TEST REPORT

1. Applicant		
Name	:	I DO IT Co., Ltd.
Brand Name	:	N/A
Address	:	#637, Smart-Hub Industry-University Convergence Center, 237 Sangidaehak-ro, Siheung-si, Gyeonggi-do, Korea(429-793)
FCC ID	:	XQ8WLE200N5-23ESD
2. Products		
Name	:	PCIe MINI CARD
Model No.	:	WLE200N5-23ESD
Variant Model No.	:	N/A
Manufacturer		I DO IT Co., Ltd.
3. Test Standard	:	FCC 47 CFR Part 15 Subpart E Canada RSS-210:issue 8
4. Test Method	:	ANSI C63.4:2009
5. Test Result	:	PASS
6. Dates of Test	:	February 02, 2015 ~ February 06, 2014
7. Date of Issue	:	February 13, 2015
8. Test Laboratory	:	Korea Standard Quality Laboratories FCC Designation Number : 100384

Tested by

Kwangmin, Lee
Test Engineer:

Approved by

YeoungRyul, Jo
Compliance Engineer:

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Korea Standard Quality Laboratories
Testing Laboratories for EMC and Safety Compliance
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1. Test Summary

Test Item	Test Specification clause		Result
6 DB EMISSION BANDWIDTH	FCC PART 15 C section 15.407(e)	Canada RSS-210：issue 8	PASS
MAXIMUM CONDUCTED OUTPUT POWER	FCC PART 15 C section 15.407(a)	Canada RSS-210：issue 8	PASS
BAND EDGES MEASUREMENT	FCC PART 15 C section 15.407(b)	Canada RSS-210：issue 8	PASS
POWER SPECTRAL DENSITY MEASUREMENT	FCC PART 15 C section 15.407(a)	Canada RSS-210：issue 8	PASS
RADIATED UNDESIRABLE EMISSION	FCC PART 15 C section 15.209(a)	Canada RSS-210：issue 8	PASS
POWERLINE CONDUCTED EMISSIONS	FCC PART 15 C section 15.207(a)	-	PASS

Remark:

N/A: not applicable. Refer to the relative section for the details.

EUT: In this whole report EUT means Equipment Under Test.

Tx: In this whole report Tx (or tx) means Transmitter.

Rx: In this whole report Rx (or rx) means Receiver.

RF: In this whole report RF means Radio Frequency.

ANSI C63.4: the detail version is ANSI C63.4:2009 in the whole report.

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3. GENERAL INFORMATION

3.1. Client Information

Applicant	:	I DO IT Co., Ltd.
Address of Applicant	:	#637, Smart-Hub Industry-University Convergence Center, 237 Sangidaehak-ro, Siheung-si, Gyeonggi-do, Korea(429-793)

3.2. General Description of E.U.T.

Product Name	:	PCIe MINI CARD
Model No.	:	WLE200N5-23ESD

3.3. Details of E.U.T.

Product Name	:	PCIe MINI CARD
Model Name	:	WLE200N5-23ESD
Series Model	:	N/A
Model Discrepancy	:	N/A
Operating Voltage	:	3.3 VDC
Frequency Range	:	5 725 MHz-5 850 MHz
Number of Channels	:	IEEE 802.11a mode: 5 Channels draft 802.11an 20MHz mode: 5 Channels draft 802.11an 40MHz mode: 3 Channels
Antenna Specification	:	PCB antennas for 5 GHz Gain 4.98 dBi

Remark:

1. The sample selected for test was engineering sample that approximated to production product and was provided by manufacturer.
2. This submittal(s) (test report) is intended for FCC ID: XQ8WLE200N5-23ESD filing to comply with FCC Part 15, Subpart E Rules.

4. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4: 2009 and FCC CFR 47 15.207, 15.209 and 15.407,.

The above equipment was tested by Compliance Certification Services Inc. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.4:2009 and the energy emitted by the sample EUT tested as described in this report is in compliance with the requirements of FCC Rules Part 15.207, 15.209, 15.407and KDB 789033 – 20140606.

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

4.1. EUT Configuration

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

4.2. EUT Exercise

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

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

4.3. General Test Procedures

Conducted Emissions

The EUT is placed on the turntable, which is positioned at 0.8 m above the ground plane. According to the requirements in Section 13.3 of ANSI C63.4, the conducted emission from the EUT is measured in the frequency range between 0.15 MHz and 30MHz, using the CISPR Quasi-Peak detector mode.

Radiated Emissions

The EUT is placed on the turntable, which is 0.8 m above the ground plane. The turntable is then rotated for 360 degrees to determine the proper orientation for the maximum emission level. The EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission level. And, each emission is to be maximized by changing the horizontal and vertical polarization of the receiving antenna. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 13.4 of ANSI C63.4.

4.4. Testing Applied Standards

According to the specification of EUT, the EUT must comply with following standards and KDB documents.

47 CFR FCC Part 15.407

ANSI C63.4-2009

FCC KDB 412172

FCC KDB 789033 D02 General UNII Test Procedures New Rules v01

FCC KDB 662911 D01 Multiple Transmitter Output v02r01

4.5. Description of Test Modes

Description	Modulation Technology	Modulation Technology
26dB Bandwidth and 99% Bandwidth	OFDM	BPSK
Maximum conducted output power	OFDM	BPSK
Band edges measurement	OFDM	BPSK
Peak Power Spectral Density	OFDM	BPSK
Peak excursion	OFDM	BPSK
Radiated undesirable emission	OFDM	BPSK
Conducted undesirable emission	OFDM	BPSK
Powerline conducted emission	OFDM	BPSK

The EUT transmitting and receiving with three antennas simultaneously working at a/an mode, so 2x2 configuration was used for all testing in this report.

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

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

IEEE 802.11a mode:

Channel Low (5745MHz), Channel Mid (5785MHz) and Channel High (5825MHz) with 54Mbps data rate were chosen for full testing.

draft 802.11an Standard-20 MHz Channel mode:

Channel Low (5745MHz), Channel Mid (5785MHz) and Channel High (5825MHz) with 65Mbps data rate were chosen for full testing.

draft 802.11an Wide-40 MHz Channel mode:

Channel Low (5755MHz)and Channel Mid (5795MHz) with 135Mbps data rate were chosen for full testing.

Note: After the preliminary san the EUT 5G antenna with 4.98 dBi gain was the worst mode, which mode data was recorded.

5. EQUIPMENT USED DURING TEST

No.	Test Equipment	Manufacturer	Model No.	Serial No.	Next Cal. Data	Used equipment
1	Spectrum Analyzer	Agilent	E4440A	MY45304715	15.11.11	■
2	Frequency Counter	HP	5350B	3049A05530	15.06.02	■
3	DC Power Supply	ALINCO	DM-340MV	F001015	15.06.02	■
4	Signal Generator	Leader Electronics	3220	137231	15.06.01	■
5	Synthesized CW Generator	HP	83711B	US34490158	15.06.01	■
7	SYNTHESIZED SWEEPER	HP	8340B	2804A00830	15.05.07	■
8	Function Generator	IWATSU	SG-4105	62372780	15.04.29	□
9	Modulation Analyzer	Agilent	8901B	3438A05099	15.06.02	□
10	Audio Analyaer	Agilent	8903B	3729A18576	15.06.02	□
11	Power Meter	Agilent	E4418B	GB43312894	15.06.01	■
12	Power Sensor	HP	8485A	3316A14708	15.06.27	■
13	Power Sensor	Agilent	8482B	2703703543	15.06.29	□
14	Pre Amplifier	GTC	GA-1825A	GT0929/003	15.06.01	□
15	Attenuator	Weinschel	53-30-33	MG906	15.04.17	□
16	Step Attenuator	Agilent	8494B	MY41110204	15.06.01	□
17	Step Attenuator	Agilent	8495B	3308A17660	15.06.01	□
18	Step Attenuator	Agilent	8496B	US40152183	15.06.01	□
19	Attenuator	HP	8493C	01672	15.05.19	□
20	Attenuator	HP	30dB	-	15.04.17	□
21	Attenuator	TAE SUNG	SMA-1	-	15.06.01	□
22	Attenuator	TAE SUNG	SMA-2	-	15.06.01	□
23	Termination	KWANG YEOK	KYTE-NJ-150W	2040004	15.06.01	□
24	Spectrum Analyzer	LIG	ISA-265	L0812M002	15.10.23	□
25	Bluetooth Tester	TESCOM	TC-3000A	3000A590236	15.06.01	□
26	Loop ANT.	Com-Power	AL-130	121010	15.04.25	□
27	Horn ANT.	SCHWARZBECK	BBHA 9120D	831	16.07.21	■
28	Temp & Humidity Chamber	Seoksan Tech	SE-CT-02	S7400JD5340618	15.06.02	■
29	Vibration Tester	Gana	GNV-400	C114	15.06.19	□
30	Drop Tester	Self-made	DOC-800	DOC-01-43-14	N/A	□
31	Power Divider	Agilent	11636B	12002	15.06.19	■
32	Power Divider	Agilent	11636B	50591	15.06.19	□
33	RMS Multimeter	RMS Multimeter	FLUKE87	61160149	15.06.02	■
34	TEST RECEIVER	ROHDE&SCHWARZ	ESPI	101014	15.08.05	■
35	Bi-log Antenna	SCHWARZBECK	VULB9160	1163	15.11.21	■
36	Spectrum Analyzer	ROHDE&SCHWARZ	FSV-40	100994	16.03.30	■
37	Horn ANT.	SCHWARZBECK	BBHA 9170	BBHA9170 573	16.03.24	■
38	LISN	ROHDE & SCHWARZ	ENV216	101732	16.03.01	■
39	LISN	KNW-407	Kyoritsu	8-1010-14	15.06.09	■

6. SETUP OF EQUIPMENT UNDER TEST

6.1. Setup Configuration of EUT

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

6.2. Support Equipment

No.	Equipment	Manufacturer	Model No.
1	DeskTop Computer	dell	E5430
2	Monitor	CARDINAL	CS-172
3	Mouse	Dell	MS111-T
4	Keyboard	Azio Levetron	KB528U

Remark:

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

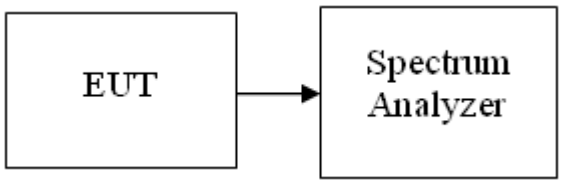
7. FCC PART 15 REQUIREMENTS

7.1. 6 DB Emission Bandwidth

LIMIT

Section 15.407(e) specifies the minimum 6 dB emission bandwidth of at least 500 KHz for the band 5.715-5.85 GHz.

Test Configuration



TEST PROCEDURE

1. Place the EUT on the table and set it in the transmitting mode.
2. Remove the antenna from the EUT and then connect a low-loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as RBW =100KHz, VBW≥ 3RBW, Detector = Peak. Trace mode = max hold.
4. Measure the maximum width of the emission that is 6 dB down from the peak of the emission..
5. Measure and record the results in the test report

TEST RESULTS

No non-compliance noted

Test Data

Test mode: IEEE 802.11a mode/ANT 1

5745~5850MHz

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	FCC 6 dB Bandwidth Min. Limit (MHz)
Low	5745	16.46	0.5
Mid	5785	16.51	0.5
High	5825	16.47	0.5

Test mode: IEEE 802.11a mode/ANT 2

5745~5850MHz

Channel	Frequency (MHz)	Bandwidth (B) (MHz)	FCC 6 dB Bandwidth Min. Limit (MHz)
Low	5745	16.50	0.5
Mid	5785	16.48	0.5
High	5825	16.48	0.5

Test mode: IEEE 802.11a mode/ANT 1+2

5745~5850MHz

Channel	Frequency (MHz)	Bandwidth (B) (MHz)	FCC 6 dB Bandwidth Min. Limit (MHz)
Low	5745	16.44	0.5
Mid	5785	16.45	0.5
High	5825	16.47	0.5

Test mode: draft 802.11n Standard-20 MHz Channel mode / ANT 1

5745~5850MHz

Channel	Frequency (MHz)	Bandwidth (B) (MHz)	FCC 6 dB Bandwidth Min. Limit (MHz)
Low	5745	17.73	0.5
Mid	5785	17.72	0.5
High	5825	17.72	0.5

Test mode: draft 802.11n Standard-20 MHz Channel mode / ANT 2

5745~5850MHz

Channel	Frequency (MHz)	Bandwidth (B) (MHz)	FCC 6 dB Bandwidth Min. Limit (MHz)
Low	5745	17.74	0.5
Mid	5785	17.74	0.5
High	5825	17.66	0.5

Test mode: draft 802.11n Standard-20 MHz Channel mode / ANT 1+2

5745~5850MHz

Channel	Frequency (MHz)	Bandwidth (B) (MHz)	FCC 6 dB Bandwidth Min. Limit (MHz)
Low	5745	17.71	0.5
Mid	5785	17.66	0.5
High	5825	17.66	0.5

Test mode: draft 802.11n Wide-40 MHz Channel mode / ANT 1

5745~5850MHz

Channel	Frequency (MHz)	Bandwidth (B) (MHz)	FCC 6 dB Bandwidth Min. Limit (MHz)
Low	5755	36.45	0.5
High	5795	36.46	0.5

Test mode: draft 802.11n Wide-40 MHz Channel mode / ANT 2

5745~5850MHz

Channel	Frequency (MHz)	Bandwidth (B) (MHz)	FCC 6 dB Bandwidth Min. Limit (MHz)
Low	5755	36.48	0.5
High	5795	36.45	0.5

Test mode: draft 802.11n Wide-40 MHz Channel mode / ANT 1+2

5745~5850MHz

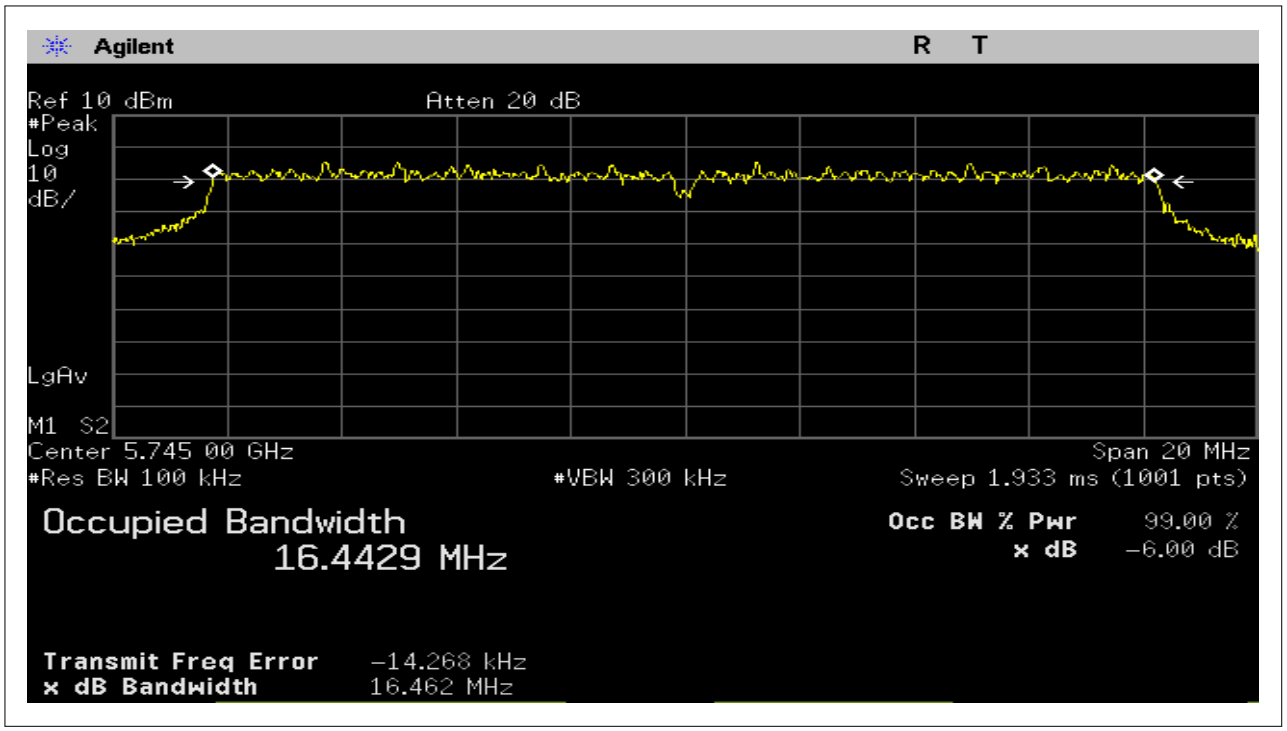
Channel	Frequency (MHz)	Bandwidth (B) (MHz)	FCC 6 dB Bandwidth Min. Limit (MHz)
Low	5755	36.28	0.5
High	5795	35.37	0.5

Test Plot

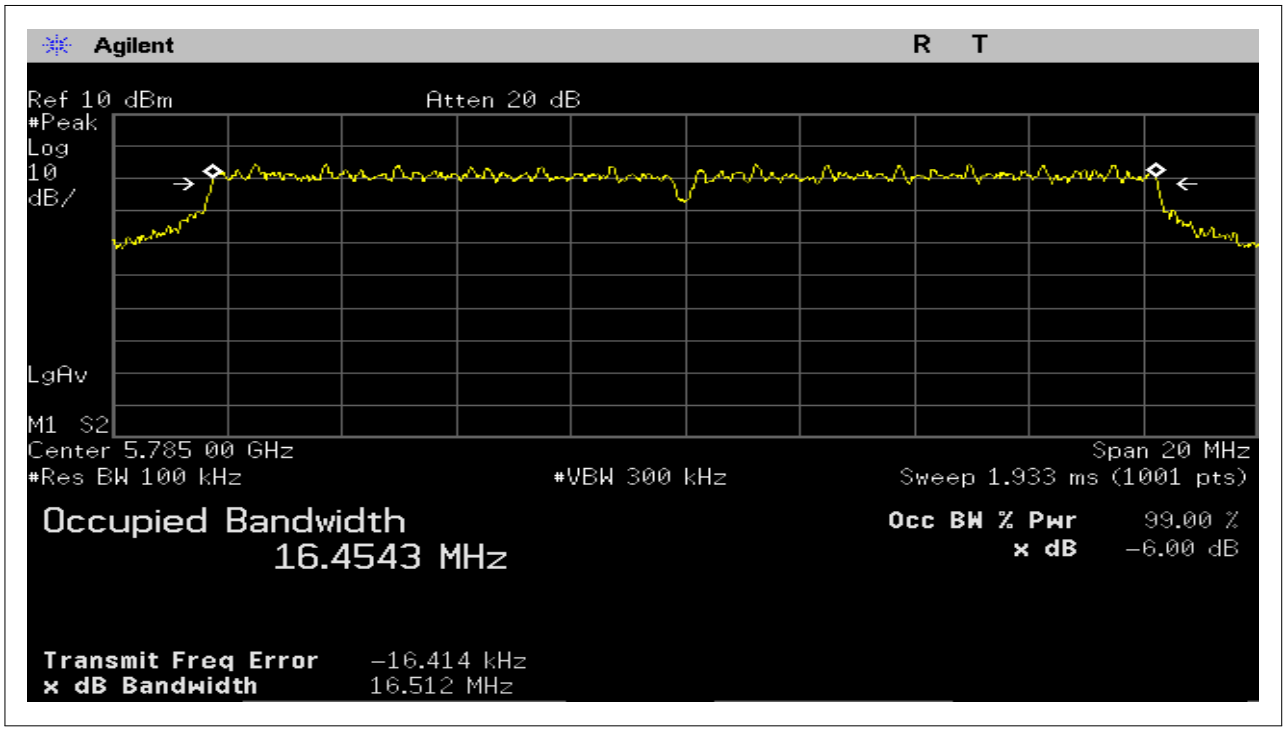
IEEE 802.11a mode/ANT 1:

5745~5850MHz

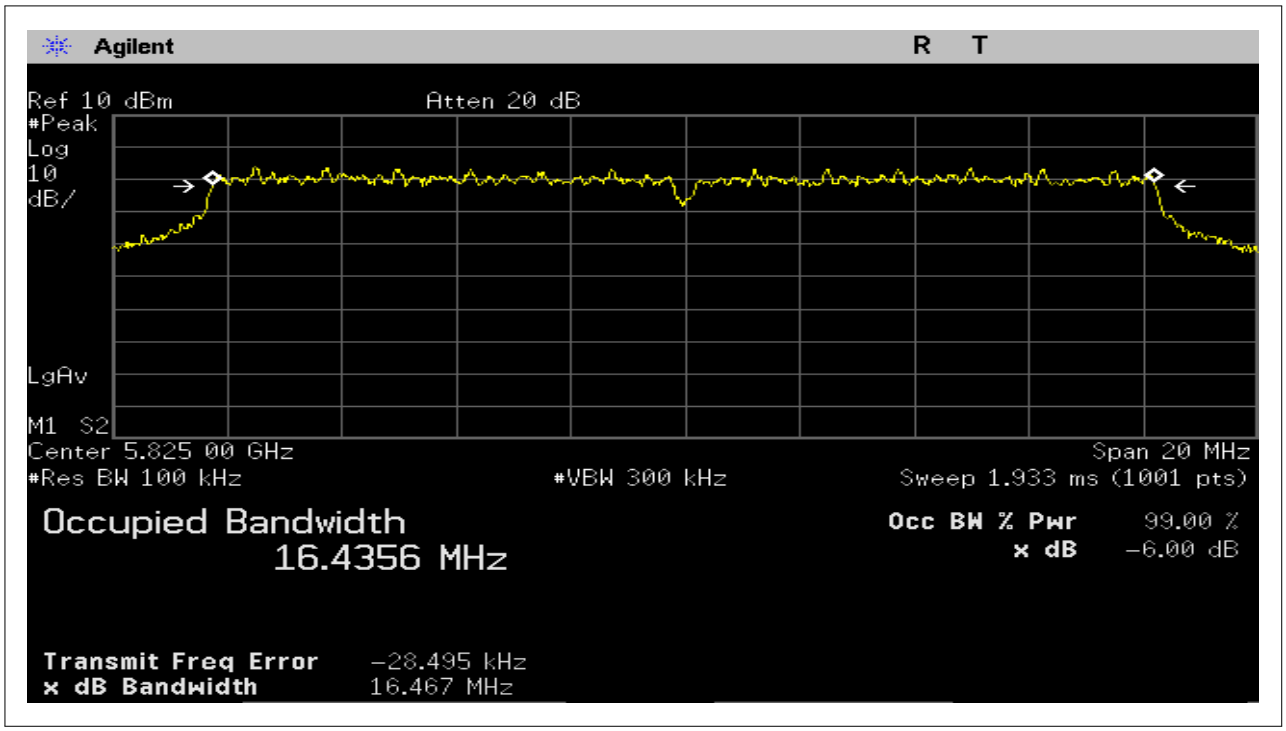
CH Low



CH Mid



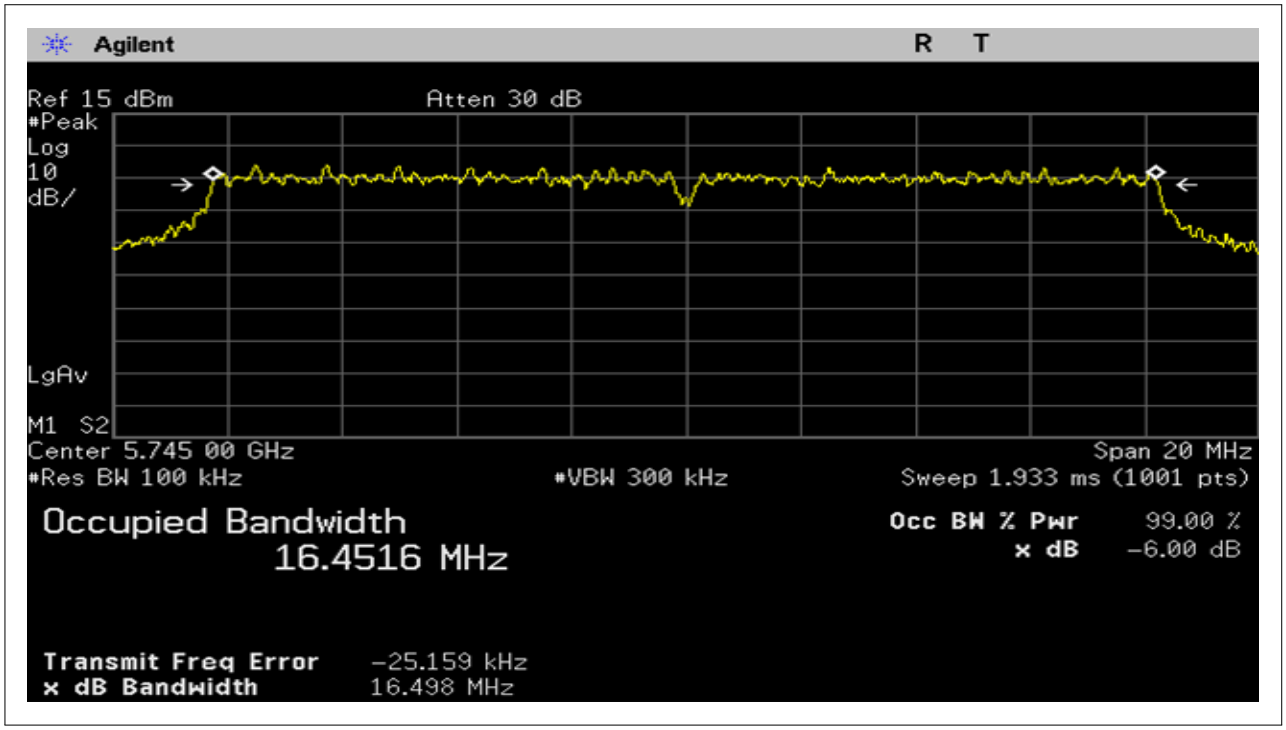
CH High



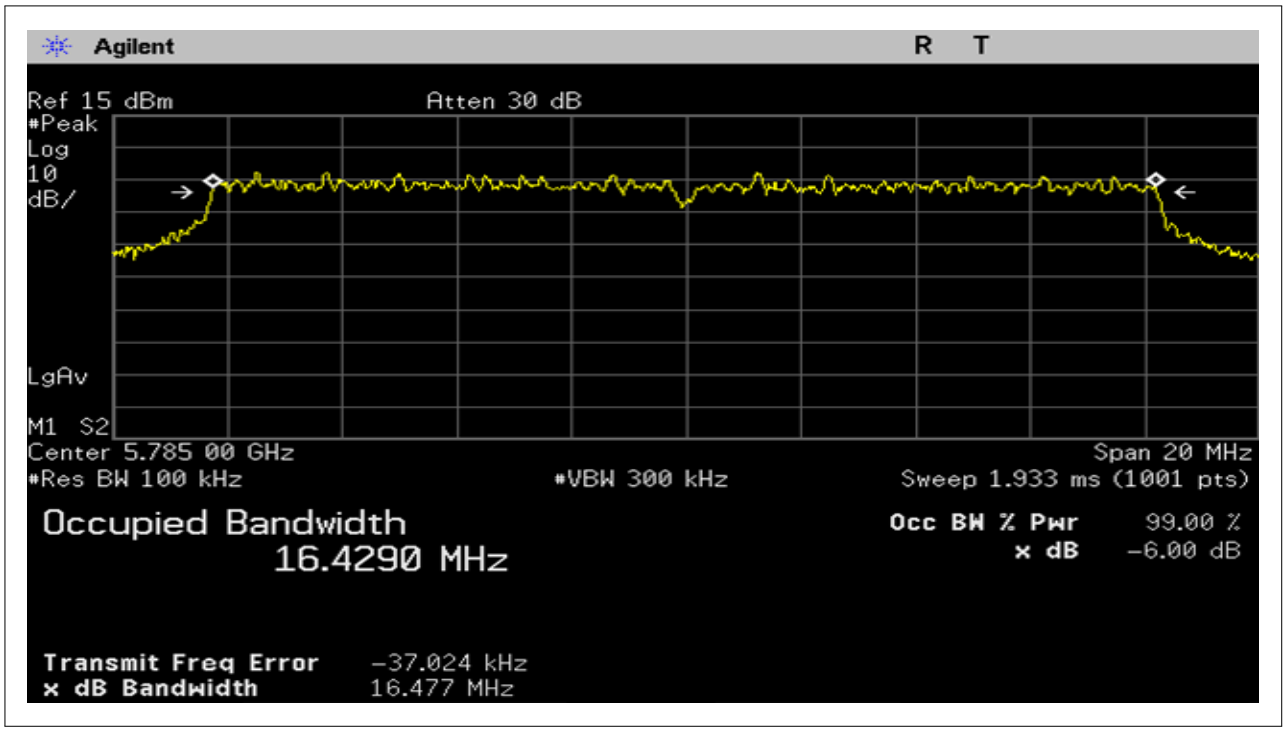
IEEE 802.11a mode/ANT 2:

5745~5850MHz

CH Low



CH Mid



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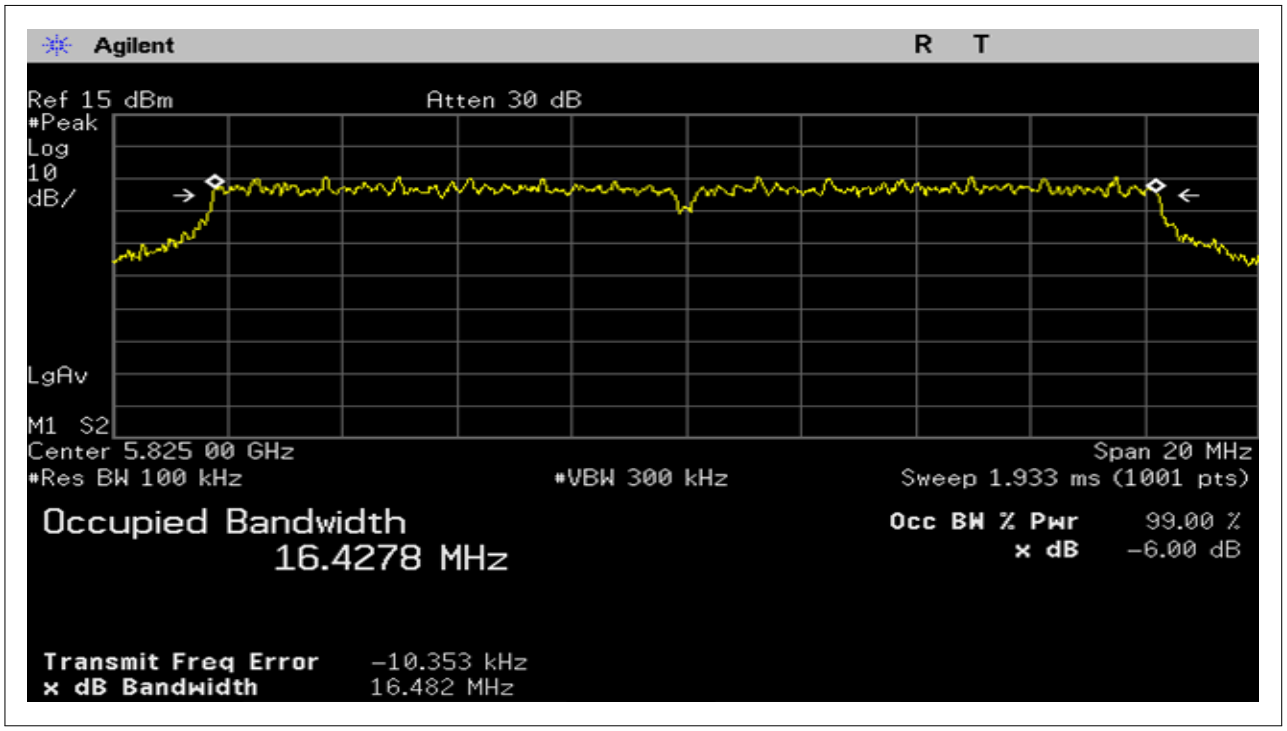
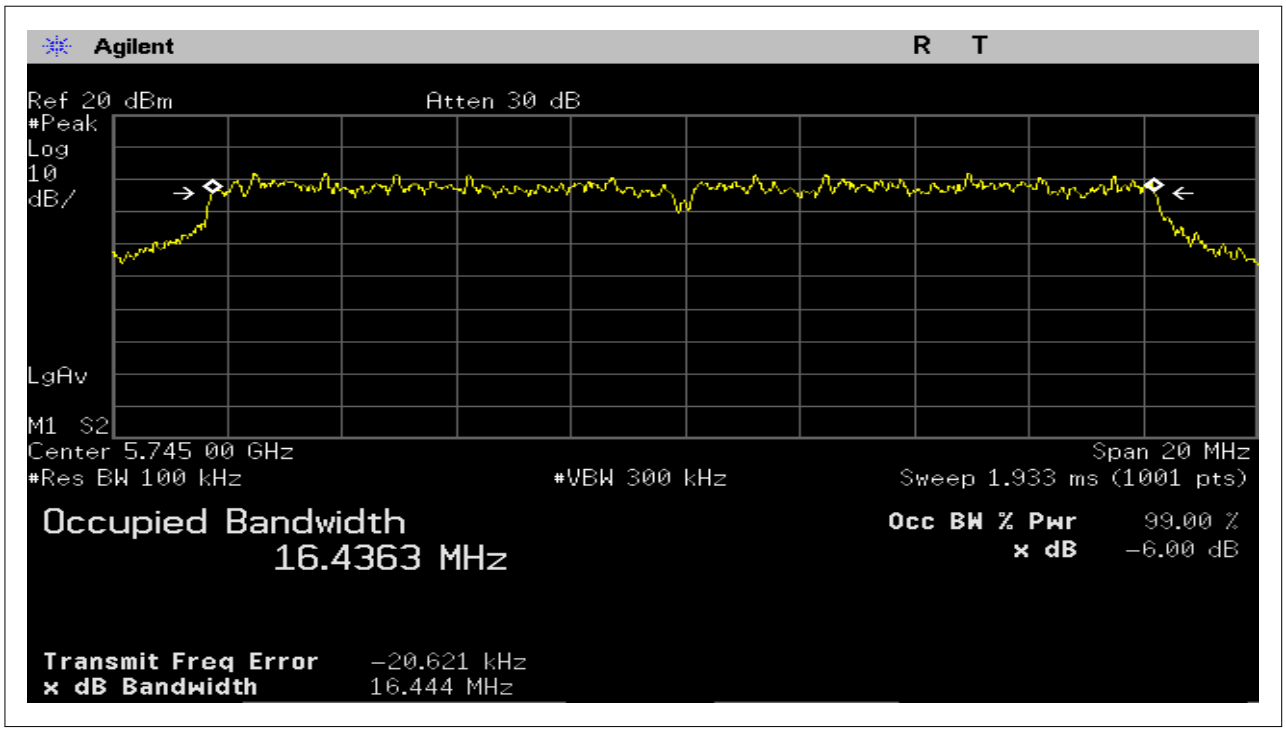


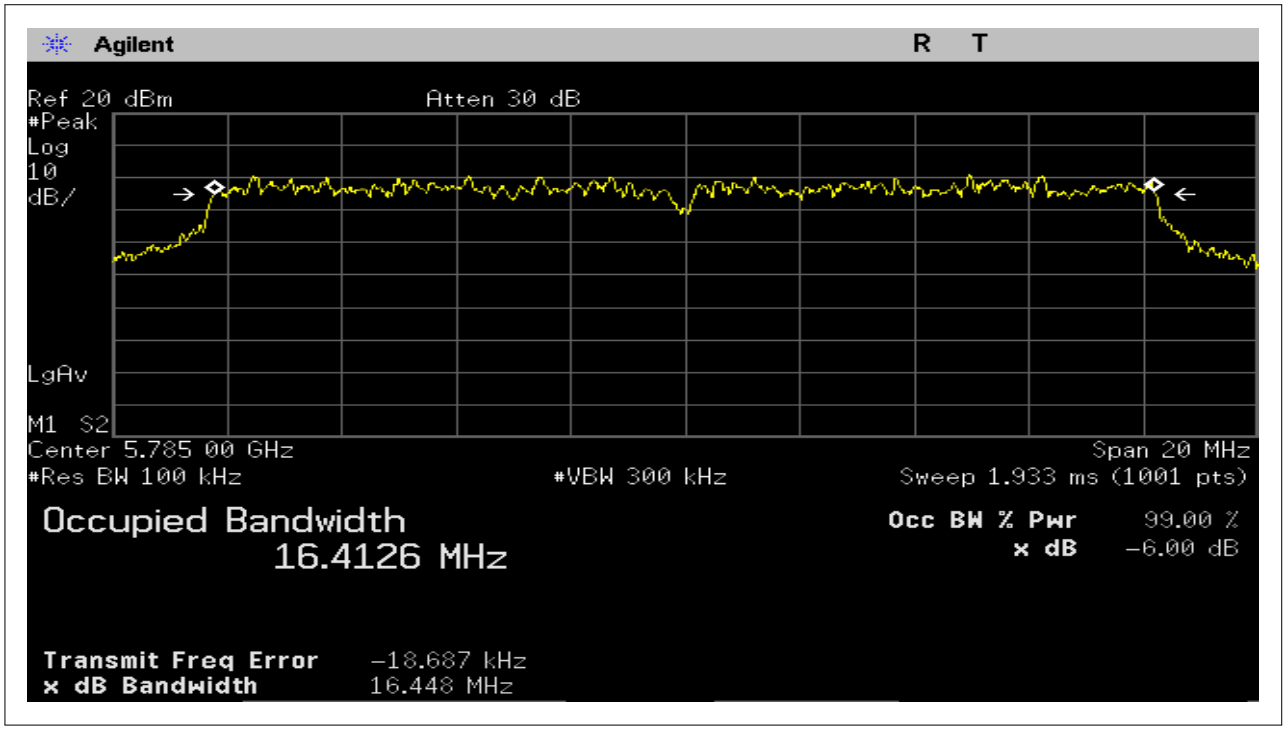
IEEE 802.11a mode/ANT 1+2:

5745~5850MHz

CH Low



CH Mid



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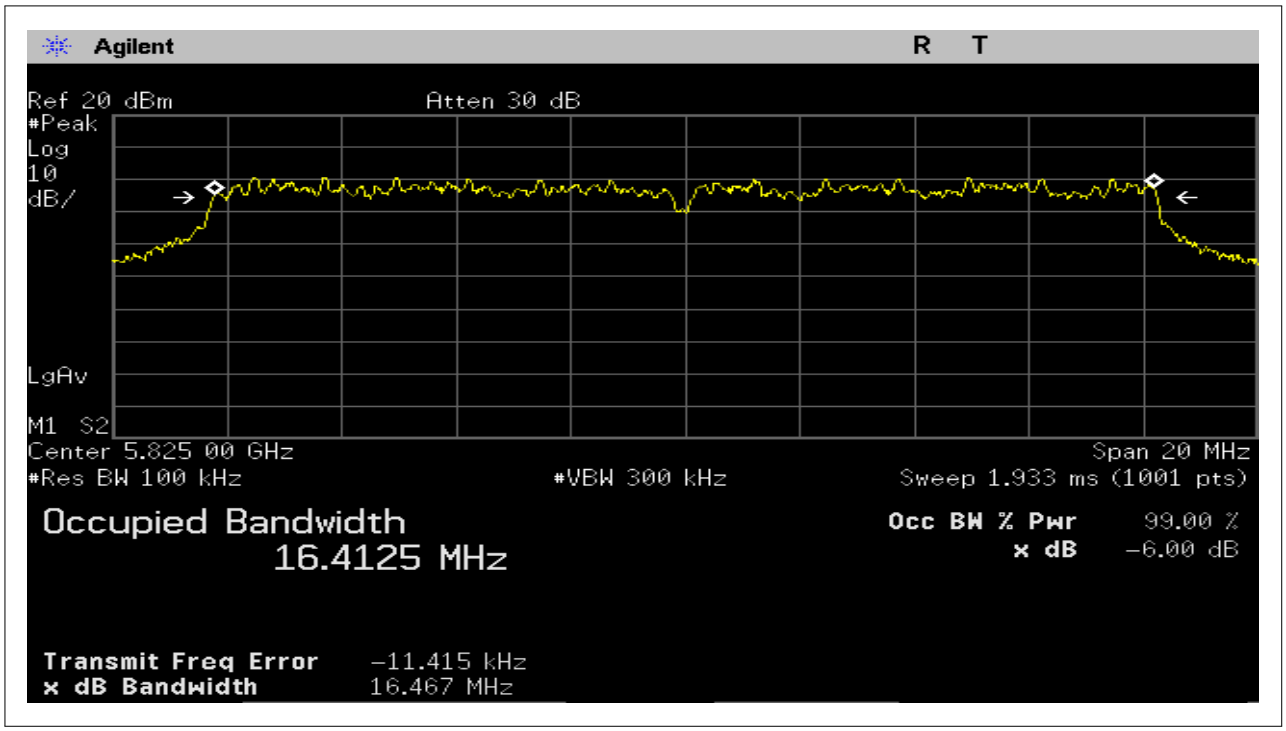
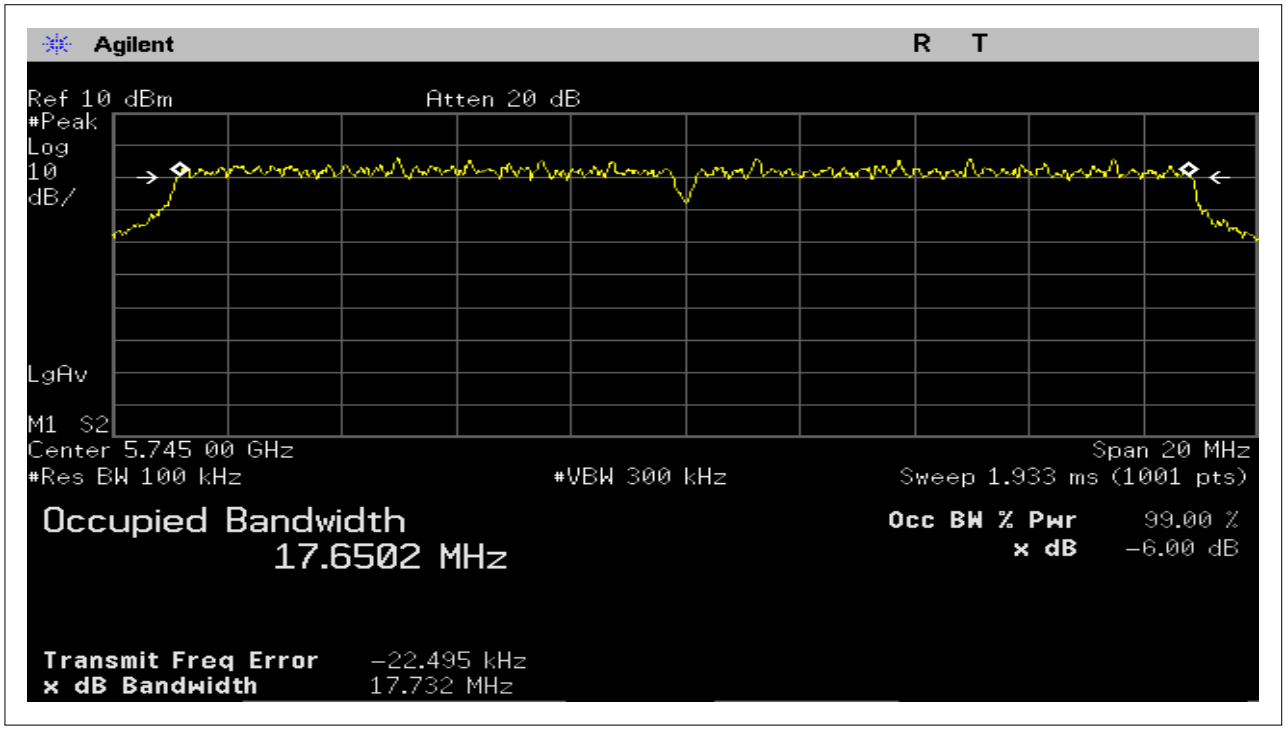


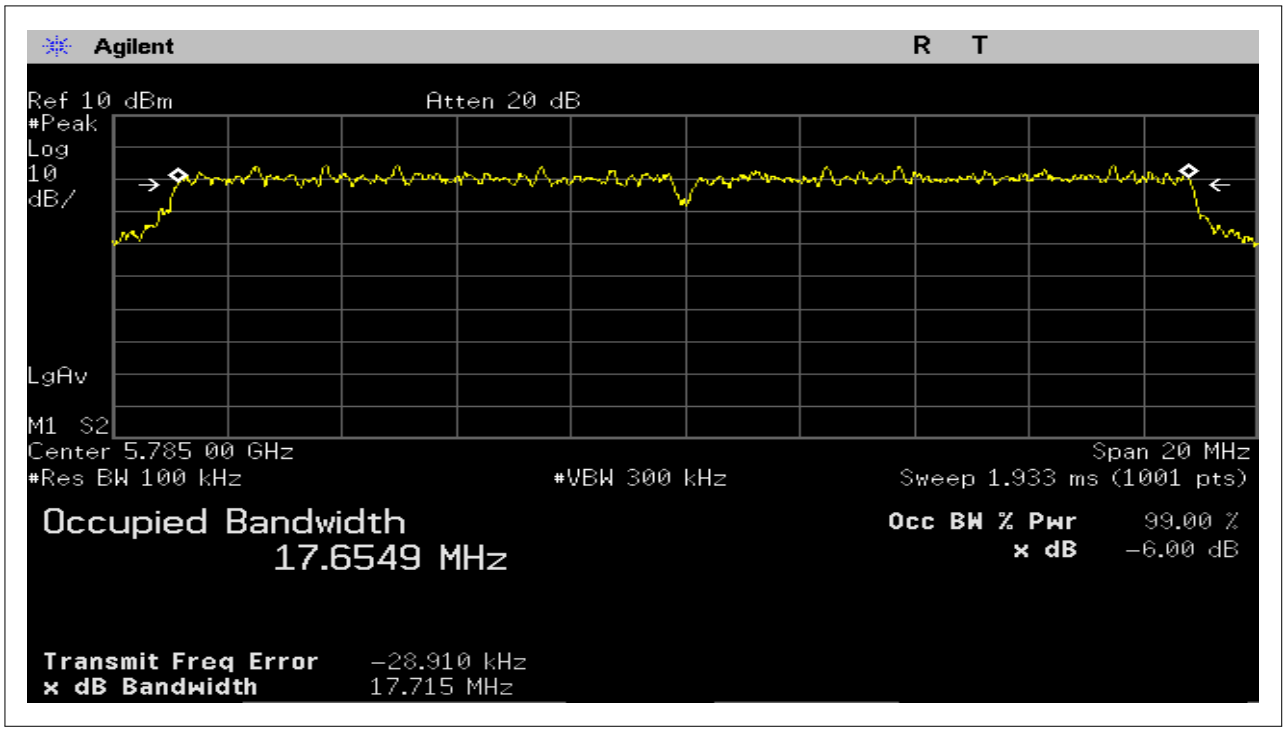
draft 802.11n Standard-20 MHz Channel mode / ANT 1

5745~5850MHz

CH Low



CH Mid



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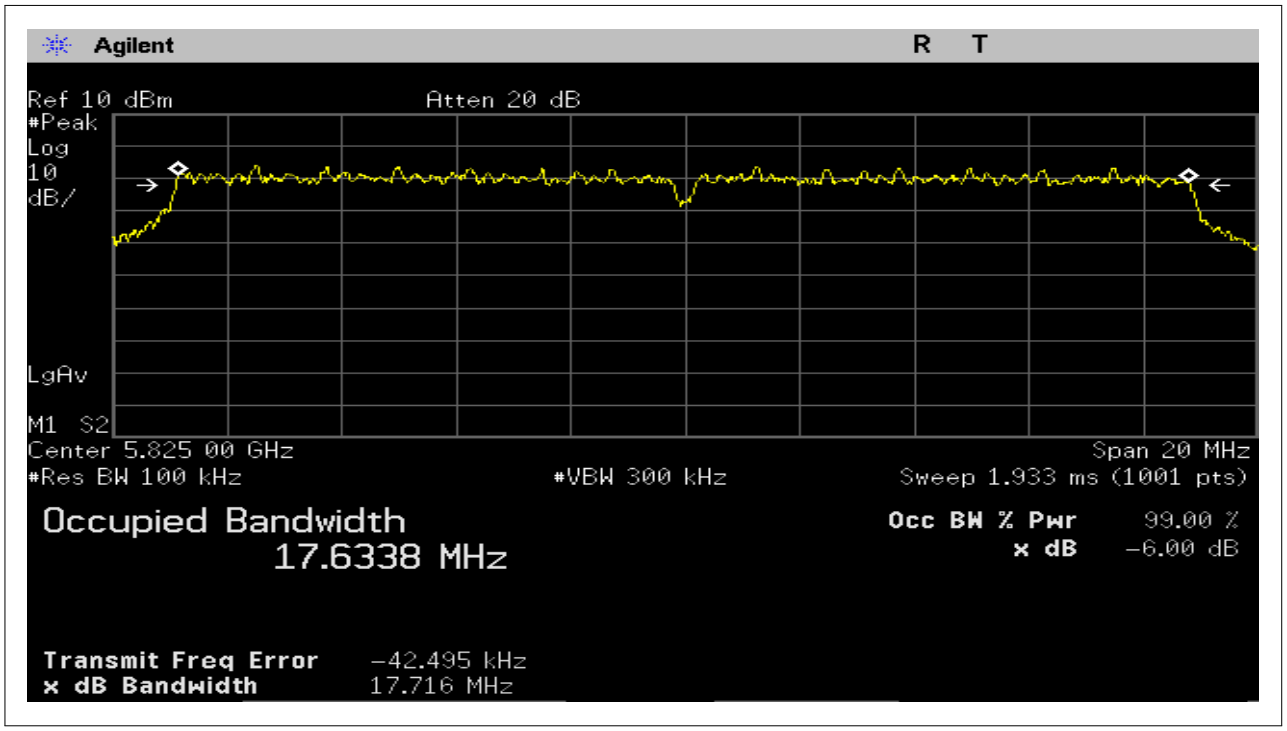
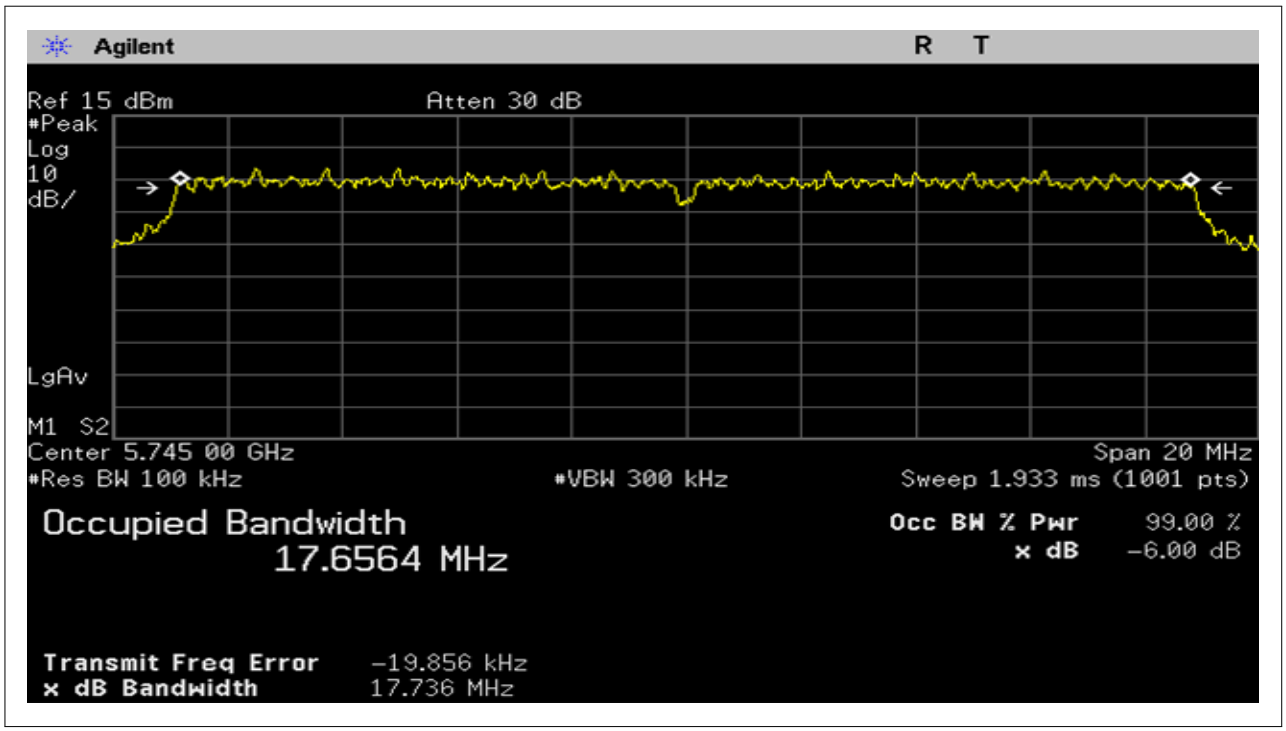


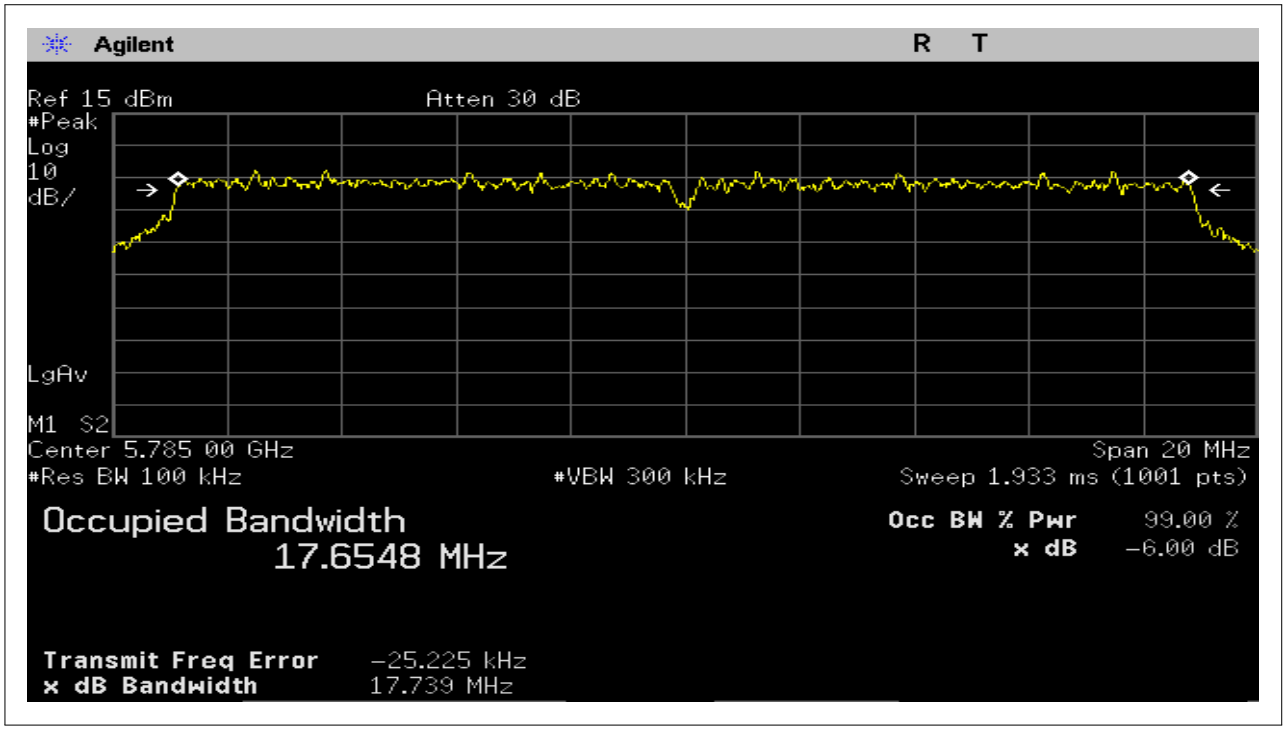
draft 802.11n Standard-20 MHz Channel mode / ANT 2

5745~5850MHz

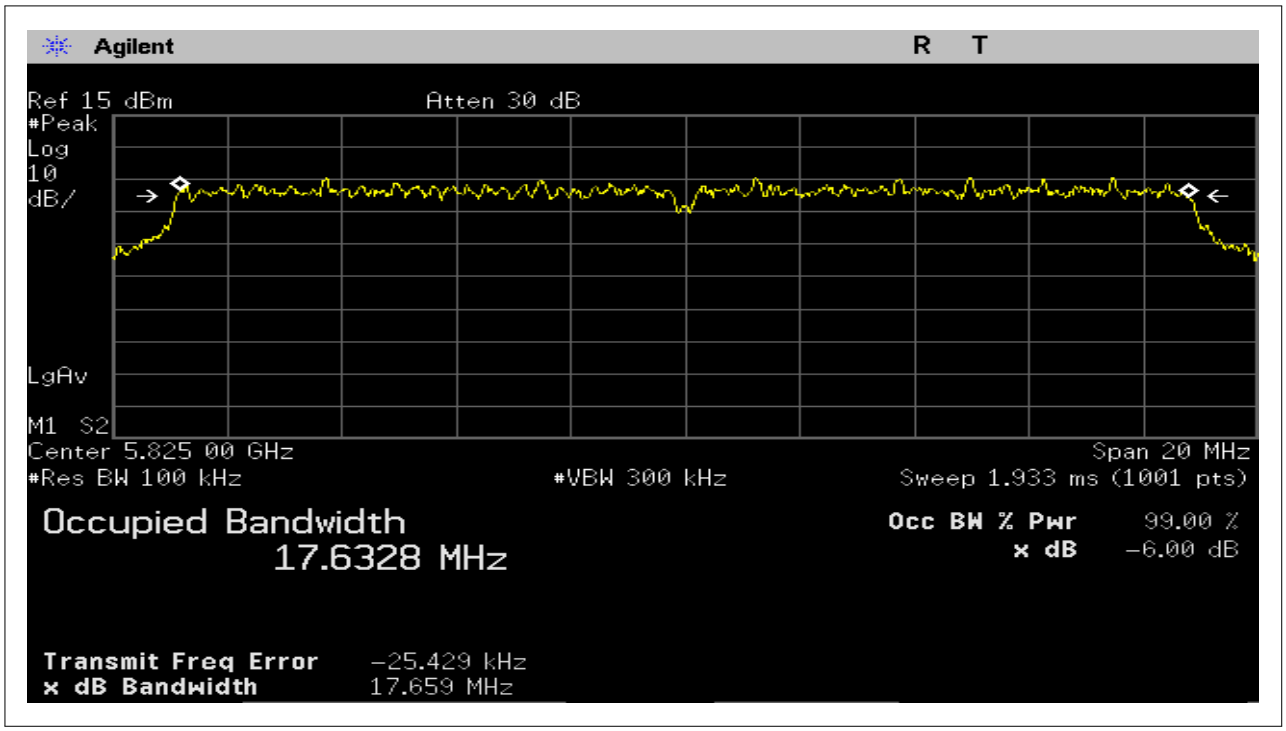
CH Low



CH Mid



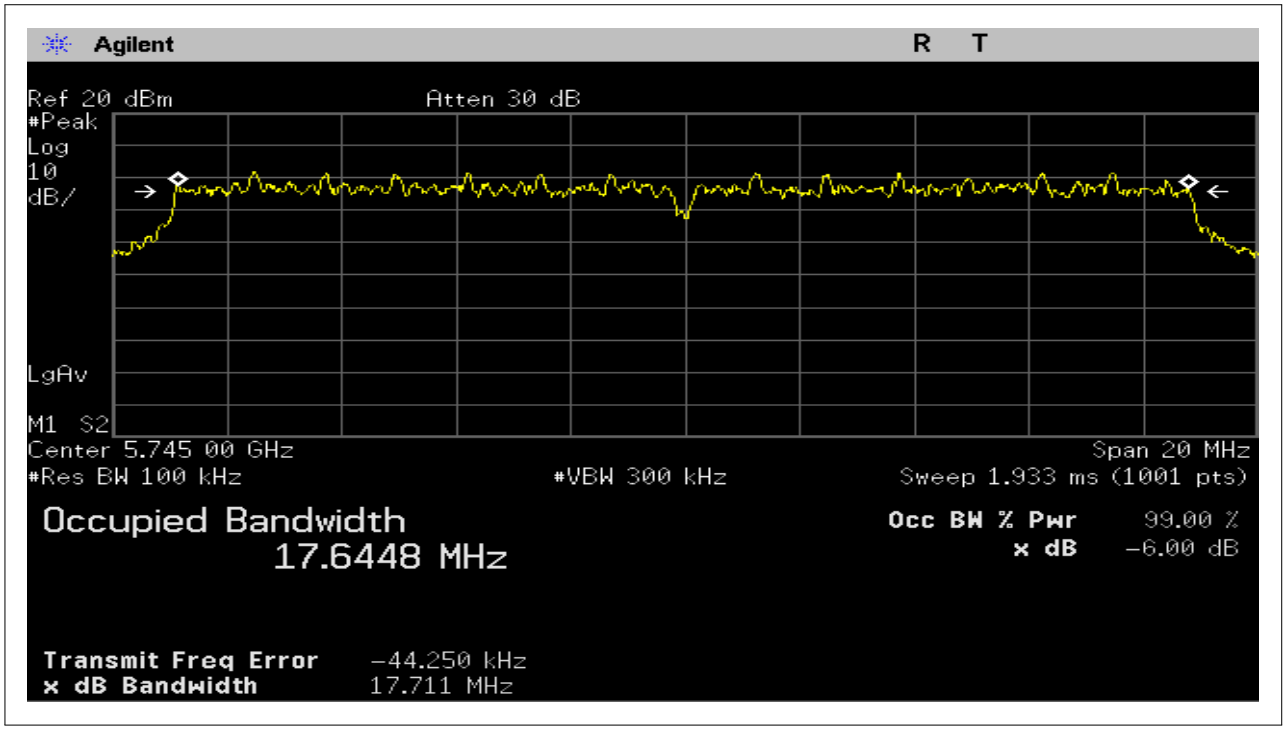
CH High



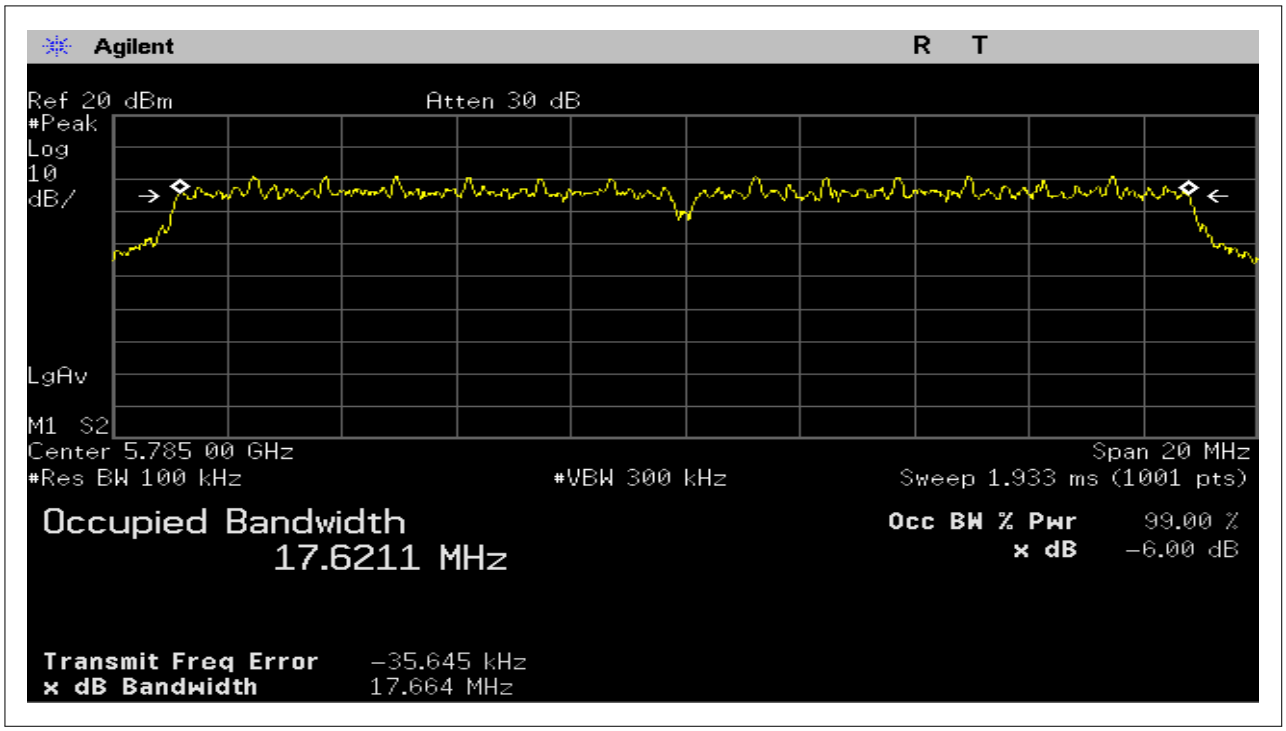
draft 802.11n Standard-20 MHz Channel mode / ANT 1+2

5745~5850MHz

CH Low



CH Mid



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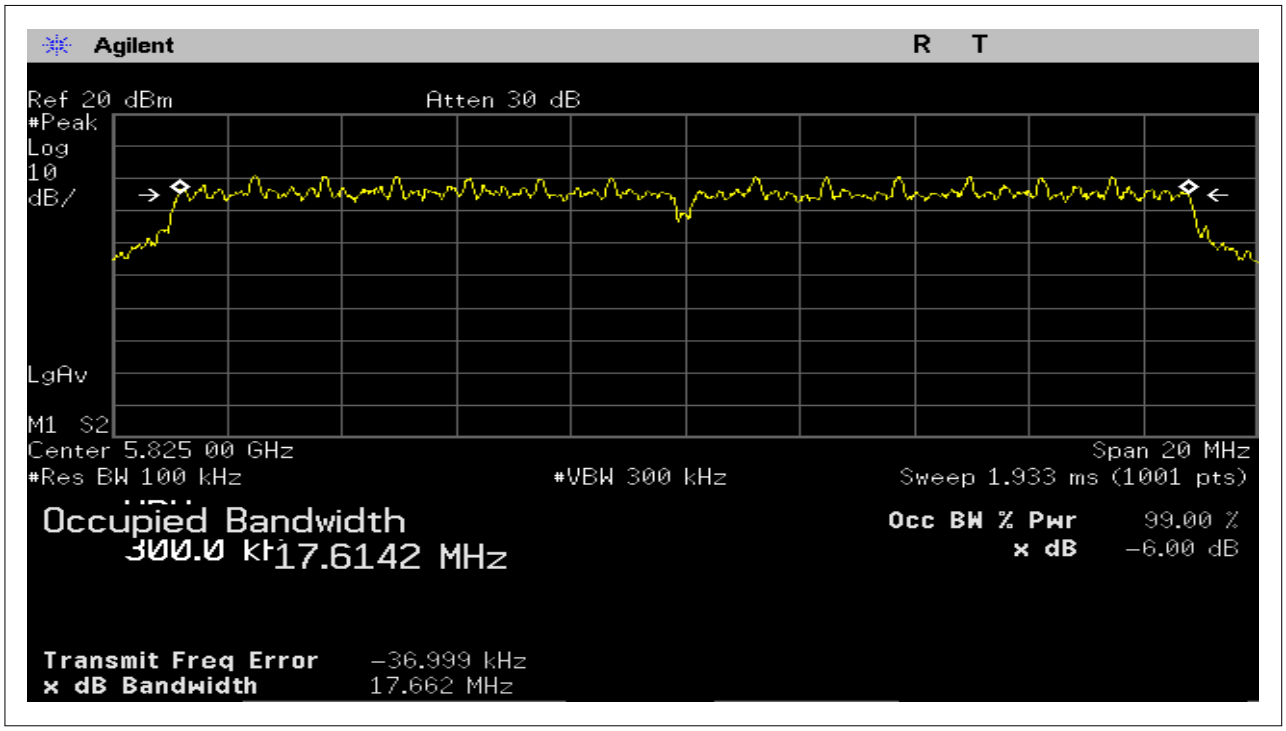
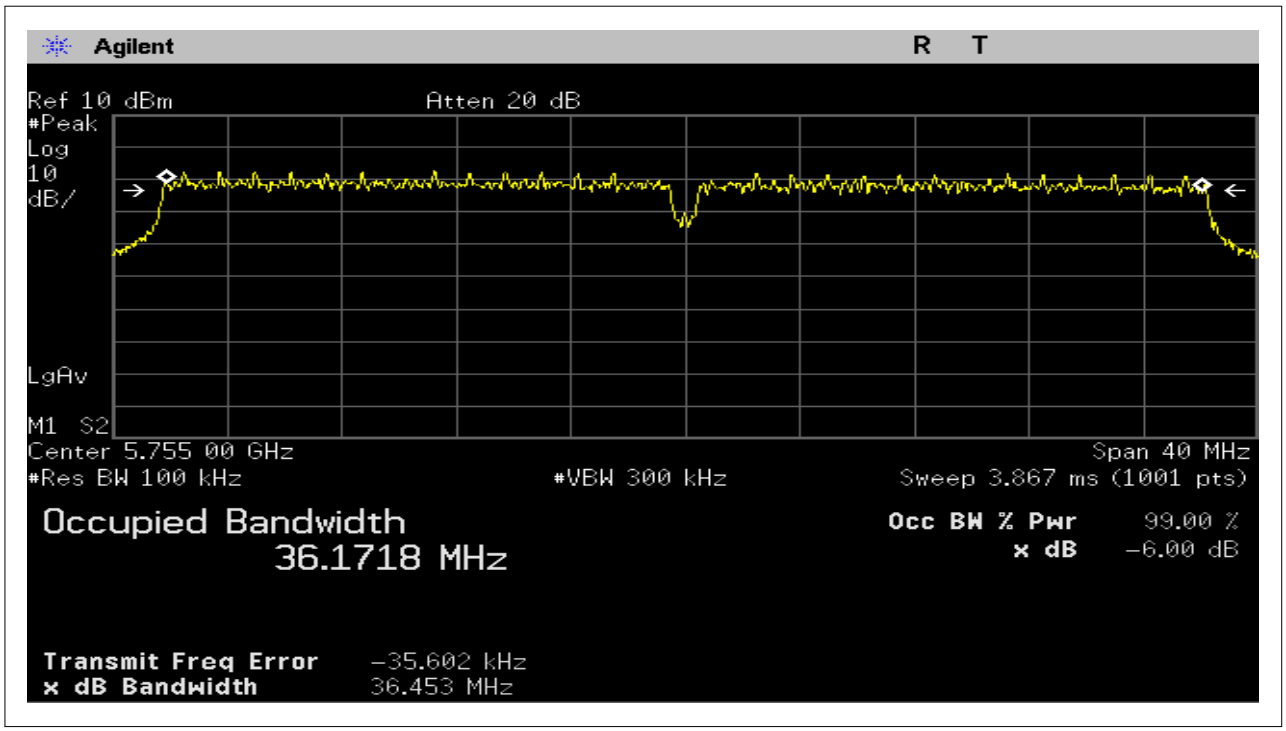


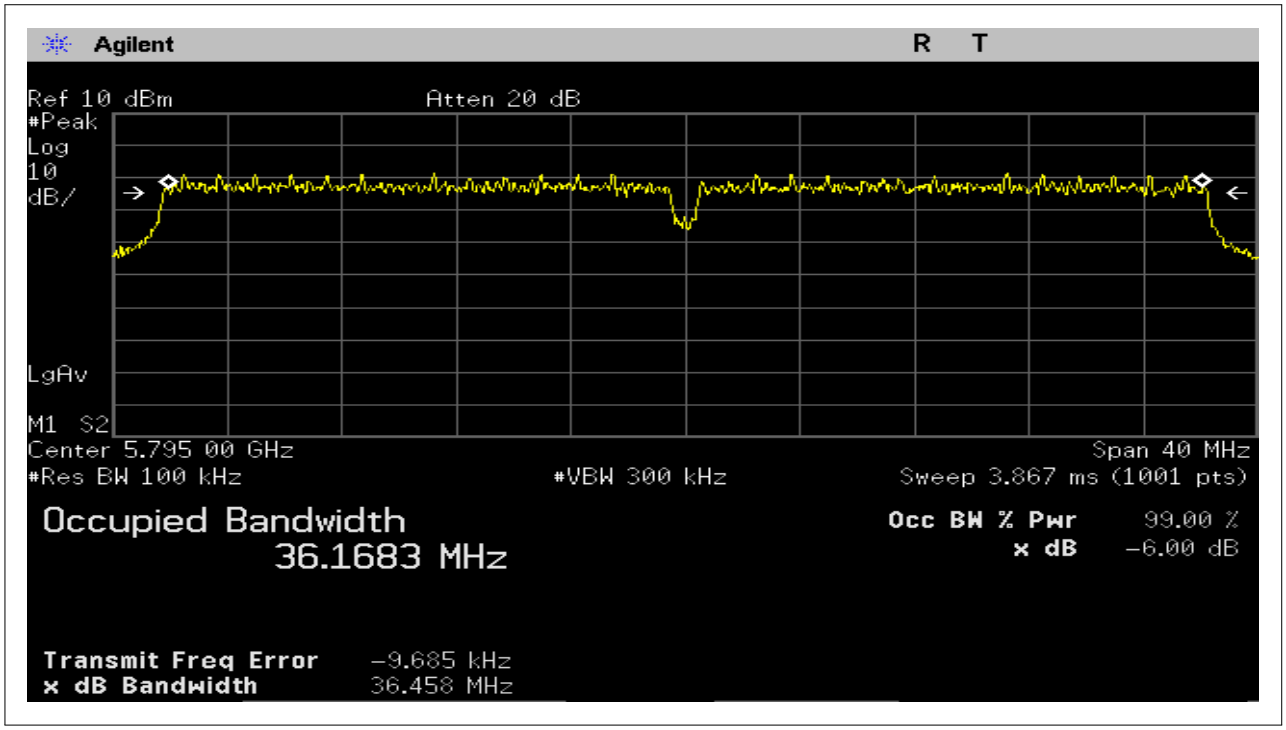
draft 802.11n Wide-40 MHz Channel mode / ANT 1

5745~5850MHz

CH Low



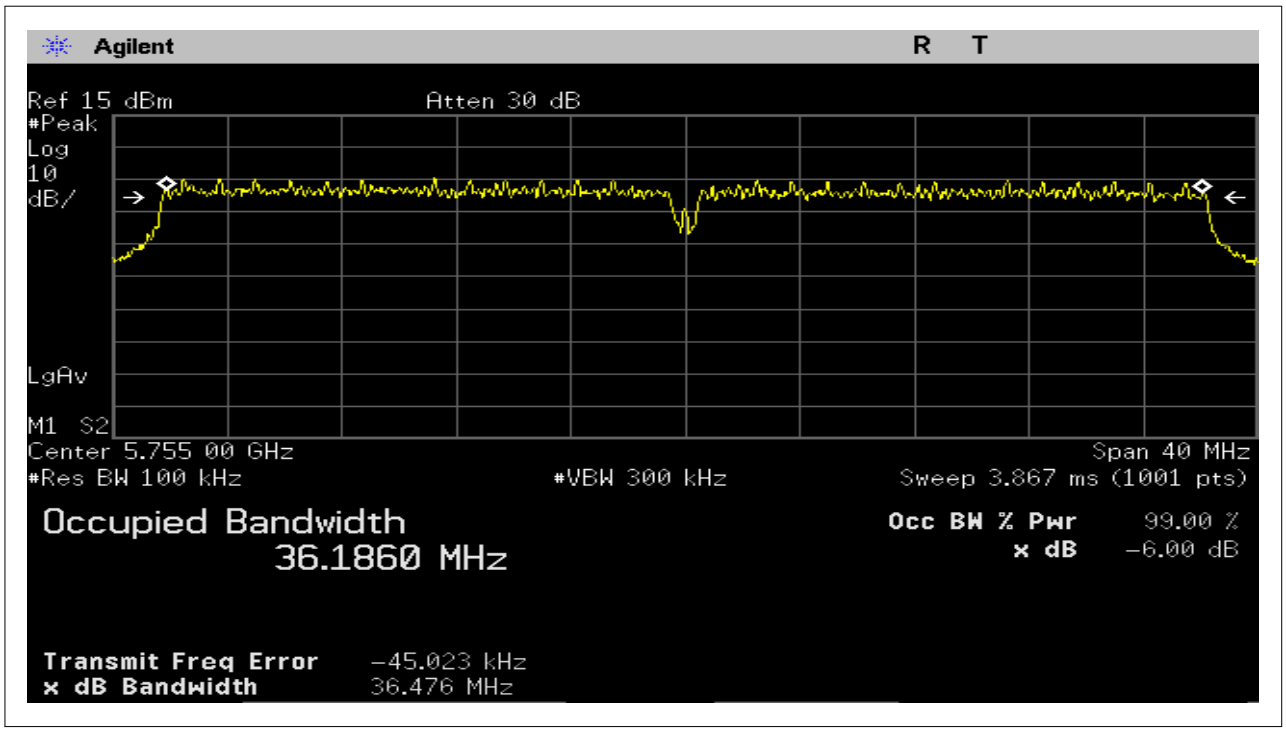
CH High



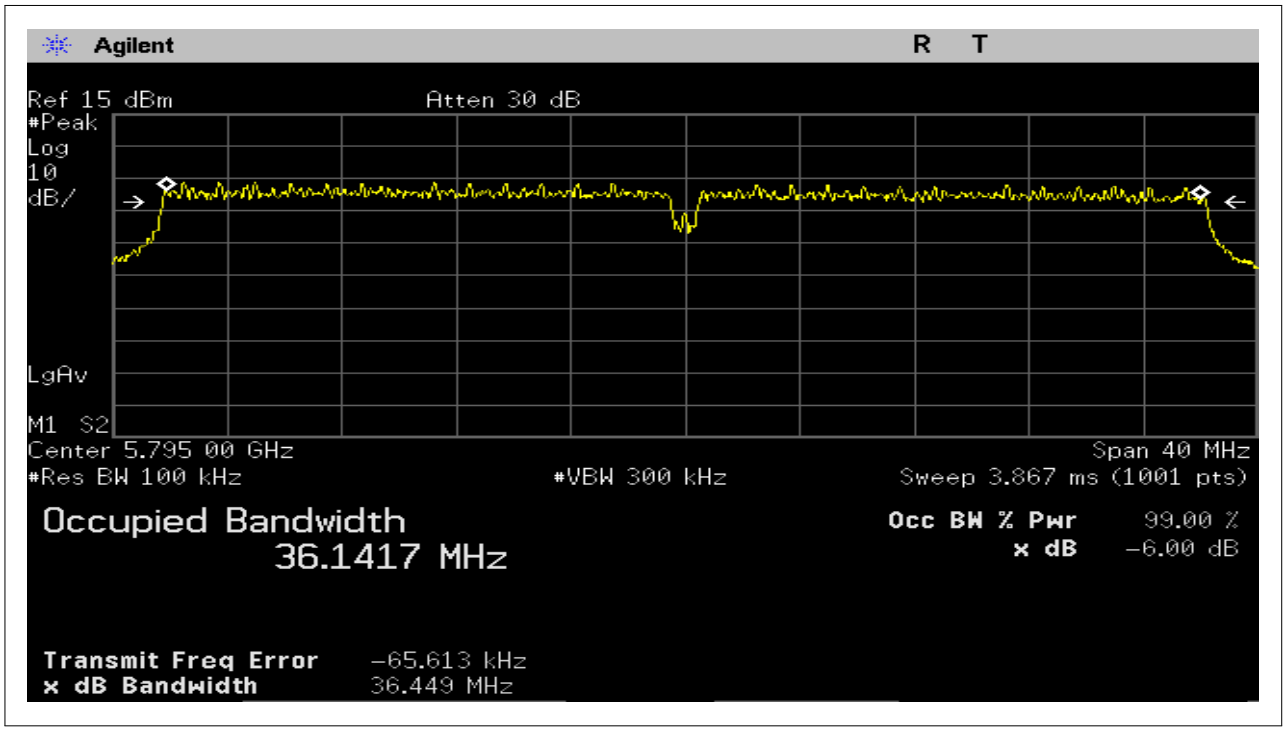
draft 802.11n Wide-40 MHz Channel mode / ANT 2

5745~5850MHz

CH Low



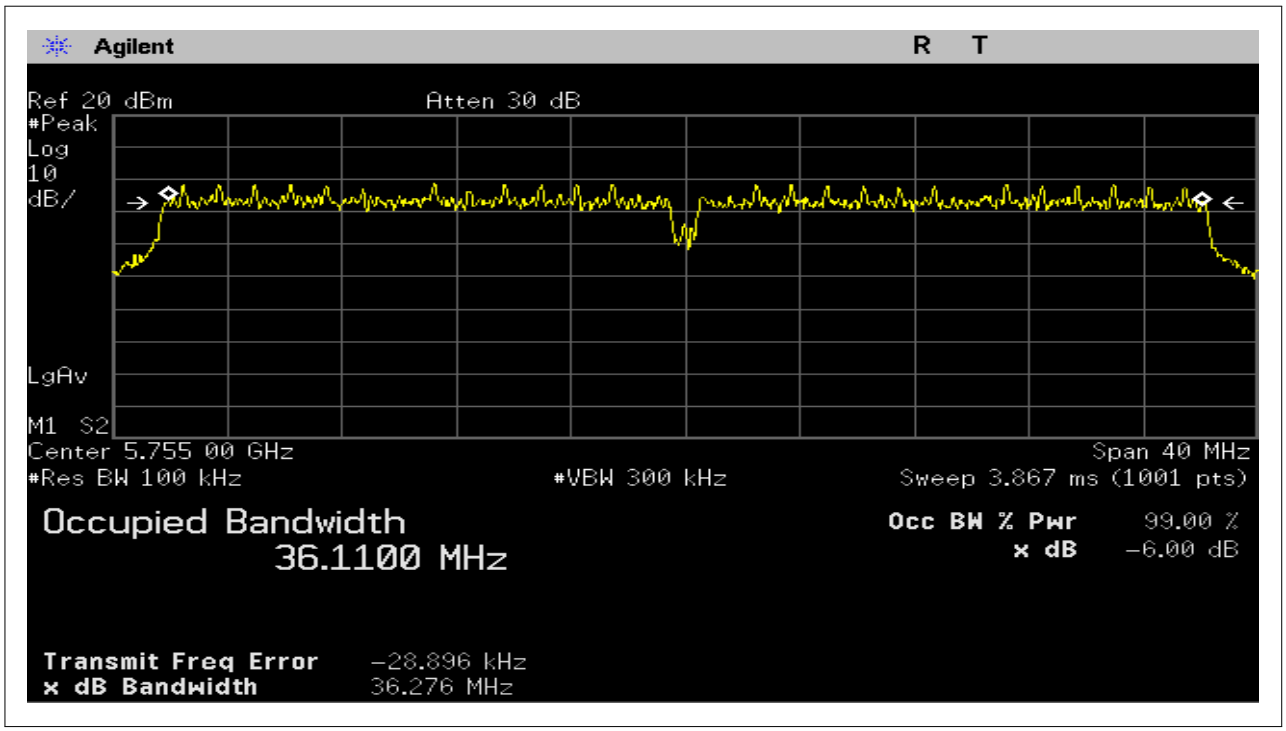
CH High



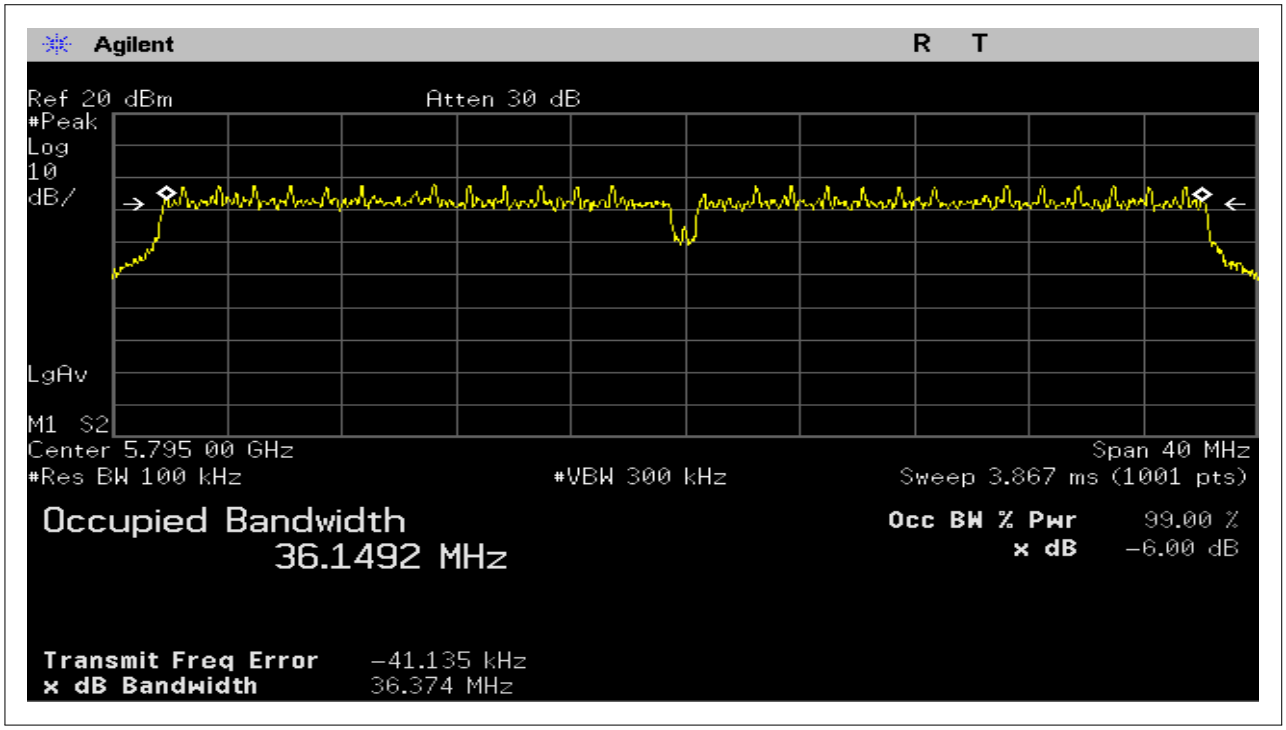
draft 802.11n Wide-40 MHz Channel mode / ANT 1+2

5745~5850MHz

CH Low



CH High



7.2. Maximum Conducted Output Power

LIMIT

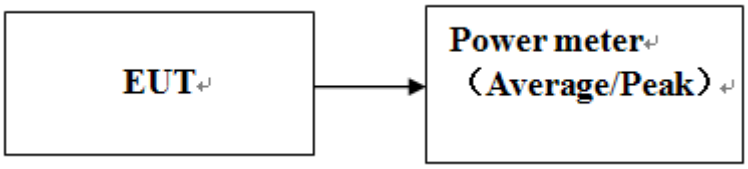
According to §15.407(a),

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

The peak power shall not exceed the limit as follow:

Test Configuration



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

TEST PROCEDURE

The testing follows Method PM of FCC KDB 789033 D02 General UNII Test Procedures New Rules v01.

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

1. Measurement is performed using a wideband RF power meter.
2. The EUT is configured to transmit continuously with a consistent duty cycle at its maximum power control level.
3. Measure the average power of the transmitter, and the average power is corrected with duty factor, 10 log(1/x), where x is the duty cycle.

TEST RESULTS

No non-compliance noted

Test Data

Test mode: IEEE 802.11a mode / ANT 1

5745~5850MHz

Channel	Frequency (MHz)	Duty factor (dB)	Average Conducted Power (dBm)	Limit (dBm)
Low	5745	0.19	2.67	30
Mid	5785	0.19	2.42	30
High	5825	0.19	1.85	30

Test mode: IEEE 802.11a mode / ANT 2

5745~5850MHz

Channel	Frequency (MHz)	Duty factor (dB)	Average Conducted Power (dBm)	Limit (dBm)
Low	5745	0.20	6.05	30
Mid	5785	0.20	4.51	30
High	5825	0.20	2.72	30

Test mode: IEEE 802.11a mode / ANT 1+2

5745~5850MHz

Channel	Frequency (MHz)	Duty factor (dB)	Average Conducted Power (dBm)	Limit (dBm)
Low	5745	0.18	8.97	30
Mid	5785	0.18	8.88	30
High	5825	0.18	8.73	30

Test mode: draft 802.11n Standard-20 MHz Channel mode / ANT 1

5745~5850MHz

Channel	Frequency (MHz)	Duty factor (dB)	Average Conducted Power (dBm)	Limit (dBm)
Low	5745	0.20	2.93	30
Mid	5785	0.20	2.19	30
High	5825	0.20	1.68	30

Test mode: draft 802.11n Standard-20 MHz Channel mode / ANT 2

5745~5850MHz

Channel	Frequency (MHz)	Duty factor (dB)	Average Conducted Power (dBm)	Limit (dBm)
Low	5745	0.20	5.69	30
Mid	5785	0.20	3.82	30
High	5825	0.20	3.13	30

Test mode: draft 802.11n Standard-20 MHz Channel mode / ANT 1+2

5745~5850MHz

Channel	Frequency (MHz)	Duty factor (dB)	Average Conducted Power (dBm)	Limit (dBm)
Low	5745	0.32	8.11	30
Mid	5785	0.32	7.88	30
High	5825	0.32	7.45	30

Test mode: draft 802.11n Wide-40 MHz Channel mode / ANT 1

5745~5850MHz

Channel	Frequency (MHz)	Duty factor (dB)	Average Conducted Power (dBm)	Limit (dBm)
Low	5745	0.34	-0.26	30
High	5785	0.34	-1.57	30

Test mode: draft 802.11n Wide-40 MHz Channel mode / ANT 2

5745~5850MHz

Channel	Frequency (MHz)	Duty factor (dB)	Average Conducted Power (dBm)	Limit (dBm)
Low	5745	0.35	1.95	30
High	5785	0.35	1.57	30

Test mode: draft 802.11n Wide-40 MHz Channel mode / ANT 1+2

5745~5850MHz

Channel	Frequency (MHz)	Duty factor (dB)	Average Conducted Power (dBm)	Limit (dBm)
Low	5745	0.53	4.71	30
High	5785	0.53	3.93	30

Note: Measured power(dBm) has offiset with cable loss and duty factor

7.3. Band Edges Measurement

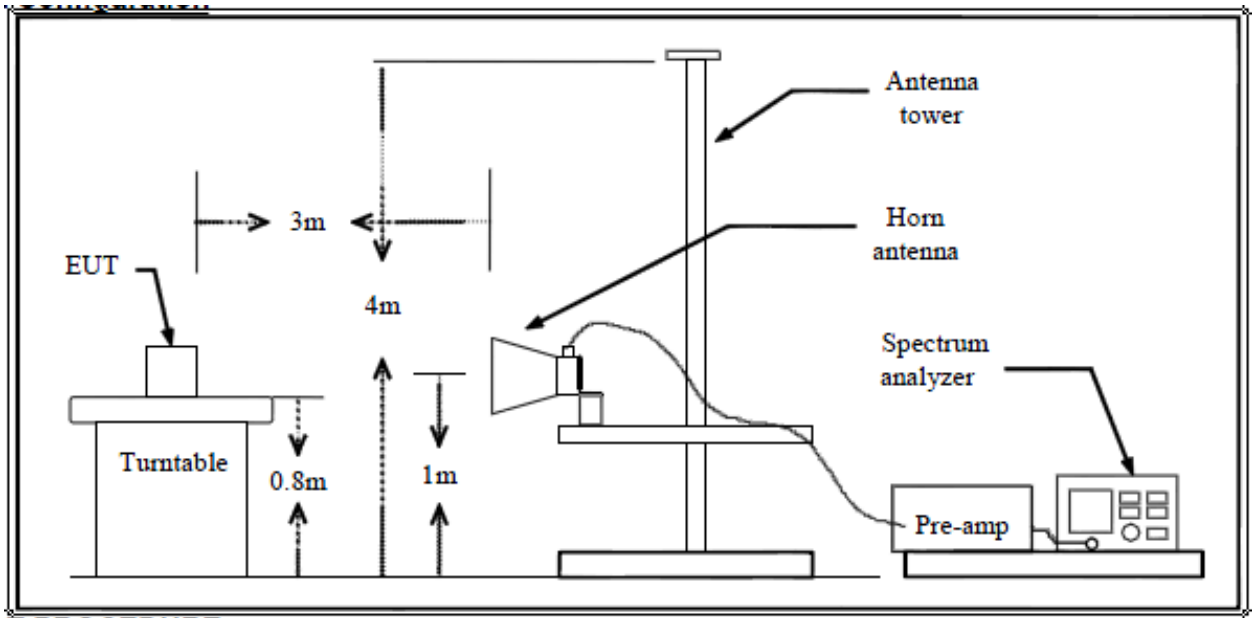
LIMIT

According to §15.407(b),

(1) The provisions of Section 15.205 of this part apply to intentional radiators operating under this section.

(2) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the upper and lower frequency block edges as the design of the equipment permits.

Test Configuration



TEST PROCEDURE

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

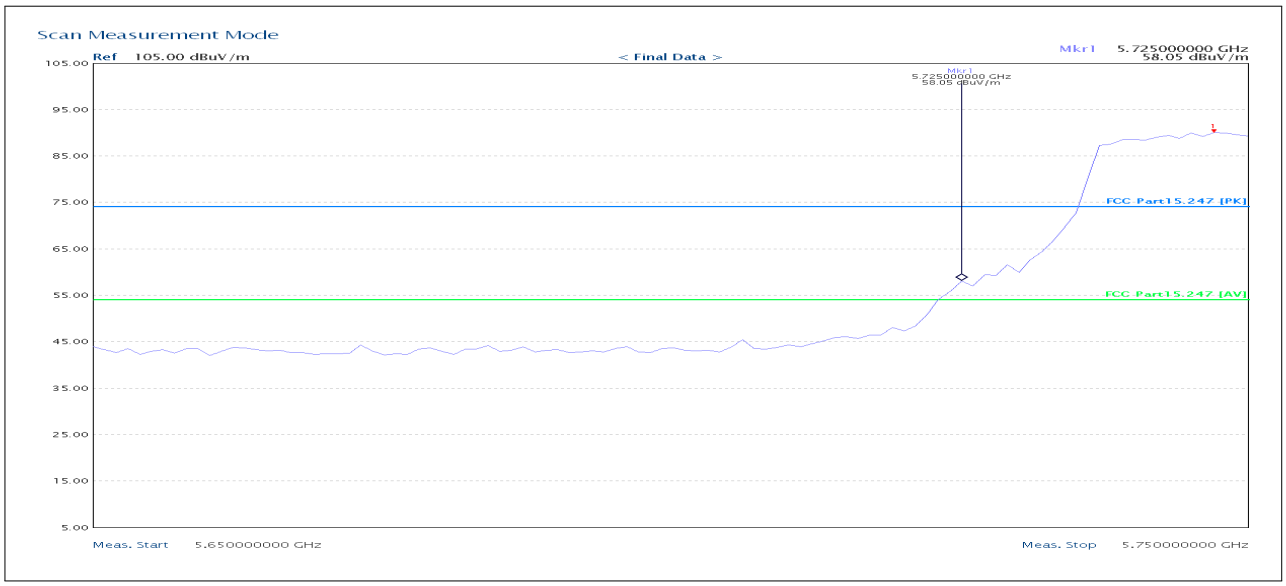
TEST RESULTS

Refer to attach spectrum analyzer data chart.

Band Edges (draft 802.11a mode) / ANT 1

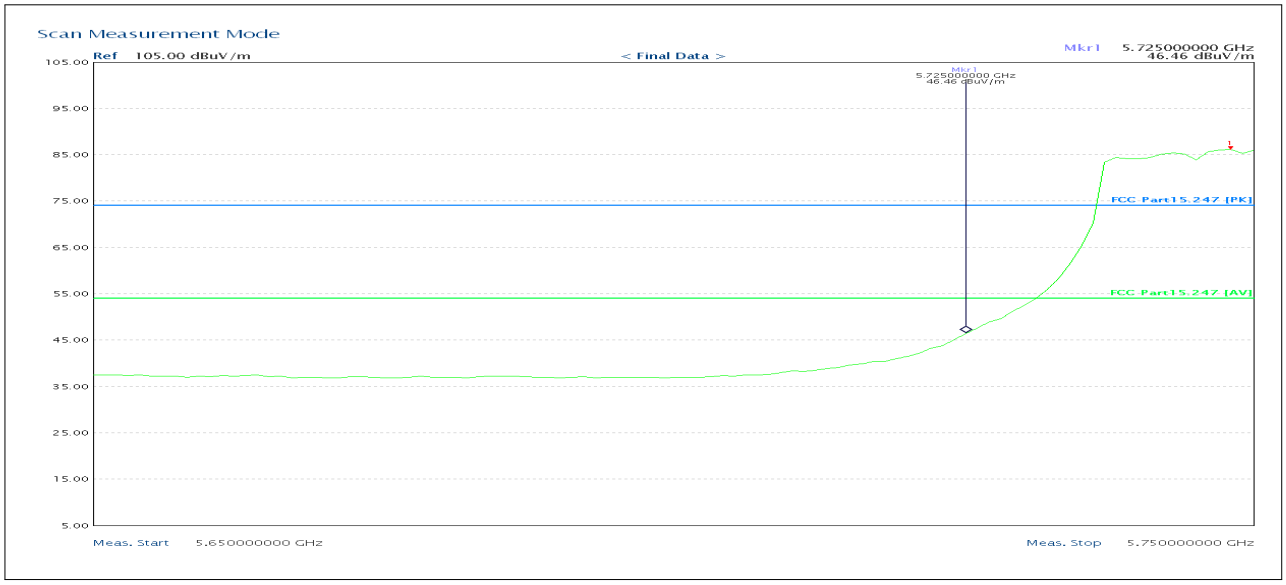
5745MHz

Detector mode: Peak Polarity: Vertical



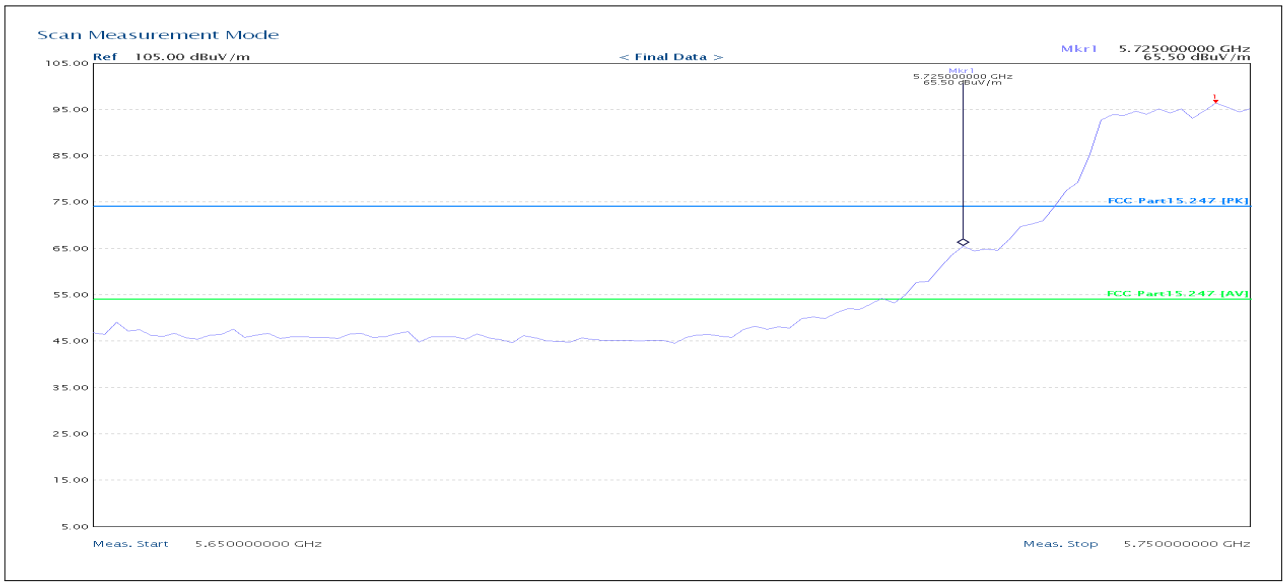
Frequency (MHz)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
5725.00	58.05	74.00	15.95

Detector mode: Average Polarity: Vertical



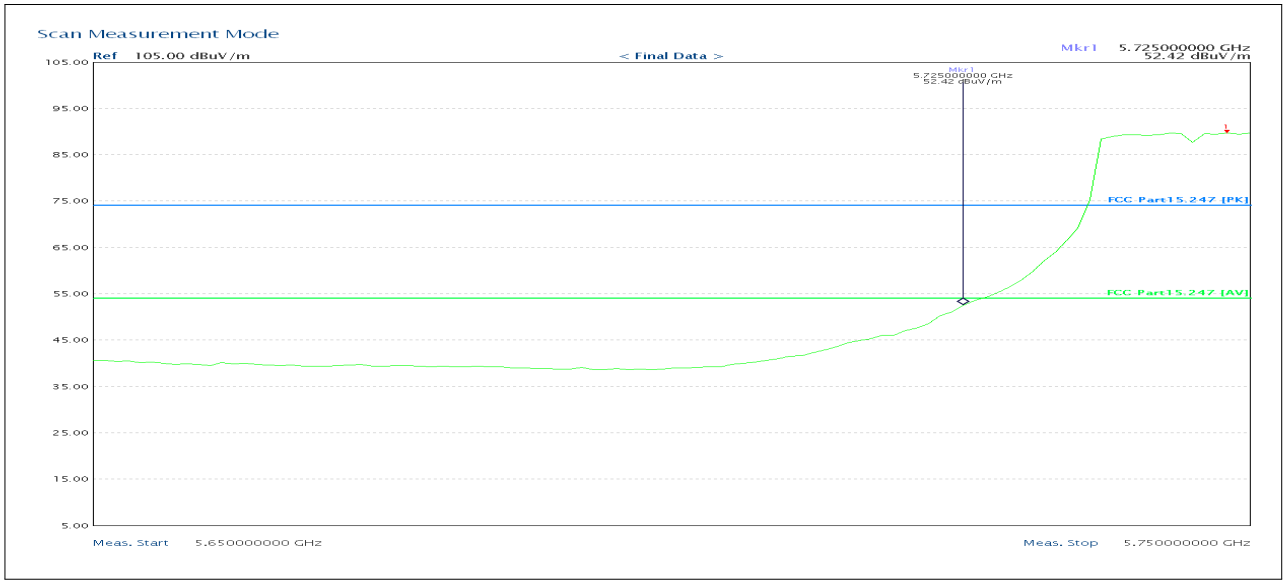
Frequency (MHz)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
5725.00	46.46	54.00	7.54

Detector mode: Peak Polarity: Horizontal



Frequency (MHz)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
5725.00	65.50	74.00	8.50

Detector mode: Average Polarity: Horizontal

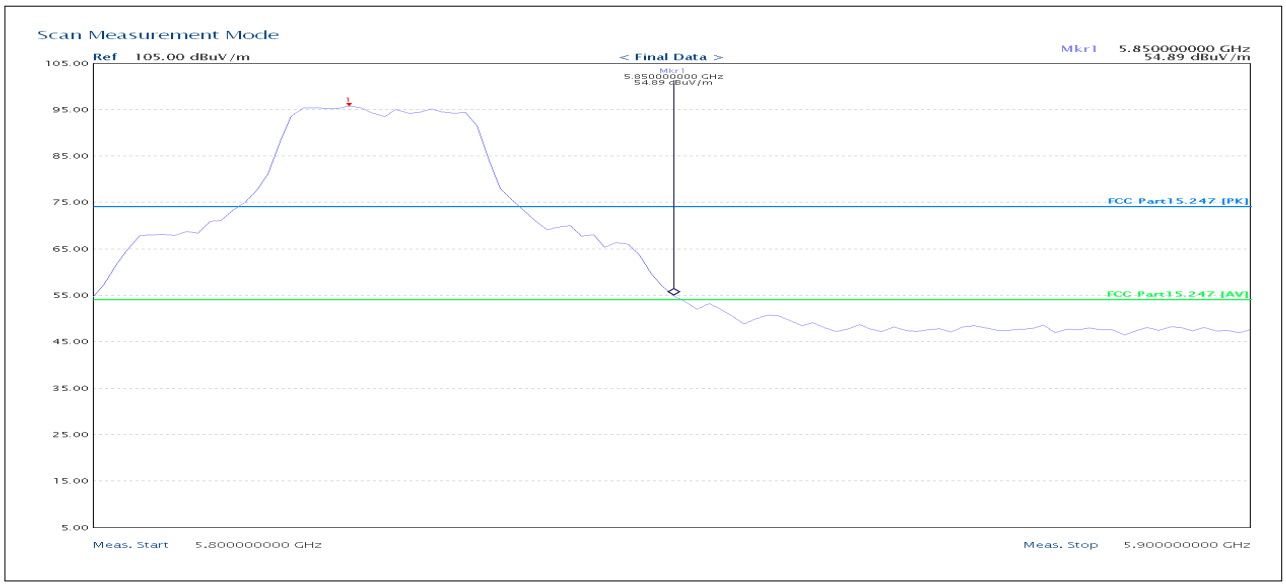


Frequency (MHz)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
5725.00	52.42	54.00	1.58

Band Edges (draft 802.11a mode) / ANT 1

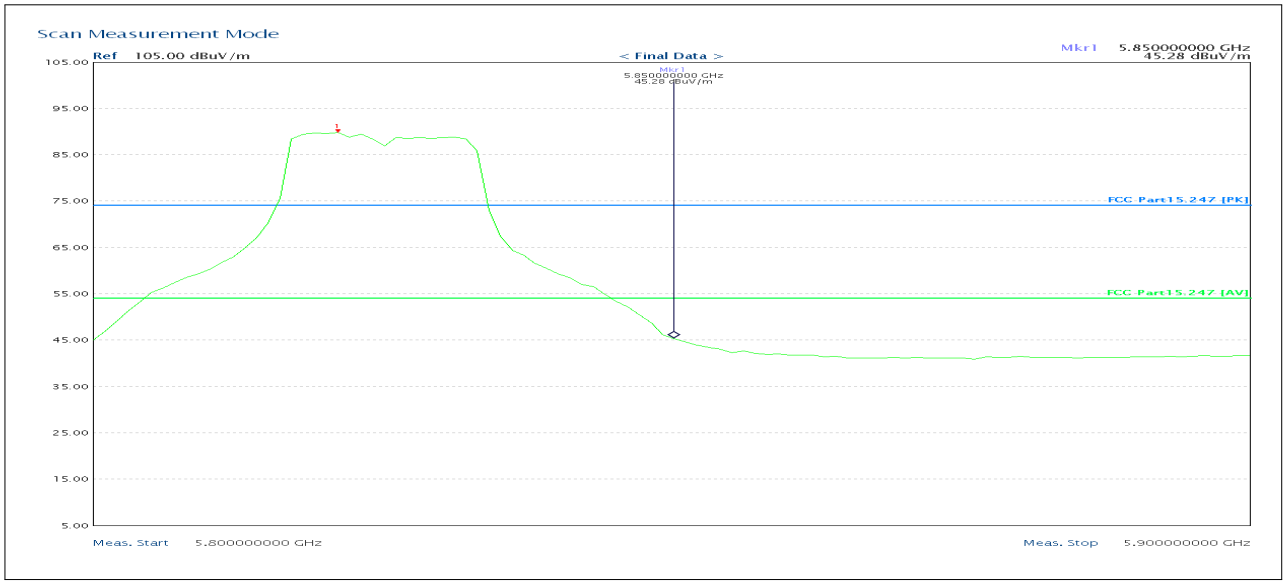
5825MHz

Detector mode: Peak Polarity: Vertical



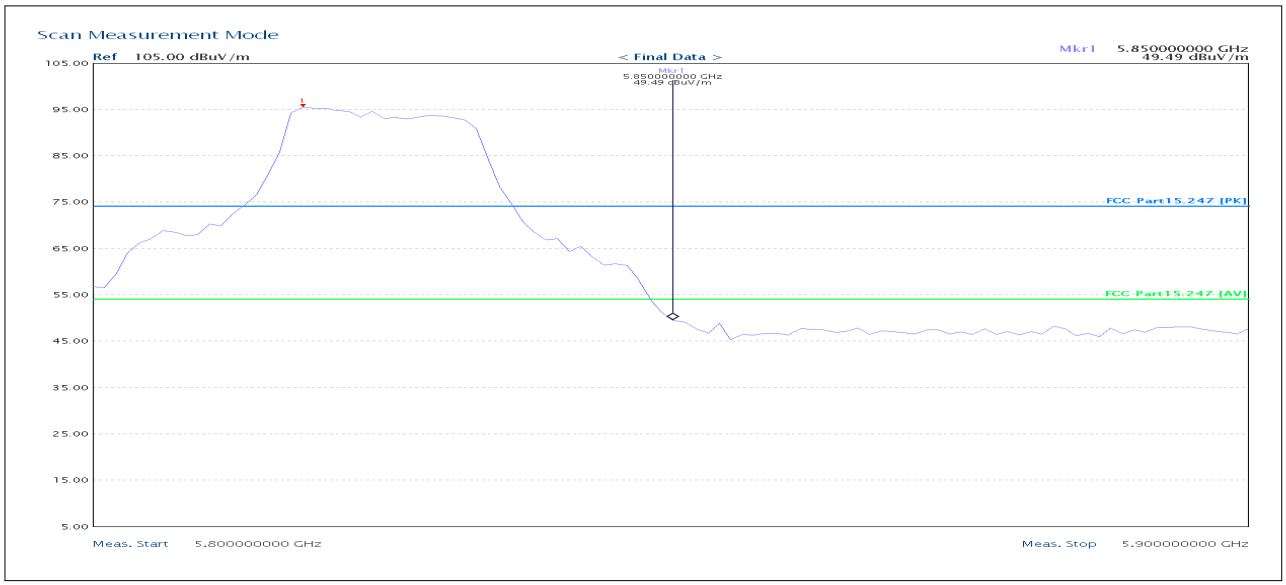
Frequency (MHz)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
5725.00	54.89	74.00	19.11

Detector mode: Average Polarity: Vertical



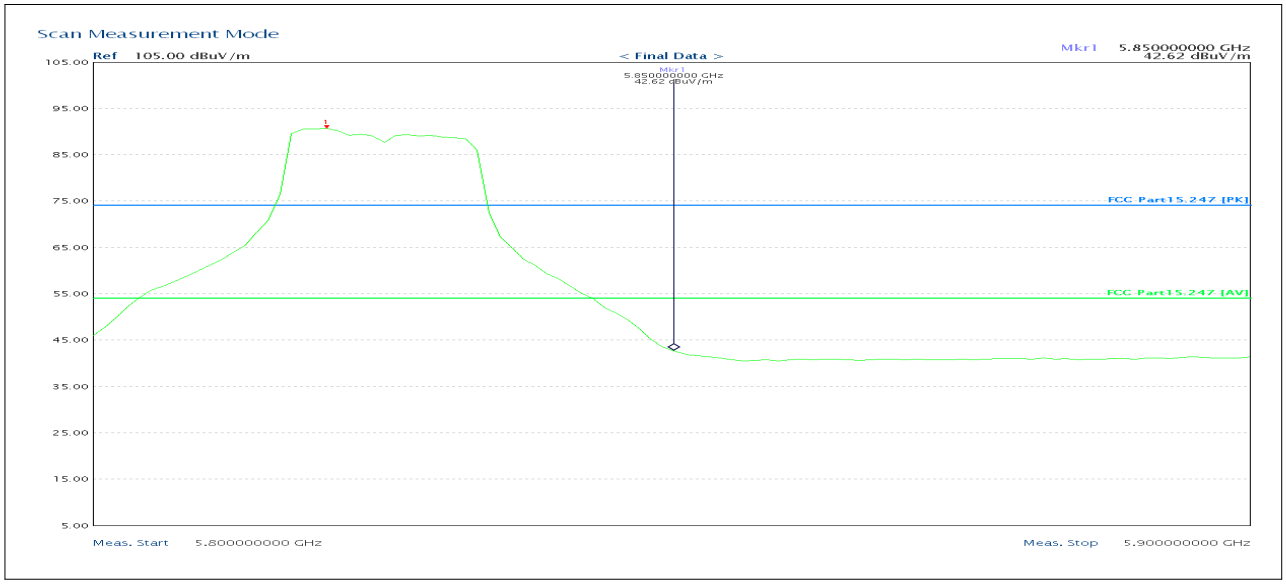
Frequency (MHz)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
5725.00	45.28	54.00	8.72

Detector mode: Peak Polarity: Horizontal



Frequency (MHz)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
5725.00	49.49	74.00	24.51

Detector mode: Average Polarity: Horizontal

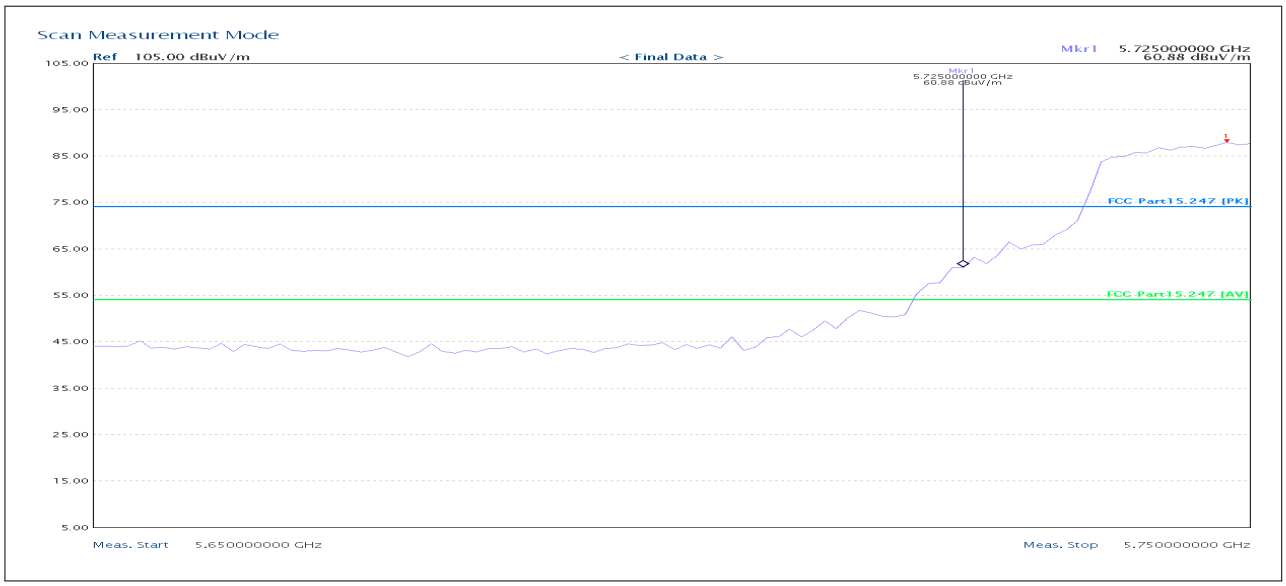


Frequency (MHz)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
5725.00	42.62	54.00	11.38

Band Edges (draft 802.11a mode) / ANT 2

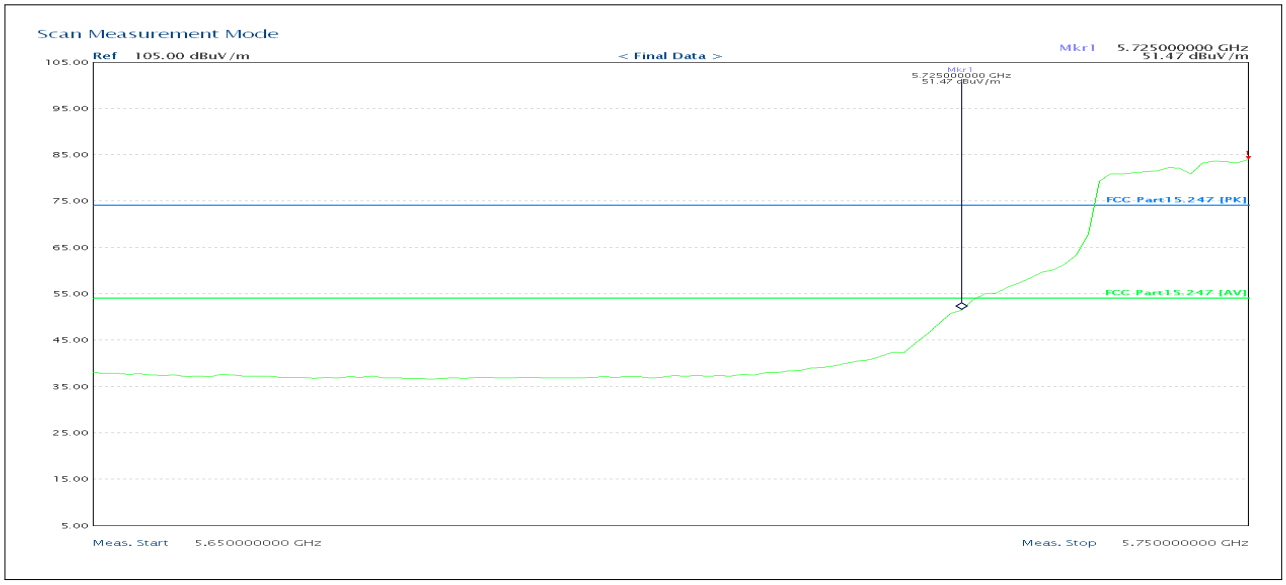
5745MHz

Detector mode: Peak Polarity: Vertical



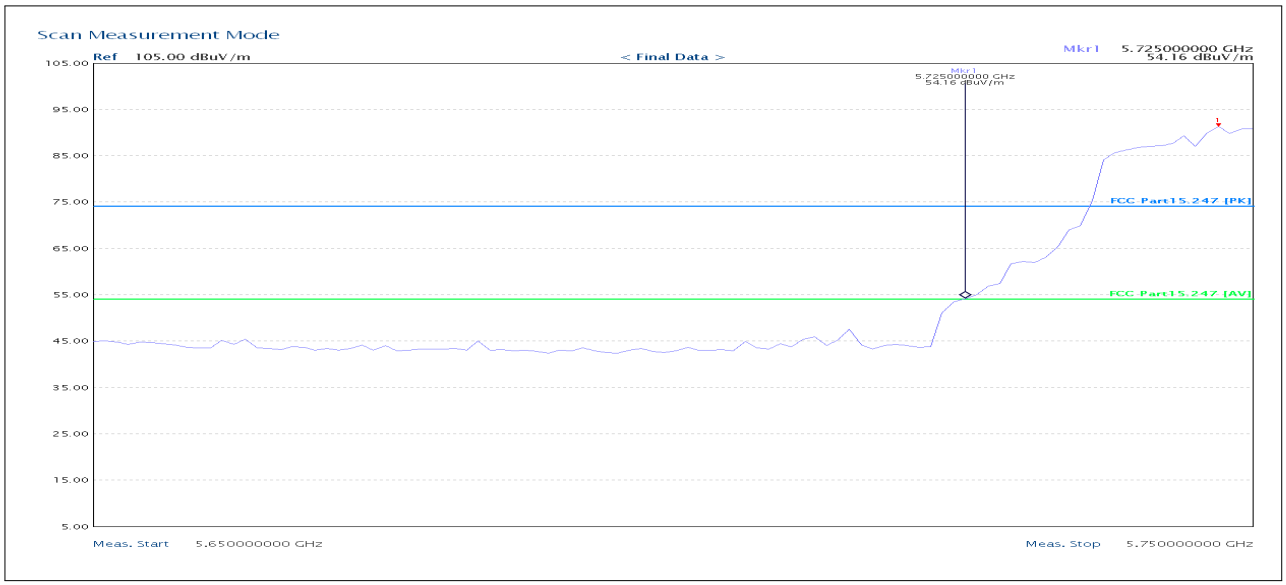
Frequency (MHz)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
5725.00	60.88	74.00	13.12

Detector mode: Average Polarity: Vertical



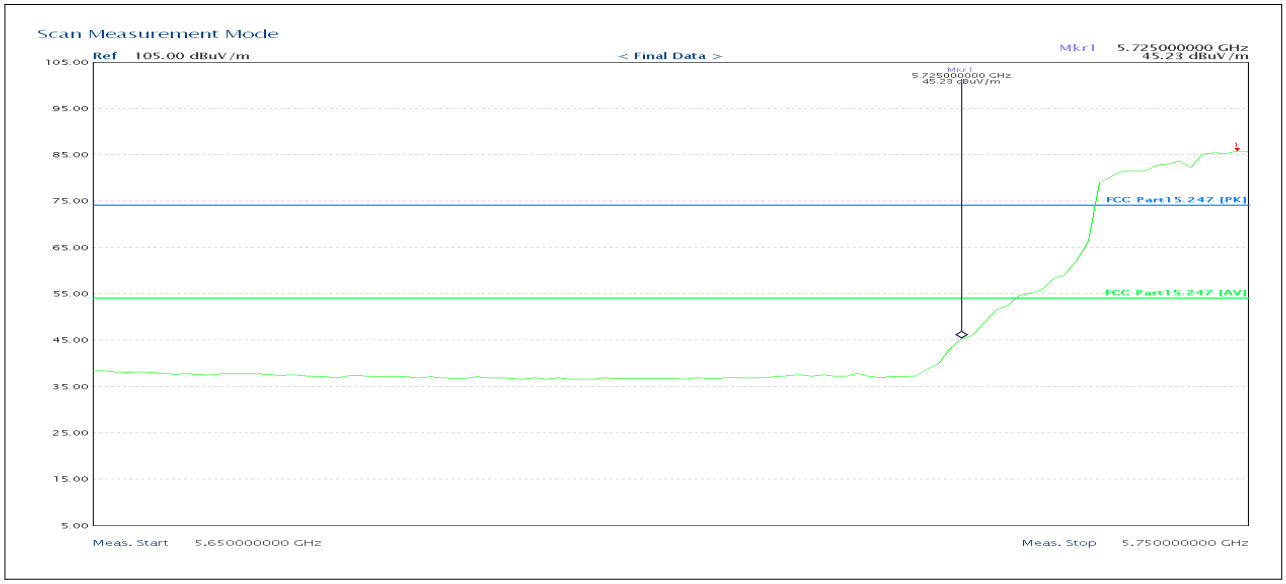
Frequency (MHz)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
5725.00	51.47	54.00	2.53

Detector mode: Peak Polarity: Horizontal



Frequency (MHz)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
5725.00	54.16	74.00	19.84

Detector mode: Average Polarity: Horizontal

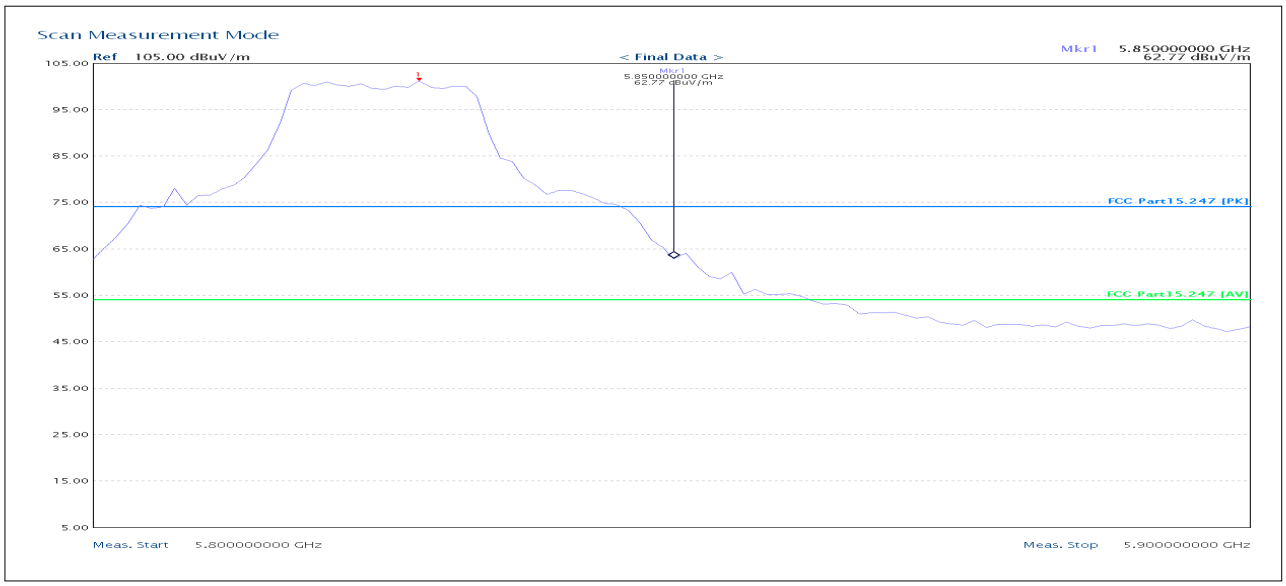


Frequency (MHz)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
5725.00	45.23	54.00	8.77

Band Edges (draft 802.11a mode) / ANT 2

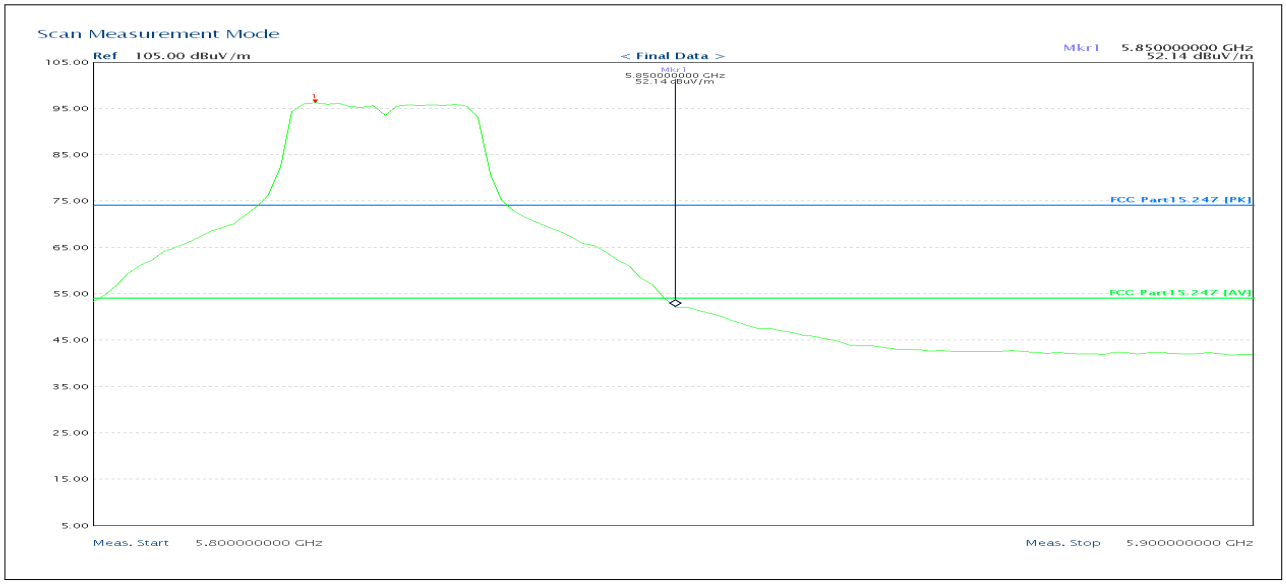
5825MHz

Detector mode: Peak Polarity: Vertical



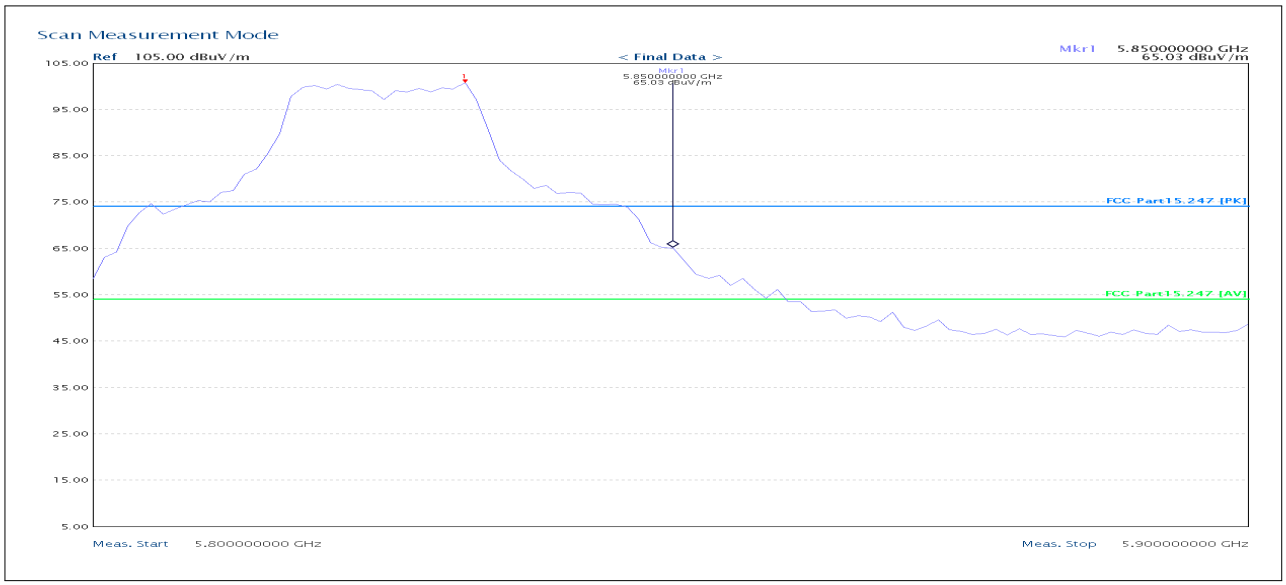
Frequency (MHz)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
5725.00	62.77	74.00	11.23

Detector mode: Average Polarity: Vertical



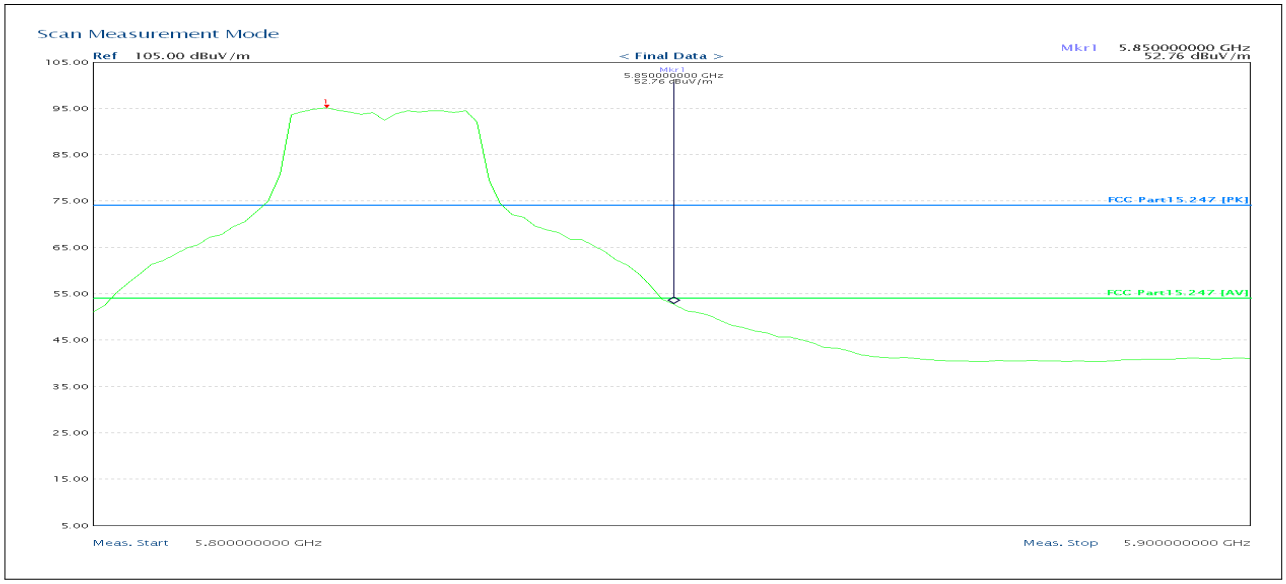
Frequency (MHz)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
5725.00	52.14	54.00	1.86

Detector mode: Peak Polarity: Horizontal



Frequency (MHz)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
5725.00	65.03	74.00	8.97

Detector mode: Average Polarity: Horizontal

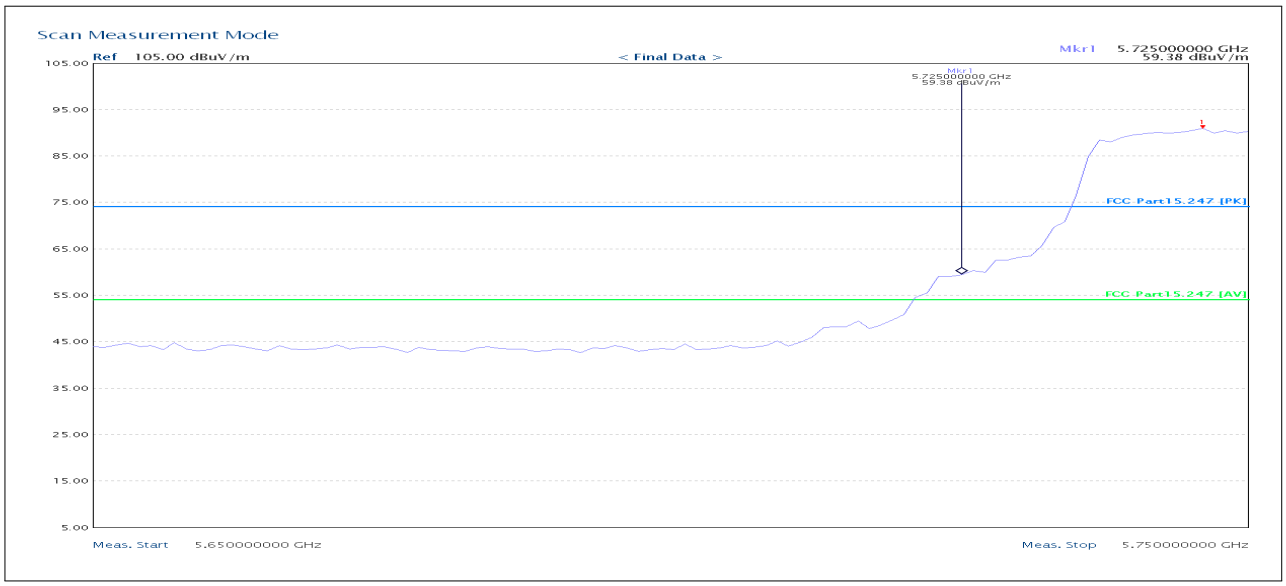


Frequency (MHz)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
5725.00	52.76	54.00	1.24

Band Edges (draft 802.11n Standard-20 MHz Channel mode) / ANT 1+2

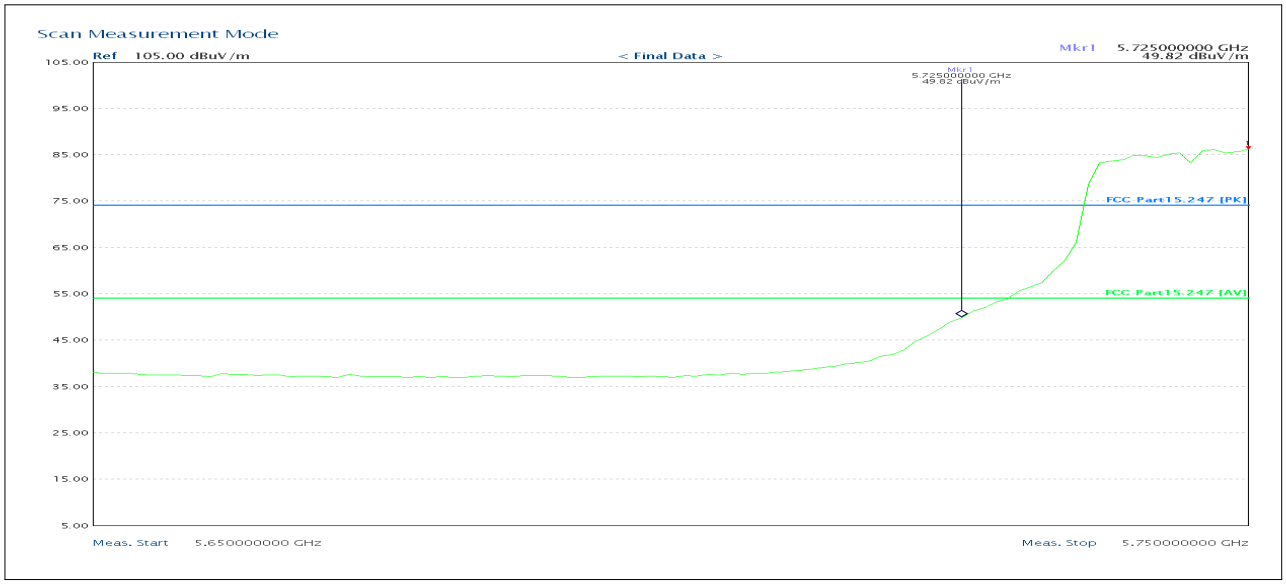
5745MHz

Detector mode: Peak Polarity: Vertical



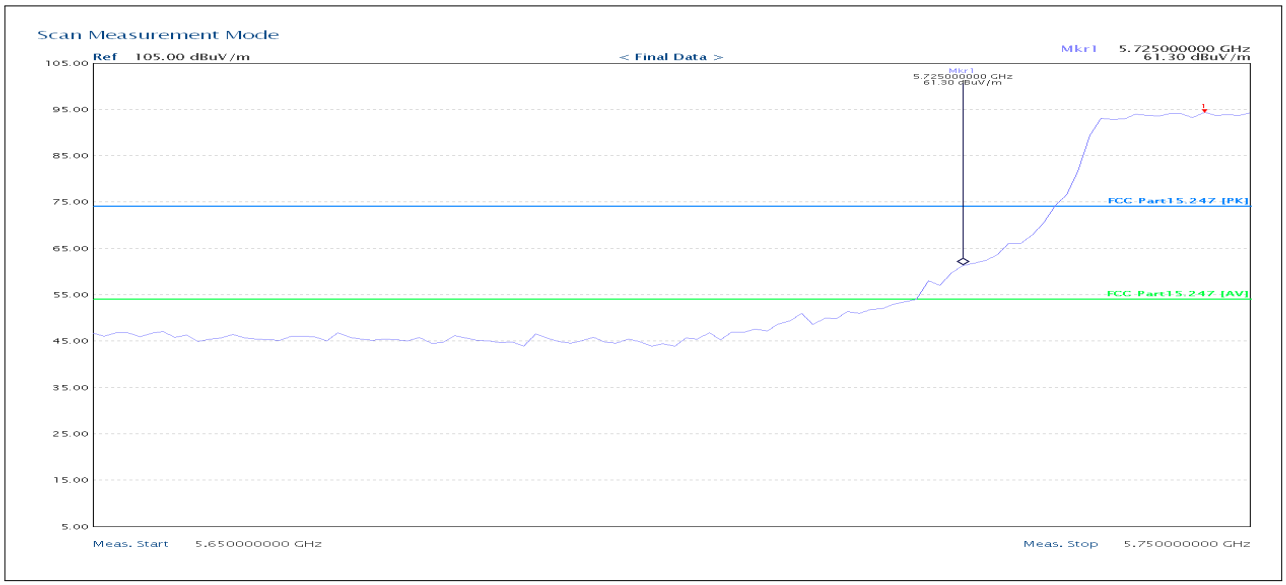
Frequency (MHz)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
5725.00	59.38	74.00	14.62

Detector mode: Average Polarity: Vertical



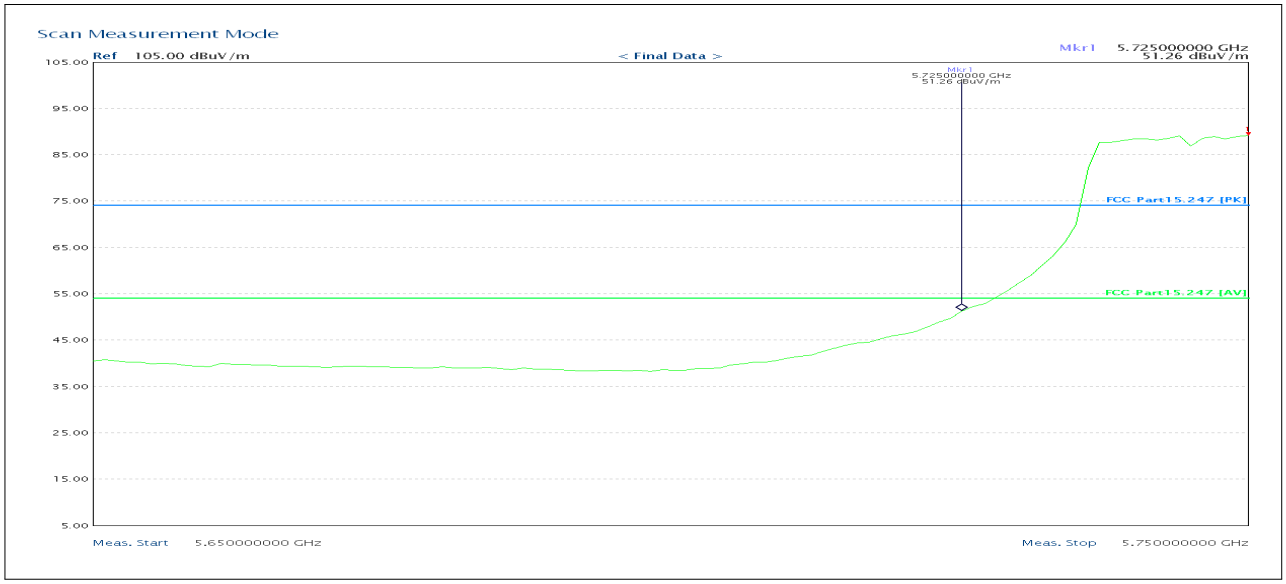
Frequency (MHz)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
5725.00	49.82	54.00	4.18

Detector mode: Peak Polarity: Horizontal



Frequency (MHz)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
5725.00	61.30	74.00	12.70

Detector mode: Average Polarity: Horizontal

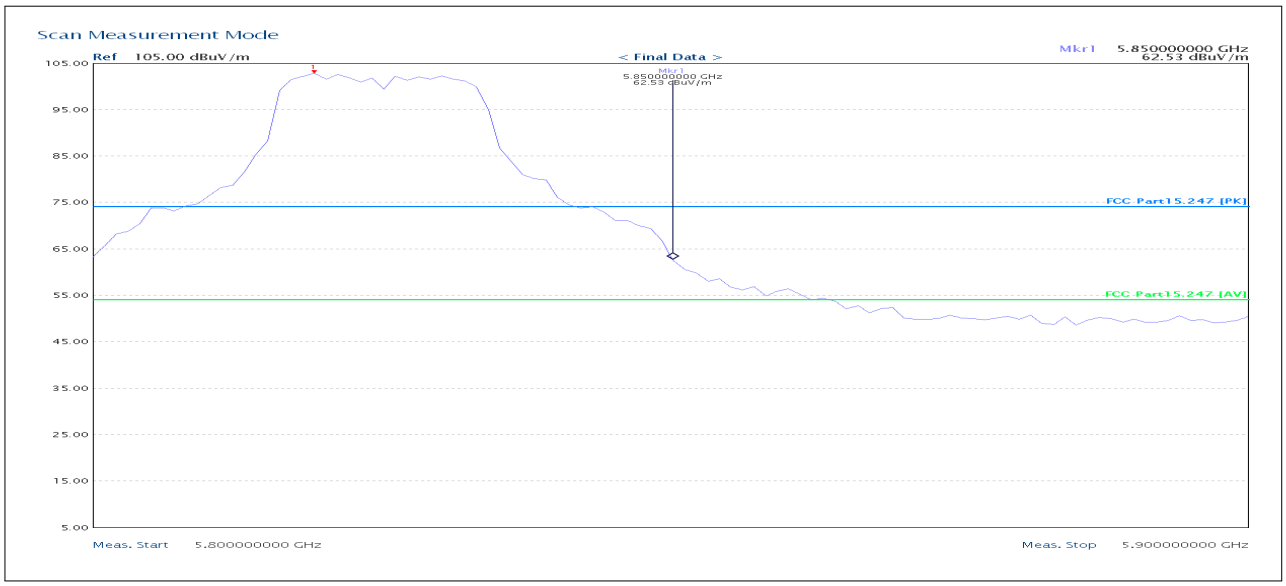


Frequency (MHz)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
5725.00	51.26	54.00	2.74

Band Edges (draft 802.11n Standard-20 MHz Channel mode) / ANT 1+2

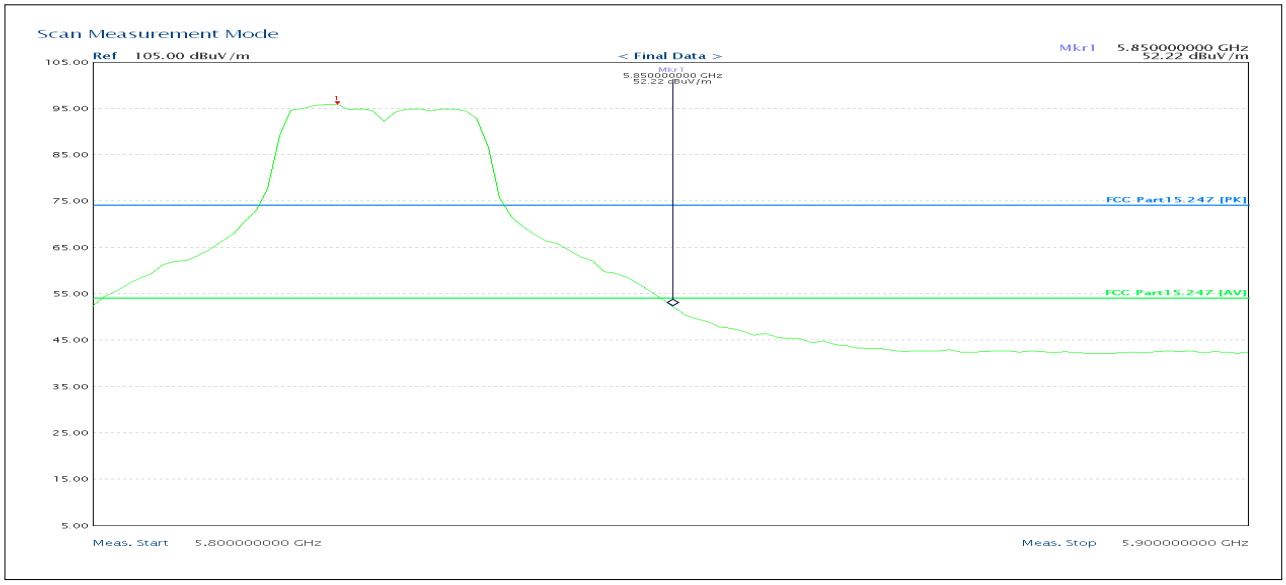
5825MHz

Detector mode: Peak Polarity: Vertical



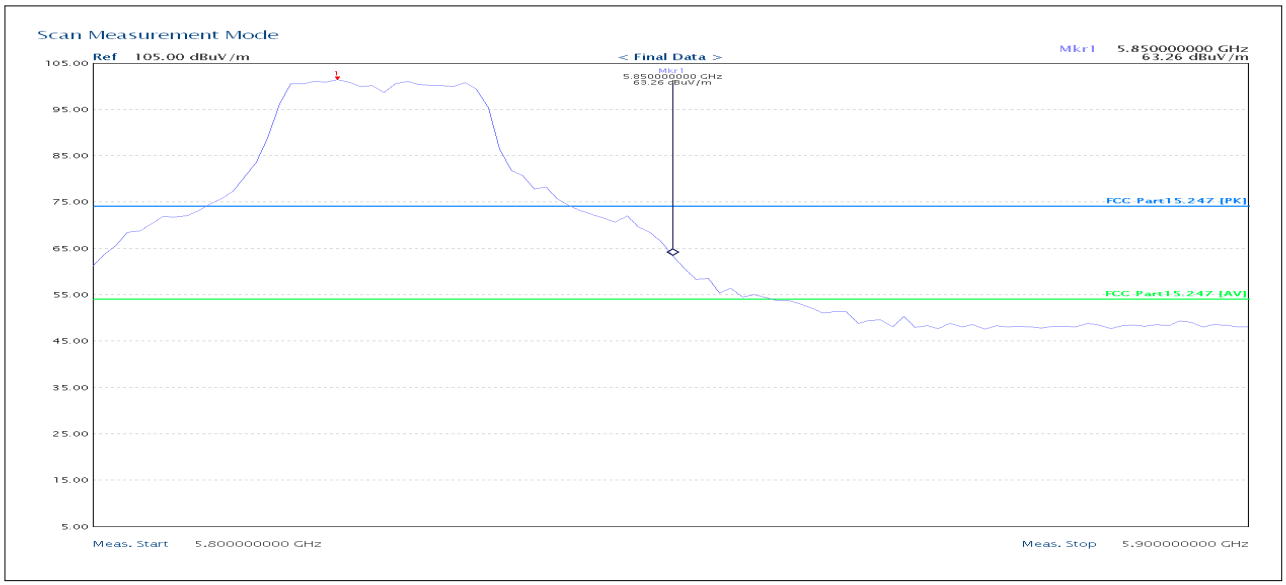
Frequency (MHz)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
5725.00	62.53	74.00	11.47

Detector mode: Average Polarity: Vertical



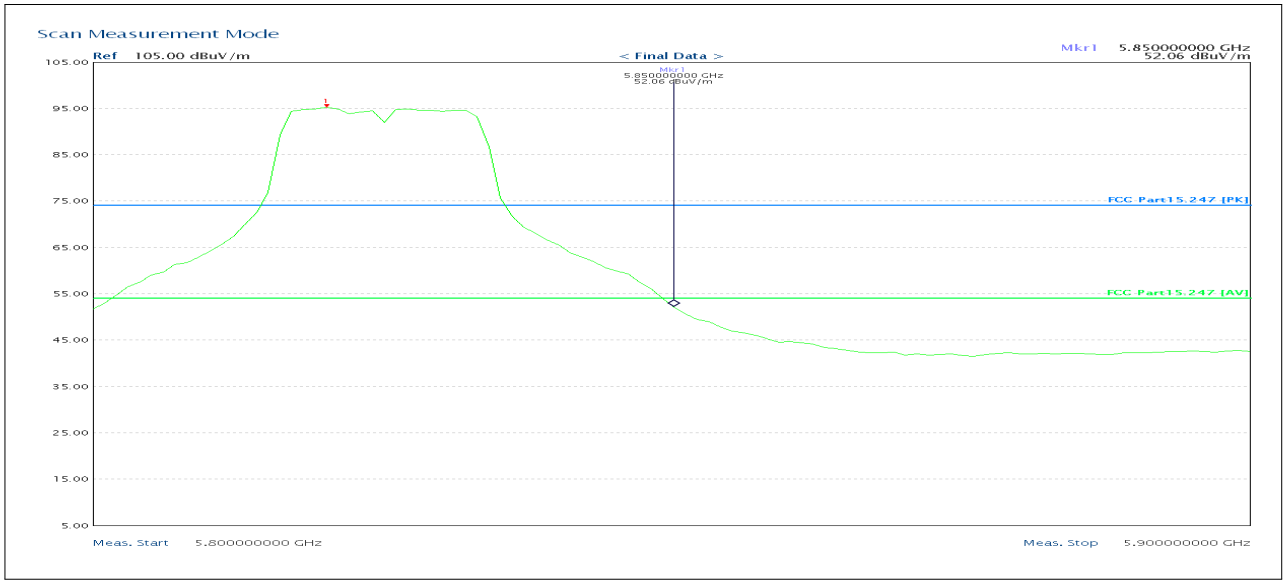
Frequency (MHz)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
5725.00	52.22	54.00	1.78

Detector mode: Peak Polarity: Horizontal



Frequency (MHz)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
5725.00	63.26	74.00	10.74

Detector mode: Average Polarity: Horizontal

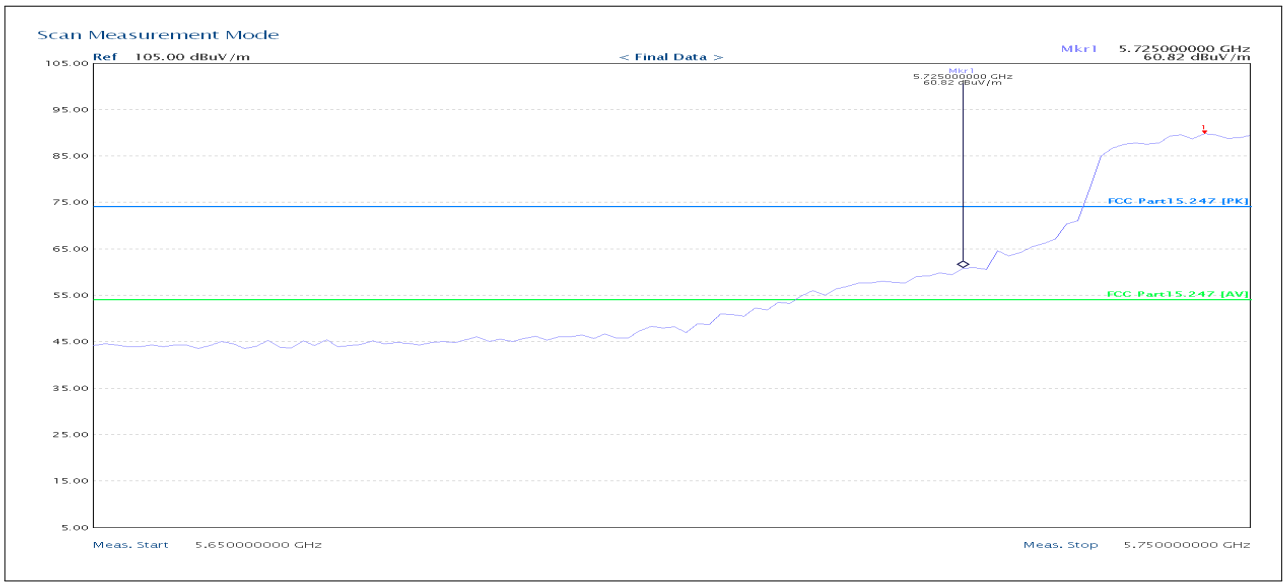


Frequency (MHz)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
5725.00	52.06	54.00	1.94

Band Edges (draft 802.11n Wide-40 MHz Channel mode) / ANT 1+2

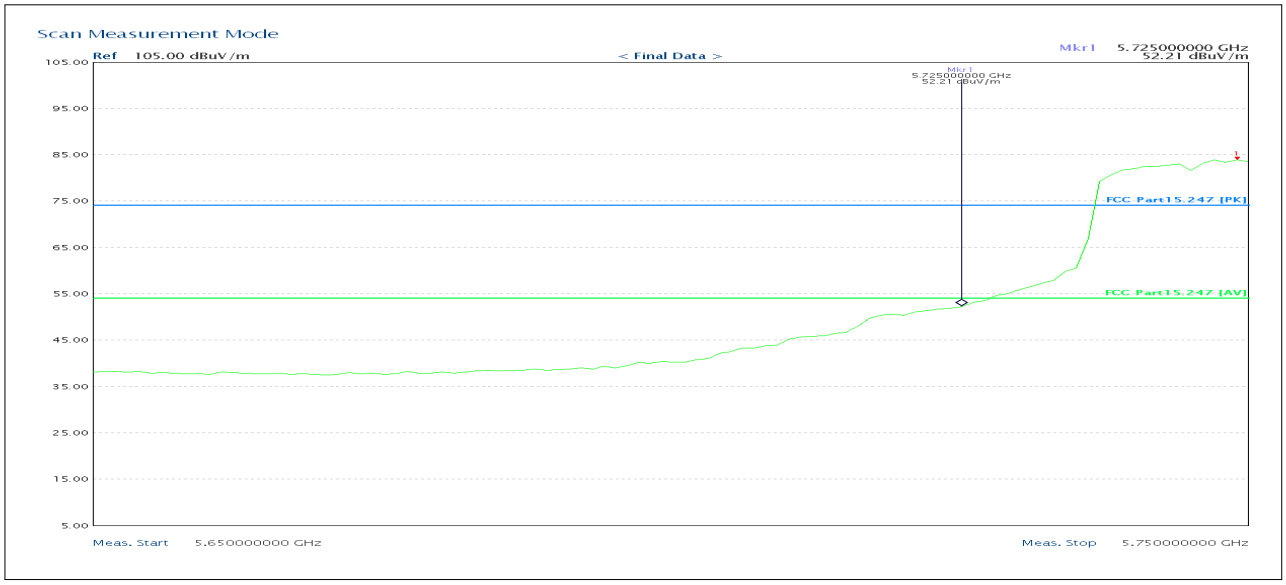
5755MHz

Detector mode: Peak Polarity: Vertical



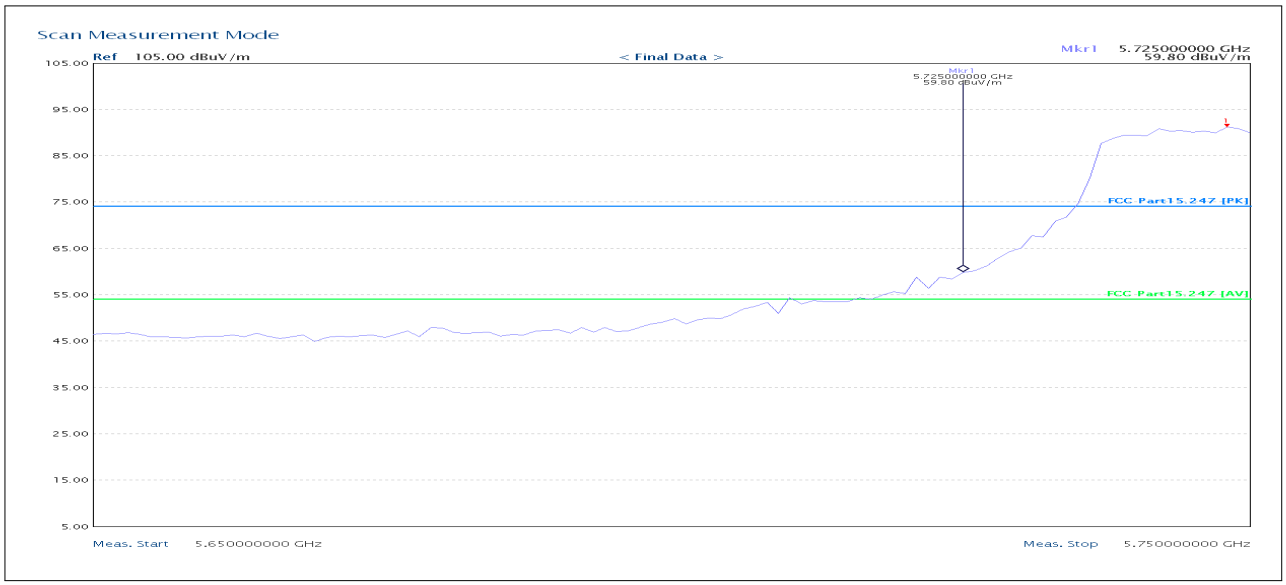
Frequency (MHz)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
5725.00	60.82	74.00	13.18

Detector mode: Average Polarity: Vertical



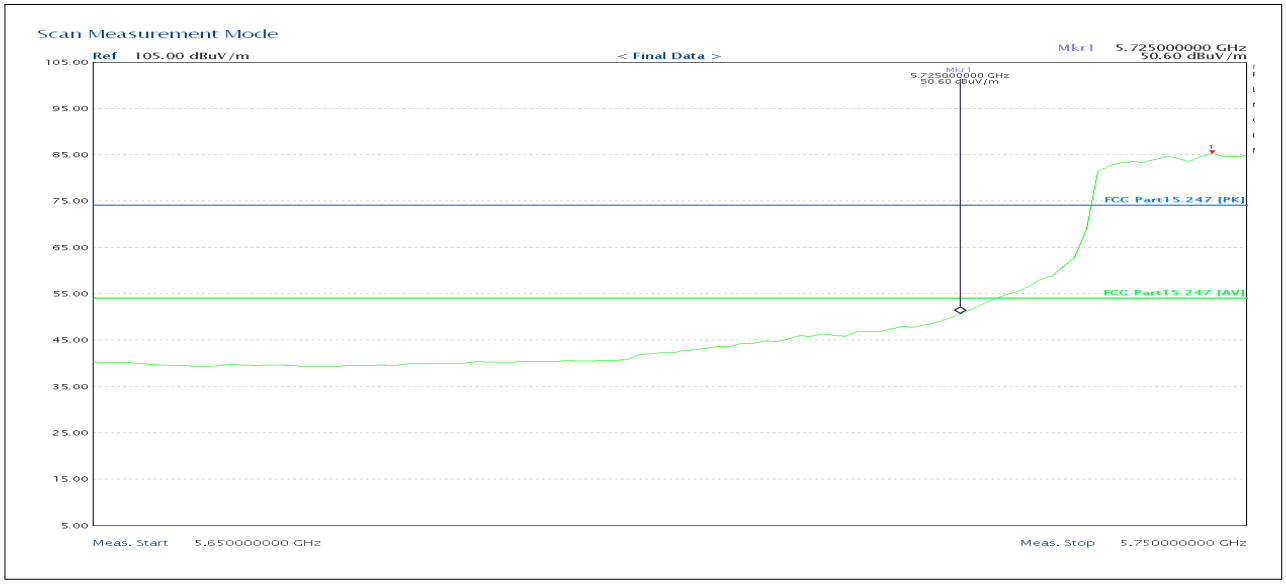
Frequency (MHz)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
5725.00	52.21	54.00	1.79

Detector mode: Peak Polarity: Horizontal



Frequency (MHz)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
5725.00	59.80	74.00	14.20

Detector mode: Average Polarity: Horizontal

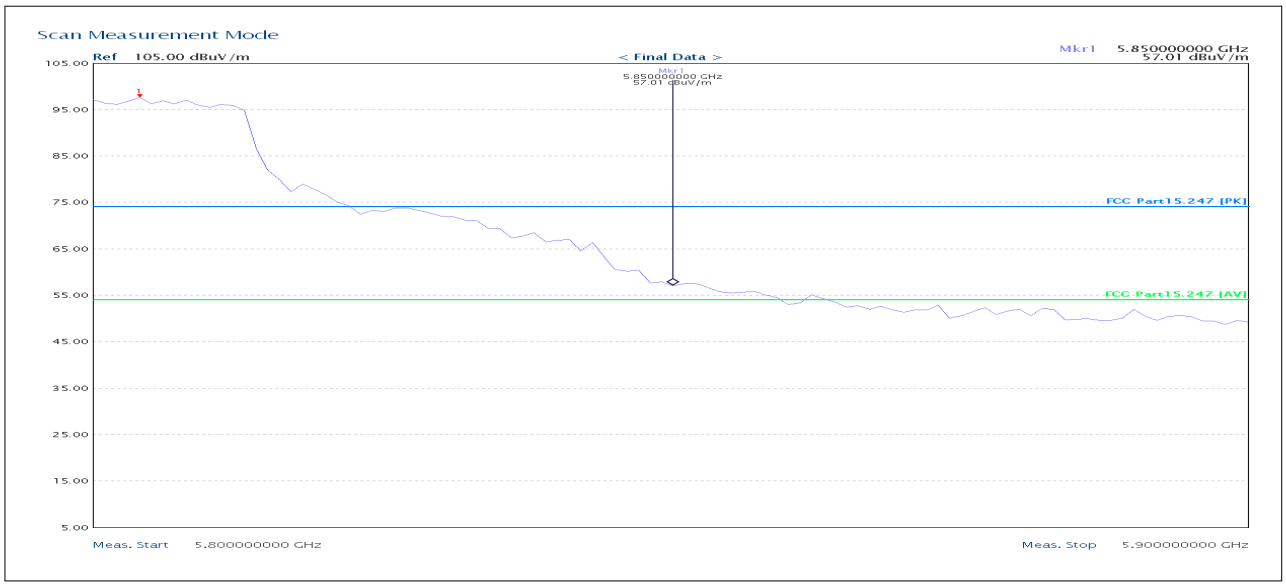


Frequency (MHz)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
5725.00	50.60	54.00	3.40

Band Edges (draft 802.11n Wide-40 MHz Channel mode) / ANT 1+2

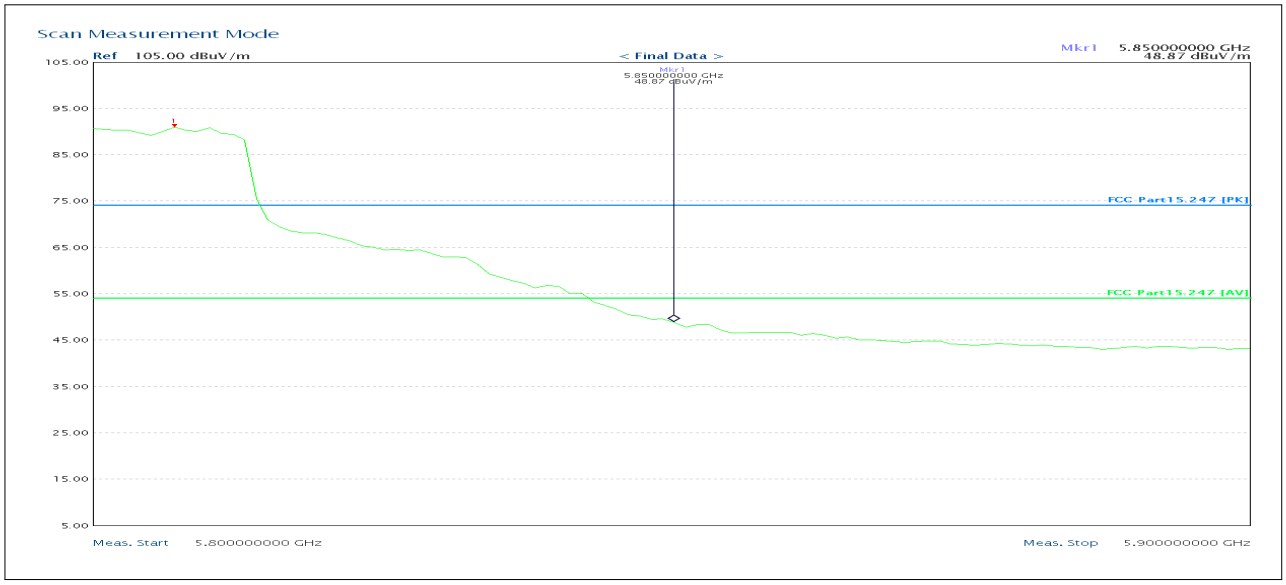
5795MHz

Detector mode: Peak Polarity: Vertical



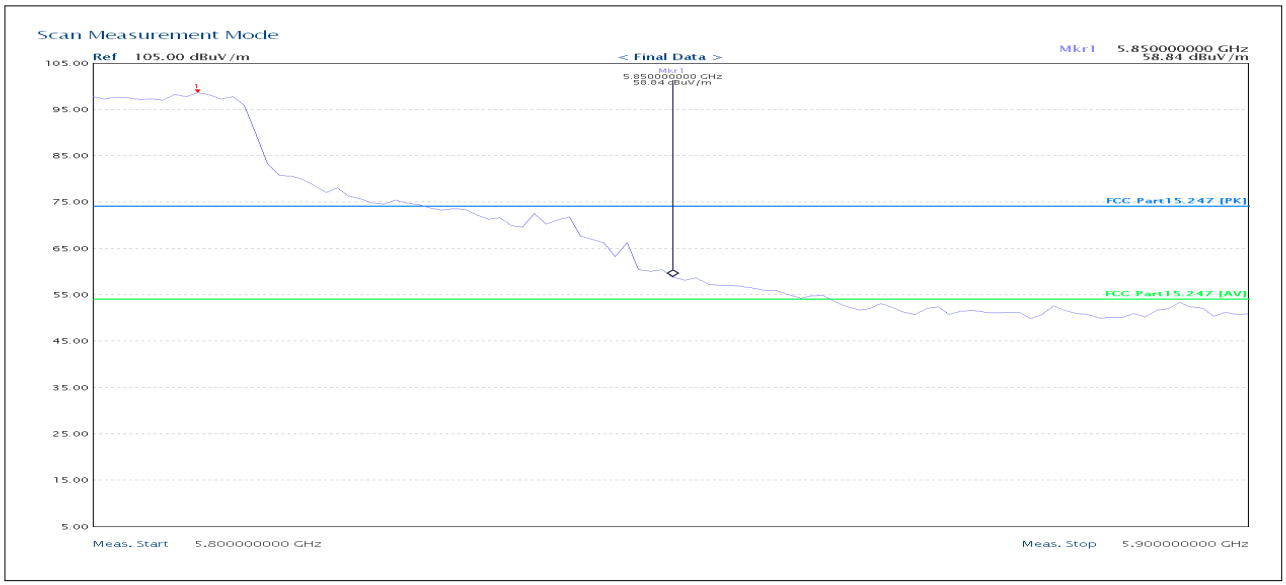
Frequency (MHz)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
5725.00	57.01	74.00	16.99

Detector mode: Average Polarity: Vertical



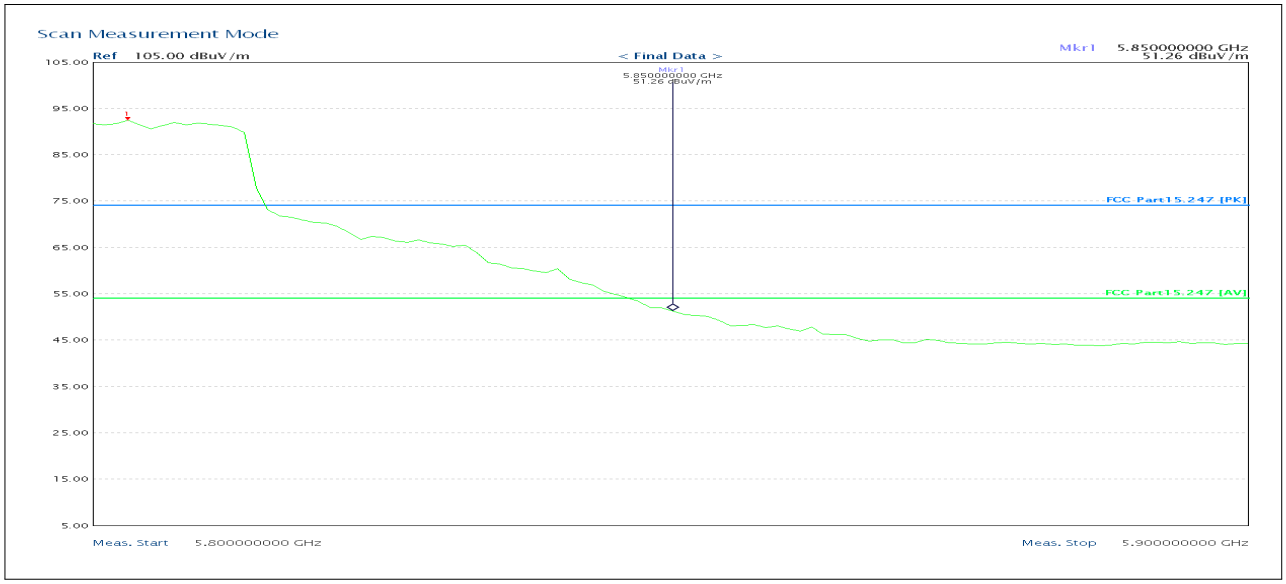
Frequency (MHz)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
5725.00	48.87	54.00	5.13

Detector mode: Peak Polarity: Horizontal



Frequency (MHz)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
5725.00	58.84	74.00	15.16

Detector mode: Average Polarity: Horizontal



Frequency (MHz)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
5725.00	51.26	54.00	2.74

7.4. Power Spectral Density Measurement

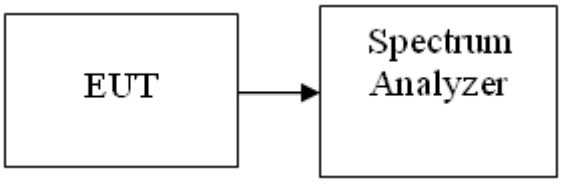
LIMIT

According to §15.407(a),

For the band 5.725–5.85 GHz, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band.

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

Test Configuration



TEST PROCEDURE

1. The testing follows Method SA-2 of FCC KDB 789033 D01 General UNII Test Procedures v01r03.
2. Measure the duty cycle, Set span to encompass the entire emission bandwidth (EBW) of the signal. Set RBW = 300 kHz. Set VBW ≥ 1 MHz. Number of points in sweep ≥ 2 Span / RBW. Sweep time = auto. Detector = RMS, Trace average at least 100 traces in power averaging mode. Add 10 log(500kHz/RBW) to the test result. Add 10 log(1/x), where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times. For example, add 10 log(1/0.25) = 6 dB if the duty cycle is 25 percent.
3. The RF output of EUT was connected to the spectrum analyzer by a low loss cable.
4. Each plot has already offset with cable loss, and attenuator loss. Measure the PPSD and record it.
5. For MIMO mode, calculation method follows FCC KDB 662911 D01 Multiple Transmitter Output v02r01.

Method (1): Measure and sum the spectra across the outputs. The total final Power Spectral Density is from a device with 2 transmitter outputs. The spectrum measurements of the individual outputs are all performed with the same span and number of points, the spectrum value in the first spectral bin of output 1 is summed with that in the first spectral bin of output 2 to obtain the value for the first frequency bin of the summed spectrum.

TEST RESULTS

No non-compliance noted

Test Data

Test mode: IEEE 802.11a mode /ANT 1

5745~5850MHz

Channel	Frequency (MHz)	Duty factor (dB)	Average PSD (dBm/MHz)	Average PSD Limit (dBm)	Result
Low	5745	0.19	-1.89	17.00	PASS
Mid	5785	0.19	-2.40	17.00	PASS
High	5825	0.19	-3.50	17.00	PASS

Test mode: IEEE 802.11a mode /ANT 2

5745~5850MHz

Channel	Frequency (MHz)	Duty factor (dB)	Average PSD (dBm/MHz)	Average PSD Limit (dBm)	Result
Low	5745	0.20	0.87	17.00	PASS
Mid	5785	0.20	-0.29	17.00	PASS
High	5825	0.20	-1.39	17.00	PASS

Test mode: IEEE 802.11a mode /ANT 1+2

5745~5850MHz

Channel	Frequency (MHz)	Duty factor (dB)	Average PSD (dBm/MHz)	Average PSD Limit (dBm)	Result
Low	5745	0.18	4.41	17.00	PASS
Mid	5785	0.18	3.73	17.00	PASS
High	5825	0.18	3.11	17.00	PASS

Test mode: draft 802.11n Standard-20 MHz Channel mode / ANT 1

5745~5850MHz

Channel	Frequency (MHz)	Duty factor (dB)	Average PSD (dBm/MHz)	Average PSD Limit (dBm)	Result
Low	5745	0.20	-1.95	17.00	PASS
Mid	5785	0.20	-2.63	17.00	PASS
High	5825	0.20	-3.50	17.00	PASS

Test mode: draft 802.11n Standard-20 MHz Channel mode / ANT 2

5745~5850MHz

Channel	Frequency (MHz)	Duty factor (dB)	Average PSD (dBm/MHz)	Average PSD Limit (dBm)	Result
Low	5745	0.20	0.97	17.00	PASS
Mid	5785	0.20	-0.38	17.00	PASS
High	5825	0.20	-1.49	17.00	PASS

Test mode: draft 802.11n Standard-20 MHz Channel mode / ANT 1+2

5745~5850MHz

Channel	Frequency (MHz)	Duty factor (dB)	Average PSD (dBm/MHz)	Average PSD Limit (dBm)	Result
Low	5745	0.32	3.54	17.00	PASS
Mid	5785	0.32	2.06	17.00	PASS
High	5825	0.32	1.73	17.00	PASS

Test mode: draft 802.11n Wide-40 MHz Channel mode / ANT 1

5745~5850MHz

Channel	Frequency (MHz)	Duty factor (dB)	Average PSD (dBm/MHz)	Average PSD Limit (dBm)	Result
Low	5755	0.34	-5.57	17.00	PASS
High	5795	0.34	-5.95	17.00	PASS

Test mode: draft 802.11n Wide-40 MHz Channel mode / ANT 2

5745~5850MHz

Channel	Frequency (MHz)	Duty factor (dB)	Average PSD (dBm/MHz)	Average PSD Limit (dBm)	Result
Low	5755	0.35	-2.60	17.00	PASS
High	5795	0.35	-3.86	17.00	PASS

Test mode: draft 802.11n Wide-40 MHz Channel mode / ANT 1+2

5745~5850MHz

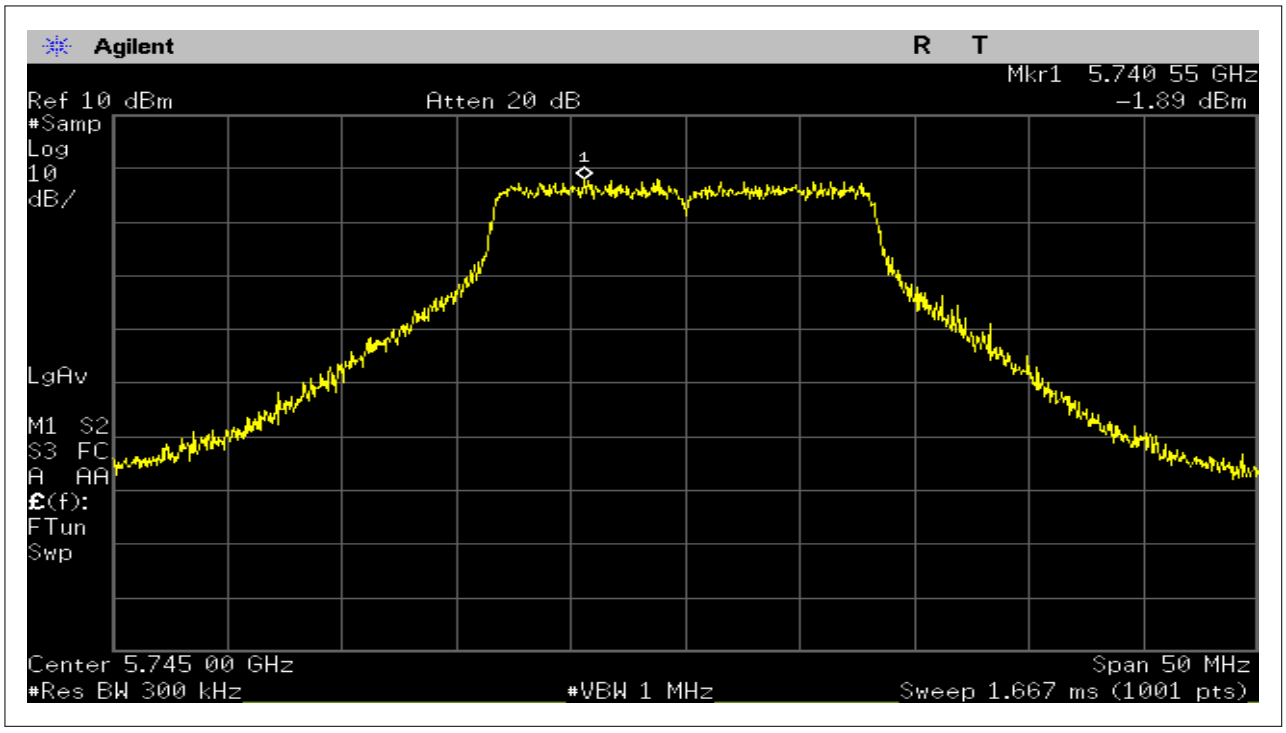
Channel	Frequency (MHz)	Duty factor (dB)	Average PSD (dBm/MHz)	Average PSD Limit (dBm)	Result
Low	5755	0.53	0.58	17.00	PASS
High	5795	0.53	-1.09	17.00	PASS

Test Plot

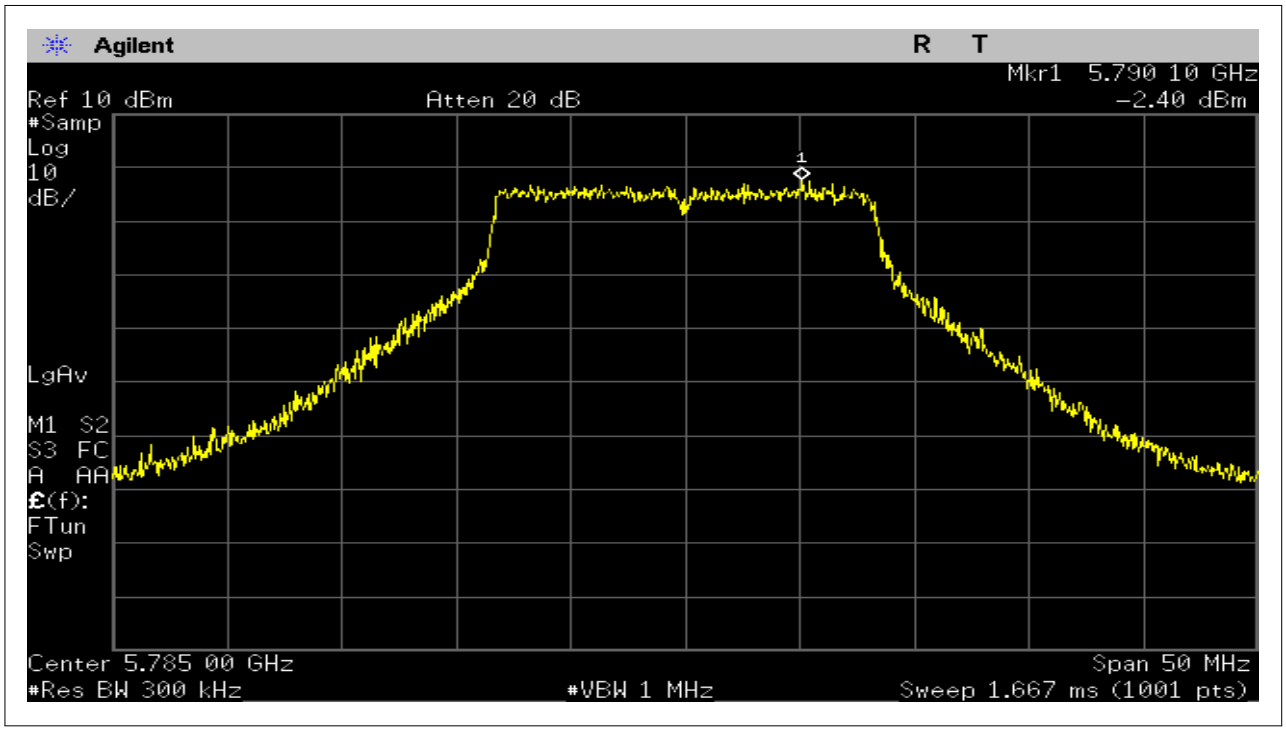
IEEE 802.11a mode/ANT 1:

5745~5850MHz

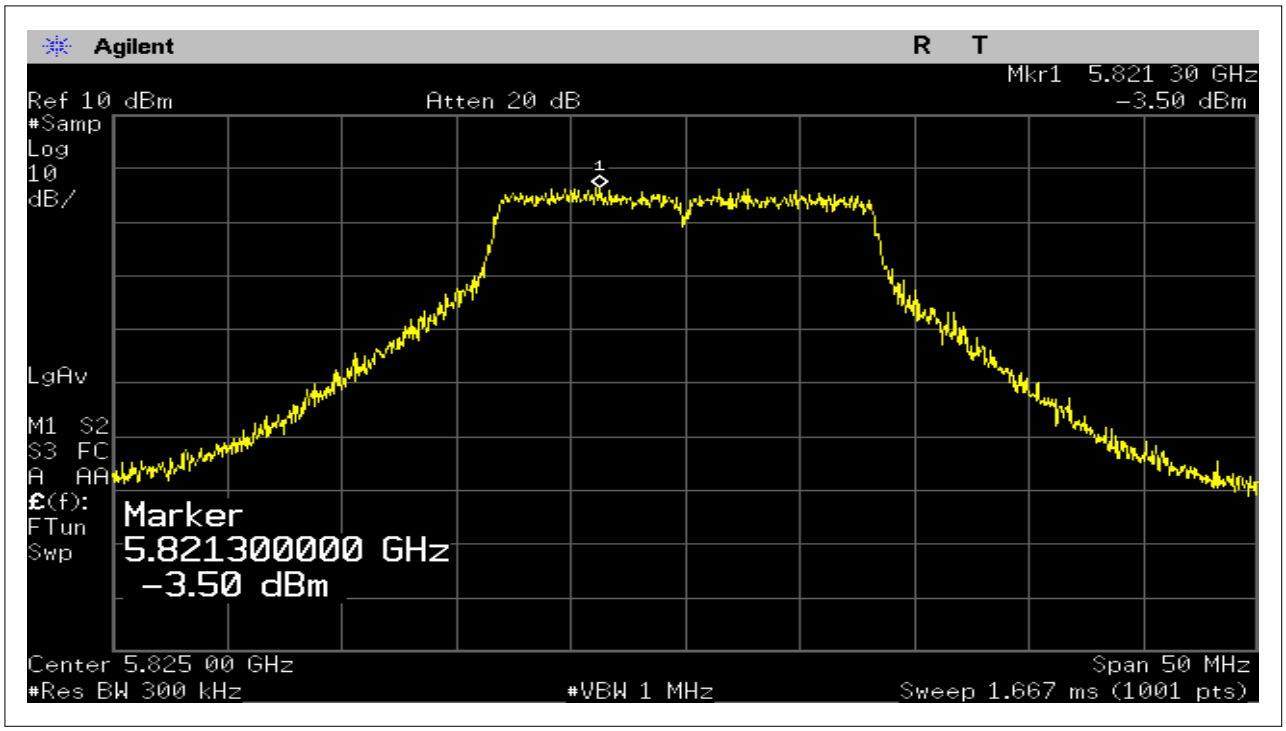
CH Low



CH Mid



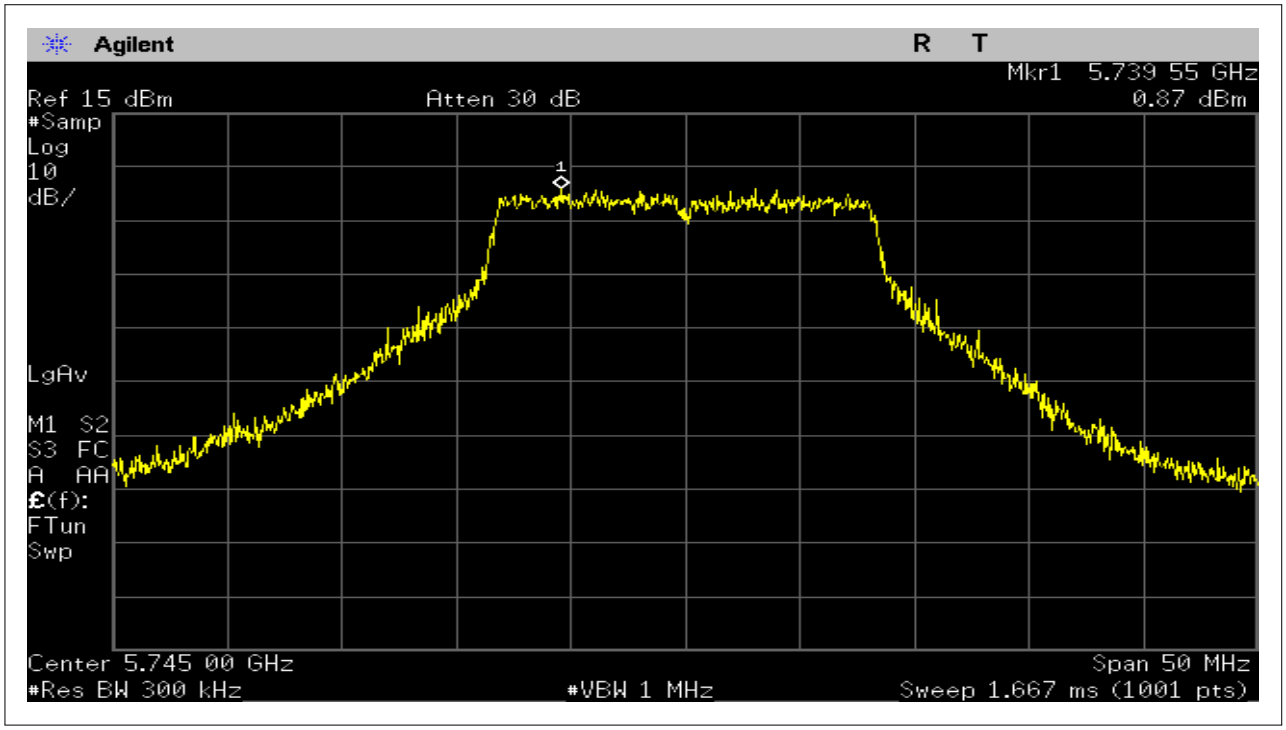
CH High



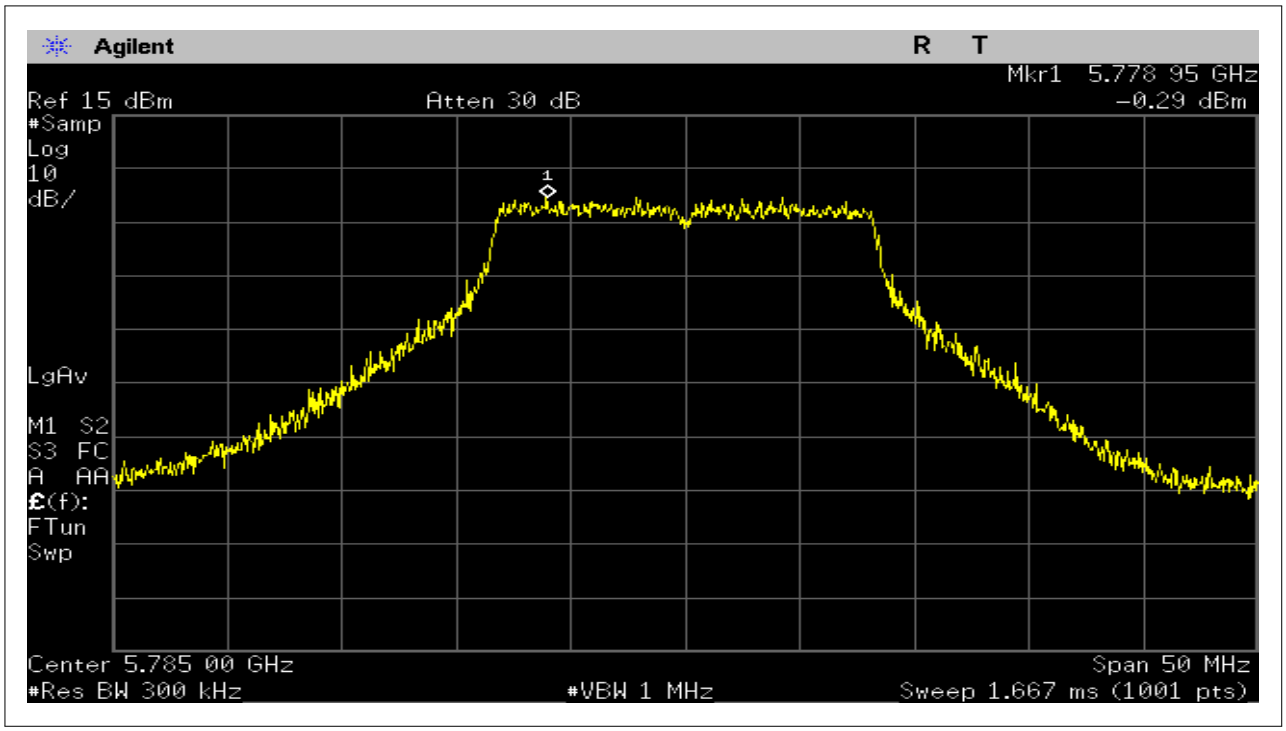
IEEE 802.11a mode/ANT 2:

5745~5850MHz

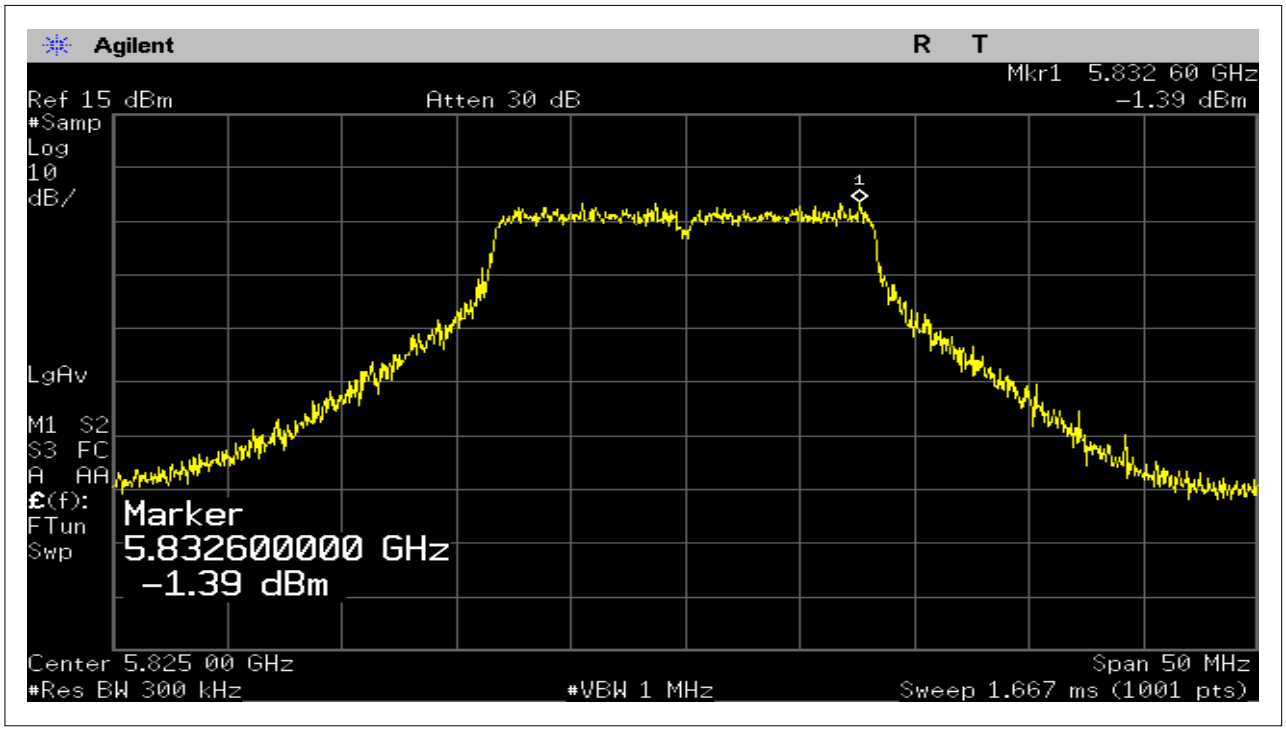
CH Low



CH Mid



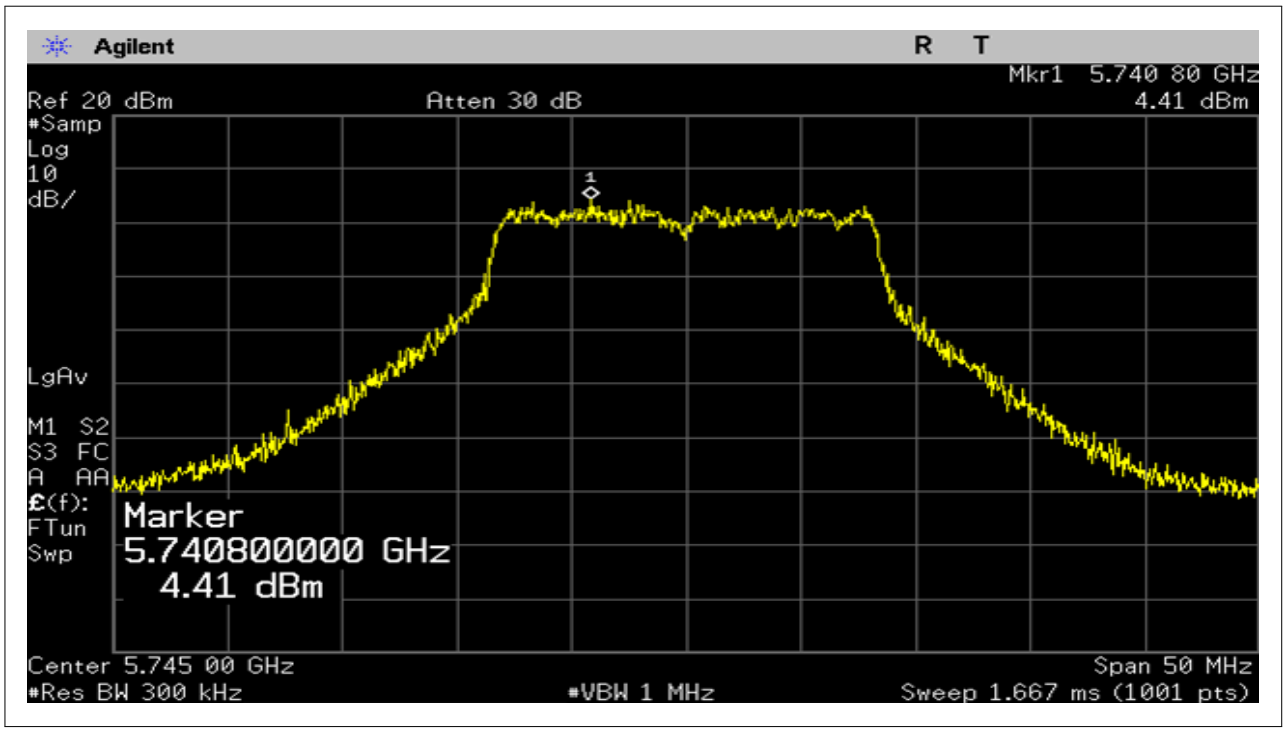
CH High



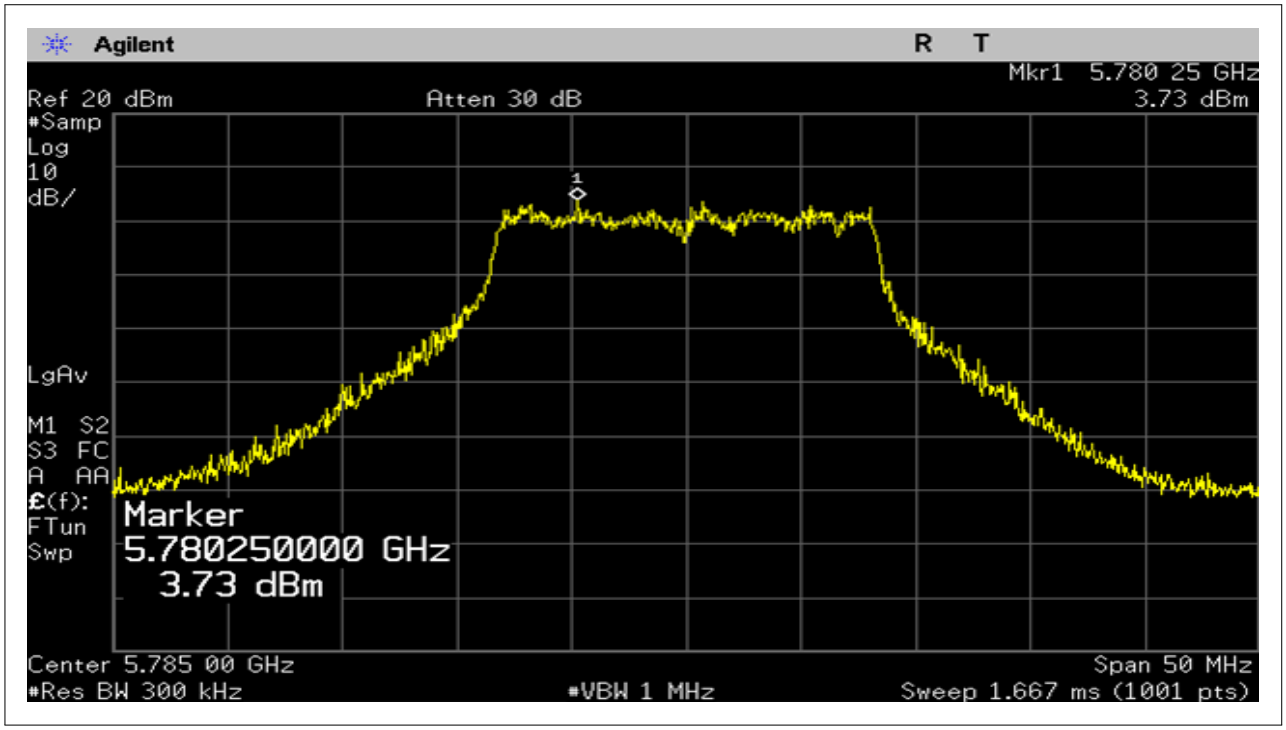
IEEE 802.11a mode/ANT 1+2:

5745~5850MHz

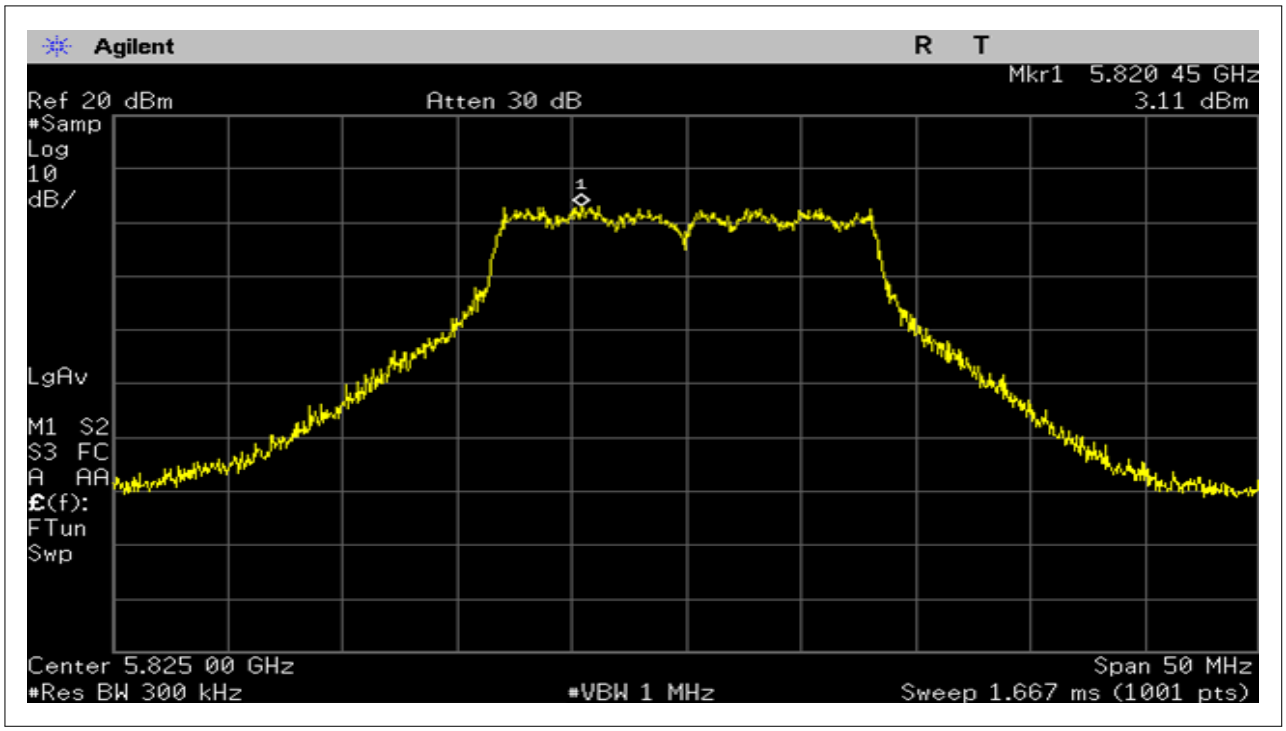
CH Low



CH Mid



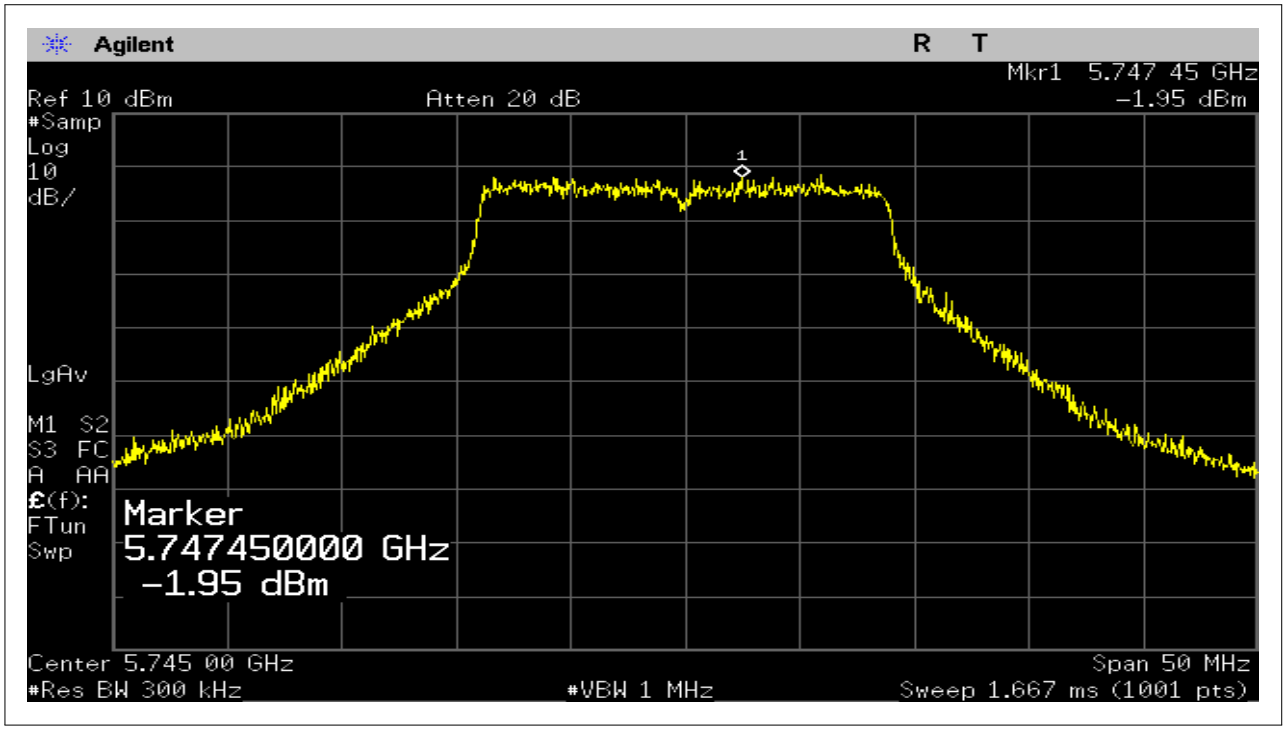
CH High



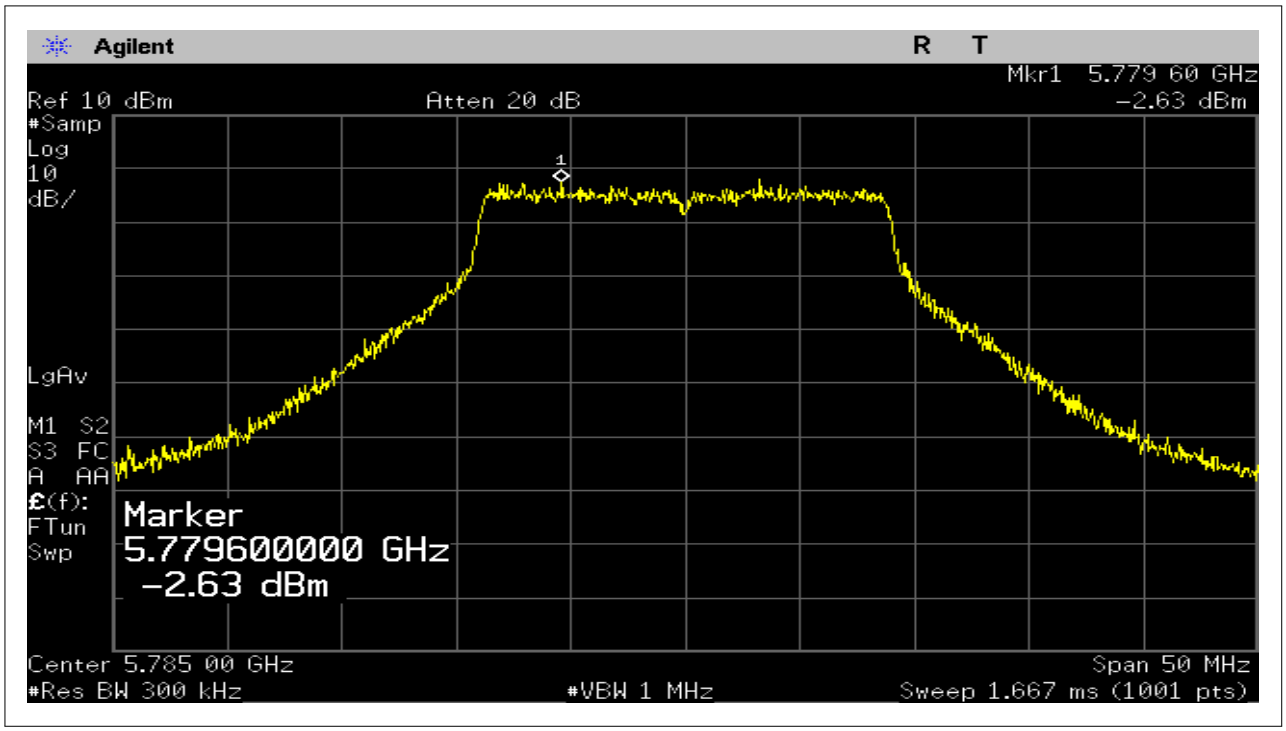
draft 802.11n Standard-20 MHz Channel mode / ANT 1

5745~5850MHz

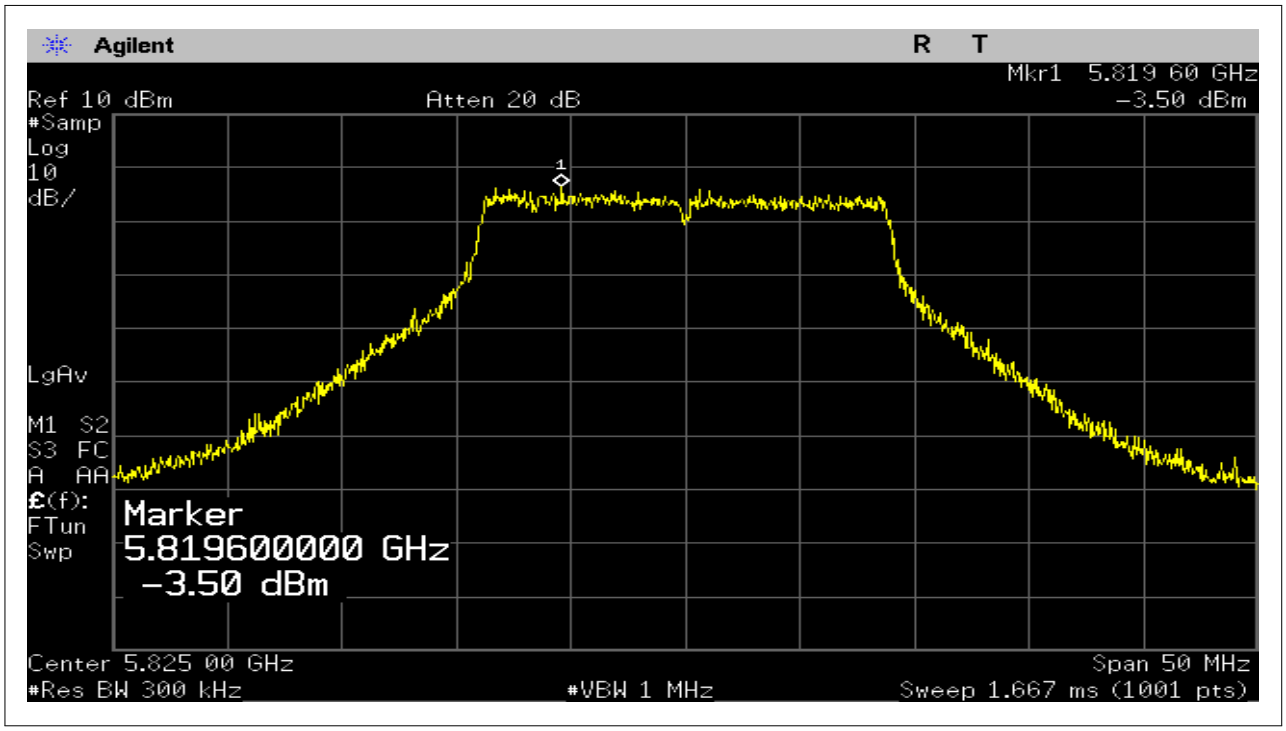
CH Low



CH Mid



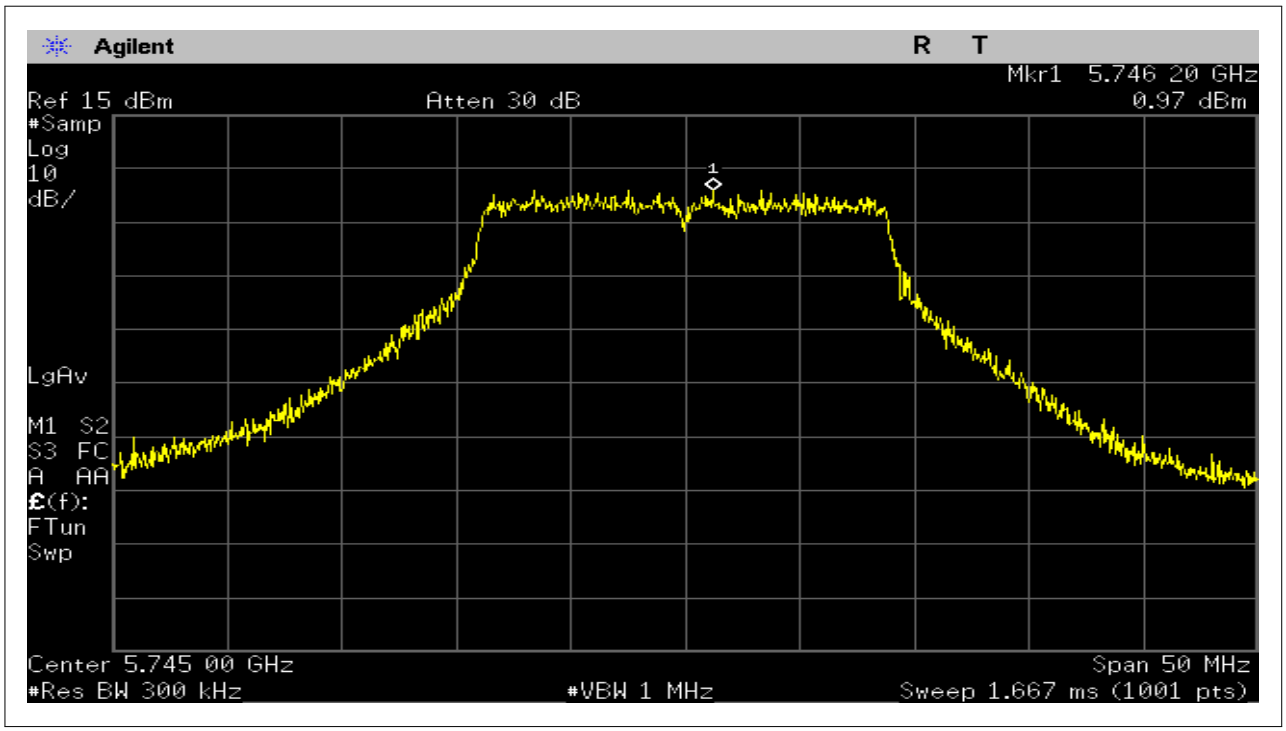
CH High



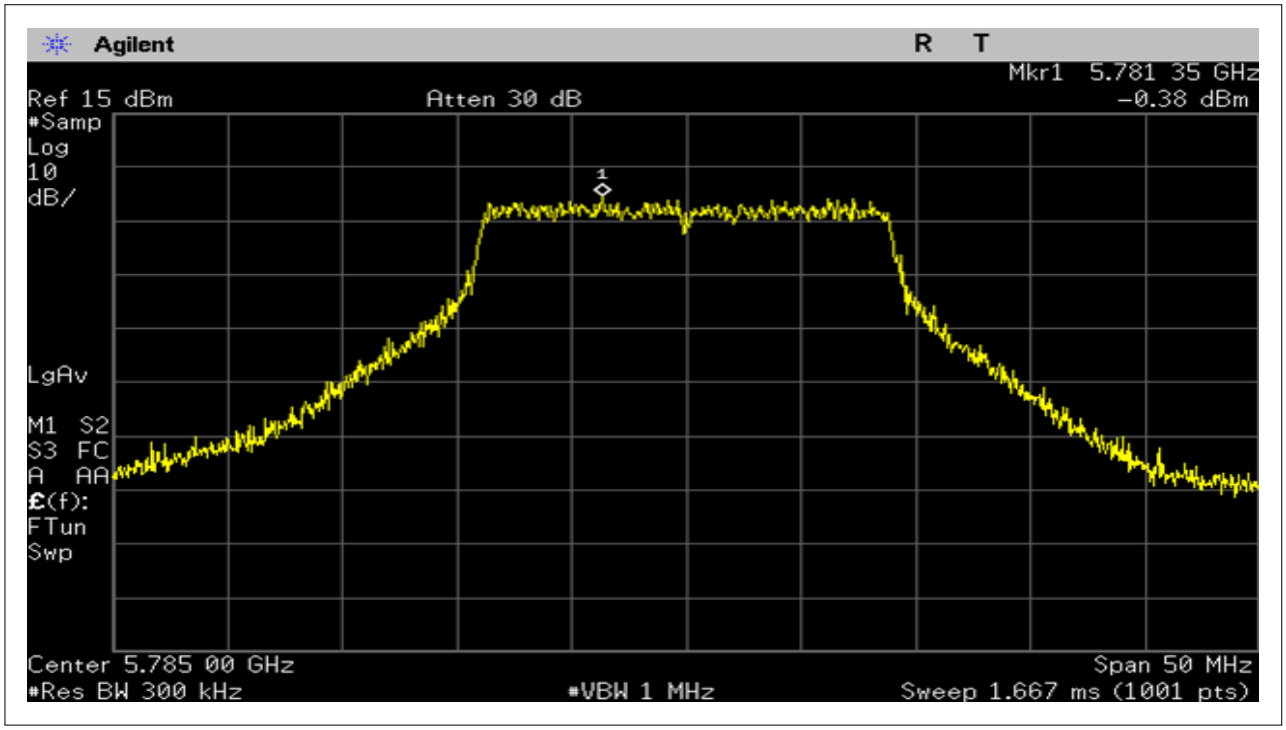
draft 802.11n Standard-20 MHz Channel mode / ANT 2

5745~5850MHz

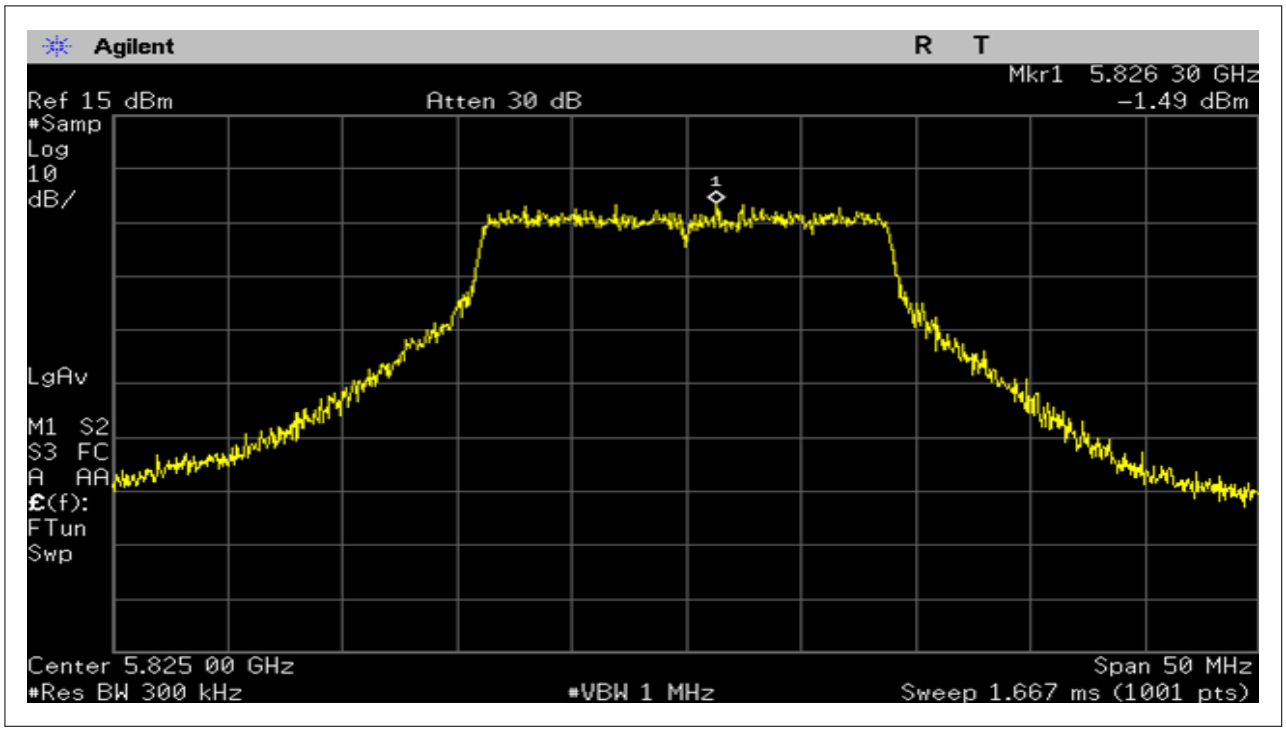
CH Low



CH Mid



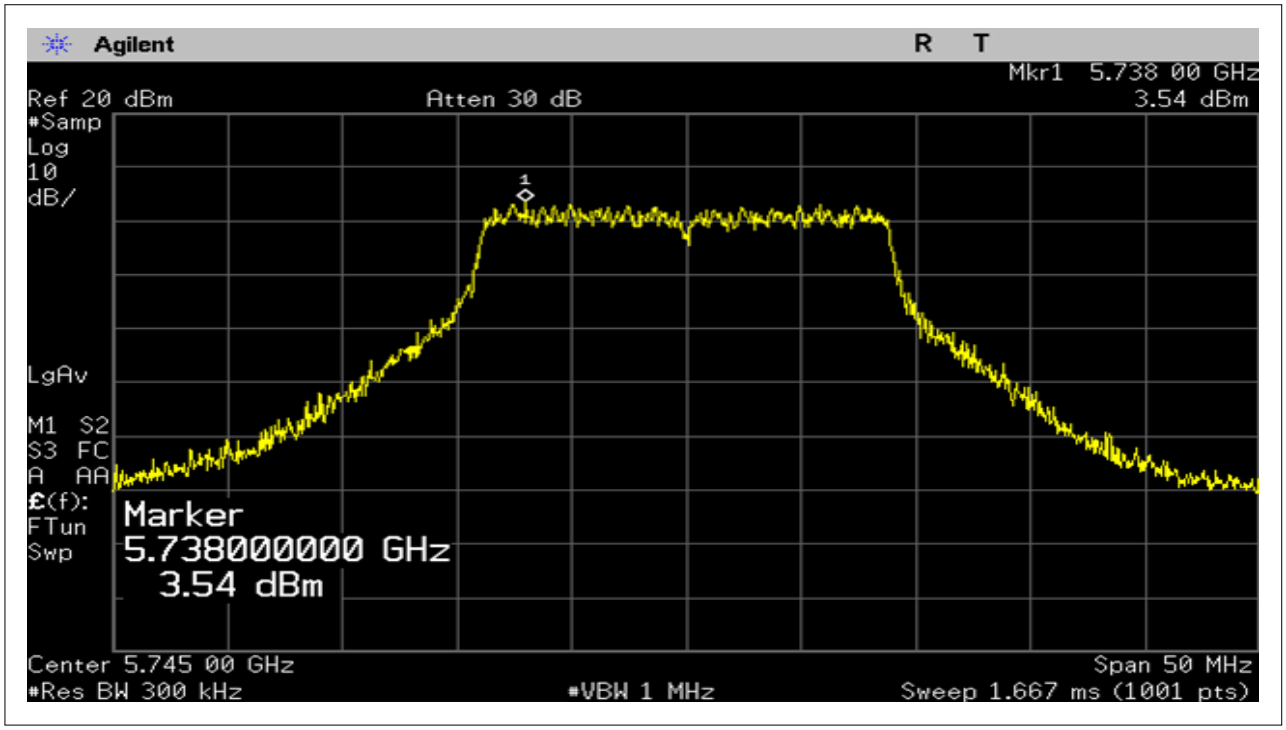
CH High



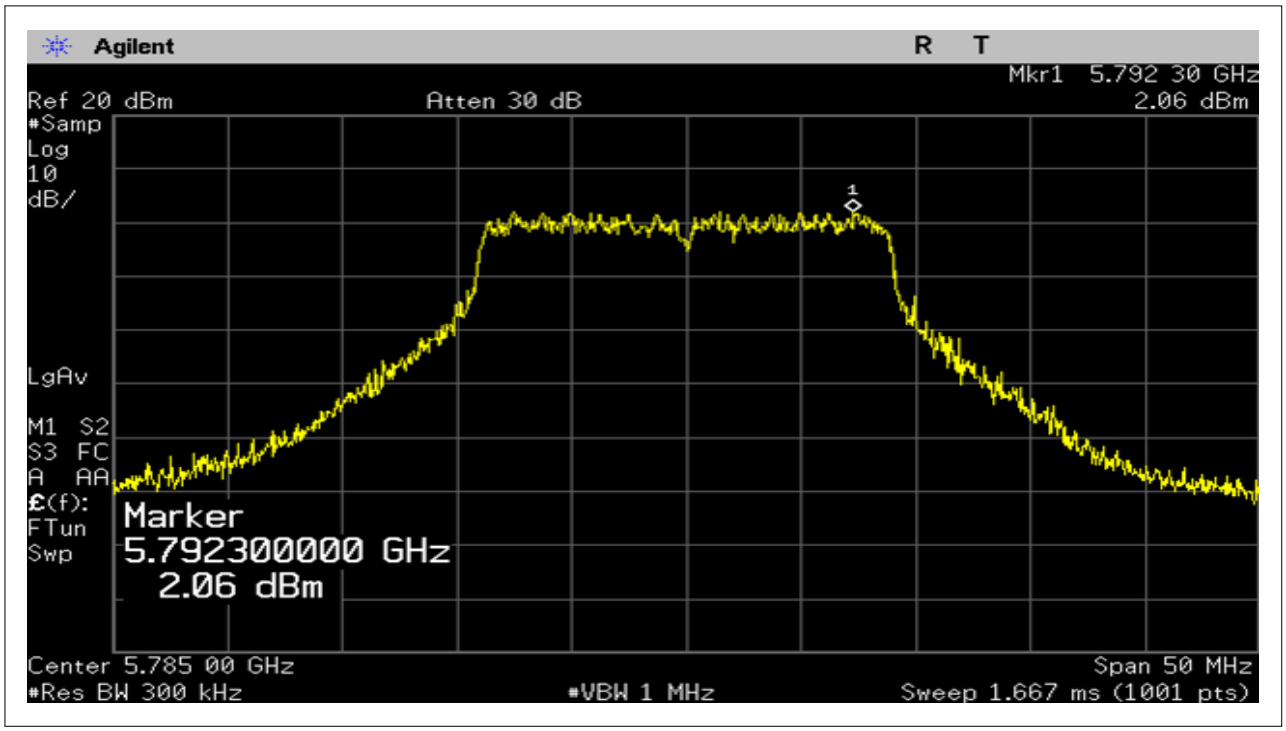
draft 802.11n Standard-20 MHz Channel mode / ANT 1+2

5745~5850MHz

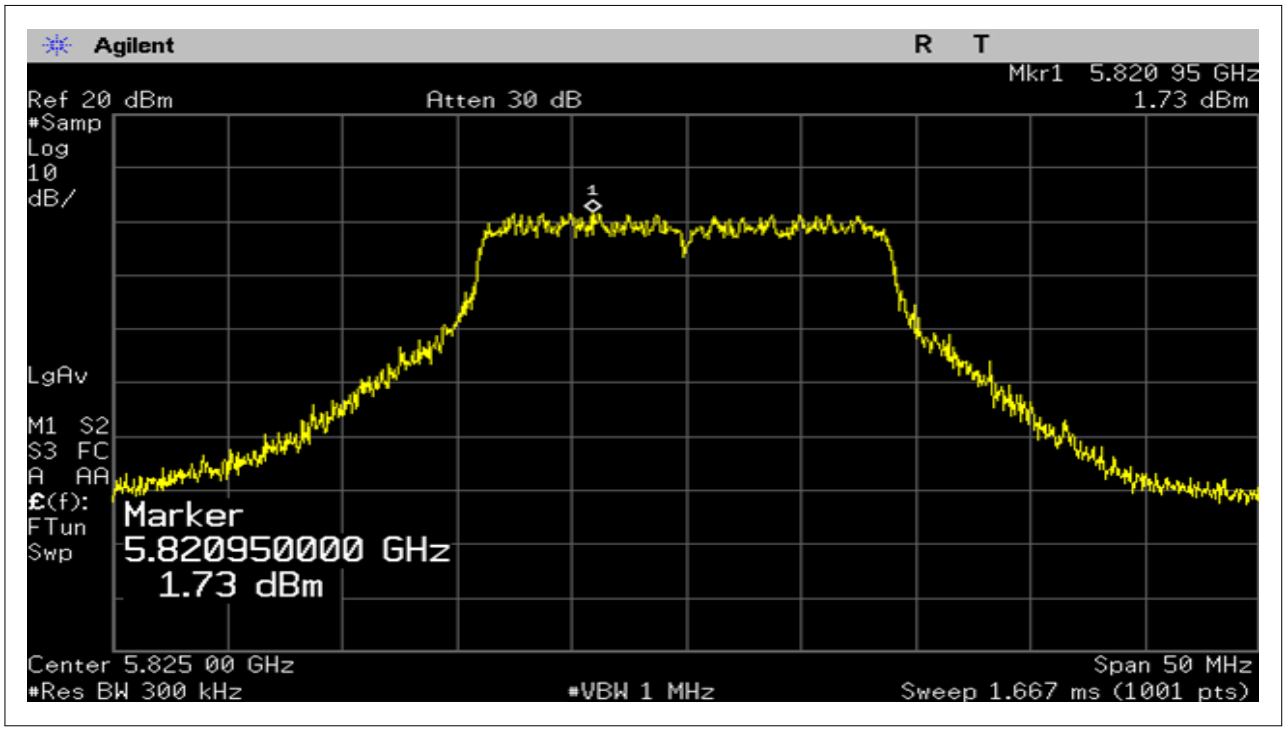
CH Low



CH Mid



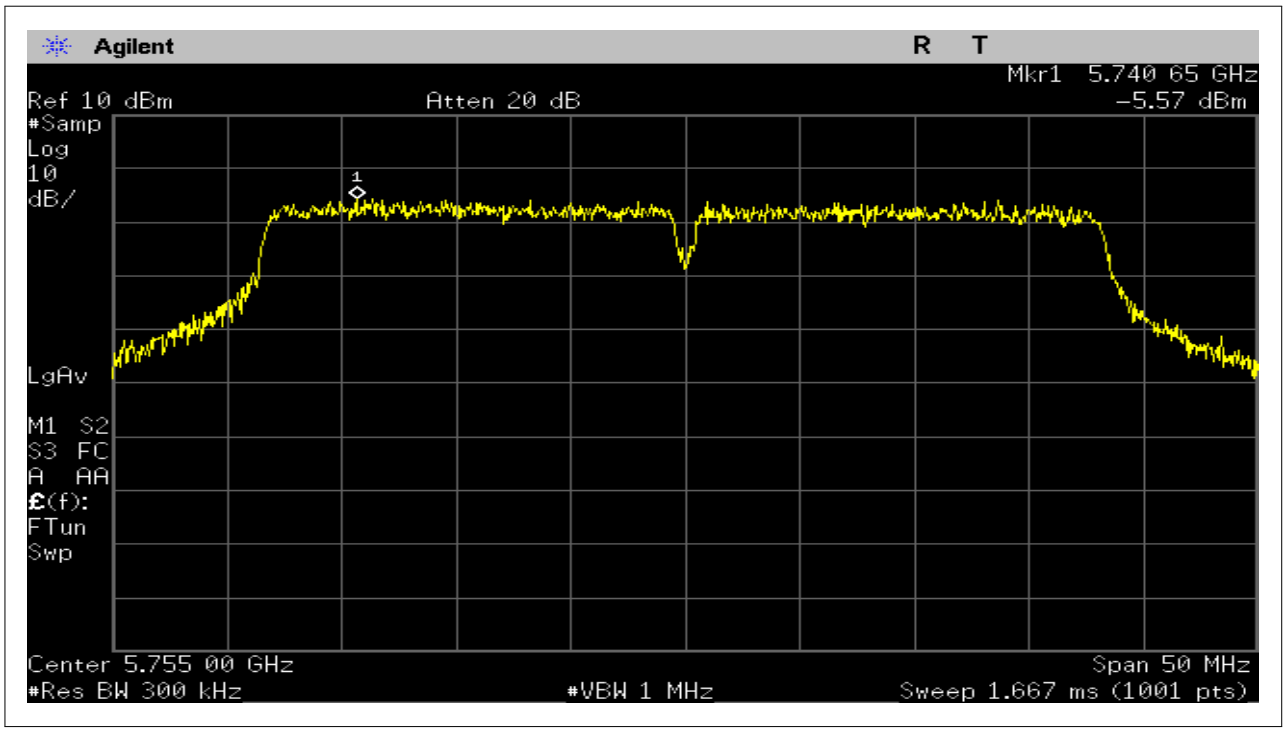
CH High



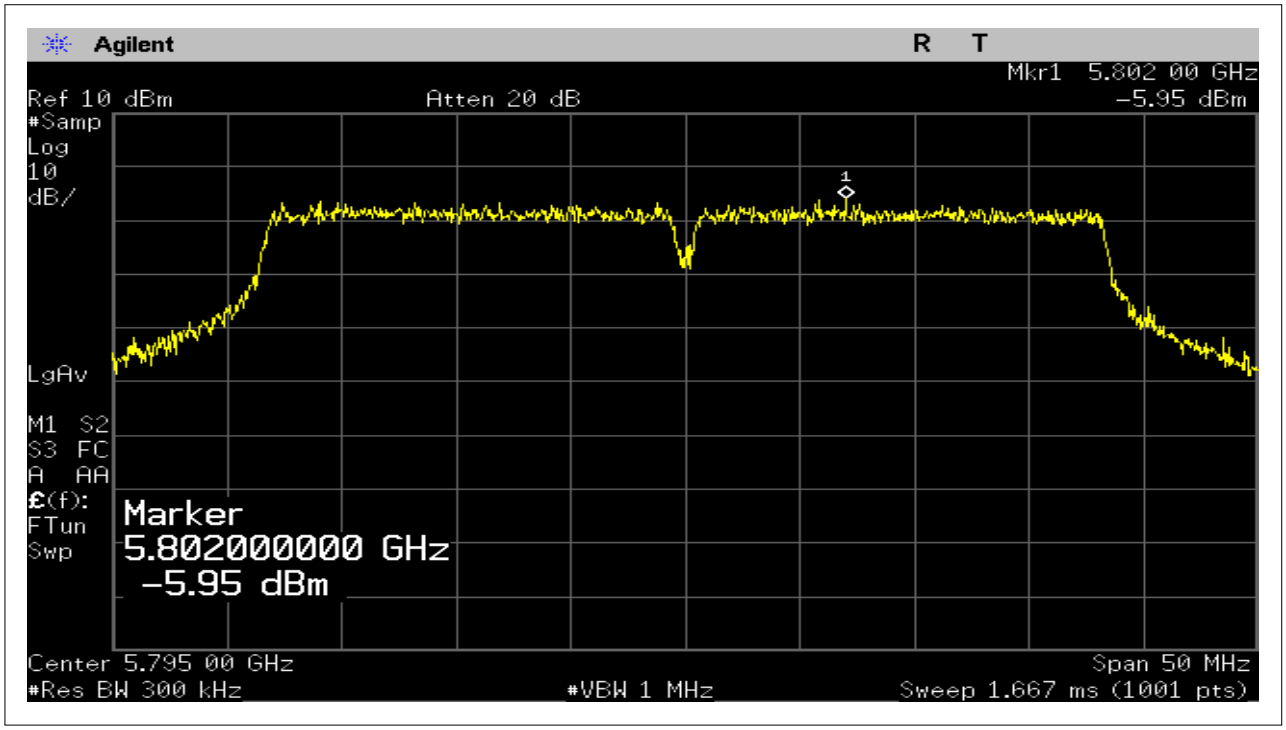
draft 802.11n Wide-40 MHz Channel mode / ANT 1

5745~5850MHz

CH Low



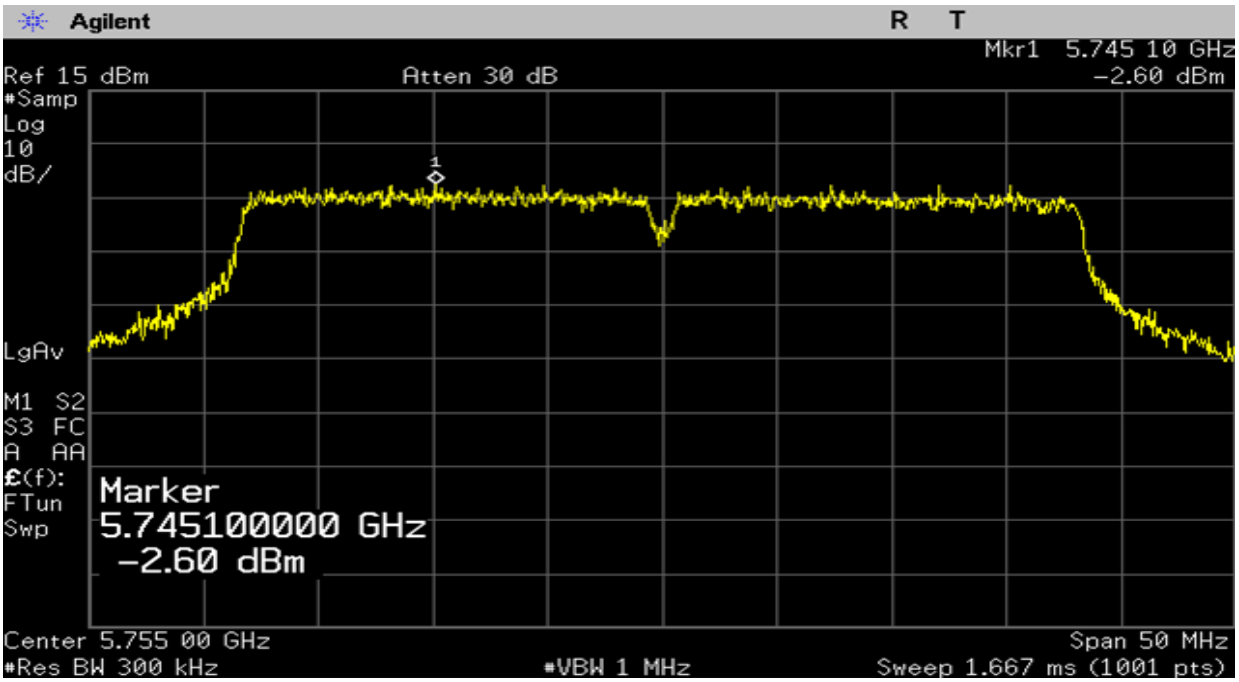
CH High



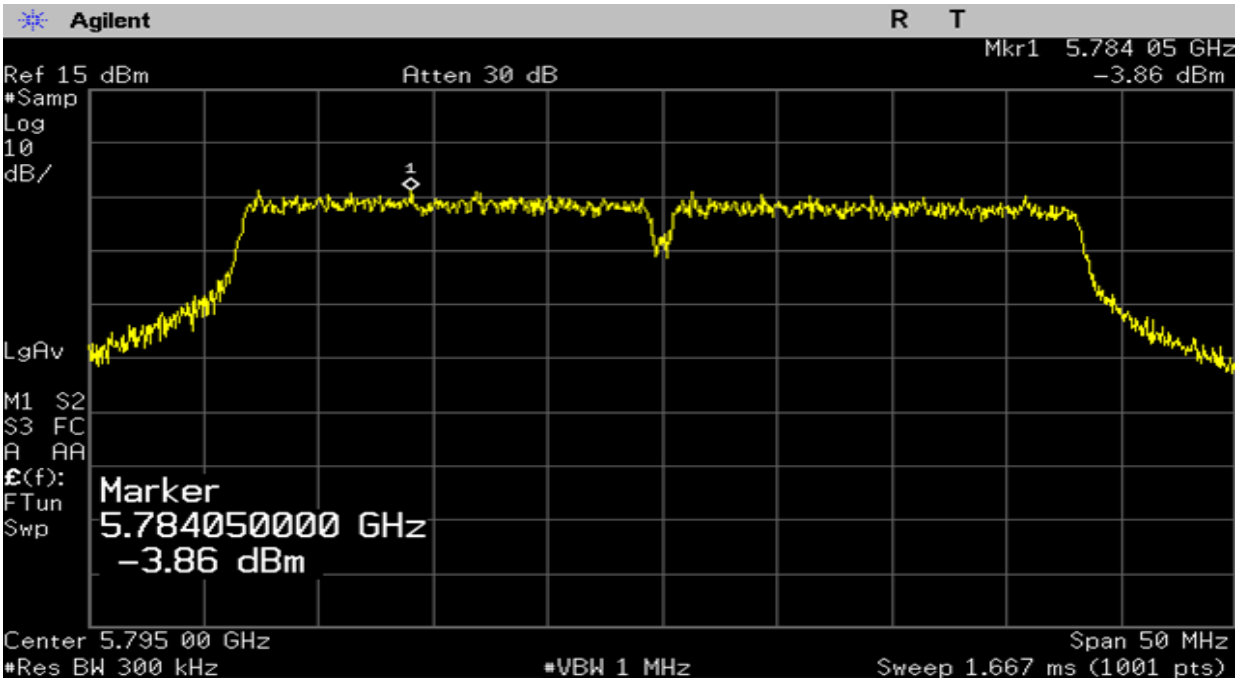
draft 802.11n Wide-40 MHz Channel mode / ANT 2

5745~5850MHz

CH Low



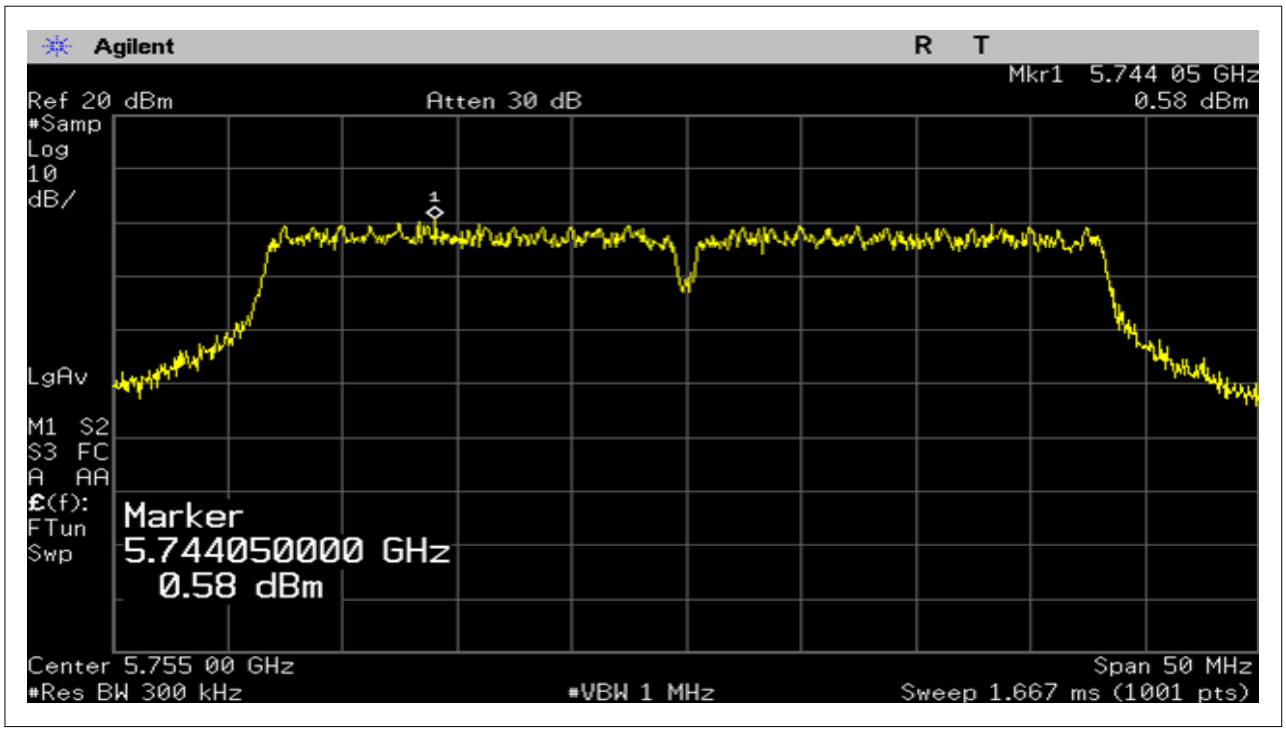
CH High



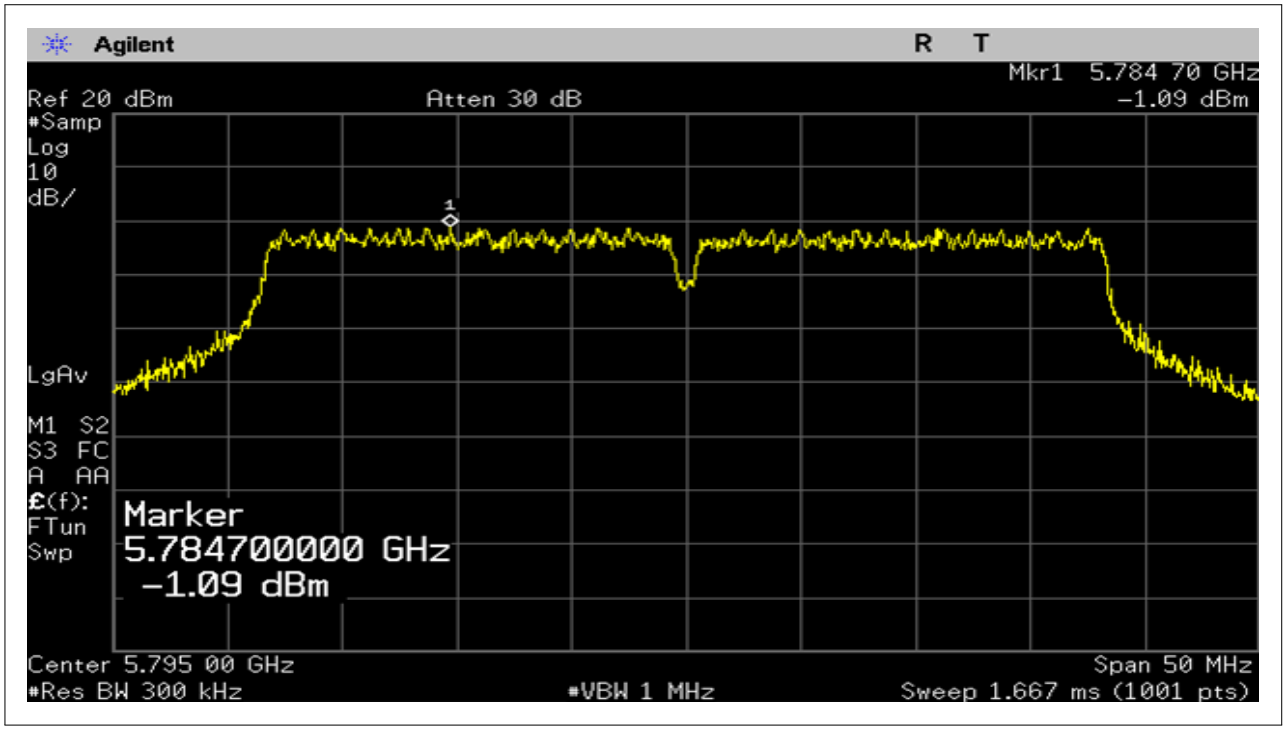
draft 802.11n Wide-40 MHz Channel mode / ANT 1+2

5745~5850MHz

CH Low



CH High



7.5. Radiated Undesirable Emission

LIMIT

Radiated emissions from 9 kHz to 25 GHz were measured according to the methods defines in ANSI C63.4-2009. The EUT was placed, 0.8 meter above the ground plane, as shown in section 5.6.3. The interface cables and equipment positions were varied within limits of reasonable applications to determine the positions producing maximum radiated emissions

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

FREQUENCIES (MHz)	FIELD STRENGTH (microvolts/meter)	MEASUREMENT DISTANCE (meters)
0.009~0.490	2400/F(kHz)	300
0.490~1.705	24000/F(kHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

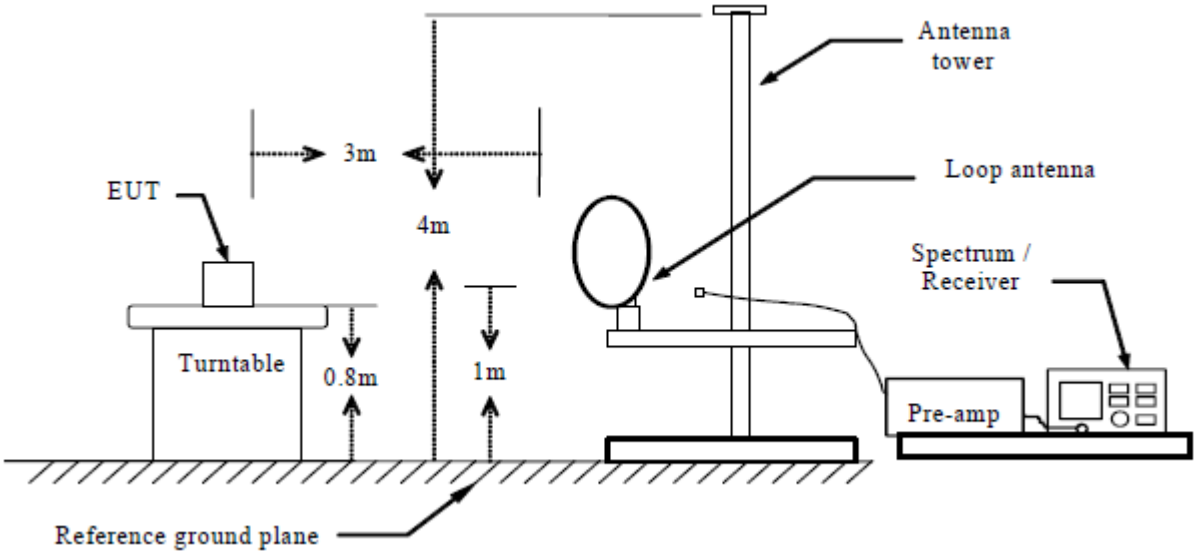
Remark: Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of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

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

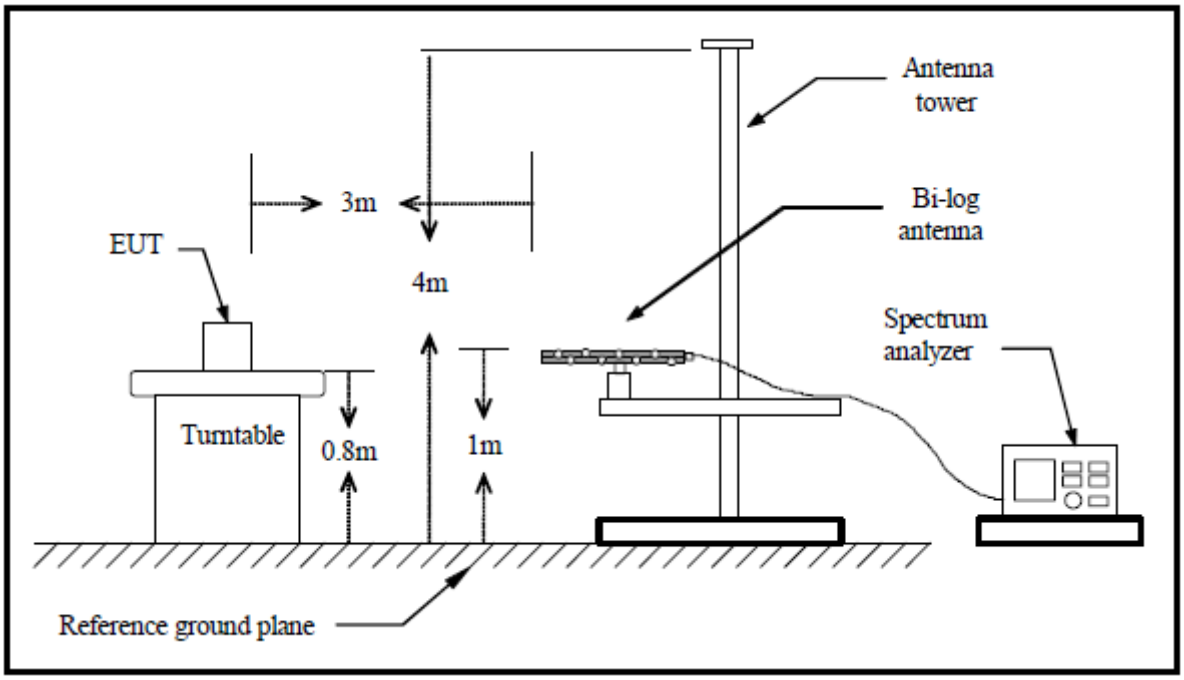
Frequency (MHz)	Field Strength (µV/m at 3-meter)	Field Strength (dBµV/m at 3-meter)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

Test Configuration

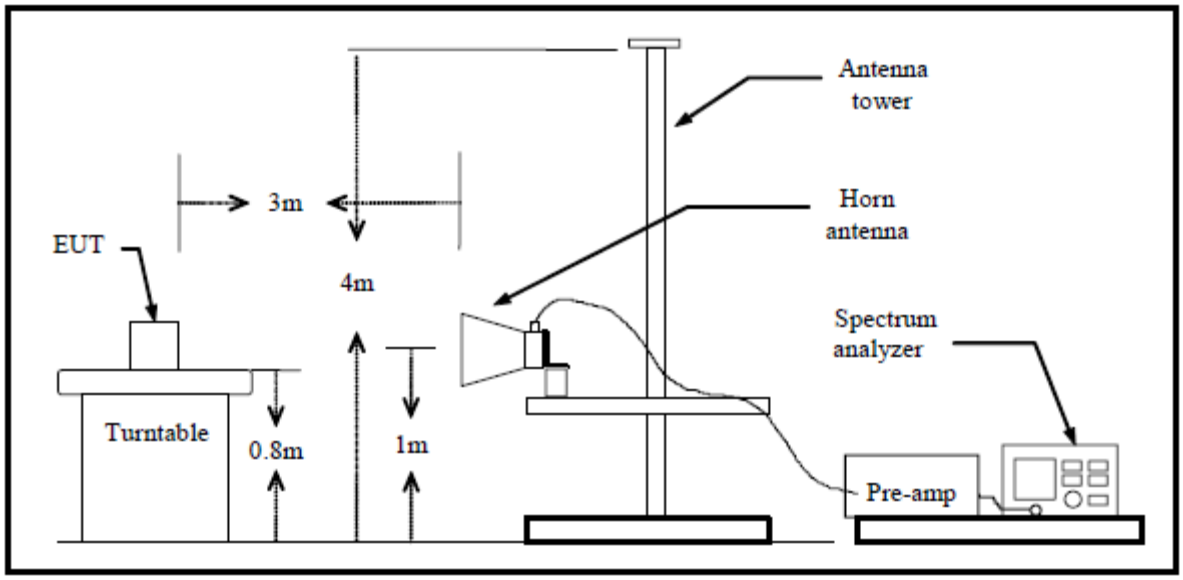
Below 30MHz



Below 1 GHz



Above 1 GHz



TEST PROCEDURE

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

   Below 1GHz:

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

   Above 1GHz:

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

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

TEST RESULTS

Test mode: ANT 1

30 MHz ~ 1 GHz

Frequency (MHz)	Detect Mode	Ant. Pol. (H/V)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
82.93	PK	V	15.93	9.66	25.59	40.00	14.41
163.34	PK	V	11.55	15.23	26.78	43.5	16.72
271.82	PK	V	16.95	15.59	32.54	46.00	13.46
380.41	PK	V	19.34	19.05	38.39	46.00	7.61
500.25	PK	V	8.17	22.26	30.43	46.00	15.57
720.52	PK	V	7.50	27.16	34.66	46.00	11.34
100.46	PK	H	14.14	11.17	25.31	43.50	18.19
163.34	PK	H	15.73	15.23	30.96	43.50	12.54
233.92	PK	H	14.34	13.78	28.12	46.00	17.88
432.40	PK	H	14.67	20.52	35.19	46.00	10.81
528.56	PK	H	12.37	23.04	35.41	46.00	10.59
801.52	PK	H	13.00	28.73	41.73	46.00	4.27

1 GHz ~ 40 GHz

Frequency (MHz)	Detect Mode	Polarization (V/H)	Reading (dBuV)	Correct Factor (dB/m)	Amplifier Gain (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
1599.00	PK	V	42.50	29.96	26.54	45.92	74.00	28.08
1599.00	AV	V	45.24	29.96	26.54	48.66	54.00	5.34
2398.00	PK	V	37.52	34.59	25.80	46.30	74.00	27.70
2398.00	AV	V	40.06	34.59	25.80	48.84	54.00	5.16
2498.00	PK	V	38.94	34.30	25.70	47.53	74.00	26.47
2498.00	AV	V	36.81	34.30	25.70	45.40	54.00	8.60
1601.00	PK	H	44.42	30.33	26.46	48.29	74.00	25.71
1601.00	AV	H	37.41	30.33	26.46	41.28	54.00	12.72
2497.50	PK	H	42.60	34.30	25.70	51.19	74.00	22.81
2497.50	AV	H	40.76	34.30	25.70	49.35	54.00	4.65
3000.00	PK	H	37.43	34.51	25.14	46.80	74.00	27.20
3000.00	AV	H	35.02	34.51	25.14	44.39	54.00	9.61

Remark:

1. Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).

Test mode: ANT 2

30 MHz ~ 1 GHz

Frequency (MHz)	Detect Mode	Ant. Pol. (H/V)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
48.71	PK	V	13.32	13.02	26.34	40.00	13.66
163.34	PK	V	13.14	15.23	28.37	43.50	15.13
271.82	PK	V	16.69	15.59	32.28	46.00	13.72
380.41	PK	V	18.32	19.05	37.37	46.00	8.63
500.26	PK	V	8.66	22.26	30.92	46.00	15.08
720.52	PK	V	7.27	27.16	34.43	46.00	11.57
40.89	PK	H	17.26	12.67	29.93	40.00	10.07
102.71	PK	H	16.92	11.42	28.34	43.50	15.16
240.43	PK	H	13.12	14.13	27.25	46.00	18.75
380.41	PK	H	12.72	19.05	31.77	46.00	14.23
528.56	PK	H	11.27	23.04	34.31	46.00	11.69
801.17	PK	H	8.54	28.73	37.27	46.00	8.73

1 GHz ~ 40 GHz

Frequency (MHz)	Detect Mode	Polarization (V/H)	Reading (dBuV)	Correct Factor (dB/m)	Amplifier Gain (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
1598.50	PK	V	43.55	29.96	26.54	46.97	74.00	27.03
1598.50	AV	V	36.64	29.96	26.54	40.06	54.00	13.94
2498.50	PK	V	40.47	34.30	25.70	49.06	74.00	24.94
2498.50	AV	V	38.29	34.30	25.70	46.88	54.00	7.12
4889.00	PK	V	30.39	39.84	23.51	46.72	74.00	27.28
4889.00	AV	V	25.00	39.84	23.51	41.33	54.00	12.67
1601.50	PK	H	44.82	30.33	26.46	48.69	74.00	25.31
1601.50	AV	H	38.84	30.33	26.46	42.71	54.00	11.29
2498.50	PK	H	41.73	34.30	25.70	50.32	74.00	23.68
2498.50	AV	H	39.61	34.30	25.70	48.20	54.00	5.80
5147.00	PK	H	35.10	40.21	23.68	51.63	74.00	22.37
5147.00	AV	H	28.18	40.21	23.68	44.71	54.00	9.29

Remark:

1. Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).

Test mode: ANT 1+2

30 MHz ~ 1 GHz

Frequency (MHz)	Detect Mode	Ant. Pol. (H/V)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
78.20	PK	V	15.08	9.92	25.00	40.00	15.00
163.34	PK	V	13.47	15.23	28.70	43.50	14.80
271.82	PK	V	16.40	15.59	31.99	46.00	14.01
380.41	PK	V	20.03	19.05	39.08	46.00	6.92
500.25	PK	V	8.60	22.26	30.86	46.00	15.14
720.52	PK	V	7.96	27.16	35.12	46.00	10.88
102.00	PK	H	15.51	11.34	26.85	43.50	16.65
144.39	PK	H	10.54	14.96	25.50	43.50	18.00
233.56	PK	H	13.52	13.76	27.28	46.00	18.72
380.41	PK	H	12.86	19.05	31.91	46.00	14.09
528.56	PK	H	10.56	23.04	33.60	46.00	12.40
799.98	PK	H	9.05	28.71	37.76	46.00	8.24

1 GHz ~ 40 GHz

Frequency (MHz)	Detect Mode	Polarization (V/H)	Reading (dBuV)	Correct Factor (dB/m)	Amplifier Gain (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
1598.50	PK	V	45.51	29.96	26.54	48.93	74.00	25.07
1598.50	AV	V	38.62	29.96	26.54	42.04	54.00	11.96
2498.50	PK	V	41.16	34.30	25.70	49.75	74.00	24.25
2498.50	AV	V	39.53	34.30	25.70	48.12	54.00	5.88
4879.00	PK	V	34.88	39.84	23.51	51.21	74.00	22.79
4879.00	AV	V	27.98	39.84	23.51	44.31	54.00	9.69
1601.50	PK	H	45.06	30.33	26.46	48.93	74.00	25.07
1601.50	AV	H	38.17	30.33	26.46	42.04	54.00	11.96
2498.00	PK	H	41.16	34.30	25.70	49.75	74.00	24.25
2498.00	AV	H	39.53	34.30	25.70	48.12	54.00	5.88
5194.00	PK	H	34.68	40.21	23.68	51.21	74.00	22.79
5194.00	AV	H	27.78	40.21	23.68	44.31	54.00	9.69

Remark:

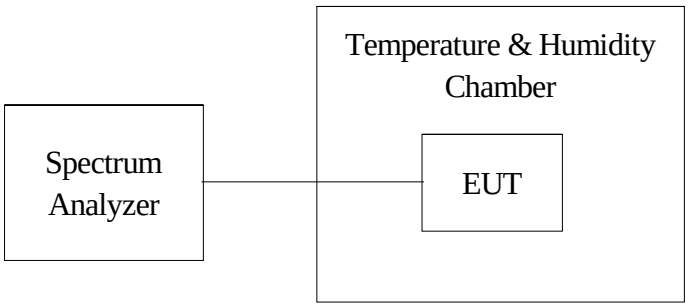
1. Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).

7.6. Frequency Stability

Limit

Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

Test Configuration



Test Procedures

1. The EUT is installed in an environment test chamber with external power source.
2. Set the chamber to operate at 50 centigrade and external power source to output at nominal voltage of EUT.
3. A sufficient stabilization period at each temperature is used prior to each frequency measurement.
4. When temperature is stabled, measure the frequency stability.
5. The test shall be performed under -20 to 50 centigrade and nominal voltage.

Test Data

Frequency: 5785 MHz	Frequency Drift (ppm)		
Temperature (℃)	0 minute	5 minutes	10 minutes
T 50 ℃ Vnom	-3.25	-3.18	-3.22
T 40 ℃ Vnom	-6.32	-5.27	-5.33
T 30 ℃ Vnom	-4.52	-4.44	-4.21
T 20 ℃ Vnom	-6.63	-6.59	-6.60
T 10 ℃ Vnom	0.71	0.69	0.67
T 0 ℃ Vnom	0.92	1.02	0.94
T −10 ℃ Vnom	1.33	1.28	1.40
T −20 ℃ Vnom	2.36	2.14	2.11
Vnom [Vdc]: 3.3			
Tmax [°C]: 50		Tmin [°C]: -20	

7.7. Radio Frequency Exposure Procedures

LIMIT

According to §15.247(i) and § 1.1307(b)(1) , systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines.

KDB 447498 D01: Approximate SAR test exclusion power thresholds at selected frequencies and test separation distances are illustrated in the following table:

MHz	5	10	15	20	25	mm
150	39	77	116	155	194	SAR Test Exclusion Threshold (mW)
300	27	55	82	110	137	
450	22	45	67	89	112	
835	16	33	49	66	82	
900	16	32	47	63	79	
1500	12	24	37	49	61	
1900	11	22	33	44	54	
2450	10	19	29	38	48	
3600	8	16	24	32	40	
5200	7	13	20	26	33	
5400	6	13	19	26	32	
5800	6	12	19	25	31	

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] · [√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where

- f(GHz) is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison

The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

Maximum Measured Transmitter Power:

TEST Mode	Maximum Peak Conducted Output Power		Max Antenna Gain (dBi)	Numeric antenna gain (mW)
	(dBm)	(mW)		
ANT 1	2.67	1.85	4.96	3.13
ANT 2	6.05	4.03	4.96	3.13
ANT 1+2	8.97	7.89	7.97	6.27

[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] · [√f(GHz)] = 7.89/25*√5.745 = 0.76≤ 3.0

Threshold at which no SAR required is 48mW and ≤ 3.0 for 1-g SAR, Separation distance is 25mm. Conclusion : The SAR measurement is exempt.