

FCC TEST REPORT

For

SUNVALLEYTEK INTERNATIONAL, INC.

FileHub

Model No.: RP-WD009

Prepared For : SUNVALLEYTEK INTERNATIONAL, INC.
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TEST REPORT

Applicant : SUNVALLEYTEK INTERNATIONAL, INC.
Manufacturer : Shenzhen NearbyExpress Technology Development Company Limited
Product Name : FileHub
Model No. : RP-WD009
Trade Mark : RAVPOWER
Rating(s) : Input: DC 5V, 2A
Output: DC 5V, 1A
(with DC 3.6V, 6700mAh Battery inside)
Test Standard(s) : FCC Part15 Subpart E 2017, Paragraph 15.407
Test Method(s) : ANSI C63.10: 2013
KDB 789033 D02 General UNII Test Procedures New Rules v01r04

The device described above is tested by Shenzhen Anbotech Compliance Laboratory Limited to determine the maximum emission levels emanating from the device and the severe levels of the device can endure and its performance criterion. The measurement results are contained in this test report and Shenzhen Anbotech Compliance Laboratory Limited is assumed full of responsibility for the accuracy and completeness of these measurements. Also, this report shows that the EUT (Equipment Under Test) is technically compliant with the FCC Part 15 Subpart E requirements.

This report applies to above tested sample only and shall not be reproduced in part without written approval of Shenzhen Anbotech Compliance Laboratory Limited.

Date of Test

Dec. 07~24, 2018

Prepared by



Oliay Yang

(Engineer / Oliay Yang)

Reviewer

Snowy Meng

(Supervisor / Snowy Meng)

Approved & Authorized Signer

Sally Zhang

(Manager / Sally Zhang)

1. General Information

1.1. Client Information

Applicant	:	SUNVALLEYTEK INTERNATIONAL, INC.
Address	:	46724 Lakeview Blvd, Fremont, California, United States 94538-6529
Manufacturer	:	Shenzhen NearbyExpress Technology Development Company Limited
Address	:	333 Bulong Road, Jialianda Industrial Park, Building 1, Bantian, Longgang District, Shenzhen, China
Factory	:	Shenzhen NearbyExpress Technology Development Company Limited
Address	:	333 Bulong Road, Jialianda Industrial Park, Building 1, Bantian, Longgang District, Shenzhen, China

1.2. Description of Device (EUT)

Product Name	:	FileHub
Model No.	:	RP-WD009
Trade Mark	:	RAVPOWER
Test Power Supply	:	AC 120V 60Hz/ DC 3.6V battery inside
Product Description	:	Operation Frequency: WIFI 5G: 5745MHz~5825MHz / 5755MHz~5795MHz/ 5775MHz
	Number of Channel:	WIFI 5G: 5 Channels for 802.11a 5 Channels for 802.11n(HT20) 5 Channels for 802.11ac(HT20) 2 Channels for 802.11n(HT40) 2 Channels for 802.11ac(HT40) 1 Channels for 802.11ac(HT80)
	Modulation Type:	OFDM with BPSK/QPSK/16QAM/64QAM for 802.11a/n; OFDM with BPSK/QPSK/16QAM/64QAM/ 256QAM for 802.11ac
	Antenna Type:	PCB Antenna
	Antenna Gain(Peak):	2 dBi
Remark: 1) For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual. 2) This report is for Wifi 5.8G.		

1.3. Auxiliary Equipment Used During Test

Adapter	:	Manufacturer: Samsung M/N: ETA-U90CBC S/N: RT6FB17ZS/B-E Input: 100-240V~ 50-60Hz, 0.35A Output: DC 5V, 2A
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1.4. Description of Test Modes

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

Mode	Test channel	Frequency (MHz)
OFDM(802.11a/n20/ac20)	CH 149	5745MHz
	CH 157	5785MHz
	CH 165	5825MHz
OFDM(802.11n40/ac40)	CH 151	5755MHz
	CH159	5795MHz
OFDM(802.11ac80)	CH 155	5775MHz

Note:

1. The measurements are performed at the highest, middle, lowest available channels.
2. The EUT has been tested as an independent unit. And Continual Transmitting in maximum power.
3. For the relevant Conducted Measurement, the temporary antenna connector is used during the measurement. Antenna Connector Impedance: 50 Ω , Cable Loss: 1.0 dB
4. The EUT was programmed to be in continuously transmitting mode and the transmit duty cycle is more than 98%

1.5. List of channels

802.11a/n20/ac20

Channel	Freq. (MHz)	Channel	Freq. (MHz)
149	5745	153	5765
157	5785	161	5805
165	5825		

802.11n40/ac40

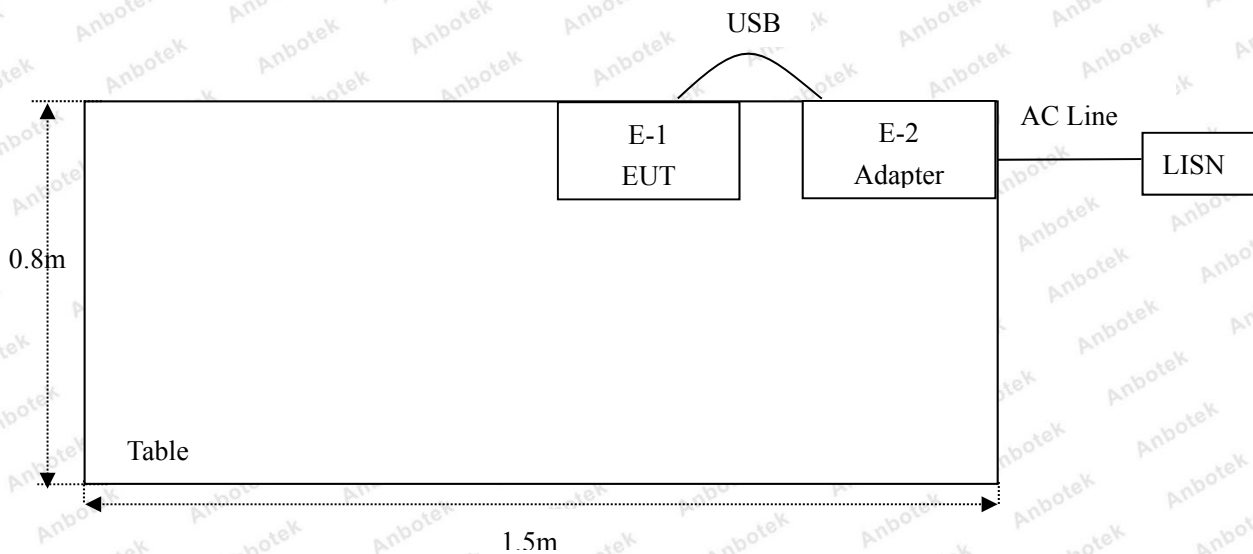
Channel	Freq. (MHz)	Channel	Freq. (MHz)
151	5755	159	5795

802.11ac80

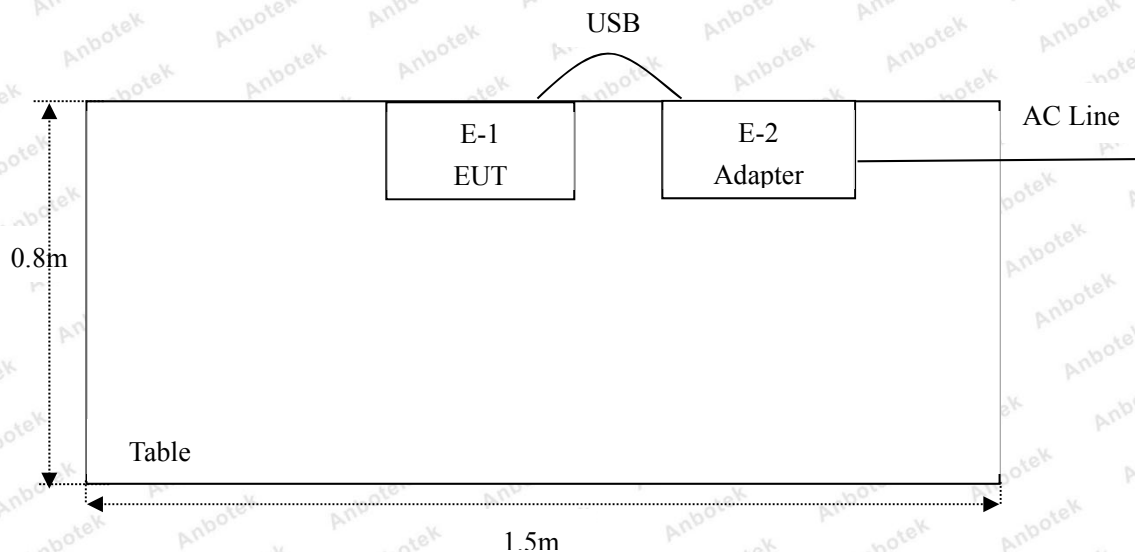
Channel	Freq. (MHz)
155	5775

1.6. Description Of Test Setup

CE



RE



1.7. Test Equipment List

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	L.I.S.N. Artificial Mains Network	Rohde & Schwarz	ENV216	100055	Nov. 05, 2018	1 Year
2.	EMI Test Receiver	Rohde & Schwarz	ESPI3	101604	Nov. 05, 2018	1 Year
3.	RF Switching Unit	Compliance Direction	RSU-M2	38303	Nov. 05, 2018	1 Year
4.	Spectrum Analysis	Agilent	E4407B	US39390582	Nov. 05, 2018	1 Year
5.	MAX Spectrum Analysis	Agilent	N9020A	MY51170037	Nov. 05, 2018	1 Year
6.	Preamplifier	SKET Electronic	BK1G18G30D	KD17503	Nov. 05, 2018	1 Year
7.	Double Ridged Horn Antenna	Instruments corporation	GTH-0118	351600	Nov. 20, 2018	1 Year
8.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	VULB 9163-289	Nov. 19, 2018	1 Year
9.	Loop Antenna	Schwarzbeck	FMZB1519B	00053	Nov. 20, 2018	1 Year
10.	Horn Antenna	A-INFO	LB-180400-KF	J211060628	Nov. 20, 2018	1 Year
11.	Pre-amplifier	SONOMA	310N	186860	Nov. 05, 2018	1 Year
12.	EMI Test Software EZ-EMC	SHURPLE	N/A	N/A	N/A	N/A
13.	RF Test Control System	YIHENG	YH3000	2017430	Nov. 05, 2018	1 Year
14.	Power Sensor	DAER	RPR3006W	15I00041SN045	Nov. 05, 2018	1 Year
15.	Power Sensor	DAER	RPR3006W	15I00041SN046	Nov. 05, 2018	1 Year
16.	MXA Spectrum Analysis	Agilent	N9020A	MY51170037	Nov. 05, 2018	1 Year
17.	MXG RF Vector Signal Generator	Agilent	N5182A	MY48180656	Nov. 05, 2018	1 Year
18.	Signal Generator	Agilent	E4421B	MY41000743	Nov. 05, 2018	1 Year
19.	DC Power Supply	IVYTECH	IV3605	1804D360510	Apr. 02, 2018	1 Year
20.	Constant Temperature Humidity Chamber	ZHONGJIAN	ZJ-KHWS80B	N/A	Nov. 01, 2018	1 Year

1.8. Measurement Uncertainty

Radiation Uncertainty	:	Ur = 3.9 dB (Horizontal)
		Ur = 3.8 dB (Vertical)
Conduction Uncertainty	:	Uc = 3.4 dB

1.9. Description of Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

FCC-Designation No.: CN5023

Shenzhen Anbotech Compliance Laboratory Limited, EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Designation CN5023, July 31, 2017.

ISED-Registration No.: 8058A-1

Shenzhen Anbotech Compliance Laboratory Limited, EMC Laboratory has been registered and fully described in a report filed with the (ISED) Innovation, Science and Economic Development Canada. The acceptance letter from the ISED is maintained in our files. Registration 8058A-1, June 13, 2016.

Test Location

Shenzhen Anbotech Compliance Laboratory Limited.

1/F, Building D, Sogood Science and Technology Park, Sanwei community, Hangcheng Street, Bao'an District, Shenzhen, Guangdong, China.518102

2. Summary of Test Results

Standard	Test Type	Result
15.207 & 15.407	Conducted Emission	PASS
15.205/15.209	Spurious Emission	PASS
15.407(b)	Band Edge	PASS
15.407(a)(5)	Occupy Bandwidth	PASS
15.407(a)(1)(3)	Maximum Conducted Output Power	PASS
15.407(a)(1)(3)	Peak Power Spectral Density	PASS
15.203/15.407g	Antenna Requirement	PASS

3. Conducted Emission Test

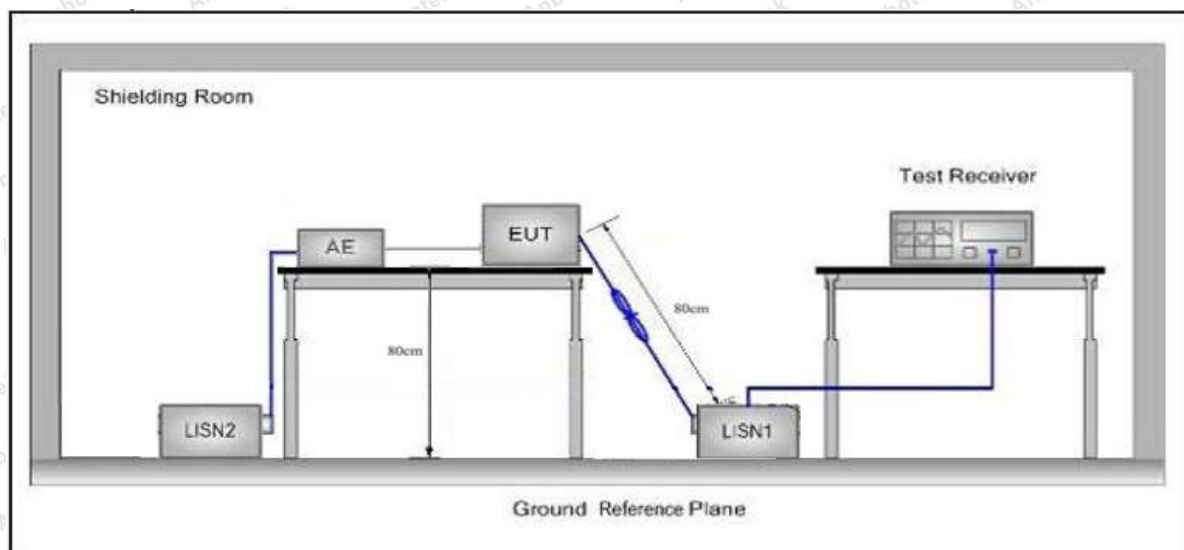
3.1. Test Standard and Limit

Test Standard	FCC Part15 Section 15.207&15.407		
Test Limit	Frequency	Maximum RF Line Voltage (dBuV)	
		Quasi-peak Level	Average Level
	150kHz~500kHz	66 ~ 56 *	56 ~ 46 *
	500kHz~5MHz	56	46
	5MHz~30MHz	60	50

Remark: (1) *Decreasing linearly with logarithm of the frequency.

(2) The lower limit shall apply at the transition frequency.

3.2. Test Setup



3.3. Test Procedure

The EUT system is connected to the power mains through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm coupling impedance for the EUT system. Please refer the block diagram of the test setup and photographs. Both sides of AC line are checked to find out the maximum conducted emission. In order to find the maximum emission levels, the relative positions of equipment and all of the interface cables shall be changed according to FCC ANSI C63.10-2013 on Conducted Emission Measurement.

The bandwidth of test receiver (ESCI) set at 9kHz.

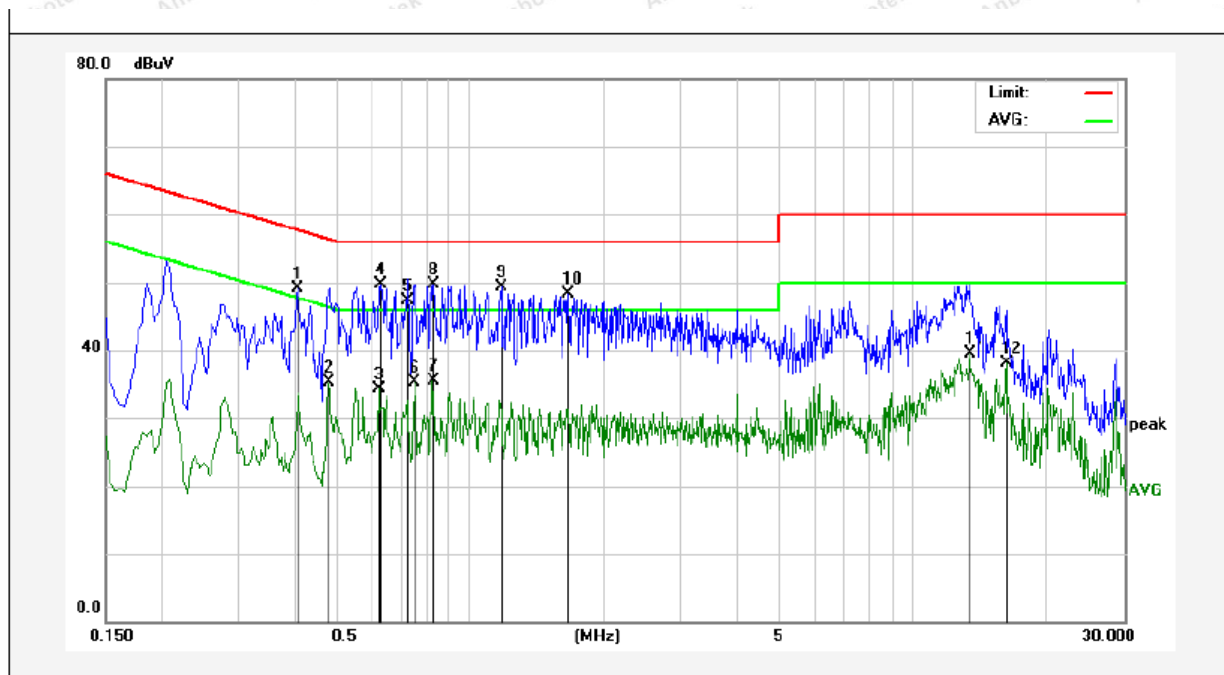
The frequency range from 150kHz to 30MHz is checked.

3.4. Test Data

Please to see the following pages

Conducted Emission Test Data

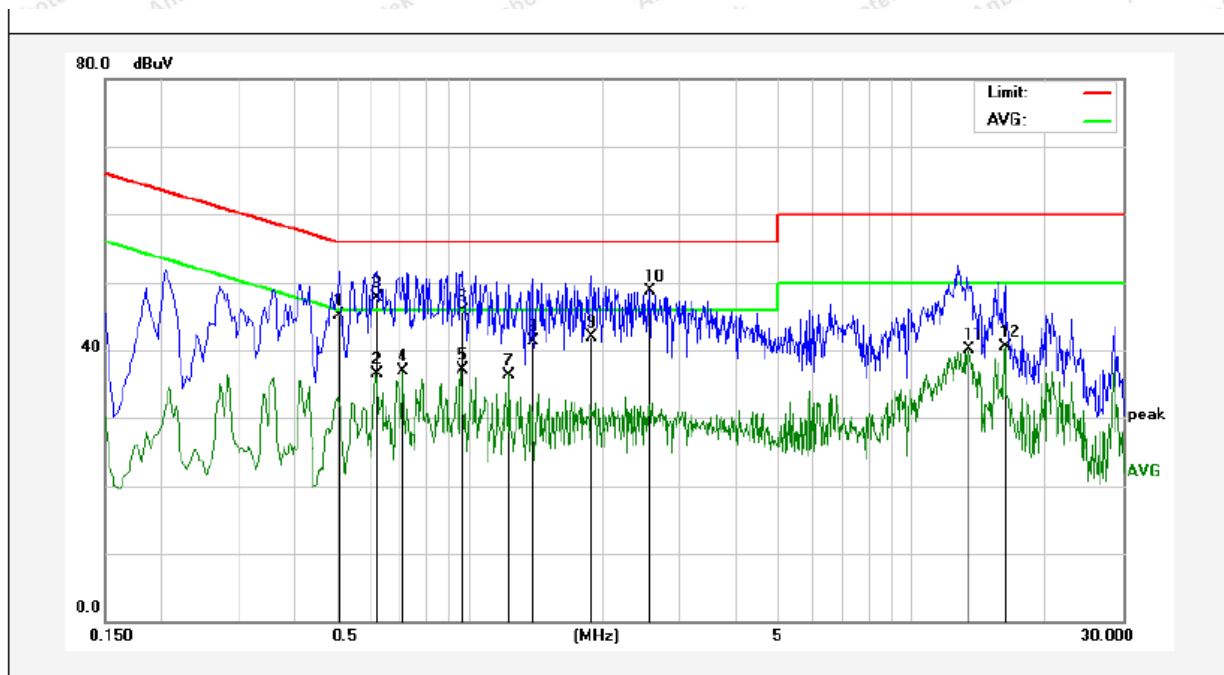
Test Site: 1# Shielded Room
Operating Condition: Keeping TX mode(802.11n40)
Test Specification: AC 120V 60Hz
Comment: Live Line
Tem.: 23.8°C Hum.: 48%



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Over Limit (dB)	Detector	Remark
1	0.4100	39.52	9.51	49.03	57.65	-8.62	QP	
2	0.4780	25.88	9.51	35.39	46.37	-10.98	AVG	
3	0.6220	24.76	9.51	34.27	46.00	-11.73	AVG	
4	0.6300	40.21	9.51	49.72	56.00	-6.28	QP	
5	0.7260	37.70	9.51	47.21	56.00	-8.79	QP	
6	0.7500	25.79	9.51	35.30	46.00	-10.70	AVG	
7	0.8220	25.95	9.51	35.46	46.00	-10.54	AVG	
8	0.8300	40.25	9.51	49.76	56.00	-6.24	QP	
9	1.1740	39.72	9.51	49.23	56.00	-6.77	QP	
10	1.6700	38.84	9.51	48.35	56.00	-7.65	QP	
11	13.4220	29.93	9.55	39.48	50.00	-10.52	AVG	
12	16.2300	28.59	9.57	38.16	50.00	-11.84	AVG	

Conducted Emission Test Data

Test Site: 1# Shielded Room
Operating Condition: Keeping TX mode(802.11n40)
Test Specification: AC 120V 60Hz
Comment: Neutral Line
Tem.: 23.8°C Hum.: 48%



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Over Limit (dB)	Detector	Remark
1	0.5100	35.51	9.51	45.02	56.00	-10.98	QP	
2	0.6140	26.98	9.51	36.49	46.00	-9.51	AVG	
3	0.6180	38.15	9.51	47.66	56.00	-8.34	QP	
4	0.7100	27.41	9.51	36.92	46.00	-9.08	AVG	
5	0.9620	27.66	9.51	37.17	46.00	-8.83	AVG	
6	0.9660	36.13	9.51	45.64	56.00	-10.36	QP	
7	1.2340	26.89	9.51	36.40	46.00	-9.60	AVG	
8	1.3900	31.84	9.51	41.35	56.00	-14.65	QP	
9	1.8900	32.34	9.51	41.85	56.00	-14.15	QP	
10	2.5540	39.13	9.51	48.64	56.00	-7.36	QP	
11	13.4260	30.51	9.55	40.06	50.00	-9.94	AVG	
12	16.2260	30.90	9.57	40.47	50.00	-9.53	AVG	

4. Radiation Spurious Emission and Band Edge

4.1. Test Standard and Limit

Test Standard	FCC Part15 C Section 15.209, 15.205 and 15.407, KDB 789033 D02 General UNII Test Procedures New Rules v01r04
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Unwanted spurious emissions fallen in restricted bands per FCC Part15.205 shall comply with the general field strength limits set forth in § 15.209 as below table,

Test Standard	FCC Part15 C Section 15.209, 15.205 and 15.407				
Test Limit	Frequency (MHz)	Field strength (microvolt/meter)	Limit (dBuV/m)	Remark	Measurement distance (m)
	0.009MHz~0.490MHz	2400/F(kHz)	-	-	300
	0.490MHz-1.705MHz	24000/F(kHz)	-	-	30
	1.705MHz-30MHz	30	-	-	30
	30MHz~88MHz	100	40.0	Quasi-peak	3
	88MHz~216MHz	150	43.5	Quasi-peak	3
	216MHz~960MHz	200	46.0	Quasi-peak	3
	960MHz~1000MHz	500	54.0	Quasi-peak	3
	Above 1000MHz	500	54.0	Average	3
		-	68.2	Peak	3

Remark:

- (1)The lower limit shall apply at the transition frequency.
 - (2) 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.
 - (3)Above 1GHz Unwanted Emissions in the Restricted Bands limit: $E[dBuV/m] = EIRP[dBm] + 95.2 = 68.2 dBuV/m$, for $EIRP[dBm] = -27dBm$
 - (4) Unwanted Emissions that fall Outside of the Restricted Bands limits of § 15.209
- According to the above different limit requirements, we have adopted strict limits and the data can meet the two limit requirements.

For transmitters operating in the 5.725-5.85GHz band:

15.407(b)(4)(i) All emissions shall be limited to a level of -27dBm/MHz at 75MHz or more above or below the band edge increasing linearly to 10dBm/MHz at 25MHz above or below the band edge, and from 25MHz above or below the band edge increasing linearly to a level of 15.6dBm/MHz at 5MHz above or below the band edge, and from 5MHz above or below the band edge increasing linearly to a level of 27dBm/MHz at the band edge.

KDB789033 D02 v01r04 (G)(2)(c)

- (i) Sections 15.407(b)(1) to (b)(3) specify the unwanted emission limits for the U-NII-1 and U-NII-2 bands. As specified, emissions above 1000 MHz that are outside of the restricted bands are subject to a peak emission limit of -27dBm/MHz.³
- (ii) Section 15.407(b)(4) specifies the unwanted emission limit for the U-NII-3 band. A band emissions mask is

specified in Section 15.407(b)(4)(i). The emission limits are in terms of a Peak detector. An alternative to the band emissions mask is specified in Section 15.407(b)(4)(ii). The alternative limits are based on the highest antenna gain specified in the filing. There are also marketing and importation restrictions for the devices using the alternative limit.⁴

Note 3: An out-of-band emission that complies with both the average and peak limits of Section 15.209 is not required to satisfy the -27 dBm/MHz peak emission limit.

Note 4: Only devices with antenna gains of 10 dBi or less may be approved using the emission limits specified in Section 15.247(d) till March 2, 2018; all other devices operating in this band must use the mask specified in Section 15.407(b)(4)(i).

4.2. Test Setup

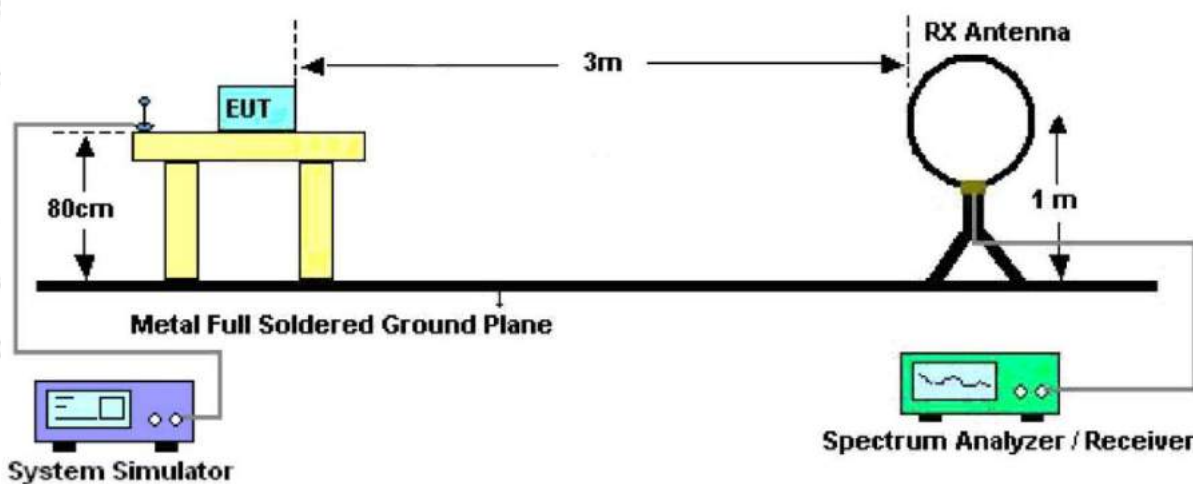


Figure 1. Below 30MHz

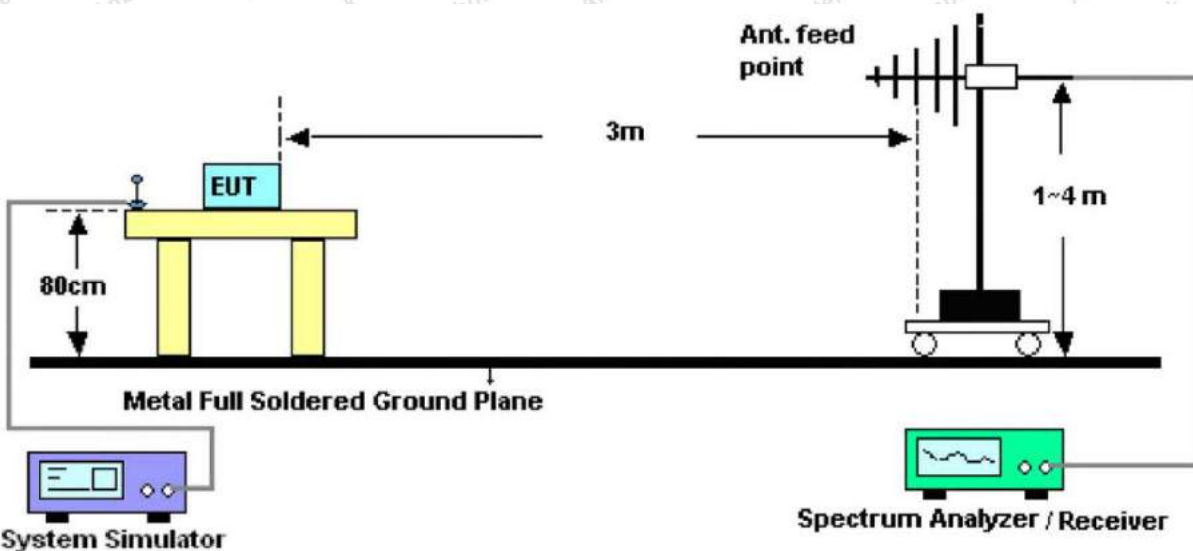


Figure 2. 30MHz to 1GHz

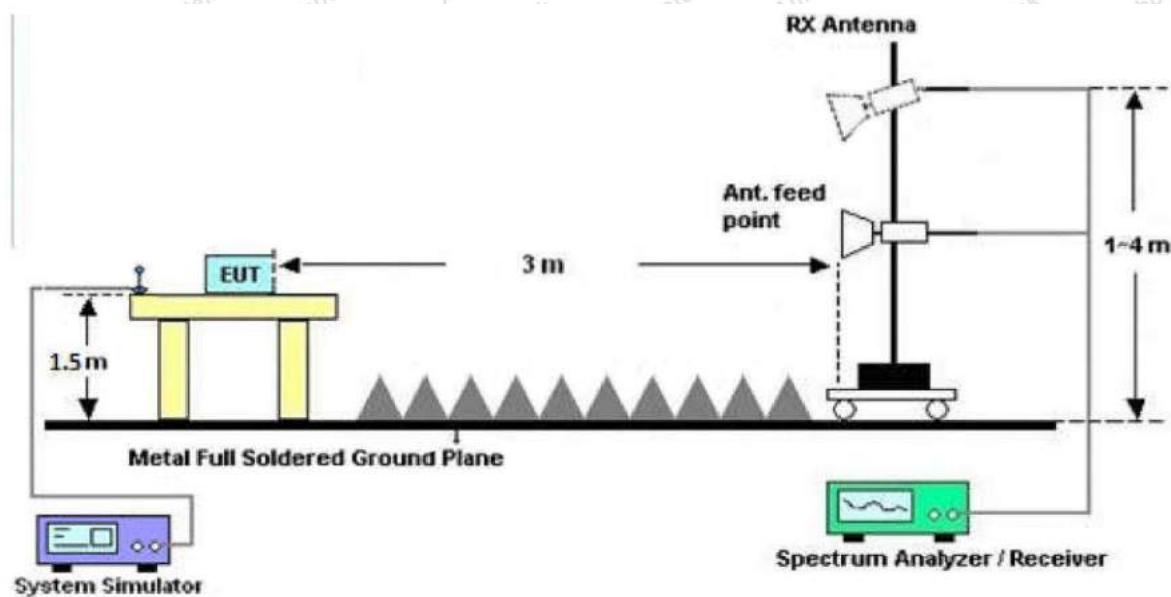


Figure 3. Above 1 GHz

4.3. Test Procedure

For below 1GHz: The EUT is placed on a turntable, which is 0.8m above the ground plane.

For above 1GHz: The EUT is placed on a turntable, which is 1.5m above the ground plane.

The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT is set 3 meters away from the receiving antenna which is mounted on a antenna tower. The antenna can be moved up and down from 1 to 4 meters to find out the maximum emission level. Rotated the EUT through three orthogonal axes to determine the maximum emissions, both horizontal and vertical polarization of the antenna are set on test. The EUT is tested in 9*6*6 Chamber. The device is evaluated in xyz orientation.

For 9kHz to 150kHz, Set the spectrum analyzer as:

RBW = 200Hz, VBW = 1kHz, Detector = Quasi-Peak, Trace mode = Max hold, Sweep = auto couple.

For 150kHz to 30MHz, Set the spectrum analyzer as:

RBW = 9kHz, VBW = 30kHz, Detector = Quasi-Peak, Trace mode = Max hold, Sweep = auto couple.

For 30MHz to 1000MHz, Set the spectrum analyzer as:

RBW = 100kHz, VBW = 300kHz, Detector = Quasi-Peak, Trace mode = Max hold, Sweep = auto couple.

For above 1GHz, Set the spectrum analyzer as:

RBW = 1MHz, VBW = 1MHz, Detector = Peak, Trace mode = Max hold, Sweep = auto couple.

RBW = 1MHz, VBW = 10Hz, Detector = Average, Trace mode = Max hold, Sweep = auto couple.

4.4. Test Data

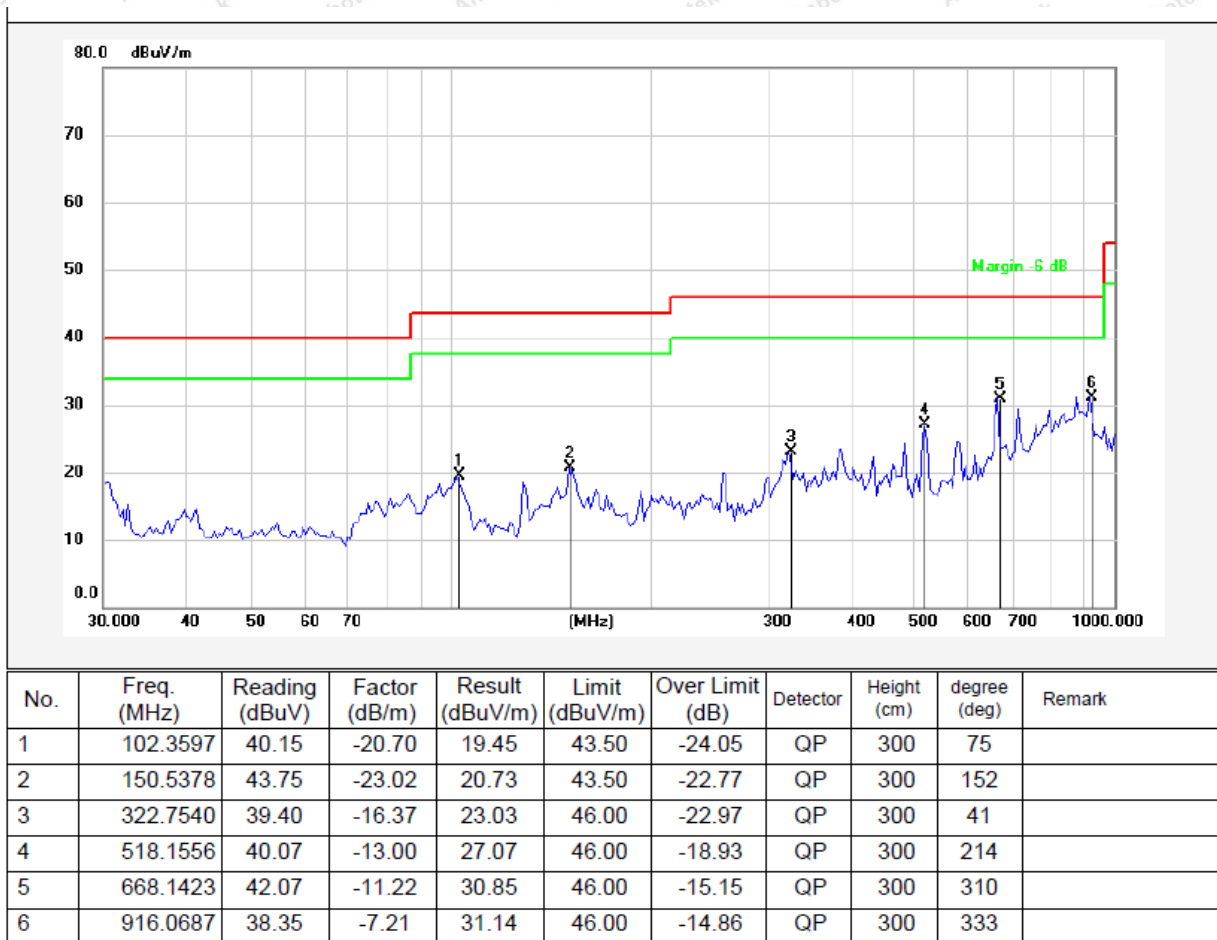
PASS

The test results of 9kHz-30MHz and above 1800MHz are attenuated more than 20dB below the permissible limits, so the results don't record in the report.

worst case: 802.11n40 (CH151)

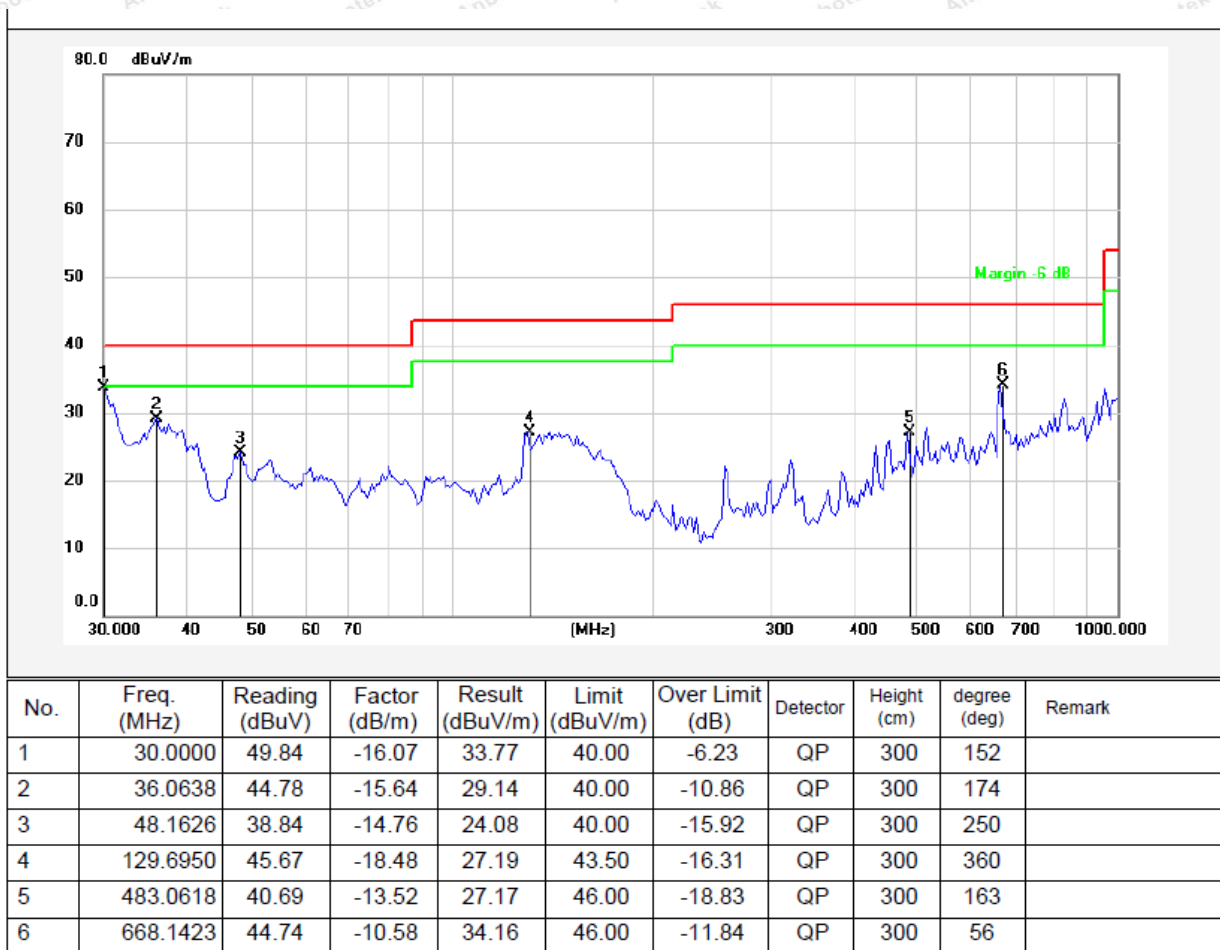
Test Results (30~1000MHz)

Job No.: SZAWW180831003-01 Temp.(°C)/Hum.(%RH): 16.2°C/52%RH
Standard: FCC PART 15C Power Source: DC 3.6V battery inside
Test Mode: 802.11n40 (CH151) Polarization: Horizontal



Test Results (30~1000MHz)

Job No.: SZAWW180831003-01 Temp.(°C)/Hum.(%RH): 16.2°C/52%RH
Standard: FCC PART 15C Temp.(°C)/Hum.(%RH): DC 3.6V battery inside
Test Mode: 802.11n40 (CH151) Polarization: Vertical



Test Results (Above 1000MHz)

Test mode:	IEEE 802.11a	Test channel:	Low CH
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Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Pol.
11490.00	42.32	31.98	17.08	33.91	57.47	68.20	-10.73	V
17235.00	35.02	32.65	20.03	34.85	52.85	68.20	-15.35	V
11490.00	37.65	31.98	17.08	33.91	52.80	68.20	-15.40	H
17235.00	35.78	32.65	20.03	34.85	53.61	68.20	-14.59	H

Average value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Pol.
11490.00	31.32	31.98	17.08	33.91	46.47	54.00	-7.53	V
17235.00	28.35	32.65	20.03	34.85	46.18	54.00	-7.82	V
11490.00	28.31	31.98	17.08	33.91	43.46	54.00	-10.54	H
17235.00	27.36	32.65	20.03	34.85	45.19	54.00	-8.81	H

Test mode:	IEEE 802.11a	Test channel:	Mid CH
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Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Pol.
11570.00	40.06	32.44	17.18	33.91	55.77	68.20	-12.43	V
17355.00	36.45	32.78	20.12	34.86	54.49	68.20	-13.71	V
11570.00	38.53	32.44	17.18	33.91	54.24	68.20	-13.96	H
17355.00	35.96	32.78	20.12	34.86	54.00	68.20	-14.20	H

Average value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Pol.
11570.00	30.02	32.44	17.18	33.91	45.73	54.00	-8.27	V
17355.00	28.36	32.78	20.12	34.86	46.40	54.00	-7.60	V
11570.00	30.01	32.44	17.18	33.91	45.72	54.00	-8.28	H
17355.00	29.34	32.78	20.12	34.86	47.38	54.00	-6.62	H

Test mode:	IEEE 802.11a	Test channel:	High CH
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Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Pol.
11650.00	40.06	32.59	18.02	33.92	56.75	68.20	-11.45	V
17475.00	39.25	32.87	20.15	34.88	57.39	68.20	-10.81	V
11650.00	41.32	32.59	18.02	33.92	58.01	68.20	-10.19	H
17475.00	40.21	32.87	20.15	34.88	58.35	68.20	-9.85	H

Average value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Pol.
11650.00	30.21	32.59	18.02	33.92	46.90	54.00	-7.10	V
17475.00	30.11	32.87	20.15	34.88	48.25	54.00	-5.75	V
11650.00	29.65	32.59	18.02	33.92	46.34	54.00	-7.66	H
17475.00	29.35	32.87	20.15	34.88	47.49	54.00	-6.51	H

Test mode:	IEEE 802.11n(HT20)	Test channel:	Low CH
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Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Pol.
11490.00	39.81	31.98	17.08	33.91	54.96	68.20	-13.24	V
17235.00	36.21	32.65	20.03	34.85	54.04	68.20	-14.16	V
11490.00	37.15	31.98	17.08	33.91	52.30	68.20	-15.90	H
17235.00	36.25	32.65	20.03	34.85	54.08	68.20	-14.12	H

Average value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Pol.
11490.00	31.12	31.98	17.08	33.91	46.27	54.00	-7.73	V
17235.00	28.32	32.65	20.03	34.85	46.15	54.00	-7.85	V
11490.00	30.57	31.98	17.08	33.91	45.72	54.00	-8.28	H
17235.00	28.35	32.65	20.03	34.85	46.18	54.00	-7.82	H

Test mode:	IEEE 802.11n(HT20)	Test channel:	Mid CH
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Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Pol.
11570.00	40.35	32.44	17.18	33.91	56.06	68.20	-12.14	V
17355.00	39.12	32.78	20.12	34.86	57.16	68.20	-11.04	V
11570.00	38.35	32.44	17.18	33.91	54.06	68.20	-14.14	H
17355.00	36.12	32.78	20.12	34.86	54.16	68.20	-14.04	H

Average value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Pol.
11570.00	29.13	32.44	17.18	33.91	44.84	54.00	-9.16	V
17355.00	27.32	32.78	20.12	34.86	45.36	54.00	-8.64	V
11570.00	29.03	32.44	17.18	33.91	44.74	54.00	-9.26	H
17355.00	28.36	32.78	20.12	34.86	46.40	54.00	-7.60	H

Test mode:	IEEE 802.11n(HT20)	Test channel:	High CH
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Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Pol.
11650.00	41.21	32.59	18.02	33.92	57.90	68.20	-10.30	V
17475.00	38.35	32.87	20.15	34.88	56.49	68.20	-11.71	V
11650.00	36.23	32.59	18.02	33.92	52.92	68.20	-15.28	H
17475.00	38.13	32.87	20.15	34.88	56.27	68.20	-11.93	H

Average value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Pol.
11650.00	31.25	32.59	18.02	33.92	47.94	54.00	-6.06	V
17475.00	32.41	32.87	20.15	34.88	50.55	54.00	-3.45	V
11650.00	29.32	32.59	18.02	33.92	46.01	54.00	-7.99	H
17475.00	28.74	32.87	20.15	34.88	46.88	54.00	-7.12	H

Test mode:	IEEE 802.11ac(HT20)	Test channel:	Low CH
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Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Pol.
11490.00	41.87	31.98	17.08	33.91	57.02	68.20	-11.18	V
17235.00	35.23	32.65	20.03	34.85	53.06	68.20	-15.14	V
11490.00	38.46	31.98	17.08	33.91	53.61	68.20	-14.59	H
17235.00	35.05	32.65	20.03	34.85	52.88	68.20	-15.32	H

Average value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Pol.
11490.00	32.16	31.98	17.08	33.91	47.31	54.00	-6.69	V
17235.00	29.34	32.65	20.03	34.85	47.17	54.00	-6.83	V
11490.00	30.25	31.98	17.08	33.91	45.40	54.00	-8.60	H
17235.00	27.22	32.65	20.03	34.85	45.05	54.00	-8.95	H

Test mode:	IEEE 802.11ac(HT20)	Test channel:	Mid CH
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Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Pol.
11570.00	40.73	32.44	17.18	33.91	56.44	68.20	-11.76	V
17355.00	37.41	32.78	20.12	34.86	55.45	68.20	-12.75	V
11570.00	39.22	32.44	17.18	33.91	54.93	68.20	-13.27	H
17355.00	36.10	32.78	20.12	34.86	54.14	68.20	-14.06	H

Average value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Pol.
11570.00	30.35	32.44	17.18	33.91	46.06	54.00	-7.94	V
17355.00	27.49	32.78	20.12	34.86	45.53	54.00	-8.47	V
11570.00	29.42	32.44	17.18	33.91	45.13	54.00	-8.87	H
17355.00	27.15	32.78	20.12	34.86	45.19	54.00	-8.81	H

Test mode:	IEEE 802.11ac(HT20)	Test channel:	High CH
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Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Pol.
11650.00	40.34	32.59	18.02	33.92	57.03	68.20	-11.17	V
17475.00	38.56	32.87	20.15	34.88	56.70	68.20	-11.50	V
11650.00	39.22	32.59	18.02	33.92	55.91	68.20	-12.29	H
17475.00	37.25	32.87	20.15	34.88	55.39	68.20	-12.81	H

Average value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Pol.
11650.00	30.17	32.59	18.02	33.92	46.86	54.00	-7.14	V
17475.00	28.14	32.87	20.15	34.88	46.28	54.00	-7.72	V
11650.00	28.85	32.59	18.02	33.92	45.54	54.00	-8.46	H
17475.00	27.42	32.87	20.15	34.88	45.56	54.00	-8.44	H

Test mode:	IEEE 802.11n(HT40)	Test channel:	Low CH
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Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Pol.
11510.00	37.76	31.98	17.08	33.91	52.91	68.20	-15.29	V
17265.00	35.87	32.65	20.03	34.85	53.70	68.20	-14.50	V
11510.00	37.63	31.98	17.08	33.91	52.78	68.20	-15.42	H
17265.00	35.74	32.65	20.03	34.85	53.57	68.20	-14.63	H

Average value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Pol.
11510.00	30.11	31.98	17.08	33.91	45.26	54.00	-8.74	V
17265.00	28.83	32.65	20.03	34.85	46.66	54.00	-7.34	V
11510.00	30.11	31.98	17.08	33.91	45.26	54.00	-8.74	H
17265.00	27.34	32.65	20.03	34.85	45.17	54.00	-8.83	H

Test mode:	IEEE 802.11n(HT40)	Test channel:	High CH
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Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Pol.
11590.00	42.25	32.59	18.02	33.92	58.94	68.20	-9.26	V
17385.00	39.12	32.87	20.15	34.88	57.26	68.20	-10.94	V
11590.00	37.41	32.59	18.02	33.92	54.10	68.20	-14.10	H
17385.00	38.53	32.87	20.15	34.88	56.67	68.20	-11.53	H

Average value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Pol.
11590.00	32.13	32.59	18.02	33.92	48.82	54.00	-5.18	V
17385.00	29.49	32.87	20.15	34.88	47.63	54.00	-6.37	V
11590.00	31.47	32.59	18.02	33.92	48.16	54.00	-5.84	H
17385.00	28.41	32.78	20.12	34.86	46.45	54.00	-7.55	H

Test mode:	IEEE 802.11ac(HT40)	Test channel:	Low CH
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Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Pol.
11510.00	37.48	31.98	17.08	33.91	52.63	68.20	-15.57	V
17265.00	35.27	32.65	20.03	34.85	53.10	68.20	-15.10	V
11510.00	37.21	31.98	17.08	33.91	52.36	68.20	-15.84	H
17265.00	35.53	32.65	20.03	34.85	53.36	68.20	-14.84	H

Average value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Pol.
11510.00	31.24	31.98	17.08	33.91	46.39	54.00	-7.61	V
17265.00	28.35	32.65	20.03	34.85	46.18	54.00	-7.82	V
11510.00	30.34	31.98	17.08	33.91	45.49	54.00	-8.51	H
17265.00	27.69	32.65	20.03	34.85	45.52	54.00	-8.48	H

Test mode:	IEEE 802.11ac(HT40)	Test channel:	High CH
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Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Pol.
11590.00	41.78	32.59	18.02	33.92	58.47	68.20	-9.73	V
17385.00	38.47	32.87	20.15	34.88	56.61	68.20	-11.59	V
11590.00	39.27	32.59	18.02	33.92	55.96	68.20	-12.24	H
17385.00	37.42	32.87	20.15	34.88	55.56	68.20	-12.64	H

Average value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Pol.
11590.00	31.78	32.59	18.02	33.92	48.47	54.00	-5.53	V
17385.00	28.89	32.87	20.15	34.88	47.03	54.00	-6.97	V
11590.00	30.27	32.59	18.02	33.92	46.96	54.00	-7.04	H
17385.00	28.35	32.78	20.12	34.86	46.39	54.00	-7.61	H

Test mode:	IEEE 802.11ac(HT80)	Test channel:	
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Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Pol.
11550.00	41.29	32.44	17.18	33.91	57.00	68.20	-11.20	V
17325.00	36.49	32.78	20.12	34.86	54.53	68.20	-13.67	V
11550.00	38.73	32.44	17.18	33.91	54.44	68.20	-13.76	H
17325.00	35.47	32.78	20.12	34.86	53.51	68.20	-14.69	H

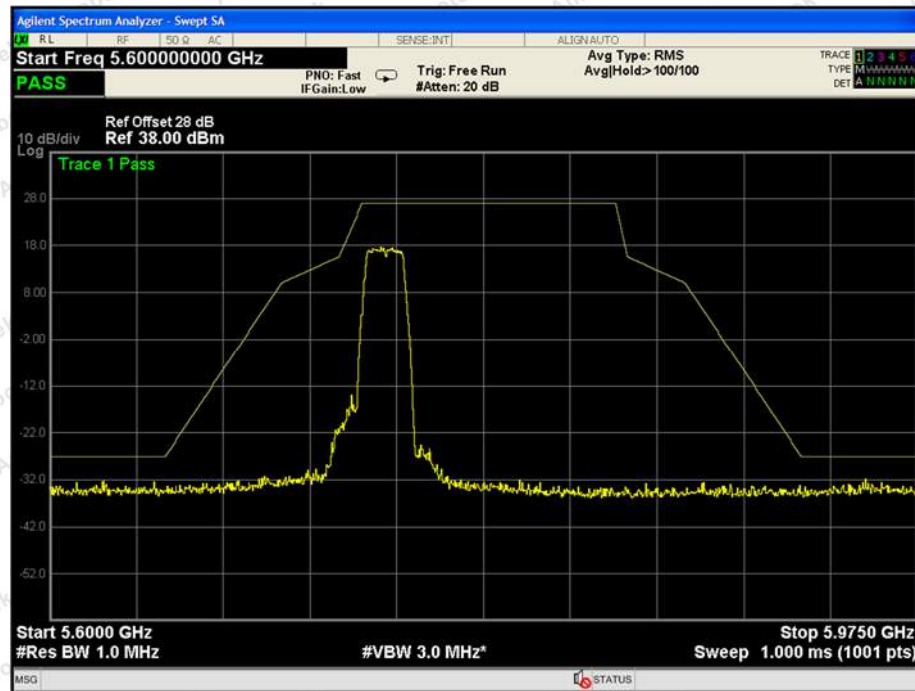
Average value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Pol.
11550.00	30.19	32.44	17.18	33.91	45.90	54.00	-8.10	V
17325.00	28.25	32.78	20.12	34.86	46.29	54.00	-7.71	V
11550.00	30.04	32.44	17.18	33.91	45.75	54.00	-8.25	H
17325.00	27.93	32.78	20.12	34.86	45.97	54.00	-8.03	H

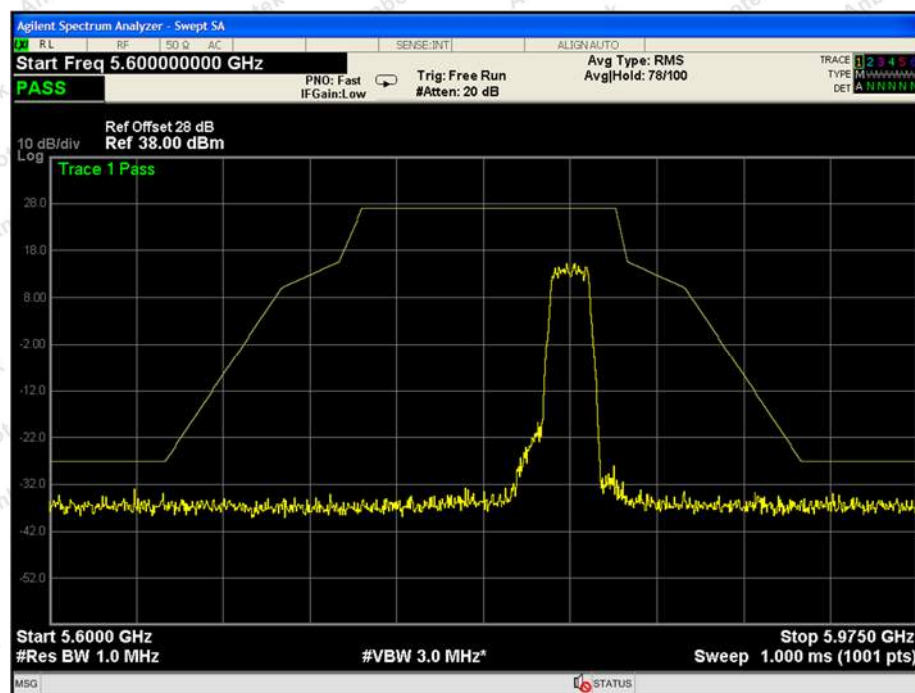
Note:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss - Preamplifier Factor

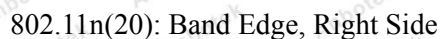
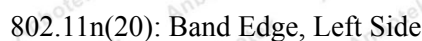
Band Edge test:

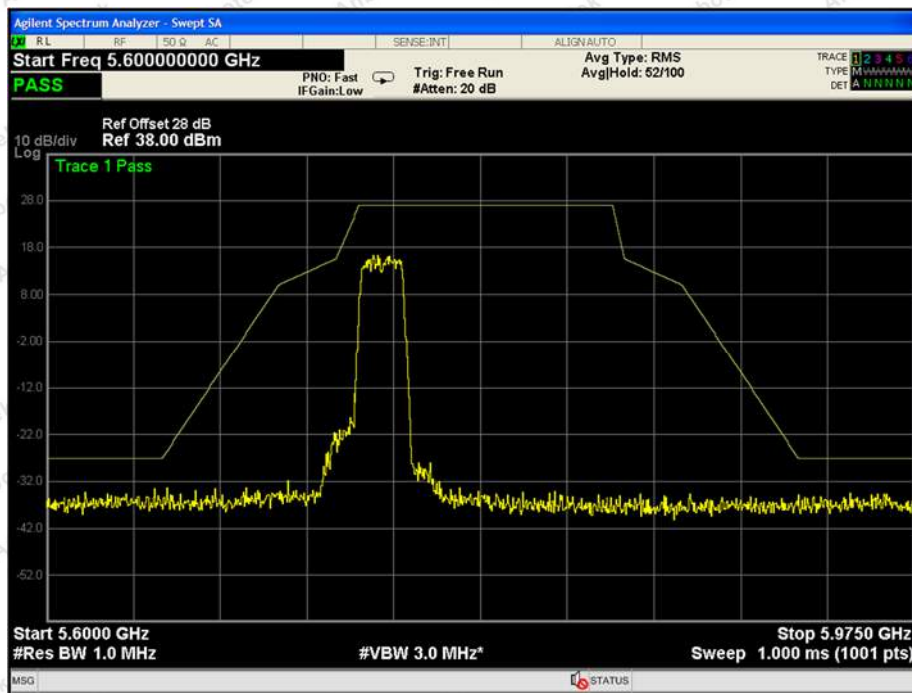


802.11a: Band Edge, Left Side

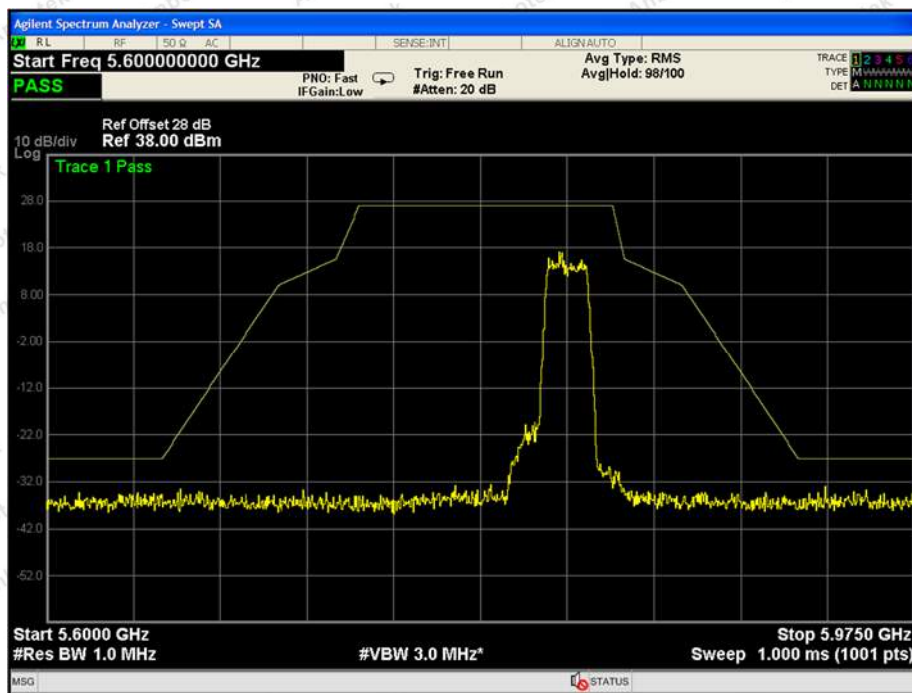


802.11a: Band Edge, Right Side

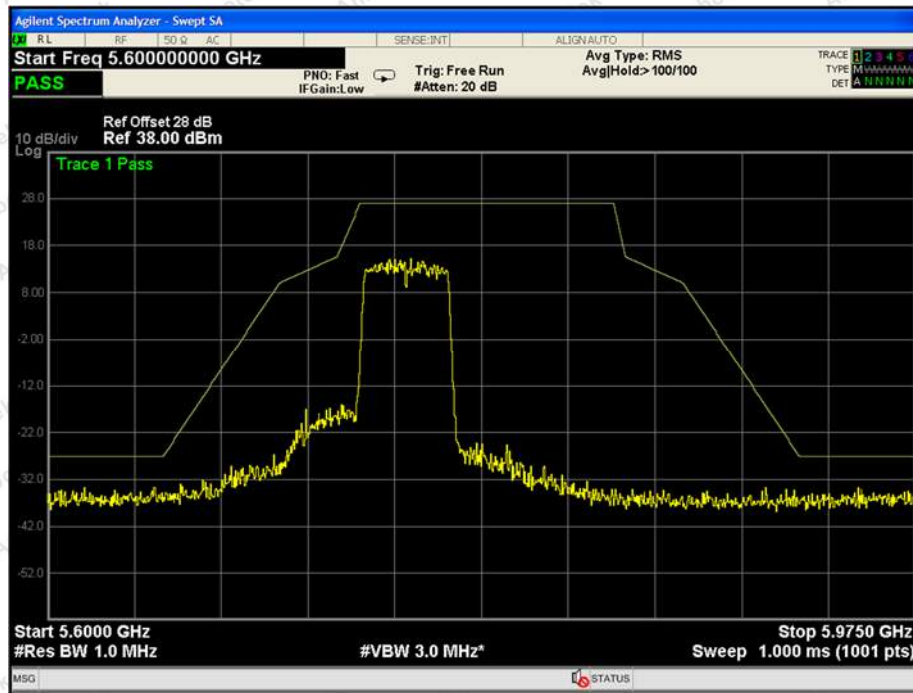




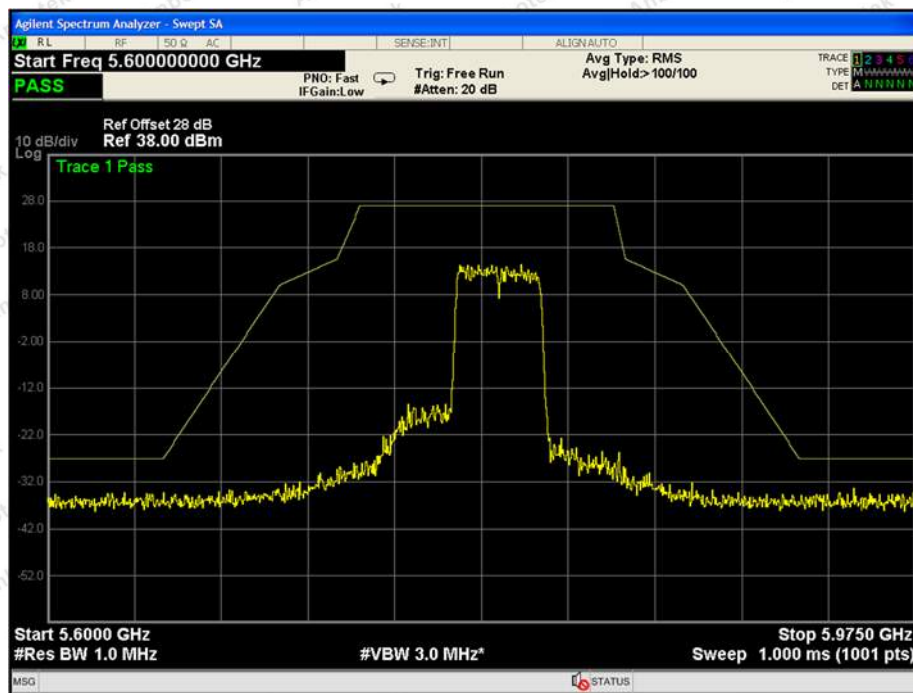
802.11ac(20): Band Edge, Left Side



802.11ac(20): Band Edge, Right Side



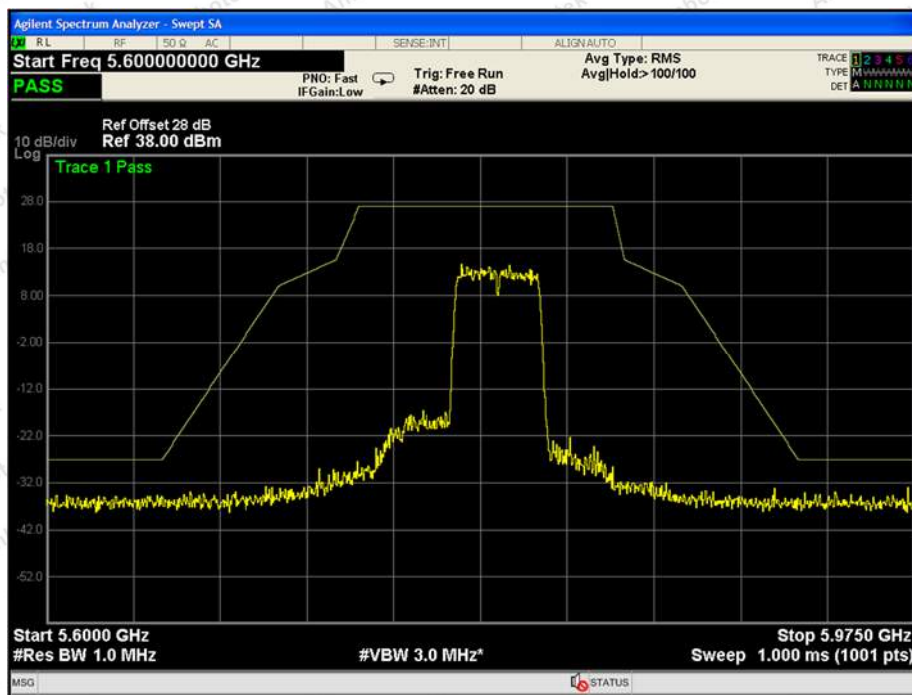
802.11n(40): Band Edge, Left Side



802.11n(40): Band Edge, Right Side



802.11ac(40): Band Edge, Left Side



802.11ac(40): Band Edge, Right Side



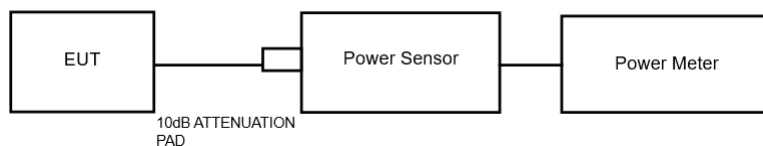
802.11ac(80): Band Edge

5. Maximum Peak Output Power Test

5.1. Test Standard and Limit

Test Standard	FCC Part15 C Section 15.407 (a)(1) (3)
Test Limit	30dBm (1W)

5.2. Test Setup



5.3. Test Procedure

1. The Transmitter output (antenna port) was connected to the power meter.
2. Turn on the EUT and power meter and then record the power value.
3. Repeat above procedures on all channels needed to be tested.

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

5.4. Test Data

Test Item	:	Max. peak output power	Test Mode	:	CH Low ~ CH High
Test Voltage	:	DC 3.6V battery inside	Temperature	:	24℃
Test Result	:	PASS	Humidity	:	55%RH

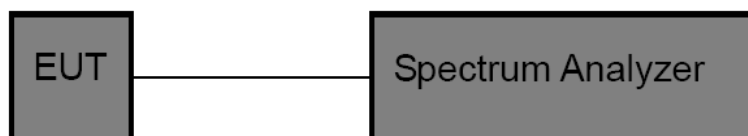
Mode	Channel Frequency (MHz)	Peak Power output (dBm)	Correctional Limit (dBm)	Results
802.11a	5745	16.02	30	PASS
	5785	15.59	30	PASS
	5825	15.16	30	PASS
802.11n20	5745	14.94	30	PASS
	5785	15.17	30	PASS
	5825	15.40	30	PASS
802.11ac20	5745	14.95	30	PASS
	5785	14.80	30	PASS
	5825	15.35	30	PASS
802.11n40	5755	16.64	30	PASS
	5795	15.36	30	PASS
802.11ac40	5755	16.00	30	PASS
	5795	16.21	30	PASS
802.11ac80	5775	15.92	30	PASS

6. Occupy Bandwidth Test

6.1. Test Standard

Test Standard	FCC Part15 C Section 15.403(i), 15.407 (e)
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6.2. Test Setup



6.3. 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:

26 dB & 99% bandwidth

RBW = approximately 1% of the emission bandwidth;

Set the VBW > RBW;

Detector= Peak

Trace mode= Max hold.

Sweep- auto couple.

6 dB bandwidth

RBW = 100kHz;

Set the video bandwidth (VBW) ≥ 3 RBW;

Detector= Peak

Trace mode= Max hold.

Sweep- auto couple.

4. Measure the maximum width of the emission that is 26dB /6dB down from the maximum of the emission.
Compare this with the RBW setting of the analyzer.

5. Repeat until all the rest channels are investigated.

6.4. Test Data

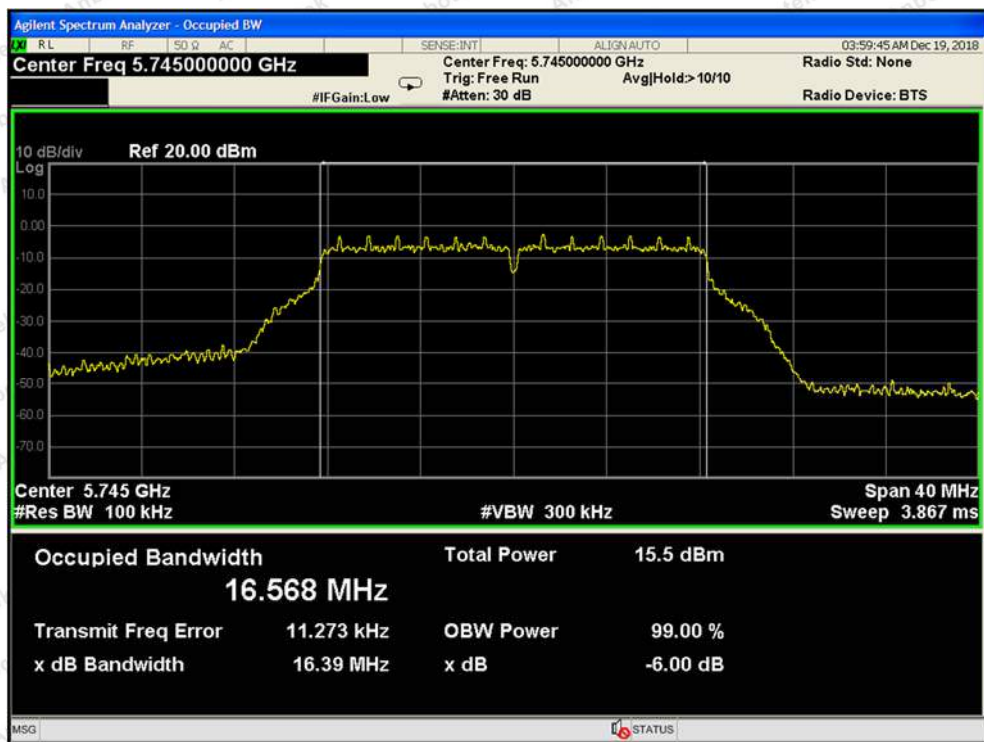
Test Item : 6dB & 26dB BW
Test Voltage : DC 3.6V battery inside
Test Result : PASS

Test Mode : CH Low ~ CH High
Temperature : 24°C
Humidity : 55%RH

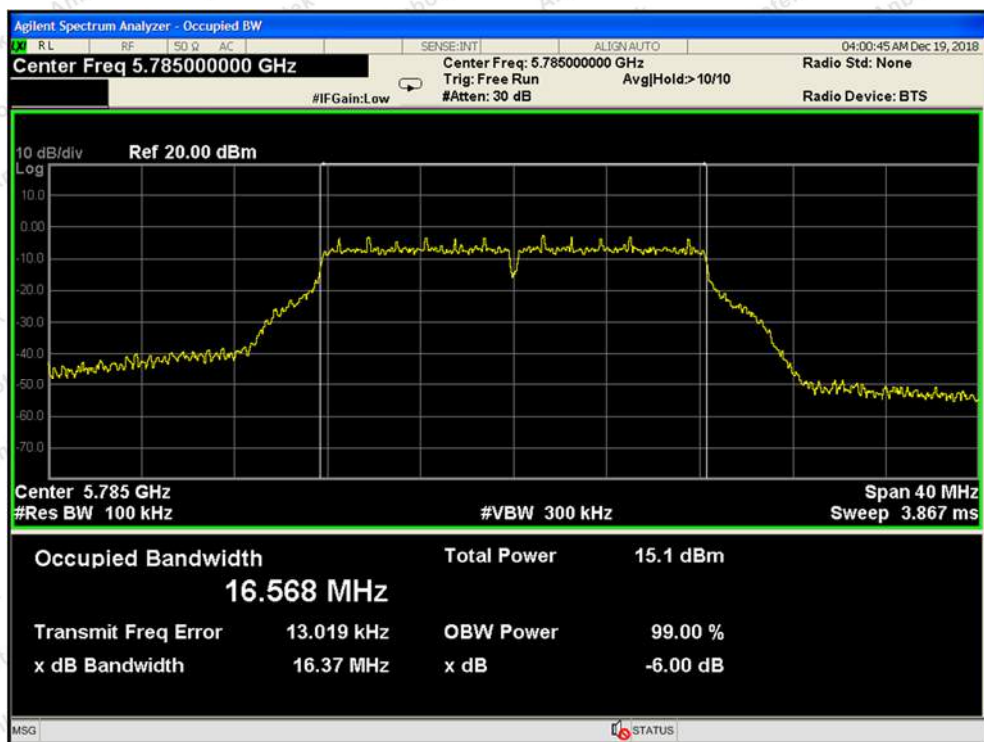
Mode	Channel Frequency (MHz)	6dB BW(MHz)	Limit	Results
802.11a	5745	16.39	>0.5MHz	PASS
	5785	16.37		PASS
	5825	16.41		PASS
802.11n20	5745	17.62		PASS
	5785	17.62		PASS
	5825	17.64		PASS
802.11ac20	5745	17.63		PASS
	5785	17.60		PASS
	5825	17.61		PASS
802.11n40	5755	36.40		PASS
	5795	36.36		PASS
802.11ac40	5755	36.39		PASS
	5795	36.35		PASS
802.11ac80	5775	75.76		PASS

Mode	Channel Frequency (MHz)	26dB BW(MHz)	99% Bandwidth (MHz)
802.11a	5745	21.36	16.859
	5785	21.71	16.871
	5825	21.40	16.874
802.11n20	5745	21.82	18.014
	5785	21.68	17.969
	5825	21.97	18.063
802.11ac20	5745	21.72	17.980
	5785	21.77	17.983
	5825	21.94	18.077
802.11n40	5755	40.03	36.387
	5795	40.03	36.359
802.11ac40	5755	39.70	36.372
	5795	40.11	36.342
802.11ac80	5775	81.87	75.814

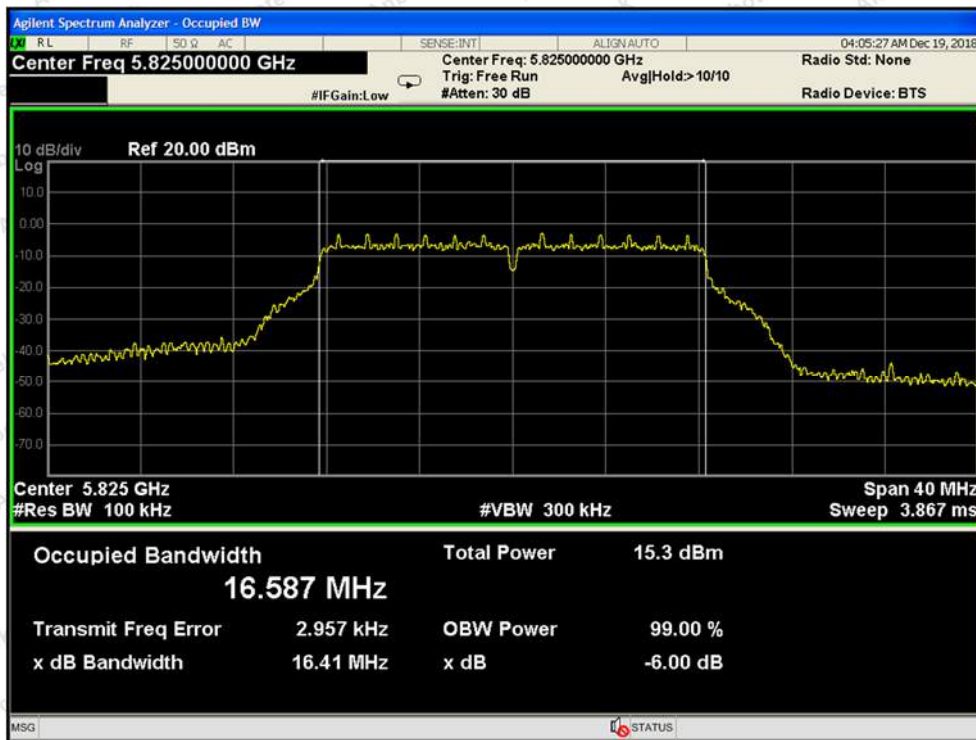
6dB Bandwidth



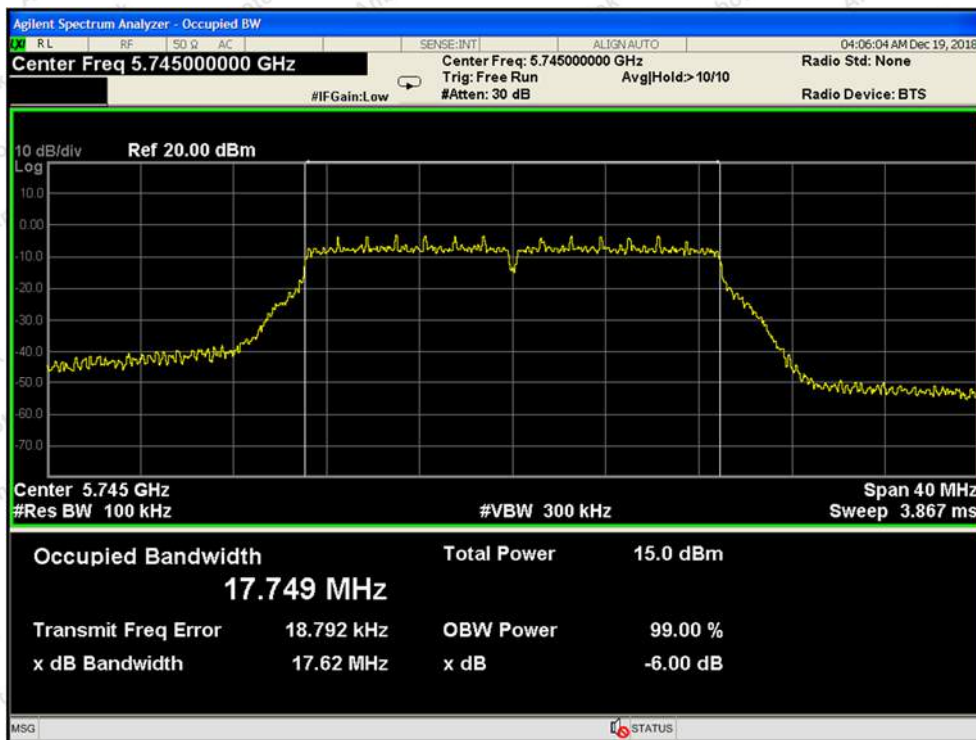
Test Mode: 802.11a--Low



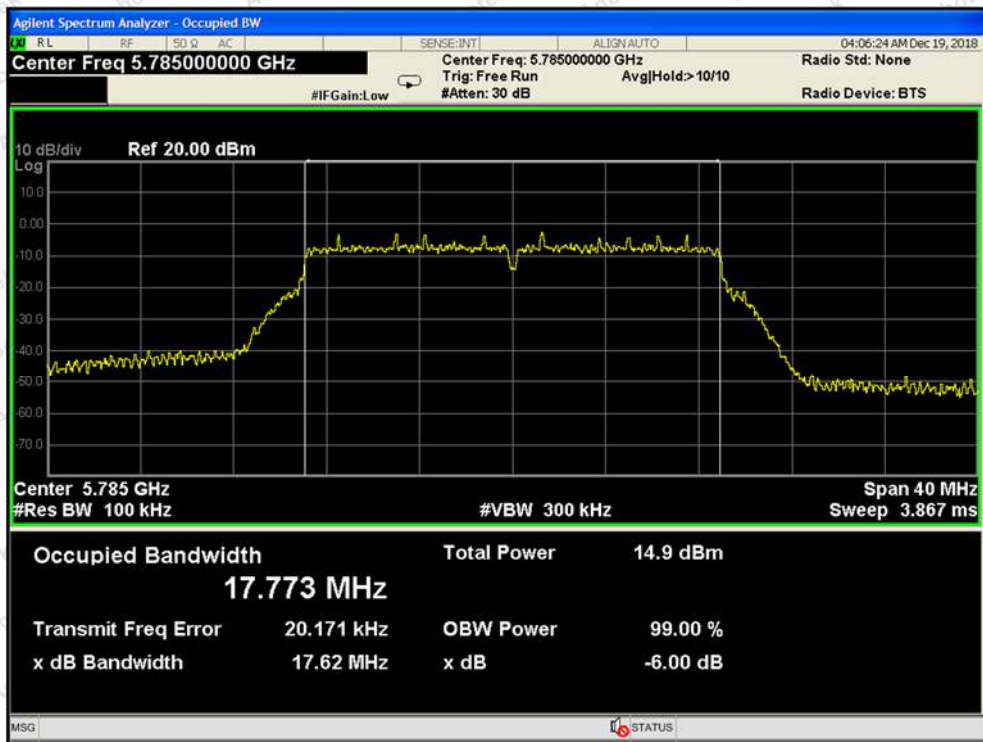
Test Mode: 802.11a---Middle



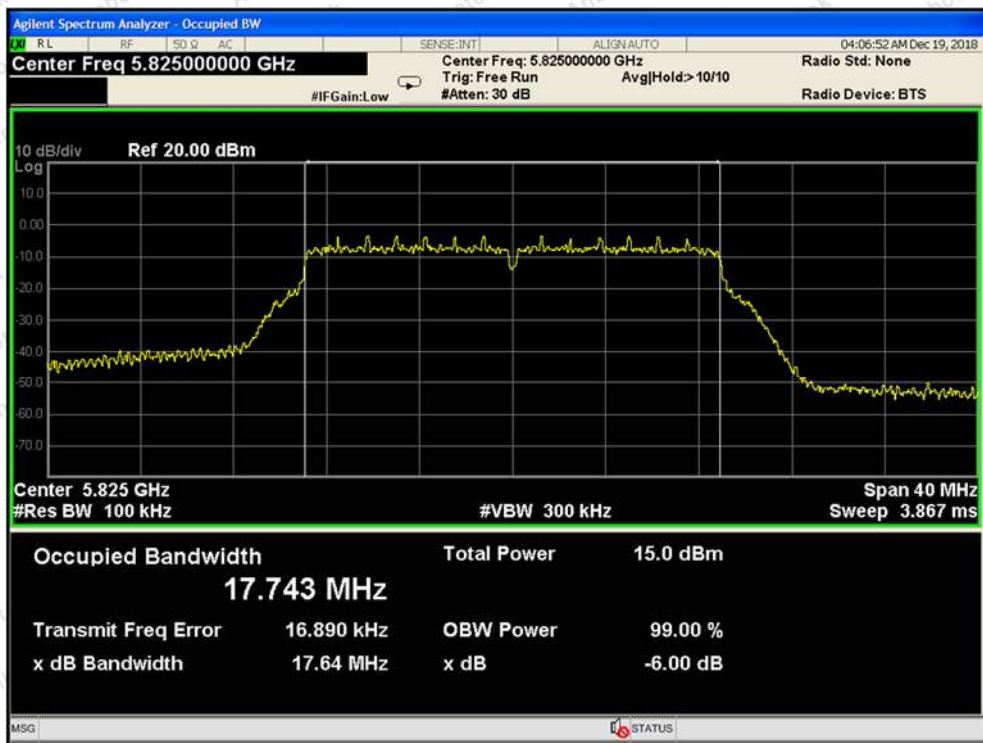
Test Mode: 802.11a---High



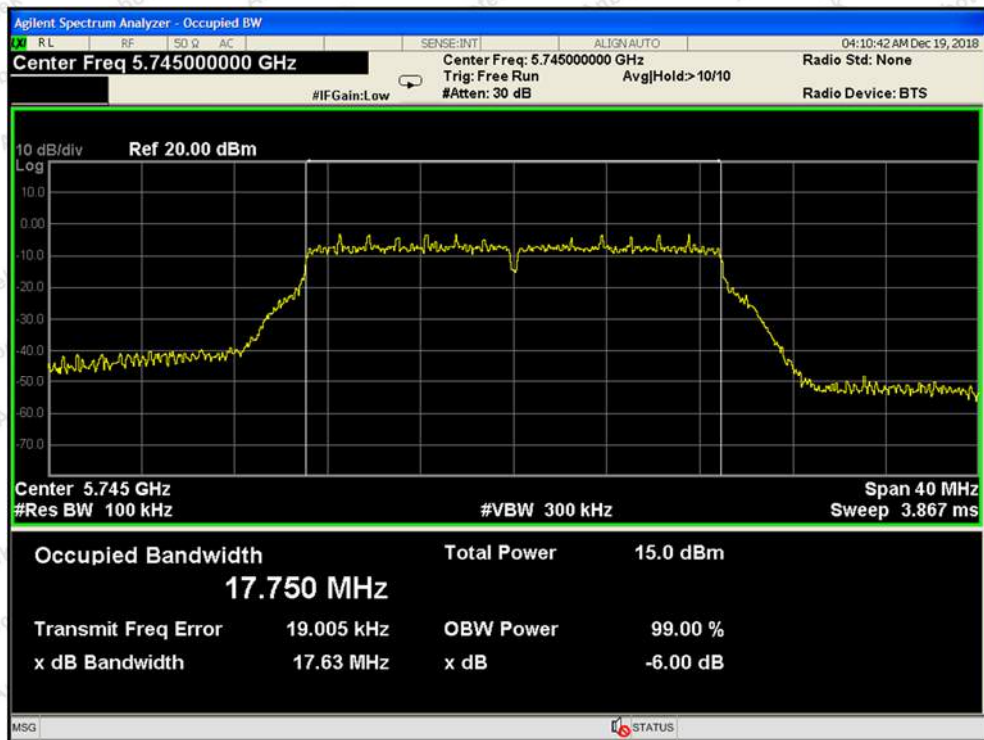
Test Mode: 802.11n20---Low



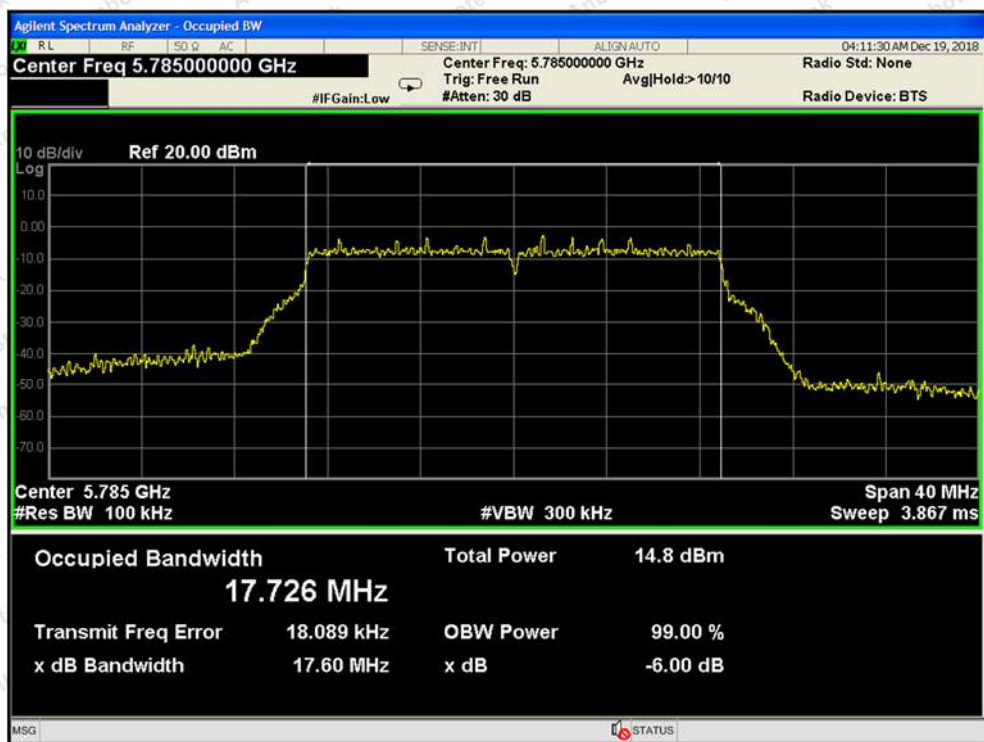
Test Mode: 802.11n20---Middle



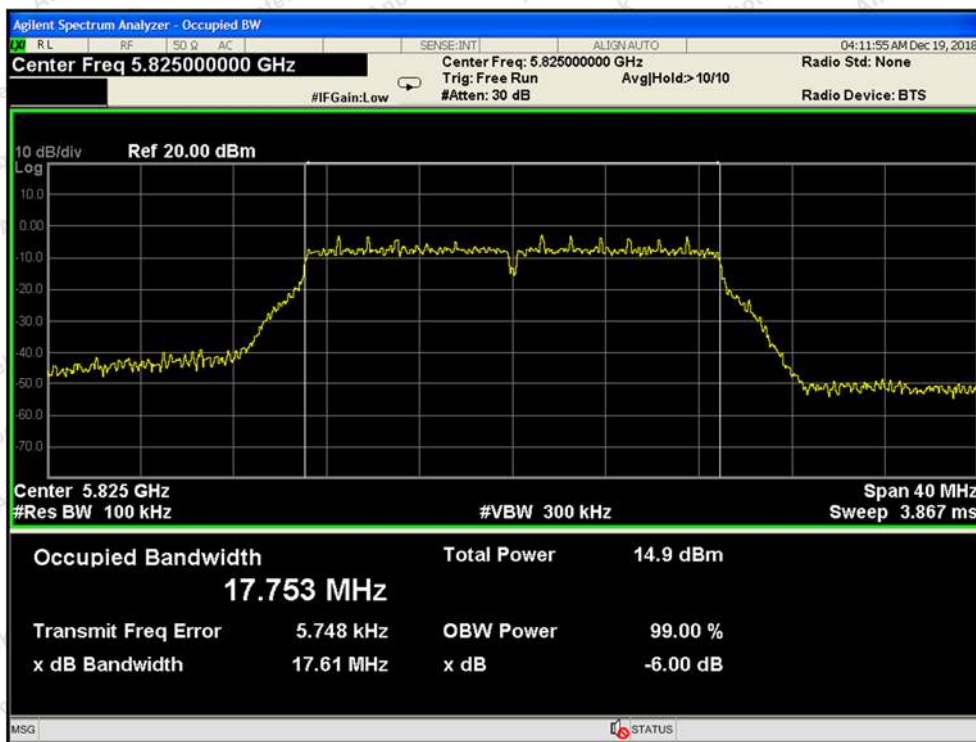
Test Mode: 802.11n20---High



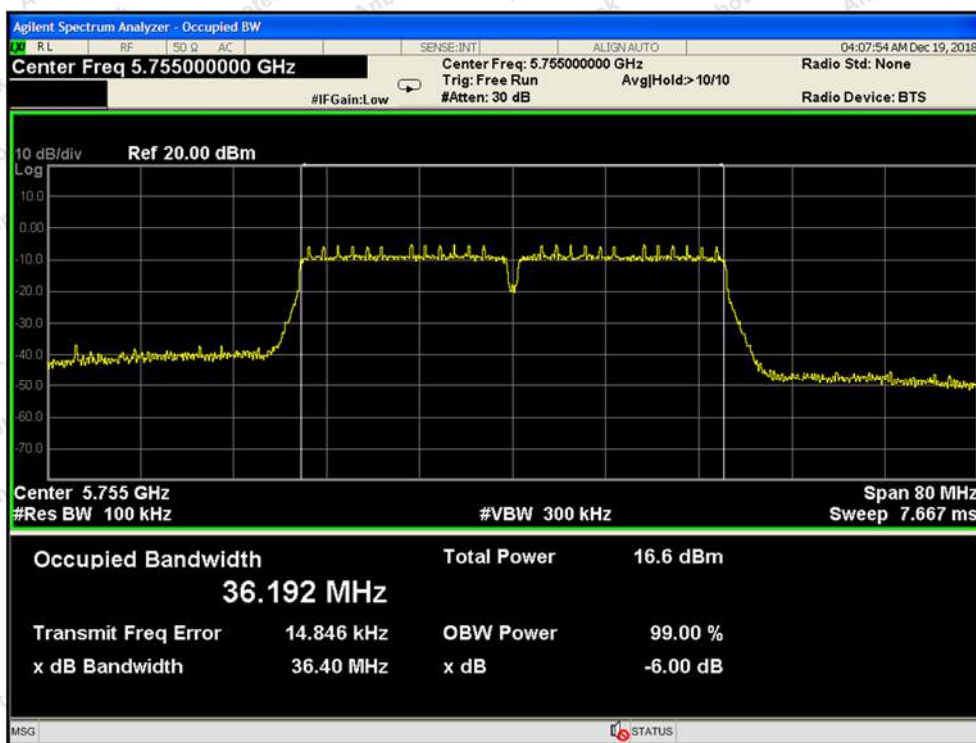
Test Mode: 802.11ac20--Low



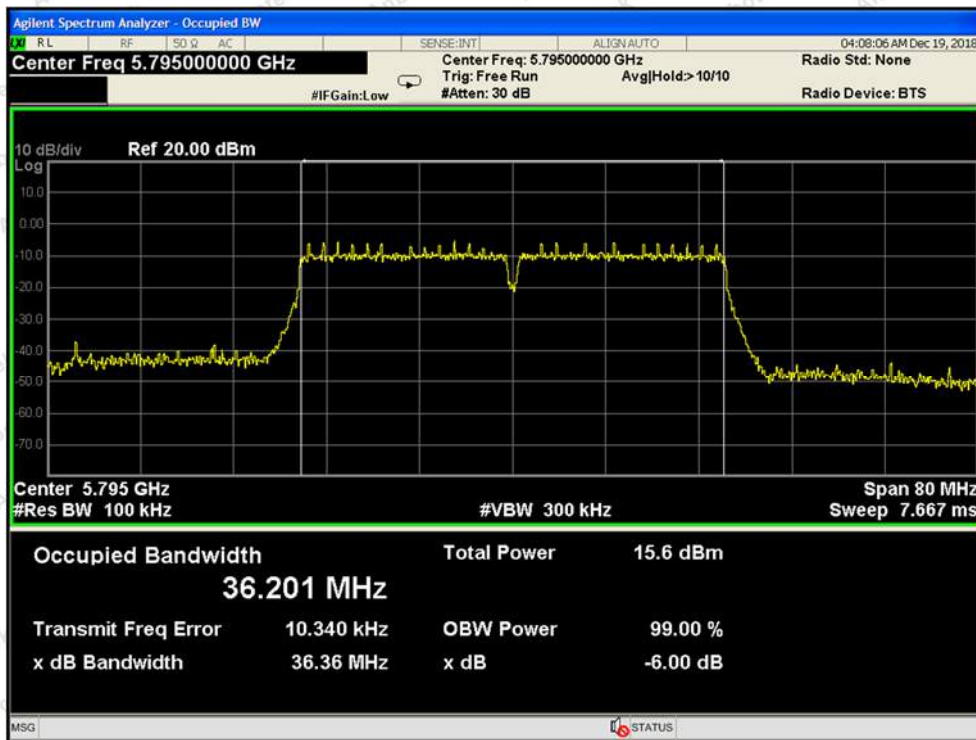
Test Mode: 802.11ac20---Middle



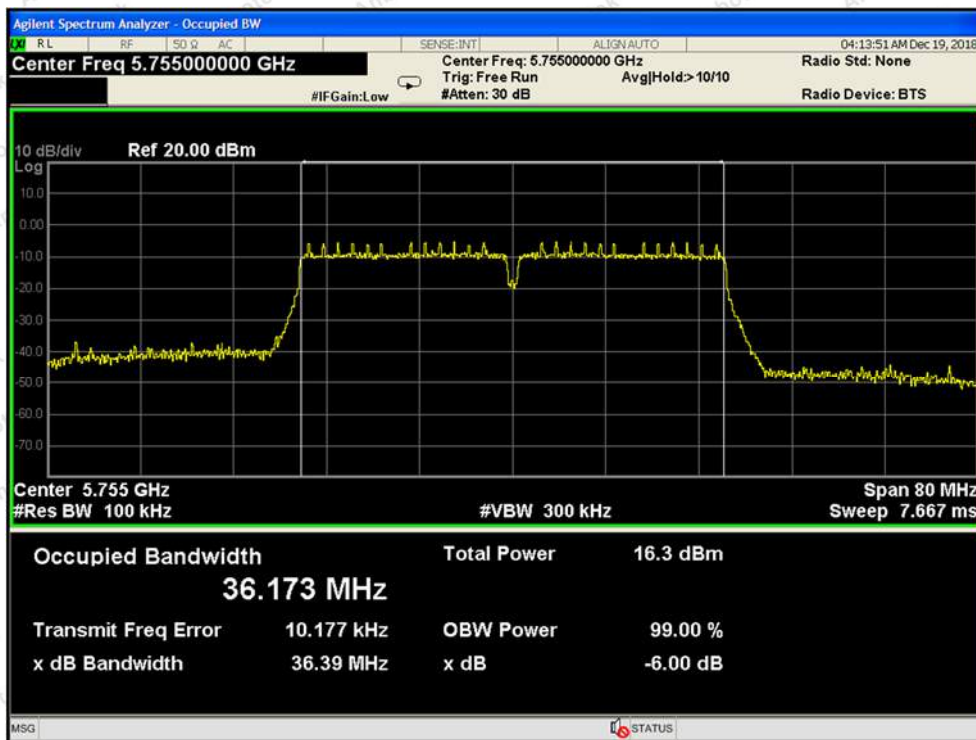
Test Mode: 802.11ac20---High



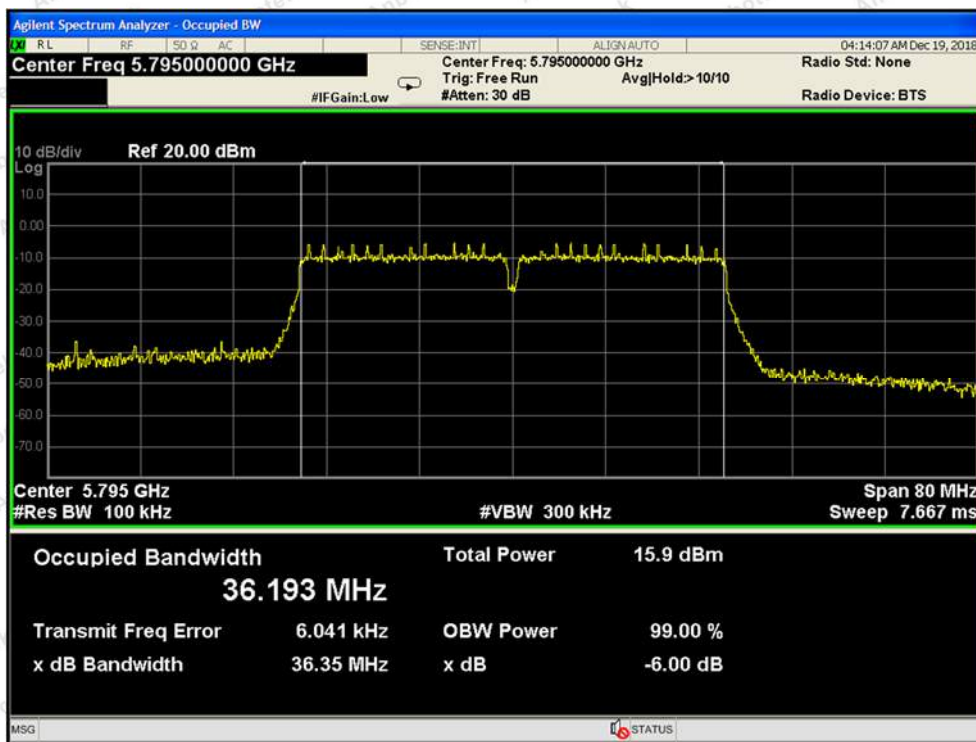
Test Mode: 802.11n40---Low



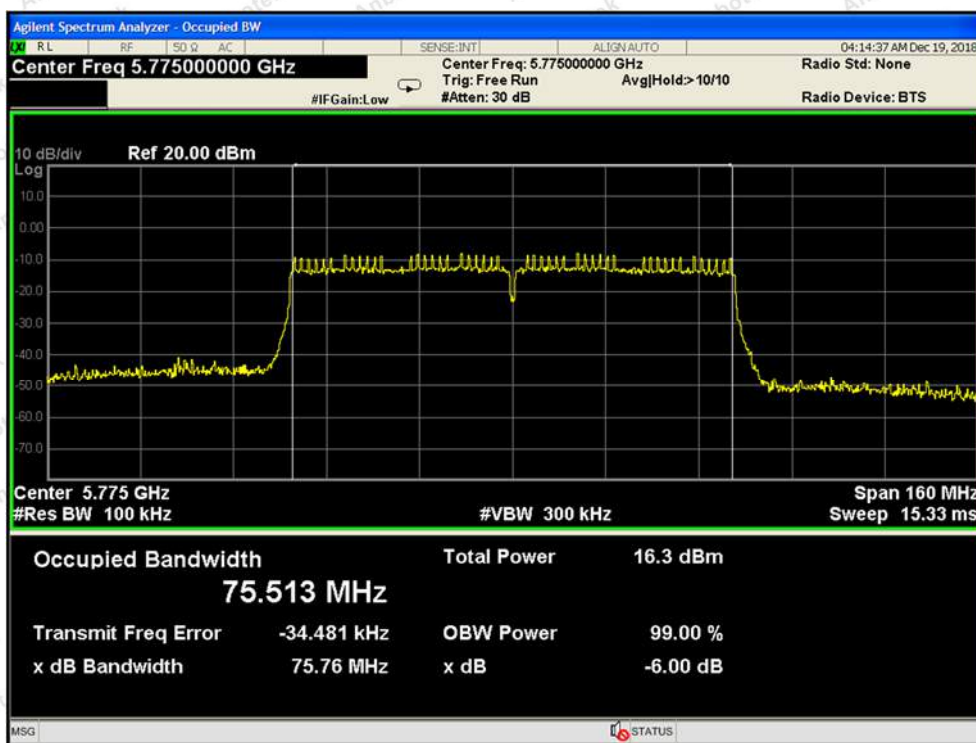
Test Mode: 802.11n40---High



Test Mode: 802.11ac40---Low

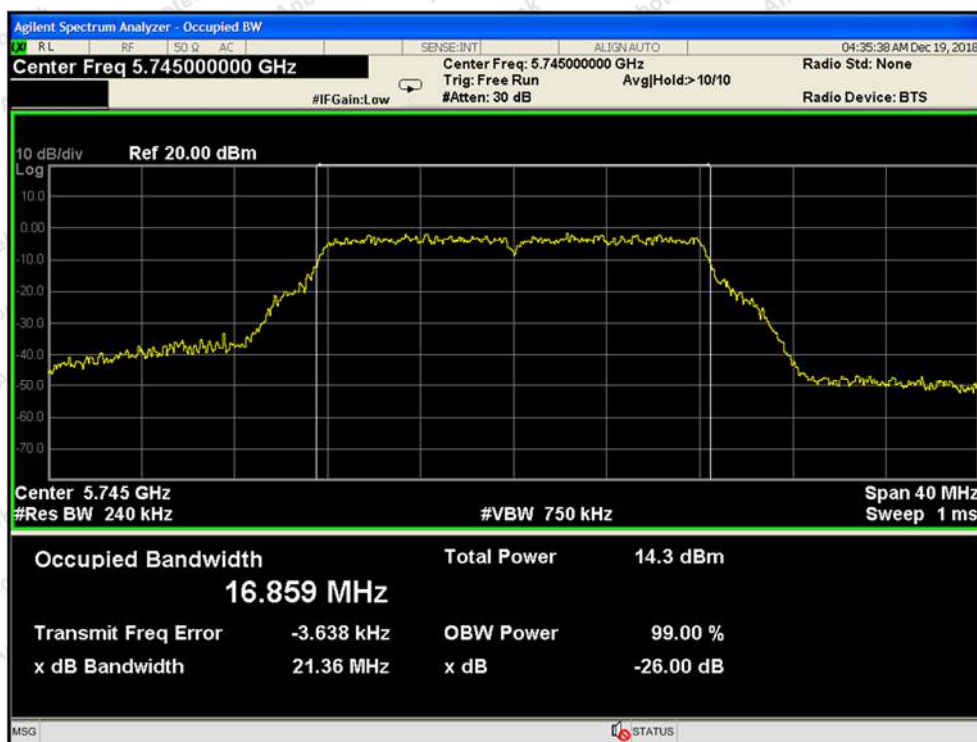


Test Mode: 802.11ac40---High

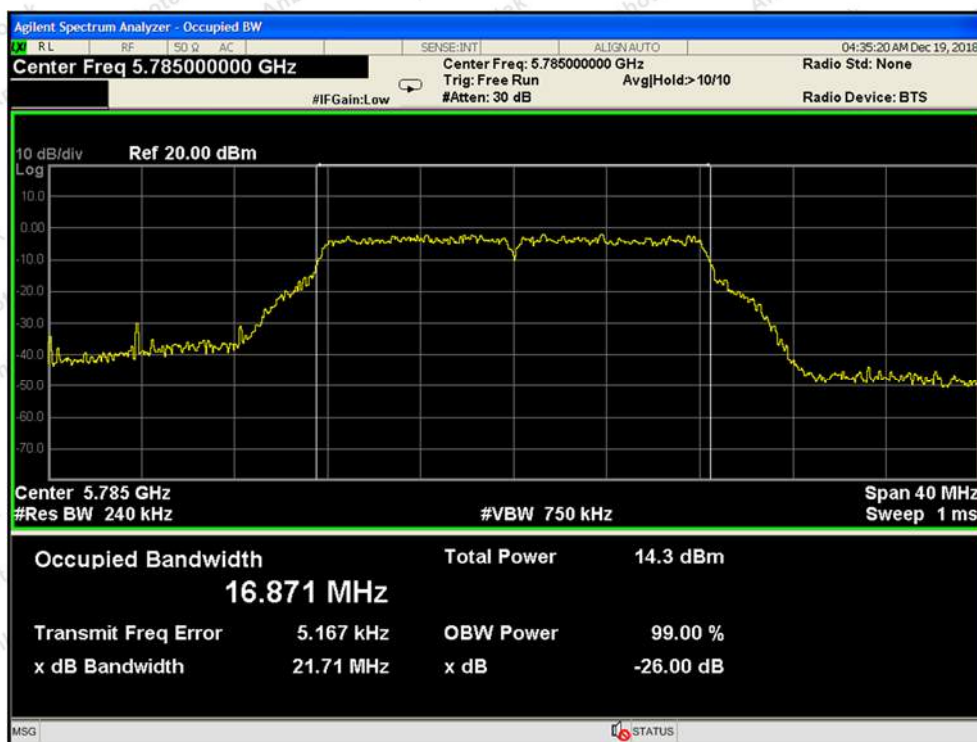


Test Mode: 802.11ac80

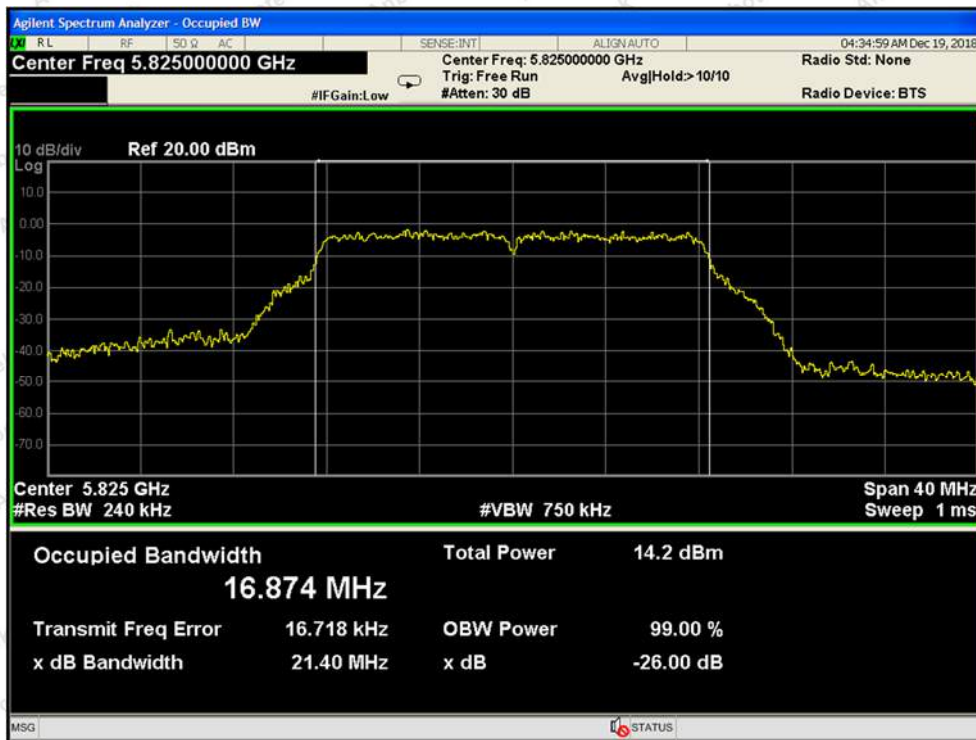
26dB & 99% Bandwidth



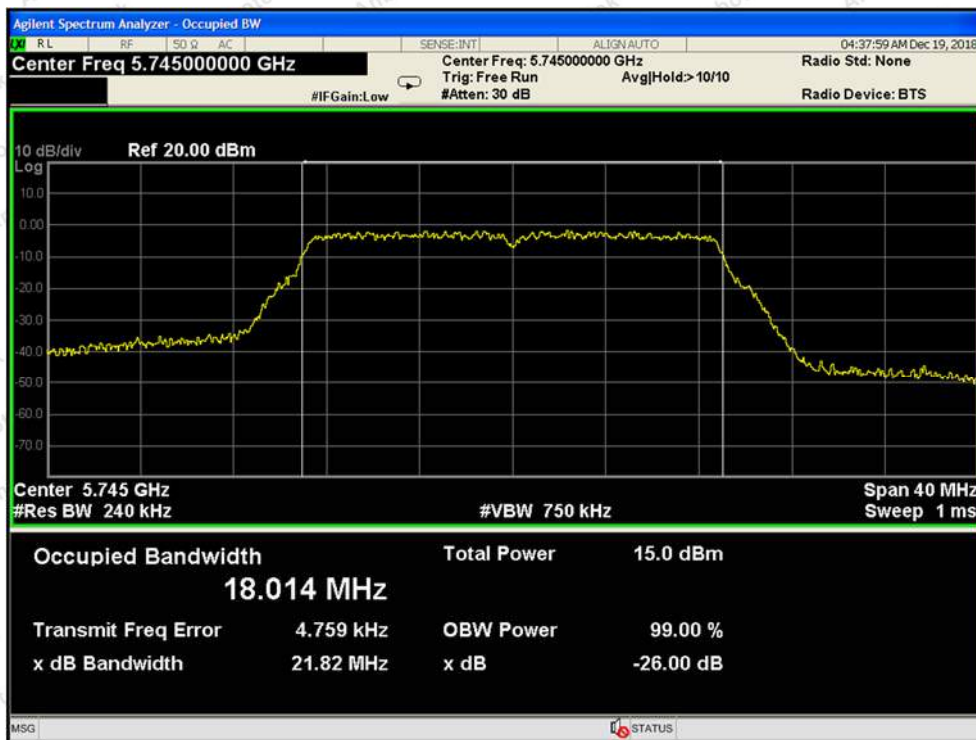
Test Mode: 802.11a--Low



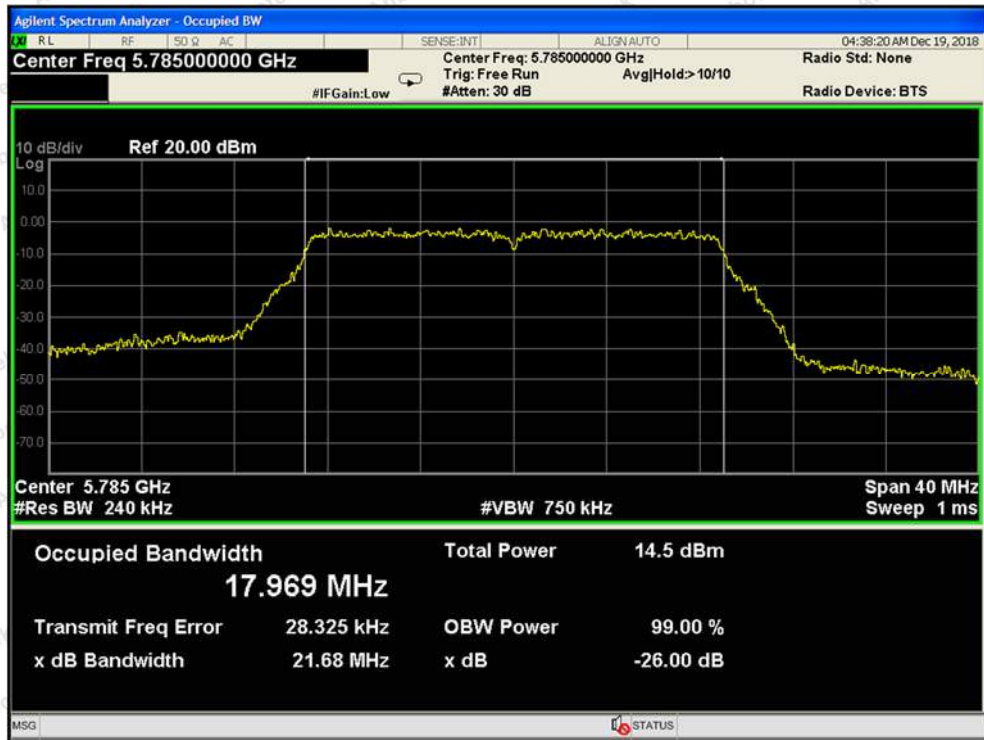
Test Mode: 802.11a---Middle



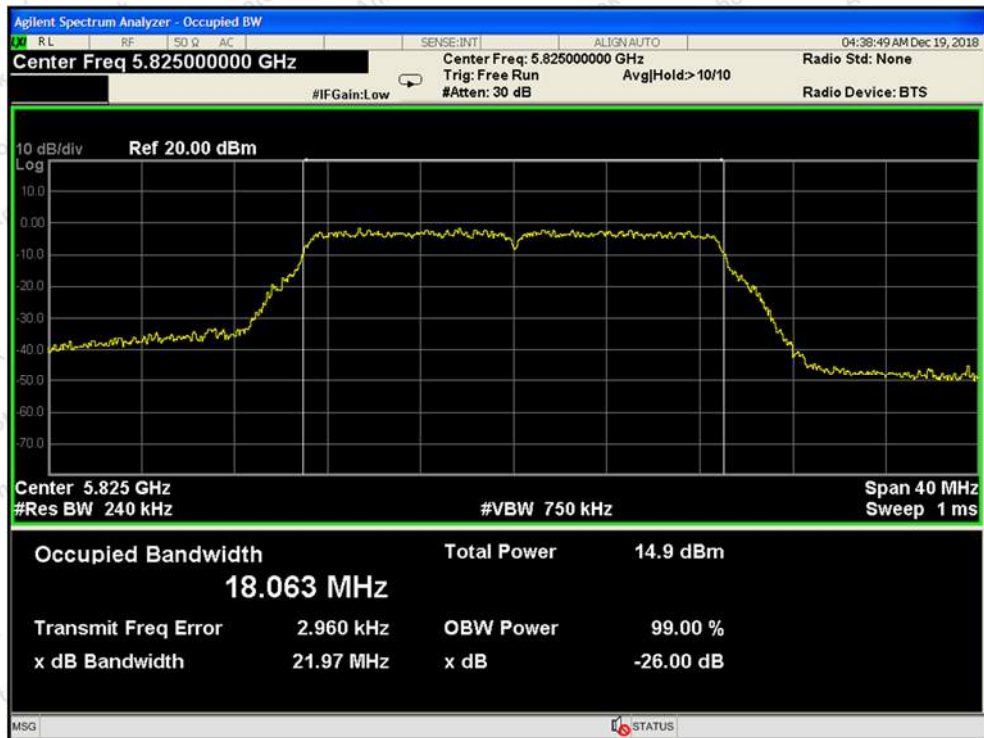
Test Mode: 802.11a---High



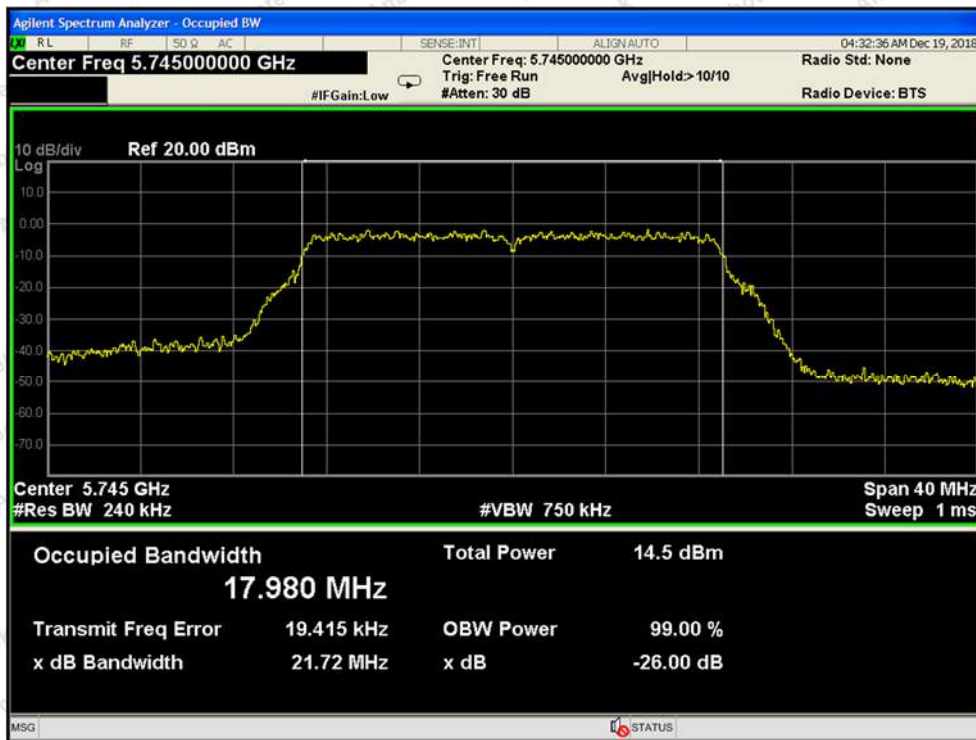
Test Mode: 802.11n20---Low



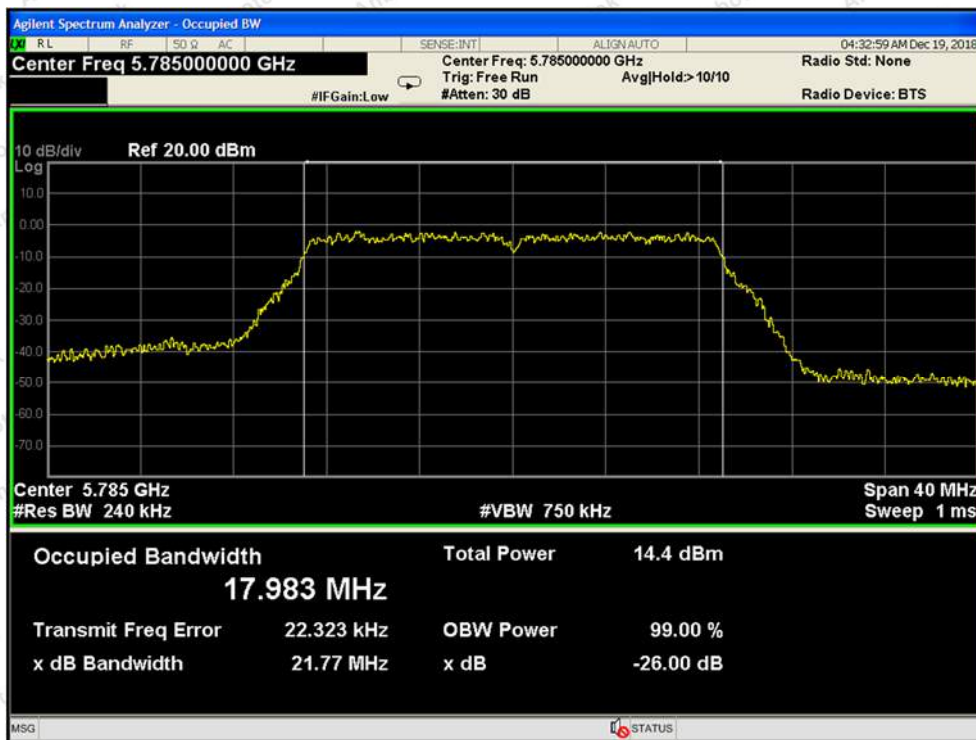
Test Mode: 802.11n20---Middle



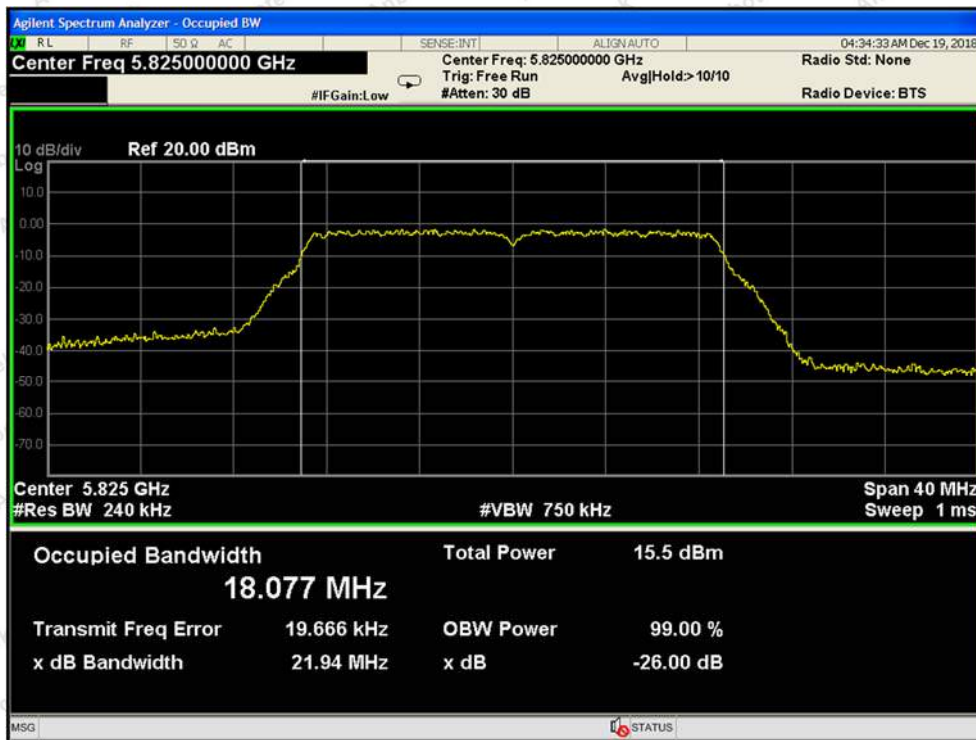
Test Mode: 802.11n20---High



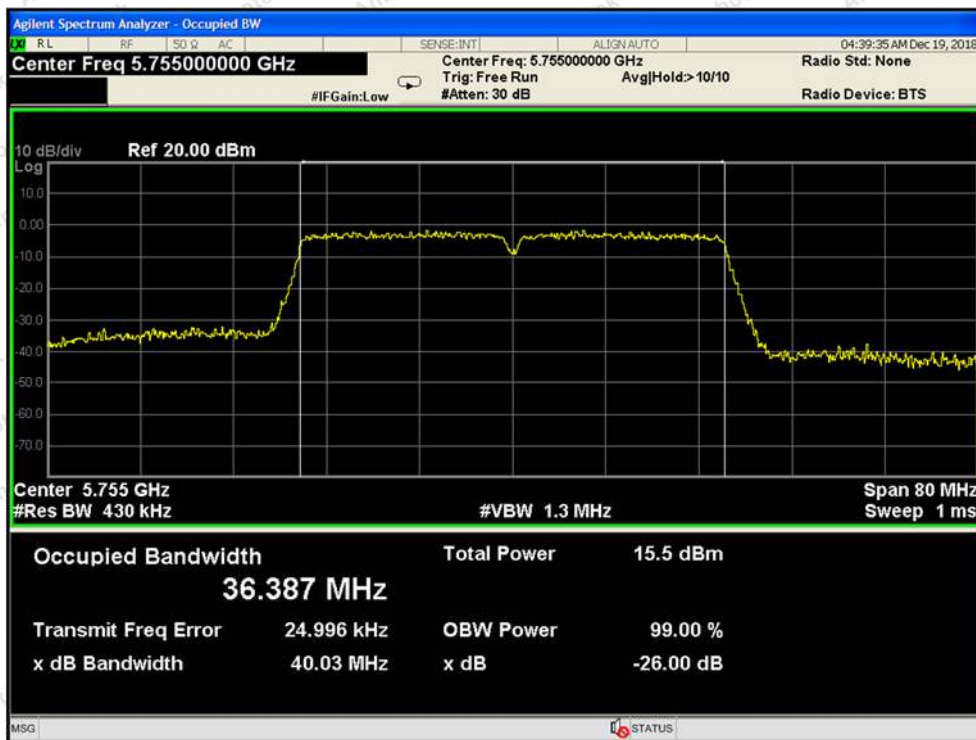
Test Mode: 802.11ac20--Low



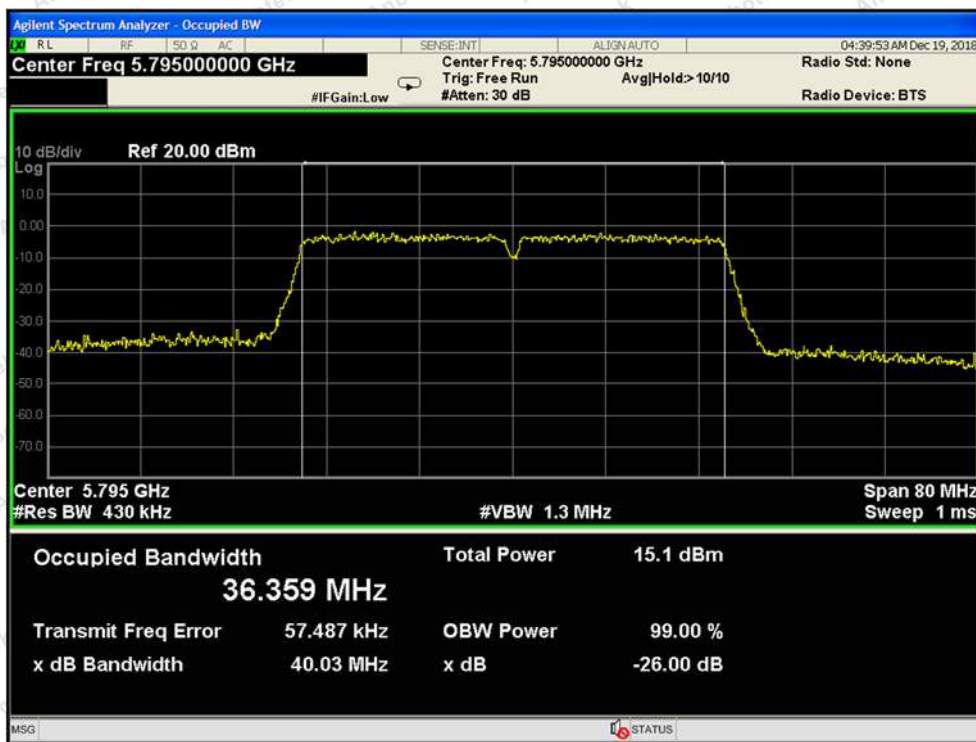
Test Mode: 802.11ac20---Middle



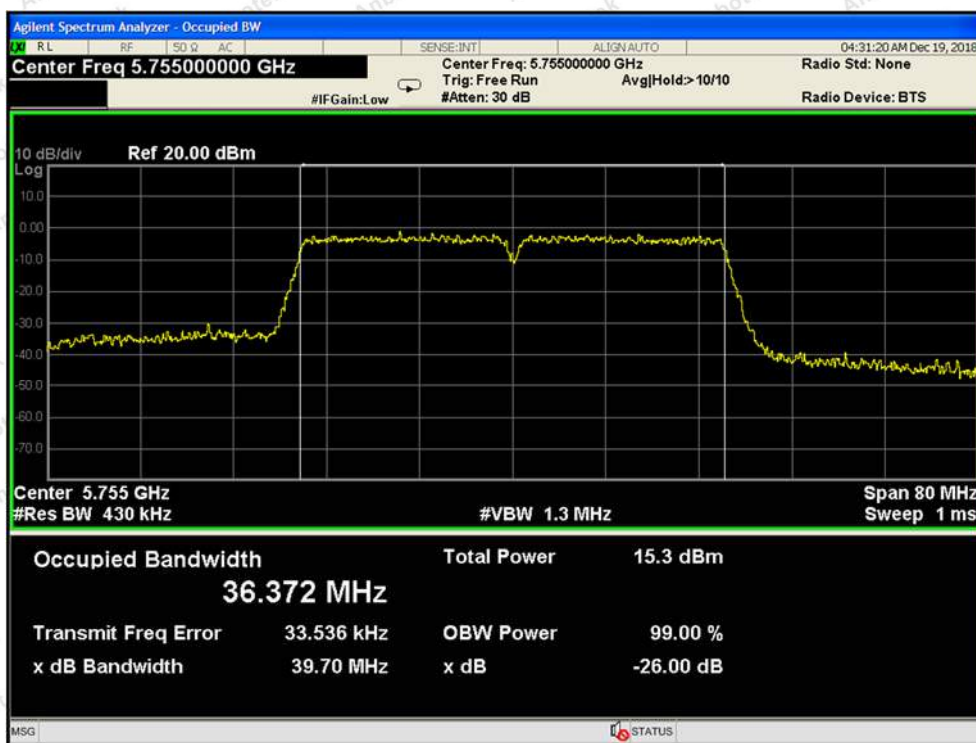
Test Mode: 802.11ac20---High



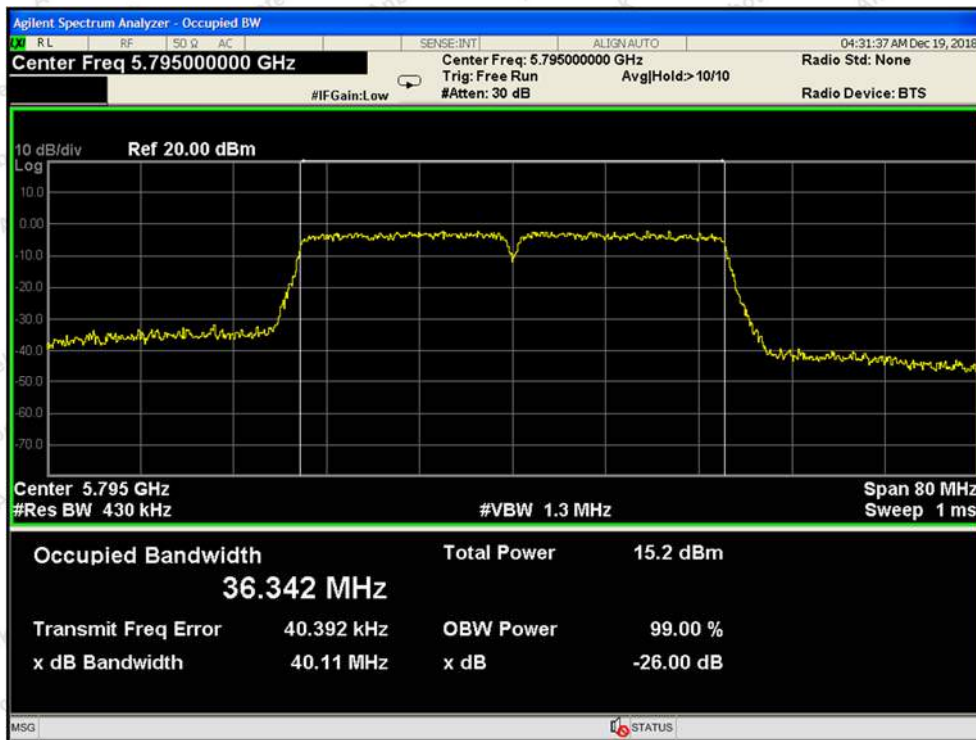
Test Mode: 802.11n40---Low



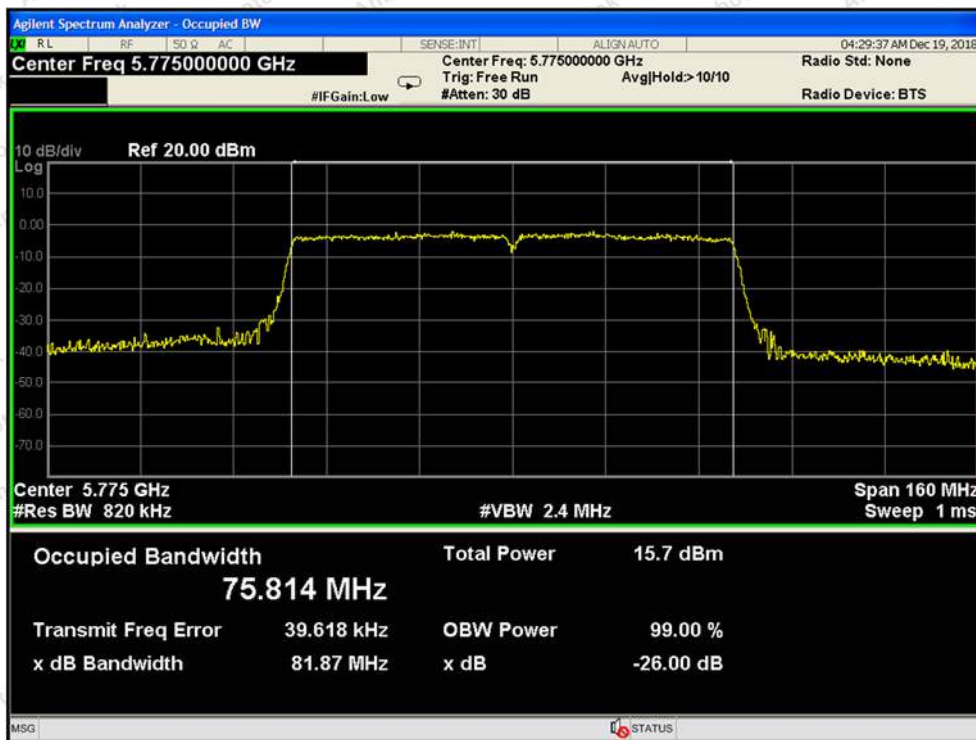
Test Mode: 802.11n40---High



Test Mode: 802.11ac40---Low



Test Mode: 802.11ac40---High



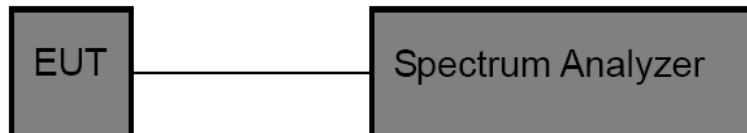
Test Mode: 802.11ac80

7. Power Spectral Density Test

7.1. Test Standard and Limit

Test Standard	FCC Part15 C Section 15.407 (a) (3)
Test Limit	not exceed 30dBm/500kHz

7.2. Test Setup



7.3. Test Procedure

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).

1. The EUT is directly connected to the spectrum analyzer;
2. Set RBW =510KHz;
3. Set VBW ≥ 3 RBW;
3. Set the span to encompass the entire emissions bandwidth (EBW) of the signal;
5. Detector=RMS;
6. Sweep time= auto couple;
7. Trace mode=max. hold;

7.4. Test Data

Test Item : Power Spectral Density
Test Voltage : DC 3.6V battery inside
Test Result : PASS

Test Mode : CH Low ~ CH High
Temperature : 24℃
Humidity : 55%RH

Test Mode	Channel Frequency (MHz)	Final Power Spectral Density (dBm/500KHz)	Correctional Limit (dBm/500KHz)	Results
802.11a	5745	0.494	30	PASS
	5785	0.476	30	PASS
	5825	-0.257	30	PASS
802.11n20	5745	-0.476	30	PASS
	5785	0.628	30	PASS
	5825	0.140	30	PASS
802.11ac20	5745	0.463	30	PASS
	5785	0.149	30	PASS
	5825	-0.328	30	PASS
802.11n40	5755	-1.716	30	PASS
	5795	-2.514	30	PASS
802.11ac40	5755	-1.652	30	PASS
	5795	-1.889	30	PASS
802.11ac80	5775	-5.479	30	PASS



Test Mode: 802.11a--Low



Test Mode: 802.11a---Middle



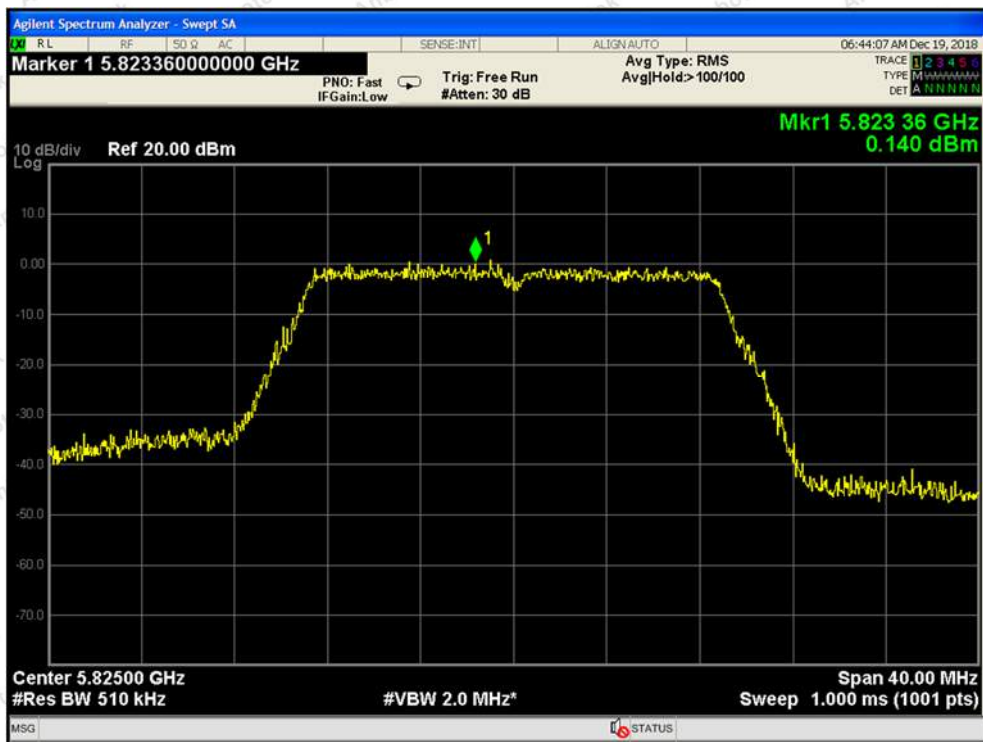
Test Mode: 802.11a---High



Test Mode: 802.11n20---Low



Test Mode: 802.11n20---Middle



Test Mode: 802.11n20---High



Test Mode: 802.11ac20--Low



Test Mode: 802.11ac20---Middle



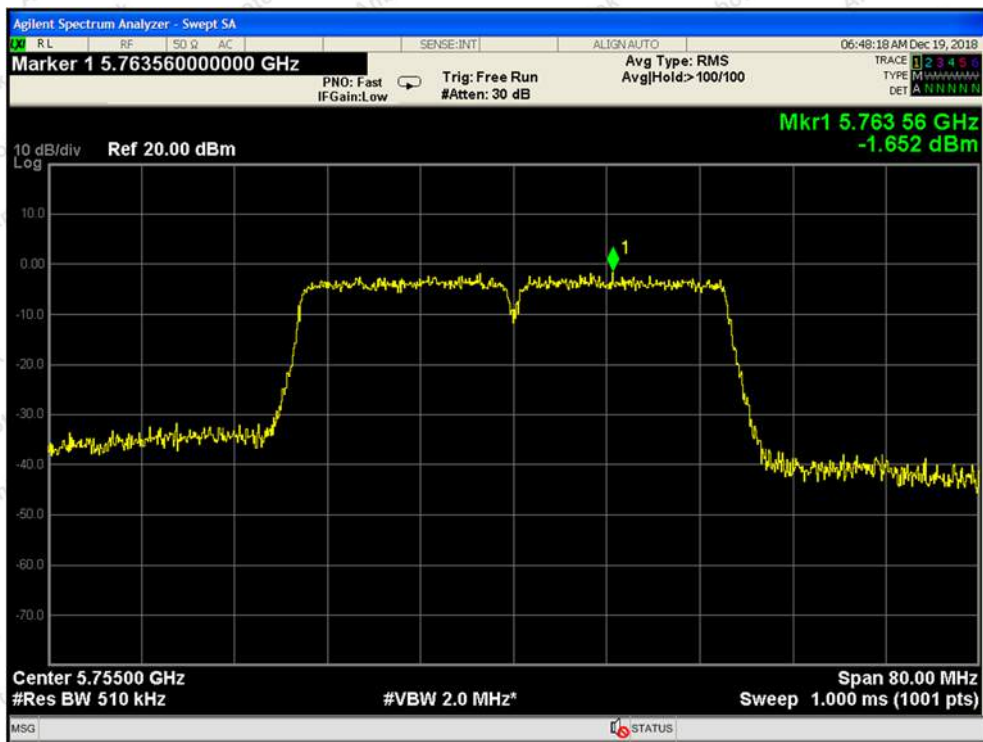
Test Mode: 802.11ac20---High



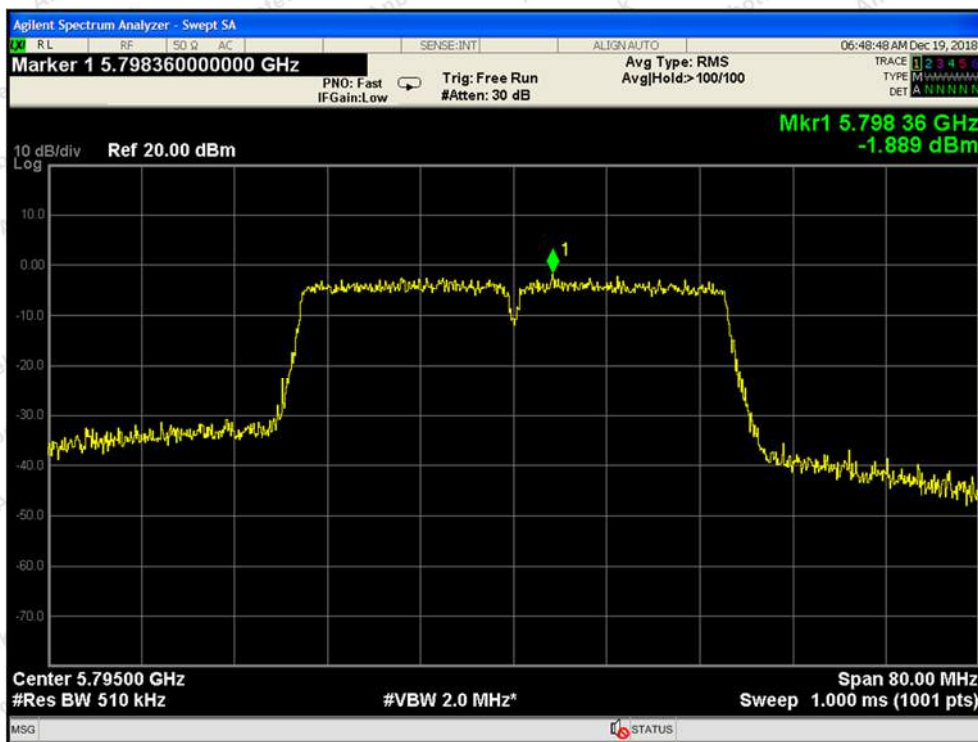
Test Mode: 802.11n40---Low



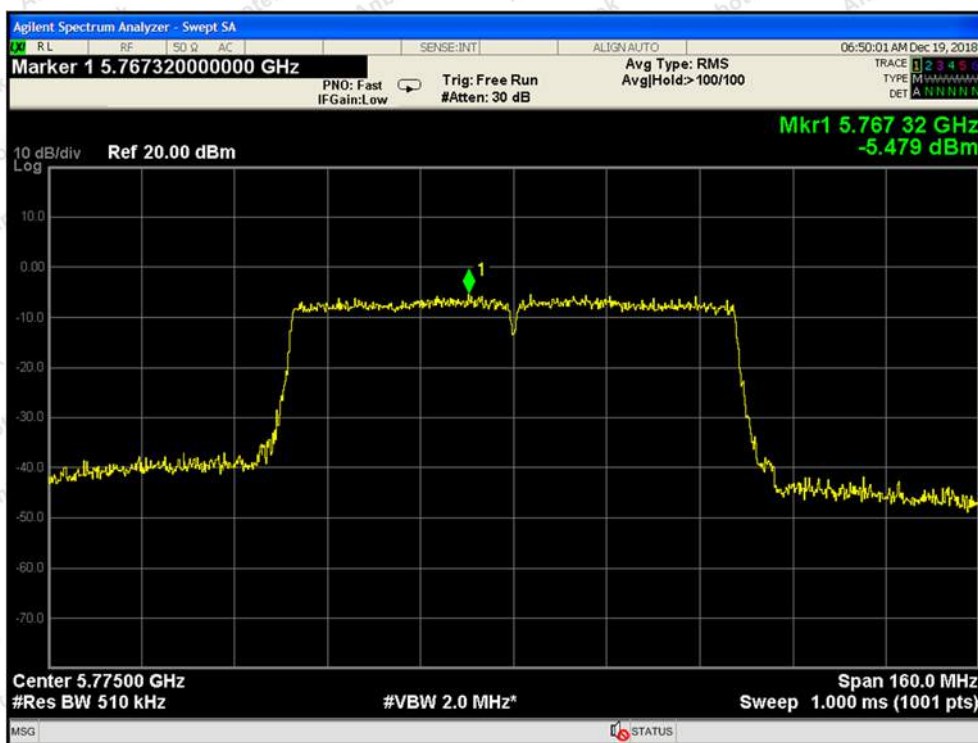
Test Mode: 802.11n40---High



Test Mode: 802.11ac40---Low



Test Mode: 802.11ac40---High



Test Mode: 802.11ac80

8. Antenna Requirement

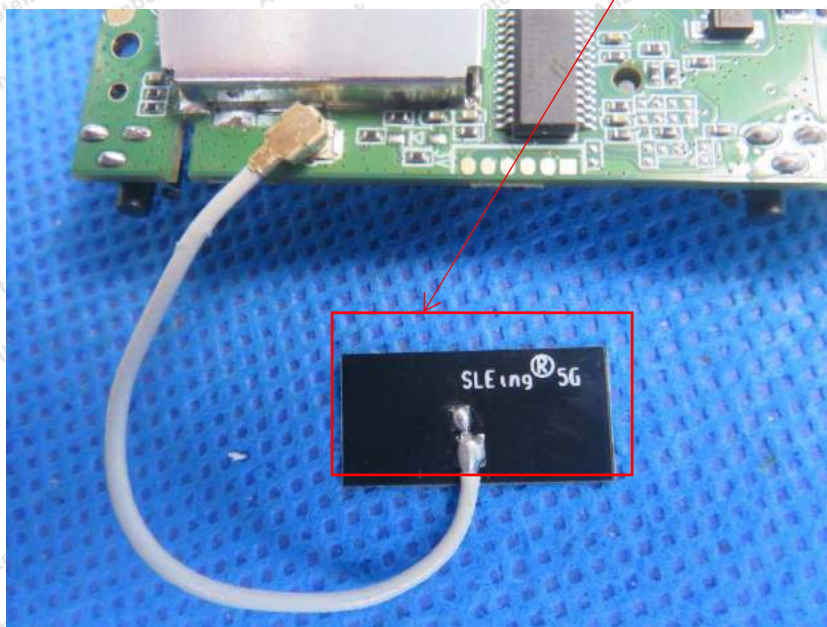
8.1. Test Standard and Requirement

Test Standard	FCC Part15 Section 15.203 /15.407
Requirement	<p>1) 15.203 requirement: 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, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.</p> <p>2) 15.407 requirement: 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 use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.</p>

8.2. Antenna Connected Construction

The antenna is an PCB Antenna which permanently attached, and the best case gain of the antenna is 2 dBi each antenna (It is reduced power treatment). It complies with the standard requirement.

5.8G WIFI Antenna



APPENDIX I -- TEST SETUP PHOTOGRAPH

Photo of Power Line Conducted Emission Test



Photo of Radiation Emission Test





APPENDIX II -- EXTERNAL PHOTOGRAPH

Please see the test report of SZAWW181207003-02

APPENDIX III -- INTERNAL PHOTOGRAPH

Please see the test report of SZAWW181207003-02

----- End of Report -----