



**FCC CFR47 PART 15 SUBPART E  
INDUSTRY CANADA RSS-210 ISSUE 8**

**CERTIFICATION TEST REPORT**

**FOR**

**The Apple iPad is a tablet device with multimedia functions (music, application support, and video), 802.11a/b/g/n radio, and Bluetooth radio functions**

**MODEL NUMBER: A1432, A1454, & A1455\***

**FCC ID: BCGA1432  
IC: 579C-A1432**

**REPORT NUMBER: 12U14526-2, Revision A**

**ISSUE DATE: OCTOBER 3, 2012**

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\*Models differences are detailed within the body of this report



NVLAP LAB CODE 200065-0

Revision History

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
--	08/30/12	Initial Issue	F. Ibrahim
A	10/03/12	Updated Model Differences section	A. Zaffar

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# 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** APPLE, INC.  
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CUPERTINO, CA 95014, U.S.A.

**EUT DESCRIPTION:** The Apple iPad is a tablet device with multimedia functions (music, application support, and video), 802.11a/b/g/n radio, and Bluetooth radio functions

**MODEL:** A1432, A1454, & A1455

**SERIAL NUMBER:** PT758824

**DATE TESTED:** JULY 15 - AUGUST 22, 2012

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart E	Pass
INDUSTRY CANADA RSS-210 Issue 8 Annex 9	Pass
INDUSTRY CANADA RSS-GEN Issue 3	Pass

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

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

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UL CCS

## 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 06-96, FCC KDB 789033, ANSI C63.10-2003, RSS-GEN Issue 3, and RSS-210 Issue 8.

## 3. FACILITIES AND ACCREDITATION

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

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

## 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:

$$\begin{aligned} \text{Field Strength (dBuV/m)} &= \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \\ &\text{Cable Loss (dB)} - \text{Preamp Gain (dB)} \\ 36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} &= 28.9 \text{ dBuV/m} \end{aligned}$$

### 4.3. MEASUREMENT UNCERTAINTY

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

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

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

## 5. EQUIPMENT UNDER TEST

### 5.1. DESCRIPTION OF EUT

The EUT is a iPad tablet device with iPod functions (music, application support, and video), 802.11a/b/g/n radio, and Bluetooth radio functions.

### 5.2. DESCRIPTION OF MODELS DIFFERENCES

FCC ID: BCGA1432  
IC ID: 579C-A1432  
Model #: A1432

Model A1432, is a tablet with multimedia functions (music, application support, and video)IEEE 802.11a/b/g/n radio and Bluetooth radio. The rechargeable battery is not user accessible.

FCC ID: BCGA1454  
IC ID: 579C-A1454  
Model #: A1454

Model A1454 is a tablet with multimedia functions (music, application support, and video), cellular GSM/GPRS/EGPRS/WCDMA/HSPA+/DC-HSDPA/LTE radio, IEEE 802.11a/b/g/n and Bluetooth radio. The rechargeable battery is not user accessible.

FCC ID: BCGA1455  
IC ID: 579C-A1455  
Model #: A1455

Model A1455, is a tablet with multimedia functions (music, application support, and video), cellular GSM/GPRS/EGPRS/WCDMA/HSPA+/DC-HSDPA/CDMA1xRTT/ EV-DO Rev 0, A, B / LTE radio, IEEE 802.11a/b/g/n radio and Bluetooth radio. The rechargeable battery is not user accessible.



### 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	14.257	26.650
5180 - 5240	802.11n HT20	14.354	27.252
5190 - 5230	802.11n HT40	15.780	37.844
5260 - 5320	802.11a	17.176	52.192
5260 - 5320	802.11n HT20	17.278	53.432
5270 - 5310	802.11n HT40	17.260	53.211
5500 - 5700	802.11a	16.585	45.551
5500 - 5700	802.11n HT20	16.421	43.863
5510 - 5670	802.11n HT40	16.491	44.576

### 5.4. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a PIFA antenna, with a maximum gain as shown below:

Frequency Band (GHz)	Antenna Gain (dBi)
2.4-2.4835	1.41
5.15-5.25	4.70
5.25-5.35	5.08
5.5-5.7	5.42
5.725-5.85	5.27

---

## **5.5. SOFTWARE AND FIRMWARE**

The firmware installed in the EUT during testing was 10A378

The EUT driver software installed during testing was Broadcom\_Rel\_6\_10\_56\_166

The EUT is connected to the power meter.

## **5.6. WORST-CASE CONFIGURATION AND MODE**

For the fundamental investigation, since the EUT is a portable device that has three orientations; X, Y and Z orientations have been investigated, also with AC/DC adapter, and earphone, and the worst case was found to be at Y orientation without AC adapter and earphone for both 2.4GHz and 5GHz band.

For Radiated Emissions below 1 GHz and Power line Conducted Emissions, the channel with the highest conducted output power was selected as a worst-case scenario.

Worst-case data rates as provided by the manufacturer are:

For 802.11a mode: 6Mbps

For 802.11n HT20: MCS0

For 802.11n HT40: MCS0

For 2.4 GHz band, an investigation of the fundamental frequency on both Ant0 and Ant1 ports showed that Ant0 is worst-case; therefore, all final radiated testing was performed using Ant0.

For 5 GHz bands, an investigation of the fundamental frequency on both Ant0 and Ant1 ports showed that Ant1 is worst-case; therefore, all final radiated testing was performed using Ant1.

Low channel for both 11a and 11n HT20 in the 5.6 GHz band, was tested for harmonics and BE at the power level of Low1 channel (5520 MHz) as worst-case scenario.

High channel for both 11a and 11n HT20 in the 5.6 GHz band, was tested for harmonics and BE at the power level of High1 channel (5680 MHz) as worst-case scenario.

## 5.7. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	FCC ID
AC Adapter	Apple	A1401	D060812	DoC
Power Splitter	Krytar	158010	99250	N/A
Dc Power Supply	Agilent	E3610A	KR24104150	N/A
Laptop PC	Apple	MacBook Pro	AOU269116	N/A

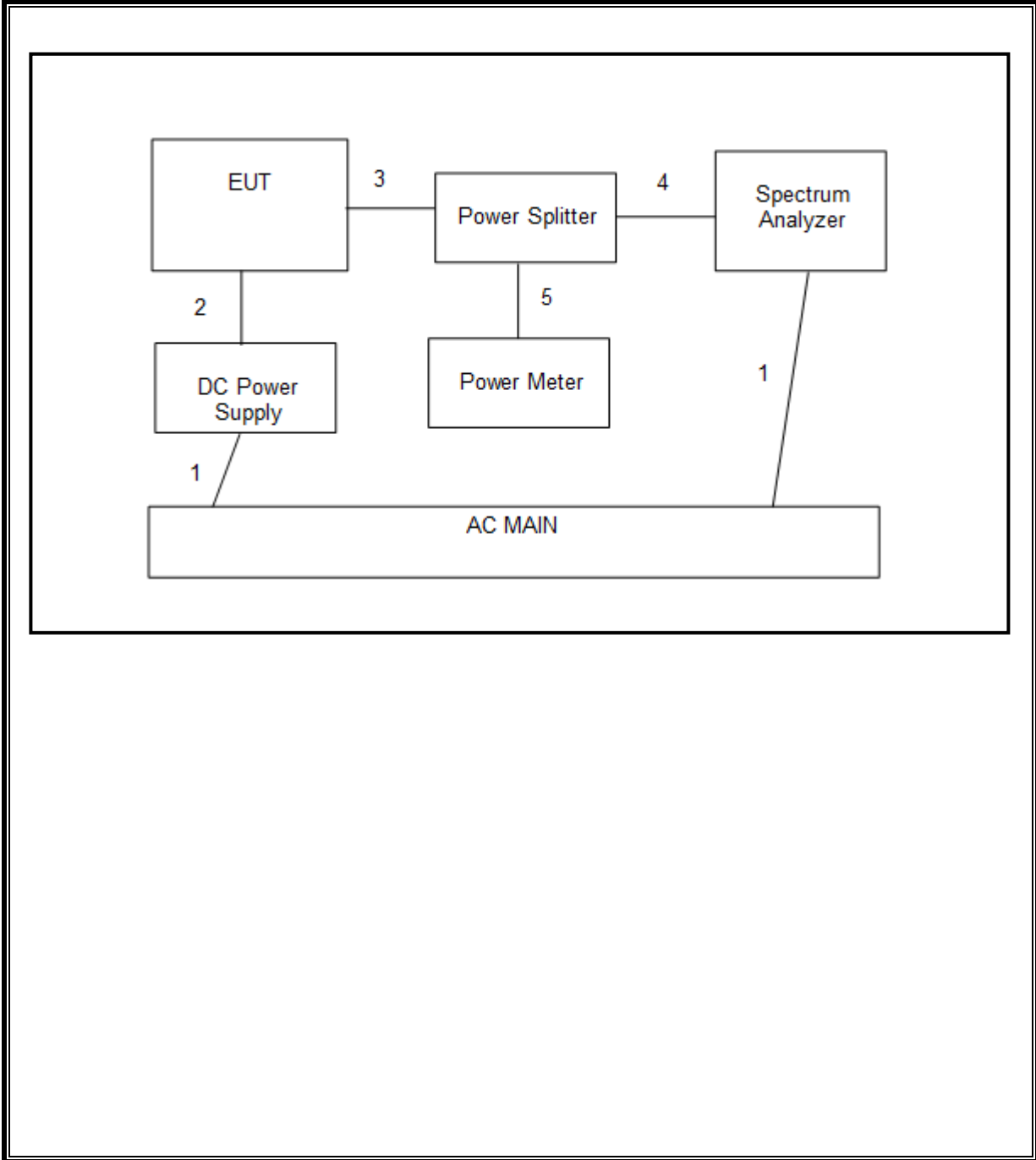
### I/O CABLES (CONDUCTED SETUP)

I/O CABLE LIST						
Cable No.	Port	#of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	2	AC	Un-shielded	2.0m	N/A
2	DC	1	DC	Un-shielded	1.0m	N/A
3	Antenna Port	1	Splitter	Un-shielded	0.1m	N/A
4	RF out	1	Spectrum Analyzer	Un-Shielded	None	N/A
5	RF out	1	Power Meter	Shielded	None	NA

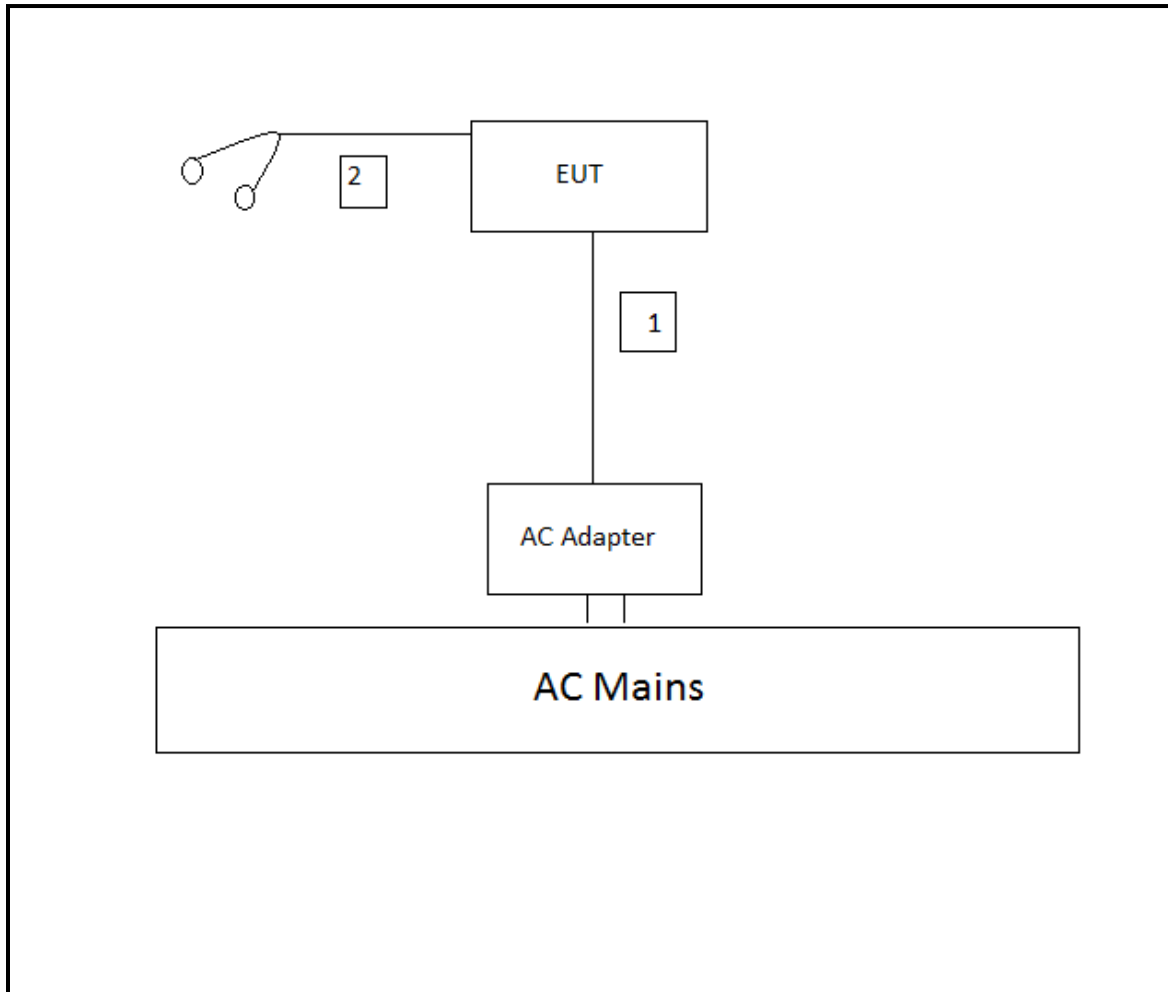
### I/O CABLES (RADIATED SETUP)

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	DC	1	MINI USB	UN-SHELDED	1.0m	N/A
2	AUDIO	1	MINI JACK	UN-SHELDED	1.0m	N/A

**SETUP DIAGRAM FOR CONDUCTED TEST**



**SETUP DIAGRAM FOR RADIATED TEST**



## 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
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01052	11/11/12
Antenna, Horn, 18 GHz	EMCO	3115	C00945	10/06/12
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00580	11/11/12
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1		02/07/13
Horn Antenna, 26.5 GHz	ARA	MWH-1826/B	C00589	04/23/13
Horn Antenna, 40 GHz	ARA	MWH-2640/B	C00981	06/14/13
Preamplifier, 40 GHz	Miteq	NSP4000-SP2	C00990	03/14/13
Reject Filter, 2.0-2.9 GHz	Micro-Tronics	BRM50702	N02684	CNR
High Pass Filter, 7.6 GHz	Micro-Tronics	HPM13195	N02682	CNR
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01069	12/15/12
E-Series Power Sensor 9 kHz~18 GHz	Agilent	E9304A	1260847C	05/23/13
P-Series single channel Power Meter	Agilent / HP	N1911A		07/27/13
Reject Filter, 5.725-5.825 GHz	Micro-Tronics	BRC13192	N02676	CNR
Reject Filter, 2.4-2.5 GHz	Micro-Tronics	BRM50702	N02685	CNR
Highpass Filter, 7.6 GHz	Micro-Tronics	HPM13195	N02682	CNR
EMI Test Receiver, 30MHz	R & S	ESHS 20	N02396	08/19/13
LISN, 30 MHz	FCC	LISN-50/250-25-2	N02625	12/13/12

## 7. ON TIME, DUTY CYCLE AND MEASUREMENT METHODS

### LIMITS

None; for reporting purposes only.

### PROCEDURE

KDB 789033 Zero-Span Spectrum Analyzer Method.

#### 7.1. ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
802.11a 20 MHz	2.055	2.094	0.981	98.1%	0.08	0.487
802.11n HT20	1.917	1.947	0.985	98.5%	0.07	0.522
802.11n HT40	0.9445	0.9599	0.984	98.4%	0.07	1.059

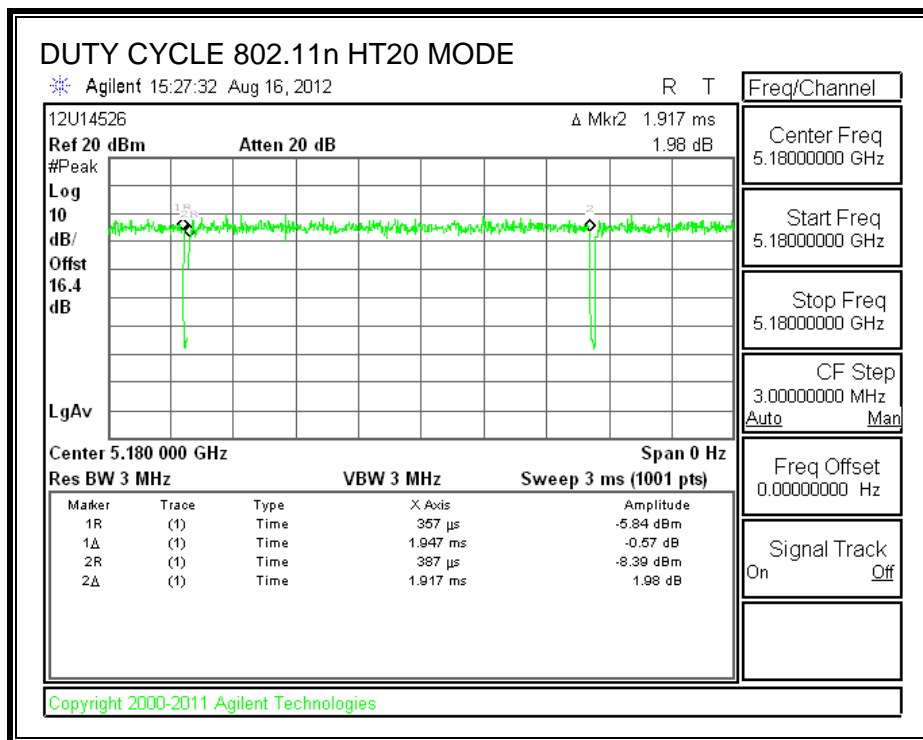
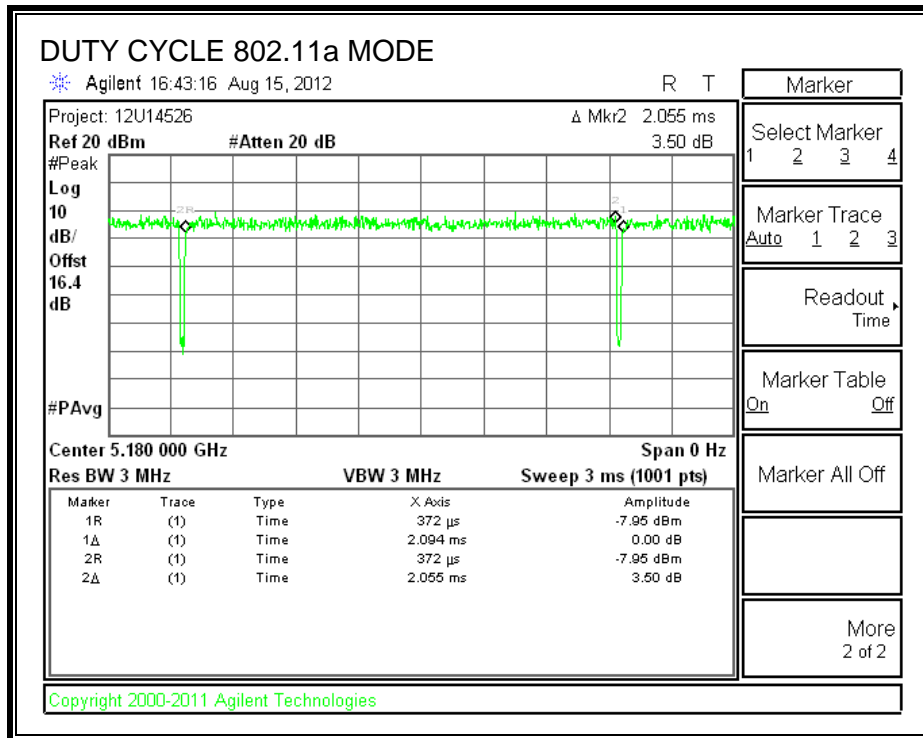
#### 7.2. MEASUREMENT METHOD FOR POWER AND PPSD

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

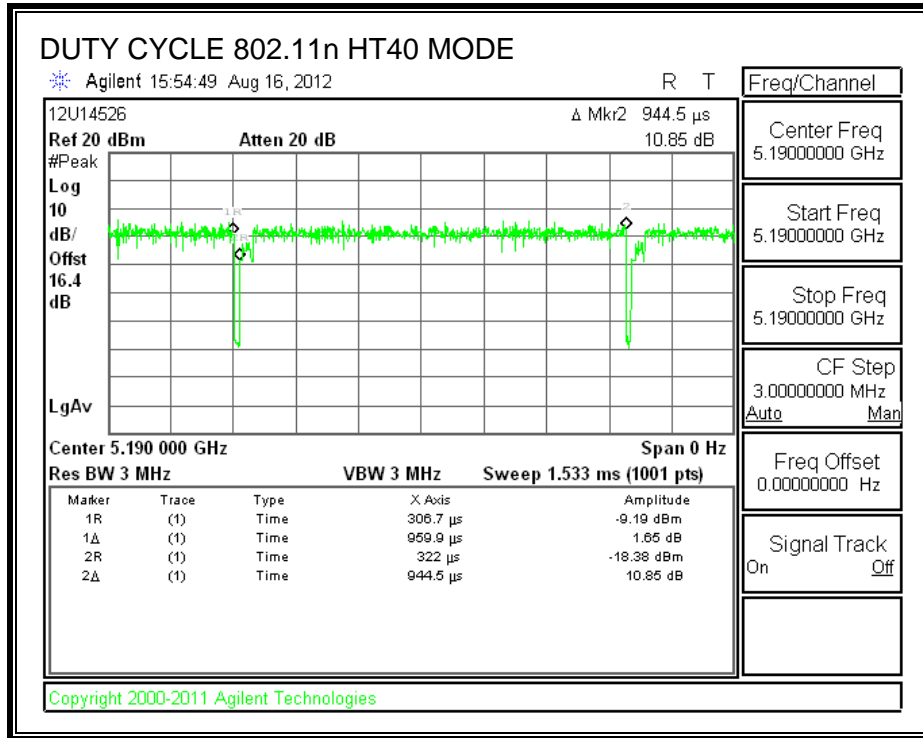
#### 7.3. MEASUREMENT METHOD FOR AVG SPURIOUS EMISSIONS ABOVE 1 GHz

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

### 7.4. DUTY CYCLE PLOTS







## 8. ANTENNA PORT TEST RESULTS

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

#### 8.1.1. 26 dB BANDWIDTH

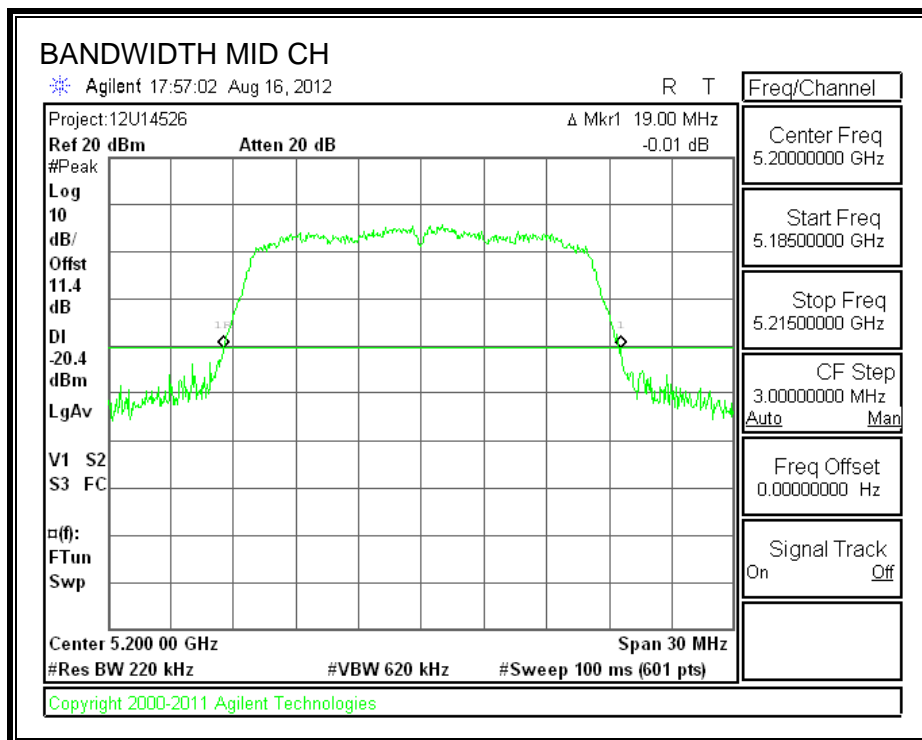
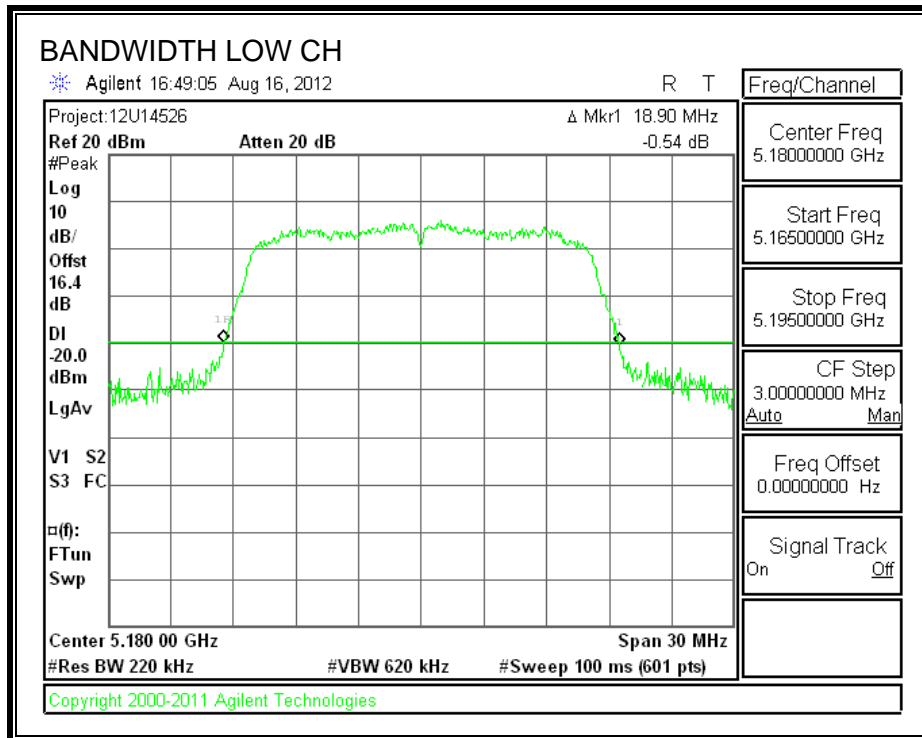
##### LIMITS

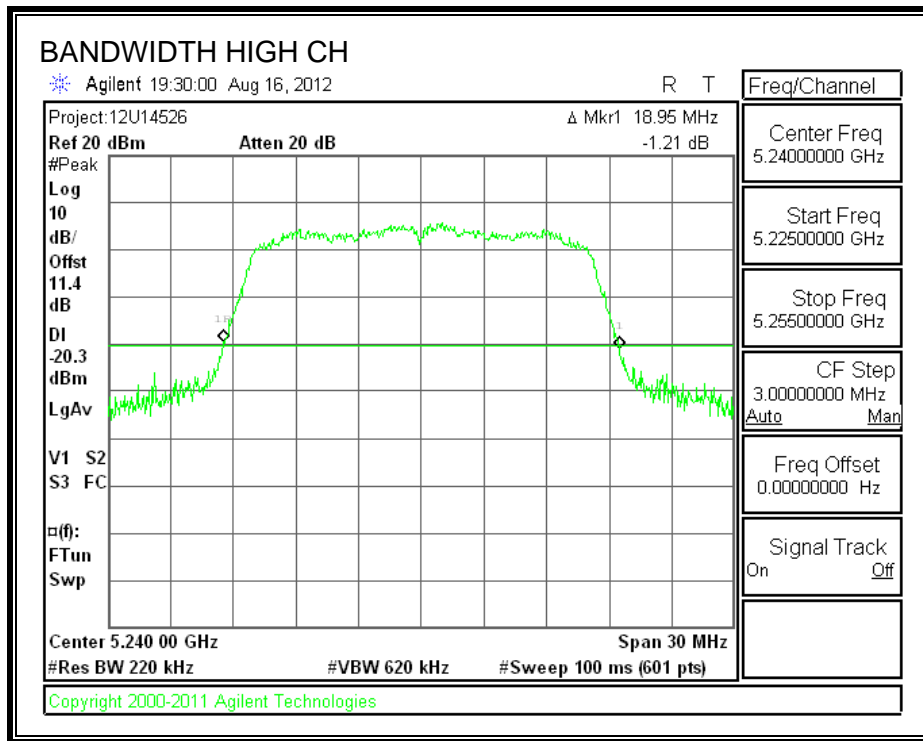
None; for reporting purposes only.

##### RESULTS

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
Low	5180	18.90
Mid	5200	19.00
High	5240	18.95

**26 dB BANDWIDTH**





**8.1.2. 99% BANDWIDTH**

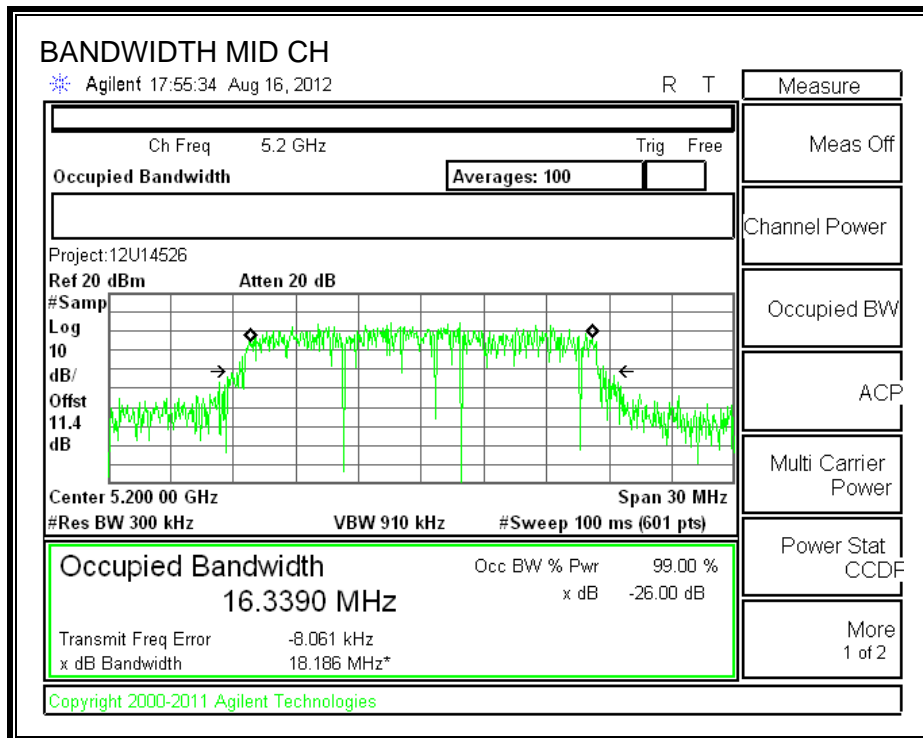
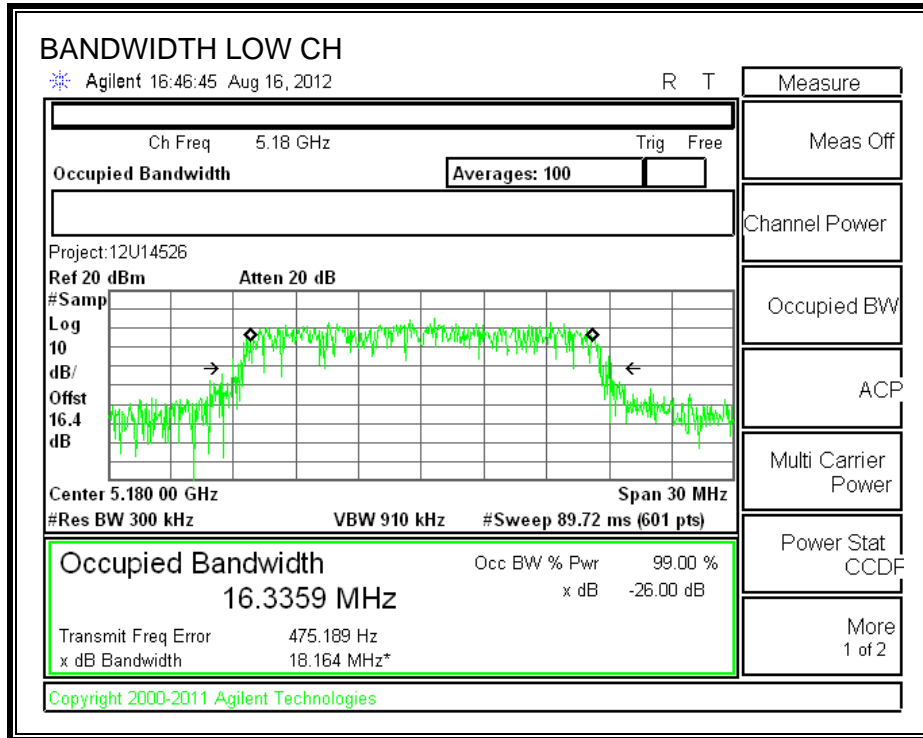
**LIMITS**

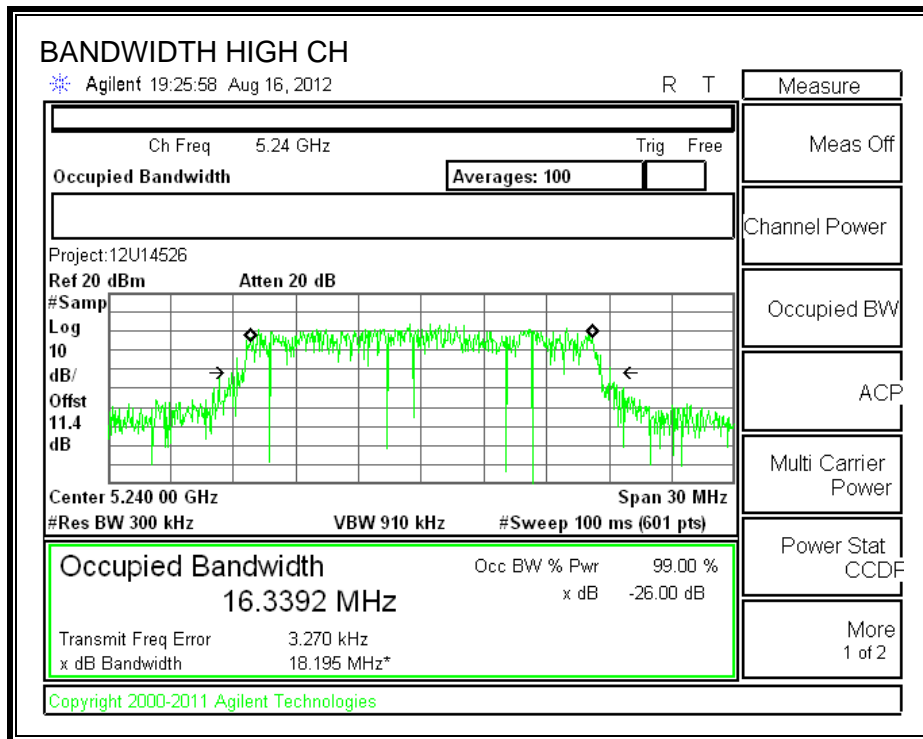
None; for reporting purposes only.

**RESULTS**

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5180	16.3359
Mid	5200	16.3390
High	5240	16.3392

**99% BANDWIDTH**





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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 11.4 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 (MHz)	Power (dBm)
Low	5180	13.98
Mid	5200	13.93
High	5240	13.85



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## **8.1.4. OUTPUT POWER AND PPSD**

### **LIMITS**

FCC §15.407 (a) (1)

IC RSS-210 A9.2 (1)

For the band 5.15–5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or  $4 \text{ dBm} + 10 \log B$ , where B is the 26-dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 4 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.

**RESULTS**

**Limits FCC 15.407**

Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	4 + 10 Log B Limit (dBm)	Directional Gain (dBi)	Power Limit (dBm)	PPSD Limit (dBm)
Low	5180	17	18.90	16.76	4.70	16.76	4.00
Mid	5200	17	19.00	16.79	4.70	16.79	4.00
High	5240	17	18.95	16.78	4.70	16.78	4.00

**Output Power Results**

Channel	Frequency (MHz)	Meas Power (dBm)	Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5180	14.213	14.213	16.76	-2.552
Mid	5200	14.257	14.257	16.79	-2.531
High	5240	14.124	14.124	16.78	-2.652

**PPSD Results**

Channel	Frequency (MHz)	Meas PPSD (dBm)	Corr'd PPSD (dBm)	PPSD Limit (dBm)	PPSD Margin (dB)
Low	5180	3.84	3.84	4.00	-0.16
Mid	5200	3.87	3.87	4.00	-0.13
High	5240	3.70	3.70	4.00	-0.30

**IC RSS-210 A9.2 (1)**

Channel	Frequency (MHz)	Fixed EIRP Limit (dBm)	B 99% (MHz)	10 + 10 Log B EIRP Limit (dBm)	Directional Gain (dBi)	Power Limit (dBm)	PPSD Limit (dBm)
Low	5180	23	16.3359	22.1314	4.70	22.1314	10.0000
Mid	5200	23	16.3390	22.1323	4.70	22.1323	10.0000
High	5240	23	16.3392	22.1323	4.70	22.1323	10.0000

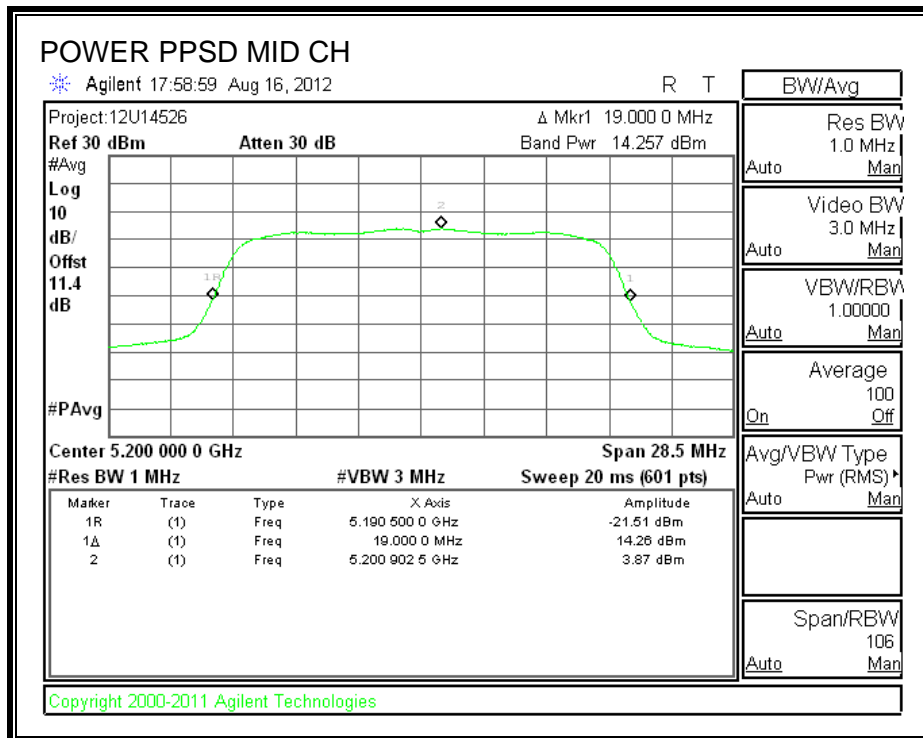
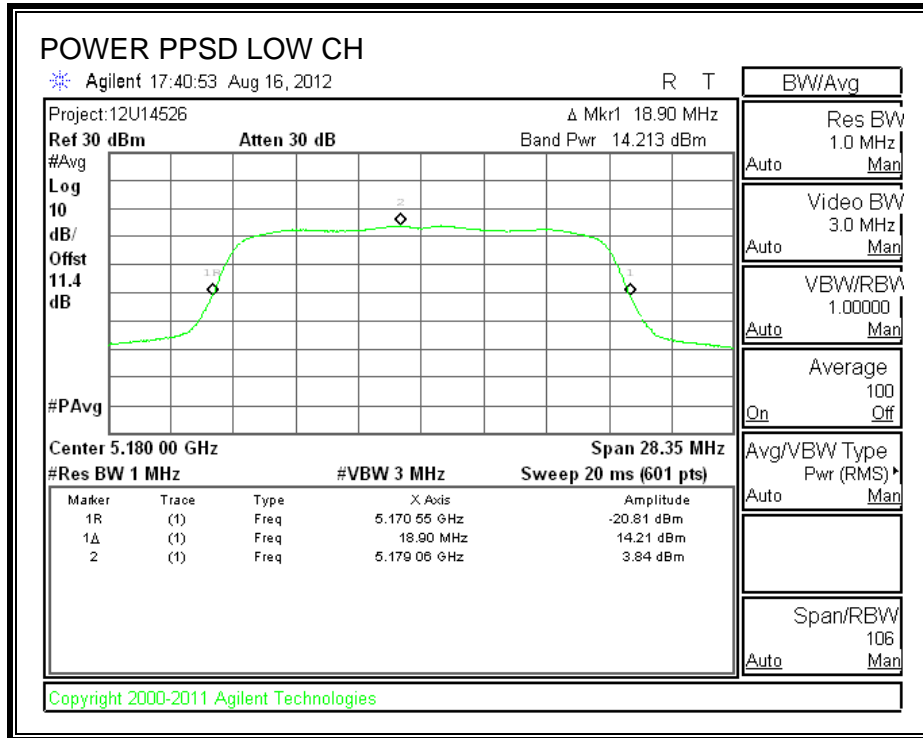
**Output Power Results**

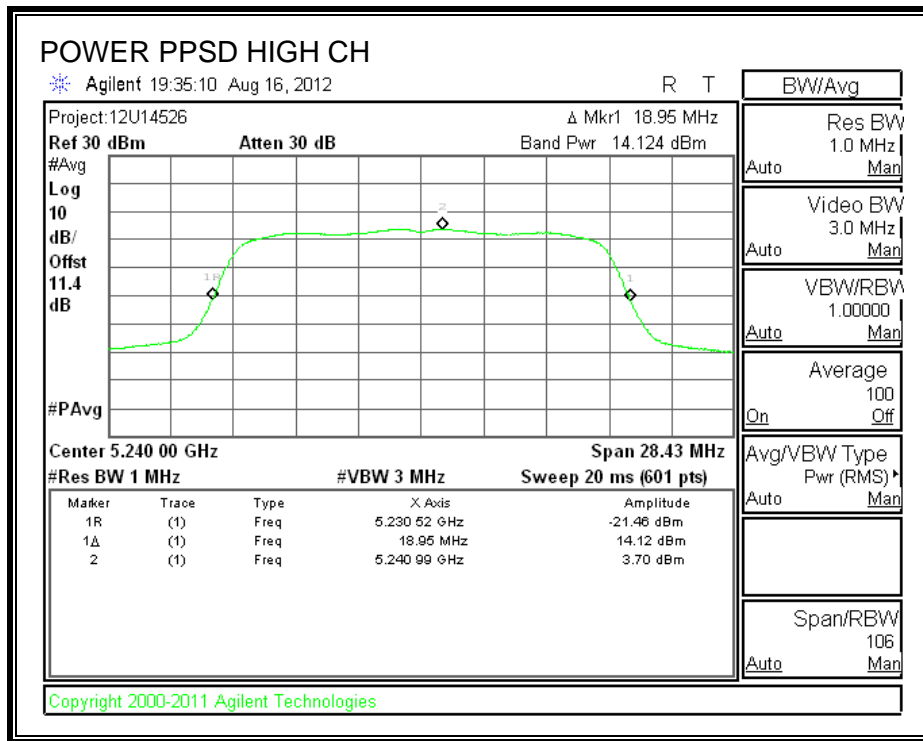
Channel	Frequency (MHz)	Meas Power (dBm)	Corr'd Power (dBm)	Directional Gain (dBi)	Power EIRP Limit (dBm)	Power Margin (dB)
Low	5180	14.21	14.213	4.70	22.1314	-3.2184
Mid	5200	14.26	14.257	4.70	22.1323	-3.1753
High	5240	14.12	14.124	4.70	22.1323	-3.3083

**PPSD Results**

Channel	Frequency (MHz)	Meas PPSD (dBm)	Corr'd PPSD (dBm)	Directional Gain (dBi)	PPSD EIRP Limit (dBm)	PPSD Margin (dB)
Low	5180	3.84	3.84	4.70	10.0000	-1.4600
Mid	5200	3.87	3.87	4.70	10.0000	-1.4300
High	5240	3.70	3.70	4.70	10.0000	-1.6000

**OUTPUT POWER AND PPSD**





### 8.1.5. PEAK EXCURSION

#### LIMITS

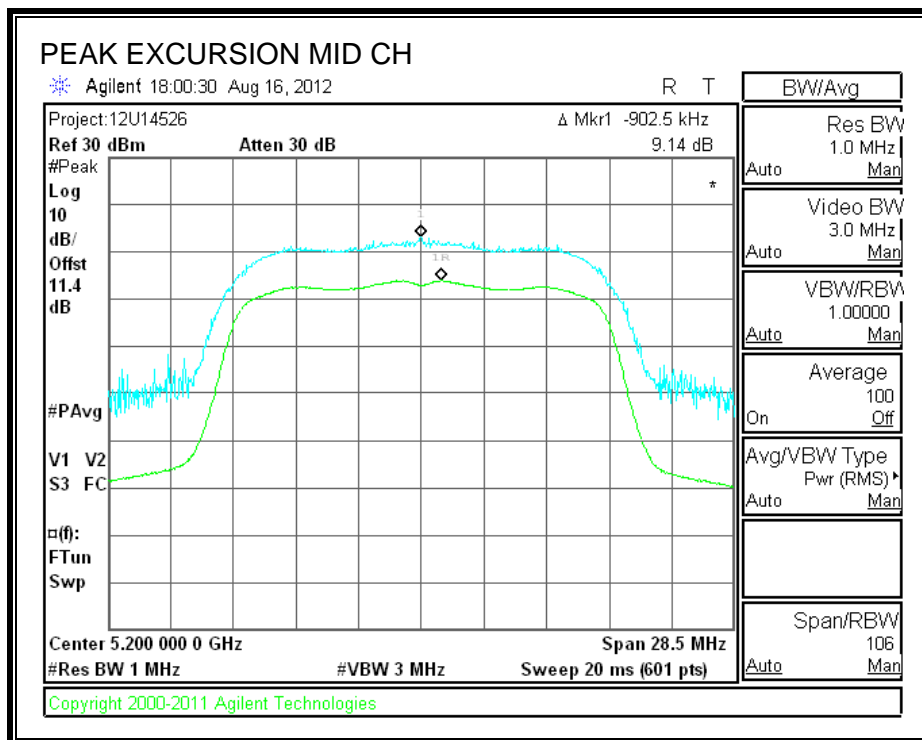
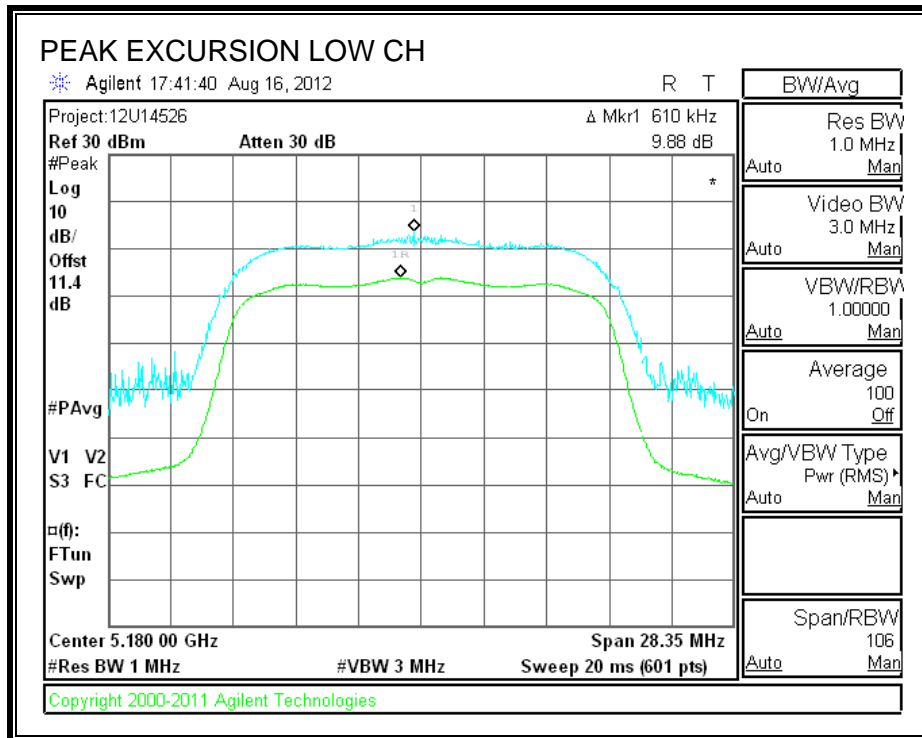
FCC §15.407 (a) (6)

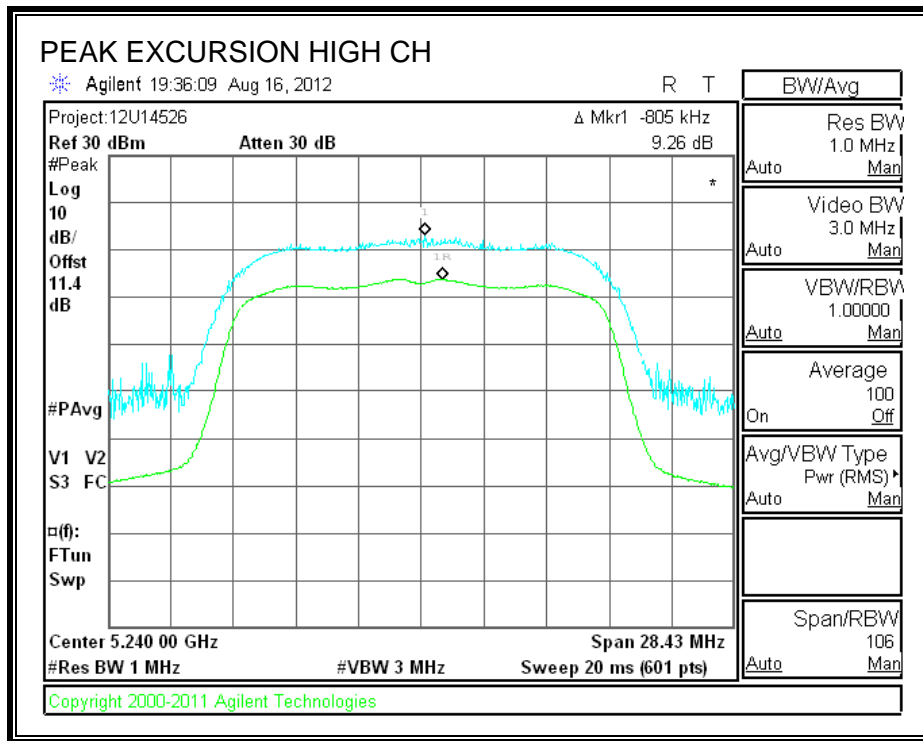
The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

#### RESULTS

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	5180	9.88	13	-3.12
Mid	5200	9.14	13	-3.86
High	5240	9.26	13	-3.74

**PEAK EXCURSION**







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

**8.2.1. 26 dB BANDWIDTH**

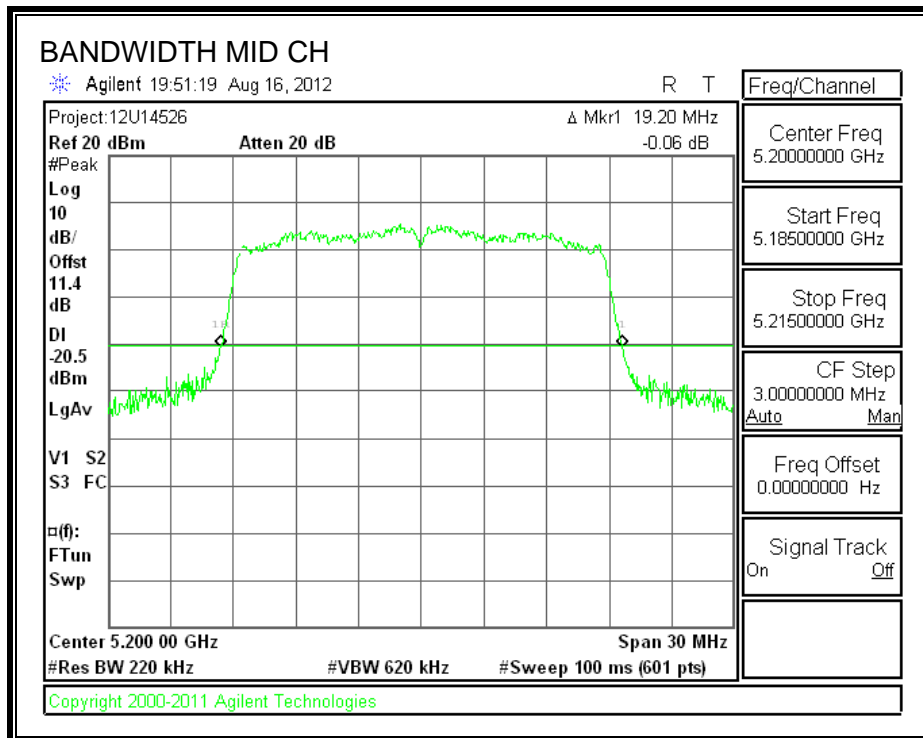
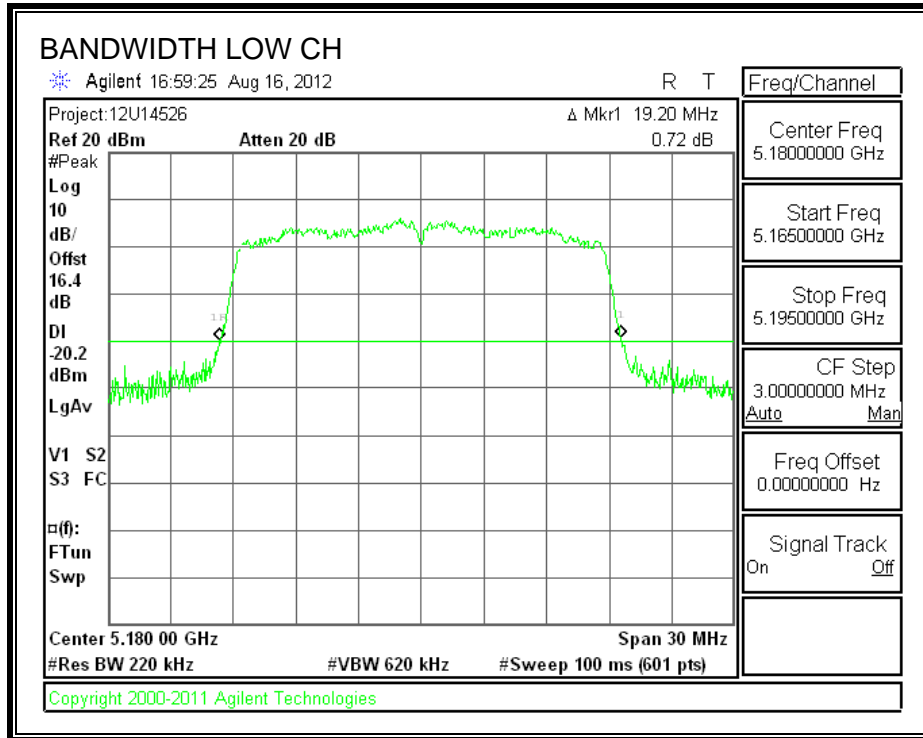
**LIMITS**

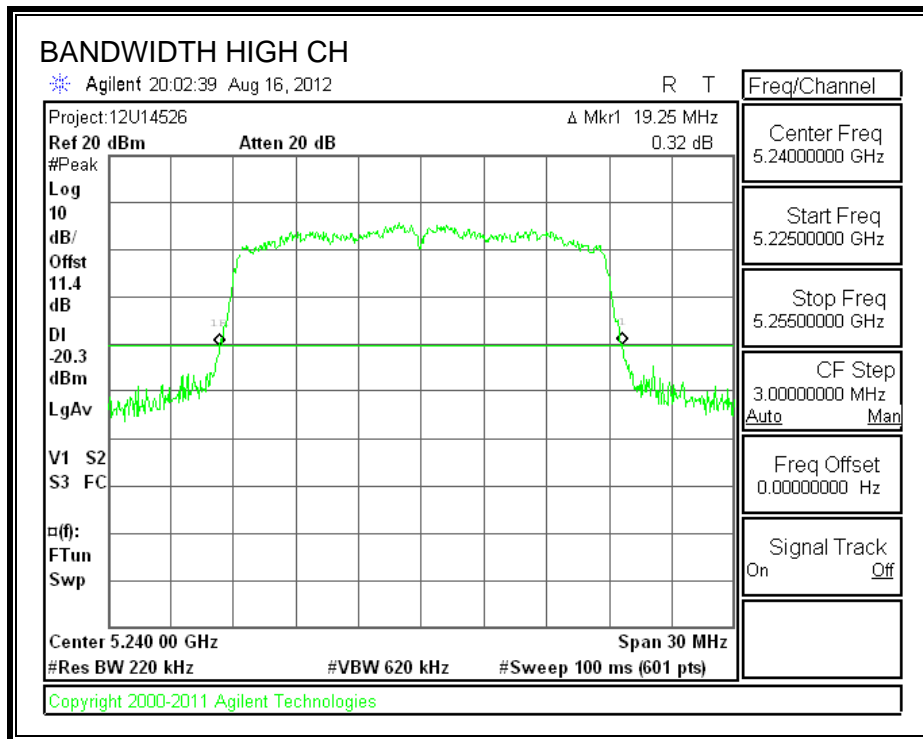
None; for reporting purposes only.

**RESULTS**

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
Low	5180	19.20
Mid	5200	19.20
High	5240	19.25

**26 dB BANDWIDTH**





**8.2.2. 99% BANDWIDTH**

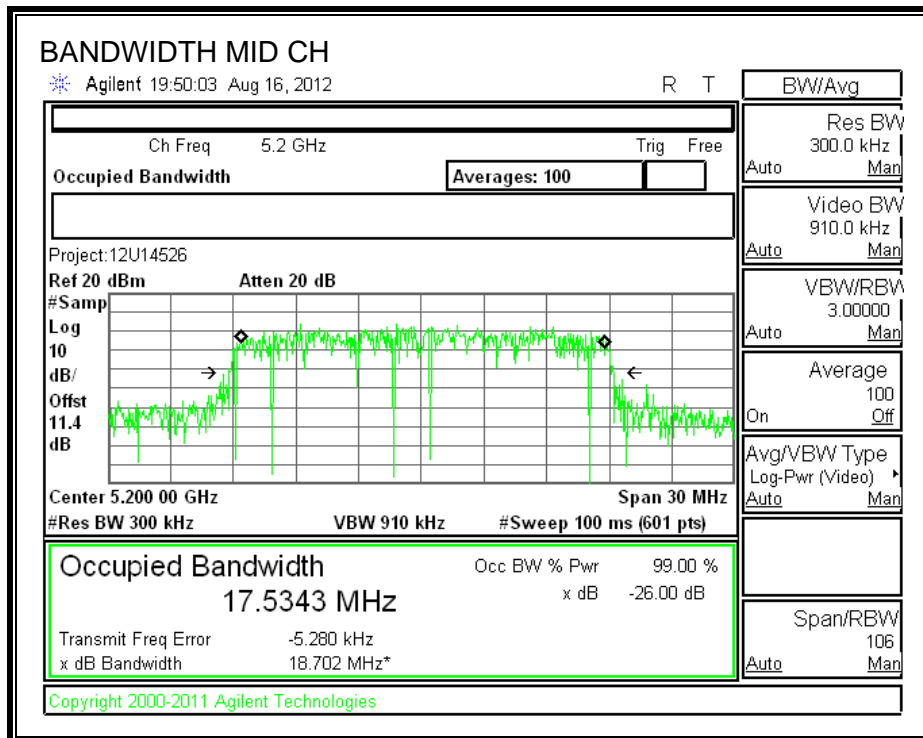
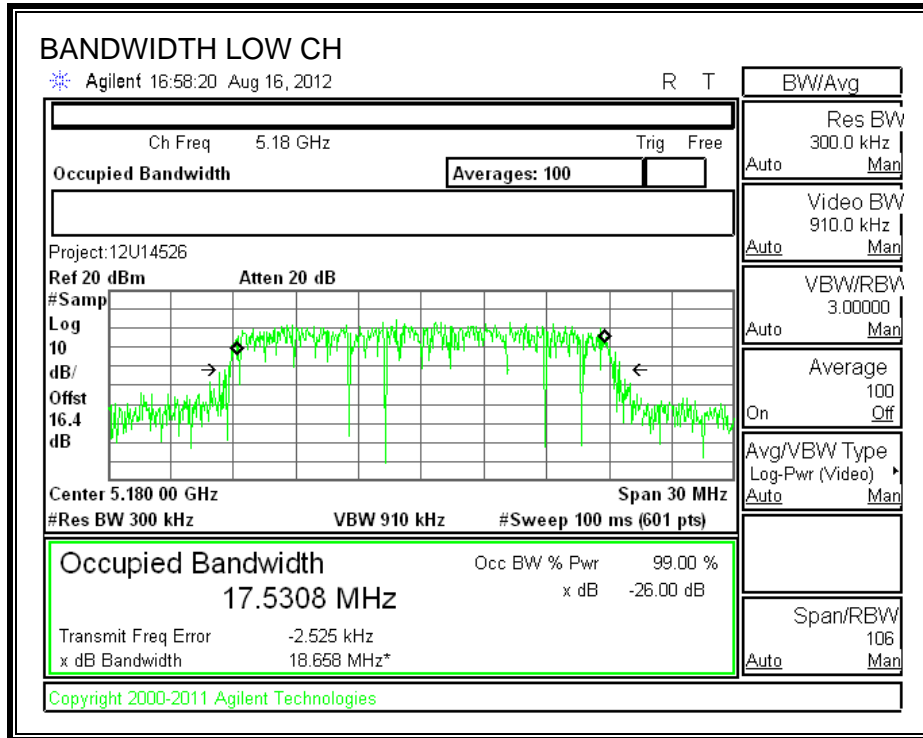
**LIMITS**

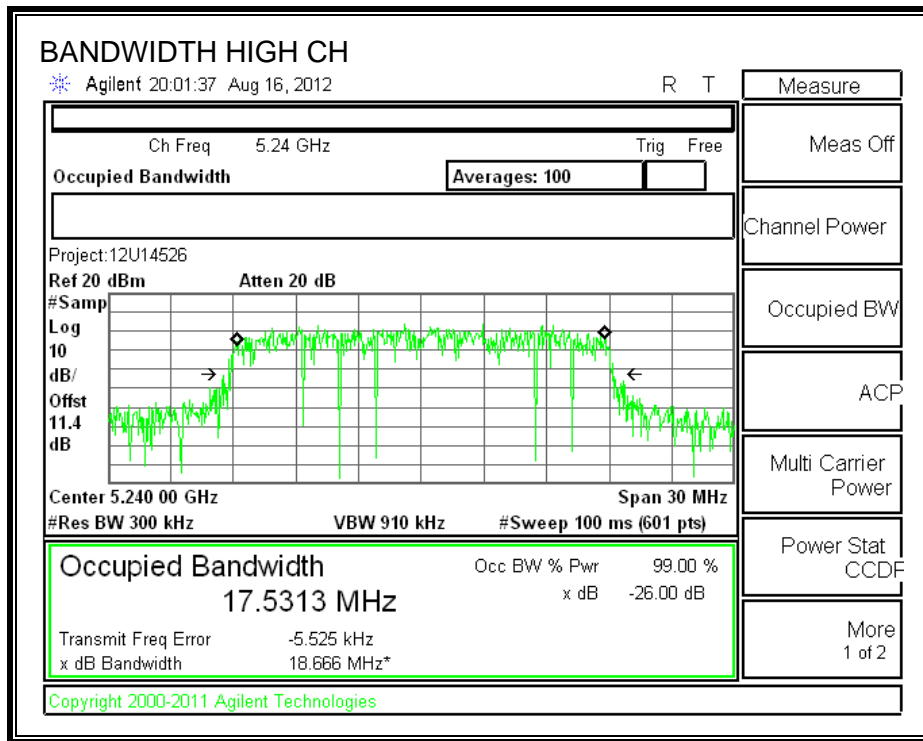
None; for reporting purposes only.

**RESULTS**

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5180	17.5308
Mid	5200	17.5343
High	5240	17.5313

**99% BANDWIDTH**





### **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 11.4 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 (MHz)	Power (dBm)
Low	5180	13.94
Mid	5200	13.94
High	5240	13.87

---

## 8.2.4. OUTPUT POWER AND PPSD

### LIMITS

FCC §15.407 (a) (1)

IC RSS-210 A9.2 (1)

For the band 5.15–5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or  $4 \text{ dBm} + 10 \log B$ , where B is the 26-dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 4 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.



**RESULTS**

**Limits FCC 15.407**

Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	4 + 10 Log B Limit (dBm)	Directional Gain (dBi)	Power Limit (dBm)	PPSD Limit (dBm)
Low	5180	17	19.20	16.83	4.70	16.83	4.00
Mid	5200	17	19.20	16.83	4.70	16.83	4.00
High	5240	17	19.25	16.84	4.70	16.84	4.00

**Output Power Results**

Channel	Frequency (MHz)	Meas Power (dBm)	Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5180	14.354	14.354	16.83	-2.479
Mid	5200	14.155	14.155	16.83	-2.678
High	5240	14.298	14.298	16.84	-2.546

**PPSD Results**

Channel	Frequency (MHz)	Meas PPSD (dBm)	Corr'd PPSD (dBm)	PPSD Limit (dBm)	PPSD Margin (dB)
Low	5180	3.69	3.69	4.00	-0.31
Mid	5200	3.52	3.52	4.00	-0.48
High	5240	3.67	3.67	4.00	-0.33

**IC RSS-210 A9.2 (1)**

Channel	Frequency (MHz)	Fixed EIRP Limit (dBm)	B 99% (MHz)	10 + 10 Log B EIRP Limit (dBm)	Directional Gain (dBi)	Power Limit (dBm)	PPSD Limit (dBm)
Low	5180	23	17.5308	22.4380	4.70	22.4380	10.0000
Mid	5200	23	17.5343	22.4389	4.70	22.4389	10.0000
High	5240	23	17.5313	22.4381	4.70	22.4381	10.0000

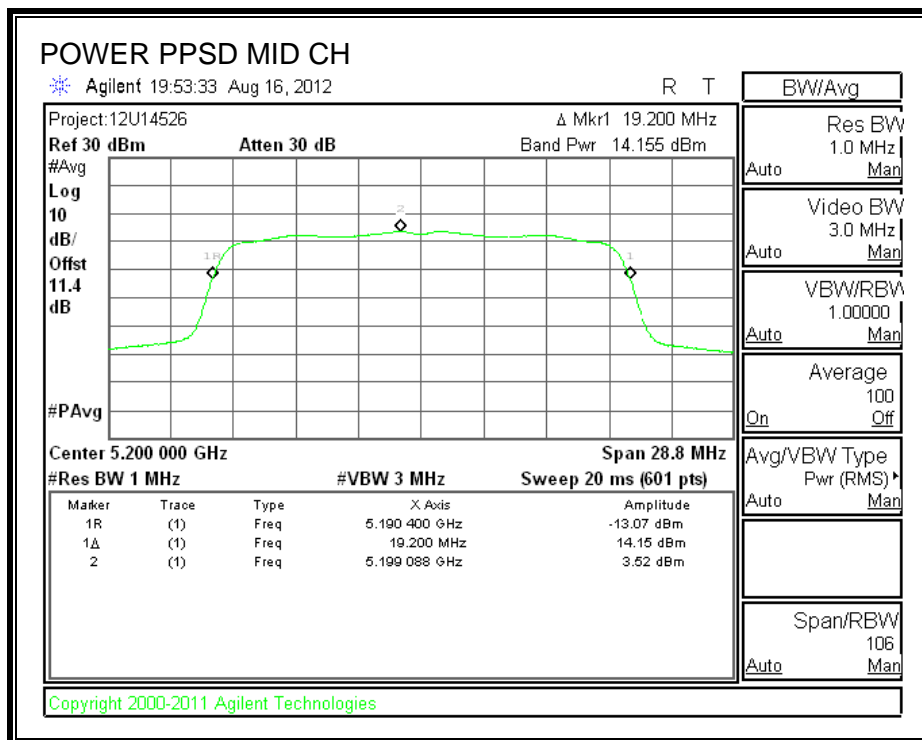
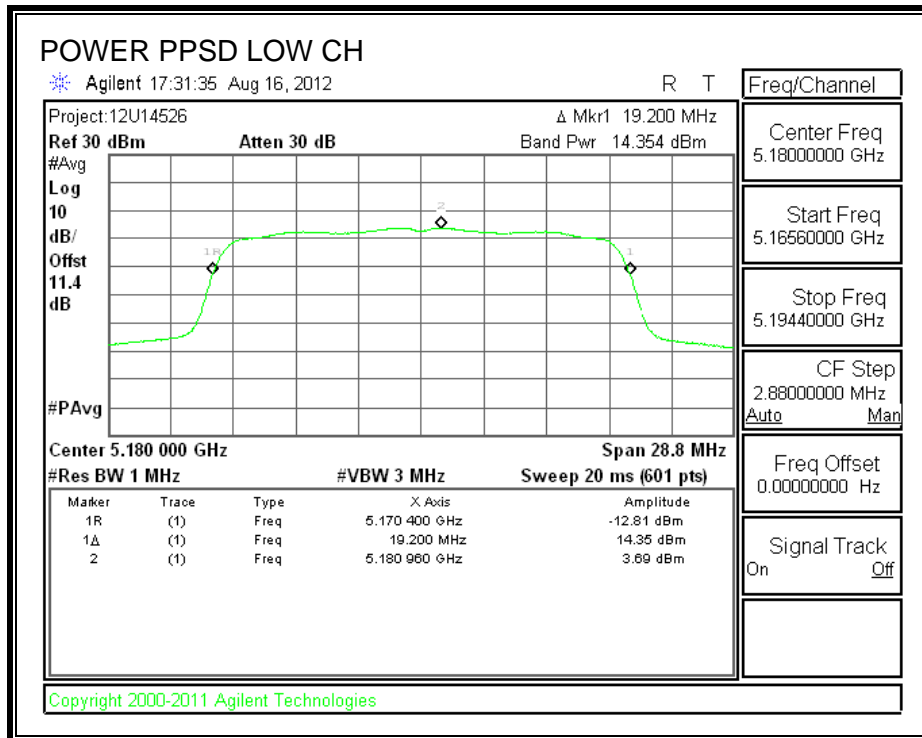
**Output Power Results**

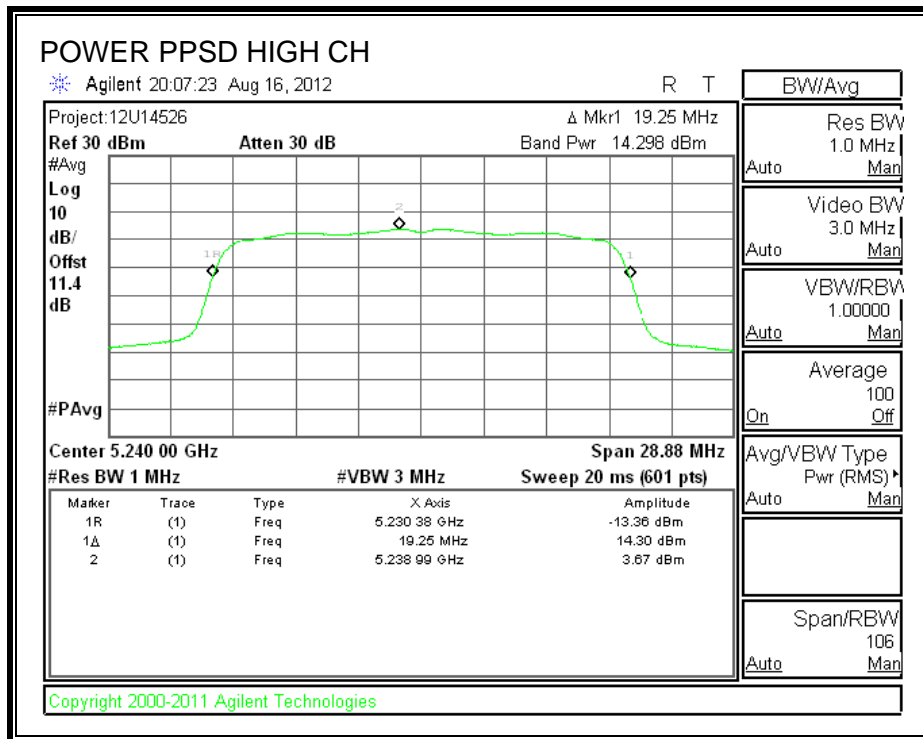
Channel	Frequency (MHz)	Meas Power (dBm)	Corr'd Power (dBm)	Directional Gain (dBi)	Power EIRP Limit (dBm)	Power Margin (dB)
Low	5180	14.354	14.354	4.70	22.4380	-3.3840
Mid	5200	14.155	14.155	4.70	22.4389	-3.5839
High	5240	14.298	14.298	4.70	22.4381	-3.4401

**PPSD Results**

Channel	Frequency (MHz)	Meas PPSD (dBm)	Corr'd PPSD (dBm)	Directional Gain (dBi)	PPSD EIRP Limit (dBm)	PPSD Margin (dB)
Low	5180	3.69	3.69	4.70	10.0000	-1.6100
Mid	5200	3.52	3.52	4.70	10.0000	-1.7800
High	5240	3.67	3.67	4.70	10.0000	-1.6300

**OUTPUT POWER AND PPSD**





## 8.2.5. PEAK EXCURSION

### LIMITS

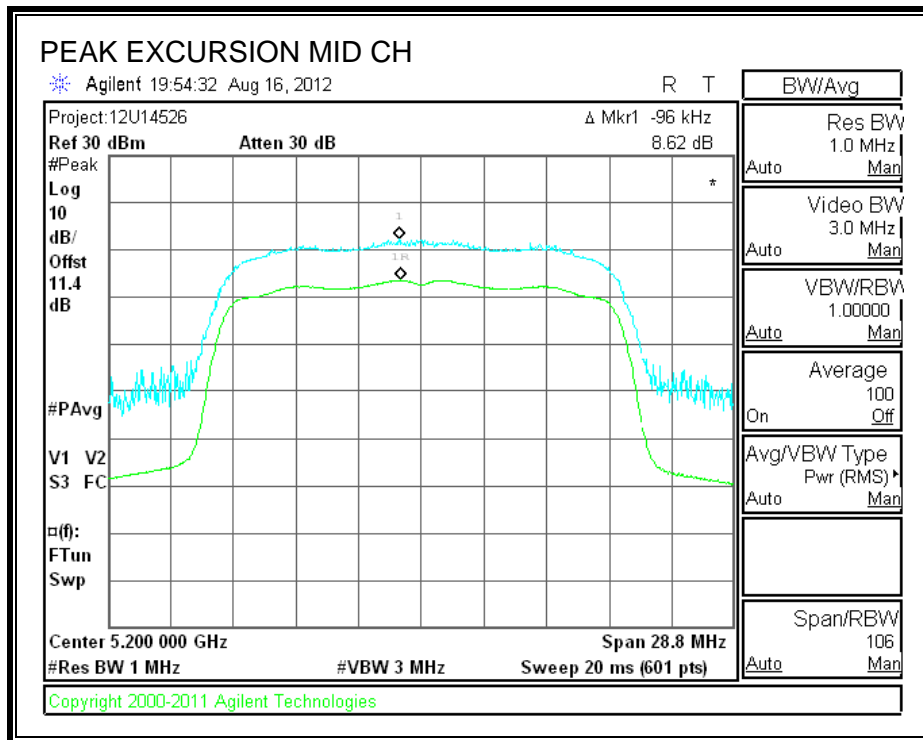
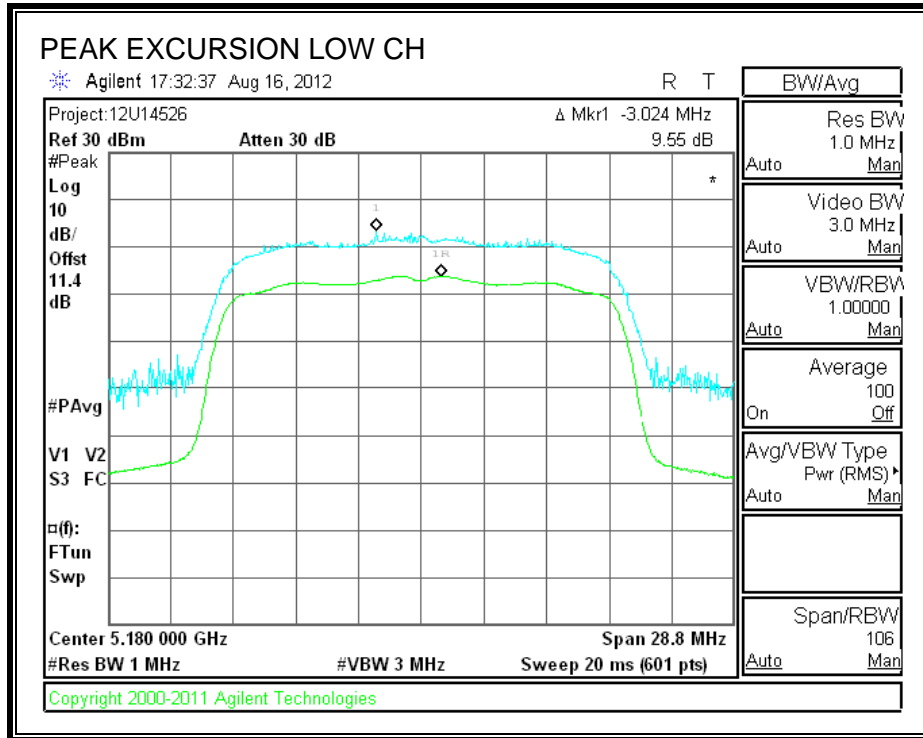
FCC §15.407 (a) (6)

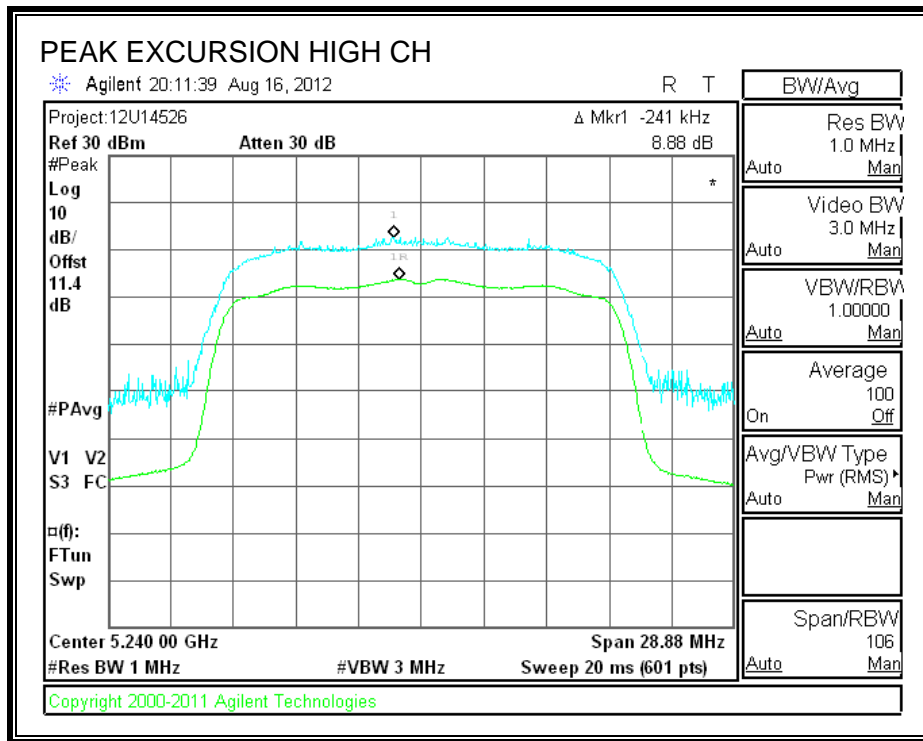
The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

### RESULTS

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	5180	9.55	13	-3.45
Mid	5200	8.62	13	-4.38
High	5240	8.88	13	-4.12

**PEAK EXCURSION**





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

**8.3.1. 26 dB BANDWIDTH**

**LIMITS**

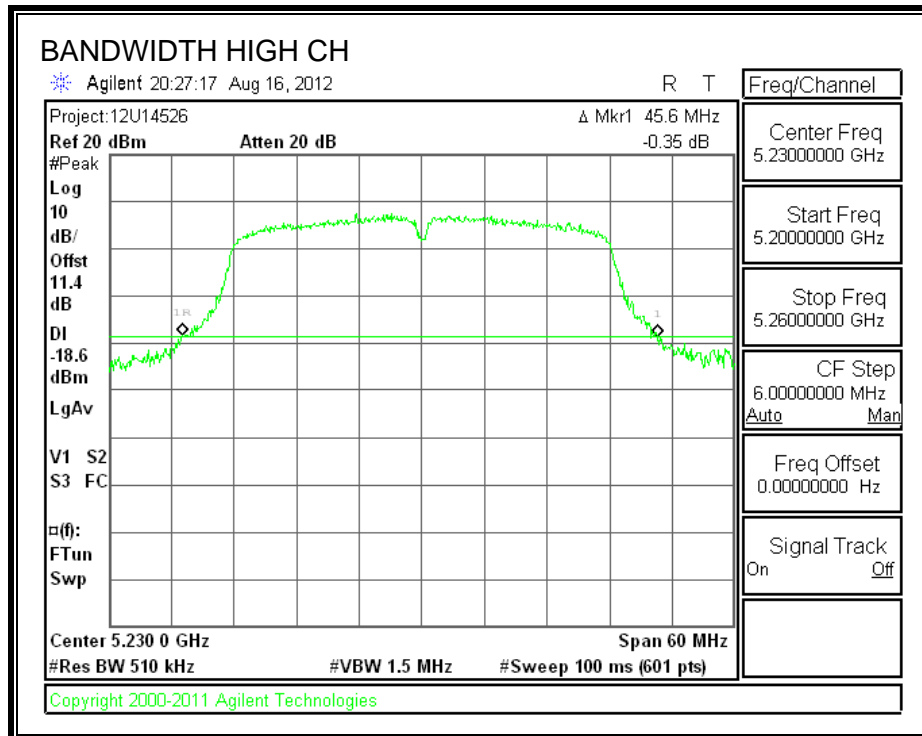
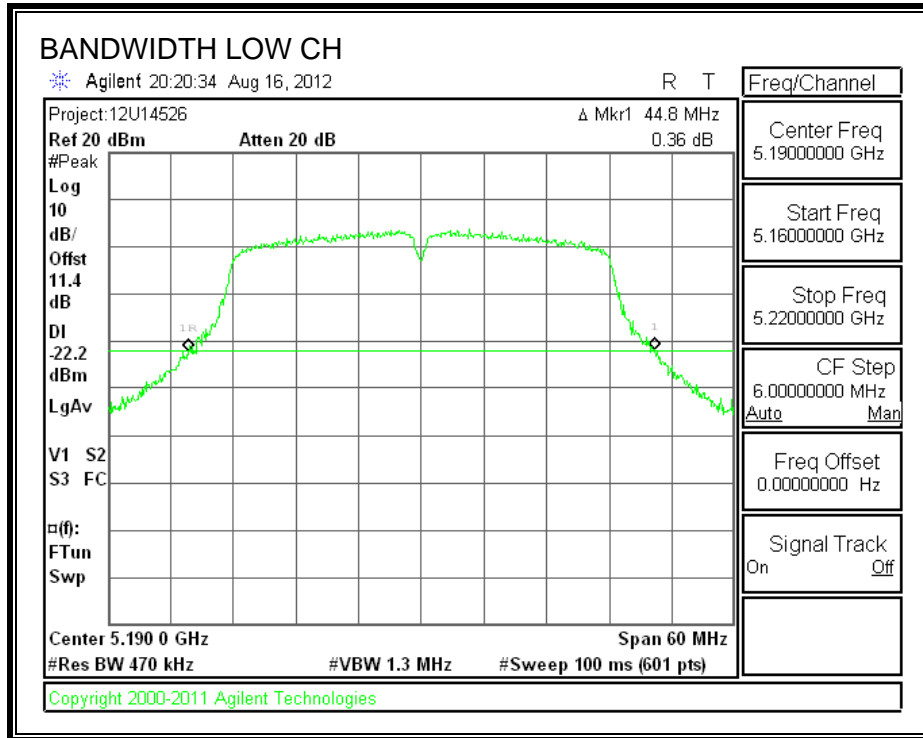
None; for reporting purposes only.

**RESULTS**

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
Low	5190	44.8
High	5230	45.6



**26 dB BANDWIDTH**



**8.3.2. 99% BANDWIDTH**

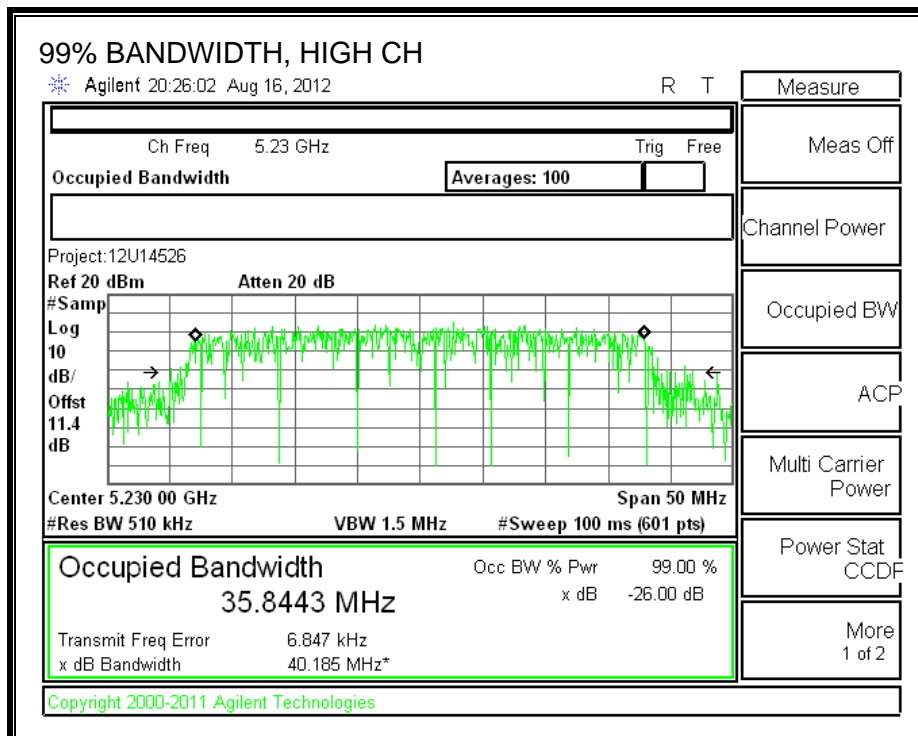
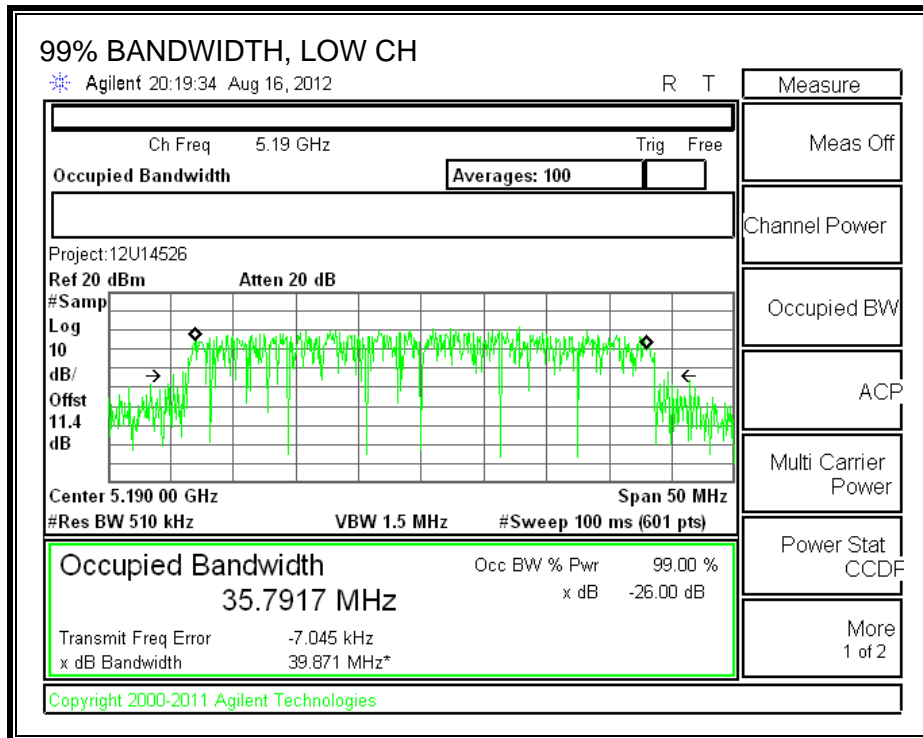
**LIMITS**

None; for reporting purposes only.

**RESULTS**

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5190	35.7917
High	5230	35.8443

**99% BANDWIDTH**



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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 (MHz)	Power (dBm)
Low	5190	11.95
High	5230	15.45

---

### **8.3.4. OUTPUT POWER AND PPSD**

#### **LIMITS**

FCC §15.407 (a) (1)

IC RSS-210 A9.2 (1)

For the band 5.15–5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or  $4 \text{ dBm} + 10 \log B$ , where B is the 26-dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 4 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.

**RESULTS**

**Limits**

Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	4 + 10 Log B Limit (dBm)	Directional Gain (dBi)	Power Limit (dBm)	PPSD Limit (dBm)
Low	5190	17	44.8	20.51	4.70	17.00	4.00
High	5230	17	45.6	20.59	4.70	17.00	4.00

**Output Power Results**

Channel	Frequency (MHz)	Meas Power (dBm)	Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5190	12.279	12.279	17.00	-4.721
High	5230	15.780	15.780	17.00	-1.220

**PPSD Results**

Channel	Frequency (MHz)	Meas PPSD (dBm)	Corr'd PPSD (dBm)	PPSD Limit (dBm)	PPSD Margin (dB)
Low	5190	-1.75	-1.75	4.00	-5.75
High	5230	1.72	1.72	4.00	-2.28

**IC RSS-210 A9.2 (1)**

Channel	Frequency (MHz)	Fixed EIRP Limit (dBm)	B 99% (MHz)	10 + 10 Log B EIRP Limit (dBm)	Directional Gain (dBi)	Power Limit (dBm)	PPSD Limit (dBm)
Low	5190	23	35.7917	25.5378	4.70	23.0000	10.0000
High	5230	23	35.8443	25.5442	4.70	23.0000	10.0000

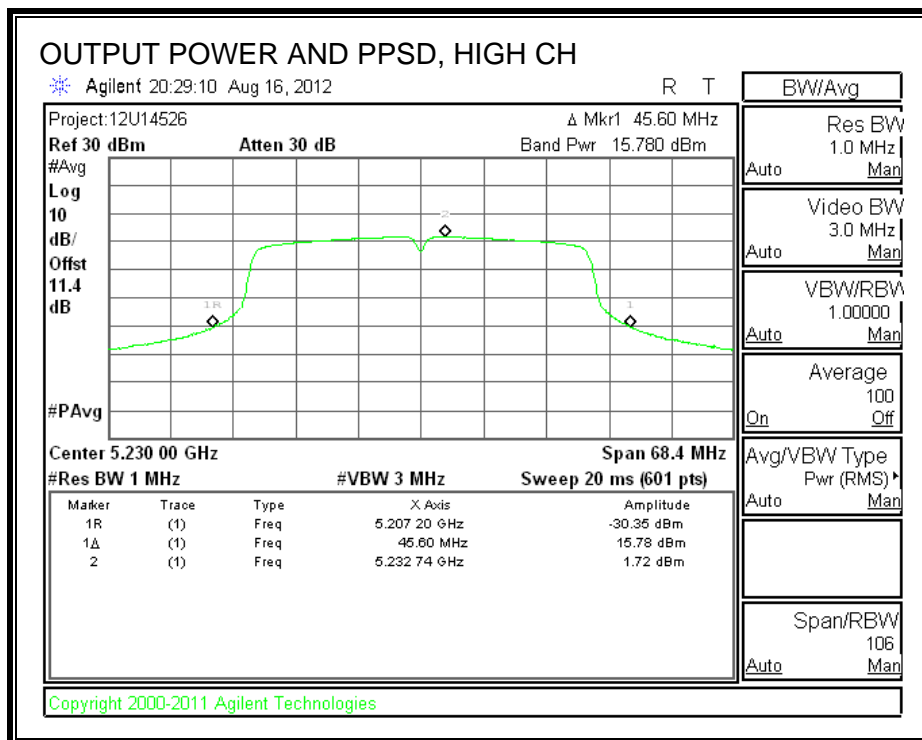
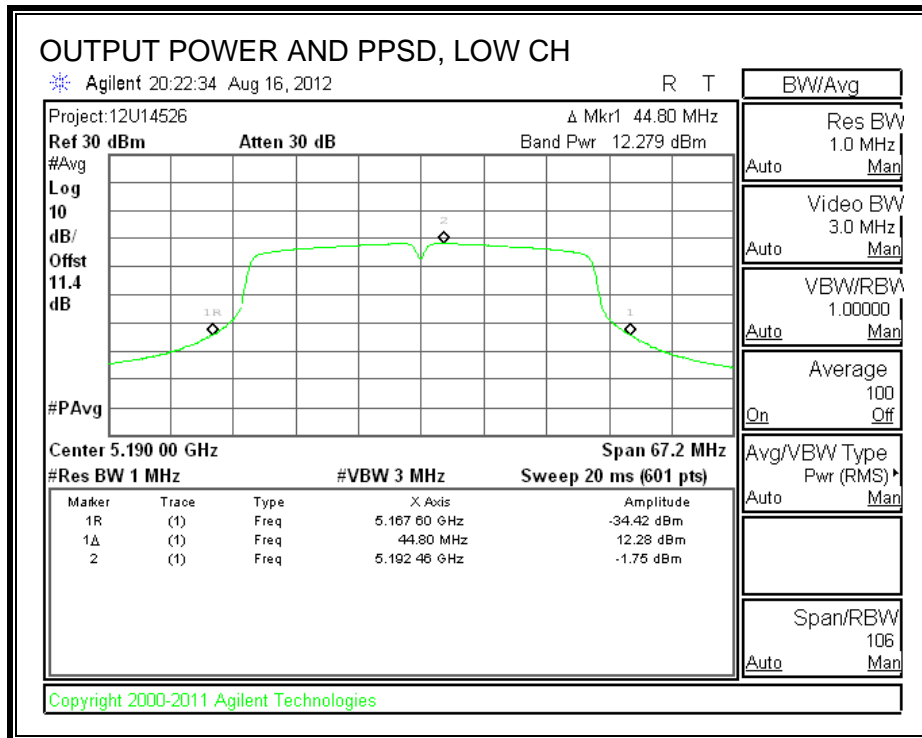
**Output Power Results**

Channel	Frequency (MHz)	Meas Power (dBm)	Corr'd Power (dBm)	Directional Gain (dBi)	Power EIRP Limit (dBm)	Power Margin (dB)
Low	5190	12.280	12.280	4.70	23.0000	-6.0200
High	5230	15.780	15.780	4.70	23.0000	-2.5200

**PPSD Results**

Channel	Frequency (MHz)	Meas PPSD (dBm)	Corr'd PPSD (dBm)	Directional Gain (dBi)	PPSD EIRP Limit (dBm)	PPSD Margin (dB)
Low	5190	-1.75	-1.75	4.70	10.0000	-7.0500
High	5230	1.72	1.72	4.70	10.0000	-3.5800

**OUTPUT POWER AND PPSD**





### 8.3.5. PEAK EXCURSION

#### LIMITS

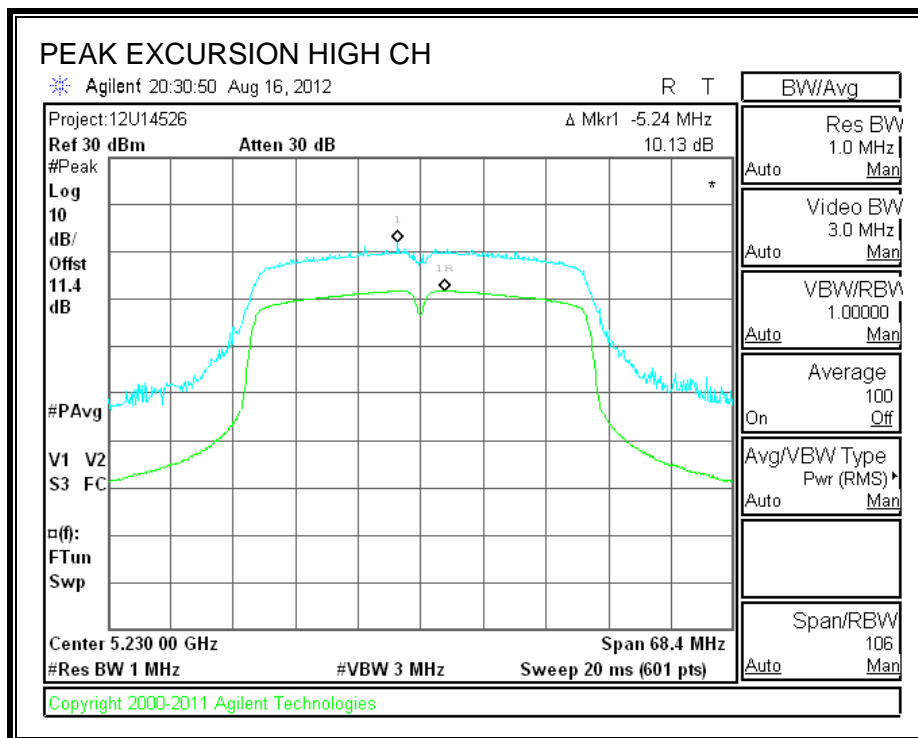
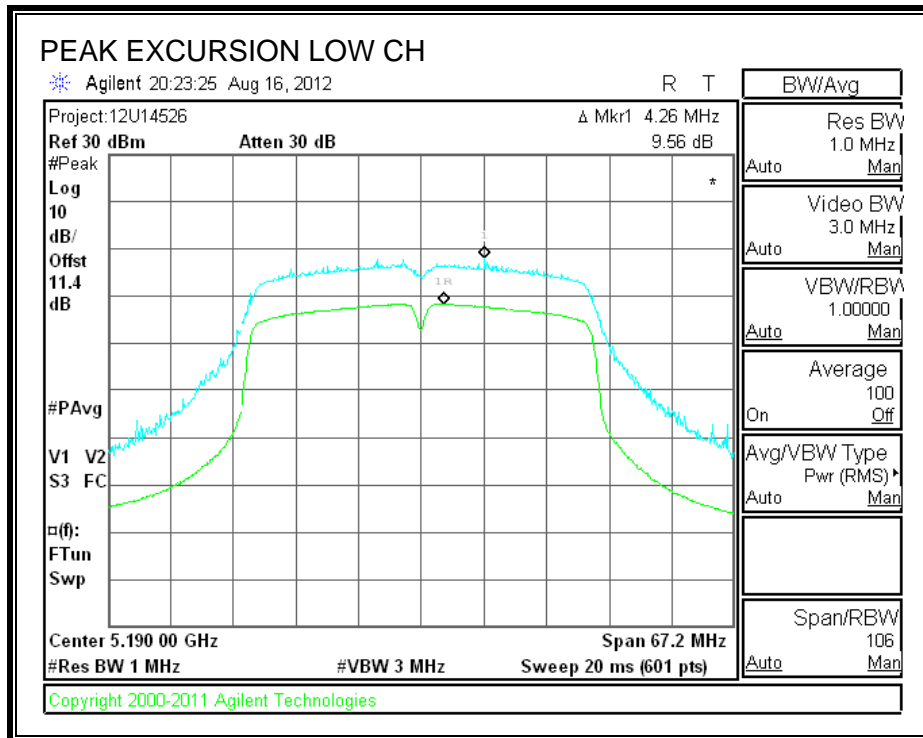
FCC §15.407 (a) (6)

The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

#### RESULTS

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	5190	9.56	13	-3.44
High	5230	10.13	13	-2.87

**PEAK EXCURSION**



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## 8.4. 802.11a MODE IN THE 5.3 GHz BAND

### 8.4.1. 26 dB BANDWIDTH

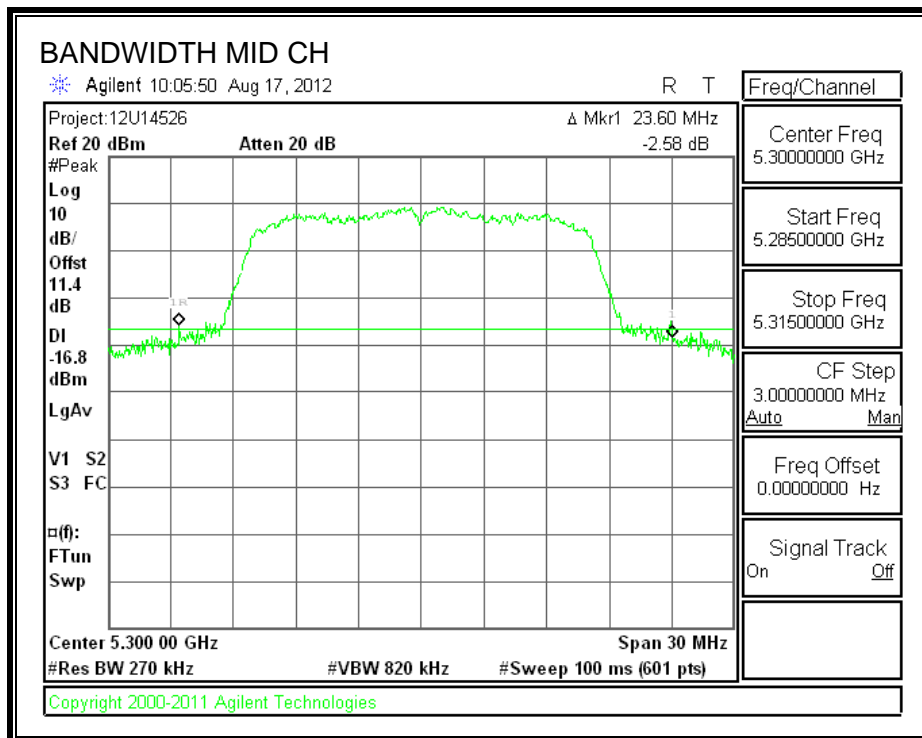
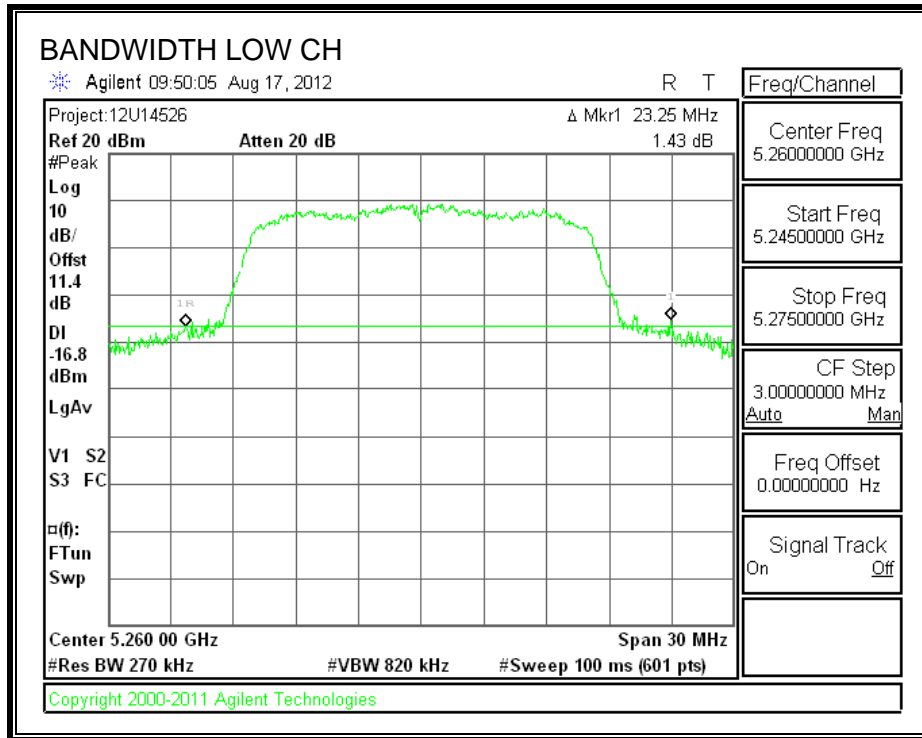
#### LIMITS

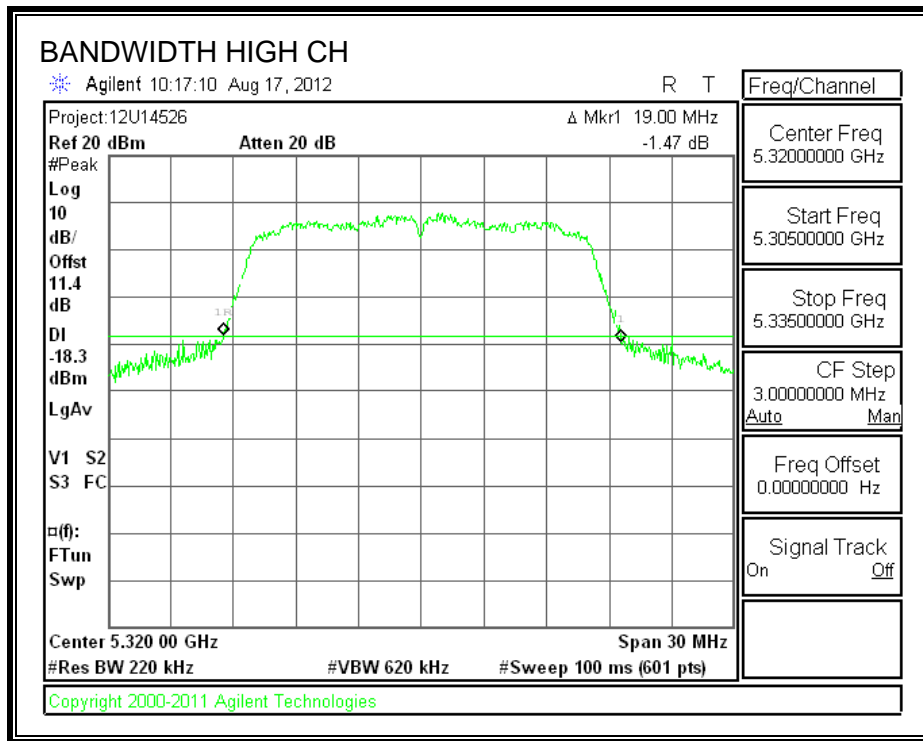
None; for reporting purposes only.

#### RESULTS

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
Low	5260	23.25
Mid	5300	23.60
High	5320	19.00

**26 dB BANDWIDTH**





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### 8.4.2. 99% BANDWIDTH

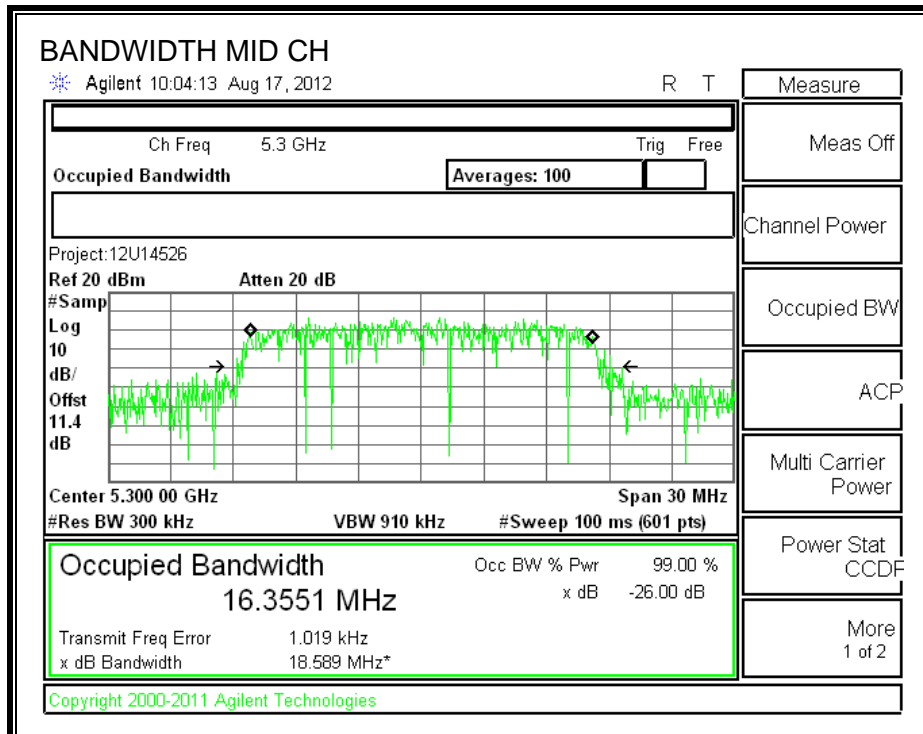
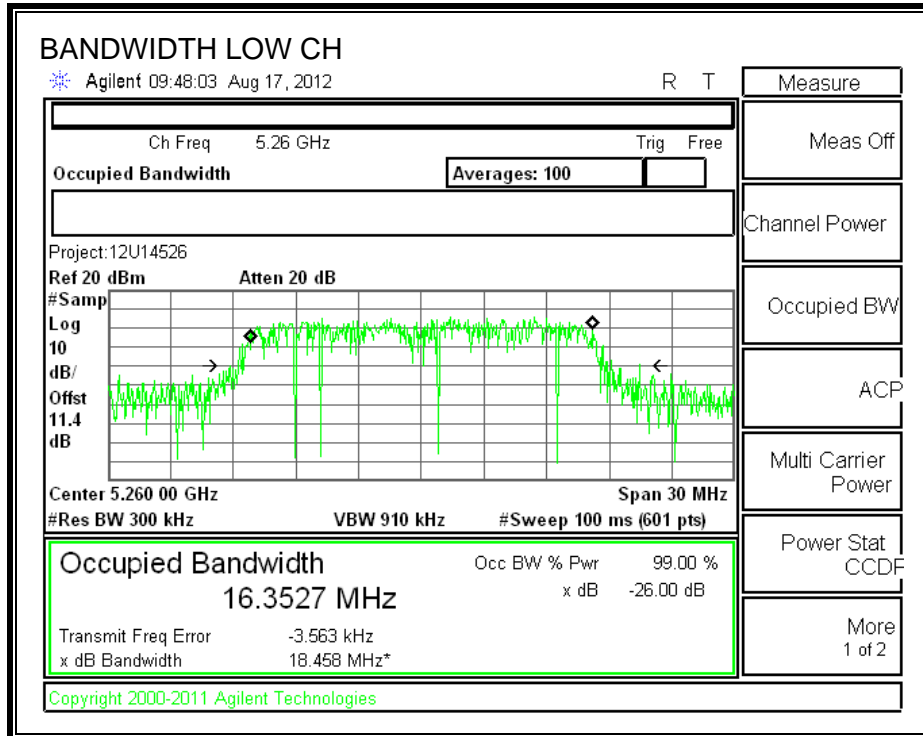
#### LIMITS

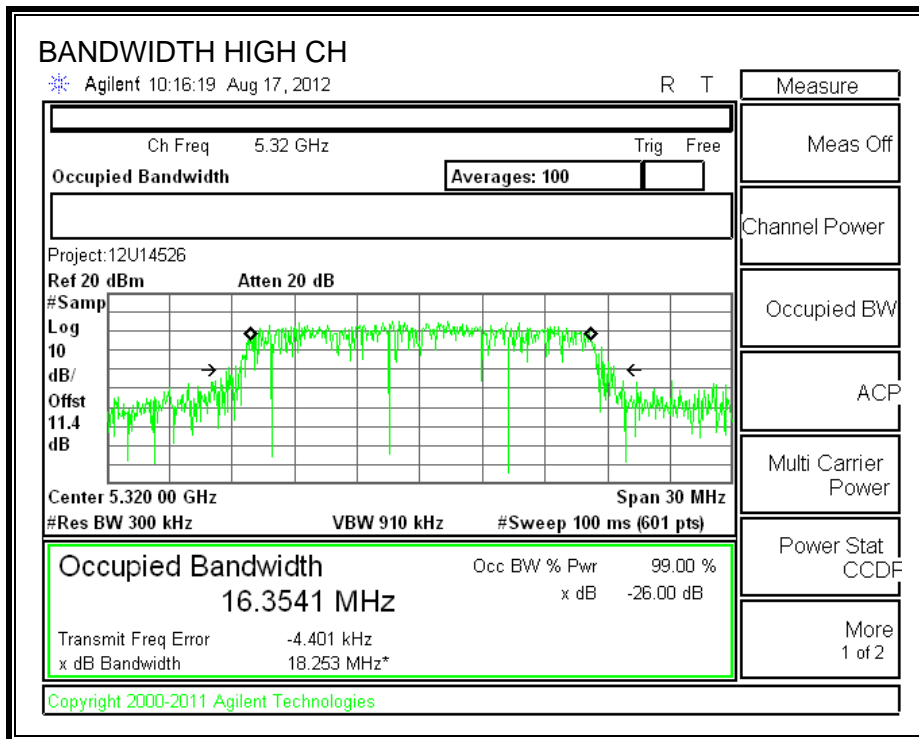
None; for reporting purposes only.

#### RESULTS

Frequency (MHz)	99% Bandwidth (MHz)
5260	16.3527
5300	16.3551
5320	16.3541

**99% BANDWIDTH**







### **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 (MHz)	Power (dBm)
Low	5260	16.90
Mid	5300	16.87
High	5320	15.97

---

#### **8.4.4. OUTPUT POWER AND PPSD**

##### **LIMITS**

FCC §15.407 (a) (2)

IC RSS-210 A9.2 (2)

For the 5.25–5.35 GHz and 5.47–5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or  $11 \text{ dBm} + 10 \log B$ , where B is the 26 dB emission bandwidth in megahertz. In addition, the peak 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 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.

**RESULTS**

**Limits**

Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	11 + 10 Log B Limit (dBm)	Directional Gain (dBi)	Power Limit (dBm)	PPSD Limit (dBm)
Low	5260	24	16.3527	23.14	5.08	23.14	11.00
Mid	5300	24	16.3551	23.14	5.08	23.14	11.00
High	5320	24	16.3541	23.14	5.08	23.14	11.00

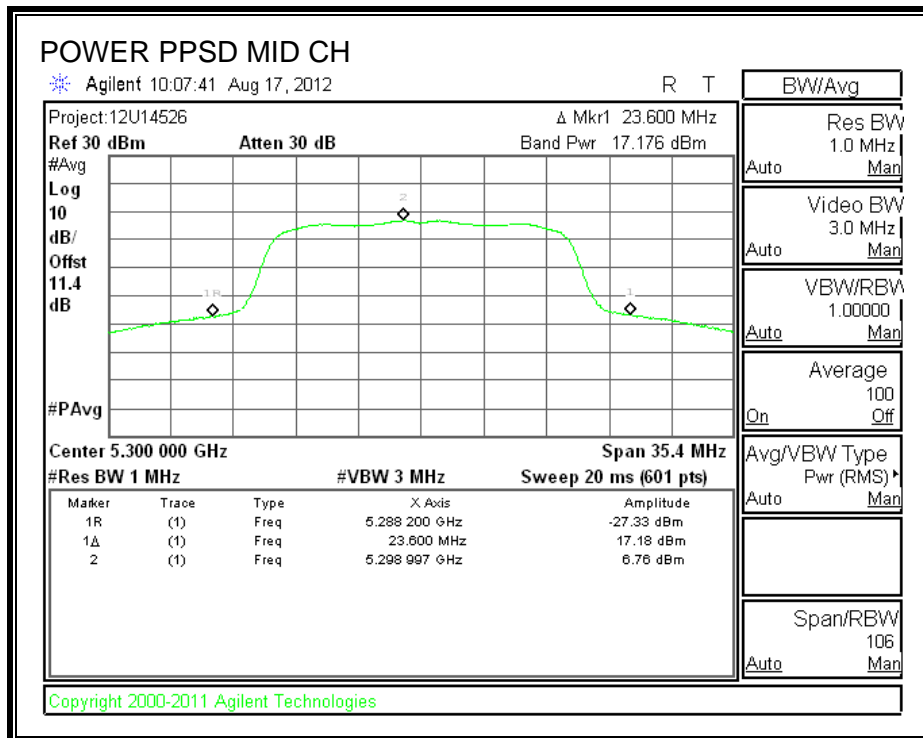
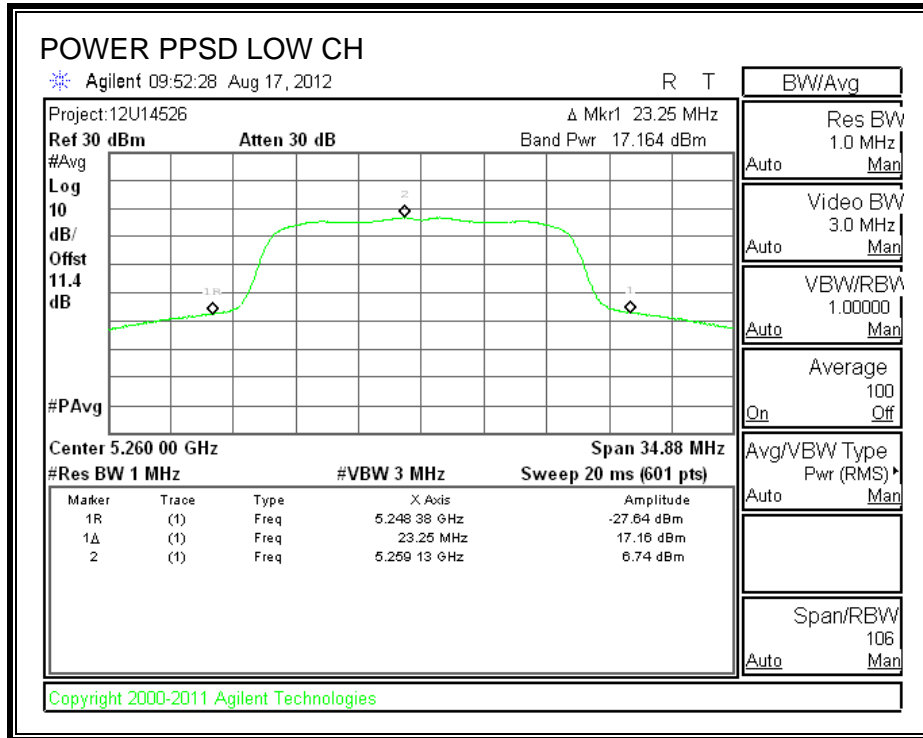
**Output Power Results**

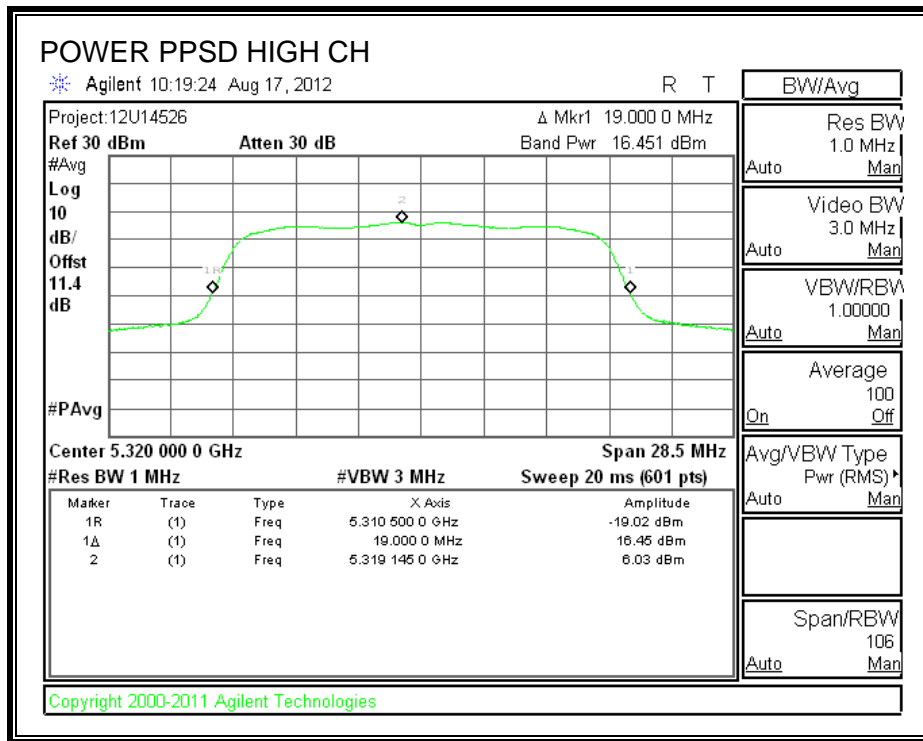
Channel	Frequency (MHz)	Meas Power (dBm)	Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5260	17.164	17.164	23.14	-5.972
Mid	5300	17.176	17.176	23.14	-5.961
High	5320	16.451	16.451	23.14	-6.685

**PPSD Results**

Channel	Frequency (MHz)	Meas PPSD (dBm)	Corr'd PPSD (dBm)	PPSD Limit (dBm)	PPSD Margin (dB)
Low	5260	6.74	6.74	11.00	-4.26
Mid	5300	6.76	6.76	11.00	-4.24
High	5320	6.03	6.03	11.00	-4.97

**OUTPUT POWER AND PPSD**





### 8.4.5. PEAK EXCURSION

#### LIMITS

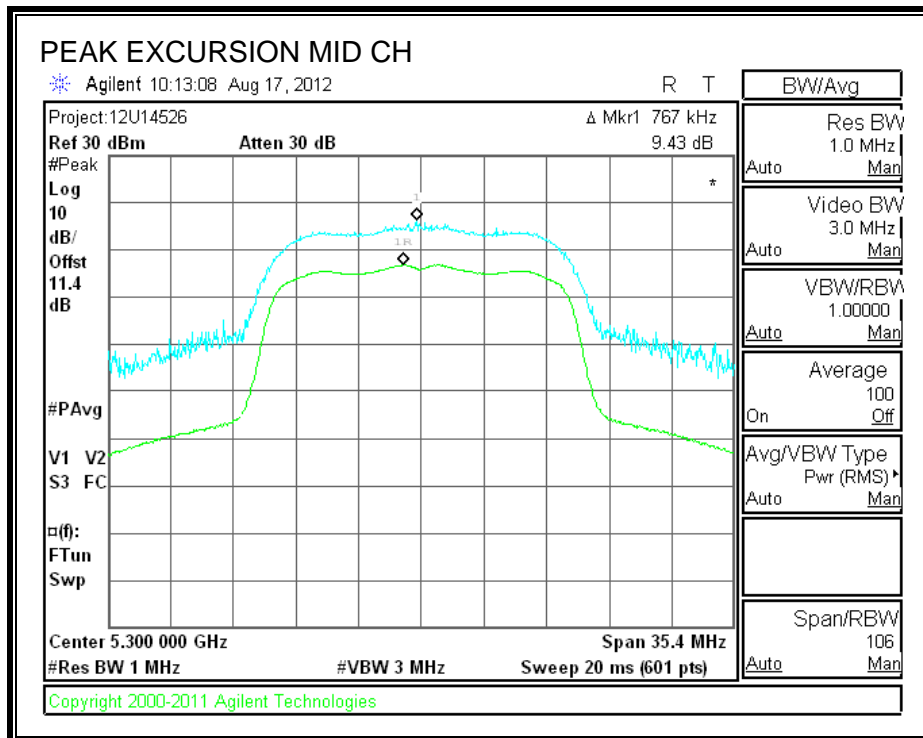
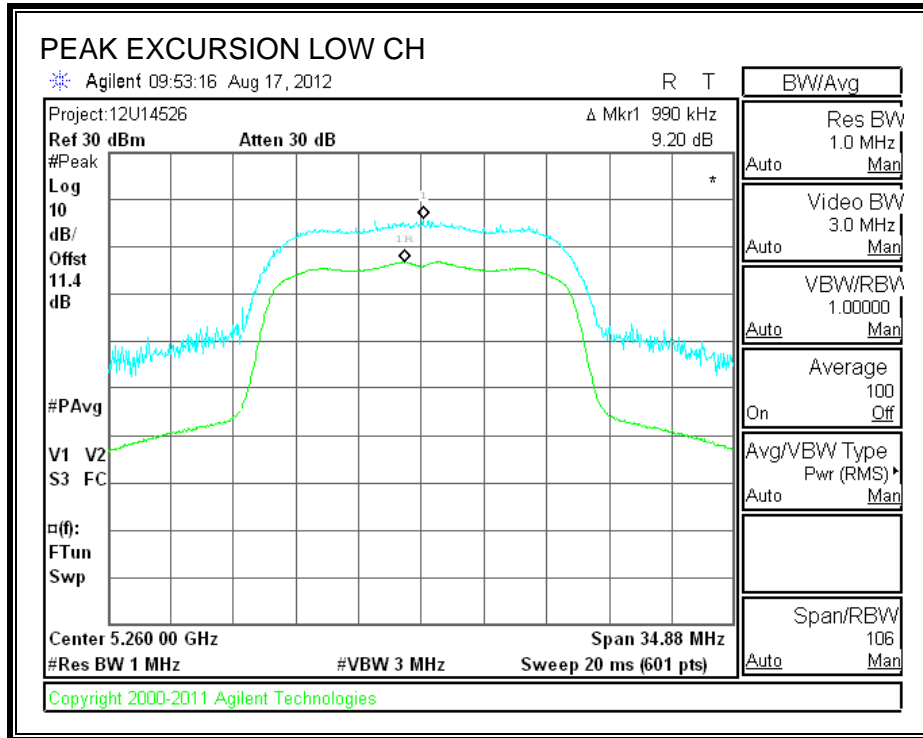
FCC §15.407 (a) (6)

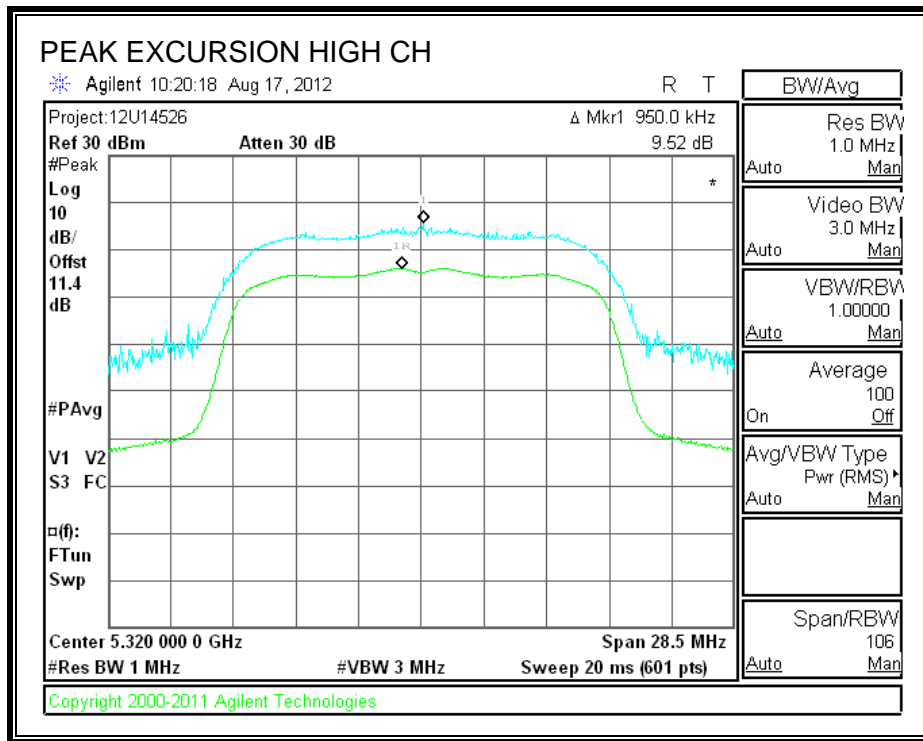
The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

#### RESULTS

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	5260	9.20	13	-3.80
Mid	5300	9.43	13	-3.57
High	5320	9.52	13	-3.48

**PEAK EXCURSION**







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

**8.5.1. 26 dB BANDWIDTH**

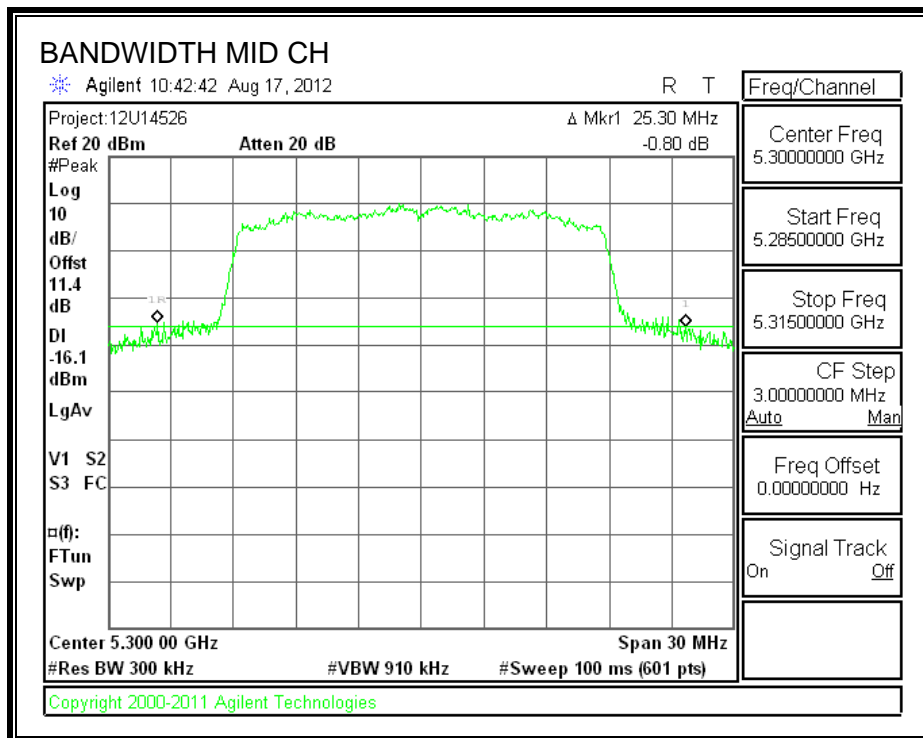
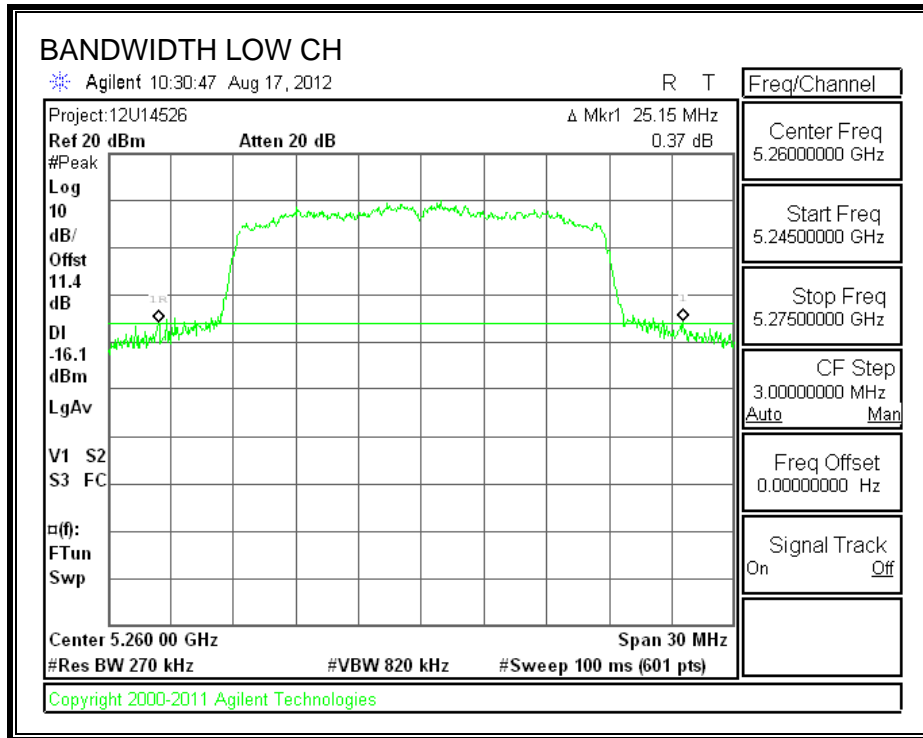
**LIMITS**

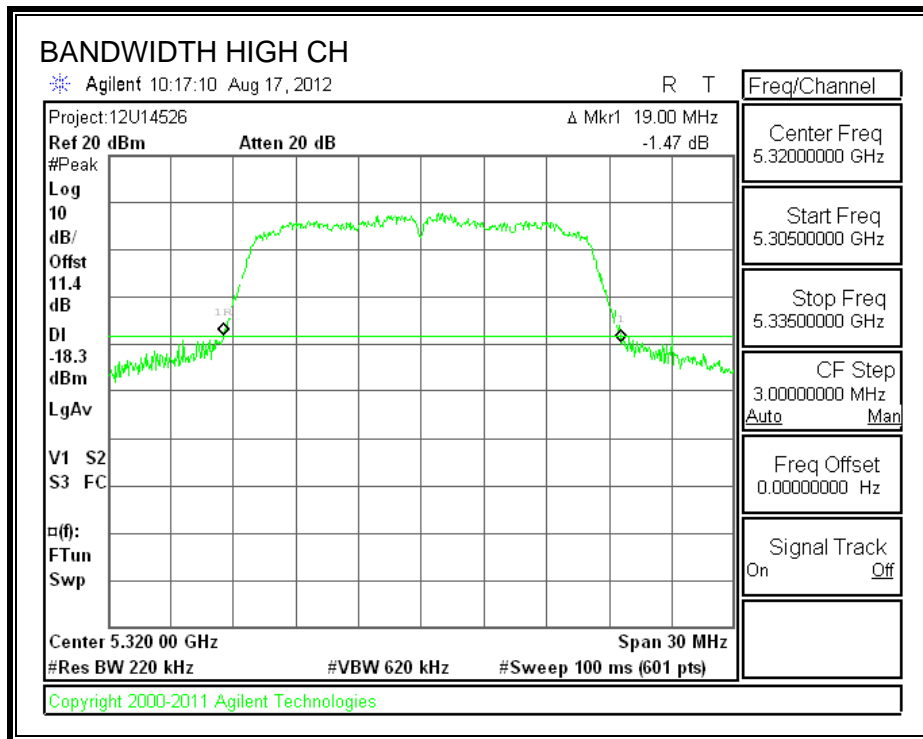
None; for reporting purposes only.

**RESULTS**

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
Low	5260	25.15
Mid	5300	25.30
High	5320	19.60

**26 dB BANDWIDTH**





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### 8.5.2. 99% BANDWIDTH

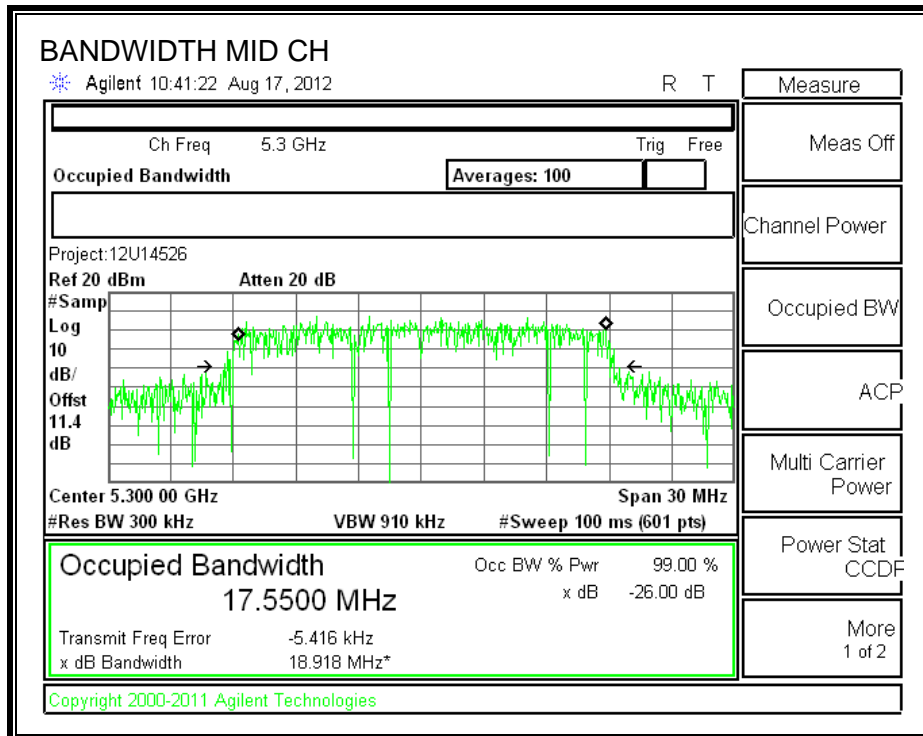
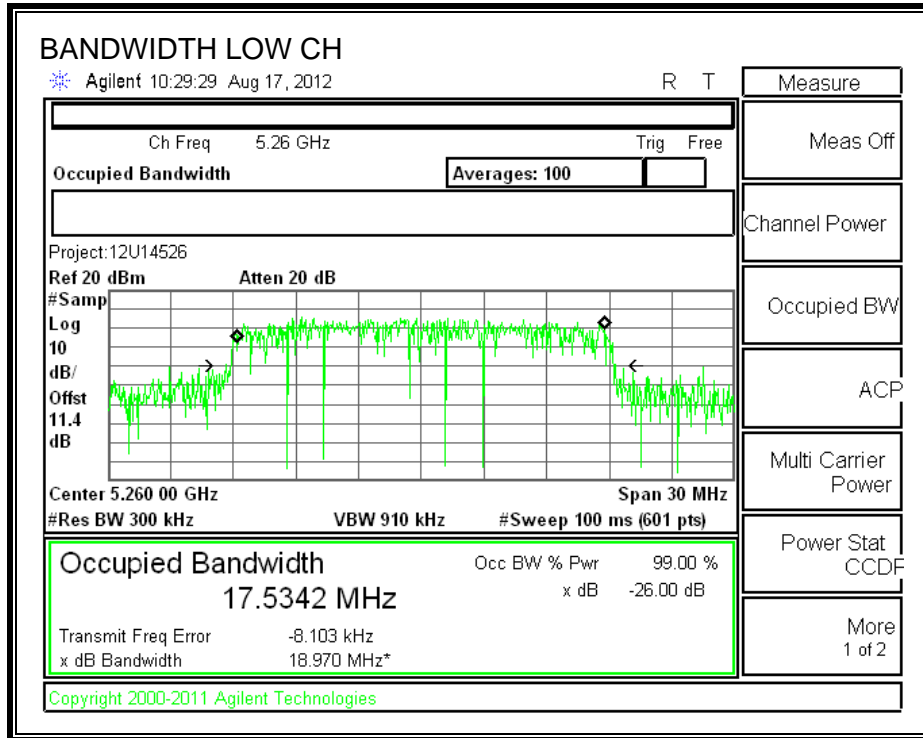
#### LIMITS

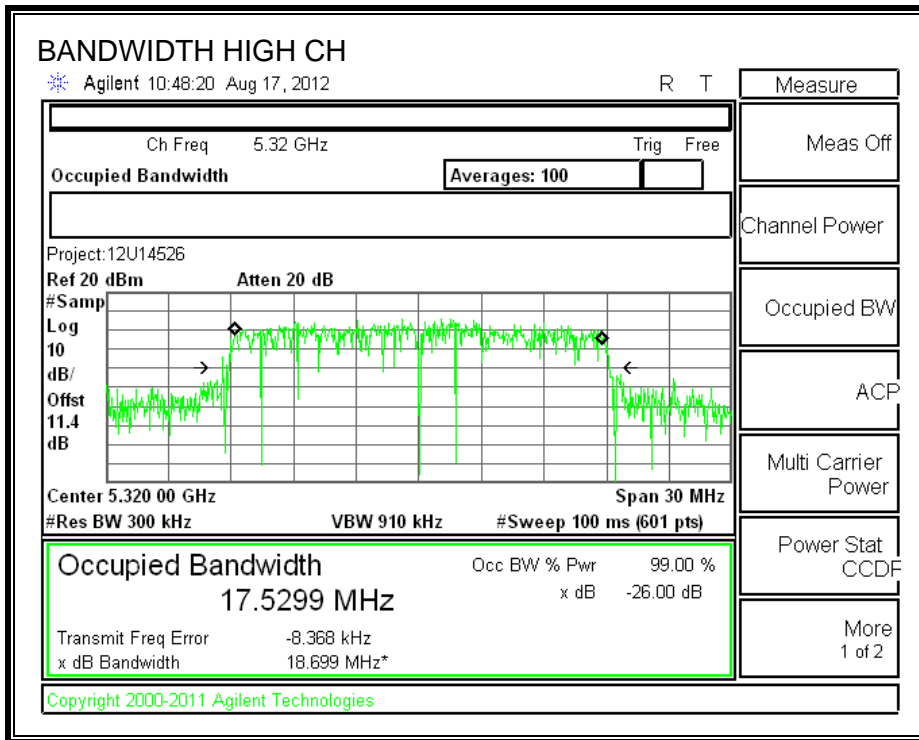
None; for reporting purposes only.

#### RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5260	17.5342
Mid	5300	17.5500
High	5320	17.5299

**99% BANDWIDTH**





### **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 (MHz)	Power (dBm)
Low	5260	16.91
Mid	5300	16.90
High	5320	15.91

---

## 8.5.4. OUTPUT POWER AND PPSD

### LIMITS

FCC §15.407 (a) (2)

IC RSS-210 A9.2 (2)

For the 5.25–5.35 GHz and 5.47–5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or  $11 \text{ dBm} + 10 \log B$ , where B is the 26 dB emission bandwidth in megahertz. In addition, the peak 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 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.



**RESULTS**

**Limits**

Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	11 + 10 Log B Limit (dBm)	Directional Gain (dBi)	Power Limit (dBm)	PPSD Limit (dBm)
Low	5260	24	17.5342	23.44	5.08	23.44	11.00
Mid	5300	24	17.5500	23.44	5.08	23.44	11.00
High	5320	24	17.5299	23.44	5.08	23.44	11.00

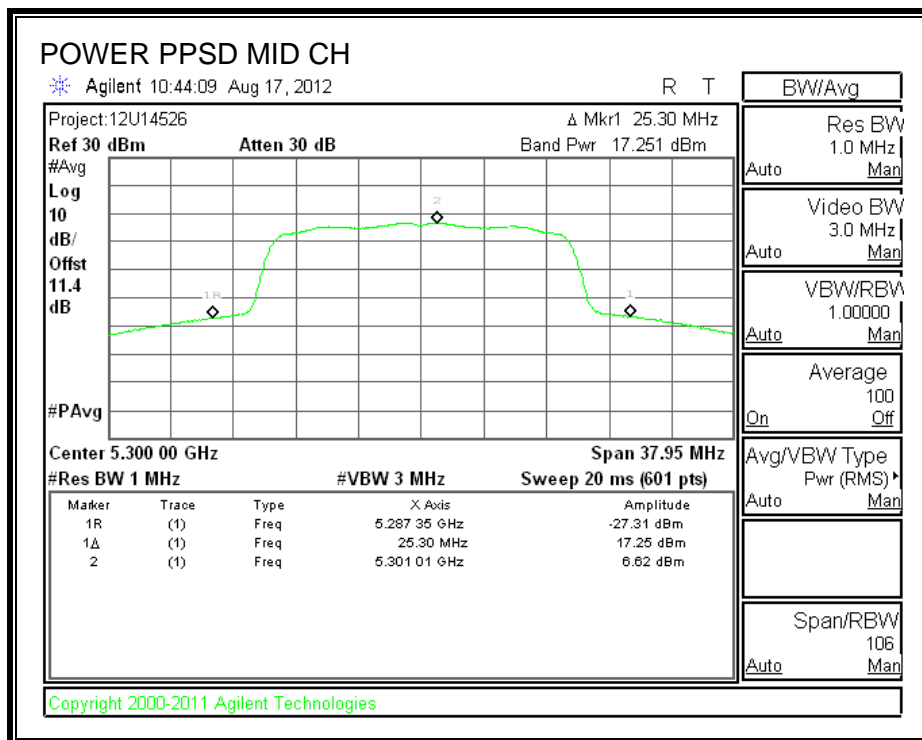
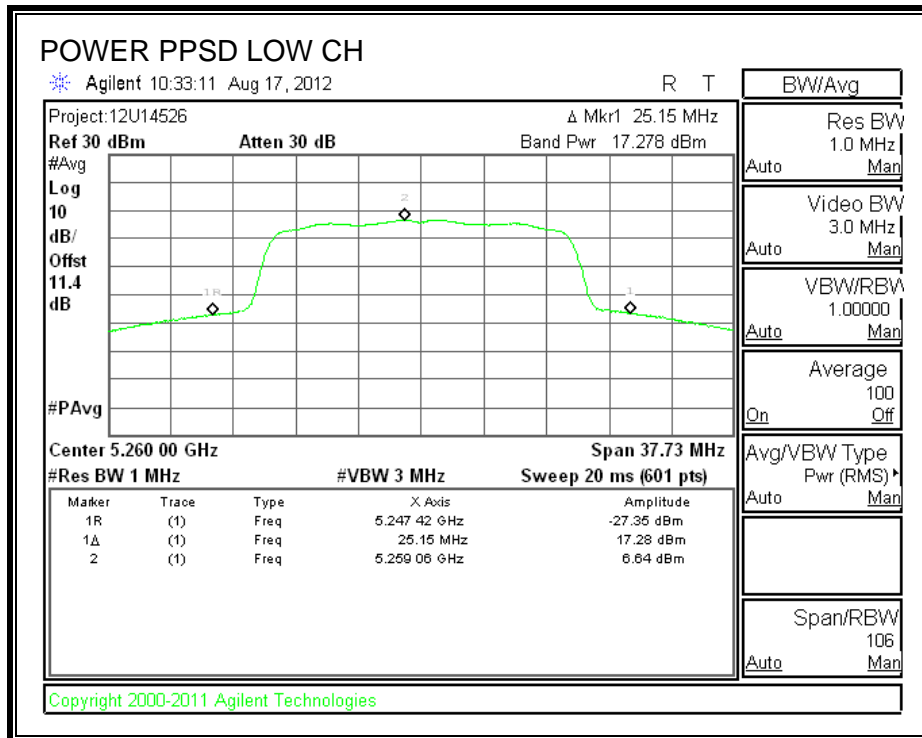
**Output Power Results**

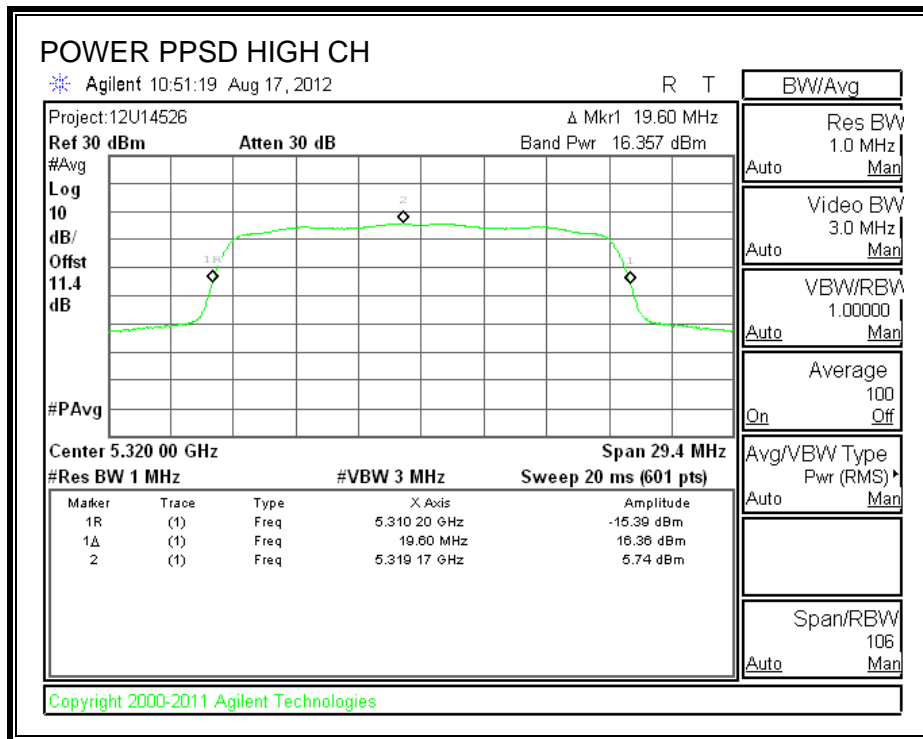
Channel	Frequency (MHz)	Meas Power (dBm)	Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5260	17.278	17.278	23.44	-6.161
Mid	5300	17.251	17.251	23.44	-6.192
High	5320	16.357	16.357	23.44	-7.081

**PPSD Results**

Channel	Frequency (MHz)	Meas PPSD (dBm)	Corr'd PPSD (dBm)	PPSD Limit (dBm)	PPSD Margin (dB)
Low	5260	6.64	6.64	11.00	-4.36
Mid	5300	6.62	6.62	11.00	-4.38
High	5320	5.74	5.74	11.00	-5.26

**OUTPUT POWER AND PPSD**





### 8.5.5. PEAK EXCURSION

#### LIMITS

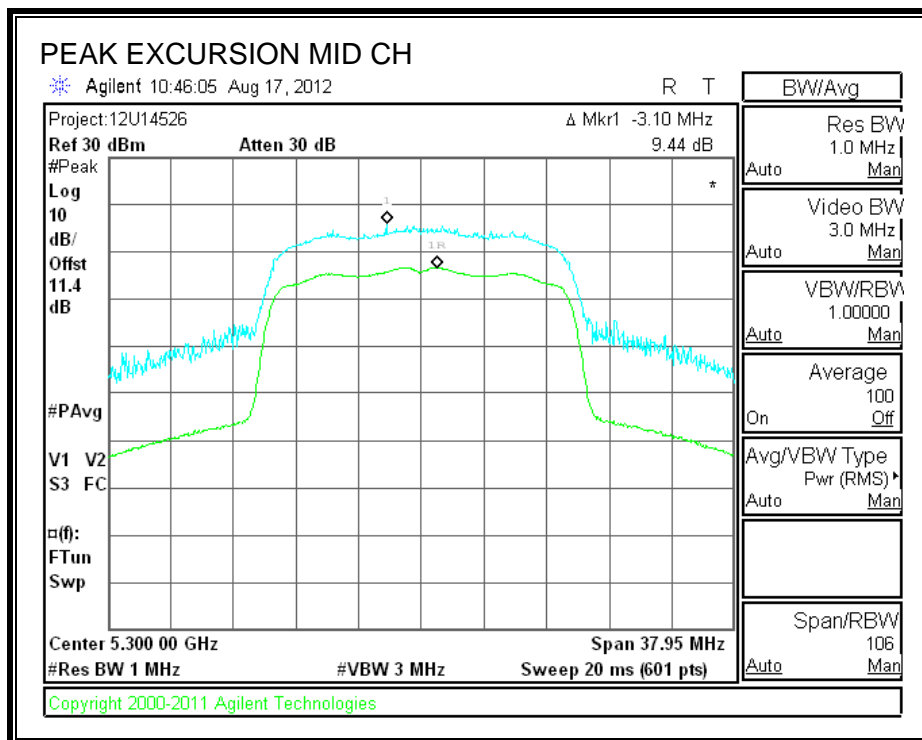
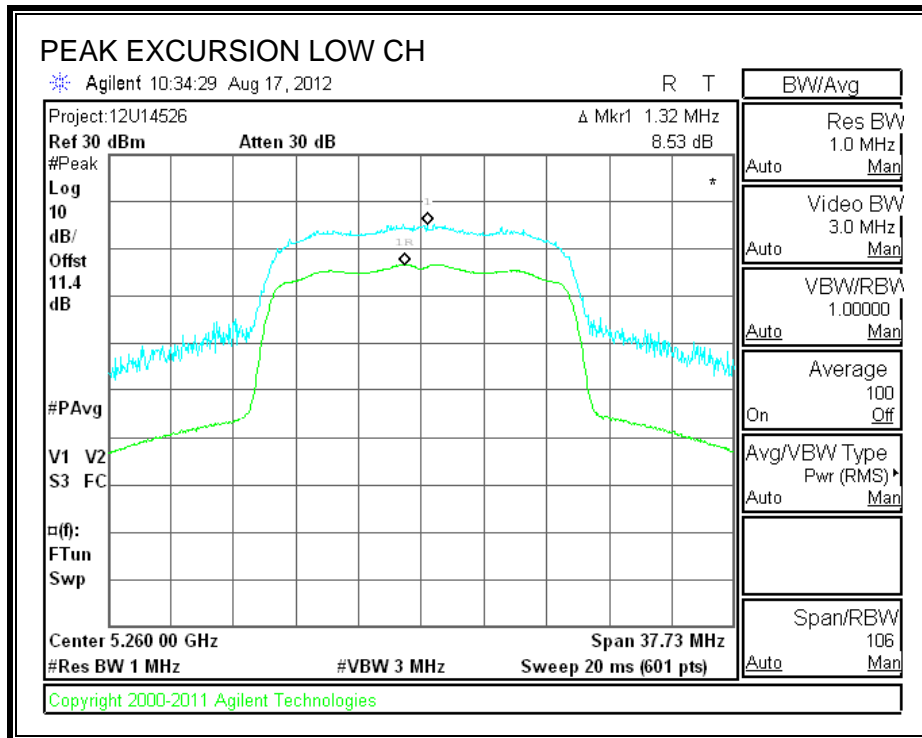
FCC §15.407 (a) (6)

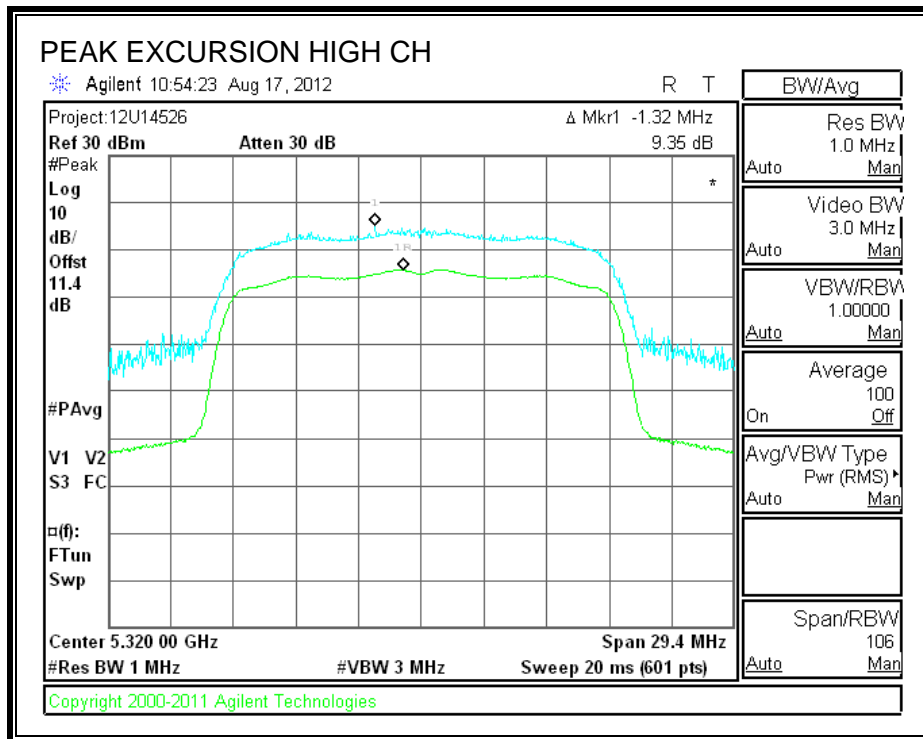
The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

#### RESULTS

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	5260	8.53	13	-4.47
Mid	5300	9.44	13	-3.56
High	5320	9.35	13	-3.65

**PEAK EXCURSION**





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

**8.6.1. 26 dB BANDWIDTH**

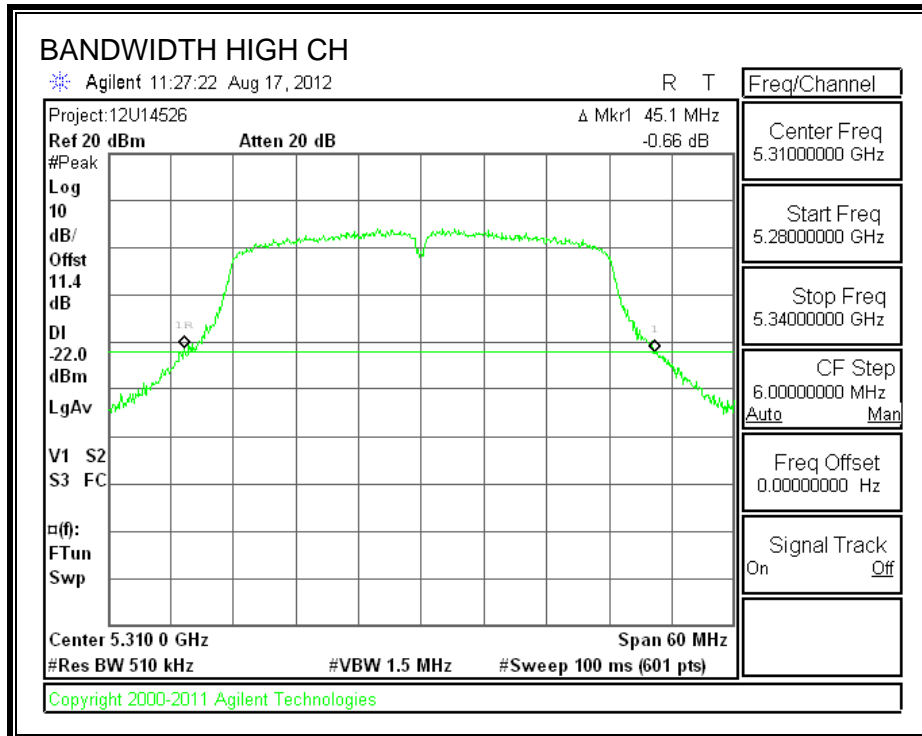
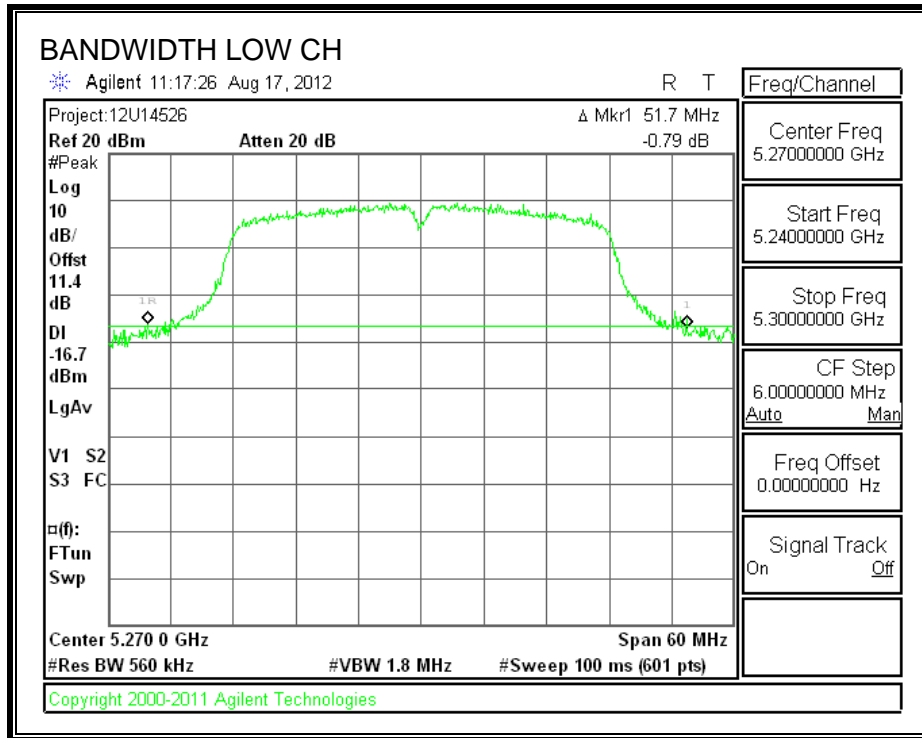
**LIMITS**

None; for reporting purposes only.

**RESULTS**

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
Low	5270	51.70
High	5310	45.10

**26 dB BANDWIDTH**





**8.6.2. 99% BANDWIDTH**

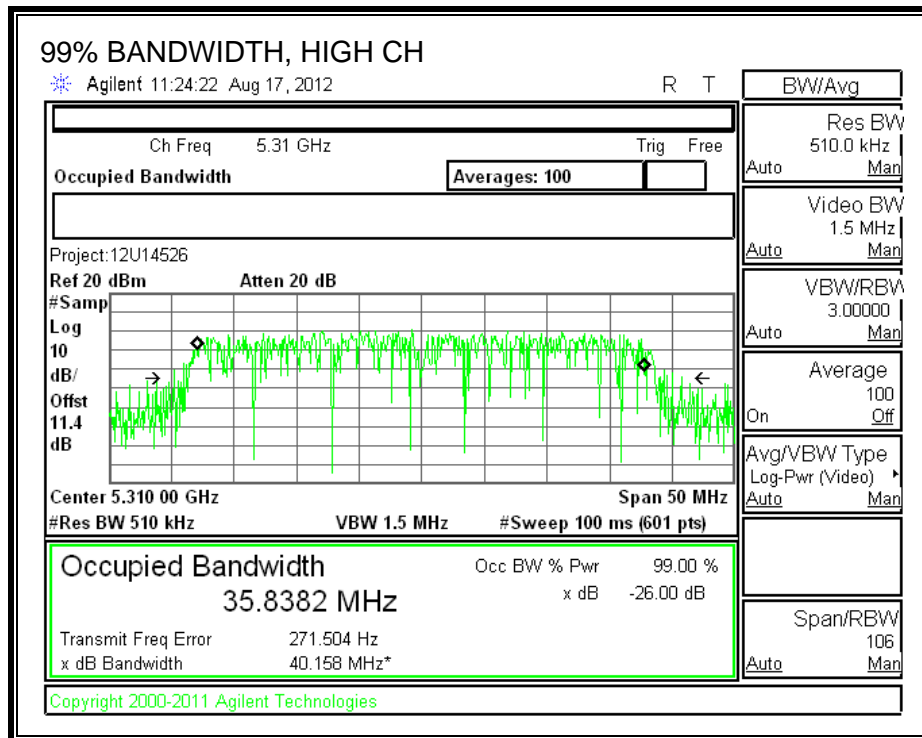
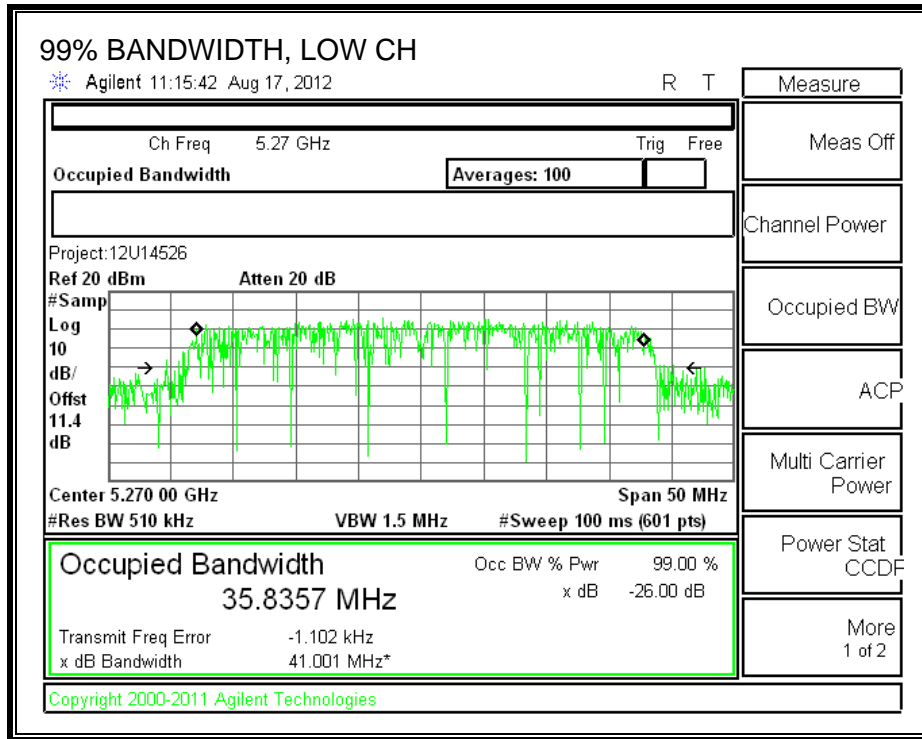
**LIMITS**

None; for reporting purposes only.

**RESULTS**

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5270	35.8357
High	5310	35.8382

**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 11.4 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 (MHz)	Power (dBm)
Low	5270	17.0
High	5310	11.9

---

## **8.6.4. OUTPUT POWER AND PPSD**

### **LIMITS**

FCC §15.407 (a) (2)

IC RSS-210 A9.2 (2)

For the 5.25–5.35 GHz and 5.47–5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or  $11 \text{ dBm} + 10 \log B$ , where B is the 26 dB emission bandwidth in megahertz. In addition, the peak 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 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.

**RESULTS**

**Limits**

Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	11 + 10 Log B Limit (dBm)	Directional Gain (dBi)	Power Limit (dBm)	PPSD Limit (dBm)
Low	5270	24	35.8357	26.54	5.08	24.00	11.00
High	5310	24	35.8380	26.54	5.08	24.00	11.00

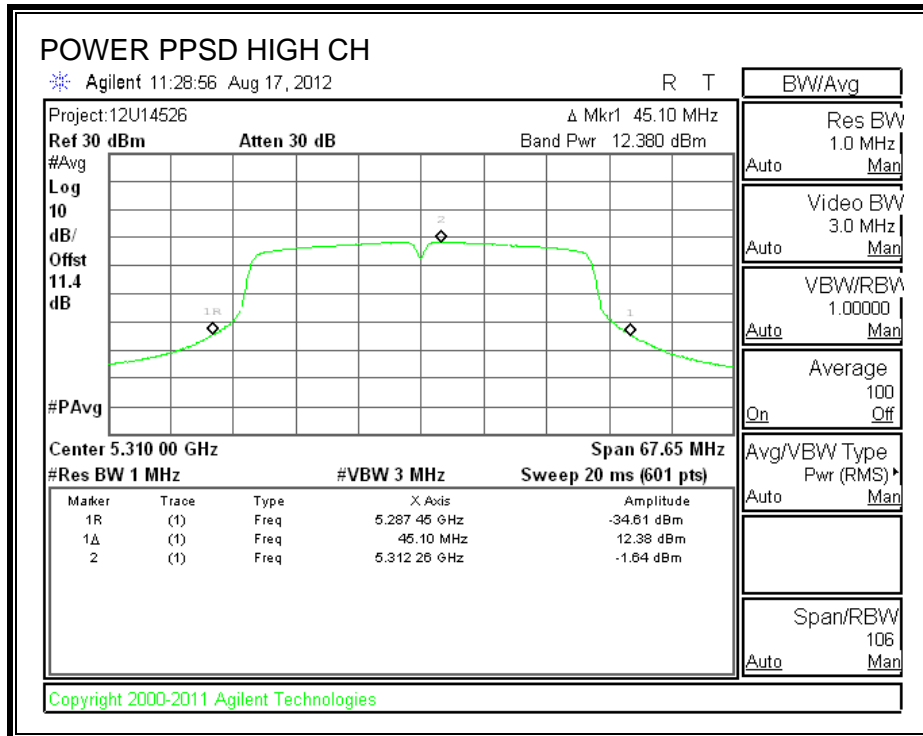
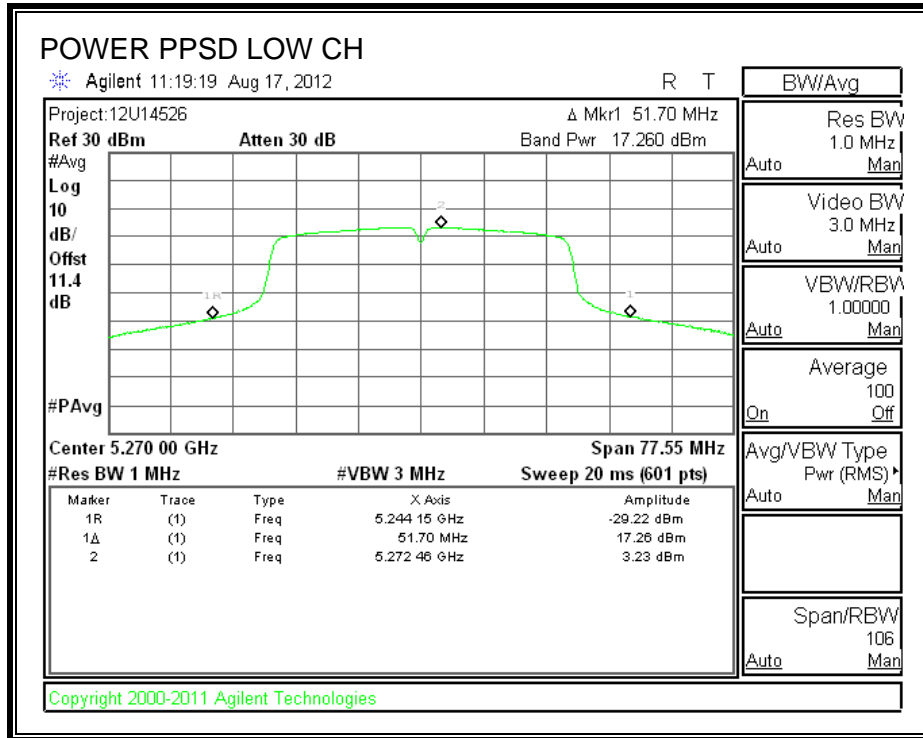
**Output Power Results**

Channel	Frequency (MHz)	Meas Power (dBm)	Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5270	17.260	17.260	24.00	-6.740
High	5310	12.380	12.380	24.00	-11.620

**PPSD Results**

Channel	Frequency (MHz)	Meas PPSD (dBm)	Corr'd PPSD (dBm)	PPSD Limit (dBm)	PPSD Margin (dB)
Low	5270	3.29	3.29	11.00	-7.71
High	5310	-1.64	-1.64	11.00	-12.64

**OUTPUT POWER AND PPSD**



### 8.6.5. PEAK EXCURSION

#### LIMITS

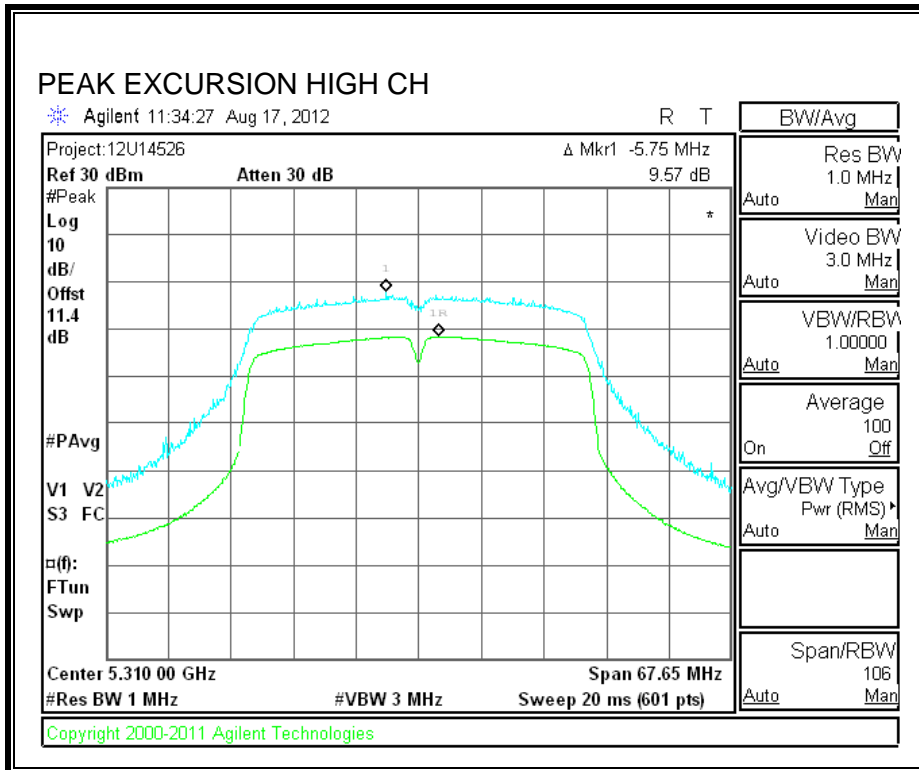
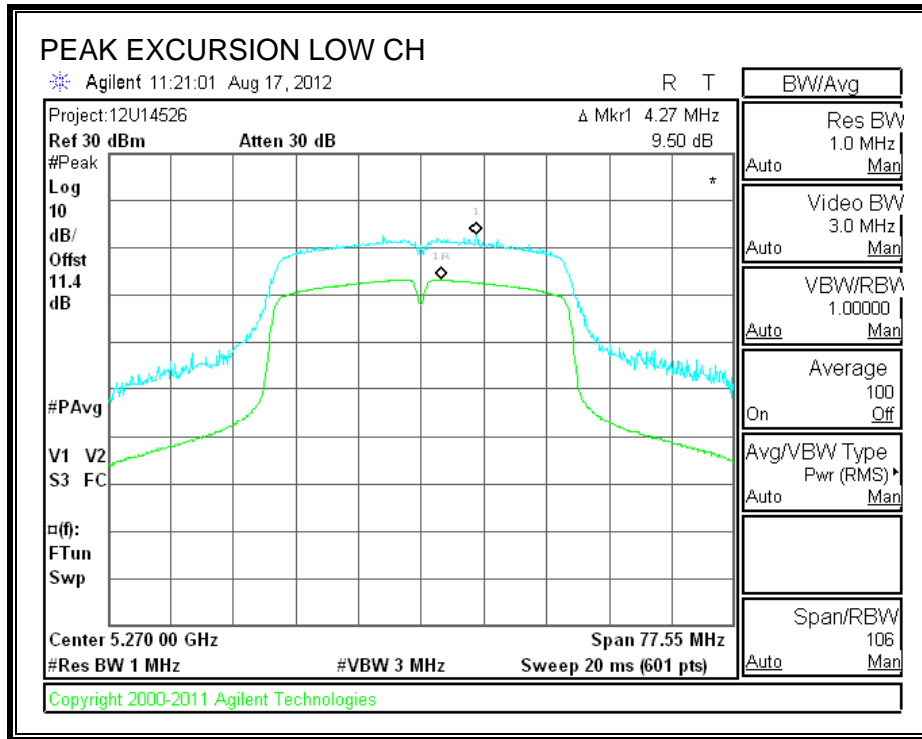
FCC §15.407 (a) (6)

The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

#### RESULTS

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	5270	9.50	13	-3.50
High	5310	9.57	13	-3.43

**PEAK EXCURSION**





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## 8.7. 802.11a MODE IN THE 5.6 GHz BAND

### 8.7.1. 26 dB BANDWIDTH

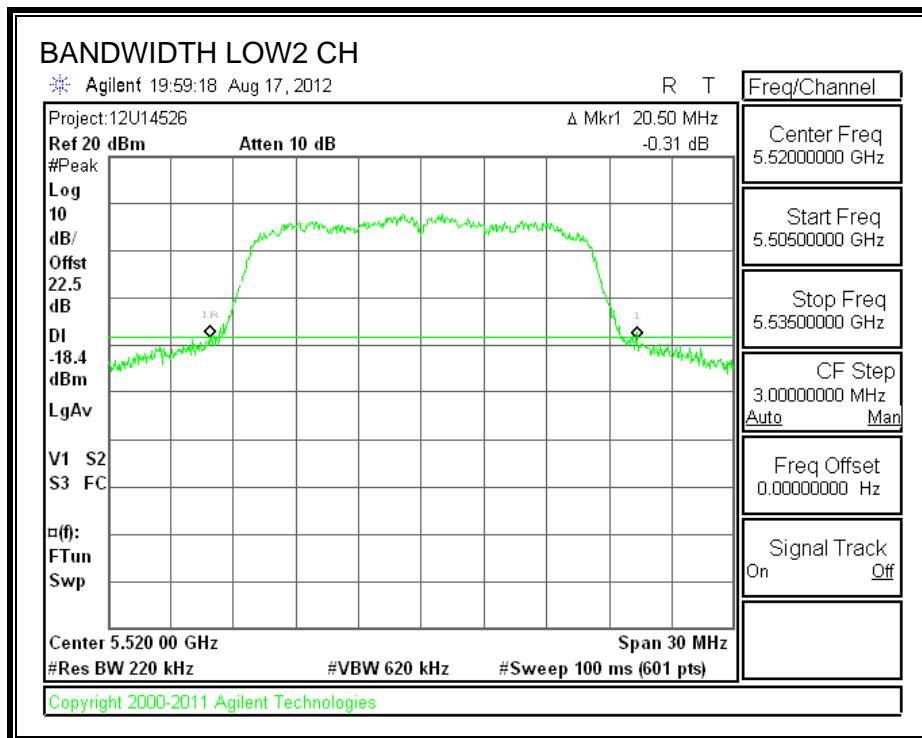
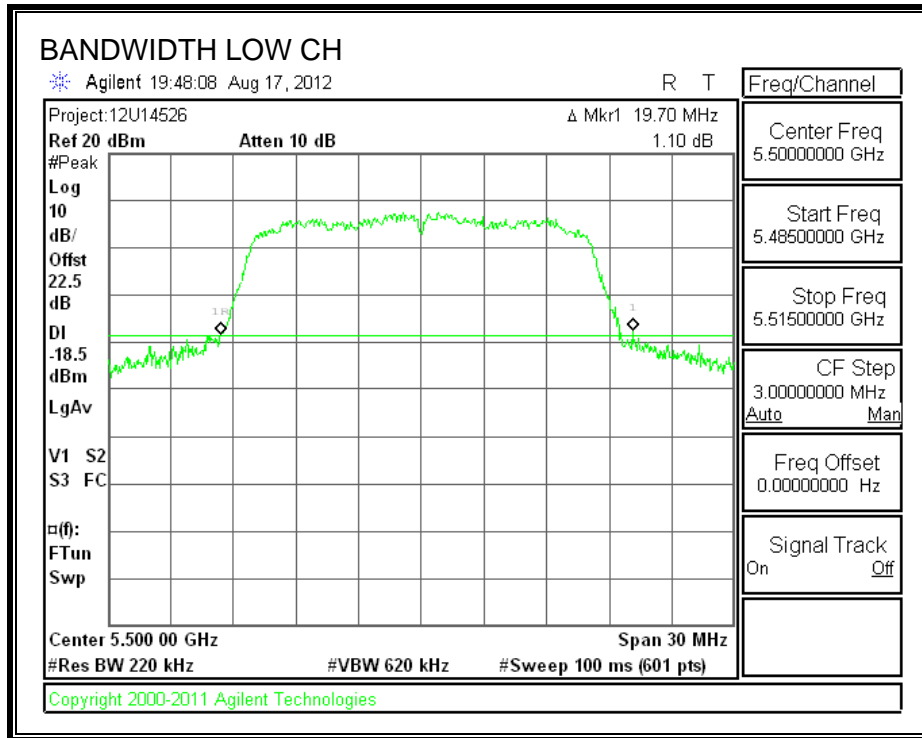
#### LIMITS

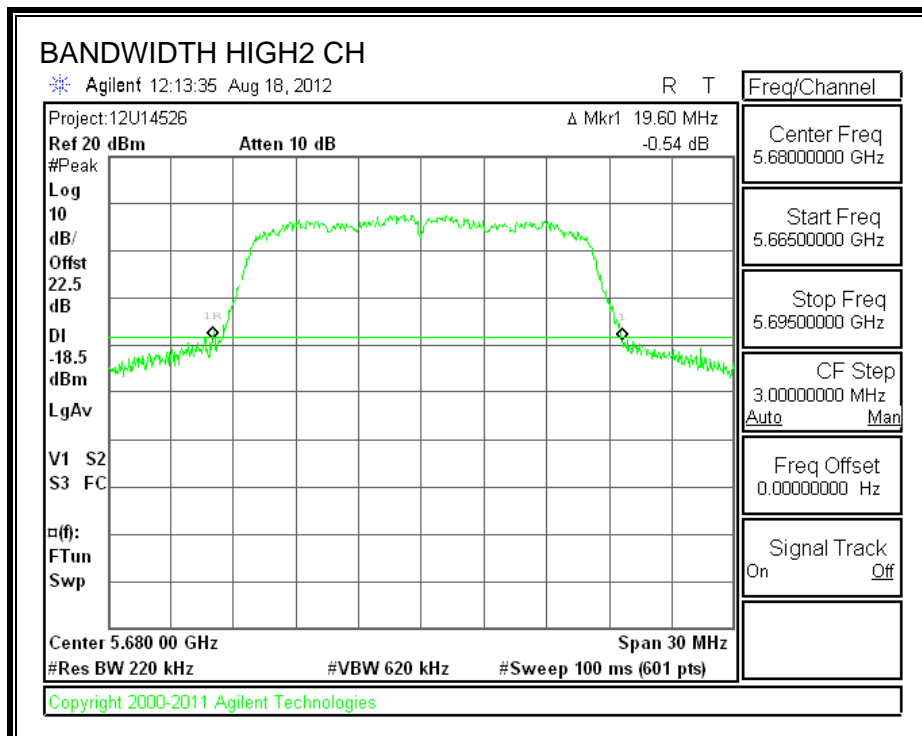
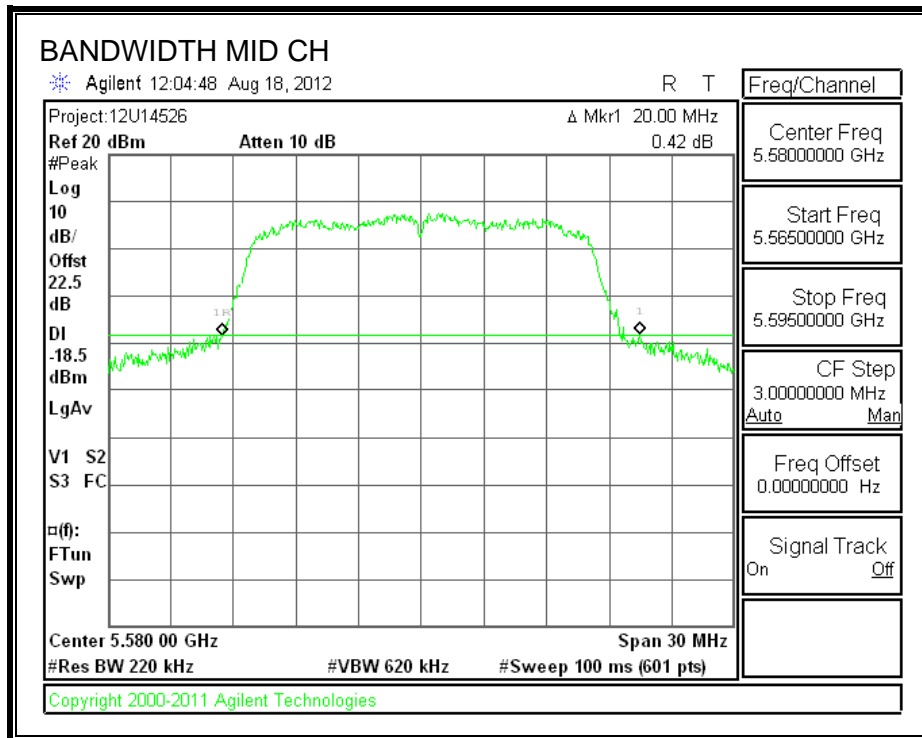
None; for reporting purposes only.

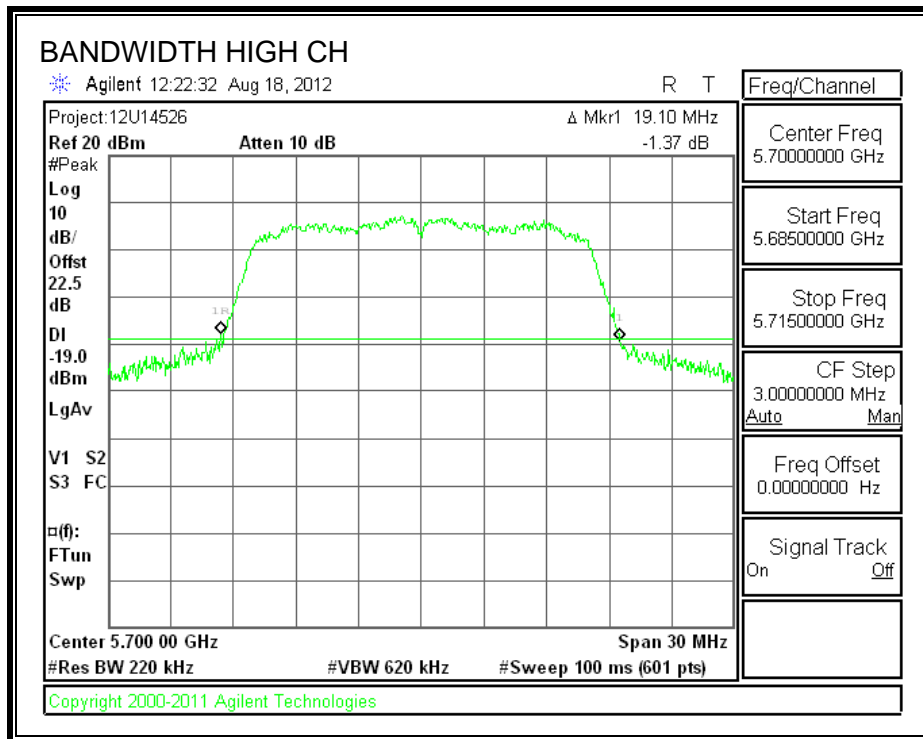
#### RESULTS

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
Low	5500	19.70
Low2	5520	20.50
Mid	5580	20.00
High2	5680	19.60
High	5700	19.10

**26 dB BANDWIDTH**







**8.7.2. 99% BANDWIDTH**

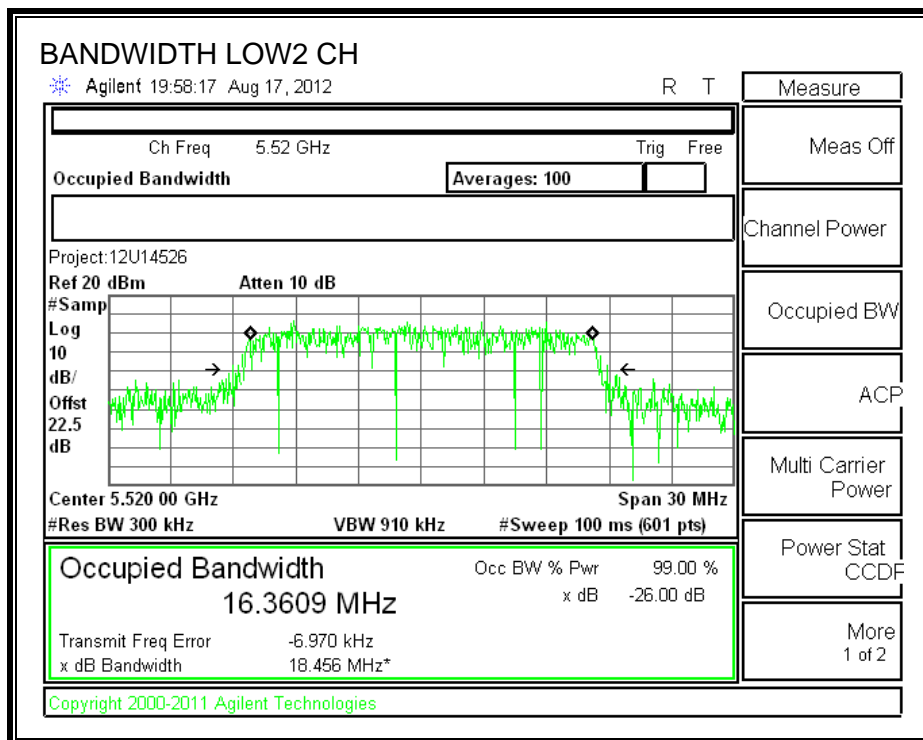
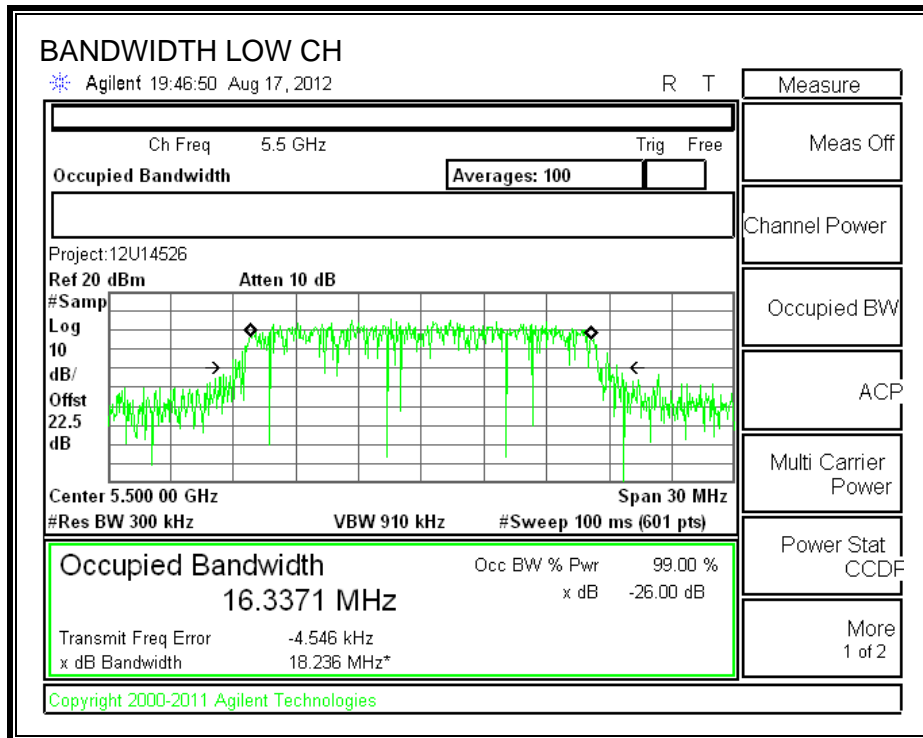
**LIMITS**

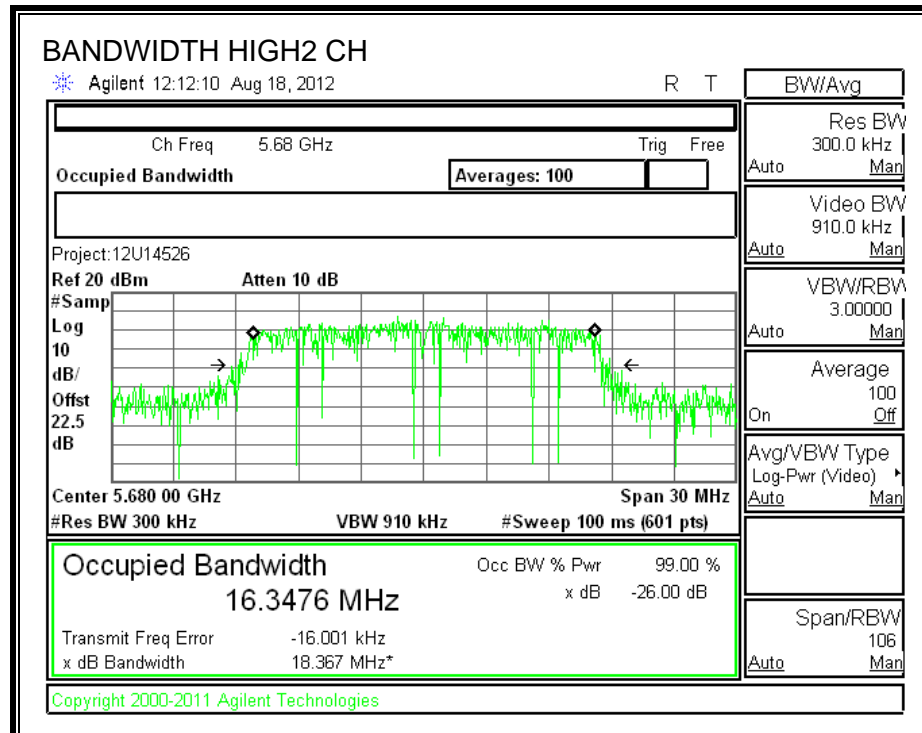
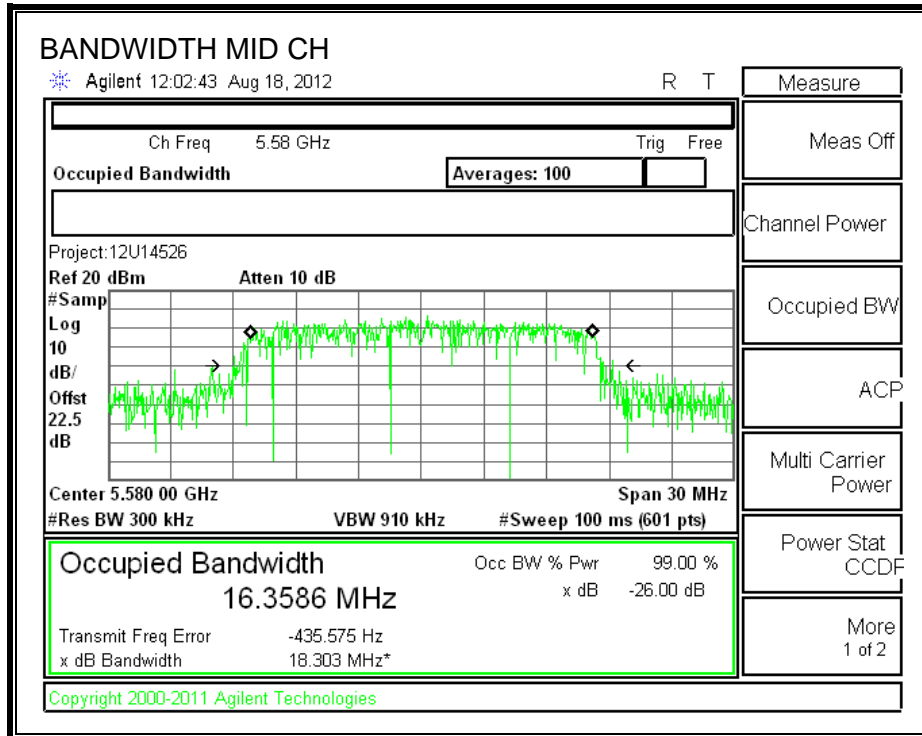
None; for reporting purposes only.

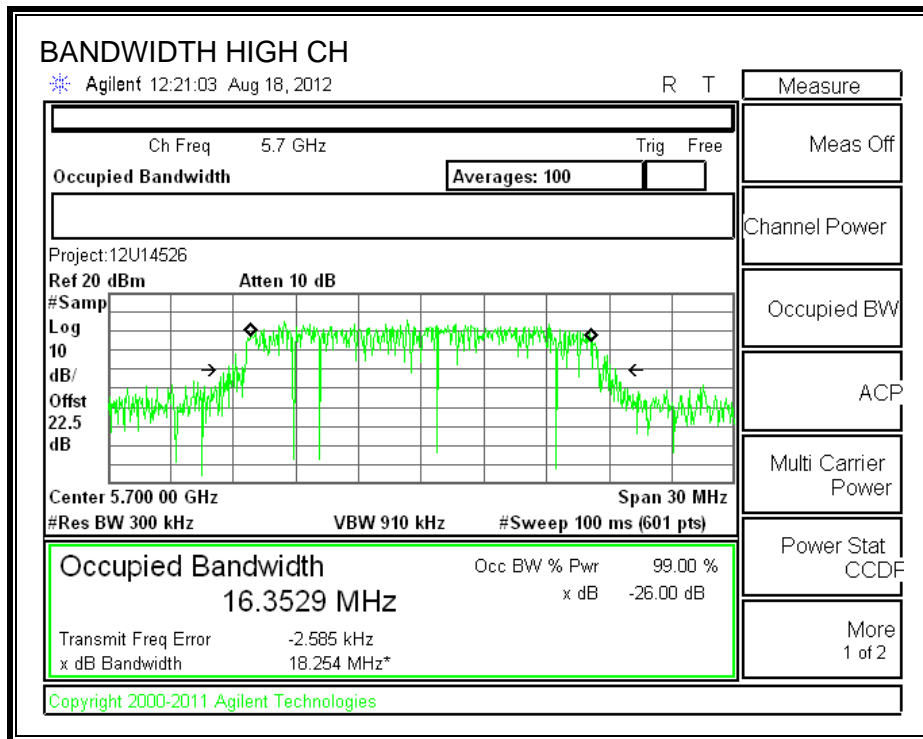
**RESULTS**

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5500	16.3371
Low2	5520	16.3609
Mid	5580	16.3586
High2	5680	16.3476
High	5700	16.3529

**99% BANDWIDTH**









### **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 (MHz)	Power (dBm)
Low	5500	15.49
Low2	5520	15.97
Mid	5580	15.94
High2	5680	15.97
High	5700	15.50

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## 8.7.4. OUTPUT POWER AND PPSD

### LIMITS

FCC §15.407 (a) (2)

IC RSS-210 A9.2 (3)

For the 5.25–5.35 GHz and 5.47–5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or  $11 \text{ dBm} + 10 \log B$ , where B is the 26 dB emission bandwidth in megahertz. In addition, the peak 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 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.

**RESULTS**

**Limits**

Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	11 + 10 Log B Limit (dBm)	Directional Gain (dBi)	Power Limit (dBm)	PPSD Limit (dBm)
Low	5500	24	16.3371	23.13	5.42	23.13	11.00
Low2	5520	24	16.3609	23.14	5.42	23.14	11.00
Mid	5580	24	16.3586	23.14	5.42	23.14	11.00
High2	5680	24	16.3476	23.13	5.42	23.13	11.00
High	5700	24	16.3529	23.14	5.42	23.14	11.00

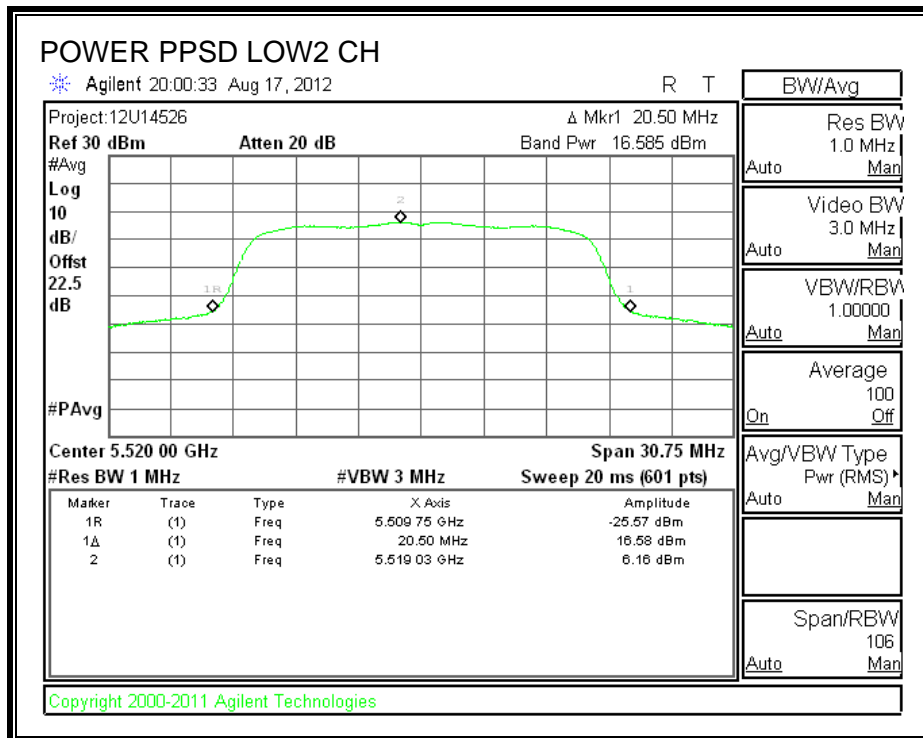
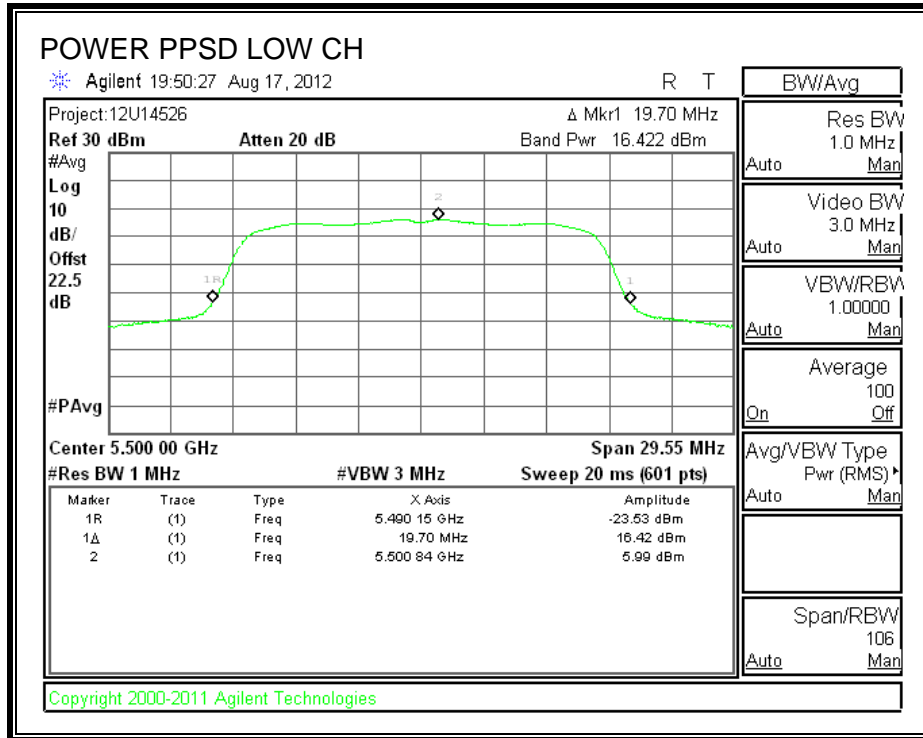
**Output Power Results**

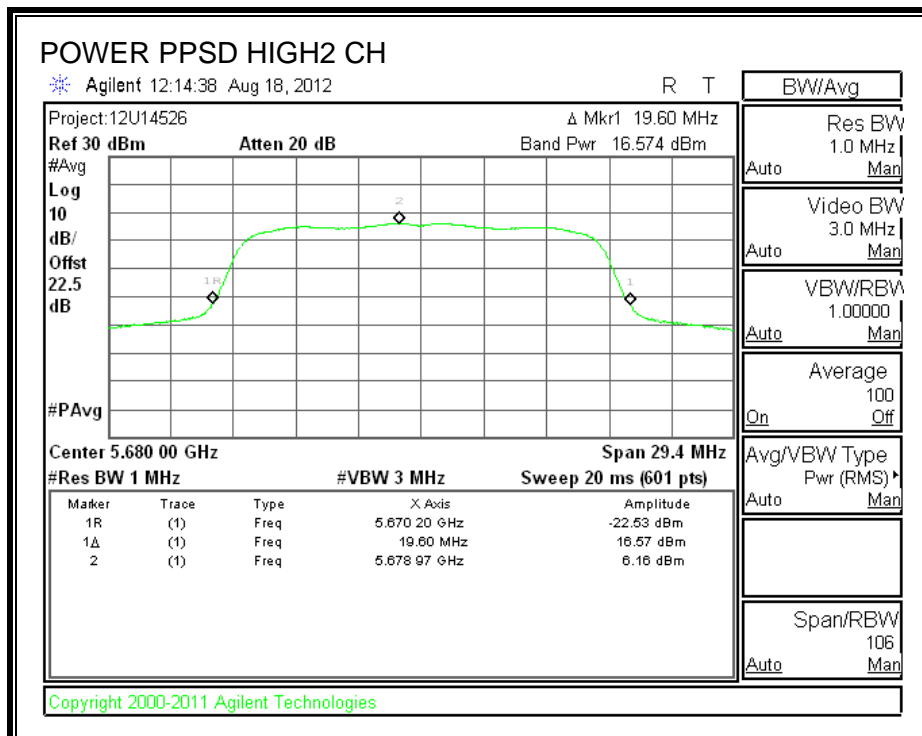
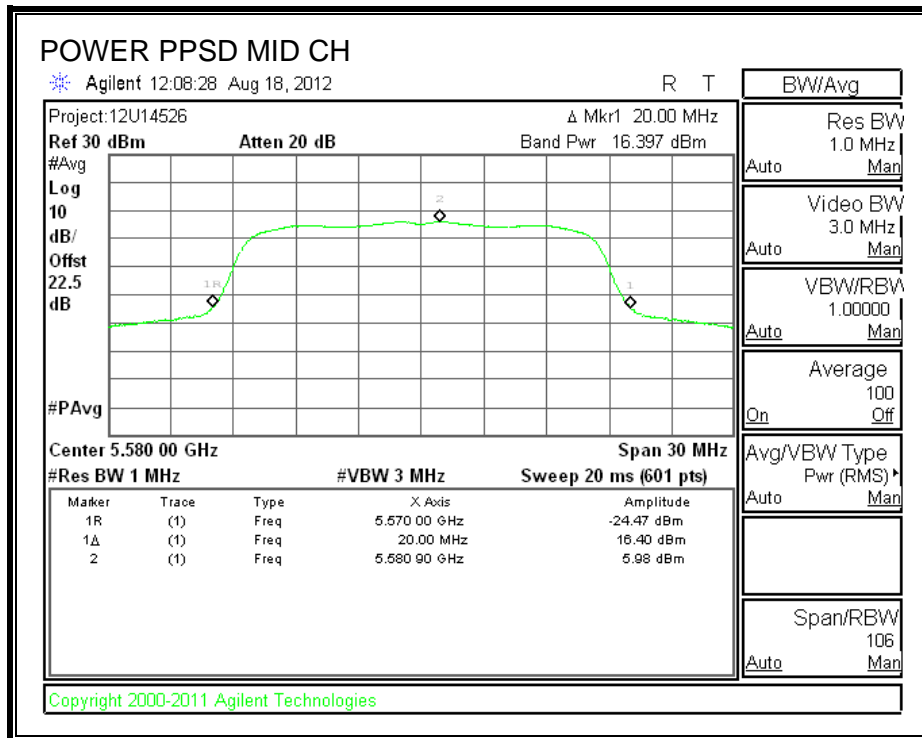
Channel	Frequency (MHz)	Meas Power (dBm)	Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5500	16.422	16.422	23.13	-6.710
Low2	5520	16.585	16.585	23.14	-6.552
Mid	5580	16.397	16.397	23.14	-6.740
High2	5680	16.574	16.574	23.13	-6.561
High	5700	16.089	16.089	23.14	-7.047

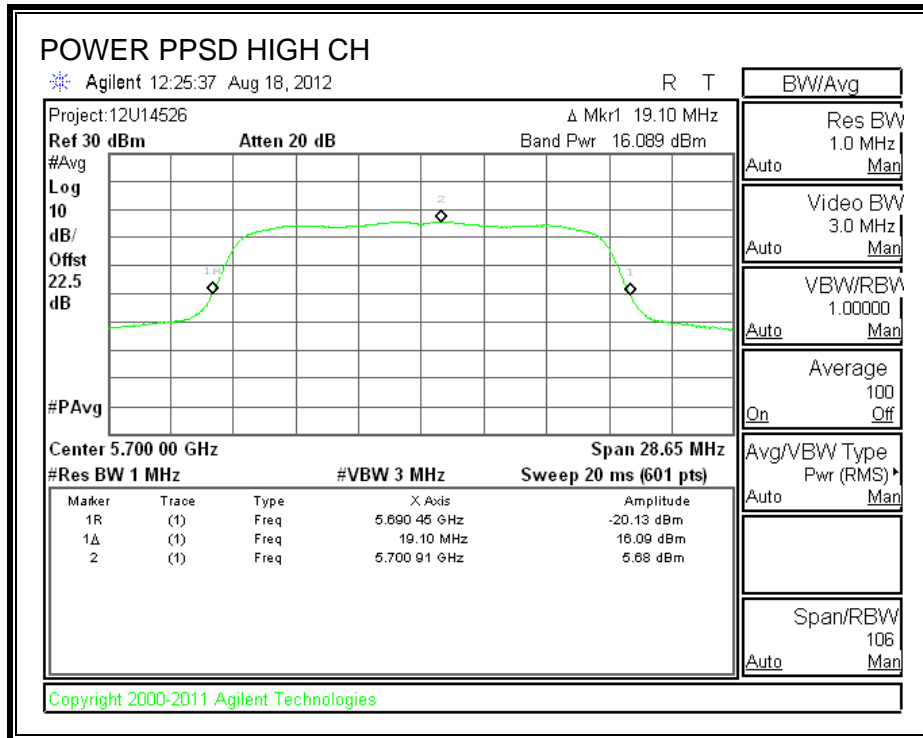
**PPSD Results**

Channel	Frequency (MHz)	Meas PPSD (dBm)	Corr'd PPSD (dBm)	PPSD Limit (dBm)	PPSD Margin (dB)
Low	5500	5.99	5.99	11.00	-5.01
Low2	5520	6.16	6.16	11.00	-4.84
Mid	5580	5.98	5.98	11.00	-5.02
High2	5680	6.16	6.16	11.00	-4.84
High	5700	5.68	5.68	11.00	-5.32

**OUTPUT POWER AND PPSD**







### 8.7.5. PEAK EXCURSION

#### LIMITS

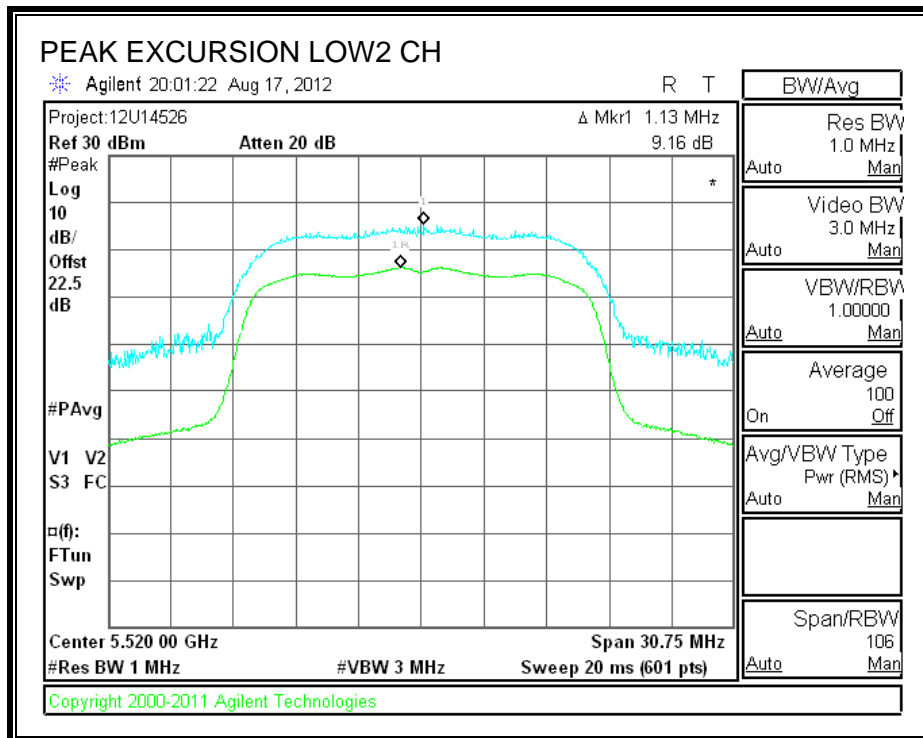
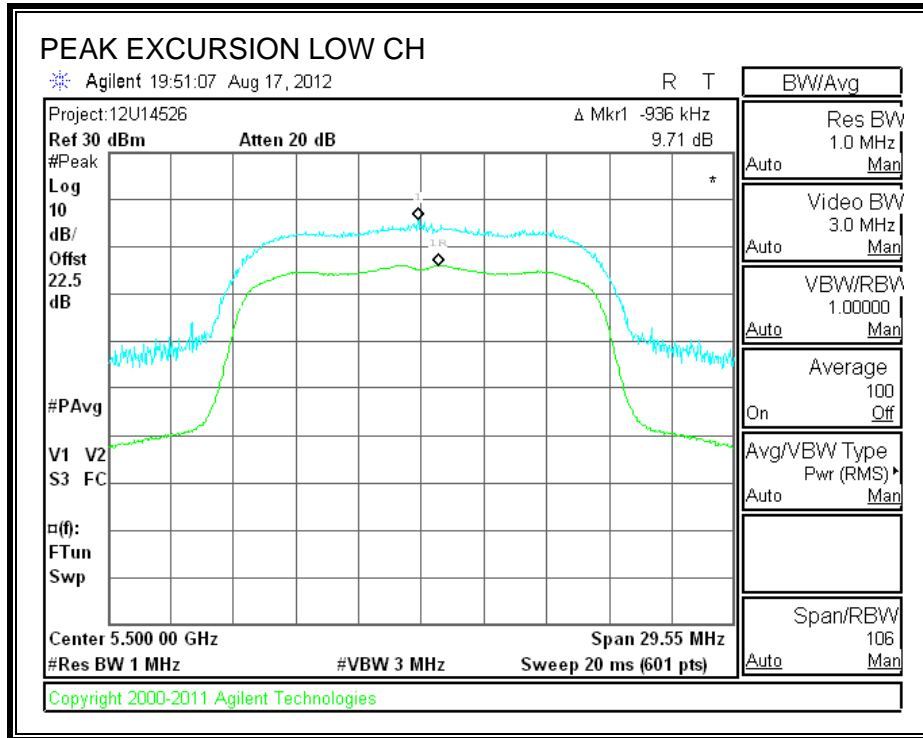
FCC §15.407 (a) (6)

The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

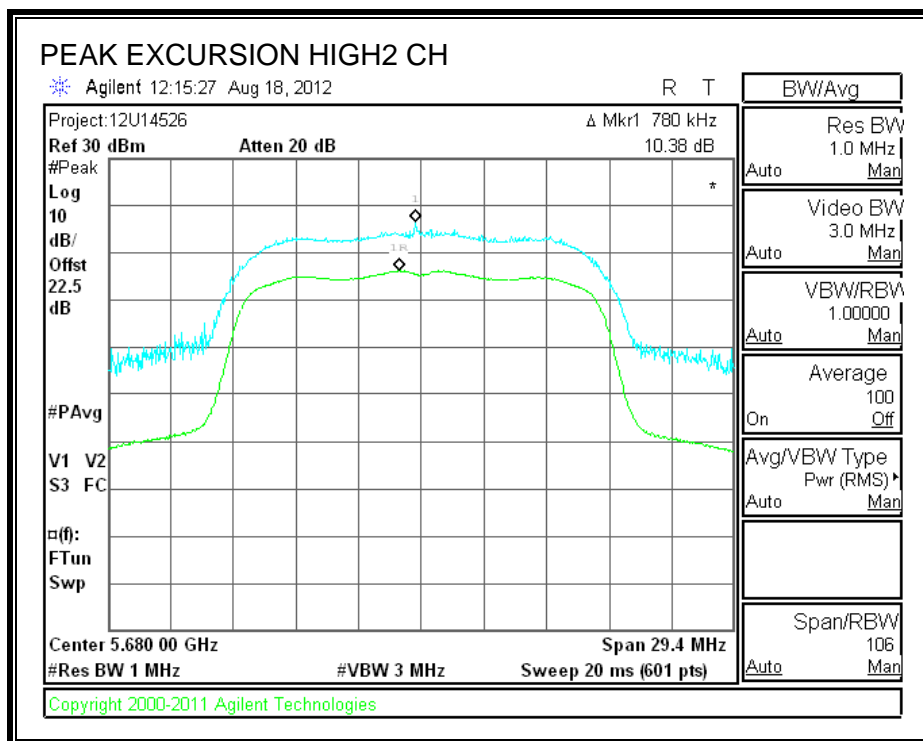
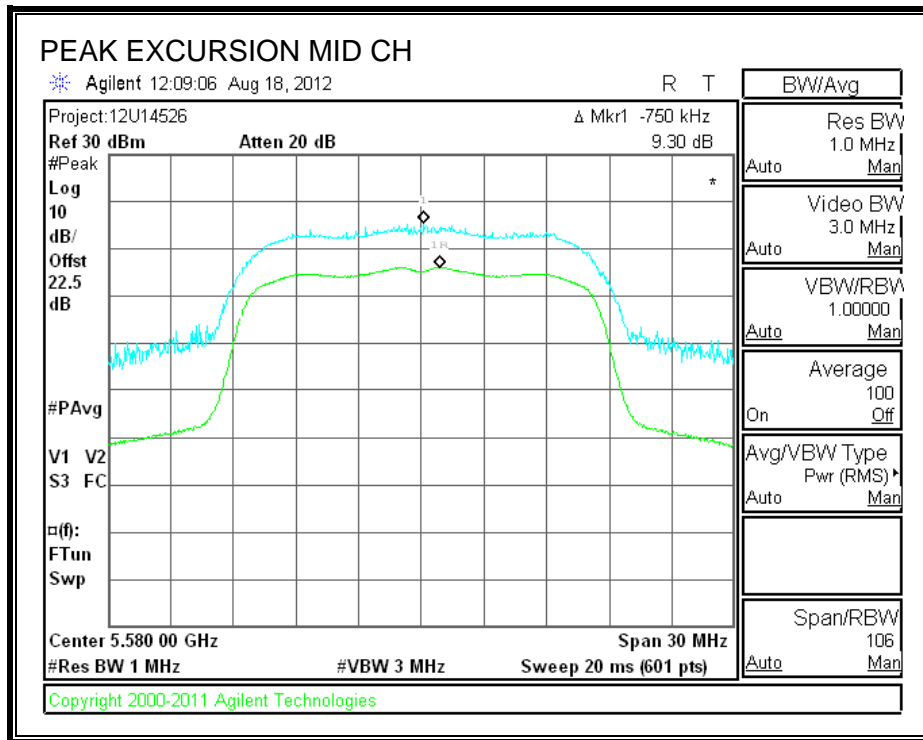
#### RESULTS

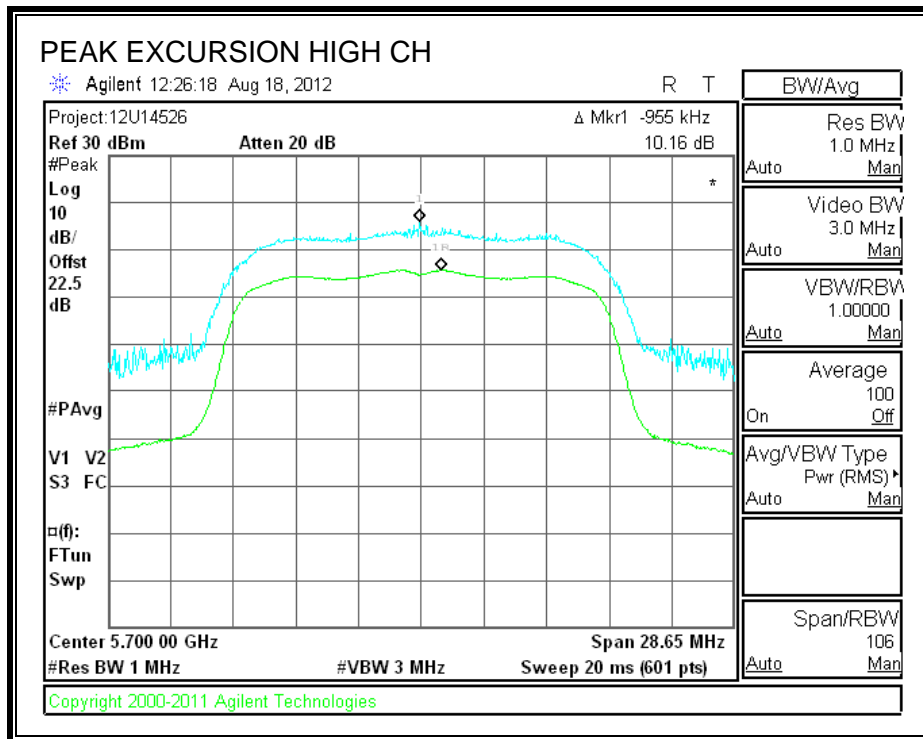
Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	5500	9.71	13	-3.29
Low2	5520	9.16	13	-3.84
Mid	5580	9.30	13	-3.70
High2	5680	10.38	13	-2.62
High	5700	10.16	13	-2.84

**PEAK EXCURSION**









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

**8.8.1. 26 dB BANDWIDTH**

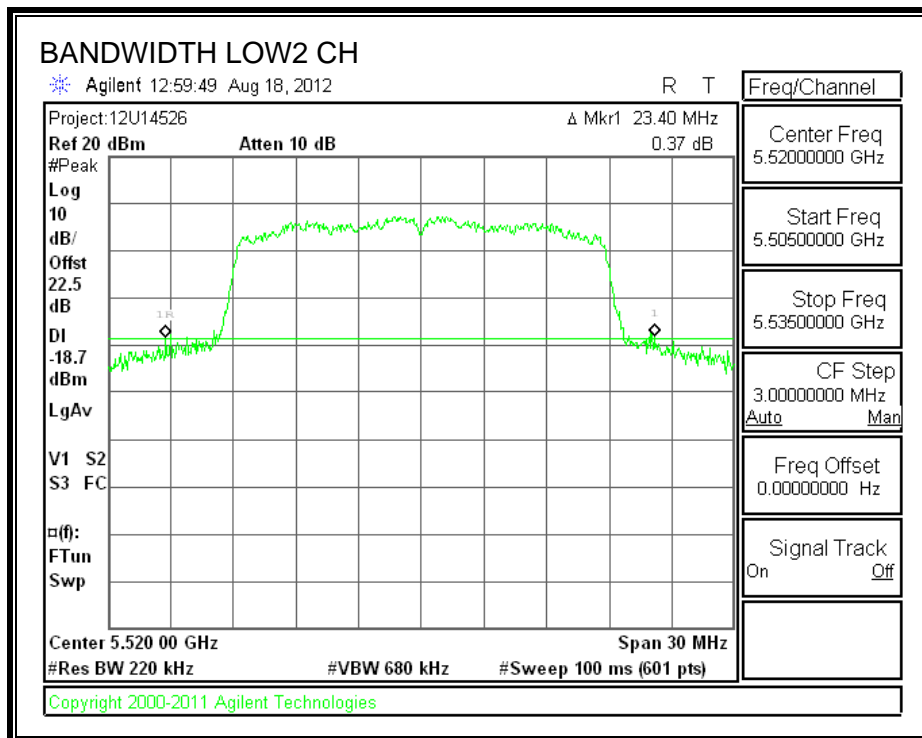
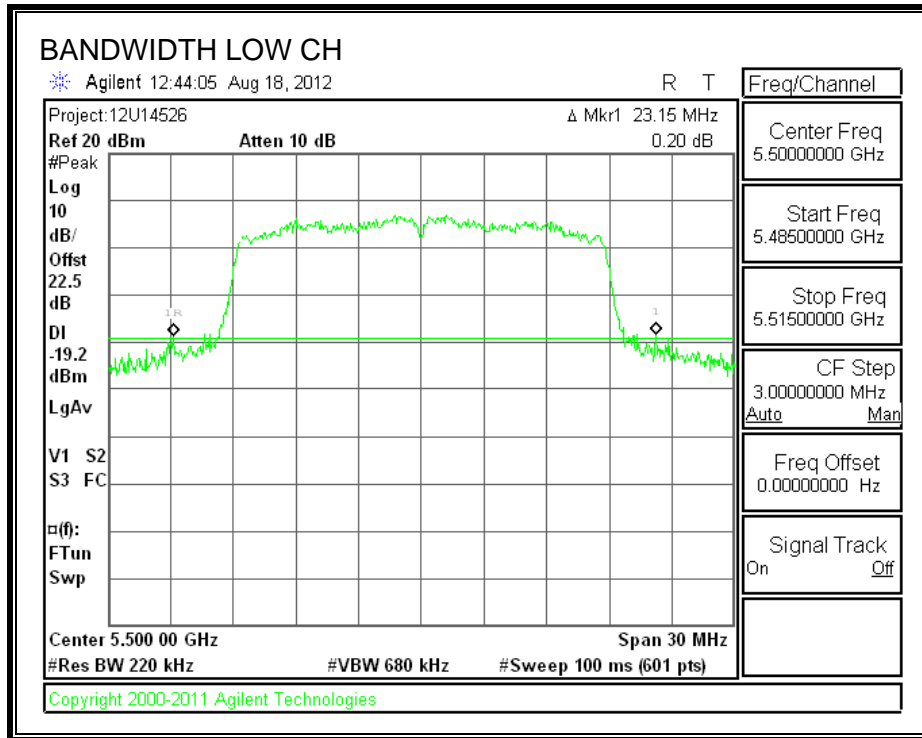
**LIMITS**

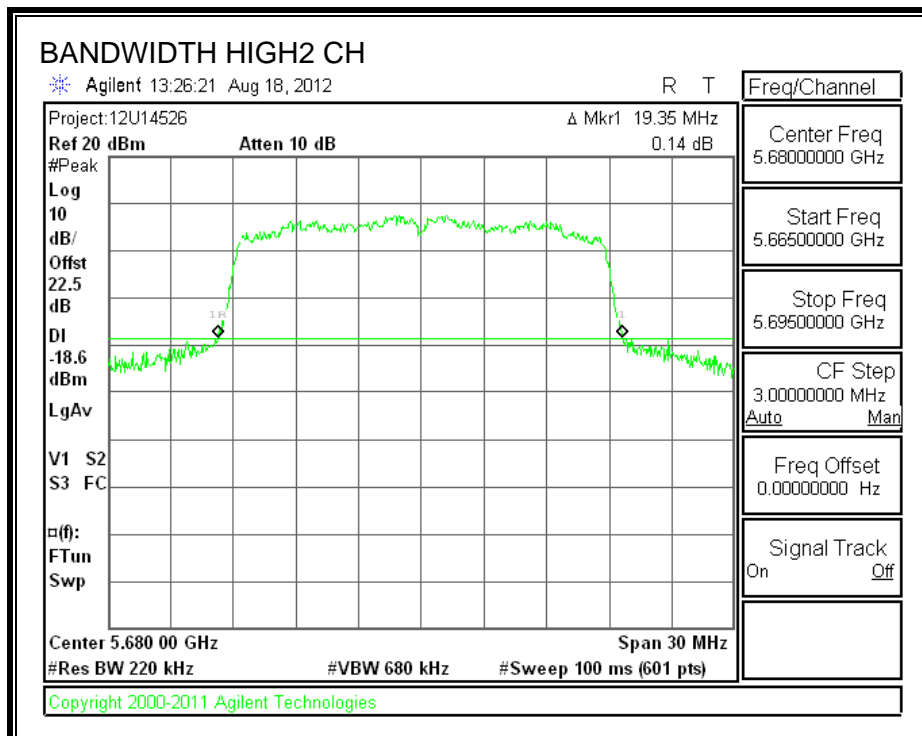
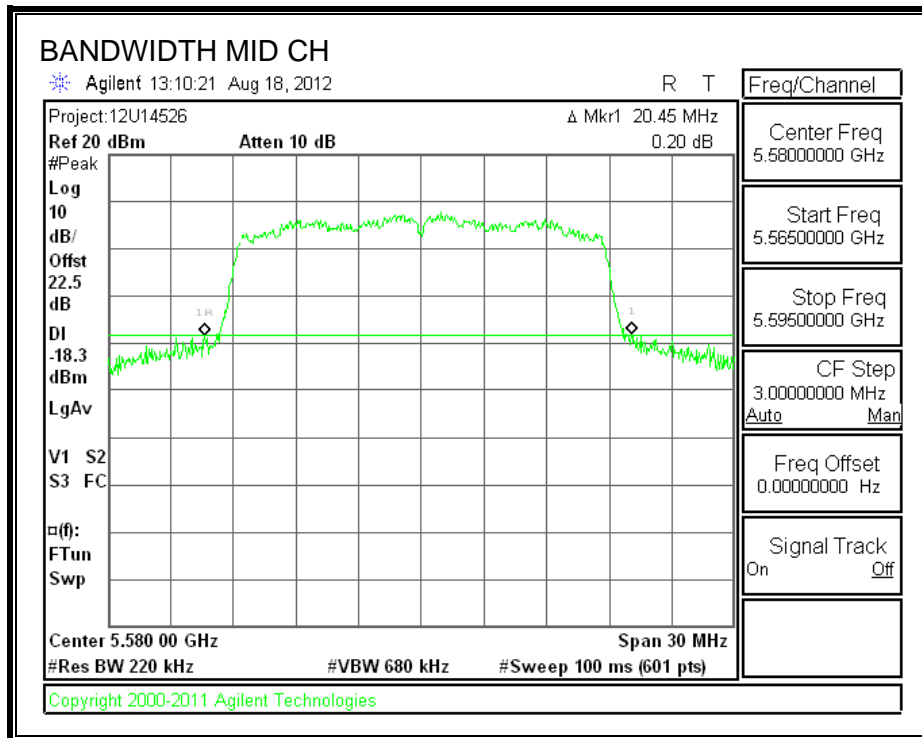
None; for reporting purposes only.

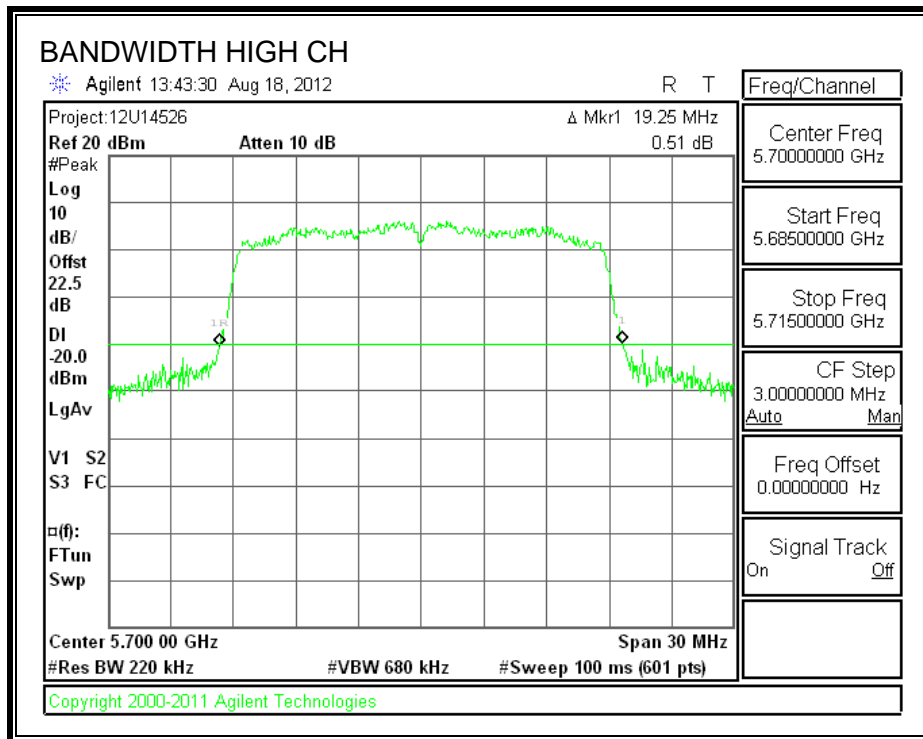
**RESULTS**

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
Low	5500	23.15
Low2	5520	23.40
Mid	5580	20.45
High2	5680	19.35
High	5700	19.25

**26 dB BANDWIDTH**







**8.8.2. 99% BANDWIDTH**

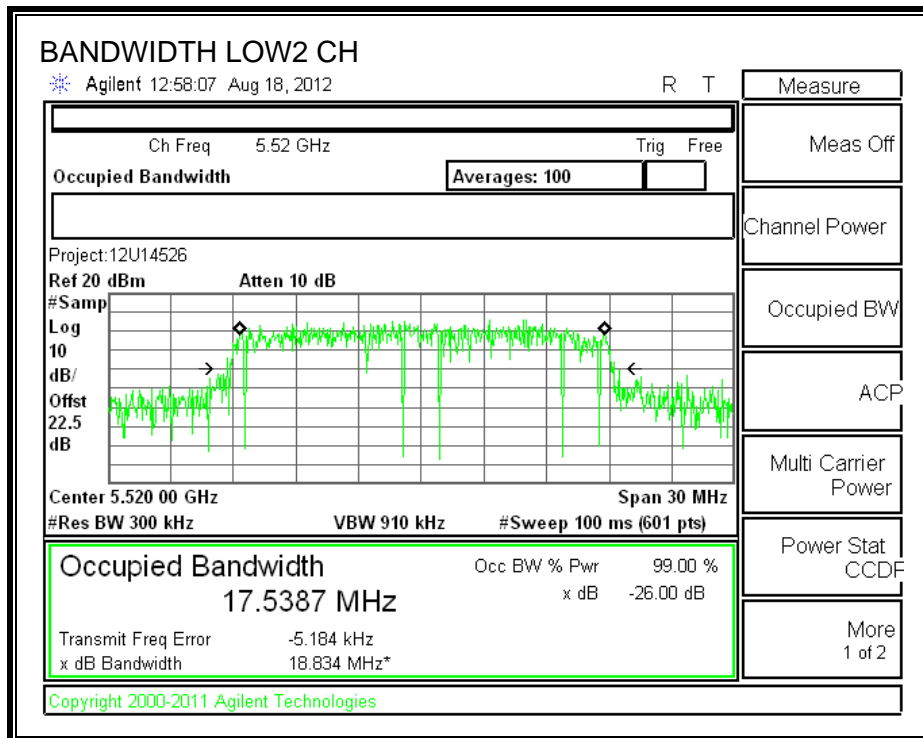
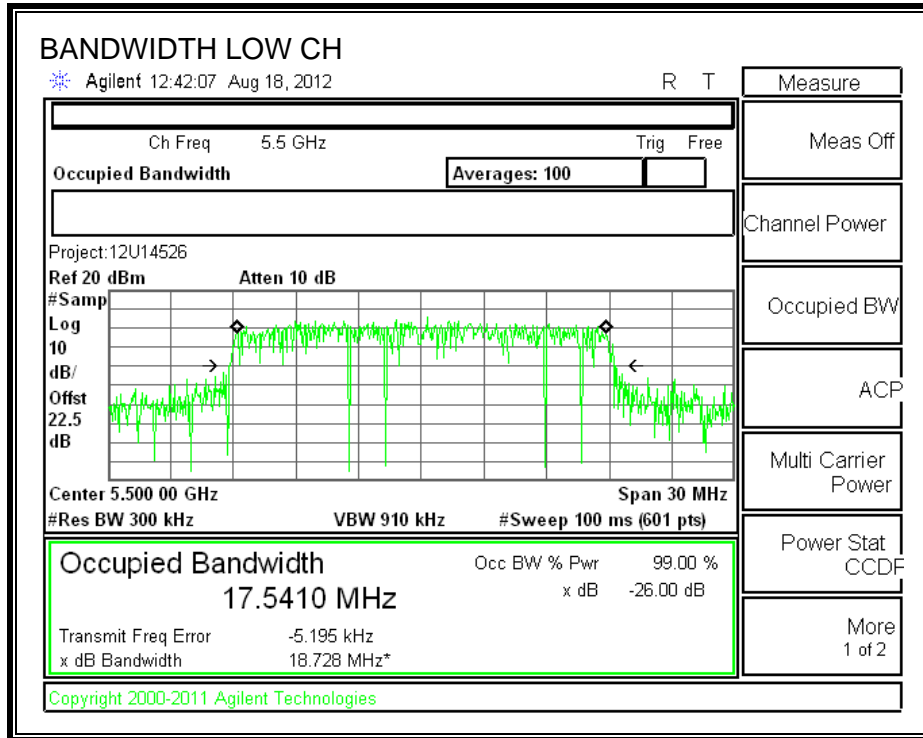
**LIMITS**

None; for reporting purposes only.

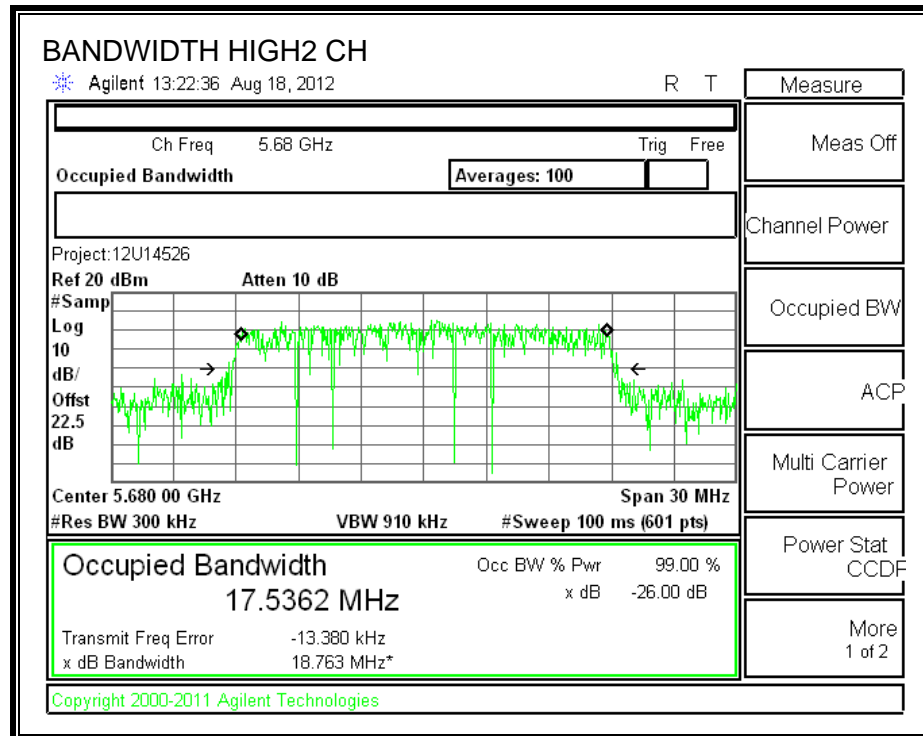
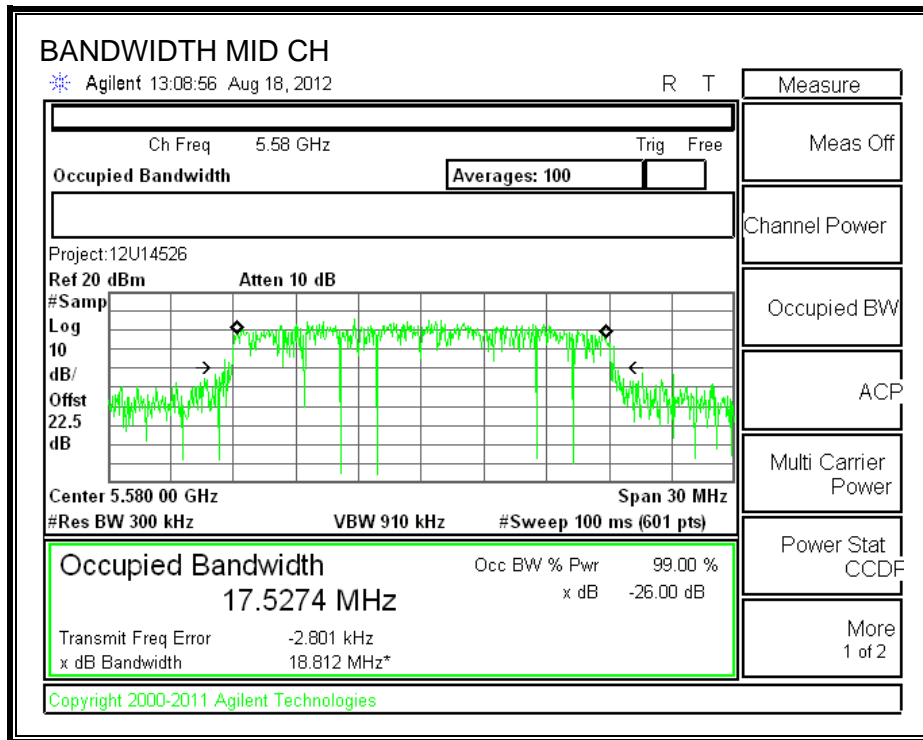
**RESULTS**

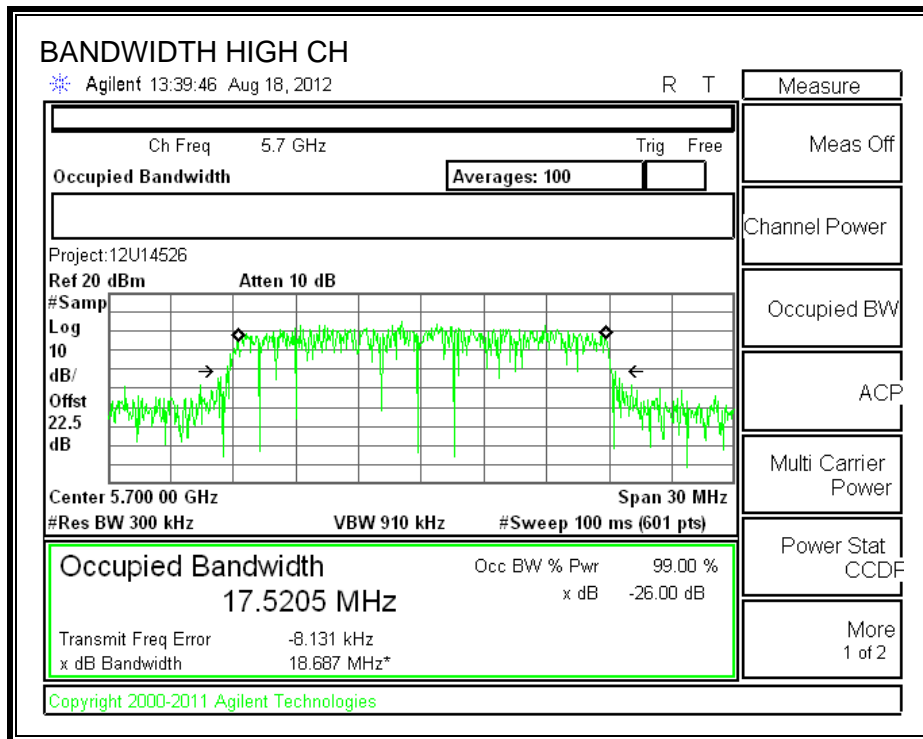
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5500	17.5410
Low2	5520	17.5387
Mid	5580	17.5274
High2	5680	17.5362
High	5700	17.5205

**99% BANDWIDTH**









### **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 (MHz)	Power (dBm)
Low	5500	15.48
Low2	5520	15.95
Mid	5580	15.93
High2	5680	15.97
High	5700	14.46

---

## **8.8.4. OUTPUT POWER AND PPSD**

### **LIMITS**

FCC §15.407 (a) (2)

IC RSS-210 A9.2 (3)

For the 5.25–5.35 GHz and 5.47–5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or  $11 \text{ dBm} + 10 \log B$ , where B is the 26 dB emission bandwidth in megahertz. In addition, the peak 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 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.

**RESULTS**

**Limits**

Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	11 + 10 Log B Limit (dBm)	Directional Gain (dBi)	Power Limit (dBm)	PPSD Limit (dBm)
Low	5500	24	17.5410	23.44	5.42	23.44	11.00
Low2	5520	24	17.5387	23.44	5.42	23.44	11.00
Mid	5580	24	17.5274	23.44	5.42	23.44	11.00
High2	5680	24	17.5362	23.44	5.42	23.44	11.00
High	5700	24	17.5205	23.44	5.42	23.44	11.00

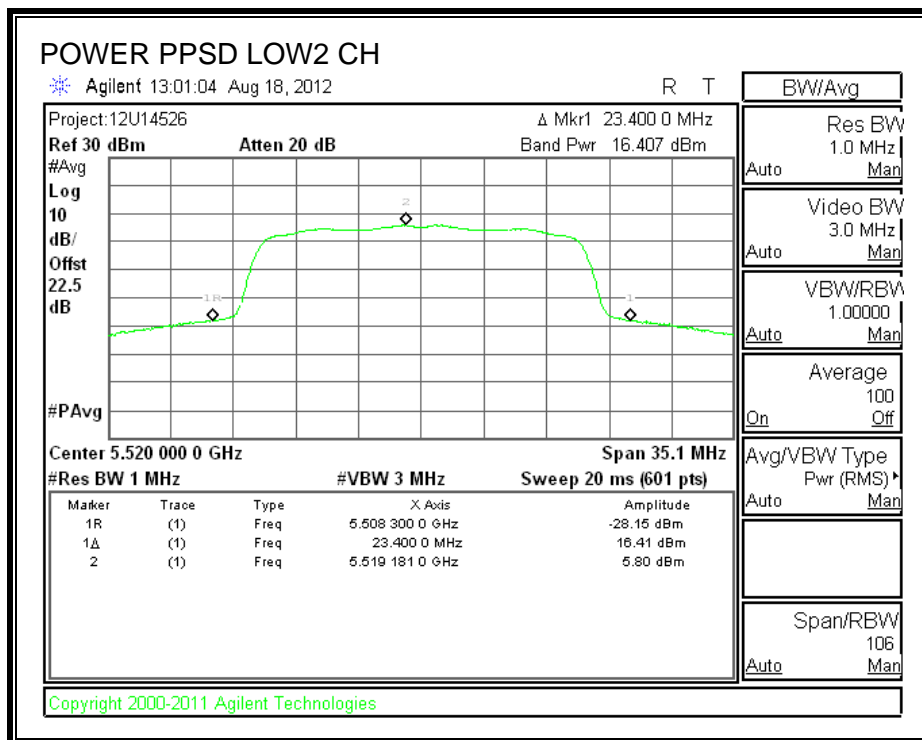
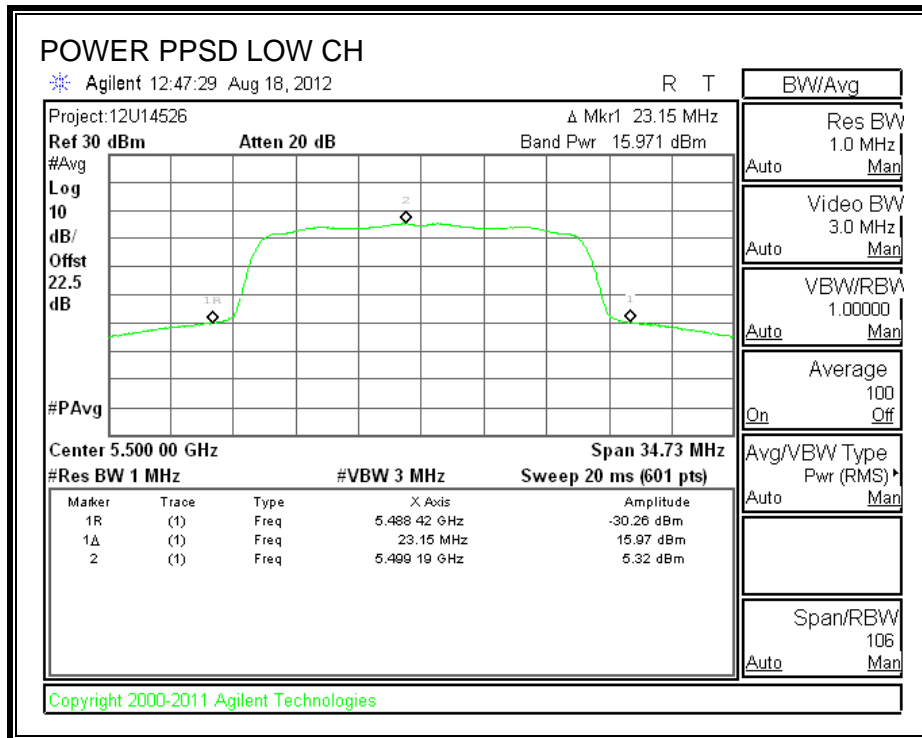
**Output Power Results**

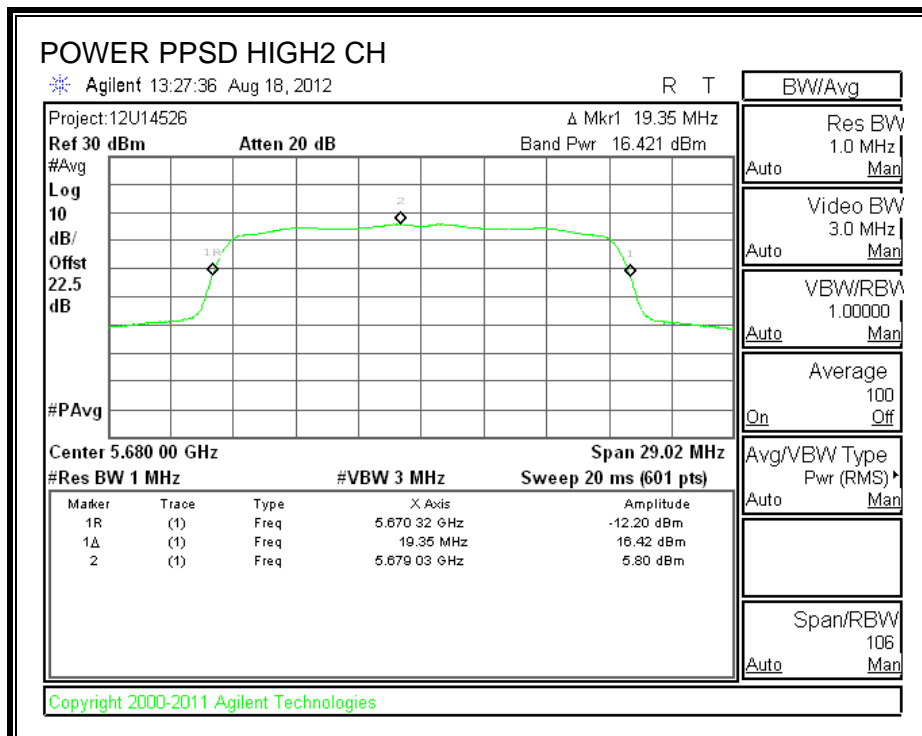
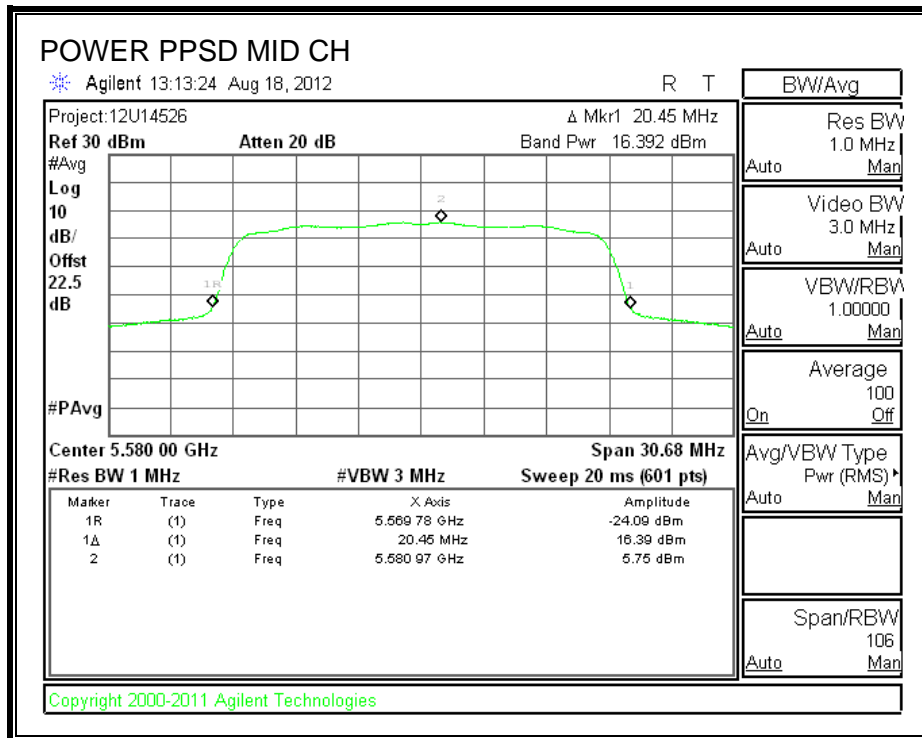
Channel	Frequency (MHz)	Meas Power (dBm)	Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5500	15.971	15.971	23.44	-7.470
Low2	5520	16.407	16.407	23.44	-7.030
Mid	5580	16.392	16.392	23.44	-7.045
High2	5680	16.421	16.421	23.44	-7.018
High	5700	15.009	15.009	23.44	-8.426

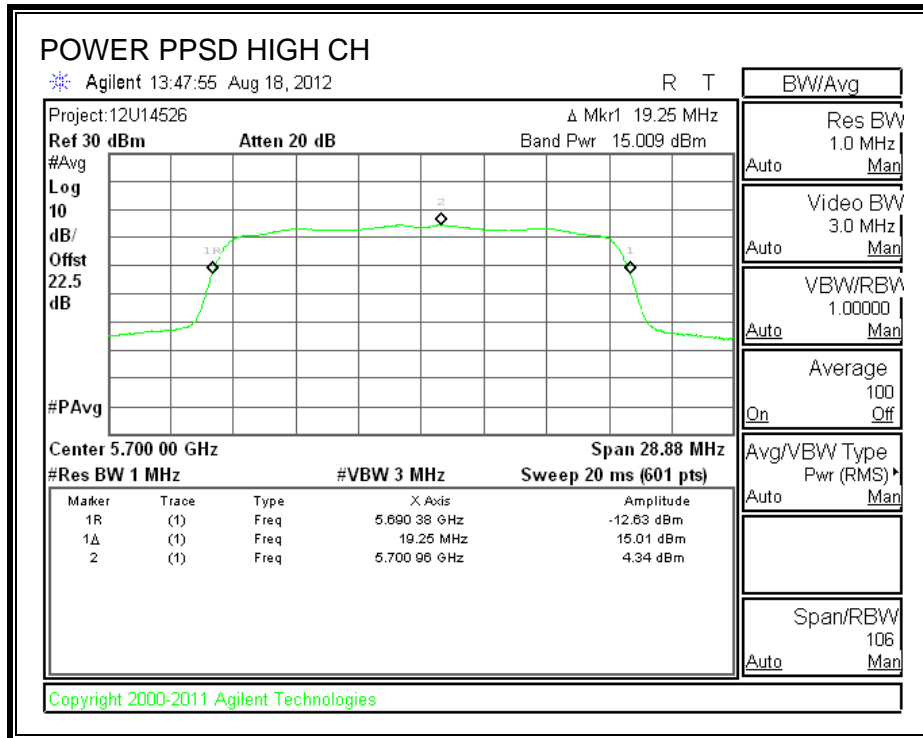
**PPSD Results**

Channel	Frequency (MHz)	Meas PPSD (dBm)	Corr'd PPSD (dBm)	PPSD Limit (dBm)	PPSD Margin (dB)
Low	5500	5.32	5.32	11.00	-5.68
Low2	5520	5.80	5.80	11.00	-5.20
Mid	5580	5.75	5.75	11.00	-5.25
High2	5680	5.80	5.80	11.00	-5.20
High	5700	4.34	4.34	11.00	-6.66

**OUTPUT POWER AND PPSD**









### 8.8.5. PEAK EXCURSION

#### LIMITS

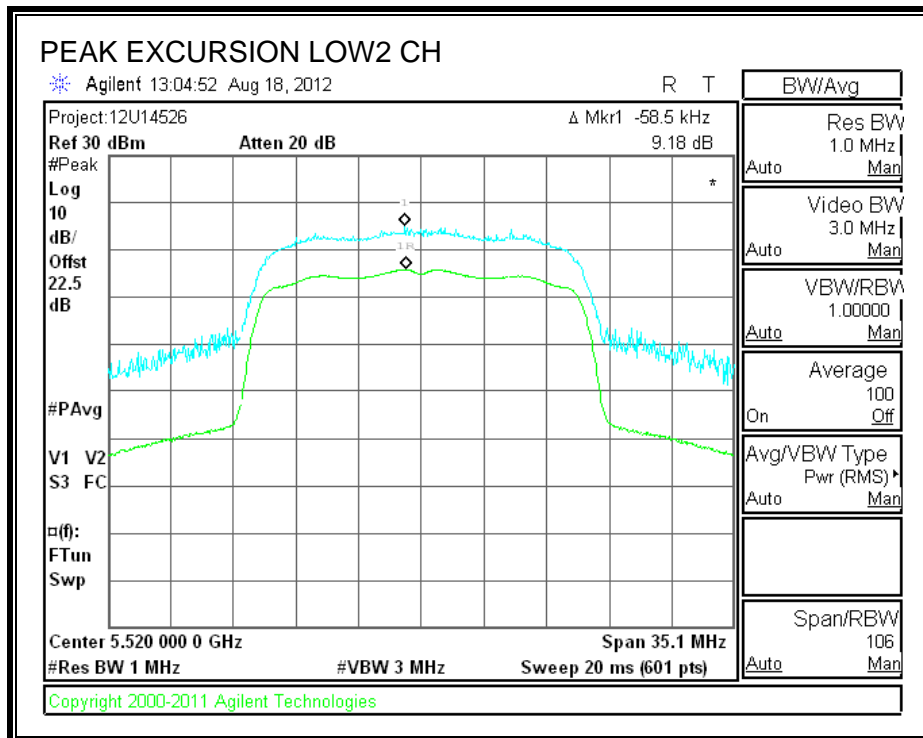
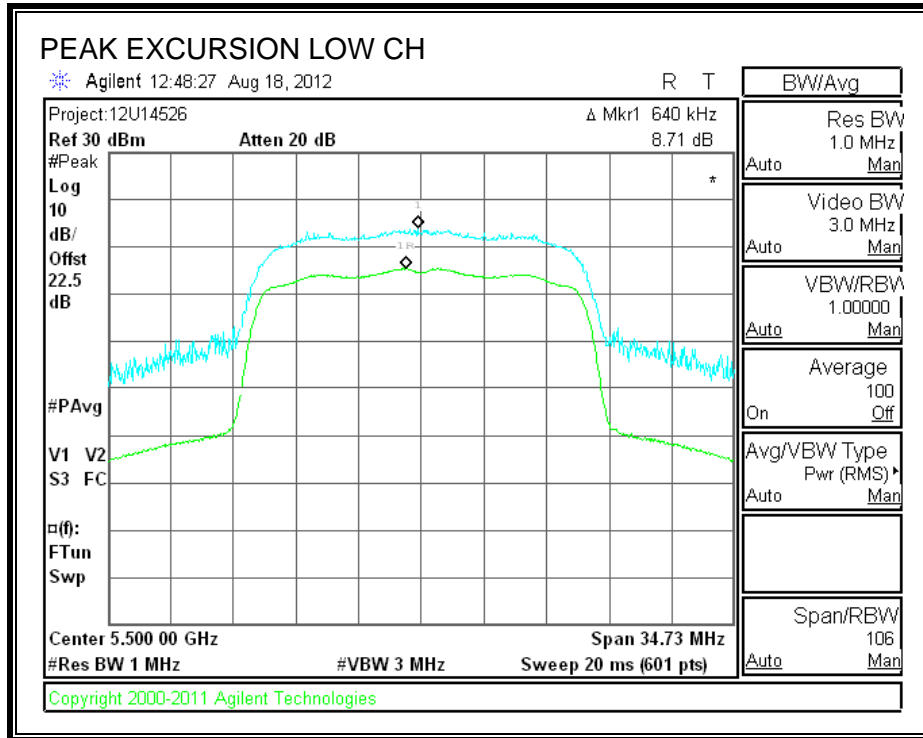
FCC §15.407 (a) (6)

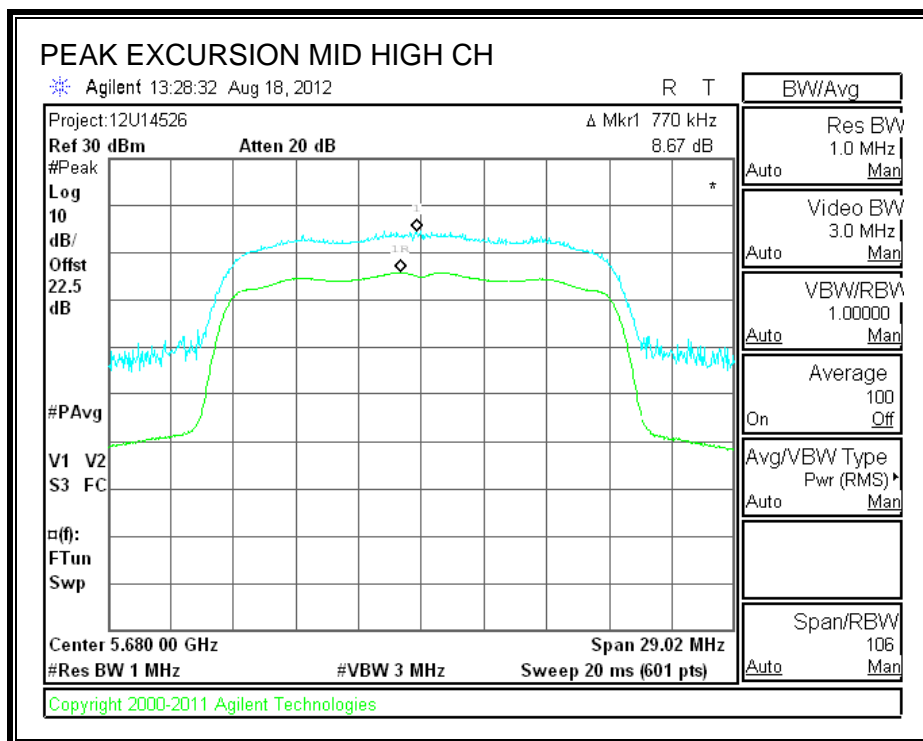
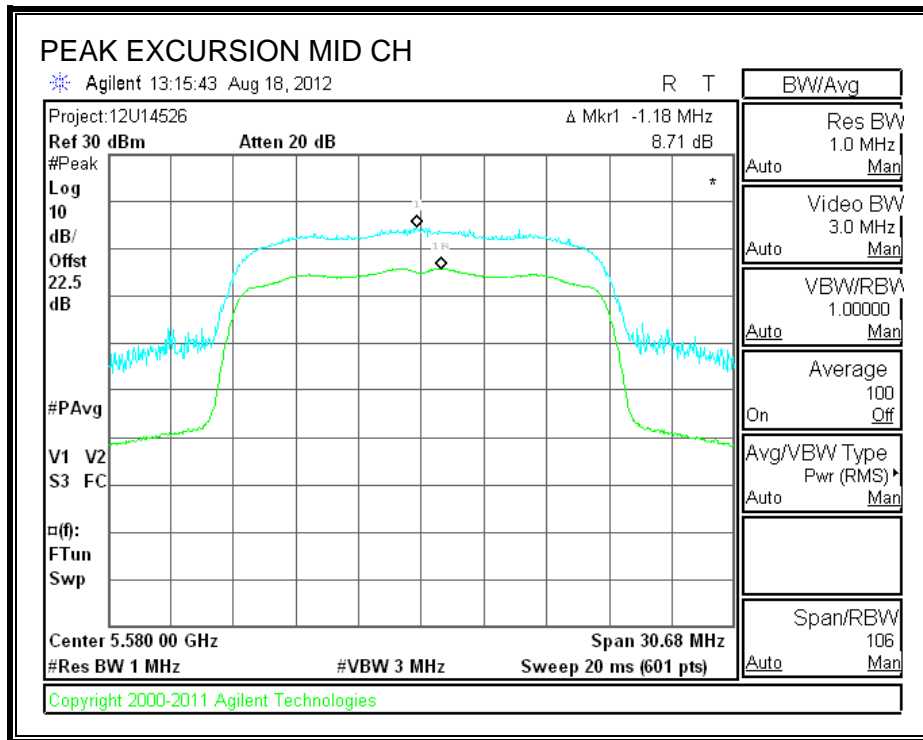
The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

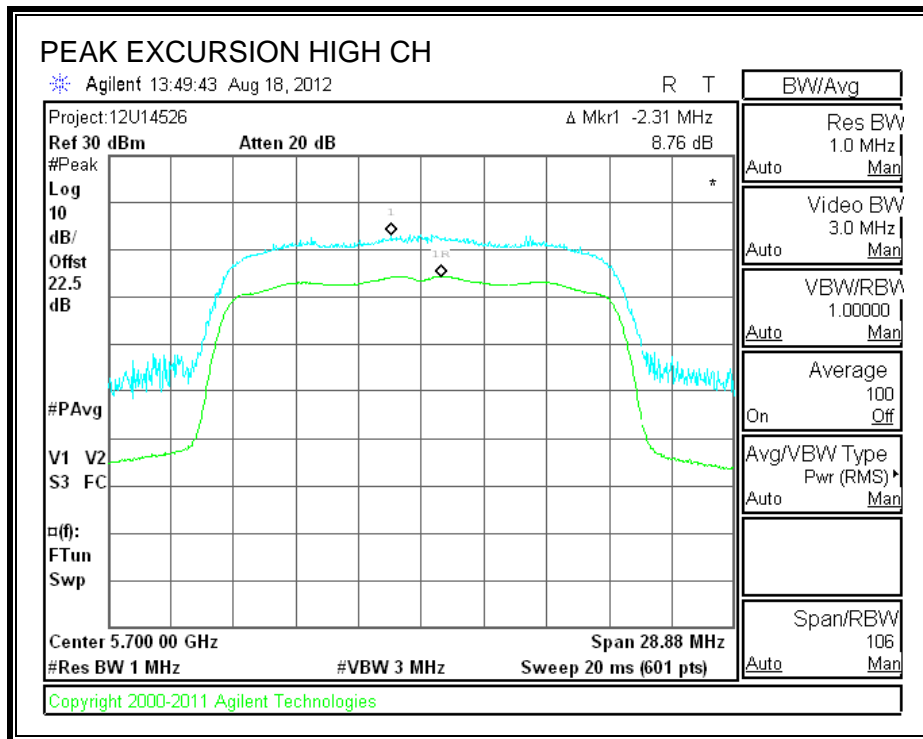
#### RESULTS

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	5500	8.71	13	-4.29
Low2	5520	9.18	13	-3.82
Mid	5580	8.71	13	-4.29
High2	5680	8.67	13	-4.33
High	5700	8.76	13	-4.24

**PEAK EXCURSION**







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

**8.9.1. 26 dB BANDWIDTH**

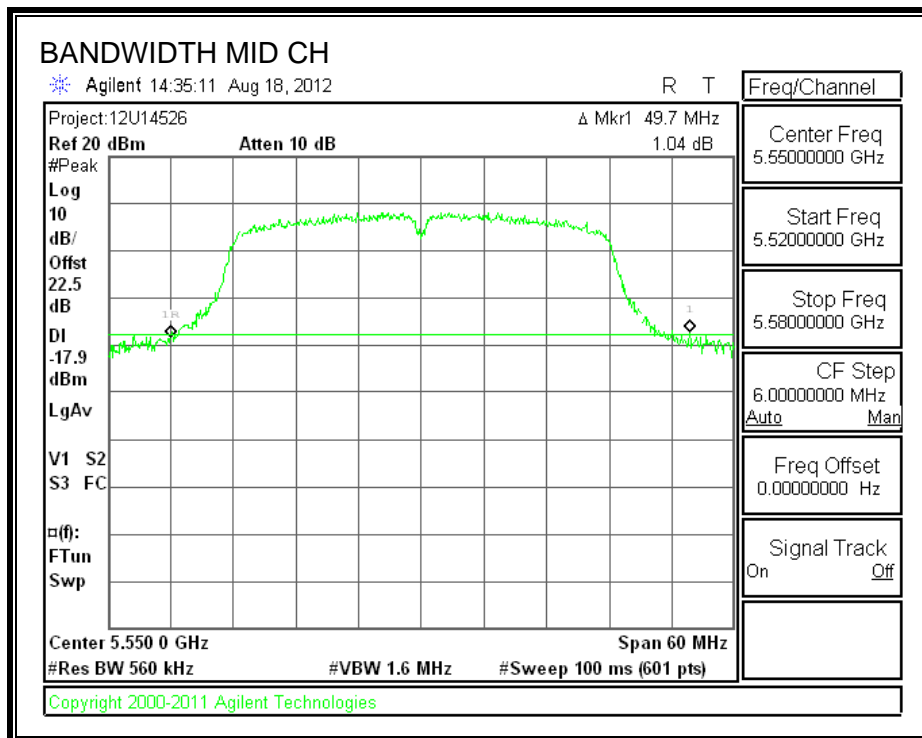
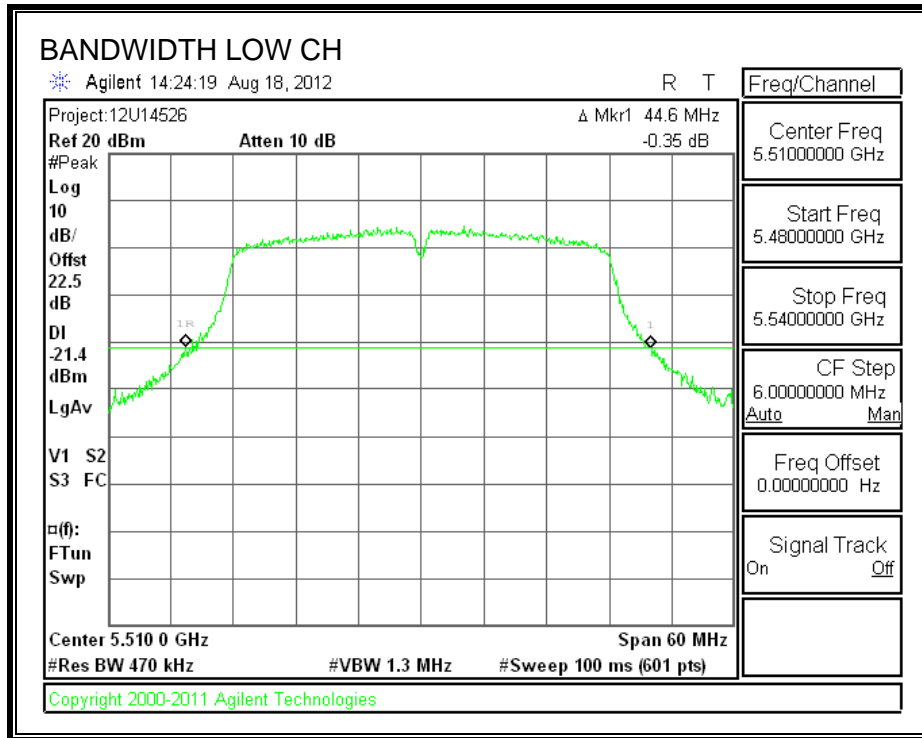
**LIMITS**

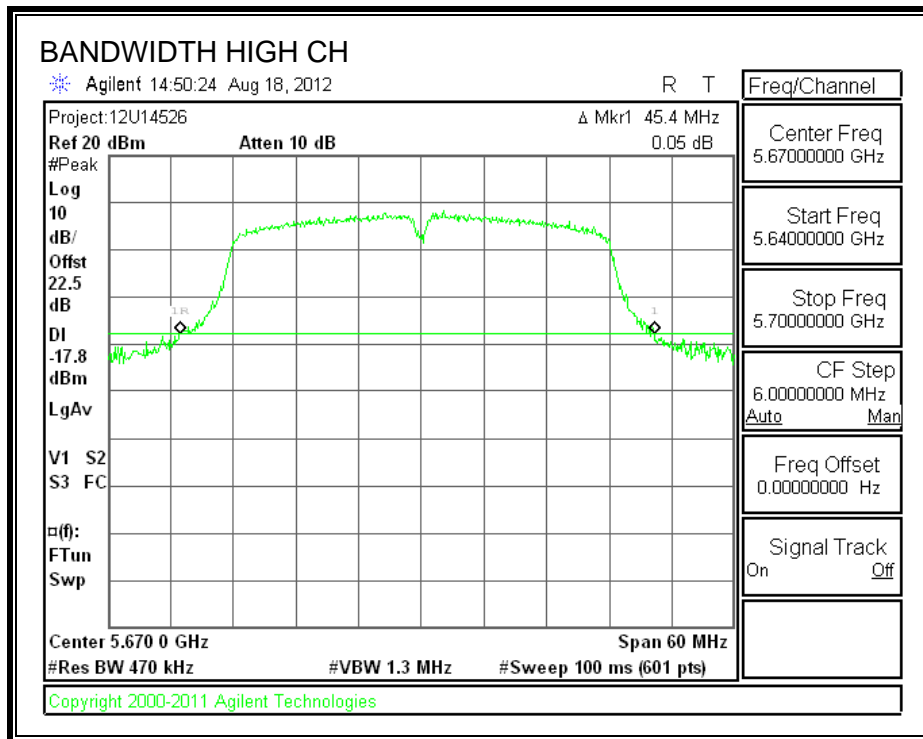
None; for reporting purposes only.

**RESULTS**

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
Low	5510	44.60
Mid	5550	49.70
High	5670	45.40

**26 dB BANDWIDTH**





**8.9.2. 99% BANDWIDTH**

**LIMITS**

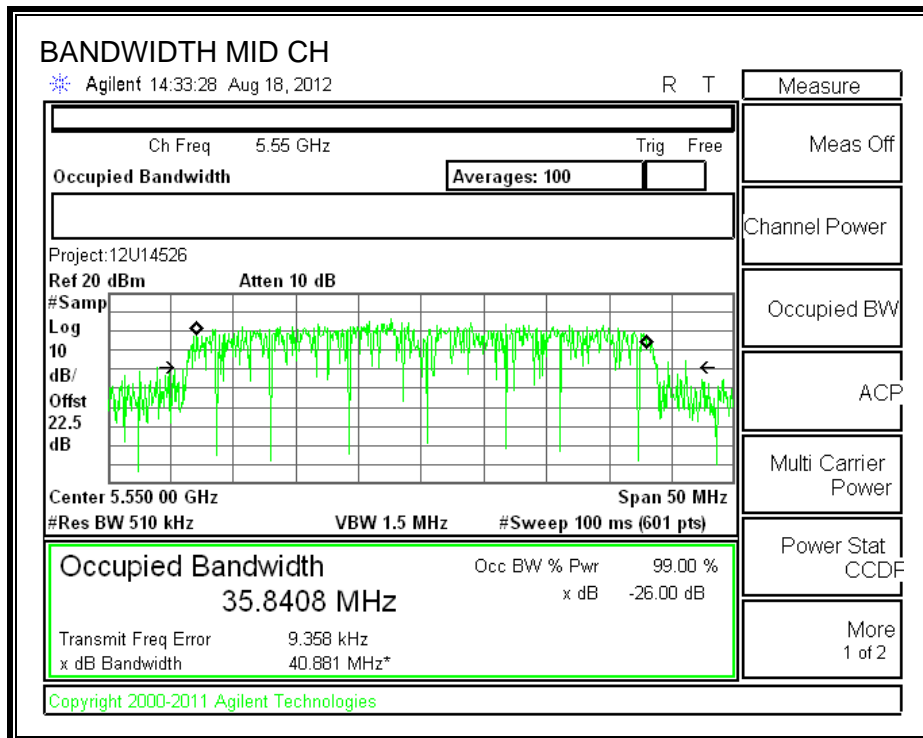
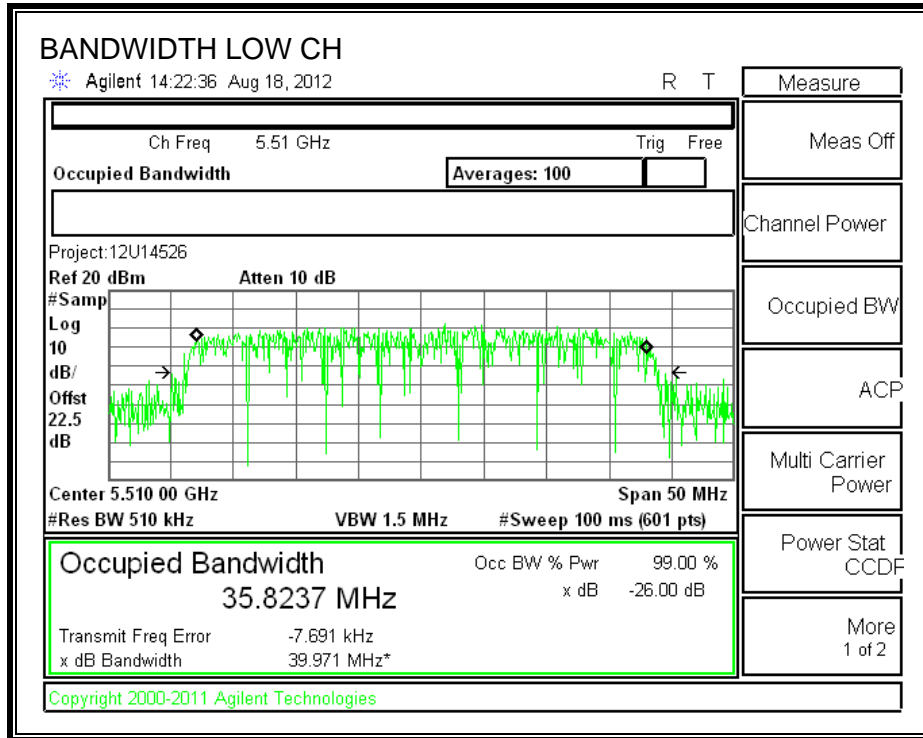
None; for reporting purposes only.

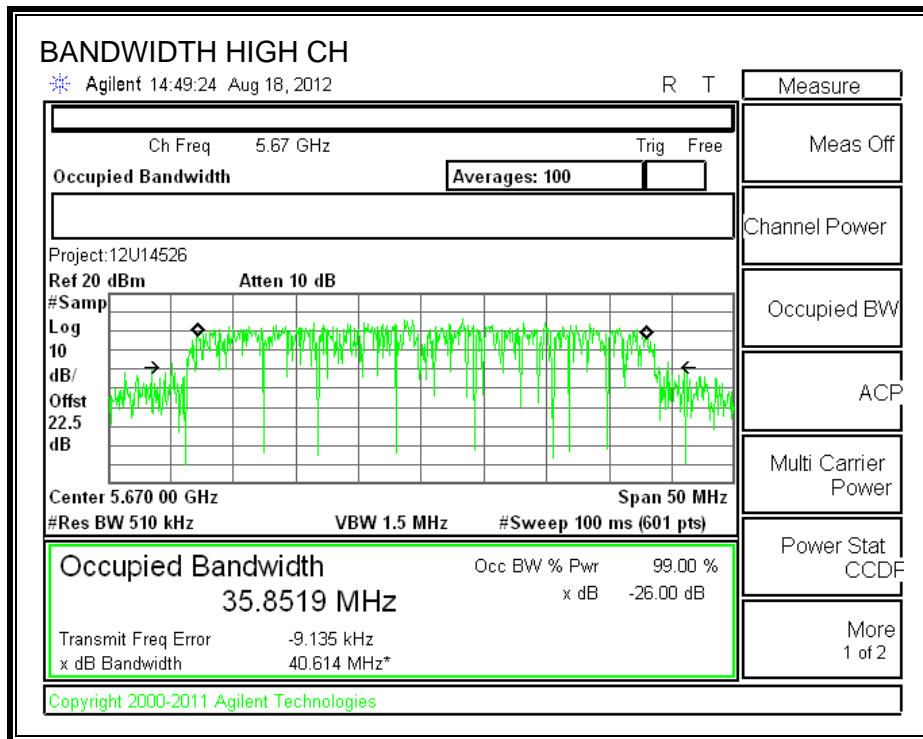
**RESULTS**

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5510	35.8237
Mid	5550	35.8408
High	5670	35.8519



**99% BANDWIDTH**





### **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 1.5 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

#### **RESULTS**

Channel	Frequency (MHz)	Power (dBm)
Low	5510	12.47
Mid	5550	15.99
High	5670	15.96

---

## 8.9.4. OUTPUT POWER AND PPSD

### LIMITS

FCC §15.407 (a) (2)

IC RSS-210 A9.2 (3)

For the 5.25–5.35 GHz and 5.47–5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or  $11 \text{ dBm} + 10 \log B$ , where B is the 26 dB emission bandwidth in megahertz. In addition, the peak 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 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.

**RESULTS**

**Limits**

Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	11 + 10 Log B Limit (dBm)	Directional Gain (dBi)	Power Limit (dBm)	PPSD Limit (dBm)
Low	5510	24	35.8237	26.54	5.42	24.00	11.00
Mid	5550	24	35.8408	26.54	5.42	24.00	11.00
High	5670	24	35.8519	26.55	5.42	24.00	11.00

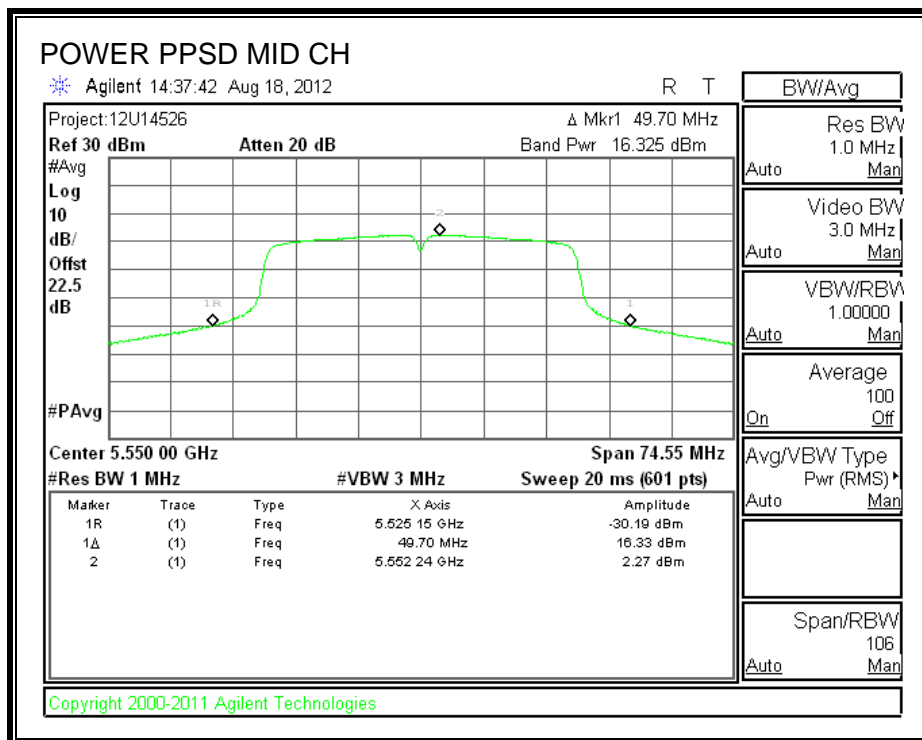
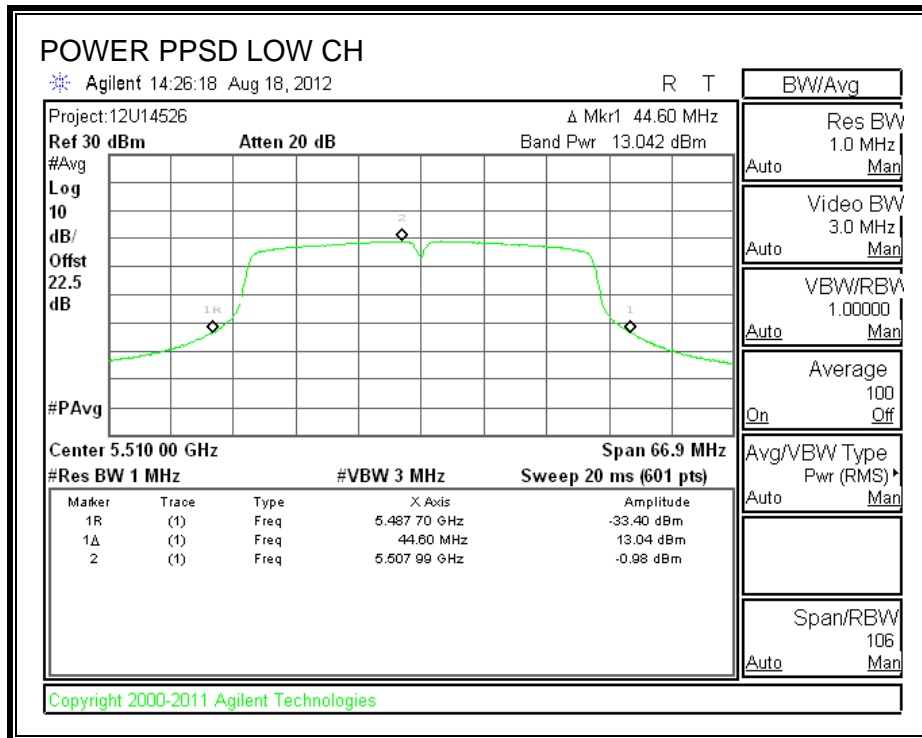
**Output Power Results**

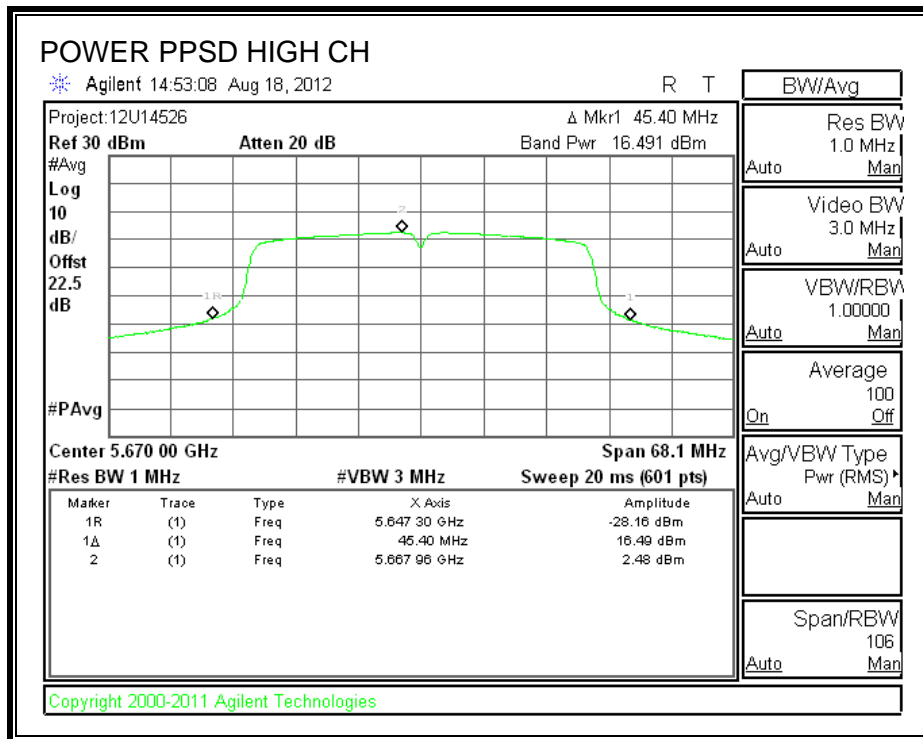
Channel	Frequency (MHz)	Meas Power (dBm)	Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5510	13.042	13.042	24.00	-10.958
Mid	5550	16.325	16.325	24.00	-7.675
High	5670	16.491	16.491	24.00	-7.509

**PPSD Results**

Channel	Frequency (MHz)	Meas PPSD (dBm)	Corr'd PPSD (dBm)	PPSD Limit (dBm)	PPSD Margin (dB)
Low	5510	-0.98	-0.98	11.00	-11.98
Mid	5550	2.27	2.27	11.00	-8.73
High	5670	2.48	2.48	11.00	-8.52

**OUTPUT POWER AND PPSD**





### 8.9.5. PEAK EXCURSION

#### LIMITS

FCC §15.407 (a) (6)

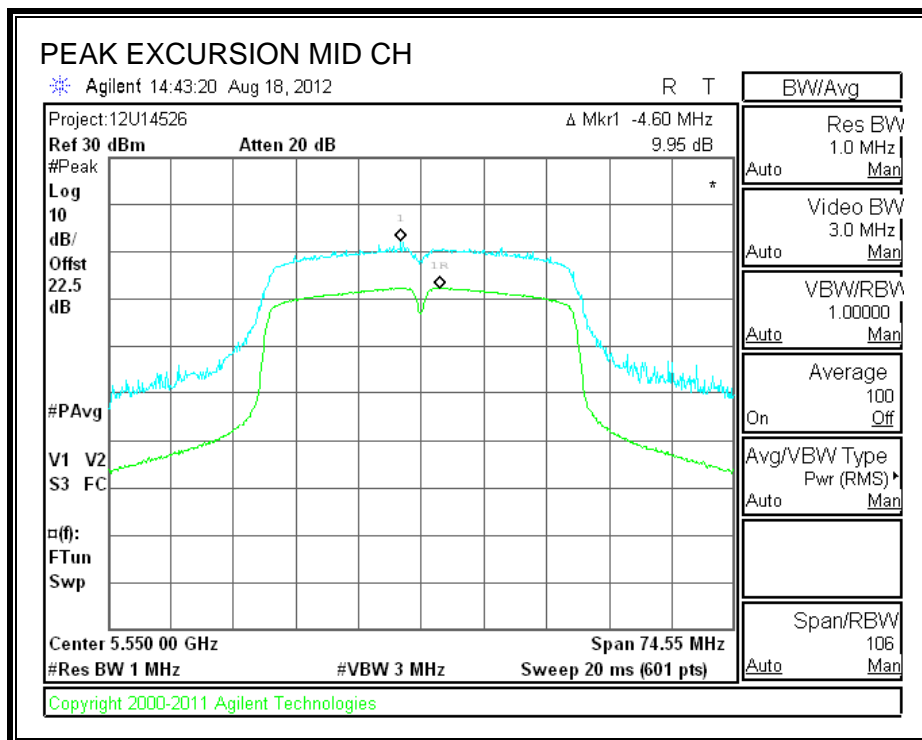
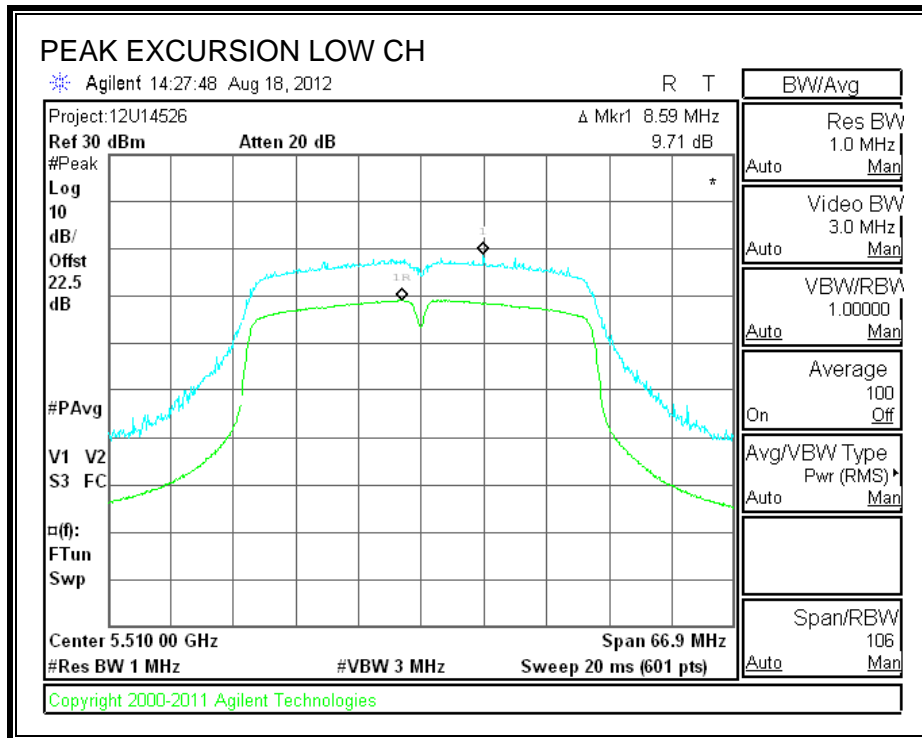
The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

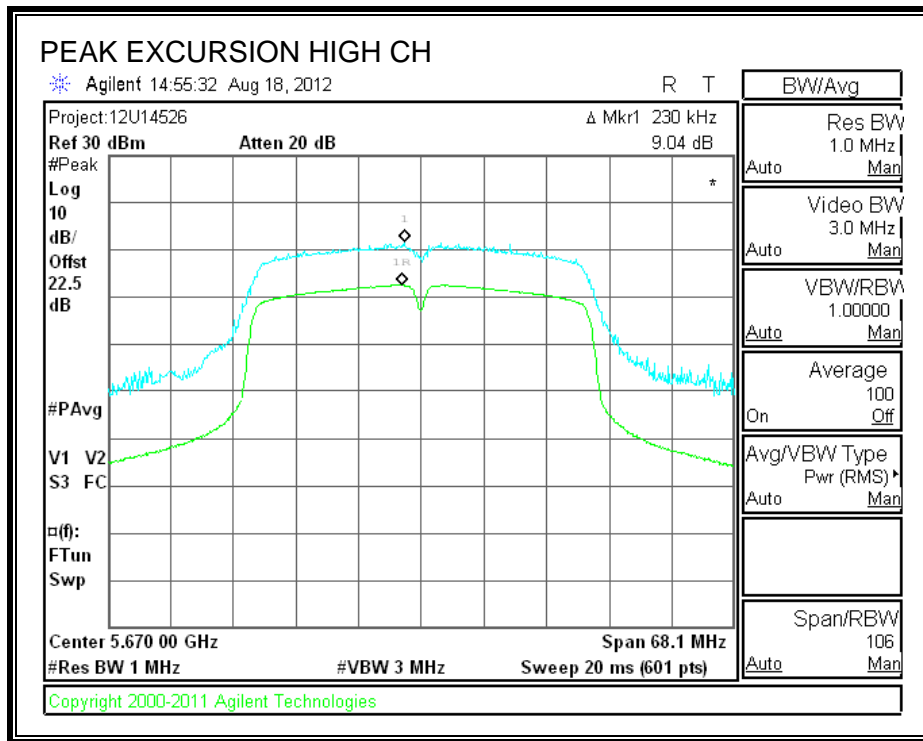
#### RESULTS

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	5510	9.71	13	-3.29
Mid	5550	9.95	13	-3.05
High	5670	9.04	13	-3.96



**PEAK EXCURSION**





## 9. RADIATED TEST RESULTS

### 9.1. LIMITS AND PROCEDURE

#### LIMITS

FCC §15.205 and §15.209

IC RSS-210 Clause 2.6 (Transmitter)

IC RSS-GEN Clause 6 (Receiver)

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

#### TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters.

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.

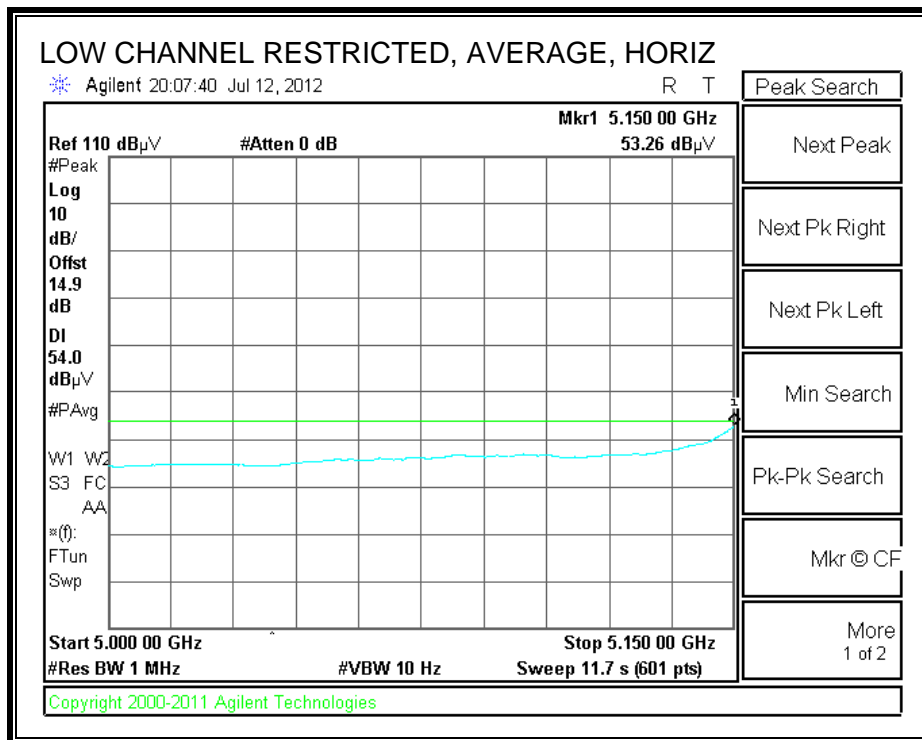
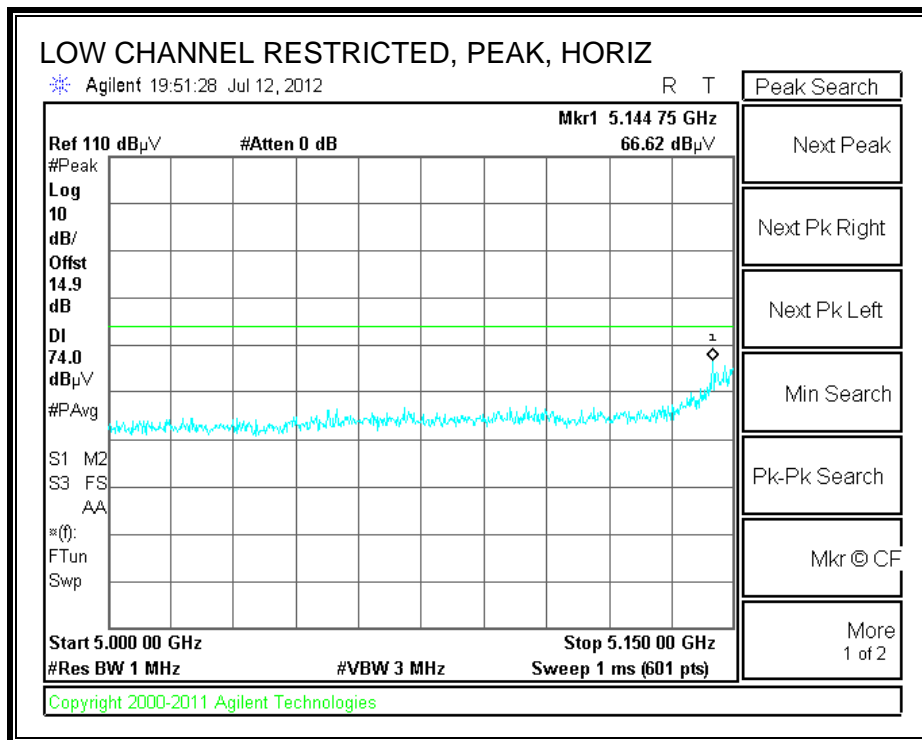
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band.

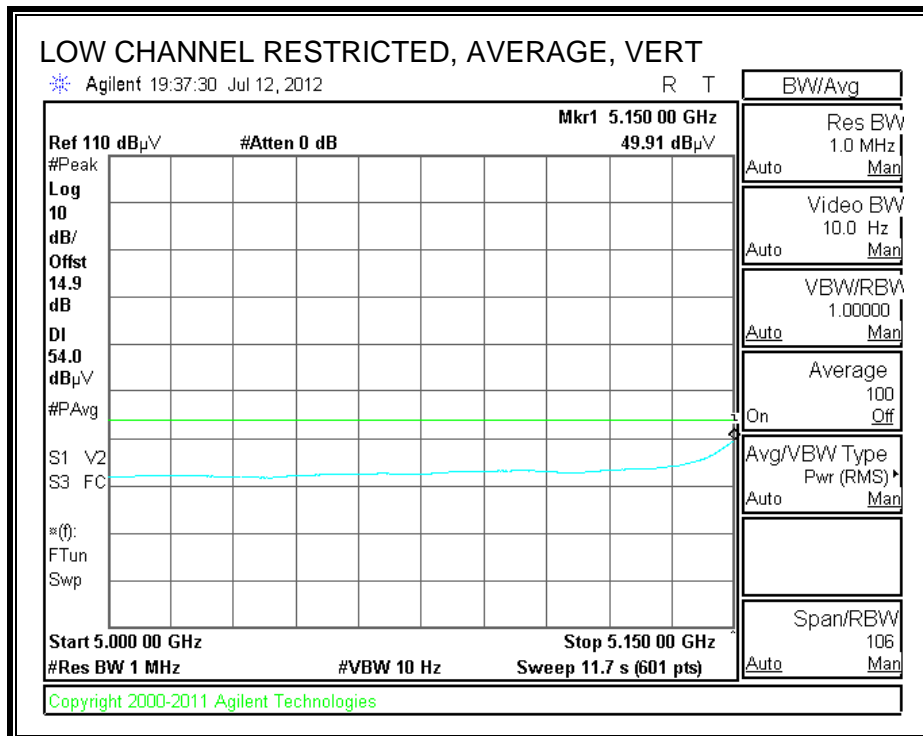
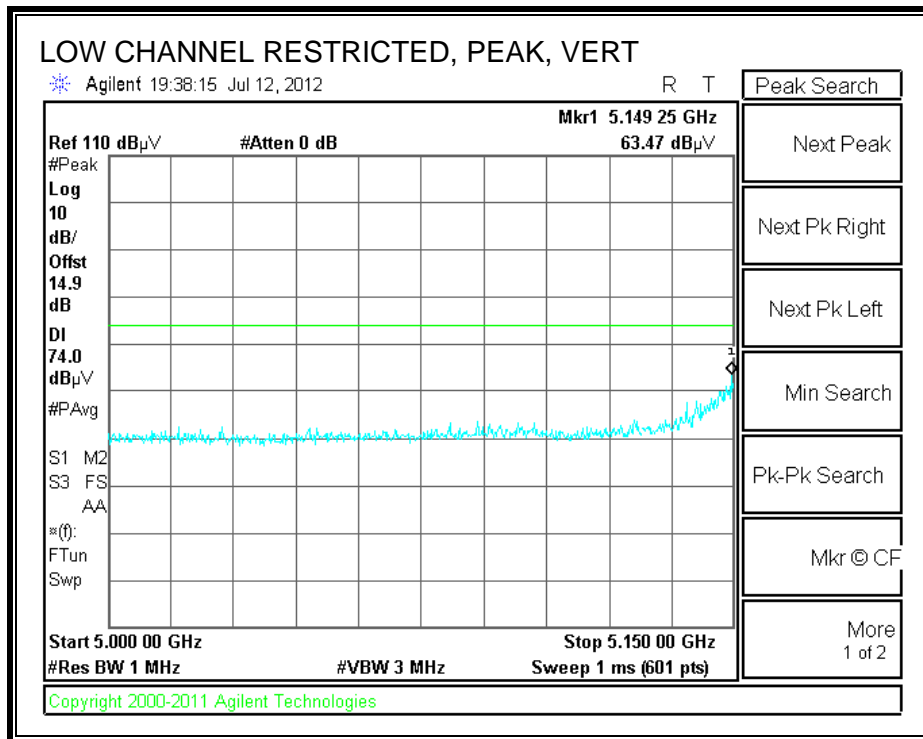
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

## 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)





**HARMONICS AND SPURIOUS EMISSIONS**

**High Frequency Measurement**  
 Compliance Certification Services, Fremont 5m Chamber

Test Engr: Chin Pang  
 Date: 08/13/12  
 Project #: 12U14526  
 Company: Apple  
 Test Target: FCC 15.407  
 Mode Oper: a mode, 5.2GHz ( Worst Case)

f Measurement Frequency Amp Preamp Gain Average Field Strength Limit  
 Dist Distance to Antenna D Corr Distance Correct to 3 meters Peak Field Strength Limit  
 Read Analyzer Reading Avg Average Field Strength @ 3 m Margin vs. Average Limit  
 AF Antenna Factor Peak Calculated Peak Field Strength Margin vs. Peak Limit  
 CL Cable Loss HPF High Pass Filter

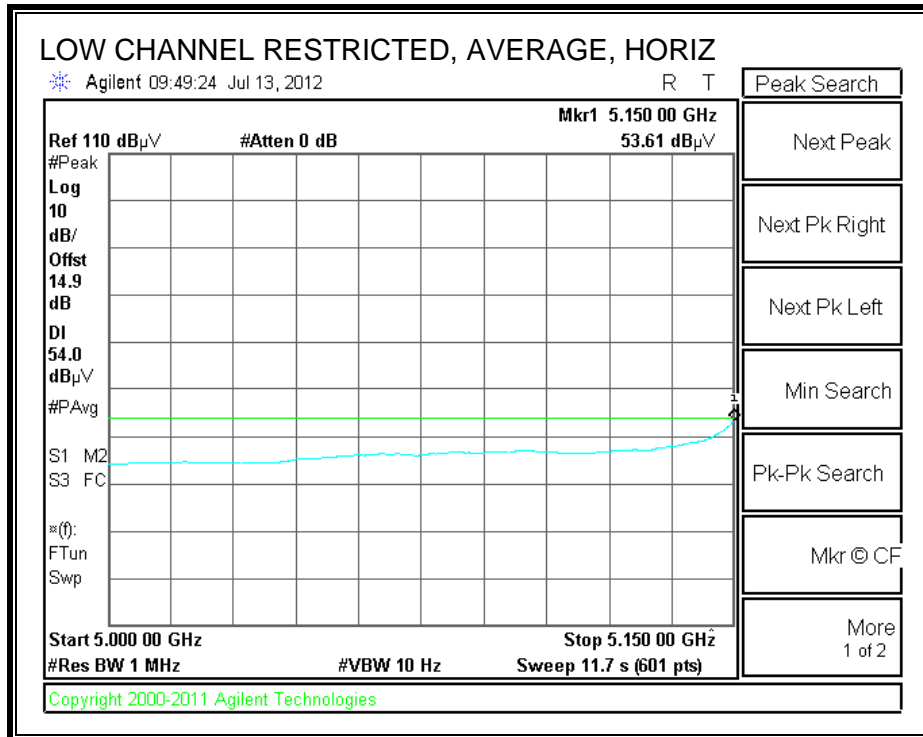
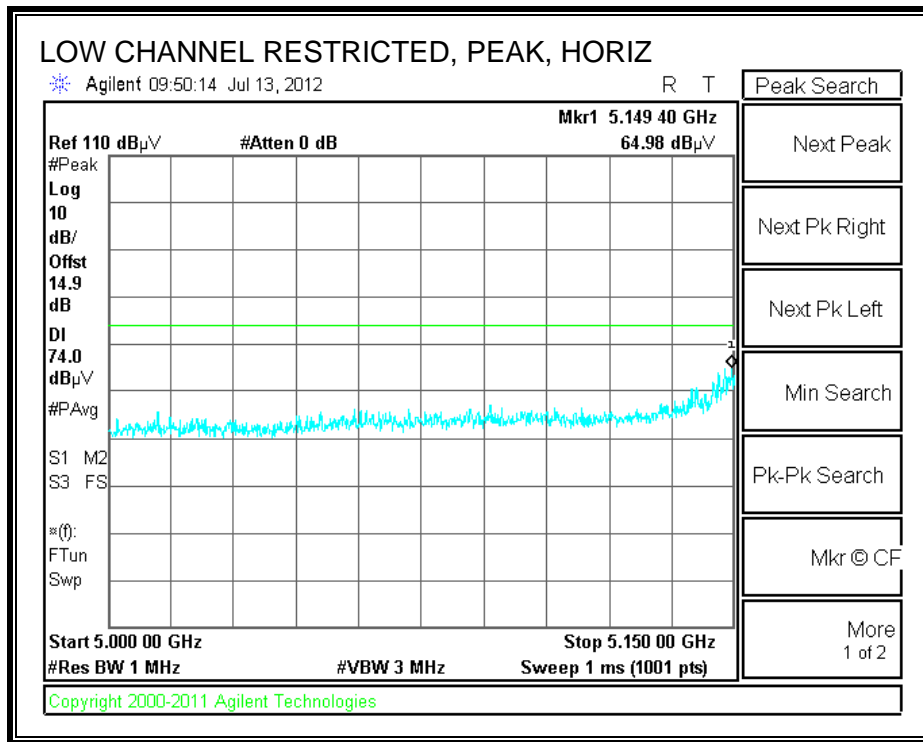
f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
<b>Low Ch, 5180MHz</b>													
15.540	3.0	34.3	39.0	12.5	-34.0	0.0	0.0	51.8	74.0	-22.2	V	P	
15.540	3.0	22.4	39.0	12.5	-34.0	0.0	0.0	39.8	54.0	-14.2	V	A	
15.540	3.0	34.7	39.0	12.5	-34.0	0.0	0.0	52.2	74.0	-21.8	H	P	
15.540	3.0	22.8	39.0	12.5	-34.0	0.0	0.0	40.3	54.0	-13.7	H	A	
<b>Mid Ch, 5200MHz</b>													
15.600	3.0	34.5	38.8	12.5	-34.0	0.0	0.0	51.8	74.0	-22.2	V	P	
15.600	3.0	22.3	38.8	12.5	-34.0	0.0	0.0	39.7	54.0	-14.3	V	A	
15.600	3.0	35.0	38.8	12.5	-34.0	0.0	0.0	52.3	74.0	-21.7	H	P	
15.600	3.0	22.3	38.8	12.5	-34.0	0.0	0.0	39.7	54.0	-14.3	H	A	
<b>High Ch, 5240mhz</b>													
15.720	3.0	33.5	38.4	12.6	-34.0	0.0	0.0	50.6	74.0	-23.4	V	P	
15.720	3.0	22.0	38.4	12.6	-34.0	0.0	0.0	39.0	54.0	-15.0	V	A	
15.720	3.0	34.0	38.4	12.6	-34.0	0.0	0.0	51.0	74.0	-23.0	H	P	
15.720	3.0	22.0	38.4	12.6	-34.0	0.0	0.0	39.0	54.0	-15.0	H	A	

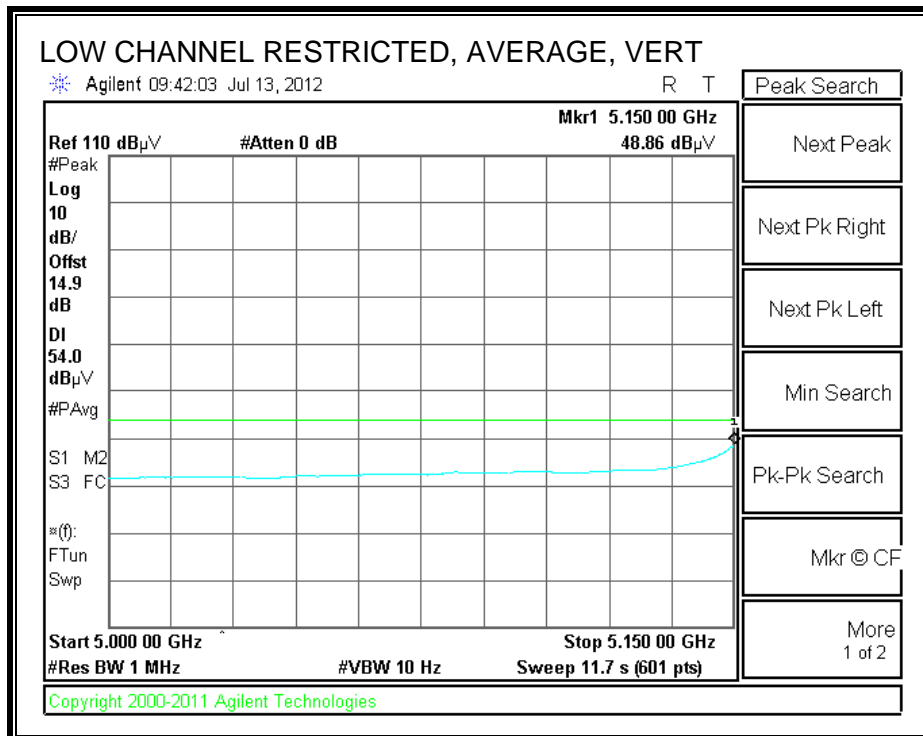
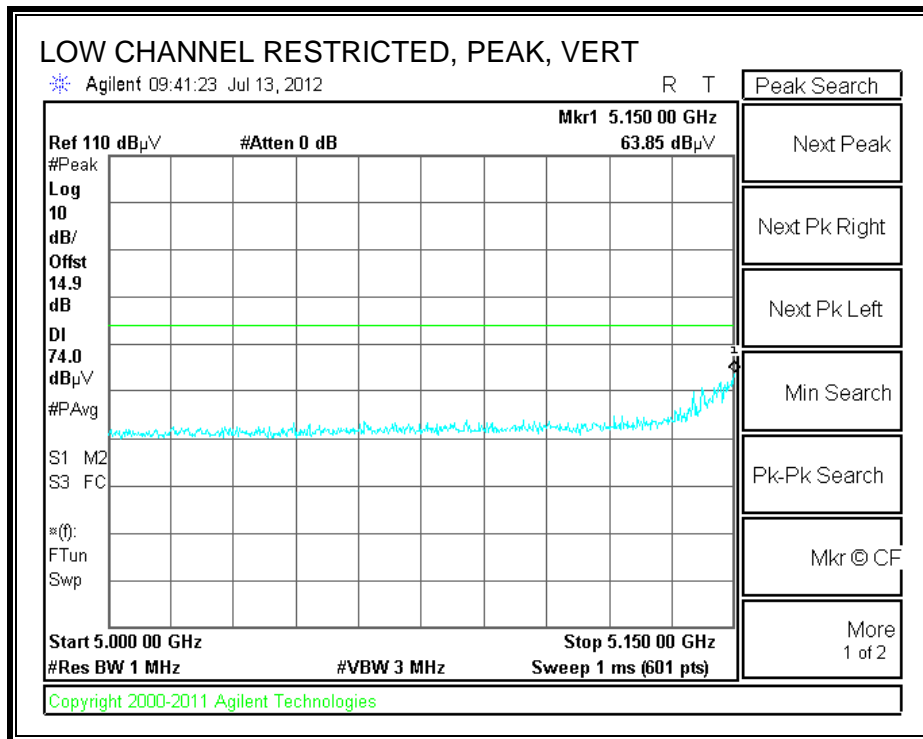
Rev. 4.1.2.7

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

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

#### RESTRICTED BANDEDGE (LOW CHANNEL)







**HARMONICS AND SPURIOUS EMISSIONS**

**High Frequency Measurement**  
 Compliance Certification Services, Fremont 5m Chamber

Test Engr: Chin Pang  
 Date: 08/13/12  
 Project #: 12U14526  
 Company: Apple  
 Test Target: FCC 15.407  
 Mode Oper: HT20, 5.2GHz, TX (Worst Case)

f Measurement Frequency Amp Preamp Gain Average Field Strength Limit  
 Dist Distance to Antenna D Corr Distance Correct to 3 meters Peak Field Strength Limit  
 Read Analyzer Reading Avg Average Field Strength @ 3 m Margin vs. Average Limit  
 AF Antenna Factor Peak Calculated Peak Field Strength Margin vs. Peak Limit  
 CL Cable Loss HPF High Pass Filter

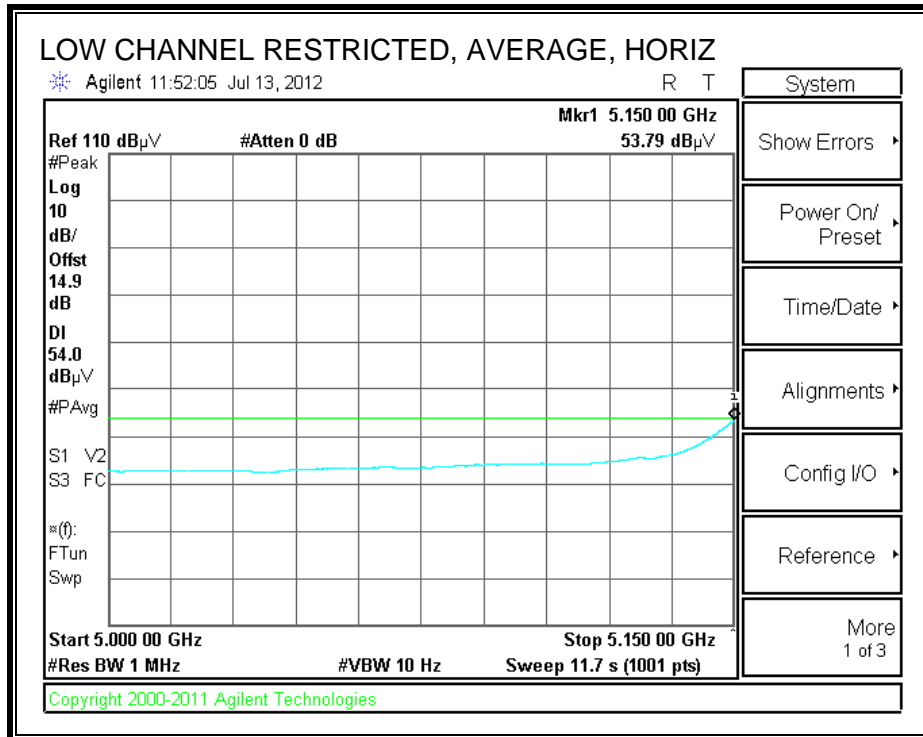
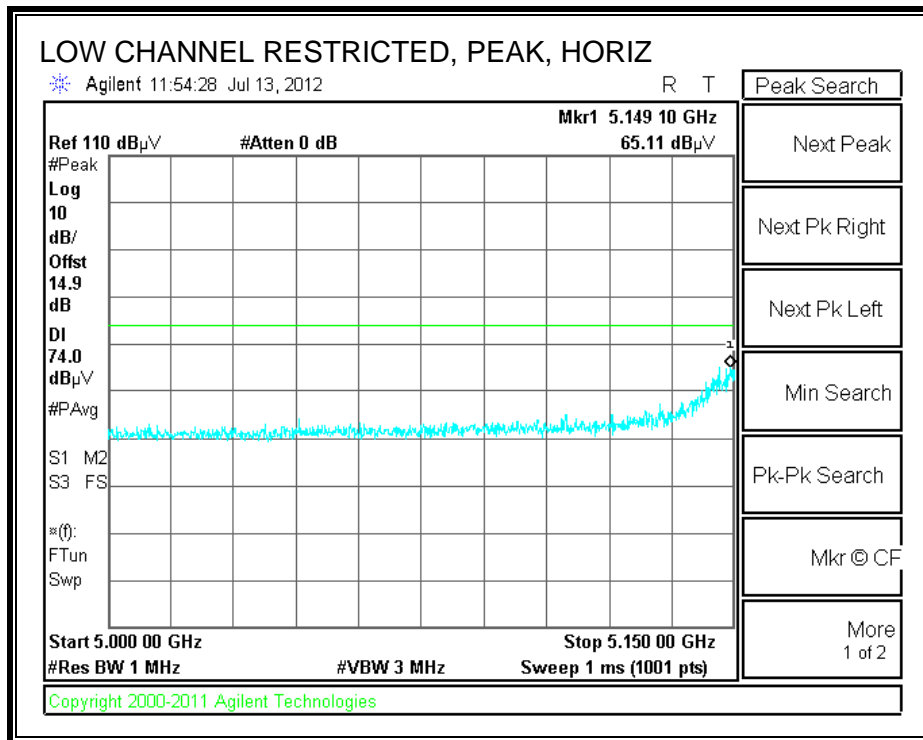
f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
<b>Low Ch, 5180MHz</b>													
15.540	3.0	35.0	39.0	12.5	-34.0	0.0	0.0	52.4	74.0	-21.6	V	P	
15.540	3.0	22.4	39.0	12.5	-34.0	0.0	0.0	39.9	54.0	-14.1	V	A	
15.540	3.0	34.6	39.0	12.5	-34.0	0.0	0.0	52.1	74.0	-21.9	H	P	
15.540	3.0	22.4	39.0	12.5	-34.0	0.0	0.0	39.9	54.0	-14.1	H	A	
<b>Mid Ch, 5200MHz</b>													
15.600	3.0	34.9	38.8	12.5	-34.0	0.0	0.0	52.2	74.0	-21.8	V	P	
15.600	3.0	22.4	38.8	12.5	-34.0	0.0	0.0	39.7	54.0	-14.3	V	A	
15.600	3.0	34.7	38.8	12.5	-34.0	0.0	0.0	52.0	74.0	-22.0	H	P	
15.600	3.0	22.4	38.8	12.5	-34.0	0.0	0.0	39.7	54.0	-14.3	H	A	
<b>High Ch, 5240MHz</b>													
15.720	3.0	34.7	38.4	12.6	-34.0	0.0	0.0	51.8	74.0	-22.2	V	P	
15.720	3.0	22.0	38.4	12.6	-34.0	0.0	0.0	39.0	54.0	-15.0	V	A	
15.720	3.0	34.2	38.4	12.6	-34.0	0.0	0.0	51.2	74.0	-22.8	H	P	
15.720	3.0	22.0	38.4	12.6	-34.0	0.0	0.0	39.0	54.0	-15.0	H	A	

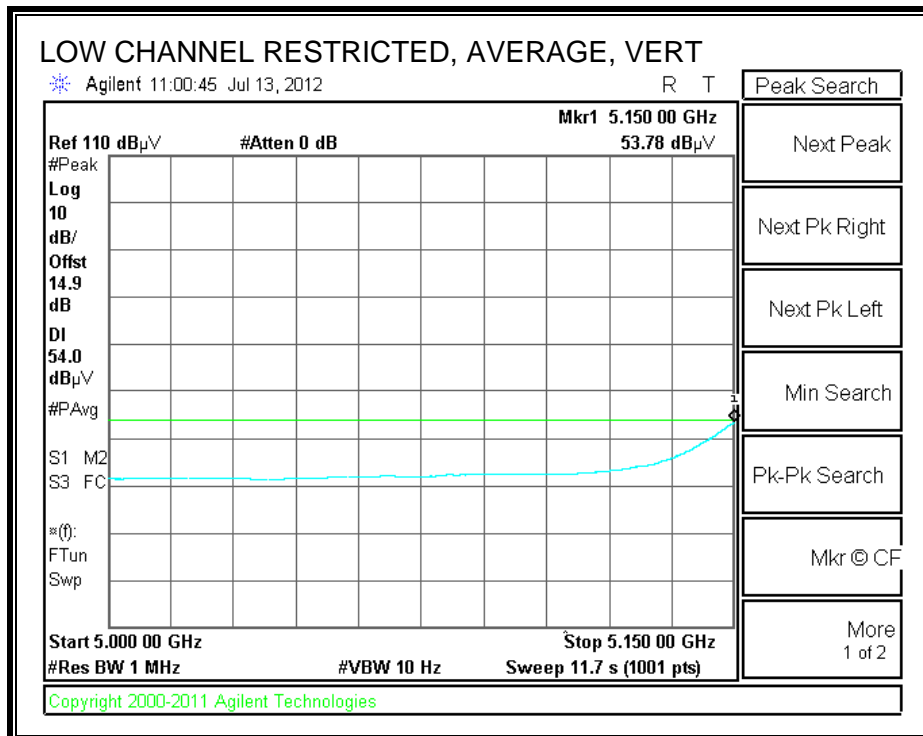
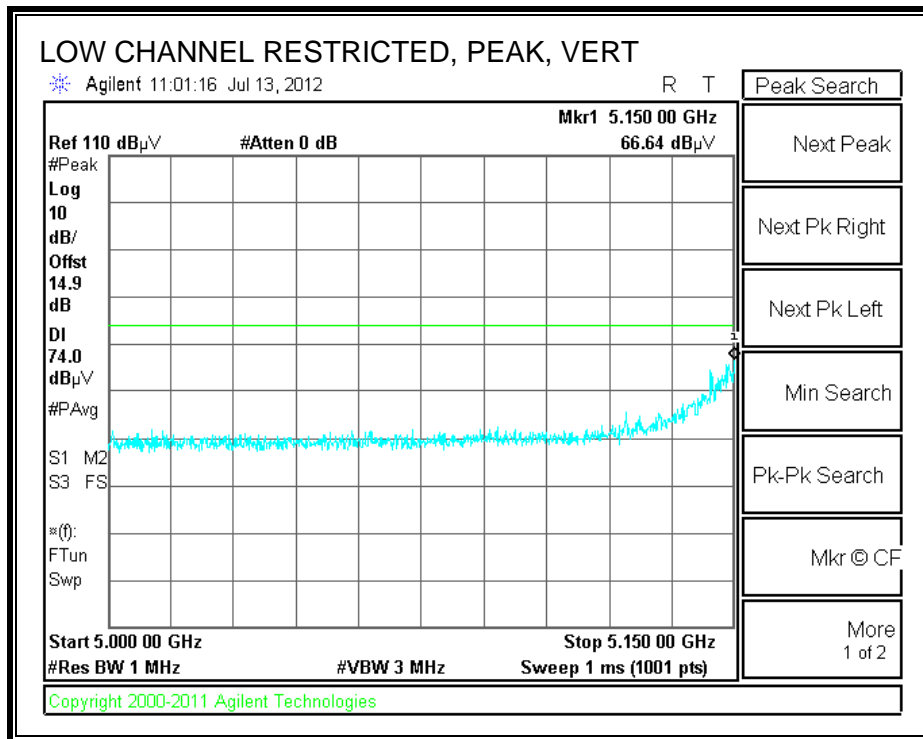
Rev. 4.1.2.7

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

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

#### RESTRICTED BANDEDGE (LOW CHANNEL)





**HARMONICS AND SPURIOUS EMISSIONS**

**High Frequency Measurement**  
 Compliance Certification Services, Fremont 5m Chamber

Test Engr: Chin Pang  
 Date: 08/13/12  
 Project #: 12U14526  
 Company: Apple  
 Test Target: FCC 15.407  
 Mode Oper: HT40, 5.2GHz, TX ( Worst Case)

f Measurement Frequency Amp Preamp Gain Average Field Strength Limit  
 Dist Distance to Antenna D Corr Distance Correct to 3 meters Peak Field Strength Limit  
 Read Analyzer Reading Avg Average Field Strength @ 3 m Margin vs. Average Limit  
 AF Antenna Factor Peak Calculated Peak Field Strength Margin vs. Peak Limit  
 CL Cable Loss HPF High Pass Filter

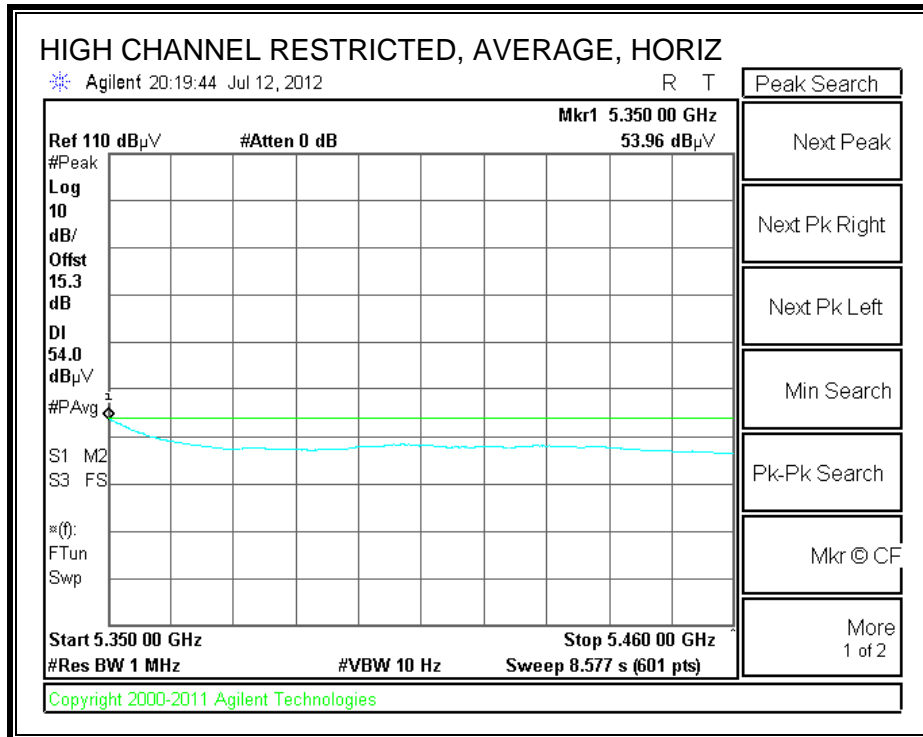
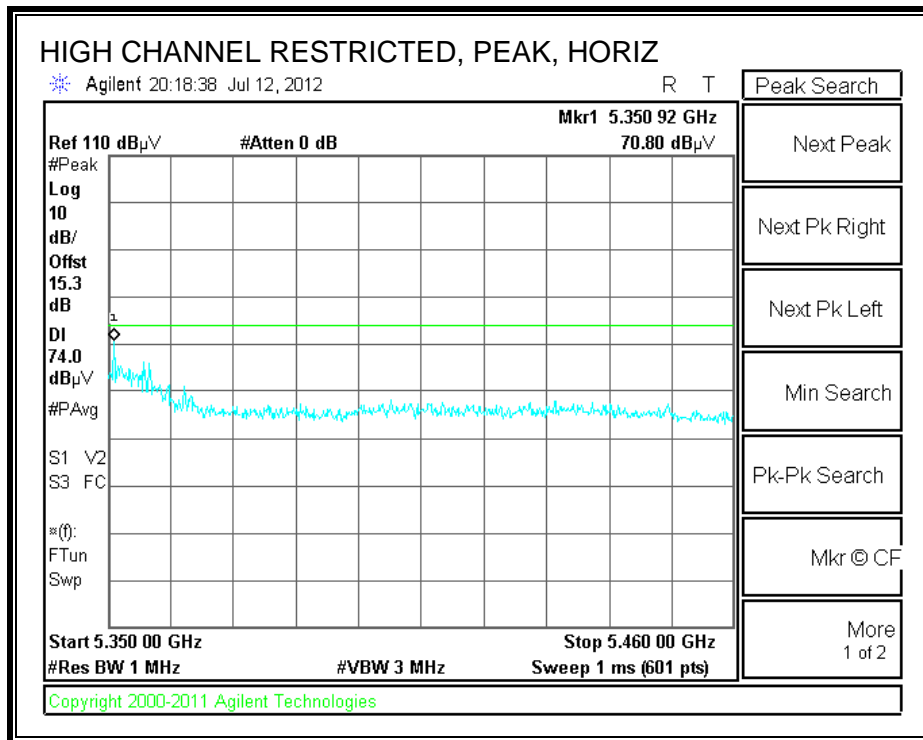
f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
<b>Low Ch, 5190MHz</b>													
15.570	3.0	35.3	38.9	12.5	-34.0	0.0	0.0	52.7	74.0	-21.3	H	P	
15.570	3.0	22.5	38.9	12.5	-34.0	0.0	0.0	39.9	54.0	-14.1	H	A	
15.570	3.0	35.2	38.9	12.5	-34.0	0.0	0.0	52.6	74.0	-21.4	V	P	
15.570	3.0	22.4	38.9	12.5	-34.0	0.0	0.0	39.9	54.0	-14.1	V	A	
<b>High Ch, 5230MHz</b>													
15.690	3.0	34.3	38.5	12.6	-34.0	0.0	0.0	51.4	74.0	-22.6	H	P	
15.690	3.0	22.3	38.5	12.6	-34.0	0.0	0.0	39.4	54.0	-14.6	H	A	
15.690	3.0	34.6	38.5	12.6	-34.0	0.0	0.0	51.7	74.0	-22.3	V	P	
15.690	3.0	22.2	38.5	12.6	-34.0	0.0	0.0	39.3	54.0	-14.7	V	A	

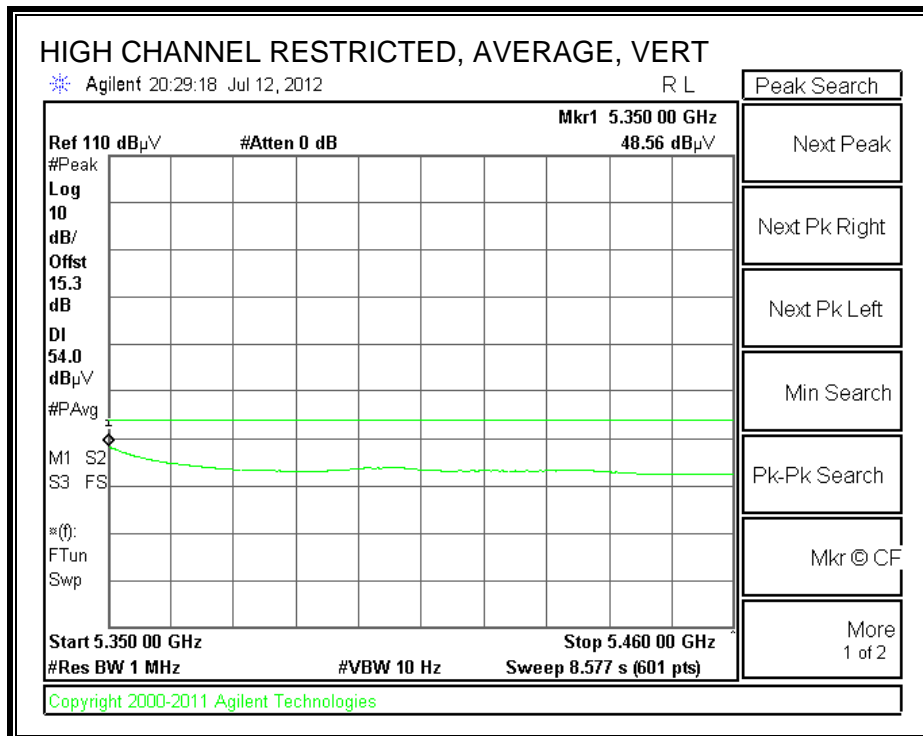
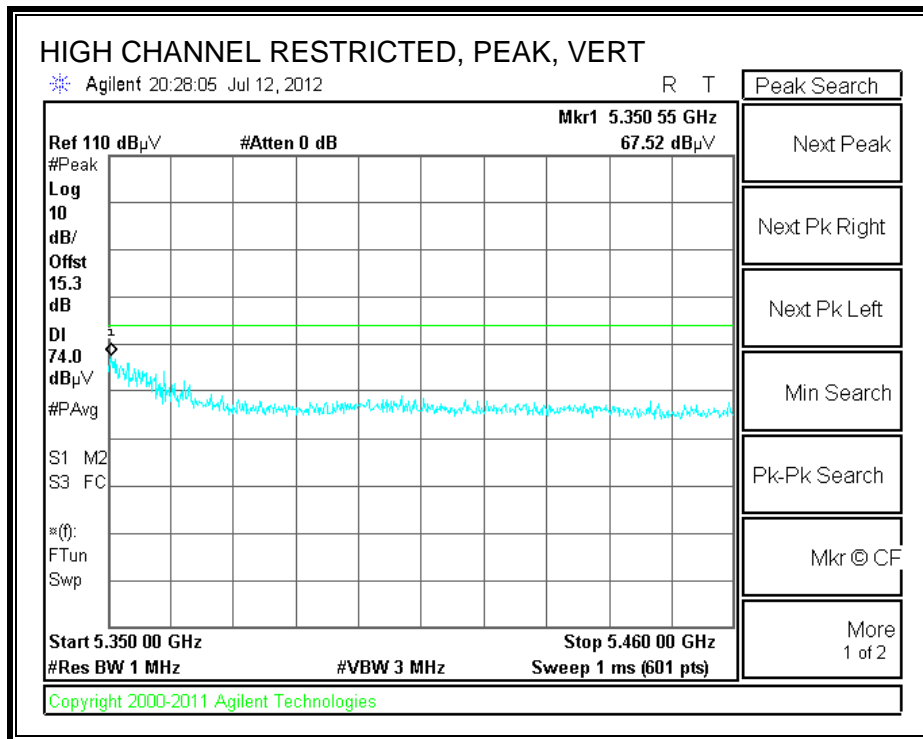
Rev. 4.1.2.7

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

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

#### RESTRICTED BANDEDGE (HIGH CHANNEL)





**HARMONICS AND SPURIOUS EMISSIONS**

High Frequency Measurement  
 Compliance Certification Services, Fremont 5m Chamber

Test Engr: Chin Pang  
 Date: 08/13/12  
 Project #: 12U14526  
 Company: Apple  
 Test Target: FCC 15.407  
 Mode Oper: a mode 5.3GHz TX(Worst Case)

f Measurement Frequency Amp Preamp Gain Average Field Strength Limit  
 Dist Distance to Antenna D Corr Distance Correct to 3 meters Peak Field Strength Limit  
 Read Analyzer Reading Avg Average Field Strength @ 3 m Margin vs. Average Limit  
 AF Antenna Factor Peak Calculated Peak Field Strength Margin vs. Peak Limit  
 CL Cable Loss HPF High Pass Filter

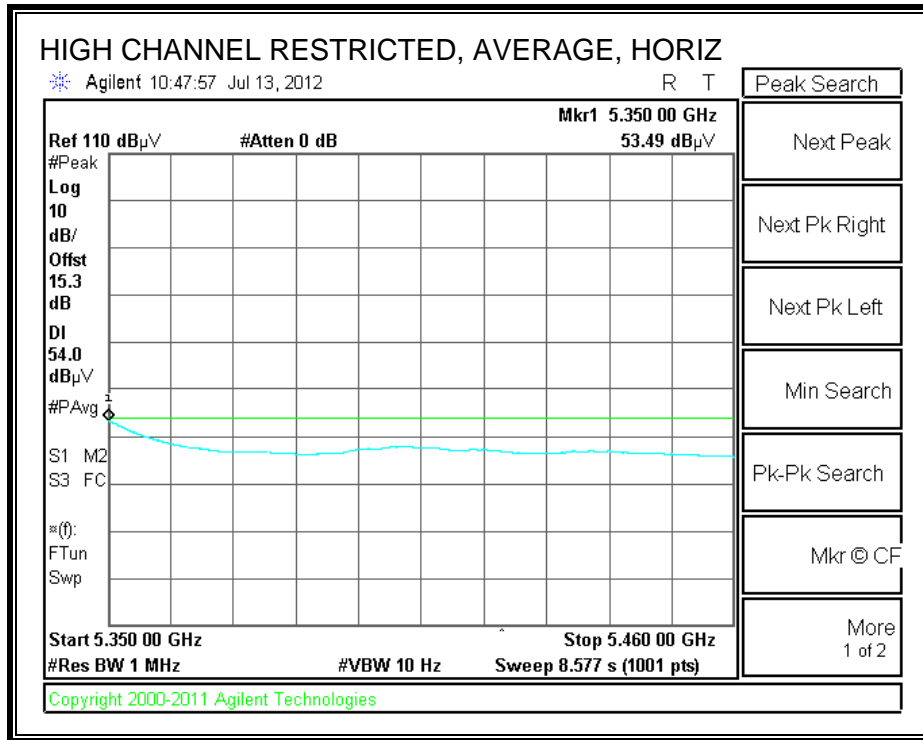
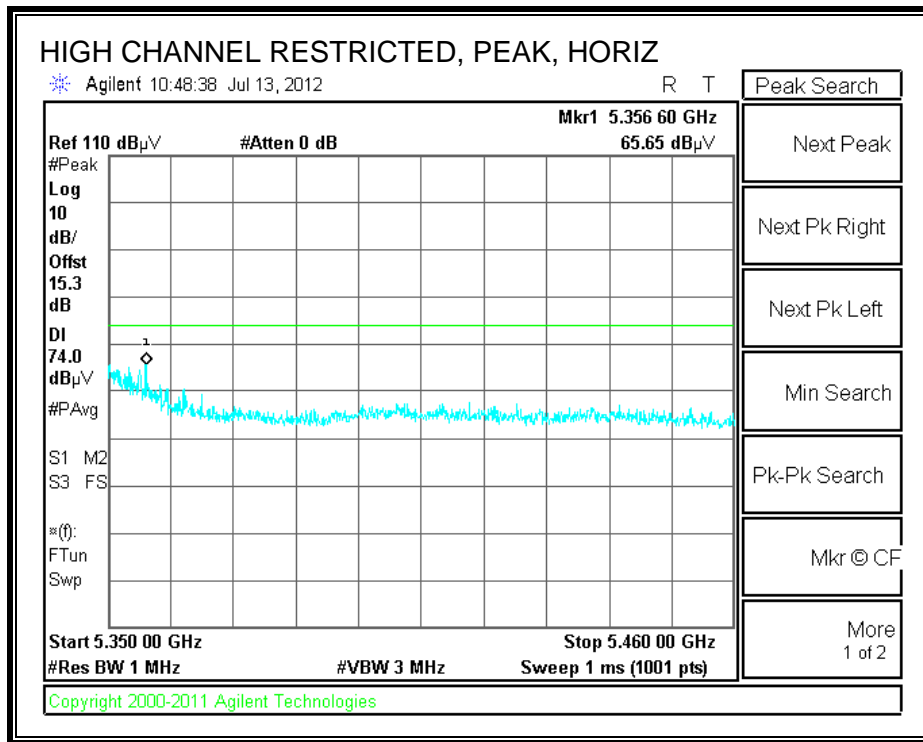
f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Filtr dB	Corr. dB	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
<b>Low Ch, 5260MHz</b>													
15.780	3.0	34.3	38.2	12.6	-33.9	0.0	0.0	51.2	74.0	-22.8	V	P	
15.780	3.0	22.2	38.2	12.6	-33.9	0.0	0.0	39.1	54.0	-14.9	V	A	
15.780	3.0	34.1	38.2	12.6	-33.9	0.0	0.0	51.0	74.0	-23.0	H	P	
15.780	3.0	22.1	38.2	12.6	-33.9	0.0	0.0	39.0	54.0	-15.0	H	A	
<b>Mid Ch, 5300MHz</b>													
10.600	3.0	36.6	38.3	9.7	-35.7	0.0	0.0	48.8	74.0	-25.2	V	P	
10.600	3.0	24.5	38.3	9.7	-35.7	0.0	0.0	36.7	54.0	-17.3	V	A	
15.900	3.0	34.3	37.8	12.7	-33.9	0.0	0.0	50.8	74.0	-23.2	V	P	
15.900	3.0	22.3	37.8	12.7	-33.9	0.0	0.0	38.9	54.0	-15.1	V	A	
10.600	3.0	34.2	38.3	9.7	-35.7	0.0	0.0	46.4	74.0	-27.6	H	P	
10.600	3.0	21.9	38.3	9.7	-35.7	0.0	0.0	34.0	54.0	-20.0	H	A	
15.900	3.0	34.0	37.8	12.7	-33.9	0.0	0.0	50.6	74.0	-23.4	H	P	
15.900	3.0	22.3	37.8	12.7	-33.9	0.0	0.0	38.8	54.0	-15.2	H	A	
<b>High Ch, 5320MHz</b>													
10.640	3.0	35.1	38.3	9.7	-35.7	0.0	0.0	47.3	74.0	-26.7	V	P	
10.640	3.0	22.8	38.3	9.7	-35.7	0.0	0.0	35.0	54.0	-19.0	V	A	
15.960	3.0	34.9	37.6	12.7	-33.9	0.0	0.0	51.3	74.0	-22.7	V	P	
15.960	3.0	22.4	37.6	12.7	-33.9	0.0	0.0	38.8	54.0	-15.2	V	A	
10.640	3.0	34.0	38.3	9.7	-35.7	0.0	0.0	46.3	74.0	-27.7	H	P	
10.640	3.0	21.9	38.3	9.7	-35.7	0.0	0.0	34.2	54.0	-19.8	H	A	
15.960	3.0	34.4	37.6	12.7	-33.9	0.0	0.0	50.9	74.0	-23.1	H	P	
15.960	3.0	22.3	37.6	12.7	-33.9	0.0	0.0	38.7	54.0	-15.3	H	A	

Rev. 4.1.2.7

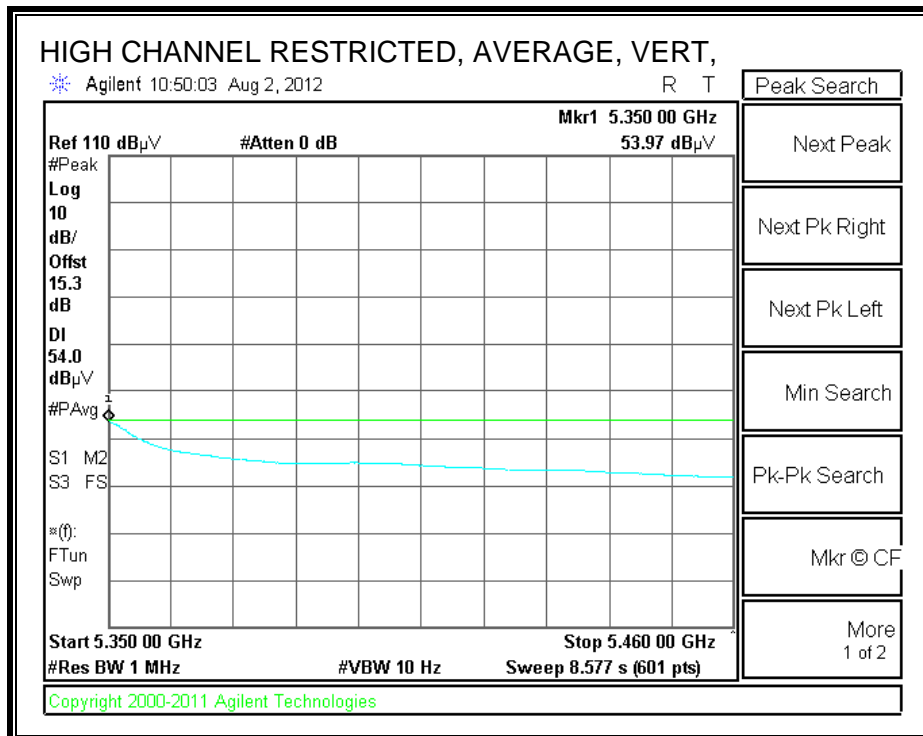
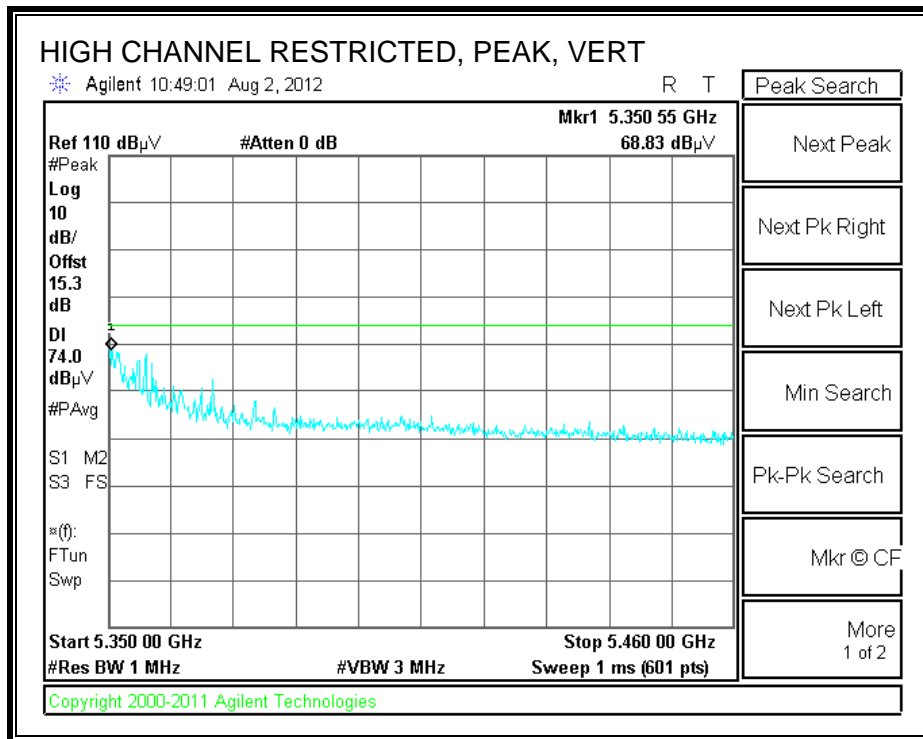
Note: No other emissions were detected above the system noise floor.

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

#### RESTRICTED BANEDGE (HIGH CHANNEL)







**HARMONICS AND SPURIOUS EMISSIONS**

High Frequency Measurement  
 Compliance Certification Services, Fremont 5m Chamber

Test Engr: Chin Pang  
 Date: 08/13/12  
 Project #: 12U14526  
 Company: Apple  
 Test Target: FCC15.407  
 Mode Oper: HT20, 5.3GHz, TX ( Worst Case)

f Measurement Frequency Amp Preamp Gain Average Field Strength Limit  
 Dist Distance to Antenna D Corr Distance Correct to 3 meters Peak Field Strength Limit  
 Read Analyzer Reading Avg Average Field Strength @ 3 m Margin vs. Average Limit  
 AF Antenna Factor Peak Calculated Peak Field Strength Margin vs. Peak Limit  
 CL Cable Loss HPF High Pass Filter

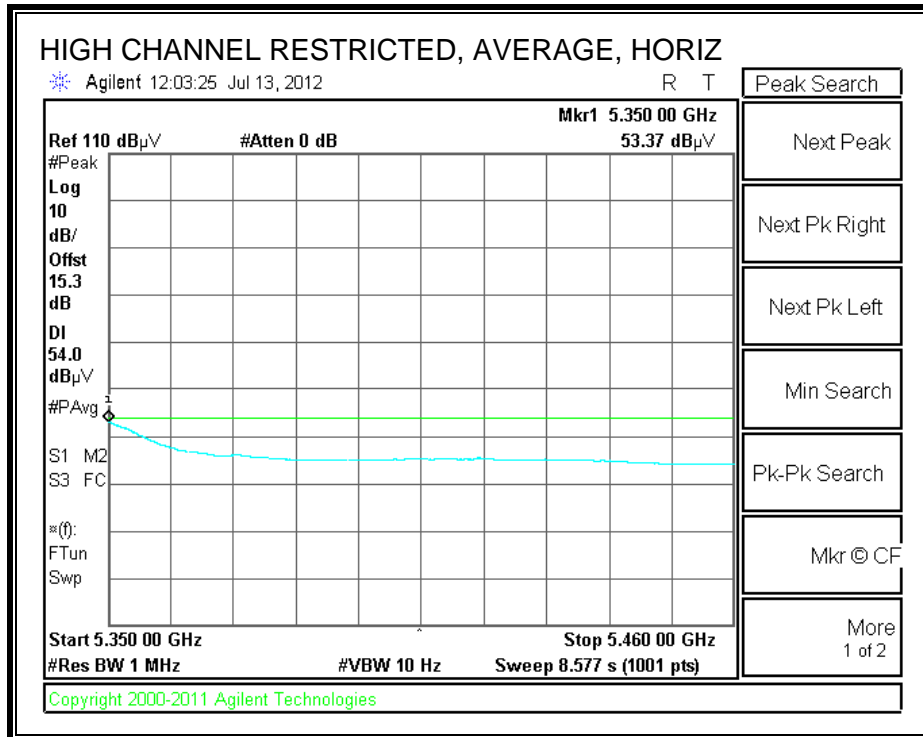
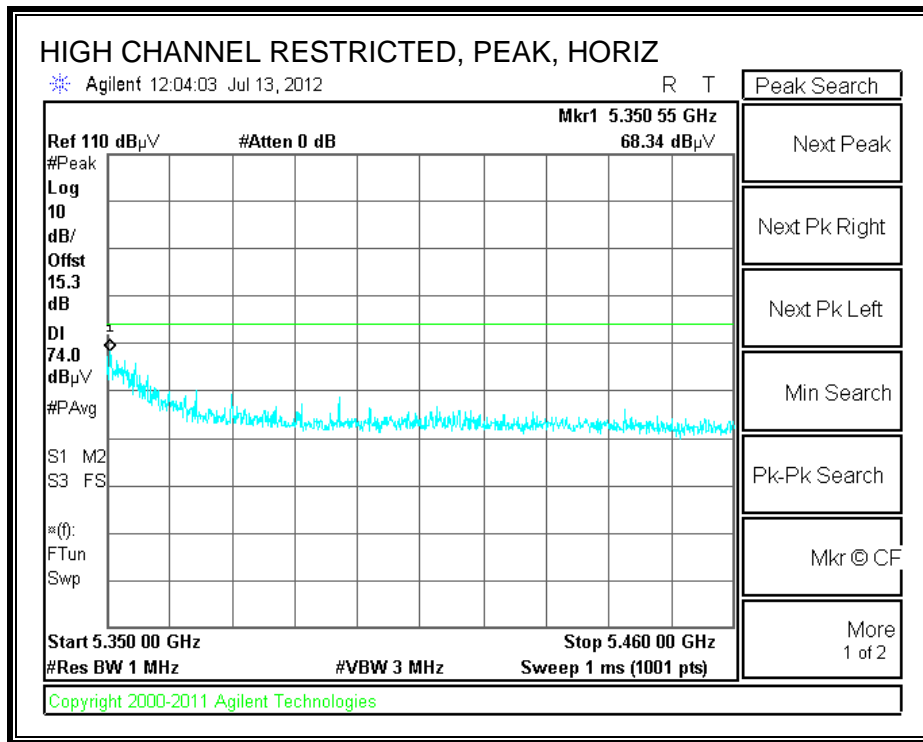
f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Filtr dB	Corr. dB	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
<b>Low Ch, 5260MHz</b>													
15.780	3.0	34.6	38.2	12.6	-33.9	0.0	0.0	51.5	74.0	-22.5	V	P	
15.780	3.0	22.1	38.2	12.6	-33.9	0.0	0.0	39.0	54.0	-15.0	V	A	
15.780	3.0	35.2	38.2	12.6	-33.9	0.0	0.0	52.0	74.0	-22.0	H	P	
15.780	3.0	22.1	38.2	12.6	-33.9	0.0	0.0	38.9	54.0	-15.1	H	A	
<b>Mid Ch, 5300MHz</b>													
10.600	3.0	37.1	38.3	9.7	-35.7	0.0	0.0	49.3	74.0	-24.7	V	P	
10.600	3.0	24.1	38.3	9.7	-35.7	0.0	0.0	36.3	54.0	-17.7	V	A	
15.900	3.0	35.0	37.8	12.7	-33.9	0.0	0.0	51.6	74.0	-22.4	V	P	
15.900	3.0	22.2	37.8	12.7	-33.9	0.0	0.0	38.8	54.0	-15.2	V	A	
10.600	3.0	33.4	38.3	9.7	-35.7	0.0	0.0	45.5	74.0	-28.5	H	P	
10.600	3.0	21.5	38.3	9.7	-35.7	0.0	0.0	33.7	54.0	-20.3	H	A	
15.900	3.0	34.2	37.8	12.7	-33.9	0.0	0.0	50.8	74.0	-23.2	H	P	
15.900	3.0	22.2	37.8	12.7	-33.9	0.0	0.0	38.8	54.0	-15.2	H	A	
<b>High Ch, 5320MHz</b>													
10.640	3.0	33.8	38.3	9.7	-35.7	0.0	0.0	46.0	74.0	-28.0	V	P	
10.640	3.0	21.3	38.3	9.7	-35.7	0.0	0.0	33.5	54.0	-20.5	V	A	
15.960	3.0	34.5	37.6	12.7	-33.9	0.0	0.0	50.9	74.0	-23.1	V	P	
15.960	3.0	22.3	37.6	12.7	-33.9	0.0	0.0	38.7	54.0	-15.3	V	A	
10.640	3.0	33.8	38.3	9.7	-35.7	0.0	0.0	46.0	74.0	-28.0	H	P	
10.640	3.0	21.3	38.3	9.7	-35.7	0.0	0.0	33.5	54.0	-20.5	H	A	
15.960	3.0	35.3	37.6	12.7	-33.9	0.0	0.0	51.7	74.0	-22.3	H	P	
15.960	3.0	22.3	37.6	12.7	-33.9	0.0	0.0	38.7	54.0	-15.3	H	A	

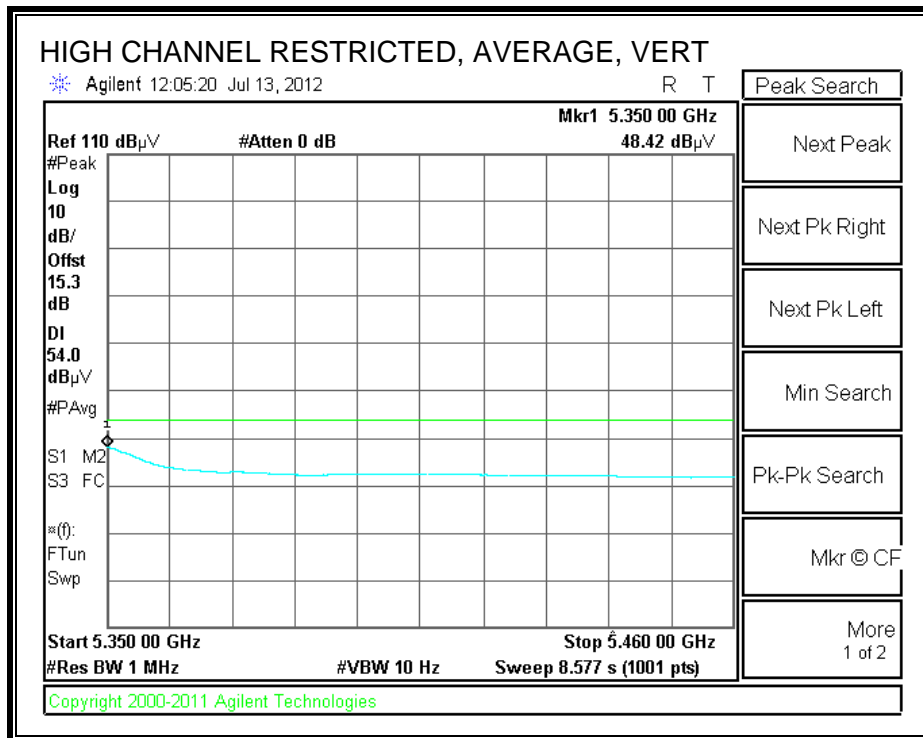
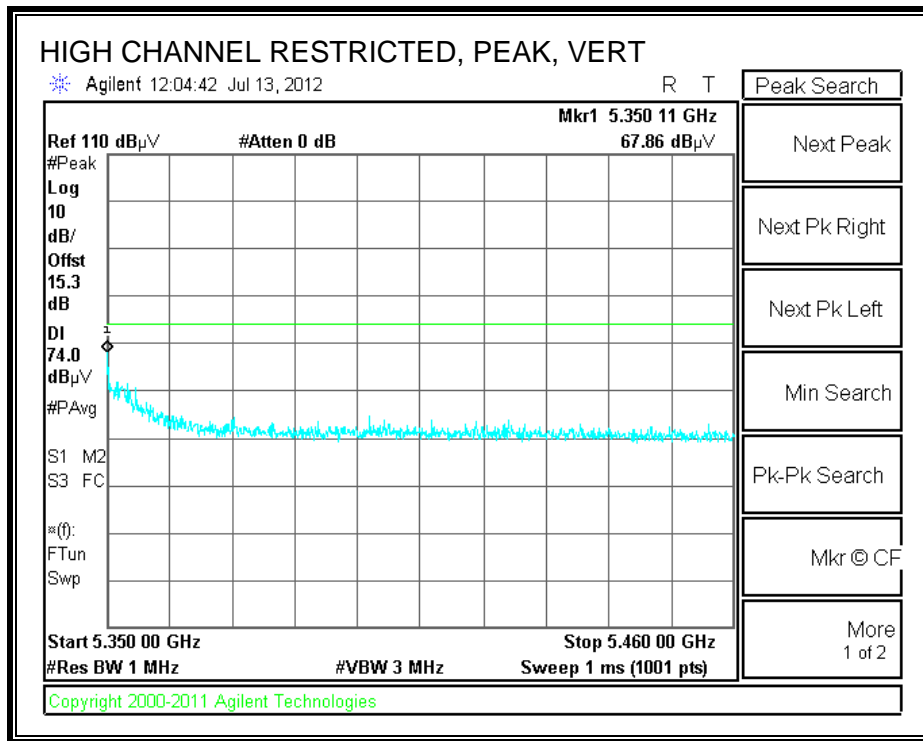
Rev. 4.1.2.7

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

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

**RESTRICTED BANDEDGE (HIGH CHANNEL)**





**HARMONICS AND SPURIOUS EMISSIONS**

**High Frequency Measurement**  
 Compliance Certification Services, Fremont 5m Chamber

Test Engr: Chin Pang  
 Date: 08/13/12  
 Project #: 12U14526  
 Company: Apple  
 Test Target: FCC 15.407  
 Mode Oper: HT40, 5.3GHz, TX ( Worst Case)

f Measurement Frequency Amp Preamp Gain Average Field Strength Limit  
 Dist Distance to Antenna D Corr Distance Correct to 3 meters Peak Field Strength Limit  
 Read Analyzer Reading Avg Average Field Strength @ 3 m Margin vs. Average Limit  
 AF Antenna Factor Peak Calculated Peak Field Strength Margin vs. Peak Limit  
 CL Cable Loss HPF High Pass Filter

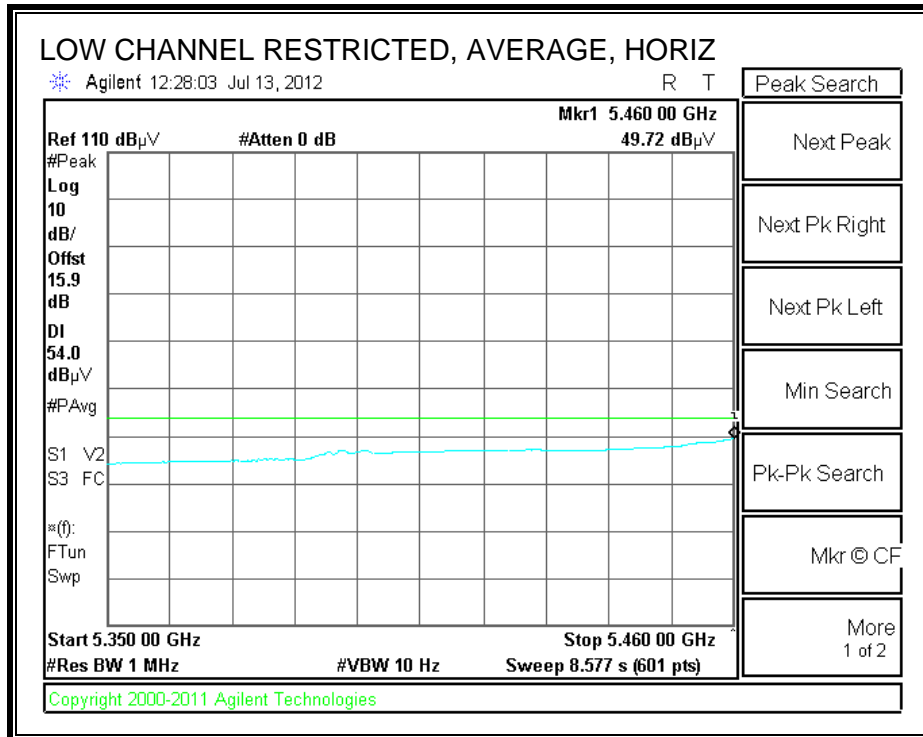
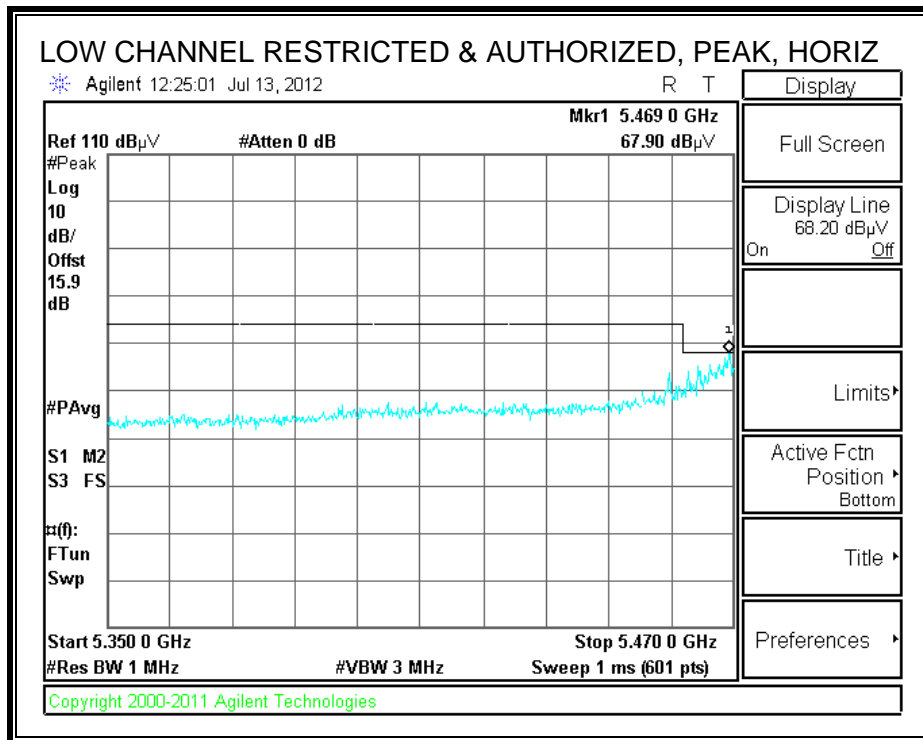
f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Filtr dB	Corr. dB	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
<b>Low Ch. 5270MHz</b>													
15.810	3.0	34.6	38.1	12.6	-33.9	0.0	0.0	51.4	74.0	-22.6	V	P	
15.810	3.0	22.3	38.1	12.6	-33.9	0.0	0.0	39.1	54.0	-14.9	V	A	
15.810	3.0	34.9	38.1	12.6	-33.9	0.0	0.0	51.6	74.0	-22.4	H	P	
15.810	3.0	22.3	38.1	12.6	-33.9	0.0	0.0	39.1	54.0	-14.9	H	A	
<b>High Ch. 5310</b>													
10.620	3.0	33.8	38.3	9.7	-35.7	0.0	0.0	46.0	74.0	-28.0	V	P	
10.620	3.0	21.3	38.3	9.7	-35.7	0.0	0.0	33.5	54.0	-20.5	V	A	
15.930	3.0	34.3	37.7	12.7	-33.9	0.0	0.0	50.8	74.0	-23.2	V	P	
15.930	3.0	22.3	37.7	12.7	-33.9	0.0	0.0	38.8	54.0	-15.2	V	A	
10.620	3.0	33.7	38.3	9.7	-35.7	0.0	0.0	45.9	74.0	-28.1	H	P	
10.620	3.0	21.4	38.3	9.7	-35.7	0.0	0.0	33.7	54.0	-20.3	H	A	
15.930	3.0	35.0	37.7	12.7	-33.9	0.0	0.0	51.5	74.0	-22.5	H	P	
15.930	3.0	22.5	37.7	12.7	-33.9	0.0	0.0	39.0	54.0	-15.0	H	A	

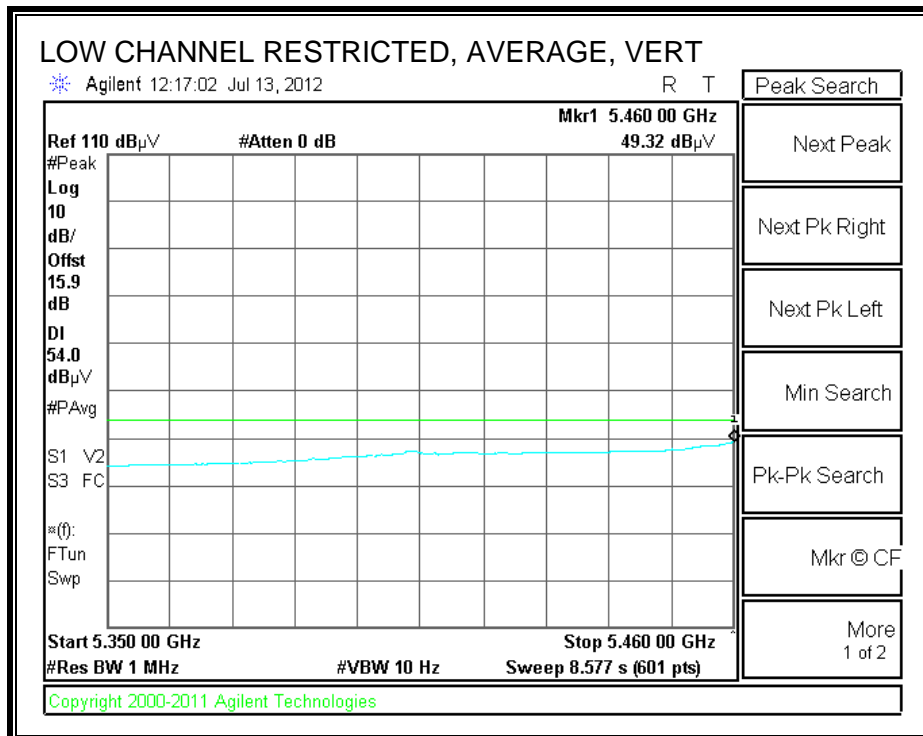
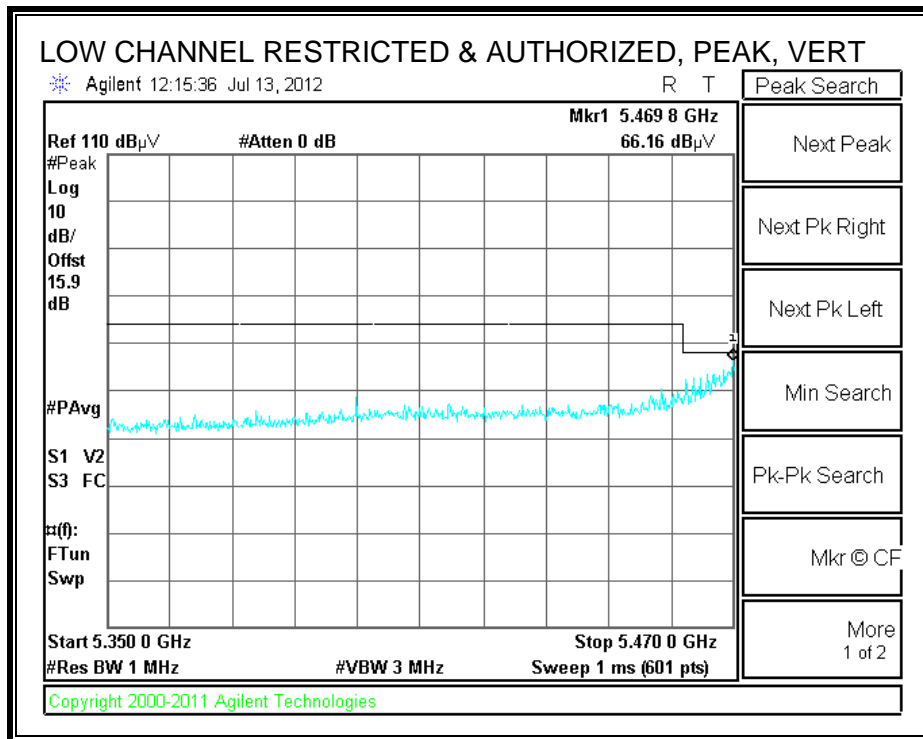
Rev. 4.1.2.7

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

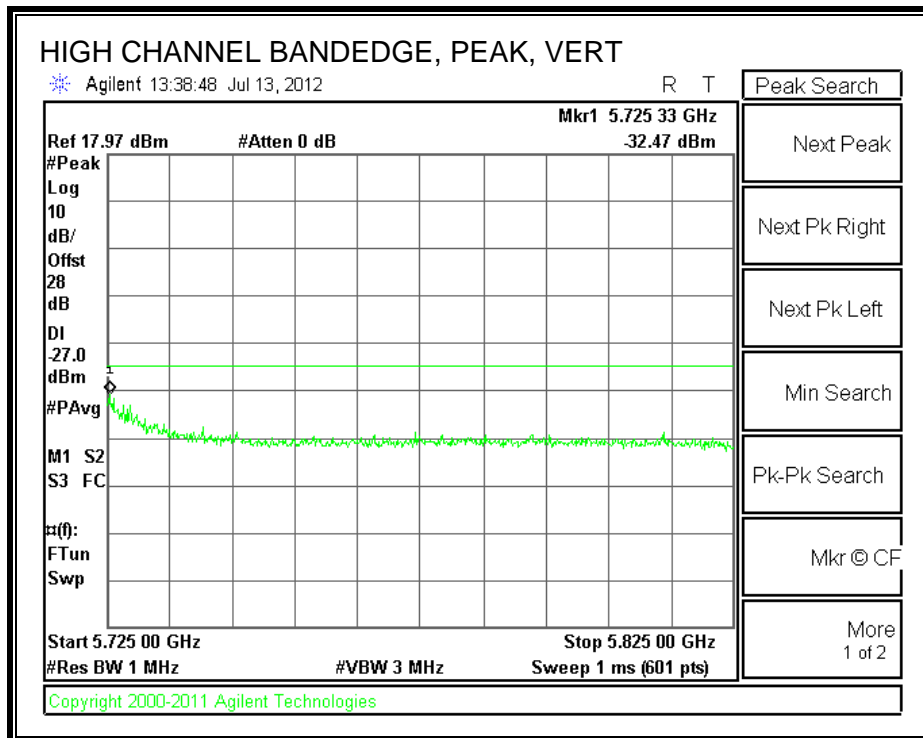
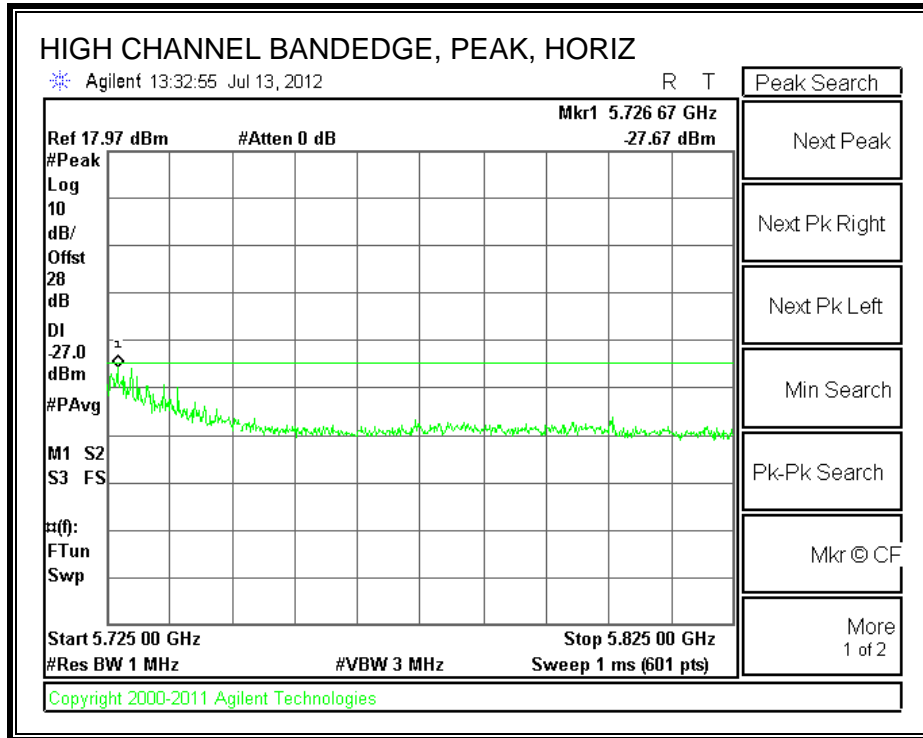
**9.2.7. TX ABOVE 1 GHz 802.11a MODE IN THE 5.6 GHz BAND**

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





**AUTHORIZED BANDEDGE (HIGH CHANNEL)**





**HARMONICS AND SPURIOUS EMISSIONS**

**High Frequency Measurement  
 Compliance Certification Services, Fremont 5m Chamber**

Test Engr: Chin Pang  
 Date: 08/13/12  
 Project #: 12U14526  
 Company: Apple  
 Test Target: FCC 15.407  
 Mode Oper: a mode, 5.6GHz, TX ( Worst Case)

f Measurement Frequency Amp Preamp Gain Average Field Strength Limit  
 Dist Distance to Antenna D Corr Distance Correct to 3 meters Peak Field Strength Limit  
 Read Analyzer Reading Avg Average Field Strength @ 3 m Margin vs. Average Limit  
 AF Antenna Factor Peak Calculated Peak Field Strength Margin vs. Peak Limit  
 CL Cable Loss HPF High Pass Filter

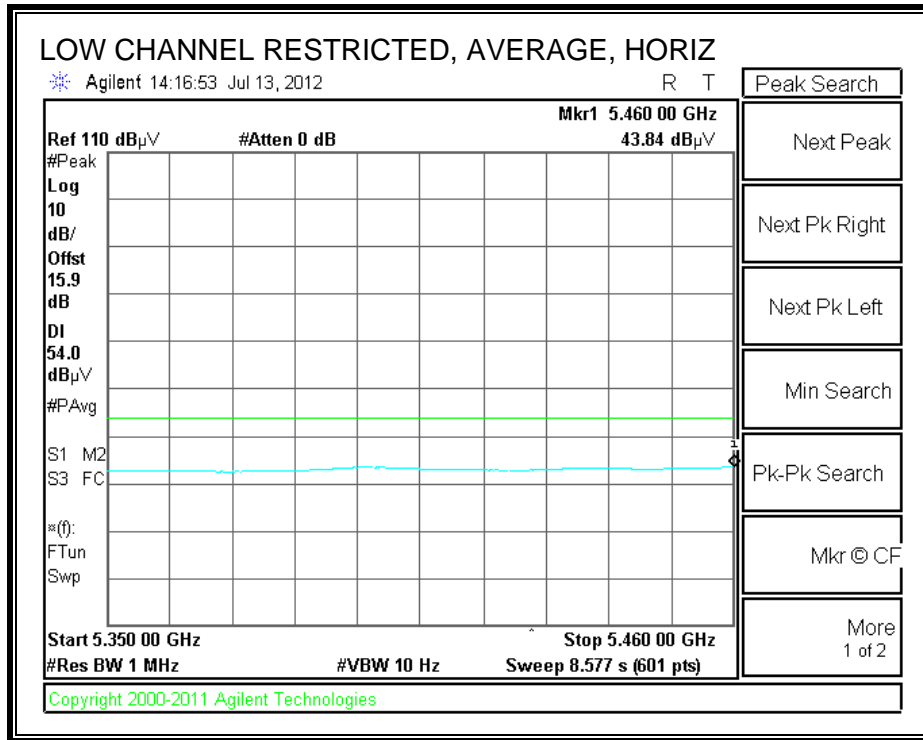
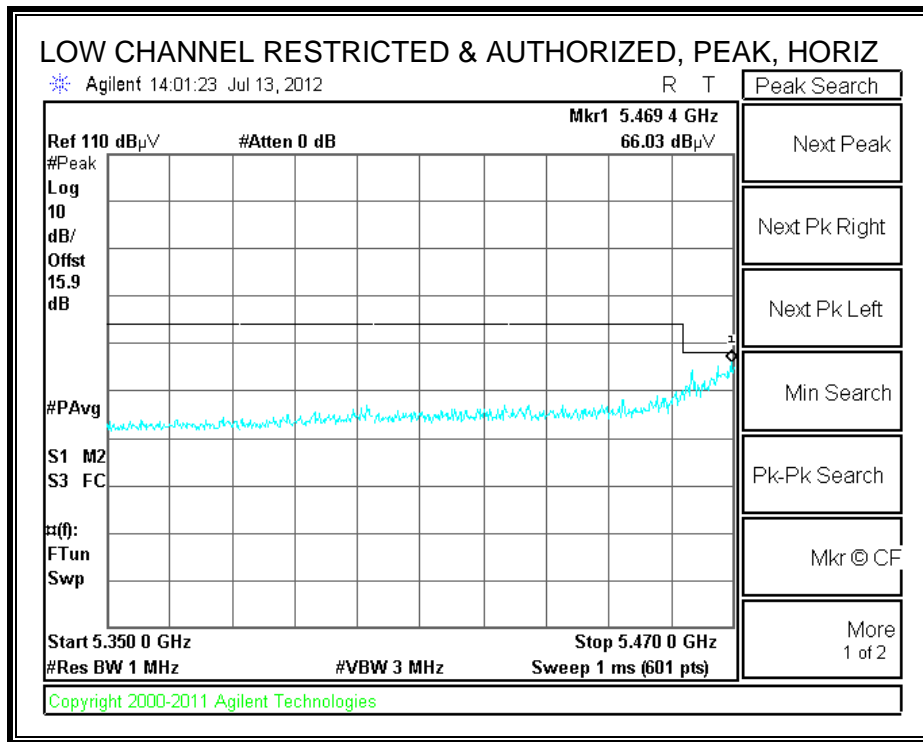
f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Filtr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
<b>Low Ch. 5500MHz</b>													
11.000	3.0	33.0	38.4	10.1	-35.6	0.0	0.0	45.7	74.0	-28.3	V	P	
11.000	3.0	21.0	38.4	10.1	-35.6	0.0	0.0	33.7	54.0	-20.3	V	A	
11.000	3.0	33.3	38.4	10.1	-35.6	0.0	0.0	46.1	74.0	-27.9	H	P	
11.000	3.0	21.0	38.4	10.1	-35.6	0.0	0.0	33.8	54.0	-20.2	H	A	
<b>Mid Ch. 5580MHz</b>													
11.160	3.0	35.0	38.5	10.2	-35.6	0.0	0.0	48.2	74.0	-25.8	V	P	
11.160	3.0	22.4	38.5	10.2	-35.6	0.0	0.0	35.6	54.0	-18.4	V	A	
11.160	3.0	35.5	38.5	10.2	-35.6	0.0	0.0	48.7	74.0	-25.3	H	P	
11.160	3.0	22.3	38.5	10.2	-35.6	0.0	0.0	35.5	54.0	-18.5	H	A	
<b>High Ch. 5700MHz</b>													
11.400	3.0	33.9	38.7	10.4	-35.6	0.0	0.0	47.6	74.0	-26.4	V	P	
11.400	3.0	21.8	38.7	10.4	-35.6	0.0	0.0	35.4	54.0	-18.6	V	A	
11.400	3.0	33.9	38.7	10.4	-35.6	0.0	0.0	47.5	74.0	-26.5	H	P	
11.400	3.0	21.8	38.7	10.4	-35.6	0.0	0.0	35.4	54.0	-18.6	H	A	

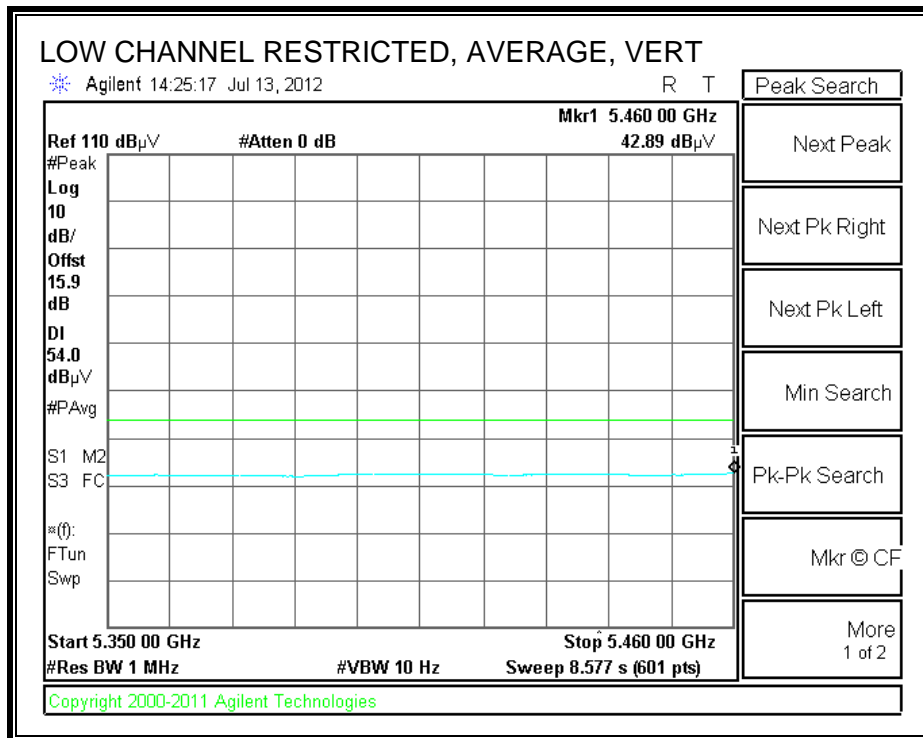
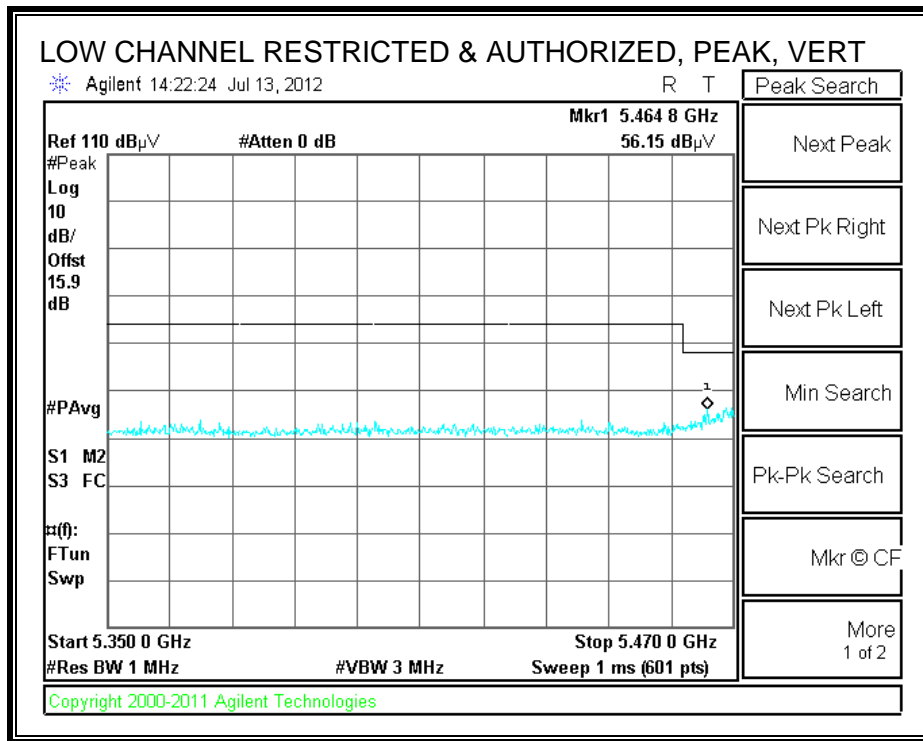
Rev. 4.1.2.7

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

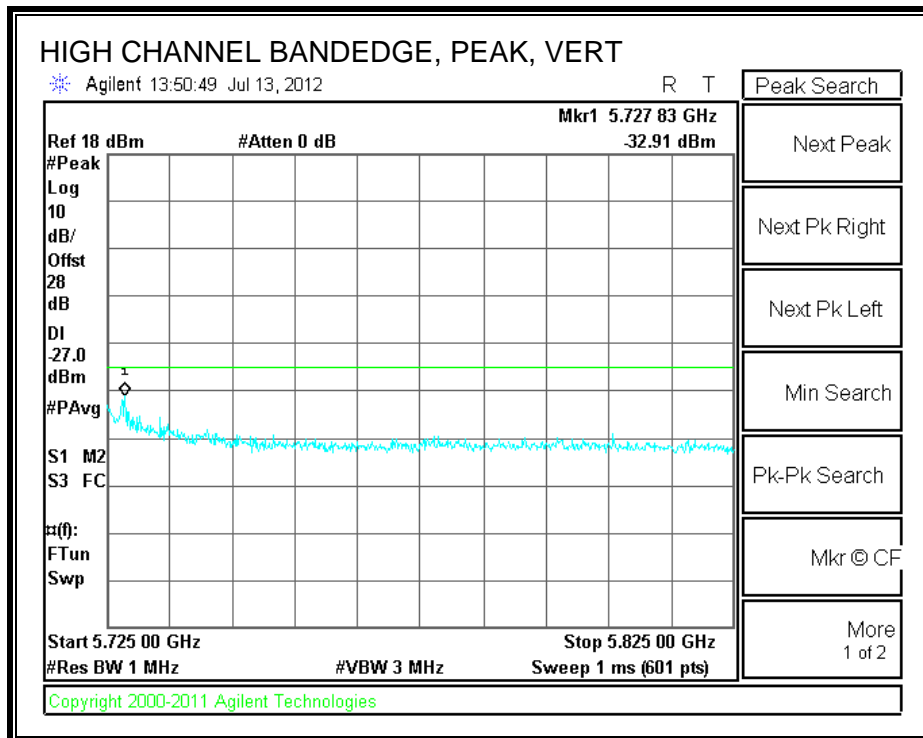
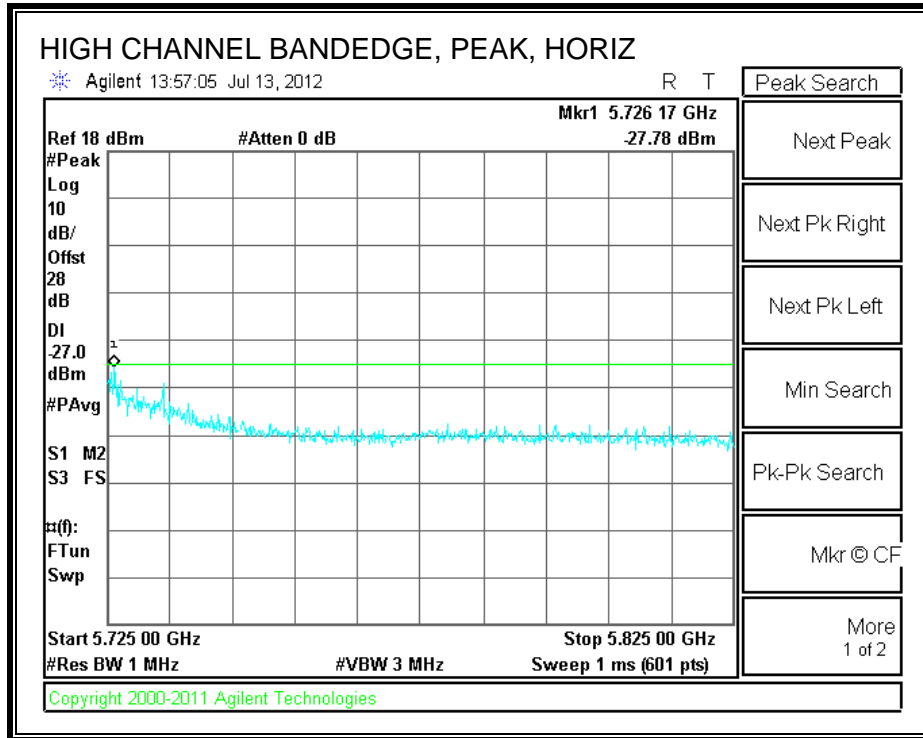
### 9.2.8. TX ABOVE 1 GHz 802.11n HT20 MODE IN THE 5.6 GHz BAND

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





**AUTHORIZED BANDEDGE (HIGH CHANNEL)**



**HARMONICS AND SPURIOUS EMISSIONS**

**High Frequency Measurement**  
 Compliance Certification Services, Fremont 5m Chamber

Test Engr: Chin Pang  
 Date: 08/13/12  
 Project #: 12U14526  
 Company: Apple  
 Test Target: FCC 15.407  
 Mode Oper: HT20 mode, 5.6GHz, TX ( Worst Case)

f Measurement Frequency Amp Preamp Gain Average Field Strength Limit  
 Dist Distance to Antenna D Corr Distance Correct to 3 meters Peak Field Strength Limit  
 Read Analyzer Reading Avg Average Field Strength @ 3 m Margin vs. Average Limit  
 AF Antenna Factor Peak Calculated Peak Field Strength Margin vs. Peak Limit  
 CL Cable Loss HPF High Pass Filter

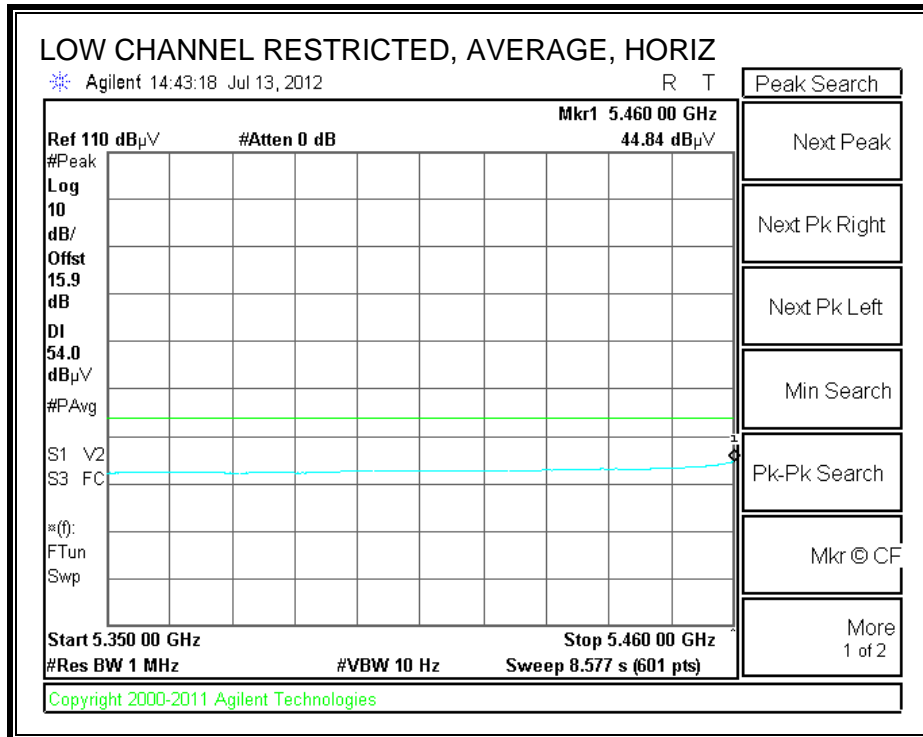
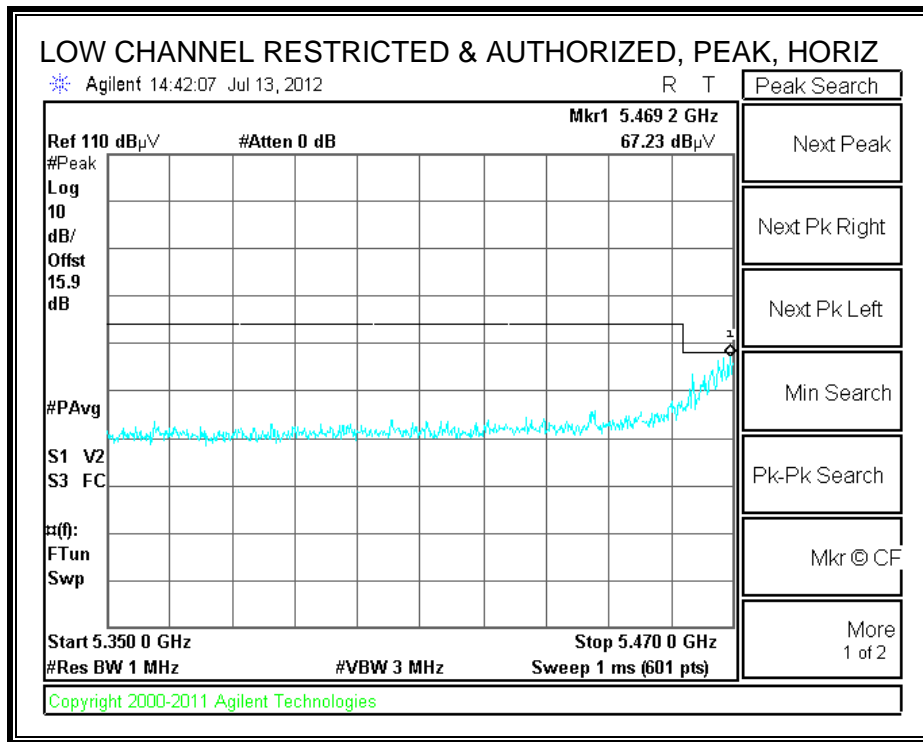
f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Filtr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
<b>Low Ch. 5500MHz</b>													
11.000	3.0	32.9	38.4	10.1	-35.6	0.0	0.0	45.6	74.0	-28.4	V	P	
11.000	3.0	21.0	38.4	10.1	-35.6	0.0	0.0	33.8	54.0	-20.2	V	A	
11.000	3.0	33.4	38.4	10.1	-35.6	0.0	0.0	46.2	74.0	-27.8	H	P	
11.000	3.0	21.0	38.4	10.1	-35.6	0.0	0.0	33.8	54.0	-20.2	H	A	
<b>Mid Ch. 5600MHz</b>													
11.160	3.0	34.3	38.5	10.2	-35.6	0.0	0.0	47.5	74.0	-26.5	V	P	
11.160	3.0	22.5	38.5	10.2	-35.6	0.0	0.0	35.7	54.0	-18.3	V	A	
11.160	3.0	34.3	38.5	10.2	-35.6	0.0	0.0	47.5	74.0	-26.5	H	P	
11.160	3.0	21.8	38.5	10.2	-35.6	0.0	0.0	35.0	54.0	-19.0	H	A	
<b>High Ch. 5700MHz</b>													
11.400	3.0	33.7	38.7	10.4	-35.6	0.0	0.0	47.4	74.0	-26.6	V	P	
11.400	3.0	21.6	38.7	10.4	-35.6	0.0	0.0	35.3	54.0	-18.7	V	A	
11.400	3.0	34.5	38.7	10.4	-35.6	0.0	0.0	48.1	74.0	-25.9	H	P	
11.400	3.0	21.6	38.7	10.4	-35.6	0.0	0.0	35.3	54.0	-18.7	H	A	

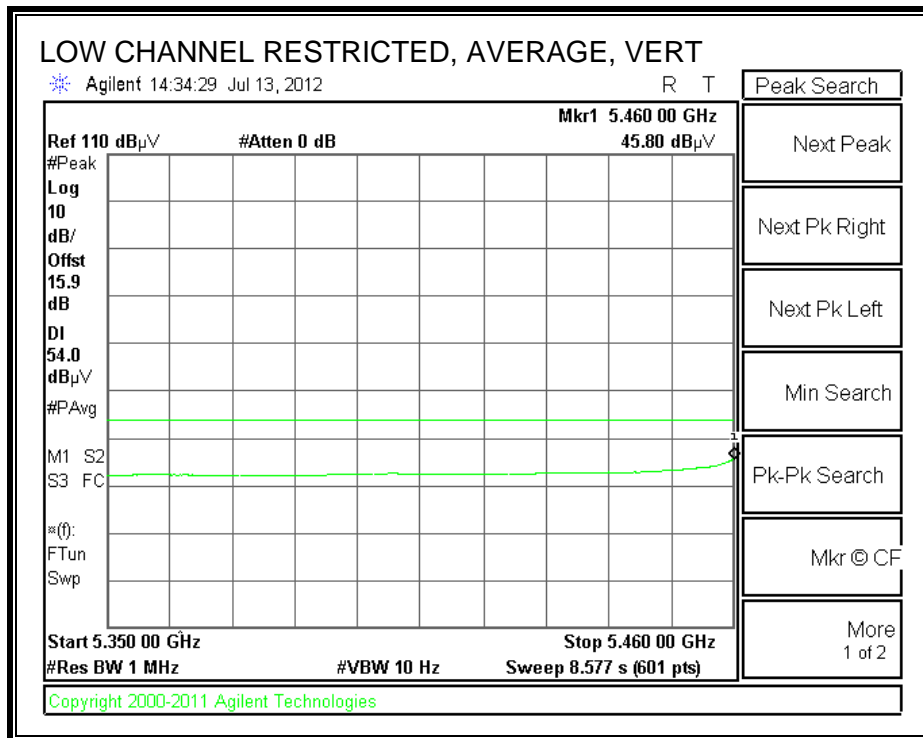
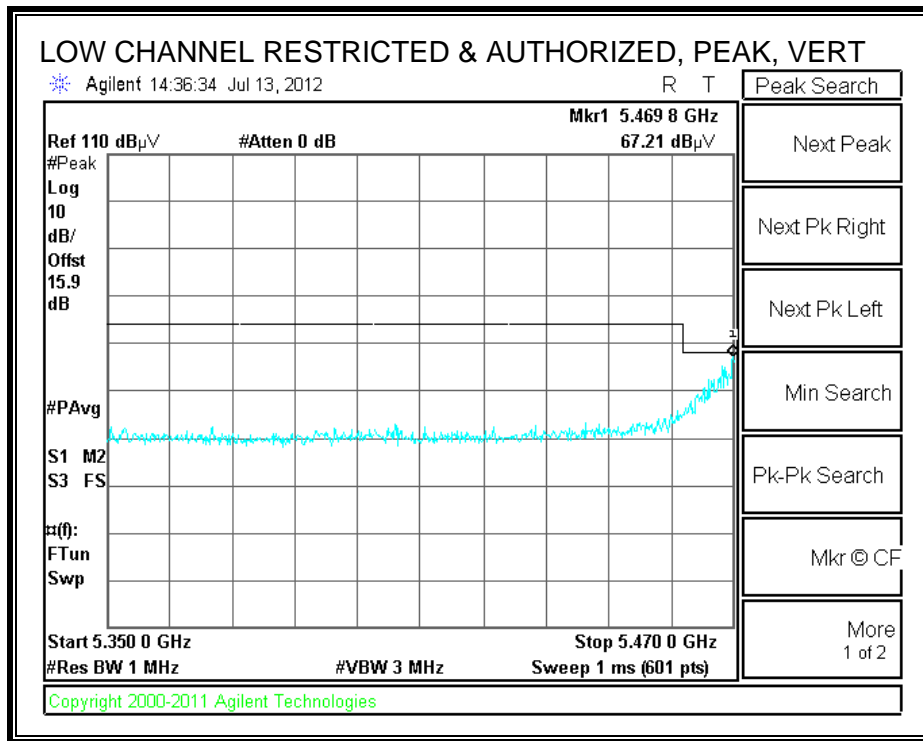
Rev. 4.1.2.7

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

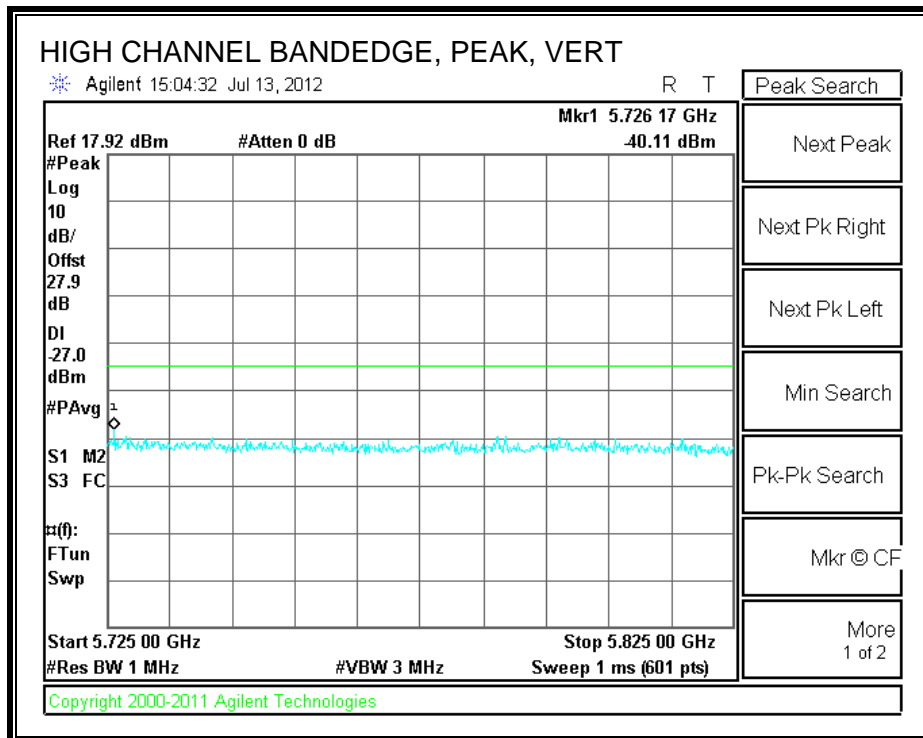
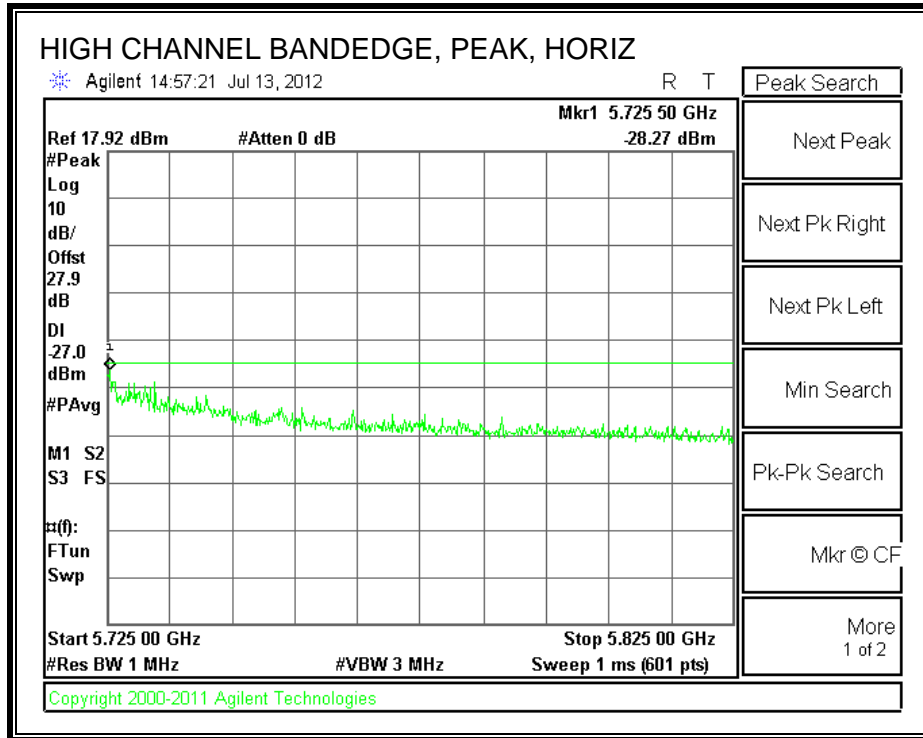
### 9.2.9. TX ABOVE 1 GHz 802.11n HT40 MODE IN THE 5.6 GHz BAND

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





**AUTHORIZED BANDEDGE (HIGH CHANNEL)**





**HARMONICS AND SPURIOUS EMISSIONS**

**High Frequency Measurement  
 Compliance Certification Services, Fremont 5m Chamber**

Test Engr: Chin Pang  
 Date: 08/13/12  
 Project #: 12U14526  
 Company: Apple  
 Test Target: FCC 15.407  
 Mode Oper: HT40, 5.6GHz, TX ( Worst Case)

f Measurement Frequency Amp Preamp Gain Average Field Strength Limit  
 Dist Distance to Antenna D Corr Distance Correct to 3 meters Peak Field Strength Limit  
 Read Analyzer Reading Avg Average Field Strength @ 3 m Margin vs. Average Limit  
 AF Antenna Factor Peak Calculated Peak Field Strength Margin vs. Peak Limit  
 CL Cable Loss HPF High Pass Filter

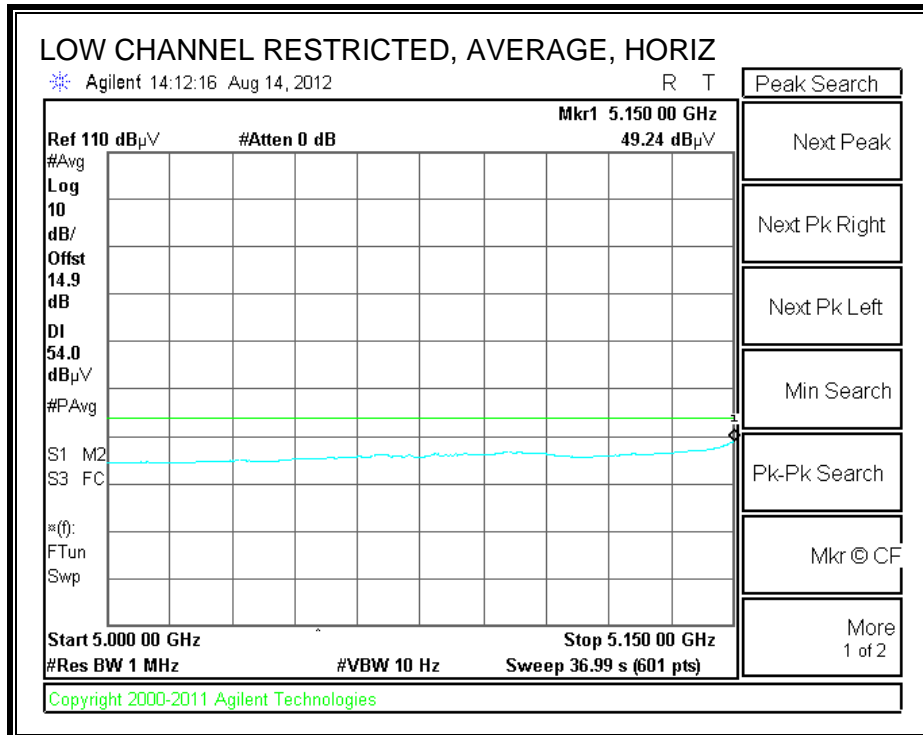
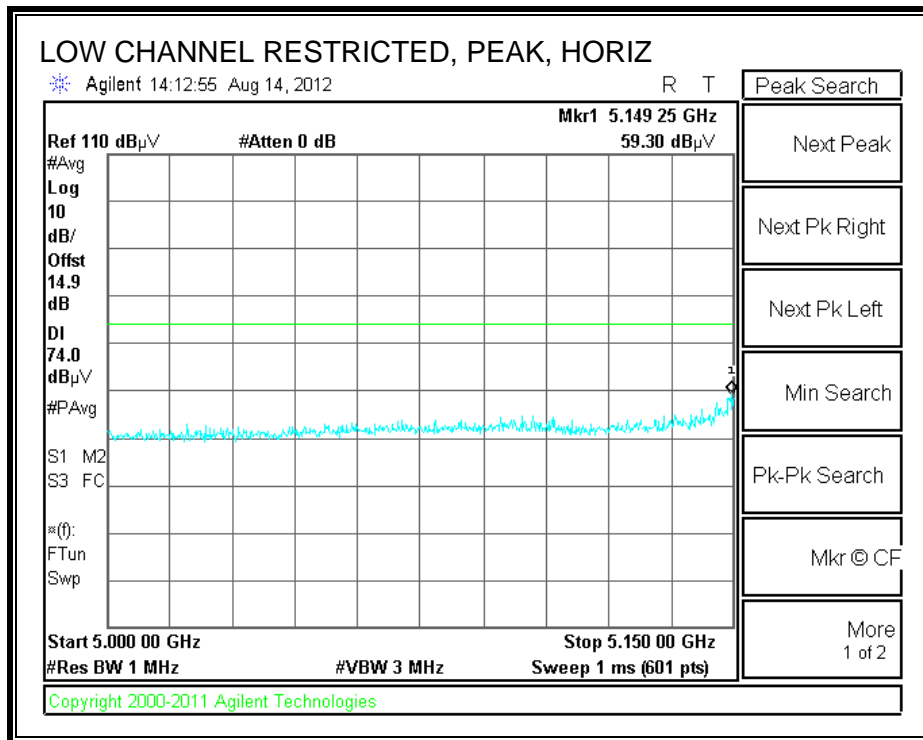
f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Filtr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
<b>Low Ch. 5510MHz</b>													
11.020	3.0	32.4	38.4	10.1	-35.6	0.0	0.0	45.2	74.0	-28.8	V	P	
11.020	3.0	20.8	38.4	10.1	-35.6	0.0	0.0	33.6	54.0	-20.4	V	A	
11.020	3.0	32.9	38.4	10.1	-35.6	0.0	0.0	45.7	74.0	-28.3	H	P	
11.020	3.0	20.8	38.4	10.1	-35.6	0.0	0.0	33.6	54.0	-20.4	H	A	
<b>Mid Ch. 5550MHz</b>													
11.100	3.0	34.6	38.5	10.2	-35.6	0.0	0.0	47.7	74.0	-26.3	V	P	
11.100	3.0	22.4	38.5	10.2	-35.6	0.0	0.0	35.5	54.0	-18.5	V	A	
11.100	3.0	34.6	38.5	10.2	-35.6	0.0	0.0	47.7	74.0	-26.3	H	P	
11.100	3.0	22.5	38.5	10.2	-35.6	0.0	0.0	35.6	54.0	-18.4	H	A	
<b>High Ch. 5670MHz</b>													
11.340	3.0	33.5	38.7	10.4	-35.6	0.0	0.0	47.0	74.0	-27.0	V	P	
11.340	3.0	21.5	38.7	10.4	-35.6	0.0	0.0	35.0	54.0	-19.0	V	A	
11.340	3.0	33.8	38.7	10.4	-35.6	0.0	0.0	47.3	74.0	-26.7	H	P	
11.340	3.0	21.6	38.7	10.4	-35.6	0.0	0.0	35.1	54.0	-18.9	H	A	

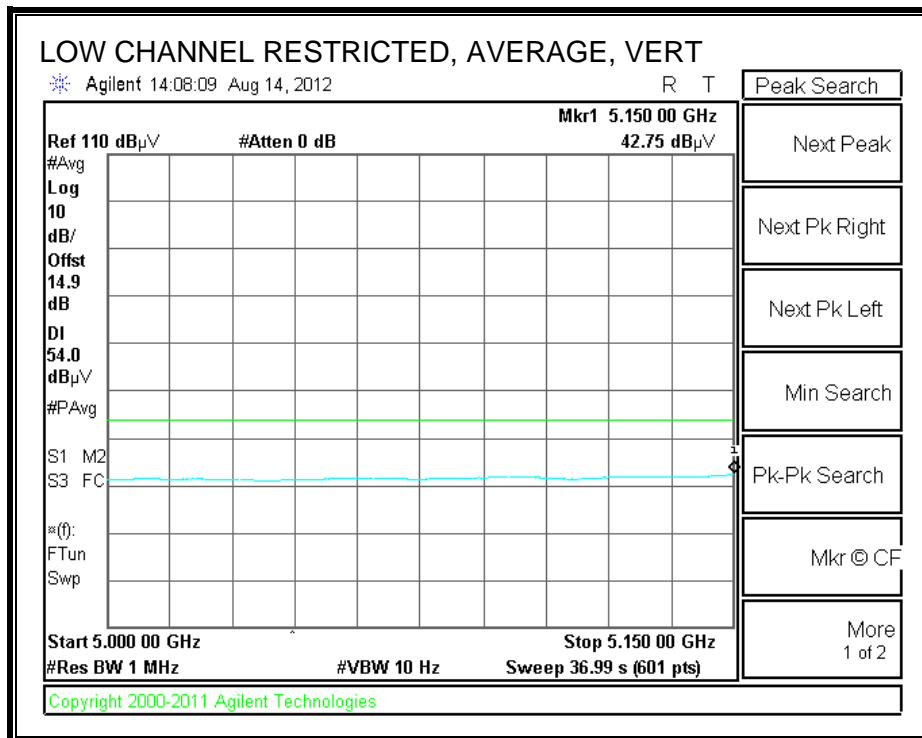
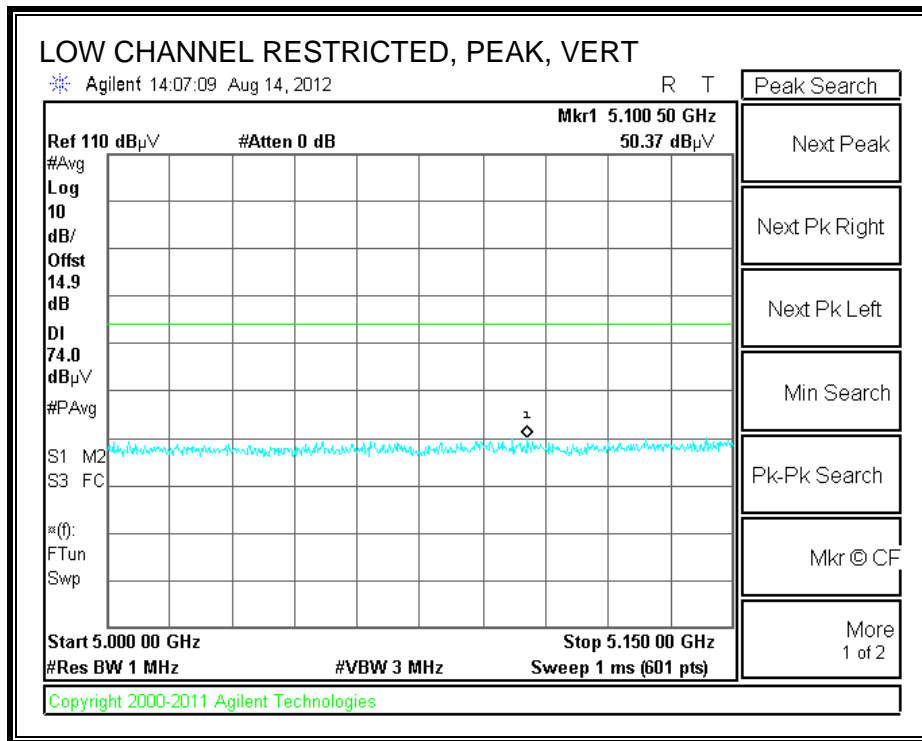
Rev. 4.1.2.7

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

**9.2.10. 2.4 GHz and 5GHz band Colocation**

**BANDEDGE (CHANNEL 36 and Bluetooth High CHANNEL)**





**HARMONICS AND SPURIOUS EMISSIONS**

**High Frequency Measurement**  
 Compliance Certification Services, Fremont 5m Chamber

Test Engr: Chin pang  
 Date: 08/14/12  
 Project #: 12U14526  
 Company: Apple  
 Test Target: FCC 15.407  
 Mode Oper: Co-location, 5GHz and BT TX.

f Measurement Frequency Amp Preamp Gain Average Field Strength Limit  
 Dist Distance to Antenna D Corr Distance Correct to 3 meters Peak Field Strength Limit  
 Read Analyzer Reading Avg Average Field Strength @ 3 m Margin vs. Average Limit  
 AF Antenna Factor Peak Calculated Peak Field Strength Margin vs. Peak Limit  
 CL Cable Loss HPF High Pass Filter

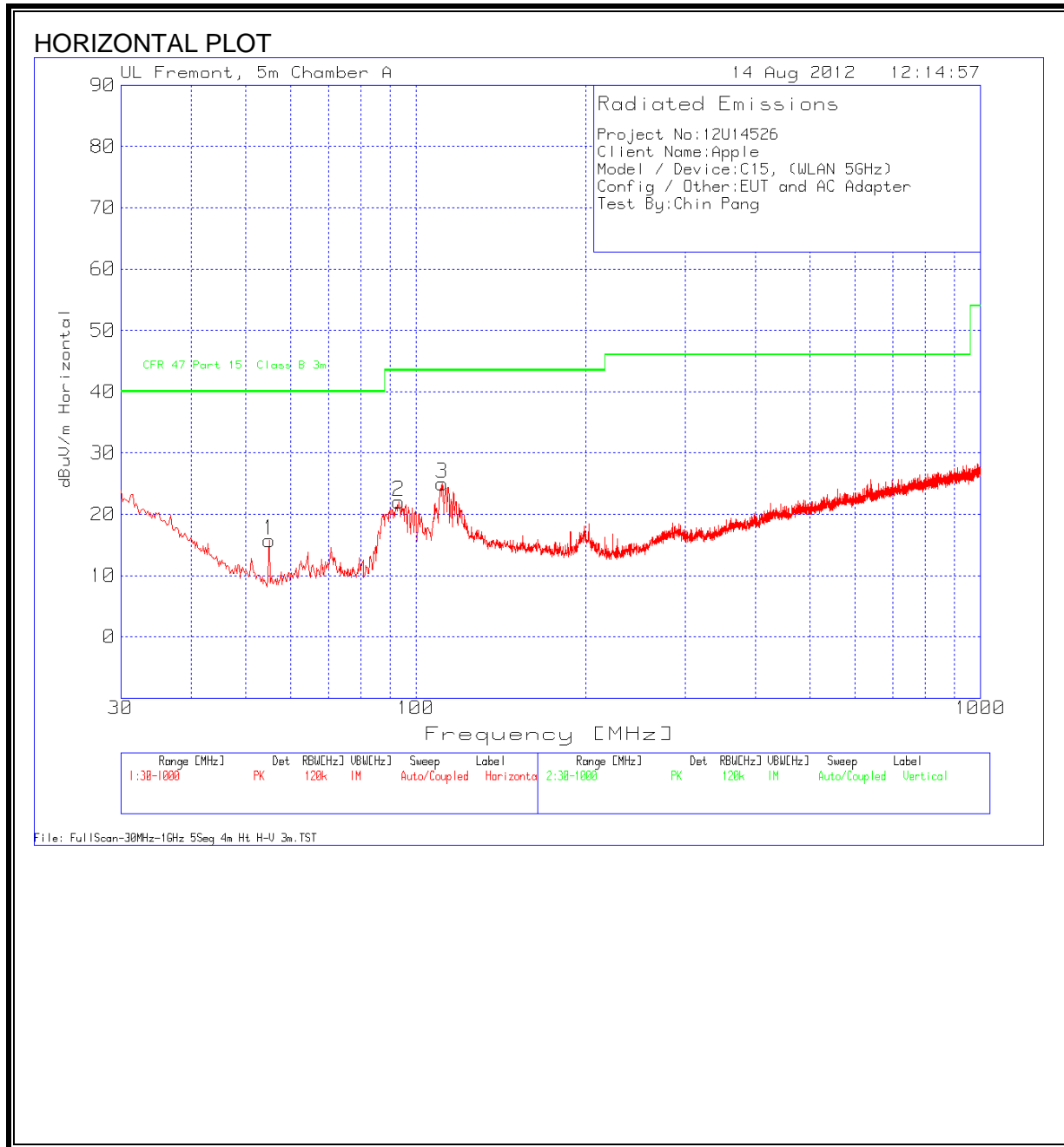
f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dB	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/Q/P	Notes
<b>Low Ch, 5180MHz</b>													
10.360	3.0	34.9	38.2	9.4	-35.8	0.0	0.0	46.8	74.0	-27.2	V	P	
10.360	3.0	22.4	38.2	9.4	-35.8	0.0	0.0	34.3	54.0	-19.7	V	A	
15.540	3.0	35.5	39.0	12.5	-34.0	0.0	0.0	53.0	74.0	-21.0	V	P	
15.540	3.0	22.3	39.0	12.5	-34.0	0.0	0.0	39.7	54.0	-14.3	V	A	
10.360	3.0	35.3	38.2	9.4	-35.8	0.0	0.0	47.1	74.0	-26.9	H	P	
10.360	3.0	22.4	38.2	9.4	-35.8	0.0	0.0	34.3	54.0	-19.7	H	A	
15.540	3.0	35.2	39.0	12.5	-34.0	0.0	0.0	52.7	74.0	-21.3	H	P	
15.540	3.0	22.3	39.0	12.5	-34.0	0.0	0.0	39.8	54.0	-14.2	H	A	
<b>BT High ch, 2480MHz</b>													
4.960	3.0	55.6	33.6	6.4	-35.5	0.0	0.0	60.0	74.0	-14.0	H	P	
4.960	3.0	40.2	33.6	6.4	-35.5	0.0	0.0	44.6	54.0	-9.4	H	A	
7.440	3.0	50.4	35.9	8.5	-35.5	0.0	0.0	59.4	74.0	-14.6	H	P	
7.440	3.0	36.1	35.9	8.5	-35.5	0.0	0.0	45.2	54.0	-8.9	H	A	
9.920	3.0	35.9	38.1	9.1	-35.9	0.0	0.0	47.2	74.0	-26.8	H	P	
9.920	3.0	23.1	38.1	9.1	-35.9	0.0	0.0	34.4	54.0	-19.6	H	A	
4.960	3.0	48.5	33.6	6.4	-35.5	0.0	0.0	53.0	74.0	-21.0	V	P	
4.960	3.0	36.4	33.6	6.4	-35.5	0.0	0.0	40.8	54.0	-13.2	V	A	
7.440	3.0	41.3	35.9	8.5	-35.5	0.0	0.0	50.3	74.0	-23.7	V	P	
7.440	3.0	30.1	35.9	8.5	-35.5	0.0	0.0	39.1	54.0	-14.9	V	A	

Rev. 4.1.2.7

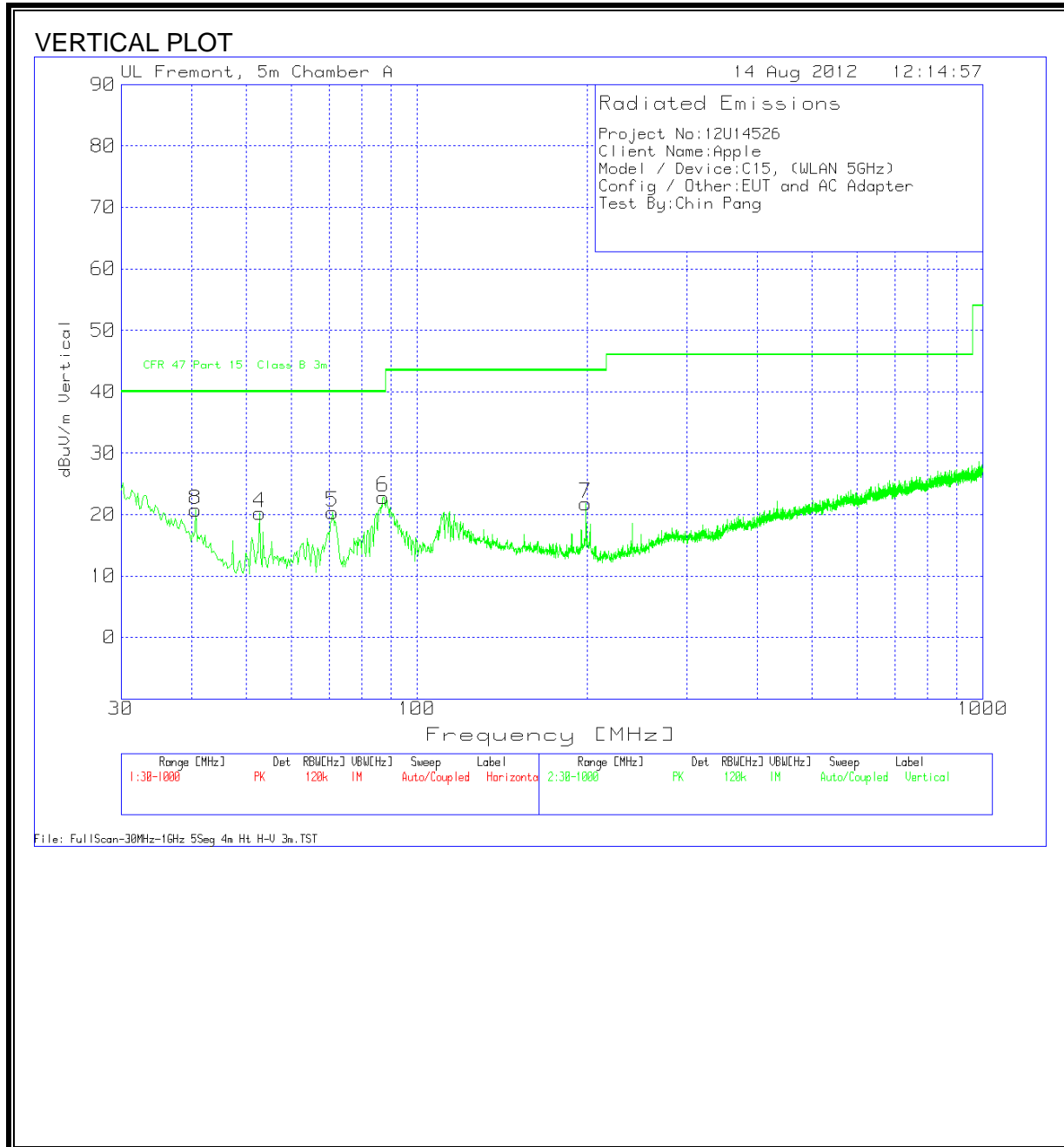
Note: No other emissions were detected above the system noise floor.

### 9.3. WORST-CASE BELOW 1 GHz

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



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



**HORIZONTAL AND VERTICAL DATA**

Project No:12U14526  
 Client Name:Apple  
 Model / Device:C15, (WLAN 5GHz)  
 Config / Other:EUT and AC Adapter  
 Test By:Chin Pang

Horizontal 30 - 1000MHz

Frequency	Reading	Detector	25MHz-1GHz ChmbrA Amplified.TX (dB)	T243 Sunol Bilog.TXT (dB)	dBuV/m	CFR 47 Part 15B 3m	Margin	Polarity
55.006	35.91	PK	-27.3	7.1	15.71	40	-24.29	Horz
93.3873	40.68	PK	-27	8.4	22.08	43.5	-21.42	Horz
111.221	38.86	PK	-26.7	12.9	25.06	43.5	-18.44	Horz

Vertical 30 - 1000MHz

Frequency	Reading	Detector	25MHz-1GHz ChmbrA Amplified.TX (dB)	T243 Sunol Bilog.TXT (dB)	dBuV/m	CFR 47 Part 15B 3m	Margin	Polarity
52.6799	40.15	PK	-27.3	7.4	20.25	40	-19.75	Vert
70.9013	39.37	PK	-27.1	8.1	20.37	40	-19.63	Vert
87.1843	42.43	PK	-27	7.4	22.83	40	-17.17	Vert
198.8389	35.85	PK	-26.2	12.2	21.85	43.5	-21.65	Vert
40.6615	34.51	PK	-27.3	13.5	20.71	40	-19.29	Vert

## 10. AC POWER LINE CONDUCTED EMISSIONS

### LIMITS

FCC §15.207 (a)

RSS-Gen 7.2.2

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

<sup>\*</sup>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.

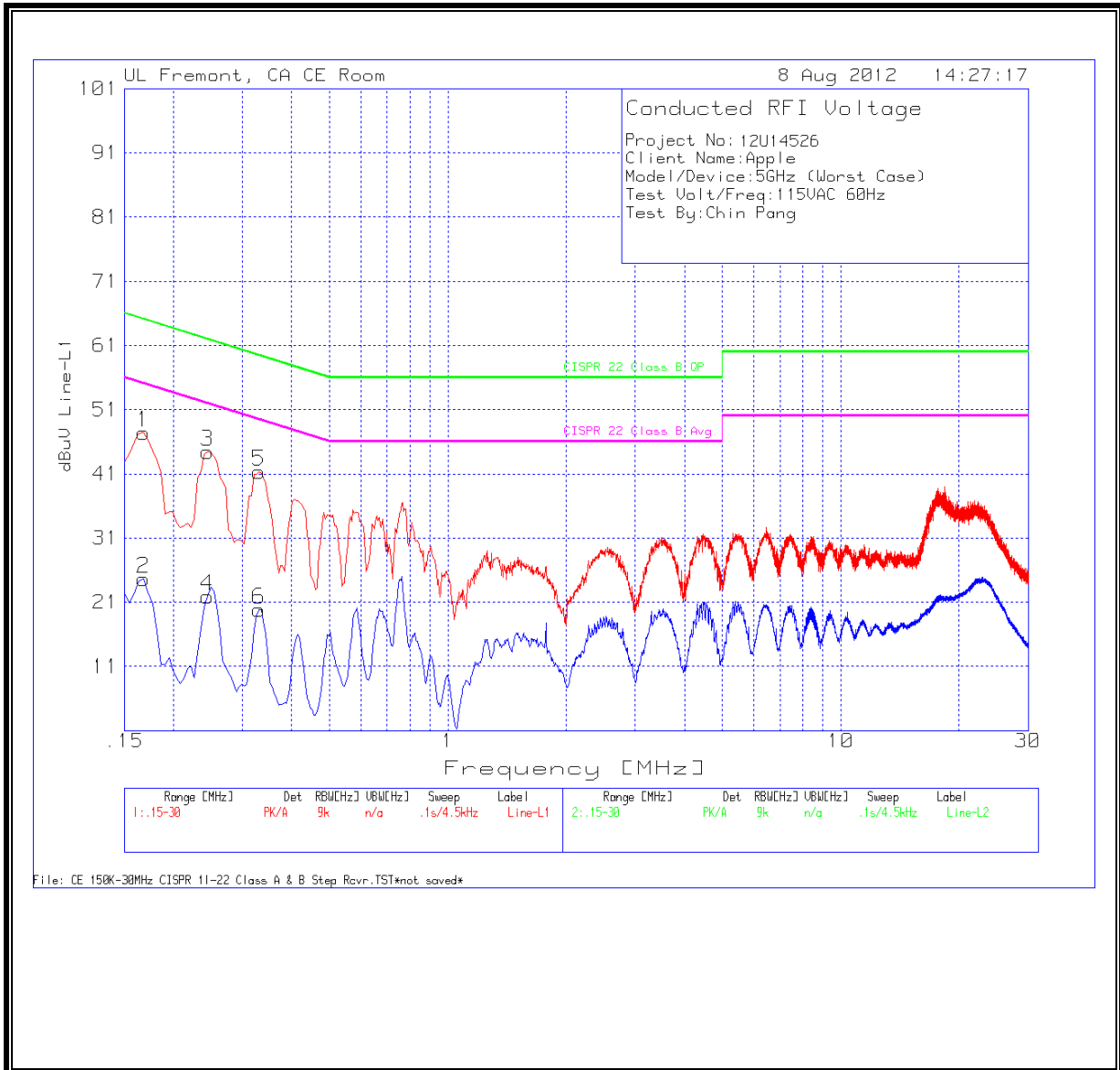


**RESULTS**

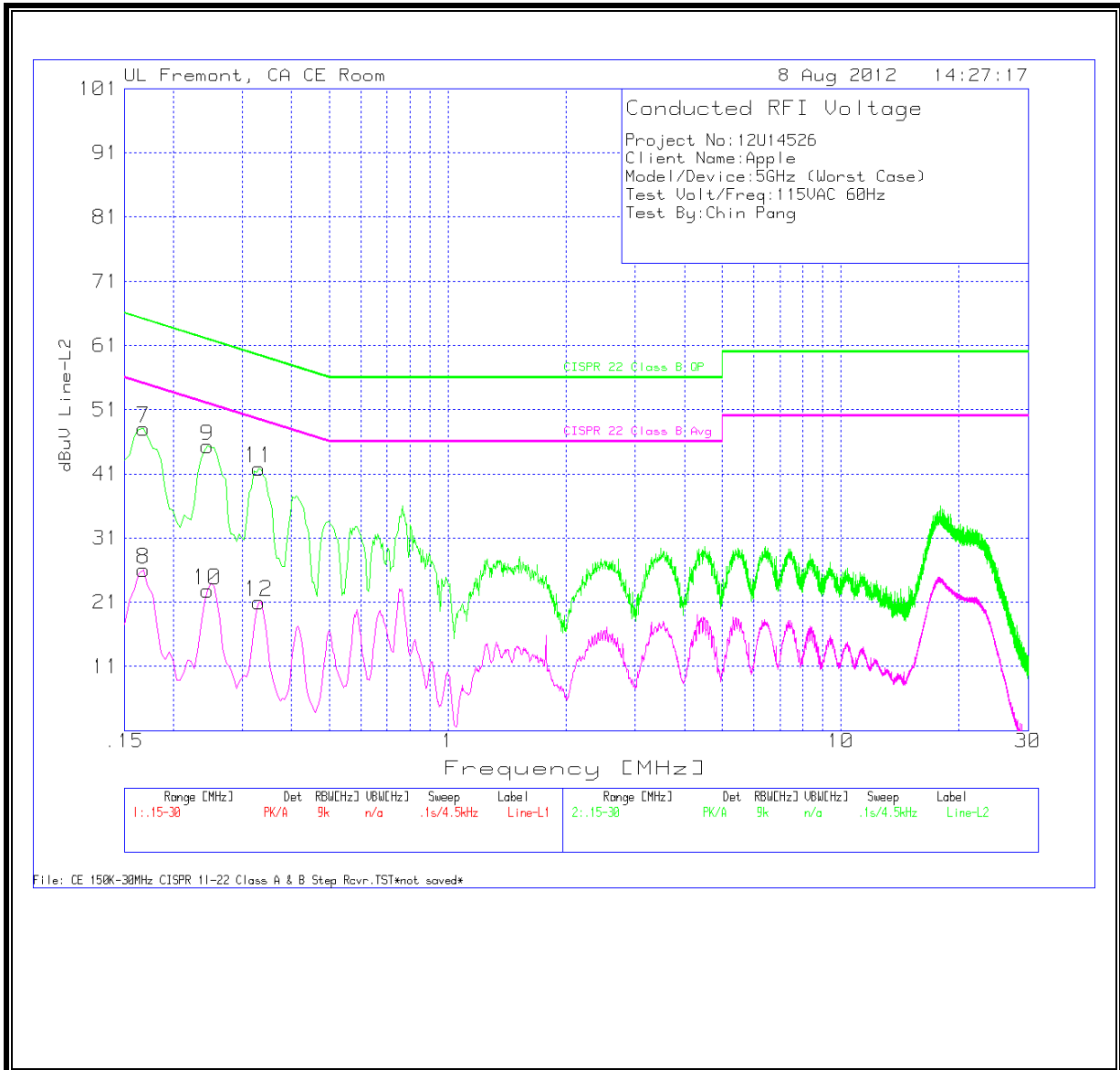
**6 WORST EMISSIONS**

Project No:12U14526									
Client Name:Apple									
Model/Device:5GHz (Worst Case)									
Test Volt/Freq:115VAC 60Hz									
Test By:Chin Pang									
Line-L1 .15 - 30MHz									
Frequency	Reading	Detector	T24 IL L1	LC Cables	dBuV	CISPR 22B	Margin	CISPR 22B	Margin
0.168	47.28	PK	0.1	0	47.38	65.1	-17.72	-	-
0.168	24.53	Av	0.1	0	24.63	-	-	55.1	-30.47
0.2445	44.34	PK	0.1	0	44.44	61.9	-17.46	-	-
0.2445	21.81	Av	0.1	0	21.91	-	-	51.9	-29.99
0.33	41.21	PK	0.1	0	41.31	59.5	-18.19	-	-
0.33	19.79	Av	0.1	0	19.89	-	-	49.5	-29.61
Line-L2 .15 - 30MHz									
Frequency	Reading	Detector	T24 IL L1	LC Cables	dBuV	CISPR 22B	Margin	CISPR 22B	Margin
0.168	47.94	PK	0.1	0	48.04	65.1	-17.06	-	-
0.168	25.97	Av	0.1	0	26.07	-	-	55.1	-29.03
0.2445	45.18	PK	0.1	0	45.28	61.9	-16.62	-	-
0.2445	22.76	Av	0.1	0	22.86	-	-	51.9	-29.04
0.33	41.78	PK	0.1	0	41.88	59.5	-17.62	-	-
0.33	20.89	Av	0.1	0	20.99	-	-	49.5	-28.51

**LINE 1 RESULTS**



**LINE 2 RESULTS**



## 11. DYNAMIC FREQUENCY SELECTION

### 11.1. OVERVIEW

#### 11.1.1. LIMITS

#### INDUSTRY CANADA

IC RSS-210 is closely harmonized with FCC Part 15 DFS rules. The deviations are as follows:

RSS-210 Issue 7 A9.4 (b) (ii) **Channel Availability Check Time:** ...

**Additional requirements for the band 5600-5650 MHz:** Until further notice, devices subject to this Section shall not be capable of transmitting in the band 5600-5650 MHz, so that Environment Canada weather radars operating in this band are protected.

RSS-210 Issue 7 A9.4 (b) (iv) **Channel closing time:** the maximum channel closing time is 260 ms.

#### 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".

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

Requirement	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 (without DFS)	Client (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-Service Monitoring**

Maximum Transmit Power	Value (see note)
≥ 200 milliwatt	-64 dBm
< 200 milliwatt	-62 dBm

Note 1: This is the level at the input of the receiver assuming a 0 dBi receive antenna  
 Note 2: Throughout these test procedures an additional 1 dB has been added to the amplitude of the test transmission waveforms to account for variations in measurement equipment. This will ensure that the test signal is at or above the detection threshold level to trigger a DFS response.

**Table 4: DFS Response requirement values**

Parameter	Value
<i>Non-occupancy period</i>	30 minutes
<i>Channel Availability Check Time</i>	60 seconds
<i>Channel Move Time</i>	10 seconds
<i>Channel Closing Transmission Time</i>	200 milliseconds + approx. 60 milliseconds over remaining 10 second period
<p>The instant that the <i>Channel Move Time</i> and the <i>Channel Closing Transmission Time</i> begins is as follows:                      For the Short pulse radar Test Signals this instant is the end of the <i>Burst</i>.                      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.</p>	

**Table 5 – Short Pulse Radar Test Waveforms**

Radar Type	Pulse Width (Microseconds)	PRI (Microseconds)	Pulses	Minimum Percentage of Successful Detection	Minimum Trials
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 (Radar Types 1-4)				80%	120

**Table 6 – Long Pulse Radar Test Signal**

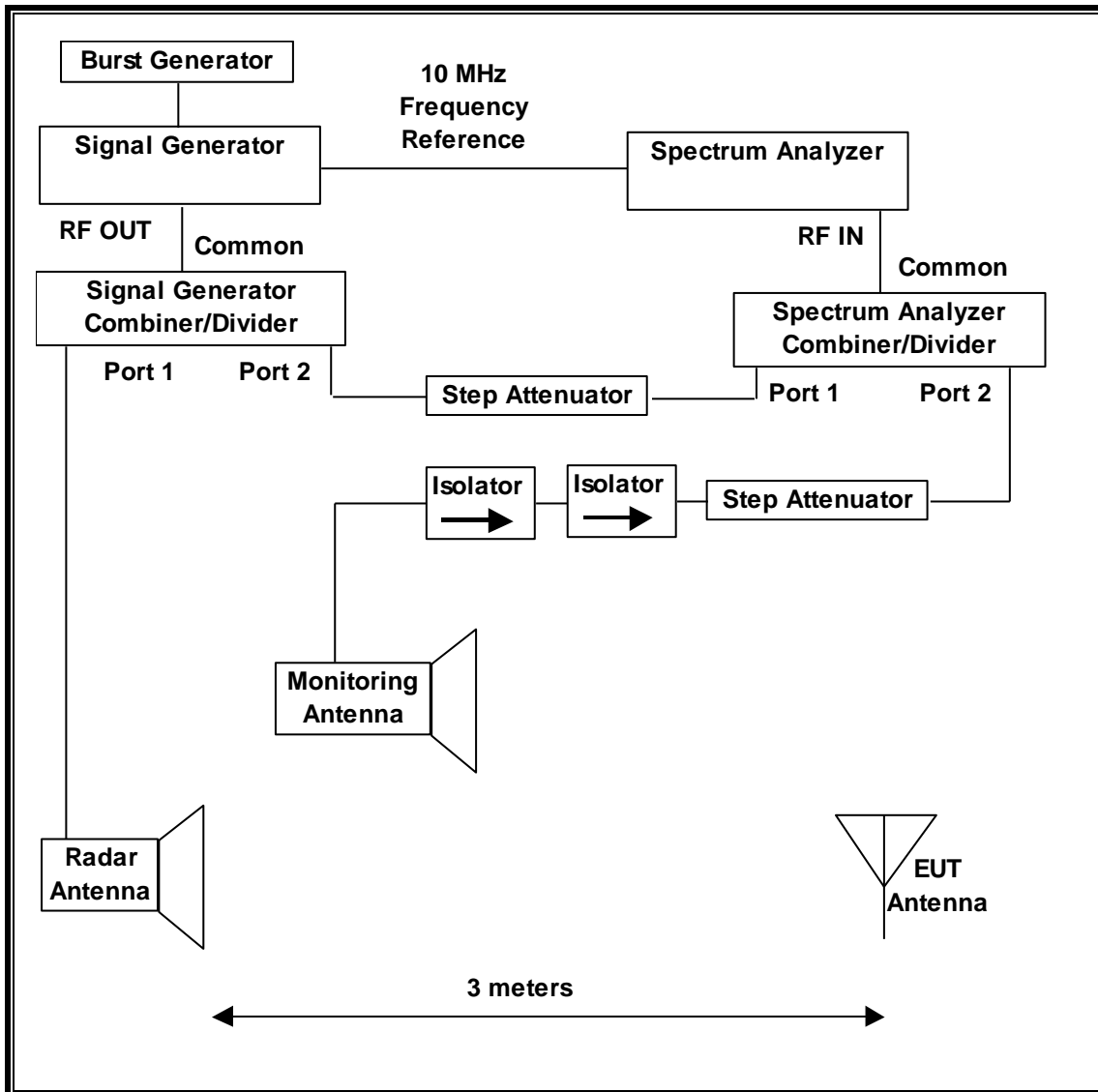
Radar Waveform	Bursts	Pulses per Burst	Pulse Width (µsec)	Chirp Width (MHz)	PRI (µsec)	Minimum Percentage of Successful Detection	Minimum Trials
5	8-20	1-3	50-100	5-20	1000-2000	80%	30

**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

### 11.1.2. TEST AND MEASUREMENT SYSTEM

#### RADIATED METHOD SYSTEM BLOCK DIAGRAM



## **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 run-time.

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.



**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**

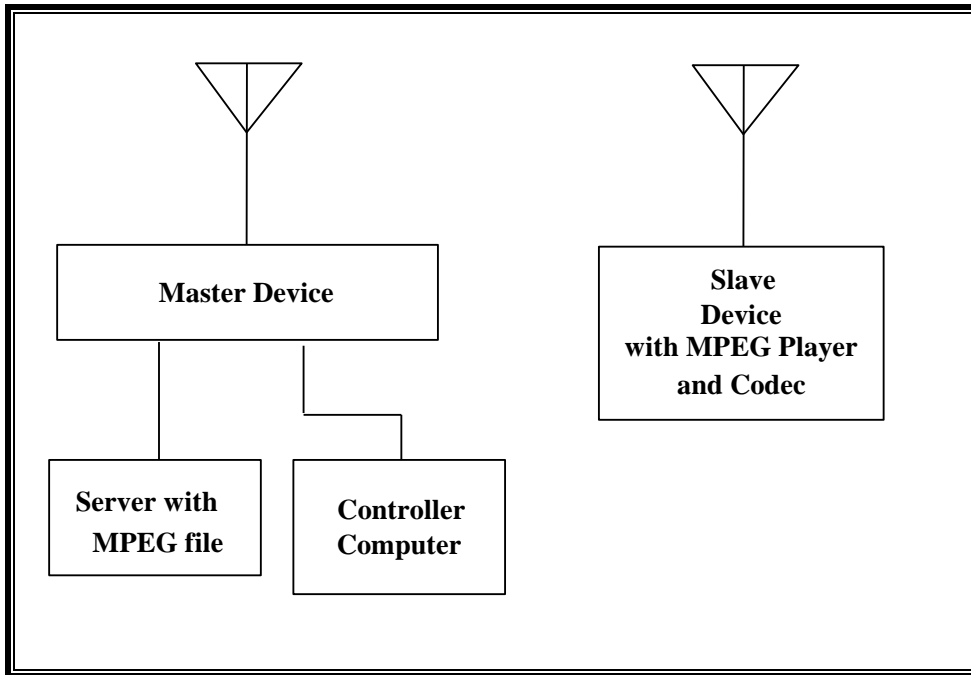
The following test and measurement equipment was utilized for the DFS tests documented in this report:

<b>TEST EQUIPMENT LIST</b>				
<b>Description</b>	<b>Manufacturer</b>	<b>Model</b>	<b>Asset Number</b>	<b>Cal Due</b>
Spectrum Analyzer, 26.5 GHz	Agilent / HP	E4440A	C01178	08/15/12
Vector Signal Generator, 20GHz	Agilent / HP	E8267C	C01066	11/17/12

**11.1.3. SETUP OF EUT**

**CLIENT MODE:**

**RADIATED METHOD EUT TEST SETUP**



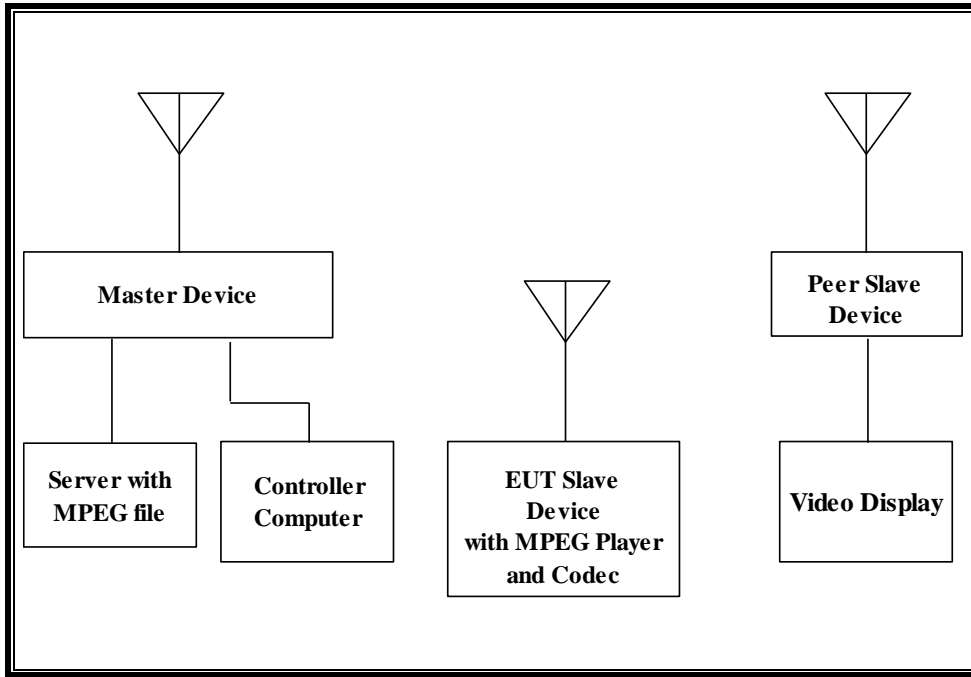
**SUPPORT EQUIPMENT**

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
AC Adapter (AP)	Delta Electronics	EADP-45BB B	DTH1049902N	DoC
Notebook PC (Server)	Apple	MacBook Pro A1150	AOU257941	DoC
AC Adapter (Server)	Delta Electronics	A1344	MV05104CNAL1A	DoC
Notebook PC (Controller)	Dell	PP18L	10657517725	DoC
AC Adapter (Controller PC)	Dell	LA65SN0-00	CN-ODF263-71615-6AU-1019	DoC

**AIRPLAY 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
AC Adapter (AP)	Delta Electronics	EADP-45BB B	DTH1049902N	DoC
Notebook PC (Server)	Apple	MacBook Pro A1150	AOU257941	DoC
AC Adapter (Server)	Delta Electronics	A1344	MV05104CNAL1A	DoC
Notebook PC (Controller)	Dell	PP18L	10657517725	DoC
AC Adapter (Controller PC)	Dell	LA65SN0-00	CN-ODF263-71615-6AU-1019	DoC
Apple TV (Peer Slave Device)	Apple	A1427	C07GY040F14P	BCGA1427
LCD Monitor	Dell	Prototype	6279	N/A

#### **11.1.4. 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 21.6 dBm EIRP in the 5250-5350 MHz band and 21.18 dBm EIRP in the 5470-5725 MHz band.

The only antenna assembly utilized with the EUT has a gain of 4.25 dBi in the 5250-5350 MHz band and 4.51 dBi 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.

In the client mode, 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. In the Client-to-Client Communications mode, WLAN traffic is generated by streaming the video file TestFile.mp2 "6 ½ Magic Hours" from the Master, to the Slave, and mirror to the peer slave device 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 in standard client mode. One nominal channel bandwidth of 20 MHz is implemented in Client-to-Client Communications mode.

The software installed in the EUT is IOS (Build 10A371).

#### **UNIFORM CHANNEL SPREADING**

This requirement is not applicable to Slave radio devices.

**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.

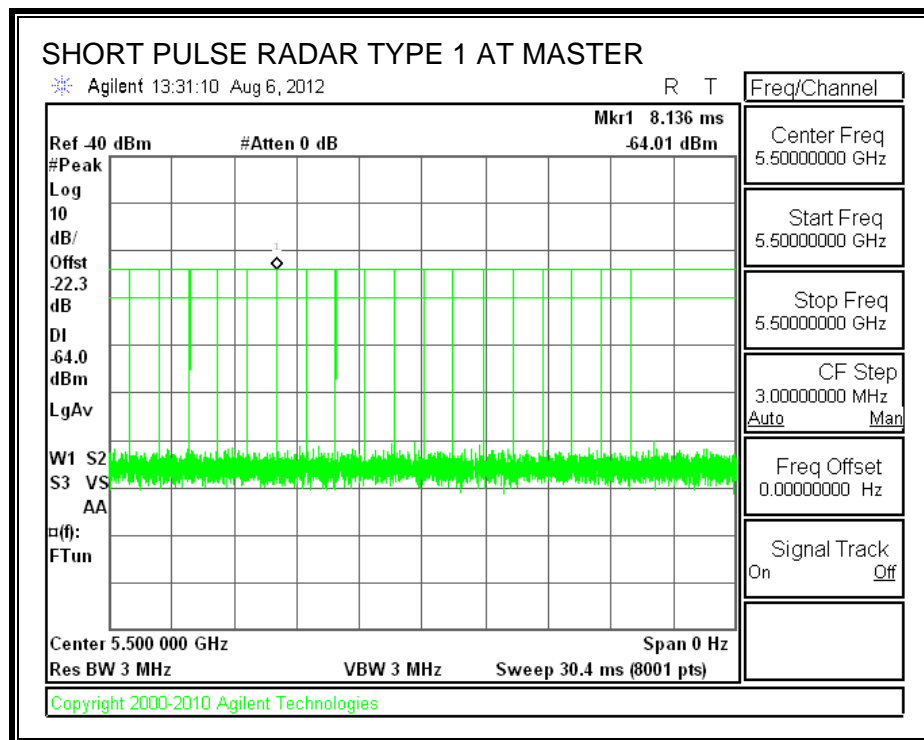
## 11.2. CLIENT MODE RESULTS FOR 20 MHz BANDWIDTH

### 11.2.1. TEST CHANNEL

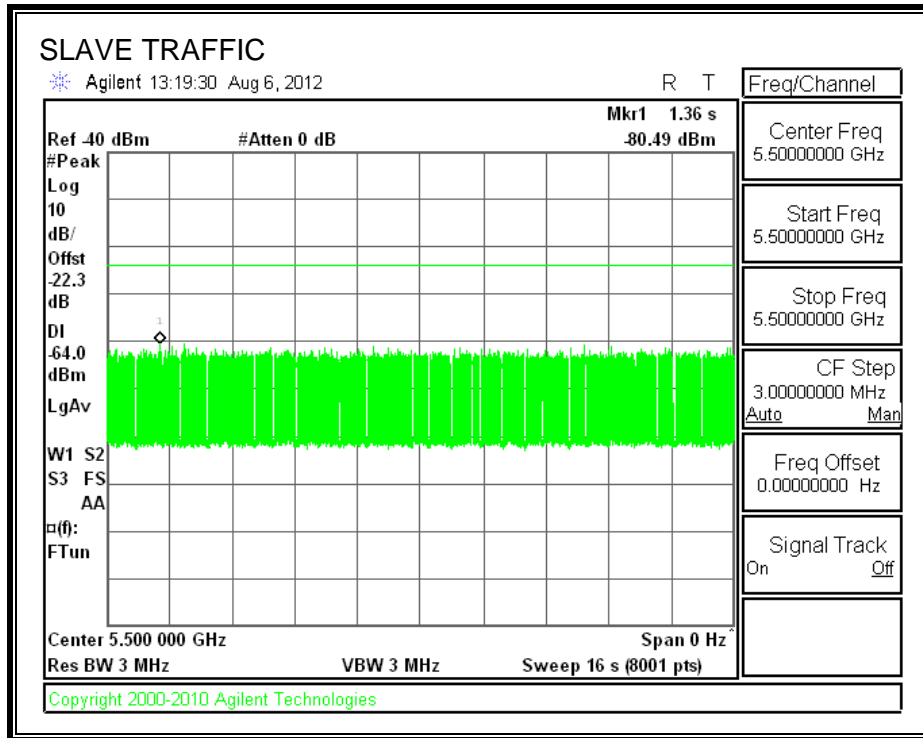
All tests were performed at a channel center frequency of 5500 MHz.

### 11.2.2. RADAR WAVEFORM AND TRAFFIC

#### RADAR WAVEFORM



**TRAFFIC**



### 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).

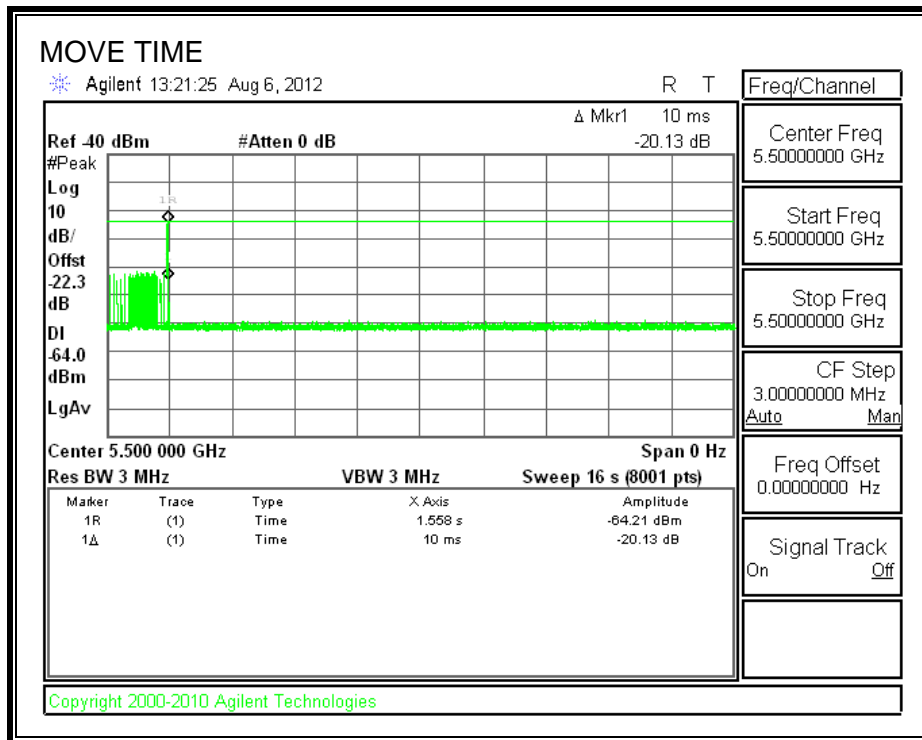
#### RESULTS

Agency	Channel Move Time (sec)	Limit (sec)
FCC / IC	0.010	10

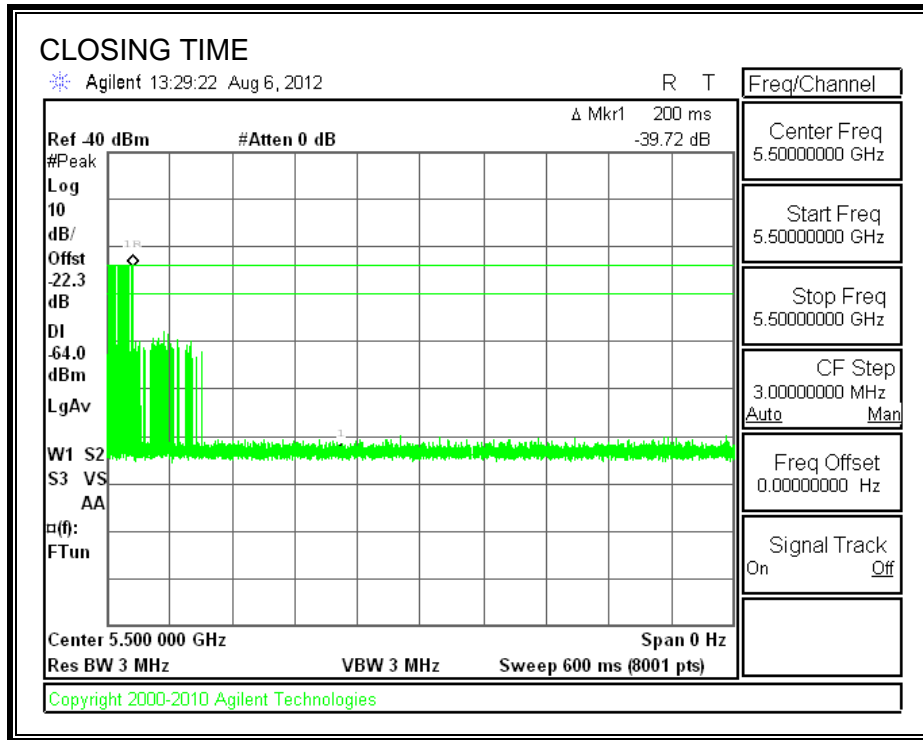
Agency	Aggregate Channel Closing Transmission Time (msec)	Limit (msec)
FCC	0.0	60
IC	4.0	260



**MOVE TIME**

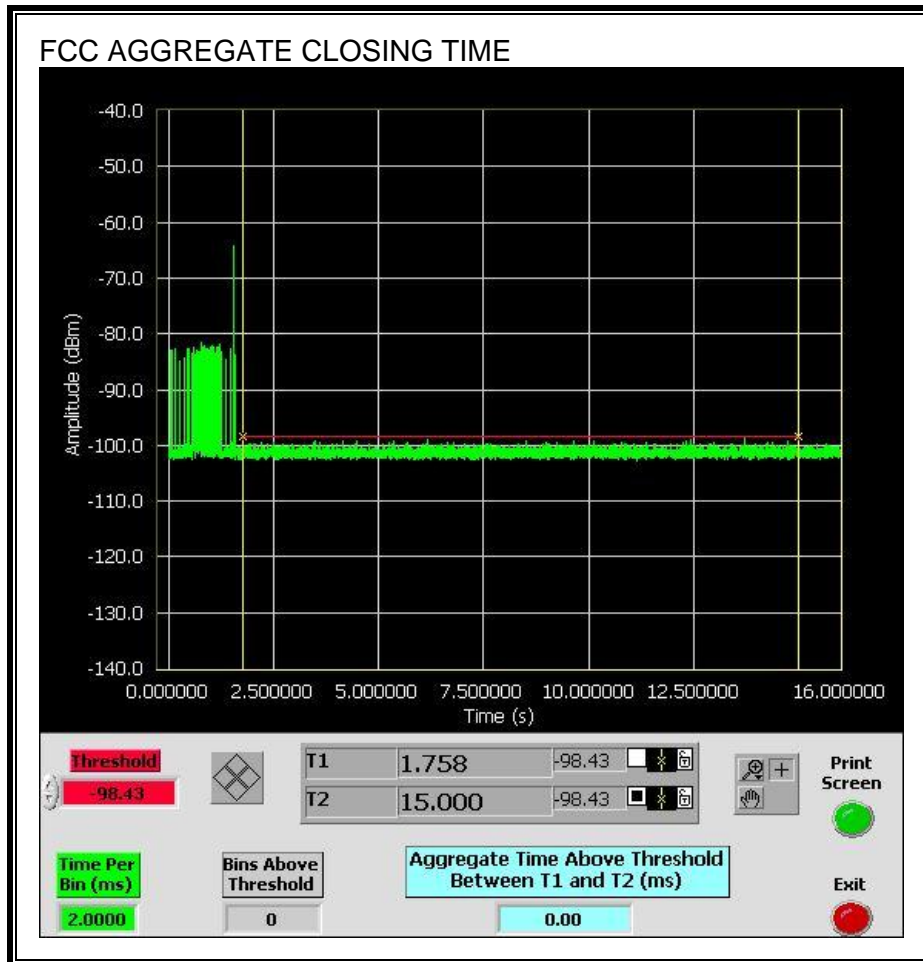


**CHANNEL CLOSING TIME**

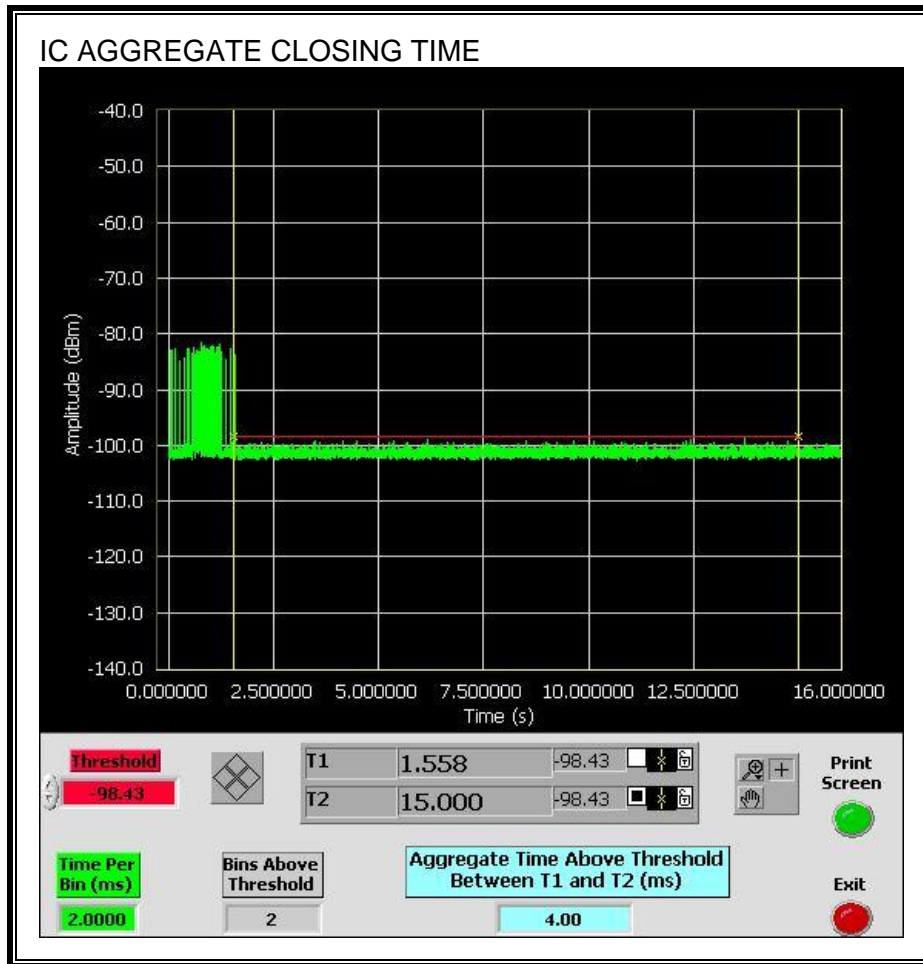


**AGGREGATE CHANNEL CLOSING TRANSMISSION TIME**

No transmissions are observed during the FCC aggregate monitoring period.



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



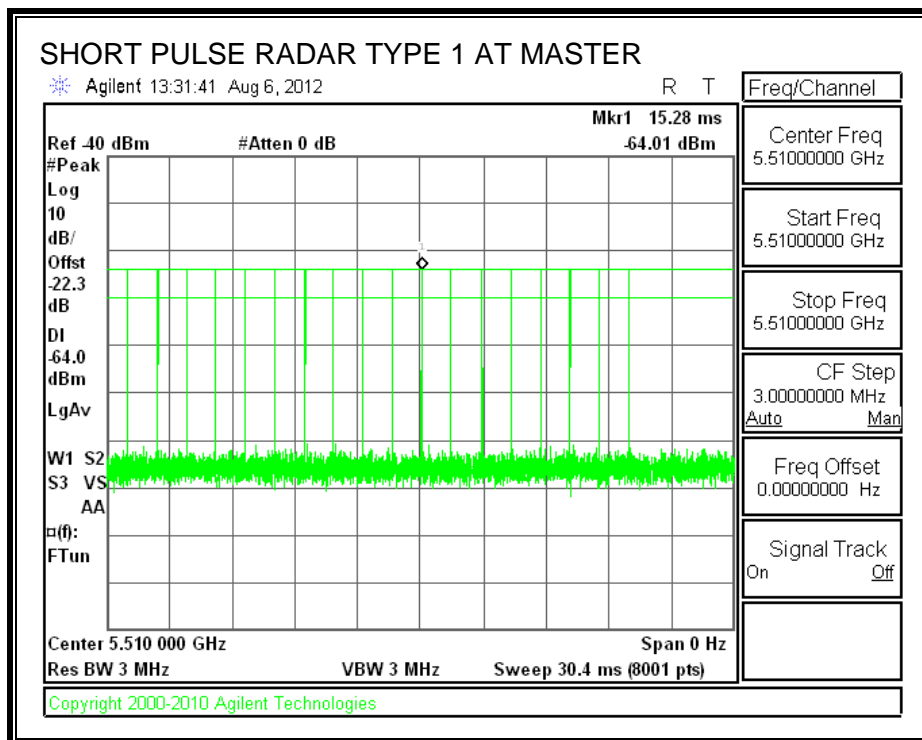
### 11.3. CLIENT MODE RESULTS FOR 40 MHz BANDWIDTH

#### 11.3.1. TEST CHANNEL

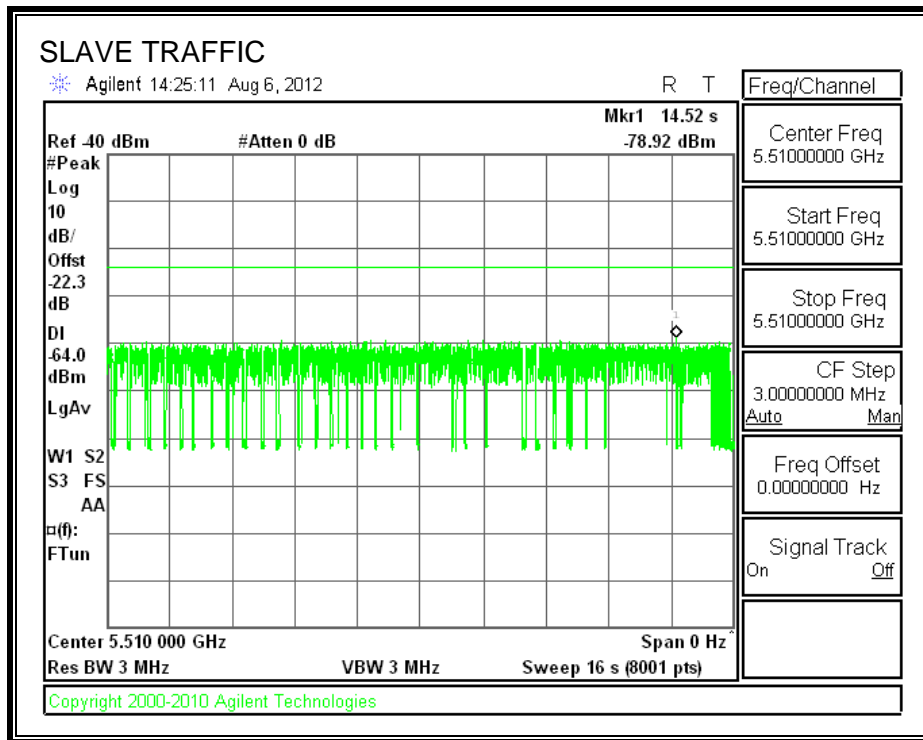
All tests were performed at a channel center frequency of 5510 MHz.

#### 11.3.2. RADAR WAVEFORM AND TRAFFIC

##### RADAR WAVEFORM



**TRAFFIC**



**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).

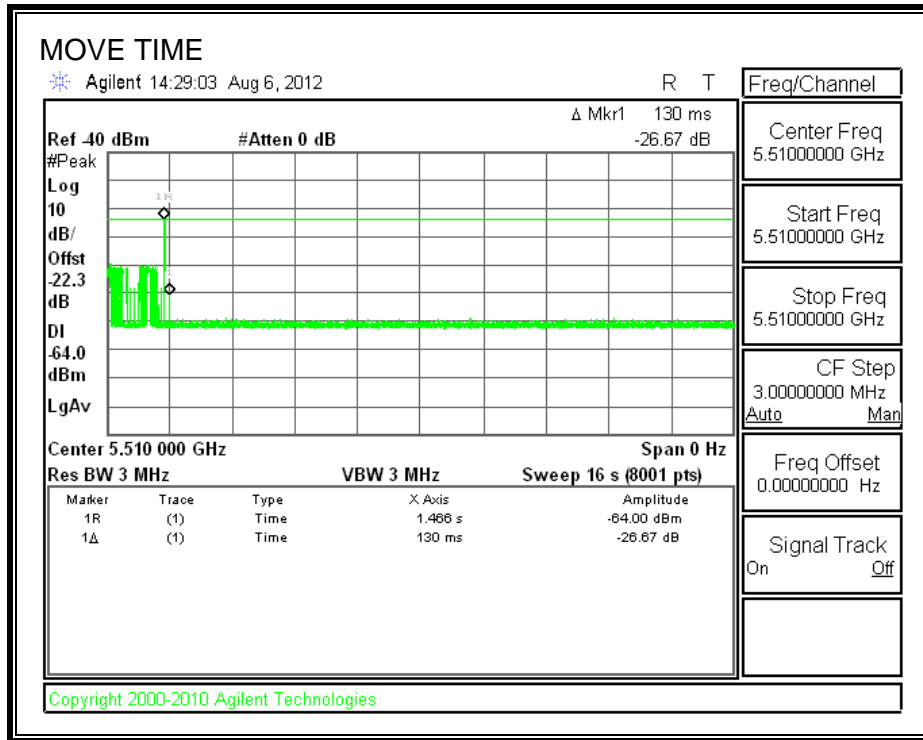
The observation period over which the IC aggregate time is calculated begins at (Reference Marker) and ends no earlier than (Reference Marker + 10 sec).

**RESULTS**

Agency	Channel Move Time (sec)	Limit (sec)
FCC / IC	0.130	10

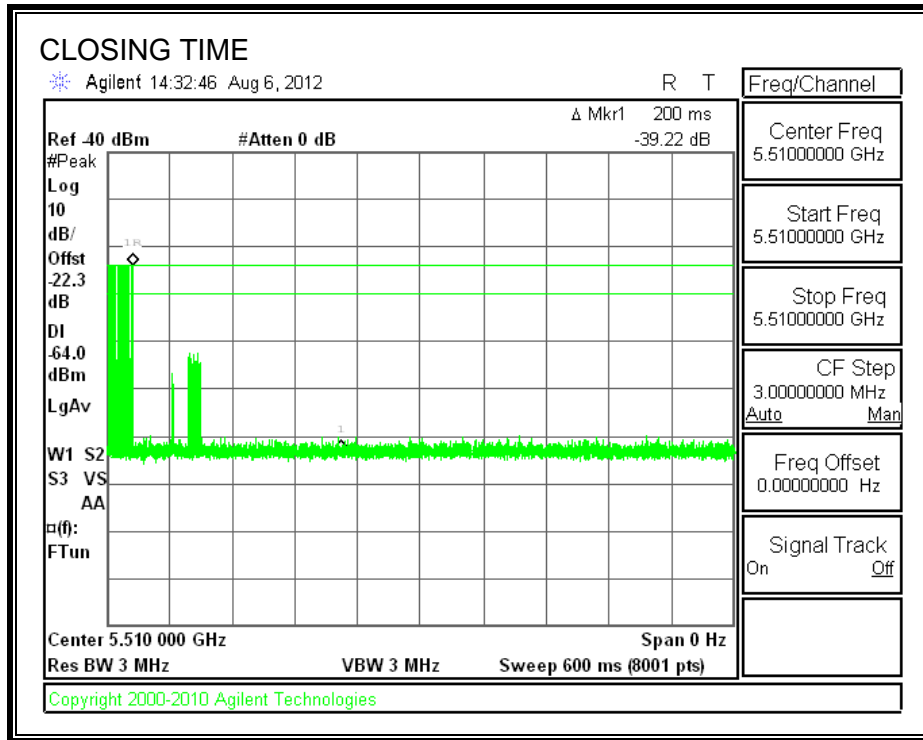
Agency	Aggregate Channel Closing Transmission Time (msec)	Limit (msec)
FCC	0.0	60
IC	2.0	260

**MOVE TIME**



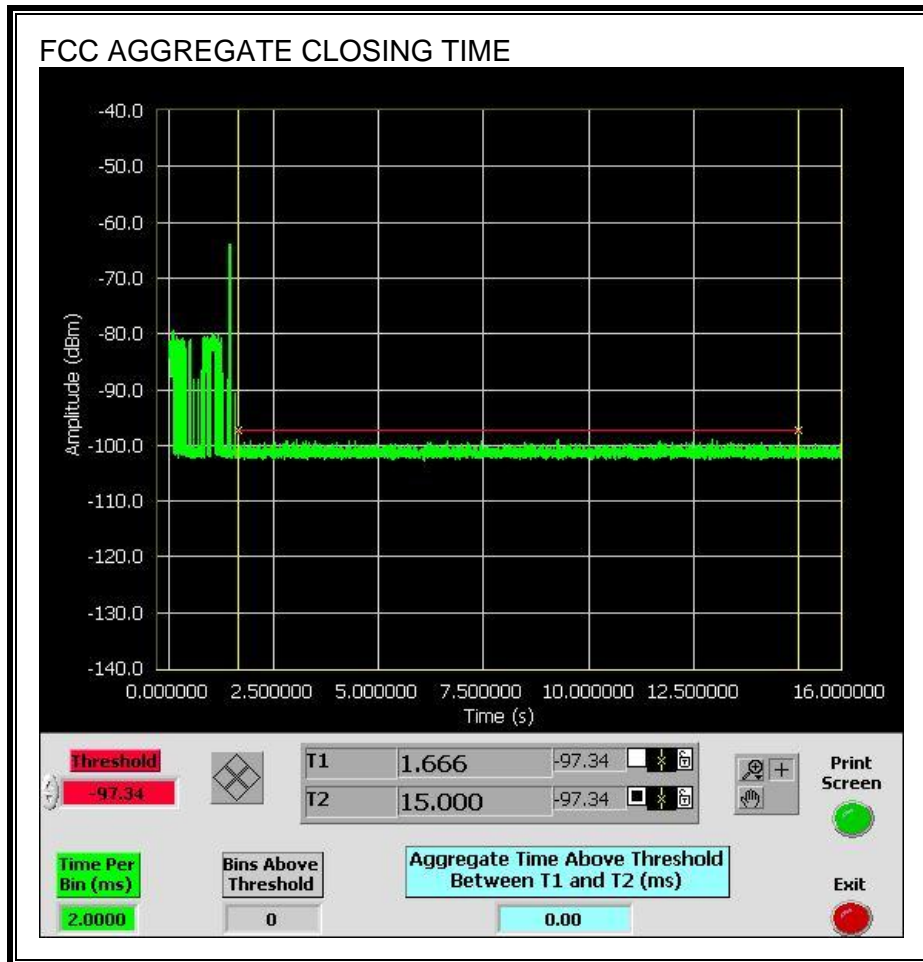


**CHANNEL CLOSING TIME**

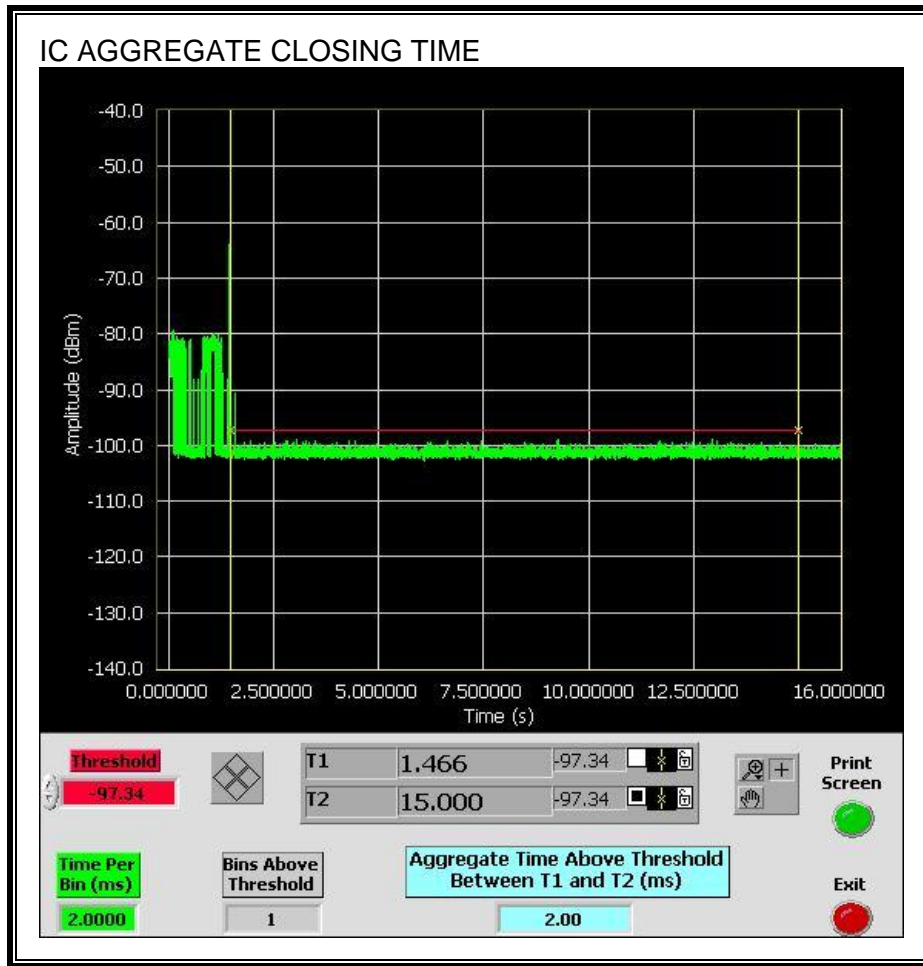


**AGGREGATE CHANNEL CLOSING TRANSMISSION TIME**

No transmissions are observed during the FCC aggregate monitoring period.



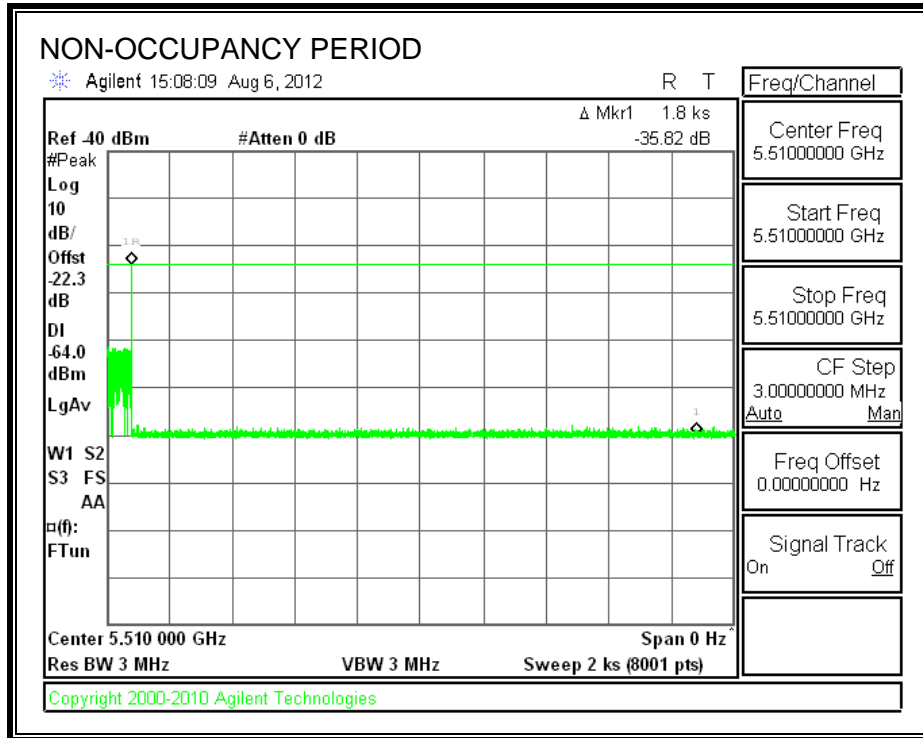
Only intermittent transmissions are observed during the IC aggregate monitoring period.



### 11.3.5. NON-OCCUPANCY PERIOD

#### RESULTS

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



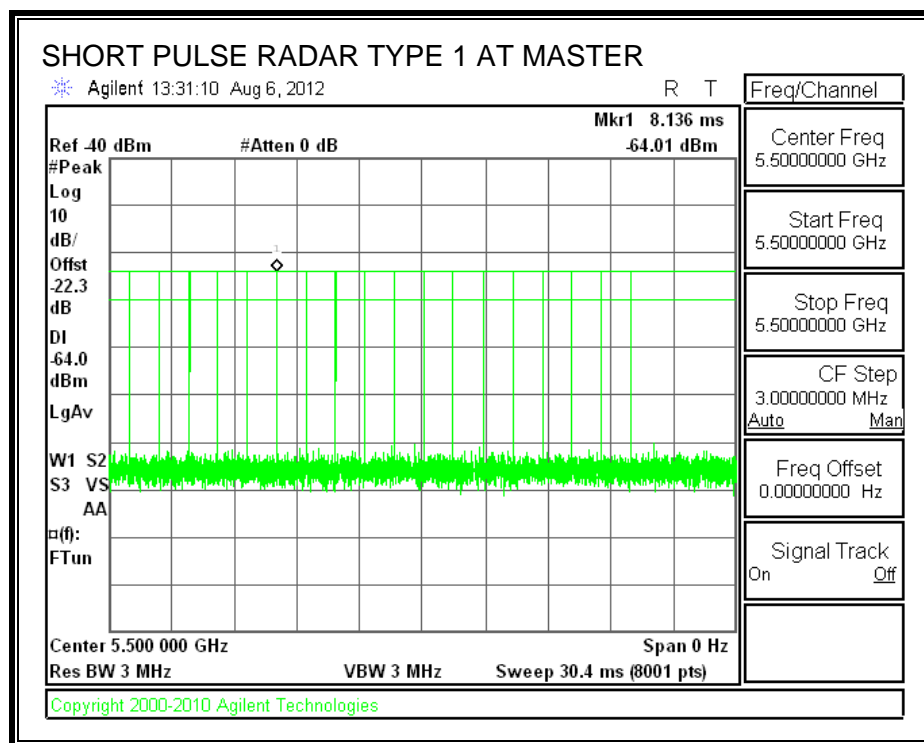
## 11.4. CLIENT-TO-CLIENT COMMUNICATIONS MODE RESULTS FOR 20 MHz BANDWIDTH

### 11.4.1. TEST CHANNEL

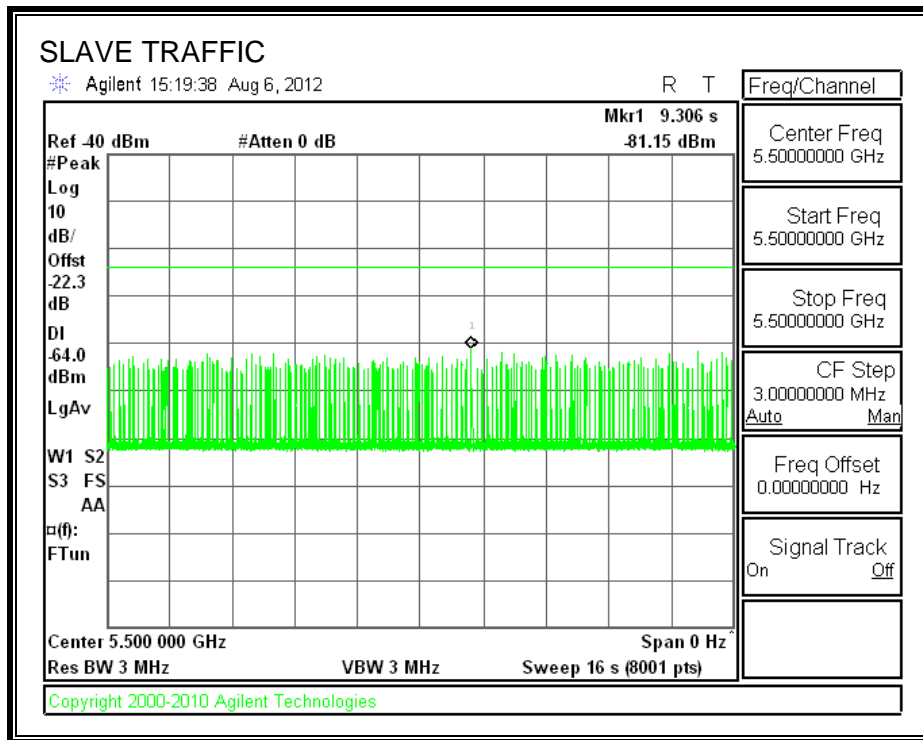
All tests were performed at a channel center frequency of 5500 MHz.

### 11.4.2. RADAR WAVEFORM AND TRAFFIC

#### RADAR WAVEFORM



**TRAFFIC**



### 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).

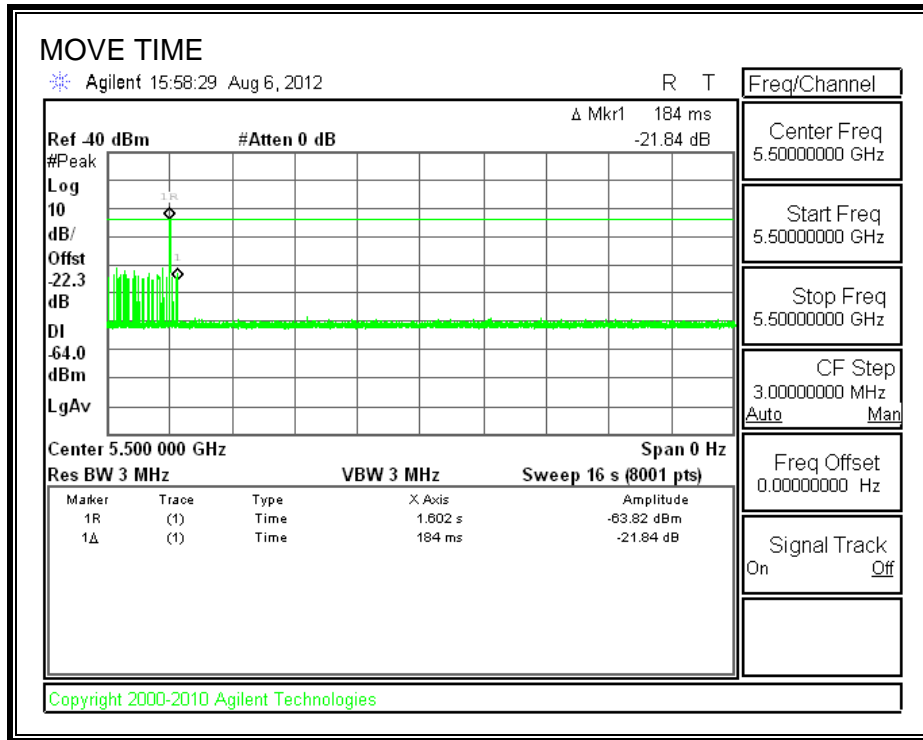
The observation period over which the IC aggregate time is calculated begins at (Reference Marker) and ends no earlier than (Reference Marker + 10 sec).

#### RESULTS

Agency	Channel Move Time (sec)	Limit (sec)
FCC / IC	0.184	10

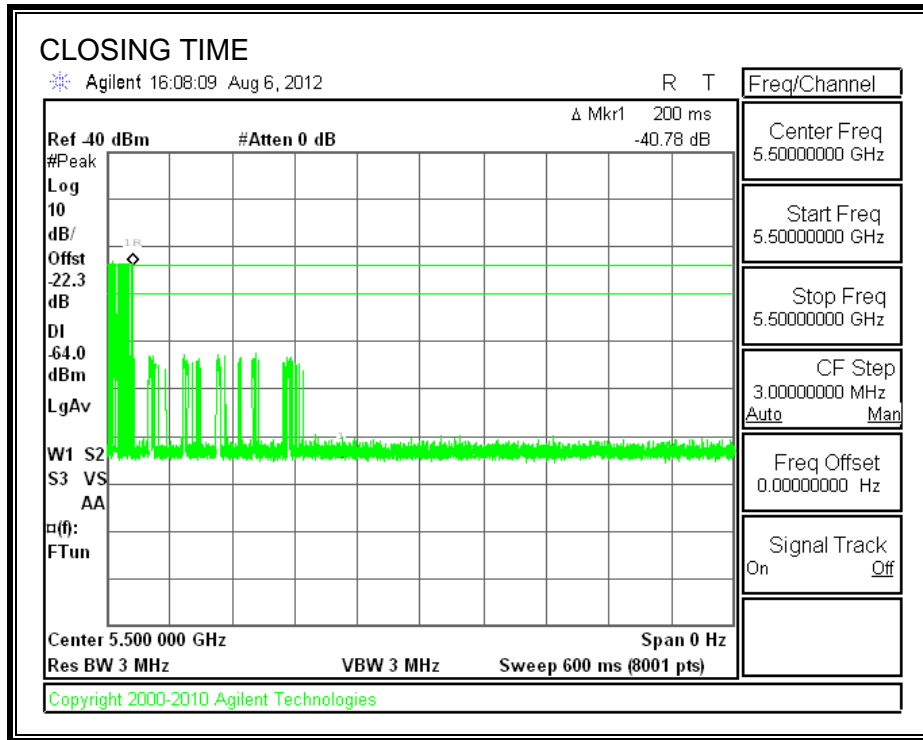
Agency	Aggregate Channel Closing Transmission Time (msec)	Limit (msec)
FCC	0.0	60
IC	10.0	260

**MOVE TIME**



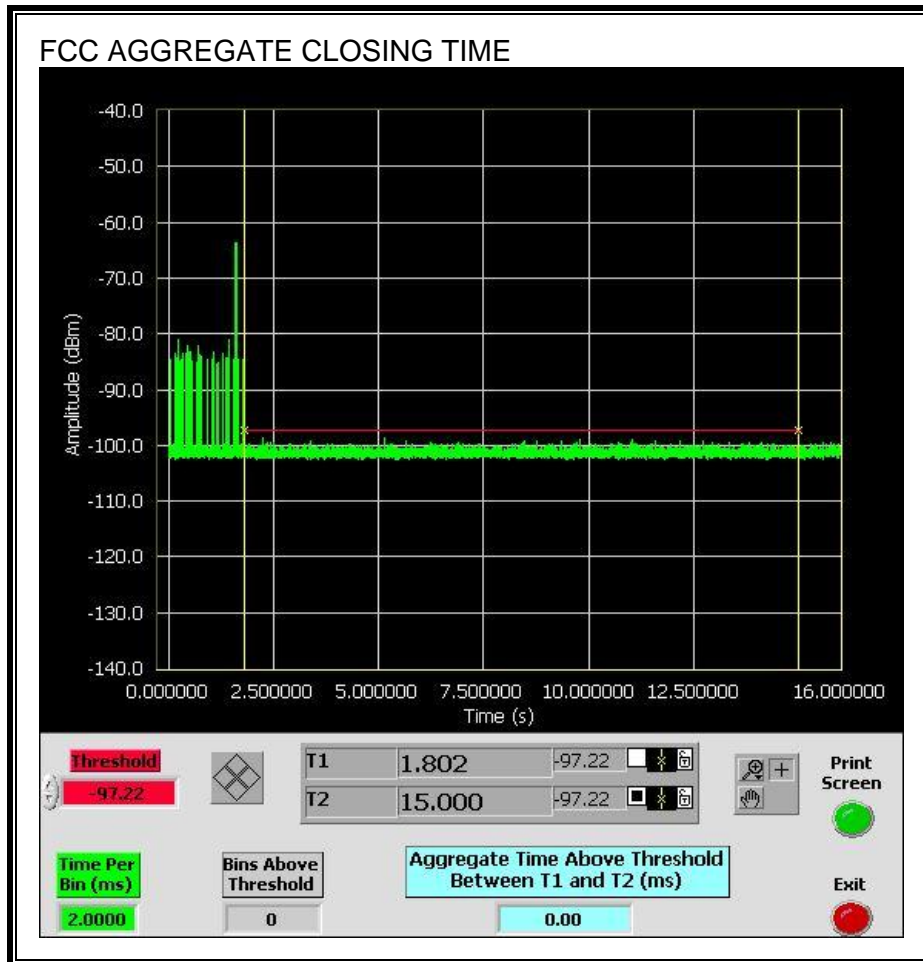


**CHANNEL CLOSING TIME**



**AGGREGATE CHANNEL CLOSING TRANSMISSION TIME**

No transmissions are observed during the FCC aggregate monitoring period.



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

