FCC 47 CFR PART 15 SUBPART E

TEST REPORT

For

Industrial Access Point and Router

Model:
IAP-620+_US, IAP-620_US, IAP-320_US, IAP-320+_US, IAR-620_US, IAR-620+_US, IAR-320_US, IAR-320+_US

Trade Name: ORING

Issued to

ORing Industrial Networking Corp.
4F., No.3, Lane 235, Baociao Rd., Sindian City,
Taipei County, Taiwan (R.O.C.)

Issued by

Compliance Certification Services Inc.
No.11, Wu-Gong 6th Rd., Wugu Industrial Park,
New Taipei City 248, Taiwan (R.O.C.)
http://www.ccsrf.com
service@ccsrf.com
Issued Date: August 23, 2012

Testing Laboratory
1309

Revision History

Rev.		Issue Date		Revisions	Effect Page	Revised By
00		August 23, 2012		Initial Issue	ALL	Eunice Shen

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1. TEST RESULT CERTIFICATION

Applicant:	ORing Industrial Networking Corp. 4F., No.3, Lane 235, Baociao Rd., Sindian City, Taipei County, Taiwan (R.O.C.)
Equipment Under Test:	Industrial Access Point and Router
Trade Name:	ORING
Model:	IAP-620+_US IAP-620_US, IAP-320_US, IAP-320+_US, IAR-620_US, IAR-620+_US, IAR-320_US, IAR-320+_US
Date of Test:	July 11 ~ August 23, 2012

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:

Miller Lee
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>Industrial Access Point and Router</td></tr>
<tr><td>Trade Name</td><td>ORING</td></tr>
<tr><td>Model Number</td><td>IAP-620+_US, IAP-620_US, IAP-320_US, IAP-320+_US,
IAR-620_US, IAR-620+_US, IAR-320_US, IAR-320+_US</td></tr>
<tr><td>Received Date</td><td>June 27, 2012</td></tr>
<tr><td>Power Supply</td><td>VDC from Power Adapter</td></tr>
<tr><td>Operating Frequency Range & Number of Channels</td><td>
<table>
<tr><th></th><th>Mode</th><th>Frequency Range (MHz)</th><th>Number of Channels</th></tr>
<tr><td rowspan="3">UNII Band I</td><td>IEEE 802.11a</td><td>5180 – 5240</td><td>4 Channels</td></tr>
<tr><td>IEEE 802.11n HT 20 MHz mode</td><td>5180 – 5240</td><td>4 Channels</td></tr>
<tr><td>IEEE 802.11n HT 40 MHz mode</td><td>5190 ~ 5230</td><td>2 Channels</td></tr>
</table>
</td></tr>
<tr><td>Transmit Power</td><td>IEEE 802.11a mode / 5180 ~ 5240MHz: 13.65 dBm
IEEE 802.11n HT 20 MHz mode / 5180 ~ 5240MHz: 13.92 dBm
IEEE 802.11n HT 40 MHz mode / 5190 ~ 5230MHz: 15.63dBm</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>Antenna Designation</td><td>Dipole Antenna</td></tr>
<tr><td>Antenna Specification</td><td>Gain: 3.58 dBi
MIMO: 3.58 dBi + 10 log (2) = 6.58 dBi (Numeric gain: 4.54)</td></tr>
</table>

Operation Frequency

UNLICENSED NATIONAL INFORMATION INFRASTRUCTURE (U-NII)	
CHANNEL	**MHz**
36	5180
38	5190
40	5200
46	5230
48	5240

Remark:

1. *The sample selected for test was production product and was provided by manufacturer.*
2. *1. This submittal(s) (test report) is intended for FCC ID:* ***WHD-IAP620*** *filing to comply with Section 15.407 of the FCC Part 15, Subpart E Rules.*

Model Discrepancy

Model	***Model Discrepancy***
IAP-620+_US	Industrial IEEE 802.11 a/b/g/n wireless access point with 2x10/100Base-T(X)
IAP-620_US	Industrial IEEE 802.11 a/b/g/n wireless access point with 2x10/100Base-T(X), 1-port PoE P.D.
IAP-320_US	Industrial IEEE 802.11 a/b/g wireless access point with 2x10/100Base-T(X), 1-port PoE P.D.
IAP-320+_US	Industrial IEEE 802.11 a/b/g wireless access point with 2x10/100Base-T(X)
IAR-620_US	Industrial IEEE 802.11 a/b/g/n wireless access point router with 2x10/100Base-T(X), 1-port PoE P.D.
IAR-620+_US	Industrial IEEE 802.11 a/b/g/n wireless access point router with 2x10/100Base-T(X)
IAR-320_US	Industrial IEEE 802.11 a/b/g wireless access point router with 2x10/100Base-T(X), 1-port PoE P.D.
IAR-320+_US	Industrial IEEE 802.11 a/b/g wireless access point router with 2x10/100Base-T(X)

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: IAP-620+_US) had been tested under operating condition.

The EUT is a 2x2 configuration spatial MIMO (2Tx & 2Rx) without beam forming function that operate in double TX chains and double RX chains. The 2x2 configuration is implemented with two outside TX & RX chains (Chain 1 and Chain 0).

Both antennas of EUT are rotatable. After the preliminary test, the antenna position was found to the worst-case of vertical.

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 for 5180 ~ 5240MHz:
Channel Low (5180MHz), Channel Mid (5220MHz) and Channel High (5240MHz) with 6Mbps data rate were chosen for full testing.

IEEE 802.11n HT 20 MHz for 5180 ~ 5240MHz:
Channel Low (5180MHz), Channel Mid (5220MHz) and Channel High (5240MHz) with 6.5Mbps data rate were chosen for full testing.

IEEE 802.11n HT 40 MHz mode / 5190 ~ 5230MHz:

Channel Low (5190MHz) and Channel High (5230MHz) 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	03/21/2013
Power Meter	Anritsu	ML2495A	1012009	06/05/2013
Power Sensor	Anritsu	MA2411B	0917072	06/05/2013

Wugu 966 Chamber A				
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
Spectrum Analyzer	Agilent	E4446A	US42510268	11/15/2012
EMI Test Receiver	R&S	ESCI	100064	03/01/2013
Pre-Amplifier	Mini-Circults	ZFL-1000LN	SF350700823	01/13/2013
Pre-Amplifier	MITEQ	AFS44-00102650-42-10P-44	1415367	11/20/2012
Bilog Antenna	Sunol Sciences	JB3	A030105	10/03/2012
Horn Antenna	EMCO	3117	00055165	02/14/2013
Horn Antenna	EMCO	3116	00026370	10/12/2012
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	12/25/2012
Test S/W	EZ-EMC (CCS-3A1RE)			

Conducted Emission room # A				
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
EMI Test Receiver	R&S	ESCI	101203	07/25/2013
LISN	R&S	ESH3-Z5	848773/014	12/07/2012
LISN	SCHWARZBECK	NSLK 8127	8127-541	12/14/2012
Coaxial Cable	Commate	CFD300-NL	NA	12/07/2012
Test S/W	CCS-3A1-CE			

4.3 MEASUREMENT UNCERTAINTY

PARAMETER	UNCERTAINTY
Powerline Conducted Emission	+/- 1.2159
3M Semi Anechoic Chamber / 30M~200M	+/- 4.0138
3M Semi Anechoic Chamber / 200M~1000M	+/- 3.9483
3M Semi Anechoic Chamber / 1G~8G	+/- 2.5975
3M Semi Anechoic Chamber / 8G~18G	+/- 2.6112
3M Semi Anechoic Chamber / 18G~26G	+/- 2.7389
3M Semi Anechoic Chamber / 26G~40G	+/- 2.9683

***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, Wu-Gong 6th Rd., Wugu Industrial Park, New Taipei City 248, Taiwan (R.O.C.)
Tel: 886-2-2299-9720 / Fax: 886-2-2298-4045

☐ No.81-1, Lane 210, Bade 2nd Rd., Lujhu Township, Taoyuan County 33841, TAIWAN, R.O.C.
Tel: 886-3-324-0332 / Fax: 886-3-324-5235

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

No.	Device Type	Brand	Model	Series No.	FCC ID	Data Cable	Power Cord
1.	Power Adapter	UMEC	UP0121A-12PA	N/A	N/A	N/A	AC I/P: Unshielded, 1.8m DC O/P: Unshielded, 1.8m with a core
2.	Wireless Pre-N Router (Remote)	BELKIN	F5D8230-4	N/A	SA3-AGN0901AP 0100	N/A	AC I/P: Unshielded, 1.8m DC O/P: Unshielded, 1.8m with a core
3.	Notebook PC (Remote)	DELL	PP19L	61G6Q1S	FCC DoC	LAN Cable: Unshielded, 10m	AC I/P: Unshielded, 1.8m DC O/P: Unshielded, 1.8m with a core

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 DUTY CYCLE

LIMIT

KDB 789033

TEST PROCEDURE

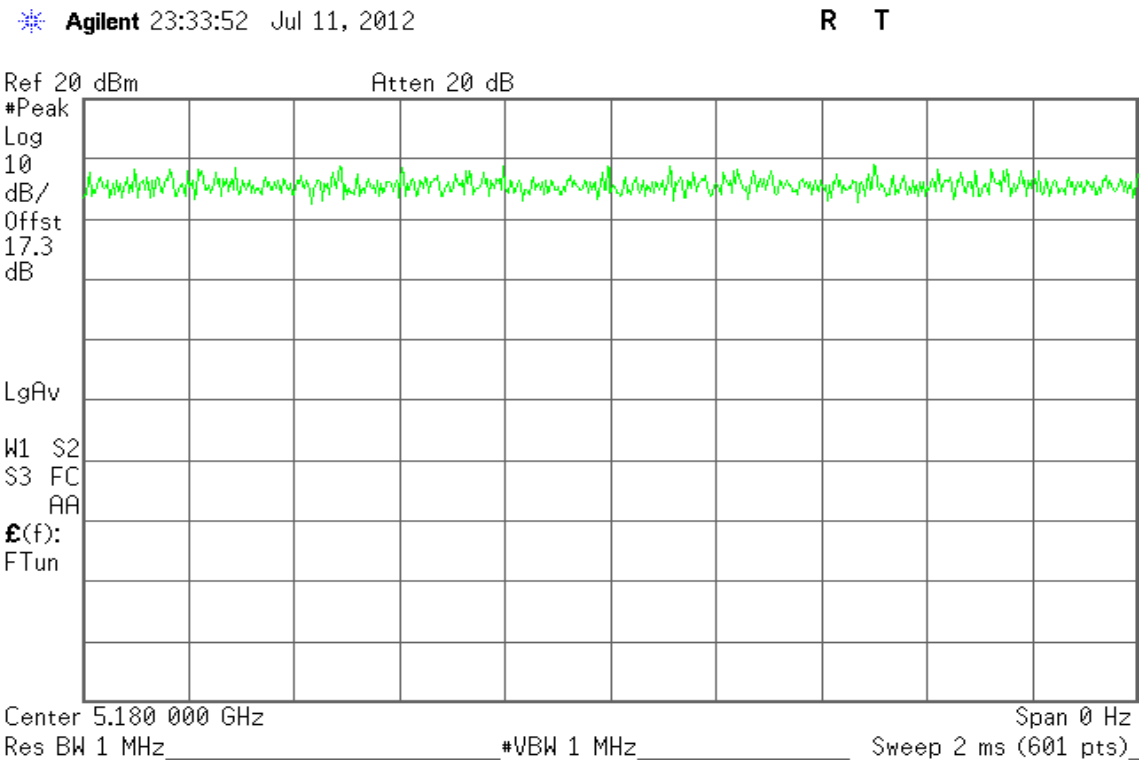
The transmitter output is connected to a spectrum analyzer or radiated field strength. The RBW is set to 1 MHz and the VBW is set to 1 MHz. The sweep time is coupled and the span is set to 0 Hz.

TEST RESULTS

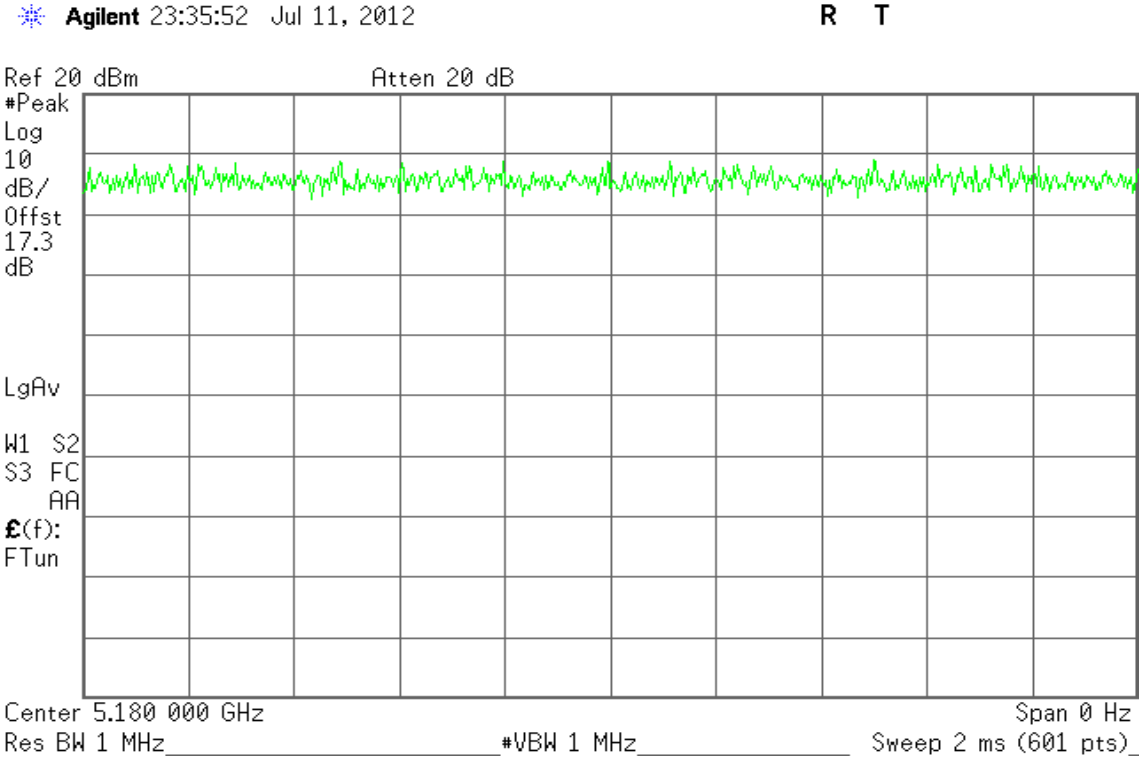
Mode	ON Time (msec)	Period (msec)	Duty Cycle (%)
IEEE 802.11a mode	--	--	≒100
IEEE 802.11n HT 20 MHz Channel mode	--	--	≒100
IEEE 802.11n HT 40 MHz Channel mode	--	--	≒100

Test Plot

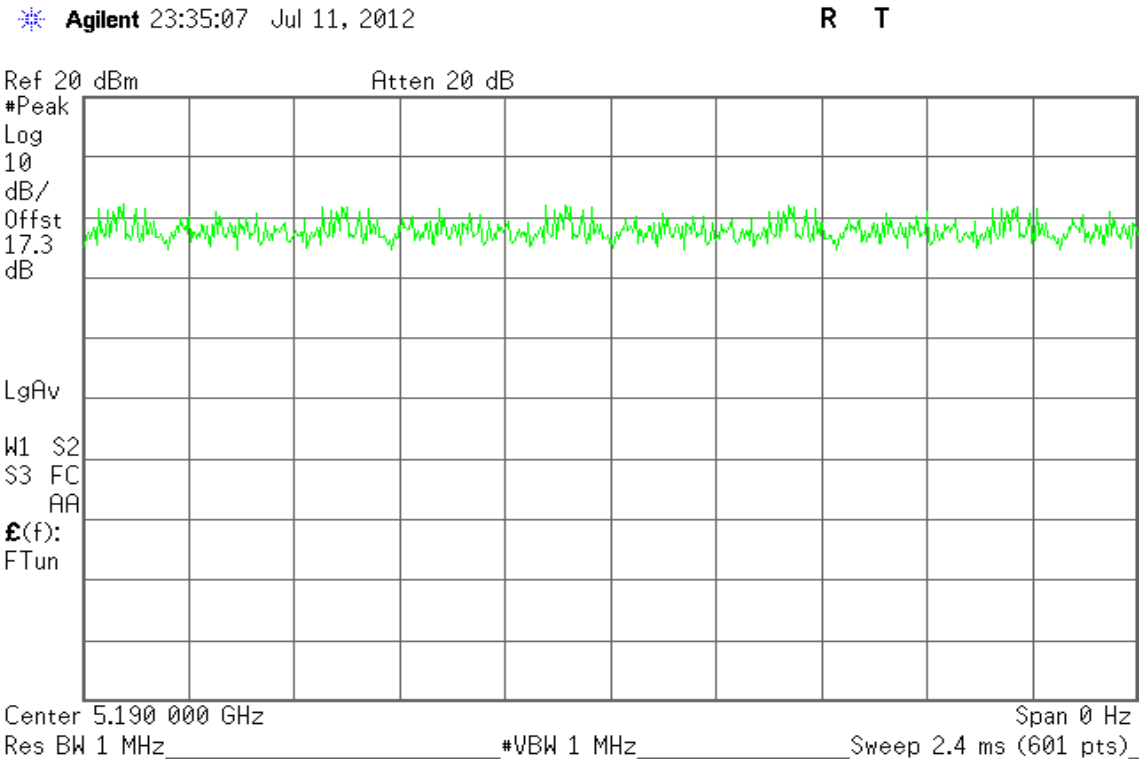
IEEE 802.11a mode



IEEE 802.11n HT 20 MHz Channel mode



IEEE 802.11n HT 40 MHz Channel mode

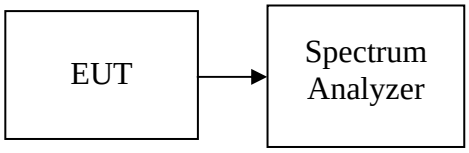


7.2 26 DB EMISSION BANDWIDTH

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 = 1%EBW, VBW = RBW, Span = 50MHz, and Sweep = auto.
   Or Set the spectrum analyzer as RBW > 1%EBW, VBW > RBW, Span >26dB bandwidth, and Sweep = auto.
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 ~ 5240MHz

Channel	Frequency (MHz)	Bandwidth (B) (MHz)
Low	5180	29.269
Mid	5220	25.223
High	5240	24.415

Test mode: IEEE 802.11n HT 20 MHz mode / 5180 ~ 5240MHz / Chain 0

Channel	Frequency (MHz)	Bandwidth (B) (MHz)
Low	5180	21.572
Mid	5220	20.660
High	5240	22.061

Test mode: IEEE 802.11n HT 20 MHz mode / 5180 ~ 5240MHz / Chain 1

Channel	Frequency (MHz)	Bandwidth (B) (MHz)
Low	5180	21.275
Mid	5220	20.227
High	5240	19.894

Test mode: IEEE 802.11n HT 40 MHz mode / 5190 ~ 5230MHz / Chain 0

Channel	Frequency (MHz)	Bandwidth (MHz)
Low	5190	39.906
High	5230	39.613

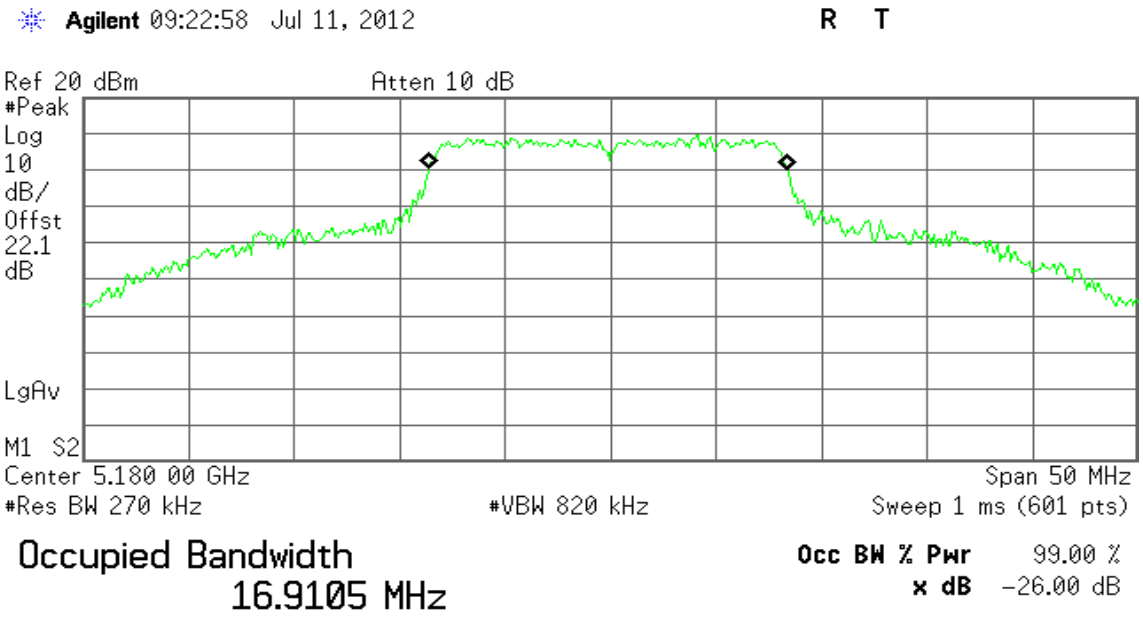
Test mode: IEEE 802.11n HT 40 MHz mode/ 5190 ~ 5230MHz / Chain 1

Channel	Frequency (MHz)	Bandwidth (MHz)
Low	5190	39.545
High	5230	39.460

Test Plot

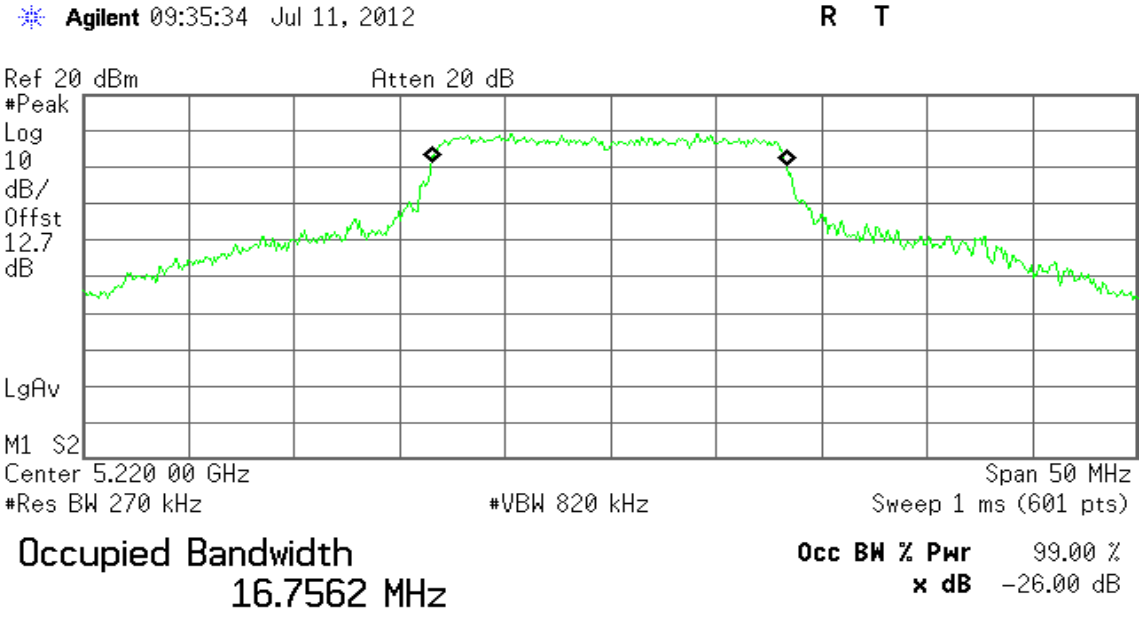
IEEE 802.11a mode / 5180 ~ 5240MHz

CH Low



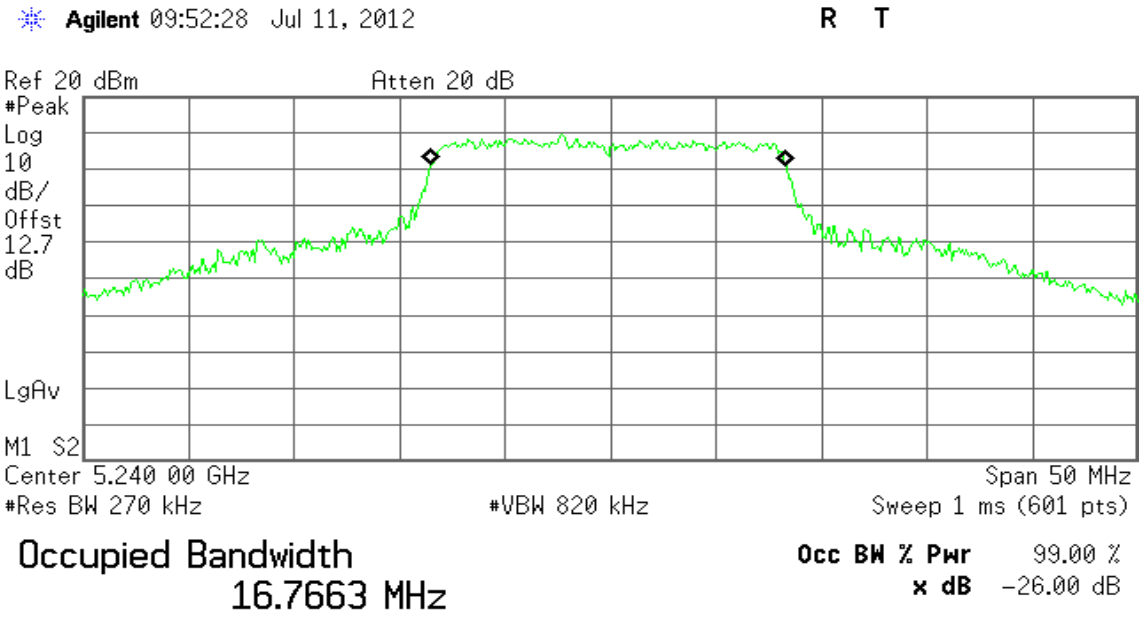
Transmit Freq Error -105.921 kHz
x dB Bandwidth 29.269 MHz

CH Mid



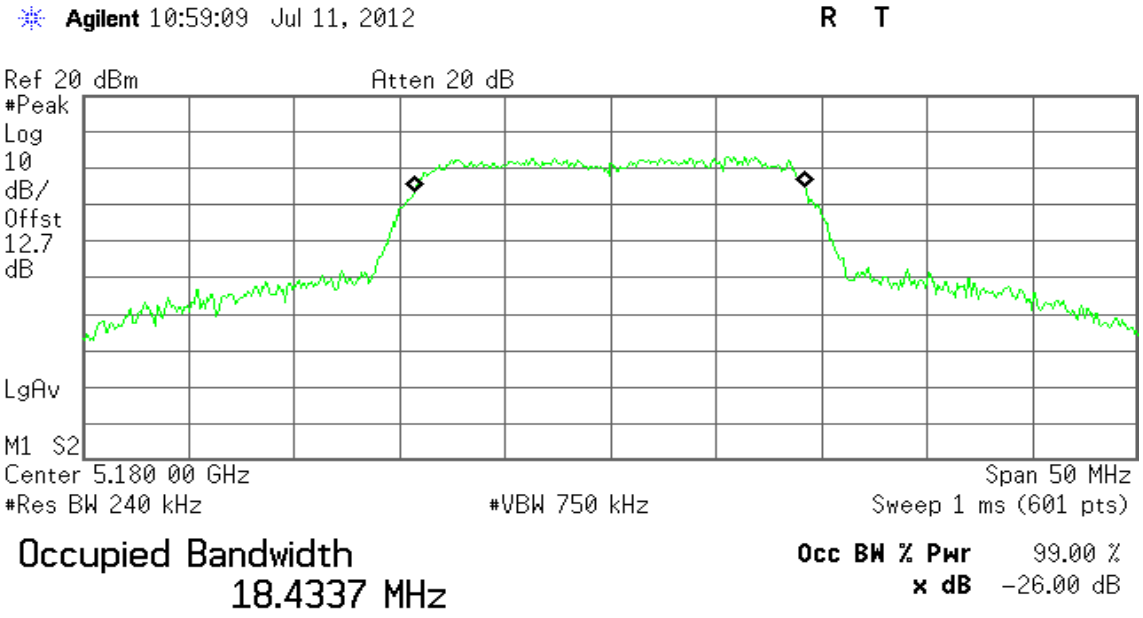
Transmit Freq Error -73.981 kHz
x dB Bandwidth 25.223 MHz

CH High

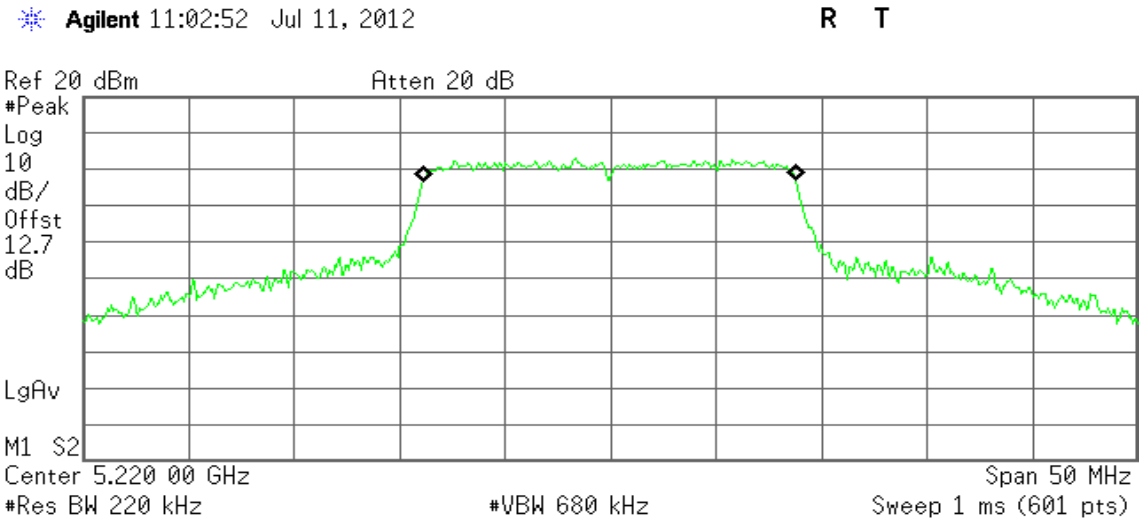


IEEE 802.11n HT 20 MHz mode / 5180 ~ 5240MHz / Chain 0

CH Low

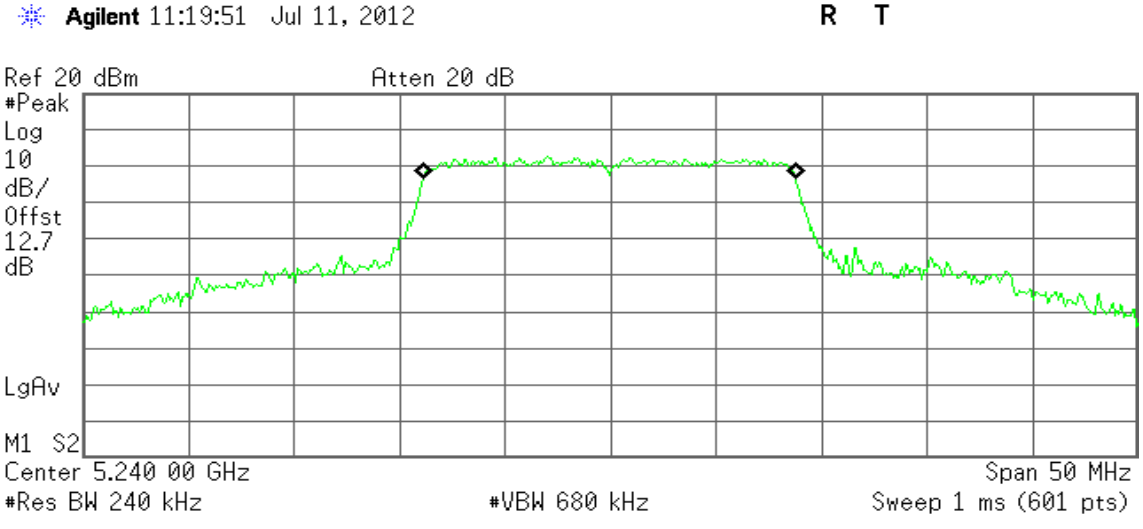


CH Mid



Transmit Freq Error	-55.458 kHz
x dB Bandwidth	20.660 MHz

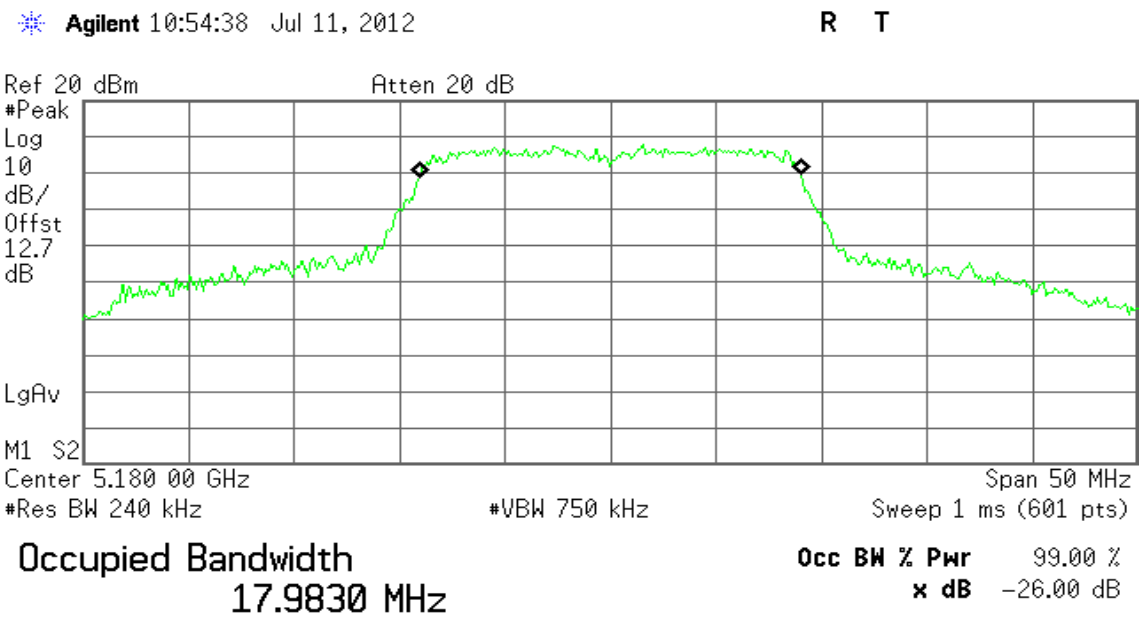
CH High



Transmit Freq Error	-52.365 kHz
x dB Bandwidth	22.061 MHz

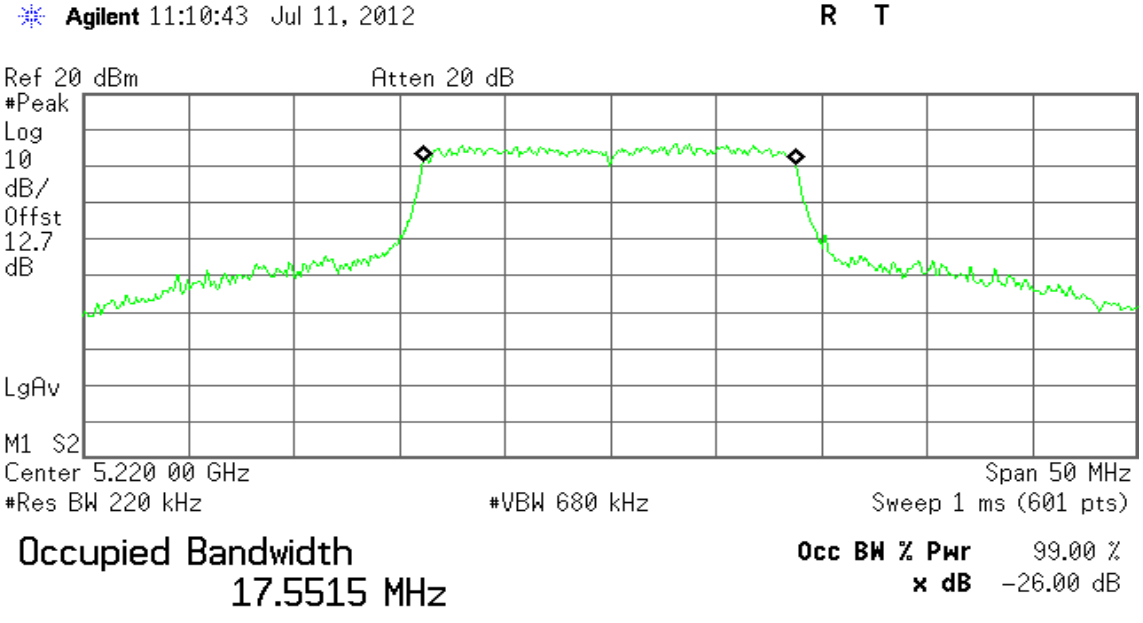
IEEE 802.11n HT 20 MHz mode / 5180 ~ 5240MHz / Chain 1

CH Low



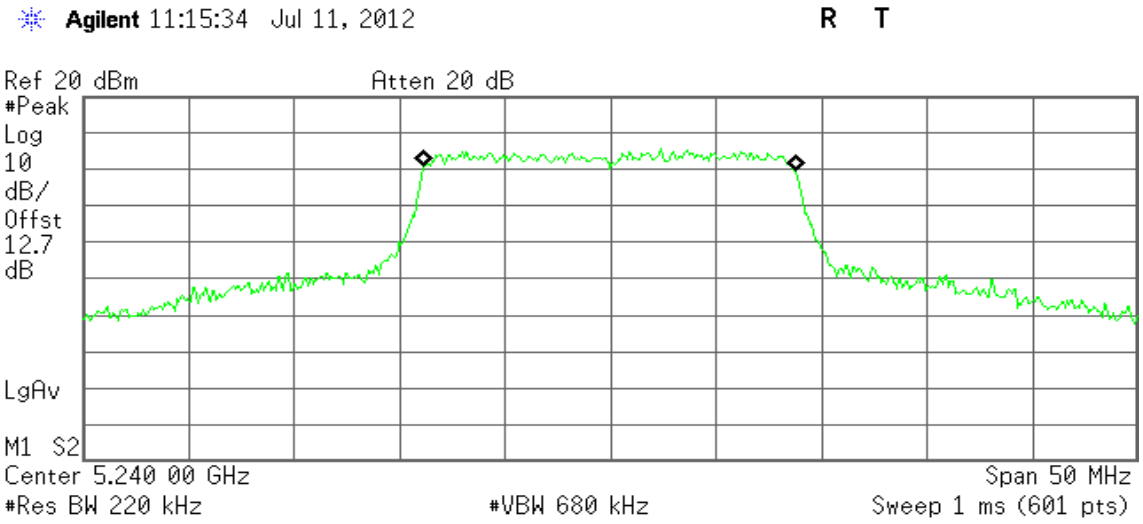
Transmit Freq Error	-27.296 kHz
x dB Bandwidth	21.275 MHz

CH Mid



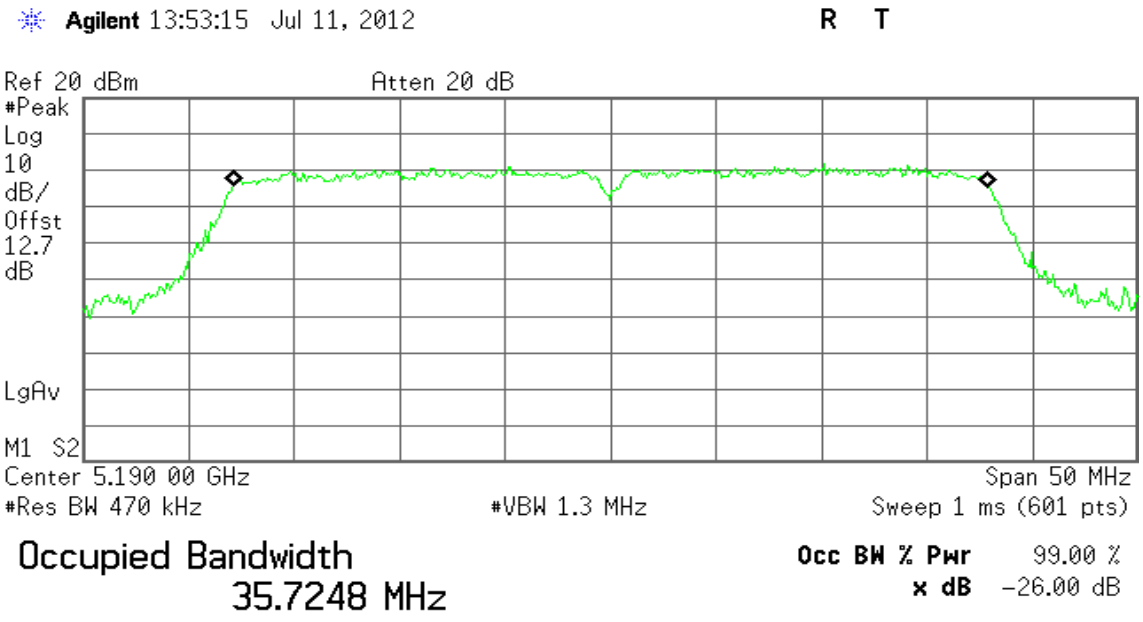
Transmit Freq Error	-61.545 kHz
x dB Bandwidth	20.227 MHz

CH High


Agilent 11:15:34 Jul 11, 2012
R T
Ref 20 dBm
Atten 20 dB
#Peak
Log
10
dB/
Offst
12.7
dB
LgAv
M1 S2
Center 5.240 00 GHz
Span 50 MHz
#Res BW 220 kHz
#VBW 680 kHz
Sweep 1 ms (601 pts)
Occupied Bandwidth
17.5511 MHz
Occ BW % Pwr 99.00 %
x dB -26.00 dB
Transmit Freq Error -52.070 kHz
x dB Bandwidth 19.894 MHz

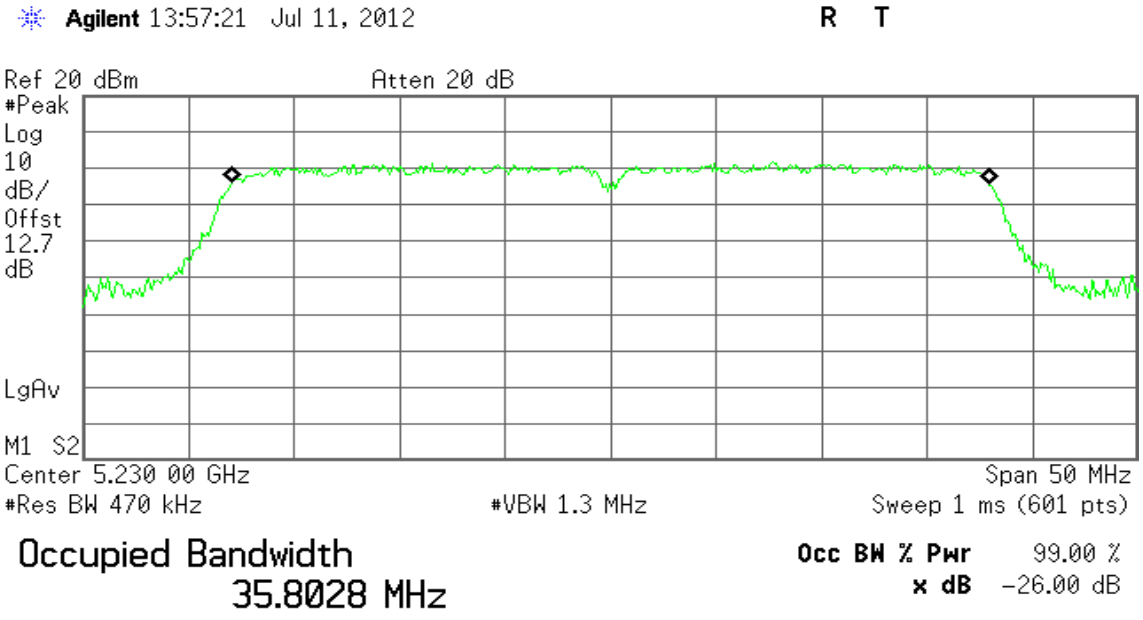
IEEE 802.11n HT 40 MHz mode / 5190 ~ 5230MHz / Chain 0

CH Low



Transmit Freq Error	7.864 kHz
x dB Bandwidth	39.906 MHz

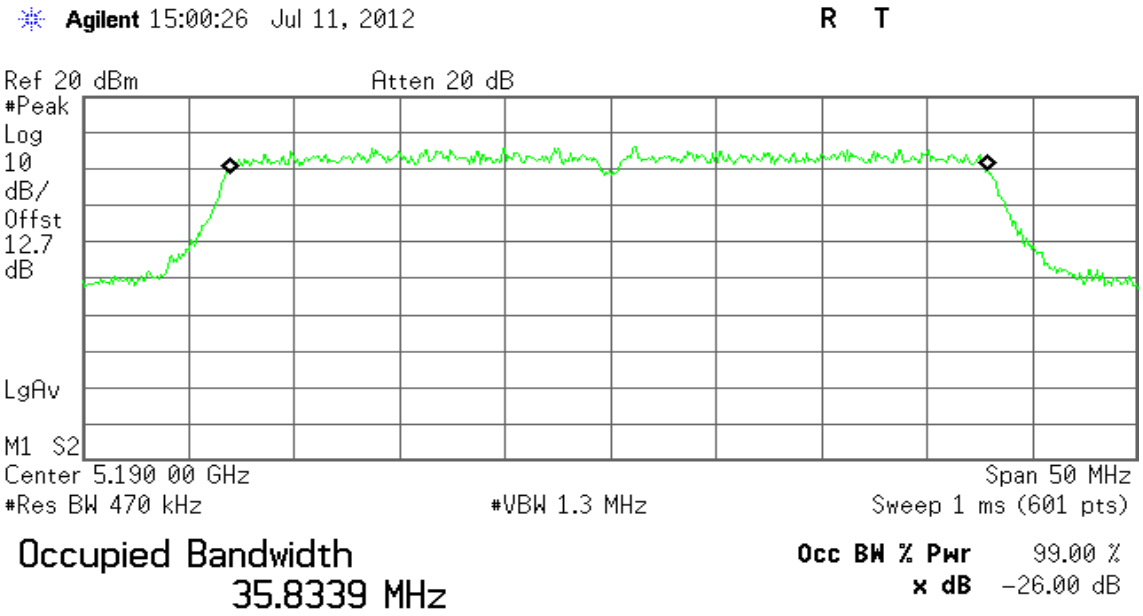
CH High



Transmit Freq Error	-23.157 kHz
x dB Bandwidth	39.613 MHz

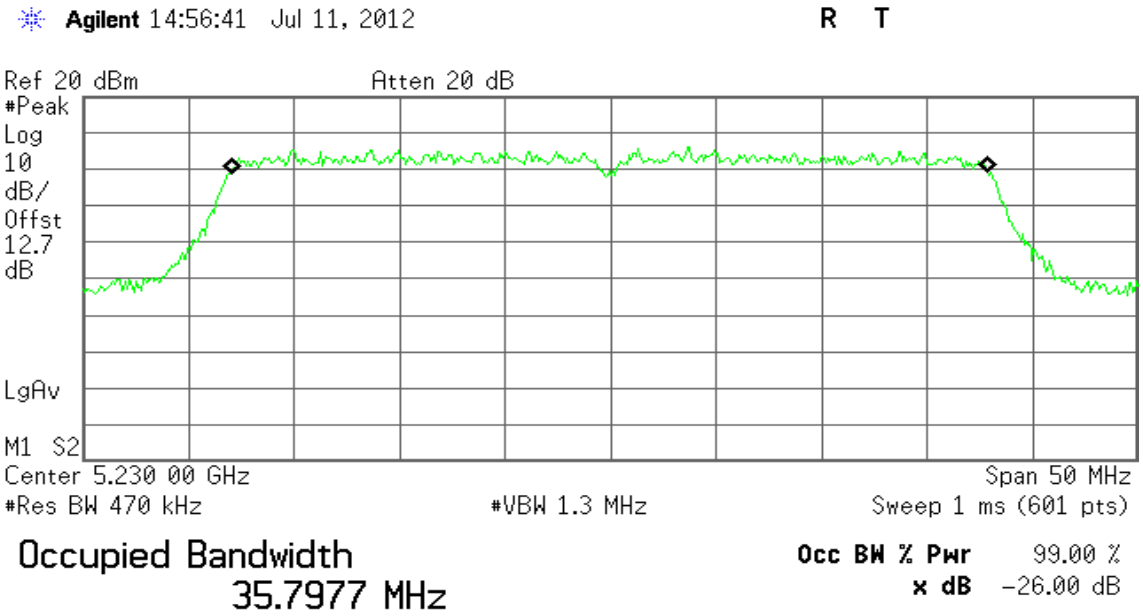
IEEE 802.11n HT 40 MHz mode / 5190 ~ 5230MHz / Chain 1

CH Low



Transmit Freq Error	-82.203 kHz
x dB Bandwidth	39.545 MHz

CH High



Transmit Freq Error	-52.882 kHz
x dB Bandwidth	39.460 MHz

7.3 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 ~ 5240MHz

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	29.27	14.66	18.66	17.00
Mid	5220	25.22	14.02	18.02	17.00
High	5240	24.42	13.88	17.88	17.00

Test mode: IEEE 802.11n HT 20 MHz mode / 5180 ~ 5240MHz

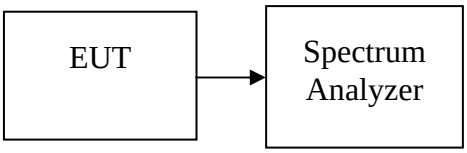
Channel	Frequency (MHz)	Chain 0 26 dB Bandwidth (B) (MHz)	Chain 1 26 dB Bandwidth (B) (MHz)	10 Log B (dB)	4 + 10 Log B (dBm)	Maximum Conducted Output Power Limit (dBm)
Low	5180	21.57	21.28	13.34	17.34	17.00
Mid	5220	20.66	20.23	13.15	17.15	17.00
High	5240	22.06	19.89	13.44	17.44	17.00

Test mode: IEEE 802.11n HT 40 MHz mode / 5190 ~ 5230MHz

Channel	Frequency (MHz)	Chain 0 26 dB Bandwidth (B) (MHz)	Chain 1 26 dB Bandwidth (B) (MHz)	10 Log B (dB)	4 + 10 Log B (dBm)	Maximum Conducted Output Power Limit (dBm)
Low	5190	39.91	39.55	16.01	20.01	17.00
High	5230	39.61	39.46	15.98	19.98	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 ~ 5240MHz

Channel	Frequency (MHz)	Output Power (dBm)	Maximum Output Power (dBm)	Limit (dBm)
Low	5180	13.65	13.65	17.00
Mid	5220	12.83	12.83	17.00
High	5240	12.32	12.32	17.00

Test mode: IEEE 802.11n HT 20 MHz mode / 5180 ~ 5240MHz

Channel	Frequency (MHz)	Chain 0 Output Power (dBm)	Maximum Output Power (dBm)	Chain 1 Output Power (dBm)	Maximum Output Power (dBm)	Total Maximum Output Power (dBm)	Limit (dBm)
Low	5180	12.44	12.44	6.67	6.67	13.46	16.42
Mid	5220	12.46	12.46	6.35	6.35	13.41	16.42
High	5240	13.34	13.34	4.89	4.89	13.92	16.42

Test mode: IEEE 802.11n HT 40 MHz mode / 5190 ~ 5230MHz

Channel	Frequency (MHz)	Chain 0 Output Power (dBm)	Maximum Output Power (dBm)	Chain 1 Output Power (dBm)	Maximum Output Power (dBm)	Total Maximum Output Power (dBm)	Limit (dBm)
Low	5190	15.21	15.21	5.32	5.32	15.63	16.42
High	5230	14.8	14.80	5.55	5.55	15.29	16.42

Remark:

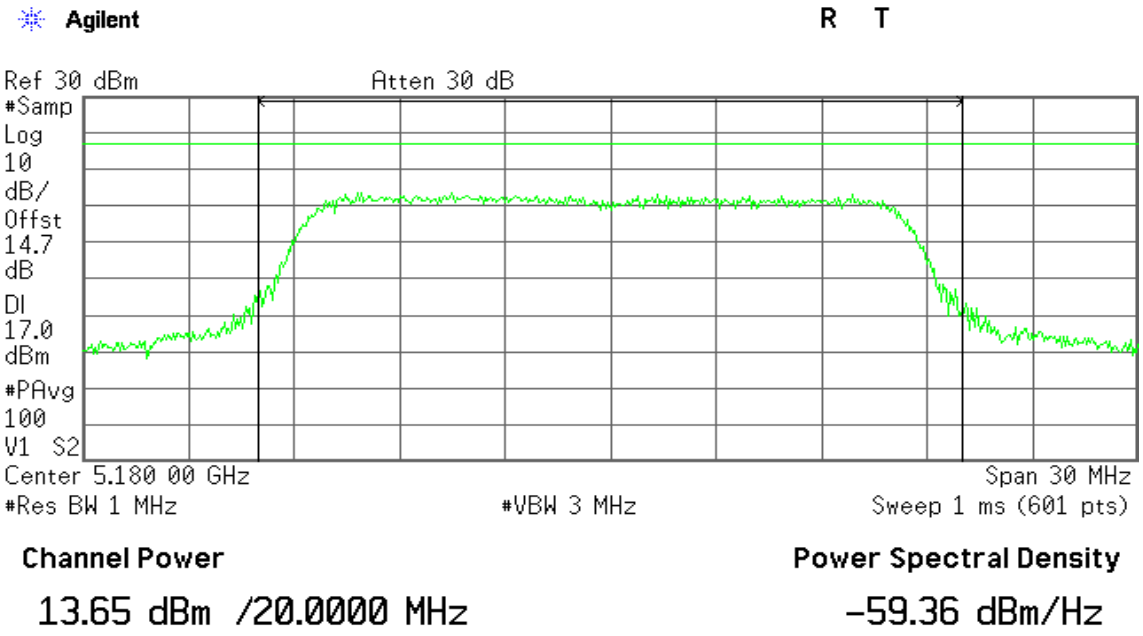
1. Total Output Power (w) = Chain 0 (10^(Output Power /10)/1000)+ Chain 1 (10^(Output Power /10)/1000)

2. The maximum antenna gain is 6.58dBi; therefore the reduction due to antenna gain is 0.58dBi, so the limit is 16.42dBm.

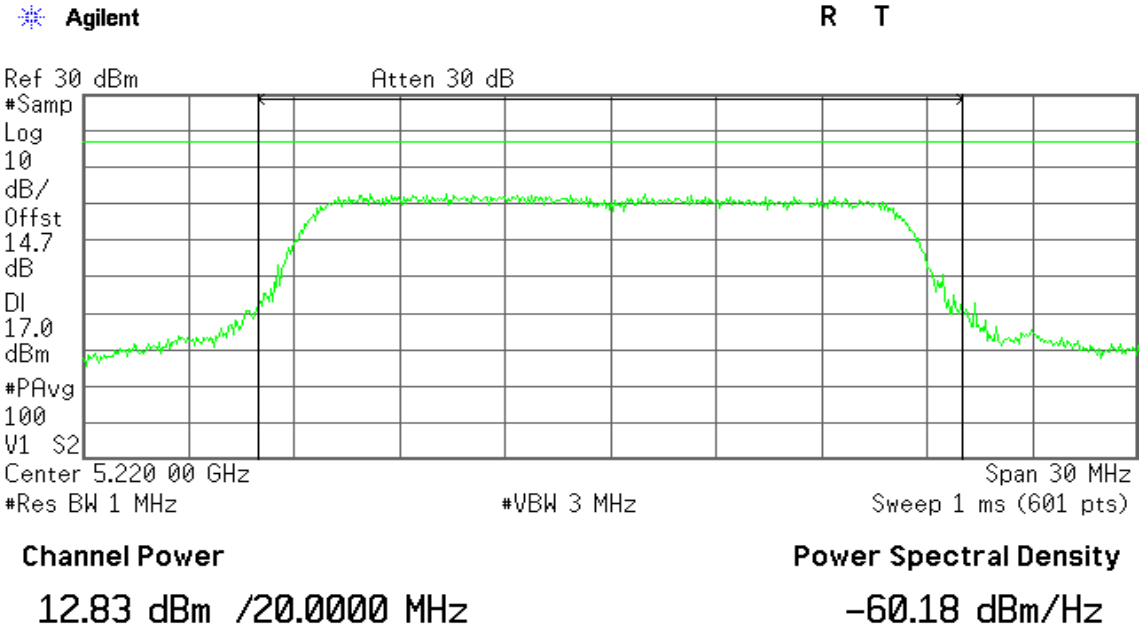
Test Plot

IEEE 802.11a mode / 5180 ~ 5240MHz

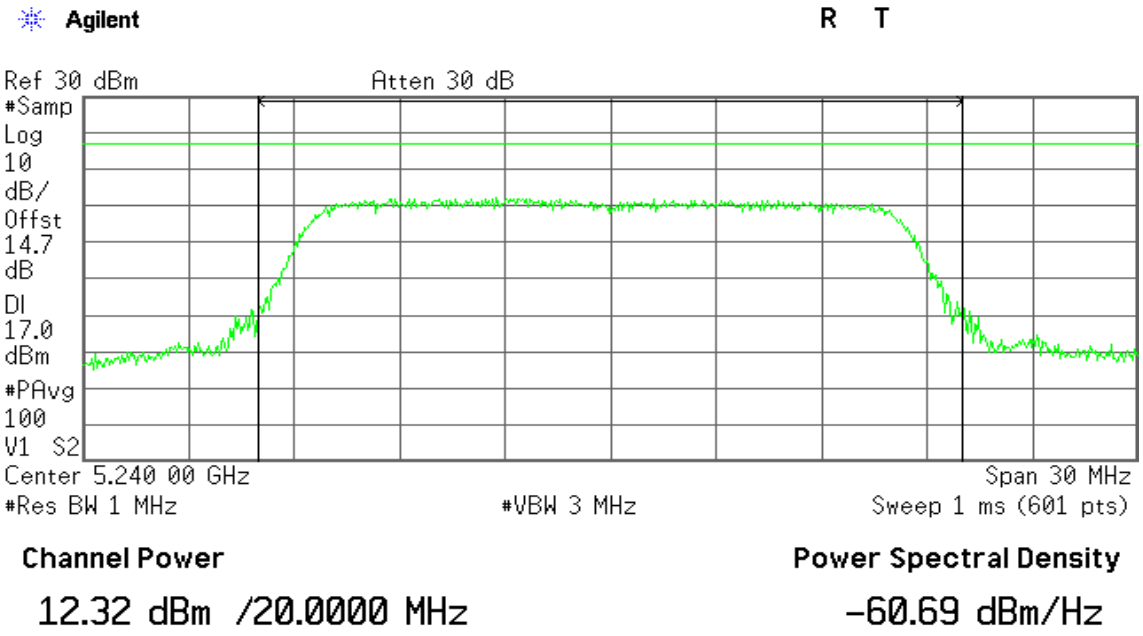
CH Low



CH Mid

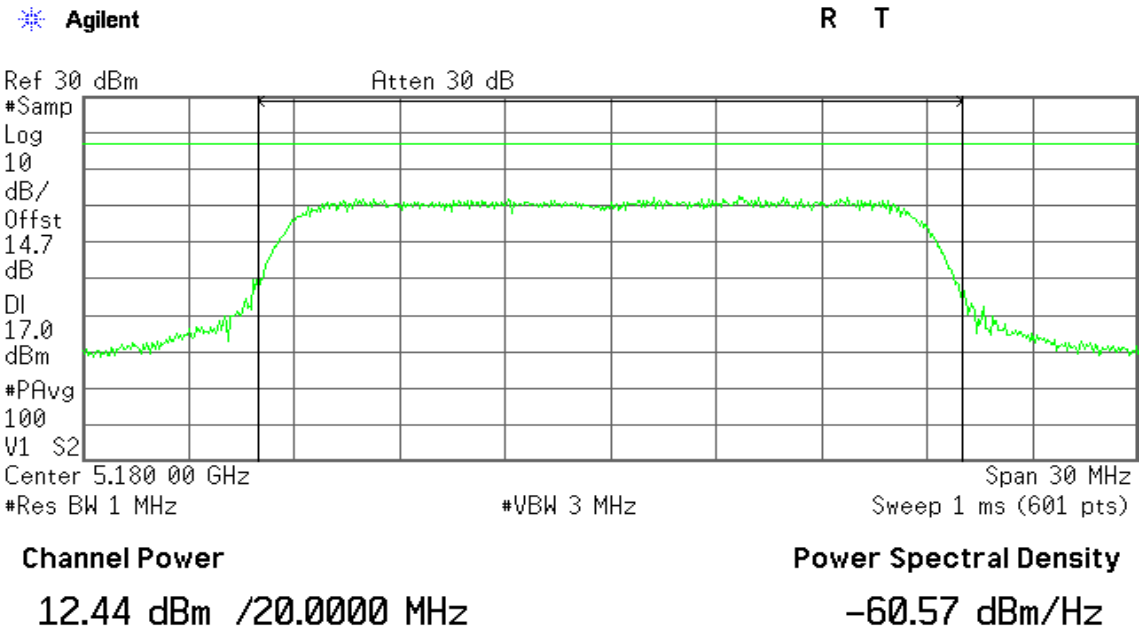


CH High

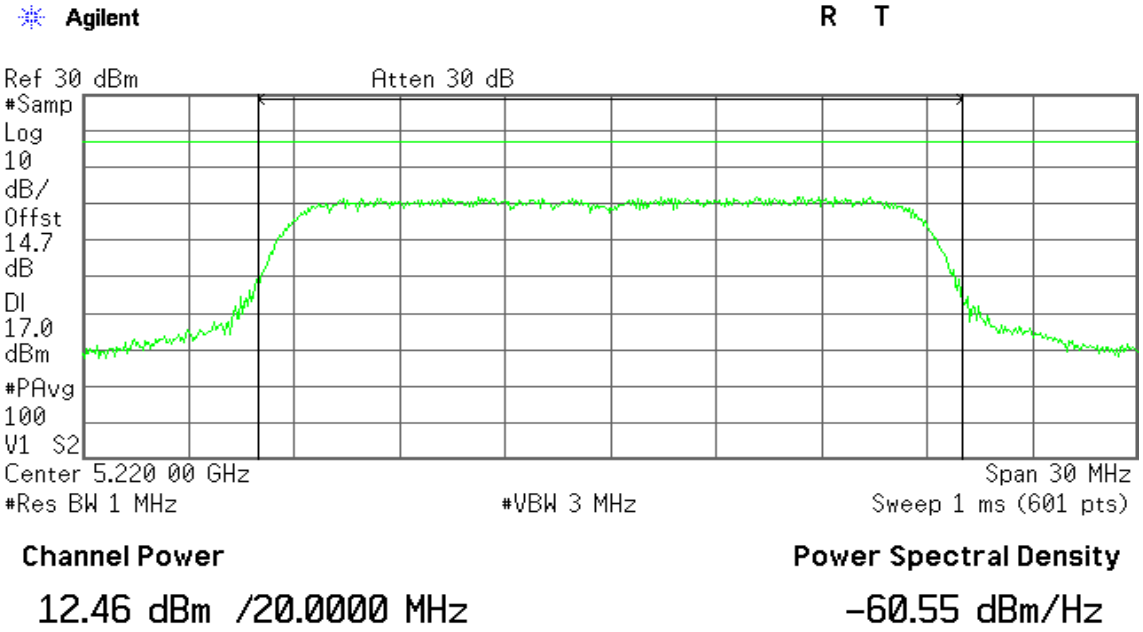


IEEE 802.11n HT 20 MHz mode / 5180 ~ 5240MHz / Chain 0

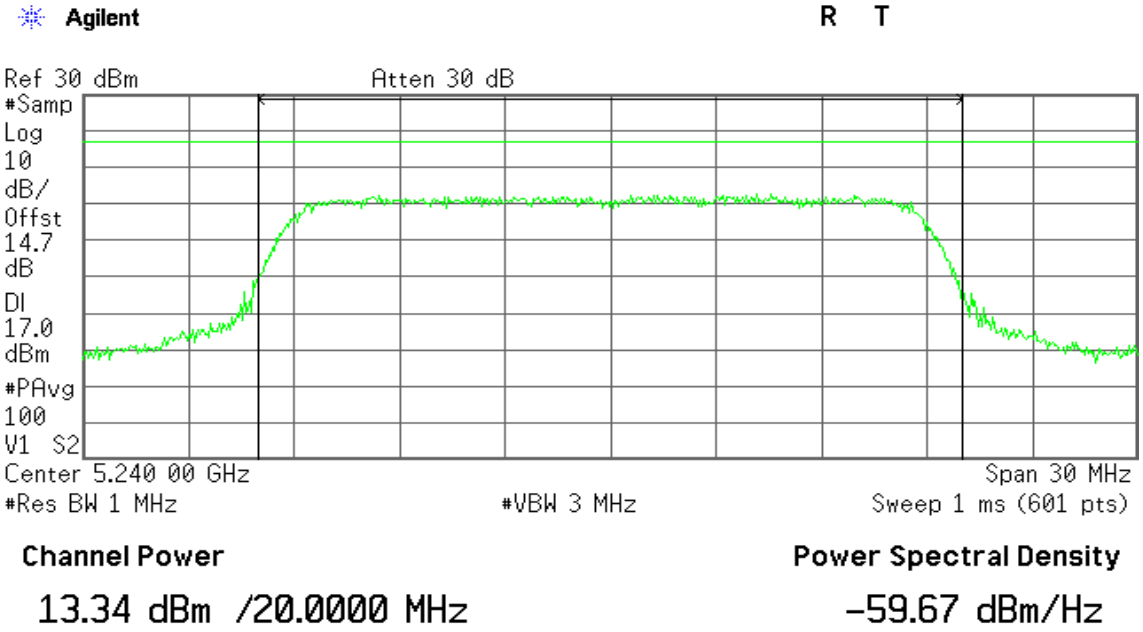
CH Low



CH Mid

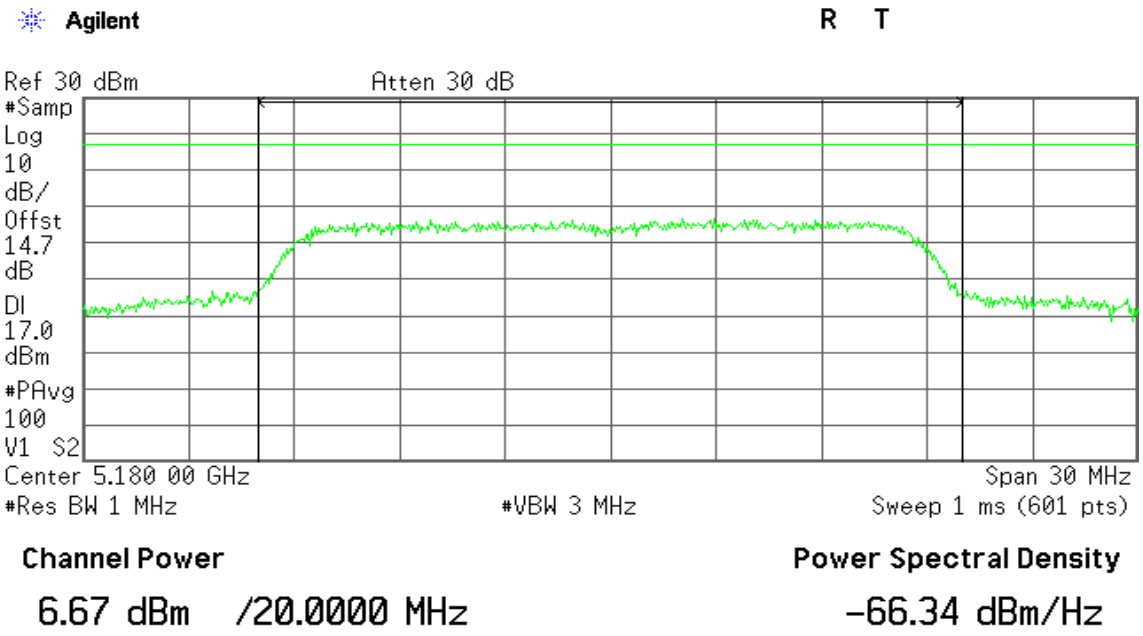


CH High

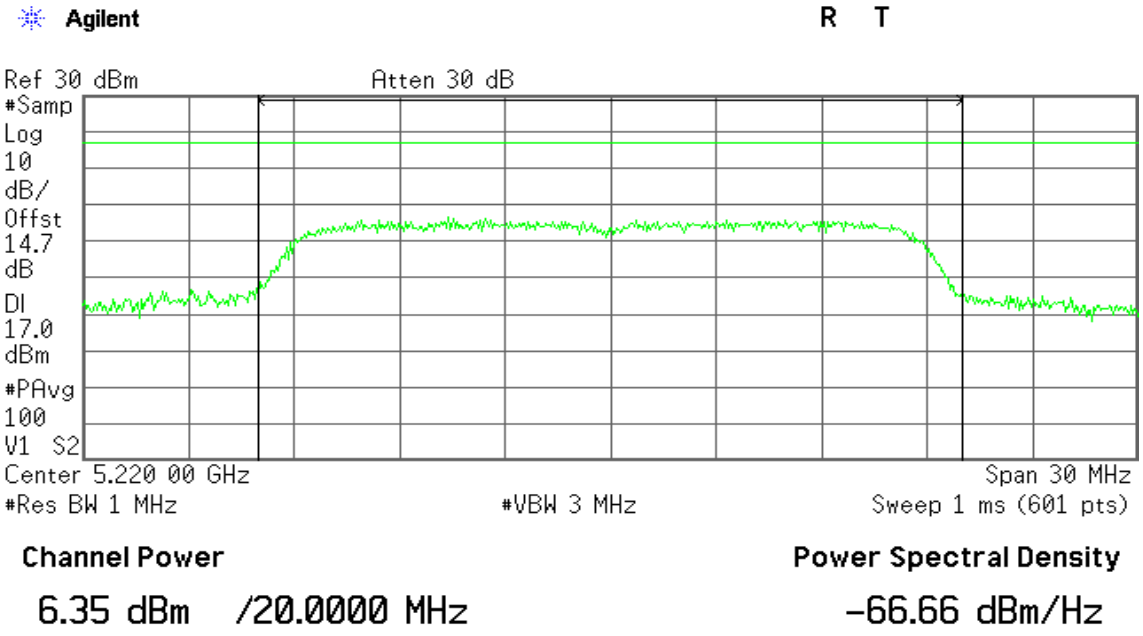


IEEE 802.11n HT 20 MHz mode / 5180 ~ 5240MHz / Chain 1

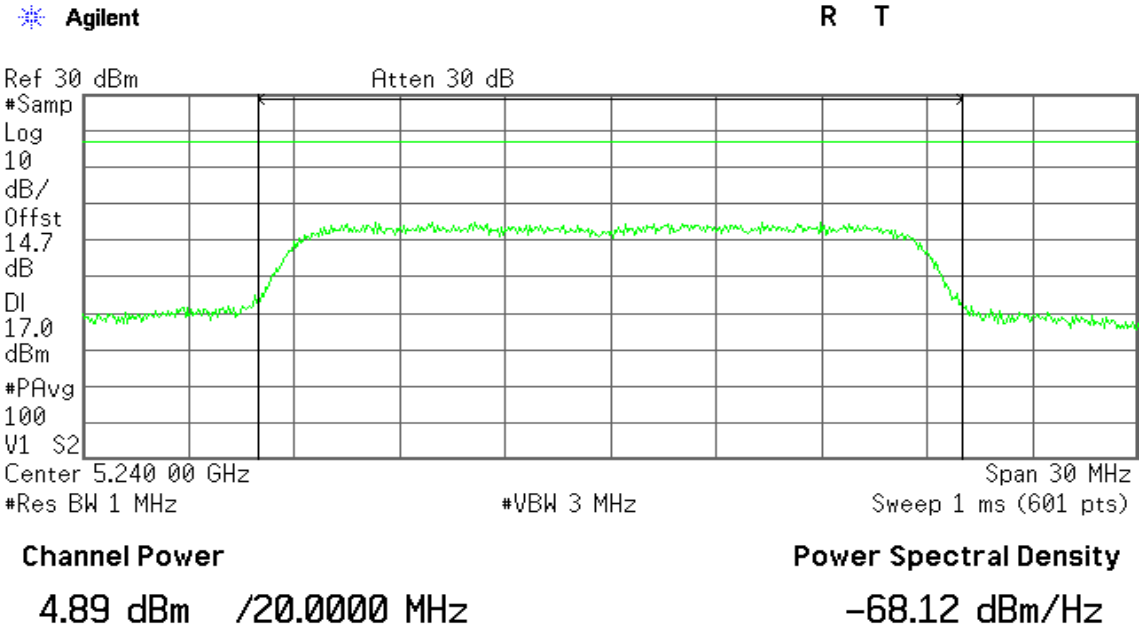
CH Low



CH Mid

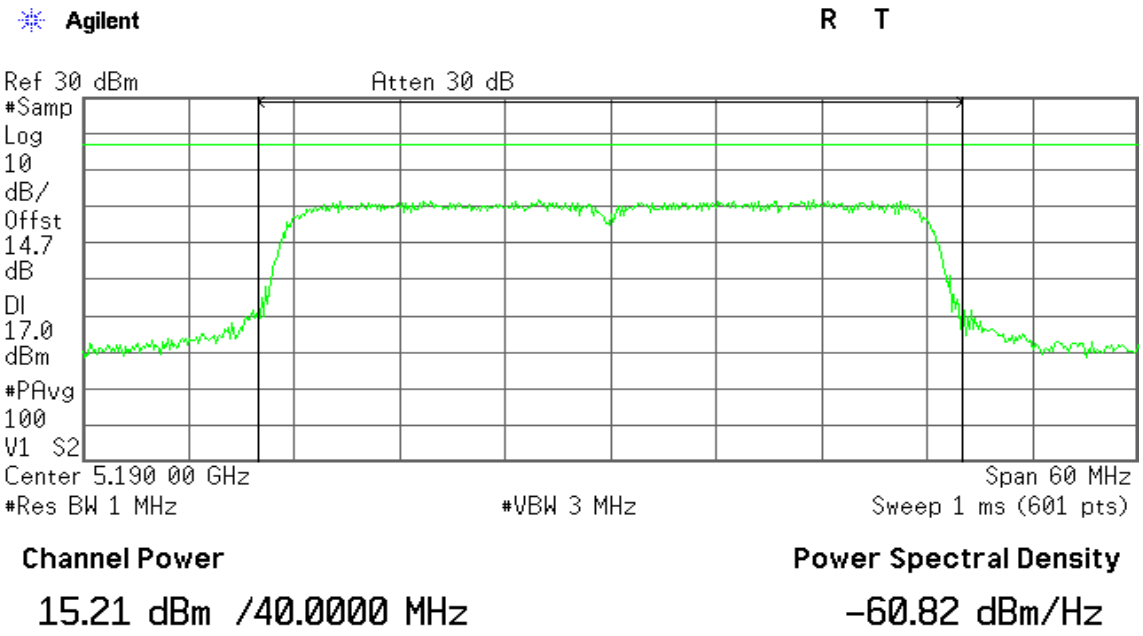


CH High

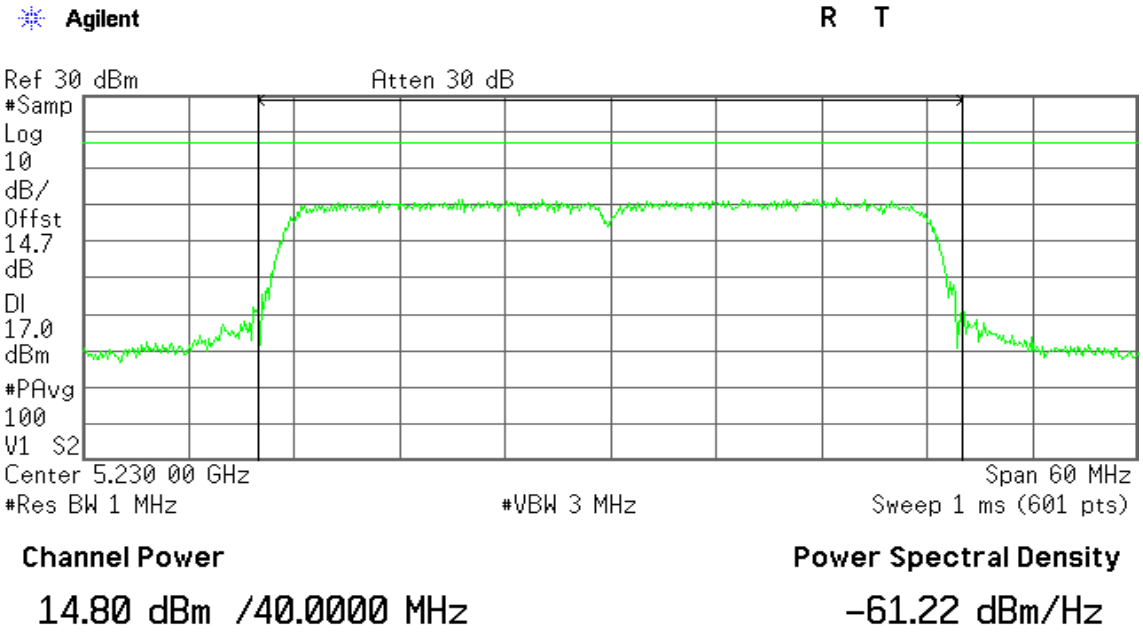

Agilent
R T
Ref 30 dBm
Atten 30 dB
#Samp
Log
10
dB/
Offst
14.7
dB
Dl
17.0
dBm
#PAvg
100
V1 S2
Center 5.240 00 GHz
Span 30 MHz
#Res BW 1 MHz
#VBW 3 MHz
Sweep 1 ms (601 pts)
Channel Power
4.89 dBm /20.0000 MHz
Power Spectral Density
-68.12 dBm/Hz

IEEE 802.11n HT 40 MHz mode / 5190 ~ 5230MHz / Chain 0

CH Low

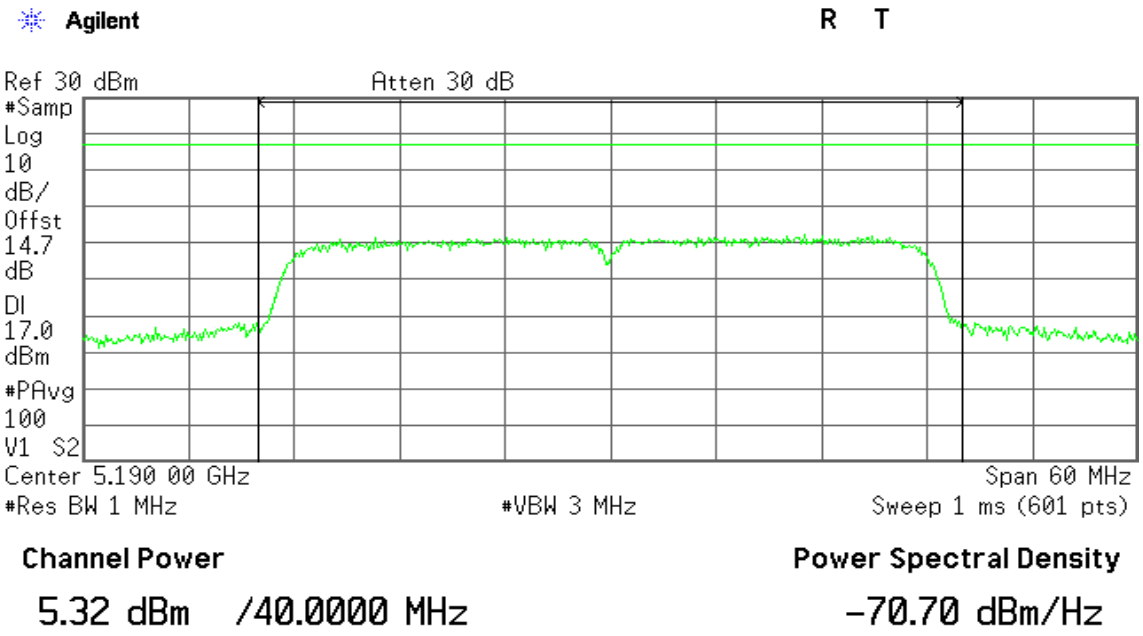


CH High

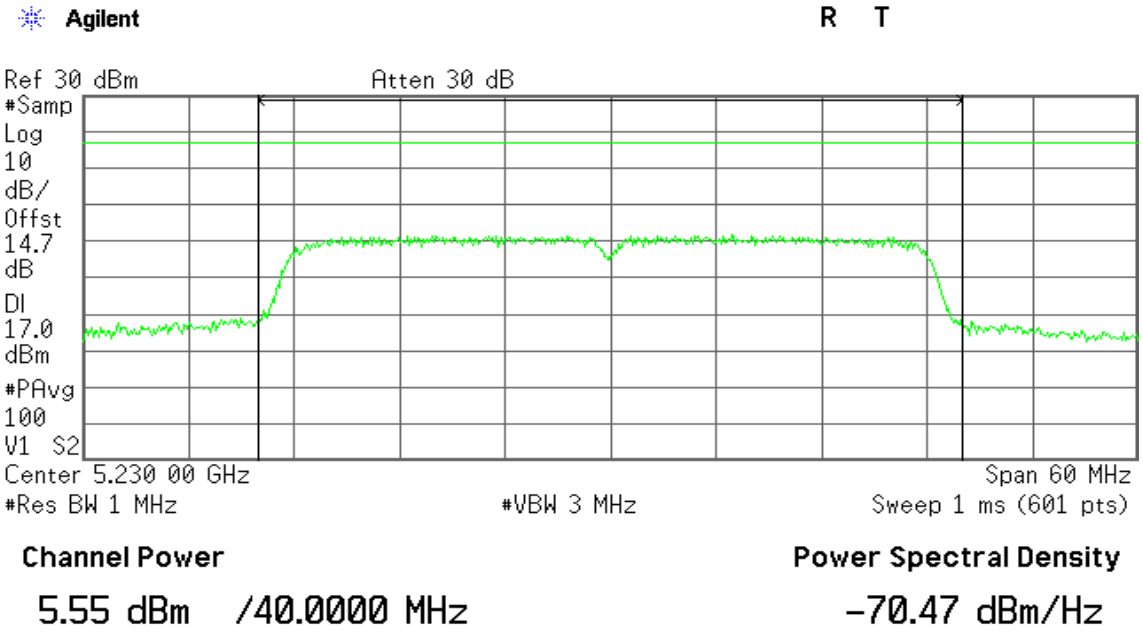


IEEE 802.11n HT 40 MHz mode / 5190 ~ 5230MHz / Chain 1

CH Low



CH High

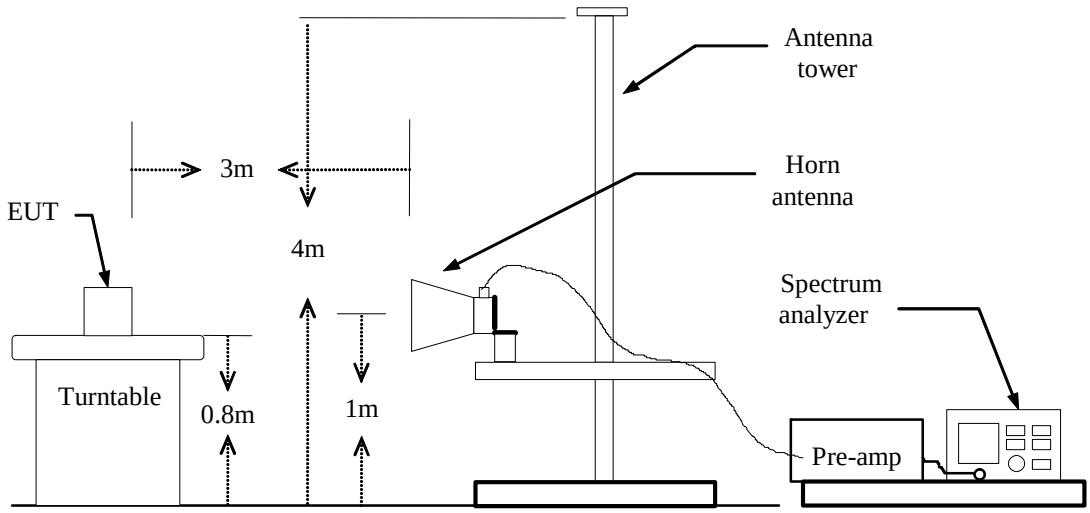


7.4 BAND EDGES MEASUREMENT

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

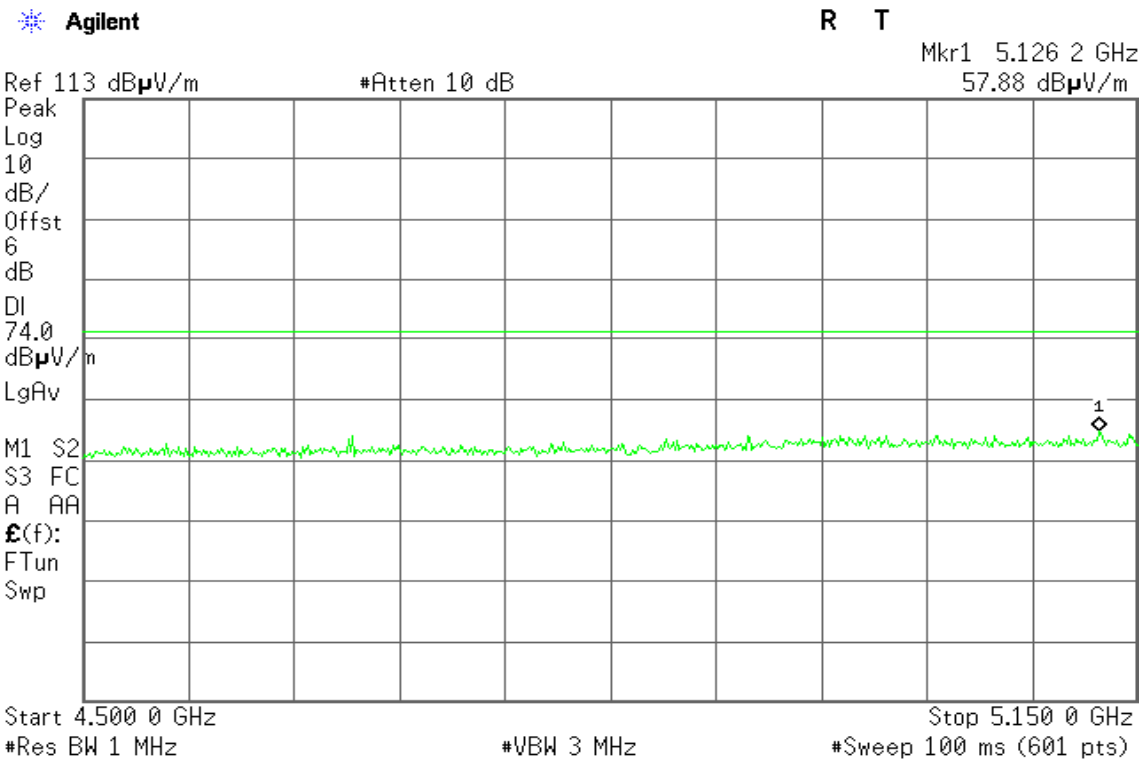
1. The EUT is placed on a turntable, which is 0.8m above the ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.
4. Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of the emission:
   (a) PEAK: RBW=1MHz, VBW=3MHz / Sweep=AUTO
   (b) AVERAGE: RBW=1MHz, VBW=11Hz / Sweep=AUTO
5. Repeat the procedures until all the PEAK and AVERAGE versus POLARIZATION are measured.

TEST RESULTS

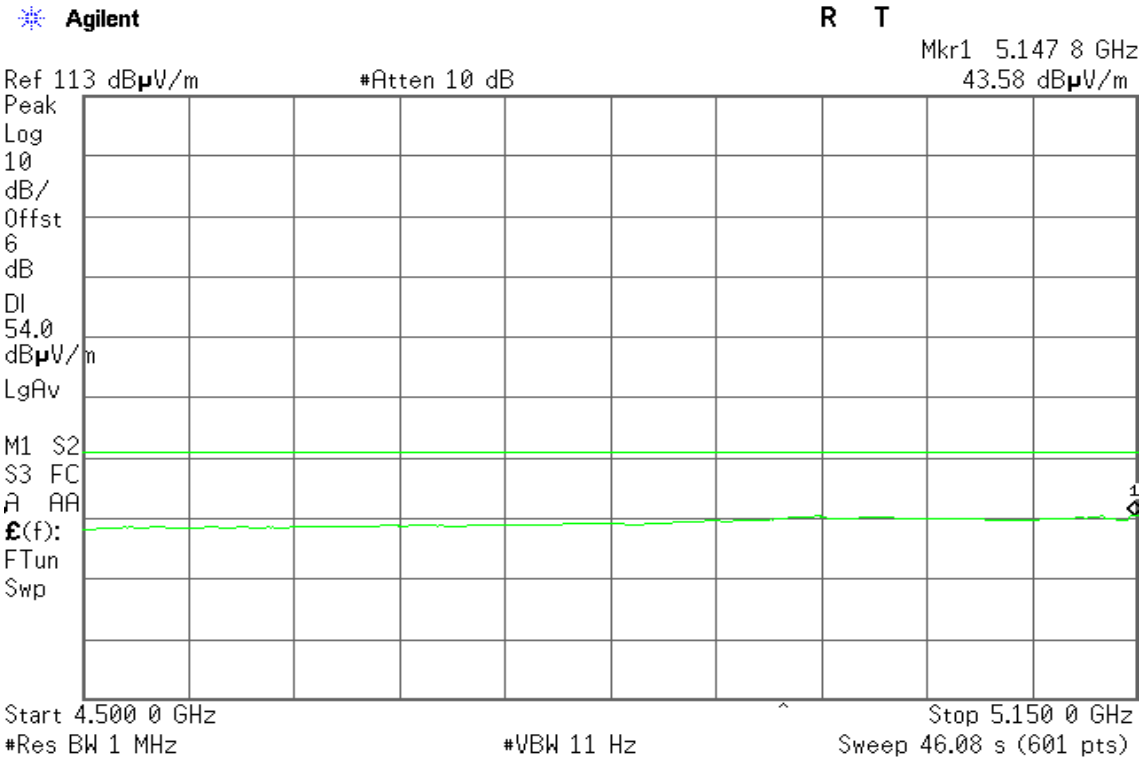
Refer to attach spectrum analyzer data chart.

Band Edges (IEEE 802.11a mode / 5180 MHz)

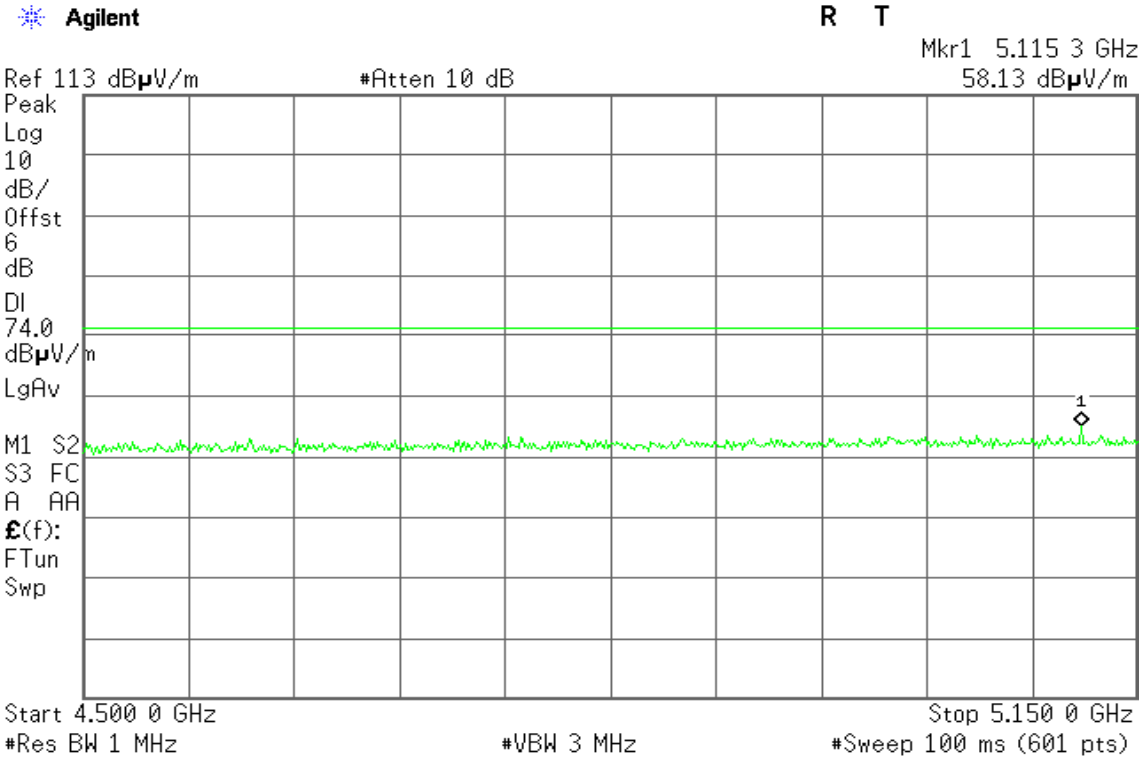
Detector mode: Peak **Polarity: Vertical**



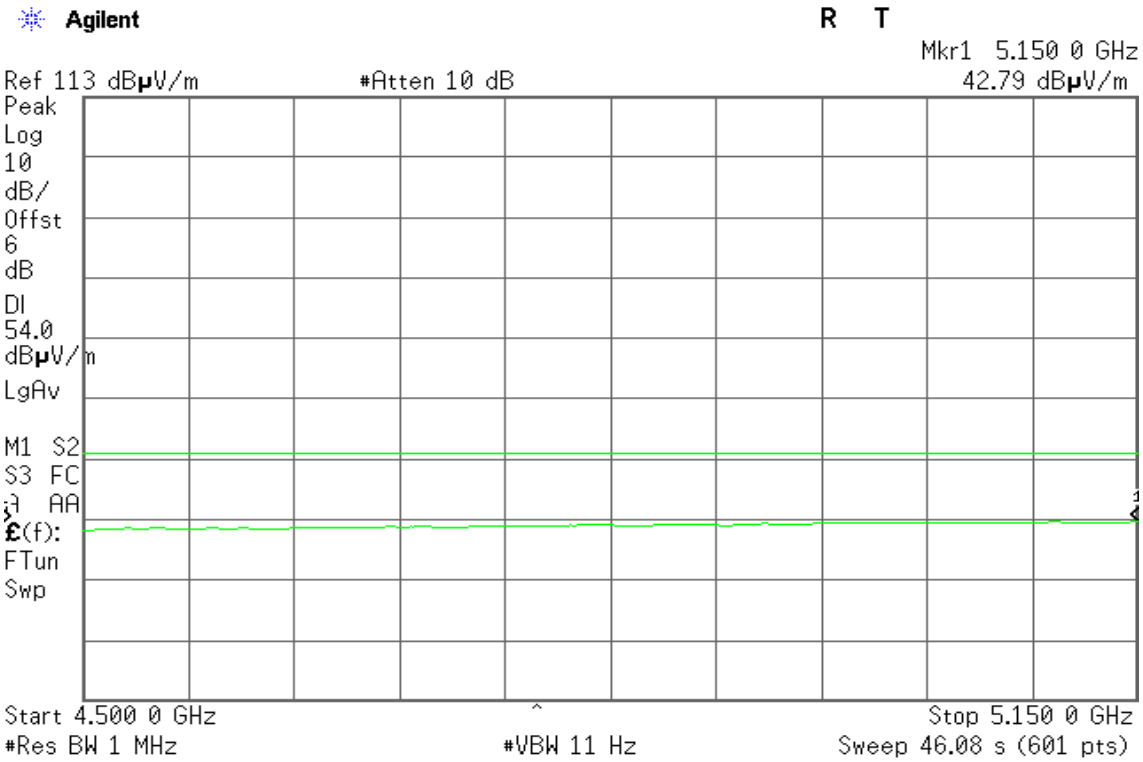
Detector mode: Average **Polarity: Vertical**



Detector mode: Peak **Polarity: Horizontal**

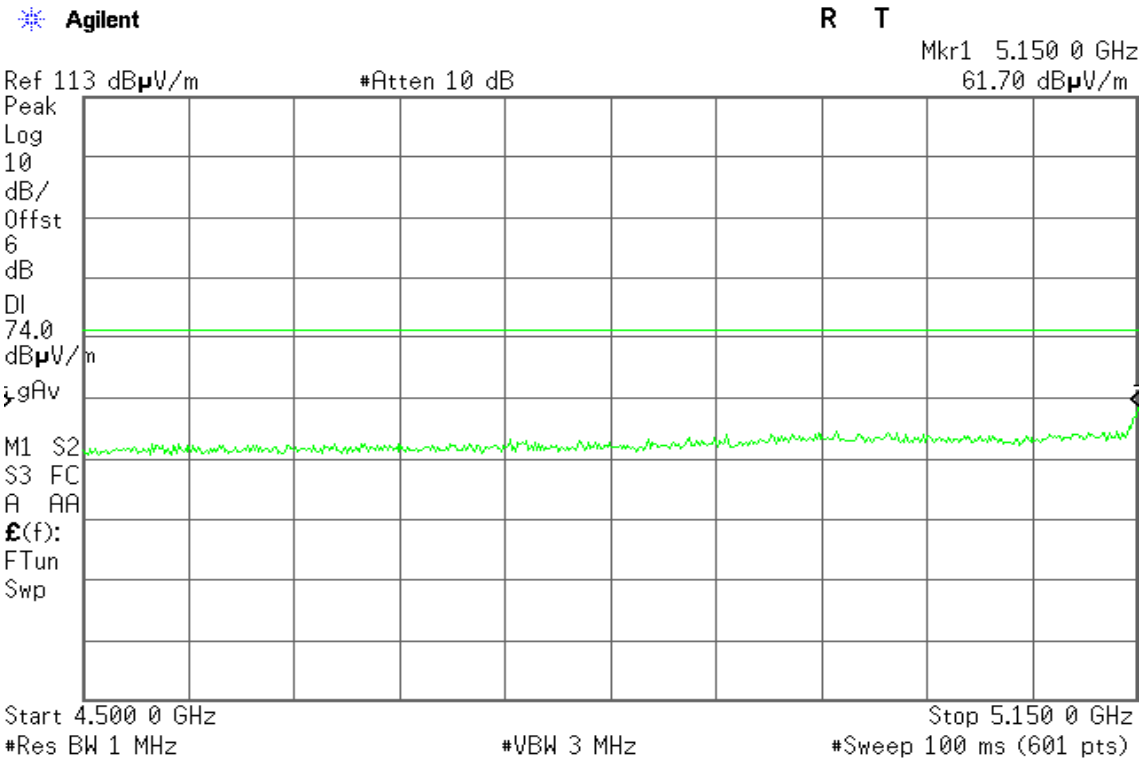


Detector mode: Average **Polarity: Horizontal**

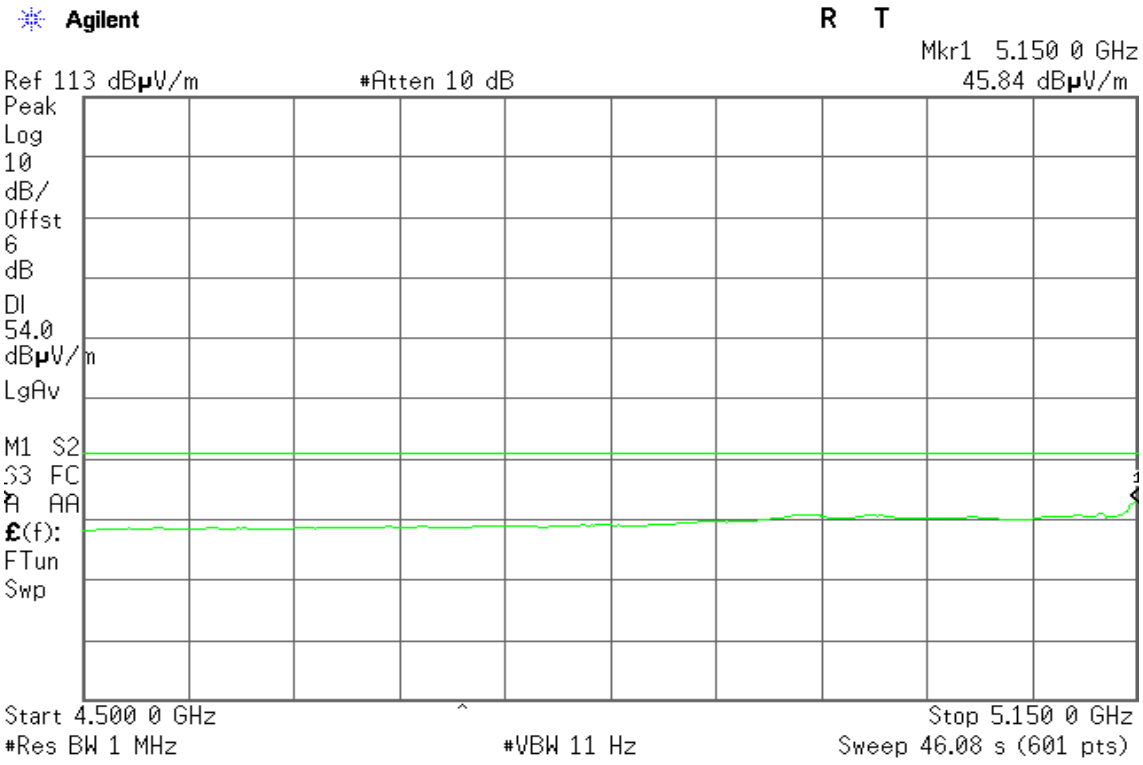


Band Edges (IEEE 802.11n HT 20 MHz mode / 5180 MHz)

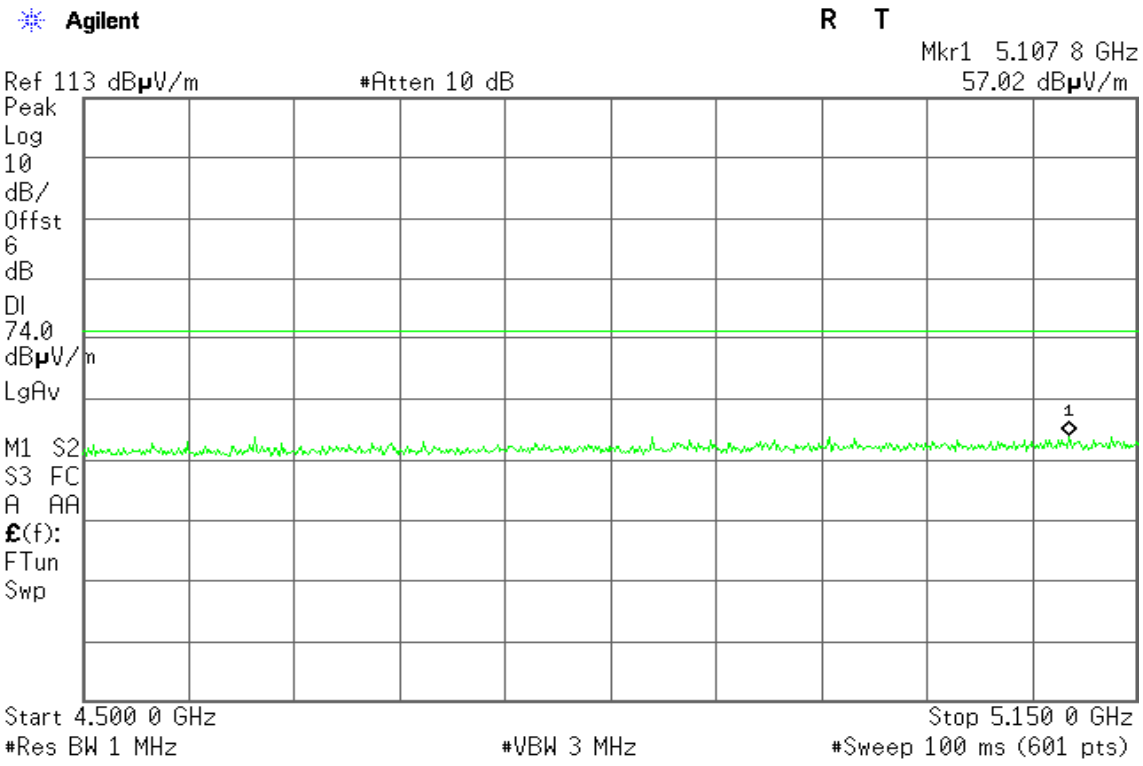
Detector mode: Peak **Polarity: Vertical**



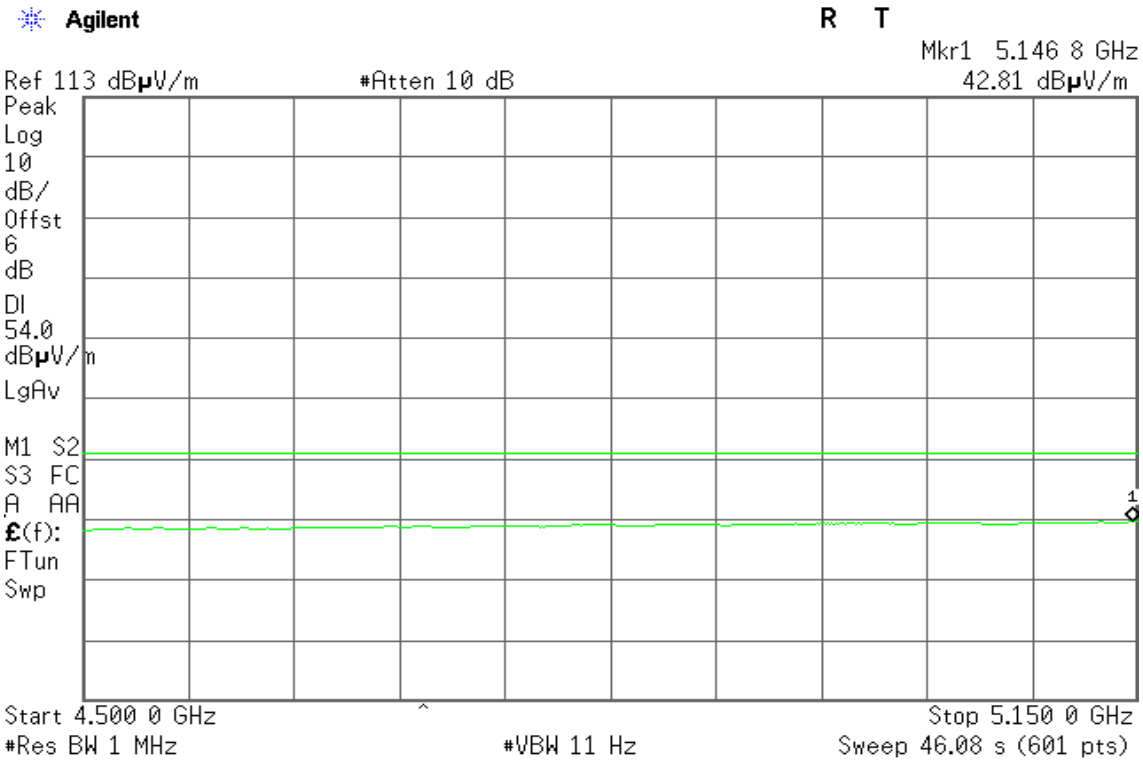
Detector mode: Average **Polarity: Vertical**



Detector mode: Peak **Polarity: Horizontal**

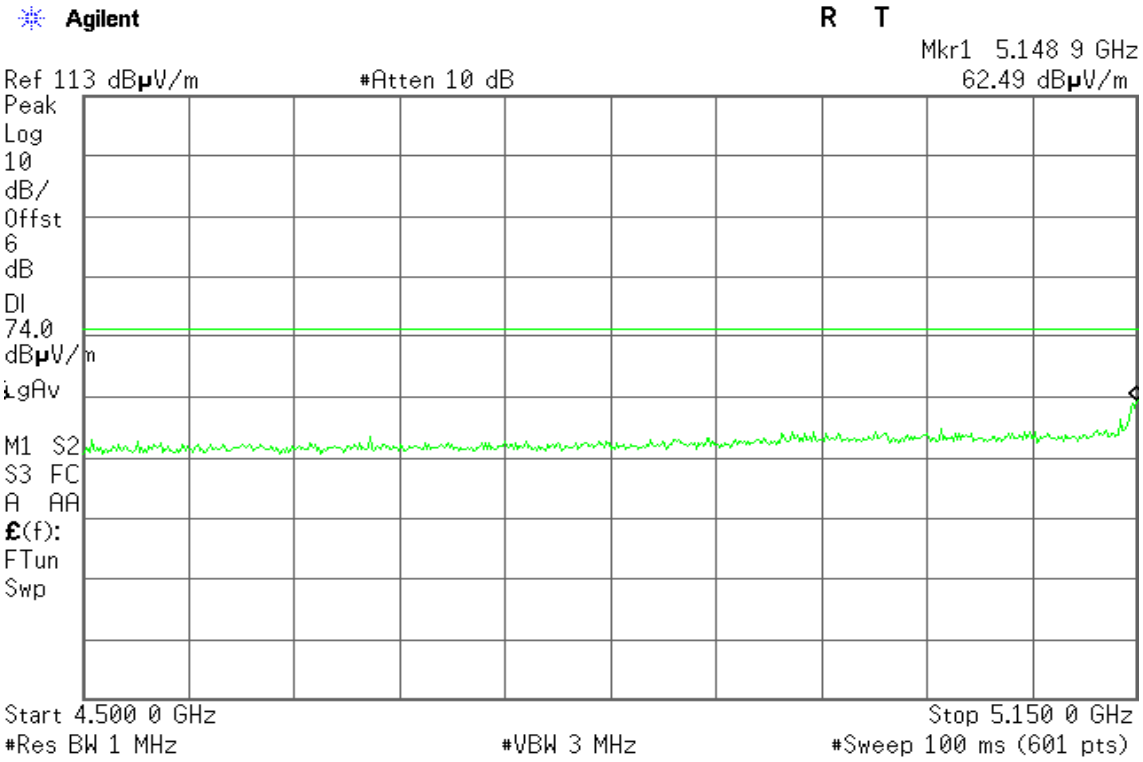


Detector mode: Average **Polarity: Horizontal**

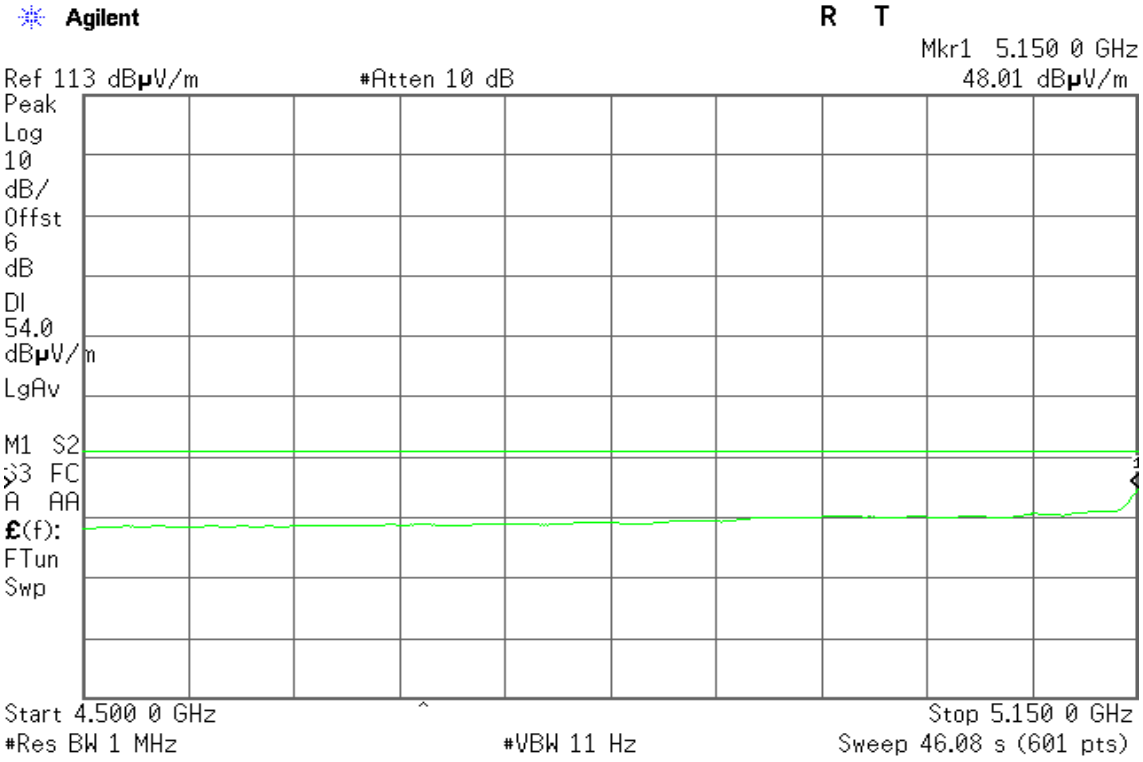


Band Edges (IEEE 802.11n HT 40 MHz mode / 5190 MHz)

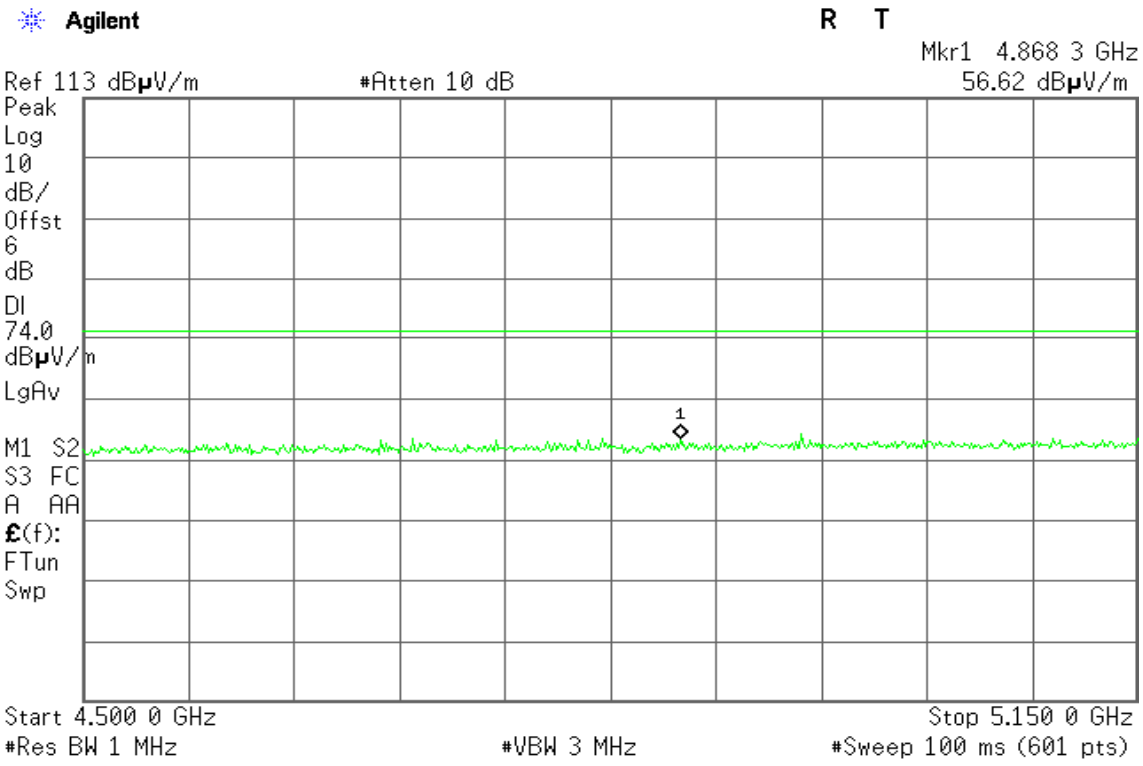
Detector mode: Peak **Polarity: Vertical**



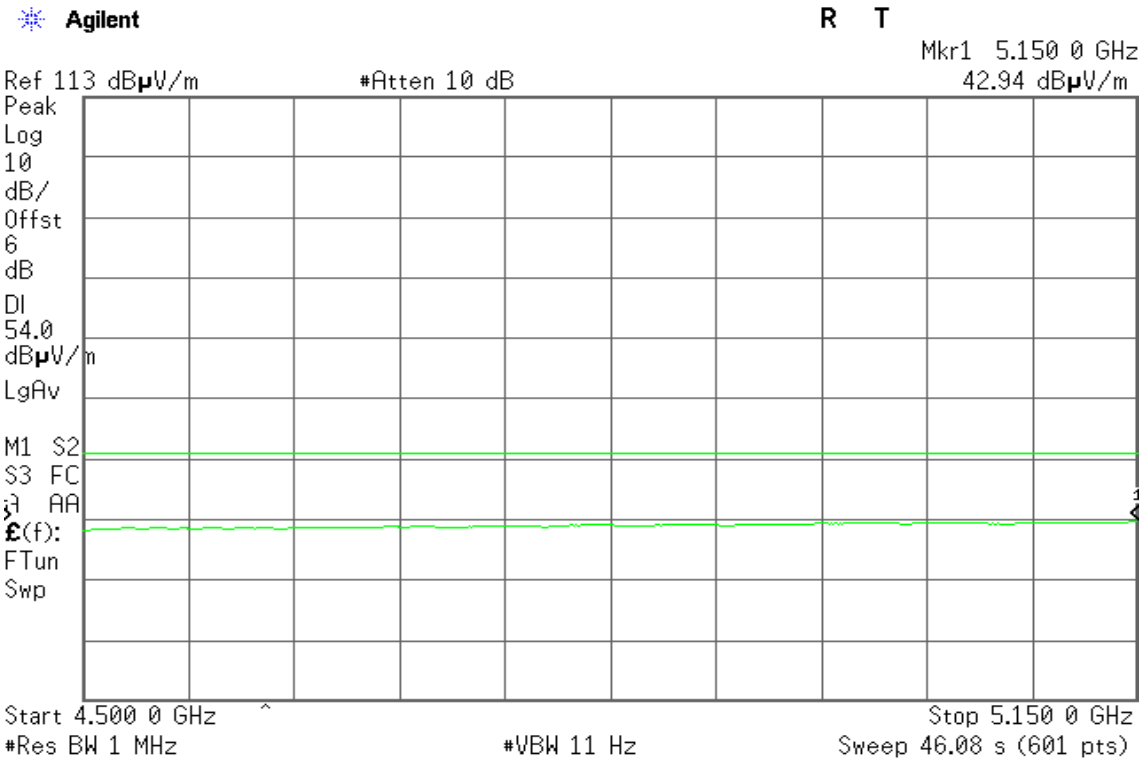
Detector mode: Average **Polarity: Vertical**



Detector mode: Peak **Polarity: Horizontal**



Detector mode: Average **Polarity: Horizontal**



7.5 PEAK POWER SPECTRAL DENSITY

LIMIT

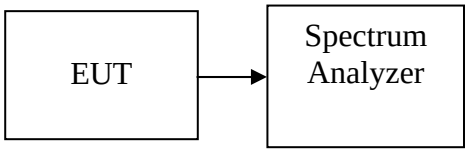
According to §15.407(a),

(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 ~ 5240MHz

Channel	Frequency (MHz)	PPSD (dBm)	MAX PPSD (dBm)	Limit (dBm)	Margin
Low	5180	3.55	3.55	4	0.45
Mid	5220	2.86	2.86	4	1.14
High	5240	2.50	2.50	4	1.50

Test mode: IEEE 802.11n HT 20 MHz mode / 5180 ~ 5240MHz

Channel	Frequency (MHz)	Chain 0 PPSD (dBm)	Chain 0 Max PPSD (dBm)	Chain 1 PPSD (dBm)	Chain 1 Max PPSD (dBm)	Total Max PPSD (dBm)	Limit (dBm)	Margin
Low	5180	2.29	2.29	-3.49	-3.49	3.31	3.42	0.10
Mid	5220	2.03	2.03	-3.31	-3.31	3.15	3.42	0.26
High	5240	2.59	2.59	-5.04	-5.04	3.28	3.42	0.13

Test mode: IEEE 802.11n HT 40 MHz mode / 5190 ~ 5230MHz

Channel	Frequency (MHz)	Chain 0 PPSD (dBm)	Chain 0 Max PPSD (dBm)	Chain 1 PPSD (dBm)	Chain 1 Max PPSD (dBm)	Total Max PPSD (dBm)	Limit (dBm)	Margin
Low	5190	1.92	1.92	-7.75	-7.75	2.36	3.42	1.05
High	5230	1.76	1.76	-8.29	-8.29	2.16	3.42	1.25

Remark:

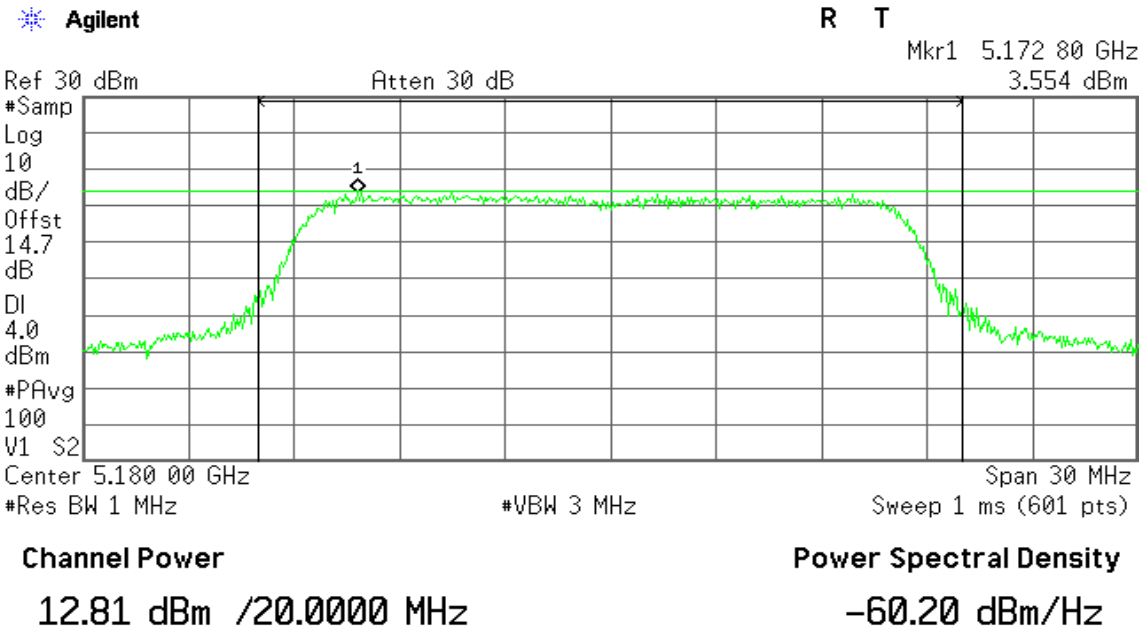
*1. Total PPSD (dBm) = 10*LOG(10^(Chain 0 PPSD / 10)+10^(Chain 1 PPSD /10))*

2. The maximum antenna gain is 6.58dBi; therefore the reduction due to antenna gain is 0.58dBi, so the limit is 3.42dBm.

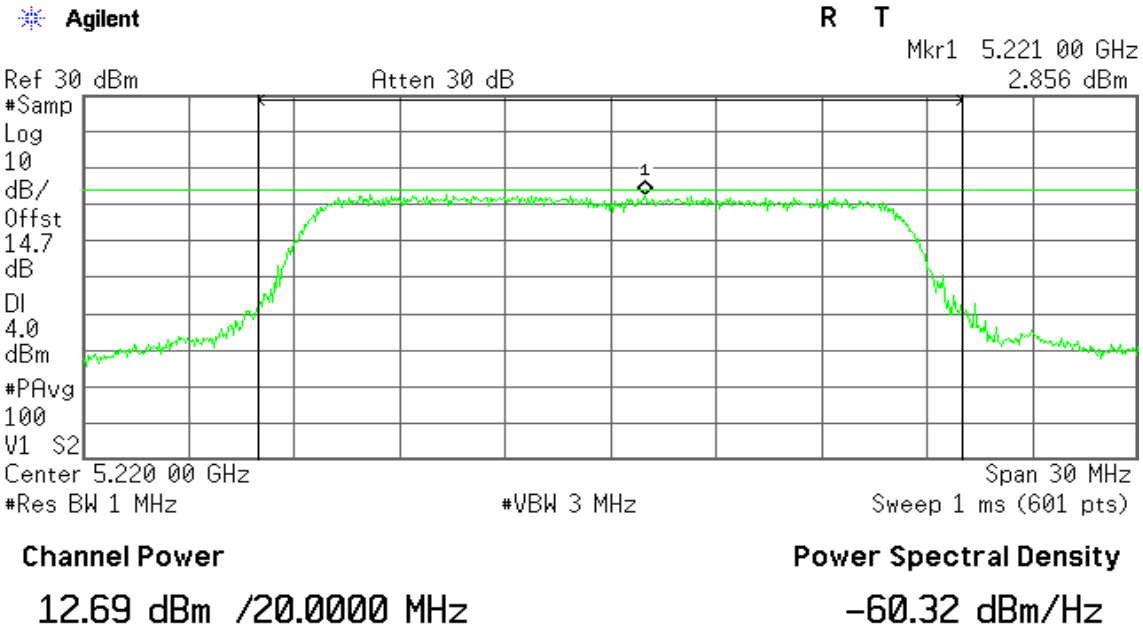
Test Plot

IEEE 802.11a mode / 5180 ~ 5240MHz

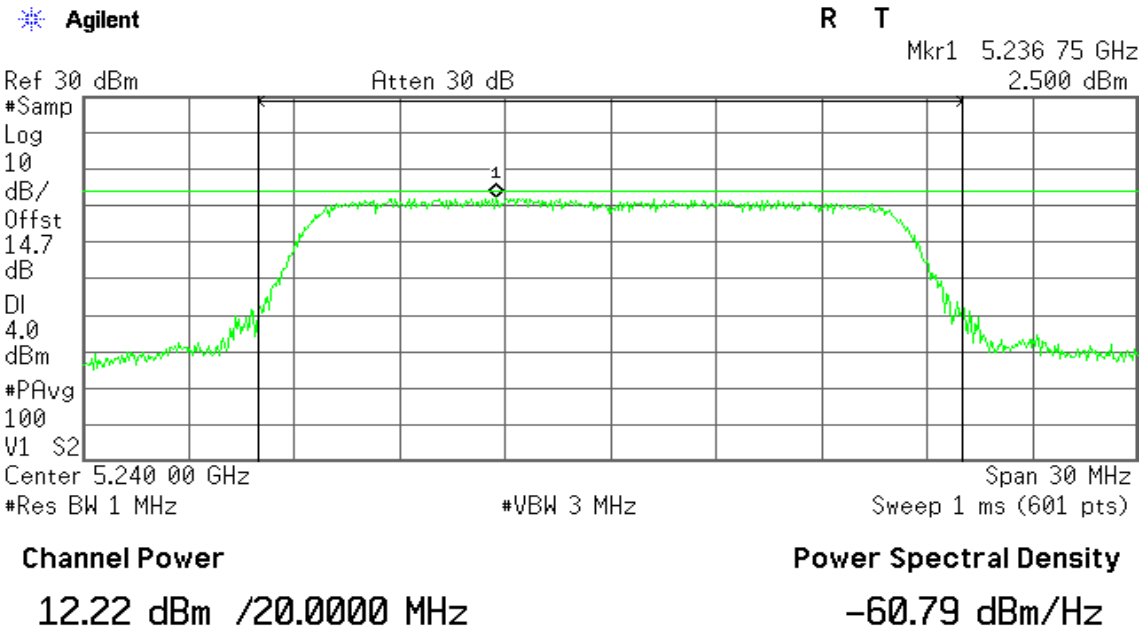
CH Low



CH Mid

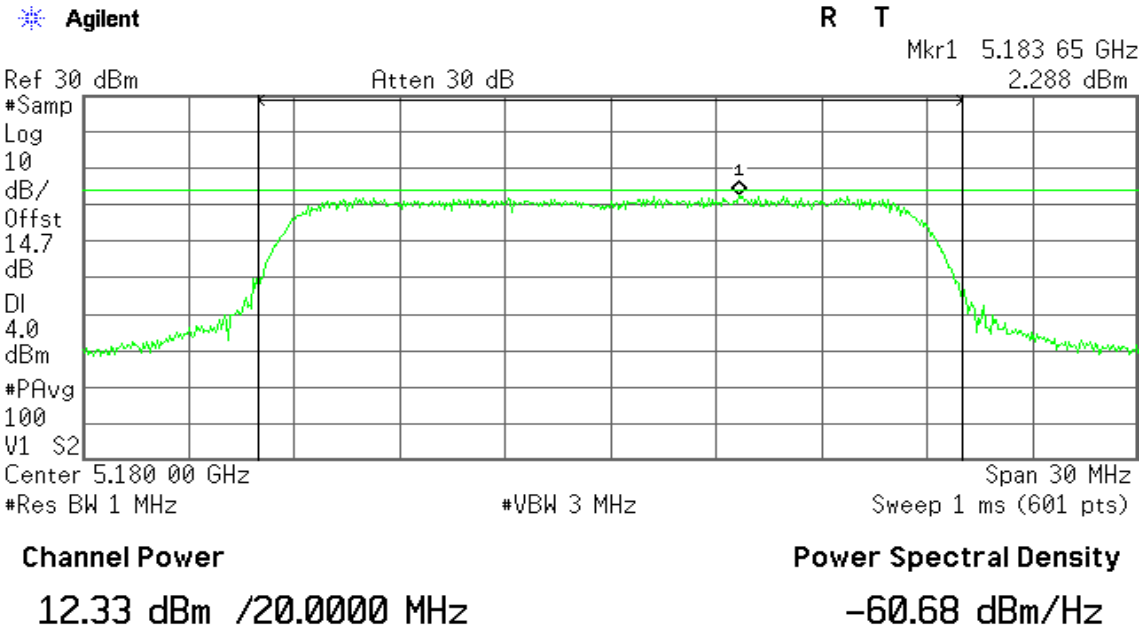


CH High

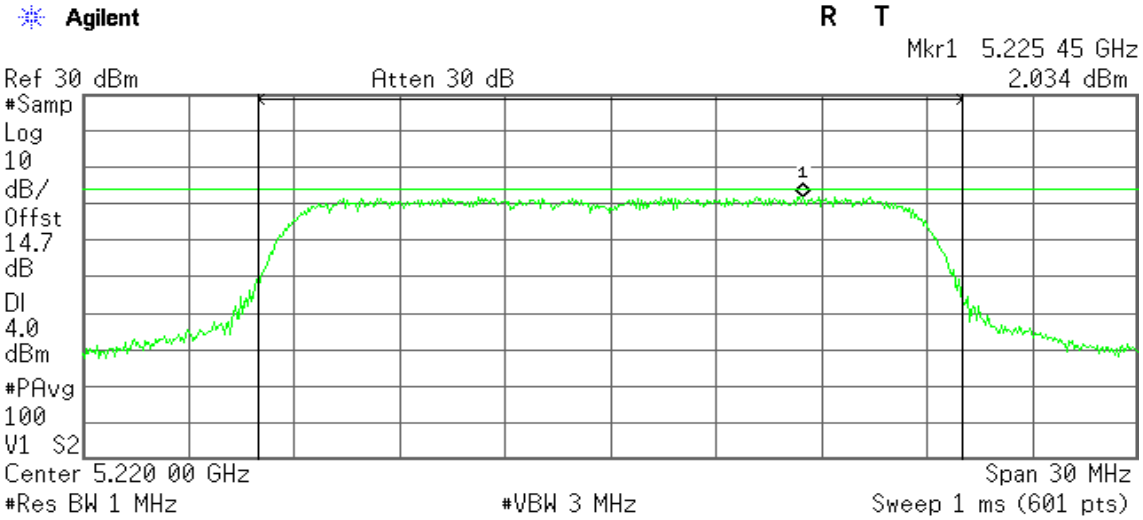


IEEE 802.11n HT 20 MHz mode / 5180 ~ 5240MHz / Chain 0

CH Low



CH Mid



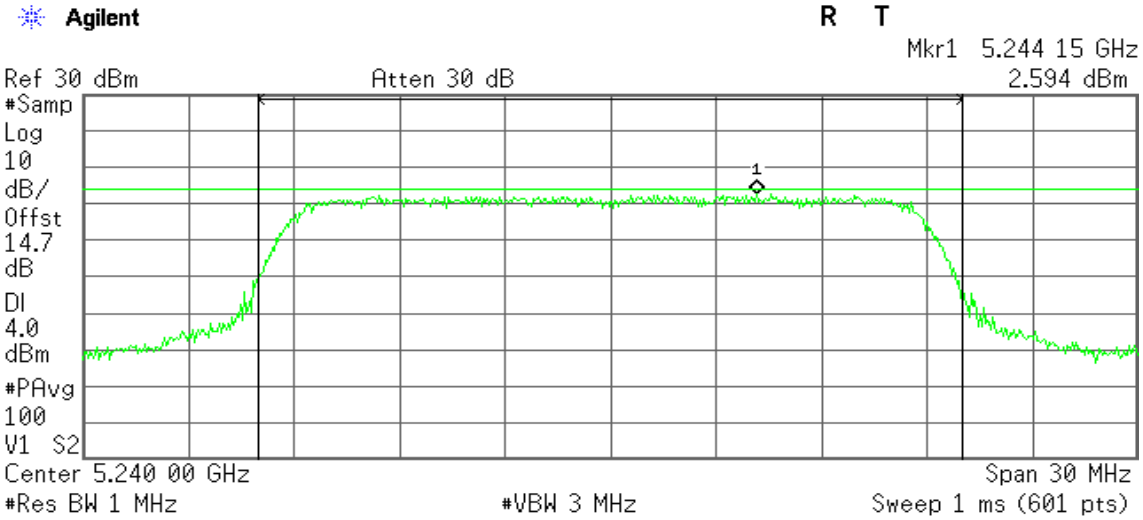
Channel Power

12.68 dBm /20.0000 MHz

Power Spectral Density

-60.33 dBm/Hz

CH High



Channel Power

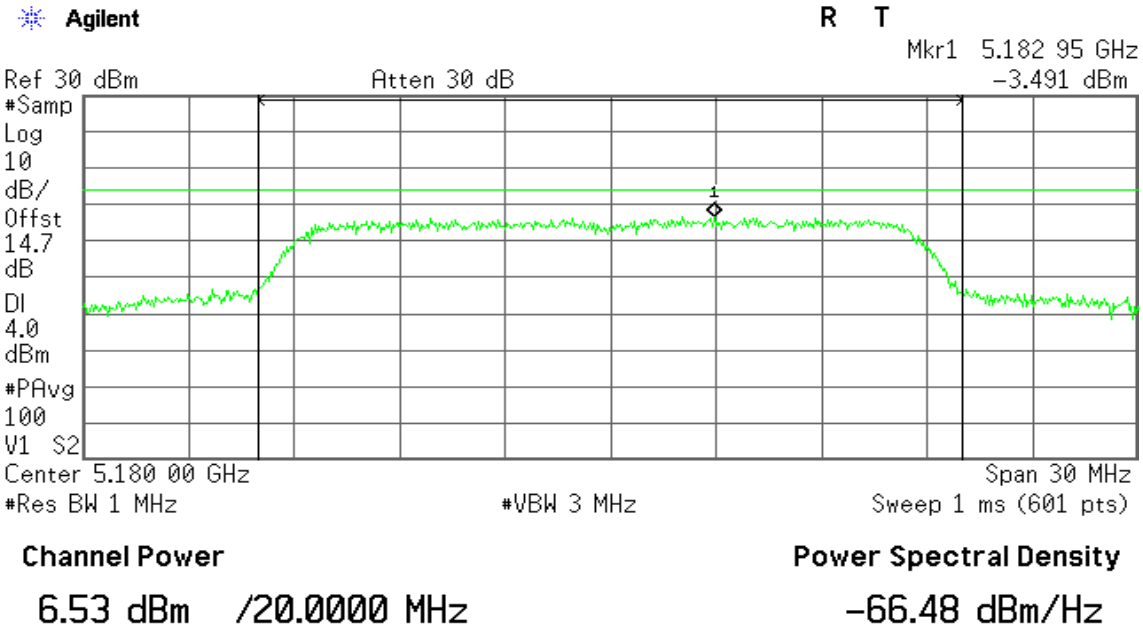
12.72 dBm /20.0000 MHz

Power Spectral Density

-60.29 dBm/Hz

IEEE 802.11n HT 20 MHz mode / 5180 ~ 5240MHz / Chain 1

CH Low



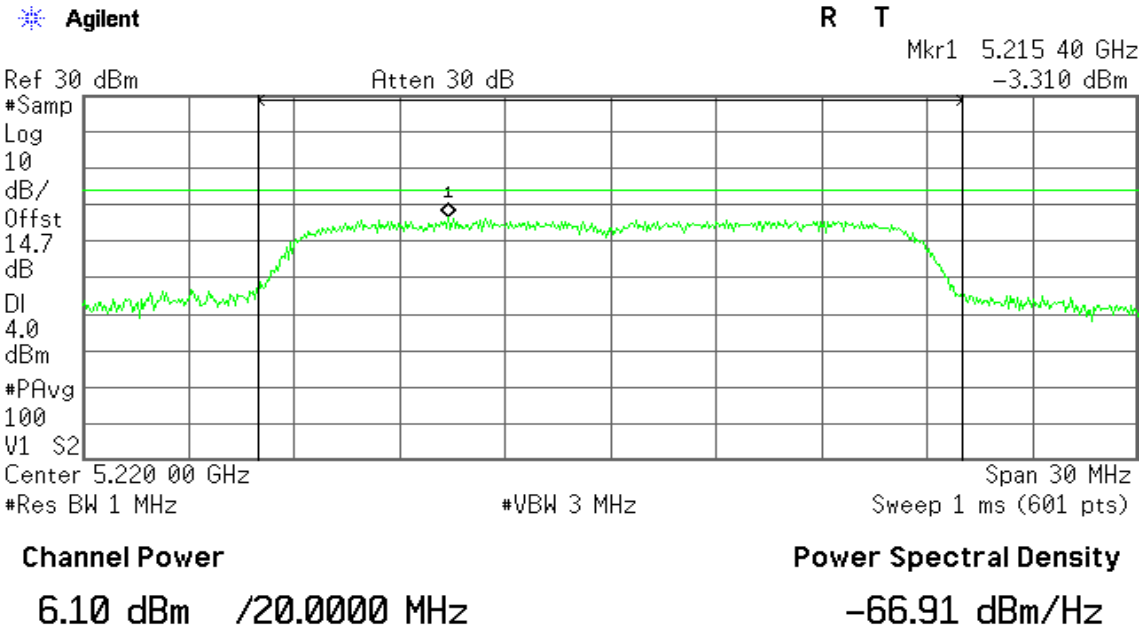
Channel Power

6.53 dBm /20.0000 MHz

Power Spectral Density

-66.48 dBm/Hz

CH Mid



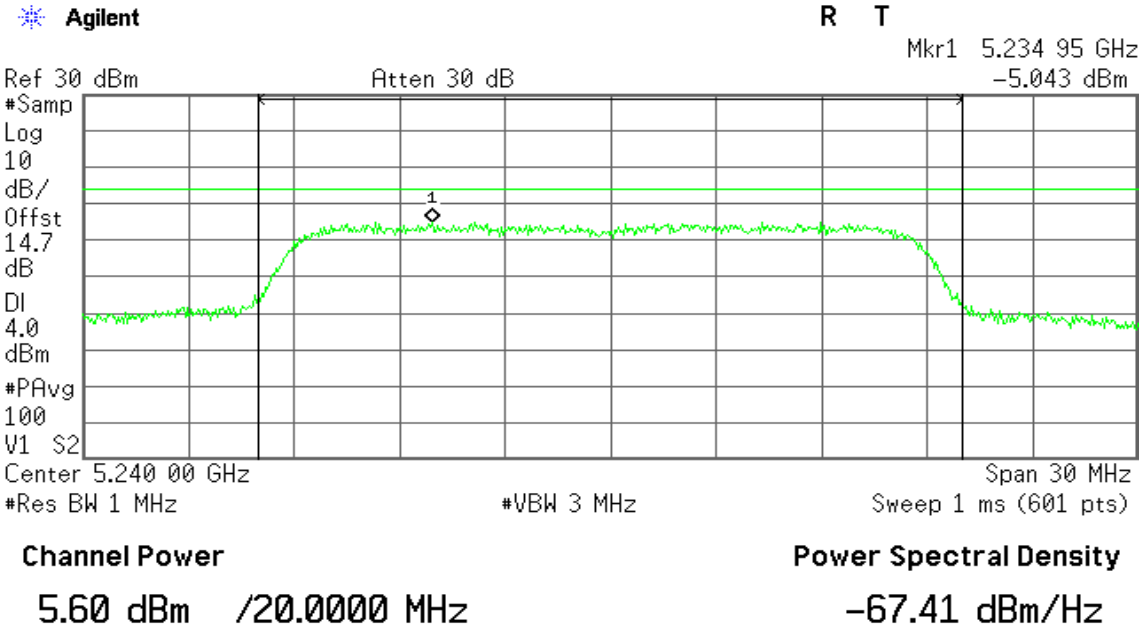
Channel Power

6.10 dBm /20.0000 MHz

Power Spectral Density

-66.91 dBm/Hz

CH High



Channel Power

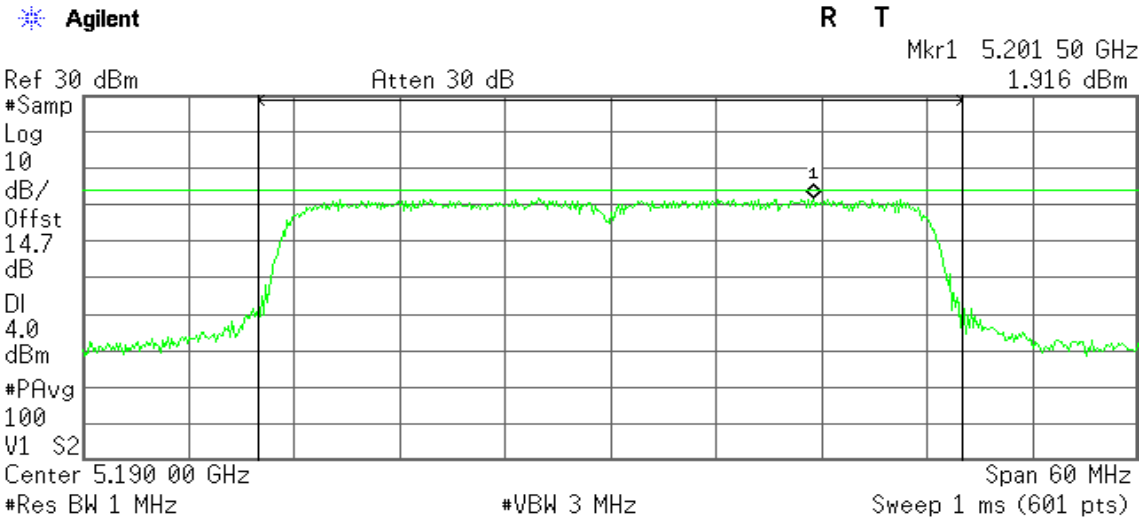
5.60 dBm /20.0000 MHz

Power Spectral Density

-67.41 dBm/Hz

IEEE 802.11n HT 40 MHz mode / 5190 ~ 5230MHz / Chain 0

CH Low



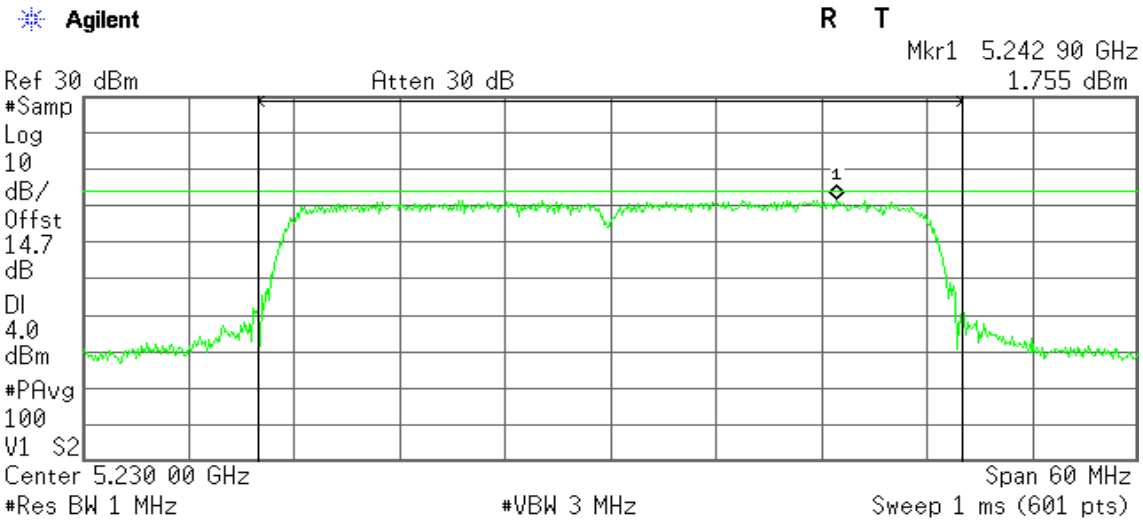
Channel Power

15.17 dBm /40.0000 MHz

Power Spectral Density

-60.85 dBm/Hz

CH High



Channel Power

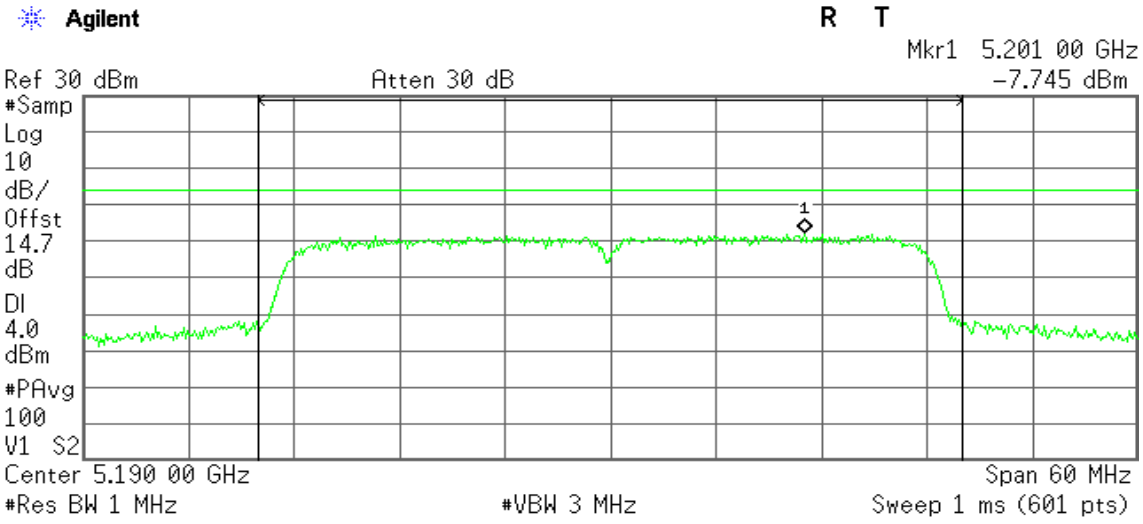
14.79 dBm /40.0000 MHz

Power Spectral Density

-61.23 dBm/Hz

IEEE 802.11n HT 40 MHz mode / 5190 ~ 5230MHz / Chain 1

CH Low



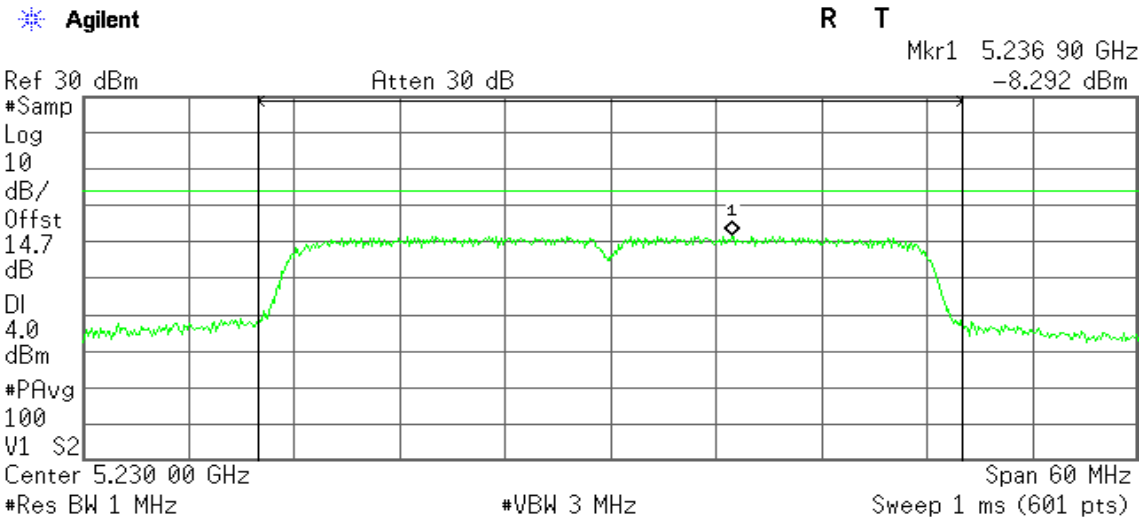
Channel Power

5.61 dBm /40.0000 MHz

Power Spectral Density

-70.41 dBm/Hz

CH High



Channel Power

5.27 dBm /40.0000 MHz

Power Spectral Density

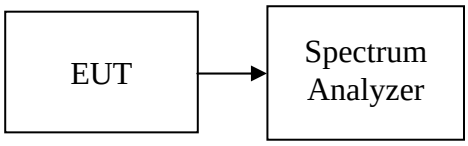
-70.75 dBm/Hz

7.6 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 ~ 5240MHz

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)	Result
Low	5180	7.23	13.00	-5.77	PASS
Mid	5220	7.90	13.00	-5.10	PASS
High	5240	7.75	13.00	-5.25	PASS

Test mode: IEEE 802.11n HT 20 MHz mode / 5180 ~ 5240MHz / Chain 0

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)	Result
Low	5180	7.81	13.00	-5.19	PASS
Mid	5220	10.11	13.00	-2.89	PASS
High	5240	9.32	13.00	-3.68	PASS

Test mode: IEEE 802.11n HT 20 MHz mode / 5180 ~ 5240MHz / Chain 1

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)	Result
Low	5180	8.21	13.00	-4.79	PASS
Mid	5220	9.69	13.00	-3.31	PASS
High	5240	9.88	13.00	-3.12	PASS

Test mode: IEEE 802.11n HT 40 MHz mode / 5190 ~ 5230MHz / Chain 0

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)	Result
Low	5190	9.65	13.00	-3.35	PASS
High	5230	9.21	13.00	-3.79	PASS

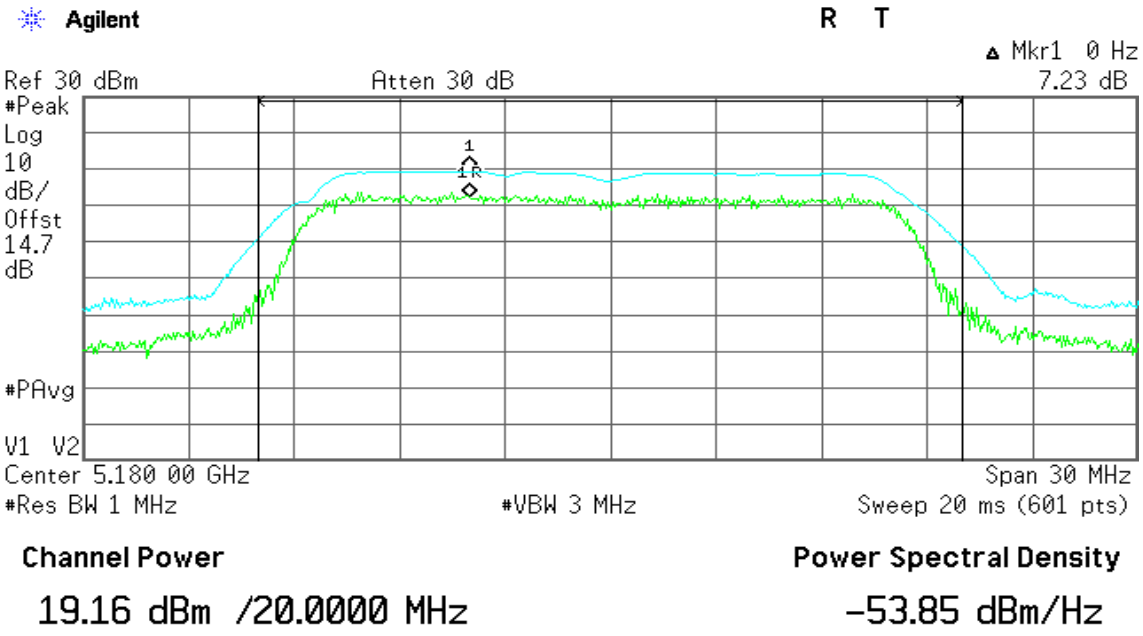
Test mode: IEEE 802.11n HT 40 MHz mode / 5190 ~ 5230MHz / Chain 1

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)	Result
Low	5190	8.87	13.00	-4.13	PASS
High	5230	8.33	13.00	-4.67	PASS

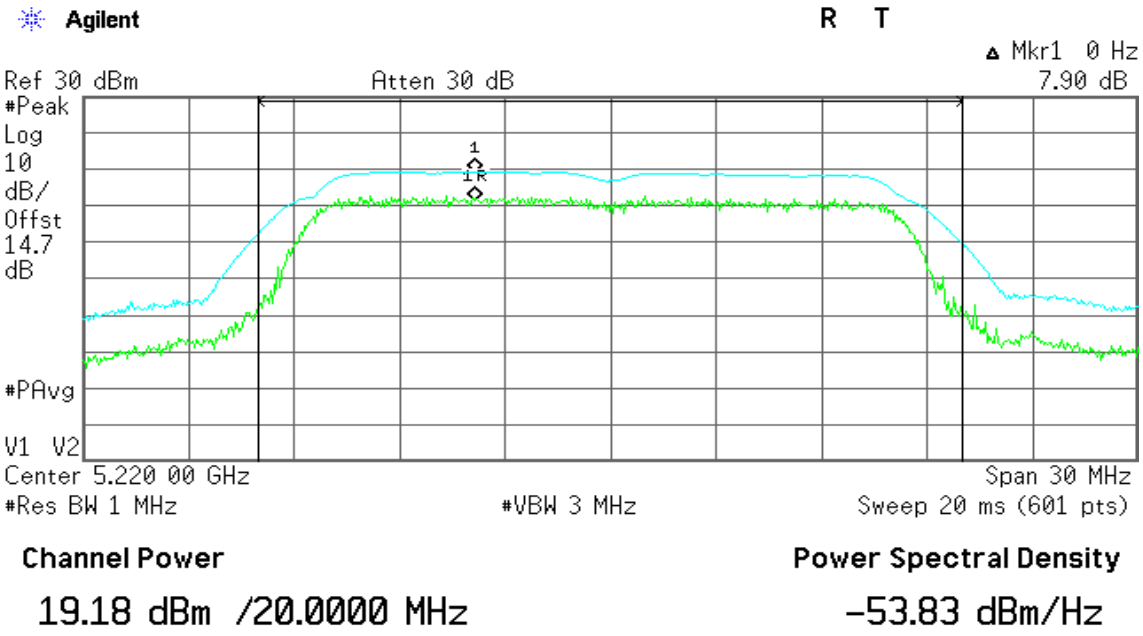
Test Plot

IEEE 802.11a mode / 5180 ~ 5240MHz

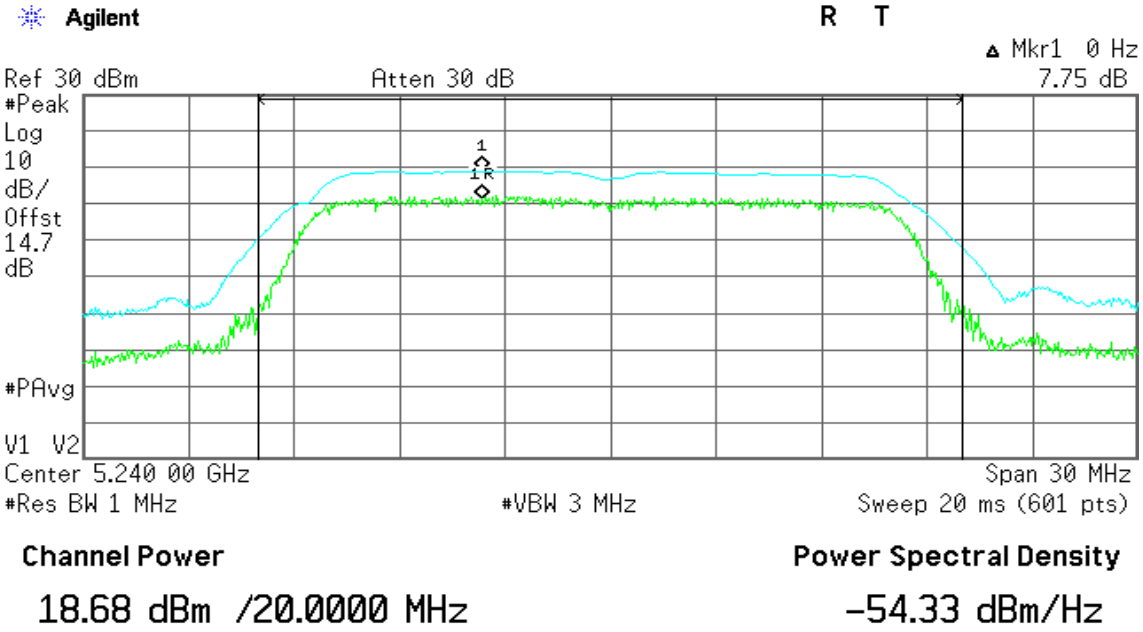
CH Low



CH Mid

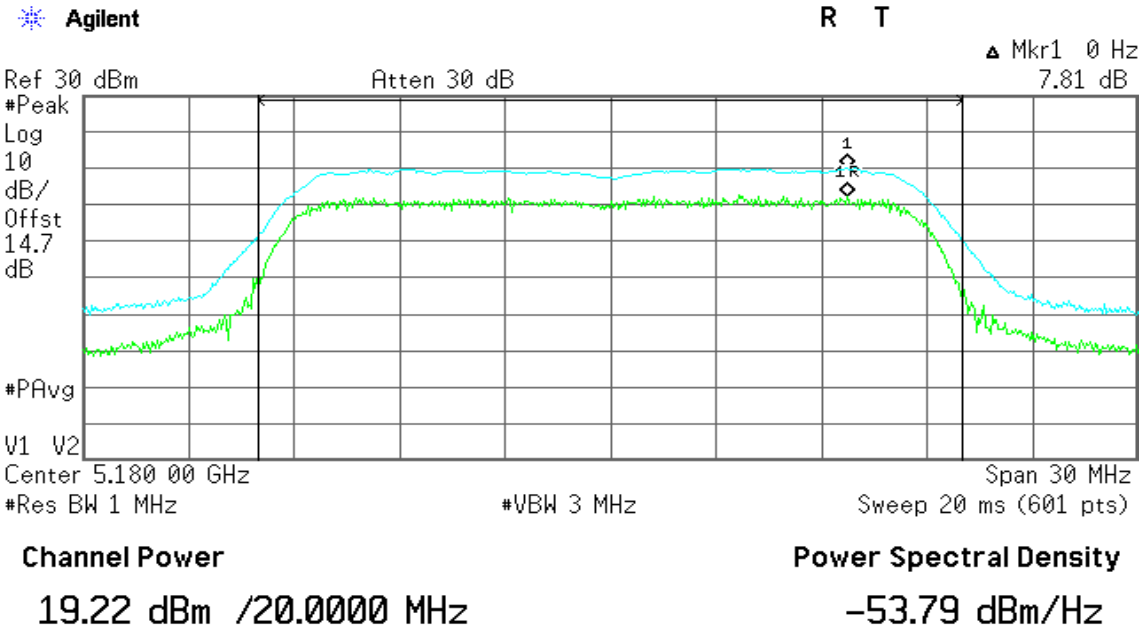


CH High

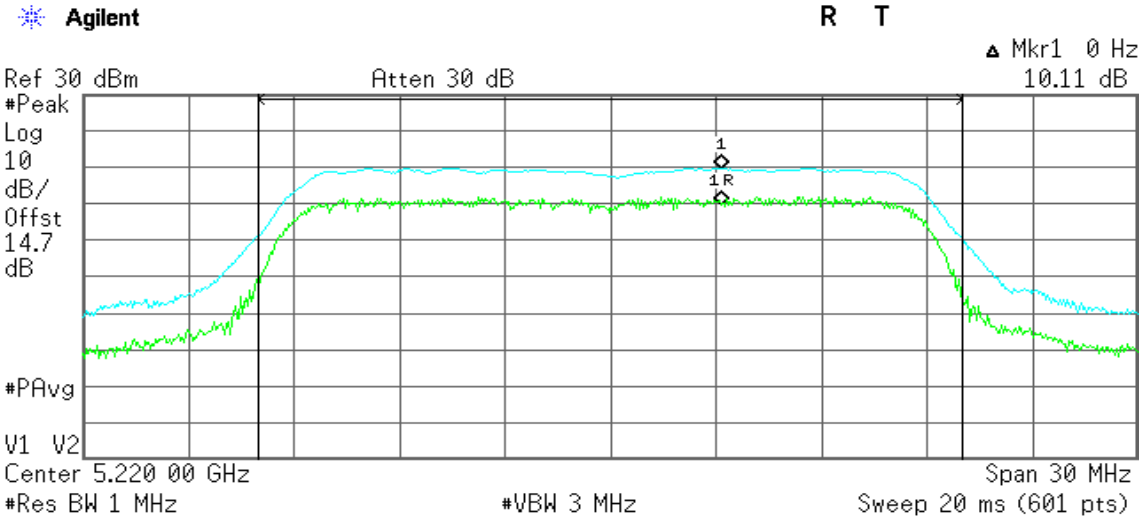


IEEE 802.11n HT 20 MHz mode / 5180 ~ 5240MHz / Chain 0

CH Low



CH Mid



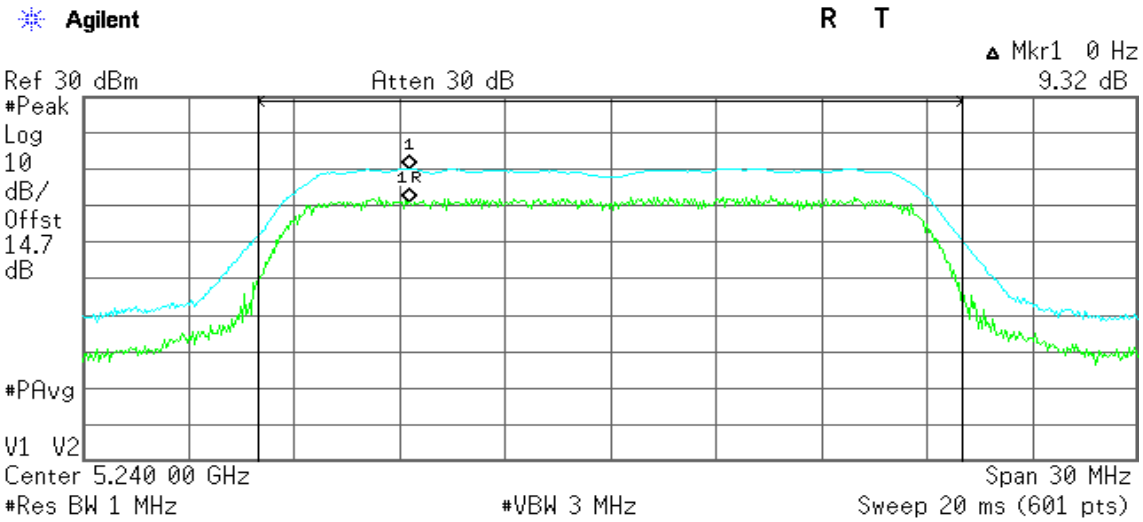
Channel Power

19.23 dBm /20.0000 MHz

Power Spectral Density

-53.78 dBm/Hz

CH High



Channel Power

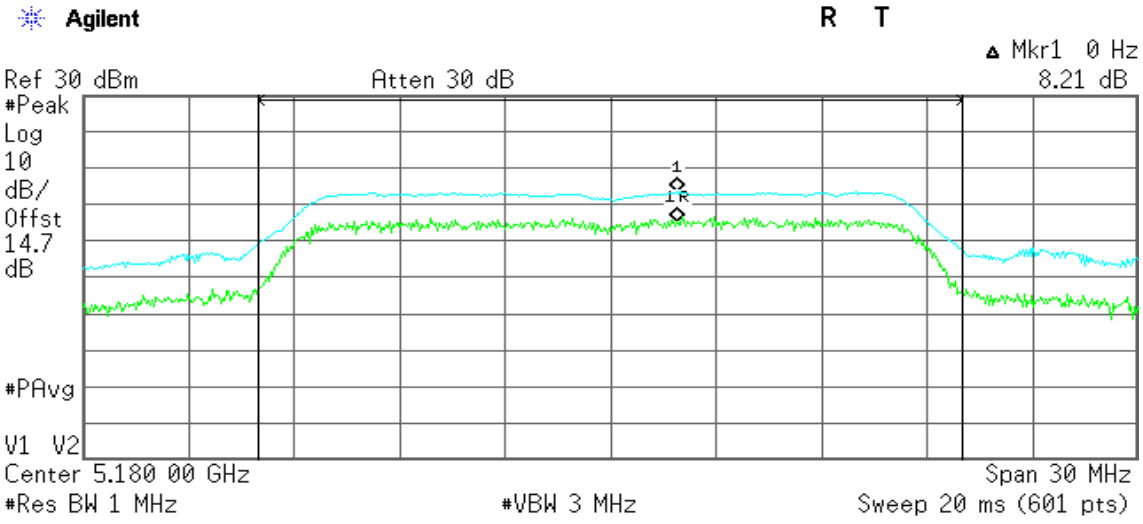
19.68 dBm /20.0000 MHz

Power Spectral Density

-53.33 dBm/Hz

IEEE 802.11n HT 20 MHz mode / 5180 ~ 5240MHz / Chain 1

CH Low



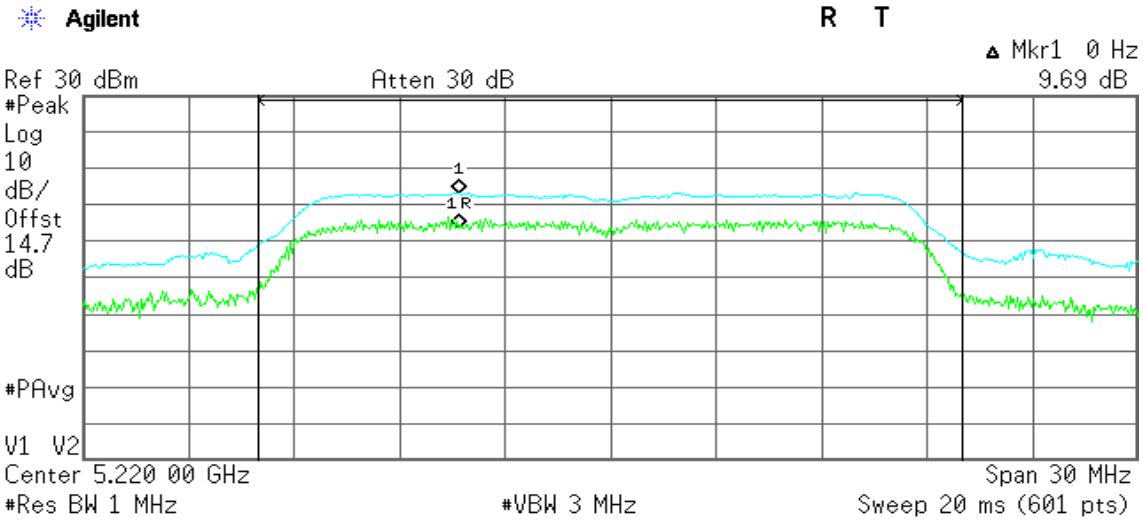
Channel Power

13.04 dBm /20.0000 MHz

Power Spectral Density

-59.97 dBm/Hz

CH Mid



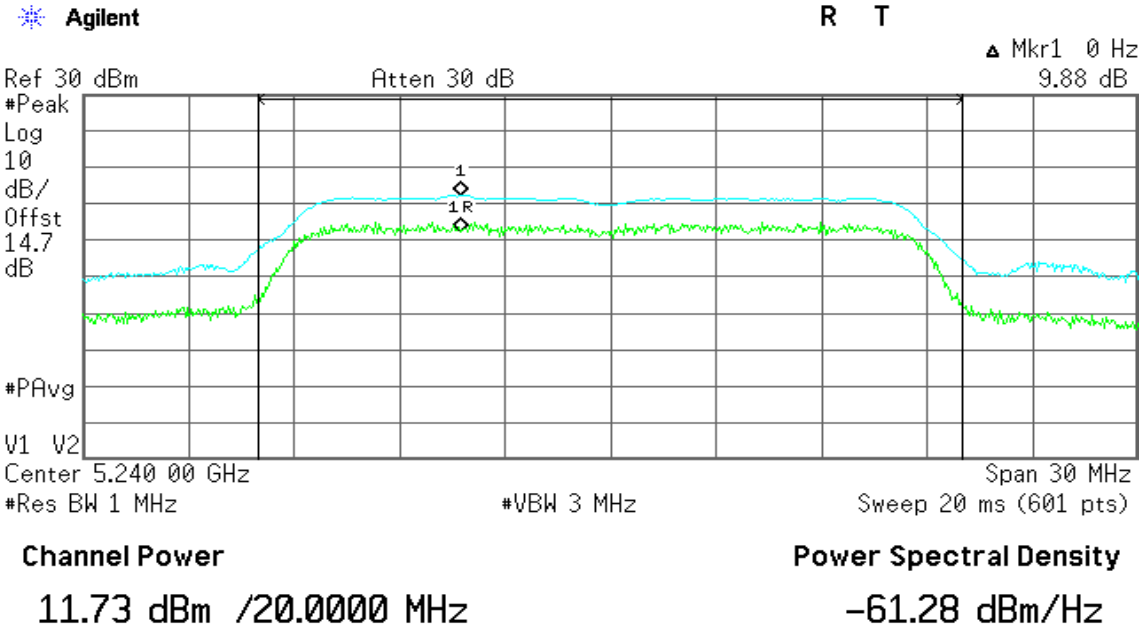
Channel Power

12.82 dBm /20.0000 MHz

Power Spectral Density

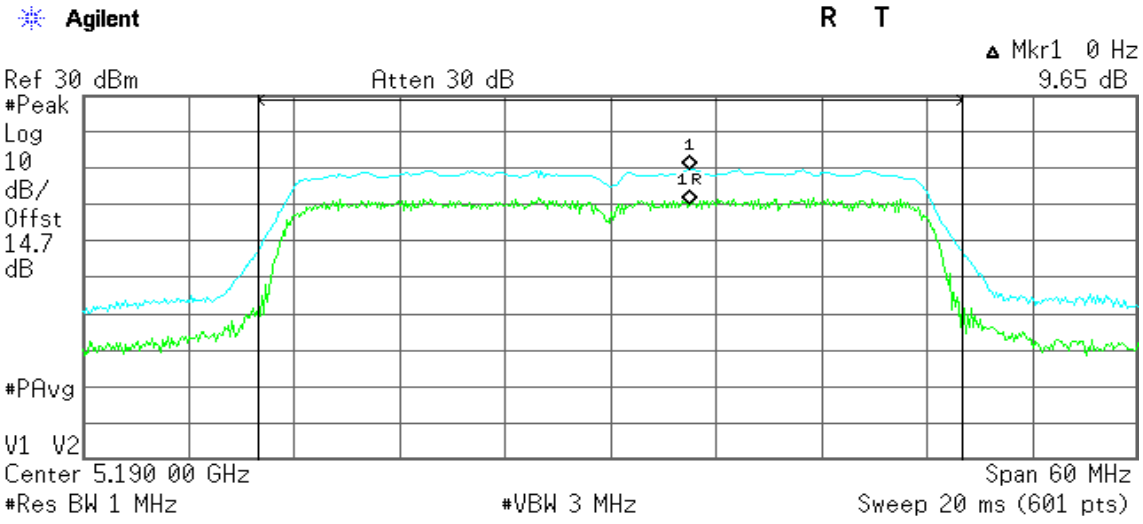
-60.19 dBm/Hz

CH High


Agilent
R T
Mkr1 0 Hz
9.88 dB
Ref 30 dBm
Atten 30 dB
#Peak
Log
10
dB/
Offst
14.7
dB
#PAvg
V1 V2
Center 5.240 00 GHz
Span 30 MHz
#Res BW 1 MHz
#VBW 3 MHz
Sweep 20 ms (601 pts)
Channel Power
11.73 dBm /20.0000 MHz
Power Spectral Density
-61.28 dBm/Hz

IEEE 802.11n HT 40 MHz mode / 5190 ~ 5230MHz / Chain 0

CH Low



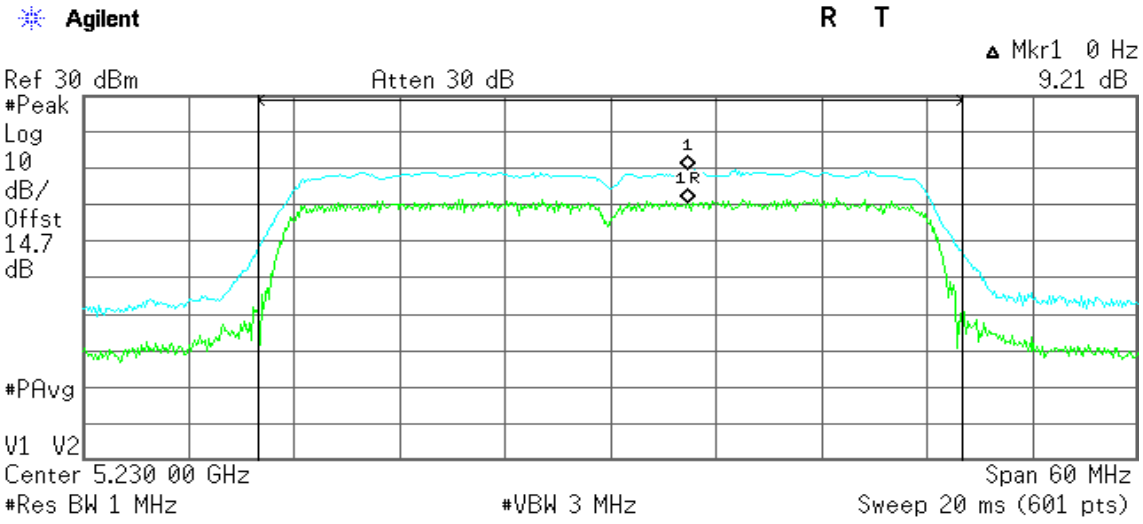
Channel Power

21.46 dBm /40.0000 MHz

Power Spectral Density

-54.56 dBm/Hz

CH High



Channel Power

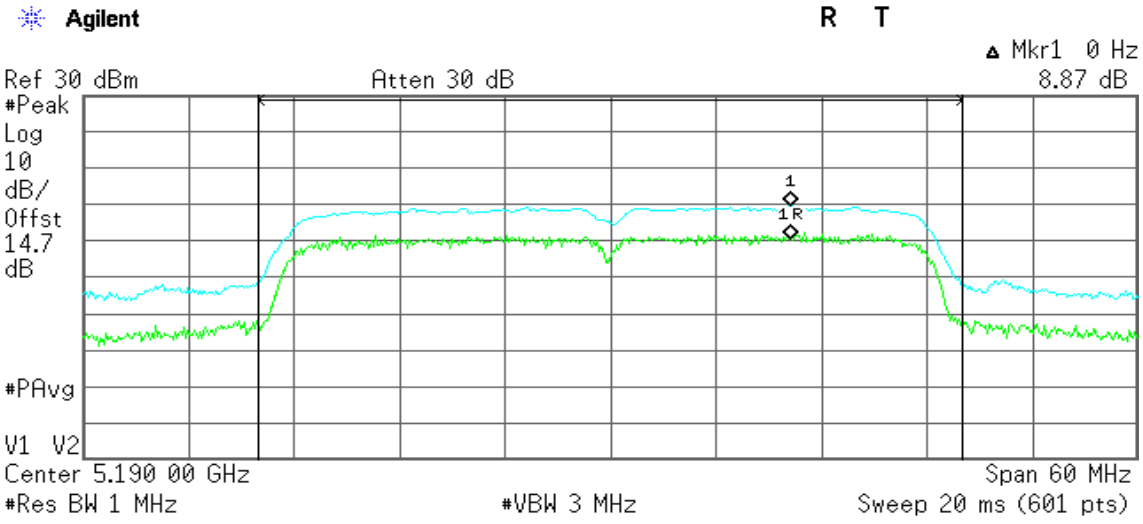
21.28 dBm /40.0000 MHz

Power Spectral Density

-54.74 dBm/Hz

IEEE 802.11n HT 40 MHz mode / 5190 ~ 5230MHz / Chain 1

CH Low



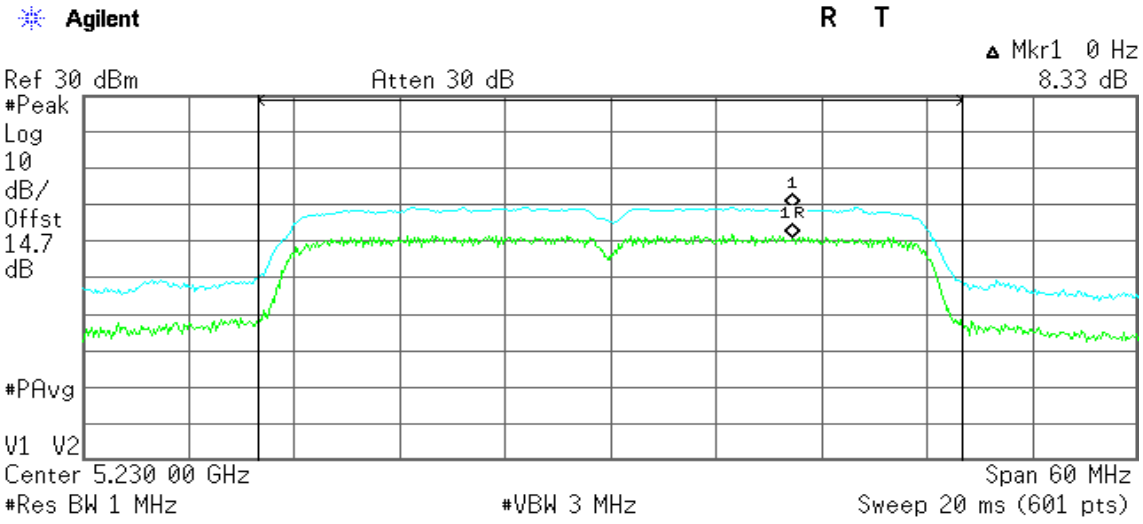
Channel Power

11.65 dBm /40.0000 MHz

Power Spectral Density

-64.37 dBm/Hz

CH High



Channel Power

11.78 dBm /40.0000 MHz

Power Spectral Density

-64.24 dBm/Hz

7.7 CONDUCTED UNDESIRABLE EMISSION

LIMIT

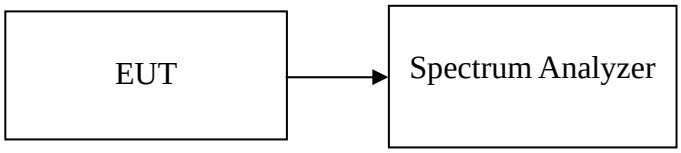
According to 15.407(b),

(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 30 MHz to 40 GHz range with the transmitter set to the lowest, middle, and highest channels.

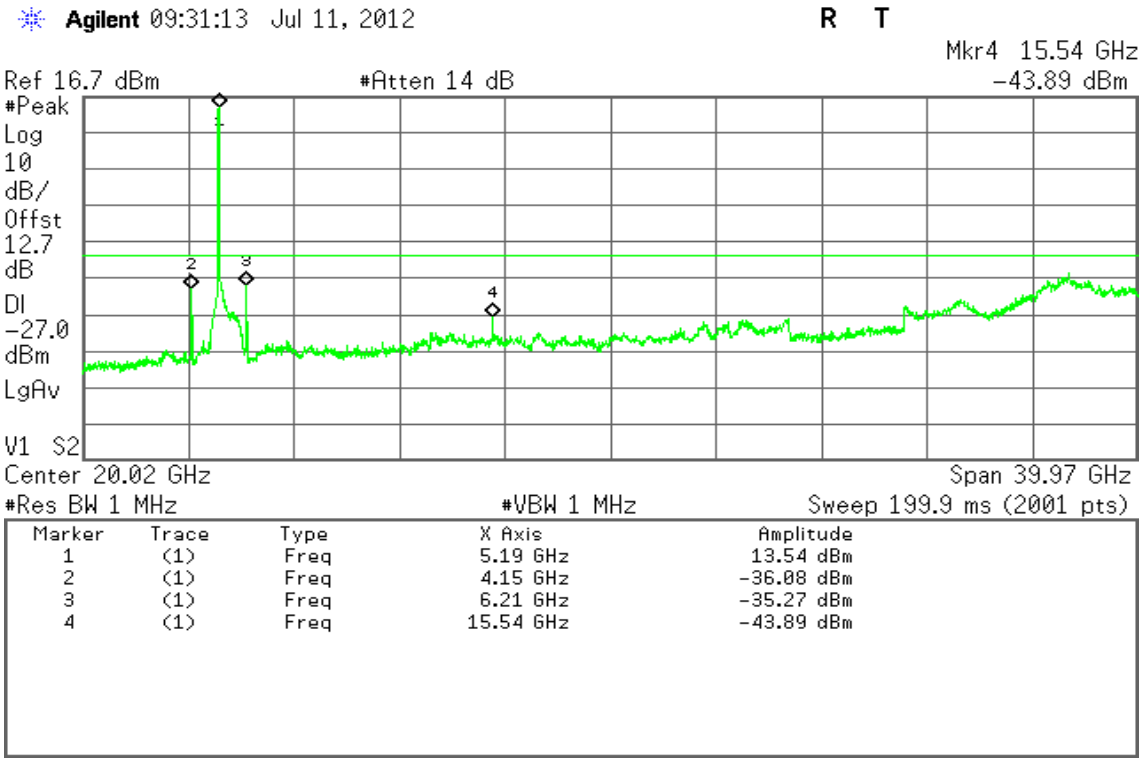
TEST RESULTS

No non-compliance noted

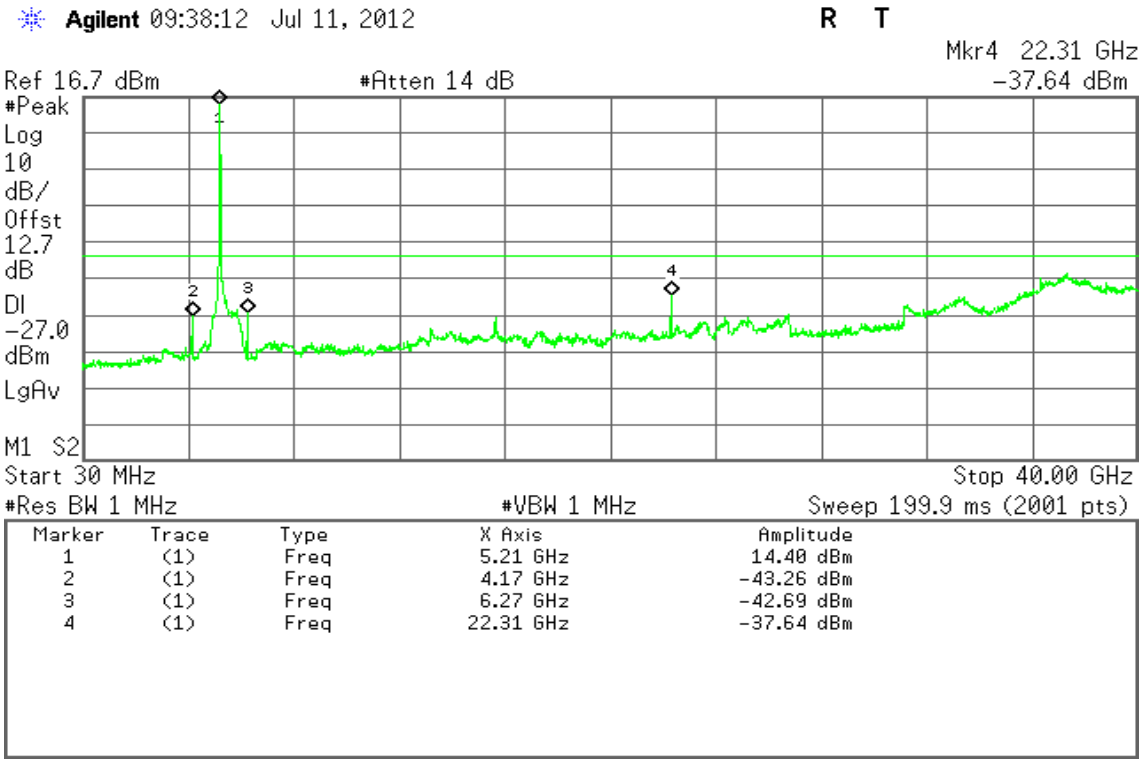
Test Plot

IEEE 802.11a (5180 ~ 5240MHz)

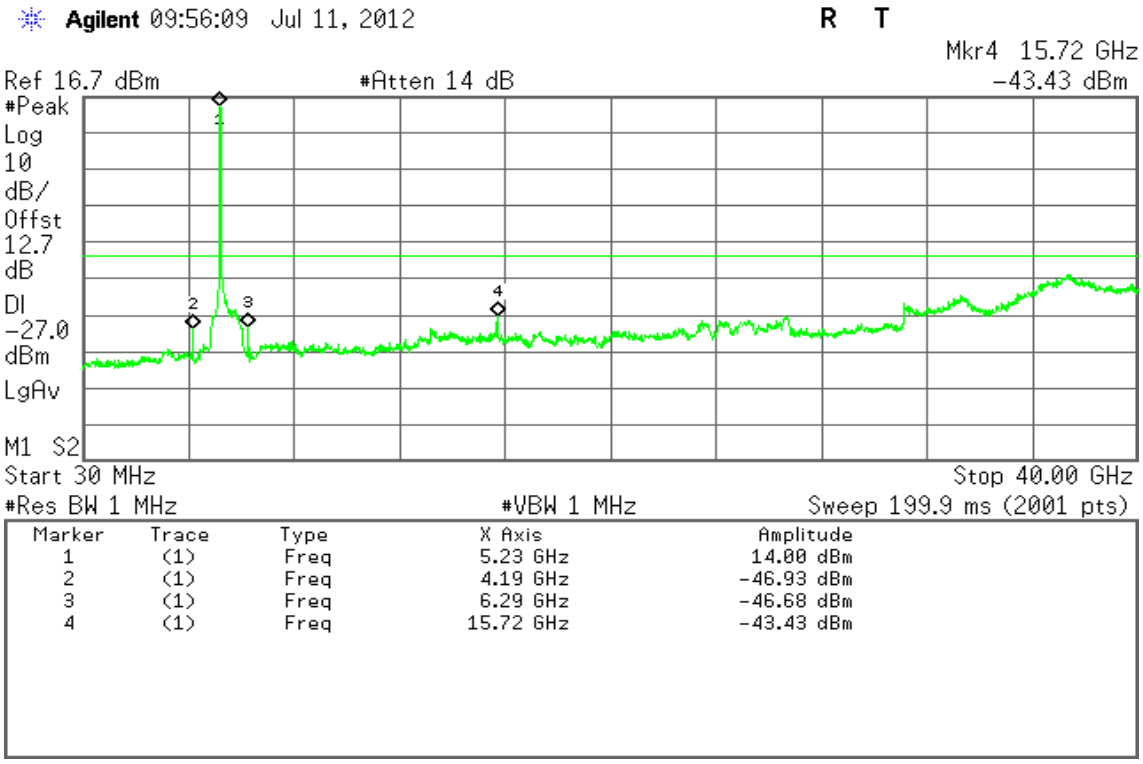
CH Low



CH Mid

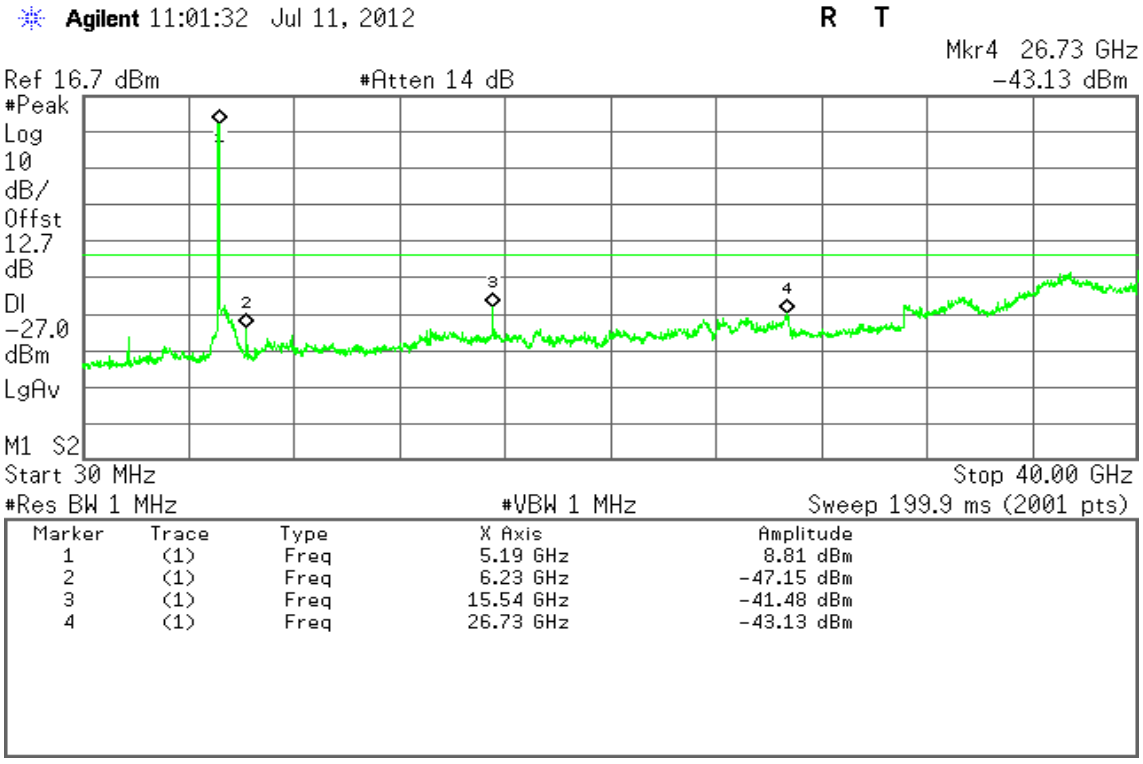


CH High

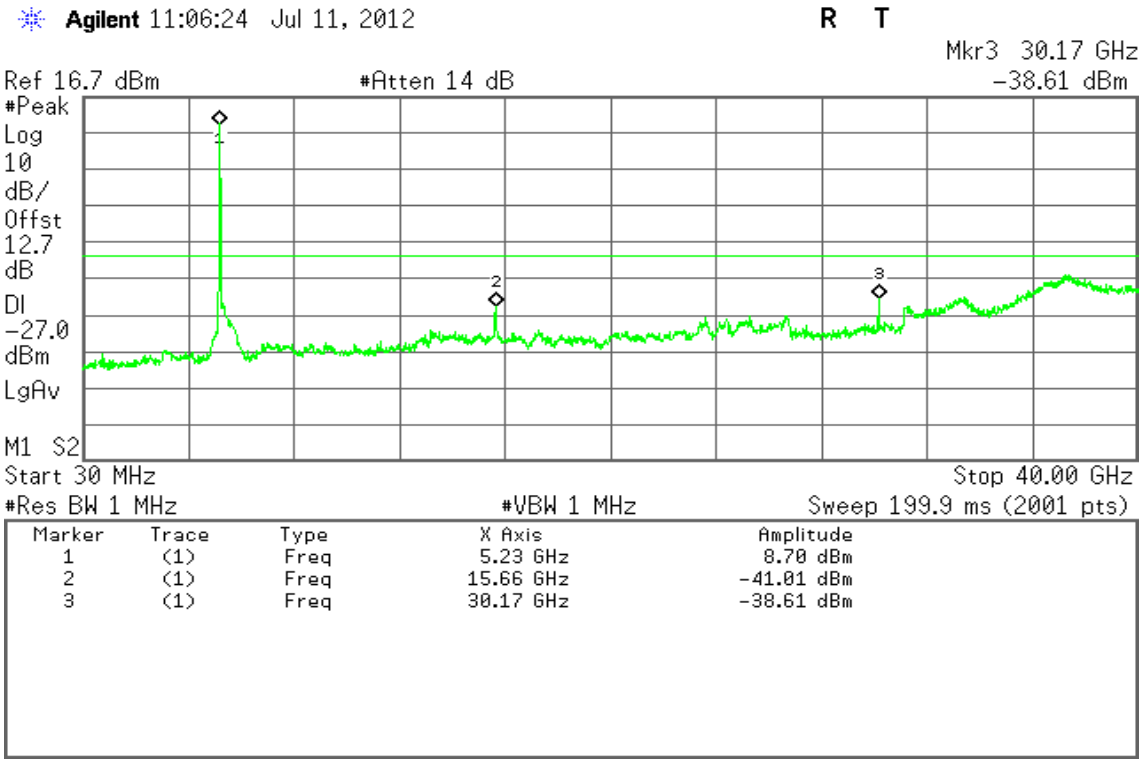


IEEE 802.11n HT 20 MHz (5180 ~ 5240MHz) / Chain 0

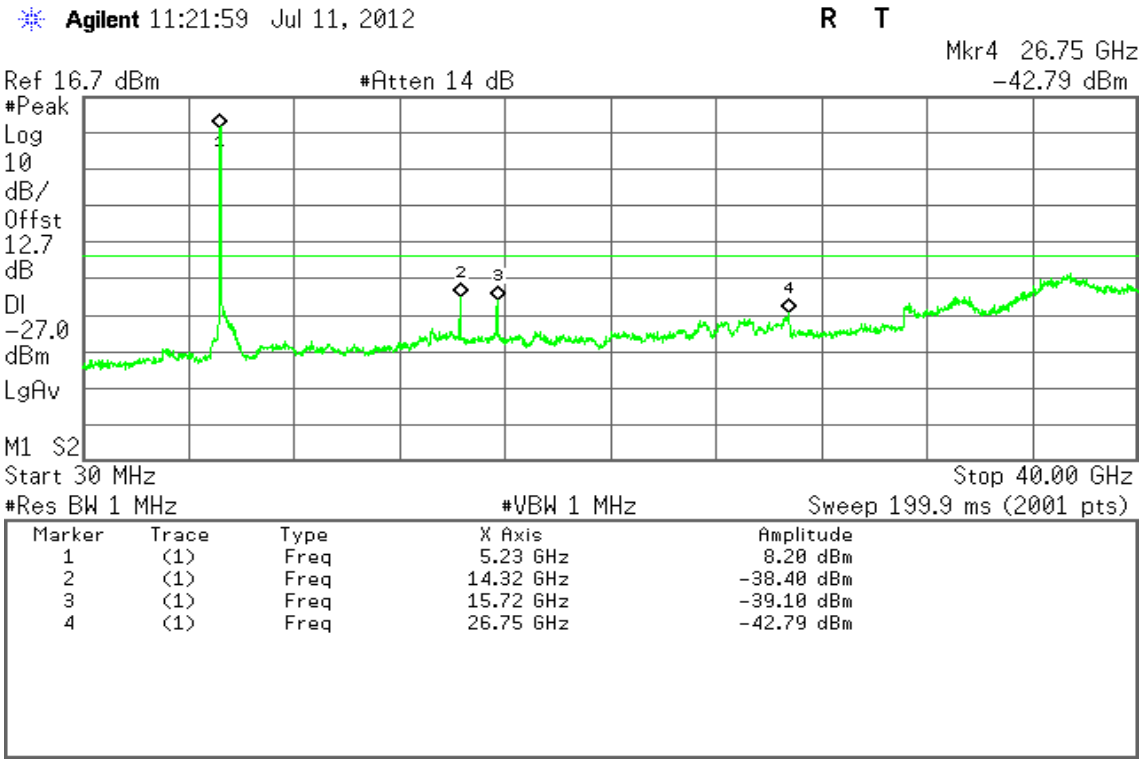
CH Low



CH Mid

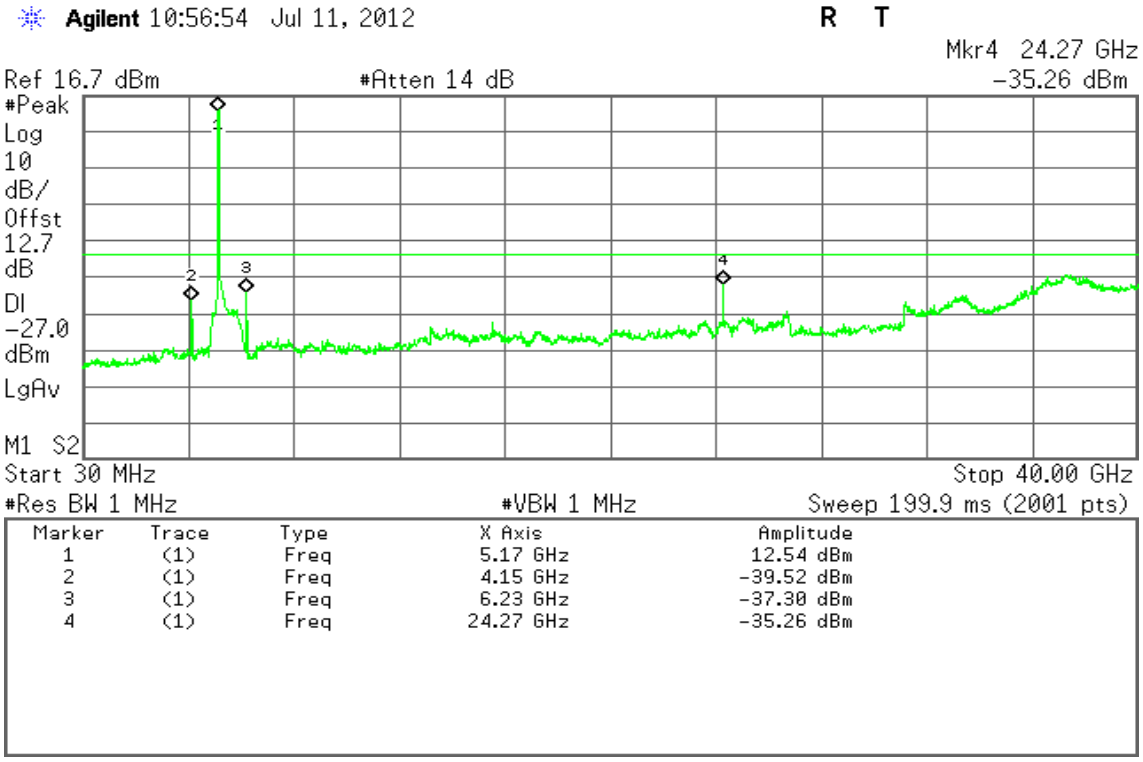


CH High



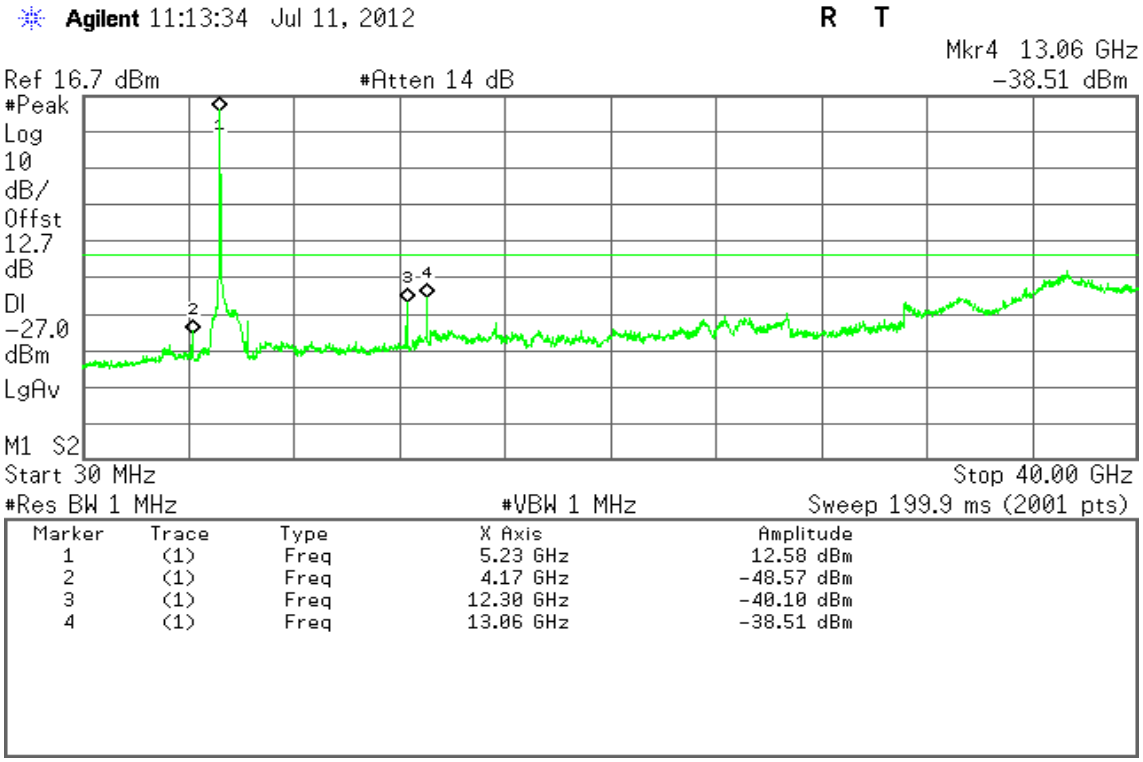
IEEE 802.11n HT 20 MHz (5180 ~ 5240MHz) / Chain 1

CH Low



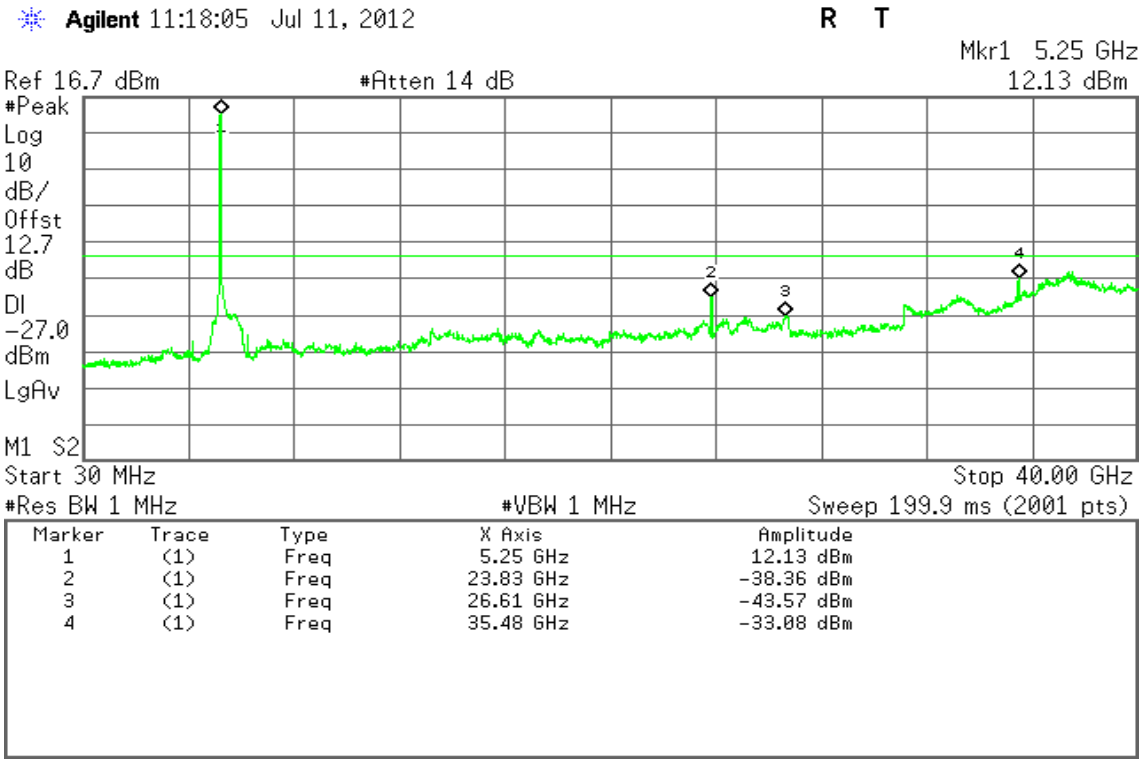
Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	5.17 GHz	12.54 dBm
2	(1)	Freq	4.15 GHz	-39.52 dBm
3	(1)	Freq	6.23 GHz	-37.30 dBm
4	(1)	Freq	24.27 GHz	-35.26 dBm

CH Mid



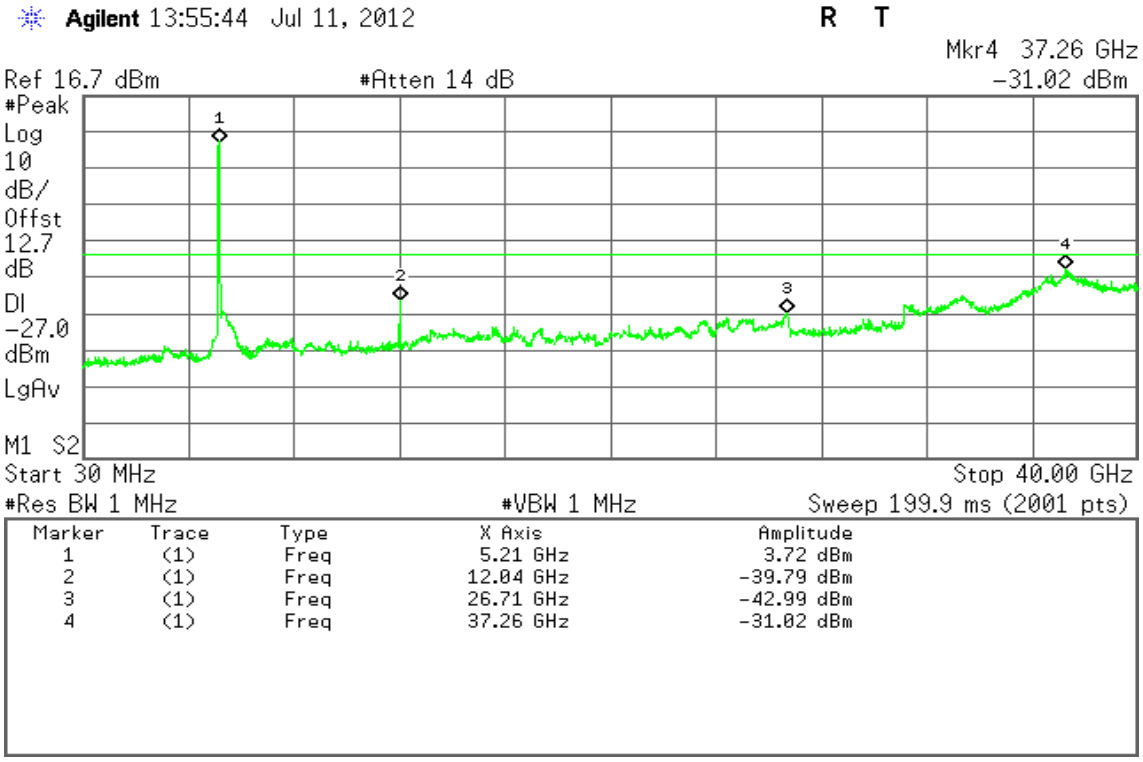
Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	5.23 GHz	12.58 dBm
2	(1)	Freq	4.17 GHz	-48.57 dBm
3	(1)	Freq	12.30 GHz	-40.10 dBm
4	(1)	Freq	13.06 GHz	-38.51 dBm

CH High


Agilent 11:18:05 Jul 11, 2012
R T
Mkr1 5.25 GHz
12.13 dBm
Ref 16.7 dBm
#Atten 14 dB
#Peak
Log
10
dB/
Offst
12.7
dB
Dl
-27.0
dBm
LgAv
M1 S2
Start 30 MHz
Stop 40.00 GHz
#Res BW 1 MHz
#VBW 1 MHz
Sweep 199.9 ms (2001 pts)
Marker Trace Type X Axis Amplitude
1 (1) Freq 5.25 GHz 12.13 dBm
2 (1) Freq 23.83 GHz -38.36 dBm
3 (1) Freq 26.61 GHz -43.57 dBm
4 (1) Freq 35.48 GHz -33.08 dBm

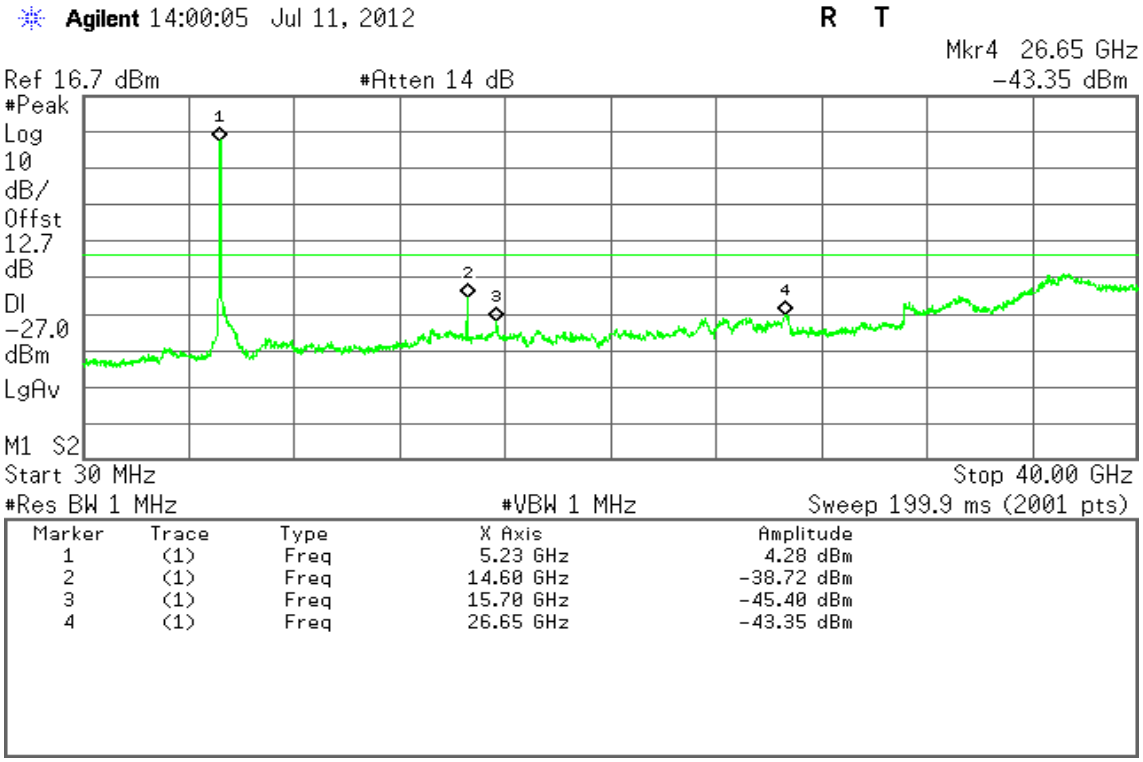
IEEE 802.11n HT 40 MHz (5180 ~ 5240MHz) / Chain 0

CH Low



Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	5.21 GHz	3.72 dBm
2	(1)	Freq	12.04 GHz	-39.79 dBm
3	(1)	Freq	26.71 GHz	-42.99 dBm
4	(1)	Freq	37.26 GHz	-31.02 dBm

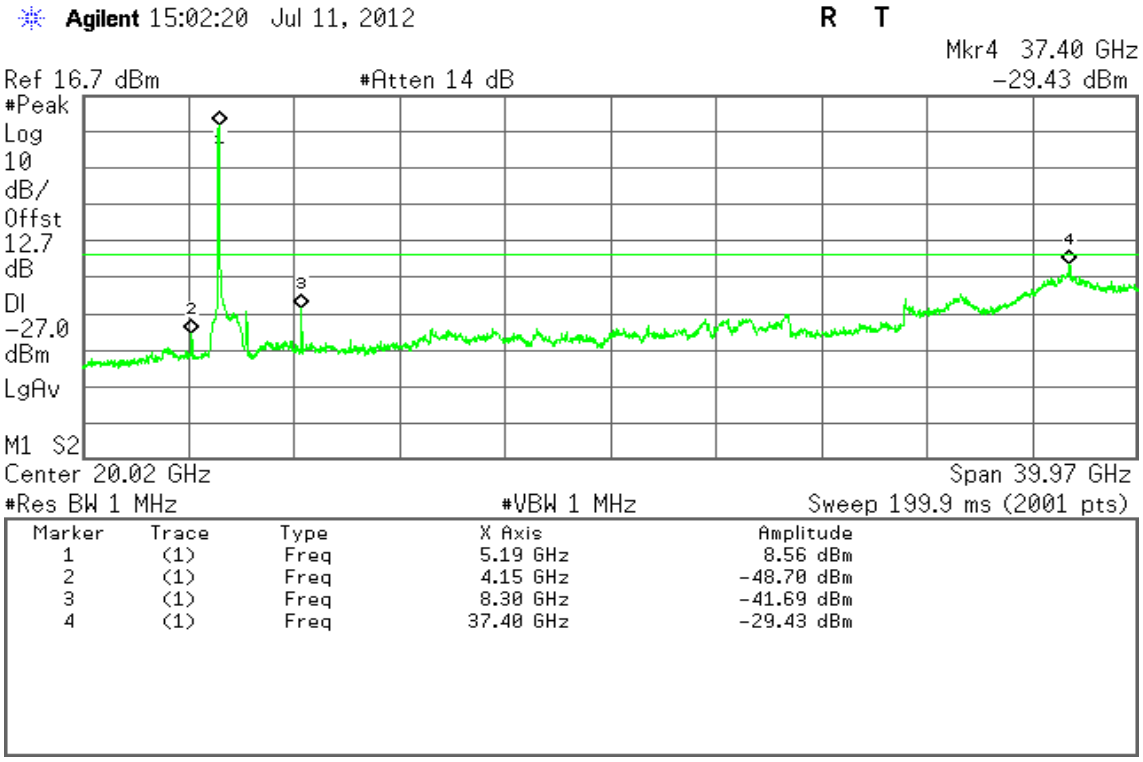
CH High



Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	5.23 GHz	4.28 dBm
2	(1)	Freq	14.60 GHz	-38.72 dBm
3	(1)	Freq	15.70 GHz	-45.40 dBm
4	(1)	Freq	26.65 GHz	-43.35 dBm

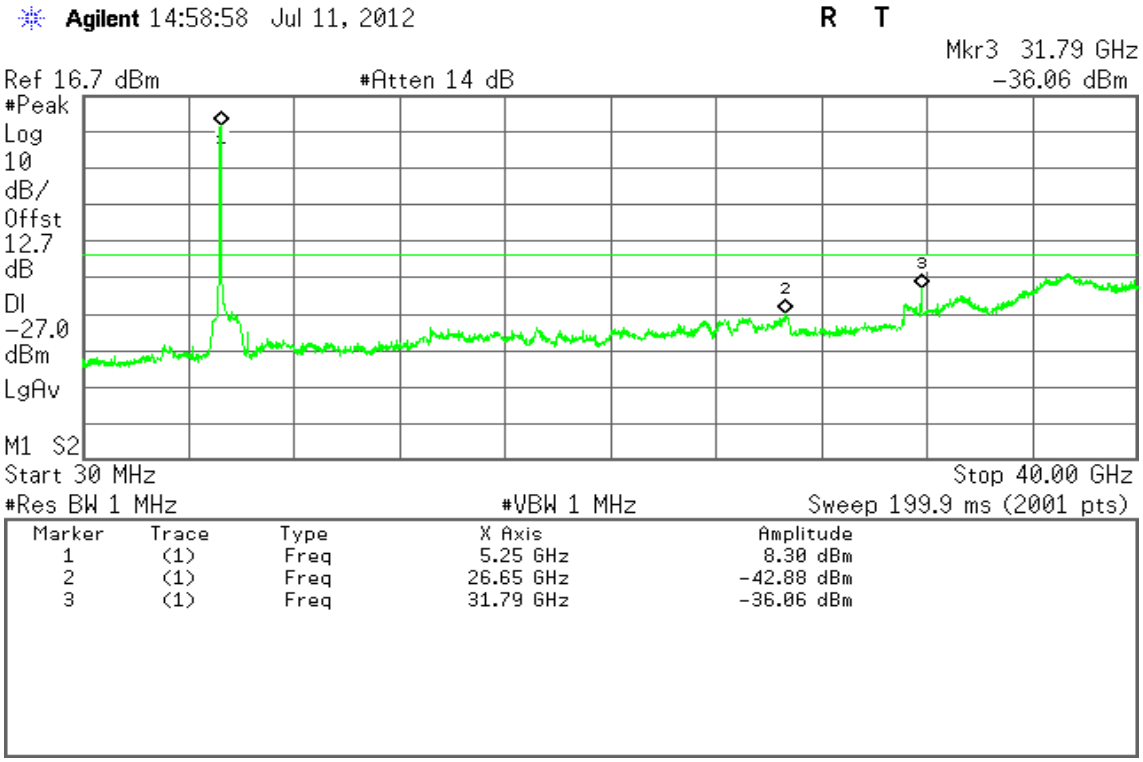
IEEE 802.11n HT 40 MHz (5180 ~ 5240MHz) / Chain 1

CH Low



Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	5.19 GHz	8.56 dBm
2	(1)	Freq	4.15 GHz	-48.70 dBm
3	(1)	Freq	8.30 GHz	-41.69 dBm
4	(1)	Freq	37.40 GHz	-29.43 dBm

CH High



Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	5.25 GHz	8.30 dBm
2	(1)	Freq	26.65 GHz	-42.88 dBm
3	(1)	Freq	31.79 GHz	-36.06 dBm

7.8 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

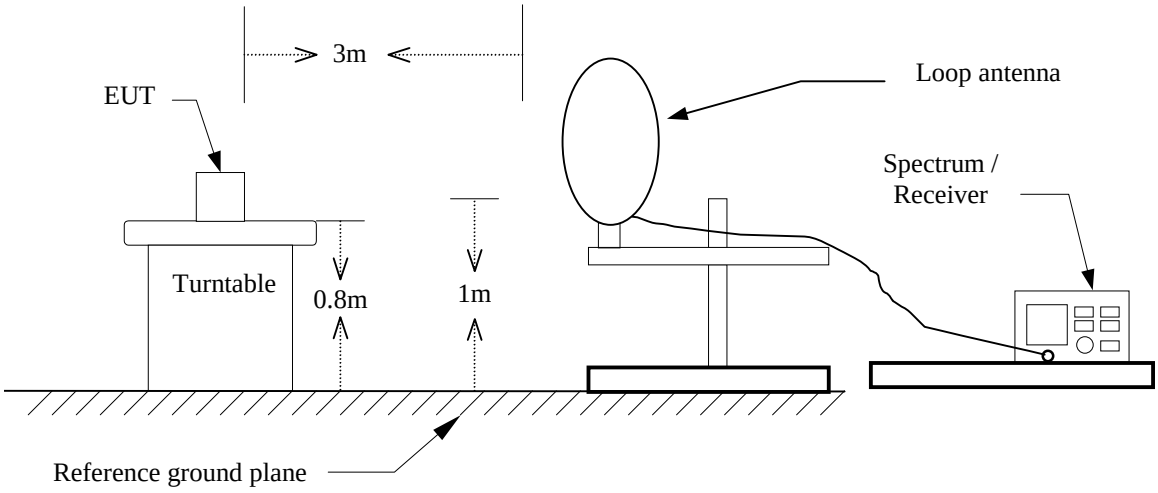
Remark: *Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of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

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

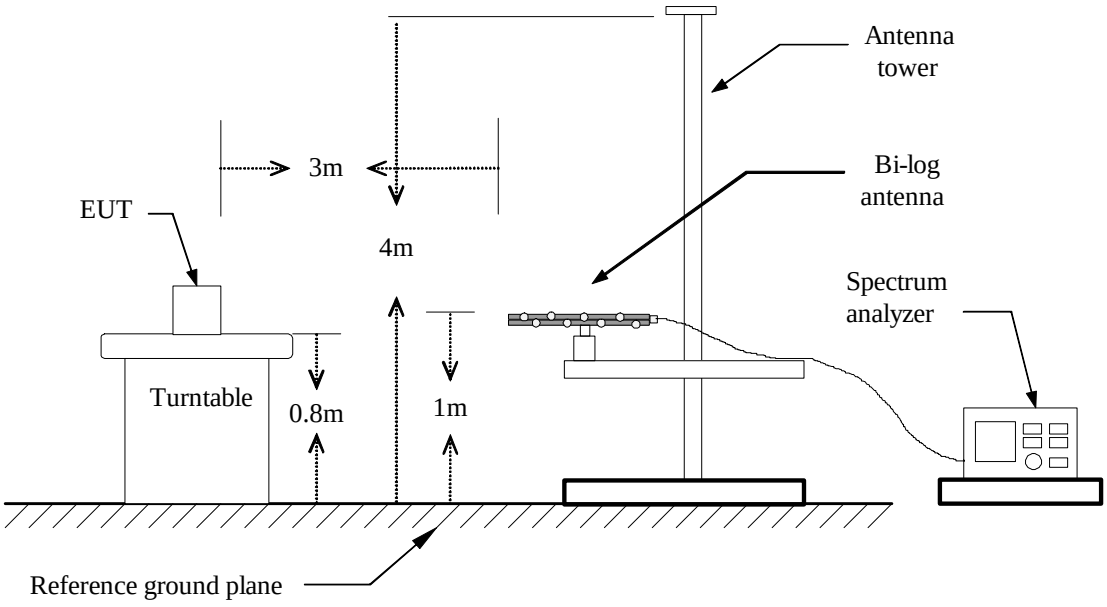
Frequency (MHz)	Field Strength (μV/m at 3-meter)	Field Strength (dBμV/m at 3-meter)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

Test Configuration

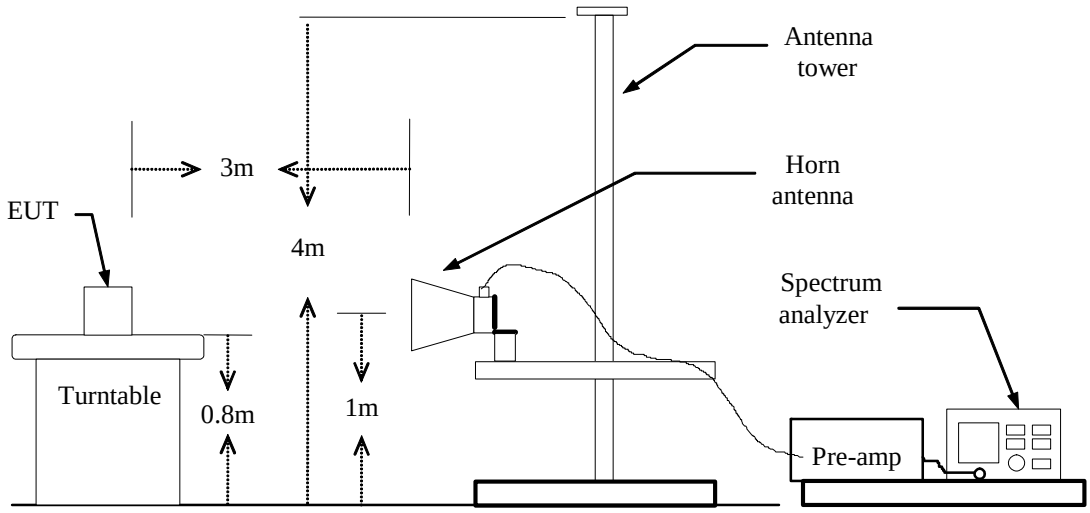
9kHz ~ 30MHz



30MHz ~ 1GHz



Above 1 GHz


Antenna
tower
3m
Horn
antenna
EUT
4m
Spectrum
analyzer
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:**	August 17, 2012
Temperature:	26°C	**Tested by:**	Ali Shu
Humidity:	50% 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)
99.52	46.99	-16.07	30.93	43.50	-12.57	Peak	V
165.80	49.41	-13.52	35.89	43.50	-7.61	Peak	V
500.45	44.92	-8.13	36.79	46.00	-9.21	Peak	V
566.73	43.64	-7.47	36.17	46.00	-9.83	Peak	V
666.97	43.03	-5.95	37.08	46.00	-8.92	Peak	V
899.77	43.12	-3.18	39.94	46.00	-6.06	Peak	V
164.18	48.11	-13.44	34.67	43.50	-8.83	Peak	H
400.22	44.57	-9.63	34.94	46.00	-11.06	Peak	H
500.45	41.64	-8.13	33.51	46.00	-12.49	Peak	H
666.97	44.34	-5.95	38.39	46.00	-7.61	Peak	H
799.53	44.24	-4.35	39.89	46.00	-6.11	Peak	H
899.77	44.90	-3.18	41.72	46.00	-4.28	QP	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 ~ 5240MHz / CH Low	**Test Date:**	July 11, 2012
Temperature:	26°C	**Tested by:**	Shawn Wu
Humidity:	50% 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)
2061.67	54.33	---	-4.90	49.44	---	68.30	54.00	-4.56	Peak	V
N/A										
1816.67	54.87	---	-7.33	47.54	---	68.30	54.00	-6.46	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 ~ 5240MHz / CH Mid	**Test Date:**	July 11, 2012
Temperature:	26°C	**Tested by:**	Shawn Wu
Humidity:	50% 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)
1933.33	54.91	---	-6.15	48.76	---	68.30	54.00	-5.24	Peak	V
N/A										
2155.00	53.89	---	-4.03	49.86	---	68.30	54.00	-4.14	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 802.11a mode / 5180 ~ 5240MHz / CH High	**Test Date:**	July 11, 2012
Temperature:	26°C	**Tested by:**	Shawn Wu
Humidity:	50% 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)
2073.33	53.47	---	-4.79	48.68	---	68.30	54.00	-5.32	Peak	V
N/A										
2295.00	53.67	---	-2.74	50.93	---	74.00	54-00	-3.07	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 Channel mode / 5180 ~ 5240MHz / CH Low	**Test Date:**	July 11, 2012
Temperature:	26°C	**Tested by:**	Shawn Wu
Humidity:	50% 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)
2120.00	53.88	---	-4.36	49.52	---	68.30	54.00	-4.48	Peak	V
N/A										
2120.00	54.05	---	-4.36	49.69	---	68.30	54.00	-4.31	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 Channel mode / 5180 ~ 5240MHz / CH Mid	**Test Date:**	July 11, 2012
Temperature:	26°C	**Tested by:**	Shawn Wu
Humidity:	50% 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)
2131.67	53.92	---	-4.25	49.67	---	68.30	54.00	-4.33	Peak	V
N/A										
1886.67	55.75	---	-6.62	49.13	---	68.30	54.00	-4.87	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 Channel mode / 5180 ~ 5240MHz / CH High **Test Date:** July 11, 2012

Temperature: 26°C **Tested by:** Shawn Wu

Humidity: 50% 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)
2120.00	53.74	---	-4.36	49.38	---	68.30	54.00	-4.62	Peak	V
N/A										
2131.67	53.50	---	-4.25	49.25	---	68.30	54.00	-4.75	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 Channel mode / 5190 ~ 5230MHz / CH Low	**Test Date:**	July 11, 2012
Temperature:	26°C	**Tested by:**	Shawn Wu
Humidity:	50% 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)
2225.00	53.34	---	-3.38	49.96	---	74.00	54.00	-4.04	Peak	V
N/A										
2155.00	53.94	---	-4.03	49.91	---	68.30	54.00	-4.09	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 Channel mode / 5190 ~ 5230MHz / CH High **Test Date:** July 11, 2012

Temperature: 26°C **Tested by:** Shawn Wu

Humidity: 50% 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)
1968.33	54.72	---	-5.79	48.93	---	68.30	54.00	-5.07	Peak	V
N/A										
2096.67	54.35	---	-4.57	49.77	---	68.30	54.00	-4.23	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).*

7.9 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

Operation Mode:	Normal Link	**Test Date:**	August 23, 2012
Temperature:	26°C	**Tested by:**	Chester Tsai
Humidity:	60% RH		

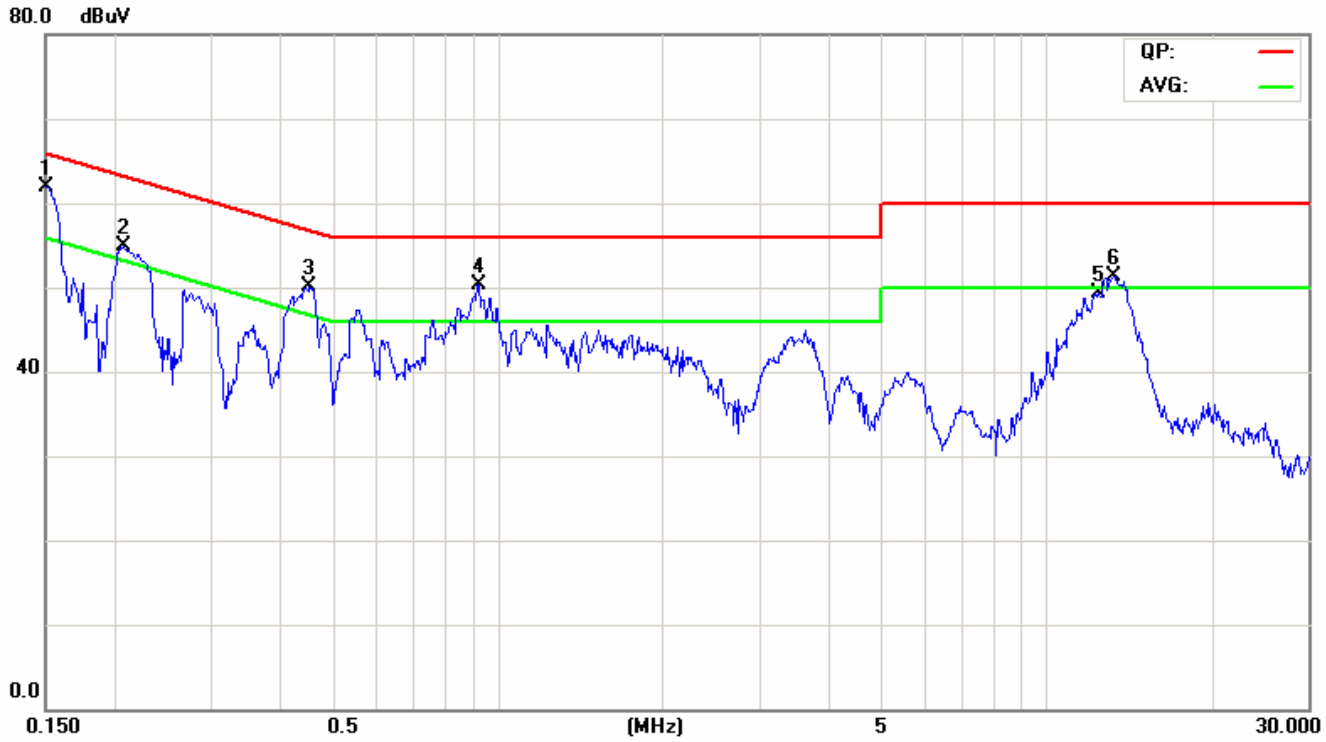
Freq. (MHz)	QP Reading (dBuV)	AV Reading (dBuV)	Corr. factor (dB)	QP Result (dBuV)	AV Result (dBuV)	QP Limit (dBuV)	AV Limit (dBuV)	QP Margin (dB)	AV Margin (dB)	Note
0.1505	59.26	41.97	0.09	59.35	42.06	65.97	55.97	-6.62	-13.91	L1
0.2056	51.23	36.43	0.09	51.32	36.52	63.38	53.38	-12.06	-16.86	L1
0.4553	47.11	32.35	0.10	47.21	32.45	56.78	46.78	-9.57	-14.33	L1
0.9314	44.11	34.08	0.11	44.22	34.19	56.00	46.00	-11.78	-11.81	L1
12.2601	43.95	38.00	0.51	44.46	38.51	60.00	50.00	-15.54	-11.49	L1
13.2286	45.51	39.70	0.56	46.07	40.26	60.00	50.00	-13.93	-9.74	L1
0.1504	57.15	40.35	0.09	57.24	40.44	65.98	55.98	-8.74	-15.54	L2
0.2077	50.49	37.96	0.09	50.58	38.05	63.30	53.30	-12.72	-15.25	L2
0.4539	47.97	33.43	0.09	48.06	33.52	56.80	46.80	-8.74	-13.28	L2
0.9073	43.69	35.24	0.10	43.79	35.34	56.00	46.00	-12.21	-10.66	L2
3.4182	40.00	32.16	0.16	40.16	32.32	56.00	46.00	-15.84	-13.68	L2
13.6376	41.20	35.30	0.43	41.63	35.73	60.00	50.00	-18.37	-14.27	L2

Remark:

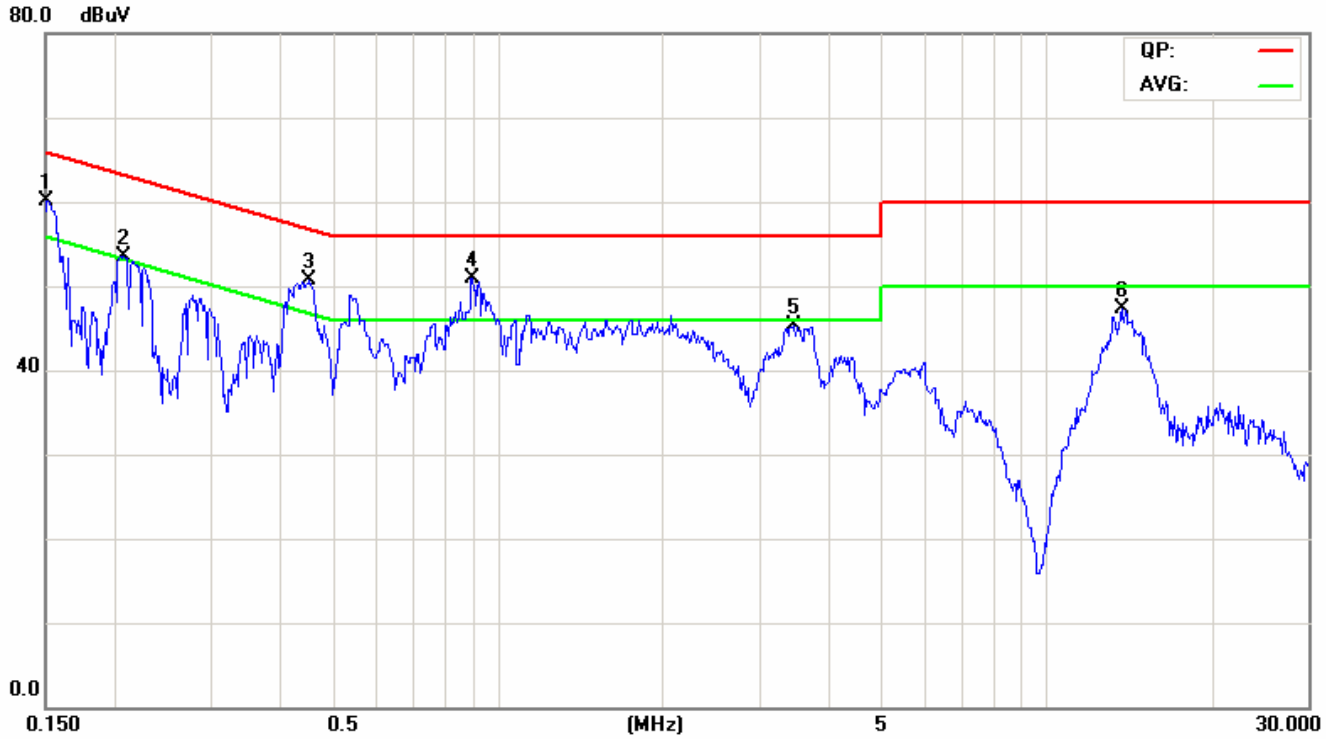
1. *Measuring frequencies from 0.15 MHz to 30MHz.*
2. *The emissions measured in frequency range from 0.15 MHz to 30MHz were made with an instrument using Quasi-peak detector and average detector.*
3. *The IF bandwidth of SPA between 0.15MHz to 30MHz was 10kHz; the IF bandwidth of Test Receiver between 0.15MHz to 30MHz was 9kHz.*
4. *L1 = Line One (Live Line) / L2 = Line Two (Neutral Line)*

Test Plots

Conducted emissions (Line 1)



Conducted emissions (Line 2)

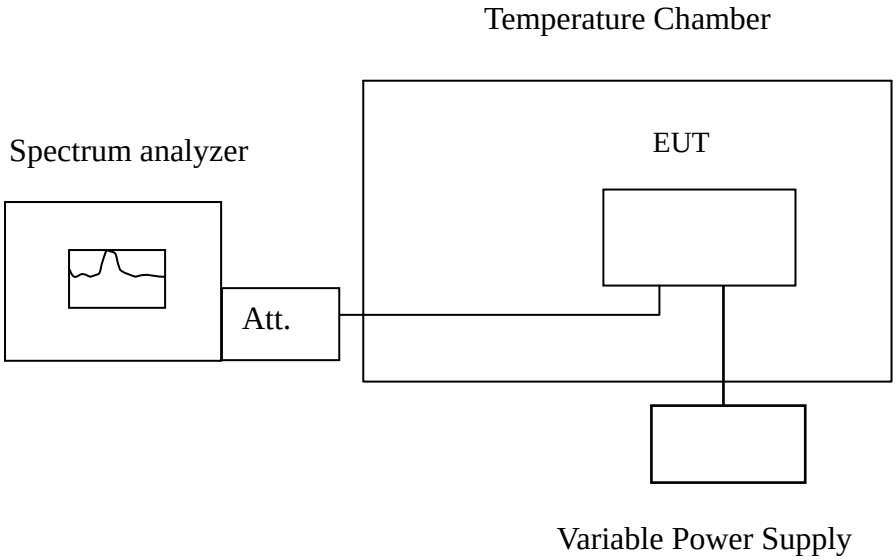


7.10 FREQUENCY STABILITY

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 ~ 5240 MHz:

CH Low

Operating Frequency: 5180 MHz				
Environment Temperature (°C)	Voltage (V)	Measured Frequency (MHz)	Limit Range	Test Result
50	110	5179.989529	5150~5250	Pass
40	110	5179.988312	5150~5250	Pass
30	110	5179.998286	5150~5250	Pass
20	110	5180.007437	5150~5250	Pass
10	110	5179.991483	5150~5250	Pass
0	110	5179.985953	5150~5250	Pass
-10	110	5179.974197	5150~5250	Pass
-20	110	5179.990587	5150~5250	Pass

Operating Frequency: 5180 MHz				
Environment Temperature (°C)	Voltage (V)	Measured Frequency (MHz)	Limit Range	Test Result
20	99	5180.00355	5150~5250	Pass
	110	5180.004409	5150~5250	Pass
	121	5179.998988	5150~5250	Pass

CH High

Operating Frequency: 5240 MHz				
Environment Temperature (°C)	Voltage (V)	Measured Frequency (MHz)	Limit Range	Test Result
50	110	5239.989419	5150~5250	Pass
40	110	5240.020681	5150~5250	Pass
30	110	5240.003290	5150~5250	Pass
20	110	5239.970001	5150~5250	Pass
10	110	5239.998110	5150~5250	Pass
0	110	5240.018288	5150~5250	Pass
-10	110	5240.002642	5150~5250	Pass
-20	110	5239.977821	5150~5250	Pass

Operating Frequency: 5240 MHz				
Environment Temperature (°C)	Voltage (V)	Measured Frequency (MHz)	Limit Range	Test Result
20	99	5240.017469	5150~5250	Pass
	110	5239.996448	5150~5250	Pass
	121	5239.988832	5150~5250	Pass

IEEE 802.11n HT 20 MHz mode / 5180 ~ 5240 MHz:

CH Low

Operating Frequency: 5180 MHz				
Environment Temperature (°C)	Voltage (V)	Measured Frequency (MHz)	Limit Range	Test Result
50	110	5179.997416	5150~5250	Pass
40	110	5179.979583	5150~5250	Pass
30	110	5179.979588	5150~5250	Pass
20	110	5179.998196	5150~5250	Pass
10	110	5180.003426	5150~5250	Pass
0	110	5179.982241	5150~5250	Pass
-10	110	5179.986851	5150~5250	Pass
-20	110	5179.990860	5150~5250	Pass

Operating Frequency: 5180 MHz				
Environment Temperature (°C)	Voltage (V)	Measured Frequency (MHz)	Limit Range	Test Result
20	99	5179.970218	5150~5250	Pass
	110	5180.014203	5150~5250	Pass
	121	5180.017003	5150~5250	Pass

CH High

Operating Frequency: 5240 MHz				
Environment Temperature (°C)	Voltage (V)	Measured Frequency (MHz)	Limit Range	Test Result
50	110	5240.007435	5150~5250	Pass
40	110	5239.974199	5150~5250	Pass
30	110	5239.994157	5150~5250	Pass
20	110	5240.015372	5150~5250	Pass
10	110	5239.998311	5150~5250	Pass
0	110	5240.014170	5150~5250	Pass
-10	110	5239.985436	5150~5250	Pass
-20	110	5239.999026	5150~5250	Pass

Operating Frequency: 5240 MHz				
Environment Temperature (°C)	Voltage (V)	Measured Frequency (MHz)	Limit Range	Test Result
20	99	5239.985865	5150~5250	Pass
	110	5240.00024	5150~5250	Pass
	121	5239.976755	5150~5250	Pass

IEEE 802.11n HT 40 MHz mode / 5190 ~ 5230 MHz:

CH Low

Operating Frequency: 5190 MHz				
Environment Temperature (°C)	Voltage (V)	Measured Frequency (MHz)	Limit Range	Test Result
50	110	5190.014019	5150~5250	Pass
40	110	5189.974553	5150~5250	Pass
30	110	5189.977154	5150~5250	Pass
20	110	5189.991308	5150~5250	Pass
10	110	5190.000745	5150~5250	Pass
0	110	5189.983833	5150~5250	Pass
-10	110	5190.014652	5150~5250	Pass
-20	110	5189.982773	5150~5250	Pass

Operating Frequency: 5190 MHz				
Environment Temperature (°C)	Voltage (V)	Measured Frequency (MHz)	Limit Range	Test Result
20	99	5190.013612	5150~5250	Pass
	110	5189.970715	5150~5250	Pass
	121	5189.976504	5150~5250	Pass

CH High

Operating Frequency: 5230 MHz				
Environment Temperature (°C)	Voltage (V)	Measured Frequency (MHz)	Limit Range	Test Result
50	110	5229.971806	5150~5250	Pass
40	110	5230.017270	5150~5250	Pass
30	110	5229.989804	5150~5250	Pass
20	110	5229.970771	5150~5250	Pass
10	110	5230.020241	5150~5250	Pass
0	110	5230.017171	5150~5250	Pass
-10	110	5230.011445	5150~5250	Pass
-20	110	5229.994407	5150~5250	Pass

Operating Frequency: 5230 MHz				
Environment Temperature (°C)	Voltage (V)	Measured Frequency (MHz)	Limit Range	Test Result
20	99	5230.005649	5150~5250	Pass
	110	5229.990426	5150~5250	Pass
	121	5229.978727	5150~5250	Pass