



Wireless Transceiver Test Report

FCC ID: A94BA1 IC: 3232A-BA1



Certificate # 1514.1

Report number: EMC.411834.13.71.1

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: 

March 12, 2013

Report reviewed by: Chad Bell

Signature: 

March 12, 2013

Report issue date: March 12, 2013

Changes from previous revision: Original version

Without written permission of laboratory, this report shall not be reproduced except in full.



Wireless Transceiver Test Report

FCC ID: A94BA1 IC: 3232A-BA1



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	19
6.5. Time of occupancy.....	26
6.6. Spurious emissions- Conducted.....	32
6.7. Harmonics	36
6.8. Spurious emissions 1-25 GHz.....	38
6.9. Receiver spurious emissions	52
6.10. SAR calculation	55

Without written permission of laboratory, this report shall not be reproduced except in full.



Wireless Transceiver Test Report

FCC ID: A94BA1 IC: 3232A-BA1



Certificate # 1514.1

1. Report Summary

1.1 Product Bose® Bluetooth headphones (BA1)

1.2 Client Bose Corporation
The Mountain, FraminghamMA01701

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.

Without written permission of laboratory, this report shall not be reproduced except in full.



Wireless Transceiver Test Report

FCC ID: A94BA1 IC: 3232A-BA1



Certificate # 1514.1

2. Product description

Bluetooth wireless headset.

A USB cable is provided for charging the EUT battery from any USB source such as PC or laptop.
Battery charger is supplied as an optional device.

Without written permission of laboratory, this report shall not be reproduced except in full.



Wireless Transceiver Test Report

FCC ID: A94BA1 IC: 3232A-BA1



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
OET65	Canada Health and Safety code 6		MPE calculation	Complies Section 6.10

Without written permission of laboratory, this report shall not be reproduced except in full.



Wireless Transceiver Test Report

FCC ID: A94BA1 IC: 3232A-BA1



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 ± 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 using a non-supplied USB source such as a personal computer, laptop or other mini USB type charger. The headset can not be used while it is charging. The EUT battery was fully charged prior to each test.

Without written permission of laboratory, this report shall not be reproduced except in full.



Wireless Transceiver Test Report

FCC ID: A94BA1 IC: 3232A-BA1



Certificate # 1514.1

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 optional USB battery charger.

Without written permission of laboratory, this report shall not be reproduced except in full.



Wireless Transceiver Test Report

FCC ID: A94BA1 IC: 3232A-BA1

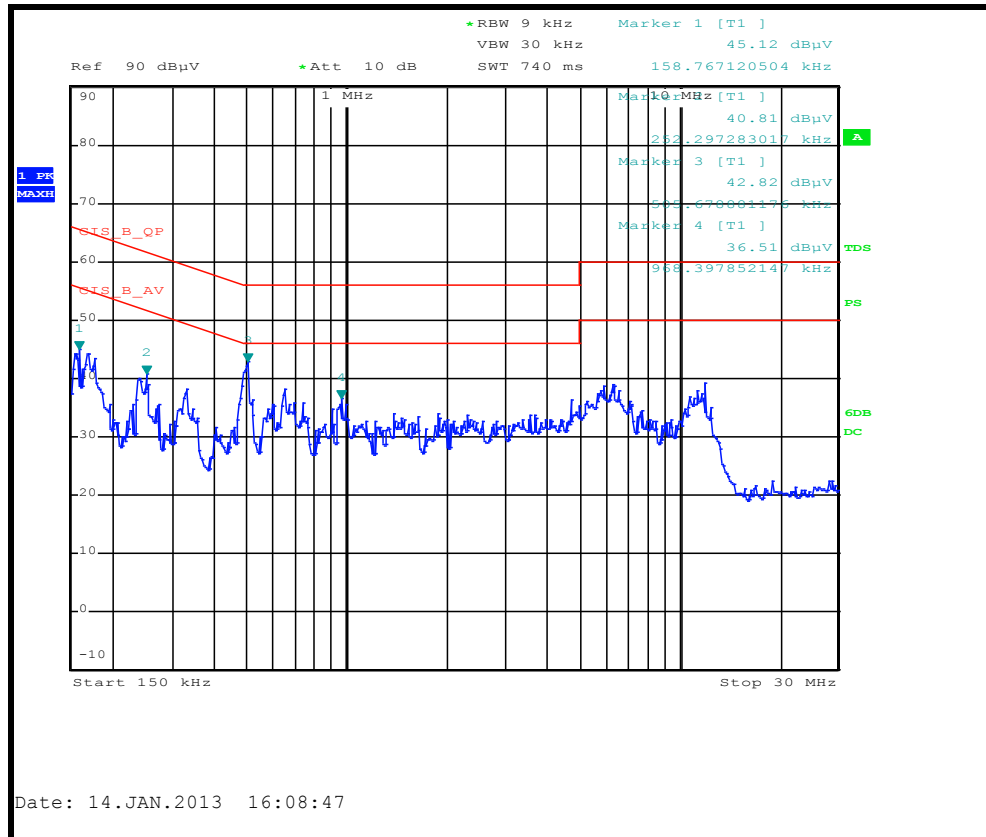


Certificate # 1514.1

6.1.3. Test data

Optional USB charger charging EUT battery
EUT cannot be used while charging.

120 VAC 60 Hz, Line side, Max Peak Scan



Frequency MHz	MEASURED		LIMIT		MARGIN	
	dBμV QP	dBμV AVG	dBμV QP	dBμV AVG	dB QP	dB AVG
0.1588	33.20	11.30	65.5	55.5	32.3	44.2
0.2523	26.80	10.00	61.7	51.7	34.9	41.7
0.4962	32.50	12.70	56.1	46.1	23.6	33.4
0.9684	32.50	12.70	56.0	46.0	23.5	33.3
5.9100	23.90	8.30	60.0	50.0	36.1	41.7
11.4700	25.40	8.00	60.0	50.0	34.6	42.0

Worst case emissions are more than 20 dB below the limit.

Without written permission of laboratory, this report shall not be reproduced except in full.



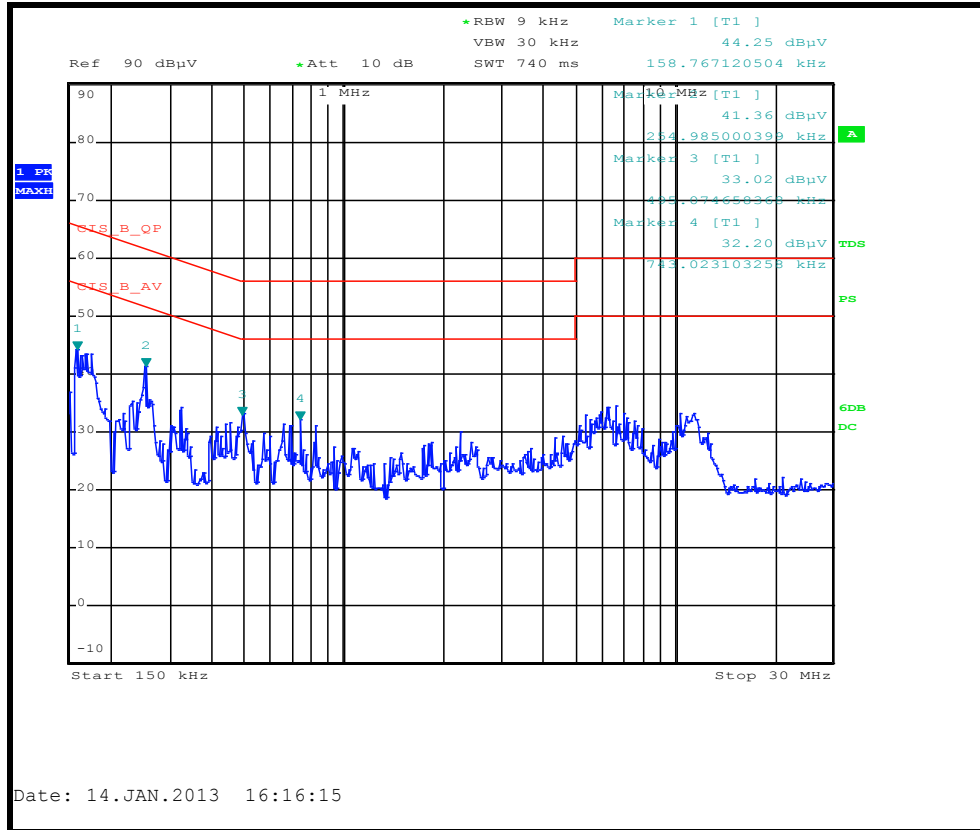
Wireless Transceiver Test Report

FCC ID: A94BA1 IC: 3232A-BA1



Certificate # 1514.1

120 VAC 60 Hz, Neutral side, Max Peak Scan



Frequency MHz	MEASURED		LIMIT		MARGIN	
	dB μ V QP	dB μ V AVG	dB μ V QP	dB μ V AVG	dB QP	dB AVG
0.1568	31.60	10.10	65.6	55.6	34.0	45.5
0.2480	0.00	0.00	61.8	51.8	61.8	51.8
0.4978	24.90	9.40	56.0	46.0	31.1	36.6
0.7430	14.00	6.50	56.0	46.0	42.0	39.5
6.3160	18.90	6.80	60.0	50.0	41.1	43.2
11.5800	21.50	7.00	60.0	50.0	38.5	43.0

Worst case emissions more than 20 dB below the limit.

Without written permission of laboratory, this report shall not be reproduced except in full.



Wireless Transceiver Test Report

FCC ID: A94BA1 IC: 3232A-BA1



Certificate # 1514.1

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:	1/14/2013	Test location :	DCE lab – Henry room
EUT serial:	SN 213067, PS # 1	Tested by:	B. Cerqua
Test Conclusion:	Pass		

Without written permission of laboratory, this report shall not be reproduced except in full.



Wireless Transceiver Test Report

FCC ID: A94BA1 IC: 3232A-BA1



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 μ 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. A power supply for charging is not provided with the EUT. A USB power supply is sold as an accessory and radiated emissions in addition to normal operation were also measured while charging the EUT battery.

6.2.3. Test data

Summary:

Worst case QP margin of 20.3 dB at 176 MHz under normal operation.

Worst case QP margin of 21.6 dB at 40.6 MHz while charging battery.

Without written permission of laboratory, this report shall not be reproduced except in full.



Wireless Transceiver Test Report

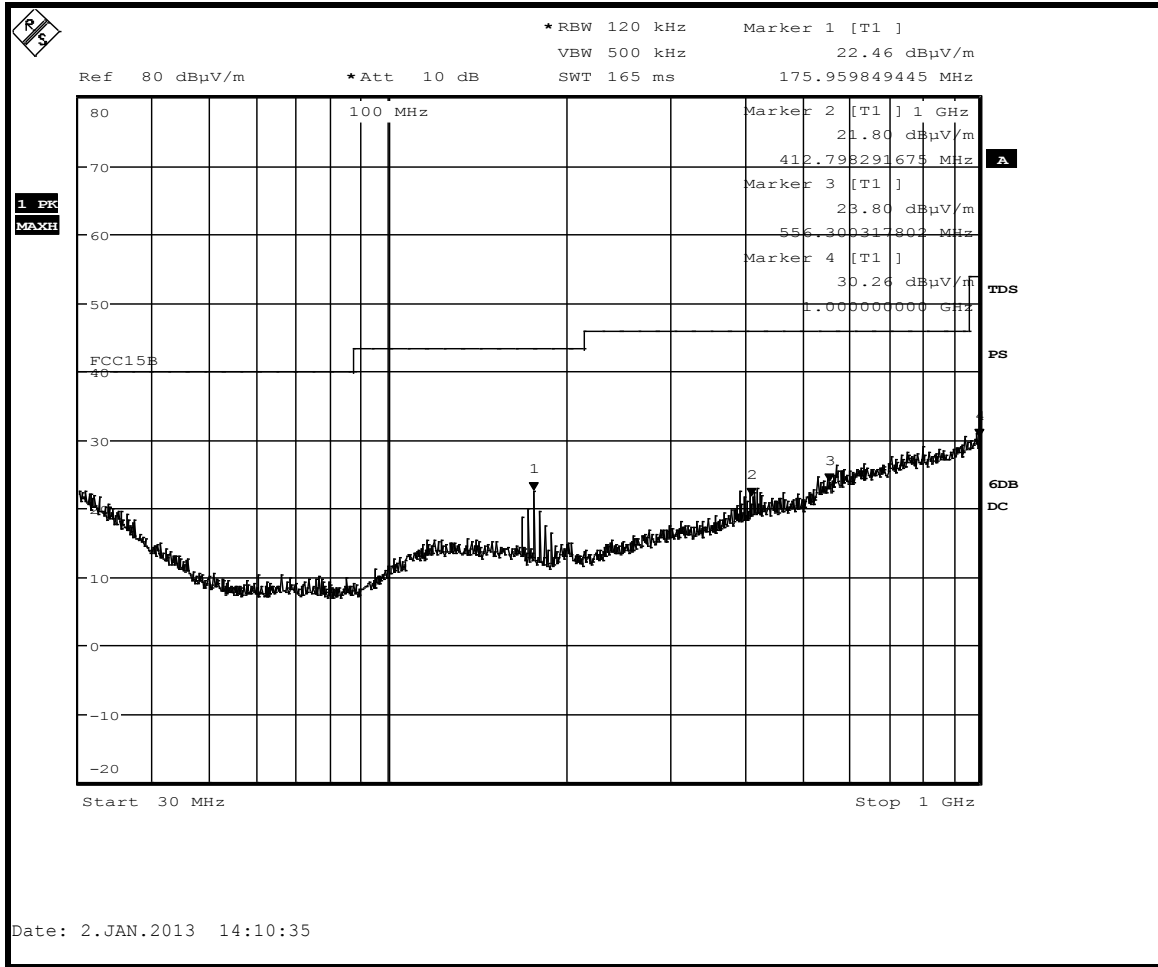


FCC ID: A94BA1 IC: 3232A-BA1

Certificate # 1514.1

Bluetooth mode paired up with iPod playing pink noise at maximum volume.
EUT positioned in normal upright position in frequency hopping mode.

Max-Hold Peak Pre-scan, 30MHz – 1GHz



Date: 2.JAN.2013 14:10:35

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)
176.000	23.20	27.60	43.5	N/A	20.3	N/A	16	H	1.4
412.000	22.10	26.70	46.0	N/A	23.9	N/A	0	V	1.2
1000.000	28.00	34.70	54.0	N/A	26.0	N/A	0	H	1.0

Without written permission of laboratory, this report shall not be reproduced except in full.



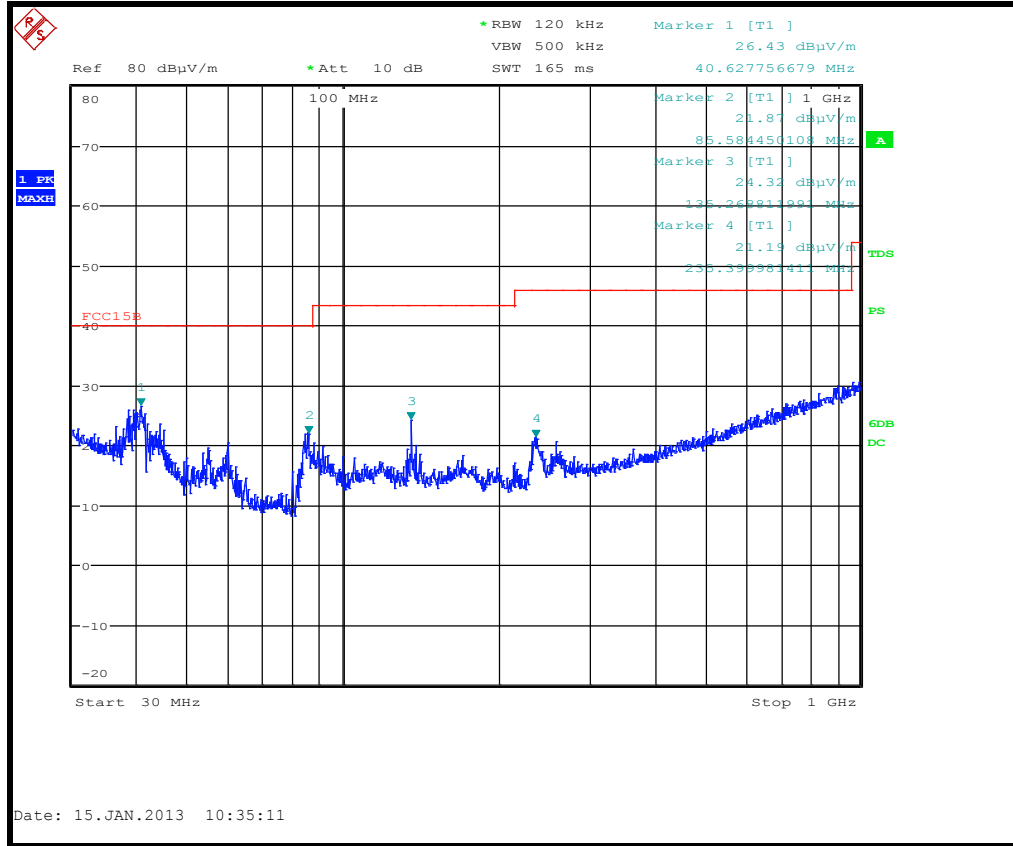
Wireless Transceiver Test Report

FCC ID: A94BA1 IC: 3232A-BA1



Certificate # 1514.1

Radiated emissions using the optional battery charger, sold separately.
Bluetooth operation is not possible while charging the battery.



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)
40.630	18.40	31.00	40.0	N/A	21.6	N/A	295	V	1.0
85.585	14.90	25.40	40.0	N/A	25.1	N/A	360	H	1.0
135.269	12.80	25.40	43.5	N/A	30.7	N/A	160	H	1.0
235.700	16.30	23.90	46.0	N/A	29.7	N/A	0	V	1.0
1000.000	28.00	33.90	54.0	N/A	26.0	N/A	0	V	1.0

Without written permission of laboratory, this report shall not be reproduced except in full.



Wireless Transceiver Test Report

FCC ID: A94BA1 IC: 3232A-BA1



Certificate # 1514.1

6.2.4. Test Equipment

Equipment Type	Manufacturer	Model	Serial or other ID	Service	
				Last	Due
Antenna	Sunol Sciences	JB6	TN1541	7/3/2012	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	3/2/2012	3/2/2013
Pre-amp	Mini-Circuits	ZX60-3018G+	TN2077	6/15/2012	6/15/2013

6.2.5. Test information

Date of test:	1/2/2013, 1/15/2013	Test location :	DCE - Maxwell House
EUT serial:	SN 213067, PS #1	Tested by:	B. Cerqua
Test Conclusion:	Pass		

Without written permission of laboratory, this report shall not be reproduced except in full.



Wireless Transceiver Test Report

FCC ID: A94BA1 IC: 3232A-BA1



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 EUT is controlled via the USB cable with CSR's Blue Suite software which is used to set the test modes of the Bluetooth device. 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 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. 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.

6.3.3. Test data.

Summary: RBW = 2 MHz, detector = peak, max power = 7.5 dBm (5.6 mW)

Channel	Center Frequency (MHz)	Basic Rate: DH5 (15,339) (dBm)	EDR: 3-DH5 (31,1020) (dBm)
0	2402	1.89	1.32
30	2432	7.50	6.89
40	2442	6.17	5.21
78	2480	5.66	4.89

Channel 30 measured the highest power.

Without written permission of laboratory, this report shall not be reproduced except in full.



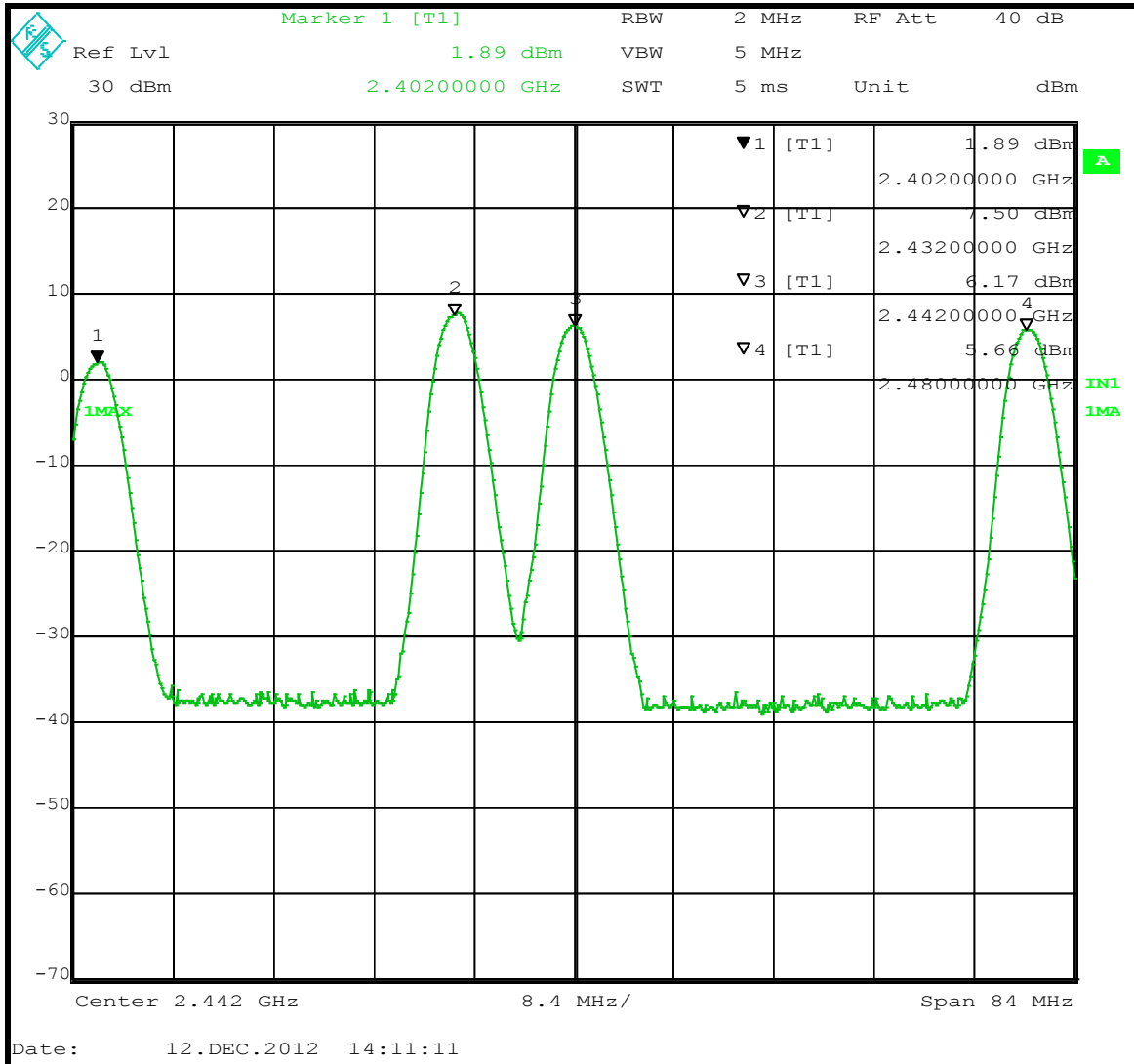
Wireless Transceiver Test Report

FCC ID: A94BA1 IC: 3232A-BA1



Certificate # 1514.1

Basic Rate: DH5:



Without written permission of laboratory, this report shall not be reproduced except in full.



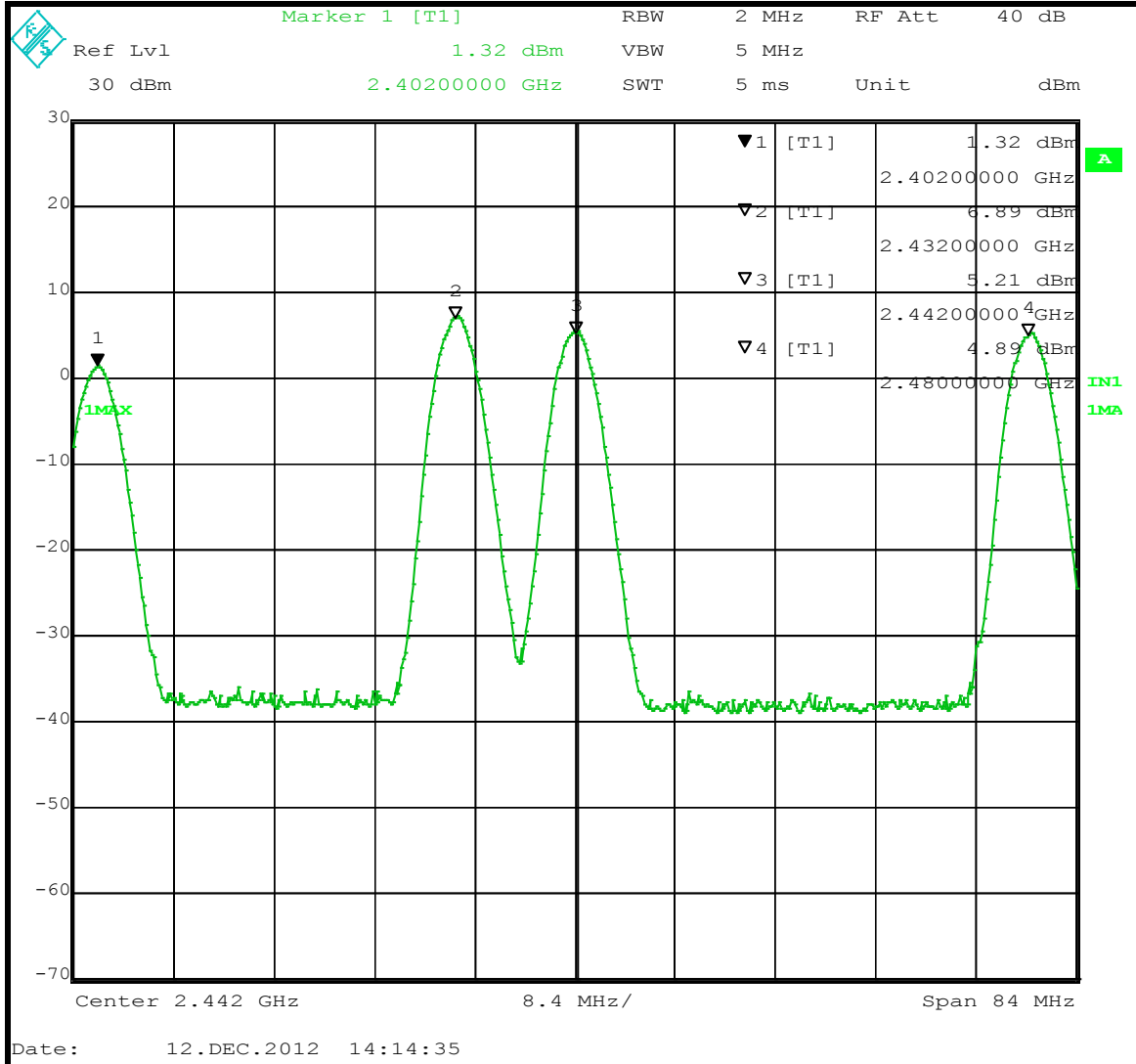
Wireless Transceiver Test Report

FCC ID: A94BA1 IC: 3232A-BA1



Certificate # 1514.1

Enhanced Rate: 3-DH5:



Without written permission of laboratory, this report shall not be reproduced except in full.



Wireless Transceiver Test Report

FCC ID: A94BA1 IC: 3232A-BA1



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	ESIB40	TN1560	4/4/2012	4/4/2013

6.3.5. Test information

Date of test:	12/12/2012	Test location:	Transmitter Test Bench
EUT serial:	SN230	Tested by:	B. Cerqua
Test Conclusion:	Pass		

Without written permission of laboratory, this report shall not be reproduced except in full.



Wireless Transceiver Test Report

FCC ID: A94BA1 IC: 3232A-BA1



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)

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 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	1.41	1.23
39	2441	1.41	1.23
78	2480	1.40	1.22

Conclusion: $2/3^{\text{rd}}$ of the largest OBW = $2/3 \times 1.41 \text{ MHz} = 940 \text{ kHz}$, 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 RSS210A8.1 (a) is:

79 channels times 1.23 MHz = 97.17MHz.

Without written permission of laboratory, this report shall not be reproduced except in full.



Wireless Transceiver Test Report

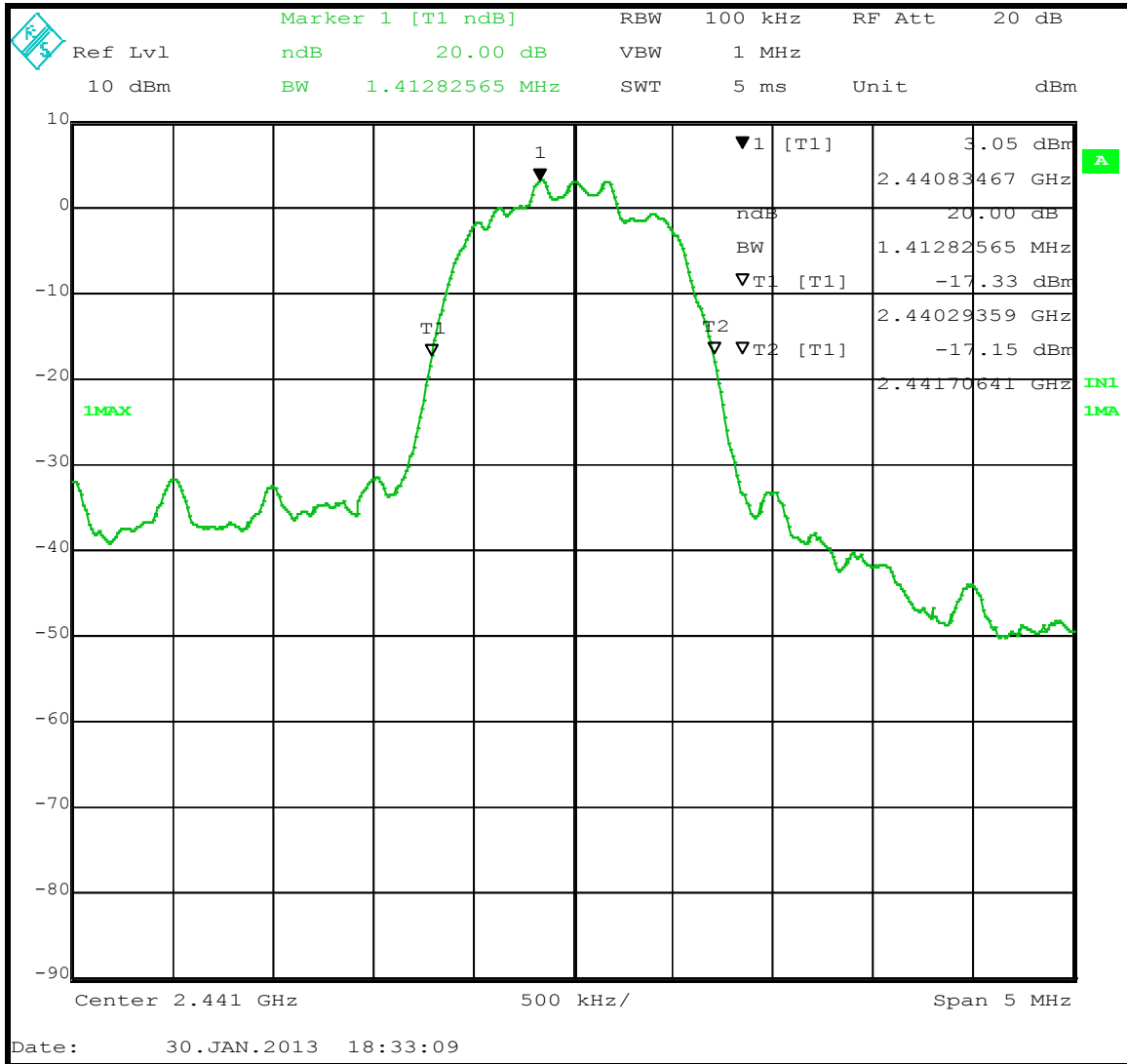
FCC ID: A94BA1 IC: 3232A-BA1



Certificate # 1514.1

Example spectrum analyzer plot showing how the 20 dB bandwidth is measured.
Used the built in n dB down measurement on the R&S ESIB40.

20 dB OBW = 1.40 MHz. (EDR 3-DH5)



Without written permission of laboratory, this report shall not be reproduced except in full.



Wireless Transceiver Test Report

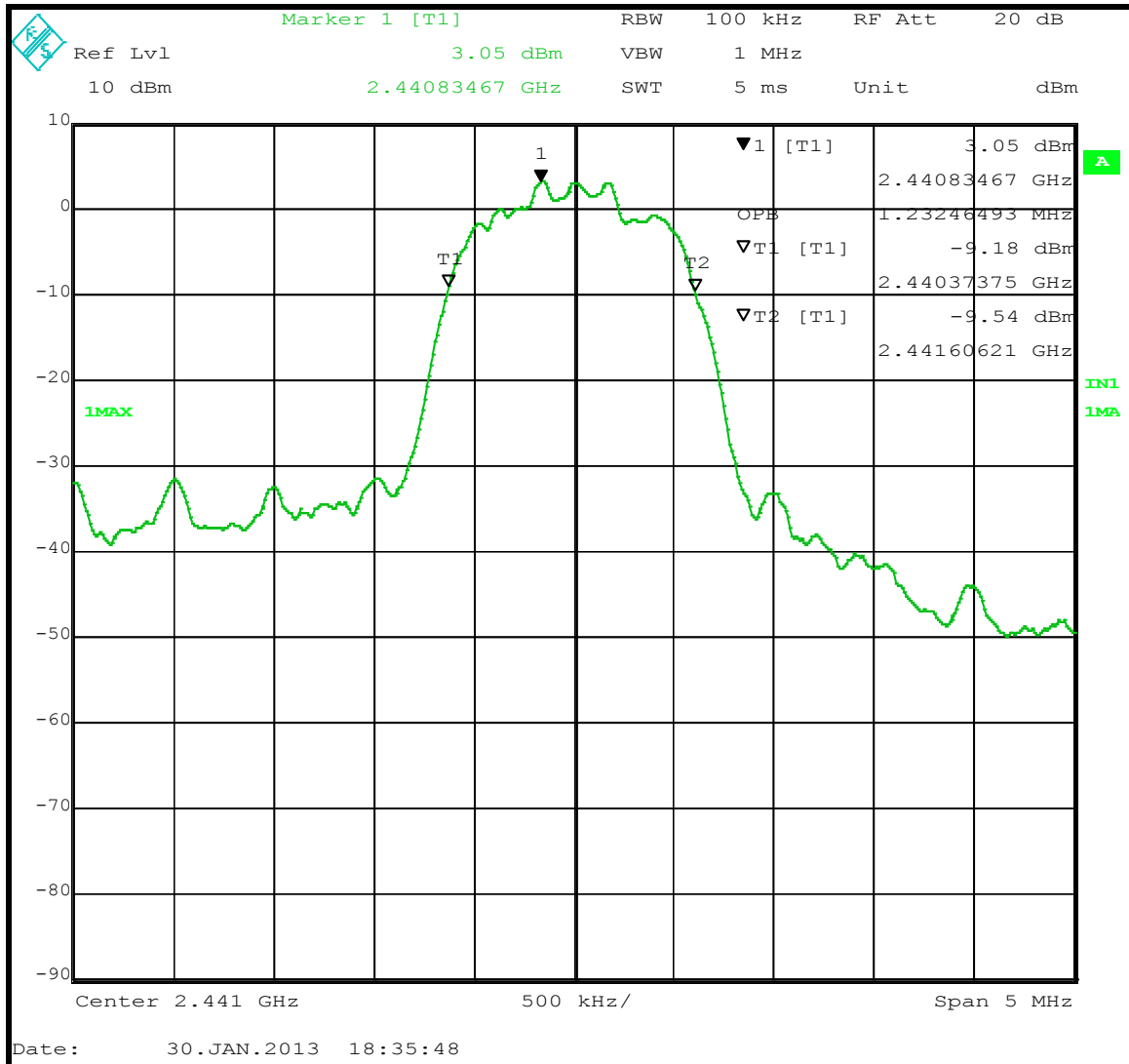
FCC ID: A94BA1 IC: 3232A-BA1



Certificate # 1514.1

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

99% OBW = 1.22 MHz. (EDR 3-DH5)



Without written permission of laboratory, this report shall not be reproduced except in full.



Wireless Transceiver Test Report

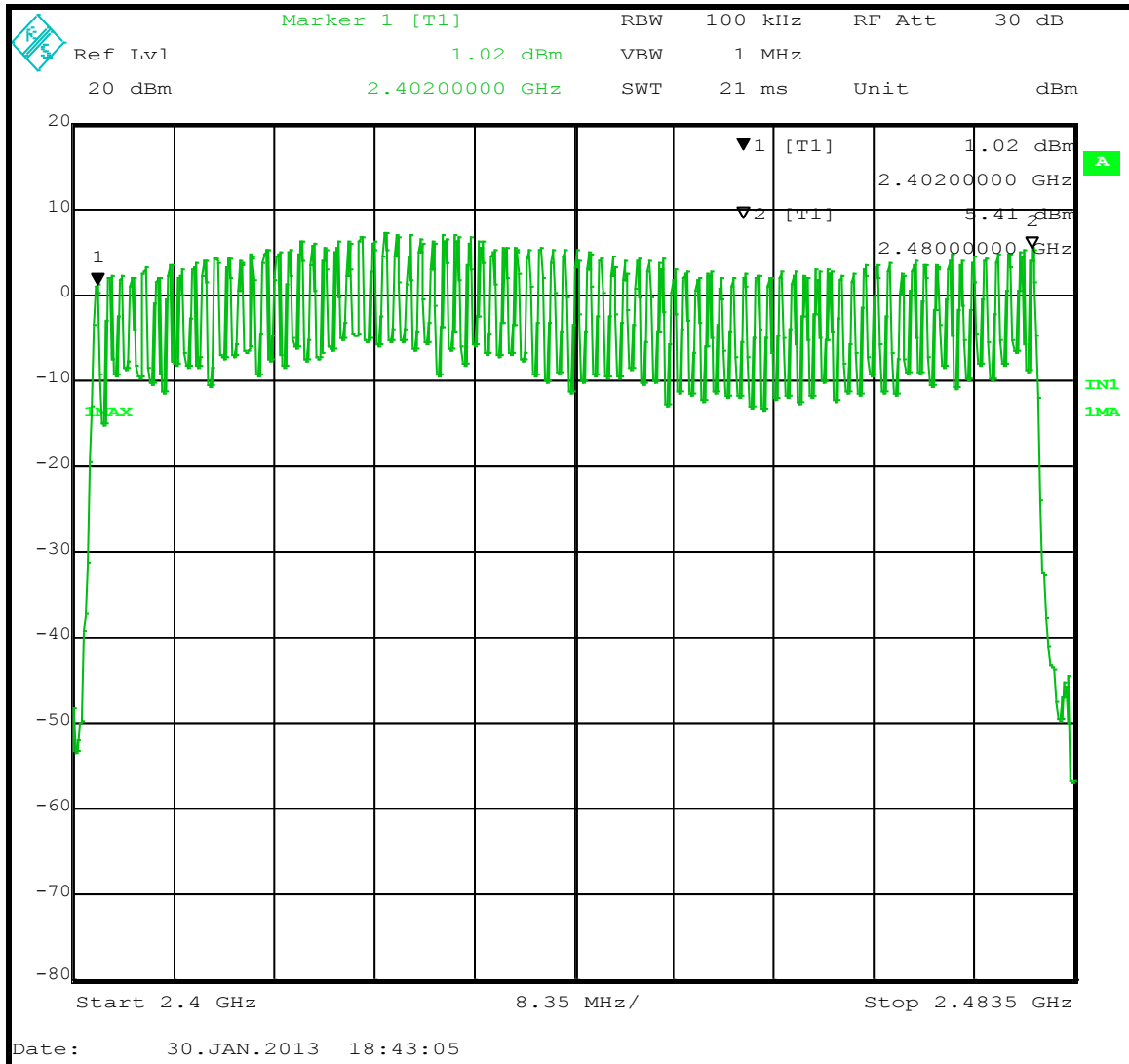
FCC ID: A94BA1 IC: 3232A-BA1



Certificate # 1514.1

Channel Spacing

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



Without written permission of laboratory, this report shall not be reproduced except in full.



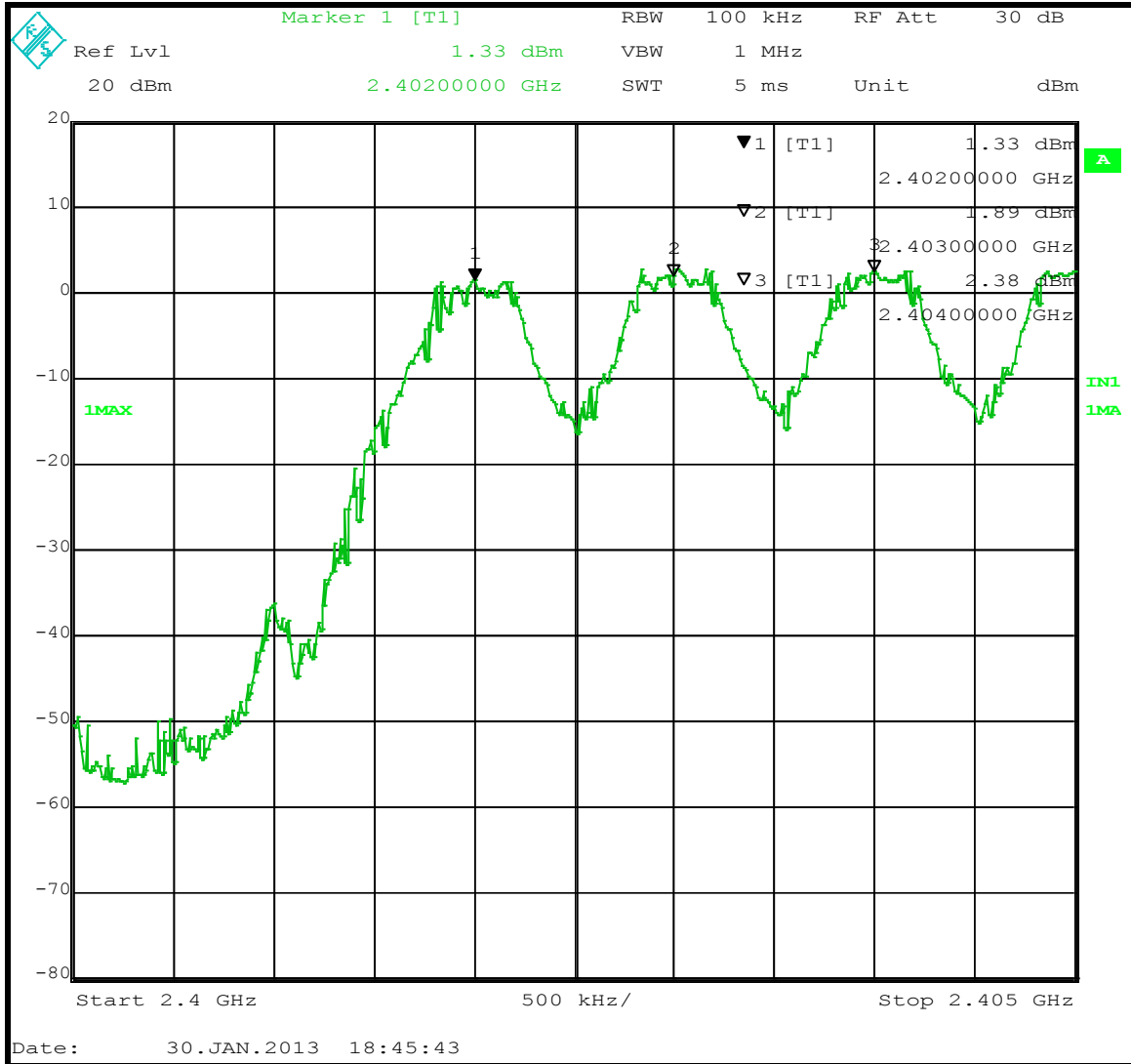
Wireless Transceiver Test Report

FCC ID: A94BA1 IC: 3232A-BA1



Certificate # 1514.1

Low band end channel spacing detail



Without written permission of laboratory, this report shall not be reproduced except in full.



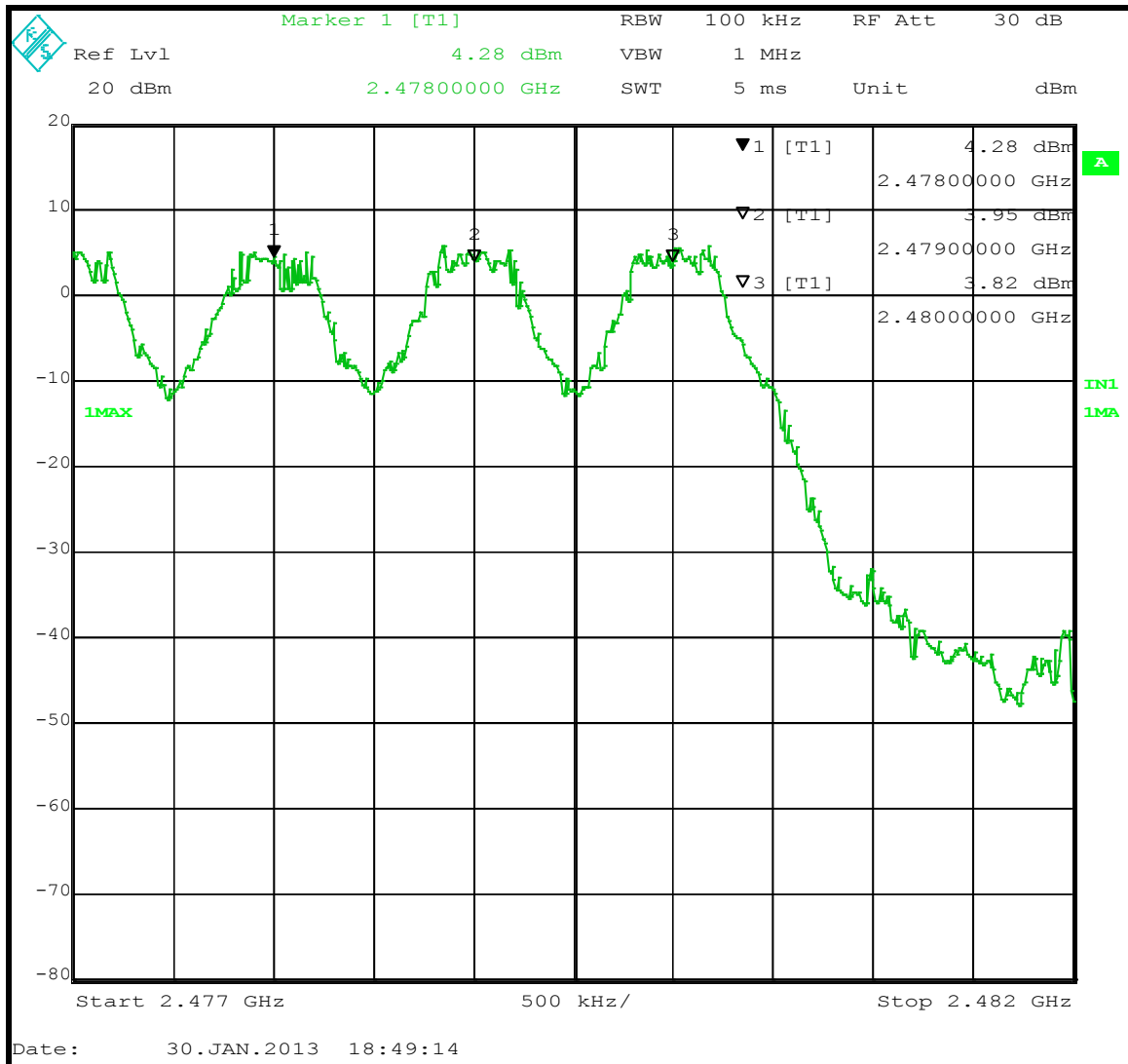
Wireless Transceiver Test Report



FCC ID: A94BA1 IC: 3232A-BA1

Certificate # 1514.1

High band end channel spacing detail



Without written permission of laboratory, this report shall not be reproduced except in full.



Wireless Transceiver Test Report

FCC ID: A94BA1 IC: 3232A-BA1



Certificate # 1514.1

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

6.4.4. Test information

Date of test:	1/30/2013	Test location:	Transmitter Test Bench
EUT serial:	SN214	Test by:	B. Cerqua
Test Conclusion:	Pass		

Without written permission of laboratory, this report shall not be reproduced except in full.



Wireless Transceiver Test Report

FCC ID: A94BA1 IC: 3232A-BA1



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 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 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.

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

$$\begin{aligned} \text{Dwell Time} &= (\text{TX Pulse Width}) * (\text{Hop Rate}) / (\# \text{ of Channels}) / (\# \text{ of slots}) * 31.6 \\ &= (\text{TX Pulse Width}) * 1600 / 79 / (\# \text{ of Slots}) * 31.6 \\ &= (\text{TX Pulse Width}) * 640 / (\# \text{ Slots}) \end{aligned}$$

$$\begin{aligned} \text{Hop Rate} &= 1600 \text{ hops} / \text{S} \\ \# \text{ of channels} &= 79 \end{aligned}$$

$$\# \text{ of slots} = \text{number of slots used per packet in a given mode; DH1} = 2, \text{ DH3} = 4, \text{ DH5} = 6$$

$$31.6 \text{ Seconds} = (79 \text{ channels}) * 0.4 \text{ Seconds}$$

Without written permission of laboratory, this report shall not be reproduced except in full.



Wireless Transceiver Test Report

FCC ID: A94BA1 IC: 3232A-BA1



Certificate # 1514.1

Dwell time summary table.

Frequency (MHz)	Channel Number	Mode	# of Slots	Measured TX Pulse Width (uS)	Dwell Time (S)	Limit (S)	Result
2402	0	DH1	2	412.8	0.132	0.4	Pass
2402	0	DH3	4	1685.3	0.269	0.4	Pass
2402	0	DH5	6	2942.1	0.313	0.4	Pass
2441	39	DH1	2	420.8	0.134	0.4	Pass
2441	39	DH3	4	1681.3	0.269	0.4	Pass
2441	39	DH5	6	2953.9	0.315	0.4	Pass
2480	78	DH1	2	420.8	0.134	0.4	Pass
2480	78	DH3	4	1689.4	0.270	0.4	Pass
2480	78	DH5	6	2951.9	0.315	0.4	Pass

Without written permission of laboratory, this report shall not be reproduced except in full.



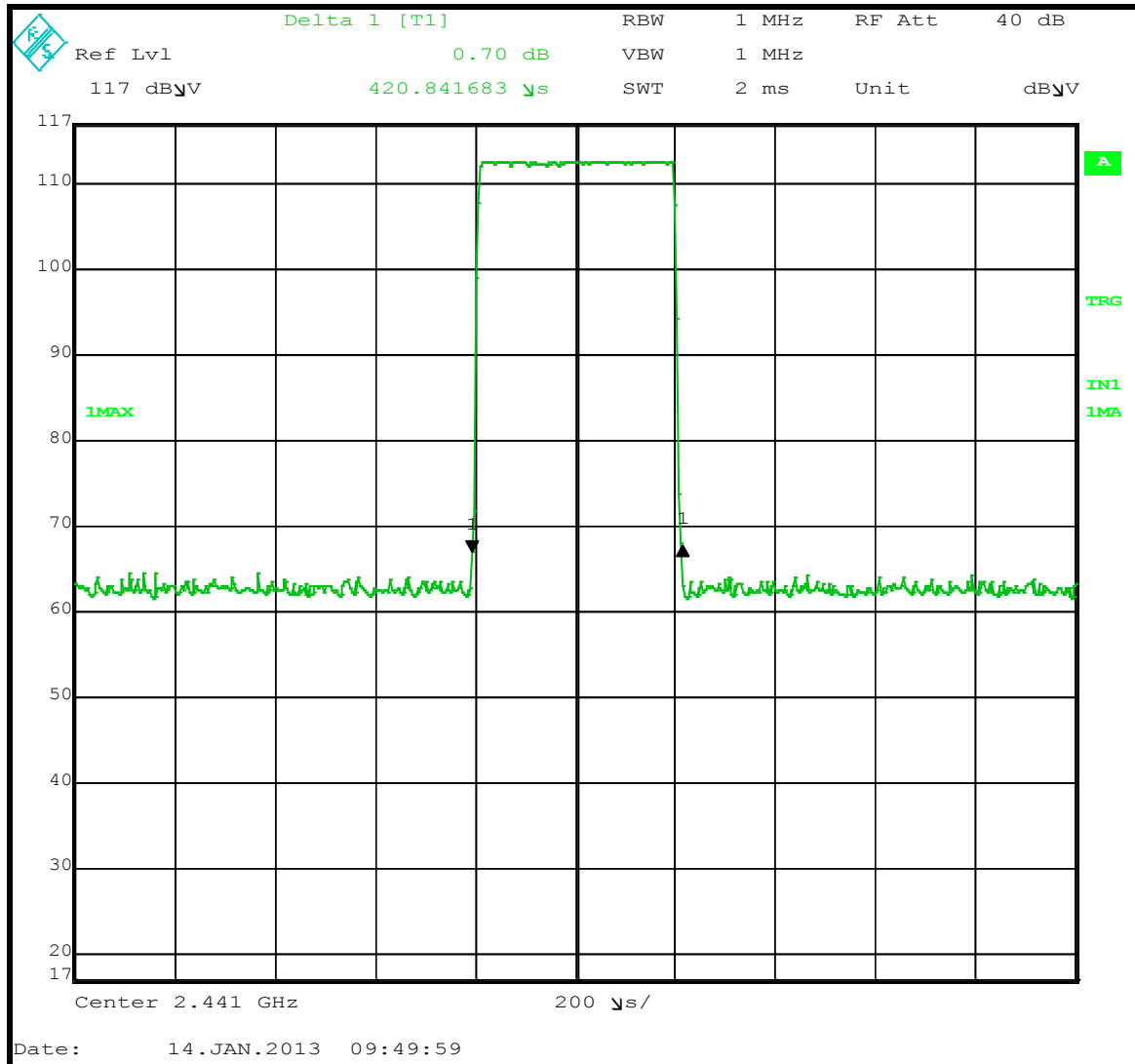
Wireless Transceiver Test Report



FCC ID: A94BA1 IC: 3232A-BA1

Certificate # 1514.1

Representative plot DH1 with maximum payload size
Channel frequency 2441 MHz
Measured TX pulse width is 420.8 uS



Without written permission of laboratory, this report shall not be reproduced except in full.



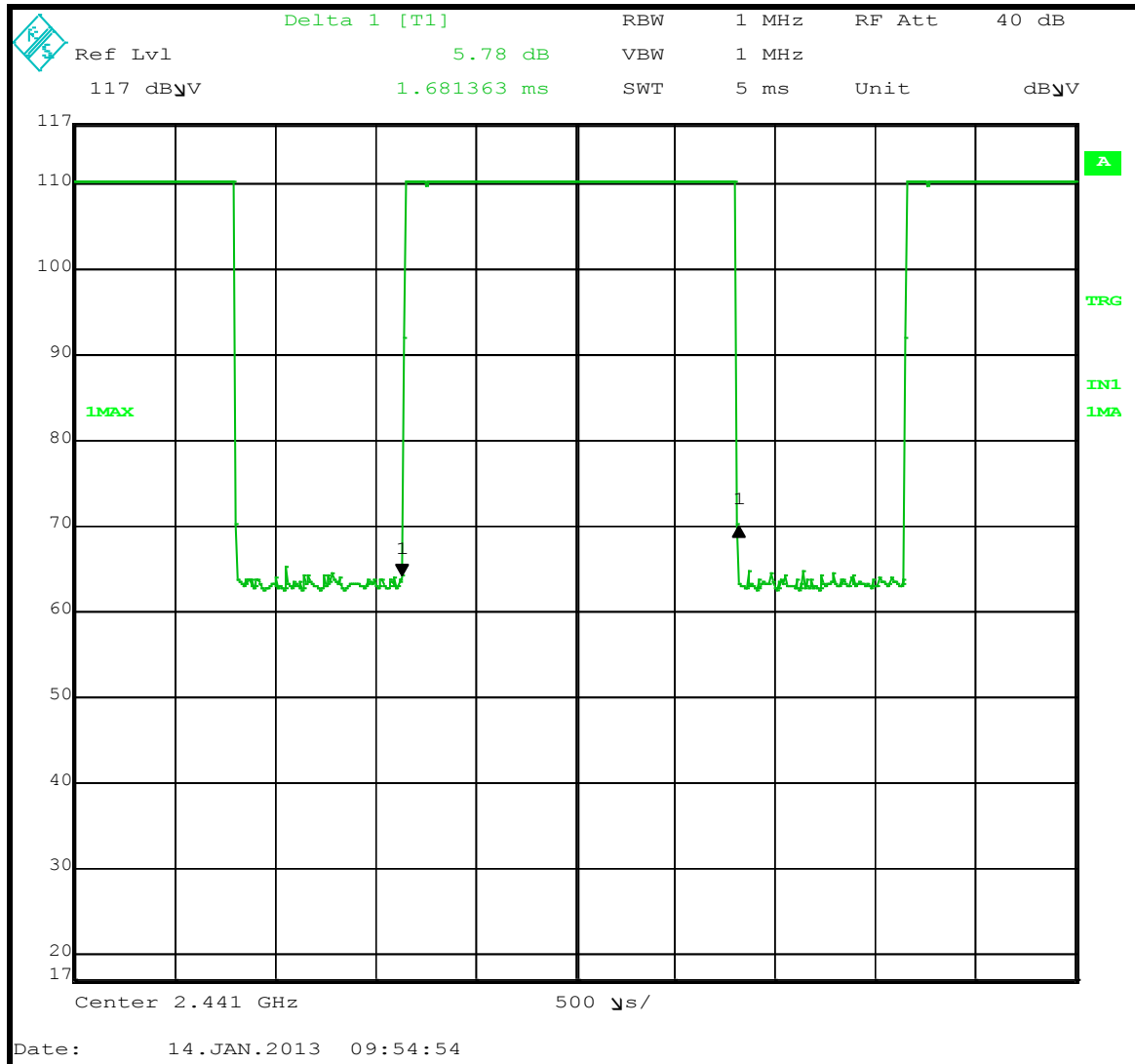
Wireless Transceiver Test Report



FCC ID: A94BA1 IC: 3232A-BA1

Certificate # 1514.1

Representative plot DH3 with maximum payload size
Channel frequency 2441 MHz
Measured TX pulse width is 1.681 mS



Without written permission of laboratory, this report shall not be reproduced except in full.



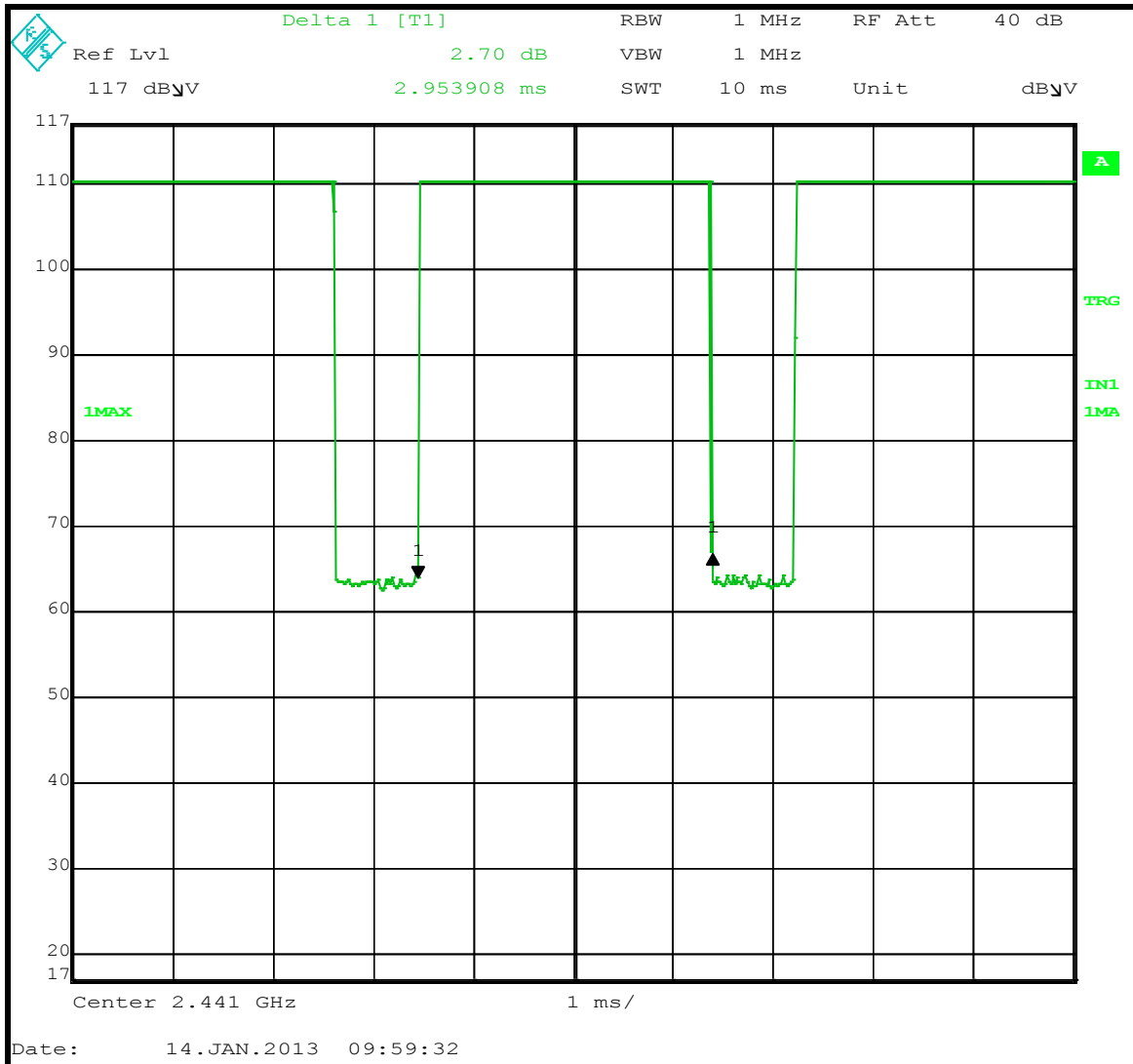
Wireless Transceiver Test Report



FCC ID: A94BA1 IC: 3232A-BA1

Certificate # 1514.1

Representative plot DH5 with maximum payload size
Channel frequency 2441 MHz
Measured TX pulse width is 2.954 mS



Without written permission of laboratory, this report shall not be reproduced except in full.



Wireless Transceiver Test Report

FCC ID: A94BA1 IC: 3232A-BA1



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	4/4/2012	4/4/2013

6.5.5. Test information

Date of test:	12/4/2012	Test location:	Transmitter Test Bench
Serial number:	SN214	Tested by:	B. Cerqua
Test Conclusion:	Pass		

Without written permission of laboratory, this report shall not be reproduced except in full.



Wireless Transceiver Test Report

FCC ID: A94BA1 IC: 3232A-BA1



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 test setup is described section 6.3.2

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.

Without written permission of laboratory, this report shall not be reproduced except in full.



Wireless Transceiver Test Report

FCC ID: A94BA1 IC: 3232A-BA1



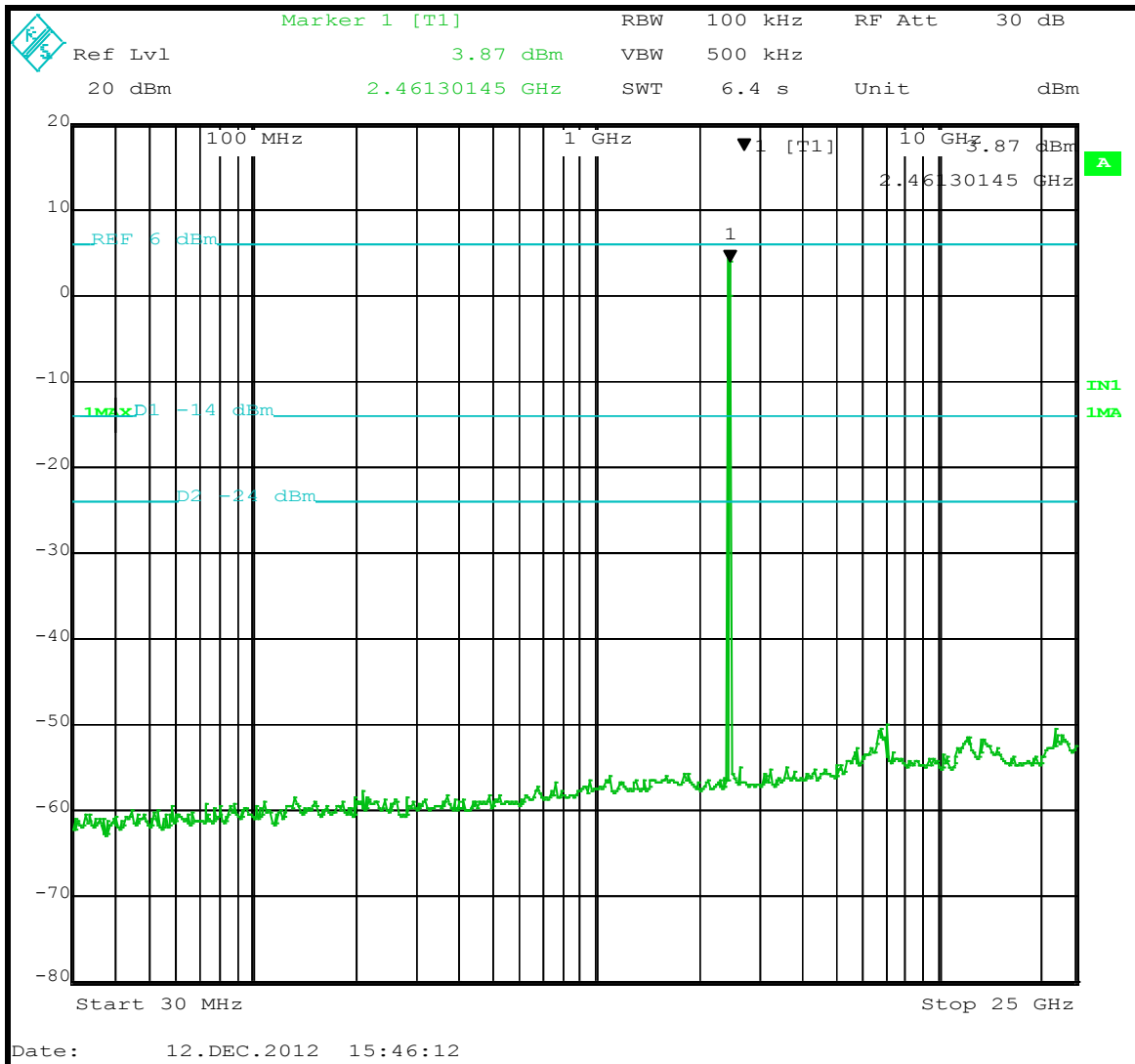
Certificate # 1514.1

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)

Hopping all channels, Basic Data Rate, DH5
Maximum in band peak measured 6 dBm



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

Without written permission of laboratory, this report shall not be reproduced except in full.



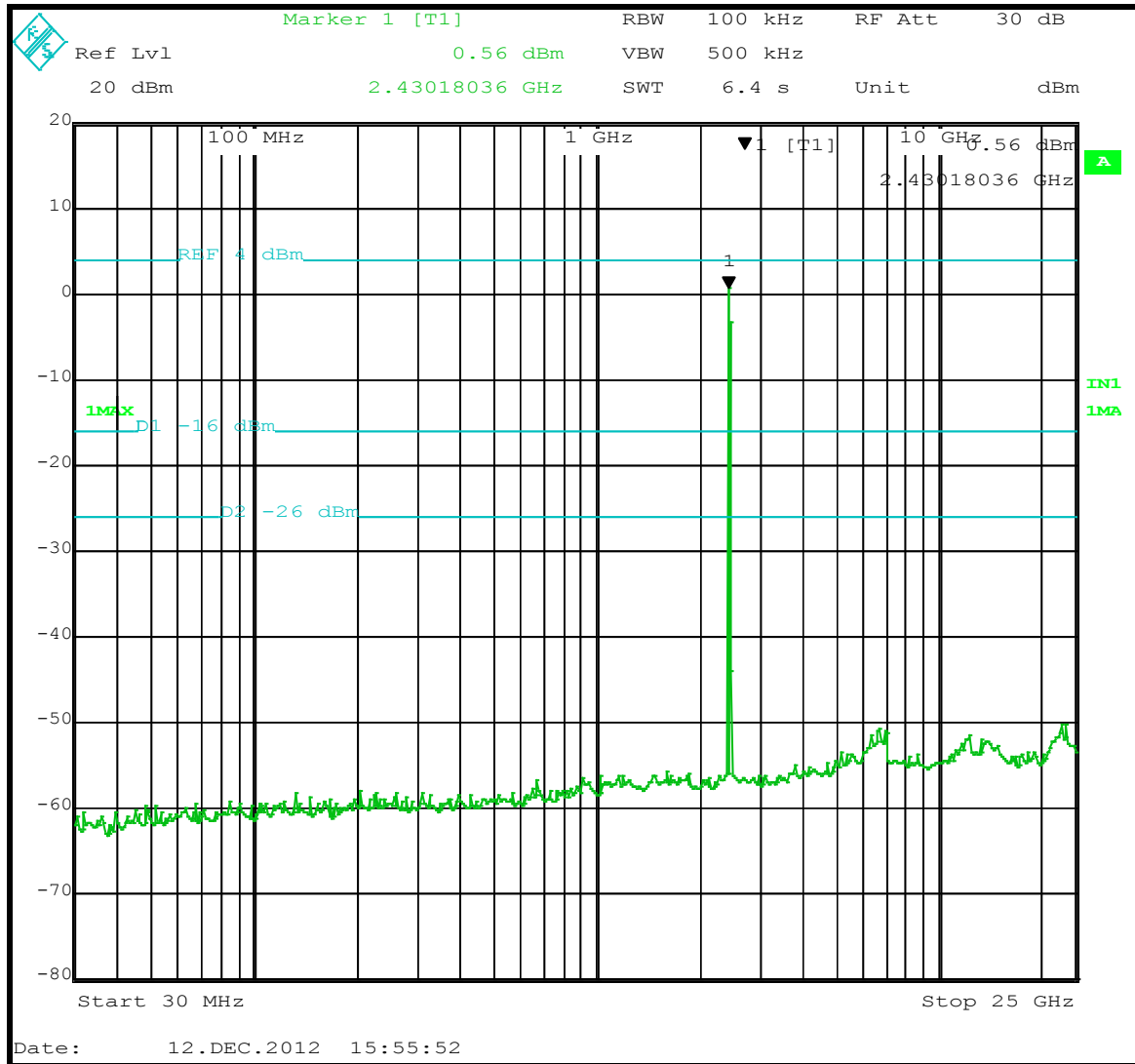
Wireless Transceiver Test Report

FCC ID: A94BA1 IC: 3232A-BA1



Certificate # 1514.1

Hopping all channels, Enhanced Data Rate, 3-DH5
Maximum in band peak measured 4 dBm



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

Without written permission of laboratory, this report shall not be reproduced except in full.



Wireless Transceiver Test Report

FCC ID: A94BA1 IC: 3232A-BA1



Certificate # 1514.1

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

6.6.5. Test information

Date of test:	12/4/2012	Test Location:	Transmitter Test Bench
EUT serial:	SN214	Tested by:	B. Cerqua
Test Conclusion:	Pass		

Without written permission of laboratory, this report shall not be reproduced except in full.



Wireless Transceiver Test Report

FCC ID: A94BA1 IC: 3232A-BA1



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. 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 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

2nd Harmonic

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)
4804.000	41.80	47.60	54.0	74.0	12.2	26.4	41	V	1.0
4882.000	41.70	47.20	54.0	74.0	12.3	26.8	26	V	1.1
4960.000	39.30	45.50	54.0	74.0	14.7	28.5	34	V	1.0

3rd Harmonic

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)
7206.000	32.70	44.00	54.0	74.0	21.3	30.0	0	H	1.0
7323.000	32.00	43.80	54.0	74.0	22.0	30.2	0	H	1.1
7440.000	32.90	44.80	54.0	74.0	21.1	29.2	0	H	1.0

Without written permission of laboratory, this report shall not be reproduced except in full.



Wireless Transceiver Test Report

FCC ID: A94BA1 IC: 3232A-BA1



Certificate # 1514.1

4th – 7th harmonics

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)
9764.000	33.40	47.40	54.0	74.0	20.6	26.6	359	H	1.0
12205.000	37.50	50.40	54.0	74.0	16.5	23.6	360	H	1.0
14646.000	39.30	52.80	54.0	74.0	14.7	21.2	360	H	1.0
17087.000	41.00	54.30	54.0	74.0	13.0	19.7	360	H	1.0

At the 8th 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.

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	9/20/2012	9/20/2013
40 GHz pre-amp	MITEQ	JS4018004000-30-8P-A1	TN1757	6/14/2012	6/14/2013
Cable	Rhode & Schwarz	HFE160D	TN1692	3/2/2012	3/2/2013

6.7.5. Test information

Date of test:	12/14/2012	Test Location:	Maxwell House
EUT serial:	213067	Tested by:	B. Cerqua
Test Conclusion:	Pass		

Without written permission of laboratory, this report shall not be reproduced except in full.



Wireless Transceiver Test Report

FCC ID: A94BA1 IC: 3232A-BA1



Certificate # 1514.1

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, 54dB μ V/m (average) or 74dB μ 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.

6.8.3. 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 6.8.4

Without written permission of laboratory, this report shall not be reproduced except in full.



Wireless Transceiver Test Report

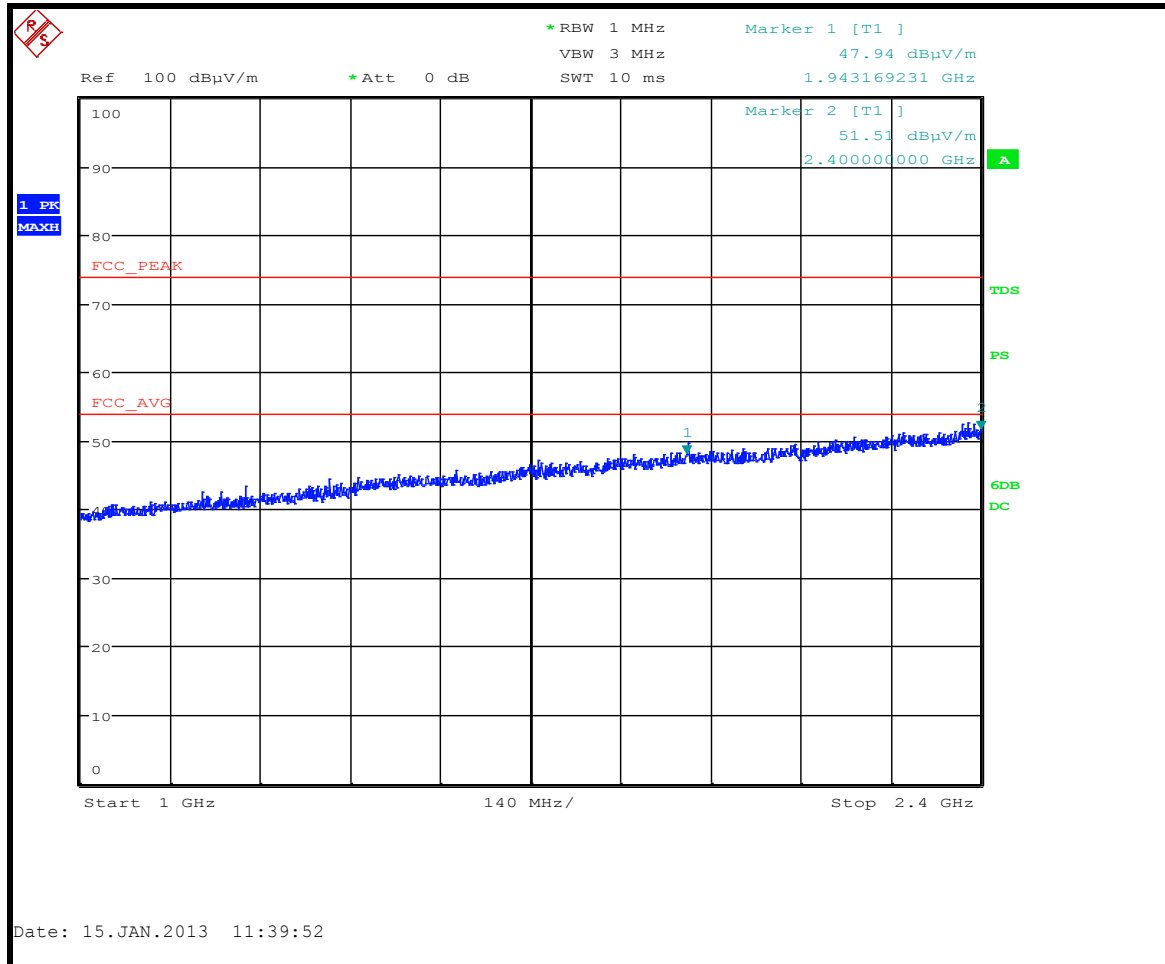
FCC ID: A94BA1 IC: 3232A-BA1



Certificate # 1514.1

Radiated Emissions 1 GHz to 2.4 GHz

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



Max peak hold emissions are more than 10 dB below the peak limit.

Without written permission of laboratory, this report shall not be reproduced except in full.



Wireless Transceiver Test Report

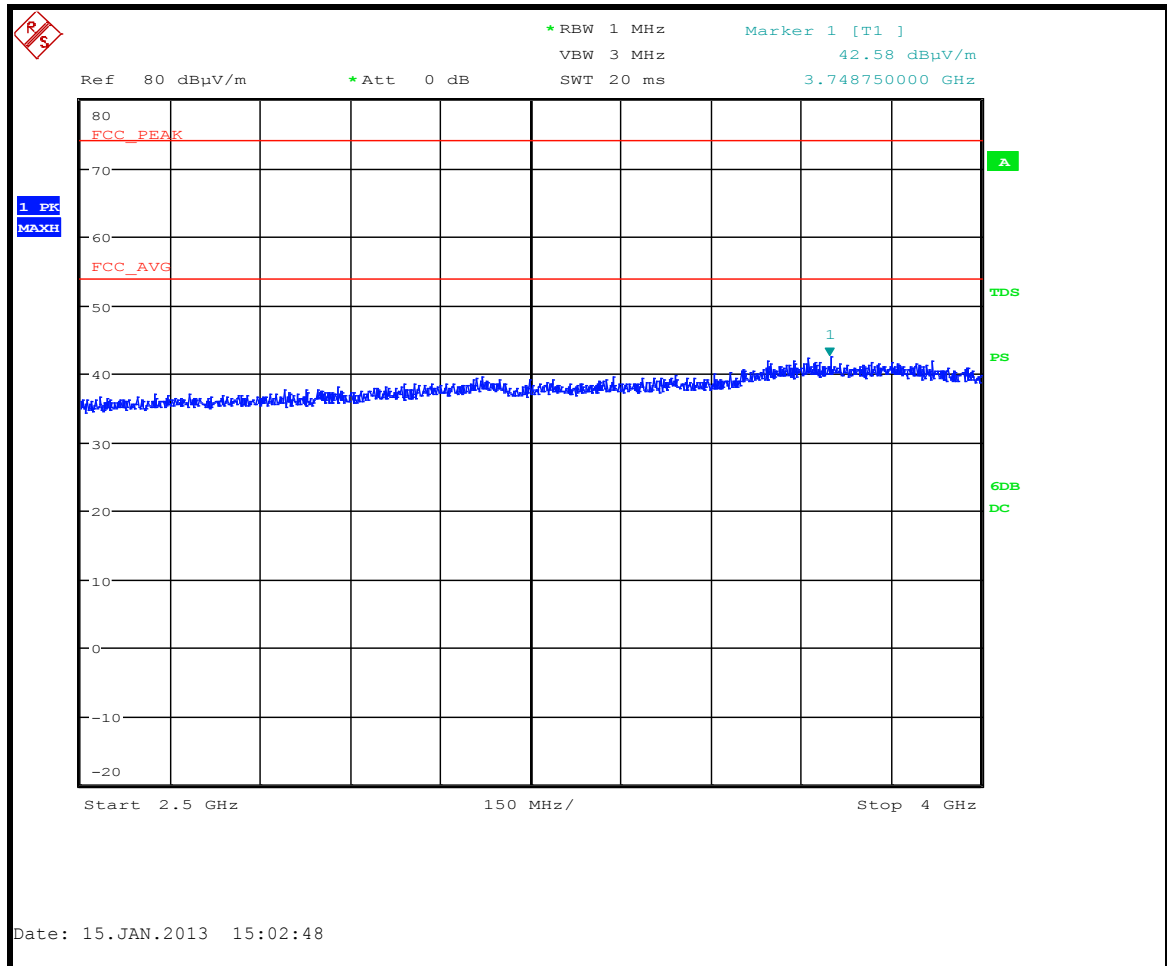
FCC ID: A94BA1 IC: 3232A-BA1



Certificate # 1514.1

Radiated Emissions 2.5 – 4.0 GHz

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



Max peak hold emissions are more than 10 dB below the peak limit.

Without written permission of laboratory, this report shall not be reproduced except in full.



Wireless Transceiver Test Report

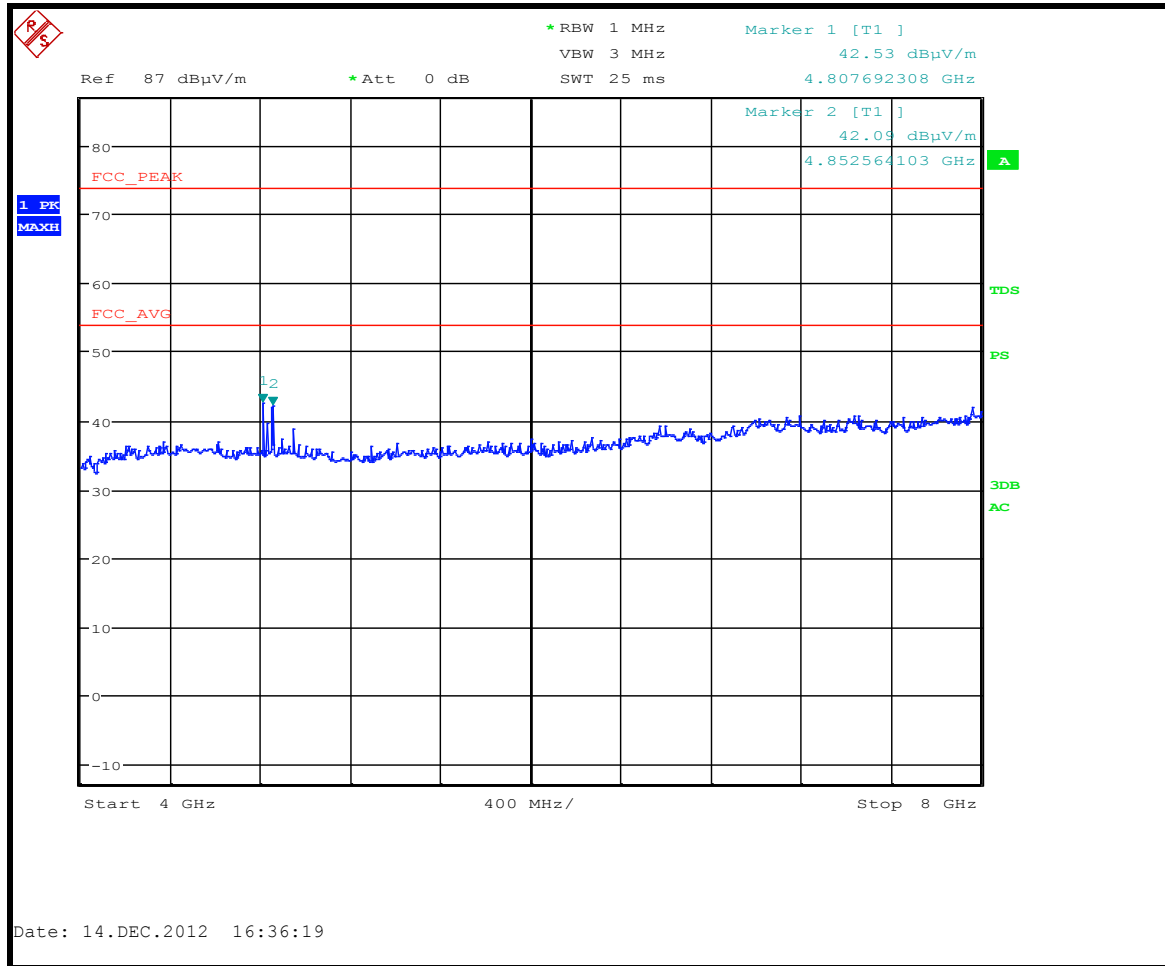
FCC ID: A94BA1 IC: 3232A-BA1



Certificate # 1514.1

Radiated emissions 4 GHz to 8 GHz,

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



Note that the emissions from 4804 – 4960 MHz are covered in this report in section 6.7.

Without written permission of laboratory, this report shall not be reproduced except in full.



Wireless Transceiver Test Report

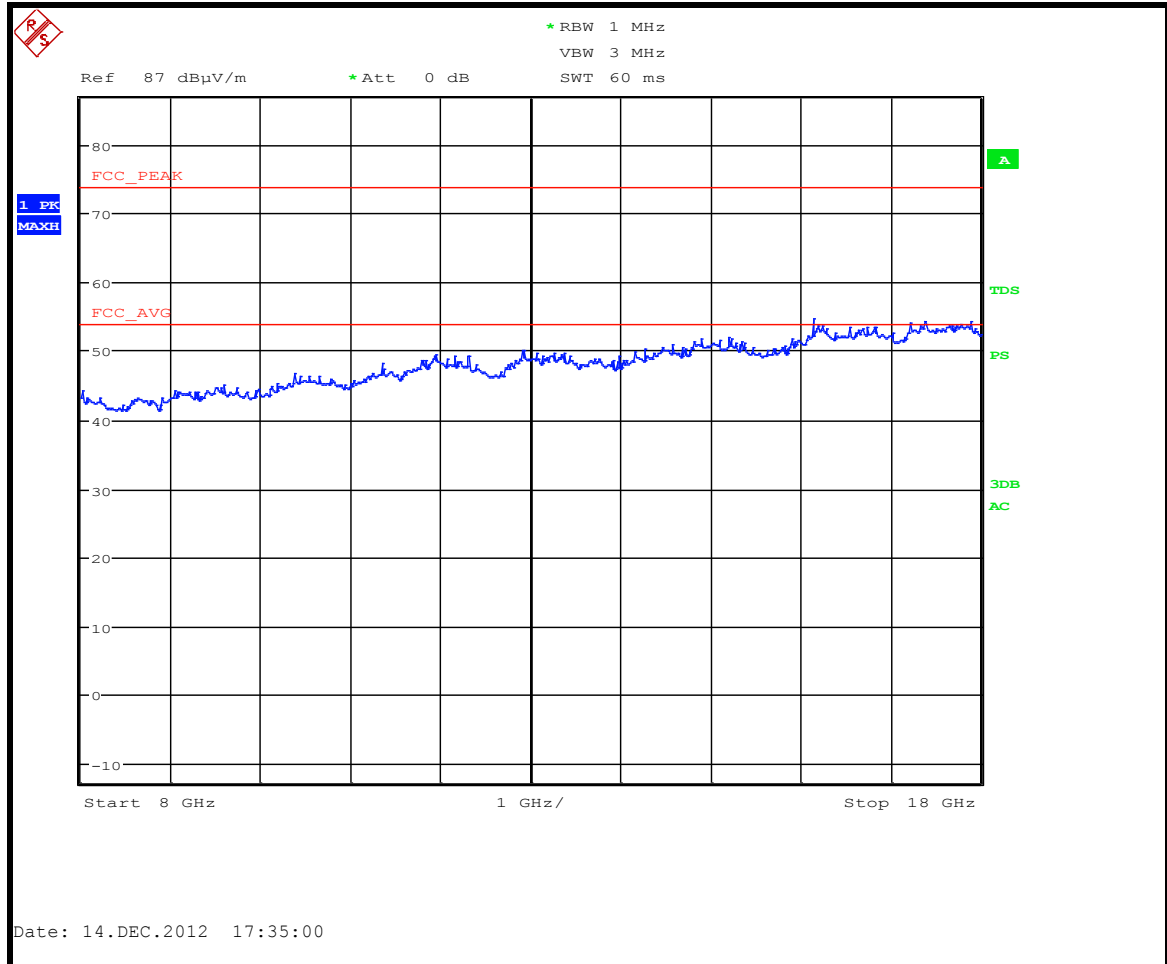
FCC ID: A94BA1 IC: 3232A-BA1



Certificate # 1514.1

Radiated emissions 8 GHz to 18 GHz,

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



Max peak hold emissions are more than 10 dB below the peak limit.

Without written permission of laboratory, this report shall not be reproduced except in full.



Wireless Transceiver Test Report

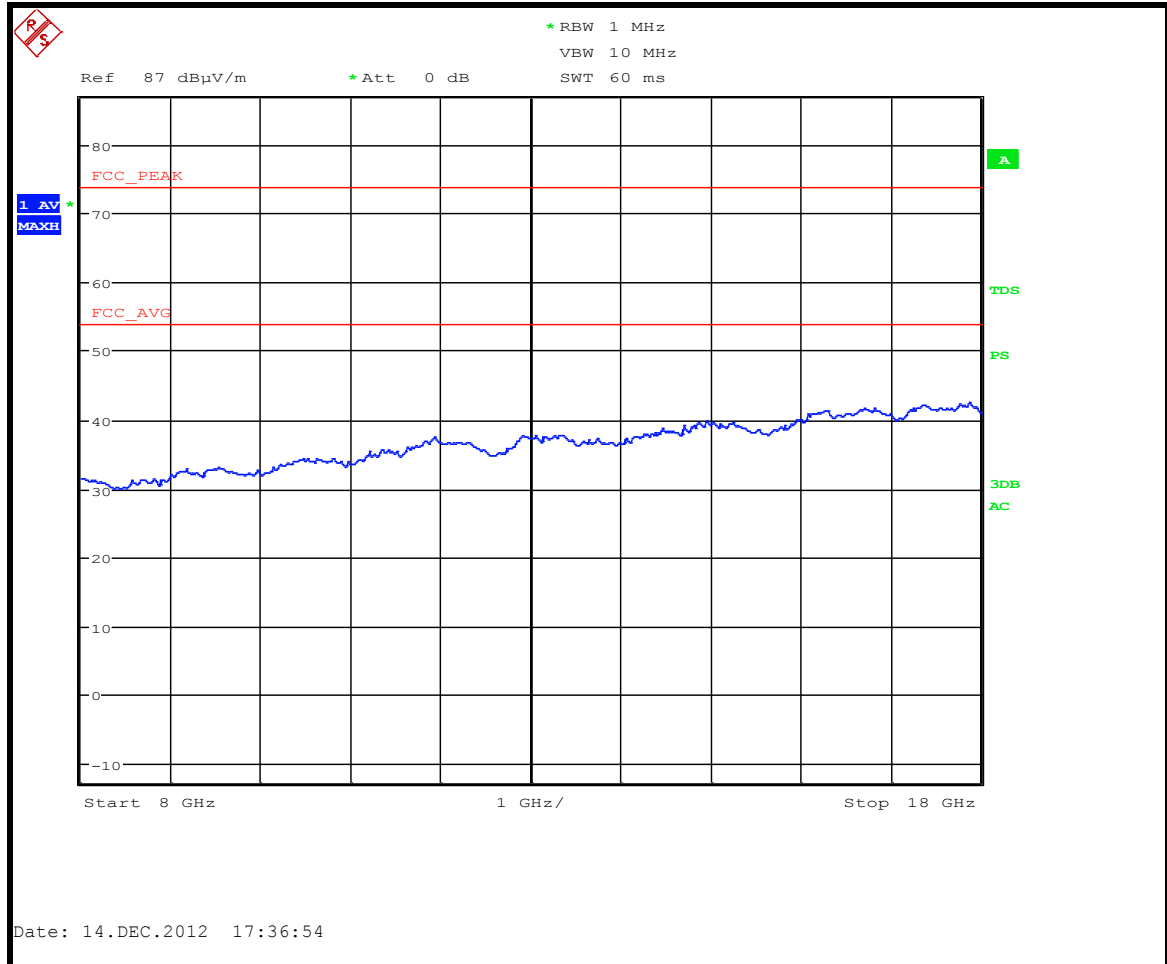
FCC ID: A94BA1 IC: 3232A-BA1



Certificate # 1514.1

Radiated emissions 8 GHz to 18 GHz.

Max-Hold Average Pre-scan, MAX volume pink noise via Bluetooth



Max peak hold average emissions are more than 10 dB below the average limit.

Without written permission of laboratory, this report shall not be reproduced except in full.



Wireless Transceiver Test Report

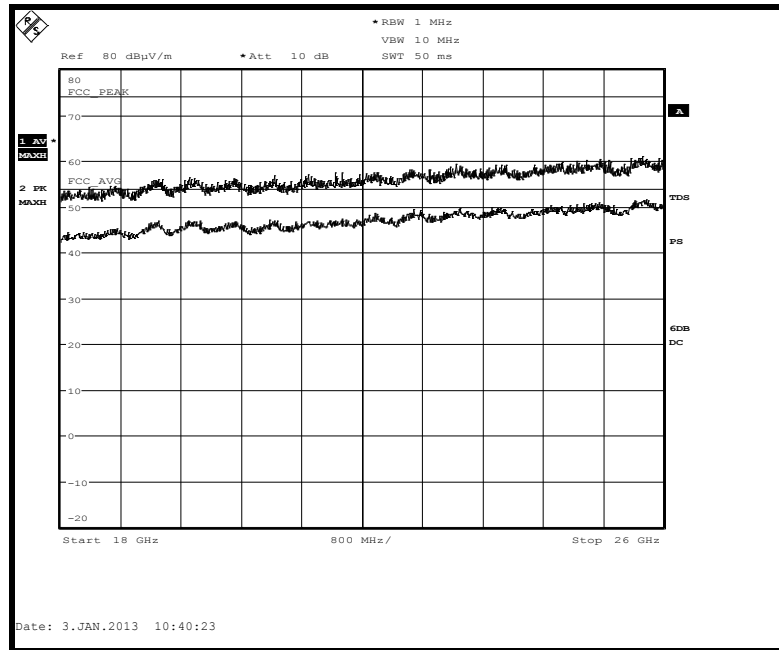
FCC ID: A94BA1 IC: 3232A-BA1



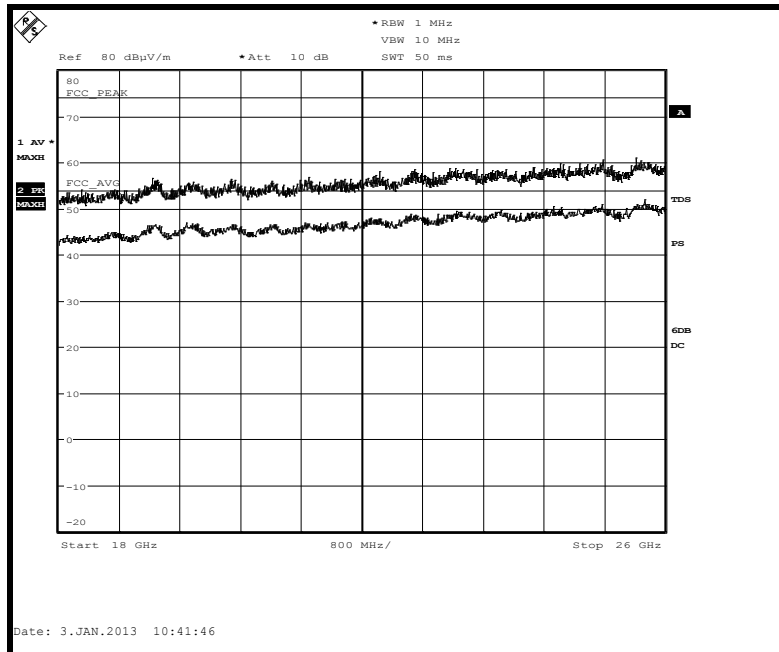
Certificate # 1514.1

Radiated Emission, 18 to 26 GHz
Normal operation, hopping on all channels.

Distance 3 meters
Horn antenna vertically polarized.



Horn antenna horizontally polarized



Without written permission of laboratory, this report shall not be reproduced except in full.



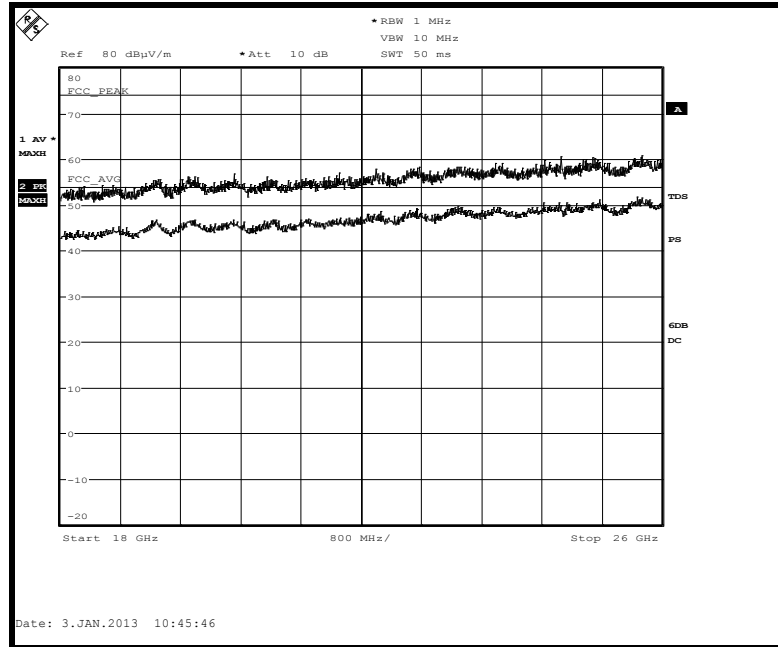
Wireless Transceiver Test Report

FCC ID: A94BA1 IC: 3232A-BA1

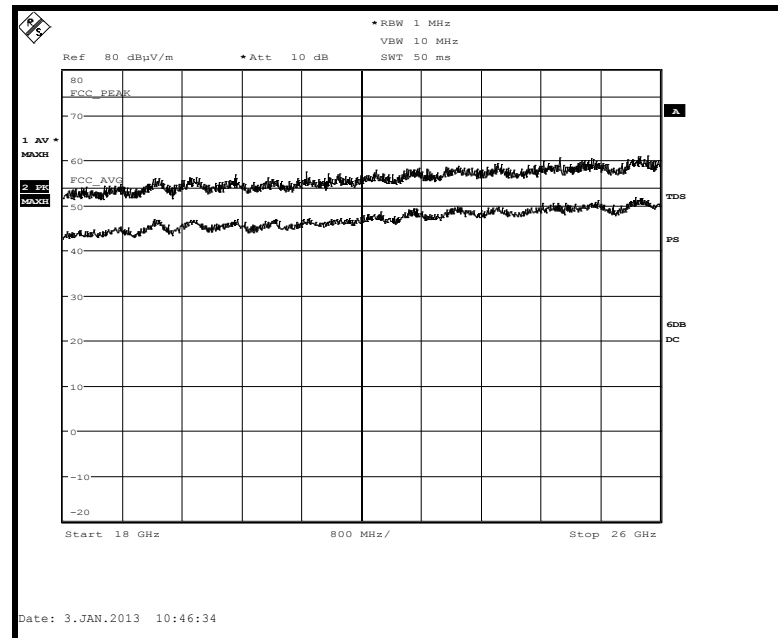


Certificate # 1514.1

Measurement distance reduced to 12 inches
Horn antenna vertically polarized.



Horn antenna horizontally polarized



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

Without written permission of laboratory, this report shall not be reproduced except in full.



Wireless Transceiver Test Report

FCC ID: A94BA1 IC: 3232A-BA1



Certificate # 1514.1

6.8.4. Band edge measurements, 15.247 (d)

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

(a) More than 20 dB, RBW = 100 kHz

Band edge measurements summary table, (Marker delta method).

EDGE	RATE	Detector	Peak or Avg Value, RBW=1MHz (dBuV/m)	Delta Inband dB (RBW = 100kHz)	Calculated dB * (RBW = 1MHz)	Limit (dBuV/m)	Margin (dB)
Lower	BR	Peak	101.7	50.5	51.2	74	22.8
Lower	BR	Average	98.9	50.5	48.4	54	5.6
Lower	EDR	Peak	99.4	49.7	49.7	74	24.3
Lower	EDR	Average	93.3	49.7	43.6	54	10.4
Upper	BR	Peak	104.7	61.3	43.4	74	30.6
Upper	BR	Average	101.9	61.3	40.6	54	13.4
Upper	EDR	Peak	103.2	59.9	43.3	74	30.7
Upper	EDR	Average	97.2	59.9	37.3	54	16.7

* Calculated dB = measured (peak of avg) |_{RBW=1 MHz} - (max inband – value at band edge) |_{RBW= 100 kHz}

Without written permission of laboratory, this report shall not be reproduced except in full.



Wireless Transceiver Test Report

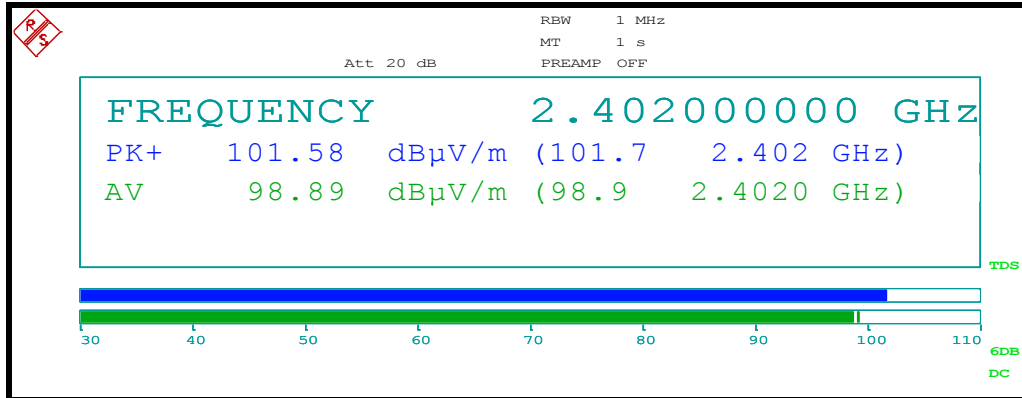
FCC ID: A94BA1 IC: 3232A-BA1



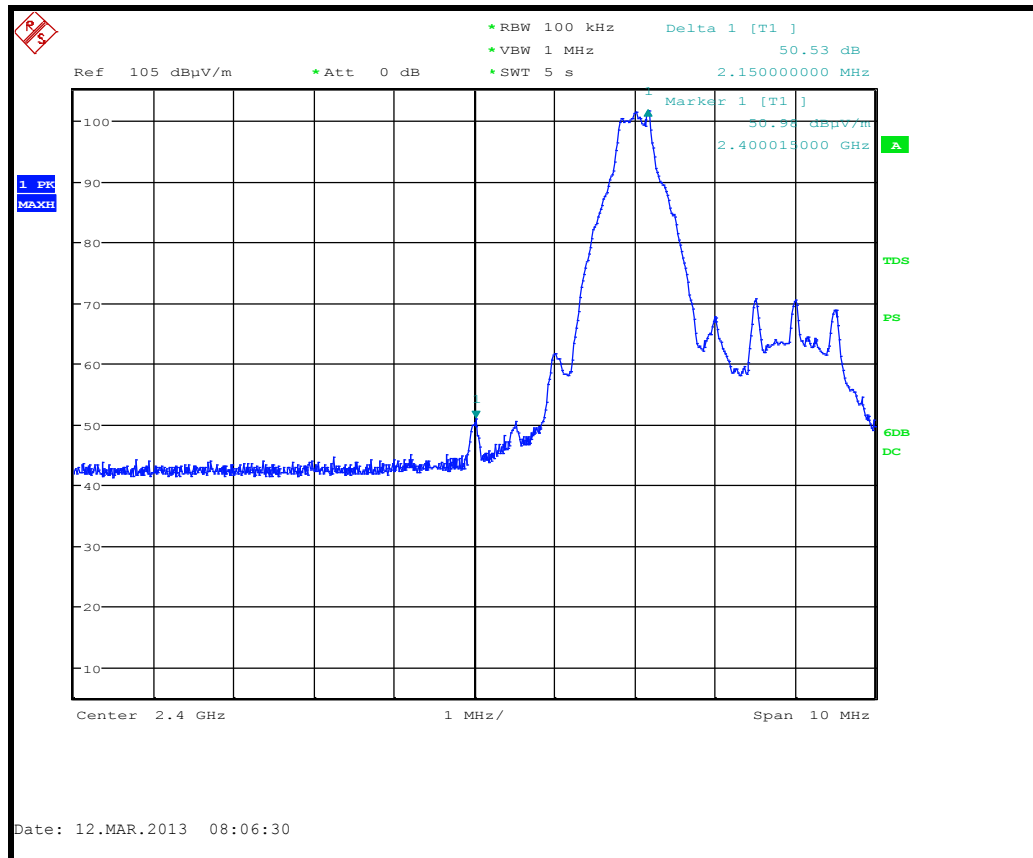
Certificate # 1514.1

Lower Band Edge, (Basic Rate)

Max field strength



Delta 50.5 dB



Without written permission of laboratory, this report shall not be reproduced except in full.



Wireless Transceiver Test Report

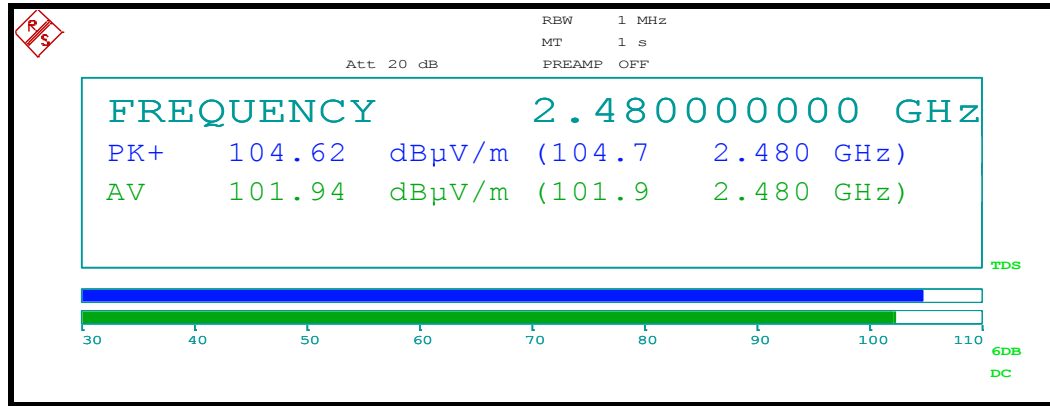


FCC ID: A94BA1 IC: 3232A-BA1

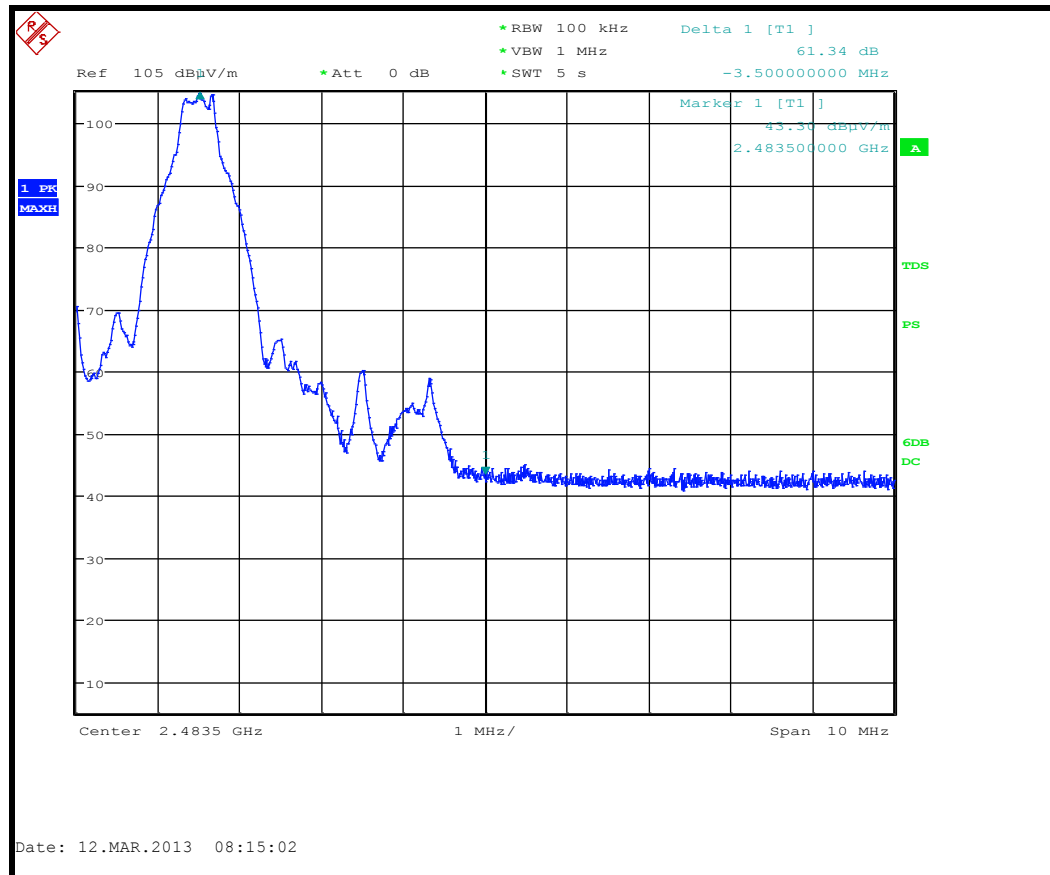
Certificate # 1514.1

Upper band edge, (Basic Rate)

Max Field Strength



Delta 61.3 dB



Without written permission of laboratory, this report shall not be reproduced except in full.



Wireless Transceiver Test Report

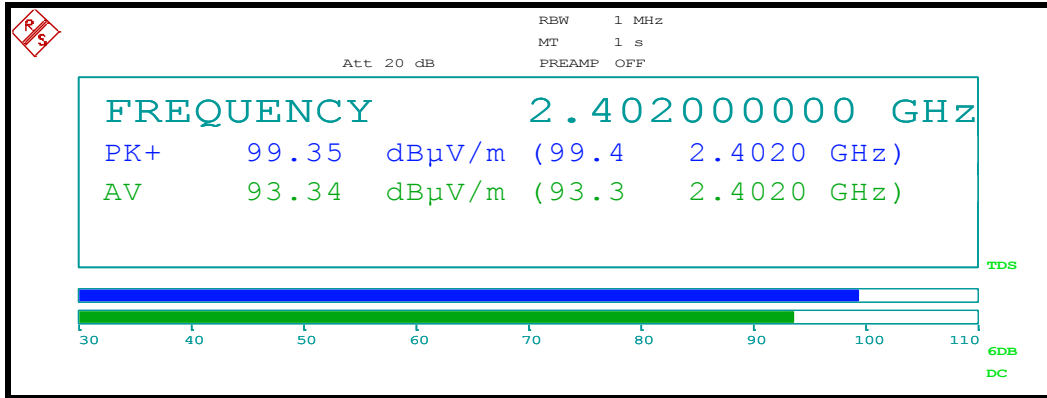
FCC ID: A94BA1 IC: 3232A-BA1



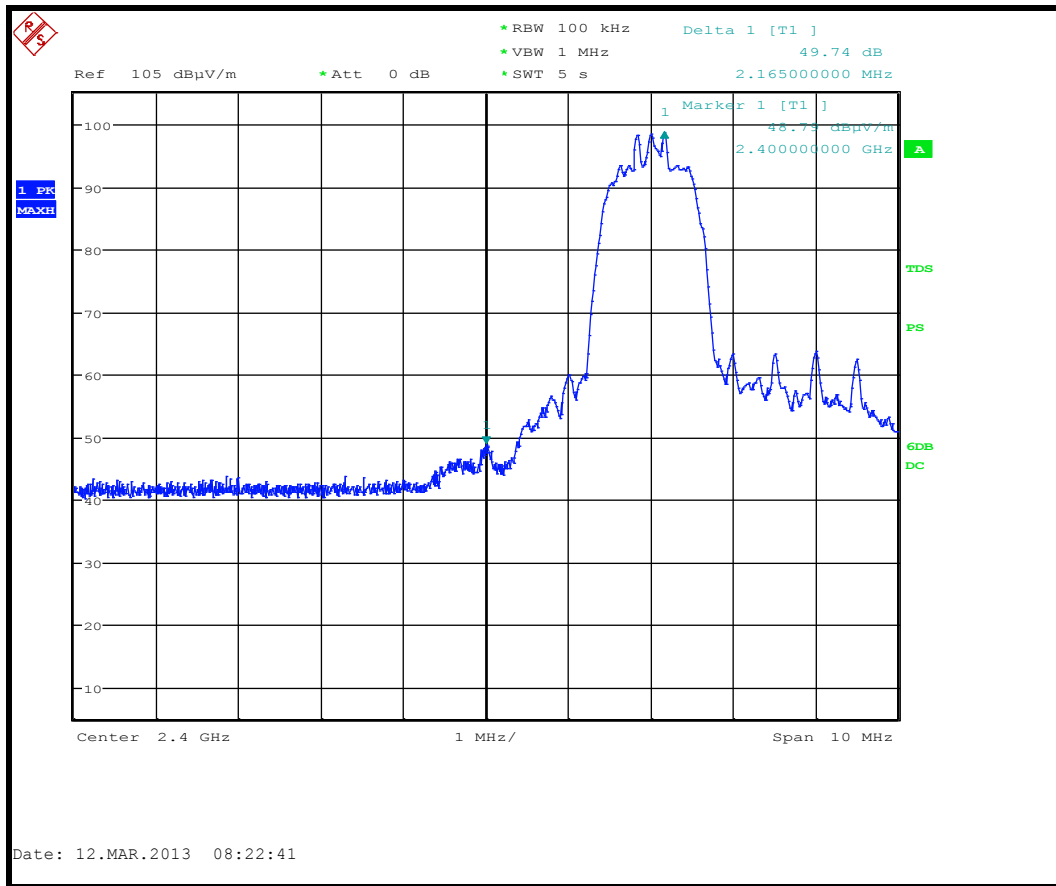
Certificate # 1514.1

Lower band edge (Enhanced Rate)

Max Field Strength



Delta 49.7 dB



Without written permission of laboratory, this report shall not be reproduced except in full.



Wireless Transceiver Test Report

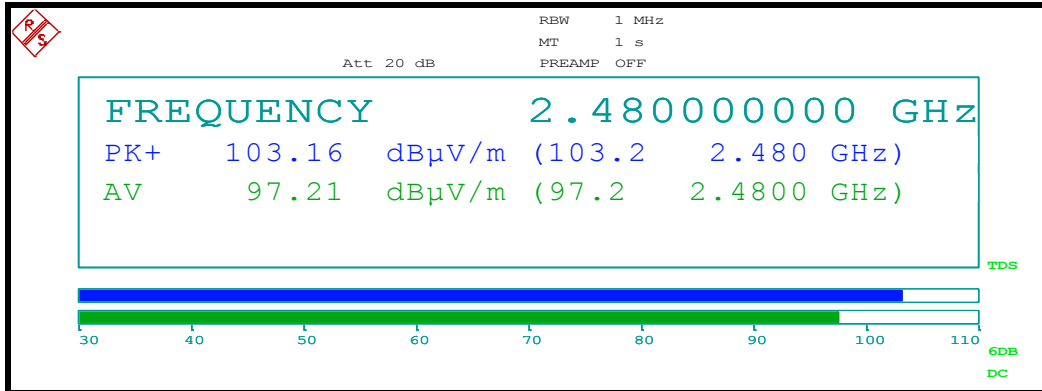
FCC ID: A94BA1 IC: 3232A-BA1



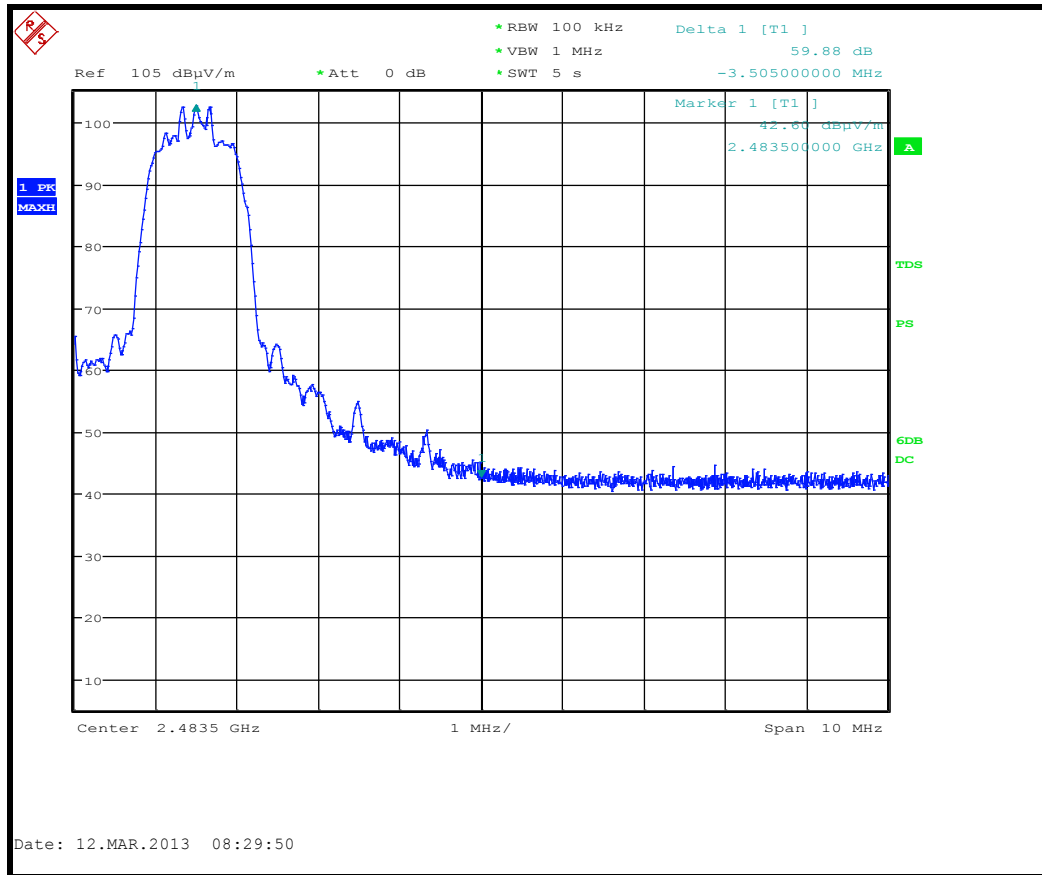
Certificate # 1514.1

Upper band edge (Enhanced Rate)

Max Field Strength



Delta 59.9 dB



Without written permission of laboratory, this report shall not be reproduced except in full.



Wireless Transceiver Test Report

FCC ID: A94BA1 IC: 3232A-BA1



Certificate # 1514.1

6.8.5. 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	Rhode & Schwarz	JB6	TN1541	7/3/2012	7/3/2013
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
Pre-amp	Mini-Circuits	ZX60 3018G+	TN2077	6/15/2012	6/15/2013
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
Maxwell House Radiated Emissions Cable set	Bose Corporation	N/A	TN1445	3/2/2012	3/2/2013
Cable	Rohde & Schwarz	HFE160D	TN1692	3/2/2012	3/2/2013

6.8.6. Test information

Date of test:	1/2/2013 - 3/12/2013	Test Location:	Maxwell House
EUT serial:	SN 213067	Tested by:	B. Cerqua
Test Conclusion:	Pass		

Without written permission of laboratory, this report shall not be reproduced except in full.



Wireless Transceiver Test Report

FCC ID: A94BA1 IC: 3232A-BA1



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 controlled via the USB charging 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 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 25 GHz

(Covering the required 30MHz – 7.5 GHz range) with a 30 kHz RBW.

6.9.3. Test data

RX Frequency (MHz)	Worst case frequency (GHz)	Emission amplitude (dBm)	Margin (dB)
2402	9.626	-71.3	18.3
2441	9.776	-71.5	18.5
2480	9.926	-72.7	19.7

Without written permission of laboratory, this report shall not be reproduced except in full.



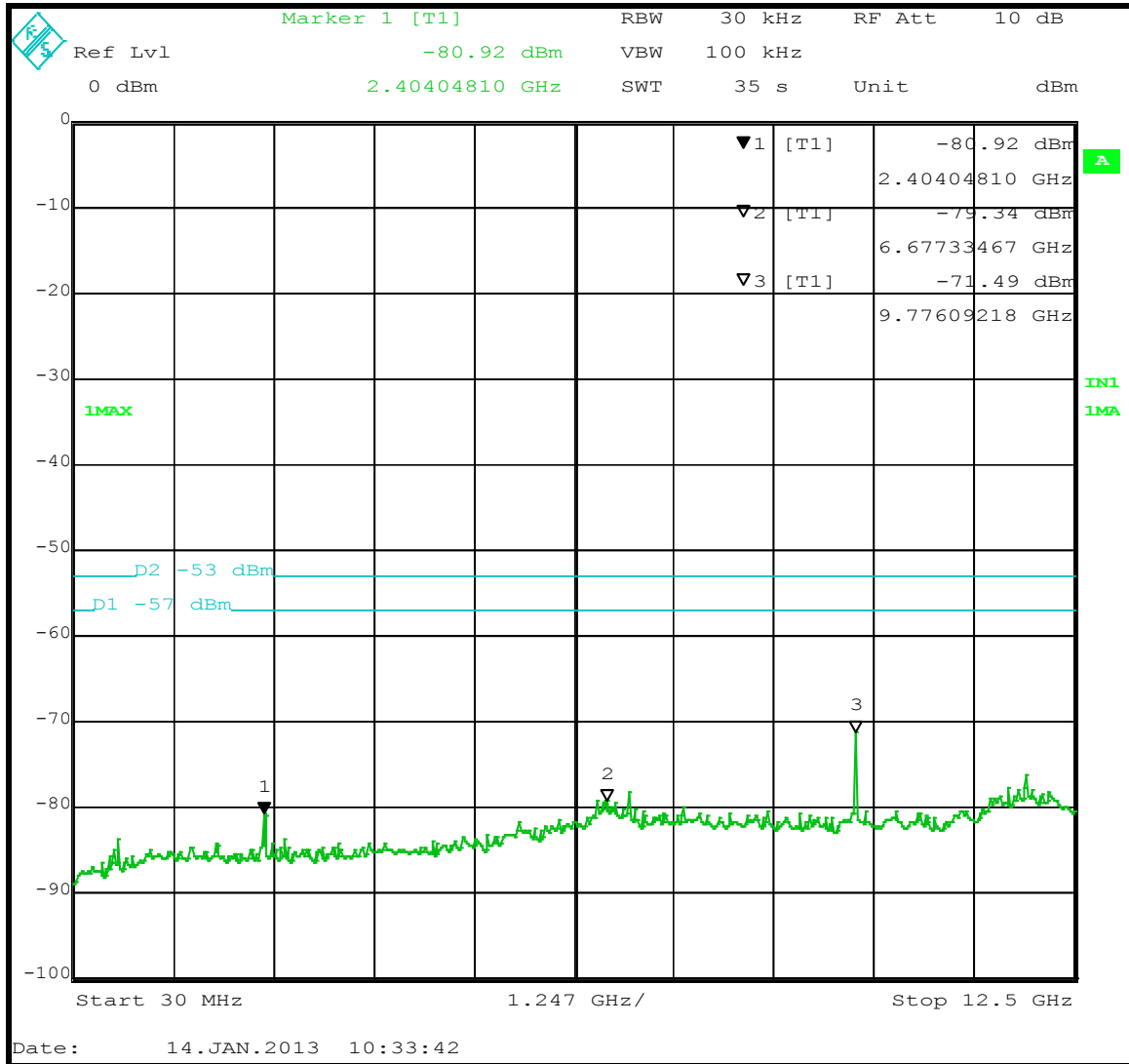
Wireless Transceiver Test Report

FCC ID: A94BA1 IC: 3232A-BA1



Certificate # 1514.1

Representative plot, receiver mode on 2441 GHz



Without written permission of laboratory, this report shall not be reproduced except in full.



Wireless Transceiver Test Report

FCC ID: A94BA1 IC: 3232A-BA1



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	4/4/2012	4/4/2013

6.9.5. Test information

Date of test:	1/14/2013	Test location:	Transmitter Test Bench
EUT serial:	SN 214	Tested by:	B. Cerqua
Test Conclusion:	Pass		

Without written permission of laboratory, this report shall not be reproduced except in full.



Wireless Transceiver Test Report

FCC ID: A94BA1 IC: 3232A-BA1



Certificate # 1514.1

6.10. SAR exemption calculation

Frequency Range: 2402-2480MHz

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

Equation 1:

$[(\text{max. power of channel, including tune-up tolerance, mW})/(\text{min. test separation distance, mm})] * [\sqrt{f(\text{GHz})}]$

Distance between EUT and body (head) is 10mm

Maximum conducted output power measured (dBm) = 7.5 dBm (5.6 mW) (see section 6.3 of this report)

Applying equation 1:

$$(5.6/10) * [\sqrt{f(2.432)}] = 0.87 \leq 3.0$$

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.

Without written permission of laboratory, this report shall not be reproduced except in full.