RF TEST REPORT

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Report No.: 16040115-FCC-R1

Supersede Report No.: N/A

Applicant	Panasonic corporation of North America
Product Name	Car Audio System with Bluetooth and Wi-Fi
Model No.	AH1801
Serial No.	N/A
Test Standard	FCC Part 15.407: 2014, ANSI C63.10: 2013
Test Date	April 25 to October 13, 2016
Issue Date	October 14, 2016
Test Result	☑ Pass ☐ Fail
Equipment complied with the specification	☑
Equipment did not comply with the specification	☐

Loren Luo	David Huang	
Loren Luo Test Engineer	David Huang Checked By	

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Test result presented in this test report is applicable to the tested sample only

Issued by:

SIEMIC (SHENZHEN-CHINA) LABORATORIES

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Laboratories Introduction

SIEMIC, headquartered in the heart of Silicon Valley, with superior facilities in US and Asia, is one of the leading independent testing and certification facilities providing customers with one-stop shop services for Compliance Testing and Global Certifications.

In addition to testing and certification, SIEMIC provides initial design reviews and compliance management throughout a project. Our extensive experience with China, Asia Pacific, North America, European, and International compliance requirements, assures the fastest, most cost effective way to attain regulatory compliance for the global markets.

Accreditations for Conformity Assessment

Country/Region	Scope
USA	EMC, RF/Wireless, SAR, Telecom
Canada	EMC, RF/Wireless, SAR, Telecom
Taiwan	EMC, RF, Telecom, SAR, Safety
Hong Kong	RF/Wireless, SAR, Telecom
Australia	EMC, RF, Telecom, SAR, Safety
Korea	EMI, EMS, RF, SAR, Telecom, Safety
Japan	EMI, RF/Wireless, SAR, Telecom
Singapore	EMC, RF, SAR, Telecom
Europe	EMC, RF, SAR, Telecom, Safety

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1. Report Revision History

Report No.	Report Version	Description	Issue Date
16040115-FCC-R1	NONE	Original	October 1,2016
16040115-FCC-R1	V1	Adding the channel 122 testing and changing the setup photos	October 14, 2016

2. Customer information

Applicant Name	Panasonic corporation of North America
Applicant Add	Two Riverfront Plaza, 9th Floor, Newark, New Jersey NJ07102-5490 USA
Manufacturer	Panasonic Automotive Systems de Mexico S.A. de C.V.
Manufacturer Add	88785 Mike Allen1231, Parque Industrial Reynosa, Reynosa Tamaulipas, Mexico.

3. Test site information

Lab performing tests	SIEMIC (Shenzhen-China) LABORATORIES
Lab Address	Zone A, Floor 1, Building 2 Wan Ye Long Technology Park South Side of Zhoushi Road, Bao' an District, Shenzhen, Guangdong China 518108
FCC Test Site No.	718246
IC Test Site No.	4842E-1
Test Software	Radiated Emission Program-To Shenzhen v2.0

4. Equipment under Test (EUT) Information

Description of EUT:	Car Audio System with Bluetooth and Wi-Fi
Main Model:	AH1801
Serial Model:	N/A
Date EUT received:	April 25, 2016
Test Date(s):	April 25 to October 13, 2016
Equipment Category：	NII
Antenna Gain:	Bluetooth(2.4G): -0.53 dBi WIFI(2.4G): -0.53 dBi WIFI(5150-5350MHz): -0.98 dBi WIFI(5470-5725MHz): -0.26 dBi WIFI(5725-5850MHz): -0.63 dBi **(Note: The AH1801 will be sold without antenna, this antenna only used for DFS or radiated spurious emission test.)**
Type of Modulation:	Bluetooth: GFSK, π /4DQPSK, 8DPSK 802.11b: DSSS 802.11a/g/n20/n40/ac20/ac40/ac80: OFDM
Input Power:	DC 13.2V, 5A
Number of Channels:	Bluetooth: 79CH WIFI :802.11b/g: 11CH WIFI :802.11a: 24CH WIFI :802.11n20: 11CH(2.4GHz); 24CH(5GHz) WIFI :802.11n40: 9CH(2.4GHz); 12CH(5GHz) WIFI :802.11ac20: 24CH WIFI :802.11ac40: 12CH WIFI :802.11ac80: 6CH

RF Operating Frequency (ies):	Bluetooth: 2402-2480 MHz 802.11b/g: 2412-2462 MHz (TX/RX) 802.11n20: 2412-2462MHz ;5180-5320 MHz; 5500-5700 MHz; 5745-5825 MHz； (TX/RX) 802.11n40: 2422-2452 MHz (TX/RX); 5190-5310 MHz; 5510-5710 MHz;5755-5795 MHz；(TX/RX) 802.11 a: 5180-5320 MHz; 5500-5700 MHz; 5745-5825 MHz (TX/RX) 802.11ac 20: 5180-5320 MHz; 5500-5700 MHz; 5745-5825 MHz；(TX/RX) 802.11ac 40: 5190-5310 MHz; 5510-5710 MHz; 5755-5795 MHz；(TX/RX) 802.11ac 80: 5210-5290 MHz; 5530-5690 MHz; 5775 MHz； (TX/RX)
Max. Output Power:	802.11a: 8.58 dBm 802.11n(20M): 7.78 dBm 802.11n(40M): 7.96 dBm 802.11ac(20M): 7.68 dBm 802.11ac(40M): 7.96 dBm 802.11ac(80M): 5.21 dBm
Port:	GPS antenna Connector; XM antenna connector; BT/WiFi antenna Connector; Extension 2 Connector; RS485 Connector; S/PDIF Connector (AMP/DVD/RT); USB Connector(TCU/NFC);GA-NET Connector;LVDS Connector(CTR/MTR); USB Connector(1,2); Extension 1 Connector; MAIN Connector
Trade Name :	Panasonic
GPRS/EGPRS Multi-slot class	8/10/12
FCC ID:	ACJAH1801
Antenna Type:	PIFA antenna

5. Test Summary

The product was tested in accordance with the following specifications.

All testing has been performed according to below product classification:

FCC Rules	Description of Test	Result
§15.407 (i), §2.1093	RF Exposure	Compliance
§15.203	Antenna Requirement	Compliance
§15.407 (a)(1)	DTS (99%&26 dB) CHANNEL BANDWIDTH	Compliance
§15.407 (e)	DTS (99%&6 dB) CHANNEL BANDWIDTH	Compliance
§15.407(a/1/2)	Conducted Maximum Output Power	Compliance
§15.407(a/1/2)	Peak Power Spectral Density	Compliance
§15.407(a)(6)	Peak Power Excursion	Compliance
§15.207 (a),	AC Power Line Conducted Emissions	N/A
§15.205, §15.209, §15.247(b/1/2/3/6)	Radiated Spurious Emissions & Unwanted Emissions into Restricted Frequency Bands	Compliance

6. Measurements, Examination And Derived Results

6.1 §15.203 - ANTENNA REQUIREMENT

Applicable Standard

According to § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the user of a standard antenna jack or electrical connector is prohibited.
The structure and application of the EUT were analyzed to determine compliance with section §15.203 of the rules. §15.203 state that the subject device must meet the following criteria:

a. Antenna must be permanently attached to the unit.
b. Antenna must use a unique type of connector to attach to the EUT.

Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.
And according to FCC 47 CFR section 15.247 (b), if the transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Antenna Connector Construction

The EUT has 1 antenna:
The antenna which is in the LCD display uses a unique type of connector to attach to the EUT. For Bluetooth//WIFI, the gain is -0.53dBi for Bluetooth, the gain is -0.53dBi for 2400-2483.5MHz WIFI, the gain is 0.98dBi for 5150-5350MHz WIFI, the gain is 0.26dBi for 5470-5725MHz WIFI, the gain is -0.63dBi for 5725-2850MHz WIFI.

Result: Pass

6.2 §15.407(a)-DTS (99% &26 dB) Channel Bandwidth

1. Conducted Measurement

   EUT was set for low, mid, high channel with modulated mode and highest RF output power.

   The spectrum analyzer was connected to the antenna terminal.

2. Environmental Conditions

Environmental Conditions	Temperature	23°C
	Relative Humidity	55%
	Atmospheric Pressure	1022mbar

3. Conducted Emissions Measurement Uncertainty

   All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2, in the range 30MHz – 40GHz is ±1.5dB.

4. Test date : May 18, 2016 &September 22, 2016 &October 9, 2016

   Tested By : Loren Luo

Standard Requirement:

None; for reporting purposes only.

Procedures:

99% Bandwidth:

1. Set center frequency to the nominal EUT channel center frequency
2. Set span = 1.5 times to 5.0 times the OBW.
3. Set RBW = 1 % to 5 % of the OBW
4. he video bandwidth (VBW) ≥ 3 x RBW.
5. Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used
6. Use the 99 % power bandwidth function of the instrument (if available)
7. If the instrument does not have a 99 % power bandwidth function, the trace data points are recovered and directly summed in power units. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 % of the total is reached; that

frequency is recorded as the lower frequency. The process is repeated until 99.5 % of the total is reached; that frequency is recorded as the upper frequency. The 99% occupied bandwidth is the

difference between these two frequencies.

Emission Bandwidth (EBW)

1) Set RBW = approximately 1% of the emission bandwidth.
2) Set the VBW > RBW.
3) Detector = Peak.
4) Trace mode = max hold.
5) Measure the maximum width of the emission that is 26 dB down from the maximum of the emission. Compare this with the RBW setting of the analyzer. Readjust

Test Result: Pass.

Please refer to the following tables and plots.

Measurement result

Test mode	Freq Band (MHz)	CH	Freq (MHz)	99% Bandwidth (MHz)	26dB Bandwidth (MHz)
820.11a	5150-5250	Low	5180	16.3602	19.482
		Middle	5220	16.2720	18.940
		High	5240	16.3413	19.068
	5250-5350	Low	5260	16.3476	18.989
		Middle	5300	16.2630	19.320
		High	5320	16.3497	19.615
	5470-5725	Low	5500	16.3306	19.490
		Mid	5600	16.3278	19.925
		High	5700	16.3199	19.283
	5725-5850	Low	5745	16.2960	19.089
		Mid	5785	16.3233	18.959
		High	5825	16.3487	19.170
802.11n (20M)	5150-5250	Low	5180	17.5263	20.569
		Middle	5220	17.401	20.040
		High	5240	17.5275	20.214
	5250-5350	Low	5260	17.4296	20.845
		Middle	5300	17.405	19.880
		High	5320	17.4251	20.463
	5470-5725	Low	5500	17.4503	20.737
		Mid	5600	17.4222	19.970
		High	5700	17.4393	20.408
	5725-5850	Low	5745	17.4406	20.897
		Mid	5785	17.4467	20.548
		High	5825	17.4504	20.720

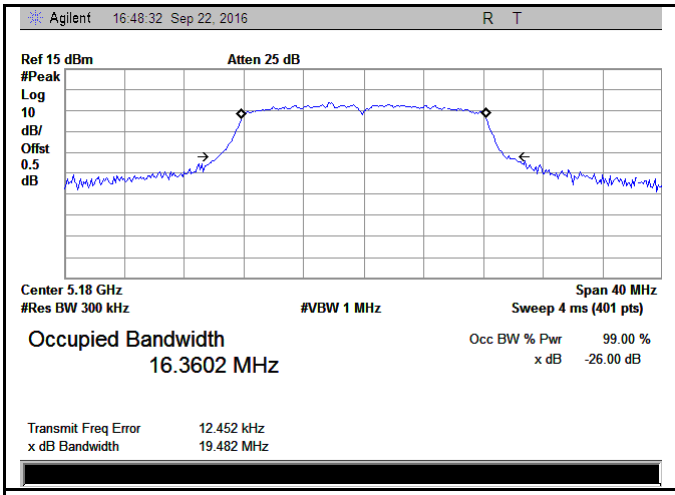
802.11n (40M)	5150-5250	Low	5190	36.2514	47.322
		High	5230	36.2374	47.927
	5250-5350	Low	5270	36.0392	45.430
		High	5310	36.0583	43.561
	5470-5725	Low	5510	36.0996	45.776
		Mid	5590	36.0994	41.676
		High	5670	36.098	42.38
		Straddle	5710	36.0573	41.663
	5725-5850	Low	5755	36.0435	44.289
		High	5795	36.0188	44.453
802.11ac (20M)	5150-5250	Low	5180	17.4246	20.387
		Middle	5220	17.4090	19.820
		High	5240	17.4218	20.694
	5250-5350	Low	5260	17.4332	20.518
		Middle	5300	17.428	20.210
		High	5320	17.4315	20.320
	5470-5725	Low	5500	17.4537	20.185
		Mid	5600	17.4544	20.296
		High	5700	17.4569	20.659
	5725-5850	Low	5745	17.4650	20.939
		Mid	5785	17.4374	20.311
		High	5825	17.4413	20.577
802.1ac (40M)	5150-5250	Low	5190	36.1133	46.058
		High	5230	36.3284	50.119
	5250-5350	Low	5270	36.0748	44.167
		High	5310	35.9749	44.883
	5470-5725	Low	5510	36.0134	46.744
		Mid	5590	36.0264	48.940
		High	5670	36.0950	41.24
		Straddle	5710	36.0122	46.639
	5725-5850	Low	5755	35.9686	41.348
		High	5795	35.9526	43.525

802.11ac (80M)	5150-5250	One	5210	75.0160	83.692
	5250-5350	One	5290	75.0992	83.532
	5470-5725	Low	5530	74.8824	83.114
		High	5610	74.8758	83.758
		Straddle	5690	75.1172	83.646
	5725-5850	One	5775	75.1254	83.120

Test Plots

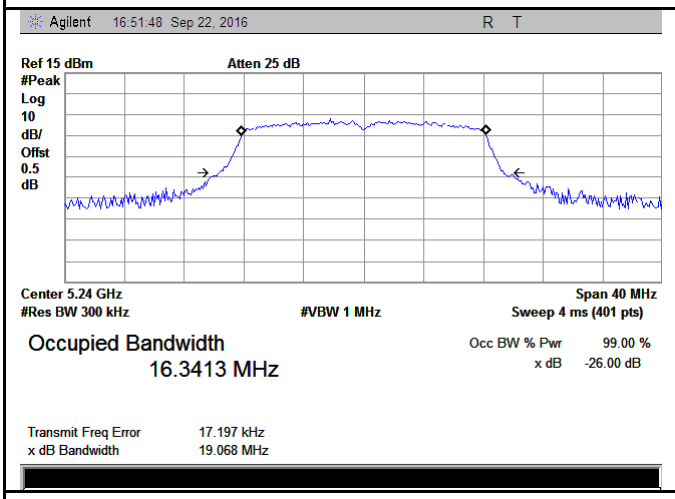
Bandwidth measurement result

802.11a

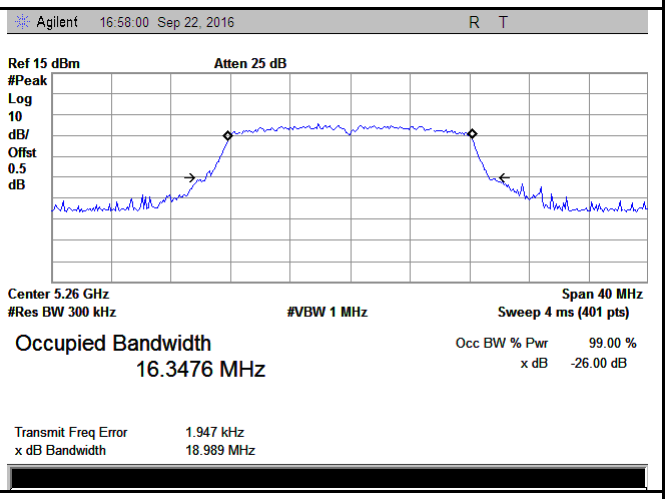


5150-5250MHz Bandwidth - Low CH 5180

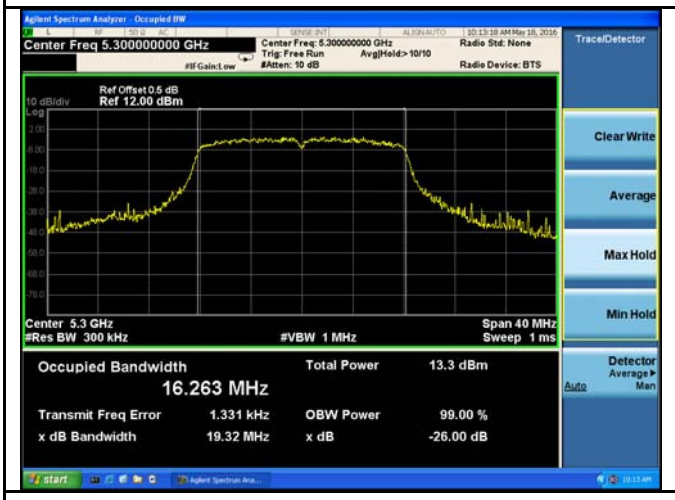
5150-5250MHz Bandwidth - Middle CH 5220



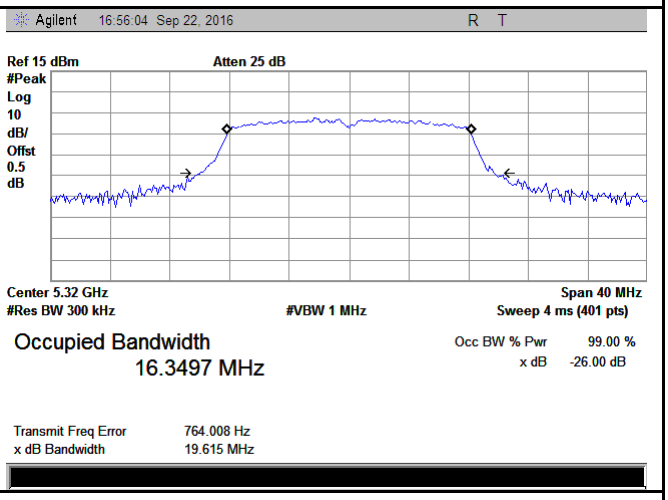
5150-5250MHz Bandwidth - High CH 5240



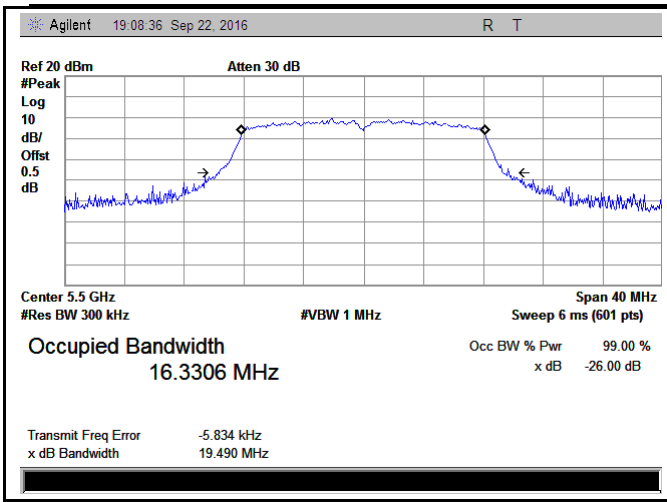
5250-5350MHz Bandwidth - Low CH 5260



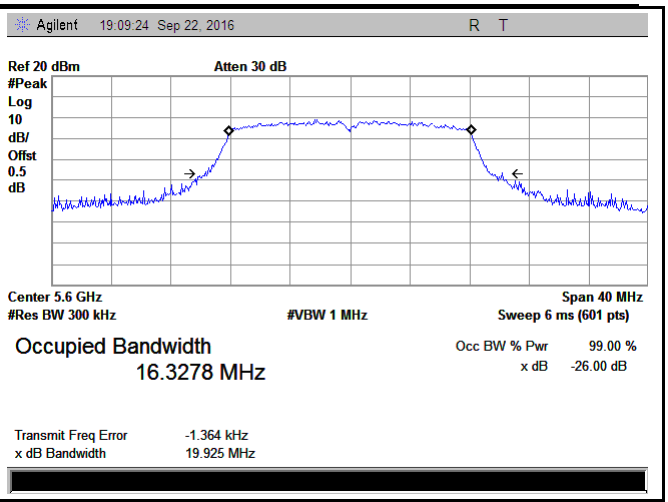
5250-5350MHz Bandwidth - Middle CH 5300



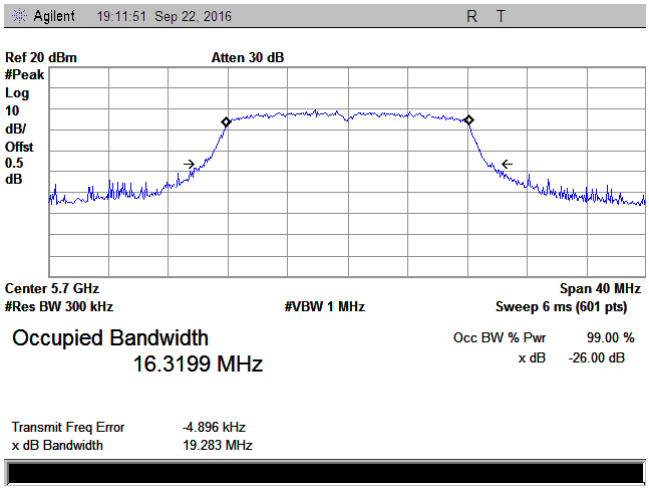
5250-5350MHz Bandwidth - High CH 5320



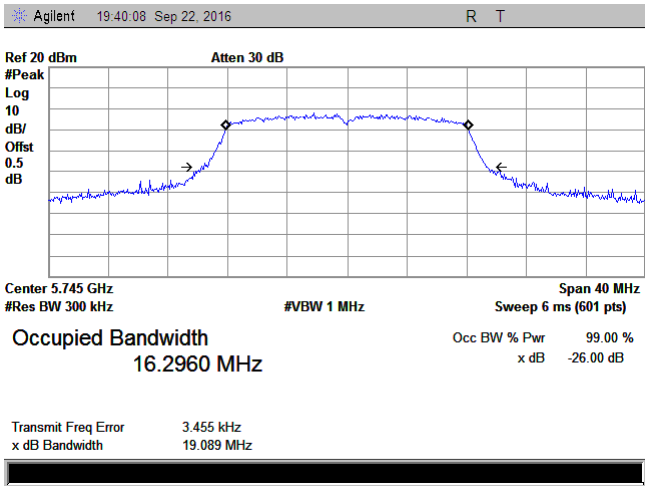
5470-5725MHz Bandwidth - Low CH 5500



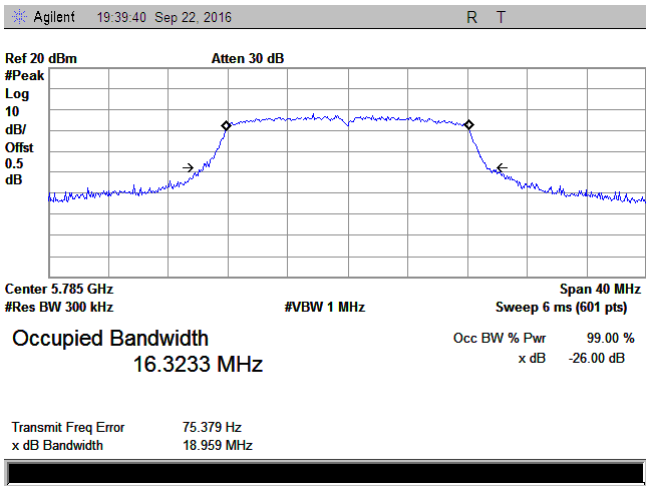
5470-5725MHz Bandwidth - Mid CH 5600



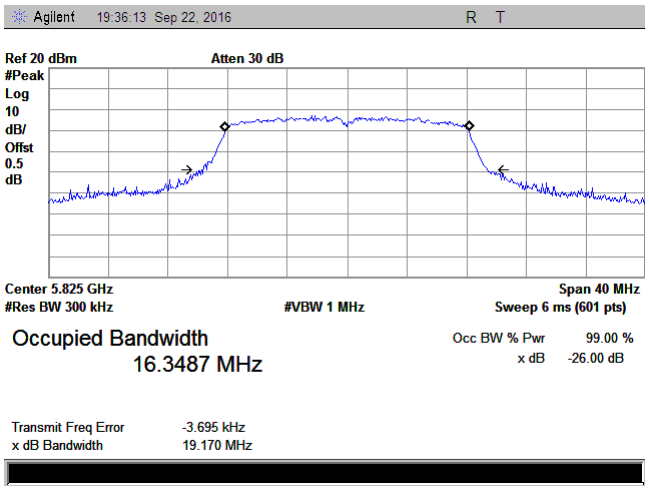
5470-5725MHz Bandwidth - High CH 5700



5725-5850MHz Bandwidth - Low CH 5745

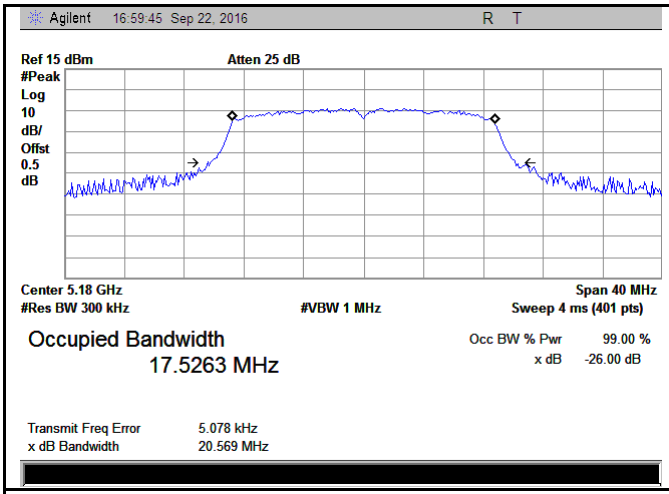


5725-5850MHz Bandwidth - Mid CH 5785



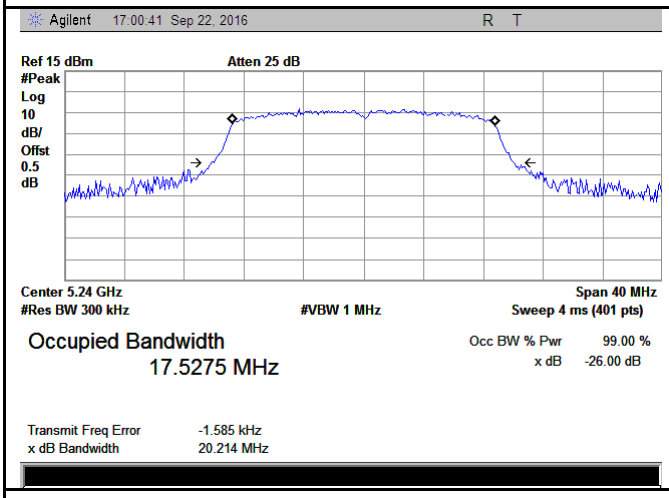
5725-5850MHz Bandwidth - High CH 5825

802.11n (20M)

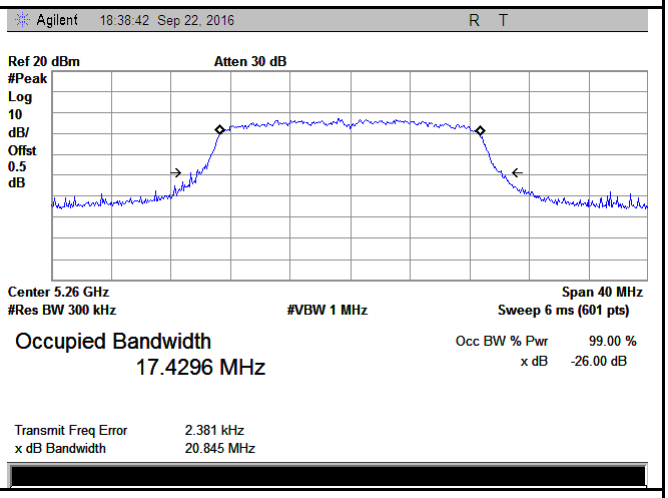


5150-5250MHz Bandwidth - Low CH 5180

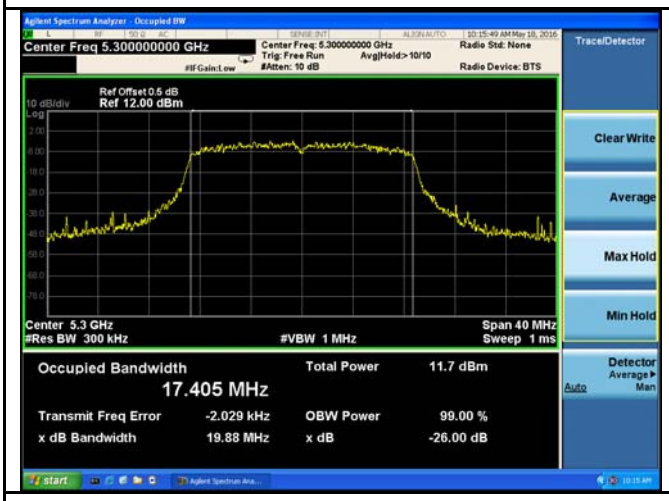
5150-5250MHz Bandwidth - Middle CH 5220



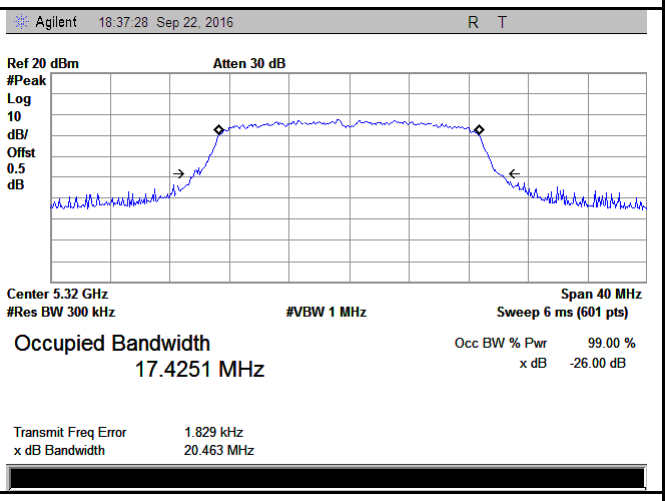
5150-5250MHz Bandwidth - High CH 5240



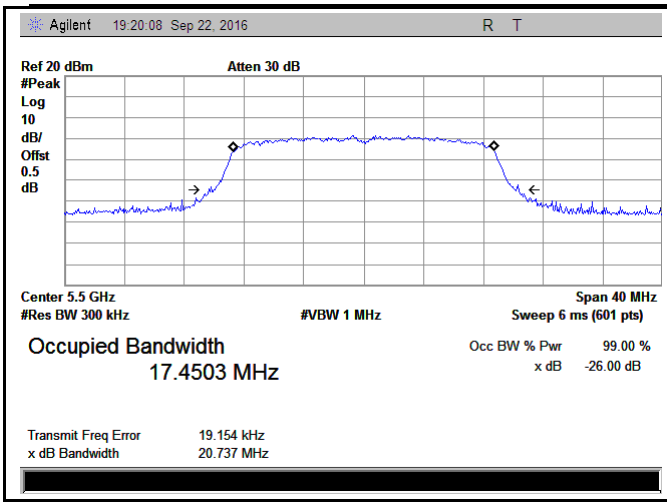
5250-5350MHz Bandwidth - Low CH 5260



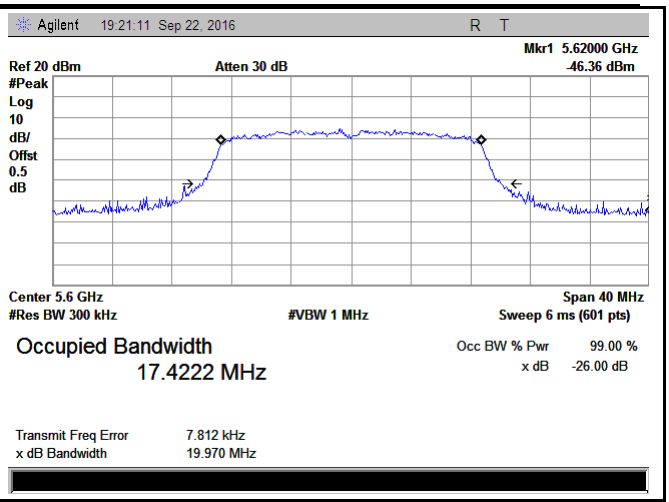
5250-5350MHz Bandwidth - Middle CH 5300



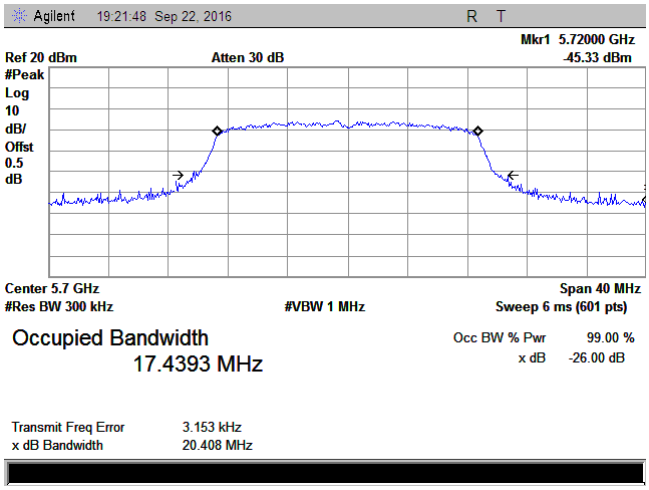
5250-5350MHz Bandwidth - High CH 5320



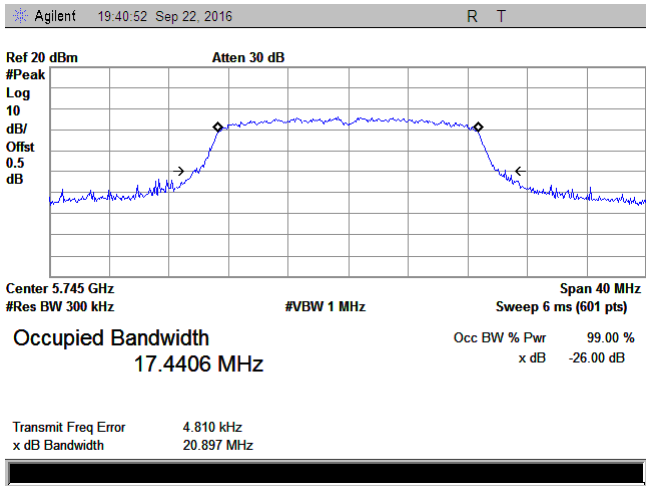
5470-5725MHz Bandwidth - Low CH 5500



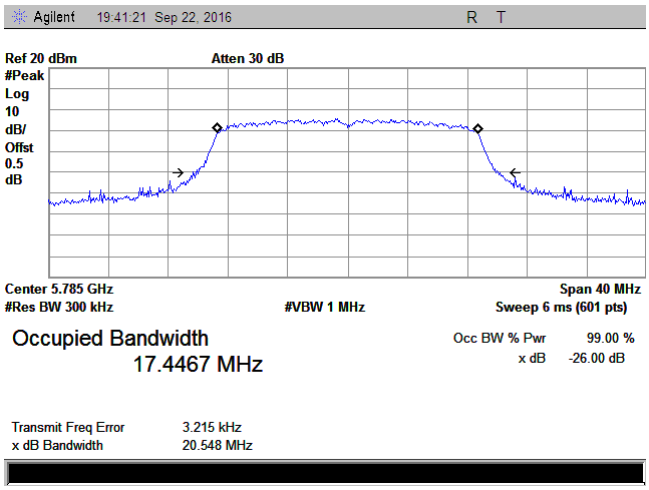
5470-5725MHz Bandwidth - Mid CH 5600



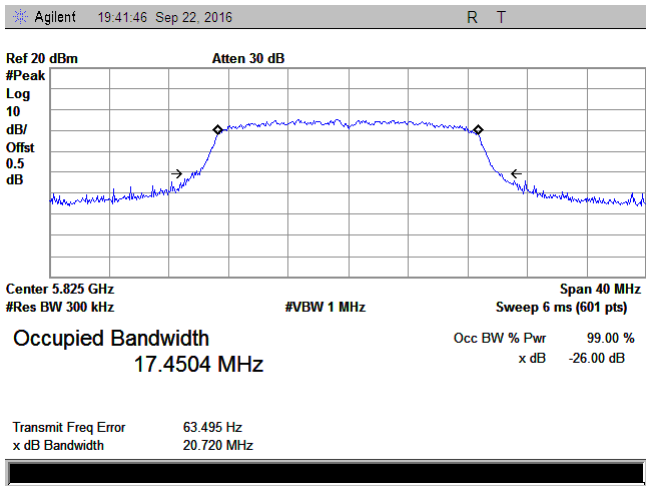
5470-5725MHz Bandwidth - High CH 5700



5725-5850MHz Bandwidth - Low CH 5745

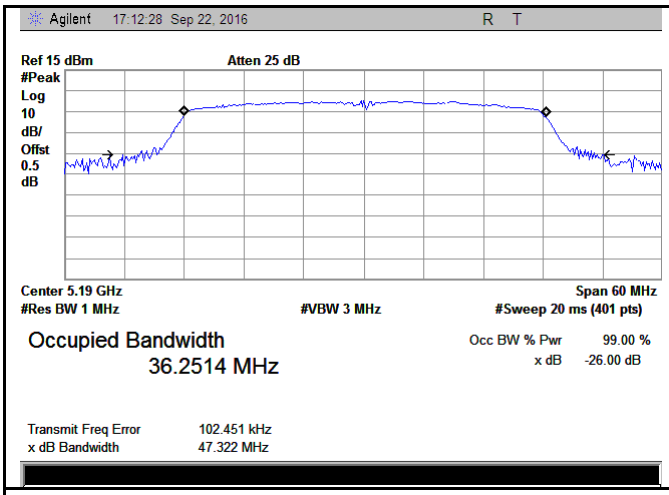


5725-5850MHz Bandwidth - Mid CH 5785

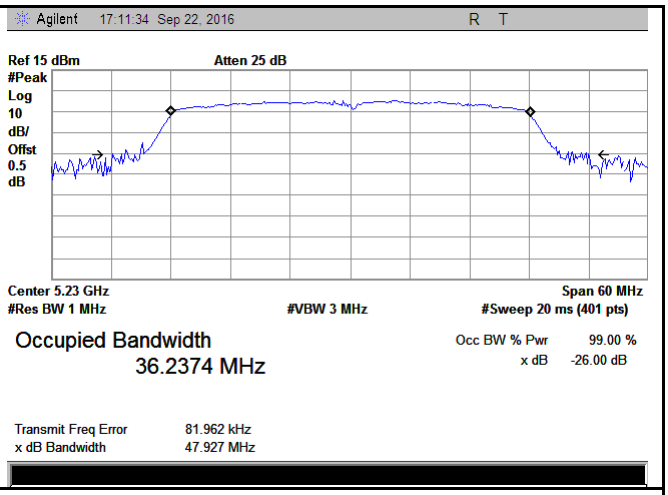


5725-5850MHz Bandwidth - High CH 5825

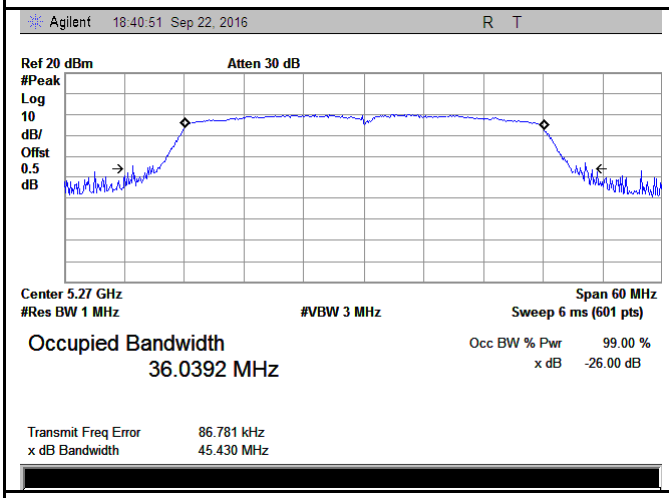
802.11n (40M)



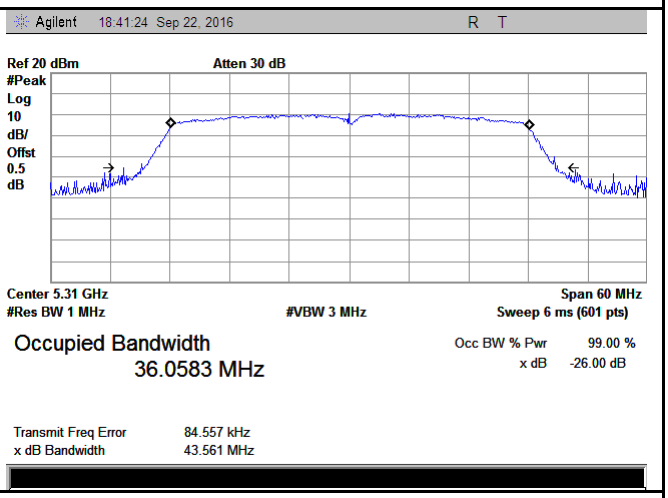
5150-5250MHz Bandwidth - Low CH 5190



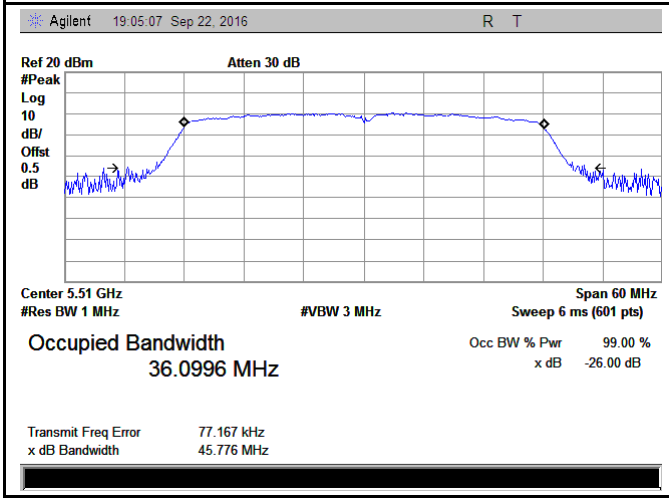
5150-5250MHz Bandwidth - High CH 5230



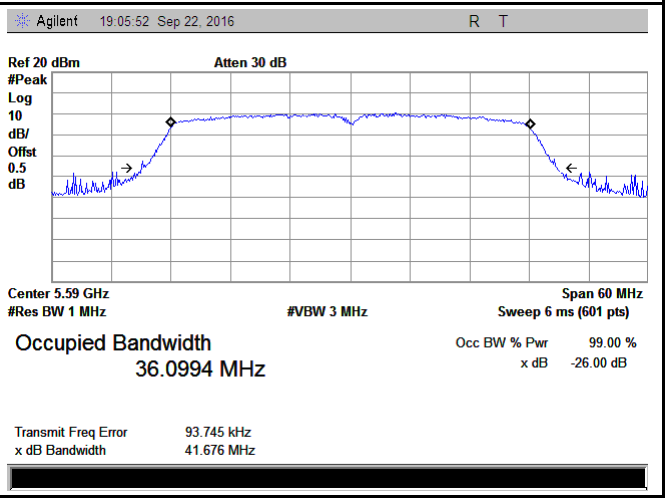
5250-5350MHz Bandwidth - Low CH 5270



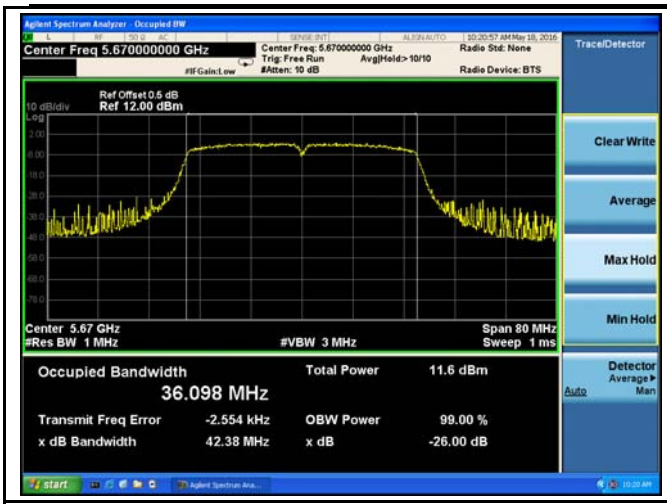
5250-5350MHz Bandwidth - High CH 5310



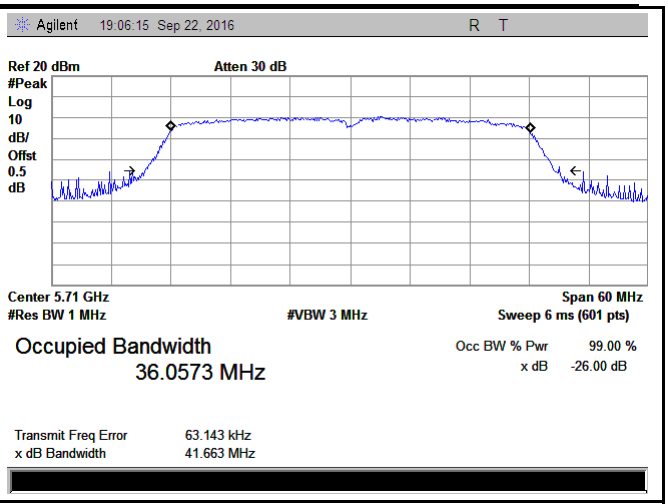
5470-5725MHz Bandwidth - Low CH 5510



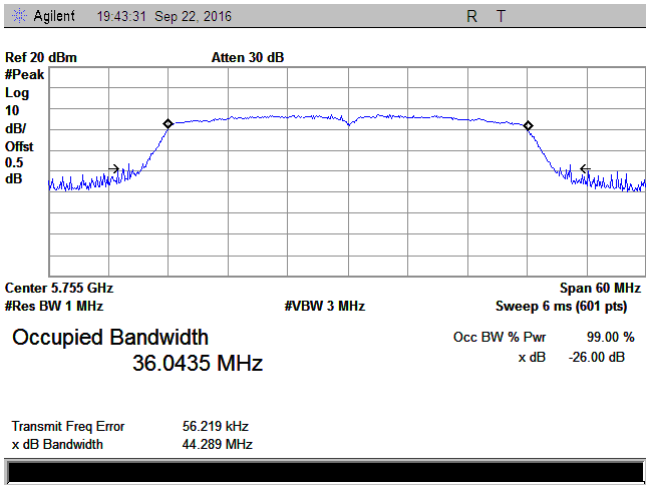
5470-5725MHz Bandwidth - Mid CH 5590



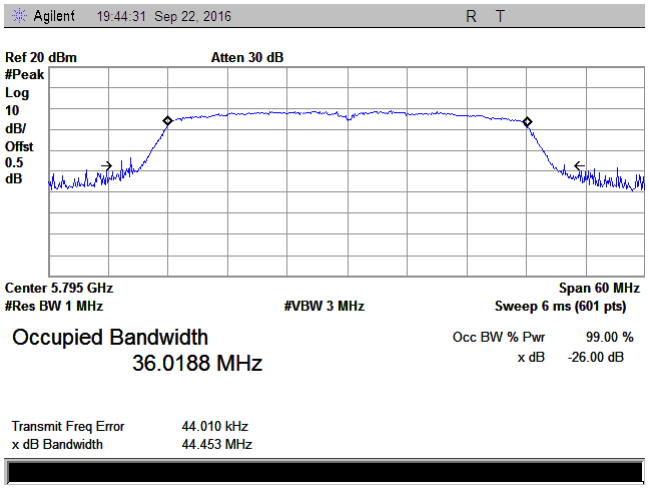
5470-5725MHz Bandwidth - High CH 5670



5470-5725MHz Bandwidth - Straddle CH 5710

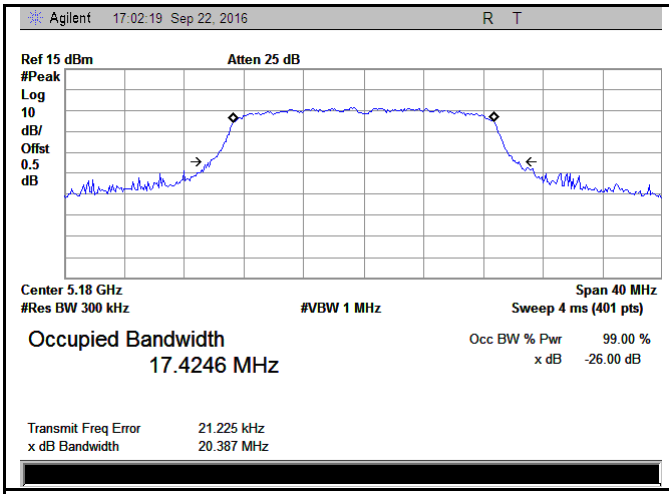


5725-5850MHz Bandwidth - Low CH 5755



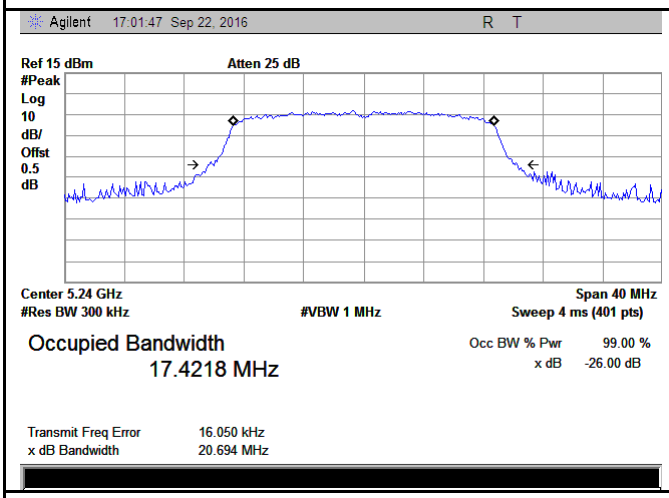
5725-5850MHz Bandwidth - High CH 5795

802.11ac(20M)

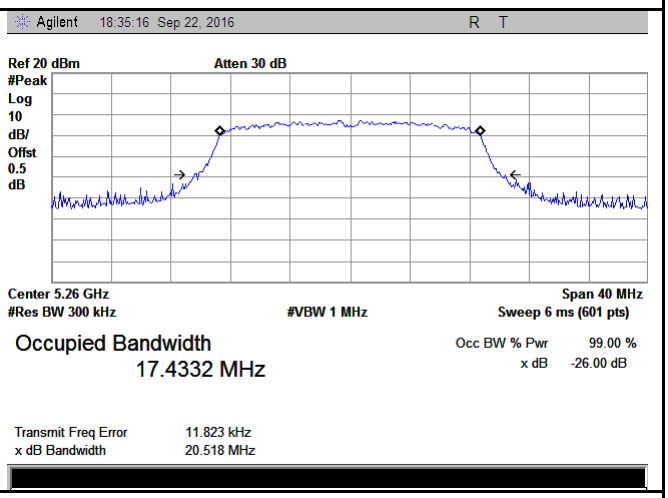


5150-5250MHz Bandwidth - Low CH 5180

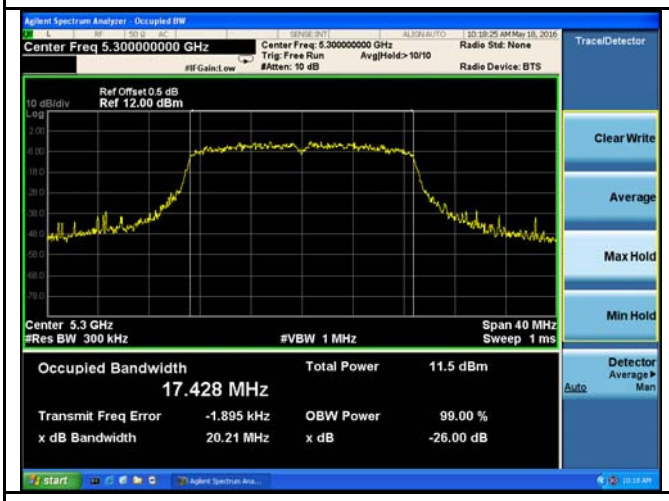
5150-5250MHz Bandwidth - Middle CH 5220



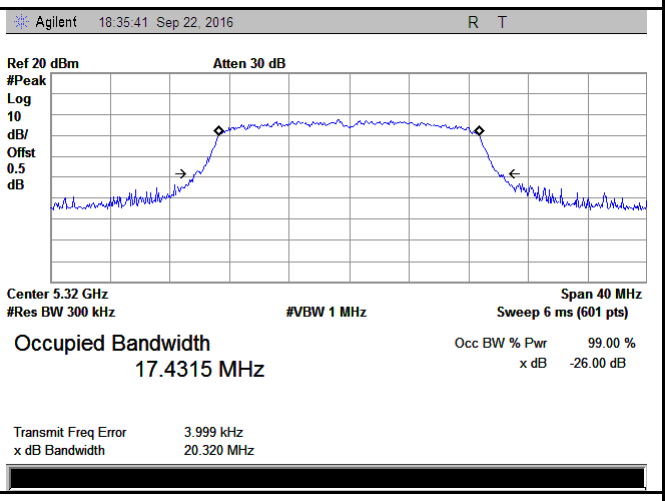
5150-5250MHz Bandwidth - High CH 5240



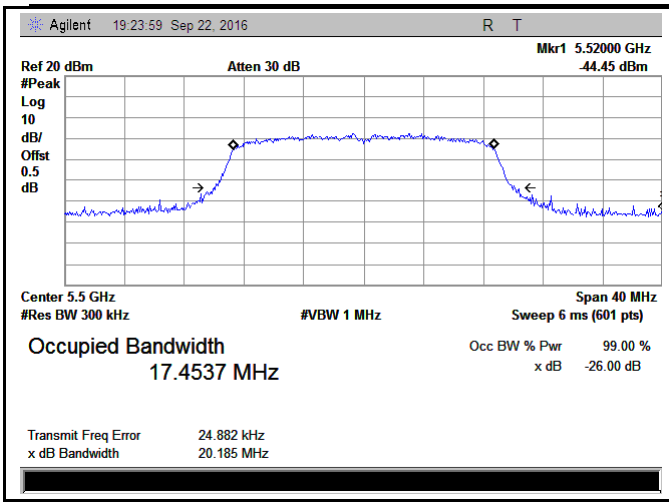
5250-5350MHz Bandwidth - Low CH 5260



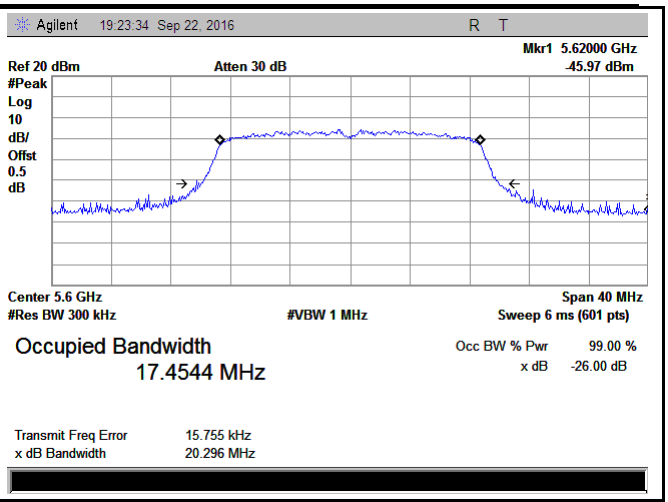
5250-5350MHz Bandwidth - Middle CH 5300



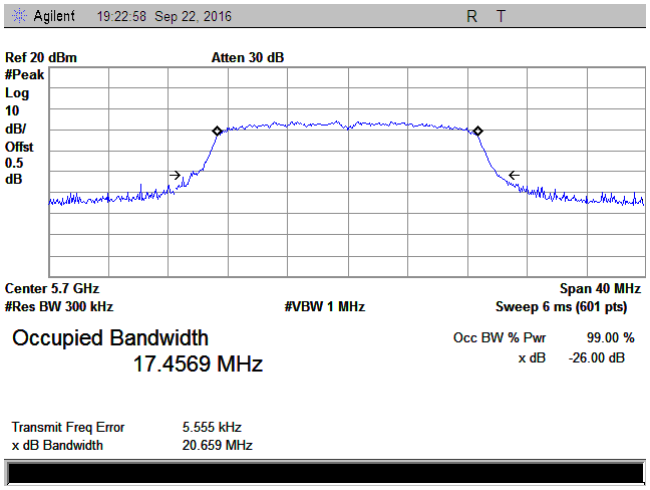
5250-5350MHz Bandwidth - High CH 5320



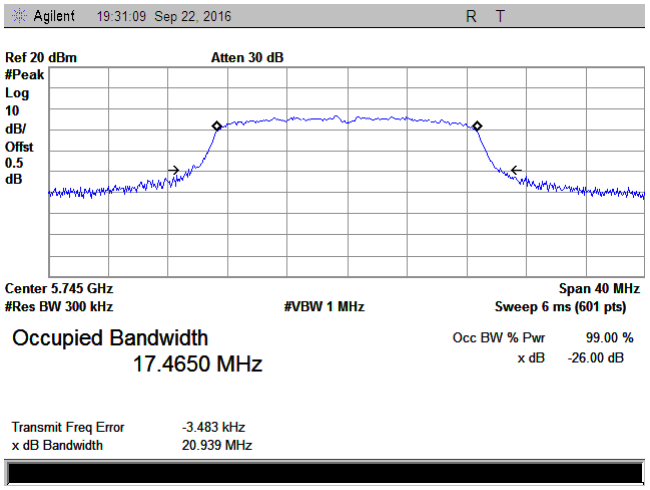
5470-5725MHz Bandwidth - Low CH 5500



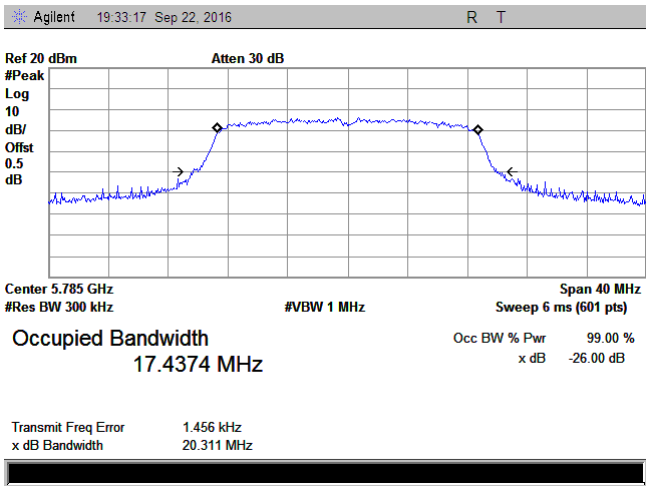
5470-5725MHz Bandwidth - Mid CH 5600



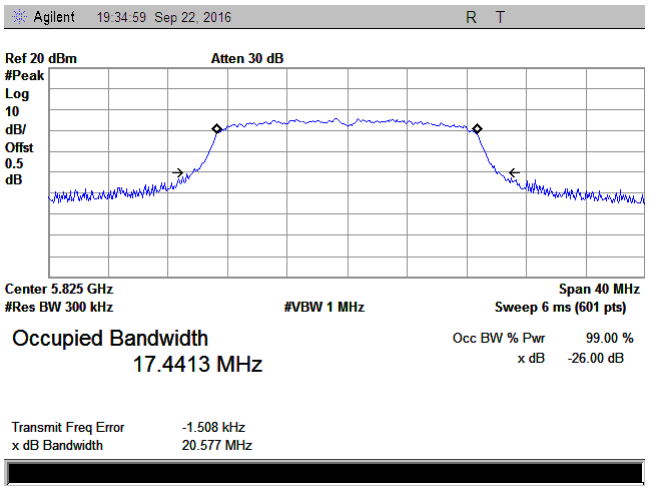
5470-5725MHz Bandwidth - High CH 5700



5725-5850MHz Bandwidth - Low CH 5745

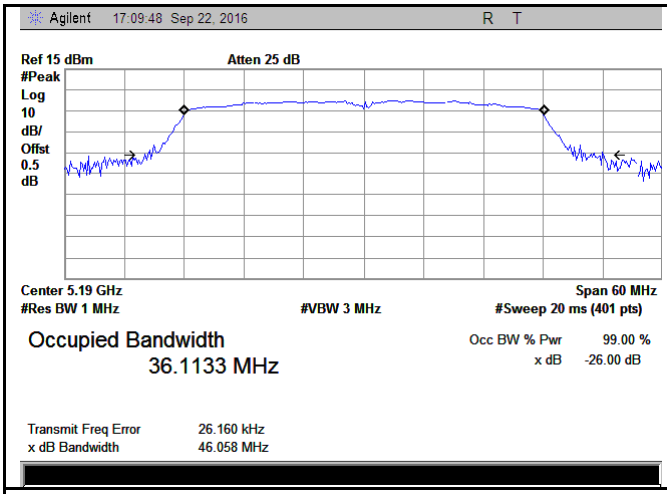


5725-5850MHz Bandwidth - Mid CH 5785

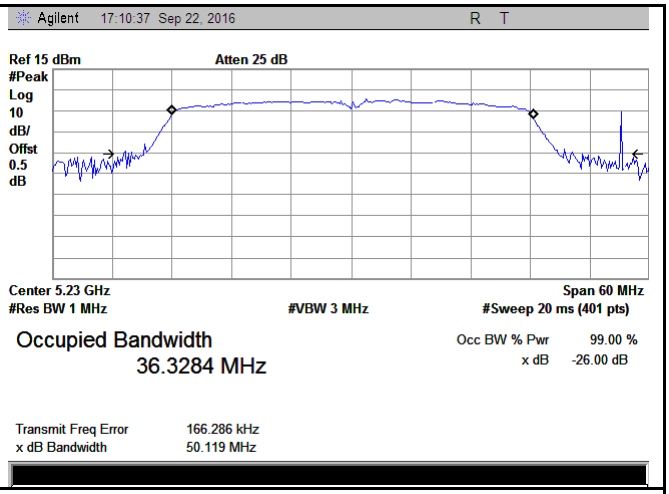


5725-5850MHz Bandwidth - High CH 5825

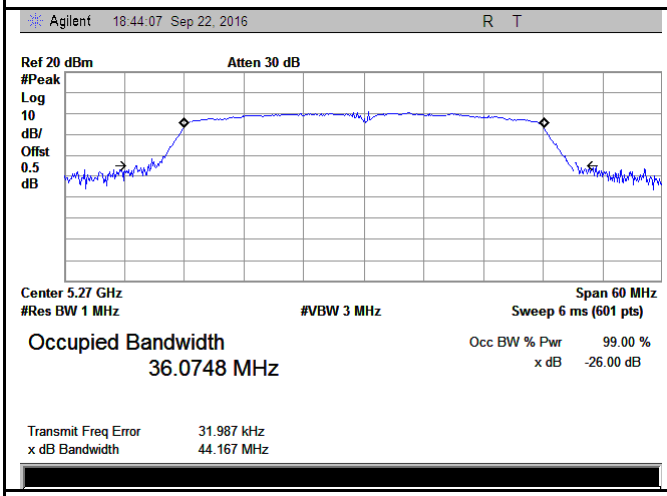
802.11ac(40M)



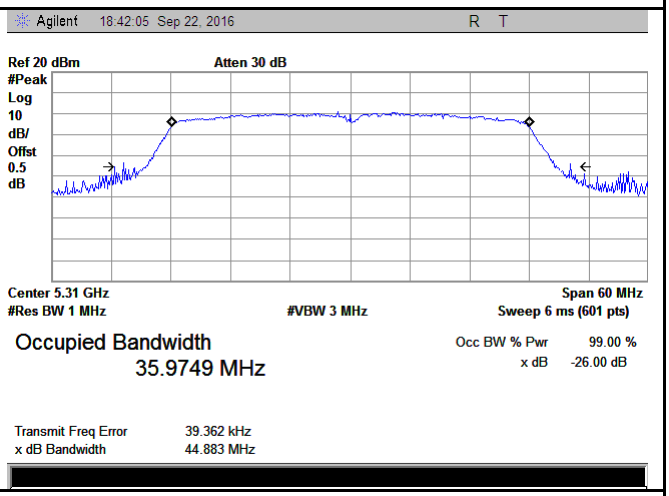
5150-5250MHz Bandwidth - Low CH 5190



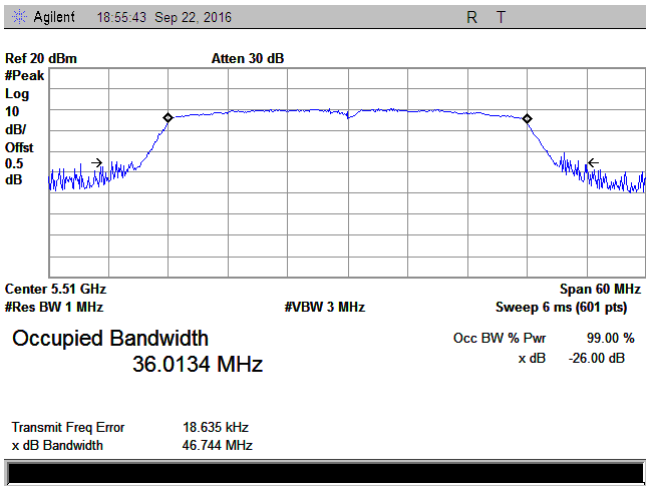
5150-5250MHz Bandwidth - High CH 5230



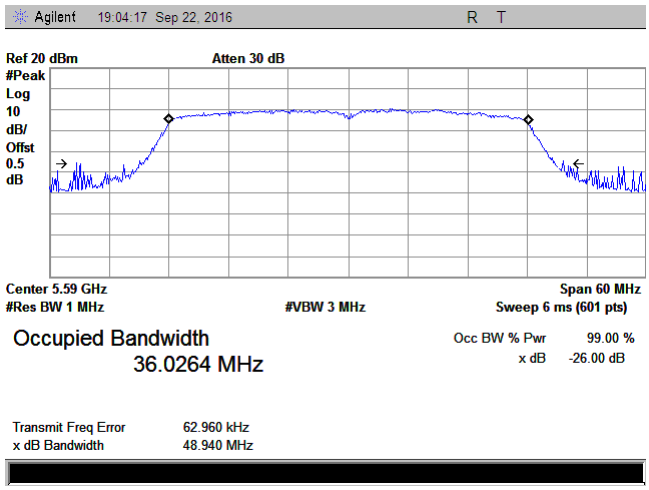
5250-5350MHz Bandwidth - Low CH 5270



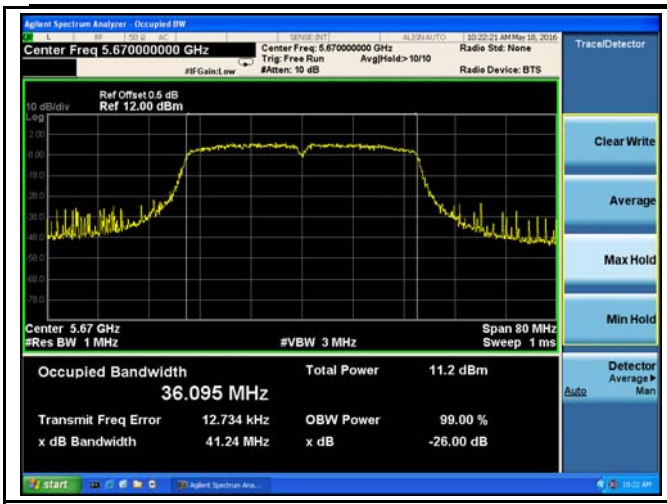
5250-5350MHz Bandwidth - High CH 5310



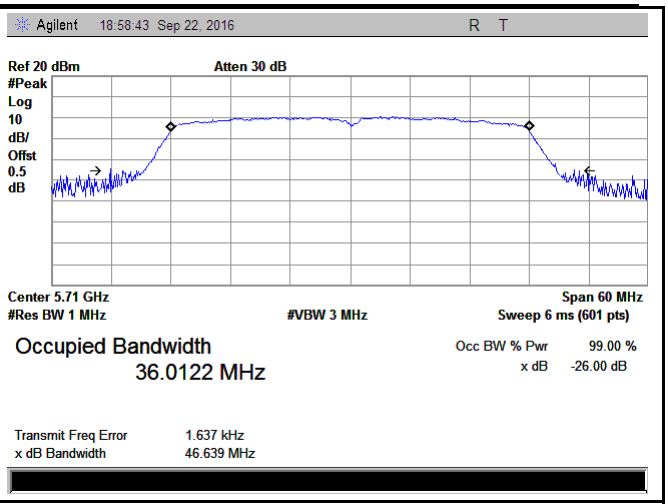
5470-5725MHz Bandwidth - Low CH 5510



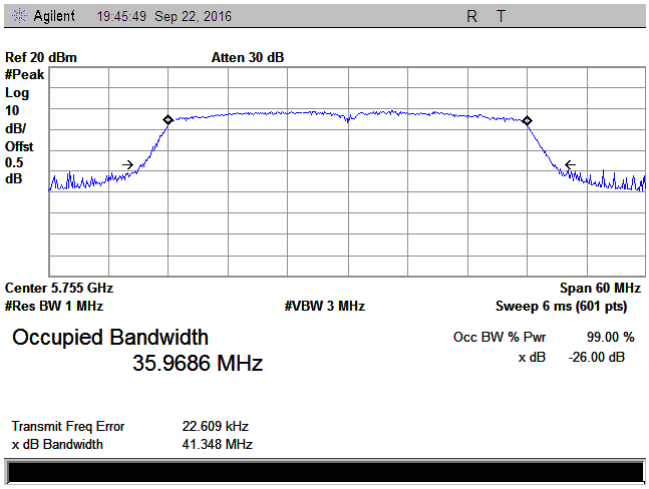
5470-5725MHz Bandwidth - Mid CH 5590



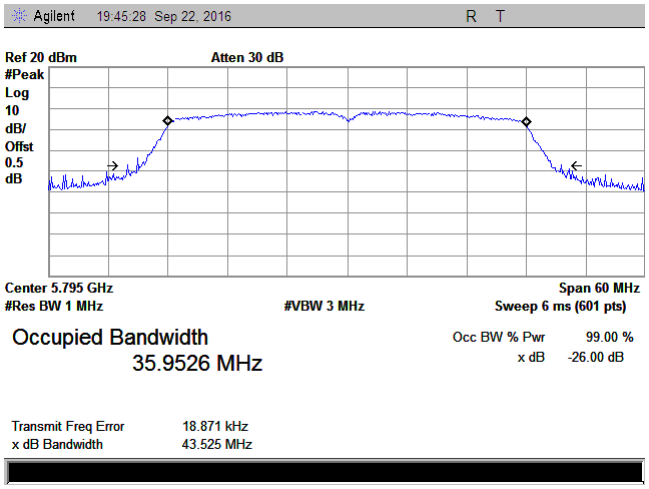
5470-5725MHz Bandwidth - High CH 5670



5470-5725MHz Bandwidth - Straddle CH 5710

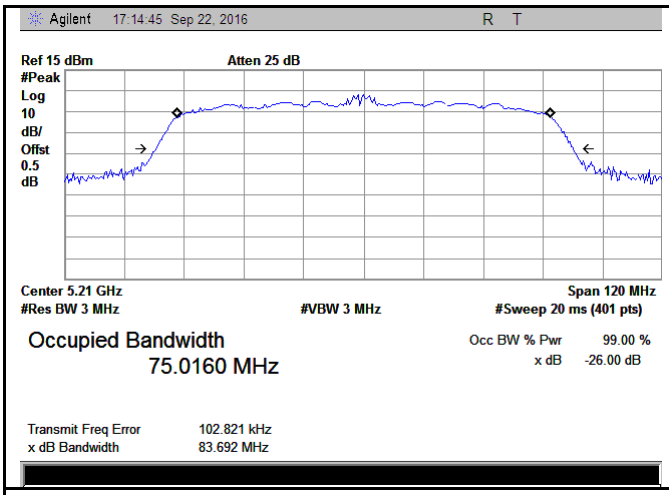


5725-5850MHz Bandwidth- Low CH 5755

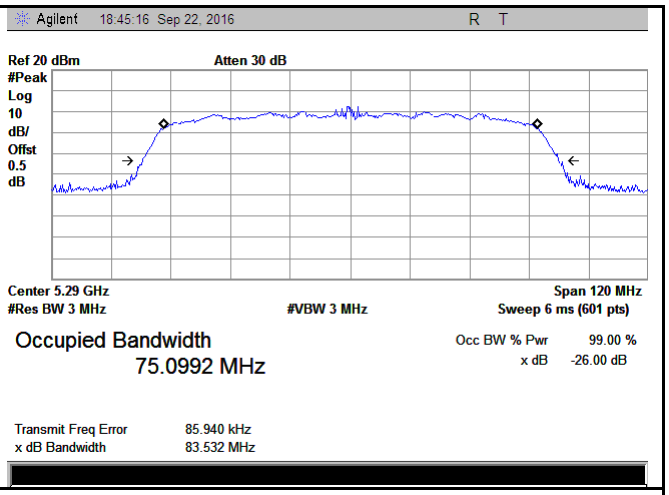


5725-5850MHz Bandwidth- High CH 5795

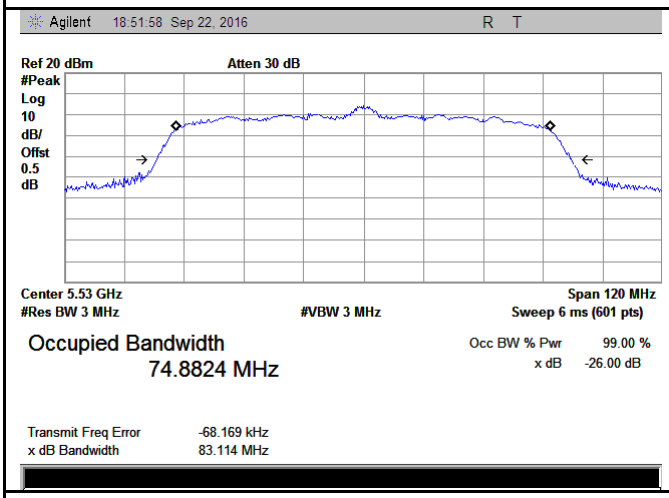
802.11ac(80M)



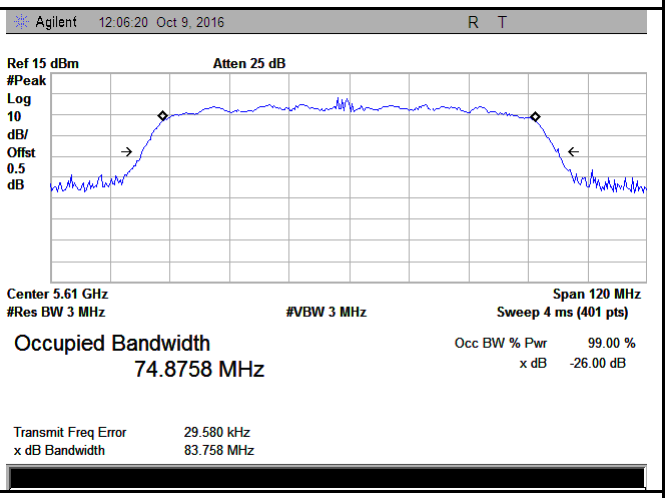
5150-5250MHz Bandwidth - One CH 5210



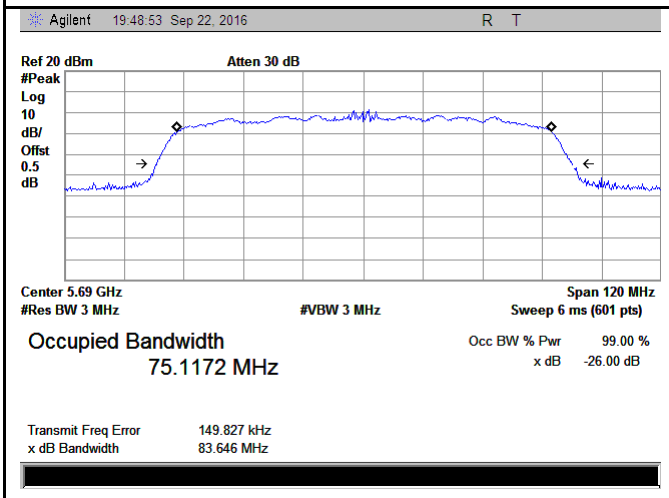
5250-5350MHz Bandwidth - Low CH 5290



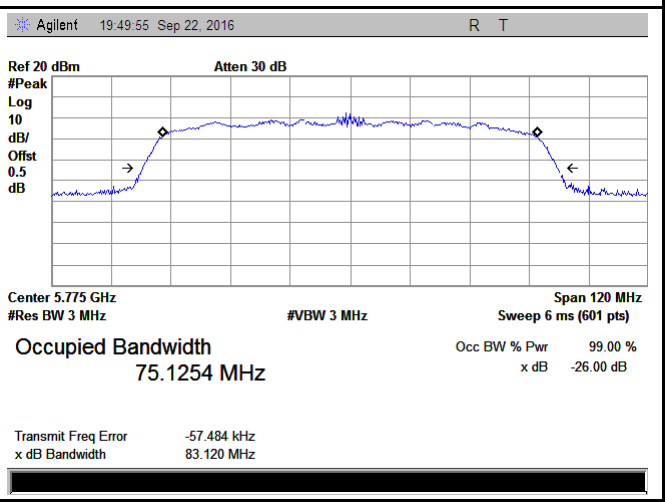
5470-5725MHz Bandwidth - Low CH 5530



5470-5725MHz Bandwidth - High CH 5610



5470-5725MHz Bandwidth - Straddle CH 5690



5725-5850MHz Bandwidth - One CH 5775

6.3 §15.407(a)-DTS (99% &6 dB) Channel Bandwidth

1. Conducted Measurement

   EUT was set for low, mid, high channel with modulated mode and highest RF output power.

   The spectrum analyzer was connected to the antenna terminal.

2. Environmental Conditions

Temperature	25℃
Relative Humidity	53%
Atmospheric Pressure	1020mbar

3. Conducted Emissions Measurement Uncertainty

   All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2, in the range 30MHz – 40GHz is ±1.5dB.

4. Test date : October 20, 2016

   Tested By : Loren Luo

Standard Requirement:

Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

Procedures:

99% &6 dB Bandwidth:

Section 15.407(e) specifies the minimum 6 dB emission bandwidth of at least 500 KHz for the band 5.715-5.85 GHz. The following procedure shall be used for measuring this bandwidth:

a) Set RBW = 100 kHz.

b) Set the video bandwidth (VBW) ≥ 3 × RBW.

c) Detector = Peak.

d) Trace mode = max hold.

e) Sweep = auto couple.

f) Allow the trace to stabilize.

g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

Note: The automatic bandwidth measurement capability of a spectrum analyzer or EMI receiver may be employed if it implements the functionality described above.

Emission Bandwidth (EBW)

1) Set RBW = approximately 1% of the emission bandwidth.

2) Set the VBW > RBW.

3) Detector = Peak.

4) Trace mode = max hold.

5) Measure the maximum width of the emission that is 26 dB down from the maximum of the emission. Compare this with the RBW setting of the analyzer. Readjust

Test Result: Pass.

Please refer to the following tables and plots.

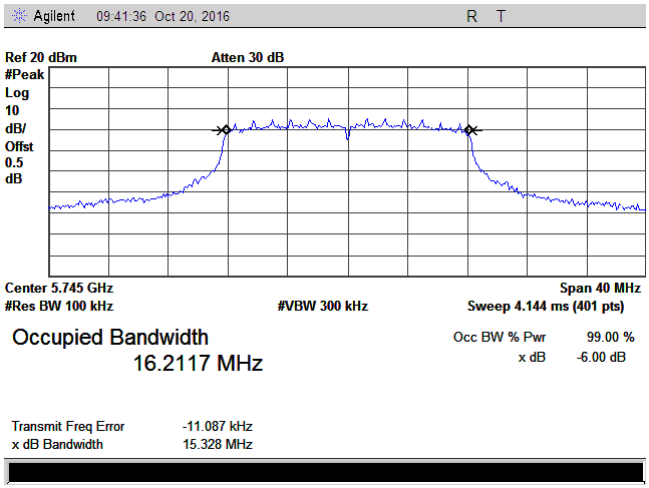
Measurement result

Test mode	Freq Band (MHz)	CH	Freq (MHz)	6dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
802.11a (20M)	5725-5850	Low	5745	15.328	16.2117
		Mid	5785	15.451	16.2069
		High	5825	14.844	16.2326
802.11n (20M)	5725-5850	Low	5745	15.539	17.3412
		Mid	5785	15.323	17.3517
		High	5825	15.214	17.3843
802.11n (40M)	5725-5850	Low	5755	35.298	35.6042
		High	5795	35.296	35.6163
802.1ac (20M)	5725-5850	Low	5745	15.334	17.3673
		Mid	5785	15.477	17.3931
		High	5825	15.207	17.3910
802.1ac (40M)	5725-5850	Low	5755	35.294	35.5897
		High	5795	35.250	35.6134
802.1ac (80M)	5725-5850	One	5775	75.378	74.9129

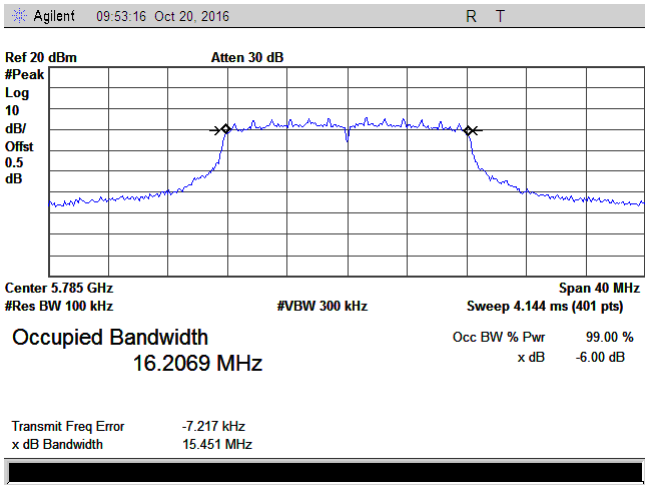
Test Plots (Bandwidth measurement result)

5725-5850MHz

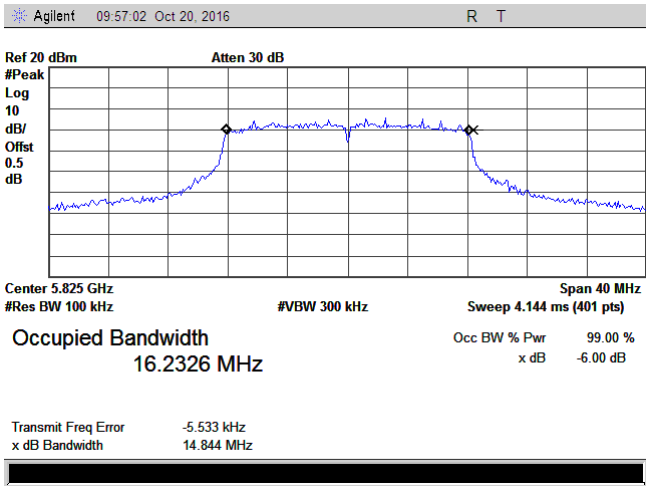
802.11a (20M)



5725-5850MHz Bandwidth - Low CH 5745

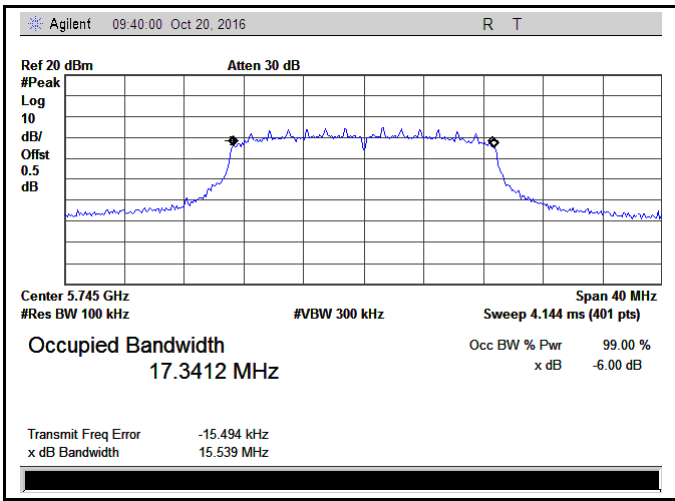


5725-5850MHz Bandwidth - Mid CH 5785

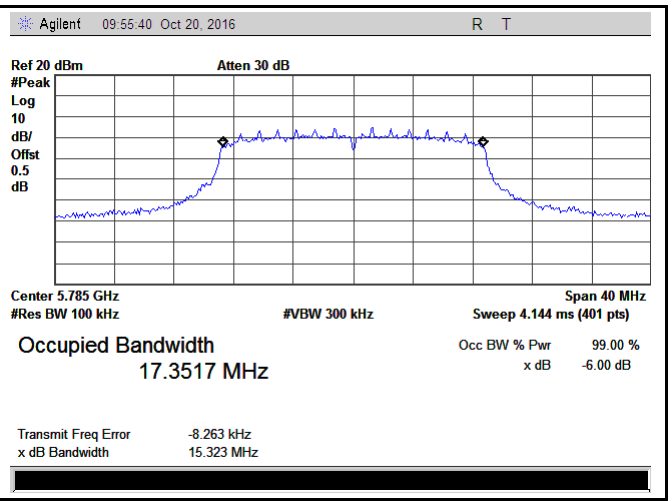


5725-5850MHz Bandwidth - High CH 5825

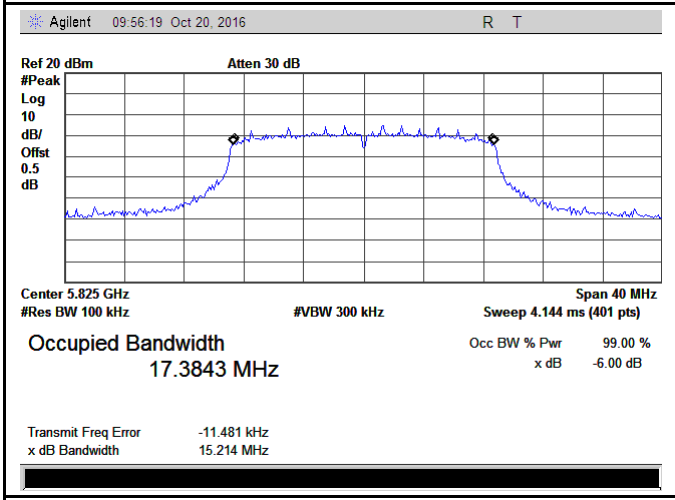
802.11n (20M)



5725-5850MHz Bandwidth - Low CH 5745

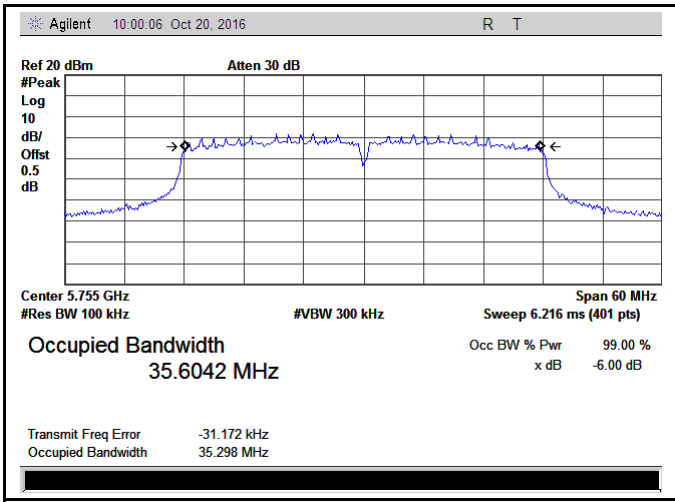


5725-5850MHz Bandwidth - Mid CH 5785

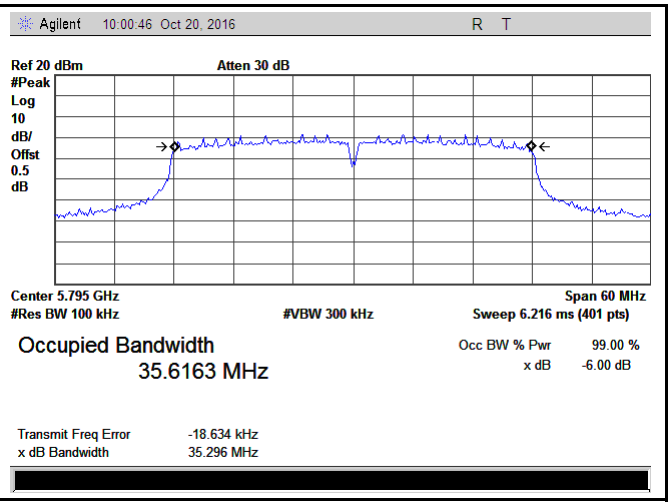


5725-5850MHz Bandwidth - High CH 5825

802.11n (40M)

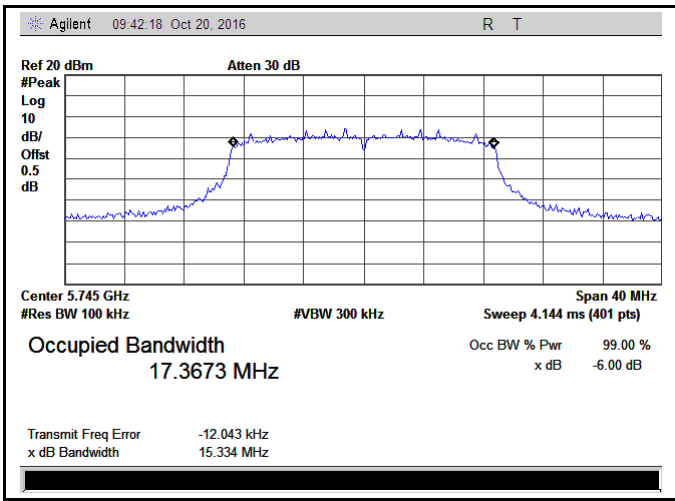


5725-5850MHz Bandwidth - Low CH 5755

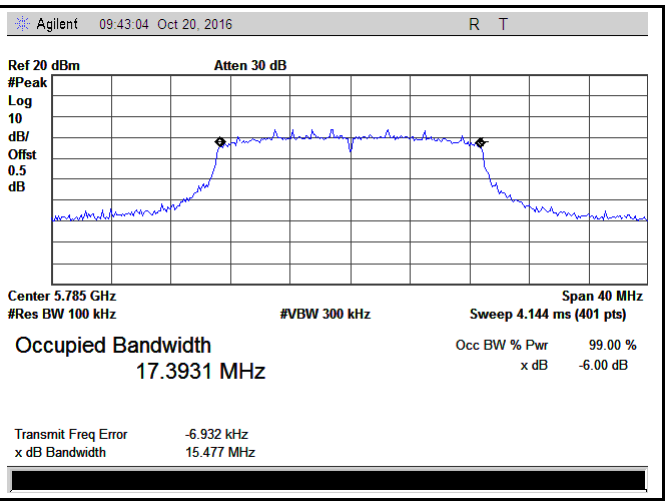


5725-5850MHz Bandwidth - High CH 5795

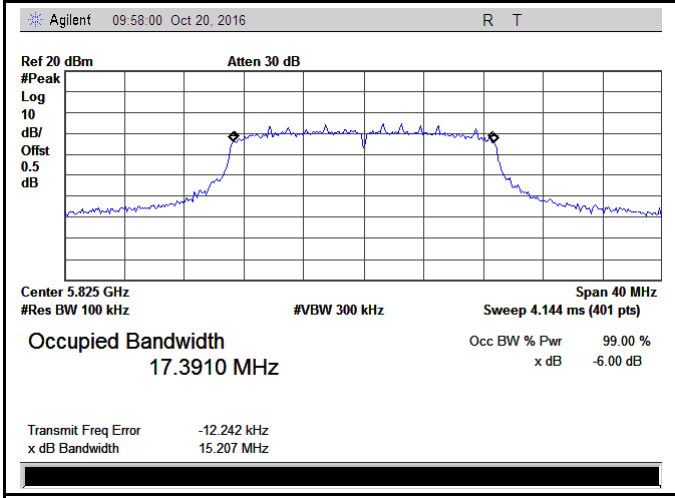
802.1ac(20M)



5725-5850MHz Bandwidth - Low CH 5745

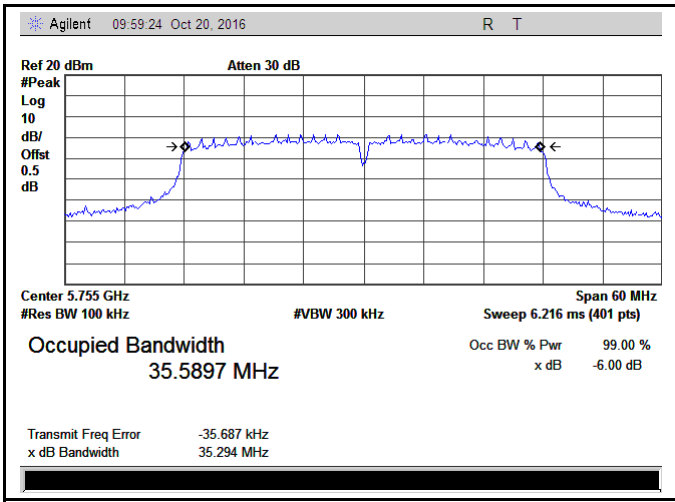


5725-5850MHz Bandwidth - Mid CH 5785

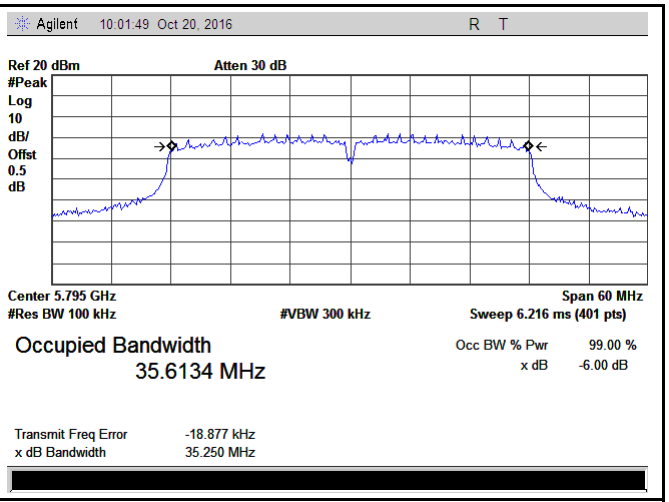


5725-5850MHz Bandwidth - High CH 5825

802.1ac(40M)

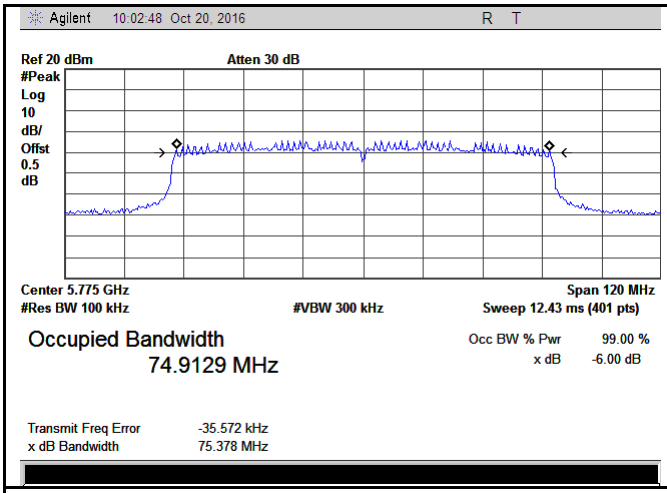


5725-5850MHz Bandwidth - Low CH 5755



5725-5850MHz Bandwidth - Low CH 5975

802.1ac(80M)



5725-5850MHz Bandwidth - One CH 5775

6.4 §15.407(a)-Conducted Maximum Output Power

1. Conducted Measurement
   EUT was set for low, mid, high channel with modulated mode and highest RF output power.
   The spectrum analyzer was connected to the antenna terminal.
2. Conducted Emissions Measurement Uncertainty
   All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2, in the range 30MHz – 40GHz is ±1.5dB.
3. Environmental Conditions

Temperature	23°C
Relative Humidity	55%
Atmospheric Pressure	1022mbar

4. Test date : September 22, 2016 &October 9, 2016 &October 13, 2016

   Tested By : Loren Luo

Standard Requirement:

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. f 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).

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 + 10 log B, where B is the 26 dB emission bandwidth in megahertz. 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.

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of

operation shall not exceed 1 W.

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.

Procedures:

Measurement Procedure Maximum conducted output power:

Maximum conducted output power may be measured using a spectrum analyzer/EMI receiver or an RF power meter.

1. Device Configuration

If possible, configure or modify the operation of the EUT so that it transmits continuously at its maximum power control level (see section II.B.).

a) The intent is to test at 100 percent duty cycle; however a small reduction in duty cycle (to no lower than 98 percent) is permitted if required by the EUT for amplitude control purposes. Manufacturers are expected to provide software to the test lab to permit such continuous operation.

b) If continuous transmission (or at least 98 percent duty cycle) cannot be achieved due to hardware limitations (e.g., overheating), the EUT shall be operated at its maximum power control level with the transmit duration as long as possible and the duty cycle as high as possible.

2. Measurement using a Power Meter (PM)

a) Method PM (Measurement using an RF average power meter):

(i) Measurements may be performed using a wideband RF power meter with a thermocouple detector or equivalent if all of the conditions listed below are satisfied.

- The EUT is configured to transmit continuously or to transmit with a constant duty cycle.
- At all times when the EUT is transmitting, it must be transmitting at its maximum power control level.

- The integration period of the power meter exceeds the repetition period of the transmitted signal by at least a factor of five.

(ii) If the transmitter does not transmit continuously, measure the duty cycle, x, of the transmitter output signal as described in section II.B.
(iii) Measure the average power of the transmitter. This measurement is an average over both the on and off periods of the transmitter.
(iv) Adjust the measurement in dBm by adding 10 log(1/x) where x is the duty cycle (e.g., 10

log(1/0.25) if the duty cycle is 25 percent).

Test Result: Pass.

Please refer to the following tables and plots:

Output Power measurement result

Test mode	Freq Band (MHz)	CH	Frequency (MHz)	Conducted Power (dBm)	Duty factor (dB)	Conducted Power with D.F(dBm)	Limit (dBm)	Result
820.11a	5150-5250	Low	5180	8.0	0.18	8.18	30	Pass
		Middle	5220	8.2	0.18	8.38	30	Pass
		High	5240	8.2	0.18	8.38	30	Pass
	5250-5350	Low	5260	8.1	0.18	8.28	23.79	Pass
		Middle	5300	8.2	0.18	8.38	23.86	Pass
		High	5320	8.4	0.18	**8.58**	23.93	Pass
	5470-5725	Low	5500	8.4	0.18	8.58	23.90	Pass
		Mid	5600	8.0	0.18	8.18	23.98	Pass
		High	5700	8.2	0.18	8.38	23.85	Pass
	5725-5850	Low	5745	7.7	0.18	7.88	30	Pass
		Mid	5785	5.9	0.18	6.08	30	Pass
		High	5825	5.7	0.18	5.88	30	Pass
802.11n (20M)	5150-5250	Low	5180	7.2	0.18	7.38	30	Pass
		Middle	5220	7.3	0.18	7.48	30	Pass
		High	5240	7.3	0.18	7.48	30	Pass
	5250-5350	Low	5260	7.0	0.18	7.18	23.98	Pass
		Middle	5300	7.4	0.18	7.58	23.98	Pass
		High	5320	7.5	0.18	7.68	23.98	Pass
	5470-5725	Low	5500	7.6	0.18	**7.78**	23.98	Pass
		Mid	5600	7.2	0.18	7.38	23.98	Pass
		High	5700	7.4	0.18	7.58	23.98	Pass
	5725-5850	Low	5745	6.8	0.18	6.98	30	Pass
		Mid	5785	7.0	0.18	7.18	30	Pass
		High	5825	7.0	0.18	7.18	30	Pass

802.11n (40M)	5150-5250	Low	5190	7.3	0.36	7.66	30	Pass
		High	5230	7.4	0.36	7.76	30	Pass
	5250-5350	Low	5270	7.3	0.36	7.66	23.98	Pass
		High	5310	7.5	0.36	7.86	23.98	Pass
	5470-5725	Low	5510	7.6	0.36	**7.96**	23.98	Pass
		Mid	5590	7.3	0.36	7.66	23.98	Pass
		High	5670	7.3	0.36	7.66	23.98	Pass
		Straggle	5710	7.2	0.36	7.56	23.98	Pass
	5725-5850	Low	5755	7.0	0.36	7.36	30	Pass
		High	5795	7.1	0.36	7.46	30	Pass
802.11ac (20M)	5150-5250	Low	5180	7.1	0.18	7.28	30	Pass
		Middle	5200	7.1	0.18	7.28	30	Pass
		High	5240	7.3	0.18	7.48	30	Pass
	5250-5350	Low	5260	7.2	0.18	7.38	23.98	Pass
		Middle	5300	7.4	0.18	7.58	23.98	Pass
		High	5320	7.5	0.18	**7.68**	23.98	Pass
	5470-5725	Low	5500	7.5	0.18	7.68	23.98	Pass
		Mid	5600	7.2	0.18	7.38	23.98	Pass
		High	5700	7.4	0.18	7.58	23.98	Pass
	5725-5850	Low	5745	6.8	0.18	6.98	30	Pass
		Mid	5785	7.0	0.18	7.18	30	Pass
		High	5825	7.0	0.18	7.18	30	Pass
802.1ac (40M)	5150-5250	Low	5190	7.3	0.36	7.66	30	Pass
		High	5230	7.3	0.36	7.66	30	Pass
	5250-5350	Low	5270	7.3	0.36	7.66	23.98	Pass
		High	5310	7.5	0.36	7.86	23.98	Pass
	5470-5725	Low	5510	7.6	0.36	**7.96**	23.98	Pass
		Mid	5590	7.4	0.36	7.76	23.98	Pass
		High	5670	7.3	0.36	7.66	23.98	Pass
		Straggle	5710	7.4	0.36	7.76	23.98	Pass
	5725-5850	Low	5755	6.9	0.36	7.26	30	Pass
		High	5795	7.1	0.36	7.46	30	Pass

802.11ac (80M)	5150-5250	One	5210	4.5	0.71	**5.21**	30	Pass
	5250-5350	One	5290	4.4	0.71	5.11	30	Pass
	5470-5725	Low	5530	4.5	0.71	5.21	23.98	Pass
		High	5610	4.5	0.71	5.21	23.98	Pass
		Straddle	5690	4.3	0.71	5.01	23.98	Pass
	5725-5850	One	5775	4.3	0.71	5.01	30	Pass

Note 1: Duty factor=10log(1/x), where x is the duty cycle.
For 20 MHz bandwidth, the duty cycle is 96%;
For 40 MHz bandwidth, the duty cycle is 92%;
For 80 MHz bandwidth, the duty cycle is 85%;

Note 2: The AH1801 will be sold without antenna, it is no requirement that 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) for an outdoor access point operating in the band 5.15-5.25 GHz,.

6.5 §15.407(a) - Power Spectral Density

1. Conducted Measurement

   EUT was set for low, mid, high channel with modulated mode and highest RF output power.

   The spectrum analyzer was connected to the antenna terminal.

2. Environmental Conditions

Environmental Conditions	Temperature	23°C
	Relative Humidity	55%
	Atmospheric Pressure	1022mbar

3. Conducted Emissions Measurement Uncertainty

   All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2, in the range 30MHz – 40GHz is ±1.5dB.

4. Test date : May 18, 2016 &October 9, 2016 &October 13, 2016

   Tested By : Loren Luo

Standard Requirement:

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).

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.

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.

Procedures:

The rules requires " maximum power spectral density" measurements where the intent is to measure the maximum value of the time average of the power spectral density measured during a period of continuous transmission.

1. Create an average power spectrum for the EUT operating mode being tested by following the instructions in section II.E.2. for measuring maximum conducted output power using a spectrum analyzer or EMI receiver: select the appropriate test method (SA-1, SA-2, SA-3, or alternatives to each) and apply it up to, but not including, the step labeled, " Compute power…" . (This procedure is required even if the maximum conducted output power measurement was performed using a power meter, method PM.)

2. Use the peak search function on the instrument to find the peak of the spectrum and record its value.

3. Make the following adjustments to the peak value of the spectrum, if applicable:

a) If Method SA-2 or SA-2 Alternative was used, add 10 log(1/x), where x is the duty cycle, to the peak of the spectrum.

b) If Method SA-3 Alternative was used and the linear mode was used in step II.E.2.g)(viii), add 1 dB to the final result to compensate for the difference between linear averaging and power averaging.

4. The result is the Maximum PSD over 1 MHz reference bandwidth.

5. For devices operating in the bands 5.15-5.25 GHz, 5.25-5.35 GHz, and 5.47-5.725 GHz, the above procedures make use of 1 MHz RBW to satisfy directly the 1 MHz reference bandwidth specified in § 15.407(a)(5). For devices operating in the band 5.725-5.85 GHz, the rules specify a measurement bandwidth of 500 kHz. Many spectrum analyzers do not have 500 kHz RBW, thus a narrower RBW may need to be used. The rules permit the use of a RBWs less than 1 MHz, or 500 kHz, " provided that the measured power is integrated over the full reference bandwidth" to show the total power over the specified measurement bandwidth (i.e., 1 MHz, or 500 kHz). If measurements are performed using a reduced resolution bandwidth (< 1 MHz, or < 500 kHz) and

integrated over 1 MHz, or 500 KHz bandwidth, the following adjustments to the procedures apply:

a) Set RBW ≥ 1/T, where T is defined in section II.B.l.a).

b) Set VBW ≥ 3 RBW.

c) If measurement bandwidth of Maximum PSD is specified in 500 kHz, add 10log(500kHz/RBW) to the measured result, whereas RBW (< 500 KHz) is the reduced resolution bandwidth of the spectrum analyzer set during measurement.

d) If measurement bandwidth of Maximum PSD is specified in 1 MHz, add 10log(1MHz/RBW) to the measured result, whereas RBW (< 1 MHz) is the reduced resolution bandwidth of spectrum analyzer set during measurement.

e) Care must be taken to ensure that the measurements are performed during a period of continuous transmission or are corrected upward for duty cycle.

Note: As a practical matter, it is recommended to use reduced RBW of 100 KHz for the sections 5.c) and 5.d) above, since RBW=100 KHZ is available on nearly all spectrum analyzers.

Test Result: Pass.

Please refer to the following tables and plots.

Power Spectral Density measurement result

Test mode	Freq Band (MHz)	CH	Frequency (MHz)	Measured PSD (dBm)	Duty cycle factor (dB)	PSD (dBm)	Limit (dBm)	Result
820.11a	5150-5250	Low	5180	-4.086	0.18	-3.906	17	Pass
		Mid	5220	-3.814	0.18	-3.634	17	Pass
		High	5240	-3.271	0.18	-3.091	17	Pass
	5250-5350	Low	5260	-3.819	0.18	-3.639	11	Pass
		Mid	5300	-4.131	0.18	-3.951	11	Pass
		High	5320	-5.582	0.18	-5.402	11	Pass
	5470-5725	Low	5500	-3.632	0.18	-3.452	11	Pass
		Mid	5600	-3.564	0.18	-3.384	11	Pass
		High	5700	-3.750	0.18	-3.57	11	Pass
	5725-5850	Low	5745	-6.603	0.18	-6.423	30	Pass
		Mid	5785	-6.470	0.18	-6.29	30	Pass
		High	5825	-7.178	0.18	-6.998	30	Pass
802.11n (20M)	5150-5250	Low	5180	-5.568	0.18	-5.388	17	Pass
		Middle	5220	-5.113	0.18	-4.933	17	Pass
		High	5240	-4.753	0.18	-4.573	17	Pass
	5250-5350	Low	5260	-4.954	0.18	-4.774	11	Pass
		Middle	5300	-5.515	0.18	-5.335	11	Pass
		High	5320	-5.325	0.18	-5.145	11	Pass
	5470-5725	Low	5500	-4.929	0.18	-4.749	11	Pass
		Mid	5600	-5.287	0.18	-5.107	11	Pass
		High	5700	-5.192	0.18	-5.012	11	Pass
	5725-5850	Low	5745	-8.471	0.18	-8.291	30	Pass
		Mid	5785	-7.920	0.18	-7.74	30	Pass
		High	5825	-8.258	0.18	-8.078	30	Pass

802.11n (40M)	5150-5250	Low	5190	-8.246	0.36	-7.886	17	Pass
		High	5230	-8.007	0.36	-7.647	17	Pass
	5250-5350	Low	5270	-8.186	0.36	-7.826	11	Pass
		High	5310	-8.185	0.36	-7.825	11	Pass
	5470-5725	Low	5510	-7.619	0.36	-7.259	11	Pass
		Mid	5590	-7.746	0.36	-7.386	11	Pass
		High	5670	-7.816	0.36	-7.456	11	Pass
		Straggle	5710	-7.834	0.36	-7.474	11	Pass
	5725-5850	Low	5755	-10.980	0.36	-10.62	30	Pass
		High	5795	-11.177	0.36	-10.817	30	Pass
802.11ac (20M)	5150-5250	Low	5180	-5.448	0.18	-5.268	17	Pass
		Middle	5220	-5.371	0.18	-5.191	17	Pass
		High	5240	-5.351	0.18	-5.171	17	Pass
	5250-5350	Low	5260	-5.156	0.18	-4.976	11	Pass
		Middle	5300	-5.378	0.18	-5.198	11	Pass
		High	5320	-5.294	0.18	-5.114	11	Pass
	5470-5725	Low	5500	-5.452	0.18	-5.272	11	Pass
		Mid	5600	-5.439	0.18	-5.259	11	Pass
		High	5700	-5.102	0.18	-4.922	11	Pass
	5725-5850	Low	5745	-8.258	0.18	-8.078	30	Pass
		Mid	5785	-8.249	0.18	-8.069	30	Pass
		High	5825	-8.471	0.18	-8.291	30	Pass
802.1ac (40M)	5150-5250	Low	5190	-7.803	0.36	-7.443	17	Pass
		High	5230	-7.599	0.36	-7.239	17	Pass
	5250-5350	Low	5270	-7.755	0.36	-7.395	11	Pass
		High	5310	-8.189	0.36	-7.829	11	Pass
	5470-5725	Low	5510	-7.946	0.36	-7.586	11	Pass
		Mid	5590	-7.729	0.36	-7.369	11	Pass
		High	5670	-7.727	0.36	-7.367	11	Pass
		Straggle	5710	-7.921	0.36	-7.561	11	Pass
	5725-5850	Low	5755	-10.695	0.36	-10.335	30	Pass
		High	5795	-10.703	0.36	-10.343	30	Pass

802.11ac (80M)	5150-5250	One	5210	-14.376	0.71	-13.666	17	Pass
	5250-5350	One	5290	-14.588	0.71	-13.878	11	Pass
	5470-5725	Low	5530	-14.139	0.71	-13.429	11	Pass
		High	5610	-12.91	0.71	-12.2	11	Pass
		Straggle	5690	-14.157	0.71	-13.447	11	Pass
	5725-5850	One	5775	-17.251	0.71	-16.541	30	Pass

Note: Duty factor=10log(1/x), where x is the duty cycle.

For 20 MHz bandwidth, the duty cycle is 96%;

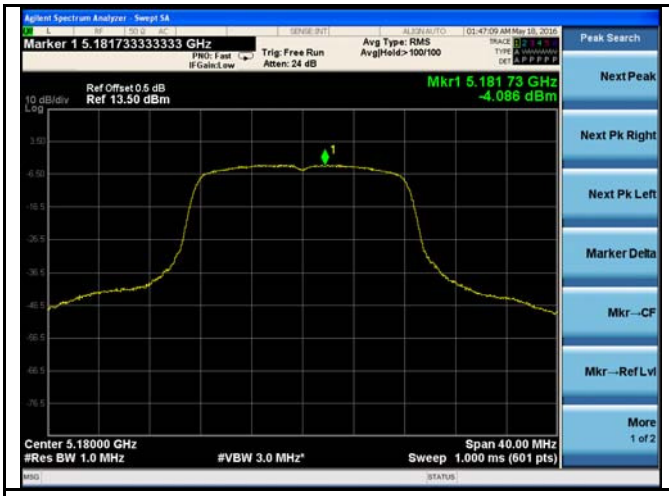
For 40 MHz bandwidth, the duty cycle is 92%;

For 80 MHz bandwidth, the duty cycle is 85%;

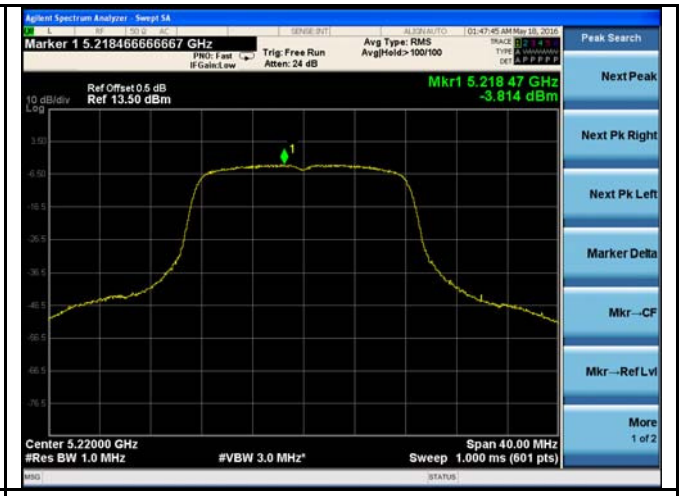
Test Plots

Power Spectral Density measurement result Test Plots

802.11a

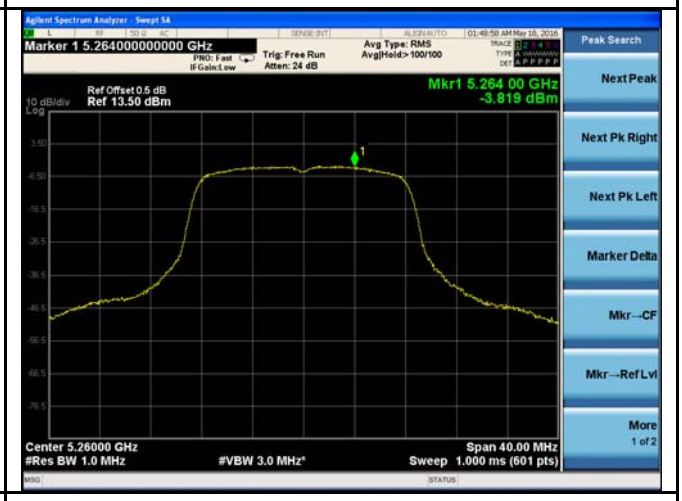


5150-5250MHz PSD - Low CH 5180

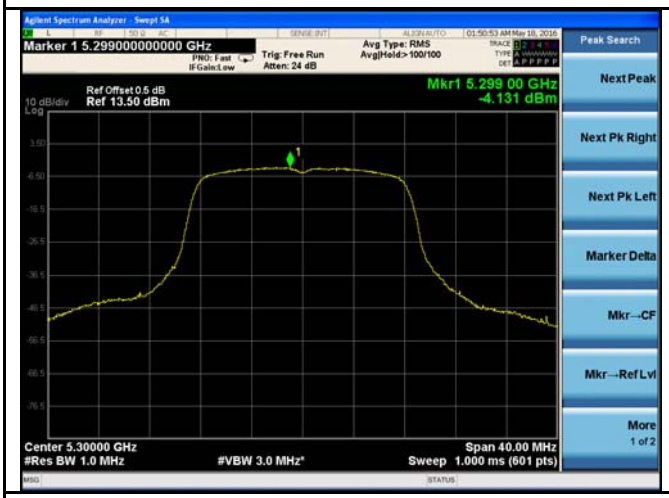


5150-5250MHz PSD - Middle CH 5220

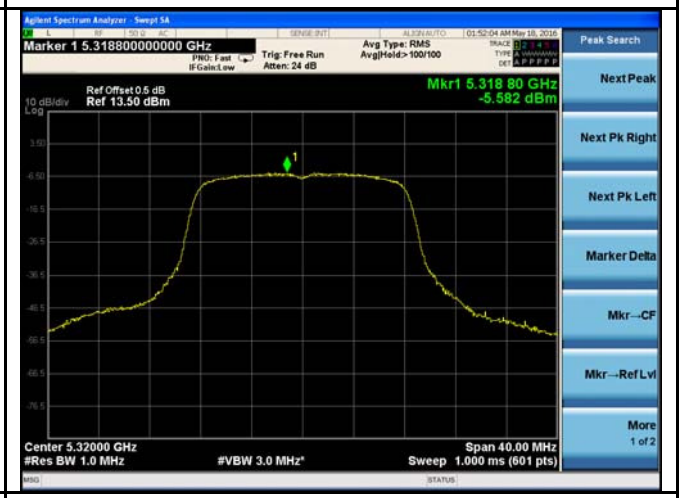
5150-5250MHz PSD - High CH 5240



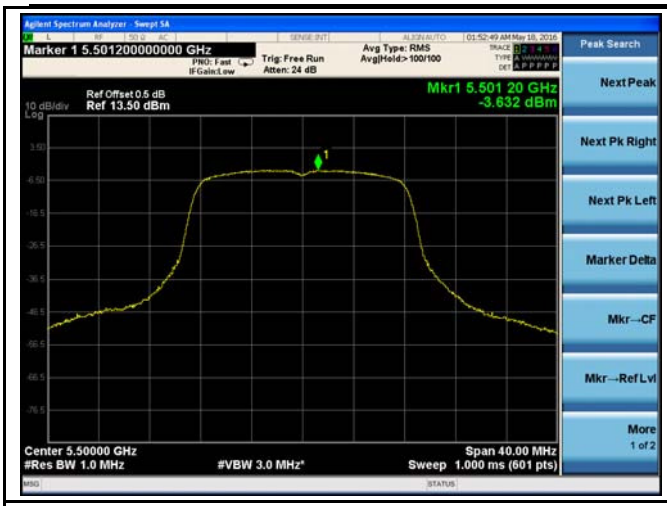
5250-5350MHz PSD - Low CH 5260



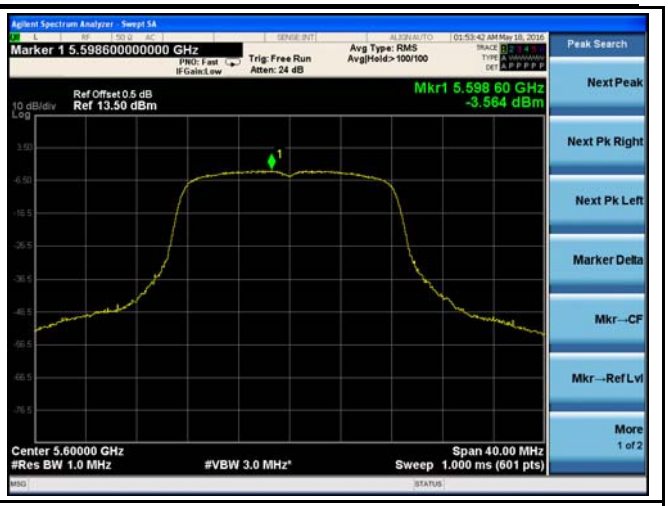
5250-5350MHz PSD - Middle CH 5300



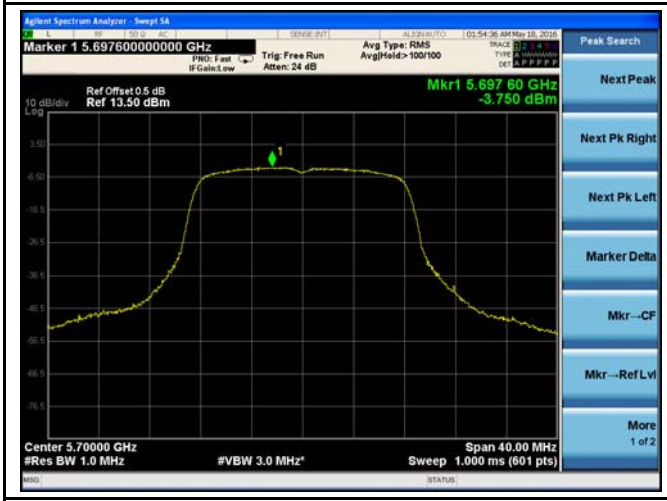
5250-5350MHz PSD - High CH 5320



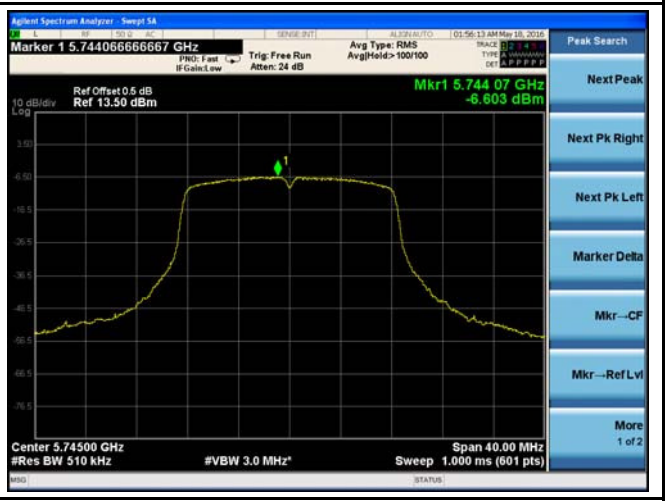
5470-5725MHz PSD - Low CH 5500



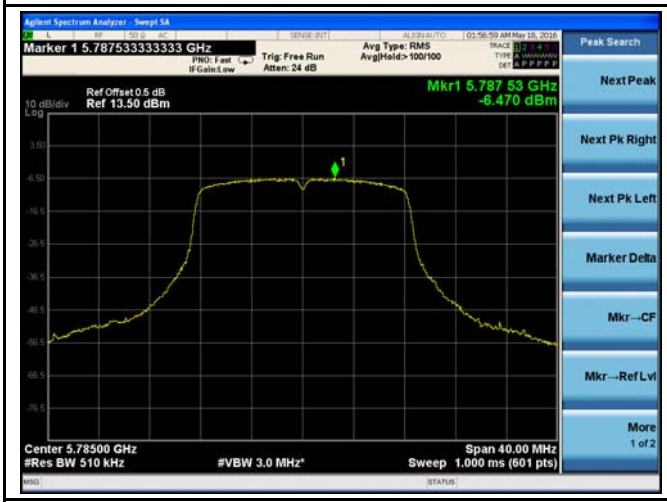
5470-5725MHz PSD - Mid CH 5600



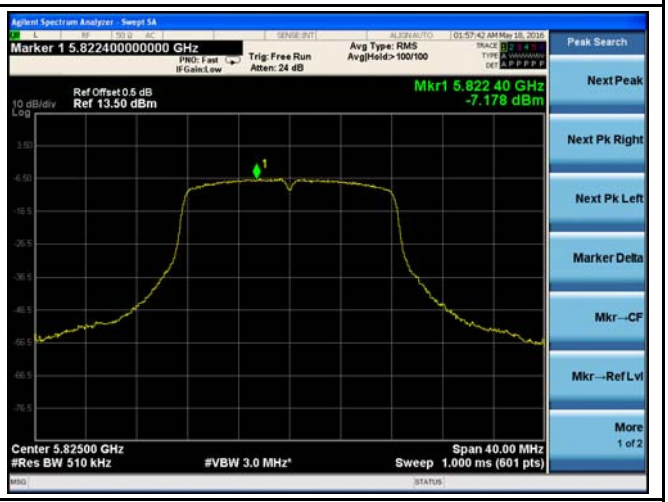
5470-5725MHz PSD - High CH 5700



5725-5850MHz PSD - Low CH 5745

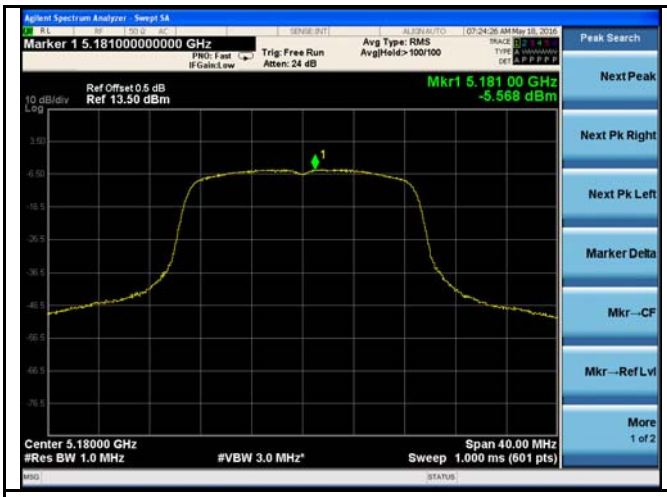


5725-5850MHz PSD - Mid CH 5785

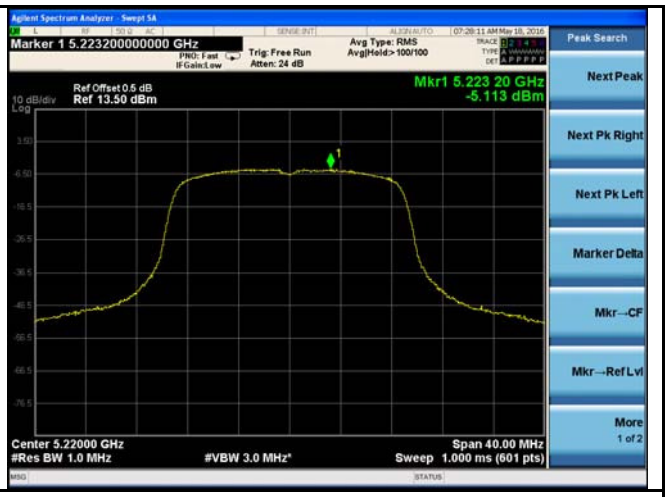


5725-5850MHz PSD - High CH 5825

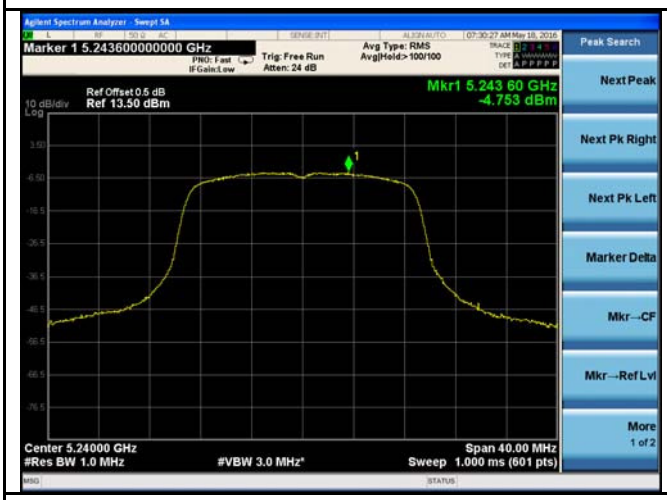
802.11n (20M)



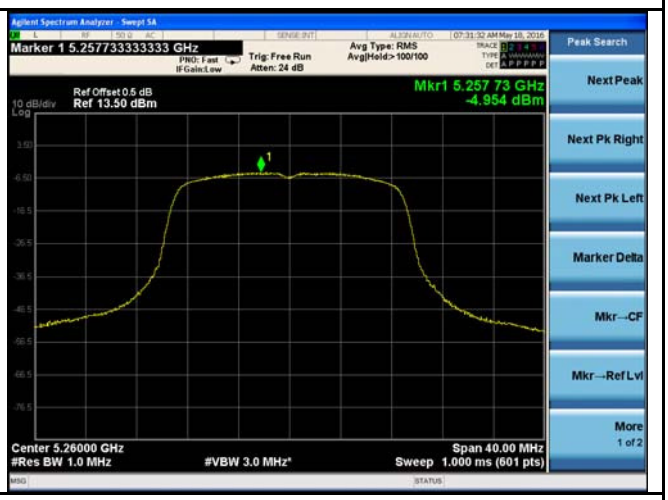
5150-5250MHz PSD - Low CH 5180



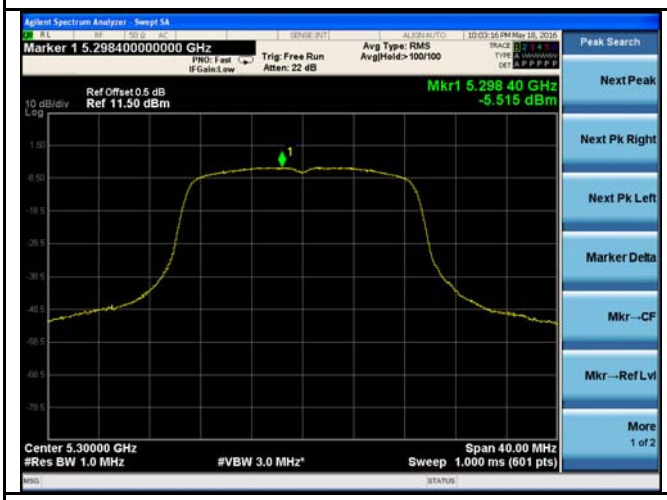
5150-5250MHz PSD - Middle CH 5220



5150-5250MHz PSD - High CH 5240

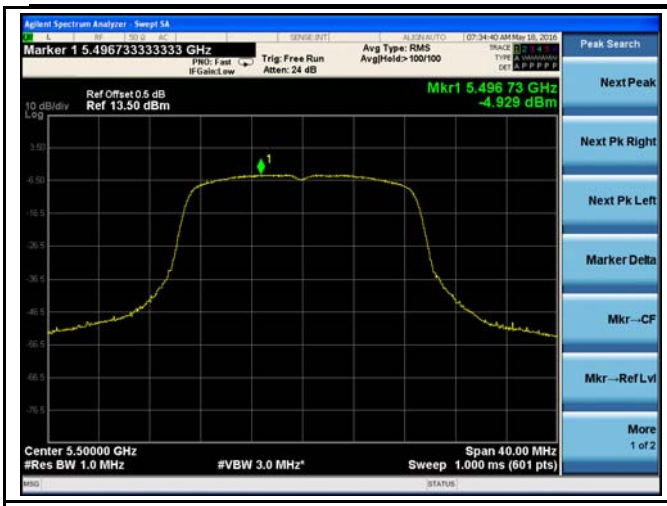


5250-5350MHz PSD - Low CH 5260

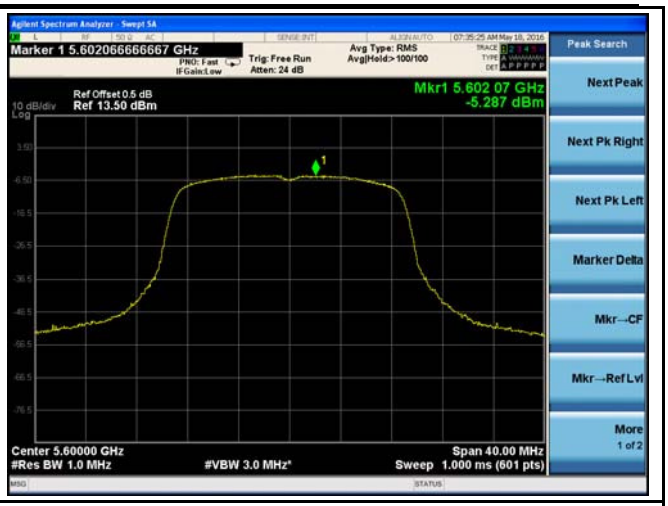


5250-5350MHz PSD - Middle CH 5300

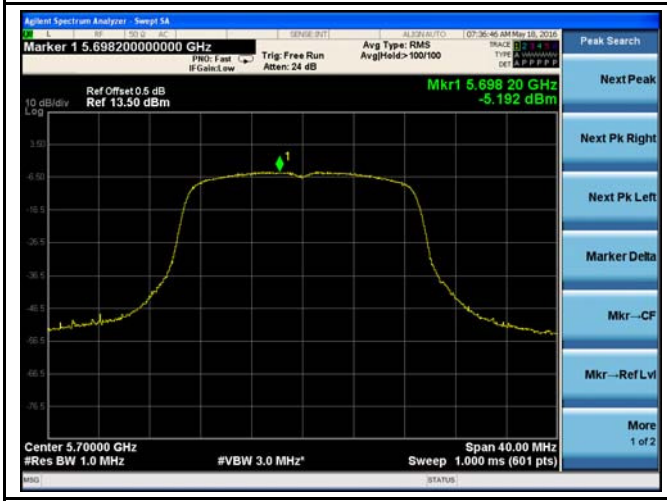
5250-5350MHz PSD - High CH 5320



5470-5725MHz PSD - Low CH 5500

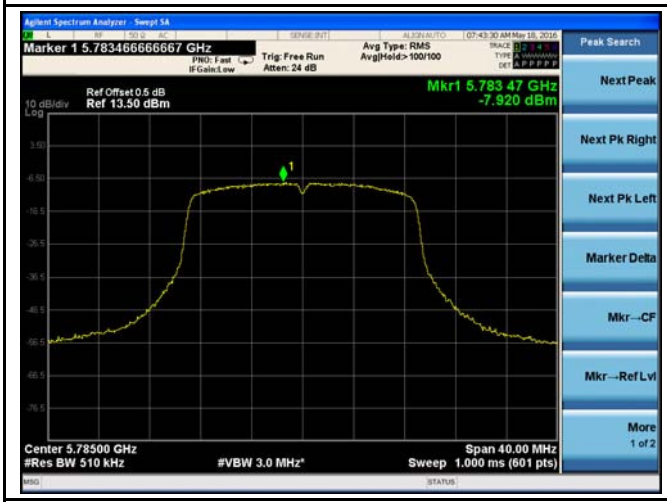


5470-5725MHz PSD - Mid CH 5600

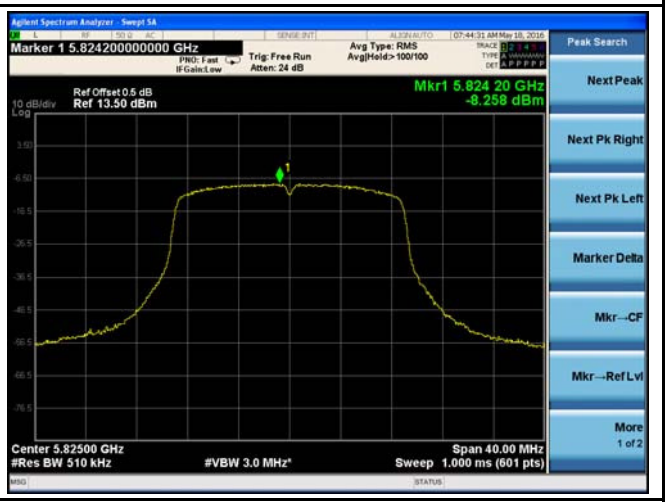


5470-5725MHz PSD - High CH 5700

5725-5850MHz PSD - Low CH 5745

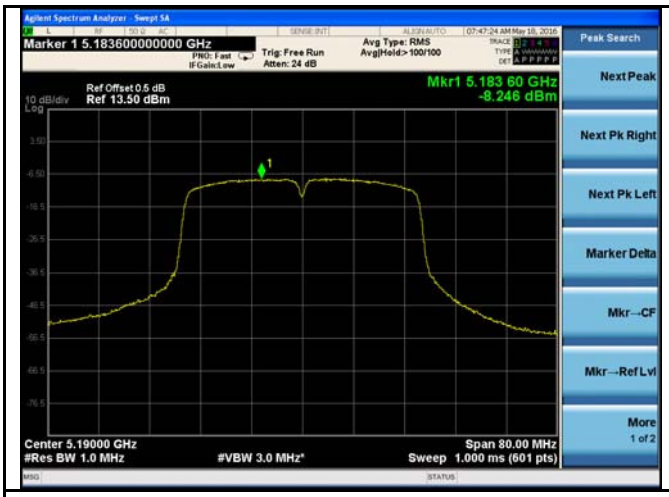


5725-5850MHz PSD - Mid CH 5785



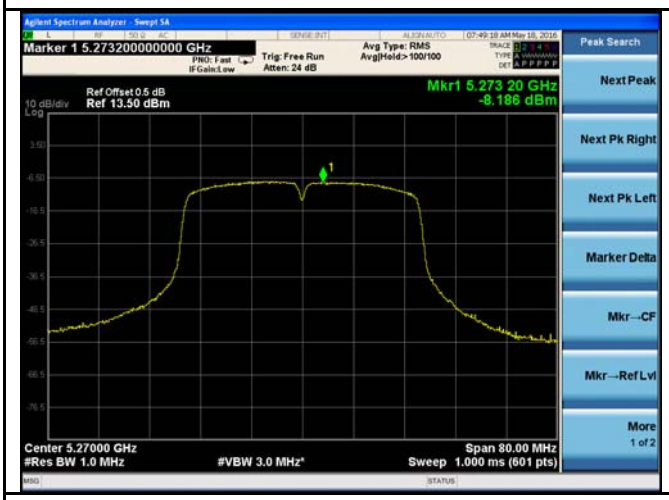
5725-5850MHz PSD - High CH 5825

802.11n (40M)

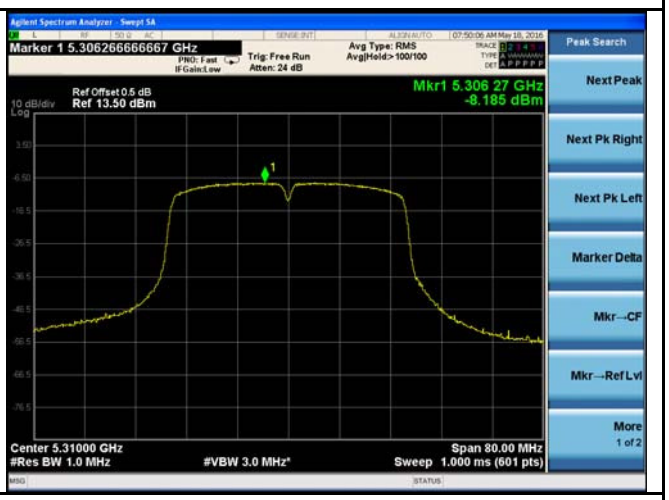


5150-5250MHz PSD - Low CH 5190

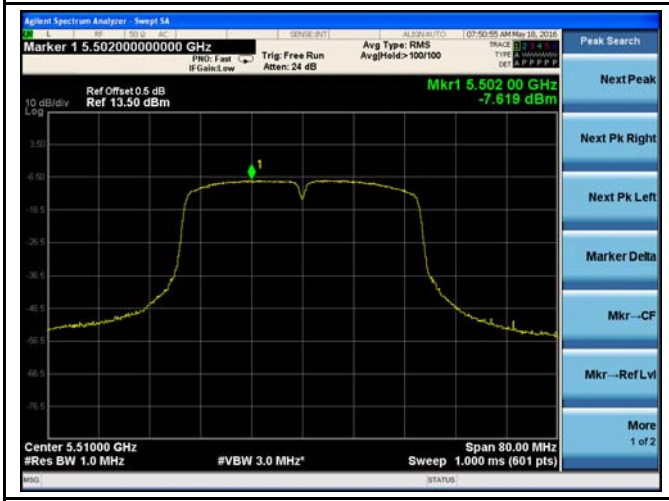
5150-5250MHz PSD - High CH 5230



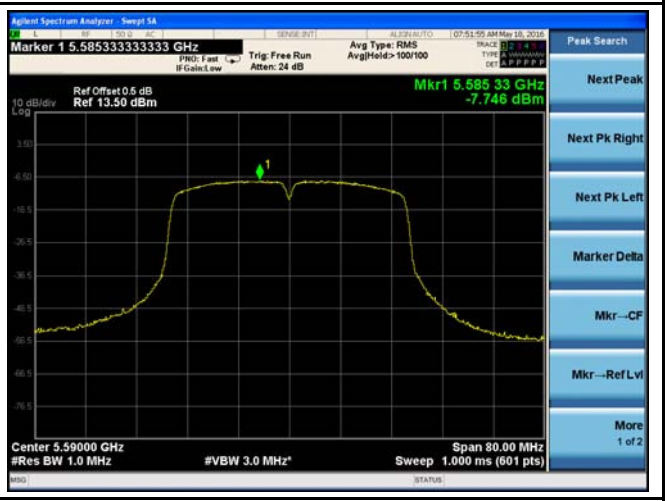
5250-5350MHz PSD - Low CH 5270



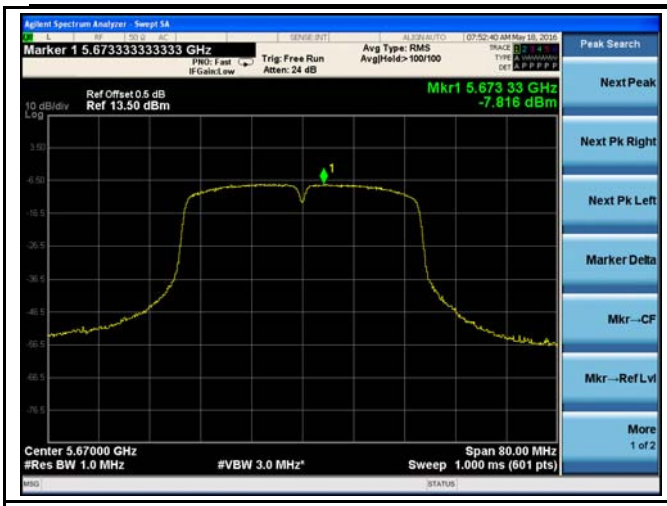
5250-5350MHz PSD - High CH 5310



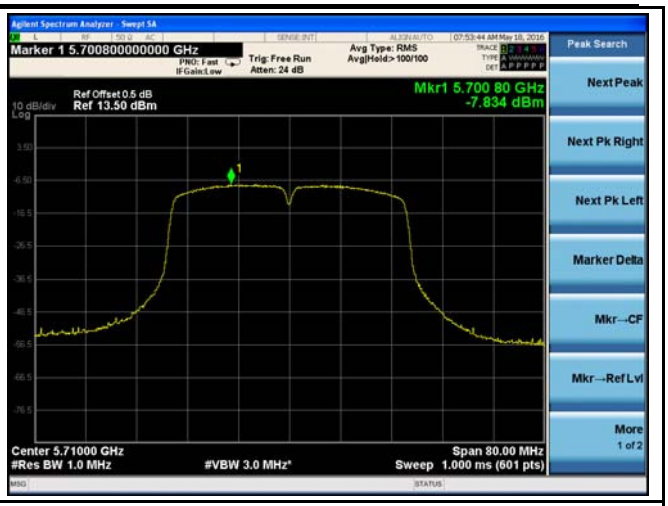
5470-5725MHz PSD - Low CH 5510



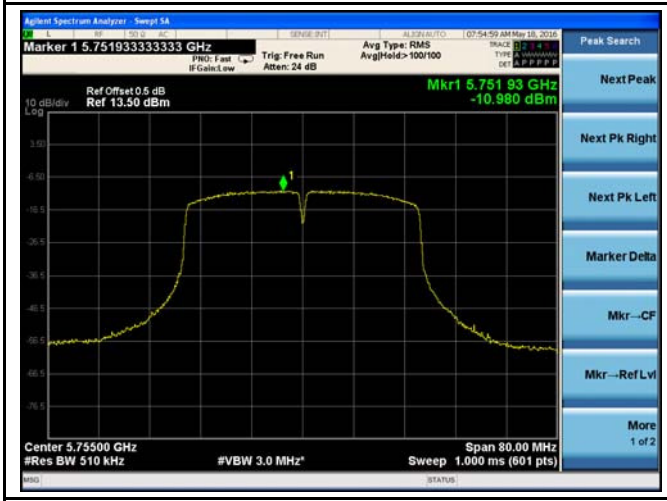
5470-5725MHz PSD - Mid CH 5590



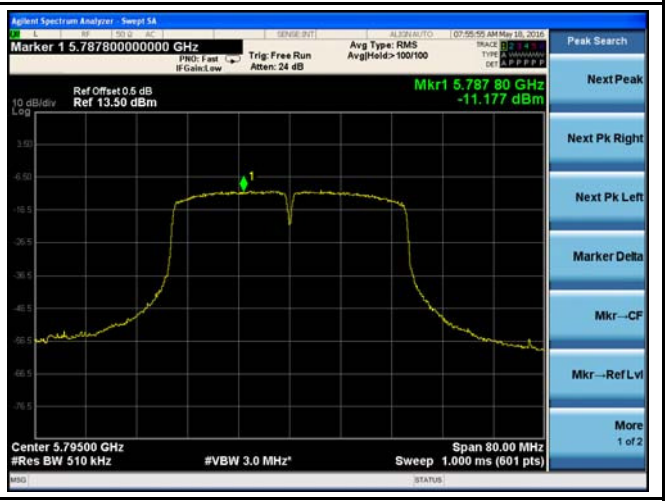
5470-5725MHz PSD - High CH 5670



5470-5725MHz PSD - Straddle CH 5710

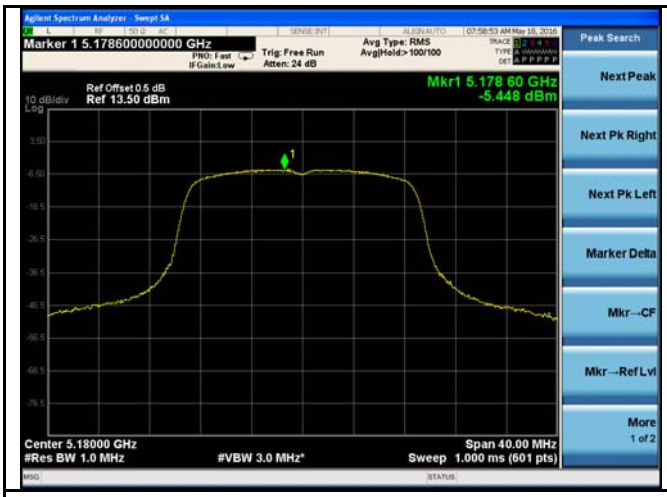


5725-5850MHz PSD - Low CH 5755



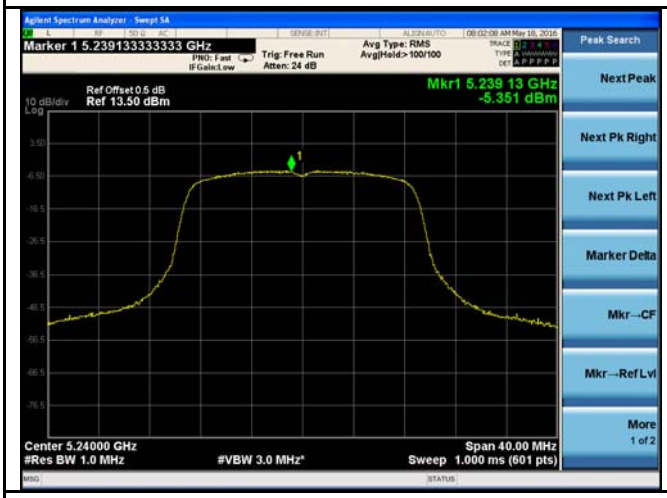
5725-5850MHz PSD - High CH 5795

802.11ac(20M)

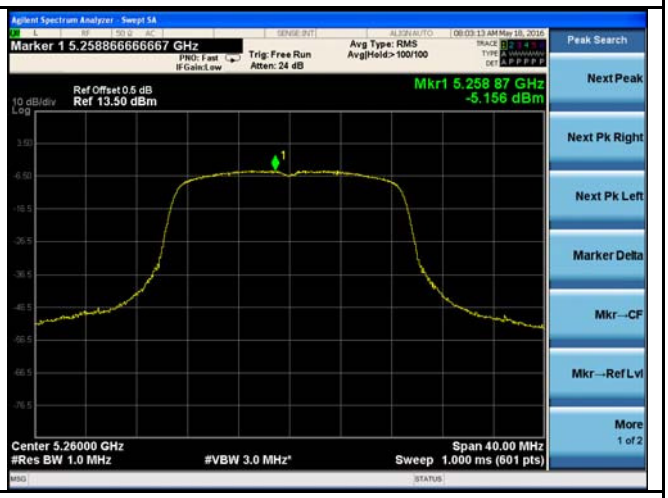


5150-5250MHz PSD - Low CH 5180

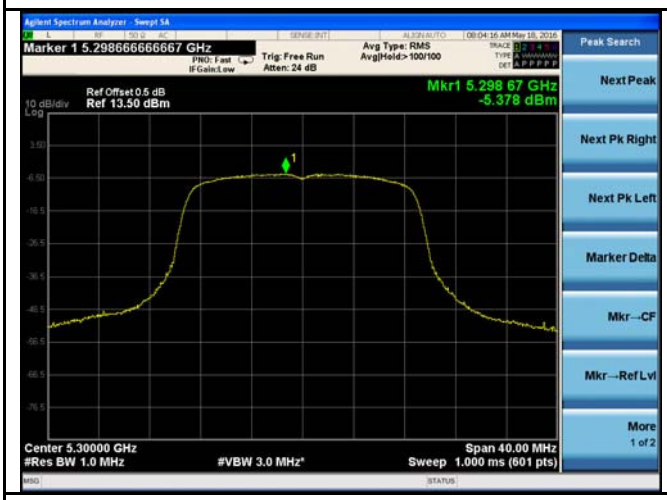
5150-5250MHz PSD - Middle CH 5220



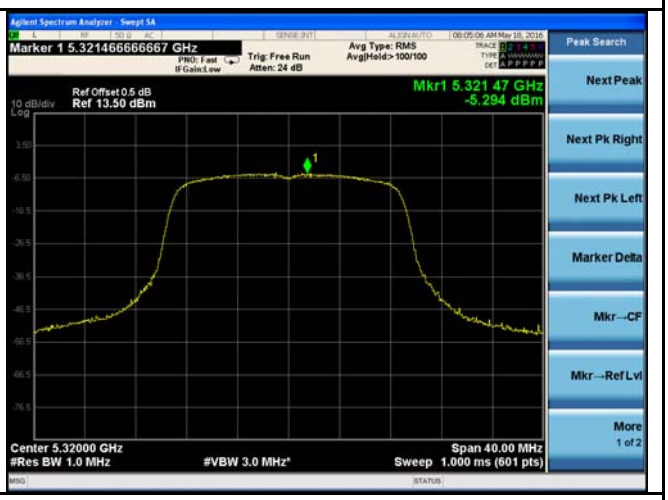
5150-5250MHz PSD - High CH 5240



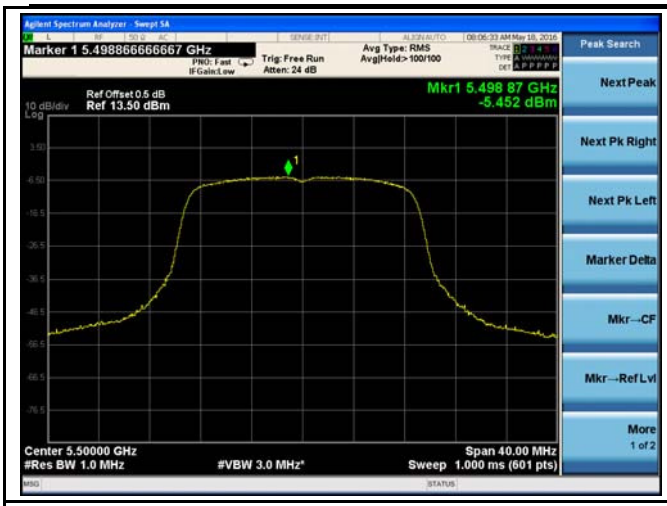
5250-5350MHz PSD - Low CH 5260



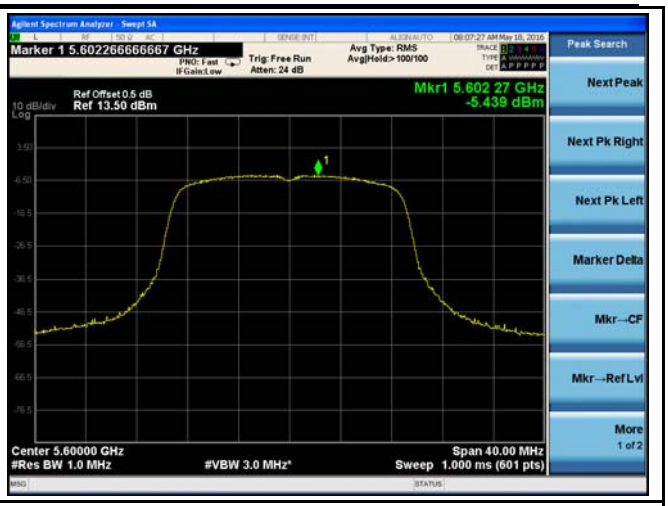
5250-5350MHz PSD - Middle CH 5300



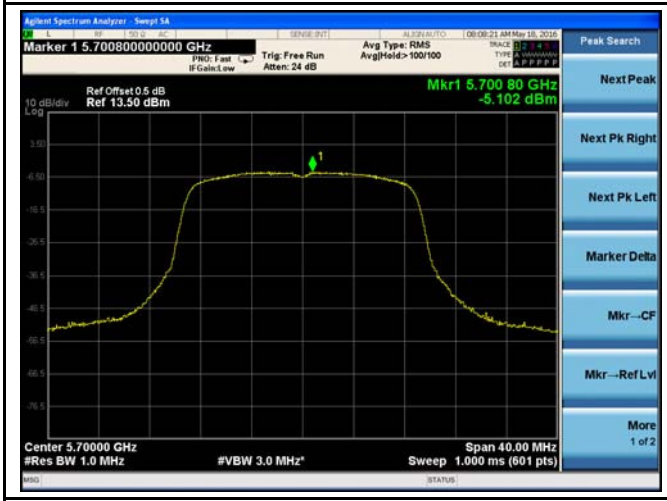
5250-5350MHz PSD - High CH 5320



5470-5725MHz PSD - Low CH 5500

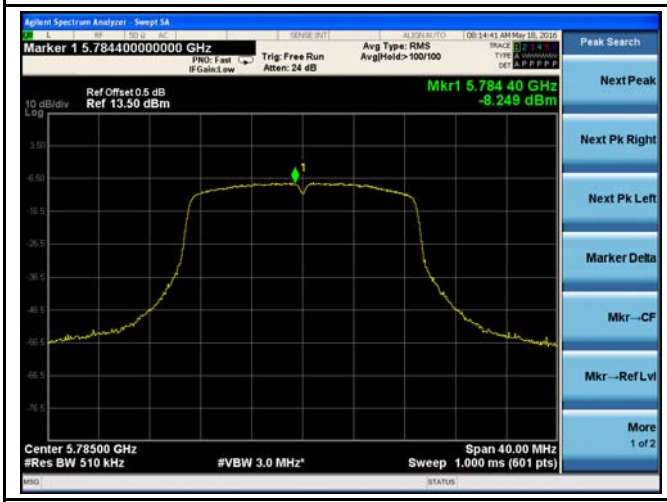


5470-5725MHz PSD - Mid CH 5600



5470-5725MHz PSD - High CH 5700

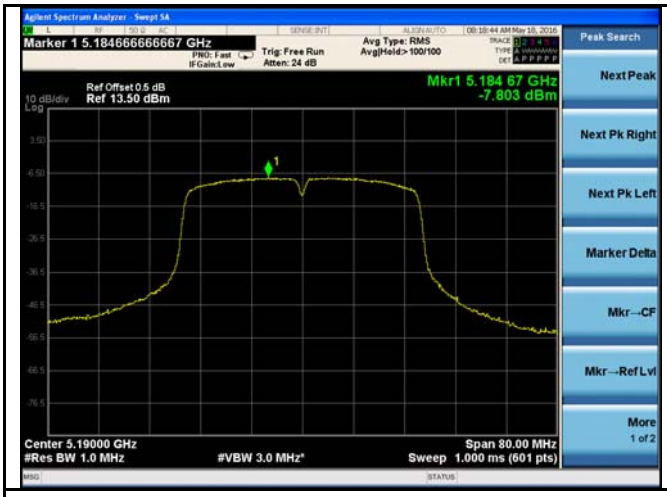
5725-5850MHz PSD - Low CH 5745



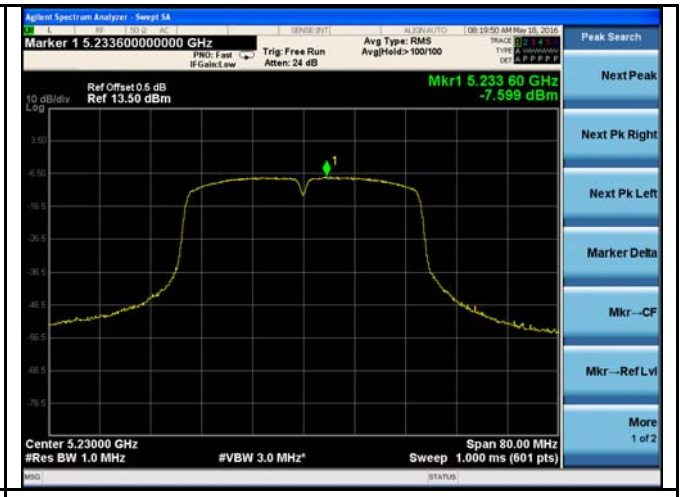
5725-5850MHz PSD - Mid CH 5785

5725-5850MHz PSD - High CH 5825

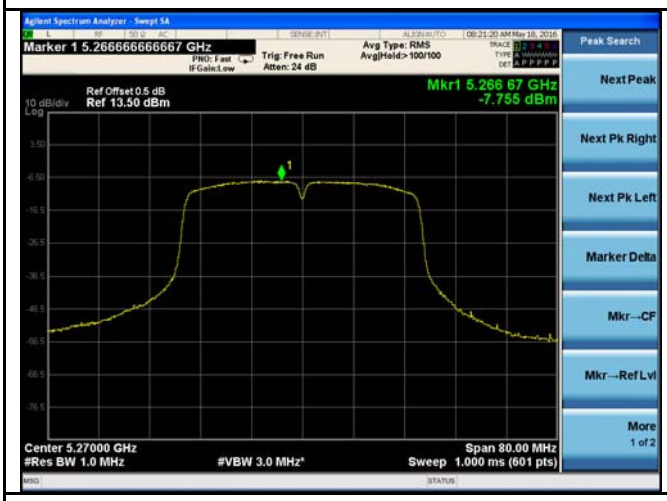
802.11ac(40M)



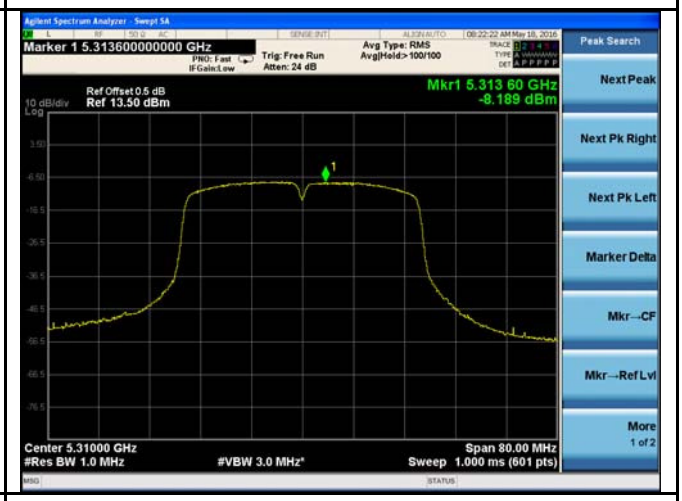
5150-5250MHz PSD - Low CH 5190



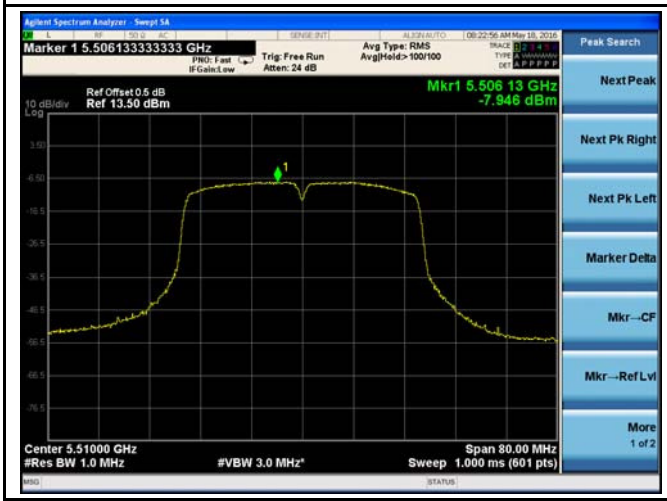
5150-5250MHz PSD - High CH 5230



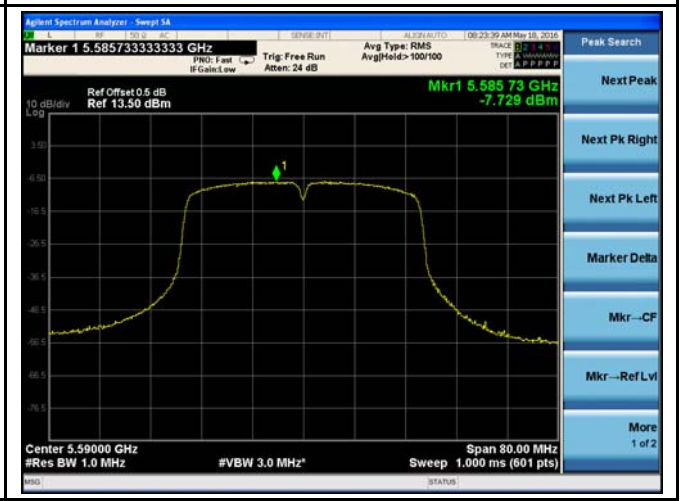
5250-5350MHz PSD - Low CH 5270



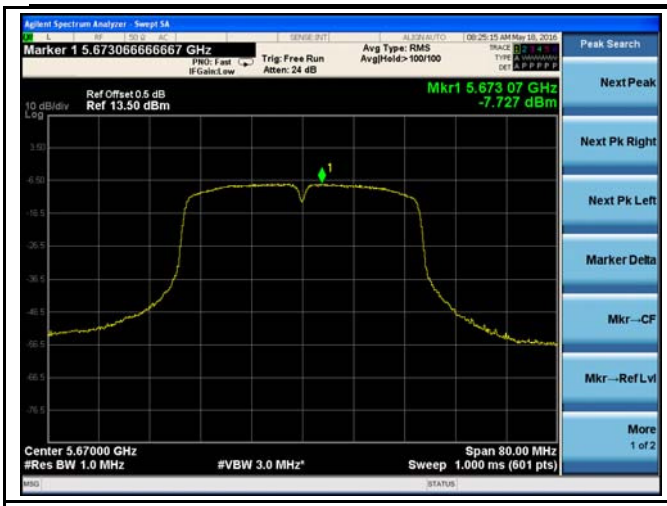
5250-5350MHz PSD - High CH 5310



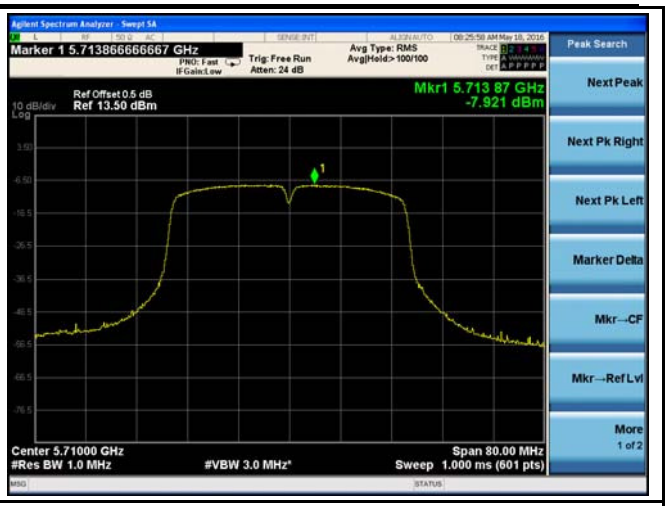
5470-5725MHz PSD - Low CH 5510



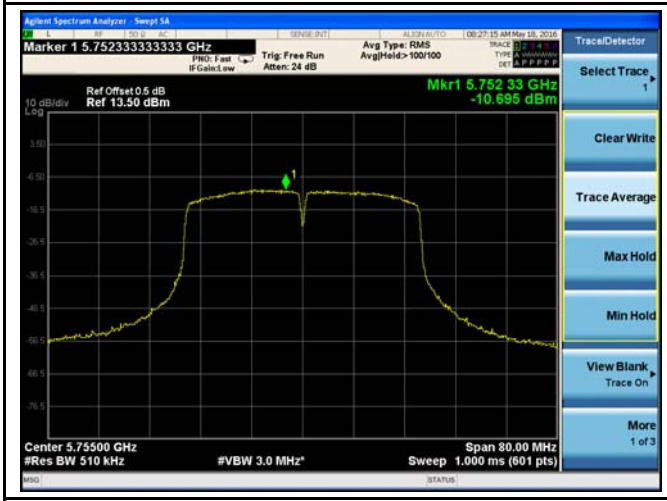
5470-5725MHz PSD - Mid CH 5590



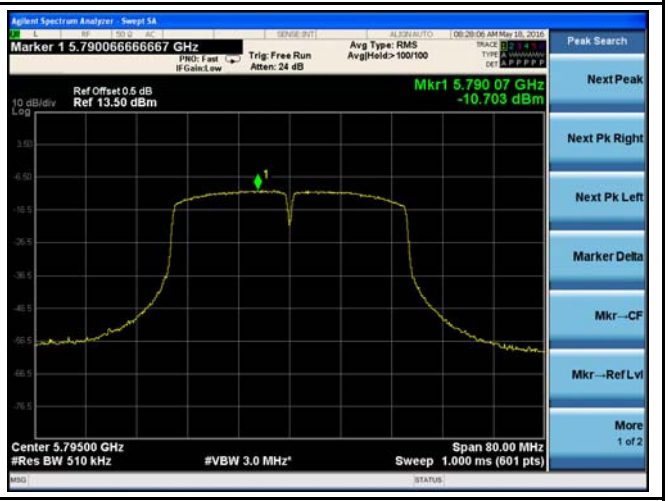
5470-5725MHz PSD - High CH 5670



5470-5725MHz PSD - Straddle CH 5710

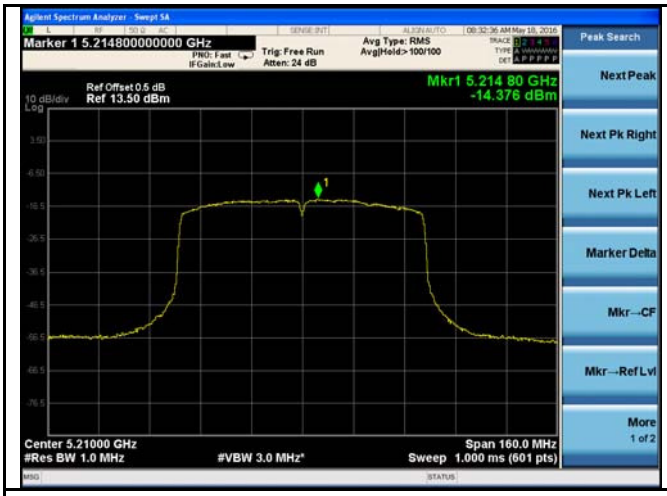


5725-5850MHz PSD - Low CH 5755



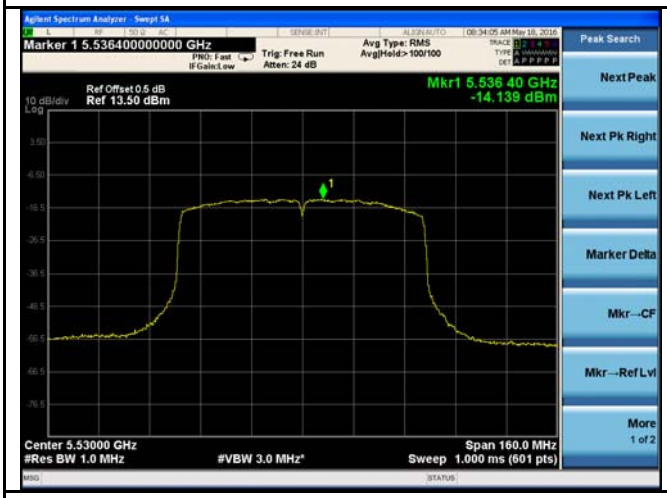
5725-5850MHz PSD - High CH 5795

802.11ac(80M)

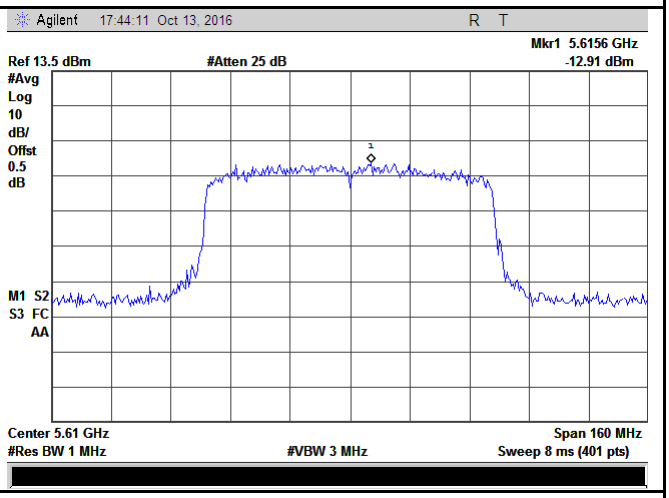


5150-5250MHz PSD - One CH 5210

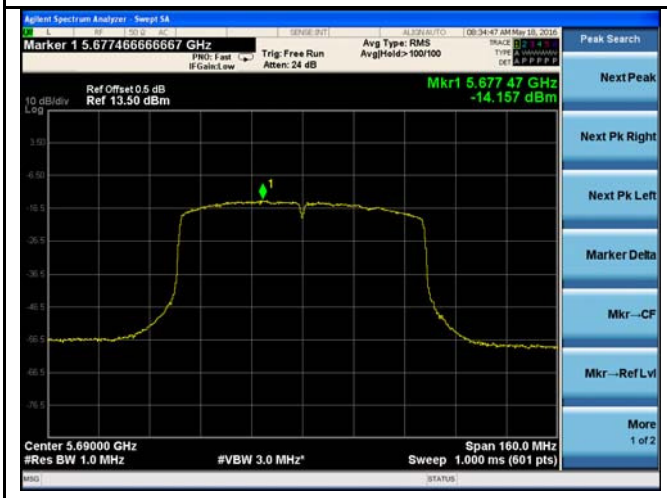
5250-5350MHz PSD - One CH 5290



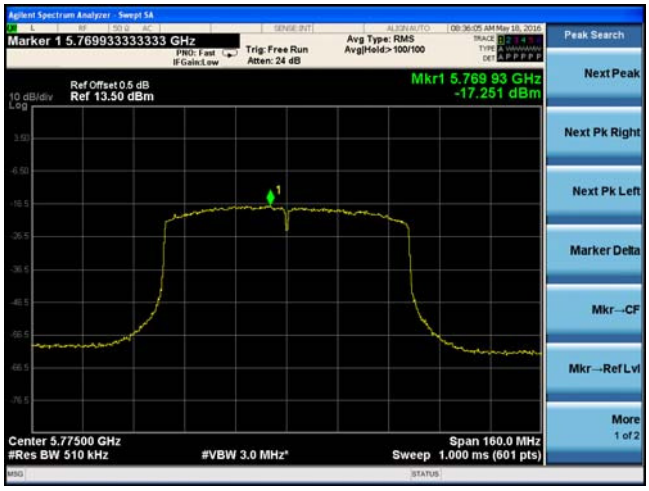
5470-5725MHz PSD - One CH 5530



5470-5725MHz PSD - One CH 5610



5470-5725MHz PSD - Straddle CH 5690



5725-5850MHz PSD - One CH 5775

6.6 §15.407(1) and b(4) Band-Edge

1. Conducted Measurement

   EUT was set for low, mid, high channel with modulated mode and highest RF output power.

   The spectrum analyzer was connected to the antenna terminal.

2. Environmental Conditions

	Temperature	23°C
	Relative Humidity	54%
	Atmospheric Pressure	1030mbar

3. Conducted Emissions Measurement Uncertainty

   All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2, in the range 30MHz – 40GHz is ±1.5dB.

4. Test date : May 18, 2016 &October 9, 2016

   Tested By : Loren Luo

Standard Requirement:

(b) Undesirable emission limits. Except as shown in paragraph (b)(7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

(1) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of − 27 dBm/MHz.

(2) For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of − 27 dBm/MHz.

(3) For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of − 27 dBm/MHz.

(4) For transmitters operating in the 5.725-5.85 GHz band:

Procedures:

Measurement Procedure Band edge:

Bandedge are measured by setting the analyzer as follows:

(i) RBW = 1 MHz.

(ii) VBW ≥ 3 MHz.

(iii) Detector = Peak.

(iv) Sweep time = auto.

(v) Trace mode = max hold.

(vi) Allow sweeps to continue until the trace stabilizes. Note that if the transmission is not continuous, the time required for the trace to stabilize will increase by a factor of approximately 1/x, where x is the duty cycle. For example, at 50 percent duty cycle, the measurement time will increase by a factor of two relative to measurement time for continuous transmission.

Unwanted band-edge emissions may be measured using either of the special band-edge measurement techniques (the marker-delta or integration methods) described below. Note that the marker-delta method is primarily a radiated measurement technique that requires the 99% occupied bandwidth edge to be within 2 MHz of the authorized band edge, whereas the integration method can be used in either a radiated or conducted measurement without any special requirement with regards to the displacement of the unwanted emission(s) relative to the authorized bandwidth.

(i) Marker-Delta Method.

The marker-delta method, as described in ANSI C63.10, can be used to perform measurements of the radiated unwanted emissions level of emissions provided that the 99% occupied bandwidth of the fundamental is within 2 MHz of the authorized band-edge..

(ii) Integration Method •

For maximum emissions measurements, follow the procedures described in section II.G.5., " Procedures for Unwanted Maximum Emissions Measurements above 1000 MHz" , except for the following changes:

◦ Set RBW = 100 kHz

◦ Set VBW ≥ 3 • RBW

◦ Perform a band-power integration across the 1 MHz bandwidth in which the band-edge emission level is to be measured. CAUTION: You must ensure that the spectrum analyzer or EMI

receiver is set for peak-detection and max-hold for this measurement.

• For average emissions measurements, follow the procedures described in section II.G.6., " Procedures for Average Unwanted Emissions Measurements above 1000 MHz" , except for the following changes:

◦ Set RBW = 100 kHz

◦ Set VBW ≥ 3 • RBW

◦ Perform a band-power integration across the 1 MHz bandwidth in which the band-edge emission level is to be measured.

Test Result: Pass.

Please refer to the following tables and plots.

Band edge measurement result

Test mode	Freq Band (MHz)	CH	Frequency (MHz)	Measured Bandedge (dBm)	Corrected factor (dB)	Bandedge (dBm)	Limit (dBm)	Result
820.11a	5150-5350	Low	5180	-49.348	10	-39.348	-27	Pass
		High	5320	-49.715	10	-39.715	-27	Pass
	5470-5725	Low	5500	-50.591	10	-40.591	-27	Pass
		High	5700	-47.919	10	-37.919	-27	Pass
	5725-5850	Low	5745	-46.833	10	-36.833	-27	Pass
		High	5825	-50.341	10	-40.341	-27	Pass
802.11n (20M)	5150-5350	Low	5180	-51.554	10	-41.554	-27	Pass
		High	5320	-44.491	10	-34.491	-27	Pass
	5470-5725	Low	5500	-50.421	10	-40.421	-27	Pass
		High	5700	-51.274	10	-41.274	-27	Pass
	5725-5850	Low	5745	-46.416	10	-36.416	-27	Pass
		High	5825	-49.824	10	-39.824	-27	Pass
802.11n (40M)	5150-5350	Low	5190	-50.838	10	-40.838	-27	Pass
		High	5310	-49.758	10	-39.758	-27	Pass
	5470-5725	Low	5510	-47.847	10	-37.847	-27	Pass
		High	5710	-54.746	10	-44.746	-27	Pass
	5725-5850	Low	5755	-44.586	10	-34.586	-27	Pass
		High	5795	-54.755	10	-44.755	-27	Pass
802.11ac (20M)	5150-5350	Low	5180	-50.343	10	-40.343	-27	Pass
		High	5320	-51.755	10	-41.755	-27	Pass
	5470-5725	Low	5500	-52.104	10	-42.104	-27	Pass
		High	5700	-49.746	10	-39.746	-27	Pass
	5725-5850	Low	5745	-47.105	10	-37.105	-27	Pass
		High	5825	-50.954	10	-40.954	-27	Pass
802.1ac (40M)	5150-5350	Low	5190	-47.931	10	-37.931	-27	Pass
		High	5310	-48.731	10	-38.731	-27	Pass
	5470-5725	Low	5510	-49.335	10	-39.335	-27	Pass
		High	5710	-52.202	10	-42.202	-27	Pass
	5725-5850	Low	5755	-45.767	10	-35.767	-27	Pass
		High	5795	-54.277	10	-44.277	-27	Pass

802.1ac (80M)	5150-5350	Low	5210	-51.961	10	-41.961	-27	Pass
		High	5290	-54.219	10	-44.219	-27	Pass
	5470-5725	Low	5530	-53.572	10	-43.572	-27	Pass
		High	5610	-56.480	10	-46.480	-27	Pass
	5725-5850	Low	5775	-51.404	10	-41.404	-27	Pass
		High	5775	-56.883	10	-46.883	-27	Pass

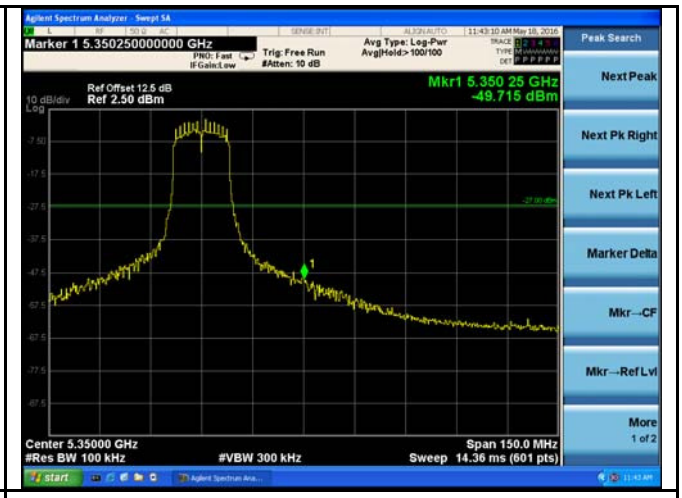
Note: Corrected factor=10log(1MHz/100KHz)=10.

Test Plots

Band Edge measurement result

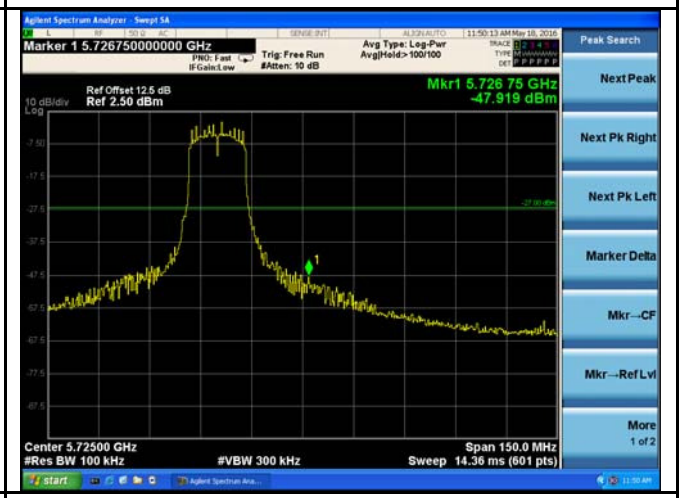
802.11a

5150-5350MHz Band Edge - Low CH 5180



5150-5350MHz Band Edge - High CH 5320

5470-5725MHz Band Edge - Low CH 5500

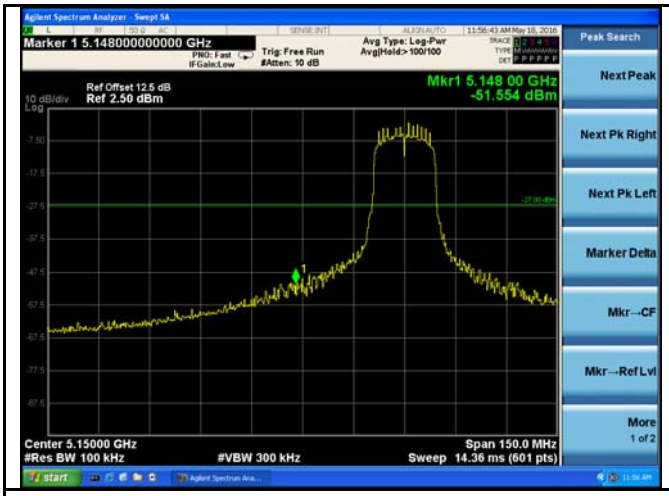


5470-5725MHz Band Edge - High CH 5700

5725-5850MHz Band Edge - Low CH 5745

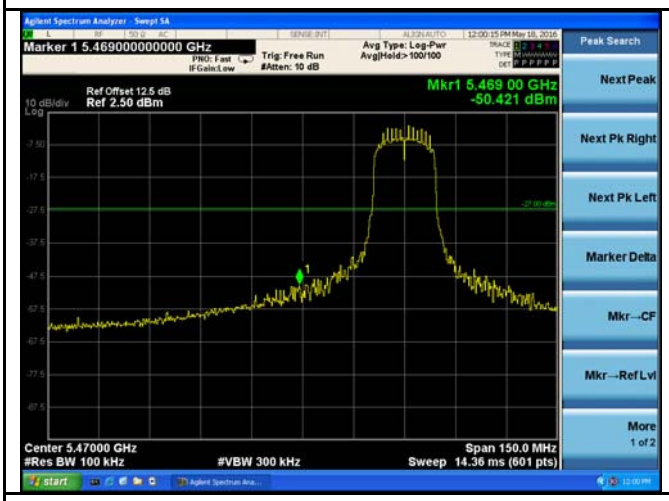
5725-5850MHz Band Edge - High CH 5825

802.11n (20M)



5150-5350MHz Band Edge - Low CH 5180

5150-5350MHz Band Edge - High CH 5320



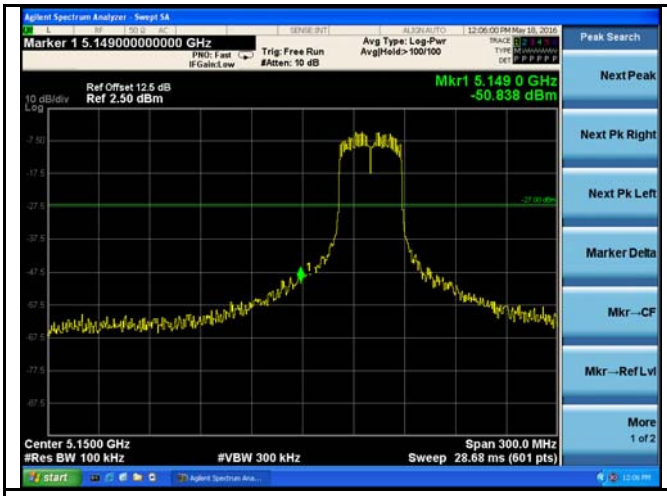
5470-5725MHz Band Edge - Low CH 5500

5470-5725MHz Band Edge - High CH 5700

5725-5850MHz Band Edge - Low CH 5745

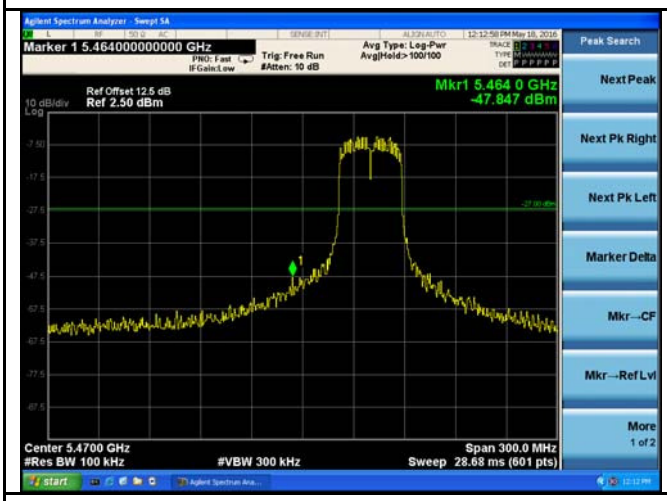
5725-5850MHz Band Edge - High CH 5825

802.11n (40M)

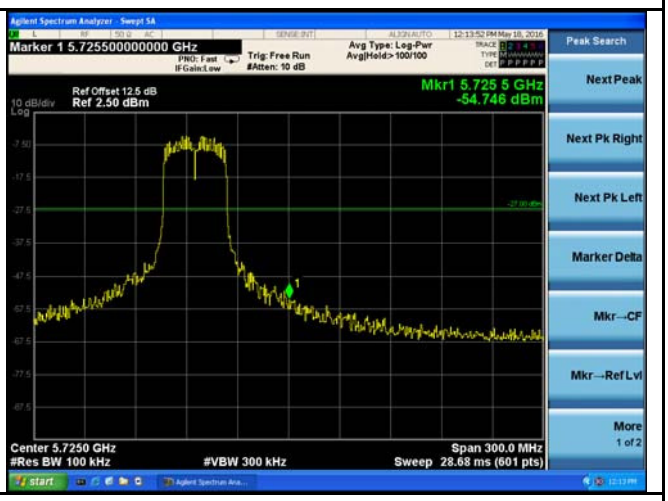


5150-5350MHz Band Edge - Low CH 5190

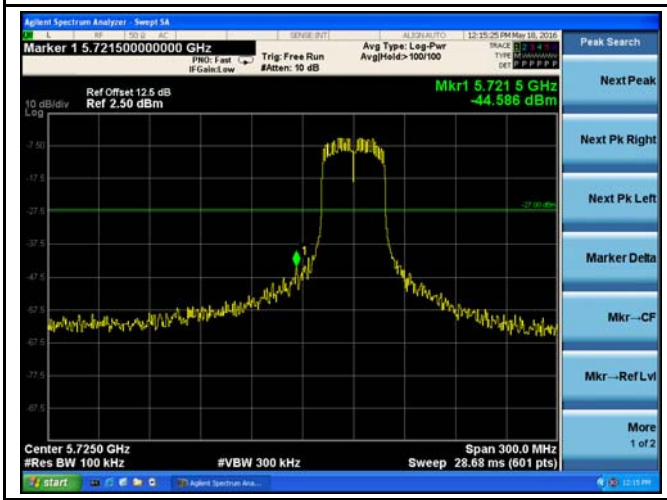
5150-5350MHz Band Edge - High CH 5310



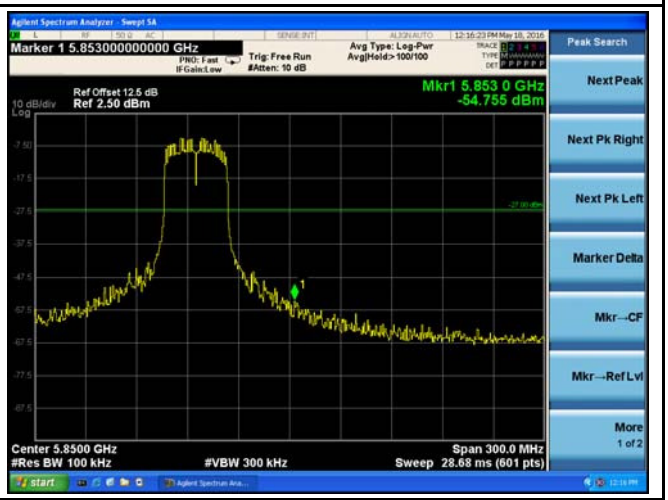
5470-5725MHz Band Edge - Low CH 5510



5470-5725MHz Band Edge - High CH 5670

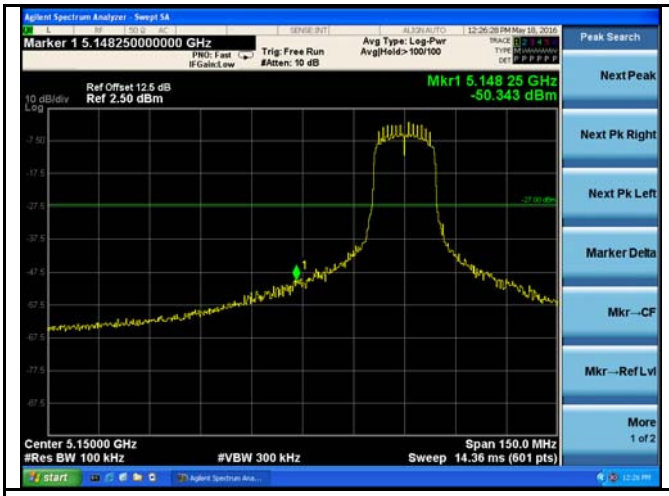


5725-5850MHz Band Edge - Low CH 5755

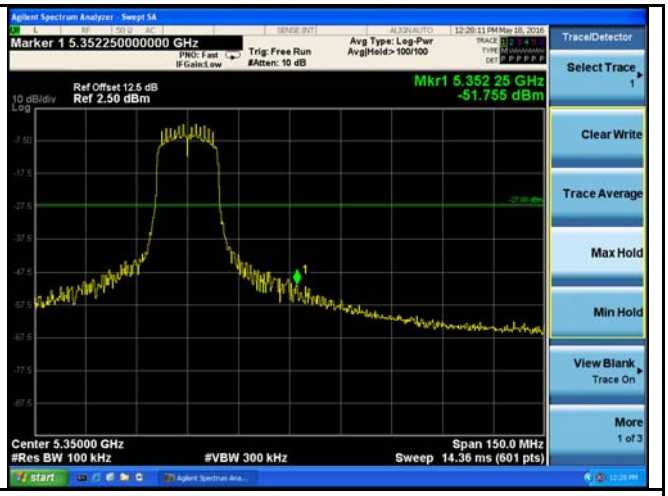


5725-5850MHz Band Edge - High CH 5795

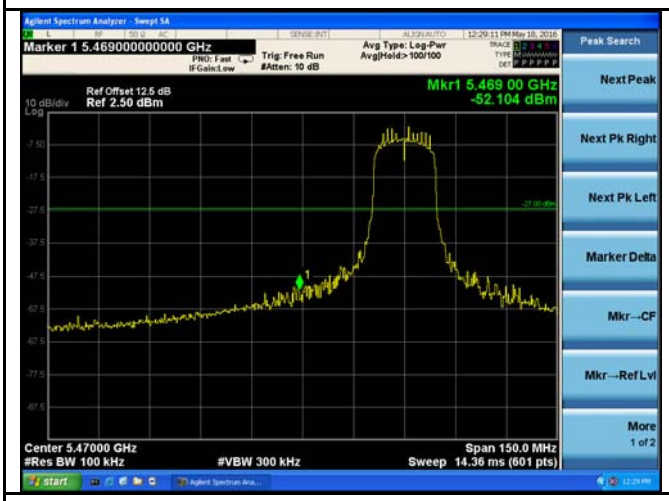
802.11ac(20M)



5150-5350MHz Band Edge - Low CH 5180

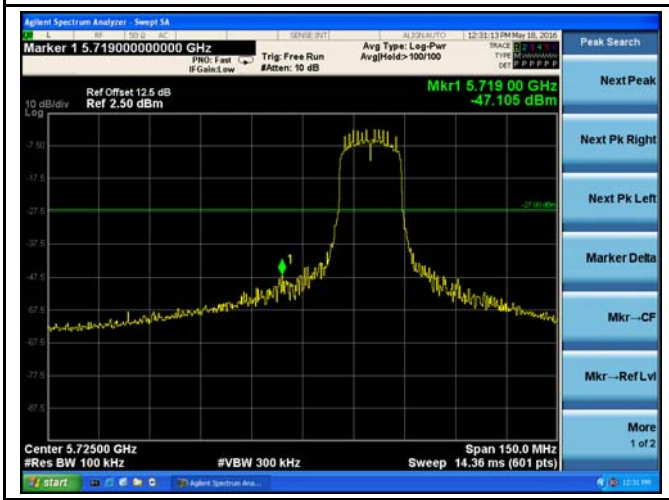


5150-5350MHz Band Edge - High CH 5320

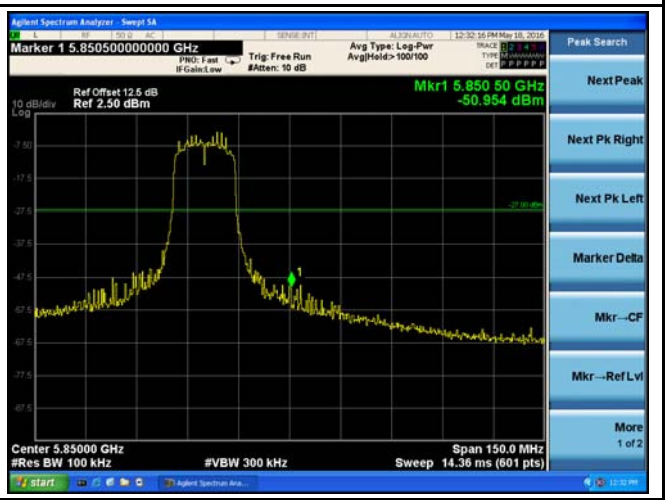


5470-5725MHz Band Edge - Low CH 5500

5470-5725MHz Band Edge - High CH 5700

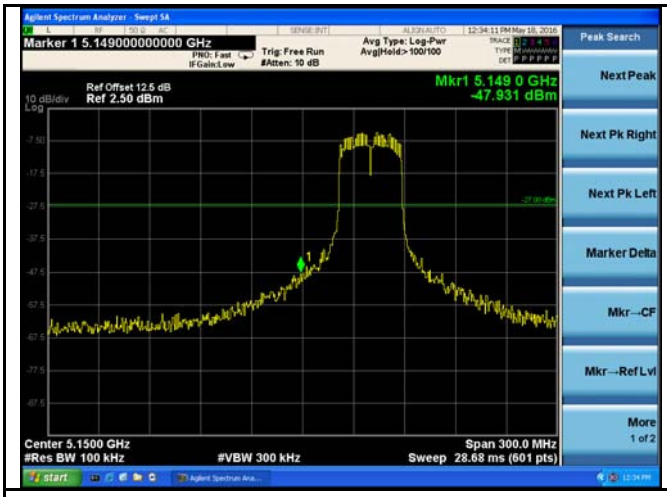


5725-5850MHz Band Edge - Low CH 5745

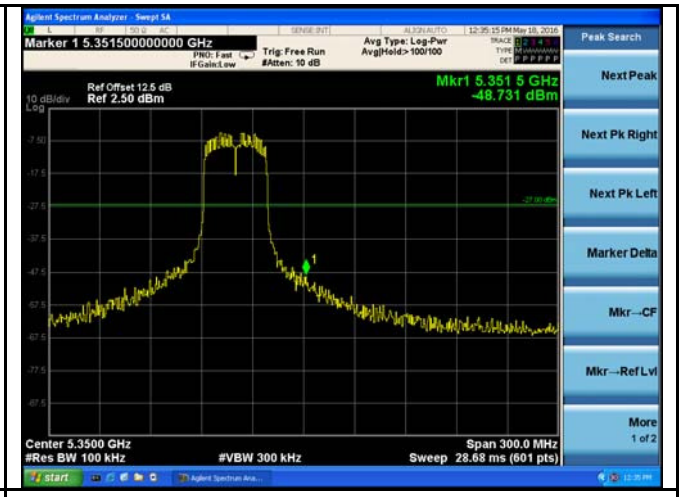


5725-5850MHz Band Edge - High CH 5825

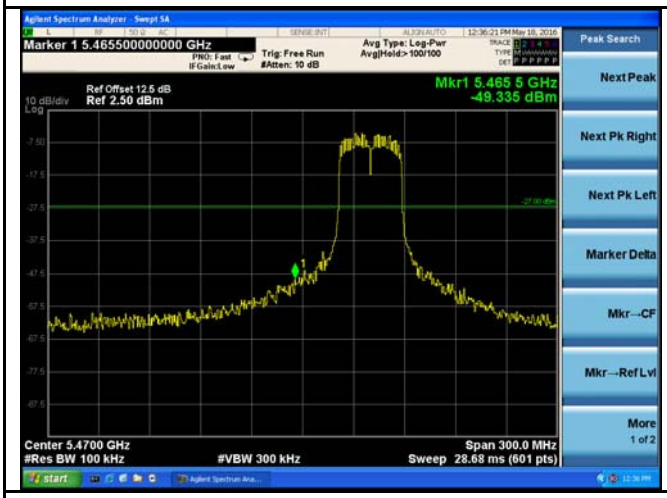
802.11ac(40M)



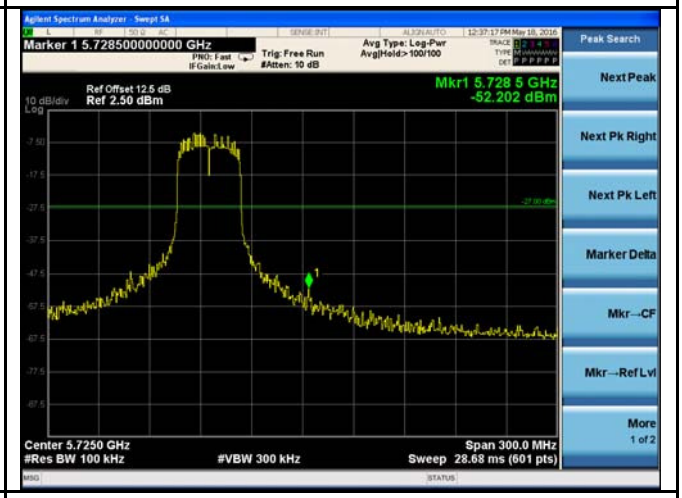
5150-5350MHz Band Edge - Low CH 5190



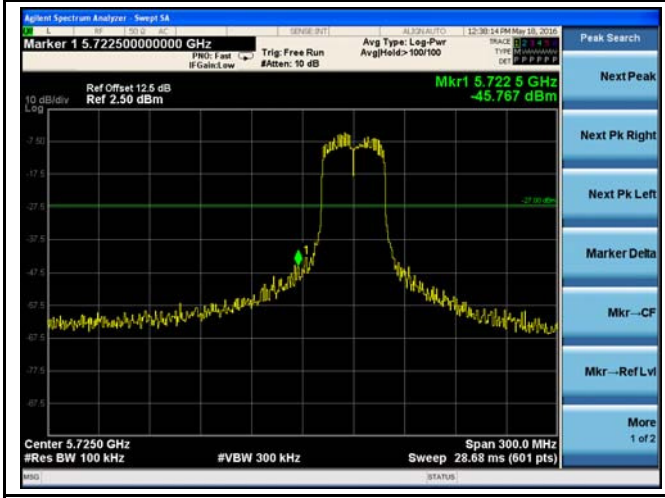
5150-5350MHz Band Edge - High CH 5310



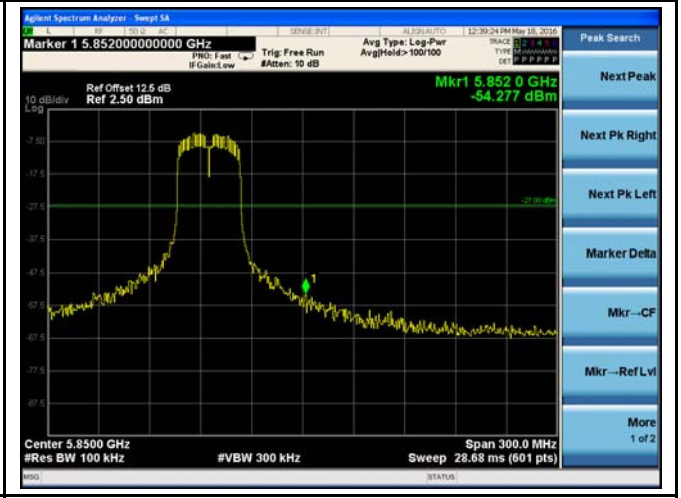
5470-5725MHz Band Edge - Low CH 5510



5470-5725MHz Band Edge - High CH 5670

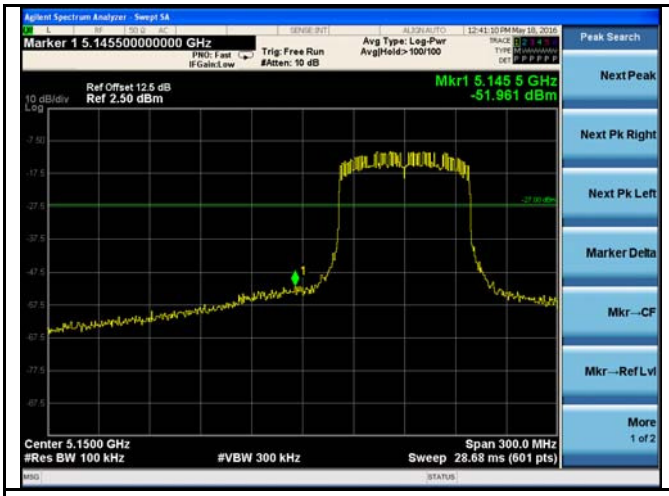


5725-5850MHz Band Edge - Low CH 5755

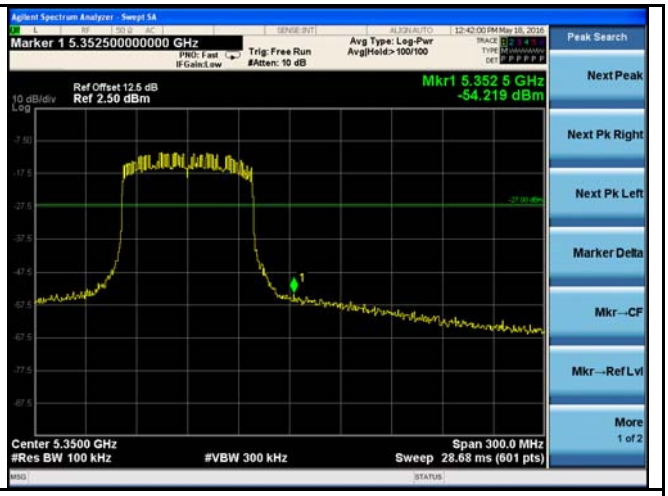


5725-5850MHz Band Edge - High CH 5795

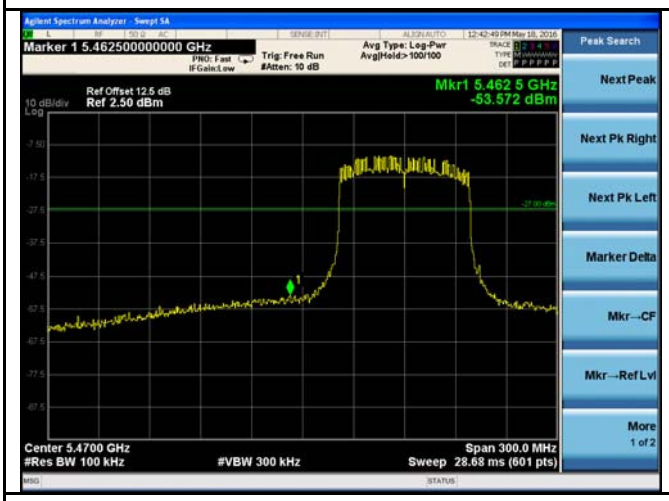
802.11ac(80M)



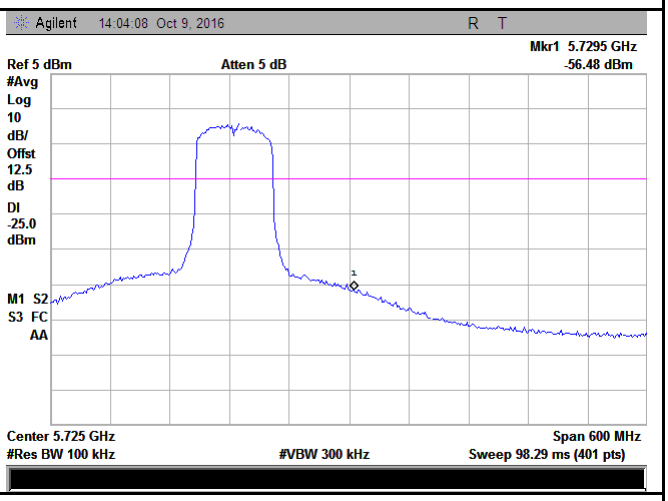
5150-5350MHz Band Edge - Low CH 5210



5150-5350MHz Band Edge - High CH 5290

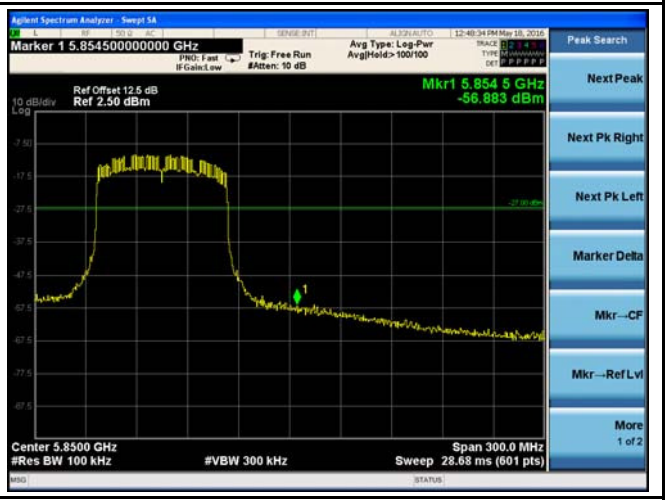


5470-5725MHz Band Edge - Low CH 5530



5470-5725MHz Band Edge - High CH 5610

5725-5850MHz Band Edge - Low CH 5775



5725-5850MHz Band Edge - High CH 5775

Note: Add a correction factor (antenna gain+ attenuator loss + cable loss) to the offset of the spectrum analyzer.

6.7 §15.207 (a) - AC Power Line Conducted Emissions

Requirement:

Frequency of emission (MHz)	Conducted limit (dBμ V)	
	Quasi-peak	Average
0.15– 0.5	66 to 56*	56 to 46*
0.5– 5	56	46
5– 30	60	50

*Decreases with the logarithm of the frequency.

Procedures:

1. All possible modes of operation were investigated. Only the 6 worst case emissions measured, using the correct CISPR and Average detectors, are reported. All other emissions were relatively insignificant.
2. A "-ve" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency.
3. Conducted Emissions Measurement Uncertainty
   All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2, in the range 9kHz – 30MHz (Average & Quasi-peak) is ±3.5dB.
4. Environmental Conditions Temperature 22°C
   Relative Humidity 57%
   Atmospheric Pressure 1005mbar
5. Test date: --------
   Tested By :---------

Result : N/A

Note: The AH1801 is powered by battery, so it is no need to test against this item.

6.8 §15.209, §15.205 & §15.407(b) - Radiated Spurious Emissions & Unwanted Emissions into Restricted Frequency Bands

1. All possible modes of operation were investigated. Only the 6 worst case emissions measured, using the correct CISPR detectors, are reported. All other emissions were relatively insignificant.
2. A "-ve" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency.
3. Radiated Emissions Measurement Uncertainty
   All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2, in the range 30MHz – 1GHz & 1GHz above (3m & 10m) is +/-6dB.
4. Environmental Conditions

Environmental Conditions	Temperature	22°C
	Relative Humidity	57%
	Atmospheric Pressure	1005mbar

5. Test date : May 05, 2016
   Tested By : Loren Luo

Requirement: §15.407(b) specifies that emissions which fall in the restricted bands, as defined in **§15.205(a)**, must comply with the radiated emission limits specified in **§15.209(a)**.

Procedures:

Radiated Spurious Emissions Measurement

An additional consideration when performing conducted measurements of restricted band emissions is that unwanted emissions radiating from the EUT cabinet, control circuits, power leads, or intermediate circuit elements will likely go undetected in a conducted measurement configuration. To address this concern, a radiated test shall be performed to ensure that emissions emanating from the EUT cabinet (rather than the antenna port) also comply with the applicable limits.

For these radiated spurious emission measurements the EUT transmit antenna may be replaced with a termination matching the nominal impedance of the antenna. Established procedures for performing radiated measurements shall be used (see C63.10). All detected emissions must comply with the applicable limits.

Measurement Detectors

§15.35(a) specifies that on frequencies less than and below 1000 MHz, the radiated emissions limits assume the use of a CISPR quasi-peak detector function and related measurement bandwidths. **§15.35(b)** specifies that on frequencies above 1000 MHz, the radiated emissions limits assume the use of an average detector and a minimum resolution bandwidth of 1 MHz. In addition, **§15.35(b)** that when average radiated emissions measurements are specified there is also a limit on the peak emissions level which is 20 dB above the applicable maximum permitted average emission limit. These specifications also apply to conducted emissions measurements.

1. CISPR Quasi-Peak Measurement

The specifications for the measuring instrument using the CISPR quasi-peak detector can be found in Publication 16 of the International Special Committee on Radio Frequency Interference (CISPR) of the International Electrotechnical Commission.

As an alternative to CISPR quasi-peak measurement, compliance can be demonstrated to the applicable emission limits using a peak detector.

2. Peak Power Measurement Procedure

Utilize the peak power measurement procedure specified in Section 8.1.1 with the following modifications:

Set analyzer center frequency to the frequency associated with the restricted band emission under examination.

Set RBW = 1 MHz.

Note that if the peak measured value complies with the average limit, it is not necessary to perform a separate average measurement. If this option is exercised, it should be so noted in the test report.

3. Average Power Measurement Procedures

The average restricted band emission levels must be measured with the EUT transmitting continuously (≥ 98% duty cycle) at its maximum power control level. Optionally, video triggering/signal gating can be used to ensure that measurements are performed only when the EUT is transmitting at its maximum power control level.

The average power measurement procedures described in Section 8.2 shall be used with the following modifications:

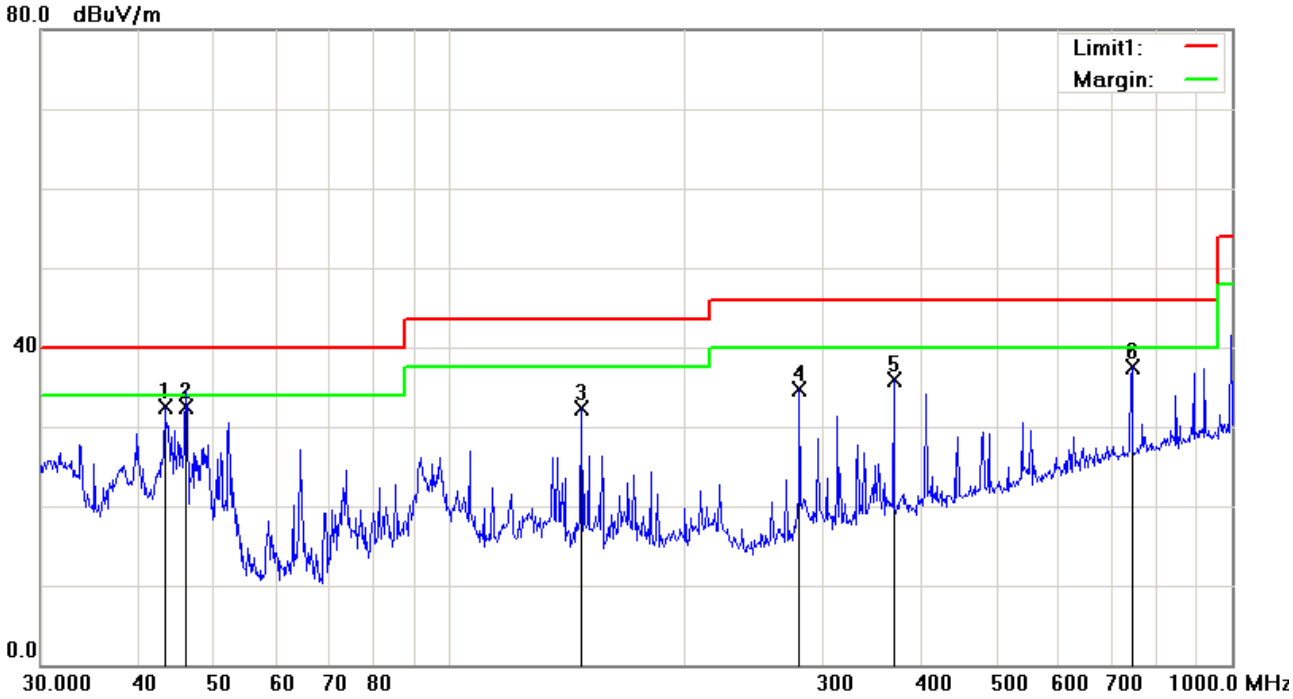
Set analyzer center frequency to the frequency associated with the restricted band emission.

Set span to at least 1 MHz.

Use peak marker function to determine the highest amplitude within the RBW (1 MHz).

Test Mode:	Transmitting Mode

(Below 1GHz)

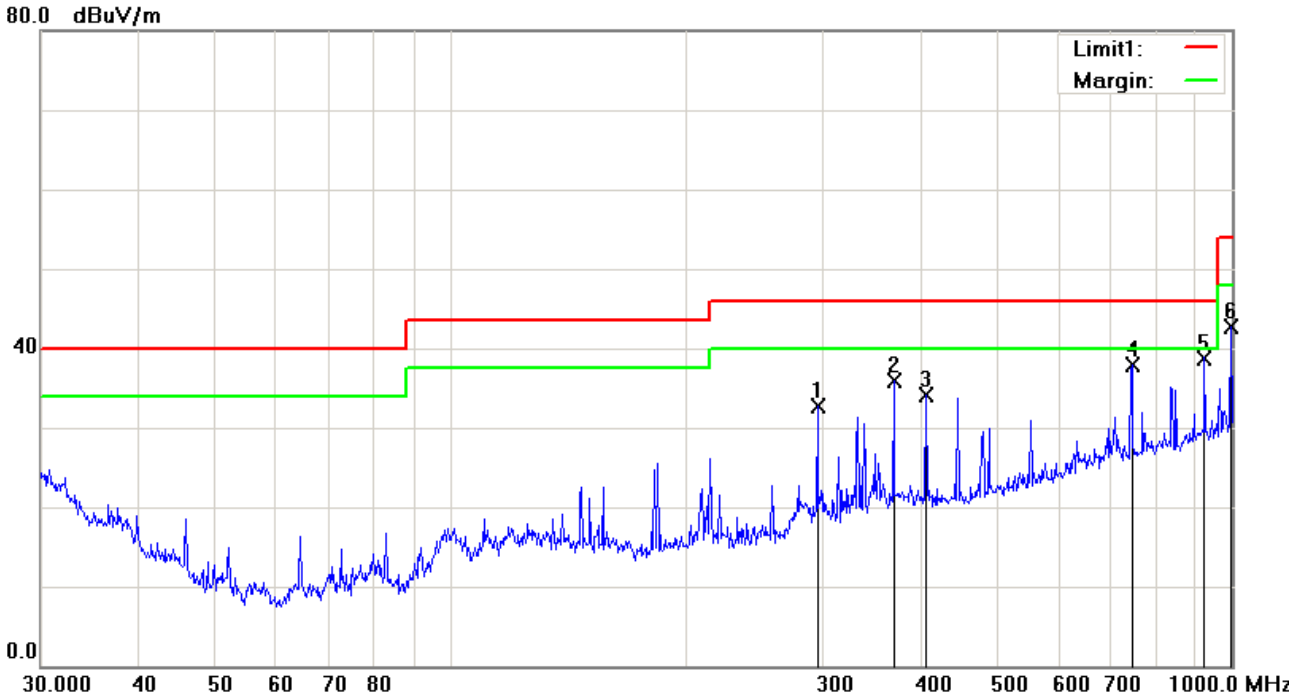


Test Data

Vertical Polarity Plot @3m

No	P/L	Frequency (MHz)	Reading (dBμV)	Detector	Corrected (dB)	Result (dBμV)	Limit (dBμV)	Margin (dB)	Height	Degree
1	V	43.2017	42.26	peak	-9.74	32.52	40.00	-7.48	100	191
2	V	46.0164	43.97	QP	-11.40	32.57	40.00	-7.43	100	320
3	V	147.4036	40.78	peak	-8.44	32.34	43.50	-11.16	100	186
4	V	280.0238	42.49	peak	-7.82	34.67	46.00	-11.33	100	66
5	V	369.4047	40.86	peak	-5.01	35.85	46.00	-10.15	100	179
6	V	744.8661	35.11	peak	2.31	37.42	46.00	-8.58	100	142

(Below 1GHz)



Test Data

Horizontal Polarity Plot @3m

No	P/L	Frequency (MHz)	Reading (dBμV)	Detector	Corrected (dB)	Result (dBμV)	Limit (dBμV)	Margin (dB)	Height	Degree
1	H	295.1469	39.81	peak	-7.12	32.69	46.00	-13.31	100	258
2	H	369.4047	40.87	peak	-5.01	35.86	46.00	-10.14	100	192
3	H	406.0880	38.23	peak	-4.16	34.07	46.00	-11.93	100	74
4	H	744.8661	35.66	peak	2.31	37.97	46.00	-8.03	100	147
5	H	922.5157	33.91	peak	4.89	38.80	46.00	-7.20	100	153
6	H	996.4996	37.02	peak	5.73	42.75	54.00	-11.25	100	230

Above 1GHz

Test Mode:	Transmitting Mode

Low Channel (5180 MHz) (802.11n20 mode worst case)

Frequency (MHz)	S.A. Reading (dBµV)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord Amp. (dBµV/m)	Limit (dBµV/m)	Margin (dB)
10360	32.49	AV	V	39.86	10.25	32.51	50.09	54	-3.91
10360	32.24	AV	H	39.86	10.25	32.51	49.84	54	-4.16
10360	45.53	PK	V	39.86	10.25	32.51	63.13	74	-10.87
10360	46.18	PK	H	39.86	10.25	32.51	63.78	74	-10.22
17853	27.36	AV	V	40.93	12.67	31.28	49.68	54	-4.32
17853	27.25	AV	H	40.93	12.67	31.28	49.57	54	-4.43
17853	44.19	PK	V	40.93	12.67	31.28	66.51	74	-7.49
17853	44.53	PK	H	40.93	12.67	31.28	66.85	74	-7.15

Middle Channel (5200 MHz) (802.11n20 mode worst case)

Frequency (MHz)	S.A. Reading (dBµV)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord Amp. (dBµV/m)	Limit (dBµV/m)	Margin (dB)
10400	32.61	AV	V	39.86	10.25	32.51	50.21	54	-3.79
10400	32.18	AV	H	39.86	10.25	32.51	49.78	54	-4.22
10400	45.35	PK	V	39.86	10.25	32.51	62.95	74	-11.05
10400	46.02	PK	H	39.86	10.25	32.51	63.62	74	-10.38
17829	27.51	AV	V	40.73	12.55	31.38	49.41	54	-4.59
17829	27.38	AV	H	40.73	12.55	31.38	49.28	54	-4.72
17829	44.35	PK	V	40.73	12.55	31.38	66.25	74	-7.75
17829	44.22	PK	H	40.73	12.55	31.38	66.12	74	-7.88

High Channel (5240 MHz) (802.11n20 mode worst case)

Frequency (MHz)	S.A. Reading (dBμV)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord Amp. (dBμV/m)	Limit (dBμV/m)	Margin (dB)
10480	32.37	AV	V	39.86	10.25	32.51	49.97	54	-4.03
10480	32.05	AV	H	39.86	10.25	32.51	49.65	54	-4.35
10480	45.21	PK	V	39.86	10.25	32.51	62.81	74	-11.19
10480	45.63	PK	H	39.86	10.25	32.51	63.23	74	-10.77
17835	27.59	AV	V	40.76	12.52	31.29	49.58	54	-4.42
17835	27.42	AV	H	40.76	12.52	31.29	49.41	54	-4.59
17835	44.35	PK	V	40.76	12.52	31.29	66.34	74	-7.66
17835	44.19	PK	H	40.76	12.52	31.29	66.18	74	-7.82

Note:

1, The testing has been conformed to 40GHz;
2, All other emissions more than 30 dB below the limit
3, X-Axis, Y-Axis and Z-Axis were investigated. The results above show only the worst case.

Annex A. TEST INSTRUMENT

Annex A.i. TEST INSTRUMENTATION & GENERAL PROCEDURES

#1 2015-2016

Instrument	Model	Serial #	Cal Date	Cal Due	In use
RF conducted test					
Agilent ESA-E SERIES	E4407B	MY45108319	09/17/2015	09/16/2016	☑
Power Splitter	1#	1#	09/01/2015	08/31/2016	☑
DC Power Supply	E3640A	MY40004013	09/17/2015	09/16/2016	☑
Radiated Emissions					
EMI test receiver	ESL6	100262	09/17/2015	09/16/2016	☑
Positioning Controller	UC3000	MF780208282	11/19/2015	11/18/2016	☑
OPT 010 AMPLIFIER (0.1-1300MHz)	8447E	2727A02430	09/01/2015	08/31/2016	☑
Microwave Preamplifier (1 ~ 26.5GHz)	8449B	3008A02402	03/24/2016	03/23/2017	☑
Bilog Antenna (30MHz~6GHz)	JB6	A110712	09/21/2015	09/20/2016	☑
Double Ridge Horn Antenna (1 ~18GHz)	AH-118	71283	09/24/2015	09/23/2016	☑
Universal Radio Communication Tester	CMU200	121393	09/25/2015	09/24/2016	☑

#2 2016-2017

Instrument	Model	Serial #	Cal Date	Cal Due	In use
RF conducted test					
Agilent ESA-E SERIES	E4407B	MY45108319	09/16/2016	09/15/2017	☑
Power Splitter	1#	1#	08/31/2016	08/30/2017	☑
DC Power Supply	E3640A	MY40004013	09/16/2016	09/15/2017	☑
Radiated Emissions					
EMI test receiver	ESL6	100262	09/16/2016	09/15/2017	☑
Positioning Controller	UC3000	MF780208282	11/18/2016	11/17/2017	☑
OPT 010 AMPLIFIER (0.1-1300MHz)	8447E	2727A02430	08/31/2016	08/30/2017	☑
Microwave Preamplifier (1 ~ 26.5GHz)	8449B	3008A02402	03/24/2016	03/23/2017	☑
Bilog Antenna (30MHz~6GHz)	JB6	A110712	09/20/2016	09/19/2017	☑
Double Ridge Horn Antenna (1 ~18GHz)	AH-118	71283	09/23/2016	09/22/2017	☑
Universal Radio Communication Tester	CMU200	121393	09/24/2016	09/23/2017	☑

Annex A.ii. CONDUCTED EMISSIONS TEST DESCRIPTION

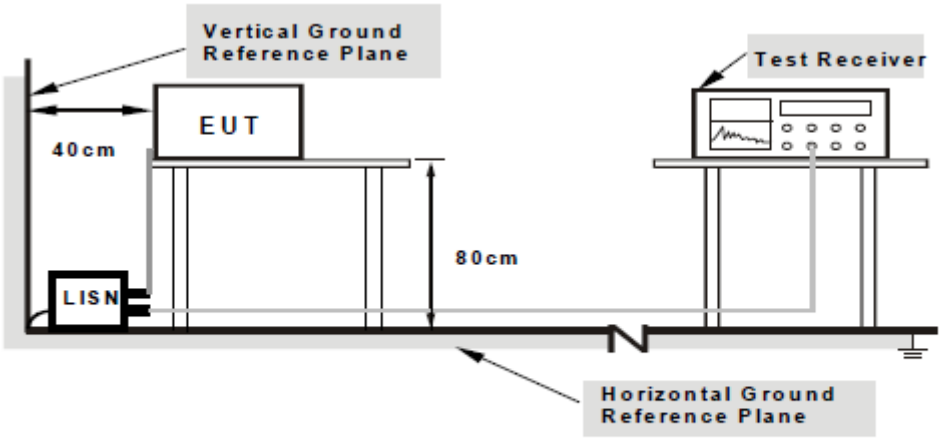
Test Set-up

1. The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m x 1m x 0.8m high, non-metallic table, as shown in Annex B.

2. The power supply for the EUT was fed through a 50Ω/50μH EUT LISN, connected to filtered mains.

3. The RF OUT of the EUT LISN was connected to the EMI test receiver via a low-loss coaxial cable.

4. All other supporting equipments were powered separately from another main supply.



Note: 1.Support units were connected to second LISN.
2.Both of LISNs (AMN) are 80cm from EUT and at least 80cm from other units and other metal planes support units.

For the actual test configuration, please refer to the related item – Photographs of the Test Configuration1.

Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition.

2. A scan was made on the NEUTRAL line (for AC mains) or Earth line (for DC power) over the required frequency range using an EMI test receiver.

3. High peaks, relative to the limit line, were then selected.

4. The EMI test receiver was then tuned to the selected frequencies and the necessary measurements made with a receiver bandwidth setting of 10 kHz. For FCC tests, only Quasi-peak measurements were made; while for CISPR/EN tests, both Quasi-peak and Average measurements were made.

5. Steps 2 to 4 were then repeated for the LIVE line (for AC mains) or DC line (for DC power).

Description of Conducted Emission Program

This EMC Measurement software run LabView automation software and offers a common user interface for electromagnetic interference (EMI) measurements. This software is a modern and powerful tool for controlling and monitoring EMI test receivers and EMC test systems. It guarantees reliable collection, evaluation, and documentation of measurement results. Basically, this program will run a pre-scan measurement before it proceeds with the final measurement. The pre-scan routine will run the common scan range from 150 kHz to 30 MHz; the program will first start a peak and average scan on selectable measurement time and step size. After the program complete the pre-scan, this program will perform the Quasi Peak and Average measurement, based on the pre-scan peak data reduction result.

Sample Calculation Example

At 20 MHz limit = 250 μV = 47.96 dBμV

Transducer factor of LISN, pulse limiter & cable loss at 20 MHz = 11.20 dB

Q-P reading obtained directly from EMI Receiver = 40.00 dBμV
(Calibrated for system losses)

Therefore, Q-P margin = 47.96 – 40.00 = 7.96 i.e. **7.96 dB below limit**

Annex A. iii RADIATED EMISSIONS TEST DESCRIPTION

EUT Characterisation

EUT characterisation, over the frequency range from 30MHz to 10th Harmonic , was done in order to minimise radiated emissions testing time while still maintaining high confidence in the test results.

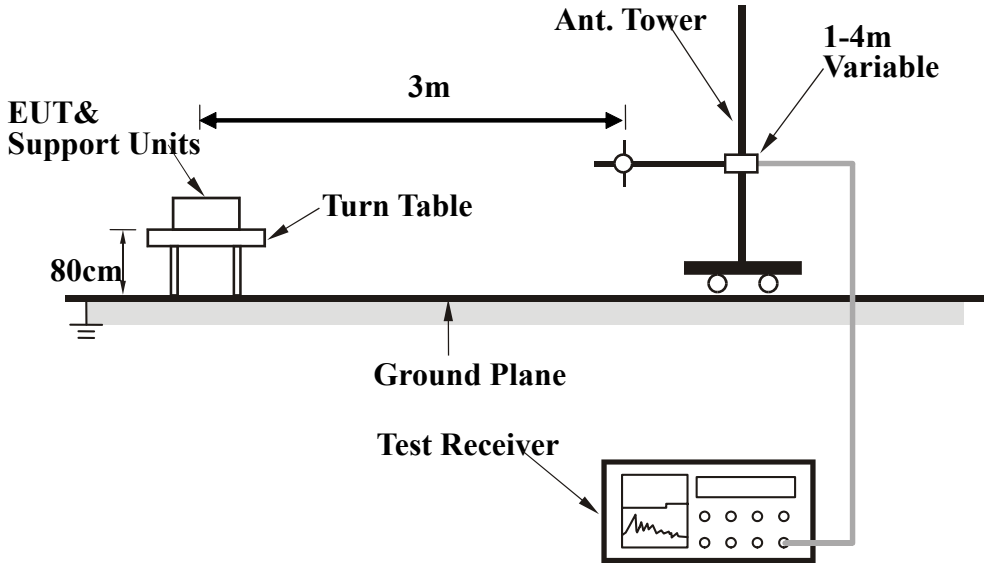
The EUT was placed in the chamber, at a height of about 0.8m on a turntable. Its radiated emissions frequency profile was observed, using a spectrum analyzer /receiver with the appropriate broadband antenna placed 3m away from the EUT. Radiated emissions from the EUT were maximised by rotating the turntable manually, changing the antenna polarisation and manipulating the EUT cables while observing the frequency profile on the spectrum analyzer / receiver. Frequency points at which maximum emissions occurred, clock frequencies and operating frequencies were then noted for the formal radiated emissions test at the Open Area Test Site (OATS).

Test Set-up

1. The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m X 1.0m X 0.8m high, non-metallic table.

2. The filtered power supply for the EUT and supporting equipment were tapped from the appropriate power sockets located on the turntable.

3. The relevant broadband antenna was set at the required test distance away from the EUT and supporting equipment boundary.



Test Method

The following procedure was performed to determine the maximum emission axis of EUT:

1. With the receiving antenna is H polarization, rotate the EUT in turns with three orthogonal axes to determine the axis of maximum emission.
2. With the receiving antenna is V polarization, rotate the EUT in turns with three orthogonal axes to determine the axis of maximum emission.
3. Compare the results derived from above two steps. So, the axis of maximum emission from EUT was determined and the configuration was used to perform the final measurement.

Final Radiated Emission Measurement

1. Setup the configuration according to figure 1. Turn on EUT and make sure that it is in normal function.

2. For emission frequencies measured below 1 GHz, a pre-scan is performed in a shielded chamber to determine the accurate frequencies of higher emissions will be checked on a open test site. As the same purpose, for emission frequencies measured above 1 GHz, a pre-scan also be performed with a 1 meter measuring distance before final test.

3. For emission frequencies measured below and above 1 GHz, set the spectrum analyzer on a 100 kHz and 1 MHz resolution bandwidth respectively for each frequency measured in step 2.

4. The search antenna is to be raised and lowered over a range from 1 to 4 meters in horizontally polarized orientation. Position the highness when the highest value is indicated on spectrum analyzer, then change the orientation of EUT on test table over a range from 0。 to 360。 with a speed as slow as possible, and keep the azimuth that highest emission is indicated on the spectrum analyzer. Vary the antenna position again and record the highest value as a final reading.

5. Repeat step 4 until all frequencies need to be measured was complete.

6. Repeat step 5 with search antenna in vertical polarized orientations.

During the radiated emission test, the Spectrum Analyzer was set with the following configurations:

Frequency Band (MHz)	Function	Resolution bandwidth	Video Bandwidth
30 to 1000	Peak	100 kHz	100 kHz

Above 1000	Peak	1 MHz	1 MHz
	Average	1 MHz	10 Hz

Sample Calculation Example

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. For the limit is employed average value, therefore the peak value can be transferred to average value by subtracting the duty factor. The basic equation with a sample calculation is as follows:

Peak = Reading + Corrected Factor

where

Corr. Factor = Antenna Factor + Cable Factor - Amplifier Gain (if any)

And the average value is

Average = Peak Value + Duty Factor or

Set RBW = 1MHz, VBW = 10Hz.

Note :

If the measured frequencies are fall in the restricted frequency band, the limit employed must be quasi peak value when frequencies are below or equal to 1 GHz. And the measuring instrument is set to quasi peak detector function.

Annex C. TEST SETUP AND SUPPORTING EQUIPMENT

EUT TEST CONDITIONS

Annex C. i. SUPPORTING EQUIPMENT DESCRIPTION

The following is a description of supporting equipment and details of cables used with the EUT.

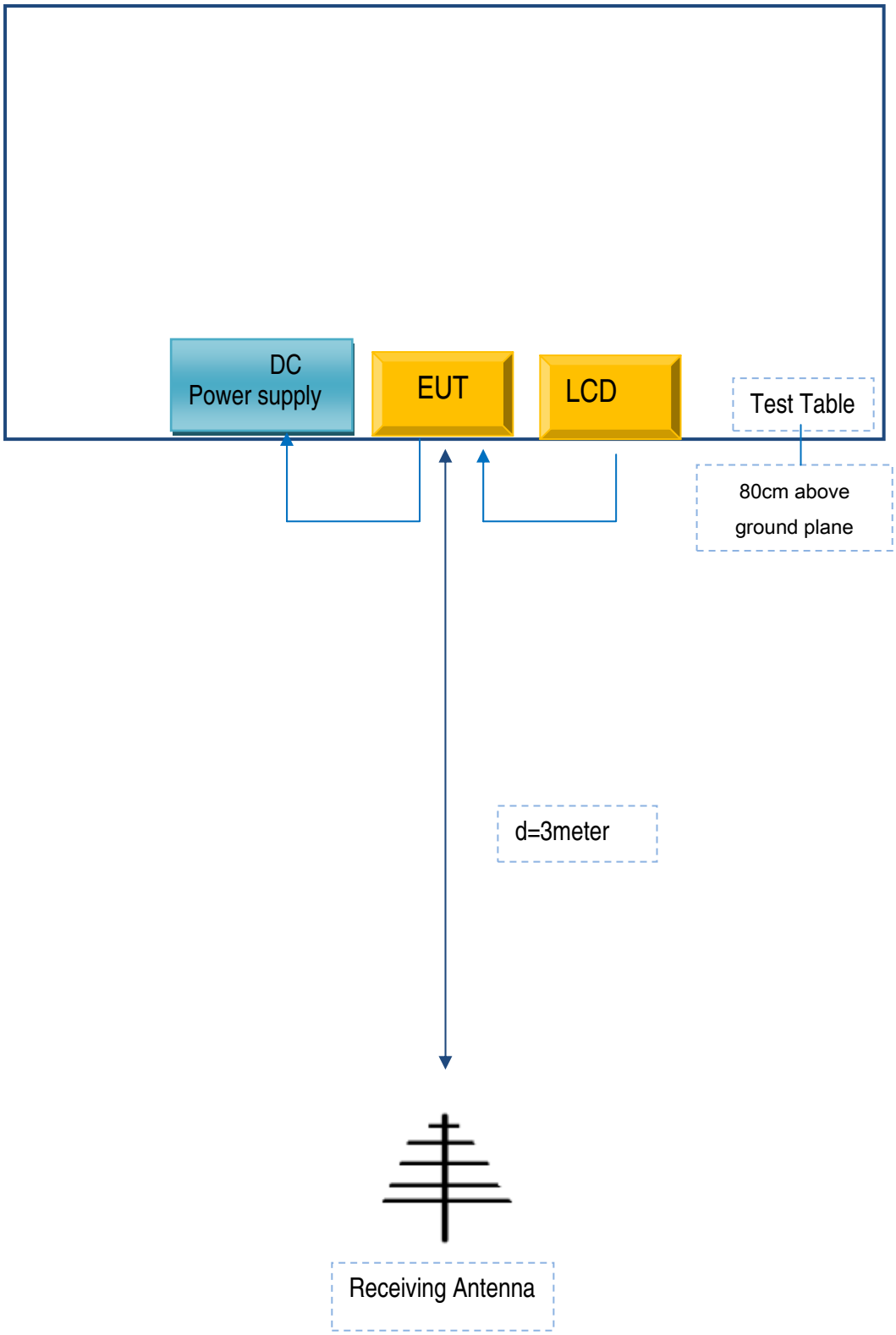
Supporting Equipment:

Manufacturer	Equipment Description	Model	Serial No
ALPINE Electronics INC	LCD	39710-TVAF-A21	S-IW-2015222
Agilent	System Power Supply	6032A	MY41000896

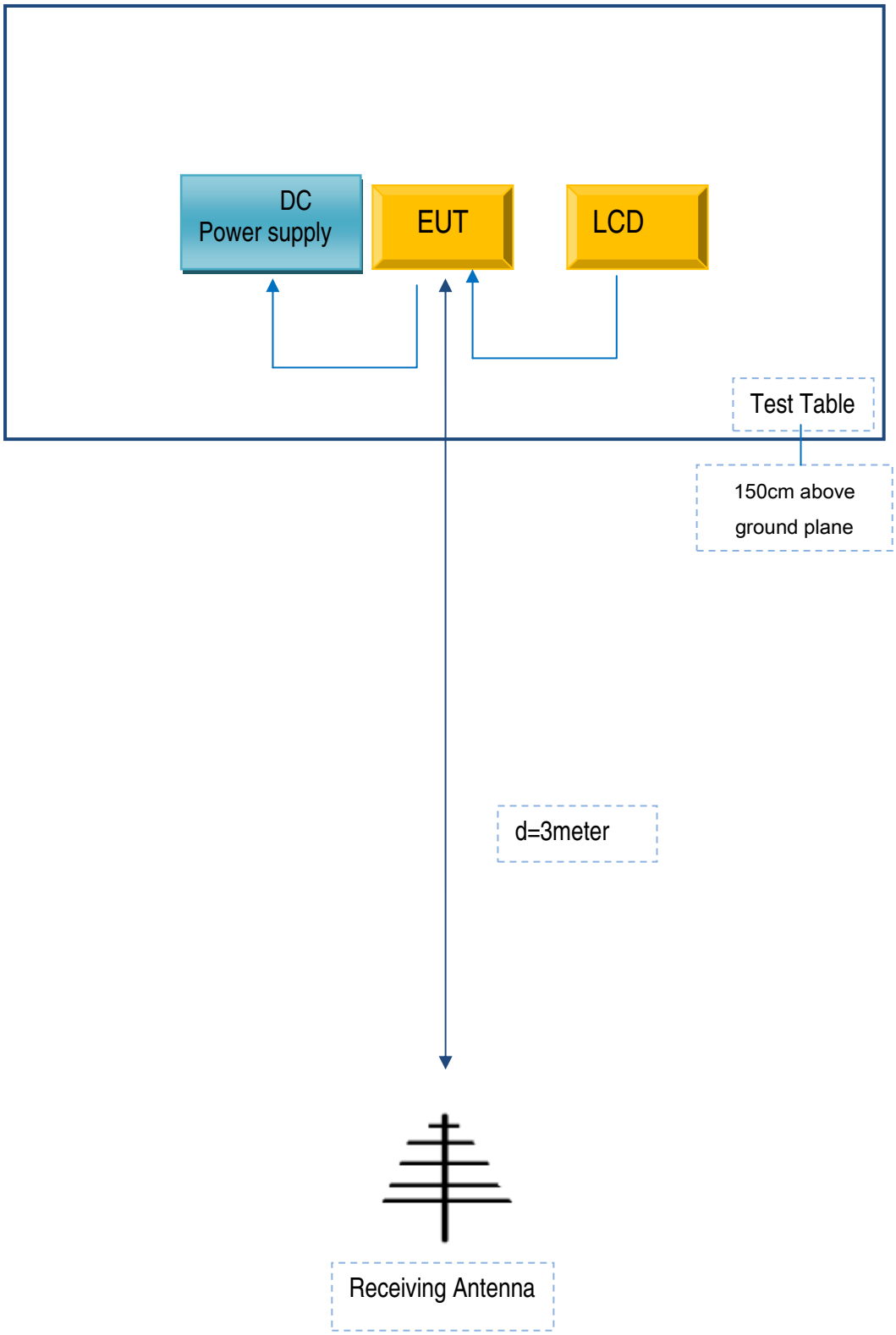
Block Configuration Diagram for AC Line Conducted Emissions

N/A

Block Configuration Diagram for Radiated Emissions （Below 1GHz）.



Block Configuration Diagram for Radiated Emissions （Above 1GHz）.



Annex C.ii. EUT OPERATING CONDITIONS

The following is the description of how the EUT is exercised during testing.

Test	Description Of Operation
Emissions Testing	The EUT was continuously transmitting to stimulate the worst case.

Annex D. User Manual / Block Diagram / Schematics / Partlist

See attachment

Annex E. DECLARATION OF SIMILARITY

N/A