FCC 47 CFR PART 15 SUBPART E

TEST REPORT

For

Wireless Hotspot Gateway / Enterprise Access Point

Trade Name / Model:

Brand	Model	Product Description
4ipnet	EAP300	Enterprise Access Point
4ipnet	EAP305	Enterprise Access Point
4ipnet	EAP306	Enterprise Access Point
4ipnet	HSG300	Wireless Hotspot Gateway
Cipherium	A600	Enterprise Access Point
Cipherium	W1160	Wireless Hotspot Gateway
USC	A600	Enterprise Access Point
USC	W1160	Wireless Hotspot Gateway

Issued to

4IPNET, INC.
3F-3, No. 369, Fusing N. Rd., Taipei 105,
Taiwan, R.O.C.

Issued by

Compliance Certification Services Inc.
No. 11, Wu-Gong 6th Rd., Wugu Industrial Park,
Taipei Hsien 248, Taiwan (R.O.C.)
http://www.ccsrf.com
service@ccsrf.com

Testing Laboratory
1309

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1. TEST RESULT CERTIFICATION

Applicant: 4IPNET, INC.
3F-3, No. 369, Fusing N. Rd., Taipei 105, Taiwan, R.O.C.

Equipment Under Test: Wireless Hotspot Gateway / Enterprise Access Point

Trade Name / Model:

Brand	Model	Product Description
4ipnet	EAP300	Enterprise Access Point
4ipnet	EAP305	Enterprise Access Point
4ipnet	EAP306	Enterprise Access Point
4ipnet	HSG300	Wireless Hotspot Gateway
Cipherium	A600	Enterprise Access Point
Cipherium	W1160	Wireless Hotspot Gateway
USC	A600	Enterprise Access Point
USC	W1160	Wireless Hotspot Gateway

Date of Test: January 24 ~ March 21, 2011

APPLICABLE STANDARDS	
STANDARD	**TEST RESULT**
FCC 47 CFR Part 15 Subpart E	No non-compliance noted

We hereby certify that:

Compliance Certification Services Inc. tested the above equipment. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.4: 2003 and the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits of FCC Rules Part 15.407.

The test results of this report relate only to the tested sample identified in this report.

Approved by:

Rex Lai
Section Manager
Compliance Certification Services Inc.

Reviewed by:

Gina Lo
Section Manager
Compliance Certification Services Inc.

2. EUT DESCRIPTION

<table>
<tr><td>Product</td><td>Wireless Hotspot Gateway / Enterprise Access Point</td></tr>
<tr><td>Trade Name /
Model Name</td><td>
<table>
<tr><th>Brand</th><th>Model</th><th>Product Description</th></tr>
<tr><td>4ipnet</td><td>EAP300</td><td>Enterprise Access Point</td></tr>
<tr><td>4ipnet</td><td>EAP305</td><td>Enterprise Access Point</td></tr>
<tr><td>4ipnet</td><td>EAP306</td><td>Enterprise Access Point</td></tr>
<tr><td>4ipnet</td><td>HSG300</td><td>Wireless Hotspot Gateway</td></tr>
<tr><td>Cipherium</td><td>A600</td><td>Enterprise Access Point</td></tr>
<tr><td>Cipherium</td><td>W1160</td><td>Wireless Hotspot Gateway</td></tr>
<tr><td>USC</td><td>A600</td><td>Enterprise Access Point</td></tr>
<tr><td>USC</td><td>W1160</td><td>Wireless Hotspot Gateway</td></tr>
</table>
</td></tr>
<tr><td>Model Difference</td><td>All the specification and layout are identical except they come with different model numbers for marketing purposes.</td></tr>
<tr><td>Power Supply</td><td>APD / WA-24E12
I/P: 100-240V, 50-60Hz, 0.65A
O/P: 12V, 2A</td></tr>
<tr><td>Operating Frequency Range & Number of Channels</td><td>
<table>
<tr><th></th><th>Mode</th><th>Frequency Range (MHz)</th></tr>
<tr><td rowspan="3">UNII Band I</td><td>IEEE 802.11a</td><td>5180 – 5220</td></tr>
<tr><td>IEEE 802.11n HT 20 MHz mode</td><td>5180 – 5220</td></tr>
<tr><td>IEEE 802.11n HT 40 MHz mode</td><td>5190 ~ 5210</td></tr>
</table>
</td></tr>
<tr><td>Transmit Power</td><td>IEEE 802.11a mode / 5180 ~ 5220MHz: 16.59 dBm
IEEE 802.11n HT 20 MHz mode / 5180 ~ 5220MHz: 12.31 dBm
IEEE 802.11n HT 40 MHz mode / 5190 ~ 5210MHz: 11.51 dBm</td></tr>
<tr><td>Modulation Technique</td><td>OFDM (QPSK, BPSK, 16-QAM, 64-QAM)</td></tr>
<tr><td>Transmit Data Rate</td><td>IEEE 802.11a mode: 54, 48, 36, 24, 18, 12, 9, 6 Mbps
IEEE 802.11n HT 20 MHz mode: OFDM (6.50, 13.00, 19.50, 26.00, 39.00, 52.00, 58.50, 65.00, 78.00, 104.0, 117.0, 130.0, 156.0, 175.5, 195.0Mbps)
IEEE 802.11n HT 40 MHz mode: OFDM (13.50, 27.00, 40.50, 54.00, 81.00, 108.0, 121.5, 135.0, 162.0, 216.0, 243.0, 270.0, 324.0, 364.5, 405.0Mbps)</td></tr>
<tr><td rowspan="2">Antenna Specification</td><td>Antenna Type: Omni Antenna
Antenna Gain: 5 dBi</td></tr>
<tr><td>Antenna Calculation for MIMO Mode:
5 dBi + 10 log (3) = 9 dBi (Numeric gain: 7.9)</td></tr>
</table>

Operation Frequency

UNLICENSED NATIONAL INFORMATION INFRASTRUCTURE (U-NII)	
CHANNEL	**MHz**
36	5180
38	5190
40	5200
44	5220
46	5230

Remark:

1. *The sample selected for test was production product and was provided by manufacturer.*
2. *This submittal(s) (test report) is intended for FCC ID: **VZ9110001** filing to comply with Section 15.407 of the FCC Part 15, Subpart E Rules.*

3. TEST METHODOLOGY

Both conducted and radiated testing was performed according to the procedures in ANSI C63.4 Radiated testing was performed at an antenna to EUT distance 3 meters.

3.1 EUT CONFIGURATION

The EUT configuration for testing is installed for RF field strength measurement to meet the Commissions requirement, and is operated in a manner intended to generate the maximum emission in a continuous normal application.

3.2 EUT EXERCISE

The EUT is operated in the engineering mode to fix the Tx frequency for the purposes of measurement.

According to its specifications, the EUT must comply with the requirements of Section 15.407 under the FCC Rules Part 15 Subpart E.

3.3 GENERAL TEST PROCEDURES

Conducted Emissions

The EUT is placed on the turntable, which is positioned at 0.8 m above the ground plane. According to the requirements in Section 13.1.4.1 of ANSI C63.4, the conducted emission from the EUT is measured in the frequency range between 0.15 MHz and 30MHz, using the CISPR Quasi-Peak detector mode.

Radiated Emissions

The EUT is placed on the turntable, which is 0.8 m above the ground plane. The turntable is then rotated for 360 degrees to determine the proper orientation for the maximum emission level. The EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission level. And, each emission is to be maximized by changing the horizontal and vertical polarization of the receiving antenna. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 13.1.4.1 of ANSI C63.4.

3.4 FCC PART 15.205 RESTRICTED BANDS OF OPERATIONS

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1]0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 -	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.52525	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	156.7 - 156.9	3260 - 3267	23.6 - 24.0
12.29 - 12.293	162.0125 - 167.17	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	167.72 - 173.2	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	240 - 285	3600 - 4400	([2])
13.36 - 13.41	322 - 335.4		

[1] Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

[2] Above 38.6

(b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

3.5 DESCRIPTION OF TEST MODES

The EUT (model: HSG300) had been tested under operating condition.

The EUT is a 3x3 configuration spatial MIMO (3Tx & 3Rx) without beam forming function that operate in triple TX chains and triple RX chains. The 3x3 configuration is implemented with three outside TX & RX chains (Chain 0, Chain 1 and Chain 2).

Software used to control the EUT for staying in continuous transmitting mode was programmed.

After verification, all tests were carried out with the worst case test modes as shown below except radiated spurious emission below 1GHz and power line conducted emissions below 30MHz, which worst case was in normal link mode only.

IEEE 802.11a mode / 5180 ~ 5220MHz:

Channel Low (5180MHz), Channel High (5220MHz) with 6Mbps data rate were chosen for full testing.

IEEE 802.11n HT 20 MHz mode / 5180 ~ 5220MHz:

Channel Low (5180MHz), Channel High (5220MHz) with 6.5Mbps data rate were chosen for full testing.

IEEE 802.11n HT 40 MHz mode / 5190 ~ 5210MHz:

Channel Low (5190MHz) and Channel High (5210MHz) with 13.5Mbps data rate were chosen for full testing.

4. INSTRUMENT CALIBRATION

4.1 MEASURING INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

4.2 MEASUREMENT EQUIPMENT USED

Equipment Used for Emissions Measurement

Remark: *Each piece of equipment is scheduled for calibration once a year and Loop Antenna is scheduled for calibration once three years.*

Conducted Emissions Test Site				
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
Spectrum Analyzer	Agilent	E4446A	MY43360131	03/02/2012

Wugu 966 Chamber A				
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
Spectrum Analyzer	Agilent	E4446A	US42510252	11/03/2011
EMI Test Receiver	R&S	ESCI	100064	02/03/2012
Pre-Amplifier	Mini-Circults	ZFL-1000LN	SF350700823	01/12/2012
Pre-Amplifier	MITEQ	AFS44-00102650-42-10P-44	1415367	11/19/2011
Bilog Antenna	Sunol Sciences	JB3	A030105	10/06/2011
Horn Antenna	EMCO	3117	00055165	01/12/2012
Loop Antenna	EMCO	6502	8905/2356	06/10/2013
Turn Table	CCS	CC-T-1F	N/A	N.C.R
Antenna Tower	CCS	CC-A-1F	N/A	N.C.R
Controller	CCS	CC-C-1F	N/A	N.C.R
Site NSA	CCS	N/A	N/A	12/26/2011
Test S/W	EZ-EMC (CCS-3A1RE)			

Conducted Emission room #1				
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
L.I.S.N.	SCHWARZBECK	NNLK 8121	8121-308	MAR. 08, 2012
TEST RECEIVER	Rohde & Schwarz	ESCS 30	100348	JUL. 13, 2011
BNC COAXIAL CABLE	CCS	BNC50	11	OCT. 04, 2011
Test S/W	e-3 (5.04211c) R&S (2.27)			

4.3 MEASUREMENT UNCERTAINTY

PARAMETER	UNCERTAINTY
Powerline Conducted Emission	+/- 2.01
3M Semi Anechoic Chamber / 30M~200M	+/- 4.0606
3M Semi Anechoic Chamber / 200M~1000M	+/- 3.9979
3M Semi Anechoic Chamber / 1G~8G	+/- 2.5790
3M Semi Anechoic Chamber / 8G~18G	+/- 2.5928
3M Semi Anechoic Chamber / 18G~26G	+/- 2.7212
3M Semi Anechoic Chamber / 26G~40G	+/- 2.9520

***Remark**: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.*

5. FACILITIES AND ACCREDITATIONS

5.1 FACILITIES

All measurement facilities used to collect the measurement data are located at

☐ No. 199, Chunghsen Road, Hsintien City, Taipei Hsien, Taiwan, R.O.C.
Tel: 886-2-2217-0894 / Fax: 886-2-2217-1029

☒ No. 11, Wugong 6th Rd., Wugu Industrial Park, Taipei Hsien 248, Taiwan
Tel: 886-2-2299-9720 / Fax: 886-2-2298-4045

☐ No.81-1, Lane 210, Bade 2nd Rd., Luchu Hsiang, Taoyuan Hsien 338, Taiwan
Tel: 886-3-324-0332 / Fax: 886-3-324-5235

☒ No. 8, Jiu Ceng Ling, Jiaokeng Village, Sinhua Township, Tainan Hsien 712, Taiwan (R.O.C.)
Tel: 886-6-580-2201 / Fax: 886-6-580-2202

***Remark**: The powerline emissions test items was tested at Compliance Certification Services Inc. (Sinhua u Lab.) The test equipments were listed in page 8 and the test data, please refer page 81-82.*

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

5.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of linearly polarized antennas: tuned dipole, biconical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, “Radio Interference Measuring Apparatus and Measurement Methods.”

5.3 TABLE OF ACCREDITATIONS AND LISTINGS

Country	Agency	Scope of Accreditation	Logo
USA	FCC	3M Semi Anechoic Chamber (FCC MRA: TW1039) to perform FCC Part 15 measurements	FCC MRA: TW1039
Taiwan	TAF	LP0002, RTTE01, FCC Method-47 CFR Part 15 Subpart C, D, E, RSS-210, RSS-310 IDA TS SRD, AS/NZS 4268, AS/NZS 4771, TS 12.1 & 12,2, ETSI EN 300 440-1, ETSI EN 300 440-2, ETSI EN 300 328, ETSI EN 300 220-1, ETSI EN 300 220-2, ETSI EN 301 893, ETSI EN 301 489-1/3/7/17 FCC OET Bulletin 65 + Supplement C, EN 50360, EN 50361, EN 50371, RSS 102, EN 50383, EN 50385, EN 50392, IEC 62209, CNS 14958-1, CNS 14959 FCC Method –47 CFR Part 15 Subpart B IEC / EN 61000-3-2, IEC / EN 61000-3-3, IEC / EN 61000-4-2/3/4/5/6/8/11	TAF Testing Laboratory 1309
Canada	Industry Canada	3M Semi Anechoic Chamber (IC 2324G-1 / IC 2324G-2) to perform	Canada IC 2324G-1 IC 2324G-2

** No part of this report may be used to claim or imply product endorsement by A2LA or any agency of the US Government.*

6. SETUP OF EQUIPMENT UNDER TEST

6.1 SETUP CONFIGURATION OF EUT

See test photographs attached in Appendix II for the actual connections between EUT and support equipment.

6.2 SUPPORT EQUIPMENT

Wugu Lab.

No.	Device Type	Brand	Model	Series No.	FCC ID	Data Cable	Power Cord
1.	Notebook PC	DELL	PP19L	GK102 A00	QDS-BRCM1021	LAN Cable: Unshielded, 10m	AC I/P: Unshielded, 1.8m DC O/P: Unshielded, 1.8m with a core
2.	USB Dongle	Transcend	JF V85	N/A	N/A	N/A	N/A

Tainan Lab.

No.	Product	Manufacturer	Model No.	Certify No.	Signal cable
1	Note Book	IBM	R51	R33026	Power cable, unshd, 1.6m
2	Note Book	IBM	T43	DoC	Power cable, unshd, 1.6m
3	Flash Disk	Kingston	DTI/512	DoC	N/A
4	HUB	BARRICAD	SMC7008BR	DoC	Power cable, unshd, 1.6m

Remark:

1. *All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.*
2. *Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.*

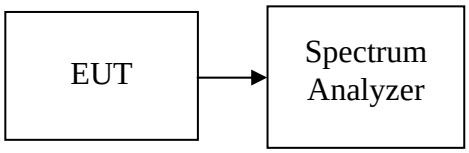
7. FCC PART 15 REQUIREMENTS

7.1 26 DB EMISSION BANDWIDTH

LIMIT

According to §15.303(c), for purposes of this subpart the emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 26 dB down relative to the maximum level of the modulated carrier. Compliance with the emissions limits is based on the use of measurement instrumentation employing a peak detector function with an instrument resolutions bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement.

Test Configuration



TEST PROCEDURE

1. Place the EUT on the table and set it in the transmitting mode.
2. Remove the antenna from the EUT and then connect a low-loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as RBW = 240kHz, VBW = 750kHz, Span = 50MHz, and Sweep = 1ms.
4. Mark the peak frequency and –26dB (upper and lower) frequency.
5. Repeat until all the rest channels were investigated.

TEST RESULTS

No non-compliance noted

Test Data

Test mode: IEEE 802.11a mode / 5180 ~ 5220MHz

Channel	Frequency (MHz)	Bandwidth (MHz)
Low	5180	21.895
High	5220	22.433

Test mode: IEEE 802.11n HT 20 MHz mode / 5180 ~ 5220MHz / Chain 0

Channel	Frequency (MHz)	Bandwidth (MHz)
Low	5180	23.337
High	5220	23.101

Test mode: IEEE 802.11n HT 20 MHz mode / 5180 ~ 5220MHz / Chain 1

Channel	Frequency (MHz)	Bandwidth (MHz)
Low	5180	23.304
High	5220	22.711

Test mode: IEEE 802.11n HT 20 MHz mode / 5180 ~ 5220MHz / Chain 2

Channel	Frequency (MHz)	Bandwidth (MHz)
Low	5180	22.896
High	5220	23.990

Test mode: IEEE 802.11n HT 40 MHz mode / 5190 ~ 5210MHz / Chain 0

Channel	Frequency (MHz)	Bandwidth (MHz)
Low	5190	46.638
High	5210	45.962

Test mode: IEEE 802.11n HT 40 MHz mode/ 5190 ~ 5210MHz / Chain 1

Channel	Frequency (MHz)	Bandwidth (MHz)
Low	5190	45.065
High	5210	46.044

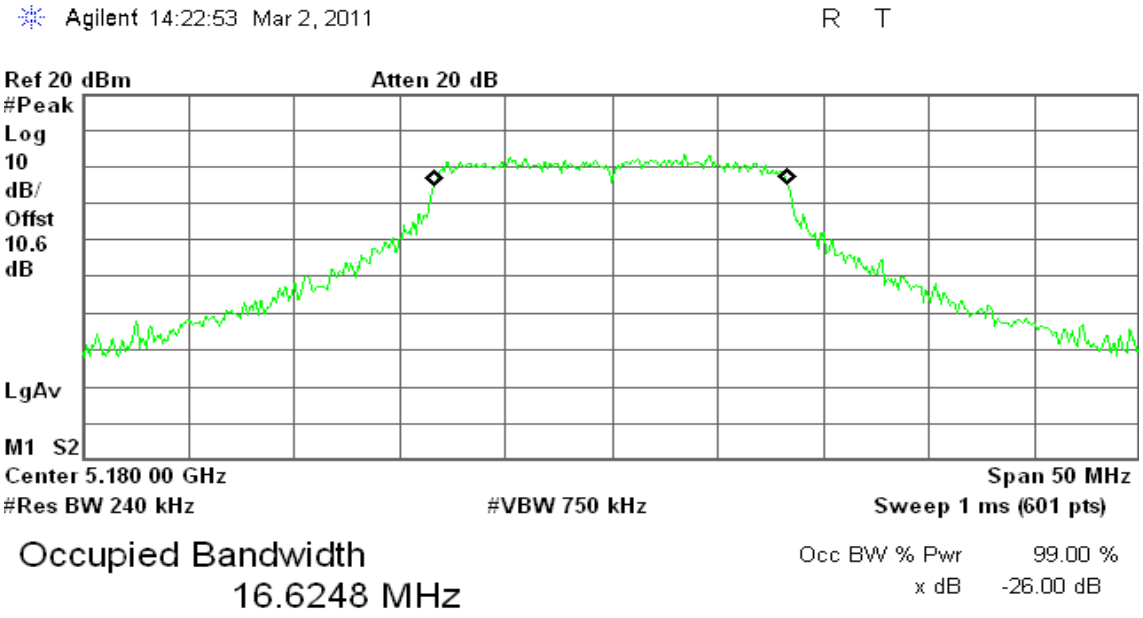
Test mode: IEEE 802.11n HT 40 MHz mode/ 5190 ~ 5210MHz / Chain 2

Channel	Frequency (MHz)	Bandwidth (MHz)
Low	5190	45.005
High	5210	44.618

Test Plot

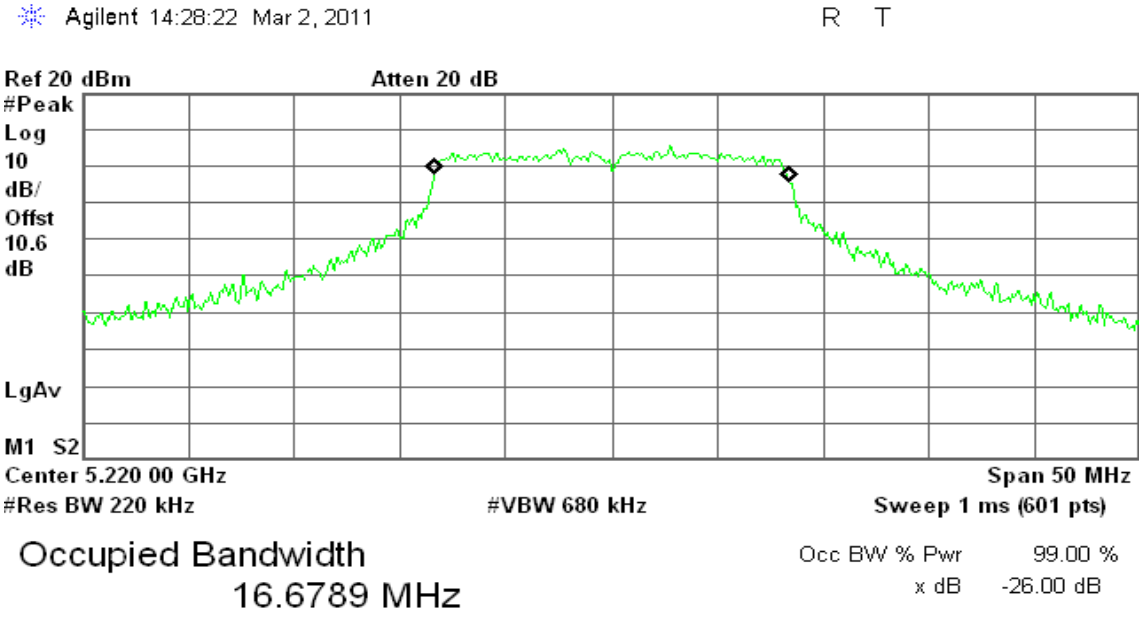
IEEE 802.11a mode / 5180 ~ 5220MHz

CH Low



Transmit Freq Error	-27.684 kHz
x dB Bandwidth	21.895 MHz

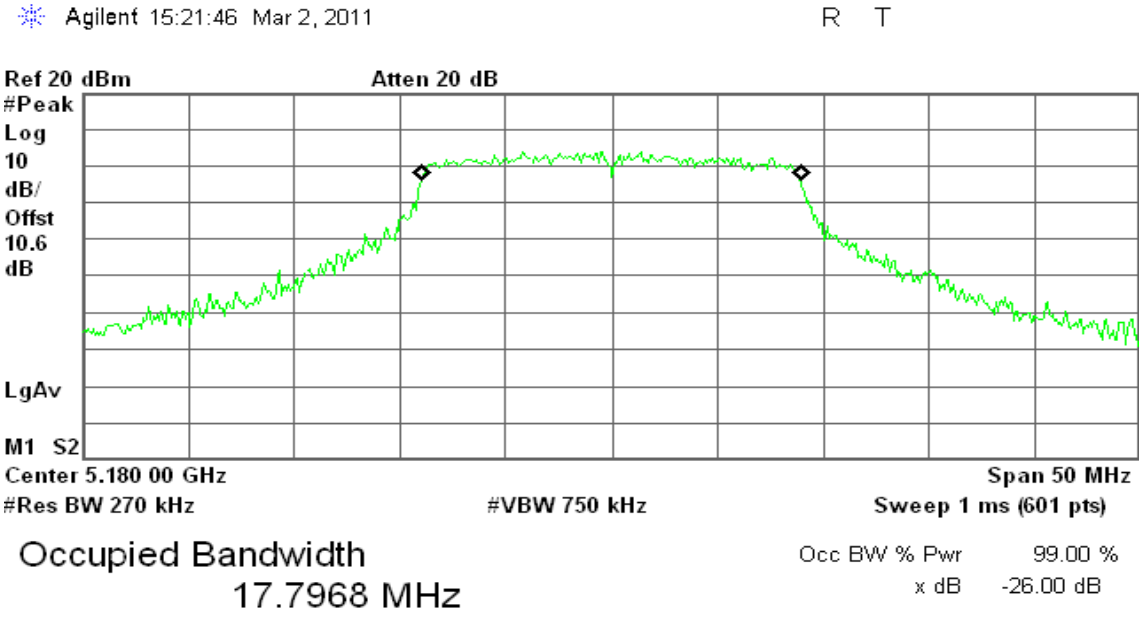
CH High



Transmit Freq Error	21.435 kHz
x dB Bandwidth	22.433 MHz

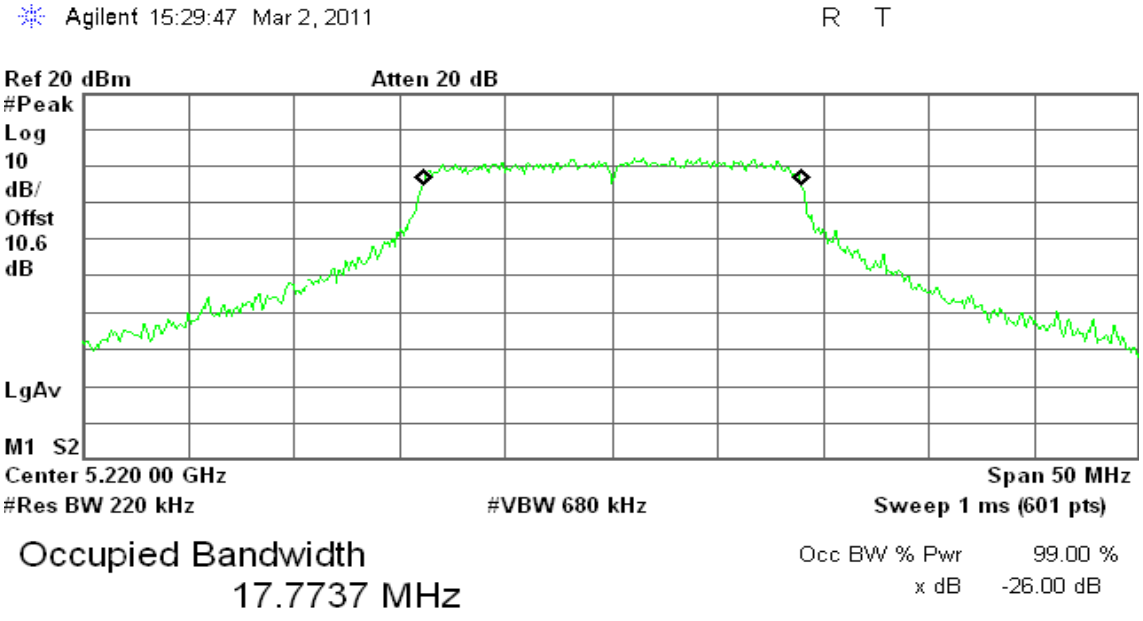
IEEE 802.11n HT 20 MHz mode / 5180 ~ 5220MHz / Chain 0

CH Low



Transmit Freq Error	-14.368 kHz
x dB Bandwidth	23.337 MHz

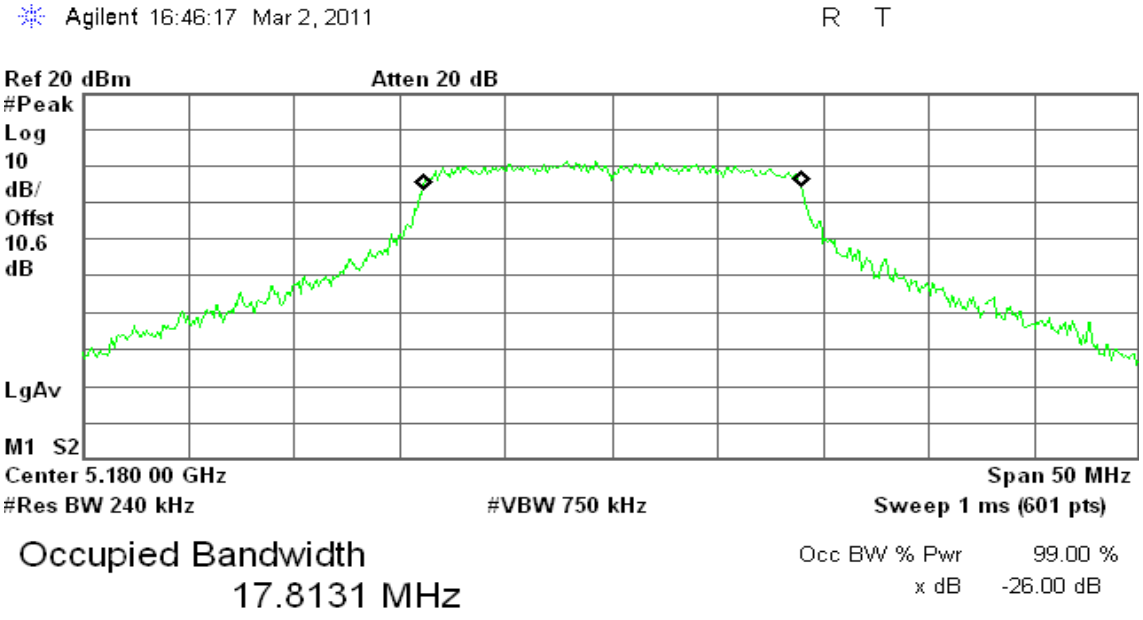
CH High



Transmit Freq Error	25.743 kHz
x dB Bandwidth	23.101 MHz

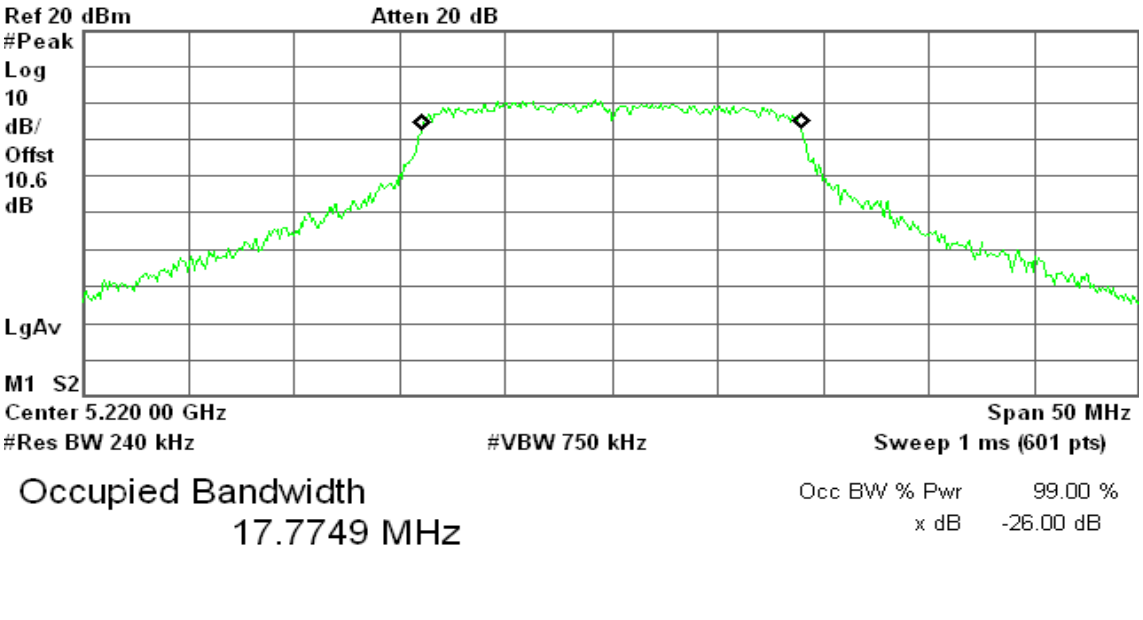
IEEE 802.11n HT 20 MHz mode / 5180 ~ 5220MHz / Chain 1

CH Low



Transmit Freq Error	35.939 kHz
x dB Bandwidth	23.304 MHz

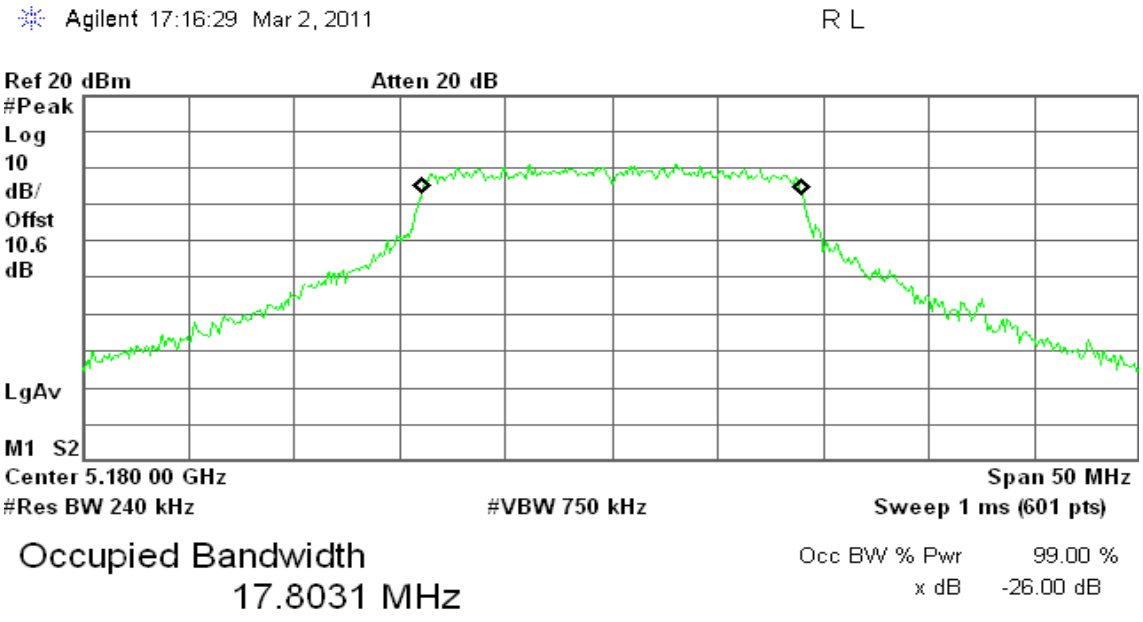
CH High



Transmit Freq Error	-485.712 Hz
x dB Bandwidth	22.711 MHz

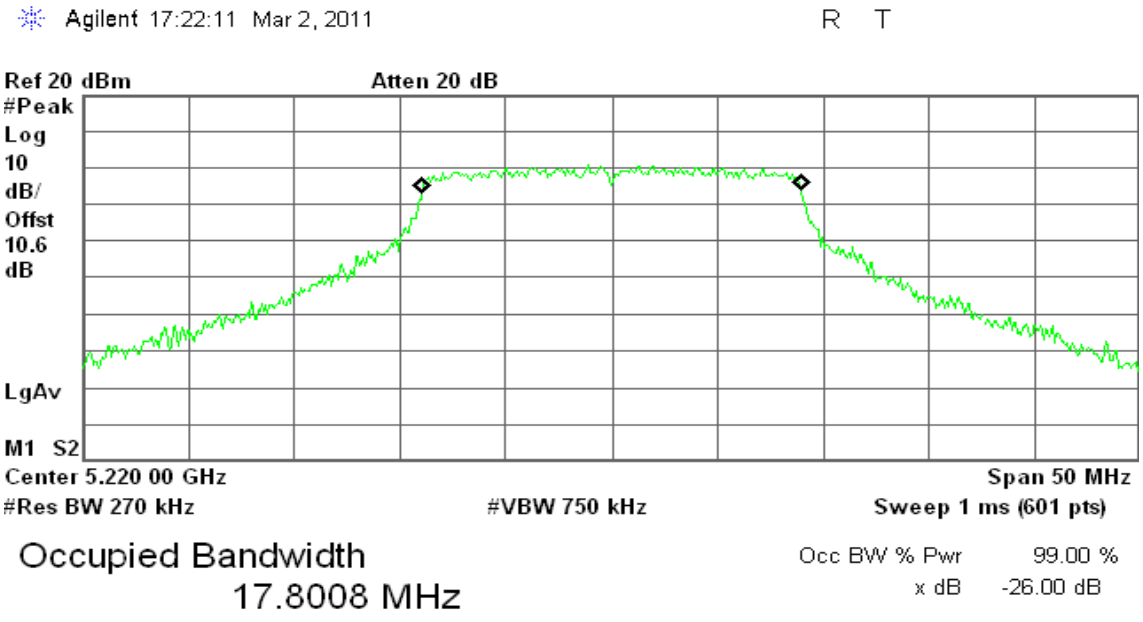
IEEE 802.11n HT 20 MHz mode / 5180 ~ 5220MHz / Chain 2

CH Low



Transmit Freq Error	16.533 kHz
x dB Bandwidth	22.896 MHz

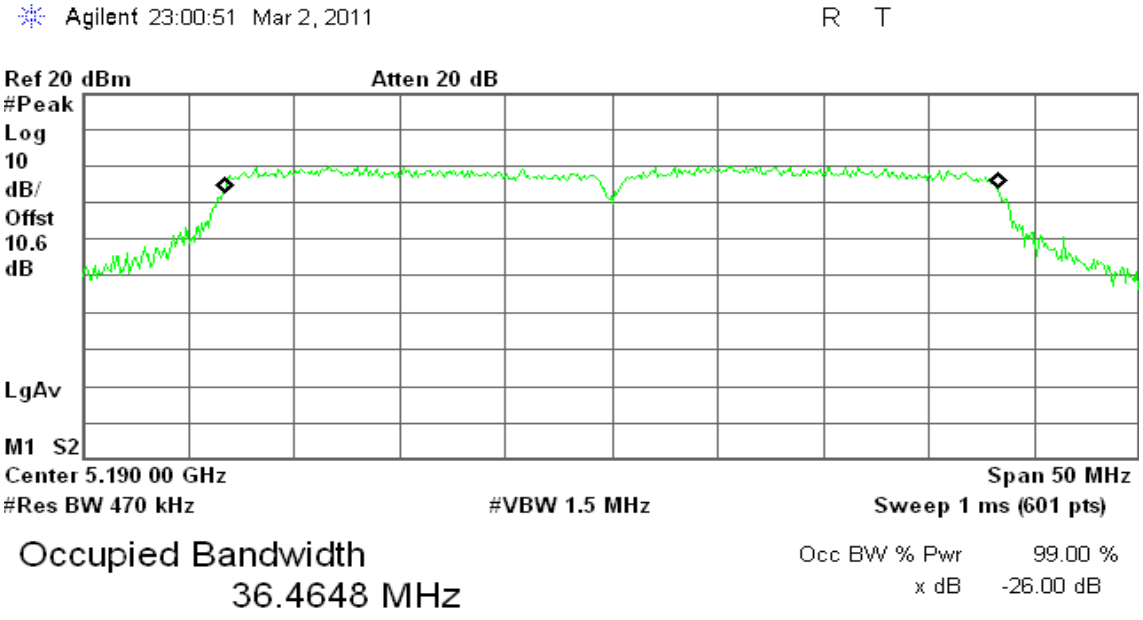
CH High



Transmit Freq Error	13.821 kHz
x dB Bandwidth	23.990 MHz

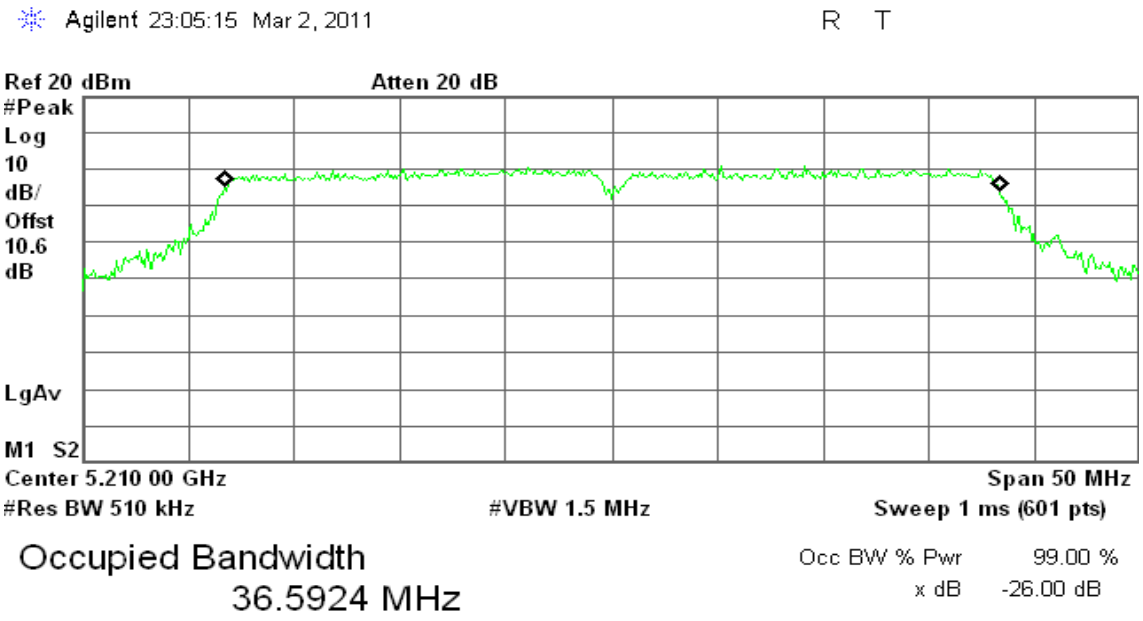
IEEE 802.11n HT 40 MHz mode / 5190 ~ 5210MHz / Chain 0

CH Low



Transmit Freq Error	-16.640 kHz
x dB Bandwidth	46.638 MHz

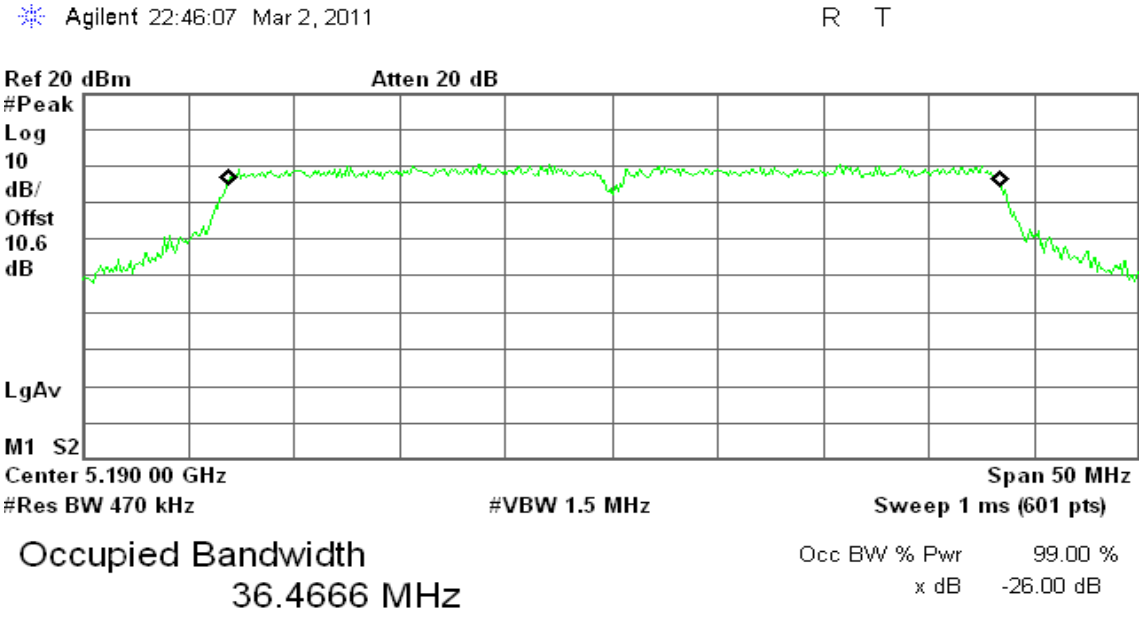
CH High



Transmit Freq Error	40.944 kHz
x dB Bandwidth	45.962 MHz

IEEE 802.11n HT 40 MHz mode / 5190 ~ 5210MHz / Chain 1

CH Low

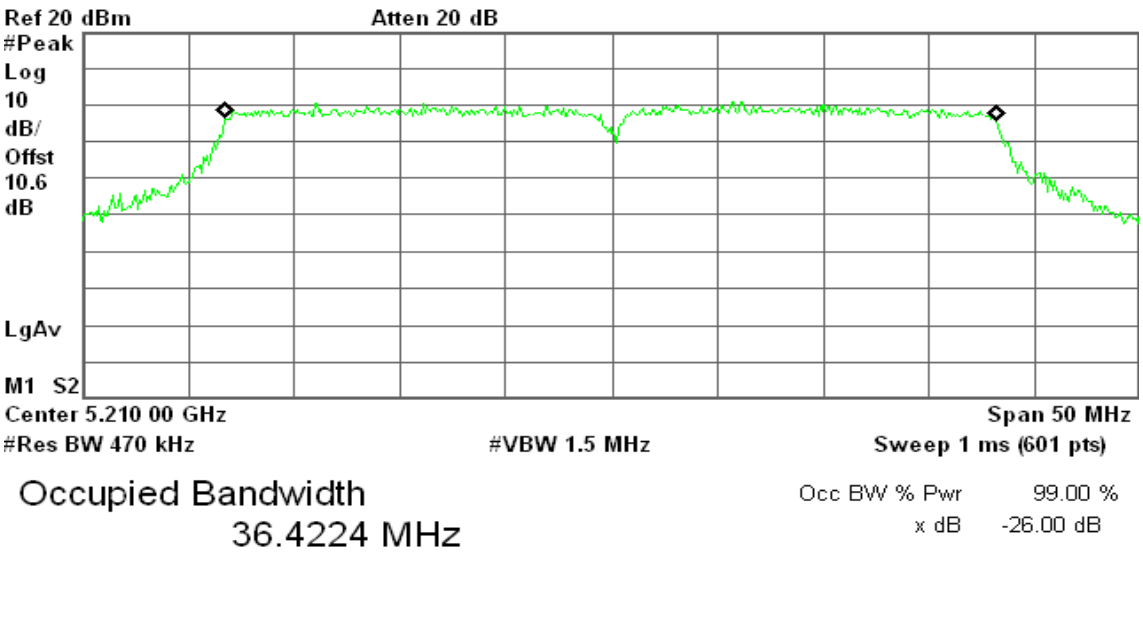


Occupied Bandwidth
36.4666 MHz

Occ BW % Pwr 99.00 %
x dB -26.00 dB

Transmit Freq Error 113.976 kHz
x dB Bandwidth 45.065 MHz

CH High



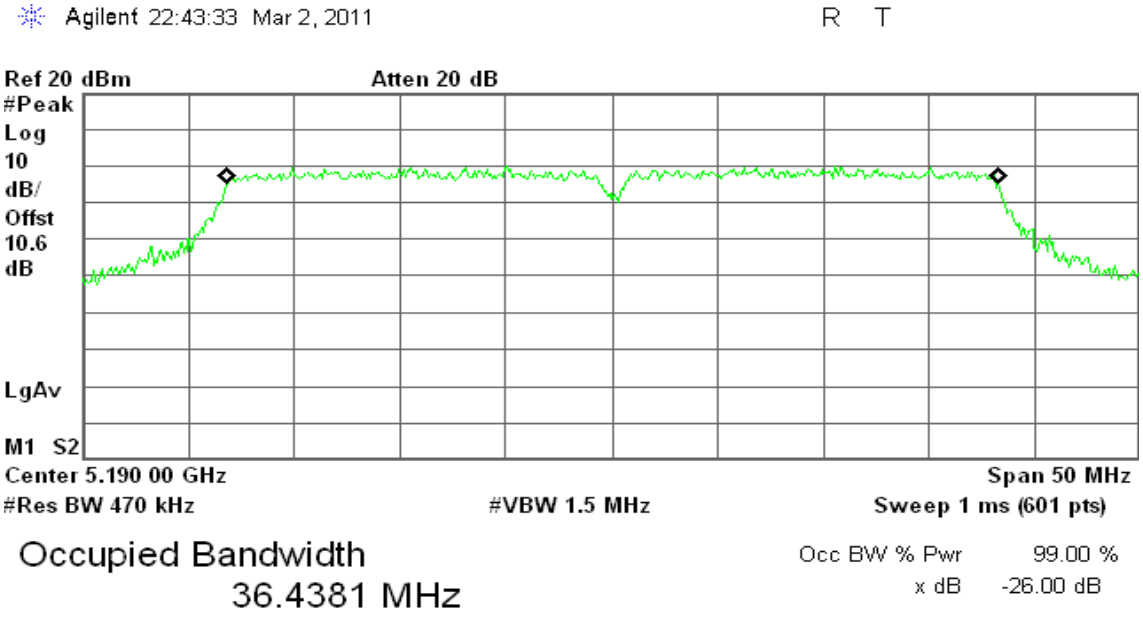
Occupied Bandwidth
36.4224 MHz

Occ BW % Pwr 99.00 %
x dB -26.00 dB

Transmit Freq Error -20.499 kHz
x dB Bandwidth 46.044 MHz

IEEE 802.11n HT 40 MHz mode / 5190 ~ 5210MHz / Chain 2

CH Low

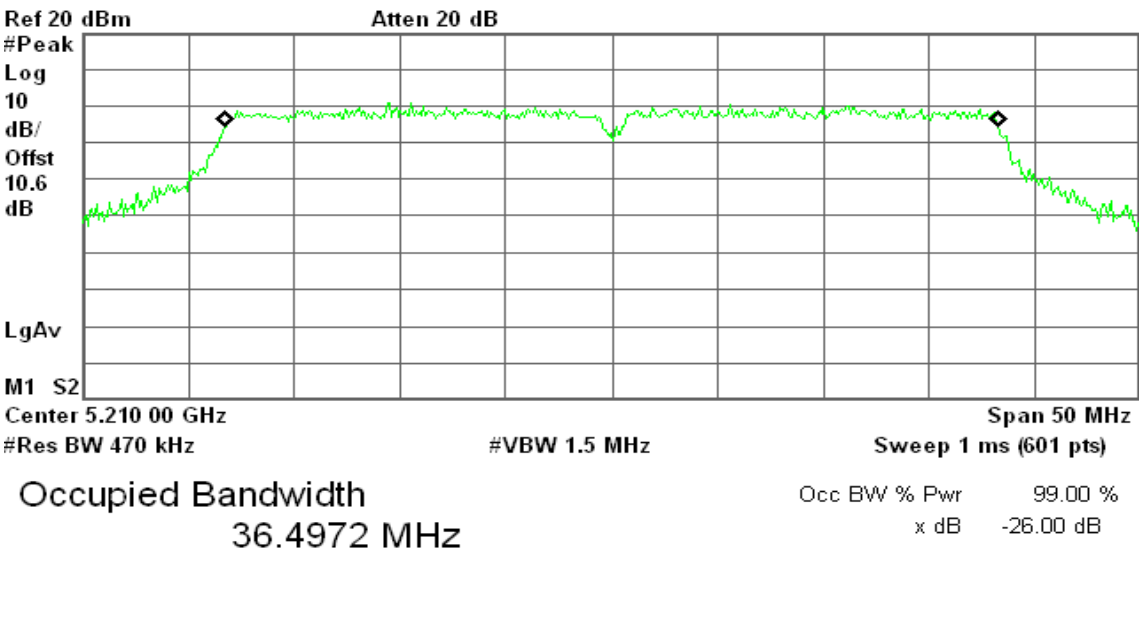


Occupied Bandwidth
36.4381 MHz

Occ BW % Pwr 99.00 %
x dB -26.00 dB

Transmit Freq Error 53.085 kHz
x dB Bandwidth 45.005 MHz

CH High



Occupied Bandwidth
36.4972 MHz

Occ BW % Pwr 99.00 %
x dB -26.00 dB

Transmit Freq Error 28.671 kHz
x dB Bandwidth 44.618 MHz

7.2 PEAK POWER

LIMIT

According to §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 dBm + 10log B, where B is the 26 dB emission bandwidth in MHz.

(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 dBm + 10log B, where B is the 26 dB emission bandwidth in MHz.

If transmitting antennas of directional gain greater than 6dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

The peak power shall not exceed the limit as follow:

Specified Limit of the Peak Power

Test mode: IEEE 802.11a mode / 5180 ~ 5220MHz

Channel	Frequency (MHz)	26 dB Bandwidth (B) (MHz)	10 Log B (dB)	4 + 10 Log B (dBm)	Maximum Conducted Output Power Limit (dBm)
Low	5180	21.895	13.40	17.40	17.00
High	5220	22.433	13.50	17.50	17.00

Test mode: IEEE 802.11n HT 20 MHz mode / 5180 ~ 5220MHz

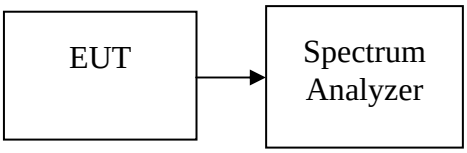
Channel	Frequency (MHz)	Chain 0 26 dB Bandwidth (B) (MHz)	Chain 1 26 dB Bandwidth (B) (MHz)	Chain 2 26 dB Bandwidth (B) (MHz)	10 Log B (dB)	4 + 10 Log B (dBm)	Maximum Conducted Output Power Limit (dBm)
Low	5180	23.337	23.304	22.896	13.68	17.68	17.00
High	5220	23.101	22.711	23.990	13.80	17.80	17.00

Test mode: IEEE 802.11n HT 40 MHz mode / 5190 ~ 5210MHz

Channel	Frequency (MHz)	Chain 0 26 dB Bandwidth (B) (MHz)	Chain 1 26 dB Bandwidth (B) (MHz)	Chain 2 26 dB Bandwidth (B) (MHz)	10 Log B (dB)	4 + 10 Log B (dBm)	Maximum Conducted Output Power Limit (dBm)
Low	5190	46.638	45.065	45.005	16.68	20.68	17.00
High	5210	45.962	46.044	44.618	16.63	20.63	17.00

Test Configuration

The EUT was connected to a spectrum analyzer through a 50Ω RF cable.



TEST PROCEDURE

Set span to encompass the entire emission bandwidth (EBW) of the signal.

Set RBW = 1 MHz / Set VBW = 3 MHz.

Use sample detector mode if bin width (i.e., span/number of points in spectrum display) < 0.5 RBW. Otherwise use peak detector mode. Use a video trigger with the trigger level set to enable triggering only on full power pulses. Transmitter must operate at full control power for entire sweep of every sweep. If the device transmits continuously, with no off intervals or reduced power intervals, the trigger may be set to "free run".·Trace average 100 traces in power averaging mode. Compute power by integrating the spectrum across the 26 dB EBW of the signal. The integration can be performed using the spectrum analyzer's band power measurement function with band limits set equal to the EBW band edges or by summing power levels in each 1 MHz band in linear power terms. The 1 MHz band power levels to be summed can be obtained by averaging, in linear power terms, power levels in each frequency bin across the 1 MHz.

TEST RESULTS

No non-compliance noted

Test Data

Test mode: IEEE 802.11a mode / 5180 ~ 5220MHz

Channel	Frequency (MHz)	Maximum Conducted Output Power (dBm)	Limit (dBm)
Low	5180	16.55	17.00
High	5220	16.59	17.00

Test mode: IEEE 802.11n HT 20 MHz mode / 5180 ~ 5220MHz

Channel	Frequency (MHz)	Chain 0 Output Power (dBm)	Chain 1 Output Power (dBm)	Chain 2 Output Power (dBm)	Total Maximum Conducted Output Power (dBm)	Limit (dBm)
Low	5180	7.31	7.33	7.76	12.24	14.00
High	5220	7.51	7.63	7.46	12.31	14.00

Test mode: IEEE 802.11n HT 40 MHz mode / 5190 ~ 5210MHz

Channel	Frequency (MHz)	Chain 0 Output Power (dBm)	Chain 1 Output Power (dBm)	Chain 2 Output Power (dBm)	Total Maximum Conducted Output Power (dBm)	Limit (dBm)
Low	5190	6.84	6.73	6.64	11.51	14.00
High	5210	6.67	6.62	6.72	11.44	14.00

Remark:

1. Total Output Power (w) = Chain 0 (10^(Output Power /10)/1000) + Chain 1 (10^(Output Power /10)/1000) + Chain 2 (10^(Output Power /10)/1000)

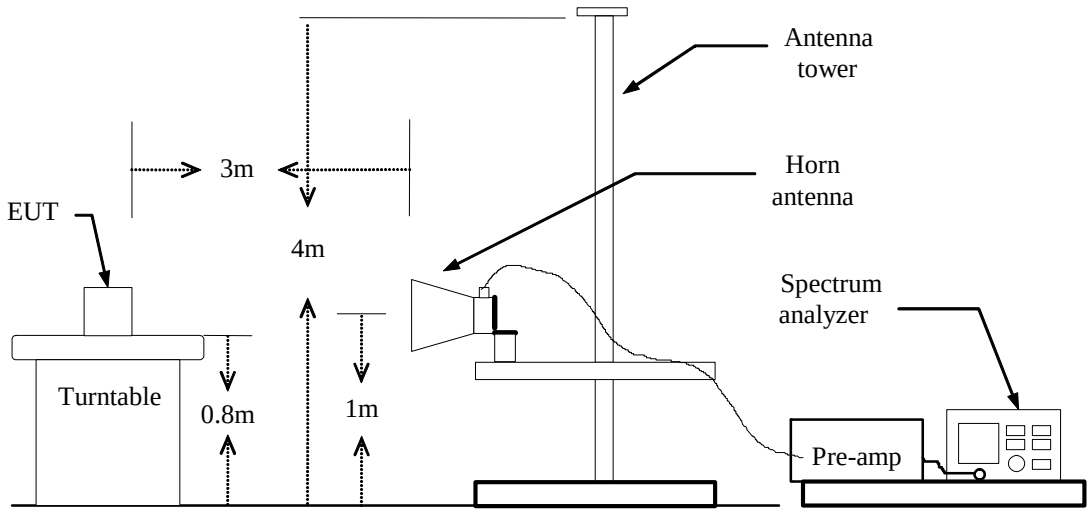
2. The maximum antenna gain is 9dBi; therefore the reduction due to antenna gain is 3dBi, so the limit is 14dBm.

7.3 BAND EDGES MEASUREMENT

LIMIT

According to §15.407(b),
(1) The provisions of Section 15.205 of this part apply to intentional radiators operating under this section.
(2) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the upper and lower frequency block edges as the design of the equipment permits.

Test Configuration



TEST PROCEDURE

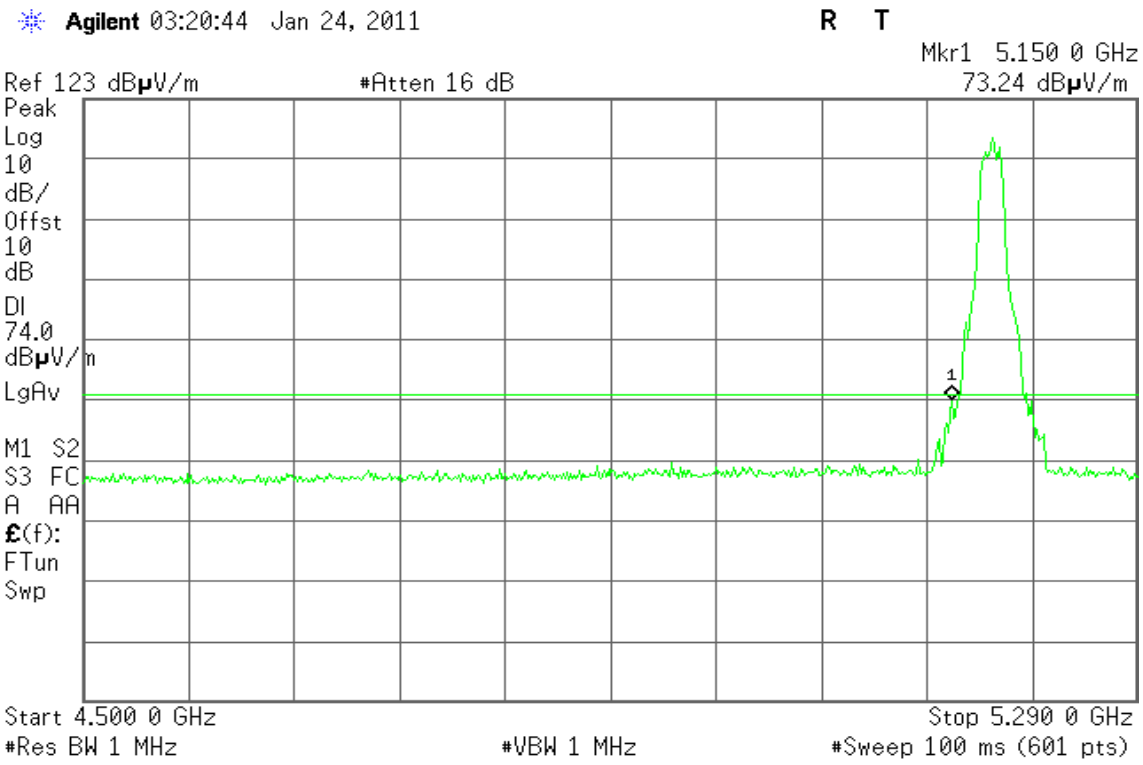
1. The EUT is placed on a turntable, which is 0.8m above the ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.
4. Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of the emission:
   (a) PEAK: RBW=VBW=1MHz / Sweep=AUTO
   (b) AVERAGE: RBW=1MHz / VBW=10Hz / Sweep=AUTO
5. Repeat the procedures until all the PEAK and AVERAGE versus POLARIZATION are measured.

TEST RESULTS

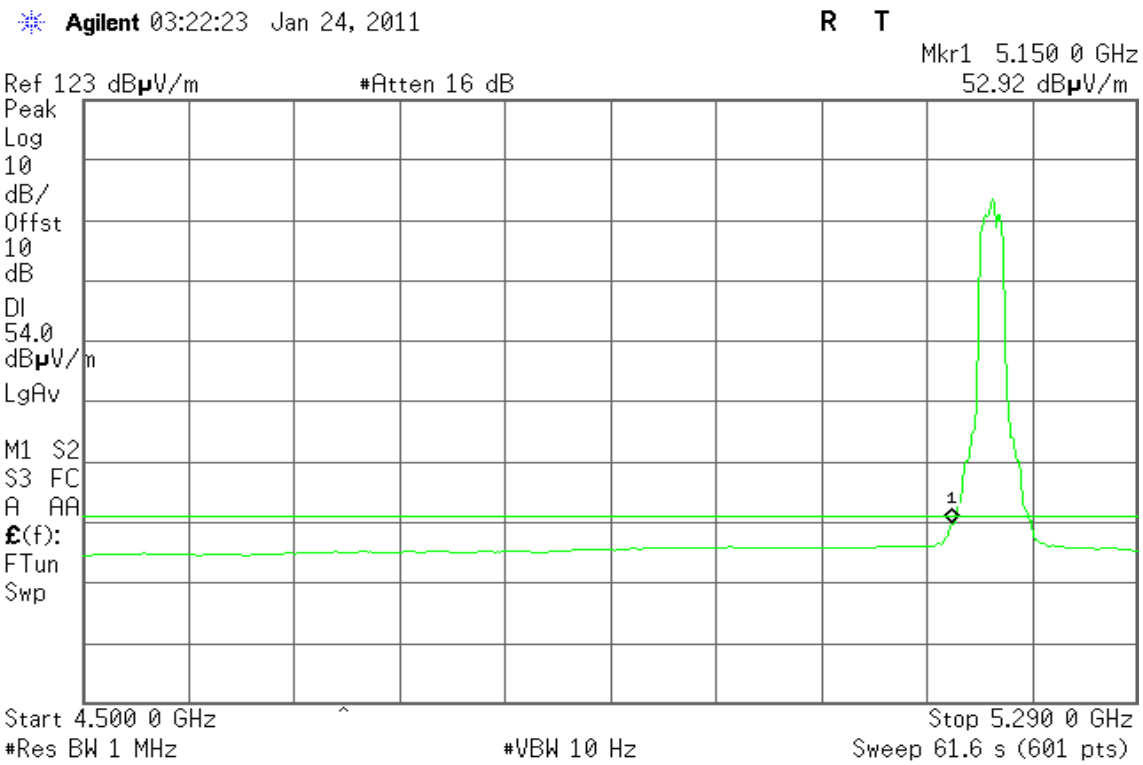
Refer to attach spectrum analyzer data chart.

Band Edges (IEEE 802.11a mode / 5180 MHz)

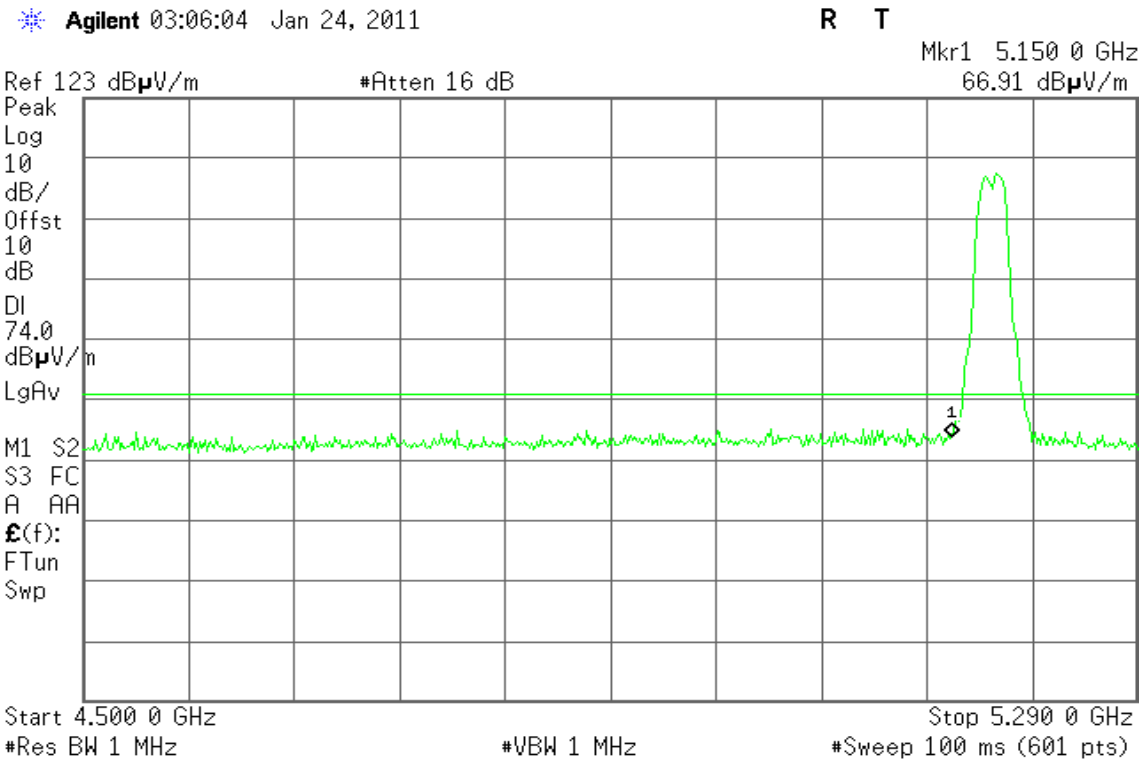
Detector mode: Peak **Polarity: Vertical**



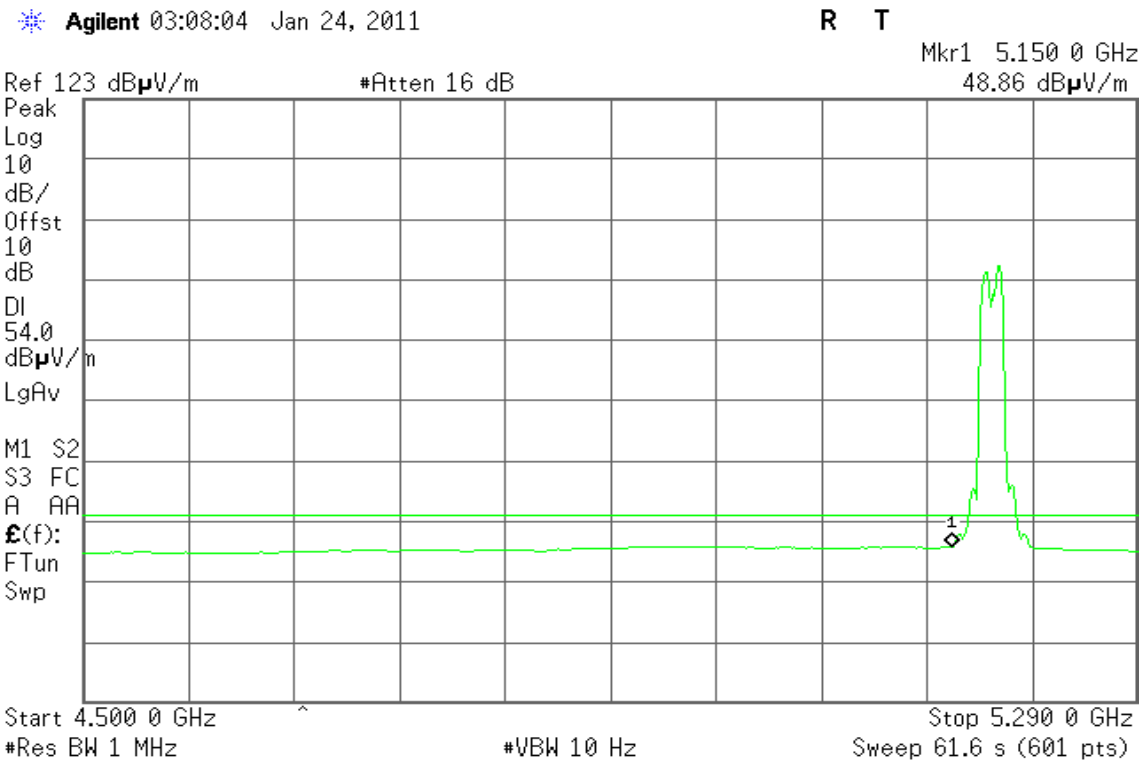
Detector mode: Average **Polarity: Vertical**



Detector mode: Peak **Polarity: Horizontal**

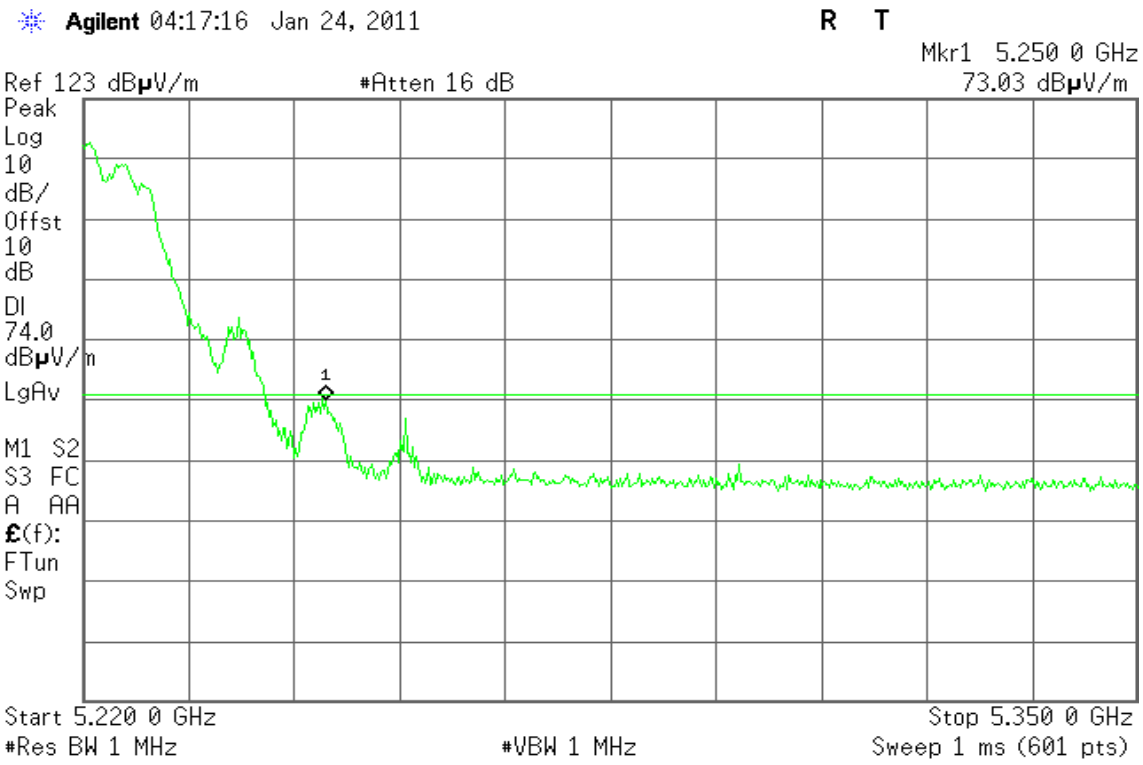


Detector mode: Average **Polarity: Horizontal**

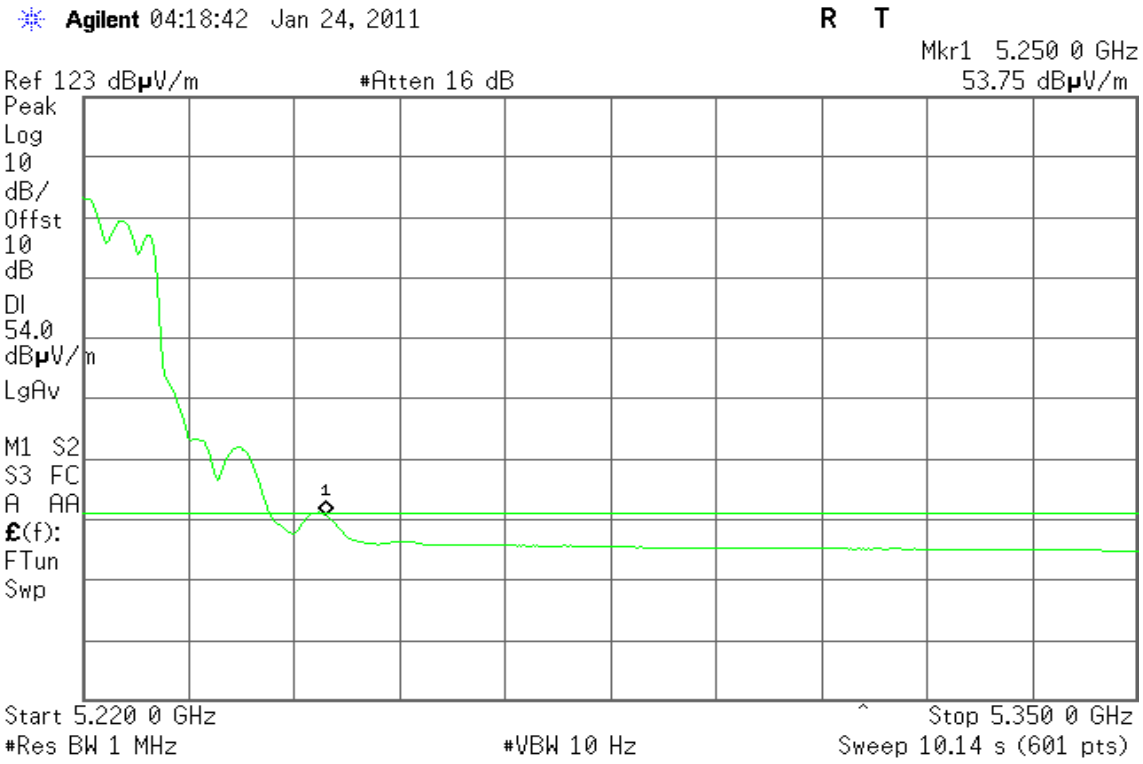


Band Edges (IEEE 802.11a mode / 5220 MHz)

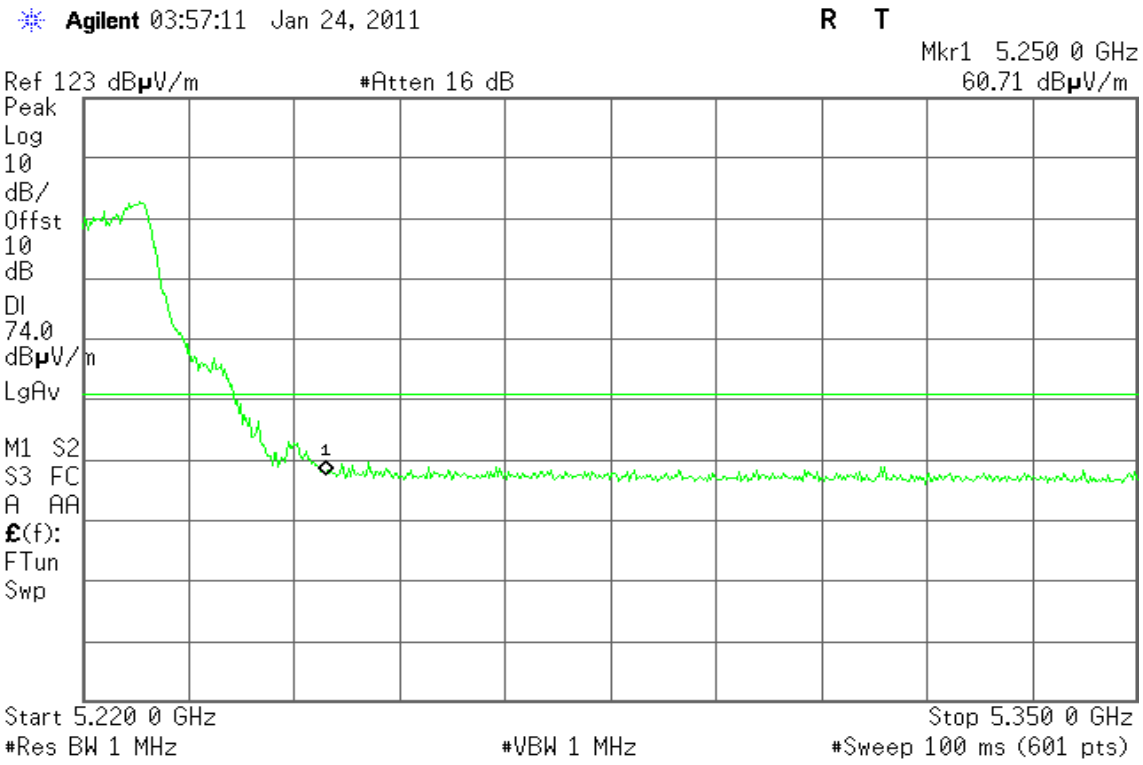
Detector mode: Peak **Polarity: Vertical**



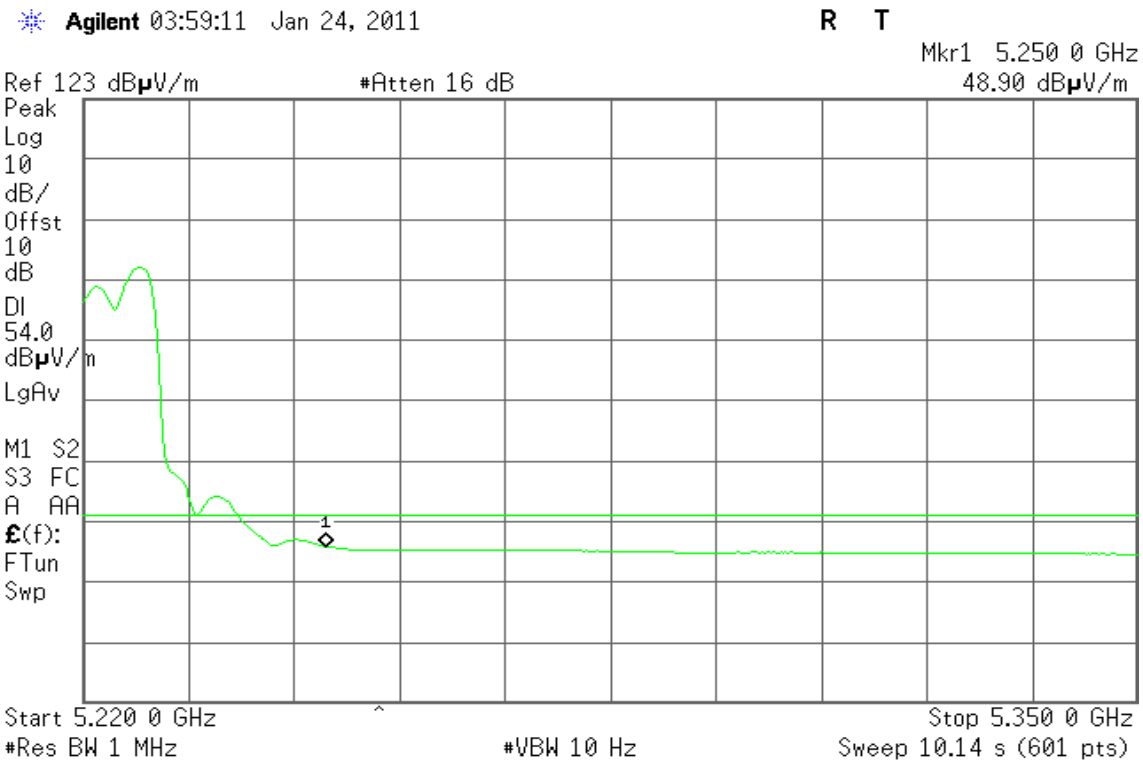
Detector mode: Average **Polarity: Vertical**



Detector mode: Peak **Polarity: Horizontal**

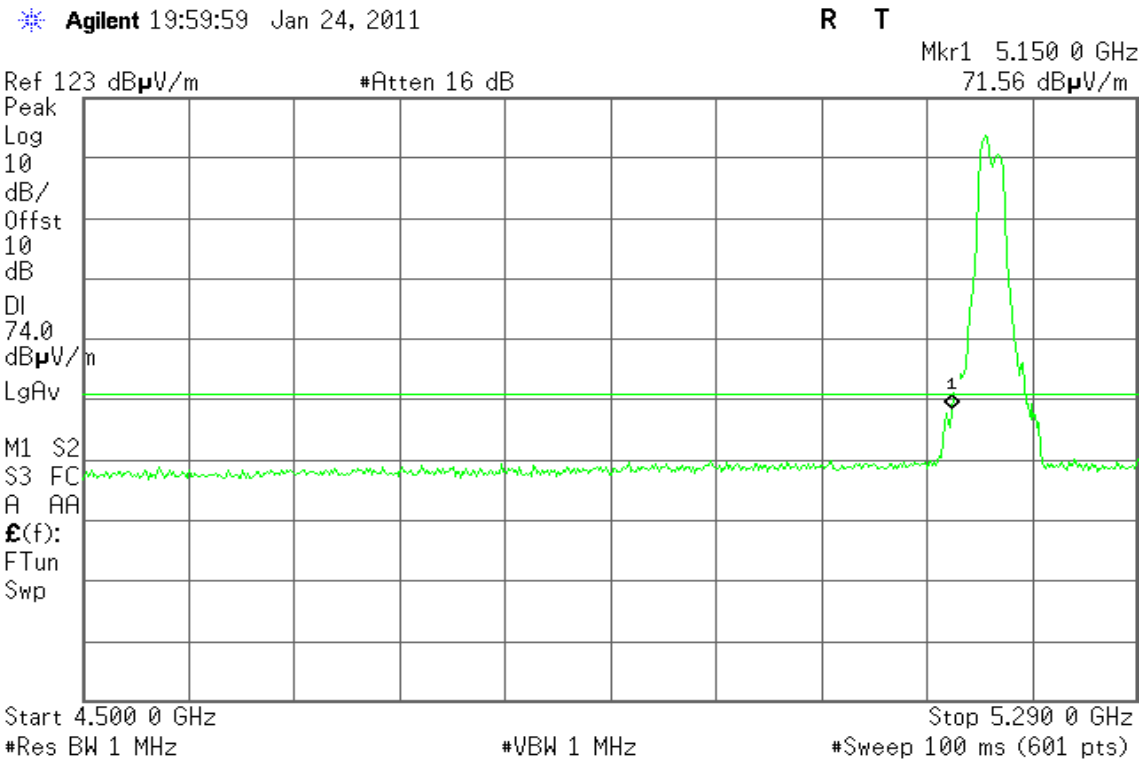


Detector mode: Average **Polarity: Horizontal**

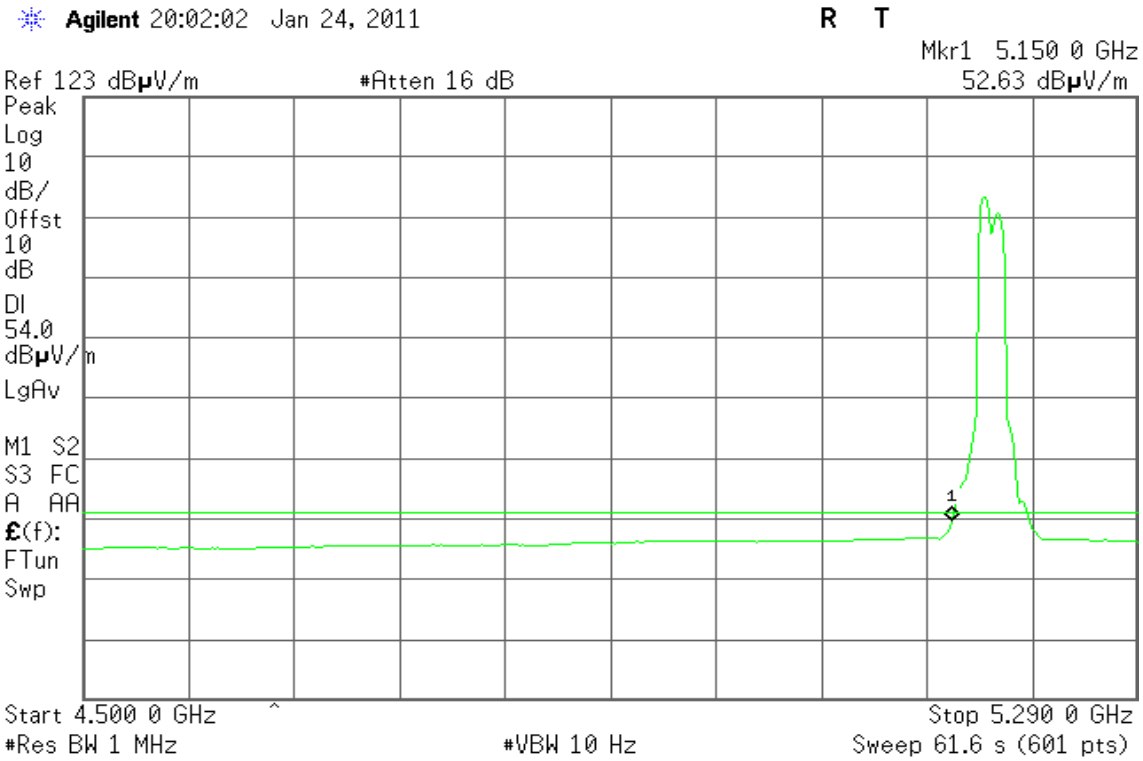


Band Edges (IEEE 802.11n HT 20 MHz mode / 5180 MHz)

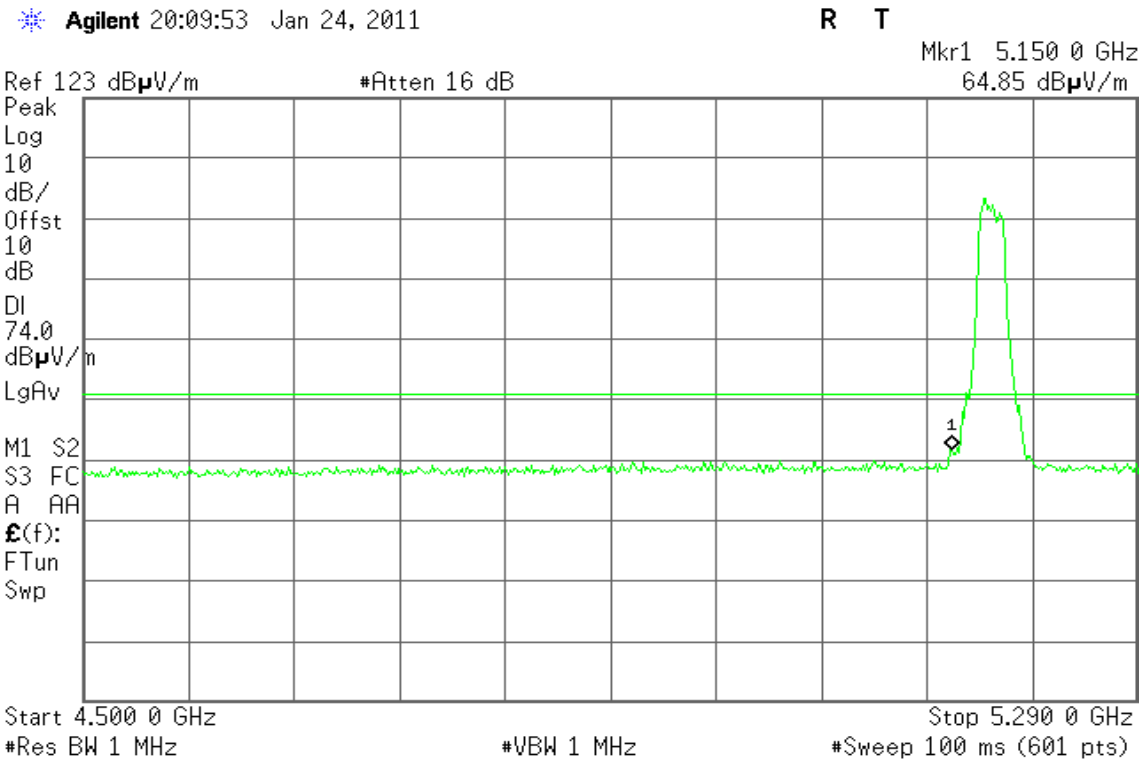
Detector mode: Peak **Polarity: Vertical**



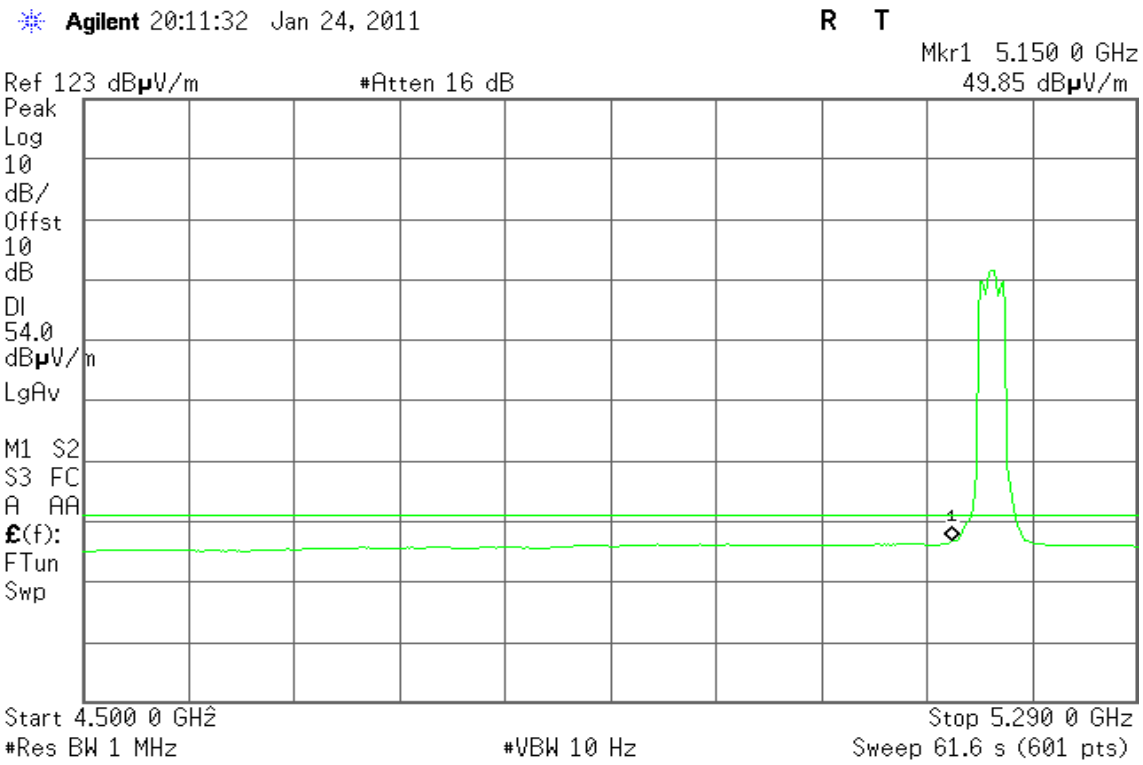
Detector mode: Average **Polarity: Vertical**



Detector mode: Peak **Polarity: Horizontal**

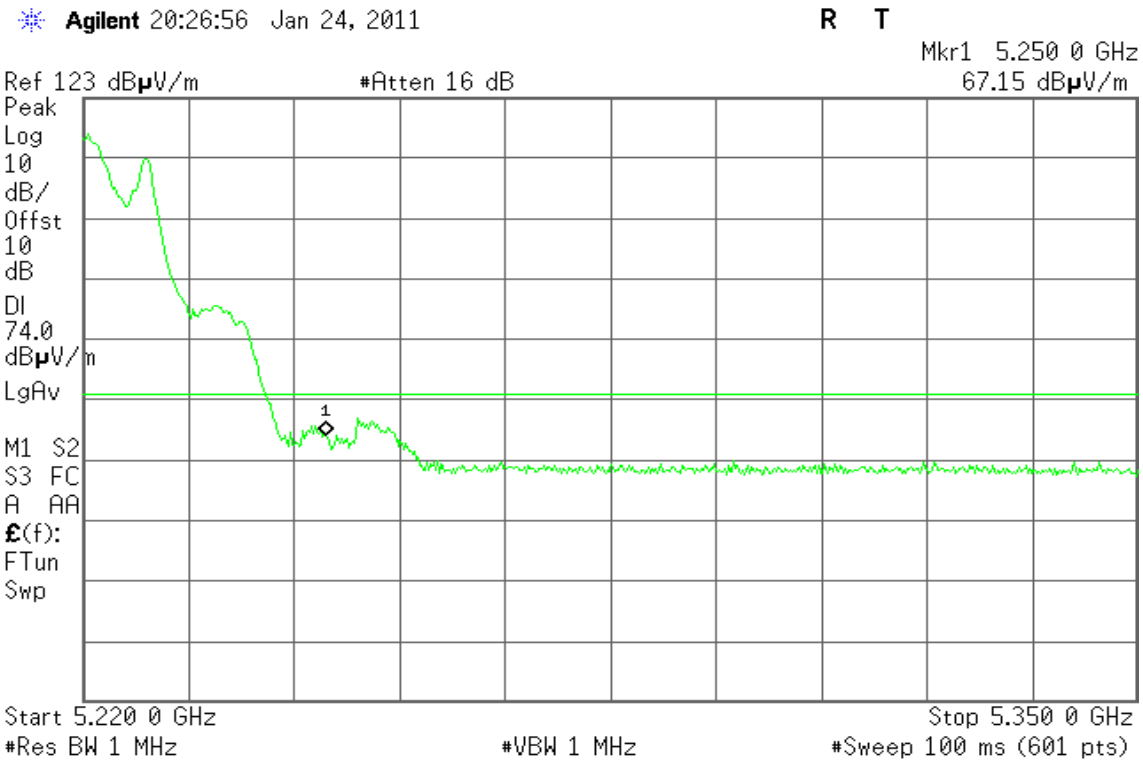


Detector mode: Average **Polarity: Horizontal**

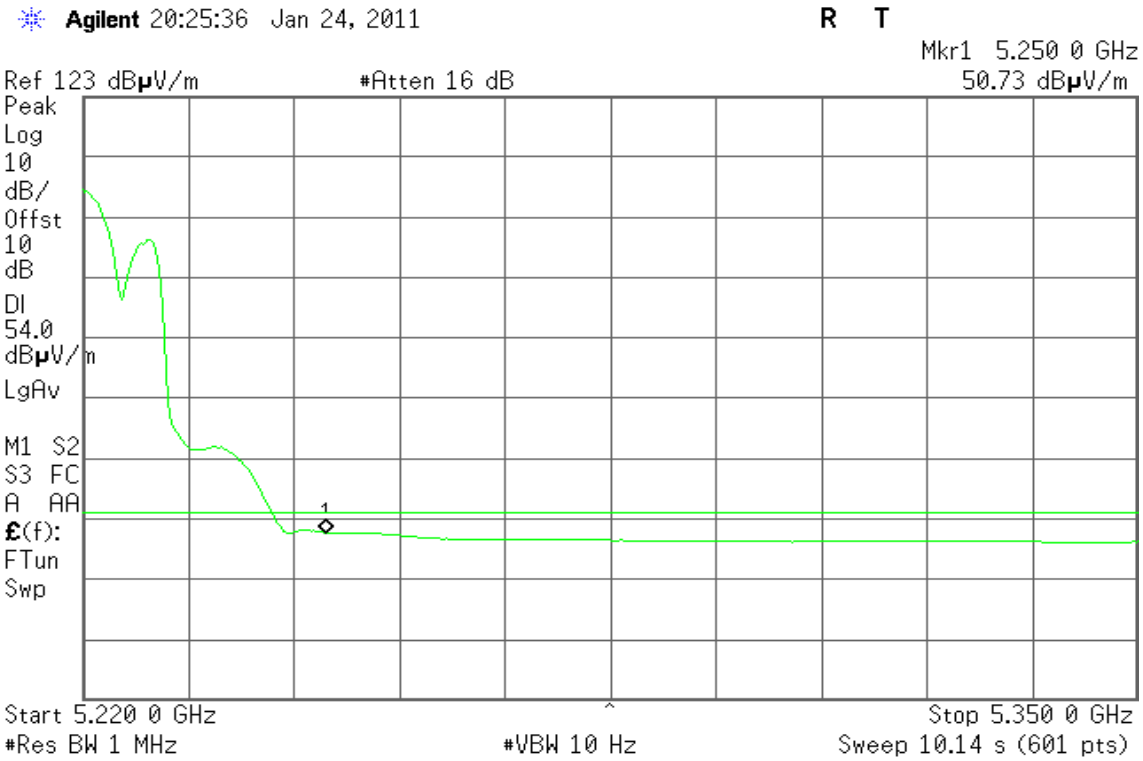


Band Edges (IEEE 802.11n HT 20 MHz mode / 5220 MHz)

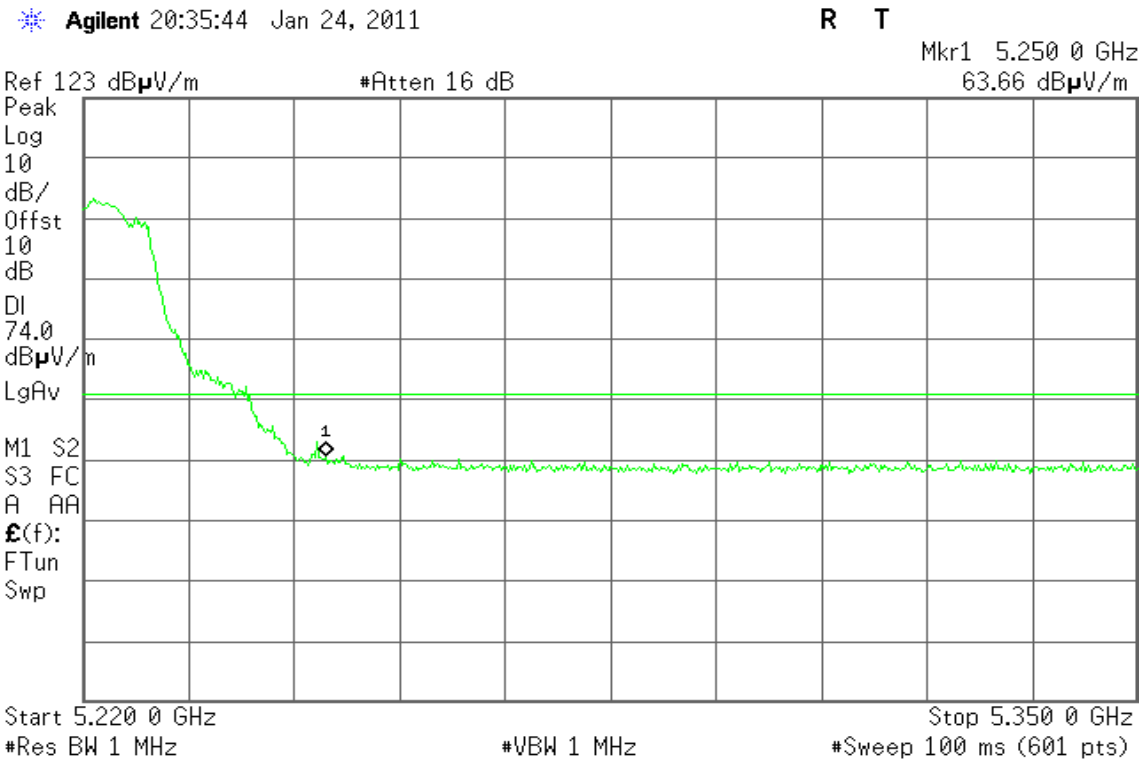
Detector mode: Peak **Polarity: Vertical**



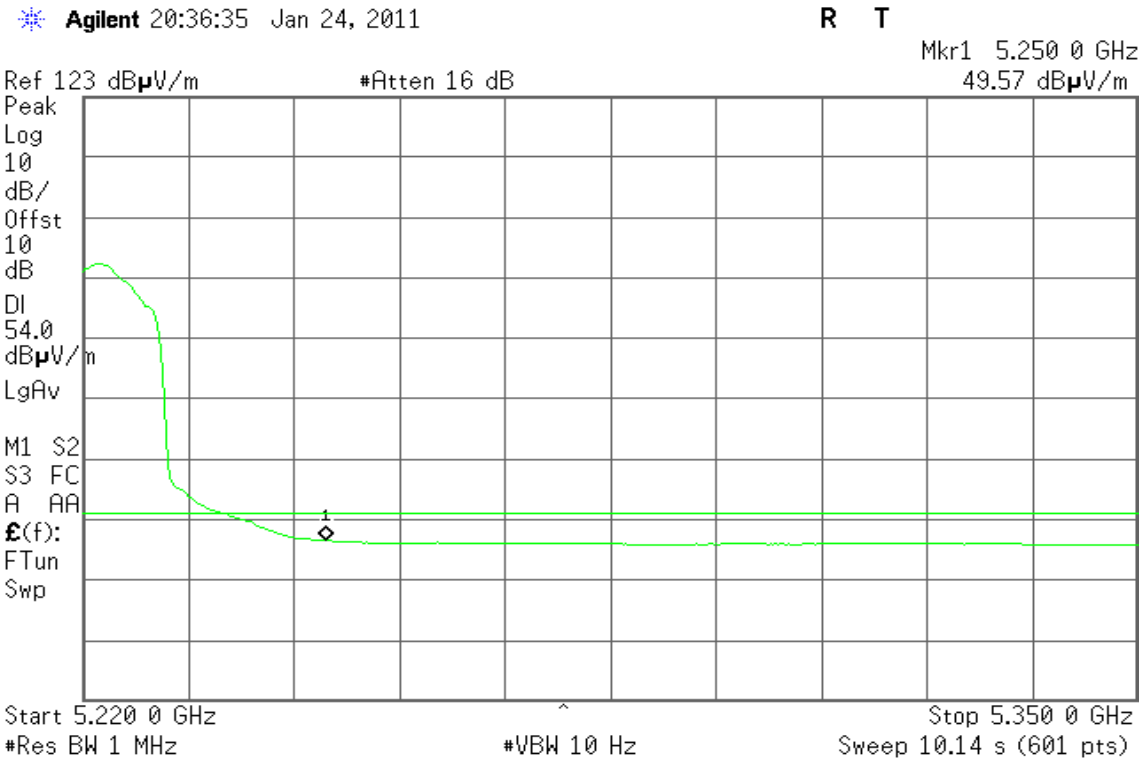
Detector mode: Average **Polarity: Vertical**



Detector mode: Peak **Polarity: Horizontal**

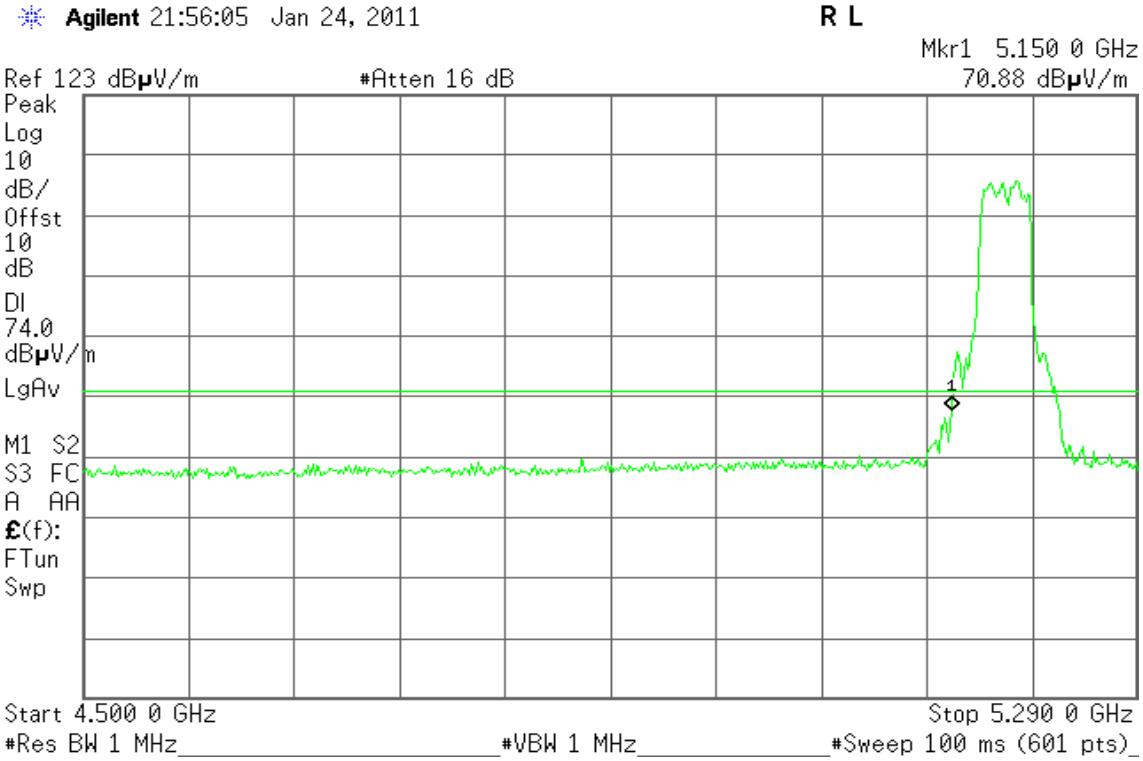


Detector mode: Average **Polarity: Horizontal**

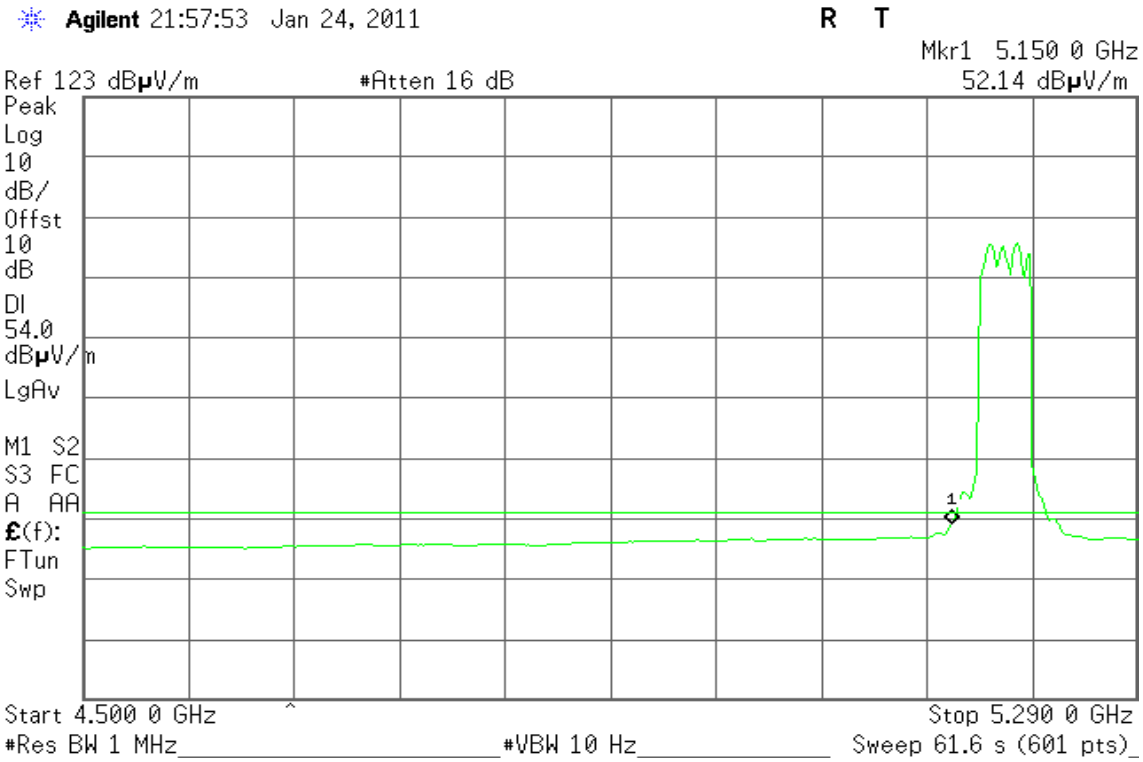


Band Edges (IEEE 802.11n HT 40 MHz mode / 5190 MHz)

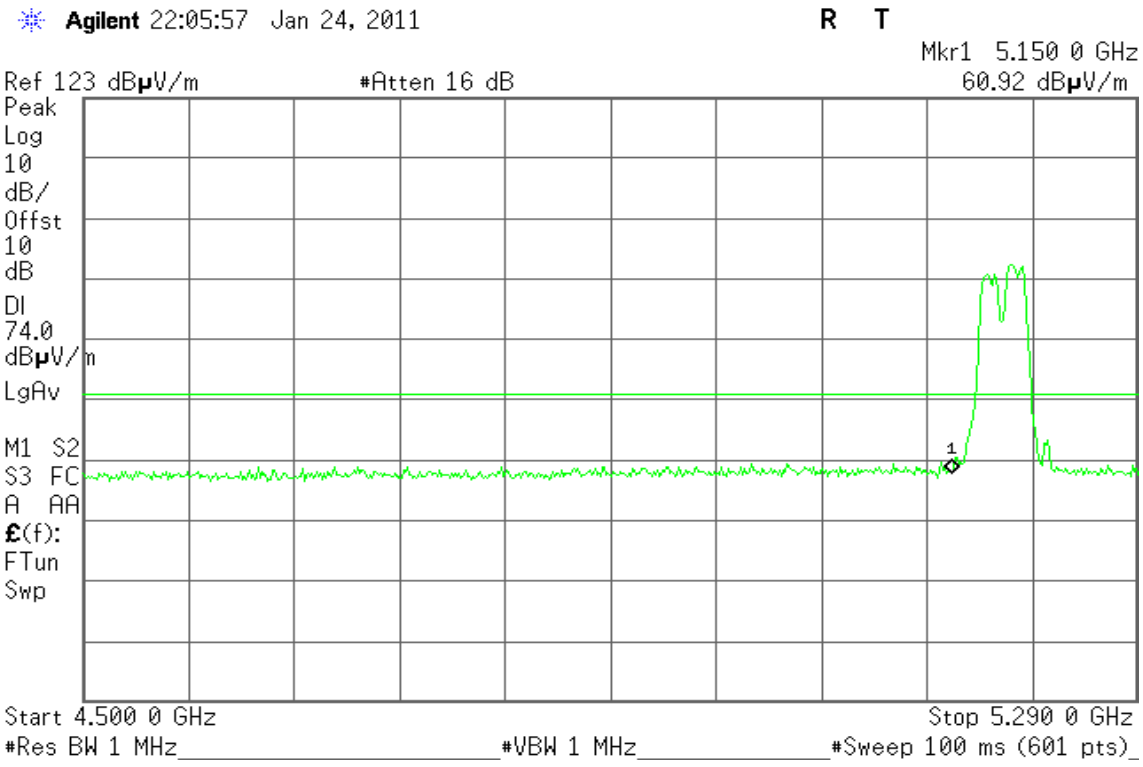
Detector mode: Peak **Polarity: Vertical**



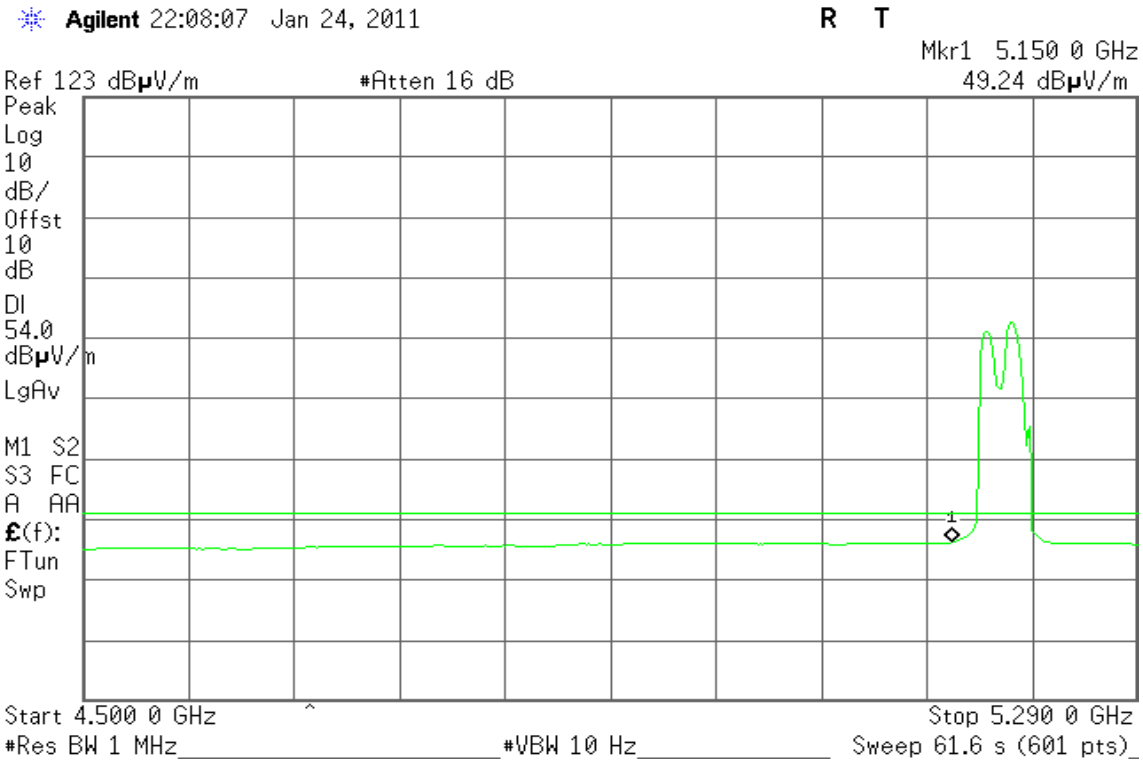
Detector mode: Average **Polarity: Vertical**



Detector mode: Peak **Polarity: Horizontal**

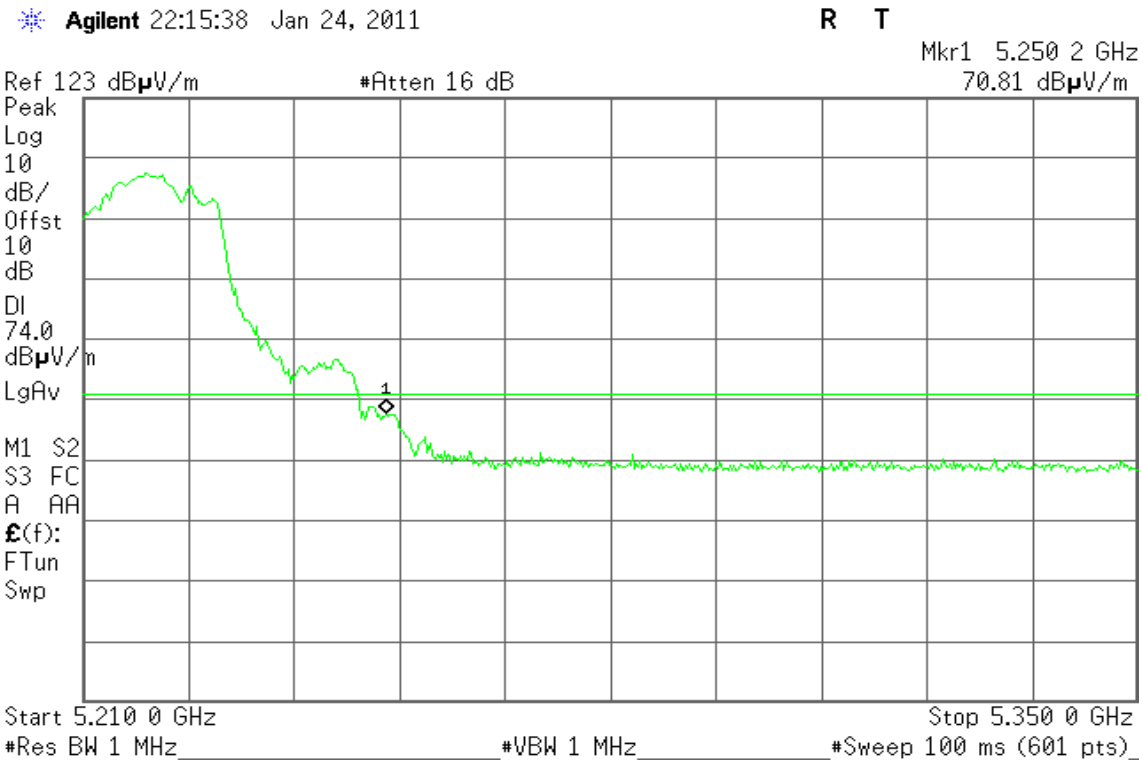


Detector mode: Average **Polarity: Horizontal**

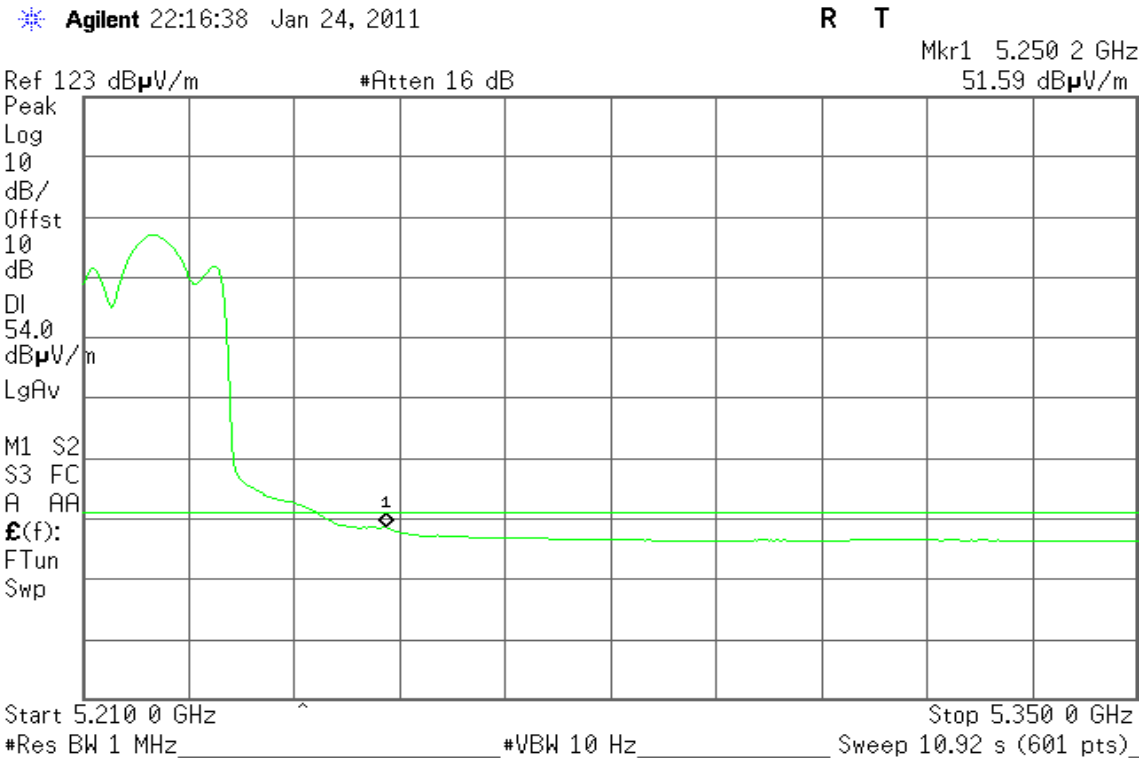


Band Edges (IEEE 802.11n HT 40 MHz mode / CH 5210 MHz)

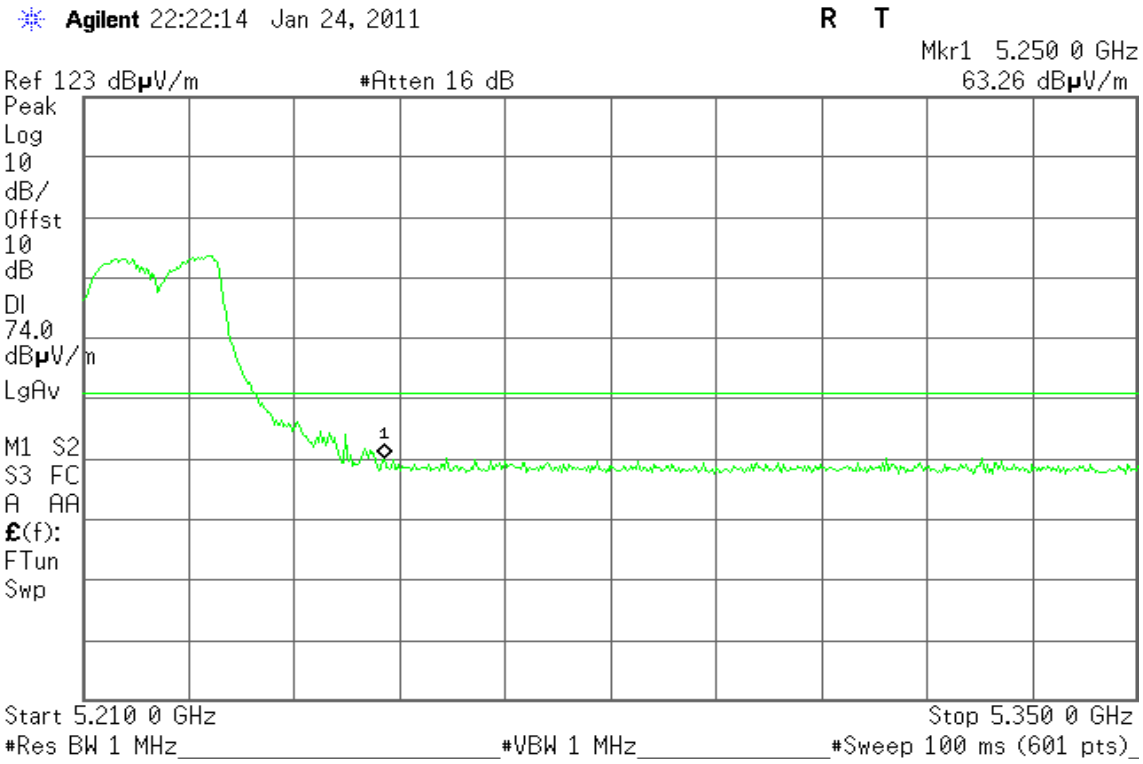
Detector mode: Peak **Polarity: Vertical**



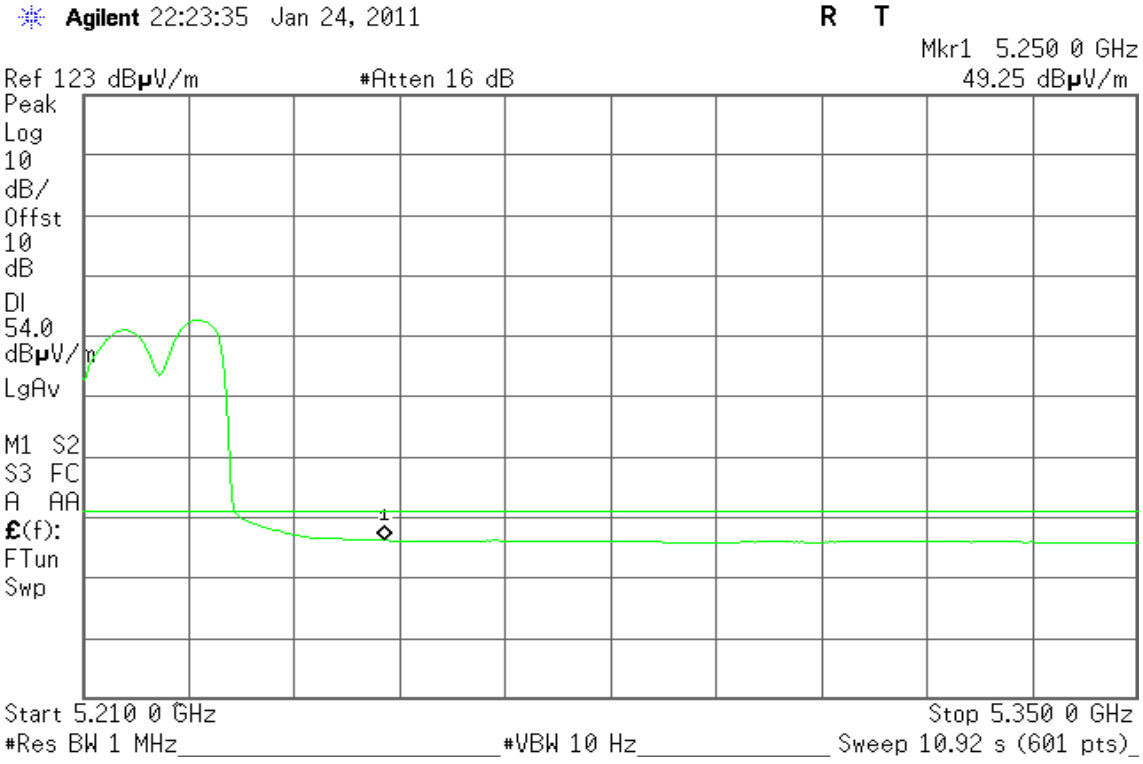
Detector mode: Average **Polarity: Vertical**



Detector mode: Peak **Polarity: Horizontal**



Detector mode: Average **Polarity: Horizontal**



7.4 PEAK POWER SPECTRAL DENSITY

LIMIT

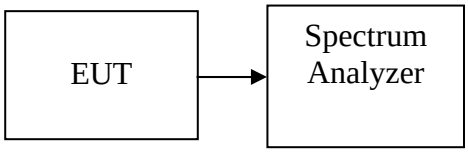
According to §15.407(a),

(1) For the band 5.15-5.25 GHz, the peak power spectral density shall not exceed 4dBm in any 1MHz band.

(2) For the band 5.25-5.35 GHz, the peak power spectral density shall not exceed 11dBm in any 1MHz band.

If transmitting antennas of directional gain greater than 6dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

Test Configuration



TEST PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.
   Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
2. Set the spectrum analyzer as RBW = 1MHz, VBW = 3MHz, Span = 30MHz, Sweep=1ms
3. Record the max. reading.
4. Repeat the above procedure until the measurements for all frequencies are completed

TEST RESULTS

No non-compliance noted

Test Data

Test mode: IEEE 802.11a mode / 5180 ~ 5220MHz

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin	Result
Low	5180	0.143	4.00	-3.86	PASS
High	5220	0.121	4.00	-3.88	PASS

Test mode: IEEE 802.11n HT 20 MHz mode / 5180 ~ 5220MHz

Channel	Frequency (MHz)	Chain 0 PPSD (dBm)	Chain 1 PPSD (dBm)	Chain 2 PPSD (dBm)	PPSD (dBm)	Limit (dBm)	Margin	Result
Low	5180	-9.552	-9.063	-9.032	-4.44	1.00	-6.44	PASS
High	5220	-9.822	-9.209	-9.514	-4.74	1.00	-6.74	PASS

Test mode: IEEE 802.11n HT 40 MHz mode / 5190 ~ 5210MHz

Channel	Frequency (MHz)	Chain 0 PPSD (dBm)	Chain 1 PPSD (dBm)	Chain 2 PPSD (dBm)	PPSD (dBm)	Limit (dBm)	Margin	Result
Low	5190	-13.596	-12.466	-12.919	-8.20	1.00	-10.20	PASS
High	5210	-13.377	-12.945	-13.393	-8.46	1.00	-10.46	PASS

Test mode: IEEE 802.11n HT 20 MHz mode / 5180 ~ 5220MHz with combiner

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin	Result
Low	5180	-4.010	1.00	-6.01	PASS
High	5220	-3.132	1.00	-5.13	PASS

Test mode: IEEE 802.11n HT 40 MHz mode / 5190 ~ 5210MHz with combiner

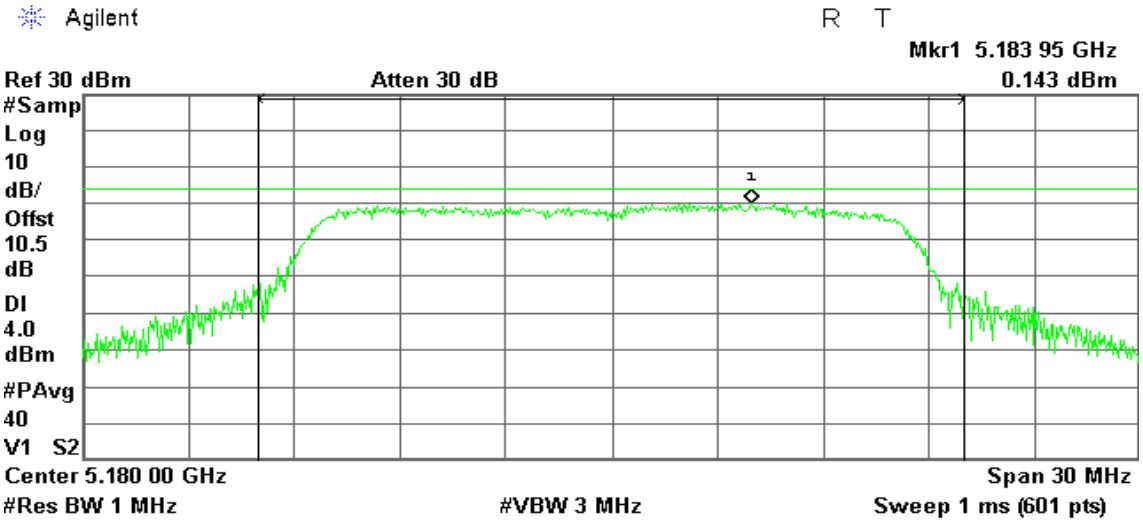
Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin	Result
Low	5190	-6.829	1.00	-8.83	PASS
High	5210	-7.133	1.00	-9.13	PASS

Remark:

*1. Total PPSD (dBm) = 10*LOG(10^(Chain 0 PPSD / 10)+10^(Chain 1 PPSD /10)+10^(Chain 2 PPSD /10))*
2. The maximum antenna gain is 9 dBi; therefore the reduction due to antenna gain is 3 dBi, so the limit is 1 dBm.

Test Plot
IEEE 802.11a mode / 5180 ~ 5220MHz

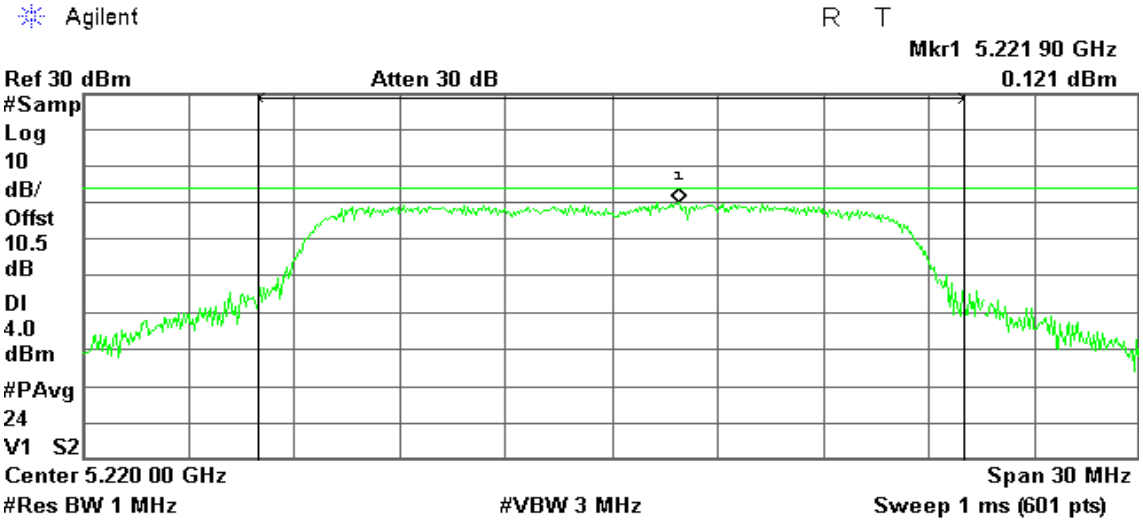
CH Low



Channel Power
10.06 dBm / 20.0000 MHz

Power Spectral Density
-62.95 dBm/Hz

CH High

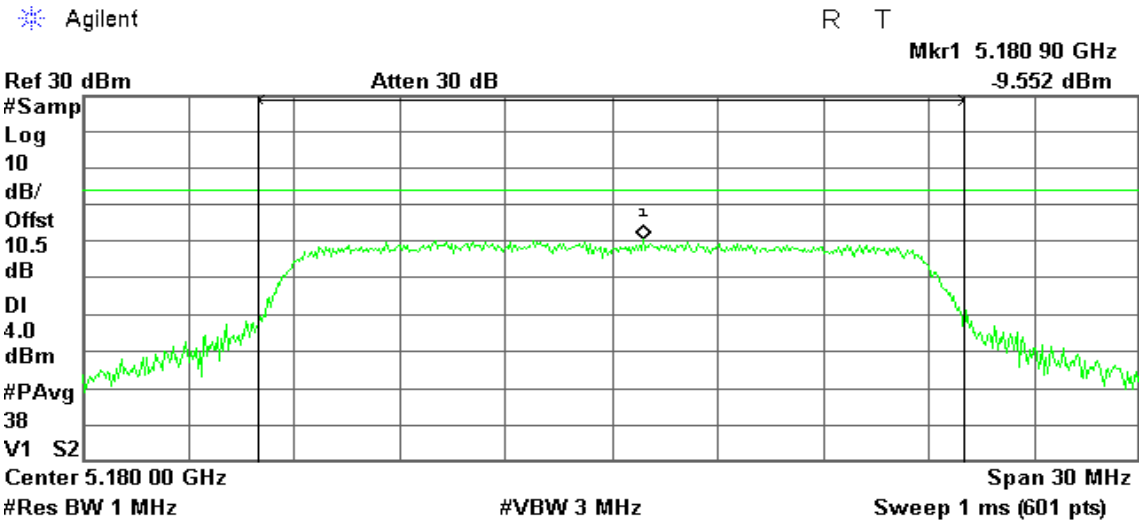


Channel Power
9.49 dBm / 20.0000 MHz

Power Spectral Density
-63.52 dBm/Hz

IEEE 802.11n HT 20 MHz mode / 5180 ~ 5220MHz / Chain 0

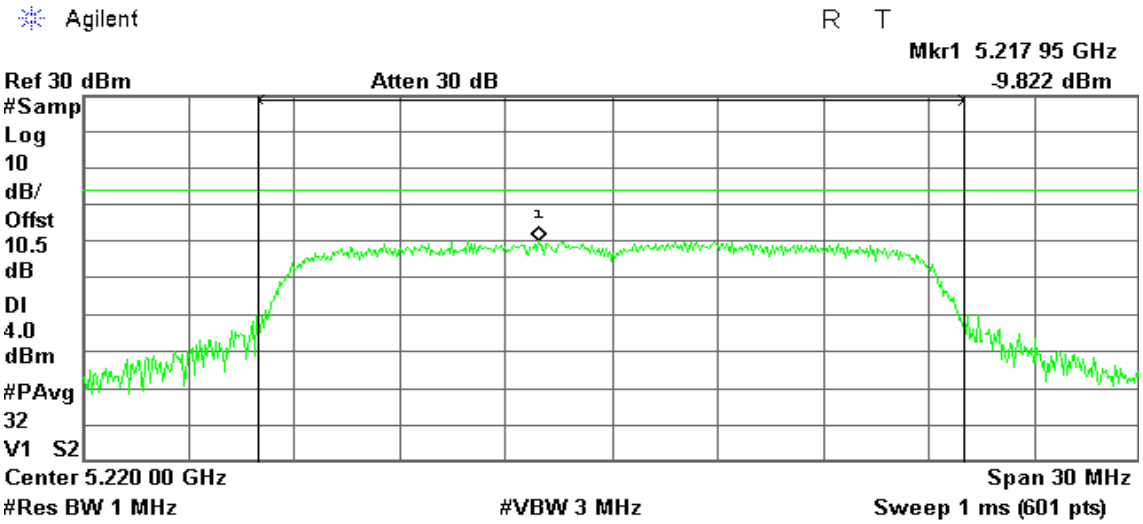
CH Low



Channel Power
0.31 dBm /20.0000 MHz

Power Spectral Density
-72.70 dBm/Hz

CH High

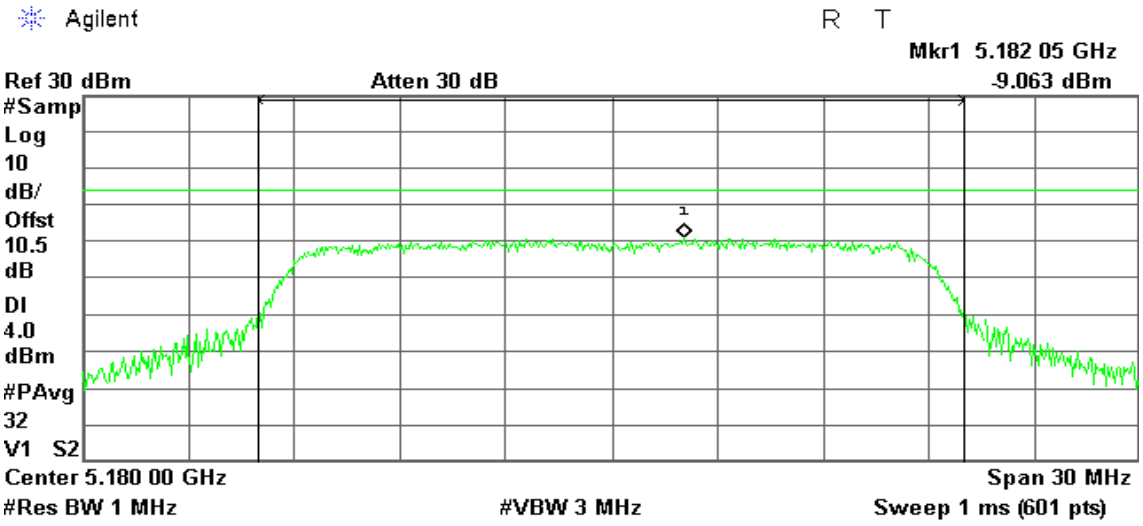


Channel Power
-0.40 dBm /20.0000 MHz

Power Spectral Density
-73.41 dBm/Hz

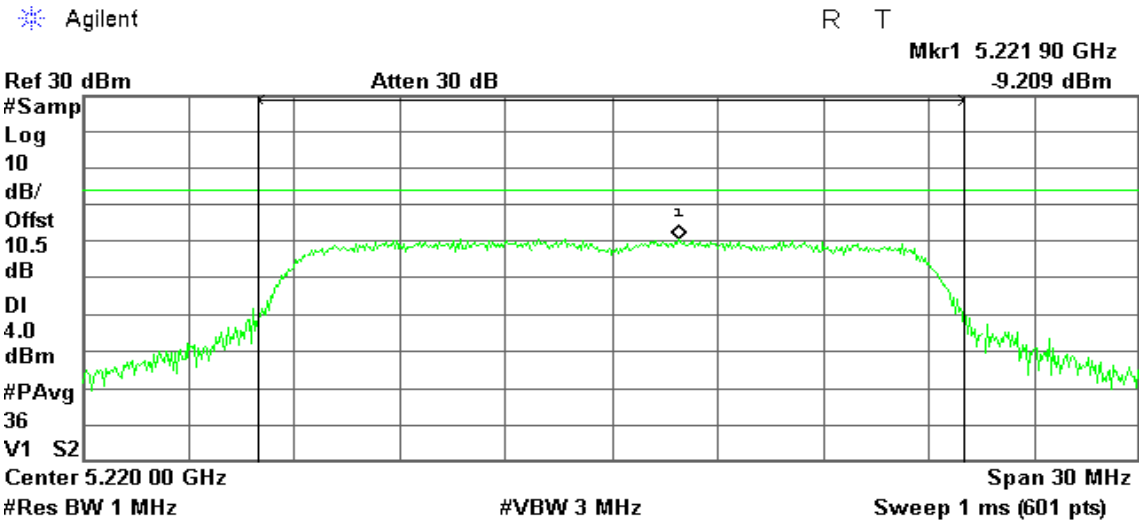
IEEE 802.11n HT 20 MHz mode / 5180 ~ 5220MHz / Chain 1

CH Low



Channel Power	Power Spectral Density
1.03 dBm / 20.0000 MHz	-71.98 dBm/Hz

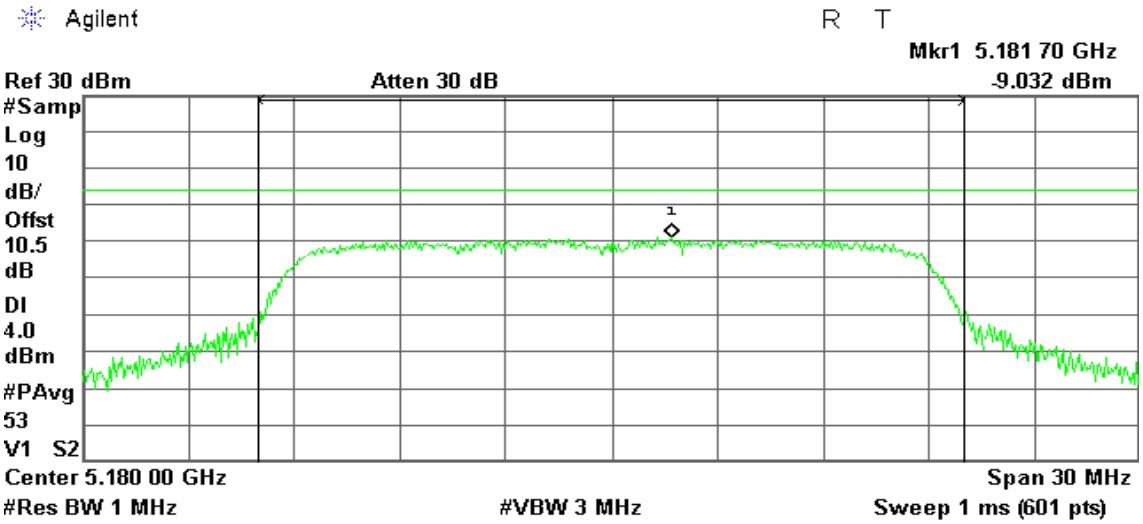
CH High



Channel Power	Power Spectral Density
0.85 dBm / 20.0000 MHz	-72.16 dBm/Hz

IEEE 802.11n HT 20 MHz mode / 5180 ~ 5220MHz / Chain 2

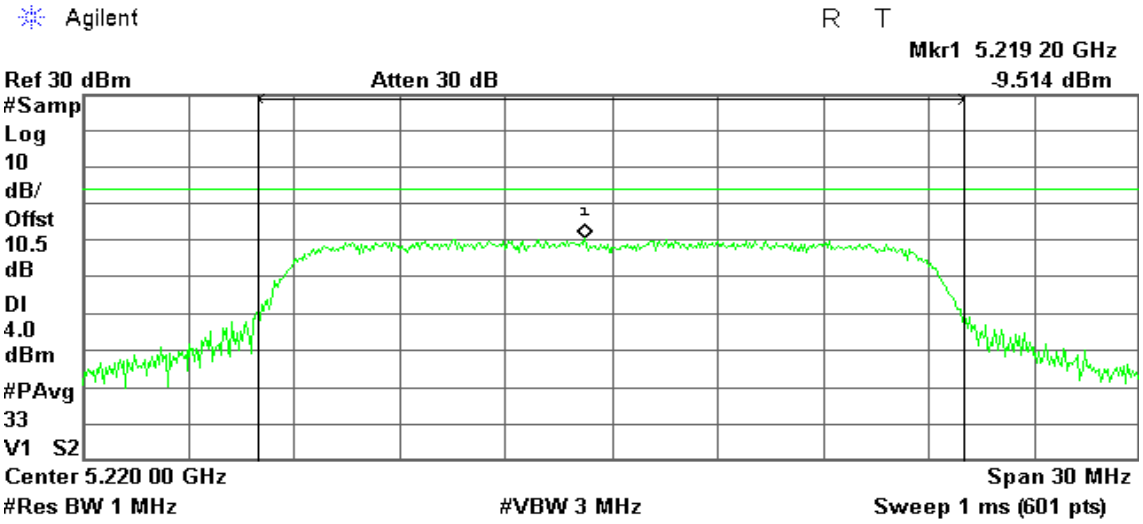
CH Low



Channel Power
1.45 dBm /20.0000 MHz

Power Spectral Density
-71.56 dBm/Hz

CH High

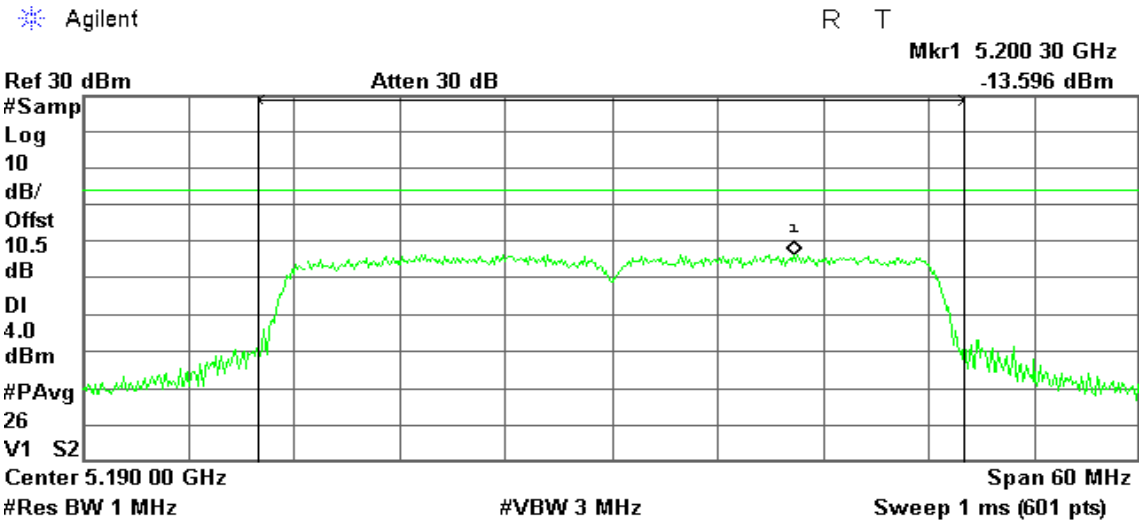


Channel Power
0.97 dBm /20.0000 MHz

Power Spectral Density
-72.04 dBm/Hz

IEEE 802.11n HT 40 MHz mode / 5190 ~ 5210MHz / Chain 0

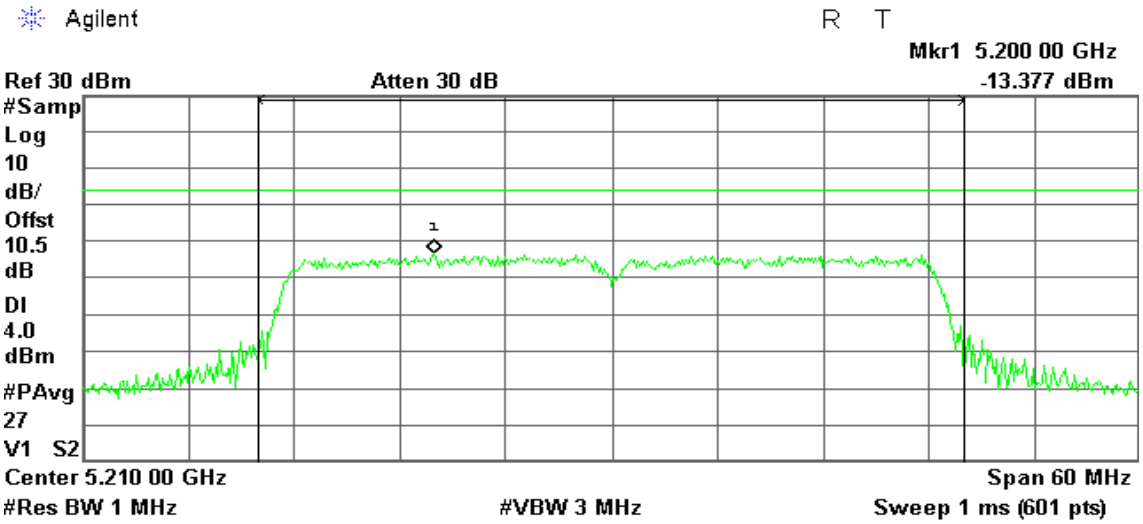
CH Low



Channel Power
0.93 dBm /40.0000 MHz

Power Spectral Density
-75.09 dBm/Hz

CH High

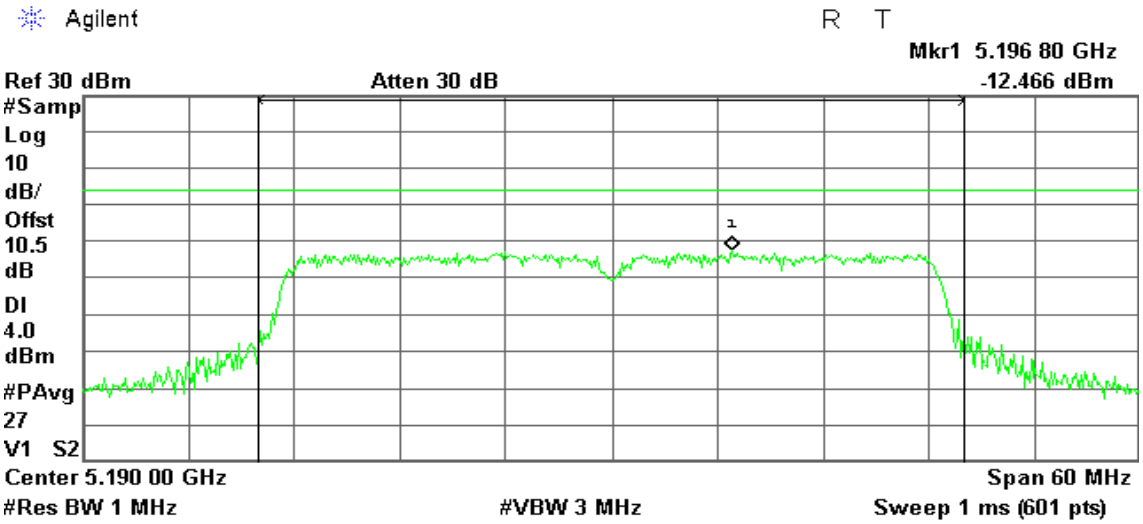


Channel Power
-0.70 dBm /40.0000 MHz

Power Spectral Density
-76.72 dBm/Hz

IEEE 802.11n HT 40 MHz mode / 5190 ~ 5210MHz / Chain 1

CH Low



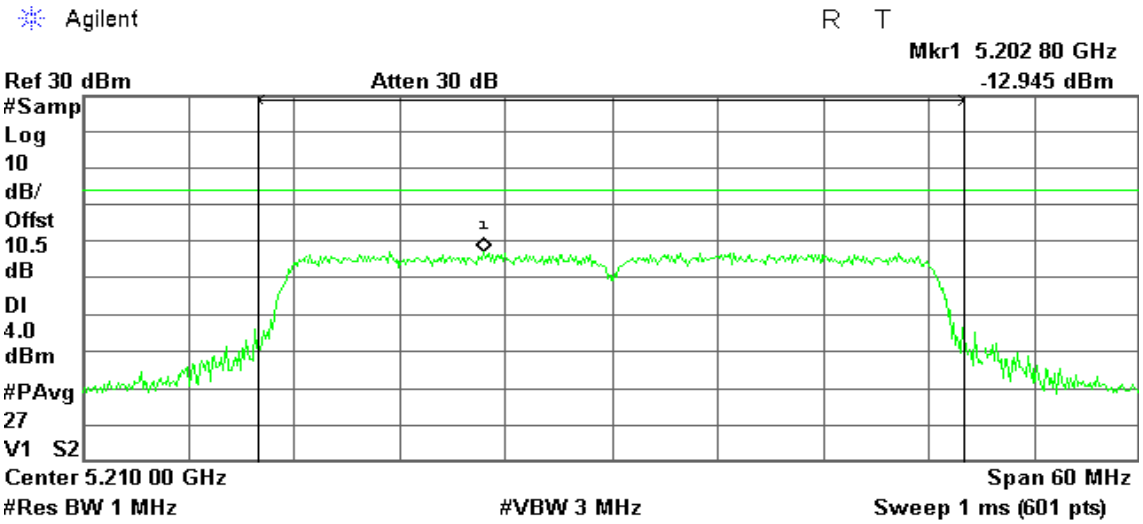
Channel Power

0.45 dBm /40.0000 MHz

Power Spectral Density

-75.57 dBm/Hz

CH High



Channel Power

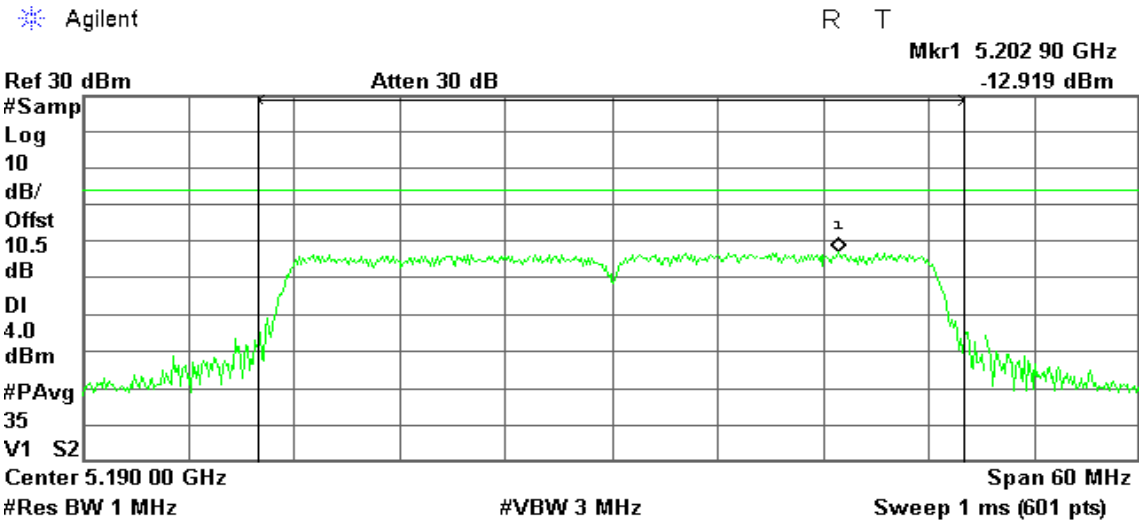
-0.29 dBm /40.0000 MHz

Power Spectral Density

-76.31 dBm/Hz

IEEE 802.11n HT 40 MHz mode / 5190 ~ 5210MHz / Chain 2

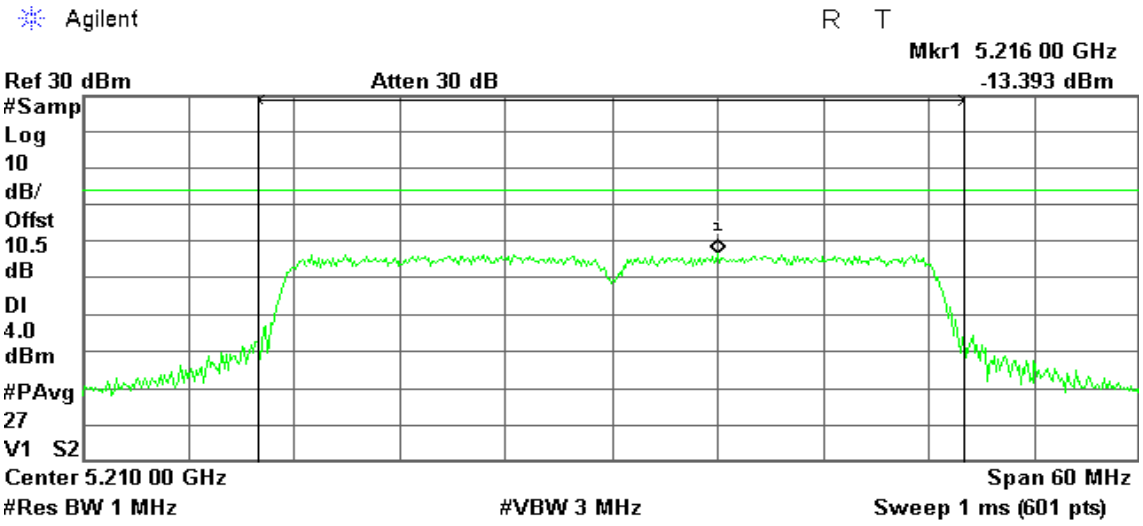
CH Low



Channel Power
1.06 dBm /40.0000 MHz

Power Spectral Density
-74.96 dBm/Hz

CH High

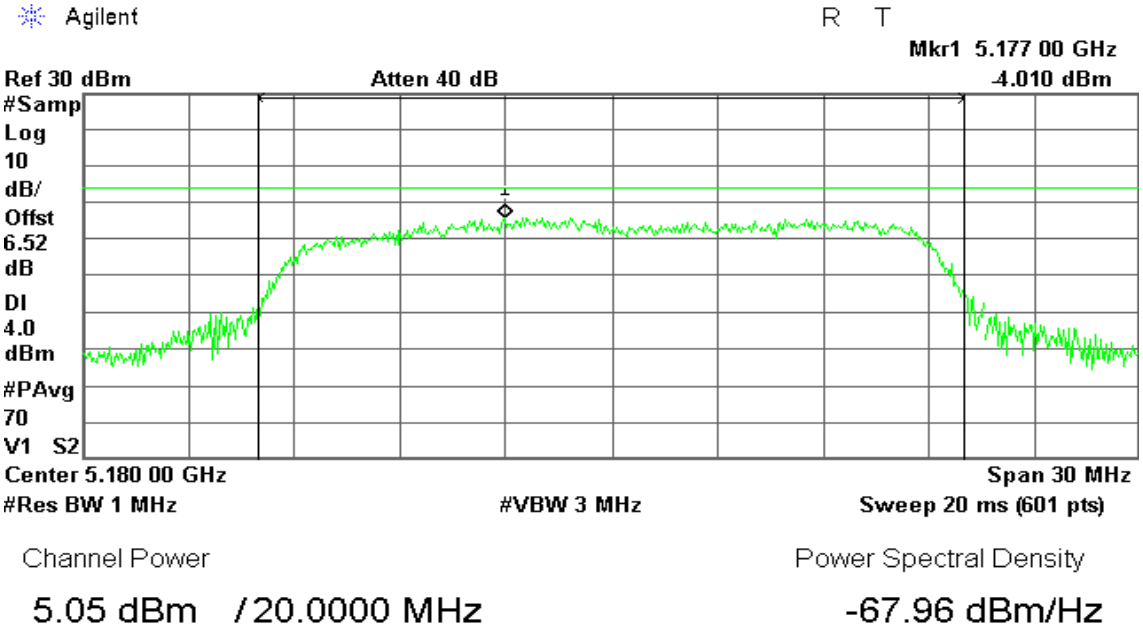


Channel Power
0.26 dBm /40.0000 MHz

Power Spectral Density
-75.76 dBm/Hz

Test mode: IEEE 802.11n HT 20 MHz mode / 5180 ~ 5220MHz with combiner:

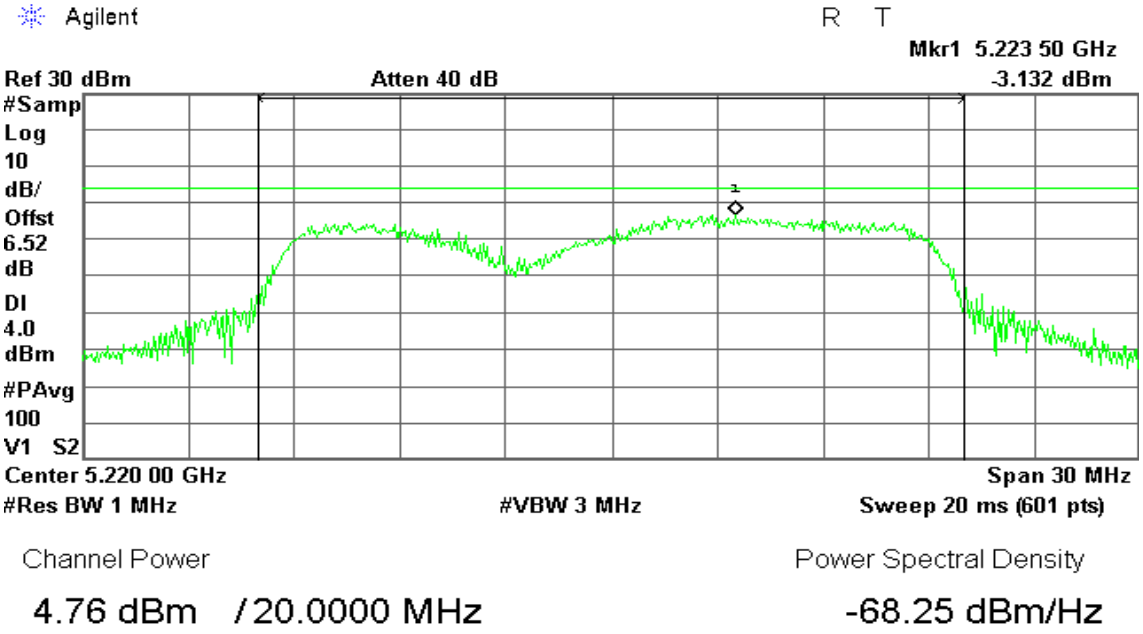
CH Low



Channel Power
5.05 dBm /20.0000 MHz

Power Spectral Density
-67.96 dBm/Hz

CH High

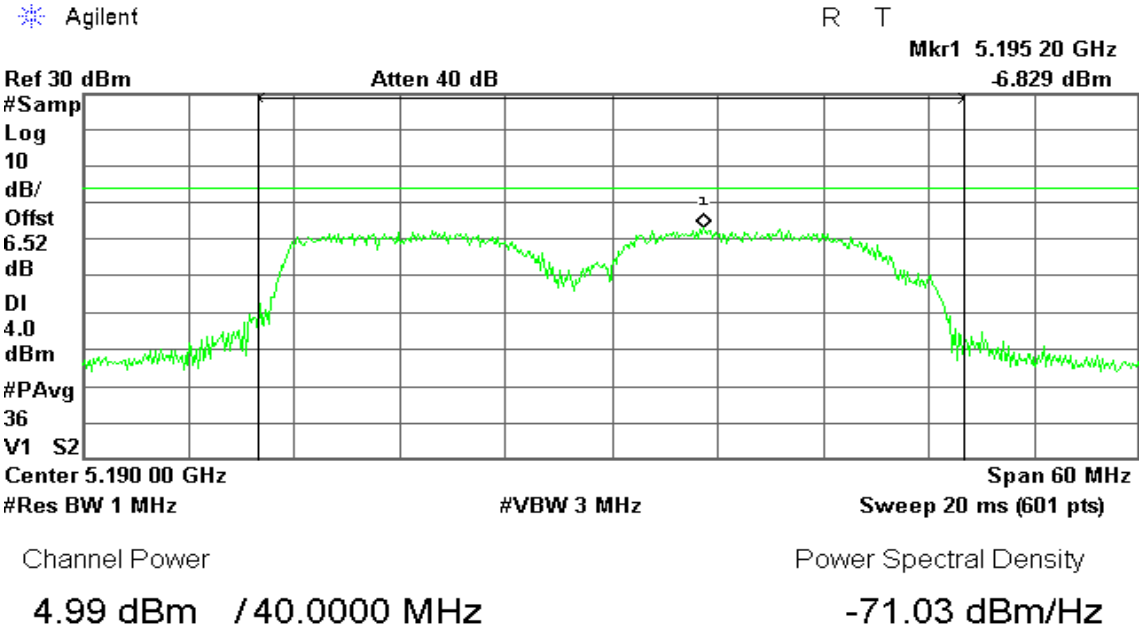


Channel Power
4.76 dBm /20.0000 MHz

Power Spectral Density
-68.25 dBm/Hz

Test mode: IEEE 802.11n HT 40 MHz mode / 5190 ~ 5210MHz with combiner:

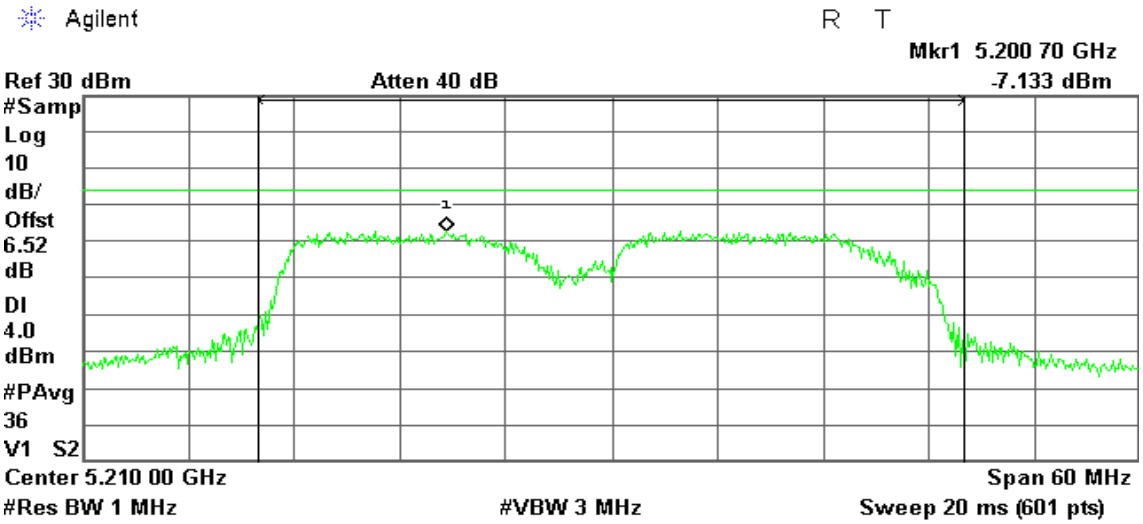
CH Low



Channel Power
4.99 dBm /40.0000 MHz

Power Spectral Density
-71.03 dBm/Hz

CH High



Channel Power
4.84 dBm /40.0000 MHz

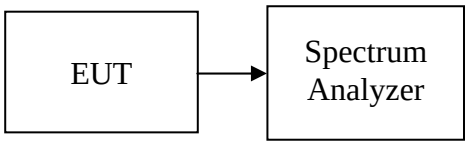
Power Spectral Density
-71.18 dBm/Hz

7.5 PEAK EXCURSION

LIMIT

According to §15.407(a)(6), the ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the maximum conducted output power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

Test Configuration



TEST PROCEDURE

The test is performed in accordance with <FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices> – Part 15, Subpart E, August 2002.

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to spectrum.
3. Trace A, Set RBW =1MHz, VBW = 3MHz, Span >26dB bandwidth, Max. hold.
4. Trace B, Set RBW = 1MHz, VBW = 30kHz, Span >26dB bandwidth, Max. hold.
5. Delta Mark trace A Maximum frequency and trace B same frequency.
6. Repeat the above procedure until measurements for all frequencies were complete.

TEST RESULTS

No non-compliance noted

Test Data

Test mode: IEEE 802.11a mode / 5180 ~ 5220MHz

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)	Result
Low	5180	8.51	13.00	-4.49	PASS
High	5220	9.18	13.00	-3.82	PASS

Test mode: IEEE 802.11n HT 20 MHz mode / 5180 ~ 5220MHz / Chain 0

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)	Result
Low	5180	10.71	13.00	-2.29	PASS
High	5220	10.28	13.00	-2.72	PASS

Test mode: IEEE 802.11n HT 20 MHz mode / 5180 ~ 5220MHz / Chain 1

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)	Result
Low	5180	11.56	13.00	-1.44	PASS
High	5220	11.61	13.00	-1.39	PASS

Test mode: IEEE 802.11n HT 20 MHz mode / 5180 ~ 5220MHz / Chain 2

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)	Result
Low	5180	11.84	13.00	-1.16	PASS
High	5220	10.86	13.00	-2.14	PASS

Test mode: IEEE 802.11n HT 40 MHz mode / 5190 ~ 5210MHz / Chain 0

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)	Result
Low	5190	11.29	13.00	-1.71	PASS
High	5210	10.88	13.00	-2.12	PASS

Test mode: IEEE 802.11n HT 40 MHz mode / 5190 ~ 5210MHz / Chain 1

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)	Result
Low	5190	11.06	13.00	-1.94	PASS
High	5210	11.46	13.00	-1.54	PASS

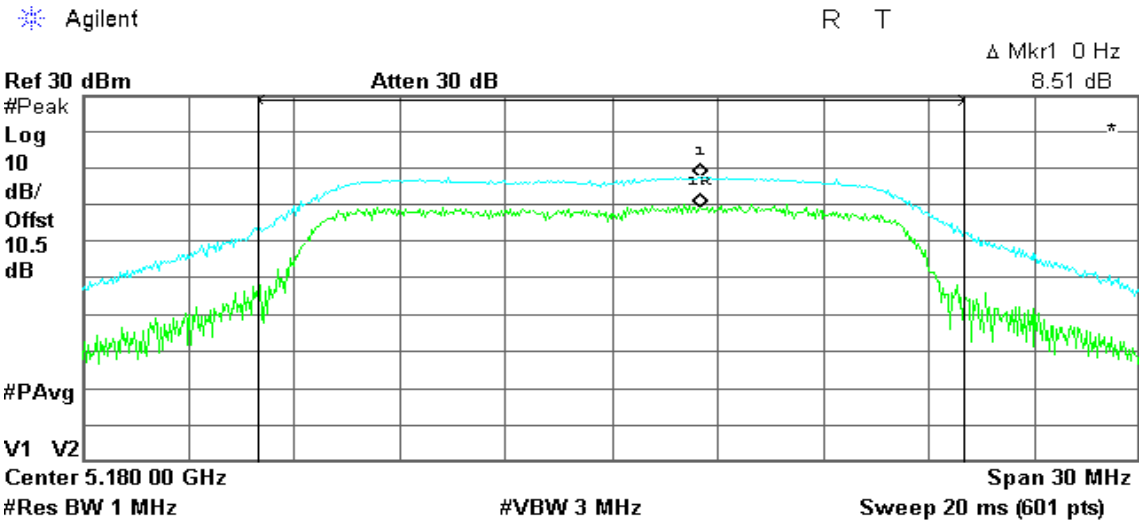
Test mode: IEEE 802.11n HT 40 MHz mode / 5190 ~ 5210MHz / Chain 2

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)	Result
Low	5190	11.48	13.00	-1.52	PASS
High	5210	10.96	13.00	-2.04	PASS

Test Plot

IEEE 802.11a mode / 5180 ~ 5220MHz

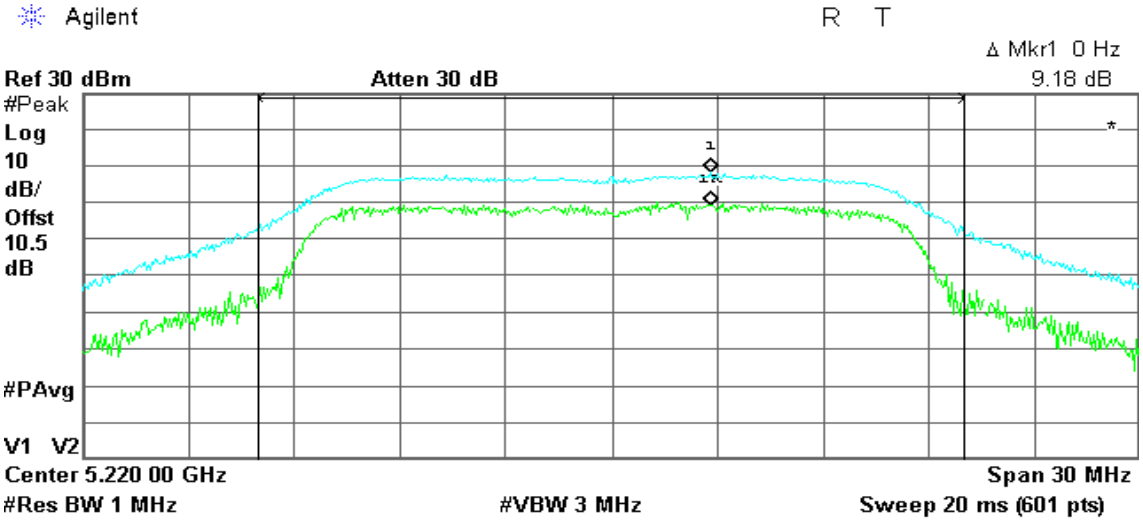
CH Low



Channel Power
16.55 dBm / 20.0000 MHz

Power Spectral Density
-56.46 dBm/Hz

CH High

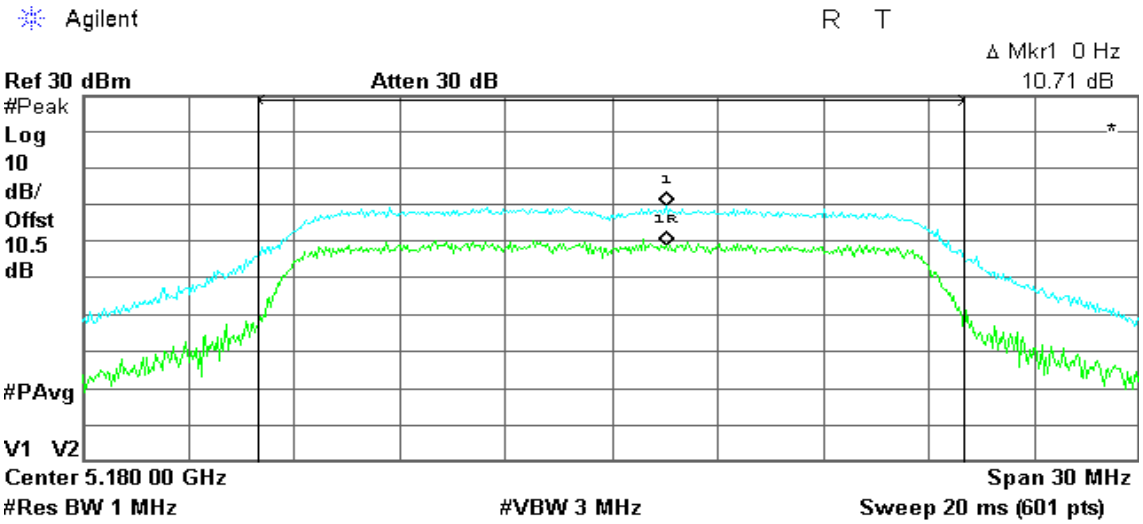


Channel Power
16.59 dBm / 20.0000 MHz

Power Spectral Density
-56.42 dBm/Hz

IEEE 802.11n HT 20 MHz mode / 5180 ~ 5220MHz / Chain 0

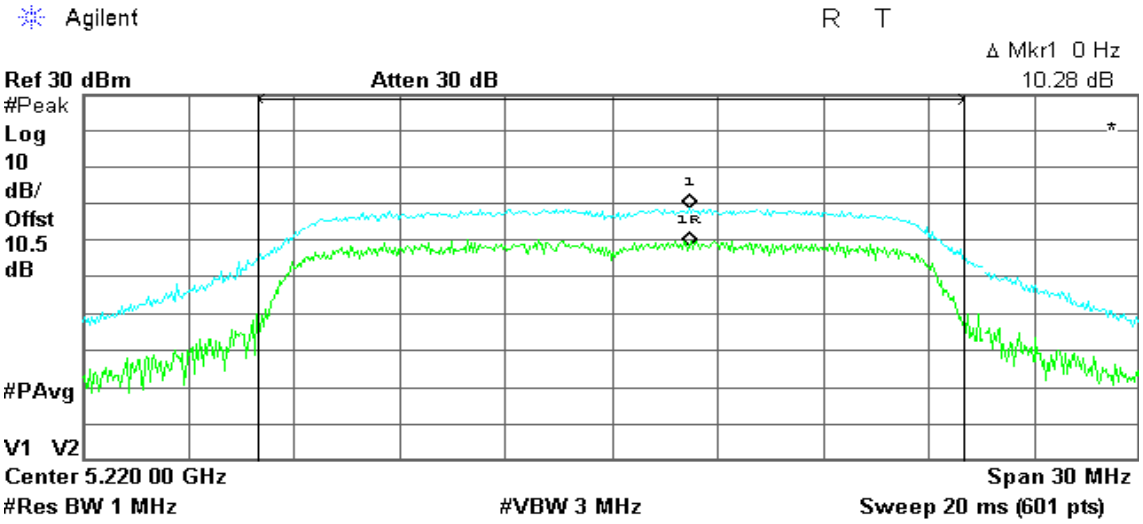
CH Low



Channel Power
7.71 dBm /20.0000 MHz

Power Spectral Density
-65.31 dBm/Hz

CH High

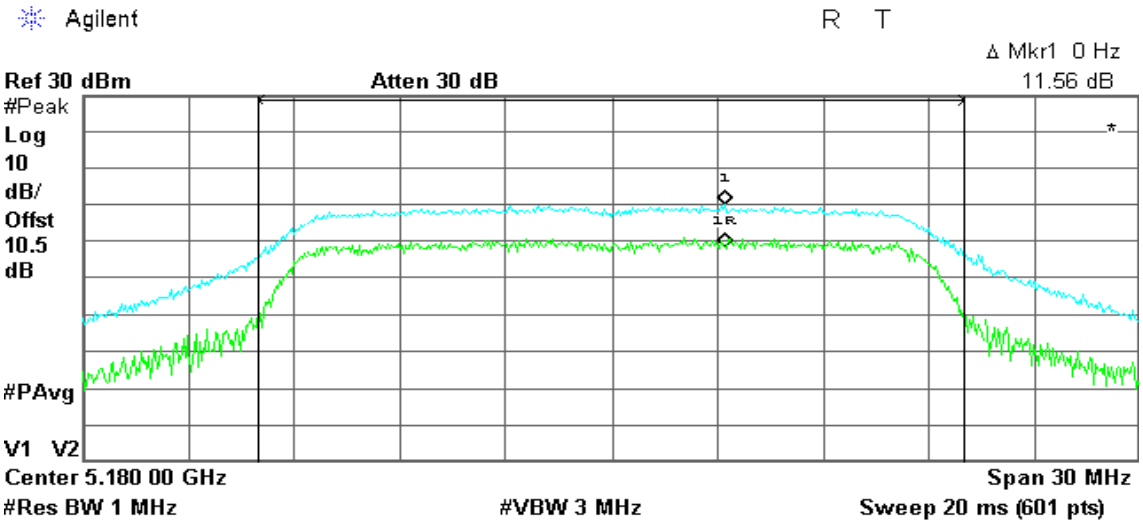


Channel Power
7.19 dBm /20.0000 MHz

Power Spectral Density
-65.82 dBm/Hz

IEEE 802.11n HT 20 MHz mode / 5180 ~ 5220MHz / Chain 1

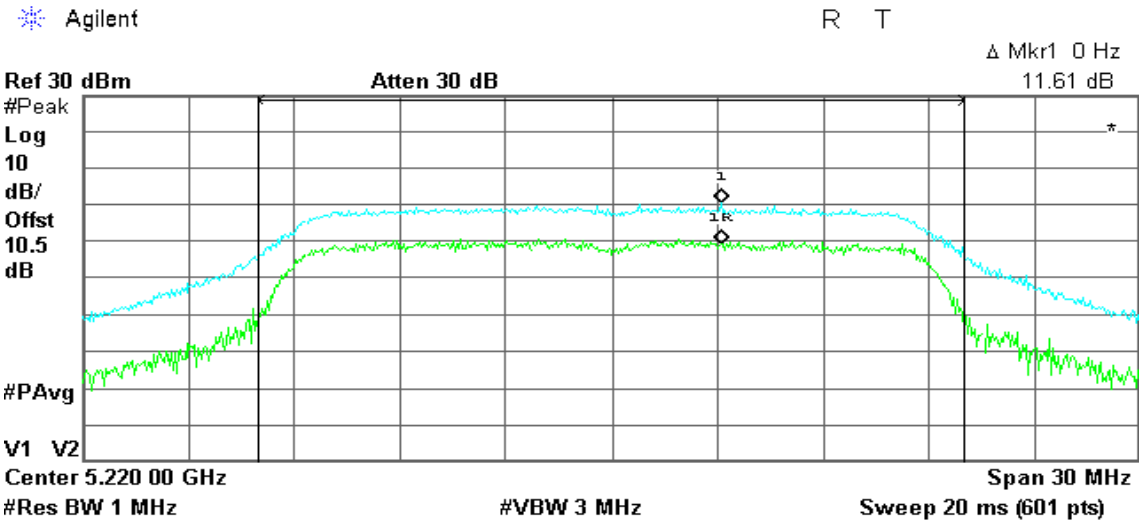
CH Low



Channel Power
7.99 dBm /20.0000 MHz

Power Spectral Density
-65.02 dBm/Hz

CH High

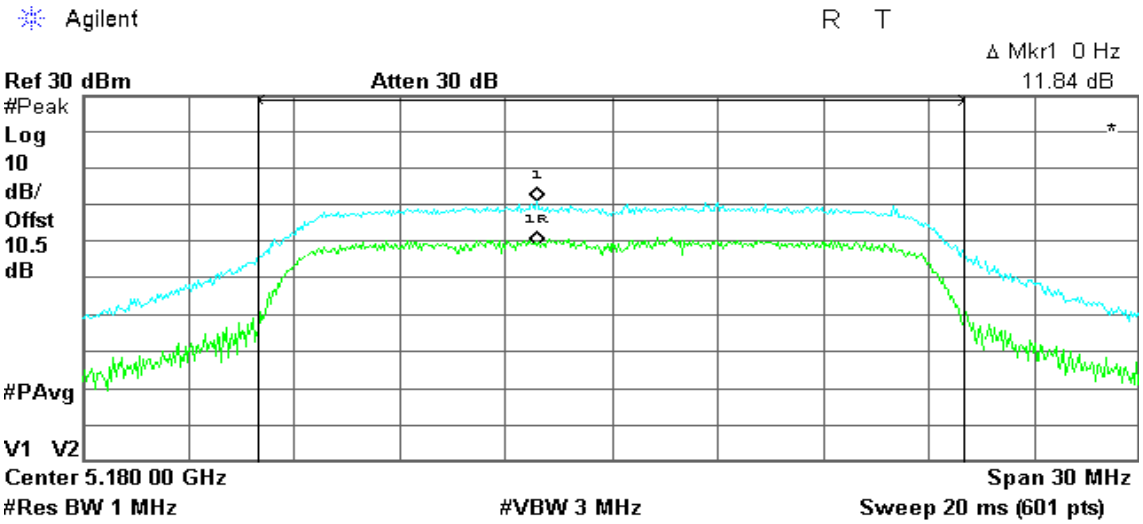


Channel Power
8.04 dBm /20.0000 MHz

Power Spectral Density
-64.97 dBm/Hz

IEEE 802.11n HT 20 MHz mode / 5180 ~ 5220MHz / Chain 2

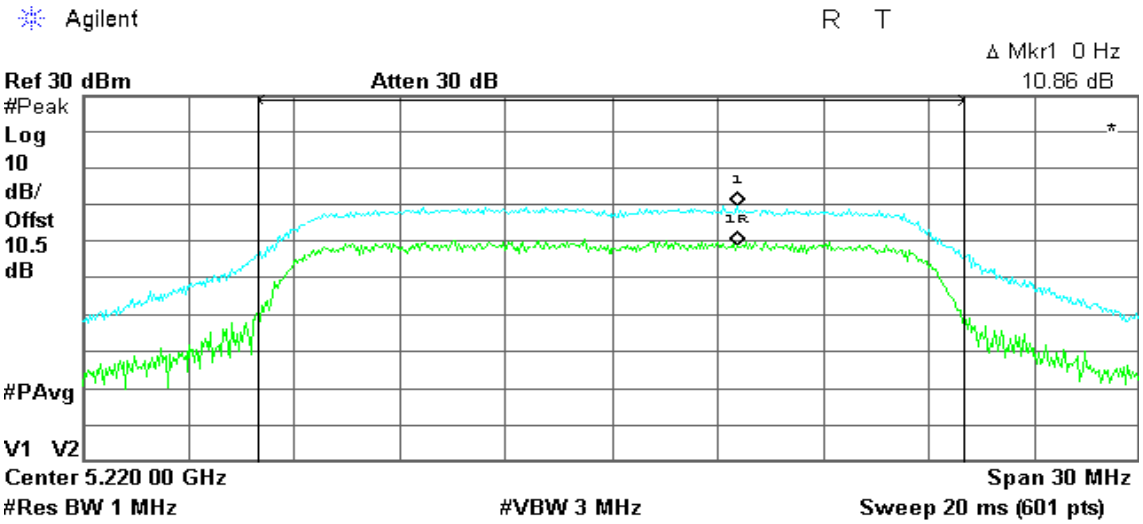
CH Low



Channel Power
7.76 dBm /20.0000 MHz

Power Spectral Density
-65.25 dBm/Hz

CH High

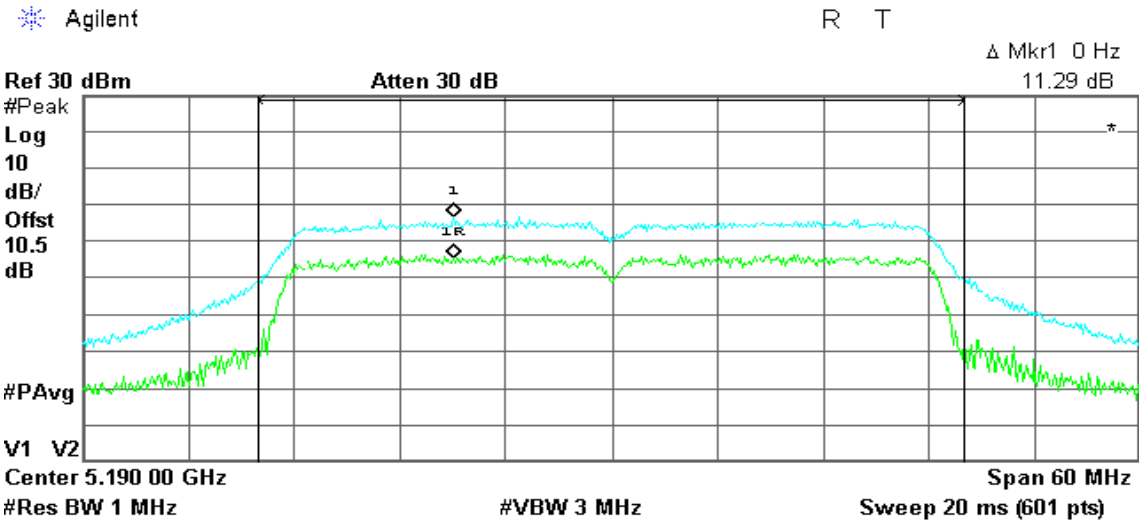


Channel Power
7.89 dBm /20.0000 MHz

Power Spectral Density
-65.12 dBm/Hz

IEEE 802.11n HT 40 MHz mode / 5190 ~ 5210MHz / Chain 0

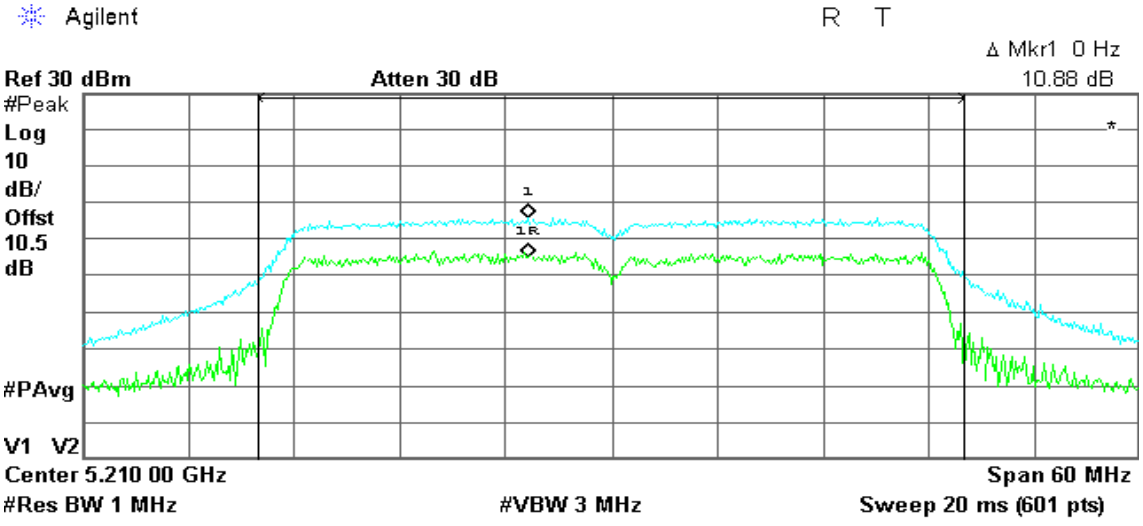
CH Low



Channel Power
6.85 dBm /40.0000 MHz

Power Spectral Density
-69.17 dBm/Hz

CH High

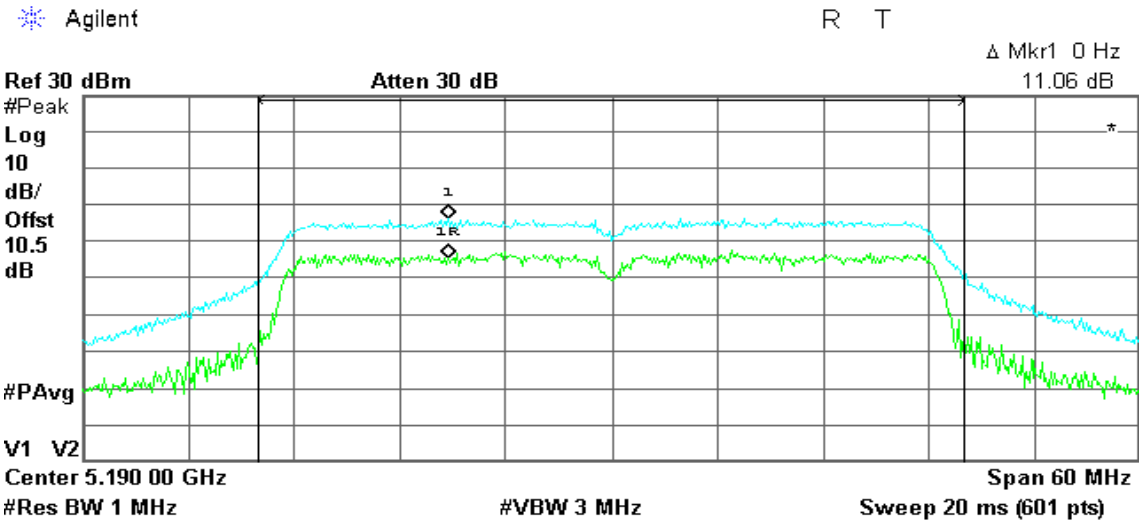


Channel Power
6.74 dBm /40.0000 MHz

Power Spectral Density
-69.28 dBm/Hz

IEEE 802.11n HT 40 MHz mode / 5190 ~ 5210MHz / Chain 1

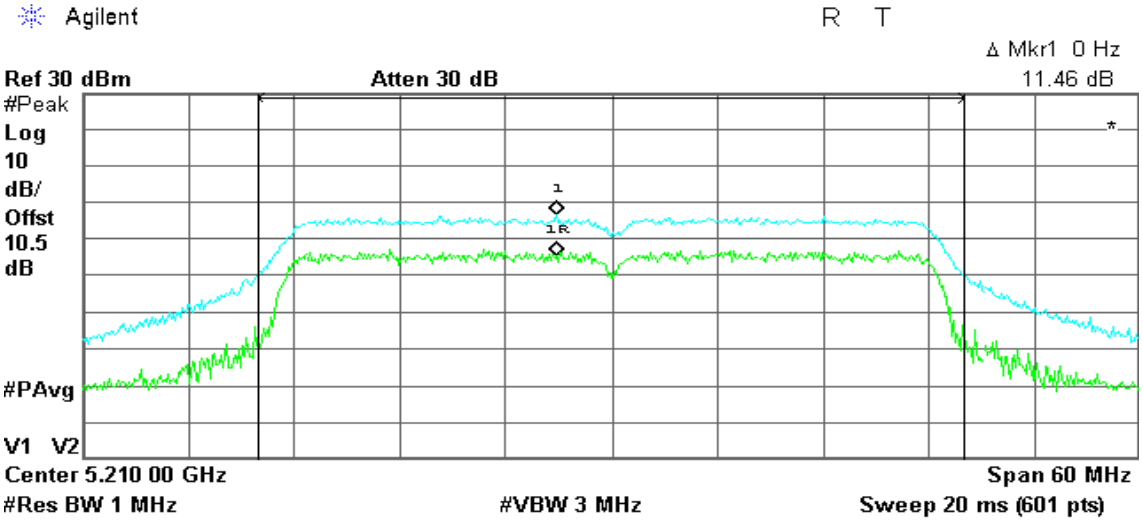
CH Low



Channel Power
7.38 dBm / 40.0000 MHz

Power Spectral Density
-68.64 dBm/Hz

CH High

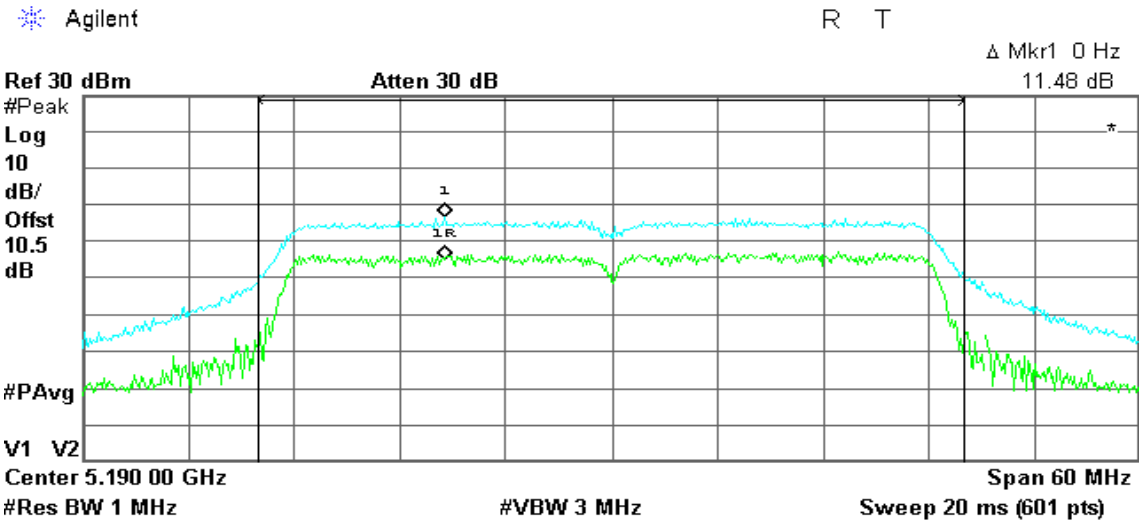


Channel Power
7.34 dBm / 40.0000 MHz

Power Spectral Density
-68.69 dBm/Hz

IEEE 802.11n HT 40 MHz mode / 5190 ~ 5210MHz / Chain 2

CH Low



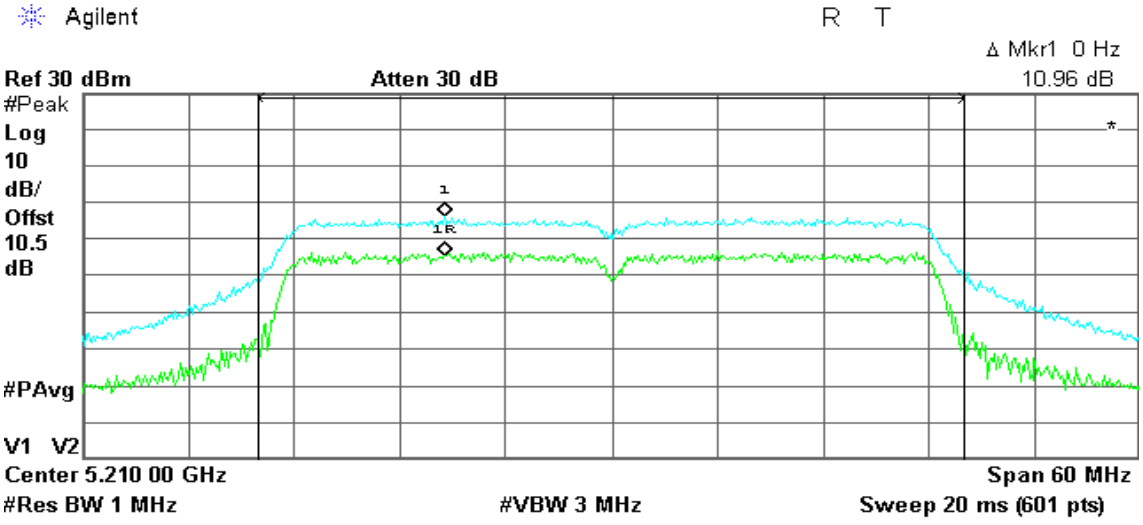
Channel Power

7.29 dBm /40.0000 MHz

Power Spectral Density

-68.73 dBm/Hz

CH High



Channel Power

7.05 dBm /40.0000 MHz

Power Spectral Density

-68.97 dBm/Hz

7.6 RADIATED UNDESIRABLE EMISSION

1. According to §15.209(a), except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (m)
30-88	100*	3
88-216	150*	3
216-960	200*	3
Above 960	500	3

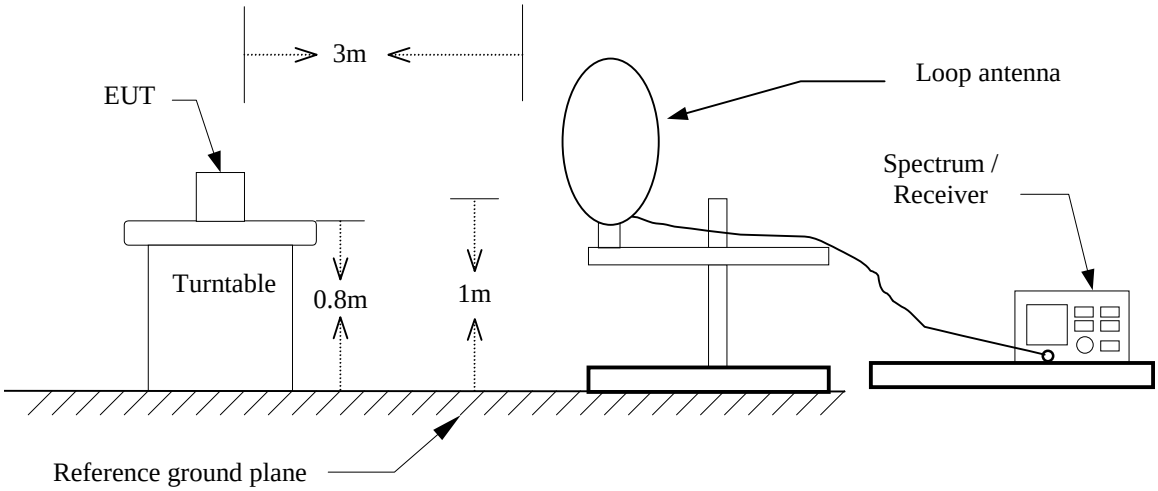
Remark: *Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.*

2. In the emission table above, the tighter limit applies at the band edges.

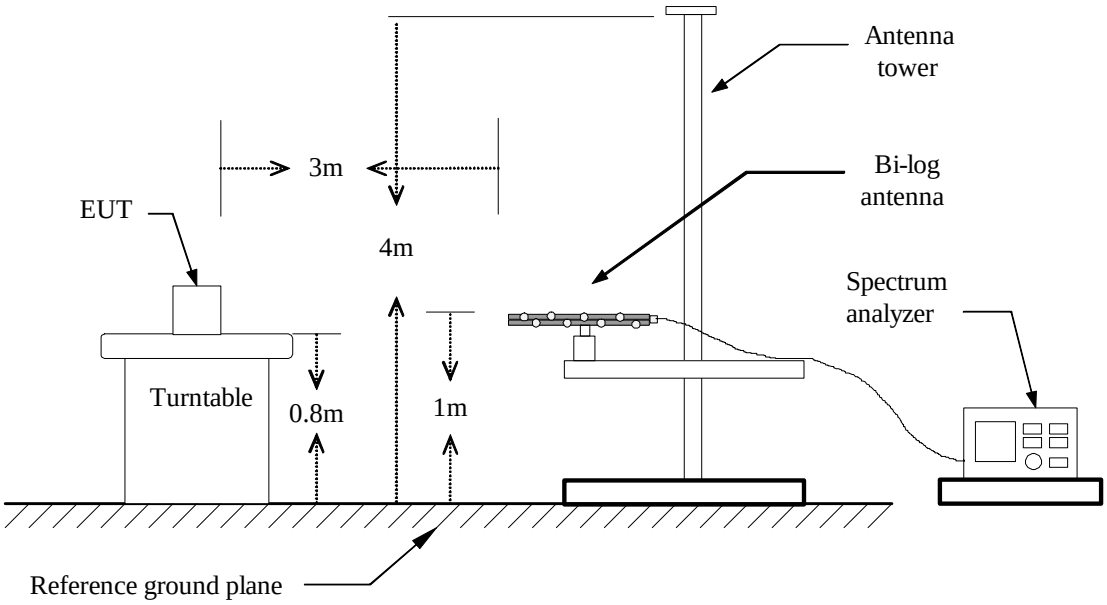
Frequency (MHz)	Field Strength (μV/m at 3-meter)	Field Strength (dBμV/m at 3-meter)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

Test Configuration

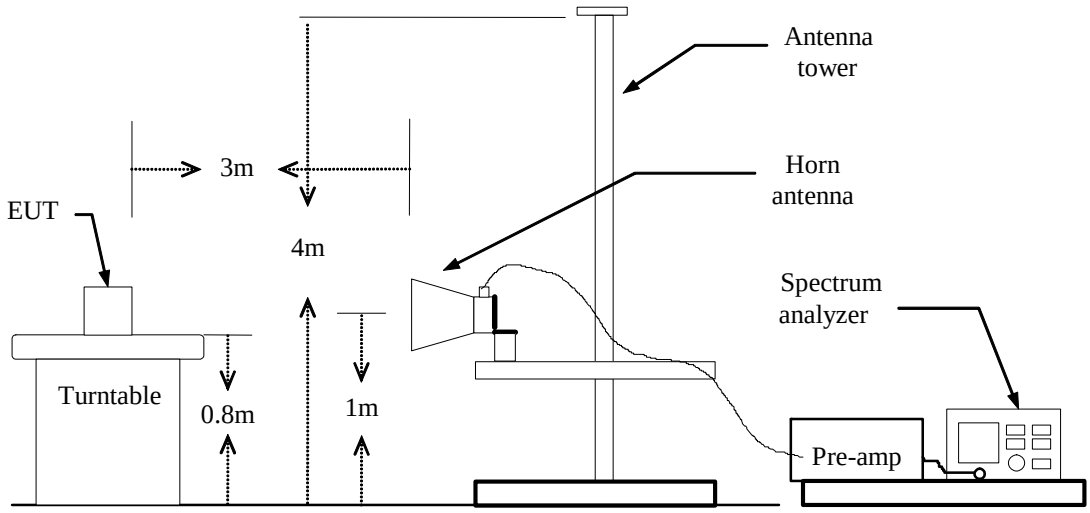
9kHz ~ 30MHz



30MHz ~ 1GHz



Above 1 GHz


Antenna
tower
Horn
antenna
Spectrum
analyzer
3m
4m
EUT
Turntable
0.8m
1m
Pre-amp

TEST PROCEDURE

1. The EUT is placed on a turntable, which is 0.8m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Set the spectrum analyzer in the following setting as:

   Below 1GHz:

   RBW=100kHz / VBW=300kHz / Sweep=AUTO

   Above 1GHz:

   (a) PEAK: RBW=VBW=1MHz / Sweep=AUTO

   (b) AVERAGE: RBW=1MHz / VBW=10Hz / Sweep=AUTO
7. Repeat above procedures until the measurements for all frequencies are complete.

Below 1 GHz

Operation Mode: Normal Link **Test Date:** March 21, 2011

Temperature: 24°C **Tested by:** Ali Shu

Humidity: 48% RH **Polarity:** Ver. / Hor.

Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
374.35	39.73	-7.58	32.15	46.00	-13.85	Peak	V
500.45	39.35	-5.14	34.21	46.00	-11.79	Peak	V
574.82	37.81	-4.27	33.54	46.00	-12.46	Peak	V
624.93	40.73	-3.48	37.26	46.00	-8.74	Peak	V
725.17	34.81	-2.18	32.63	46.00	-13.37	Peak	V
875.52	37.77	-0.73	37.03	46.00	-8.97	Peak	V
374.35	43.96	-7.58	36.37	46.00	-9.63	Peak	H
574.82	36.48	-4.27	32.21	46.00	-13.79	Peak	H
624.93	42.09	-3.48	38.61	46.00	-7.39	Peak	H
675.05	39.08	-2.71	36.36	46.00	-9.64	Peak	H
725.17	37.57	-2.18	35.39	46.00	-10.61	Peak	H
875.52	34.69	-0.73	33.95	46.00	-12.05	Peak	H

Remark:

1. *No emission found between lowest internal used/generated frequency to 30MHz (9kHz~30MHz)*
2. *Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using peak/quasi-peak detector mode.*
3. *Quasi-peak test would be performed if the peak result were greater than the quasi-peak limit.*
4. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
5. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Quasi-peak limit (dBuV/m).*

Above 1 GHz

Operation Mode:	Tx / IEEE 802.11a mode / 5180 ~ 5220MHz / CH Low	**Test Date:**	March 1, 2011
Temperature:	24°C	**Tested by:**	Ali Shu
Humidity:	48% RH	**Polarity:**	Ver. / Hor.

Frequency (MHz)	Reading (Peak) (dBuV)	Reading (Average) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
1306.67	57.90	---	-10.75	47.15	---	74.00	54.00	-6.85	Peak	V
1500.00	56.12	---	-10.55	45.57	---	74.00	54.00	-8.43	Peak	V
1666.67	56.11	---	-8.86	47.25	---	74.00	54.00	-6.75	Peak	V
2330.00	55.92	---	-4.57	51.35	---	74.00	54.00	-2.65	Peak	V
2660.00	53.05	---	-3.33	49.72	---	74.00	54.00	-4.28	Peak	V
N/A										
1310.00	58.05	---	-10.75	47.30	---	74.00	54.00	-6.70	Peak	H
1496.67	58.91	---	-10.55	48.36	---	74.00	54.00	-5.64	Peak	H
1666.67	57.20	---	-8.86	48.34	---	74.00	54.00	-5.66	Peak	H
2330.00	53.65	---	-4.57	49.08	---	74.00	54.00	-4.92	Peak	H
N/A										

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit.*
4. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
5. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

Operation Mode: Tx / IEEE 802.11a mode / 5180 ~ 5220MHz /CH High **Test Date:** March 1, 2011

Temperature: 24°C **Tested by:** Ali Shu

Humidity: 48% RH **Polarity:** Ver. / Hor.

Frequency (MHz)	Reading (Peak) (dBuV)	Reading (Average) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
1306.67	58.28	---	-10.75	47.53	---	74.00	54.00	-6.47	Peak	V
1333.33	58.41	---	-10.72	47.69	---	74.00	54.00	-6.31	Peak	V
1496.67	56.16	---	-10.55	45.60	---	74.00	54.00	-8.40	Peak	V
1666.67	56.89	---	-8.86	48.03	---	74.00	54.00	-5.97	Peak	V
2330.00	54.25	---	-4.57	49.68	---	74.00	54.00	-4.32	Peak	V
2663.33	52.76	---	-3.31	49.44	---	74.00	54.00	-4.56	Peak	V
1306.67	57.69	---	-10.75	46.94	---	74.00	54.00	-7.06	Peak	H
1330.00	57.84	---	-10.73	47.11	---	74.00	54.00	-6.89	Peak	H
1376.67	58.41	---	-10.68	47.73	---	74.00	54.00	-6.27	Peak	H
1496.67	57.72	---	-10.55	47.16	---	74.00	54.00	-6.84	Peak	H
1663.33	57.03	---	-8.89	48.14	---	74.00	54.00	-5.86	Peak	H
2330.00	53.70	---	-4.57	49.13	---	74.00	54.00	-4.87	Peak	H

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit.*
4. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
5. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

Operation Mode:	Tx / IEEE 802.11n HT 20 MHz mode / 5180 ~ 5220MHz / CH Low	**Test Date:**	March 1, 2011
Temperature:	24°C	**Tested by:**	Ali Shu
Humidity:	48% RH	**Polarity:**	Ver. / Hor.

Frequency (MHz)	Reading (Peak) (dBuV)	Reading (Average) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
1496.67	57.59	---	-10.55	47.03	---	74.00	54.00	-6.97	Peak	V
1563.33	58.40	---	-9.91	48.50	---	74.00	54.00	-5.50	Peak	V
1666.67	58.38	---	-8.86	49.52	---	74.00	54.00	-4.48	Peak	V
2493.33	54.79	---	-3.90	50.89	---	74.00	54.00	-3.11	Peak	V
N/A										
1310.00	58.74	---	-10.75	47.99	---	74.00	54.00	-6.01	Peak	H
1663.33	56.69	---	-8.89	47.80	---	74.00	54.00	-6.20	Peak	H
N/A										

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit.*
4. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
5. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

Operation Mode: Tx / IEEE 802.11n HT 20 MHz mode / 5180 ~ 5220MHz / CH High **Test Date:** March 1, 2011

Temperature: 24°C **Tested by:** Ali Shu

Humidity: 48% RH **Polarity:** Ver. / Hor.

Frequency (MHz)	Reading (Peak) (dBuV)	Reading (Average) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
1176.67	60.48	---	-10.89	49.59	---	74.00	54.00	-4.41	Peak	V
1330.00	60.46	---	-10.73	49.73	---	74.00	54.00	-4.27	Peak	V
1560.00	58.21	---	-9.94	48.27	---	74.00	54.00	-5.73	Peak	V
1666.67	58.85	---	-8.86	49.99	---	74.00	54.00	-4.01	Peak	V
2496.67	59.66	38.26	-3.88	55.78	34.38	74.00	54.00	-19.62	AVG	V
N/A										
1250.00	57.53	---	-10.81	46.72	---	74.00	54.00	-7.28	Peak	H
1496.67	57.32	---	-10.55	46.77	---	74.00	54.00	-7.23	Peak	H
1666.67	57.35	---	-8.86	48.49	---	74.00	54.00	-5.51	Peak	H
N/A										

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit.*
4. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
5. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

Operation Mode:	Tx / IEEE 802.11n HT 40 MHz mode / 5190 ~ 5210MHz / CH Low	**Test Date:**	March 1, 2011
Temperature:	24°C	**Tested by:**	Ali Shu
Humidity:	48% RH	**Polarity:**	Ver. / Hor.

Frequency (MHz)	Reading (Peak) (dBuV)	Reading (Average) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
1330.00	57.93	---	-10.73	47.20	---	74.00	54.00	-6.80	Peak	V
1583.33	58.39	---	-9.70	48.68	---	74.00	54.00	-5.32	Peak	V
1666.67	58.84	---	-8.86	49.98	---	74.00	54.00	-4.02	Peak	V
2663.33	53.39	---	-3.31	50.08	---	74.00	54.00	-3.92	Peak	V
N/A										
1500.00	56.20	---	-10.55	45.65	---	74.00	54.00	-8.35	Peak	H
1663.33	56.75	---	-8.89	47.86	---	74.00	54.00	-6.14	Peak	H
N/A										

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit.*
4. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
5. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

Operation Mode: Tx / IEEE 802.11n HT 40 MHz mode / 5190 ~ 5210MHz / CH High **Test Date:** March 1, 2011

Temperature: 24°C **Tested by:** Ali Shu

Humidity: 48% RH **Polarity:** Ver. / Hor.

Frequency (MHz)	Reading (Peak) (dBuV)	Reading (Average) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
1173.33	58.90	---	-10.89	48.01	---	74.00	54.00	-5.99	Peak	V
1576.67	58.86	---	-9.77	49.09	---	74.00	54.00	-4.91	Peak	V
1666.67	58.00	---	-8.86	49.14	---	74.00	54.00	-4.86	Peak	V
N/A										
1500.00	58.92	---	-10.55	48.37	---	74.00	54.00	-5.63	Peak	H
1523.33	59.23	---	-10.31	48.92	---	74.00	54.00	-5.08	Peak	H
1666.67	56.03	---	-8.86	47.18	---	74.00	54.00	-6.82	Peak	H
N/A										

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit.*
4. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
5. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

7.7 CONDUCTED UNDESIRABLE EMISSION

LIMIT

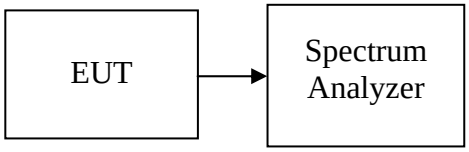
According to 15.407(b),

(1) For transmitters operating in the 5.15-5.25 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz.

(2) For transmitters operating in the 5.25-5.35 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz. Devices operating in the 5.25-5.35 GHz band that generate emissions in the 5.15-5.25 GHz band must meet all applicable technical requirements for operation in the 5.15-5.25 GHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of -27 dBm/MHz in the 5.15-5.25 GHz band.

The provisions of §15.205 apply to intentional radiators operating under this section.

Test Configuration



TEST PROCEDURE

Conducted RF measurements of the transmitter output were made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 1 MHz. The video bandwidth is set to 1 MHz. Peak detection measurements are compared to the average EIRP limit, adjusted for the maximum antenna gain. If necessary, additional average detection measurements are made.

Measurements are made over the 20 GHz to 40 GHz range with the transmitter set to the lowest, middle, and highest channels.

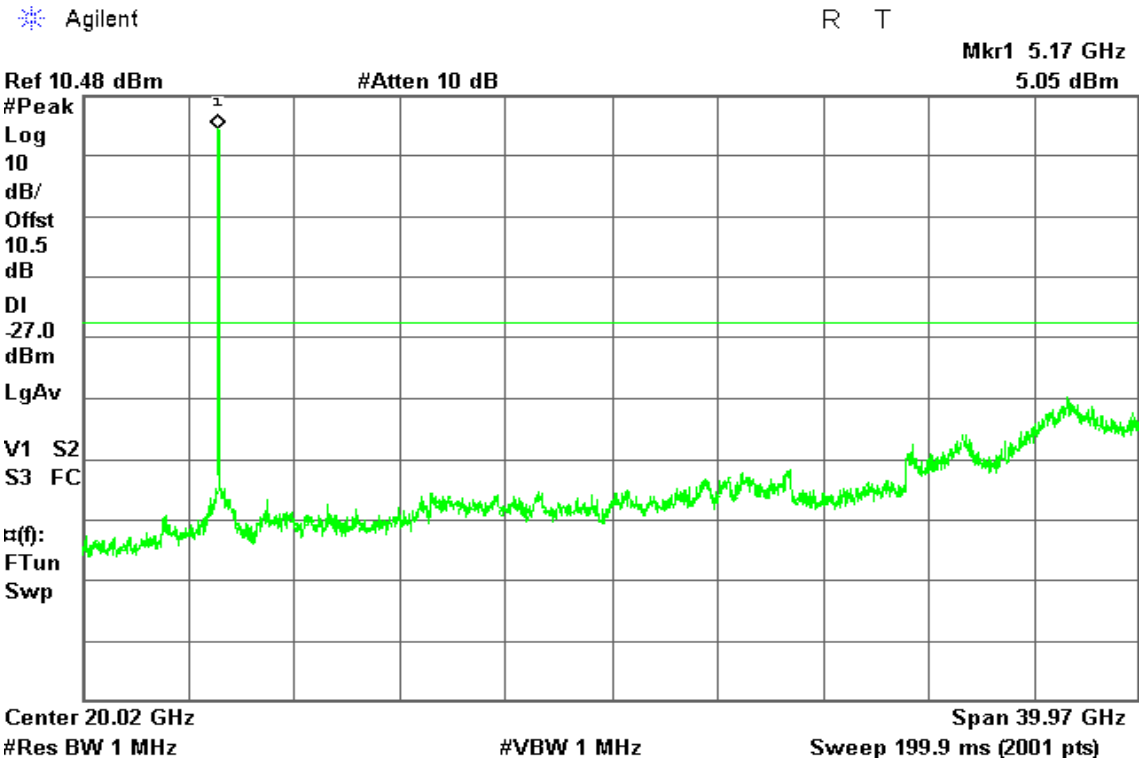
TEST RESULTS

No non-compliance noted

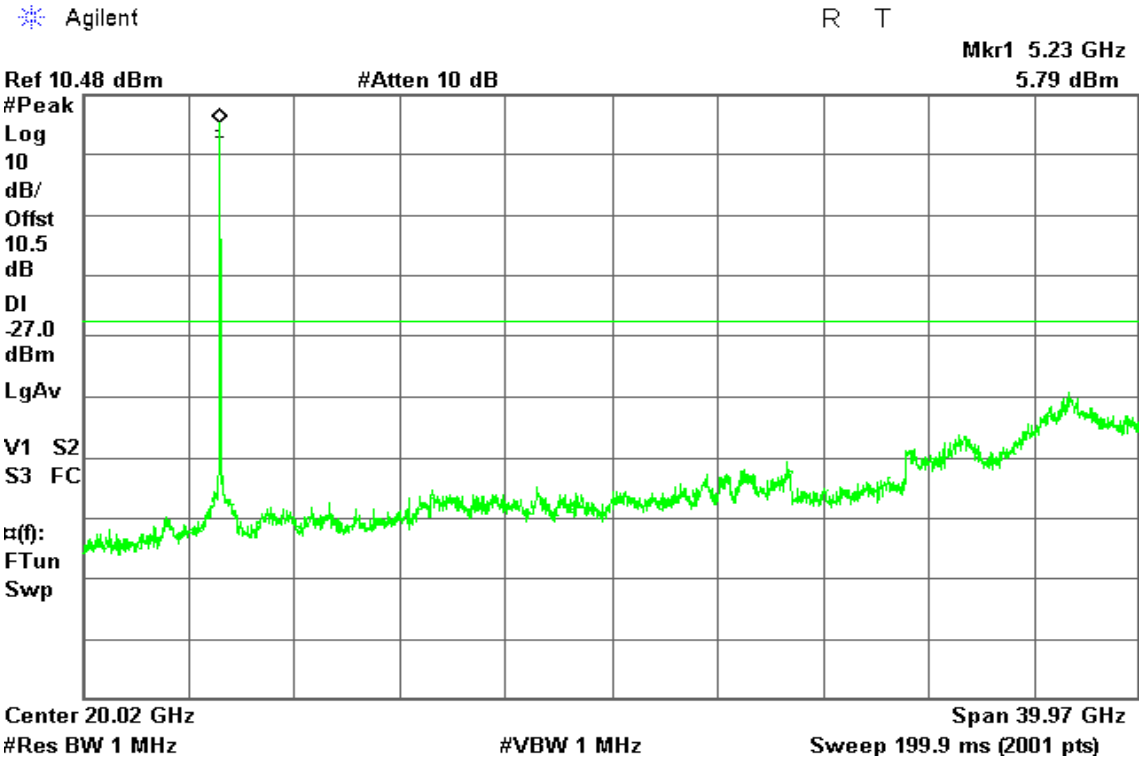
Test Plot

IEEE 802.11a mode / 5180 ~ 5220MHz

CH Low

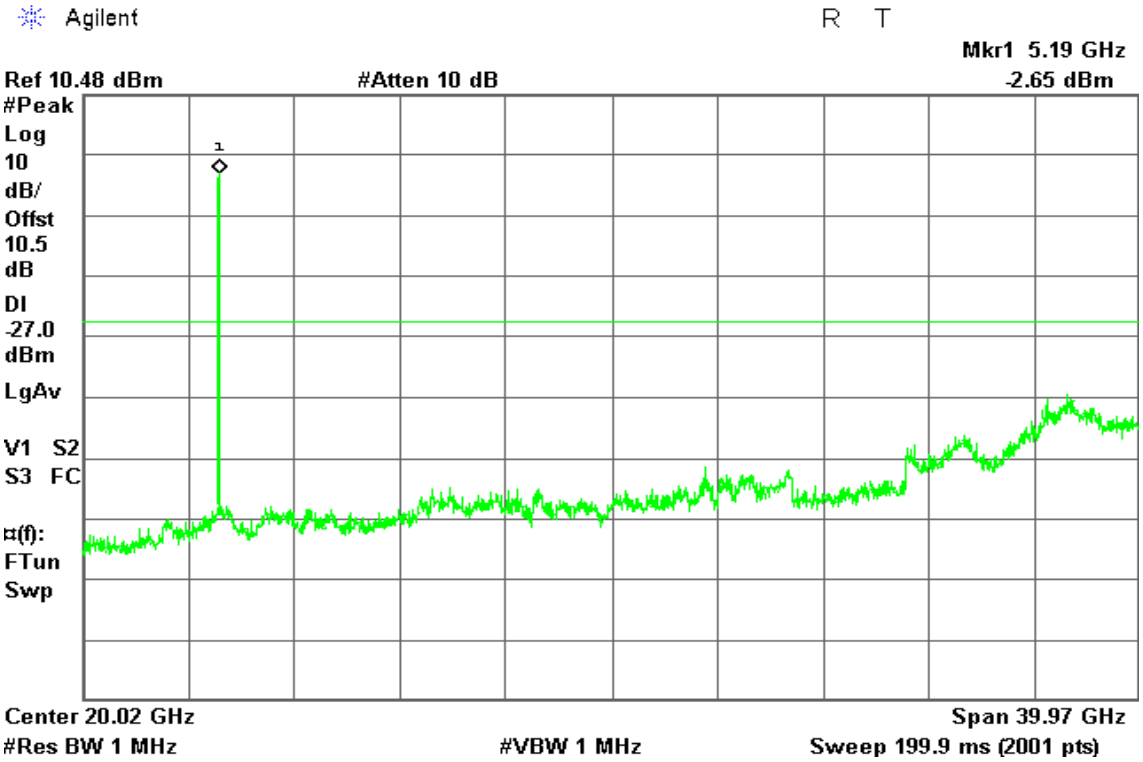


CH High

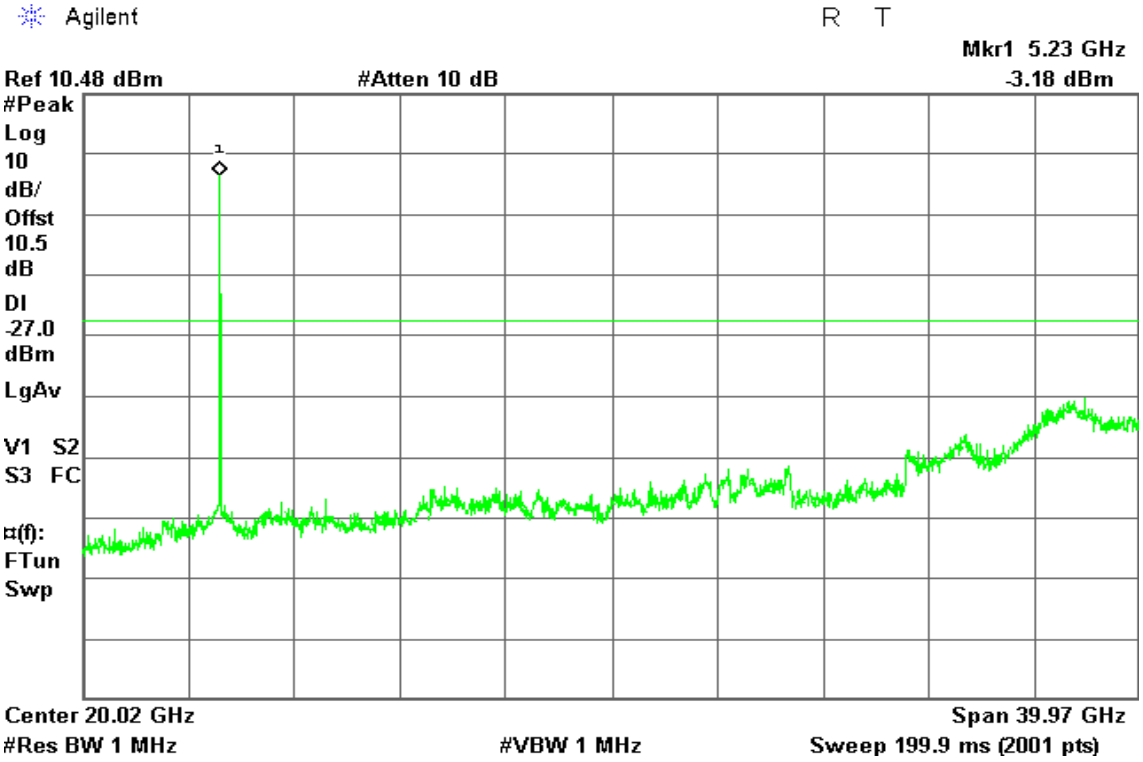


IEEE 802.11n HT 20 MHz mode / 5180 ~ 5220MHz / Chain 0

CH Low

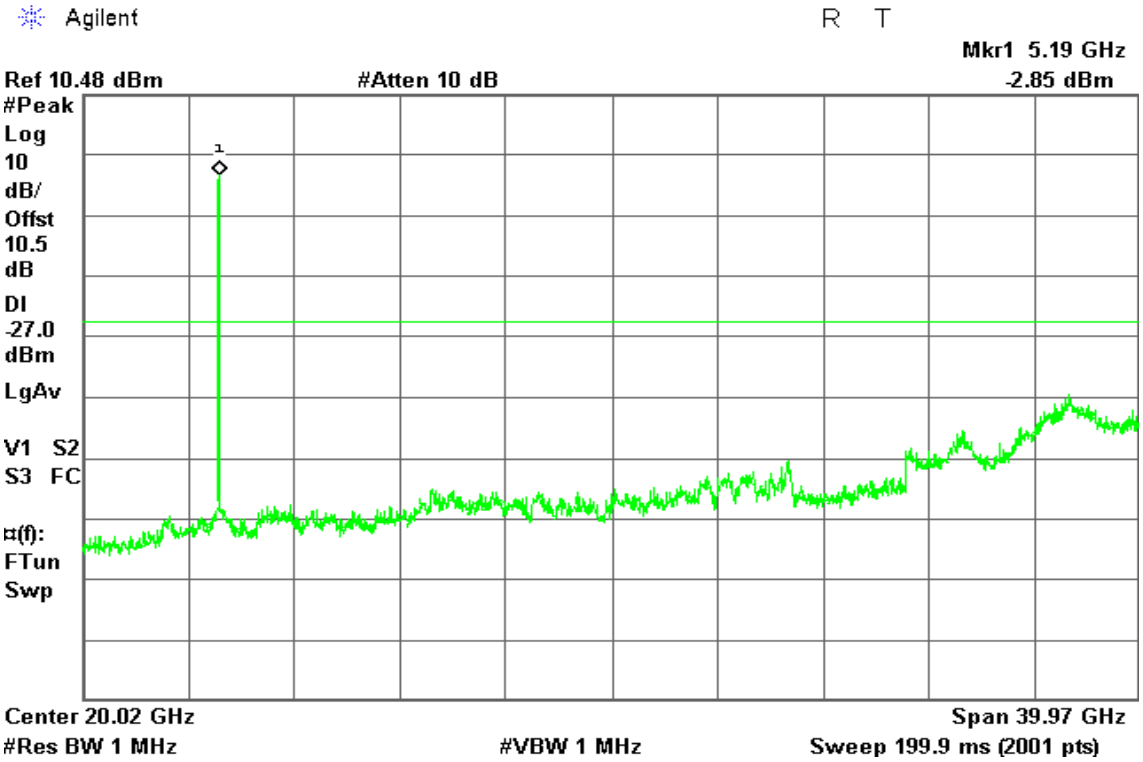


CH High

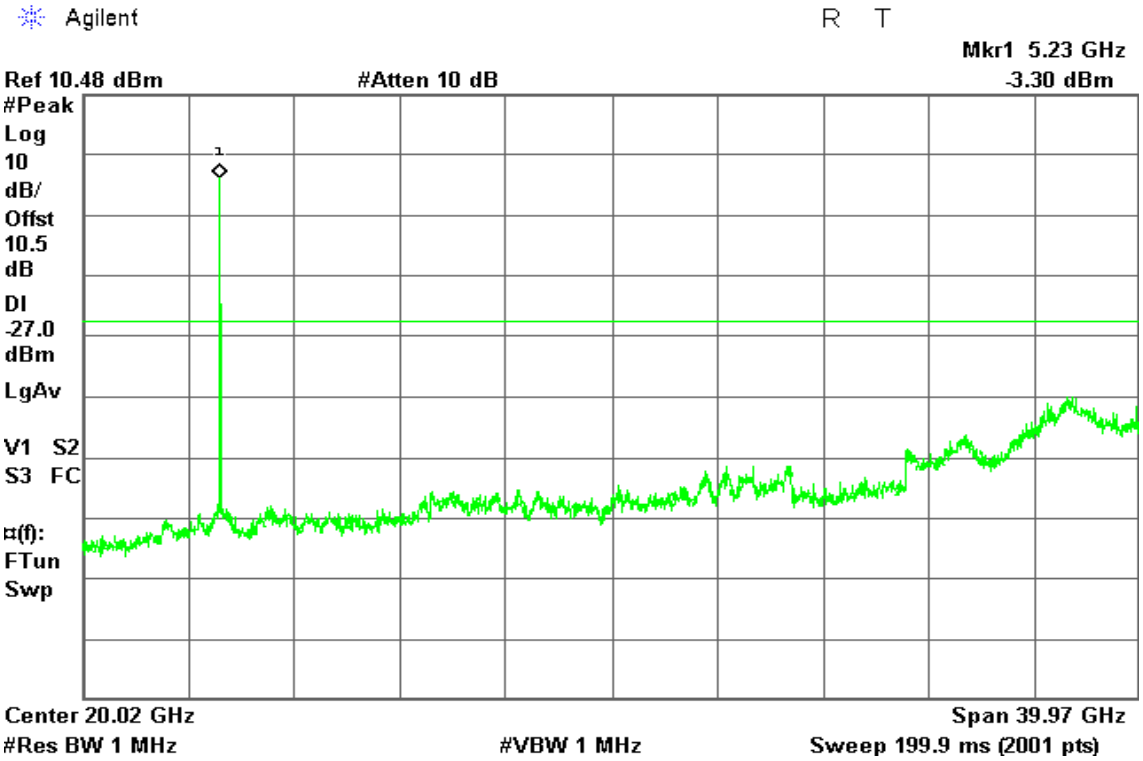


IEEE 802.11n HT 20 MHz mode / 5180 ~ 5220MHz / Chain 1

CH Low

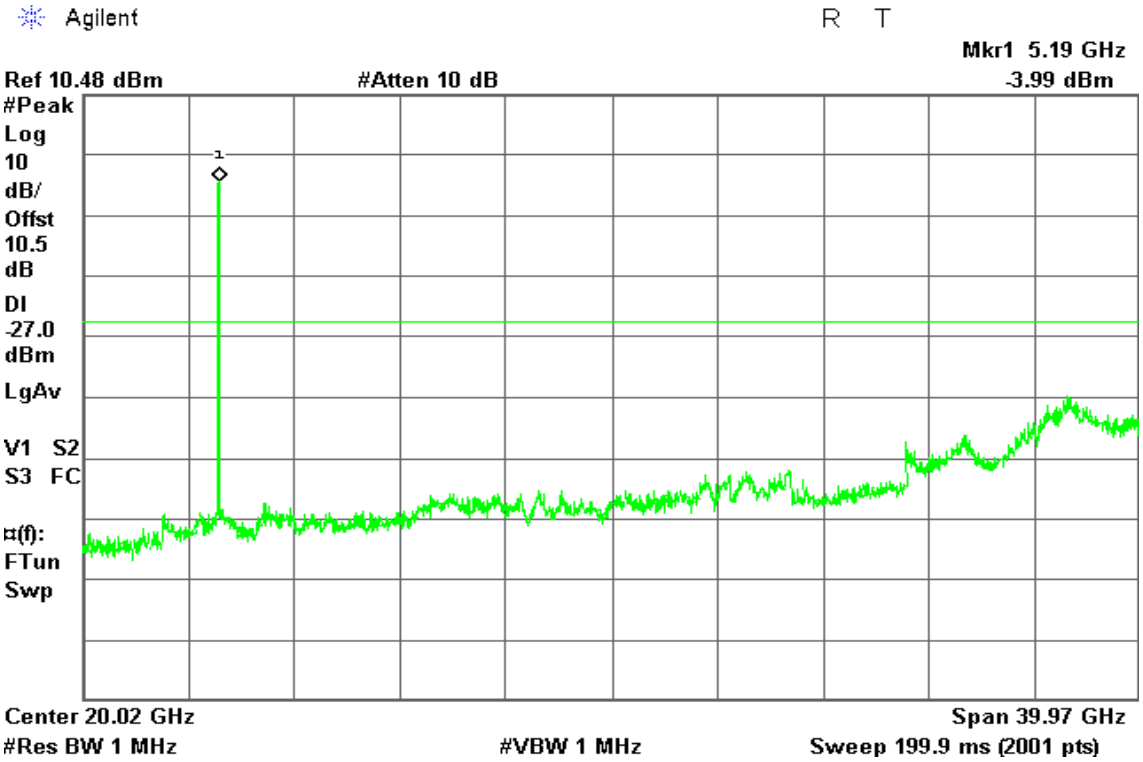


CH High

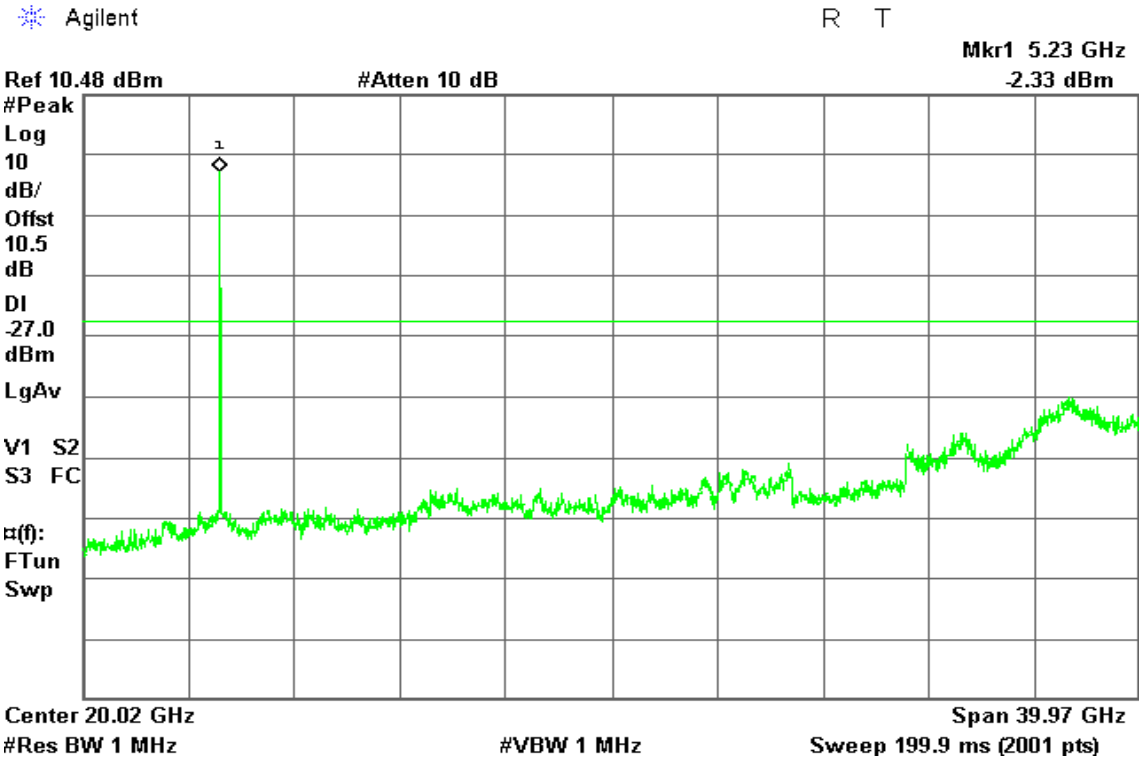


IEEE 802.11n HT 20 MHz mode / 5180 ~ 5220MHz / Chain 2

CH Low

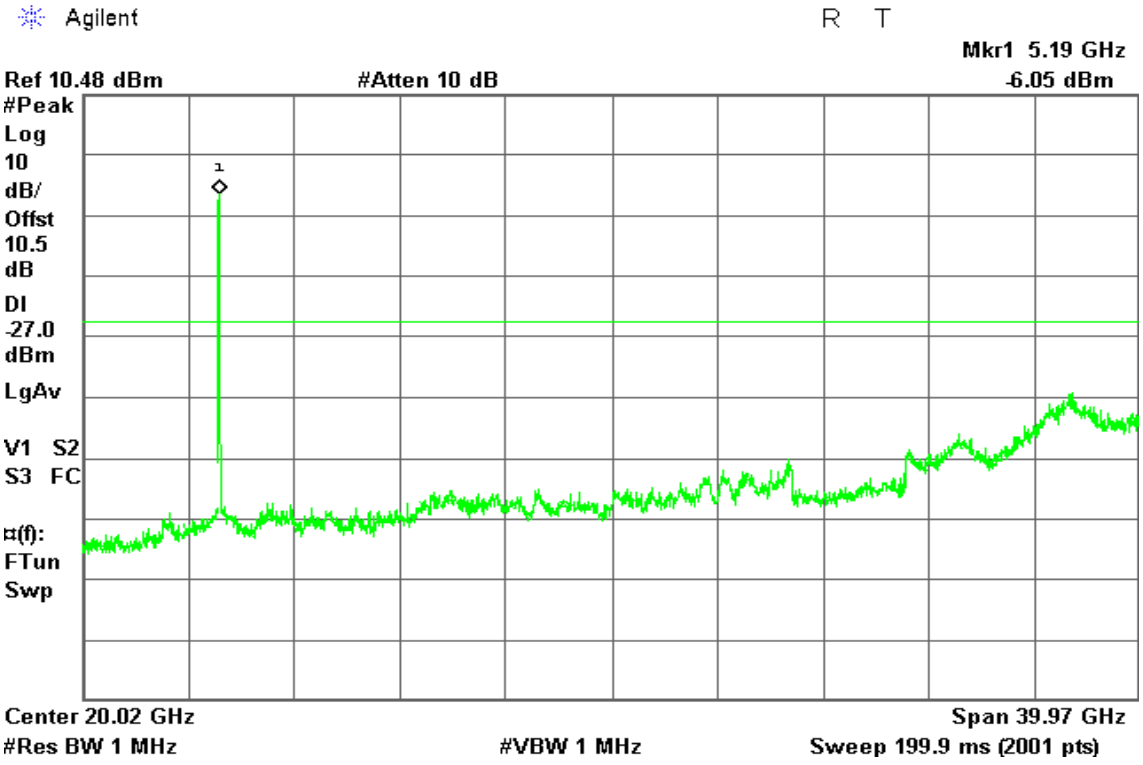


CH High

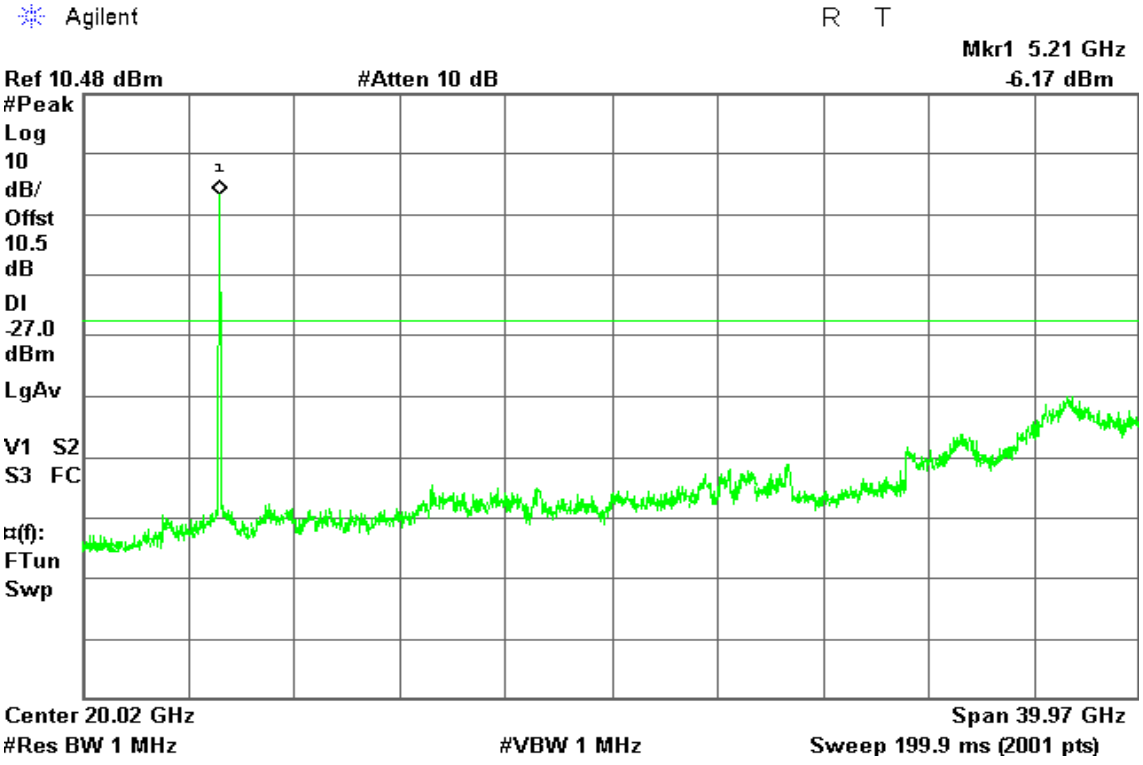


IEEE 802.11n HT 40 MHz mode / 5190 ~ 5210MHz / Chain 0

CH Low

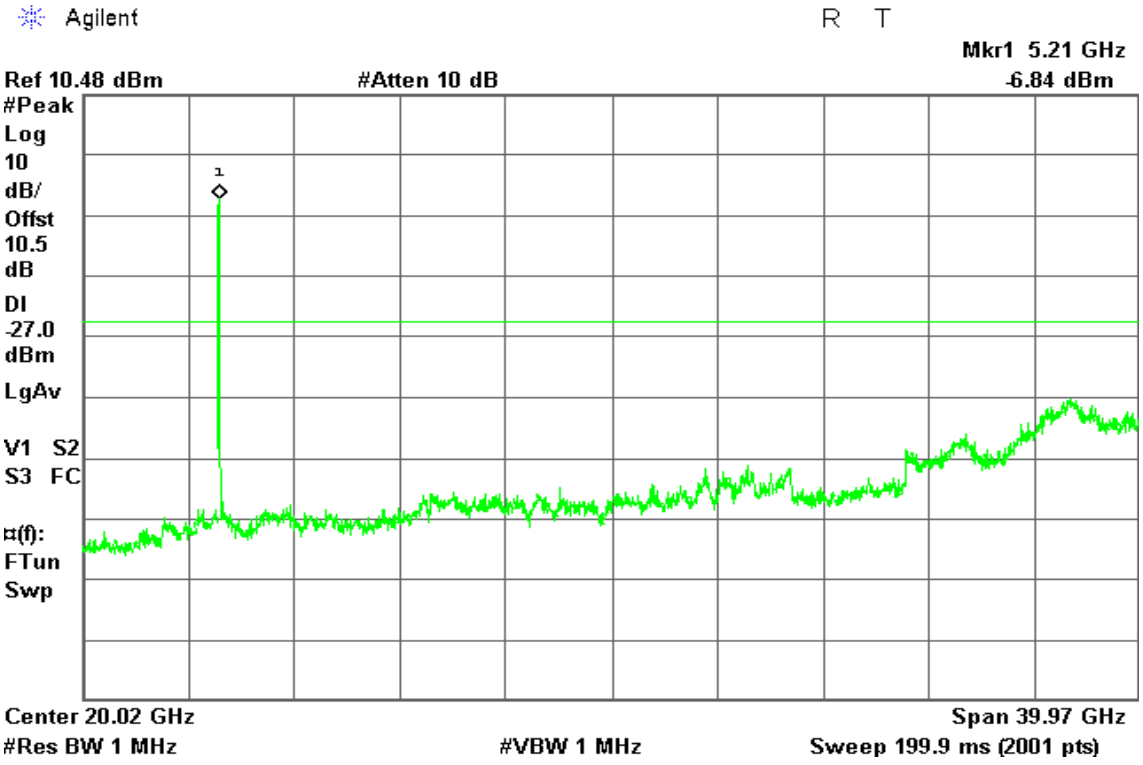


CH High

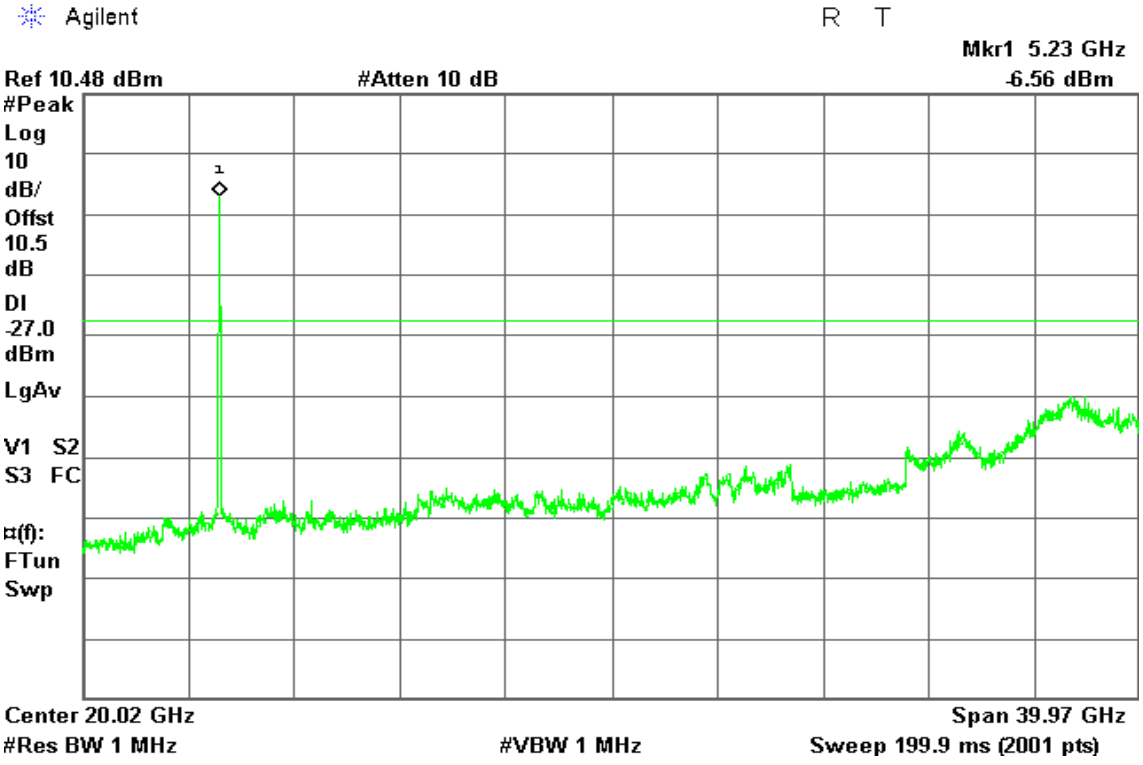


IEEE 802.11n HT 40 MHz mode / 5190 ~ 5210MHz / Chain 1

CH Low

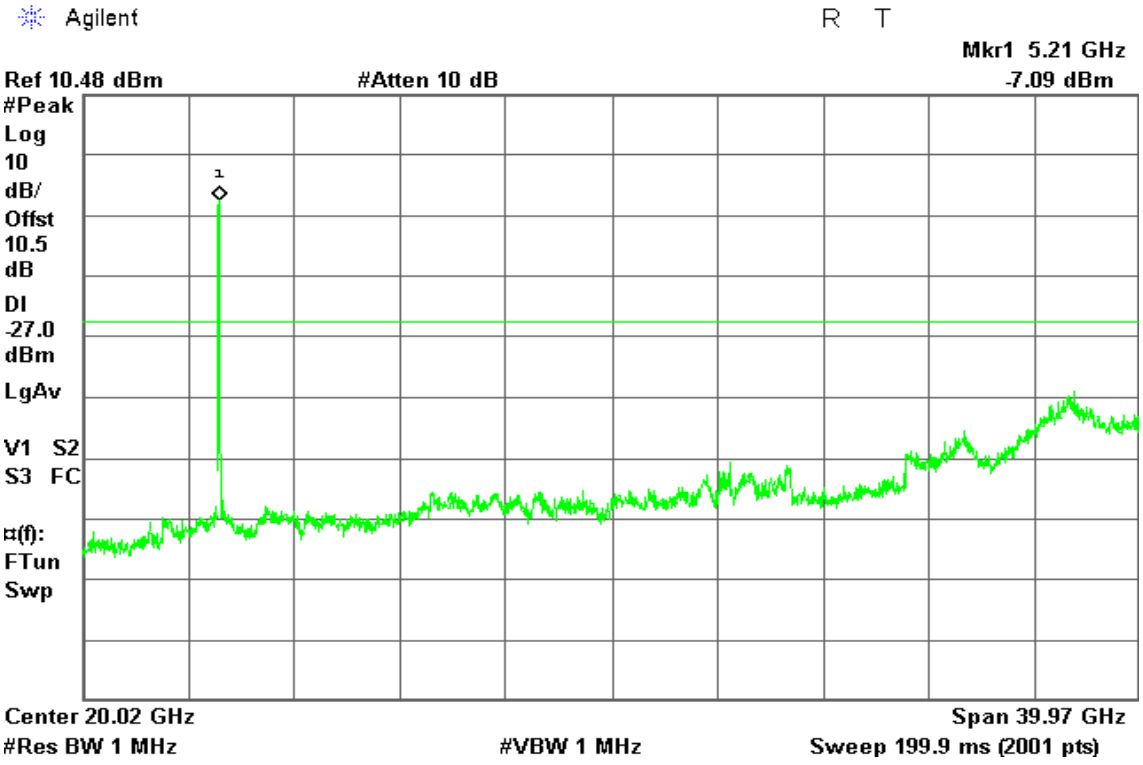


CH High

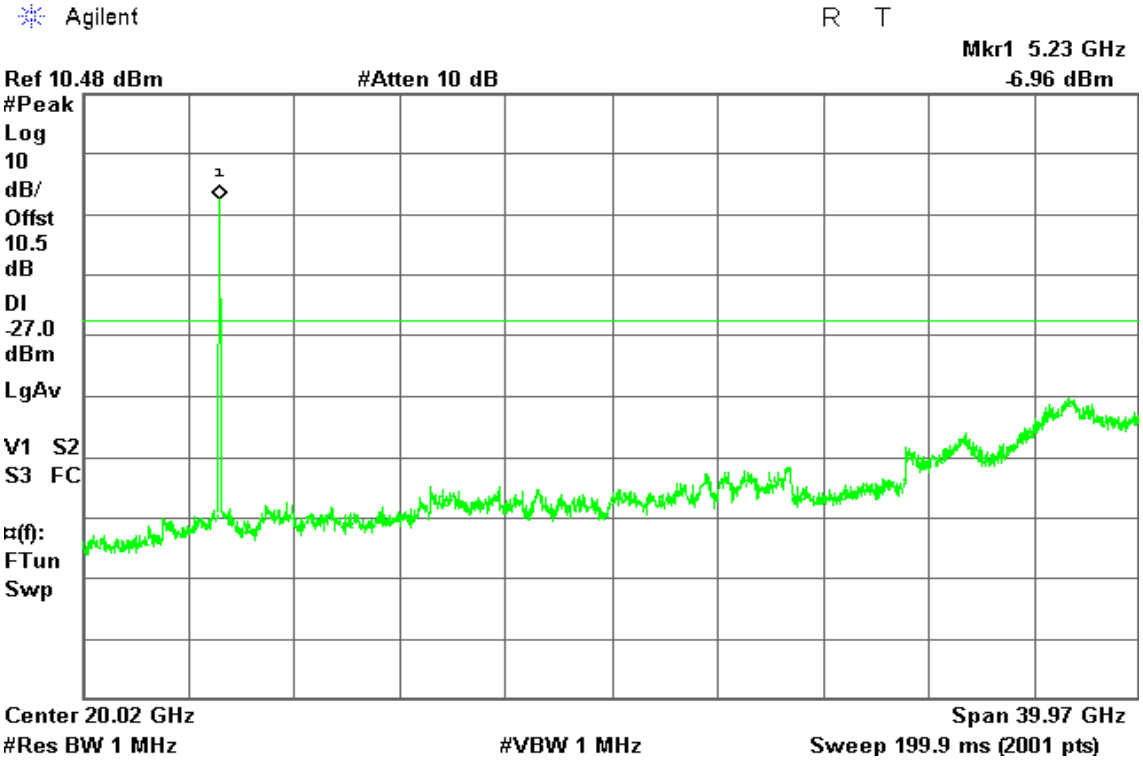


IEEE 802.11n HT 40 MHz mode / 5190 ~ 5210MHz / Chain 2

CH Low

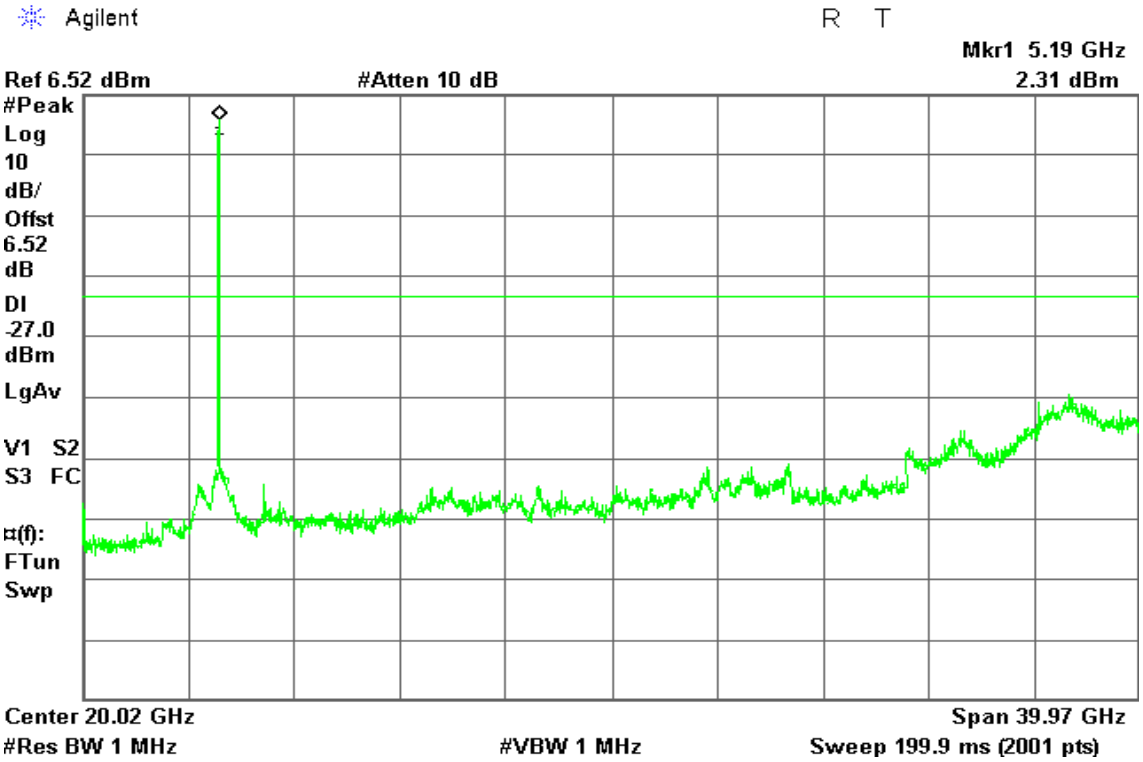


CH High

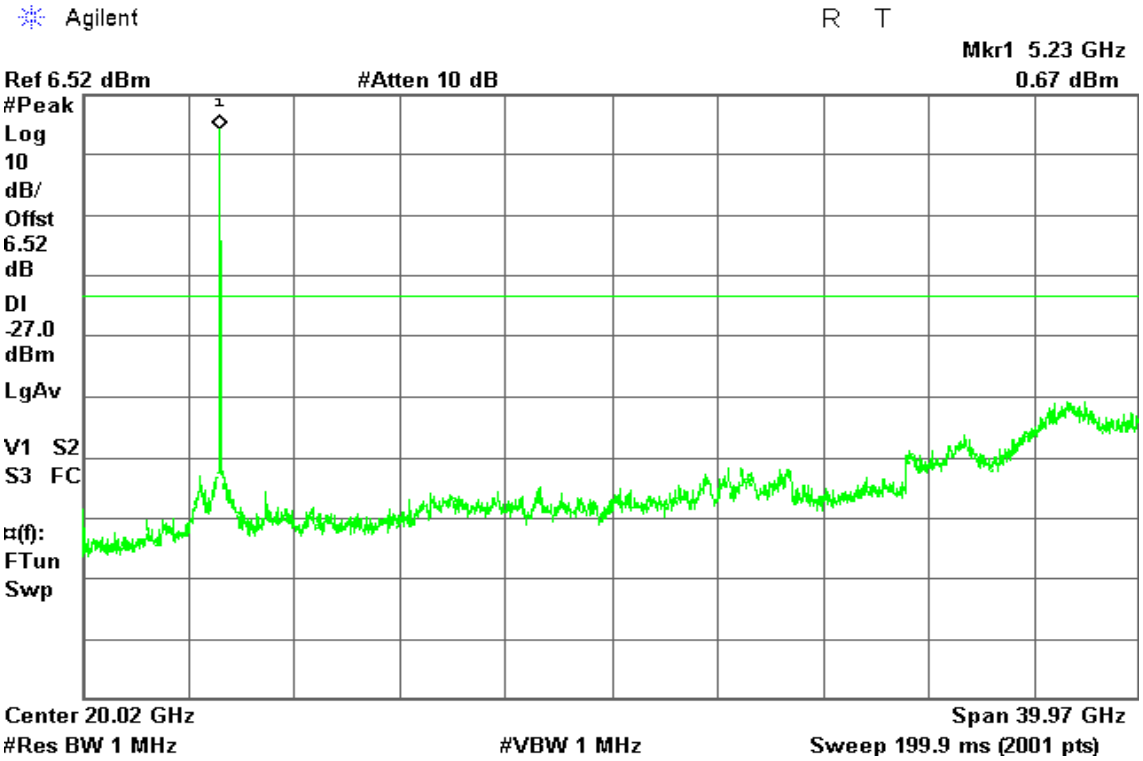


IEEE 802.11n HT 20 MHz mode / 5180 ~ 5220MHz / with combiner

CH Low

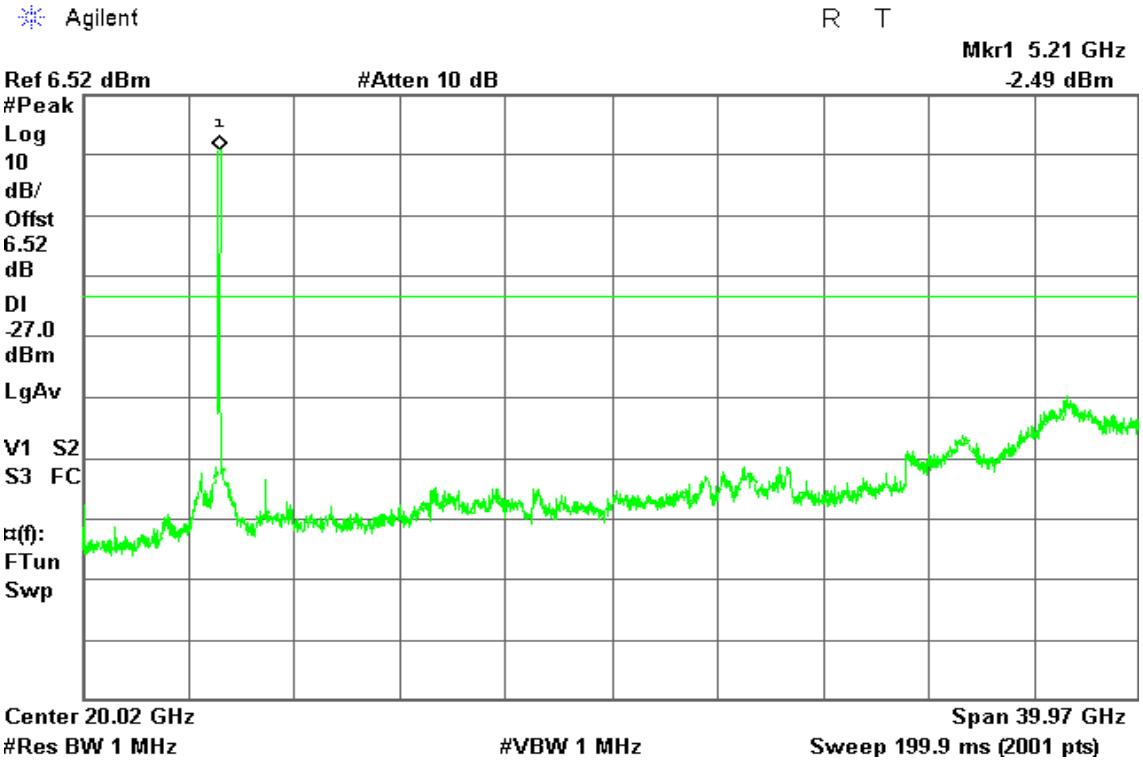


CH High

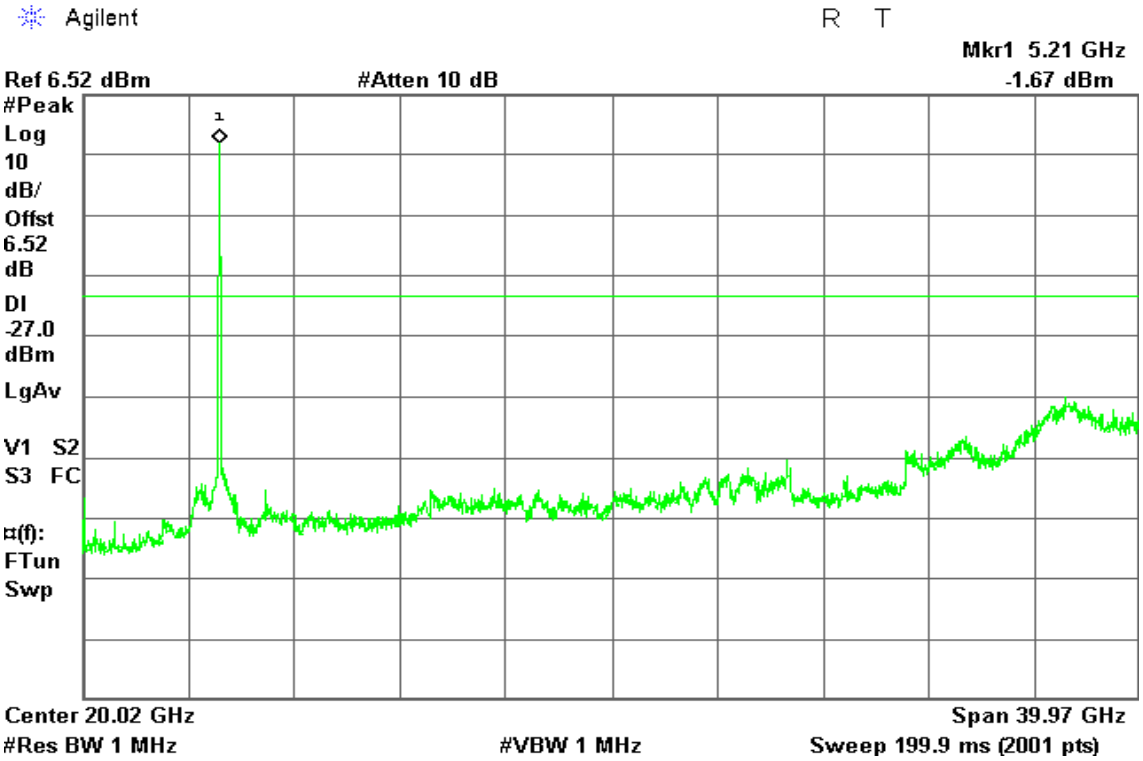


IEEE 802.11n HT 40 MHz mode / 5190 ~ 5210MHz / with combiner

CH Low



CH High



7.8 POWERLINE CONDUCTED EMISSIONS

LIMIT

According to §15.207(a), except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 µH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency Range (MHz)	Limits (dBµV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56*	56 to 46*
0.50 to 5	56	46
5 to 30	60	50

** Decreases with the logarithm of the frequency.*

TEST CONFIGURATION

See test photographs attached in Appendix 1 for the actual connections between EUT and support equipment.

TEST PROCEDURE

1. The EUT was placed on a table, which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.

TEST RESULTS

The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range. Significant peaks are then marked as shown on the following data page, and these signals are then quasi-peaked.

Test Data

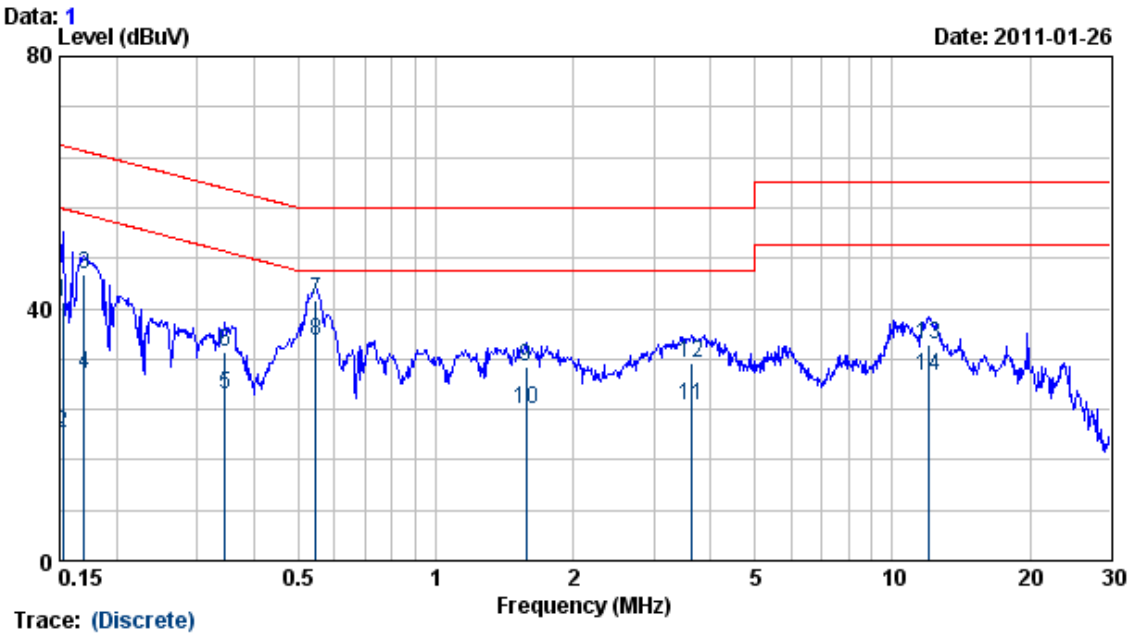
EUT:802.11a/b/g/n Router & Access Point Power: 120V/60Hz

M/N:BR51N1 Test mode: Normal Operation

POL: NEUTRAL Temp.: 22 Humidity: 55%

ENGINEER : Shiang.Su

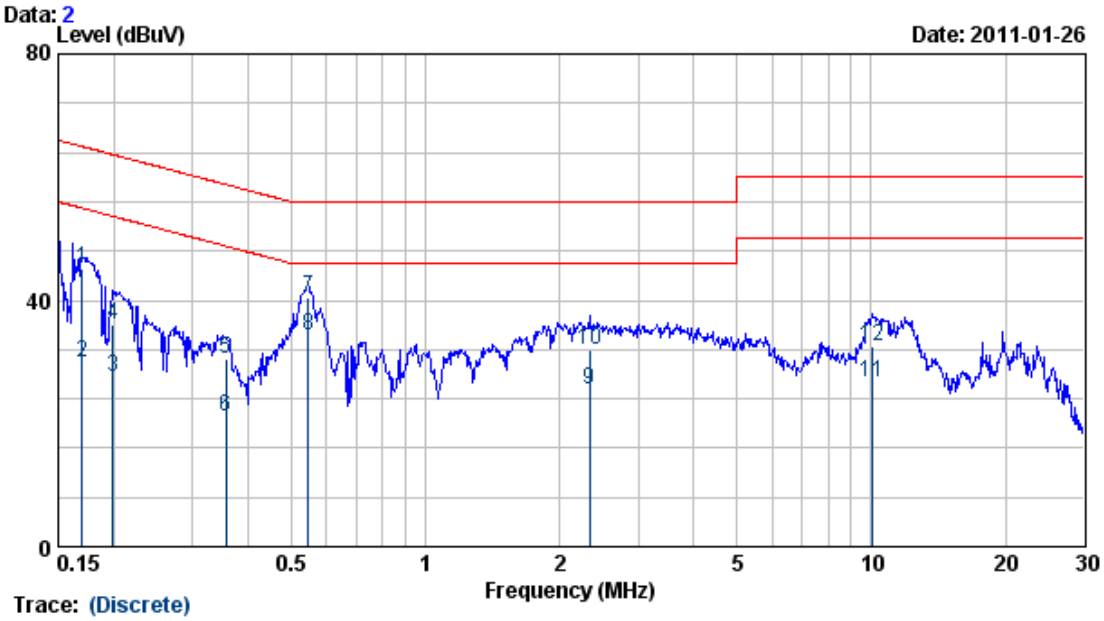
REMARK1:



Freq. MHz	LISN Factor dB	Cable Loss dB	Meter Reading dBuV	Measured Level dBuV	Limits dBuV	Over Limits dBuV	Detector
0.152	8.64	0.01	32.49	41.14	65.87	-24.73	QP
0.152	8.64	0.01	11.55	20.20	55.87	-35.67	AVERAGE
0.169	8.64	0.01	36.65	45.30	64.99	-19.68	QP
0.169	8.64	0.01	20.81	29.46	54.99	-25.52	AVERAGE
0.345	8.65	0.01	17.65	26.31	49.09	-22.78	AVERAGE
0.345	8.65	0.01	24.35	33.01	59.09	-26.08	QP
0.546	8.65	0.02	32.62	41.29	56.00	-14.71	QP
0.546	8.65	0.02	26.22	34.89	46.00	-11.11	AVERAGE
1.577	8.63	0.02	22.13	30.78	56.00	-25.22	QP
1.577	8.63	0.02	15.24	23.89	46.00	-22.11	AVERAGE
3.642	8.69	0.02	15.91	24.62	46.00	-21.38	AVERAGE
3.642	8.69	0.02	22.59	31.30	56.00	-24.70	QP
12.060	8.86	0.09	25.44	34.40	60.00	-25.60	QP
12.060	8.86	0.09	20.23	29.19	50.00	-20.81	AVERAGE

REMARKS:1.Level(dBuV)=Read Level(dBuV)+LISN Factor(dB)+Cable loss(dB)
2.Over Limit value(dB)=Level(dBuV)-Limit Line(dBuV)

EUT:802.11a/b/g/n Router & Access Point Power: 120V/60Hz
M/N:BR51N1 Test mode: Normal Operation
POL: LINE Temp.: 22 Humidity: 55%
ENGINEER : Shiang.Su
REMARK1:



Freq. MHz	LISN Factor dB	Cable Loss dB	Meter Reading dBuV	Measured Level dBuV	Limits dBuV	Over Limits dBuV	Detector
0.169	8.64	0.01	36.62	45.27	64.99	-19.71	QP
0.169	8.64	0.01	21.11	29.76	54.99	-25.22	AVERAGE
0.199	8.65	0.01	18.81	27.47	53.67	-26.20	AVERAGE
0.199	8.65	0.01	27.28	35.94	63.67	-27.73	QP
0.358	8.65	0.01	21.68	30.34	58.78	-28.44	QP
0.358	8.65	0.01	12.51	21.17	48.78	-27.61	AVERAGE
0.546	8.65	0.02	31.84	40.51	56.00	-15.49	QP
0.546	8.65	0.02	25.70	34.37	46.00	-11.63	AVERAGE
2.334	8.64	0.02	16.94	25.60	46.00	-20.40	AVERAGE
2.334	8.64	0.02	23.39	32.05	56.00	-23.95	QP
10.019	8.91	0.06	17.57	26.54	50.00	-23.46	AVERAGE
10.019	8.91	0.06	23.57	32.54	60.00	-27.46	QP

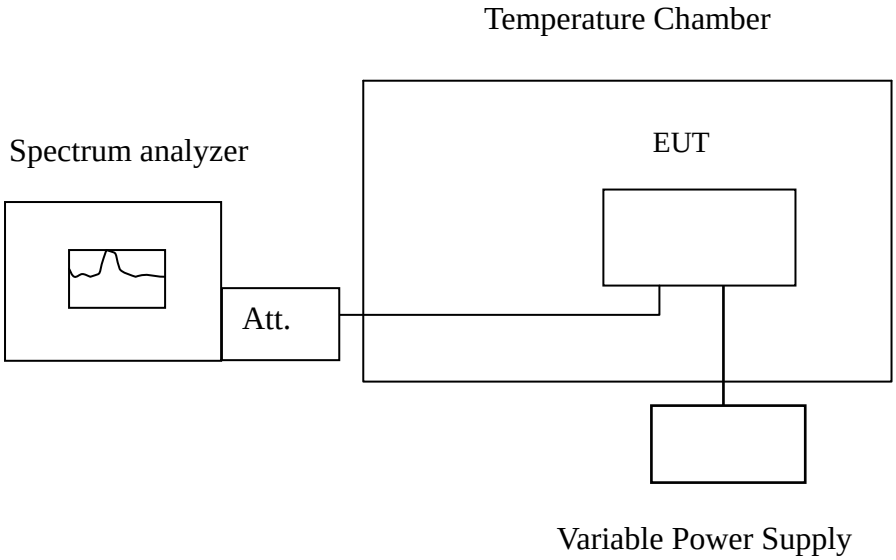
REMARKS:1.Level(dBuV)=Read Level(dBuV)+LISN Factor(dB)+Cable loss(dB)
2.Over Limit value(dB)=Level(dBuV)-Limit Line(dBuV)

7.9 FREQUENCY STABILITY

LIMIT

According to §15.407(g), manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

Test Configuration



Remark: *Measurement setup for testing on Antenna connector*

TEST PROCEDURE

The equipment under test was connected to an external AC or DC power supply and input rated voltage. RF output was connected to a frequency counter or spectrum analyzer via feed through attenuators. The EUT was placed inside the temperature chamber. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and measure EUT 20°C operating frequency as reference frequency. Turn EUT off and set the chamber temperature to –20°C. After the temperature stabilized for approximately 30 minutes recorded the frequency. Repeat step measure with 10°C increased per stage until the highest temperature of +50°C reached.

TEST RESULTS

No non-compliance noted.

IEEE 802.11a mode / 5180 ~ 5220 MHz:

CH Low

Operating Frequency: 5180 MHz				
Environment Temperature (°C)	Voltage (V)	Measured Frequency (MHz)	Limit Range	Test Result
50	110	5180.010144	5150~5250	Pass
40	110	5180.010046	5150~5250	Pass
30	110	5179.979911	5150~5250	Pass
20	110	5179.989333	5150~5250	Pass
10	110	5179.986031	5150~5250	Pass
0	110	5179.974087	5150~5250	Pass
-10	110	5179.976610	5150~5250	Pass
-20	110	5179.986716	5150~5250	Pass

Operating Frequency: 5180 MHz				
Environment Temperature (°C)	Voltage (V)	Measured Frequency (MHz)	Limit Range	Test Result
20	99	5179.974216	5150~5250	Pass
	110	5179.994645	5150~5250	Pass
	121	5179.97024	5150~5250	Pass

CH High

Operating Frequency: 5220 MHz				
Environment Temperature (°C)	Voltage (V)	Measured Frequency (MHz)	Limit Range	Test Result
50	110	5219.972898	5150~5250	Pass
40	110	5220.006537	5150~5250	Pass
30	110	5220.014948	5150~5250	Pass
20	110	5219.974646	5150~5250	Pass
10	110	5219.978765	5150~5250	Pass
0	110	5219.980063	5150~5250	Pass
-10	110	5219.975894	5150~5250	Pass
-20	110	5219.983963	5150~5250	Pass

Operating Frequency: 5220 MHz				
Environment Temperature (°C)	Voltage (V)	Measured Frequency (MHz)	Limit Range	Test Result
20	99	5220.019453	5150~5250	Pass
	110	5219.985162	5150~5250	Pass
	121	5220.004851	5150~5250	Pass

IEEE 802.11n HT 20 MHz mode / 5180 ~ 5220 MHz:

CH Low

Operating Frequency: 5180 MHz				
Environment Temperature (°C)	Voltage (V)	Measured Frequency (MHz)	Limit Range	Test Result
50	110	5179.990508	5150~5250	Pass
40	110	5179.987865	5150~5250	Pass
30	110	5180.018633	5150~5250	Pass
20	110	5180.017691	5150~5250	Pass
10	110	5179.985172	5150~5250	Pass
0	110	5179.983014	5150~5250	Pass
-10	110	5179.987853	5150~5250	Pass
-20	110	5179.972503	5150~5250	Pass

Operating Frequency: 5180 MHz				
Environment Temperature (°C)	Voltage (V)	Measured Frequency (MHz)	Limit Range	Test Result
20	99	5180.001412	5150~5250	Pass
	110	5180.003362	5150~5250	Pass
	121	5179.983447	5150~5250	Pass

CH High

Operating Frequency: 5220 MHz				
Environment Temperature (°C)	Voltage (V)	Measured Frequency (MHz)	Limit Range	Test Result
50	110	5219.9771	5150~5250	Pass
40	110	5219.978438	5150~5250	Pass
30	110	5219.973224	5150~5250	Pass
20	110	5219.9771	5150~5250	Pass
10	110	5219.978438	5150~5250	Pass
0	110	5219.973224	5150~5250	Pass
-10	110	5219.9771	5150~5250	Pass
-20	110	5219.978438	5150~5250	Pass

Operating Frequency: 5220 MHz				
Environment Temperature (°C)	Voltage (V)	Measured Frequency (MHz)	Limit Range	Test Result
20	99	5219.9771	5150~5250	Pass
	110	5219.978438	5150~5250	Pass
	121	5219.973224	5150~5250	Pass

IEEE 802.11n HT 40 MHz mode / 5190 ~ 5210 MHz:

CH Low

Operating Frequency: 5190 MHz				
Environment Temperature (°C)	Voltage (V)	Measured Frequency (MHz)	Limit Range	Test Result
50	110	5189.974316	5150~5250	Pass
40	110	5189.987707	5150~5250	Pass
30	110	5189.987703	5150~5250	Pass
20	110	5189.990419	5150~5250	Pass
10	110	5189.985652	5150~5250	Pass
0	110	5189.980812	5150~5250	Pass
-10	110	5189.989749	5150~5250	Pass
-20	110	5189.98708	5150~5250	Pass

Operating Frequency: 5190 MHz				
Environment Temperature (°C)	Voltage (V)	Measured Frequency (MHz)	Limit Range	Test Result
20	99	5190.012688	5150~5250	Pass
	110	5189.9932	5150~5250	Pass
	121	5190.019132	5150~5250	Pass

CH High

Operating Frequency: 5210 MHz				
Environment Temperature (°C)	Voltage (V)	Measured Frequency (MHz)	Limit Range	Test Result
50	110	5209.986203	5150~5250	Pass
40	110	5209.980552	5150~5250	Pass
30	110	5209.989614	5150~5250	Pass
20	110	5210.019921	5150~5250	Pass
10	110	5209.972782	5150~5250	Pass
0	110	5210.017391	5150~5250	Pass
-10	110	5210.018018	5150~5250	Pass
-20	110	5209.986683	5150~5250	Pass

Operating Frequency: 5210 MHz				
Environment Temperature (°C)	Voltage (V)	Measured Frequency (MHz)	Limit Range	Test Result
20	99	5209.990728	5150~5250	Pass
	110	5209.9845	5150~5250	Pass
	121	5209.974513	5150~5250	Pass

APPENDIX I
RADIO FREQUENCY EXPOSURE

LIMIT

According to §15.407(f), U-NII devices are subject to the radio frequency radiation exposure requirements specified in §§ 1.1307(b), 2.1091 and 2.1093 of this chapter, as appropriate. All equipment shall be considered to operate in a "general population/uncontrolled" environment. Applications for equipment authorization of devices operating under this section must contain a statement confirming compliance with these requirements for both fundamental emissions and unwanted emissions. Technical information showing the basis for this statement must be submitted to the Commission upon request.

EUT Specification

EUT	Wireless Hotspot Gateway / Enterprise Access Point
Frequency band (Operating)	☐ WLAN: 2.412GHz ~ 2.462GHz ☒ WLAN: 5.15GHz ~ 5.250GHz ☐ Bluetooth: 2.402 GHz ~ 2.482 GHz ☐ Others: _____
Device category	☐ Portable (<20cm separation) ☒ Mobile (>20cm separation) ☐ Others: _____
Exposure classification	General Population/Uncontrolled exposure *(S=1mW/cm^2)*
Antenna diversity	☐ Single antenna ☒ Multiple antennas ☐ Tx diversity ☐ Rx diversity ☒ Tx/Rx diversity
Max. output power	IEEE 802.11a mode / 5180 ~ 5220MHz: 16.59 dBm (45.60mW) IEEE 802.11n HT 20 MHz mode / 5180 ~ 5220MHz: 12.31 dBm (17.02mW) IEEE 802.11n HT 40 MHz mode / 5190 ~ 5210MHz: 11.51 dBm (14.15mW)
Antenna gain (Max)	5 dBi (Numeric gain: 3.16)
	MIMO Mode: 5 dBi + 10 log (3) = 9 dBi (Numeric gain: 7.9)
Evaluation applied	☒ MPE Evaluation* ☐ SAR Evaluation ☐ N/A
Remark: *The maximum output power is 16.59dBm (45.60mW) at 5220MHz (with 7.9 numeric antenna gain.)*	

TEST RESULTS

No non-compliance noted.

Calculation

Given $E = \frac{\sqrt{30 \times P \times G}}{d}$ & $S = \frac{E^2}{3770}$

Where *E = Field strength in Volts / meter*

P = Power in Watts
G = Numeric antenna gain
d = Distance in meters

S = Power density in milliwatts / square centimeter

Combining equations and re-arranging the terms to express the distance as a function of the remaining variables yields:

$$S = \frac{30 \times P \times G}{3770 d^2}$$

Changing to units of mW and cm, using:

P (mW) = P (W) / 1000 and
d (cm) = d(m) / 100

Yields

$$S = \frac{30 \times (P/1000) \times G}{3770 \times (d/100)^2} = 0.0796 \times \frac{P \times G}{d^2}$$ ***Equation 1***

Where *d = Distance in cm*
P = Power in mW
G = Numeric antenna gain
S = Power density in mW / cm2

Maximum Permissible Exposure

IEEE 802.11a mode:

EUT output power = 45.60mW

Numeric Antenna gain = 3.16

Substituting the MPE safe distance using d = 20 cm into Equation 1:

Yields

$$S = 0.000199 \times P \times G$$

Where *P = Power in mW*

G = Numeric antenna gain

S = Power density in mW / cm²

→ Power density =0.02867 mW / cm2

IEEE 802.11n HT 20 MHz mode:

EUT output power = 17.02mW

Numeric Antenna gain = 7.9

Substituting the MPE safe distance using d = 20 cm into Equation 1:

Yields

$$S = 0.000199 \times P \times G$$

Where *P = Power in mW*

G = Numeric antenna gain

S = Power density in mW / cm²

→ Power density = 0.0267mW / cm2

IEEE 802.11n HT 40 MHz mode:

EUT output power = 14.15mW

Numeric Antenna gain = 7.9

Substituting the MPE safe distance using d = 20 cm into Equation 1:

Yields

$$S = 0.000199 \times P \times G$$

Where *P = Power in mW*

G = Numeric antenna gain

S = Power density in mW / cm²

→ Power density = 0.0222 mW / cm2

(For mobile or fixed location transmitters, the maximum power density is 1.0 mW/cm² even if the calculation indicates that the power density would be larger.)