FCC 47 CFR PART 15 SUBPART E

TEST REPORT

For

11n Dual Band Wireless Access Point

Model: AP221AI

Trade Name: SERCOMM

Issued to

Sercomm Corporation
8F, No.3-1,YuanQu St., NanKang,Taipei115,Taiwan, R.O.C.

Issued by

Compliance Certification Services Inc.
No.11, Wugong 6th Rd., Wugu Dist.,
New Taipei City 24891, Taiwan. (R.O.C.)
http://www.ccsrf.com
service@ccsrf.com
Issued Date: February 19, 2014

Testing Laboratory
1309

Revision History

Rev.		Issue Date		Revisions	Effect Page	Revised By
00		February 19, 2014		Initial Issue	ALL	Kelly Cheng

TABLE OF CONTENTS

1. TEST RESULT CERTIFICATION 4

2. EUT DESCRIPTION 5

3. TEST METHODOLOGY 7

3.1 EUT CONFIGURATION 7
3.2 EUT EXERCISE 7
3.3 GENERAL TEST PROCEDURES 7
3.4 FCC PART 15.205 RESTRICTED BANDS OF OPERATIONS 8
3.5 DESCRIPTION OF TEST MODES 9

4. INSTRUMENT CALIBRATION 10

4.1 MEASURING INSTRUMENT CALIBRATION 10
4.2 MEASUREMENT EQUIPMENT USED 10
4.3 MEASUREMENT UNCERTAINTY 11

5. FACILITIES AND ACCREDITATIONS 12

5.1 FACILITIES 12
5.2 EQUIPMENT 12
5.3 TABLE OF ACCREDITATIONS AND LISTINGS 13

6. SETUP OF EQUIPMENT UNDER TEST 14

6.1 SETUP CONFIGURATION OF EUT 14
6.2 SUPPORT EQUIPMENT 14

7. FCC PART 15 REQUIREMENTS 15

7.1 DUTY CYCLE 15
7.2 DB EMISSION BANDWIDTH 18
7.3 PEAK POWER 36
7.4 BAND EDGES MEASUREMENT 39
7.5 PEAK POWER SPECTRAL DENSITY 46
7.6 PEAK EXCURSION 64
7.7 RADIATED UNDESIRABLE EMISSION 77
7.8 POWERLINE CONDUCTED EMISSIONS 90
7.9 FREQUENCY STABILITY 92

APPENDIX I PHOTOGRAPHS OF TEST SETUP 99

APPENDIX 1 - PHOTOGRAPHS OF EUT

1. TEST RESULT CERTIFICATION

Applicant: Sercomm Corporation
8F, No.3-1,YuanQu St., NanKang,Taipei115,Taiwan, R.O.C.

Equipment Under Test: 11n Dual Band Wireless Access Point

Trade Name:

Model: AP221AI

Date of Test: December 30, 2013 ~ February 5, 2014

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: 2009 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:

Angel Cheng
Section Manager
Compliance Certification Services Inc.

2. EUT DESCRIPTION

<table>
<tr><td>Product</td><td>11n Dual Band Wireless Access Point</td></tr>
<tr><td>Trade Name</td><td>SERCOMM</td></tr>
<tr><td>Model Number</td><td>AP221AI</td></tr>
<tr><td>Received Date</td><td>December 02, 2013</td></tr>
<tr><td>Power Supply</td><td>Powered from DC48V(POE)</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 mode</td><td>5180 – 5240</td><td>4 Channels</td></tr>
<tr><td>IEEE 802.11n HT 40 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:16.96 dBm
IEEE 802.11n HT 20 mode / 5180 ~ 5240MHz: 16.87 dBm
IEEE 802.11n HT 40 mode / 5190 ~ 5230MHz: 16.86 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 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 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 Specification</td><td>Gain: 3.37 dBi</td></tr>
<tr><td>Antenna Designation</td><td>Dipole Antenna</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. *This submittal(s) (test report) is intended for FCC ID: **P27AP221AI** 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: AP221AI) had been tested under operating condition.

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 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	03/27/2014
Power Meter	Anritsu	ML2495A	1012009	06/04/2014
Power Sensor	Anritsu	MA2411A	0917072	06/04/2014

Wugu 966 Chamber A				
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
Spectrum Analyzer	Agilent	E4446A	US42510268	11/05/2014
EMI Test Receiver	R&S	ESCI	100064	02/16/2015
Pre-Amplifier	Mini-Circults	ZFL-1000LN	SF350700823	01/11/2015
Pre-Amplifier	MITEQ	AFS44-00102650-42-10P-44	1415367	11/17/2014
Bilog Antenna	Sunol Sciences	JB3	A030105	10/01/2014
Horn Antenna	EMCO	3117	00055165	02/16/2015
Horn Antenna	EMCO	3116	2487	10/09/2014
Loop Antenna	EMCO	6502	8905/2356	06/12/2014
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	12/21/2014
Test S/W	EZ-EMC (CCS-3A1RE)			

4.3MEASUREMENT UNCERTAINTY

PARAMETER	UNCERTAINTY
Powerline Conducted Emission	N/A
3M Semi Anechoic Chamber / <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, Wugong 6th Rd., Wugu Dist., New Taipei City 24891, 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.

5.2EQUIPMENT

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.”

5.3TABLE 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	Testing Laboratory 1309
Canada	Industry Canada	3M Semi Anechoic Chamber (IC 2324G-1 / IC 2324G-2) to perform	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
	N/A						

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

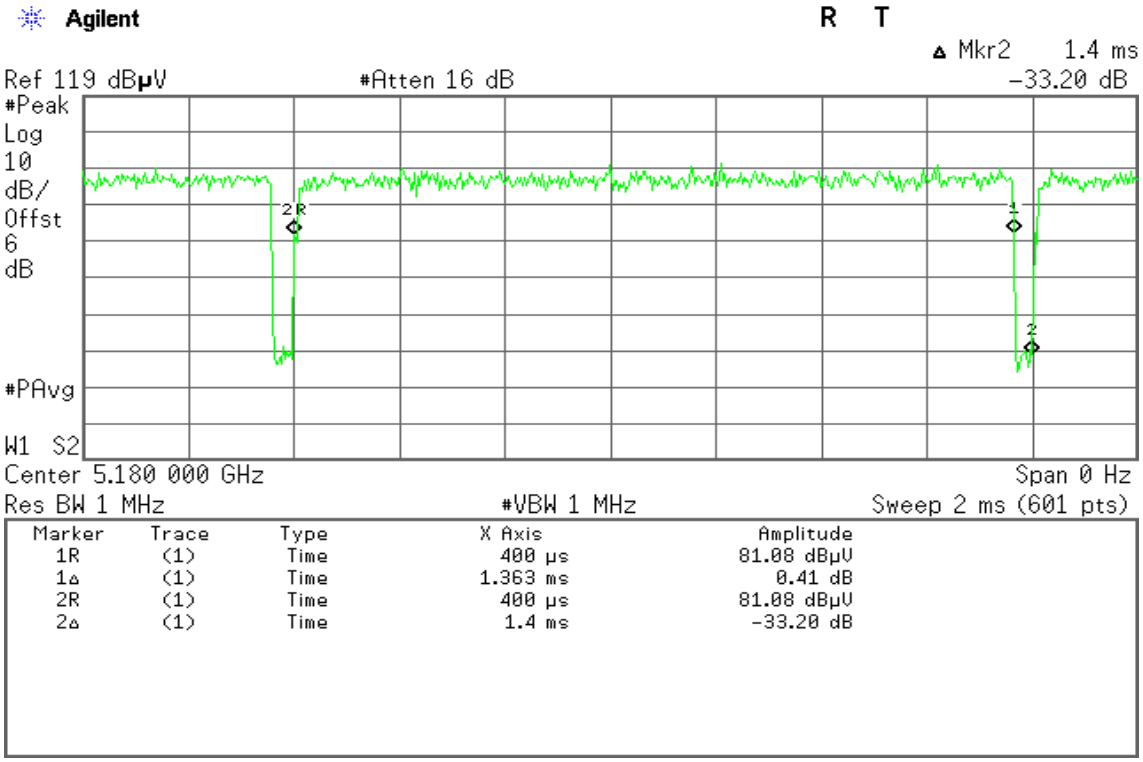
The transmitter output is connected to a spectrum analyzer or radiated field strength. The RBW is set to 1 MHz and the VBW is set to 1 MHz. The sweep time is coupled and the span is set to 0 Hz.

TEST RESULTS

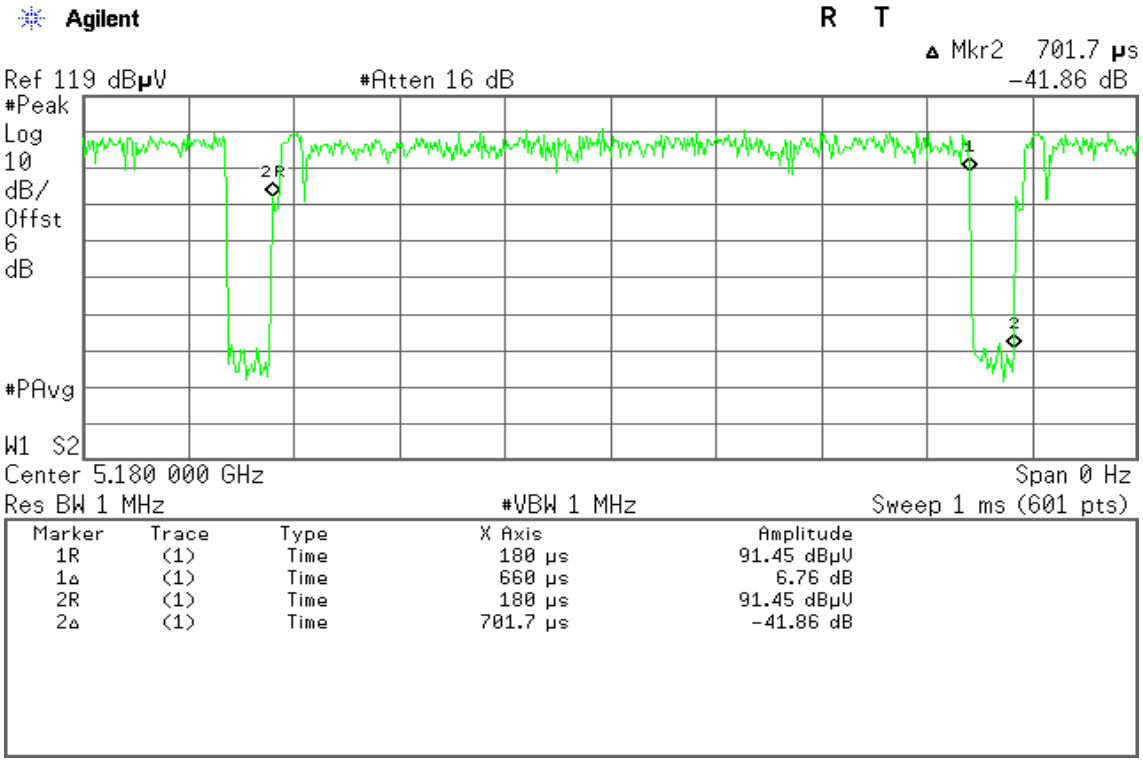
Mode	ON Time (msec)	Period (msec)	Duty Cycle (%)
IEEE 802.11a mode	1.36	1.4	97
IEEE 802.11n HT 20 MHz Channel mode	0.6617	0.7033	94
IEEE 802.11n HT 40 MHz Channel mode	0.3417	0.3717	91

Test Plot

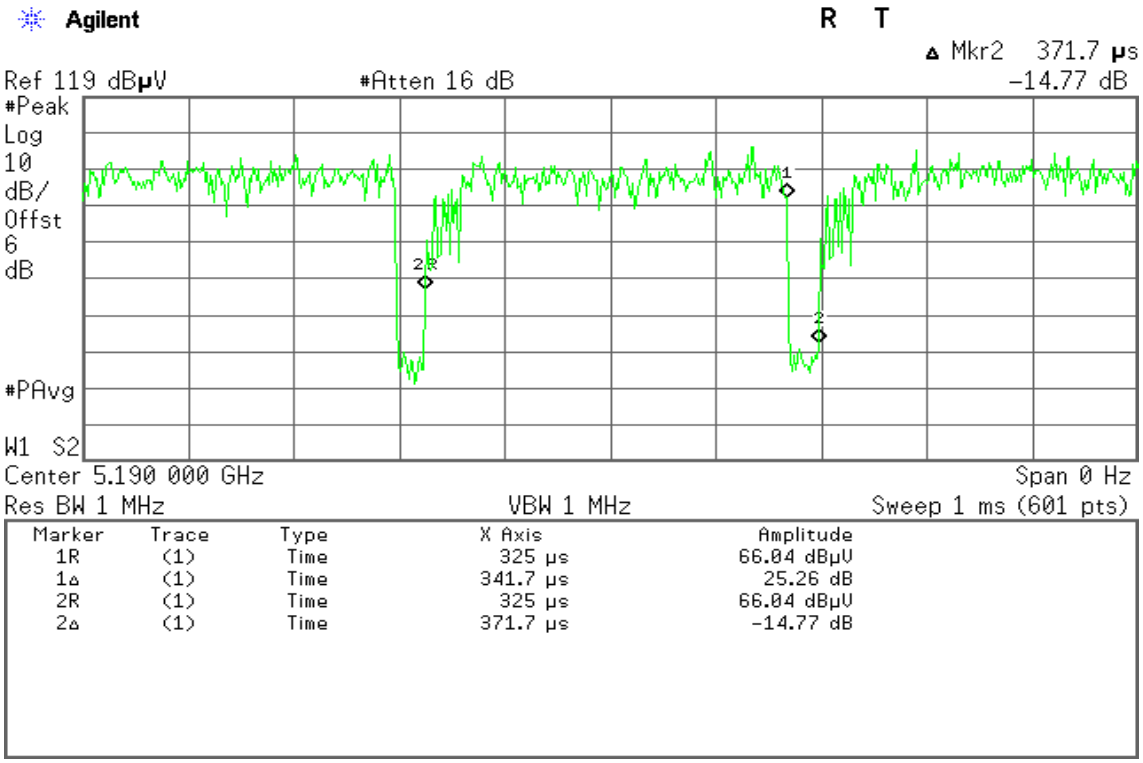
IEEE 802.11a mode



IEEE 802.11n HT 20 MHz Channel mode



IEEE 802.11n HT 40 MHz Channel mode

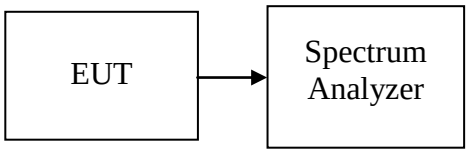


7.2 26DB EMISSION BANDWIDTH

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 / Chain 0

Channel	Frequency (MHz)	Bandwidth (B) (MHz)
Low	5180	23.0667
Mid	5220	23.8
High	5240	22.8667

Test mode: IEEE 802.11a mode / 5180 ~ 5240MHz / Chain 1

Channel	Frequency (MHz)	Bandwidth (B) (MHz)
Low	5180	22.4
Mid	5220	22.2666
High	5240	22.1333

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

Channel	Frequency (MHz)	Bandwidth (B) (MHz)
Low	5180	22.8
Mid	5220	23.0667
High	5240	22.6

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

Channel	Frequency (MHz)	Bandwidth (B) (MHz)
Low	5180	22.7333
Mid	5220	22.7333
High	5240	22.6667

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

Channel	Frequency (MHz)	Bandwidth (MHz)
Low	5190	44.7
High	5230	45.4

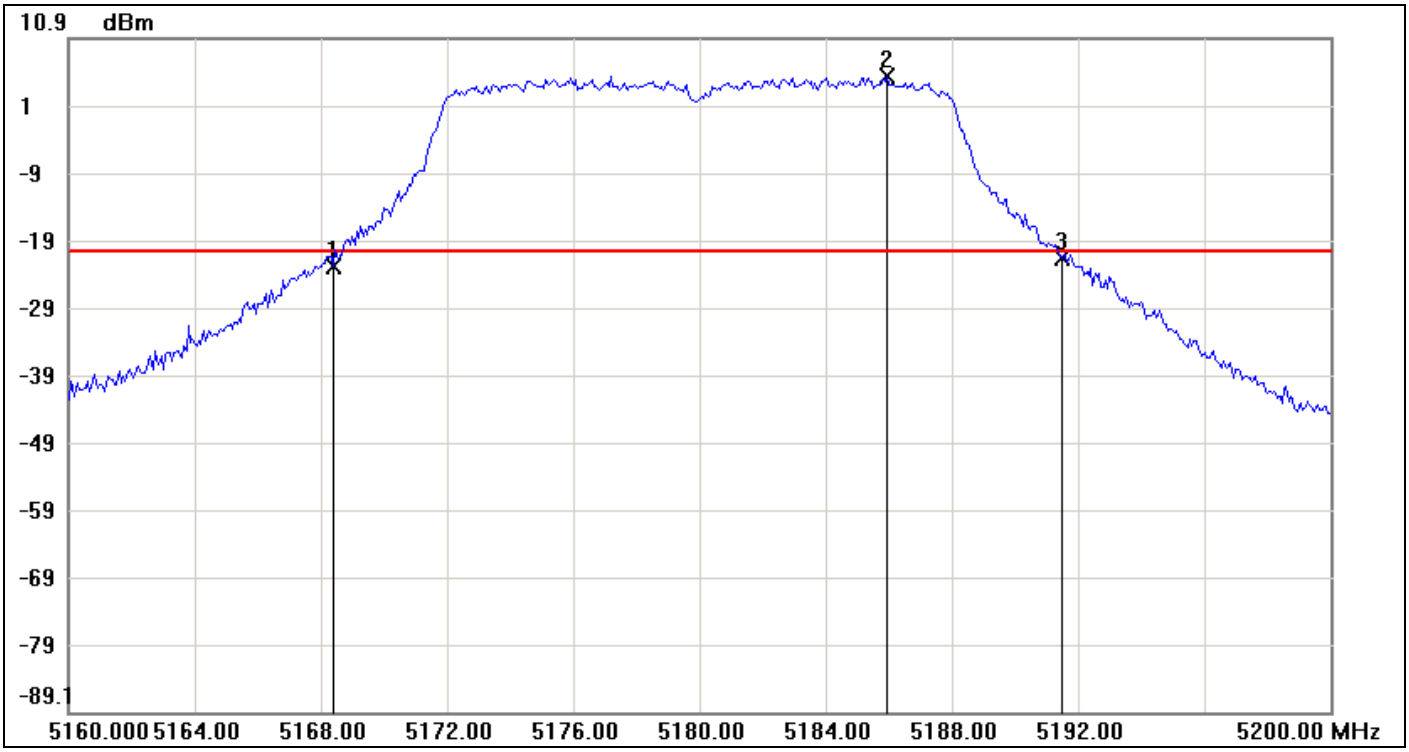
Test mode: IEEE 802.11n HT 40 mode/ 5190 ~ 5230MHz / Chain 1

Channel	Frequency (MHz)	Bandwidth (MHz)
Low	5190	44.6
High	5230	44.9

Test Plot

IEEE 802.11a mode / 5180 ~ 5240MHz / Chain 0

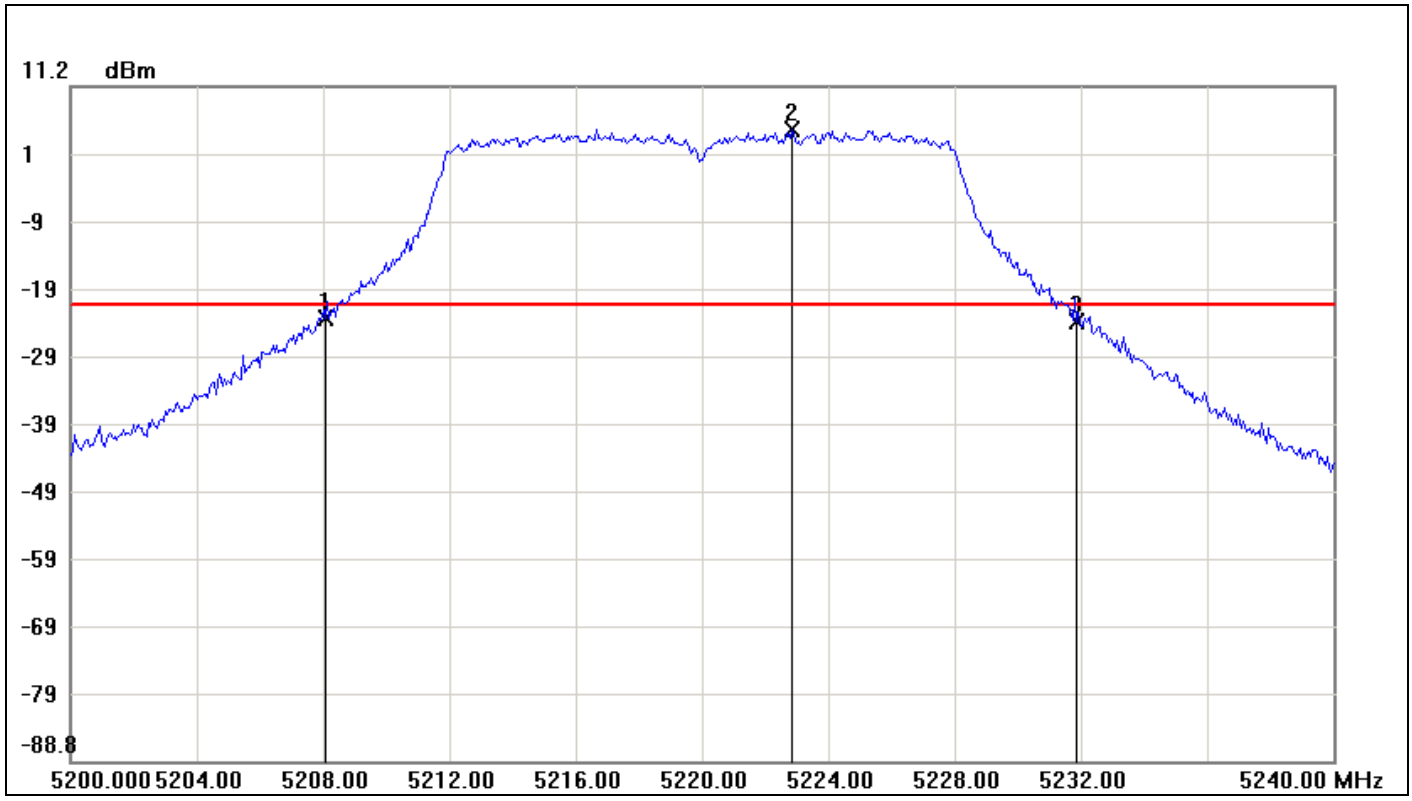
CH Low



No.	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	5168.4000	-22.89	-20.65	-2.24
2	5185.9333	5.35	-20.65	26.00
3	5191.4667	-21.62	-20.65	-0.97

No.		△Frequency(MHz)	△Level(dB)
1	mk3-mk1	23.0667	1.27

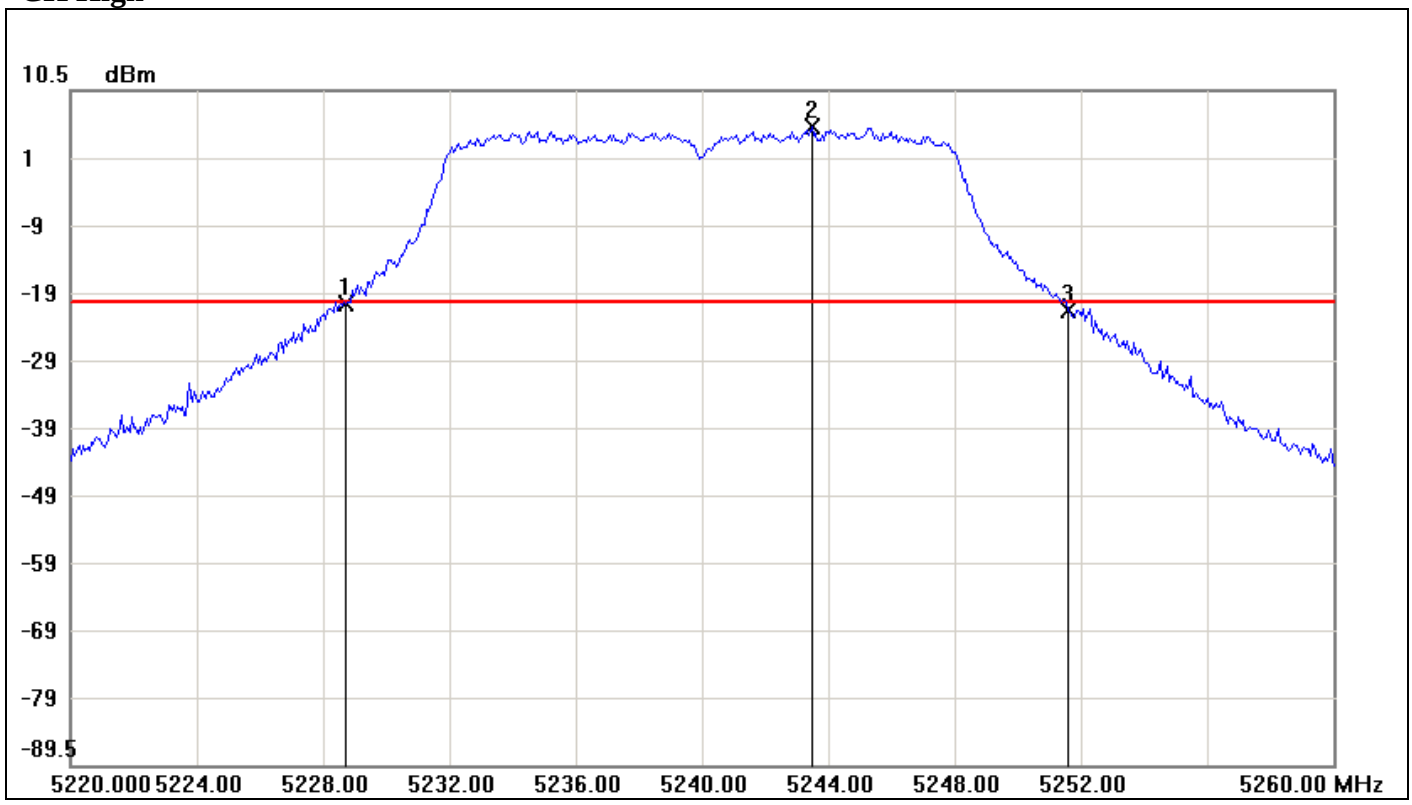
CH Mid



No.	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	5208.0667	-23.16	-21.18	-1.98
2	5222.8667	4.82	-21.18	26.00
3	5231.8667	-23.80	-21.18	-2.62

No.		△Frequency(MHz)	△Level(dB)
1	mk3-mk1	23.8	-0.64

CH High

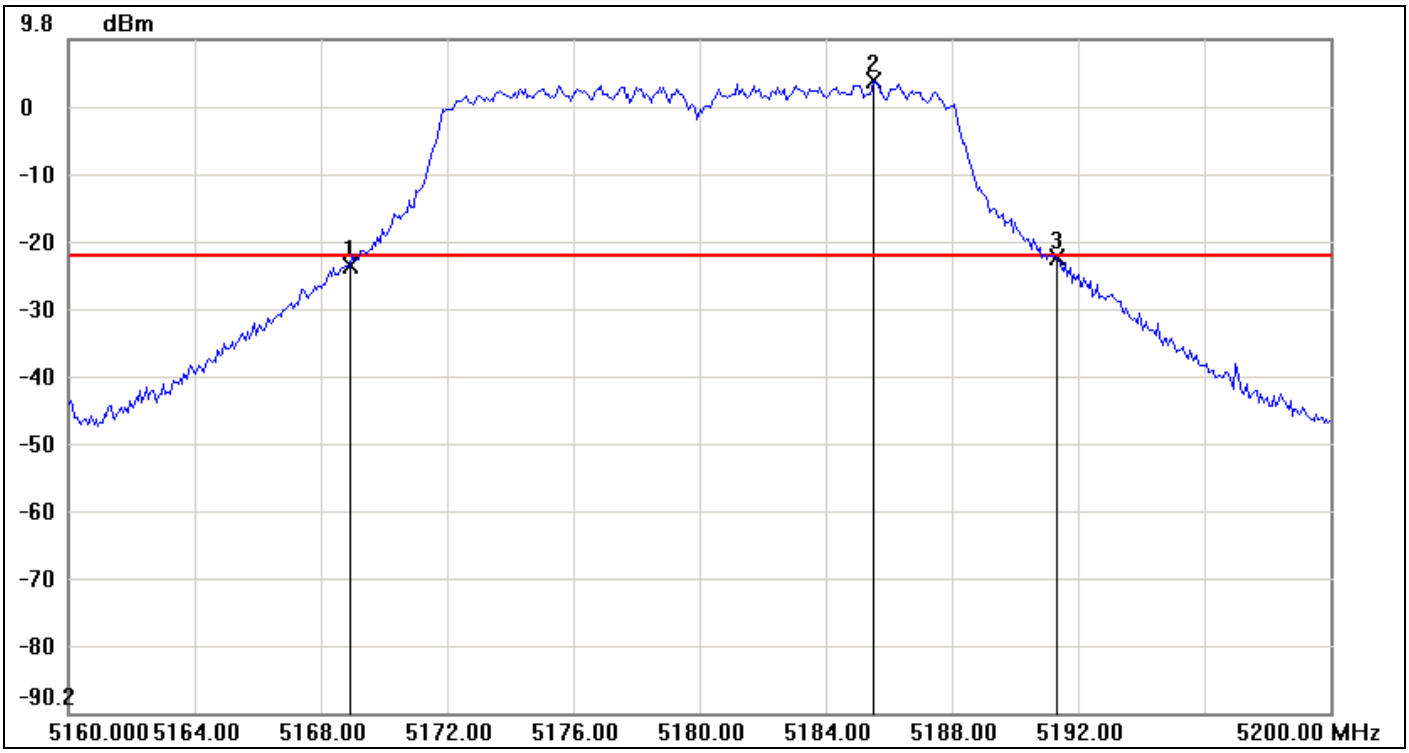


No.	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	5228.7333	-21.21	-20.78	-0.43
2	5243.4667	5.22	-20.78	26.00
3	5251.6000	-22.18	-20.78	-1.40

No.		△Frequency(MHz)	△Level(dB)
1	mk3-mk1	22.8667	-0.97

IEEE 802.11a mode / 5180 ~ 5240MHz / Chain 1

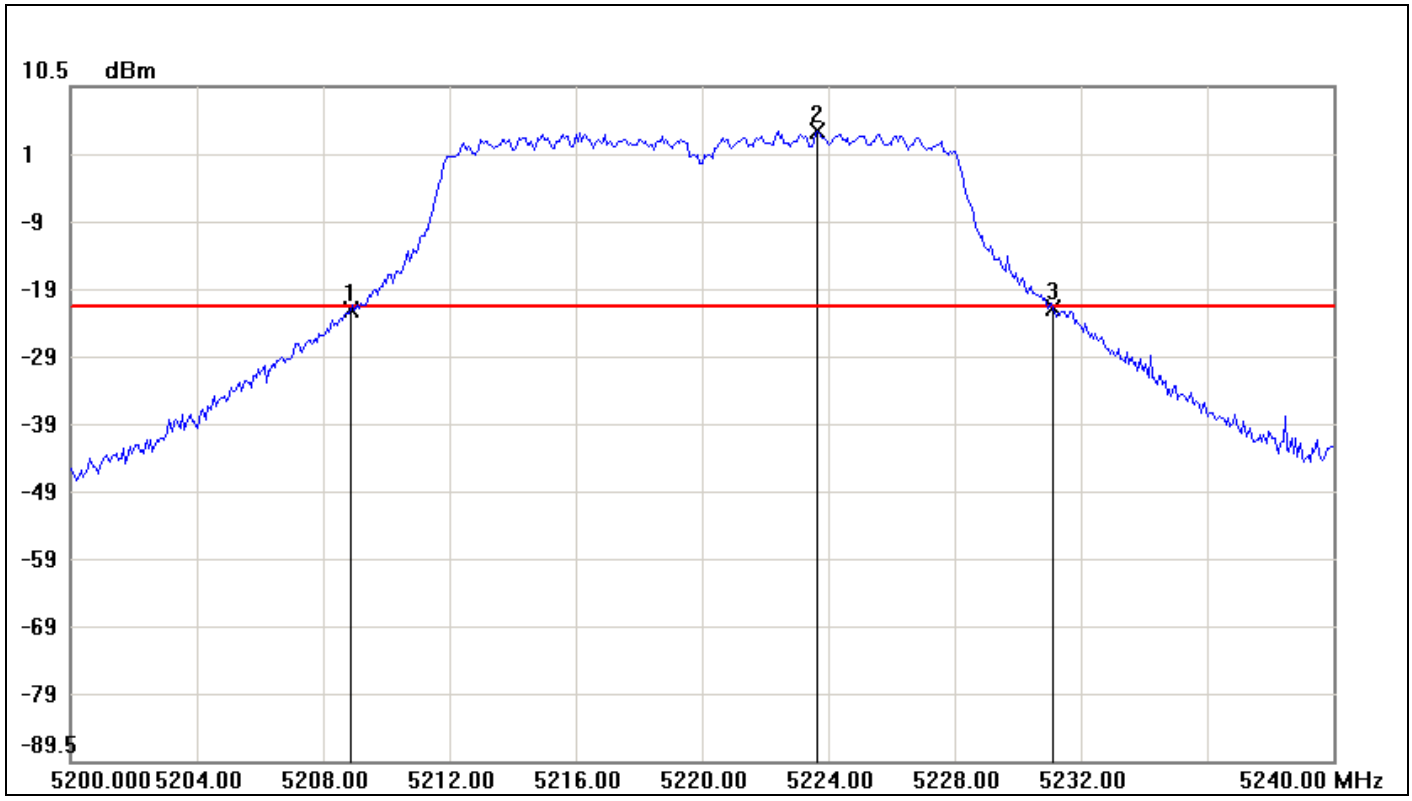
CH Low



No.	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	5168.9333	-23.85	-22.35	-1.50
2	5185.5333	3.65	-22.35	26.00
3	5191.3333	-22.56	-22.35	-0.21

No.		△Frequency(MHz)	△Level(dB)
1	mk3-mk1	22.4	1.29

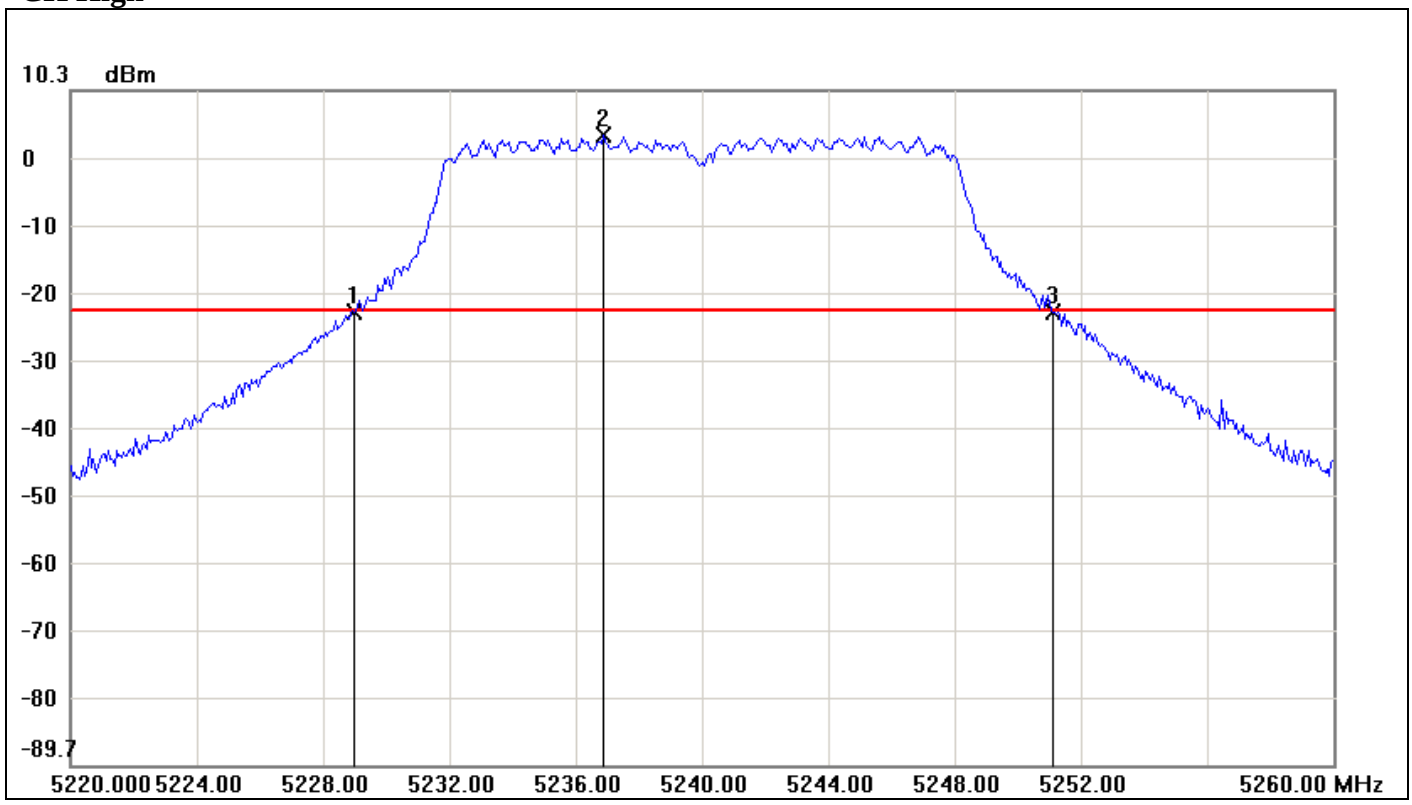
CH Mid



No.	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	5208.8667	-22.52	-22.17	-0.35
2	5223.6667	3.83	-22.17	26.00
3	5231.1333	-22.46	-22.17	-0.29

No.		△Frequency(MHz)	△Level(dB)
1	mk3-mk1	22.2666	0.06

CH High

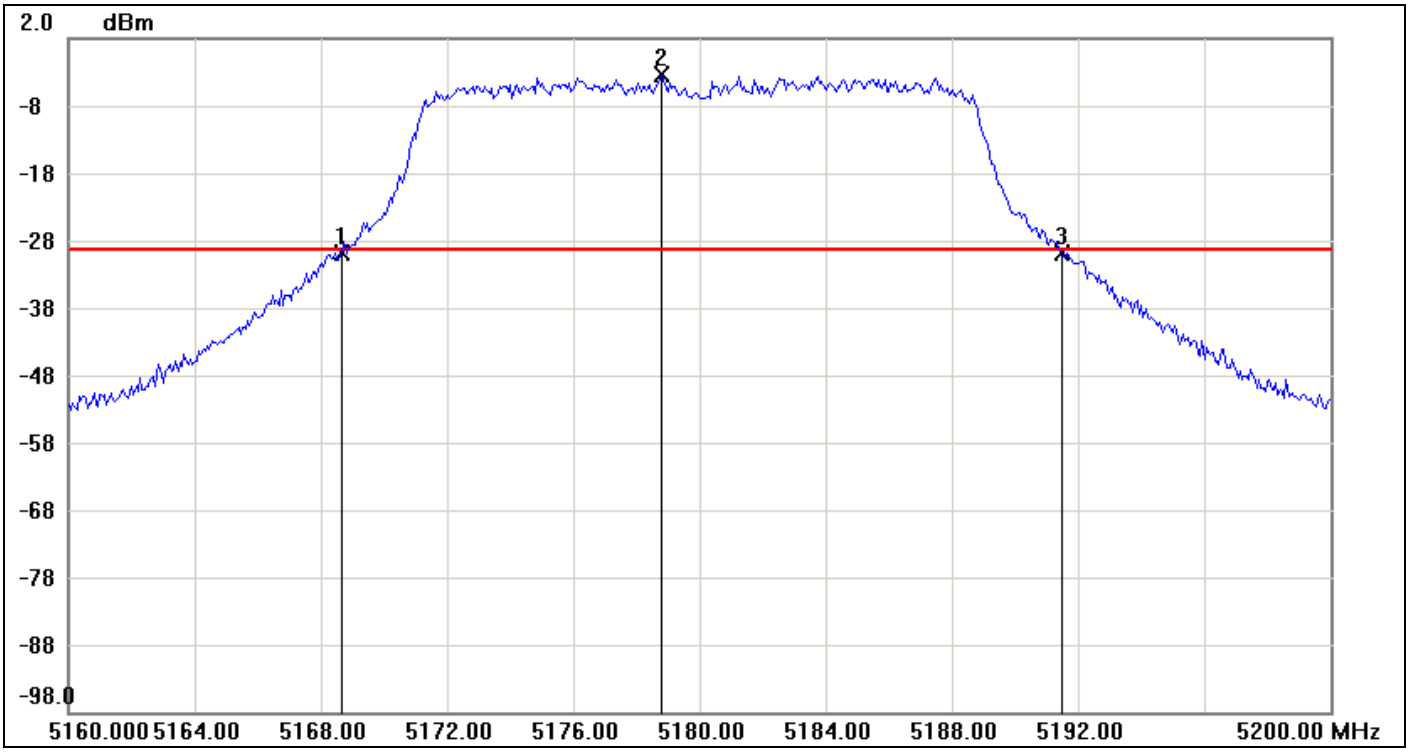


No.	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	5229.0000	-22.48	-22.23	-0.25
2	5236.8667	3.77	-22.23	26.00
3	5251.1333	-22.50	-22.23	-0.27

No.		△Frequency(MHz)	△Level(dB)
1	mk3-mk1	22.1333	-0.02

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

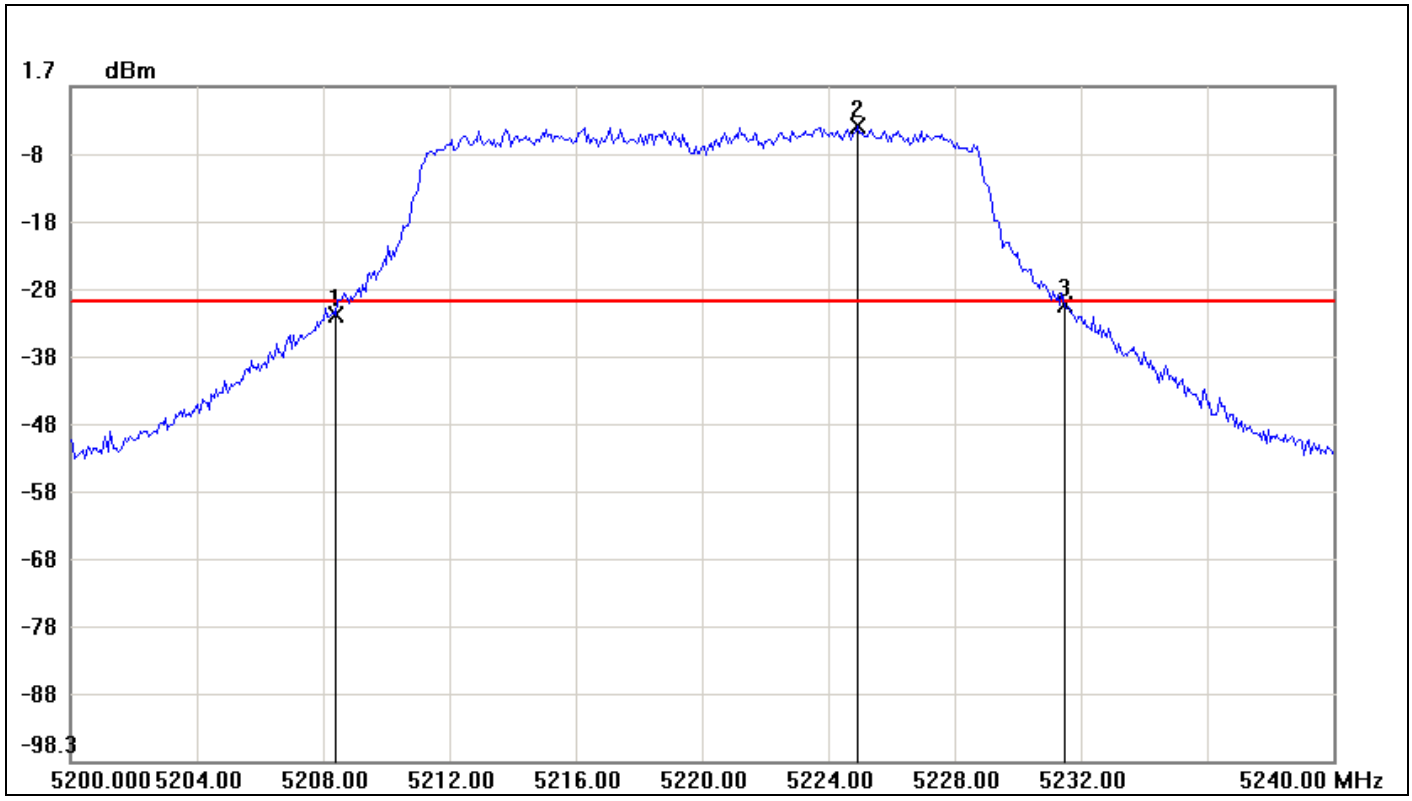
CH Low



No.	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	5168.6667	-29.85	-29.46	-0.39
2	5178.8000	-3.46	-29.46	26.00
3	5191.4667	-29.93	-29.46	-0.47

No.		ΔFrequency(MHz)	ΔLevel(dB)
1	mk3-mk1	22.8	-0.08

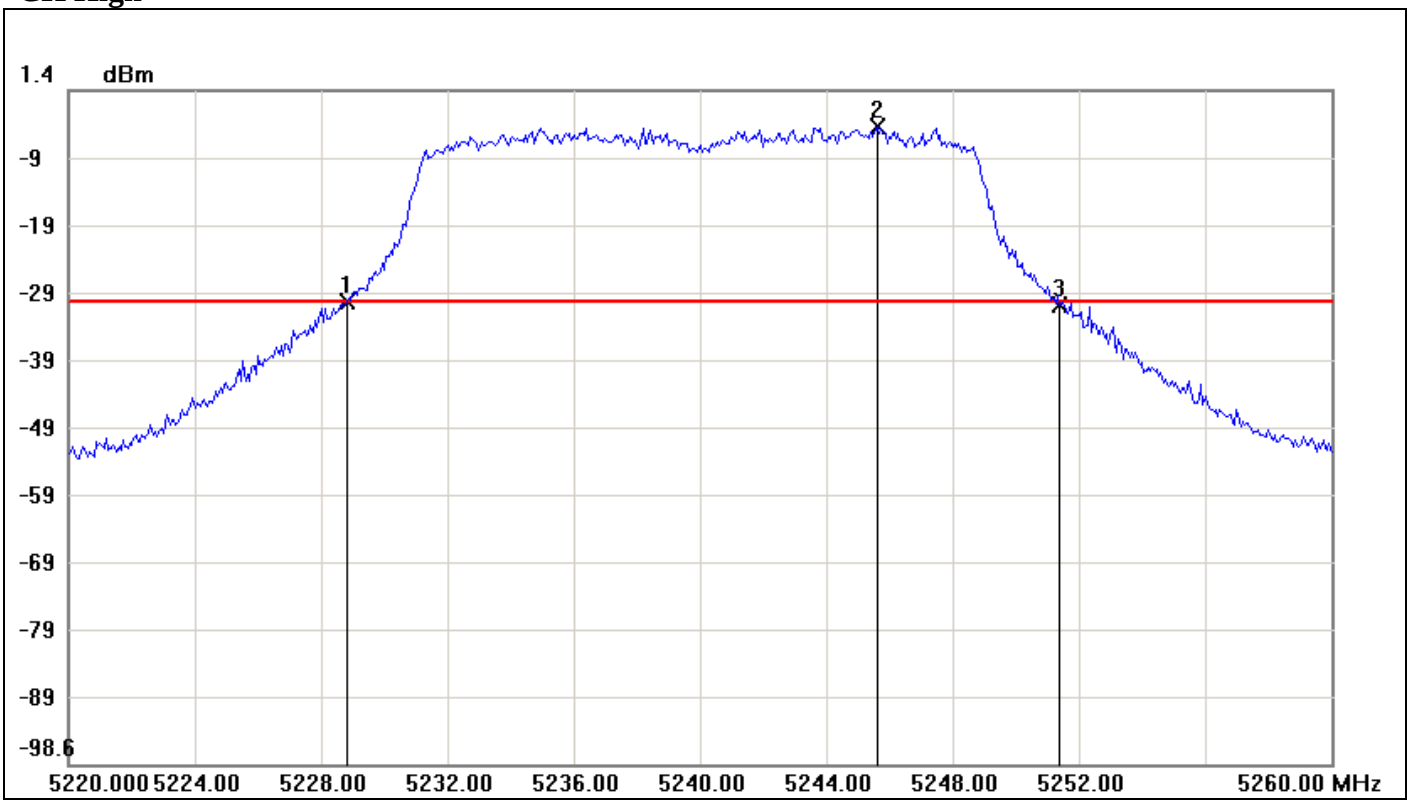
CH Mid



No.	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	5208.4000	-32.06	-30.24	-1.82
2	5224.9333	-4.24	-30.24	26.00
3	5231.4667	-30.79	-30.24	-0.55

No.		ΔFrequency(MHz)	ΔLevel(dB)
1	mk3-mk1	23.0667	1.27

CH High

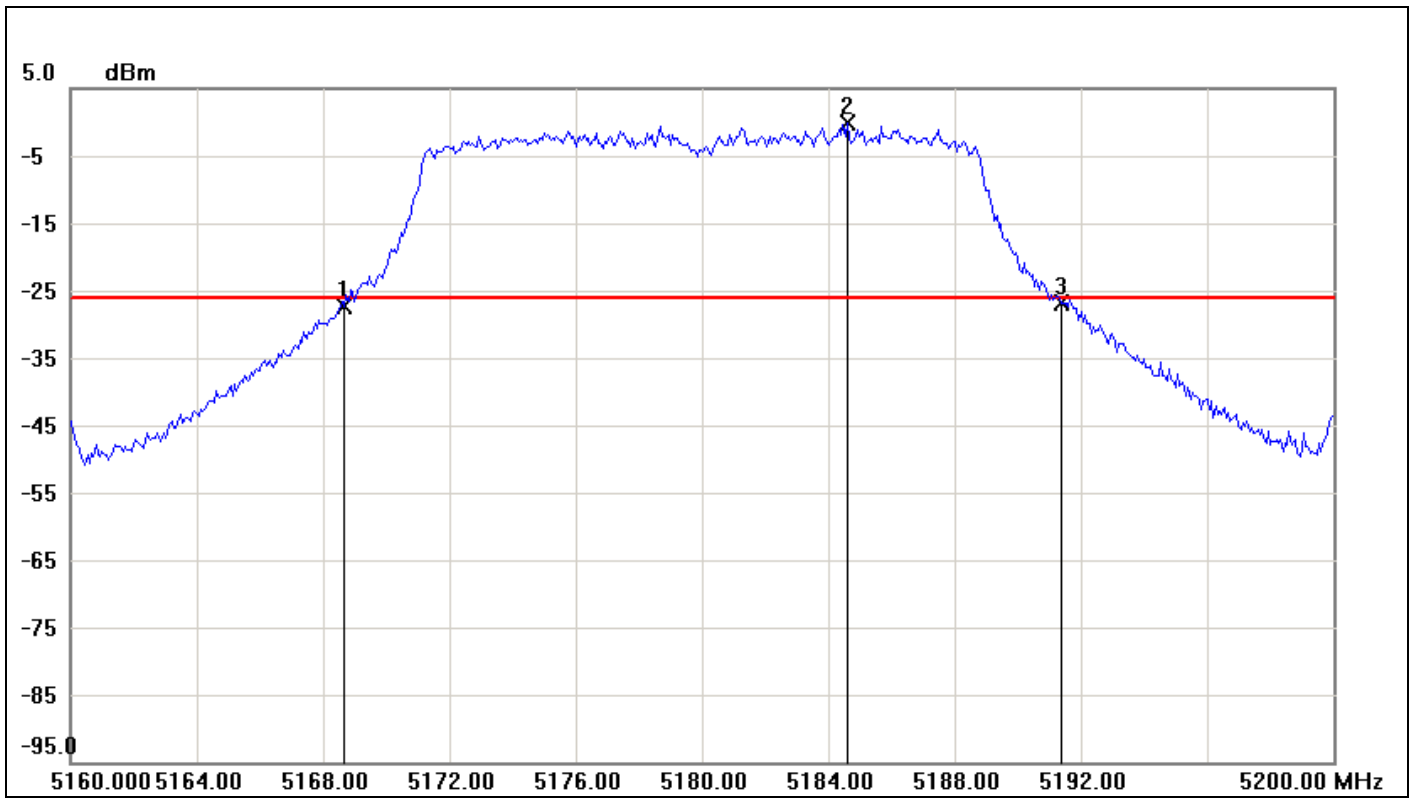


No.	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	5228.8000	-30.13	-30.05	-0.08
2	5245.6000	-4.05	-30.05	26.00
3	5251.4000	-30.52	-30.05	-0.47

No.		ΔFrequency(MHz)	ΔLevel(dB)
1	mk3-mk1	22.6	-0.39

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

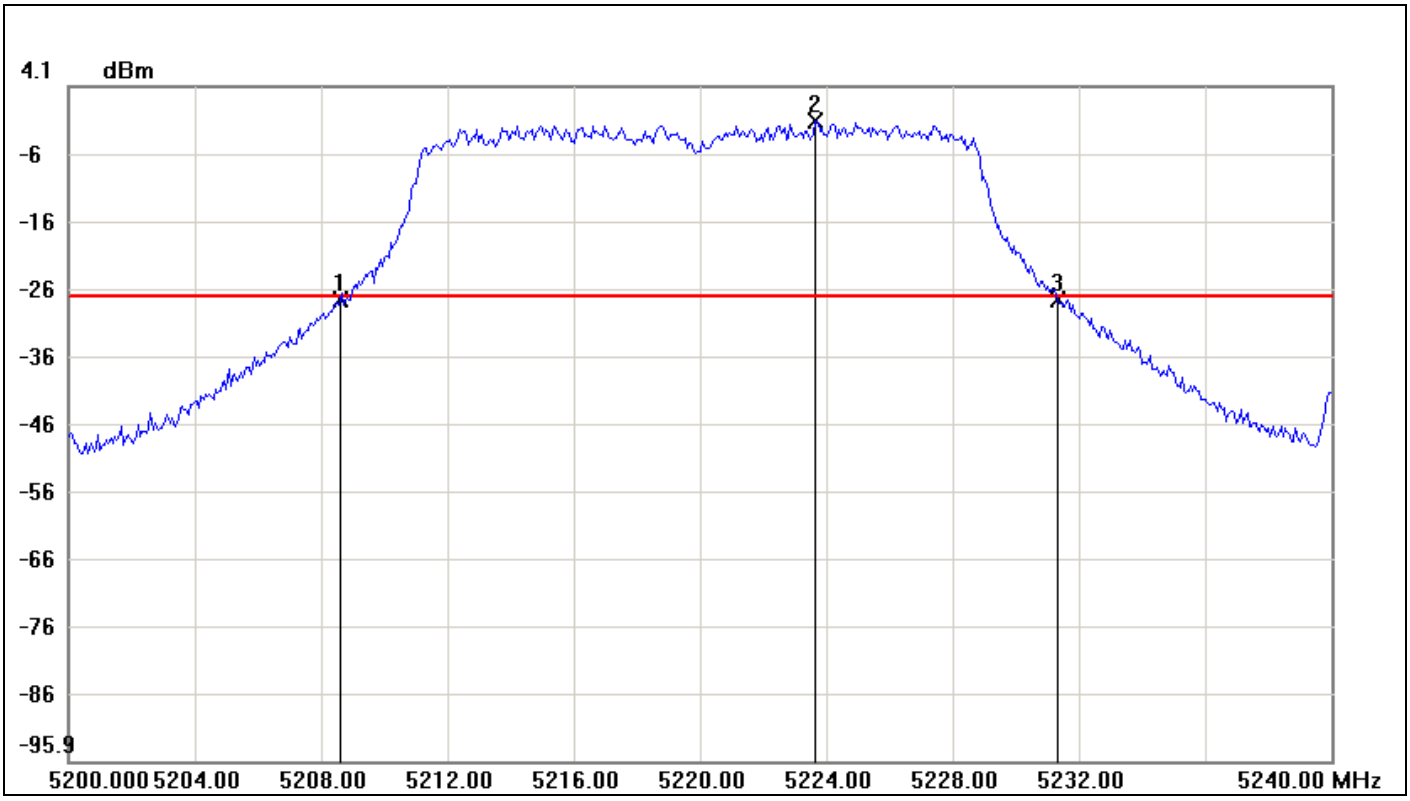
CH Low



No.	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	5168.6667	-27.32	-26.19	-1.13
2	5184.6000	-0.19	-26.19	26.00
3	5191.4000	-26.83	-26.19	-0.64

No.		ΔFrequency(MHz)	ΔLevel(dB)
1	mk3-mk1	22.7333	0.49

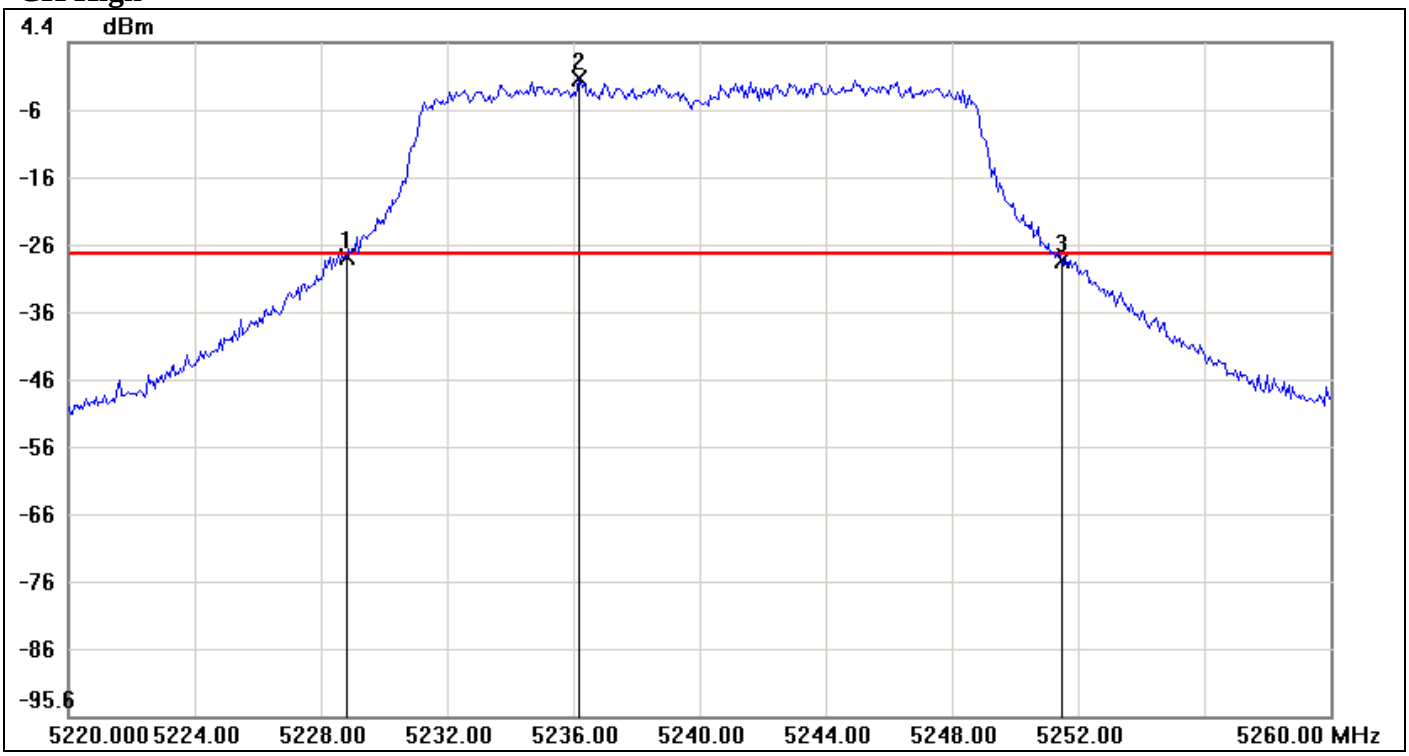
CH Mid



No.	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	5208.6000	-27.50	-26.95	-0.55
2	5223.6667	-0.95	-26.95	26.00
3	5231.3333	-27.51	-26.95	-0.56

No.		ΔFrequency(MHz)	ΔLevel(dB)
1	mk3-mk1	22.7333	-0.01

CH High

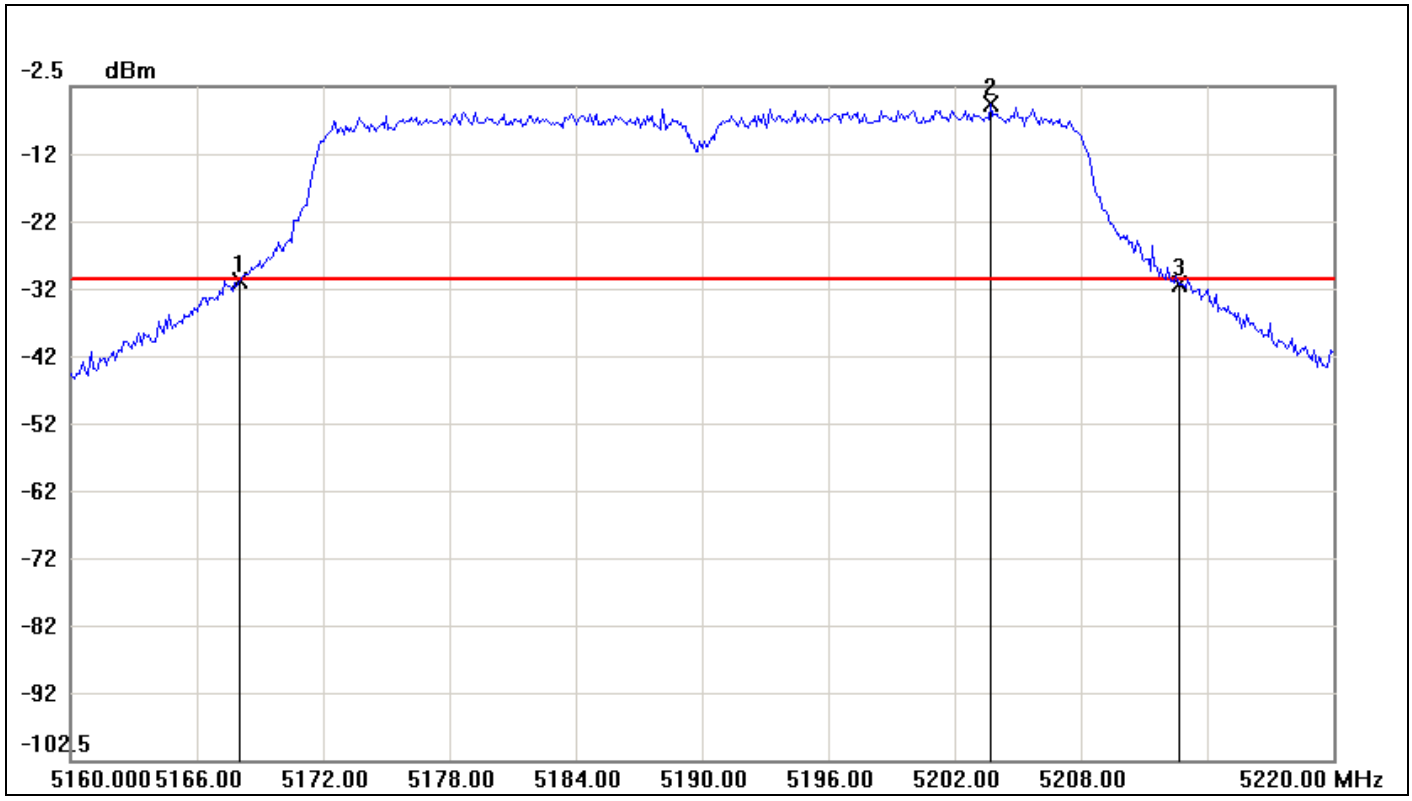


No.	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	5228.8000	-27.55	-26.89	-0.66
2	5236.2000	-0.89	-26.89	26.00
3	5251.4667	-27.90	-26.89	-1.01

No.		ΔFrequency(MHz)	ΔLevel(dB)
1	mk3-mk1	22.6667	-0.35

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

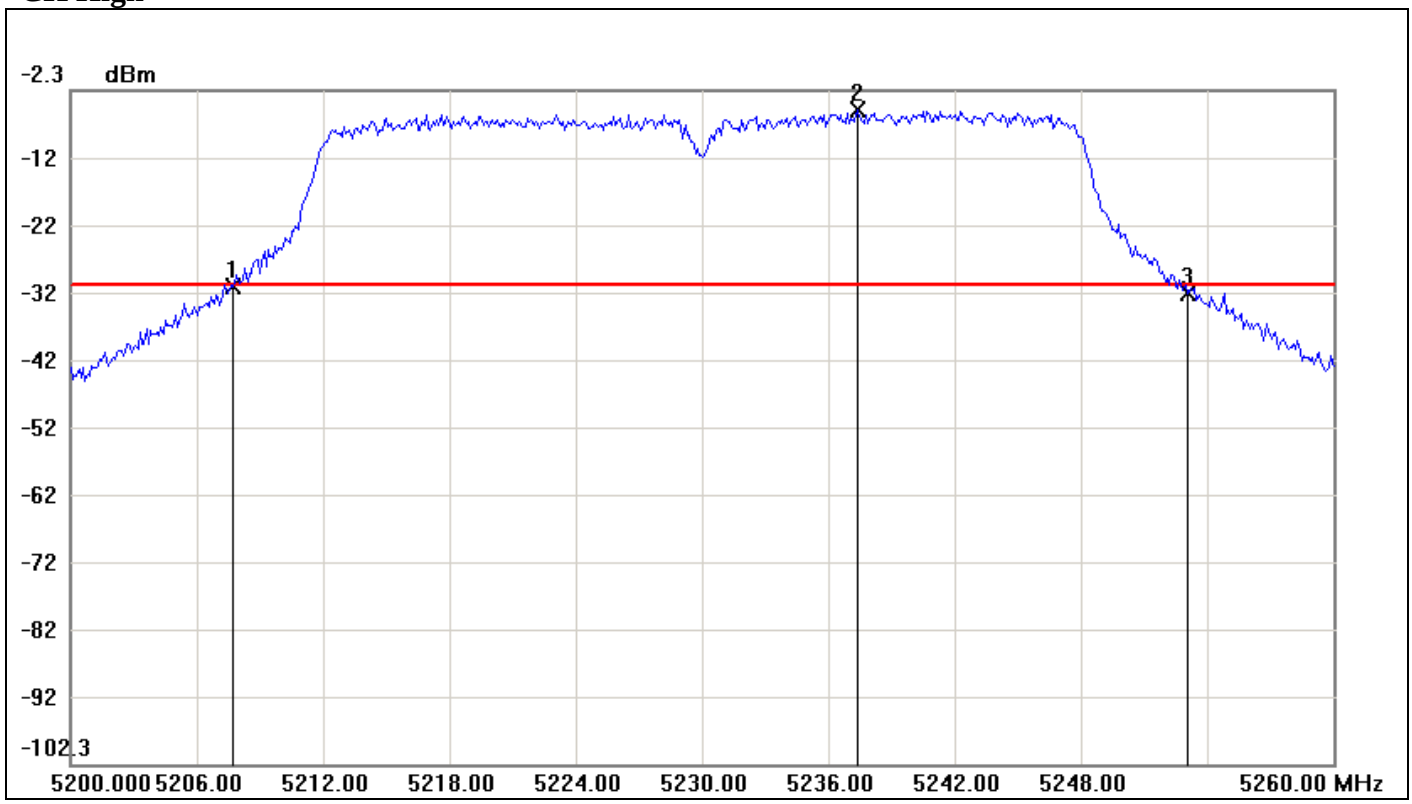
CH Low



No.	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	5168.0000	-31.41	-31.09	-0.32
2	5203.7000	-5.09	-31.09	26.00
3	5212.7000	-31.78	-31.09	-0.69

No.		ΔFrequency(MHz)	ΔLevel(dB)
1	mk3-mk1	44.7	-0.37

CH High

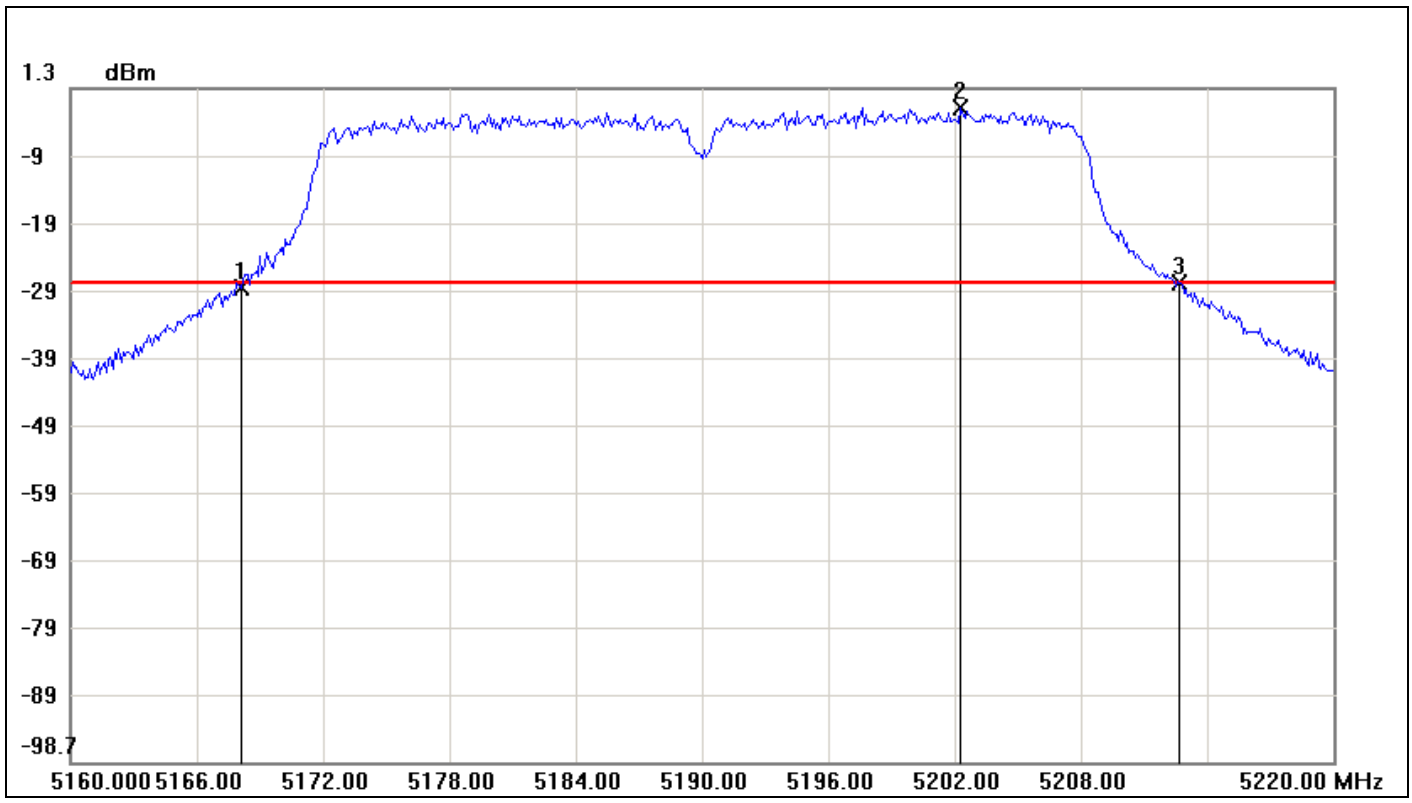


No.	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	5207.7000	-31.52	-31.22	-0.30
2	5237.4000	-5.22	-31.22	26.00
3	5253.1000	-32.56	-31.22	-1.34

No.		ΔFrequency(MHz)	ΔLevel(dB)
1	mk3-mk1	45.4	-1.04

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

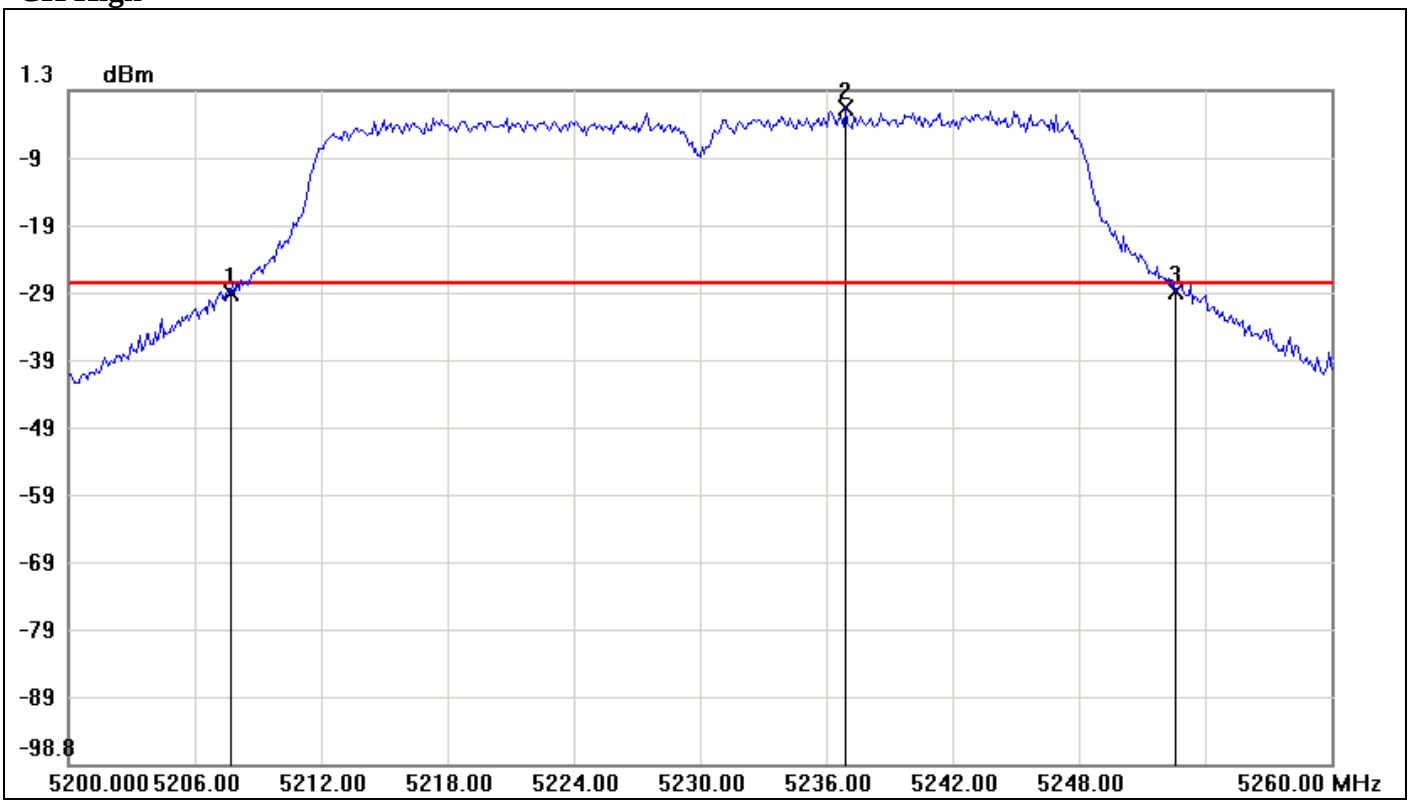
CH Low



No.	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	5168.1000	-28.30	-27.58	-0.72
2	5202.3000	-1.58	-27.58	26.00
3	5212.7000	-27.67	-27.58	-0.09

No.		ΔFrequency(MHz)	ΔLevel(dB)
1	mk3-mk1	44.6	0.63

CH High



No.	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	5207.7000	-28.98	-27.48	-1.50
2	5236.9000	-1.48	-27.48	26.00
3	5252.6000	-28.68	-27.48	-1.20

No.		ΔFrequency(MHz)	ΔLevel(dB)
1	mk3-mk1	44.9	0.3

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)	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	23.0667	22.4	13.6299	17.6299	17.00
Mid	5220	23.8	22.2666	13.7658	17.7658	17.00
High	5240	22.8667	22.1333	13.5920	17.5920	17.00

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

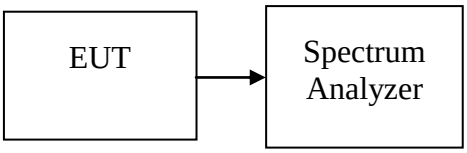
Channel	Frequency (MHz)	Chain 0 26 dB Bandwidth (B) (MHz)	Chain 1 26 dB Bandwidth (B) (MHz)	10 Log B (dB)	4 + 10 Log B (dBm)	Maximum Conducted Output Power Limit (dBm)
Low	5180	22.8	22.7333	13.5793	17.5793	17.00
Mid	5220	23.0667	22.7333	13.6299	17.6299	17.00
High	5240	22.6	22.6667	13.5539	17.5539	17.00

Test mode: IEEE 802.11n HT 40 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	44.7	44.6	16.5031	20.5031	17.00
High	5230	45.4	44.9	16.5706	20.5706	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)	Chain 0 Output Power (dBm)	Chain 1 Output Power (dBm)	Total Maximum Conducted Output Power (dBm)	Limit (dBm)
Low	5180	13.91	12.48	16.26	17.00
Mid	5220	14.44	13.28	16.91	17.00
High	5240	14.63	13.15	***16.96**	17.00

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

Channel	Frequency (MHz)	Chain 0 Output Power (dBm)	Chain 1 Output Power (dBm)	Total Maximum Conducted Output Power (dBm)	Limit (dBm)
Low	5180	14.28	13.39	***16.87**	17.00
Mid	5220	13.65	13.27	16.47	17.00
High	5240	14.13	13.42	16.80	17.00

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

Channel	Frequency (MHz)	Chain 0 Output Power (dBm)	Chain 1 Output Power (dBm)	Total Maximum Conducted Output Power (dBm)	Limit (dBm)
Low	5190	13.87	13.82	***16.86**	17.00
High	5230	13.97	13.67	16.83	17.00

Remark:

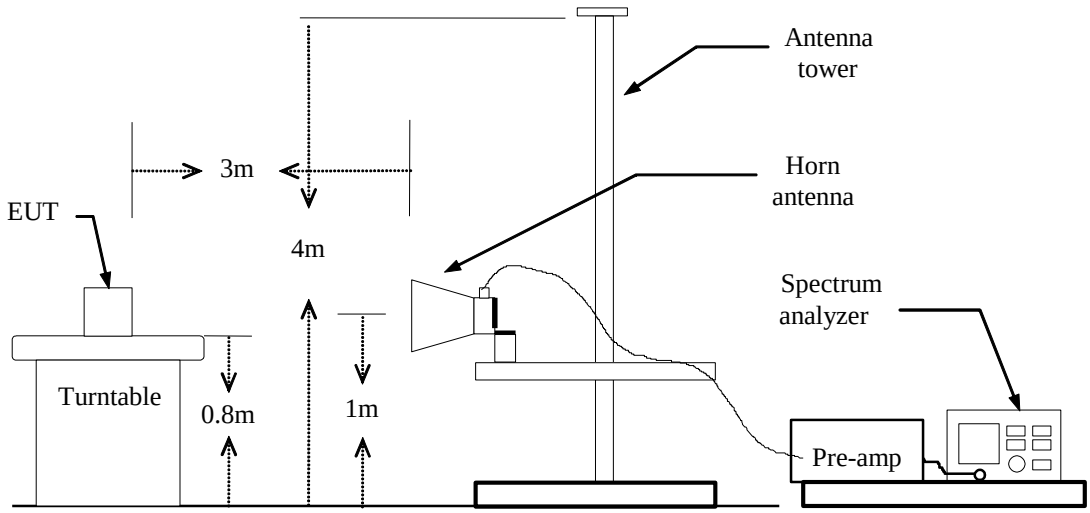
1. Total Output Power (w) = Chain 0 (10^(Output Power /10)/1000) + Chain 1 (10^(Output Power /10)/1000) + Chain 2 (10^(Output Power /10)/1000)

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

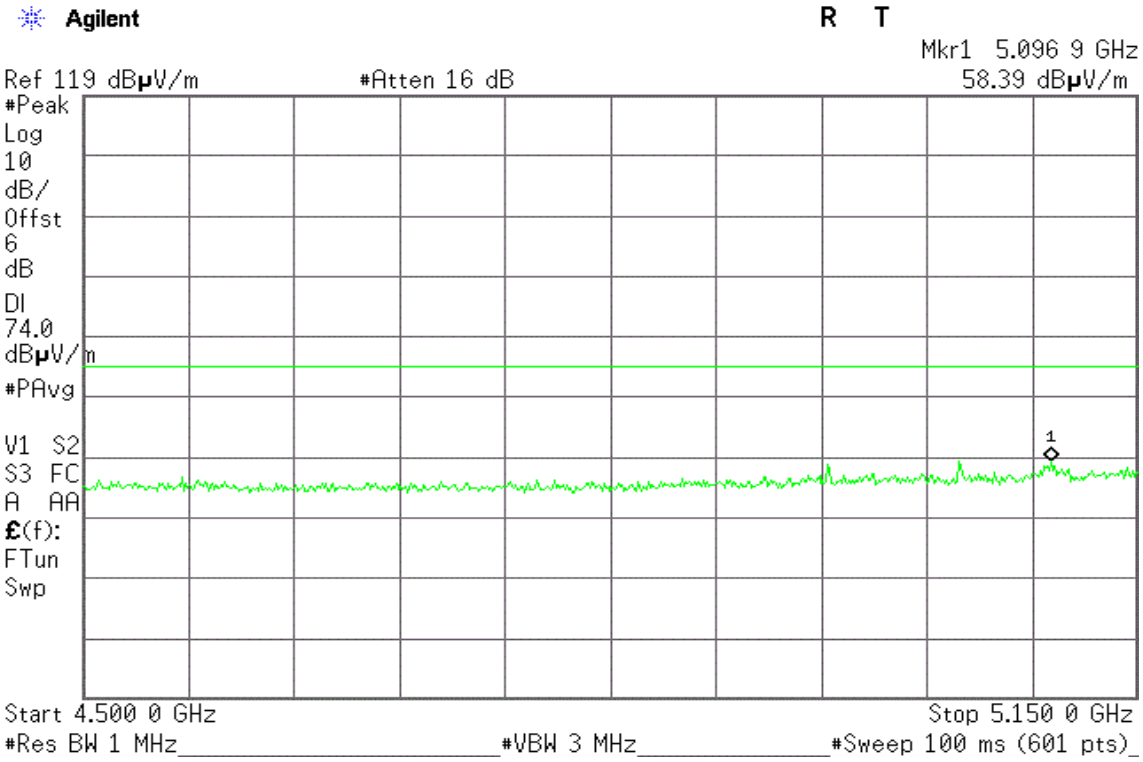
1. The EUT is placed on a turntable, which is 0.8m above the ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.
4. Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of the emission:
   (a) PEAK: RBW=VBW=1MHz / Sweep=AUTO
   (b) AVERAGE: RBW=1MHz / VBW=300Hz / Sweep=AUTO
5. Repeat the procedures until all the PEAK and AVERAGE versus POLARIZATION are measured.

TEST RESULTS

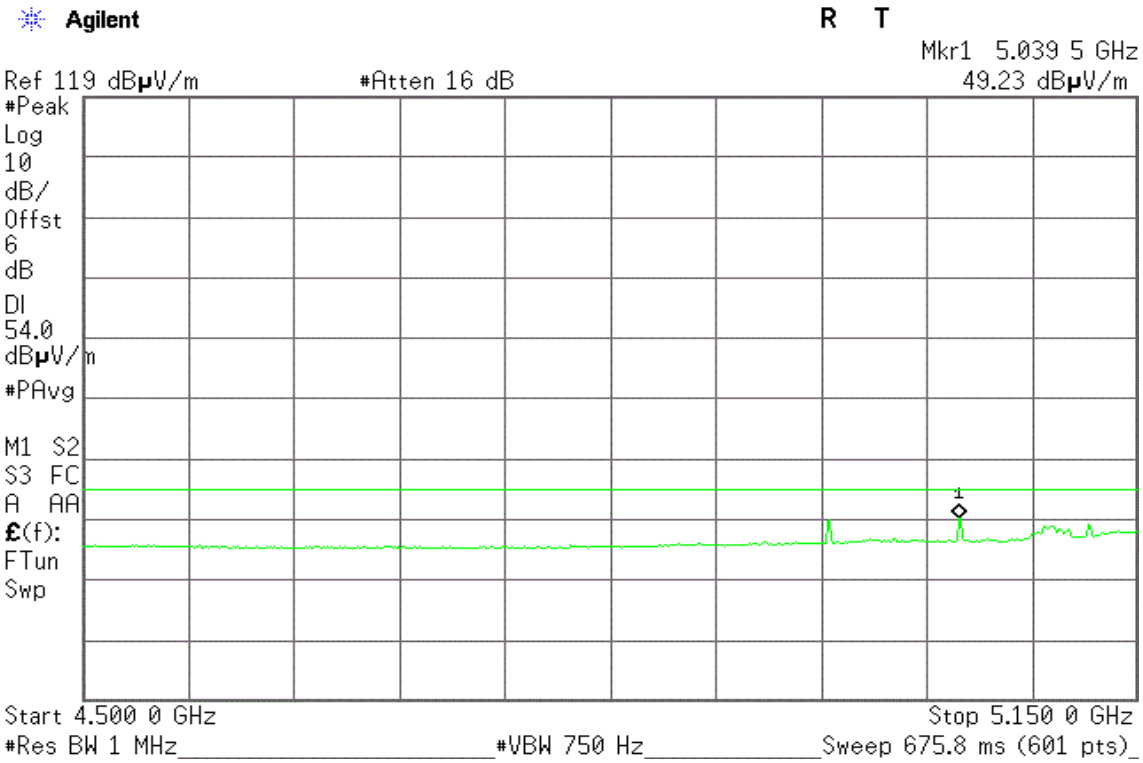
Refer to attach spectrum analyzer data chart.

Band Edges (IEEE 802.11a mode / 5180 MHz)

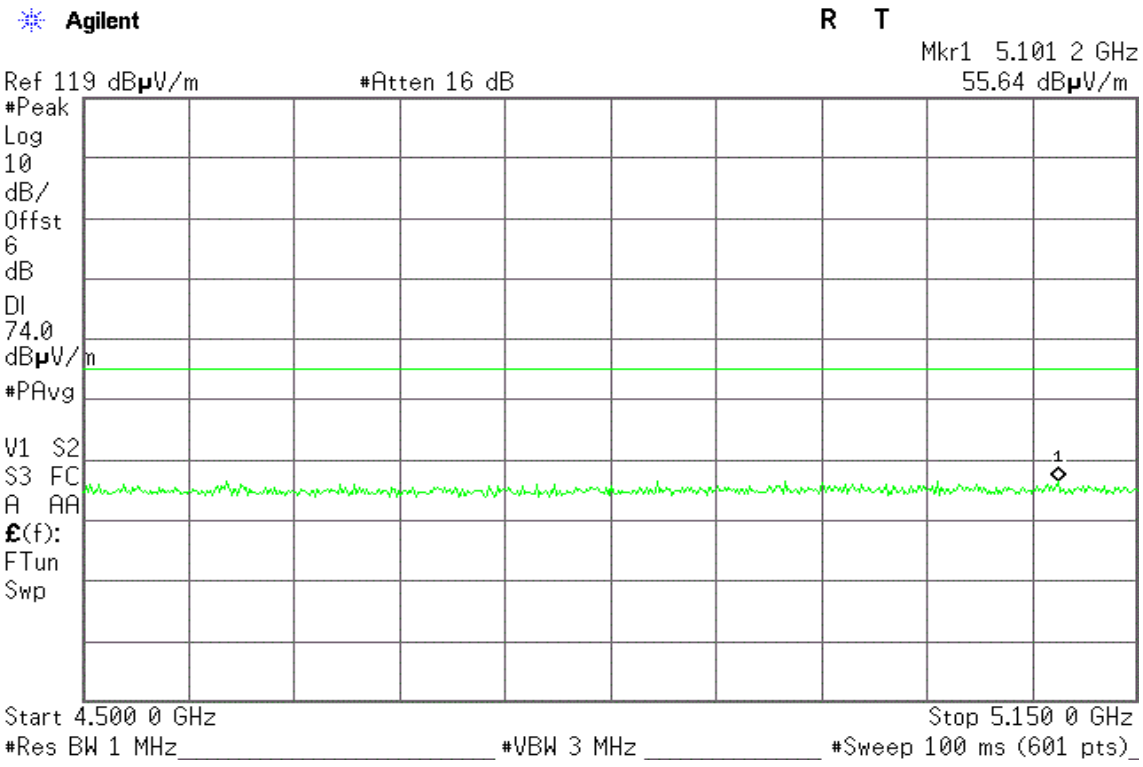
Detector mode: Peak **Polarity: Vertical**



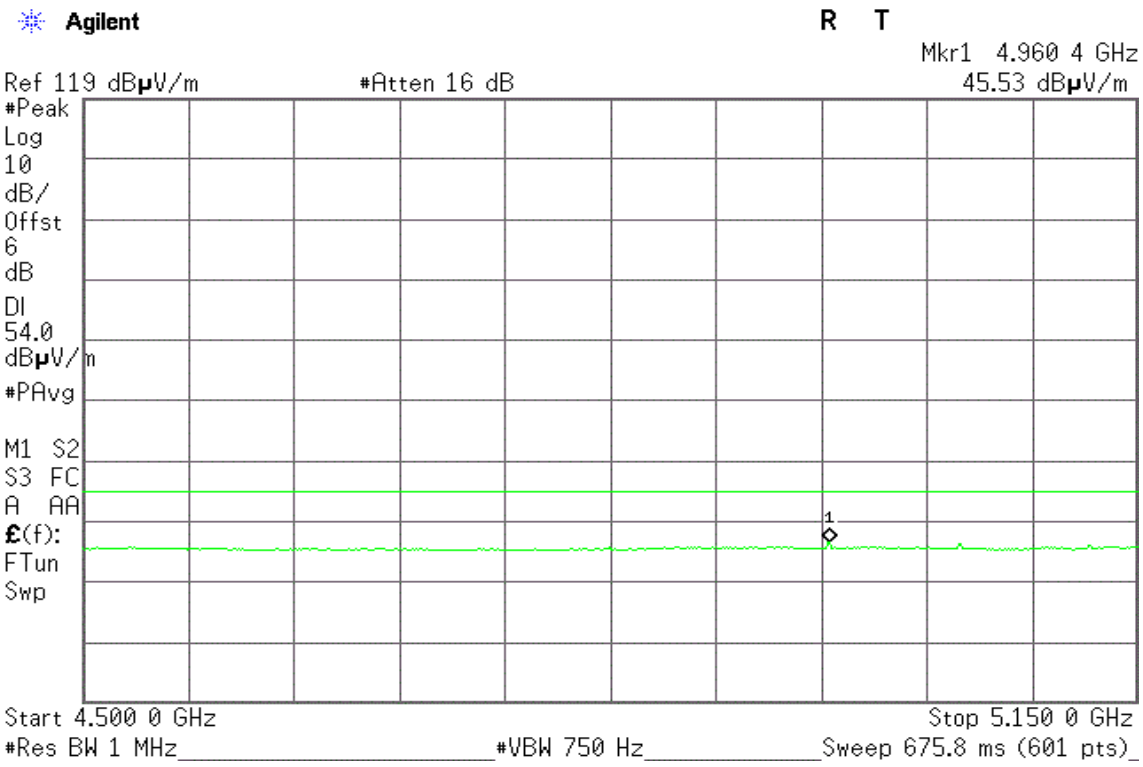
Detector mode: Average **Polarity: Vertical**



Detector mode: Peak **Polarity: Horizontal**

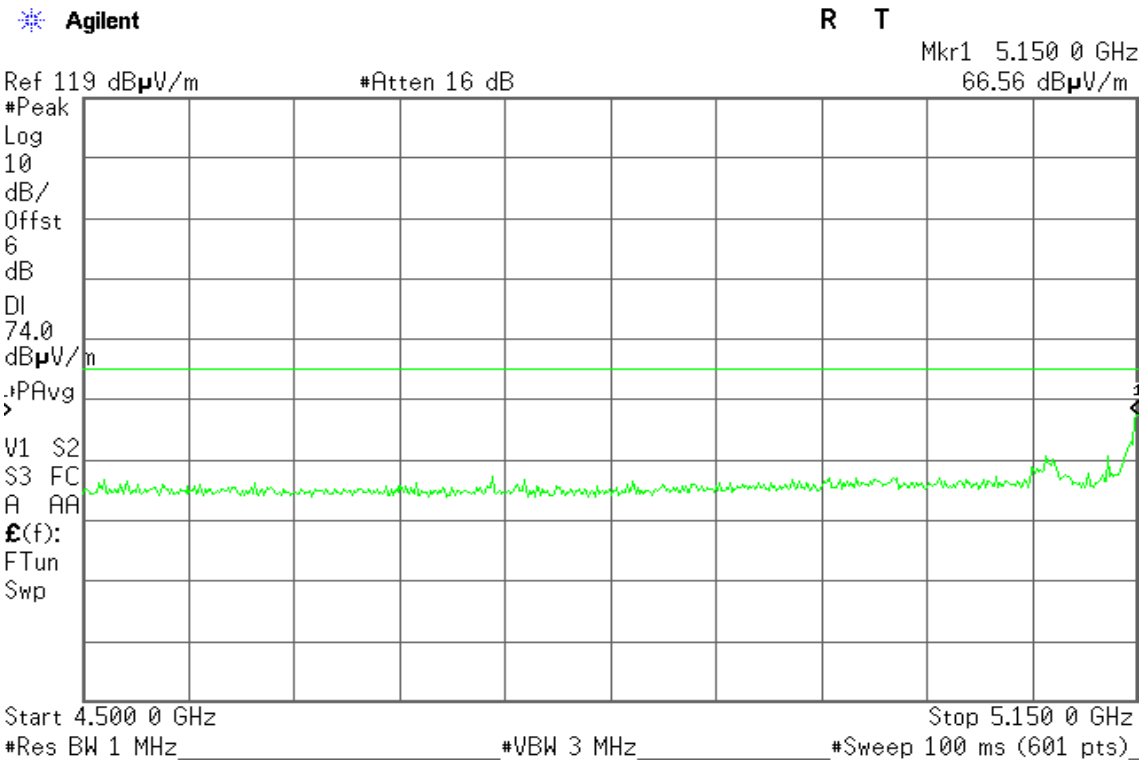


Detector mode: Average **Polarity: Horizontal**

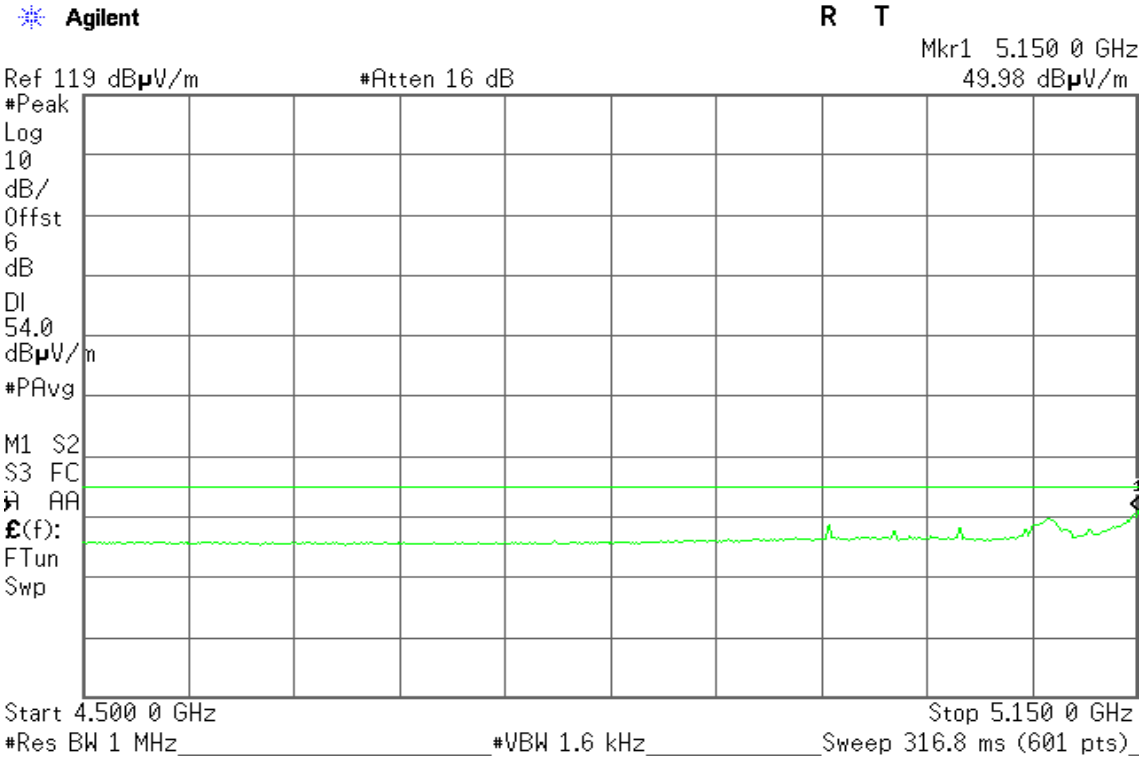


Band Edges (IEEE 802.11n HT 20 mode / 5180 MHz)

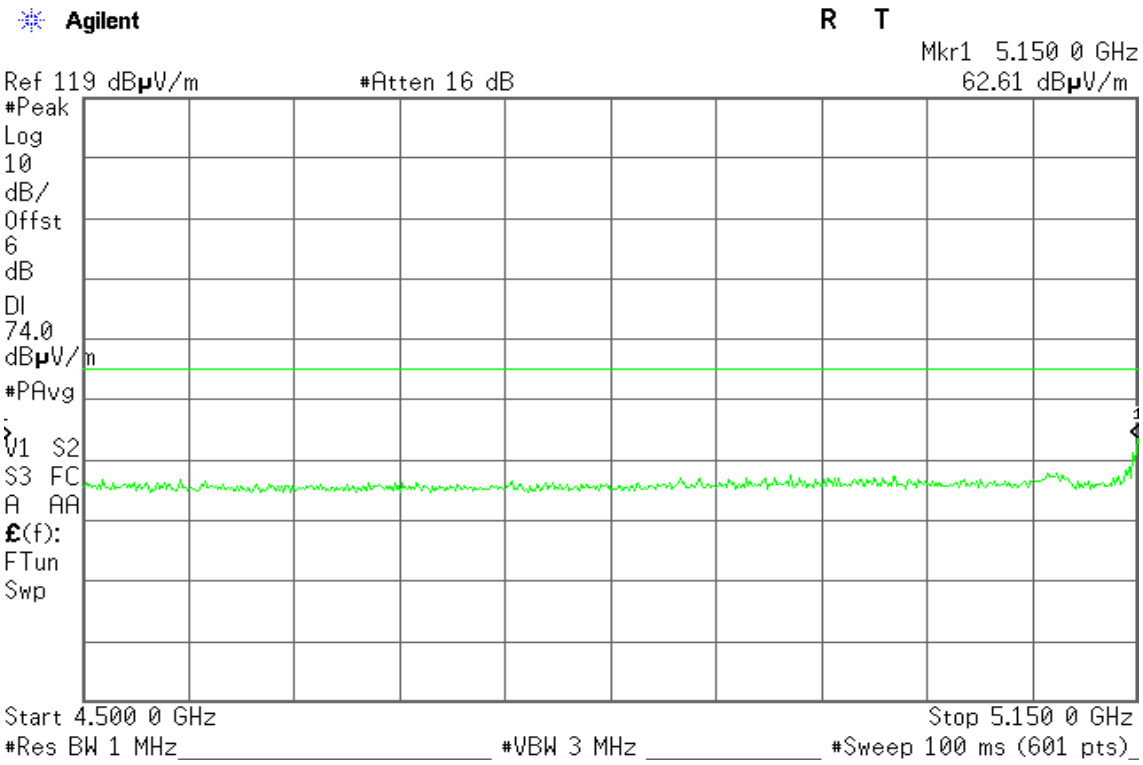
Detector mode: Peak **Polarity: Vertical**



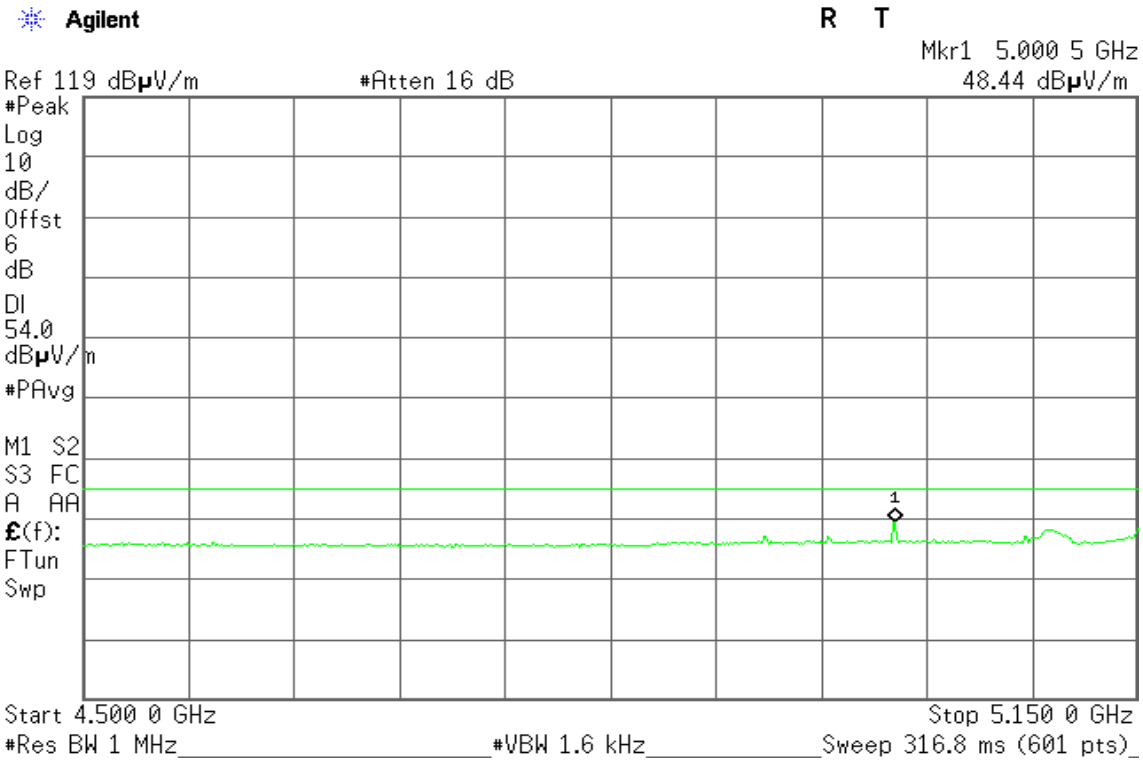
Detector mode: Average **Polarity: Vertical**



Detector mode: Peak **Polarity: Horizontal**

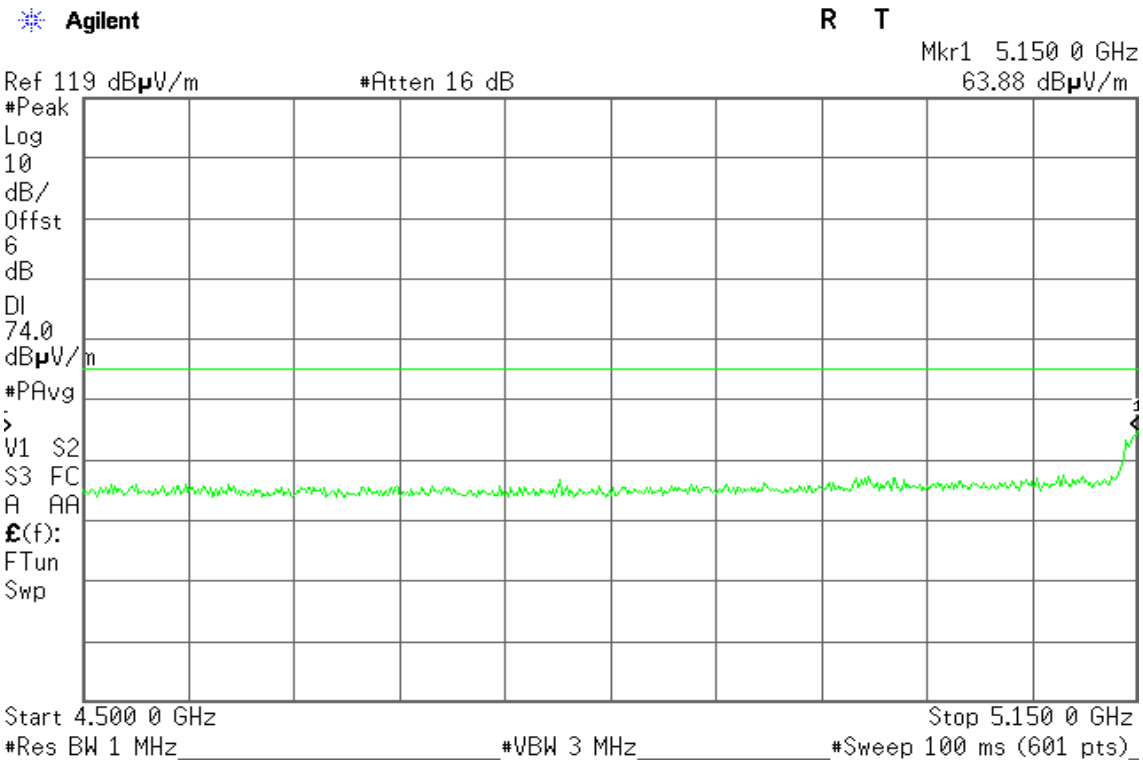


Detector mode: Average **Polarity: Horizontal**

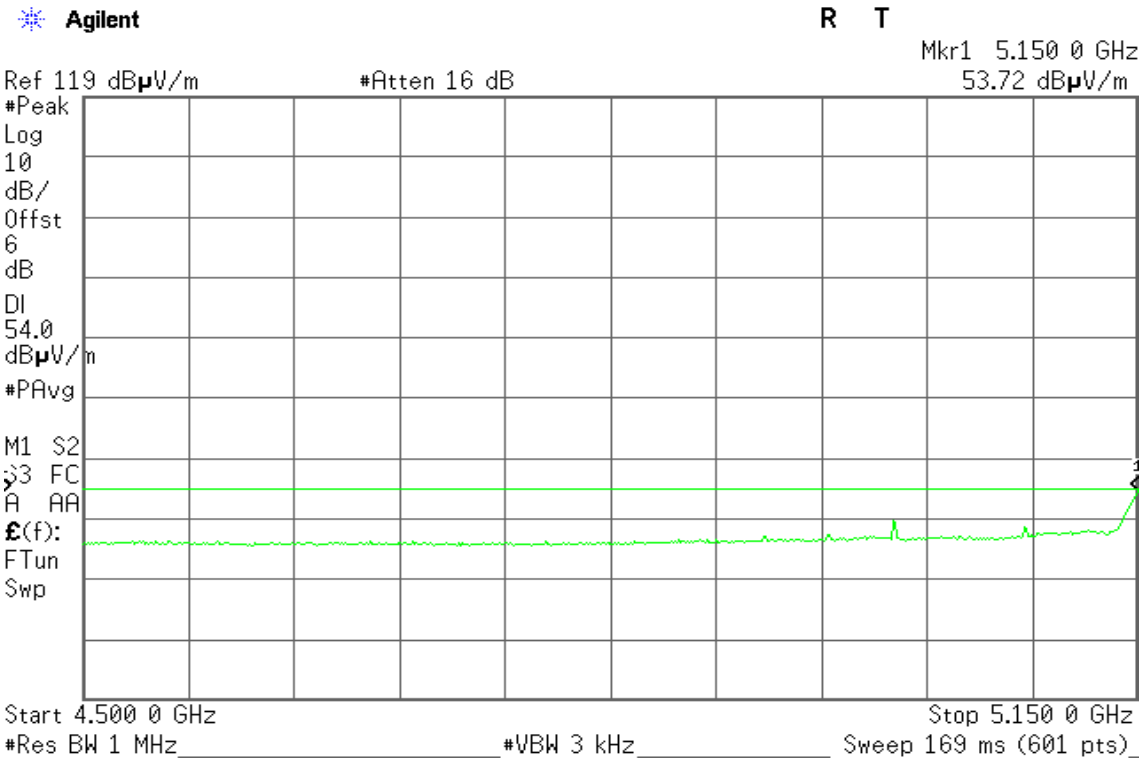


Band Edges (IEEE 802.11n HT 40 mode / 5190 MHz)

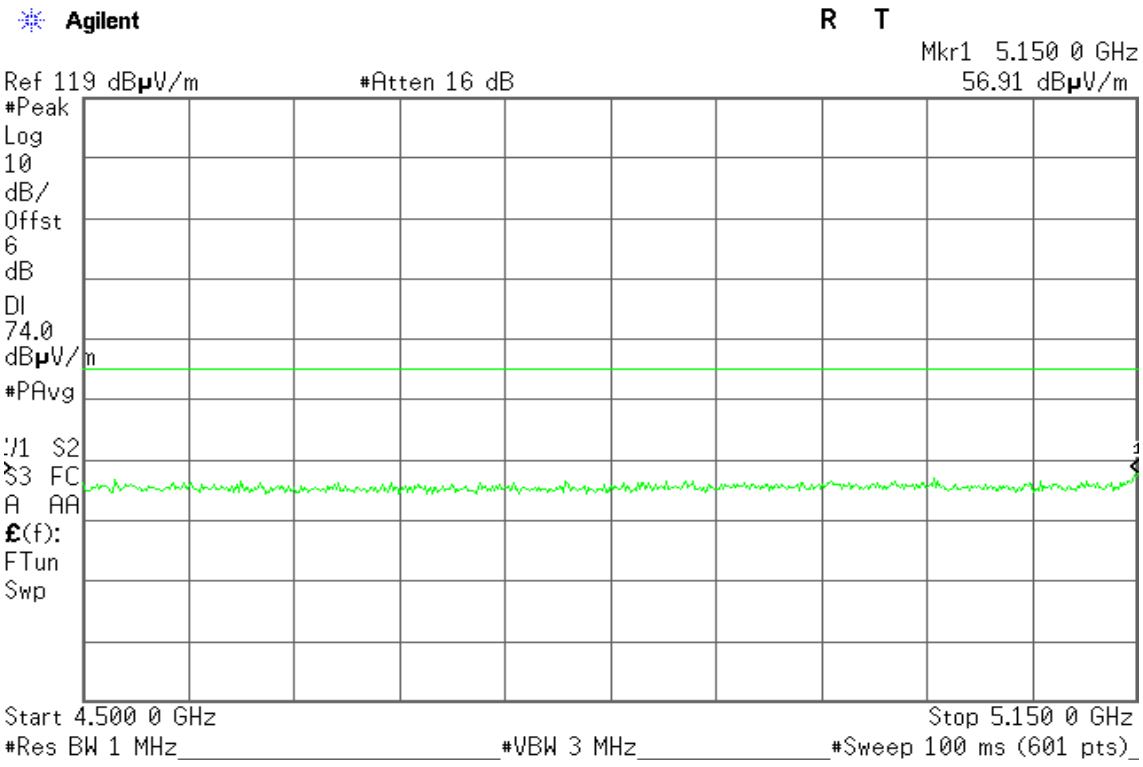
Detector mode: Peak **Polarity: Vertical**



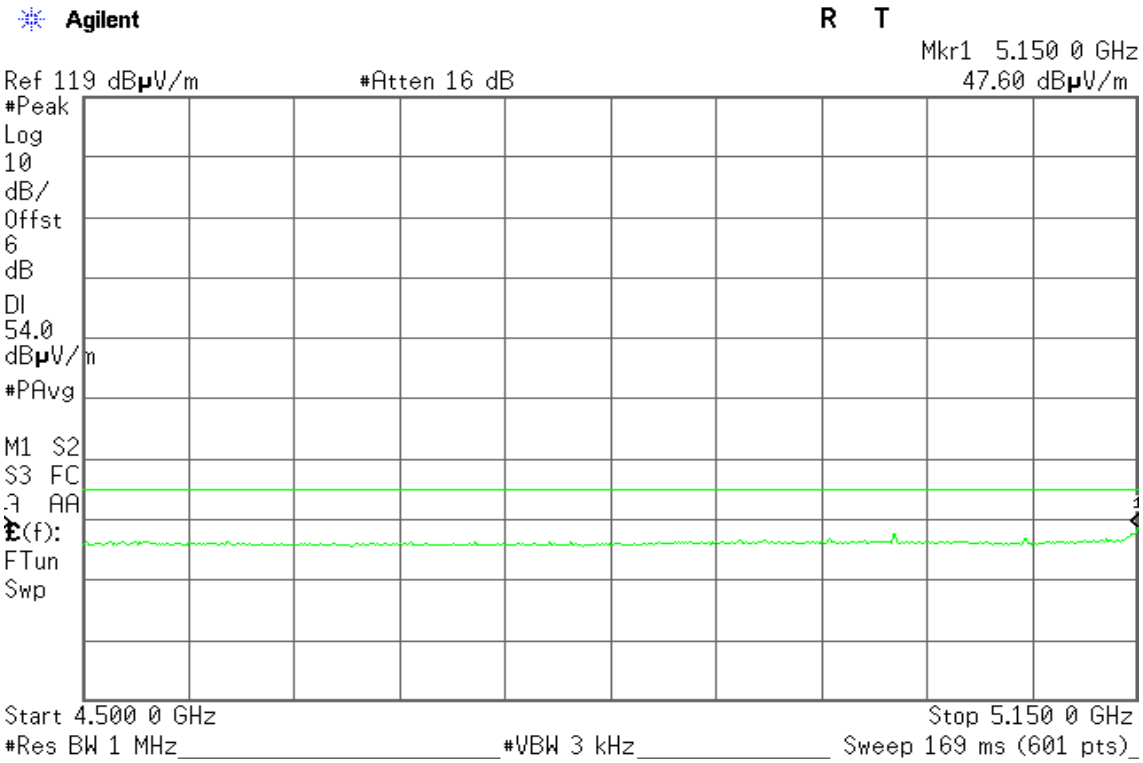
Detector mode: Average **Polarity: Vertical**



Detector mode: Peak **Polarity: Horizontal**



Detector mode: Average **Polarity: Horizontal**



7.5 PEAK POWER SPECTRAL DENSITY

LIMIT

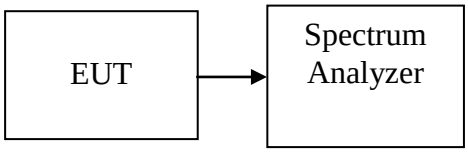
According to §15.407(a),

(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 = 50MHz, 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)	Chain 0 PPSD (dBm)	Chain 1 PPSD (dBm)	MAX PPSD (dBm)	Limit (dBm)	Margin	Result
Low	5180	1.76	-0.25	3.88	4.00	-0.12	PASS
Mid	5220	1.41	0.18	3.85	4.00	-0.15	PASS
High	5240	1.82	0.00	4.01	4.00	0.01	PASS

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

Channel	Frequency (MHz)	Chain 0 PPSD (dBm)	Chain 1 PPSD (dBm)	MAX PPSD (dBm)	Limit (dBm)	Margin	Result
Low	5180	-8.05	-5.45	-3.55	4.00	-7.55	PASS
Mid	5220	-8.61	-5.78	-3.96	4.00	-7.96	PASS
High	5240	-8.53	-5.71	-3.88	4.00	-7.88	PASS

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

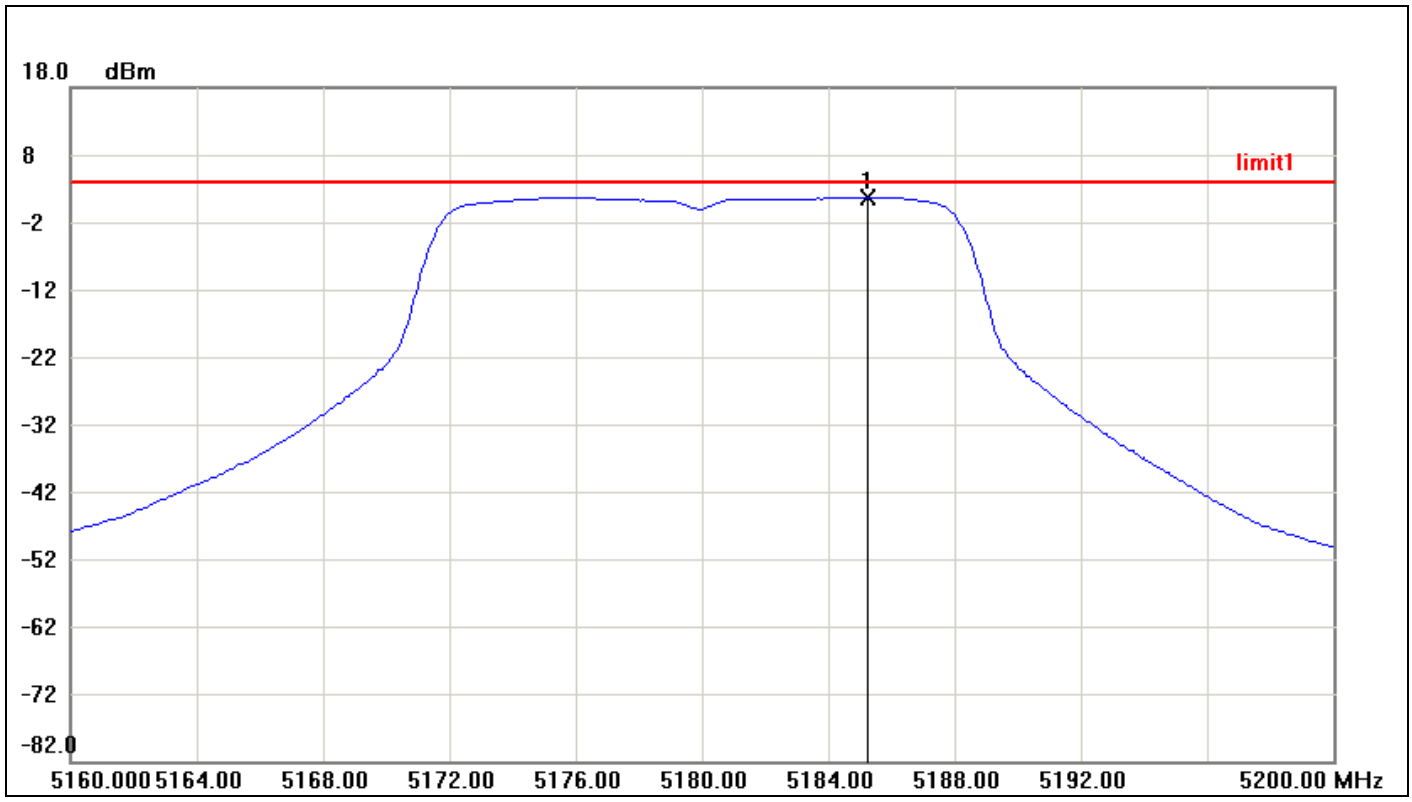
Channel	Frequency (MHz)	Chain 0 PPSD (dBm)	Chain 1 PPSD (dBm)	MAX PPSD (dBm)	Limit (dBm)	Margin	Result
Low	5190	-12.35	-8.86	-7.25	4.00	-7.25	PASS
High	5230	-12.14	-8.92	-7.23	4.00	-7.23	PASS

Remark:

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

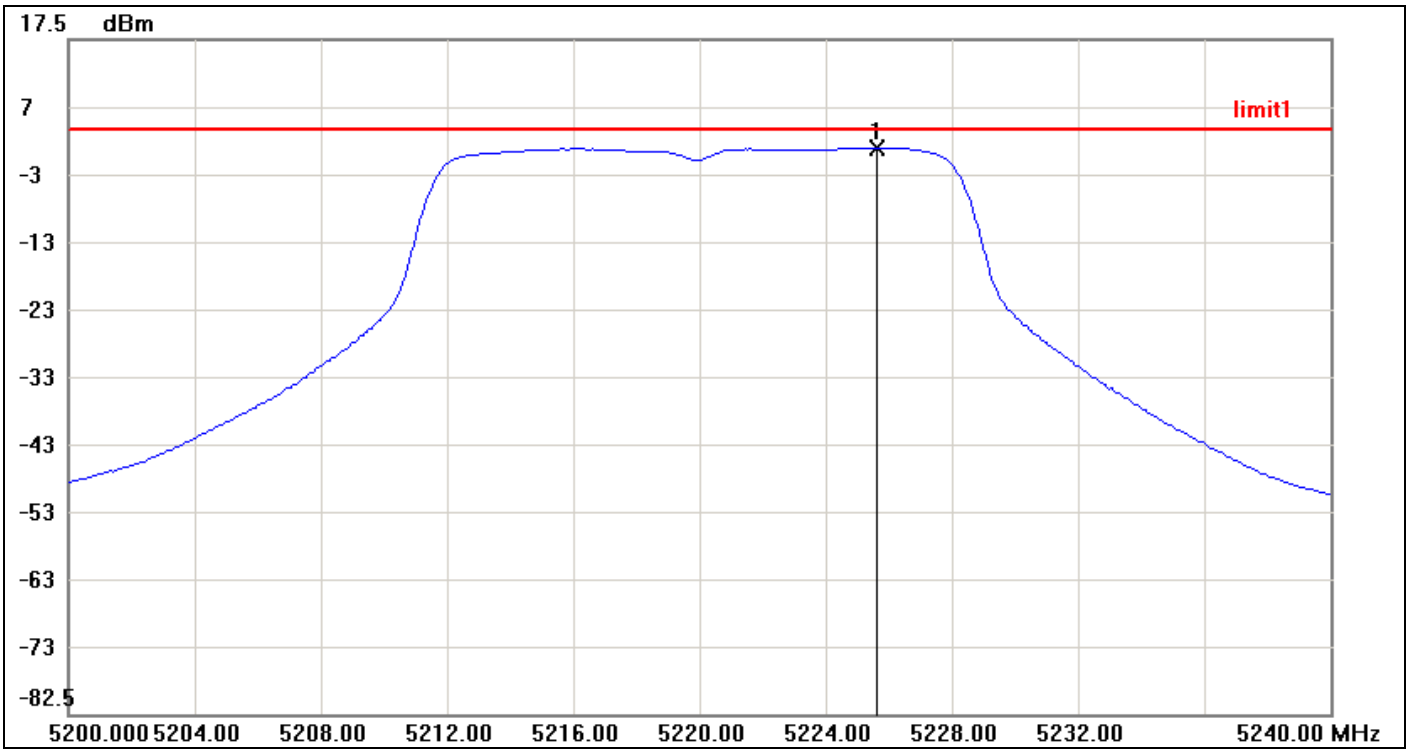
Test Plot
IEEE 802.11a mode / 5180 ~ 5240MHz / Chain 0

CH Low



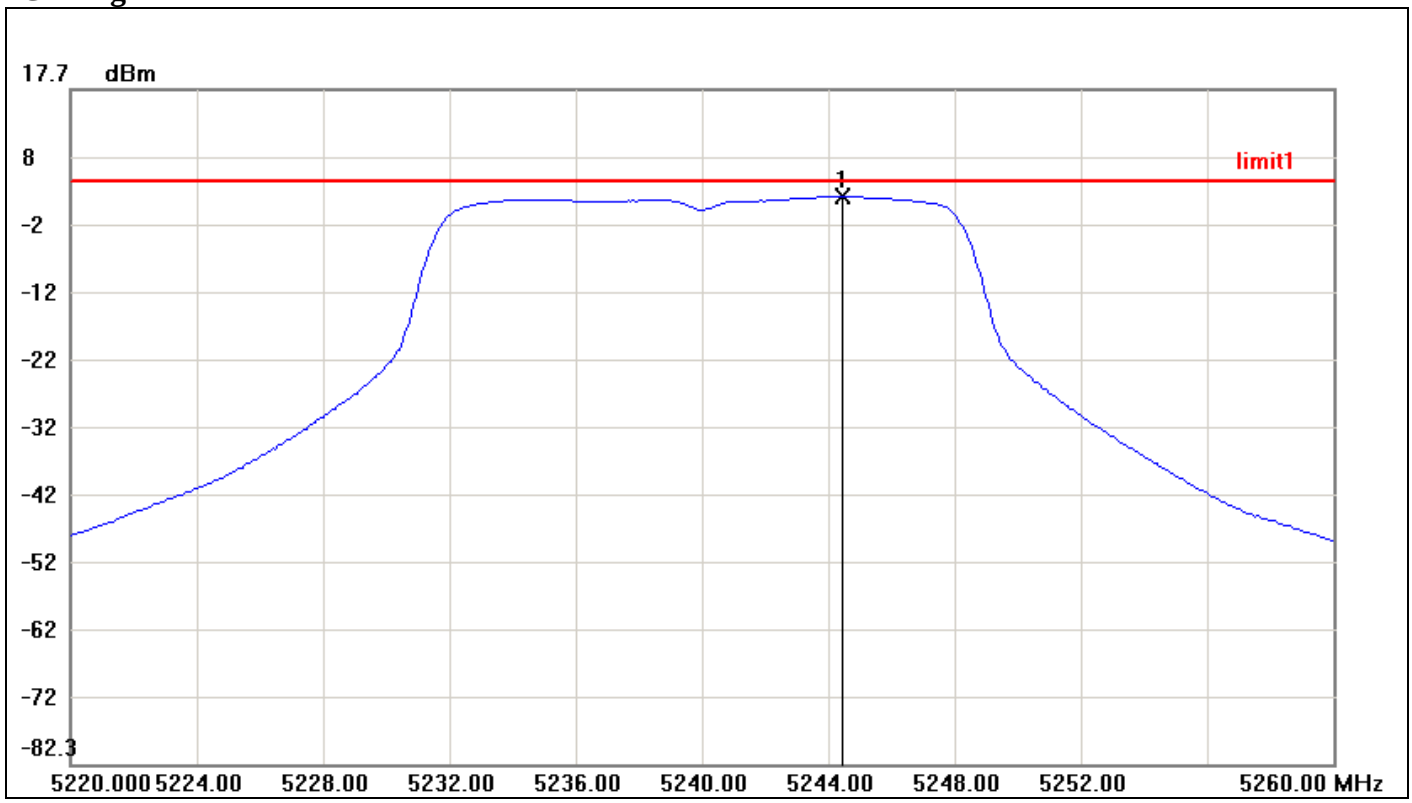
No.	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	5185.2667	1.76	4.00	-2.24

CH Mid



No.	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	5225.6000	1.41	4.00	-2.59

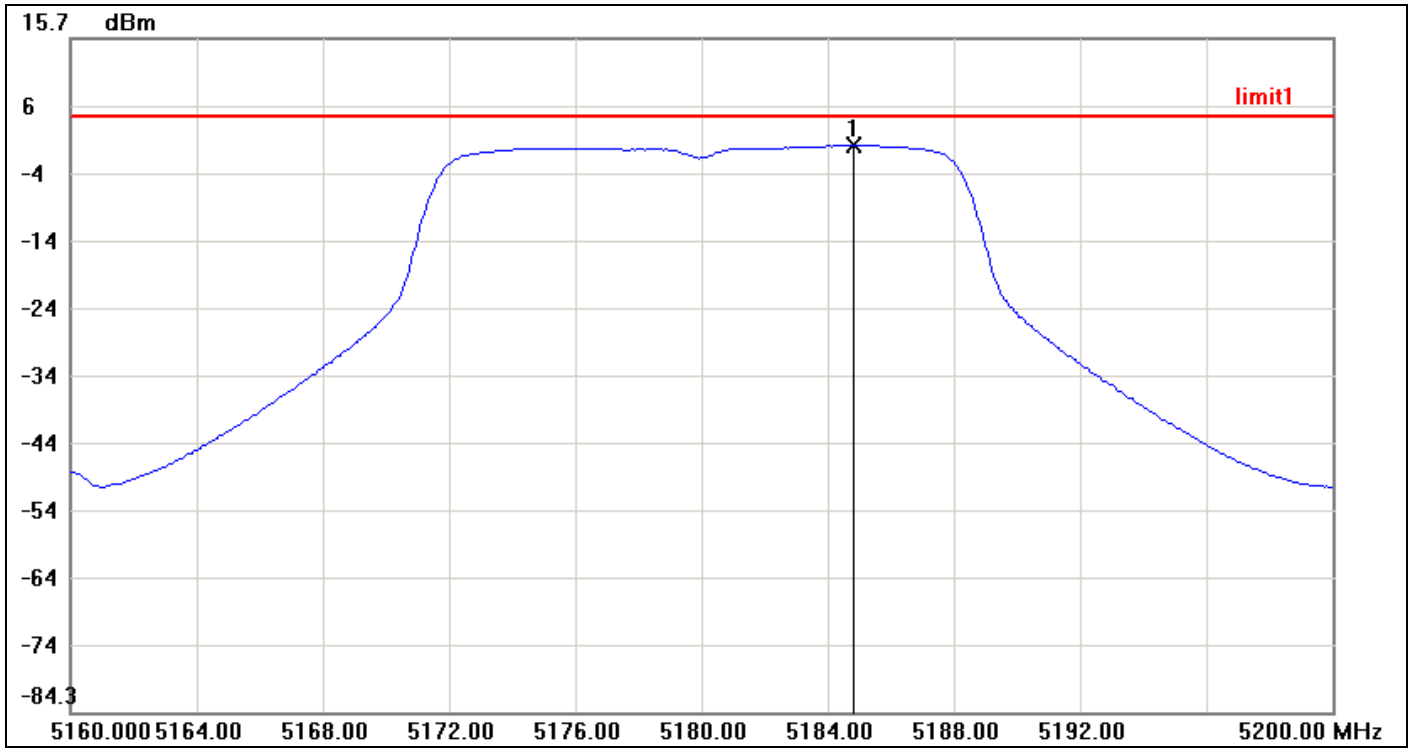
CH High



No.	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	5244.4667	1.82	4.00	-2.18

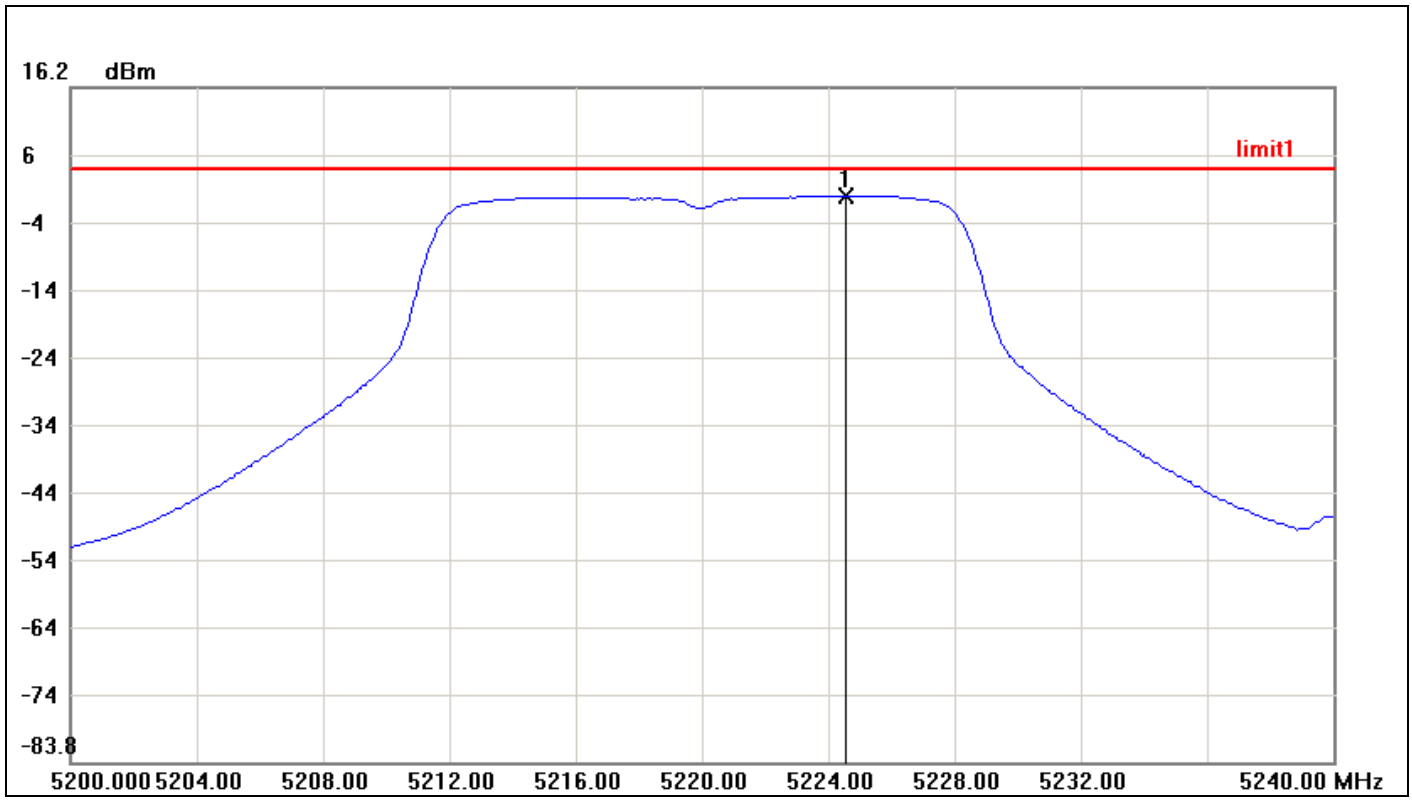
IEEE 802.11a mode / 5180 ~ 5240MHz / Chain 1

CH Low



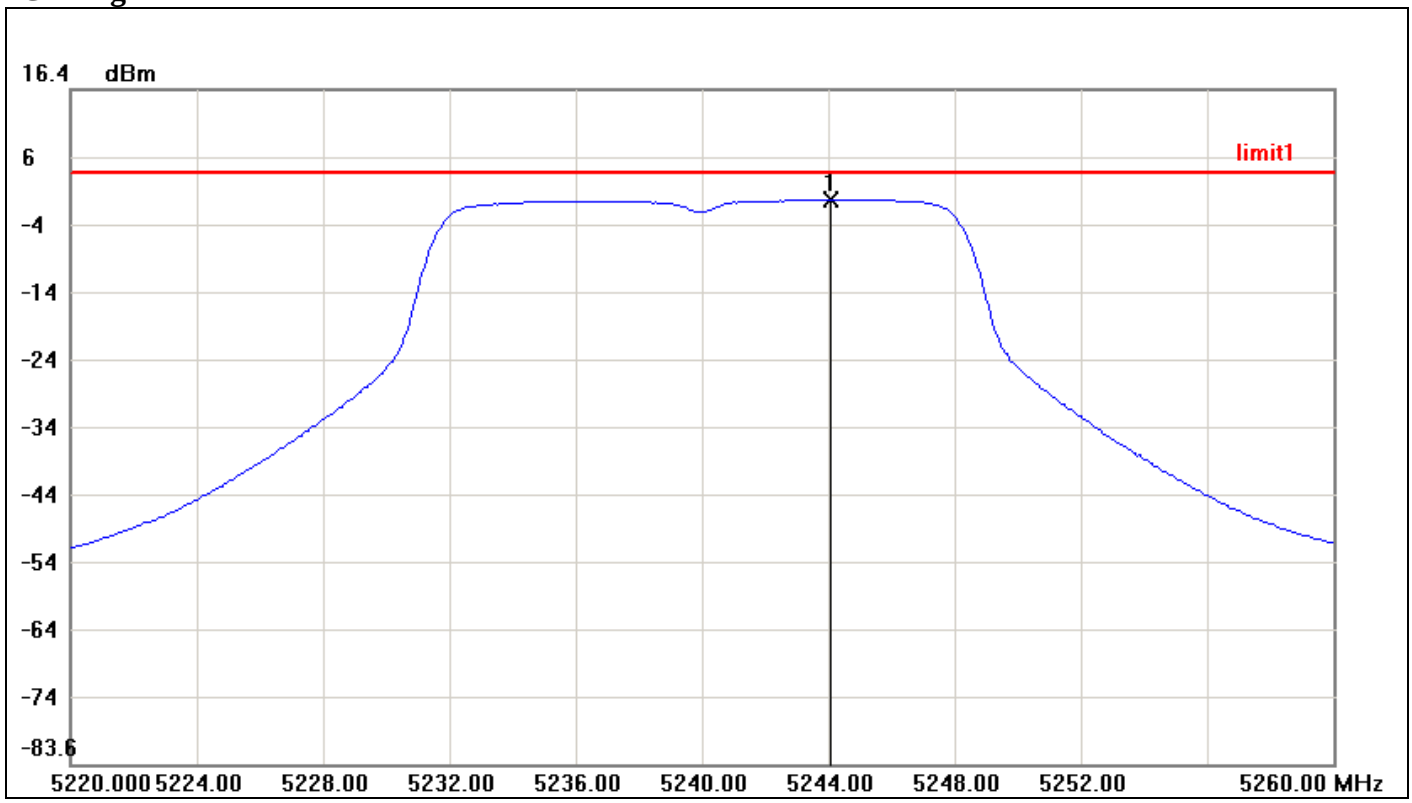
No.	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	5184.8000	-0.25	4.00	-4.25

CH Mid



No.	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	5224.5333	0.18	4.00	-3.82

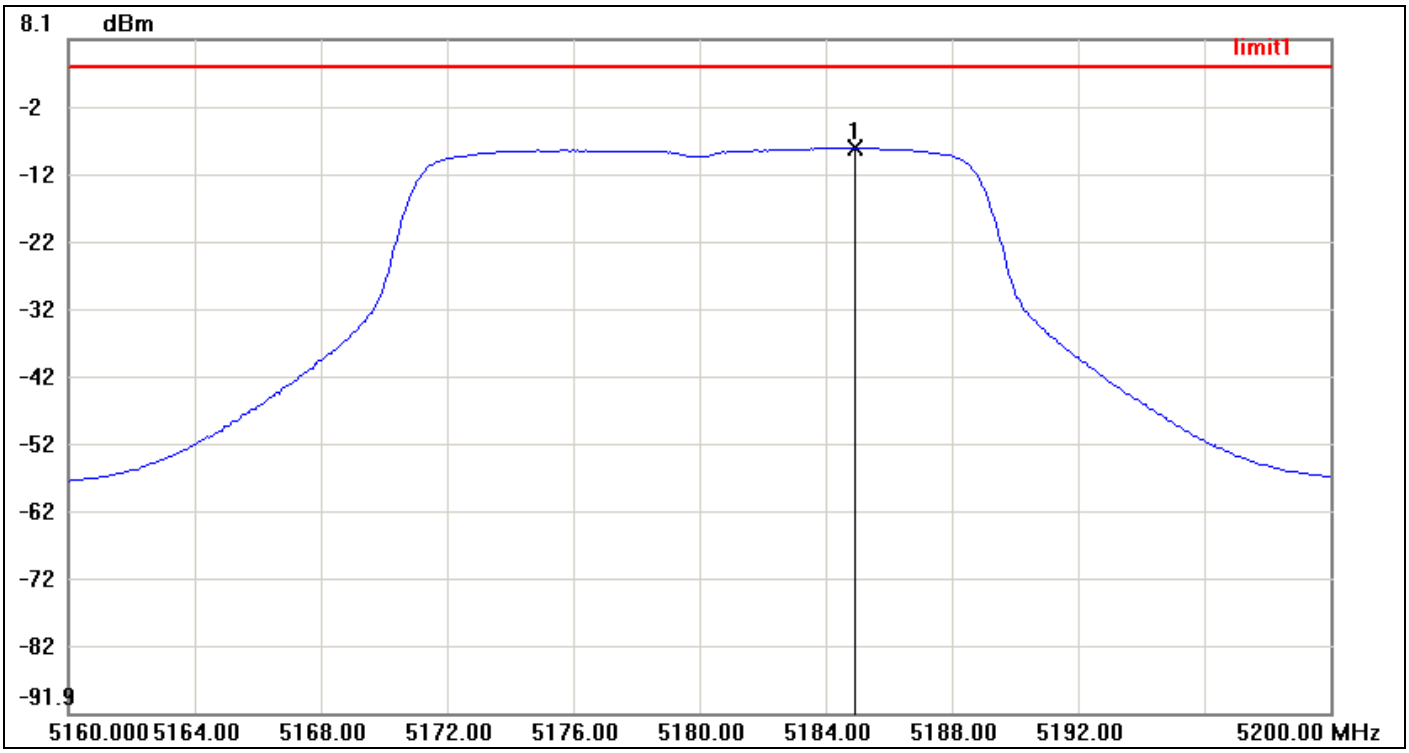
CH High



No.	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	5244.0667	0.00	4.00	-4.00

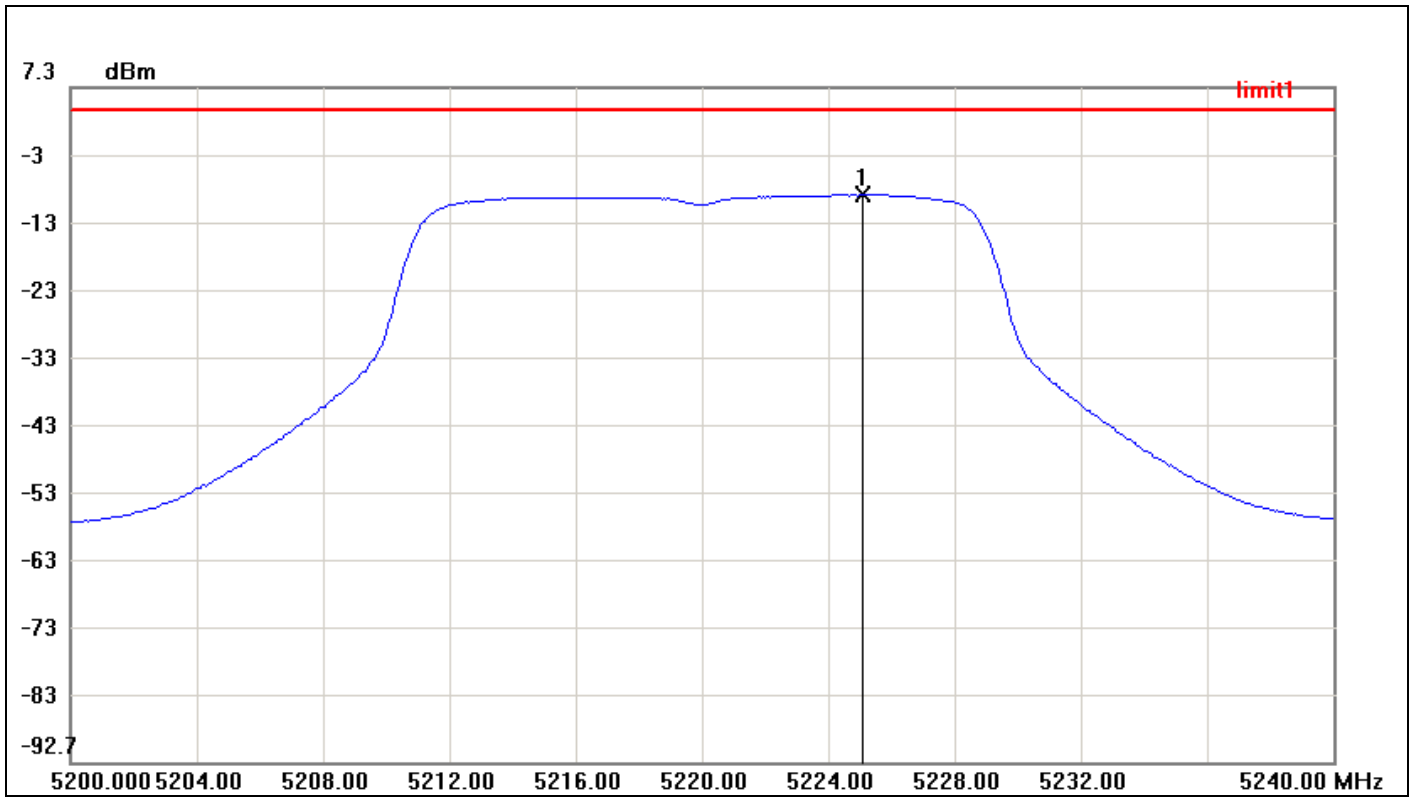
IEEE 802.11n HT 20 mode / 5180 ~ 5240MHz / Chain 0

CH Low



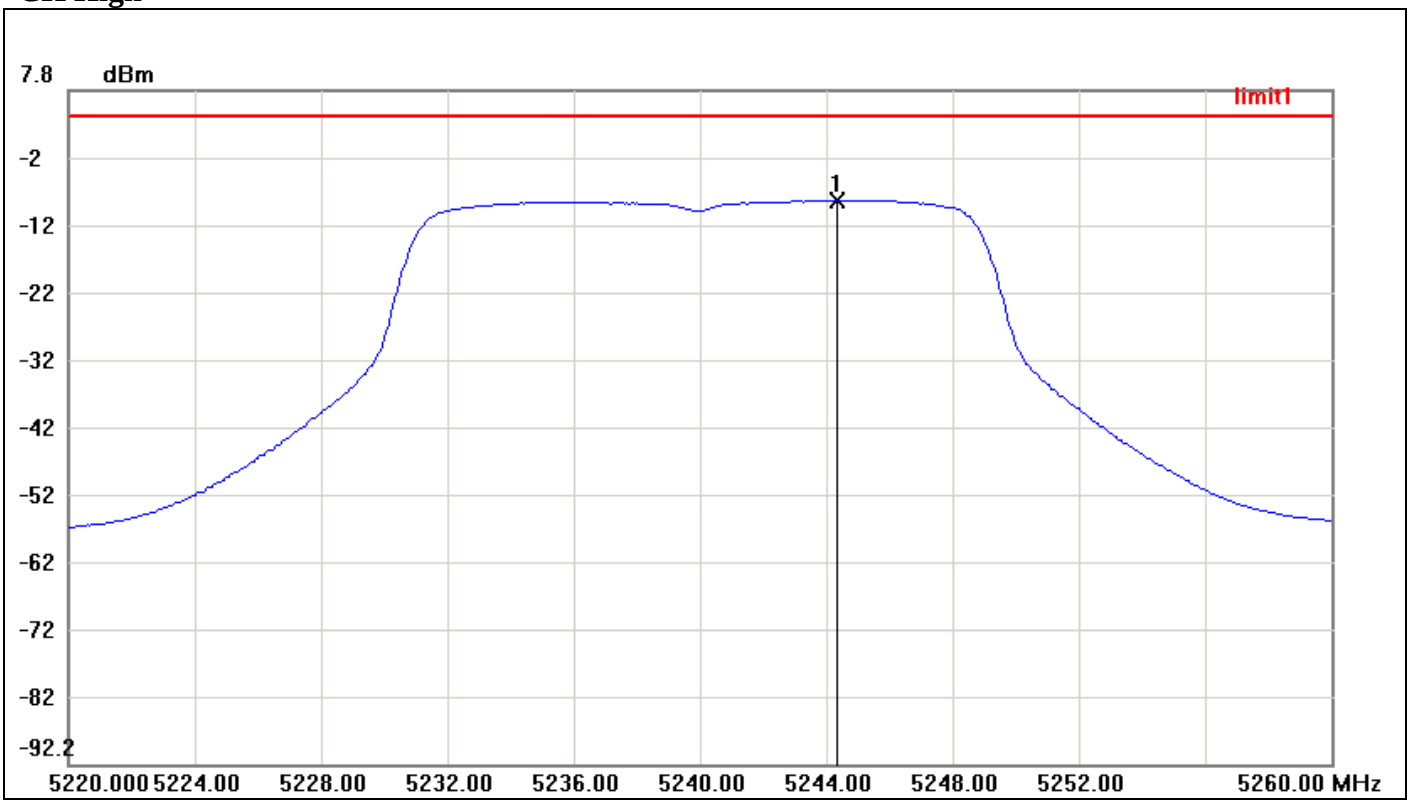
No.	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	5184.9333	-8.05	4.00	-12.05

CH Mid



No.	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	5225.0667	-8.61	4.00	-12.61

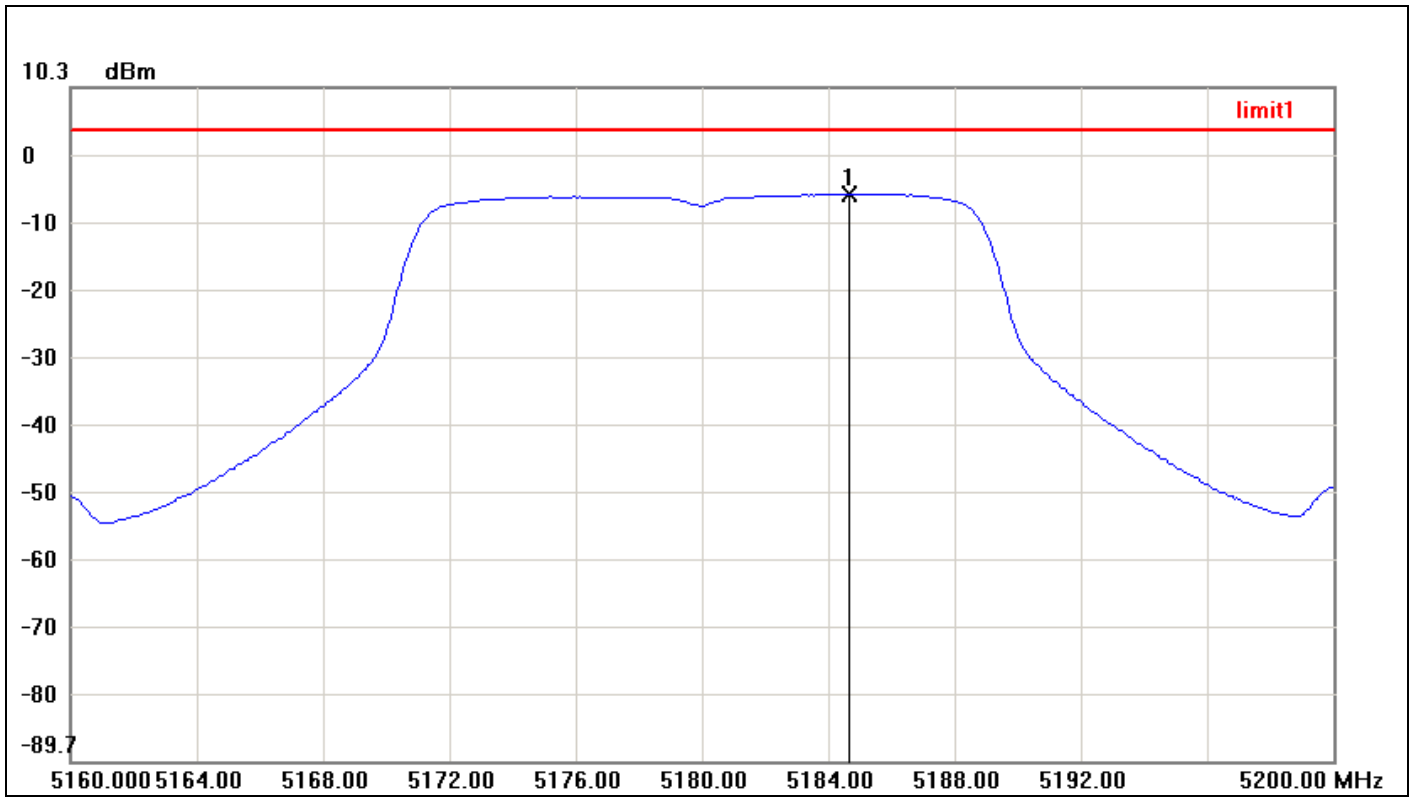
CH High



No.	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	5244.3333	-8.53	4.00	-12.53

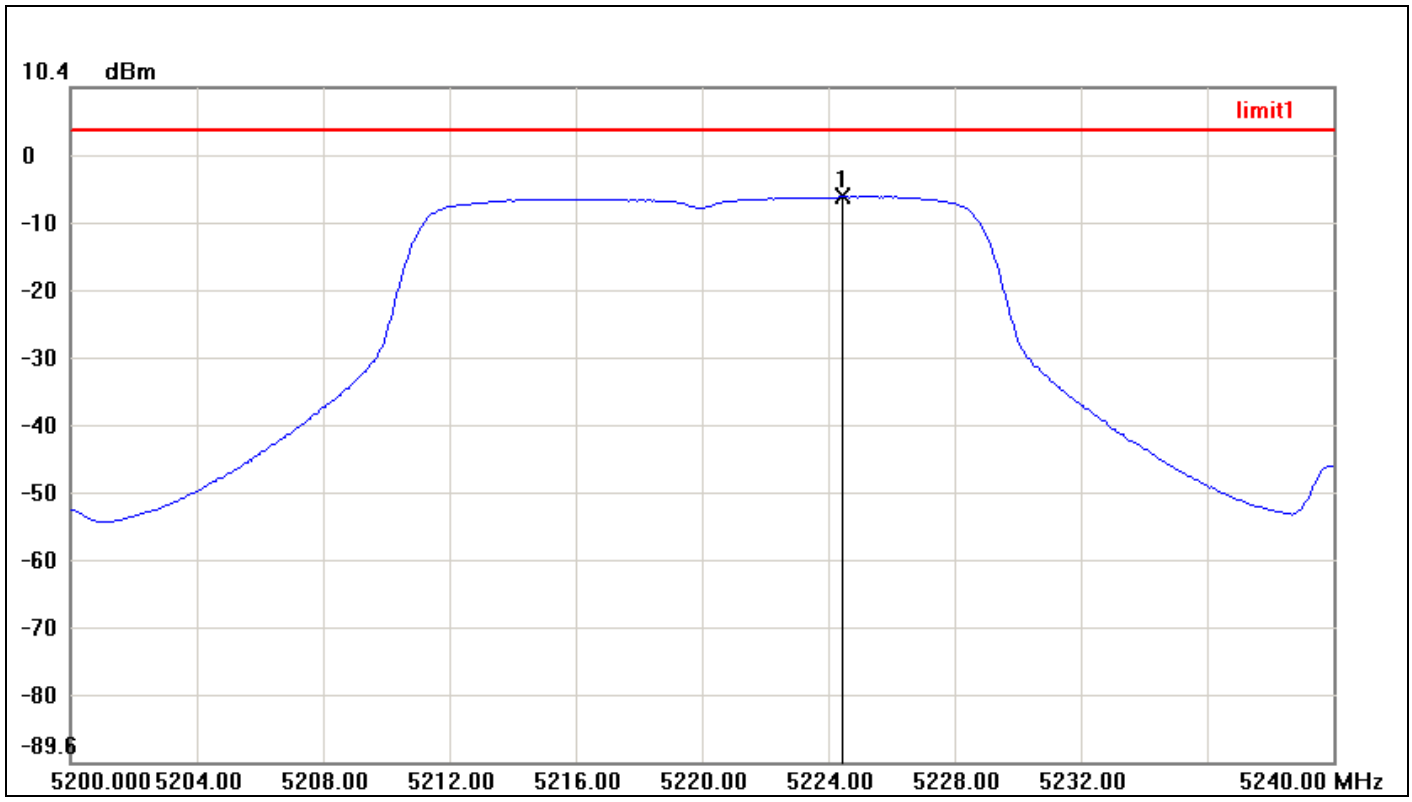
IEEE 802.11n HT 20 mode / 5180 ~ 5240MHz / Chain 1

CH Low



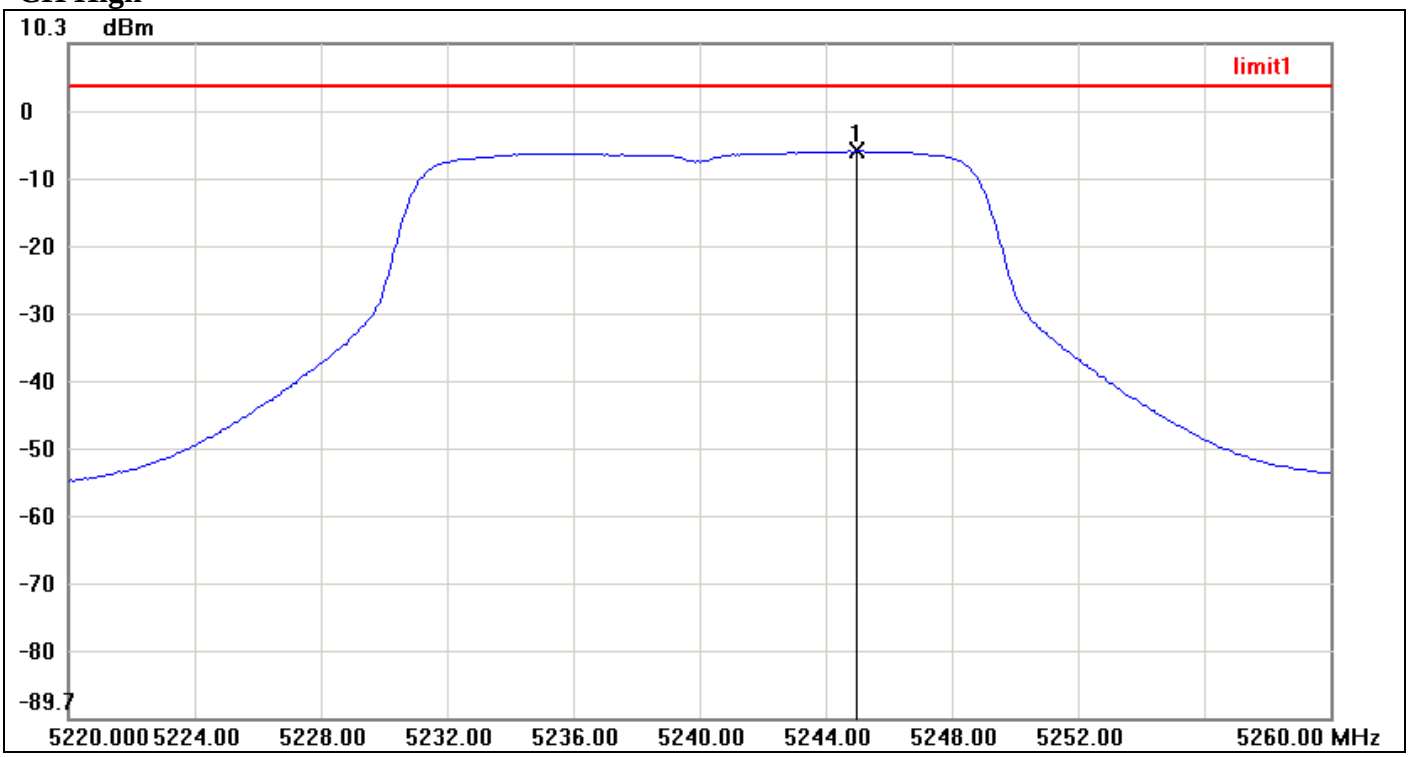
No.	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	5184.6667	-5.45	4.00	-9.45

CH Mid



No.	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	5224.4667	-5.78	4.00	-9.78

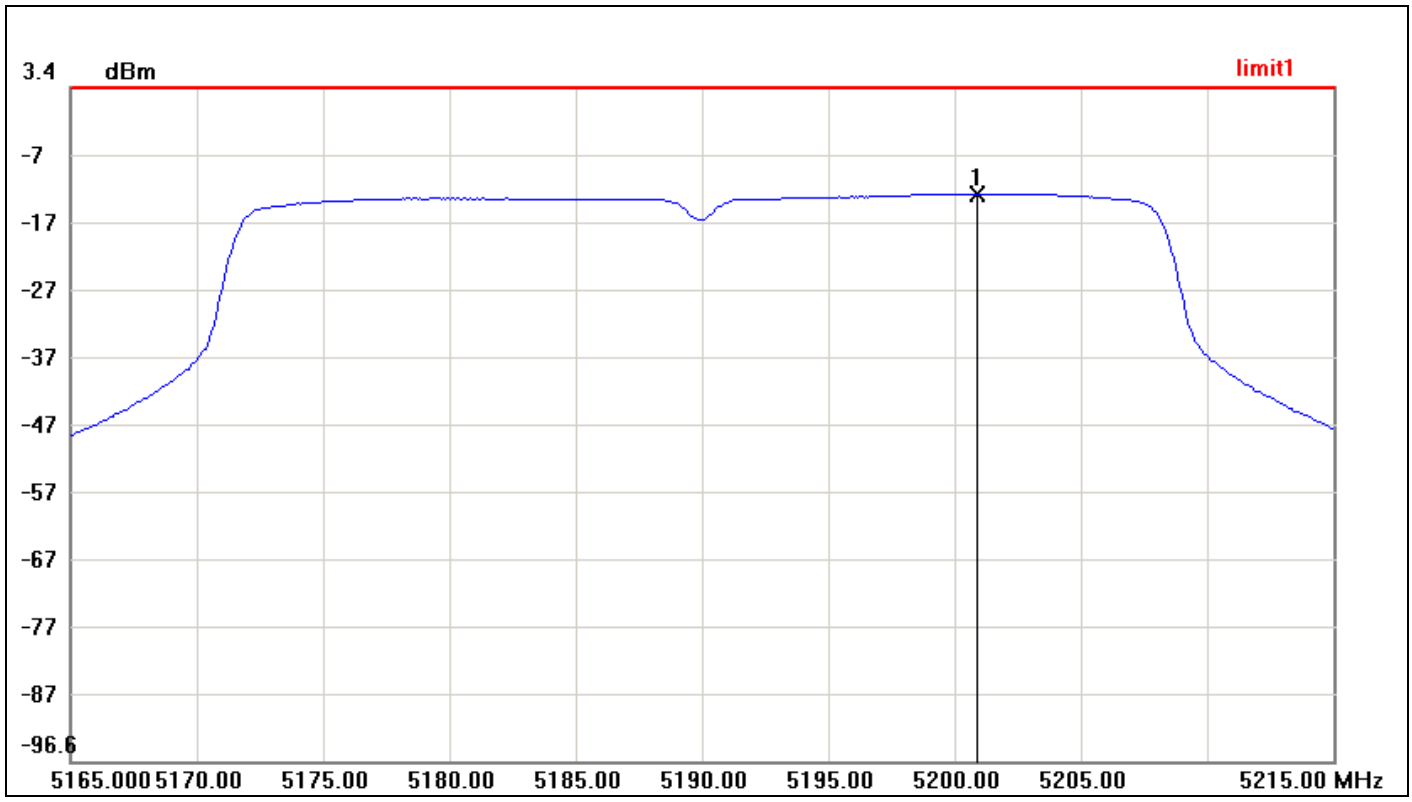
CH High



No.	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	5245.0000	-5.71	4.00	-9.71

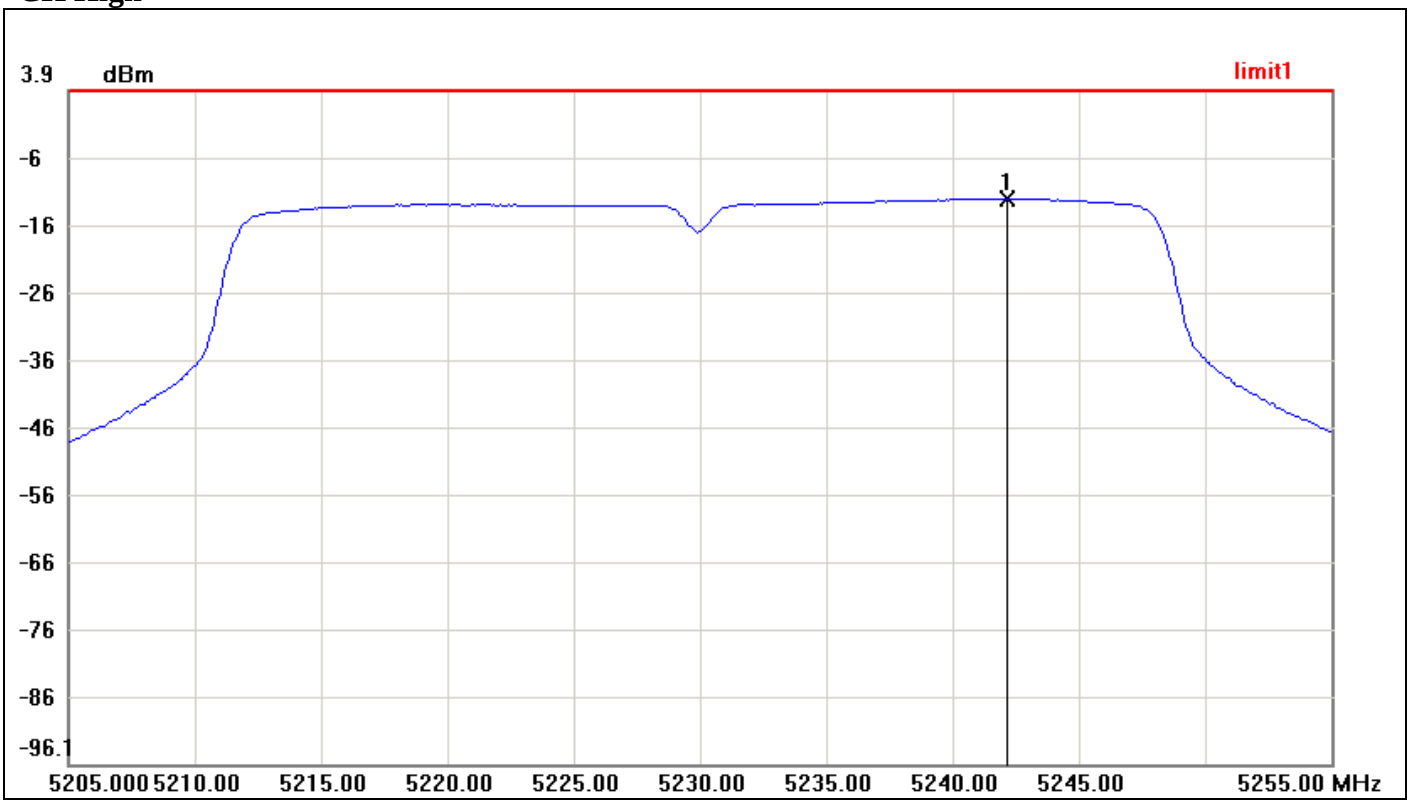
IEEE 802.11n HT 40 mode / 5190 ~ 5230MHz / Chain 0

CH Low



No.	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	5200.9167	-12.35	4.00	-16.35

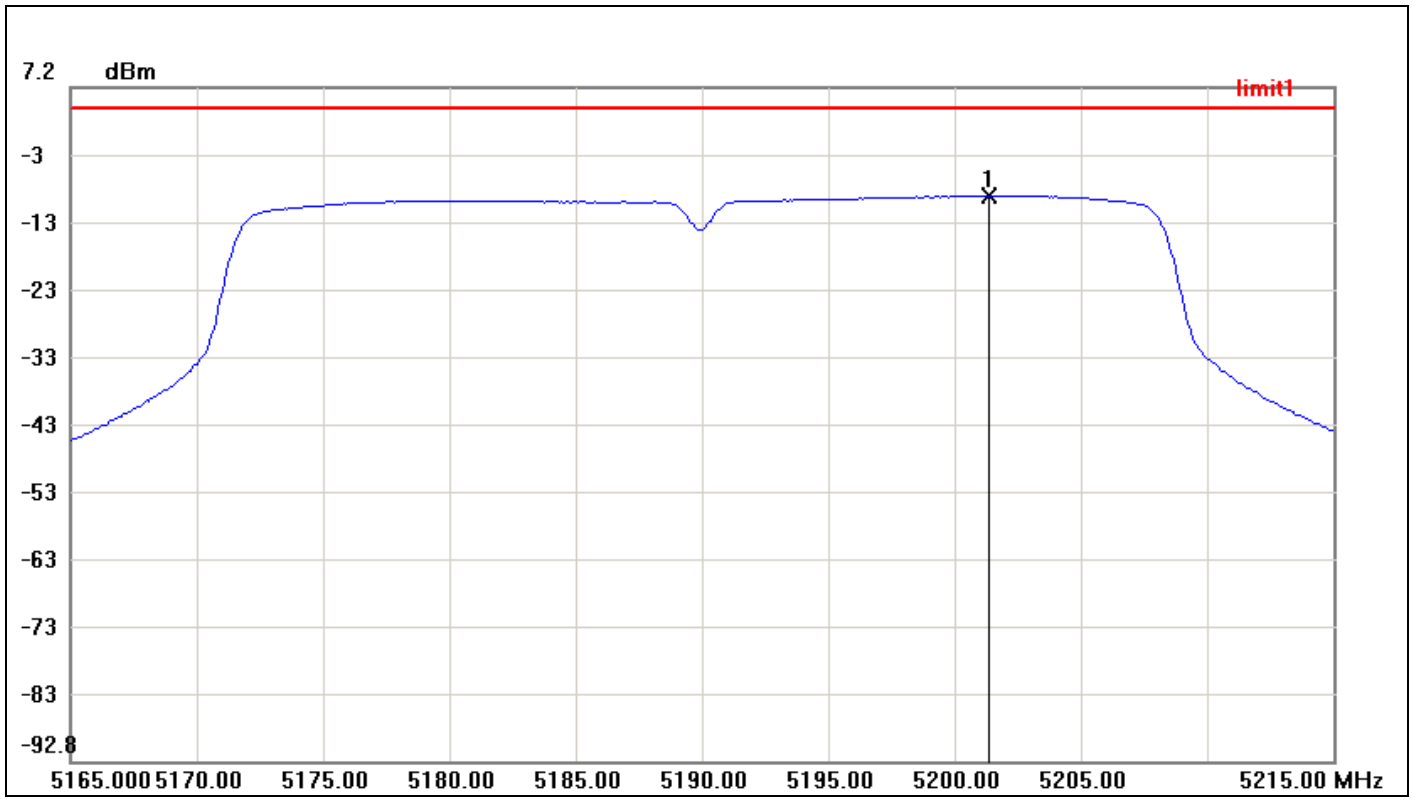
CH High



No.	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	5242.1667	-12.14	4.00	-16.14

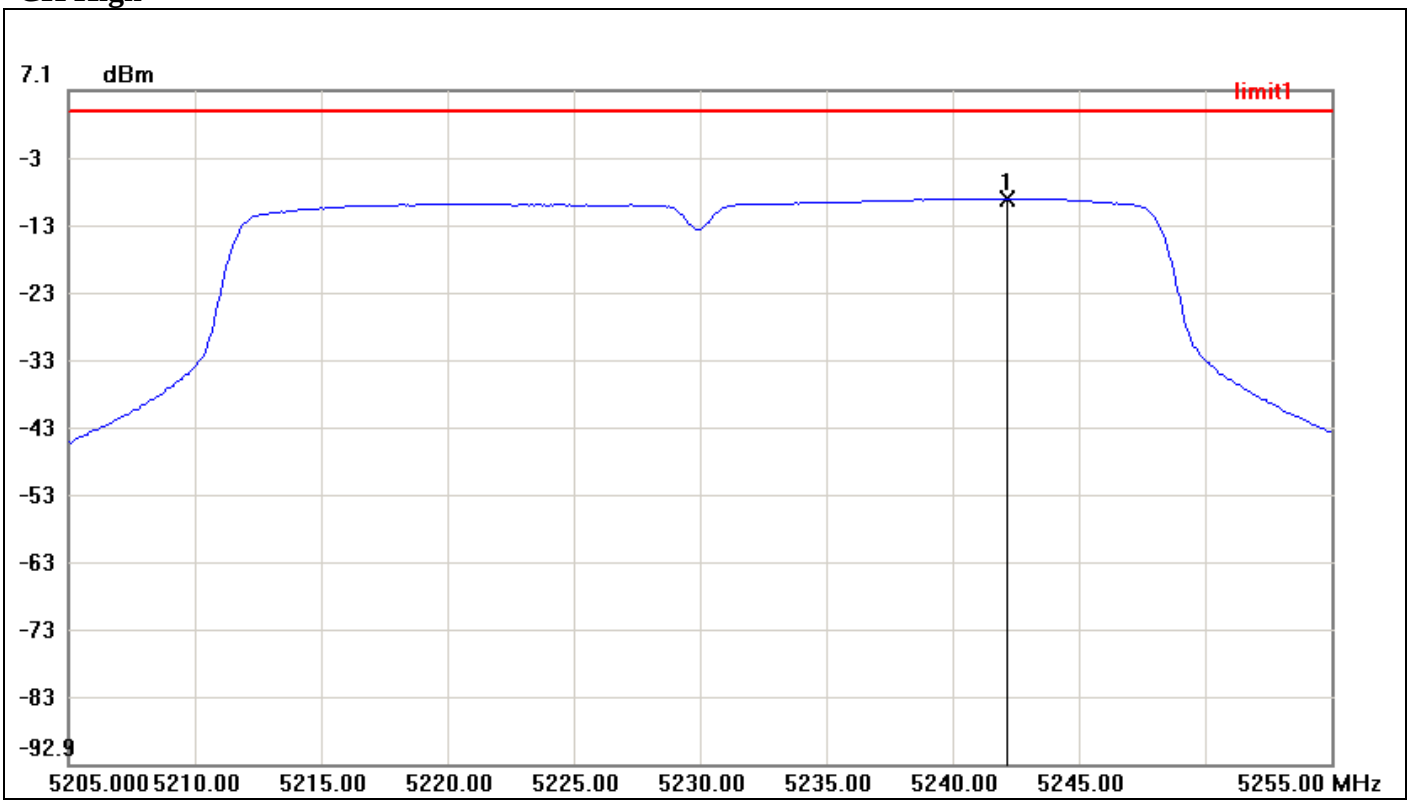
IEEE 802.11n HT 40 mode / 5190 ~ 5230MHz / Chain 1

CH Low



No.	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	5201.3333	-8.86	4.00	-12.86

CH High



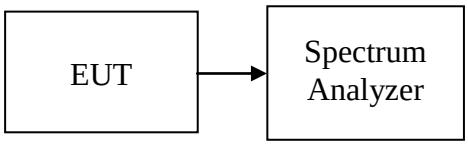
No.	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	5242.1667	-8.92	4.00	-12.92

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 / Chain 0

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)	Result
Low	5180	9.19	13.00	-3.81	PASS
Mid	5220	9.24	13.00	-3.76	PASS
High	5240	9.29	13.00	-3.71	PASS

Test mode: IEEE 802.11a mode / 5180 ~ 5240MHz / Chain 1

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)	Result
Low	5180	10.85	13.00	-2.15	PASS
Mid	5220	10.77	13.00	-2.23	PASS
High	5240	11.24	13.00	-1.76	PASS

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

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)	Result
Low	5180	10.25	13.00	-2.75	PASS
Mid	5220	10.12	13.00	-2.88	PASS
High	5240	10.51	13.00	-2.49	PASS

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

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)	Result
Low	5180	10.29	13.00	-2.71	PASS
Mid	5220	10.43	13.00	-2.57	PASS
High	5240	10.27	13.00	-2.73	PASS

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

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)	Result
Low	5190	10.66	13.00	-2.34	PASS
High	5230	10.41	13.00	-2.59	PASS

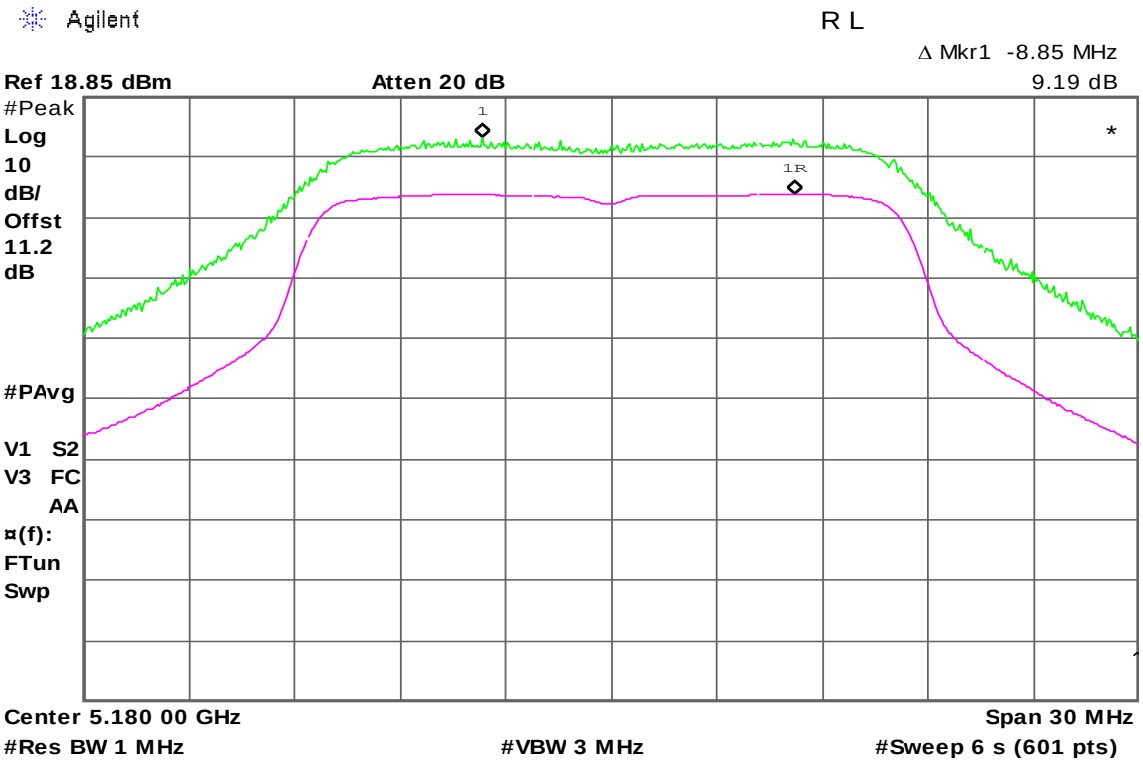
Test mode: IEEE 802.11n HT 40 mode / 5190 ~ 5230MHz / Chain 1

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)	Result
Low	5190	10.31	13.00	-2.69	PASS
High	5230	10.45	13.00	-2.55	PASS

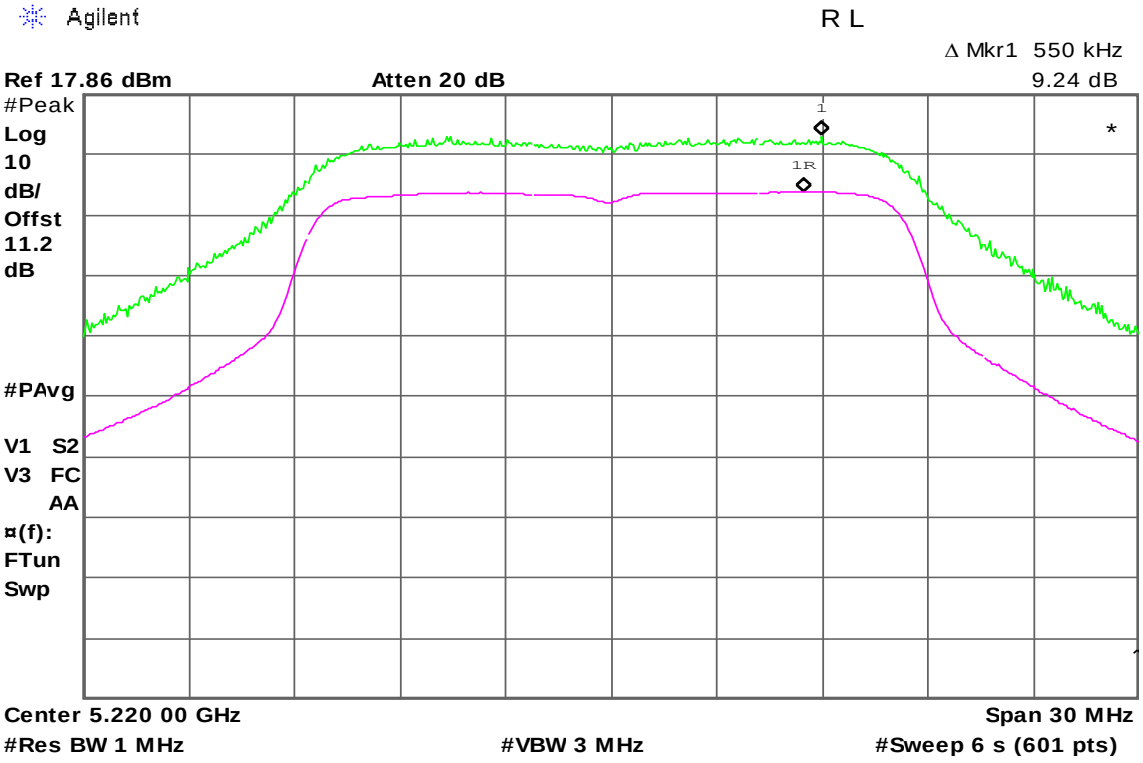
Test Plot

IEEE 802.11a mode / 5180 ~ 5240MHz / Chain 0

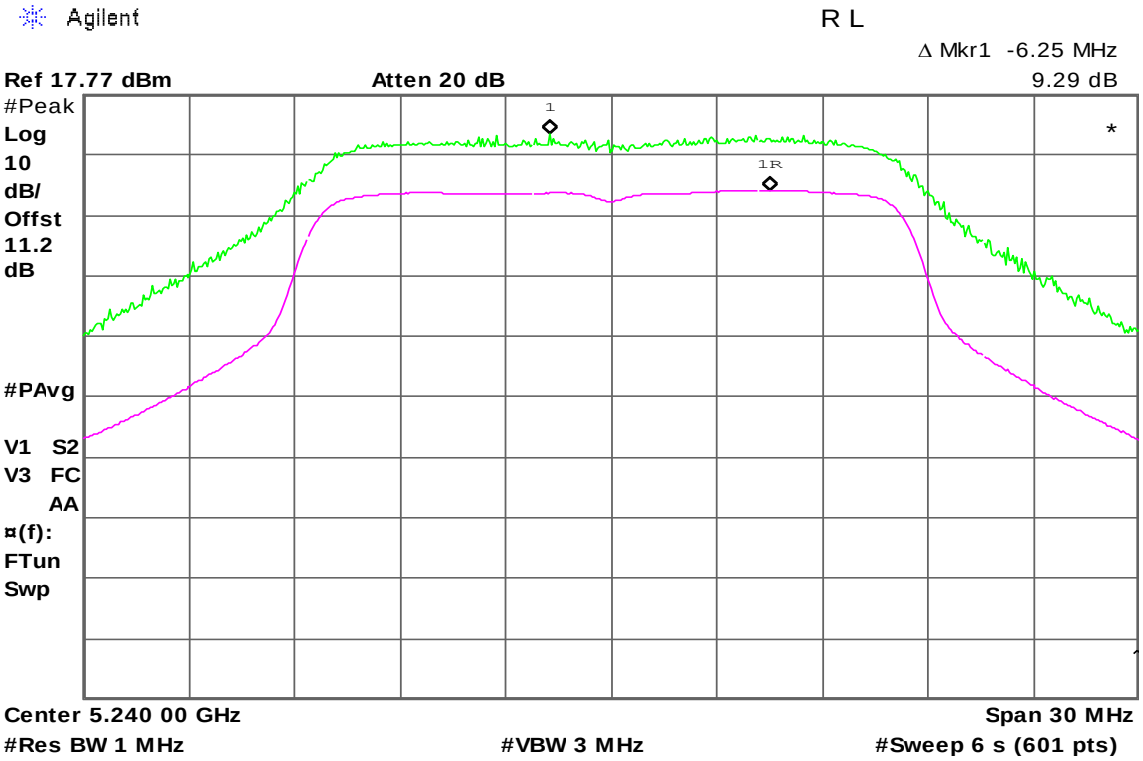
CH Low



CH Mid

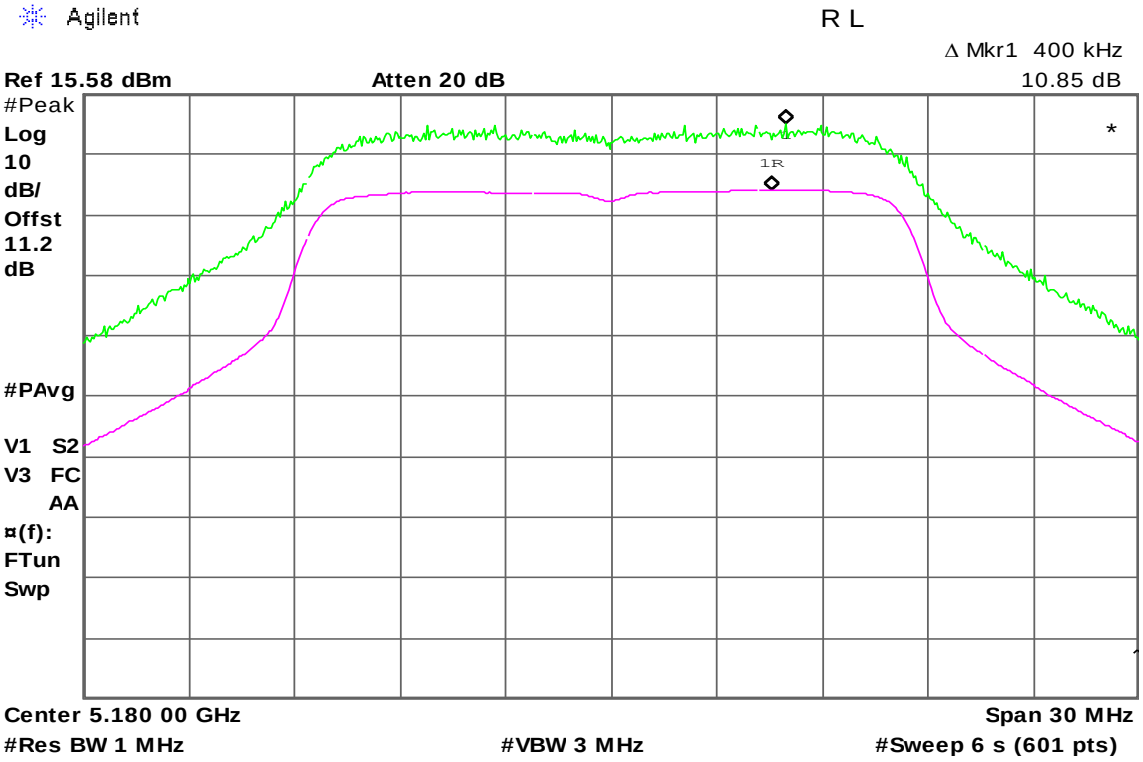


CH High

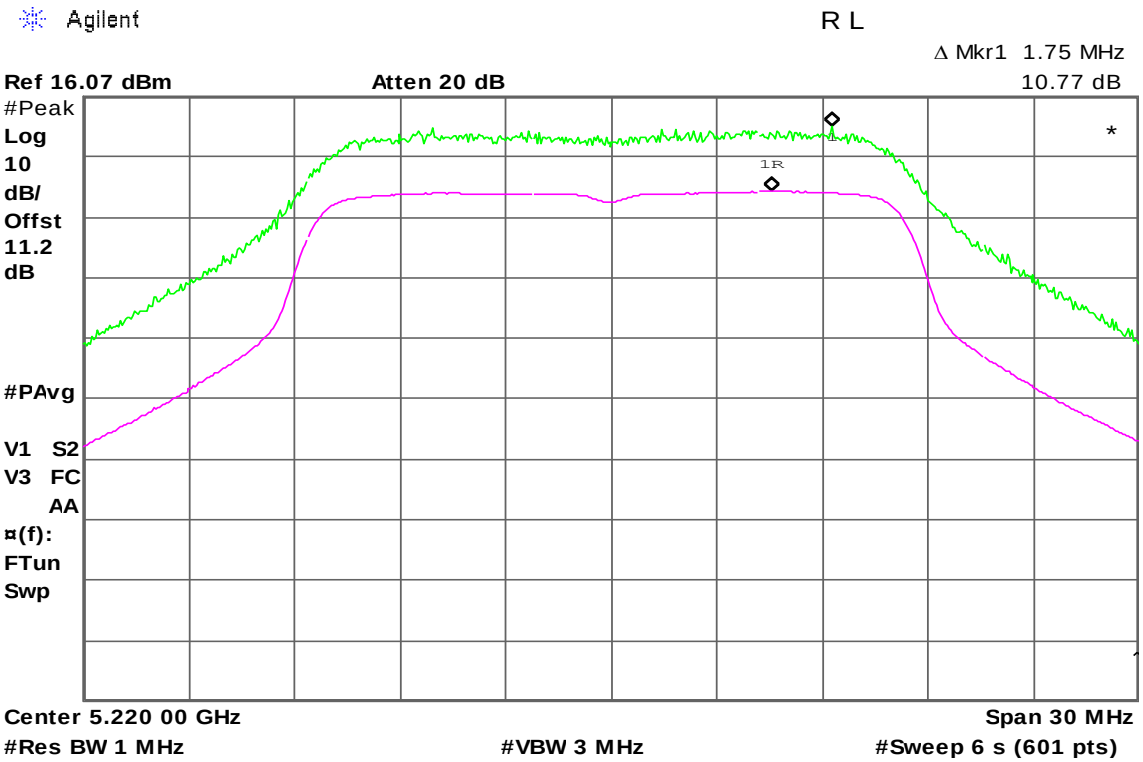

Agilent
R L
Δ Mkr1 -6.25 MHz
9.29 dB
Ref 17.77 dBm
Atten 20 dB
#Peak
Log
10
dB/
Offst
11.2
dB
#PAvg
V1 S2
V3 FC
AA
¤(f):
FTun
Swp
1
1R
*
Center 5.240 00 GHz
Span 30 MHz
#Res BW 1 MHz
#VBW 3 MHz
#Sweep 6 s (601 pts)

IEEE 802.11a mode / 5180 ~ 5240MHz / Chain 1

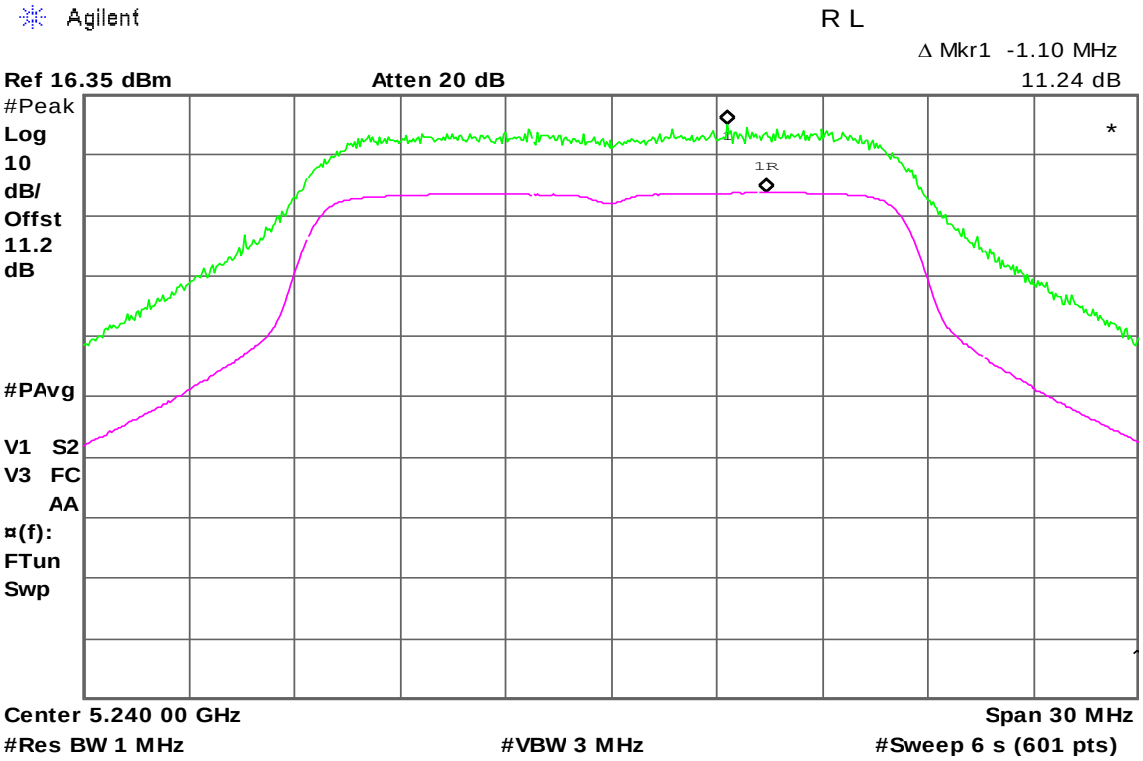
CH Low



CH Mid

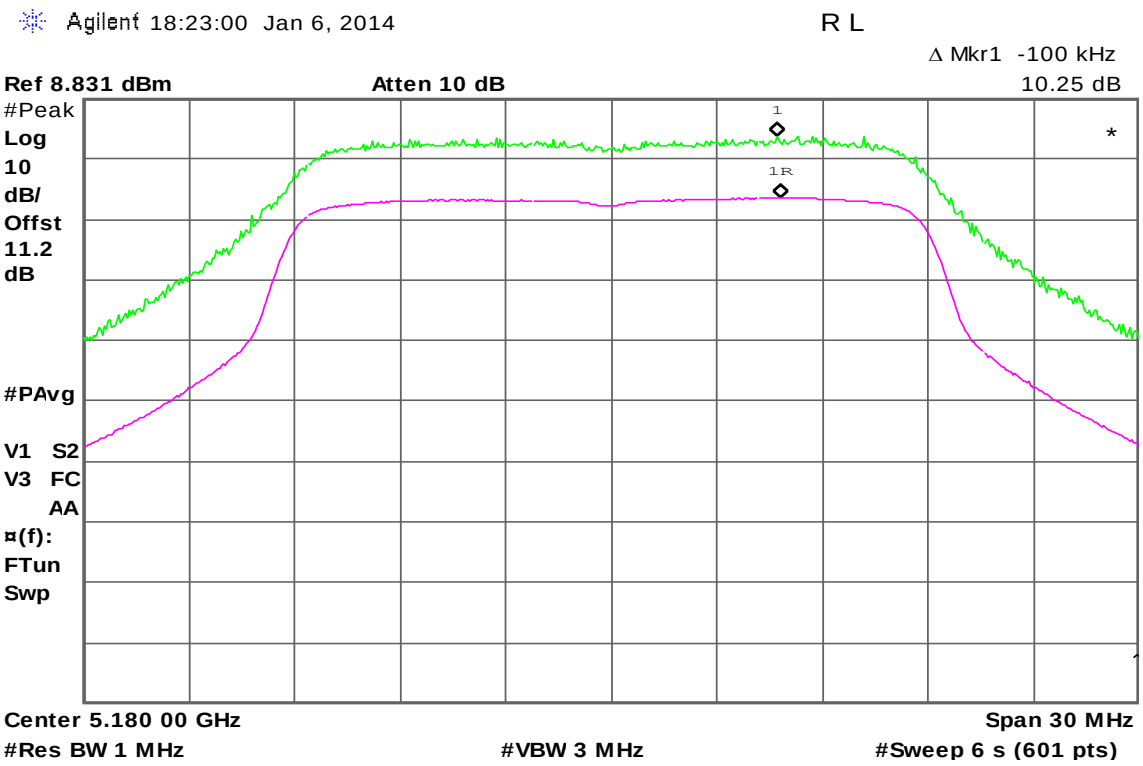


CH High

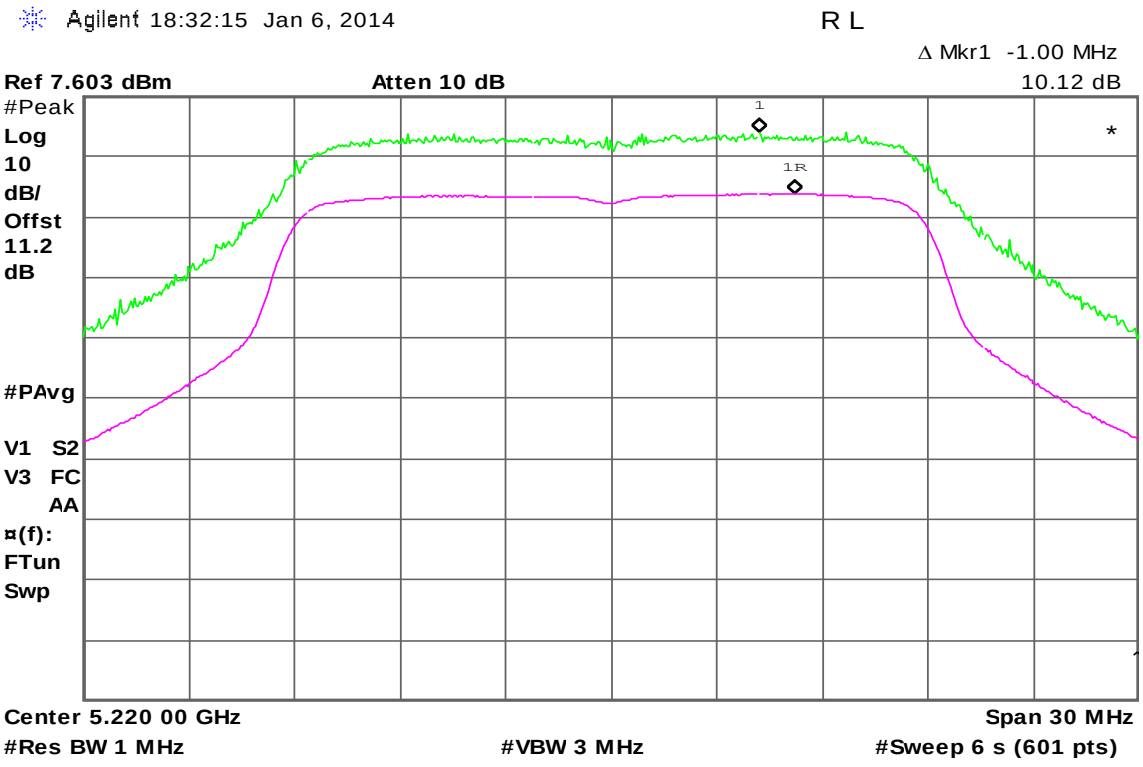

Agilent
R L
Δ Mkr1 -1.10 MHz
11.24 dB
Ref 16.35 dBm
Atten 20 dB
#Peak
Log
10
dB/
Offst
11.2
dB
#PAvg
V1 S2
V3 FC
AA
¤(f):
FTun
Swp
1R
*
Center 5.240 00 GHz
Span 30 MHz
#Res BW 1 MHz
#VBW 3 MHz
#Sweep 6 s (601 pts)

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

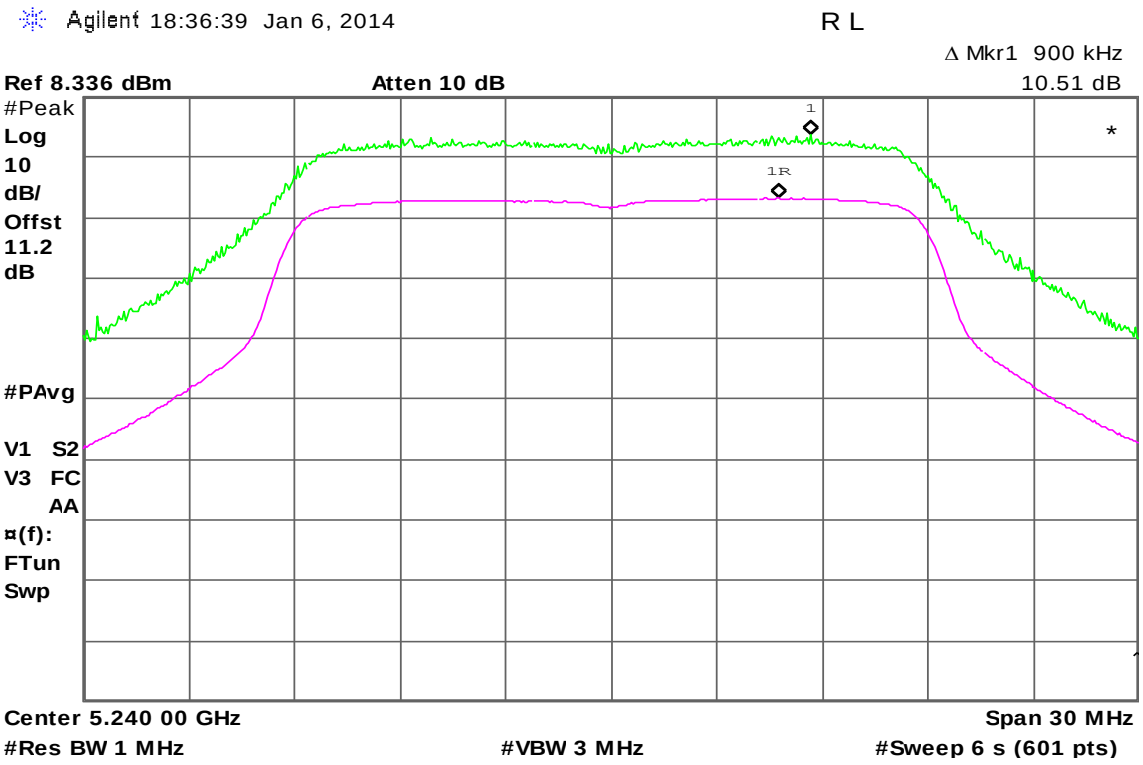
CH Low



CH Mid

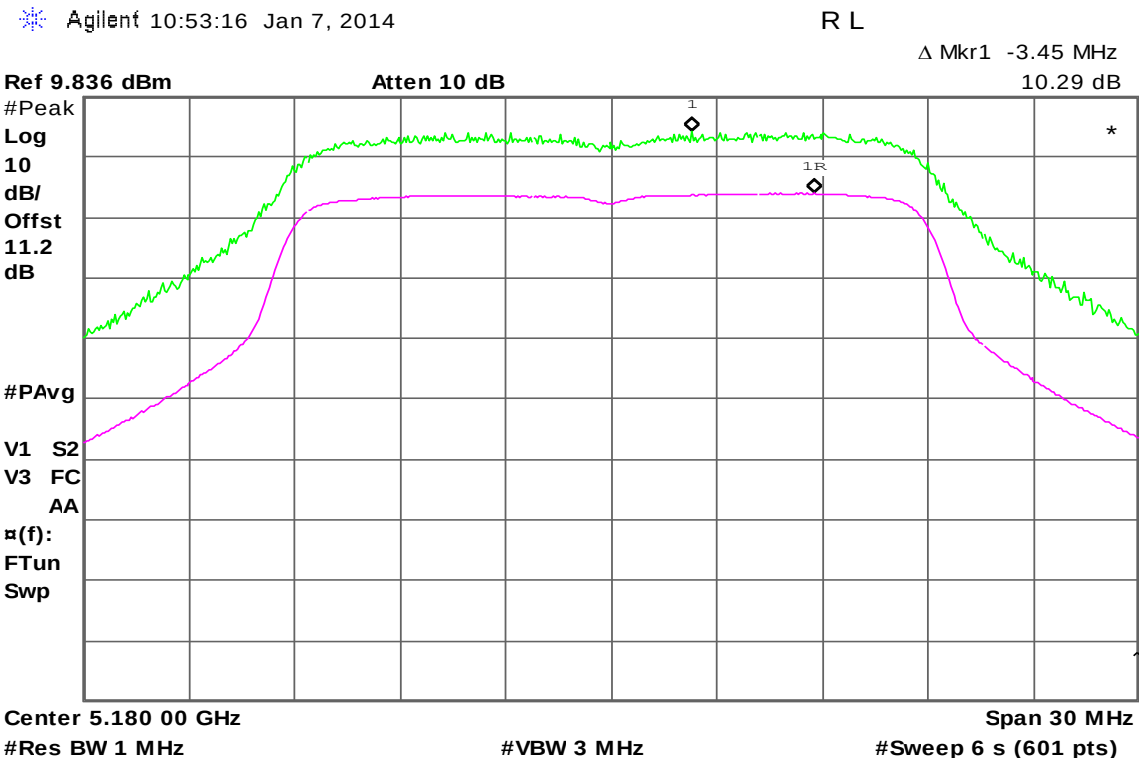


CH High

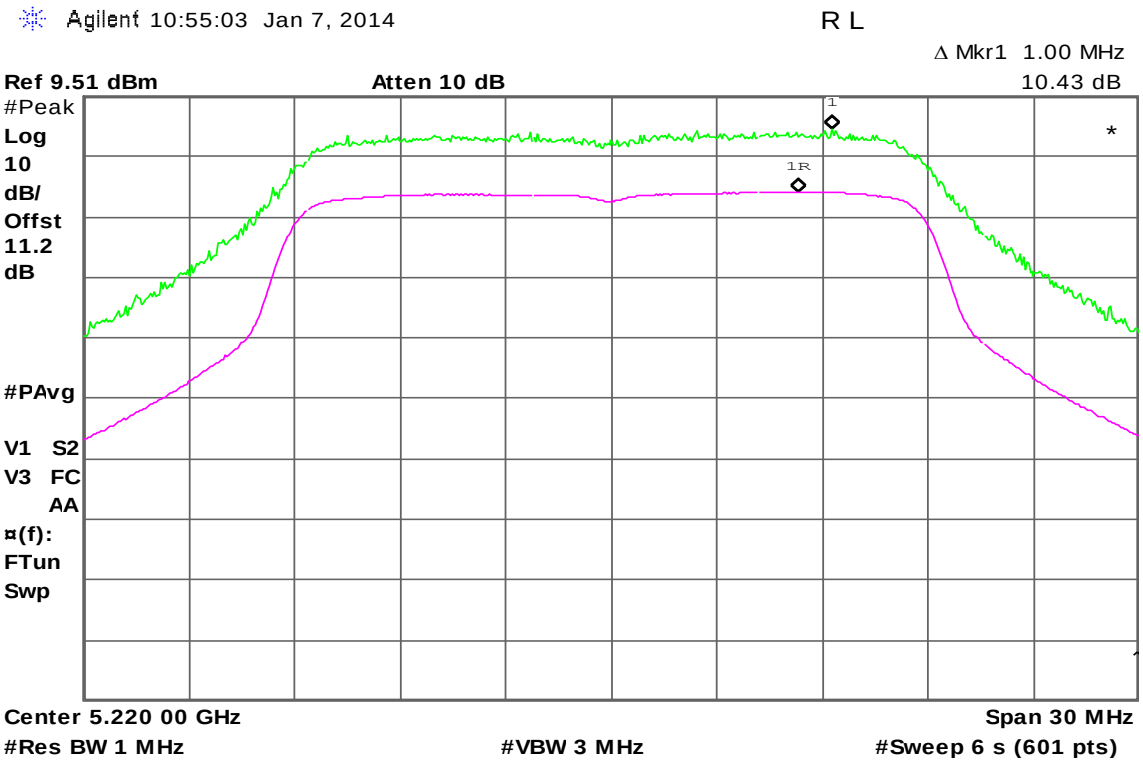

Agilent 18:36:39 Jan 6, 2014
R L
Δ Mkr1 900 kHz
10.51 dB
Ref 8.336 dBm
Atten 10 dB
#Peak
Log
10
dB/
Offst
11.2
dB
#PAvg
V1 S2
V3 FC
AA
¤(f):
FTun
Swp
1
1R
*
Center 5.240 00 GHz
Span 30 MHz
#Res BW 1 MHz
#VBW 3 MHz
#Sweep 6 s (601 pts)

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

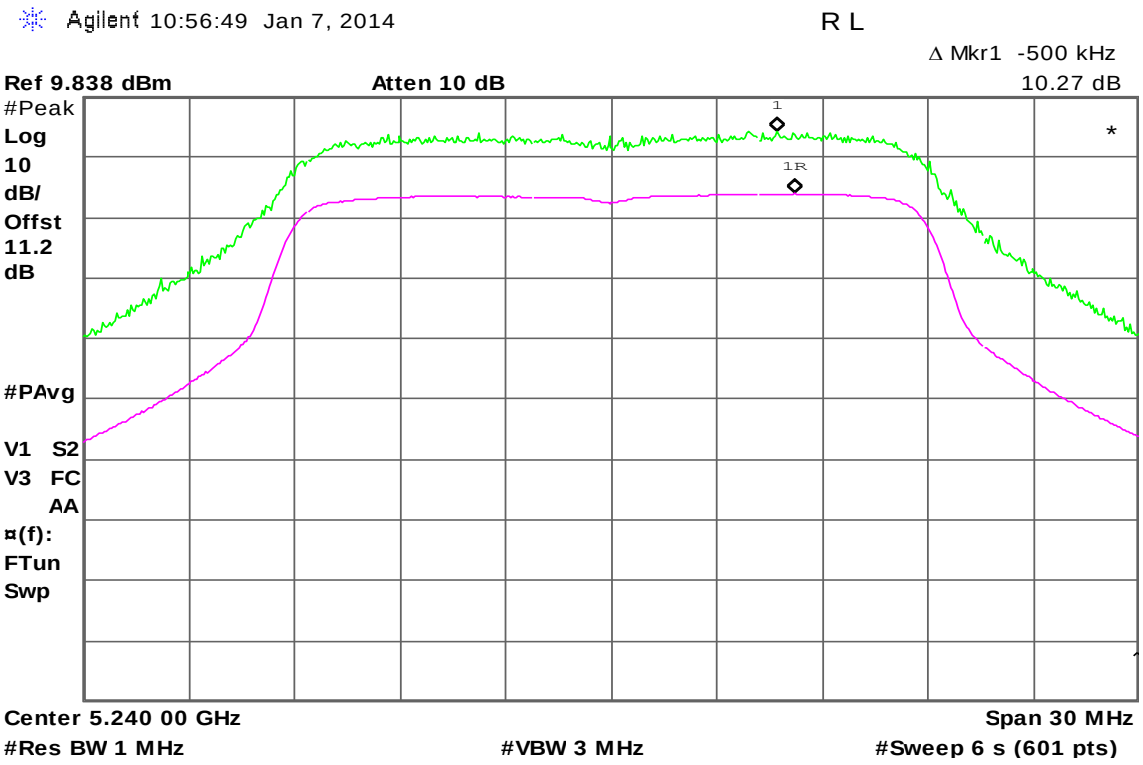
CH Low



CH Mid

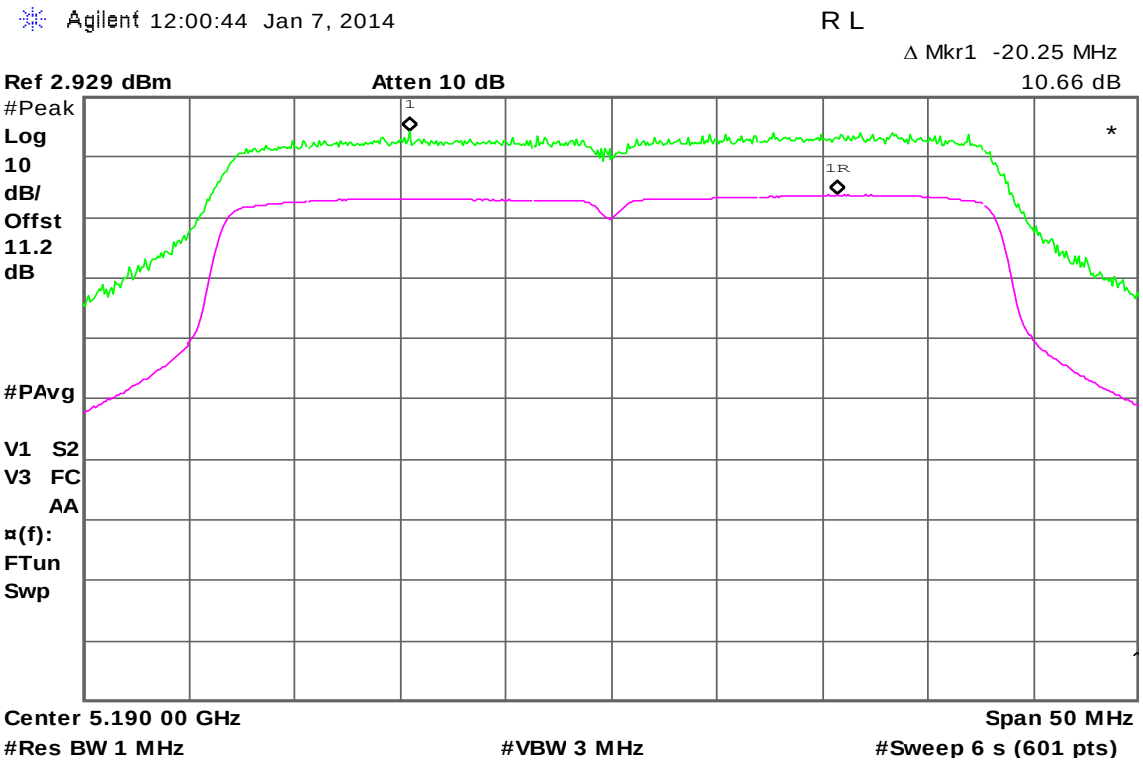


CH High

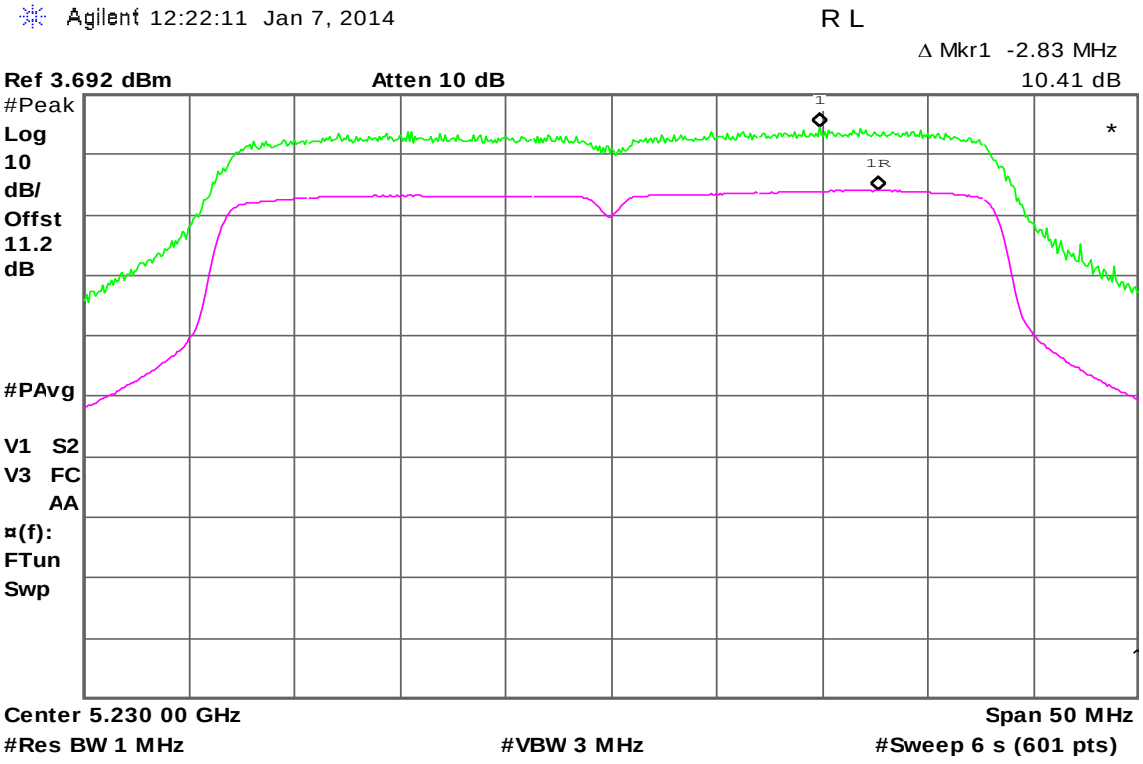

Agilent 10:56:49 Jan 7, 2014
R L
Δ Mkr1 -500 kHz
10.27 dB
Ref 9.838 dBm
Atten 10 dB
#Peak
Log
10
dB/
Offst
11.2
dB
#PAvg
V1 S2
V3 FC
AA
¤(f):
FTun
Swp
1
1R
*
Center 5.240 00 GHz
Span 30 MHz
#Res BW 1 MHz
#VBW 3 MHz
#Sweep 6 s (601 pts)

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

CH Low

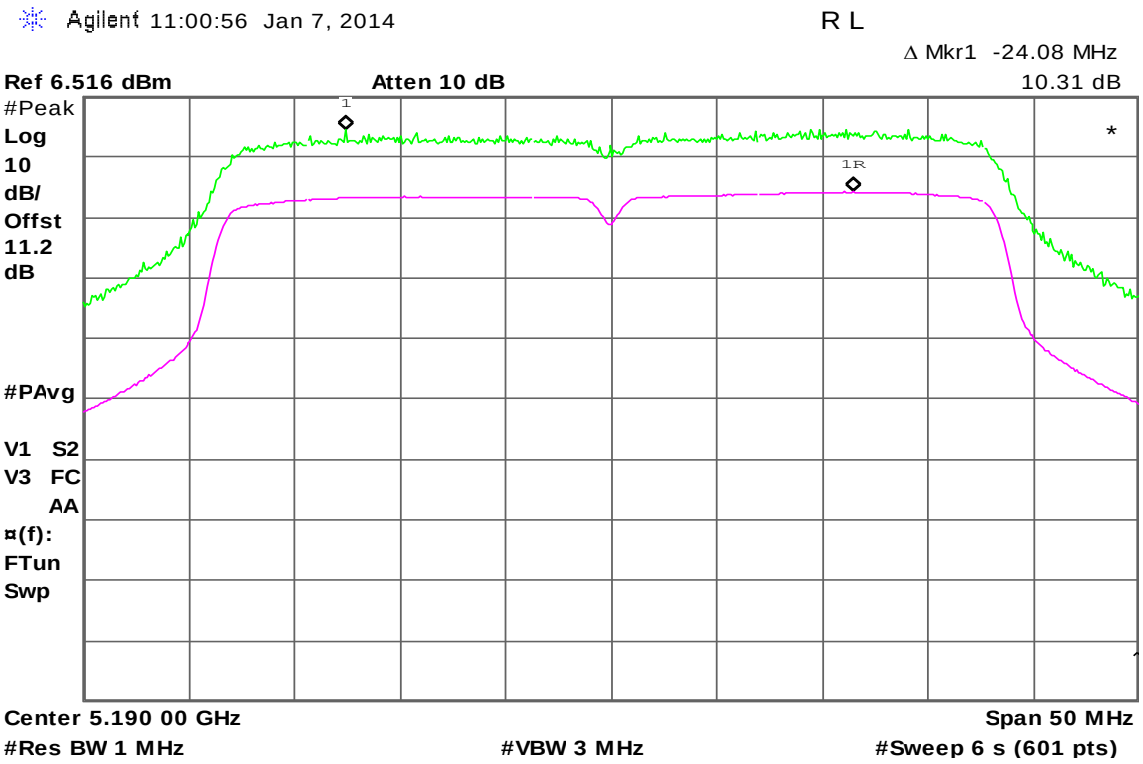


CH High

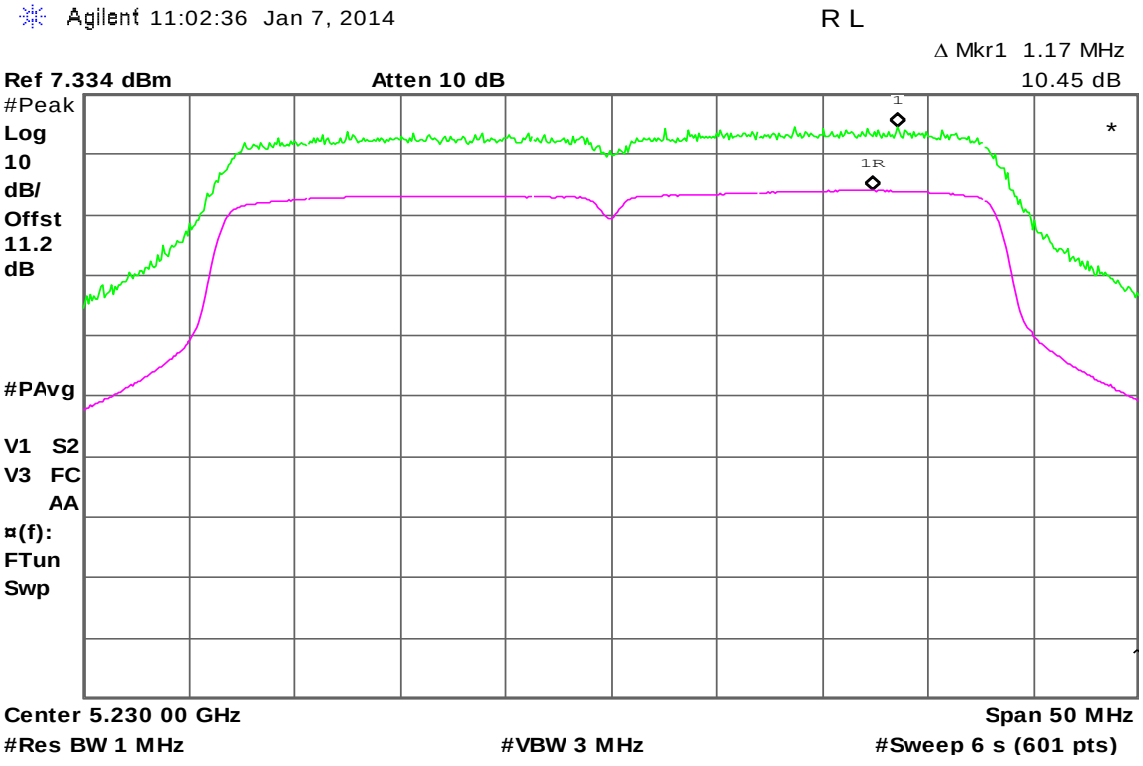


IEEE 802.11n HT 40 mode / 5190 ~ 5230MHz / Chain 1

CH Low



CH High



7.7 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)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

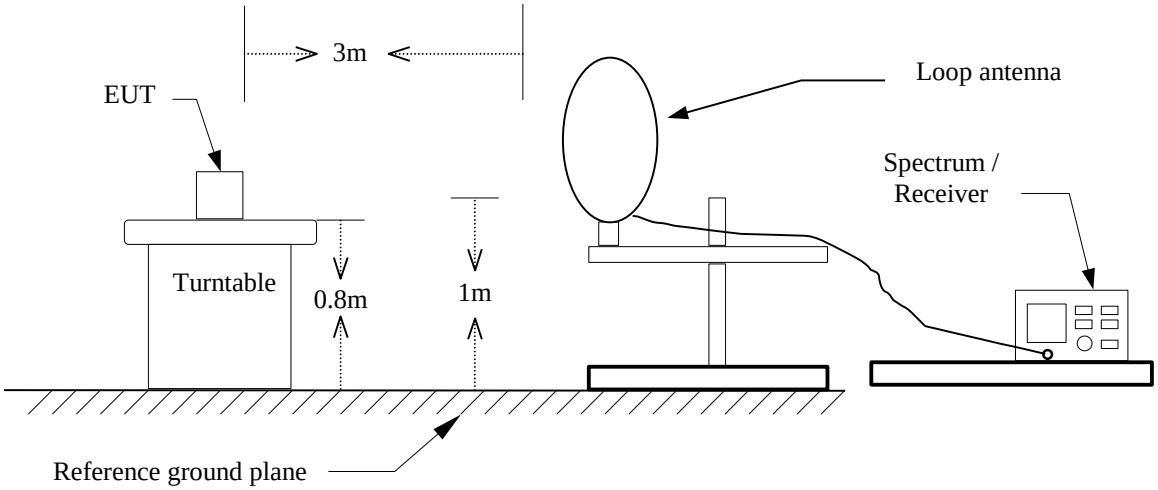
Remark: *Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of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

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

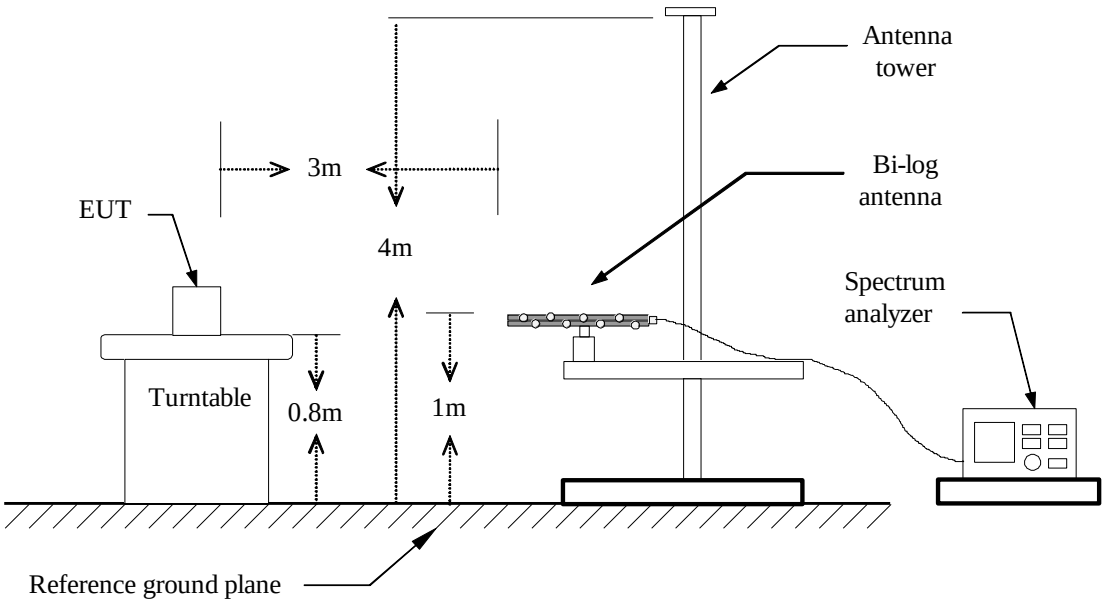
Frequency (MHz)	Field Strength (μV/m at 3-meter)	Field Strength (dBμV/m at 3-meter)
0.009 - 0.490	2400/F(kHz) +80	20LOG((2400/F(kHz))+80)
0.490 - 1.705	24000/F(kHz) +40	20LOG((24000/F(kHz))+40)
1.705 – 30.0	30	69.54
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

Test Configuration

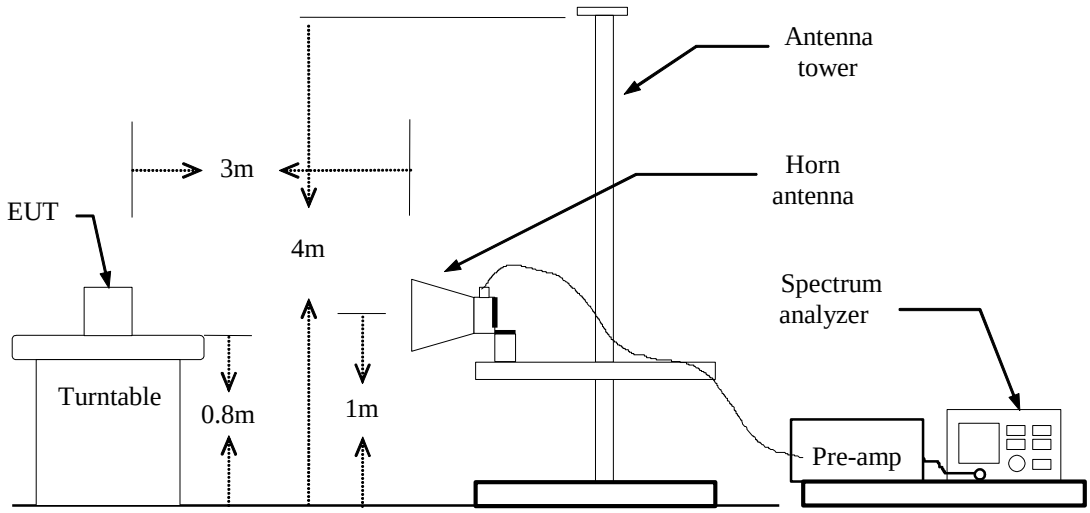
9kHz ~ 30MHz



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=300Hz / Sweep=AUTO
7. Repeat above procedures until the measurements for all frequencies are complete.

Below 1 GHz

Operation Mode: Normal Link **Test Date:** December 30, 2013

Temperature: 27℃ **Tested by:** Rex Huang

Humidity: 53% 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)
39.7000	53.75	-16.98	36.77	40.00	-3.23	QP	V
65.5667	59.88	-23.17	36.71	40.00	-3.29	QP	V
101.1333	58.06	-20.72	37.34	43.50	-6.16	peak	V
154.4832	54.83	-18.11	36.72	43.50	-6.78	peak	V
337.1666	42.83	-15.50	27.33	46.00	-18.67	peak	V
479.4333	39.07	-12.17	26.90	46.00	-19.10	peak	V
39.7000	48.75	-16.98	31.77	40.00	-8.23	peak	H
104.3667	55.43	-20.14	35.29	43.50	-8.21	peak	H
172.2667	52.99	-18.93	34.06	43.50	-9.44	peak	H
324.2333	50.70	-15.82	34.88	46.00	-11.12	peak	H
720.3167	37.91	-8.42	29.49	46.00	-16.51	peak	H
844.8000	36.58	-6.84	29.74	46.00	-16.26	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 / CH 5180 **Test Date:** February 5, 2014

Temperature: 27℃ **Tested by:** Rex Huang

Humidity: 53% RH **Polarity:** Ver. / Hor.

Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
2948.333	52.19	-2.50	49.69	74.00	-24.31	peak	V
N/A							
2913.333	51.99	-2.58	49.41	74.00	-24.59	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 / CH 5220 **Test Date:** February 5, 2014

Temperature: 27℃ **Tested by:** Rex Huang

Humidity: 53% RH **Polarity:** Ver. / Hor.

Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
2808.333	51.89	-2.81	49.08	74.00	-24.92	peak	V
N/A							
2843.333	52.72	-2.73	49.99	74.00	-24.01	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 / CH 5240 **Test Date:** February 5, 2014

Temperature: 27℃ **Tested by:** Rex Huang

Humidity: 53% RH **Polarity:** Ver. / Hor.

Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
2866.667	52.53	-2.68	49.85	74.00	-24.15	peak	V
N/A							
3391.667	52.77	-0.89	51.88	74.00	-22.12	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 mode / CH 5180 **Test Date:** January 20, 2014

Temperature: 27℃ **Tested by:** Rex Huang

Humidity: 53% RH **Polarity:** Ver. / Hor.

Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
2715.000	51.63	-3.01	48.62	74.00	-25.38	peak	V
N/A							
2808.333	51.90	-2.81	49.09	74.00	-24.91	peak	H
10366.667	42.41	13.32	55.73	74.00	-18.27	peak	H
10366.667	38.14	13.32	51.46	54.00	-2.54	AVG	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 mode / CH 5220 **Test Date:** January 20, 2014

Temperature: 27°C **Tested by:** Rex Huang

Humidity: 53% RH **Polarity:** Ver. / Hor.

Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
2598.333	52.11	-3.27	48.84	74.00	-25.16	peak	V
N/A							
2761.667	52.72	-2.91	49.81	74.00	-24.19	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 mode / CH 5240 **Test Date:** January 20, 2014

Temperature: 27°C **Tested by:** Rex Huang

Humidity: 53% RH **Polarity:** Ver. / Hor.

Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
2866.667	52.39	-2.68	49.71	74.00	-24.29	peak	V
N/A							
2901.667	51.88	-2.60	49.28	74.00	-24.72	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 mode / CH 5190 **Test Date:** January 20, 2014

Temperature: 27℃ **Tested by:** Rex Huang

Humidity: 53% RH **Polarity:** Ver. / Hor.

Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
2855.000	51.70	-2.71	48.99	74.00	-25.01	peak	V
N/A							
2925.000	52.19	-2.55	49.64	74.00	-24.36	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 mode / CH 5230 **Test Date:** January 20, 2014

Temperature: 27°C **Tested by:** Rex Huang

Humidity: 53% RH **Polarity:** Ver. / Hor.

Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
2983.333	51.67	-2.43	49.24	74.00	-24.76	peak	V
N/A							
2890.000	51.91	-2.63	49.28	74.00	-24.72	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).*

7.8 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

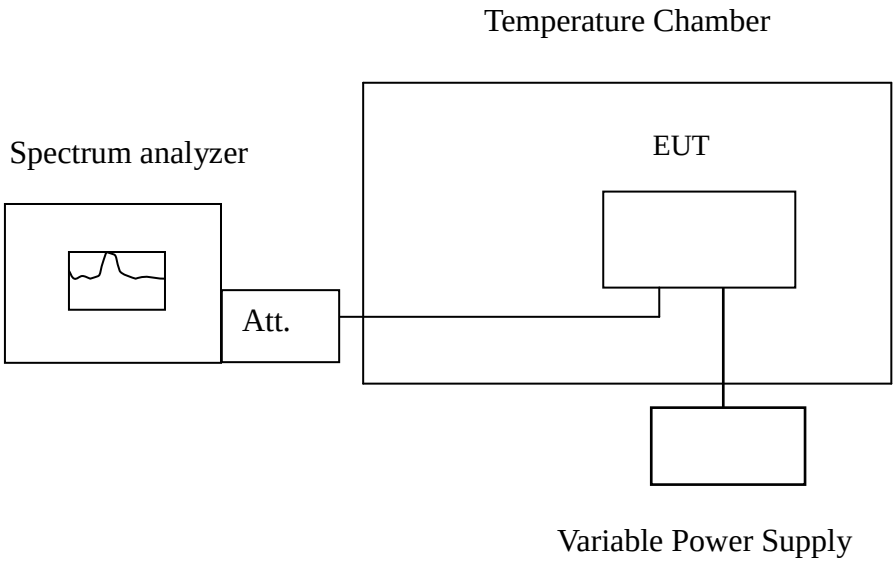
Not applicable, because EUT not connect to AC Main Source direct.

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 ~ 5240 MHz:

CH Low

Operating Frequency: 5180 MHz				
Environment Temperature (°C)	Voltage (V)	Measured Frequency (MHz)	Limit Range	Test Result
50	48	5180.004891	5150~5250	Pass
40	48	5179.977760	5150~5250	Pass
30	48	5179.970219	5150~5250	Pass
20	48	5179.985735	5150~5250	Pass
10	48	5179.989836	5150~5250	Pass
0	48	5180.004991	5150~5250	Pass
-10	48	5179.997624	5150~5250	Pass
-20	48	5179.987446	5150~5250	Pass

Operating Frequency: 5180 MHz				
Environment Temperature (°C)	Voltage (V)	Measured Frequency (MHz)	Limit Range	Test Result
20	52.8	5179.994267	5150~5250	Pass
	48	5180.016892	5150~5250	Pass
	43.2	5179.973131	5150~5250	Pass

CH High

Operating Frequency: 5240 MHz				
Environment Temperature (°C)	**Voltage (V)**	**Measured Frequency (MHz)**	**Limit Range**	**Test Result**
50	48	5239.989419	5150~5250	Pass
40	48	5240.020681	5150~5250	Pass
30	48	5240.003290	5150~5250	Pass
20	48	5239.970001	5150~5250	Pass
10	48	5239.998110	5150~5250	Pass
0	48	5240.018288	5150~5250	Pass
-10	48	5240.002642	5150~5250	Pass
-20	48	5239.977821	5150~5250	Pass

Operating Frequency: 5240 MHz				
Environment Temperature (°C)	**Voltage (V)**	**Measured Frequency (MHz)**	**Limit Range**	**Test Result**
20	52.8	5240.017469	5150~5250	Pass
	48	5239.996448	5150~5250	Pass
	43.2	5239.988832	5150~5250	Pass

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

CH Low

Operating Frequency: 5180 MHz				
Environment Temperature (°C)	**Voltage (V)**	**Measured Frequency (MHz)**	**Limit Range**	**Test Result**
50	48	5179.997416	5150~5250	Pass
40	48	5179.979583	5150~5250	Pass
30	48	5179.979588	5150~5250	Pass
20	48	5179.998196	5150~5250	Pass
10	48	5180.003426	5150~5250	Pass
0	48	5179.982241	5150~5250	Pass
-10	48	5179.986851	5150~5250	Pass
-20	48	5179.990860	5150~5250	Pass

Operating Frequency: 5180 MHz				
Environment Temperature (°C)	**Voltage (V)**	**Measured Frequency (MHz)**	**Limit Range**	**Test Result**
20	52.8	5179.970218	5150~5250	Pass
	48	5180.014203	5150~5250	Pass
	43.2	5180.017003	5150~5250	Pass

CH High

Operating Frequency: 5240 MHz				
Environment Temperature (°C)	**Voltage (V)**	**Measured Frequency (MHz)**	**Limit Range**	**Test Result**
50	48	5239.994386	5150~5250	Pass
40	48	5240.004706	5150~5250	Pass
30	48	5240.014982	5150~5250	Pass
20	48	5239.976917	5150~5250	Pass
10	48	5239.990378	5150~5250	Pass
0	48	5240.007698	5150~5250	Pass
-10	48	5239.971833	5150~5250	Pass
-20	48	5240.013293	5150~5250	Pass

Operating Frequency: 5240 MHz				
Environment Temperature (°C)	**Voltage (V)**	**Measured Frequency (MHz)**	**Limit Range**	**Test Result**
20	52.8	5239.998569	5150~5250	Pass
	48	5240.020281	5150~5250	Pass
	43.2	5240.001349	5150~5250	Pass

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

CH Low

Operating Frequency: 5190 MHz				
Environment Temperature (°C)	Voltage (V)	Measured Frequency (MHz)	Limit Range	Test Result
50	48	5190.014019	5150~5250	Pass
40	48	5189.974553	5150~5250	Pass
30	48	5189.977154	5150~5250	Pass
20	48	5189.991308	5150~5250	Pass
10	48	5190.000745	5150~5250	Pass
0	48	5189.983833	5150~5250	Pass
-10	48	5190.014652	5150~5250	Pass
-20	48	5189.982773	5150~5250	Pass

Operating Frequency: 5190 MHz				
Environment Temperature (°C)	Voltage (V)	Measured Frequency (MHz)	Limit Range	Test Result
20	52.8	5190.013612	5150~5250	Pass
	48	5189.970715	5150~5250	Pass
	43.2	5189.976504	5150~5250	Pass

CH High

Operating Frequency: 5230 MHz				
Environment Temperature (°C)	**Voltage (V)**	**Measured Frequency (MHz)**	**Limit Range**	**Test Result**
50	48	5230.001785	5150~5250	Pass
40	48	5229.970317	5150~5250	Pass
30	48	5230.012180	5150~5250	Pass
20	48	5230.016849	5150~5250	Pass
10	48	5230.015025	5150~5250	Pass
0	48	5230.016411	5150~5250	Pass
-10	48	5230.014393	5150~5250	Pass
-20	48	5229.988860	5150~5250	Pass

Operating Frequency: 5230 MHz				
Environment Temperature (°C)	**Voltage (V)**	**Measured Frequency (MHz)**	**Limit Range**	**Test Result**
20	52.8	5230.020234	5150~5250	Pass
	48	5229.970845	5150~5250	Pass
	43.2	5230.006929	5150~5250	Pass