

### FCC CFR47 PART 15 SUBPART E

CERTIFICATION TEST REPORT CLASS II PERMISSIVE CHANGE

### FOR

## QUAD-BAND RADIO WITH WLAN AND BT RADIO

### **MODEL NUMBER: A1529**

FCC ID: BCG-E2694A

### REPORT NUMBER: 15U21850-E38V2

**ISSUE DATE: NOVEMBER 24, 2015** 

Prepared for

APPLE INC. 1 INFINITE LOOP CUPERTINO, CA 95014, U.S.A.

Prepared by UL VERIFICATION SERVICES INC. 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.	lssue Date	Revisions	Revised By
V1	11/16/15	Initial issue. Upgrade 13U15037-13 report to 5.2/5.3/5.6GHz band to new rule per KDB 789033 D02 v01.	T. Chu
V2	11/24/15	Revised report to address TCB's questions	T. Chu

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## **1. ATTESTATION OF TEST RESULTS**

COMPANY NAME:	APPLE, INC. 1 INFINITE LOOP CUPERTINO, CA 95014, U.S.A.					
EUT DESCRIPTION:	QUAD-BAND RADIO WITH WLAN AND BT RADIO					
MODEL:	A1529					
SERIAL NUMBER:	C7JKV03GFLW6 (DVT-9GW10C-2099) (RF) and C7JKT0UEFLW7 (DFS)					
DATE TESTED:	JUNE 17 to JUNE 25, 2013 (RF) and JULY 16, 2013 (DFS)					
	APPLICABLE STANDARDS					
ST	ANDARD TEST RESULTS					
CFR 47 F	Part 15 Subpart E Pass					

UL Verification Services Inc. 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 Verification Services Inc. 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 Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. 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 Verification Services Inc. By:

Thu Chan WiSE Operations Manager UL Verification Services Inc.

Tested By:

Francisco Guarnero WiSE Lab Technician UL Verification Services Inc.

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# 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, FCC 14-30, FCC KDB 662911 D01 v02r01, FCC KDB 905462 D02 v01r02/D03 v01r01/D06 v01, FCC KDB 789033 D02 v01, ANSI C63.10-2009.

# 3. FACILITIES AND ACCREDITATION

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

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <u>http://ts.nist.gov/standards/scopes/2000650.htm</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%.

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# 5. EQUIPMENT UNDER TEST

## 5.1. DESCRIPTION OF EUT

Model A1529 is a mobile phone with multimedia functions (music, application support, and video), cellular GSM/GPRS/EGPRS/WCDMA/HSPA+/DC-HSDPA/LTE radio, IEEE 802.11a/b/g/n, Bluetooth and GPS radio. The rechargeable battery is not user accessible.

## 5.2. DESCRIPTION OF CLASS II PERMISSIVE CHANGE

Upgrade 5.2/5.3/5.6GHz band to new rule per KDB 789033 D02 v01.

We have reviewed the original test report for UNII-1, UNII-2A and UNII-2C bands and are hereby attesting that all current technical requirements are still met and all applicable test procedures remain the same. Therefore, the original report is still applicable and no additional testing is done.

We updated the following on this report:

- Updated report to latest KDB 789033 D02 v01.
- 5.2G output power table limit/PPSD limit.
- Removed IC related information.
- Removed Peak Excursion.

## 5.3. MAXIMUM OUTPUT POWER

The transmitter has a maximum conducted output power as follows:

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5180 - 5240	802.11a	14.25	26.61
5180 - 5240	802.11n HT20	14.18	26.18
5190 - 5230	802.11n HT40	16.45	44.16
5260 - 5320	802.11a	16.04	40.18
5260 - 5320	802.11n HT20	16.25	42.17
5270 - 5310	802.11n HT40	16.28	42.46
5500 - 5700	802.11a	14.18	26.18
5500 - 5700	802.11n HT20	14.23	26.49
5510 - 5670	802.11n HT40	14.26	26.67

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## 5.4. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a PiFA antenna, with a maximum gain as below table.

FREQUENCY (MHZ)	ANTENNA GAIN ( dBi)
2400 - 2483.5	0.21
5150 - 5250	-0.73
5250 - 5350	-0.37
5500 - 5700	1.31
5725 - 5850	1.59

## 5.5. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was WL Tool FW 6.10.56.166 5.6. WORST-CASE CONFIGURATION AND MODE

The worst-case channel for RF radiated emissions below 1GHz tests is channel with highest RF output power.

Based on the investigation results, the highest peak power and enhanced data rate is the worstcase scenario for all measurements.

For the fundamental investigation, the EUT is investigated for vertical and horizontal antenna orientations and the worst case was determined to be at X-position.

Based on the manufacturer's attestation that the nominal output power is reduced as the data rate increases, the data rates tested represent the highest power and worst-case with respect to EMC performance.

Worst-case data rates were used:

802.11b mode: 1 Mbps 802.11g mode: 6 Mbps 802.11a mode: 6 Mbps 802.11n HT20mode: MCS0 802.11n HT40mode: MCS0

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## 5.7. DESCRIPTION OF TEST SETUP

#### SUPPORT EQUIPMENT

Support Equipment List						
Description	Manufacturer	Model	Serial Number			
AC adapter	Apple	A1385	D292365D11QDHLHCA			
Earphone	Apple	NA	NA			

#### I/O CABLES (Conducted Setup)

	I/O Cable List							
Cable Port # d		# of identical Connector Cable Type Cable		Cable Remarks				
No		ports	Туре		Length (m)			
1	Antenna	1	SMA	Shielded	0.1m	To Spectrum Analyzer		

#### I/O CABLES

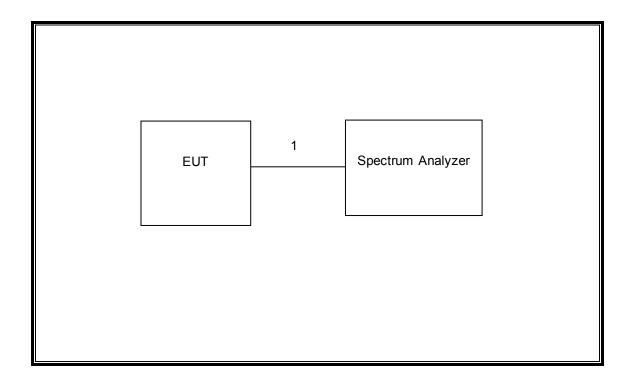
	I/O Cable List							
Cable Port # of identical Connector Cable Ty			Cable Type	Cable	Remarks			
No		ports	Туре		Length (m)			
1	Jack	1	Earphone	Unshielded	0.5m	N/A		

#### TEST SETUP

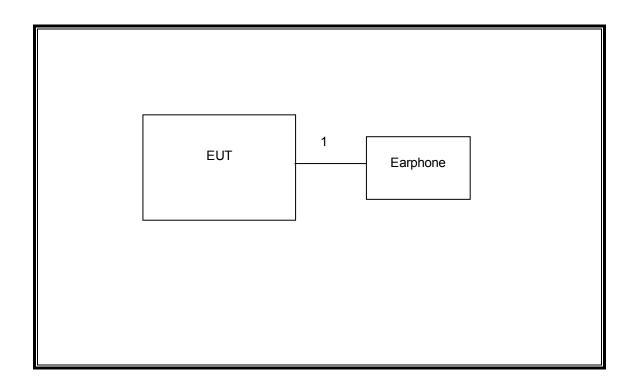
The EUT is a stand-alone device.

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#### SETUP DIAGRAM FOR TESTS

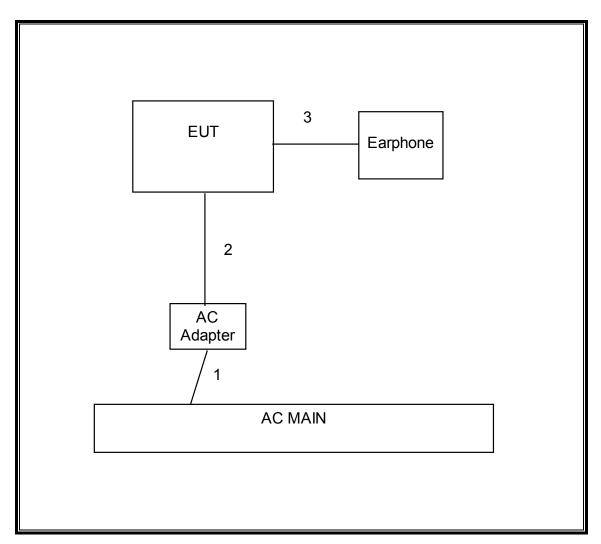


#### SETUP DIAGRAM FOR RADIATED TESTS



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### SETUP DIAGRAM FOR AC POWER CONDUCTED 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			
Horn Antenna 1-18GHz	ETS Lindgren	3117	F00133	02/19/14			
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00580	01/28/14			
Antenna, Horn, 26.5 GHz	ARA	SWH-28	C01015	05/06/14			
Antenna, Biconolog, 30MHz-1 GHz	Sunol Sciences	JB3	F00215	03/07/14			
Peak / Average Power Sensor	Agilent / HP	E9323A	F00026	07/27/13			
P-Series single channel Power Meter	Agilent / HP	N1911A	F00153	07/26/13			
Spectrum Analyzer, 3Hz-44GHz	Agilent	N9030A	F00127	02/22/14			
PreApmplifier, 1-26.5GHz	Agilent	8449B	C01052	10/22/13			
LISN, 30 MHz	FCC	LISN-50/250-	N02625	04/17/14			
		25-2					
Antenna, Horn, 40 GHz	ARA	MWH-2640/B	C00981	06/14/14			
EMI Test Receiver, 30 MHz	R & S	ESHS 20	N02396	08/08/13			
Preamplifier, 40 GHz	Miteq	NSP4000-SP2	C00990	08/02/13			

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# 7. ON TIME, DUTY CYCLE AND MEASUREMENT METHODS

#### LIMITS

None; for reporting purposes only.

#### PROCEDURE

KDB 789033 Zero-Span Spectrum Analyzer Method.

### 7.1.1. ON TIME AND DUTY CYCLE RESULTS

Mode	<b>ON</b> Time	Period	<b>Duty Cycle</b>	Duty	Duty Cycle	1/B
	В		x	Cycle	<b>Correction Factor</b>	Minimum VBW
	(msec)	(msec)	(linear)	(%)	(dB)	(kHz)
802.11a 20 MHz	2.03	2.07	0.980	98.0%	0.09	0.493
802.11n HT20	1.91	1.94	0.985	98.5%	0.07	0.524
802.11n HT40	0.94	0.97	0.963	96.3%	0.16	1.070

### 7.1.2. MEASUREMENT METHOD FOR POWER AND PPSD

The Duty Cycle is greater than or equal to 98% therefore KDB 789033 Method SA-1 is used.

The Duty Cycle is less than 98% and consistent therefore KDB 789033 Method SA-2 is used.

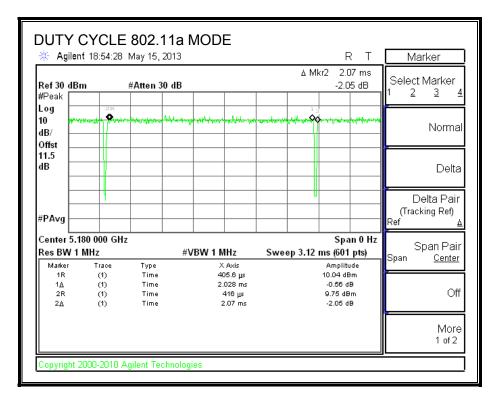
### 7.1.3. MEASUREMENT METHOD FOR AVERAGE SPURIOUS EMISSIONS ABOVE 1 GHz

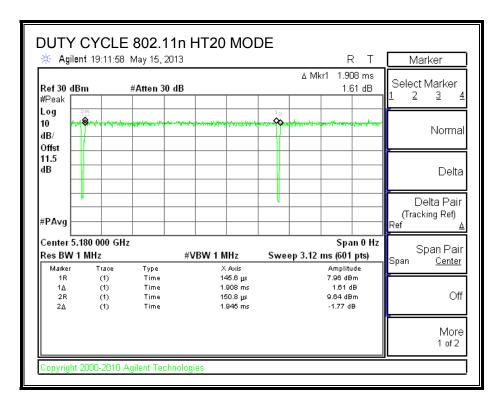
The Duty Cycle is greater than or equal to 98%, KDB 789033 Method AD with Power RMS Averaging is used.

The Duty Cycle is less than 98% and consistent, KDB 789033 Method AD with Power RMS Averaging and duty cycle correction is used.

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## 7.1.4. DUTY CYCLE PLOTS





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-			1n HT40	MOD	E		F	? Т	L. Mari	
Ref 30 (		:19 May 14,2 #Atten 30				Δ Mk	r2 96	с I 8 µs 3 dB	Mar Select N 1 <u>2</u>	i
Log 10 dB/ Offst	harry yaqarradan	Any Anglery	vhannet te fan weer	worthelinew	www	°¢√~		, tough at United		Normal
11.5 dB										Delta
#PA∨g										lta Pair ng Ref) ≜
	5.190 000 / 8 MHz	GHz	#VBW 50 I	MHz	Sweep	1.76	Spa ms (601	n 0 Hz pts)	Sp Span	an Pair <sub>Center</sub>
Манкет 1R 1 <u>∆</u> 2R 2 <u>∆</u>	Trace (1) (1) (1) (1)	: Type Time Time Time Time	90	Axis 352 μs 35.7 μs 352 μs 968 μs			Amplitu 13.03 dB 3.92 d 13.03 dB -0.43 dI	m B m	Ohan	Off
										More 1 of 2
Copyrig	ht 2000-201	10 Agilent Tec	hnologies							

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## 8. ANTENNA PORT TEST RESULTS

## 8.1. 802.11a MODE IN THE 5.2 GHz BAND

### 8.1.1. 26 dB BANDWIDTH

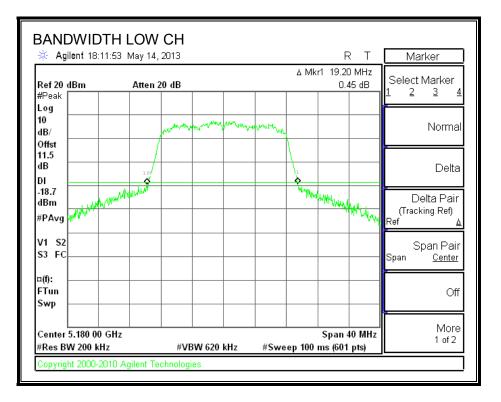
#### **LIMITS**

None; for reporting purposes only.

#### **RESULTS**

Channel	Frequency	26 dB Bandwidth
	(MHz)	(MHz)
Low	5180	19.20
Mid	5200	19.20
High	5240	19.07

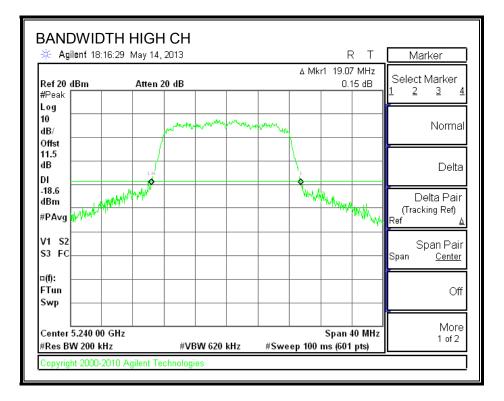
#### 26 dB BANDWIDTH



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🔆 Agilent 1	8:14:45	May 14,	2013					F	₹ T	Mai	rker
Ref 20 dBm #Peak		Atten 2	20 dB				∆ Mk	r1 19.20 0.3	) MHz 37 dB	Select I 1 2	Marker <u>3</u> 4
Log 10 dB/ Offst			monion	mm	and the second	vana					Normal
11.5 dB		1R									Delta
18.6 dBm #PA∨g √/****	HANNIN MAN	WW <sup>AV</sup>					WWH	thelphyl	And the state of t		elta Pair ing Ref) ≜
V1 S2 S3 FC										Span St	oan Pair <u>Center</u>
¤(f): FTun Swp											Off
Center 5.200 #Res BW 200			 #VE	3W 620	kHz	#Swe	ep 100	Span 4 ms (601	40 MHz pts)		More 1 of 2



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### 8.1.2. 99% BANDWIDTH

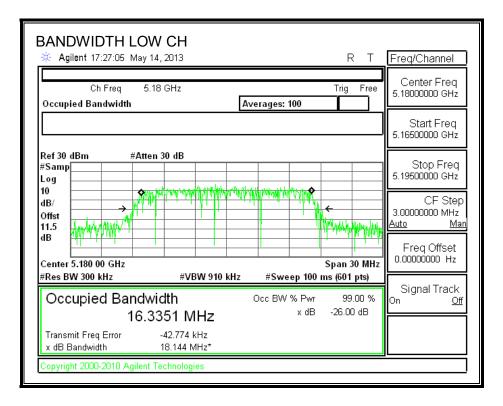
#### **LIMITS**

None; for reporting purposes only.

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

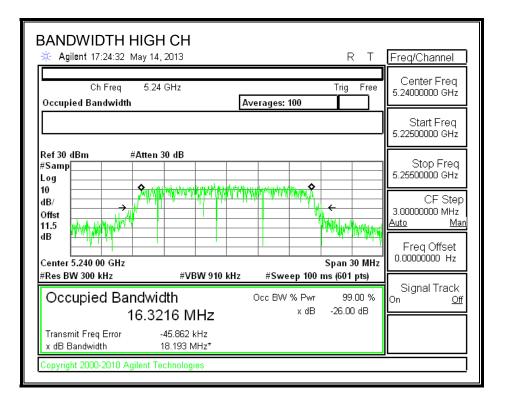
Channel	Frequency	99% Bandwidth
	(MHz)	(MHz)
Low	5180	16.3351
Mid	5200	16.3323
High	5240	16.3216

#### 99% BANDWIDTH



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BANDWIDTH MID CH	Freq/Channel
Ch Freq 5.2 GHz Trig Free Occupied Bandwidth Averages: 100	Center Freq 5.20000000 GHz
	Start Freq 5.18500000 GHz
Ref 30 dBm         #Atten 30 dB           #Samp	Stop Freq 5.21500000 GHz
10 dB/ Offst 11.5 dB dB/ dB/ dB/ dB/ dB/ dB/ dB/	CF Step 3.0000000 MHz <u>Auto Man</u>
Center 5.200 00 GHz Span 30 MHz	Freq Offset 0.00000000 Hz
#Res BW 300 kHz         #VBW 910 kHz         #Sweep 100 ms (601 pts)           Occupied Bandwidth         Occ BW % Pwr         99.00 %	Signal Track
16.3323 MHz x dB -26.00 dB	On <u>Off</u>
Transmit Freq Error -44.075 kHz x dB Bandwidth 18.120 MHz*	
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### 8.1.3. AVERAGE POWER

#### **LIMITS**

None; for reporting purposes only.

#### TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 11.5 dB (including 10 dB pad and 1.5 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

#### RESULTS

Channel	Frequency	Power
	(MHz)	(dBm)
Low	5180	13.98
Mid	5200	13.81
High	5240	14.03

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## 8.1.4. OUTPUT POWER AND PSD

#### LIMITS

FCC §15.407 (a) (1)

(i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

(ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

#### **DIRECTIONAL ANTENNA GAIN**

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

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#### Antenna Gain

Channel	Frequency	Directio
		Gain
	(MHz)	(dBi)
Low	5180.00	-6.00
Mid	5200.00	-6.00
High	5240.00	-6.00

#### Limits

Channel	Frequency	FCC Power Limit	FCC PPSD Limit
	(MHz)	(dBm)	(dBm)
Low	5180	24.00	11.00
2011	0.00	21.00	11.00
Mid	5200	24.00	11.00

#### Duty Cycle CF (dB) 0.09 Included in Calculations of Corr'd Power & PPSD

#### Output Power Results

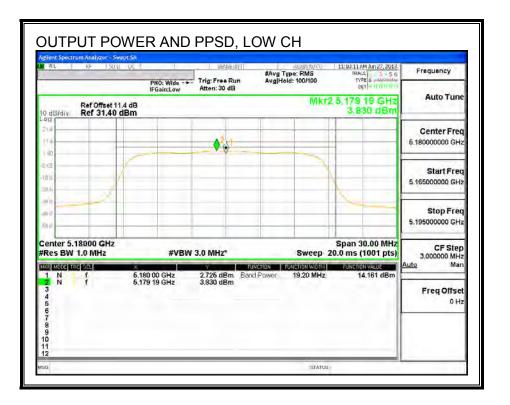
Channel	Frequency	Meas	Total	Power	Power
		Power	Corr'd	Limit	Margin
			Power		
	(MHz)	(dBm)	(dBm)	(dBm)	(dB)
Low	5180	14.161	14.25	24.00	-9.75
Mid	5200	14.025	14.12	24.00	-9.89
High	5240	14.060	14.15	24.00	-9.85

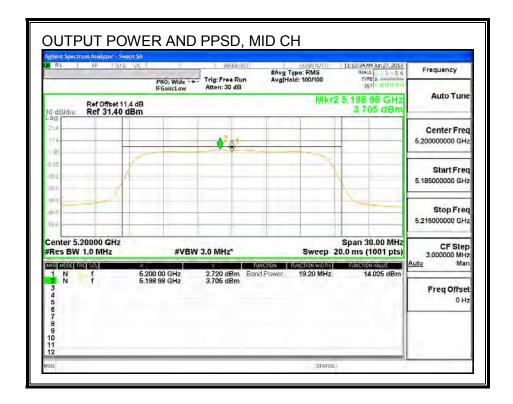
#### **PPSD Results**

Channel	Frequency	Meas	Total	PPSD	PPSD
		PPSD	Corr'd	Limit	Margin
			PPSD		
	(MHz)	(dBm)	(dBm)	(dBm)	(dB)
Low	5180	3.830	3.92	11.00	-7.08
Mid	5200	3.705	3.80	11.00	-7.21
High	5240	3.728	3.82	11.00	-7.18

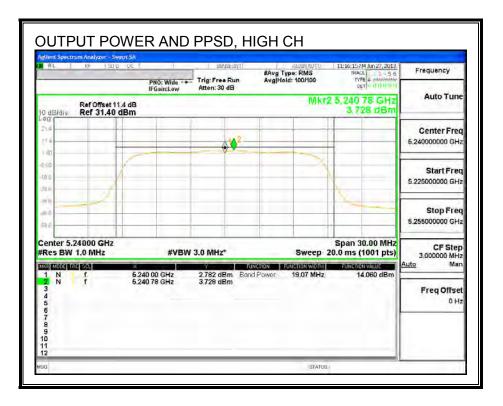
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#### OUTPUT POWER AND PSD





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## 8.2. 802.11n HT20 MODE IN THE 5.2 GHz BAND

## 8.2.1. 26 dB BANDWIDTH

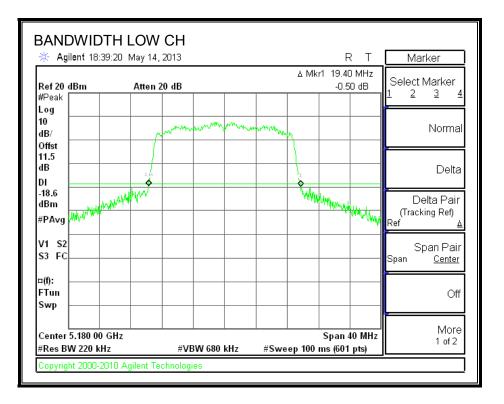
#### **LIMITS**

None; for reporting purposes only.

#### **RESULTS**

Channel	Frequency	26 dB Bandwidth
	(MHz)	(MHz)
Low	5180	19.40
Mid	5200	19.40
High	5240	19.47

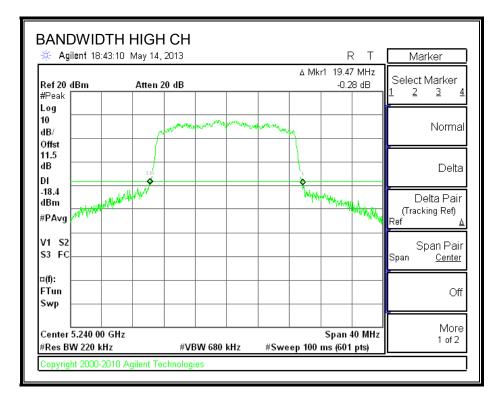
#### 26 dB BANDWIDTH



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🔆 Agilent 18:40:	47 May 14, 2013			RΤ	Marker
Ref 20 dBm #Peak	Atten 20 dB		∆ Mk	r1 19.40 MHz -0.70 dB	Select Marker
Log 10 dB/ Offst	harma	and the second second	www.en.en.en		- Normal
11.5 dB					Delta
DI -18.5 dBm #PA∨g ₩₩₩₩₩₩	allow-how		<sup>b</sup> W/We	WWWWW	Delta Pair (Tracking Ref) Ref ≜
V1 S2 S3 FC					- Span Pair - Span <u>Center</u>
¤(f): FTun Swp					- Off
Center 5.200 00 G #Res BW 220 kHz		3W 680 kHz	#Sweep 100	Span 40 MHz ms (601 pts)	More 1 of 2



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### 8.2.2. 99% BANDWIDTH

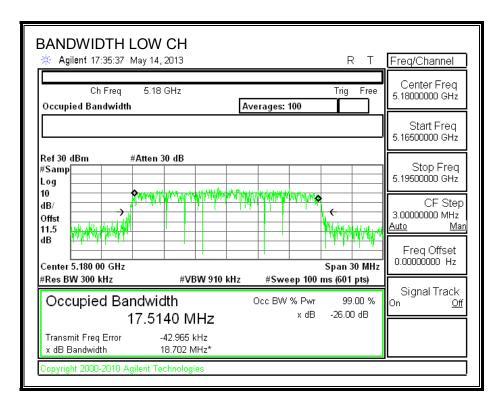
#### **LIMITS**

None; for reporting purposes only.

#### **RESULTS**

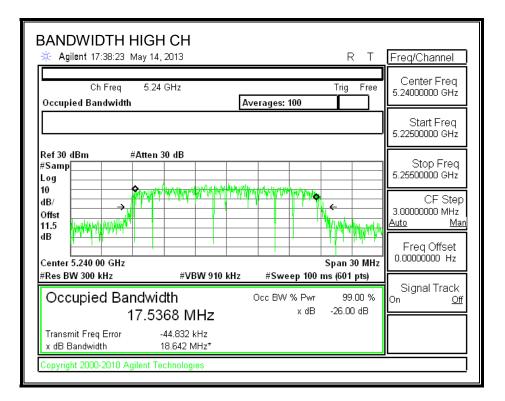
Channel	Frequency	99% Bandwidth
	(MHz)	(MHz)
Low	5180	17.5140
Mid	5200	17.5162
High	5240	17.5368

#### 99% BANDWIDTH



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BANDWIDTH MID ( Agilent 17:37:09 May 14,	-		RТ	Freq/Channel
Ch Freq 5.2 Occupied Bandwidth	_	verages: 100	Trig Free	Center Freq 5.20000000 GHz
			]	Start Freq 5.18500000 GHz
Ref 30 dBm #Atten 3 #Samp Log				Stop Freq 5.21500000 GHz
dB/ Offst 11.5				CF Step 3.0000000 MHz <u>Auto Man</u>
dB	#VBW 910 kHz	#Sweep 100 m	Span 30 MHz	Freq Offset 0.00000000 Hz
Occupied Bandwid		Occ BW % Pwr	· · ·	Signal Track On <u>Off</u>
	45.415 kHz 18.680 MHz*			
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## 8.2.3. AVERAGE POWER

#### **LIMITS**

None; for reporting purposes only.

#### TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 11.5 dB (including 10 dB pad and 1.5 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

#### **RESULTS**

Channel	Frequency	Power
	(MHz)	(dBm)
Low	5180	14.05
Mid	5200	14.01
High	5240	14.04

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## 8.2.4. OUTPUT POWER AND PSD

#### LIMITS

FCC §15.407 (a) (1)

(i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

(ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

#### **DIRECTIONAL ANTENNA GAIN**

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

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#### **RESULTS**

#### Antenna Gain

Channel	Frequency	Directio
		Gain
	(MHz)	(dBi)
Low	5180.00	-6.00
Mid	5200.00	-6.00
High	5240.00	-6.00

#### Limits

Channel	Frequency (MHz)	FCC Power Limit (dBm)	FCC PPSD Limit (dBm)
Low	5180	24.00	11.00
Mid	5200	24.00	11.00
High	5240	24.00	11.00

#### Duty Cycle CF (dB) 0.07 Included in Calculations of Corr'd Power & PPSD

#### Output Power Results

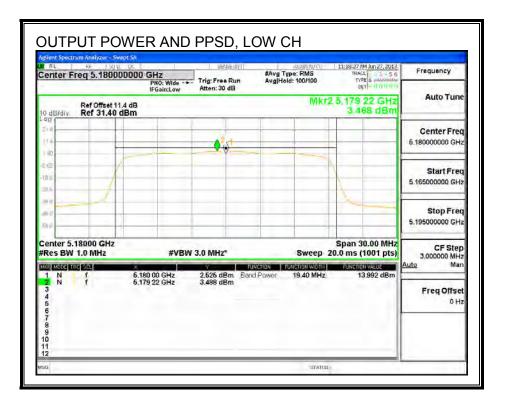
Channel	Frequency	Meas	Total	Power	Power
		Power	Corr'd	Limit	Margin
			Power		
	(MHz)	(dBm)	(dBm)	(dBm)	(dB)
Low	5180	13.992	14.06	24.00	-9.94
Mid	5200	14.110	14.18	24.00	-9.82
High	5240	14.011	14.08	24.00	-9.92

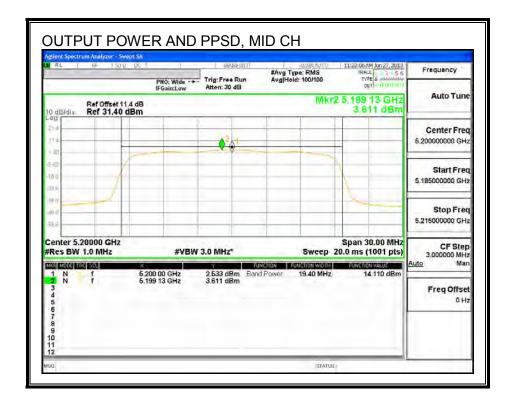
#### **PPSD Results**

Channel	Frequency	Meas	Total	PPSD	PPSD
		PPSD	Corr'd	Limit	Margin
			PPSD		
	(MHz)	(dBm)	(dBm)	(dBm)	(dB)
Low	5180	3.488	3.56	11.00	-7.44
Mid	5200	3.611	3.68	11.00	-7.32
High	5240	3.497	3.57	11.00	-7.43

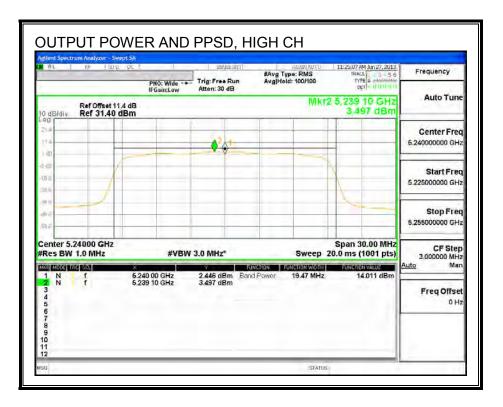
DATE: NOVEMBER 24, 2015

#### OUTPUT POWER AND PSD





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## 8.3. 802.11n HT40 MODE IN THE 5.2 GHz BAND

## 8.3.1. 26 dB BANDWIDTH

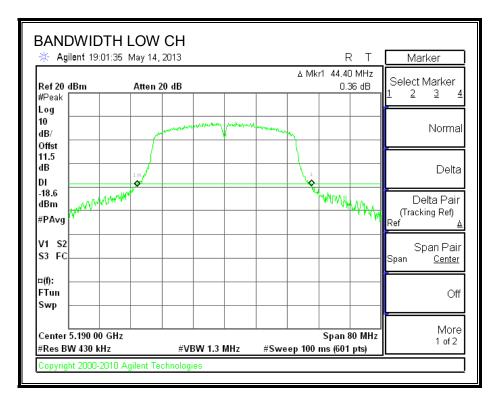
#### **LIMITS**

None; for reporting purposes only.

#### **RESULTS**

Channel Frequency		26 dB Bandwidth
	(MHz)	(MHz)
Low	5190	44.40
5230	5230	43.87

#### 26 dB BANDWIDTH



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🔆 Agilent 19:03	:56 May 14, 2013			RΤ	Marker
Ref 20 dBm #Peak	Atten 20 dB		∆ Mk	r1 43.87 MHz 0.58 dB	Select Marker 1 2 3 4
Log 10 dB/		and any ensure	a contraction of the second se		Normal
Offst 11.5 dB DI	1.0				Delta
-18.4 dBm #PAvg	Juin T			www.www.www.	Delta Pair (Tracking Ref) Ref ∆
V1 S2 S3 FC					Span Pair Span <u>Center</u>
¤(f): FTun Swp					Off
Center 5.230 00 G #Res BW 430 kHz		BW 1.3 MHz	#Sweep 100	Span 80 MHz ms (601 pts)	More 1 of 2

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## 8.3.2. 99% BANDWIDTH

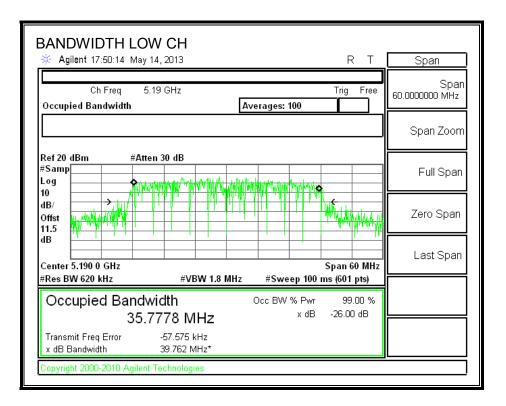
#### **LIMITS**

None; for reporting purposes only.

#### **RESULTS**

Channel Frequency		99% Bandwidth
	(MHz)	(MHz)
Low	5190	35.7778
High	5230	35.7688

#### 99% BANDWIDTH



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BANDWIDTH HIGH CH	Freq/Channel
Ch Freq 5.23 GHz Trig Free Occupied Bandwidth Averages: 100	Center Freq 5.23000000 GHz
	Start Freq 5.20000000 GHz
Ref 20 dBm #Atten 30 dB #Samp	Stop Freq 5.26000000 GHz
dB/ Offst 11.5	CF Step 6.00000000 MHz <u>Auto Man</u>
dB Center 5.230 0 GHz Span 60 MHz	Freq Offset 0.00000000 Hz
#Res BW 620 kHz #VBW 1.8 MHz #Sweep 100 ms (601 pts)	Signal Track
Occupied Bandwidth Occ BW % Pwr 99.00 % 35.7688 MHz × dB -26.00 dB	On <u>Off</u>
Transmit Freq Error -49.984 kHz x dB Bandwidth 39.740 MHz*	
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# 8.3.3. AVERAGE POWER

## **LIMITS**

None; for reporting purposes only.

#### TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 11.4 dB (including 10 dB pad and 1.4 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

#### **RESULTS**

Channel	Frequency	Power
	(MHz)	(dBm)
Mid	5190	16.20
High	5230	16.00

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# 8.3.4. OUTPUT POWER AND PPSD

## LIMITS

FCC §15.407 (a) (1)

(i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

(ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

## **DIRECTIONAL ANTENNA GAIN**

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

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#### **RESULTS**

#### Antenna Gain

Channel	Frequency	Directio Gain
	(MHz)	(dBi)
Low	5190	-6.00
High	5230	-6.00

Limits

Channel	Frequency	FCC	FCC
		Power	PPSD
		Limit	Limit
	(MHz)	(dBm)	(dBm)
Low	5190	24.00	11.00
High	5230	24.00	11.00

Duty Cycle CF (dB) 0.16 Included in Calculations of Corr'd Power & PPSD

#### **Output Power Results**

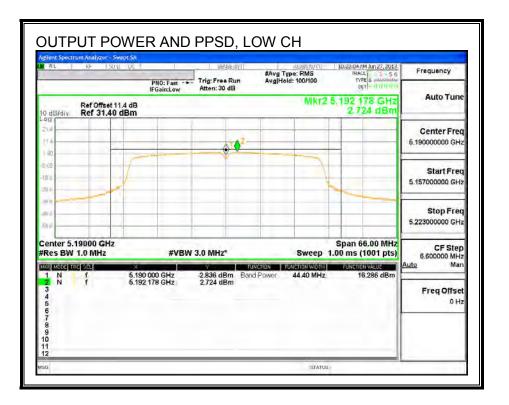
Channel	Frequency	Meas	Total	Power	Power
		Power	Corr'd	Limit	Margin
			Power		
	(MHz)	(dBm)	(dBm)	(dBm)	(dB)
Low	5190	16.286	16.45	24.00	-7.55

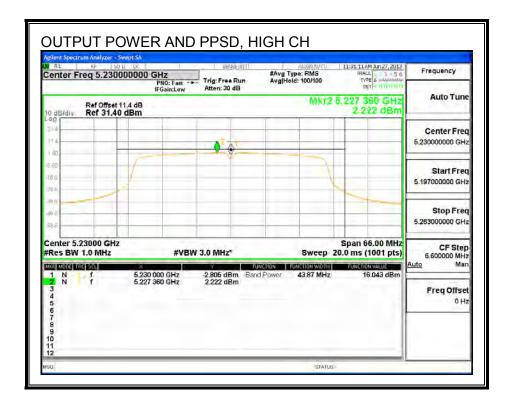
#### **PPSD Results**

Channel	Frequency	Meas	Total	PPSD	PPSD
		PPSD	Corr'd	Limit	Margin
			PPSD		
	(MHz)	(dBm)	(dBm)	(dBm)	(dB)
Low	<b>(MHz)</b> 5190	(dBm) 2.724	(dBm) 2.88	<b>(dBm)</b> 11.00	(dB) -8.12

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## OUTPUT POWER AND PPSD





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# 8.4. 802.11a MODE IN THE 5.3 GHz BAND

# 8.4.1. 26 dB BANDWIDTH

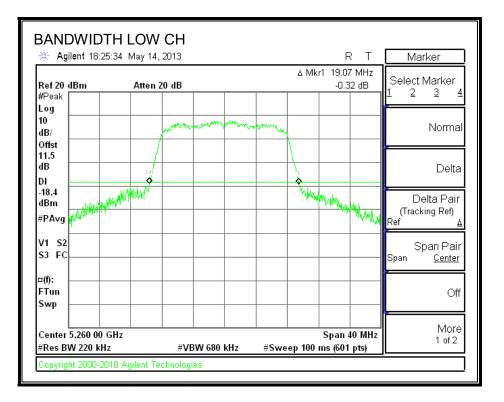
#### **LIMITS**

None; for reporting purposes only.

## **RESULTS**

Channel	Frequency	26 dB Bandwidth
	(MHz)	(MHz)
Low	5260	19.07
Mid	5300	19.13
High	5320	19.27

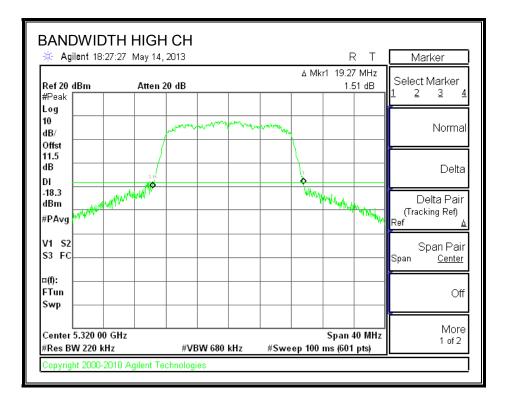
#### 26 dB BANDWIDTH



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🔆 Agilent 18:23	:57 May 14, 2013			RT	Marker
Ref 20 dBm #Peak	Atten 20 dB		∆ Mk	r1 19.13 MHz 0.43 dB	Select Marker
Log 10 dB/ Offst		un and the form the form	www.		Norma
11.5 dB					Delta
-18.0 dBm #PAvg				My man Million	Delta Pair (Tracking Ref) Ref
V1 S2 S3 FC					Span Pair Span <u>Center</u>
¤(f): FTun Swp					Off
Center 5.300 00 G #Res BW 220 kHz		BW 680 kHz	#Sweep 100	Span 40 MHz ms (601 pts)	More 1 of 2



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## 8.4.2. 99% BANDWIDTH

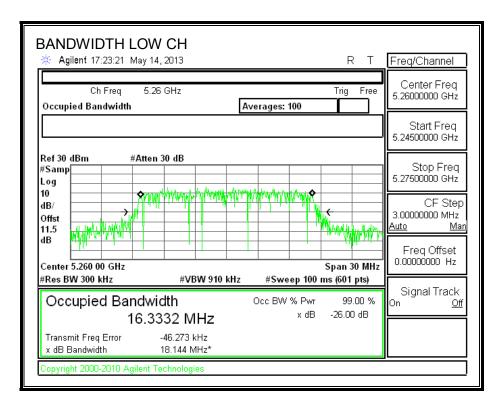
#### **LIMITS**

None; for reporting purposes only.

#### **RESULTS**

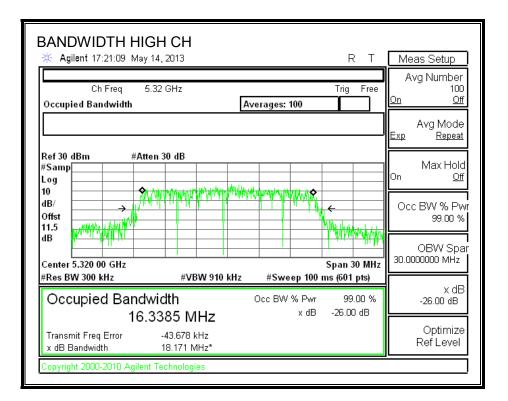
Channel	Frequency	99% Bandwidth
	(MHz)	(MHz)
Low	5260	16.3332
Mid	5300	16.3261
High	5320	16.3385

#### 99% BANDWIDTH



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BANDWIDTH MII	-		RТ	Freq/Channel
Ch Freq 5	5.3 GHz	Averages: 100	Trig Free	Center Freq 5.30000000 GHz
				Start Freq 5.28500000 GHz
#Samp Log	en 30 dB	want da mada u		Stop Freq 5.31500000 GHz
dB/ Offst 11.5				CF Step 3.0000000 MHz <u>Auto Man</u>
Center 5.300 00 GHz			Span 30 MHz	Freq Offset 0.00000000 Hz
#Res BW 300 kHz Occupied Band	#VBW 910 vidth 3261 MHz	Occ BW % Pwr		Signal Track <sup>On <u>Off</u></sup>
Transmit Freq Error x dB Bandwidth	-48.204 kHz 18.160 MHz*			
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# 8.4.3. AVERAGE POWER

#### **LIMITS**

None; for reporting purposes only.

#### TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 11.4 dB (including 10 dB pad and 1.4 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

#### RESULTS

Channel	Frequency	Power
	(MHz)	(dBm)
Low	5260	15.90
Mid	5300	15.91
High	5320	15.95

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# 8.4.4. OUTPUT POWER AND PPSD

## LIMITS

FCC §15.407 (a) (2)

For the band 5.25–5.35 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26–dB emission bandwidth in MHz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1–MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

## **DIRECTIONAL ANTENNA GAIN**

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

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#### **RESULTS**

#### Bandwidth and Antenna Gain

Channel	Frequency	Min	Directio
		26 dB	Gain
		BW	
	(MHz)	(MHz)	(dBi)
Low	5260	19.07	-6.00
Mid	5300	19.13	-6.00
High	5320	19.27	-6.00

#### Limits

Channel	Frequency	FCC	FCC
		Power	PPSD
		Limit	Limit
	(MHz)	(dBm)	(dBm)
Low	5260	23.80	11.00
Mid	5300	23.82	11.00
High	5320	23.85	11.00

Duty Cycle CF (dB) 0.07 Included in Calculations of Corr'd Power & PPSD

## **Output Power Results**

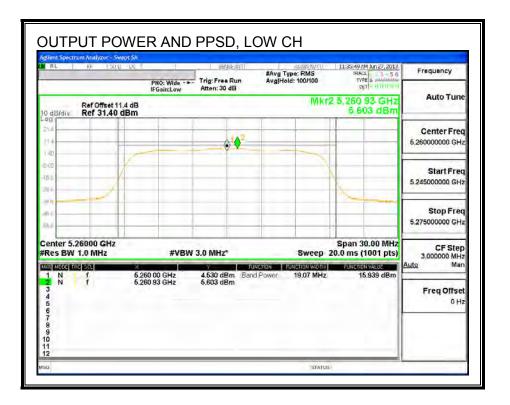
Channel	Frequency	Meas	Total	Power	Power
		Power	Corr'd	Limit	Margin
			Power		
	(MHz)	(dBm)	(dBm)	(dBm)	(dB)
Low	5260	15.939	16.01	23.80	-7.79
Mid	5300	15.947	16.02	23.82	-7.80
High	5320	15.973	16.04	23.85	-7.81

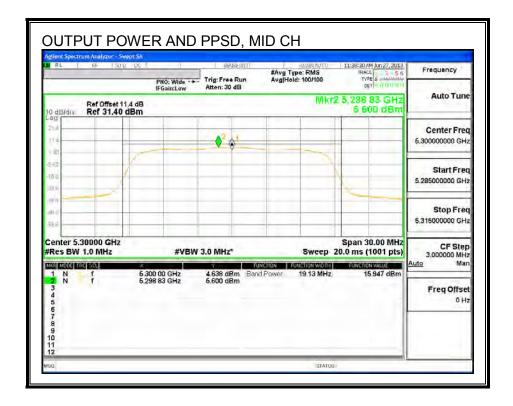
#### **PPSD Results**

Channel	Frequency	Meas	Total	PPSD	PPSD
		PPSD	Corr'd	Limit	Margin
			PPSD		
	(MHz)	(dBm)	(dBm)	(dBm)	(dB)
Low	5260	5.603	5.67	11.00	-5.33
Mid	5300	5.600	5.67	11.00	-5.33
High	5320	5.636	5.71	11.00	-5.29

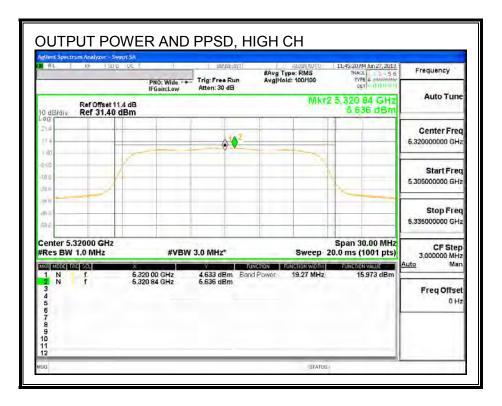
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## OUTPUT POWER AND PPSD





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# 8.5. 802.11n HT20 MODE IN THE 5.3 GHz BAND

# 8.5.1. 26 dB BANDWIDTH

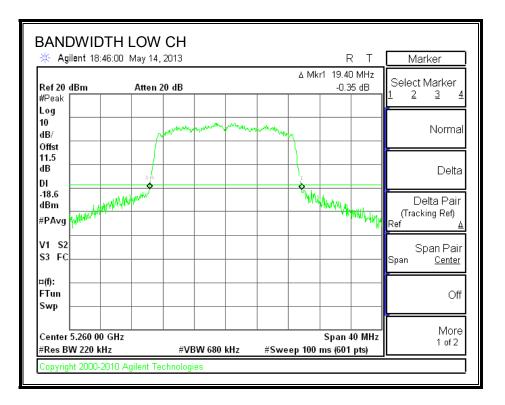
## LIMITS

None; for reporting purposes only.

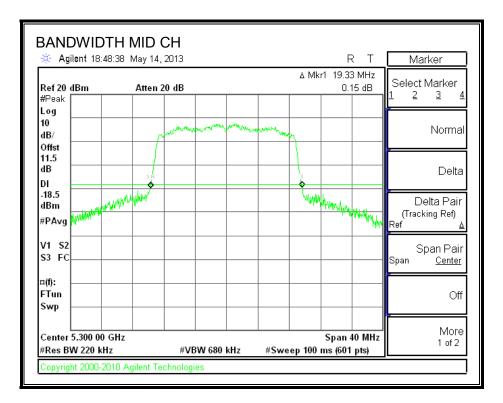
## **RESULTS**

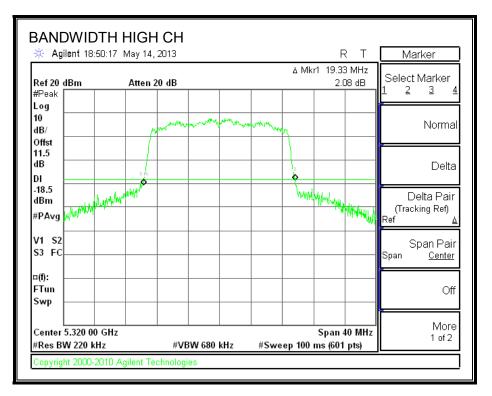
Channel	Frequency	26 dB Bandwidth
	(MHz)	(MHz)
Low	5260	19.40
Mid	5300	19.33
High	5320	19.33

## 26 dB BANDWIDTH



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## 8.5.2. 99% BANDWIDTH

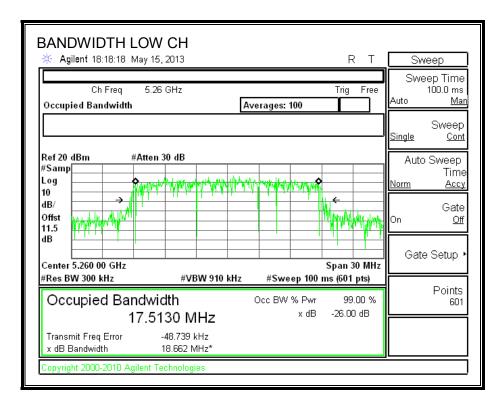
#### **LIMITS**

None; for reporting purposes only.

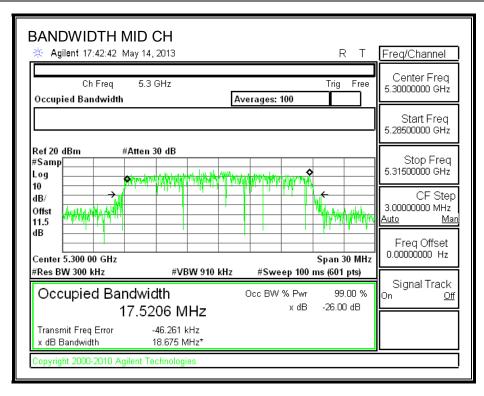
#### **RESULTS**

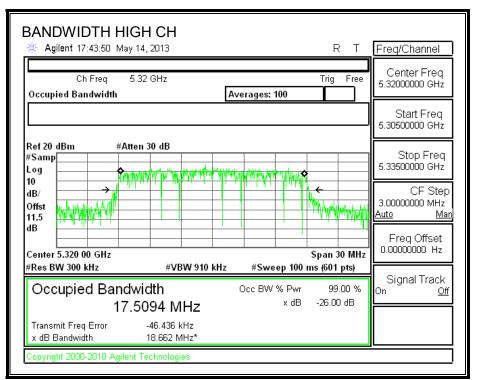
Channel	Frequency	99% Bandwidth
	(MHz)	(MHz)
Low	5260	17.5130
Mid	5300	17.5206
High	5320	17.5094

#### 99% BANDWIDTH



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# 8.5.3. AVERAGE POWER

#### **LIMITS**

None; for reporting purposes only.

#### TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 11.4 dB (including 10 dB pad and 1.4 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

#### RESULTS

Channel	Frequency	Power
	(MHz)	(dBm)
Low	5260	16.04
Mid	5300	16.00
High	5320	16.00

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# 8.5.4. OUTPUT POWER AND PPSD

## LIMITS

FCC §15.407 (a) (2)

For the band 5.25–5.35 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26–dB emission bandwidth in MHz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1–MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

## **DIRECTIONAL ANTENNA GAIN**

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

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#### **RESULTS**

#### Bandwidth and Antenna Gain

Channel	Frequency	Min	Direction
		26 dB	Gain
		BW	
	(MHz)	(MHz)	(dBi)
Low	5260	19.40	-6.00
Mid	5300	19.33	-6.00
High	5320	19.33	-6.00

#### Limits

Channel	Frequency	FCC	FCC
		Power	PPSD
		Limit	Limit
	(MHz)	(dBm)	(dBm)
Low	5260	23.88	11.00
Mid	5300	23.86	11.00
High	5320	23.86	11.00

Duty Cycle CF (dB) 0.07 Included in Calculations of Corr'd Power & PPSD

#### **Output Power Results**

Channel	Frequency	Meas	Total	Power	Power
		Power	Corr'd	Limit	Margin
			Power		
	(MHz)	(dBm)	(dBm)	(dBm)	(dB)
Low	5260	16.178	16.25	23.88	-7.63
Mid	5300	16.183	16.25	23.86	-7.61
High	5320	16.048	16.12	23.86	-7.74

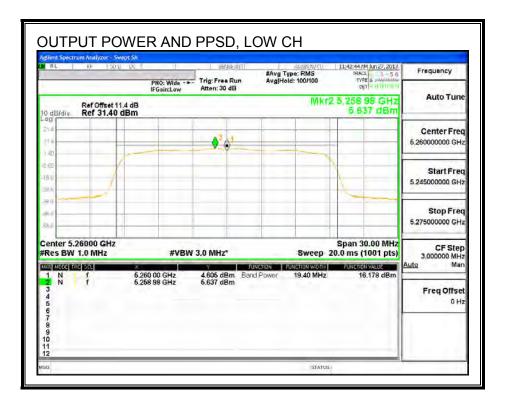
#### **PPSD Results**

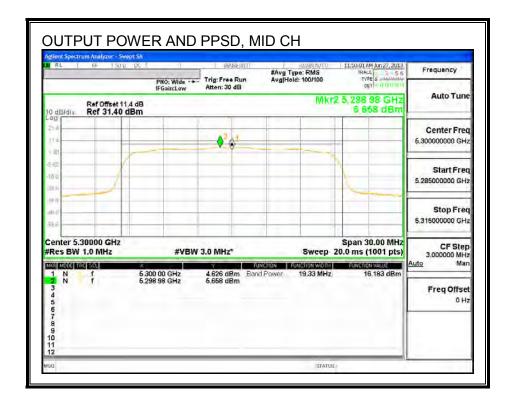
Channel	Frequency	Meas	Total	PPSD	PPSD
		PPSD	Corr'd	Limit	Margin
			PPSD		
	(MHz)	(dBm)	(dBm)	(dBm)	(dB)
Low	5260	5.637	5.71	11.00	-5.29
Mid	5300	5.658	5.73	11.00	-5.27
High	5320	5.547	5.62	11.00	-5.38

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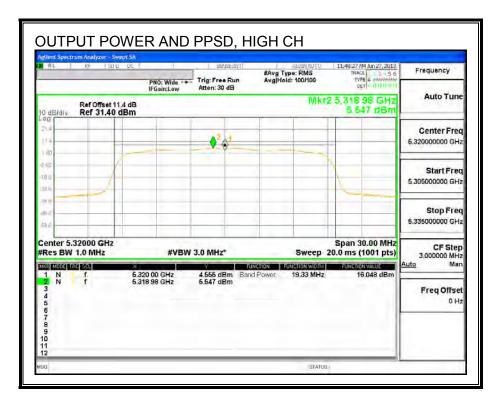
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## OUTPUT POWER AND PPSD





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# 8.6. 802.11n HT40 MODE IN THE 5.3 GHz BAND

# 8.6.1. 26 dB BANDWIDTH

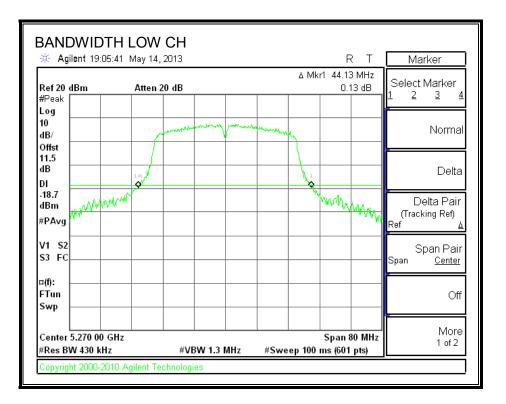
## LIMITS

None; for reporting purposes only.

## **RESULTS**

Channel	Frequency	26 dB Bandwidth
	(MHz)	(MHz)
Low	5270	44.13
High	5310	44.00

#### 26 dB BANDWIDTH



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🔆 Agilent 19	:07:32 May 14,	2013			R	т [	Marker
Ref 20 dBm #Peak	Atten 2	20 dB		۸ Mk	r1 44.00 M 0.68 d		Select Marker . <u>2</u> <u>3</u> 4
Log 10 dB/		er and a start of the	and have a second	harmon and have			Norma
Offst 11.5 dB DI	18						Delta
-18.6 dBm #PA∨g	WWWWW				month where	WW 10 F	Delta Pair (Tracking Ref) ≳ef ∆
V1 S2 S3 FC						Ē	Span Pair Span <u>Center</u>
¤(f): FTun Swp							Off
Center 5.310 0 #Res BW 430 I		#VBW 1	.3 MHz	#Sweep 100	Span 80 f ms (601 pts		More 1 of 2

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# 8.6.2. 99% BANDWIDTH

## **LIMITS**

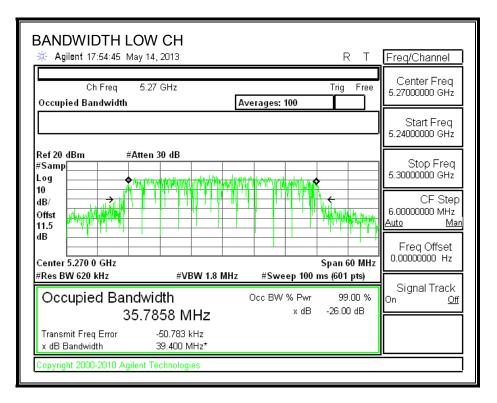
None; for reporting purposes only.

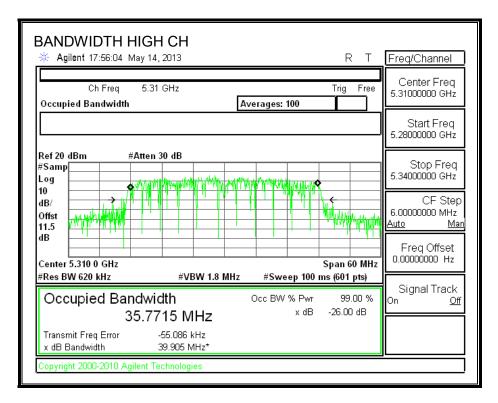
## **RESULTS**

Channel Frequency		99% Bandwidth
	(MHz)	(MHz)
Low	5270	35.7858
High	5310	35.7715

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## 99% BANDWIDTH





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# 8.6.3. AVERAGE POWER

## **LIMITS**

None; for reporting purposes only.

#### TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 11.5 dB (including 10 dB pad and 1.5 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

#### **RESULTS**

Channel	Frequency	Power
	(MHz)	(dBm)
Low	5270	15.99
High	5310	15.94

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# 8.6.4. OUTPUT POWER AND PPSD

## LIMITS

FCC §15.407 (a) (2)

For the band 5.25–5.35 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26–dB emission bandwidth in MHz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1–MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

## **DIRECTIONAL ANTENNA GAIN**

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

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#### **RESULTS**

#### Bandwidth and Antenna Gain

Channel	Frequency	Min	Direction
		26 dB	Gain
		BW	
	(MHz)	(MHz)	(dBi)
Low	<b>(MHz)</b> 5270	<b>(MHz)</b> 44.13	(dBi) -6.00

#### Limits

Channel	Frequency	FCC	FCC
		Power	PPSD
		Limit	Limit
	(MHz)	(dBm)	(dBm)
Low	5270	24.00	11.00
High	5310	24.00	11.00

Duty Cycle CF (dB) 0.16 Included in Calculations of Corr'd Power & PPSD

## **Output Power Results**

Channel	Frequency	Meas	Total	Power	Power
		Power	Corr'd	Limit	Margin
			Power		
		(dDm)	(dDma)	(dDm)	
	(MHz)	(dBm)	(dBm)	(dBm)	(dB)
Low	5270	( <b>dBill)</b> 16.120	( <b>авт)</b> 16.28	24.00	-7.72

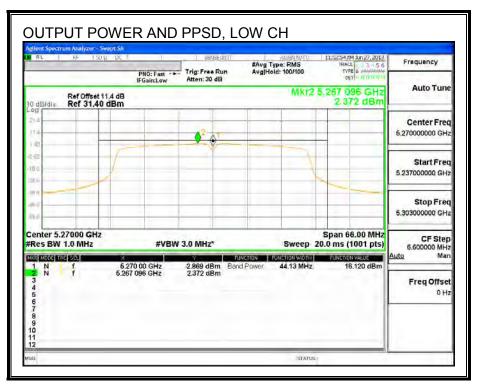
#### **PPSD Results**

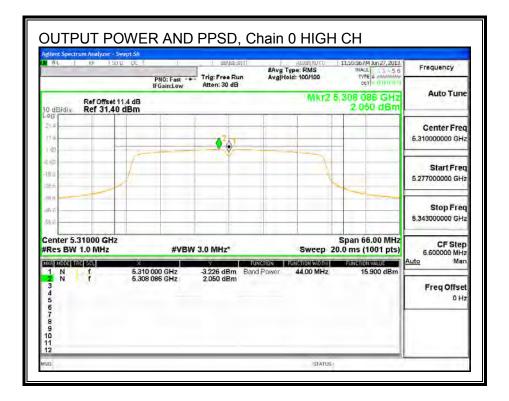
Channel	Frequency	Meas	Total	PPSD	PPSD
		PPSD	Corr'd	Limit	Margin
			PPSD		
	(MHz)	(dBm)	(dBm)	(dBm)	(dB)
Low	<b>(MHz)</b> 5270	(dBm) 2.372	(dBm) 2.53	(dBm) 11.00	(dB) -8.47

DATE: NOVEMBER 24, 2015

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## OUTPUT POWER AND PPSD,





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# 8.7. 802.11a MODE IN THE 5.6 GHz BAND

# 8.7.1. 26 dB BANDWIDTH

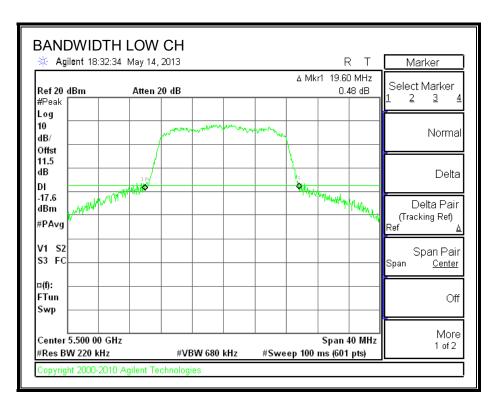
## **LIMITS**

None; for reporting purposes only.

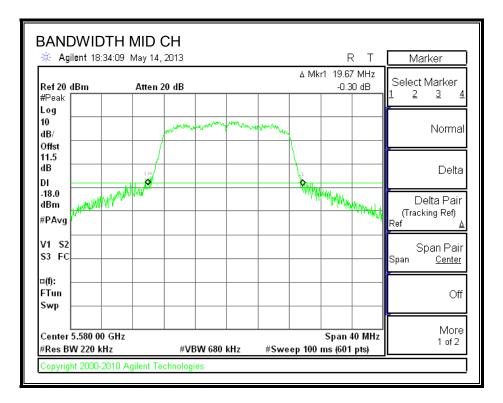
## **RESULTS**

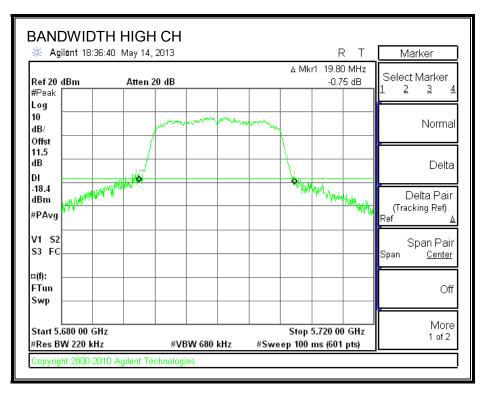
Channel Frequency		26 dB Bandwidth
	(MHz)	(MHz)
Low	5500	19.60
Mid	5580	19.67
High	5700	19.80

## 26 dB BANDWIDTH



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# 8.7.2. 99% BANDWIDTH

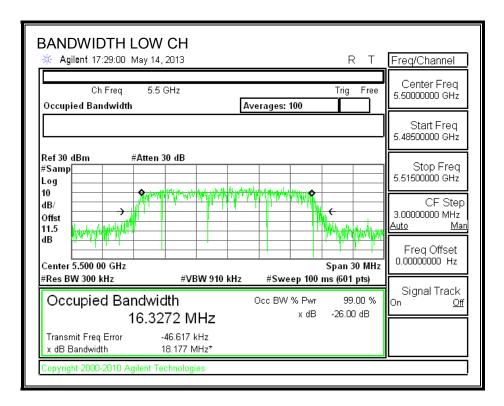
#### **LIMITS**

None; for reporting purposes only.

#### **RESULTS**

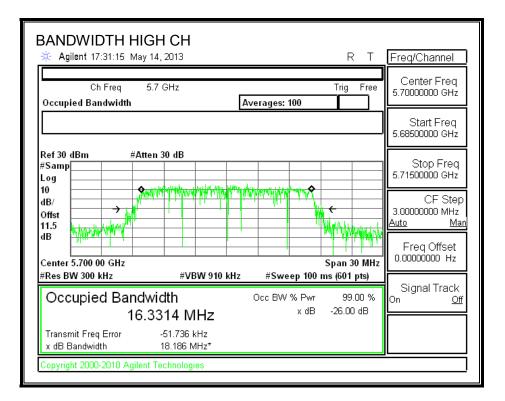
Channel	Frequency	99% Bandwidth
	(MHz)	(MHz)
Low	5500	16.3272
Mid	5580	16.3301
High	5700	16.3314

#### 99% BANDWIDTH



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BANDWIDTH MID CH Agilent 17:30:11 May 14, 2013	R T	Freq/Channel
Ch Freq 5.58 GHz Occupied Bandwidth	Trig Free	Center Freq 5.58000000 GHz
		Start Freq 5.56500000 GHz
Ref 30 dBm #Atten 30 dB #Samp Log		Stop Freq 5.59500000 GHz
10 dB/ Offst 11.5 dB		CF Step 3.00000000 MHz <u>Auto Man</u>
Center 5.580 00 GHz	Span 30 MHz	Freq Offset 0.00000000 Hz
#Res BW 300 kHz #VBW 910 k Occupied Bandwidth	Hz #Sweep 100 ms (601 pts) Occ BW % Pwr 99.00 %	Signal Track On <u>Off</u>
16.3301 MHz	x dB -26.00 dB	
Transmit Freq Error-53.418 kHzx dB Bandwidth18.163 MHz*		
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## 8.7.3. AVERAGE POWER

### **LIMITS**

None; for reporting purposes only.

### TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 11.5 dB (including 10 dB pad and 1.5 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

### **RESULTS**

Channel	Frequency	Power
	(MHz)	(dBm)
Low	5500	14.00
Mid	5580	13.95
High	5700	13.92

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# 8.7.4. OUTPUT POWER AND PPSD

## LIMITS

FCC §15.407 (a) (2)

For the band 5.47–5.725 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26–dB emission bandwidth in MHz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1–MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

## **DIRECTIONAL ANTENNA GAIN**

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

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### **RESULTS**

## Bandwidth and Antenna Gain

Channel	Frequency	Min	Direction
		26 dB	Gain
		BW	
	(MHz)	(MHz)	(dBi)
Low	5500	19.60	-5.50
Mid	5580	19.67	-5.50
High	5700	19.80	-5.50

#### Limits

Channel	Frequency	FCC	FCC
		Power	PPSD
		Limit	Limit
	(MHz)	(dBm)	(dBm)
Low	5500	23.92	11.00
Mid	5580	23.94	11.00
High	5700	23.97	11.00

## Duty Cycle CF (dB) 0.07 Included in Calculations of Corr'd Power & PPSD

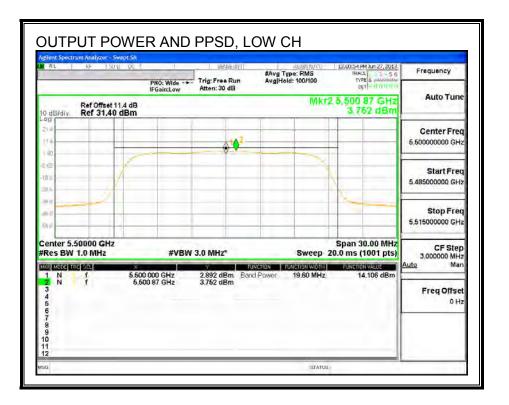
### **Output Power Results**

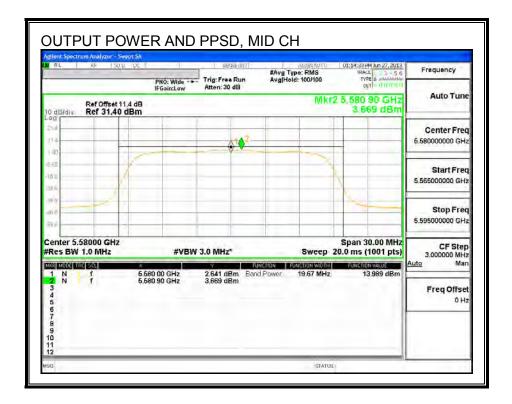
Channel	Frequency	Meas	Total	Power	Power
		Power	Corr'd	Limit	Margin
			Power		
	(MHz)	(dBm)	(dBm)	(dBm)	(dB)
Low	5500	14.106	14.18	23.92	-9.75
Mid	5580	13.989	14.06	23.94	-9.88
High	5700	13.948	14.02	23.97	-9.95

## **PPSD Results**

Channel	Frequency	Meas	Total	PPSD	PPSD
		PPSD	Corr'd	Limit	Margin
			PPSD		
	(MHz)	(dBm)	(dBm)	(dBm)	(dB)
Low	5500	3.752	3.82	11.00	-7.18
Mid	5580	3.669	3.74	11.00	-7.26
High	5700	3.626	3.70	11.00	-7.30

## OUTPUT POWER AND PPSD





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RL RF	150 g pc 1		seveenut ree Run :30 dB	#Avg Type: RMS Avg[Hold: 100/100	01:16:54 9M Jun 27, 2013 TRACL 3 5 6 TV7E 5 2444444 DET 9 01 01 01	Frequency
O dB/div Ref :	ffset 11.4 dB 31.40 dBm	Gain:Low Atten	.50 00	Mkr2	5,700 81 GHz 3.626 dBm	Auto Tune
00 21 ± 11 ±			0 <sup>10<sup>2</sup></sup>			Center Fred 5.700000000 GH;
1 60 10 2 10 4	1					Start Free 5.685000000 GH:
10 1 10 1 13 2					~	Stop Fred 5.715000000 GH
enter 5.70000 Res BW 1.0 M		#VBW 3.0 M		Sweep 2	Span 30.00 MHz 0.0 ms (1001 pts)	CF Ster 3.000000 MH: Auto Mar
1 N 1 f 22 N 1 f 34 56 67 89 90	5.700 0 5.700 8		dBm Ban dBm	d Power 19.80 MHz	13,948 dBm	Freq Offse 0 H;

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# 8.8. 802.11n HT20 MODE IN THE 5.6 GHz BAND

## 8.8.1. 26 dB BANDWIDTH

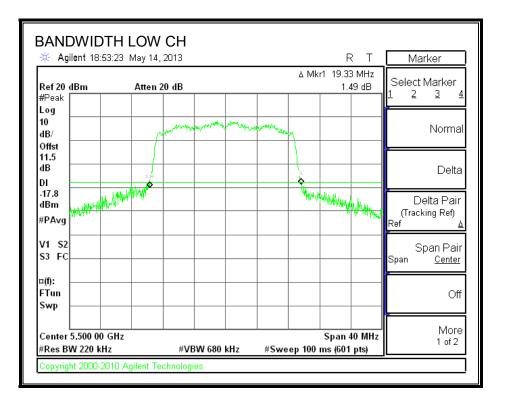
## <u>LIMITS</u>

None; for reporting purposes only.

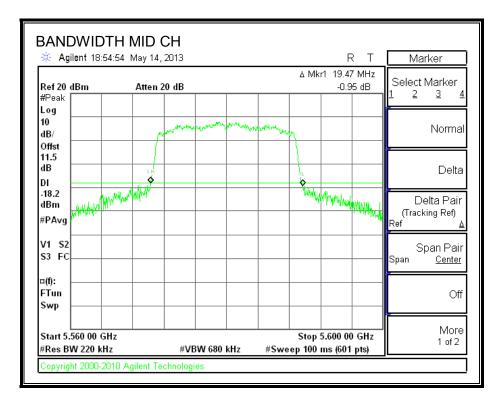
### **RESULTS**

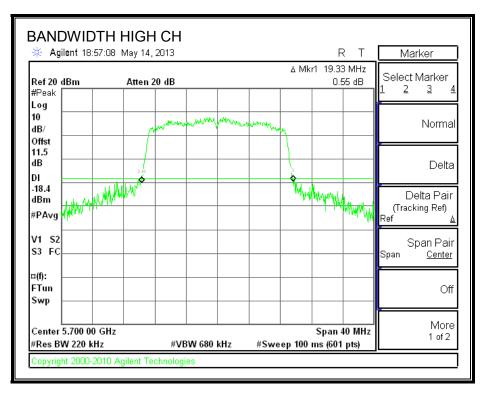
Channel	Frequency	26 dB Bandwidth
	(MHz)	(MHz)
Low	5500	19.33
Mid	5580	19.47
High	5700	19.33

### 26 dB BANDWIDTH



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## 8.8.2. 99% BANDWIDTH

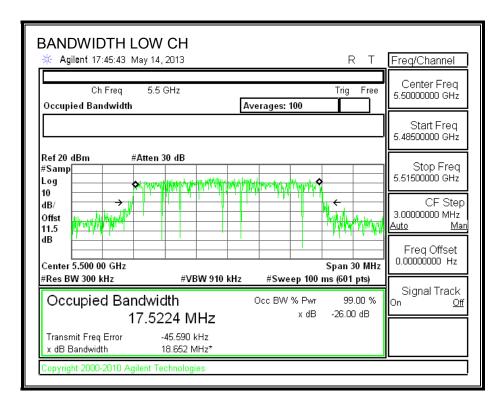
#### **LIMITS**

None; for reporting purposes only.

### **RESULTS**

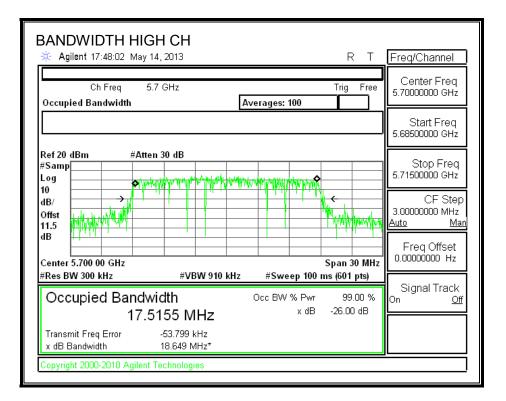
Channel	Frequency	99% Bandwidth
	(MHz)	(MHz)
Low	5500	17.5224
Mid	5580	17.5123
High	5700	17.5155

### 99% BANDWIDTH



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BANDWIDTH MID CH	Freq/Channel
Ch Freq 5.58 GHz Trig Free Occupied Bandwidth Averages: 100	Center Freq 5.58000000 GHz
	Start Freq 5.56500000 GHz
Ref 20 dBm #Atten 30 dB #Samp Log	Stop Freq 5.59500000 GHz
10 dB/ Offst 11.5	CF Step 3.0000000 MHz <u>Auto Man</u>
dB Center 5.580 00 GHz Span 30 MHz	Freq Offset 0.00000000 Hz
#Res BW 300 kHz #VBW 910 kHz #Sweep 100 ms (601 pts)	Signal Track
Occupied Bandwidth         Occ BW % Pwr         99.00 %           17.5123 MHz         x dB         -26.00 dB	On <u>Off</u>
Transmit Freq Error-45.741 kHzx dB Bandwidth18.695 MHz*	
Copyright 2000-2010 Agilent Technologies	



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## 8.8.3. AVERAGE POWER

## **LIMITS**

None; for reporting purposes only.

### TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 11.5 dB (including 10 dB pad and 1.5 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

### **RESULTS**

Channel	Frequency	Power
	(MHz)	(dBm)
Low	5500	13.95
Mid	5580	14.00
High	5700	14.00

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## 8.8.4. OUTPUT POWER AND PPSD

## LIMITS

FCC §15.407 (a) (2)

For the band 5.47–5.725 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26–dB emission bandwidth in MHz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1–MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

## **DIRECTIONAL ANTENNA GAIN**

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

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### **RESULTS**

## Bandwidth and Antenna Gain

Channel	Frequency	Min	Directio
		26 dB	Gain
		BW	
	(MHz)	(MHz)	(dBi)
Low	5500	19.33	-5.50
Mid	5580	19.47	-5.50
High	5700	19.33	-5.50

#### Limits

Channel	Frequency	FCC	FCC
		Power	PPSD
		Limit	Limit
	(MHz)	(dBm)	(dBm)
Low	5500	23.86	11.00
Mid	5580	23.89	11.00
High	5700	23.86	11.00

Duty Cycle CF (dB) 0.09 Included in Calculations of Corr'd Power & PPSD

### Output Power Results

Channel	Frequency	Meas	Total	Power	Power
		Power	Corr'd	Limit	Margin
			Power		
	(MHz)	(dBm)	(dBm)	(dBm)	(dB)
Low	5500	13.978	14.07	23.86	-9.79
Mid	5580	14.138	14.23	23.89	-9.67
High	5700	14.116	14.21	23.86	-9.66

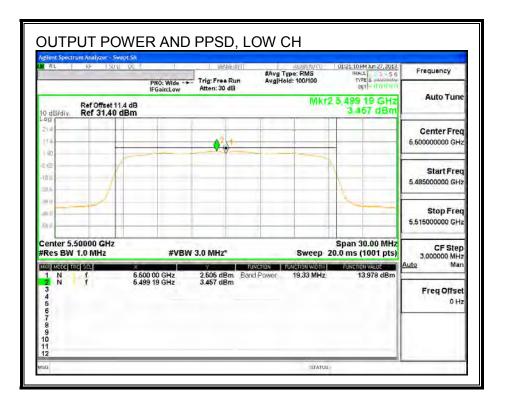
### **PPSD Results**

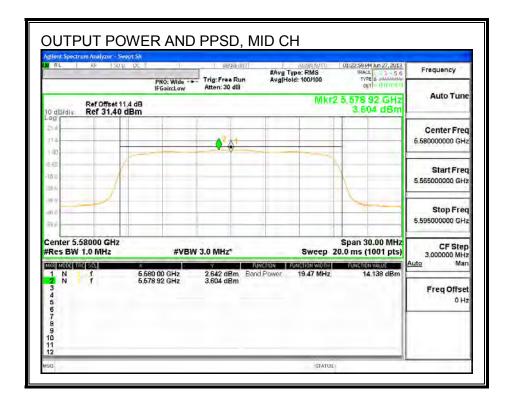
Channel	Frequency	Meas	Total	PPSD	PPSD
		PPSD	Corr'd	Limit	Margin
			PPSD		
	(MHz)	(dBm)	(dBm)	(dBm)	(dB)
Low	5500	3.457	3.55	11.00	-7.45
Mid	5580	3.604	3.69	11.00	-7.31
High	5700	3.593	3.68	11.00	-7.32

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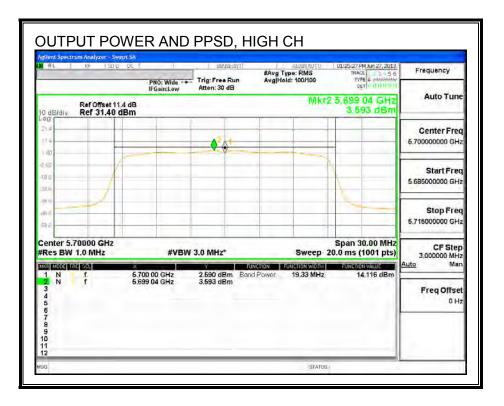
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## OUTPUT POWER AND PPSD





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# 8.9. 802.11n HT40 MODE IN THE 5.6 GHz BAND

# 8.9.1. 26 dB BANDWIDTH

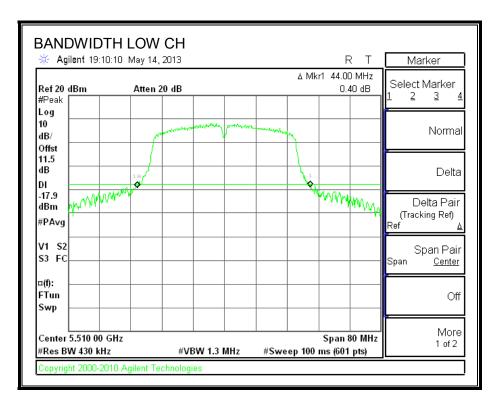
## LIMITS

None; for reporting purposes only.

## **RESULTS**

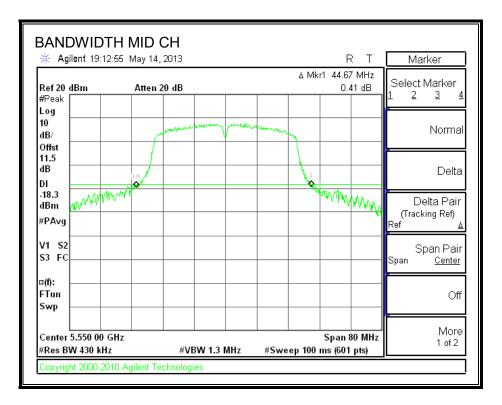
Channel	Frequency	26 dB Bandwidth
	(MHz)	(MHz)
Low	5510	44.00
Mid	5550	44.67
High	5670	44.80

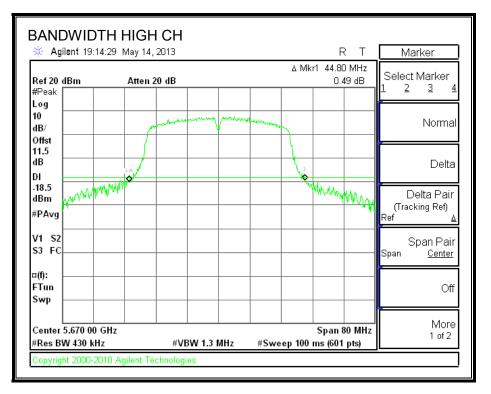
## 26 dB BANDWIDTH



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## 8.9.2. 99% BANDWIDTH

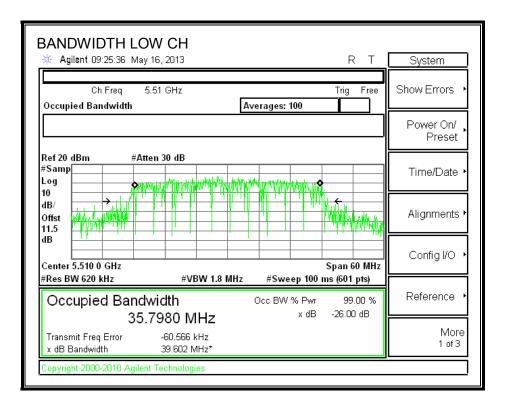
#### **LIMITS**

None; for reporting purposes only.

### **RESULTS**

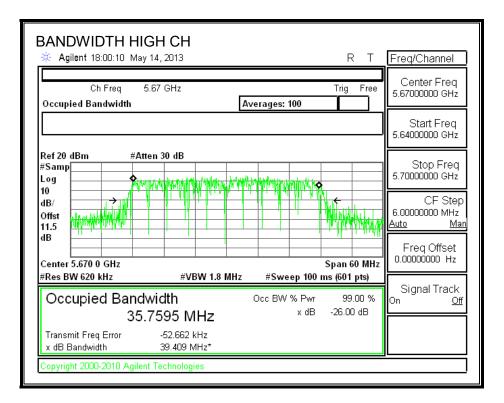
Channel	Frequency	99% Bandwidth
	(MHz)	(MHz)
Low	5510	35.7980
Mid	5550	35.7564
High	5670	35.7595

### 99% BANDWIDTH



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BANDWIDTH MID CH * Agilent 17:58:58 May 14, 2013 R T	Freq/Channel
Ch Freq 5.55 GHz Trig Free Occupied Bandwidth Averages: 100	Center Freq 5.5500000 GHz
	Start Freq 5.5200000 GHz
Ref 20 dBm         #Atten 30 dB           #Samp	Stop Freq 5.5800000 GHz CF Step 6.0000000 MHz
11.5         Image: Constraint of the second se	<u>Auto Man</u> Freq Offset 0.0000000 Hz
Occupied Bandwidth         Occ BW % Pwr         99.00 %           35.7564 MHz         x dB         -26.00 dB	Signal Track <sup>On <u>Off</u></sup>
Transmit Freq Error     -66.593 kHz       x dB Bandwidth     39.734 MHz*       Copyright 2000-2010 Agilent Technologies	



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## 8.9.3. AVERAGE POWER

### **LIMITS**

None; for reporting purposes only.

### TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 11.5 dB (including 10 dB pad and 11.5 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

### **RESULTS**

Channel	Frequency	Power
	(MHz)	(dBm)
Low	5510	14.02
Mid	5550	13.95
High	5670	14.08

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## 8.9.4. OUTPUT POWER AND PPSD

## LIMITS

FCC §15.407 (a) (2)

For the band 5.47–5.725 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26–dB emission bandwidth in MHz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1–MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

## **DIRECTIONAL ANTENNA GAIN**

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

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### **RESULTS**

## Bandwidth and Antenna Gain

Channel	Frequency	Min	Directio
		26 dB	Gain
		BW	
	(MHz)	(MHz)	(dBi)
Low	5510	44.00	-5.50
Mid	5550	44.67	-5.50
High	5670	44.80	-5.50

#### Limits

Channel	Frequency	FCC	FCC	
		Power	PPSD	
		Limit	Limit	
	(MHz)	(dBm)	(dBm)	
Low	5510	24.00	11.00	
Mid	5550	24.00	11.00	
High	5670	24.00	11.00	

## Duty Cycle CF (dB) 0.16 Included in Calculations of Corr'd Power & PPSD

### Output Power Results

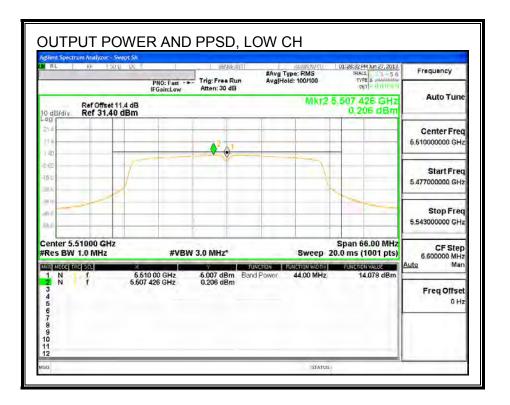
Channel	Frequency	Meas	Meas Total		Power
		Power	Corr'd	Limit	Margin
			Power		
	(MHz)	(dBm)	(dBm)	(dBm)	(dB)
Low	5510	14.078	14.24	24.00	-9.76
Mid	5550	14.096	14.26	24.00	-9.74
High	5670	14.077	14.24	24.00	-9.76

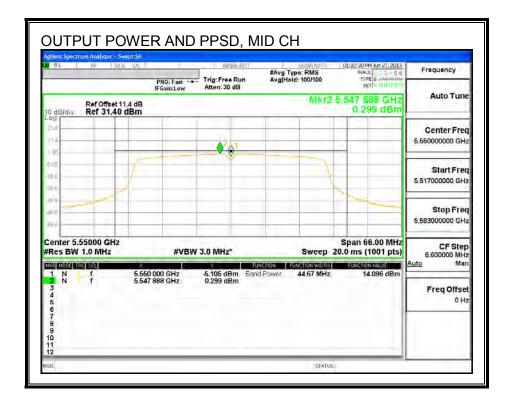
### **PPSD Results**

Channel	Frequency	Meas	Total	PPSD	PPSD
		PPSD	Corr'd	Limit	Margin
			PPSD		
	(MHz)	(dBm)	(dBm)	(dBm)	(dB)
Low	5510	0.206	0.37	11.00	-10.63
Mid	5550	0.299	0.46	11.00	-10.54
High	5670	0.264	0.42	11.00	-10.58

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## OUTPUT POWER AND PPSD





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Frequency	01:35:39 PM Jun 27, 2013 TRACE 5 - 5.6 TYPE 5 - 10111 - 11	Type: RMS old: 100/100		SENSE INT	PNO: Fast	50.12 pc 1	RF 1	RL
Auto Tune		Mkr2 5		Atten: 30 dB	IFGain:Low	et 11.4 dB 40 dBm		0 dB/div
Center Free 5.670000000 GHz				A1 42				og 21.4 11.4
Start Free 5.637000000 GHz						F		10 0 10 0
Stop Fred 5.703000000 GH;	<u> </u>							9 iy 10 il 3 il
CF Step 6.600000 MHz Auto Man	Span 66.00 MHz 1.0 ms (1001 pts) Function value	Sweep 20			-	X	1.0 MHz	enter 5. Res BW
Freq Offset 0 Hz	14.077 dBm	44.80 MHz	d Power	-5.066 dBm Bar 0.264 dBm	000 GHz 310 GHz	5.670 ( 5.672 (	ł	1 N N N 3 4 5 6 7 8 9

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# 9. RADIATED TEST RESULTS

# 9.1. LIMITS AND PROCEDURE

## <u>LIMITS</u>

FCC §15.205 and §15.209

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.

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; the video bandwidth is set to 1 MHz for peak measurements and as applicable for average measurements.

The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable 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.

### TEST RESULT

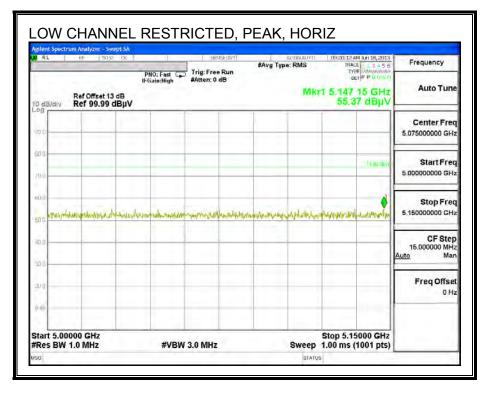
No other spurious emissions were found above 18G.

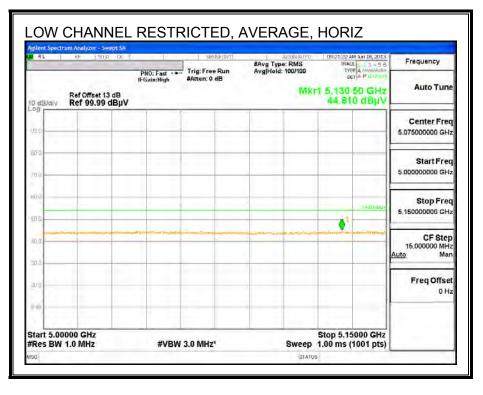
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# 9.2. TRANSMITTER ABOVE 1 GHz

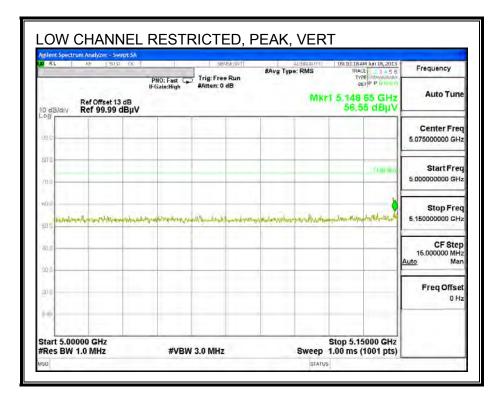
# 9.2.1. TX ABOVE 1 GHz 802.11a MODE IN THE 5.2 GHz BAND

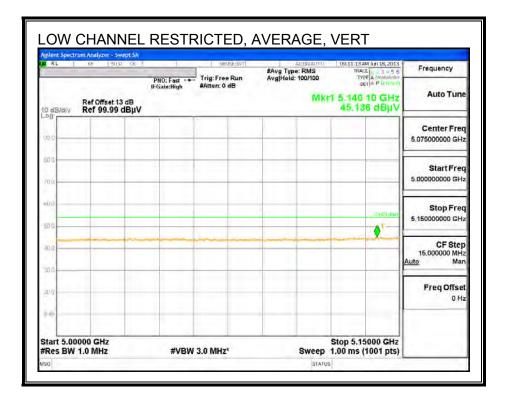
## **RESTRICTED BANDEDGE (LOW CHANNEL)**





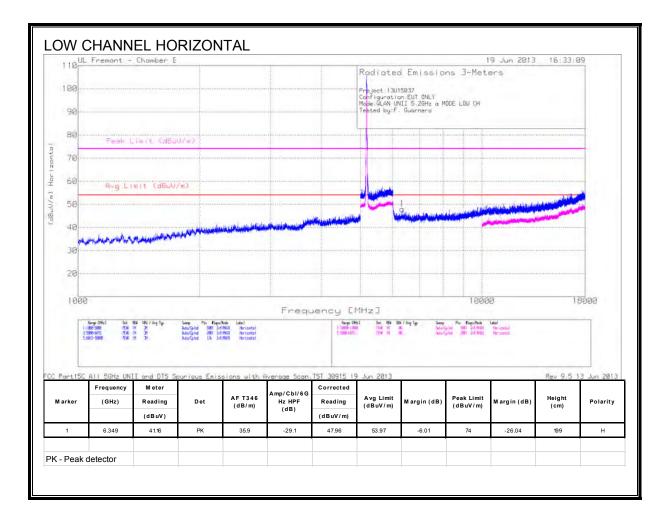
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## HARMONICS AND SPURIOUS EMISSIONS

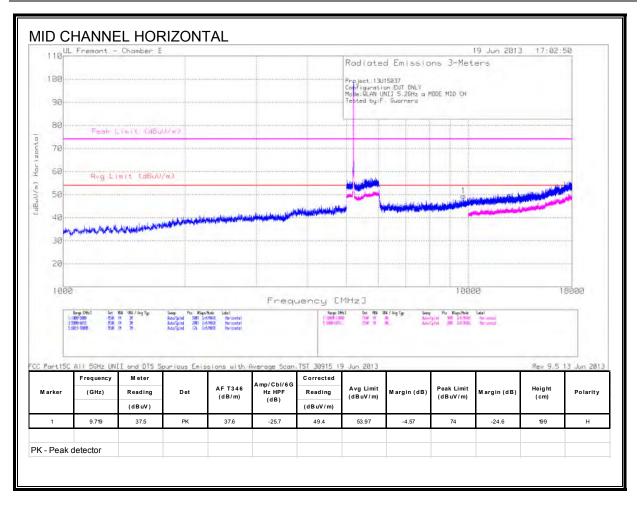


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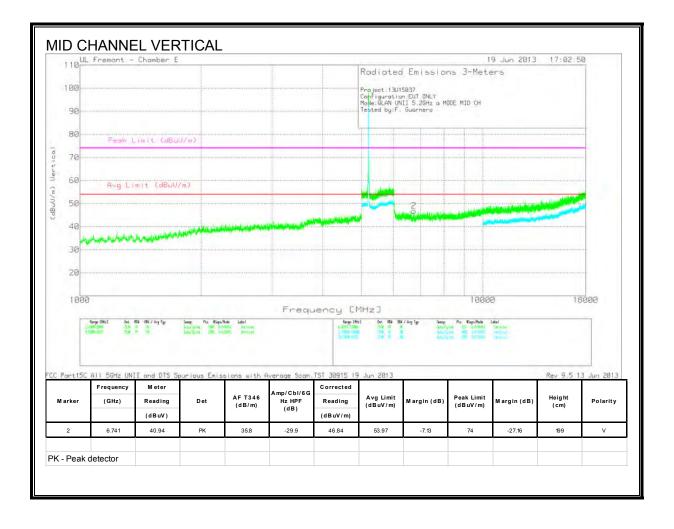
Page 99 of 222

118	Fremont -	Chamber E			10					9 Jun 2013	16:33:0	39
100							Radiated Emissions 3-Meters Project.13015837 Configuration.EUT ONLY Mode: CULAN UNIT 5.20Hz a MODE LOW CH Trebted by:F. Guarnero					
80							ul garanda					
70	Peak I.	imit (dBo	J/m)									
60	0	mit (dBuV/										
50	HVGLI	mit jabuv/	r mu									
70 60 50									3			<b>*</b>
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1000	)			_	France	iency [	MHa J		1000	8	11	5000
4	Range DHz.] Det. 7.0 7.0 7.0	Rsa 0407Ang1ge N	Saap Pta Kap haaritalaa kaaritalaa	u'Node Lobel Anna Jertum Anna Jertum Anna Jertyal		Range IX		N / Ang Typ Sweep And And And And And And And And And And	Pas Raps/Role	ladat Tary saa Tary saat Tary saat		
Part15C	All 5GHz UN	I and DTS Sp Meter	ourious Eni	ssions with	Average Scan.	Corrected	9 Jun 2013				Rev 9.5 1	13 Jun 2013
M arker	(GHz)	Reading (dBuV)	Det	AF T346 (dB/m)	Amp/Cbl/6G Hz HPF (dB)	Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Height (cm)	Polarity
2	8.26	39.39	РК	36.2	-27.9	47.69	53.97	-6.28	74	-26.31	199	v
< - Peak	detector											_

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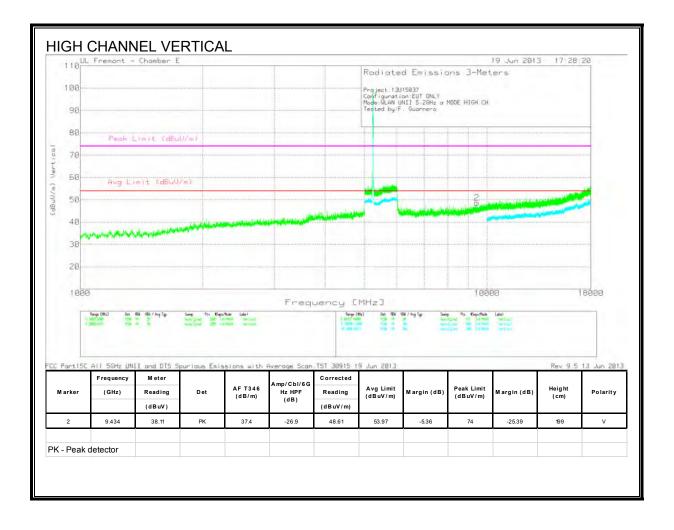
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	Range OH23 Set 1:1809-5088 IEA 3:5809-5875 IEA 5:5815-18888 IEA	RSA ON / Ang Tap IN 3H IN 3H IN 3H	Autoripied St Autoripied St Autoripied 12	HT Lef/MAIX Herizonte HT Lef/MAIX Herizonte & Lef/MAIX Herizonte		8.9	non-Lana 764 Non-Lana 754	11	AutorOpine 1981 AutorOpine 2991	bil/Mild Hirsental bil/Mild Hirsental		
r	Range (Miz) Det	Rs UN/Ag Typ	Supp Pta	Kieps/Node Label		quency	Report (Mir) Carl	184 184 / Avg Typ	Sietp Pla Ki	ps/Mode Label		
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50							المرت المر	and a state	and the Real	A REAL PROPERTY.	and the second second	
1	Rvg	imit (dBu)	U/m2				-			-	1.10	Louis
70												
70									and an	1		
80	Feak	Limit Cab	0U/m0									****
36												
90	Project (13U15037 Configuration:EUT.ONLY Mode:@LAN_UNII_5.20Hz_a_MODE_HIGH_CH Tested by:F. Guarnero											
100	Prq.ject   13/15837											
	E TT SHOTT	- Chamber					Radio	ted Emis	sions 3-	19 Jun Meters	EDIS I	7:28:20

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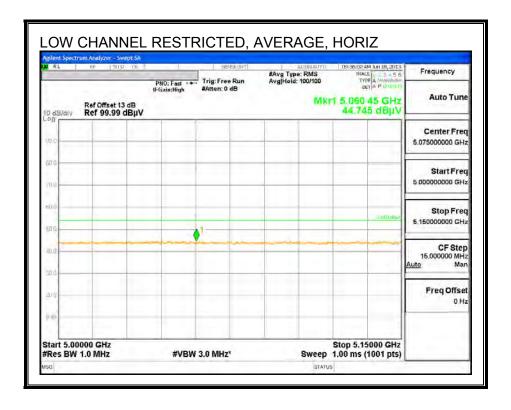


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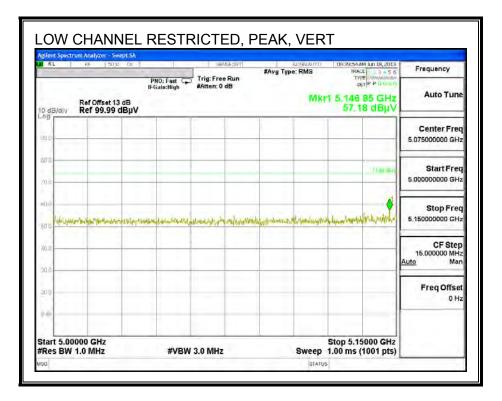
## 9.2.2. TX ABOVE 1 GHz 802.11n HT20 MODE IN THE 5.2 GHz BAND

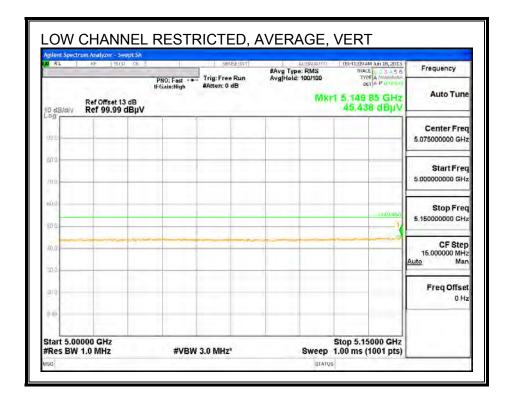
#### **RESTRICTED BANDEDGE (LOW CHANNEL)**

LOW CHANNEL RESTRICTED, PEAK, HORIZ 09/33:53 AM Jun 18, 2013 Frequency #Avg Type: RMS TYPE MMMM DET P P U Trig: Free Run #Atten: 0 dB PNO: Fast 🗭 IFGain:High Auto Tune Mkr1 5.148 65 GHz 56.739 dBµV Ref Offset 13 dB Ref 99.99 dBµV 10 dB/div Center Freq 5.075000000 GHz Start Freq 110016 5.000000000 GHz Stop Freq 5.150000000 GHz and the production of the second of the seco and the part of the start and the ALALA atura Handley CF Step 15.000000 MHz Mar Auto Freq Offset 0 Hz Stop 5.15000 GHz Start 5.00000 GHz #Res BW 1.0 MHz #VBW 3.0 MHz Sweep 1.00 ms (1001 pts) STATUS



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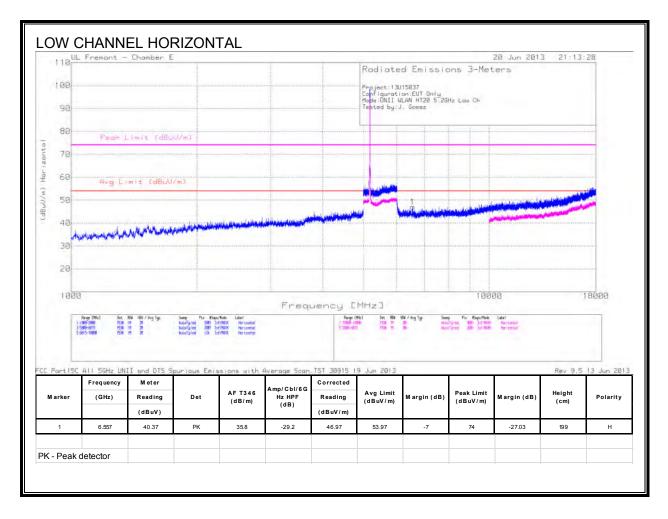




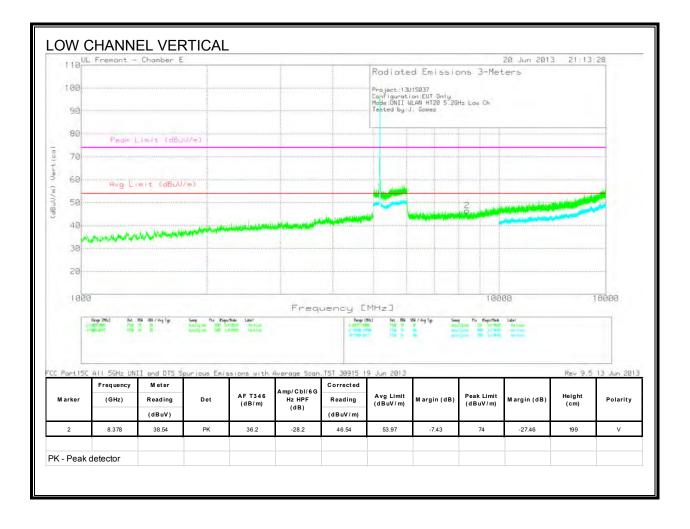
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## HARMONICS AND SPURIOUS EMISSIONS



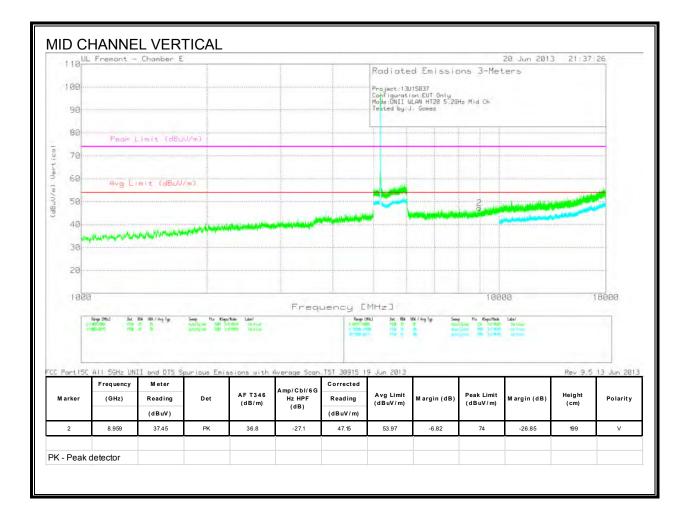
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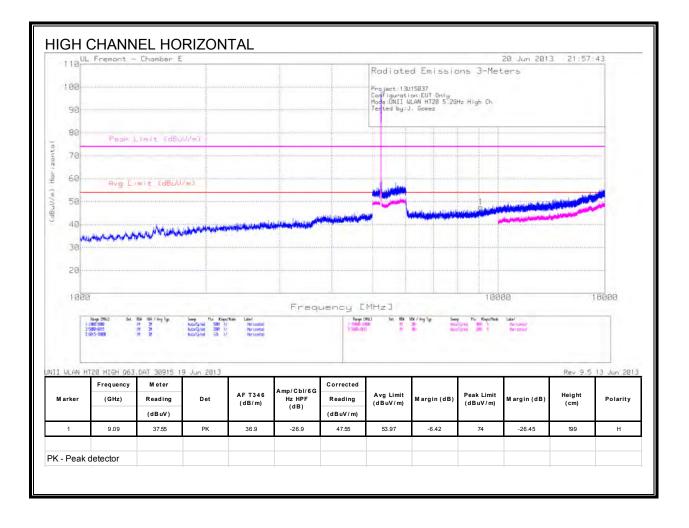
Page 108 of 222

118	L Fremont -	Chomper t			1	1	Radiate	d Emissic		28 Jun 2013 ers	21:37	20
100-							Project:13			513		
90-							Tested by:	J. Gomez	12 110 51			
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100					Frequ	uency D			100	10		18000
	Range (1962) Brt 1: (1865-5888) 7534 3: 5889-5875 F53 3: 589-5-12888 P534 3: 589-5-12888 P534	Riv UNV / Ang Typ. 34 34 34 34 34 34 34 34 34 34 34 34 34	laan ha Ka Autorgalad 2021 Autorgalad 2021 Autorgalad 2021 Autorgalad 202	porticate Label Lod / MURI Hor isosital Lod / MURI Hor isosital Lod / MURI Hor isosital		Parge 1-1008-11 3-2009-68		WW / Ang Tage Same 30 ritus 30 ritus 30 ritus	η Pila Bapantade Agres Ten Linnate Agres 2001 Linnate	Lebel Harrowial Harrowial		
Part150	Frequency	II and DTS S Meter	purious Emi	asions with	Average Scan	TST 30915 I Corrected	9 Jun 2013				Rev 9.5	13 Jun 201
M arker	(GHz)	Reading	Det	AF T346 (dB/m)	Amp/Cbl/6G Hz HPF	Reading	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Height (cm)	Polarity
		(dBuV)			(dB)	(dBuV/m)	<u> </u>				. ,	
1	6.999	39.75	РК	36	-29	46.75	53.97	-7.22	74	-27.25	199	н
K - Peak	detector											

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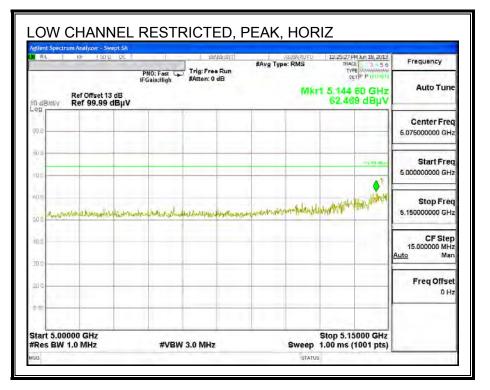
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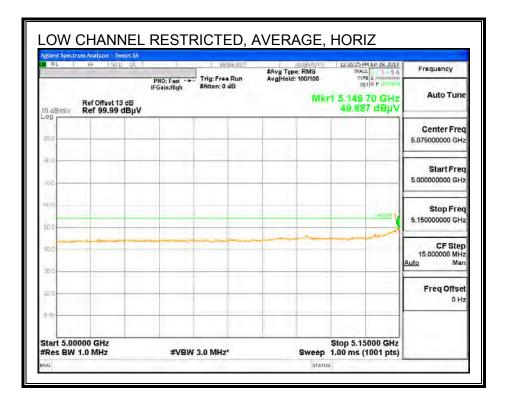
110	IL Fremont -	Chamber E								20 Jun 2013	21:57	:43
100-							Project :13	Ion:EUT Only JLAN HT28 5.26		ers		
80	Pack	imit (dBu)	1200									*****
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20-					1							*****
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	Roya DHU3 BH MOLECT	00T 30915 1	Jun 2013	C Merel spore		Parage C		WV / Ang Tgy See Hou Hou Hou Hou Hou Hou Hou Hou Hou Hou	n Pia Españfiale Glass II - Glass II - Glas II - Glas II - Glass I	Label Ne Char Ar Thop Ar Nexe	Rev 9.5	13 Jun 20
	Frequency	Meter	our Loro		Amp/Cbl/6G	Corrected						10 001 00
M arker	(GHz)	Reading (dBuV)	Det	AF T346 (dB/m)	Hz HPF (dB)	Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Height (cm)	Polarity
2	7.235	40.92	PK	36	-29.4	47.52	53.97	-6.45	74	-26.48	199	v
( - Peal	detector											

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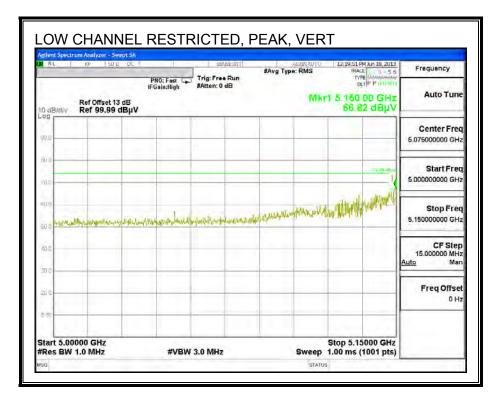
# 9.2.3. TX ABOVE 1 GHz 802.11n HT40 MODE IN THE 5.2 GHz BAND

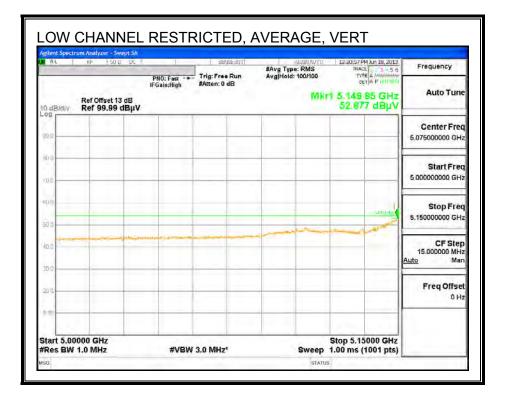
#### **RESTRICTED BANDEDGE (LOW CHANNEL)**





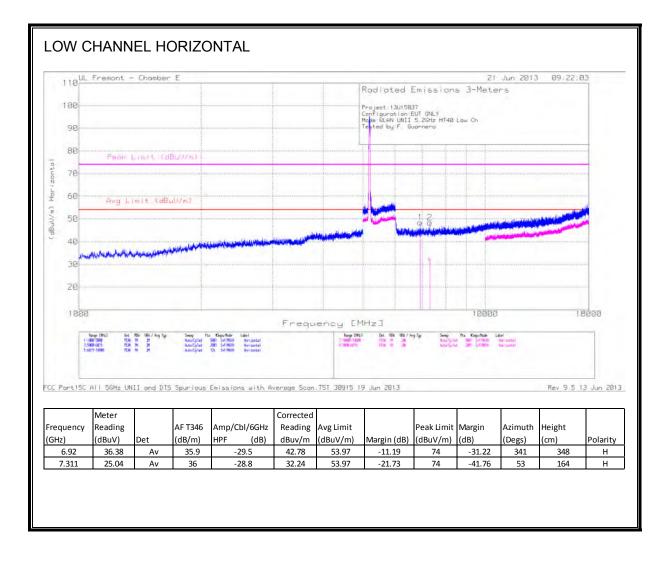
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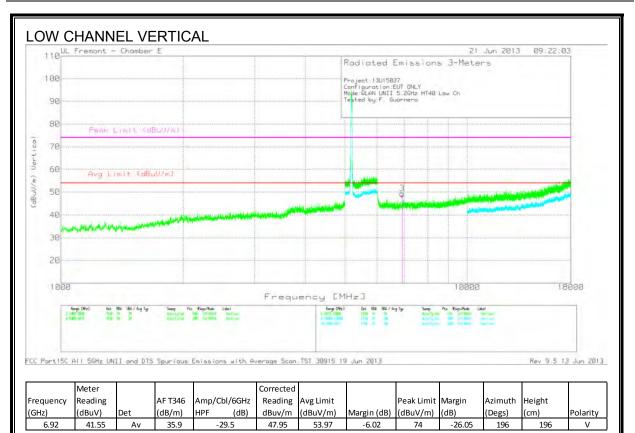


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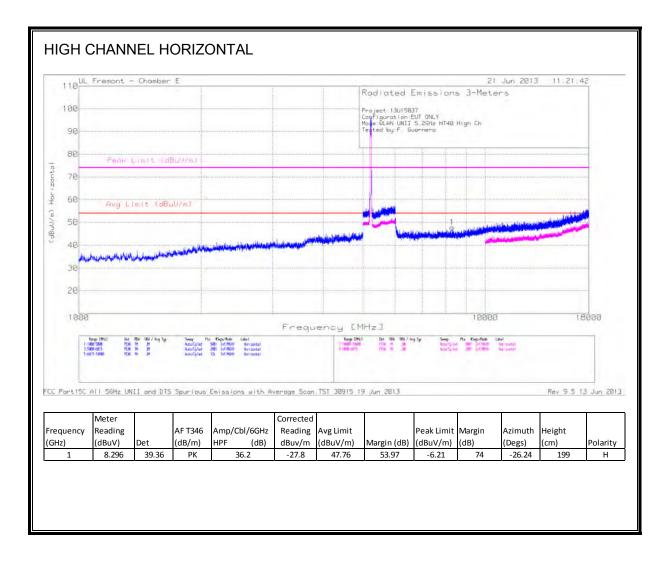
### HARMONICS AND SPURIOUS EMISSIONS



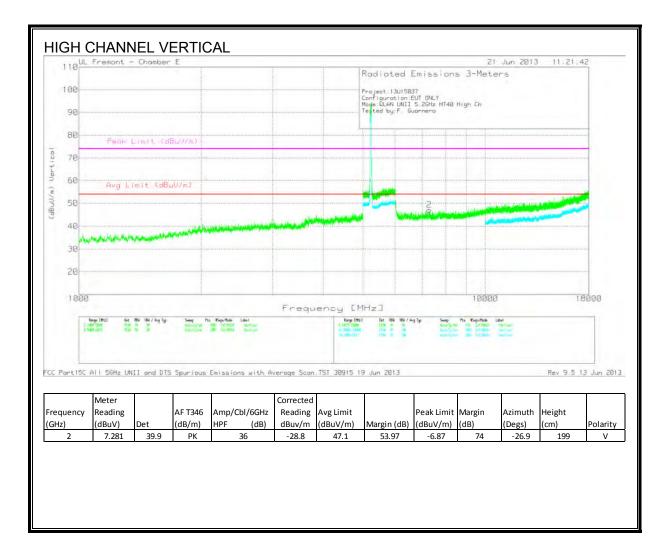
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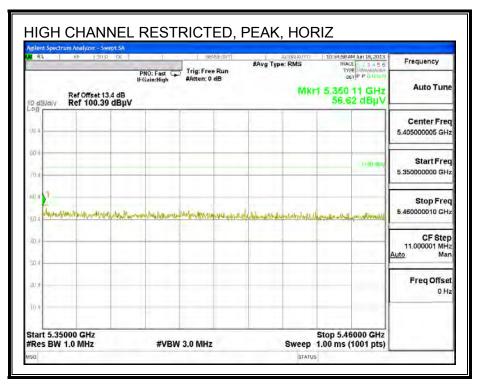
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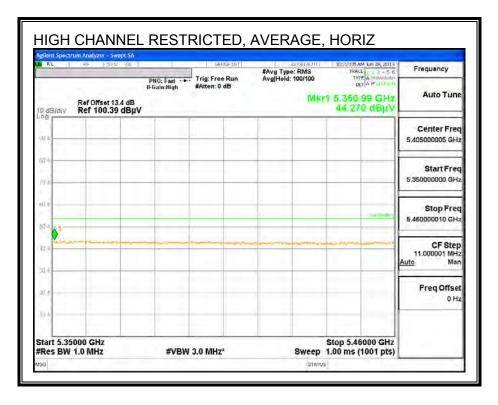


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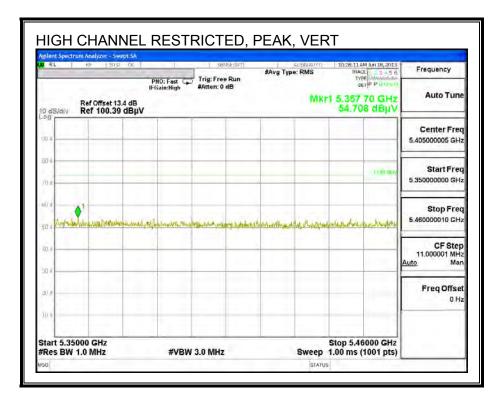
## 9.2.4. TX ABOVE 1 GHz 802.11a MODE IN THE 5.3 GHz BAND

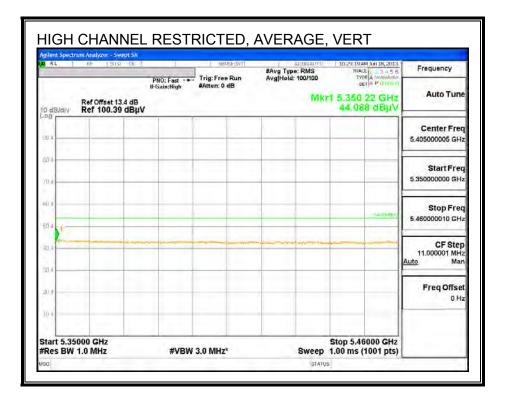
### **RESTRICTED BANDEDGE (HIGH CHANNEL)**





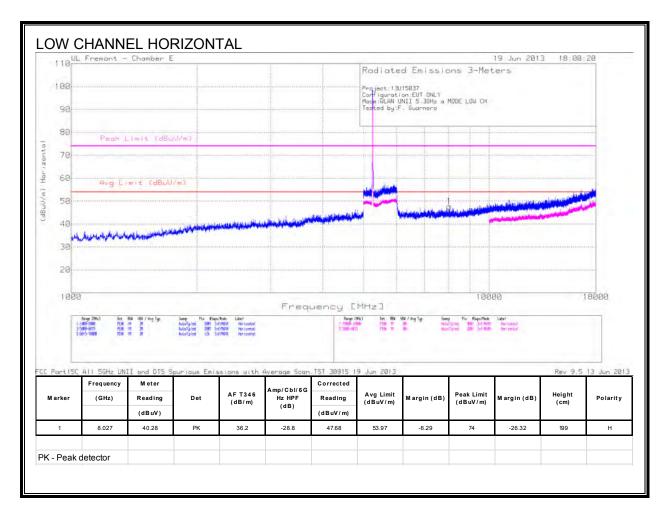
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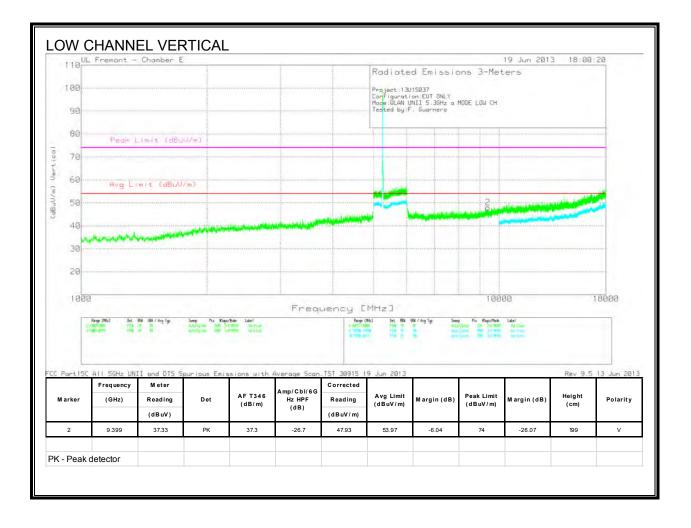


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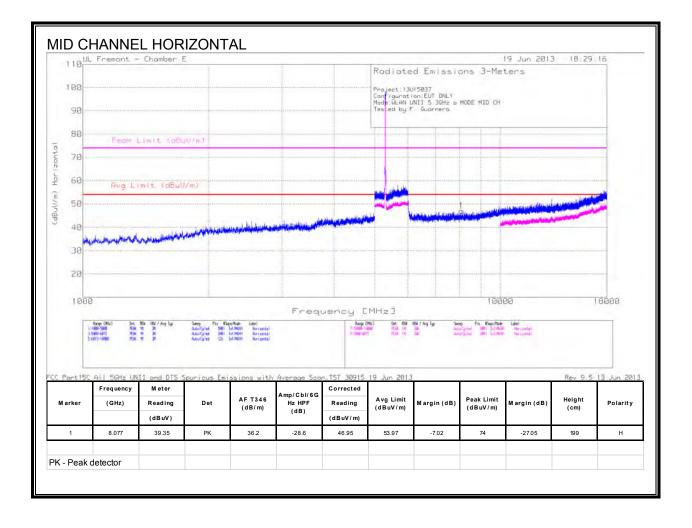
### HARMONICS AND SPURIOUS EMISSIONS



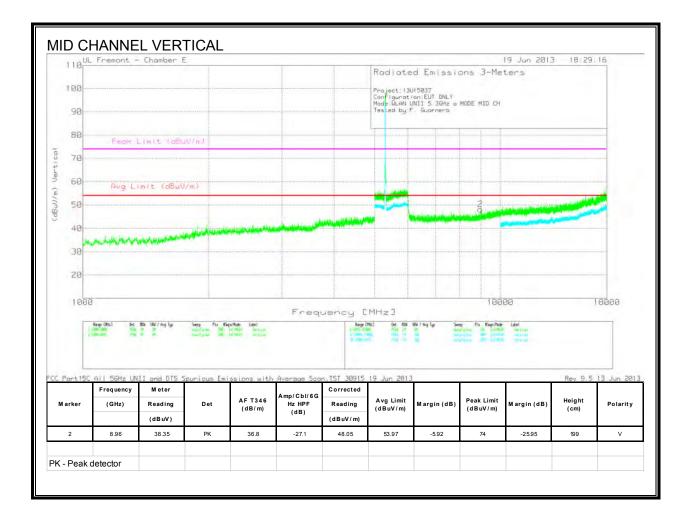
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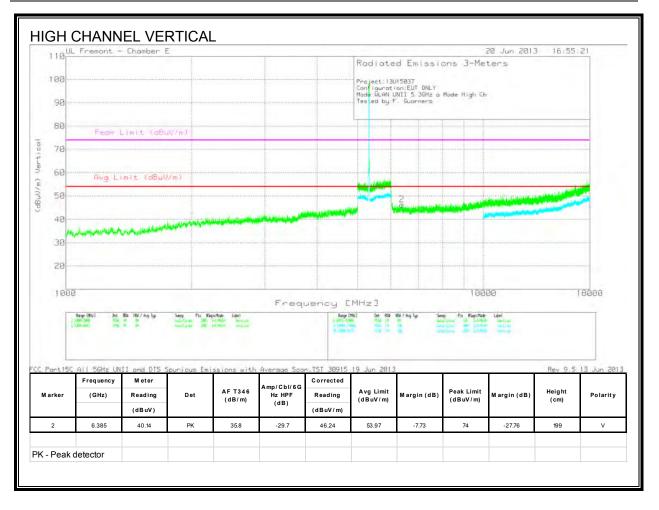
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BUL         Freemont - Chamber E         28 Jun 2013         16           100         Radiated Emissions 3-Meters         Project 130/5037         Configuration Eff UM, Y           90         Project 130/5037         Configuration Eff UM, Y         How Project 130/5037         Configuration Eff UM, Y           90         Project 130/5037         Configuration Eff UM, Y         How Project 130/5037         Configuration Eff UM, Y           90         Project Limit (dBuU/m)         Project 130/5037         Configuration Eff UM, Y           80         Project (dBuU/m)         Project (dBuU/m)         Project (dBuU/m)         Project (dBuU/m)           50         Project (dBuU/m)         Project (dBuU/m)         Project (dBuU/m)         Project (dBuU/m)           50         Project (dBuU/m)         Project (dBuU/m)         Project (dBuU/m)         Project (dBuU/m)           50         Project (dBuU/m)         Project (dBuU/m)         Project (dBuU/m)         Project (dBuU/m)           50         Project (dBuU/m)         Project (dBuU/m)         Project (dBuU/m)         Project (dBuU/m)           50         Project (dBuU/m)         Project (dBuU/m)         Project (dBuU/m)         Project (dBuU/m)           30         Project (dBuU/m)         Project (dBuU/m)         Project (dBuU/m)         Project (dBuU/m)	
Peck Limit (dbul/m)  Rog L	
78         68         Avg Limit: (d6oU/m)         58         48         48         48         48         48         48         48         48         48         58	
Hog Limit (decomm)       58       48       58       48       58       48       58 <t< td=""><td></td></t<>	
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30 28 1888 Frequency [MHz]	
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arker (GHz) Reading Det AF T346 (dB/m) (dB) (dB/m) (dB/m) (dB) (dB/m) (dB/m) (dB) (dB/m) (dB) (dB/m) (dB) (dB/m) (dB) (dB/m) (dB) (dB/m) (dB/m) (dB) (dB/m) (dB/m) (dB) (dB/m) (dB) (dB/m) (dB) (dB/m) (dB/m) (dB) (dB/m) (dB/m) (dB/m) (dB) (dB/m) (d	
(dBuV)         (dBuV/m)         (dBuV/m)	э н
Peak detector	

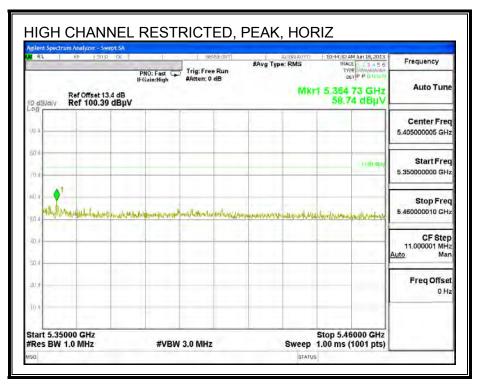
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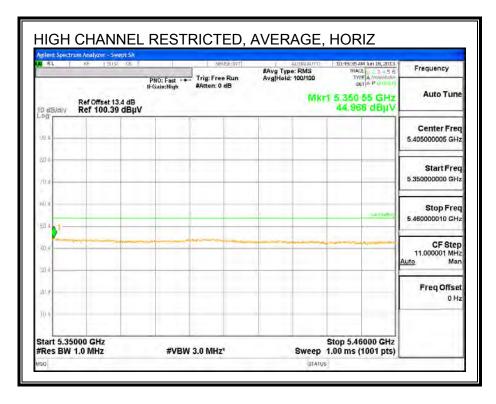


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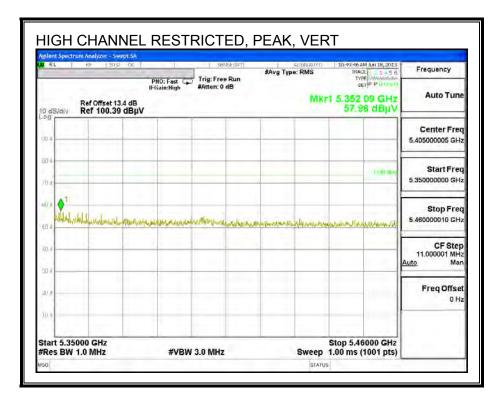
# 9.2.5. TX ABOVE 1 GHz 802.11n HT20 MODE IN THE 5.3 GHz BAND

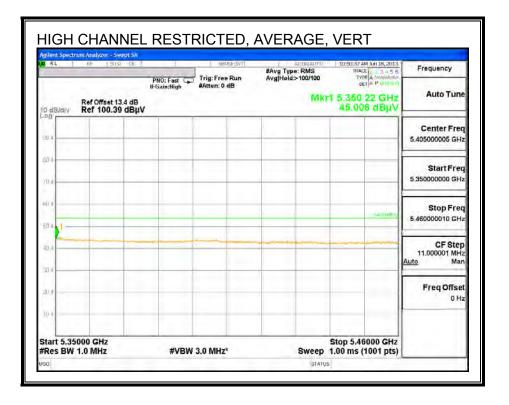
### **RESTRICTED BANDEDGE (HIGH CHANNEL)**





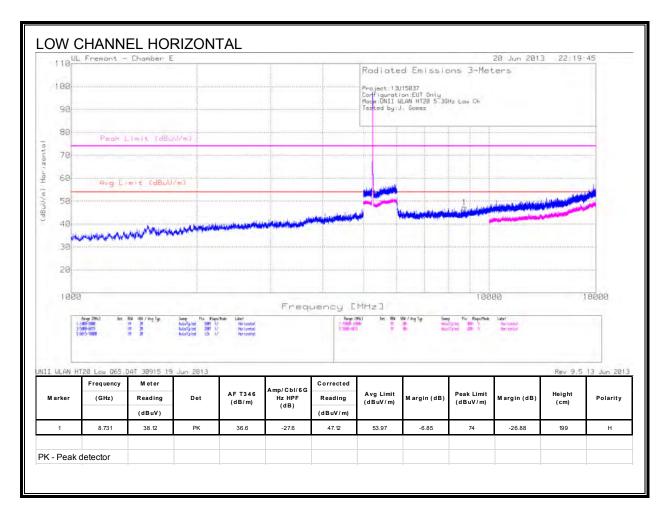
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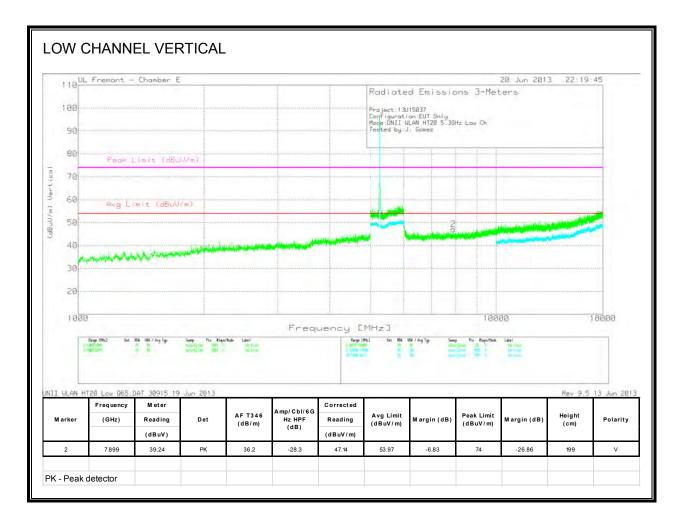


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### HARMONICS AND SPURIOUS EMISSIONS

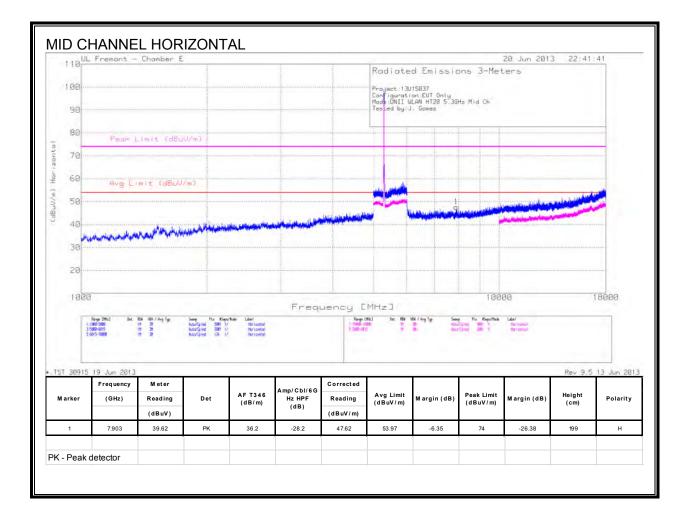


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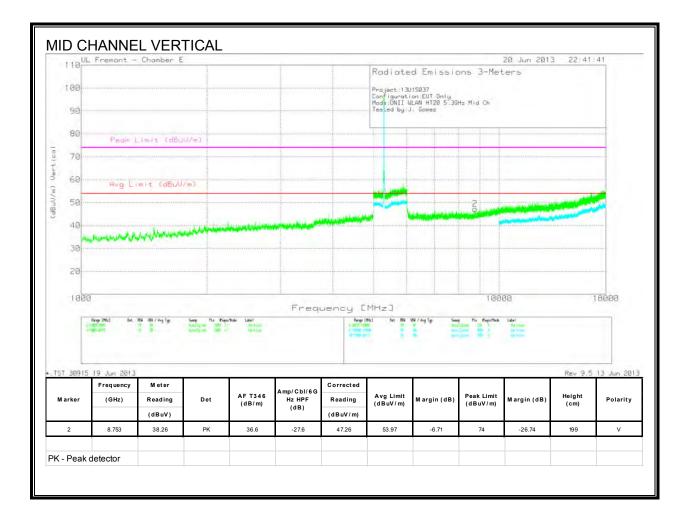


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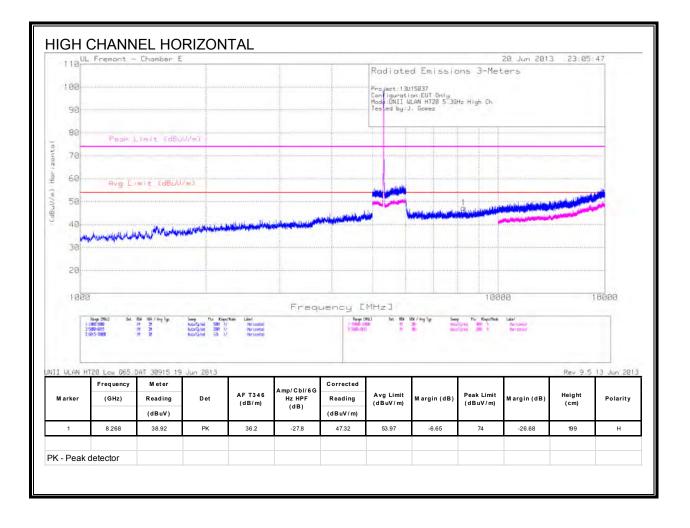
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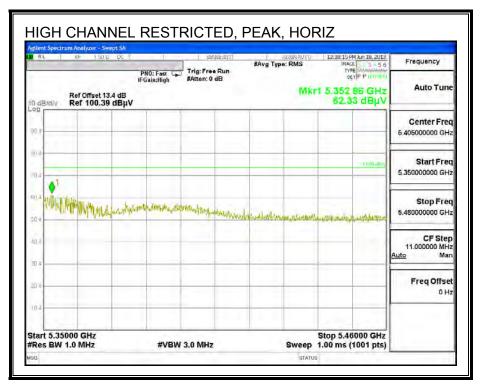
Page 133 of 222

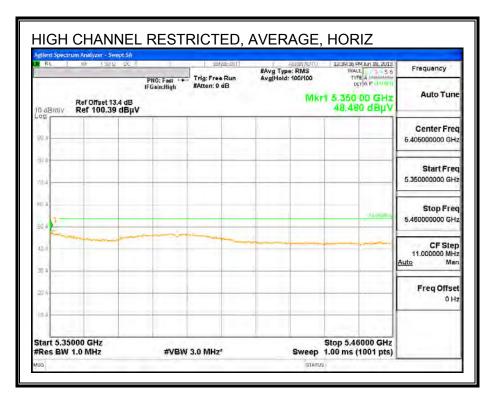
	1 PUL	L Fremont -	Chamber E								20 Jun 2013	23:05	:47
	00-							Project :13	d Emissio 115037 ion:EUT Dnly JLAN HT20 5.30		iers		
0	90							Mode:UNII ( Tested by:	J. Gomez	Hz High Ch			
1	80	Peak J	imit (d6u	U/m3									
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	60	Avg L	mit (dBuV	(m).									ana
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	30											*******	
6	20		*****		*******							*****	
	100	8		1		Frequ	Jency D	MHz]		100	80		18000
		CARDING CARD	RN 189/ing (gr.	Seep Pro KS Incontante Seet Incontante Seet	Ter Markington		Range (		WV / Ang Tge See NO NO NO	y Pia BayaMate Cara In L Cara II I Cara II I Cara II I	Label Ne Chae der Khree Aan Khree		
IW	LAN H	Frequency	Meter	Jun 2013		Amp/Cbl/6G	Corrected				<u>г</u>	Rev 9.5	13 Jun 28
Mar	ker	(GHz)	Reading (dBuV)	Det	AF T346 (dB/m)	Hz HPF (dB)	Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Height (cm)	Polarity
2		7.272	40.16	PK	36	-28.9	47.26	53.97	-6.71	74	-26.74	199	v
< - F	Peak	detector											
			40.16	PK	36	-28.9	47.26	53.97	-6.71	74	-26.74	199	

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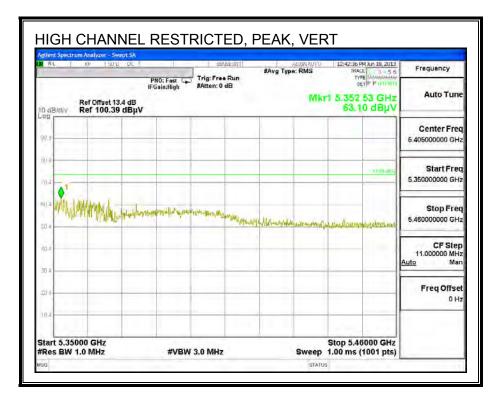
# 9.2.6. TX ABOVE 1 GHz 802.11n HT40 MODE IN THE 5.3 GHz BAND

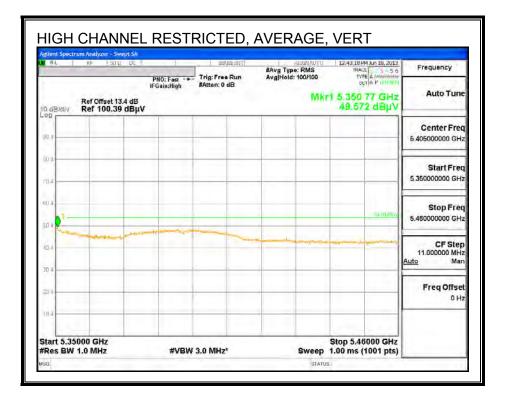
### **RESTRICTED BANDEDGE (HIGH CHANNEL)**





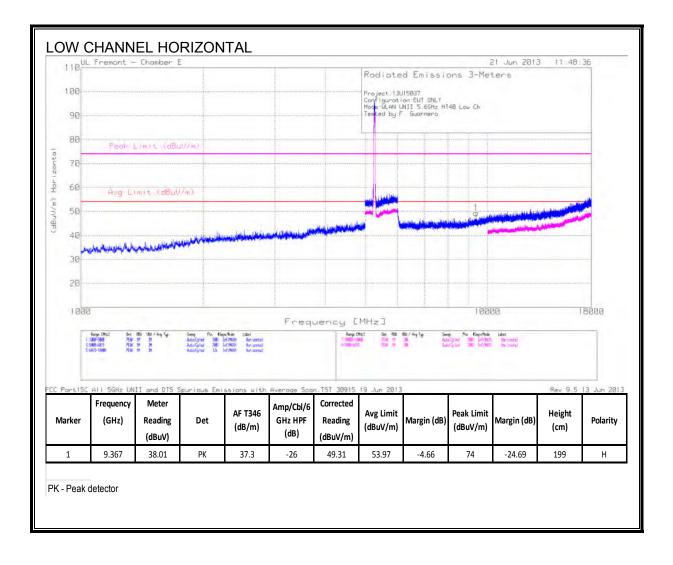
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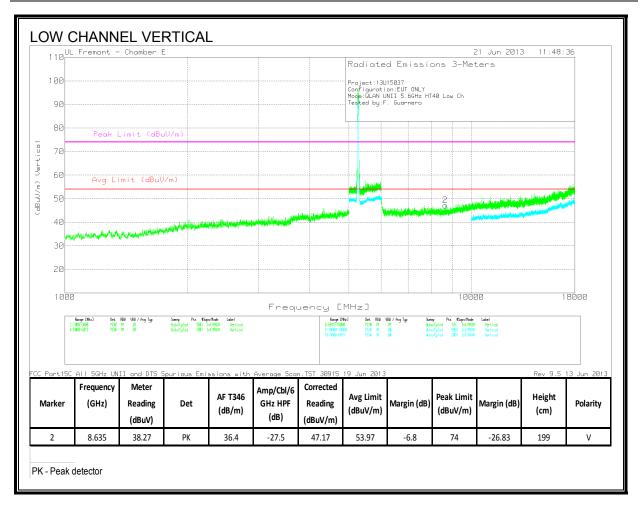


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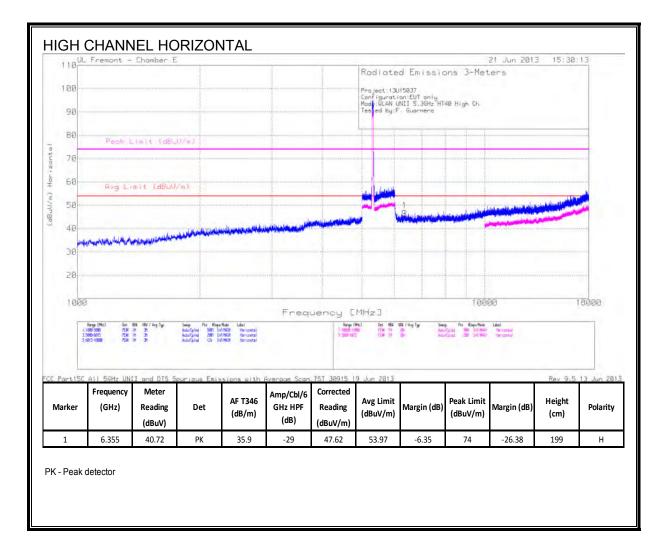
#### HARMONICS AND SPURIOUS EMISSIONS



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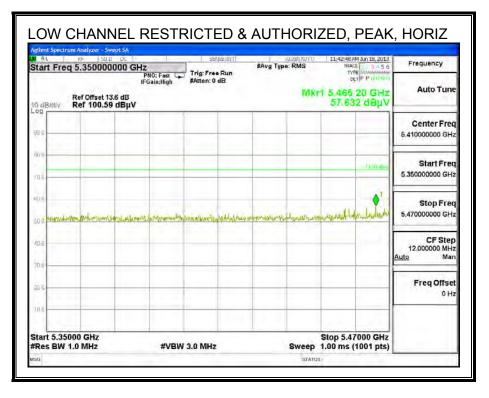
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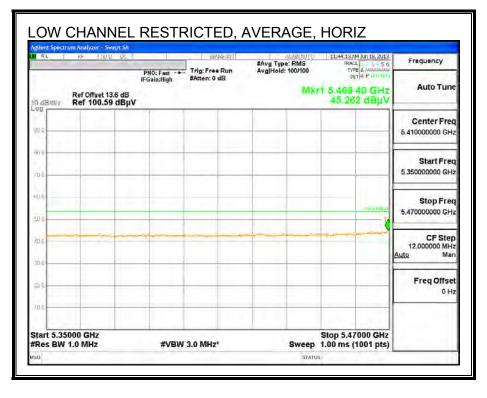
110	CHANN	Chamber E								21 Jun 201	3 15:30	:13
							Radiate	d Emissio	ons 3-Met	iers		
100							Project:13	J15037 ion:EUT.op.lu				
90							Mode:WLAN U	ion:EUT only JNII 5.3GHz HT 5. Guarnero	40 High Ch			
80	Peak l	_imit (dBu	iV∕m)									
70												
60												
	HVg Li	imit (dBuV	/mJ				and states					
50							and provide the	2 Aller Birdenista				2
40		Walkington	A STATE AND A STATE	ndarpylandipilium	and the second secon		n'					
30	had have been and a stand of the	Nierieraniperiodeneous										
20												
100	Ø								1000	яя		18000
_					Frequ	uency [						
	Range DME2 Bet 2:1885-5888 FEak 4:5889-6915 FEak CAII 5GHz UN	HBU VHU/AngTyp III 3H III 3H	Sweep Pts KSm AutorOpted 5981 AutorOpted 2081 :		Average Scan	Range I 5:0015-100 8:10808-10 10:5088-00 10:5088-00	80 PEAK IM 888 PEAK IM 15 PEAK IM	38k Auto	p PLs 1Sep./Hole UCpled 12% IP/N48H UCpled 9881 Inf/N48H UCpled 2881 Inf/N48H	Label Vertical Vertical Vertical	Rev 9.5	13 Jun 20
	Frequency	Meter			Amp/Cbl/6	Corrected						
Marker	(GHz)	Reading	Det	AF T346 (dB/m)	GHz HPF	Reading	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Height	Polarity
		(dBuV)		(dB/m)	(dB)	(dBuV/m)	(авиу/т)		(авиу/т)		(cm)	
n	6.902	40.8	PK	35.9	-29.8	46.9	53.97	-7.07	74	-27.1	199	V
2												

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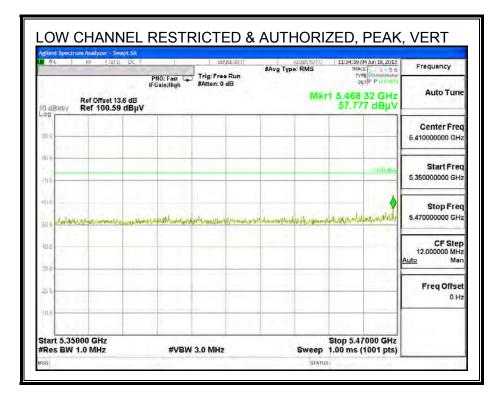
# 9.2.7. TX ABOVE 1 GHz 802.11a MODE IN THE 5.6 GHz BAND

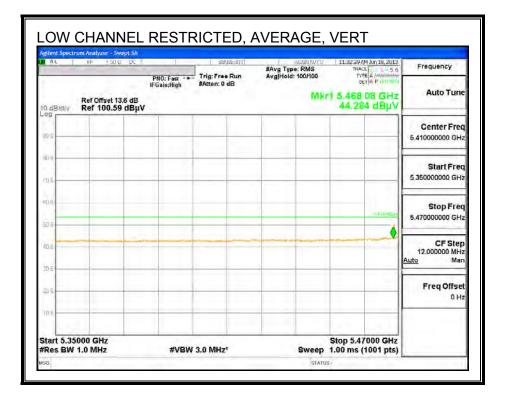
#### **RESTRICTED & AUTHORIZED BANDEDGE (LOW CHANNEL)**





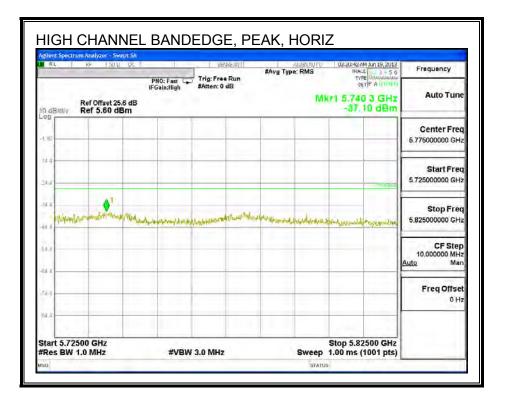
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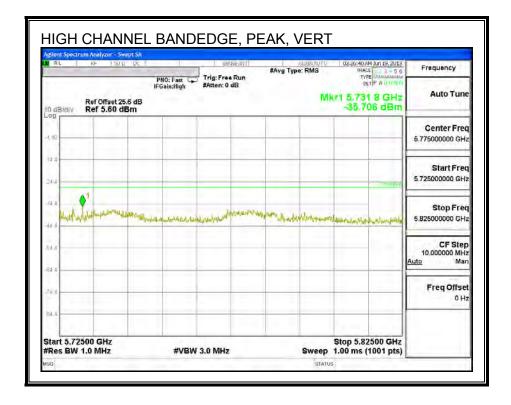




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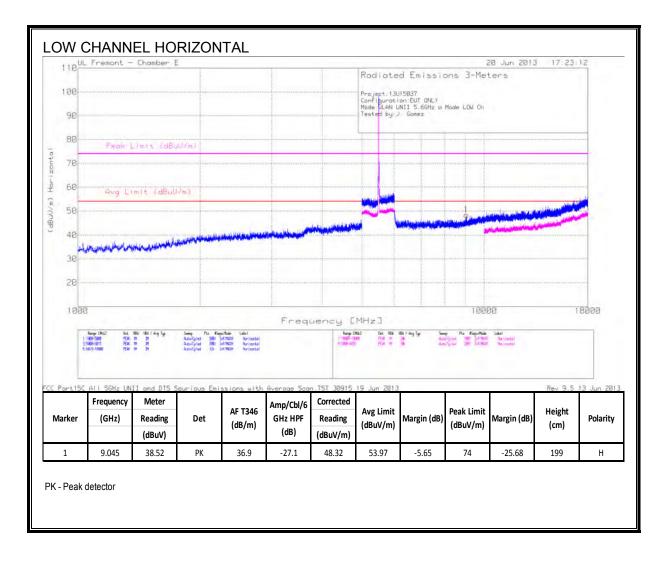
#### AUTHORIZED BANDEDGE (HIGH CHANNEL)



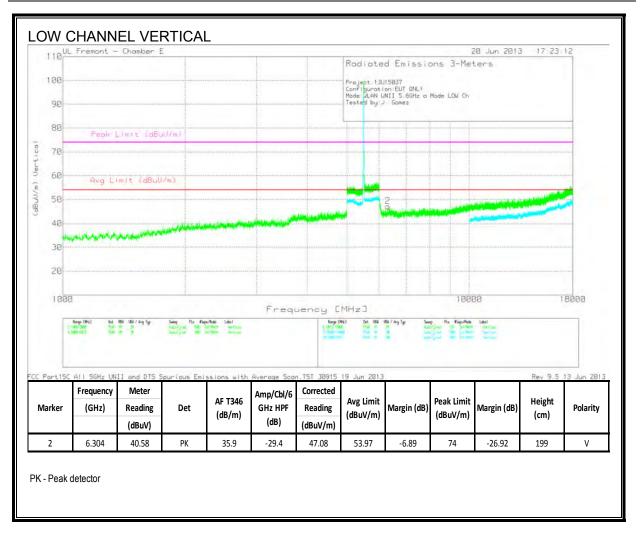


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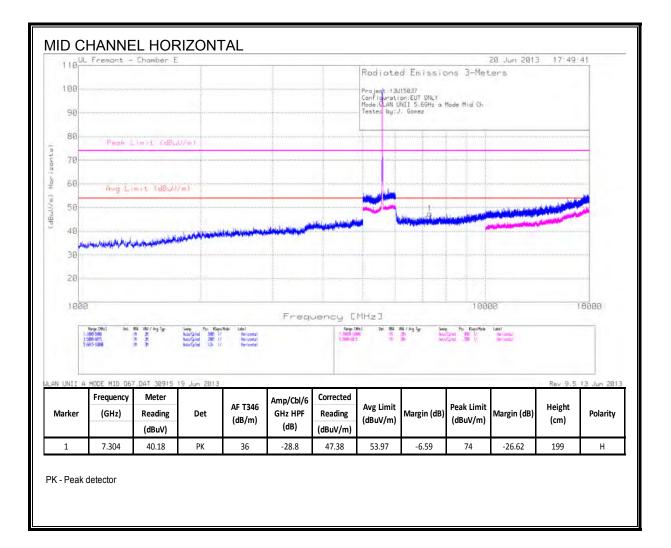
### HARMONICS AND SPURIOUS EMISSIONS



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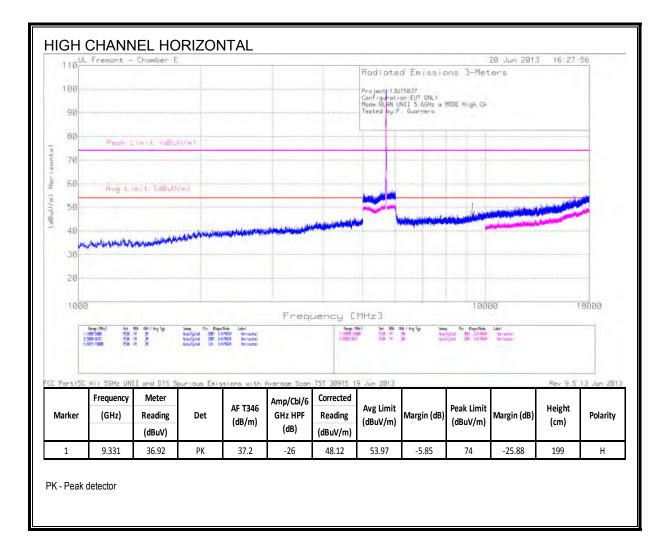
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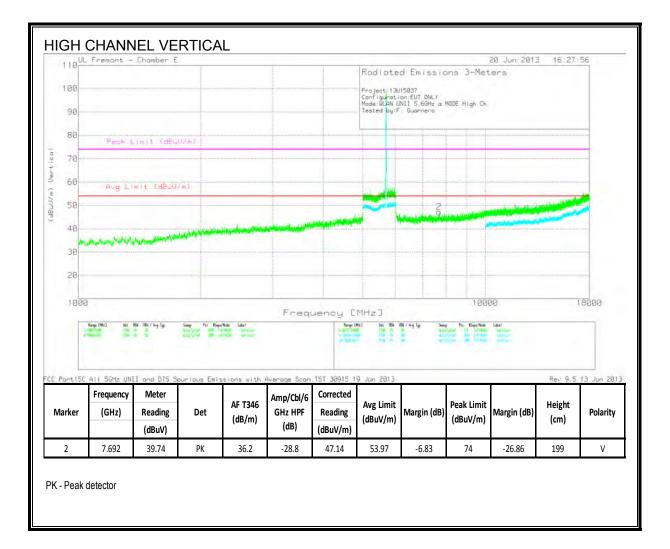
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2	8.287	(dBuV) 38.91	РК	36.2	-27.8	(dBuV/m) 47.31	53.97	-6.66	74	-26.69	199	V
Marker	(GHz)	Reading	Det	AF T346 (dB/m)	GHz HPF (dB)	Reading	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Height (cm)	Polarity
A GHEE H	Frequency	Meter	a oun core		Amp/Cbl/6	Corrected						
	MODE MID 067	1.047.300.5	10 1. 2013								Rev 9.5	12
	Range DHz3 det	BN 1847Ang⊺ngo	See Pas Ba	a/Node Label		Range D		Rik / Ang Typ Swam	r fts. Kieps/Yote			
1000	3		3		Frequ	Jency D	MHz]		1000	30		18000
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50									2			
60	Avg Li	mit EdBuU	/m) [									
70												
80	Peak L	.)mit (dBu	(Vm)	(412)44-44-544(54)(54)-540						() + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 +	94 - 4 - ( ) ) d - 4 - ( ) - F - 4 - ( ) -	****
90							Mode: CLAN L Testec by:.	NII 5.66Hz a Govez	Mode Mid Ch			
100			anna fai			territe little	10000000	n:EUT DNLY NII 5,66Hz a				
1.10		Chamber E	-			1	Radiote	d Emissio		20 Jun 2013 ers	3 17:49	

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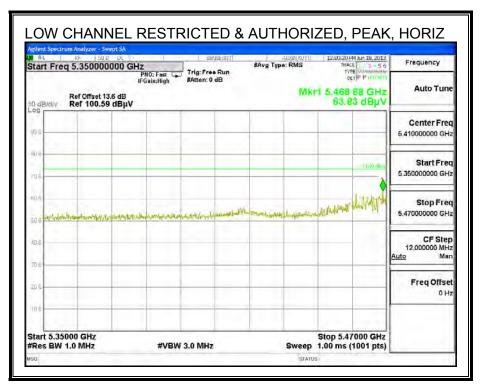
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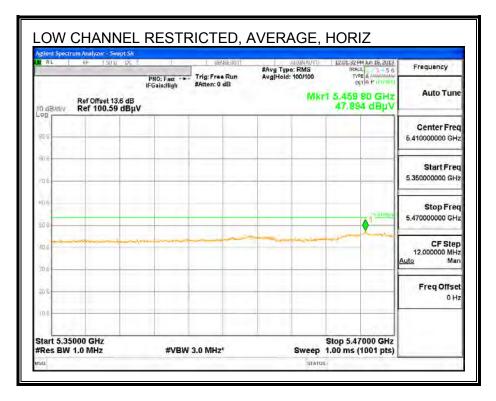


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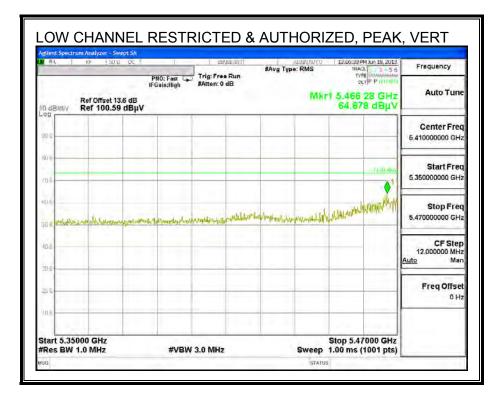
# 9.2.8. TX ABOVE 1 GHz 802.11n HT20 MODE IN THE 5.6 GHz BAND

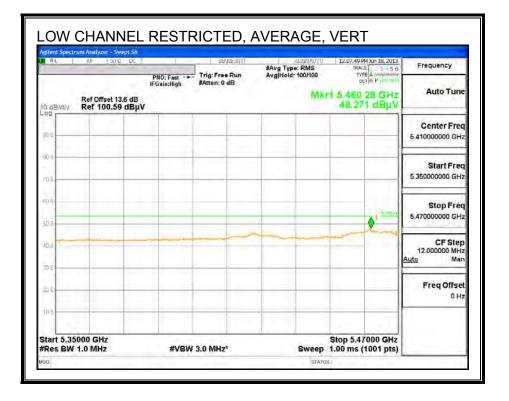
#### **RESTRICTED & AUTHORIZED BANDEDGE (LOW CHANNEL)**





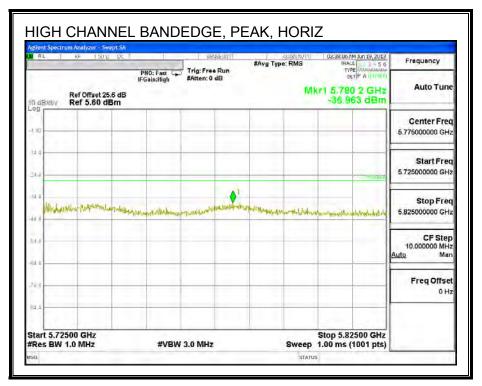
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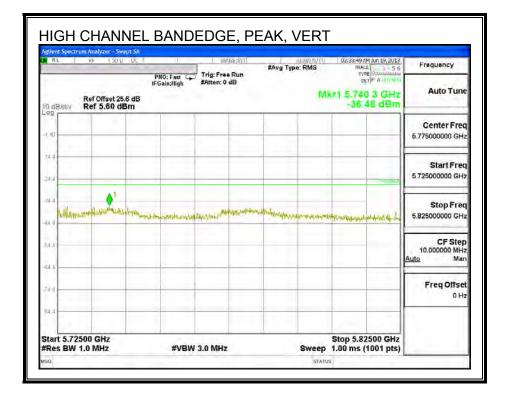




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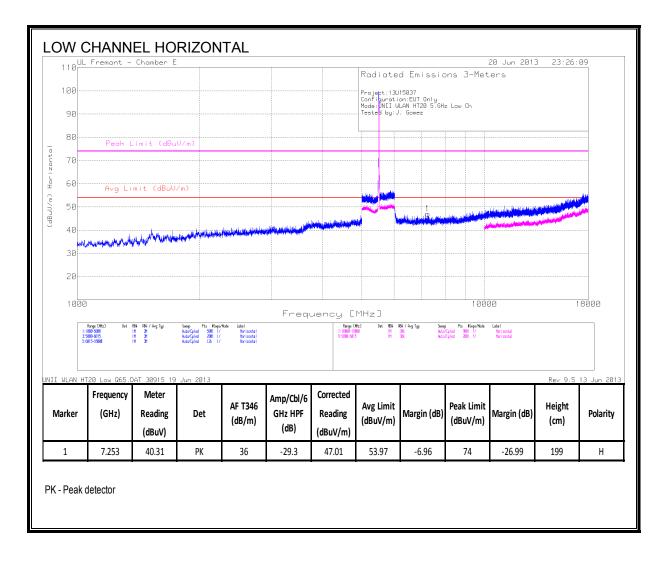
## AUTHORIZED BANDEDGE (HIGH CHANNEL)



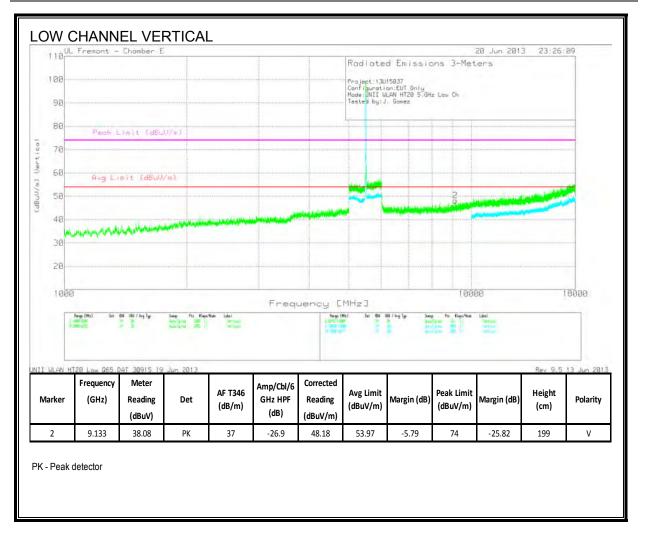


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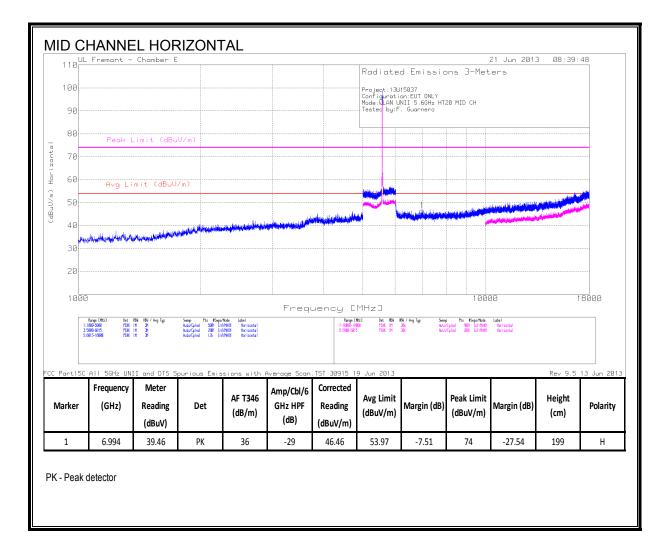
# HARMONICS AND SPURIOUS EMISSIONS



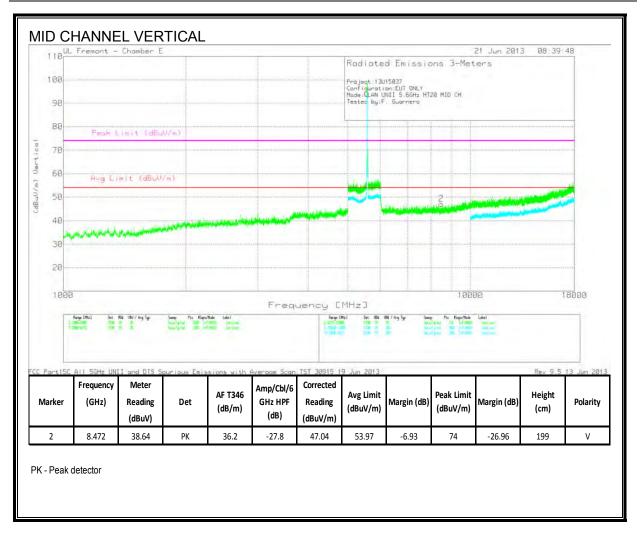
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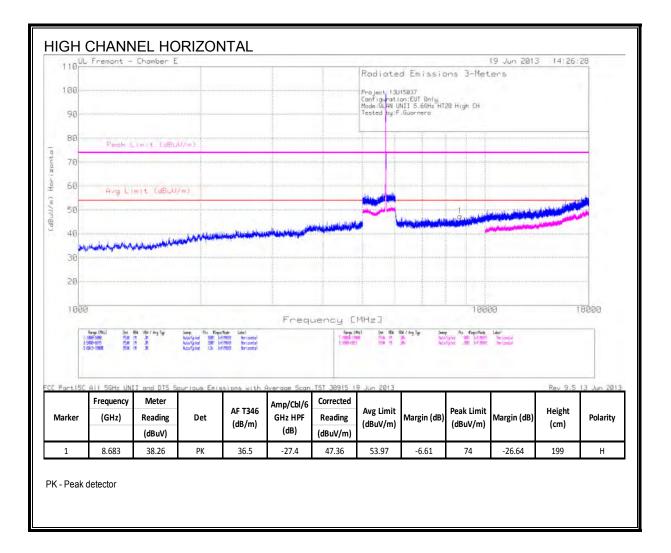
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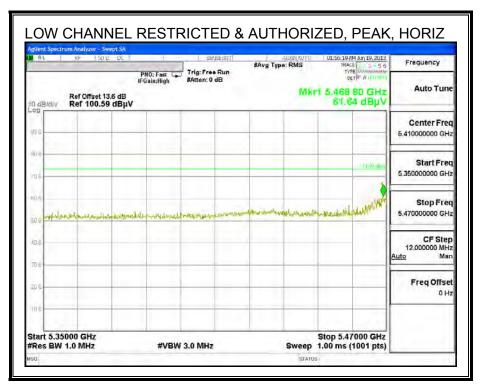
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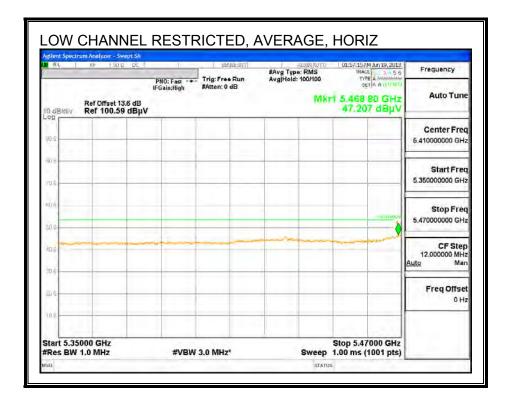
1000	3	2			Frequ	uency [		184 / ƙng Taya Saen	1000	30	8000
20											
30											
40	marken	here where the second	minnen	al and the second states							
70 60							24				
60	Avg (L)	mit (dBuV	(m)			1100000					 
70	feak (	im/t (dBu	100 m 1								 
90····							Tested by:F	Guarnero			 
100		*****					Project.13U Configurati Mode:ULAN U	NII 5.66Hz HT	20 High CH		
		*****				a se de la contra de		d Emissic II5037 on:EUT Only INII 5.66Hz HT: Guarnero			

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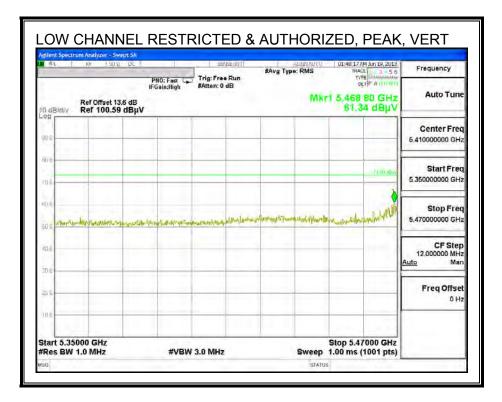
# 9.2.9. TX ABOVE 1 GHz 802.11n HT40 MODE IN THE 5.6 GHz BAND

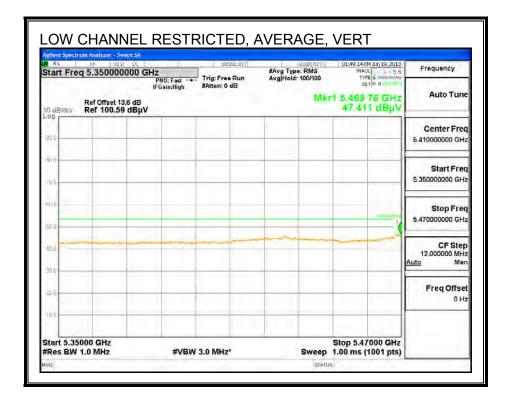
#### **RESTRICTED & AUTHORIZED BANDEDGE (LOW CHANNEL)**





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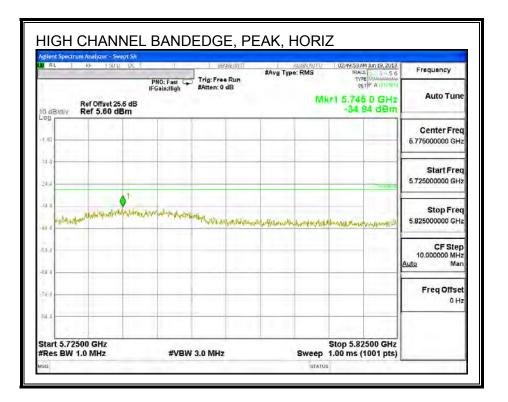


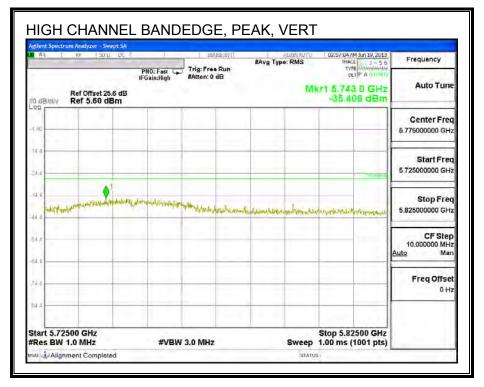


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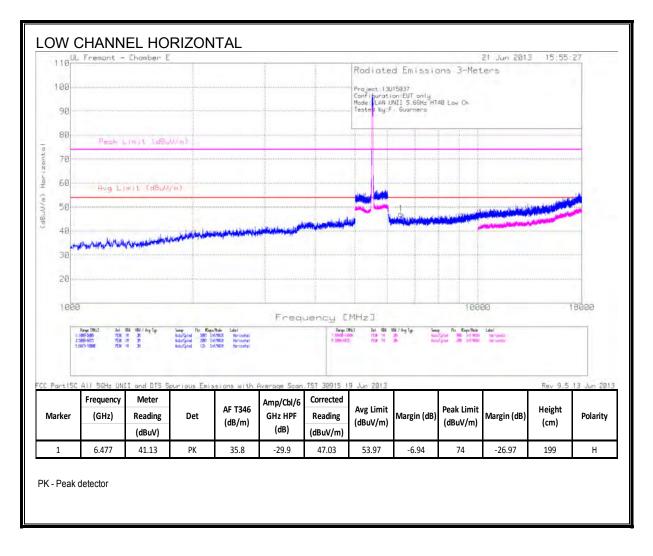
## AUTHORIZED BANDEDGE (HIGH CHANNEL)



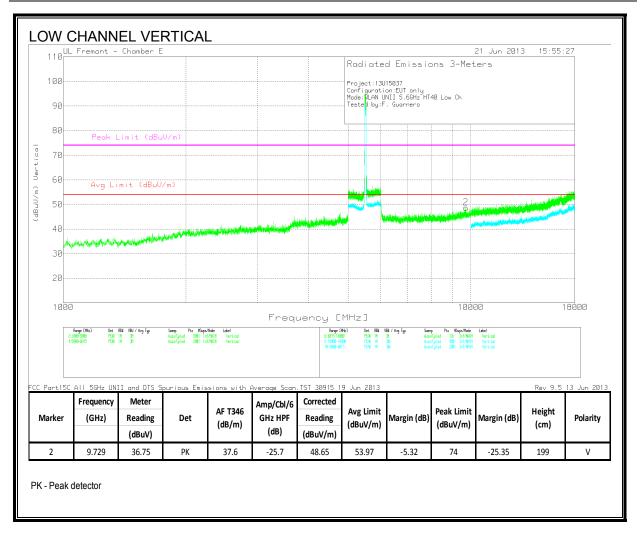


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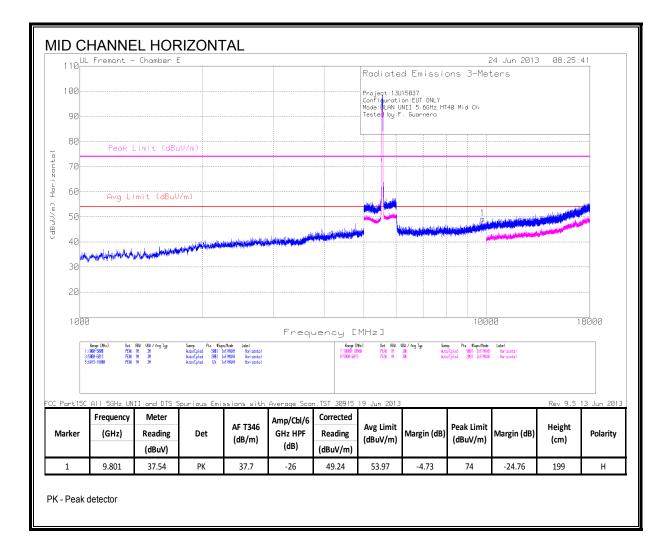
# HARMONICS AND SPURIOUS EMISSIONS



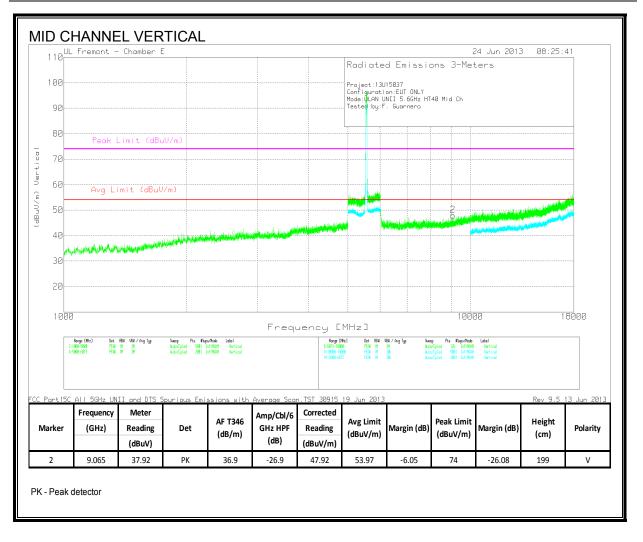
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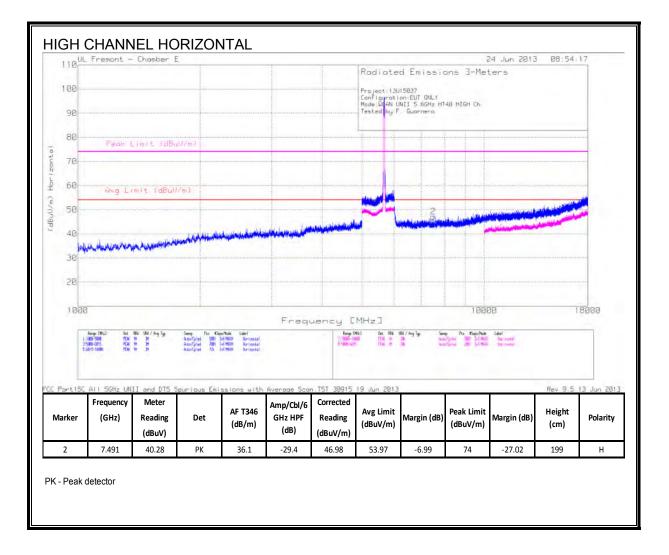
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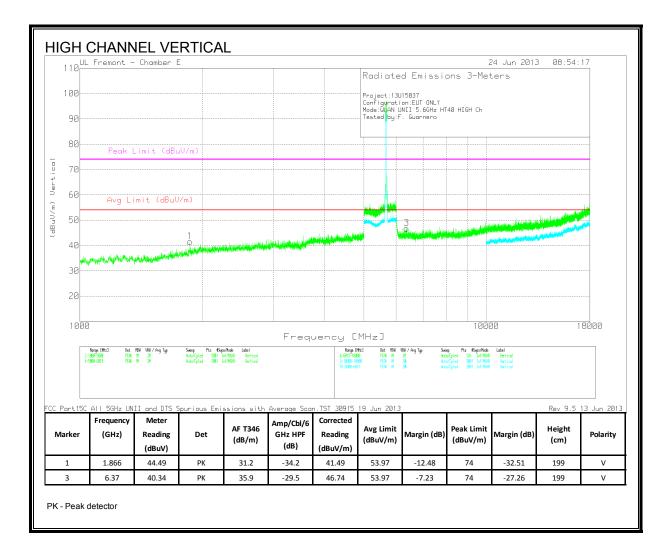
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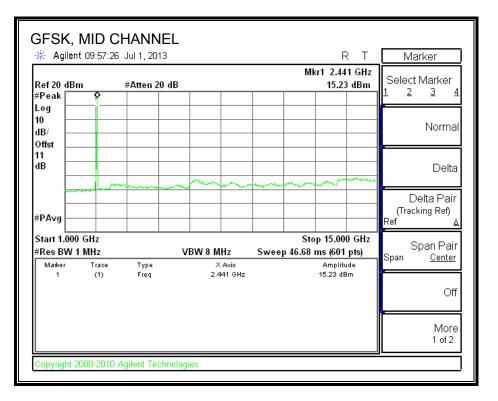
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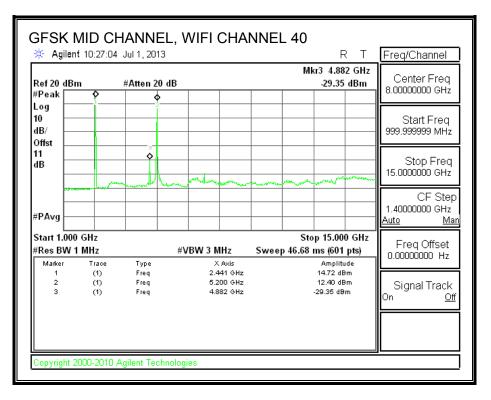
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# 9.2.10. 2.4GHz and 5GHz Band Co-Location

#### **BLUETOOTH ON**

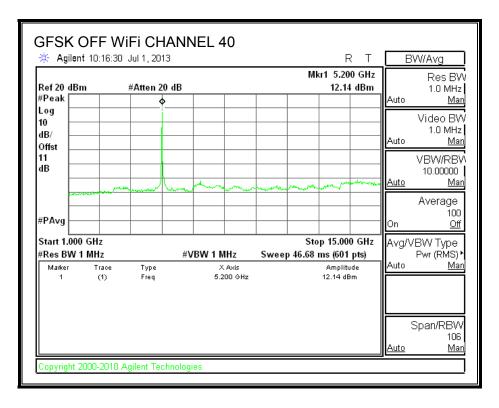


#### **BLUETOOTH AND WIFI ON**



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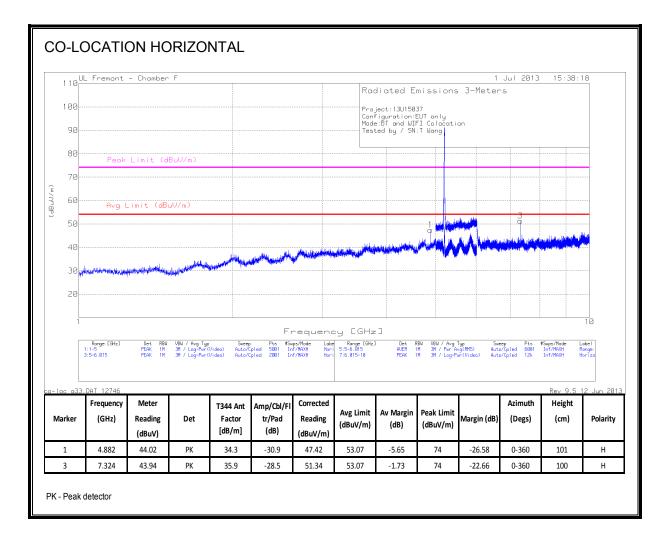
## **BLUETOOTH OFF WiFi ON**



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# HARMONICS AND SPURIOUS EMISSIONS



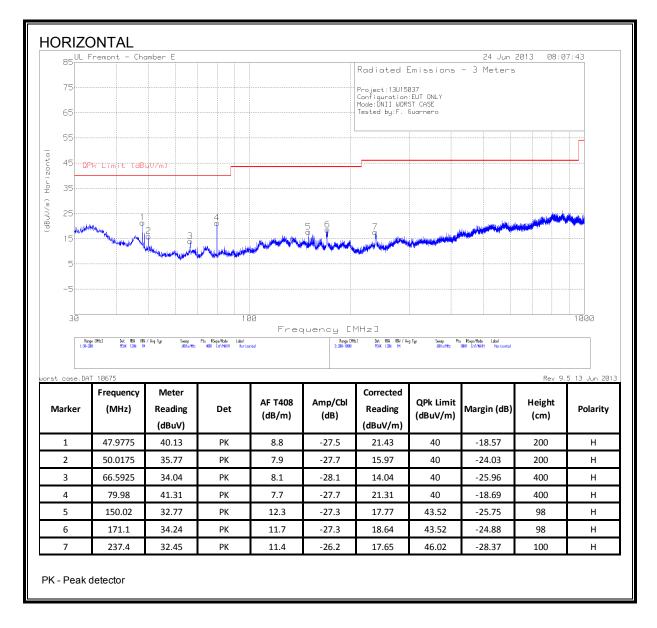
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110	L Fremont	- Chamber	F							1	Jul 2013	15:38:	8
118							Rad	diated Er	missions	3-Meter	5		
100							Cont	ject:13U150. figuration:E	EIIT on lu				
90							Mode	e:BT and WIF ted by / SN	FI Colodati	on			
80	Peak	Limit (d	BuV∕m)										
70													
60	Avg L	.imit (dBu	JU/m)										
50									2		-4		
40								dela cie colimite	A MAN	AA	and the start	ار الفليدية الي محمد إن المحمد ال	
30	thereiten den Nagdagilinsen fö	n hit anvället <b>Ha</b> tstat		Withorkalawing	بالطفر بالجروية الجلمانية	A MARINA MA		an an an an A					
18 <mark>8</mark>	Aliana a kanadikaling sejad ji	ana kalimban na majila	an a state of the										
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1			URL / Over 7			requenc	-		90 101 7 A	Tup Swe	ep Pts #	FSwps∕Mode L	abel
1	Rocce [GHz]	Det RRU		Jucer Jucer	Pts #Swp pled 5001 Inf pled 2001 Inf	F/MAXH Vert F/MAXH Vert	6:5-6.015	AUER 1	RBM UBM / Avg. IM 3M / Pwn An IM 1M / Log-Pi	vg(RMS) Auto wr(Video) Auto	/Cpled 6001	Inf/MAXH R	ange: entic
	Range [GHz] 2:1-5 4:5-6.015	Det RBW PEAK 1M PEAK 1M	3M / Log-Pur ( 3M / Log-Pur (	Video) Auto/C	pled 2001 Int	Vinan veru	8:6.015-10	PERK I					
	2:1-5	Det RBW PEAK 1M PEAK 1M	3M / Log-Pur( 3M / Log-Pur(	Video) Huto/C Video) Auto/C	pled 2001 Int	veru	8:5.815-18	PEAK	in in raight				
	2:1-5	Det RBW PEAK 1M PEAK 1M	3M / Log-Pur ( 3M / Log-Pur (	Video) Huto/C Video) Auto/C	pled 2861 Int	i i i i i i i i i i i i i i i i i i i	8:6.015-10	РЕНК І				Rev 9.5 1	2 Jun 28
oc a33	2:1-5 4:5-6.015 DAT 12746 Frequency	Meter		T344 Ant	Amp/Cbl/Fl	Corrected			Peak Limit		Azimuth	Height	
	2:1-5 4:5-6.015 .DAT 12746		3H / Log-Pur( 3H / Log-Pur( Det	1			Avg Limit (dBuV/m)	Av Margin (dB)		Margin (dB)	Azimuth (Degs)		2 Jun 20 Polarity
oc a33	2:1-5 4:5-6.015 DAT 12746 Frequency	Meter Reading		T344 Ant Factor	Amp/Cbl/Fl tr/Pad	Corrected Reading	Avg Limit	Av Margin	Peak Limit			Height	

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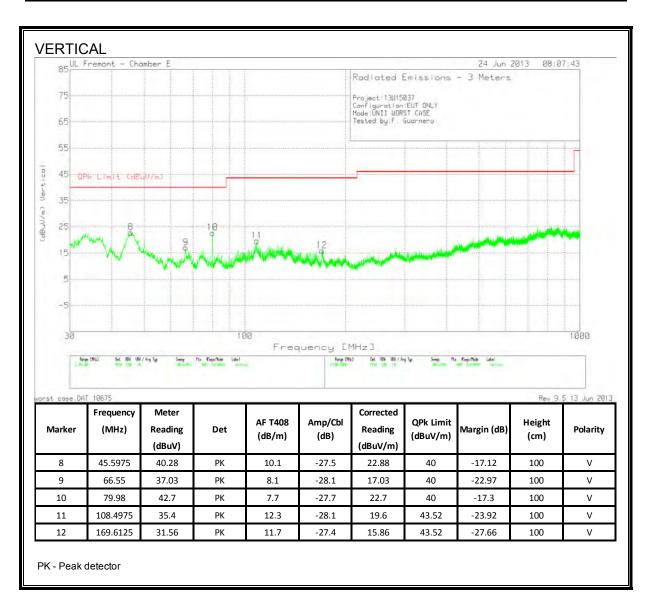
# 9.3. WORST-CASE BELOW 1 GHz

# 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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# 9.4. RECEIVER ABOVE 1 GHz

Note: No emissions were detected above the system noise floor.

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# **10. AC POWER LINE CONDUCTED EMISSIONS**

### LIMITS

FCC §15.207 (a)

Frequency of Emission (MHz)	Conducted I	Limit (dBµV)
	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

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.4.

The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

Line conducted data is recorded for both NEUTRAL and HOT lines.

RESULTS

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#### **6 WORST EMISSIONS**

Line-L1 .15 -						CISPR			
	ĺ							CICDD	
	ĺ					11/22		CISPR	
<b>_</b> .			T24 IL	LC Cables		Class B		11/22	
Test -	Meter		L1.TXT	1&3.TXT		Quasi-		Class B	
Frequency	Reading	Detector	(dB)	(dB)	dB(uVolts)	peak	Margin	Average	Margin
0.159	54.38	QP	0.1	0	54.48	65.52	-11.04	-	-
0.159	48.7	Av	0.1	0	48.8	-	-	55.5	-6.7
0.8295	48.8	РК	0.1	0	48.9	56	-7.1	-	-
0.8295	30.76	Av	0.1	0	30.86	-	-	46	-15.14
7.278	39.71	РК	0.1	0.1	39.91	60	-20.09	-	-
7.278	25.72	Av	0.1	0.1	25.92	-	-	50	-24.08
16.854	45.42	РК	0.2	0.2	45.82	60	-14.18	-	-
16.854	28.85 - <b>30MHz</b>	Av	0.2	0.2	29.25	-	-	50	-20.75
16.854		Av	0.2	0.2	29.25	CISPR	-		-20.75
		Av			29.25	CISPR 11/22	_	CISPR	-20.75
16.854 Line-L2 .15 -	- 30MHz	Av	T24 IL	LC Cables	29.25	CISPR 11/22 Class B	-	CISPR 11/22	-20.75
16.854 Line-L2 .15 - Test	- 30MHz Meter		T24 IL L2.TXT	LC Cables 2&3.TXT		CISPR 11/22 Class B Quasi-		CISPR 11/22 Class B	
16.854 Line-L2 .15 - Test	- 30MHz	Av	T24 IL	LC Cables	29.25 dB(uVolts)	CISPR 11/22 Class B	- Margin	CISPR 11/22	-20.75 Margin
16.854 Line-L2 .15 - Test	- 30MHz Meter Reading 54.75		T24 IL L2.TXT	LC Cables 2&3.TXT		CISPR 11/22 Class B Quasi-		CISPR 11/22 Class B	
16.854 Line-L2 .15 - Test Frequency	- 30MHz Meter Reading	Detector	T24 IL L2.TXT (dB)	LC Cables 2&3.TXT (dB)	dB(uVolts)	CISPR 11/22 Class B Quasi- peak	Margin	CISPR 11/22 Class B	
16.854 Line-L2 .15 - Test Frequency 0.1545	- 30MHz Meter Reading 54.75	<b>Detector</b> PK	<b>T24 IL</b> <b>L2.TXT</b> (dB) 0.1	LC Cables 2&3.TXT (dB) 0	<b>dB(uVolts)</b> 54.85	CISPR 11/22 Class B Quasi- peak 65.8	Margin	CISPR 11/22 Class B Average	Margin -
16.854 Line-L2 .15 - Test Frequency 0.1545 0.1545	- 30MHz Meter Reading 54.75 40.25	Detector PK Av	<b>T24 IL</b> <b>L2.TXT</b> (dB) 0.1 0.1	LC Cables 2&3.TXT (dB) 0 0	<b>dB(uVolts)</b> 54.85 40.35	CISPR 11/22 Class B Quasi- peak 65.8	<b>Margin</b> -10.95 -	CISPR 11/22 Class B Average	Margin -
16.854 Line-L2 .15 - Test Frequency 0.1545 0.1545 0.78	- 30MHz Meter Reading 54.75 40.25 42.3	Detector PK Av PK	<b>T24 IL</b> <b>L2.TXT</b> (dB) 0.1 0.1 0.1	LC Cables 2&3.TXT (dB) 0 0 0	<b>dB(uVolts)</b> 54.85 40.35 42.4	CISPR 11/22 Class B Quasi- peak 65.8	<b>Margin</b> -10.95 -	CISPR 11/22 Class B Average - 55.8 -	Margin - -15.45 -
16.854 Line-L2 .15 - Test Frequency 0.1545 0.1545 0.78 0.78	- 30MHz Meter Reading 54.75 40.25 42.3 24.89	Detector PK Av PK Av	<b>T24 IL</b> <b>L2.TXT</b> (dB) 0.1 0.1 0.1 0.1	LC Cables 2&3.TXT (dB) 0 0 0 0	<b>dB(uVolts)</b> 54.85 40.35 42.4 24.99	CISPR 11/22 Class B Quasi- peak 65.8 - 56 -	<b>Margin</b> -10.95 - -13.6 -	CISPR 11/22 Class B Average - 55.8 - 46	Margin - -15.45 -
16.854 Line-L2 .15 - Test Frequency 0.1545 0.1545 0.78 0.78 2.4585	- 30MHz Meter Reading 54.75 40.25 42.3 24.89 35.55	Detector PK Av PK Av PK	<b>T24 IL</b> <b>L2.TXT</b> (dB) 0.1 0.1 0.1 0.1 0.1 0.1	LC Cables 2&3.TXT (dB) 0 0 0 0 0 0	<b>dB(uVolts)</b> 54.85 40.35 42.4 24.99 35.75	CISPR 11/22 Class B Quasi- peak 65.8 - 56 - 56	Margin -10.95 - -13.6 - -20.25	CISPR 11/22 Class B Average - 55.8 - 46 -	Margin - -15.45 - -21.01 -

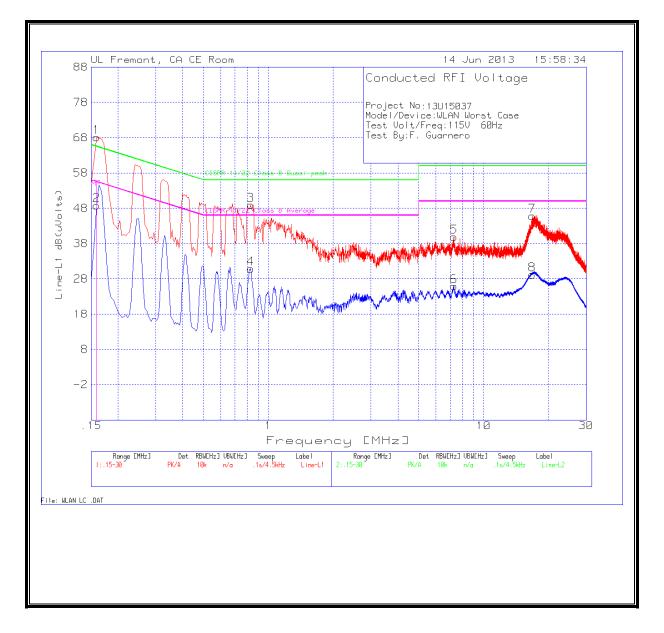
PK - Peak detector

QP - Quasi-Peak detector

Av - Average detector

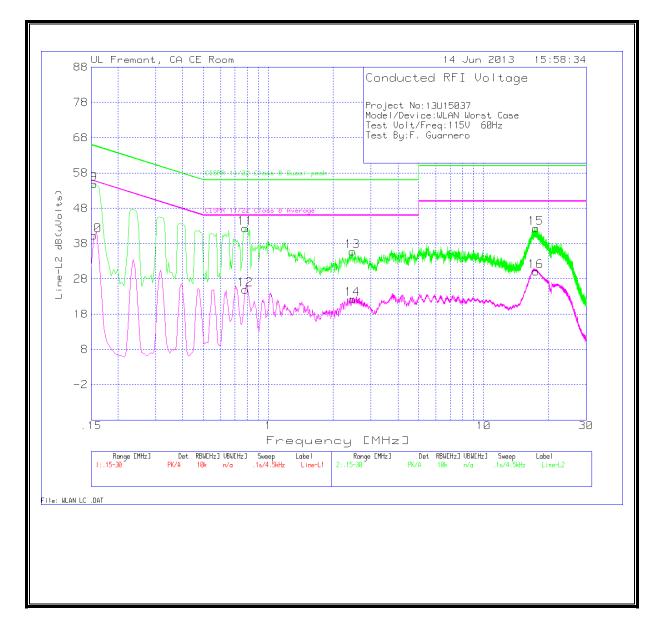
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# LINE 1 RESULTS



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# LINE 2 RESULTS



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# 11. DYNAMIC FREQUENCY SELECTION

# 11.1. OVERVIEW

# 11.1.1. LIMITS

FCC

§15.407 (h) and FCC 06-96 APPENDIX "COMPLIANCE MEASUREMENT PROCEDURES FOR UNLICENSED-NATIONAL INFORMATION INFRASTRUCTURE DEVCIES OPERATING IN THE 5250-5350 MHz AND 5470-5725 MHz BANDS INCORPORATING DYNAMIC FREQUENCY SELECTION".

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## Table 1: Applicability of DFS requirements prior to use of a channel

Requirement	Operatio	Operational Mode					
	Master	Client (without radar detection)	Client (with radar detection)				
Non-Occupancy Period	Yes	Not required	Yes				
DFS Detection Threshold	Yes	Not required	Yes				
Channel Availability Check Time	Yes	Not required	Not required				
Uniform Spreading	Yes	Not required	Not required				

# Table 2: Applicability of DFS requirements during normal operation

Requirement	Operational	Mode	
	Master	Client	Client
		(without DFS)	(with DFS)
DFS Detection Threshold	Yes	Not required	Yes
Channel Closing Transmission Time	Yes	Yes	Yes
Channel Move Time	Yes	Yes	Yes

# Table 3: Interference Threshold values, Master or Client incorporating In-ServiceMonitoring

	(see note)
≥ 200 milliwatt	-64 dBm
< 200 milliwatt	-62 dBm
Note 1: This is the level at the input of the receiver assuming Note 2: Throughout these test procedures an additional 1 df of the test transmission waveforms to account for variations will ensure that the test signal is at or above the detection the response.	A has been added to the amplitude in measurement equipment. This

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## Table 4: DFS Response requirement values

Parameter	Value
Non-occupancy period	30 minutes
Channel Availability Check Time	60 seconds
Channel Move Time	10 seconds
Channel Closing Transmission Time	200 milliseconds +
	approx. 60 milliseconds
	over remaining 10 second
	period

The instant that the *Channel Move Time* and the *Channel Closing Transmission Time* begins is as follows:

For the Short pulse radar Test Signals this instant is the end of the Burst.

For the Frequency Hopping radar Test Signal, this instant is the end of the last radar burst generated.

For the Long Pulse radar Test Signal this instant is the end of the 12 second period defining the radar transmission.

The Channel Closing Transmission Time is comprised of 200 milliseconds starting at the beginning of the Channel Move Time plus any additional intermittent control signals required to facilitate channel changes (an aggregate of approximately 60 milliseconds) during the remainder of the 10 second period. The aggregate duration of control signals will not count quiet periods in between transmissions.

## Table 5 – Short Pulse Radar Test Waveforms

Radar	Pulse Width	PRI	Pulses	Minimum	Minimum
Туре	(Microseconds)	(Microseconds)		Percentage of	Trials
-				Successful	
				Detection	
1	1	1428	18	60%	30
2	1-5	150-230	23-29	60%	30
3	6-10	200-500	16-18	60%	30
4	11-20	200-500	12-16	60%	30
Aggregate (I	Radar Types 1-4)			80%	120

## Table 6 – Long Pulse Radar Test Signal

Radar Waveform	Bursts	Pulses per Burst	Pulse Width (µsec)	Chirp Width (MHz)	PRI (µsec)	Minimum Percentage of Successful Detection	Minimum Trials
5	8-20	1-3	50-100	5-20	1000- 2000	80%	30

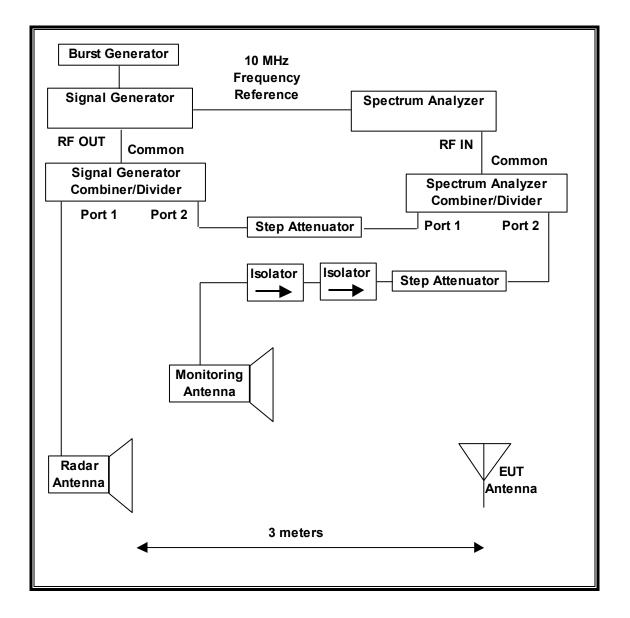
## Table 7 – Frequency Hopping Radar Test Signal

Radar Waveform	Pulse Width (µsec)	PRI (µsec)	Burst Length (ms)	Pulses per Hop	Hopping Rate (kHz)	Minimum Percentage of Successful Detection	Minimum Trials
6	1	333	300	9	.333	70%	30

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# 11.1.2. TEST AND MEASUREMENT SYSTEM

#### RADIATED METHOD SYSTEM BLOCK DIAGRAM



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## SYSTEM OVERVIEW

The short pulse and long pulse signal generating system utilizes the NTIA software. The Vector Signal Generator has been validated by the NTIA. The hopping signal generating system utilizes the CCS simulated hopping method and system, which has been validated by the DoD, FCC and NTIA. The software selects waveform parameters from within the bounds of the signal type on a random basis using uniform distribution.

The short pulse types 2, 3 and 4, and the long pulse type 5 parameters are randomized at runtime.

The hopping type 6 pulse parameters are fixed while the hopping sequence is based on the August 2005 NTIA Hopping Frequency List. The initial starting point randomized at run-time and each subsequent starting point is incremented by 475. Each frequency in the 100-length segment is compared to the boundaries of the EUT Detection Bandwidth and the software creates a hopping burst pattern in accordance with Section 7.4.1.3 Method #2 Simulated Frequency Hopping Radar Waveform Generating Subsystem of FCC 06-96 APPENDIX. The frequency of the signal generator is incremented in 1 MHz steps from  $F_L$  to  $F_H$  for each successive trial. This incremental sequence is repeated as required to generate a minimum of 30 total trials and to maintain a uniform frequency distribution over the entire Detection Bandwidth.

The signal monitoring equipment consists of a spectrum analyzer. The aggregate ON time is calculated by multiplying the number of bins above a threshold during a particular observation period by the dwell time per bin, with the analyzer set to peak detection and max hold.

#### SYSTEM CALIBRATION

A 50-ohm load is connected in place of the spectrum analyzer, and the spectrum analyzer is connected to a horn antenna via a coaxial cable, with the reference level offset set to (horn antenna gain – coaxial cable loss). The signal generator is set to CW mode. The amplitude of the signal generator is adjusted to yield a level of –64 dBm as measured on the spectrum analyzer.

Without changing any of the instrument settings, the spectrum analyzer is reconnected to the Common port of the Spectrum Analyzer Combiner/Divider. The Reference Level Offset of the spectrum analyzer is adjusted so that the displayed amplitude of the signal is –64 dBm.

The spectrum analyzer displays the level of the signal generator as received at the antenna ports of the Master Device. The interference detection threshold may be varied from the calibrated value of –64 dBm and the spectrum analyzer will still indicate the level as received by the Master Device.

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## ADJUSTMENT OF DISPLAYED TRAFFIC LEVEL

A link is established between the Master and Slave and the distance between the units is adjusted as needed to provide a suitable received level at the Master and Slave devices. The video test file is streamed to generate WLAN traffic. The monitoring antenna is adjusted so that the WLAN traffic level, as displayed on the spectrum analyzer, is at lower amplitude than the radar detection threshold.

#### TEST AND MEASUREMENT EQUIPMENT

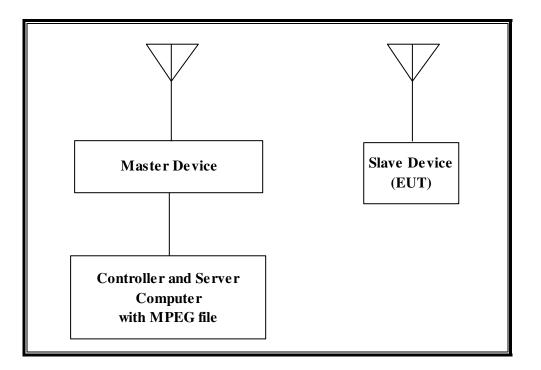
The following test and measurement equipment was utilized for the DFS tests documented in this report:

TEST EQUIPMENT LIST					
Description Manufacturer Model Asset Number Cal Due					
Spectrum Analyzer, 26.5 GHz	Agilent / HP	E4440A	C01178	08/18/13	
Vector Signal Generator, 20GHz	Agilent / HP	E8267C	C01066	11/20/13	

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# 11.1.3. SETUP OF EUT (CLIENT MODE)

## RADIATED METHOD EUT TEST SETUP



#### SUPPORT EQUIPMENT

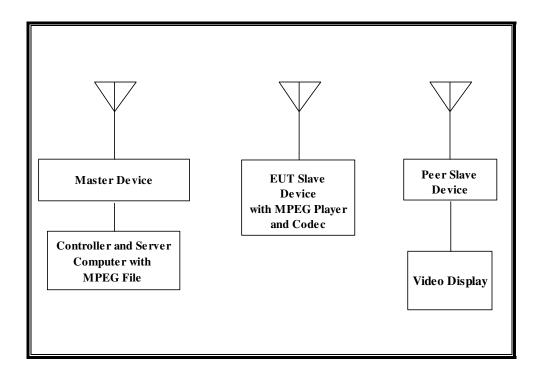
The following support equipment was utilized for the DFS tests documented in this report:

	PERIPHERAL SUPPORT EQUIPMENT LIST					
Description	Manufacturer	Model	Serial Number	FCC ID		
Wireless Access Point (Master Device)	Cisco	AIR-AP1252AG-A- K9	FTX130390D9	LDK102061		
( )	Dalta Electronico			DeC		
AC Adapter (AP)	Delta Electronics	EADP-45BB B	DTH1049902N	DoC		
Notebook PC (Controller/Server)	Apple	MacBook Pro A1150	AOU257941	DoC		
AC Adapter (Controller/Server PC)	Delta Electronics	A1330	MV952157KAGKA	DoC		

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# 11.1.4. SETUP OF EUT (CLIENT-TO-CLIENT COMMUNICATIONS MODE)

## RADIATED METHOD EUT TEST SETUP



#### SUPPORT EQUIPMENT

The following support equipment was utilized for the DFS tests documented in this report:

F	PERIPHERAL SUPPORT EQUIPMENT LIST					
Description	Manufacturer	Model	Serial Number	FCC ID		
Wireless Access Point (Master Device)	Cisco	AIR-AP1252AG-A- K9	FTX130390D9	LDK102061		
AC Adapter (AP)	Delta Electronics	EADP-45BB B	DTH1049902N	DoC		
Notebook PC (Controller/Server)	Apple	MacBook Pro A1150	AOU257941	DoC		
AC Adapter (Controller/Server PC)	Delta Electronics	A1330	MV952157KAGKA	DoC		
Apple TV (Peer Slave	Apple	A1469	V07JV1Z7FF54	BCGA1469		
Video Display	Dell	U2410f	CN-0FJ525N- 72872-1B5-AGAL	DoC		

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# 11.1.5. DESCRIPTION OF EUT

The EUT operates over the 5250-5350 MHz and 5470-5725 MHz ranges.

The EUT is a Slave Device without Radar Detection.

The highest power level within these bands is 15.81 dBm EIRP in the 5250-5350 MHz band and 15.45 dBm EIRP in the 5470-5725 MHz band.

The only antenna assembly utilized with the EUT has a gain of –0.37dBi in the 5250-5350 MHz band and 1.31dBi in the 5470-5725 MHz band.

The rated output power of the Master unit is > 23dBm (EIRP). Therefore the required interference threshold level is -64 dBm. After correction for procedural adjustments, the required radiated threshold at the antenna port is -64 + 1 = -63 dBm.

The calibrated radiated DFS Detection Threshold level is set to –64 dBm. The tested level is lower than the required level hence it provides margin to the limit.

The EUT uses one transmitter/receiver chain connected to an antenna to perform radiated tests.

WLAN traffic is generated by streaming the video file TestFile.mp2 "6 ½ Magic Hours" from the Master to the Slave in full motion video mode using Safari web browser.

TPC is not required since the maximum EIRP is less than 500 mW (27 dBm).

The EUT utilizes the 802.11a/n architecture. Two nominal channel bandwidths of 20 MHz and 40 MHz are implemented.

The software installed in the EUT is 11A5400f.

#### UNIFORM CHANNEL SPREADING

This requirement is not applicable to Slave radio devices.

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## **OVERVIEW OF MASTER DEVICE WITH RESPECT TO §15.407 (h) REQUIREMENTS**

The Master Device is a Cisco Access Point, FCC ID: LDK102061. The minimum antenna gain for the Master Device is 3.5 dBi.

The rated output power of the Master unit is > 23dBm (EIRP). Therefore the required interference threshold level is -64 dBm. After correction for procedural adjustments, the required radiated threshold at the antenna port is -64 + 1 = -63 dBm.

The calibrated radiated DFS Detection Threshold level is set to –64 dBm. The tested level is lower than the required level hence it provides margin to the limit.

The software installed in the access point is 12.4(25d)JA1.

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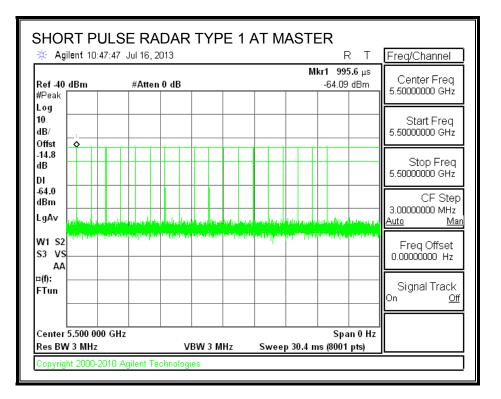
# 11.2. CLIENT MODE RESULTS FOR 20 MHz BANDWIDTH

## 11.2.1. TEST CHANNEL

All tests were performed at a channel center frequency of 5500 MHz.

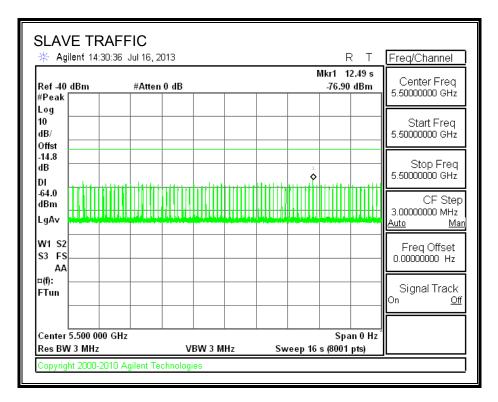
# 11.2.2. RADAR WAVEFORM AND TRAFFIC

## RADAR WAVEFORM



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#### **TRAFFIC**



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## 11.2.3. OVERLAPPING CHANNEL TESTS

## RESULTS

These tests are not applicable.

# 11.2.4. MOVE AND CLOSING TIME

## REPORTING NOTES

The reference marker is set at the end of last radar pulse.

The delta marker is set at the end of the last WLAN transmission following the radar pulse. This delta is the channel move time.

The aggregate channel closing transmission time is calculated as follows:

```
Aggregate Transmission Time = (Number of analyzer bins showing transmission) * (dwell time per bin)
```

The observation period over which the FCC aggregate time is calculated begins at (Reference Marker + 200 msec) and ends no earlier than (Reference Marker + 10 sec).

The observation period over which the IC aggregate time is calculated begins at (Reference Marker) and ends no earlier than (Reference Marker + 10 sec).

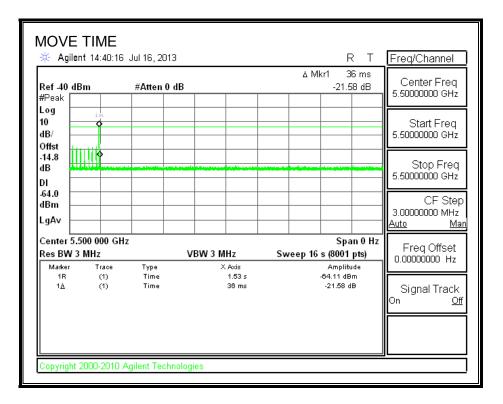
#### RESULTS

Agency	Channel Move Time	Limit
	(sec)	(sec)
FCC / IC	0.036	10

Agency	Aggregate Channel Closing Transmission Time	Limit
	(msec)	(msec)
FCC	0.0	60
IC	2.0	260

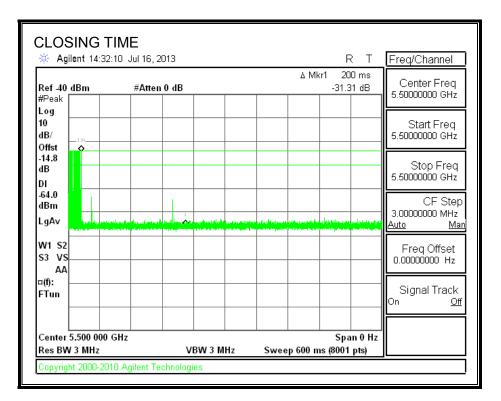
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#### MOVE TIME



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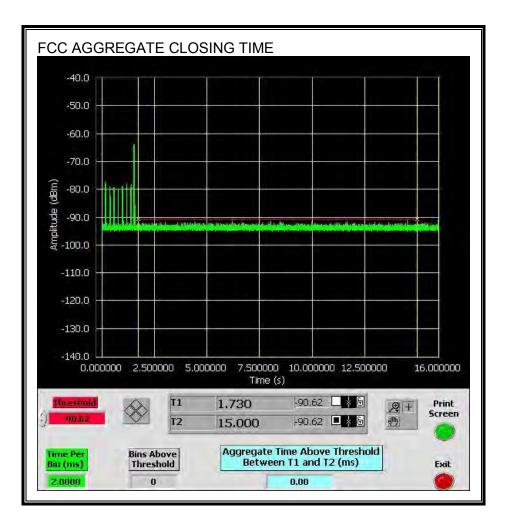
#### **CHANNEL CLOSING TIME**



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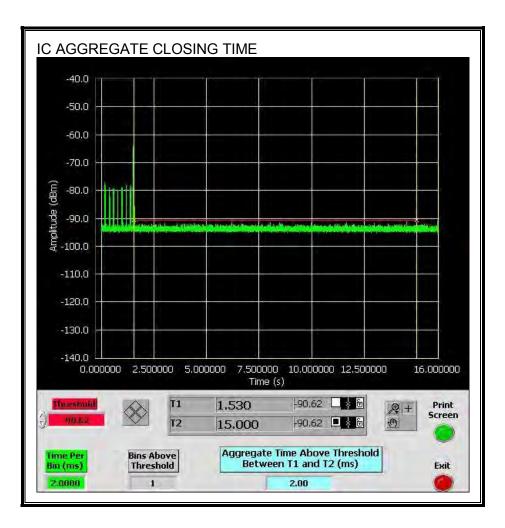
#### AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

No transmissions are observed during the FCC aggregate monitoring period.



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Only intermittent transmissions are observed during the IC aggregate monitoring period.



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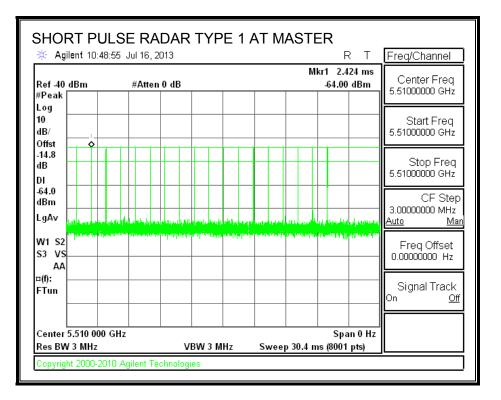
# 11.3. CLIENT MODE RESULTS FOR 40 MHz BANDWIDTH

## 11.3.1. TEST CHANNEL

All tests were performed at a channel center frequency of 5510 MHz.

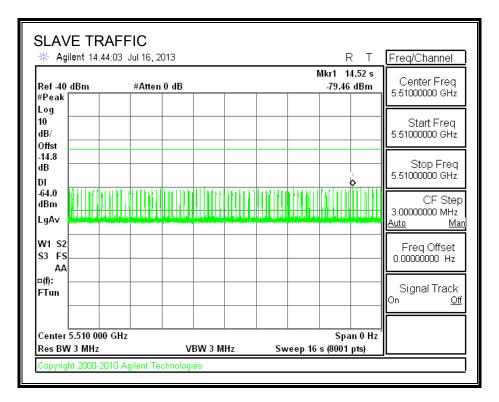
# 11.3.2. RADAR WAVEFORM AND TRAFFIC

## RADAR WAVEFORM



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#### **TRAFFIC**



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## 11.3.3. OVERLAPPING CHANNEL TESTS

## RESULTS

These tests are not applicable.

# 11.3.4. MOVE AND CLOSING TIME

## REPORTING NOTES

The reference marker is set at the end of last radar pulse.

The delta marker is set at the end of the last WLAN transmission following the radar pulse. This delta is the channel move time.

The aggregate channel closing transmission time is calculated as follows:

```
Aggregate Transmission Time = (Number of analyzer bins showing transmission) * (dwell time per bin)
```

The observation period over which the FCC aggregate time is calculated begins at (Reference Marker + 200 msec) and ends no earlier than (Reference Marker + 10 sec).

The observation period over which the IC aggregate time is calculated begins at (Reference Marker) and ends no earlier than (Reference Marker + 10 sec).

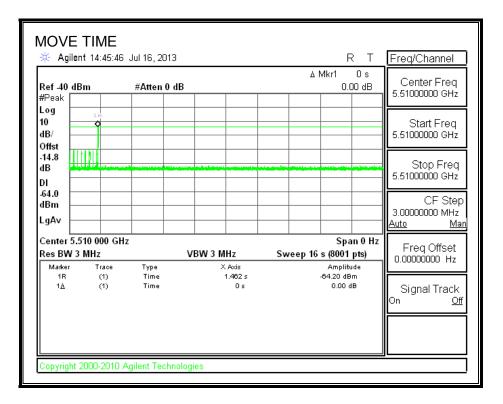
#### RESULTS

Agency	Channel Move Time	Limit
	(sec)	(sec)
FCC / IC	0.000	10

Agency	Aggregate Channel Closing Transmission Time	Limit
	(msec)	(msec)
FCC	0.0	60
IC	0.0	260

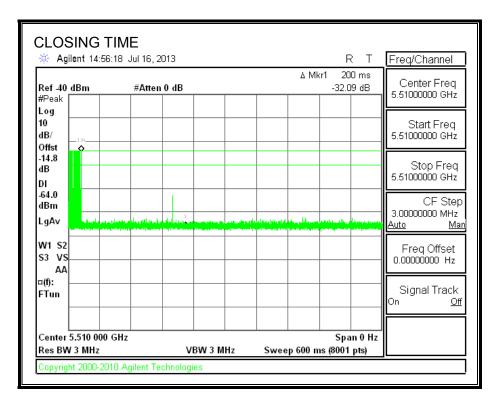
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#### MOVE TIME



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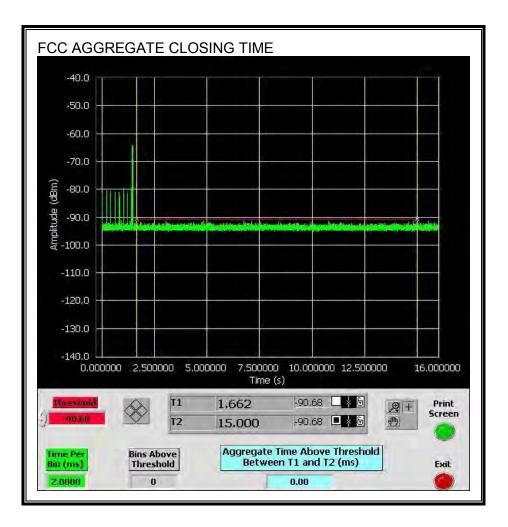
#### **CHANNEL CLOSING TIME**



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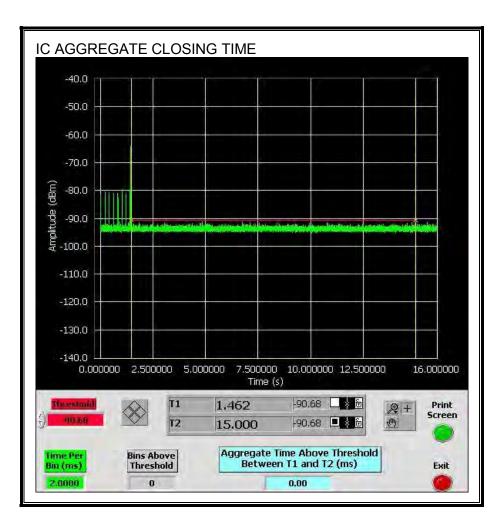
#### AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

No transmissions are observed during the FCC aggregate monitoring period.



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No transmissions are observed during the IC aggregate monitoring period.



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# 11.3.5. NON-OCCUPANCY PERIOD

## **RESULTS**

No EUT transmissions were observed on the test channel during the 30-minute observation time.

NON-OCCU	PANCY PERIOD 19 Jul 16, 2013	RT	Freq/Channel
Ref -40 dBm #Peak	#Atten 0 dB	∆ Mkr1 1.8 ks -27.66 dB	Center Freq 5.51000000 GHz
Log 10 dB/ Offst &			Start Freq 5.51000000 GHz
-14.8 dB DI			Stop Freq 5.51000000 GHz
-64.0 dBm LgAv			CF Step 3.00000000 MHz <u>Auto Mar</u>
W1 S2 S3 FS AA			Freq Offset 0.00000000 Hz
¤(f): FTun			Signal Track <sup>On <u>Off</u></sup>
Center 5.510 000 ( Res BW 3 MHz	GHz VBW 3 MHz	Span 0 Hz Sweep 2 ks (8001 pts)	
Copyright 2000-201	0 Agilent Technologies	· · · ·	

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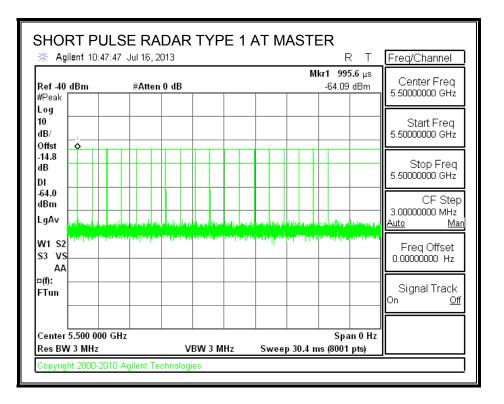
# 11.4. CLIENT-TO-CLIENT COMMUNICATIONS MODE RESULTS FOR 20 MHz BANDWIDTH

# 11.4.1. TEST CHANNEL

All tests were performed at a channel center frequency of 5500 MHz.

# 11.4.2. RADAR WAVEFORM AND TRAFFIC

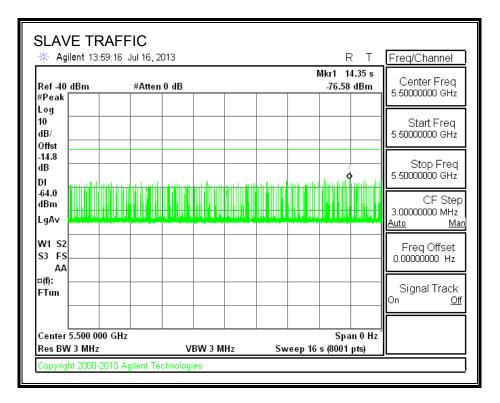
## RADAR WAVEFORM



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#### **TRAFFIC**



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## 11.4.3. OVERLAPPING CHANNEL TESTS

## RESULTS

These tests are not applicable.

# 11.4.4. MOVE AND CLOSING TIME

## REPORTING NOTES

The reference marker is set at the end of last radar pulse.

The delta marker is set at the end of the last WLAN transmission following the radar pulse. This delta is the channel move time.

The aggregate channel closing transmission time is calculated as follows:

```
Aggregate Transmission Time = (Number of analyzer bins showing transmission) * (dwell time per bin)
```

The observation period over which the FCC aggregate time is calculated begins at (Reference Marker + 200 msec) and ends no earlier than (Reference Marker + 10 sec).

The observation period over which the IC aggregate time is calculated begins at (Reference Marker) and ends no earlier than (Reference Marker + 10 sec).

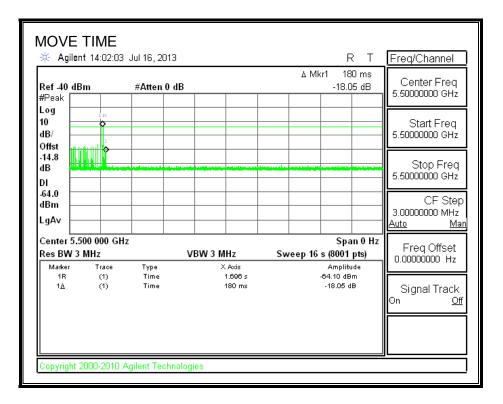
#### RESULTS

Agency	Channel Move Time	Limit
	(sec)	(sec)
FCC / IC	0.180	10

Agency	Aggregate Channel Closing Transmission Time	Limit
	(msec)	(msec)
FCC	0.0	60
IC	10.0	260

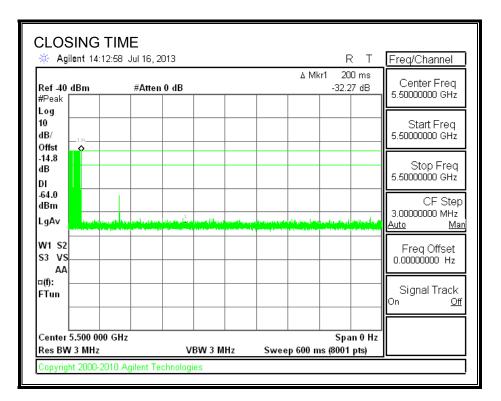
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#### MOVE TIME



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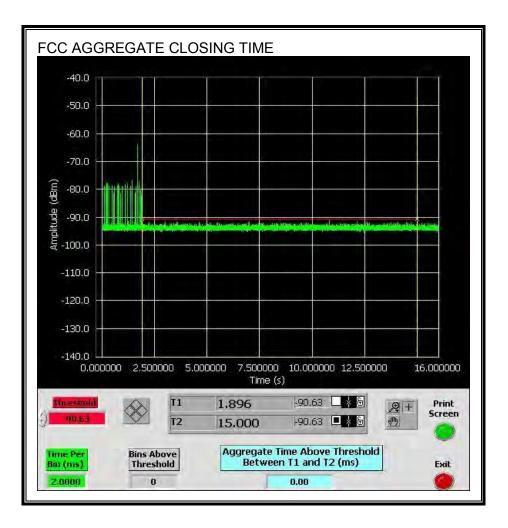
#### **CHANNEL CLOSING TIME**



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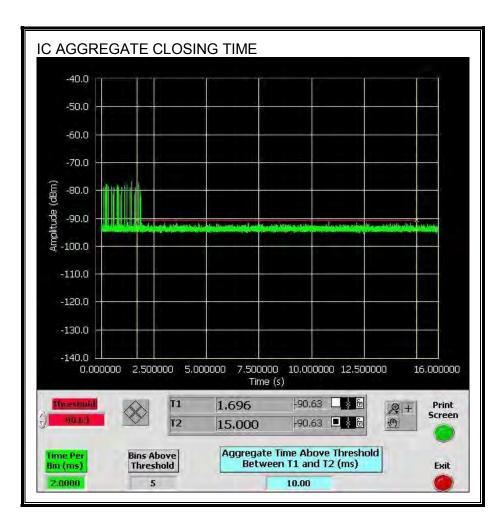
#### AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

No transmissions are observed during the FCC aggregate monitoring period.



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Only intermittent transmissions are observed during the IC aggregate monitoring period.



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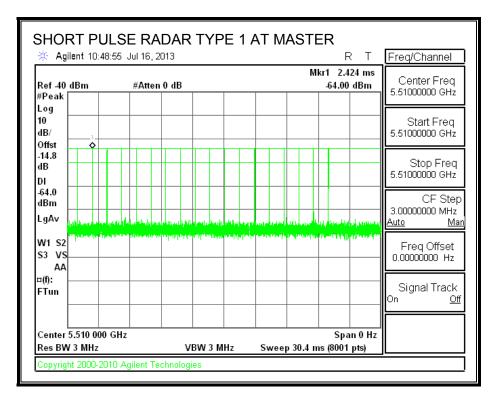
# 11.5. CLIENT-TO-CLIENT COMMUNICATIONS MODE RESULTS FOR 40 MHz BANDWIDTH

## 11.5.1. TEST CHANNEL

All tests were performed at a channel center frequency of 5510 MHz.

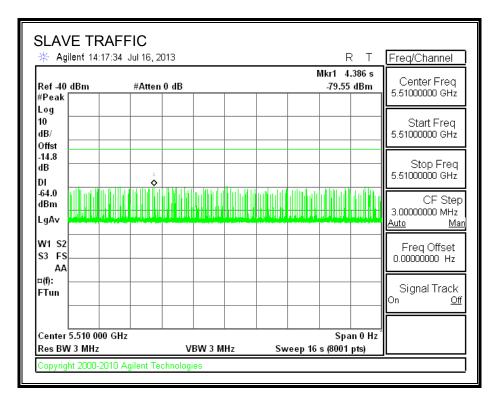
# 11.5.2. RADAR WAVEFORM AND TRAFFIC

## RADAR WAVEFORM



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#### **TRAFFIC**



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## 11.5.3. OVERLAPPING CHANNEL TESTS

#### RESULTS

These tests are not applicable.

# 11.5.4. MOVE AND CLOSING TIME

#### **REPORTING NOTES**

The reference marker is set at the end of last radar pulse.

The delta marker is set at the end of the last WLAN transmission following the radar pulse. This delta is the channel move time.

The aggregate channel closing transmission time is calculated as follows:

```
Aggregate Transmission Time = (Number of analyzer bins showing transmission) * (dwell time per bin)
```

The observation period over which the FCC aggregate time is calculated begins at (Reference Marker + 200 msec) and ends no earlier than (Reference Marker + 10 sec).

The observation period over which the IC aggregate time is calculated begins at (Reference Marker) and ends no earlier than (Reference Marker + 10 sec).

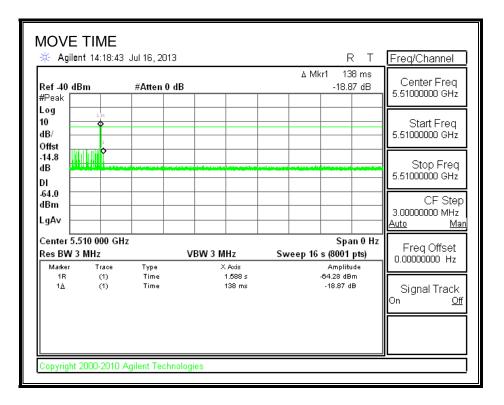
#### RESULTS

Agency	Channel Move Time	Limit
	(sec)	(sec)
FCC / IC	0.138	10

Agency	Aggregate Channel Closing Transmission Time	Limit
	(msec)	(msec)
FCC	0.0	60
IC	4.0	260

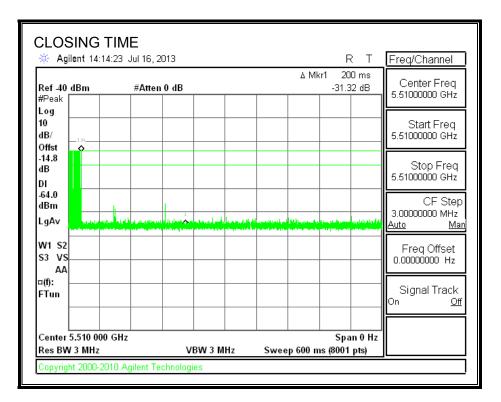
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#### MOVE TIME



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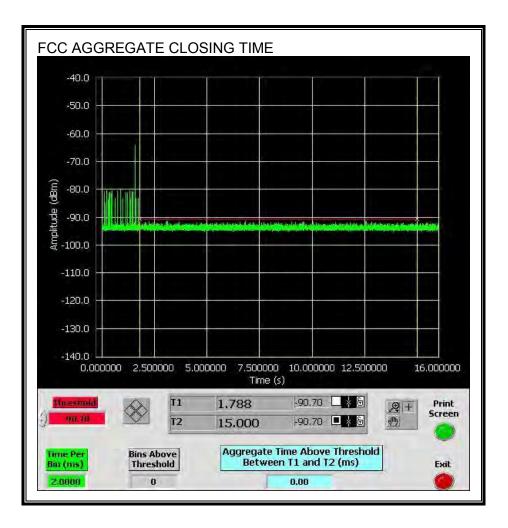
#### **CHANNEL CLOSING TIME**



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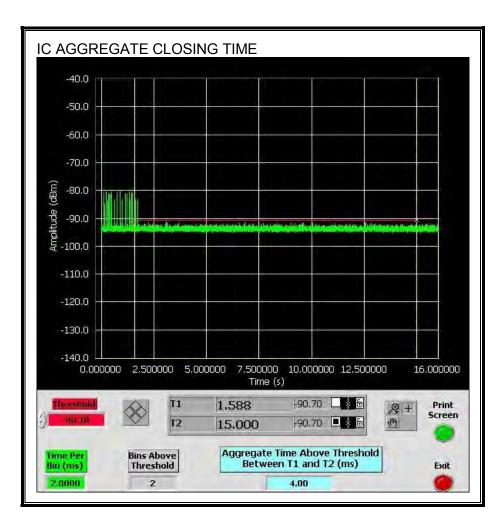
#### AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

No transmissions are observed during the FCC aggregate monitoring period.



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Only intermittent transmissions are observed during the IC aggregate monitoring period.



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