Wireless Transceiver Test Report

FCC ID: A94414642 IC: 3232A-414642

Certificate # 1514.1

Report number: EMC.414642.14.157.1

Prepared for: Bose Corporation
DCE - EMC
1 New York Ave, Framingham MA 01701

Product Name/Number: Model 414642

Standards: FCC part 15, RSS210, RSS-gen and ICES-003

Report prepared by: Michael Royer

Signature: Michael A. Royer

June 6, 2014

Report reviewed by: Jon Kanter

Signature: Jon Kanter

June 6, 2014

Report issue date: June 6, 2014

Changes from previous revision: None, original document version.

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1. Report Summary

1.1 Product	**Model 414642**
1.2 Client	Bose Corporation The Mountain, Framingham, MA 01701
1.3 Applicable Standards	**FCC part 15.B and C** **RSS-210 issue 8** **RSS-Gen issue 3** **ICES-003 issue 5**
Test Results:	Pass ☒ Fail ☐
1.4 Test Laboratory	Bose DCE laboratories 1 New York Ave Framingham, MA01701. IC registration : 3232A FCC site registration under A2LA cert. #1514

This report relates only to the items tested.

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2. Product description

The product is a sound console for listening to audio sources. A wireless transmitter is used to link the audio signal a speaker, where the console is the master in a master slave communications system.

The product is tested as a Digital Transmission System (DTS) but it also does hop among a set of 18 channels. It always uses the wide DTS signaling so it is always DTS. It is not a hybrid system.

The power delivery is supplied by direct connection to the AC mains and power conversion is performed internally.

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3. Applicable standards, requirements and tests

FCC part 15	RSS210	RSS-Gen	ICES -003	Test references.	Result / Data section
15.15(b)		5.4		There are no user-accessible controls for the adjustment of any transmitter parameters in the device under test.	Complies
15.27				There are no special devices such as shielded cables or special connectors required for compliance to the applicable standards.	Complies
15.203				An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The antenna is not accessible by the user.	Complies
15.205	2.2			The device does not operate in either the US or Canadian restricted bands.	Complies
15.107 15.207		7.2.4	**6.1**	Conducted emissions, 150kHz–30 MHz	Complies Section 6.1
15.109 15.209			**6.2**	Radiated emissions, 30MHz–1GHz Spurious emissions, 30MHz–1GHz	Complies Section 6.2
15.247 (a)(2)	A8.2 (a)			Emission Bandwidth	Complies Section 6.3
FCC part 15.247(e)	A8.2 (b)			Power spectral Density	Complies Section 6.4
15.247 (b)(3)	A8.4 (4)			Transmitter output power:	Complies Section 6.5
15.247(d)	A8.5	4.9		Transmitter conducted spurious emissions	Complies Section 6.6
15.247(d)		4.9		Transmitter harmonics.	Complies Section 6.7
15.247(d)		7.2.5		Transmitted radiated spurious emissions	Complies Section 6.8
		4.10, 6.2		Receiver Spurious emissions	Complies Section 6.9
OET65	Canada Health and Safety code 6			MPE calculation	Complies Section 6.10

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4. Environmental Conditions

All testing is performed under the following conditions, unless otherwise defined in the detail test report section.

Temperature:	22 ± 4 °C
Humidity:	30 – 60 % RH
Mains Voltage:	120 V AC

5. EUT configuration:

The Bose® sound console was powered by 120 V AC mains source. A two wire AC power cord brings the mains voltage inside the console for internal conversion to DC. During emissions tests peripherals were used to populate the ports as expected of typical use and sound was passed from the HDMI player to the 5 wired speakers. During some of the transmitter tests, RF control commands were sent to the TI RF transmitter chip through the processor interface for the purpose of controlling the transmitter activity and parameters.

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6. Detailed Test Results

6.1. Conducted Emissions

6.1.1. Requirements

47CFR15.207, RSS GEN section 7.2.4, ICES-003

Frequency	Limits dB(µV)	
MHz	Quasi-peak	Average
0.15 -0.5	66-56	56-46
0.5 – 5	56	46
5 – 30	60	50

6.1.2. Test setup details

The EUT was tested in accordance with ANSI C63.4 test setup conditions in a typical user configuration. The AC power cable to the EUT was connected to the 120 VAC source through a LISN. HDMI signaling was passed through from a Blue-ray player to a Television. An iPod was connected to the line in port, and a Bose Sound Touch module was connected to the Boselink port. Five satellite speakers were connected, playing at full volume. Full volume was found to be the worst case due to loading of the AC power conversion circuit.

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6.1.3. Results summary AC port

Worse case levels, found on Ethernet is 2.9 dB to the regulatory limit.

6.1.4. Results summary AC power port

Frequency	MEASURED		LIMIT		MARGIN	
MHz	dBµV QP	dBµV AVG	dBµV QP	dBµV AVG	dB QP	dB AVG
0.18825		44.5194	64.1	54.1		9.6
0.18375	54.5214		64.3	54.3	9.8	

Worse case levels were found on AC Line 2 (Neutral) in CBL-SAT mode.

6.1.5. Results summary Ethernet port

Frequency	MEASURED		LIMIT		MARGIN	
MHz	dBµV QP	dBµV AVG	dBµV QP	dBµV AVG	dB QP	dB AVG
23.1293		61.1	74.0	64.0		2.9
0.18375	74.7		82.2	72.2	8.4	

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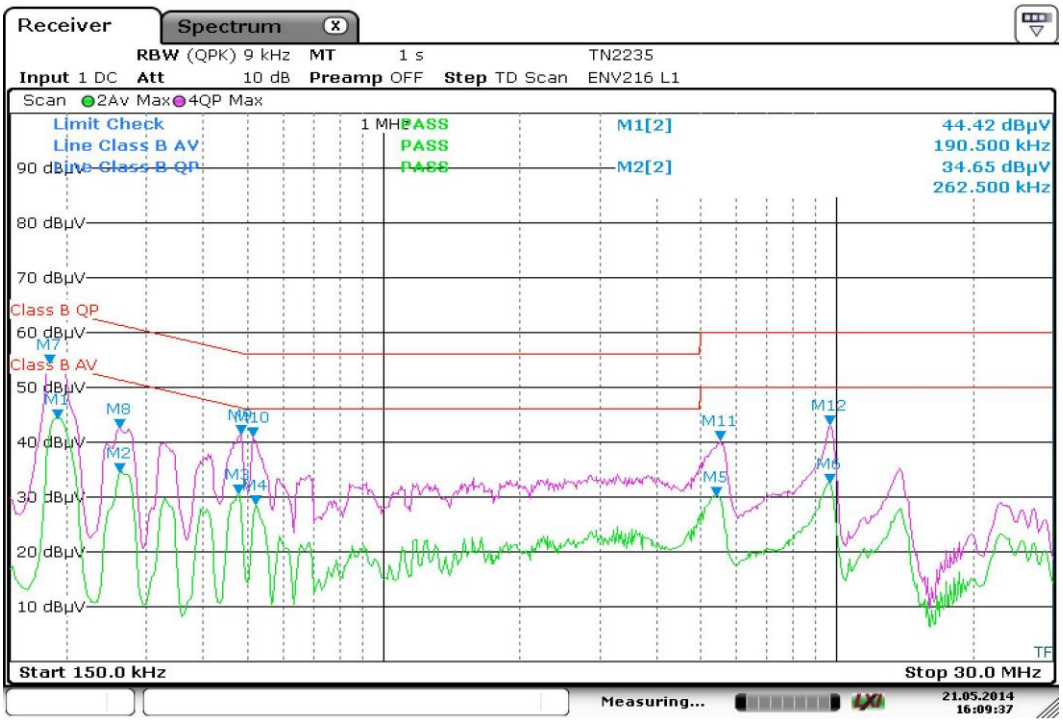
6.1.6. Test data 120VAC 60Hz data:



Date: 21.MAY.2014 16:09:37

AC Line 1 (Hot) **EUT NOT GROUNDED**
120VAC 60Hz HDMI CBL-SAT mode, playing pink noise from DVD at maximum volume.

Frequency	MEASURED		LIMIT		MARGIN	
MHz	dBµV QP	dBµV AVG	dBµV QP	dBµV AVG	dB QP	dB AVG
0.1905		44.42	64.0	54.0		9.6
0.2625		34.6535	61.3	51.3		16.7
0.4785		30.7226	56.4	46.4		15.6
0.5235		28.6625	56.0	46.0		17.3
5.41275		30.3225	60.0	50.0		19.7
9.6405		32.569	60.0	50.0		17.4
0.18375	54.3806		64.3	54.3	9.9	
0.2625	42.5479		61.3	51.3	18.8	
0.48525	41.4707		56.2	46.2	14.8	
0.51675	40.9873		56.0	46.0	15.0	
5.5365	40.4253		60.0	50.0	19.6	
9.63825	43.3101		60.0	50.0	16.7	

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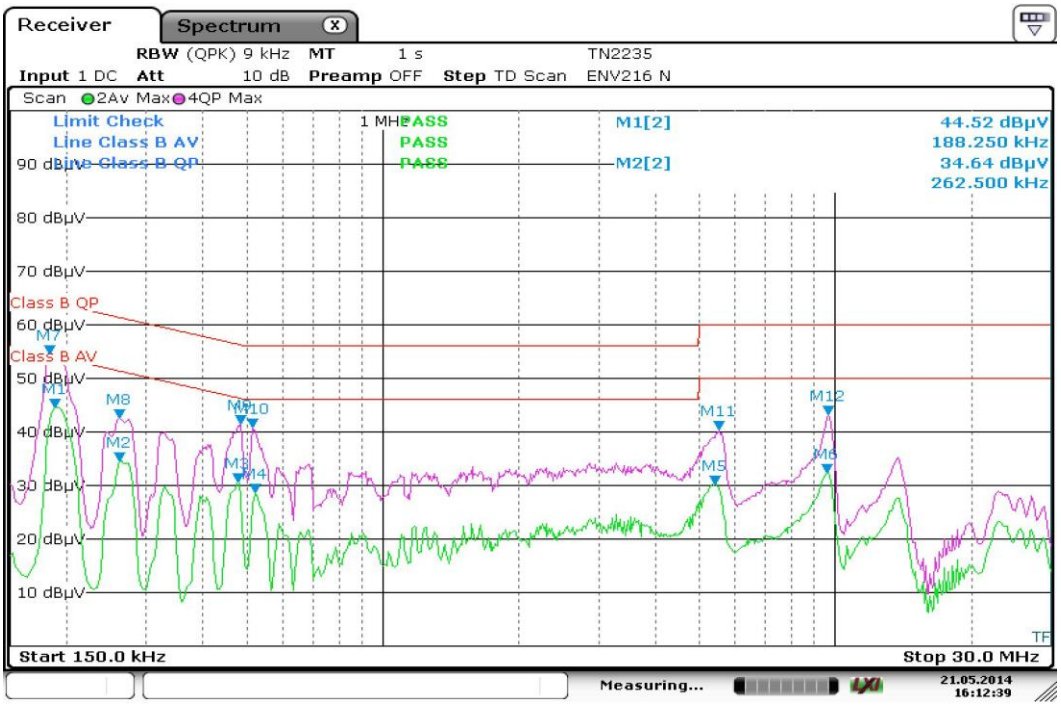

Date: 21.MAY.2014 16:12:40

AC Line 2 (Neutral) **EUT NOT GROUNDED**

120VAC 60Hz HDMI CBL-SAT mode, playing pink noise from DVD at maximum volume.

Frequency	MEASURED		LIMIT		MARGIN	
MHz	dBµV QP	dBµV AVG	dBµV QP	dBµV AVG	dB QP	dB AVG
0.18825		44.5194	64.1	54.1		9.6
0.2625		34.6417	61.3	51.3		16.7
0.4785		30.6946	56.4	46.4		15.7
0.5235		28.6507	56.0	46.0		17.3
5.415		30.254	60.0	50.0		19.7
9.58875		32.4554	60.0	50.0		17.5
0.18375	54.5214		64.3	54.3	9.8	
0.2625	42.5356		61.3	51.3	18.8	
0.48525	41.432		56.2	46.2	14.8	
0.51675	40.9646		56.0	46.0	15.0	
5.5365	40.4649		60.0	50.0	19.5	
9.63825	43.2677		60.0	50.0	16.7	

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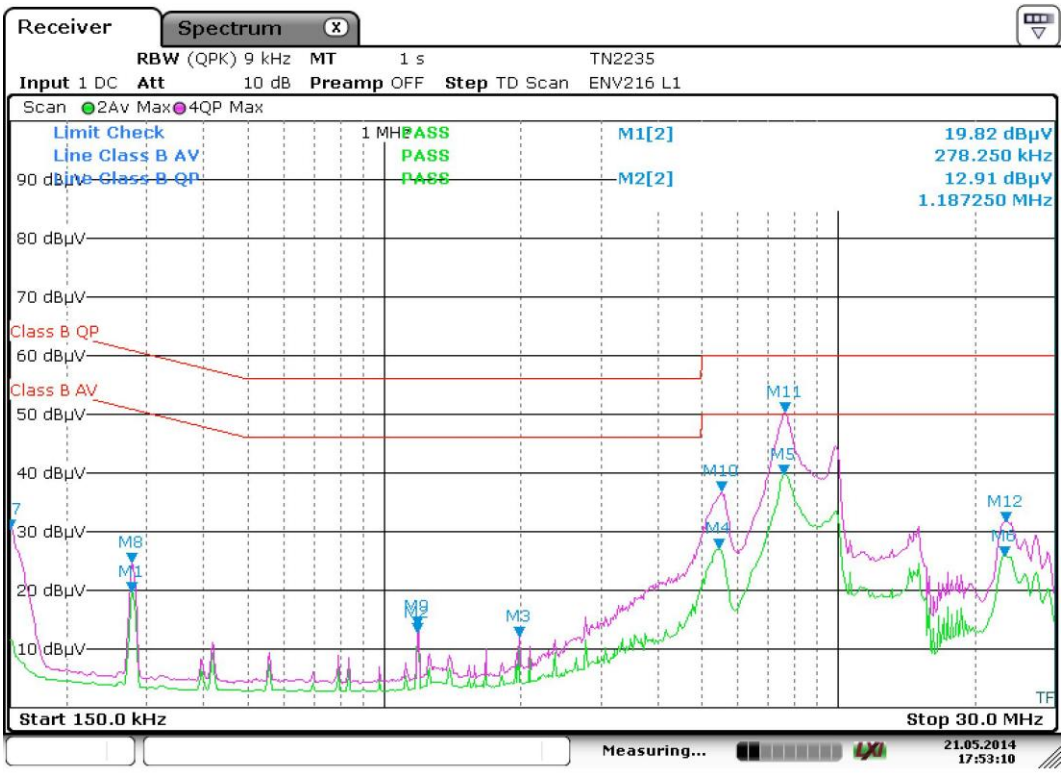

Date: 21.MAY.2014 17:53:10

AC Line 1 (Hot) **EUT GROUNDED** at iPod end of audio cable.

120VAC 60Hz HDMI CBL-SAT mode, playing pink noise from DVD at maximum volume.

Frequency	MEASURED		LIMIT		MARGIN	
MHz	dBµV QP	dBµV AVG	dBµV QP	dBµV AVG	dB QP	dB AVG
0.27825		19.8225555	60.9	50.9		31.0
1.18725		12.9085541	56.0	46.0		33.1
1.97925		12.1527786	56.0	46.0		33.8
5.4735		27.0741348	60.0	50.0		22.9
7.593		39.881134	60.0	50.0		10.1
23.2935		25.9728012	60.0	50.0		24.0
0.15	30.5139389		66.0	56.0	35.5	
0.27825	24.7291412		60.9	50.9	36.1	
1.18725	13.8175278		56.0	46.0	42.2	
5.541	36.9934387		60.0	50.0	23.0	
7.66275	50.3756943		60.0	50.0	9.6	
23.39025	31.7212601		60.0	50.0	28.3	

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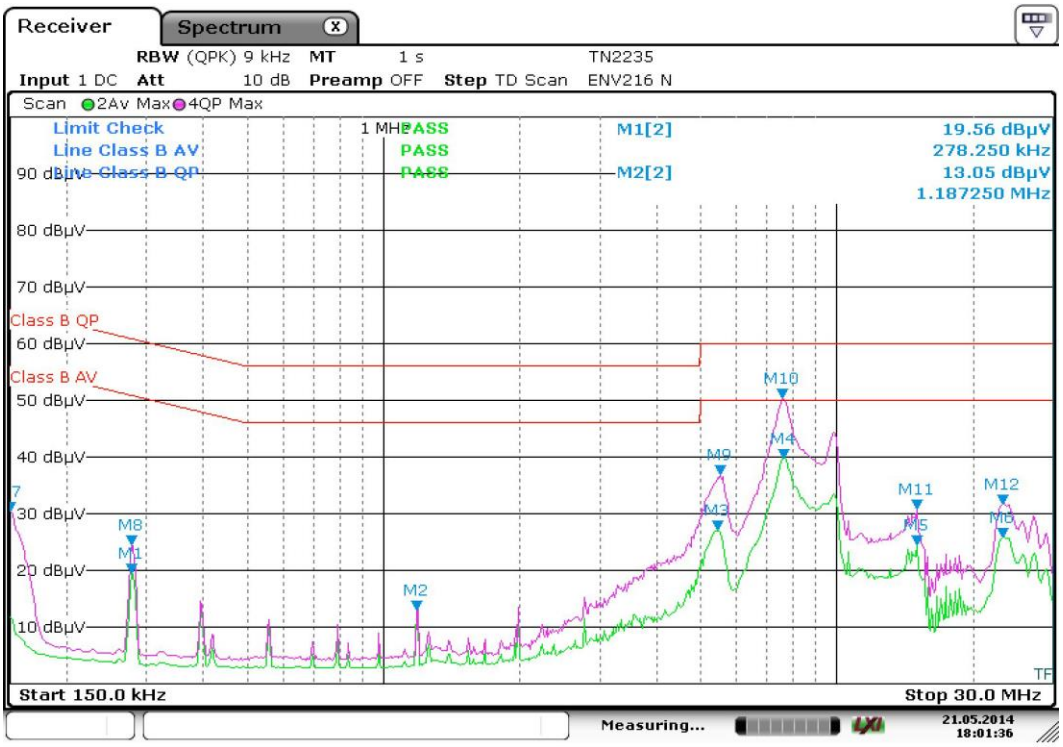

Date: 21.MAY.2014 18:01:36

AC Line 2 (Neutral) **EUT GROUNDED** at iPod end of audio cable.

120VAC 60Hz HDMI CBL-SAT mode, playing pink noise from DVD at maximum volume.

Frequency	MEASURED		LIMIT		MARGIN	
MHz	dBµV QP	dBµV AVG	dBµV QP	dBµV AVG	dB QP	dB AVG
0.27825		19.5573196	60.9	50.9		31.3
1.18725		13.052124	56.0	46.0		32.9
5.47125		27.1867599	60.0	50.0		22.8
7.6605		39.7931213	60.0	50.0		10.2
15.0405		24.5989456	60.0	50.0		25.4
23.18775		25.9405746	60.0	50.0		24.1
0.15	30.348793		66.0	56.0	35.6	
0.27825	24.5527267		60.9	50.9	36.3	
5.53875	36.9740906		60.0	50.0	23.0	
7.593	50.5002747		60.0	50.0	9.5	
15.0405	30.7792282		60.0	50.0	29.2	
23.18775	31.7177505		60.0	50.0	28.3	

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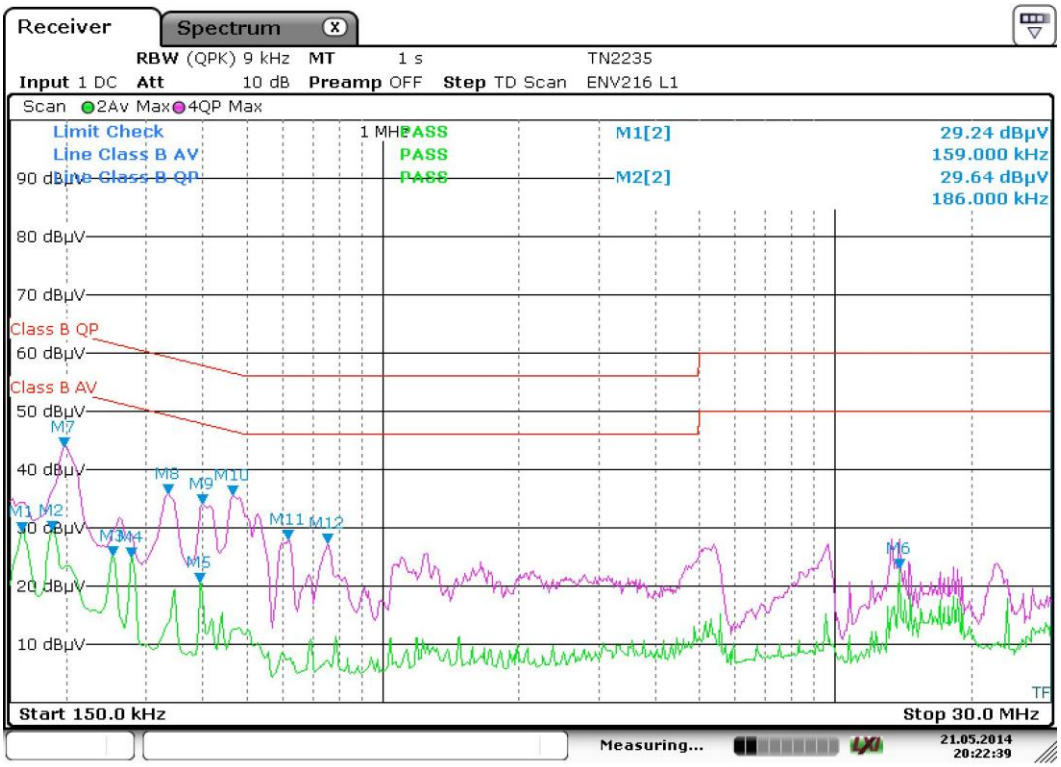

Date: 21.MAY.2014 20:22:39

AC Line 1 (Hot) **EUT NOT GROUNDED**

120VAC 60Hz TV Analog mode, IEC 6dB CF pink noise playing from iPod.

Frequency	MEASURED		LIMIT		MARGIN	
MHz	dBµV QP	dBµV AVG	dBµV QP	dBµV AVG	dB QP	dB AVG
0.159		29.2444229	65.5	55.5		26.3
0.186		29.6434708	64.2	54.2		24.6
0.2535		25.3043289	61.6	51.6		26.3
0.27825		25.0397644	60.9	50.9		25.8
0.39525		20.6622772	57.9	47.9		27.3
0.19725	43.9060974		63.7	53.7	19.8	
0.3345	35.8487167		59.3	49.3	23.5	
0.39975	34.1528244		57.9	47.9	23.7	
0.46725	35.544693		56.6	46.6	21.0	
0.618	27.9701386		56.0	46.0	28.0	
0.75525	27.3727646		56.0	46.0	28.6	

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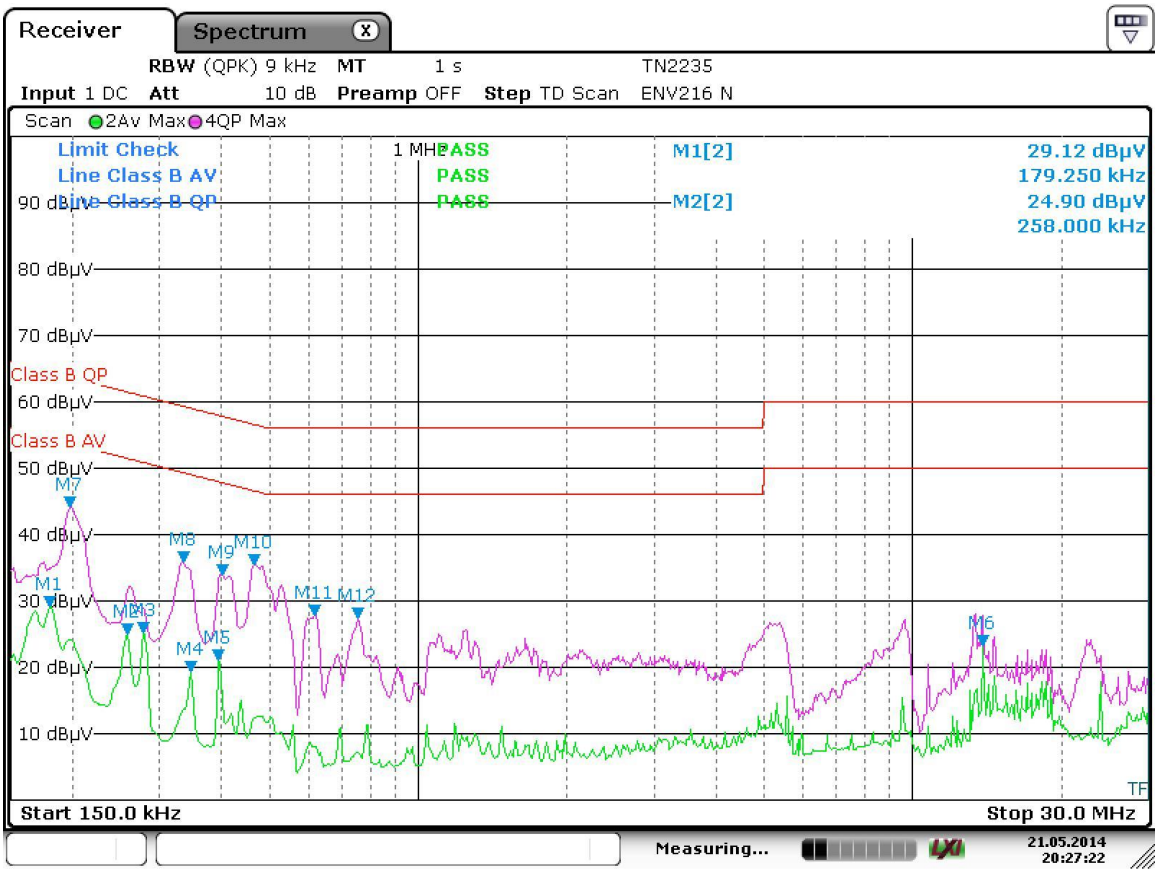

Date: 21.MAY.2014 20:27:22

AC Line 2 (Neutral) **EUT NOT GROUNDED**

120VAC 60Hz TV Analog mode, IEC 6dB CF pink noise playing from iPod.

Frequency	MEASURED		LIMIT		MARGIN	
MHz	dBµV QP	dBµV AVG	dBµV QP	dBµV AVG	dB QP	dB AVG
0.17925		29.1221619	64.5	54.5		25.4
0.258		24.8952942	61.5	51.5		26.6
0.27825		25.1642303	60.9	50.9		25.7
0.34575		19.3873367	59.1	49.1		29.7
0.19725	44.0776901		63.7	53.7	19.6	
0.3345	35.8424072		59.3	49.3	23.5	
0.402	34.0121078		57.8	47.8	23.8	
0.46725	35.5052185		56.6	46.6	21.1	
0.618	27.9146805		56.0	46.0	28.1	

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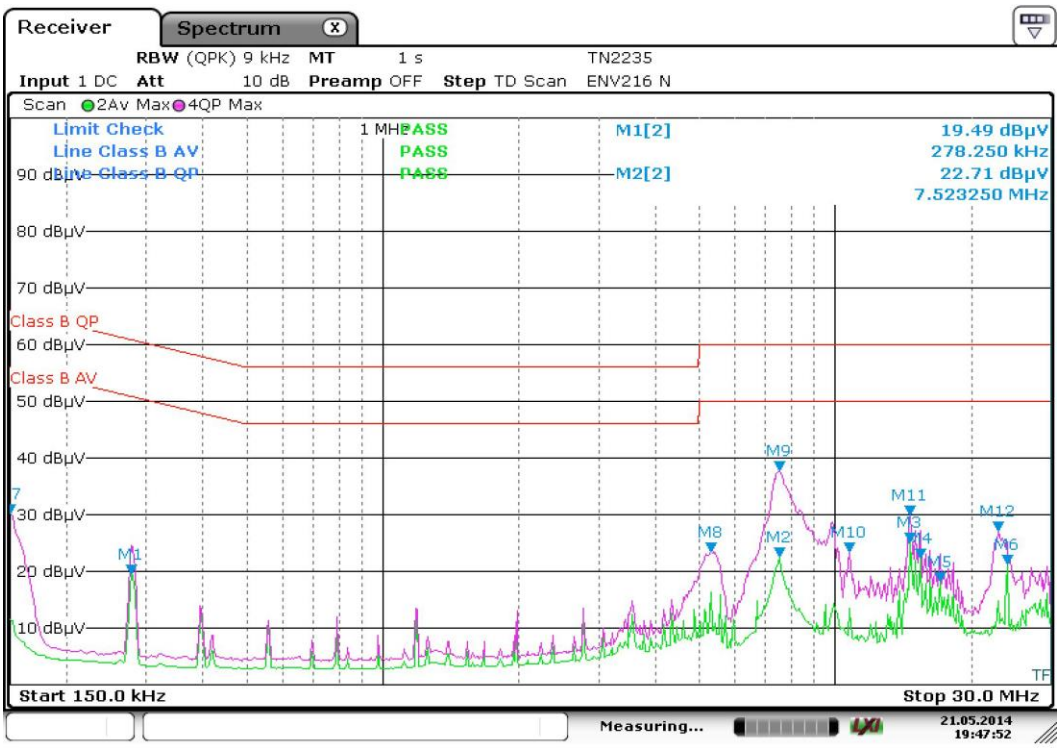

Date: 21.MAY.2014 19:47:52

AC Line 1 (Hot) **EUT GROUNDED** at iPod end of audio cable.
120VAC 60Hz TV Analog mode, IEC 6dB CF pink noise playing from iPod.

Frequency	MEASURED		LIMIT		MARGIN	
MHz	dBµV QP	dBµV AVG	dBµV QP	dBµV AVG	dB QP	dB AVG
0.27825		19.4897232	60.9	50.9		31.4
7.52325		22.7124023	60.0	50.0		27.3
14.65125		25.2520523	60.0	50.0		24.7
15.44325		22.3049927	60.0	50.0		27.7
17.02725		18.2910233	60.0	50.0		31.7
24		21.4007416	60.0	50.0		28.6
0.15	30.2179718		66.0	56.0	35.8	
5.3025	23.4804306		60.0	50.0	36.5	
7.5345	37.888176		60.0	50.0	22.1	
10.74525	23.575325		60.0	50.0	36.4	
14.6535	30.0915833		60.0	50.0	29.9	
22.96725	27.2282791		60.0	50.0	32.8	

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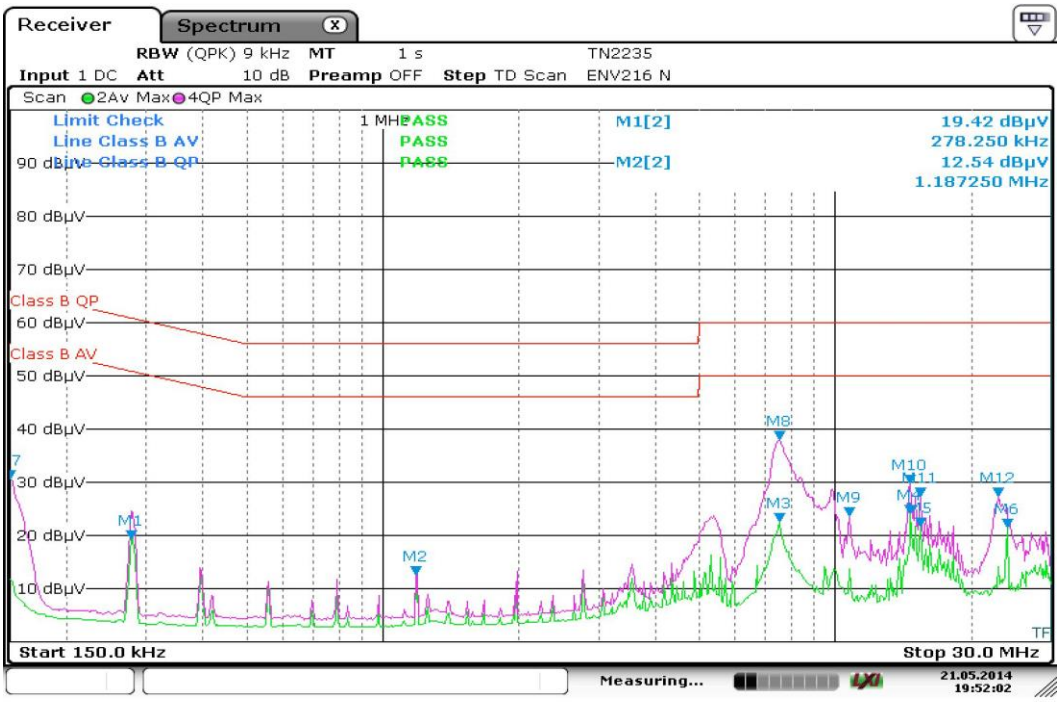

Date: 21.MAY.2014 19:52:02

AC Line 2 (Neutral) **EUT GROUNDED** at iPod end of audio cable.
120VAC 60Hz TV Analog mode, IEC 6dB CF pink noise playing from iPod.

Frequency	MEASURED		LIMIT		MARGIN	
MHz	dBµV QP	dBµV AVG	dBµV QP	dBµV AVG	dB QP	dB AVG
0.27825		19.4216003	60.9	50.9		31.4
1.18725		12.5388794	56.0	46.0		33.5
7.521		22.5945511	60.0	50.0		27.4
14.6445		24.134552	60.0	50.0		25.9
15.4365		21.6952057	60.0	50.0		28.3
24		21.4279251	60.0	50.0		28.6
0.15	30.630867		66.0	56.0	35.4	
7.5345	38.0066986		60.0	50.0	22.0	
10.761	23.6533966		60.0	50.0	36.3	
14.6535	29.8900299		60.0	50.0	30.1	
15.432	27.3309708		60.0	50.0	32.7	
22.965	27.3144608		60.0	50.0	32.7	

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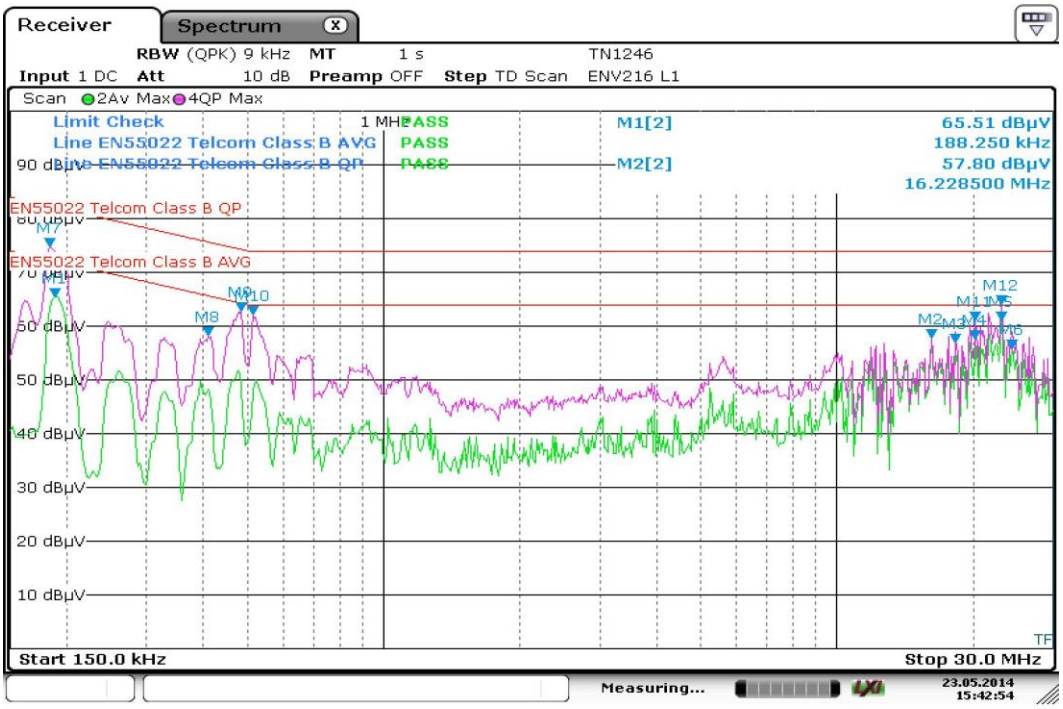
Ethernet port on the Bose Link module conducted emissions

120VAC 60Hz data:



Date: 23.MAY.2014 15:42:54

Frequency	MEASURED		LIMIT		MARGIN	
MHz	dBµV QP	dBµV AVG	dBµV QP	dBµV AVG	dB QP	dB AVG
0.1905		65.0	82.0	72.0		7.0
16.2285		57.9	74.0	64.0		6.1
18.2445		57.0	74.0	64.0		7.0
20.2583		57.6	74.0	64.0		6.4
23.1293		61.0	74.0	64.0		2.9
24.3510		55.9	74.0	64.0		8.1
0.186	73.8		82.2	72.2	8.4	
0.4178	58.2		75.5	65.5	17.3	
0.4875	60.4		74.2	64.2	13.8	
0.5168	62.9		74.0	64.0	11.1	
20.2583	61.0		74.0	64.0	13.0	

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6.1.7. Test Equipment

Equipment Type	Manufacturer	Model	Serial or other ID	Service	
				Last	Due
LISN	Rohde & Schwarz	ENV216	TN2235	Nov 15, 2013	Nov 15, 2014
EMI Test Receiver	Rohde & Schwarz	ESR7	TN2247	Dec 2, 2013	Dec 2, 2014
Voltmeter	Fluke	189	TN1480	Jan 20, 2014	Jan 20, 2015
Comb Generator	Com-Power	CGC-510	TN1380	Jan 6, 2014	Jan 6, 2015
Impedance Stabilization Network	Fischer Custom Communications	FCC-TLISN-T4	TN1246	June 27, 2013	June 27, 2014

6.1.8. Test information

Date of test:	5/21/2014	**Test location :**	DCE lab – Henry room
EUT serial:	38	**Tested by:**	D. Sterrett
Test Conclusion:	Pass		

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6.2. Radiated emissions 30 MHz – 1 GHz

6.2.1. Requirements

FCC rules part 15.109 (g), 15.209, RSS GEN 7.2.5, ICES-003

Frequency	Limit in uV/m @ 3m	Limit in dBµV/m @3m
MHz	Quasi-peak	Quasi-peak
30 – 88	100	40
88 - 216	150	43.5
216-960	200	46
Above 960	500*	54*

***Average detector above 1GHz.**

6.2.2. Test setup details

The EUT was placed on an 80 cm high table powered by 120 V AC and configured for worst case emissions based on previous testing. HDMI signaling was passed through from a Blue-ray player to a Television. An iPod was connected to the line in port, and a Bose Sound Touch module was connected to the Boselink port. Five satellite speakers were connected, playing at full volume. Full volume was found to be the worst case due to loading of the AC power conversion circuit.

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6.2.3. Test data

Summary:

Worst case 5.3 dB margin under FCC B limit at 890.1 MHz

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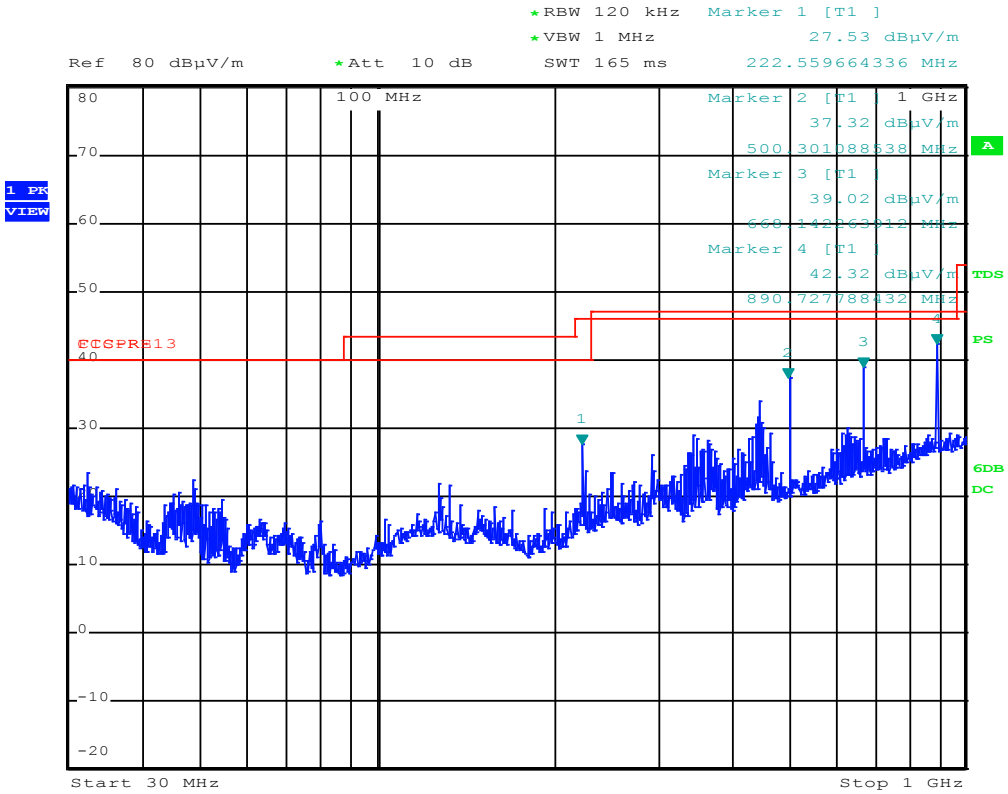

Date: 2.APR.2014 16:37:18

V & H combined max hold sweep.
120VAC 60Hz nominal AC line voltage.

Emission	Measured	CISPR 13/22		Table	Receiving Antenna	
Frequency	Amplitude	Limit	Margin	Azimuth	Pol	Height
MHz	dBuV/m QP	dBuV/m QP	dB	0° face ant	H/V	Meters
222.530	26.50	40.0	13.5	310	H	1.4
500.010	36.50	47.0	10.5	324	H	1
667.580	40.20	47.0	6.8	340	H	1.1
890.100	40.70	47.0	6.3	84	H	1

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6.2.4. Test Equipment

Equipment Type	Manufacturer	Model	Serial or other ID	Service	
				Last	Due
Antenna	Sunol Sciences	JB6	TN1541	7/24/2013	7/24/2014
EMI Test Receiver	Rohde & Schwarz	ESCI / 1166.5950K03	TN1420	4/11/2014	4/11/2015
Maxwell House Radiated Emissions Cable Set	Bose Corporation	N/A	TN1445	Verify	
Comb Generator	Com-Power	CG-520	TN1569	9/9/2013	9/9/2014
RF Preamp	Bose	TN2077	TN2077	3/27/2014	3/27/2015

6.2.5. Test information

Date of test:	4/2/14	**Test location :**	DCE - Maxwell House
EUT serial:	18	**Tested by:**	D. Sterrett
Test Conclusion:	Pass		

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6.3. Emissions Bandwidth

6.3.1. Requirements

RSS210 section A8.2 (a) and FCC part 15.247(a)(2)

Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

6.3.2. Test setup details

The EUT is controlled via the BoseLink interface with software which is used to set the test modes of the TI chip RF interface. The EUT antenna is disconnected by removing/desoldering a series component and attaching a 6 inch long flexible coax cable to the FL connector. This cable was connected to the spectrum analyzer.

Bandwidth summary table:

Channel	Center Frequency (MHz)	6dB EBW (MHz)
2	2410	2.224

Conclusion: The Emission Band Width is greater than 500 kHz.

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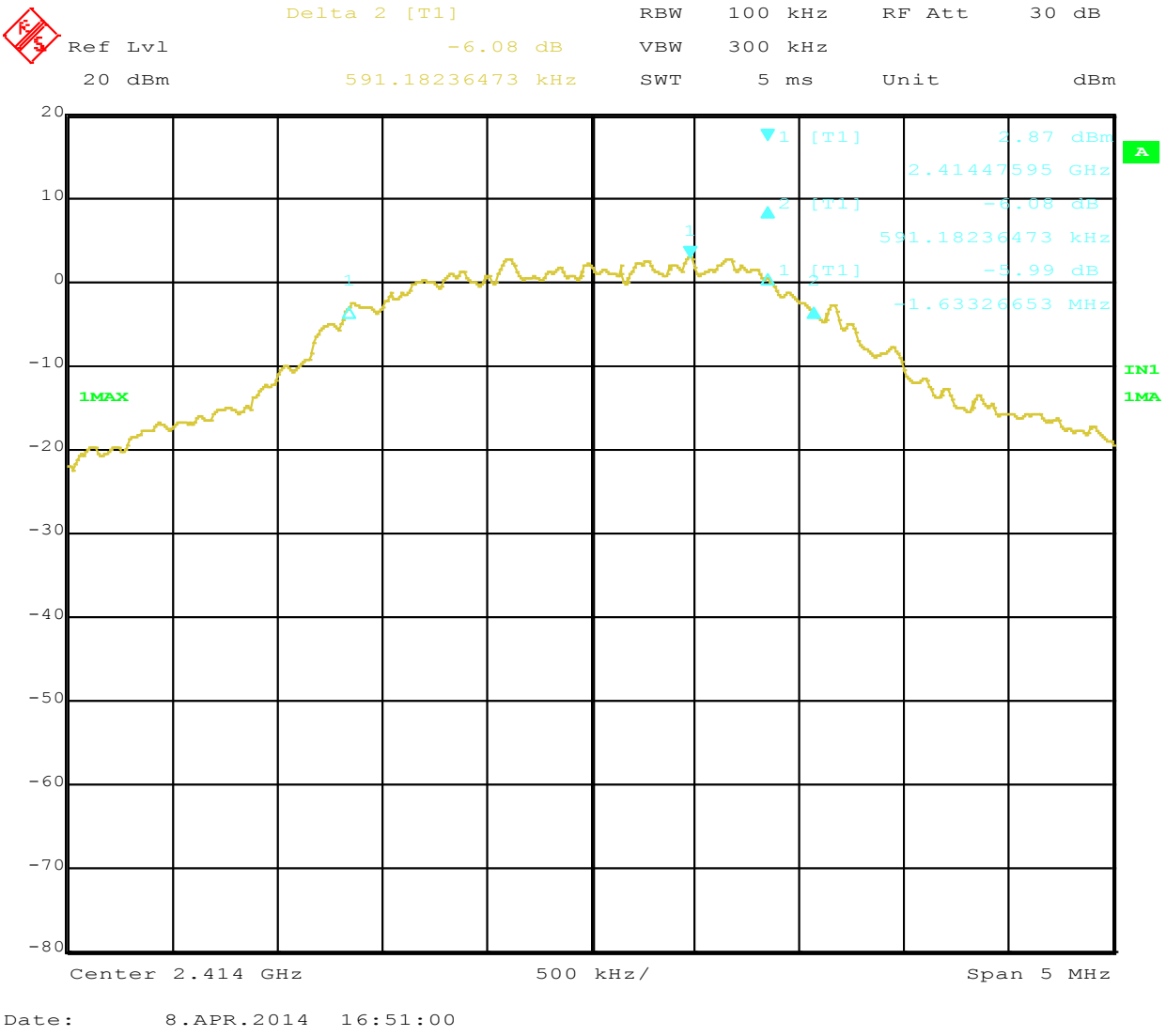
Example spectrum analyzer plot showing how the 6dB EBW is measured.



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6.3.3. Test Equipment

Equipment Type	Manufacturer	Model	Serial or other ID	Service date	
				Last	Due
EMI Test Receiver	Rohde & Schwarz	ESIB 40	TN1560	4/4/2013	4/11/2014

Note; Previous calibration of TN1560 was due on 4/4/2014, and was extended. No fault was found on 4/11/2104.

6.3.4. Test information

Date of test:	4/9/2014	**Test location:**	Transmitter Test Bench
EUT serial:	18	**Test by:**	M. Royer
Test Conclusion:	Pass		

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6.4. Power Spectral Density

6.4.1. Requirements

RSS210 section A8.2 (b) and FCC part 15.247(e)

The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

6.4.2. Test setup details

The EUT is controlled via the BoseLink interface with software which is used to set the test modes of the TI chip RF interface. The EUT antenna is disconnected by removing/desoldering a series component and attaching a 6 inch long flexible coax cable to the FL connector. This cable was connected to the spectrum analyzer.

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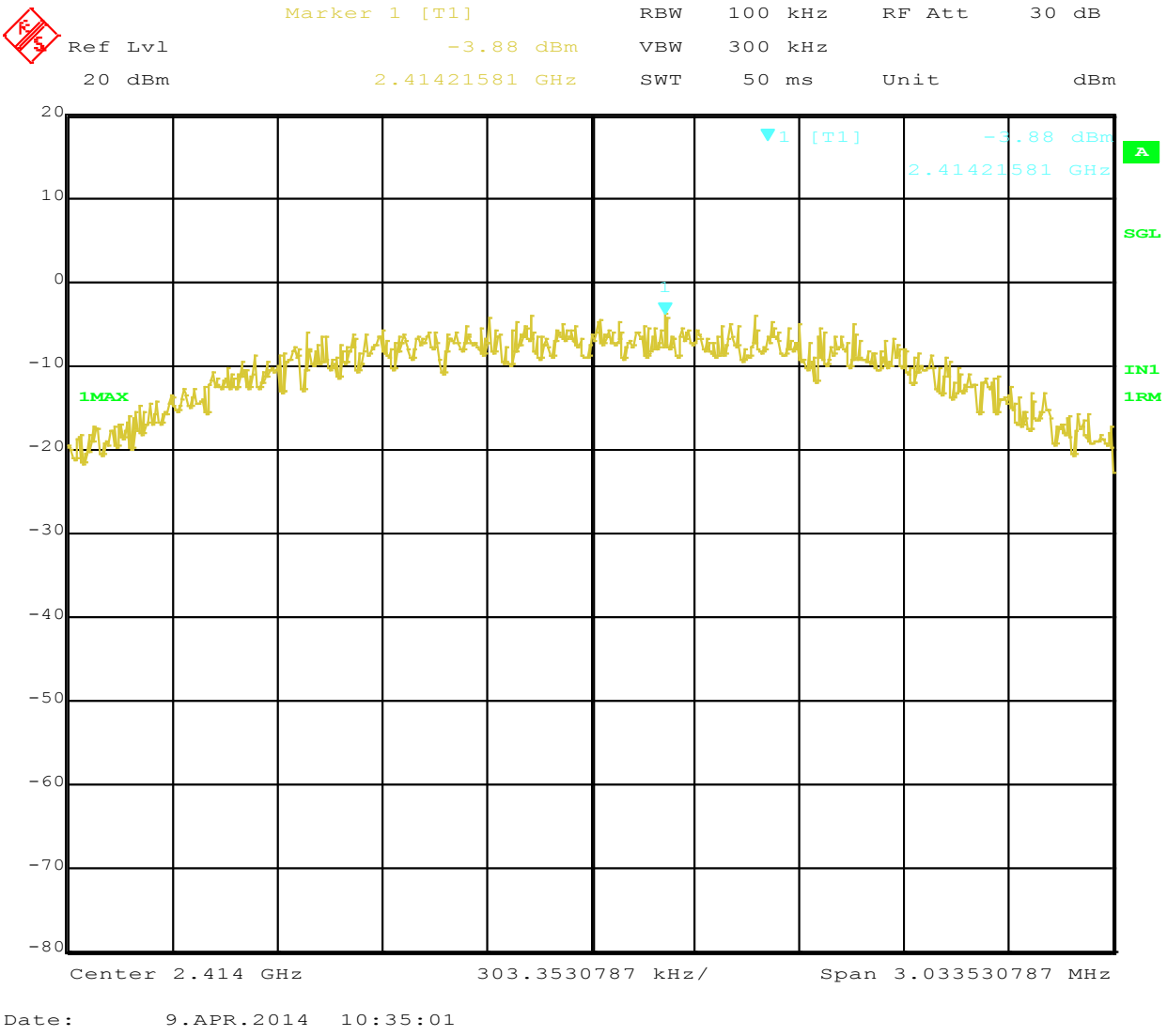
Example of how the power spectral density is measured.



BWCF = -15.2 (According to DTS Meas.Guidance v01) -3.88-15.2=-19.08 Which is less than 8 dBm. Pass

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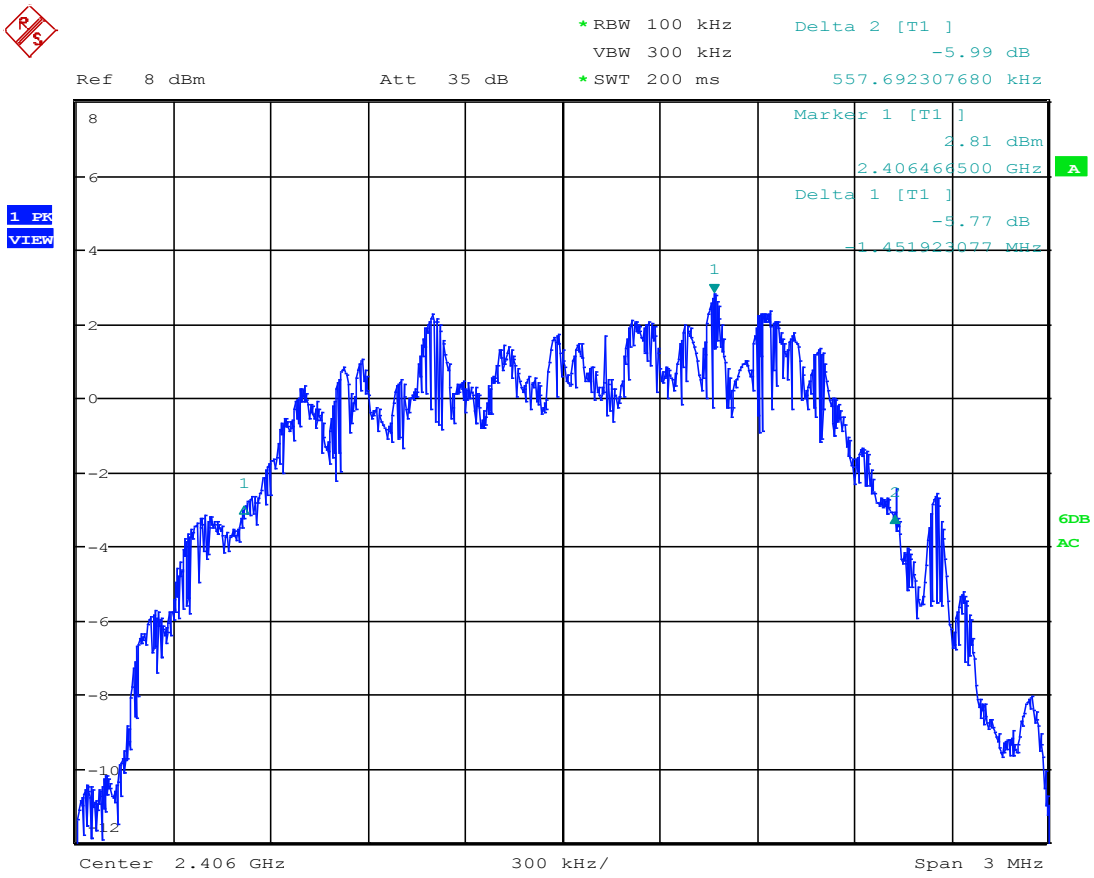
For the purposes of RSS210 A8.2, a plot of the PSD is included using 3 kHz RBW.



Date: 9.APR.2014 16:26:42

PSD = 2101 MHz

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6.4.3. Test Equipment

Equipment Type	Manufacturer	Model	Serial or other ID	Service date	
				Last	Due
EMI Test Receiver	Rohde & Schwarz	ESIB 40	TN1560	4/4/2013	4/11/2014

Note; Previous calibration of TN1560 was due on 4/4/2014, and was extended. No fault was found on 4/11/2104.

6.4.4. Test information

Date of test:	4/9/2014	**Test location:**	Transmitter Test Bench
EUT serial:	18	**Test by:**	M. Royer
Test Conclusion:	Pass		

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6.5. Output power

6.5.1. Requirements:

FCC 15.247(b)(3) , RSS 210 A8.4 (4)

For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. 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. If multiple modes of operation are possible (e.g., alternative modulation methods), the *maximum conducted output power* is the highest total transmit power occurring in any mode.

6.5.2. Test setup details:

The EUT is controlled via the BoseLink interface with software which is used to set the test modes of the TI chip RF interface. The EUT antenna is disconnected by removing/desoldering a series component and attaching a 6 inch long flexible coax cable to the FL connector. This cable was connected to the spectrum analyzer.

The EUT is programmed to operate at frequencies at the each channel in its protocol set.

The spectrum analyzer resolution bandwidth is set to 10 MHz, peak detection and max hold. The maximum output power is recorded for each channel while modulated.

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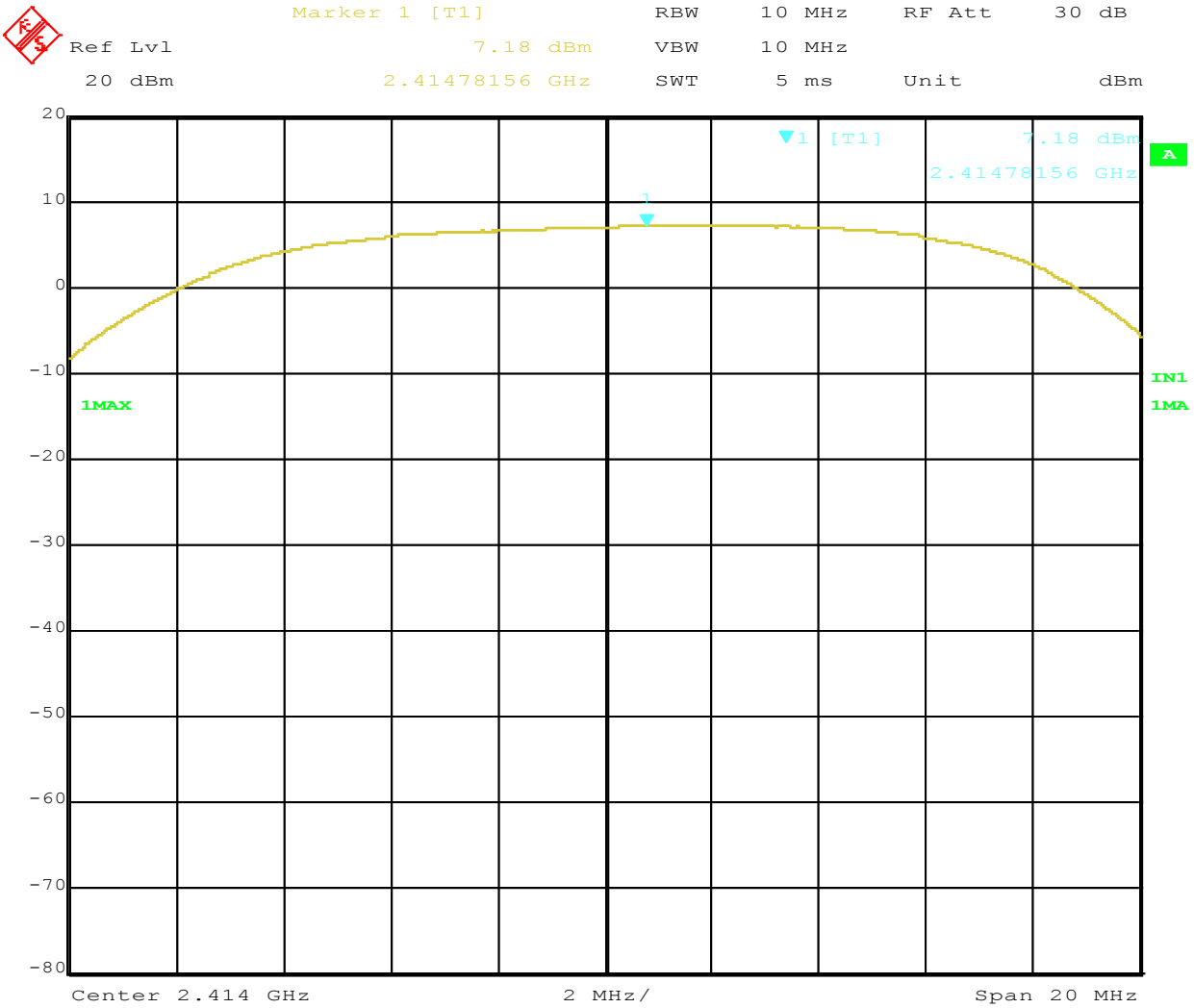
Test data: Output power



Date: 8.APR.2014 13:59:14

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Conducted power output	
Freq MHz	Peak dBm
2406	7.07
2410	7.07
2414	7.18
2418	7.07
2422	7.07
2426	7.07
2430	7.07
2434	7.07
2438	6.95
2442	7.07
2446	7.07
2450	7.07
2454	6.95
2458	6.95
2462	6.95
2466	6.83
2470	6.83
2474	6.7

6.5.3. Summary

The strongest output power measured is 7.18 dBm.

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6.5.4. Test Equipment

Equipment Type	Manufacturer	Model	Serial or other ID	Service date	
				Last	Due
EMI Test Receiver	Rohde & Schwarz	ESIB40	TN1560	4/4/2013	4/11/2014

6.5.5. Test information

Date of test:	4/8/2014	**Test location:**	Transmitter Test Bench
EUT serial:	18	**Tested by:**	M. Royer
Test Conclusion:	Pass		

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6.6. Spurious emissions- Conducted

6.6.1. Requirements

FCC part 15.247(d), RSS210 A8.5

In any 100 kHz BW, the conducted spurious emissions shall be attenuated at least 20dB below the level of the wanted signal.

6.6.2. Test Setup

The EUT was allowed to transmit on all channels in search mode without pairing.

6.6.3. Test data

Conducted spurious:

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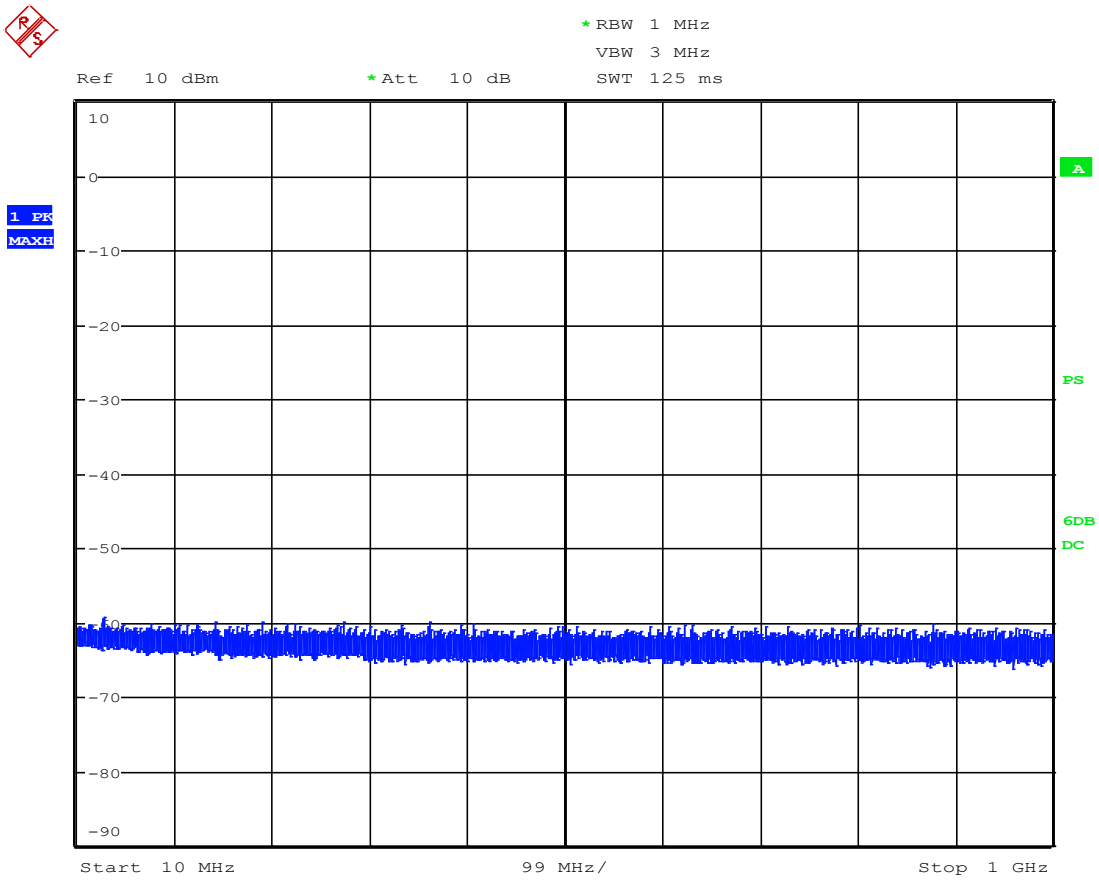

Date: 9.APR.2014 14:34:53

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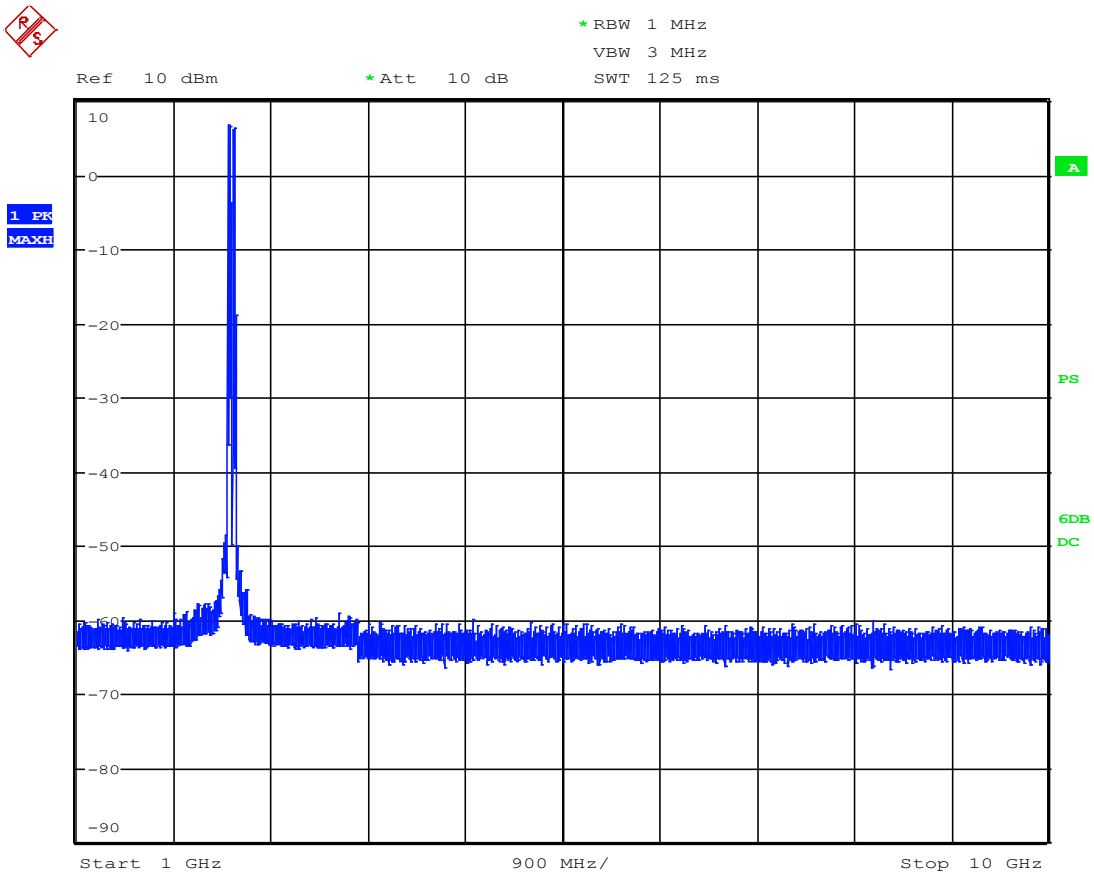

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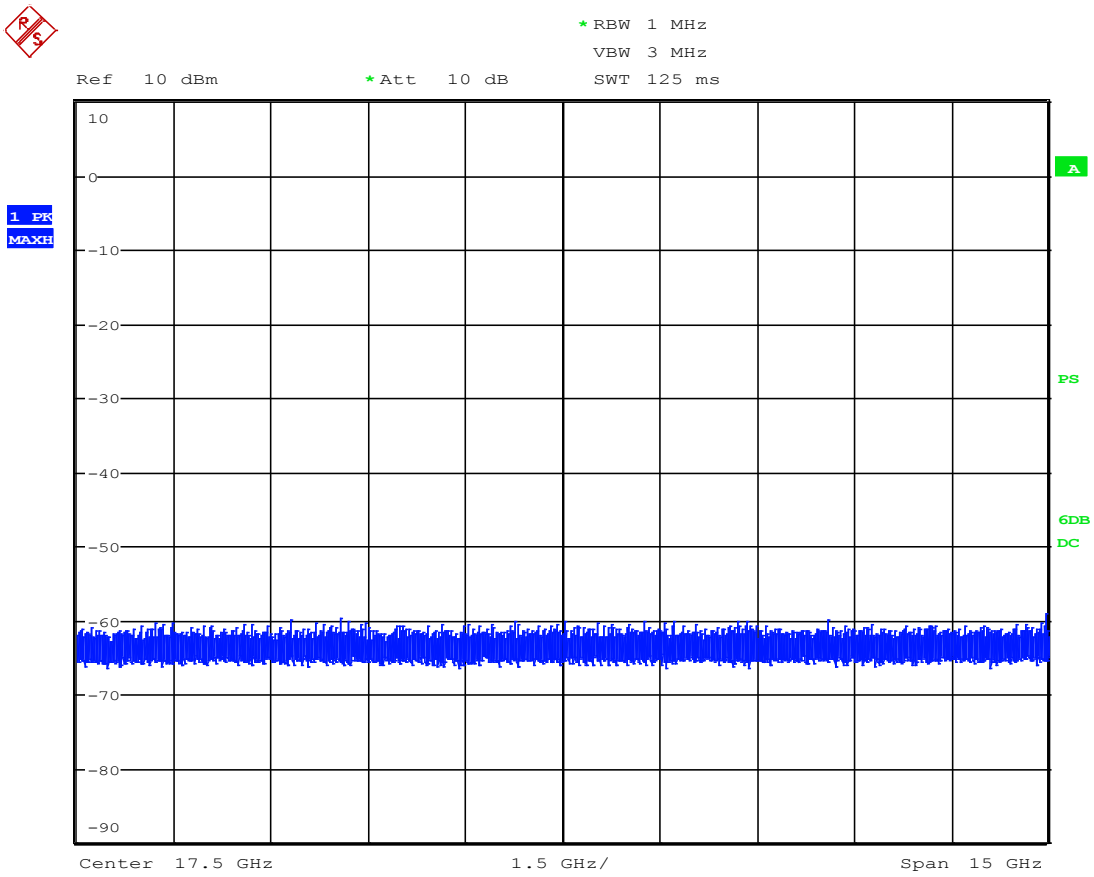

Date: 9.APR.2014 14:37:15

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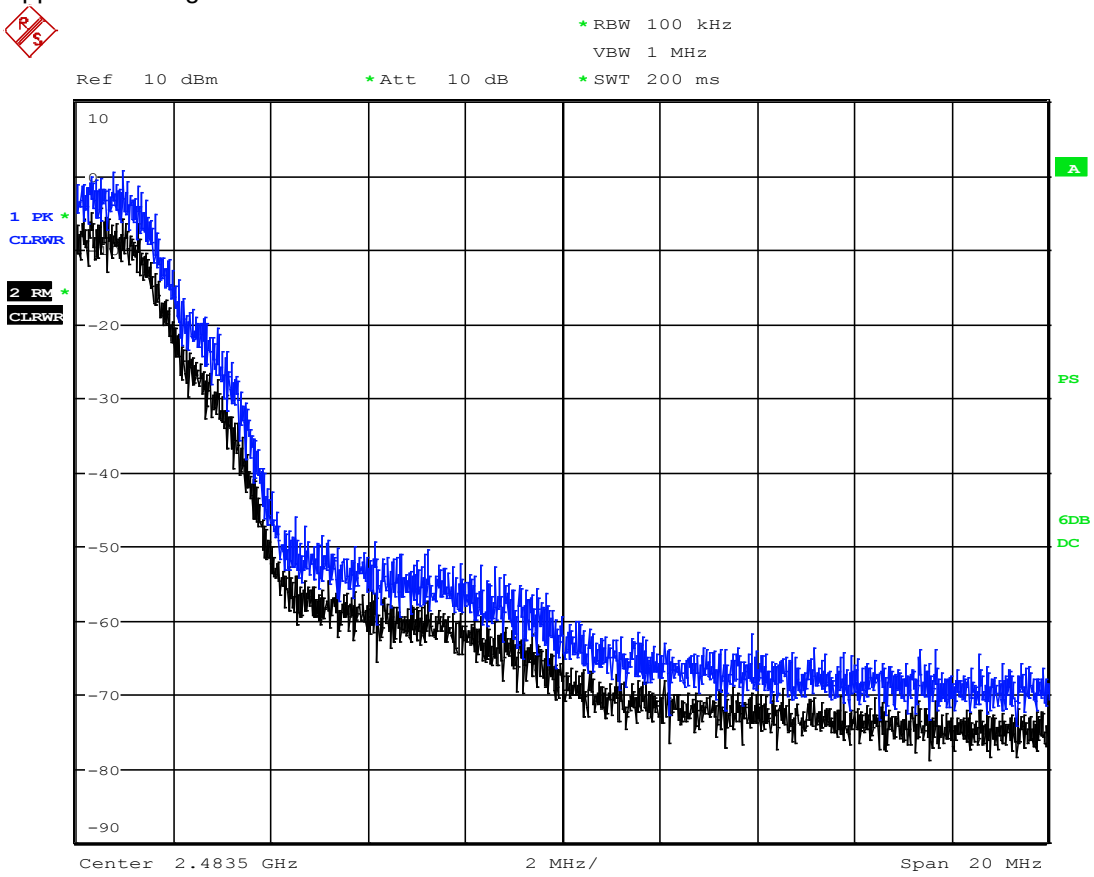
Upper Band Edge



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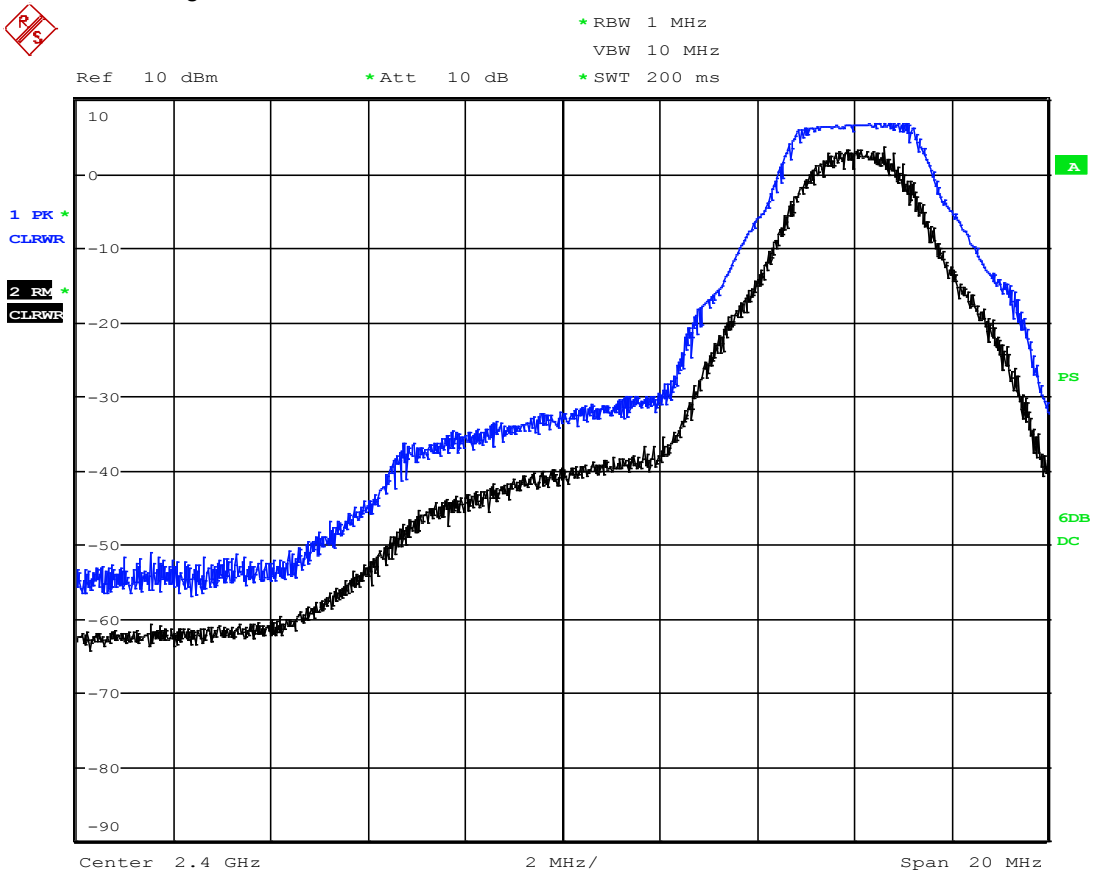
Lower Band Edge



Date: 9.APR.2014 14:42:34

Spurious emissions are more than 20 dB below maximum in band peak.

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6.6.4. Test Equipment

Equipment Type	Manufacturer	Model	Serial or other ID	Service date	
				Last	Due
EMI Test Receiver	Rohde & Schwarz	ESIB40	TN1560	4/4/2013	4/11/2014

6.6.5. Test information

Date of test:	4/9/2014	**Test Location:**	Transmitter Test Bench
EUT serial:	18	**Tested by:**	M. Royer
Test Conclusion:	Pass		

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6.7. Harmonics

6.7.1. Requirements

FCC part 15.247(d) RSS-Gen 4.9

In any of the restricted bands defined in FCC part 15.209(a), the field strength at a distance of 3 meters shall not exceed 54dBµV/m (average) or 74dBµV/m (peak)

6.7.2. Test Setup

The EUT is placed in a standard ANSI C63.10 test setup. Standard antennas and gain horns with suitable pre-amps mounted directly on the horn antennas are used for the measurement of the harmonics. The EUT hopping is stopped and measurements are made in the low, mid and high end of the frequency range at the defined limit distance of 3 meters.

The EUT is rotated around three axes, the antenna polarization changed from H to V and the antenna height is varied in order to find the maximum value of the harmonic emissions. Account is taken of the beam width of the horn antennas to make sure the EUT remains in the main lobe of the antenna.

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6.7.3. Test data

Emission Frequency (MHz)	Measured Amplitude (dBµV/m) QP/AVG*	Measured Amplitude (dBµV/m) Peak	FCC 15B			
			Limit (dBµV/m) QP/AVG*	Limit (dBµV/m) Peak	Margin (dB) QP/AVG*	Margin (dB) Peak
4812.000	45.10	54.80	54.0	74.0	8.9	19.2
4812.000	42.20	52.70	54.0	74.0	11.8	21.3
4812.000	37.40	49.00	54.0	74.0	16.6	25.0
4880.000	41.20	51.80	54.0	74.0	12.8	22.2
4880.000	39.20	50.40	54.0	74.0	14.8	23.6
4880.000	33.60	46.60	54.0	74.0	20.4	27.4
4948.000	39.30	50.10	54.0	74.0	14.7	23.9
4948.000	37.90	49.10	54.0	74.0	16.1	24.9
4948.000	32.40	45.50	54.0	74.0	21.6	28.5
7320.000	42.50	54.70	54.0	74.0	11.5	19.3
7320.000	40.30	53.10	54.0	74.0	13.7	20.9
7320.000	35.70	49.30	54.0	74.0	18.3	24.7
7422.000	44.10	56.10	54.0	74.0	9.9	17.9
7422.000	39.40	51.90	54.0	74.0	14.6	22.1
7422.000	36.30	49.60	54.0	74.0	17.7	24.4
12030.000	41.60	55.30	54.0	74.0	12.4	18.7
12030.000	41.60	55.20	54.0	74.0	12.4	18.8
12030.000	41.60	54.90	54.0	74.0	12.4	19.1
12200.000	42.40	55.90	54.0	74.0	11.6	18.1
12200.000	42.40	55.90	54.0	74.0	11.6	18.1
12200.000	42.40	55.90	54.0	74.0	11.6	18.1
12370.000	41.70	54.50	54.0	74.0	12.3	19.5
12370.000	41.70	54.90	54.0	74.0	12.3	19.1
12370.000	41.70	54.90	54.0	74.0	12.3	19.1
19248.000	47.10	60.20	54.0	74.0	6.9	13.8
19248.000	47.00	61.00	54.0	74.0	7.0	13.0
19248.000	47.00	60.20	54.0	74.0	7.0	13.8
19520.000	38.20	51.40	54.0	74.0	15.8	22.6
19520.000	38.00	51.60	54.0	74.0	16.0	22.4
19520.000	37.90	51.50	54.0	74.0	16.1	22.5
19792.000	37.20	51.10	54.0	74.0	16.8	22.9
19792.000	37.10	51.20	54.0	74.0	16.9	22.8
19792.000	37.00	51.00	54.0	74.0	17.0	23.0
22266.000	40.90	54.00	54.0	74.0	13.1	20.0
22266.000	40.90	54.10	54.0	74.0	13.1	19.9
22266.000	40.80	53.90	54.0	74.0	13.2	20.1

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6.7.4. Test Equipment

Equipment Type	Manufacturer	Model	Tracking Number	Service date	
				Last	Due
Microwave Horn Antenna 4GHz - 8GHz	Amplifier Research	AT4003	TN727	12/6/2011	12/5/2014
20 GHz Pre-amp	MITEQ	AFS4-00102000-30-10P-4	TN1672	10/8/2013	10/8/2014
Hertz Lodge 3 Meter Semi-Anechoic Chamber	Panashield Inc.		TN1499	8/21/12	8/21/14
Cable	K316MM-42 40GHz cable	K316MM-42 40GHz cable	TN1277-18	3/25/2014	3/25/2015
Antenna 1GHz-18GHz	EMCO	3115	TN478	7/12/2014	7/12/2015
Hertz Lodge Antenna Cable	Cable X-Perts	LMR600UFN25	TN1550	3/25/2014	3/25/2015
ESU 40 EMI Test Receiver	Rohde & Schwarz	ESU 40	TN1663	4/11/2014	4/11/2015
Cable	Florida RF Labs, Inc	NMS-290A-240.0-NMS	TN2076	3/25/2014	3/25/2015
Antenna 8 – 18G	AR	AT4004	TN728	12/1/2011	12/1/2014
Horn Antenna 18GHz - 26.5GHz	ETS Lindgren	3160-09	TN1307	3/13/2014	3/12/2017
40 GHz pre-amp	MITEQ	JS4018004000-30-8P-A1	TN1757	9/18/2013	9/13/2014
RF Cable	Florida Labs	KMS-160-36.0-KMS	TN2189	4/16/2013	4/16/2014

6.7.5. Test information

Date of test:	4/11/14	**Test Location:**	Hertz Lodge
EUT serial:	18	**Tested by:**	N. Sanford
Test Conclusion:	Pass		

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6.8. Spurious emissions 1-25 GHz

6.8.1. Requirements

FCC part 15.247(d), RSS-Gen7.2.5

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

In any of the restricted bands defined in FCC part 15.205(a), the field strength at a distance of 3 meters shall not exceed limits shown in 15.209, 54dBµV/m (average) or 74dBµV/m (peak).

6.8.2. Test Setup

The EUT is operating normally and measurements are made at the defined limit distance of 3 meters. Above 18GHz the measurement distance may be reduced to make sure the emissions are well below the limit.

The EUT is rotated around the vertical axis, the antenna polarization was changed from H to V and the antenna height is varied from 1 to 4 meters in order to find the maximum value of the emissions. EUT was maximized in 3 orthogonal planes for radiated spurious emissions; plots shown represent worst case orientation. Account is taken of the beam width of the horn antennas to make sure the EUT remains in the main lobe of the antenna.
Note upper and lower band edge measurements are covered in section 6.6.3 and 6.8

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6.8.3. Test Results

The EUT is operating normally and measurements are made at the defined limit distance of 3m. The plots show the emissions results. The frequencies not covered by the harmonics measurements above are listed in the table below.

Emission Frequency (MHz)	Measured Amplitude (dBµV/m) QP/AVG*	Measured Amplitude (dBµV/m) Peak	FCC 15B			
			Limit (dBµV/m) QP/AVG*	Limit (dBµV/m) Peak	Margin (dB) QP/AVG*	Margin (dB) Peak
2357.960	40.80	53.90	54.0	74.0	13.2	20.1
2357.960	40.10	52.30	54.0	74.0	13.9	21.7
2357.960	40.00	52.50	54.0	74.0	14.0	21.5

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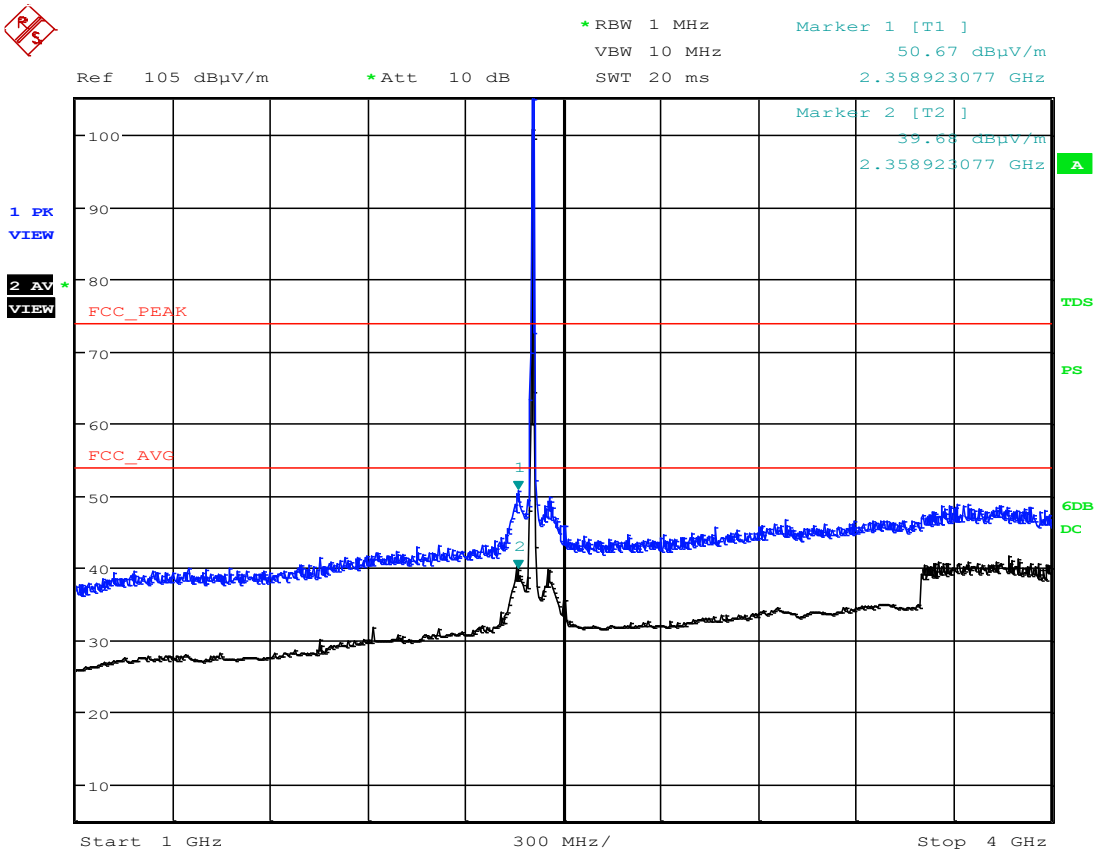
1 – 4GHz Testing



Date: 11.APR.2014 20:44:16

Max-Hold Peak Pre-scan, 1GHz – 4GHz, Low Tx channel (2406MHz) X-axis

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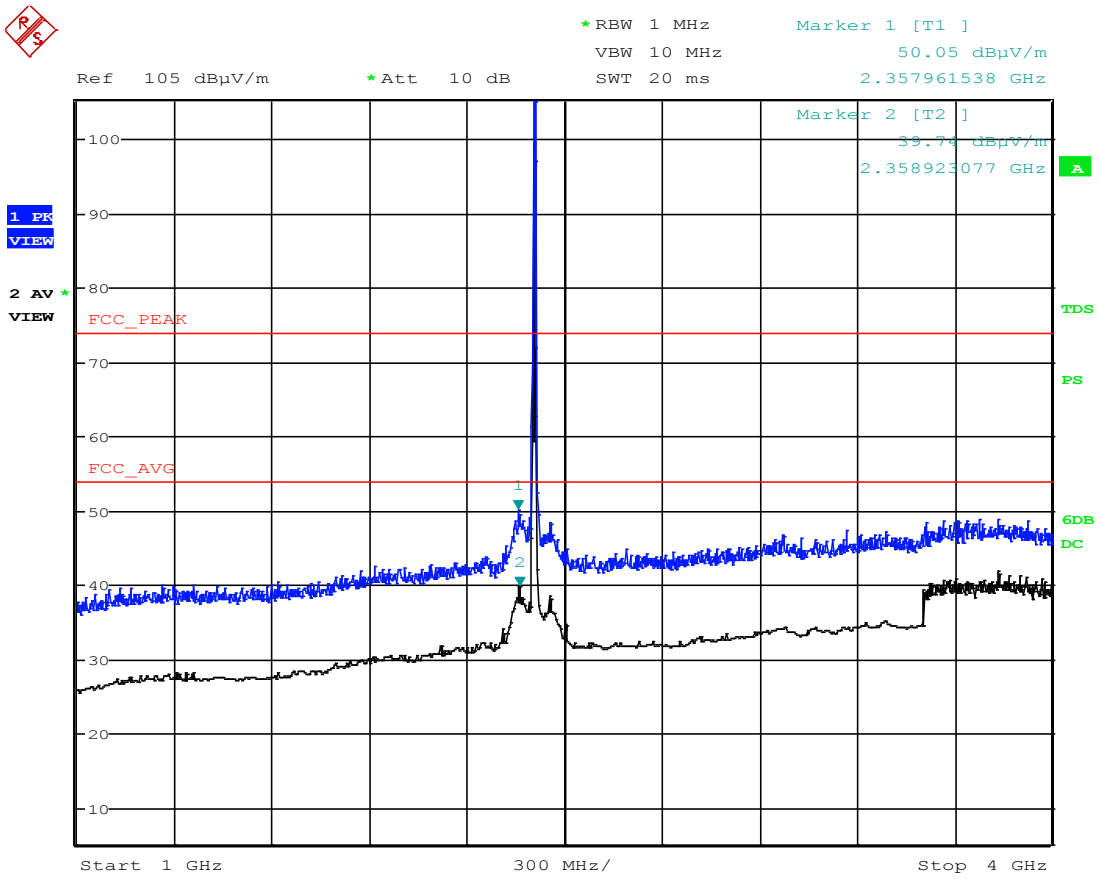

Date: 11.APR.2014 21:03:08

Max-Hold Peak Pre-scan, 1GHz – 4GHz, Low Tx channel (2406MHz) Y-axis

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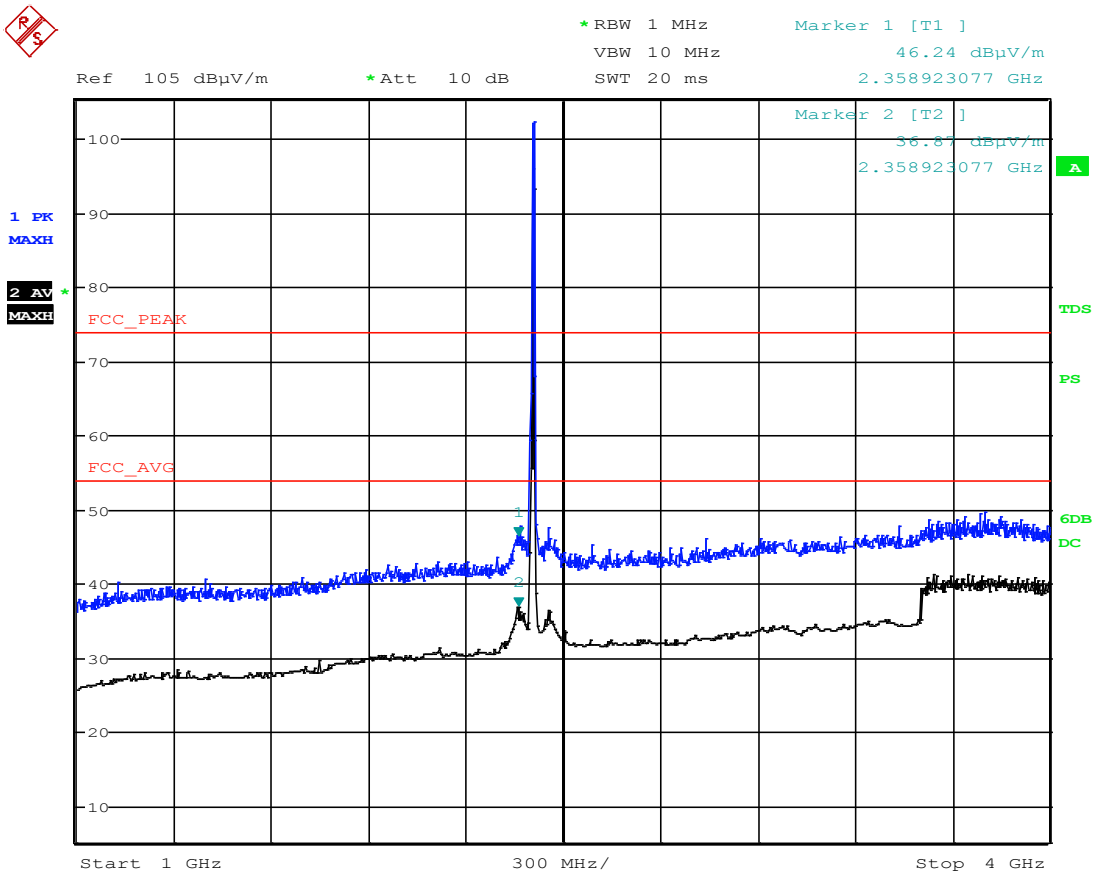

Date: 11.APR.2014 21:12:19

Max-Hold Peak Pre-scan, 1GHz – 4GHz, Low Tx channel (2406MHz) Z-axis

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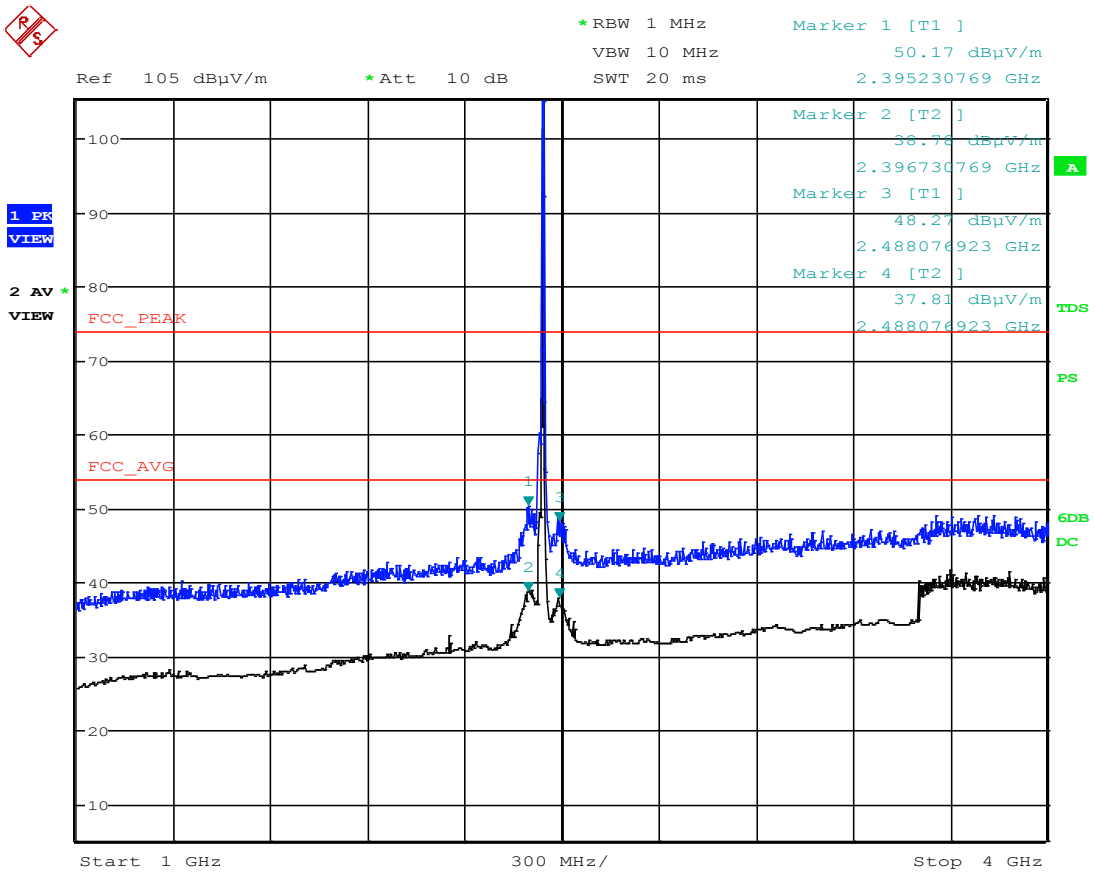

Date: 11.APR.2014 21:41:59

Max-Hold Peak Pre-scan, 1GHz – 4GHz, Mid Tx channel (2440MHz) X-axis

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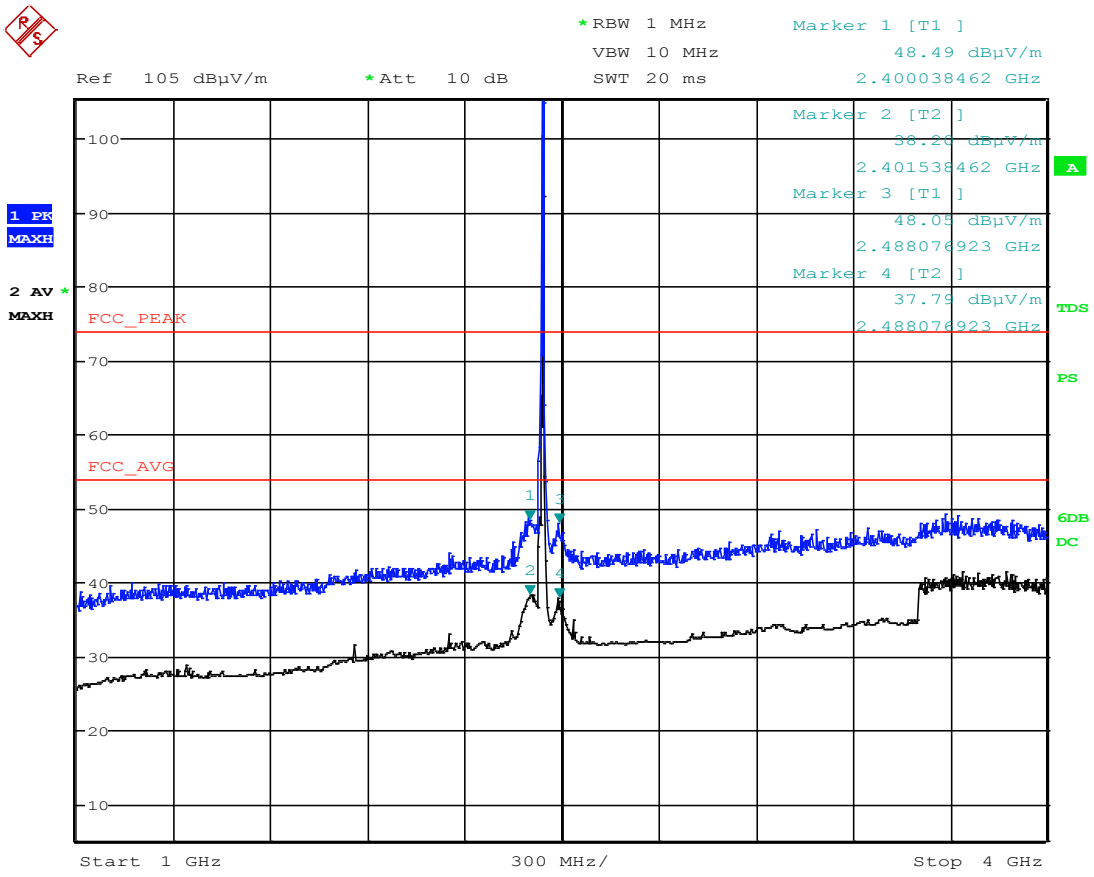

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Max-Hold Peak Pre-scan, 1GHz – 4GHz, Mid Tx channel (2440MHz) Y-axis

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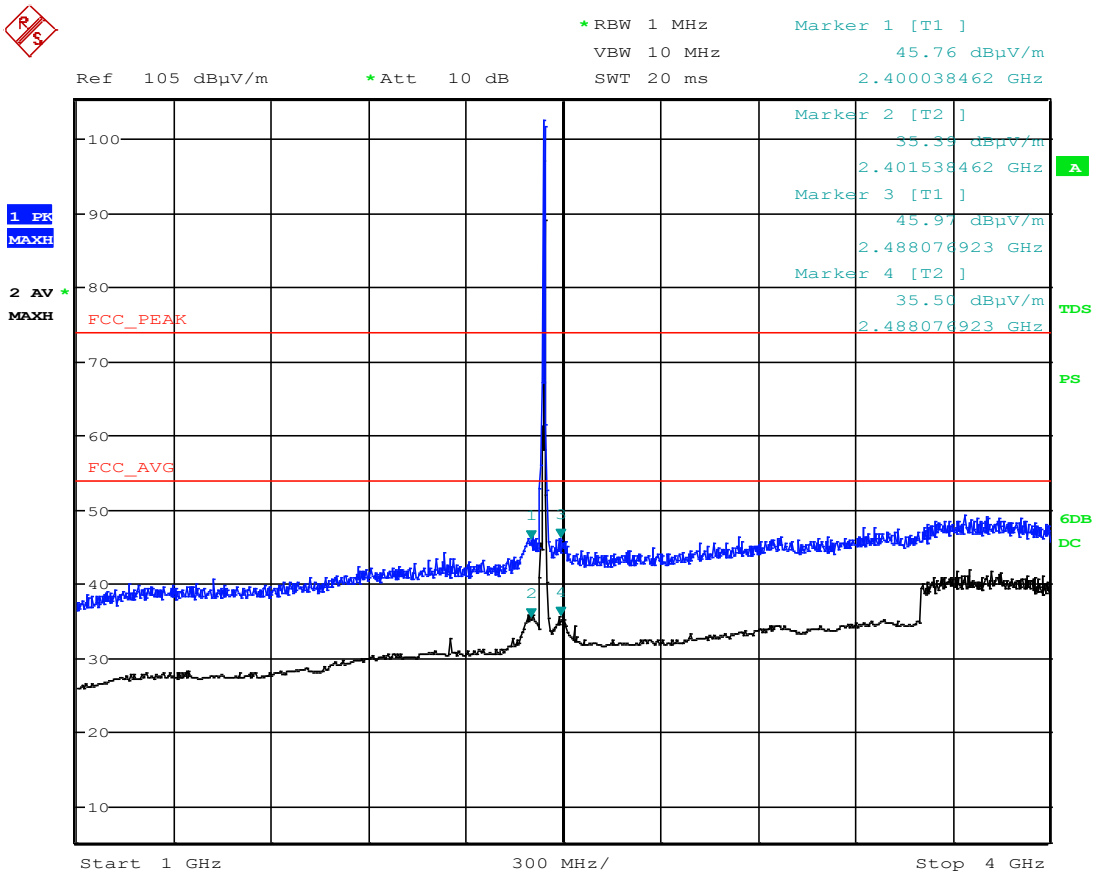

Date: 11.APR.2014 21:50:19

Max-Hold Peak Pre-scan, 1GHz – 4GHz, Mid Tx channel (2440MHz) Z-axis

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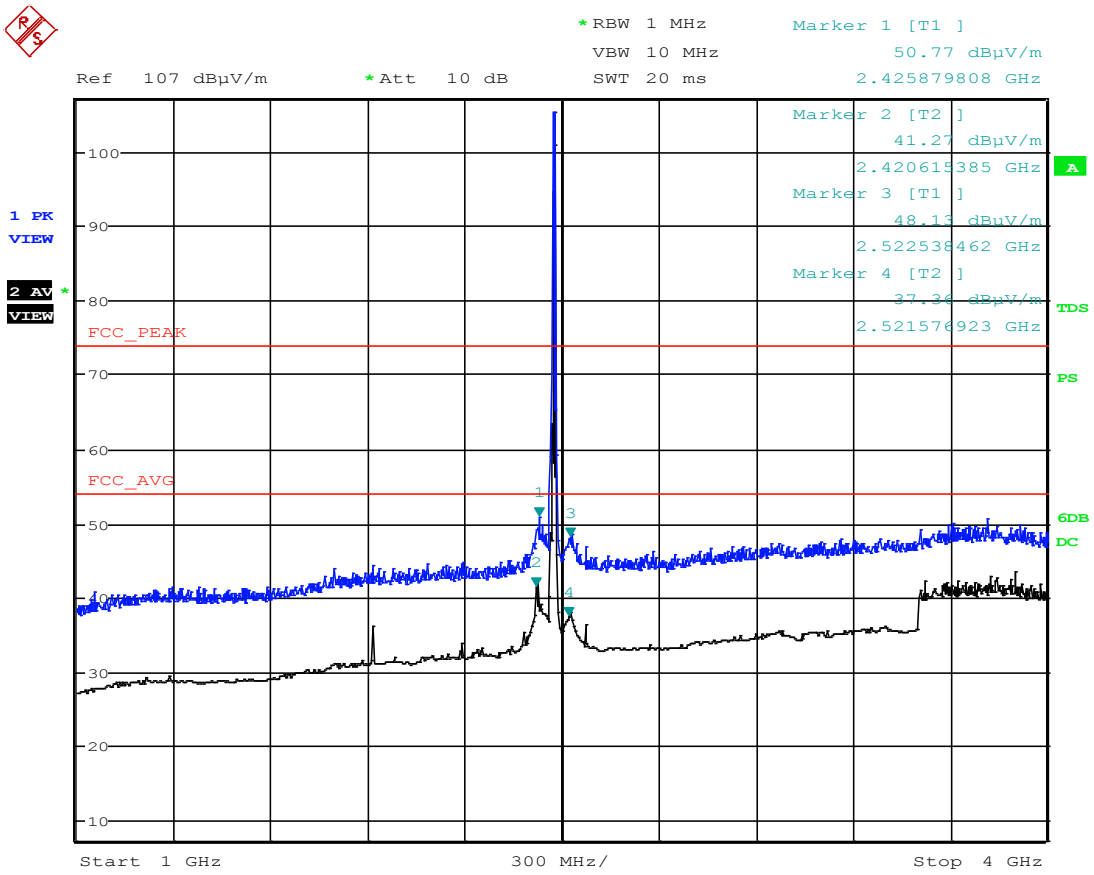

Date: 14.APR.2014 20:03:51

Max-Hold Peak Pre-scan, 1GHz – 4GHz, High Tx channel (2474MHz) X-axis

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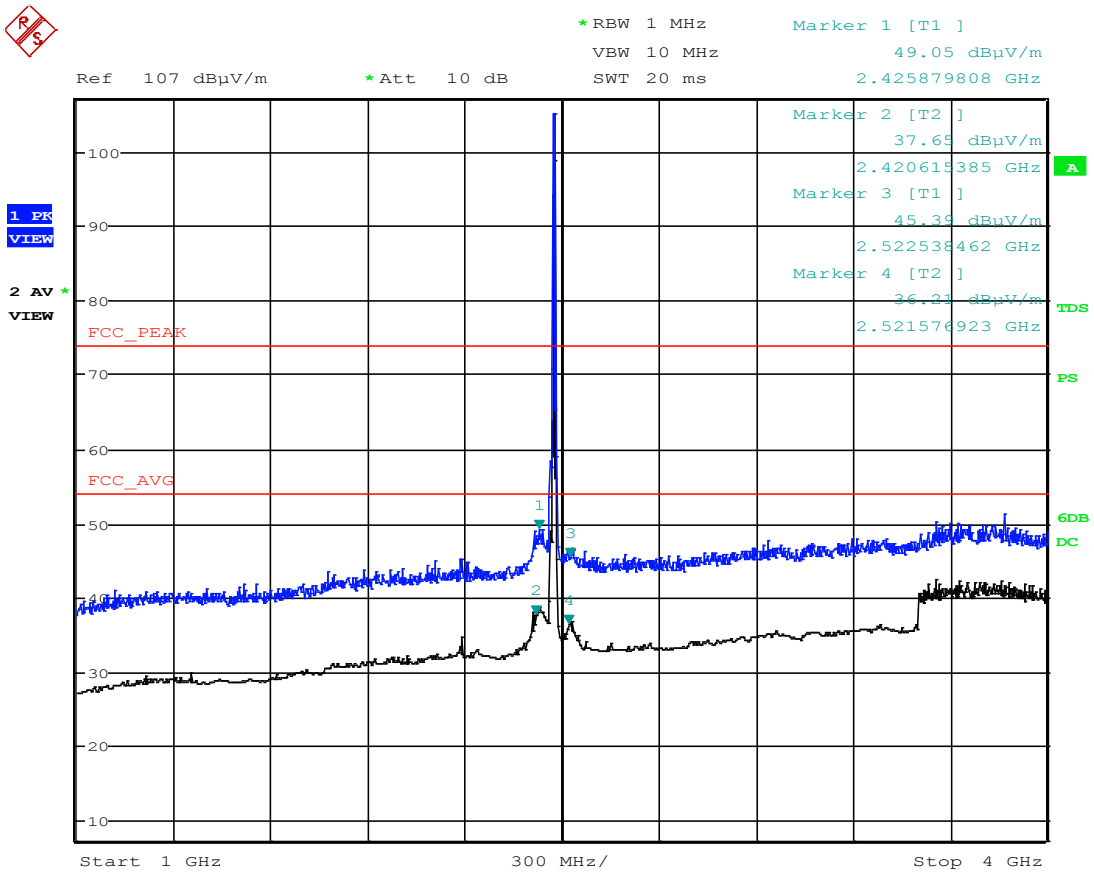

Date: 14.APR.2014 20:13:07

Max-Hold Peak Pre-scan, 1GHz – 4GHz, High Tx channel (2474MHz) Y-axis

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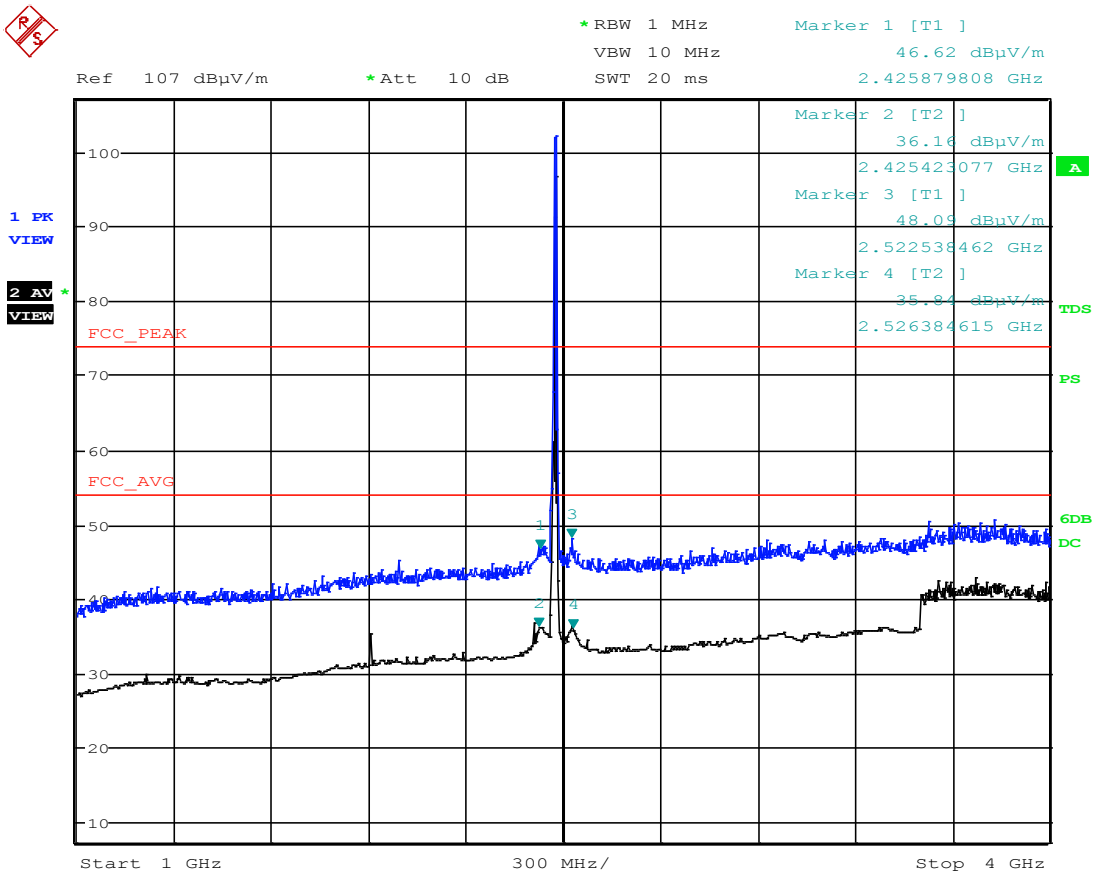

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Max-Hold Peak Pre-scan, 1GHz – 4GHz, High Tx channel (2474MHz) Z-axis

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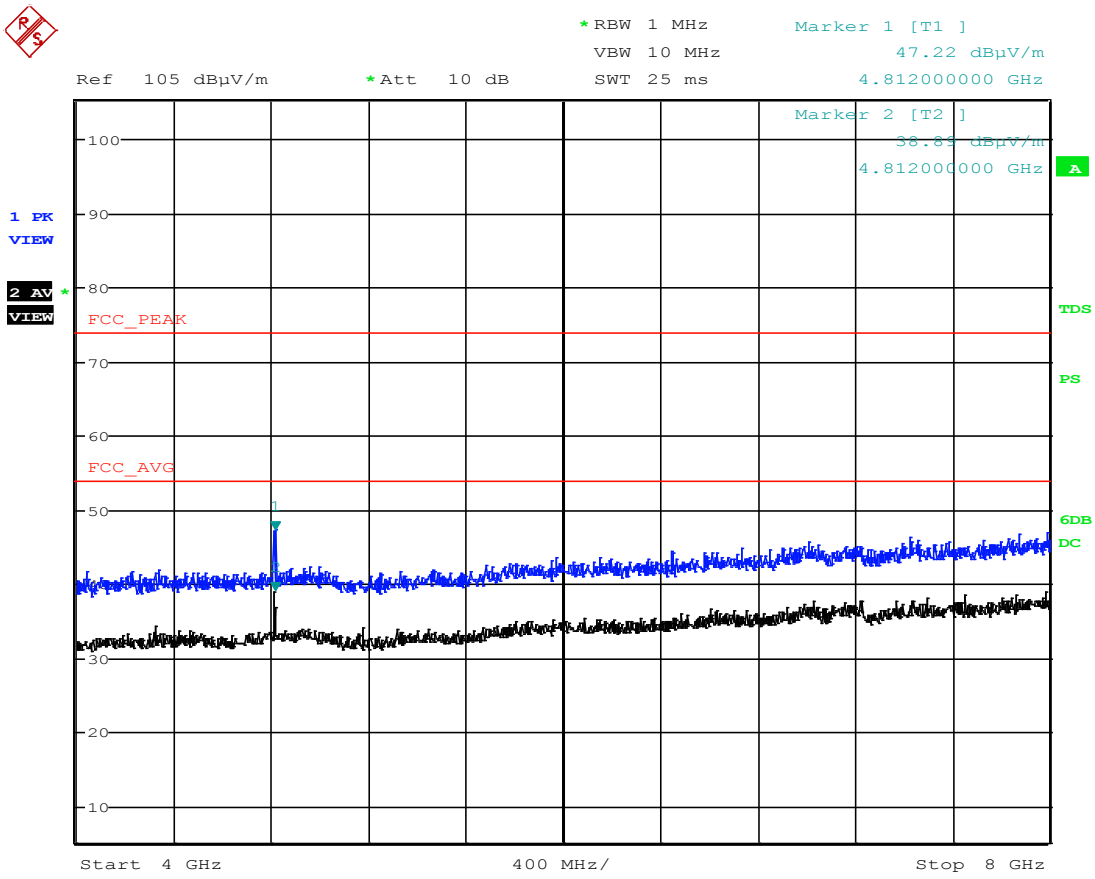
4 – 8GHz Testing



Date: 11.APR.2014 22:31:25

Max-Hold Peak Pre-scan, 4GHz – 8GHz, Low Tx channel (2406MHz) X-axis

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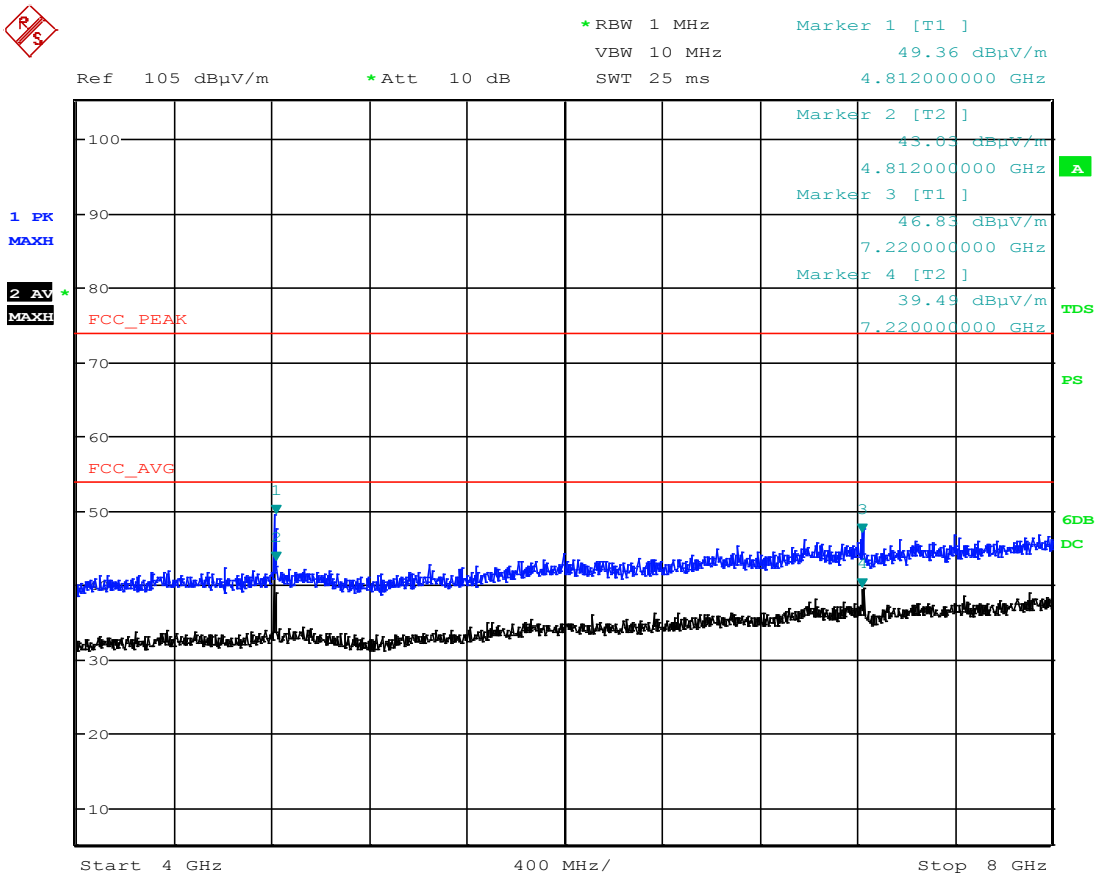

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Max-Hold Peak Pre-scan, 4GHz – 8GHz, Low Tx channel (2406MHz) Y-axis

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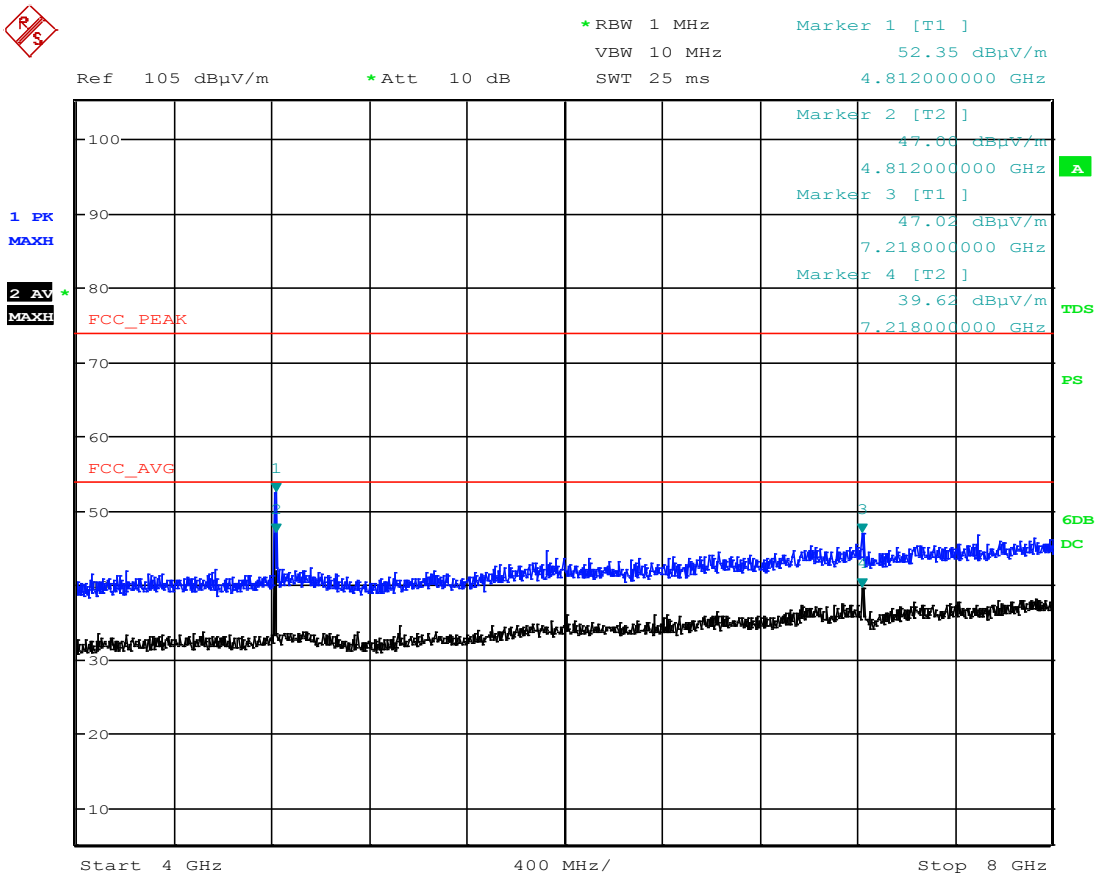

Date: 11.APR.2014 22:46:33

Max-Hold Peak Pre-scan, 4GHz – 8GHz, Low Tx channel (2406MHz) Z-axis

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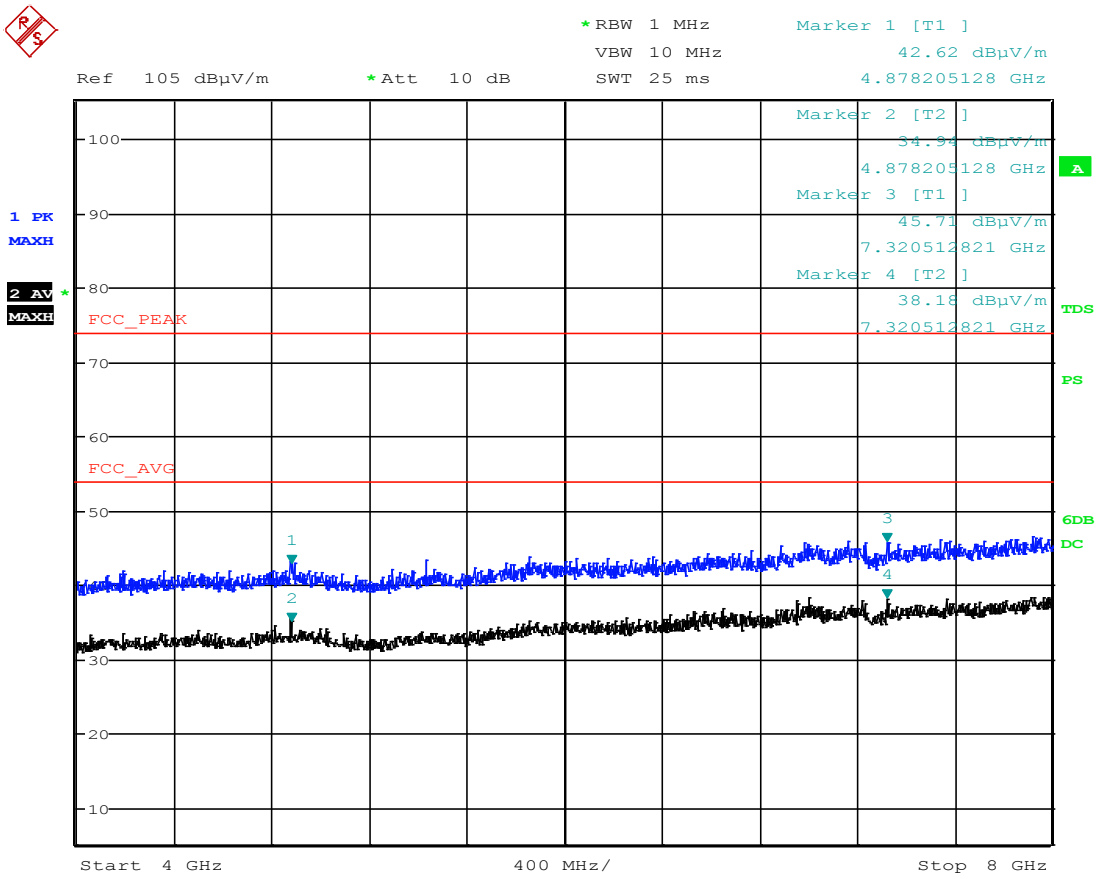

Date: 11.APR.2014 23:10:57

Max-Hold Peak Pre-scan, 4GHz – 8GHz, Mid Tx channel (2440MHz) X-axis

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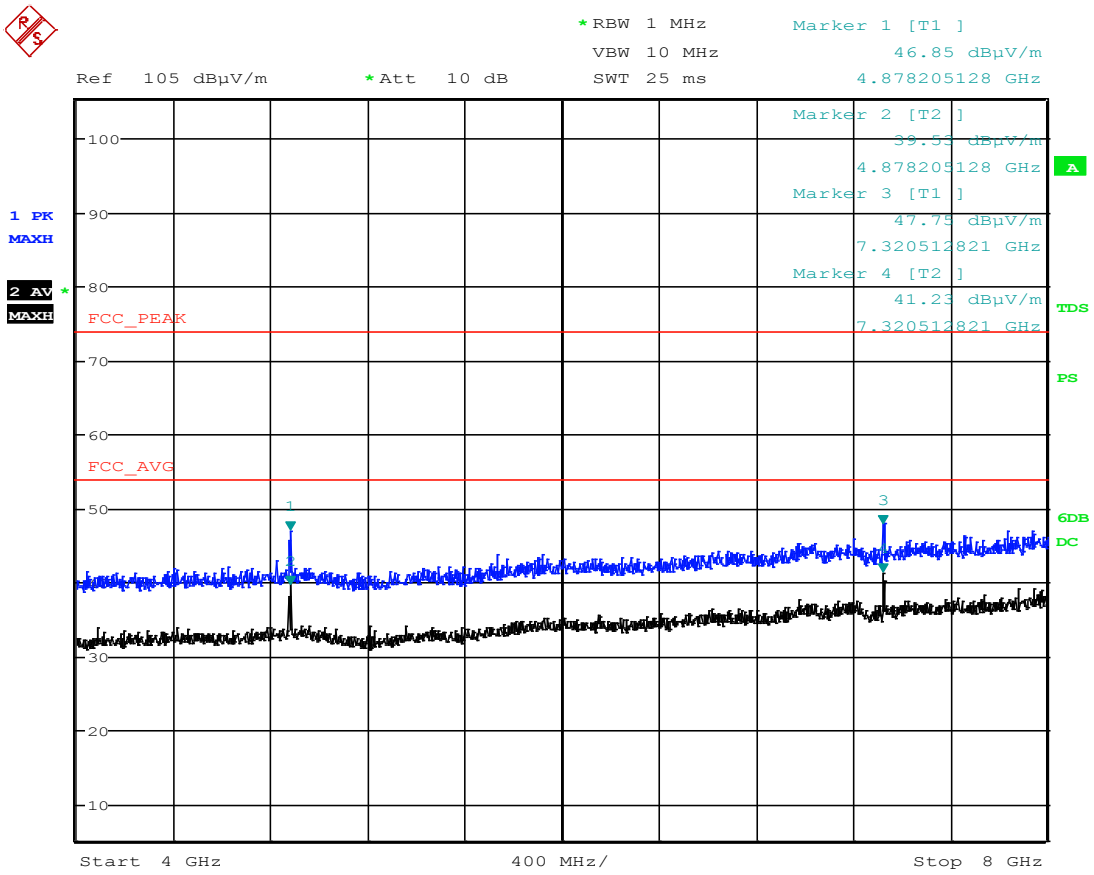

Date: 11.APR.2014 23:19:52

Max-Hold Peak Pre-scan, 4GHz – 8GHz, Mid Tx channel (2440MHz) Y-axis

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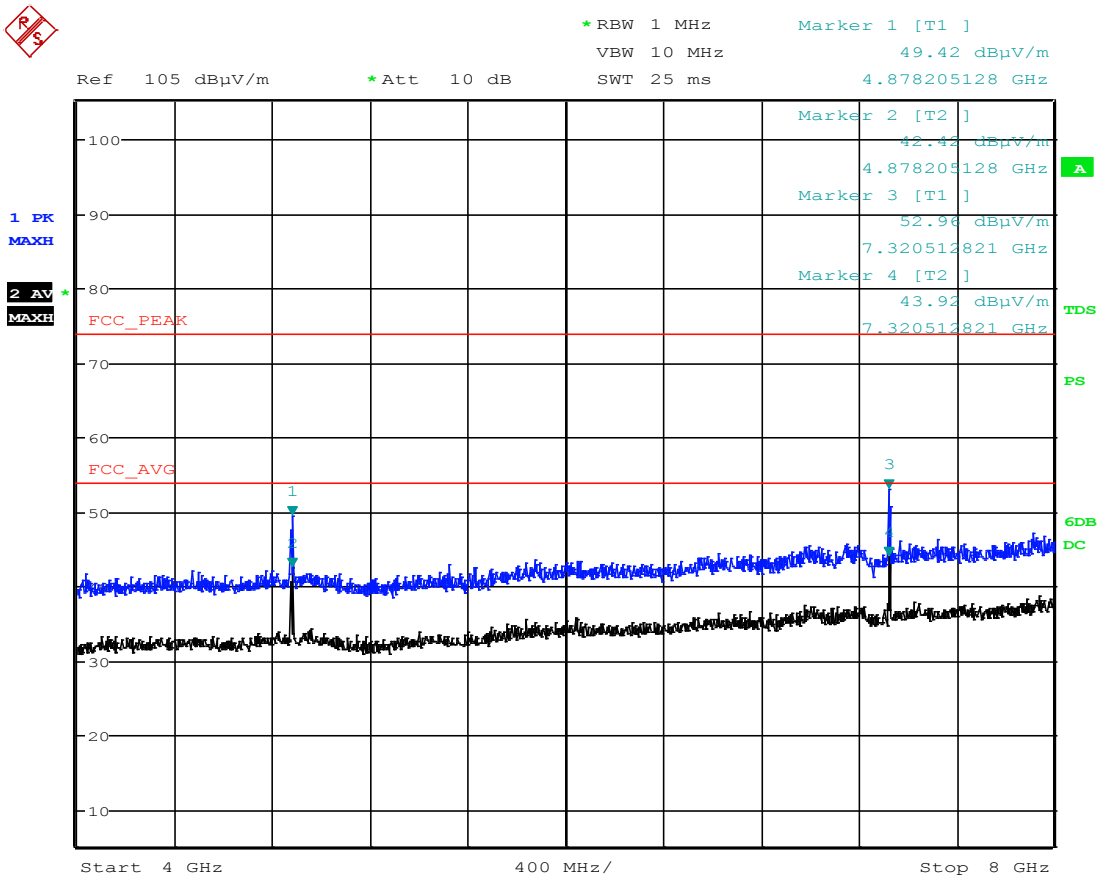

Date: 11.APR.2014 23:30:36

Max-Hold Peak Pre-scan, 4GHz – 8GHz, Mid Tx channel (2440MHz) Z-axis

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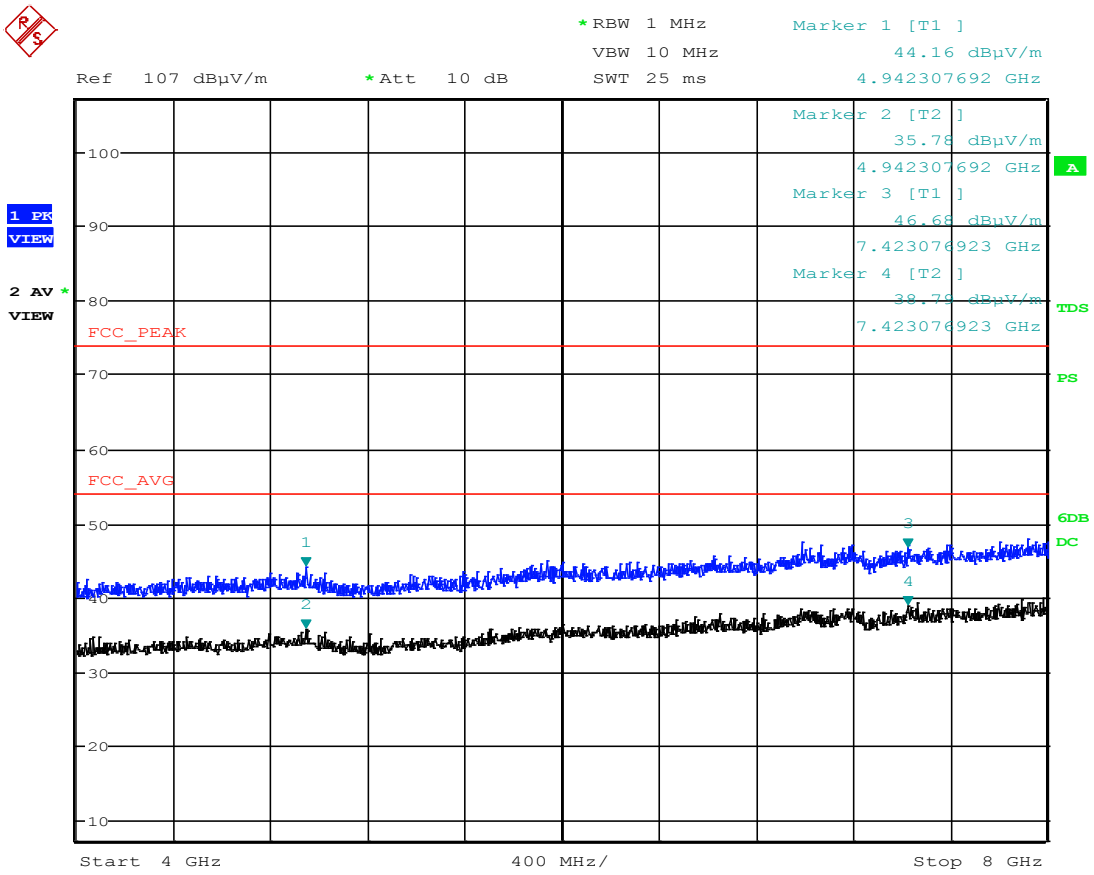

Date: 14.APR.2014 21:01:41

Max-Hold Peak Pre-scan, 4GHz – 8GHz, High Tx channel (2474MHz) X-axis

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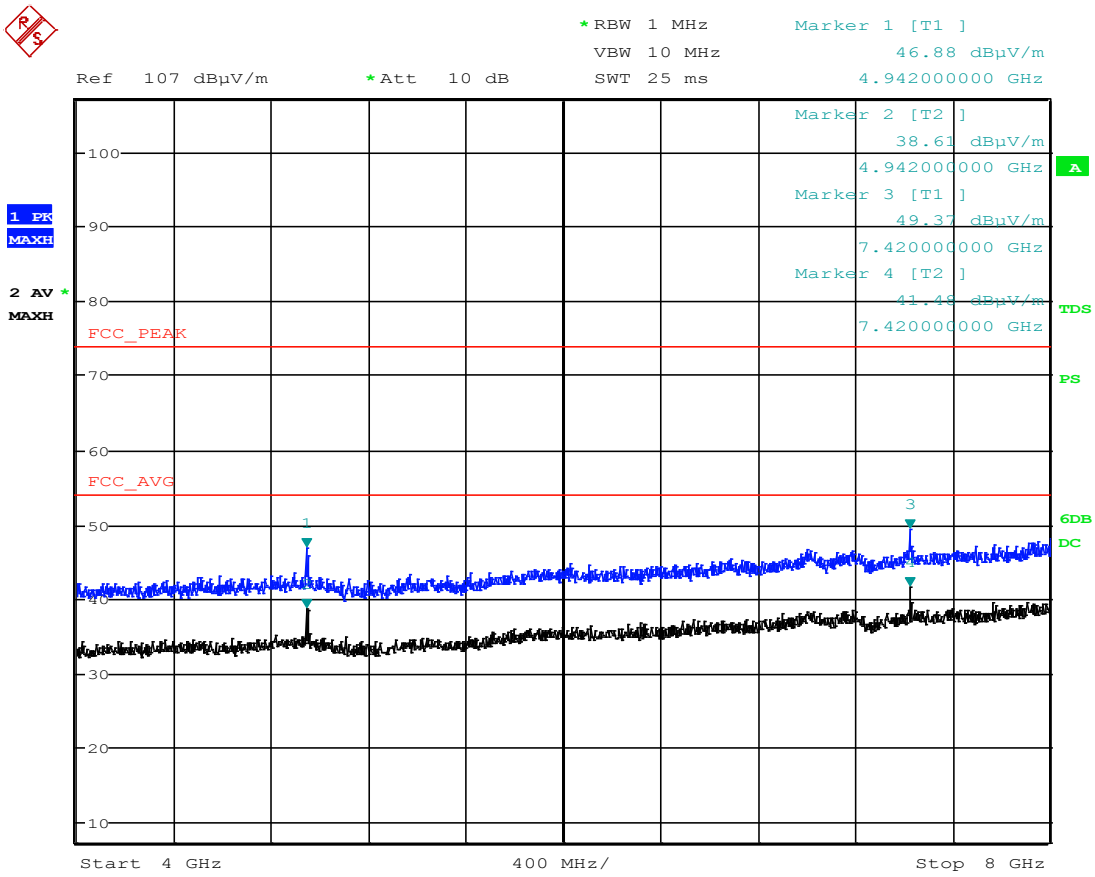

Date: 14.APR.2014 21:11:31

Max-Hold Peak Pre-scan, 4GHz – 8GHz, High Tx channel (2474MHz) Y-axis

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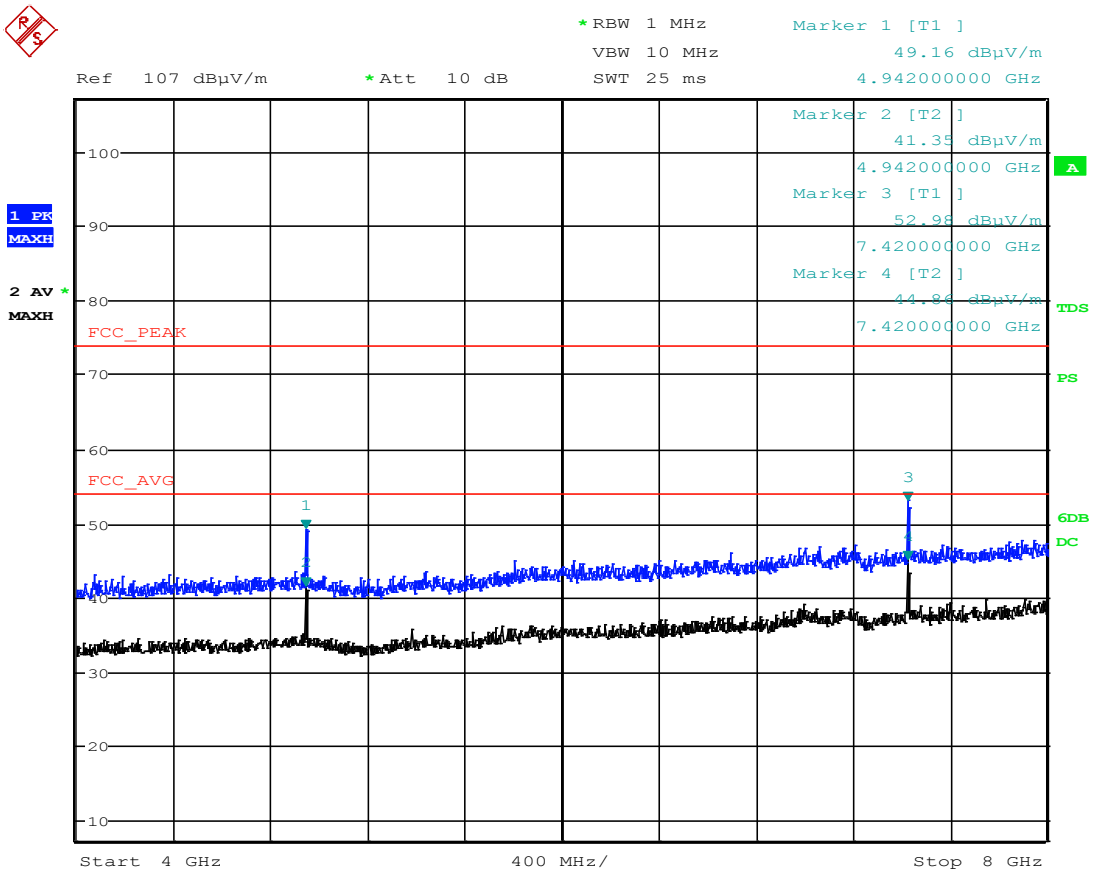

Date: 14.APR.2014 21:21:29

Max-Hold Peak Pre-scan, 4GHz – 8GHz, High Tx channel (2474MHz) Z-axis

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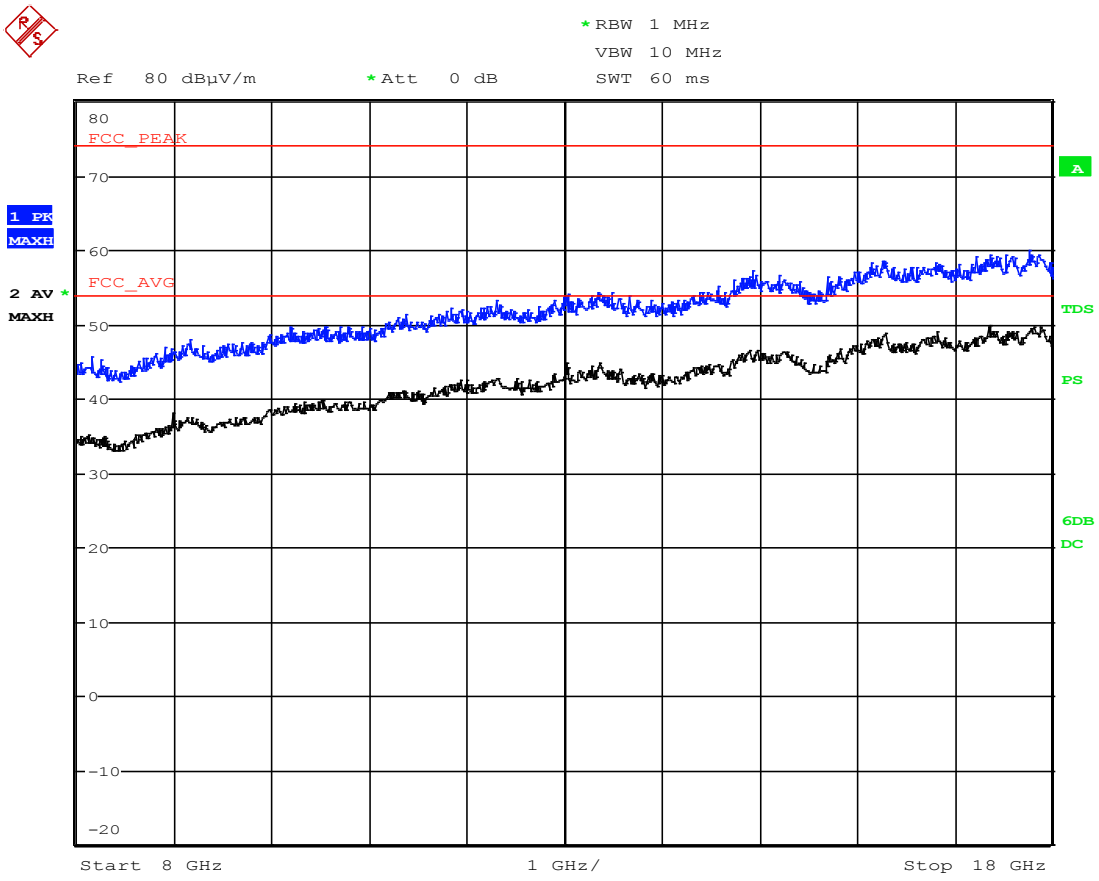
8 – 18GHz Testing



Date: 14.APR.2014 23:23:19

Max-Hold Peak Pre-scan, 8GHz –1 8GHz, Low Tx channel (2406MHz) X-axis

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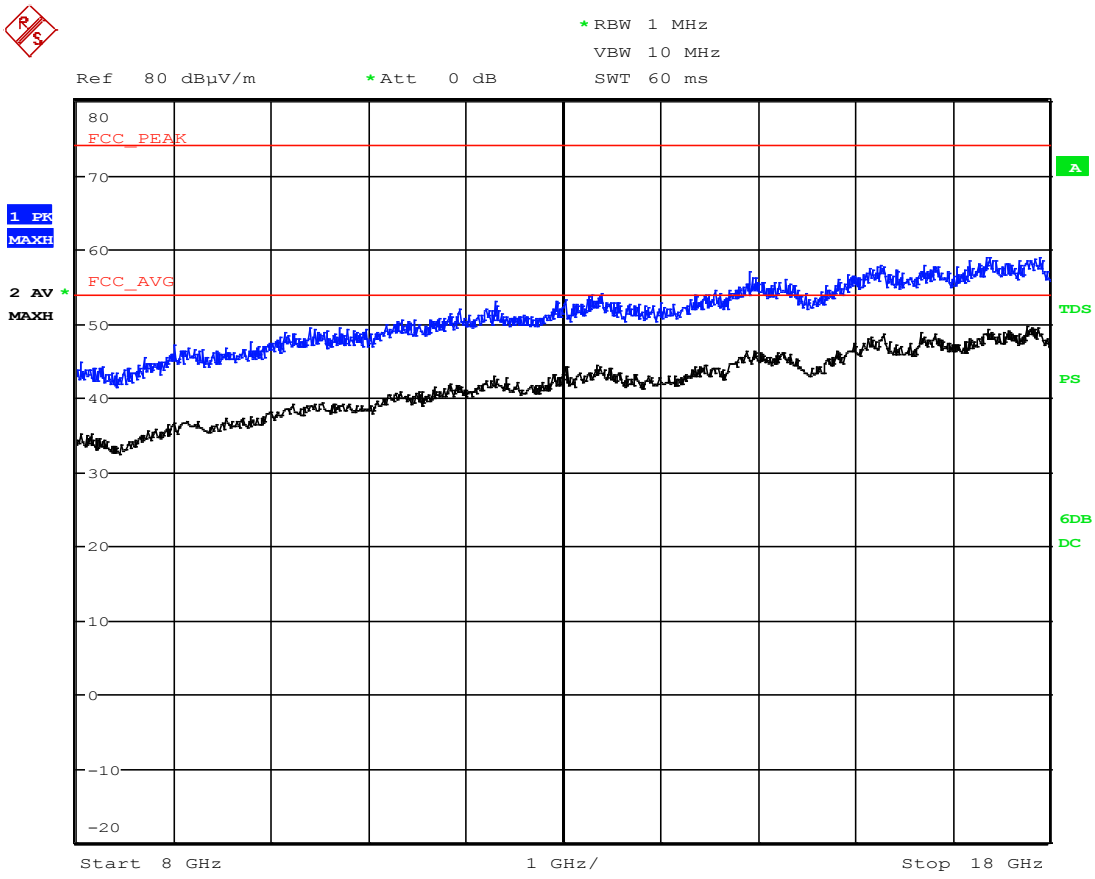

Date: 14.APR.2014 23:30:07

Max-Hold Peak Pre-scan, 8GHz –1 8GHz, Low Tx channel (2406MHz) Y-axis

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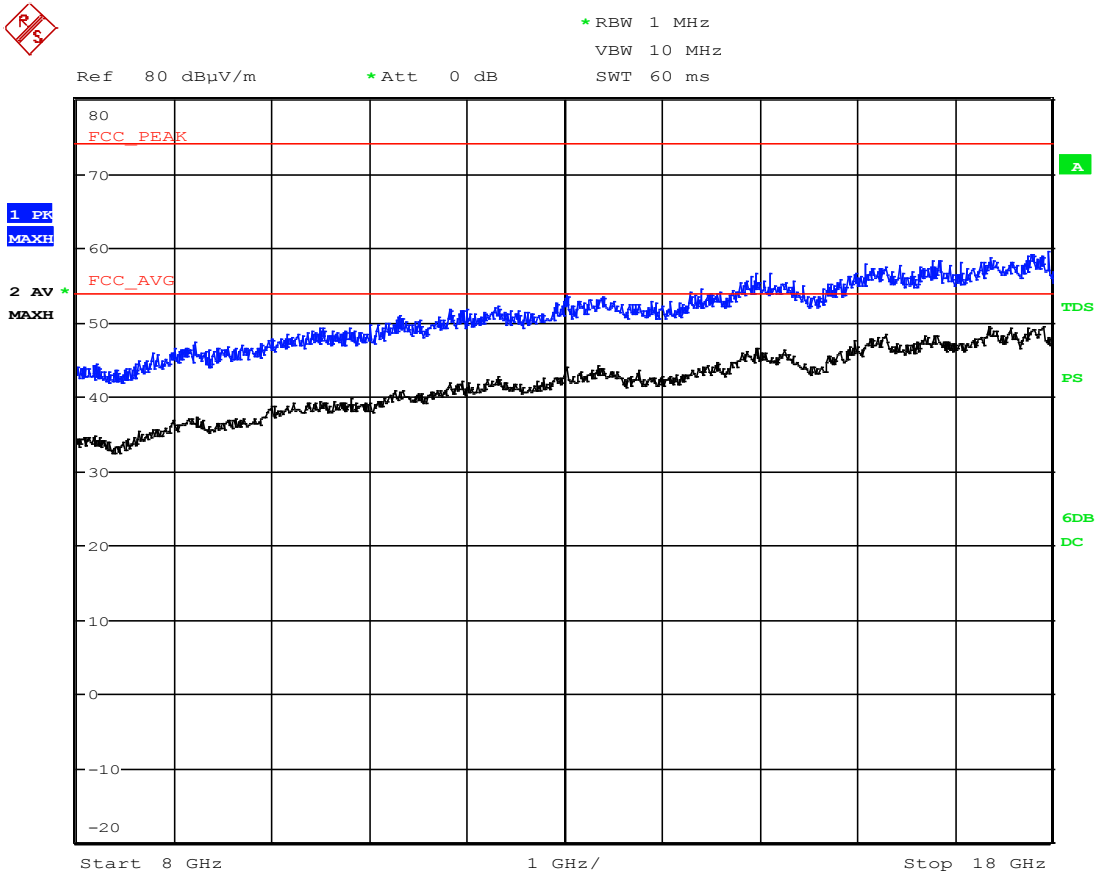

Date: 14.APR.2014 23:34:24

Max-Hold Peak Pre-scan, 8GHz –1 8GHz, Low Tx channel (2406MHz) Z-axis

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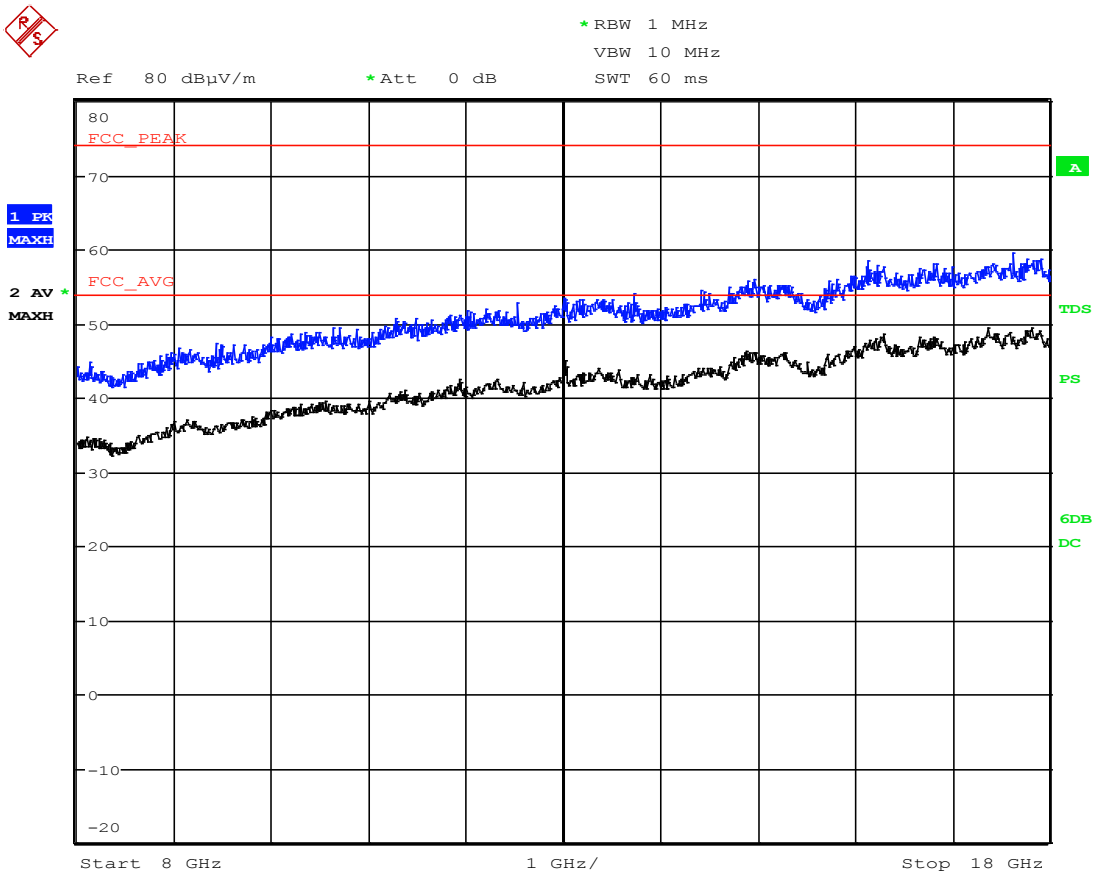

Date: 15.APR.2014 00:01:58

Max-Hold Peak Pre-scan, 8GHz – 18GHz, Mid Tx channel (2440MHz) X-axis

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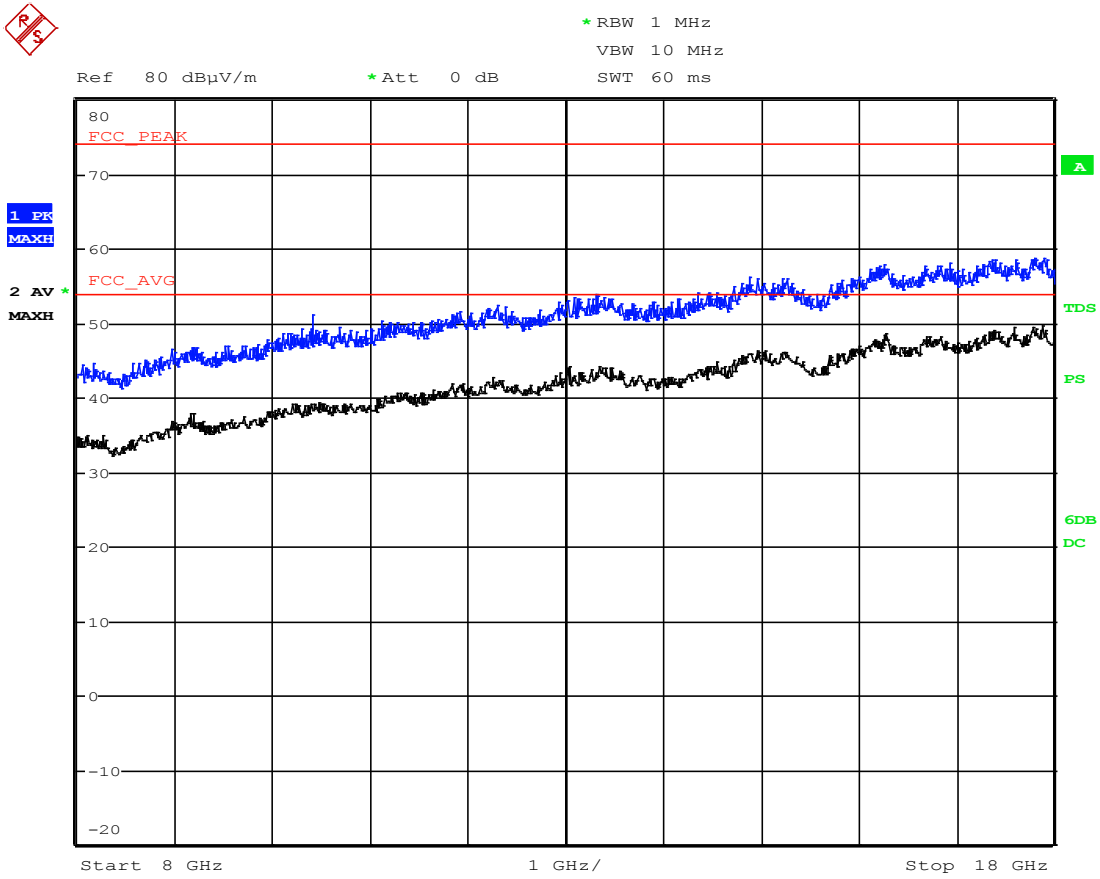

Date: 15.APR.2014 00:05:38

Max-Hold Peak Pre-scan, 8GHz – 18GHz, Mid Tx channel (2440MHz) Y-axis

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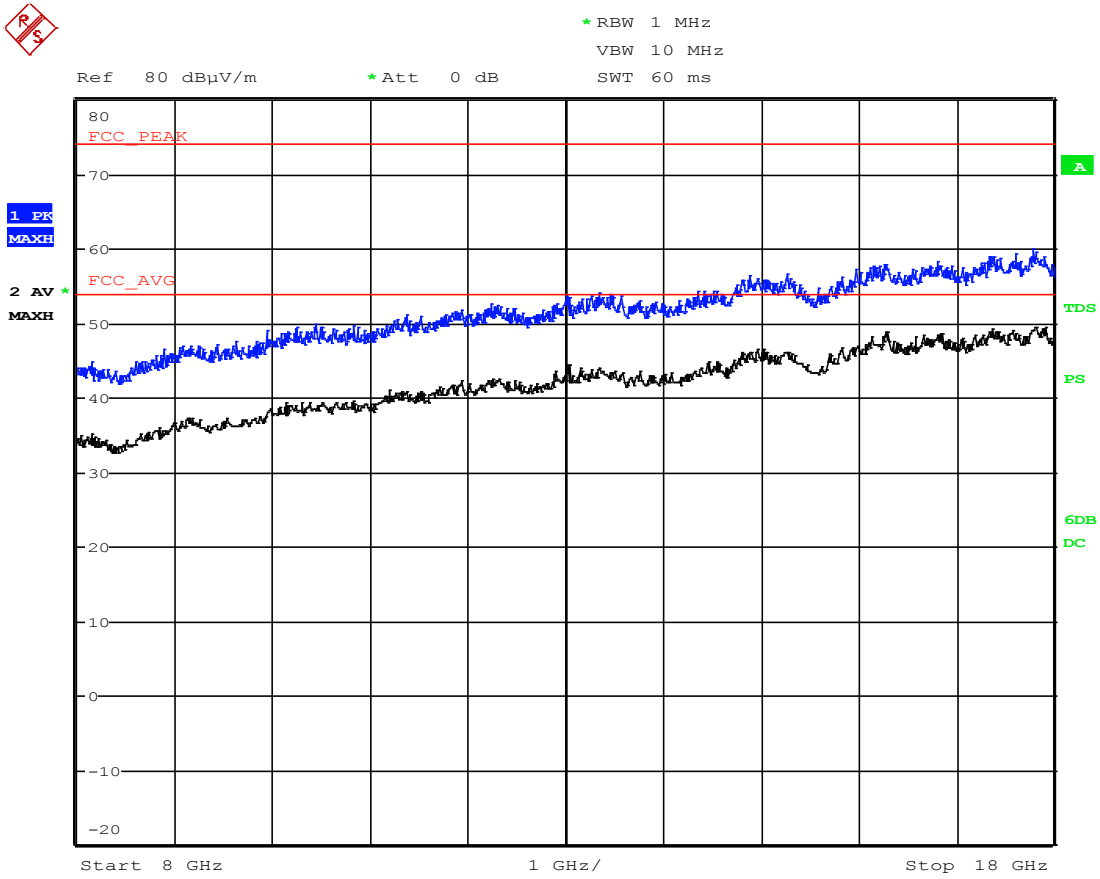

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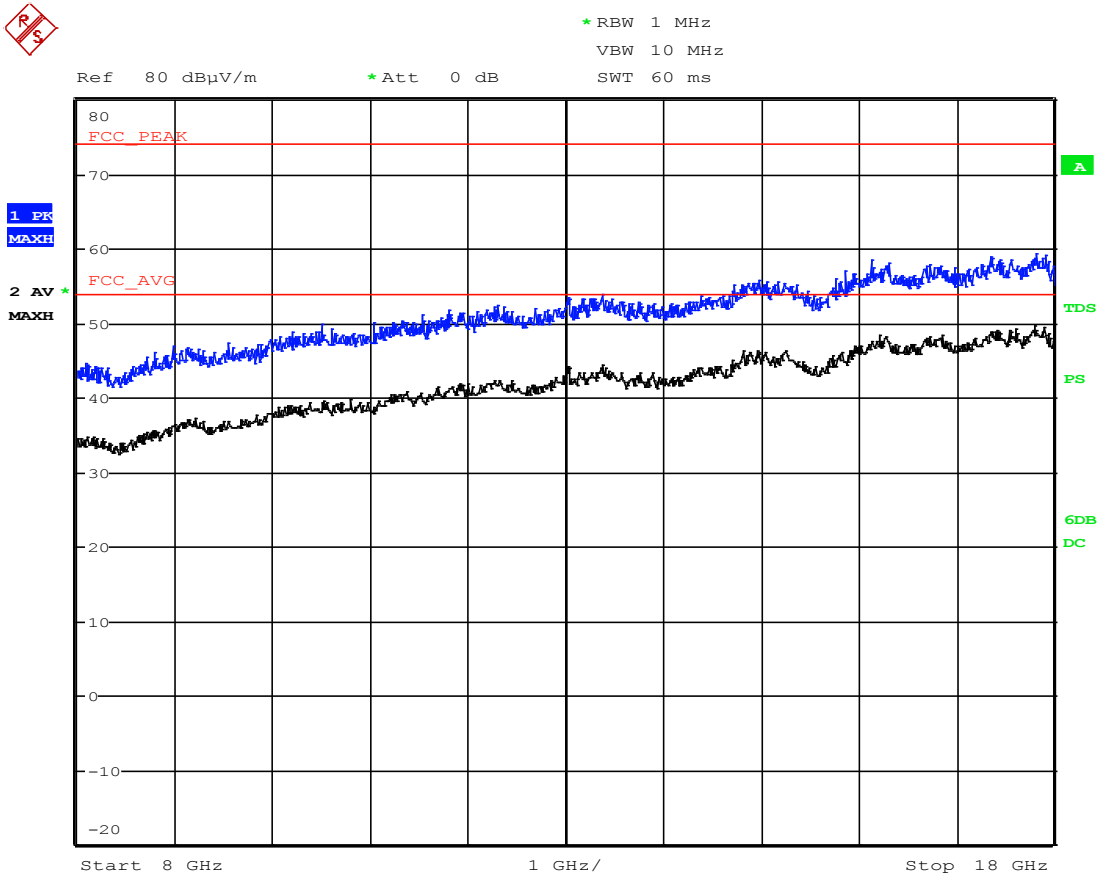

Date: 15.APR.2014 00:19:18

Max-Hold Peak Pre-scan, 8GHz – 18GHz, High Tx channel (2474MHz) X-axis

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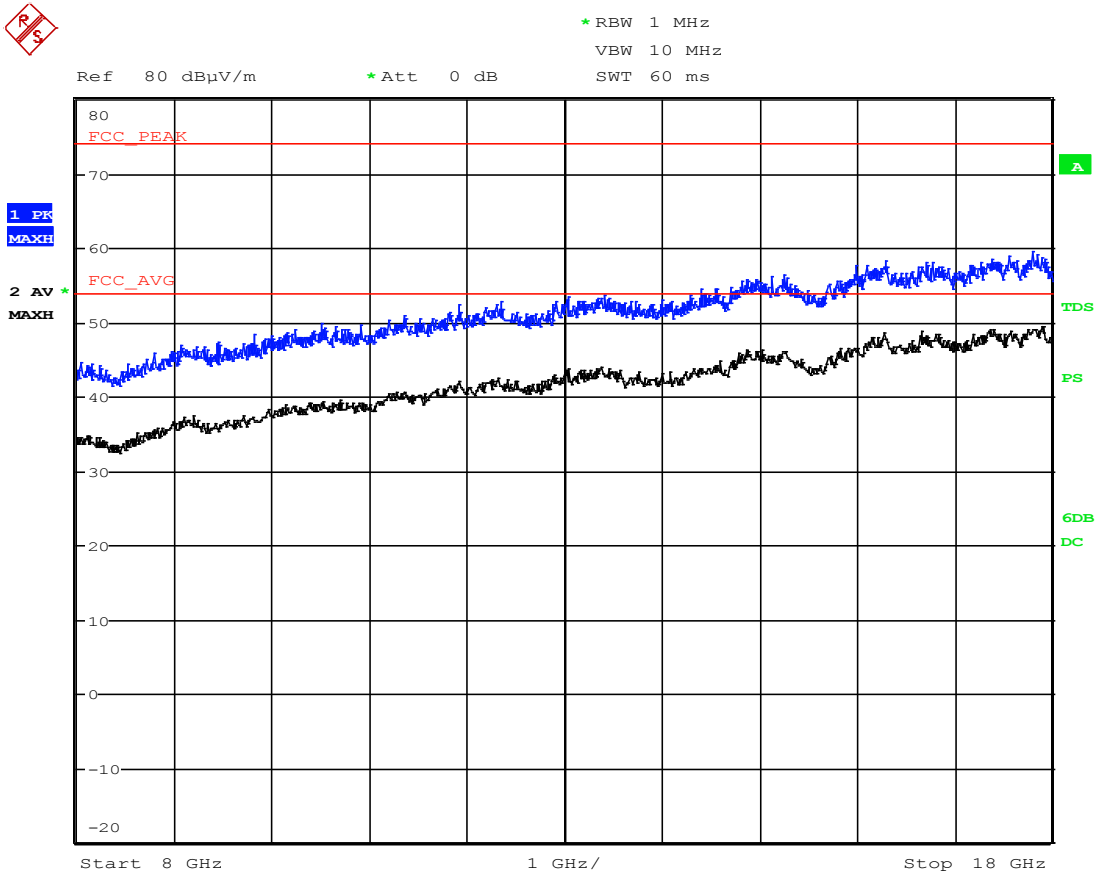

Date: 15.APR.2014 00:23:30

Max-Hold Peak Pre-scan, 8GHz – 18GHz, High Tx channel (2474MHz) Y-axis

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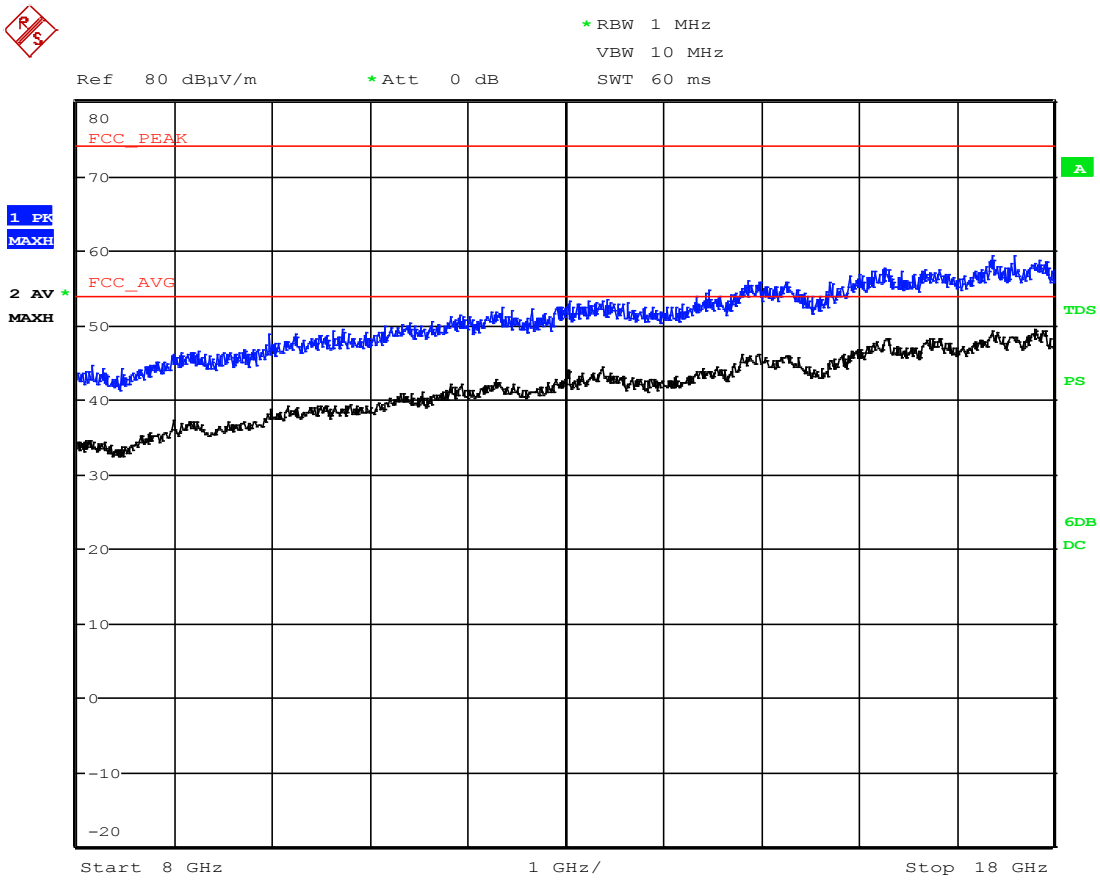

Date: 15.APR.2014 00:26:50

Max-Hold Peak Pre-scan, 8GHz – 18GHz, High Tx channel (2474MHz) Z-axis

*Above 18 GHz, no spurious emissions in peak detection were observed and the noise floor was at least 10 dB below the Average limit.

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6.8.4. Test Equipment

Equipment Type	Manufacturer	Model	Tracking Number	Service date	
				Last	Due
Microwave Horn Antenna 4GHz - 8GHz	Amplifier Research	AT4003	TN727	12/6/2011	12/2/2014
20 GHz Pre-amp	MITEQ	AFS4-00102000-30-10P-4	TN1672	10/8/2013	10/8/2014
Hertz Lodge 3 Meter Semi-Anechoic Chamber	Panashield Inc.		TN1499	8/21/12	8/21/14
Cable	K316MM-42 40GHz cable	K316MM-42 40GHz cable	TN1277-18	3/25/2014	3/25/2015
Antenna 1GHz-18GHz	EMCO	3115	TN478	7/12/2014	7/12/2015
Hertz Lodge Antenna Cable	Cable X-Perts	LMR600UFN25	TN1550	3/25/2014	3/25/2015
ESU 40 EMI Test Receiver	Rohde & Schwarz	ESU 40	TN1663	4/11/2014	4/11/2015
Cable	Florida RF Labs, Inc	NMS-290A-240.0-NMS	TN2076	3/25/2014	3/25/2015
Antenna 8 – 18G	AR	AT4004	TN728	12/1/2011	12/1/2014
Horn Antenna 18GHz - 26.5GHz	ETS Lindgren	3160-09	TN1307	3/13/2014	3/12/2017
40 GHz pre-amp	MITEQ	JS4018004000-30-8P-A1	TN1757	9/18/2013	9/13/2014
RF Cable	Florida Labs	KMS-160-36.0-KMS	TN2189	4/16/2013	4/16/2014

6.8.5. Test information

Date of test:	4/11/2014	**Test Location:**	Hertz Lodge
EUT serial:	18	**Tested by:**	N. Sanford
Test Conclusion:	Pass		

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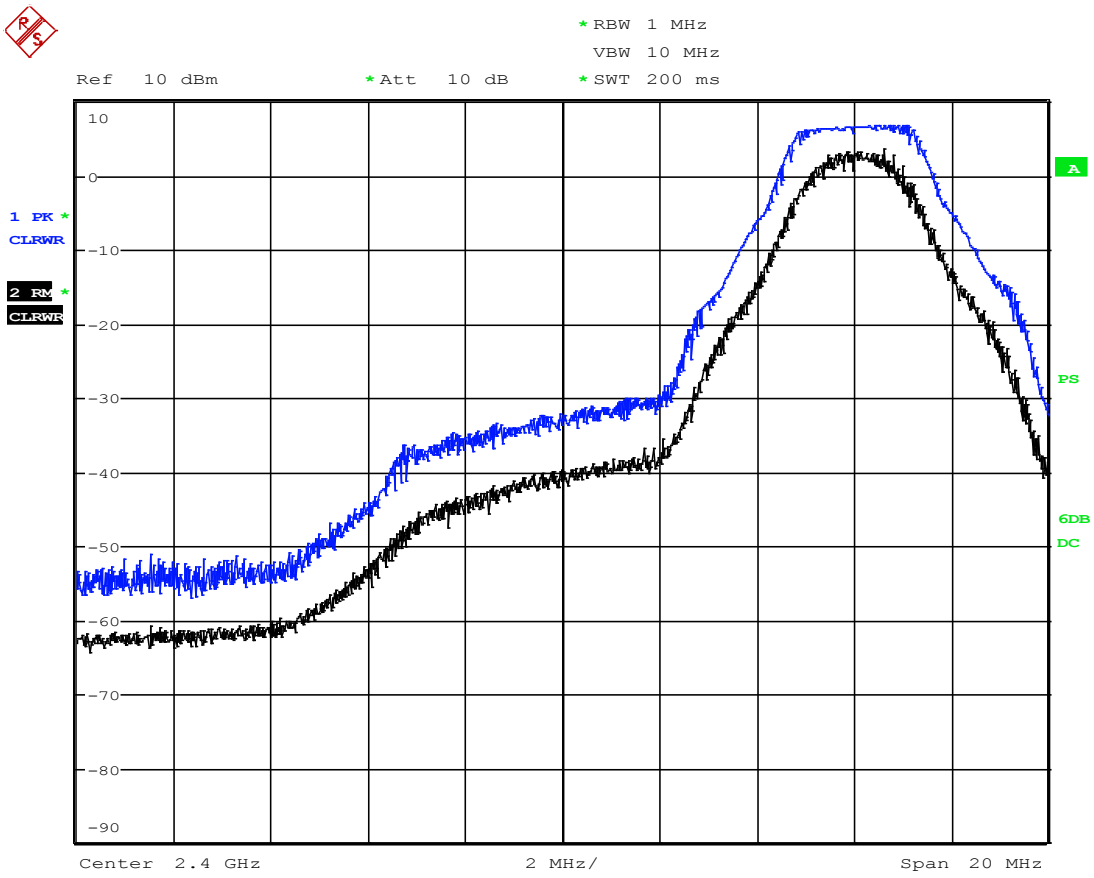
6.8.6. Band Edge Compliance (performed conducted)



Date: 9.APR.2014 14:42:34

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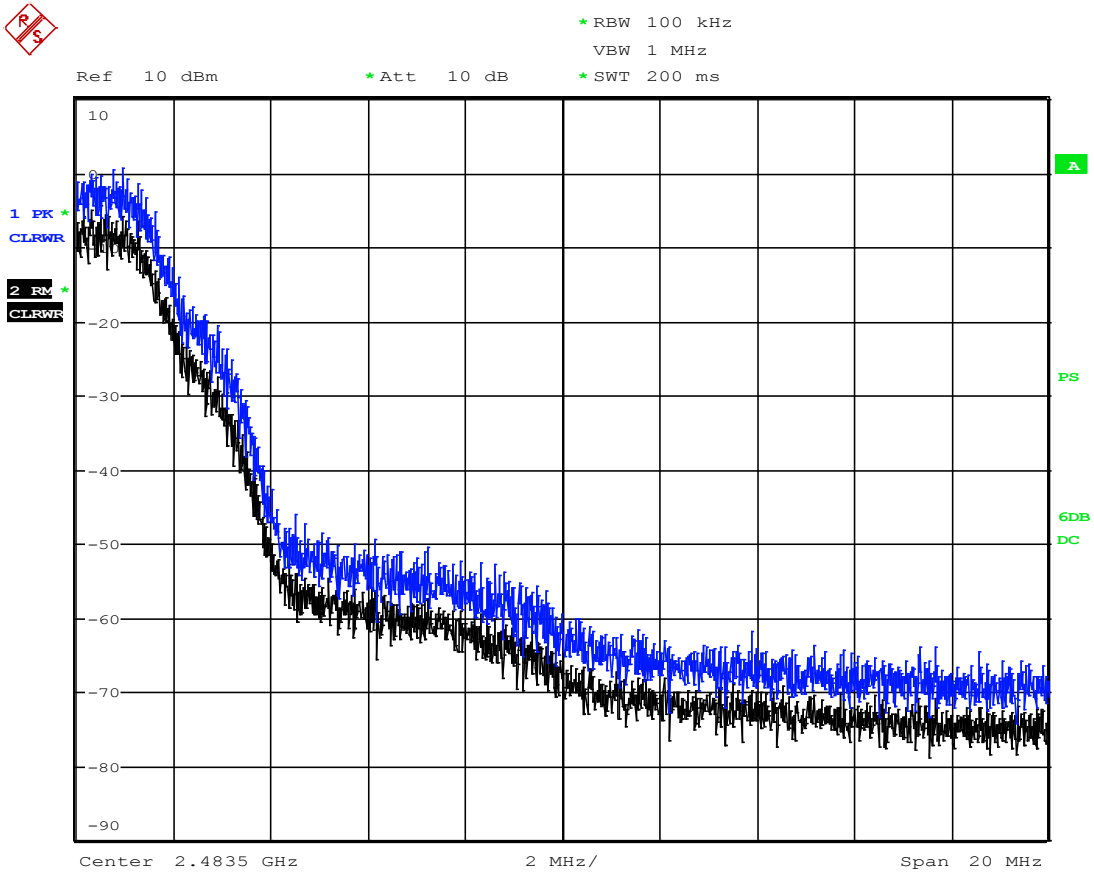

Date: 9.APR.2014 14:44:16

The emissions outside of the band are more than 50 dB below the peak emission.

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6.8.7. Test Equipment

Equipment Type	Manufacturer	Model	Tracking Number	Service date	
				Last	Due
EMI Test Receiver	Rohde & Schwarz	ESIB40	TN1560	4/11/2014	4/11/2015

Note; Previous calibration of TN1560 was due on 4/4/2014, and was extended. No fault was found on 4/11/2014.

6.8.8. Test information

Date of test:	4/9/2014	**Test location :**	DCE – Hertz lodge
EUT serial:	18	**Tested by:**	M. Royer
Test Conclusion:	Pass		

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6.9. Receiver spurious emissions

6.9.1. Requirements

RSS-Gen section 4.10
- if the antenna is detachable, a conducted measurement may be performed.

RSS-GEN section 6.2
No spurious output signals appearing at the antenna terminals shall exceed 2 nW (-57dBm) in the band 30-1000 MHz, or 5 nW (-53dBm) above 1 GHz.

6.9.2. Test Setup

A command is sent to the TI chip to control the RF receive activity, and suppress the transmit activity. A spectrum scan is made from 30 MHz to 18 GHz

(Covering the required 30MHz – 7.5 GHz range) with a 10 MHz and 1 MHz RBW

6.9.3. Test data

Emission Frequency (MHz)	Limit (nW)	Limit (dBm)	Measurement (dBm)	Margin (dB)
500	2	-57.0	-70	13.0
2440	5	-53.0	-60	7.0
15000	5	-53.0	-60	7.0

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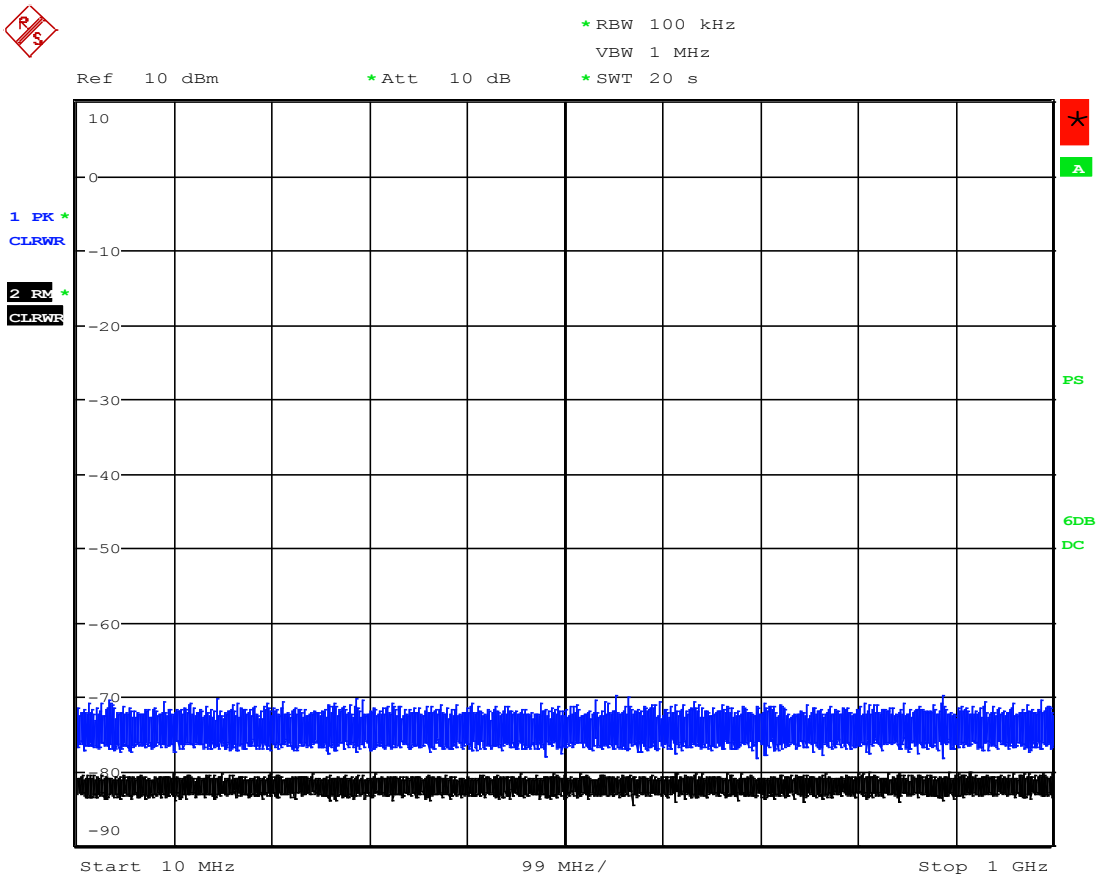
Plot of emissions, made while receiving.



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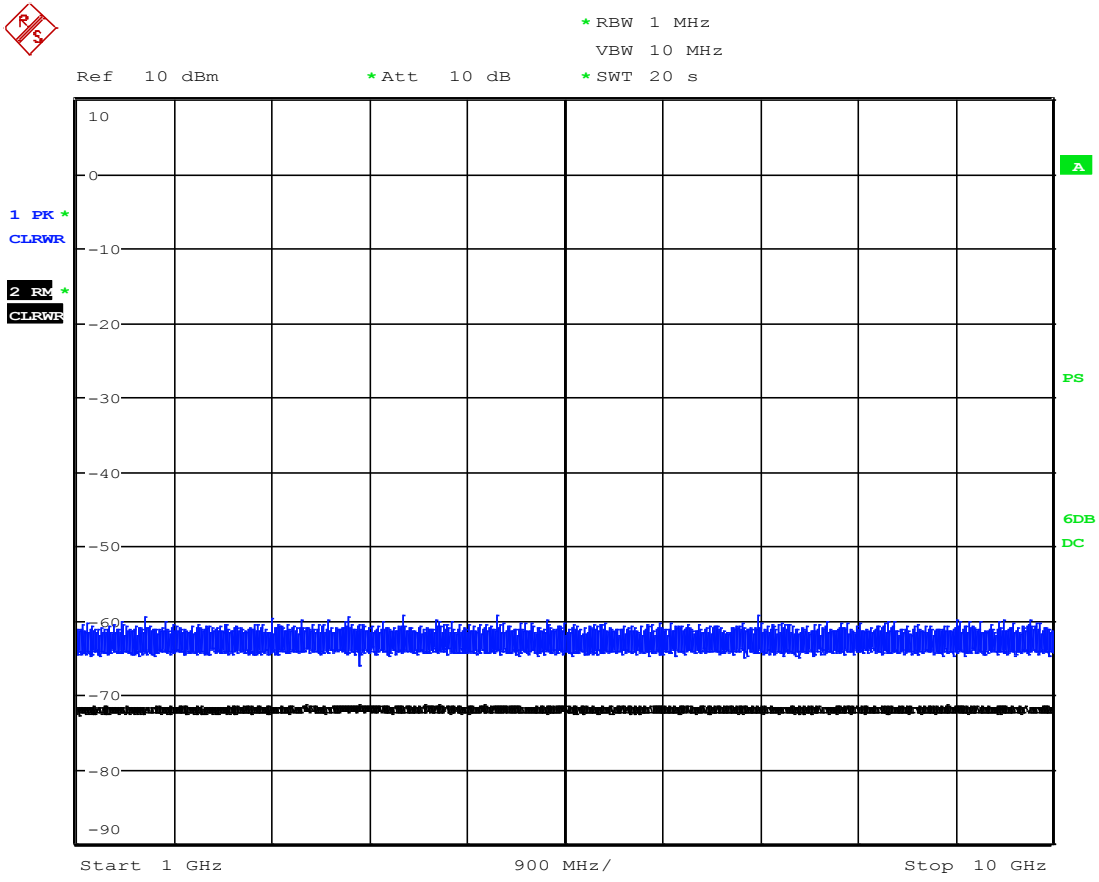

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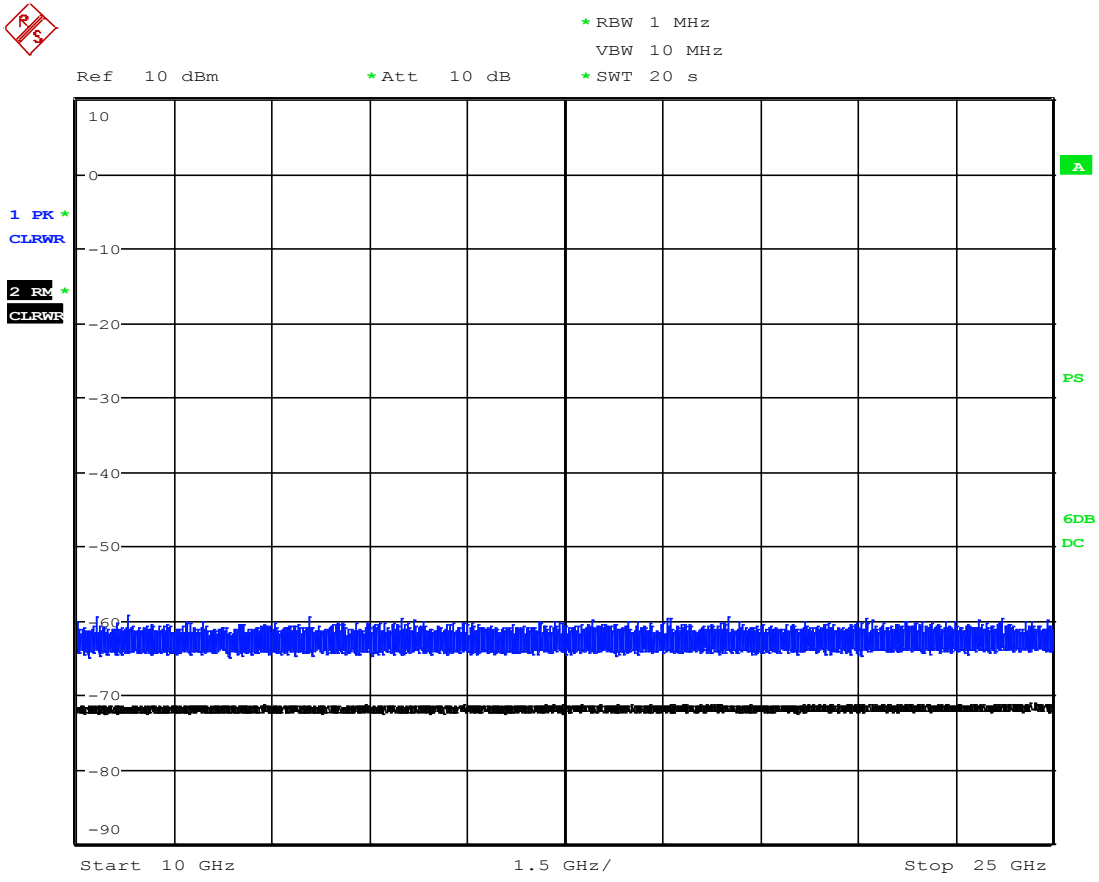

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6.9.4. Test Equipment

Equipment Type	Manufacturer	Model	Tracking Number	Service date	
				Last	Due
EMI Test Receiver	Rohde & Schwarz	ESIB40	TN1560	4/4/2013	4/11/2014

6.9.5. Test information

Date of test:	4/9/2014	Test location:	Transmitter Test Bench
EUT serial:	18	Tested by:	M. Royer
Test Conclusion:	Pass		

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6.10. SAR exemption calculation

Frequency Range: 2402-2480MHz

Based on FCC KDB 4447498 447498 D01 General RF Exposure Guidance v05

Equation 1:

[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] * [√f(GHz)]

Distance between EUT and body (head) is 10mm

Maximum conducted output power measured (dBm) = 7.18 dBm (5.22 mW) (see section 6.3 of this report)

Applying equation 1:

(5.22/10) * [√f(2.4835)] = 0.823 <= 3.0

Equation one is below the 3.0 1-g SAR exemption limit, device complies with FCC exposure limits for general population/uncontrolled exposure as a portable device without SAR evaluation.

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