

## FCC CFR47 PART 15 SUBPART C INDUSTRY CANADA RSS-210 ISSUE 8

**CERTIFICATION TEST REPORT** 

FOR

**3G/UNLICENSED WIRELESS HUB** 

MODEL NUMBER: QWH-HUB-V1.0A

FCC ID: J9C2NET IC: 2723A-2NET

REPORT NUMBER: 11U14082-3

**ISSUE DATE: NOVEMBER 30, 2011** 

Prepared for QUALCOMM INCORPORATED 5775 MOREHOUSE DRIVE SAN DIEGO, CA 92121-1714 U.S.A.

Prepared by COMPLIANCE CERTIFICATION SERVICES (UL CCS) 47173 BENICIA STREET FREMONT, CA 94538, U.S.A. TEL: (510) 771-1000 FAX: (510) 661-0888

(R)

NVLAP LAB CODE 200065-0

## **Revision History**

Rev.	Issue Date	Revisions	Revised By
	11/30/11	Initial Issue	F. Ibrahim

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8. 8	7. 1. 7. 1. 7. 1. 7. 1. 7. 1. 7. 1. 7. 1. 7. 2. 7. 2.	<ul> <li>802.11b MODE IN THE 2.4 GHz BAND.</li> <li>1. 6 dB BANDWIDTH</li> <li>2. 99% BANDWIDTH</li> <li>3. OUTPUT POWER.</li> <li>4. AVERAGE POWER</li> <li>5. POWER SPECTRAL DENSITY</li> <li>6. CONDUCTED SPURIOUS EMISSIONS.</li> <li>802.11g MODE IN THE 2.4 GHz BAND.</li> <li>1. 6 dB BANDWIDTH</li> <li>2. 99% BANDWIDTH</li> <li>3. OUTPUT POWER.</li> <li>4. AVERAGE POWER</li> <li>5. POWER SPECTRAL DENSITY</li> <li>6. CONDUCTED SPURIOUS EMISSIONS.</li> </ul>	11 15 23 24 28 35 35 39 43 43 47 48 52 59
8. 8	7. 1. 7. 1. 7. 1. 7. 1. 7. 1. 7. 1. 7. 2. 7. 3. 7. 3. 7. 4. 7. 7. 7. 7. 7. 7. 7. 7. 7. 7. 7. 7. 7. 7	<ul> <li>802.11b MODE IN THE 2.4 GHz BAND.</li> <li>6 dB BANDWIDTH</li></ul>	11 15 19 23 24 28 35 39 43 43 47 48 52 59 59 60
8. 8	7. 1. 7. 1. 7. 1. 7. 1. 7. 1. 7. 1. 7. 1. 7. 2. 7. 2.	<ul> <li>802.11b MODE IN THE 2.4 GHz BAND.</li> <li>6 dB BANDWIDTH</li> <li>99% BANDWIDTH</li> <li>OUTPUT POWER.</li> <li>AVERAGE POWER</li> <li>POWER SPECTRAL DENSITY</li> <li>CONDUCTED SPURIOUS EMISSIONS.</li> <li>802.11g MODE IN THE 2.4 GHz BAND.</li> <li>6 dB BANDWIDTH</li> <li>99% BANDWIDTH</li> <li>99% BANDWIDTH</li> <li>OUTPUT POWER.</li> <li>AVERAGE POWER</li> <li>POWER SPECTRAL DENSITY</li> <li>CONDUCTED SPURIOUS EMISSIONS.</li> </ul> DIATED TEST RESULTS <i>LIMITS AND PROCEDURE TRANSMITTER ABOVE 1 GHz</i> 1. TX ABOVE 1 GHz FOR 802.11b 1TX MODE IN THE 2.4 GHz BAND	11 15 19 23 24 28 35 39 39 43 43 47 48 52 59 59 60 60
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Pass

Pass

# **1. ATTESTATION OF TEST RESULTS**

INDUSTRY CANADA RSS-210 Issue 8 Annex 8

**INDUSTRY CANADA RSS-GEN Issue 3** 

COMPANY NAME:	QUALCOMM INCORPORATED 5775 MOREHOUSE DRIVE SAN DIEGO, CA 92121-1714 U.S.A.		
EUT DESCRIPTION:	3G/UNLICENSED WIRELESS HUB		
MODEL:	QWH-HUB-V1.0A		
SERIAL NUMBER:	FCC 5 (Antenna Port) and 145 (Radiated	d)	
DATE TESTED:	NOVEMBER 18 TO 22, 2011		
	APPLICABLE STANDARDS		
ST	ANDARD	TEST RESULTS	
CFR 47 Pa	art 15 Subpart C	Pass	

Compliance Certification Services (UL CCS) tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL CCS based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

**Note:** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL CCS will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Approved & Released For UL CCS By:

FRANK IBRAHIM EMC SUPERVISOR UL CCS

Tested By:

DAVID GARCIA EMC ENGINEER UL CCS

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# 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2009, FCC CFR 47 Part 2, FCC CFR 47 Part 15, RSS-GEN Issue 3, and RSS-210 Issue 8.

# 3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 Benicia Street, Fremont, California, USA.

UL CCS is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <u>http://www.ccsemc.com</u>.

# 4. CALIBRATION AND UNCERTAINTY

# 4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

# 4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB) 36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

# 4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	3.52 dB
Radiated Disturbance, 30 to 1000 MHz	4.94 dB

Uncertainty figures are valid to a confidence level of 95%.

# 5. EQUIPMENT UNDER TEST

# 5.1. DESCRIPTION OF EUT

The EUT is a 3G/ Unlicensed Wireless Hub with WLAN and Bluetooth.

The radio module is manufactured by Huawei.

# 5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted output power as follows:

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2412 - 2462	802.11b	18.24	66.68
2412 - 2462	802.11g	19.40	87.10

# 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an internal PIFA antenna, with a maximum gain of 3.8 dBi.

# 5.4. SOFTWARE AND FIRMWARE

The test utility software used during testing was wlanContTx2, rev. 11-2-2011

# 5.5. WORST-CASE CONFIGURATION AND MODE

The worst-case channel is determined as the channel with the highest output power.

Radiated emissions below 1 GHz and power line conducted emissions were performed with the EUT set to the channel with highest output power.

For the fundamental investigation X, Y and Z orientations have been investigated, and the worst case was found to be at Y orientation.

Worst-case data rates used based on input from the client were as follows: 802.11b mode: 1 Mbps 802.11g mode: 6 Mbps

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# 5.6. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST								
Description	Description Manufacturer Model Serial Number FCC ID							
Laptop PC	HP/Compaq	6910p	CND8153DGD	DoC				
AC Adapter	HP	PA-1131-08HC	820024302	N/A				

#### I/O CABLES

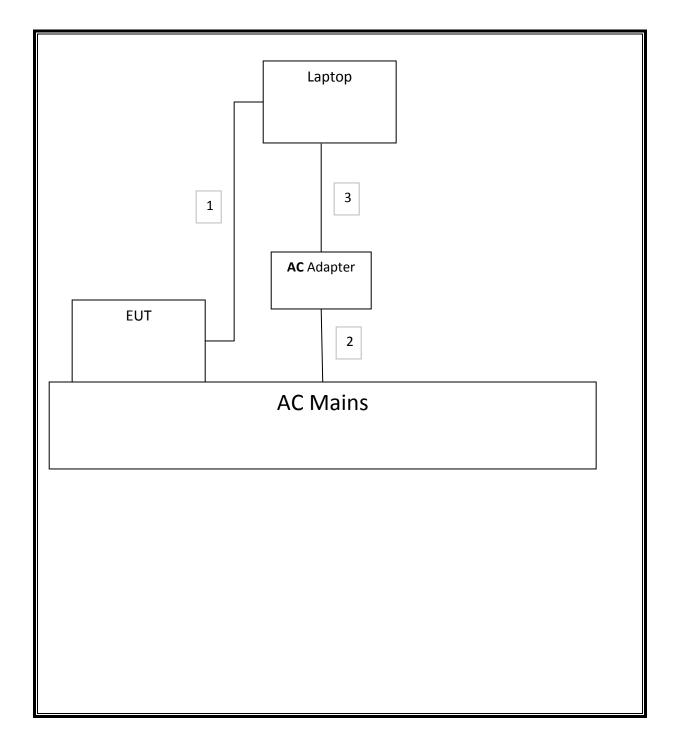
	I/O CABLE LIST							
Cable No.		# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks		
1	USB	1	USB	Shieldied	1m			
2	AC	1	AC	Unshielded	1.8m			
3	DC	1	DC	Unshielded	1.8m			

#### TEST SETUP

The EUT is set to transmit WLAN mode by temporarily connecting to a laptop via a USB cable to enter the appropriate command in the DOS CMD window.

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## **SETUP DIAGRAM FOR TESTS**



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# 6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

TEST EQUIPMENT LIST						
Description	Manufacturer	Model	Asset	Cal Due		
Spectrum Analyzer, 26.5 GHz	Agilent / HP	E4440A	C01176	08/04/12		
P-Seies single channel Power Meter	Agilent / HP	N1911A	1260847C	08/04/12		
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C00986	12/17/11		
Bi Directional coupler	RF Lambda	RFDC5M06G15				
P-Seies single channel Power Meter	Agilent / HP	N1911A	N/A	08/04/12		
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01052	06/13/12		
Preamplifier, 1300 MHz	Agilent / HP	8447D	C01048	07/16/12		
BiLog Antenna	ETS	3117	C01005	07/25/12		
Antenna, Horn, 18 GHz	EMCO	3115	C00945	06/26/12		
PSA	Agilent	E4440A	T129	04/28/12		
Power meter	Agilent	E4416A	PPM3	03/22/12		
Power Sensor	Agilent	E9327A	T233	03/22/12		
LISN, 30 MHz	FCC	LISN-50/250-25-2	N02625	11/15/12		
LISN, 10 kHz ~ 30 MHz	Solar	8012-50-R-24-BNC	N02481	11/16/12		
EMI Test Receiver	R&S	ESC17	10000741	07/02/12		
Antenna, Horn, 26.5 GHz	ARA	SWH-28	C01015	10/06/12		

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# 7. ANTENNA PORT TEST RESULTS

# 7.1. 802.11b MODE IN THE 2.4 GHz BAND

## 7.1.1.6 dB BANDWIDTH

## LIMITS

FCC §15.247 (a) (2)

IC RSS-210 A8.2 (a)

The minimum 6 dB bandwidth shall be at least 500 kHz.

## TEST PROCEDURE

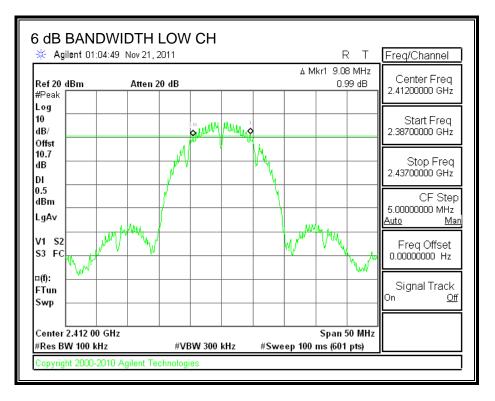
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

## **RESULTS**

Channel	Frequency	6 dB Bandwidth	Minimum Limit
	(MHz)	(MHz)	(MHz)
Low	2412	9.08	0.5
Middle	2437	9.00	0.5
High	2462	9.08	0.5

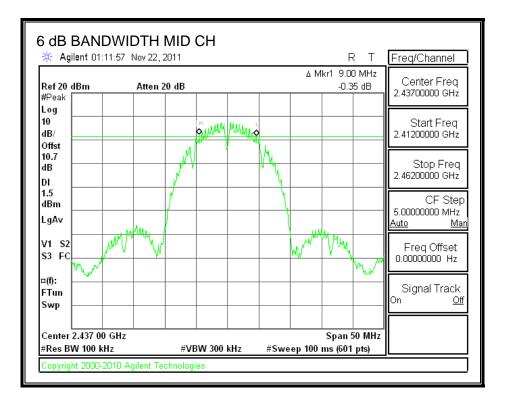
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#### 6 dB BANDWIDTH

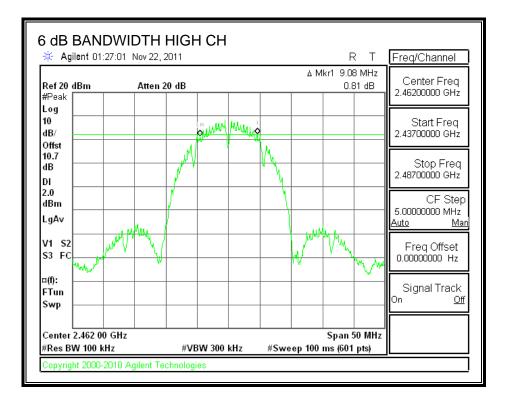


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## 7.1.2. 99% BANDWIDTH

### <u>LIMITS</u>

None; for reporting purposes only.

#### TEST PROCEDURE

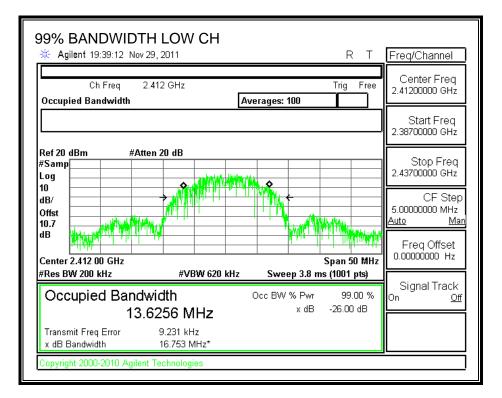
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

#### **RESULTS**

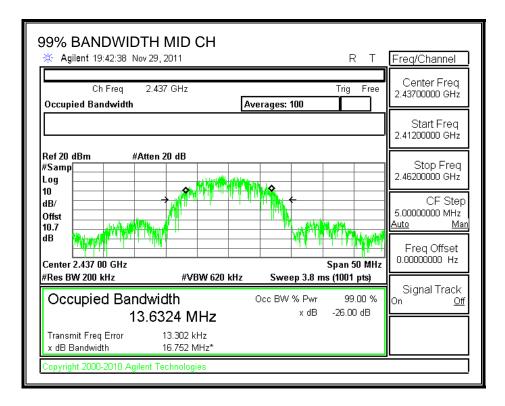
Channel	Frequency	99% Bandwidth
	(MHz)	(MHz)
Low	2412	13.6256
Middle	2437	13.6324
High	2462	13.6518

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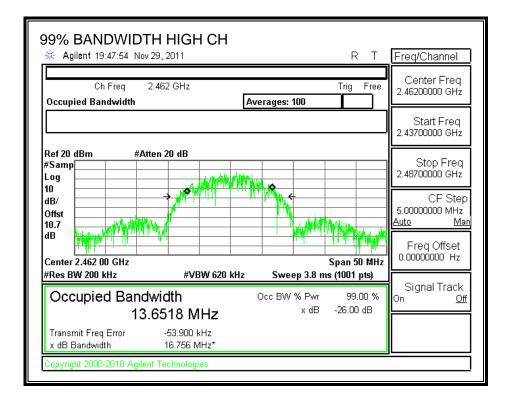
#### 99% BANDWIDTH



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## 7.1.3. OUTPUT POWER

## LIMITS

FCC §15.247 (b)

IC RSS-210 A8.4

The maximum antenna gain is less than or equal to 6 dBi, therefore the limit is 30 dBm.

### TEST PROCEDURE

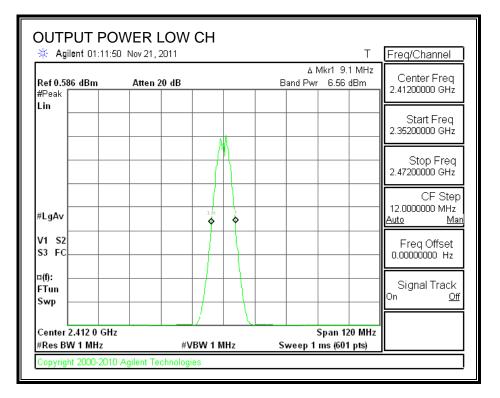
Peak power is measured using the Channel bandwidth Alternative peak output power procedure specified in "TCB Training for Devices covered under Scopes A1 - A4" by Joe Dichoso, May 2003.

### **RESULTS**

Channel	Frequency	Peak Power	Attenuator and	Output	Limit	Margin
		Reading	Cable Offset	Power		
	(MHz)	(dBm)	(dB)	(dBm)	(dBm)	(dB)
Low	2412	6.56	10.71	17.27	30	-12.73
Middle	2437	7.04	10.71	17.75	30	-12.25
High	2462	7.53	10.71	18.24	30	-11.76

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#### **OUTPUT POWER**



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OUTPUT PO	OWER MID	СН		
🔆 Agilent 01:16:	32 Nov 22, 2011		Т	Freq/Channel
Ref 1.031 dBm #Peak	Atten 20 dB		∆ Mkr1 9.0 MHz Band Pwr 7.04 dBm	Center Freq 2.43700000 GHz
Lin		hh l		Start Freq 2.37700000 GHz
				- Stop Freq 2.49700000 GHz
#LgAv				CF Step 12.000000 MHz <u>Auto Man</u>
V1 S2 S3 FC				Freq Offset 0.00000000 Hz
¤(f): FTun Swp				Signal Track
Center 2.437 0 GH #Res BW 1 MHz		//////////////////////////////////////	Span 120 MH: Sweep 1 ms (601 pts)	Z
Copyright 2000-201	0 Agilent Technolog	ies		

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		Δ Mkr1 9.1 MH Pwr 7.53 dBm	riegenanner
			Center Freq 2.46200000 GHz Start Freq 2.40200000 GHz Stop Freq 2.52200000 GHz
			2.40200000 GHz Stop Freq 2.52200000 GHz
			2.52200000 GHz
1.2.			CE Step
ΙΫ́́Υ			12.0000000 MHz Auto Man
			Freq Offset 0.00000000 Hz
			Signal Track
#VBW 1 MHz	Sweep	Span 120 Mi ) 1 ms (601 pts)	
	#VBW 1 MHz ogies		#VBW 1 MHz Sweep 1 ms (601 pts)

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## 7.1.4. AVERAGE POWER

### **LIMITS**

None; for reporting purposes only.

### TEST PROCEDURE

The transmitter output is connected to a power meter.

#### RESULTS

The cable assembly insertion loss of 10.71 dB (including 10 dB pad and 0.71 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency	Power
	(MHz)	(dBm)
Low	2412	15.25
Middle	2437	15.85
High	2462	16.22

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## 7.1.5. POWER SPECTRAL DENSITY

## <u>LIMITS</u>

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

### TEST PROCEDURE

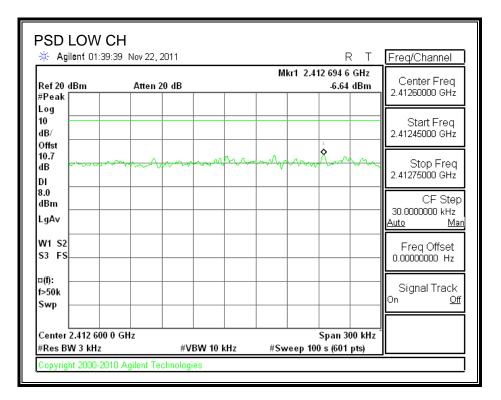
Output power was measured based on the use of a peak measurement, therefore the power spectral density was measured using PSD Option 1 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

#### <u>RESULTS</u>

Channel	Frequency	PPSD	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	2412	-6.64	8	-14.64
Middle	2437	-6.45	8	-14.45
High	2462	-5.64	8	-13.64

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#### POWER SPECTRAL DENSITY



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A right of 2	0:35 Nov 22, 2011			T	Freq/Channel
Ref 20 dBm #Peak	Atten 20 dB	1	MKr1 2.4	36 042 5 GHz -6.45 dBm	Center Freq 2.43605000 GHz
Log 10					Start Freq
dB/		1			2.43590000 GHz
10.7 dB	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	-	handhar	.h.a.	Stop Freq 2.43620000 GHz
DI 8.0 dBm					CF Step
LgAv					30.0000000 kHz <u>Auto Ma</u>
W1 S2 S3 FS					Freq Offset 0.00000000 Hz
¤(f):					Signal Track
Swp					On <u>Of</u>
Center 2.436 050 #Res BW 3 kHz		/BW 10 kHz		Span 300 kHz 0 s (601 pts)	

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, inglient of to	4:14 Nov 22, 2011		Mkr1 2	461 248 0 GHz	Freq/Channel
Ref 20 dBm #Peak □ □ □	Atten 20 dB			-5.64 dBm	Center Freq 2.46125000 GHz
Log 10					Start Freq
dB/ Offst		1			2.46110000 GHz
dB	mm	mamo	mon	man	Stop Freq 2.46140000 GHz
DI					CF Step
dBm LgAv					30.0000000 kHz Auto Ma
W1 S2 S3 FS					Freq Offset 0.00000000 Hz
¤(f): f>50k Swp					Signal Track
					╢┝──────

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## 7.1.6. CONDUCTED SPURIOUS EMISSIONS

## LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

## TEST PROCEDURE

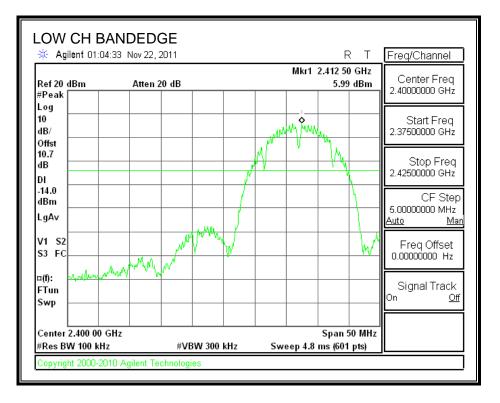
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

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### **RESULTS**

### SPURIOUS EMISSIONS, LOW CHANNEL

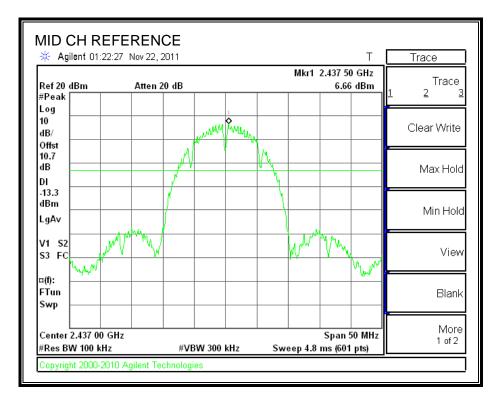


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🔆 Agilent 01:05:	49 Nov 22, 2011			RT	Freq/Channel
Ref 20 dBm #Peak	Atten 20 dB		Mkr1 25. _50.	013 GHz 63 dBm	Center Freq 13.0150000 GHz
Log 10 dB/					Start Freq 30.0000000 MHz
Offst 10.7 dB DI					Stop Freq 26.0000000 GHz
-14.0 dBm LgAv					CF Step 2.59700000 GHz <u>Auto Ma</u>
V1 S2 S3 FC		Luthaline Halls	والأقرب الموجود المراجع		Freq Offset 0.00000000 Hz
⊐(f): FTun Swp	where the second		Jun Vorte and and an	-	Signal Track On <u>Of</u>
Start 30 MHz #Res BW 100 kHz	#VBW 3	800 kHz Sw	Stop 26. eep 2.482 s (100		

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#### SPURIOUS EMISSIONS, MID CHANNEL

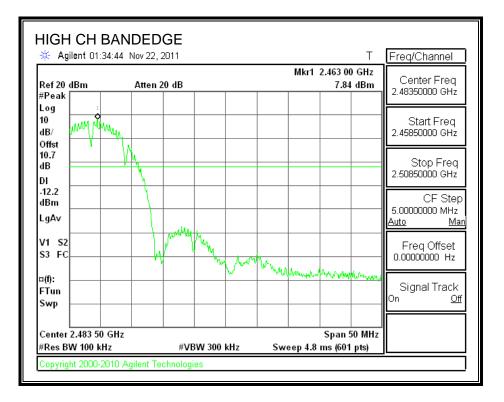


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Agilent 01:23:					Freq/Channel
Ref 20 dBm #Peak	Atten 20 dB		Mki	1 24.182 GHz -50.87 dBm	Center Freq 13.0150000 GHz
Log					
10					Start Freq
dB/					30.0000000 MHz
Offst 10.7					
dB					Stop Freq
DI					26.000000 GHz
-13.3					CF Ster
dBm					2.59700000 GHz
LgAv					<u>Auto Ma</u>
V1 S2					Freq Offset
\$3 FC					0.00000000 Hz
	-	white water and	and a stand and a stand and the	www.www.	*
⊏(f): FTun	Amendary La Labor				Signal Track
Swp					0n <u>Of</u>
Start 30 MHz		I	Sto	p 26.000 GHz	, , , , , , , , , , , , , , , , , , ,
#Res BW 100 kHz	#VBW	300 kHz	Sweep 2.482	•	

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#### SPURIOUS EMISSIONS, HIGH CHANNEL



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🔆 Agilent 01:35	.55 1407 22, 2011		T	Freq/Channel
Ref 20 dBm #Peak	Atten 20 dB		Mkr1 25.039 GHz -50.65 dBm	Center Freq 13.0150000 GHz
Log				
10 dB/ Offst				Start Freq 30.0000000 MHz
dB				Stop Freq
aB DI				26.0000000 GHz
.12.2 dBm				CF Step 2.59700000 GHz
				Auto Ma
V1 S2 S3 FC				Freq Offset 0.00000000 Hz
⊐(f):	mon	and property and the particulation of	And the second sec	
FTun Swp				Signal Track On <u>Of</u>
Start 30 MHz			Stop 26.000 GHz	

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# 7.2. 802.11g MODE IN THE 2.4 GHz BAND

## 7.2.1. 6 dB BANDWIDTH

## **LIMITS**

FCC §15.247 (a) (2)

IC RSS-210 A8.2 (a)

The minimum 6 dB bandwidth shall be at least 500 kHz.

## TEST PROCEDURE

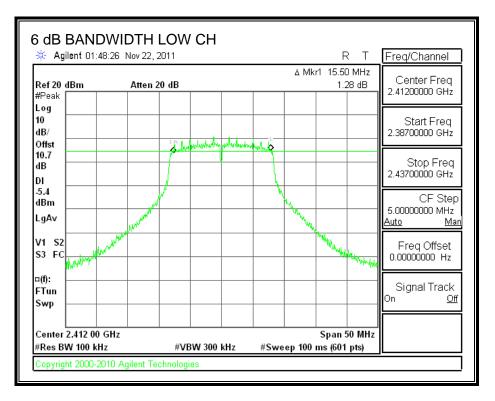
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

### **RESULTS**

Channel	Frequency	6 dB Bandwidth	Minimum Limit
	(MHz)	(MHz)	(MHz)
Low	2412	15.50	0.5
Middle	2437	15.75	0.5
High	2462	15.75	0.5

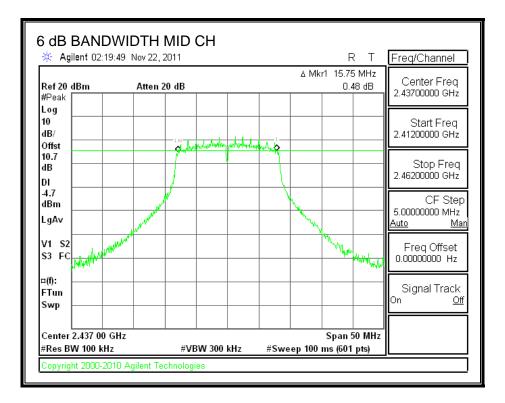
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#### 6 dB BANDWIDTH

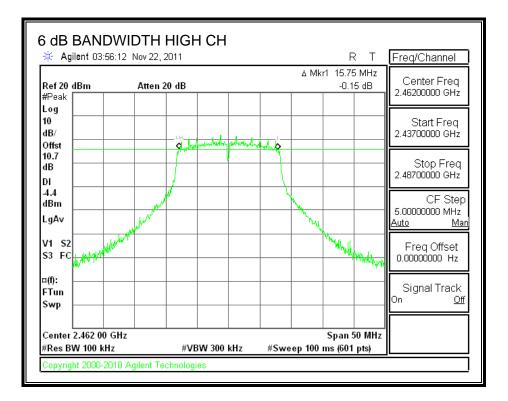


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# 7.2.2. 99% BANDWIDTH

## <u>LIMITS</u>

None; for reporting purposes only.

#### TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

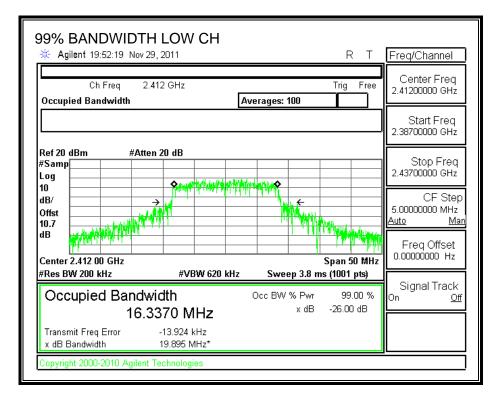
#### **RESULTS**

Channel	Frequency	99% Bandwidth
	(MHz)	(MHz)
Low	2412	16.337
Middle	2437	16.3493
High	2462	16.3577

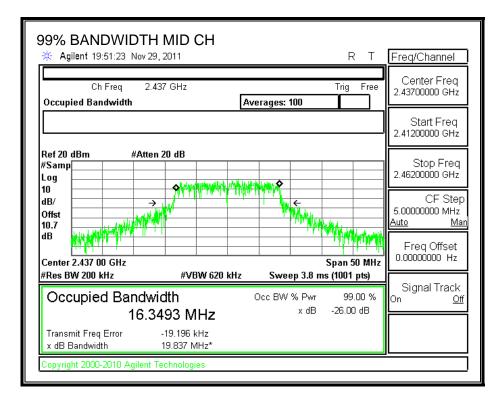
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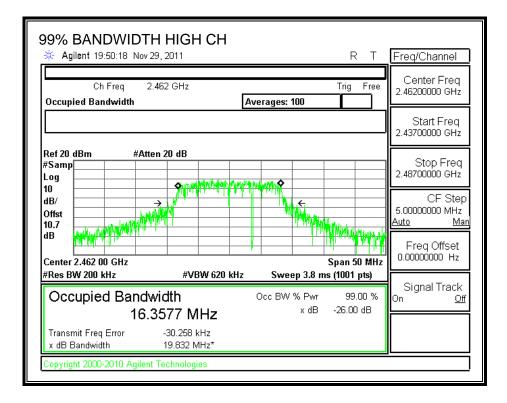
#### 99% BANDWIDTH



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# 7.2.3. OUTPUT POWER

## LIMITS

FCC §15.247 (b)

IC RSS-210 A8.4

The maximum antenna gain is less than or equal to 6 dBi, therefore the limit is 30 dBm.

## TEST PROCEDURE

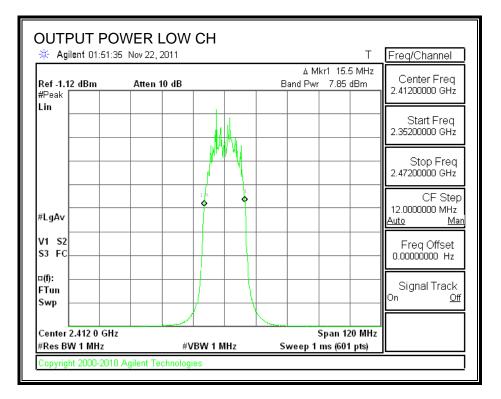
Peak power is measured using the Channel bandwidth Alternative peak output power procedure specified in "TCB Training for Devices covered under Scopes A1 - A4" by Joe Dichoso, May 2003.

## RESULTS

Channel	Frequency	Peak Power	Attenuator and	Output	Limit	Margin
		Reading	Cable Offset	Power		
	(MHz)	(dBm)	(dB)	(dBm)	(dBm)	(dB)
Low	2412	7.85	10.71	18.56	30	-11.44
Middle	2437	8.33	10.71	19.04	30	-10.96
High	2462	8.69	10.71	19.40	30	-10.60

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#### **OUTPUT POWER**



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OUTPUT PC	WER MID	СН		
🕂 🔆 Agilent 02:22:2	8 Nov 22, 2011		Т	Freq/Channel
Ref -0.518 dBm #Peak	Atten 10 dB		 1kr1 15.8 MHz r 8.33 dBm	Center Freq 2.43700000 GHz
Lin				Start Freq 2.37700000 GHz
				Stop Freq 2.49700000 GHz
#LgAv				CF Step 12.0000000 MHz <u>Auto Man</u>
V1 S2 S3 FC				Freq Offset 0.00000000 Hz
¤(f): FTun Swp				Signal Track On <u>Off</u>
Center 2.437 0 GHz #Res BW 1 MHz		/BW 1 MHz	Span 120 MHz ms (601 pts)	
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	OWER HIGH	I CH			
🔆 Agilent 03:59	:02 Nov 22, 2011			Т	Freq/Channel
Ref -0.08 dBm #Peak	Atten 10 dB			kr1 15.8 MHz 8.69 dBm	Center Freq 2.46200000 GHz
Lin					Start Freq 2.40200000 GHz
					Stop Freq 2.52200000 GHz
#LgAv					CF Step 12.000000 MHz <u>Auto Man</u>
V1 S2 S3 FC					Freq Offset 0.00000000 Hz
¤(f): FTun Swp					Signal Track On <u>Off</u>
Center 2.462 0 GI	47			Span 120 MHz	
#Res BW 1 MHz		/BW 1 MHz		ms (601 pts)	
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# 7.2.4. AVERAGE POWER

## **LIMITS**

None; for reporting purposes only.

## TEST PROCEDURE

The transmitter output is connected to a power meter.

#### RESULTS

The cable assembly insertion loss of 10.71 dB (including 10dB pad and 0.71dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency	Power
	(MHz)	(dBm)
Low	2412	11.23
Middle	2437	11.65
High	2462	12.05

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# 7.2.5. POWER SPECTRAL DENSITY

## <u>LIMITS</u>

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

## TEST PROCEDURE

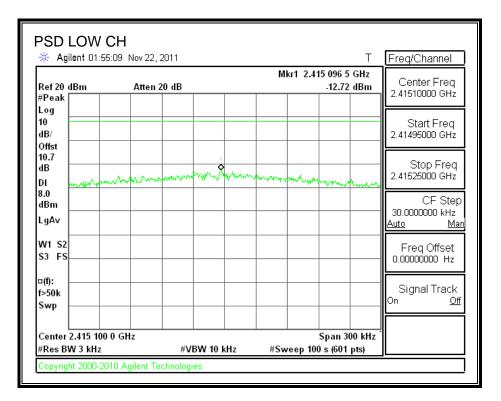
Output power was measured based on the use of a peak measurement, therefore the power spectral density was measured using PSD Option 1 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

#### <u>RESULTS</u>

Channel	Frequency	PPSD	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	2412	-12.72	8	-20.72
Middle	2437	-12.00	8	-20.00
High	2462	-12.40	8	-20.40

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#### **POWER SPECTRAL DENSITY**



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🔆 Agilent 02:25	::46 Nov 22, 2011			T	Freq/Channel
Ref 20 dBm #Peak	Atten 20 dB		Mkr1 2	.439 779 6 GHz -12.00 dBm	Center Freq 2.43975000 GHz
Log 10 dB/ Offst					Start Freq 2.43960000 GHz
10.7 dB DI	wanderstand	were work		man	- Stop Freq 2.43990000 GHz
8.0 dBm LgAv					CF Step 30.0000000 kHz <u>Auto Mar</u>
W1 S2 S3 FS					Freq Offset 0.00000000 Hz
¤(f): f>50k Swp					Signal Track On <u>Off</u>
Center 2.439 750 #Res BW 3 kHz		3W 10 kHz	#Sween '	Span 300 kHz 100 s (601 pts)	

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🔆 Agilent 04:05	:05 Nov 22, 2011			RT	Freq/Channel
Ref 20 dBm #Peak	Atten 20 dB		Mkr1 2	.460 441 0 GHz -12.40 dBm	Center Freq 2.46045000 GHz
Log 10 dB/ Offst					Start Freq 2.46030000 GHz
10.7 dB DI	y hono where a market way	north part	man	mananth	Stop Freq 2.46060000 GHz
8.0 dBm LgAv					CF Step 30.0000000 kHz <u>Auto Ma</u>
W1 S2 S3 FS					Freq Offset 0.00000000 Hz
¤(f): f>50k Swp					Signal Track On <u>Of</u>
Center 2.460 450 #Res BW 3 kHz		BW 10 kHz	#Swoon	Span 300 kHz 100 s (601 pts)	

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# 7.2.6. CONDUCTED SPURIOUS EMISSIONS

## LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

## TEST PROCEDURE

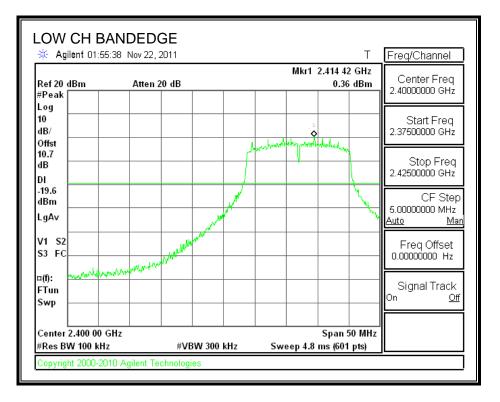
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

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## **RESULTS**

#### SPURIOUS EMISSIONS, LOW CHANNEL



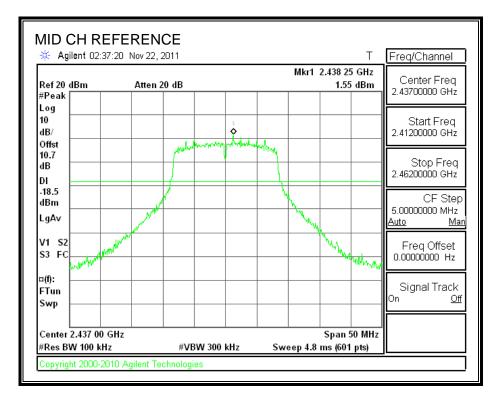
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	2 Nov 22, 2011		1 05 005 011	Freq/Channel
Ref 20 dBm #Peak	Atten 20 dB	Mkr	1 25.065 GHz -50.65 dBm	Center Freq 13.0150000 GHz
Log				
10 dB/				Start Freq 30.0000000 MHz
Offst 10.7				Ctop Frita
dB DI				Stop Freq 26.000000 GHz
-19.6 dBm				CF Ster
LgAv				2.59700000 GHz <u>Auto Ma</u>
V1 S2 S3 FC			1	Freq Offset 0.00000000 Hz
	the second start and	A management and we want	and the way when	0.0000000 Hz
⊐(f): FTun Swp	Here was a second and the second s			Signal Track On <u>O</u> f
r				
Start 30 MHz		Sto	p 26.000 GHz	

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#### SPURIOUS EMISSIONS, MID CHANNEL

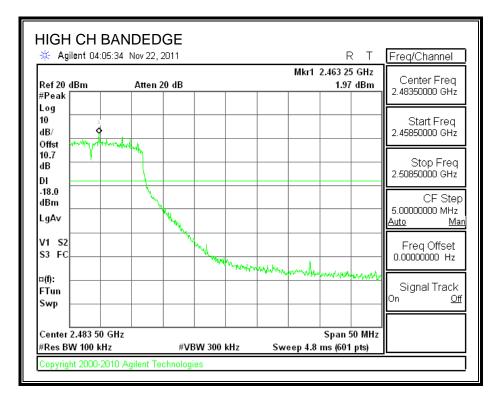


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🔆 Agilent 02:38:	· , · ·	MI	gr1 24.935 GHz	Freq/Channel
Ref 20 dBm #Peak	Atten 20 dB		-50.57 dBm	Center Freq 13.0150000 GHz
Log				
10 dB/				Start Freq 30.0000000 MHz
Offst 10.7 dB				Stop Freq
DI				20.0000000 0112
dBm				CF Step
LgAv				2.59700000 GHz <u>Auto Ma</u>
V1 S2 S3 FC			1	Freq Offset
	www.www.www.	and the stand and the stand and a	un where where	0.00000000 112
⊏(f): FTun Swp				Signal Track On <u>Of</u>
Start 30 MHz #Res BW 100 kHz		Si 0 kHz Sweep 2.482	top 26.000 GHz	

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#### SPURIOUS EMISSIONS, HIGH CHANNEL



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🔆 Agilent 04:06:3	31 Nov 22, 2011			RT	Freq/Channel
Ref 20 dBm #Peak	Atten 20 dB		Mkr1 24.9 -50.2	87 GHz 3 dBm	Center Freq 13.0150000 GHz
Log 10 dB/ Offst					Start Freq 30.0000000 MHz
dB					Stop Freq 26.0000000 GHz
-18.0 dBm LgAv					CF Step 2.59700000 GHz <u>Auto Ma</u>
V1 S2 S3 FC					Freq Offset 0.00000000 Hz
¤(f): FTun Swp		A A A A A A A A A A A A A A A A A A A			Signal Track On <u>Off</u>
Start 30 MHz #Res BW 100 kHz	#VBW 3	00 kHz Swe	Stop 26.0 ep 2.482 s (1001		

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# 8. RADIATED TEST RESULTS

# 8.1. LIMITS AND PROCEDURE

# <u>LIMITS</u>

FCC §15.205 and §15.209

IC RSS-210 Clause 2.6 (Transmitter)

IC RSS-GEN Clause 6 (Receiver)

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

# TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.4. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

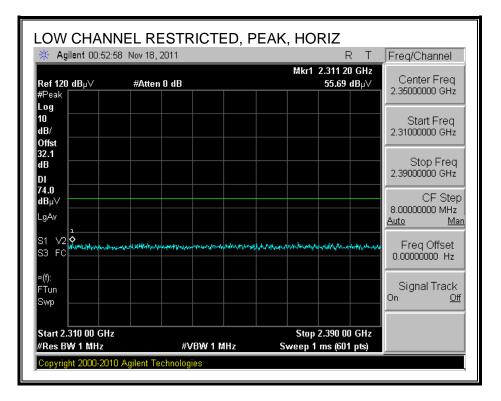
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

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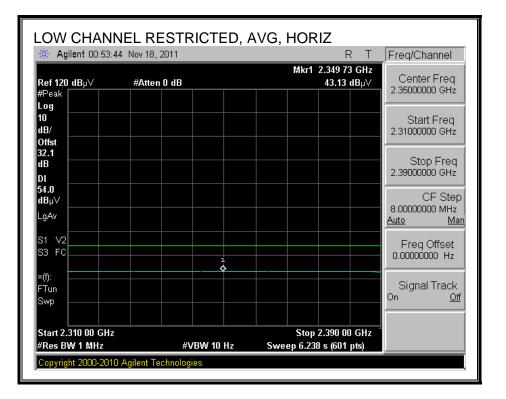
# 8.2. TRANSMITTER ABOVE 1 GHz

# 8.2.1. TX ABOVE 1 GHz FOR 802.11b 1TX MODE IN THE 2.4 GHz BAND

## **RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)**

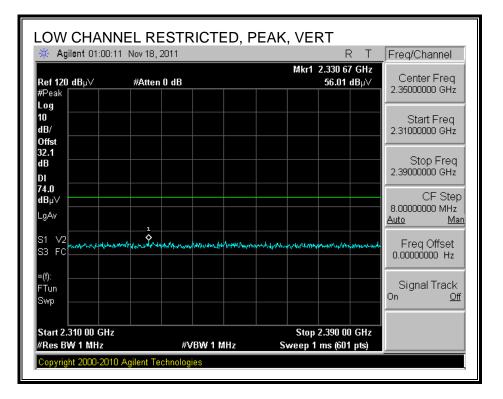


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### **RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)**



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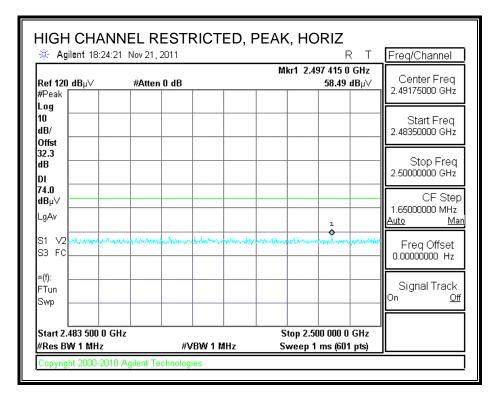
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		Mkr1	R 1 2.348 00 GH: 43.10 dBµ↓	<ul> <li>Center Freq 2.35000000 GHz</li> <li>Start Freq 2.31000000 GHz</li> <li>Stop Freq 2.39000000 GHz</li> <li>CF Step 8.00000000 MHz</li> </ul>
10 dB/ Offst 32.1 dB DI 54.0 dBµ√ LgAv S1 √2 S3 FC				2.31000000 GHz Stop Freq 2.39000000 GHz CF Step 8.00000000 MHz
32.1				2.39000000 GHz CF Step 8.00000000 MHz
dBµ/ LgAw S1 V2 S3 FC				8.0000000 MHz
S3 FC				<u>Auto Man</u>
×(f):	1 \$			Freq Offset 0.00000000 Hz
FTun Swp				Signal Track On <u>Off</u>
Start 2.310 00 GHz #Res BW 1 MHz #VBW	10 Hz	Stop Sweep 6.23	2.390 00 GHz 8 s (601 pts)	z

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## **RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)**



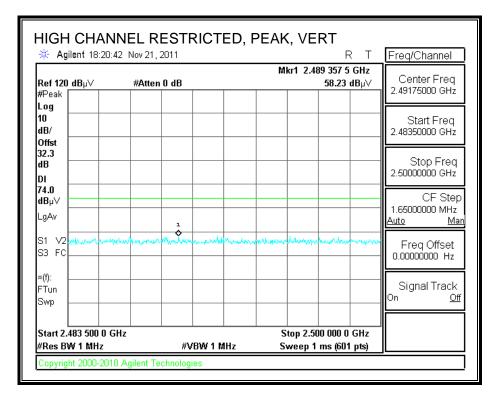
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HIGH CHANN		ED, AVG, HORIZ	Freq/Channel
Ref 120 dBµ∨ #Peak	#Atten 0 dB	Mkr1 2.499 945 0 GHz 45.37 dBµ∨	Center Freq 2.49175000 GHz
Log 10 dB/ Offst			Start Freq 2.48350000 GHz
32.3 dB DI			Stop Freq 2.5000000 GHz
54.0 dBµ∨ LgAv			CF Step 1.6500000 MHz <u>Auto Man</u>
S1 V2 S3 FC			Freq Offset 0.00000000 Hz
×(f): FTun Swp			Signal Track On <u>Off</u>
Start 2.483 500 0 GH #Res BW 1 MHz	lz #VBW 10 l	Stop 2.500 000 0 GHz Hz Sweep 1.287 s (601 pts)	
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## **RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)**



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HIGH CHANN		CTED,	AVG, VERT	Г R Т	
Ref 120 dBµ∨	#Atten 0 dB		Mkr1 2.497		Freq/Channel Center Freq 2.49175000 GHz
#Peak Log 10 dB/					Start Freq 2.48350000 GHz
Offst 32.3 dB DI					Stop Freq 2.5000000 GHz
54.0 dBµ∨ LgAv					CF Step 1.6500000 MHz <u>Auto Man</u>
S1 V2 S3 FC				1 Ø	Freq Offset 0.00000000 Hz
×(f): FTun Swp					Signal Track On <u>Off</u>
Start 2.483 500 0 GH #Res BW 1 MHz	- #VBW	10 Hz	Stop 2.500 Sweep 1.287 :	000 0 GHz s (601 pts)	ļ
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#### HARMONICS AND SPURIOUS EMISSIONS

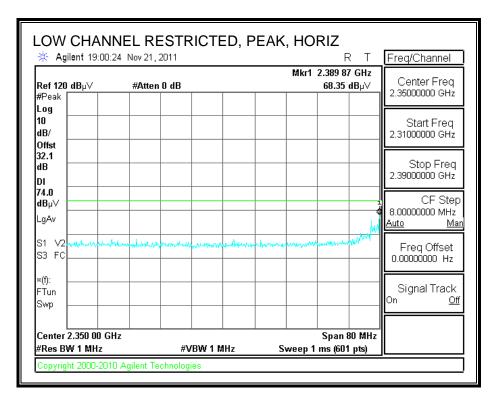
Company Project # Date: Cest Engi	:		Qualcomm 11U14082 11/21/2011 Thanh Nguyen												
Configur Aode:			EUT StandAlo Transmit b Mo	ne											
est Equi			Dre er	life	4.06	211-	Dec. am		26 40 01			orn > 180	S11_		Limit
		18GHz	Pre-an	· ·		382	Pre-am	piner	26-40GH						FCC 15.205
160; S	/N: 223	8@3m	▼ 134 HI	P 8449E		•				▼   1123	5; ARA 18-26	GHZ; 5/N.1	007	•	FCC 10.200
Hi Frequ	ency Cabl	es	1							n					
		22807700	12' c	able 2	28076	000			807500		HPF		ject Filte		<u>k Measurements</u> W=VBW=1MHz
3' ca	able 228	807700	- 12' ca	ble 228	07600	-	20' cabl	e 2280	7500 -			- R_	001		<b>age Measurements</b> 1MHz ; VBW=10Hz
f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
.ow Ch	(ш)	UDUY	UDUV	0D/III	uD	UD	uD	uD	ири у/ш	UDu v/m	UDu v/m	UDu v/m	սո	CU	(1/11)
.824	3.0	37.6	25.0	33.9	6.3	-34.1	0.0	0.0	43.7	31.1	74	54	-30.3	-22.9	Noise floor/V
.824	3.0	37.8	24.9	33.9	6.3	-34.1	0.0	0.0	43.9	31.0	74	54	-30.1	-23.0	Noise floor/H
fid Ch															
.874	3.0 3.0	38.3	25.2 25.4	33.9	6.3 6.3	-34.0 -34.0	0.0	0.0	44.5 44.8	31.4 31.6	74 74	54 54	-29.5 -29.2	-22.6 -22.4	Noise floor/V Noise floor/H
.874 Iigh Ch	3.0	38.6	25.4	33.9	0.3	-34.0	0.0	0.0	44.8	31.0	/4	34	-29.2	-22.4	Noise Hoor/H
.924	3.0	38.2	25.1	34.0	6.3	-34.0	0.0	0.0	44.5	31.4	74	54	-29.5	-22.6	Noise floor/V
.924	3.0	38.0	25.5	34.0	6.3	-34.0	0.0	0.0	44.3	31.8	74	54	-29.7	-22.2	Noise floor/H
	f Dist	Measuremo Distance to Analyzer R Antenna Fa	Reading	7		Amp D Corr Avg Peak	Average Calculate	Correc Field S	et to 3 mete Strength @ c Field Stre	3 m		Pk Lim Avg Mar	Peak Fiel Margin vs	Field Strengt d Strength Li s. Average L s. Peak Limit	imit imit

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# 8.2.2. TX ABOVE 1 GHz FOR 802.11g 1TX MODE IN THE 2.4 GHz BAND

## **RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)**



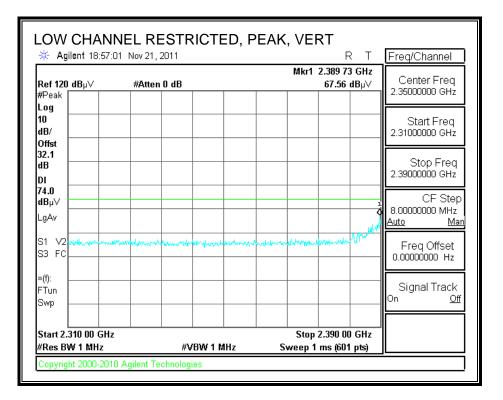
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LOW CHAN	NNEL RESTR	ICTED, /	AVG, HORIZ	Z	
🔆 Agilent 19:0	1:08 Nov 21, 2011			RΤ	Freq/Channel
<b>Ref 120 dB</b> µ∨ #Peak	#Atten 0 dB			390 00 GHz 19.48 dBµ∨	Center Freq 2.3500000 GHz
Log 10 dB/ Offst					Start Freq 2.31000000 GHz
32.1 dB DI					Stop Freq 2.3900000 GHz
<b>54.0</b> dBµ∨ LgAv					CF Step 8.0000000 MHz <u>Auto Man</u>
S1 V2 S3 FC					Freq Offset 0.00000000 Hz
×(f): FTun Swp					Signal Track On <u>Off</u>
Center 2.350 00 #Res BW 1 MHz		'BW 10 Hz	Sweep 6.238 s	Span 80 MHz \$ (601 pts)	
Copyright 2000-20	010 Agilent Technologi	es			

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## **RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)**



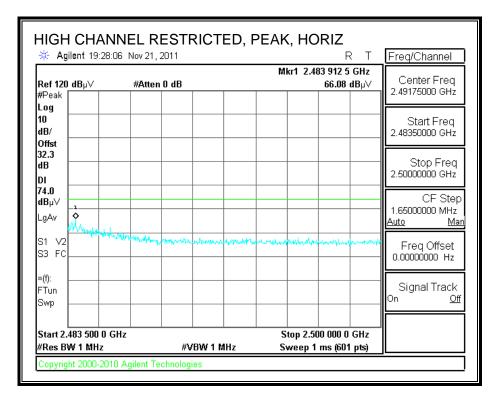
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LOW CHAN	NEL RESTRI	CTED, A	AVG, VERT	-	
🔆 Agilent 18:57:	37 Nov 21, 2011			RΤ	Freq/Channel
<b>Ref 120 dB</b> µ∨ #Peak	#Atten 0 dB			.390 00 GHz 50.06 dBµ∨	Center Freq 2.3500000 GHz
Log 10 dB/ Offst					Start Freq 2.3100000 GHz
32.1 dB DI					Stop Freq 2.3900000 GHz
<b>54.0</b> dBµ∀ LgAv					CF Step 8.0000000 MHz <u>Auto Man</u>
S1 V2 S3 FC					Freq Offset 0.00000000 Hz
×(f): FTun Swp					Signal Track On <u>Off</u>
Start 2.310 00 GHz #Res BW 1 MHz	-	W 10 Hz	Stop 2 Sweep 6.238	.390 00 GHz ´ s (601 pts)	
Copyright 2000-201	0 Agilent Technologies				

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### **RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)**



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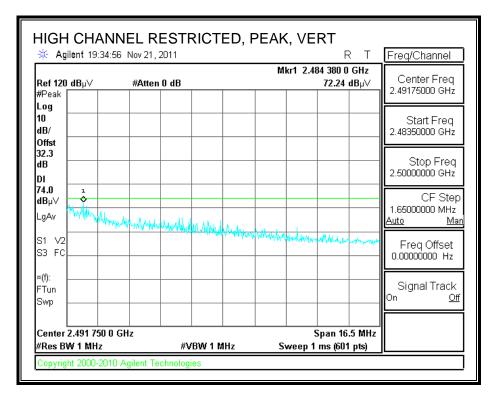
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HIGH CHAN		ED, AVG, HORIZ	T Freq/Channel
Agrient 19.20.0	0 1407 21, 2011	Mkr1 2.483 500 0 (	
Ref 120 dBµ∨ #Peak	#Atten 0 dB	MKF1 2.483 500 0 C 49.05 d	Contor Frog
Log 10 dB/ Offst			Start Freq 2.48350000 GHz
dB			Stop Freq 2.5000000 GHz
54.0 dBµ∀ LgAv			CF Step 1.6500000 MHz Auto Man
S1 V2 S3 FC			Freq Offset 0.00000000 Hz
×(f): FTun Swp			Signal Track
Start 2.483 500 0 G #Res BW 1 MHz	Hz #VBW 10	Stop 2.500 000 0 0 Hz Sweep 1.287 s (601 p	
Copyright 2000-2010	) Agilent Technologies		

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### **RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)**



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HIGH CHAN	NEL RESTRIC	CTED, A	AVG, VER	T	
🔆 Agilent 19:38:2	2 Nov 21, 2011			RT	Freq/Channel
<b>Ref 120 dB</b> µ∨ #Peak	#Atten 0 dB		Mkr1 2.48	33 500 0 GHz 53.85 dBµ∨	Center Freq 2.49175000 GHz
Log 10 dB/ Offst					Start Freq 2.48350000 GHz
32.3 dB DI					Stop Freq 2.5000000 GHz
54.0 dBµ∨ LgAv					CF Step 1.6500000 MHz <u>Auto Man</u>
S1 V2 S3 FC AA					Freq Offset 0.00000000 Hz
*(f): FTun Swp					Signal Track <sup>On <u>Off</u></sup>
Start 2.483 500 0 G #Res BW 1 MHz		/ 10 Hz	Stop 2.50 Sweep 1.287	00 000 0 GHz 7 s (601 pts)	
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### HARMONICS AND SPURIOUS EMISSIONS

Company Project # Date: Test Engi Configur Mode:	: neer:		Qualcomm 11U14082 11/21/2011 Thanh Nguyen EUT StandAlo Transmit g Mo	ne											
Test Equi	pment:														
Но	orn 1-	18GHz	Pre-ar	nplifer	1-260	GHz	Pre-am	plifer	26-40GH	z	Но	orn > 180	Hz		Limit
T59; S	/N: 324	5@3m	▼ T145 A	gilent 3	008A0	056 🖵				▼ T128	5; ARA 18-26	GHz; S/N:1	007	-	FCC 15.205
3' c	able 2	22807700		able 2 ble 2280		000 -	20' cal 20' cabl		807500 7500 -		HPF		ject Filte 001	RBV Avera	<u>k Measurements</u> W=VBW=1MHz age Measurements 1MHz ; VBW=10Hz
f	Dist		Read Avg.	AF	CL	Amp	D Corr	Fltr	Peak	Avg	Pk Lim	Avg Lim		Avg Mar	Notes
GHz Low Ch	(m)	dBuV	dBuV	dB/m	dB	dB	dB	dB	dBuV/m	dBuV/m	dBuV/m	dBuV/m	dB	dB	(V/H)
.824	3.0	36.9	25.0	33.2	6.3	-34.8	0.0	0.0	41.5	29.6	74	54	-32.5	-24.4	Noise floor/V
.824	3.0	37.9	25.0	33.2	6.3	-34.8	0.0	0.0	42.5	29.6	74	54	-31.5	-24.4	Noise floor/H
Aid Ch															
.874	3.0	37.9	25.0	33.2	6.3	-34.8	0.0	0.0	42.6	29.8	74	54	-31.4	-24.2	Noise floor/V
.874 Iigh Ch	3.0	38.1	25.0	33.2	6.3	-34.8	0.0	0.0	42.8	29.8	74	54	-31.2	-24.2	Noise floor/H
11gn Cn 1.924	3.0	38.0	24.8	33.3	6.3	-34.8	0.0	0.0	42.8	29.6	74	54	-31.2	-24.4	Noise floor/V
4.924	3.0	37.0	24.8	33.3	6.3	-34.8	0.0	0.0	41.8	29.6	74	54	-32.2	-24.4	Noise floor/H
	f Dist	Measuremo Distance to Analyzer R Antenna Fa Cable Loss	leading actor	7		Amp D Corr Avg Peak HPF	Average	Correc Field S ed Peal	ct to 3 mete Strength @ k Field Stre	3 m		Pk Lim Avg Mar	Peak Fiel Margin v	Field Strengt d Strength Li s. Average Li s. Peak Limit	mit imit

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# 8.3. RECEIVER ABOVE 1 GHz

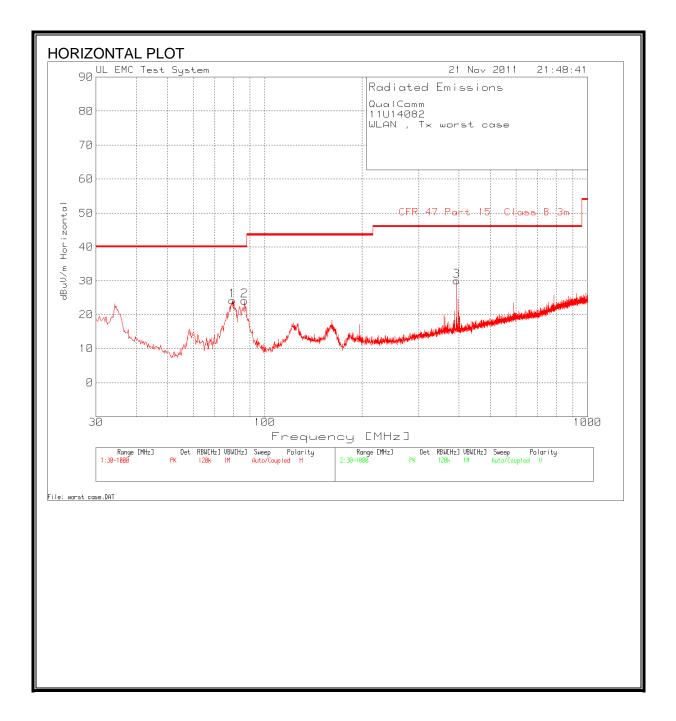
omplia	_		Measureme Services, Fre		m Cha	mber-B									
ompany oject #: te: st Engi onfigur: ode:	: neer:		Qualcomm 11U14082 11/21/2011 Thanh Nguyen EUT StandAlo Receive Mode	ne											
	pment:		1000110 11000												
Но	orn 1-	18GHz	Pre-ar	nplifer	1-260	GHz	Pre-am	plifer	26-40GH	z	Но	orn > 180	GHz		Limit
T59; S	/N: 324	5 @3m	▼ T145 A	gilent 3	008A0	056 🚽				•				•	RX R SS 210
	ency Cabl	es 2807700	12' c	able 2	28076	600	20' ca	ble 22	2807500		HPF	Re	eject Filte		<u>k Measurements</u> W=VBW=1MHz
3' ca	ible 228	07700	• 12' ca	ble 228(	07600	-	20' cabl	le 2280	7500 -			•		• Avera	a <u>ge Measurements</u> 1MHz ; VBW=10Hz
f Hz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
30	3.0	46.0	33.7	24.0	2.7	-35.9	0.0	0.0	36.7	24.4	74	54	-37.3	-29.6	Noise floor/V
50	3.0	43.6	31.0	26.8	3.4	-35.6	0.0	0.0	38.2	25.6	74	54	-35.8	-28.4	Noise floor/H
	f Dist	Measurem Distance to Analyzer F Antenna Fa Cable Loss	Reading actor	7		Amp D Corr Avg Peak HPF	Average	Corre Field ed Peal	ct to 3 mete Strength @ k Field Stro r	3 m		Pk Lim	Peak Fiel Margin v	Field Strengt d Strength Li s. Average L s. Peak Limit	imit imit

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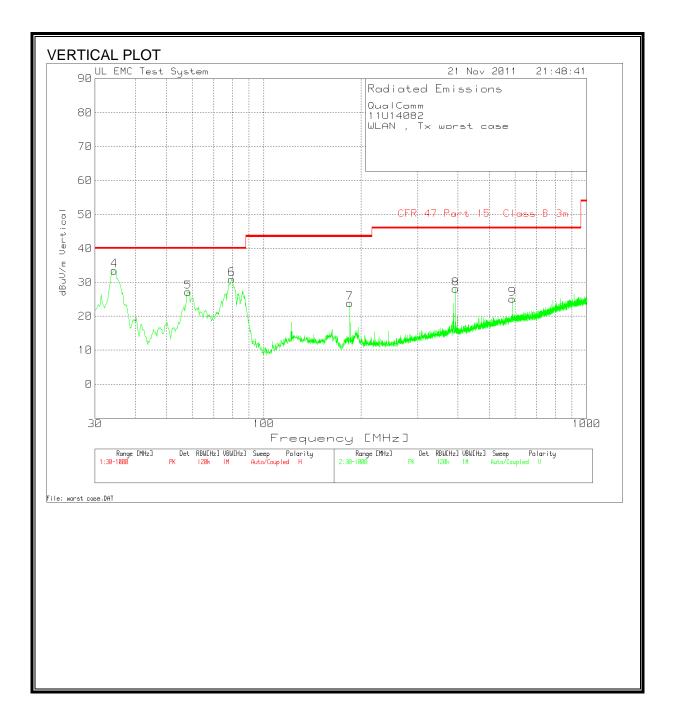
# 8.4. WORST-CASE BELOW 1 GHz

# SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)



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### SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, VERTICAL)



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#### **EMI DATA**

0									
Qualcom 11U14082									
	د Tx worst ca								
WLAN,	IX WOIST C	150							
Range 1 3	Range 1 30 - 1000MHz								
Test	Meter	Detector	Pre-Amp	Antenna	dBuV/m	CFR 47	Margin	Azimuth	Polarity
Freq.	Reading		Gain	Factor		Part 15			
(MHz)	(dBuV)		[dB]	[dB]		Class B			
						3m			
79.4305	43.25	PK	-27.1	8	24.15	40	-15.85	176	Horz
86.6027			-27	7.5	24.12	40	-15.88		Horz
392.6839	40.79	PK	-25.6	14.9	30.09	46	-15.91	99	Horz
	Range: 2 30 - 1000MHz								
Test	Meter	Detector	•	Antenna	dBuV/m	CFR 47	Margin	Azimuth	Polarity
Freq.	Reading		Gain	Factor		Part 15			
(MHz)	(dBuV)		[dB]	[dB]		Class B			
						3m			
34.4584	43.23	PK	-27.5	17.8	33.53	<b>3m</b> 40	-6.47	99	Vert
34.4584 58.3014			-27.5 -27.2		33.53 27.14		-6.47 -12.86		Vert Vert
	46.24	PK				40		99	
58.3014	46.24	PK PK	-27.2	8.1 8	27.14	40 40	-12.86	99 99	Vert
58.3014 79.6243	46.24 50.11 38.81 38.76	PK PK PK PK	-27.2 -27.1	8.1 8 11	27.14 31.01 23.81 28.06	40 40 40	-12.86 -8.99	99 99 99	Vert Vert
58.3014 79.6243 184.8821	46.24 50.11 38.81 38.76	PK PK PK PK	-27.2 -27.1 -26	8.1 8 11	27.14 31.01 23.81	40 40 40 43.5	-12.86 -8.99 -19.69	99 99 99 176	Vert Vert Vert
58.3014 79.6243 184.8821 392.6839	46.24 50.11 38.81 38.76	PK PK PK PK	-27.2 -27.1 -26 -25.6	8.1 8 11 14.9	27.14 31.01 23.81 28.06	40 40 40 43.5 46	-12.86 -8.99 -19.69 -17.94	99 99 99 176	Vert Vert Vert Vert
58.3014 79.6243 184.8821 392.6839	46.24 50.11 38.81 38.76	PK PK PK PK	-27.2 -27.1 -26 -25.6	8.1 8 11 14.9	27.14 31.01 23.81 28.06	40 40 40 43.5 46	-12.86 -8.99 -19.69 -17.94	99 99 99 176	Vert Vert Vert Vert
58.3014 79.6243 184.8821 392.6839	46.24 50.11 38.81 38.76	PK PK PK PK	-27.2 -27.1 -26 -25.6	8.1 8 11 14.9	27.14 31.01 23.81 28.06	40 40 40 43.5 46	-12.86 -8.99 -19.69 -17.94	99 99 99 176	Vert Vert Vert Vert
58.3014 79.6243 184.8821 392.6839	46.24 50.11 38.81 38.76	PK PK PK PK	-27.2 -27.1 -26 -25.6	8.1 8 11 14.9	27.14 31.01 23.81 28.06	40 40 40 43.5 46	-12.86 -8.99 -19.69 -17.94	99 99 99 176	Vert Vert Vert Vert
58.3014 79.6243 184.8821 392.6839	46.24 50.11 38.81 38.76	PK PK PK PK	-27.2 -27.1 -26 -25.6	8.1 8 11 14.9	27.14 31.01 23.81 28.06	40 40 40 43.5 46	-12.86 -8.99 -19.69 -17.94	99 99 99 176	Vert Vert Vert Vert
58.3014 79.6243 184.8821 392.6839	46.24 50.11 38.81 38.76	PK PK PK PK	-27.2 -27.1 -26 -25.6	8.1 8 11 14.9	27.14 31.01 23.81 28.06	40 40 40 43.5 46	-12.86 -8.99 -19.69 -17.94	99 99 99 176	Vert Vert Vert Vert
58.3014 79.6243 184.8821 392.6839	46.24 50.11 38.81 38.76	PK PK PK PK	-27.2 -27.1 -26 -25.6	8.1 8 11 14.9	27.14 31.01 23.81 28.06	40 40 40 43.5 46	-12.86 -8.99 -19.69 -17.94	99 99 99 176	Vert Vert Vert Vert
58.3014 79.6243 184.8821 392.6839	46.24 50.11 38.81 38.76	PK PK PK PK	-27.2 -27.1 -26 -25.6	8.1 8 11 14.9	27.14 31.01 23.81 28.06	40 40 40 43.5 46	-12.86 -8.99 -19.69 -17.94	99 99 99 176	Vert Vert Vert Vert

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# 9. AC POWER LINE CONDUCTED EMISSIONS

# LIMITS

FCC §15.207 (a)

RSS-Gen 7.2.2

Frequency of Emission (MHz)	Conducted Limit (dBuV)				
	Quasi-peak	Average			
0.15-0.5	66 to 56	56 to 46 *			
0.5-5	56	46			
5-30	60	50			

\* Decreases with the logarithm of the frequency.

# TEST PROCEDURE

ANSI C63.4

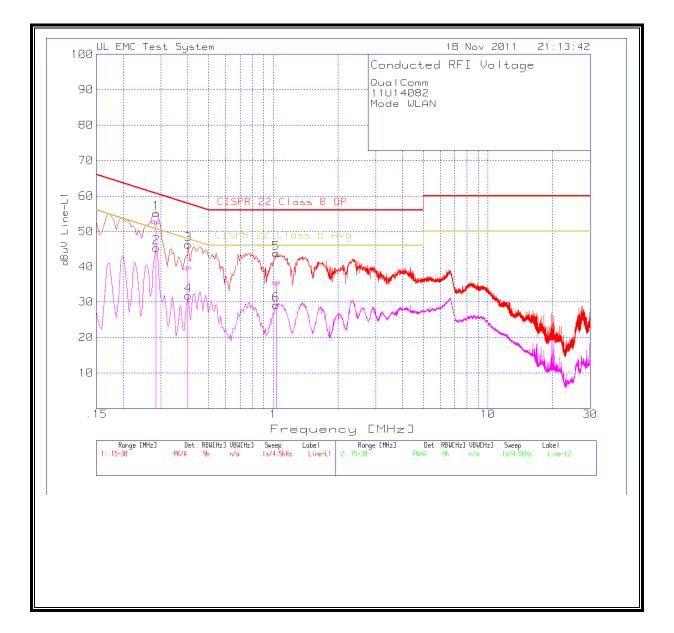
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# **RESULTS**

#### **<u>6 WORST EMISSIONS</u>**

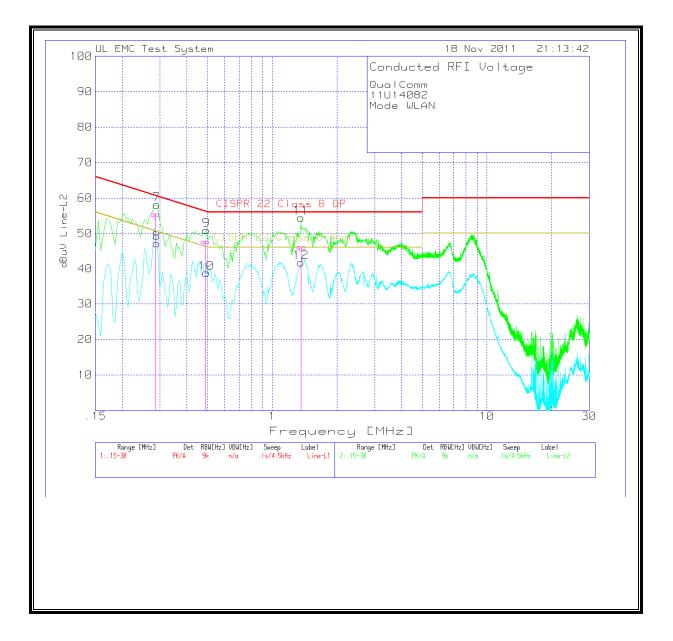
m 2							
AN							
5 - 30MHz							
Meter Reading	Detector	LISN [dB]	Correct Reading (dBuVolt s)	Class B Quasi- peak Limit	Quasi- Peak Margin	Class B Average Limit	Average Margin
54.41	PK	0.8	55.21	60.7	-5.49		
		0.8	51.69	60.7	-9.01		
44.68	Av	0.8	45.48	60.7	-15.22	50.7	-5.22
				57.8	-11.48		
						47.87	-9.17
							-15.99
						46	-11.64
		0.3	29.17	56	-26.83	46	-16.83
5 - 30MHz							
Meter Reading	Detector	LISN [dB]	Correct Reading (dBuVolt s)	Class B Quasi- peak Limit	Quasi- Peak Margin	Class B Average Limit	Average Margin
57.31	PK	0.8	58.11	60.5	-2.39		
		0.8	54.17	60.67	-6.5		
46.4	Av	0.8	47.2	60.5	-13.3	50.5	-3.3
50.49	PK	0.5	50.99	56.1	-5.11		
46.05	QP	0.5	46.55	56.21	-9.66		
	-	0.5	38.75	56.1	-17.35	46.1	-7.35
38.25	Av	0.5	30.70	50.1			
38.25 54.08		0.5	54.38	56	-1.62		
	PK						
	2 AN 5 - 30MHz Meter Reading 54.41 50.89 44.68 45.82 38.2 31.31 43.6 34.06 28.87 5 - 30MHz 5 - 30MHz	P       Image: Constraint of the sector of the	AN       Image: Solution of the sector of the	AN         Image: sector of the sector o	AN         Image: Section of the sectin of the section of the section of the section of the se	e         Image: Section of the sectin of the section of the section of the section of the sec	Reading         Detector         LISN [dB]         Correct Reading         Class B Quasi- peak         Quasi- Peak Margin         Class B Average Limit           54.41         PK         0.8         55.21         60.7         -5.49           50.89         QP         0.8         51.69         60.7         -9.01           44.68         Av         0.8         55.21         60.7         -15.22         50.7           45.82         PK         0.5         38.7         57.87         -11.48           38.2         QP         0.3         34.36         56         -21.64           43.6         PK         0.3         29.17         56         -26.83         46           28.87         Av         0.3         29.17         56         -26.83         Ac           5 - 30MHz         Imit         Imit

#### LINE 1 RESULTS



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#### LINE 2 RESULTS



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#### 10. MAXIMUM PERMISSIBLE EXPOSURE

#### **FCC RULES**

§1.1310 The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm²)	Averaging time (minutes)
(A) Lim	nits for Occupational	/Controlled Exposu	res	
0.3–3.0 3.0–30 30–300 300–1500 1500–100,000	614 1842/f 61.4	1.63 4.89/f 0.163	*(100) *(900/f²) 1.0 f/300 5	6 6 6 8
(B) Limits	for General Populati	on/Uncontrolled Exp	posure	
0.3–1.34 1.34–30	614 824/f	1.63 2.19/f	*(100) *(180/f²)	30 30

#### TABLE 1-LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

#### TABLE 1-LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)-Continued

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm²)	Averaging time (minutes)
30–300 300–1500 1500–100,000	27.5	0.073	0.2 f/1500 1.0	30 30 30

f = frequency in MHz

\* = Plane-wave equivalent power density NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occu-tions where a transient through a location where occu-

pational/controlled limits apply provided he or she is made aware of the potential for exposure. NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be ex-posed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

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# IC RULES

IC Safety Code 6, Section 2.2.1 (a) A person other than an RF and microwave exposed worker shall not be exposed to electromagnetic radiation in a frequency band listed in Column 1 of Table 5, if the field strength exceeds the value given in Column 2 or 3 of Table 5, when averaged spatially and over time, or if the power density exceeds the value given in Column 4 of Table 5, when averaged spatially and over time.

# Table 5

Exposure Limits for Persons Not Classed As RF and Microwave Ex-
posed Workers (Including the General Public)

1 Frequency (MHz)	2 Electric Field Strength; rms (V/m)	3 Magnetic Field Strength; rms (A/m)	4 Power Density (W/m <sup>2</sup> )	5 Averaging Time (min)
0.003–1	280	2.19		6
1–10	280/f	2.19/ <i>f</i>		6
10–30	28	2.19/f		6
30–300	28	0.073	2*	6
300–1 500	1.585 <i>f</i> <sup>0.5</sup>	0.0042f <sup>0.5</sup>	f/150	6
1 500–15 000	61.4	0.163	10	6
15 000–150 000	61.4	0.163	10	616 000 /f <sup>1.2</sup>
150 000–300 000	0.158f <sup>0.5</sup>	4.21 x 10 <sup>-4</sup> f <sup>0.5</sup>	6.67 x 10 <sup>-5</sup> f	616 000 /f <sup>1.2</sup>

\* Power density limit is applicable at frequencies greater than 100 MHz.

Notes: 1. Frequency, f, is in MHz.

- 2. A power density of 10 W/m<sup>2</sup> is equivalent to  $1 \text{ mW/cm}^2$ .
- A magnetic field strength of 1 A/m corresponds to 1.257 microtesla (μT) or 12.57 milligauss (mG).

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# EQUATIONS

Power density is given by:

S = EIRP / (4 \* Pi \* D^2)

where

S = Power density in W/m^2 EIRP = Equivalent Isotropic Radiated Power in W D = Separation distance in m

Power density in units of W/m<sup>2</sup> is converted to units of mWc/m<sup>2</sup> by dividing by 10.

Distance is given by:

D = SQRT (EIRP / (4 \* Pi \* S))

where

D = Separation distance in m EIRP = Equivalent Isotropic Radiated Power in W S = Power density in W/m^2

For multiple colocated transmitters operating simultaneously in frequency bands where the limit is identical, the total power density is calculated using the total EIRP obtained by summing the Power \* Gain product (in linear units) of each transmitter.

Total EIRP = (P1 \* G1) + (P2 \* G2) + ... + (Pn \* Pn)

where

Px = Power of transmitter xGx = Numeric gain of antenna x

In the table(s) below, Power and Gain are entered in units of dBm and dBi respectively and conversions to linear forms are used for the calculations.

# <u>LIMITS</u>

From FCC §1.1310 Table 1 (B), the maximum value of S = 1.0 mW/cm^2

From IC Safety Code 6, Section 2.2 Table 5 Column 4, S = 10 W/m^2

# **RESULTS**

Band	Mode	Separation	Output	Antenna	IC Power	FCC Power
		Distance	AV Power	Gain	Density	Density
		(m)	(dBm)	(dBi)	(W/m^2)	(mW/cm^2)
2.4 GHz	WLAN	0.20	16.22	3.80	0.20	0.020

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