



# Wireless Transceiver Test Report



FCC ID: A94BT2L IC: 3232A-BT2L

Certificate # 1514.1

**Report number:** EMC. 409633.11.199.1

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

**Product Tested:** Bose® Bluetooth® headset

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

**Report prepared by:** Bryan Cerqua

**Signature:** *Bryan H Cerqua*  
July 18, 2011

**Report reviewed by:** Brent G DeWitt

**Signature:** *Brent G DeWitt*  
July 18, 2011

**Report issue date:** July 18, 2011

**Changes from  
previous revision:** Original version

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## 1. Report Summary

1.1 Product Bose® Bluetooth® headset (BT2)

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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## 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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### 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:  $22 \pm 4$  °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

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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 MHz	Limits dB( $\mu$ V)	
	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 34.2dB at 0.4863MHz (Q.P. detector) on the neutral side. The Bose® Bluetooth® headset passes conducted emissions by 33.6dB at 0.1598MHz (Q.P. detector) on the neutral side. The headset also passes conducted emissions on the line and neutral side using Average detector by 38.4 dB and 39.3 dB, respectively.

Note ! Since the charger is common to both right and left ear pieces the data for the conducted emissions is the same for both.

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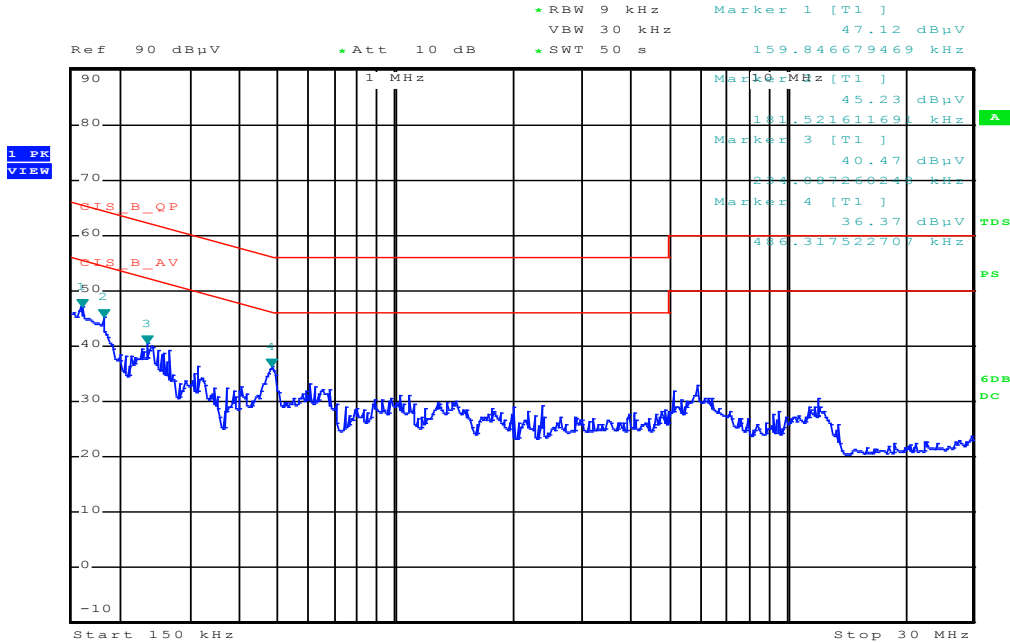
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## Bose® Bluetooth® headset, 120V AC 60Hz, Line Side – Max Peak scan



Date: 16.JUN.2011 17:04:01

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
0.1598	29.60	8.90	65.5	55.5	35.9	46.6
0.1815	24.20	8.10	64.4	54.4	40.2	46.3
0.2341	23.50	9.10	62.3	52.3	38.8	43.2
0.3149	19.10	7.30	59.8	49.8	40.7	42.5
0.4863	22.00	7.80	56.2	46.2	34.2	38.4
5.9293	14.10	5.70	60.0	50.0	45.9	44.3

Passes conducted emissions by 34.2dB at 0.48MHz (Q.P. detector) on the line side.

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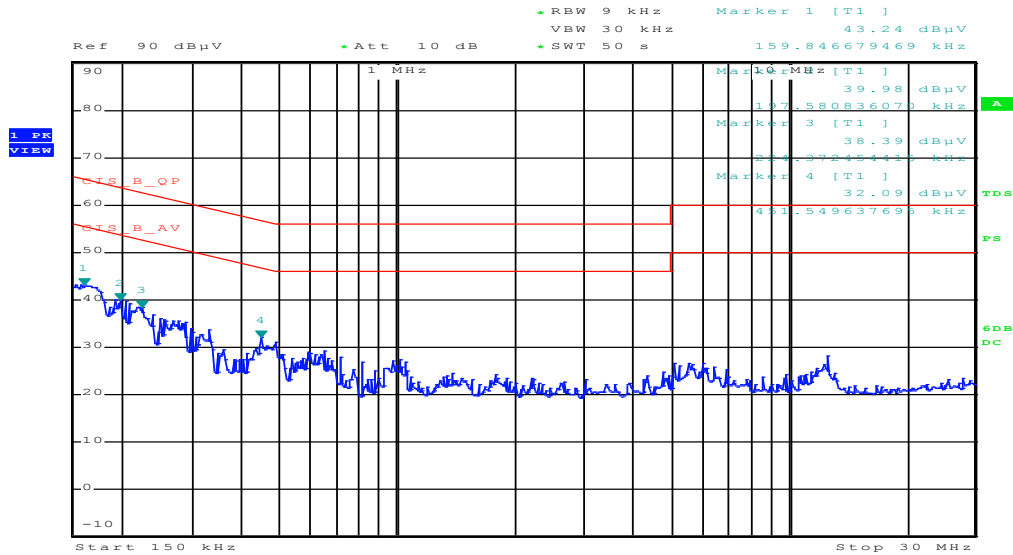
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## Bose® Bluetooth® headset, 120V AC 60Hz, Neutral Side – Max Peak scan



Date: 16.JUN.2011 17:19:44

Quasi-Peak and Average measurements on the Neutral side:

Frequency MHz	MEASURED		LIMIT		MARGIN	
	dBµV QP	dBµV AVG	dBµV QP	dBµV AVG	dB QP	dB AVG
0.1598	31.90	9.30	65.5	55.5	33.6	46.2
0.1976	24.40	7.90	63.7	53.7	39.3	45.8
0.2244	25.40	8.00	62.6	52.6	37.2	44.6
0.2744	22.80	7.60	61.0	51.0	38.2	43.4
0.4515	18.00	6.90	56.8	46.8	38.8	39.9
0.6011	13.60	6.50	56.0	46.0	42.4	39.5
1.0211	11.80	6.70	56.0	46.0	44.2	39.3
12.5821	12.90	5.10	60.0	50.0	47.1	44.9

Passes conducted emissions by 33.6dB at 0.1598MHz (Q.P. detector) on the neutral side.

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## 6.1.4. Test Equipment

Equipment Type	Manufacturer	Model	Serial or other ID	Service	
				Last	due date
LISN	EMCO	3810/2	TN600	3/11/2010	3/1/2012
EMI Test Receiver	Rohde & Schwarz	ESCI	TN1420	4/5/2011	4/5/2012
Transient Limiter	HP	11947A	TN57	11/24/2009	11/24/2011

## 6.1.5. Test information

<b>Date of test:</b>	June 16, 2011	<b>Test location :</b>	DCE lab – Henry room
<b>EUT serial:</b>	R174, Charger DP1 #1	<b>Tested by:</b>	Chad Bell
<b>Test Conclusion:</b>	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 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.

Note ! Since the charger is common to both right and left ear pieces the data for the radiated emissions is the same for both, charging mode only.

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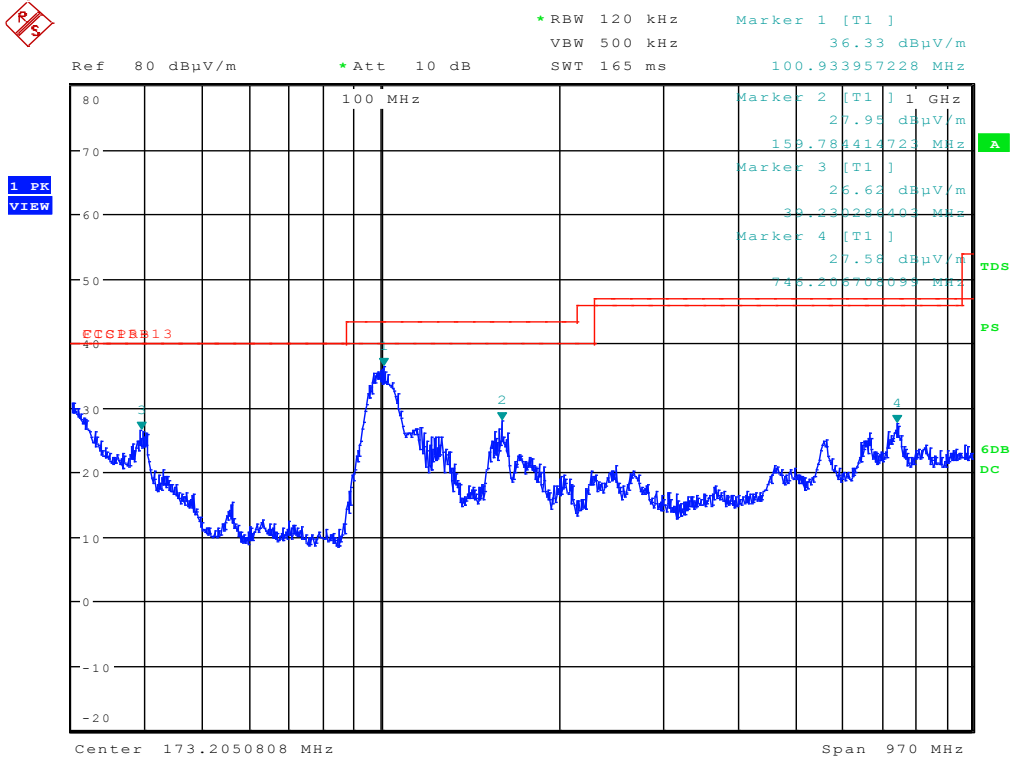


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## 6.2.3. Test data

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



Date: 2.JUN.2011 00:09:34

### 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)
39.230	19.50	27.90	40.0	N/A	20.5	N/A	360	V	1.0
100.934	30.20	36.60	43.5	N/A	13.3	N/A	268	V	1.0
159.784	19.20	28.90	43.5	N/A	24.3	N/A	99	V	1.0
746.207	21.40	27.00	46.0	N/A	24.6	N/A	243	V	1.7

Passes FCC Class B emissions in battery charging mode by 13.3dB at 100.9MHz.

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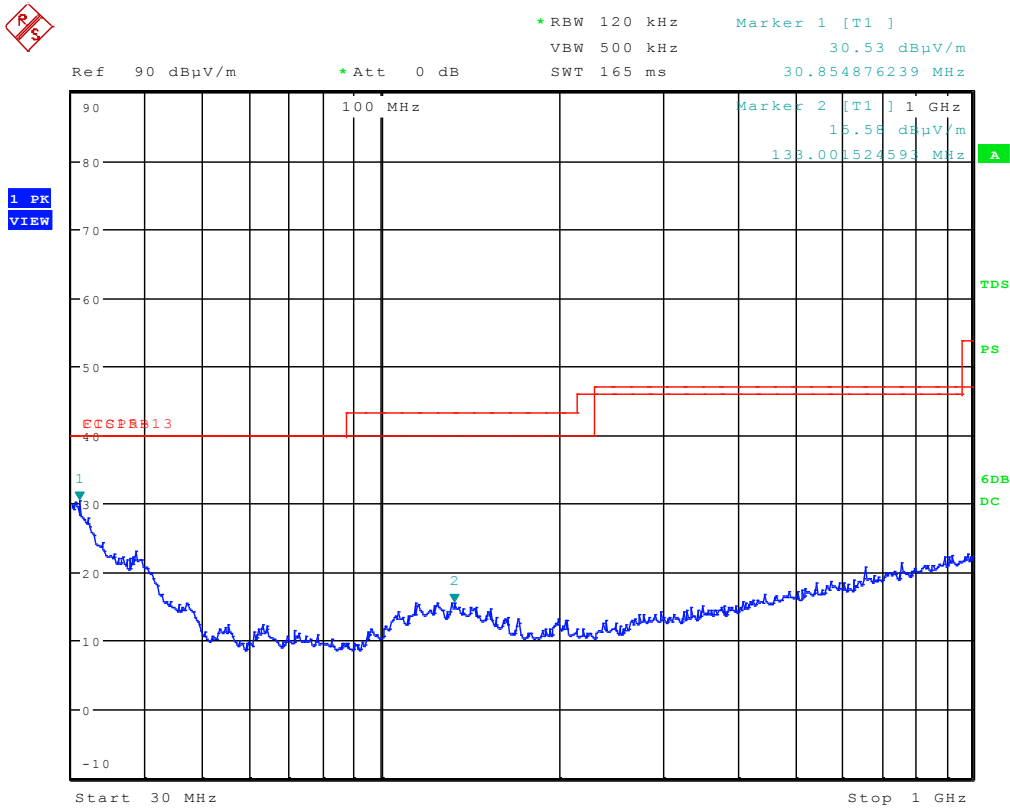


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120VAC, Max-Hold Peak Pre-scan, 30MHz – 1GHz, Bluetooth mode

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



Date: 31.MAY.2011 21:26:32

No emissions within 10dB of the limit, so Quasi-Peak readings were not taken.

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## 6.2.4. Test Equipment

Equipment Type	Manufacturer	Model	Serial or other ID	Service	
				last	due
Antenna	Sunol Sciences	JB6	TN1823	12/22/2010	7/22/2011
EMI Test Receiver	Rohde & Schwarz	ESU40	TN1663	4/6/2011	4/6/2012
Maxwell House Radiated Emissions Cable Set	Bose Corporation	N/A	TN1445	9/9/2010	9/9/2011
Pre-amp	Rohde & Schwarz	TS-PR8	TN1669	2/23/2011	2/23/2012

## 6.2.5. Test information

<b>Date of test:</b>	June 1, 2011	<b>Test location :</b>	DCE - Maxwell House
<b>EUT serial:</b>	L49	<b>Tested by:</b>	C. Bell
<b>Test Conclusion:</b>	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 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 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. 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 end, middle and high end of the authorized frequency band.

The spectrum analyzer resolution bandwidth is set to 2 MHz (higher than the OBW in EDR mode), peak detector and max hold. The maximum output power is recorded for low, mid and high band frequencies. 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 = 3.62 dBm = 2.3mW

Power measurements shown below are based on maximum value over 5 samples.

Channel	Center Frequency (MHz)	Basic Rate: DH5 (dBm)	EDR: 3-DH5 (dBm)
0	2402	2.93	3.62
39	2441	2.40	2.72
78	2480	2.08	2.56

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## 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	4/6/2011	4/6/2012

## 6.3.5. Test information

<b>Date of test:</b>	May 18, 2011	<b>Test location:</b>	Transmitter Test Bench
<b>EUT serial:</b>	L1, L43, L74, L75, L86	<b>Tested by:</b>	Chad Bell
<b>Test Conclusion:</b>	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), 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	1.373	1.212
39	2441	1.383	1.212
78	2480	1.393	1.212

Conclusion:  $2/3^{\text{rd}}$  of the largest OBW =  $2/3 \times 1.393 \text{ MHz} = 927 \text{ kHz}$ , 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 1.393 MHz = 110.05 MHz.

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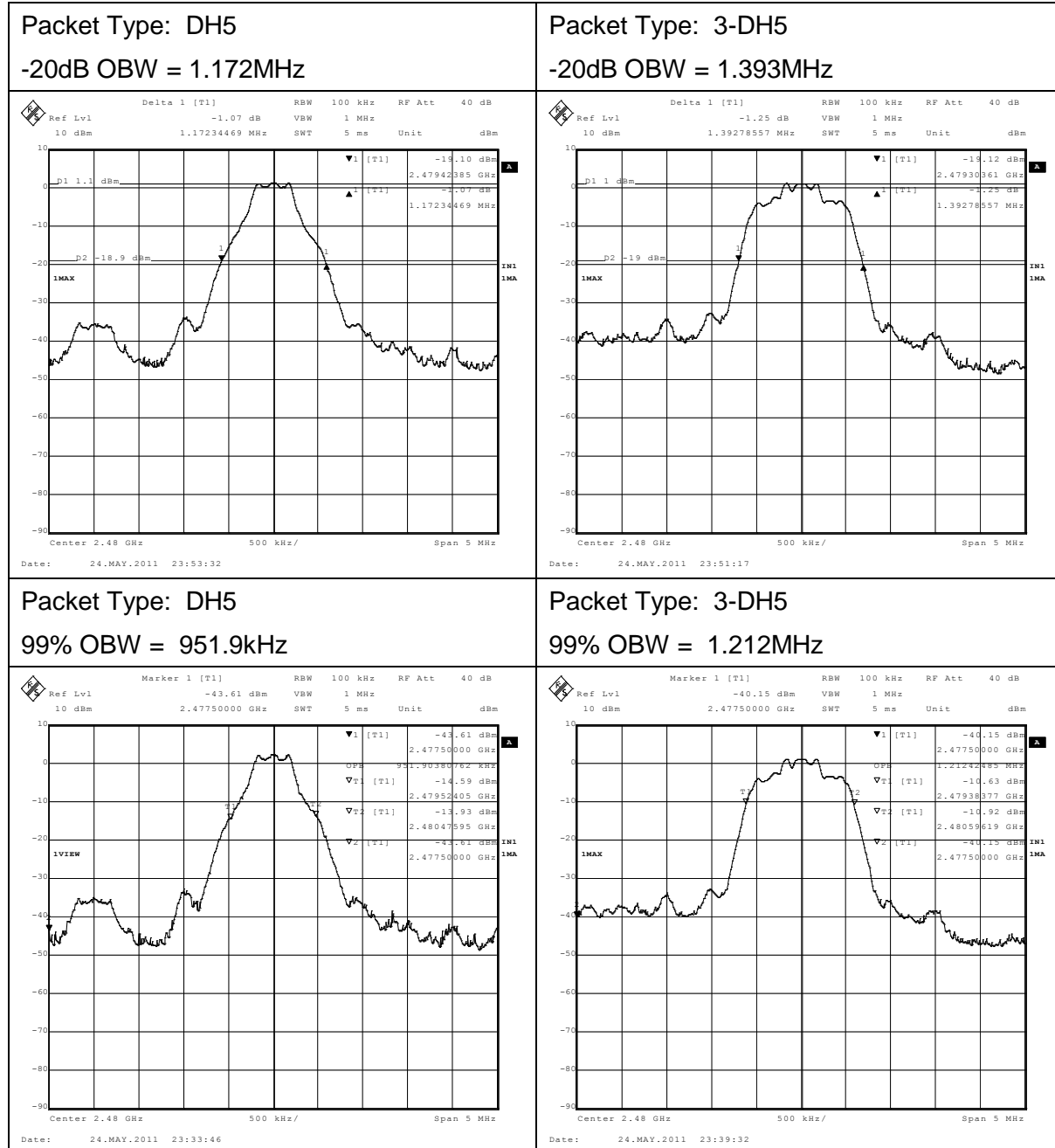
FCC ID: A94BT2L

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Detail results:

High Channel, 2480 MHz



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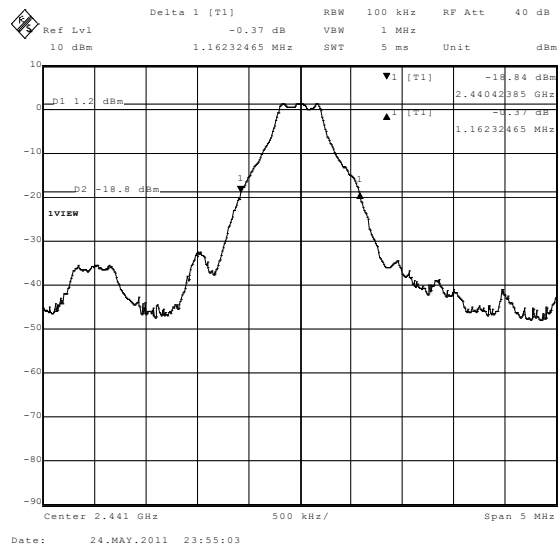
IC: 3232A-BT2L

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Mid channel, 2441 MHz

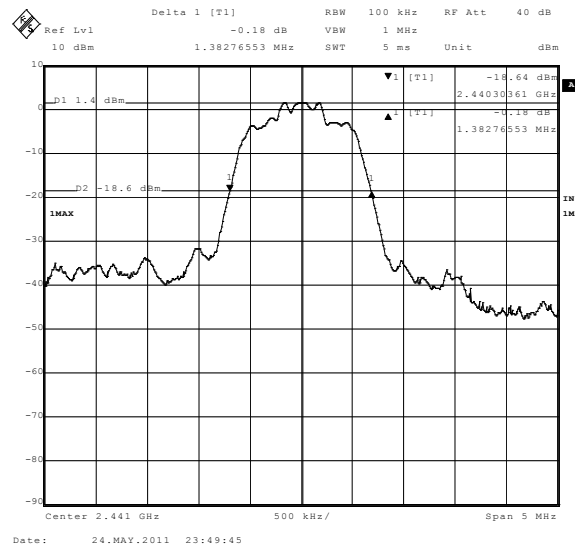
Packet Type: DH5

-20dB OBW = 1.162MHz



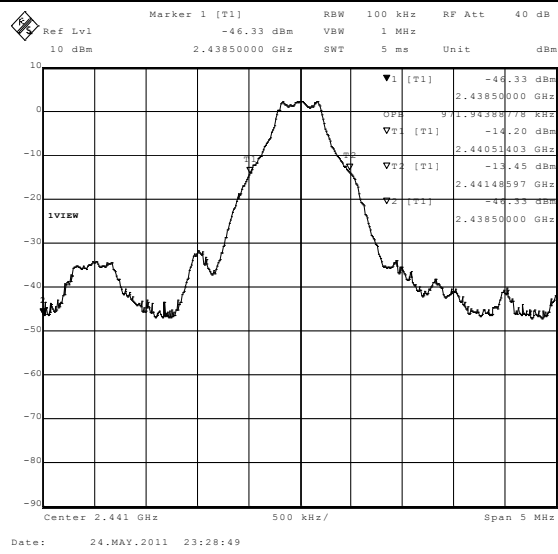
Packet Type: 3-DH5

-20dB OBW = 1.383MHz



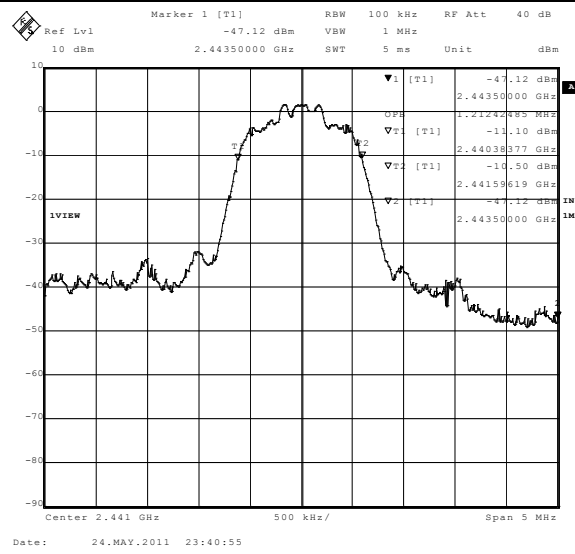
Packet Type: DH5

99% OBW = 971.9kHz



Packet Type: 3-DH5

99% OBW = 1.212MHz



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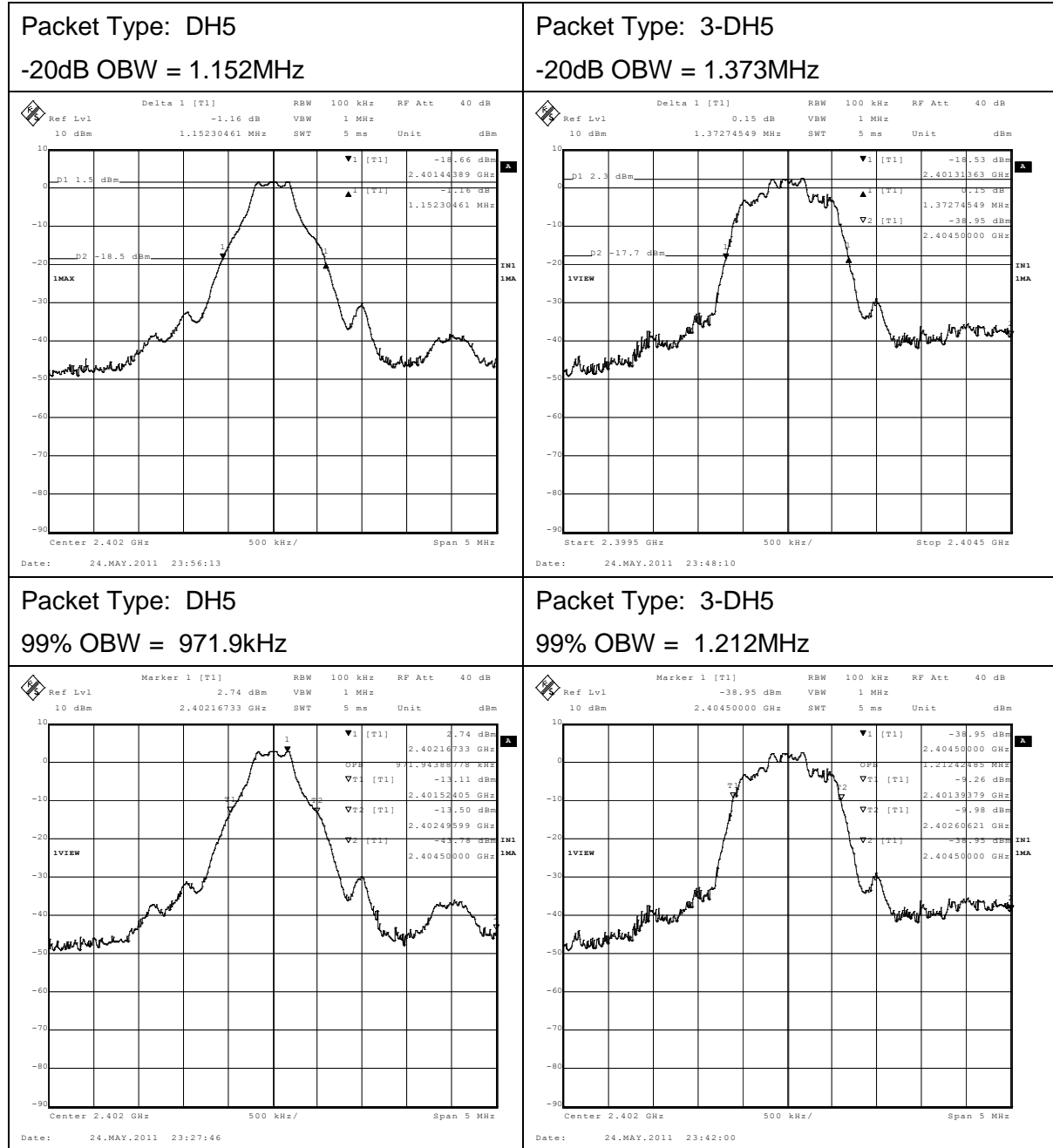


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IC: 3232A-BT2L

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Low channel, 2402 MHz



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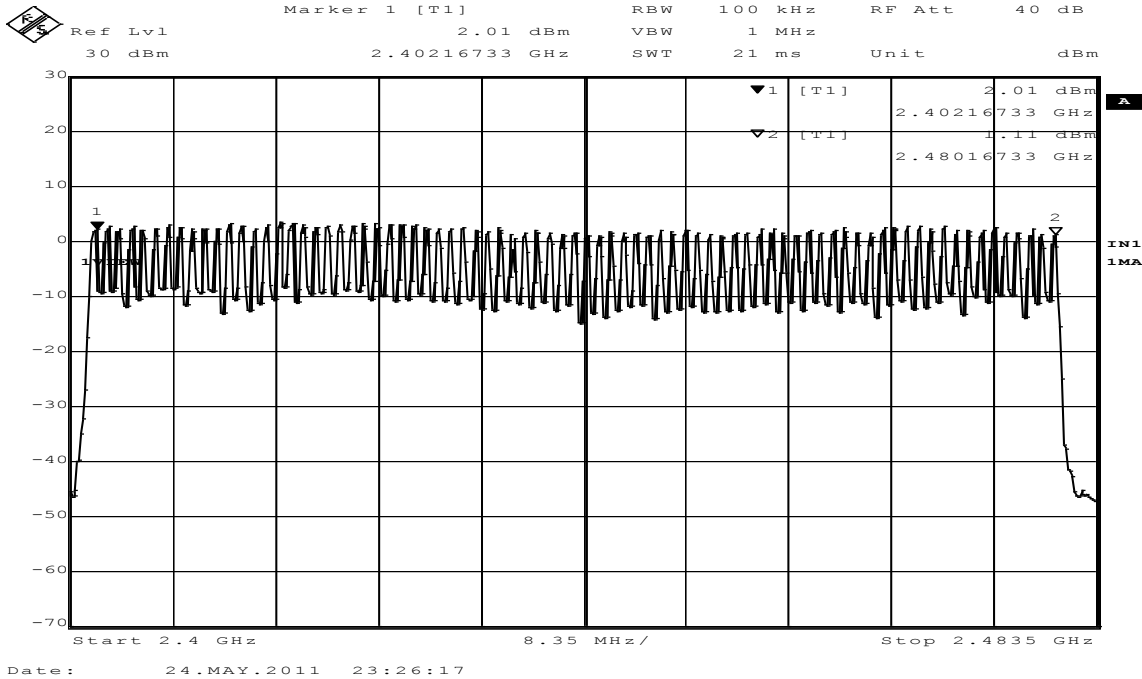
FCC ID: A94BT2L

IC: 3232A-BT2L

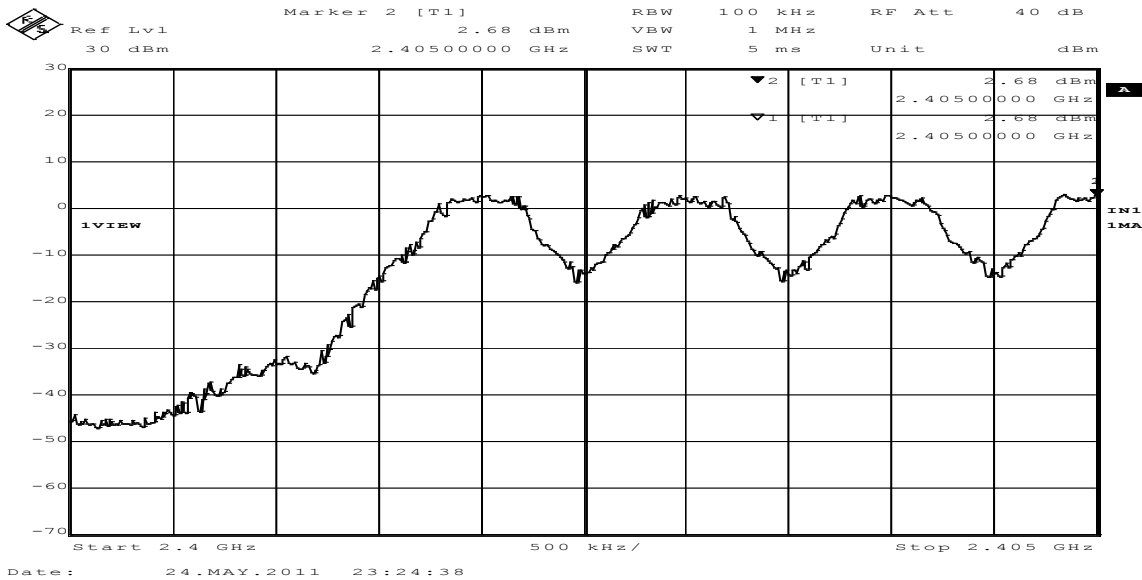
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## Channel Spacing

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



## Low band end spacing detail (2402 MHz)



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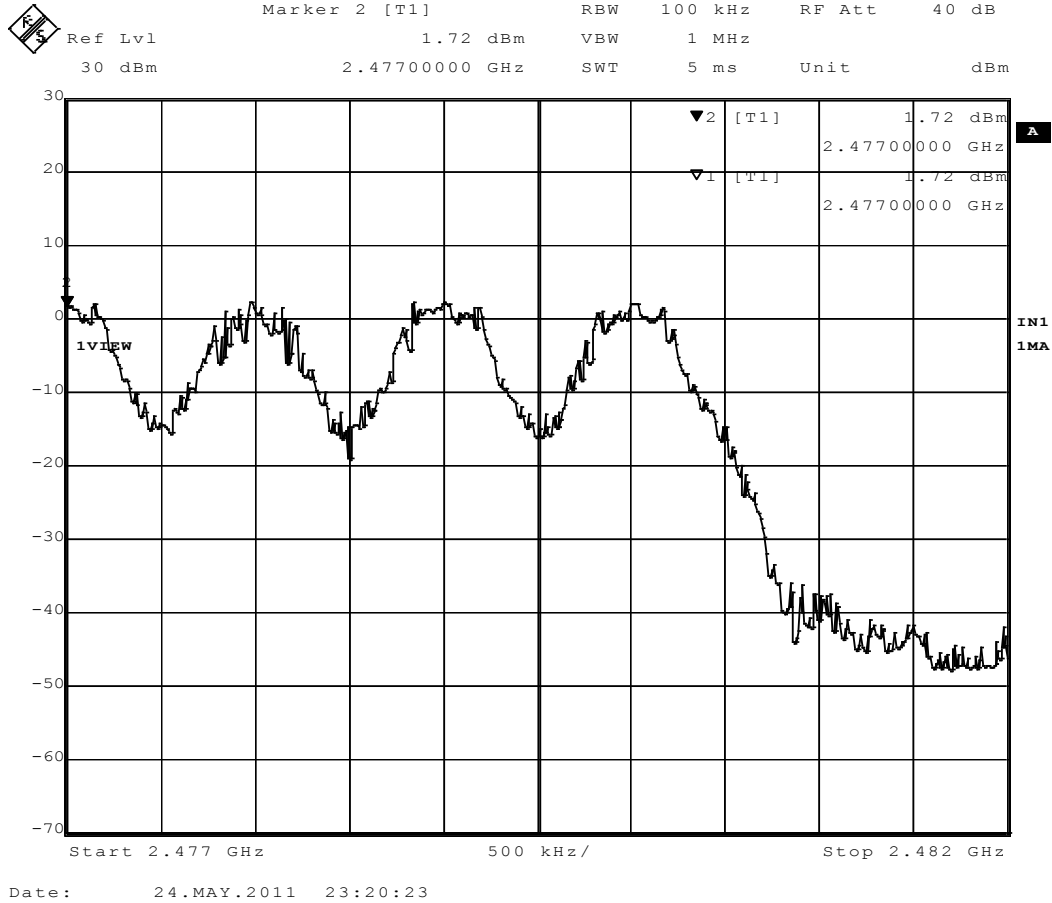


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## High band end spacing detail (2483.5 MHz)



### 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	4/6/2011	4/6/2012

### 6.4.5. Test information

<b>Date of test:</b>	May 24, 2011	<b>Test location:</b>	Transmitter Test Bench
<b>EUT serial:</b>	L1	<b>Test by:</b>	Chad Bell
<b>Test Conclusion:</b>	Pass		

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## 6.5. Time of occupancy

### 6.5.1. Requirements

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

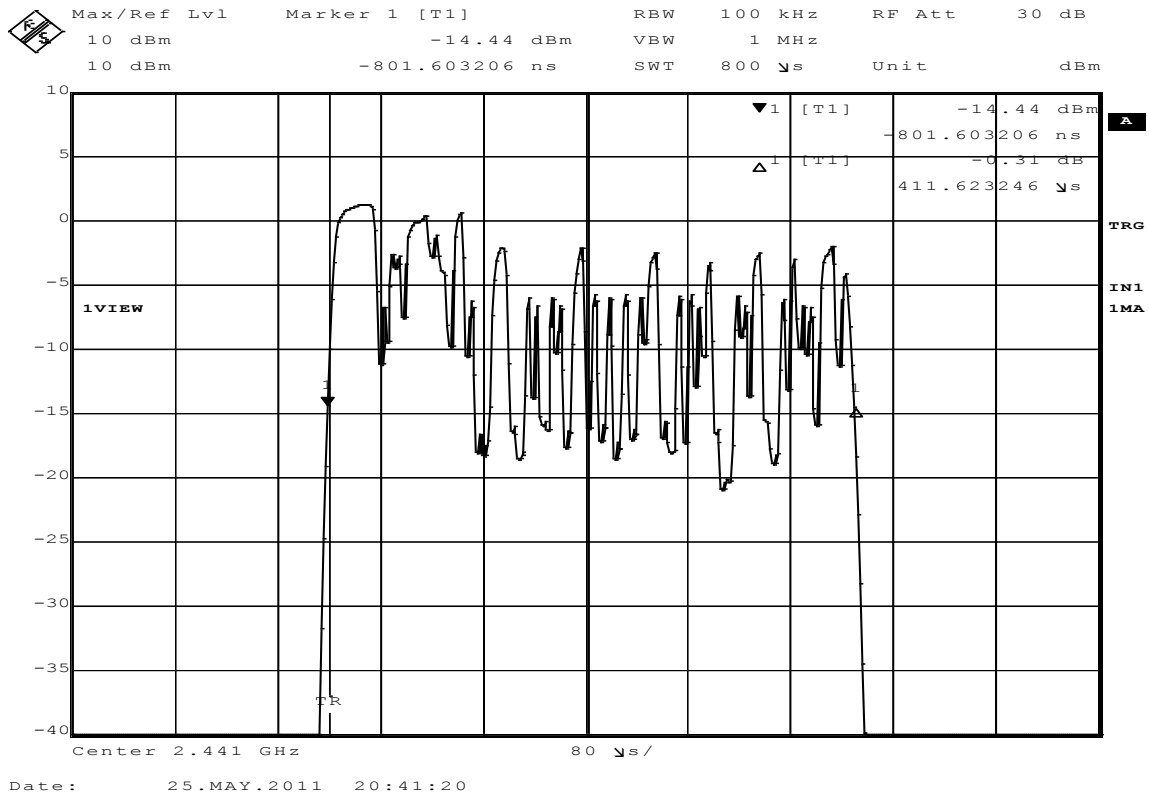
The frequency hopping operation shall have an average time of occupancy on any frequency not to exceed 0.4 seconds within the duration in seconds equal to the number of hopping frequencies employed multiplied by 0.4

### 6.5.2. Test setup details

The 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 411.62 μs for a DH5 packet type with 10% duty cycle.



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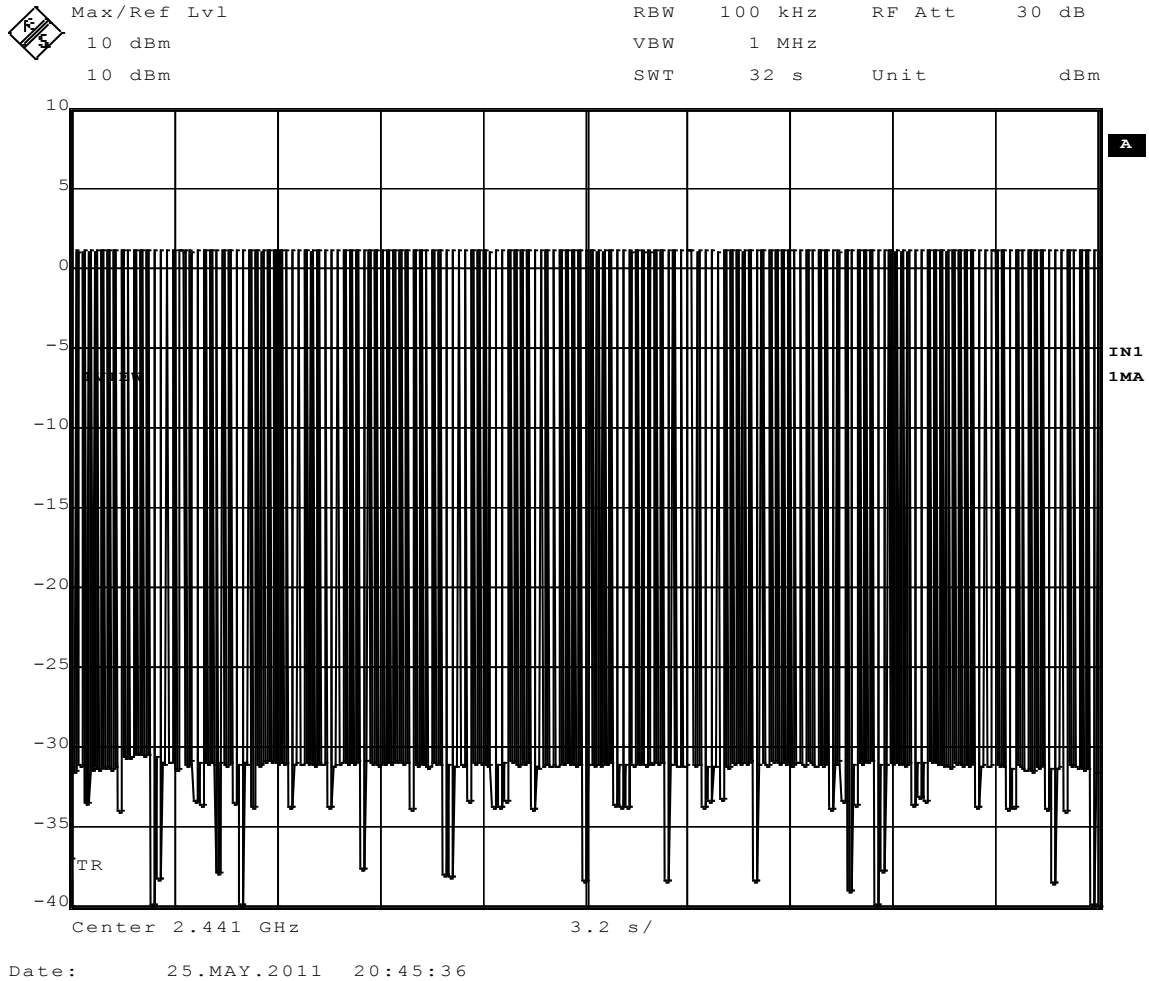


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Set to mid channel (2441 MHz) while operating in Hands-free mode. Hands-free mode is the typical use mode as well as providing the highest pulse rate, which creates the highest average dwell time per channel.



There are 160 pulses in 32 seconds.

Therefore the average dwell time per channel is  $0.411 \text{ ms} \times 160 = 65.9 \text{ ms}$  which is less than the permissible 400msec.

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## 6.5.3.1. Test Equipment

Equipment Type	Manufacturer	Model	Serial or other ID	Service date	
				Last	Due
EMI Test Receiver	Rohde & Schwarz	ESIB40	TN1560	4/6/2011	4/6/2012
CBT controller	Rohde & Schwarz	CBT	TN1758	4/4/2011	4/4/2012

## 6.5.4. Test information

<b>Date of test:</b>	May 25, 2011	<b>Test location:</b>	Transmitter Test Bench
<b>Serial number:</b>	L1	<b>Tested by:</b>	Chad Bell
<b>Test Conclusion:</b>	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 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: A94BT2L IC: 3232A-BT2L

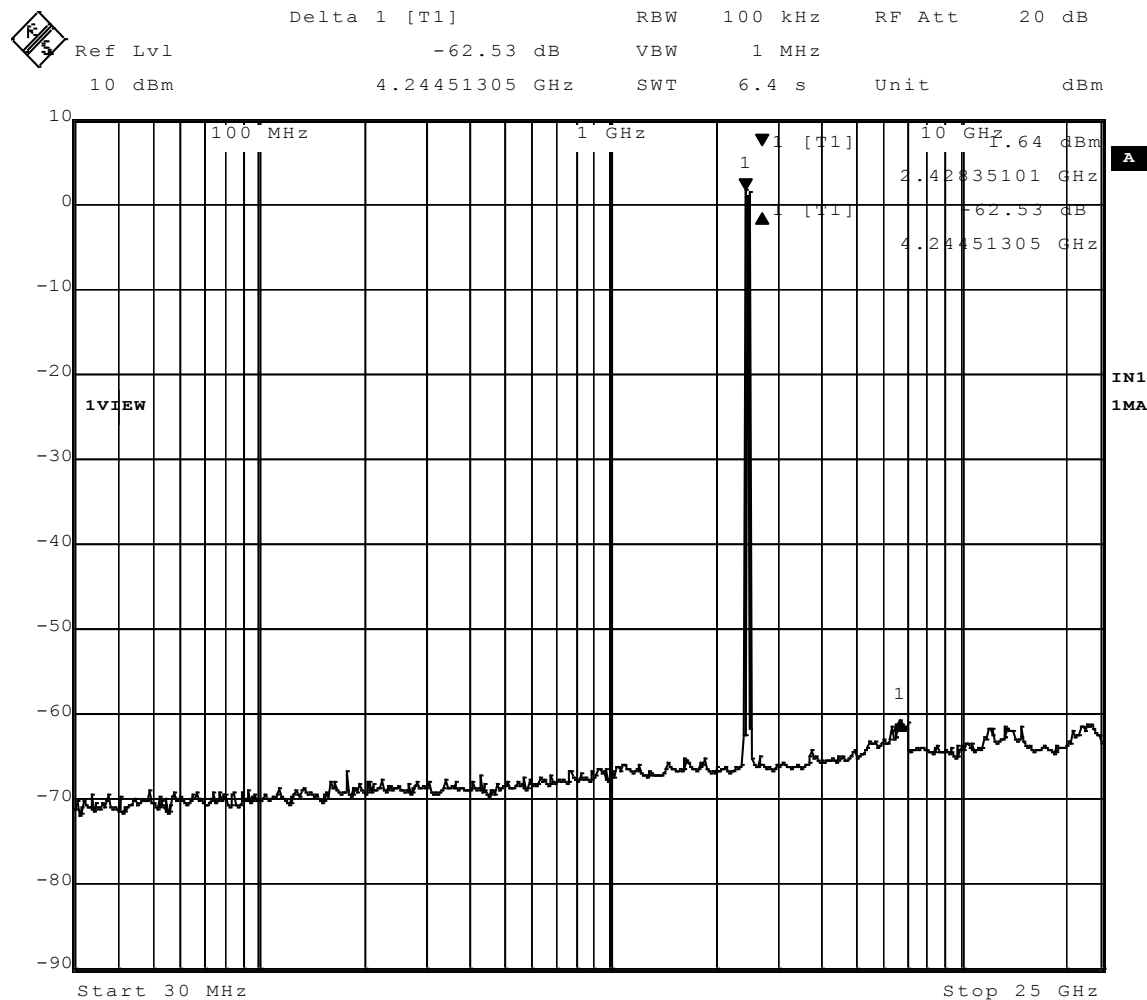
Certificate # 1514.1

### 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 62.53dB below the peak values in the desired transmission band, since it is greater than 20dB below the wanted signal it is a passing with 42.53dB of margin.



Date: 19.MAY.2011 21:06:31

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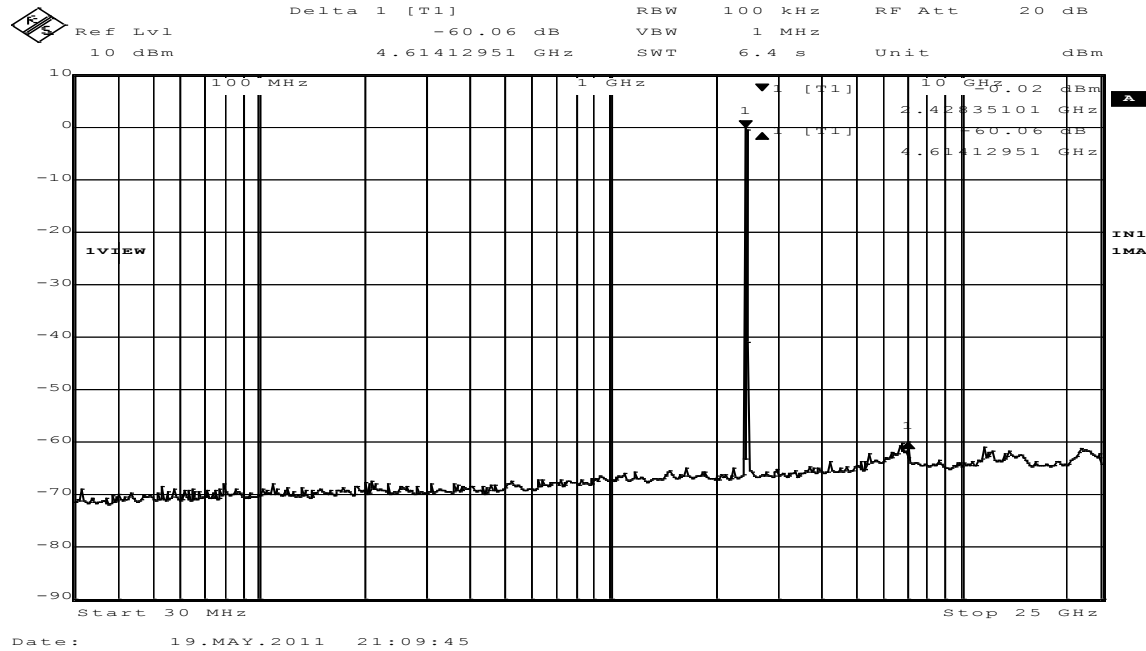
# Wireless Transceiver Test Report



FCC ID: A94BT2L      IC: 3232A-BT2L

Certificate # 1514.1

3-DH5 Enhanced Data Rate conducted spurious emissions. The worst case spurious emission is 60.06dB below the peak values in the desired transmission band, since it is greater than 20dB below the wanted signal it is a passing with 40.06dB of margin.



Date: 19.MAY.2011 21:09:45

### 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	4/6/2011	4/6/2012
40 GHz cable	-	-	TN1277	Verify before use	

### 6.6.5. Test information

<b>Date of test:</b>	May 19, 2011	<b>Test Location:</b>	Transmitter Test Bench
<b>EUT serial:</b>	L1	<b>Tested by:</b>	Chad Bell
<b>Test Conclusion:</b>	Pass		

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# Wireless Transceiver Test Report



FCC ID: A94BT2L 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 54dBµV/m (average) or 74dBµV/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) Packet Type = DH5	Measured Values		Limits			Azimuth	Pol	Height
	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, CW	61.2	41.2	74	54	12.8	330	H	1
4882, CW	49.3	29.3	74	54	24.7	321	H	1
4960, CW	56.3	36.3	74	54	17.7	208	H	1

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

Frequency (MHz) Packet Type = DH5	Measured Values		Limits			Azimuth	Pol	Height
	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, CW	42.5	22.5	74	54	31.5	325	H	1
7323, CW	39.7	19.7	74	54	34.3	35	H	1
7440, CW	44.1	24.1	74	54	29.9	40	H	1

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

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# Wireless Transceiver Test Report



FCC ID: A94BT2L 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 dBµV/m @ 3m	Average detector dBµV/m @ 3m	Peak dBµV/m	Average dBµV/m	Margin dB
9.9 (4th Harmonic)	45.9	32.3	Not in restricted band		
12.4 (5th Harmonic)	50.1	36.7	74	54	17.3
14.8 (6th Harmonic)	52.3	39.9	74	54	14.1
17.3 (7th Harmonic)	55.3	42.1	Not in restricted band		
19.5 (8th Harmonic)	52.1	38.8	74	54	15.2
22.1 (9th Harmonic)	53.8	40	74	54	14
24.5 (10th Harmonic)	52.9	40	Not in restricted band		

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# Wireless Transceiver Test Report



FCC ID: A94BT2L 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	4/6/2011	4/6/2012
Pre-amp	Rohde & Schwarz	TS-PR8	TN1669	2/23/2011	2/23/2012
Antenna 30M – 6G	Sunol	JB6	TN1823	12/22/2010	7/22/2011
Antenna 4 – 8G	AR	AT4003	TN727	11/24/2008	11/24/2011
Antenna 8 – 18G	AR	AT4004	TN728	11/24/2008	11/24/2011
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	6/2/2010	6/2/2011
40 GHz pre-amp	MITEQ	JS4018004000-30-8P-A1	TN1757	Verify before use	
Antenna cable 18GHz	Rohde & Schwarz	HFE160D	TN1692	9/9/2010	9/9/2011
BT tester	Rohde & Schwarz	CBT	TN1758	4/4/2011	4/4/2012

## 6.7.5. Test information

<b>Date of test:</b>	5/25/2011	<b>Test Location:</b>	Maxwell House
<b>EUT serial:</b>	L49	<b>Tested by:</b>	C. Bell
<b>Test Conclusion:</b>	Pass		

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# Wireless Transceiver Test Report



FCC ID: A94BT2L 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 linearly polarized hybrid bi-conical / log-periodic 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

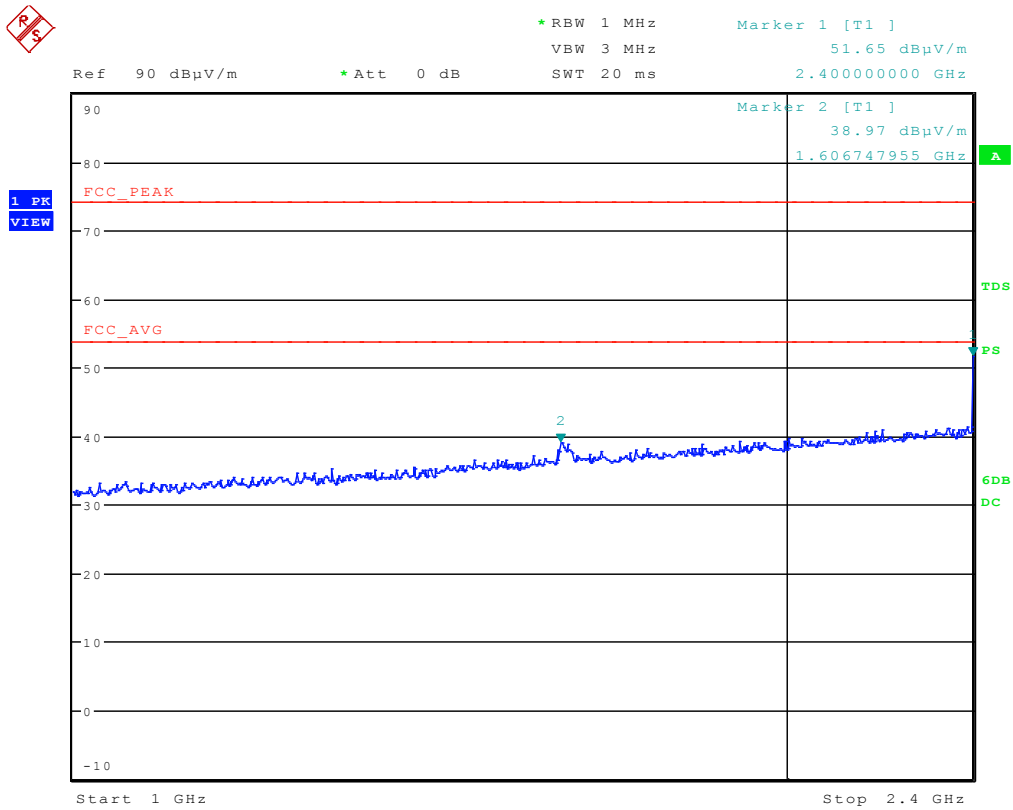


FCC ID: A94BT2L IC: 3232A-BT2L

Certificate # 1514.1

Frequency range 1 – 2.4 GHz

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



Date: 31.MAY.2011 21:19:05

There were no emissions within 20dB of the limit, so Quasi-Peak readings were not taken.

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# Wireless Transceiver Test Report

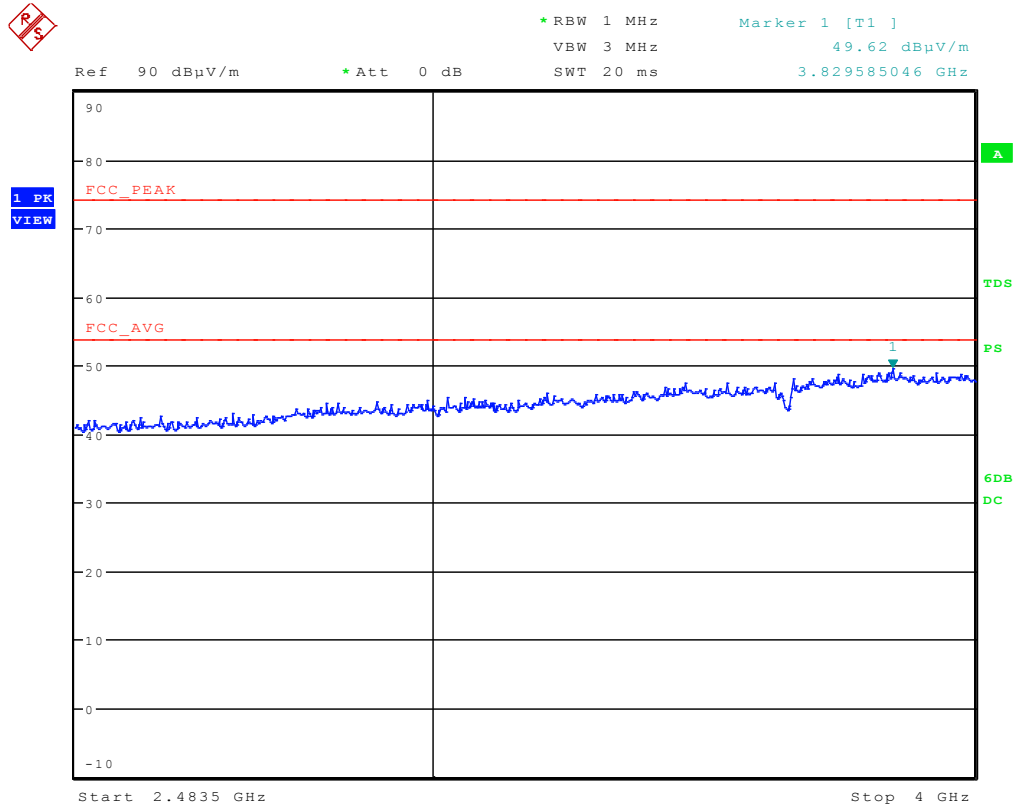


FCC ID: A94BT2L IC: 3232A-BT2L

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: 31.MAY.2011 21:12:23

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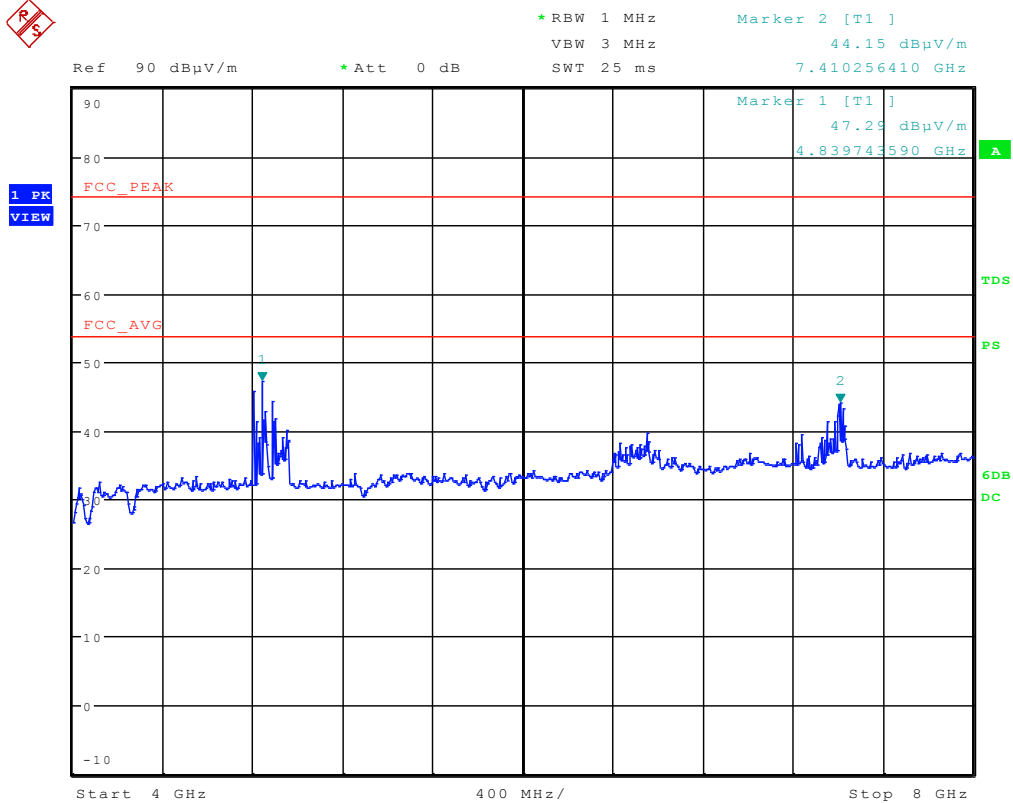
# Wireless Transceiver Test Report



FCC ID: A94BT2L IC: 3232A-BT2L

Certificate # 1514.1

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



Date: 31.MAY.2011 23:05:10

Note that the emissions from 4804 – 4960 MHz and 7206 – 7440MHz are TX harmonics and are covered in section 6.7 of this report, “Harmonic testing”.

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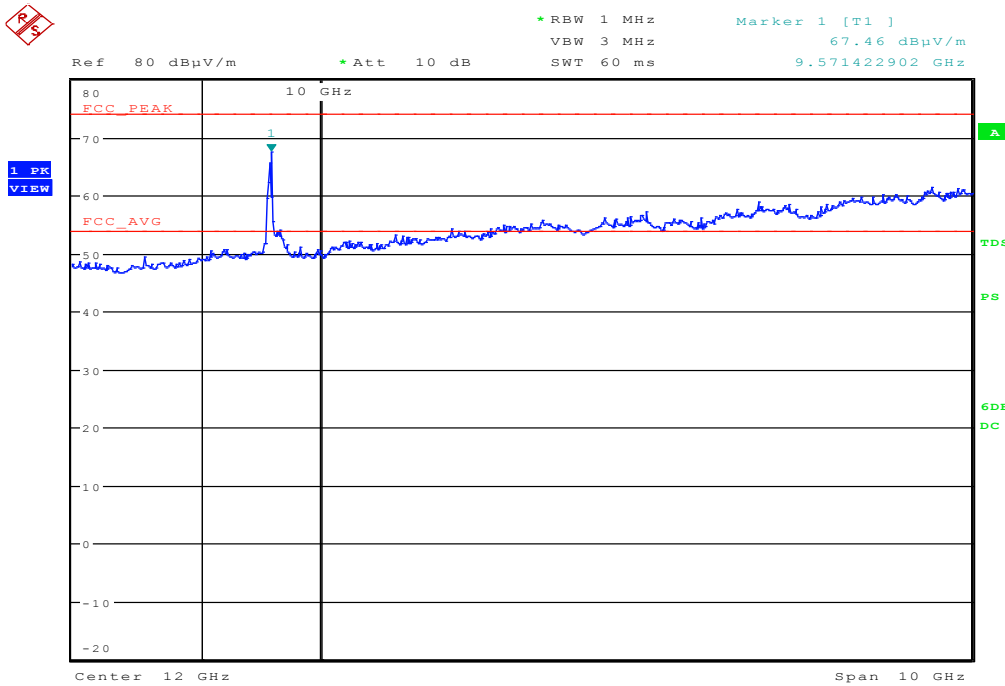
# Wireless Transceiver Test Report



FCC ID: A94BT2L IC: 3232A-BT2L

Certificate # 1514.1

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



Date: 1.JUN.2011 21:10:03

### RBW=1 MHz

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)
9571.400	40.50	67.50	54.0	74.0	13.5	6.5	340	V	1.2

9.571 GHz is not in a restricted band however it complies since the spurious emission is within the 15.209 limits.

\*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



FCC ID: A94BT2L IC: 3232A-BT2L

Certificate # 1514.1

## Band edge measurements:

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

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

Edge	Rate	Detector	Peak or Avg Value, RBW=1 MHz (dBuV/m)	Delta inband dB (RBW= 100kHz)	Calculated dB * (RBW = 1 MHz)
Lower	BR	Peak	95.22	45.17	50.03
Lower	BR	Average	92.51	45.17	47.43
Lower	EDR	Peak	95.62	46.14	49.48
Lower	EDR	Average	89.82	46.14	43.68
Upper	BR	Peak	91.73	41.37	50.36
Upper	BR	Average	89.00	41.37	47.63
Upper	EDR	Peak	90.72	41.40	49.70
Upper	EDR	Average	84.86	41.40	43.70

\* Calculated dB = measured (peak or 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  $74 - 50.36 = 23.64$  dB

Worst case average margin  $54 - 47.63 = 6.37$  dB

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# Wireless Transceiver Test Report



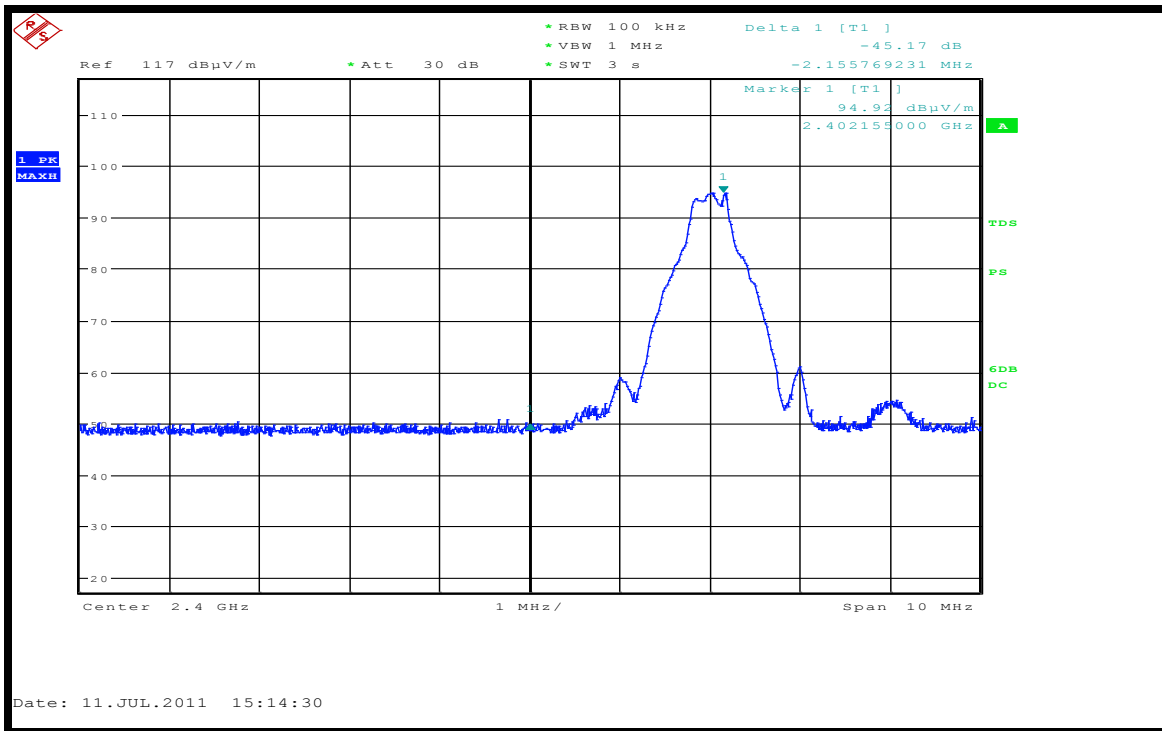
FCC ID: A94BT2L

IC: 3232A-BT2L

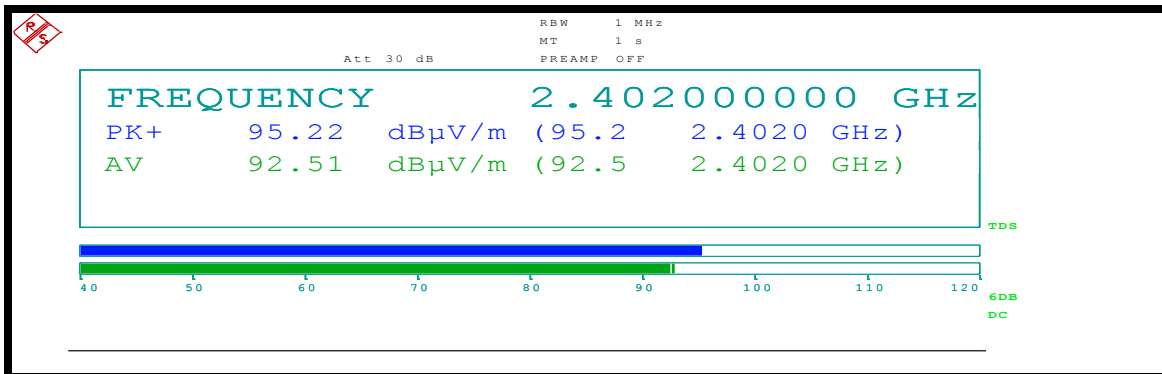
Certificate # 1514.1

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

Marker delta = 45.17 dB measured using RBW=100 kHz



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



Basic rate:  $95.22 - 45.17 = 50.03$  dBuV/m peak

$92.51 - 45.17 = 47.34$  dBuV/m average

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# Wireless Transceiver Test Report



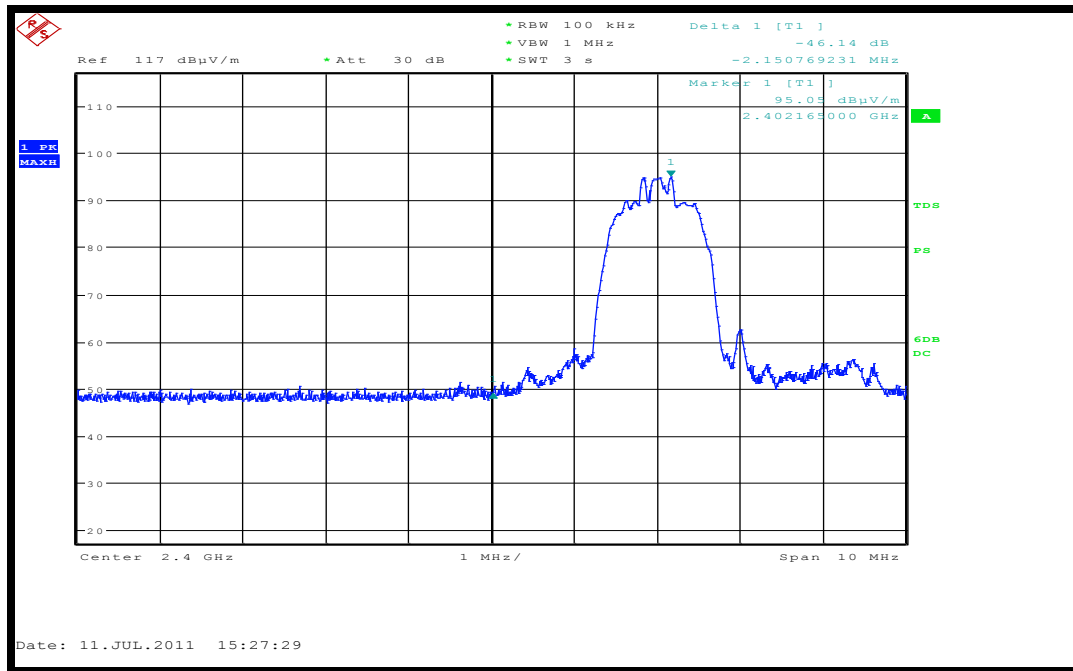
FCC ID: A94BT2L IC: 3232A-BT2L

Certificate # 1514.1

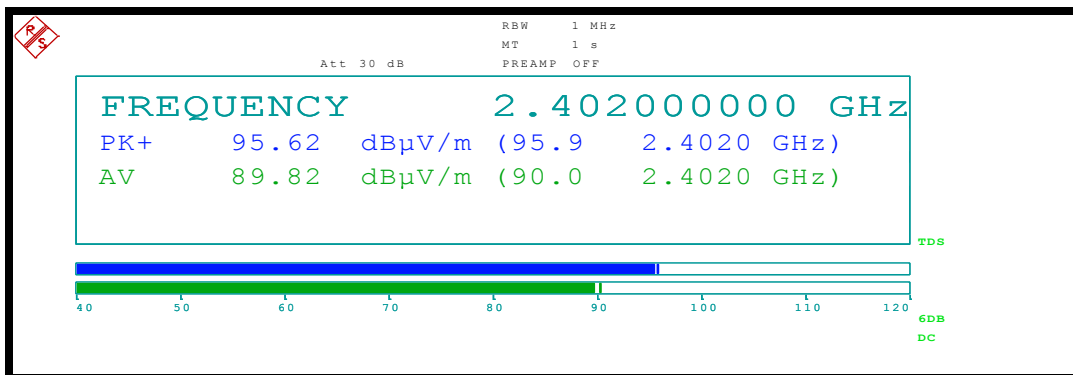
Lower band edge:

Enhanced data rate = 3-DH5

Marker delta = 46.14 dB measured using RBW=100 kHz



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



EDR:  $95.62 - 46.14 = 49.48$  dBuV/m peak

$89.82 - 46.14 = 43.68$  dBuV/m average

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# Wireless Transceiver Test Report

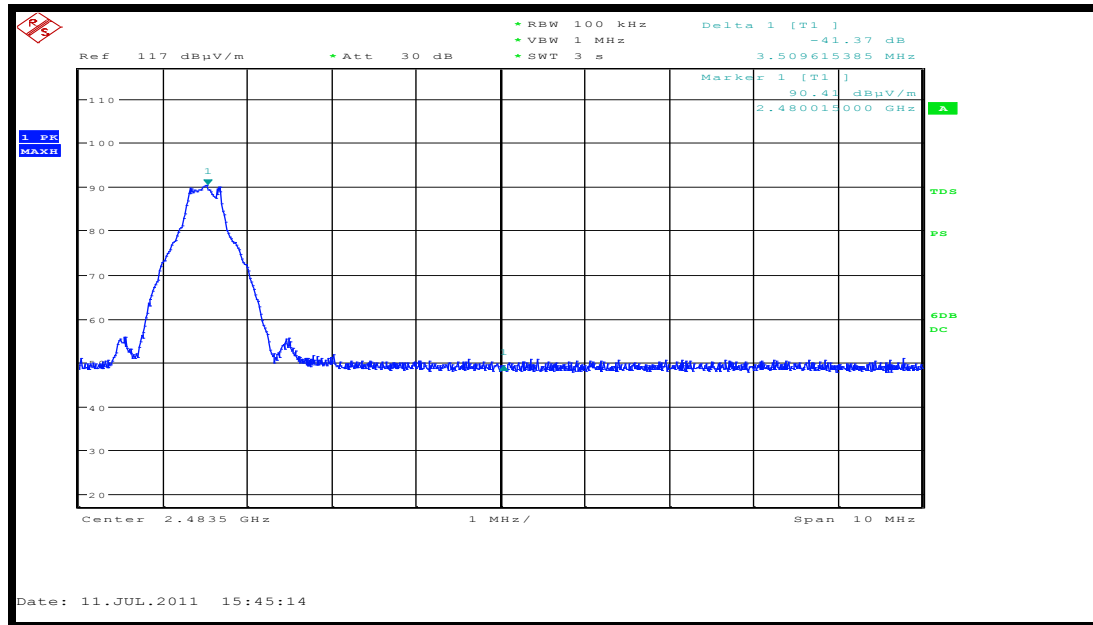


FCC ID: A94BT2L IC: 3232A-BT2L

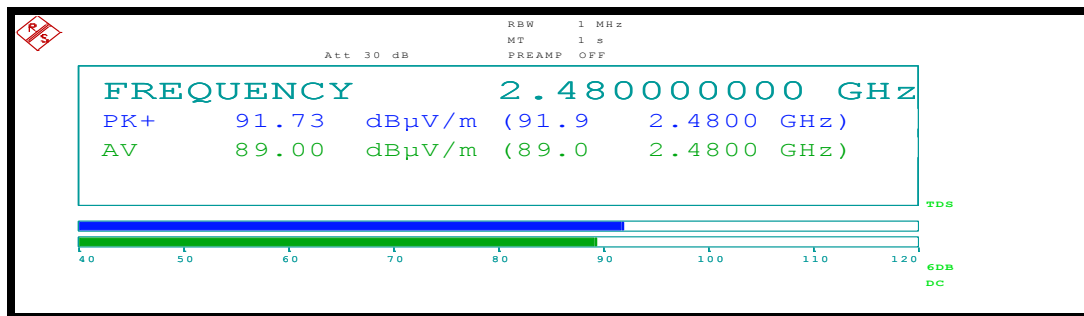
Certificate # 1514.1

Upper band edge, Basic rate.

Marker delta = 41.37 dB measured using RBW=100 kHz



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



Basic rate:  $91.73 - 41.37 = 50.36$  dBuV/m peak

$89.00 - 41.37 = 47.63$  dBuV/m average

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# Wireless Transceiver Test Report



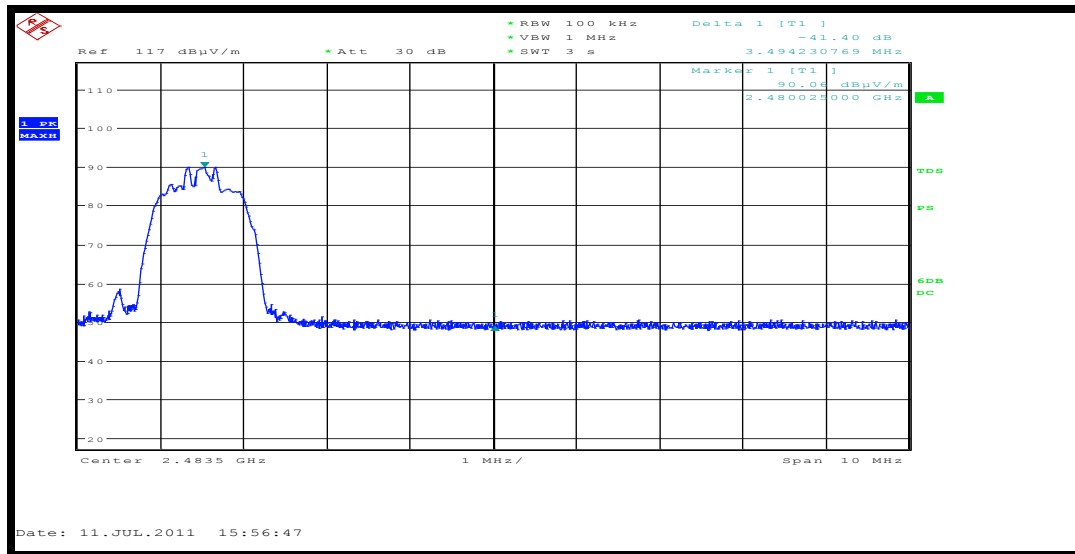
FCC ID: A94BT2L IC: 3232A-BT2L

Certificate # 1514.1

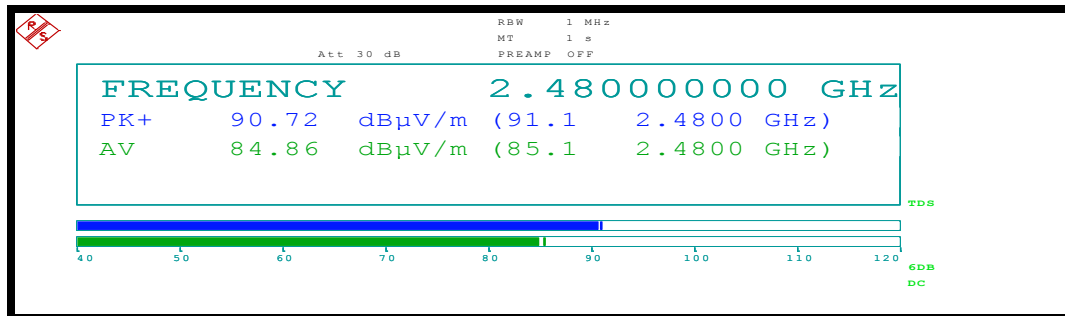
Upper band edge:

Enhanced data rate = 3-DH5

Marker delta = 41.40 dB measured using RBW=100 kHz



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



EDR:  $90.72 - 41.40 = 49.70$  dBuV/m peak

$84.86 - 41.40 = 43.70$  dBuV/m average

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# Wireless Transceiver Test Report



FCC ID: A94BT2L IC: 3232A-BT2L

Certificate # 1514.1

## 6.8.2.2. Test Equipment

Equipment Type	Manufacturer	Model	Tracking Number	Service date	
				Last	Due
EMI Test Receiver	Rohde & Schwarz	ESU40	TN1663	4/6/2011	4/6/2012
Antenna 30M – 6G	Sunol	JB6	TN1823	12/22/2010	7/22/2011
Pre-amp	Rohde & Schwarz	TS-PR8	TN1669	2/23/2011	2/23/2012
Antenna 4 – 8G	AR	AT4003	TN727	11/24/2008	11/24/2011
Antenna 8 – 18G	AR	AT4004	TN728	11/24/2008	11/24/2011
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	4/28/2011	4/28/2012
40 GHz pre-amp	MITEQ	JS4018004000-30-8P-A1	TN1757	Verify before use	
Antenna cable 18GHz	Rohde & Schwarz	HFE160D	TN1692	9/9/2010	9/9/2011
BT tester	Rohde & Schwarz	CBT	TN1758	4/4/2011	4/4/2012

## 6.8.3. Test information

<b>Date of test:</b>	7/11/2011	<b>Test Location:</b>	Maxwell House
<b>EUT serial:</b>	L18, L49	<b>Tested by:</b>	C. Bell, B. Cerqua
<b>Test Conclusion:</b>	Pass		

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# Wireless Transceiver Test Report



FCC ID: A94BT2L 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.

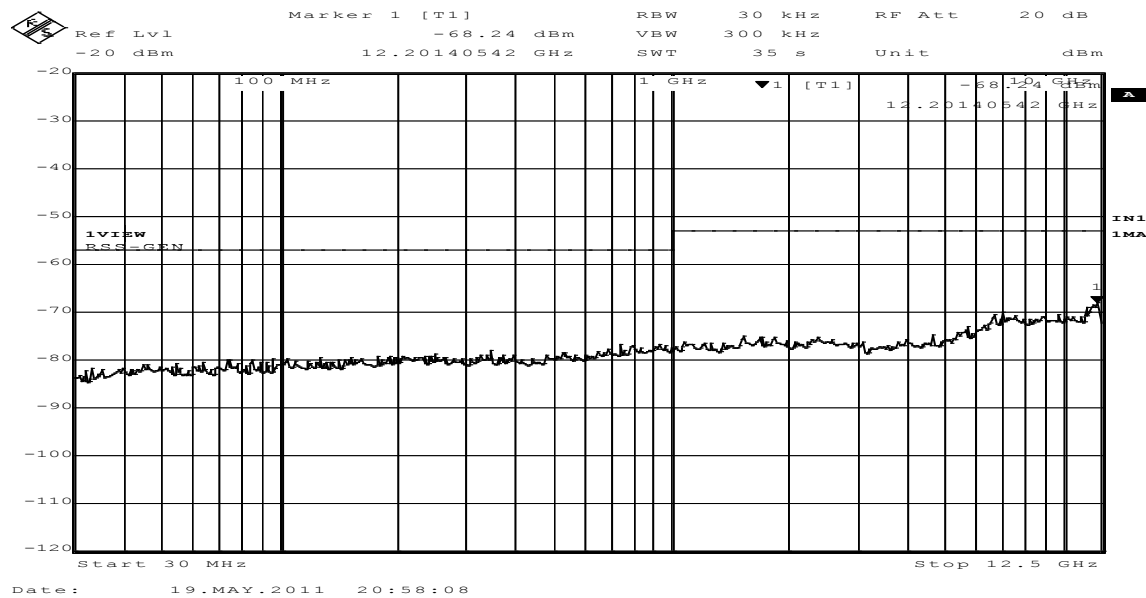
### 6.9.2. Test Setup

The EUT is tuned to the middle of the band and placed in receive mode. (TX idle).

Conducted:

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. For all conducted measurements the RG178 cable was connected directly to the receiver. EUT is placed in receive mode and tuned to the middle of the band (channel 39, 2441 MHz). 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



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

Max level @ 12.2 GHz is -68.24 dBm or 0.150 nW

**Passes by 15.2 dB**

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# Wireless Transceiver Test Report



FCC ID: A94BT2L      IC: 3232A-BT2L

Certificate # 1514.1

## 6.9.4. Test Equipment

Equipment Type	Manufacturer	Model	Serial or other ID	Service date	
				Last	Due
EMI Test Receiver	Rohde & Schwarz	ESIB40	TN1560	4/6/2011	4/6/2012
CBT controller	Rohde & Schwarz	CBT	TN1758	4/4/2011	4/4/2012

## 6.9.5. Test information

Date of test:	May 19, 2011	Test location:	Transmitter Test Bench
EUT serial:	L1	Tested by:	C. Bell
Test Conclusion:	Pass		

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# Wireless Transceiver Test Report

FCC ID: A94BT2L IC: 3232A-BT2L



Certificate # 1514.1

## 6.10. SAR calculation

Frequency Range: 2402-2480MHz

Low threshold =  $60/f(\text{GHz}) \text{ mW} = 60 / 2.480 = 24.19\text{mW}$

Conducted Output Power Measured (dBm) = 3.62dBm (See section 6.3 of this report)

Conducted Output Power (mW) = 2.3 mW

Antenna Gain (dBi) = -3.002 dBi (Measured maximum antenna gain)

EIRP = 1.15 mW

Since both Conducted Output Power and EIRP are below the low threshold, device complies with FCC and Industry Canada RF radiation exposure limits for general population/uncontrolled exposure as a portable device without SAR evaluation.

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