Wireless Transceiver Test Report

FCC ID: A94413295 IC: 3232A-413295

Certificate # 1514.1

Report number: EMC.413295.14.4.2

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

Product Tested: Bose® Wireless Speaker

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

Report prepared by: Michael Royer

Signature: Michael A. Royer

May 13, 2013

Report reviewed by: Bryan Cerqua

Signature: Bryan Cerqua

May 13, 2013

Report issue date: May 13, 2013

Changes from previous revision: Original version

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1. Report Summary

1.1 Product	**Bose® Wireless Speaker**
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 4**
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 wireless speaker for listening to music.
A battery charger is supplied.

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3. Applicable standards, requirements and tests

FCC part 15	RSS210	RSS-Gen	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	Conducted emissions, 150kHz–30 MHz	Complies Section 6.1
15.109 15.209			Radiated emissions, 30MHz–1GHz Spurious emissions, 30MHz–1GHz	Complies Section 6.2
15.247 (b)(1)	A8.4 (2)		Transmitter output power:	Complies Section 6.3
15.247 (a)(1)	A8.1 (b)		Hopper Occupied Bandwidth / channel spacing	Complies Section 6.4
15.247(a) (1) iii	A8.1 (d)		Time occupancy of a frequency hopper.	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

5. EUT configuration:

The Bose® wireless speaker is powered by an internal, re-chargeable, replaceable lithium-ion battery. The battery is re-charged using the supplied AC adapter. The EUT battery was fully discharged prior to each test, so that the internal battery charging circuit would remain active through the test. During pre-compliance testing, the depleted battery mode was determined to be worst case for the EUT and for the EUT AC adapter, when evaluated in earlier pre compliance testing. The pre-compliance tests also determined that the Aux input mode is the worst case. For conducted emissions, the Aux accessory was investigated in both the grounded and not grounded modes.

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6. Detailed Test Results

6.1. Conducted Emissions

6.1.1. Requirements

47CFR15.207, RSS 210 section 7.2.4

Frequency	Limits dB(µV)	
MHz	Quasi-peak	Average
0.15 -0.5	66-56	56-46
0.5 – 1.6	56	46
1.6 – 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 to charge the battery using the supplied 12 power adapter.

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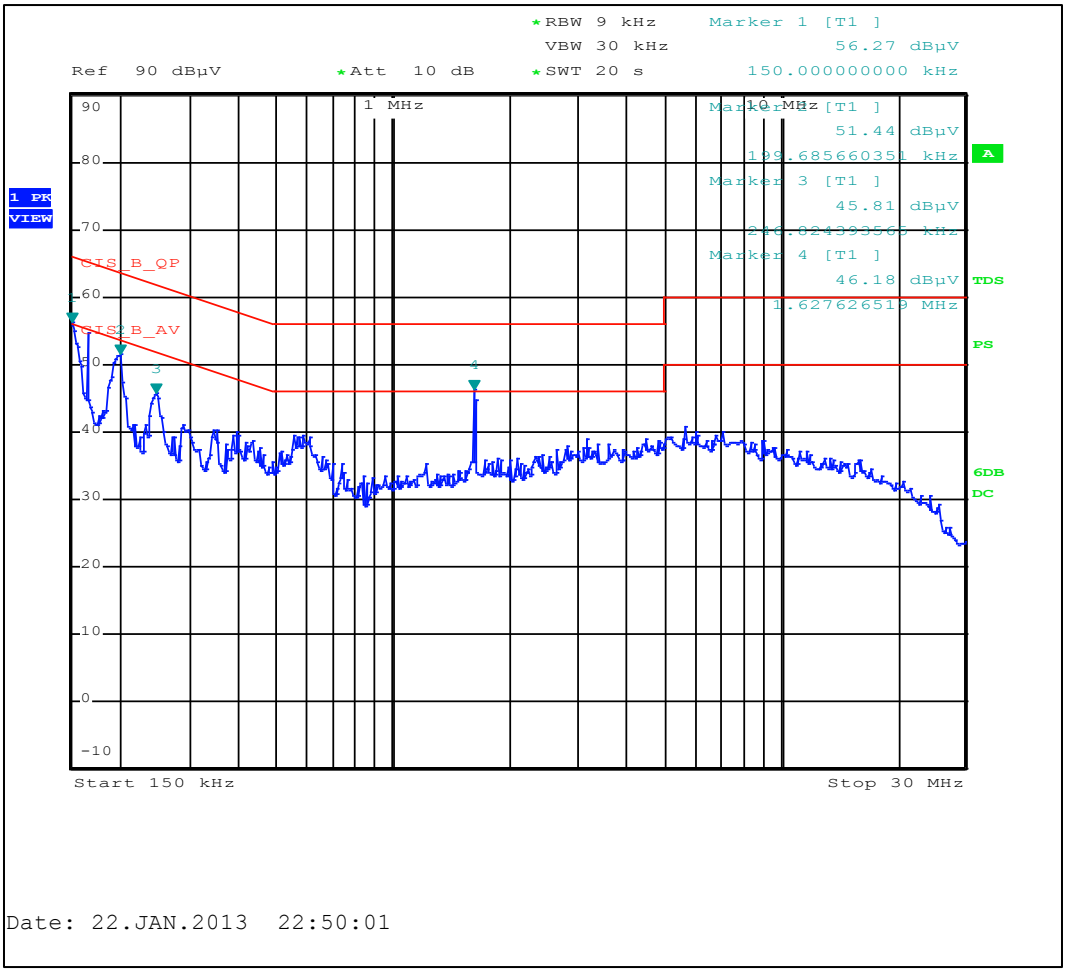
6.1.3. Test data

AC Adapter charging EUT battery
Playing pink noise at full volume

120 VAC 60 Hz, Line side, Max Peak Scan



Frequency	MEASURED		LIMIT		MARGIN	
MHz	dBµV QP	dBµV AVG	dBµV QP	dBµV AVG	dB QP	dB AVG
0.1500	53.50	41.70	66.0	56.0	12.5	14.3
0.1993	48.30	37.00	63.6	53.6	15.3	16.6
0.2482	43.40	32.10	61.8	51.8	18.4	19.7
0.4460	32.70	22.80	56.9	46.9	24.2	24.1
0.5885	34.20	27.00	56.0	46.0	21.8	19.0
1.6359	45.00	36.60	56.0	46.0	11.0	9.4

Worst case emission is 9.4 dB below the limit.

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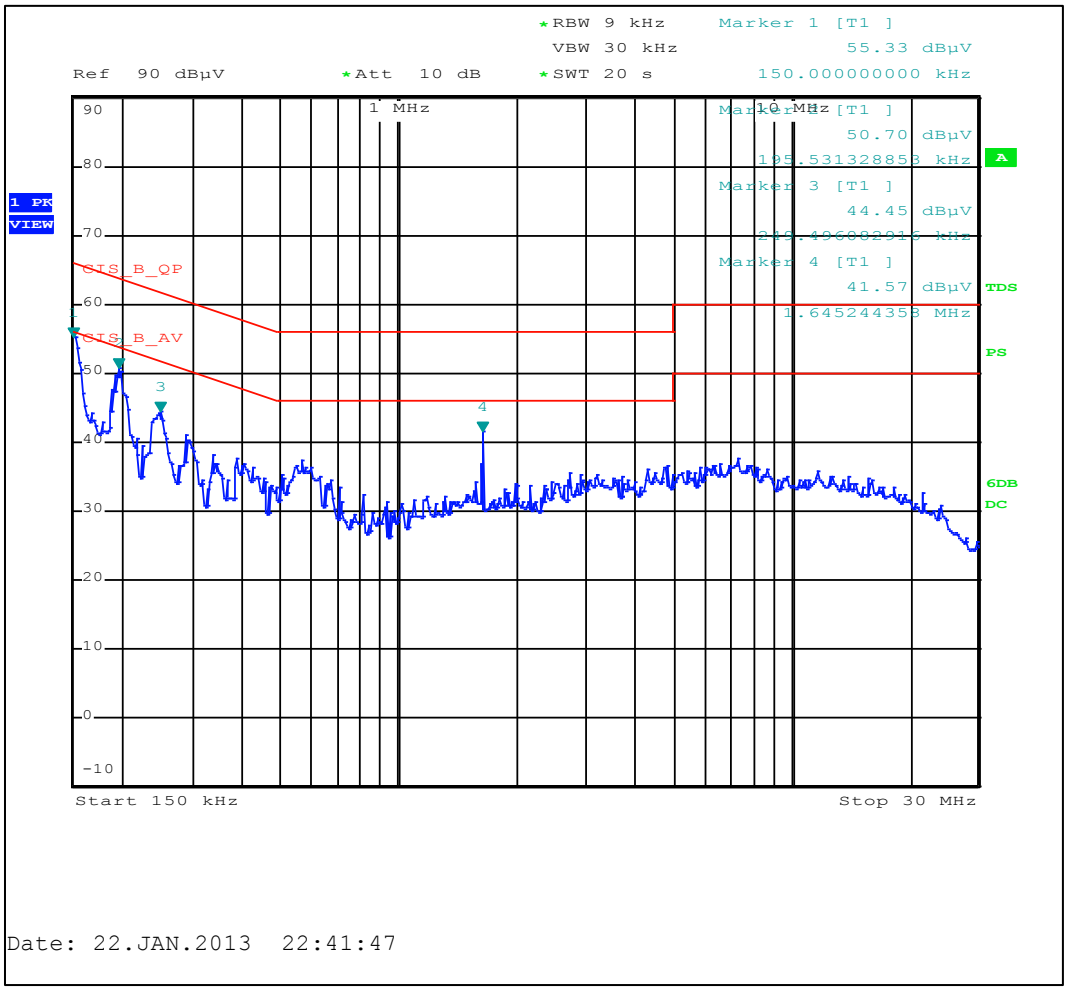
120 VAC 60 Hz, Neutral side, Max Peak Scan



Frequency	MEASURED		LIMIT		MARGIN	
MHz	dBµV QP	dBµV AVG	dBµV QP	dBµV AVG	dB QP	dB AVG
0.1500	53.10	41.50	66.0	56.0	12.9	14.5
0.1981	47.90	35.90	63.7	53.7	15.8	17.8
0.2474	42.30	30.80	61.8	51.8	19.5	21.0
0.2992	37.80	26.40	60.3	50.3	22.5	23.9
0.5781	32.40	24.30	56.0	46.0	23.6	21.7
1.6363	39.90	31.70	56.0	46.0	16.1	14.3

Worst case emission is 12.9 dB below the limit.

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6.1.4. Test Equipment

Equipment Type	Manufacturer	Model	Serial or other ID	Service	
				Last	Due
LISN	EMCO	3810/2	TN600	3/6/2012	3/6/2014
EMI Test Receiver	Rohde & Schwarz	ESCI	TN1420	4/6/2012	4/6/2013
Transient Limiter	HP	11947A	TN57	12/6/2011	12/6/2013

6.1.5. Test information

Date of test:	1/22/2013	**Test location :**	DCE lab – Henry room
EUT serial:	72	**Tested by:**	N. Sanford
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, ICES-003 issue 4 (2004) and CAN/CSA-CEI/IEC CISPR 22:02

Frequency	Limit in dBµV/m @3m
MHz	Quasi-peak
30 – 230	40
230 - 1000	47
Above 1000	54

6.2.2. Test setup details

The EUT was placed on an 80 cm high table and configured for worst case emissions based on previous testing. EUT was maximized in 3 orthogonal planes for radiated spurious emissions; plots shown represent worst case orientation. Data represents the worst case operating mode with the audio stream based on pink noise. A power adapter for charging attached. The system is measured while charging the depleted EUT battery.

6.2.3. Test data

Summary:

Worst case QP margin of 11.9 dB at 222.5 MHz while charging battery**.**

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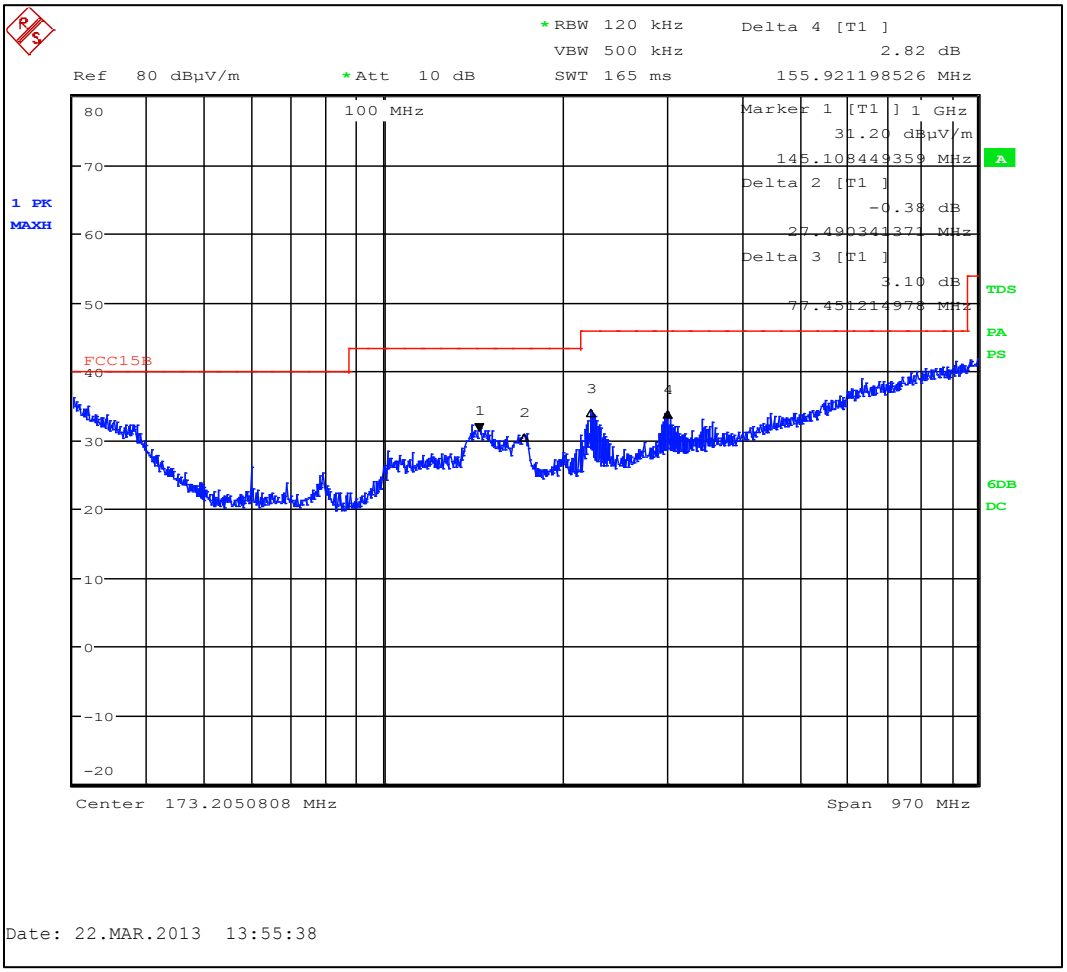
Max-Hold Peak Pre-scan, 30MHz – 1GHz

Playing Pink Noise full volume using Aux input mode. Battery charging.



Emission Frequency (MHz)	Measured Amplitude (dBµV/m) QP/AVG*	Measured Amplitude (dBµV/m) Peak	FCC 15B				Table Azimuth (0° closest to ant)	Receiving Antenna	
			Limit (dBµV/m) QP/AVG*	Limit (dBµV/m) Peak	Margin (dB) QP/AVG*	Margin (dB) Peak		Pol (H/V)	Height (Meters)
145.108	27.10	33.20	43.5	N/A	16.4	N/A	360	V	1.0
172.228	26.80	32.70	43.5	N/A	16.7	N/A	360	V	1.0
222.510	34.10	38.10	46.0	N/A	11.9	N/A	11	H	1.4

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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	7/3/2012	7/3/2013
EMI Test Receiver	Rohde & Schwarz	ESU40	TN1663	4/6/2012	4/6/2013
Maxwell House Radiated Emissions Cable Set	Bose Corporation	N/A	TN1445	Verify	

6.2.5. Test information

Date of test:	3/22/2013	**Test location :**	DCE - Maxwell House
EUT serial:	SN 40	**Tested by:**	M. Royer
Test Conclusion:	Pass		

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6.3. Output power

6.3.1. Requirements:

FCC 15.247(a)(1) , RSS 210 A8.4 (2)

Frequency hopping systems operating in the band 2400-2483.5 MHz may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 0.125 W.

6.3.2. Test setup details:

The EUT is controlled via the USB cable with software which is used to set the test modes of the Bluetooth device. The EUT antenna is disconnected and replaced with a 1 m long piece of flexible coax cable with an SMA connector. This cable is rated to 1.05 dB of loss at 2.48 GHz. For this conducted measurement the SMA cable was connected to the spectrum analyzer input using a short calibrated flexible coax cable. The EUT is programmed to stop hopping and operate at fixed frequencies at the low, middle, and high end of the authorized frequency band.

The spectrum analyzer resolution bandwidth is set to 2 MHz (higher than the occupied bandwidth), peak detector and max hold. The maximum output power is recorded for low, mid and high band frequencies in both Basic Data Rate and Enhanced Data Rate. The maximum output power settings are different for basic rate and for Enhanced Data Rate (EDR) settings.

For basic data rate the packet type is set to 15 and packet size is set to 339.

For enhanced data rate the packet type is set to 31 and packet size is set to 1020.

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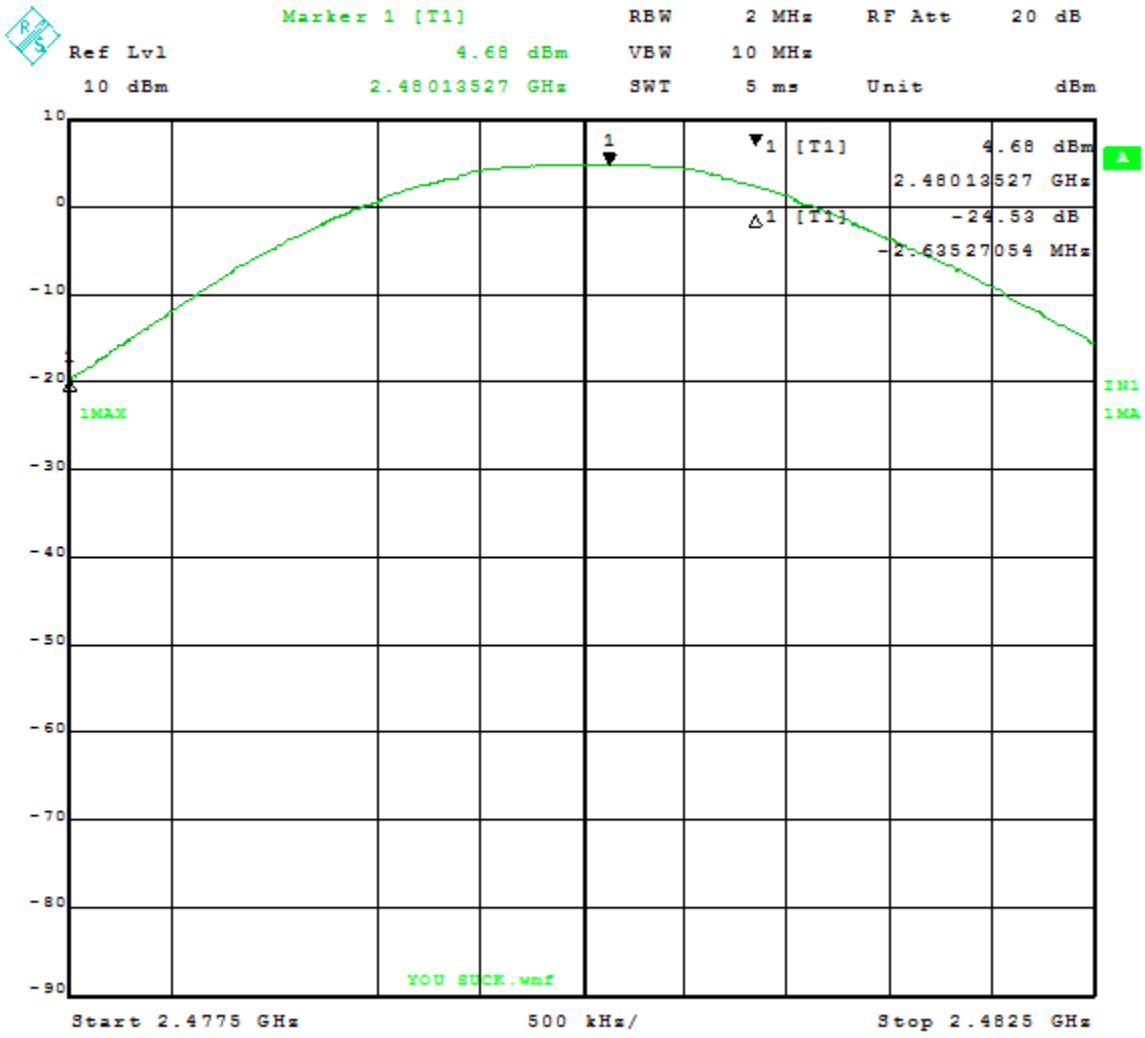
Test data: Output power



Title: aaaaaa
Comment A: asaas
Date: 10.MAY.2013 18:37:23

I sincerely apologize for the green text at the bottom of the plot. I don't know how to remove it from the SA, and didn't want to alter the plot in any way.

Apply a cable factor 1.05 dB to this result to arrive at 5.7 dBm peak power.

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Summary: RBW = 2 MHz, detector = peak, max power = 5.7 dBm (3.7 mW)

Channel	Center Frequency (MHz)	Basic Rate: DH5 (15,339) (dBm)	EDR: 3-DH5 (31,1020) (dBm)
0	2402	5.61	3.24
30	2432	5.48	2.93
78	2480	5.70	2.99

Channel 78 measured the highest power.

6.3.3. Test Equipment

Equipment Type	Manufacturer	Model	Serial or other ID	Service date	
				Last	Due
EMI Test Receiver	Rohde & Schwarz	ESIB40	TN1560	4/4/2012	4/4/2013
EMI Test Receiver (for re-test)	Rohde & Schwarz	ESIB40	TN1560	4/5/2012	4/5/2013
Cable	RF Coax Inc.	K316MM-42	TN1277-18	8/17/2011	8/17/2013

6.3.4. Test information

Date of test:	1/16/2013 Re-test/Plot 5/10/13	**Test location:**	Transmitter Test Bench
EUT serial:	SN97	**Tested by:**	M. Royer
Test Conclusion:	Pass		

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6.4. Occupied Bandwidth/Channel Spacing

6.4.1. Requirements

RSS210 section A8.1 (b)

The bandwidth of a frequency hopping channel is the 20 dB emission bandwidth, measured with the hopping stopped. The system RF bandwidth is equal to the channel bandwidth multiplied by the number of channels in the hopping frequency set.

FCC part 15.247(a)(1)
The hopping channel carrier frequencies are separated by at least 2/3rd of the 20dB bandwidth provided the output power is less than 125 mW (20.96 dBm)

6.4.2. Test setup details

The test setup is described in section 6.3.2.

Bandwidth summary table:
EDR mode packet 3-DH5 (worst case modulation)

BT Channel	Center Frequency (MHz)	-20dB OBW (MHz)	99% OBW (MHz)
0	2402	1.39	1.23
39	2441	1.41	1.23
78	2480	1.40	1.24

Conclusion: 2/3rd of the largest OBW = 2/3 x 1.41 MHz = 940 kHz, which is less than the carrier channel separation of 1 MHz. In addition, the output power is less than 125 mW. See section 6.3 for the measurement of output power.

The system RF bandwidth as defined in RSS210A8.1 (a) is:
79 channels times 1.24 MHz = 97.96 MHz.

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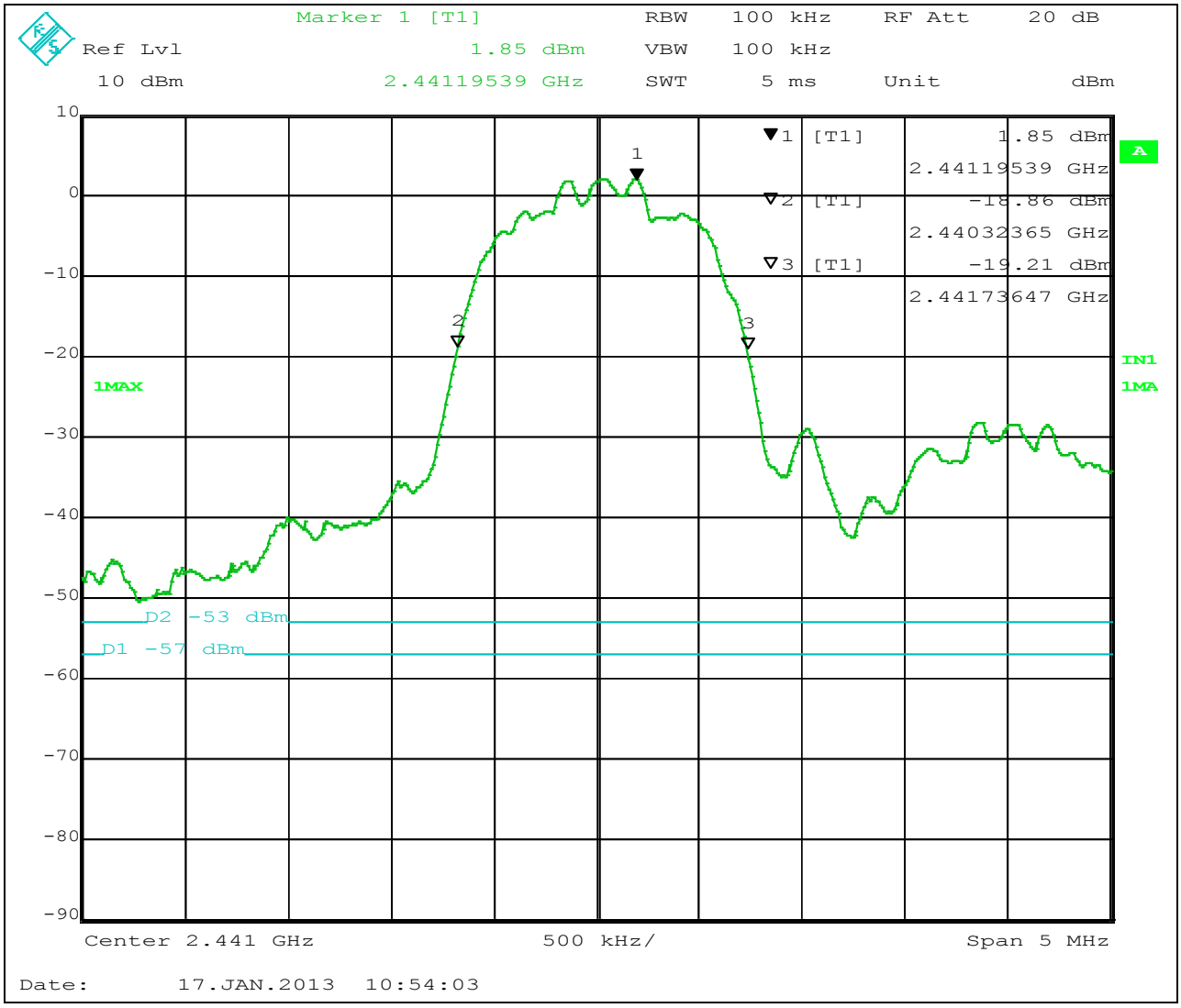
Example spectrum analyzer plot showing how the 20 dB bandwidth is measured.

20 dB OBW = 1.41 MHz. (EDR 3-DH5)



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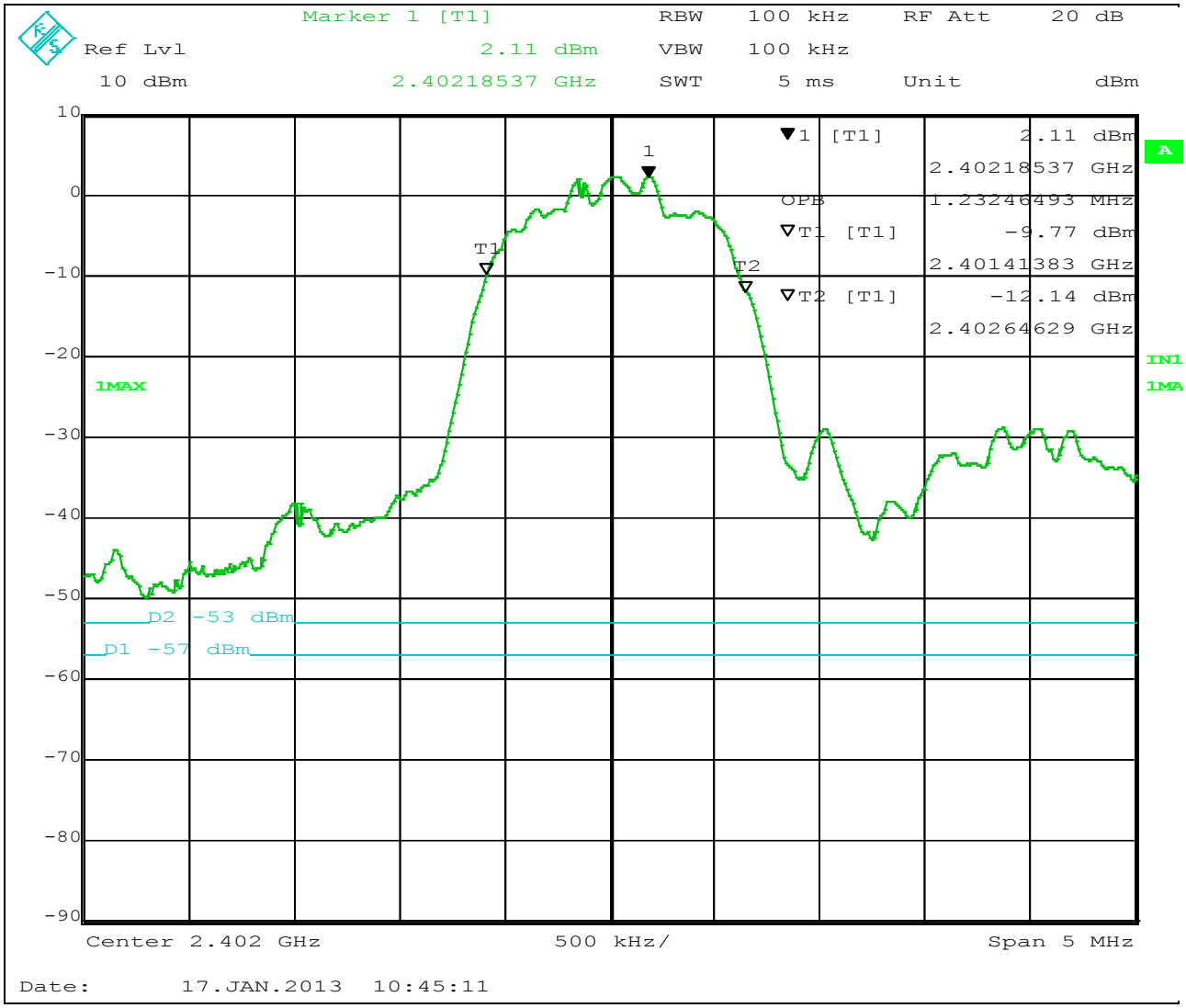
Example spectrum analyzer plot showing how the 99% bandwidth is measured.
Used the built in measurement on the R&S ESIB40.

99% OBW = 1.23 MHz. (EDR 3-DH5)



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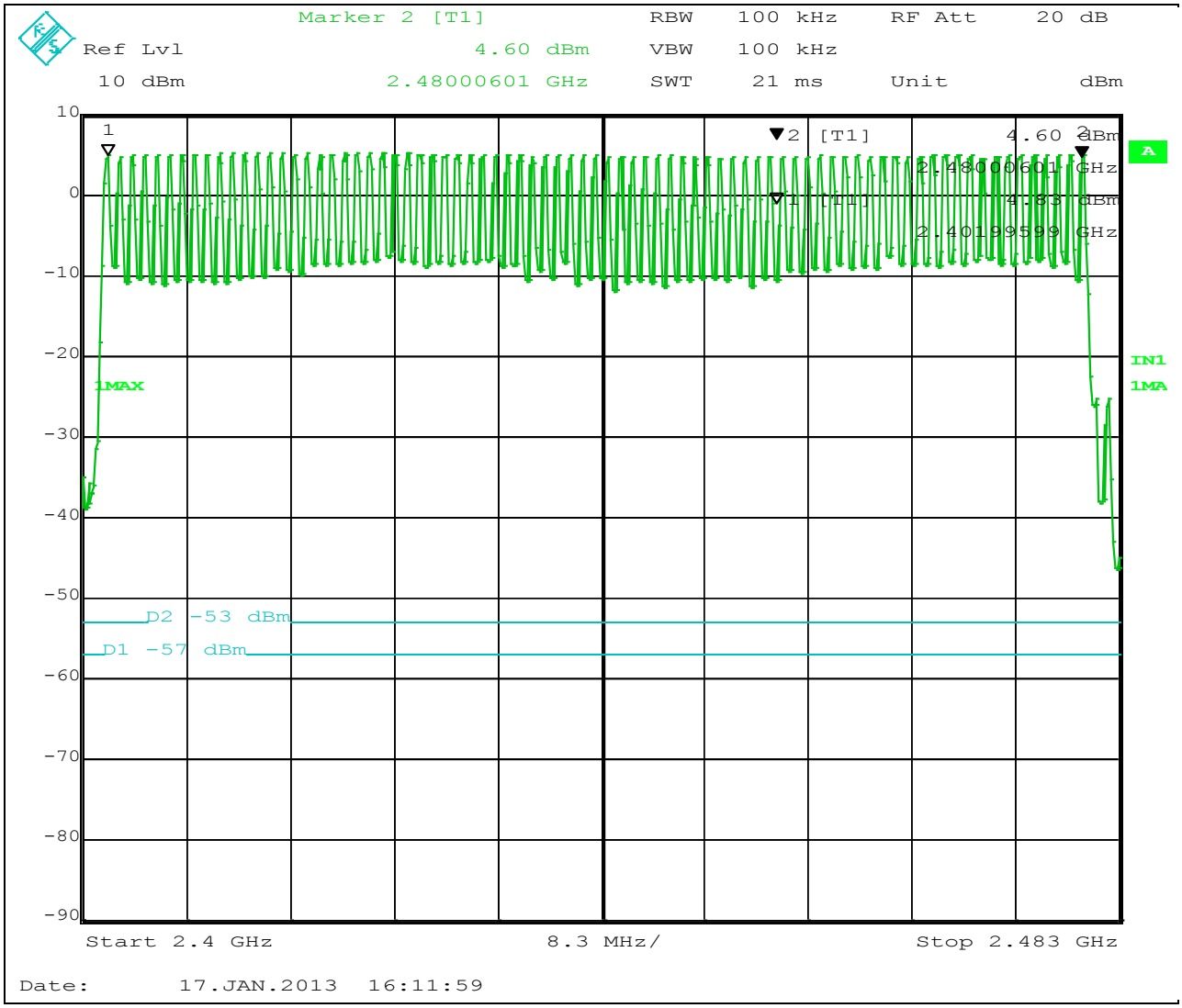
Channel Spacing

79 channels between 2402 MHz and 2480 MHz = 1 MHz/channel



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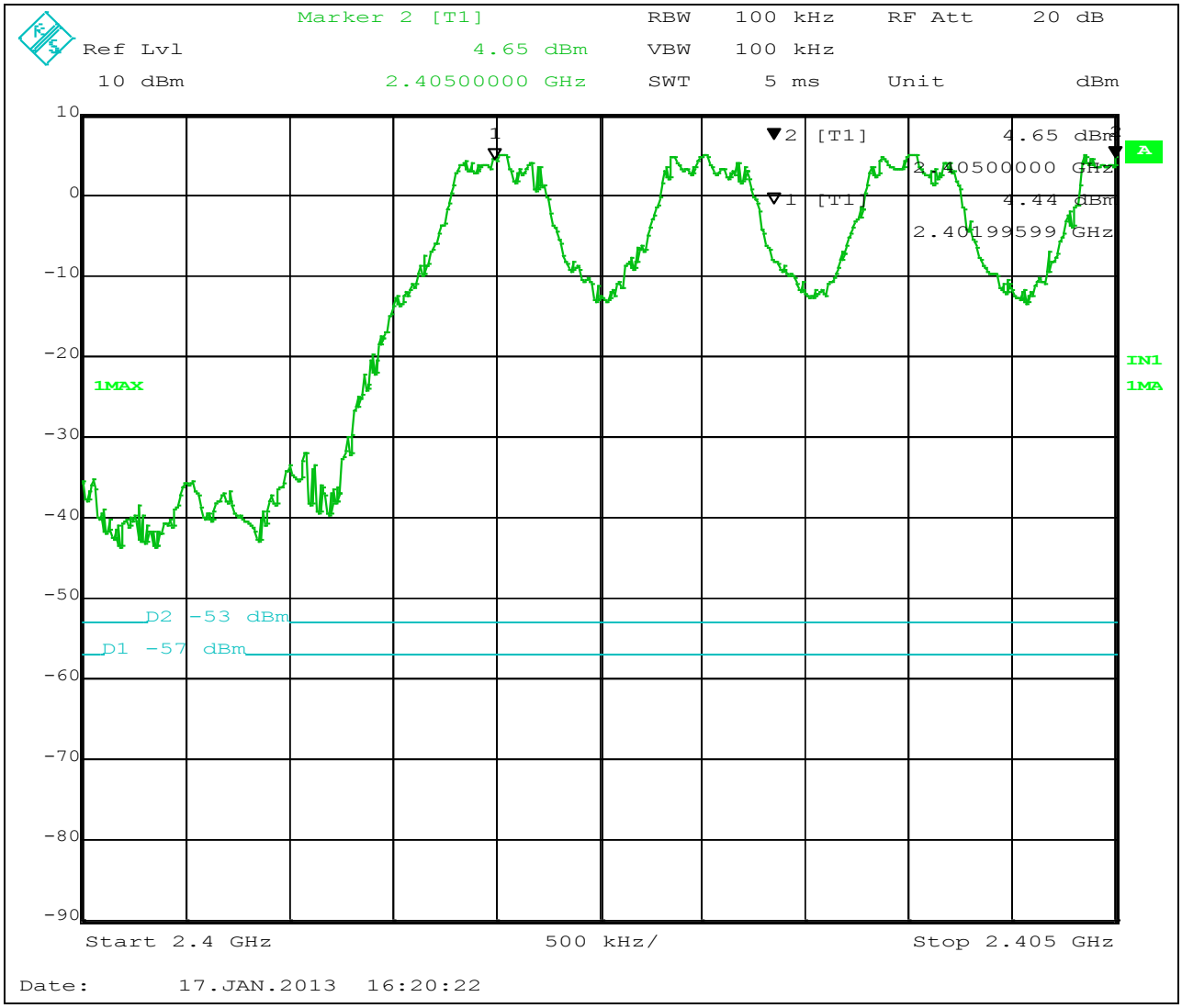
Low band end channel spacing detail 3-DH5



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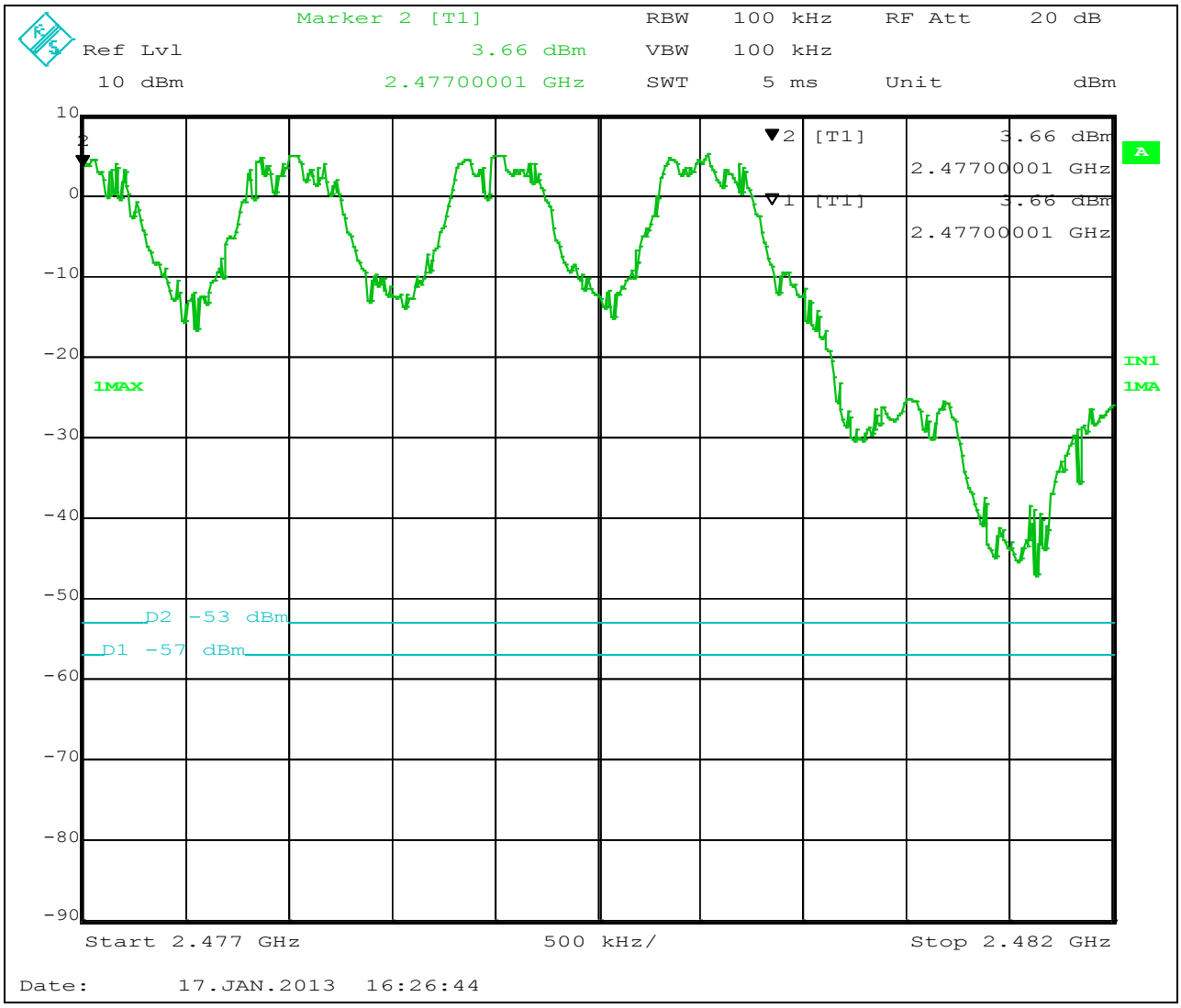
High band end channel spacing detail 3-DH5



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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	4/4/2012	4/4/2013
Cable	RF Coax Inc.	K316MM-42	TN1277-18	8/17/2011	8/17/2013

6.4.4. Test information

Date of test:	1/17/2013	**Test location:**	Transmitter Test Bench
EUT serial:	97	**Test by:**	M. Royer
Test Conclusion:	Pass		

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6.5. Time of occupancy

6.5.1. Requirements

FCC 15.247 (a) (1) iii, RSS210 A8.1 (d)

The frequency hopping operation shall have an average time of occupancy on any frequency not to exceed 0.4 seconds within the duration in seconds equal to the number of hopping frequencies employed multiplied by 0.4

6.5.2. Test setup details

The EUT is controlled via the USB cable with CSR's Blue Suite software which is used to set the test modes of the Bluetooth controller. The EUT antenna is disconnected and replaced with a 2 inch long piece of flexible semi-rigid cable with an SMA connector at the far end, this cable is rated to have less than 0.2dB of loss at 2.48GHz. For all conducted measurements the SMA cable was connected to the spectrum analyzer input using a flexible cable with one dB of loss at 2.4 GHz. The EUT is programmed to stop hopping and operated at fixed frequencies at the low, middle, and high end of the authorized frequency band.

Using zero span mode on the channel center frequency the transmit pulse width is measured for each of the following modes, DH1, DH3 & DH5 with the maximum payload size.

6.5.3. Test data

The Bluetooth algorithm in the controller chip BC5 does not repeat on any channel, unless all of the channels in the hopping sequence have been exhausted in turn. Knowing this, we can assume this reasonable formula for measured time of occupancy.

$$Time\ of\ occupancy = pulse\ width * pulse\ rate * Observation\ time$$

$$Observation\ time\ = 0.4\ s * 79\ channels = 32\ s$$

$$Pulse\ rate = \frac{1}{Period\ between\ pulses}$$

$$Time\ of\ occupancy = \frac{Pulse\ width\ (ms)}{Period\ between\ pulses\ (ms)} * 32(s)$$

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Time of occupancy summary table.

Freq MHz	Modulation	Measured Pulse width µs	Measured Period between pulses ms	Calculated occupancy time ms
2441	DH1	436	99	141
2441	2-DH1	437	99	141
2441	3-DH1	449	99	145
2441	DH3	1693	198	274
2441	2-DH3	1693	198	274
2441	3-DH3	1703	198	275
2441	DH5	2946	297	317
2441	2-DH5	2956	297	318
2441	3-DH5	2946	297	317

All of the occupancy times are less than 400 ms, so the device passes in all modes.

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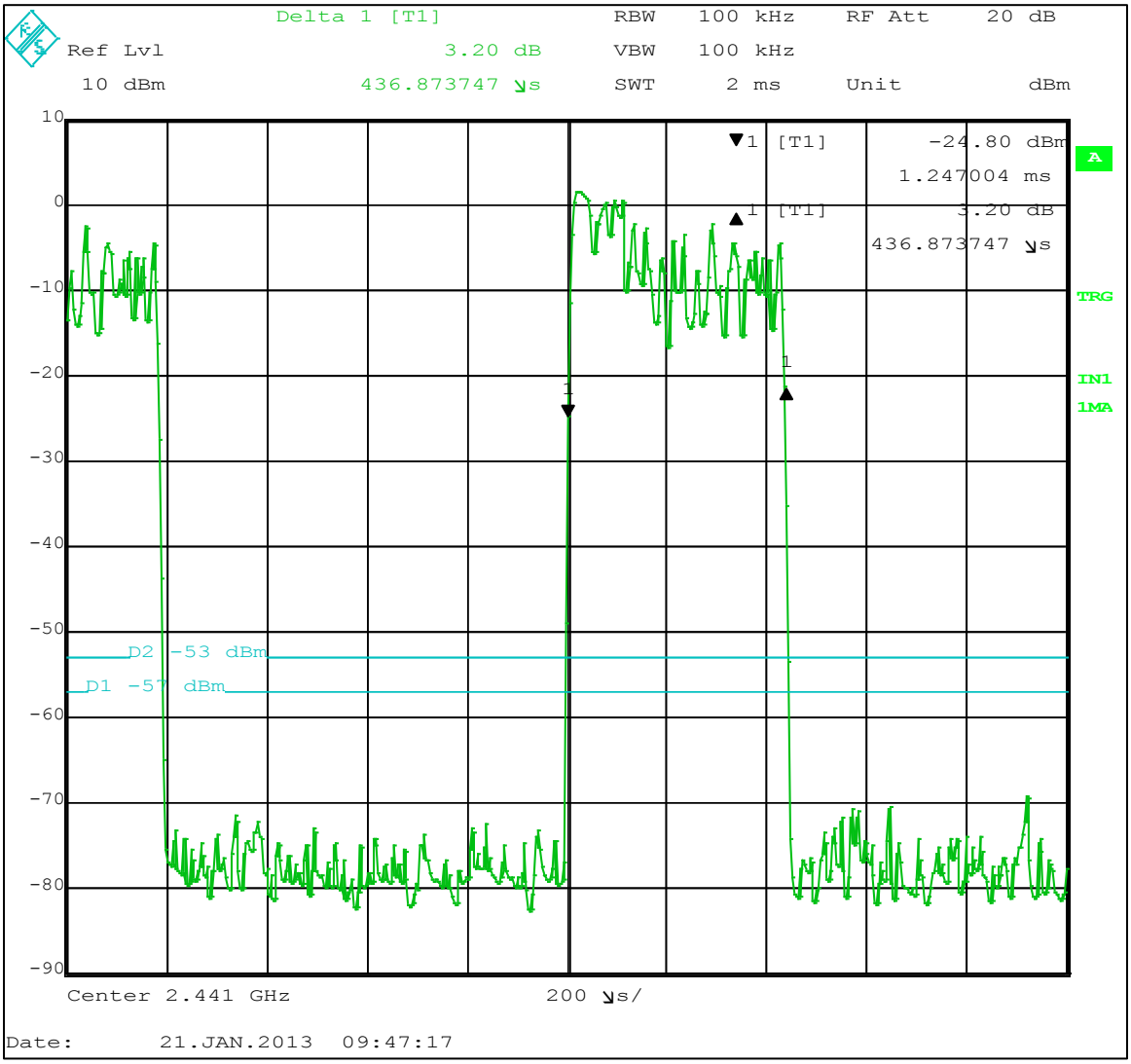
2-DH1 Example of Pulse Width Measurement



Pulse width is 436.9 microseconds

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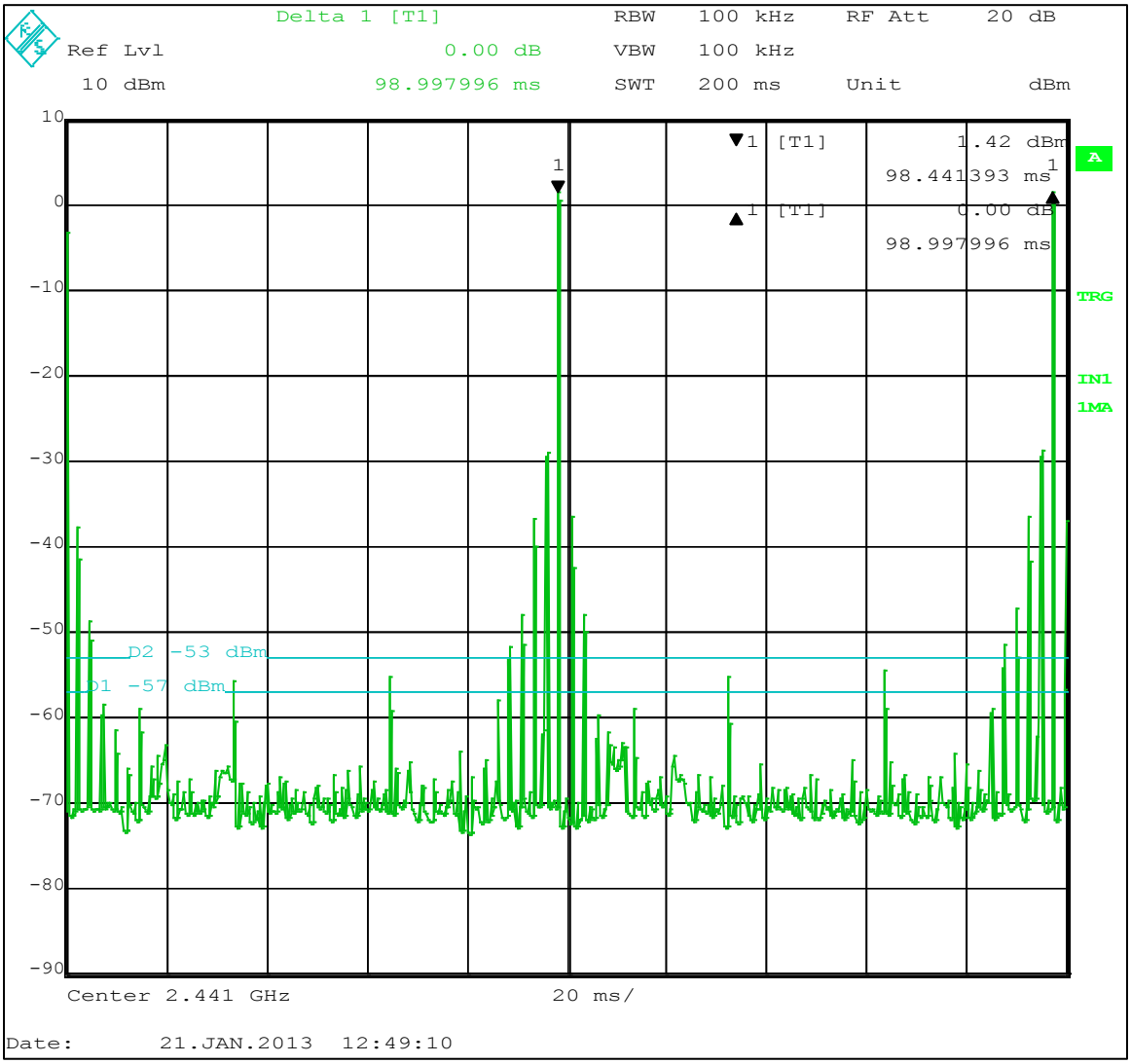
2-DH1 Example of Period between pulses Measurement



Period is 99 milliseconds

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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	4/4/2012	4/4/2013
Cable	RF Coax Inc.	K316MM-42	TN1277-18	8/17/2011	8/17/2013

6.5.5. Test information

Date of test:	1/21/13	**Test location:**	Transmitter Test Bench
Serial number:	SN97	**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 test setup is described section 6.3.2

EUT is controlled by software to enable testing of the spurious output in specific operational modes.

Measurements are made with the EUT in normal operation; Hopping through all available channels, and also fixed at high middle and low frequency. In both cases basic rate modulation and in EDR mode are used (DH1 and 3-DH5).

6.6.3. Test data

Conducted spurious:

10 MHz – 25 GHz conducted spurious scan, 1MHz RBW, peak detector

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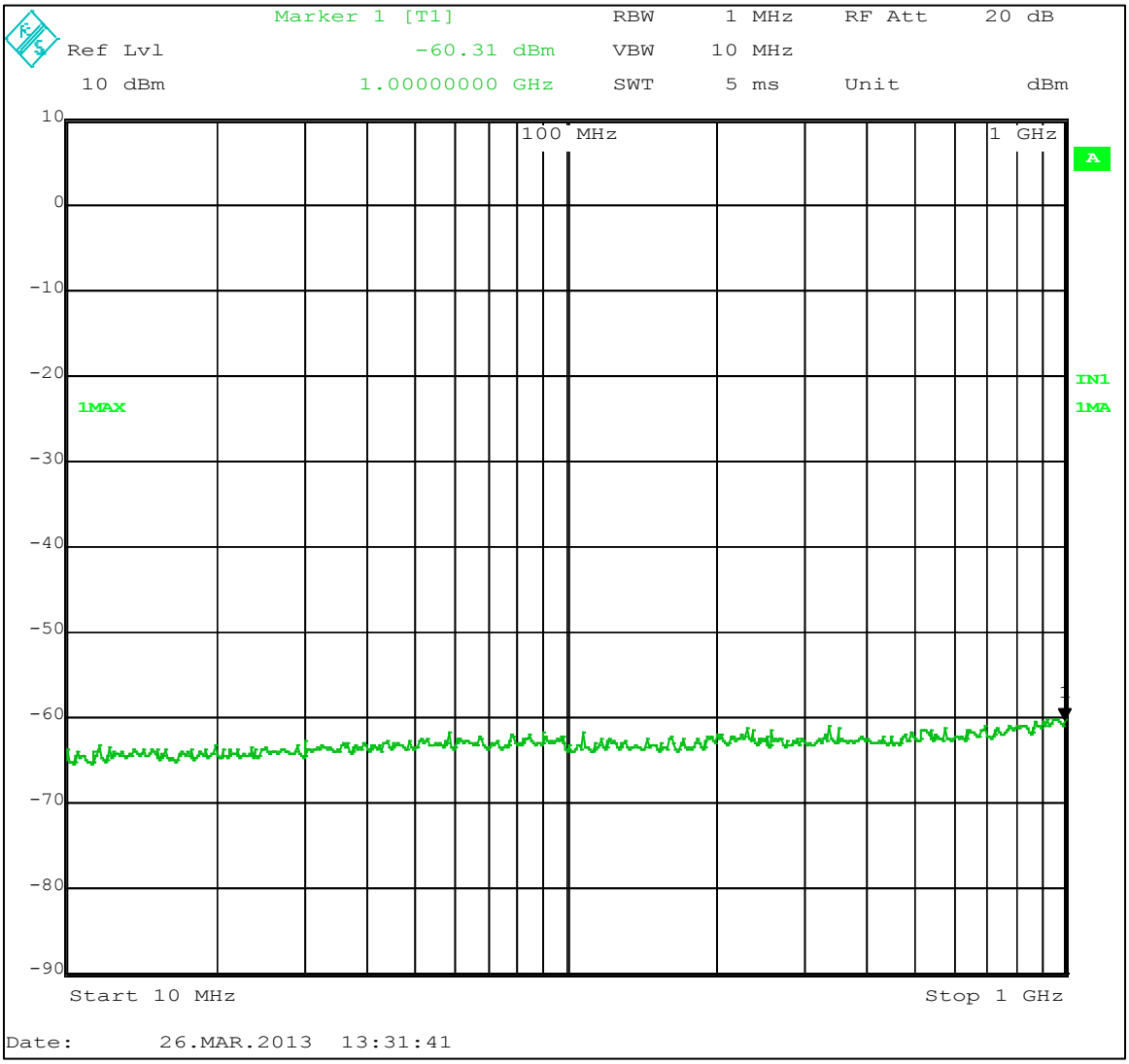
DH1
Hopping 79 channels



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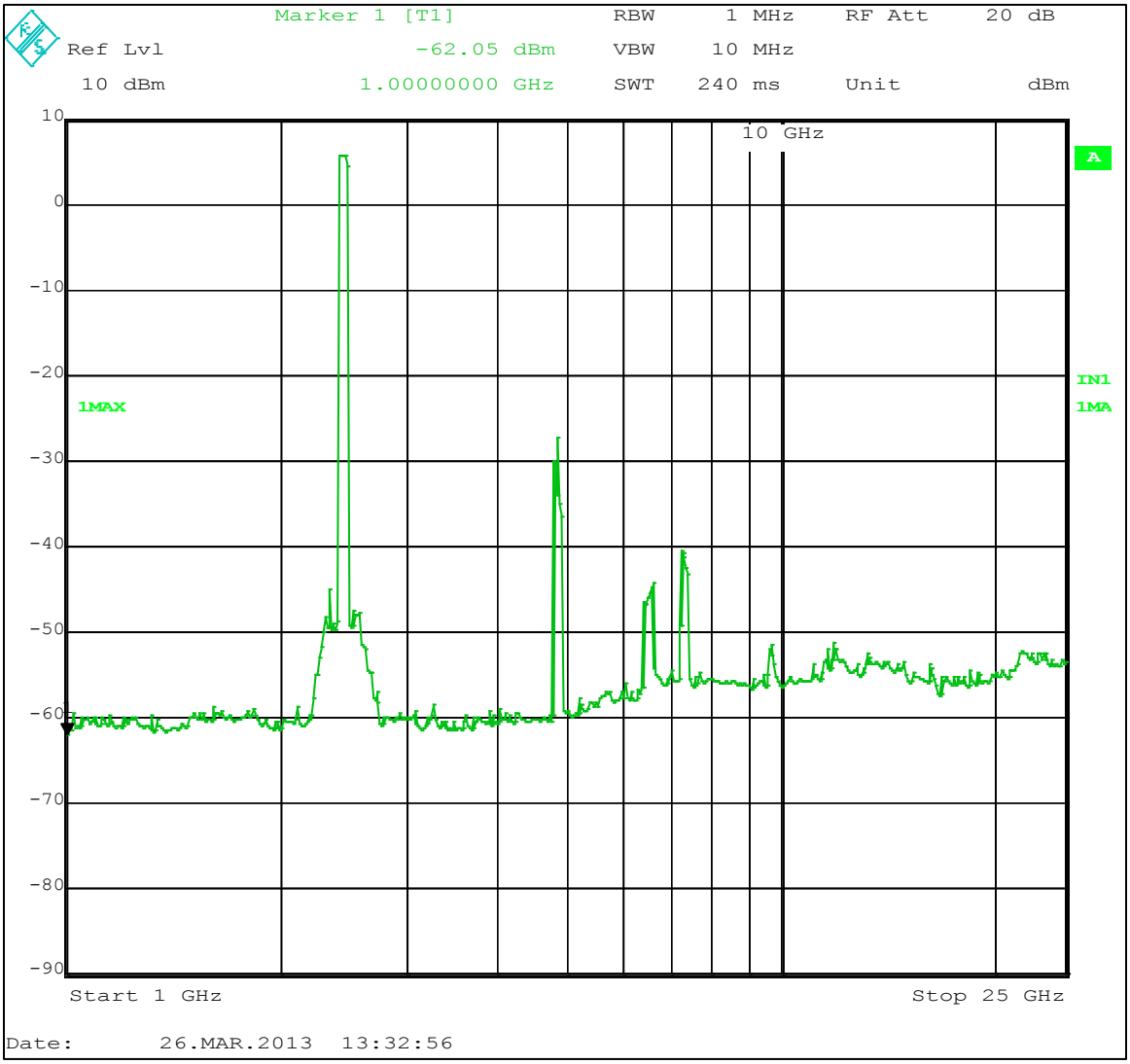
DH1
Hopping 79 channels



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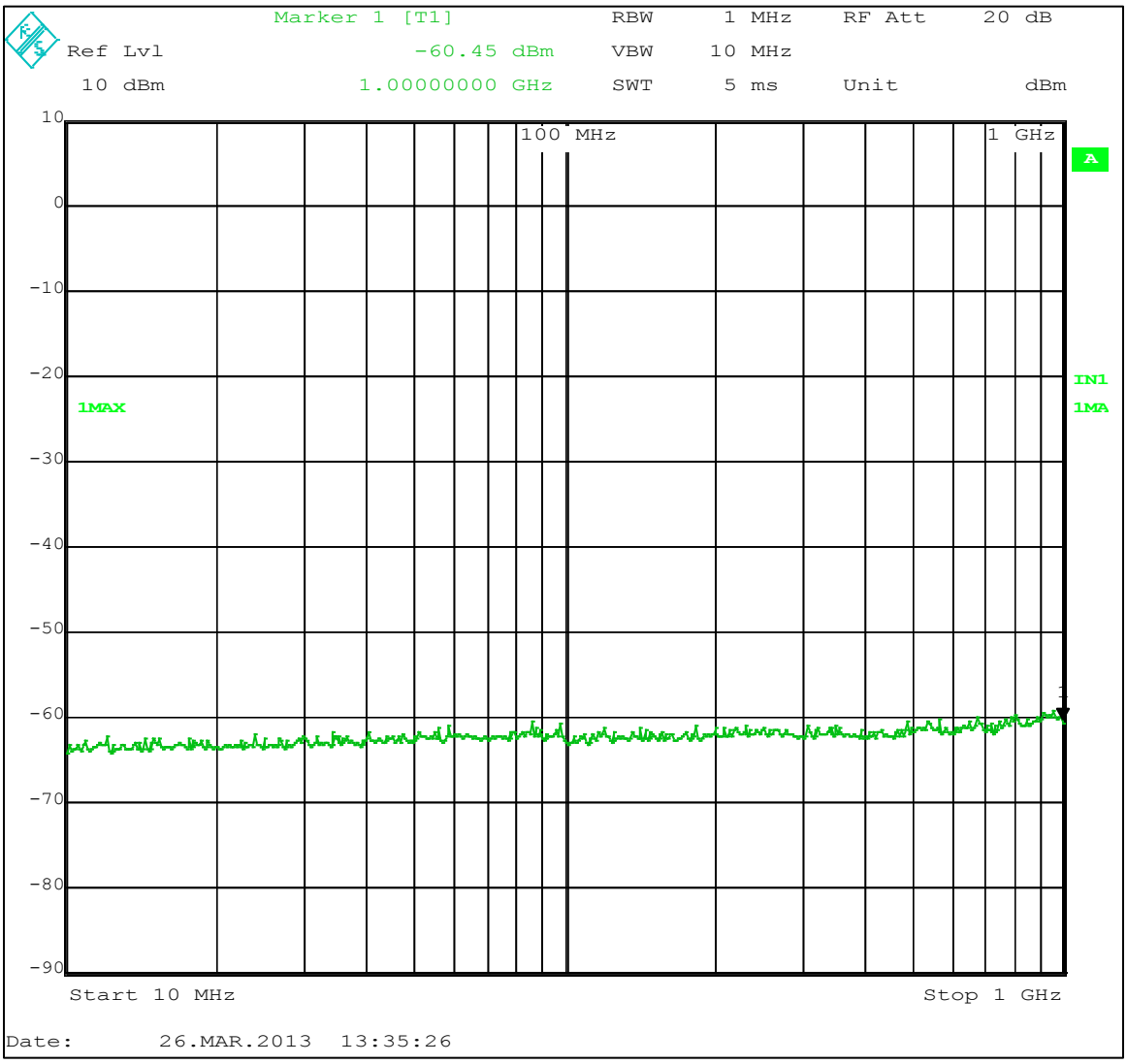
3-DH5
Hopping 79 channels



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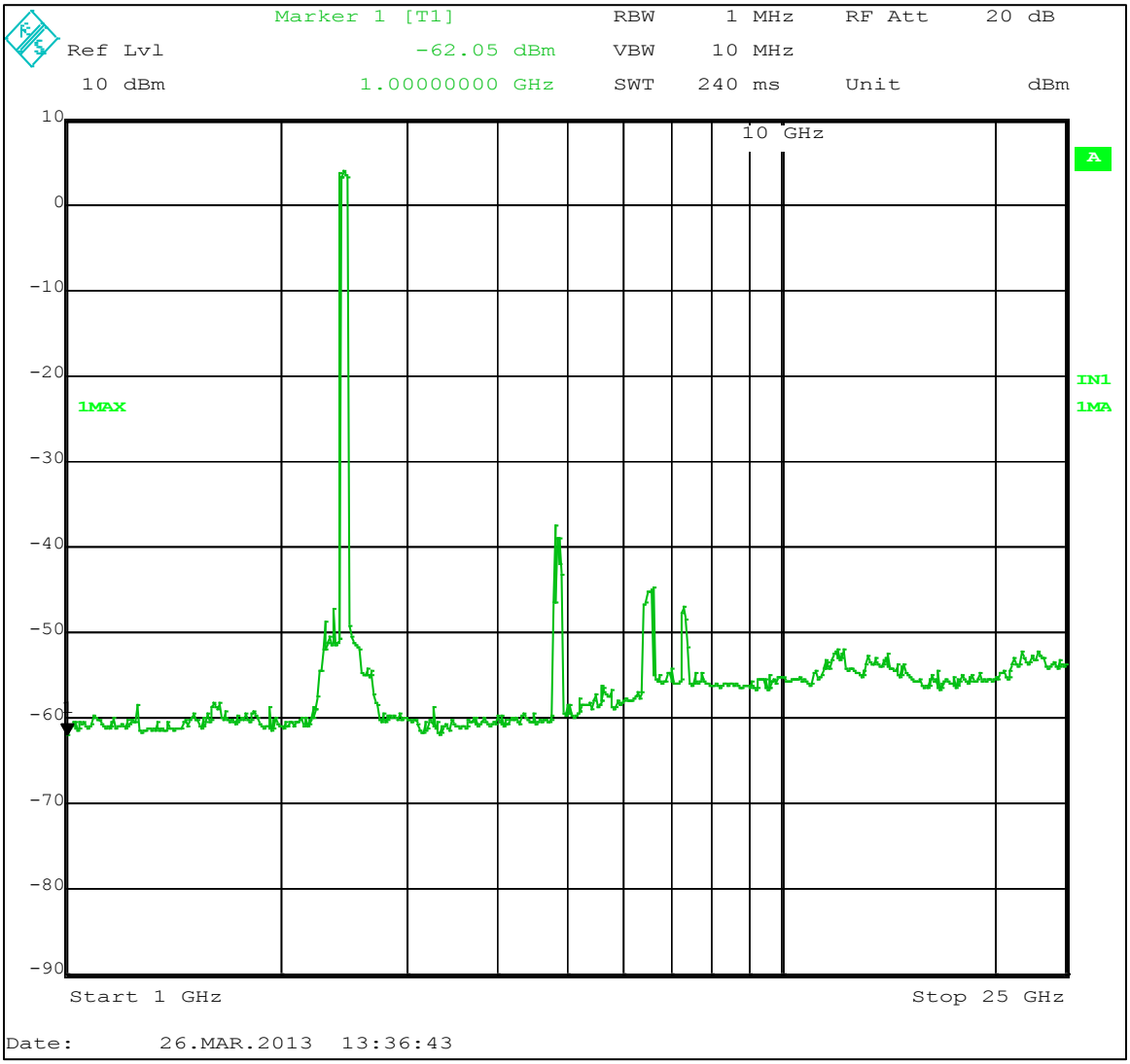
3-DH5

Hopping 79 channels



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	4/4/2012	4/4/2013
Cable	RF Coax Inc.	K316MM-42	TN1277-18	8/17/2011	8/17/2013

6.6.5. Test information

Date of test:	1/18/2013	**Test Location:**	Transmitter Test Bench
EUT serial:	SN97	**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 the vertical axis, the antenna polarization changed from H to V and the antenna height is varied in order to find the maximum value of the harmonic emission. 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

SN: 94 5/11/2013

All readings were taken with Peak detector with EUT Transmitting in DH5 (EDR) mode

2nd Harmonic						Table	Receiving Antenna	
	Measured Values		Limits			Azimuth	Pol	Height
Frequency (MHz)	Peak detector dBµV/m @ 3m	Average detector dBµV/m @ 3m *	Peak dBµV/m	Average dBµV/m	Margin dB	0° face ant	H/V	Meters
4804	56.85	36.85	74	54	17.15	57	V	1
4882	54.3	34.3	74	54	19.7	65	V	1
4960	54.78	34.78	74	54	19.22	104	V	1
3rd Harmonic						Table	Receiving Antenna	
	Measured Values		Limits			Azimuth	Pol	Height
Frequency (MHz)	Peak detector dBµV/m @ 3m	Average detector dBµV/m @ 3m	Peak dBµV/m	Average dBµV/m	Margin dB	0° face ant	H/V	Meters
7206	46.55	26.55	74	54	27.45	0	V	1
7323	42.86	22.86	74	54	31.14	0	V	1
7440	40.45	20.45	74	54	33.55	0	V	1
4th Harmonic						Table	Receiving Antenna	
	Measured Values		Limits			Azimuth	Pol	Height
Frequency (MHz)	Peak detector dBµV/m @ 3m	Average detector dBµV/m @ 3m	Peak dBµV/m	Average dBµV/m	Margin dB	0° face ant	H/V	Meters
9608	52.95	32.95	Not in restricted band			0	V	1
9764	46.96	26.96	Not in restricted band			0	V	1
9920	44.3	24.3	Not in restricted band			0	V	1

ALL NOISE FLOOR MEASUREMENTS BELOW WERE MADE ON JANUARY 25TH 2013

At the 5th through the 10th Harmonic no signal was observed above the instrumentation noise floor.
In all cases the noise floor was in excess of 10dB below the limit value.

5th – 10th harmonic instrumentation noise floor

	Measured Values		Limits		
Frequency (GHz)	Peak detector dBµV/m @ 3m	Average detector dBµV/m @ 3m	Peak dBµV/m	Average dBµV/m	Margin dB
12.4 (5th Harmonic)	46.3	32.8	74	54	21.2
14.88 (6th Harmonic)	50	36.3	74	54	17.7
17.36 (7th Harmonic)	51.6	37.9	Not in restricted band		
19.84 (8th Harmonic)	53	39.8	74	54	14.2
22.32 (9th Harmonic)	51.6	39.1	74	54	14.9
24.8 (10th Harmonic)	55	40.8	Not in restricted band		

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6.7.4. Test Equipment

4 to 18 GHz

Equipment Type	Manufacturer	Model	Tracking Number	Service date	
				Last	Due
EMI Test Receiver	Rohde & Schwarz	ESU40	TN1663	4/6/2012	4/6/2013
Antenna 8 – 18G	AR	AT4004	TN728	12/1/2011	12/1/2014
Microwave Horn Antenna 4GHz - 8GHz	Amplifier Research	AT4003	TN727	12/6/2011	12/2/2013
20 GHz Pre-amp	MITEQ	AFS4-00102000-30-10P-4	TN1672	9/20/2012	9/20/2013
Hertz Lodge 3 Meter Semi-Anechoic Chamber	Panashield Inc.		TN 1499	8/21/12	8/21/14
Cable			TN 1277-06	Verified	
Flexible cable	Florida RF Labs, Inc	NMS-290A-240.0-NMS	TN 1983	8/17/2011	8/17/2013

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18 to 25 GHz

Equipment Type	Manufacturer	Model	Tracking Number	Service date	
				Last	Due
EMI Test Receiver	Rohde & Schwarz	ESU40	TN1663	4/14/2013	4/14/2014
40 GHz pre-amp	MITEQ	JS4018004000-30-8P-A1	TN1757	6/14/2012	6/14/2013
Cable			TN 1277-18	Verified	
Cable			TN 1277-19	Verified	
Horn Antenna 18GHz - 26.5GHz	Amplifier Research	AT4640	TN 1596	No Cal required	
DC Power Supply	Agilent	E3646A	TN 1388	No Cal required	

6.7.5. Test information

Date of test:	5/9/2013	**Test Location:**	Maxwell House
EUT serial:	94	**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 (hopping), 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. Measurements are made with a 1 MHz resolution bandwidth. Measurements are made using a peak detector. The average limit is calculated. In this case, the calculated value difference exceeds the 20 dB allowed. The 20 dB is used in each case to represent the average value, based on the peak measurement minus the 20 dB.

The EUT is rotated around the vertical axis, the antenna polarization 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.

6.8.3. Test Setup

Frequency range 30MHz – 1 GHz. Passes, see section 6.2 of this report

Note upper and lower band edge measurements are covered in section 6.8.6

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EUT Operating Mode(s): EUT is hopping at max TX power in DH5 mode. TX parameters were set using software.

Test Sample S/N: 94

Summary of Test Results:

FCC 15B Class B Product (Residential) @ 3 Meters										
Emission Frequency (MHz)	Measured Amplitude (dBµV/m) AVG	Measured Amplitude (dBµV/m) Peak	FCC 15B Limit (dBµV/m) AVG	FCC 15B Limit (dBµV/m) Peak	FCC 15B Margin (dB) AVG	FCC 15B Margin (dB) Peak	Table Azimuth (0° closest to ant)	Receiving Antenna Pol (H/V)	Receiving Antenna Height (Meters)	Notes / Mode
2369.000	22.80	45.20	54.0	74.0	31.2	28.8	0	V	1.2	
2537.700	23.10	43.50	54.0	74.0	30.9	30.5	0	V	1.2	

CISPR 22 Class B Product (Residential) @ 3 Meters										
Emission Frequency (MHz)	Measured Amplitude (dBµV/m) AVG*	Measured Amplitude (dBµV/m) Peak	CISPR 22 Limit (dBµV/m) AVG	CISPR 22 Limit (dBµV/m) Peak	CISPR 22 Margin (dB) AVG*	CISPR 22 Margin (dB) Peak	Table Azimuth (0° closest to ant)	Receiving Antenna Pol (H/V)	Receiving Antenna Height (Meters)	Notes / Mode
2369.000	22.80	45.20	50.0	70.0	27.2	24.8	0	V	1.2	
2537.700	23.10	43.50	50.0	70.0	26.9	26.5	0	V	1.2	

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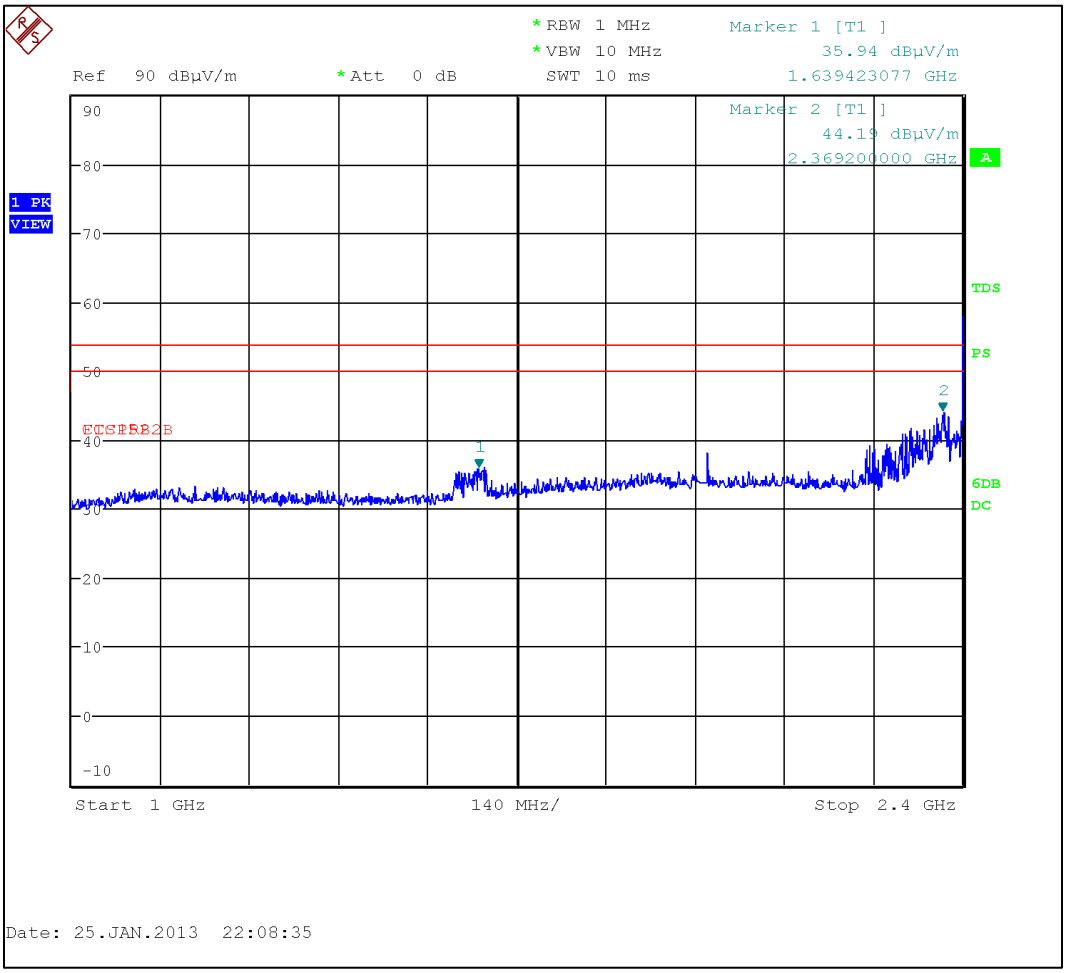

Max-Hold Peak Pre-scan, 1-2.4GHz

Emission Frequency (MHz)	Measured Amplitude (dBµV/m) AVG	Measured Amplitude (dBµV/m) Peak	FCC 15B				Table Azimuth (0° closest to ant)	Receiving Antenna	
			Limit (dBµV/m) AVG	Limit (dBµV/m) Peak	Margin (dB) AVG	Margin (dB) Peak		Pol (H/V)	Height (Meters)
2369.000	22.80	45.20	54.0	74.0	31.2	28.8	0	V	1.2

Emission Frequency (MHz)	Measured Amplitude (dBµV/m) AVG*	Measured Amplitude (dBµV/m) Peak	CISPR 22				Table Azimuth (0° closest to ant)	Receiving Antenna	
			Limit (dBµV/m) AVG	Limit (dBµV/m) Peak	Margin (dB) AVG*	Margin (dB) Peak		Pol (H/V)	Height (Meters)
2369.000	22.80	45.20	50.0	70.0	27.2	24.8	0	V	1.2

The emission at 2.4GHz will be looked at more closely during Band Edge measurements in section 6.8.6

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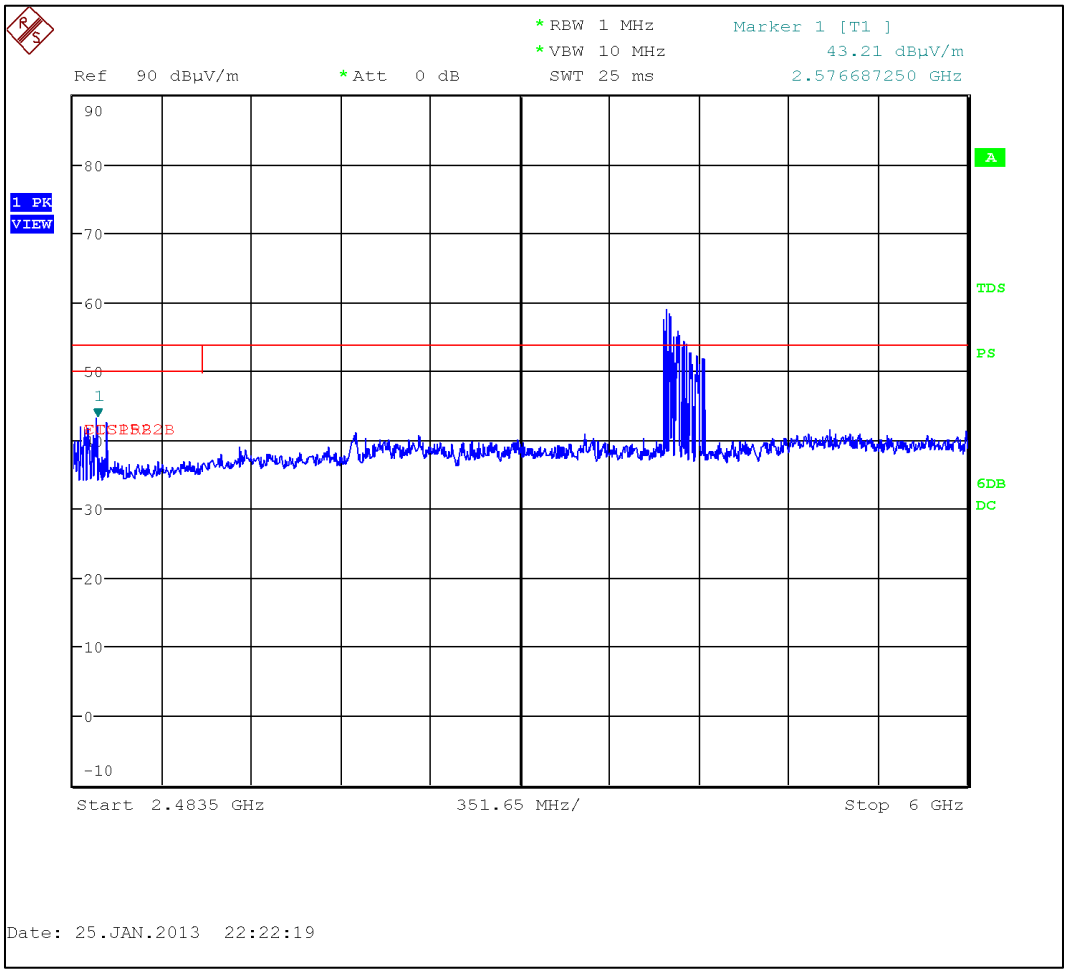

Max-Hold Peak Pre-scan, 2.4835-6.0GHz

Emission Frequency (MHz)	Measured Amplitude (dBµV/m) AVG	Measured Amplitude (dBµV/m) Peak	FCC 15B				Table Azimuth (0° closest to ant)	Receiving Antenna	
			Limit (dBµV/m) AVG	Limit (dBµV/m) Peak	Margin (dB) AVG	Margin (dB) Peak		Pol (H/V)	Height (Meters)
2537.700	23.10	43.50	54.0	74.0	30.9	30.5	0	V	1.2

Emission Frequency (MHz)	Measured Amplitude (dBµV/m) AVG*	Measured Amplitude (dBµV/m) Peak	CISPR 22				Table Azimuth (0° closest to ant)	Receiving Antenna	
			Limit (dBµV/m) AVG	Limit (dBµV/m) Peak	Margin (dB) AVG*	Margin (dB) Peak		Pol (H/V)	Height (Meters)
2537.700	23.10	43.50	50.0	70.0	26.9	26.5	0	V	1.2

Note that the emissions from 4804 – 4960 MHz are TX harmonics and will be covered by the Harmonics testing.

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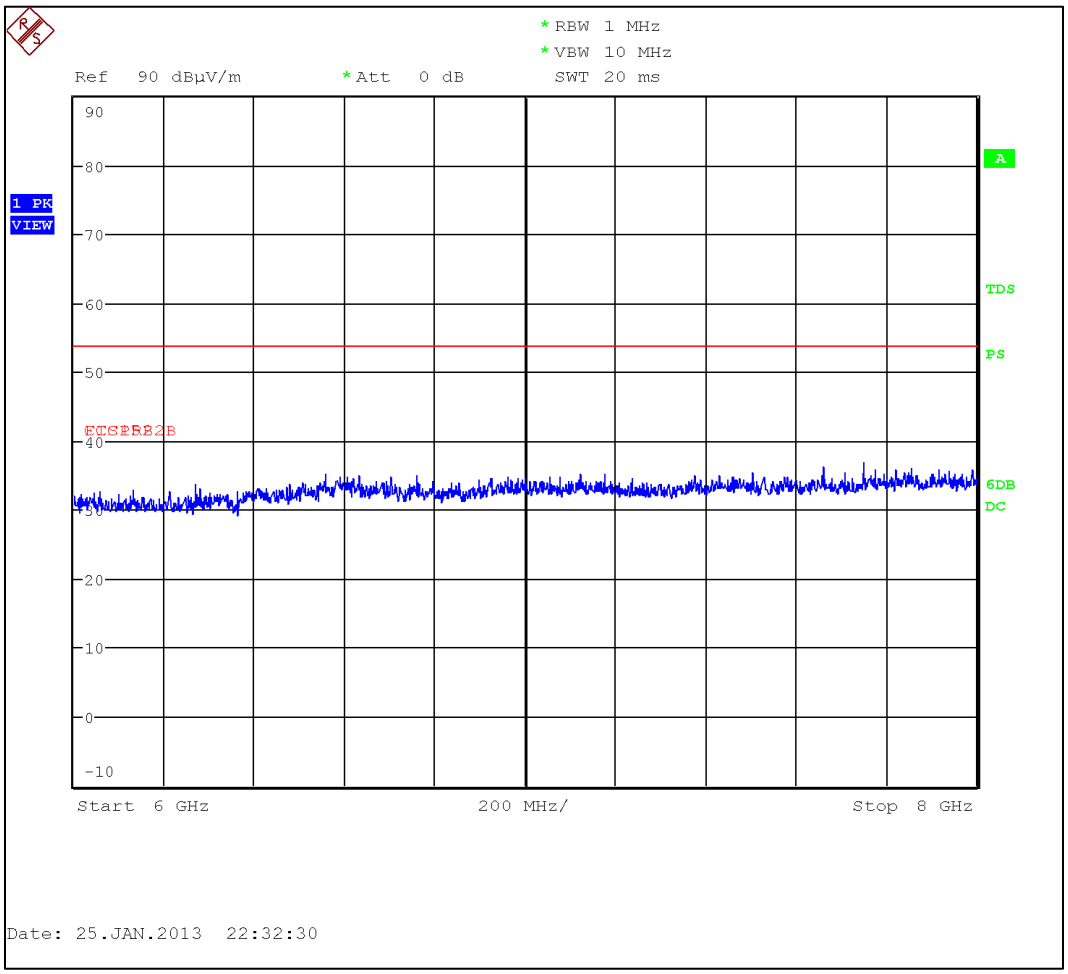

Max-Hold Peak Pre-scan, 6.0-8.0GHz

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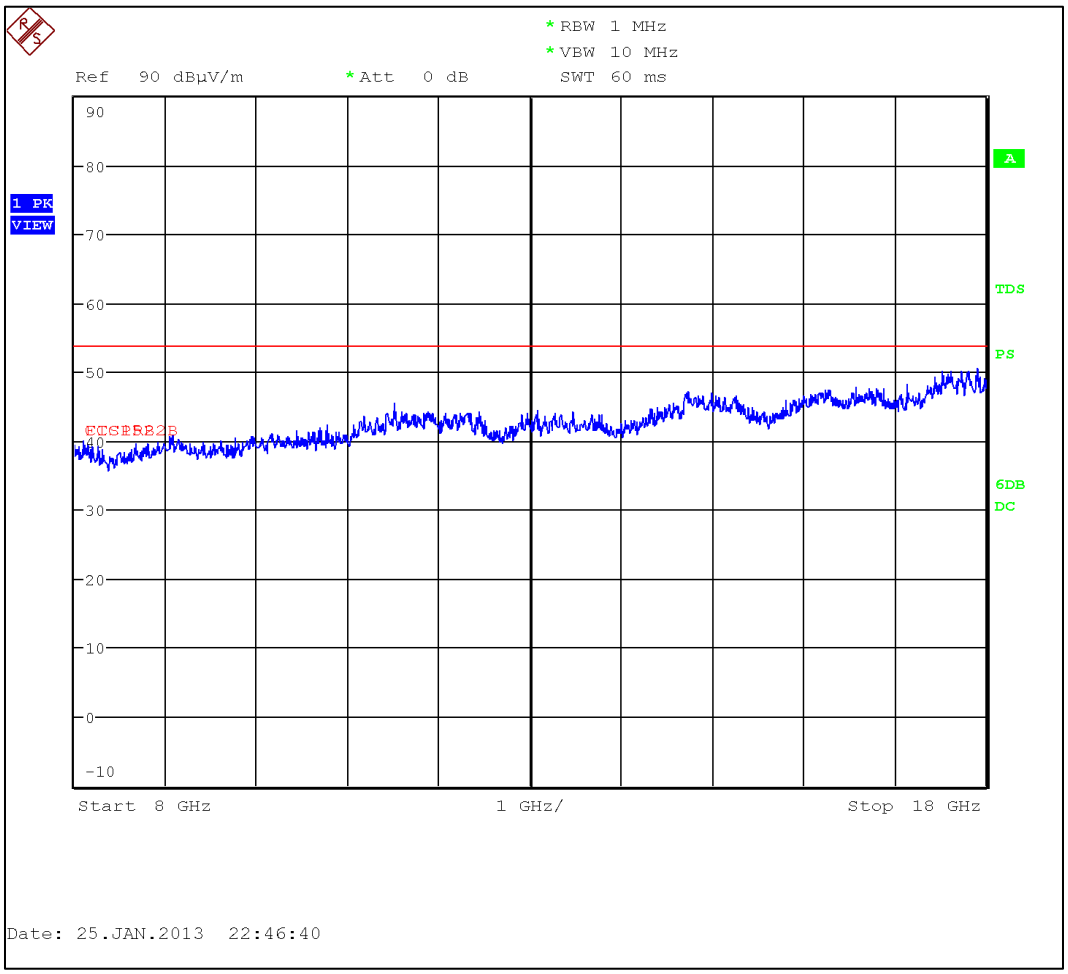

Max-Hold Peak Pre-scan, 8.0-18.0GHz

*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
EMI Test Receiver	Rohde & Schwarz	ESU40	TN1663	4/6/2012	4/6/2013
Antenna 1GHz-18GHz	Emco	3115	TN478	7/12/2012	7/12/2015
Antenna 4 – 8G	AR	AT4003	TN727	12/6/2011	12/6/2014
Antenna 8 – 18G	AR	AT4004	TN728	12/1/2011	12/1/2014
20 GHz Pre-amp	MITEQ	AFS4-00102000-30-10P-4	TN1672	9/20/2012	9/20/2013
40 GHz pre-amp	MITEQ	JS4018004000-30-8P-A1	TN1757	6/14/2012	6/14/2013
Hertz Lodge 3 Meter Semi-Anechoic Chamber	Panashield Inc.		TN1499		
Cable		18 GHz	TN1277-6	8/17/2011	8/17/2013
Cable	Florida RF Labs, Inc	NMS-290A-240.0-NMS	TN1983	8/17/2011	8/17/2013
Cable	K316MM-42 40GHz cable	K316MM-42 40GHz cable	TN1277-18	3/14/2011	3/14/2013
Horn Antenna 18GHz - 26.5GHz	Amplifier Research	AT4640	TN1596	1/27/2005	N/A

6.8.5. Test information

Date of test:	1/25/2013	**Test Location:**	Hertz Lodge
EUT serial:	SN 94	**Tested by:**	N. Sanford
Test Conclusion:	Pass		

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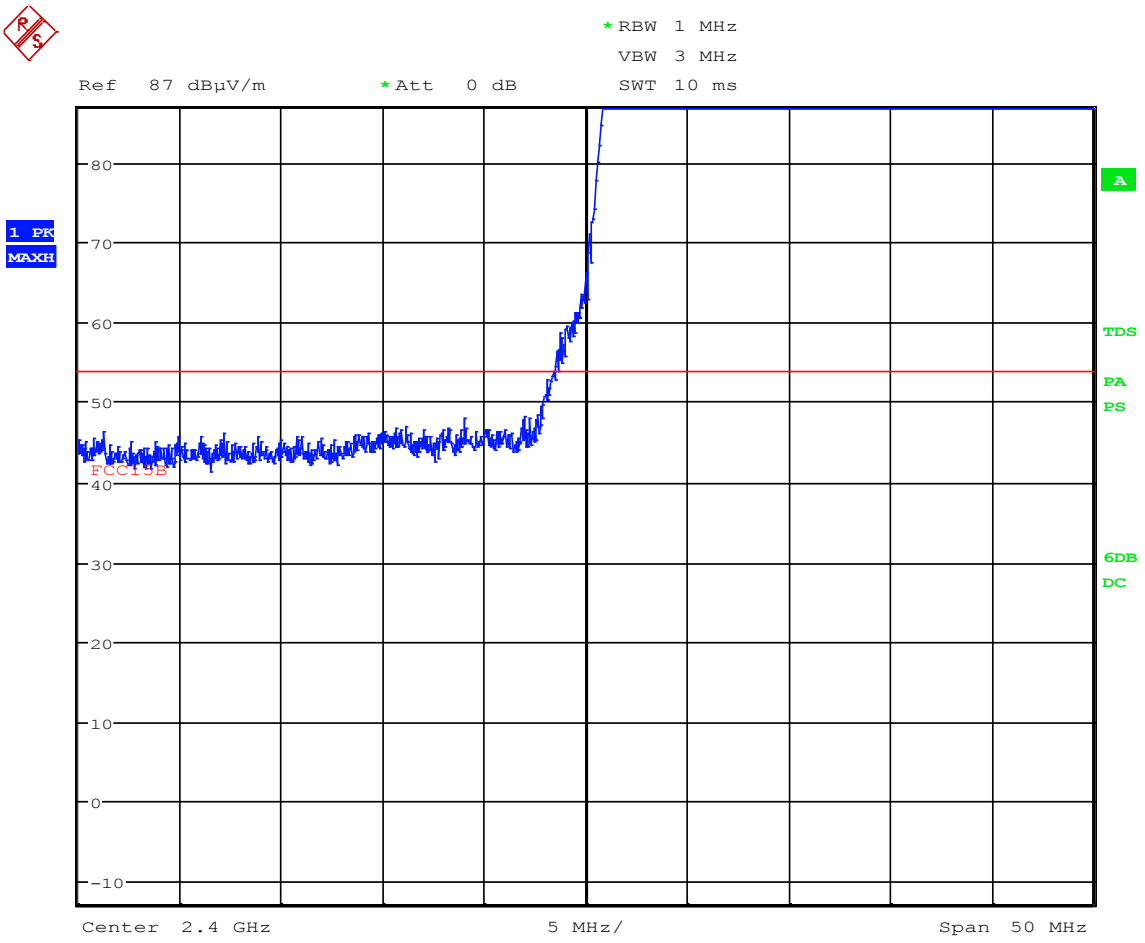
6.8.6. Band Edge Compliance

3-DH5



Emission Frequency (MHz)	Measured Amplitude (dBµV/m) QP/AVG*	Measured Amplitude (dBµV/m) Peak	FCC 15B				Table Azimuth (0° closest to ant)	Receiving Antenna	
			Limit (dBµV/m) QP/AVG*	Limit (dBµV/m) Peak	Margin (dB) QP/AVG*	Margin (dB) Peak		Pol (H/V)	Height (Meters)
2400.000	44.60	56.60	54.0	74.0	9.4	17.4	0	V	1.0

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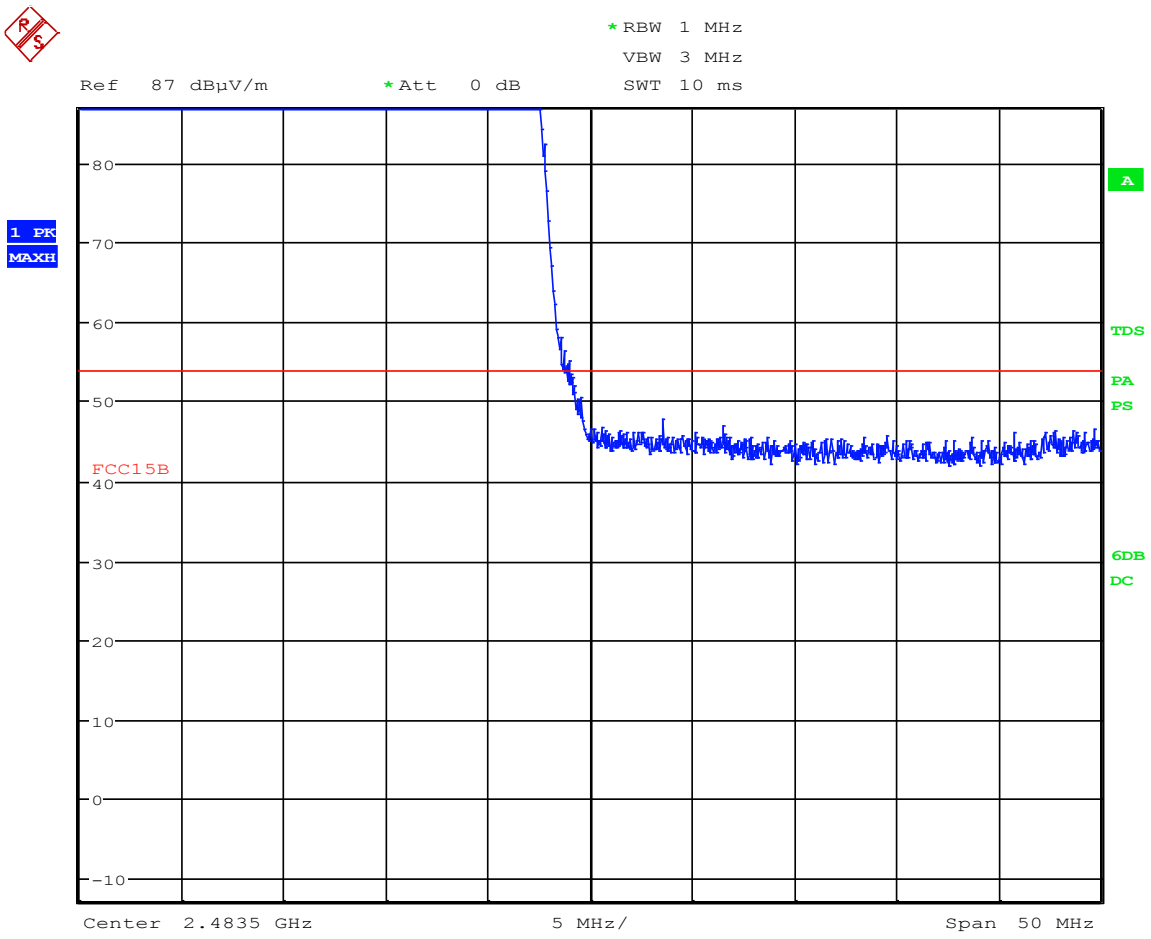

Emission Frequency (MHz)	Measured Amplitude (dBµV/m) QP/AVG*	Measured Amplitude (dBµV/m) Peak	FCC 15B				Table Azimuth (0° closest to ant)	Receiving Antenna	
			Limit (dBµV/m) QP/AVG*	Limit (dBµV/m) Peak	Margin (dB) QP/AVG*	Margin (dB) Peak		Pol (H/V)	Height (Meters)
2483.500	32.10	41.30	54.0	74.0	21.9	32.7	360	V	1.0

The emissions outside of the band are below the general limit.

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6.8.7. Test Equipment

Equipment Type	Manufacturer	Model	Serial or other ID	Service	
				Last	Due
Antenna	Sunol Sciences	JB6	TN1541	7/3/2012	7/3/2013
Pre-Amplifier	Bose	N/A	N/A	Verified	
EMI Test Receiver	Rohde & Schwarz	ESU40	TN1663	4/5/2013	4/5/2014
Maxwell House Radiated Emissions Cable Set	Bose Corporation	N/A	TN1445	Verified	

6.8.8. Test information

Date of test:	5/8/2013	**Test location :**	DCE - Maxwell House
EUT serial:	SN 94	**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

The EUT is controlled using software which is used to set the test modes of the Bluetooth controller. The EUT antenna is disconnected and replaced with a 2 inch long piece of flexible semi-rigid cable. For this conducted measurement the SMA cable was connected directly to the spectrum analyzer input. The EUT is programmed to stop hopping and operated at fixed frequencies at the low, middle, and high end of the authorized frequency band.

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

RX Frequency (MHz)	Worst case frequency (GHz)	Emission amplitude (dBm)	Margin (dB)
2402	2.398	-59.2	6.2
2441	2.440	-59	6
2480	2.468	-59.7	6.7

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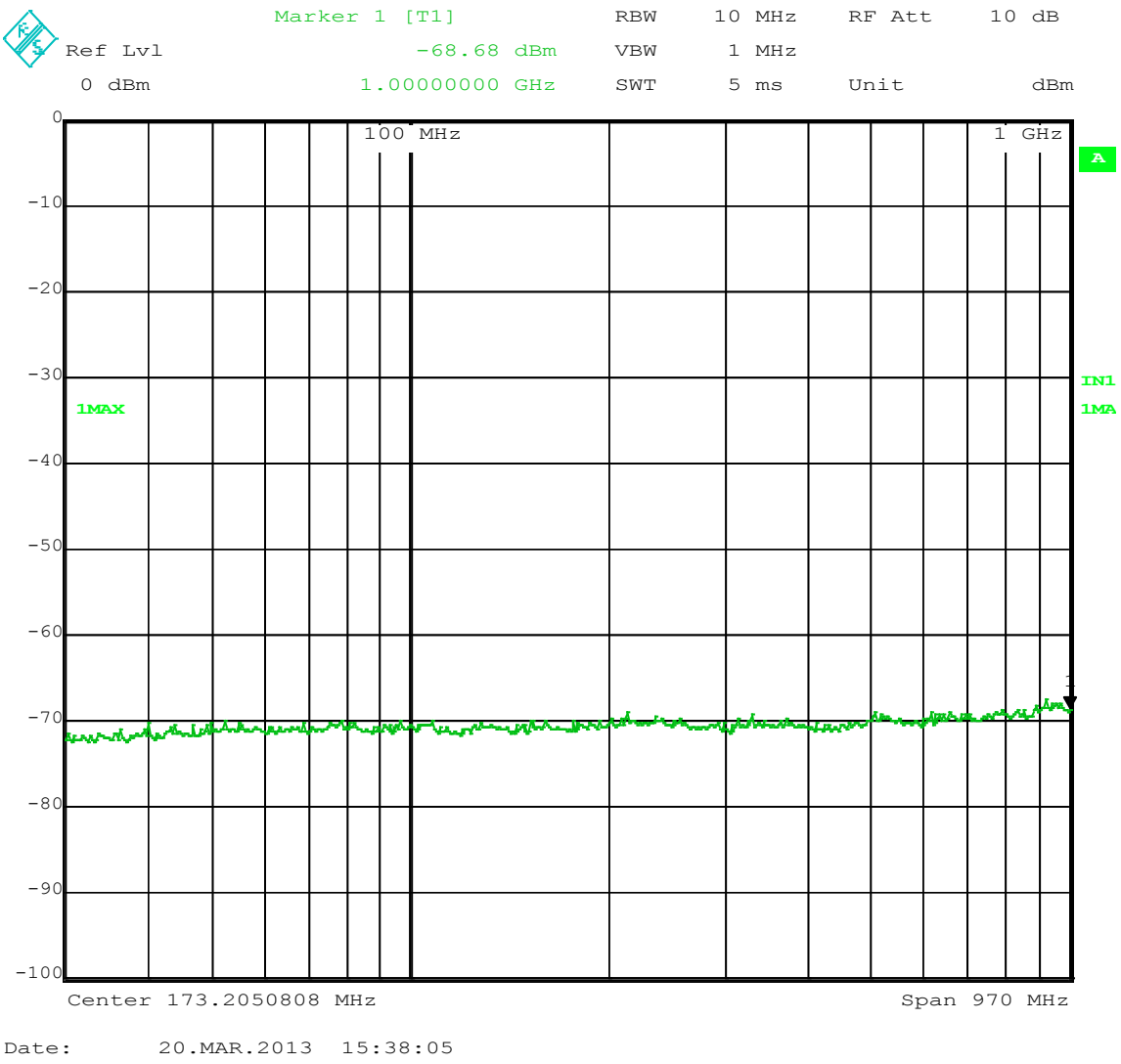
Plot of emissions, made while receiving at 2402 MHz



Plot of emissions, made while receiving at 2441 MHz

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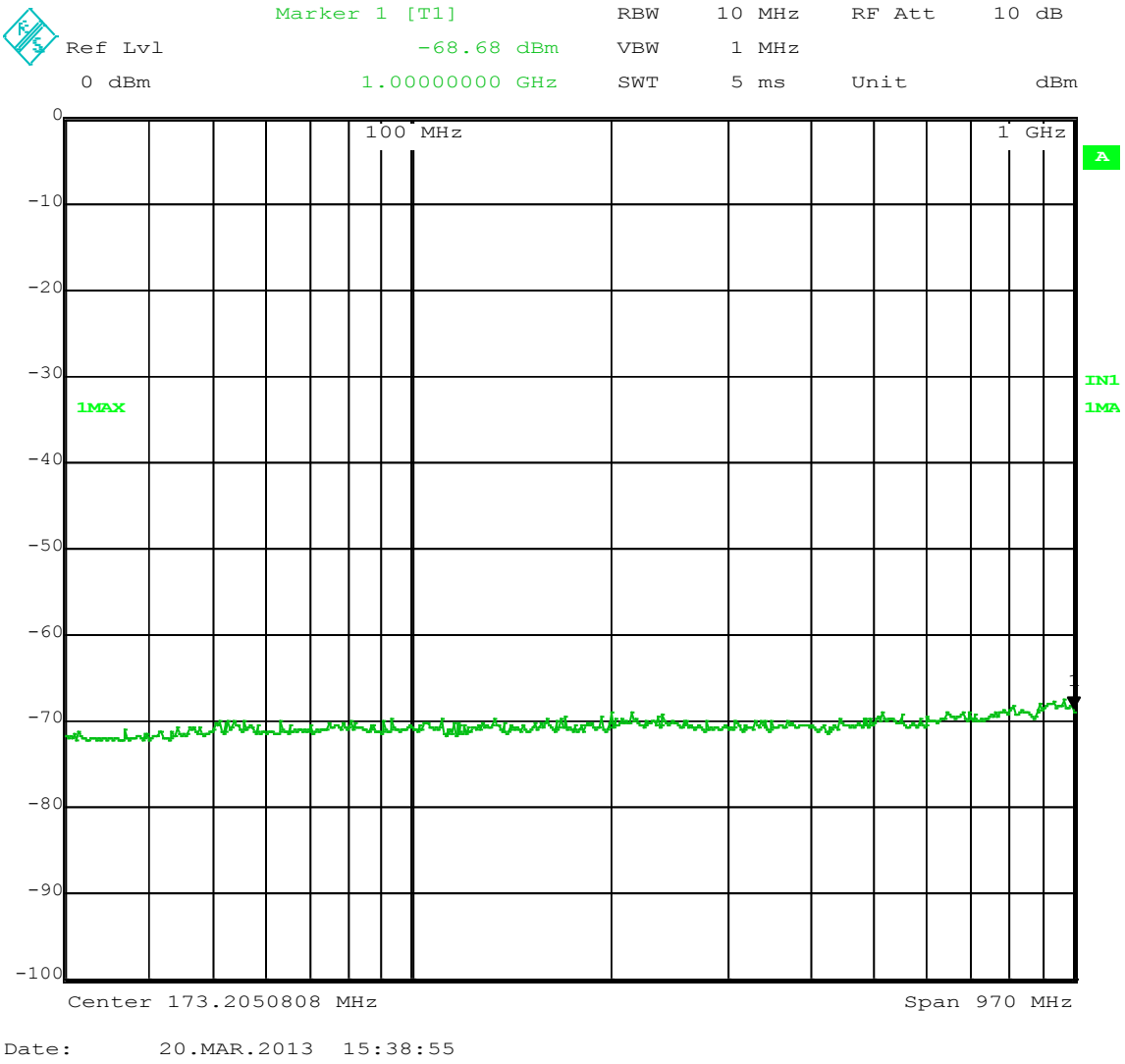

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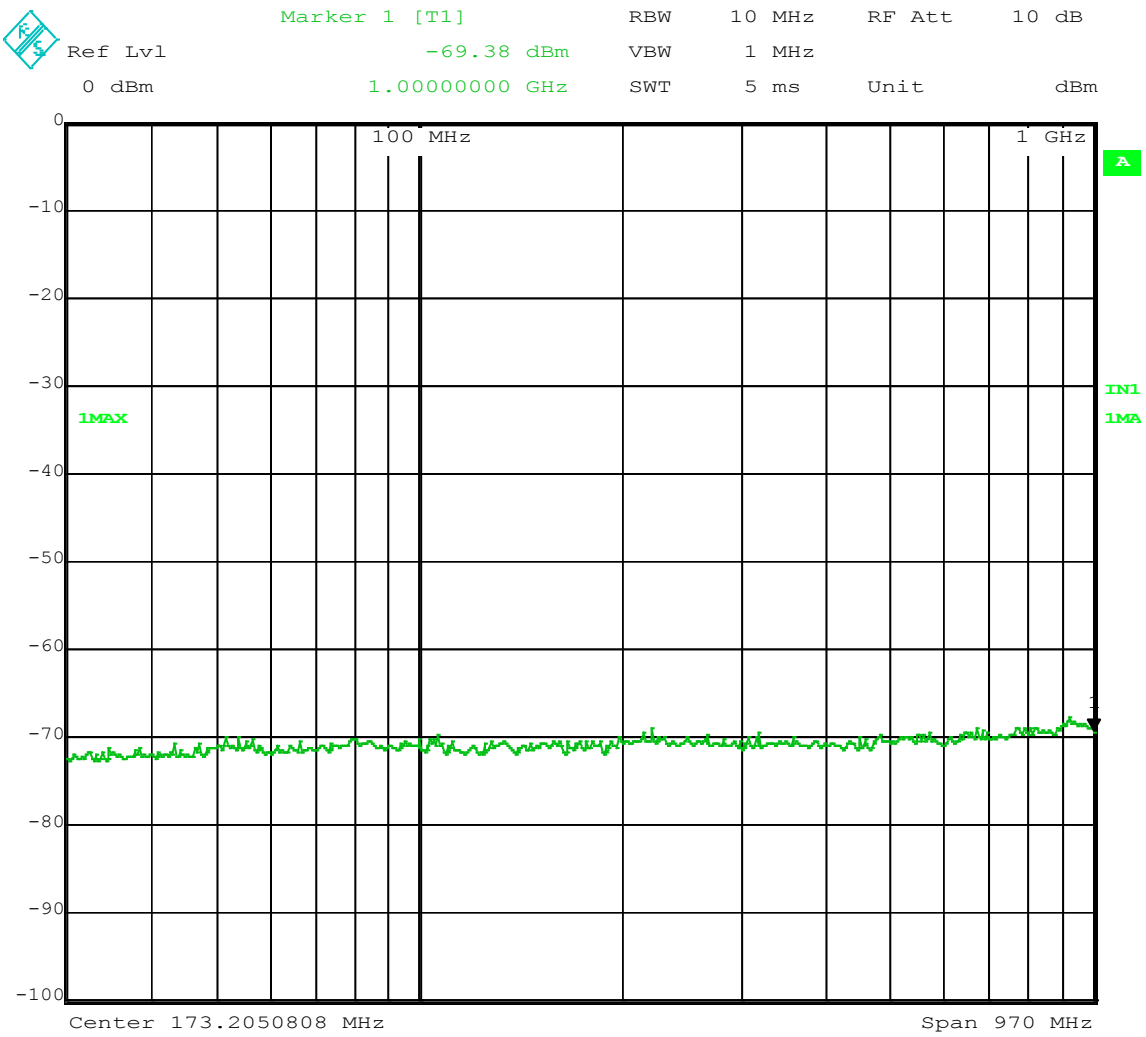
Plot of emissions, made while receiving at 2480 MHz



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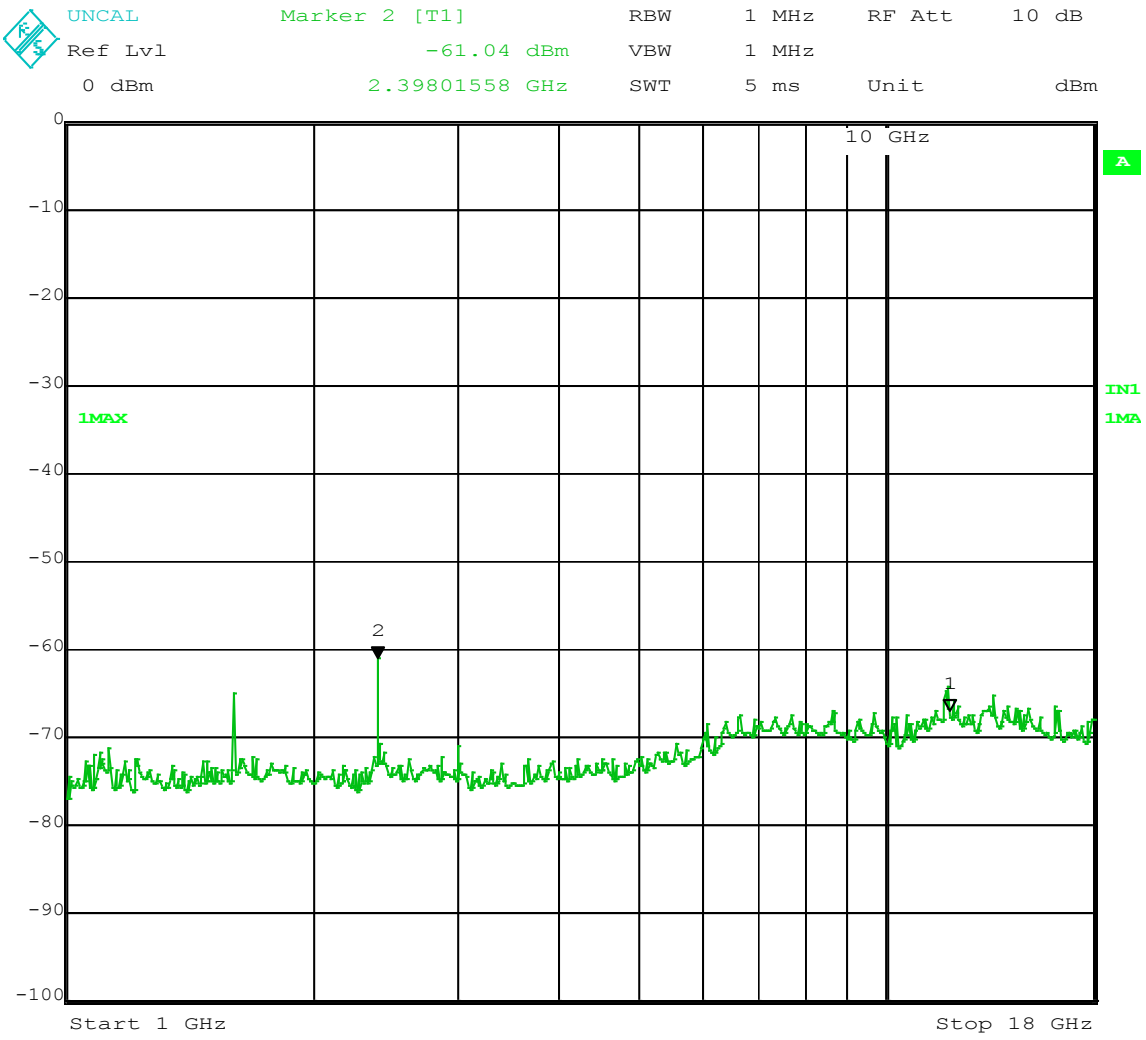
Plot of emissions, made while receiving at 2402 MHz



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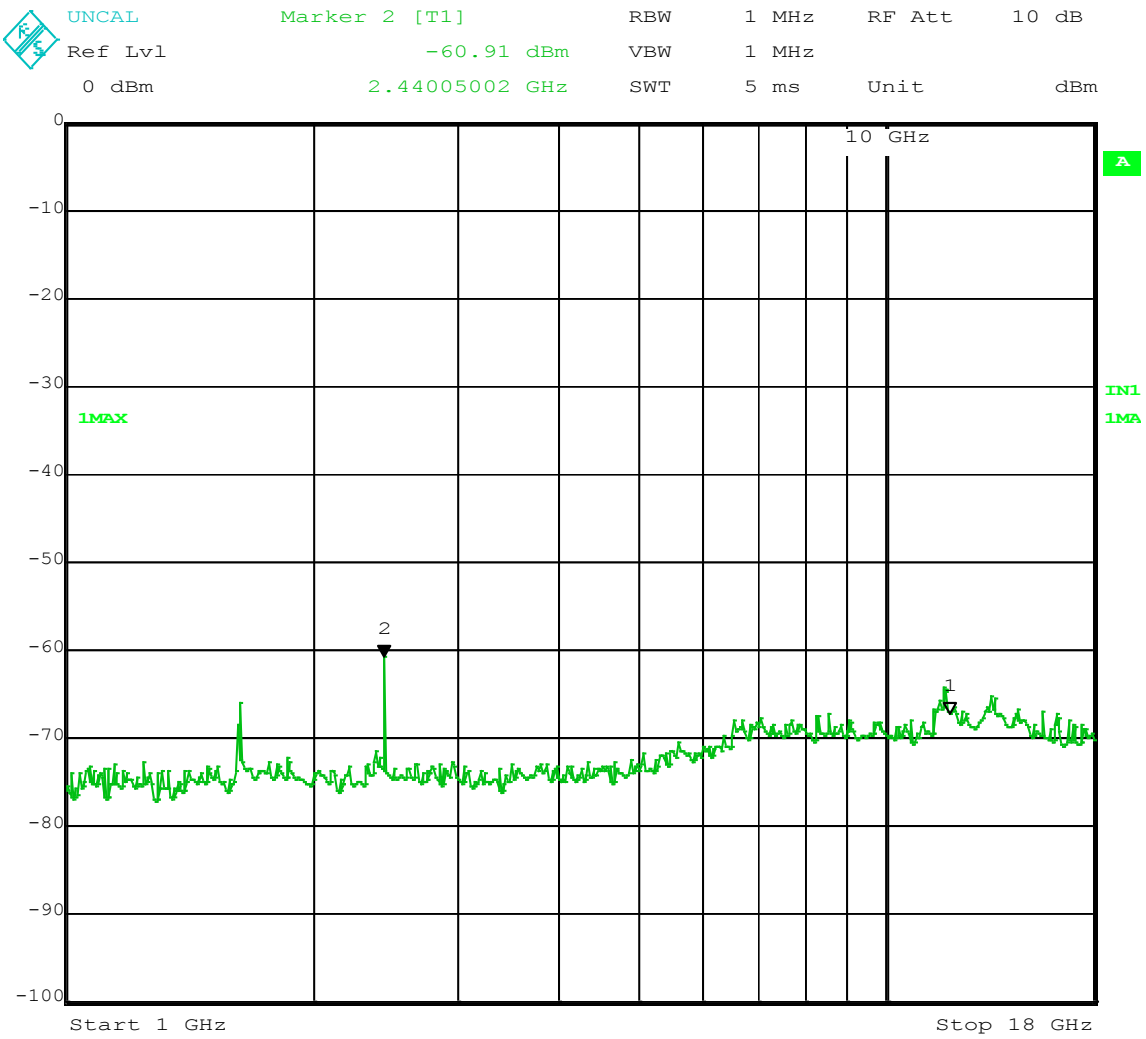
Plot of emissions, made while receiving at 2441 MHz



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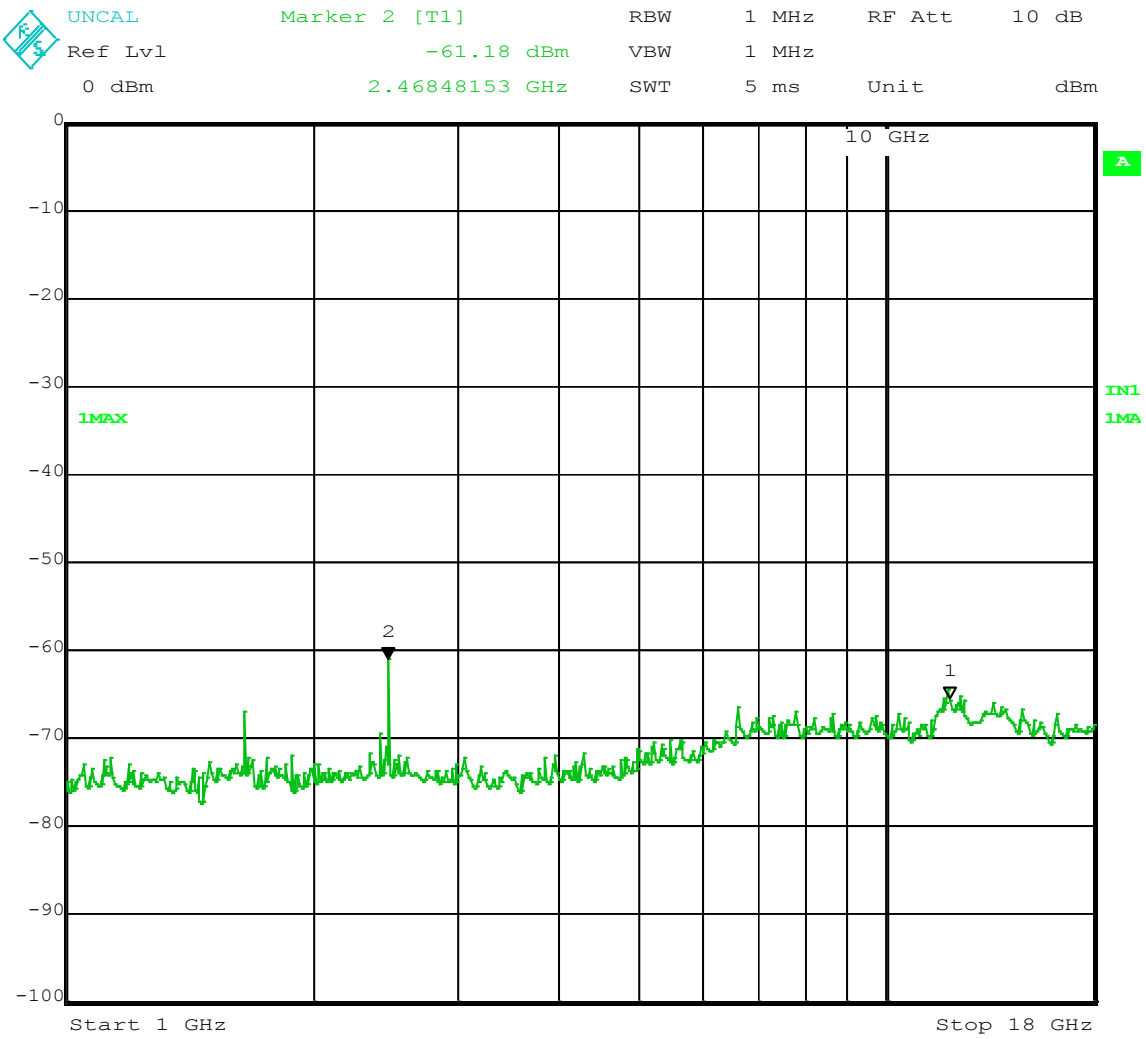
Plot of emissions, made while receiving at 2480 MHz



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6.9.4. Test Equipment

Equipment Type	Manufacturer	Model	Serial or other ID	Service date	
				Last	Due
EMI Test Receiver	Rohde & Schwarz	ESIB40	TN1560	4/4/2012	4/4/2013

6.9.5. Test information

Date of test:	3/20/2013	Test location:	Transmitter Test Bench
EUT serial:	SN 97	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) = 5.7dBm (3.7 mW) (see section 6.3 of this report)

Applying equation 1:

(5.7/10) * [√f(2.432)] = 0.89 <= 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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