



# Wireless Transceiver Test Report



FCC ID: A94410633 IC: 3232A-410633

Certificate # 1514.1

**Report number:** EMC. 410633.12.141.1

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

**Product Tested:** Bose® model 410633 wireless speaker.

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

**Report prepared by:** Bryan Cerqua

**Signature:** *Bryan H Cerqua*  
June 11, 2012

**Report reviewed by:** Brent DeWitt

**Signature:** *Brent DeWitt*  
June 11, 2012

**Report issue date:** June 11, 2012

**Changes from  
previous revision:** Original version

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## 1. Report Summary

1.1 Product Bose® model 410633 wireless speaker

1.2 Client Bose Corporation  
The Mountain, Framingham MA 01701

1.3 Applicable Standards **FCC part 15.B and C**  
**RSS-210 issue 8**  
**RSS-Gen issue 3**  
**ICES-003 issue 4**

Test Results: Pass ☒ Fail ☐

1.4 Test Laboratory Bose DCE laboratories  
1 New York Ave  
Framingham, 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® model 410633 wireless speaker operating under the IEEE 802.11b/g standard. Audio can be sourced using an existing 802.11b/g network or through the rear mounted 3.5mm stereo AUX port on the EUT. The system supports an infrared wireless remote control as well as side mounted capacitance touch volume up and down controls. The system can be operated with its supplied 20VDC power supply or by optional 16.8V lithium-ion battery pack. The battery is charged when connected to the rear of the EUT when the power supply is used.

The 802.11 radio integrated circuit used on the RF module within the EUT has one RF output that is multiplexed between two internal antennas that are not accessible by the end user. Only one antenna is actively transmitting at a given time.

Antenna (1) is a coaxial dipole antenna. The dipole is located on the left side wall of the EUT. Antenna (2) is formed sheet metal PIFA type antenna mounted to a small PCB near the top right inside corner.

**Operating channels and frequencies**

Channel	Frequency	Channel	Frequency	Channel	Frequency
1	2412	5	2432	9	2452
2	2417	6	2437	10	2457
3	2422	7	2442	11	2462
4	2427	8	2447		

**Rates and Modulation**

DSSS	Modulation	OFMD	Modulation
1 Mbps	DBPSK	6, 9 Mbps	BPSK
2 Mbps	DQPSK	12, 18 Mbps	QPSK
5.5 Mbps	DQPSK	24, 36 Mbps	QAM16
11 Mbps	DQPSK	48, 54 Mbps	QAM64

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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 antennas are 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 < 1GHz	Complies Section 6.2
15.247(d)		4.9	Radiated emissions > 1 GHz, Transmitter harmonics.	Complies Section 6.3
15.247 (b)(3)	A8.4 (2)	4.8	Maximum peak conducted output power	Complies Section 6.4
15.247 (a)(2)		4.6.2	6 dB Bandwidth, 99% occupied bandwidth	Complies Section 6.5
15.247(e)			Power spectral density	Complies Section 6.6
15.247(d)	A8.5	4.9 7.2.5	Conducted spurious emissions	Complies Section 6.7
		4.10, 6.2	Receiver Spurious emissions	Complies Section 6.8
OET65	Canada Health and Safety code 6		MPE calculation	Complies Section 6.9

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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 EUT was tested with the battery attached and being charged. Two configurations were tested, one using the AUX audio input on the rear of the EUT and the other using a LinkSys E3200 router located in range of the EUT with an iPod sourcing audio via Airplay. For both test cases the audio sourced to the EUT is IEC pink noise with a 6 dB crest factor. The EUT was operated throughout its volume range. Worst case radiated and conducted emissions were found to be using the AUX audio input with the EUT operating at a maximum volume.

The EUT used for unwanted emissions was fully assembled and received in good condition.

For intentional radiator testing, the channel frequency, modulation mode and data rate are programmed using a proprietary interface and test commands. The RF power settings are set in firmware and are not adjustable by the end user. The EUT is partially assembled to allow access to the antenna port UFL connectors located on the RF module sub assembly.

Worst case emissions are with the following settings.

DSSS 802.11b with data rate of 1 MBPS

OFDM 802.11g with data rate of 6 MBPS

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## 6. Detailed Test Results

### 6.1. AC power line conducted emissions

#### 6.1.1. Requirements

FCC rules part 15.207, 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. Worst case emissions observed with audio applied to the AUX input with the optional battery attached and charging with the LISN monitoring the neutral side. Worst case emissions are with the USB connector shell grounded to earth and with audio settings at maximum volume with IEC pink noise for the audio source supplied by an iPod.

#### 6.1.3. Test data

Worst case summary: 5.1 dB AVG margin at 470.7 kHz

Neutral side of LISN showed worst case emissions

Frequency MHz	MEASURED		LIMIT		MARGIN	
	dBμV QP	dBμV AVG	dBμV QP	dBμV AVG	dB QP	dB AVG
0.1631	49.20	35.70	65.3	55.3	16.1	19.6
0.4707	46.80	41.40	56.5	46.5	9.7	5.1
0.5450	43.60	39.00	56.0	46.0	12.4	7.0
1.2310	42.80	38.10	56.0	46.0	13.2	7.9
2.2910	43.00	38.40	56.0	46.0	13.0	7.6
5.4140	48.20	41.60	60.0	50.0	11.8	8.4
11.8100	45.40	38.80	60.0	50.0	14.6	11.2

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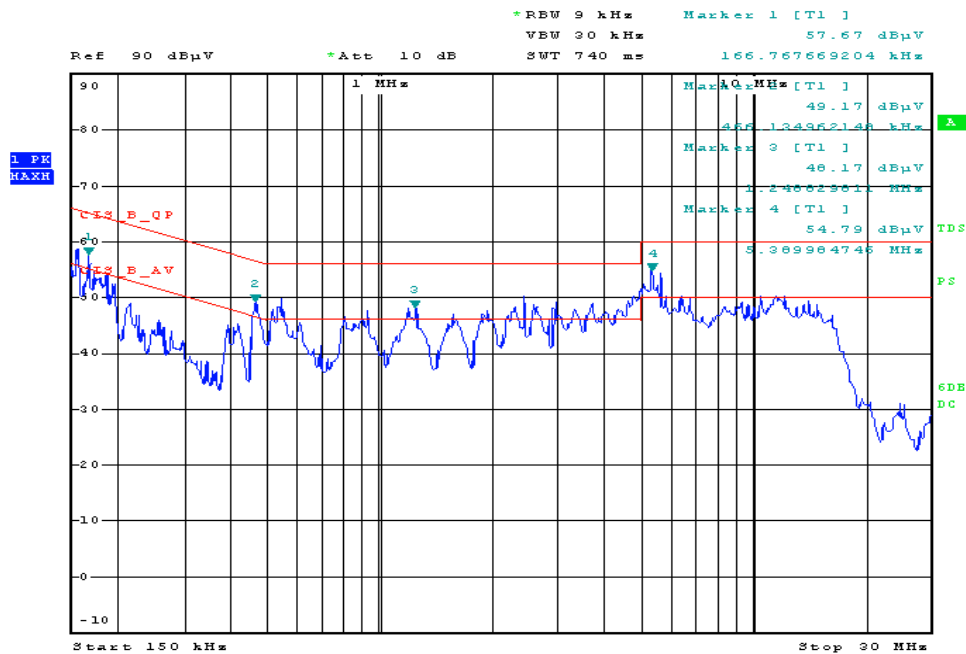


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LISN N:



Date: 22.APR.2012 09:29:51

## 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

Date of test:	4/22/2012	Test location :	DCE lab – Henry room
EUT serial:	SN 161AE	Tested by:	B. Cerqua
Test Conclusion:	Pass		

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## 6.2. Radiated emissions below 1 GHz

### 6.2.1. Requirements

FCC rules part 15.109, 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 tested in the normal upright position since this is the only valid position for this product. EUT was tested using a LinkSys E3200 router nearby in Airplay mode and also with audio sourced from iPod into AUX input on the rear of the EUT. Worst case emissions observed when using the AUX input playing IEC pink noise sourced from an iPod at maximum volume.

#### Description of cables:

Shielded mini USB to USB cable (supplied with EUT, used for initial setup only)

Unshielded 3.5 mm to 3.5 mm male audio cable

Unshielded DC power cable from 20VDC power supply (supplied with EUT).

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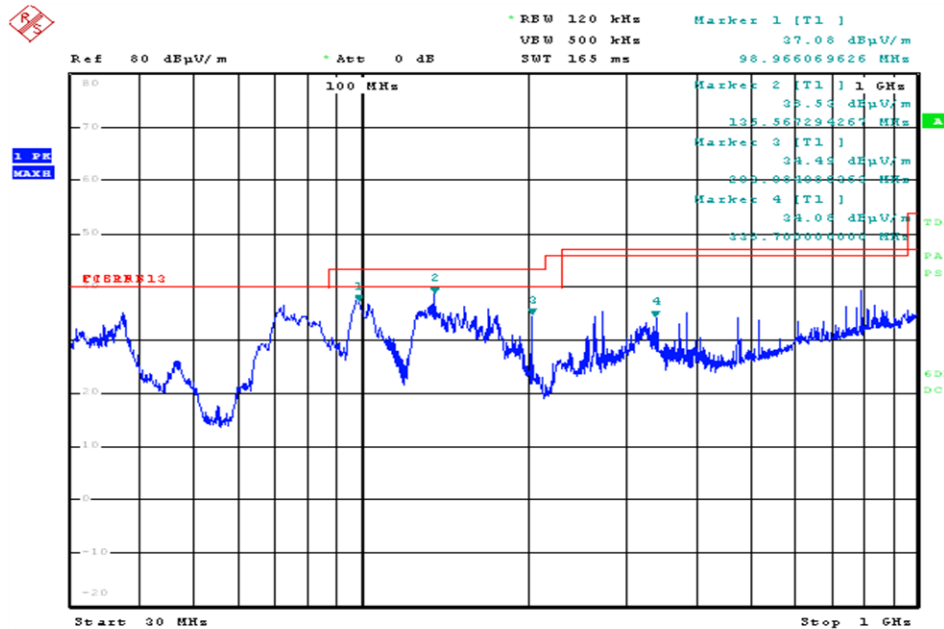
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## 6.2.3. Test data

Max-Hold Peak Pre-scan, 30MHz – 1GHz

Vertical and horizontal antenna polarizations combined.



Date: 20.APR.2012 10:17:17

Worst case 7.9 dB QP margin at 98.2 MHz with battery attached and charging.

Emission Frequency (MHz)	Measured Amplitude (dBμV/m) QP/AVG*	Measured Amplitude (dBμV/m) Peak	FCC 15B			Battery
			Limit (dBμV/m) QP/AVG*	Limit (dBμV/m) Peak	Margin (dB) QP/AVG*	
97.770	33.60	38.90	43.5	N/A	9.9	Removed
132.300	31.90	36.60	43.5	N/A	11.6	Removed
169.400	32.00	36.80	43.5	N/A	11.5	Removed
203.200	31.80	34.80	43.5	N/A	11.7	Removed
262.500	36.00	39.50	46.0	N/A	10.0	Removed
271.000	31.60	34.40	46.0	N/A	14.4	Removed
98.200	35.60	39.30	43.5	N/A	7.9	Attached
135.500	35.20	40.10	43.5	N/A	8.3	Attached
203.200	33.60	35.40	43.5	N/A	9.9	Attached
338.700	32.20	36.70	46.0	N/A	13.8	Attached
142.900	31.60	35.70	43.5	N/A	11.9	Attached

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## 6.2.4. Test Equipment

Equipment Type	Manufacturer	Model	Serial or other ID	Service	
				last	due
Antenna	Sunol Sciences	JB6	TN1541	6/5/2011	6/15/2012
EMI Test Receiver	Rohde & Schwarz	ESU40	TN1663	4/6/2012	4/6/2013
Emissions Cable Set	Bose Corporation	N/A	TN1445	3/2/2012	3/2/2013

## 6.2.5. Test information

<b>Date of test:</b>	4/20/2012	<b>Test location :</b>	DCE - Maxwell House
<b>EUT serial:</b>	SN161AE	<b>Tested by:</b>	B. Cerqua
<b>Test Conclusion:</b>	Pass		

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## 6.3. Radiated emissions above 1 GHz

### 6.3.1. Requirements

FCC part 15.205(a), 15.209, 15.247(d), RSS210 A8.5

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

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

### 6.3.2. Test Setup

The EUT was placed on an 80 cm high turn table and configured to transmit with modulation active on a given channel and antenna. The EUT is placed in the normal upright position while adjusting the turn table position and measurement antenna height through a range of 1 to 4 meters to capture the highest emissions.

#### Above 1 GHz:

Horns with suitable pre-amps mounted directly on them are used for the measurement of the harmonics. The EUT is operated on channels 1, 6 and 11 for the low, middle and high end of the frequency range at the defined limit distance of 3 meters. Above 18GHz the measurement distance is reduced to make sure the instrumentation noise floor is 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.

Above 18 GHz account is taken of the beam width of the horn antennas to make sure the EUT remains in the main lobe of the antenna.

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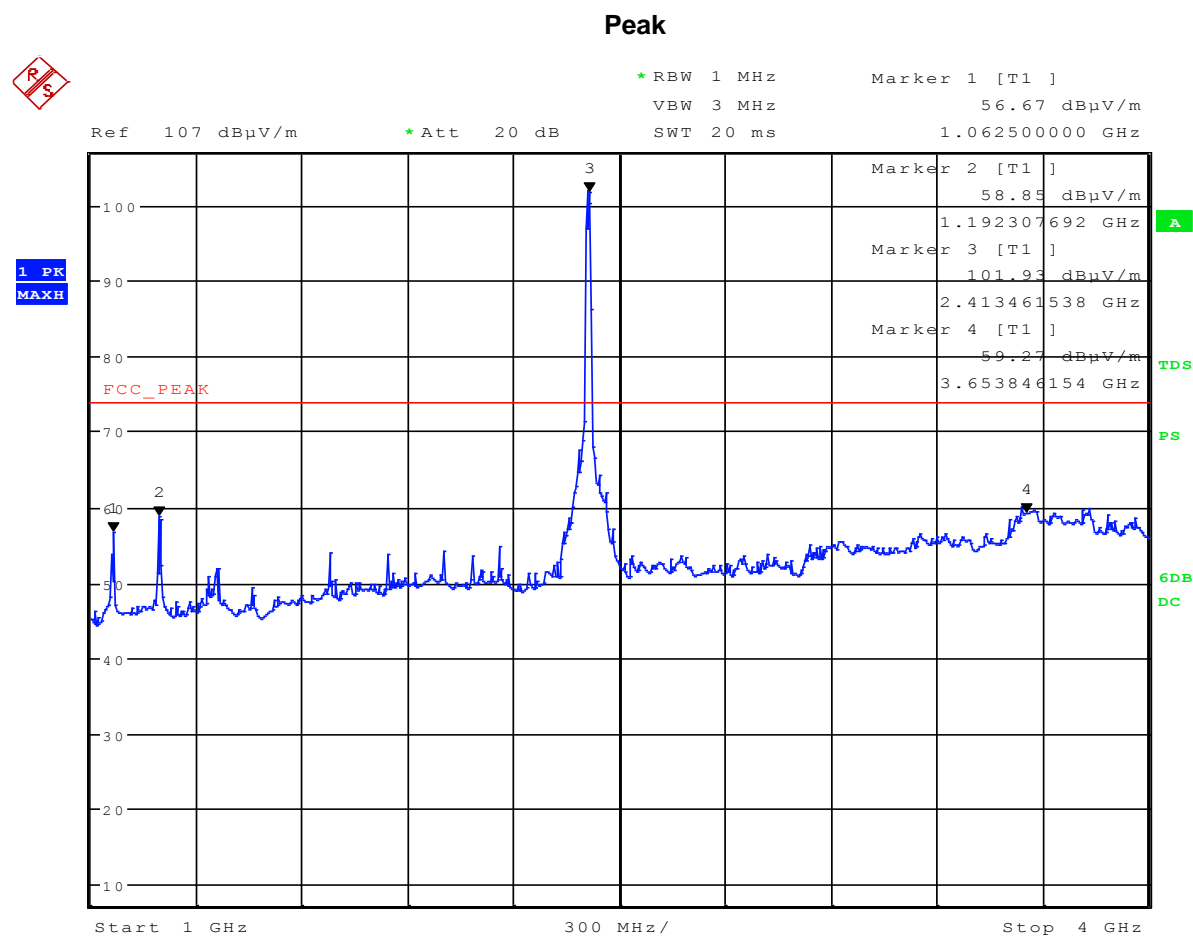
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## 6.3.3. Test Data

Radiated emissions between 1 and 4 GHz were measured for channels 1, 6 and 11 for both DSSS and OFDM modulation while operating on each antenna. Excluding the fundamental, all emissions were below the 15.209 limits by more than 10 dB (peak).

Representative plots are shown for antenna 1, channel 1 for DSSS and OFDM modulation.

### 6.3.3.1. 1 to 4 GHz



Date: 16.MAY.2012 12:09:19

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Report Number: EMC.410633.12.142.1

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Tel: (508) 766-6000 Fax: (508) 766-1145



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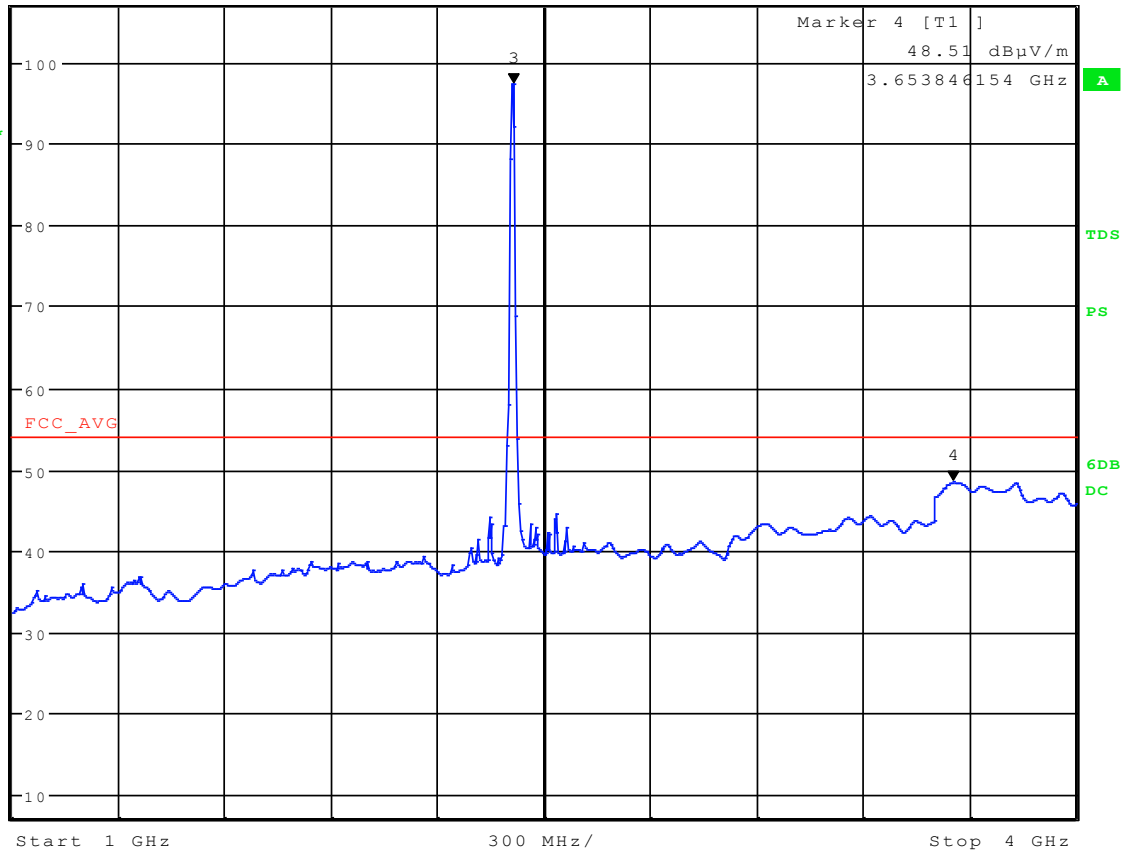
## Average



\* RBW 1 MHz  
VBW 10 MHz  
\* Att 20 dB  
\* SWT 1 s  
Marker 3 [T1]  
97.54 dBμV/m  
2.413461538 GHz

Ref 107 dBμV/m

1 AV  
MAXH



Date: 16.MAY.2012 12:12:32

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## 6.3.3.2. 4 to 8 GHz, Harmonics

Radiated emissions between 4 and 8 GHz were measured for channels 1, 6 and 11 with DSSS and OFDM modulation for antennas 1 and 2. Worst case emissions are with the horn antenna vertically polarized. The results are shown in the table below.

Worst case 2<sup>nd</sup> harmonic emission was on channel 11, antenna 1, with 12.7 dB QP margin.  
Worst case 3<sup>rd</sup> harmonic emissions show more than 24 dB QP margin.

Fundamental Frequency (MHz)	Modulation Mode	Antenna	Emission Frequency (MHz)	Measured Amplitude (dBμV/m) QP/AVG*	Measured Amplitude (dBμV/m) Peak	FCC 15B			
						Limit (dBμV/m) QP/AVG*	Limit (dBμV/m) Peak	Margin (dB) QP/AVG*	Margin (dB) Peak
2412	DSSS	1	4824.000	41.10	45.60	54.0	74.0	12.9	28.4
2412	OFDM	1	4824.000	29.20	44.90	54.0	74.0	24.8	29.1
2437	DSSS	1	4874.000	40.10	45.00	54.0	74.0	13.9	29.0
2437	OFDM	1	4874.000	28.20	43.10	54.0	74.0	25.8	30.9
2462	DSSS	1	4924.000	41.30	45.80	54.0	74.0	12.7	28.2
2462	OFDM	1	4924.000	28.90	43.30	54.0	74.0	25.1	30.7
2412	DSSS	2	4824.000	40.90	45.70	54.0	74.0	13.1	28.3
2412	OFDM	2	4824.000	26.70	41.10	54.0	74.0	27.3	32.9
2437	DSSS	2	4874.000	33.00	41.90	54.0	74.0	21.0	32.1
2437	OFDM	2	4874.000	25.50	38.90	54.0	74.0	28.5	35.1
2462	DSSS	2	4924.000	25.50	42.70	54.0	74.0	28.5	31.3
2462	OFDM	2	4924.000	26.30	39.80	54.0	74.0	27.7	34.2
2412	DSSS	1	7236.000	29.20	42.80	54.0	74.0	24.8	31.2
2412	OFDM	1	7236.000	29.00	43.20	54.0	74.0	25.0	30.8
2437	DSSS	1	7311.000	29.50	44.00	54.0	74.0	24.5	30.0
2437	OFDM	1	7311.000	29.30	42.30	54.0	74.0	24.7	31.7
2462	DSSS	1	7386.000	29.70	43.40	54.0	74.0	24.3	30.6
2462	OFDM	1	7386.000	29.70	43.40	54.0	74.0	24.3	30.6
2412	DSSS	2	7236.000	29.20	42.80	54.0	74.0	24.8	31.2
2412	OFDM	2	7236.000	29.00	43.20	54.0	74.0	25.0	30.8
2437	DSSS	2	7311.000	29.50	44.00	54.0	74.0	24.5	30.0
2437	OFDM	2	7386.000	29.30	42.30	54.0	74.0	24.7	31.7
2462	DSSS	2	7386.000	29.70	43.40	54.0	74.0	24.3	30.6
2462	OFDM	2	7386.000	29.70	43.40	54.0	74.0	24.3	30.6

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## 6.3.3.3. Restricted Bands

Emissions in the upper and lower restricted bands were measured for lowest (CH1) and highest (CH11) operating channels with DSSS and OFDM modulation on each antenna. Worst case emissions are with the horn antenna vertically polarized.

Worst case measured 4.9 dB average on antenna 2, channel 11 OFDM modulation.

### Lower and upper restricted band emissions

Antenna	Channel	Frequency (MHz)	Modulation	Marker Delta RBW=100 kHz (dB)	Detector	Max (dB)	Max - Delta (dB)	Limit dBuV/m @ 3m	Margin (dB)	Status
1	1	2412	DSSS	47.8	Peak	106.5	58.7	74	15.3	Pass
1	1	2412	DSSS	47.8	Average	92.9	45.1	54	8.9	Pass
1	1	2412	OFDM	42.2	Peak	103.7	61.6	74	12.5	Pass
1	1	2412	OFDM	42.2	Average	91.2	49.1	54	5.0	Pass
1	11	2462	DSSS	50.7	Peak	105.3	54.6	74	19.4	Pass
1	11	2462	DSSS	50.7	Average	91.8	41.1	54	12.9	Pass
1	11	2462	OFDM	41.9	Peak	101.4	59.5	74	14.5	Pass
1	11	2462	OFDM	41.9	Average	89.2	47.3	54	6.7	Pass
2	1	2412	DSSS	51.5	Peak	107.8	56.3	74	17.7	Pass
2	1	2412	DSSS	51.5	Average	94.1	42.6	54	11.4	Pass
2	1	2412	OFDM	43.7	Peak	102.5	58.9	74	15.2	Pass
2	1	2412	OFDM	43.7	Average	90.2	46.6	54	7.5	Pass
2	11	2462	DSSS	52.1	Peak	107.1	55.1	74	19.0	Pass
2	11	2462	DSSS	52.1	Average	93.4	41.4	54	12.7	Pass
2	11	2462	OFDM	42.5	Peak	103.8	61.4	74	12.7	Pass
2	11	2462	OFDM	42.5	Average	91.6	49.2	54	4.9	Pass

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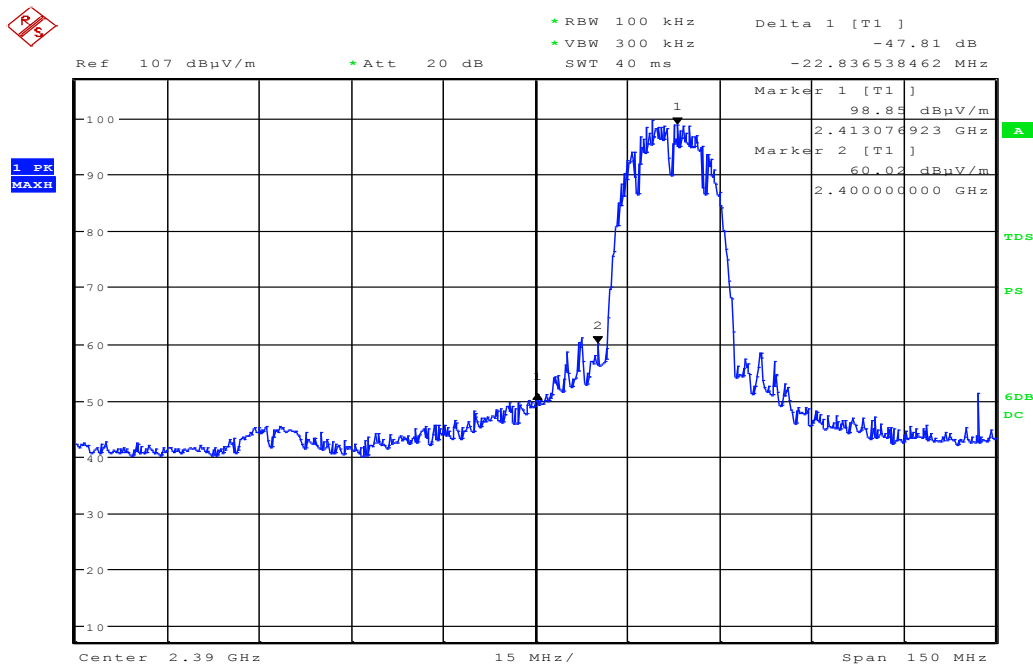
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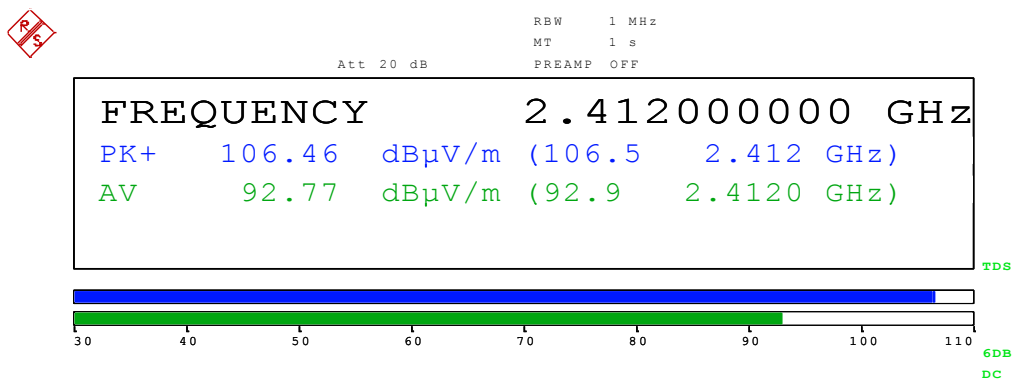
Representative plots are shown for DSSS and OFDM modulation on channel 1, antenna 1.

## Lower restricted band edge, DSSS mode



Date: 16.MAY.2012 11:50:58

## Peak and Average (RBW=1 MHz)



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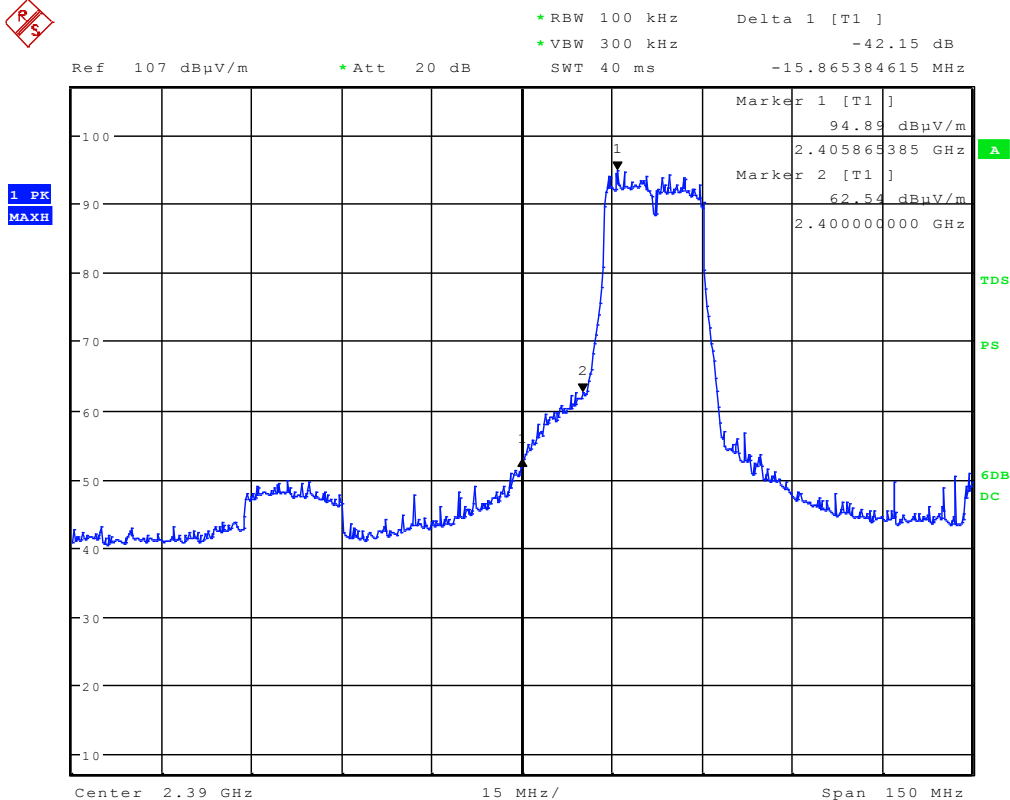


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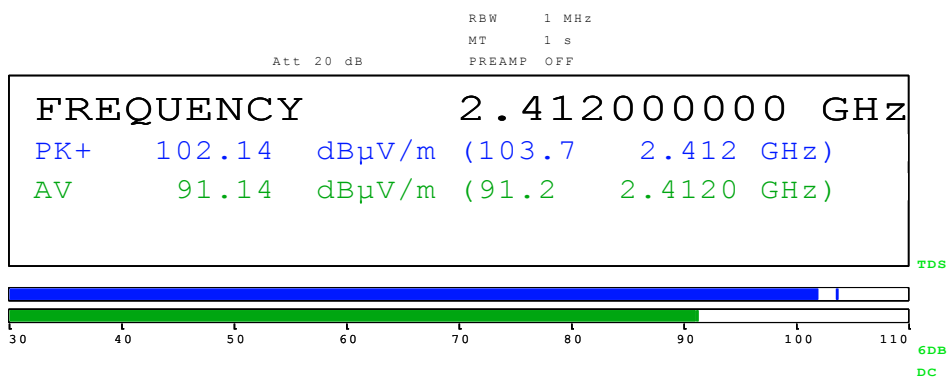
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## Lower restricted band edge, OFDM mode



Date: 16.MAY.2012 10:14:48

## Peak and Average (RBW=1 MHz)



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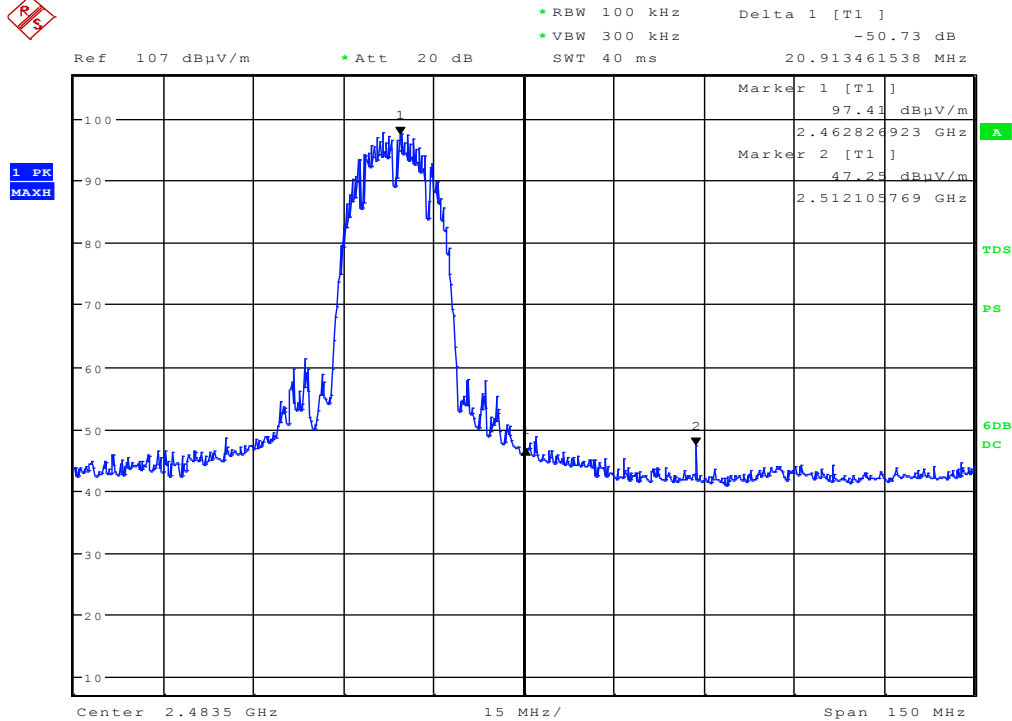


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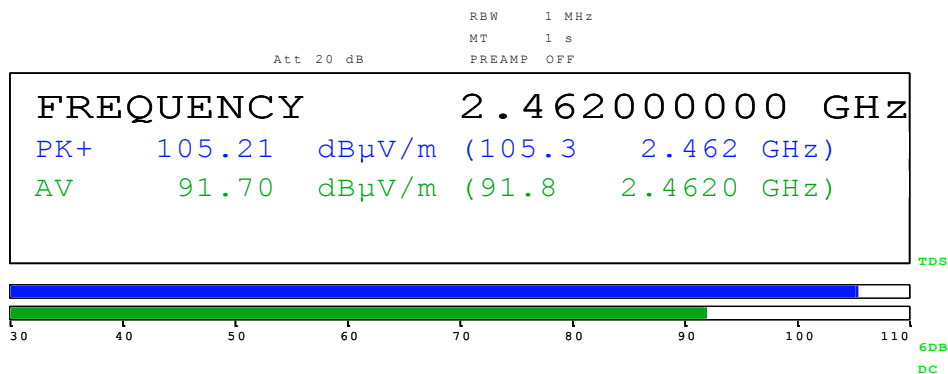
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## Upper restricted band edge, DSSS mode



Date: 16.MAY.2012 10:26:22

## Peak and Average (RBW=1 MHz)



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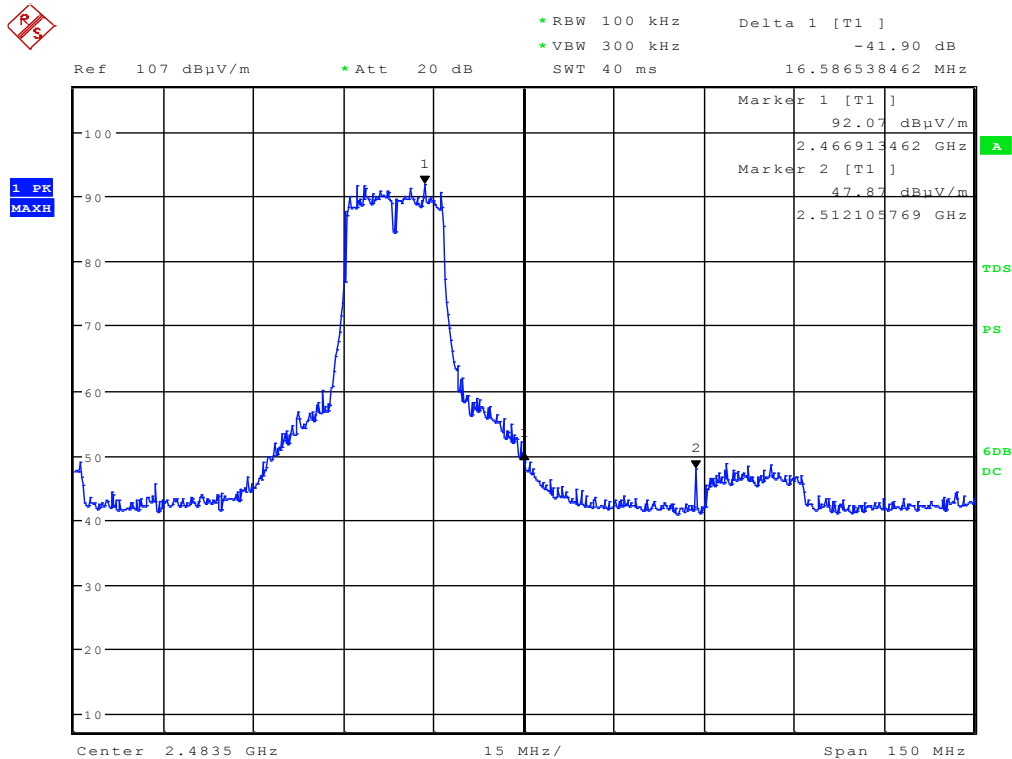


FCC ID: A94410633

IC: 3232A-410633

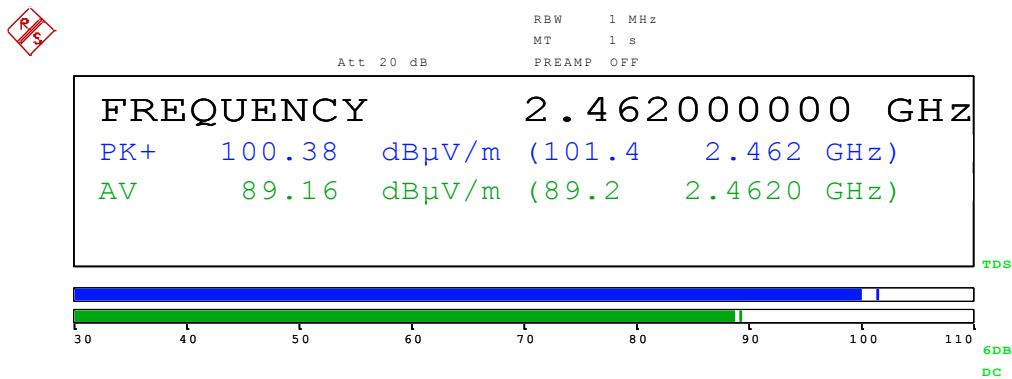
Certificate # 1514.1

## Upper restricted band edge, OFDM mode



Date: 16.MAY.2012 10:40:48

## Peak and Average (RBW=1 MHz)



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# Wireless Transceiver Test Report



FCC ID: A94410633

IC: 3232A-410633

Certificate # 1514.1

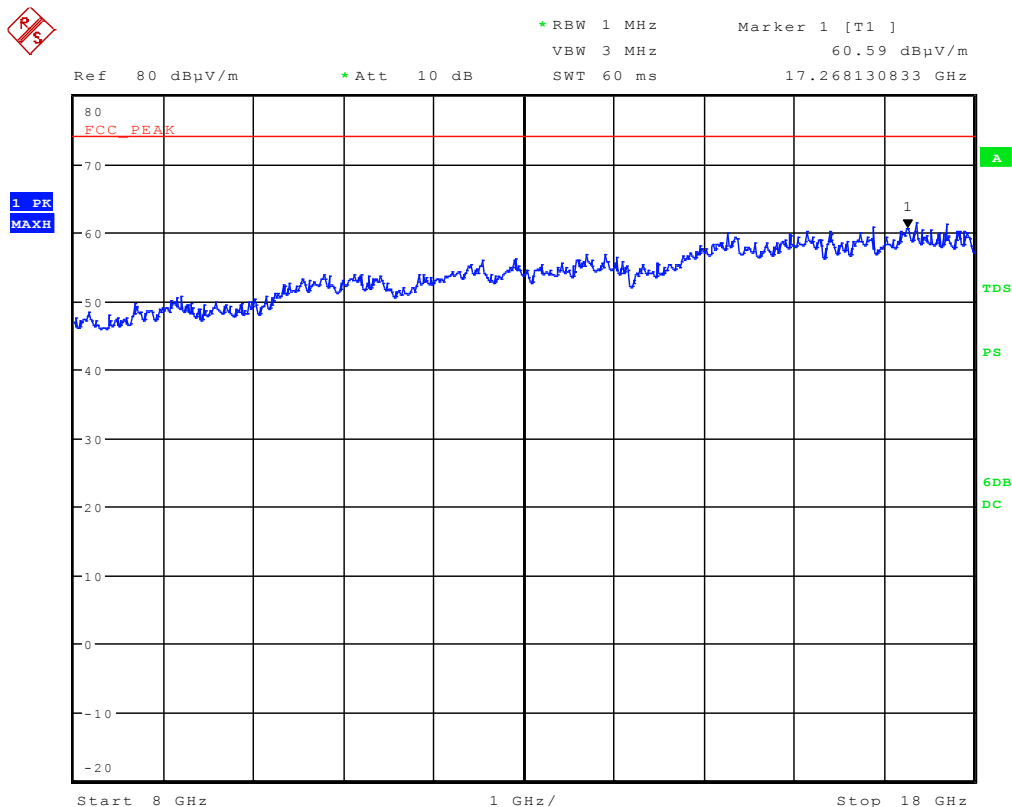
## 6.3.3.4 8 to 18 GHz

Measurements on channels 1, 6 and 11 for both antenna ports using a standard gain horn with a preamp mounted on the horn antenna. No emissions were observed above the instrumentation noise floor. The noise floor measured more than 10 dB below the FCC peak limit (74 dBuV/m) at a 3 meter distance.

No average detector measurements were made since the noise floor of the test equipment was above the limit of 54 dBuV/m.

### Representative plot for ANT1, CH1 g mode.

Vertical and Horizontal antenna polarizations combined.



Date: 18.MAY.2012 12:02:13

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# Wireless Transceiver Test Report

FCC ID: A94410633

IC: 3232A-410633

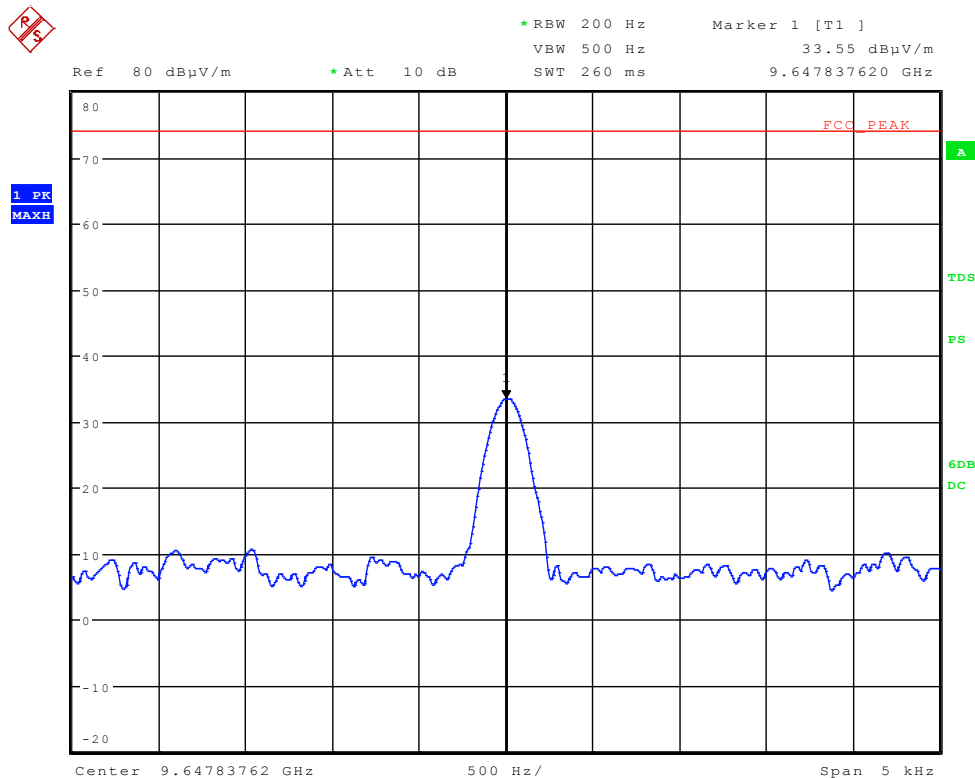


Certificate # 1514.1

In order to observe the 4<sup>th</sup> harmonic the RBW needed to be reduced to 200 Hz.  
The 4<sup>th</sup> harmonic did not show modulation on it as did the fundamental.

With these settings the 4<sup>th</sup> harmonic measured 33 dBuV/m at a 3 meter distance.

## CH1, Antenna 1 (Vertical antenna polarization)



Date: 18.MAY.2012 11:16:19

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# Wireless Transceiver Test Report



FCC ID: A94410633

IC: 3232A-410633

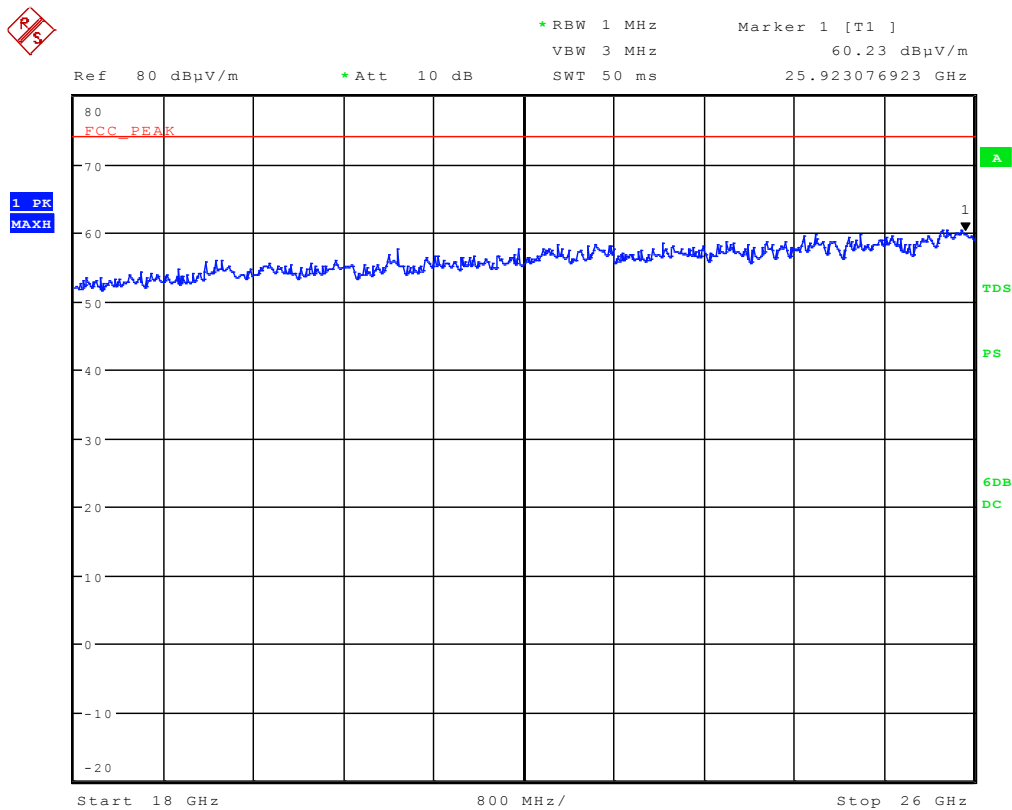
Certificate # 1514.1

## 6.3.3.5 18 to 26 GHz

The measurements distance was reduced to 1 meter using a standard gain horn antenna with a preamp mounted directly on the horn antenna. No emissions were measured above the instrumentation noise floor which was more than 10 dB below the FCC peak limit of 74 dBuV/m. The results were the same for both vertical and horizontal antenna polarizations.

### Representative plot for ANT1, CH1 g mode.

Vertical antenna polarization



Date: 18.MAY.2012 14:29:13

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# Wireless Transceiver Test Report



FCC ID: A94410633

IC: 3232A-410633

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	ESU40	TN1663	4/6/2012	4/6/2013
Antenna cable	Mini-Circuits		TN1692	3/2/2012	3/2/2013
1 to 18 GHz horn	EMCO	3115	TN478	6/23/2009	6/23/2012
4 to 8 GHz horn	AR	AT4003	TN727	Verify before use	Verify before use
8 to 18 GHz horn	AR	AT4004	TN728	Verify before use	Verify before use
18 to 26 GHz horn	Emco	3160-09	TN1307	2/23/2011	2/23/2014
20 GHz preamp	Miteq	AFS4-00102000-30-10P-4	TN1672	8/17/2011	8/17/2013
40 GHz preamp	Miteq	JS4018004000-30-8P-A1	TN1757	Verify before use	Verify before use

## 6.3.5. Test information

<b>Date of test:</b>	5/16/2012 to 5/18/2013	<b>Test location:</b>	DCE Maxwell House
<b>EUT serial:</b>	SN180AE	<b>Tested by:</b>	B. Cerqua C. Bell
<b>Test Conclusion:</b>	Pass		

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# Wireless Transceiver Test Report



FCC ID: A94410633

IC: 3232A-410633

Certificate # 1514.1

## 6.4. Maximum conducted output power

### 6.4.1 Requirements:

FCC 15.247(b)(3) , RSS 210 A8.4 (2)

The maximum peak conducted output power is 30 dBm (1 Watt)

### 6.4.2 Test setup details:

Peak output power is measured using R&S NRVS power meter with a NRV-Z4 diode detector power sensor head. A mini-circuits SMA type 10 dB pad was used on the input to the diode detector power sensor. The EUT is connected to the 10 dB pad using a 200mm UFL to SMA female RG178 coax cable. Measured loss of UFL to SMA cable with SMA-M to SMA-M adapter is 0.65 dB at 2.45 GHz. The SMA male to SMA male adapter is placed between 10 dB pad and adapter cable.

Power was measured with modulation active for 802.11b (DSSS) and 802.11g (OFDM) at low (CH1), middle (CH6) and high (CH11) operating frequencies.

Custom test commands are used to keep the EUT transmitting continuously.

### 6.4.3 Test data:

All measured peak conducted output power is below the 30 dBm limit.

Output	Channel	Frequency (MHz)	Modulation	NRVS Reading (dBm)	Pad Correction (dB)	UFL Test cable & SMA Adapter Loss (dB)	Actual EUT Output power (dB)	Status
CON1	1	2412	DSSS	5.1	10	0.65	15.75	Pass
CON1	6	2437	DSSS	5.7	10	0.65	16.35	Pass
CON1	11	2462	DSSS	6.0	10	0.65	16.65	Pass
CON1	1	2412	OFDM	7.1	10	0.65	17.75	Pass
CON1	6	2437	OFDM	7.2	10	0.65	17.85	Pass
CON1	11	2462	OFDM	7.3	10	0.65	17.95	Pass
CON2	1	2412	DSSS	5.6	10	0.65	16.25	Pass
CON2	6	2437	DSSS	6.1	10	0.65	16.75	Pass
CON2	11	2462	DSSS	6.3	10	0.65	16.95	Pass
CON2	1	2412	OFDM	7.5	10	0.65	18.15	Pass
CON2	6	2437	OFDM	7.6	10	0.65	18.25	Pass
CON2	11	2462	OFDM	7.5	10	0.65	18.15	Pass

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# Wireless Transceiver Test Report

FCC ID: A94410633

IC: 3232A-410633



Certificate # 1514.1

## 6.4.4 Test Equipment

Equipment Type	Manufacturer	Model	Serial or other ID	Service date	
				Last	Due
Power meter	Rohde & Schwarz	NRVS	TN1293	4/5/2012	4/5/2013
Power sensor	Rohde & Schwarz	NRV-Z4	TN1296	4/5/2012	4/5/2013

## 6.4.5 Test information

<b>Date of test:</b>	5/11/2012	<b>Test location:</b>	Transmitter Test Bench
<b>EUT serial:</b>	SN118AE	<b>Tested by:</b>	B. Cerqua
<b>Test Conclusion:</b>	Pass		

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# Wireless Transceiver Test Report



FCC ID: A94410633

IC: 3232A-410633

Certificate # 1514.1

## 6.5. 6 dB & 99% occupied bandwidth

### 6.5.1. Requirements

FCC 15.247 (a)(2)

6 dB bandwidth shall be at least 500 kHz.

99% occupied bandwidth for reporting purposes only.

### 6.5.2. Test setup details

The EUT is connected to input of a spectrum analyzer using 200mm UFL to SMA cable with a SMA-Male to SMA-Male adapter.

The 6 dB bandwidth is measured for each RF output for low (CH1), middle (CH6) and high (CH11) operating channels using 802.11b (DSSS) and 802.11g (OFDM) modulation.  
RBW=100 kHz, VBW = 300 kHz

For the 99% bandwidth measurements the built in measurement within the ESIB40 was used.  
RBW = 300 kHz, VBW = 1 MHz

Custom test commands are used to keep the EUT transmitting continuously.

### 6.5.3. Test data

(6 dB Bandwidth measurement results)

Output	Channel	Frequency (MHz)	Modulation	6 dB Bandwidth (MHz)	Limit (kHz)	Status
CON1	1	2412	DSSS	10.27	500	Pass
CON1	6	2437	DSSS	10.27	500	Pass
CON1	11	2462	DSSS	10.32	500	Pass
CON1	1	2412	OFDM	16.63	500	Pass
CON1	6	2437	OFDM	16.58	500	Pass
CON1	11	2462	OFDM	16.53	500	Pass
CON2	1	2412	DSSS	10.32	500	Pass
CON2	6	2437	DSSS	10.37	500	Pass
CON2	11	2462	DSSS	10.32	500	Pass
CON2	1	2412	OFDM	16.43	500	Pass
CON2	6	2437	OFDM	16.58	500	Pass
CON2	11	2462	OFDM	16.53	500	Pass

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# Wireless Transceiver Test Report

FCC ID: A94410633

IC: 3232A-410633



Certificate # 1514.1

## (99% occupied bandwidth measurement results)

Output	Channel	Frequency (MHz)	Modulation	99% Bandwidth (MHz)
CON1	1	2412	DSSS	16.2
CON1	6	2437	DSSS	16.2
CON1	11	2462	DSSS	16.2
CON1	1	2412	OFDM	17.5
CON1	6	2437	OFDM	17.4
CON1	11	2462	OFDM	17.5
CON2	1	2412	DSSS	16.2
CON2	6	2437	DSSS	16.1
CON2	11	2462	DSSS	16.1
CON2	1	2412	OFDM	17.4
CON2	6	2437	OFDM	17.3
CON2	11	2462	OFDM	17.5

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# Wireless Transceiver Test Report



FCC ID: A94410633

IC: 3232A-410633

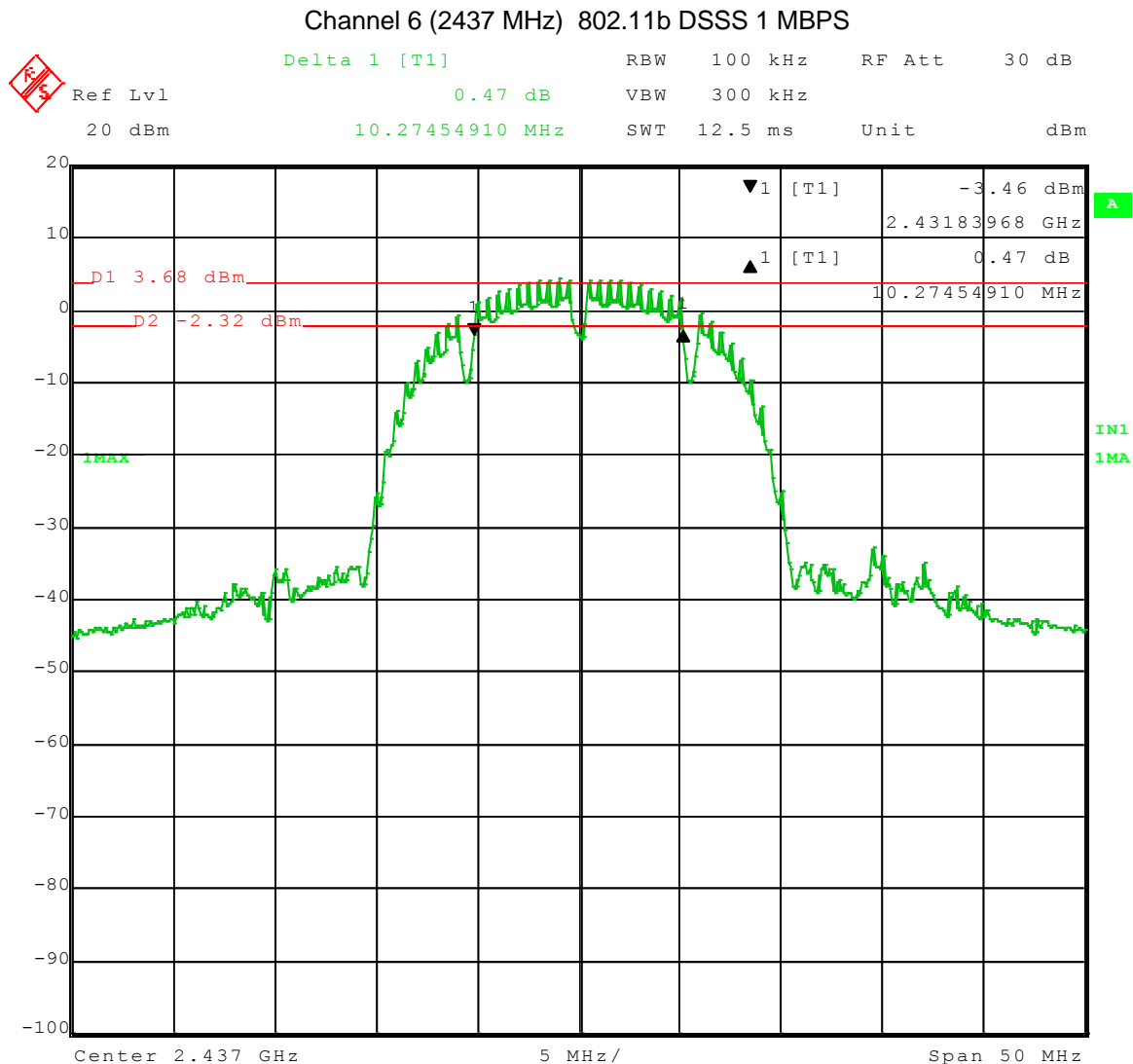
Certificate # 1514.1

Representative spectrum analyzer plot showing a 6 dB bandwidth measurement with 802.11b DSSS modulation.

Marker 1 is at peak, display line 1 is also set to peak.

Display line 2 is 6 dB down from peak.

Marker 1 delta is the frequency difference of the intersecting bandwidth profile and display line 2.



Date: 11.MAY.2012 14:15:47

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# Wireless Transceiver Test Report



FCC ID: A94410633

IC: 3232A-410633

Certificate # 1514.1

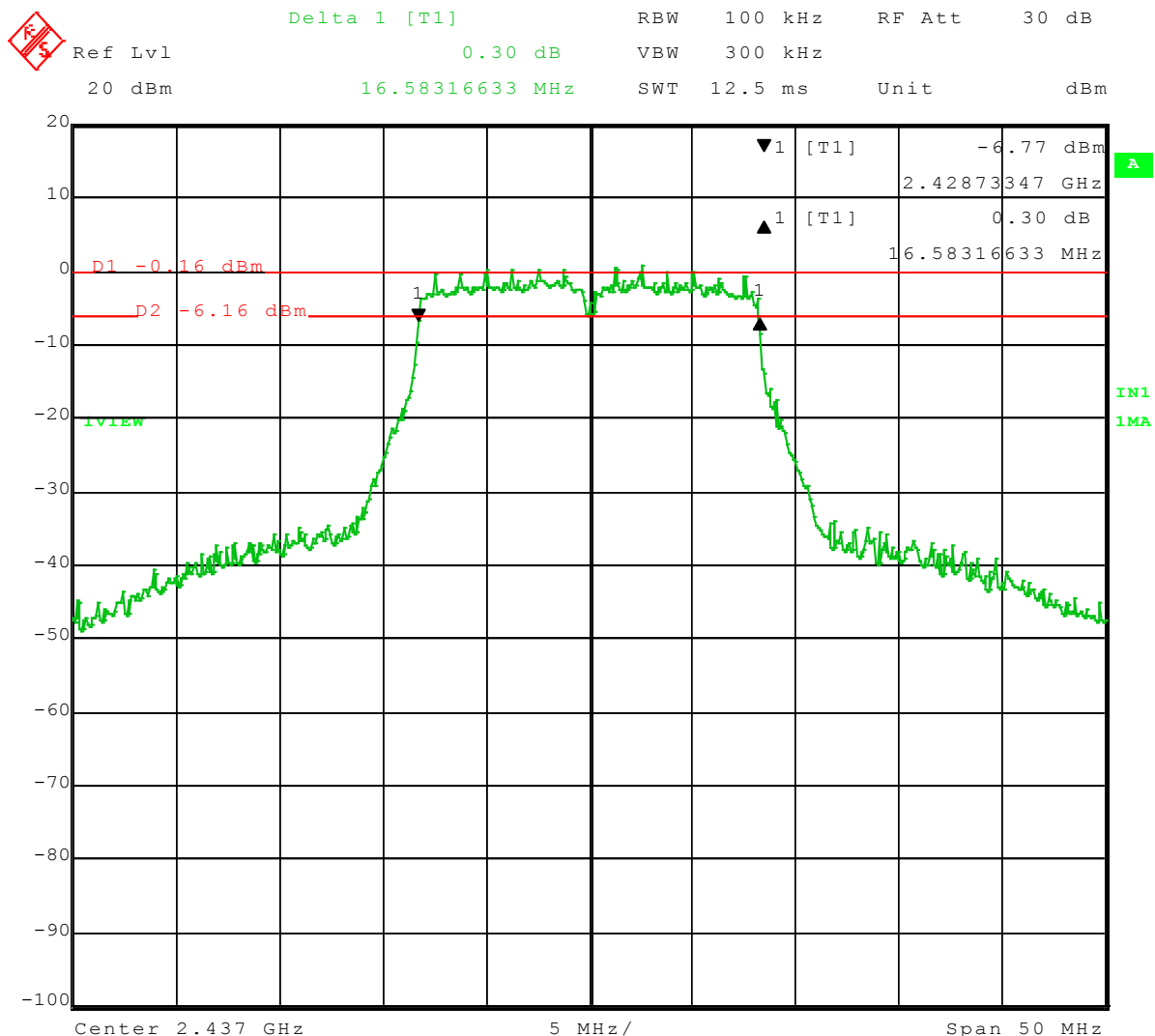
Representative spectrum analyzer plot showing a 6 dB bandwidth measurement with 802.11g OFDM modulation.

Marker 1 is at peak, display line 1 is also set to peak.

Display line 2 is 6 dB down from peak.

Marker 1 delta is the frequency difference of the intersecting bandwidth profile and display line 2.

## Channel 6 (2437 MHz) 802.11g OFDM 6 MBPS



Date: 11.MAY.2012 14:38:59

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# Wireless Transceiver Test Report

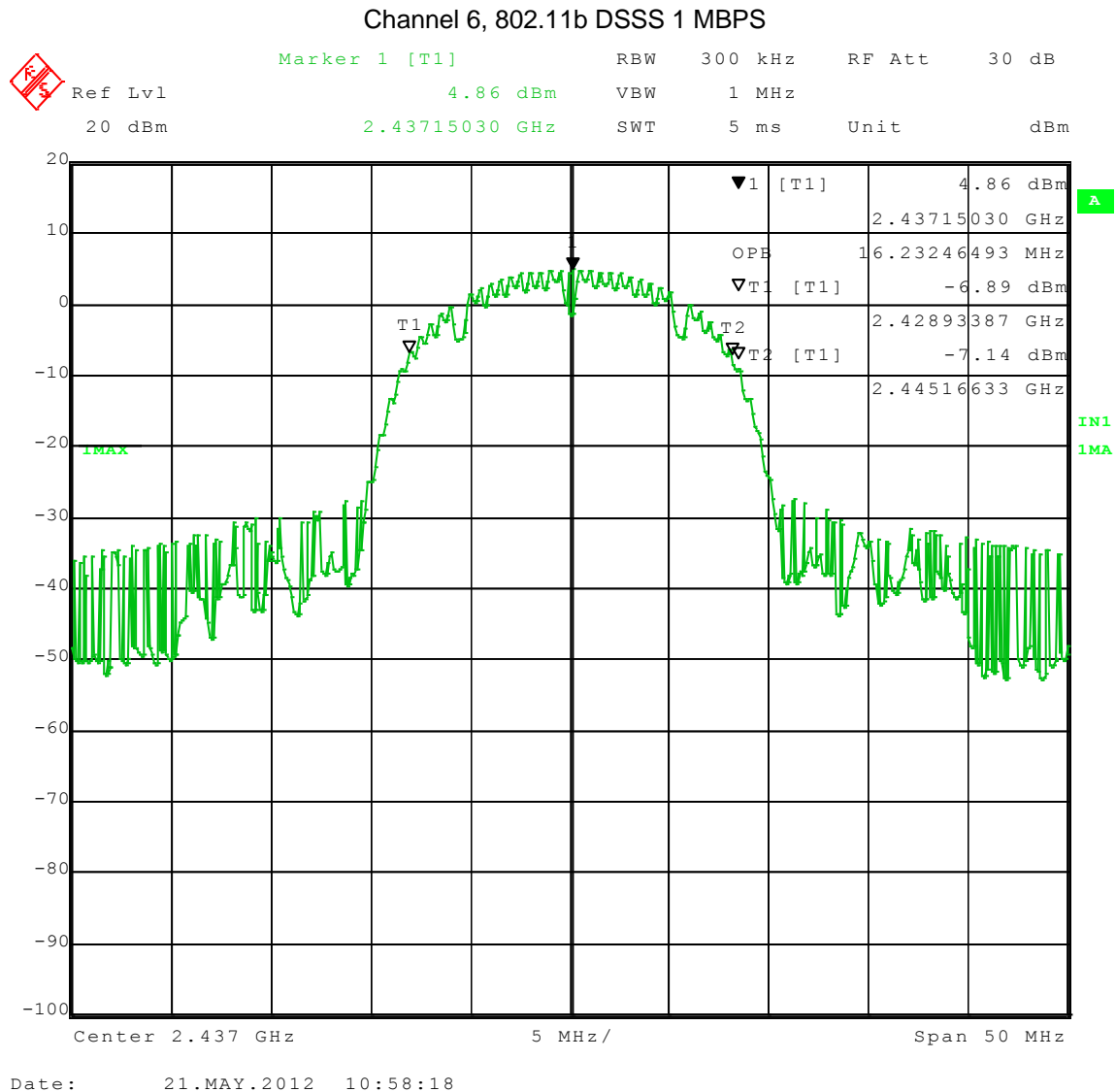


FCC ID: A94410633

IC: 3232A-410633

Certificate # 1514.1

Representative spectrum analyzer plot showing 99% occupied dB bandwidth measurement with 802.11b DSSS modulation



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# Wireless Transceiver Test Report



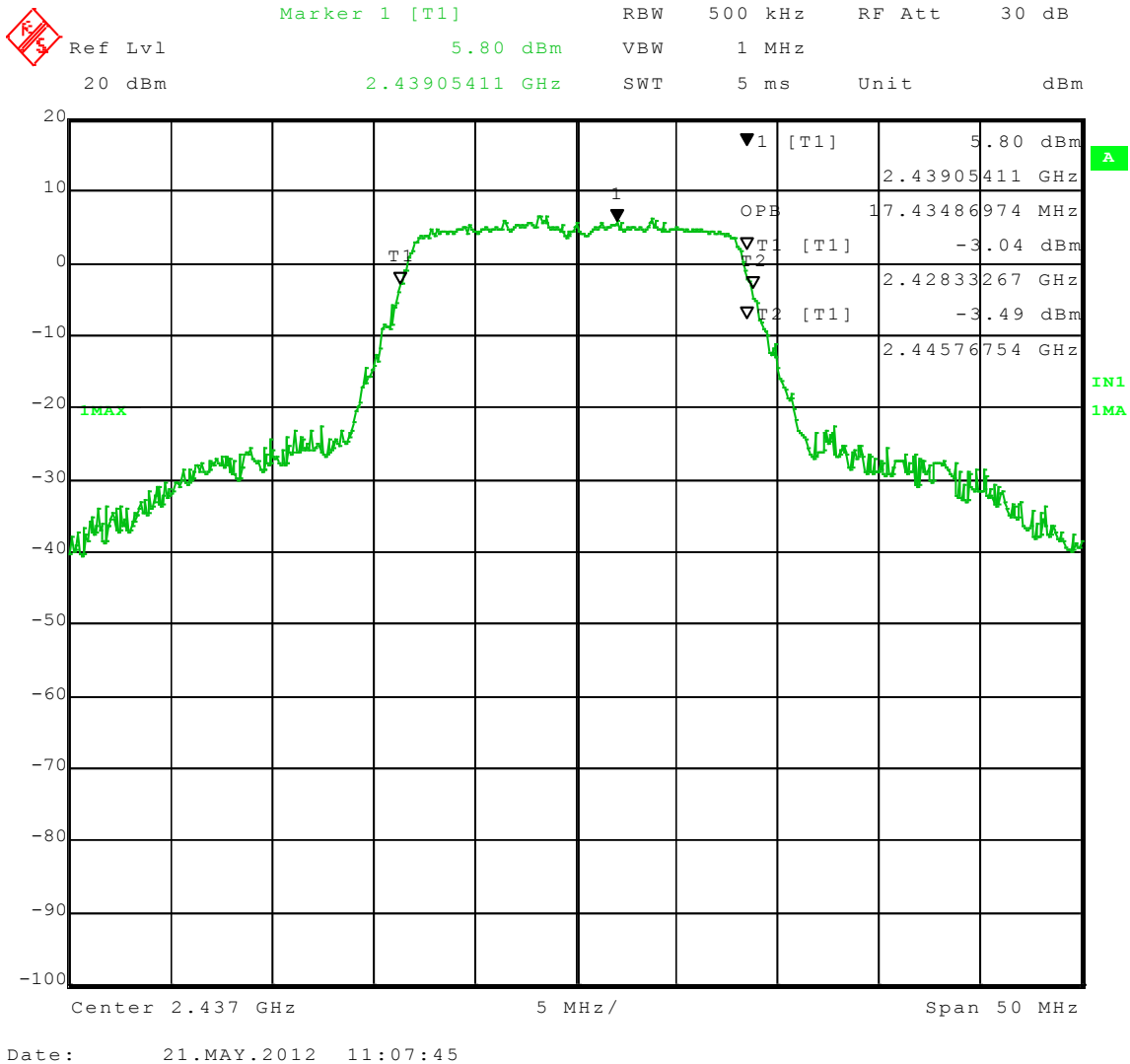
FCC ID: A94410633

IC: 3232A-410633

Certificate # 1514.1

Representative spectrum analyzer plot showing 99% occupied dB bandwidth measurement with 802.11g OFDM modulation

Channel 6, 802.11g OFDM 6 MBPS



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# Wireless Transceiver Test Report



FCC ID: A94410633

IC: 3232A-410633

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	ESIB 40	TN1560	4/4/2012	4/4/2013

## 5.5.5. Test information

<b>Date of test:</b>	5/11/2012, 5/21/2012	<b>Test location:</b>	Transmitter Test Bench
<b>EUT serial:</b>	SN118AE	<b>Test by:</b>	B. Cerqua
<b>Test Conclusion:</b>	Pass		

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# Wireless Transceiver Test Report



FCC ID: A94410633

IC: 3232A-410633

Certificate # 1514.1

## 6.6. Power spectral density

### 6.6.1. Requirements

FCC 15.247 (3) (1) iii, RSS210 A8.1 (d)

The power spectral density measured in a 3 kHz resolution bandwidth must be less than 8 dBm.

### 6.6.2. Test setup details

The EUT RF module output is connected to the spectrum analyzer using a UFL to SMA adapter cable and a SMA male to male adapter.

The procedure outline in the OET KDB 558074 D01 DTS measurement guideline document was used.

The resolution bandwidth is set to 100 kHz and the video bandwidth is set to 500 kHz. Sweep time is set to auto. The maximum peak value is scaled by applying a bandwidth correction factor (BWCF) equal to  $10 \cdot \log(3\text{kHz} / 100\text{kHz}) = -15.2 \text{ dB}$

### 6.6.3. Test data

Output	Channel	Frequency (MHz)	Modulation	100 kHz Max Peak (dBm)	BWCF (dB)	Corrected PSD in 3 kHz BW (dBm)	Limit (dBm)	Status
CON1	1	2412	DSSS	3.76	-15.2	-11.44	8.0	Pass
CON1	6	2437	DSSS	4.43	-15.2	-10.77	8.0	Pass
CON1	11	2462	DSSS	4.60	-15.2	-10.60	8.0	Pass
CON1	1	2412	OFDM	0.65	-15.2	-14.55	8.0	Pass
CON1	6	2437	OFDM	0.53	-15.2	-14.67	8.0	Pass
CON1	11	2462	OFDM	0.81	-15.2	-14.39	8.0	Pass
CON2	1	2412	DSSS	3.96	-15.2	-11.24	8.0	Pass
CON2	6	2437	DSSS	4.64	-15.2	-10.56	8.0	Pass
CON2	11	2462	DSSS	4.61	-15.2	-10.59	8.0	Pass
CON2	1	2412	OFDM	0.72	-15.2	-14.48	8.0	Pass
CON2	6	2437	OFDM	0.71	-15.2	-14.49	8.0	Pass
CON2	11	2462	OFDM	1.30	-15.2	-13.90	8.0	Pass

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# Wireless Transceiver Test Report



FCC ID: A94410633

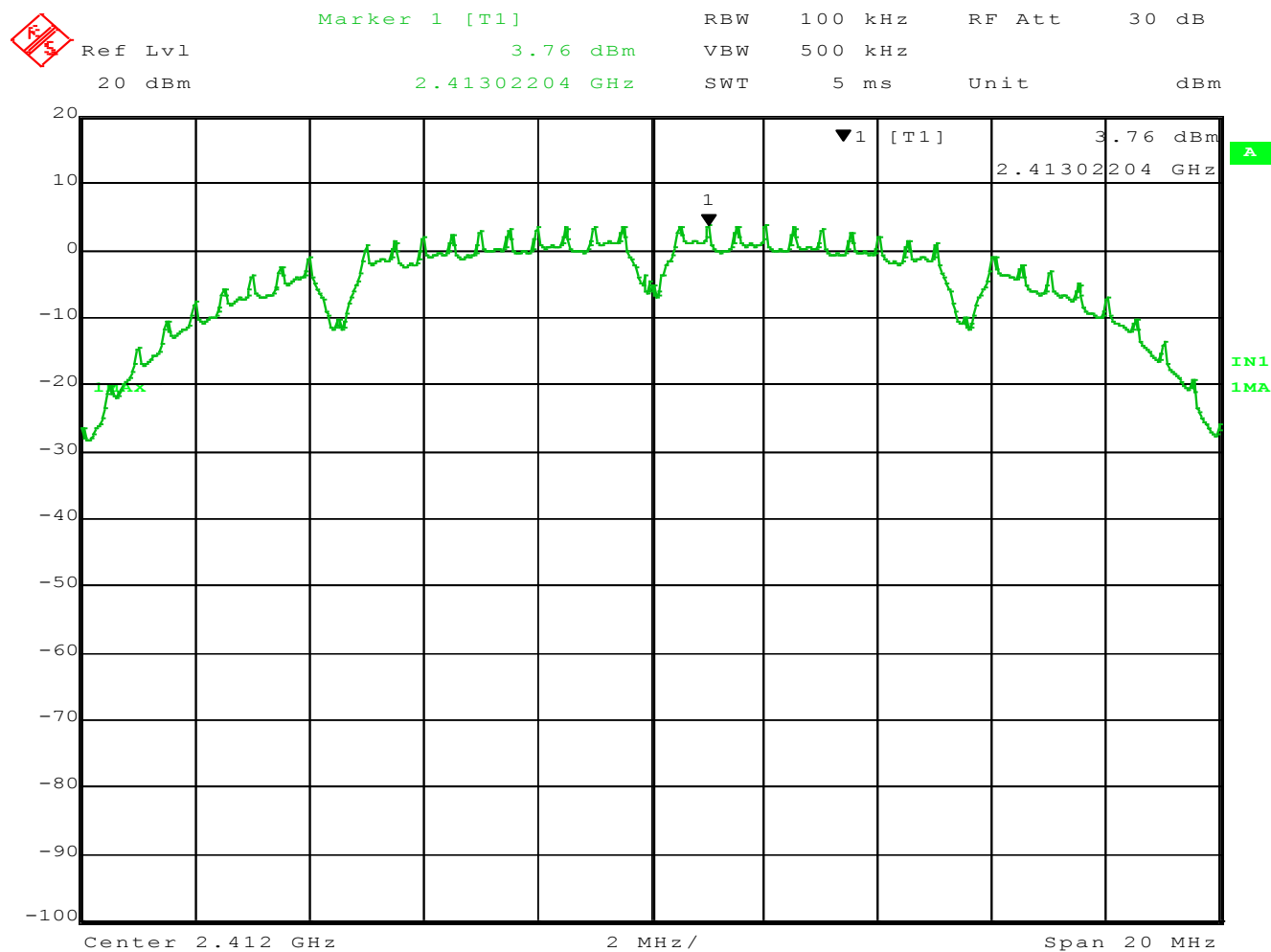
IC: 3232A-410633

Certificate # 1514.1

Representative spectrum analyzer plot showing a power spectral density measurement with 802.11b DSSS modulation.

Channel 1 (2412 MHz) 802.11b DSSS 1 MBPS

$3.76 - 15.2 = -11.44$  dBm



Date: 14.MAY.2012 11:21:39

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# Wireless Transceiver Test Report

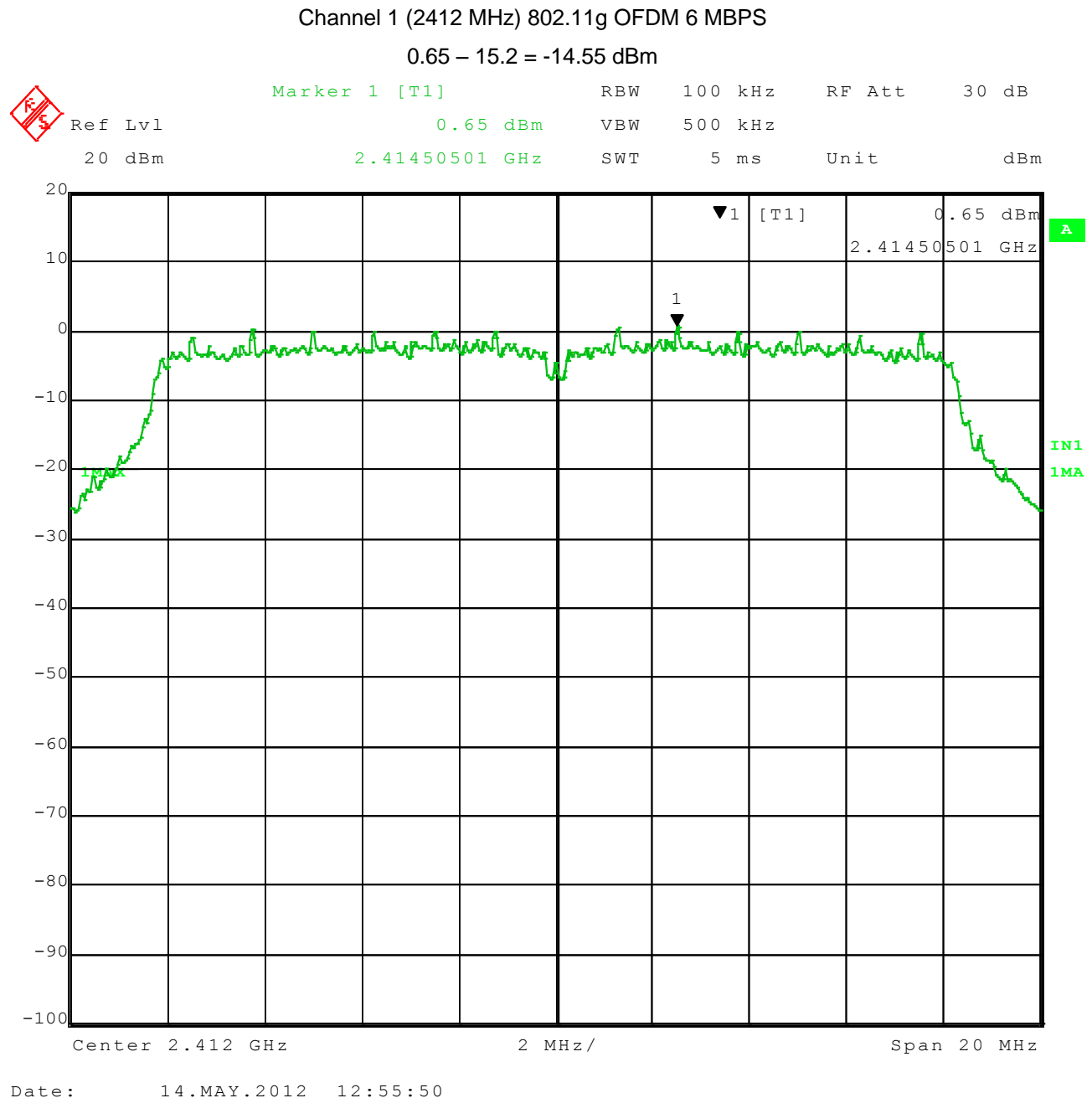


FCC ID: A94410633

IC: 3232A-410633

Certificate # 1514.1

Representative spectrum analyzer plot showing a power spectral density measurement with 802.11g OFDM modulation.



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# Wireless Transceiver Test Report

FCC ID: A94410633

IC: 3232A-410633



Certificate # 1514.1

## 6.6.4. Test information

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

## 6.6.5. Test information

<b>Date of test:</b>	5/21/2012	<b>Test Location:</b>	DCE – Transmitter Test Bench
<b>EUT serial:</b>	SN118AE	<b>Tested by:</b>	B. Cerqua
<b>Test Conclusion:</b>	Pass		

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# Wireless Transceiver Test Report



FCC ID: A94410633

IC: 3232A-410633

Certificate # 1514.1

## 6.7. Conducted spurious emissions.

### 6.7.1 Requirements

FCC part 15.247(d), RSS-Gen 7.2.5

### 6.7.2 Test Setup

The EUT was connected to the spectrum analyzer using a UFL to SMA adapter cable. Conducted spurious emissions were measured for channels 1, 6 & 11 for both 802.11b & 802.11g modulation modes and both antenna ports.

Marker one represents the maximum peak reading. The display line is placed 20 dB below the peak. The emissions were measured for the lower and upper band edges as well as from 30 MHz to 26 GHz.

RBW = 100 kHz, VBW = 300 kHz

### 6.7.3 Test Data

Output	Channel	Frequency (MHz)	Modulation	Peak (dBm)	DLIN1 (20 dB down)	Frequency (GHz)	Measurement (dBm)	Margin (dB)	Status
CON1	1	2412	DSSS	3.8	-16.24	9.658	-47.2	-31.0	Pass
CON1	6	2437	DSSS	4.2	-15.88	9.762	-48.1	-32.2	Pass
CON1	11	2462	DSSS	4.5	-15.52	9.866	-49.3	-33.8	Pass
CON1	1	2412	OFDM	0.0	-20.02	21.576	-51.0	-31.0	Pass
CON1	6	2437	OFDM	0.1	-19.96	6.951	-51.3	-31.4	Pass
CON1	11	2462	OFDM	0.7	-19.48	6.639	-50.4	-30.9	Pass
CON2	1	2412	DSSS	4.1	-16.00	9.668	-49.1	-33.1	Pass
CON2	6	2437	DSSS	4.4	-15.64	9.762	-48.8	-33.2	Pass
CON2	11	2462	DSSS	4.6	-15.40	9.866	-50.1	-34.7	Pass
CON2	1	2412	OFDM	0.9	-19.00	6.951	-51.2	-32.2	Pass
CON2	6	2437	OFDM	1.1	-19.00	6.691	-51.0	-32.0	Pass
CON2	11	2462	OFDM	1.3	-18.76	6.951	-51.0	-32.2	Pass

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# Wireless Transceiver Test Report

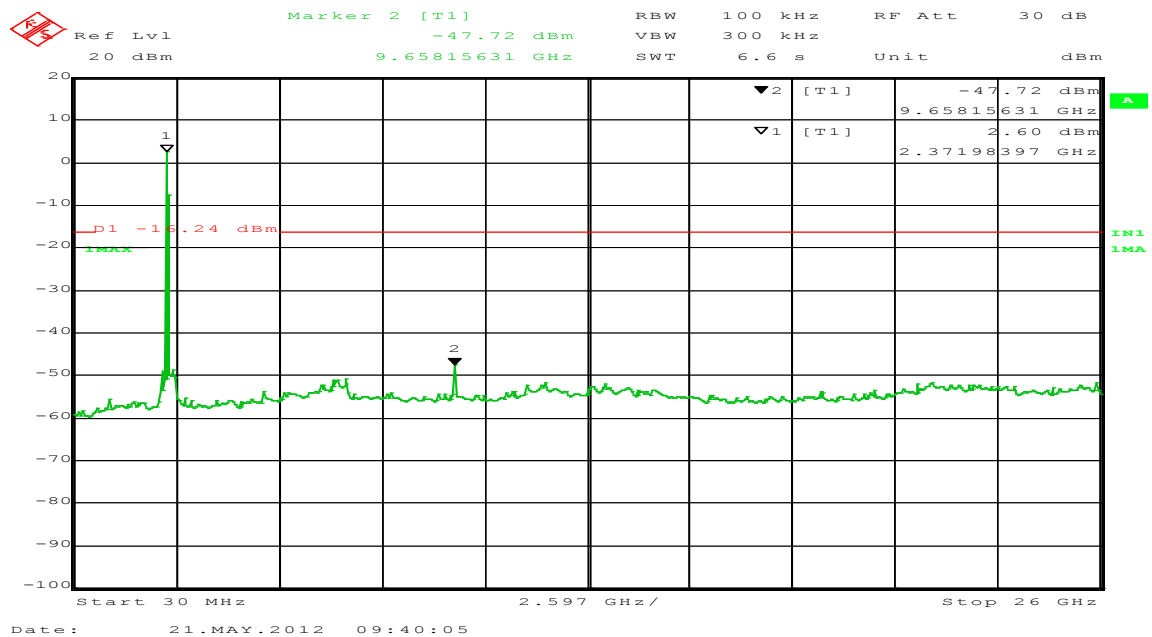
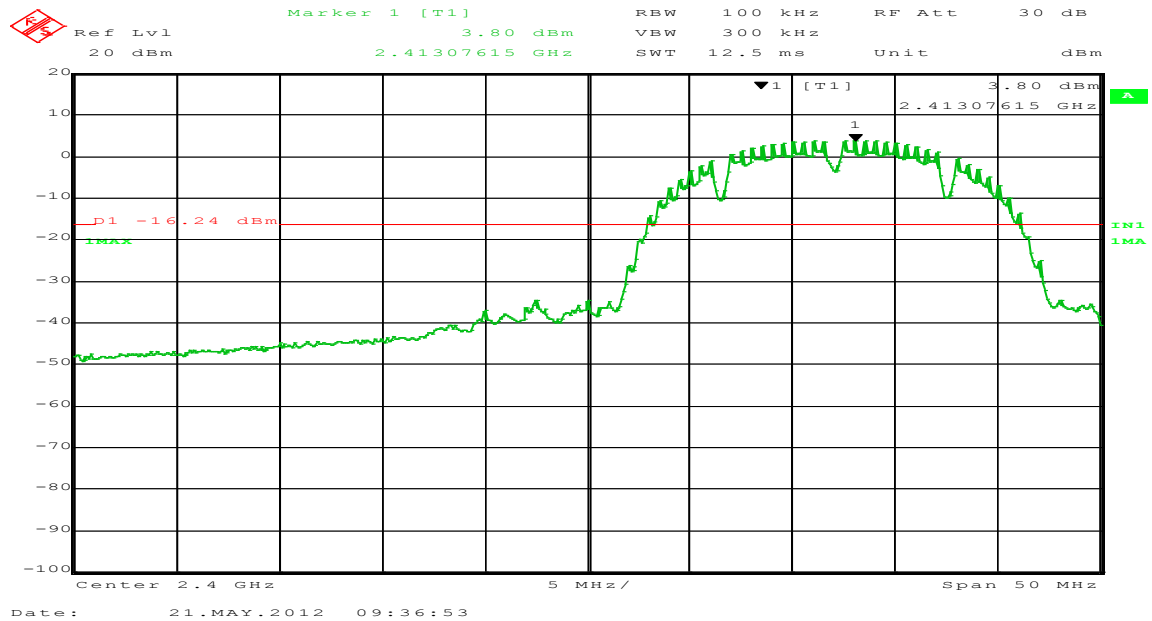


FCC ID: A94410633

IC: 3232A-410633

Certificate # 1514.1

Representative spectrum analyzer plot showing conducted spurious emission measurement.  
Channel 1, 802.11b DSSS modulation.



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# Wireless Transceiver Test Report



FCC ID: A94410633

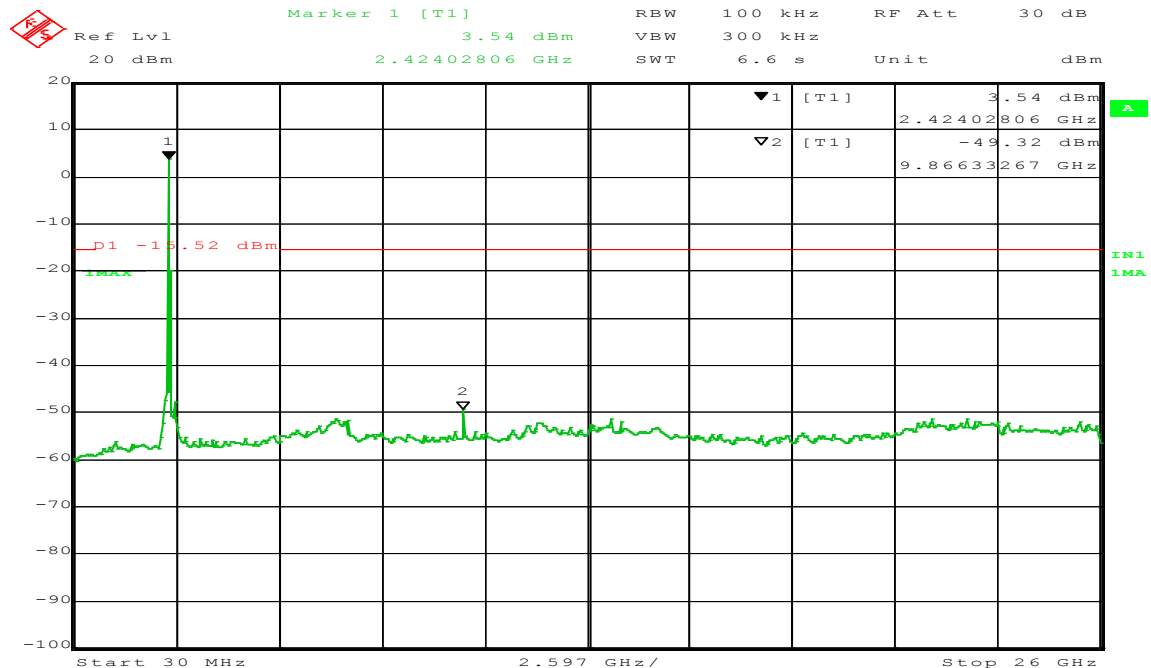
IC: 3232A-410633

Certificate # 1514.1

Representative spectrum analyzer plot showing conducted spurious emission measurement.  
Channel 11, 802.11b DSSS modulation.



Date: 21.MAY.2012 09:49:39



Date: 21.MAY.2012 09:51:23

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# Wireless Transceiver Test Report

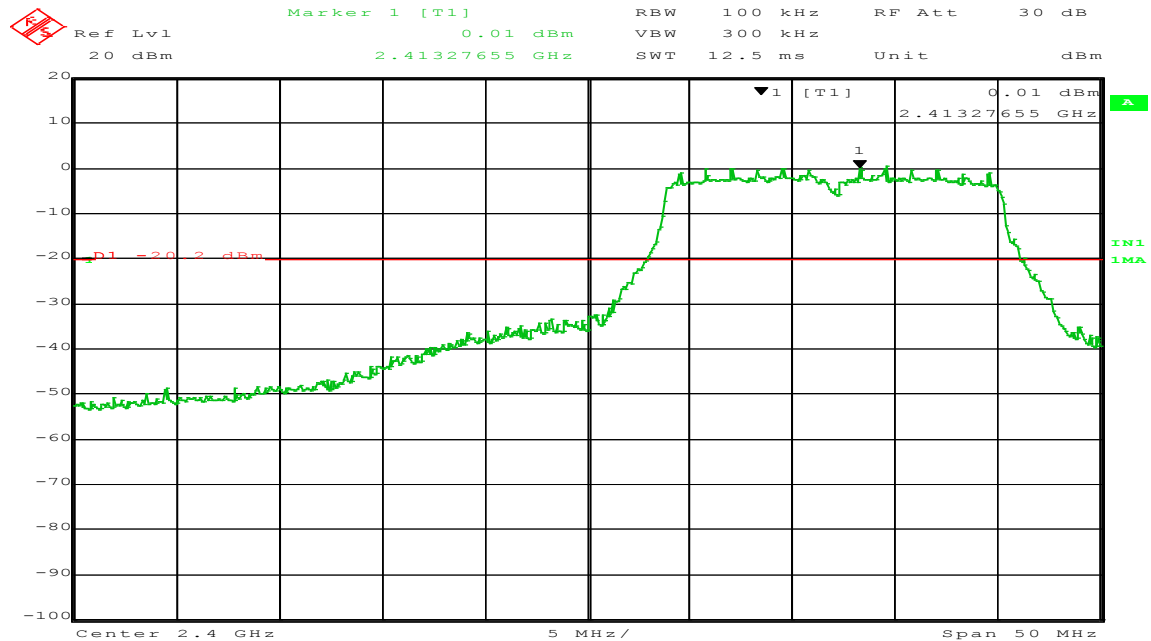


FCC ID: A94410633

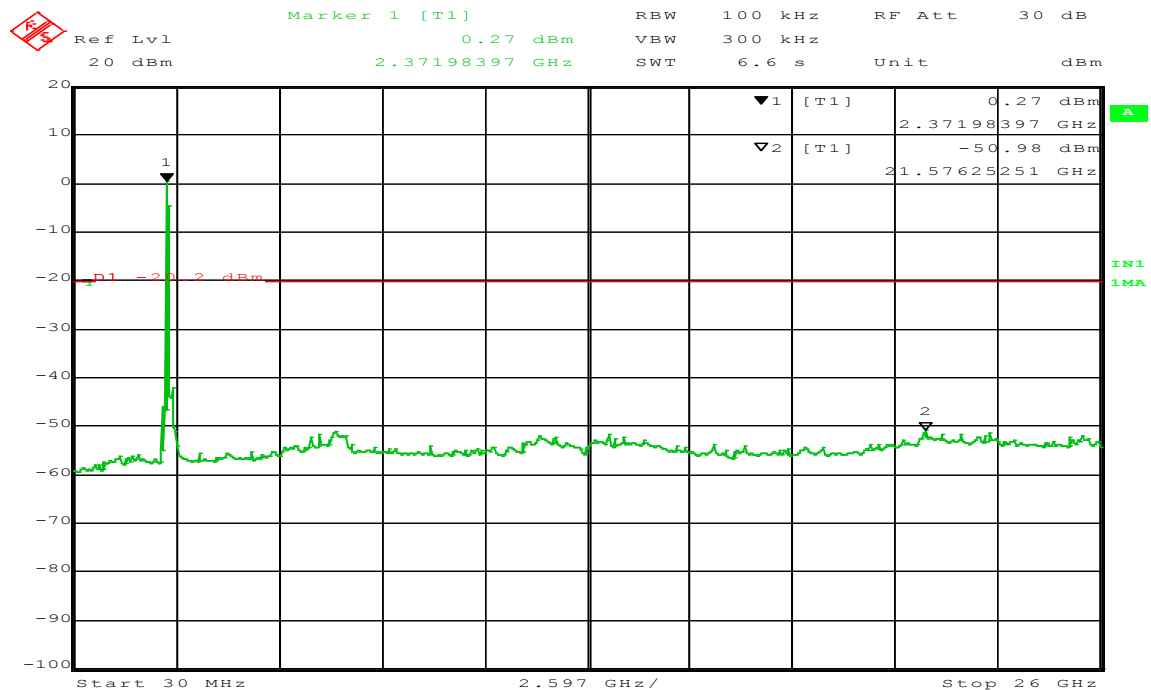
IC: 3232A-410633

Certificate # 1514.1

Representative spectrum analyzer plot showing conducted spurious emission measurement.  
Channel 1, 802.11g OFDM modulation.



Date: 21.MAY.2012 09:54:12



Date: 21.MAY.2012 09:55:56

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# Wireless Transceiver Test Report

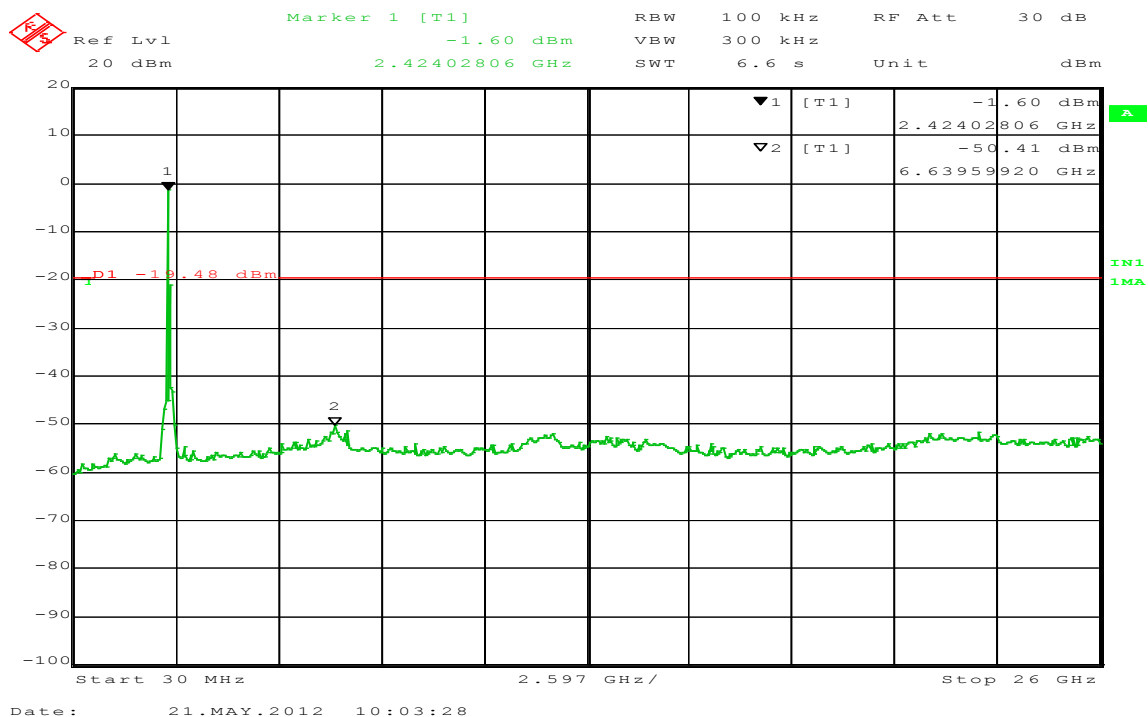
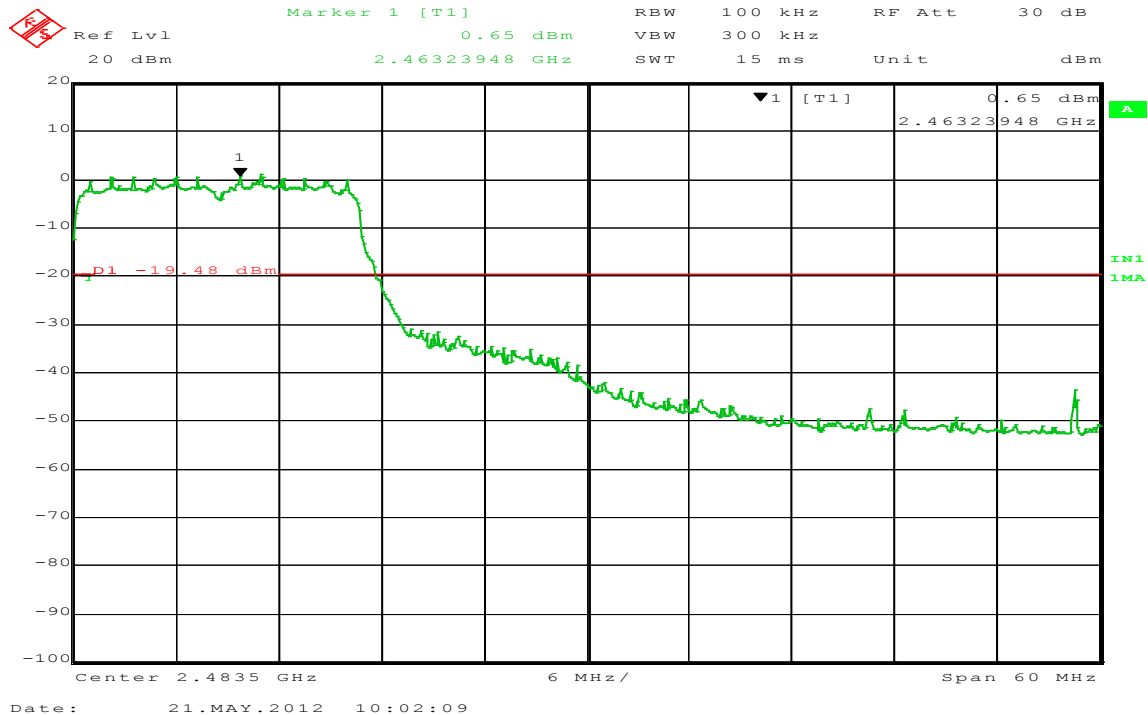


FCC ID: A94410633

IC: 3232A-410633

Certificate # 1514.1

Representative spectrum analyzer plot showing conducted spurious emission measurement.  
Channel 11, 802.11g OFDM modulation



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# Wireless Transceiver Test Report

FCC ID: A94410633

IC: 3232A-410633



Certificate # 1514.1

## 6.7.4 Test Equipment

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

## 6.7.5 Test Equipment

<b>Date of test:</b>	5/21/2012	<b>Test Location:</b>	DCE – Transmitter Test Bench
<b>EUT serial:</b>	SN118AE	<b>Tested by:</b>	B. Cerqua
<b>Test Conclusion:</b>	Pass		

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# Wireless Transceiver Test Report

FCC ID: A94410633

IC: 3232A-410633



Certificate # 1514.1

## 6.8. Receiver spurious emissions

### 6.8.1 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.

### 6.8.2 Test Setup

The EUT is tuned to the middle of the band and placed in receive mode.

Conducted:

The EUT antenna is removed and replaced with a 200mm long piece of RG178 cable with an SMA connector at the far end, this cable is rated to have less than 0.65dB of loss at 2.4GHz. For all conducted measurements the RG178 cable was connected directly to the spectrum analyzer. The EUT is placed in receive mode and tuned to the middle of the band (channel 6 = 2437 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.

### 6.8.3 Test data

Worst case RX spurious emissions on CON1 port measured at 9.676 GHz with 14.4 dB margin.

Worst case RX spurious emissions on CON2 port measured at 2.429 GHz with 20.7 dB margin.

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# Wireless Transceiver Test Report

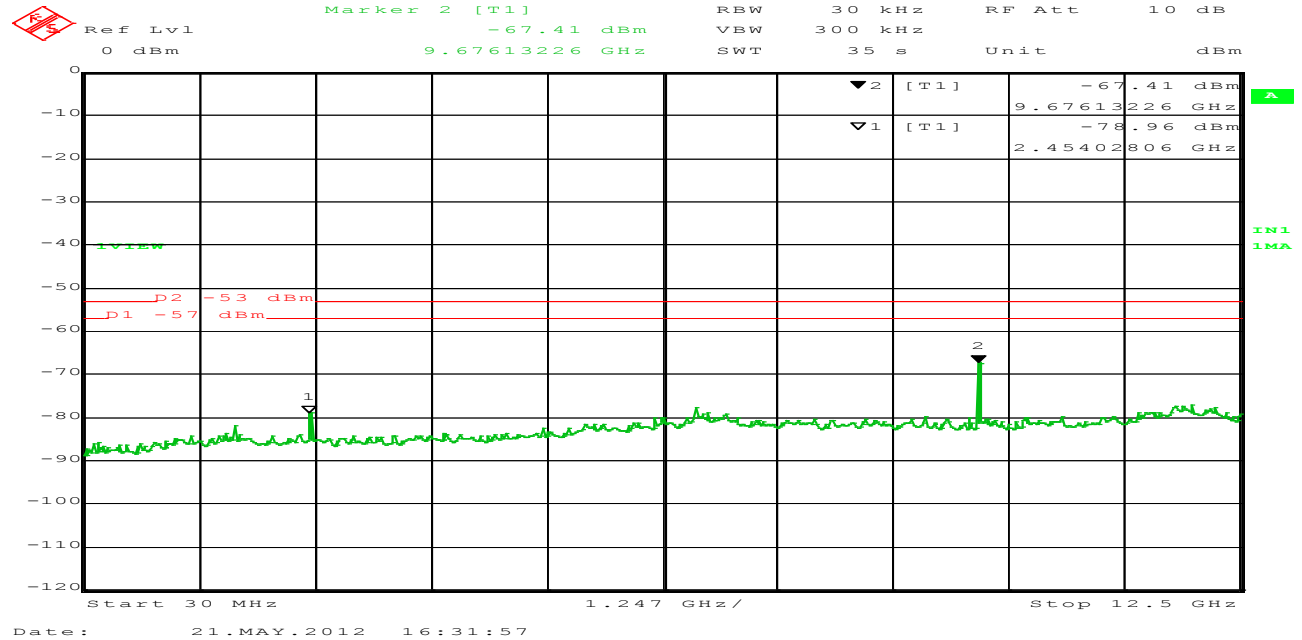


FCC ID: A94410633

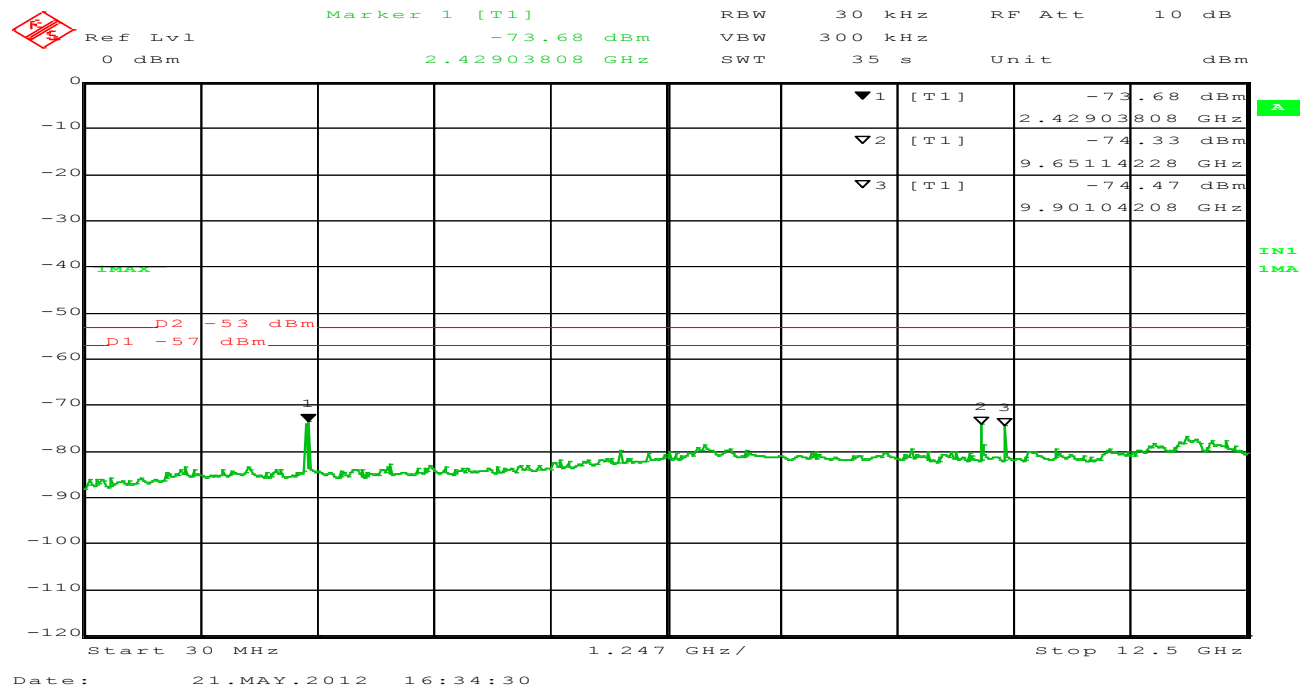
IC: 3232A-410633

Certificate # 1514.1

## CON1 port:



## CON2 port:



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# Wireless Transceiver Test Report

FCC ID: A94410633

IC: 3232A-410633



Certificate # 1514.1

## 6.8.4 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

## 6.8.5 Test information

Date of test:	5/21/2012	Test location:	Transmitter Test Bench
EUT serial:	SN118AE	Tested by:	B. Cerqua
Test Conclusion:	Pass		

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# Wireless Transceiver Test Report

FCC ID: A94410633

IC: 3232A-410633



Certificate # 1514.1

## 6.9. Maximum permissible exposure

### 6.9.1 Limits

From FCC 1.310 Table 1 (B), the maximum value of  $S = 1.0\text{mW/cm}^2$

From IC Safety Code 6, Section 2.2 Table 5 column 4, the maximum value of  $S = 10\text{W/m}^2$

### 6.9.2 MPE calculation

$$S = \text{EIRP} / (4 \cdot \pi \cdot D^2)$$

$S$  = power density in  $\text{W/m}^2$

$D$  = separation distance in meters

EIRP = Equivalent Isotropic radiated power in W

The highest measured EIRP (measured using a vertically polarized horn antenna at 3 meters) is with antenna 2 on channel 6 at 14.7 dBm (0.0295 W).

The product (typically a table mounted device, categorized as “mobile” in FCC OET Guide65) is to be used with a greater than 20cm (0.2m) distance from the human body.

The owners guide has a statement that specifies the 20cm minimum separation distance.

$$S = \text{EIRP} / (4 \cdot \pi \cdot D^2) = 0.0295 / (4 \cdot \pi \cdot 0.2^2) = 0.0587 \text{ W/m}^2 = 0.00587 \text{ mW/cm}^2$$

FCC:  $0.0587 \text{ mW/cm}^2 < 1 \text{ mW/cm}^2$       Pass

IC:  $0.0587 \text{ W/m}^2 < 10 \text{ W/m}^2$       Pass

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