



FCC 47 CFR PART 15 SUBPART E

for

POWERLINE WIFI EXTENDER

Model: PL62AC

Brand: SmartRG

Test Report Number:

C161114Z02-RP1-4

Issued Date: December 19, 2016

Issued for

SmartRG Inc.

**501 SE Columbia Shores Boulevard, Suite 500 Vancouver, Washington
98661 United States**

Issued by:

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TESTING CERT #2861.01

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Revision History

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	December 19, 2016	Initial Issue	ALL	Sabrina Wang



TABLE OF CONTENTS

1. TEST CERTIFICATION	4
2. EUT DESCRIPTION	5
3. TEST METHODOLOGY.....	8
3.1 EUT CONFIGURATION	8
3.2 EUT EXERCISE	8
3.3 GENERAL TEST PROCEDURES	8
3.4 FCC PART 15.205 RESTRICTED BANDS OF OPERATIONS	9
3.5 DESCRIPTION OF TEST MODES	10
4. SETUP OF EQUIPMENT UNDER TEST	12
4.1 DESCRIPTION OF SUPPORT UNITS.....	12
4.2 CONFIGURATION OF SYSTEM UNDER TEST	12
5. FACILITIES AND ACCREDITATIONS	13
5.1 FACILITIES	13
5.2 EQUIPMENT	13
5.3 ACCREDITATIONS	13
5.4 MEASUREMENT UNCERTAINTY	14
6. FCC PART 15 REQUIREMENTS	15
6.1 26dB EMISSION BANDWIDTH	15
6.2 6dB BANDWIDTH MEASUREMENT	36
6.3 ANTENNA GAIN	38
6.4 PEAK POWER	46
6.5 BAND EDGES MEASUREMENT	55
6.6 PEAK POWER SPECTAL DENSITY	75
6.7 RADIATED UNDESIRABLE EMISSION	101
6.8 CONDUCTED UNDESIRABLE EMISSION	149
6.9 POWERLINE CONDUCTED EMISSIONS	161
6.10 FREQUENCY STABILITY	165



1. TEST CERTIFICATION

Product	POWERLINE WIFI EXTENDER
Model	PL62AC
Brand	SmartRG
Tested	November 14~December 18, 2016
Applicant	SmartRG Inc. 501 SE Columbia Shores Boulevard, Suite 500 Vancouver, Washington 98661 United States
Manufacturer	SmartRG Inc. 501 SE Columbia Shores Boulevard, Suite 500 Vancouver, Washington 98661 United States

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

We hereby certify that:

Compliance Certification Services (Shenzhen) 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 C63.10: 2013** 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、FCC 14-30.

The TEST RESULTS of this report relate only to the tested sample identified in this report.

Approved by:

Sunday Hu
Supervisor of EMC Dept.
Compliance Certification Services (Shenzhen)
Inc.

Reviewed by:

Ruby Zhang
Supervisor of Report Dept.
Compliance Certification Services (Shenzhen)
Inc.



2. EUT DESCRIPTION

Product	POWERLINE WIFI EXTENDER
Model Number	PL62AC
Brand	SmartRG
Model Discrepancy	N/A
Serial Number	C161114Z02-RP1-4
Received Date	November 14, 2016
Power Supply	AC100-240V, 50/60Hz, 0.5A
Frequency Range	UNII Band I: IEEE 802.11a, 802.11n HT20 : 5180MHz ~ 5240MHz; IEEE 802.11n HT40: 5190MHz ~ 5230MHz IEEE 802.11ac 80: 5210MHz UNII Band II IEEE 802.11a, 802.11n HT20 : 5260MHz ~ 5320MHz IEEE 802.11n HT40: 5270MHz ~ 5310MHz IEEE 802.11ac 80: 5290MHz UNII Band III IEEE 802.11a, 802.11n HT20 : 5500MHz ~ 5700MHz IEEE 802.11n HT40: 5510MHz ~ 5670MHz IEEE 802.11ac 80: 5530MHz UNII Band IV IEEE 802.11a, 802.11n HT20 : 5745MHz ~ 5825MHz IEEE 802.11n HT40: 5755MHz ~ 5795MHz IEEE 802.11ac 80: 5775MHz
Transmit Power	UNII Band I: IEEE 802.11a: 11.67dBm IEEE 802.11n HT 20 MHz mode: 11.64dBm IEEE 802.11n HT 40 MHz mode: 14.62dBm IEEE 802.11ac 80: 14.47 dBm UNII Band II IEEE 802.11a: 15.94dBm IEEE 802.11n HT 20 MHz mode: 15.99dBm IEEE 802.11n HT 40 MHz mode: 13.95dBm IEEE 802.11ac 80: 13.85dBm UNII Band III IEEE 802.11a: 16.31dBm IEEE 802.11n HT 20 MHz mode: 16.31dBm IEEE 802.11n HT 40 MHz mode: 15.43dBm IEEE 802.11ac 80: 15.14dBm UNII Band IV IEEE 802.11a: 16.56dBm IEEE 802.11n HT 20 MHz mode: 16.15dBm IEEE 802.11n HT 40 MHz mode: 15.08dBm IEEE 802.11ac 80: 15.07dBm
Modulation Technique	OFDM (QPSK, BPSK, 16-QAM, 64-QAM)



Transmit Data Rate	IEEE 802.11a mode: 48, 36, 24, 18, 12, 9, 6Mbps IEEE802.11n HT20MHz mode(800ns GI): 6.5,13,19.5,26,39,52,58.5,65Mbps IEEE802.11n HT40MHz mode(800ns GI): 13.5,27,40.5,54,81,108,121.5,135Mbps IEEE802.11ac VHT80MHz mode(800ns GI): 29.3,58.5,84.8,117,175.5,234,263.3, 292.5,351,390Mbps
Number of Channels	UNII Band I: IEEE 802.11a, 802.11n HT20 : 4 Channels IEEE 802.11n HT40 : 2 Channels IEEE 802.11ac 80: 1 Channel UNII Band II IEEE 802.11a, 802.11n HT20 : 4 Channels IEEE 802.11n HT40: 2 Channels IEEE 802.11ac 80: 1 Channel UNII Band III IEEE 802.11a, 802.11n HT20 : 9 Channels IEEE 802.11n HT 40 MHz mode: 4 Channels IEEE 802.11ac 80: 1 Channel UNII Band IV IEEE 802.11a, 802.11n HT20 : 5 Channels IEEE 802.11n HT 40 MHz mode: 2 Channels IEEE 802.11ac 80: 1 Channel
Antenna Specification	Dipole Antenna with 4dBi gain (Max)
Channels Spacing	IEEE 802.11a, 802.11n HT20 : 20MHz IEEE 802.11n HT40: 40MHz IEEE 802.11ac 80: 80MHz
Temperature Range	0°C ~ +40°C
Hardware Version	A0
Software Version	1.0.0.2

Note: 1. The sample selected for test was engineering sample that approximated to production product and was provided by manufacturer.



Operation Frequency:

UNLICENSED NATIONAL INFORMATION INFRASTRUCTURE (U-NII)	
CHANNEL	MHz
36	5180
38	5190
40	5200
42	5210
44	5220
46	5230
48	5240
52	5260
54	5270
56	5280
58	5290
60	5300
62	5310
64	5320
100	5500
102	5510
104	5520
106	5530
108	5540
110	5550
112	5560
116	5580
132	5660
134	5670
136	5680
140	5700
149	5745
151	5755
153	5765
155	5775
157	5785
159	5795
161	5805
165	5825

Remark:

1. The sample selected for test was engineering sample that approximated to production product and was provided by manufacturer.
2. This submittal(s) (test report) is intended for **FCC ID: VW7PL62** filing to comply with Section 15.407 of the FCC Part 15, Subpart E Rules and FCC 14-30.



3. TEST METHODOLOGY

Both conducted and radiated testing was performed according to the procedures in ANSI C63.10. Radiated testing was performed at an antenna to EUT distance 3 meters.

The tests documented in this report were performed in accordance with ANSI C63.10: 2013 and FCC CFR 47 Part 15.207, 15.209, 15.407 and FCC 14-30.

Radio testing was performed according to KDB DA 02-2138, KDB 789033 D02, KDB 905462 D06;

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 C63.10, 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 (below 1GHz) /1.5m (Above 1GHz) 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 C63.10.



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 is a 2x2 configuration spatial MIMO (2TX & 2RX) without beam forming function. Software used to control the EUT for staying in continuous transmitting mode was programmed.

Test Item	Test mode	Worse mode
Conducted Emission	Mode 1: RJ45 1000Mbps 10%	☒
Radiated Emission	Mode 1: TX	☒

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

UNII Band I:

IEEE 802.11a for 5180 ~ 5240MHz:

Channel Low (5180MHz), Channel Mid (5200MHz) 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 (5200MHz) and Channel High (5240MHz) with 6.5Mbps data rate were chosen for full testing.

IEEE 802.11n HT 40 MHz Channel for 5190 ~ 5230MHz:

Channel Low (5190MHz) and Channel High (5230MHz) with 13.5Mbps data rate were chosen for full testing.

IEEE 802.11ac 80 Channel for 5210MHz:

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

UNII Band II:

IEEE 802.11a for 5260 ~ 5320MHz:

Channel Low (5260MHz), Channel Mid (5300MHz) and Channel High (5320MHz) with 6Mbps data rate were chosen for full testing.

IEEE 802.11n HT 20 MHz for 5260 ~ 5320MHz:

Channel Low (5260MHz), Channel Mid (5300MHz) and Channel High (5320MHz) with 6.5Mbps data rate were chosen for full testing.

IEEE 802.11n HT 40 MHz Channel for 5270~ 5310MHz:

Channel Low (5270MHz) and Channel High (5310MHz) with 13.5Mbps data rate were chosen for full testing.

IEEE 802.11ac 80 Channel for 5290MHz:

Channel Low (5290MHz) with 13.5Mbps data rate were chosen for full testing.



UNII Band III:

IEEE 802.11a for 5500 ~ 5700MHz:

Channel Low (5500MHz), Channel Mid (5580MHz) and Channel High (5700MHz) with 6Mbps data rate were chosen for full testing.

IEEE 802.11n HT 20 MHz for 5500 ~ 5700MHz:

Channel Low (5500MHz), Channel Mid (5580MHz) and Channel High (5700MHz) with 6.5Mbps data rate were chosen for full testing.

IEEE 802.11n HT 40 MHz Channel for 5510~ 5670MHz:

Channel Low (5510MHz) and Channel High (5670MHz) with 13.5Mbps data rate were chosen for full testing.

IEEE 802.11ac 80 Channel for 5530MHz:

Channel Low (5530MHz) with 13.5Mbps data rate were chosen for full testing.

UNII Band IV:

IEEE 802.11a for 5745 ~ 5825MHz:

Channel Low (5745MHz), Channel Mid (5785MHz) and Channel High (5825MHz) with 6Mbps data rate were chosen for full testing.

IEEE 802.11n HT 20 MHz for 5745 ~ 5825MHz:

Channel Low (5745MHz), Channel Mid (5785MHz) and Channel High (5825MHz) with 6.5Mbps data rate were chosen for full testing.

IEEE 802.11n HT 40 MHz Channel for 5755~ 5795MHz:

Channel Low (5755MHz) and Channel High (5795MHz) with 13.5Mbps data rate were chosen for full testing.

IEEE 802.11ac 80 Channel for 5775MHz:

Channel Low (5775MHz) with 13.5Mbps data rate were chosen for full testing.



4. SETUP OF EQUIPMENT UNDER TEST

4.1 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

No.	Equipment	Model No.	Serial No.	FCC ID	Brand	Data Cable	Power Cord
1	Notebook	Probook 5310M	N/A	DoC	HP	Unshielded 1.80m	Shielded 1.80m (AC cable) Unshielded 1.70m (DC cable)

Note:

Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

4.2 CONFIGURATION OF SYSTEM UNDER TEST

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



5. FACILITIES AND ACCREDITATIONS

5.1 FACILITIES

All measurement facilities used to collect the measurement data are located at **No.10-1 Mingkeda Logistics park, No.18, Huanguan South Rd., Guan Lan Town, Baoan District, Shenzhen, China**

The sites are constructed in conformance with the requirements of ANSI C63.10, ANSI C63.7 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 ACCREDITATIONS

Our laboratories are accredited and approved by the following accreditation body according to ISO/IEC 17025.

USA	A2LA
China	CNAS

The measuring facility of laboratories has been authorized or registered by the following approval agencies.

USA	FCC
Japan	VCCI(C-4815, R-4320, T-2317, G-10624)
Canada	INDUSTRY CANADA

Copies of granted accreditation certificates are available for downloading from our web site, <http://www.ccssz.com>



5.4 MEASUREMENT UNCERTAINTY

Parameter	Uncertainty
RF frequency	$\pm 1 \times 10^{-5}$
RF power conducted	$\pm 1,5 \text{ dB}$
RF power radiated	$\pm 6 \text{ dB}$
Spurious emissions, conducted	$\pm 3 \text{ dB}$
Spurious emissions, radiated	$\pm 6 \text{ dB}$
Humidity	$\pm 5 \%$
Temperature	$\pm 1^{\circ}\text{C}$
Time	$\pm 10 \%$

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



6. FCC PART 15 REQUIREMENTS

6.1 26dB EMISSION BANDWIDTH

6.1.1 LIMIT

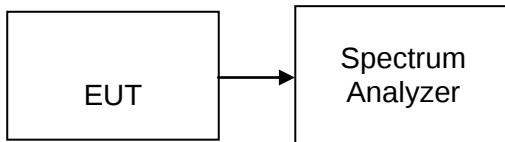
According to §15.403(c), for purposes of this subpart the emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 26 dB down relative to the maximum level of the modulated 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.

6.1.2 MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Last Calibration	Due Calibration
Spectrum Analyzer	Agilent	N9010A	MY52221469	02/21/2016	02/20/2017

Remark: Each piece of equipment is scheduled for calibration once a year.

6.1.3 TEST CONFIGURATION



6.1.4 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 >26dB bandwidth, Detector = Peak, and Sweep = auto.
4. Mark the peak frequency and -26dB (upper and lower) frequency.
5. Repeat until all the rest channels were investigated.



6.1.5 TEST RESULTS

No non-compliance noted

Test Data

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

Channel	Frequency (MHz)	26dB Bandwidth(B) (MHz)
Low	5180	21.47
Mid	5200	21.53
High	5240	21.46

Test mode: IEEE 802.11a mode / 5260 ~ 5320MHz

Channel	Frequency (MHz)	26dB Bandwidth(B) (MHz)
Low	5260	21.60
Mid	5300	21.32
High	5320	21.51

Test mode: IEEE 802.11a mode / 5500 ~ 5700MHz

Channel	Frequency (MHz)	26dB Bandwidth(B) (MHz)
Low	5500	21.54
Mid	5580	21.40
High	5700	21.51

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

Channel	Frequency (MHz)	26dB Bandwidth(B) (MHz)
Low	5180	21.90
Mid	5200	21.89
High	5240	21.83

Test mode: IEEE 802.11n HT 20 MHz mode / 5260 ~ 5320MHz

Channel	Frequency (MHz)	26dB Bandwidth(B) (MHz)
Low	5260	21.82
Mid	5300	21.75
High	5320	21.92

Test mode: IEEE 802.11n HT 20 MHz mode / 5500 ~ 5700MHz

Channel	Frequency (MHz)	26dB Bandwidth(B) (MHz)
Low	5500	21.91
Mid	5580	21.86
High	5700	21.89

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

Channel	Frequency (MHz)	26dB Bandwidth(B) (MHz)
Low	5190	40.64
High	5230	40.51

Test mode: IEEE 802.11n HT 40 MHz mode / 5270 ~ 5310MHz

Channel	Frequency (MHz)	26dB Bandwidth(B) (MHz)
Low	5270	40.51
High	5310	40.30

Test mode: IEEE 802.11n HT 40 MHz mode / 5510 ~ 5670MHz

Channel	Frequency (MHz)	26dB Bandwidth(B) (MHz)
Low	5510	40.34
Mid	5550	40.26
High	5670	40.12



Test mode: IEEE 802.11ac 80 mode / 5210MHz

Channel	Frequency (MHz)	26dB Bandwidth(B) (MHz)
	5210	81.65

Test mode: IEEE 802.11ac 80 mode / 5290MHz

Channel	Frequency (MHz)	26dB Bandwidth(B) (MHz)
	5290	82.03

Test mode: IEEE 802.11ac 80 mode / 5530MHz

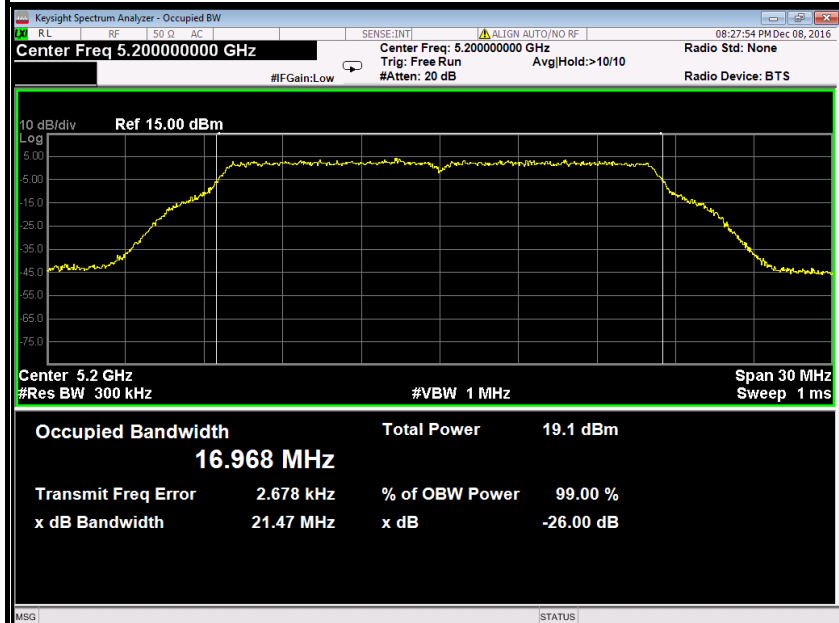
Channel	Frequency (MHz)	26dB Bandwidth(B) (MHz)
	5530	81.84



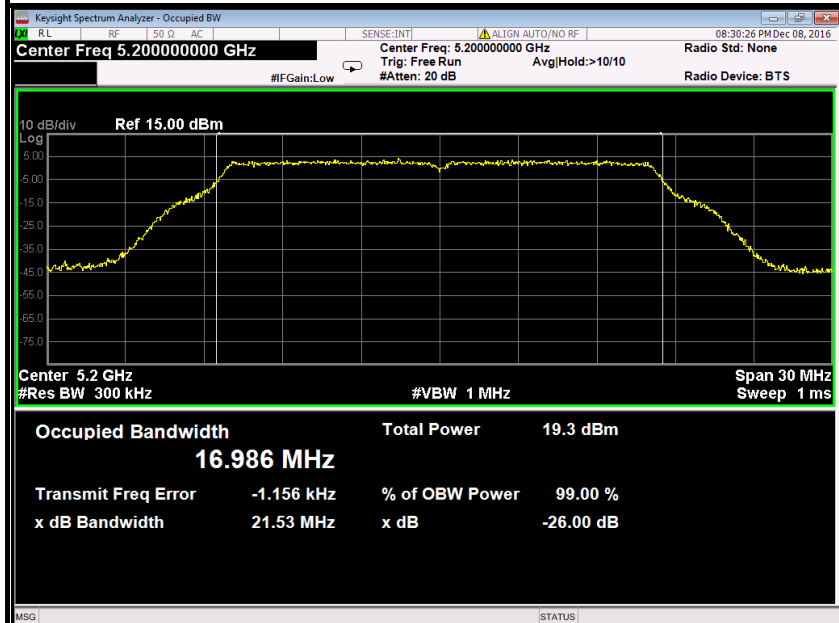
Test Plot

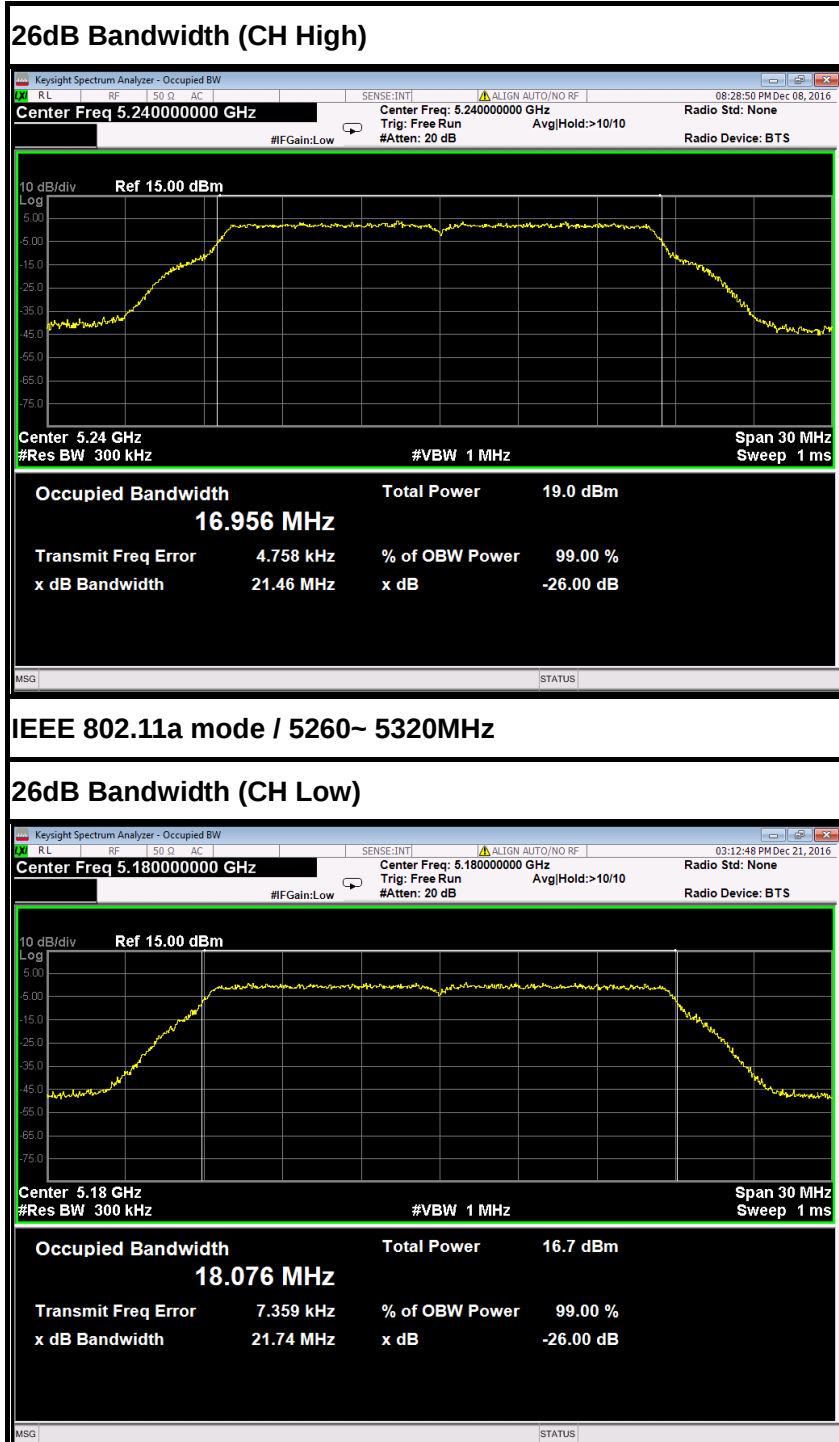
IEEE 802.11a mode / 5180 ~ 5240MHz

26dB Bandwidth (CH Low)



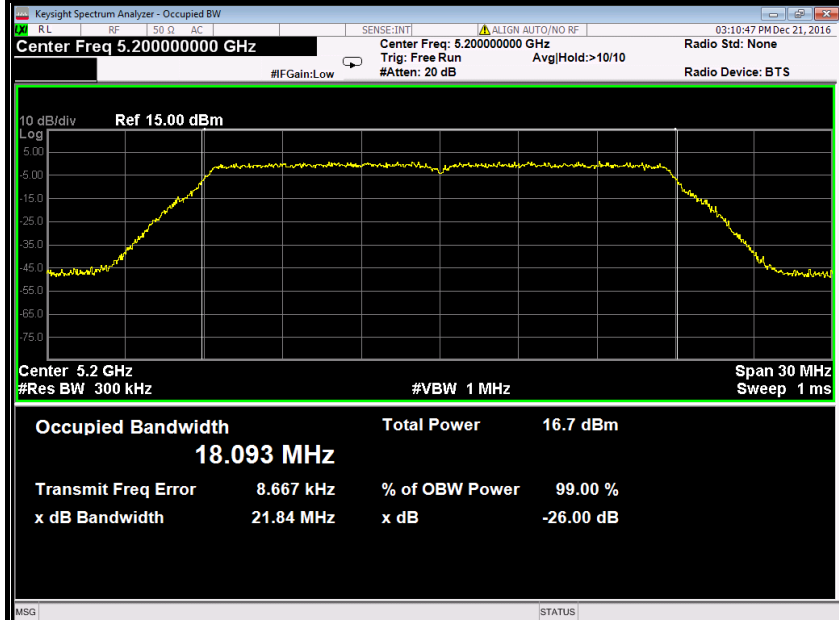
26dB Bandwidth (CH Mid)



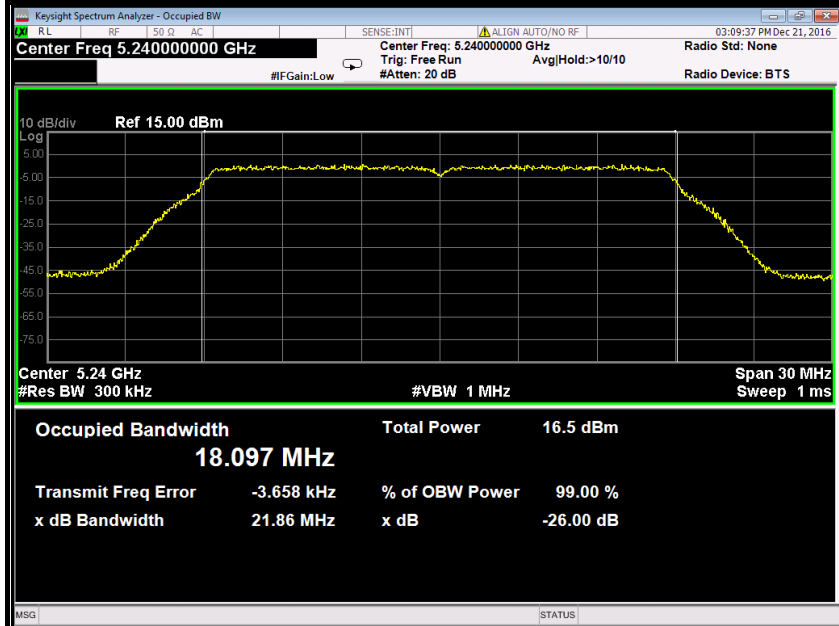




26dB Bandwidth (CH Mid)



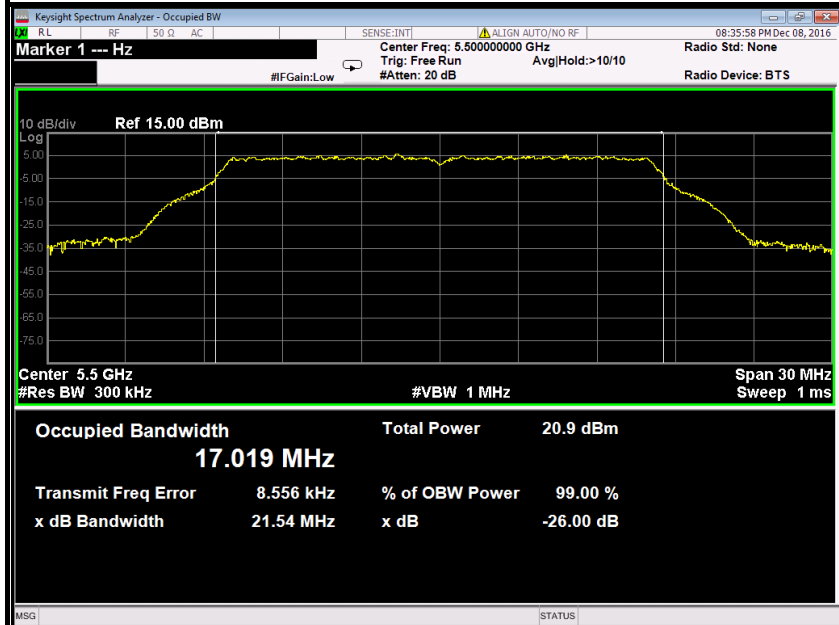
26dB Bandwidth (CH High)



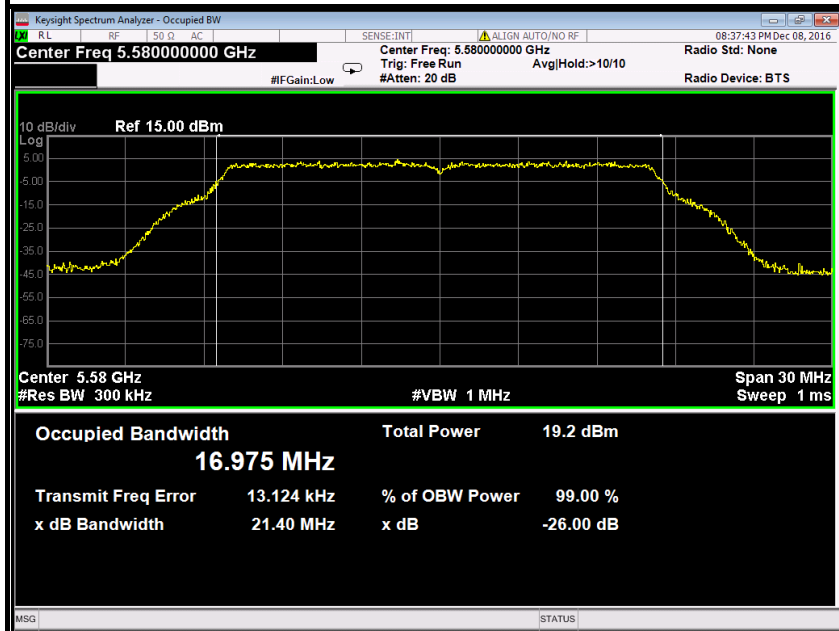


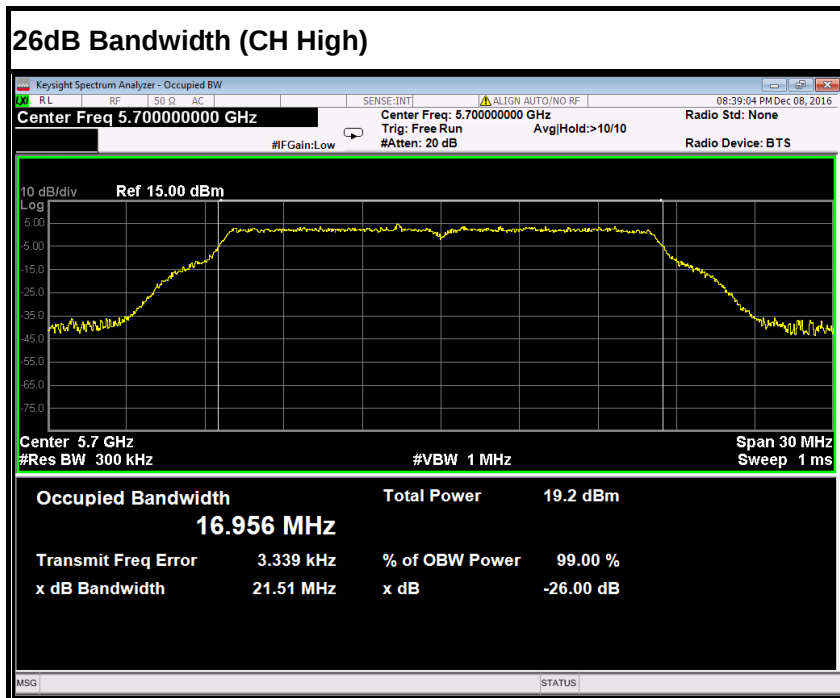
IEEE 802.11a mode / 5500 ~ 5700MHz

26dB Bandwidth (CH Low)



26dB Bandwidth (CH Mid)

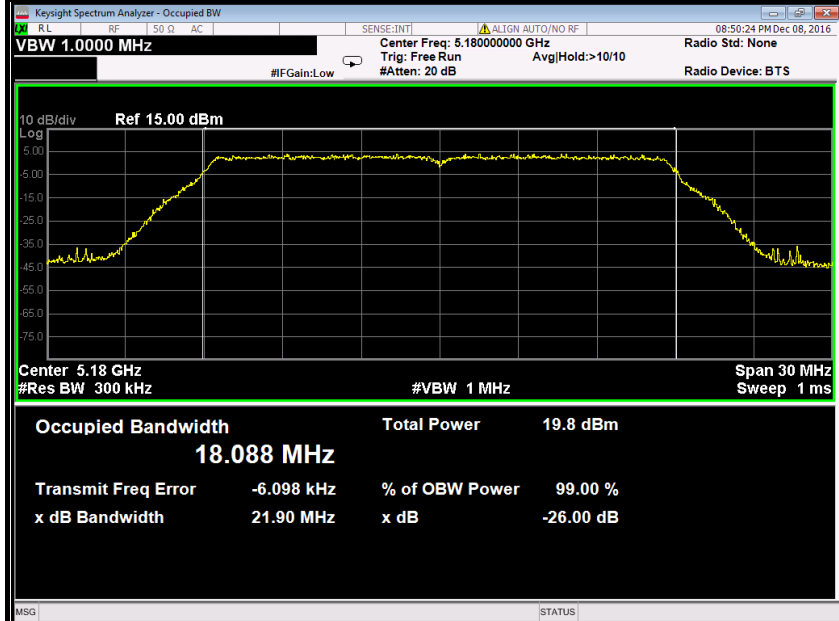




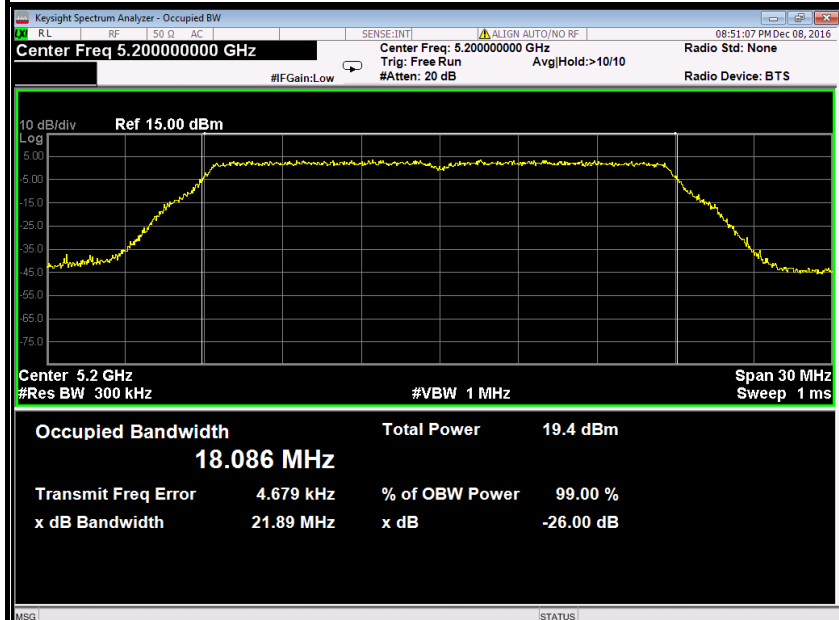


IEEE 802.11n HT 20 MHz mode / 5180 ~ 5240MHz

26dB Bandwidth (CH Low)

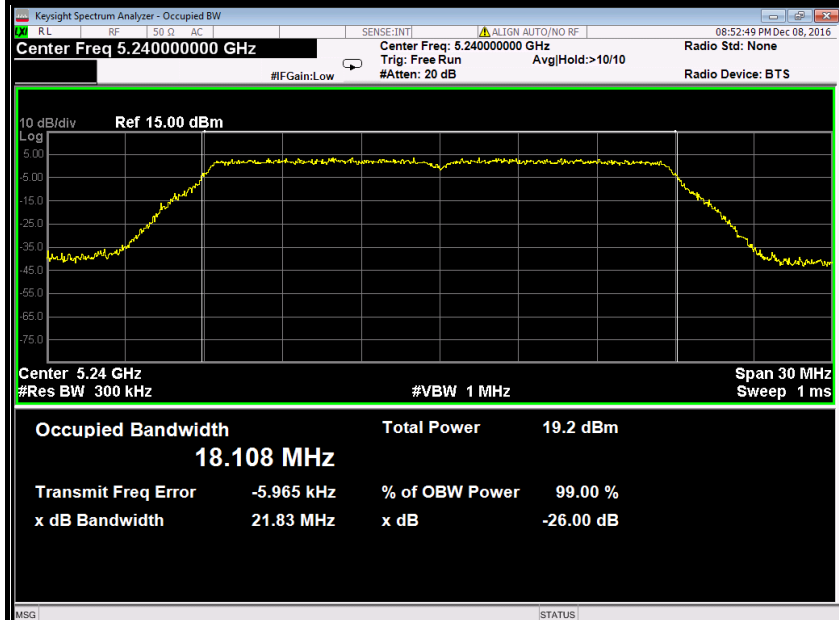


26dB Bandwidth (CH Mid)



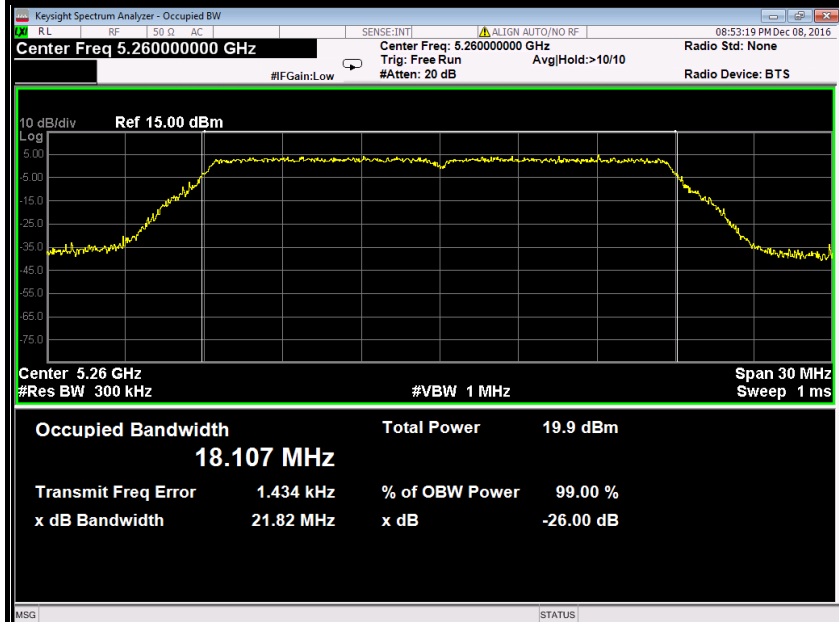


26dB Bandwidth (CH High)



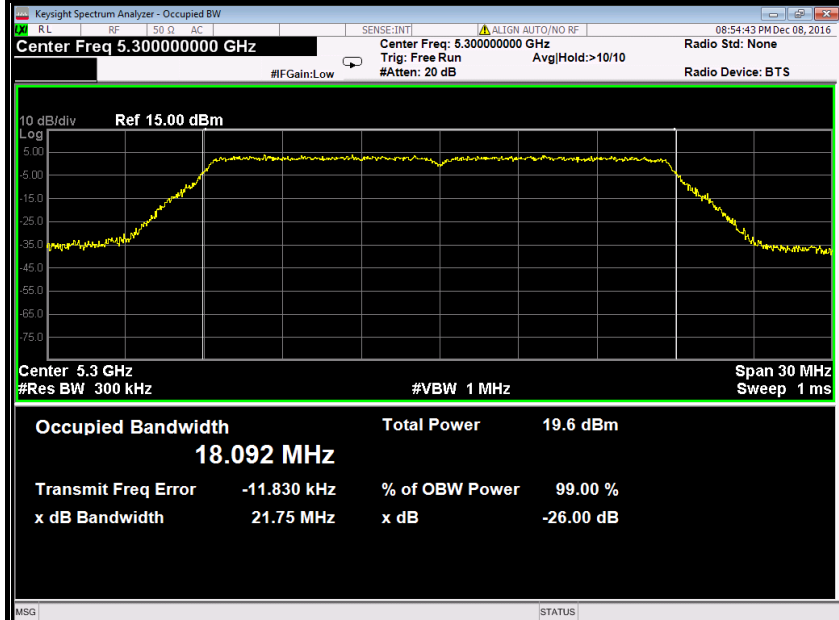
IEEE 802.11n HT 20 MHz mode / 5260~ 5320MHz

26dB Bandwidth (CH Low)

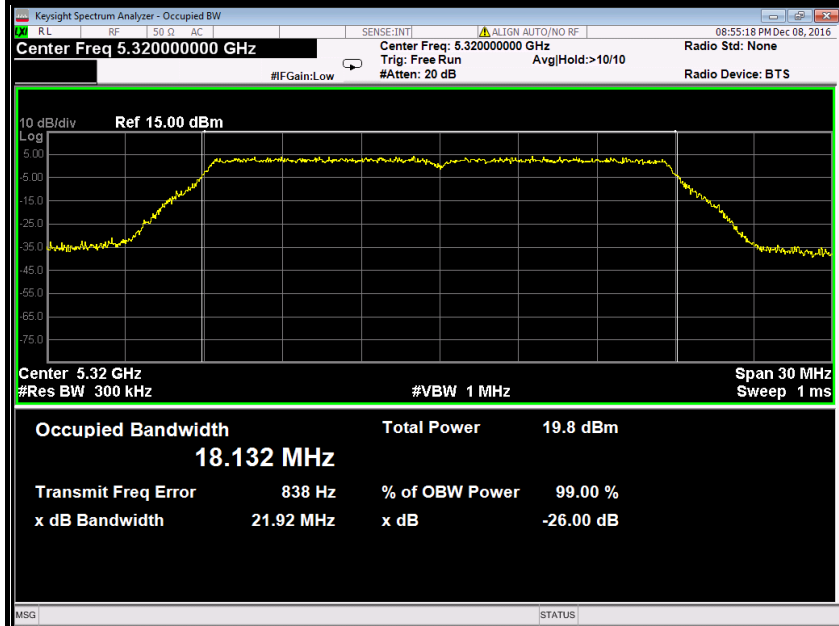




26dB Bandwidth (CH Mid)



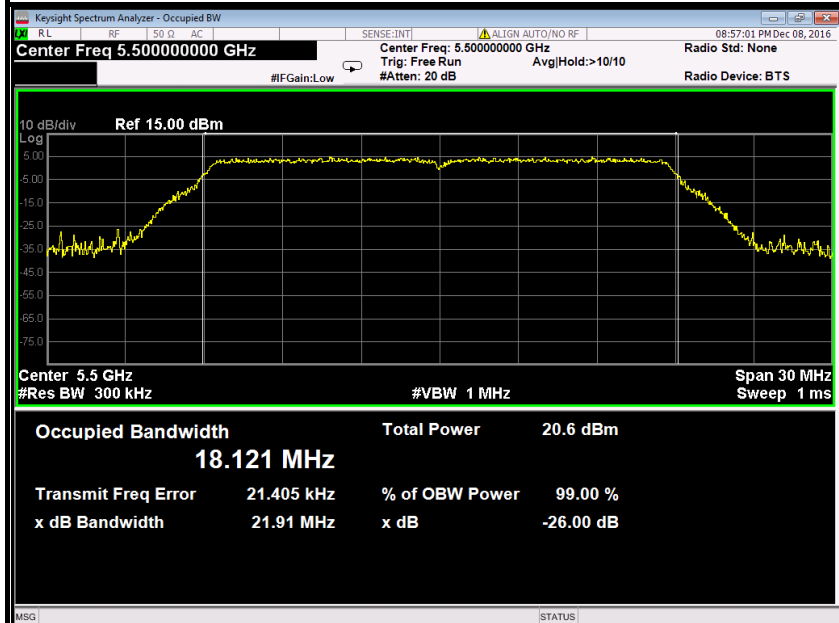
26dB Bandwidth (CH High)



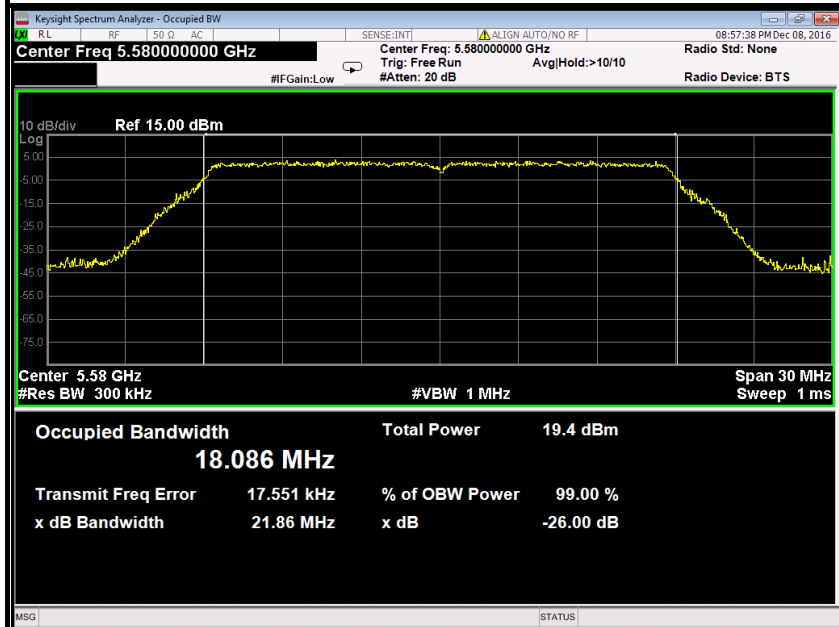


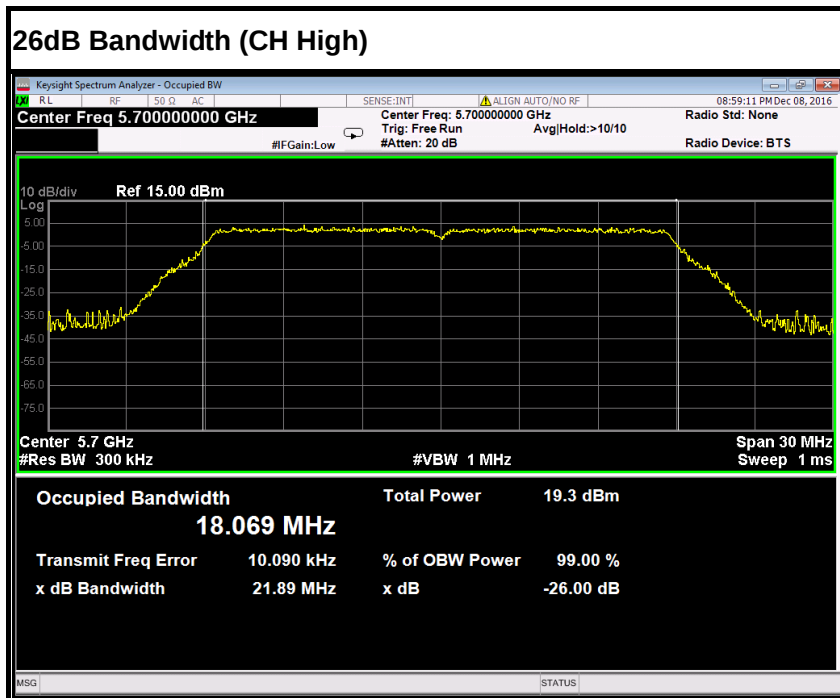
IEEE 802.11n HT 20 MHz mode / 5500 ~ 5700MHz

26dB Bandwidth (CH Low)



26dB Bandwidth (CH Mid)

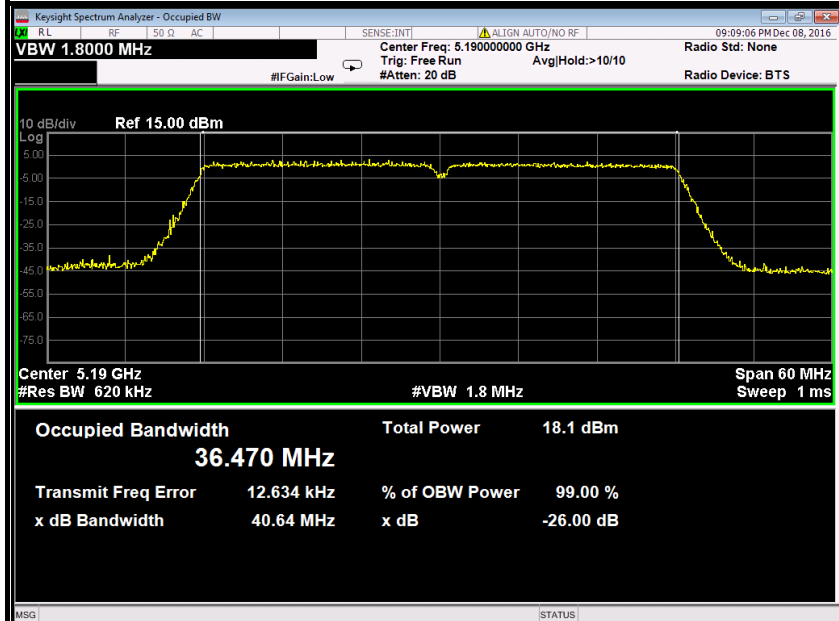




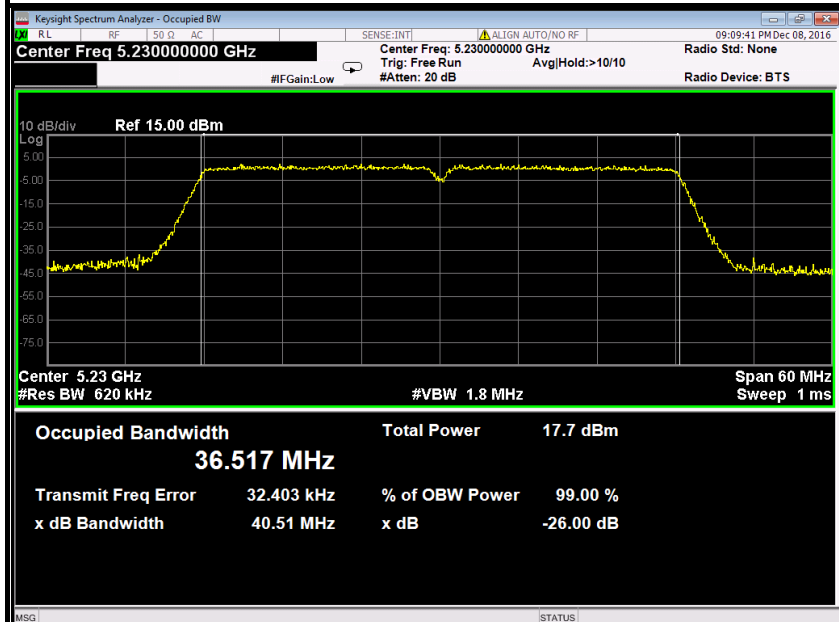


IEEE 802.11n HT 40 MHz mode / 5190 ~ 5230MHz

26dB Bandwidth (CH Low)



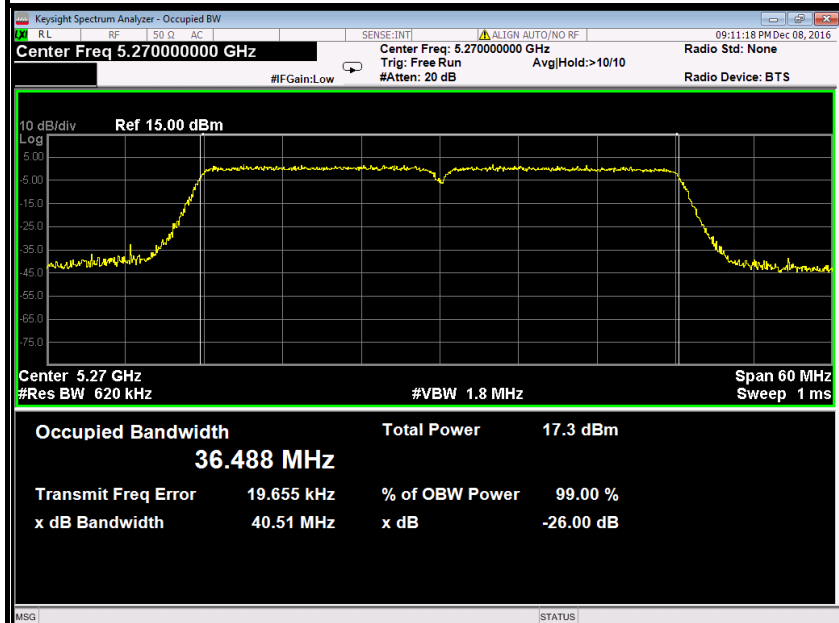
26dB Bandwidth (CH High)



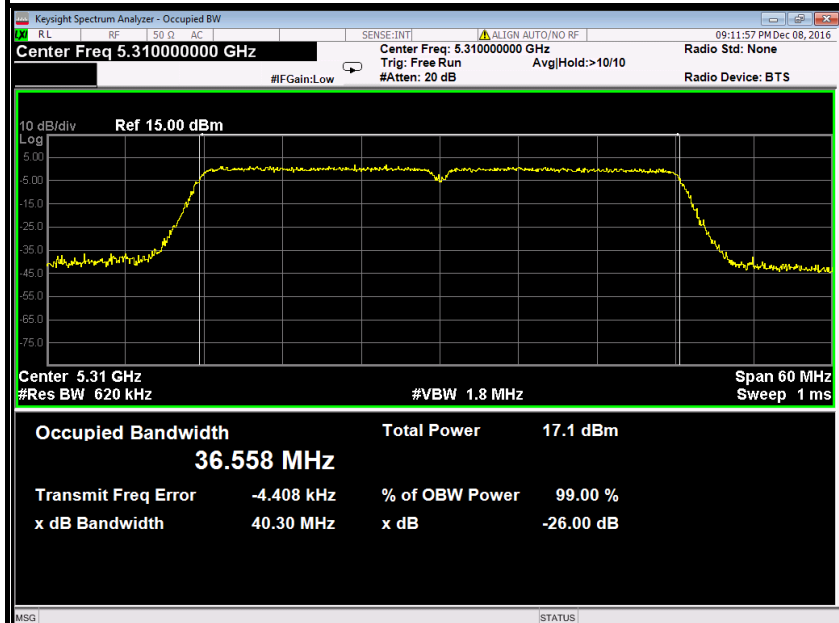


IEEE 802.11n HT 40 MHz mode / 5270 ~ 5310MHz

26dB Bandwidth (CH Low)



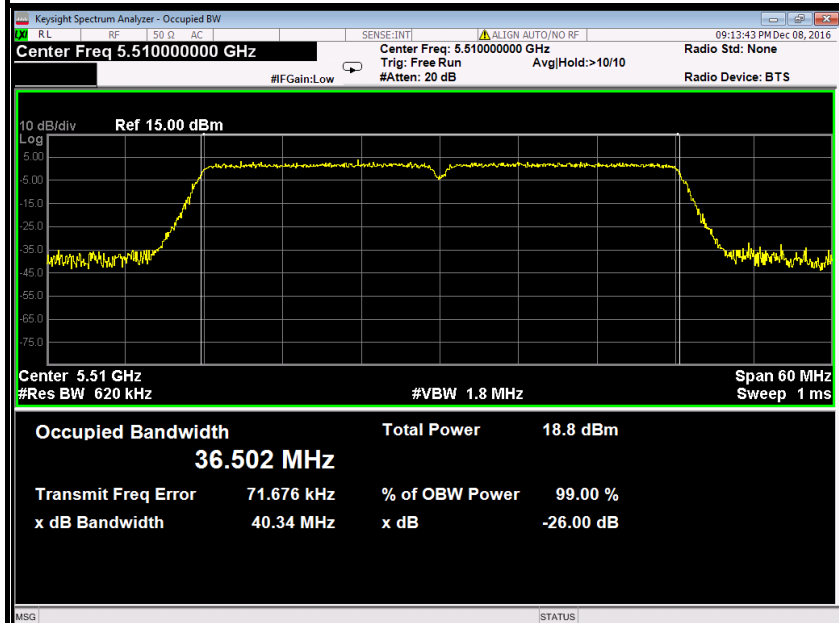
26dB Bandwidth (CH High)



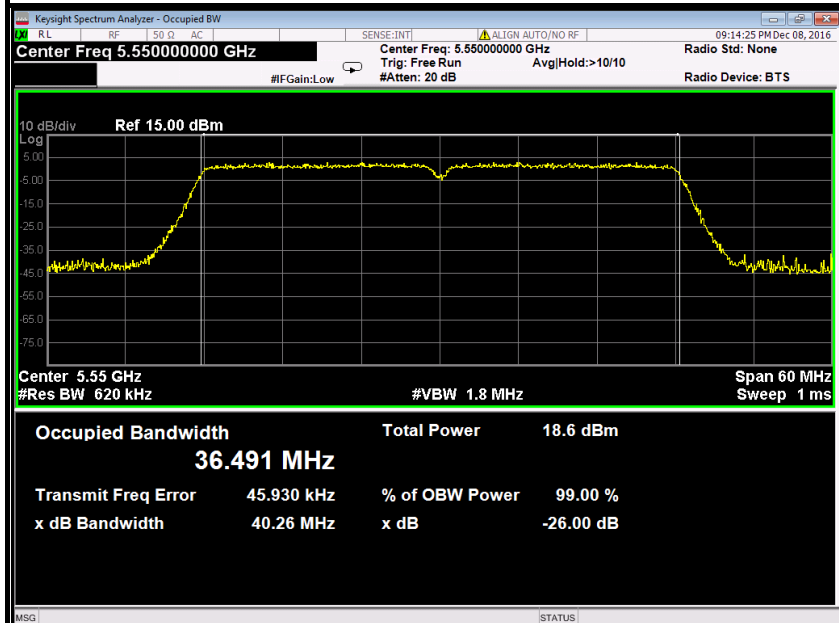


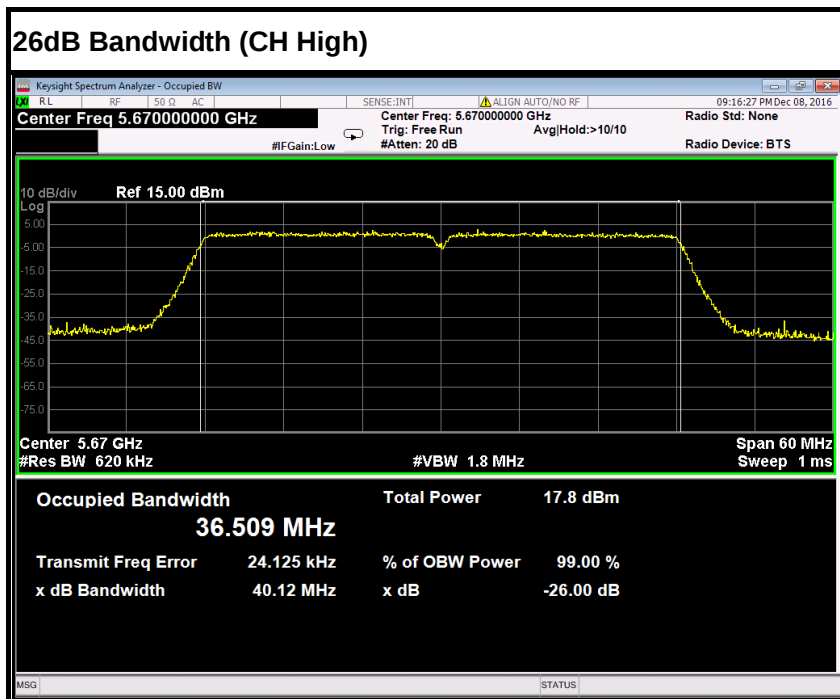
IEEE 802.11n HT 40 MHz mode / 5510 ~ 5670MHz

26dB Bandwidth (CH Low)



26dB Bandwidth (CH Mid)

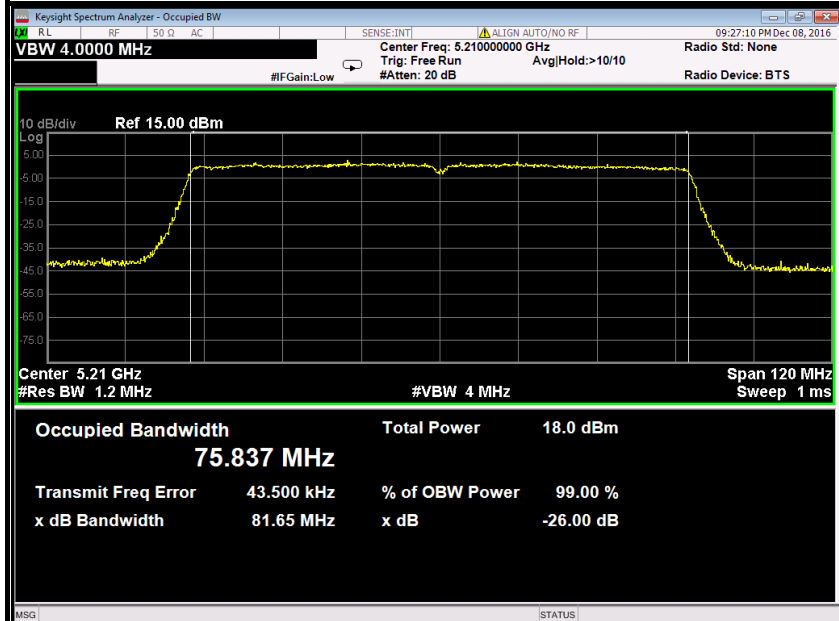






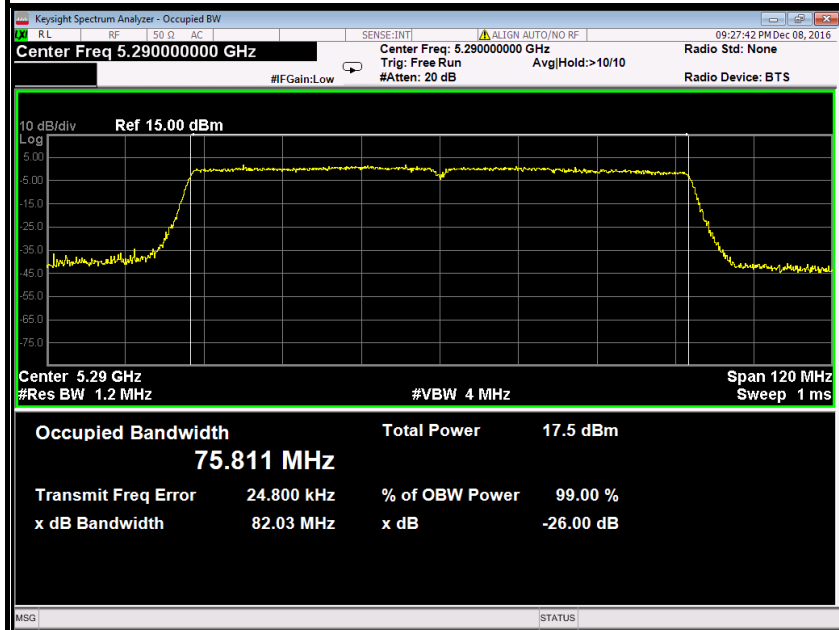
IEEE 802.11ac 80 mode / 5210MHz

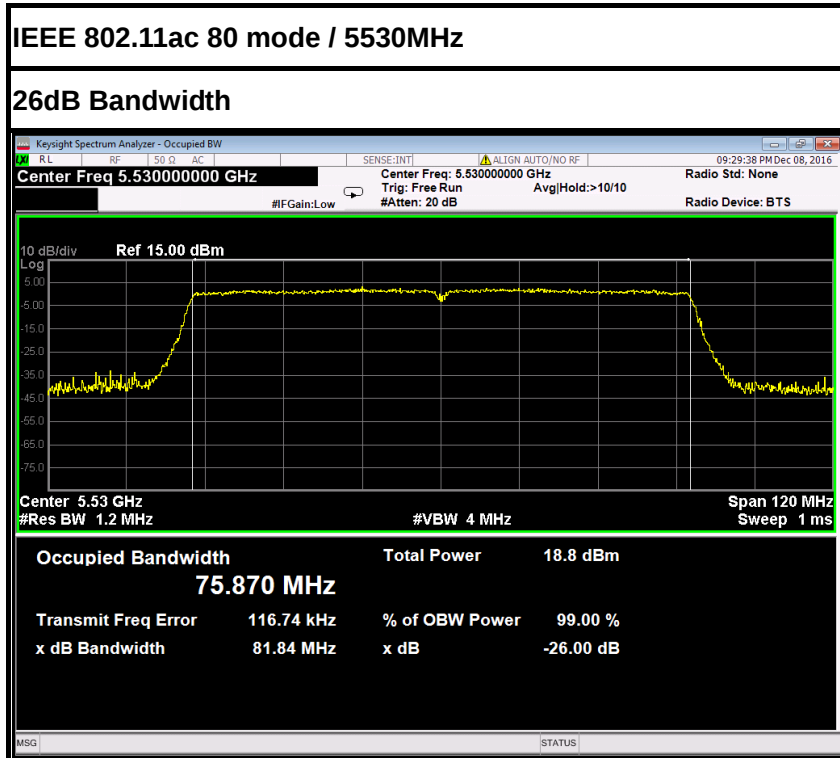
26dB Bandwidth



IEEE 802.11ac 80 mode / 5290MHz

26dB Bandwidth







6.2 6dB BANDWIDTH MEASUREMENT

6.2.1 LIMITS

According to §15.407(e), Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

6.2.2 TEST INSTRUMENTS

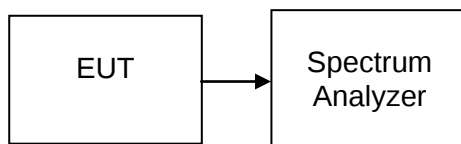
Name of Equipment	Manufacturer	Model	Serial Number	Last Calibration	Calibration Due
Spectrum Analyzer	Agilent	N9010A	MY52221469	02/21/2016	02/20/2017

6.2.3 TEST PROCEDURES (please refer to measurement standard)

8.1 Option 2:

The automatic bandwidth measurement capability of an instrument may be employed using the X dB bandwidth mode with X set to 6 dB, if the functionality described above (i.e., RBW = 100 kHz, VBW $\geq$ 3 RBW, peak detector with maximum hold) is implemented by the instrumentation function. When using this capability, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be $\geq$ 6 dB.

6.2.4 TEST SETUP





6.2.5 TEST RESULTS

No non-compliance noted

Test Data

Test mode: IEEE 802.11a mode / 5745 ~ 5825MHz

Channel	Frequency (MHz)	6dB Bandwidth(B) (MHz)	Limit (kHz)	Test Result
Low	5745	16.34	>500	PASS
Mid	5785	16.37		PASS
High	5825	16.37		PASS

Test mode: IEEE 802.11n HT 20 MHz mode / 5745 ~ 5825MHz

Channel	Frequency (MHz)	6dB Bandwidth(B) (MHz)	Limit (kHz)	Test Result
Low	5745	17.60	>500	PASS
Mid	5785	17.60		PASS
High	5825	17.60		PASS

Test mode: IEEE 802.11n HT 40 MHz mode / 5755 ~ 5795MHz

Channel	Frequency (MHz)	6dB Bandwidth(B) (MHz)	Limit (kHz)	Test Result
Low	5755	36.37	>500	PASS
High	5795	36.38		PASS

Test mode: IEEE 802.11ac 80 mode / 5775MHz

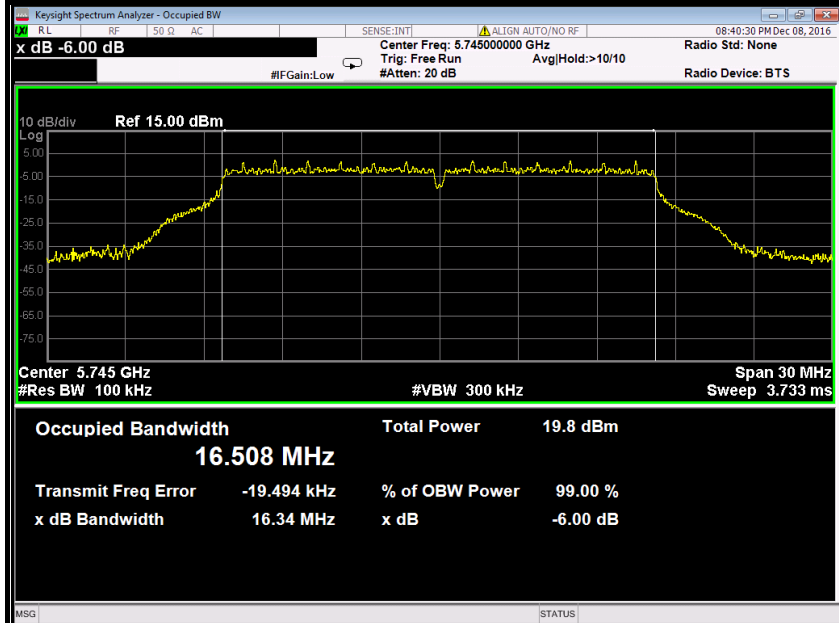
Channel	Frequency (MHz)	6dB Bandwidth(B) (MHz)	Limit (kHz)	Test Result
	5755	76.39	>500	PASS



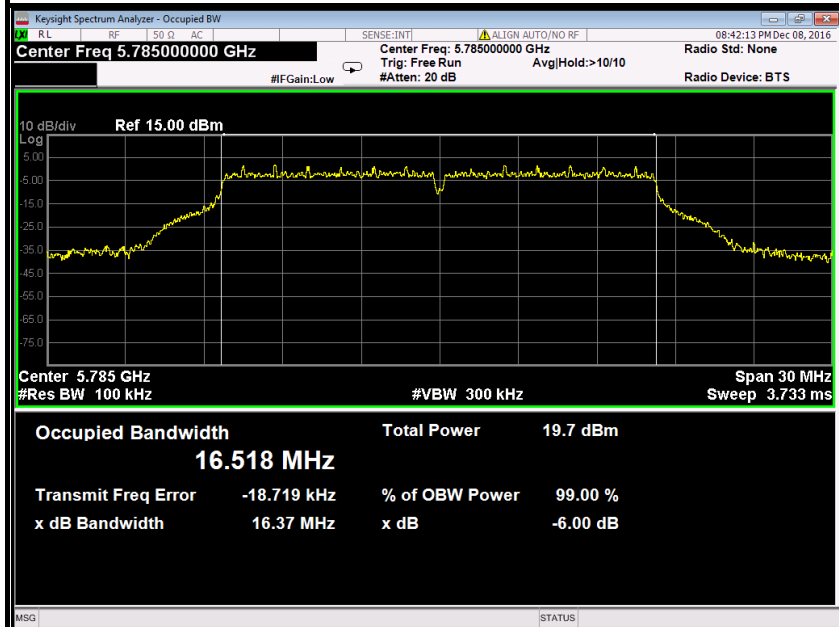
Test Plot

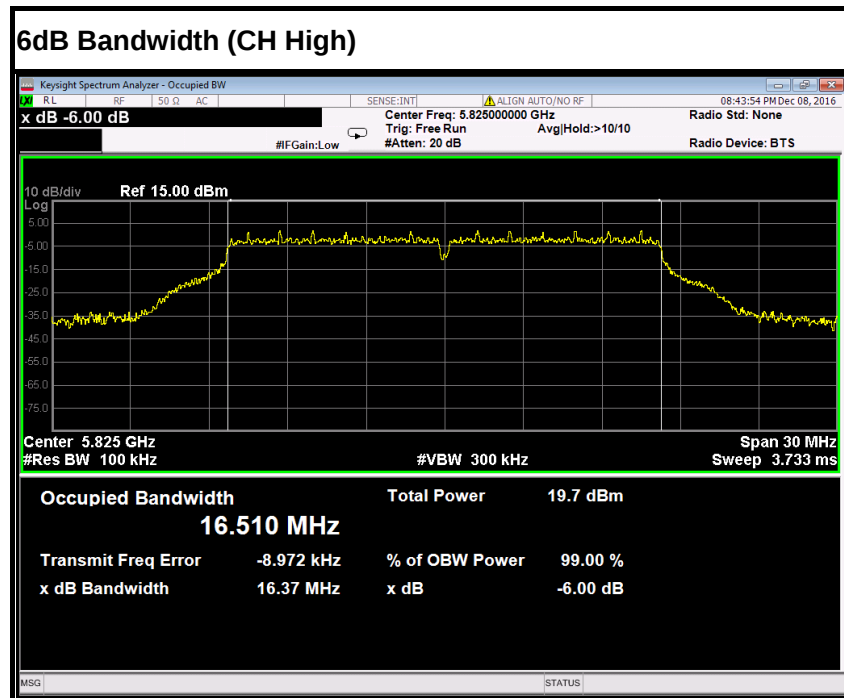
IEEE 802.11a mode / 5745 ~ 5825MHz

6dB Bandwidth (CH Low)



6dB Bandwidth (CH Mid)

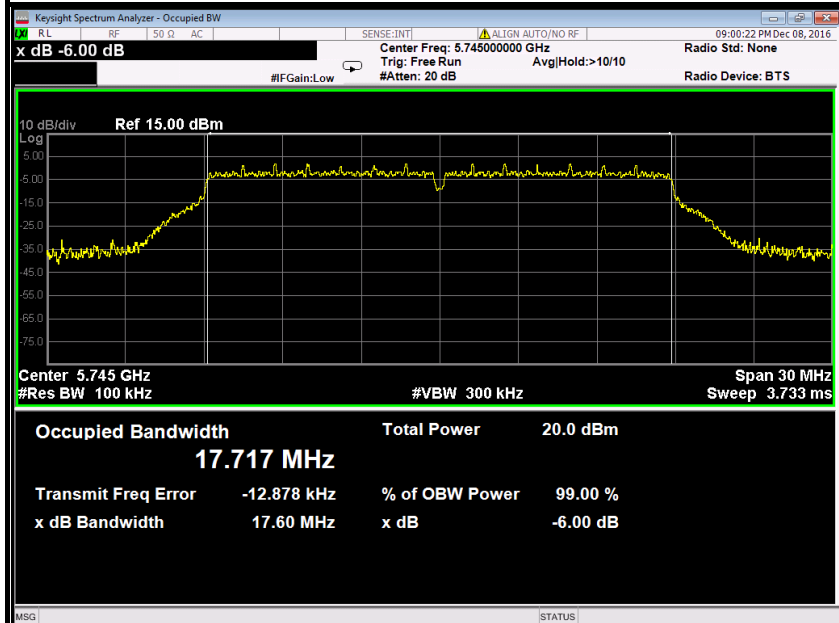




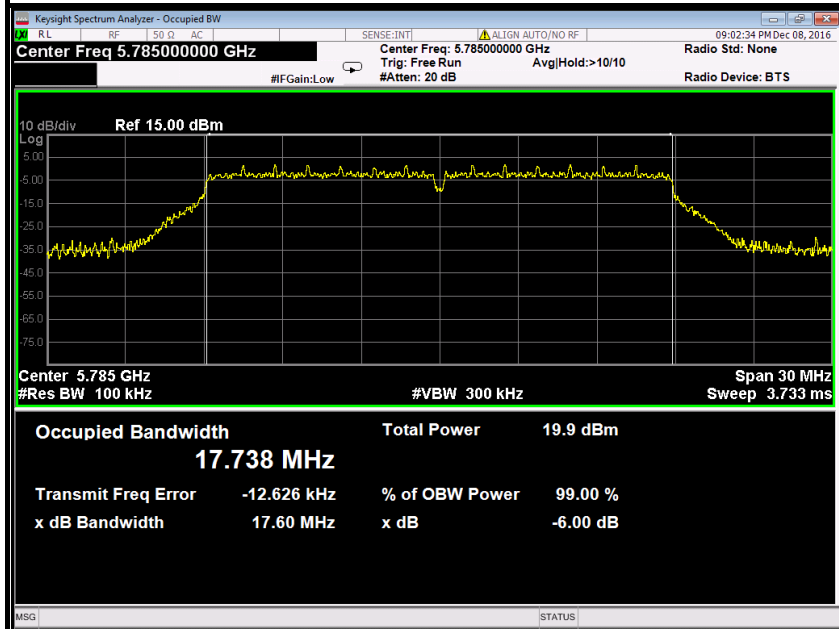


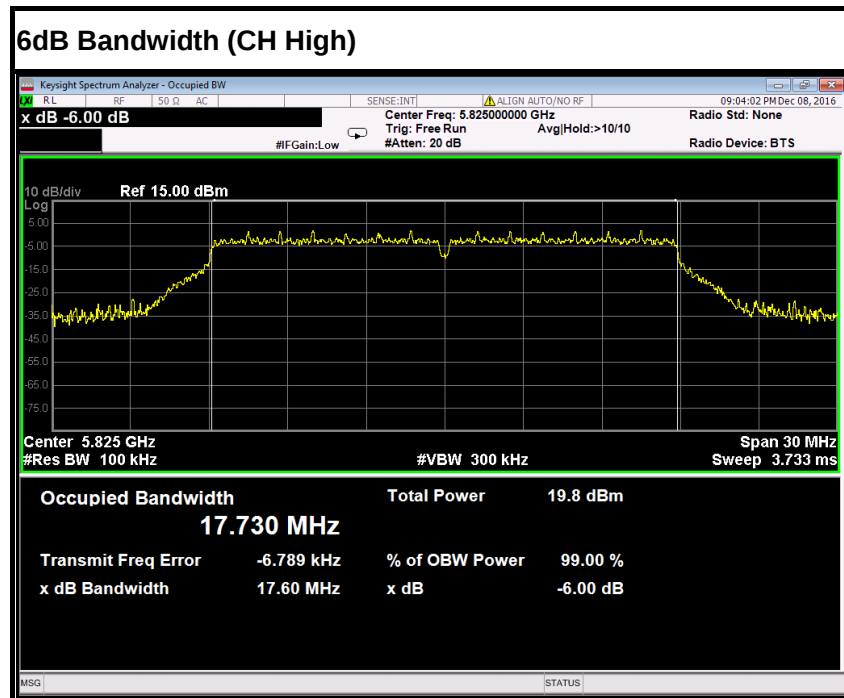
IEEE 802.11n HT 20 MHz mode / 5745 ~ 5825MHz

6dB Bandwidth (CH Low)



6dB Bandwidth (CH Mid)

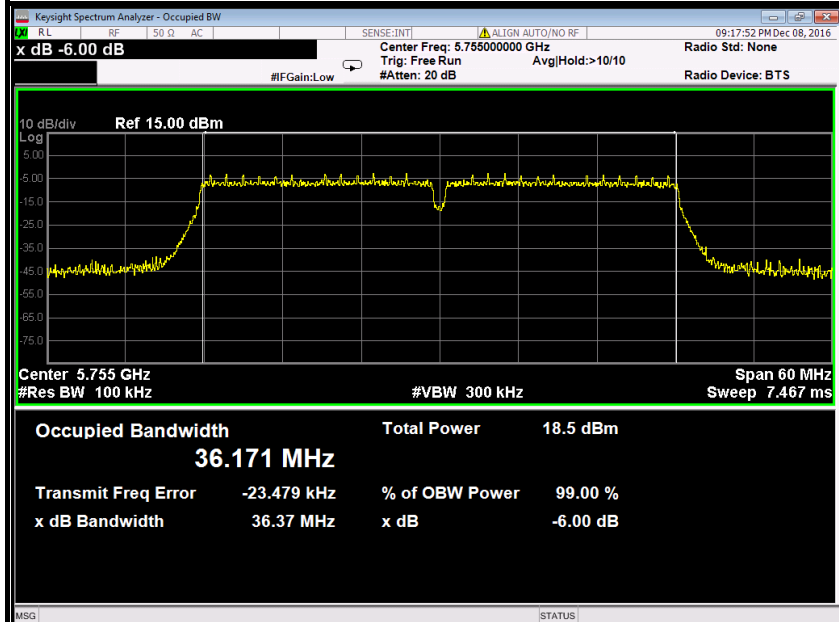




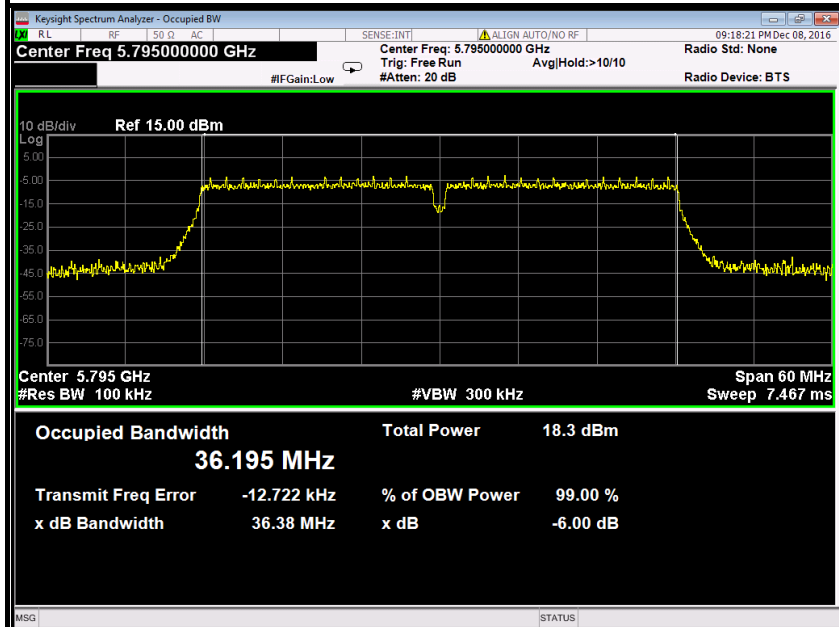


IEEE 802.11n HT 40 MHz mode / 5755 ~ 5795MHz

6dB Bandwidth (CH Low)



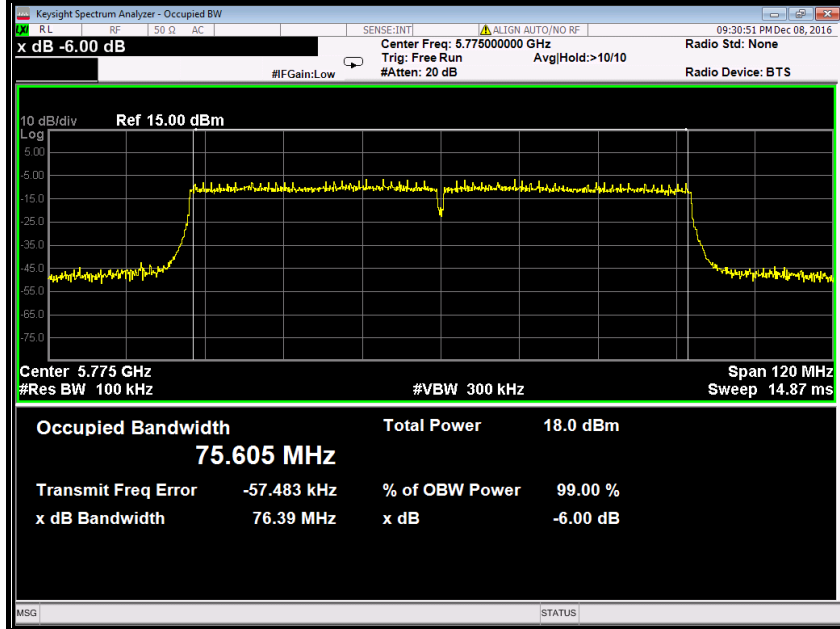
6dB Bandwidth (CH High)





IEEE 802.11ac 80 mode / 5775MHz

6dB Bandwidth





6.3 ANTENNA GAIN

MEASUREMENT

The antenna gain of the complete system is calculated by the difference of radiated power in EIRP and the conducted power of the module. For normal WLAN devices, the OFDM mode is used.

MEASUREMENT PARAMETERS

Measurement parameter	
Detector	Peak
Sweep time	Auto
Resolution bandwidth	3 MHz
Video bandwidth	3 MHz
Trace-Mode	Max hold

LIMITS

FCC	IC
Antenna Gain	
6 dBi	



TEST RESULTS

IEEE 802.11a mode / 5180 ~ 5240MHz

T _{nom}	V _{nom}	Lowest channel 5180MHz	Highest channel 5240MHz
Conducted power [dBm] Measured with OFDM modulation		3.27	2.93
Radiated power [dBm] Measured with OFDM modulation		6.52	5.75
Gain [dBi] Calculated		3.25	2.82
Measurement uncertainty		± 1.5 dB (cond.) / ± 3 dB (rad.)	

IEEE 802.11a mode / 5260 ~ 5320MHz

T _{nom}	V _{nom}	Lowest channel 5260MHz	Highest channel 5320MHz
Conducted power [dBm] Measured with OFDM modulation		3.62	3.64
Radiated power [dBm] Measured with OFDM modulation		7.13	7.49
Gain [dBi] Calculated		3.51	3.85
Measurement uncertainty		± 1.5 dB (cond.) / ± 3 dB (rad.)	

IEEE 802.11a mode / 5500 ~ 5700MHz

T _{nom}	V _{nom}	Lowest channel 5500MHz	Highest channel 5700MHz
Conducted power [dBm] Measured with OFDM modulation		4.00	3.37
Radiated power [dBm] Measured with OFDM modulation		7.25	6.58
Gain [dBi] Calculated		3.25	3.21
Measurement uncertainty		± 1.5 dB (cond.) / ± 3 dB (rad.)	

IEEE 802.11a mode / 5745 ~ 5825MHz

T _{nom}	V _{nom}	Lowest channel 5745MHz	Highest channel 5825MHz
Conducted power [dBm] Measured with OFDM modulation		4.25	3.94
Radiated power [dBm] Measured with OFDM modulation		7.69	7.38
Gain [dBi] Calculated		3.44	3.44
Measurement uncertainty		± 1.5 dB (cond.) / ± 3 dB (rad.)	



6.4 OUTPUT POWER

6.4.1 LIMIT

According to §15.407(a)& FCC R&O FCC 14 - 30,

(1) For the band 5.15-5.25 GHz.

(i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

(ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(2) For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or $11 \text{ dBm} + 10 \log B$, where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.



(3) For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple colocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

Note to paragraph (a)(3): The Commission strongly recommends that parties employing U-NII devices to provide critical communications services should determine if there are any nearby Government radar systems that could affect their operation.

**Specified Limit of the Output Power****Test mode: IEEE 802.11a mode / 5260 ~ 5320MHz**

Channel	Frequency (MHz)	26 dB Bandwidth (B) (MHz)	10*Log(B) (dB)	11 + 10*Log(B) (dBm)	Maximum Conducted Output Power Limit (dBm)
Low	5260	21.60	13.34	24.34	24.00
Mid	5300	21.32	13.29	24.29	24.00
High	5320	21.51	13.33	24.33	24.00

Test mode: IEEE 802.11a mode / 5500 ~ 5700MHz

Channel	Frequency (MHz)	26 dB Bandwidth (B) (MHz)	10*Log(B) (dB)	11 + 10*Log(B) (dBm)	Maximum Conducted Output Power Limit (dBm)
Low	5500	21.54	13.33	24.33	24.00
Mid	5580	21.40	13.30	24.30	24.00
High	5700	21.51	13.33	24.33	24.00

Test mode: IEEE 802.11n HT 20 MHz mode / 5260 ~ 5320MHz

Channel	Frequency (MHz)	26 dB Bandwidth (B) (MHz)	10*Log(B) (dB)	11 + 10*Log(B) (dBm)	Maximum Conducted Output Power Limit (dBm)
Low	5260	21.82	13.39	24.39	24.00
Mid	5300	21.75	13.37	24.37	24.00
High	5320	21.92	13.41	24.41	24.00

Test mode: IEEE 802.11n HT 20 MHz mode / 5500 ~ 5700MHz

Channel	Frequency (MHz)	26 dB Bandwidth (B) (MHz)	10*Log(B) (dB)	11 + 10*Log(B) (dBm)	Maximum Conducted Output Power Limit (dBm)
Low	5500	21.91	13.41	24.41	24.00
Mid	5580	21.86	13.40	24.40	24.00
High	5700	21.89	13.40	24.40	24.00

IEEE 802.11n HT 40 MHz mode / 5270 ~ 5310MHz

Channel	Frequency (MHz)	26 dB Bandwidth (B) (MHz)	10*Log(B) (dB)	11 + 10*Log(B) (dBm)	Maximum Conducted Output Power Limit (dBm)
Low	5270	40.51	16.08	27.08	24.00
High	5310	40.30	16.05	27.05	24.00

**IEEE 802.11n HT 40 MHz mode / 5510 ~ 5670MHz**

Channel	Frequency (MHz)	26 dB Bandwidth (B) (MHz)	10*Log(B) (dB)	11 + 10*Log(B) (dBm)	Maximum Conducted Output Power Limit (dBm)
Low	5510	40.34	16.06	27.06	24.00
Mid	5550	40.26	16.05	27.05	24.00
High	5670	40.12	16.03	27.03	24.00

Test mode: IEEE 802.11ac 80 mode / 5290MHz

Channel	Frequency (MHz)	26 dB Bandwidth (B) (MHz)	10*Log(B) (dB)	11 + 10*Log(B) (dBm)	Maximum Conducted Output Power Limit (dBm)
	5290	82.03	19.14	30.14	24.00

Test mode: IEEE 802.11ac 80 mode / 5530MHz

Channel	Frequency (MHz)	26 dB Bandwidth (B) (MHz)	10*Log(B) (dB)	11 + 10*Log(B) (dBm)	Maximum Conducted Output Power Limit (dBm)
	5530	81.84	19.13	30.13	24.00



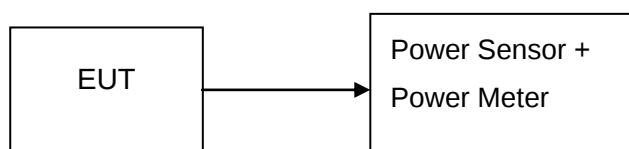
6.4.2 MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Last Calibration	Calibration Due
Power Meter	Anritsu	ML2495A	1204003	02/21/2016	02/20/2017
Power Sensor	Anritsu	MA2411B	1126150	02/21/2016	02/20/2017

Remark: Each piece of equipment is scheduled for calibration once a year.

6.4.3 TEST CONFIGURATIONS

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



6.4.4 TEST PROCEDURE

The EUT was connected to a Power Meter through a 50Ω RF cable..

6.4.5 TEST RESULTS

No non-compliance noted



6.4.6 TEST DATA

IEEE 802.11a mode / 5180 ~ 5240MHz

Channel	Frequency (MHz)	AVG Output Power (dBm)	AVG Output Power (W)	Limit (dBm)	Result
Low	5180	11.67	0.01469	30.00	PASS
Mid	5200	11.23	0.01327		PASS
High	5240	11.24	0.01330		PASS

IEEE 802.11a mode / 5260~ 5320MHz

Channel	Frequency (MHz)	AVG Output Power (dBm)	AVG Output Power (W)	Limit (dBm)	Result
Low	5260	15.91	0.03899	24.00	PASS
Mid	5300	15.73	0.03741		PASS
High	5320	15.94	0.03926		PASS

IEEE 802.11a mode / 5500 ~ 5700MHz

Channel	Frequency (MHz)	AVG Output Power (dBm)	AVG Output Power (W)	Limit (dBm)	Result
Low	5500	16.31	0.04276	24.00	PASS
Mid	5580	15.66	0.03681		PASS
High	5700	15.66	0.03681		PASS

IEEE 802.11a mode / 5745 ~ 5825MHz

Channel	Frequency (MHz)	AVG Output Power (dBm)	AVG Output Power (W)	Limit (dBm)	Result
Low	5745	16.56	0.04529	30.00	PASS
Mid	5785	16.07	0.04046		PASS
High	5825	16.24	0.04207		PASS

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

Channel	Frequency (MHz)	AVG Output Power (dBm)	AVG Output Power (W)	Limit (dBm)	Result
Low	5180	11.64	0.01459	30.00	PASS
Mid	5200	11.42	0.01387		PASS
High	5240	11.28	0.01343		PASS

IEEE 802.11n HT 20 MHz mode / 5260~ 5320MHz

Channel	Frequency (MHz)	AVG Output Power (dBm)	AVG Output Power (W)	Limit (dBm)	Result
Low	5260	15.96	0.03945	24.00	PASS
Mid	5300	15.99	0.03972		PASS
High	5320	15.86	0.03855		PASS

IEEE 802.11n HT 20 MHz mode / 5500 ~ 5700MHz

Channel	Frequency (MHz)	AVG Output Power (dBm)	AVG Output Power (W)	Limit (dBm)	Result
Low	5500	16.31	0.04276	24.00	PASS
Mid	5580	15.87	0.03864		PASS
High	5700	15.46	0.03516		PASS

IEEE 802.11n HT 20 MHz mode / 5745 ~ 5825MHz

Channel	Frequency (MHz)	AVG Output Power (dBm)	AVG Output Power (W)	Limit (dBm)	Result
Low	5745	16.05	0.04027	30.00	PASS
Mid	5785	16.11	0.04083		PASS
High	5825	16.15	0.04121		PASS

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

Channel	Frequency (MHz)	AVG Output Power (dBm)	AVG Output Power (W)	Limit (dBm)	Result
Low	5190	14.62	0.02897	30.00	PASS
High	5230	14.49	0.02812		PASS

IEEE 802.11n HT 40 MHz mode / 5270 ~ 5310MHz

Channel	Frequency (MHz)	AVG Output Power (dBm)	AVG Output Power (W)	Limit (dBm)	Result
Low	5270	13.95	0.02483	24.00	PASS
High	5310	13.88	0.02443		PASS

IEEE 802.11n HT 40 MHz mode / 5510 ~ 5670MHz

Channel	Frequency (MHz)	AVG Output Power (dBm)	AVG Output Power (W)	Limit (dBm)	Result
Low	5510	15.43	0.03491	24.00	PASS
Mid	5550	15.06	0.03206		PASS
High	5670	14.54	0.02844		PASS

IEEE 802.11n HT 40 MHz mode / 5755 ~ 5795MHz

Channel	Frequency (MHz)	AVG Output Power (dBm)	AVG Output Power (W)	Limit (dBm)	Result
Low	5755	15.08	0.03221	30.00	PASS
High	5795	14.72	0.02965		PASS

**IEEE 802.11ac 80 mode / 5210MHz**

Channel	Frequency (MHz)	AVG Output Power (dBm)	AVG Output Power (W)	Limit (dBm)	Result
	5210	14.47	0.02799	30.00	PASS

IEEE 802.11ac 80 mode / 5290MHz

Channel	Frequency (MHz)	AVG Output Power (dBm)	AVG Output Power (W)	Limit (dBm)	Result
	5290	13.85	0.02427	24.00	PASS

IEEE 802.11ac 80 mode / 5530MHz

Channel	Frequency (MHz)	AVG Output Power (dBm)	AVG Output Power (W)	Limit (dBm)	Result
	5530	15.14	0.03266	24.00	PASS

IEEE 802.11ac 80 mode / 5775MHz

Channel	Frequency (MHz)	AVG Output Power (dBm)	AVG Output Power (W)	Limit (dBm)	Result
	5775	15.07	0.03214	30.00	PASS



6.5 BAND EDGES MEASUREMENT

6.5.1 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.

6.5.2 MEASUREMENT EQUIPMENT USED

Radiated Emission Test Site 966(2)					
Name of Equipment	Manufacturer	Model Number	Serial Number	Last Calibration	Due Calibration
PSA Series Spectrum Analyzer	Agilent	N9010A	MY52221469	02/21/2016	02/20/2017
EMI TEST RECEIVER	ROHDE&SCHWARZ	ESCI	100783	02/21/2016	02/20/2017
Amplifier	EMEC	EM330	060661	03/18/2016	03/17/2017
High Noise Amplifier	Agilent	8449B	3008A01838	02/21/2016	02/20/2017
Loop Antenna	COM-POWER	AL-130	121044	09/25/2016	09/24/2017
Bilog Antenna	SCHAFFNER	CBL6143	5082	02/21/2016	02/20/2017
Horn Antenna	SCHWARZBECK	BBHA9120	D286	02/28/2016	02/27/2017
Board-Band Horn Antenna	Schwarzbeck	BBHA 9170	9170-497	02/28/2016	02/27/2017
Turn Table	N/A	N/A	N/A	N.C.R	N.C.R
Antenna Tower	SUNOL	TLT2	N/A	N.C.R	N.C.R
Controller	Sunol Sciences	SC104V	022310-1	N.C.R	N.C.R
Controller	CT	N/A	N/A	N.C.R	N.C.R
Temp. / Humidity Meter	Anymetre	JR913	N/A	02/21/2016	02/20/2017
Test S/W	FARAD	LZ-RF / CCS-SZ-3A2			

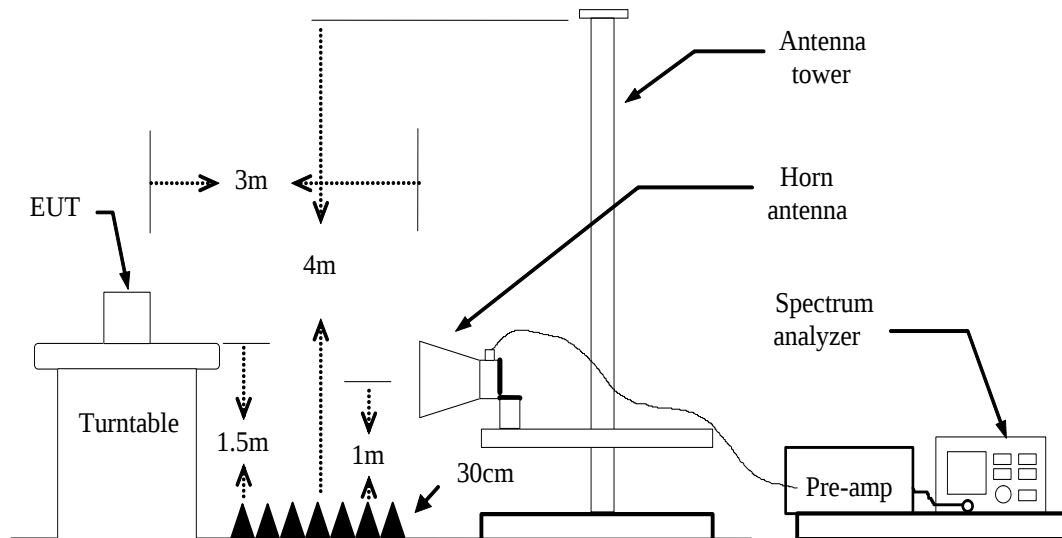
NOTE: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

2. The FCC Site Registration number is 101879.

3. N.C.R = No Calibration Required.



6.5.3 TEST CONFIGURATION



6.5.4 TEST PROCEDURE

1. The EUT is placed on a turntable, which is 1.5m 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=1 / VBW=3MHz / Sweep=AUTO
 - (b) AVERAGE: RBW=1MHz / VBW=10Hz / Sweep=AUTO / Detector=Peak
5. Repeat the procedures until all the PEAK and AVERAGE versus POLARIZATION are measured.



6.5.5 TEST RESULT

IEEE 802.11a mode / 5500 ~ 5700MHz

1. Operating Frequency: 5500-5700MHz
2. CH Low: 5500MHz, CH High: 5700MHz
3. 26dB bandwidth: CH Low: 21.54MHz, CH High: 21.51MHz
4. Frequency Range: 5489.230MHz, 5710.755MHz

IEEE 802.11a mode / 5745 ~ 5825MHz

1. Operating Frequency: 5745-5825MHz
2. CH Low: 5745MHz, CH High: 5825MHz
3. 26dB bandwidth: CH Low: 21.53MHz, CH High: 21.60MHz
4. Frequency Range: 5734.235MHz, 5835.800MHz

IEEE 802.11n HT 20 MHz mode / 5500 ~ 5700MHz

1. Operating Frequency: 5500-5700MHz
2. CH Low: 5500MHz, CH High: 5700MHz
3. 26dB bandwidth: CH Low: 21.91MHz, CH High: 21.89MHz
4. Frequency Range: 5489.095MHz, 5710.945MHz

IEEE 802.11n HT 20 MHz mode / 5745 ~ 5825MHz

1. Operating Frequency: 5745-5825MHz
2. CH Low: 5745MHz, CH High: 5825MHz
3. 26dB bandwidth: CH Low: 21.91MHz, CH High: 21.86MHz
4. Frequency Range: 5734.045MHz, 5835.930MHz

IEEE 802.11n HT 40 MHz mode / 5510 ~ 5670MHz

1. Operating Frequency: 5510-5670MHz
2. CH Low: 5510MHz, CH High: 5670MHz
3. 26dB bandwidth: CH Low: 40.34MHz, CH High: 40.12MHz
4. Frequency Range: 5489.830MHz, 5690.060MHz

IEEE 802.11n HT 40 MHz mode / 5755 ~ 5795MHz

1. Operating Frequency: 5755-5795MHz
2. CH Low: 5755MHz, CH High: 5795MHz
3. 26dB bandwidth: CH Low: 40.66MHz, CH High: 40.16MHz
4. Frequency Range: 5734.670MHz, 5815.080MHz



Test mode: IEEE 802.11ac 80 mode / 5530MHz

1. Operating Frequency: 5530MHz
2. CH: 5530MHz
3. 26dB bandwidth: CH: 81.84MHz
4. Frequency Range: 5489.080MHz, 5570.920MHz

Test mode: IEEE 802.11ac 80 mode / 5775MHz

1. Operating Frequency: 5775MHz
2. CH: 5530MHz
3. 26dB bandwidth: CH: 81.81MHz
4. Frequency Range: 5489.095MHz, 5570.905MHz

Because the mentioned conditions, the Fundamental Frequency Range was far away from the Restrict bands in the table published in 15.205, the test is not applicable.

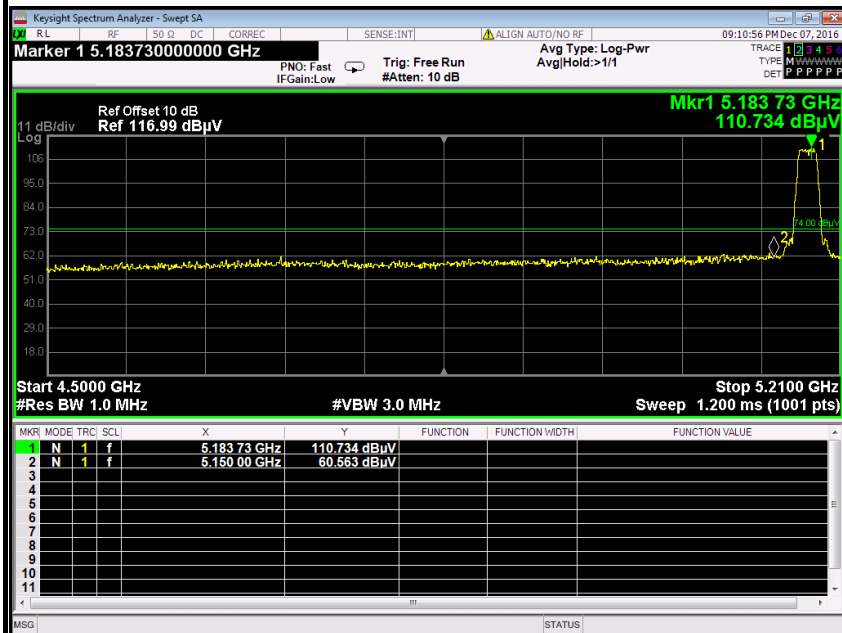


Test Plot

IEEE 802.11a mode / 5180MHz

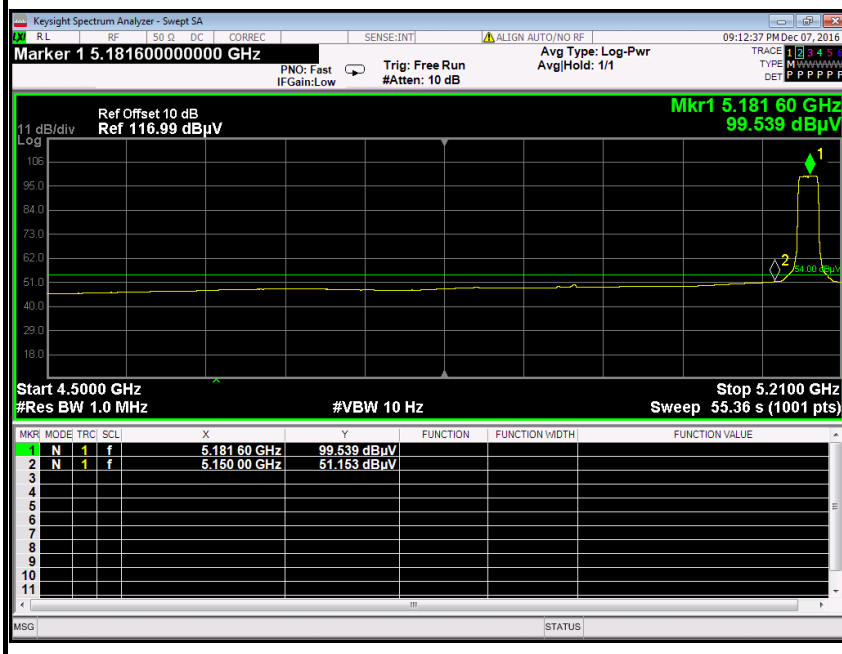
Detector mode: Peak

Polarity: Vertical

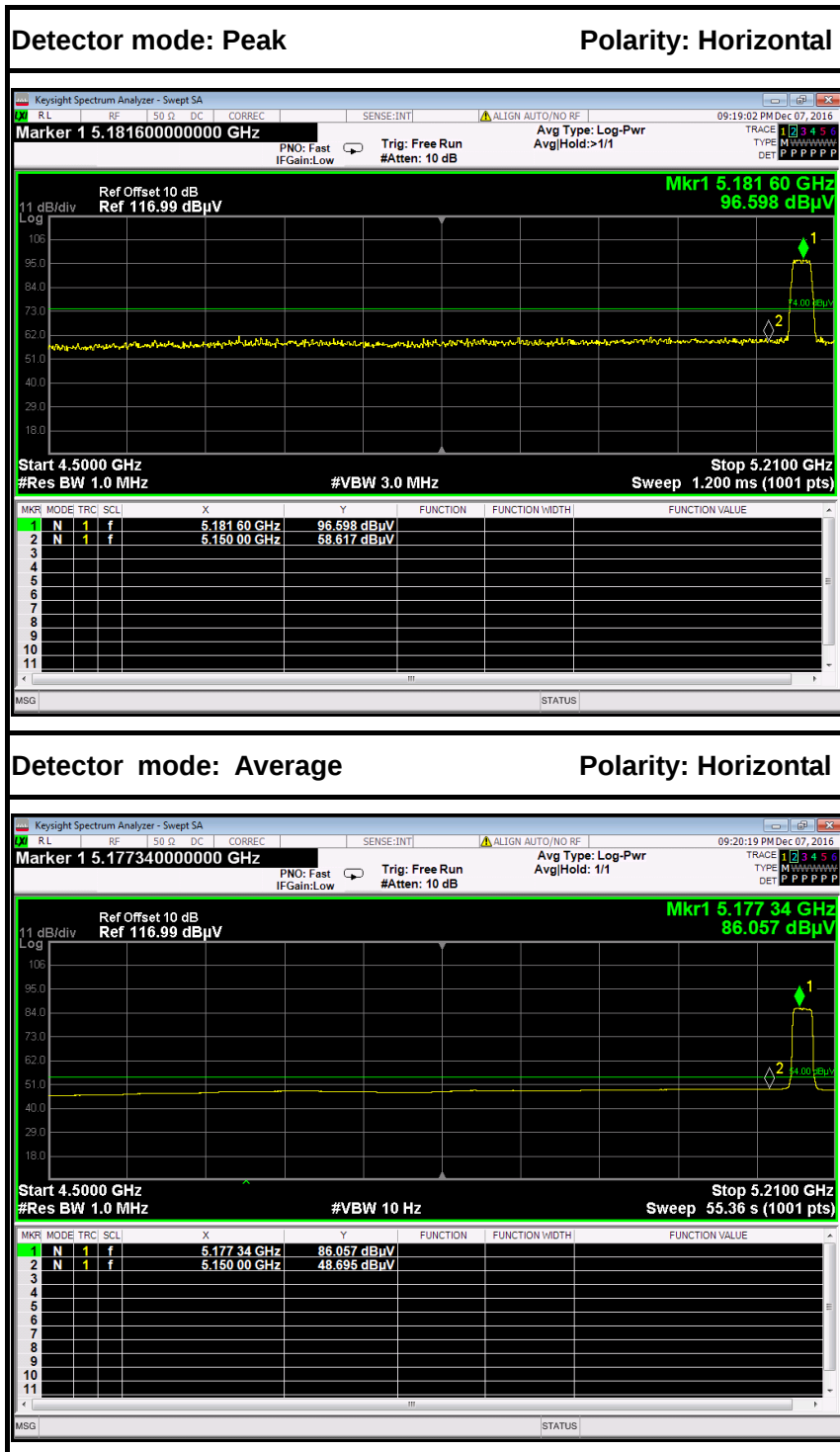


Detector mode: Average

Polarity: Vertical



No.	Frequency (MHz)	Reading (dBμV)	Corrected (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Antenna Pole
1	5150.0000	69.15	5.60	63.55	74.00	-10.45	Peak	Vertical
2	5150.0000	57.09	5.60	51.49	54.00	-2.52	Average	Vertical



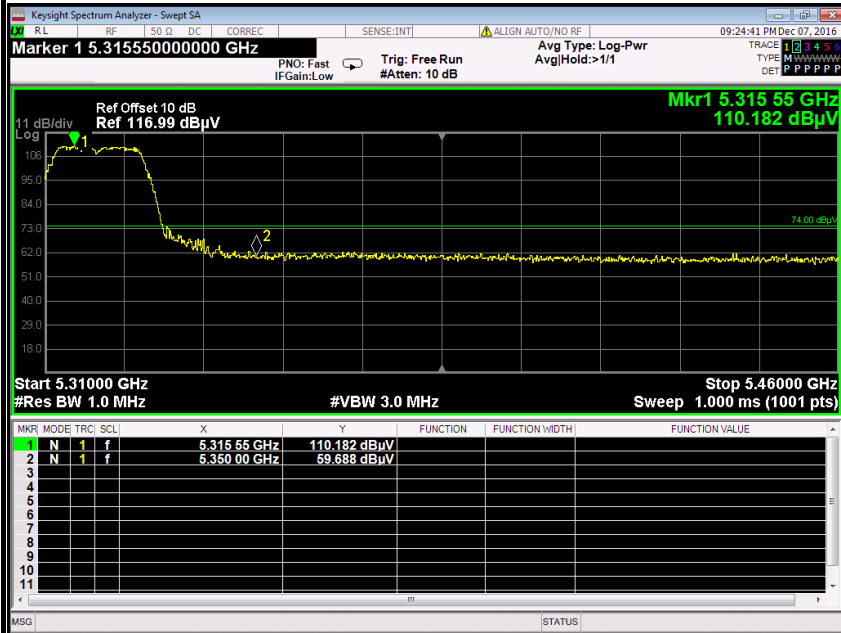
No.	Frequency (MHz)	Reading (dBuV)	Corrected (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Pole
1	5350.0000	65.87	5.60	60.27	74.00	-13.73	Peak	Vertical
2	5350.0000	55.15	5.60	49.55	54.00	-4.45	Average	Vertical



IEEE 802.11a mode / 5320MHz

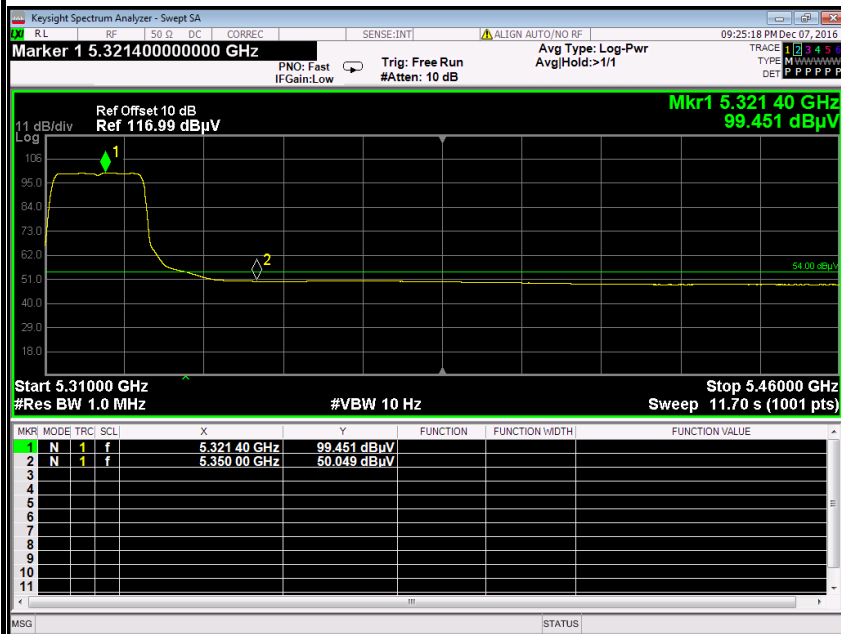
Detector mode: Peak

Polarity: Vertical

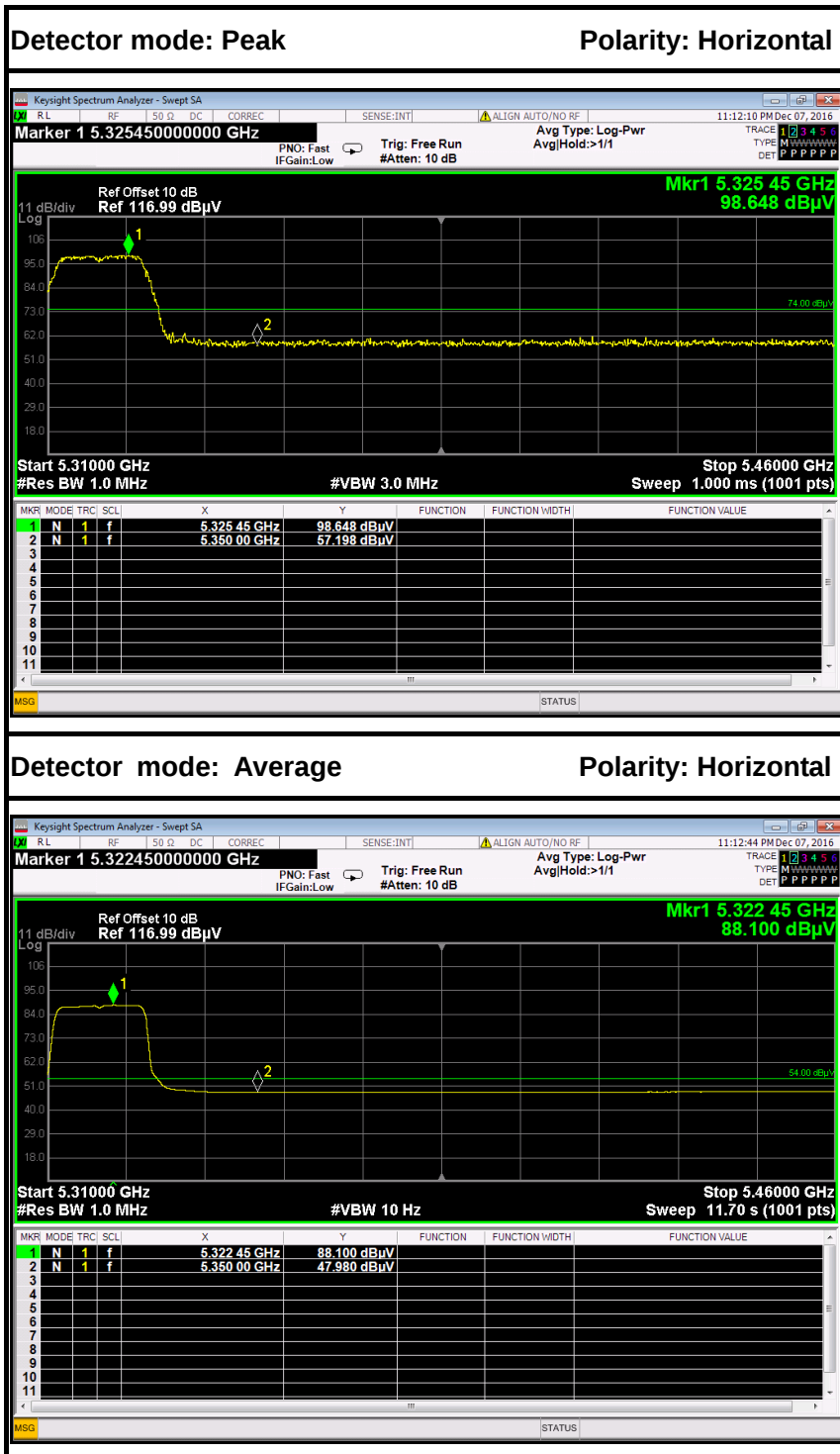


Detector mode: Average

Polarity: Vertical



No.	Frequency (MHz)	Reading (dBuV)	Corrected (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Pole
1	5350.0000	65.29	5.60	59.69	74.00	-14.31	Peak	Vertical
2	5350.0000	55.65	5.60	50.05	54.00	-3.95	Average	Vertical



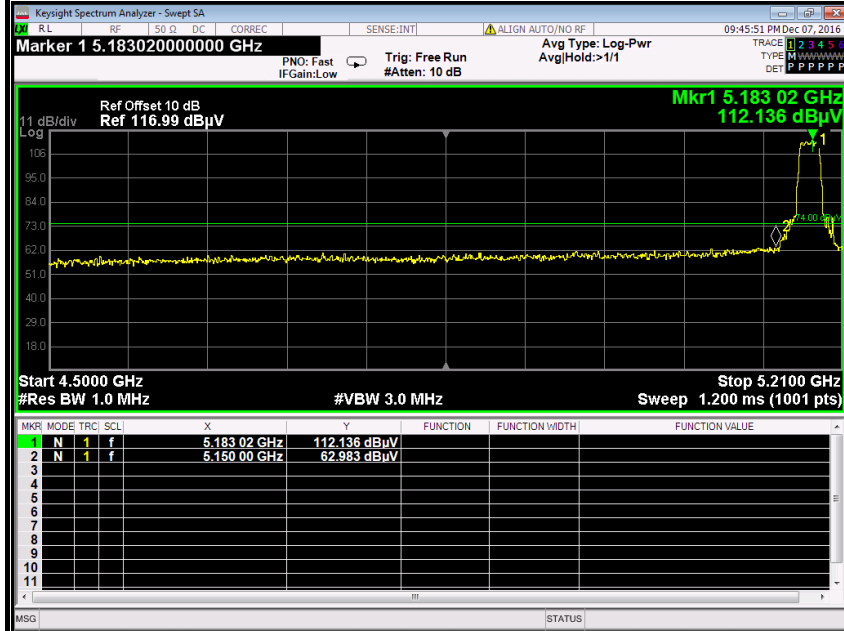
No.	Frequency (MHz)	Reading (dBuV)	Corrected (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Pole
1	5350.0000	62.80	5.60	57.20	74.00	-16.80	Peak	Horizontal
2	5350.0000	53.58	5.60	47.98	54.00	-6.02	Average	Horizontal



IEEE 802.11n HT 20 MHz mode / 5180 MHz

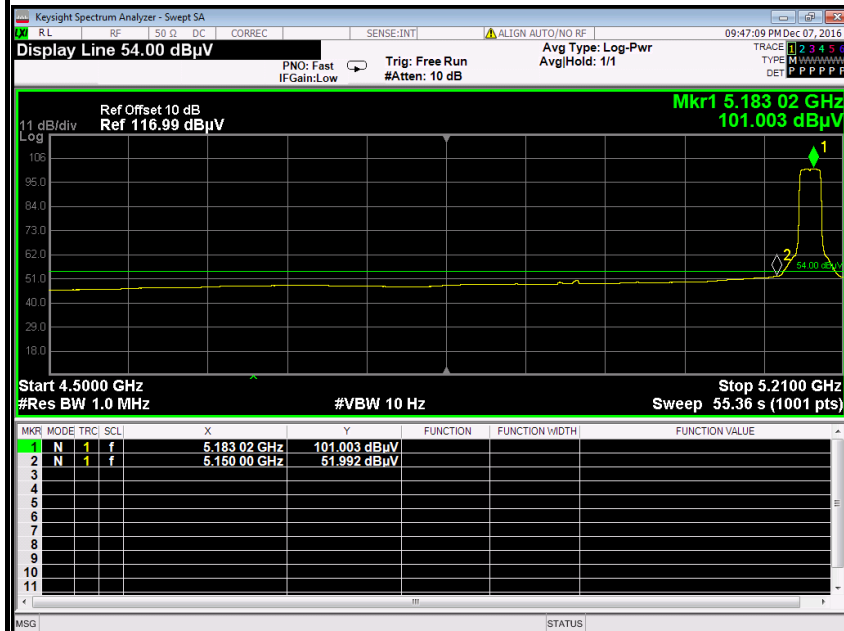
Detector mode: Peak

Polarity: Vertical

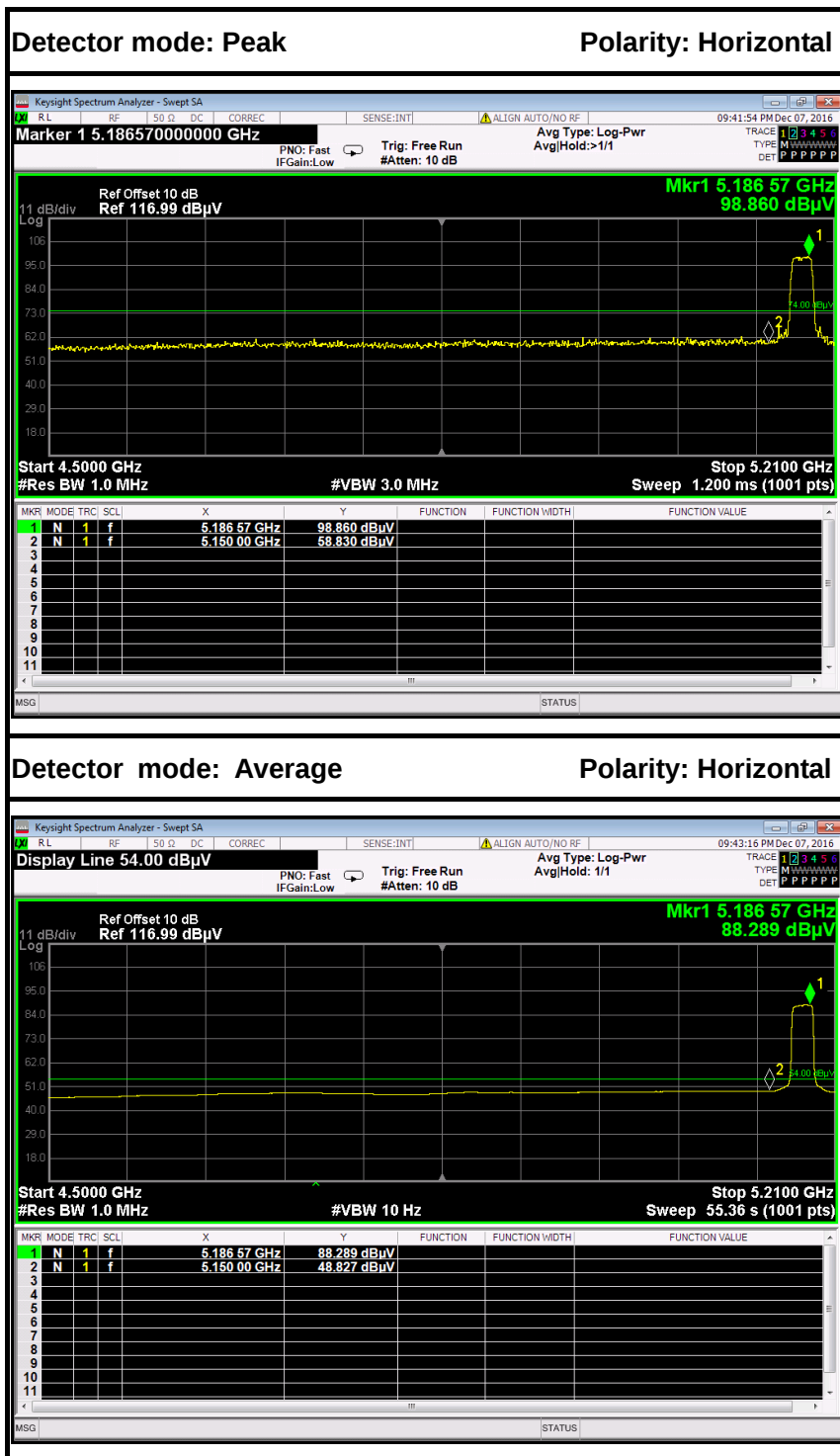


Detector mode: Average

Polarity: Vertical



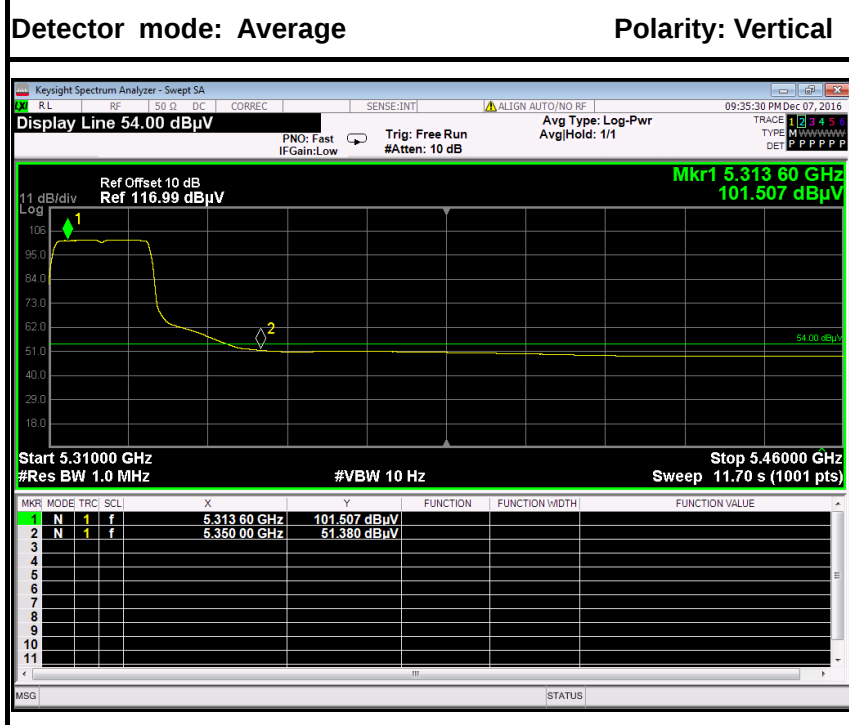
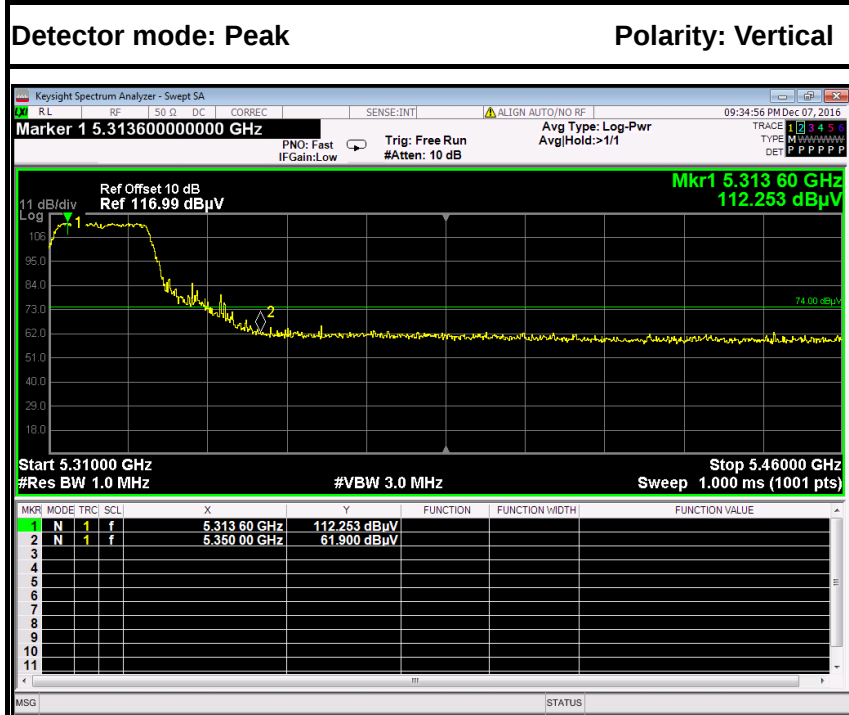
No.	Frequency (MHz)	Reading (dBuV)	Corrected (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Pole
1	5150.0000	68.58	5.60	62.98	74.00	-11.02	Peak	Vertical
2	5150.0000	57.59	5.60	51.99	54.00	-2.01	Average	Vertical



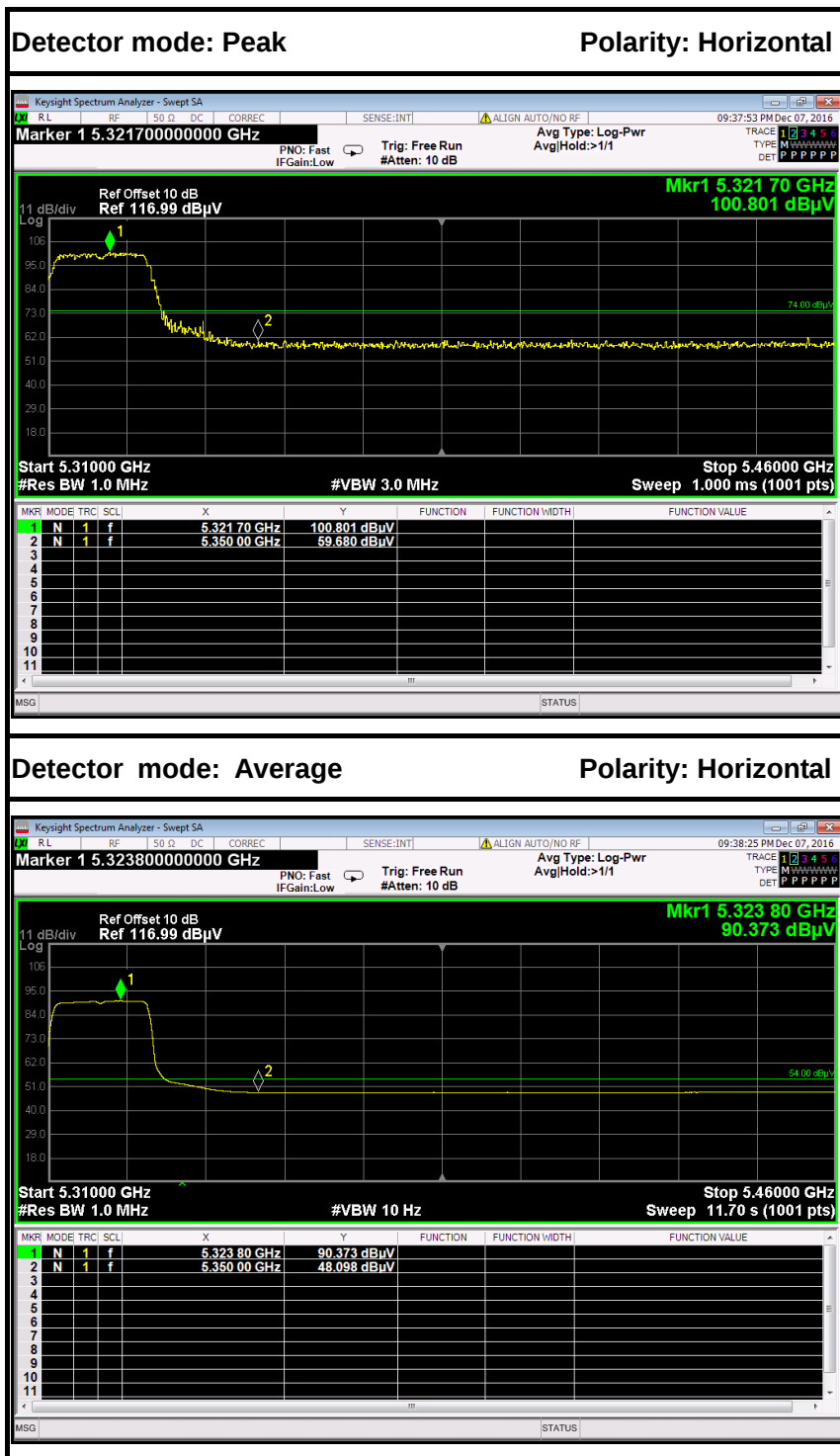
No.	Frequency (MHz)	Reading (dBuV)	Corrected (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Pole
1	5150.0000	64.43	5.60	58.83	74.00	-15.17	Peak	Horizontal
2	5150.0000	54.43	5.60	48.83	54.00	-5.17	Average	Horizontal



IEEE 802.11n HT 20 MHz mode / 5320 MHz



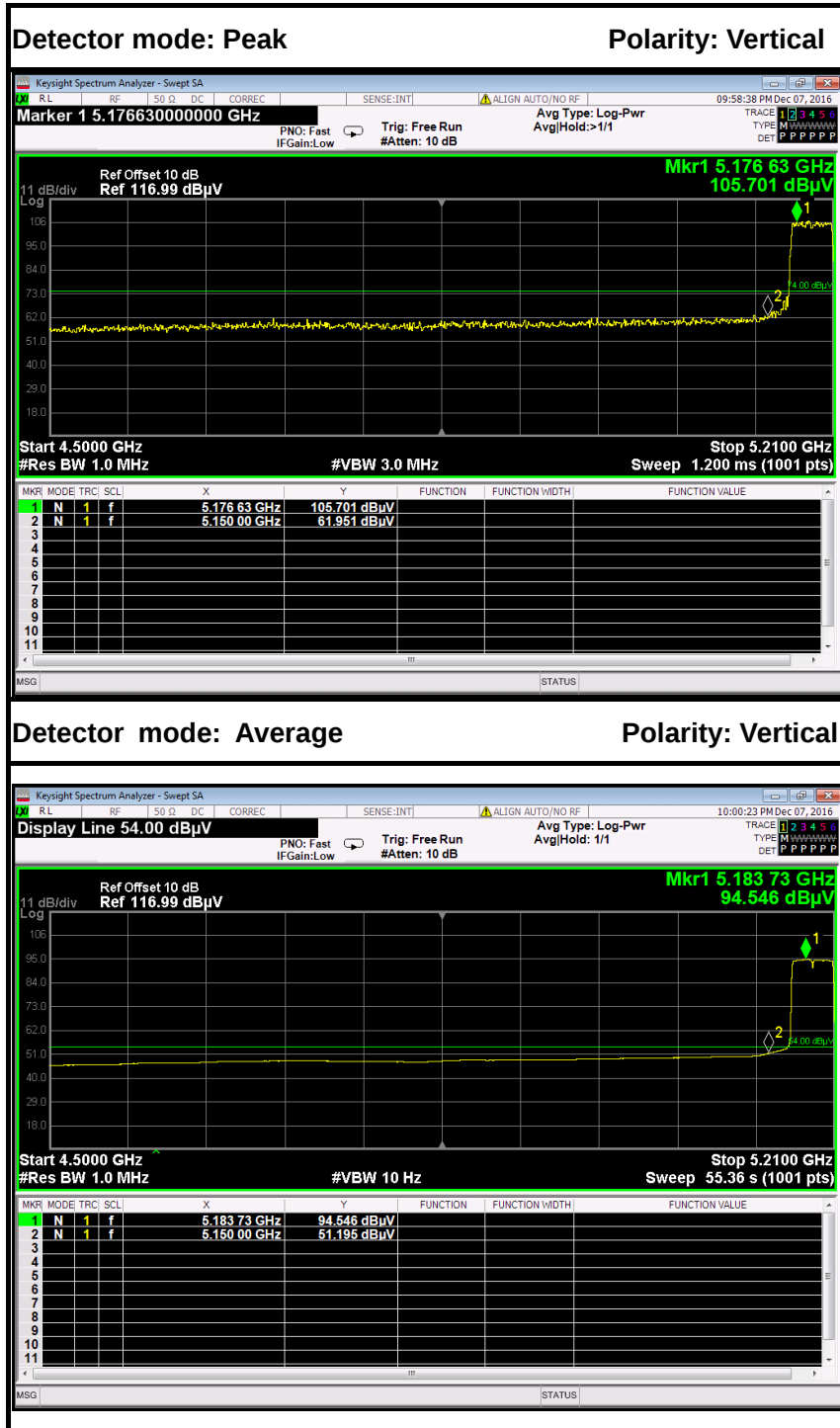
No.	Frequency (MHz)	Reading (dBuV)	Corrected (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Pole
1	5350.0000	67.50	5.60	61.90	74.00	-12.10	Peak	Vertical
2	5350.0000	56.98	5.60	51.38	54.00	-2.62	Average	Vertical



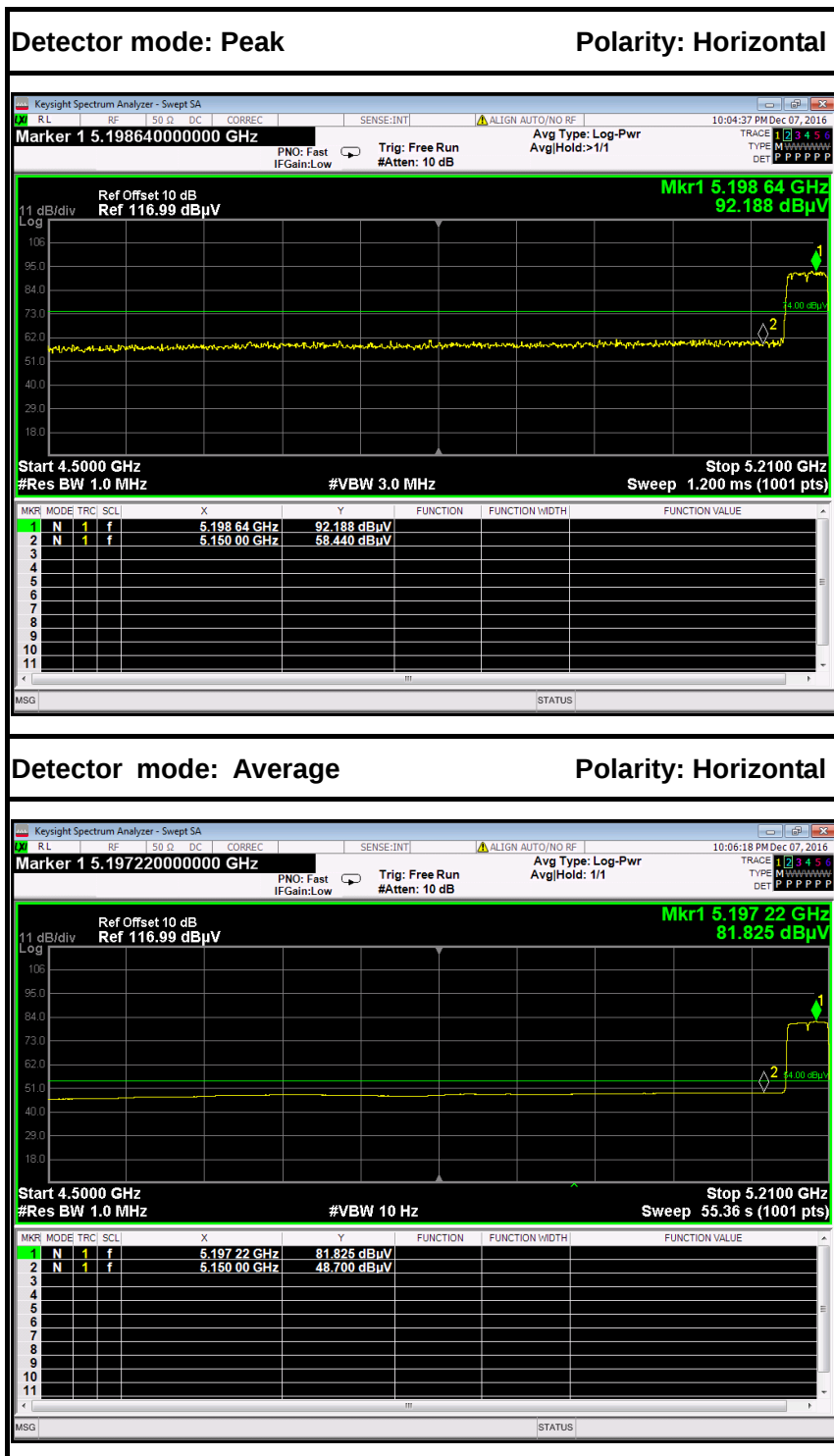
No.	Frequency (MHz)	Reading (dBuV)	Corrected (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Pole
1	5350.0000	65.28	5.60	59.68	74.00	-14.32	Peak	Horizontal
2	5350.0000	53.70	5.60	48.10	54.00	-5.90	Average	Horizontal



IEEE 802.11n HT 40 MHz mode / 5190 MHz



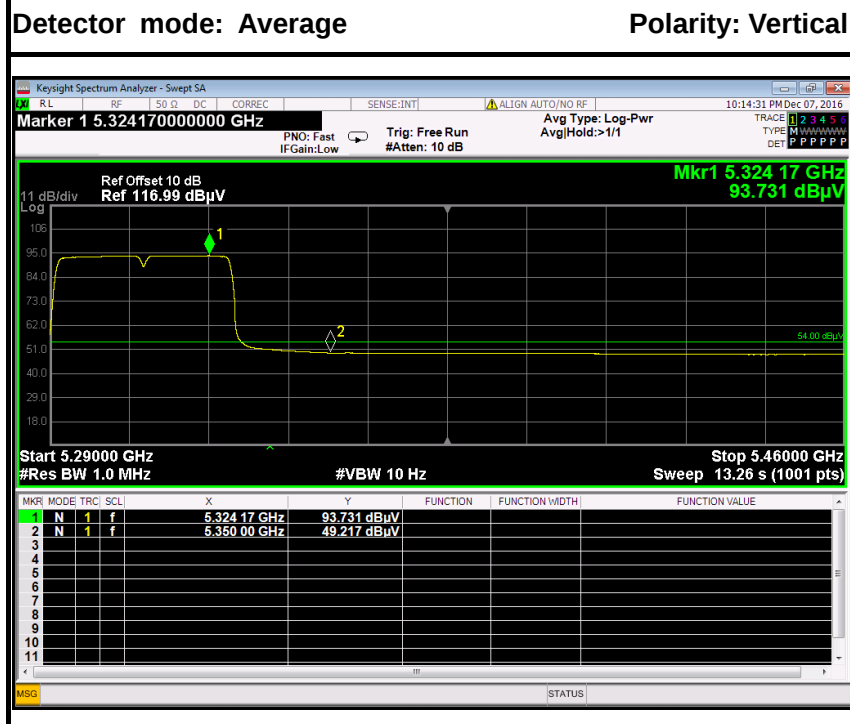
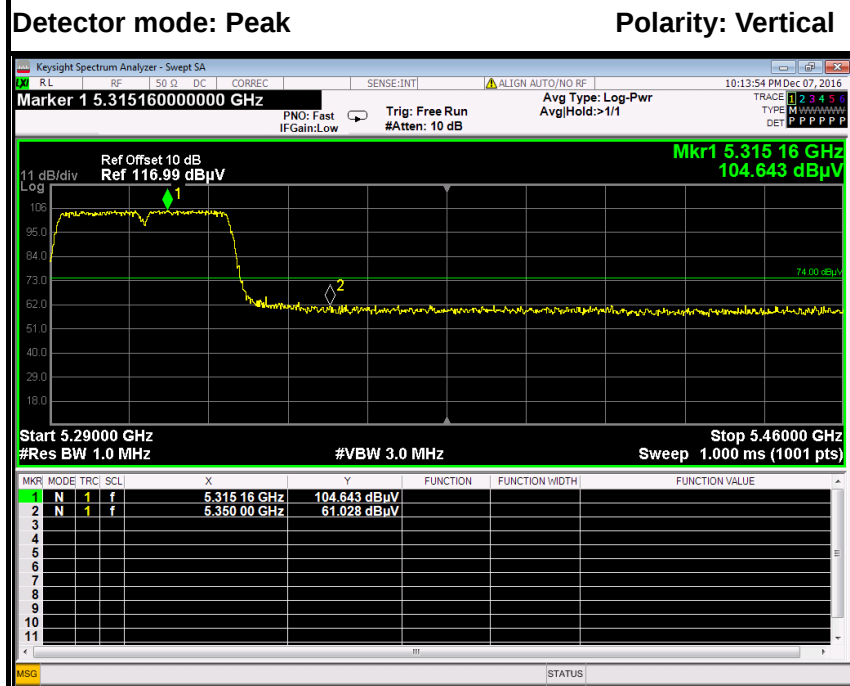
No.	Frequency (MHz)	Reading (dBuV)	Corrected (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Pole
1	5150.0000	67.55	5.60	61.95	74.00	-12.05	Peak	Vertical
2	5150.0000	56.80	5.60	51.20	54.00	-2.81	Average	Vertical



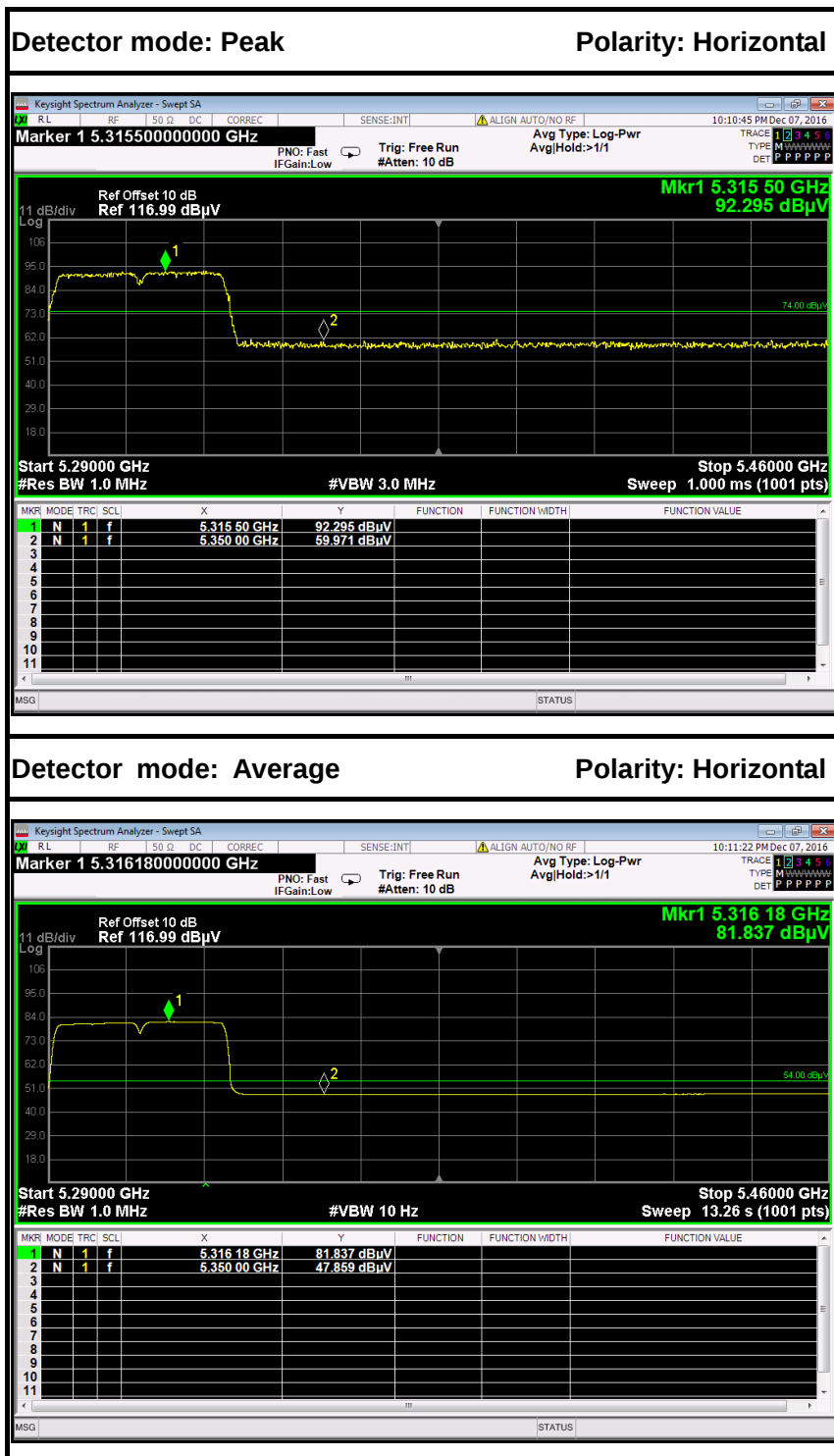
No.	Frequency (MHz)	Reading (dBuV)	Corrected (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Pole
1	5150.0000	64.04	5.60	58.44	74.00	-15.56	Peak	Horizontal
2	5150.0000	54.30	5.60	48.70	54.00	-5.30	Average	Horizontal



IEEE 802.11n HT 40 MHz mode / 5310 MHz



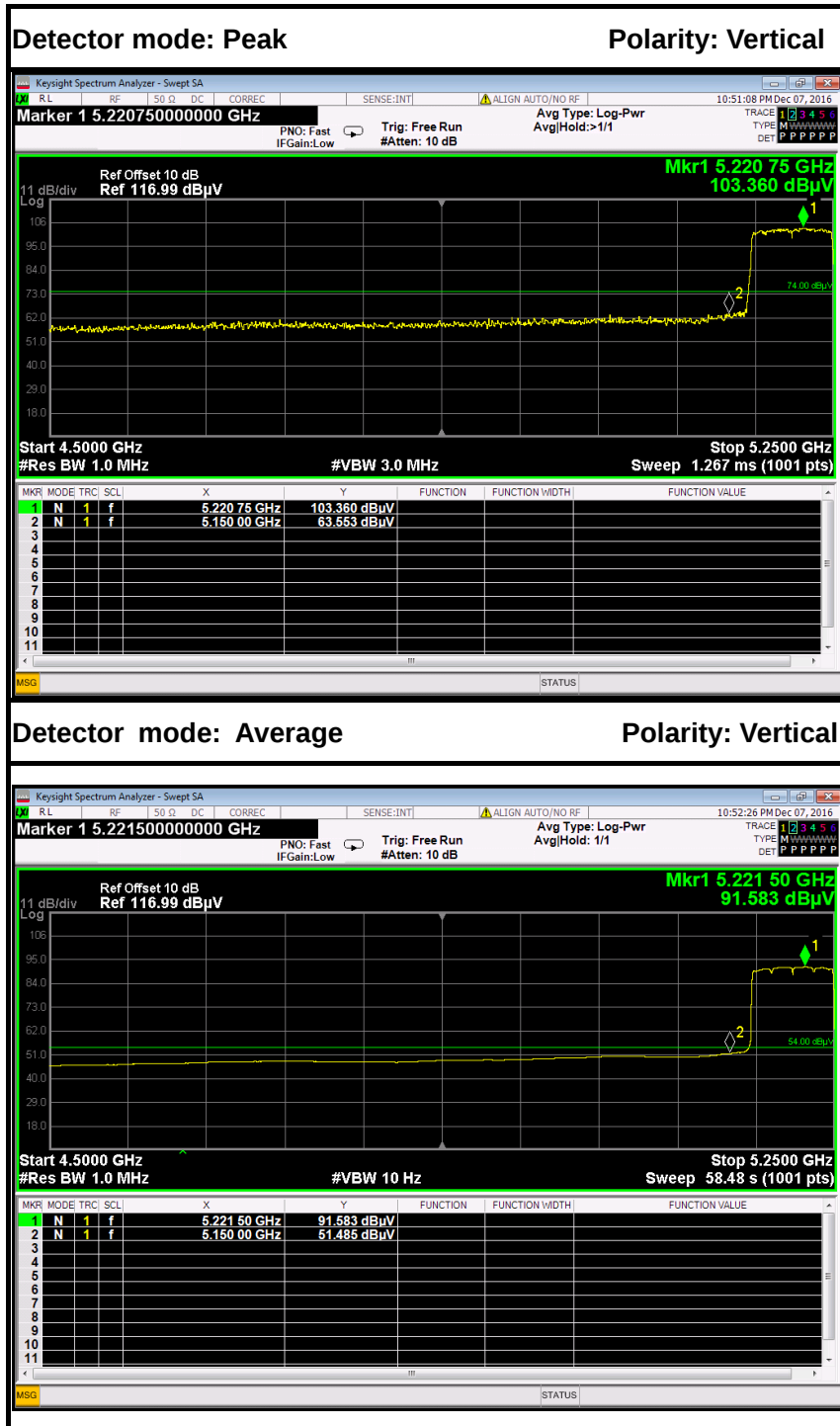
No.	Frequency (MHz)	Reading (dBuV)	Corrected (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Pole
1	5350.0000	66.63	5.60	61.03	74.00	-12.97	Peak	Vertical
2	5350.0000	54.82	5.60	49.22	54.00	-4.78	Average	Vertical



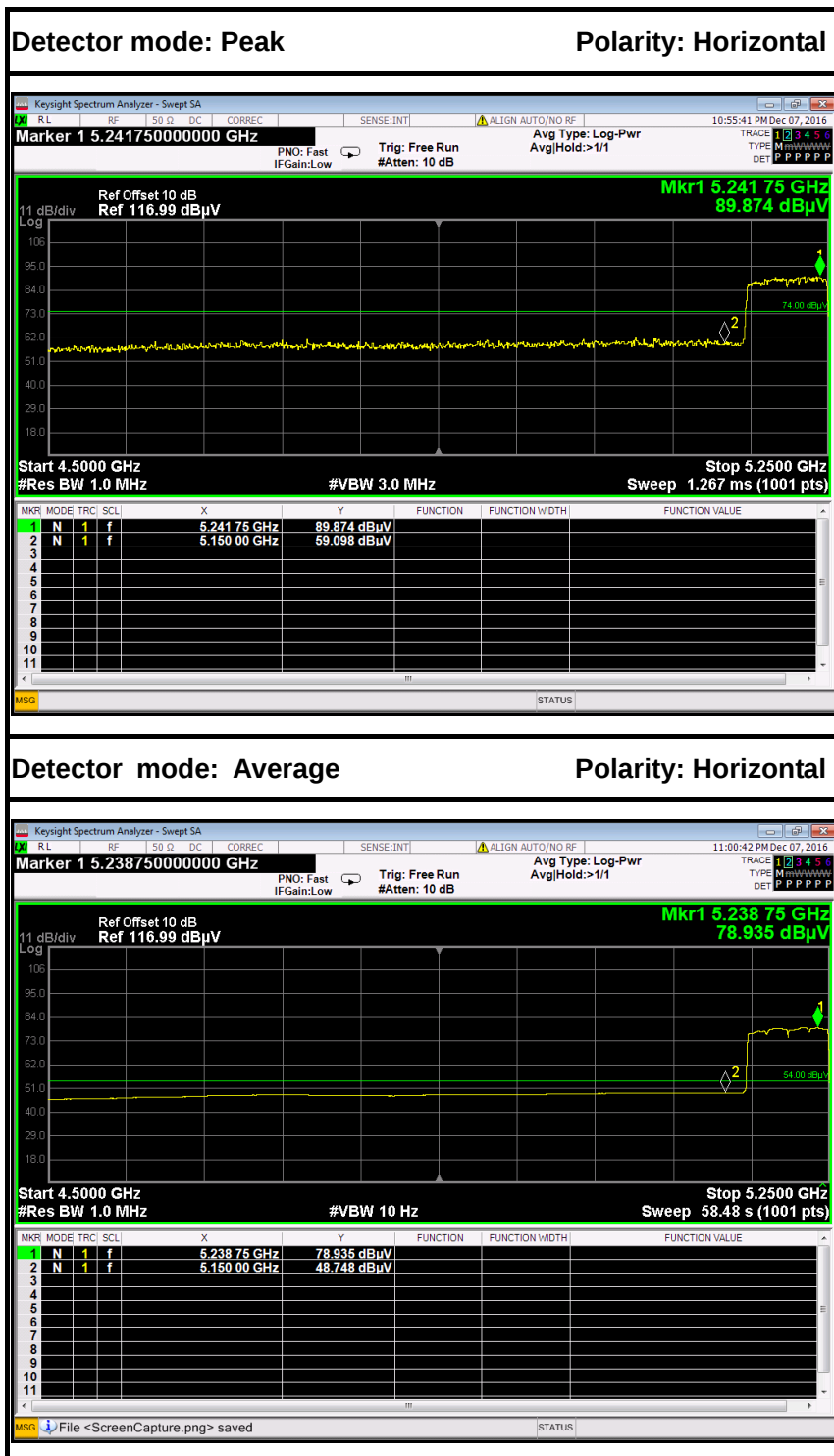
No.	Frequency (MHz)	Reading (dBuV)	Corrected (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Pole
1	5350.0000	65.57	5.60	59.97	74.00	-14.03	Peak	Horizontal
2	5350.0000	53.46	5.60	47.86	54.00	-6.14	Average	Horizontal



IEEE 802.11ac 80 mode / 5210 MHz



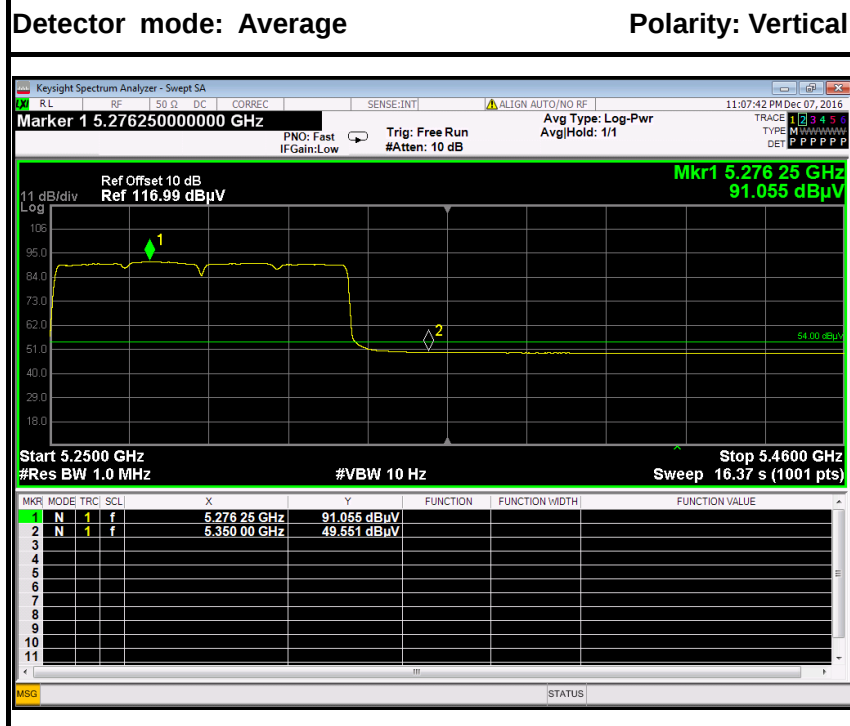
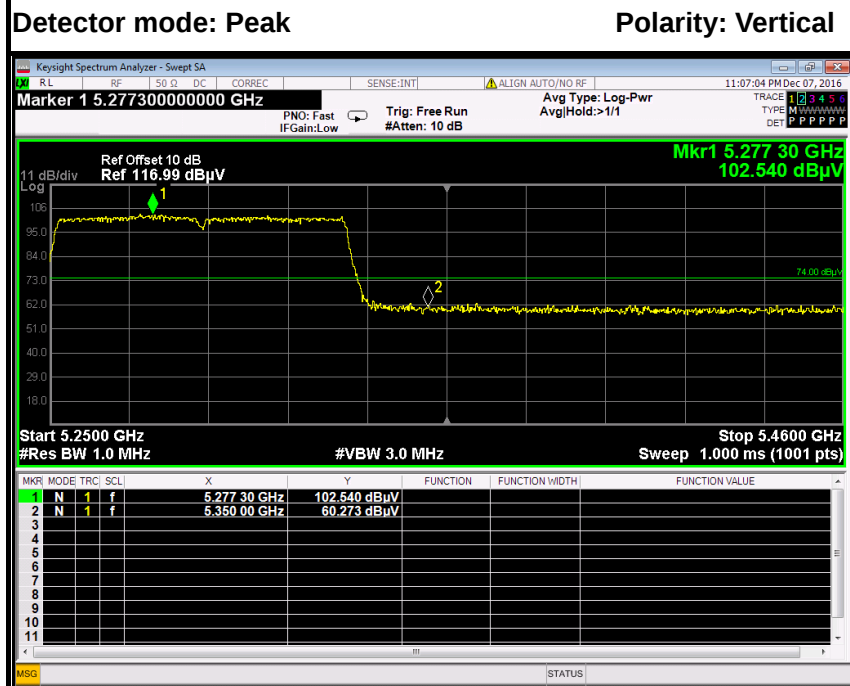
No.	Frequency (MHz)	Reading (dBuV)	Corrected (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Pole
1	5150.0000	69.15	5.60	63.55	74.00	-10.45	Peak	Vertical
2	5150.0000	57.09	5.60	51.49	54.00	-2.52	Average	Vertical



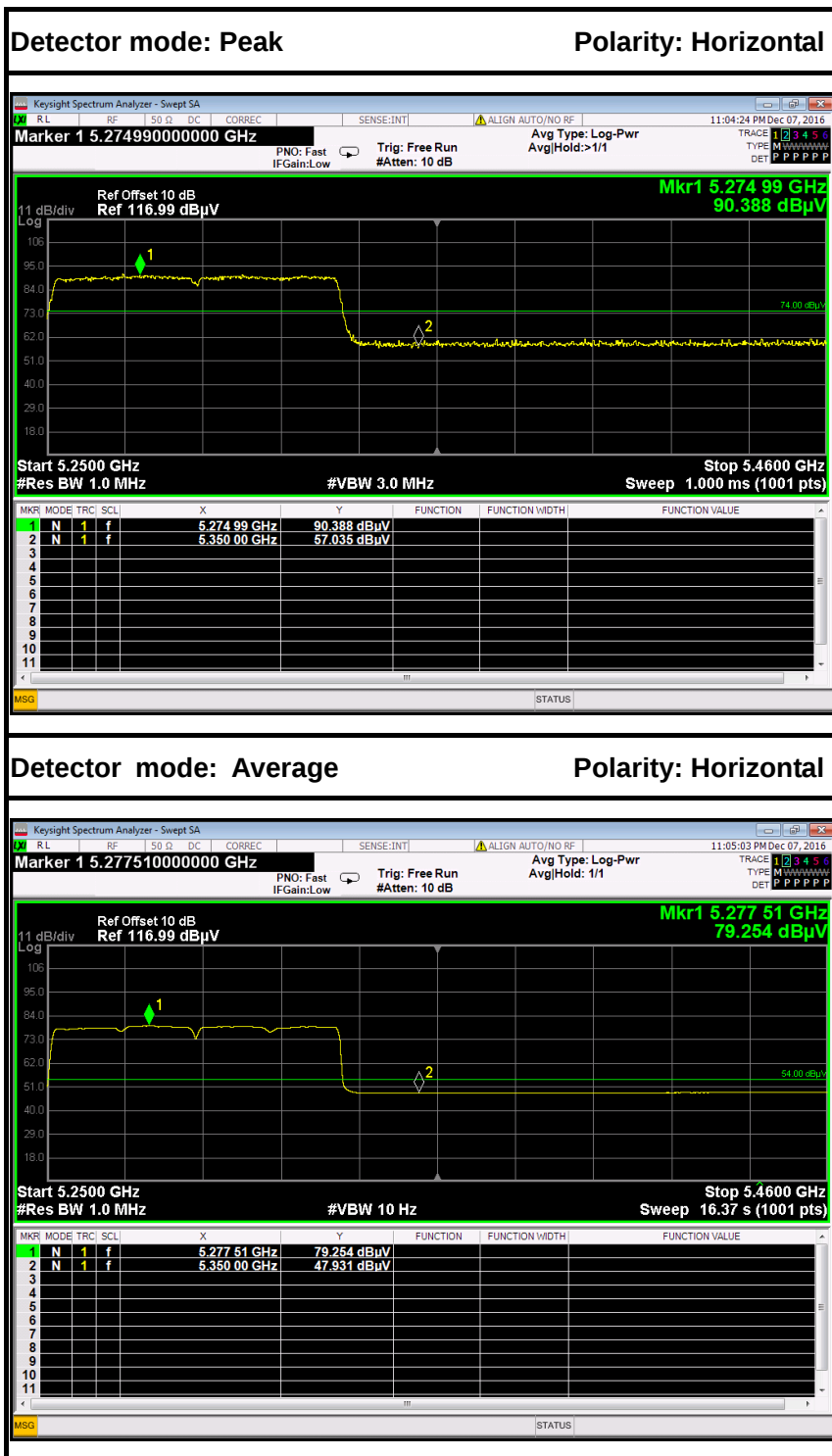
No.	Frequency (MHz)	Reading (dBuV)	Corrected (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Pole
1	5150.0000	64.70	5.60	59.10	74.00	-14.90	Peak	Horizontal
2	5150.0000	54.35	5.60	48.75	54.00	-5.25	Average	Horizontal



IEEE 802.11ac 80 mode / 5290 MHz



No.	Frequency (MHz)	Reading (dBuV)	Corrected (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Pole
1	5350.0000	65.87	5.60	60.27	74.00	-13.73	Peak	Vertical
2	5350.0000	55.15	5.60	49.55	54.00	-4.45	Average	Vertical



No.	Frequency (MHz)	Reading (dBuV)	Corrected (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Pole
1	5350.0000	62.64	5.60	57.04	74.00	-16.97	Peak	Horizontal
2	5350.0000	53.53	5.60	47.93	54.00	-6.07	Average	Horizontal



6.6 PEAK POWER SPECTRAL DENSITY

6.6.1 LIMIT

According to §15.407(a) & FCC R&O FCC 14-30

(1) For the band 5.15-5.25 GHz.

(i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

(ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(2) For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or $11 \text{ dBm} + 10 \log B$, where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.



(3) For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

Note to paragraph (a)(3): The Commission strongly recommends that parties employing U-NII devices to provide critical communications services should determine if there are any nearby Government radar systems that could affect their operation.

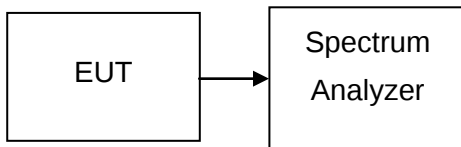
6.6.2 MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Last Calibration	Due Calibration
Spectrum Analyzer	Agilent	N9010A	MY52221469	02/21/2016	02/20/2017

Remark: Each piece of equipment is scheduled for calibration once a year.



6.6.3 TEST CONFIGURATION



6.6.4 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. For devices operating in the bands 5.15-5.25 GHz, Set the spectrum analyzer as RBW = 1MHz, VBW = 3MHz, Span > 26dB bandwidth, Sweep=1ms
3. For devices operating in the bands 5.725-5.85 GHz, Set the spectrum analyzer as RBW = 1MHz, VBW = 3MHz, Span > 26dB bandwidth, Sweep=1ms
4. Record the max. reading.
5. Repeat the above procedure until the measurements for all frequencies are completed

**6.6.5 TEST RESULTS****Test Data****Test mode: IEEE 802.11a mode / 5180 ~ 5240MHz**

Low	5180	5.086	17	-11.914	PASS
Mid	5200	5.179		-11.821	PASS
High	5240	4.737		-12.263	PASS

Test mode: IEEE 802.11a mode / 5260~ 5320MHz

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margain	Result
Low	5260	8.520	11	-2.480	PASS
Mid	5300	8.536		-2.464	PASS
High	5320	8.518		-2.482	PASS

Test mode: IEEE 802.11a mode / 5500 ~ 5700MHz

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margain	Result
Low	5500	9.079	11	-1.921	PASS
Mid	5580	7.652		-3.348	PASS
High	5700	7.794		-3.206	PASS

Test mode: IEEE 802.11a mode / 5745 ~ 5825MHz

Channel	Frequency (MHz)	PPSD (dBm)	factor	Limit (dBm)	Margain	Result
Low	5745	8.362	-3.01	30	-24.648	PASS
Mid	5785	8.514	-3.01		-24.496	PASS
High	5825	8.440	-3.01		-24.570	PASS

Remark: factor =10*lg(500/RBW)

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

Low	5180	4.994	17	-12.006	PASS
Mid	5200	5.146		-11.854	PASS
High	5240	5.034		-11.966	PASS

Test mode: IEEE 802.11n HT 20 MHz mode / 5260~ 5320MHz

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margain	Result
Low	5260	8.032	11	-2.968	PASS
Mid	5300	7.482		-3.518	PASS
High	5320	7.753		-3.247	PASS

Test mode: IEEE 802.11n HT 20 MHz mode / 5500 ~ 5700MHz

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margain	Result
Low	5500	9.088	11	-1.912	PASS
Mid	5580	7.811		-3.189	PASS
High	5700	8.171		-2.829	PASS

Test mode: IEEE 802.11n HT 20 MHz mode / 5745 ~ 5825MHz

Channel	Frequency (MHz)	PPSD (dBm)	factor	Limit (dBm)	Margain	Result
Low	5745	8.639	-3.01	30	-24.371	PASS
Mid	5785	8.913	-3.01		-24.097	PASS
High	5825	8.603	-3.01		-24.407	PASS

Remark: factor = $10 \cdot \lg(500/\text{RBW})$

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

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margain	Result
Low	5190	3.794	17	-13.206	PASS
High	5230	3.773		-13.227	PASS

Test mode: IEEE 802.11n HT 40 MHz mode / 5270 ~ 5310MHz

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margain	Result
Low	5270	3.114	11	-7.886	PASS
High	5310	3.929		-7.071	PASS

Test mode: IEEE 802.11n HT 40 MHz mode / 5510 ~ 5670MHz

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margain	Result
Low	5510	5.641	11	-5.359	PASS
Mid	5550	4.420		-6.580	PASS
High	5670	3.710		-7.290	PASS

Test mode: IEEE 802.11n HT 40 MHz mode / 5755 ~ 5795MHz

Channel	Frequency (MHz)	PPSD (dBm)	factor	Limit (dBm)	Margain	Result
Low	5755	4.624	-3.01	30	-28.386	PASS
High	5795	4.353	-3.01		-28.657	PASS

Remark: factor = $10 \cdot \lg(500/\text{RBW})$