



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

CERTIFICATION TEST REPORT

FOR

**GSM/GPRS/EGPRS/WCDMA/HSPA+/DC-HSDPA/LTE radio, IEEE 802.11a/b/g/n and
Bluetooth radio**

MODEL NUMBER: A1428 and A1429

FCC ID: BCG-E2599A

IC: 579C-E2599A

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Prepared for

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<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
--	08/06/2012	Initial Issue	T. LEE
A	08/14/12	Corrected Test Method in Section 7.1.3 Removed TPC since maximum power is less than 500 mW	T. LEE

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: APPLE
1 INFINITE LOOP
CUPERTINO, CA 95014, U.S.A.

EUT DESCRIPTION: Cellular GSM/GPRS/EGPRS/WCDMA/HSPA+/DC-HSDPA/LTE radio, IEEE 802.11a/b/g/n and Bluetooth radio.

MODEL: A1428 and A1429

SERIAL NUMBER: C39HV0HPF5P5 and C39HW025FPL

DATE TESTED: JULY 10 - AUGUST 06, 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.

Approved & Released For UL CCS By:

Tested By:



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UL CCS

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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, FCC 06-96, FCC KDB 789033, ANSI C63.4-2003, 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

Model A1428, is a mobile phone with multimedia functions (music, application support, and video), cellular GSM/GPRS/EGPRS/WCDMA/HSPA+/DC-HSDPA/CDMA1xRTT/ EV-DO Rev 0, A, B /1xAdvanced/ LTE radio, IEEE 802.11a/b/g/n radio and Bluetooth radio. The rechargeable battery is not user accessible.

5.2. 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	14.29	26.85
5180 - 5240	802.11n HT20	14.47	27.99
5190 - 5230	802.11n HT40	14.41	27.61
5260 - 5320	802.11a	14.26	26.67
5260 - 5320	802.11n HT20	14.13	25.88
5270 - 5310	802.11n HT40	14.55	28.51
5500 - 5700	802.11a	14.09	25.64
5500 - 5700	802.11n HT20	14.18	26.18
5510 - 5670	802.11n HT40	14.32	27.04

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an PIFI antenna.

Frequency (GHz)	Gain (dBi) Type: Pifa
2.400-2.480	-1.4
5.150-5.250	0.14
5.250-5.350	-1.66
5.47-5.725	-0.83
5725-5850	-2.85

5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was WL Tool FW 6.10.56.166.

The firmware installed in the EUT during DFS testing was 10A371.

5.5. MODEL DIFFERNECE

Model A1428 is identical to Model A1429 except in the license bands. Model A1429 encompasses CDMA technology. Testing conducted on Model A1428 is considered representative for Model A1429.

5.6. WORST-CASE CONFIGURATION AND MODE

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

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

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

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

Worst-case data rates were used:

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

5.7. DESCRIPTION OF TEST SETUP

RADIATED TESTS SUPPORT EQUIPMENT

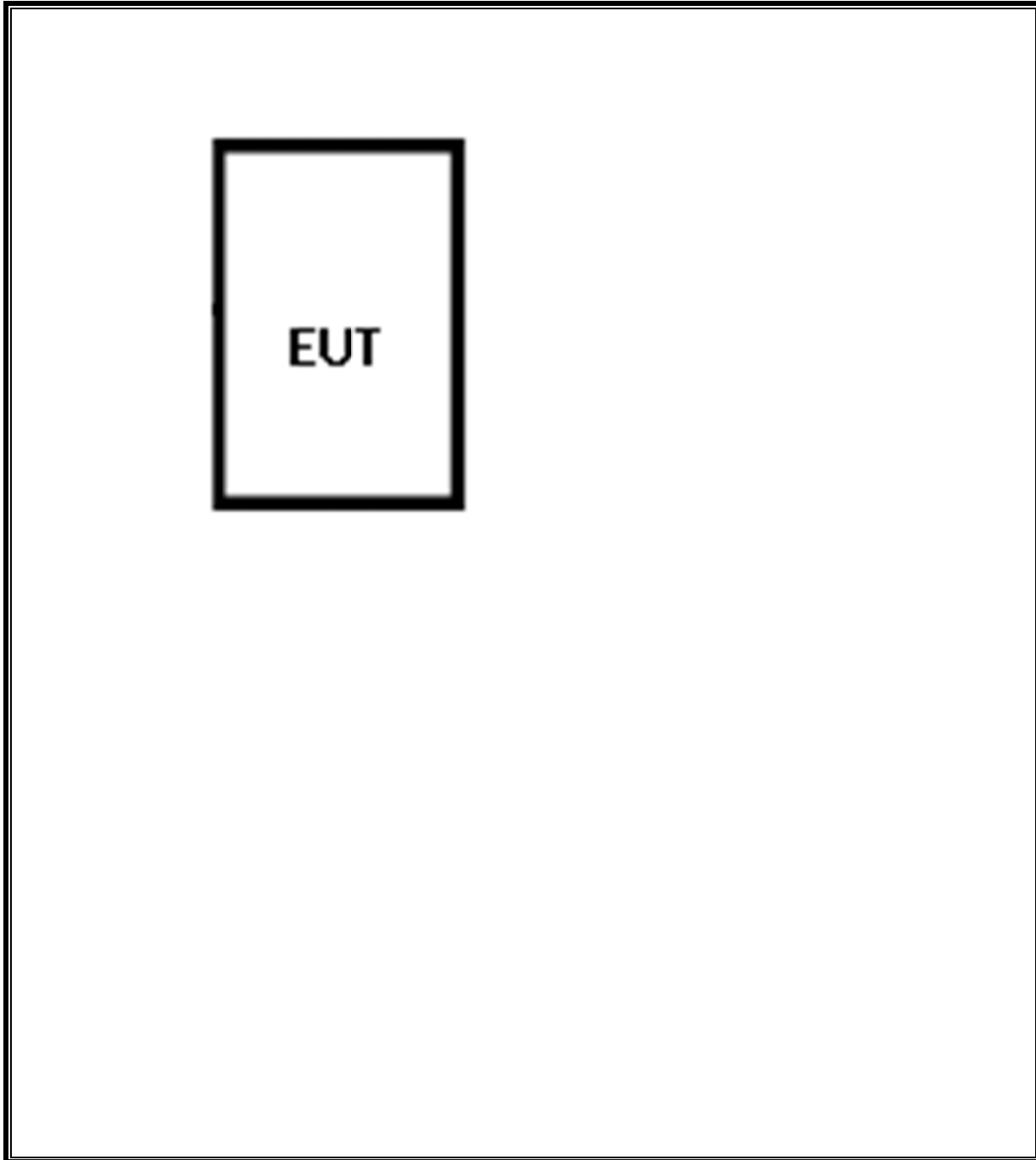
PERIPHERAL SUPPORT EQUIPMENT LIST			
Description	Manufacturer	Model	Serial Number
AC adapter	Apple	A1344	NA

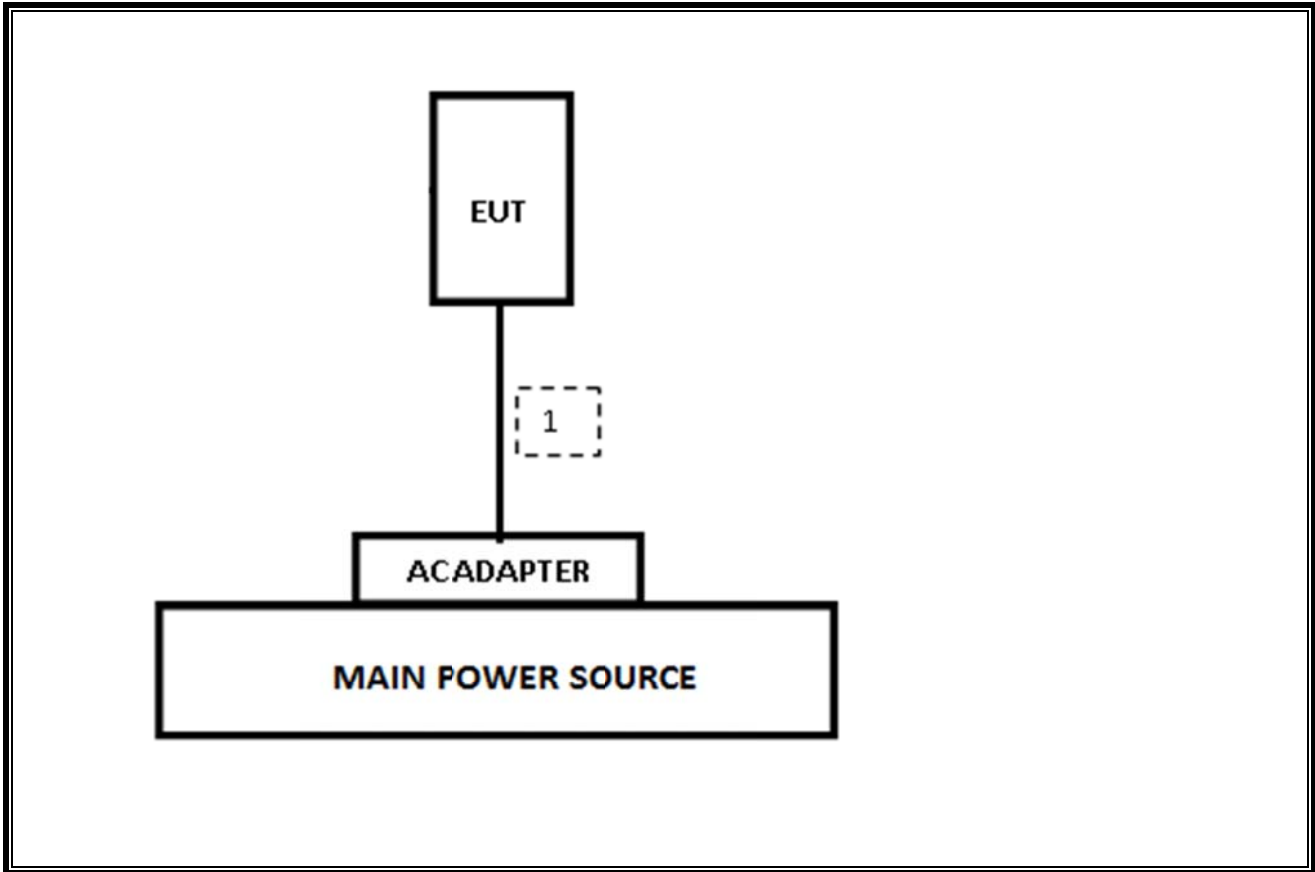
I/O CABLES

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
2	DC	1	US 115V	Un-shielded	1.5m	NA

TEST SETUP

SETUP DIAGRAM FOR TESTS





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	07/14/13
Antenna, Horn, 18 GHz	EMCO	3115	C00945	06/29/13
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00580	11/11/12
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01016	07/12/13
Horn Antenna, 26.5 GHz	ARA	MWH-1826/B	C00589	07/28/13
Horn Antenna, 40 GHz	ARA	MWH-2640/B	C00981	05/10/13
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	C01159	04/09/13
Peak Power Meter	Agilent	N1911A	1260847C	08/04/12
Peak Power Sensor	Agilent	E9323A	1244073F	08/04/12
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.

7.1.1. 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	2.04	2.08	0.981	98.1%	0.08	0.490
802.11n HT20	1.91	1.94	0.982	98.2%	0.08	0.525
802.11n HT40	0.94	0.96	0.963	96.3%	0.16	1.059

7.1.2. MEASUREMENT METHOD FOR POWER AND PPSD

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

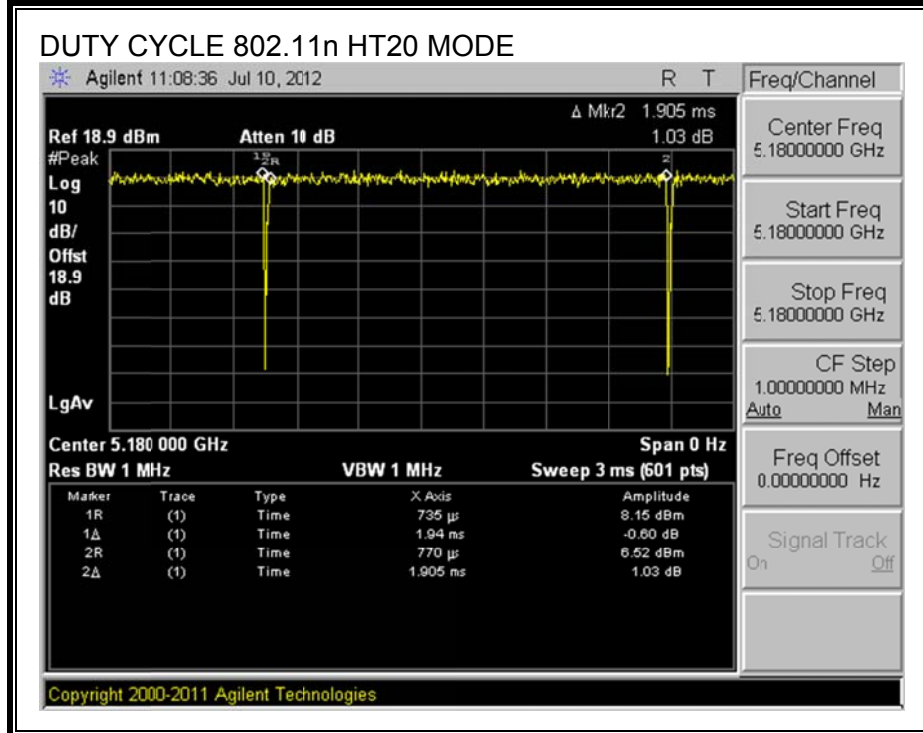
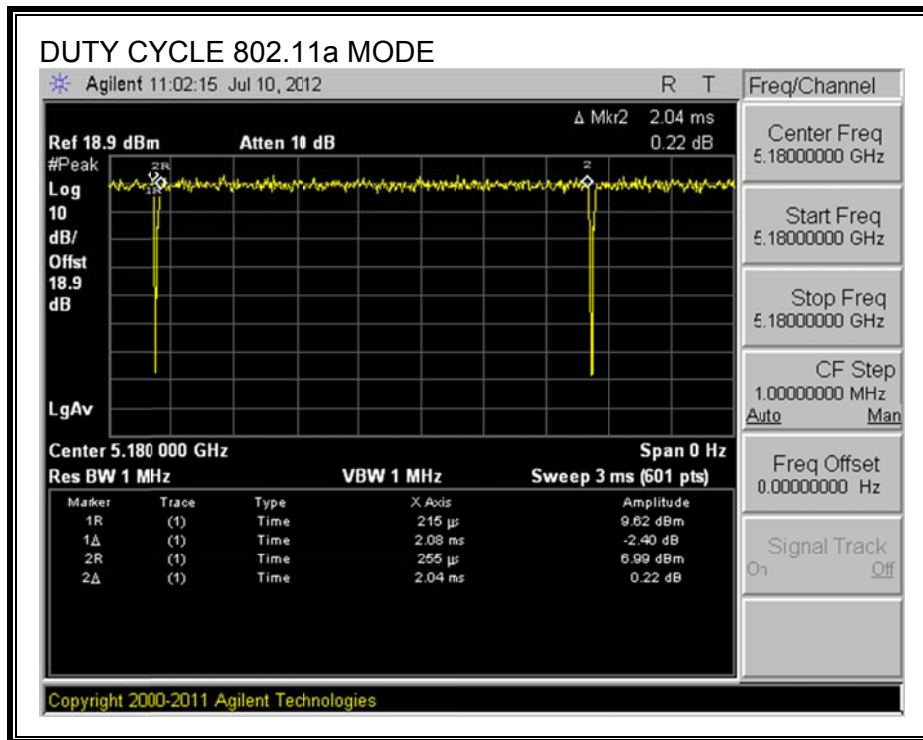
The Duty Cycle is less than 98% and consistent therefore KDB 789033 Method SA-2 Alternative is used.

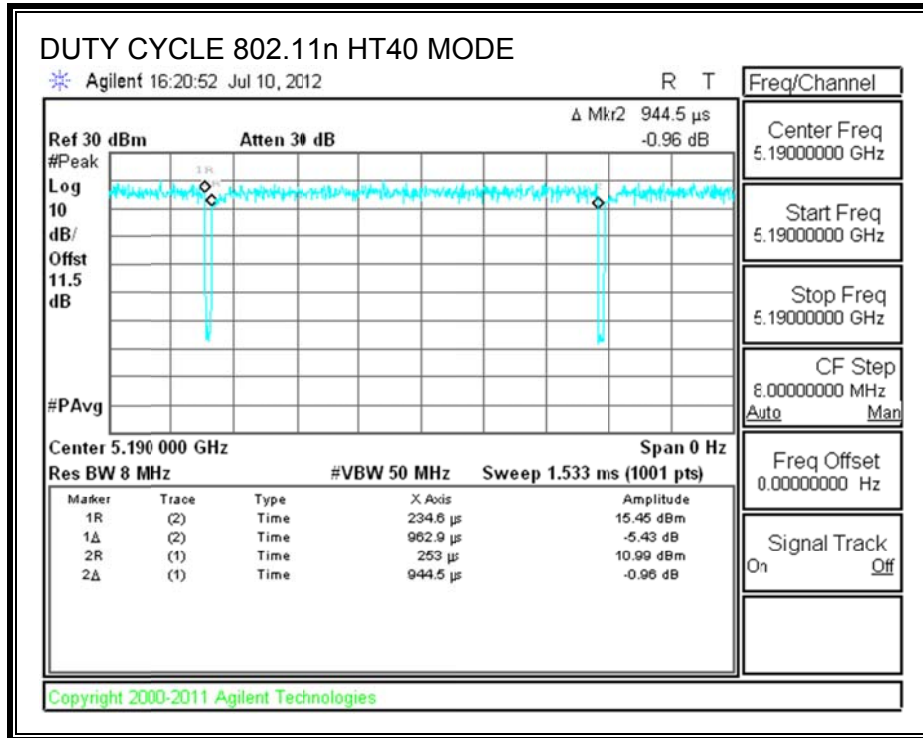
7.1.3. MEASUREMENT METHOD FOR AVERAGE SPURIOUS EMISSIONS ABOVE 1 GHz

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

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

7.1.4. 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

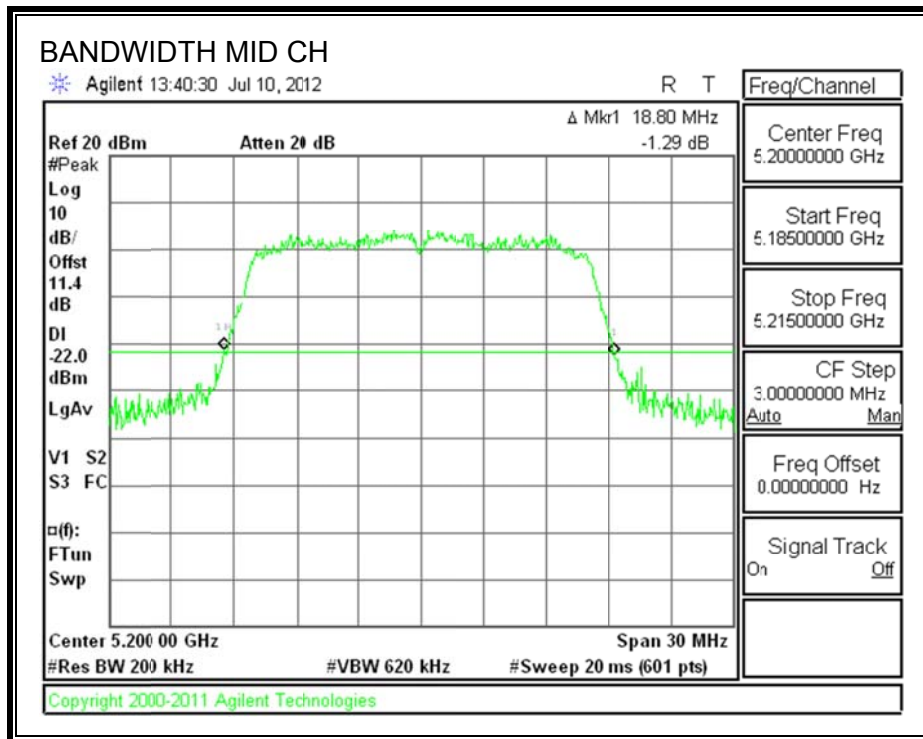
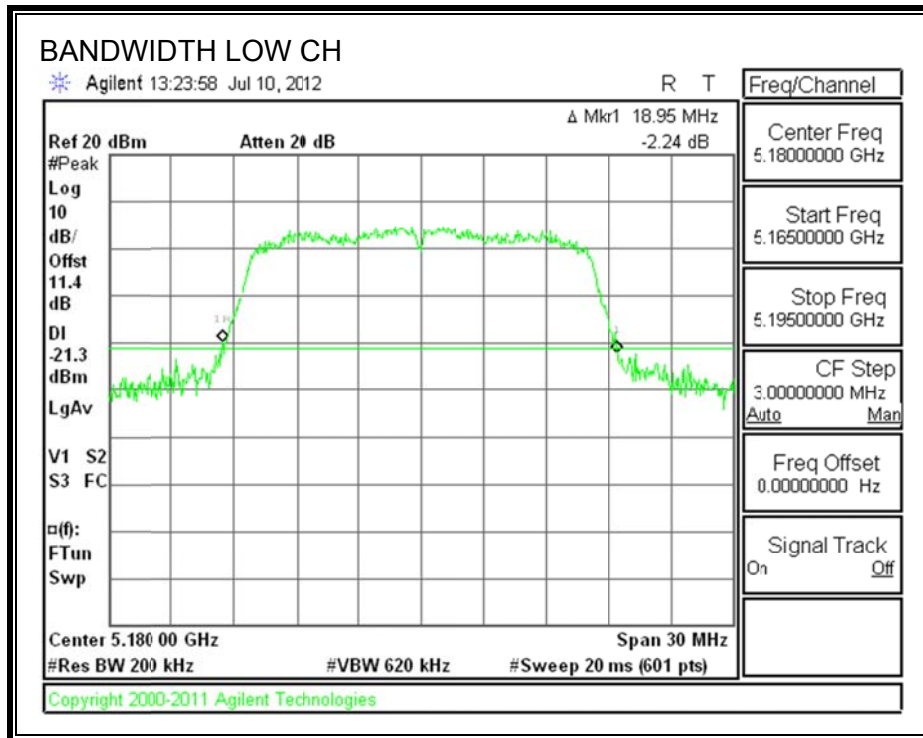
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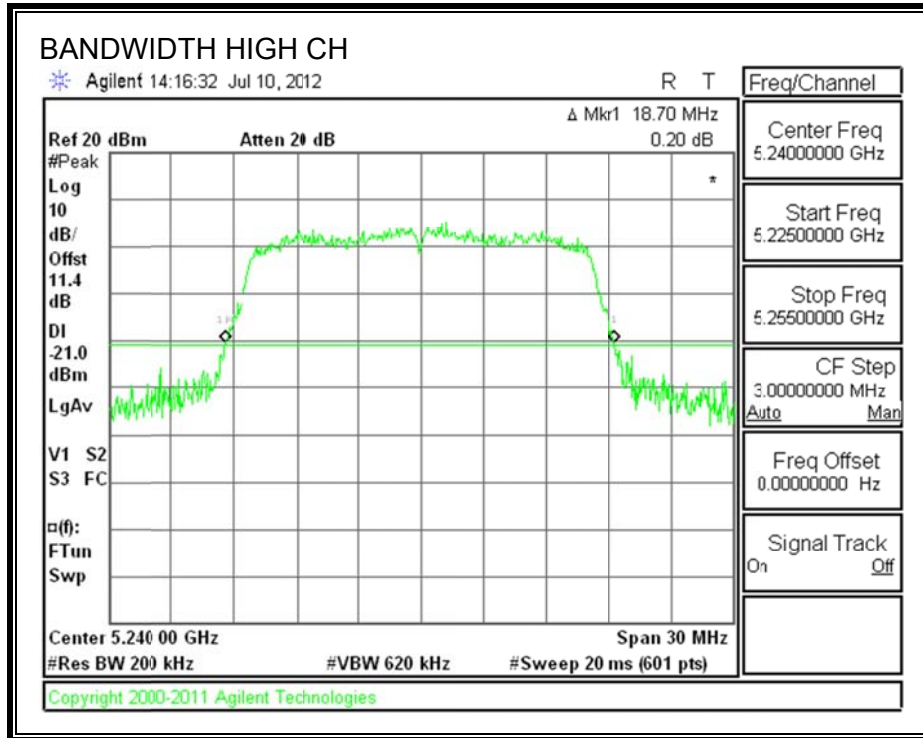
None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
Low	5180	19.0
Mid	5200	18.8
High	5240	18.7

26 dB BANDWIDTH





8.1.2. 99% BANDWIDTH

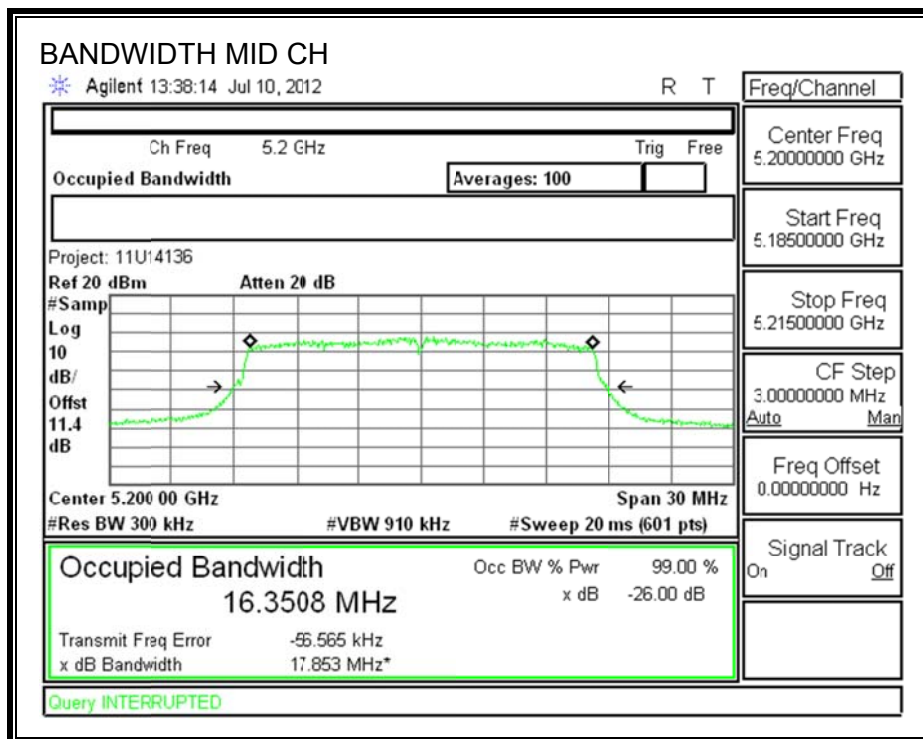
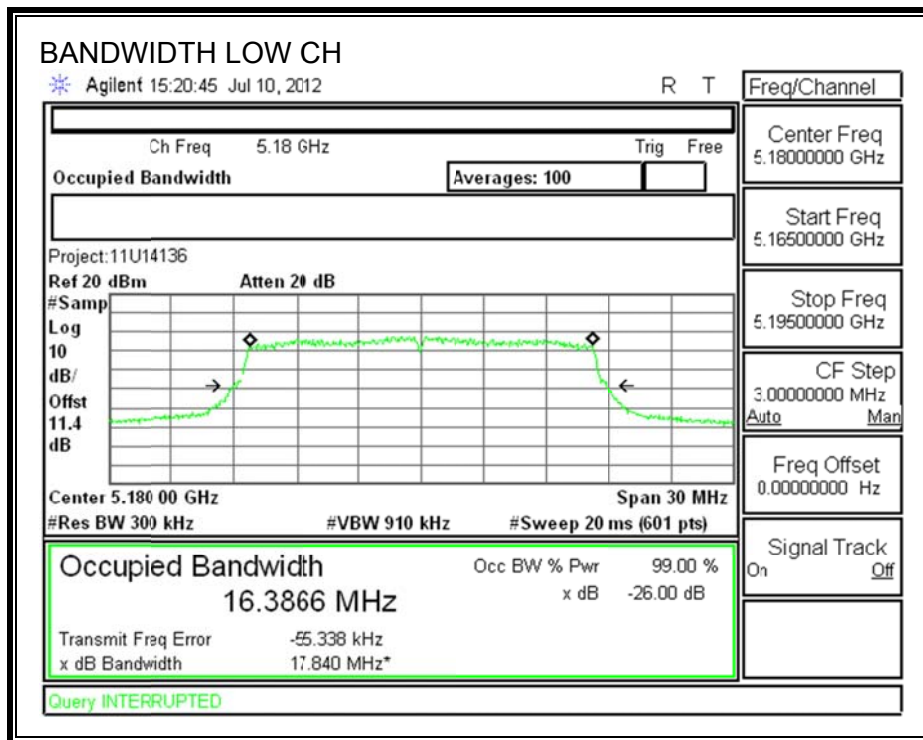
LIMITS

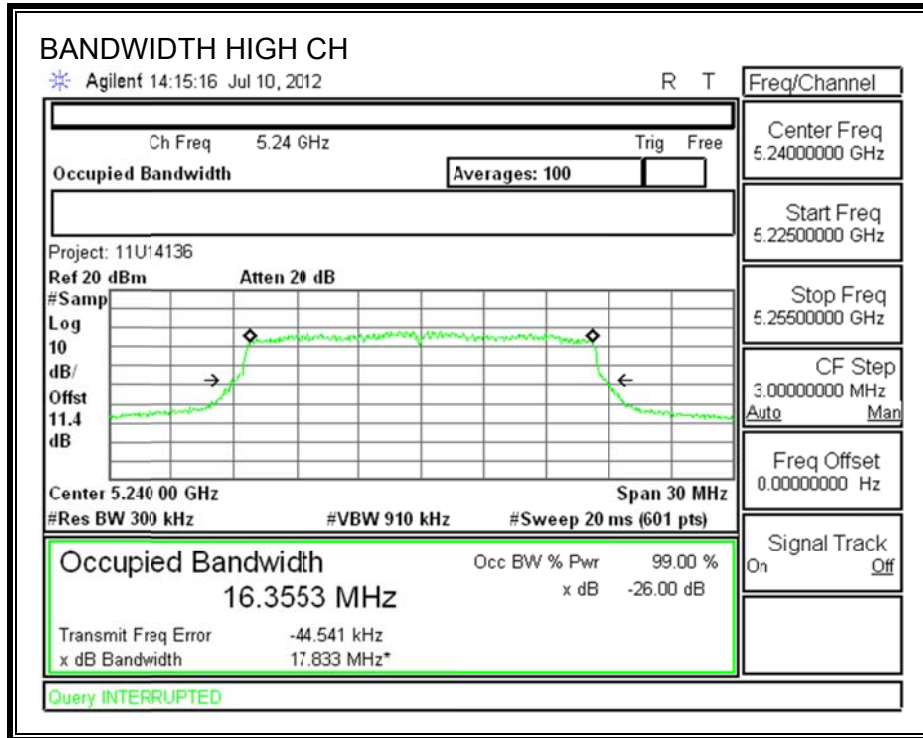
None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5180	16.387
Mid	5200	16.351
High	5240	16.355

99% BANDWIDTH





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 11.4dB (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	13.96
Mid	5200	13.94
High	5240	13.98

8.1.4. OUTPUT POWER AND PPSD

LIMITS

FCC §15.407 (a) (1)

IC RSS-210 A9.2 (1)

FCC §15.407 (a) (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.

IC RSS-210 A9.2 (1):

For the 5.15 – 5.25 GHz band, The maximum e.i.r.p. shall not exceed 200 mW or $10 + 10 \log_{10} B$, dBm, whichever power is less. B is the 99% emission bandwidth in MHz. The e.i.r.p. spectral density shall not exceed 10 dBm in any 1.0 MHz band.

DIRECTIONAL ANTENNA GAIN

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

FCC RESULTS

Limits

Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	4 + 10 Log B (dBm)	Directional Gain (dBi)	Power Limit (dBm)	PPSD Limit (dBm)
Low	5180	17	19.0	16.79	0.14	16.79	4.00
Mid	5200	17	18.8	16.74	0.14	16.74	4.00
High	5240	17	18.7	16.72	0.14	16.72	4.00

Duty Cycle CF (dB)	0.08	Included in Calculations of Corr'd Power & PPSD
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Output Power Results

Channel	Frequency (MHz)	Meas Power (dBm)	Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5180	14.15	14.23	16.79	-2.56
Mid	5200	14.00	14.08	16.74	-2.66
High	5240	14.21	14.29	16.72	-2.43

PPSD Results

Channel	Frequency (MHz)	Meas PPSD (dBm)	Corr'd PPSD (dBm)	PPSD Limit (dBm)	PPSD Margin (dB)
Low	5180	3.76	3.84	4.00	-0.16
Mid	5200	3.61	3.69	4.00	-0.31
High	5240	3.60	3.68	4.00	-0.32

ICC RESULTS

Limits

Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	10 + 10 Log B EIRP Limit (dBm)	Directional Gain (dBi)	Power Limit (dBm)	PPSD Limit (dBm)
Low	5180	17	16.4	22.14	0.14	17.00	4.00
Mid	5200	17	16.4	22.14	0.14	17.00	4.00
High	5240	17	16.4	22.14	0.14	17.00	4.00

Duty Cycle CF (dB)	0.08	Included in Calculations of Corr'd Power & PPSD
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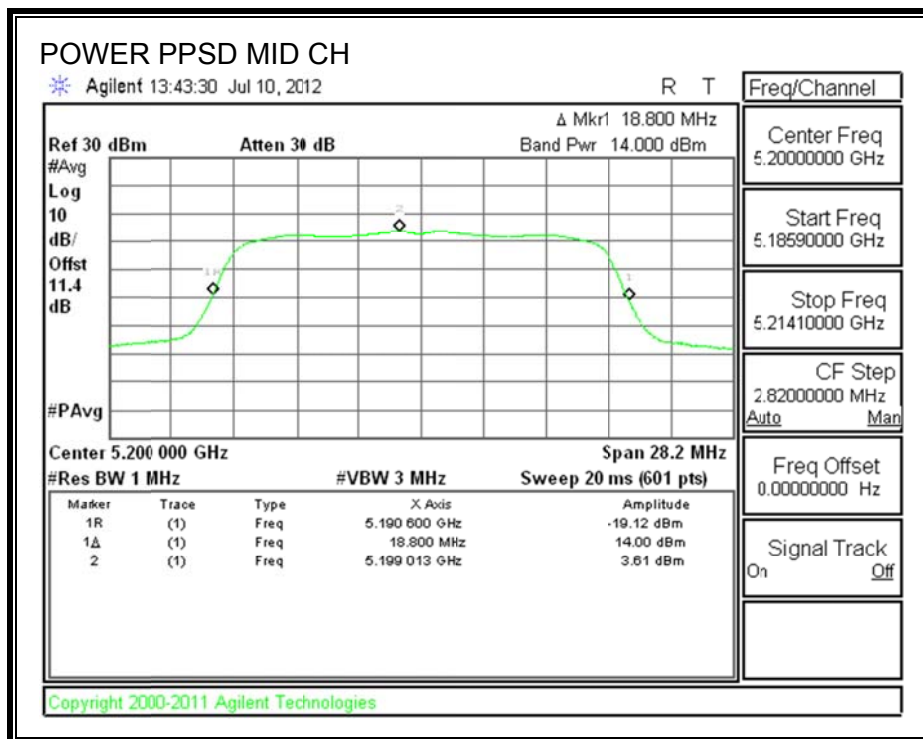
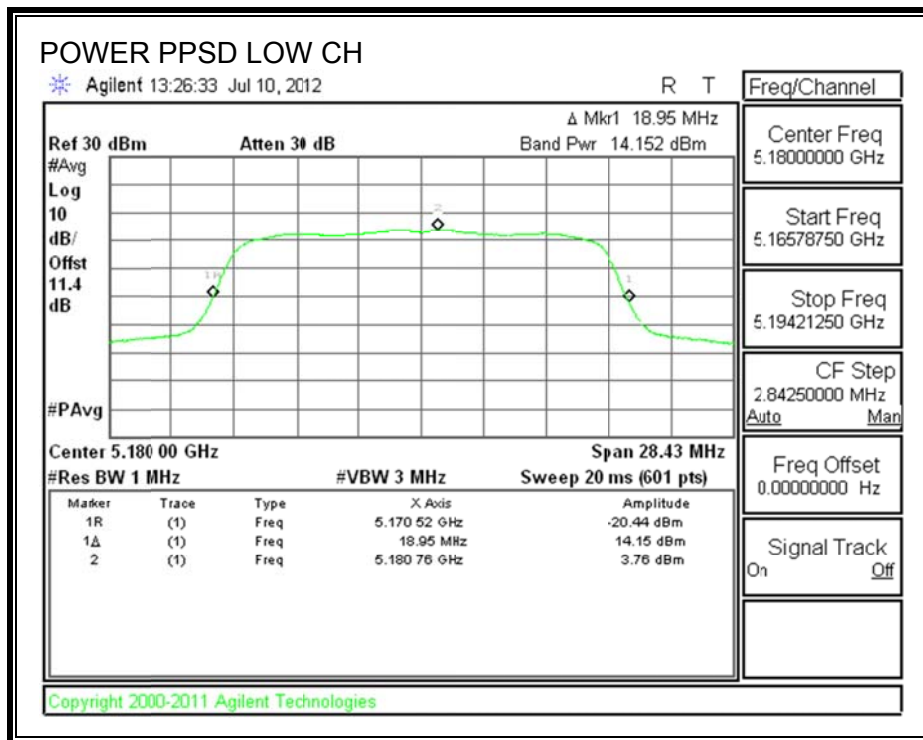
Output Power Results

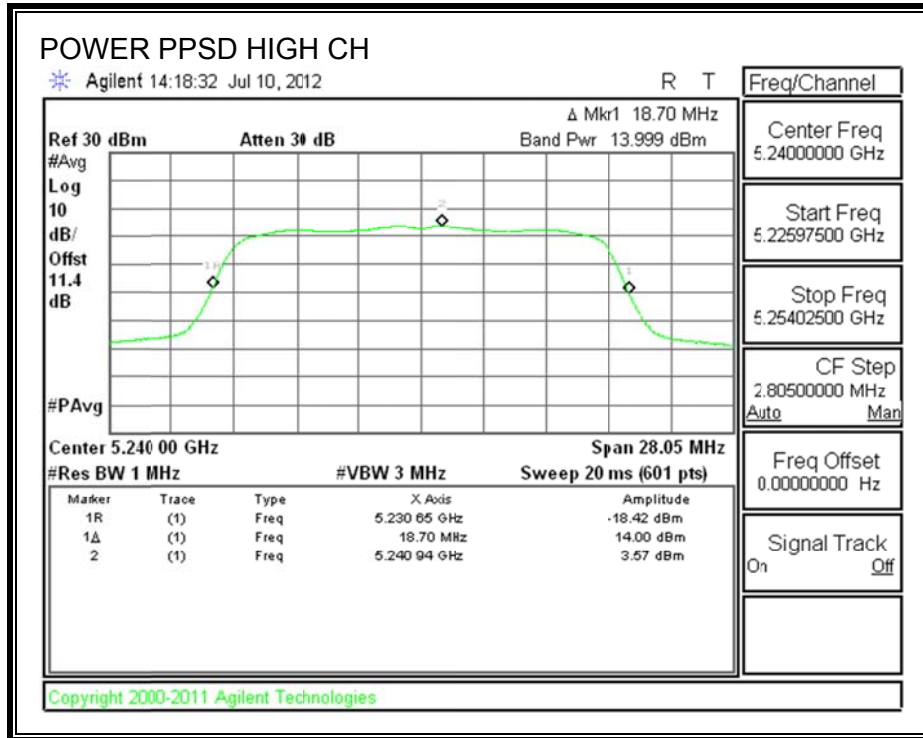
Channel	Frequency (MHz)	Meas Power (dBm)	Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5180	14.15	14.23	17.00	-2.77
Mid	5200	14.00	14.08	17.00	-2.92
High	5240	14.21	14.29	17.00	-2.71

PPSD Results

Channel	Frequency (MHz)	Meas PPSD (dBm)	Corr'd PPSD (dBm)	PPSD Limit (dBm)	PPSD Margin (dB)
Low	5180	3.76	3.84	4.00	-0.16
Mid	5200	3.61	3.69	4.00	-0.31
High	5240	3.60	3.68	4.00	-0.32

OUTPUT POWER AND PPSD





8.1.5. PEAK EXCURSION

LIMITS

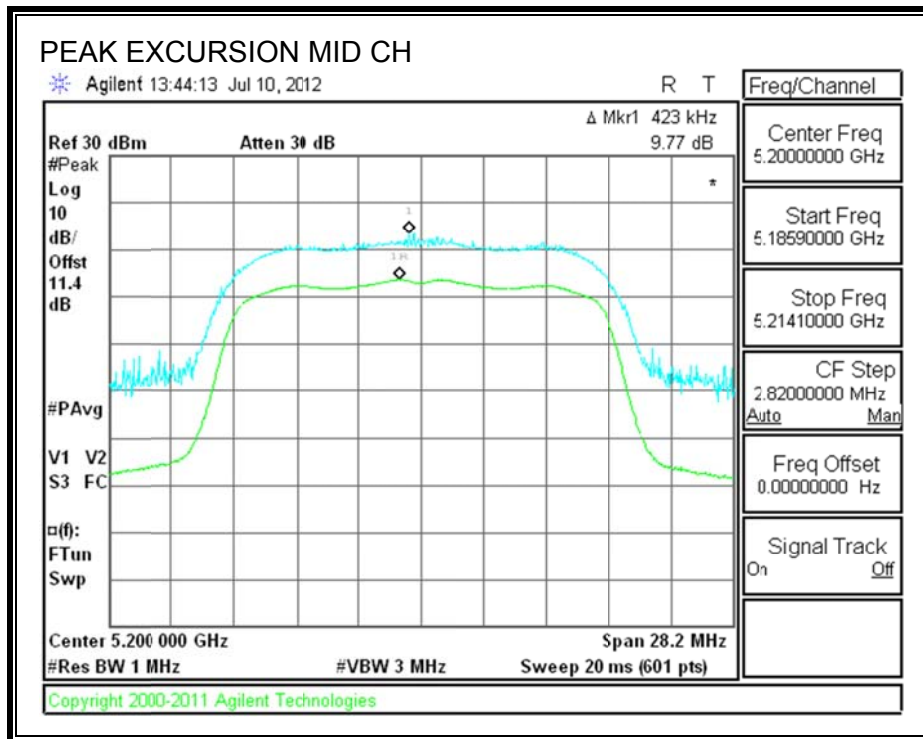
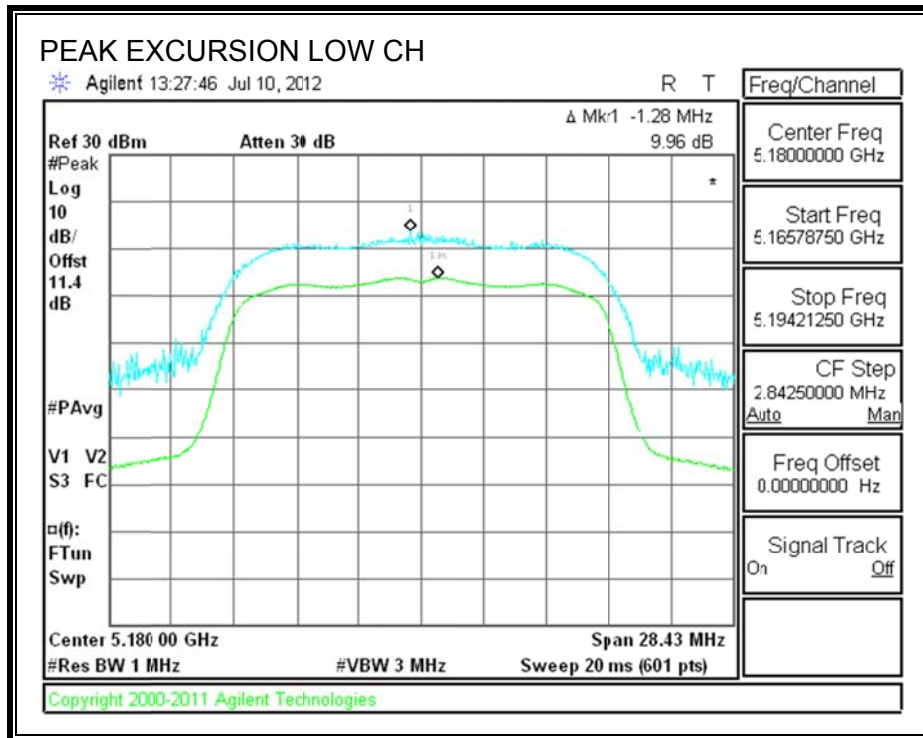
FCC §15.407 (a) (6)

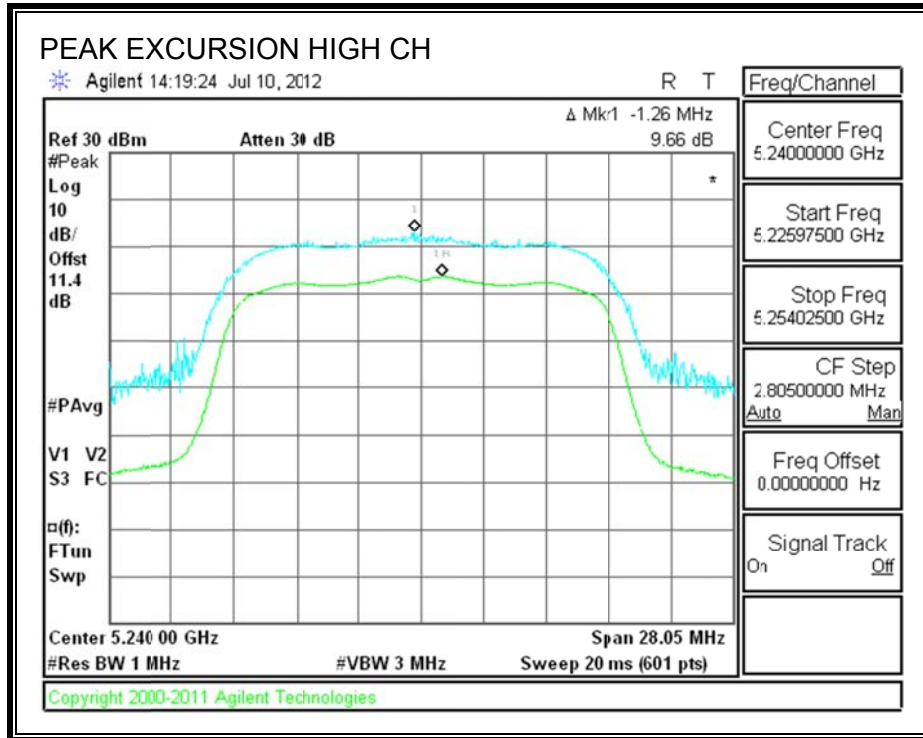
The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

RESULTS

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	5180	9.96	13	-3.04
Mid	5200	9.77	13	-3.23
High	5240	9.66	13	-3.34

PEAK EXCURSION





8.2. 802.11n HT20 MODE IN THE 5.2 GHz BAND

8.2.1. 26 dB BANDWIDTH

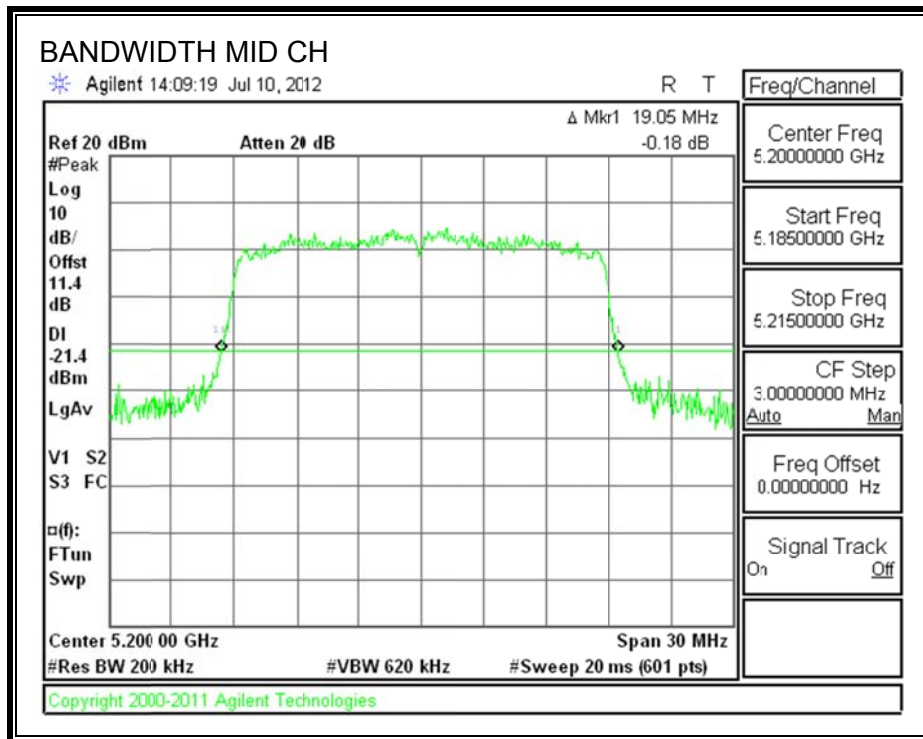
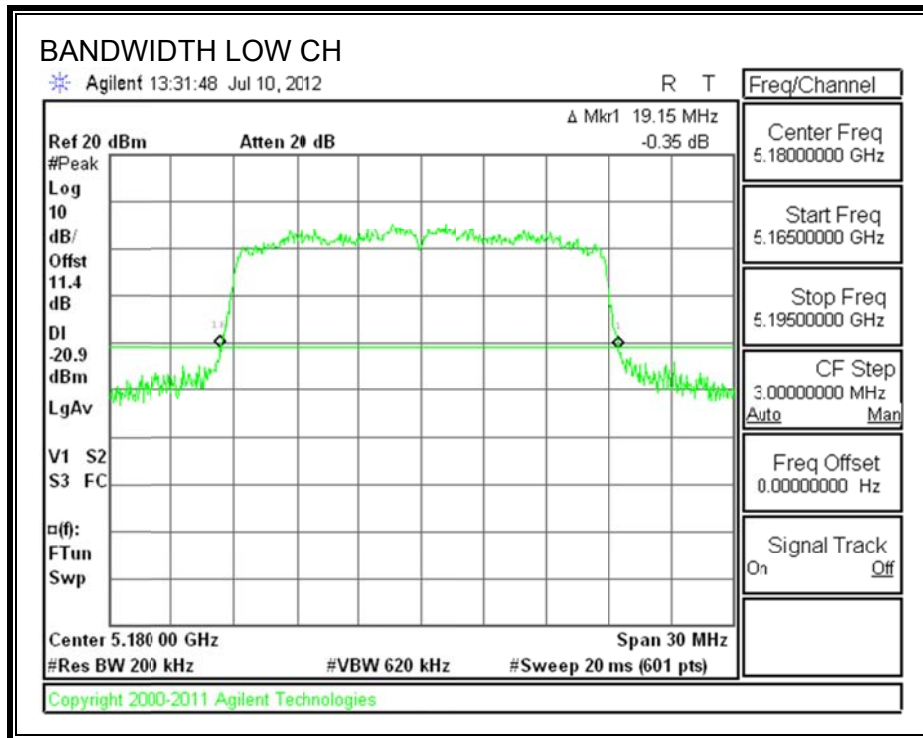
LIMITS

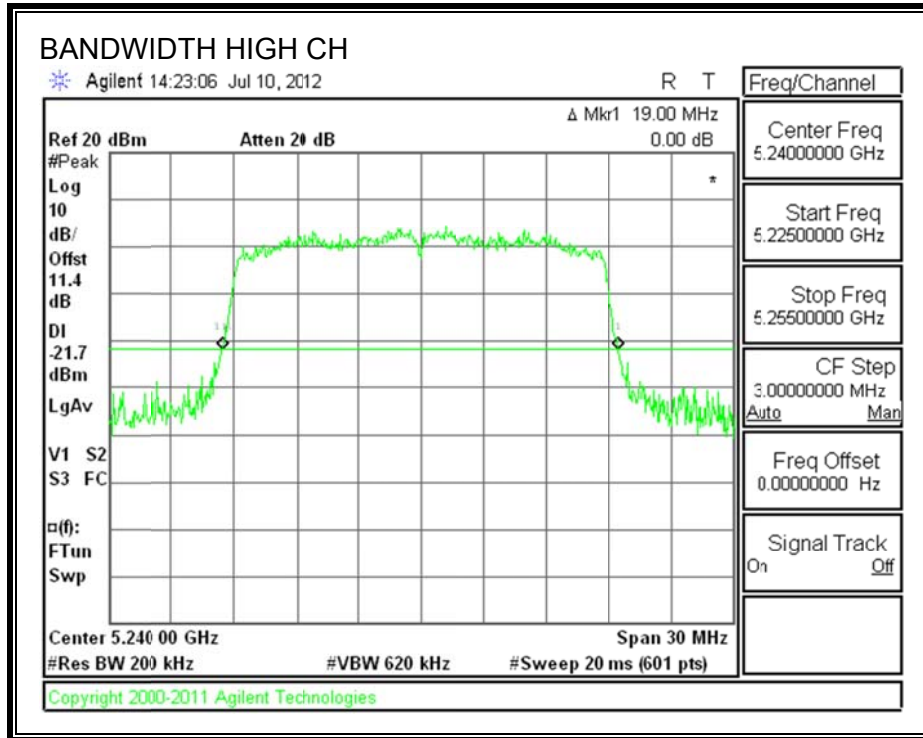
None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
Low	5180	19.15
Mid	5200	19.05
High	5240	19.00

26 dB BANDWIDTH





8.2.2. 99% BANDWIDTH

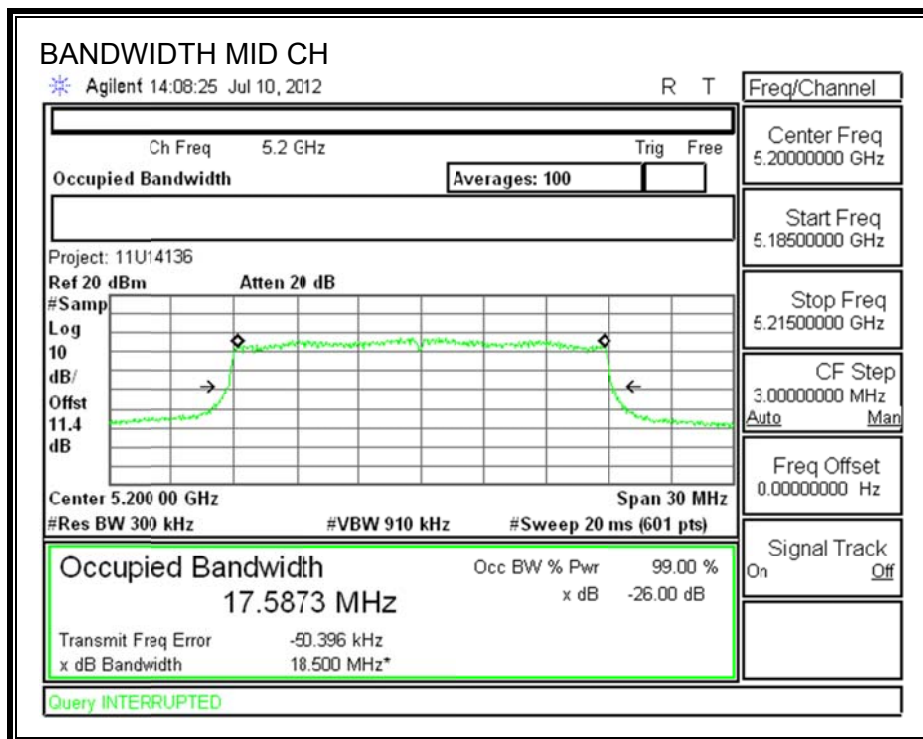
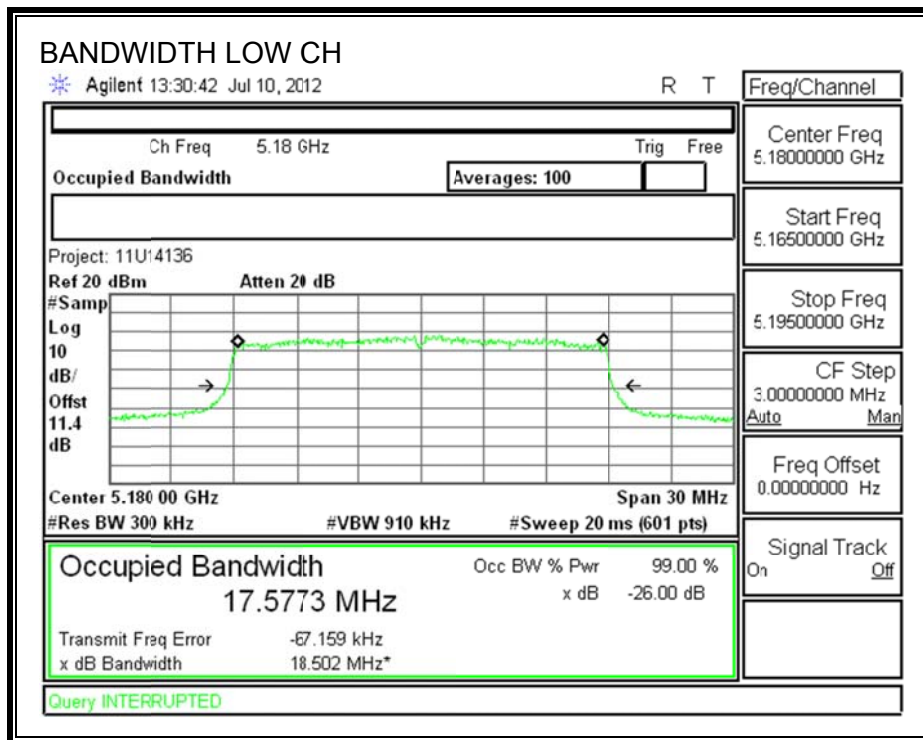
LIMITS

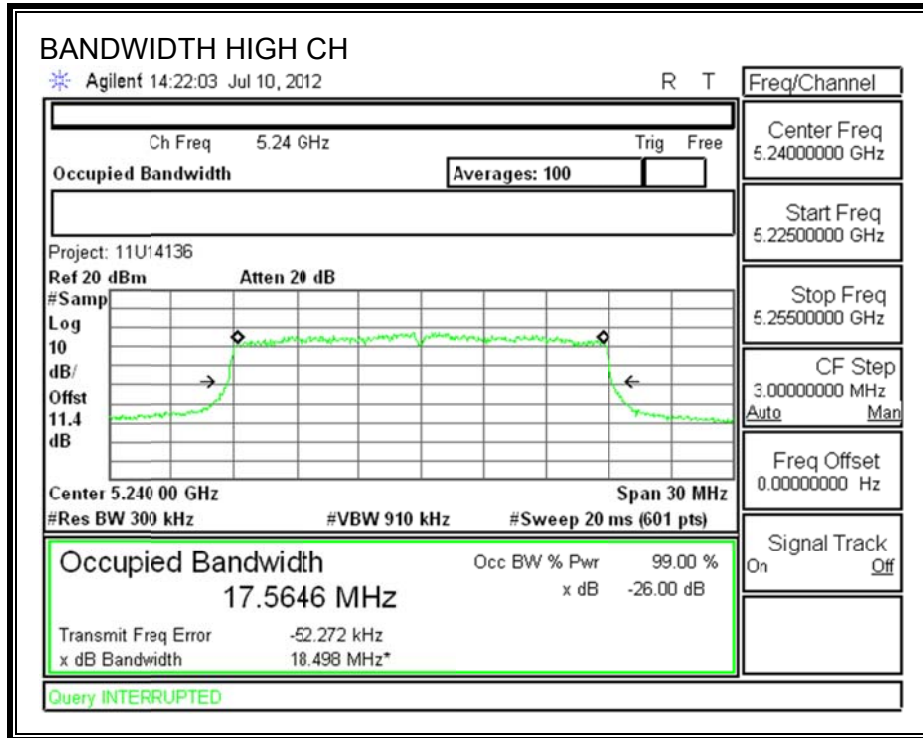
None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5180	17.577
Mid	5200	17.587
High	5240	17.565

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	14.0
Mid	5200	14.0
High	5240	14.0

8.2.4. OUTPUT POWER AND PPSD

LIMITS

FCC §15.407 (a) (1)

IC RSS-210 A9.2 (1)

FCC §15.407 (a) (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.

IC RSS-210 A9.2 (1):

For the 5.15 – 5.25 GHz band, The maximum e.i.r.p. shall not exceed 200 mW or $10 + 10 \log_{10} B$, dBm, whichever power is less. B is the 99% emission bandwidth in MHz. The e.i.r.p. spectral density shall not exceed 10 dBm in any 1.0 MHz band.

DIRECTIONAL ANTENNA GAIN

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

FCC 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	5180	17	19.2	16.82	0.14	16.82	4.00
Mid	5200	17	19.1	16.80	0.14	16.80	4.00
High	5240	17	19.0	16.79	0.14	16.79	4.00

Duty Cycle CF (dB)	0.08	Included in Calculations of Corr'd Power & PPSD
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Output Power Results

Channel	Frequency (MHz)	Meas Power (dBm)	Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5180	14.39	14.47	16.82	-2.36
Mid	5200	14.10	14.18	16.80	-2.62
High	5240	14.21	14.29	16.79	-2.50

PPSD Results

Channel	Frequency (MHz)	Meas PPSD (dBm)	Corr'd PPSD (dBm)	PPSD Limit (dBm)	PPSD Margin (dB)
Low	5180	3.85	3.93	4.00	-0.07
Mid	5200	3.50	3.58	4.00	-0.42
High	5240	3.60	3.68	4.00	-0.32

IC RESULTS

Limits

Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	10 + 10 Log B EIRP Limit (dBm)	Directional Gain (dBi)	Power Limit (dBm)	PPSD Limit (dBm)
Low	5180	17	17.6	22.45	0.14	17.00	4.00
Mid	5200	17	17.6	22.45	0.14	17.00	4.00
High	5240	17	17.6	22.45	0.14	17.00	4.00

Duty Cycle CF (dB)	0.08	Included in Calculations of Corr'd Power & PPSD
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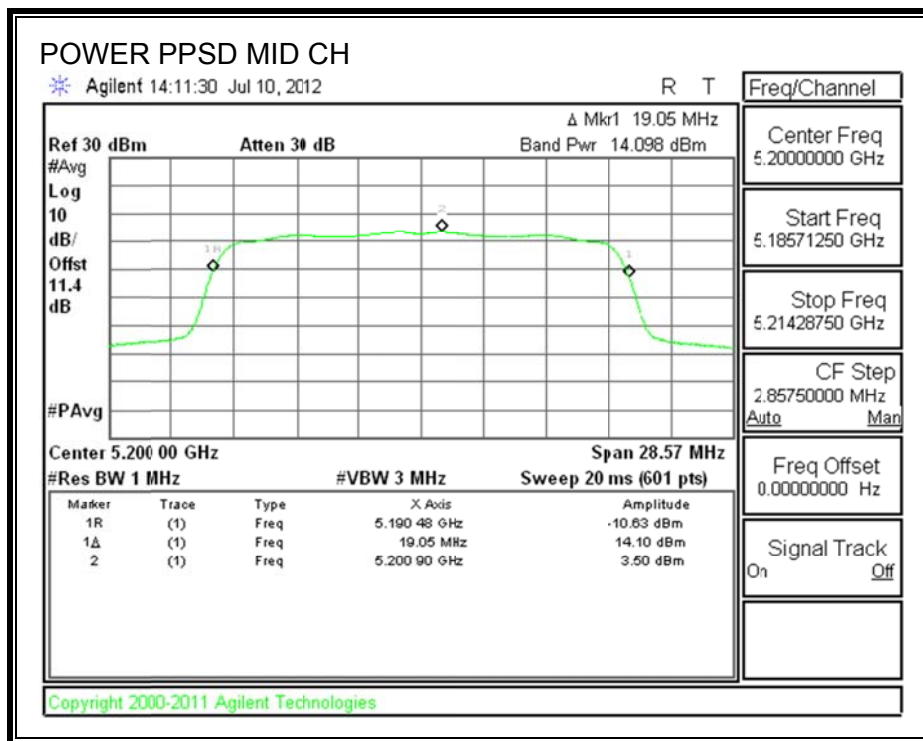
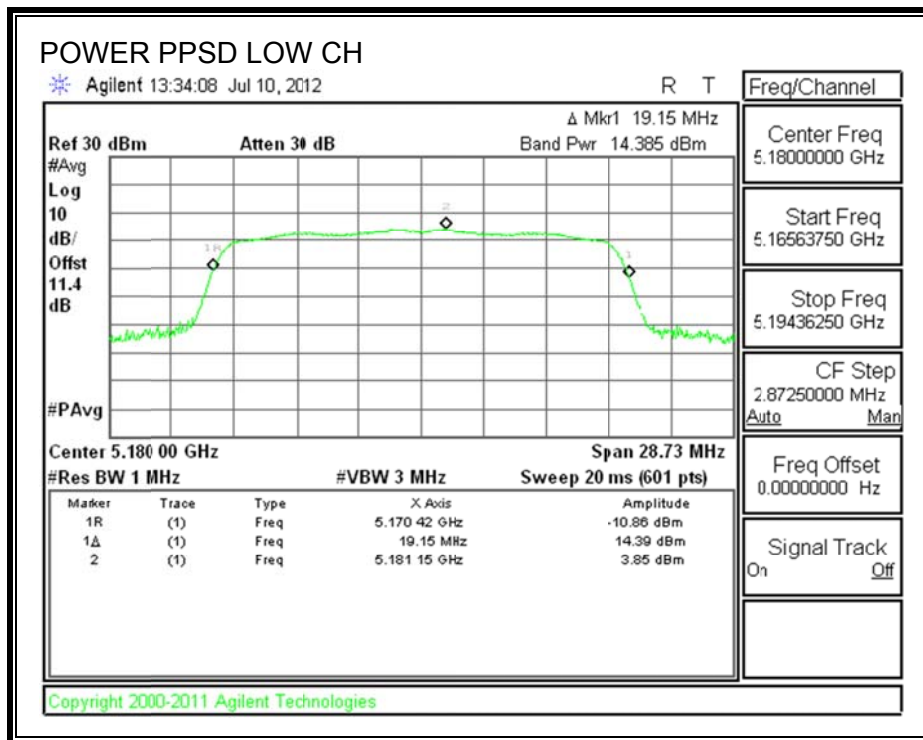
Output Power Results

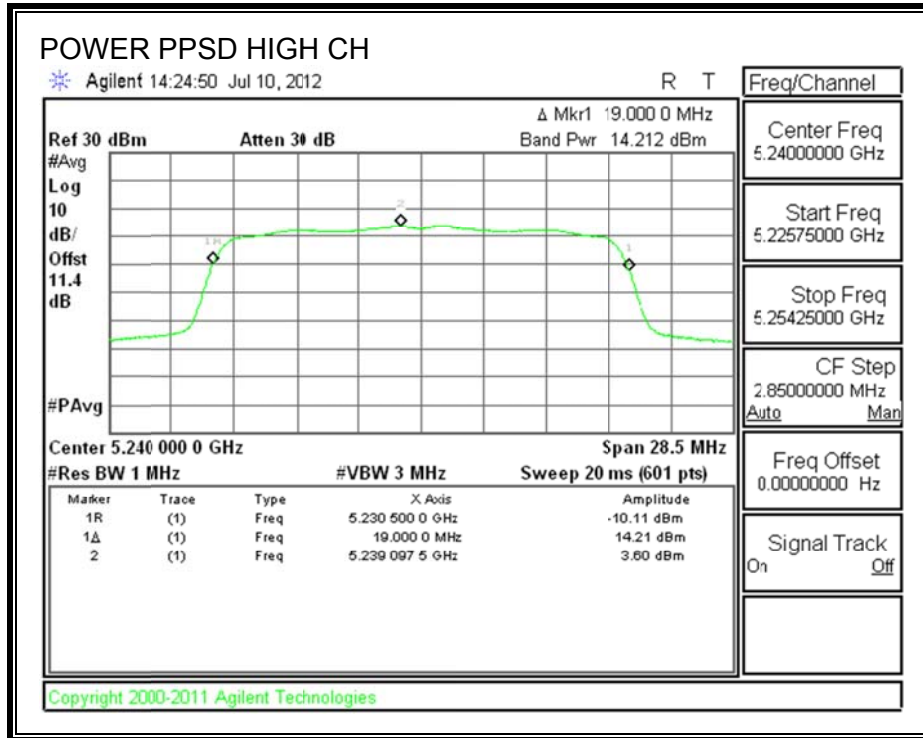
Channel	Frequency (MHz)	Meas Power (dBm)	Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5180	14.39	14.47	17.00	-2.54
Mid	5200	14.10	14.18	17.00	-2.82
High	5240	14.21	14.29	17.00	-2.71

PPSD Results

Channel	Frequency (MHz)	Meas PPSD (dBm)	Corr'd PPSD (dBm)	PPSD Limit (dBm)	PPSD Margin (dB)
Low	5180	3.85	3.93	4.00	-0.07
Mid	5200	3.50	3.58	4.00	-0.42
High	5240	3.60	3.68	4.00	-0.32

OUTPUT POWER AND PPSD





8.2.5. PEAK EXCURSION

LIMITS

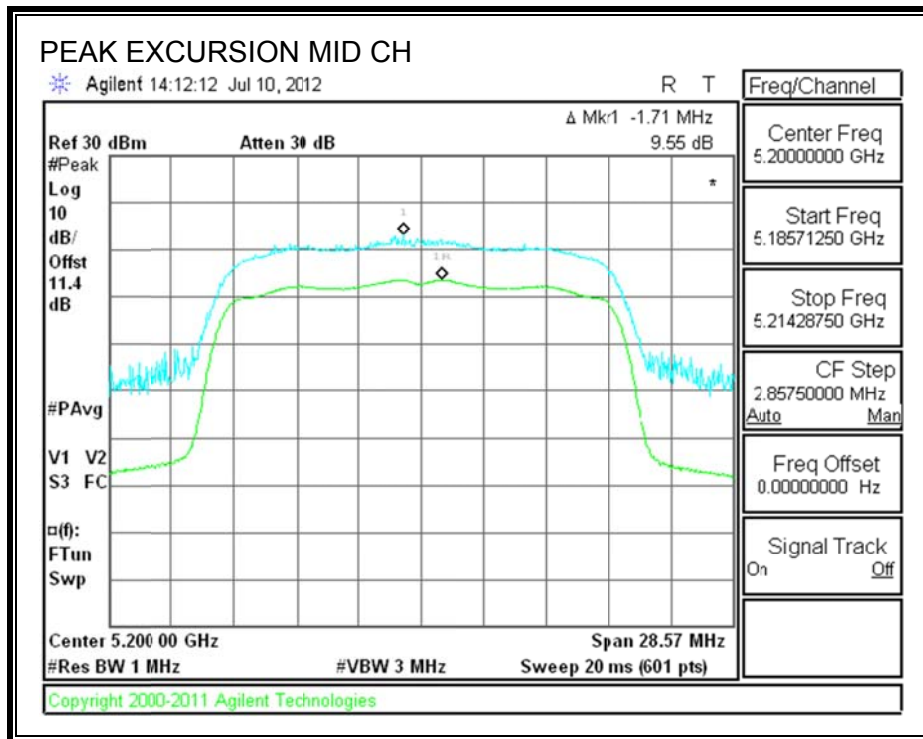
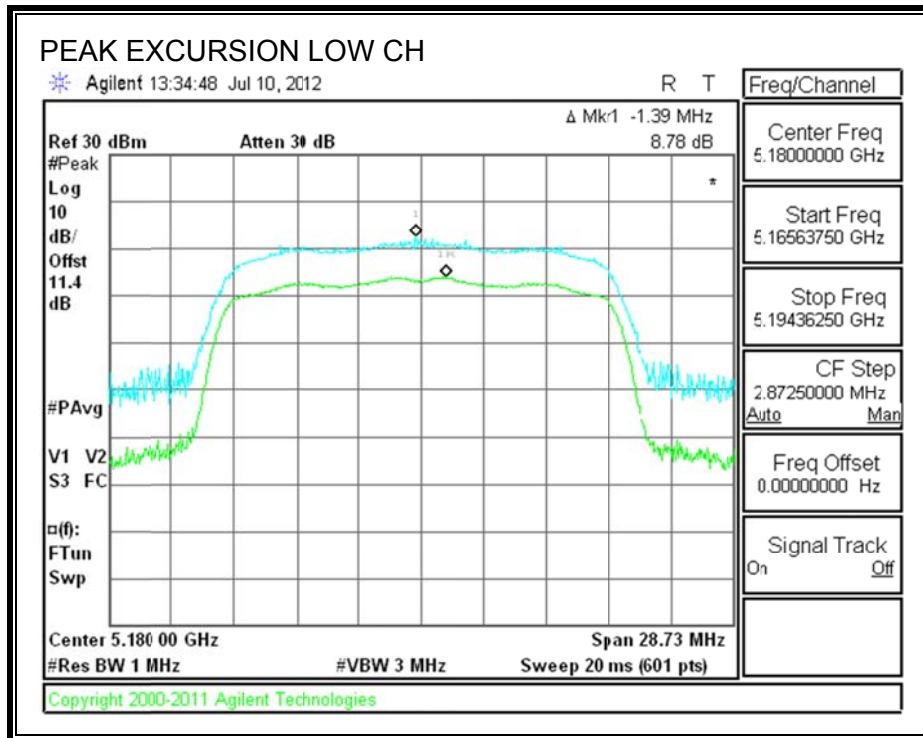
FCC §15.407 (a) (6)

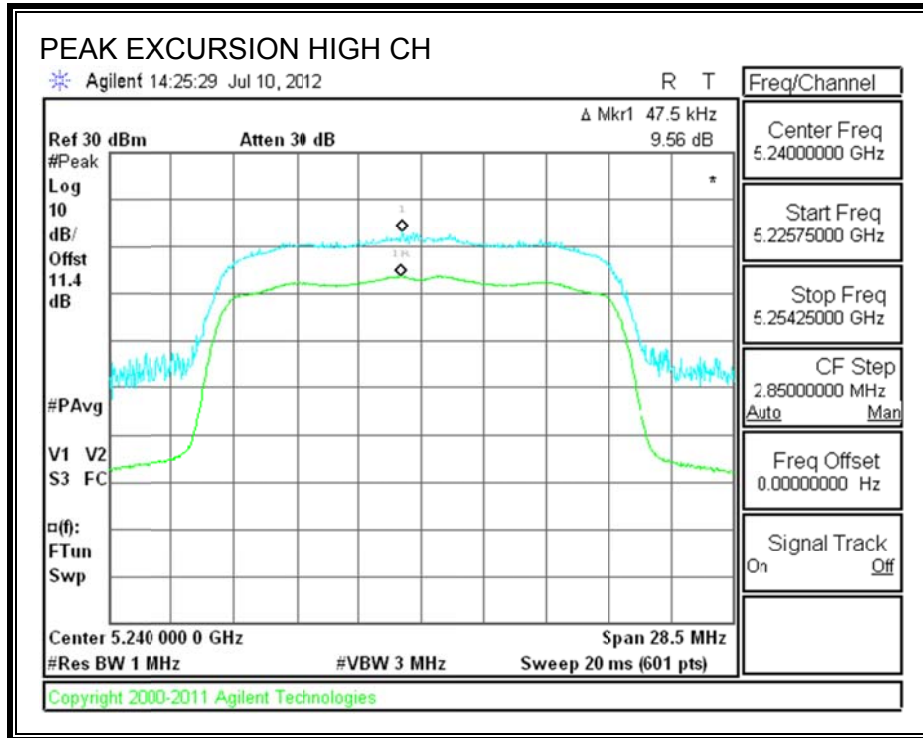
The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

RESULTS

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	5180	8.78	13	-4.22
Mid	5200	9.55	13	-3.45
High	5240	9.56	13	-3.44

PEAK EXCURSION





8.3. 802.11n HT40 MODE IN THE 5.2 GHz BAND

8.3.1. 26 dB BANDWIDTH

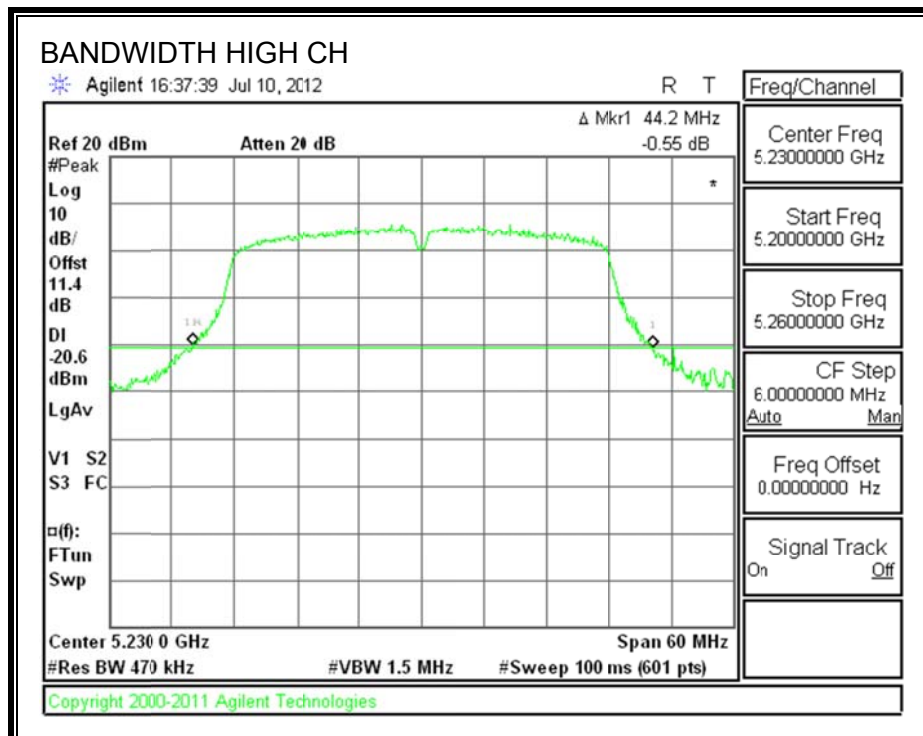
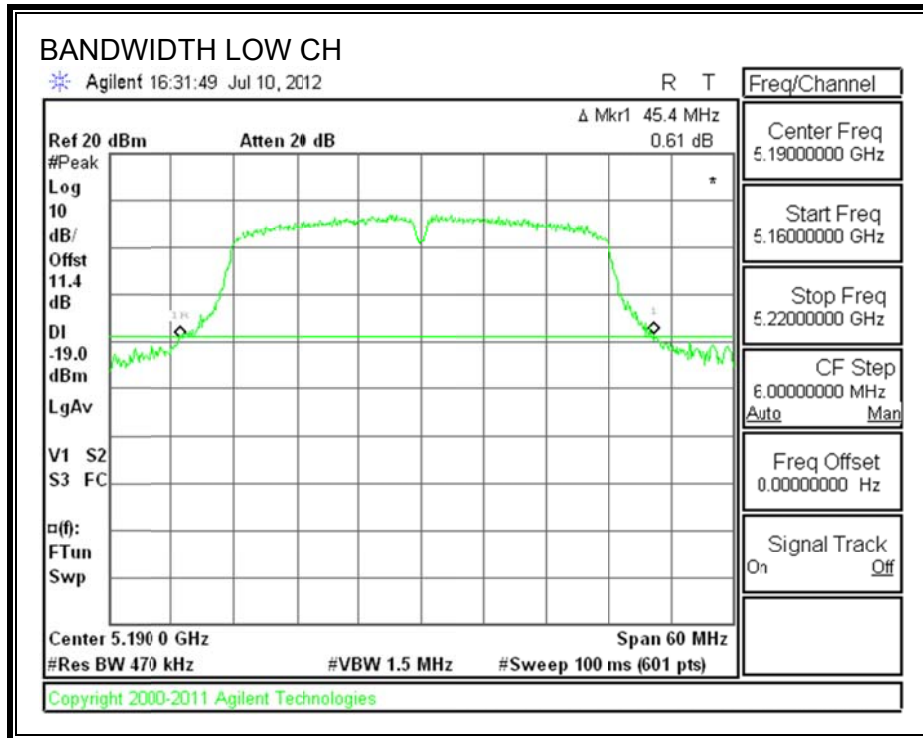
LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
Low	5190	45.4
High	5230	44.2

26 dB BANDWIDTH



8.3.2. 99% BANDWIDTH

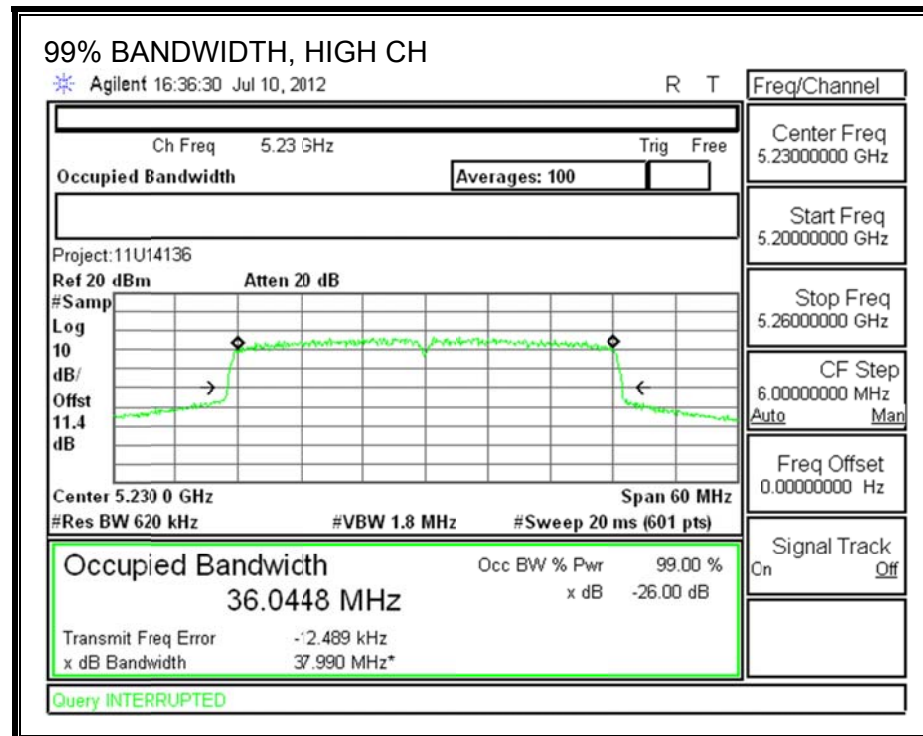
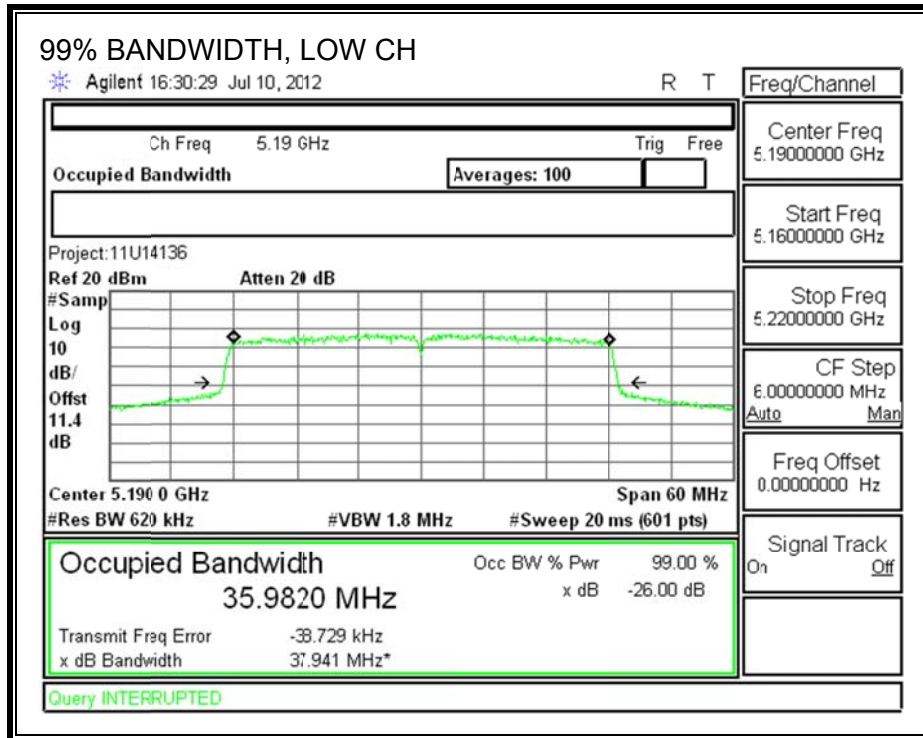
LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5190	35.982
High	5230	36.045

99% BANDWIDTH



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	14.00
High	5230	13.97

8.3.4. OUTPUT POWER AND PPSD

LIMITS

FCC §15.407 (a) (1)

IC RSS-210 A9.2 (1)

FCC §15.407 (a) (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.

IC RSS-210 A9.2 (1):

For the 5.15 – 5.25 GHz band, The maximum e.i.r.p. shall not exceed 200 mW or $10 + 10 \log_{10} B$, dBm, whichever power is less. B is the 99% emission bandwidth in MHz. The e.i.r.p. spectral density shall not exceed 10 dBm in any 1.0 MHz band.

DIRECTIONAL ANTENNA GAIN

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

FCC 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	45.4	20.57	0.14	17.00	4.00
High	5230	17	44.2	20.45	0.14	17.00	4.00

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

Channel	Frequency (MHz)	Meas Power (dBm)	Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5190	14.22	14.38	17.00	-2.62
High	5230	14.25	14.41	17.00	-2.59

PPSD Results

Channel	Frequency (MHz)	Meas PPSD (dBm)	Corr'd PPSD (dBm)	PPSD Limit (dBm)	PPSD Margin (dB)
Low	5190	0.23	0.39	4.00	-3.61
High	5230	0.22	0.38	4.00	-3.62

IC RESULTS

Limits

Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	10 + 10 Log B EIRP Limit (dBm)	Directional Gain (dBi)	Power Limit (dBm)	PPSD Limit (dBm)
Low	5190	17	36.0	25.56	0.14	17.00	4.00
High	5230	17	36.0	19.57	0.14	17.00	4.00

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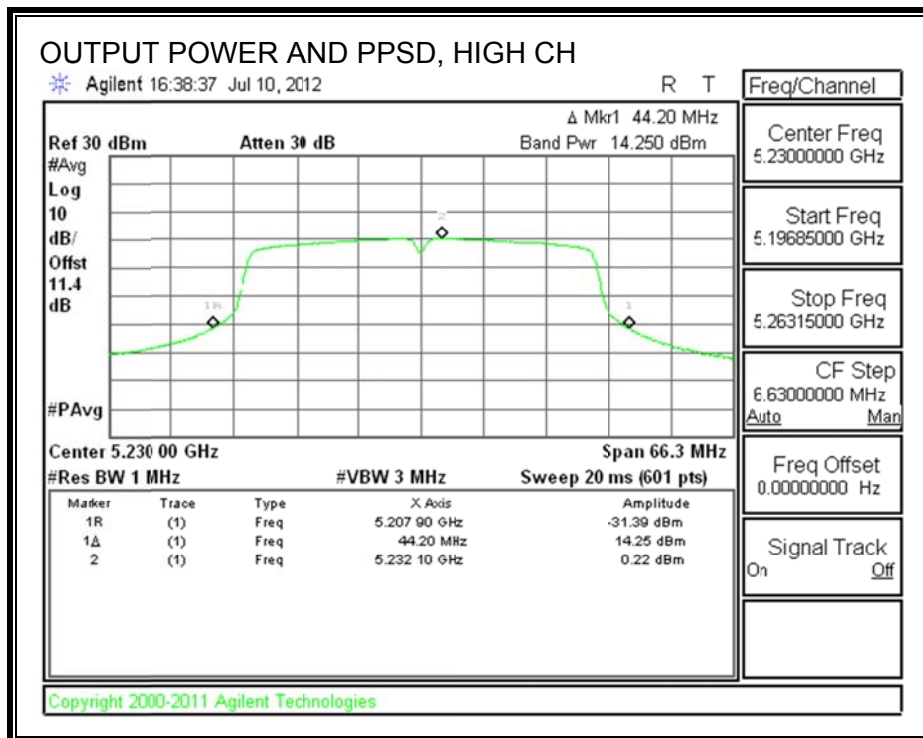
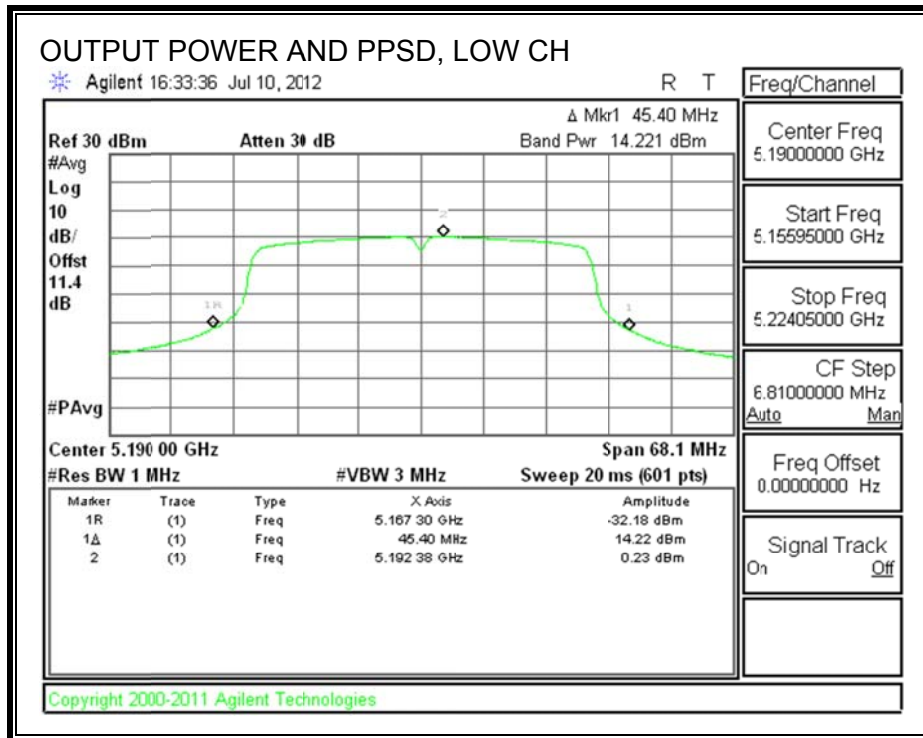
Output Power Results

Channel	Frequency (MHz)	Meas Power (dBm)	Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5190	14.22	14.38	17.00	-2.62
High	5230	14.25	14.41	17.00	-2.59

PPSD Results

Channel	Frequency (MHz)	Meas PPSD (dBm)	Corr'd PPSD (dBm)	PPSD Limit (dBm)	PPSD Margin (dB)
Low	5190	0.23	0.39	4.00	-3.61
High	5230	0.22	0.38	4.00	-3.62

OUTPUT POWER AND PPSD



8.3.5. PEAK EXCURSION

LIMITS

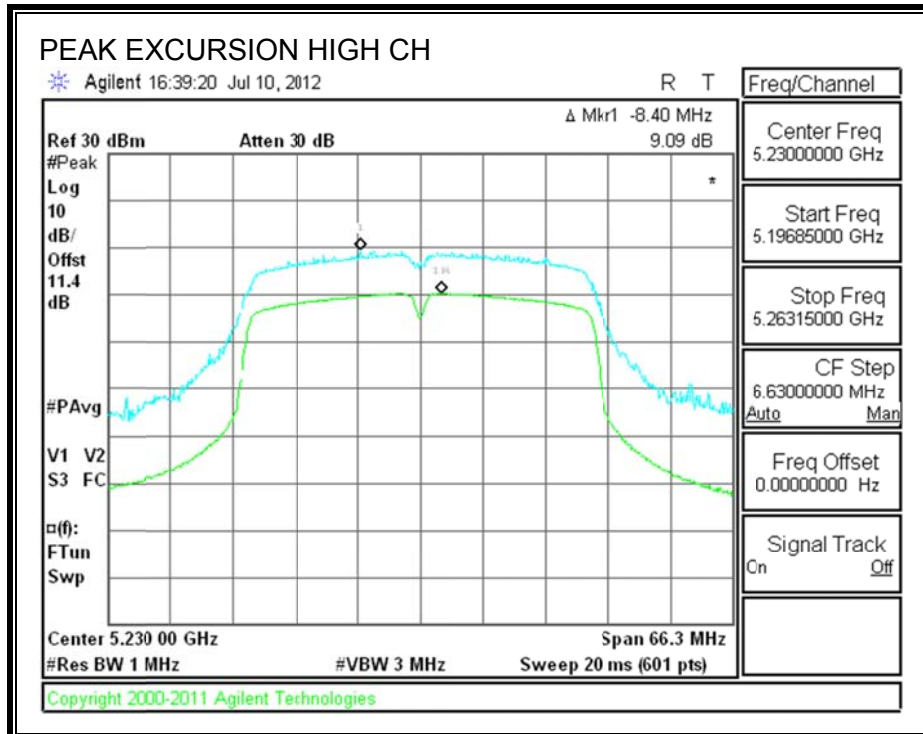
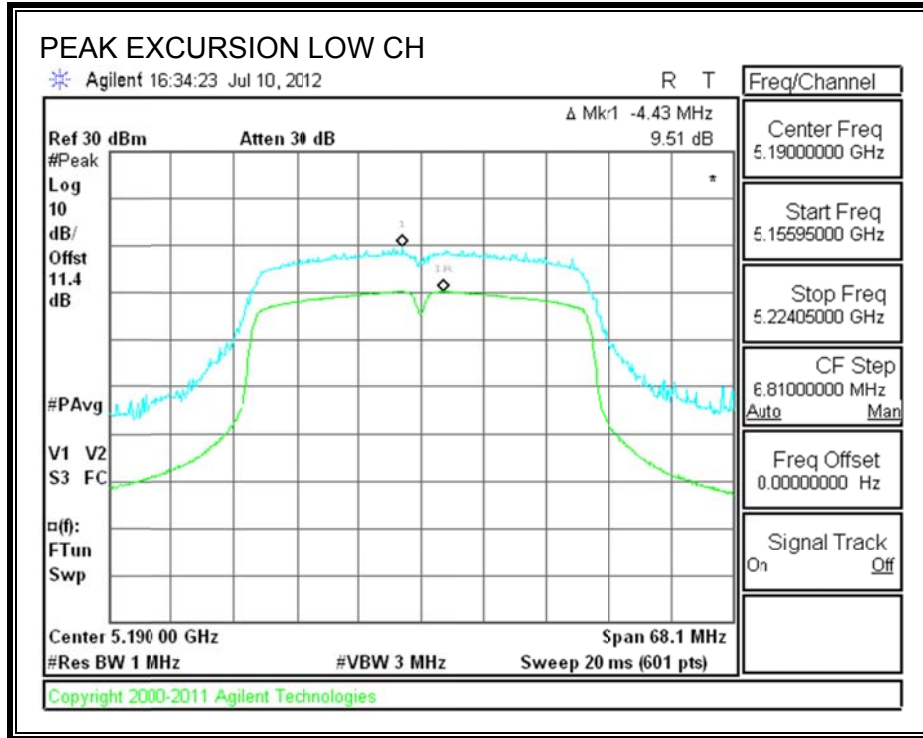
FCC §15.407 (a) (6)

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	9.51	13	-3.49
High	5230	9.09	13	-3.91

PEAK EXCURSION



8.4. 802.11a MODE IN THE 5.3 GHZ BAND

8.4.1. 26 dB BANDWIDTH

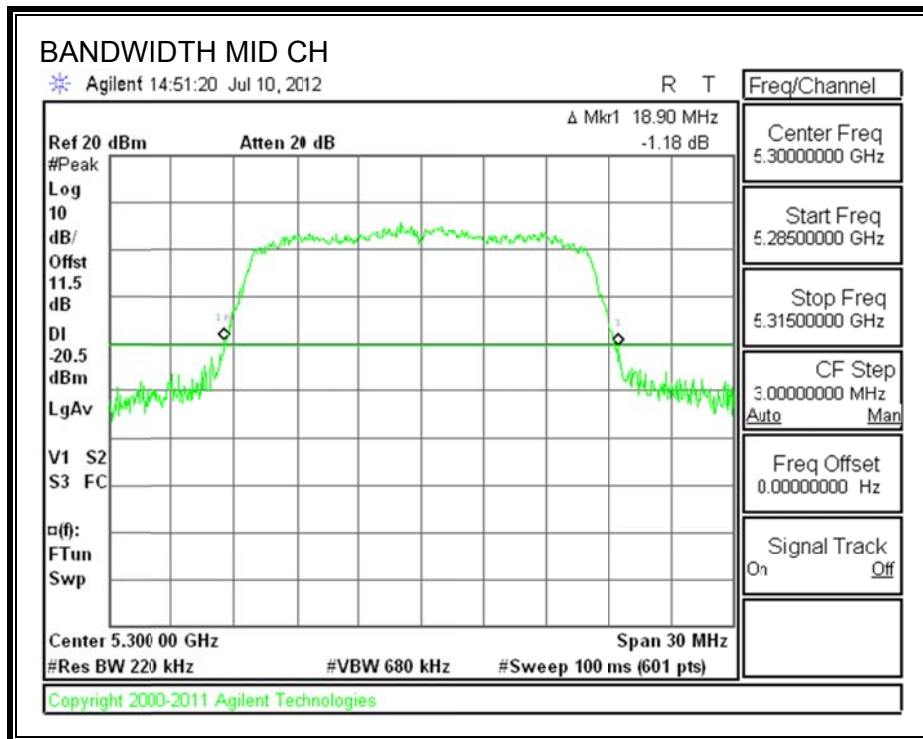
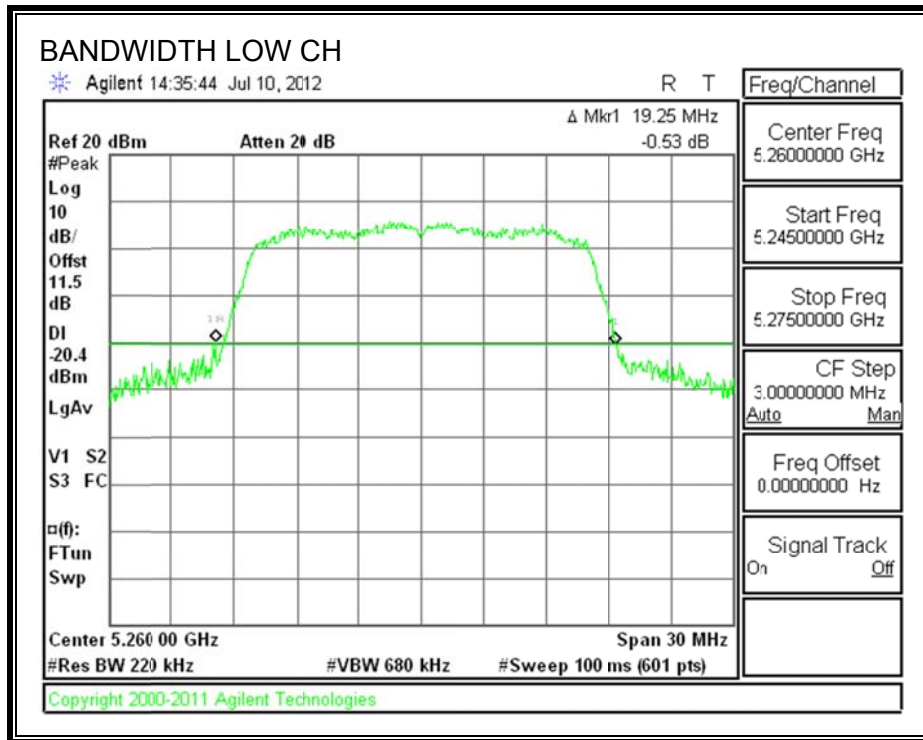
LIMITS

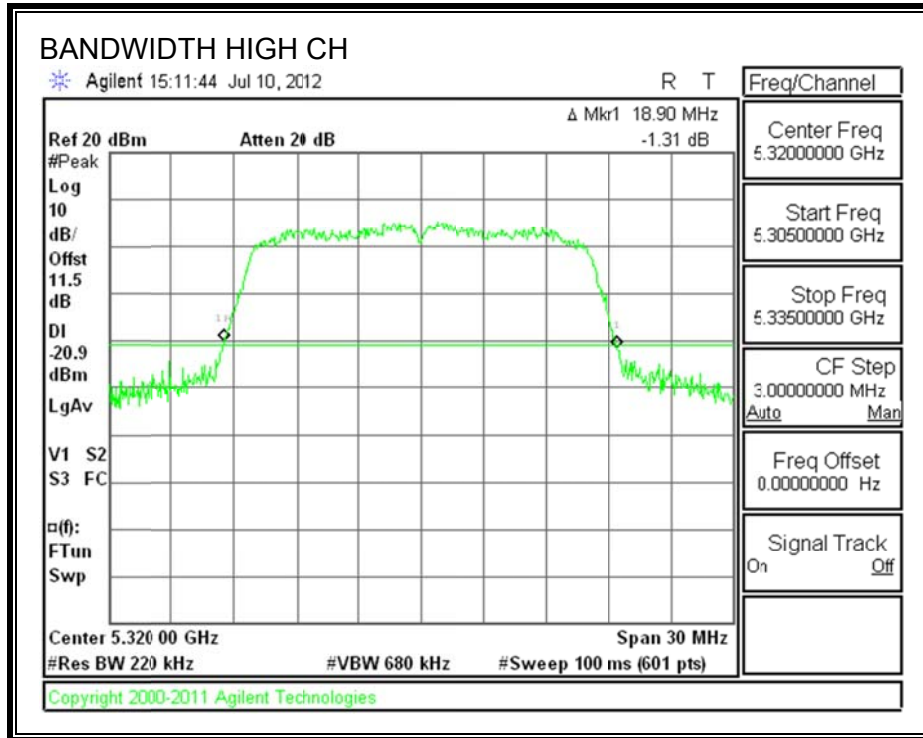
None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
Low	5260	19.25
Mid	5300	18.90
High	5320	18.90

26 dB BANDWIDTH





8.4.2. 99% BANDWIDTH

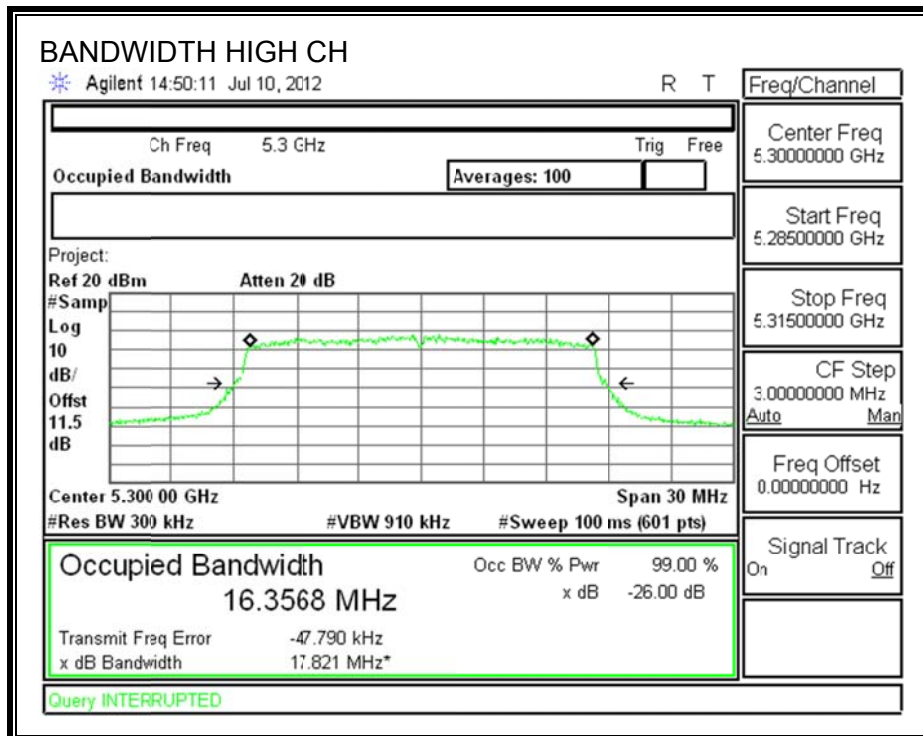
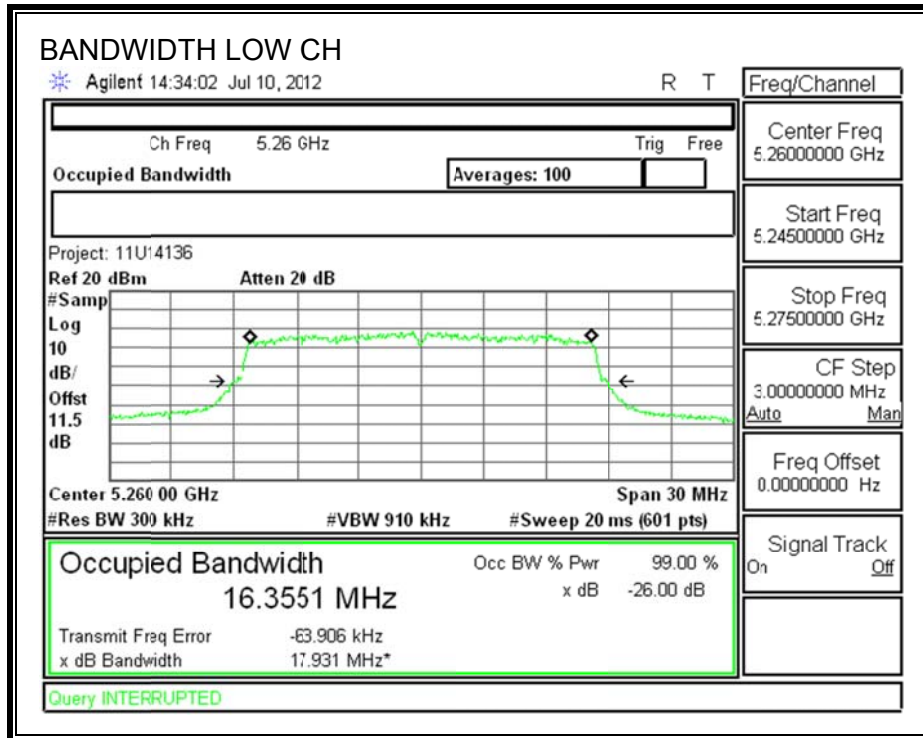
LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5260	16.355
Mid	5300	16.357
High	5320	16.363

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	13.50
Mid	5300	13.49
High	5320	13.49

8.4.4. OUTPUT POWER AND PPSD

LIMITS

FCC §15.407 (a) (2)

IC RSS-210 A9.2 (2)

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 99% emission bandwidth for IC (26dB emission bandwidth for FCC) 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.

99% bandwidth was used to calculate the power limit which was considered the worst case.

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	16.4	23.14	-1.66	23.14	11.00
Mid	5300	24	16.4	23.14	-1.66	23.14	11.00
High	5320	24	16.4	23.14	-1.66	23.14	11.00

Duty Cycle CF (dB)	0.08	Included in Calculations of Corr'd Power & PPSD
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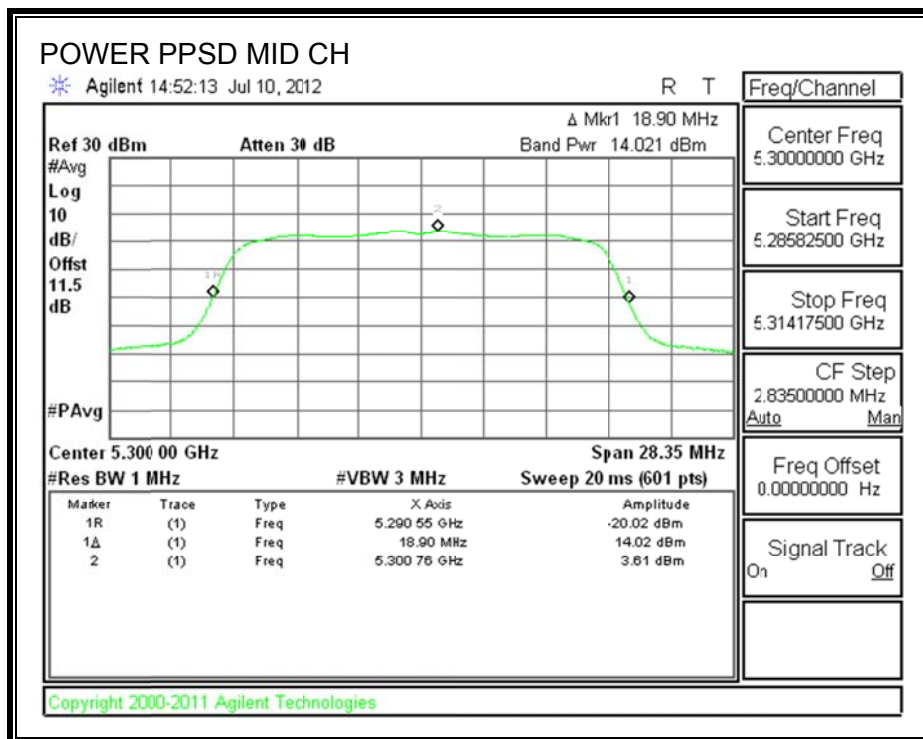
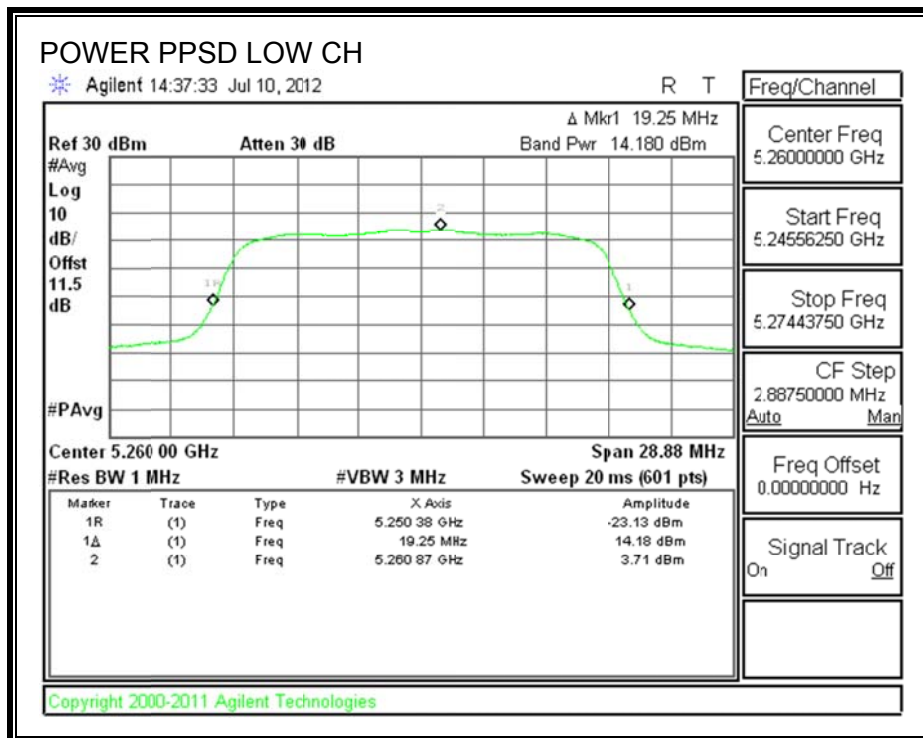
Output Power Results

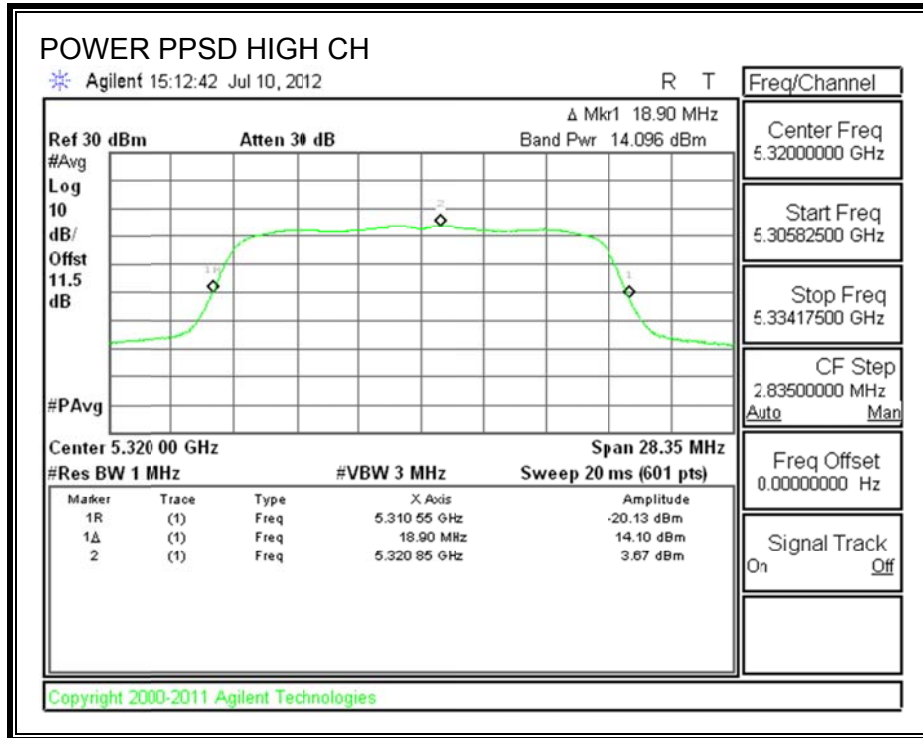
Channel	Frequency (MHz)	Meas Power (dBm)	Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5260	14.18	14.26	23.14	-8.88
Mid	5300	14.02	14.10	23.14	-9.04
High	5320	14.10	14.18	23.14	-8.96

PPSD Results

Channel	Frequency (MHz)	Meas PPSD (dBm)	Corr'd PPSD (dBm)	PPSD Limit (dBm)	PPSD Margin (dB)
Low	5260	3.71	3.79	11.00	-7.21
Mid	5300	3.61	3.69	11.00	-7.31
High	5320	3.67	3.75	11.00	-7.25

OUTPUT POWER AND PPSD





8.4.5. PEAK EXCURSION

LIMITS

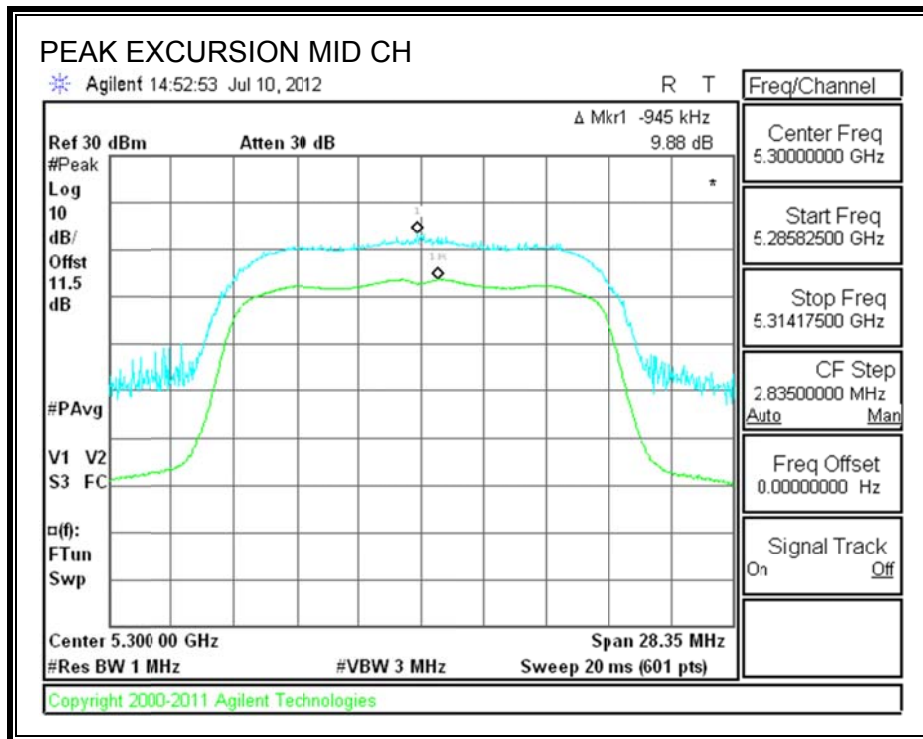
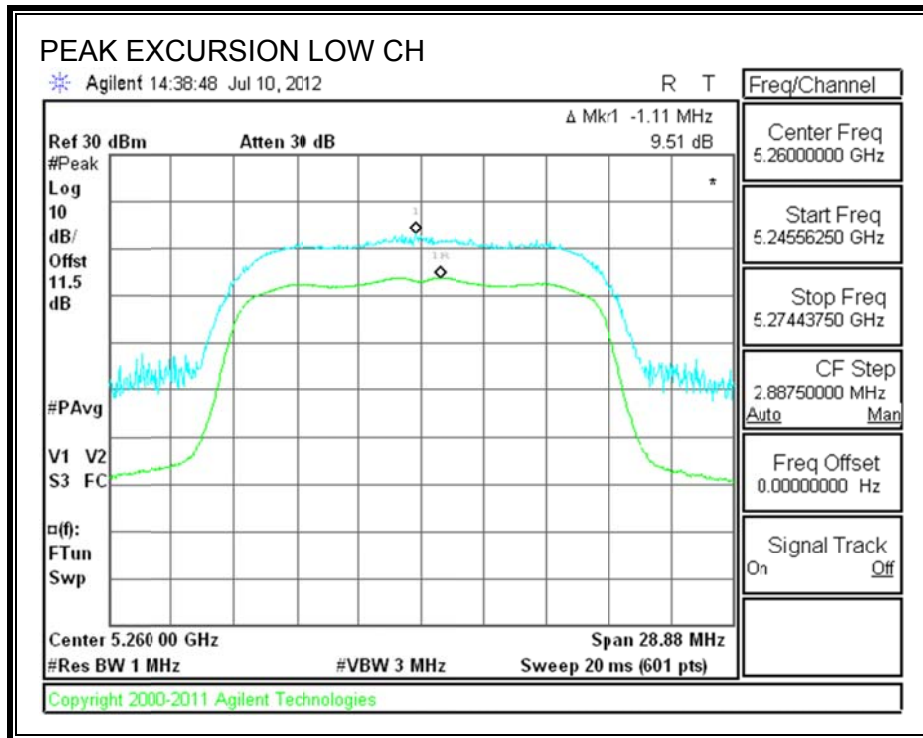
FCC §15.407 (a) (6)

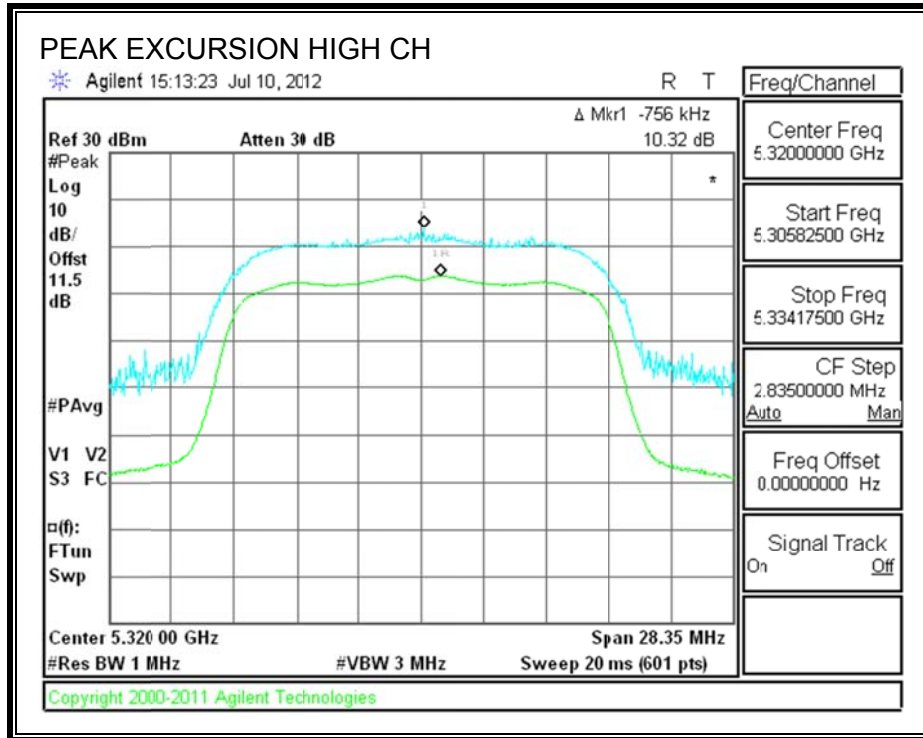
The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

RESULTS

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	5260	9.51	13	-3.49
Mid	5300	9.88	13	-3.12
High	5320	10.32	13	-2.68

PEAK EXCURSION





8.5. 802.11n HT20 MODE IN THE 5.3 GHz BAND

8.5.1. 26 dB BANDWIDTH

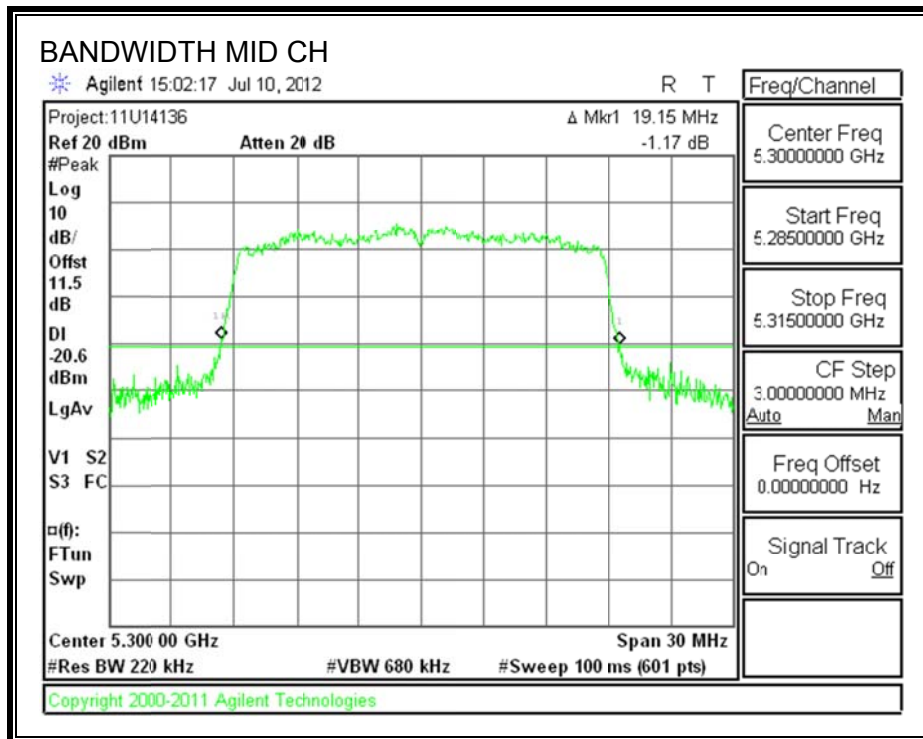
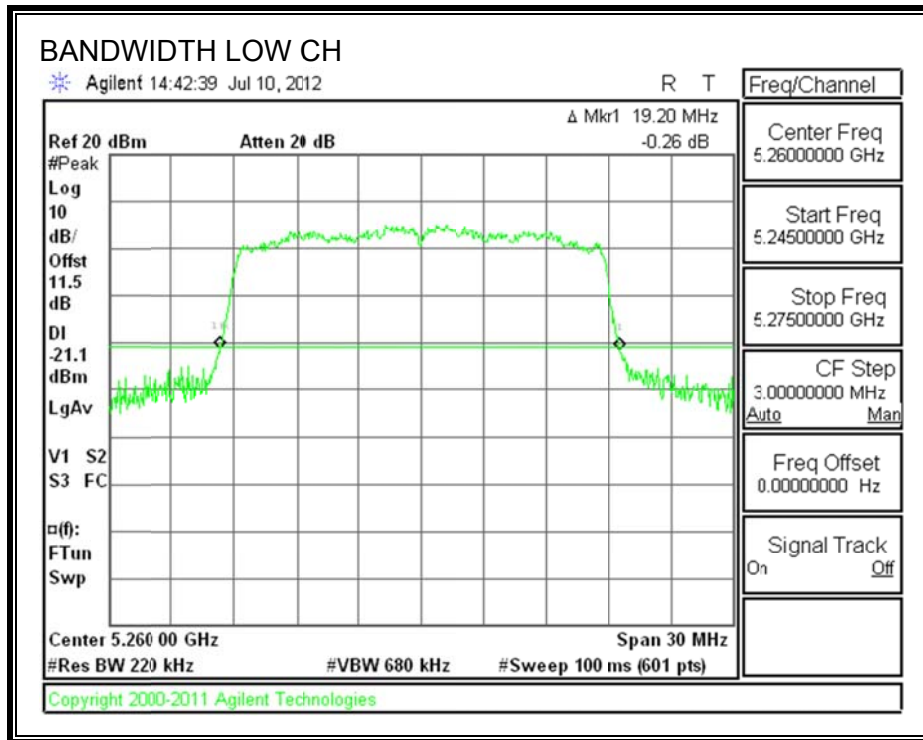
LIMITS

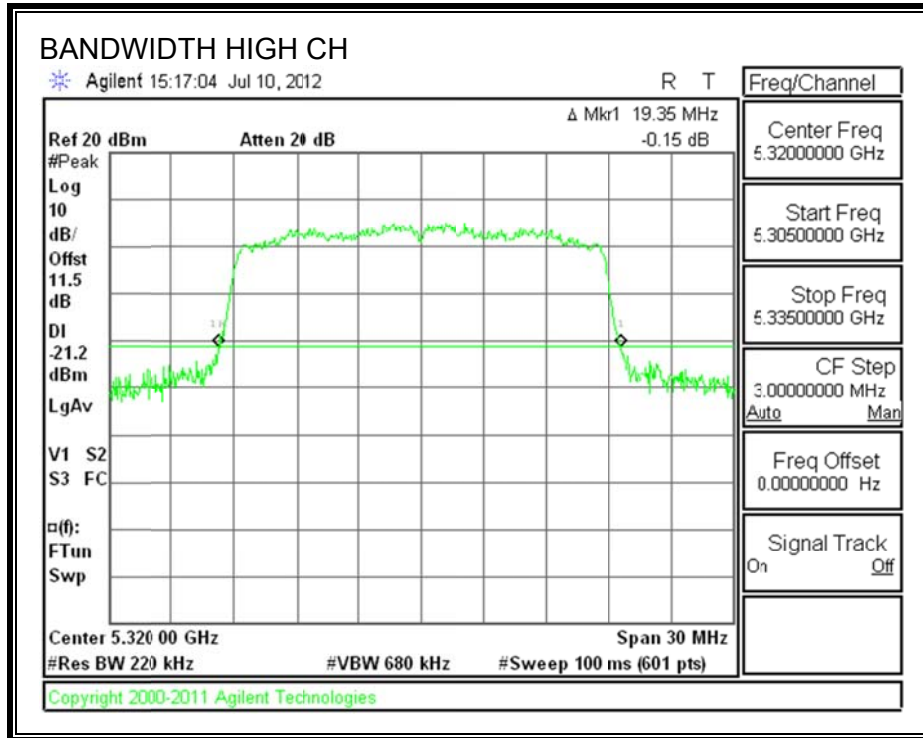
None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
Low	5260	19.20
Mid	5300	19.15
High	5320	19.35

26 dB BANDWIDTH





8.5.2. 99% BANDWIDTH

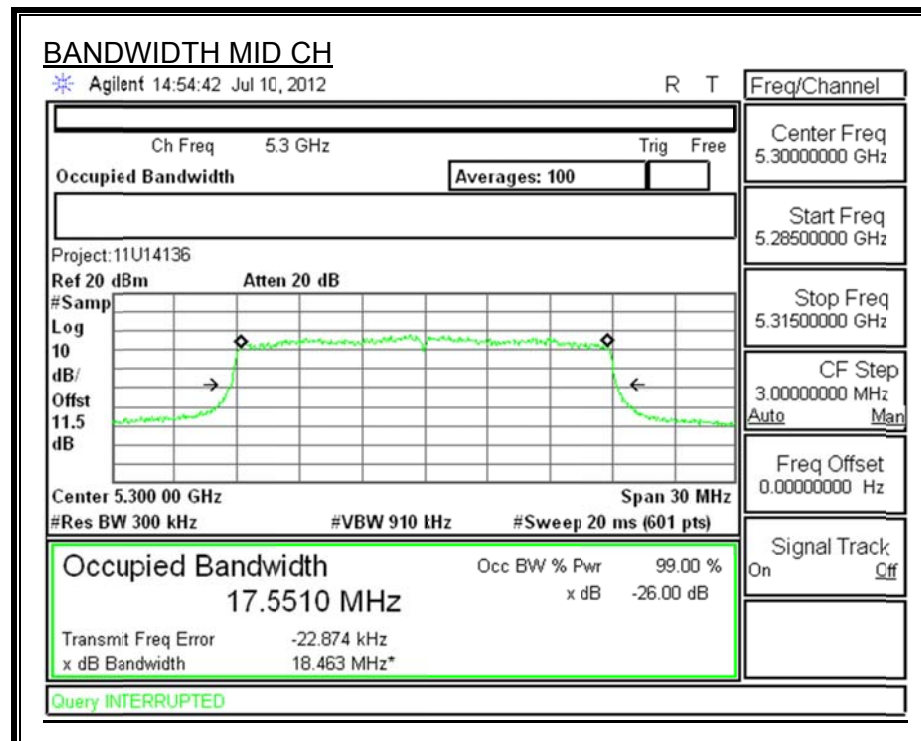
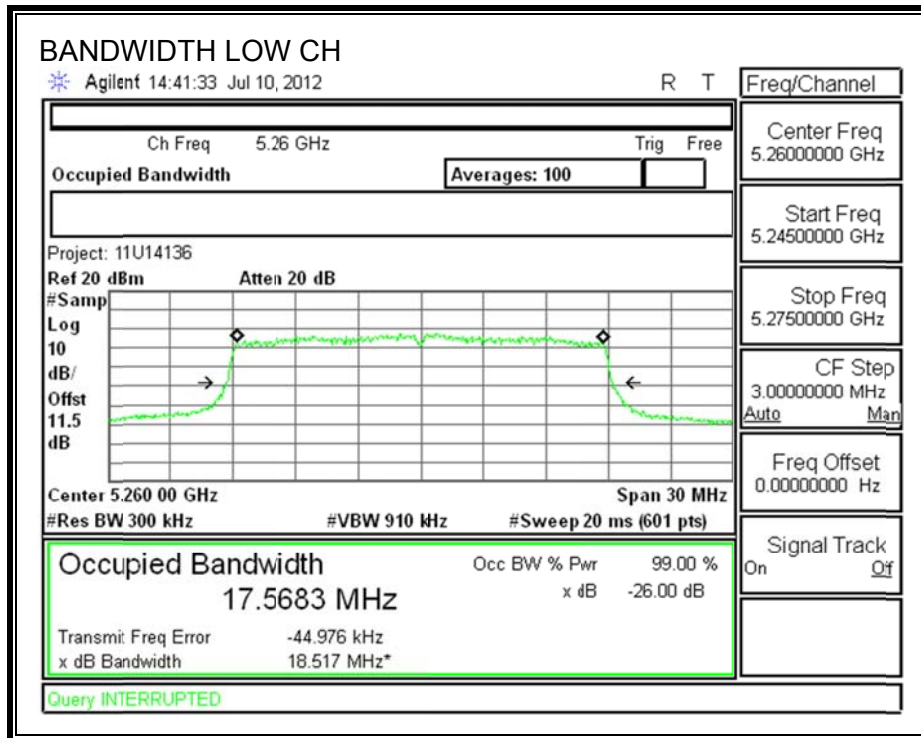
LIMITS

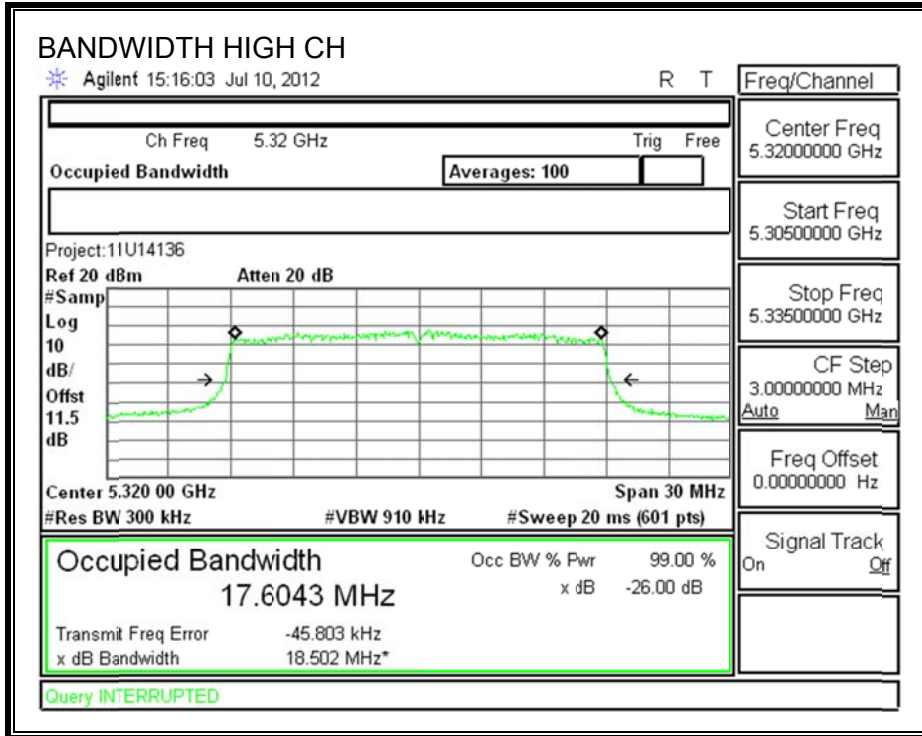
None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5260	17.568
Mid	5300	17.551
High	5320	17.604

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	13.47
Mid	5300	13.50
High	5320	13.45

8.5.4. OUTPUT POWER AND PPSD

LIMITS

FCC §15.407 (a) (2)

IC RSS-210 A9.2 (2)

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 99% emission bandwidth for IC (26dB emission bandwidth for FCC) 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.

99% bandwidth was used to calculate the power limit which was considered the worst case.

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	17.6	23.45	-1.66	23.45	11.00
Mid	5300	24	17.6	23.44	-1.66	23.44	11.00
High	5320	24	17.6	23.46	-1.66	23.46	11.00

Duty Cycle CF (dB)	0.08	Included in Calculations of Corr'd Power & PPSD
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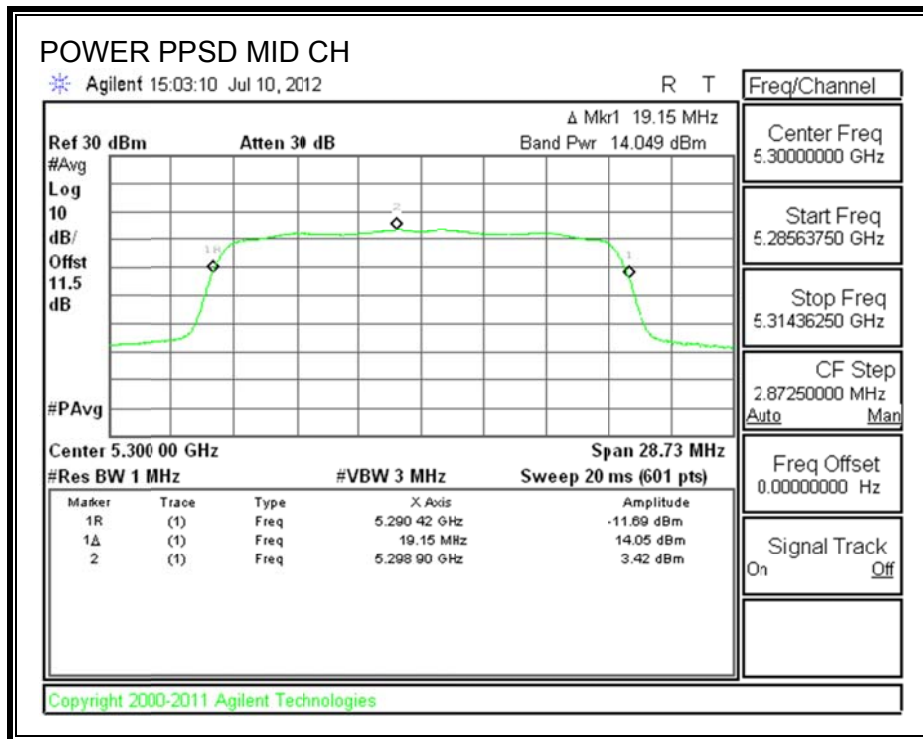
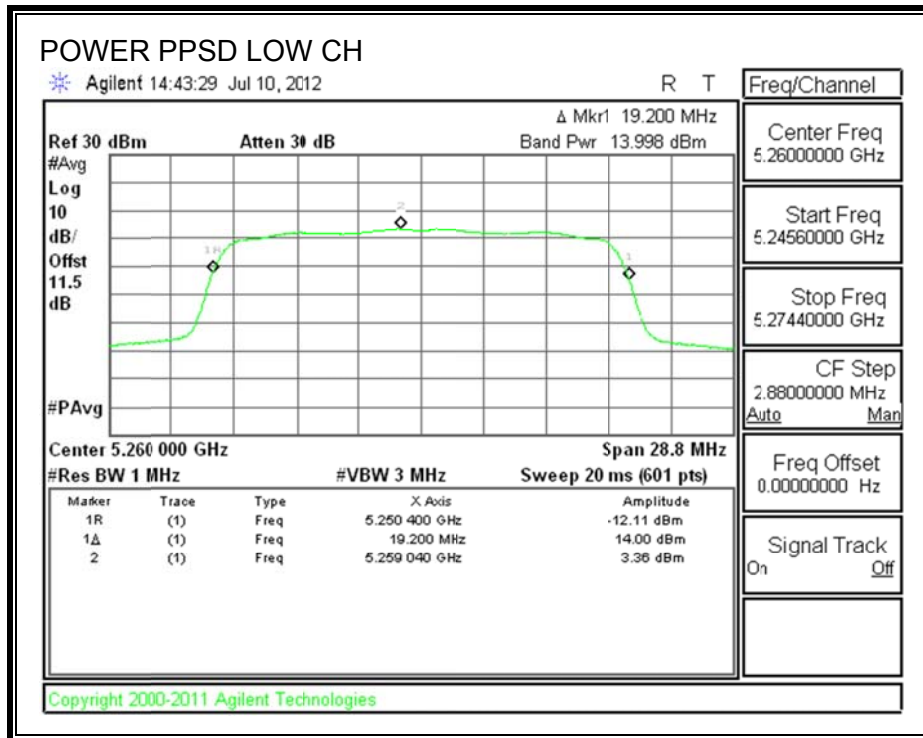
Output Power Results

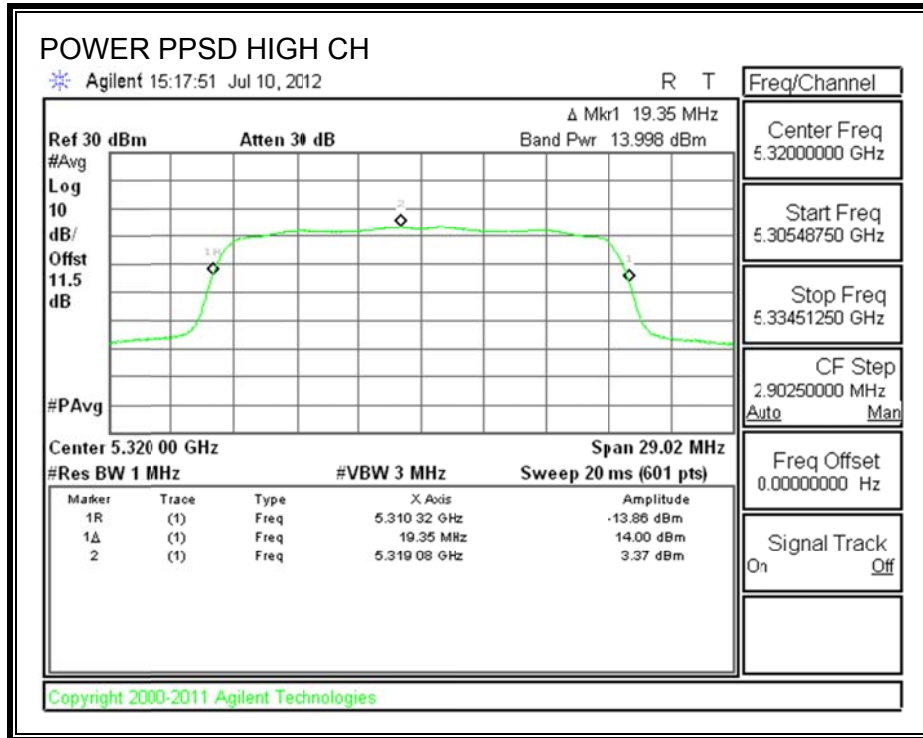
Channel	Frequency (MHz)	Meas Power (dBm)	Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5260	14.00	14.08	23.45	-9.37
Mid	5300	14.05	14.13	23.44	-9.31
High	5320	14.00	14.08	23.46	-9.38

PPSD Results

Channel	Frequency (MHz)	Meas PPSD (dBm)	Corr'd PPSD (dBm)	PPSD Limit (dBm)	PPSD Margin (dB)
Low	5260	3.36	3.44	11.00	-7.56
Mid	5300	3.42	3.50	11.00	-7.50
High	5320	3.37	3.45	11.00	-7.55

OUTPUT POWER AND PPSD





8.5.5. PEAK EXCURSION

LIMITS

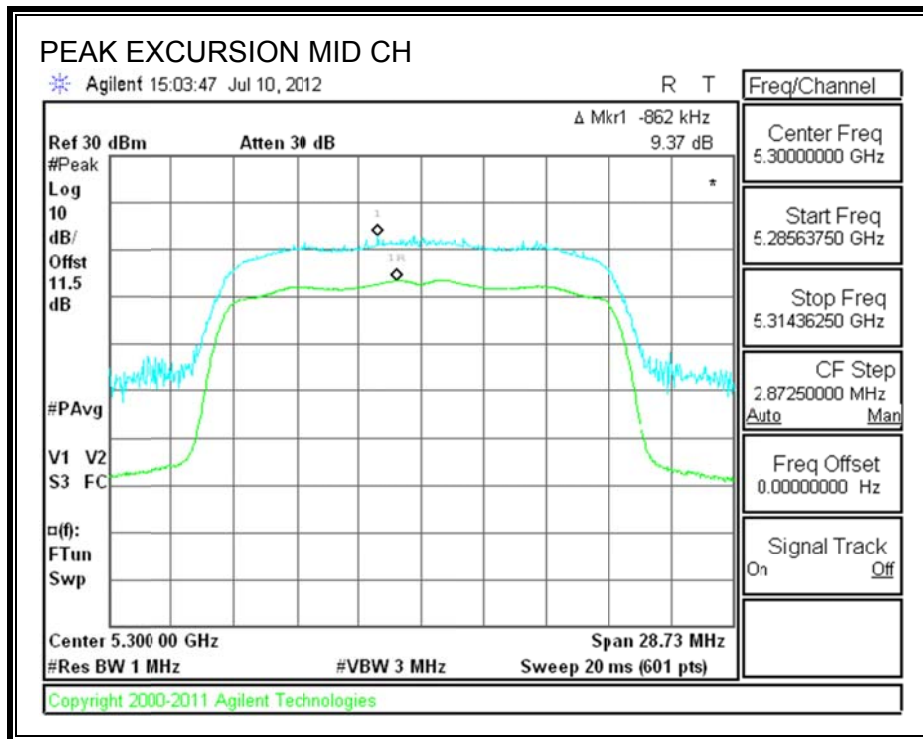
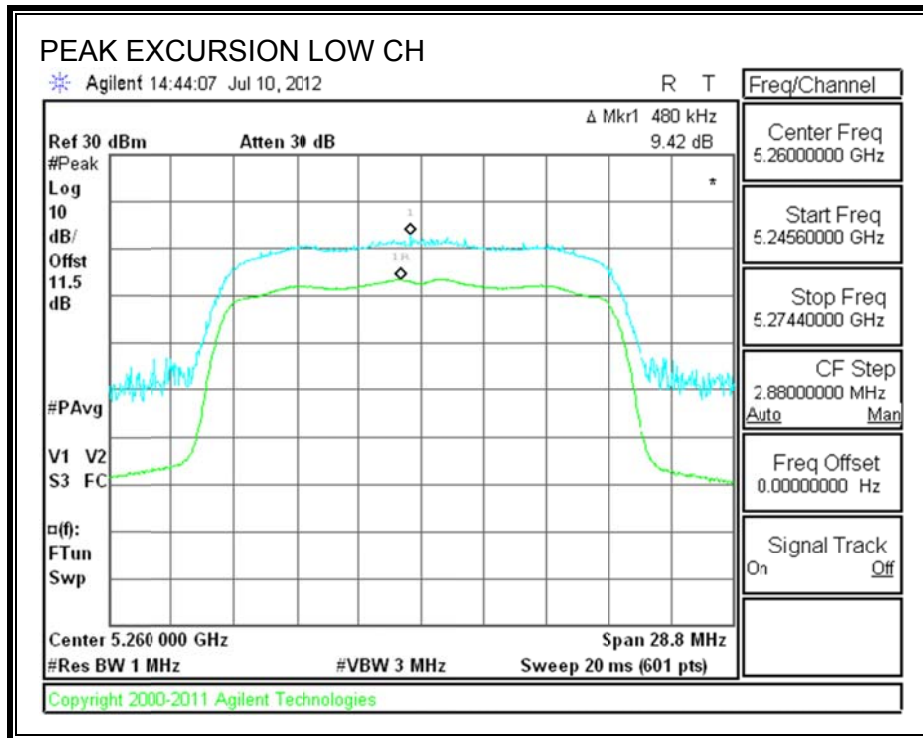
FCC §15.407 (a) (6)

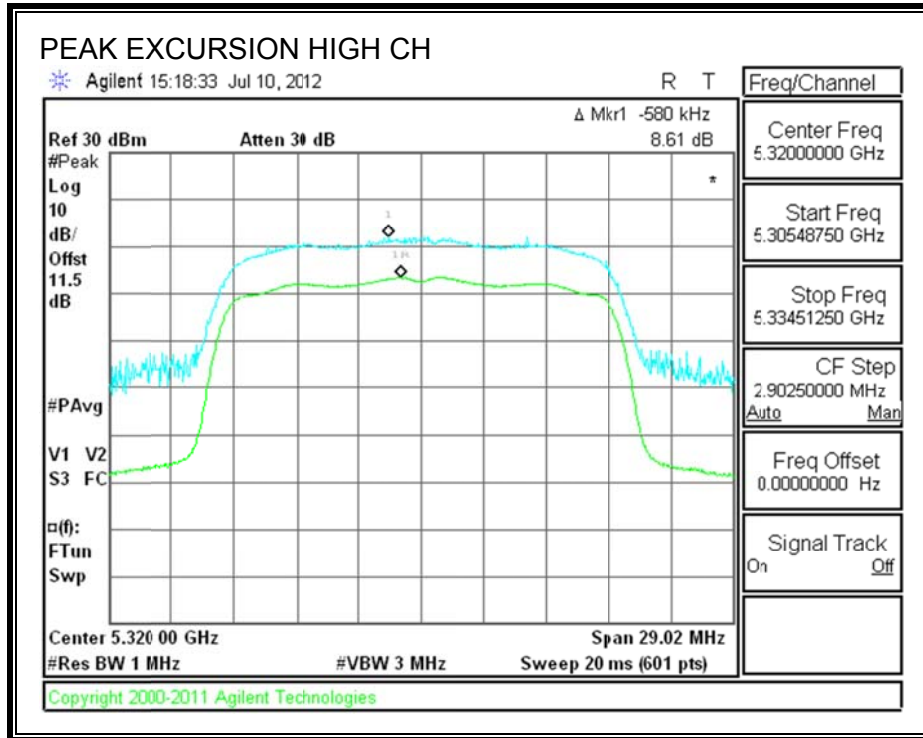
The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

RESULTS

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	5260	9.42	13	-3.58
Mid	5300	9.37	13	-3.63
High	5320	8.61	13	-4.39

PEAK EXCURSION





8.6. 802.11n HT40 MODE IN THE 5.3 GHz BAND

8.6.1. 26 dB BANDWIDTH

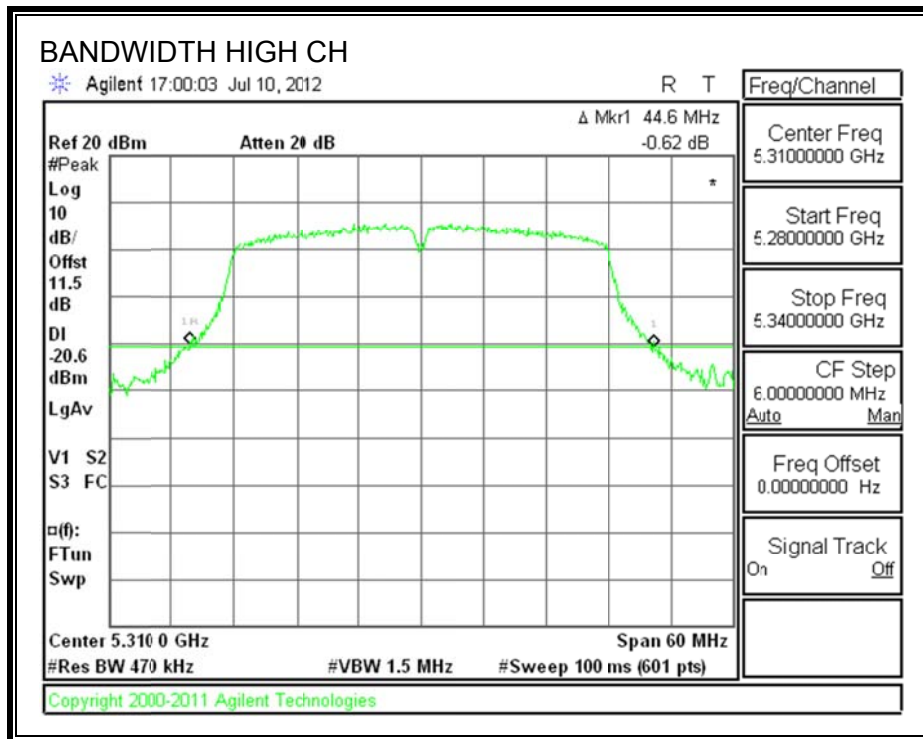
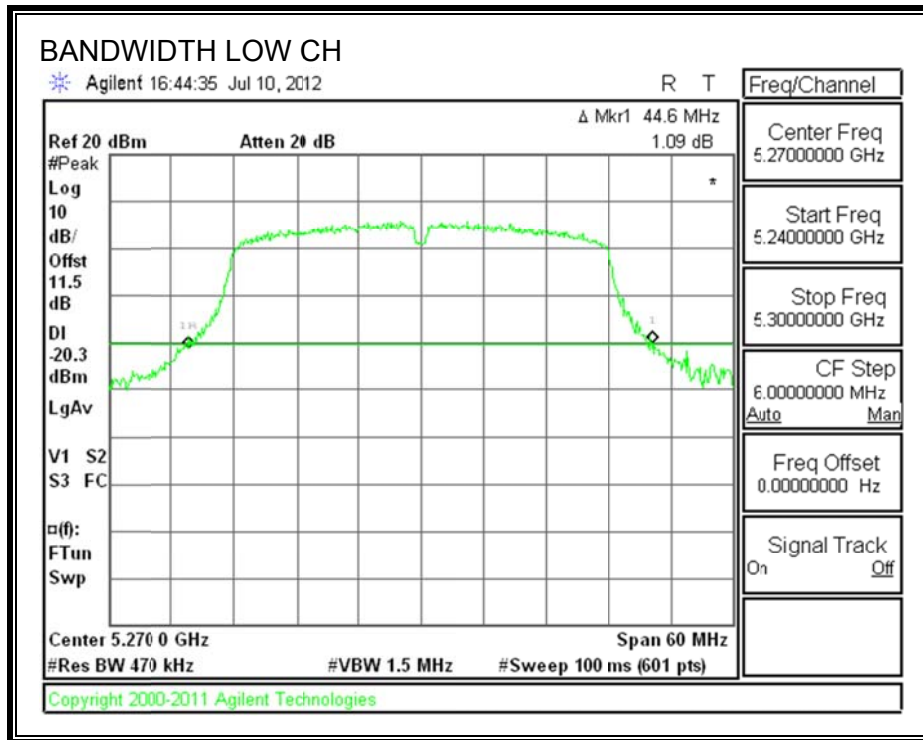
LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
Low	5270	44.6
High	5310	44.6

26 dB BANDWIDTH



8.6.2. 99% BANDWIDTH

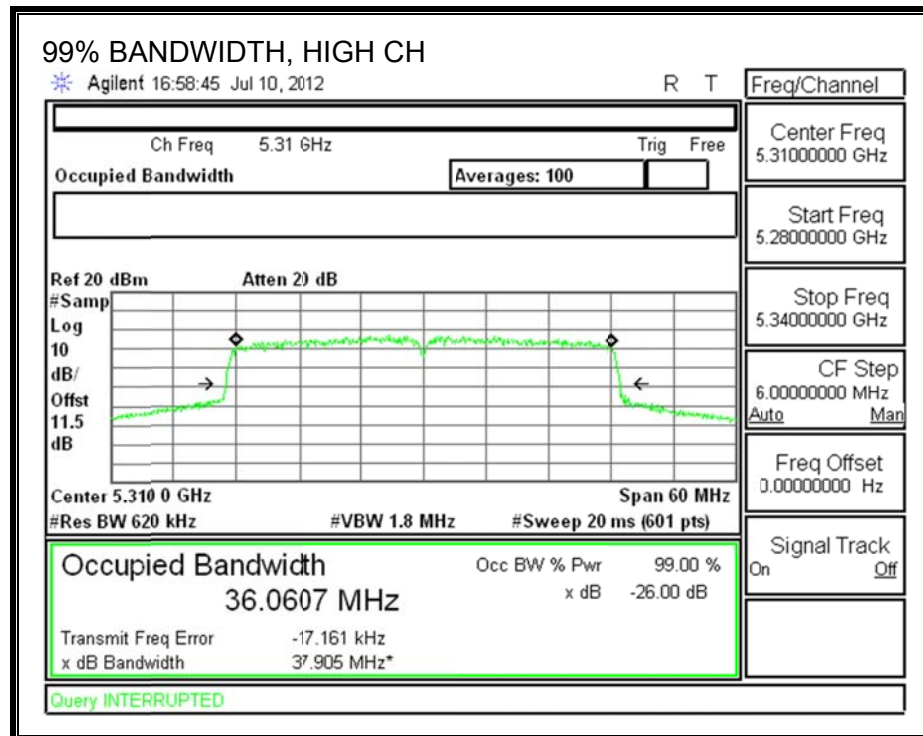
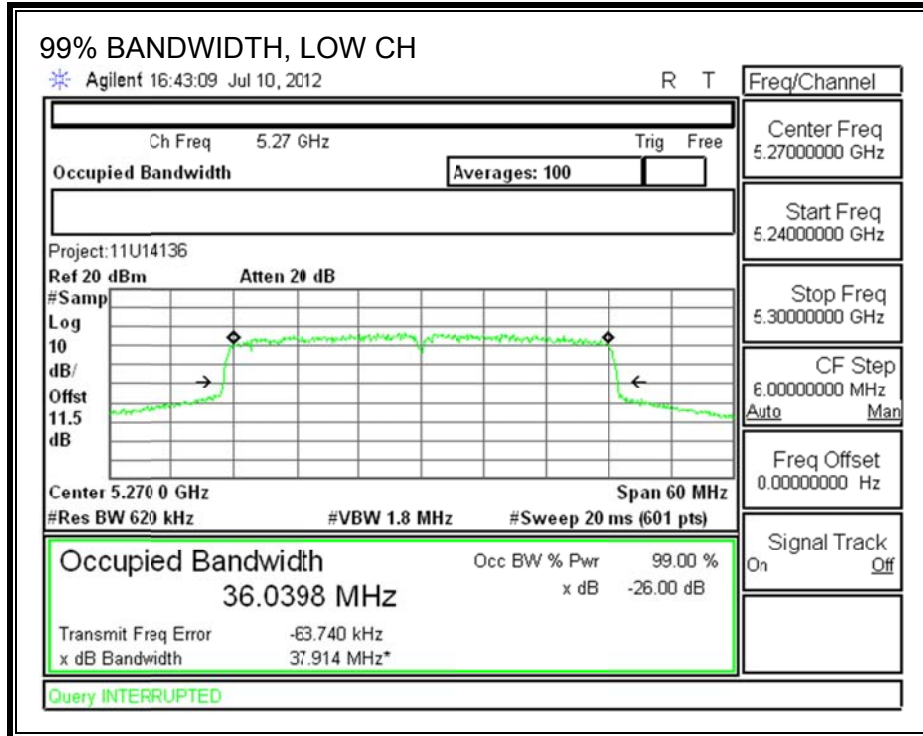
LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5270	36.040
High	5310	36.061

99% BANDWIDTH



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	13.45
High	5310	13.49

8.6.4. OUTPUT POWER AND PPSD

LIMITS

FCC §15.407 (a) (2)

IC RSS-210 A9.2 (2)

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 99% emission bandwidth for IC (26dB emission bandwidth for FCC) 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.

99% bandwidth was used to calculate the power limit which was considered the worst case.

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	36.0	26.57	-1.66	24.00	11.00
High	5310	24	36.1	26.57	-1.66	24.00	11.00

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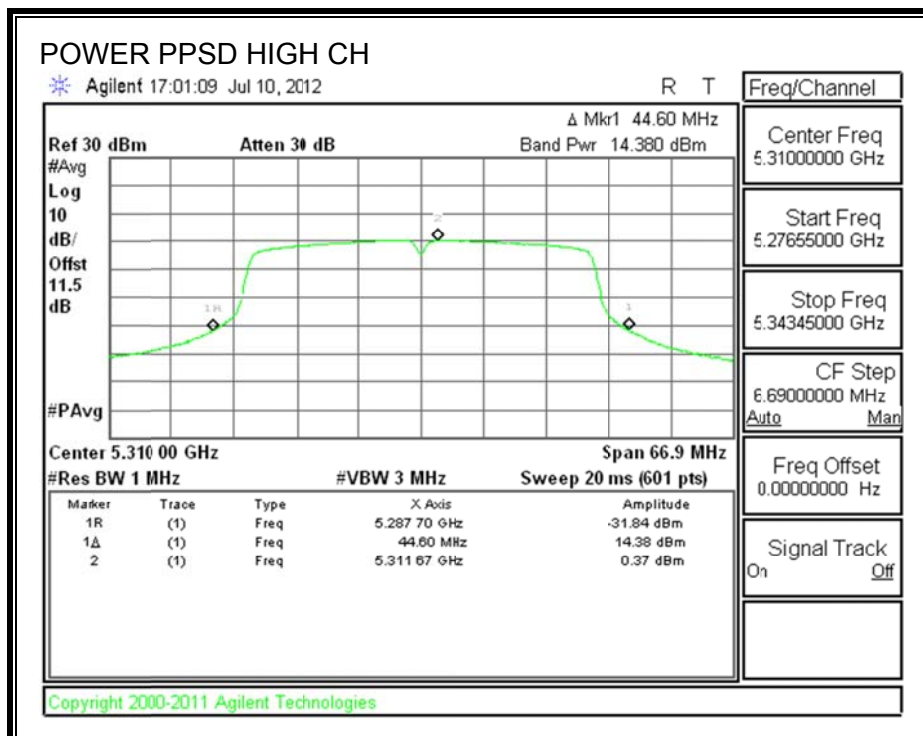
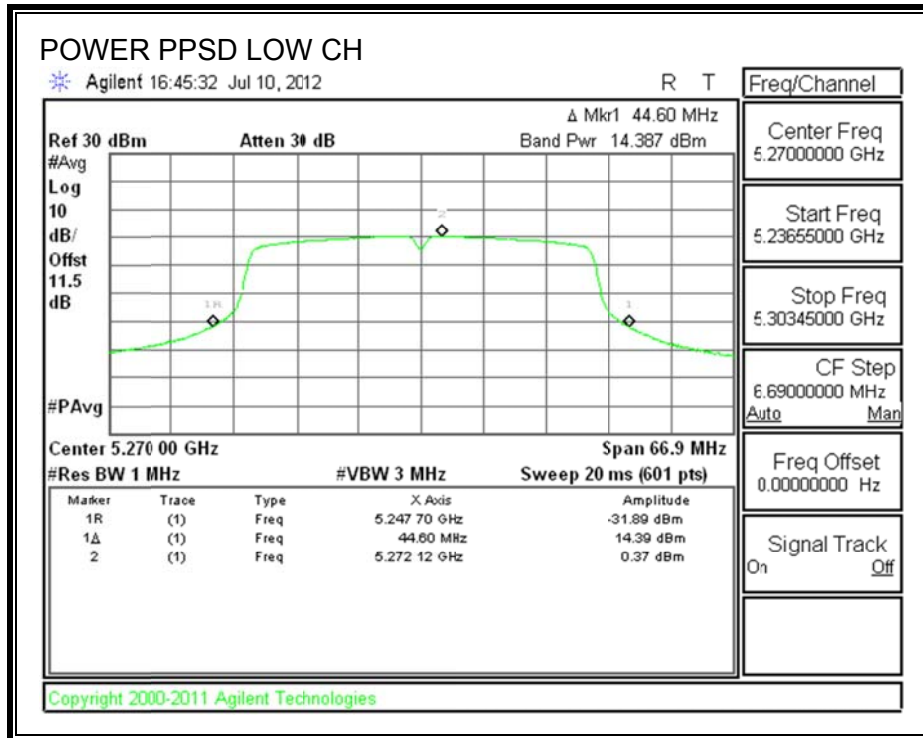
Output Power Results

Channel	Frequency (MHz)	Meas Power (dBm)	Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5270	14.39	14.55	24.00	-9.45
High	5310	14.38	14.54	24.00	-9.46

PPSD Results

Channel	Frequency (MHz)	Meas PPSD (dBm)	Corr'd PPSD (dBm)	PPSD Limit (dBm)	PPSD Margin (dB)
Low	5270	0.37	0.53	11.00	-10.47
High	5310	0.37	0.53	11.00	-10.47

OUTPUT POWER AND PPSD



8.6.5. PEAK EXCURSION

LIMITS

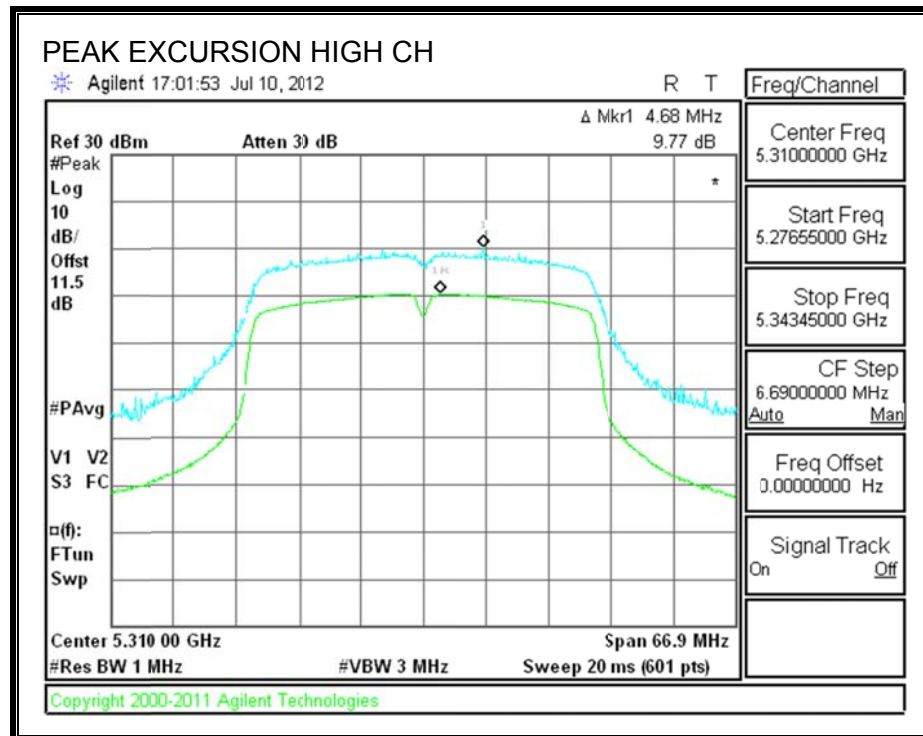
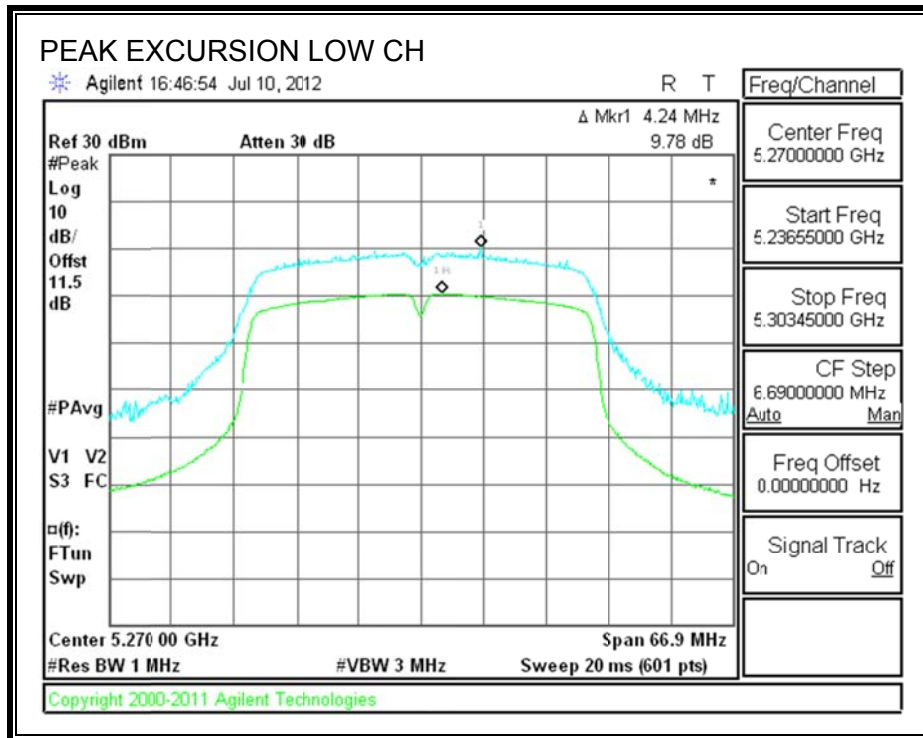
FCC §15.407 (a) (6)

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	9.78	13	-3.22
High	5310	9.77	13	-3.23

PEAK EXCURSION



8.7. 802.11a MODE IN THE 5.6 GHz BAND

8.7.1. 26 dB BANDWIDTH

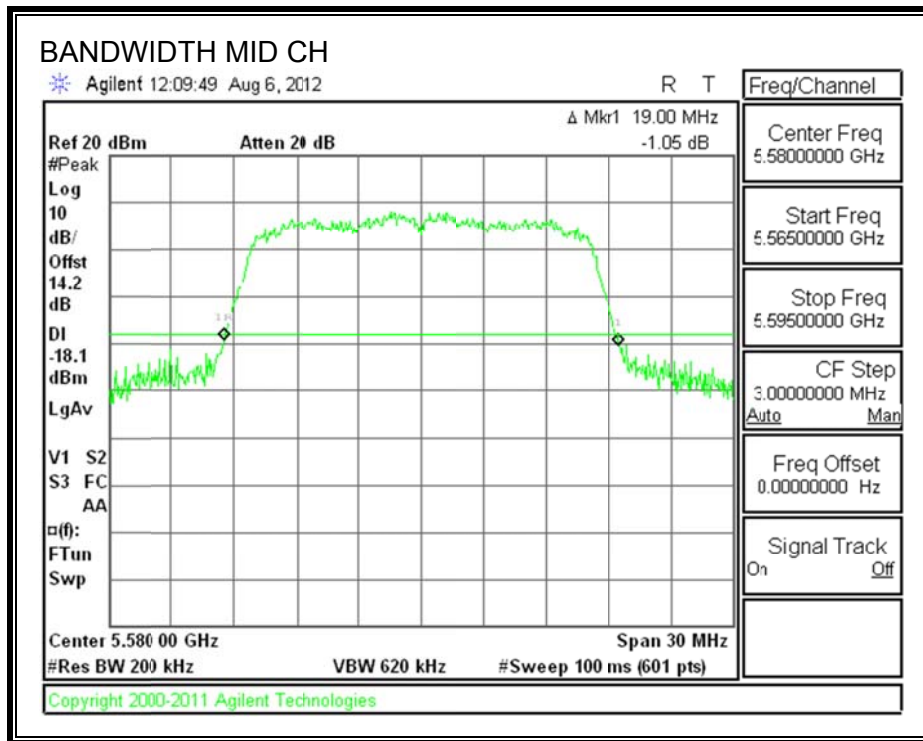
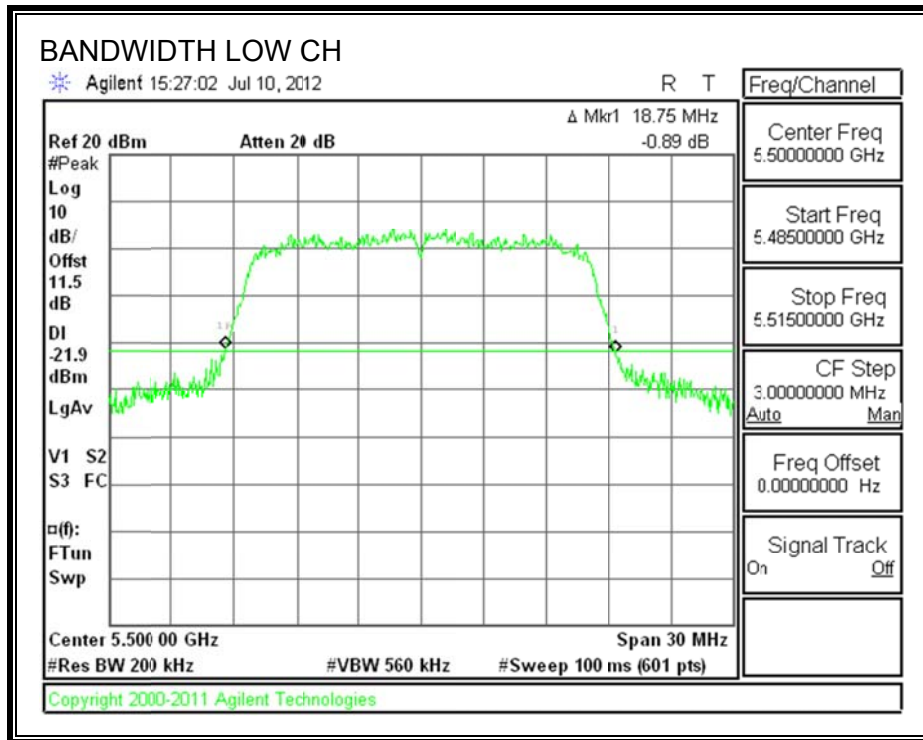
LIMITS

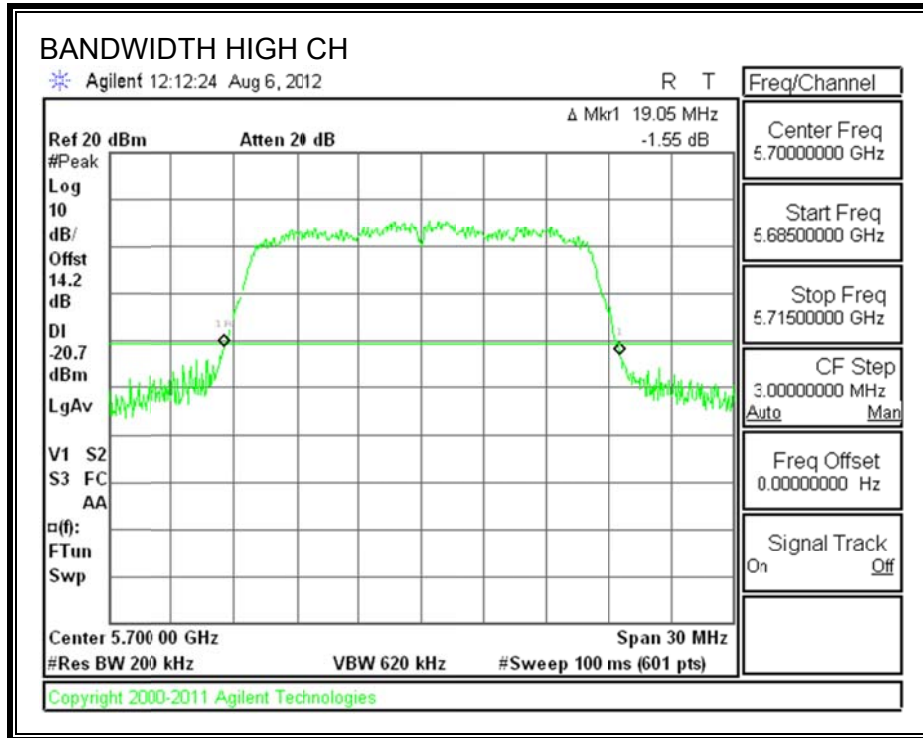
None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
Low	5500	18.8
Mid	5580	19.0
High	5700	19.1

26 dB BANDWIDTH





8.7.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5500	16.352
Mid	5580	16.534
High	5700	16.540

99% BANDWIDTH

