



# Wireless Transceiver Test Report

FCC ID: A94RVBL IC: 3232A-BT2L



Certificate # 1514.1

**Report number:** EMC. 409633L-2.13.30.1

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

**Product Tested:** Bose® Bluetooth® headset Left Ear version

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

**Report prepared by:** Chad Bell

**Signature:** 

January 30, 2013

**Report reviewed by:** Bryan Cerqua

**Signature:** 

January 30, 2013

**Report issue date:**

January 30, 2013

**Changes from previous revision:** In Section 6.3.3, updated maximum power listed in the summary section to match the table below it. Updated summary chart is Section 6.4.3 to exactly match screen shots. Removed Section 6.10 – SAR Calculation as it is now a separate exhibit. Updated Report number to reflect today's date.

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# Wireless Transceiver Test Report

FCC ID: A94RVBL IC: 3232A-BT2L



Certificate # 1514.1

## Table of Contents

1. Report Summary.....	3
2. Product description .....	4
3. Applicable standards, requirements and tests.....	5
4. Environmental Conditions .....	6
5. EUT configuration: .....	6
6. Detailed Test Results.....	7
6.1. Conducted emissions.....	7
6.2. Radiated emissions 30 MHz – 1 GHz.....	11
6.3. Output power .....	15
6.4. Occupied Bandwidth/Channel Spacing .....	17
6.5. Time of occupancy.....	23
6.6. Spurious emissions - Conducted.....	26
6.7. Harmonics .....	29
6.8. Spurious emissions 1-25 GHz.....	32
6.9. Receiver spurious emissions .....	43

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# Wireless Transceiver Test Report

FCC ID: A94RVBL IC: 3232A-BT2L



Certificate # 1514.1

## 1. Report Summary

1.1 Product Bose® Bluetooth® headset (BT2L)

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, MA 01701.  
IC registration : 3232A  
FCC site registration under A2LA cert. #1514

This report relates only to the items tested.

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# Wireless Transceiver Test Report

FCC ID: A94RVBL IC: 3232A-BT2L



Certificate # 1514.1

## 2. Product description

Bose® Bluetooth® headset allows the user to talk on their cell phone hands free.

The Bose® Bluetooth® headset has a duty cycle that does not exceed 8% in normal operation. For the purposes of the tests described in this report, where an artificial test mode is indicated or necessary for the purposes of the test, the Bose® Bluetooth® headset is operated with a 10% duty cycle which is considered a worst case for the purposes of these tests.

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# Wireless Transceiver Test Report

FCC ID: A94RVBL IC: 3232A-BT2L



Certificate # 1514.1

### 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

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# Wireless Transceiver Test Report

FCC ID: A94RVBL IC: 3232A-BT2L



Certificate # 1514.1

## 4 Environmental Conditions

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

Temperature:  $22 \pm 4$  °C

Humidity: 30 – 60 % RH

## 5. EUT configuration:

The Bose® Bluetooth® headset is powered by a rechargeable, non-replaceable lithium-ion polymer battery. The battery is to be charged with the included power supply. The headset cannot be used while it is charging. Therefore during conducted emissions the power supply was measured while charging a headset with a fully depleted battery that was in standby mode.

For any test where the Bose® Bluetooth® headset was operated on battery power the battery was fully charged prior to beginning the test and monitored during the test.

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# Wireless Transceiver Test Report

FCC ID: A94RVBL IC: 3232A-BT2L



Certificate # 1514.1

## 6. Detailed Test Results

### 6.1. Conducted emissions

#### 6.1.1. Requirements

47CFR15.207, RSS 210 section 7.2.4

Frequency (MHz)	Limits dB(μV)	
	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.

#### 6.1.3. Test data

##### Summary

The Bose® Bluetooth® headset passes conducted emissions by 26.4dB at 0.17MHz (Q.P. detector) on the neutral side. The Bose® Bluetooth® headset passes conducted emissions by 26.3dB at 0.17MHz (Q.P. detector) on the neutral side.

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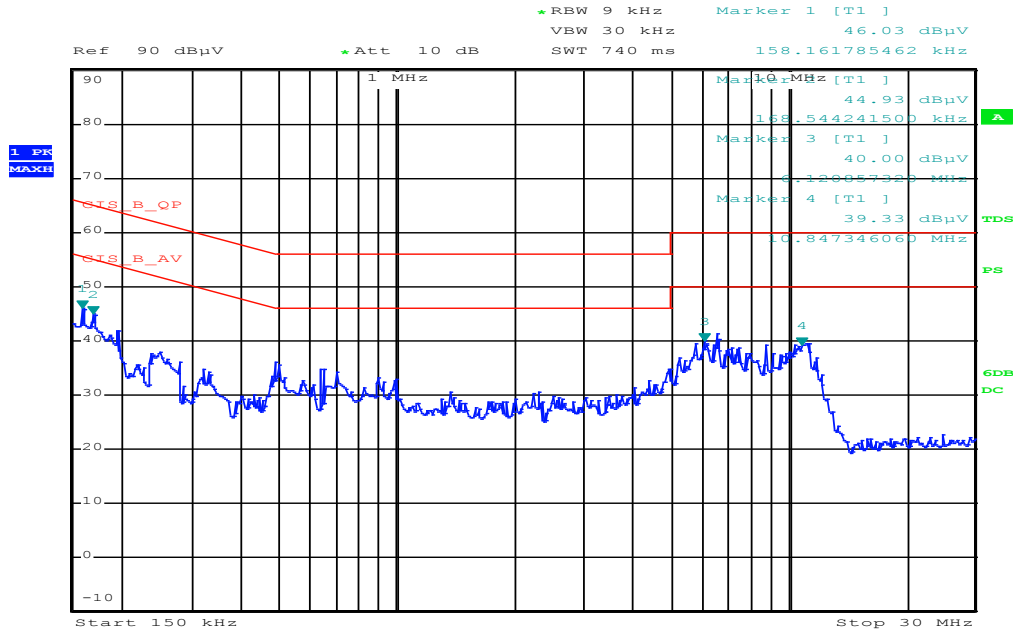
# Wireless Transceiver Test Report



FCC ID: A94RVBL IC: 3232A-BT2L

Certificate # 1514.1

## Bose® Bluetooth® headset, 120V AC 60Hz, Line Side – Max Peak scan



Date: 30.AUG.2012 08:52:25

Quasi-Peak and Average measurements on the Line side:

Frequency MHz	MEASURED		LIMIT		MARGIN	
	dBµV QP	dBµV AVG	dBµV QP	dBµV AVG	dB QP	dB AVG
0.1582	39.00	22.30	65.5	55.5	26.5	33.2
0.1685	38.60	22.20	65.0	55.0	26.4	32.8
0.2495	32.60	18.50	61.8	51.8	29.2	33.3
6.1209	31.70	20.30	60.0	50.0	28.3	29.7
6.5921	31.40	20.50	60.0	50.0	28.6	29.5
11.1977	30.90	18.90	60.0	50.0	29.1	31.1

Passes conducted emissions by 26.4dB at 0.17 MHz (Q.P. detector) on the line side.

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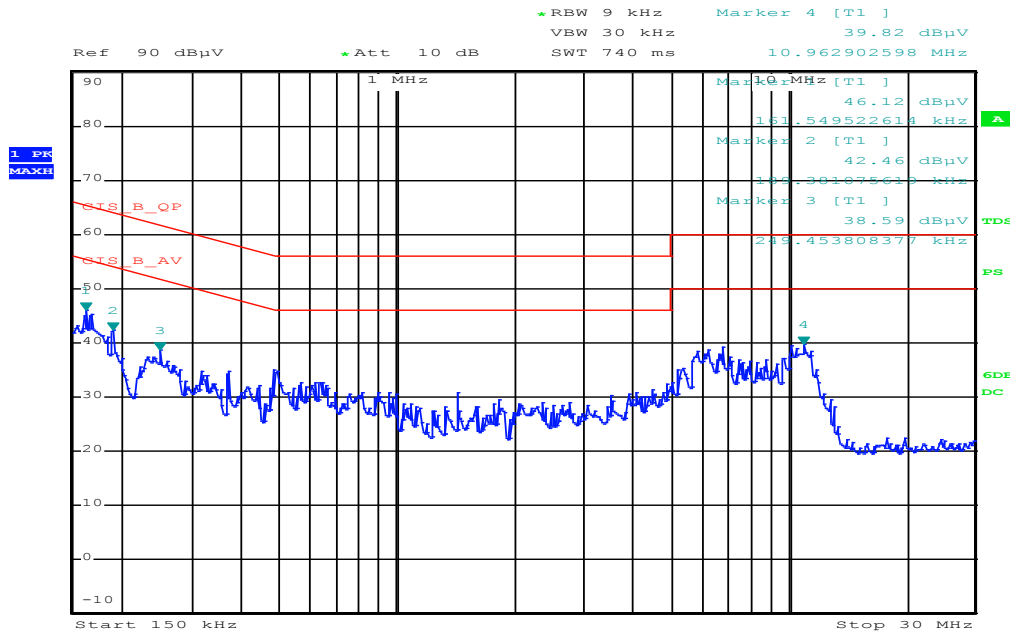
# Wireless Transceiver Test Report



FCC ID: A94RVBL IC: 3232A-BT2L

Certificate # 1514.1

## Bose® Bluetooth® headset, 120V AC 60Hz, Neutral Side – Max Peak scan



Date: 30.AUG.2012 08:56:58

Quasi-Peak and Average measurements on the Neutral side:

Frequency MHz	MEASURED		LIMIT		MARGIN	
	dBuV QP	dBuV AVG	dBuV QP	dBuV AVG	dB QP	dB AVG
0.1615	38.90	21.90	65.4	55.4	26.5	33.5
0.1668	38.80	21.90	65.1	55.1	26.3	33.2
0.1894	34.60	18.20	64.1	54.1	29.5	35.9
0.2366	32.70	17.40	62.2	52.2	29.5	34.8
6.3186	27.80	16.00	60.0	50.0	32.2	34.0
10.5079	29.20	16.70	60.0	50.0	30.8	33.3

Passes conducted emissions by 26.3dB at 0.17MHz (Q.P. detector) on the neutral side.

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# Wireless Transceiver Test Report

FCC ID: A94RVBL IC: 3232A-BT2L



Certificate # 1514.1

## 6.1.4. Test Equipment

Equipment Type	Manufacturer	Model	Serial or other ID	Service	
				Last	due date
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

<b>Date of test:</b>	August 30, 2012	<b>Test location :</b>	DCE lab – Henry room
<b>EUT serial:</b>	250436	<b>Tested by:</b>	Chad Bell
<b>Test Conclusion:</b>	Pass		

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# Wireless Transceiver Test Report

FCC ID: A94RVBL IC: 3232A-BT2L



Certificate # 1514.1

## 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 dB $\mu$ V/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. Since the Bluetooth functionality cannot be used while the battery is being charged, radiated emissions was tested once in battery charging mode (with fully depleted battery), and once in normal Bluetooth operating mode. For Bluetooth mode, 3-DH5 enhanced data rate was used because this provides the highest output power.

Description of cables:

In Bluetooth mode no cables were used, since the charging cable disables the Bluetooth functionality. In battery charging mode the 98cm USB-mini USB cable was not bundled (bundling not required to maintain 40cm height off of the ground plane). It was situated such that the power supply and the headset were separated by >10cm with the cable draped to 40cm off of the ground plane.

### 6.2.3. Test data

#### Summary:

Passes FCC Class B radiated emissions in battery charging mode by 15.6dB at 97.9 MHz. In Bluetooth Mode there were not any emissions within 20dB of the limit or above the noise floor of the test instrumentation so Quasi-Peak readings were not taken.

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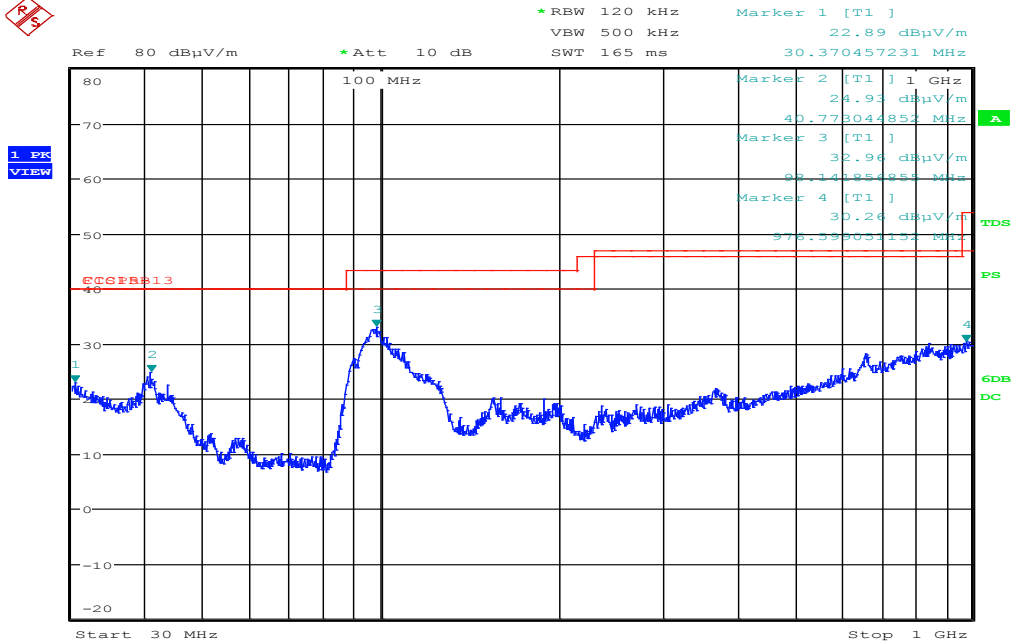
# Wireless Transceiver Test Report

FCC ID: A94RVBL IC: 3232A-BT2L



Certificate # 1514.1

120VAC, Max-Hold Peak Pre-scan, 30MHz – 1GHz, battery charging mode



Date: 29.AUG.2012 08:28:41

Max-Hold Peak Pre-scan, 30MHz – 1GHz

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)
30.371	20.00	26.30	40.0	N/A	20.0	N/A	221	V	1.0
40.679	17.30	26.00	40.0	N/A	22.7	N/A	259	V	1.0
43.617	15.20	30.10	40.0	N/A	24.8	N/A	360	V	1.0
97.904	27.90	33.50	43.5	N/A	15.6	N/A	0	V	1.0
101.839	23.70	32.10	43.5	N/A	19.8	N/A	78	V	1.0
976.599	27.20	32.80	54.0	N/A	26.8	N/A	0	H	1.0

Passes FCC Class B radiated emissions in battery charging mode by 15.6dB at 97.9 MHz

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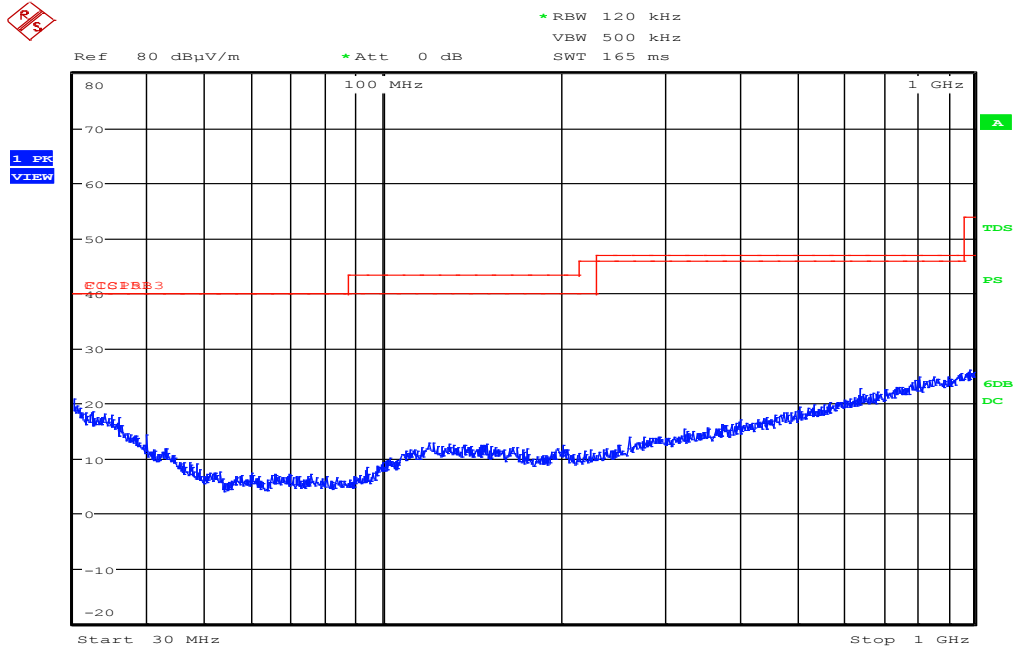
FCC ID: A94RVBL IC: 3232A-BT2L



Certificate # 1514.1

120VAC, Max-Hold Peak Pre-scan, 30MHz – 1GHz, Bluetooth mode

## Max-Hold Peak Pre-scan, 30MHz – 1GHz



Date: 28.AUG.2012 23:33:47

In Bluetooth Mode there were no emissions within 20dB of the limit or above the noise floor of the test instrumentation so Quasi-Peak readings were not taken.

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# Wireless Transceiver Test Report

FCC ID: A94RVBL IC: 3232A-BT2L



Certificate # 1514.1

## 6.2.4. Test Equipment

Equipment Type	Manufacturer	Model	Serial or other ID	Service	
				last	due
Antenna	Sunol Sciences	JB6	TN1541	7/12/2012	7/12/2013
EMI Test Receiver	Rohde & Schwarz	ESU40	TN1663	4/6/2012	4/6/2013
Maxwell House Radiated Emissions Cable Set	Bose Corporation	N/A	TN1445	3/2/2012	3/2/2013
Pre-amp	Mini-Circuits	ZX60-3018G+	TN2077	6/15/2012	6/15/2013

## 6.2.5. Test information

<b>Date of test:</b>	August 29, 2012	<b>Test location :</b>	DCE - Maxwell House
<b>EUT serial:</b>	250474 in Battery Charging Mode	<b>Tested by:</b>	C. Bell
<b>Test Conclusion:</b>	Pass		

<b>Date of test:</b>	August 28, 2012	<b>Test location :</b>	DCE - Maxwell House
<b>EUT serial:</b>	250438 in Bluetooth Mode	<b>Tested by:</b>	N. Sanford
<b>Test Conclusion:</b>	Pass		

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# Wireless Transceiver Test Report

FCC ID: A94RVBL IC: 3232A-BT2L



Certificate # 1514.1

## 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 transceiver is controlled via the USB charging cable with CSR's Blue Suite software which is can be used to set the test modes of the Bluetooth controller. The EUT antenna is disconnected and replaced with a 3 inch long piece of RG178 cable with an SMA connector at the far end, this cable is rated to have less than 0.5dB of loss at 2.48GHz. For all conducted measurements the RG178 cable was connected directly to the receiver. The transceiver is operated in an artificial test mode controlled with Blue Suite software. The EUT is programmed to stop hopping and operated at fixed frequencies at the low (2402MHz), middle (2441MHz), and high end (2480MHz) of the authorized frequency band.

The spectrum analyzer resolution bandwidth is set to 2 MHz (higher than the occupied bandwidth in EDR mode), 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.

### 6.3.3. Test data.

**Summary:** RBW=2 MHz, detector=peak, max power = 5.36 dBm = 3.44mW

Power measurements shown below are based on maximum value over 3 samples.

Channel	Center Frequency (MHz)	Basic Rate: DH5 (dBm)	EDR: 3-DH5 (dBm)
0	2402	4.76	5.22
39	2441	2.99	4.16
78	2480	4.40	5.36

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# Wireless Transceiver Test Report

FCC ID: A94RVBL IC: 3232A-BT2L



Certificate # 1514.1

## 6.3.4. Test Equipment

Equipment Type	Manufacturer	Model	Serial or other ID	Service date	
				Last	Due
EMI Test Receiver	Rohde & Schwarz	ESIB 40	TN1560	4/6/2012	4/6/2013

## 6.3.5. Test information

<b>Date of test:</b>	June 13, 2012	<b>Test location:</b>	Transmitter Test Bench
<b>EUT serial:</b>	250454, 250460, 250472	<b>Tested by:</b>	Chad Bell
<b>Test Conclusion:</b>	Pass		

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# Wireless Transceiver Test Report

FCC ID: A94RVBL IC: 3232A-BT2L



Certificate # 1514.1

## 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), RSS210 section 8.1(b)

The hopping channel carrier frequencies are separated by at least  $2/3^{\text{rd}}$  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 identical to section 6.3

### 6.4.3. Test data

Summary: EDR mode packet 3-DH5 (worst case modulation)

BT Channel	Center Frequency (MHz)	-20dB OBW (MHz)	99% OBW (MHz)
0	2402	1.393	1.222
39	2441	1.403	1.222
78	2480	1.403	1.222

Conclusion:  $2/3^{\text{rd}}$  of the largest OBW =  $2/3 \times 1.403 \text{ MHz} = 935 \text{ kHz}$ , 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 RSS210 A8.1 (a) is 79 channels times 1.222 MHz = 96.54MHz.

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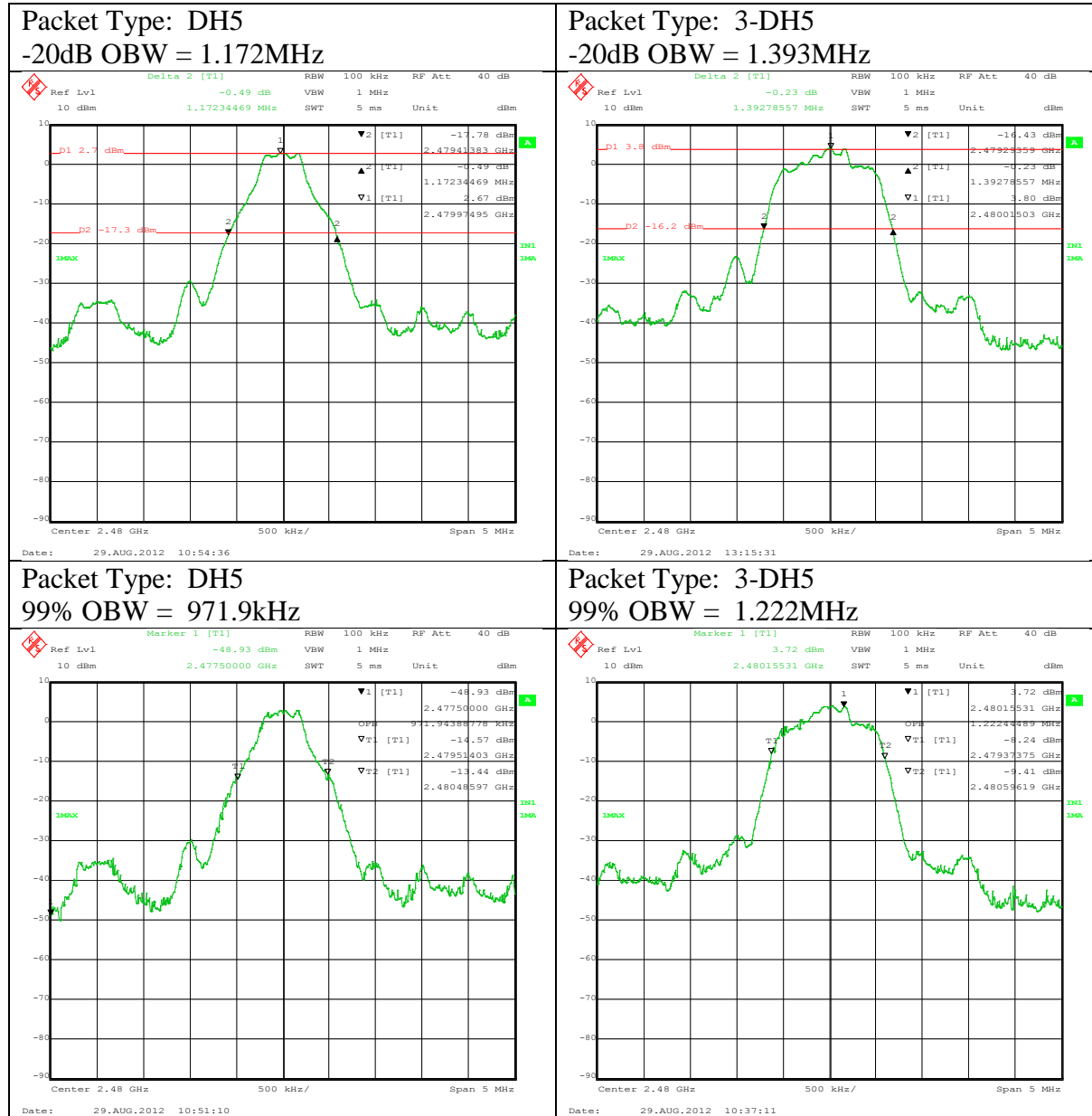
# Wireless Transceiver Test Report



FCC ID: A94RVBL IC: 3232A-BT2L

Certificate # 1514.1

Detail results:  
High Channel, 2480 MHz



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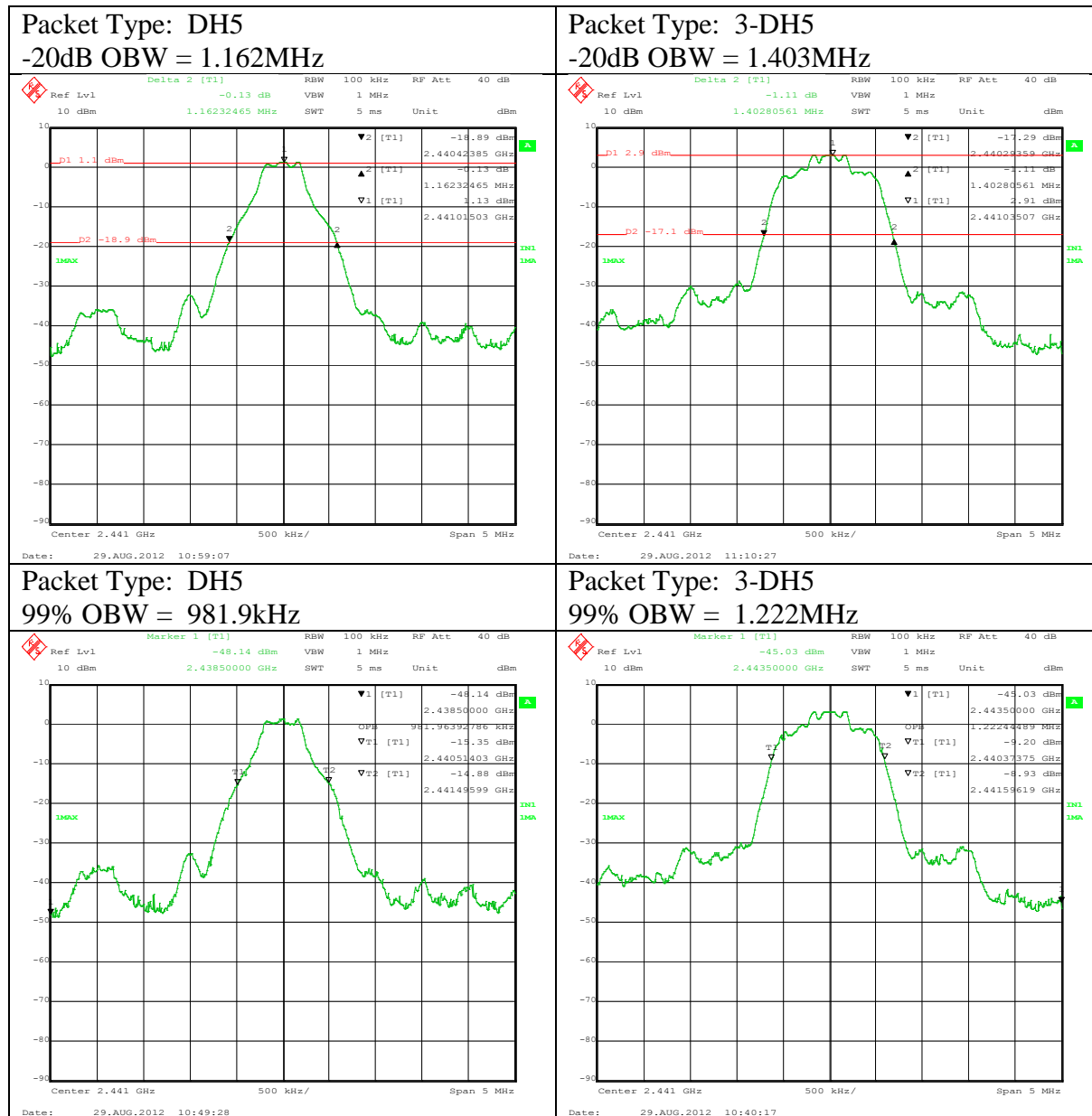
# Wireless Transceiver Test Report



FCC ID: A94RVBL IC: 3232A-BT2L

Certificate # 1514.1

Mid Channel, 2441MHz



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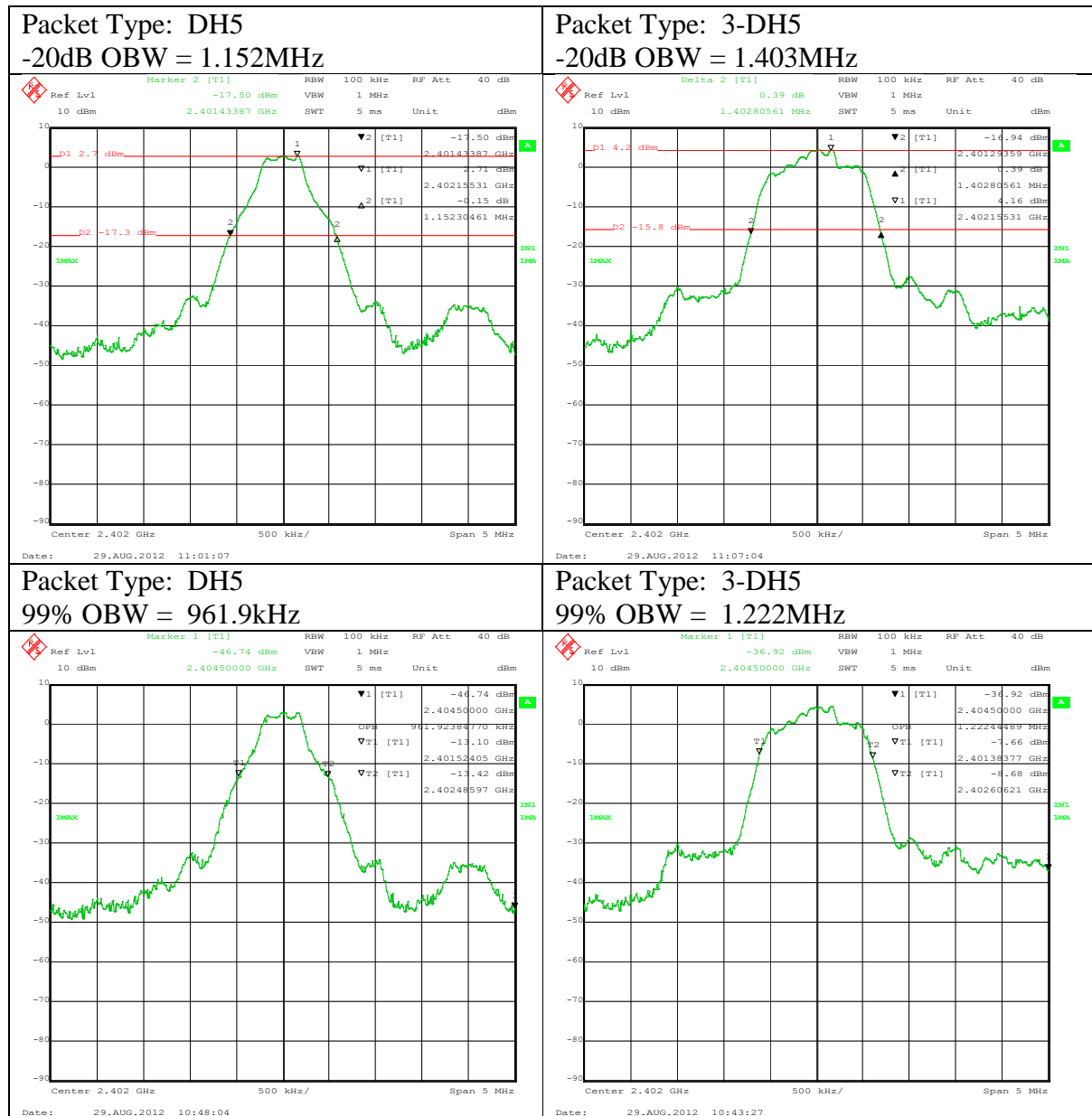
# Wireless Transceiver Test Report



FCC ID: A94RVBL IC: 3232A-BT2L

Certificate # 1514.1

Low Channel, 2402MHz



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# Wireless Transceiver Test Report

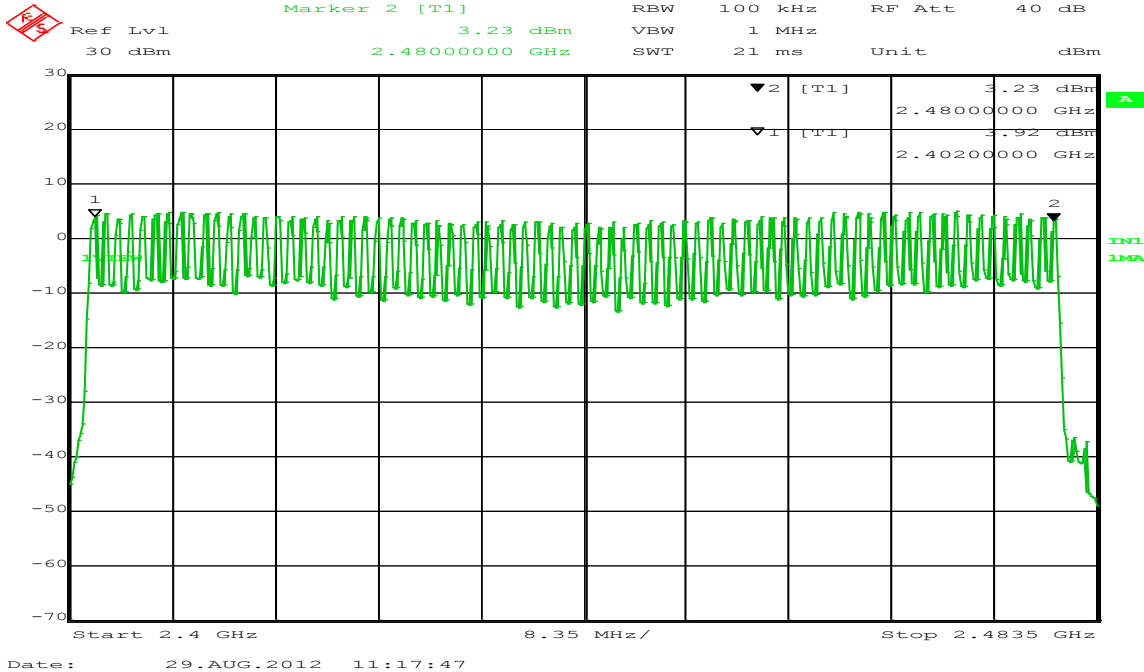


FCC ID: A94RVBL IC: 3232A-BT2L

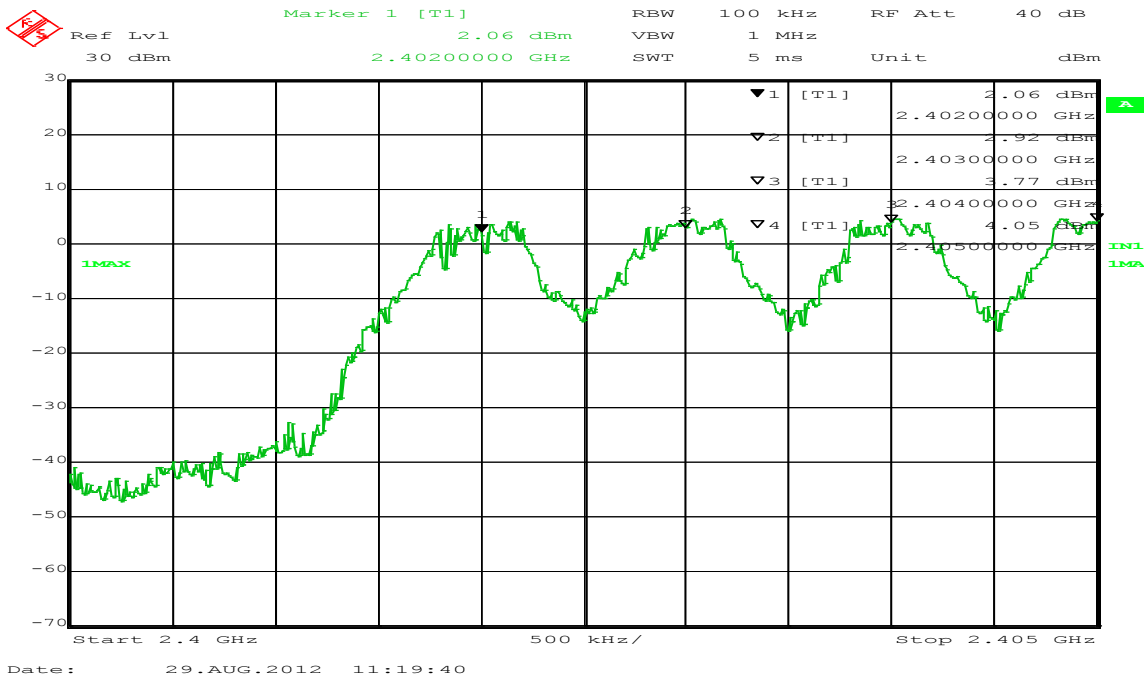
Certificate # 1514.1

## Channel Spacing

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



## Low band end spacing detail (2402 MHz)



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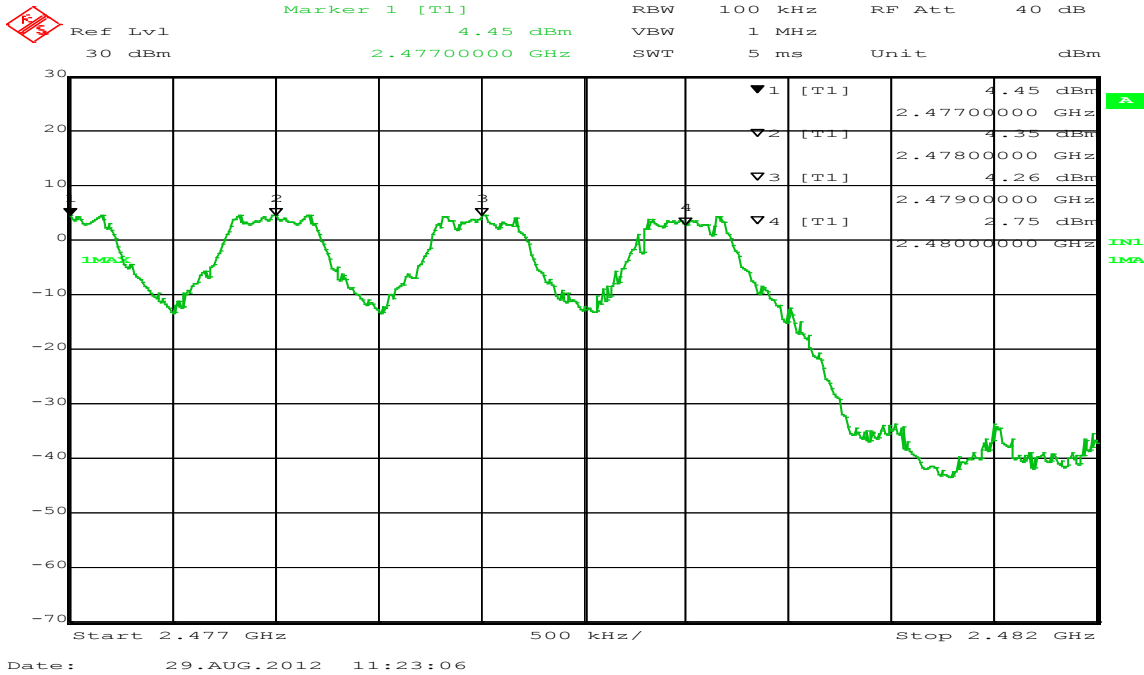
# Wireless Transceiver Test Report

FCC ID: A94RVBL IC: 3232A-BT2L



Certificate # 1514.1

## High band end spacing detail (2483.5 MHz)



### 6.4.4. Test Equipment

Equipment Type	Manufacturer	Model	Serial or other ID	Service date	
				Last	Due
EMI Test Receiver	Rohde & Schwarz	ESIB 40	TN1560	4/6/2012	4/6/2013

### 6.4.5. Test information

Date of test:	August 29, 2012	Test location:	Transmitter Test Bench
EUT serial:	250460	Test by:	Chad Bell
Test Conclusion:	Pass		

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# Wireless Transceiver Test Report

FCC ID: A94RVBL IC: 3232A-BT2L



Certificate # 1514.1

## 6.5. Time of occupancy

### 6.5.1. Requirements

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

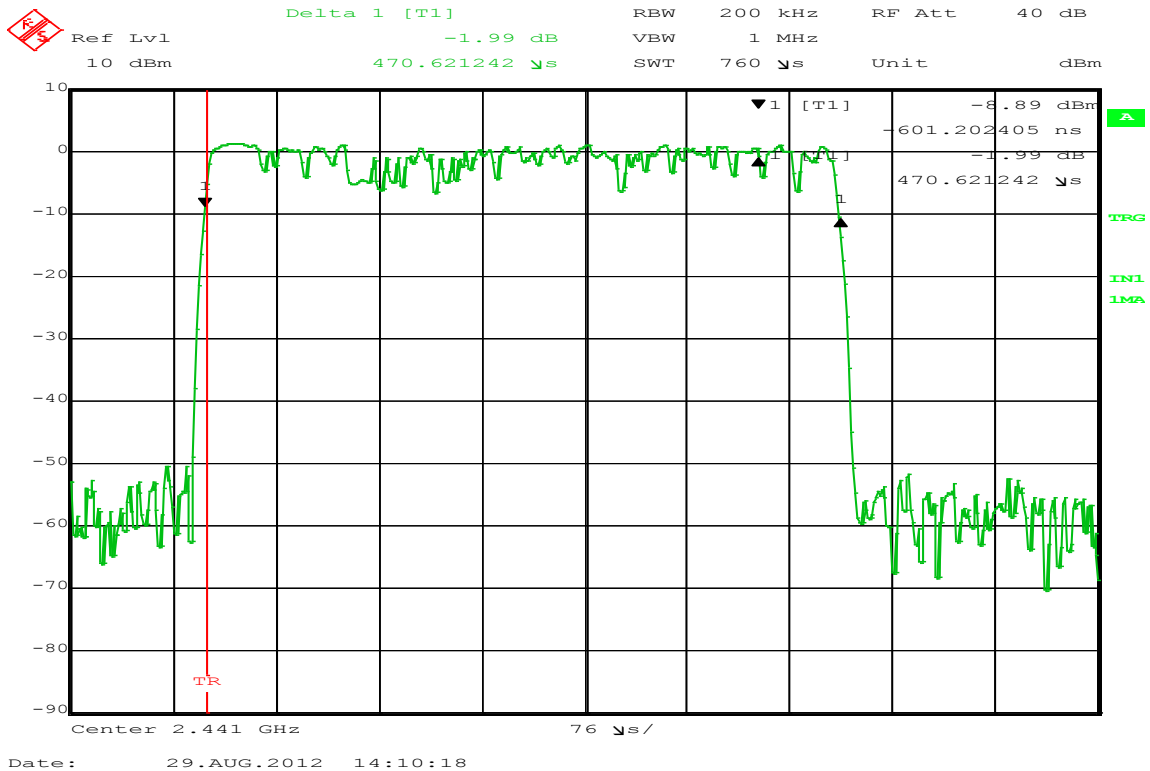
The frequency hopping operation shall have an average time of occupancy on any frequency not to exceed 0.4 seconds within the duration in seconds equal to the number of hopping frequencies employed multiplied by 0.4

### 6.5.2. Test setup details

The SA is connected to the EUT via a low loss cable. The EUT is operating on its normal hop set. The SA sweep time is set to the number of hopping channels (79) times 0.4 seconds or 31.6 seconds (rounded up to 32 seconds). The SA is tuned to mid-band (2441MHz), set to a 100 kHz RBW in order to minimize bleed-over from adjacent channels and set to a single sweep.

### 6.5.3. Test data

Number of hopping channels is 79 (2402 – 2480 in 1 MHz increments). The longest packet transmission time is 470.6  $\mu$ s for a DH5 packet type with 10% duty cycle.



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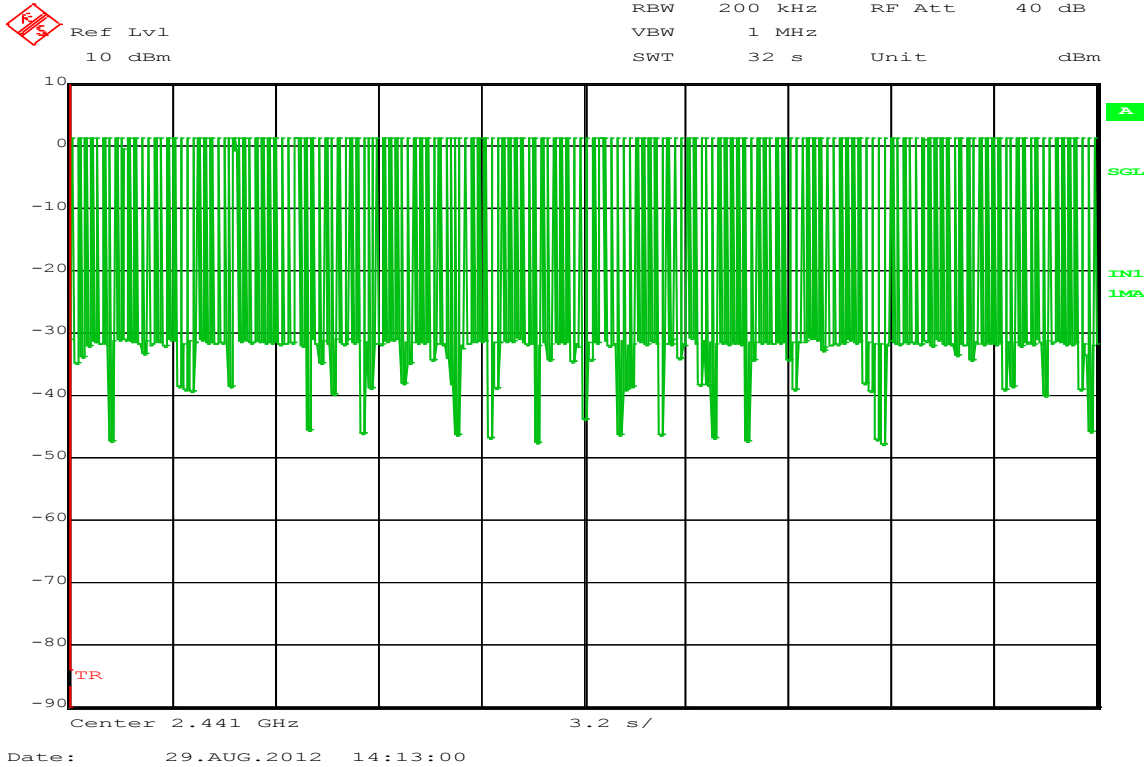
# Wireless Transceiver Test Report



FCC ID: A94RVBL IC: 3232A-BT2L

Certificate # 1514.1

Set to mid channel (2441 MHz) while operating in Hands-free mode. Hands-free mode is the typical use mode as well as providing the highest pulse rate, which creates the highest average dwell time per channel.



There are 168 pulses in 32 seconds.

Therefore the average dwell time per channel is  $0.4706 \text{ ms} \times 168 = 79.1 \text{ ms}$  which is less than the permissible 400msec.

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# Wireless Transceiver Test Report

FCC ID: A94RVBL IC: 3232A-BT2L



Certificate # 1514.1

## 6.5.4. Test Equipment

Equipment Type	Manufacturer	Model	Serial or other ID	Service date	
				Last	Due
EMI Test Receiver	Rohde & Schwarz	ESIB40	TN1560	4/6/2012	4/6/2013
CBT controller	Rohde & Schwarz	CBT	TN1758	4/6/2012	4/6/2013

## 6.5.5. Test information

<b>Date of test:</b>	August 29, 2012	<b>Test location:</b>	Transmitter Test Bench
<b>Serial number:</b>	250460	<b>Tested by:</b>	Chad Bell
<b>Test Conclusion:</b>	Pass		

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# Wireless Transceiver Test Report

FCC ID: A94RVBL IC: 3232A-BT2L



Certificate # 1514.1

## 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 is connectorized and connected to the Spectrum analyzer with a 3 inch long piece of RG178 cable. EUT is controlled by CSR's Blue Suite 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) in basic rate modulation and in EDR mode.

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# Wireless Transceiver Test Report

FCC ID: A94RVBL IC: 3232A-BT2L



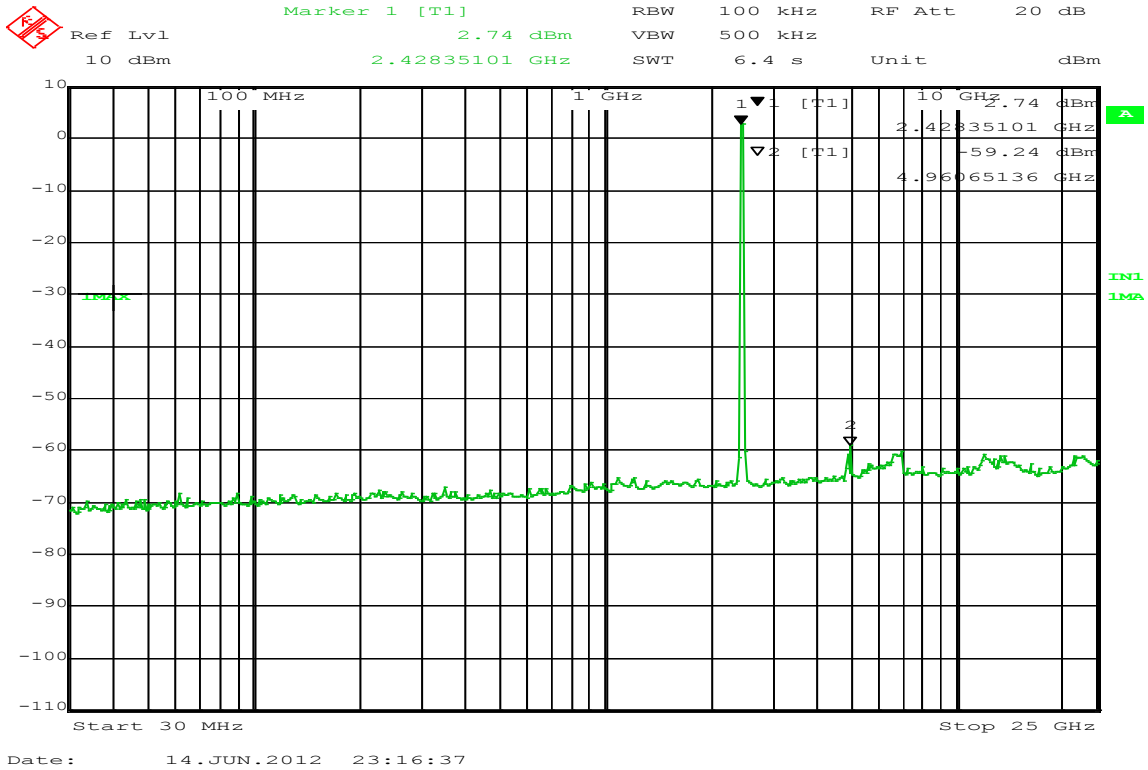
Certificate # 1514.1

## 6.6.3. Test data

### Conducted spurious:

30 MHz – 25 GHz conducted spurious scan, 100 kHz RBW, peak detector, and normal operation (hopping on all channels)

DH5 basic rate conducted spurious. The worst case spurious emission is 61.98dB below the peak values in the desired transmission band, since it is greater than 20dB below the wanted signal it is a passing with 41.98dB of margin.



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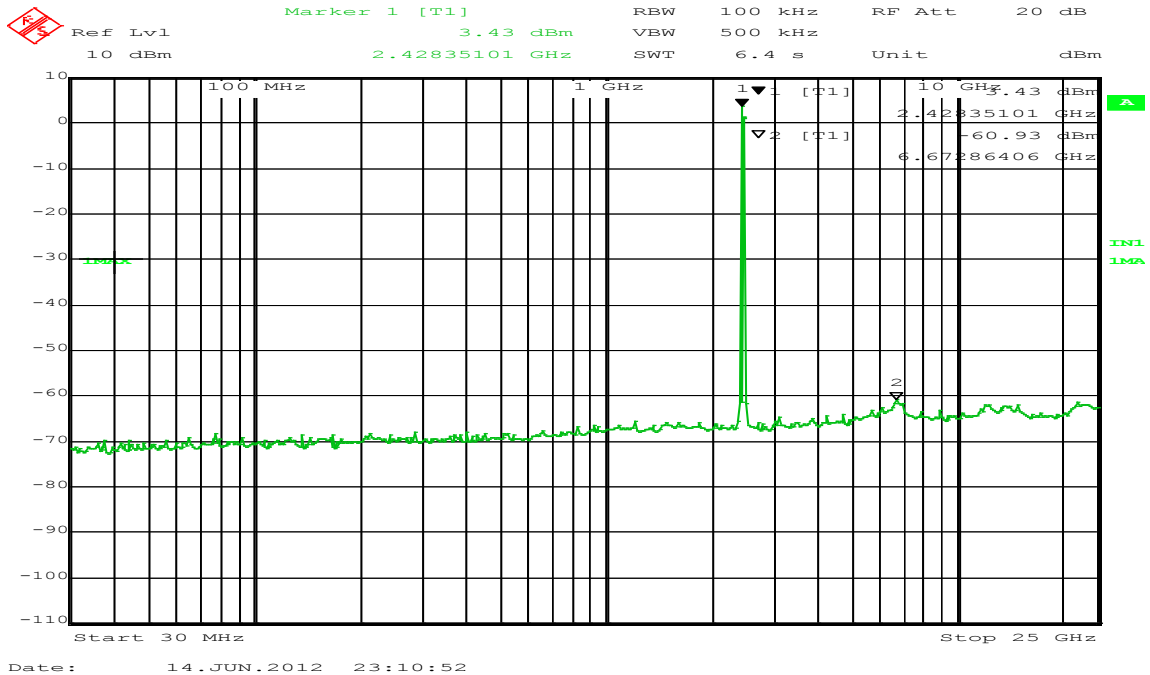
# Wireless Transceiver Test Report



FCC ID: A94RVBL IC: 3232A-BT2L

Certificate # 1514.1

3-DH5 Enhanced Data Rate conducted spurious emissions. The worst case spurious emission is 64.36dB below the peak values in the desired transmission band, since it is greater than 20dB below the wanted signal it is a passing with 44.36dB of margin.



### Conclusion:

Spurious emissions in any 100 kHz bandwidth are more than 20 dB below the peak values in the desired transmission band.

### 6.6.4. Test Equipment

Equipment Type	Manufacturer	Model	Serial or other ID	Service date	
				Last	Due
EMI Test Receiver	Rohde & Schwarz	ESIB40	TN1560	4/6/2012	4/6/2013

### 6.6.5. Test information

<b>Date of test:</b>	June 14, 2012	<b>Test Location:</b>	Transmitter Test Bench
<b>EUT serial:</b>	250460	<b>Tested by:</b>	Chad Bell
<b>Test Conclusion:</b>	Pass		

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# Wireless Transceiver Test Report

FCC ID: A94RVBL IC: 3232A-BT2L



Certificate # 1514.1

## 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 54dB $\mu$ V/m (average) or 74dB $\mu$ V/m (peak)

### 6.7.2. Test Setup

The EUT is placed in a standard ANSI C63.10 test setup. The carrier output is measured for reference purposes. 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. 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 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 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.

### 6.7.3. Test data

#### 2<sup>nd</sup> Harmonic

Frequency (MHz)	Measured Values		Limits			Azimuth 0° face ant	Pol H/V	Height Meters
	Peak detector dB $\mu$ V/m @ 3m	Average detector dB $\mu$ V/m @ 3m *	Peak dB $\mu$ V/m	Average dB $\mu$ V/m	Margin dB			
4804, CW	58.3	38.3	74	54	15.7	329	V	1
4882, CW	63	43	74	54	11	322	V	1
4960, CW	61.1	41.1	74	54	12.9	319	V	1

#### 3<sup>rd</sup> Harmonic

Frequency (MHz)	Measured Values		Limits			Azimuth 0° face ant	Pol H/V	Height Meters
	Peak detector dB $\mu$ V/m @ 3m	Average detector dB $\mu$ V/m @ 3m *	Peak dB $\mu$ V/m	Average dB $\mu$ V/m	Margin dB			
7206, CW	51.2	31.2	74	54	22.8	32	V	1
7323, CW	48.4	28.4	74	54	25.6	0	V	1
7440, CW	49.4	29.4	74	54	24.6	24	V	1

\*20 dB down from Peak used for duty cycle correction.

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# Wireless Transceiver Test Report

FCC ID: A94RVBL IC: 3232A-BT2L



Certificate # 1514.1

At the 4th through the 10<sup>th</sup> 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.

4<sup>th</sup> – 10<sup>th</sup> harmonic instrumentation noise floor

Frequency (GHz)	Measured Values		Limits		
	Peak detector dB $\mu$ V/m @ 3m	Average detector dB $\mu$ V/m @ 3m	Peak dB $\mu$ V/m	Average dB $\mu$ V/m	Margin dB
9.764 (4th Harmonic)	46.4	32.8	Not in restricted band		
12.01 (5th Harmonic)	48.3	33.9	74	54	20.1
14.88 (6th Harmonic)	51.5	38.1	74	54	15.9
17.36 (7th Harmonic)	55.6	39.5	Not in restricted band		
19.84 (8th Harmonic)	52.8	39.3	74	54	14.7
22.32 (9th Harmonic)	53.6	39.8	74	54	14.2
24.8 (10th Harmonic)	54.6	41.6	Not in restricted band		

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# Wireless Transceiver Test Report

FCC ID: A94RVBL IC: 3232A-BT2L



Certificate # 1514.1

## 6.7.4. 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 4 – 8G	AR	AT4003	TN727	12/6/2011	12/6/2014
Antenna 8 – 18G	AR	AT4004	TN728	12/1/2011	12/1/2014
Antenna 18 – 26.5G	ETS	3160-09	TN1307	2/23/2011	2/23/2014
20 GHz Pre-amp	MITEQ	AFS4-00102000-30-10P-4	TN1672	6/14/2012	6/14/2013
40 GHz pre-amp	MITEQ	JS4018004000-30-8P-A1	TN1757	6/14/2012	6/14/2013
Flexible cable	Florida RF Labs, Inc	NMS-290A-240.0-NMS	TN1983	8/17/2011	8/17/2013

## 6.7.5. Test information

<b>Date of test:</b>	August 22, 2012	<b>Test Location:</b>	Maxwell House
<b>EUT serial:</b>	250438	<b>Tested by:</b>	N. Sanford
<b>Test Conclusion:</b>	Pass		

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# Wireless Transceiver Test Report

FCC ID: A94RVBL IC: 3232A-BT2L



Certificate # 1514.1

## 6.8. Spurious emissions 1-25 GHz

### 6.8.1. Requirements

FCC part 15.247(d), RSS-Gen 7.2.5

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, 54dB $\mu$ V/m (average) or 74dB $\mu$ V/m (peak).

### 6.8.2. Test Setup

The EUT is placed in a standard ANSI C63.10 test setup. From 1 to 4 GHz a Double-Ridged Guide Horn Antenna is used. Above 4 GHz, standard gain horns with suitable pre-amps mounted directly on the horn antennas are used for the measurement of the emissions.

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 and an average detector. There is an implied peak limit 20dB above the average limit.

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.

#### 6.8.2.1. Test data

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

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# Wireless Transceiver Test Report

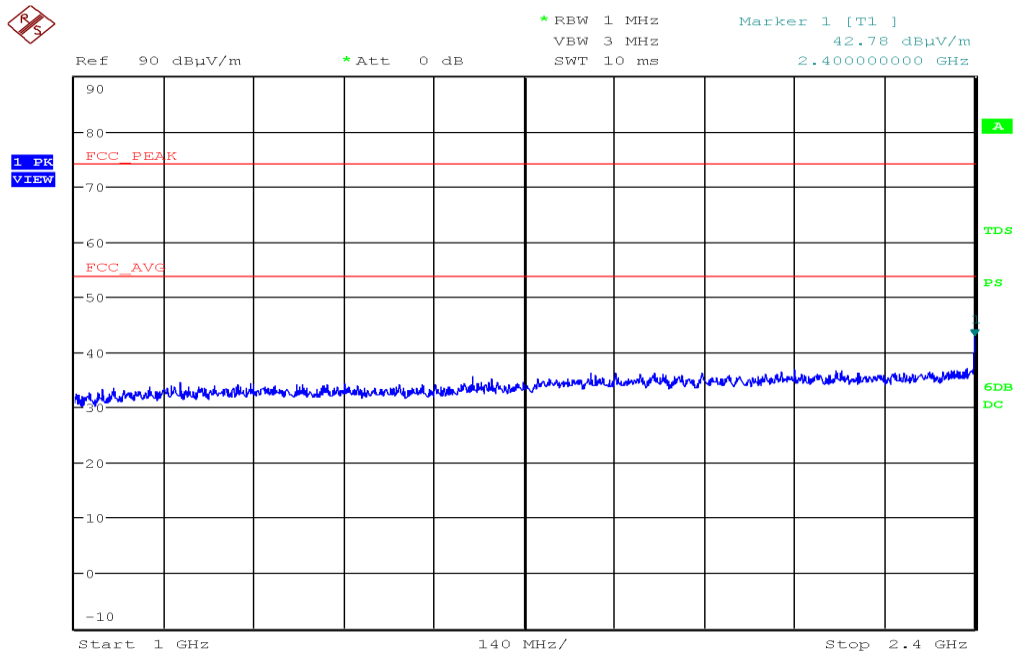
FCC ID: A94RVBL IC: 3232A-BT2L



Certificate # 1514.1

Frequency range 1 – 2.4 GHz

Max-Hold Peak Pre-scan, MAX volume pink noise via Bluetooth 1GHz-2.4GHz



Date: 28.AUG.2012 21:58:00

The emission at 2.4GHz will be looked at more closely during Band Edge measurements. Band edge measurements are covered in this report in section [6.8.3 Band edge measurements](#).

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# Wireless Transceiver Test Report

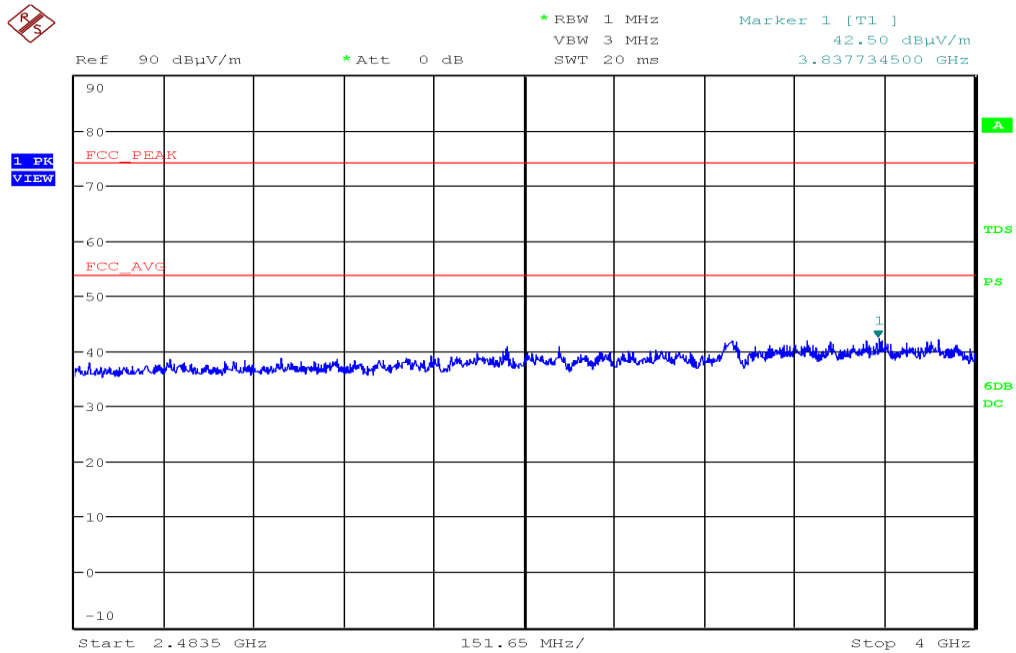
FCC ID: A94RVBL IC: 3232A-BT2L



Certificate # 1514.1

Frequency range 2.4835 – 4.0 GHz

Max-Hold Peak Pre-scan, MAX volume pink noise via Bluetooth 2.485GHz-4GHz



Date: 28.AUG.2012 22:00:11

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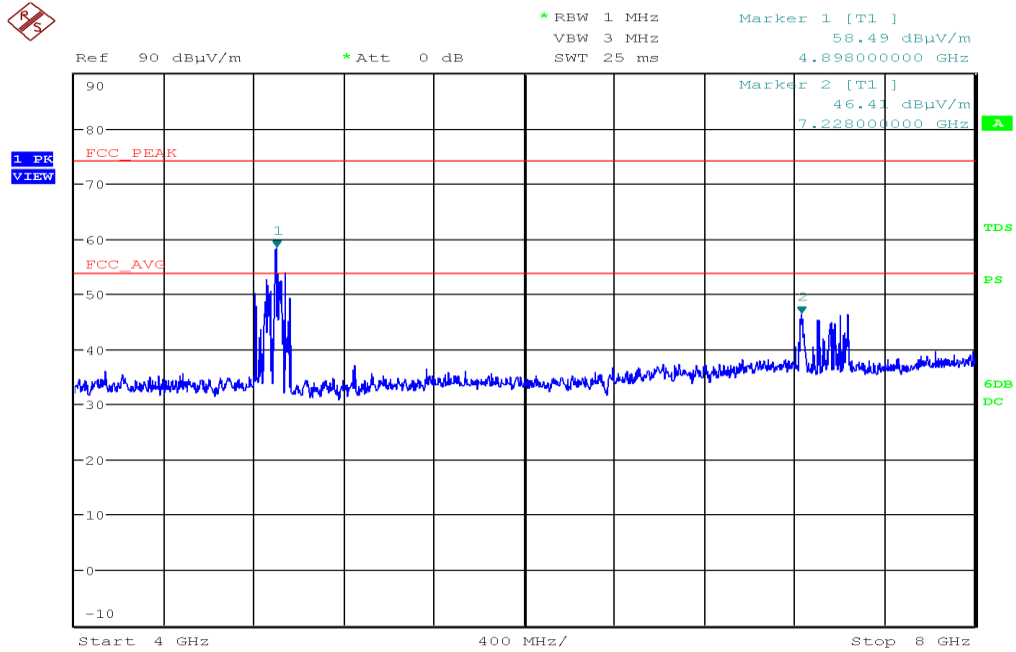
# Wireless Transceiver Test Report

FCC ID: A94RVBL IC: 3232A-BT2L



Certificate # 1514.1

Max-Hold Peak Pre-scan, MAX volume pink noise via Bluetooth 4GHz-8GHz



Date: 28.AUG.2012 22:04:33

Note that the emissions from 4804 – 4960 MHz and 7206 – 7440MHz are TX harmonics and are covered in this report in section [6.7 Harmonics](#).

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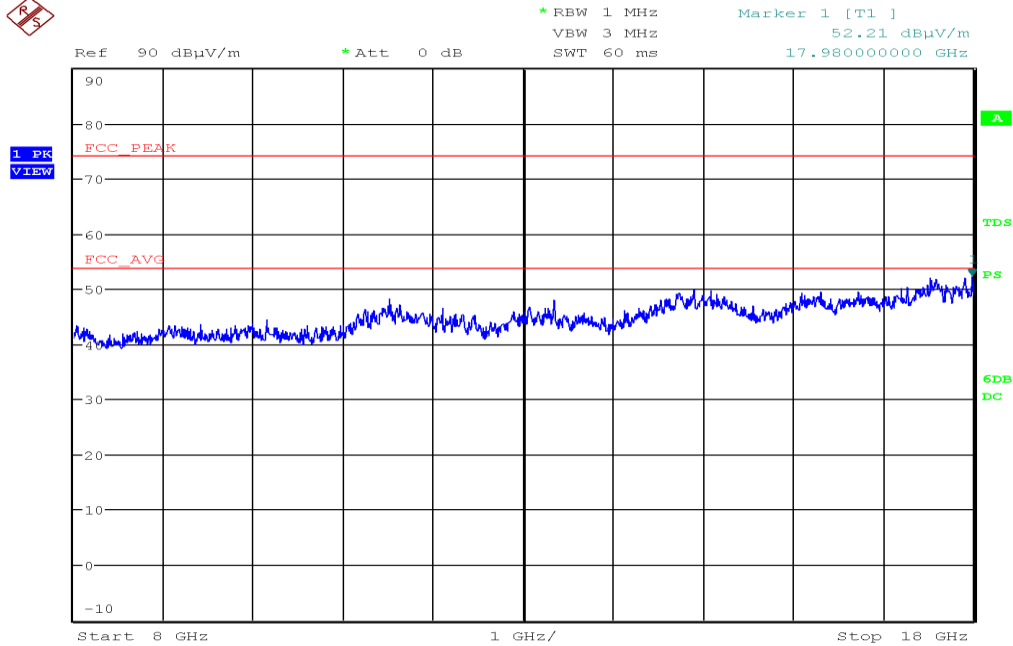
# Wireless Transceiver Test Report

FCC ID: A94RVBL IC: 3232A-BT2L



Certificate # 1514.1

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



Date: 28.AUG.2012 22:20:36

\*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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# Wireless Transceiver Test Report

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Certificate # 1514.1

## 6.8.3. Band edge measurements

Measured radiated at 3 meters, EUT is 80 cm off ground plane.

**Summary table, supporting data shown on pages 38 - 45**

Band Edge	Rate	Detector	Peak or Avg Value, RBW=1 MHz (dBuV/m)	Delta inband dB (RBW=100kHz)	Calculated dB * (RBW = 1 MHz)	Limit (dBuV/m)	Margin (dB)
Lower	BR	Peak	94	40	54	74	20
Lower	BR	Average	79.2	40	39.2	54	14.8
Lower	EDR	Peak	95.2	38.3	56.9	74	17.1
Lower	EDR	Average	78.8	38.3	40.5	54	13.5
Upper	BR	Peak	94.2	40	54.2	74	19.8
Upper	BR	Average	79.4	40	39.4	54	14.6
Upper	EDR	Peak	94.8	36.8	58	74	16
Upper	EDR	Average	79.5	36.8	41.7	54	12.3

\* Calculated dB = measured (peak of avg) |<sub>RBW=1 MHz</sub> - (max inband – value at band edge)|<sub>RBW= 100 kHz</sub>

BR = Basic data rate = DH5

EDR = Enhanced data rate = 3-DH5

Lower band edge measured at 2400 MHz.

Upper band edge measured at 2483.5 MHz

(a) More than 20 dB

(b) The maximum in the restricted band is:

Worst case peak margin 74 – 58.4 = 15.6 dB

Worst case average margin 54 – 42.88 = 12.3 dB

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# Wireless Transceiver Test Report

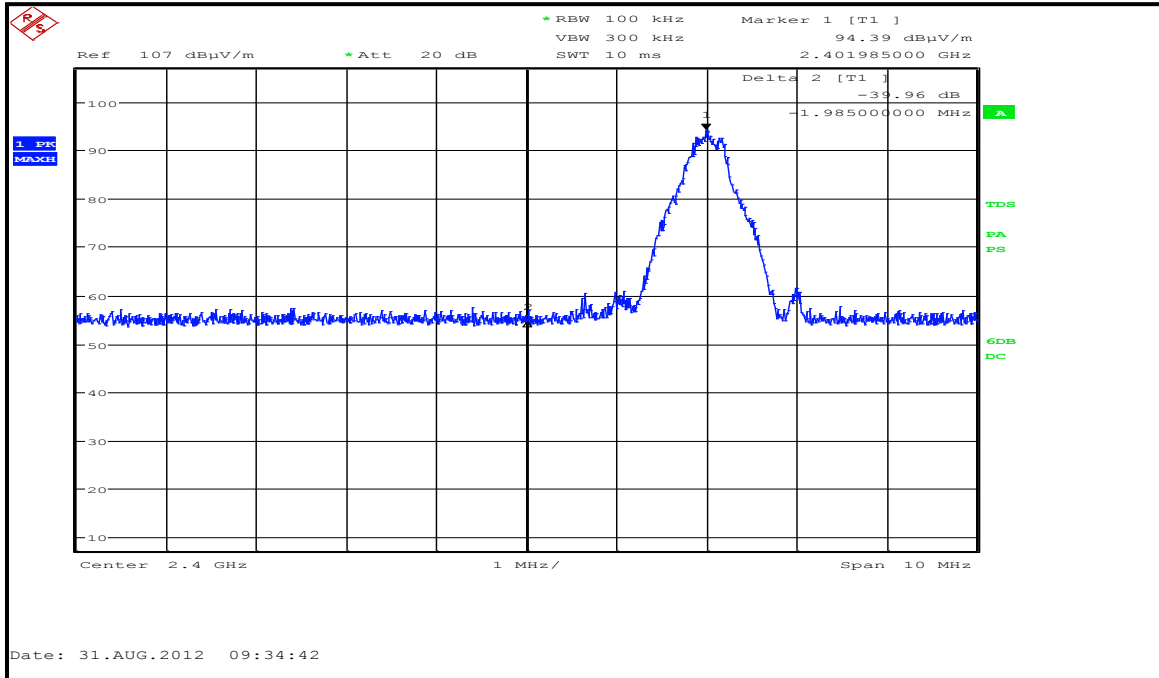
FCC ID: A94RVBL IC: 3232A-BT2L



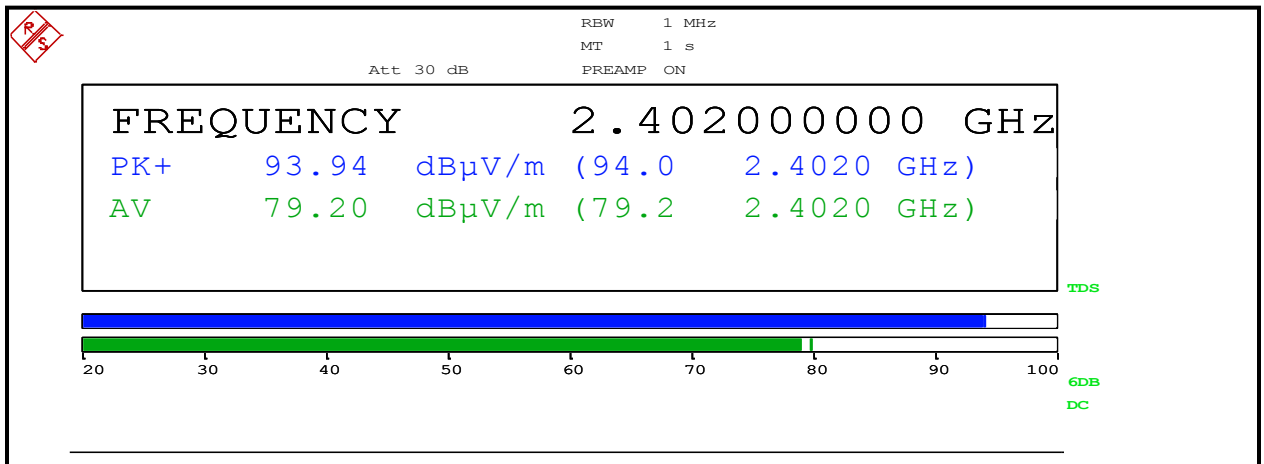
Certificate # 1514.1

Basic rate (DH5), Center frequency lower band edge, RBW=100 kHz, peak detector.

Marker delta = 40.0 dB measured using RBW=100 kHz



Maximum power measured using peak and average detectors with RBW=1 MHz



Basic rate:  $94.0 - 40.0 = 54.0$  dBuV/m peak

$79.2 - 40.0 = 39.2$  dBuV/m average

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# Wireless Transceiver Test Report

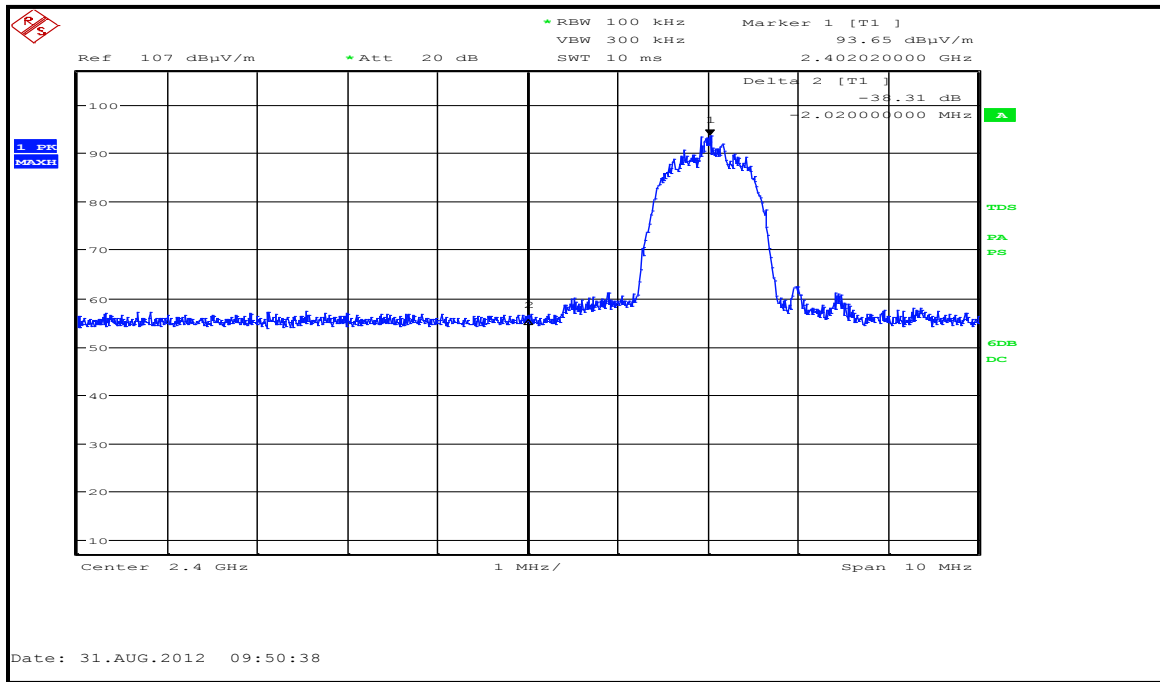


FCC ID: A94RVBL IC: 3232A-BT2L

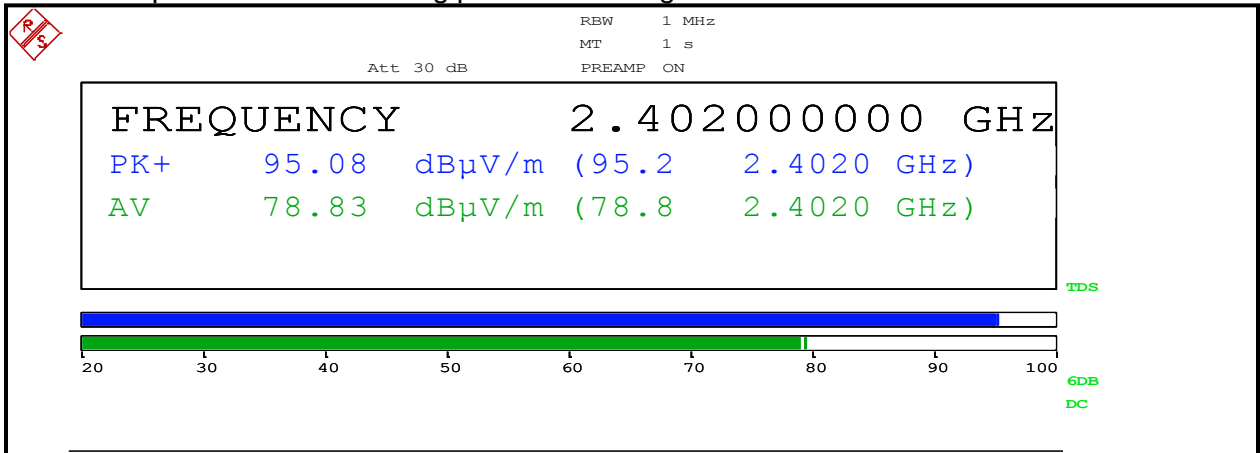
Certificate # 1514.1

Enhanced Data Rate (3-DH5), Center frequency lower band edge, RBW=100 kHz, peak detector.

Marker delta = 38.3 dB measured using RBW=100 kHz



Maximum power measured using peak and average detectors with RBW=1 MHz



EDR:  $95.2 - 38.3 = 56.9$  dBuV/m peak  
 $78.8 - 38.3 = 40.5$  dBuV/m average

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# Wireless Transceiver Test Report

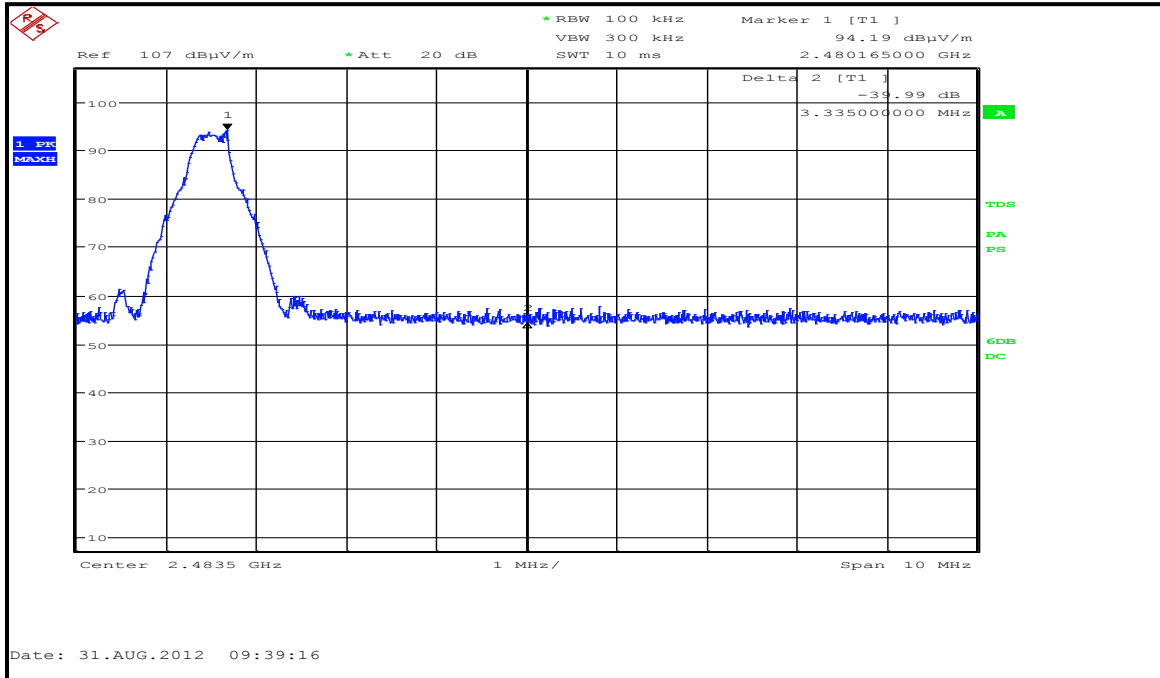


FCC ID: A94RVBL IC: 3232A-BT2L

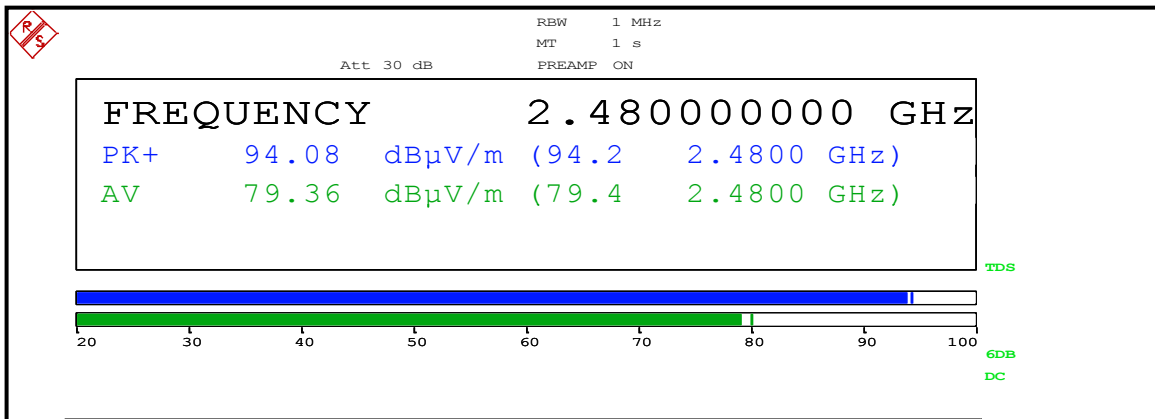
Certificate # 1514.1

Basic rate (DH5, Center frequency Upper band edge, RBW=100 kHz, peak detector).

Marker delta = 40.0 dB measured using RBW=100 kHz



Maximum power measured using peak and average detectors with RBW=1 MHz



Basic rate: 94.2 – 40.0 = 54.2 dBuV/m peak

79.4 – 40.0 = 39.4 dBuV/m average

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# Wireless Transceiver Test Report

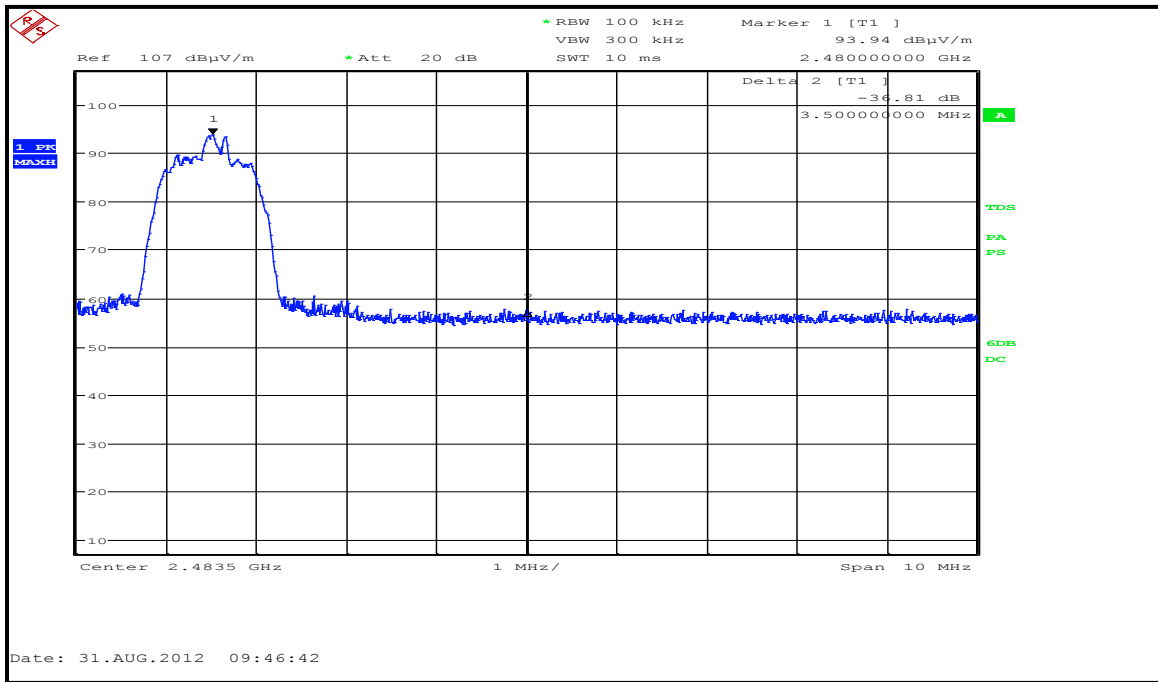


FCC ID: A94RVBL IC: 3232A-BT2L

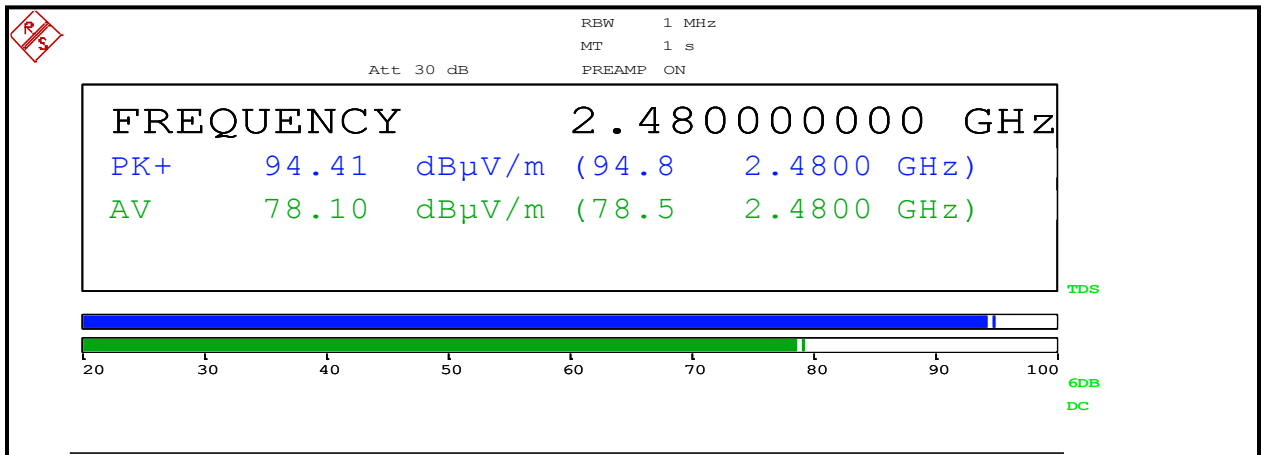
Certificate # 1514.1

Enhanced Data Rate (3-DH5), Center frequency upper band edge, RBW=100 kHz, peak detector.

Marker delta = 36.8 dB measured using RBW=100 kHz



Maximum power measured using peak and average detectors with RBW=1 MHz



EDR:  $94.8 - 36.8 = 58.0$  dBuV/m peak  
 $78.5 - 36.8 = 41.7$  dBuV/m average

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# Wireless Transceiver Test Report

FCC ID: A94RVBL IC: 3232A-BT2L



Certificate # 1514.1

## 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
Antenna 18 – 26.5G	ETS	3160-09	TN1307	2/23/2011	2/23/2014
20 GHz Pre-amp	MITEQ	AFS4-00102000-30-10P-4	TN1672	6/14/2012	6/14/2013
40 GHz pre-amp	MITEQ	JS4018004000-30-8P-A1	TN1757	6/14/2012	6/14/2013
Flexible cable	Florida RF Labs, Inc	NMS-290A-240.0-NMS	TN1983	8/17/2011	8/17/2013

## 6.8.5. Test information

<b>Date of test:</b>	August 31, 2012	<b>Test Location:</b>	Maxwell House
<b>EUT serial:</b>	250436	<b>Tested by:</b>	C. Bell
<b>Test Conclusion:</b>	Pass		

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# Wireless Transceiver Test Report

FCC ID: A94RVBL IC: 3232A-BT2L



Certificate # 1514.1

## 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.

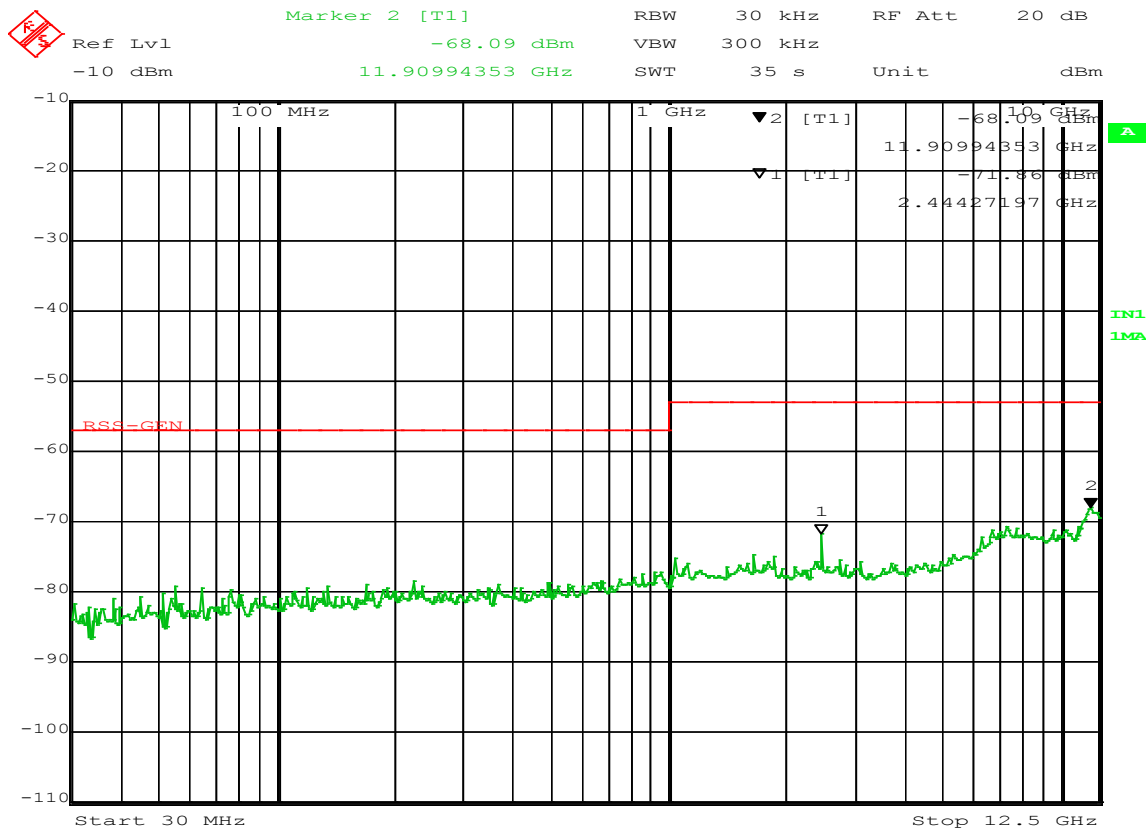
RSS-GEN section 6.2

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 antenna is removed and replaced with a 3 inch long piece of RG178 cable with an SMA connector at the far end, this cable is rated to have less than 0.5dB of loss at 2.4GHz, this cable was connected directly to the receiver. The EUT is placed in receive mode and is configured to hop through all 79 channels. A spectrum scan is made from 30 MHz to 12.5 GHz (covering the required 30MHz – 7.5 GHz range) with a 30 kHz RBW.

### 6.9.3. Test data



Date: 29.AUG.2012 10:10:27

Measurements from 30MHz - 12.5 GHz, RX mode, and receiver tuned to mid-band.

Highest reading of -68.09dBm or 0.155nW was measured at 11.91 GHz, this passes by 15.0 dB

### 6.9.4. Test Equipment

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# Wireless Transceiver Test Report



FCC ID: A94RVBL IC: 3232A-BT2L

Certificate # 1514.1

Equipment Type	Manufacturer	Model	Serial or other ID	Service date	
				Last	Due
EMI Test Receiver	Rohde & Schwarz	ESIB40	TN1560	4/6/2012	4/6/2013

## 6.9.5. Test information

Date of test:	August 29, 2012	Test location:	Transmitter Test Bench
EUT serial:	250436	Tested by:	C. Bell
Test Conclusion:	Pass		

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