:48:01

Plot 47:



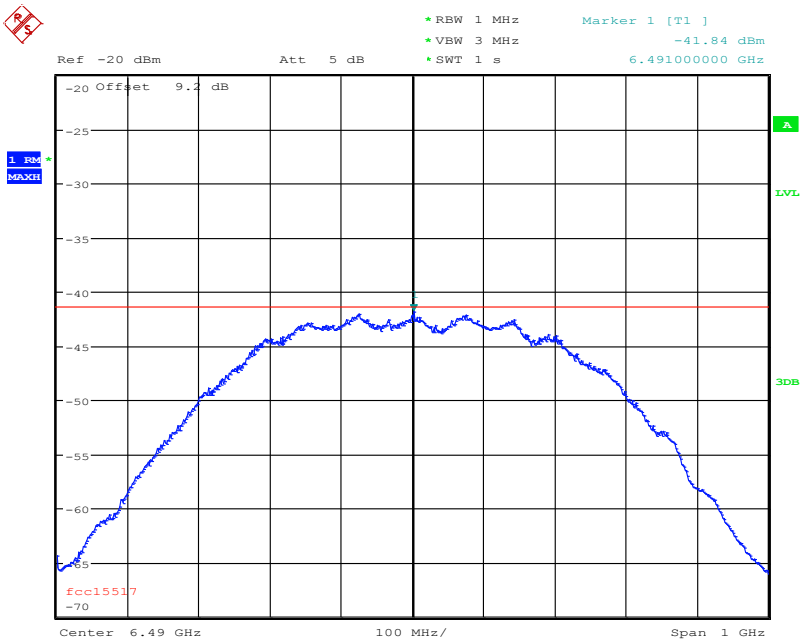
Date: 4.FEB.2016 13:51:24

Plot 48:



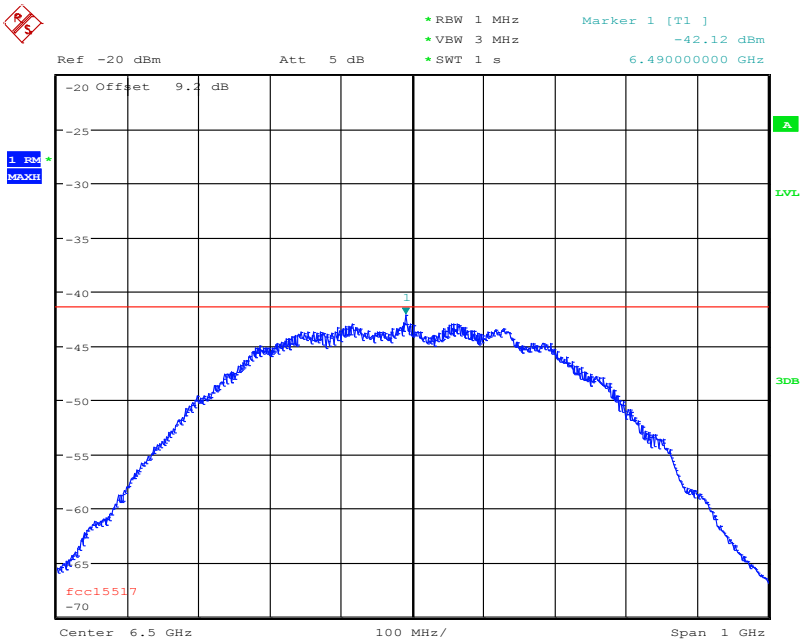
Date: 11.NOV.2015 15:38:28

Plot 49:



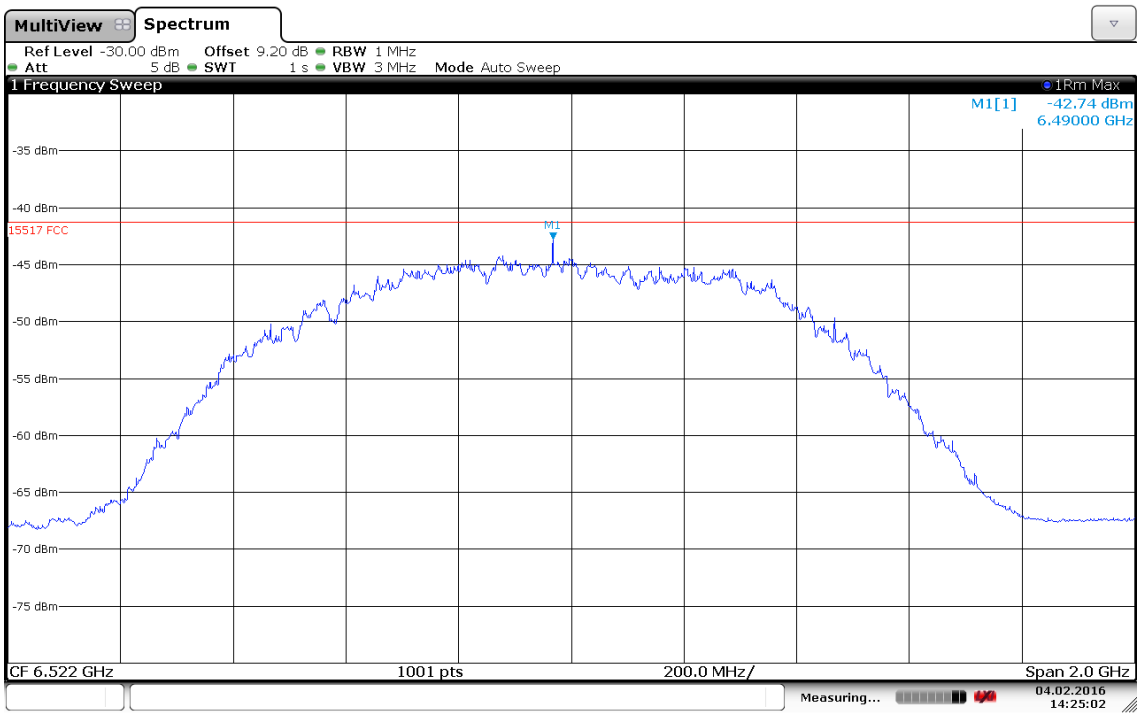
Date: 11.NOV.2015 15:09:41

Plot 50:



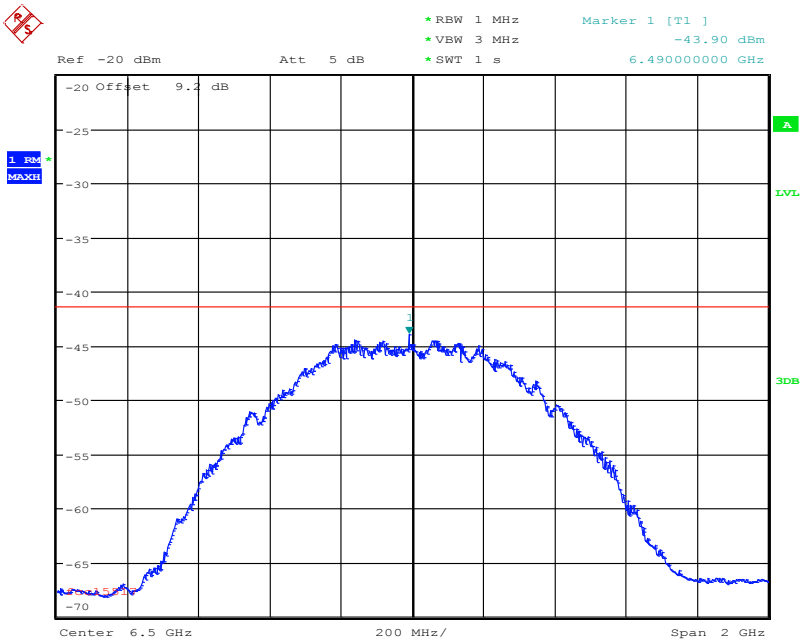
Date: 11.NOV.2015 15:24:06

Plot 51:



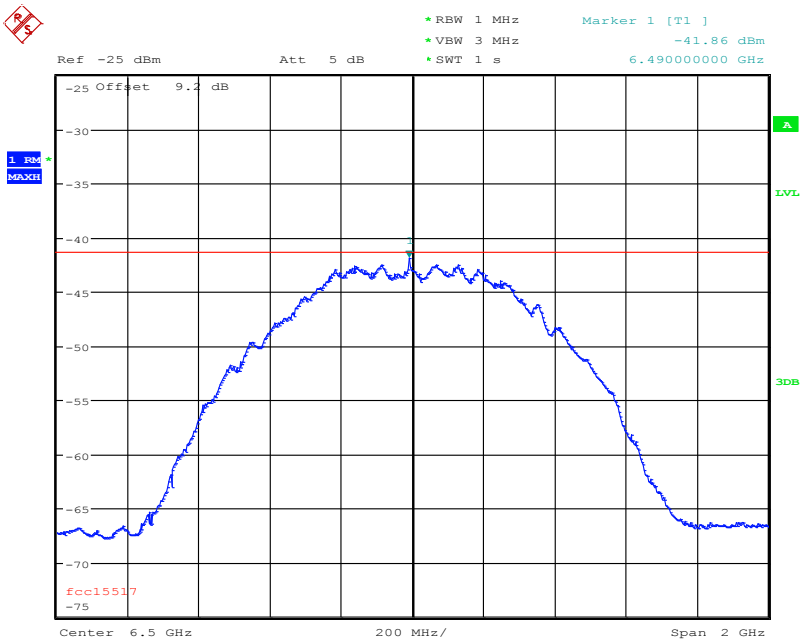
Date: 4.FEB.2016 14:25:03

Plot 52:



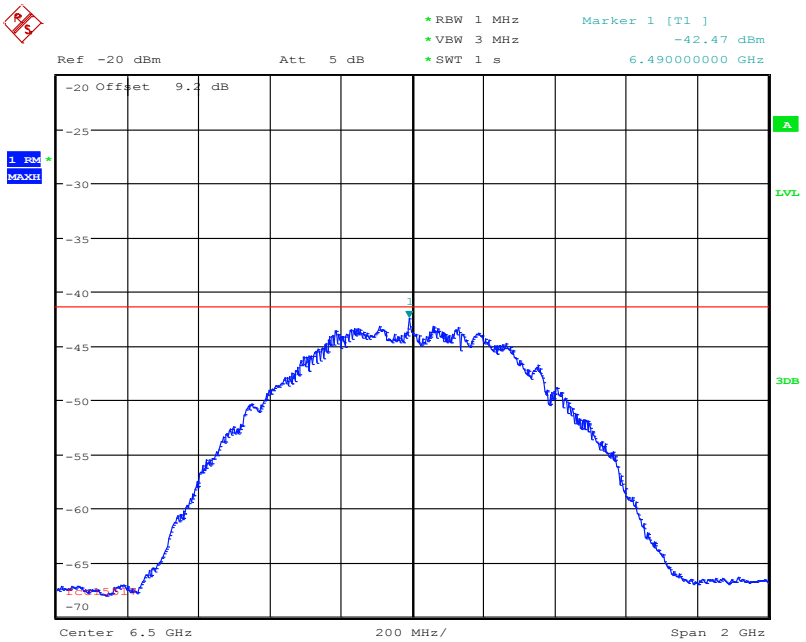
Date: 11.NOV.2015 16:04:33

Plot 53:



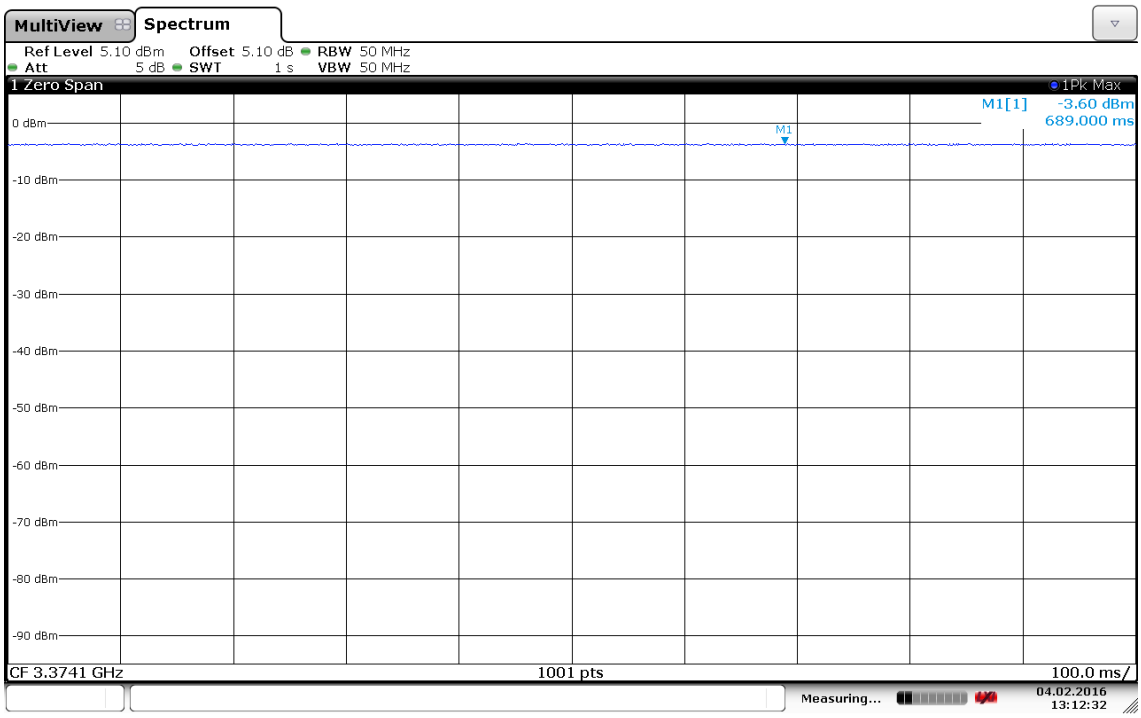
Date: 11.NOV.2015 15:44:29

Plot 54:



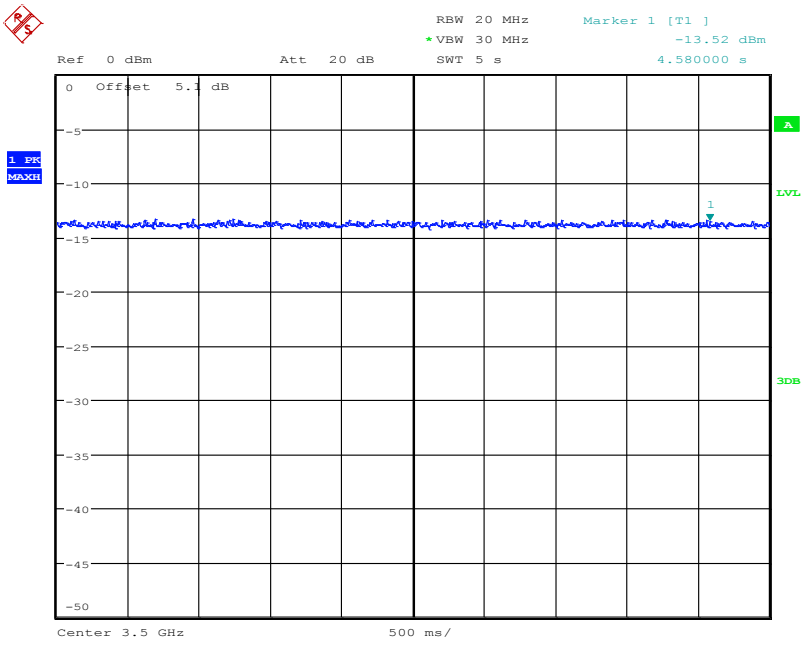
Date: 11.NOV.2015 15:47:25

Plot 55:



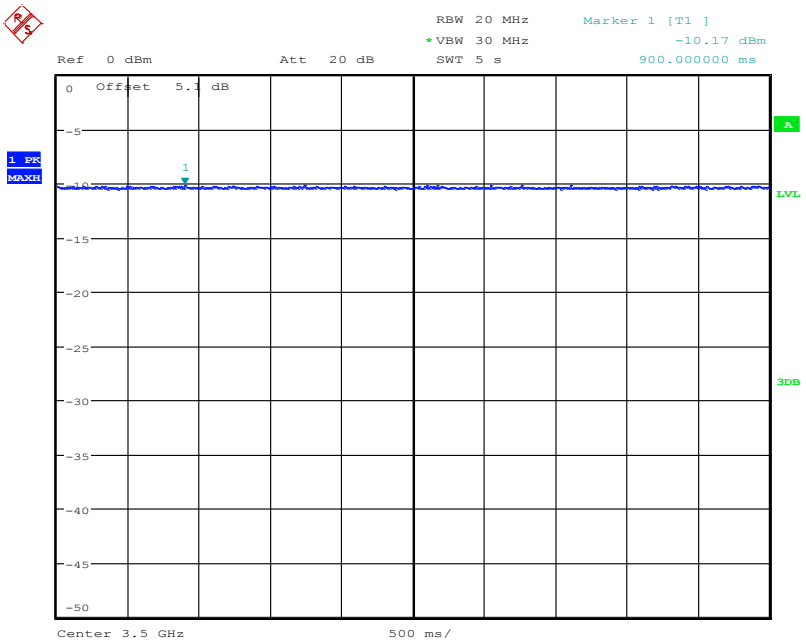
Date: 4.FEB.2016 13:12:32

Plot 56:



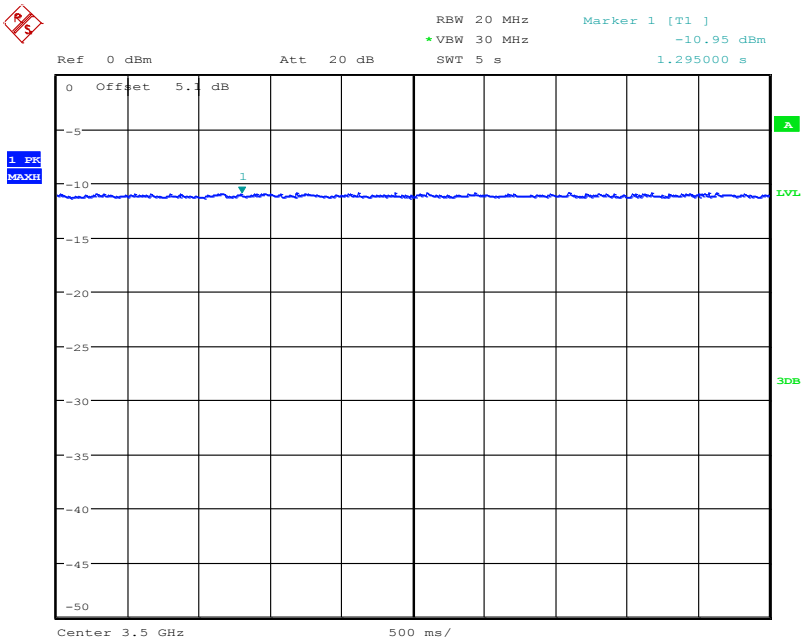
Date: 11.NOV.2015 13:29:57

Plot 57:



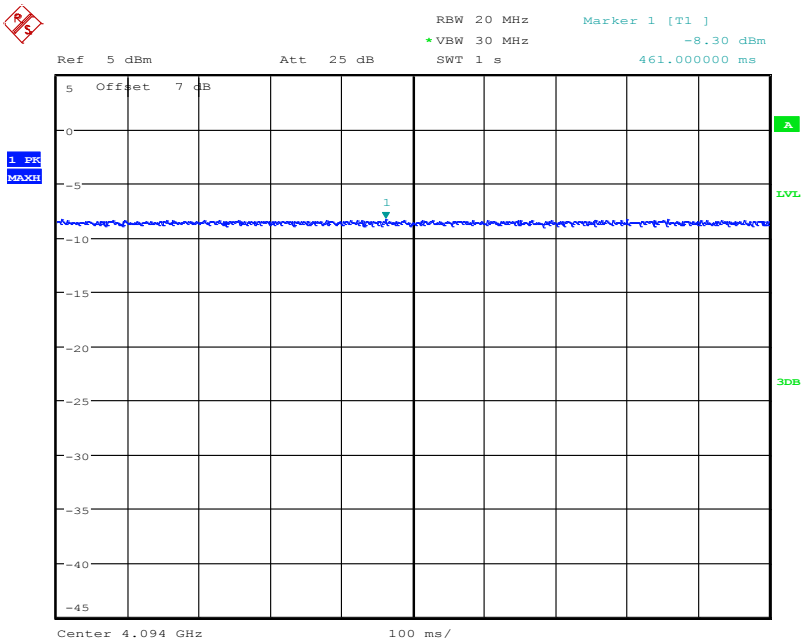
Date: 11.NOV.2015 13:35:53

Plot 58:



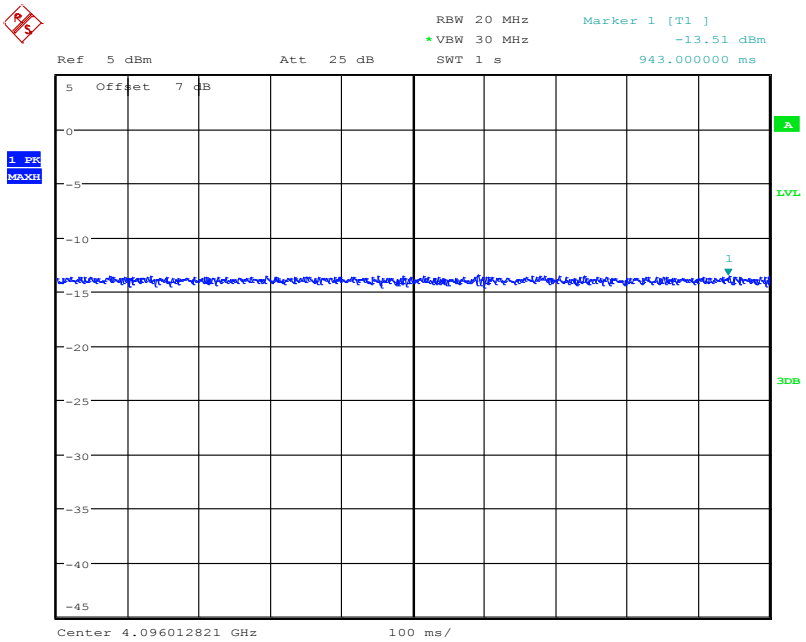
Date: 11.NOV.2015 13:33:18

Plot 59:



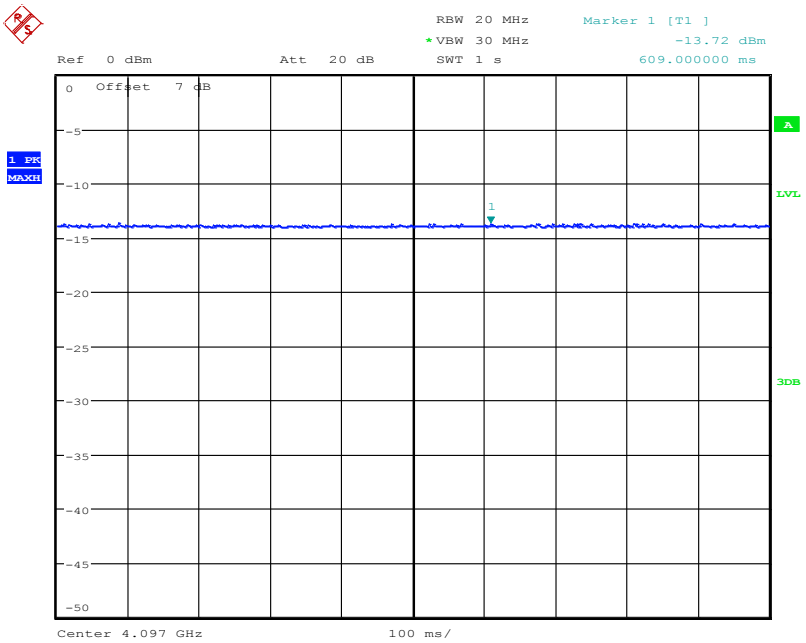
Date: 11.NOV.2015 14:05:48

Plot 60:



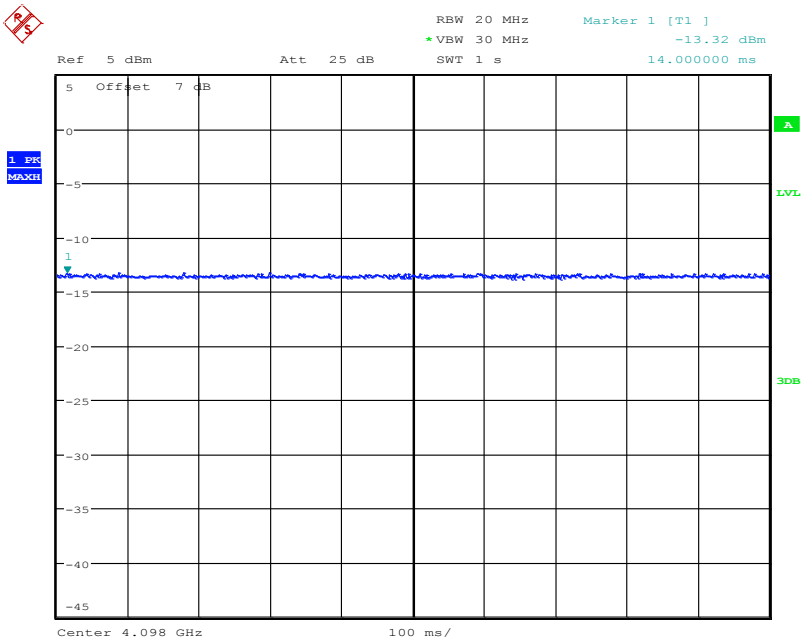
Date: 11.NOV.2015 14:12:51

Plot 61:



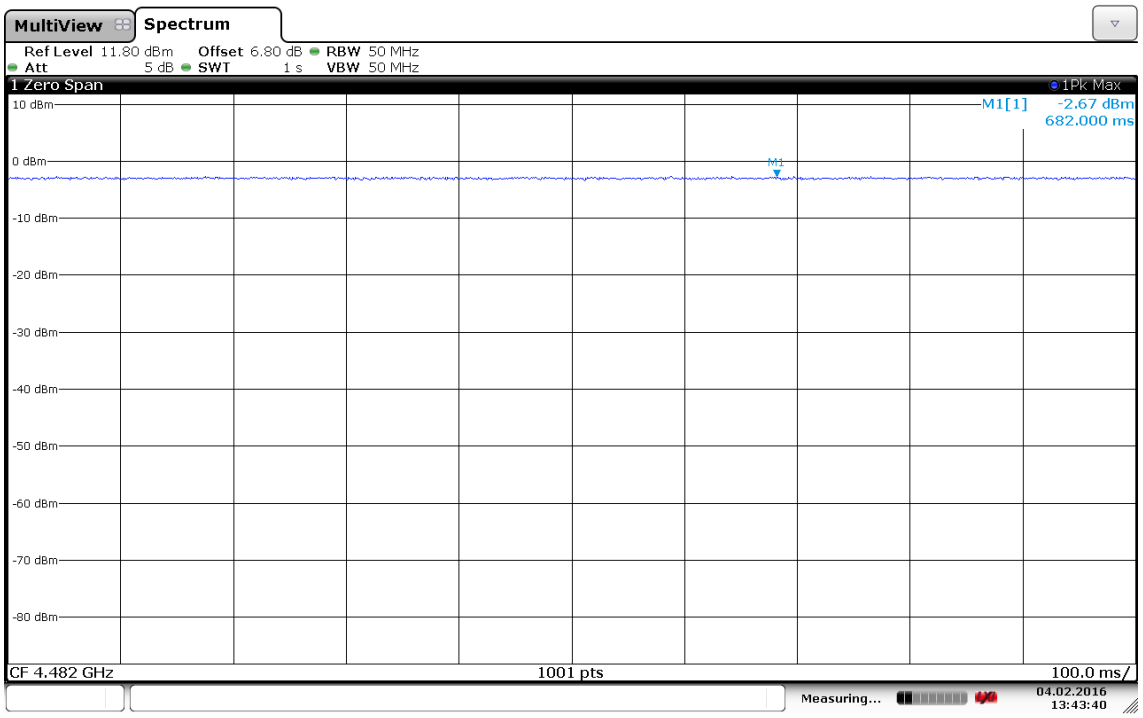
Date: 11.NOV.2015 13:56:00

Plot 62:



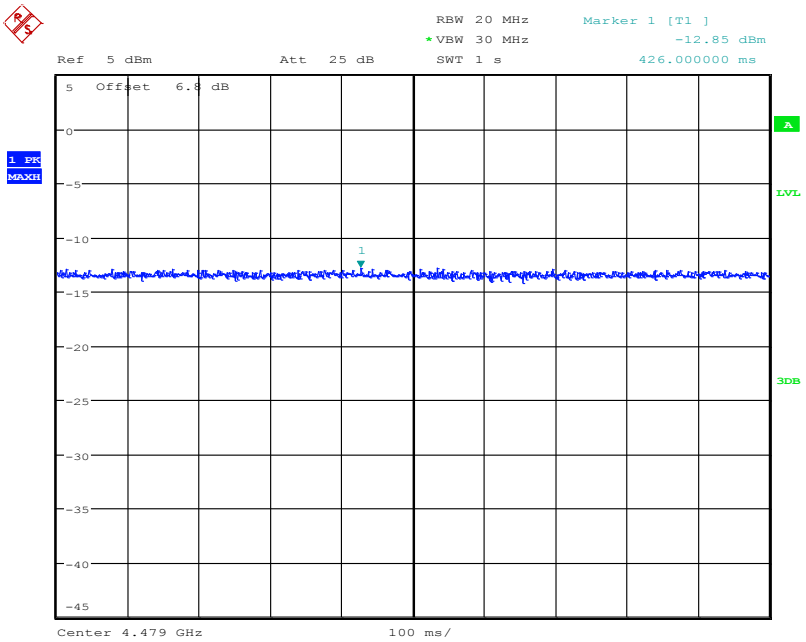
Date: 11.NOV.2015 14:00:37

Plot 63:



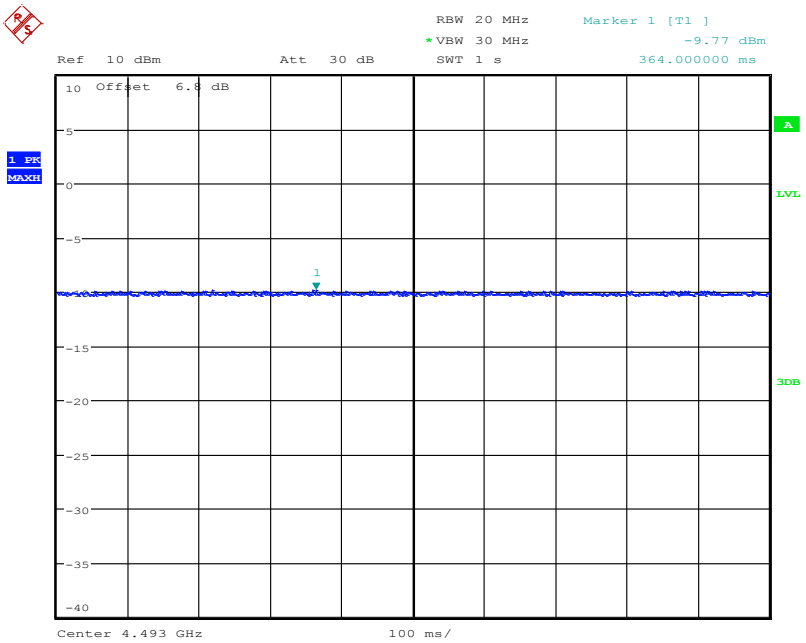
Date: 4.FEB.2016 13:43:40

Plot 64:



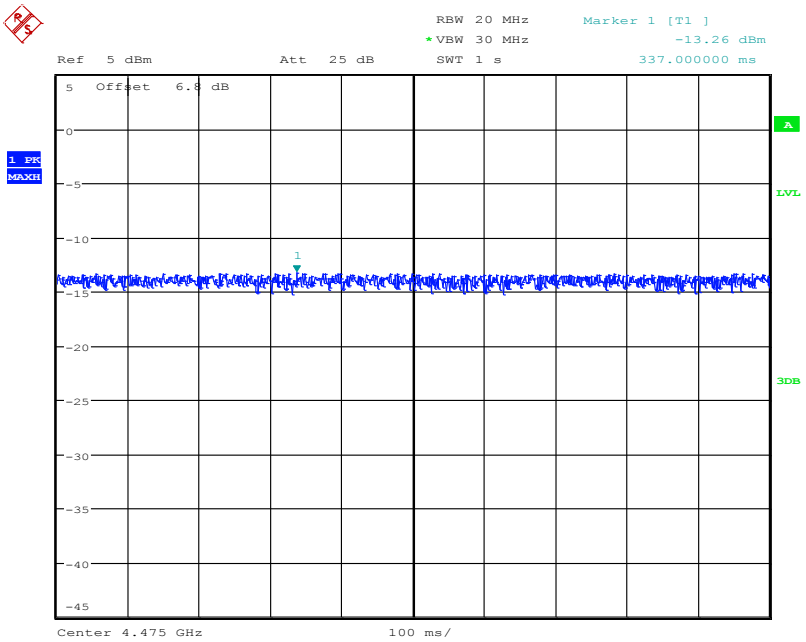
Date: 11.NOV.2015 17:43:17

Plot 65:



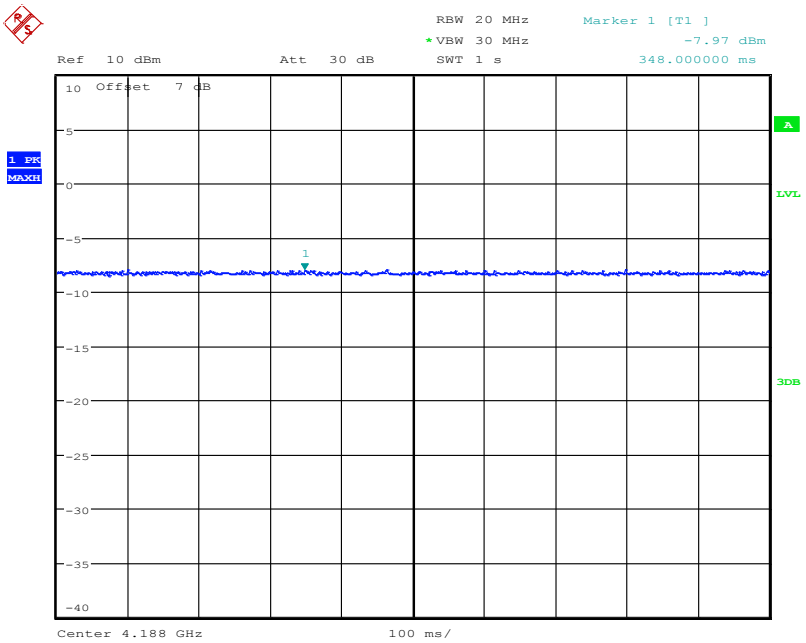
Date: 11.NOV.2015 17:48:49

Plot 66:



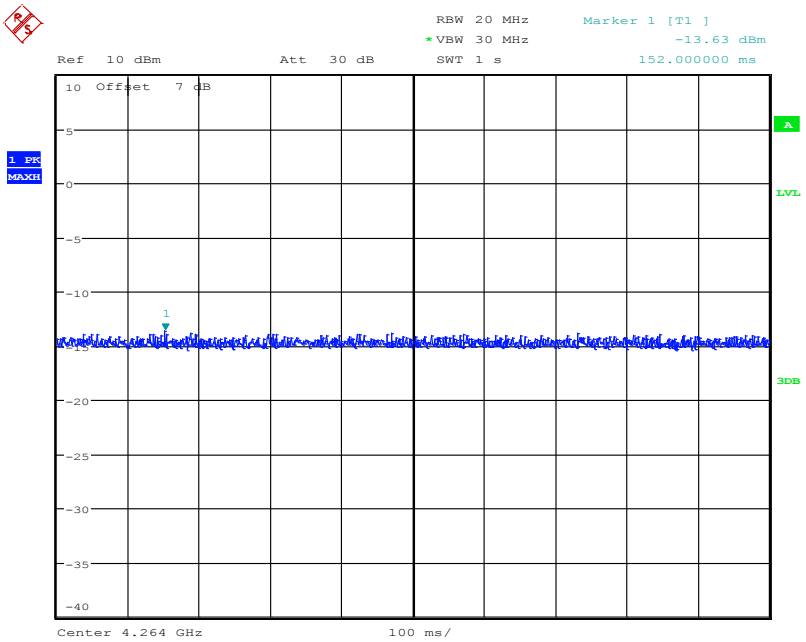
Date: 11.NOV.2015 17:50:59

Plot 67:



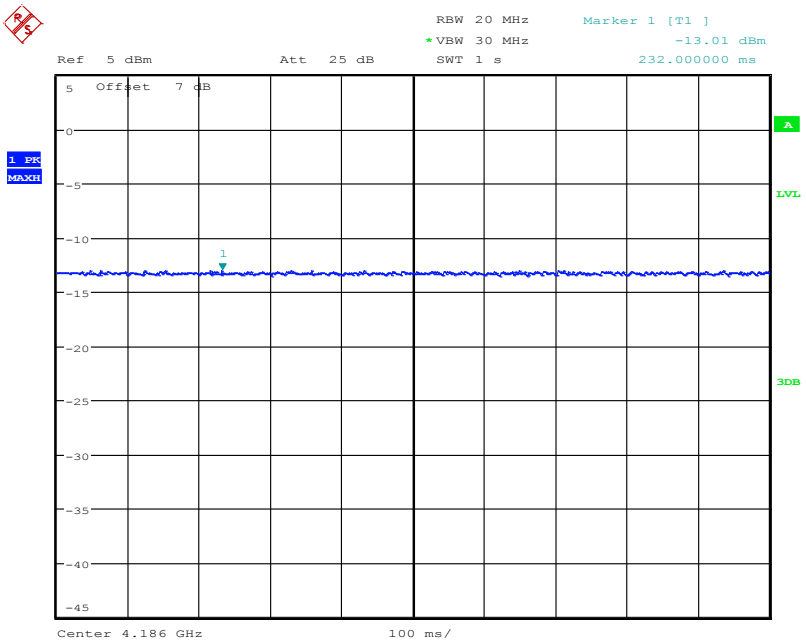
Date: 11.NOV.2015 14:54:41

Plot 68:



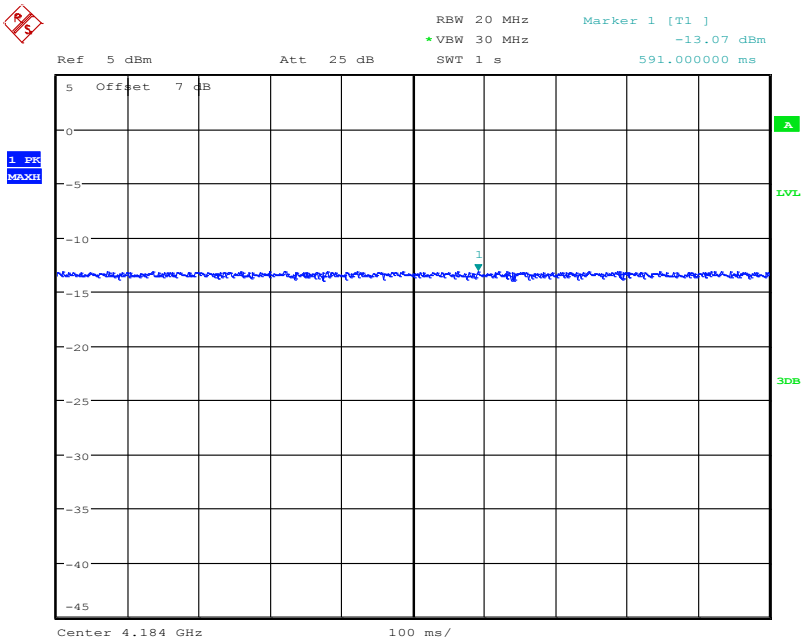
Date: 11.NOV.2015 14:57:47

Plot 69:



Date: 11.NOV.2015 14:46:14

Plot 70:

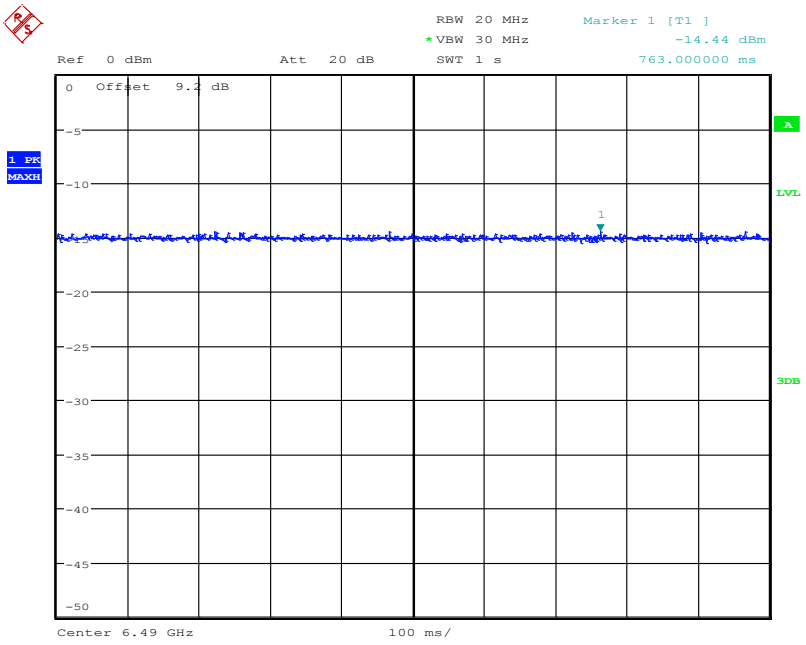


Date: 11.NOV.2015 14:48:37

Plot 71:

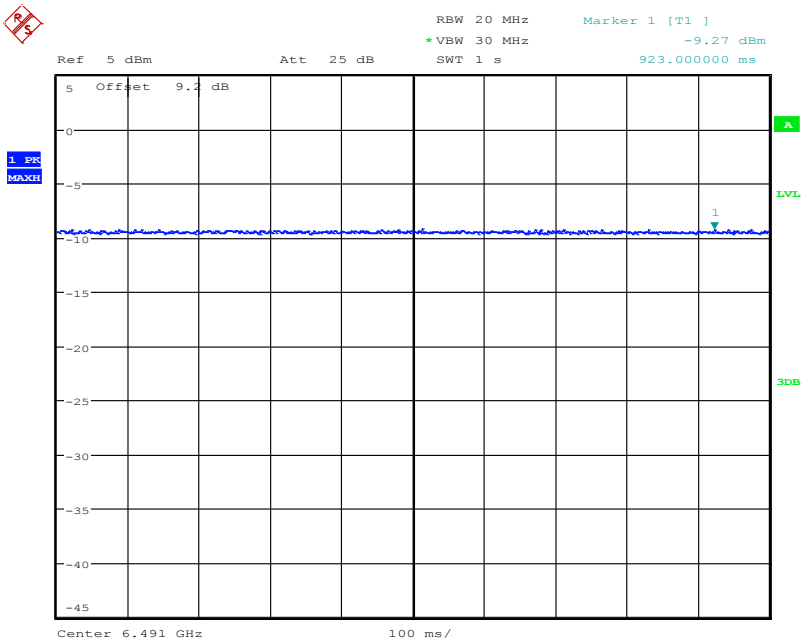
Date: 4.FEB.2016 13:52:38

Plot 72:



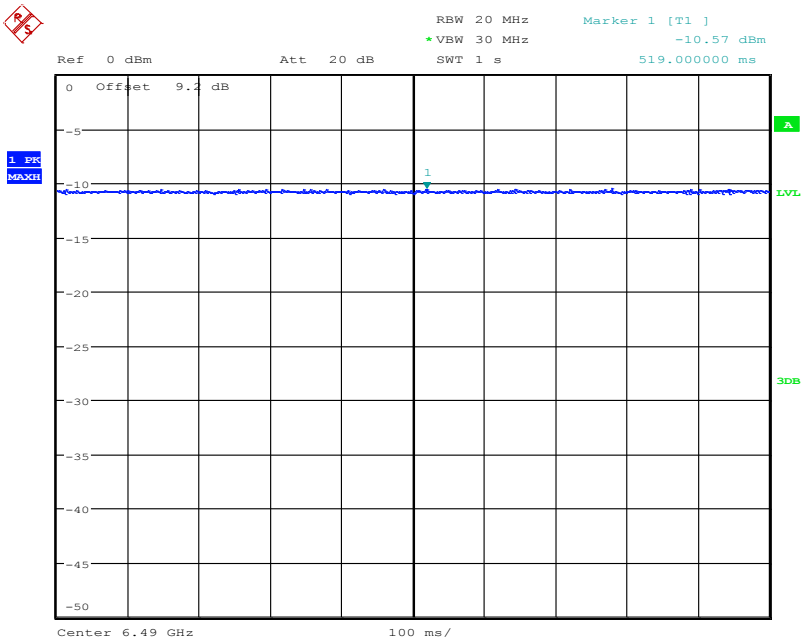
Date: 11.NOV.2015 15:39:37

Plot 73:



Date: 11.NOV.2015 15:10:35

Plot 74:

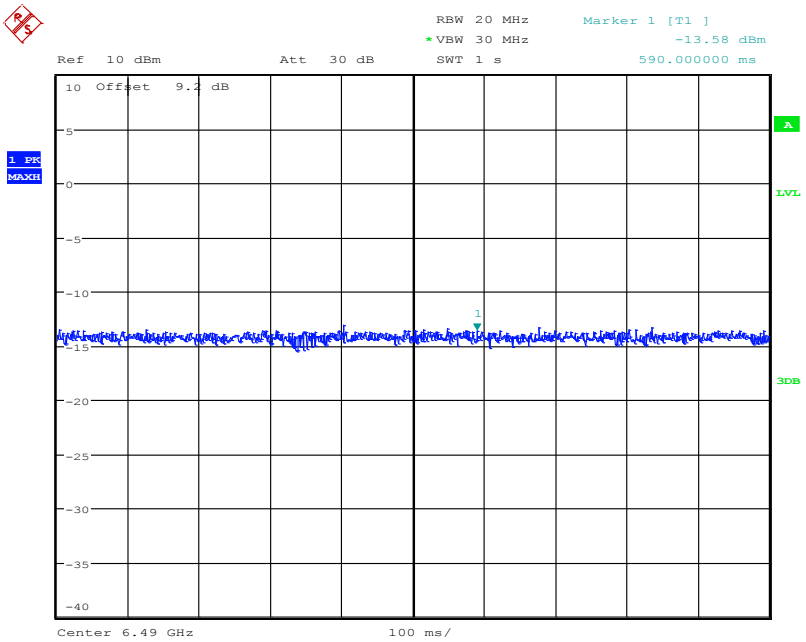


Date: 11.NOV.2015 15:25:17

Plot 75:

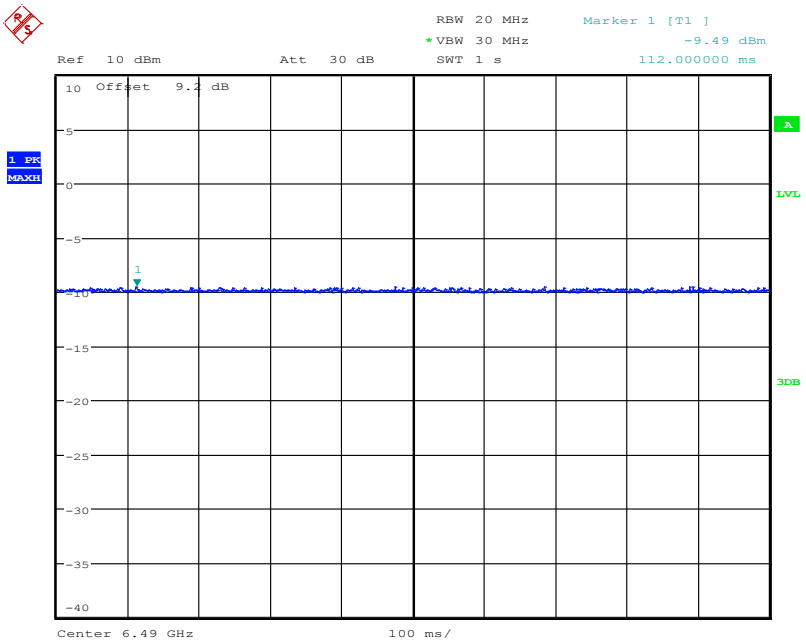
Date: 4.FEB.2016 14:26:34

Plot 76:



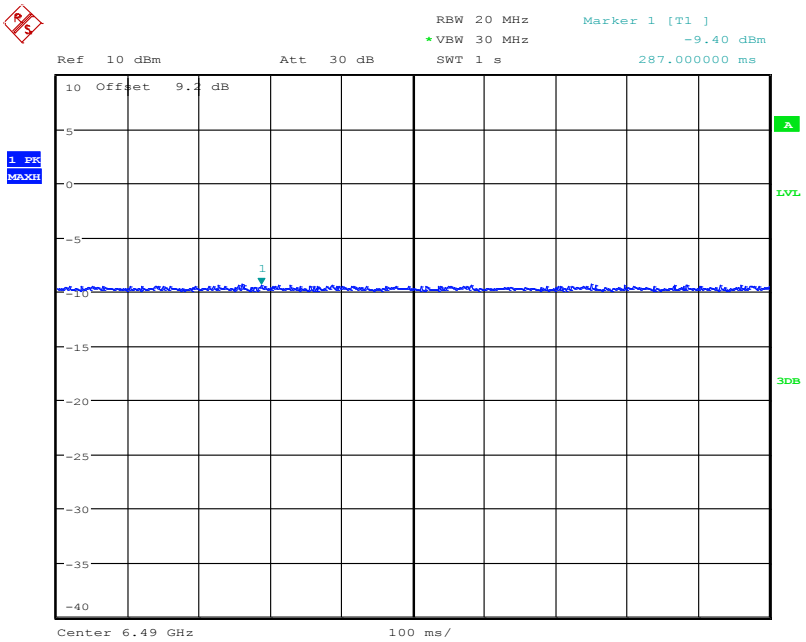
Date: 11.NOV.2015 16:05:22

Plot 77:



Date: 11.NOV.2015 15:45:59

Plot 78:

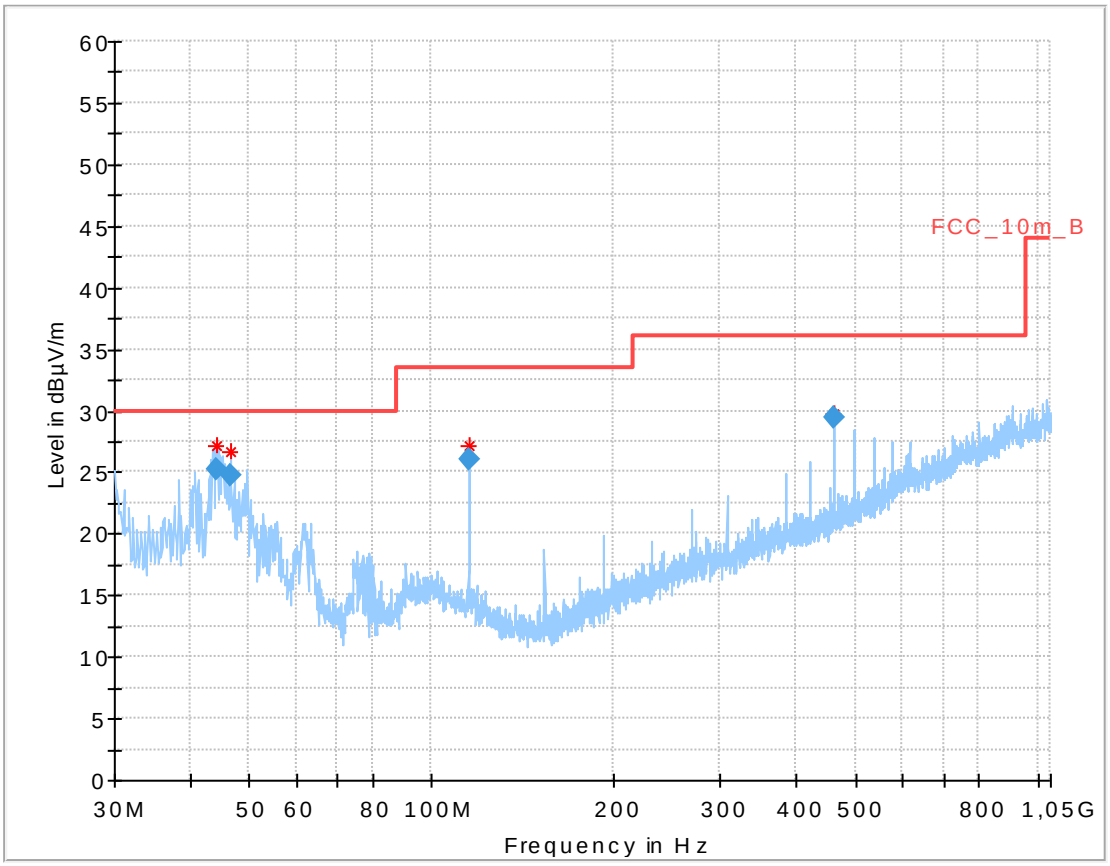


Date: 11.NOV.2015 15:49:57

Plot 79:

Common Information

EUT:	Kedge XV
Serial number:	proto
Test description:	FCC part 15
Operating condition:	TX 3494,4MHz
Operator name:	Kraus
Comment:	powered by PS



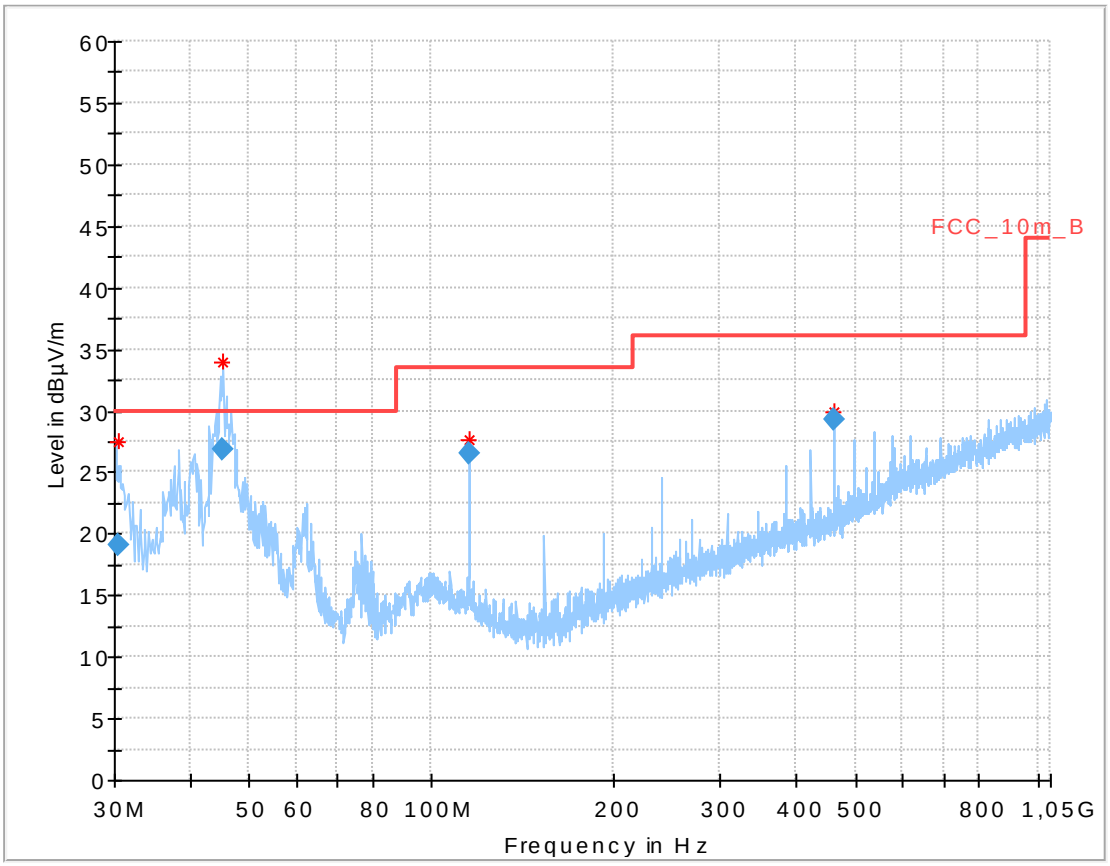
Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
44.256000	25.16	30.00	4.84	1000.0	120.000	103.0	V	275	13.9
46.754550	24.76	30.00	5.24	1000.0	120.000	100.0	V	230	13.4
115.206300	26.01	33.50	7.49	1000.0	120.000	100.0	V	28	10.6
460.795350	29.38	36.00	6.62	1000.0	120.000	272.0	V	2	17.8

Plot 80:

Common Information

EUT:	Kedge XV
Serial number:	proto
Test description:	FCC part 15
Operating condition:	TX 4492,8MHz
Operator name:	Kraus
Comment:	powered by PS



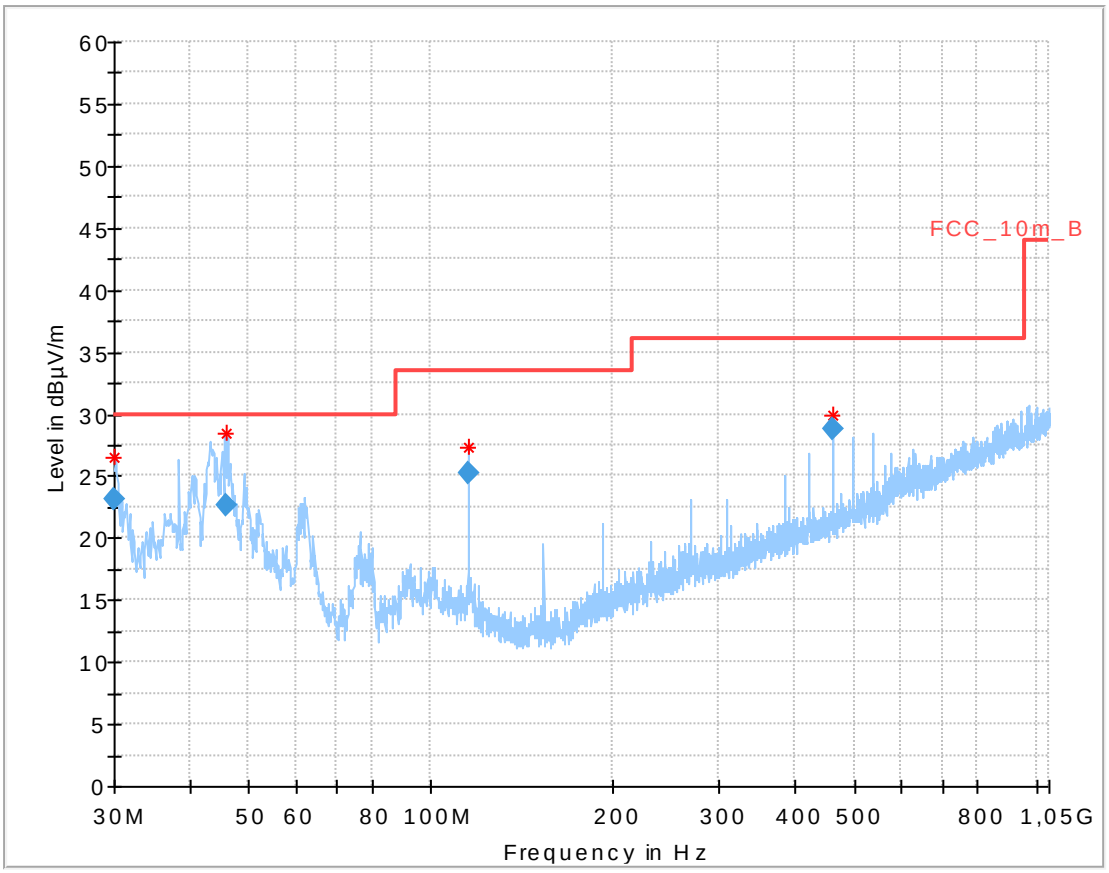
Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.474825	19.15	30.00	10.85	1000.0	120.000	275.0	V	140	13.4
45.221100	26.86	30.00	3.14	1000.0	120.000	100.0	V	275	13.8
115.192650	26.45	33.50	7.05	1000.0	120.000	100.0	V	52	10.6
460.814100	29.22	36.00	6.78	1000.0	120.000	274.0	V	2	17.8

Plot 81:

Common Information

EUT:	Kedge XV
Serial number:	proto
Test description:	FCC part 15
Operating condition:	TX 6489MHz
Operator name:	Kraus
Comment:	powered by PS

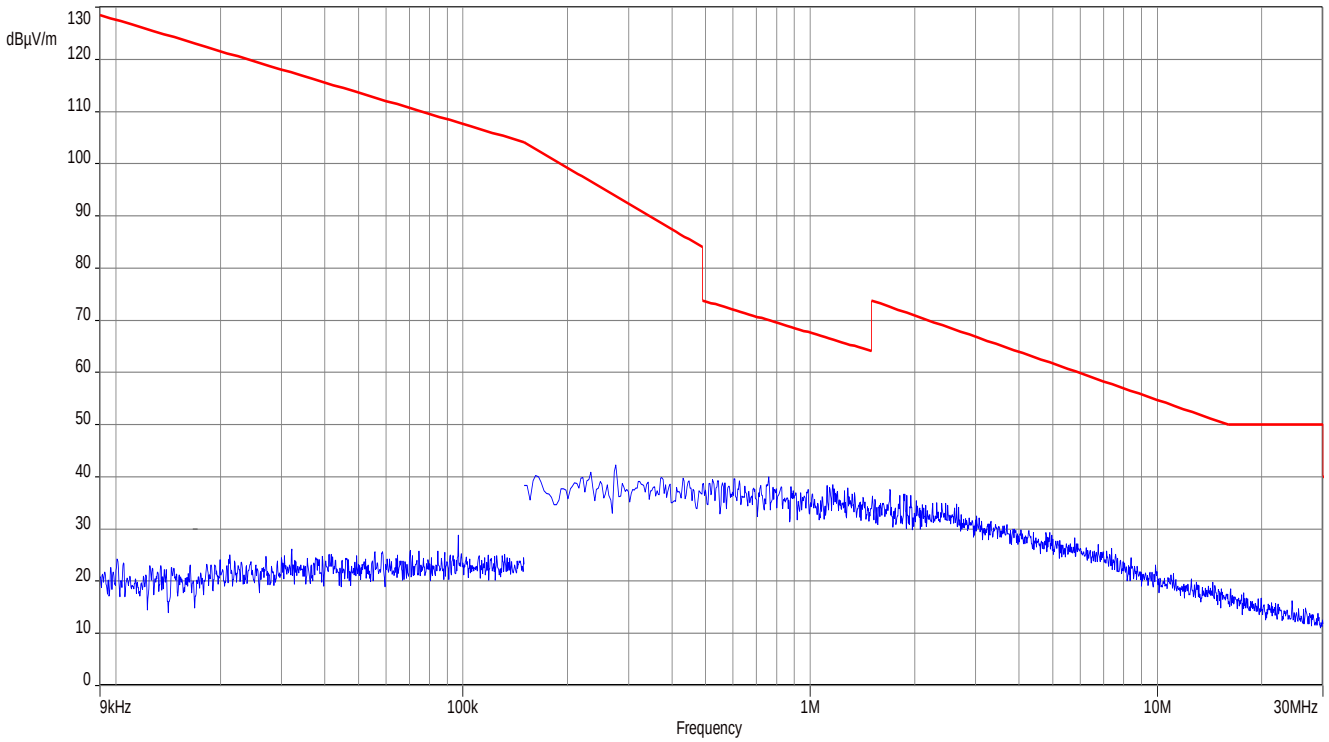


Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.021007	23.18	30.00	6.82	1000.0	120.000	103.0	V	-50	13.3
46.096500	22.58	30.00	7.42	1000.0	120.000	98.0	V	122	13.6
115.203600	25.22	33.50	8.28	1000.0	120.000	98.0	V	117	10.6
460.781100	28.81	36.00	7.19	1000.0	120.000	274.0	V	1	17.8

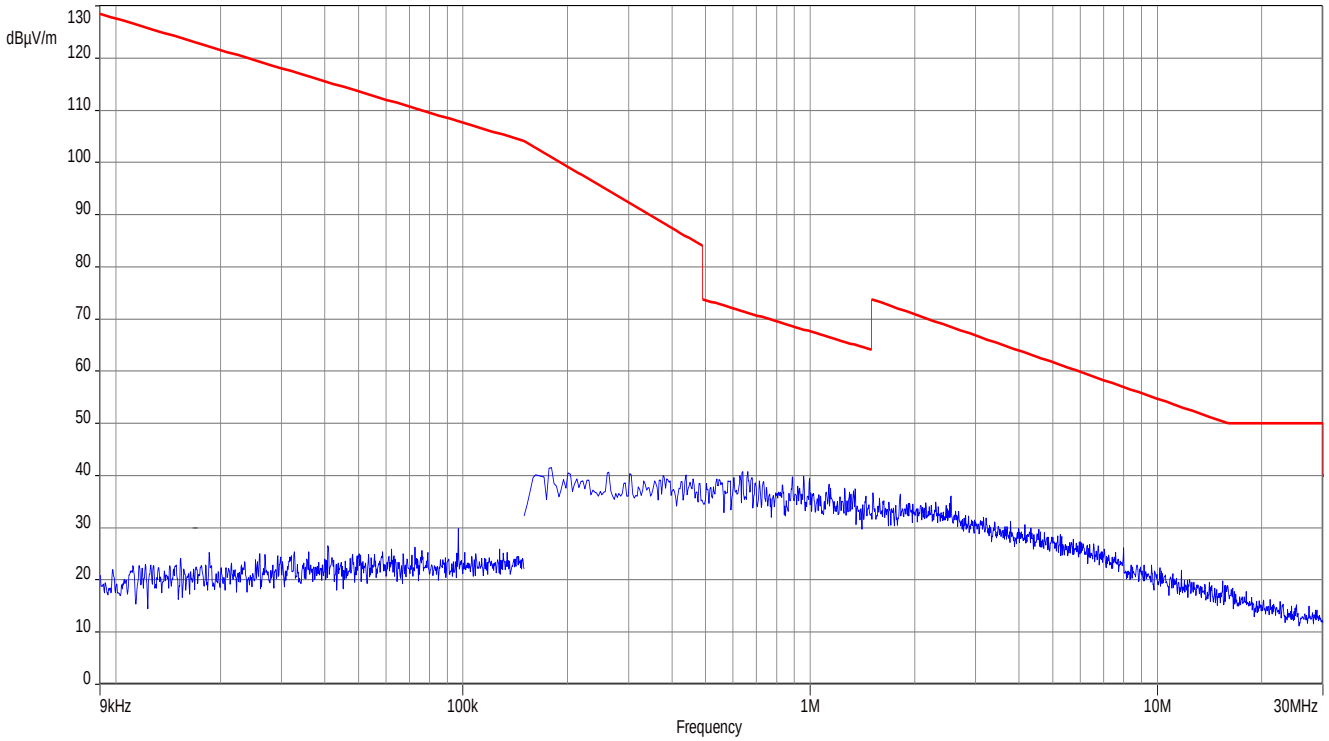
Plot 82: TX magnetic Channel 1 (bottom), RBW: 200 Hz/ 9kHz

RBW: 200 Hz, 9 kHz – 150 kHz
RBW: 9 kHz, 150 kHz – 30 MHz



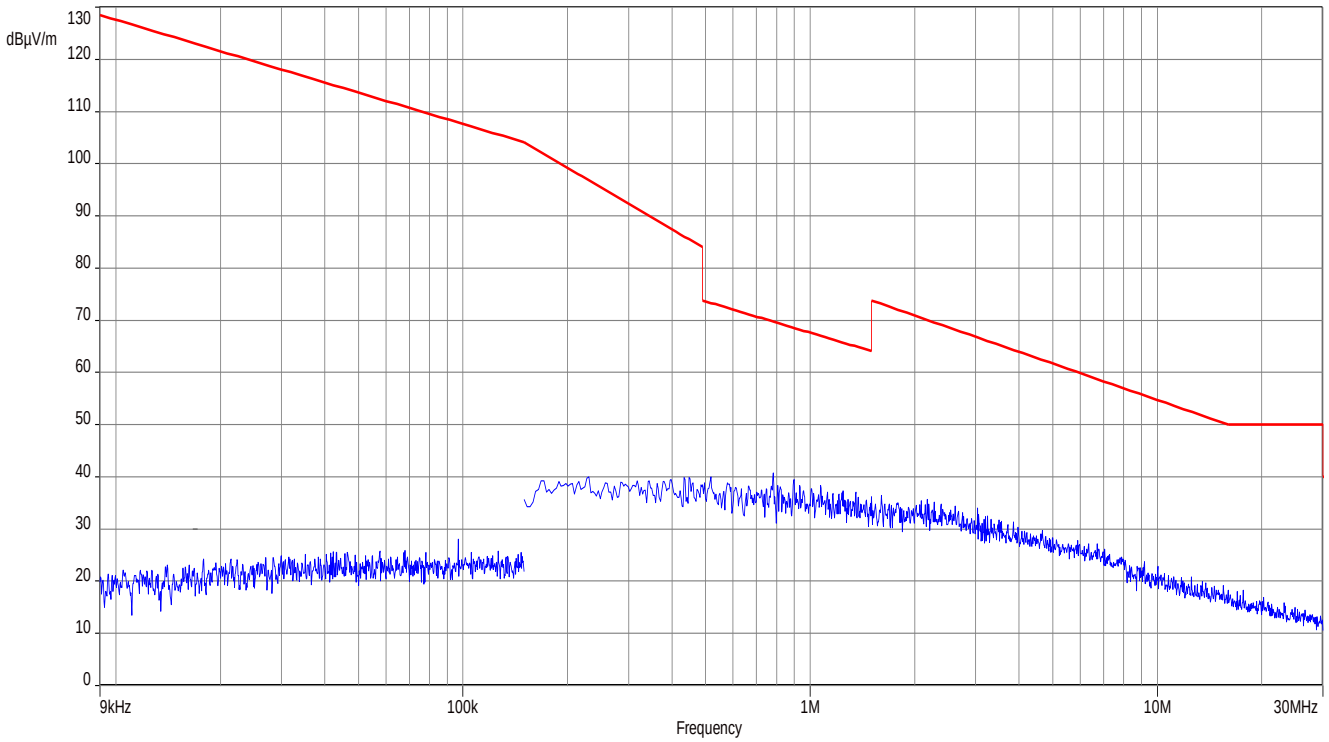
Plot 83: TX magnetic Channel 3 (middle), RBW: 200 Hz/ 9kHz

RBW: 200 Hz, 9 kHz – 150 kHz
RBW: 9 kHz, 150 kHz – 30 MHz



Plot 84: TX magnetic Channel 6 (top), RBW: 200 Hz/ 9kHz

RBW: 200 Hz, 9 kHz – 150 kHz
RBW: 9 kHz, 150 kHz – 30 MHz



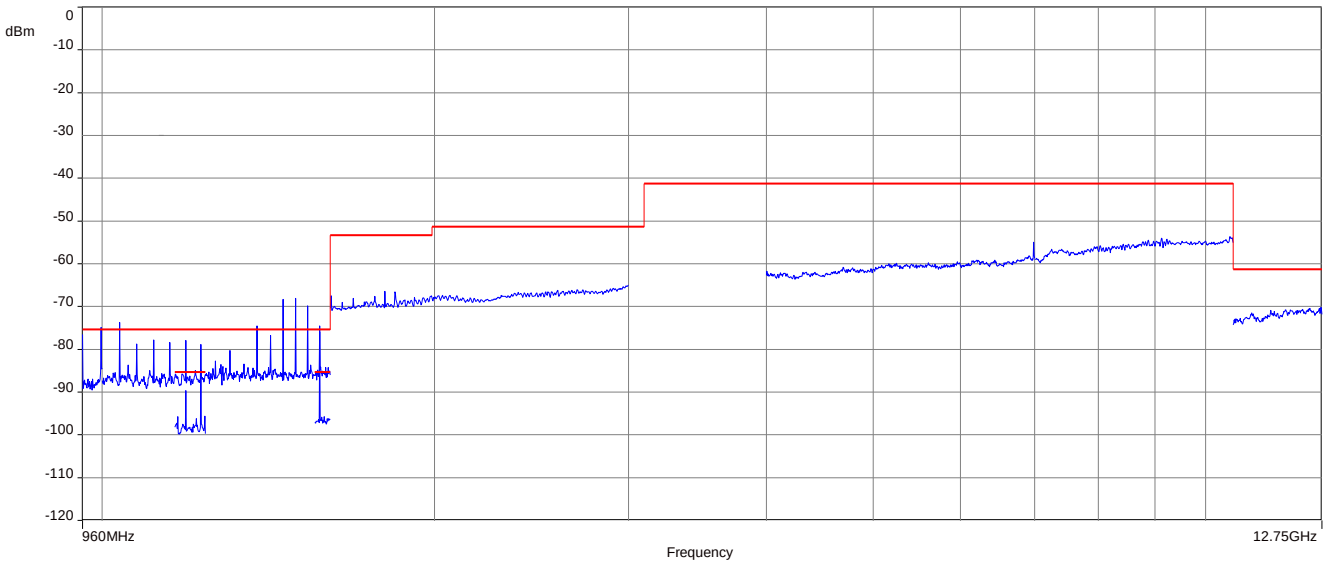
Plot 85: TX radiated, 1 GHz to 12.75 GHz, channel 1 (bottom)

Prescan:

RBW: 10 kHz 960 MHz – 1.61 GHz
10.6 GHz – 12.75 GHz

RBW: 1 MHz 1.61 GHz – 10-6 GHz

RBW: 1kHz 1.164 GHz – 1.24 GHz
1.559 GHz – 1.61 GHz



Spurious Emission Level (dBm)			
Frequency (MHz)	**RBW**	**Detector**	**Level (dBm)**
1497.577	1MHz	RMS	-61.4
1075.091	1MHz	RMS	-63.8
1574.397	1 kHz	RMS	-75.9
	Measurement uncertainty		± 3dB

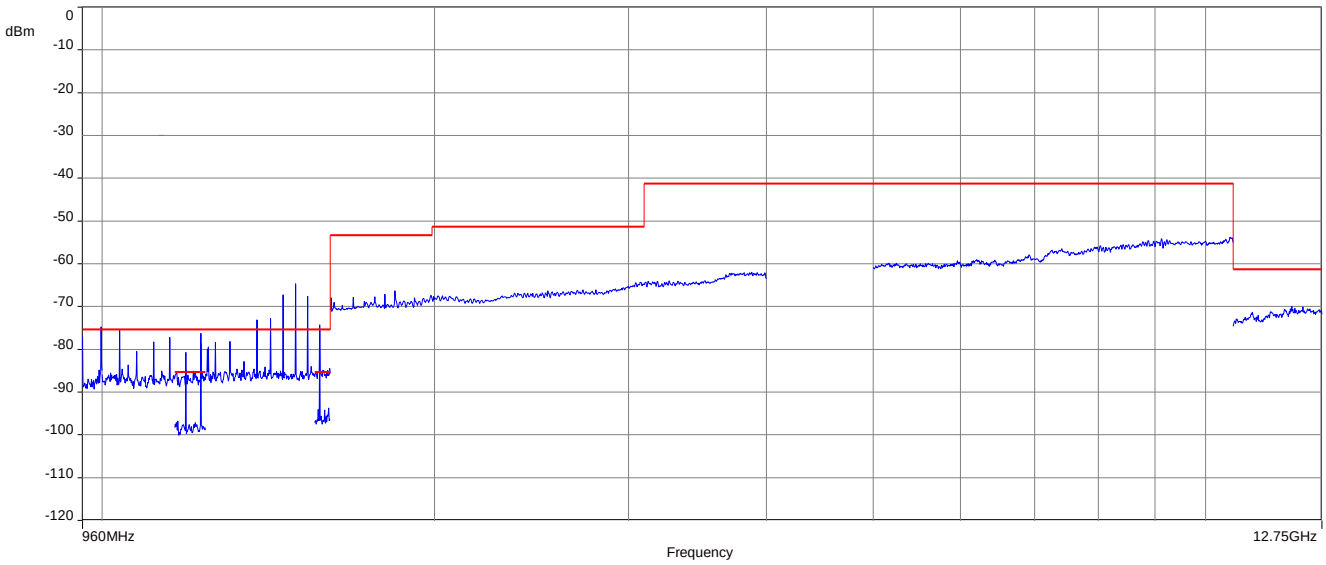
Plot 86: TX radiated, 1 GHz to 12.75 GHz, channel 3 (middle)

Prescan:

RBW: 10 kHz 960 MHz – 1.61 GHz
10.6 GHz – 12.75 GHz

RBW: 1 MHz 1.61 GHz – 10-6 GHz

RBW: 1kHz 1.164 GHz – 1.24 GHz
1.559 GHz – 1.61 GHz



Spurious Emission Level (dBm)			
Frequency (MHz)	**RBW**	**Detector**	**Level (dBm)**
1036.783	1MHz	RMS	-65.3
1497.699	1MHz	RMS	-58.0
1574.437	1 kHz	RMS	-74.3
	Measurement uncertainty		± 3dB

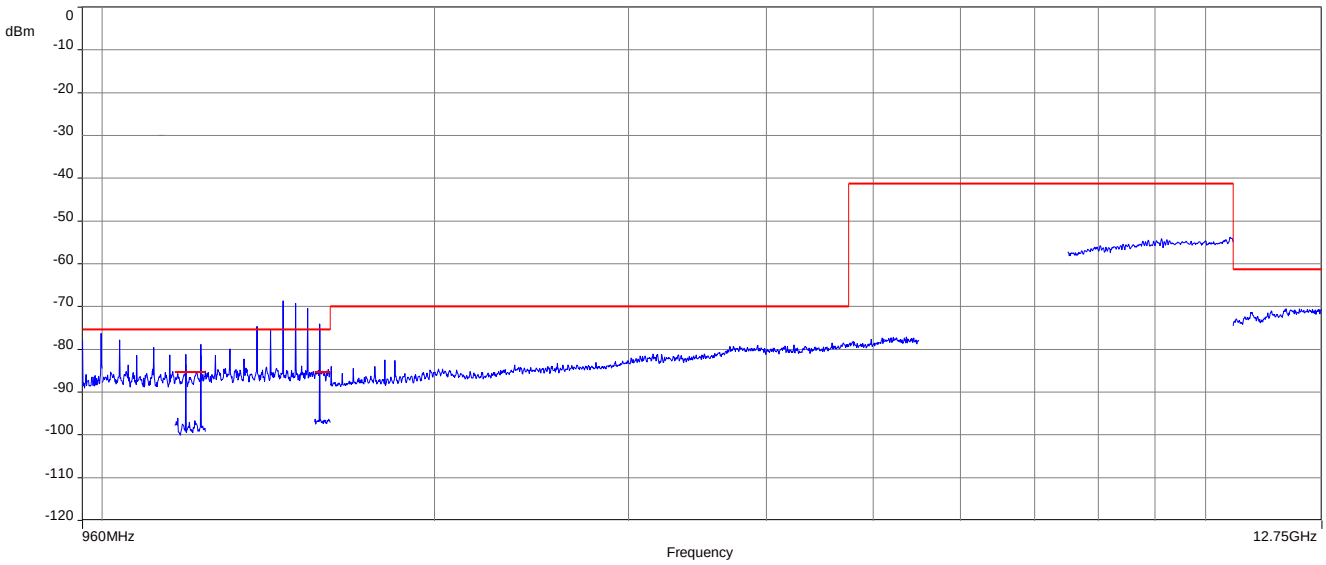
Plot 87: TX radiated, 1 GHz to 12.75 GHz, channel 6 (top), RSS 220

Prescan:

RBW: 10 kHz 960 MHz – 1.61 GHz
10.6 GHz – 12.75 GHz

RBW: 1 MHz 1.61 GHz – 10-6 GHz

RBW: 1kHz 1.164 GHz – 1.24 GHz
1.559 GHz – 1.61 GHz



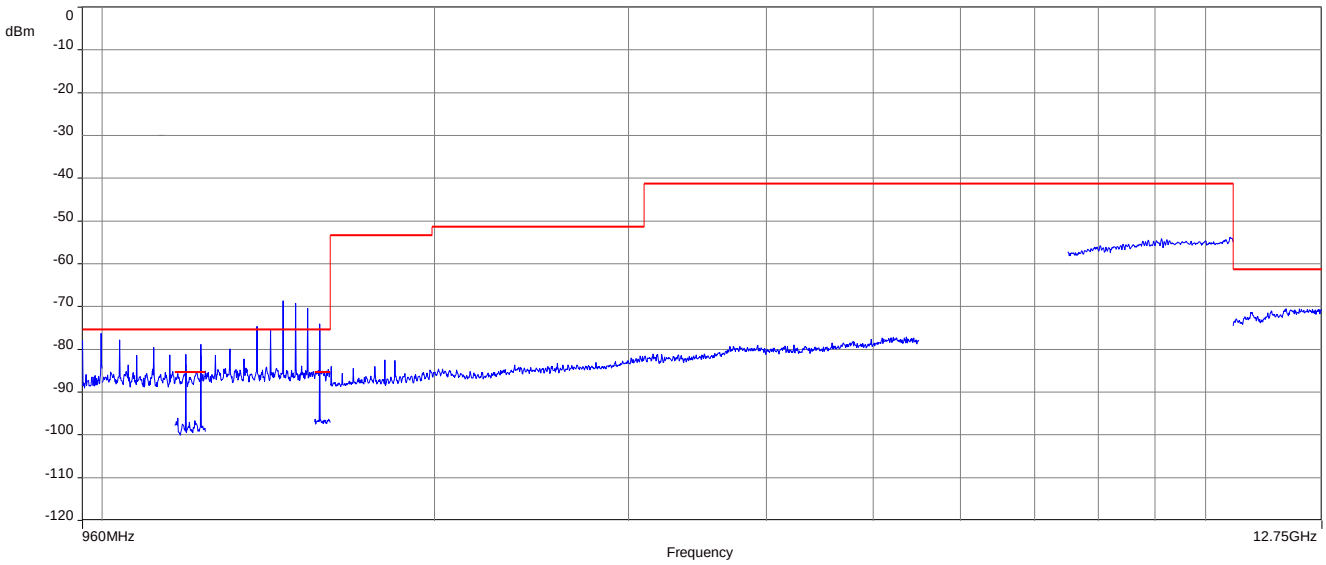
Plot 88: TX radiated, 1 GHz to 12.75 GHz, channel 6 (top), FCC Part 15

Prescan:

RBW: 10 kHz 960 MHz – 1.61 GHz
10.6 GHz – 12.75 GHz

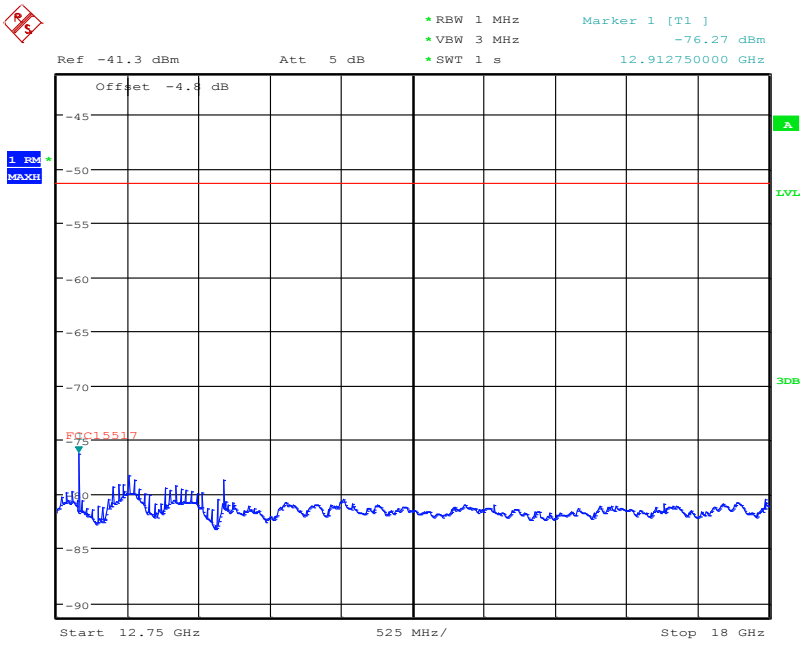
RBW: 1 MHz 1.61 GHz – 10-6 GHz

RBW: 1kHz 1.164 GHz – 1.24 GHz
1.559 GHz – 1.61 GHz



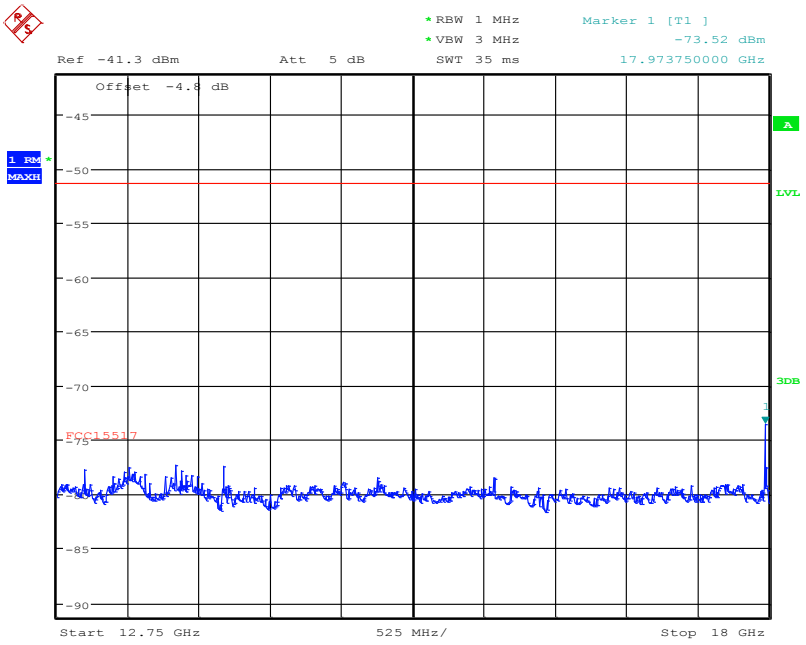
Spurious Emission Level (dBm)			
Frequency (MHz)	**RBW**	**Detector**	**Level (dBm)**
1075.274	1MHz	RMS	-65.486
1459.269	1MHz	RMS	-61.728
1574.437	1 kHz	RMS	-74.023
	Measurement uncertainty		± 3dB

Plot 89: TX radiated, 12.75 GHz to 18 GHz, channel 1 (bottom)



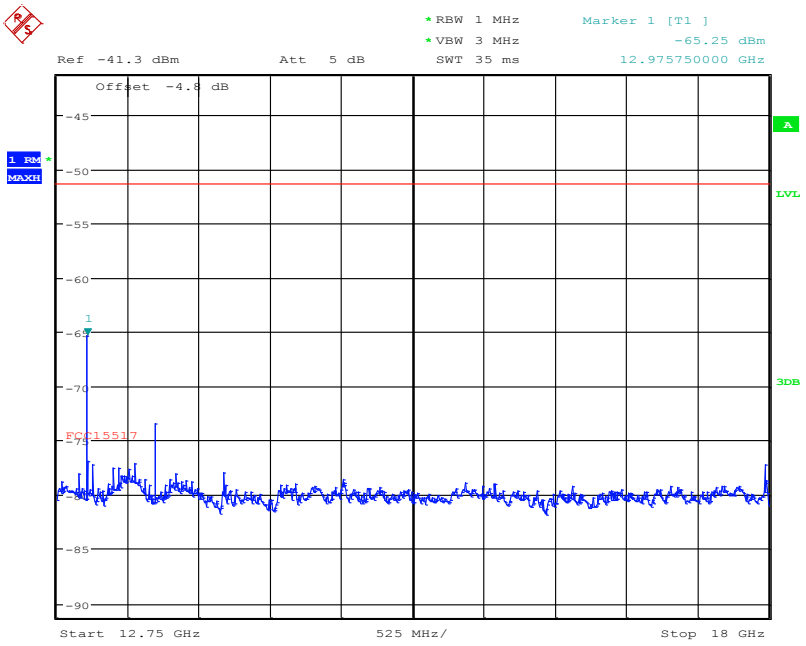
Date: 12.NOV.2015 10:46:45

Plot 90: TX radiated, 12.75 GHz to 18 GHz, channel 3 (middle)



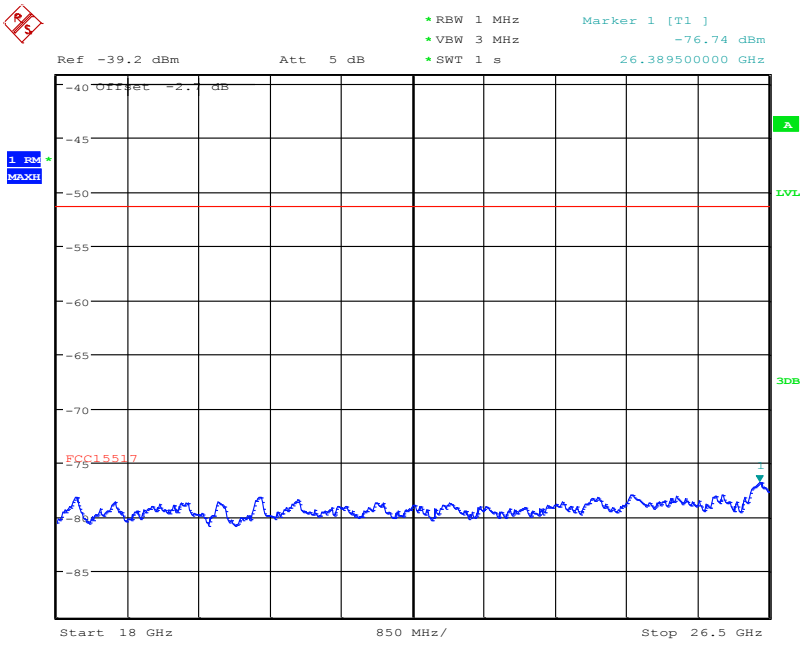
Date: 12.NOV.2015 11:01:54

Plot 91: TX radiated, 12.75 GHz to 18 GHz, channel 6 (top)



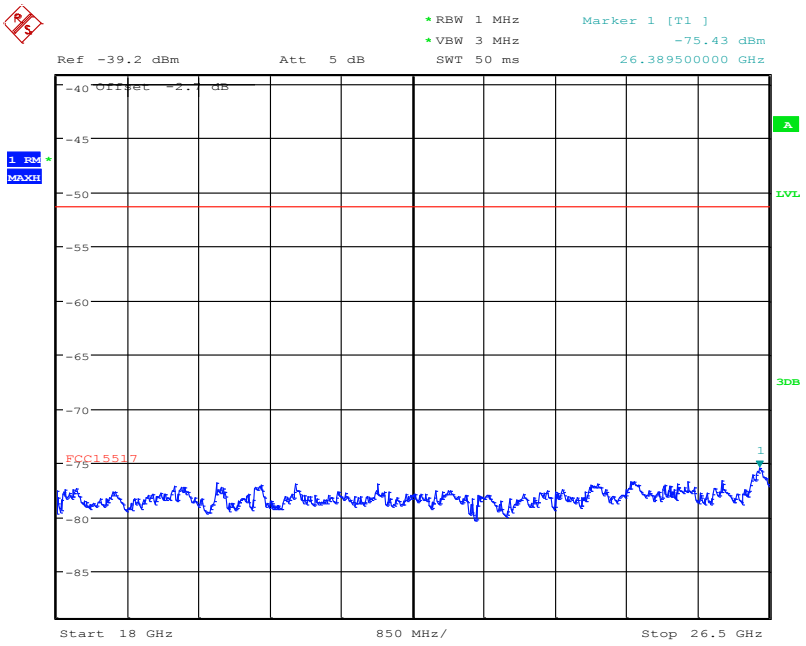
Date: 12.NOV.2015 11:04:52

Plot 92: TX radiated, 18 GHz to 26.5 GHz, channel 1 (bottom)



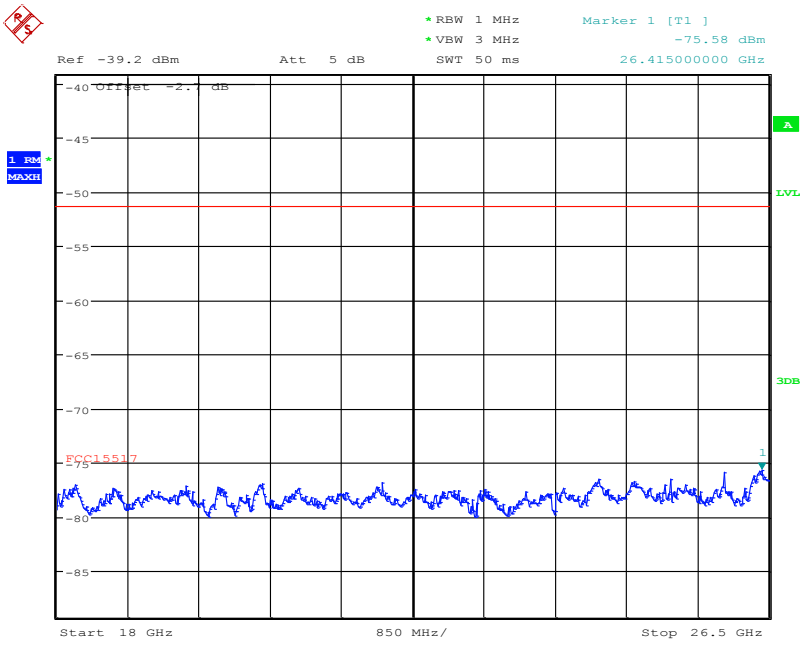
Date: 12.NOV.2015 10:50:33

Plot 93: TX radiated, 18 GHz to 26.5 GHz, channel 3 (middle)



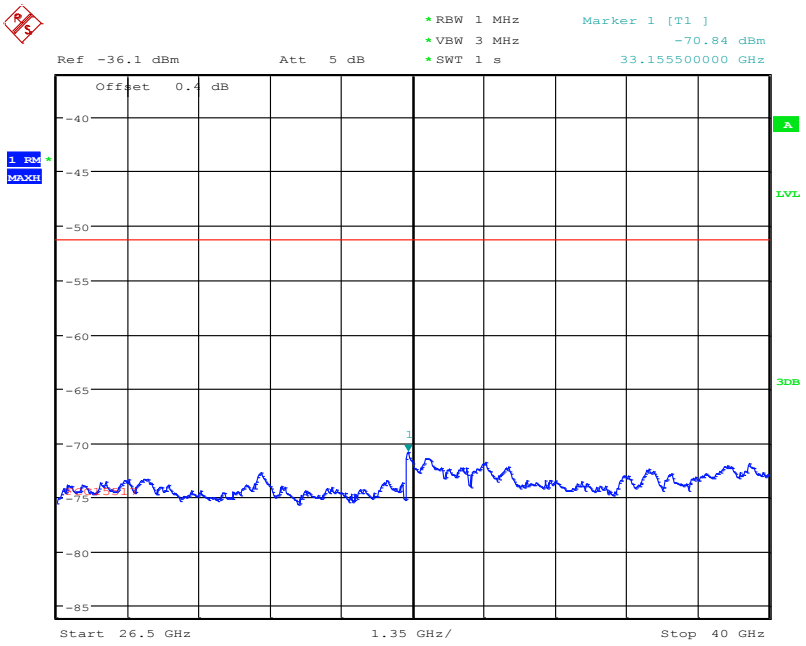
Date: 12.NOV.2015 10:59:37

Plot 94: TX radiated, 18 GHz to 26.5 GHz, channel 6 (top)



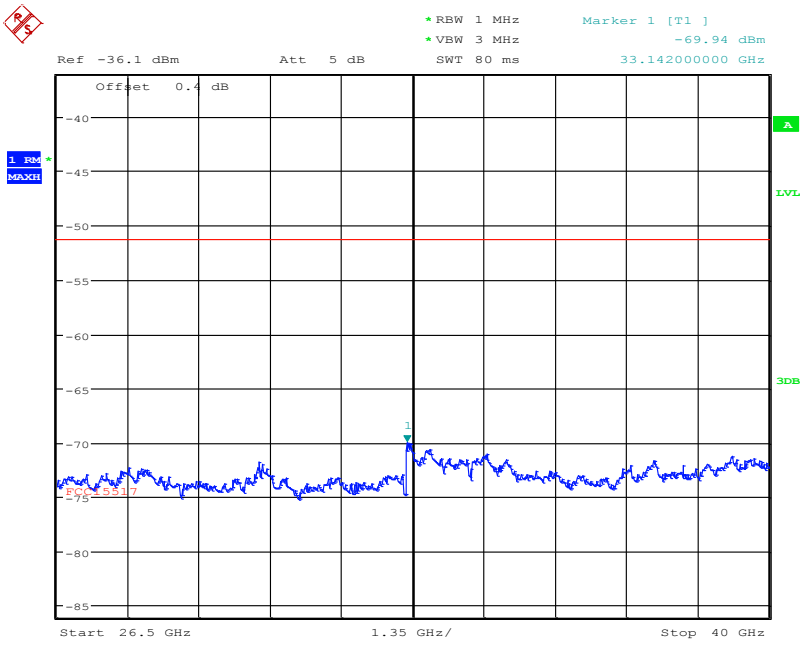
Date: 12.NOV.2015 11:07:17

Plot 95: TX radiated, 26.5 GHz to 40 GHz, channel 1 (bottom)



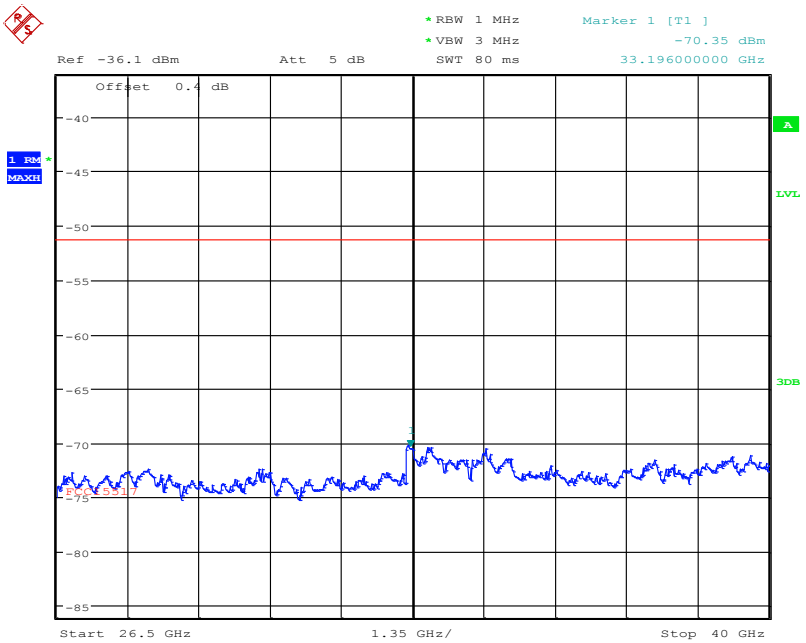
Date: 12.NOV.2015 10:54:18

Plot 96: TX radiated, 26.5 GHz to 40 GHz, channel 3 (middle)



Date: 12.NOV.2015 10:57:31

Plot 97: TX radiated, 26.5 GHz to 40 GHz, channel 6 (top)

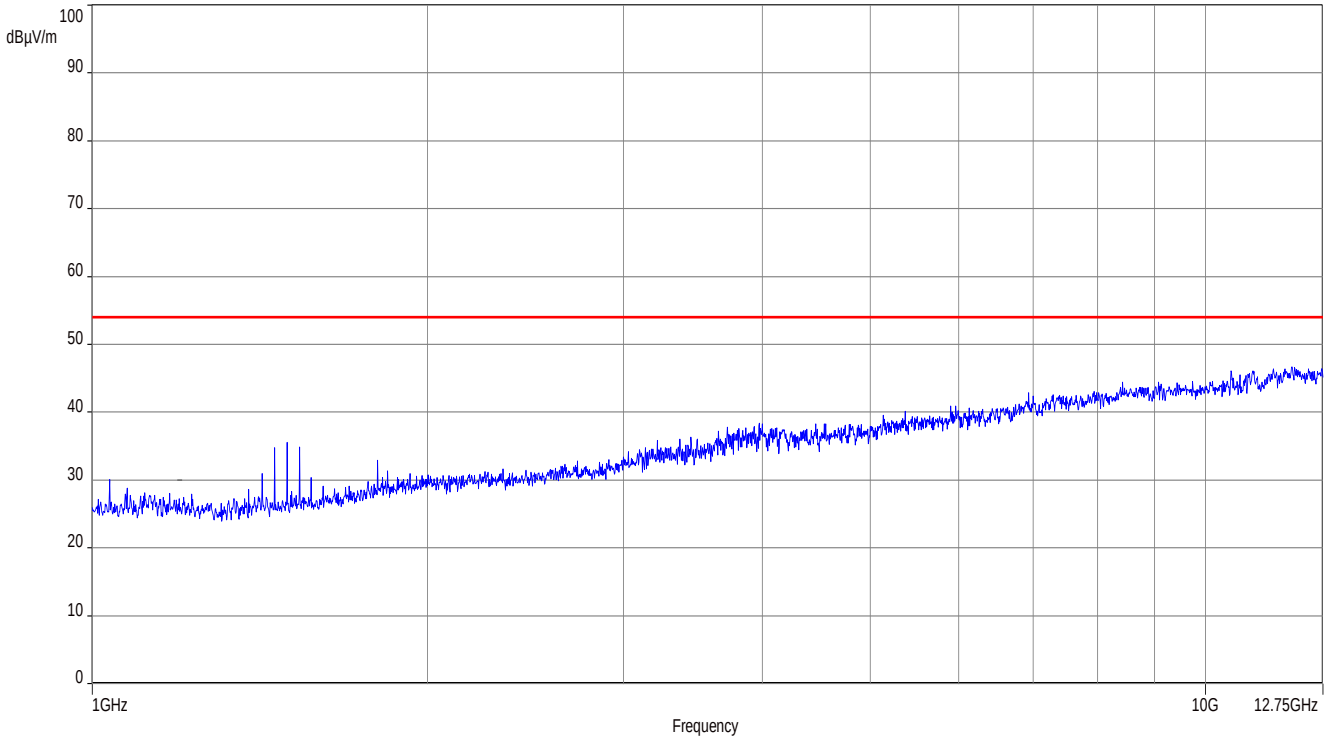


Date: 12.NOV.2015 11:08:59

Plot 98: RX radiated, 1 GHz to 12.75 GHz

Prescan:

RBW: 100 kHz 1 GHz – 12.75 GHz



10.3 RX spurious emissions AC line conducted < 30 MHz

Description:

Measurements have been performed in TX mode as a worst case scenario. Both power lines, phase and neutral line, are measured. Found peaks are remeasured with average and quasi peak detection to show compliance to the limits.

Measurement:

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

Limits:

FCC		IC
CFR Part 15.107(a)		ICES-003, Issue 5
RX Spurious Emissions Conducted < 30 MHz		
Frequency (MHz)	Quasi-Peak (dBµV/m)	Average (dBµV/m)
0.15 – 0.5	66 to 56*	56 to 46*
0.5 – 5	56	46
5 – 30.0	60	50

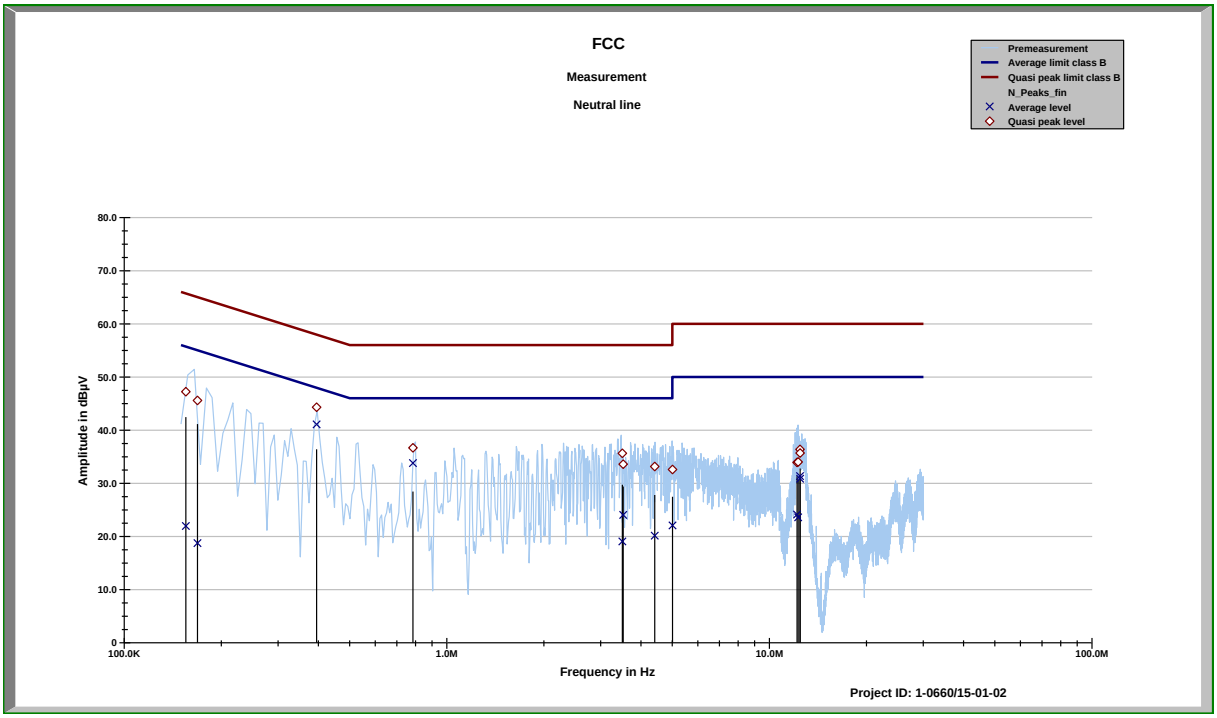
*Decreases with the logarithm of the frequency

Result:

RX Spurious Emissions Conducted < 30 MHz [dBµV/m]		
F [MHz]	Detector	Level [dBµV/m]
see tables below		
Measurement uncertainty	± 3 dB	

Verdict: complies

Plot 99:



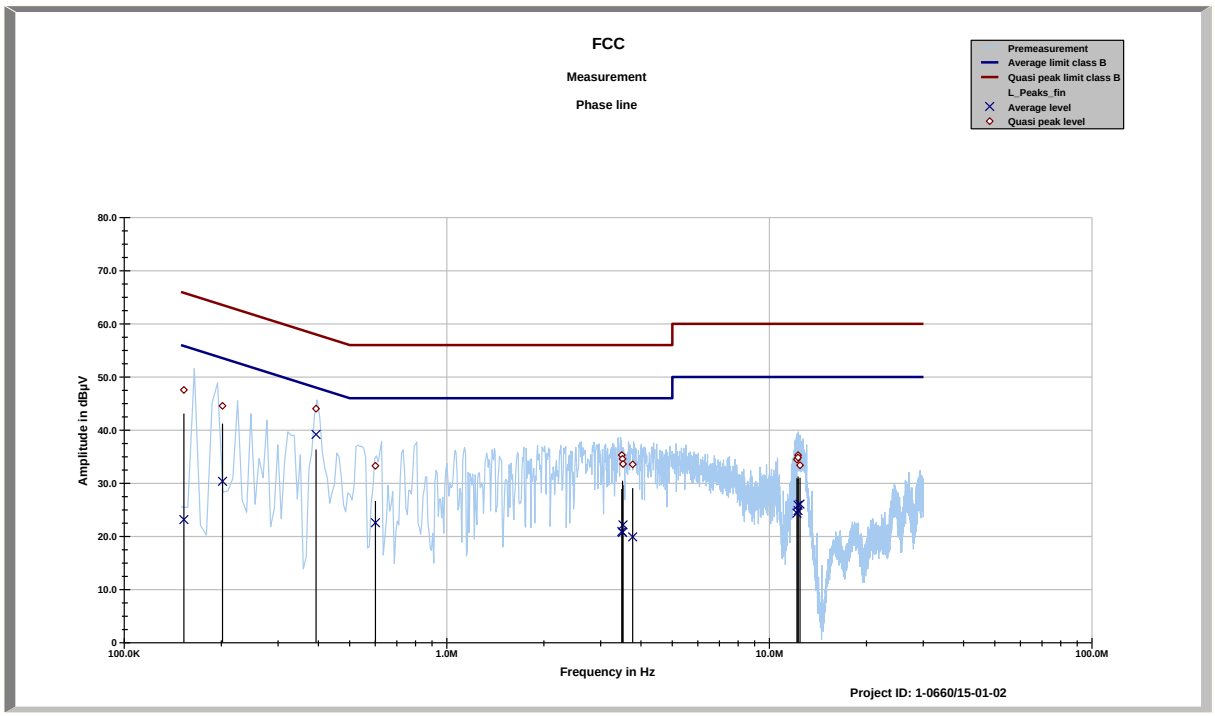
FCC
Neutral line tbl
Project ID: 1-0660/15-01-02

04:41:09 PM, Thursday, November 12, 2015

Frequency	Quasi peak level	Margin quasi peak	Average level	Margin average
MHz	dBµV	dBµV	dBµV	dBµV
0.15526	47.24	18.47	21.97	33.88
0.1687	45.58	19.44	18.75	36.72
0.39471	44.31	13.66	41.09	7.92
0.78501	36.67	19.33	33.81	12.19
3.4998	35.64	20.36	19.06	26.94
3.5196	33.59	22.41	24.05	21.95
4.4091	33.15	22.85	20.15	25.85
5.007	32.60	27.40	22.07	27.93
12.1754	33.92	26.08	24.12	25.88
12.2741	34.01	25.99	23.59	26.41
12.4366	36.37	23.63	31.35	18.65
12.4431	35.68	24.32	30.86	19.14

Project ID - 1-0660/15-01-02
EUT - Kedge XV
Serial Number - Proto
Operating mode - tx AC: 115V / 60 Hz

Plot 100:



FCC
Phase line tbl
Project ID: 1-0660/15-01-02

04:41:09 PM, Thursday, November 12, 2015

Frequency	Quasi peak level	Margin quasi peak	Average level	Margin average
MHz	dBµV	dBµV	dBµV	dBµV
0.15314	47.56	18.27	23.18	32.74
0.2017	44.57	18.97	30.36	24.16
0.39332	44.04	13.95	39.20	9.85
0.60067	33.29	22.71	22.57	23.43
3.4846	35.30	20.70	20.94	25.06
3.5037	34.59	21.41	20.76	25.24
3.515	33.62	22.38	22.17	23.83
3.7663	33.56	22.44	19.92	26.08
12.1694	34.48	25.52	24.38	25.62
12.262	35.30	24.70	25.90	24.10
12.2662	34.86	25.14	24.87	25.13
12.4337	33.39	26.61	26.09	23.91

Project ID - 1-0660/15-01-02
EUT - Kedge XV
Serial Number - Proto
Operating mode - tx AC: 115V / 60 Hz

10.4 RX spurious emissions radiated

Description:

Measurement of radiated emissions in RX mode.

Measurement: see Tx mode

No RX-only mode available in intended use

Annex A Document history

Version	Applied changes	Date of release
DRAFT	Initial release - DRAFT	2015-12-08
	minor changes based on manufacturer comments	2016-01-06
A	correction of frequency value from 38.8 MHz to 38.4 MHz (Note on page 34)	2016-01-11
B	Photo Annex changed (C,D,E) to (E,F), see chapter *5.3 Additional information* Max EIRP remeasured for Operating Conditions 1, 5, 9, 11 with higher RBW (50 MHz) for Max Peak measurement, see chapter *10.2 TX Radiated Emissions*	2016-02-04
C	References and Limits for RSS 200 / RSS Gen added remark '*' in chapter 5.2 added correction of the stated frequency bands for FCC and RSS (chapter 5.1)	2016-02-09

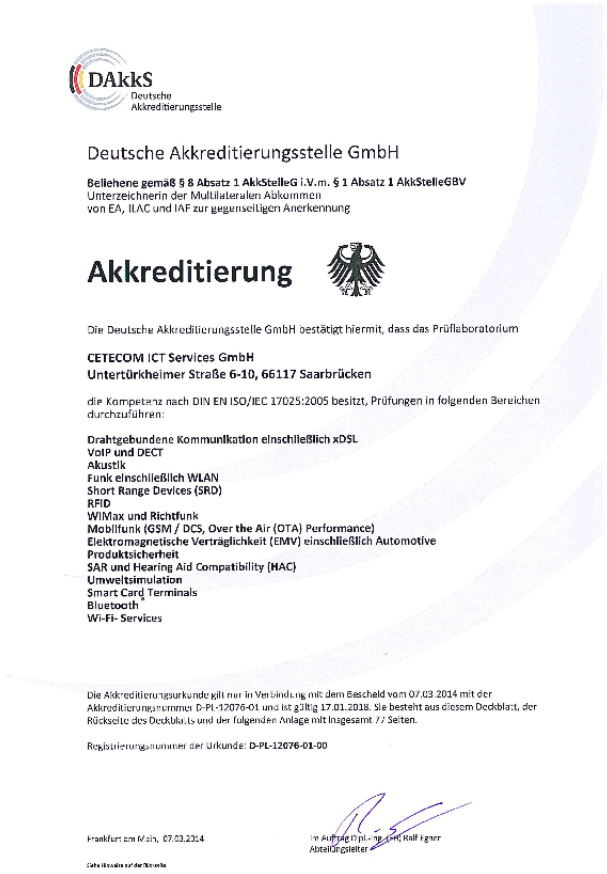
Annex B Further information

Glossary

AVG	-	Average
DUT	-	Device under test
EMC	-	Electromagnetic Compatibility
EN	-	European Standard
EUT	-	Equipment under test
ETSI	-	European Telecommunications Standard Institute
FCC	-	Federal Communication Commission
FCC ID	-	Company Identifier at FCC
HW	-	Hardware
IC	-	Industry Canada
Inv. No.	-	Inventory number
N/A	-	Not applicable
PP	-	Positive peak
QP	-	Quasi peak
S/N	-	Serial number
SW	-	Software
PMN		Product marketing name
HMN		Host marketing name
HVIN		Hardware version identification number
FVIN		Firmware version identification number

Annex C Accreditation Certificate

Front side of certificate



DAkkS
Deutsche Akkreditierungsstelle

Deutsche Akkreditierungsstelle GmbH

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

Akkreditierung

Die Deutsche Akkreditierungsstelle GmbH bestätigt hiermit, dass das Prüflaboratorium

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

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

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

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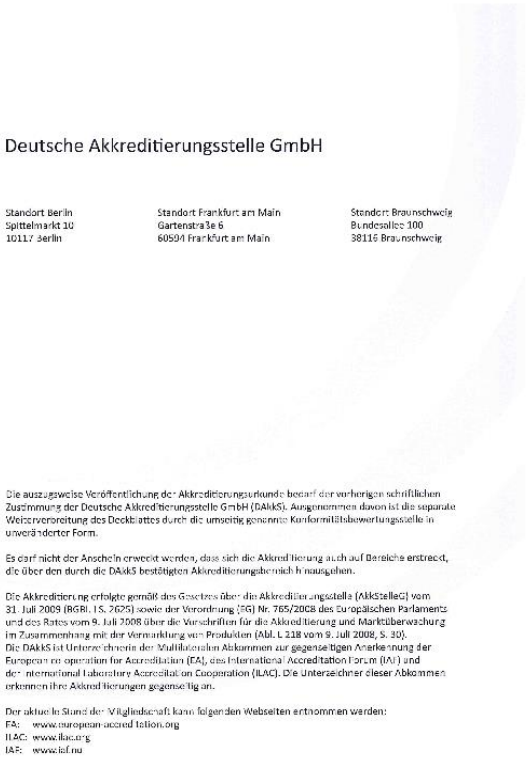
Registrierungsnummer der Urkunde: **D-PL-12076-01-00**

Frankfurt am Main, 07.03.2014

Im Auftrag Dipl.-Ing. (FH) Ralf Egner
Abteilungsleiter

Back side of certificate



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ILAC: www.ilac.org
IAF: www.iaf.nu

Note:

The current certificate including annex may be received from CETECOM ICT Services on request.

Annex D Attestation statement

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Federal Communication Commission
Equipment Authorization Division, Application Processing Branch
7435 Oakland Mills Road
Columbia, MD 21048

Zurich, 3 December 2015

Letter of attestation for model 'Kedge XV', FCC ID: 2AGUC-KDGXVA

To whom it may concern:

With respect to the test report of the model mentioned above, the spurious emissions observed in the frequency range 960MHz to 1610MHz are caused by digital circuitry used to enable the operation of the UWB transmitter.

The measurement report shows measurements of the spurious emissions when the device is transmitting as well as when it is not transmitting (reception mode). The measurements show that these spurious emissions are identical in transmission mode and reception mode. An RF switch disconnects the transmitter from the antenna in reception mode; the measurements therefore show that these spurious emissions are not intended to be radiated from the transmitter's antenna.

Kind regards,

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