FCC TEST REPORT

For

Autel Intelligent Tech. Corp., Ltd.

AUTOMOTIVE DIAGNOSTIC & ANALYSIS SYSTEM

Model No.: MaxiSys Ultra

Prepared For	:	Autel Intelligent Tech. Corp., Ltd.
Address	:	7th-8th, 10th Floor, Bldg. B1, Zhiyuan, Xueyuan Rd. Xili, Nanshan, Shenzhen, China
Prepared By	:	Shenzhen Anbotek Compliance Laboratory Limited
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Report Number	:	SZAWW180702011-06
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TEST REPORT

Applicant	:	Autel Intelligent Tech. Corp., Ltd.
Manufacturer	:	Autel Intelligent Tech. Corp., Ltd.
Product Name	:	AUTOMOTIVE DIAGNOSTIC & ANALYSIS SYSTEM
Model No.	:	MaxiSys Ultra
Trade Mark	:	Autel
Rating(s)	:	Input: DC 12V, 3A(via adapter input: AC 100~240V, 50/60Hz, 1.2A; with DC 3.8V, 18000 mAh Battery inside)
Test Standard(s)	**:**	**FCC Part15 Subpart E 2017, Paragraph 15.407** **ANSI C63.10: 2013**
Test Method(s)	**:**	**KDB 789033 D02 General UNII Test Procedures New Rules v01r04** **KDB662911 D01 Multiple Transmitter Output v02r01**

The device described above is tested by Shenzhen Anbotek 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 Anbotek 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 Anbotek Compliance Laboratory Limited.

Date of Test Jul. 02~Oct. 30, 2018

Prepared by

(Engineer / Dolly Mo)

Reviewer

(Supervisor / Snowy Meng)

Approved & Authorized Signer

(Manager / Sally Zhang)

1. General Information

1.1. Client Information

Applicant	:	Autel Intelligent Tech. Corp., Ltd.
Address	:	7th-8th, 10th Floor, Bldg. B1, Zhiyuan, Xueyuan Rd. Xili, Nanshan, Shenzhen, China
Manufacturer	:	Autel Intelligent Tech. Corp., Ltd.
Address	:	7th-8th, 10th Floor, Bldg. B1, Zhiyuan, Xueyuan Rd. Xili, Nanshan, Shenzhen, China
Factory 1	:	Autel lntelligent Technology Corp.,Ltd.
Address	:	6th Floor, Building 1, Yanxiang Zhigu, NO.11 Gaoxin West Rd, Guangming New District, Shenzhen City, Guangdong Province, China
Factory 2	:	AUTEL VIETNAM COMPANY LIMITED
Address	:	4th Floor, Factory#6, Land#CN1, An Duong Industrial Zone, Hong Phong Township, An Duong County, Hai Phong, Viet Nam

1.2. Description of Device (EUT)

Product Name	:	AUTOMOTIVE DIAGNOSTIC & ANALYSIS SYSTEM	
Model No.	:	MaxiSys Ultra	
Trade Mark	:	Autel	
Test Power Supply	:	AC 120V, 60Hz for adapter / AC 240V, 60Hz for adapter / DC 3.8V battery inside	
Test Sample No.	:	1-2-1(Normal Sample), 1-2-2(Engineering Sample)	
Product Description	:	Operation Frequency:	BT 2.1+EDR: 2402MHz~2480MHz 2.4G WIFI: 2412-2462MHz 5.1G WIFI: 5180MHz~5240MHz 5.8G WIFI: 5745MHz~5825MHz
		Transfer Rate:	BT 2.1+EDR: 1/2/3 Mbits/s
		Number of Channel:	BT 2.1+EDR: 79 Channels 2.4G WIFI: 11 Channels for 802.11b/ g/ n(HT20) 5.1G WIFI: 4 Channels for 802.11a, 802.11n(HT20), 802.11ac(HT20) 5.8G WIFI: 5 Channels for 802.11a, 802.11n(HT20), 802.11ac(HT20)
		Modulation Type:	BT 2.1+EDR: GFSK, π/4-DQPSK, 8-DPSK 2.4G WIFI: 802.11b CCK; 802.11g/n OFDM 5.1G & 5.8G WIFI: OFDM with BPSK/QPSK/16QAM/64QAM for 802.11a/n; OFDM with BPSK/QPSK/16QAM/64QAM/

			256QAM for 802.11ac
		Antenna Type:	BT 2.1+EDR: Ceramic Antenna 2.4G & 5.1G & 5.8G WIFI: PIFA Antenna
		Antenna Gain(Peak):	BT 2.1+EDR: 0 dBi 2.4G WIFI module 1 & 2.4G WIFI module 2(ANT A & ANT B) & 5.1G WIFI(ANT A & ANT B) & 5.8G WIFI(ANT A & ANT B): 1 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 5.8G WIFI module.			

1.3. Auxiliary Equipment Used During Test

Adapter	:	Model: GME36A-120300FDS Input: 100~240Vac 50/60Hz, 1.2A Output: DC 12V, 3000mA

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

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: 50Ω, 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%

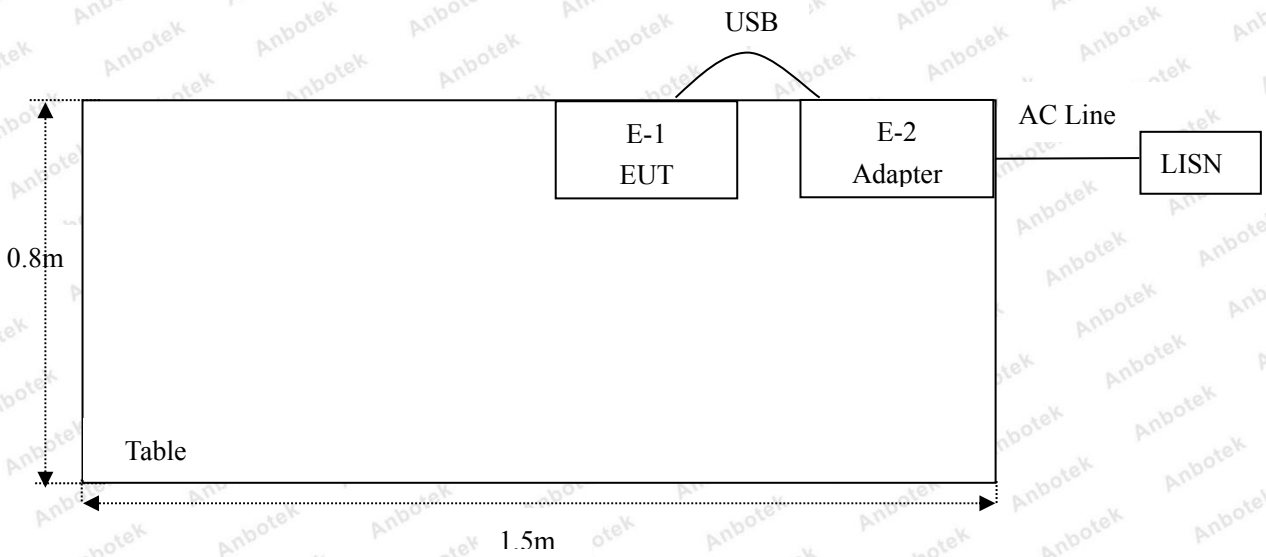
1.5. List of channels

802.11a/n20/ac20

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

1.6. Description Of Test Setup

CE



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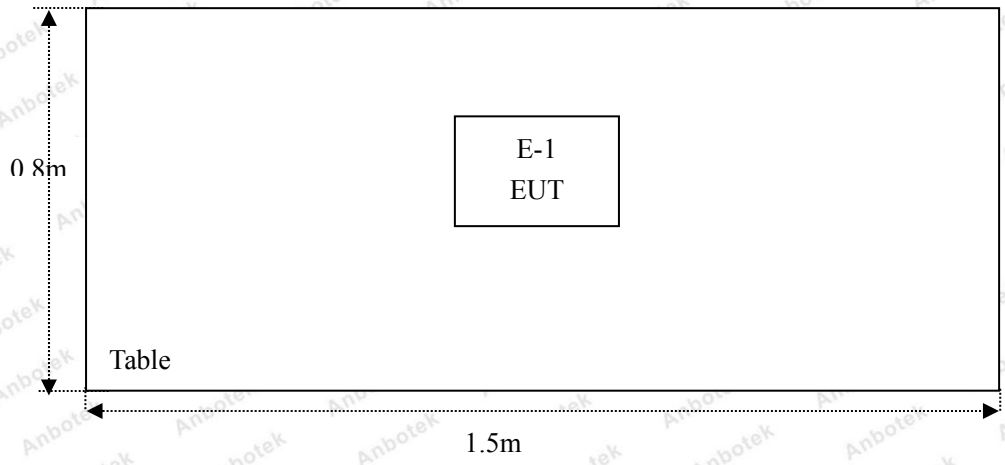


1.7. Test Equipment List

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	L.I.S.N. Artificial Mains Network	Rohde & Schwarz	ENV216	100055	Nov. 17, 2017	1 Year
2.	EMI Test Receiver	Rohde & Schwarz	ESCI	100627	Nov. 17, 2017	1 Year
3.	RF Switching Unit	Compliance Direction	RSU-M2	38303	Nov. 17, 2017	1 Year
4.	Spectrum Analysis	Agilent	E4407B	US39390582	Nov. 17, 2017	1 Year
5.	MAX Spectrum Analysis	Agilent	N9020A	MY51170037	Nov. 18, 2017	1 Year
6.	Preamplifier	SKET Electronic	BK1G18G30D	KD17503	Nov. 17, 2017	1 Year
7.	Double Ridged Horn Antenna	Instruments corporation	GTH-0118	351600	Nov. 20, 2017	1 Year
8.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	VULB 9163-289	Nov. 20, 2017	1 Year
9.	Loop Antenna	Schwarzbeck	HFH2-Z2	100047	Nov. 17, 2017	1 Year
10.	Horn Antenna	Schewarzbeck	BBHA9170	9170-375	Nov. 17, 2017	1 Year
11.	Pre-amplifier	SONOMA	310N	186860	Nov. 17, 2017	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. 18, 2017	1 Year
14.	Power Sensor	DAER	RPR3006W	15I00041SN045	Nov. 17, 2017	1 Year
15.	Power Sensor	DAER	RPR3006W	15I00041SN046	Nov. 17, 2017	1 Year
16.	MXA Spectrum Analysis	Agilent	N9020A	MY51170037	Nov. 18, 2017	1 Year
17.	MXG RF Vector Signal Generator	Agilent	N5182A	MY48180656	Nov. 18, 2017	1 Year
18.	Signal Generator	Agilent	E4421B	MY41000743	Nov. 18, 2017	1 Year
19.	DC Power Supply	LW	TPR-6410D	349315	Nov. 01, 2017	1 Year
20.	Constant Temperature Humidity Chamber	Sertep	ZJ-HWHS80B	ZJ-17042804	Nov. 01, 2017	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-Registration No.: 184111

Shenzhen Anbotek Compliance Laboratory Limited, EMC Laboratory has been registed and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration No. 184111, September 30, 2018.

ISED-Registration No.: 8058A-1

Shenzhen Anbotek 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 Anbotek 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

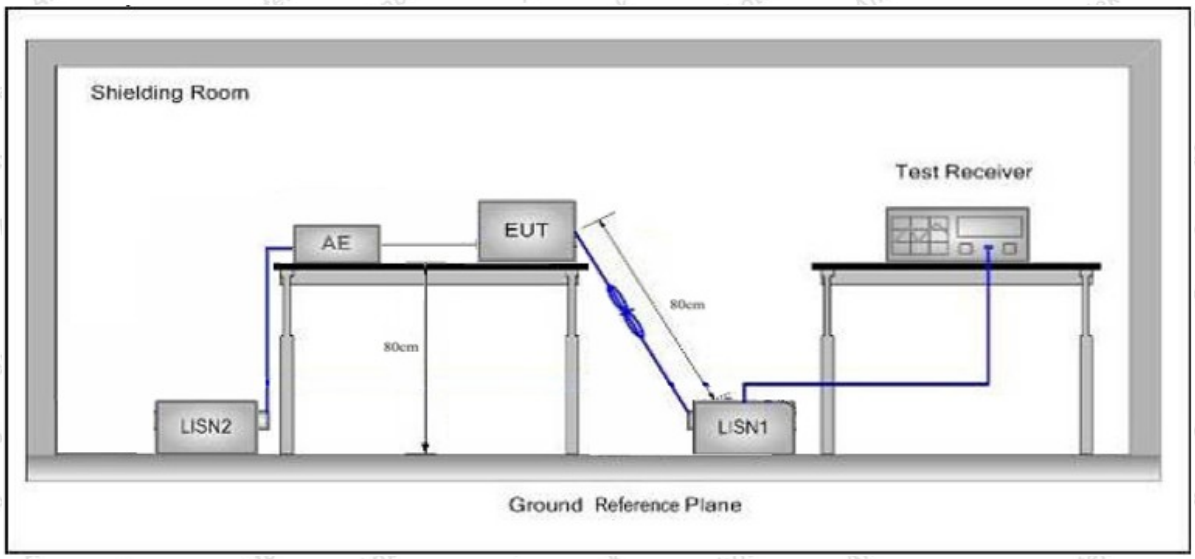
Standard	Test Type	Result
15.207 & 15.407	Conducted Emission	PASS
15.205/15.209	Spurious Emission	PASS
15.407(b)	Band Edge	PASS
15.407(a)(5)	Occupy Bandwidth	PASS
15.407(a)(1)(3)	Maximum Conducted Output Power	PASS
15.407(a)(1)(3)	Peak Power Spectral Density	PASS
15.203/15.407g	Antenna Requirement	PASS

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

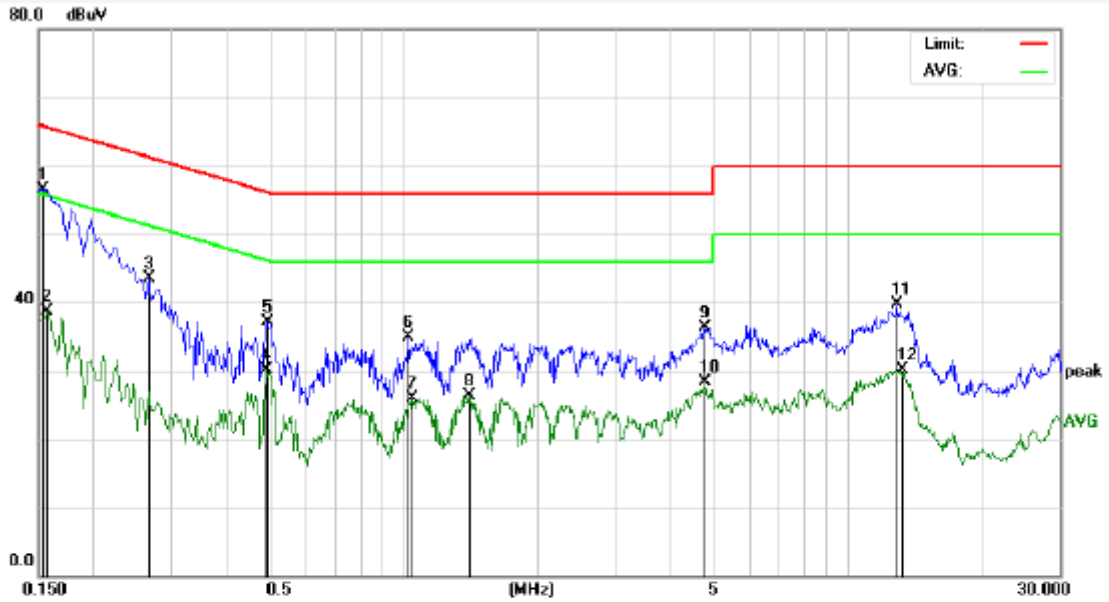
Test Site: 1# Shielded Room

Operating Condition: Keeping TX mode(802.11n20)

Test Specification: AC 240V, 60Hz for adapter

Comment: Live Line

Tem.: 22.2℃ Hum.: 59%



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Over Limit (dB)	Detector	Remark
1	0.1539	36.66	19.90	56.56	65.78	-9.22	QP	
2	0.1580	18.81	19.90	38.71	55.56	-16.85	AVG	
3	0.2660	23.63	19.89	43.52	61.24	-17.72	QP	
4	0.4900	10.11	19.98	30.09	46.17	-16.08	AVG	
5	0.4940	17.04	19.98	37.02	56.10	-19.08	QP	
6	1.0220	14.72	20.12	34.84	56.00	-21.16	QP	
7	1.0460	5.84	20.12	25.96	46.00	-20.04	AVG	
8	1.4100	6.19	20.13	26.32	46.00	-19.68	AVG	
9	4.7819	16.17	20.20	36.37	56.00	-19.63	QP	
10	4.7819	8.14	20.20	28.34	46.00	-17.66	AVG	
11	12.8580	19.45	20.29	39.74	60.00	-20.26	QP	
12	13.2620	9.87	20.29	30.16	50.00	-19.84	AVG	

Conducted Emission Test Data

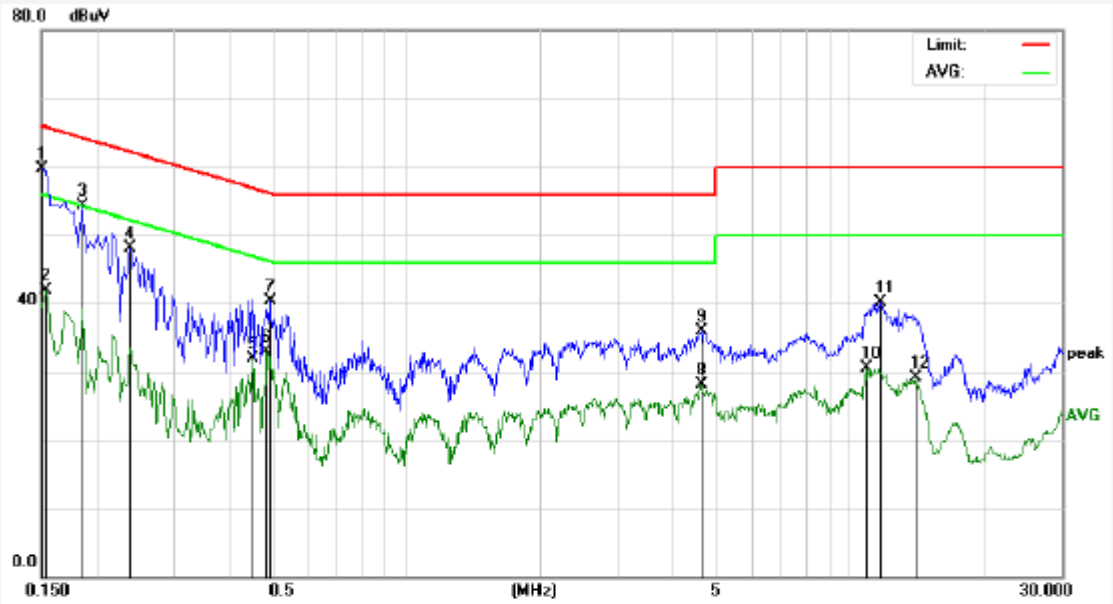
Test Site: 1# Shielded Room

Operating Condition: Keeping TX mode(802.11n20)

Test Specification: AC 240V, 60Hz for adapter

Comment: Neutral Line

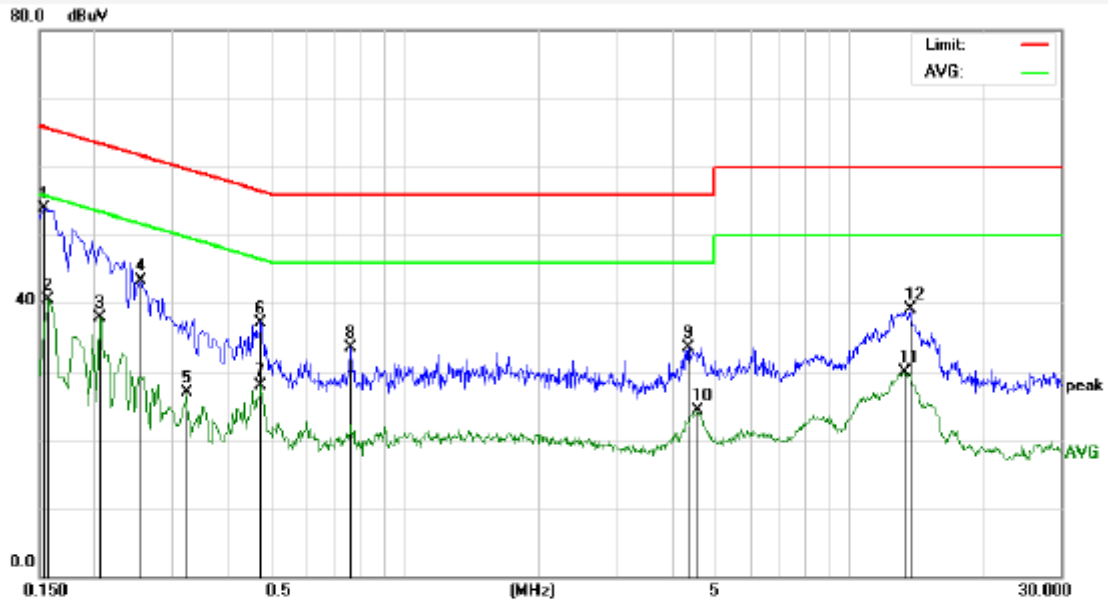
Tem.: 22.2℃ Hum.: 59%



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Over Limit (dB)	Detector	Remark
1	0.1500	39.88	19.90	59.78	65.99	-6.21	QP	
2	0.1539	21.98	19.90	41.88	55.78	-13.90	AVG	
3	0.1860	34.35	19.90	54.25	64.21	-9.96	QP	
4	0.2380	28.15	19.89	48.04	62.16	-14.12	QP	
5	0.4500	11.87	19.96	31.83	46.87	-15.04	AVG	
6	0.4860	12.95	19.97	32.92	46.24	-13.32	AVG	
7	0.4940	20.30	19.98	40.28	56.10	-15.82	QP	
8	4.6180	7.97	20.20	28.17	46.00	-17.83	AVG	
9	4.6460	15.67	20.20	35.87	56.00	-20.13	QP	
10	10.8979	10.17	20.33	30.50	50.00	-19.50	AVG	
11	11.7020	19.72	20.31	40.03	60.00	-19.97	QP	
12	14.0100	8.75	20.28	29.03	50.00	-20.97	AVG	

Conducted Emission Test Data

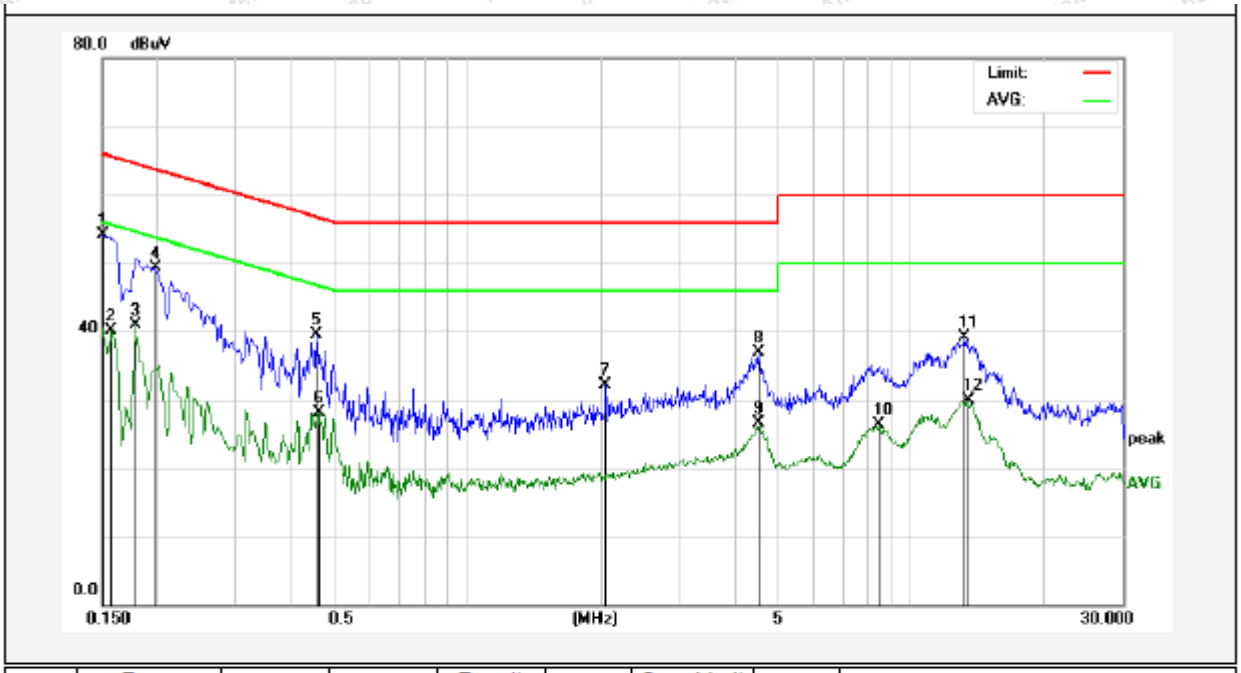
Test Site:	1# Shielded Room
Operating Condition:	Keeping TX mode(802.11n20)
Test Specification:	AC 120V, 60Hz for adapter
Comment:	Live Line
	Tem.: 22.2℃ Hum.: 59%



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Over Limit (dB)	Detector	Remark
1	0.1539	33.98	19.90	53.88	65.78	-11.90	QP	
2	0.1580	20.52	19.90	40.42	55.56	-15.14	AVG	
3	0.2060	17.92	19.90	37.82	53.36	-15.54	AVG	
4	0.2540	23.33	19.89	43.22	61.62	-18.40	QP	
5	0.3220	6.96	19.90	26.86	49.65	-22.79	AVG	
6	0.4740	17.23	19.97	37.20	56.44	-19.24	QP	
7	0.4740	7.94	19.97	27.91	46.44	-18.53	AVG	
8	0.7580	13.48	20.06	33.54	56.00	-22.46	QP	
9	4.3420	13.35	20.19	33.54	56.00	-22.46	QP	
10	4.5939	4.13	20.20	24.33	46.00	-21.67	AVG	
11	13.3460	9.55	20.29	29.84	50.00	-20.16	AVG	
12	13.7180	18.84	20.28	39.12	60.00	-20.88	QP	

Conducted Emission Test Data

Test Site:	1# Shielded Room
Operating Condition:	Keeping TX mode(802.11n20)
Test Specification:	AC 120V, 60Hz for adapter
Comment:	Neutral Line
	Tem.: 22.2℃ Hum.: 59%



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Over Limit (dB)	Detector	Remark
1	0.1500	34.11	19.90	54.01	65.99	-11.98	QP	
2	0.1580	20.22	19.90	40.12	55.56	-15.44	AVG	
3	0.1780	20.95	19.90	40.85	54.57	-13.72	AVG	
4	0.1980	29.40	19.90	49.30	63.69	-14.39	QP	
5	0.4580	19.53	19.96	39.49	56.73	-17.24	QP	
6	0.4620	8.11	19.96	28.07	46.66	-18.59	AVG	
7	2.0500	11.87	20.14	32.01	56.00	-23.99	QP	
8	4.5380	16.71	20.19	36.90	56.00	-19.10	QP	
9	4.5380	6.29	20.19	26.48	46.00	-19.52	AVG	
10	8.4220	6.01	20.30	26.31	50.00	-23.69	AVG	
11	13.2660	18.77	20.29	39.06	60.00	-20.94	QP	
12	13.3660	9.70	20.29	29.99	50.00	-20.01	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

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[dBμV/m] = EIRP[dBm] + 95.2=68.2 dBuV/m, for EIPR[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

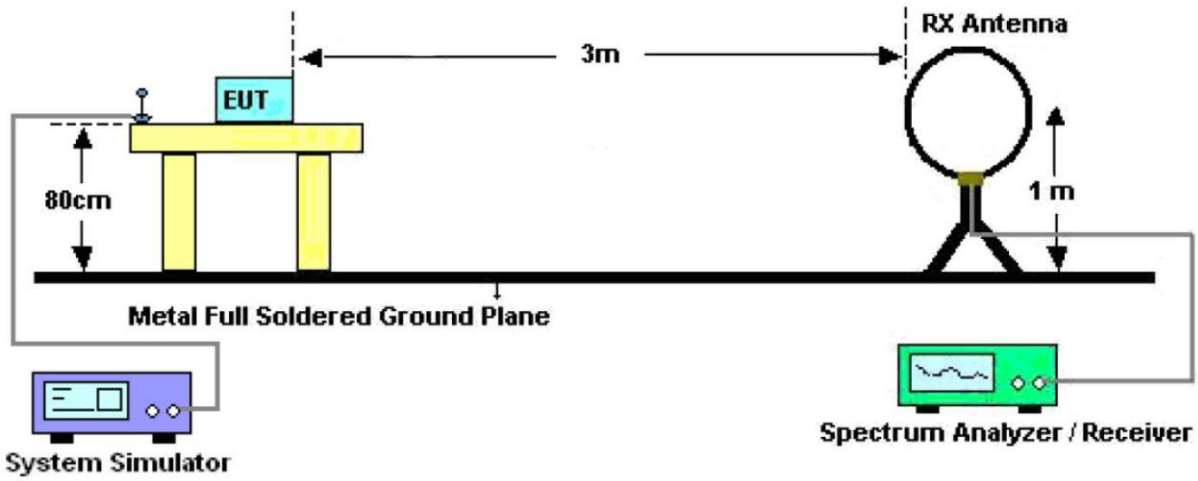


Figure 1. Below 30MHz

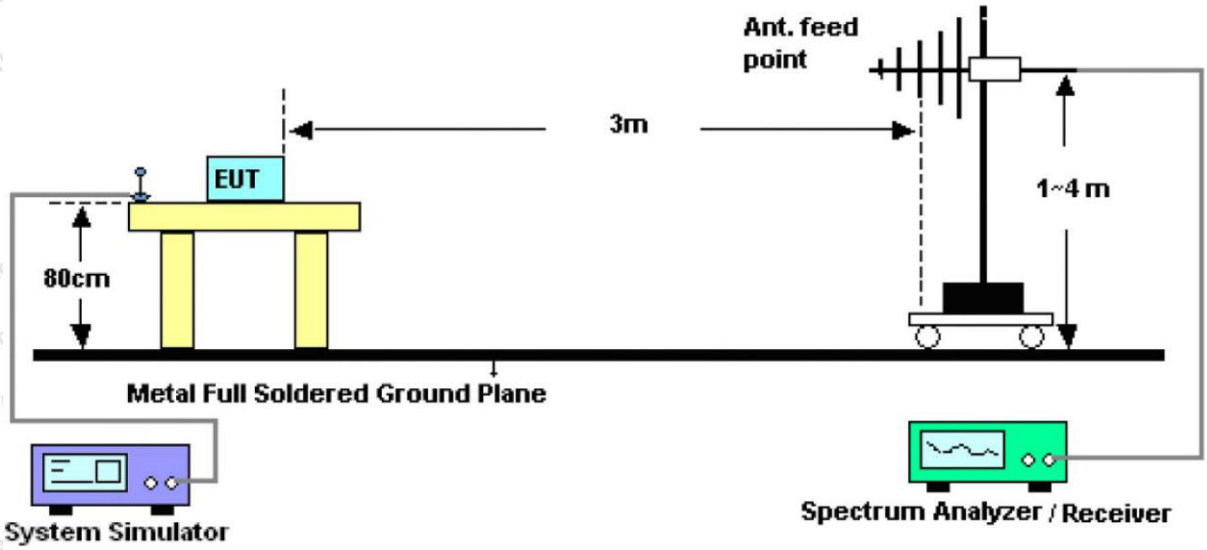


Figure 2. 30MHz to 1GHz

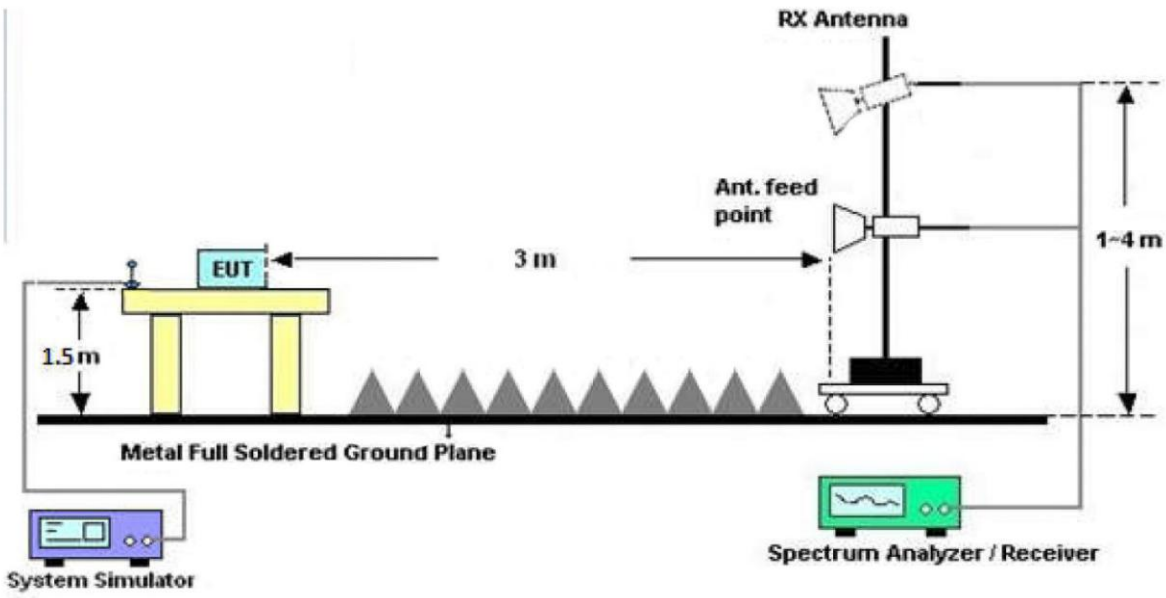


Figure 3. Above 1 GHz

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.

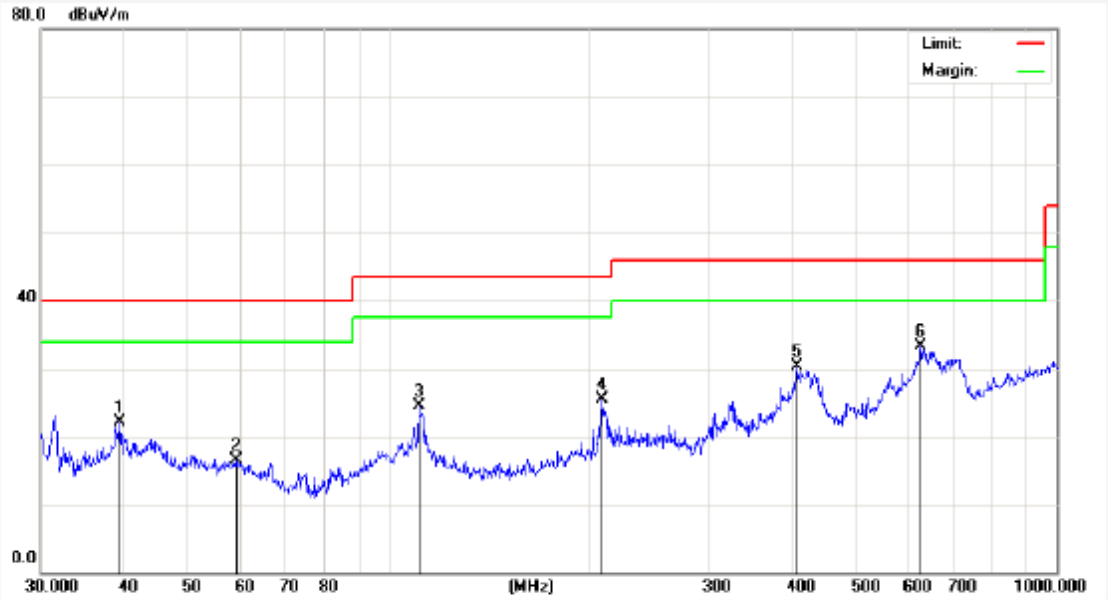
4.4. Test Data

PASS

The test results of 9kHz-30MHz and above 18000MHz are attenuated more than 20dB below the permissible limits, so the results don't record in the report.
worst case:802.11n20(CH149)

Test Results (30~1000MHz)

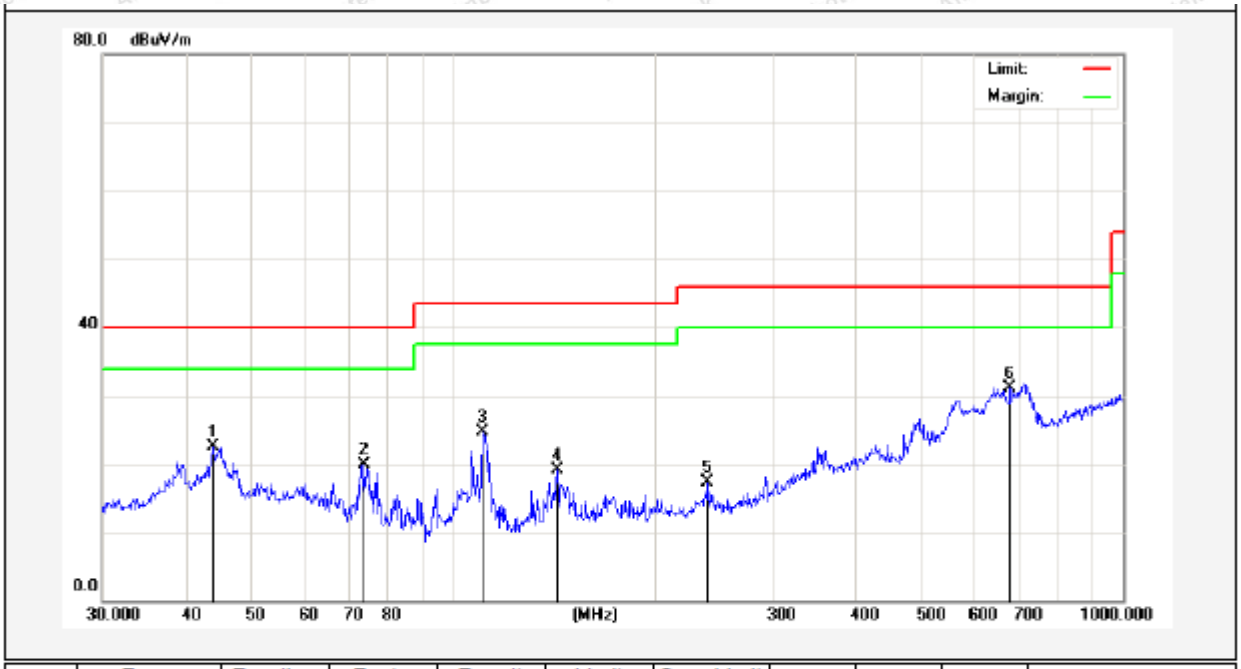
Job No.:	SZAWW180702011-06	Temp.(℃)/Hum.(%RH):	24.4℃/59%RH
Standard:	FCC PART 15C	Power Source:	DC 3.8V battery inside
Test Mode:	802.11n20(CH149)	Polarization:	Horizontal



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	39.4371	36.70	-14.67	22.03	40.00	-17.97	QP	300	76	
2	58.8185	33.38	-16.93	16.45	40.00	-23.55	QP	300	152	
3	110.5687	45.08	-20.66	24.42	43.50	-19.08	QP	300	112	
4	208.5803	44.65	-19.06	25.59	43.50	-17.91	QP	300	230	
5	407.5145	42.90	-12.69	30.21	46.00	-15.79	QP	300	276	
6	625.0780	43.84	-10.55	33.29	46.00	-12.71	QP	300	322	

Test Results (30~1000MHz)

Job No.:	SZAWW180702011-06	Temp.(℃)/Hum.(%RH):	24.4℃/59%RH
Standard:	FCC PART 15C	Temp.(℃)/Hum.(%RH):	DC 3.8V battery inside
Test Mode:	802.11n20(CH149)	Polarization:	Vertical



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	43.9658	36.53	-14.12	22.41	40.00	-17.59	QP	300	75	
2	73.8756	40.29	-20.42	19.87	40.00	-20.13	QP	300	125	
3	110.5687	39.39	-14.66	24.73	43.50	-18.77	QP	300	225	
4	143.3261	36.55	-17.44	19.11	43.50	-24.39	QP	300	65	
5	239.9874	30.85	-13.49	17.36	46.00	-28.64	QP	300	312	
6	677.5798	39.80	-8.65	31.15	46.00	-14.85	QP	300	260	

Test Results (Above 1000MHz)

Test mode:	IEEE 802.11a	Test channel:	Low CH

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	41.58	32.66	18.21	34.01	58.44	74.00	-15.56	V
17235.00	39.47	33.42	20.20	35.00	58.09	68.20	-10.11	V
11490.00	37.72	32.66	18.21	34.01	54.58	74.00	-19.42	H
17235.00	39.88	33.42	20.20	35.00	58.50	68.20	-9.70	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	31.65	32.66	18.21	34.01	48.51	54.00	-5.49	V
17235.00	29.88	33.42	20.20	35.00	48.50	54.00	-5.50	V
11490.00	31.77	32.66	18.21	34.01	48.63	54.00	-5.37	H
17235.00	31.14	33.42	20.20	35.00	49.76	54.00	-4.24	H

Test mode:	IEEE 802.11a	Test channel:	Mid CH

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	41.65	32.67	18.24	34.02	58.54	74.00	-15.46	V
17355.00	39.98	33.44	20.22	35.01	58.63	68.20	-9.57	V
11570.00	39.30	32.67	18.24	34.02	56.19	74.00	-17.81	H
17355.00	37.08	33.44	20.22	35.01	55.73	68.20	-12.47	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	31.65	32.67	18.24	34.02	48.54	54.00	-5.46	V
17355.00	29.71	33.44	20.22	35.01	48.36	54.00	-5.64	V
11570.00	30.77	32.67	18.24	34.02	47.66	54.00	-6.34	H
17355.00	31.13	33.44	20.22	35.01	49.78	54.00	-4.22	H

Test mode:	IEEE 802.11a	Test channel:	High CH

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	42.74	32.69	18.26	34.04	59.65	74.00	-14.35	V
17475.00	38.39	33.46	20.23	35.02	57.06	68.20	-11.14	V
11650.00	39.71	32.69	18.26	34.04	56.62	74.00	-17.38	H
17475.00	38.29	33.46	20.23	35.02	56.96	68.20	-11.24	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	31.78	32.69	18.26	34.04	48.69	54.00	-5.31	V
17475.00	29.05	33.46	20.23	35.02	47.72	54.00	-6.28	V
11650.00	30.97	32.69	18.26	34.04	47.88	54.00	-6.12	H
17475.00	31.02	33.46	20.23	35.02	49.69	54.00	-4.31	H

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

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	42.10	32.66	18.21	34.01	58.96	74.00	-15.04	V
17235.00	38.39	33.42	20.20	35.00	57.01	68.20	-11.19	V
11490.00	38.42	32.66	18.21	34.01	55.28	74.00	-18.72	H
17235.00	37.96	33.42	20.20	35.00	56.58	68.20	-11.62	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	31.55	32.66	18.21	34.01	48.41	54.00	-5.59	V
17235.00	29.89	33.42	20.20	35.00	48.51	54.00	-5.49	V
11490.00	30.04	32.66	18.21	34.01	46.90	54.00	-7.10	H
17235.00	30.99	33.42	20.20	35.00	49.61	54.00	-4.39	H

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

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	41.11	32.67	18.24	34.02	58.00	74.00	-16.00	V
17355.00	37.02	33.44	20.22	35.01	55.67	68.20	-12.53	V
11570.00	39.49	32.67	18.24	34.02	56.38	74.00	-17.62	H
17355.00	37.10	33.44	20.22	35.01	55.75	68.20	-12.45	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	31.39	32.67	18.24	34.02	48.28	54.00	-5.72	V
17355.00	31.34	33.44	20.22	35.01	49.99	54.00	-4.01	V
11570.00	29.20	32.67	18.24	34.02	46.09	54.00	-7.91	H
17355.00	31.55	33.44	20.22	35.01	50.20	54.00	-3.80	H

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

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	41.93	32.69	18.26	34.04	58.84	74.00	-15.16	V
17475.00	39.95	33.46	20.23	35.02	58.62	68.20	-9.58	V
11650.00	37.24	32.69	18.26	34.04	54.15	74.00	-19.85	H
17475.00	39.89	33.46	20.23	35.02	58.56	68.20	-9.64	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	32.87	32.69	18.26	34.04	49.78	54.00	-4.22	V
17475.00	31.24	33.46	20.23	35.02	49.91	54.00	-4.09	V
11650.00	31.91	32.69	18.26	34.04	48.82	54.00	-5.18	H
17475.00	31.11	33.46	20.23	35.02	49.78	54.00	-4.22	H

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

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	42.34	32.66	18.21	34.01	59.20	74.00	-14.80	V
17235.00	37.35	33.42	20.20	35.00	55.97	68.20	-12.23	V
11490.00	39.30	32.66	18.21	34.01	56.16	74.00	-17.84	H
17235.00	38.49	33.42	20.20	35.00	57.11	68.20	-11.09	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	31.69	32.66	18.21	34.01	48.55	54.00	-5.45	V
17235.00	29.33	33.42	20.20	35.00	47.95	54.00	-6.05	V
11490.00	30.80	32.66	18.21	34.01	47.66	54.00	-6.34	H
17235.00	30.14	33.42	20.20	35.00	48.76	54.00	-5.24	H

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

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	41.77	32.67	18.24	34.02	58.66	74.00	-15.34	V
17355.00	39.78	33.44	20.22	35.01	58.43	68.20	-9.77	V
11570.00	38.72	32.67	18.24	34.02	55.61	74.00	-18.39	H
17355.00	38.45	33.44	20.22	35.01	57.10	68.20	-11.10	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	31.09	32.67	18.24	34.02	47.98	54.00	-6.02	V
17355.00	30.08	33.44	20.22	35.01	48.73	54.00	-5.27	V
11570.00	31.96	32.67	18.24	34.02	48.85	54.00	-5.15	H
17355.00	31.66	33.44	20.22	35.01	50.31	54.00	-3.69	H

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

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	41.08	32.69	18.26	34.04	57.99	74.00	-16.01	V
17475.00	38.48	33.46	20.23	35.02	57.15	68.20	-11.05	V
11650.00	38.72	32.69	18.26	34.04	55.63	74.00	-18.37	H
17475.00	38.44	33.46	20.23	35.02	57.11	68.20	-11.09	H

Average value:

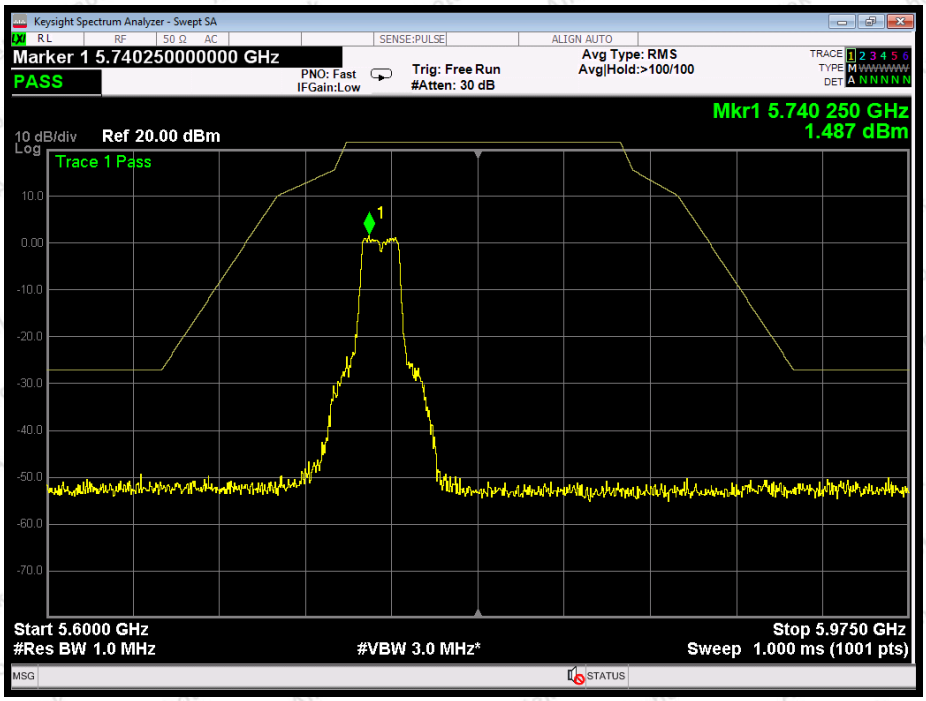
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Pol.
11650.00	31.01	32.69	18.26	34.04	47.92	54.00	-6.08	V
17475.00	30.43	33.46	20.23	35.02	49.10	54.00	-4.90	V
11650.00	29.06	32.69	18.26	34.04	45.97	54.00	-8.03	H
17475.00	29.87	33.46	20.23	35.02	48.54	54.00	-5.46	H

Note:

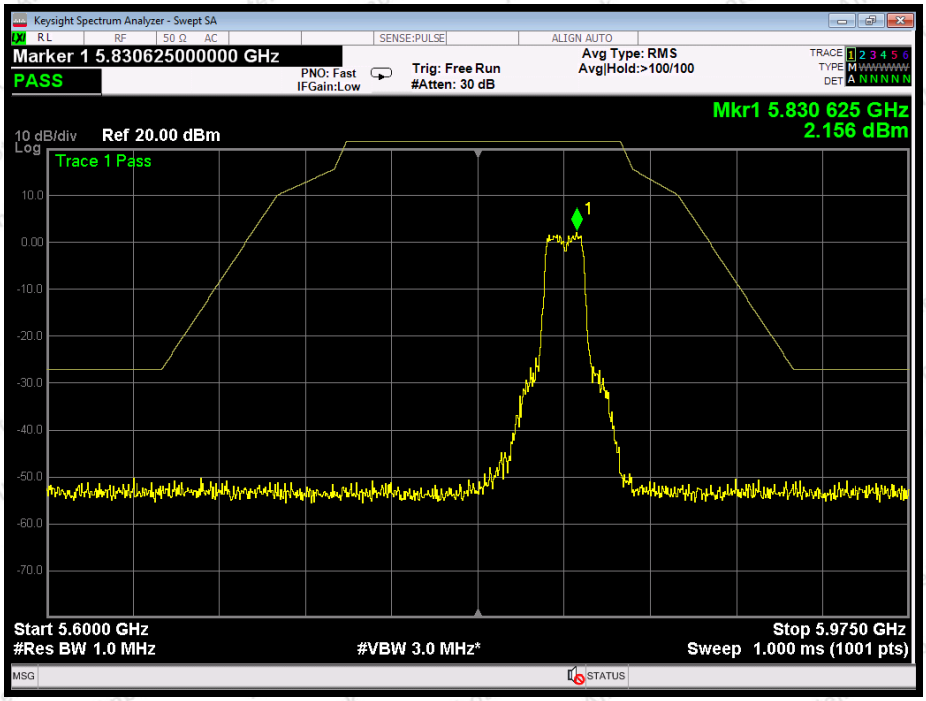
1. Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor

Band Edge test:

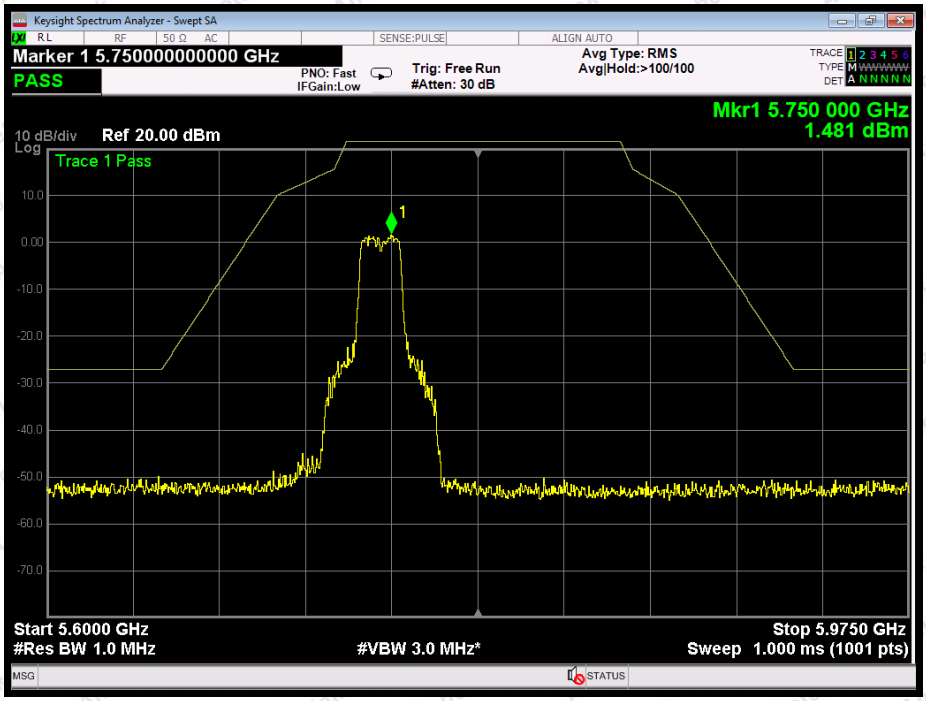
ANT A:



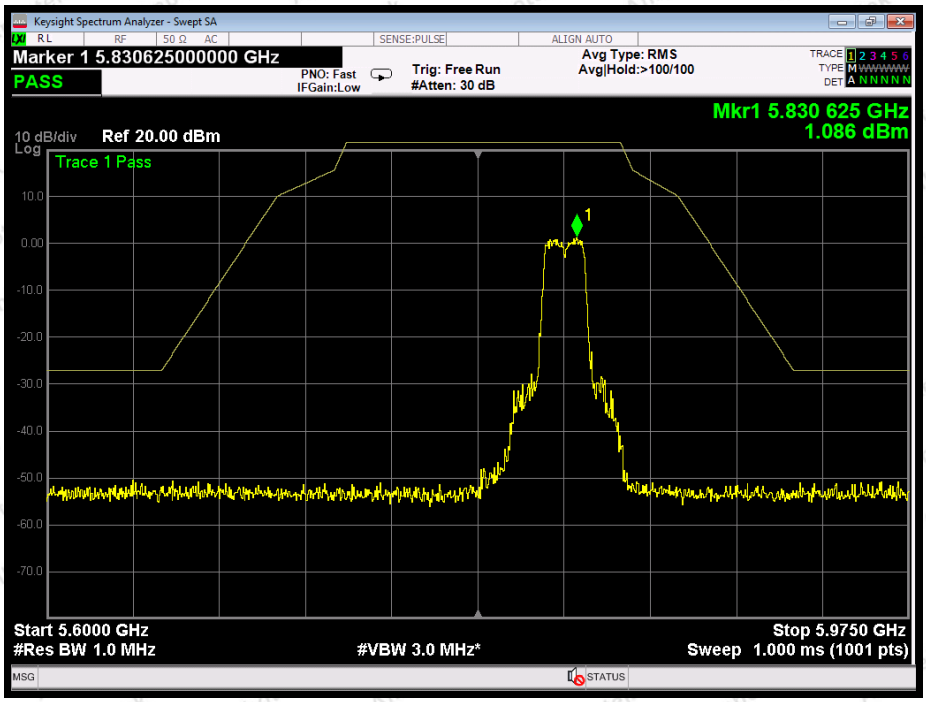
802.11a: Band Edge, Left Side



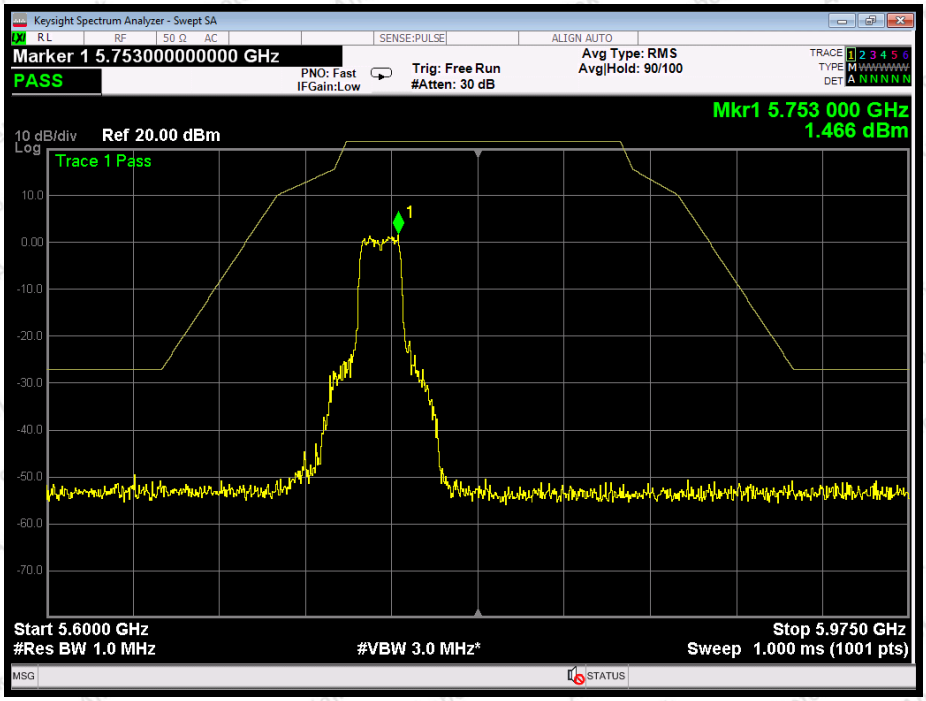
802.11a: Band Edge, Right Side



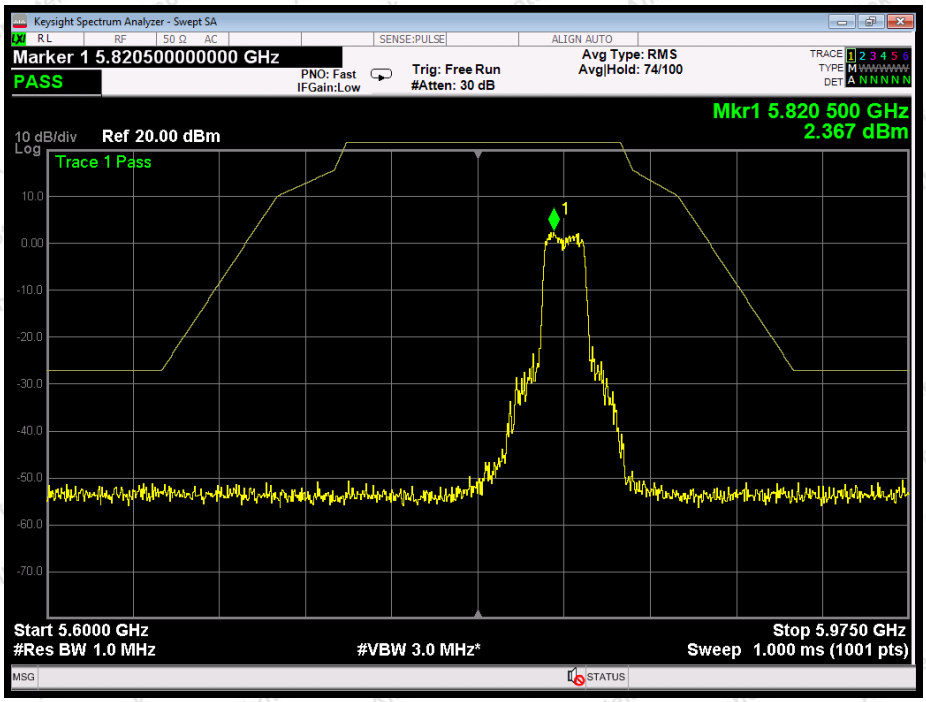
802.11n(20): Band Edge, Left Side



802.11n(20): Band Edge, Right Side

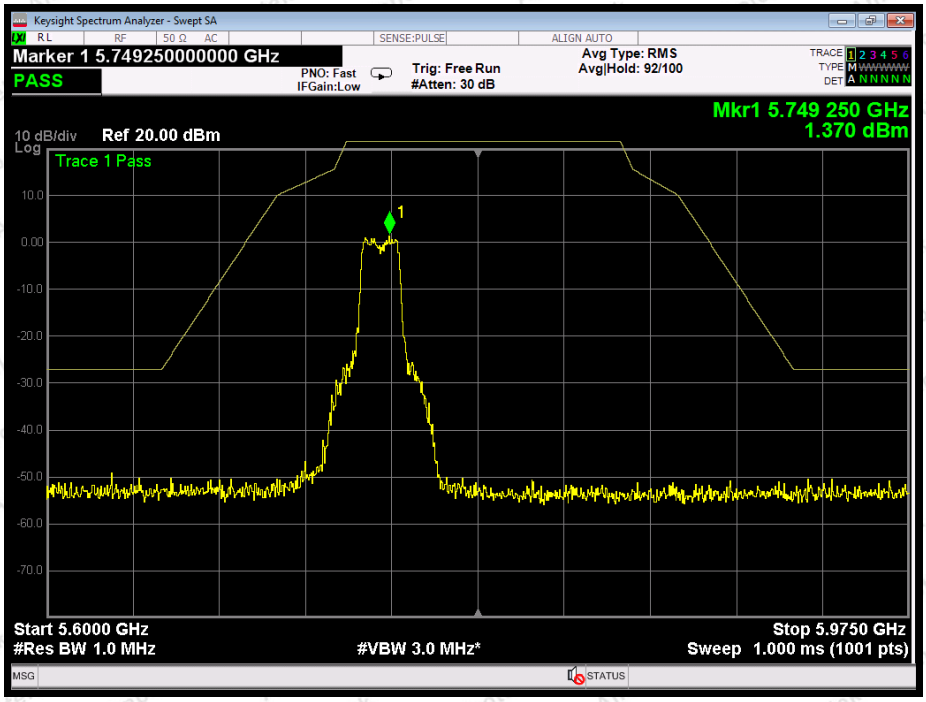


802.11ac(20): Band Edge, Left Side

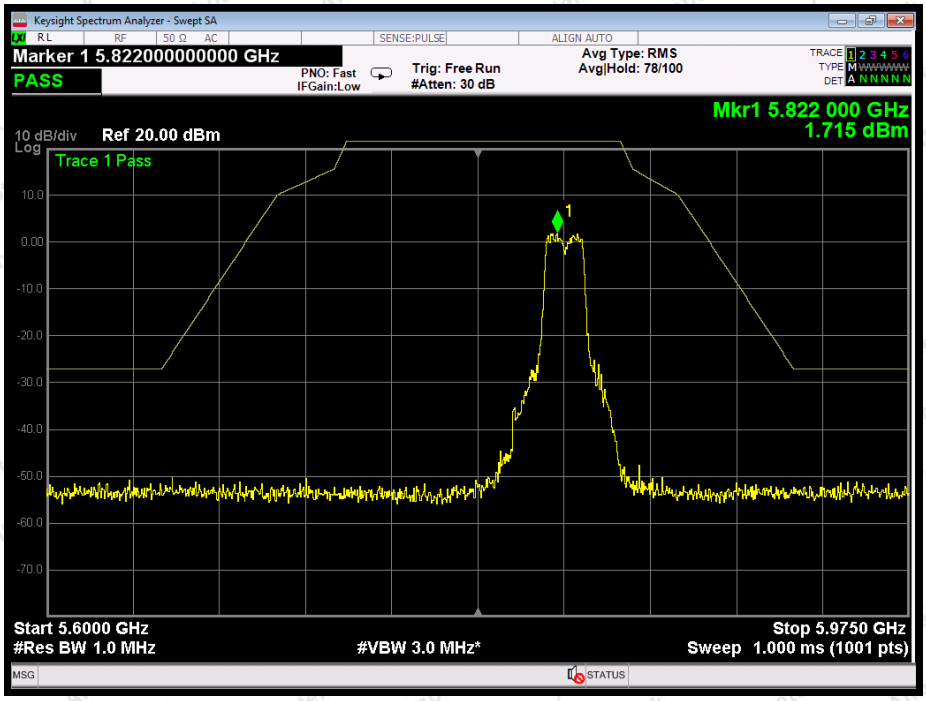


802.11ac(20): Band Edge, Right Side

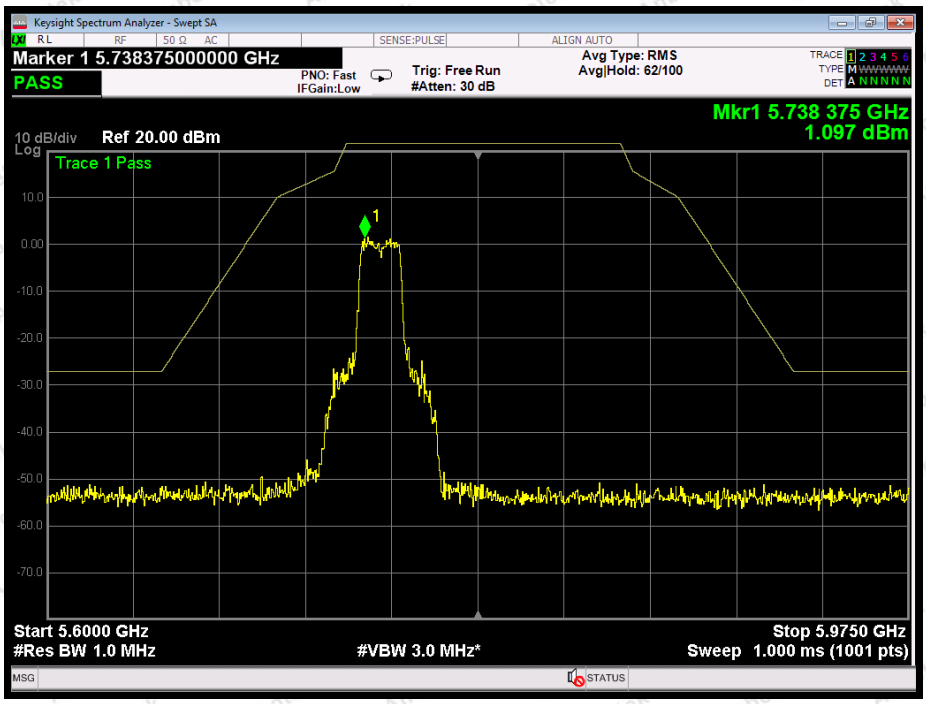
ANT B:



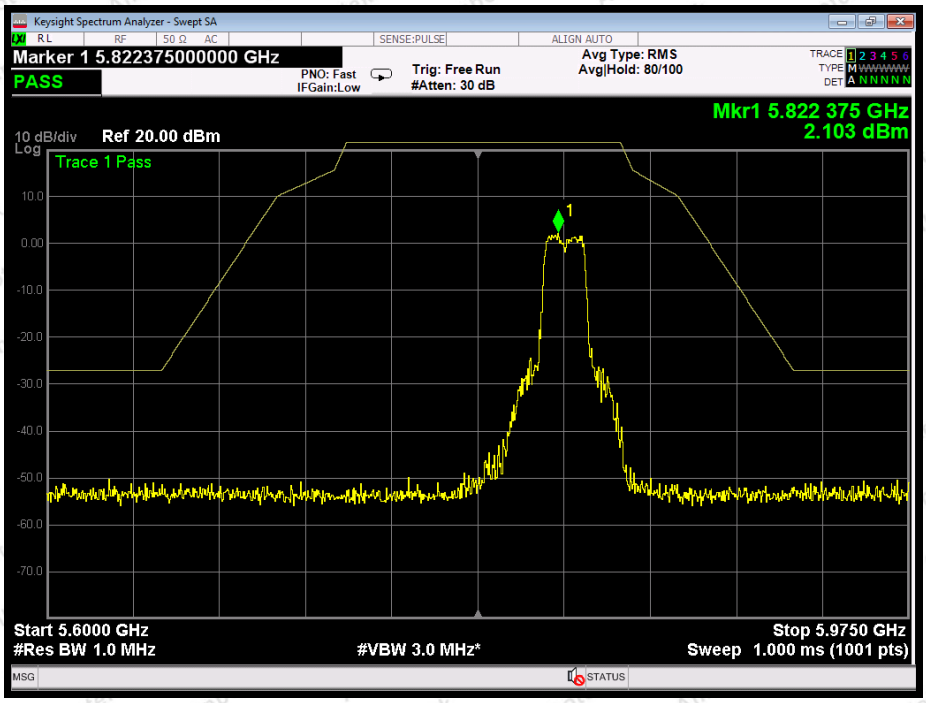
802.11a: Band Edge, Left Side



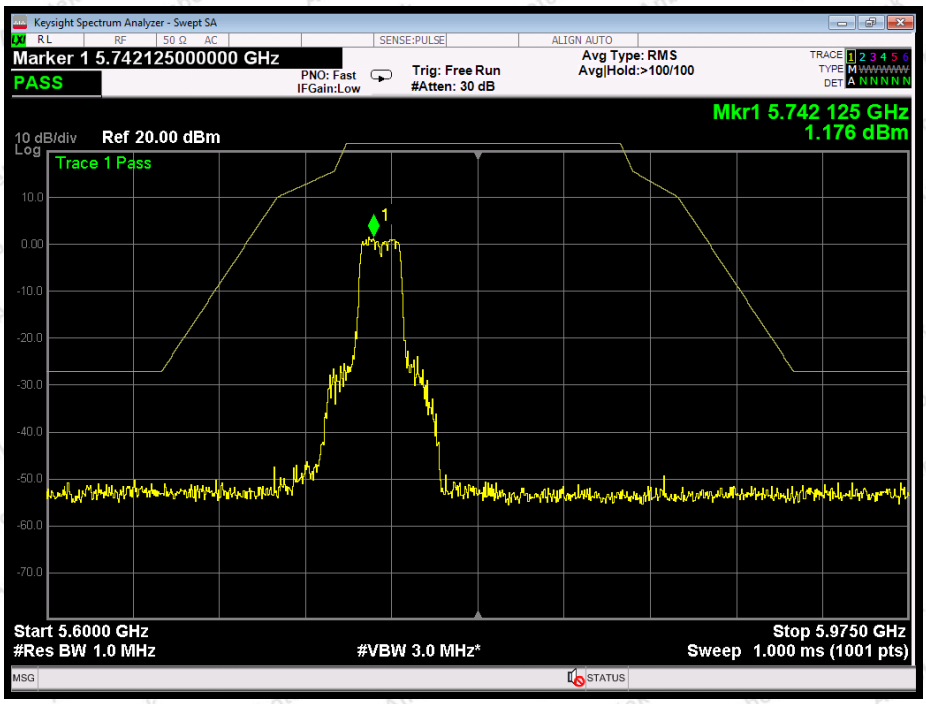
802.11a: Band Edge, Right Side



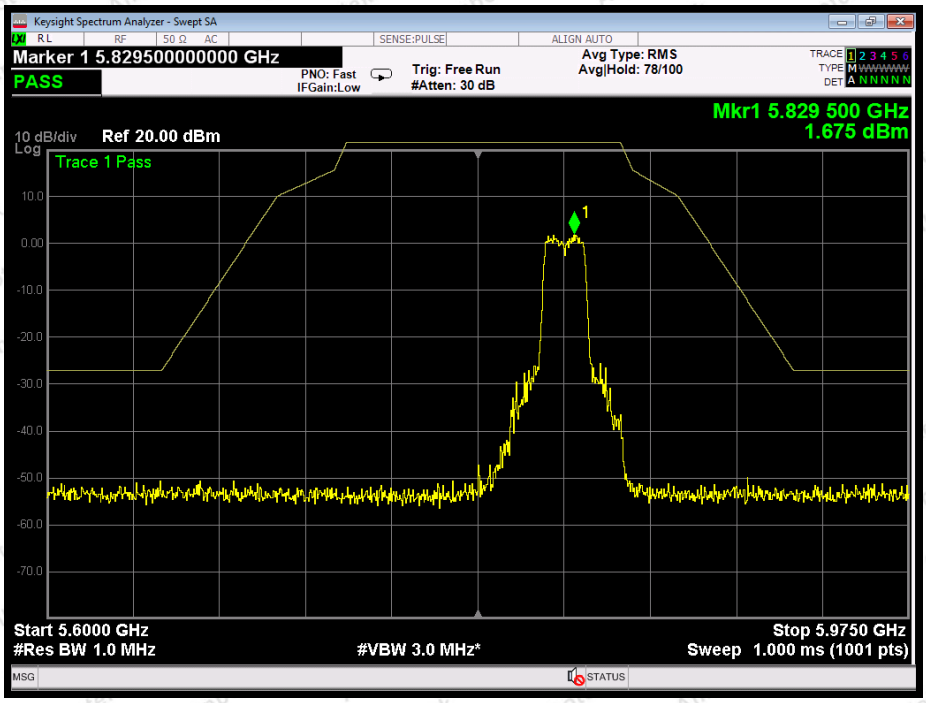
802.11n(20): Band Edge, Left Side



802.11n(20): Band Edge, Right Side



802.11ac(20): Band Edge, Left Side



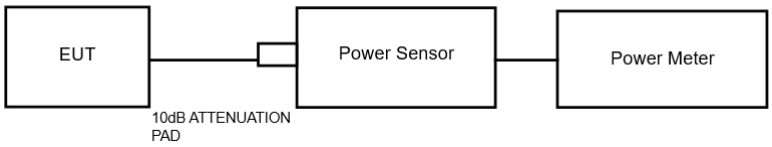
802.11ac(20): Band Edge, Right Side

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 3.8V battery inside	Temperature	:	24℃
Test Result	:	PASS	Humidity	:	55%RH

ANT A:

Mode	Channel Frequency (MHz)	Peak Power output (dBm)	Correctional Limit (dBm)	Results
802.11a	5745	10.21	30	PASS
	5785	10.16	30	PASS
	5825	10.74	30	PASS
802.11n20	5745	10.33	30	PASS
	5785	10.88	30	PASS
	5825	10.43	30	PASS
802.11ac20	5745	10.43	30	PASS
	5785	10.35	30	PASS
	5825	10.14	30	PASS

ANT B:

Mode	Channel Frequency (MHz)	Peak Power output (dBm)	Correctional Limit (dBm)	Results
802.11a	5745	10.77	30	PASS
	5785	10.19	30	PASS
	5825	10.44	30	PASS
802.11n20	5745	10.66	30	PASS
	5785	10.15	30	PASS
	5825	10.14	30	PASS
802.11ac20	5745	10.88	30	PASS
	5785	10.41	30	PASS
	5825	10.20	30	PASS

ANT A+B:

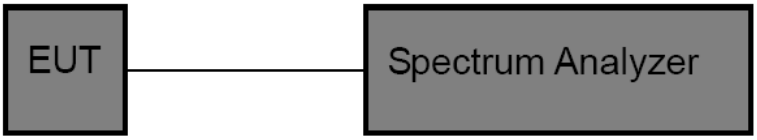
Mode	Channel Frequency (MHz)	Peak Power output (dBm)	Correctional Limit (dBm)	Results
802.11a	5745	13.509	30	PASS
	5785	13.185	30	PASS
	5825	13.603	30	PASS
802.11n20	5745	13.51	30	PASS
	5785	13.54	30	PASS
	5825	13.30	30	PASS
802.11ac20	5745	**13.67**	30	PASS
	5785	13.39	30	PASS
	5825	13.18	30	PASS

6. Occupy Bandwidth Test

6.1. Test Standard

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

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 Mode	:	CH Low ~ CH High
Test Voltage	:	DC 3.8V battery inside	Temperature	:	24℃
Test Result	:	PASS	Humidity	:	55%RH

ANT A:

Mode	Channel Frequency (MHz)	6dB BW(MHz)	Limit	Results
802.11a	5745	16.38	>0.5MHz	PASS
	5785	16.39		PASS
	5825	16.41		PASS
802.11n20	5745	17.65		PASS
	5785	17.65		PASS
	5825	17.65		PASS
802.11ac20	5745	17.65		PASS
	5785	17.65		PASS
	5825	17.68		PASS

Mode	Channel Frequency (MHz)	26dB BW(MHz)	99% Bandwidth (MHz)
802.11a	5745	21.73	16.908
	5785	21.85	16.914
	5825	21.42	16.863
802.11n20	5745	21.66	17.899
	5785	21.73	17.939
	5825	21.84	17.911
802.11ac20	5745	21.78	17.928
	5785	21.70	17.962
	5825	21.64	17.967

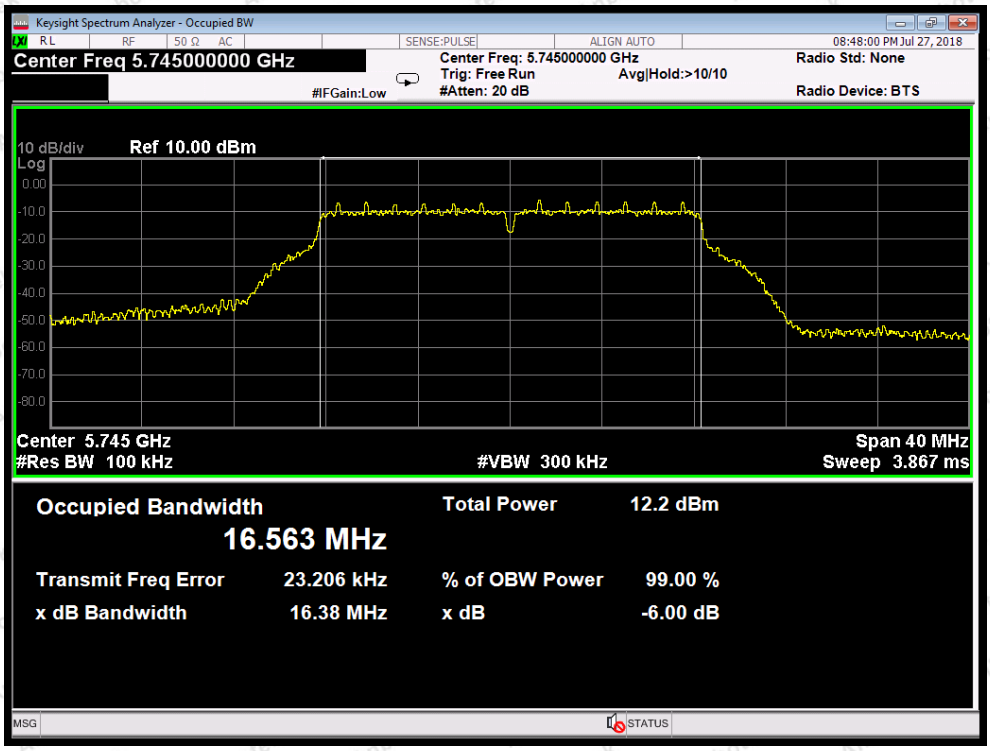
ANT B:

Mode	Channel Frequency (MHz)	6dB BW(MHz)	Limit	Results
802.11a	5745	16.38	>0.5MHz	PASS
	5785	16.40		PASS
	5825	16.39		PASS
802.11n20	5745	17.67		PASS
	5785	17.65		PASS
	5825	17.62		PASS
802.11ac20	5745	17.66		PASS
	5785	17.65		PASS
	5825	17.66		PASS

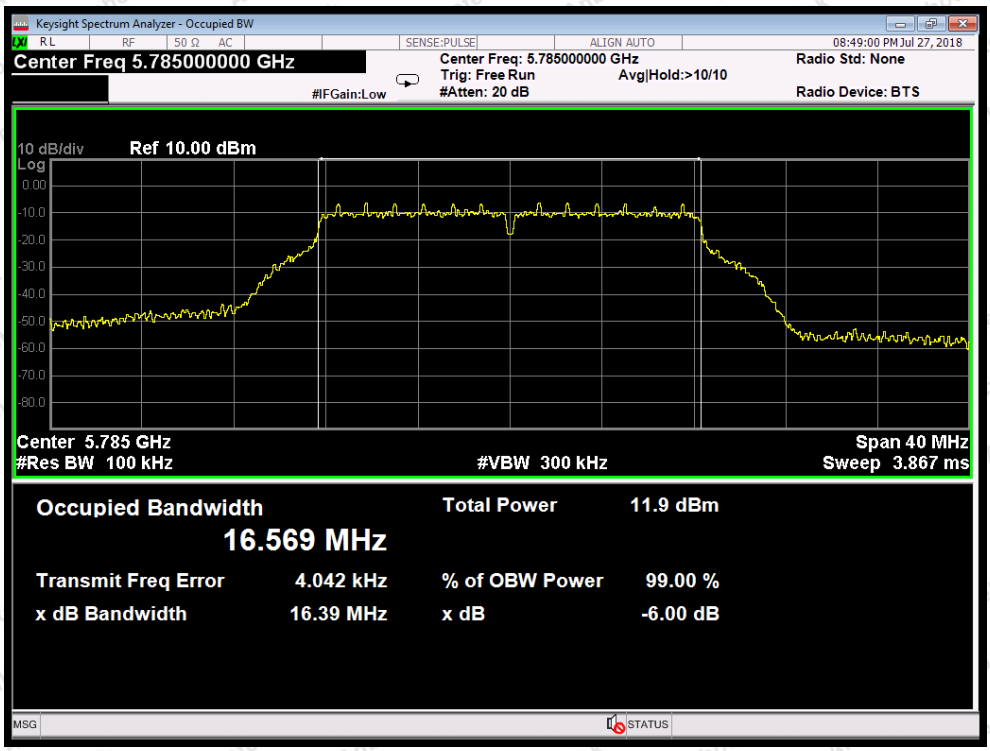
Mode	Channel Frequency (MHz)	26dB BW(MHz)	99% Bandwidth (MHz)
802.11a	5745	21.68	16.892
	5785	21.81	16.887
	5825	21.54	16.877
802.11n20	5745	21.65	17.916
	5785	21.52	17.883
	5825	21.72	17.962
802.11ac20	5745	21.79	17.921
	5785	21.53	17.923
	5825	21.65	17.958

ANT A:

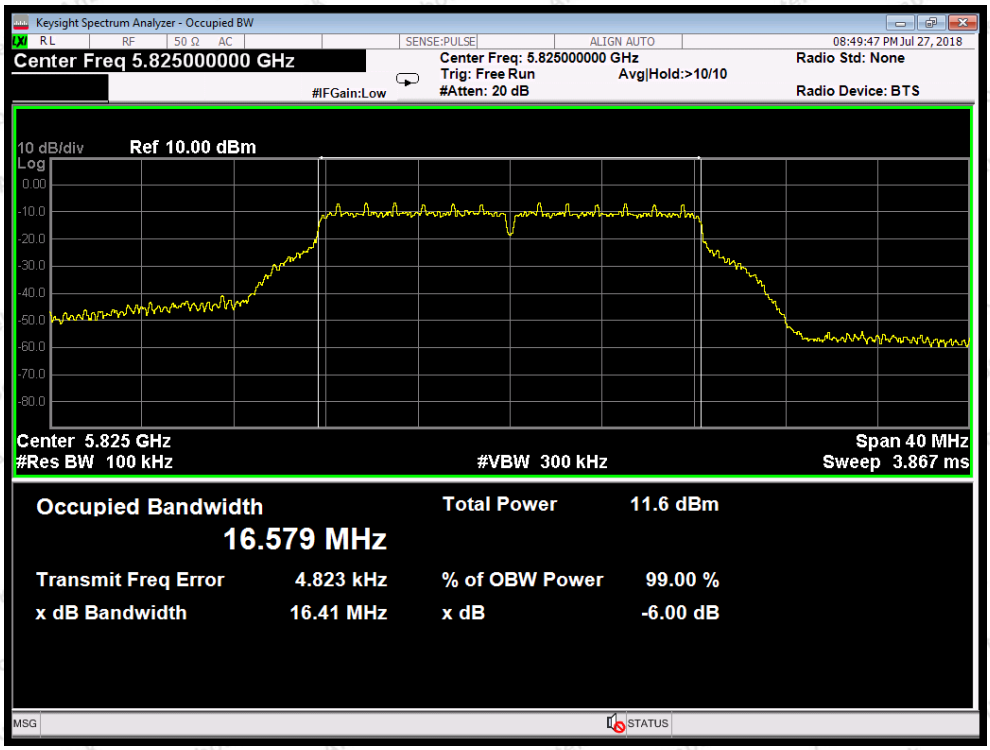
6dB Bandwidth



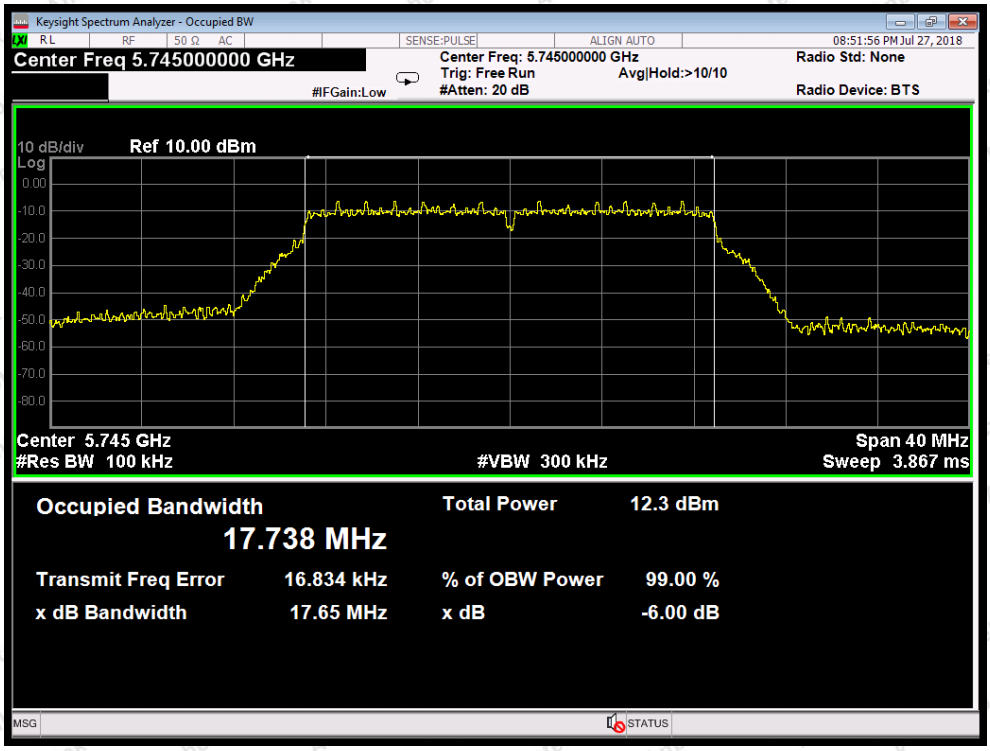
Test Mode: 802.11a--Low



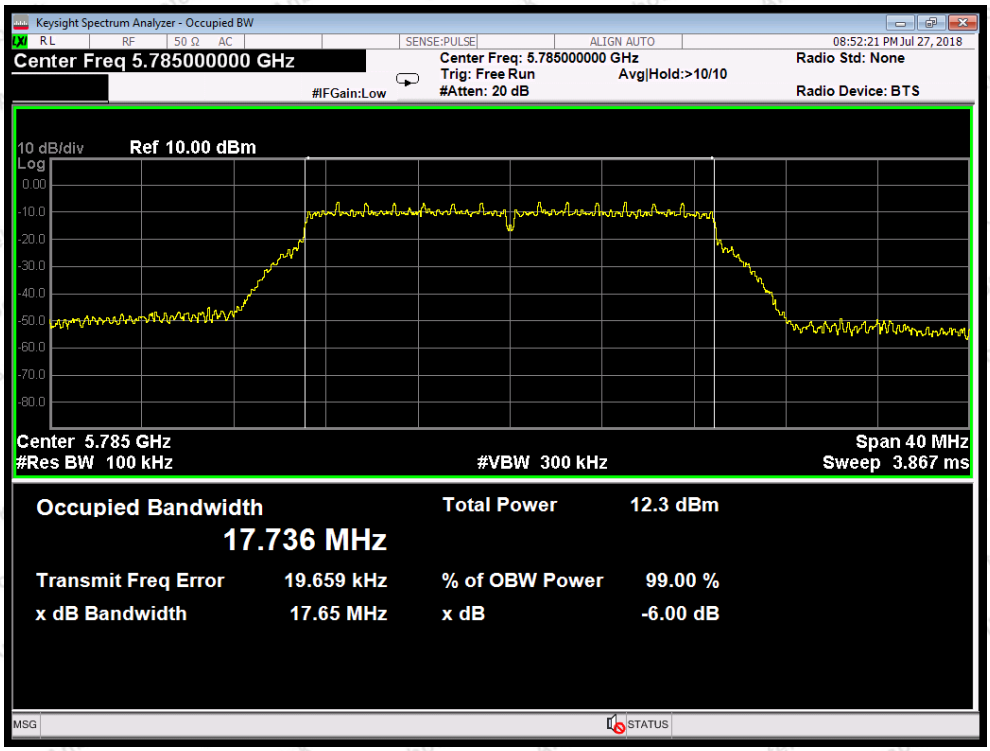
Test Mode: 802.11a---Middle



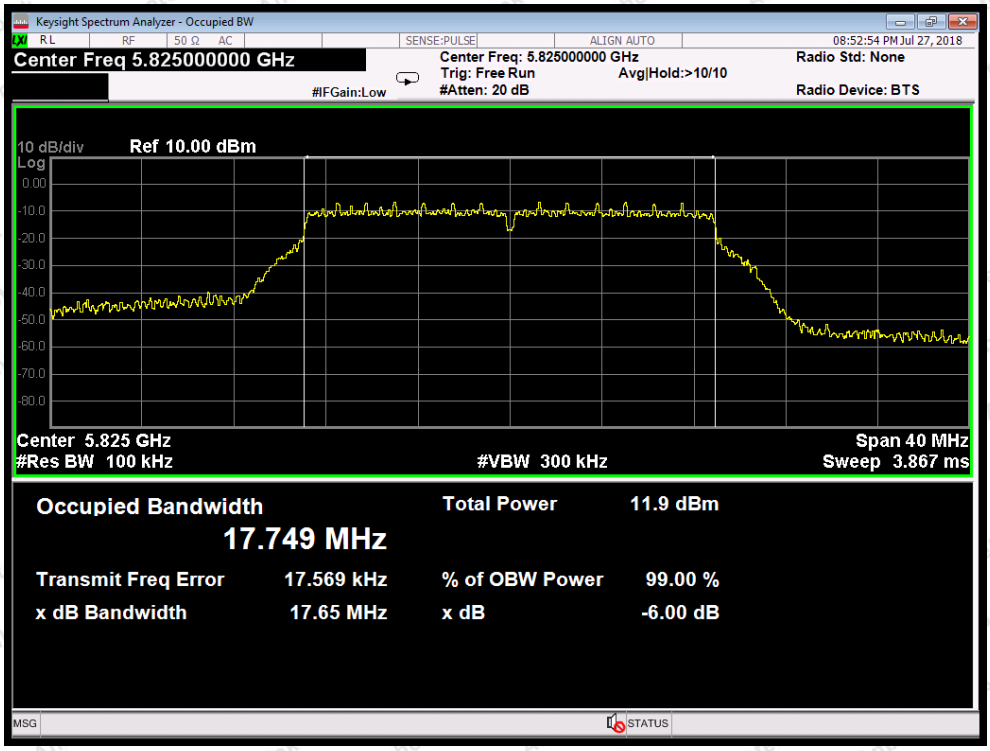
Test Mode: 802.11a---High



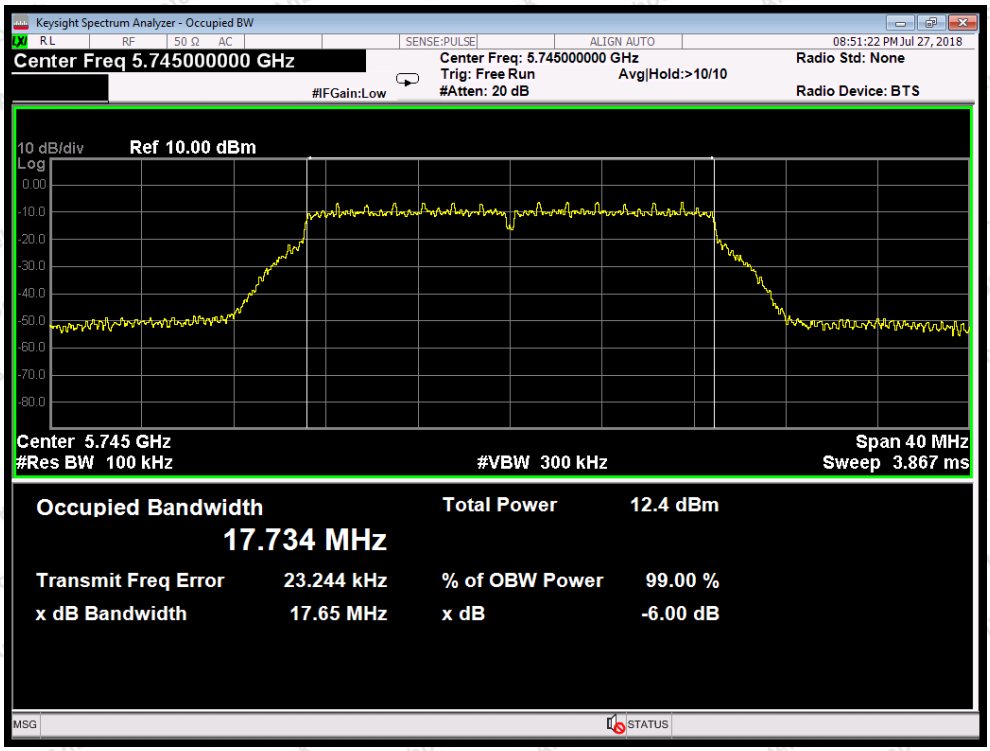
Test Mode: 802.11n20---Low



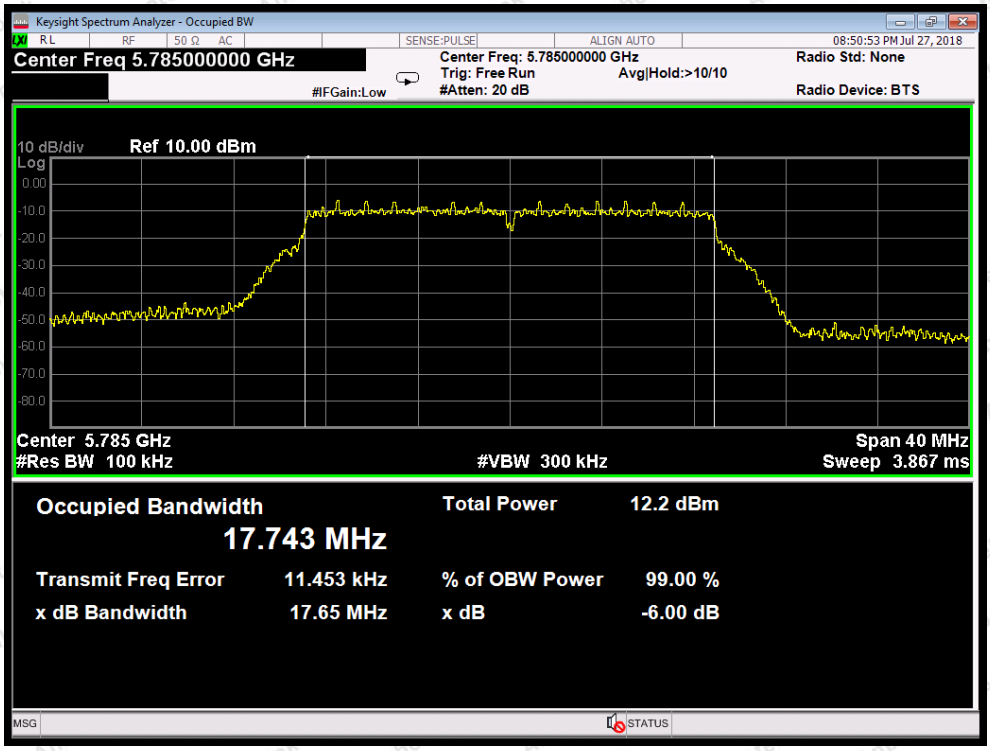
Test Mode: 802.11n20---Middle



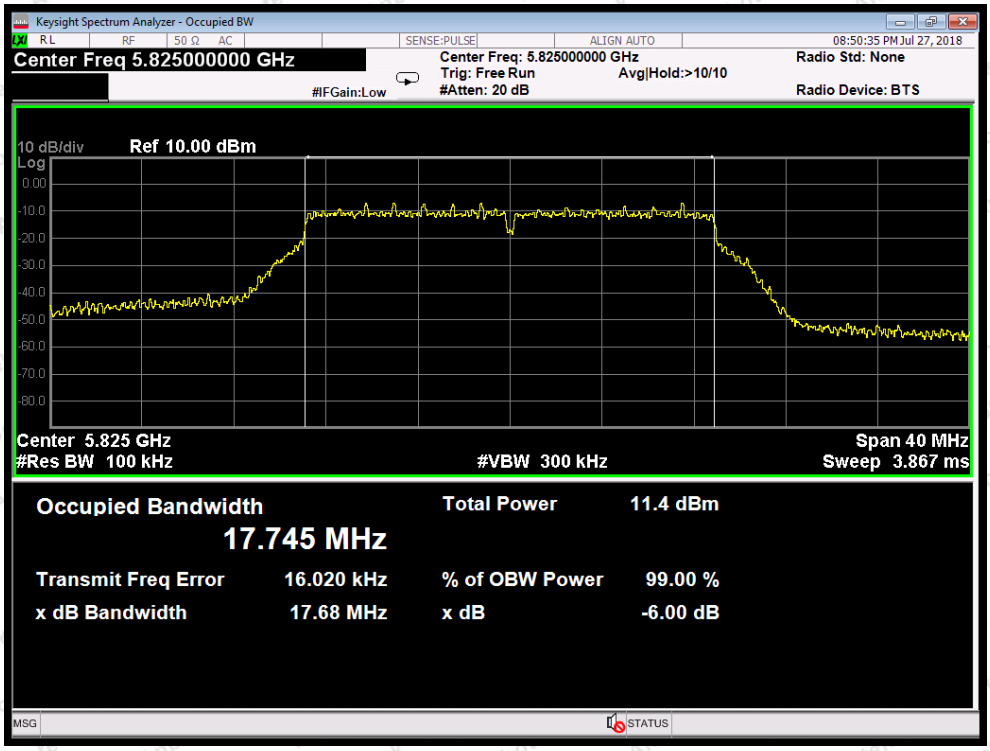
Test Mode: 802.11n20---High



Test Mode: 802.11ac20--Low

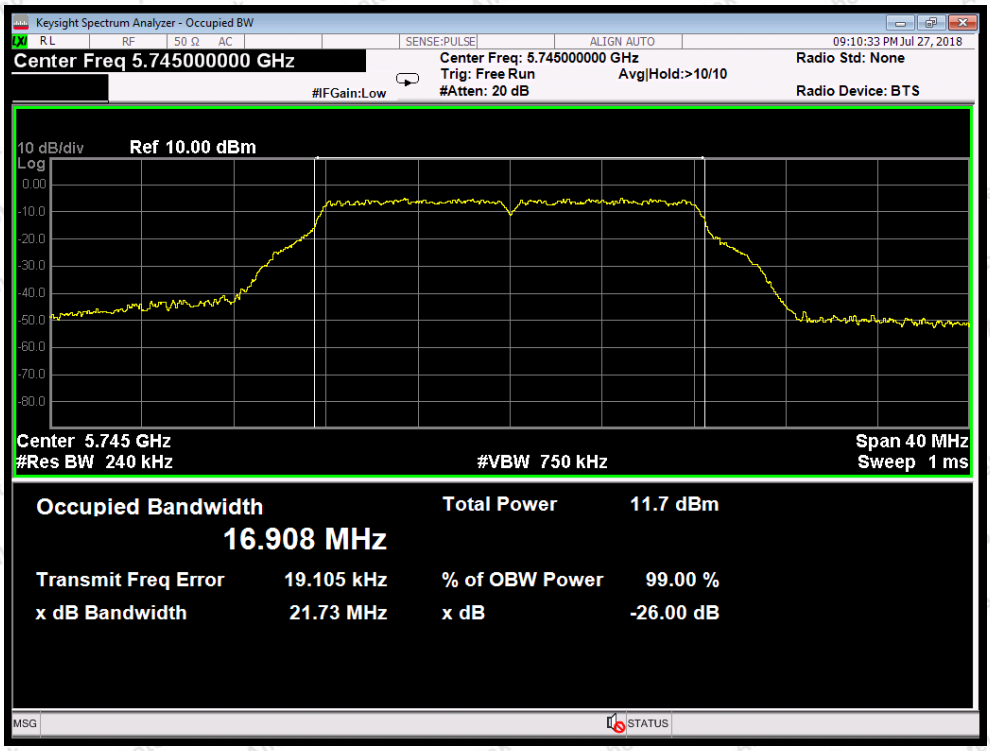


Test Mode: 802.11ac20---Middle

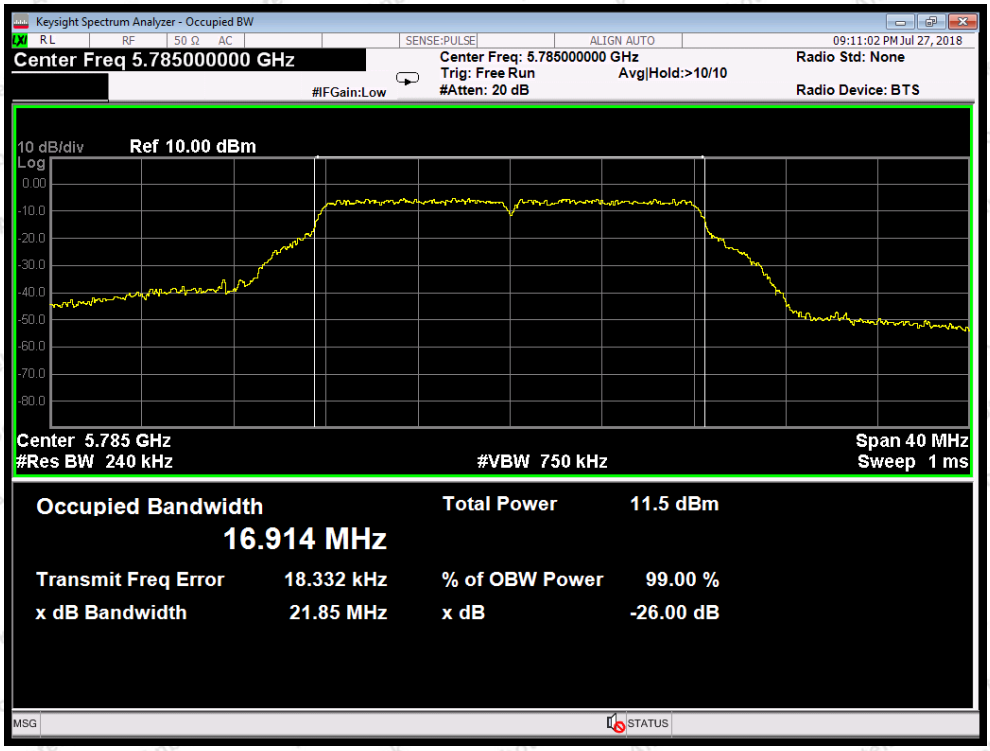


Test Mode: 802.11ac20---High

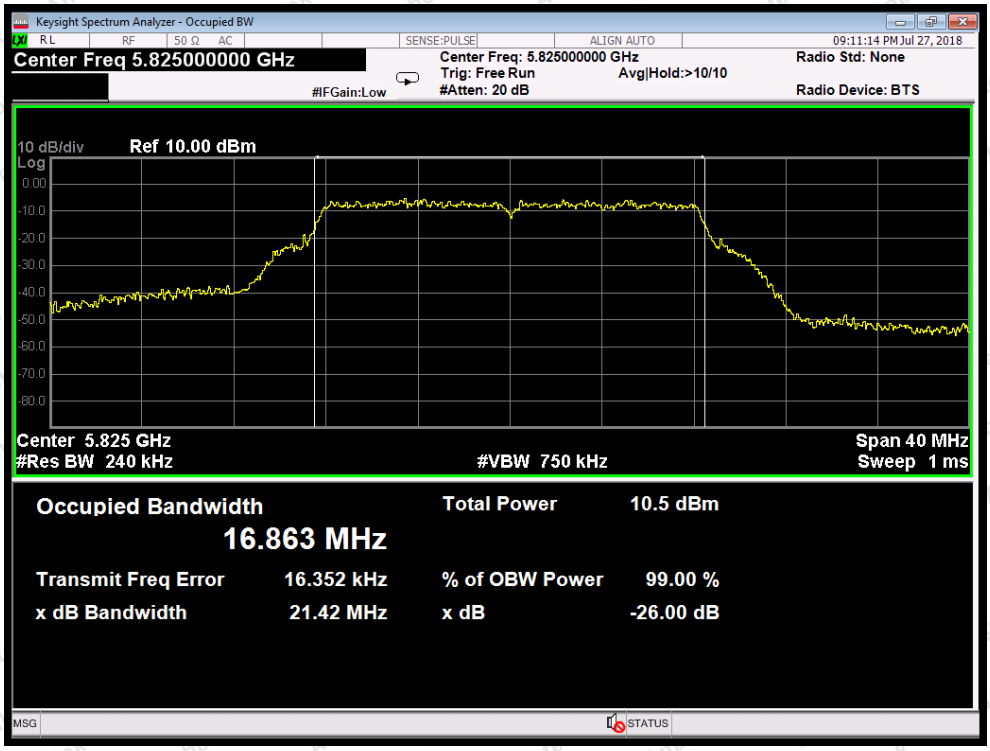
26dB & 99% Bandwidth



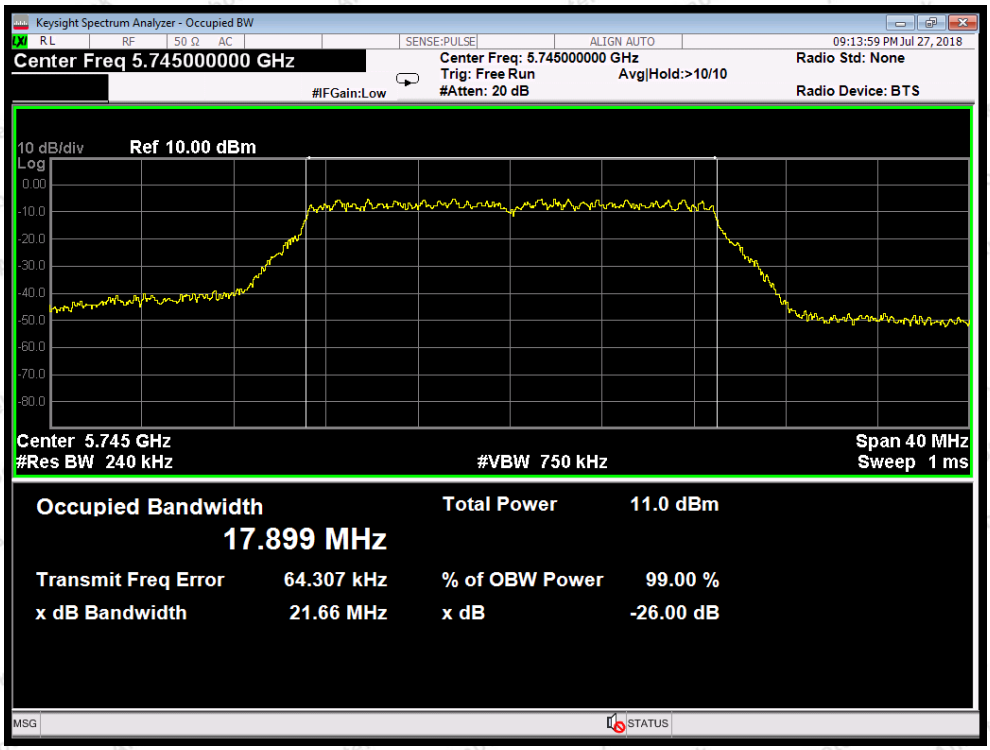
Test Mode: 802.11a--Low



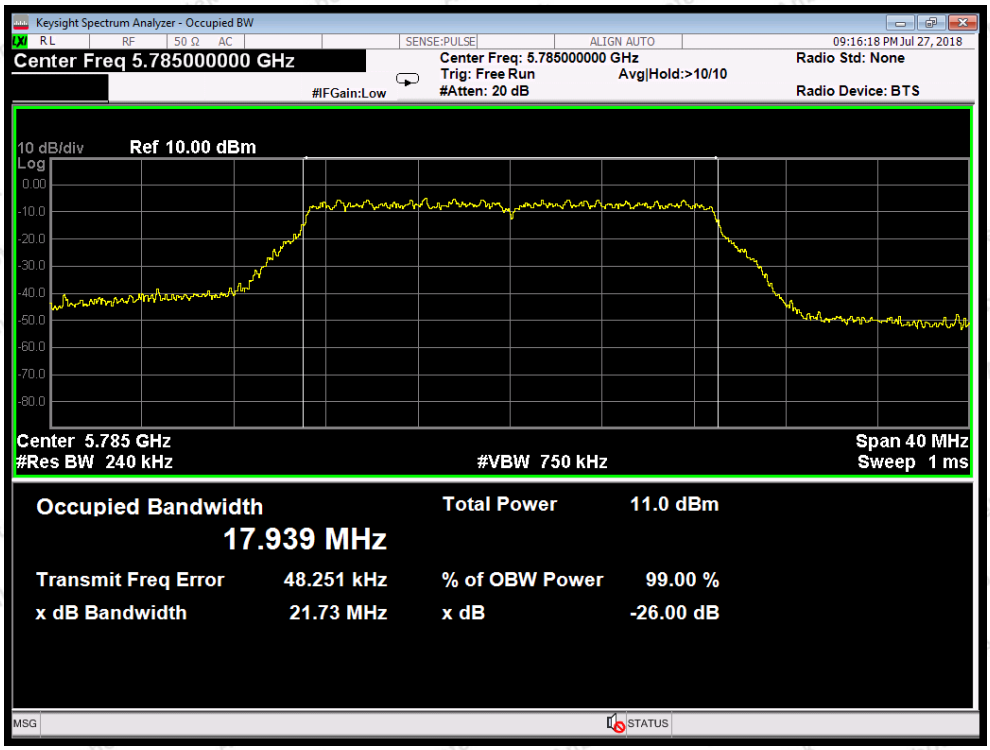
Test Mode: 802.11a---Middle



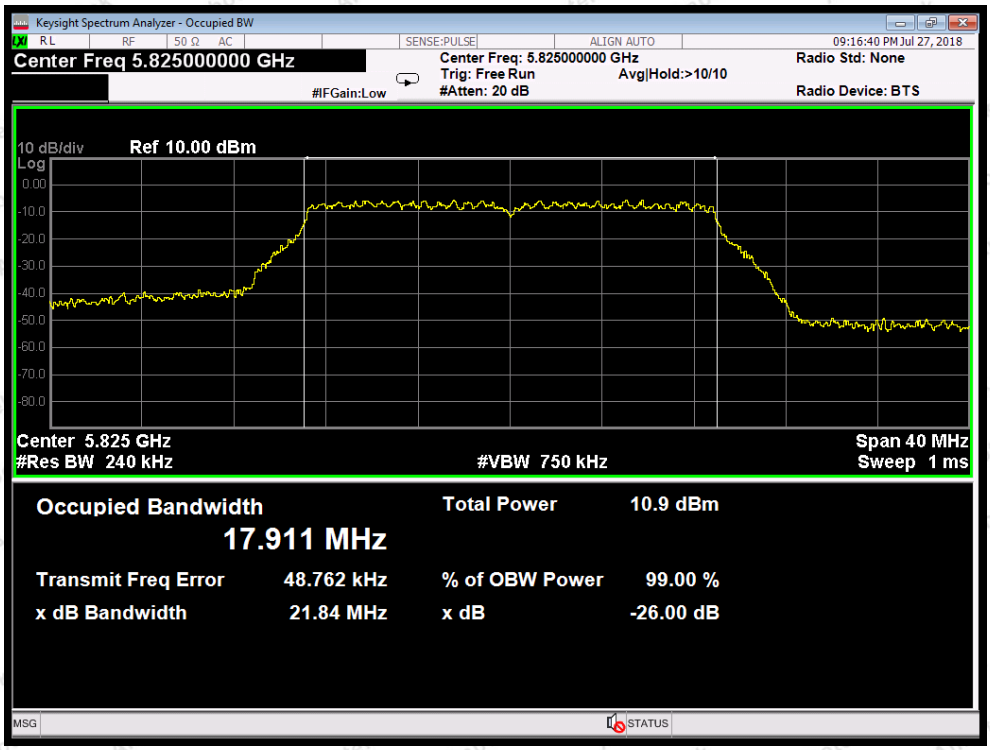
Test Mode: 802.11a---High



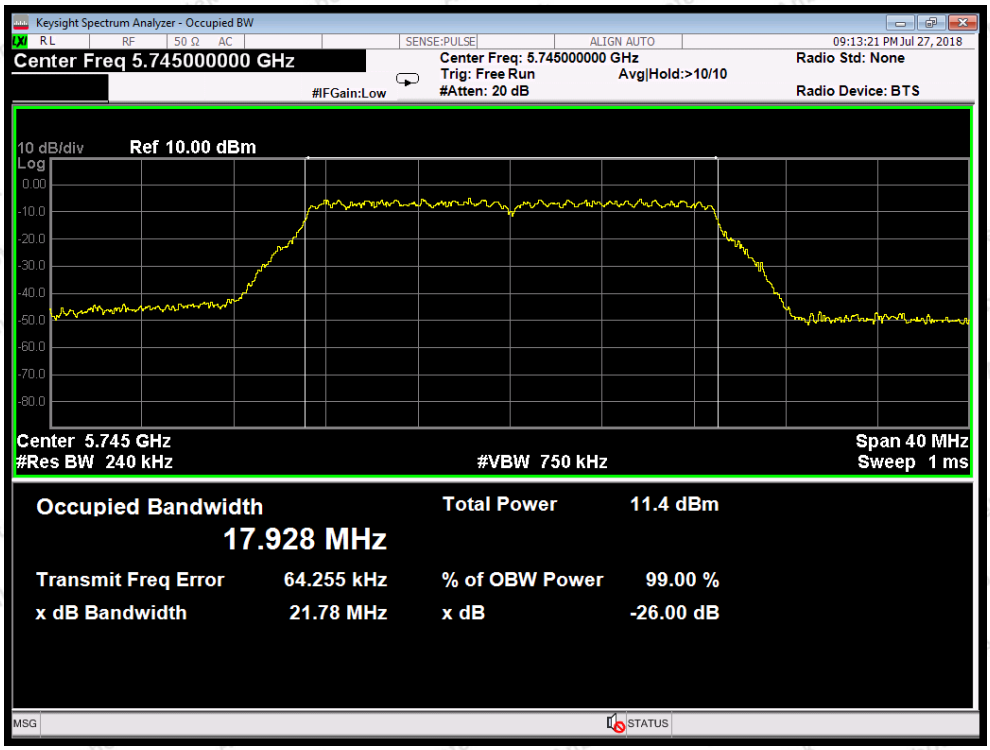
Test Mode: 802.11n20---Low



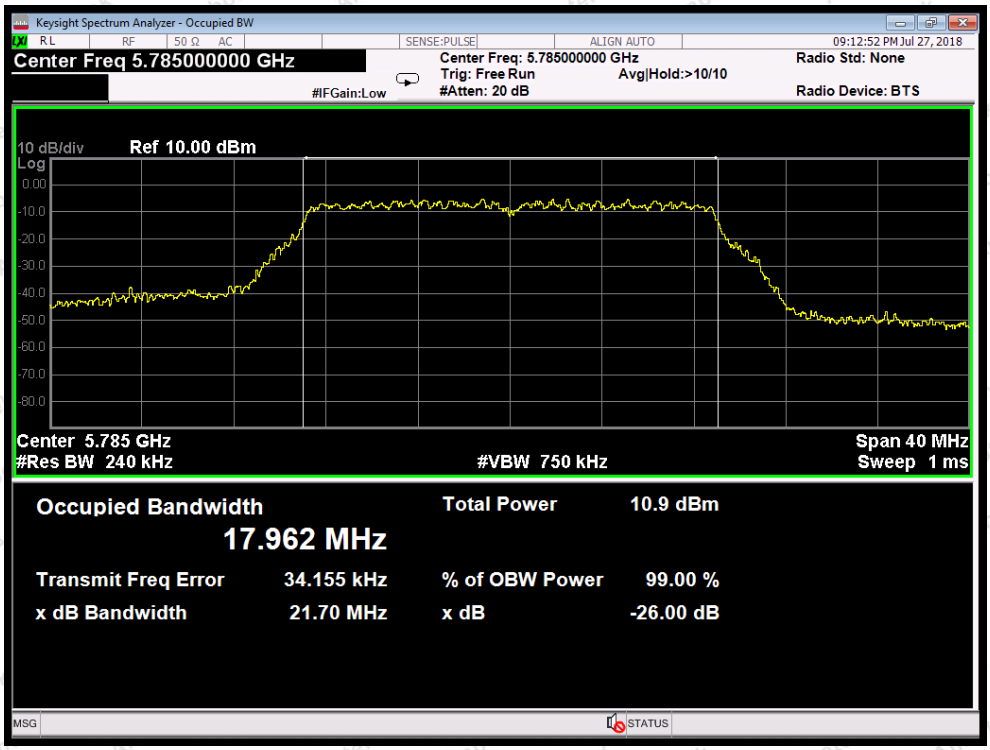
Test Mode: 802.11n20---Middle



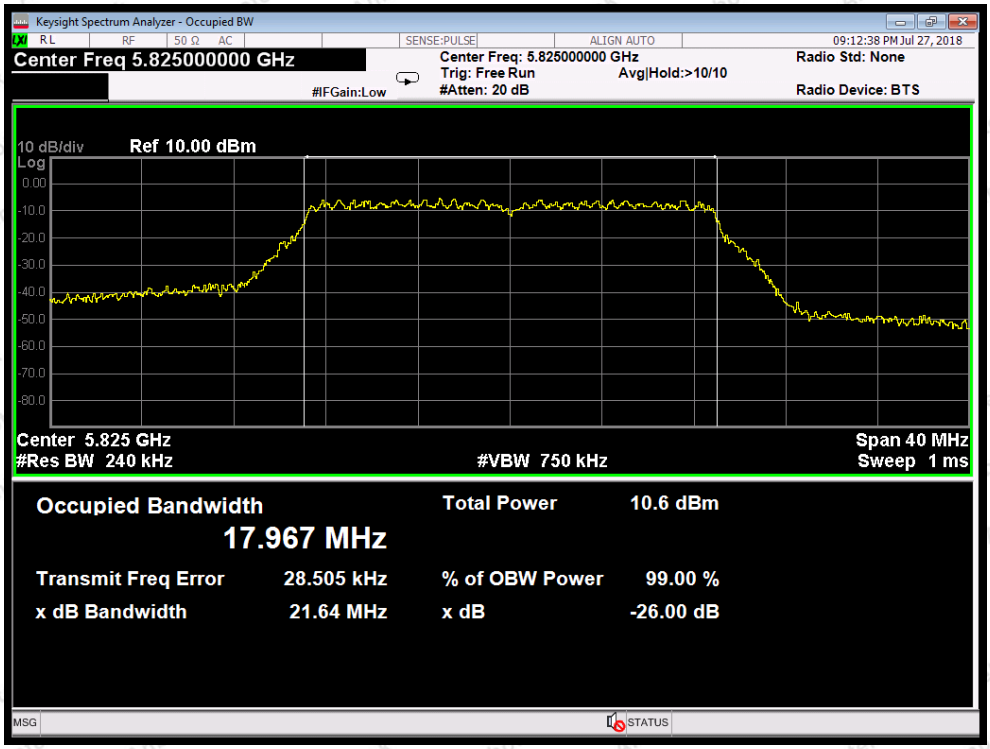
Test Mode: 802.11n20---High



Test Mode: 802.11ac20--Low



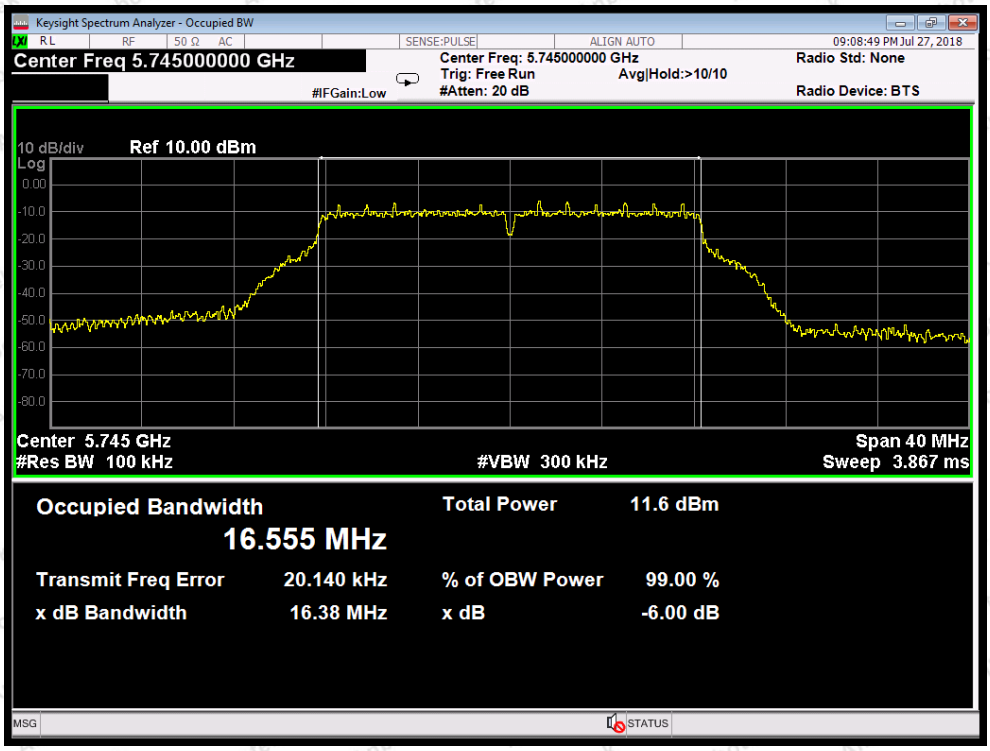
Test Mode: 802.11ac20---Middle



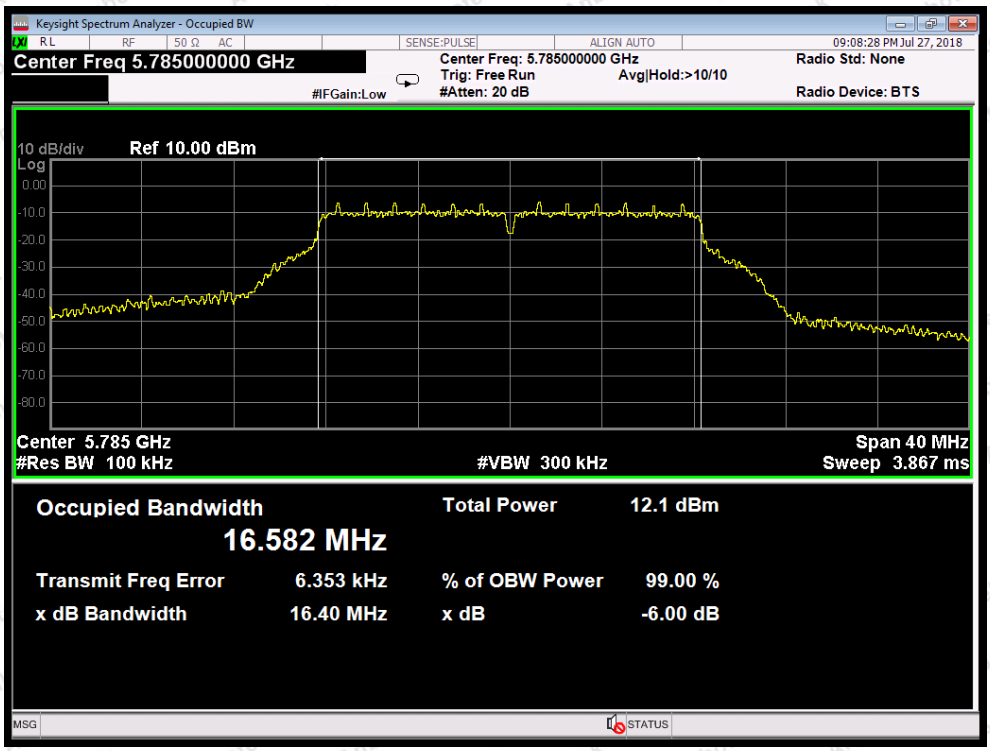
Test Mode: 802.11ac20---High

ANT B:

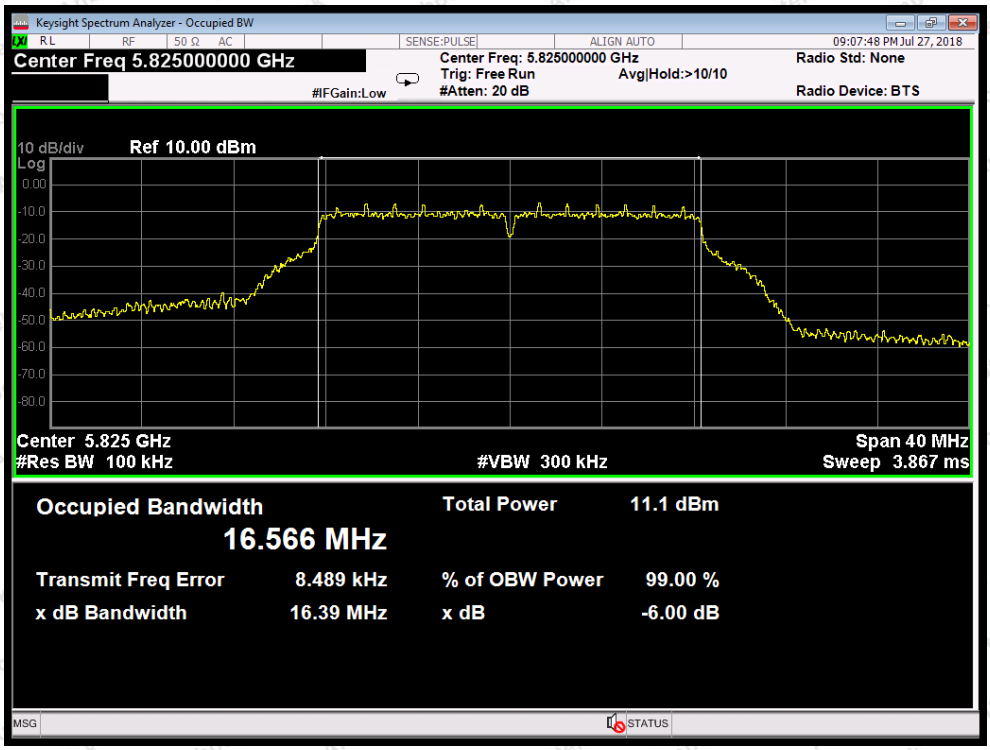
6dB Bandwidth



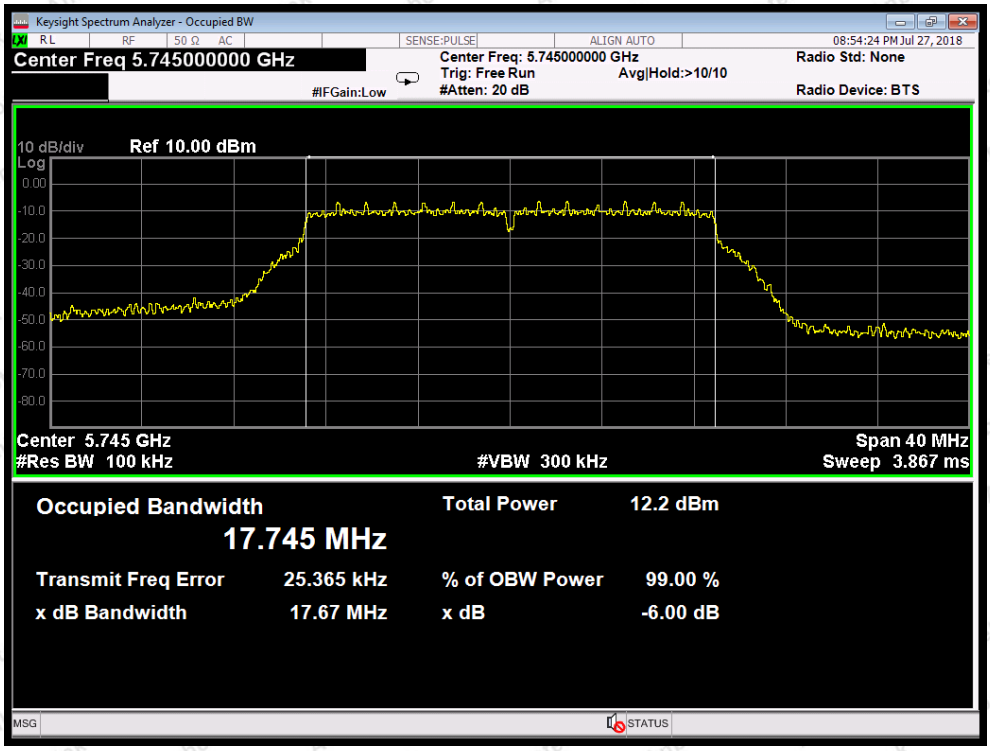
Test Mode: 802.11a--Low



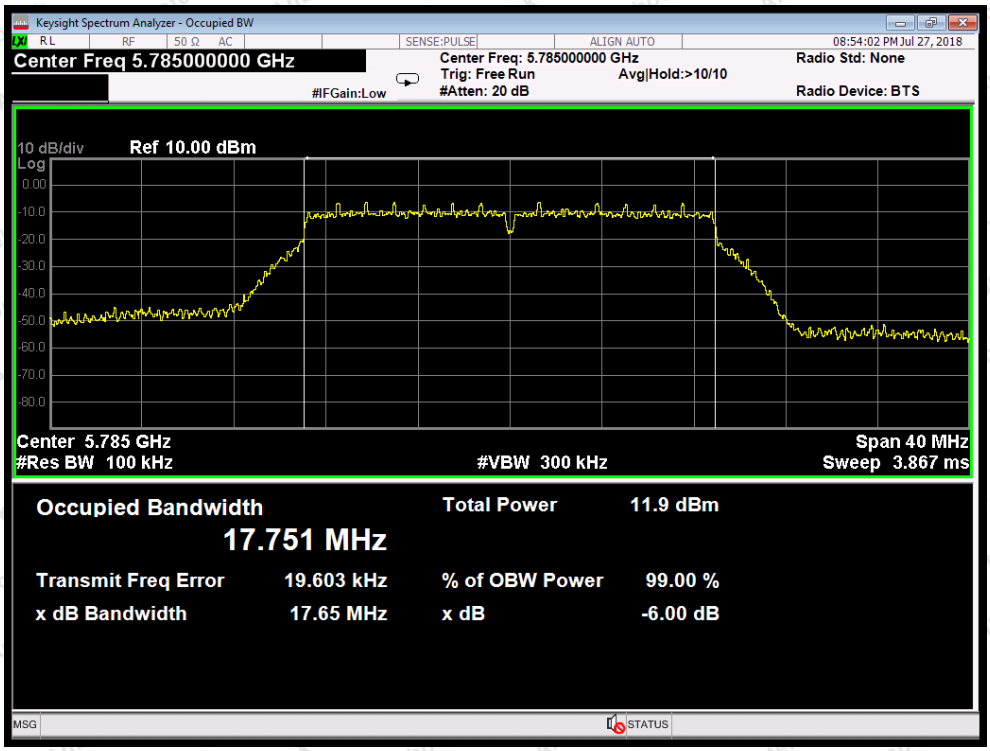
Test Mode: 802.11a---Middle



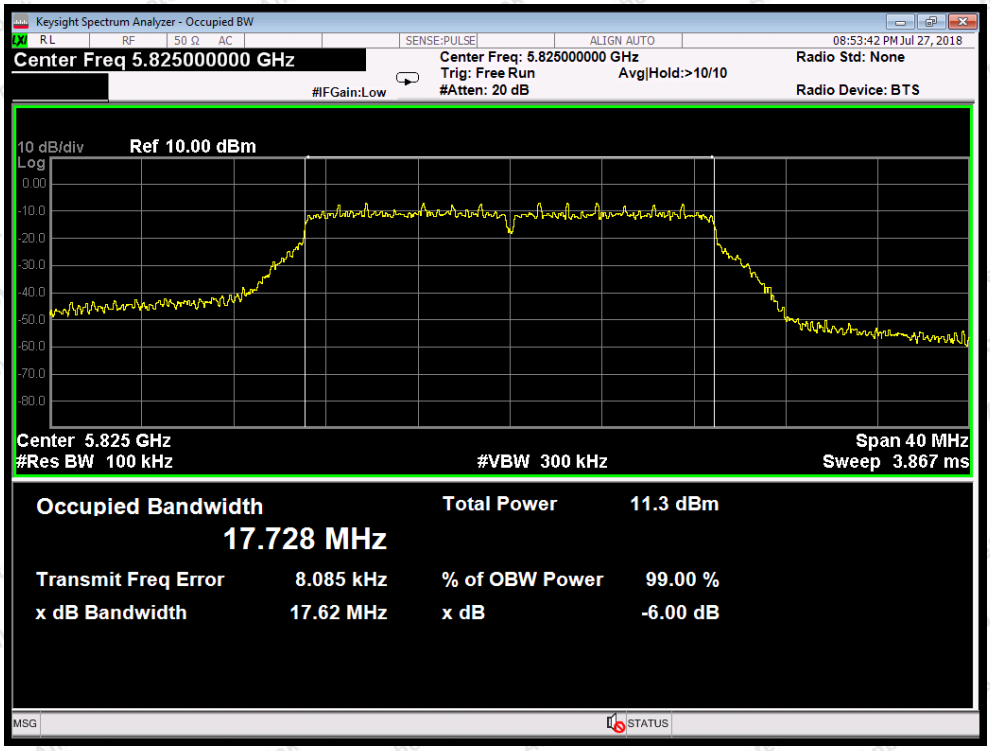
Test Mode: 802.11a---High



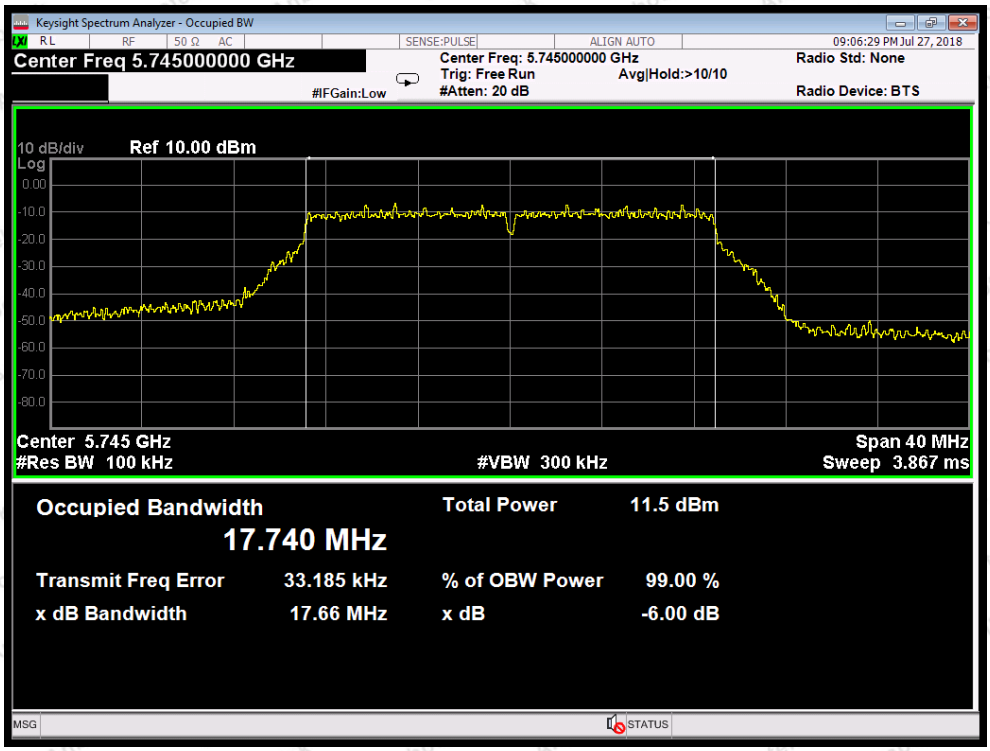
Test Mode: 802.11n20---Low



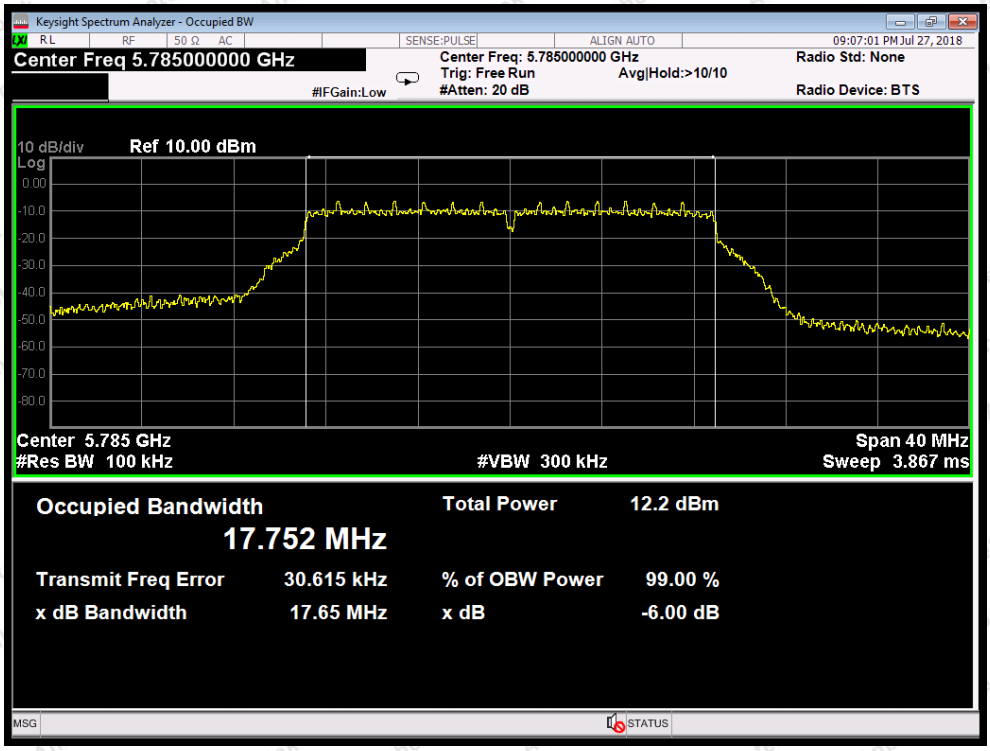
Test Mode: 802.11n20---Middle



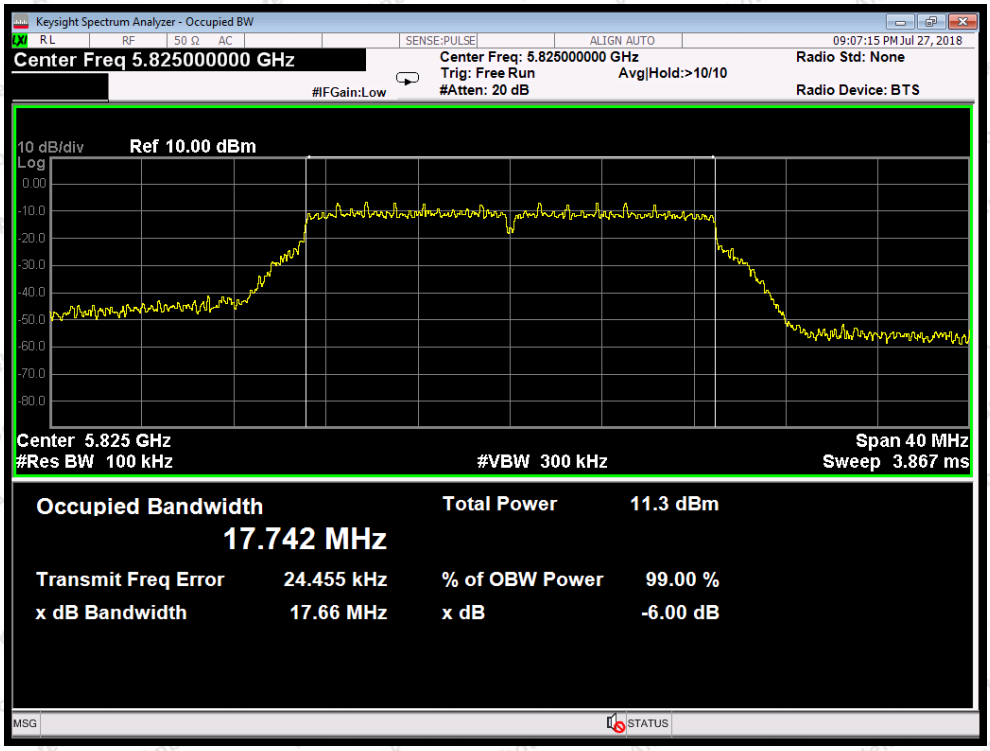
Test Mode: 802.11n20---High



Test Mode: 802.11ac20--Low

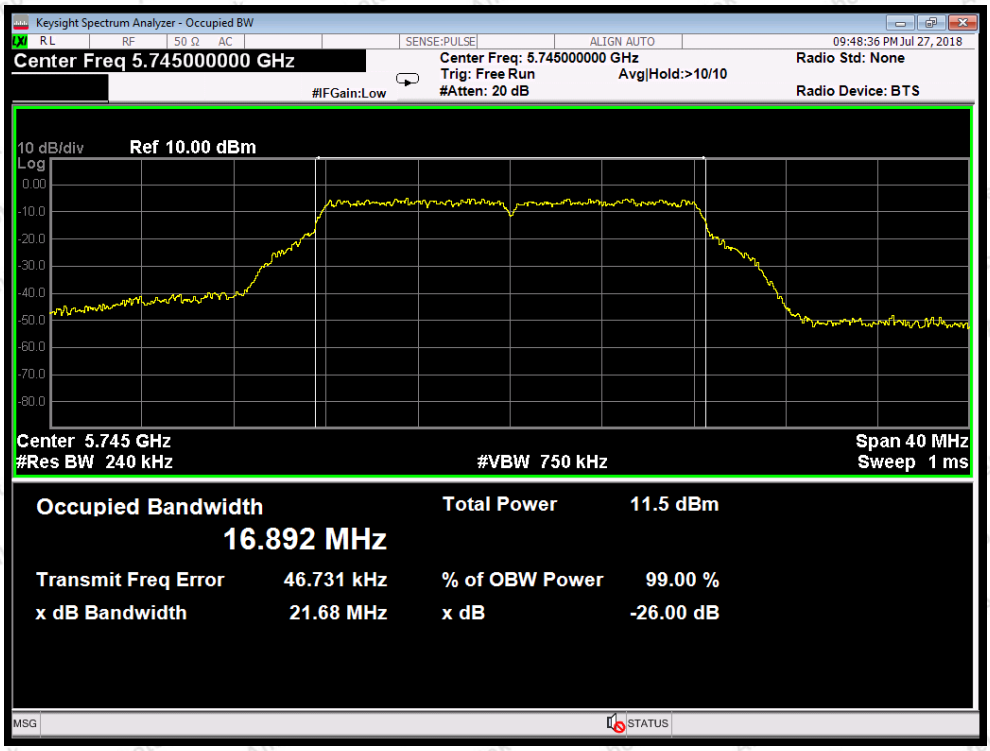


Test Mode: 802.11ac20---Middle

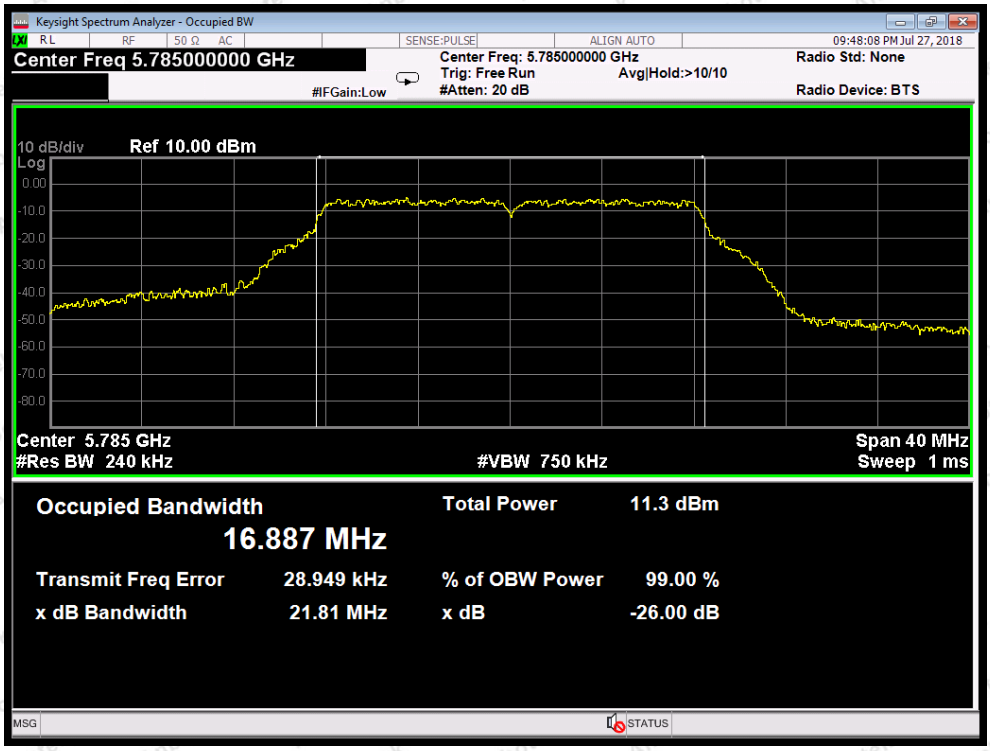


Test Mode: 802.11ac20---High

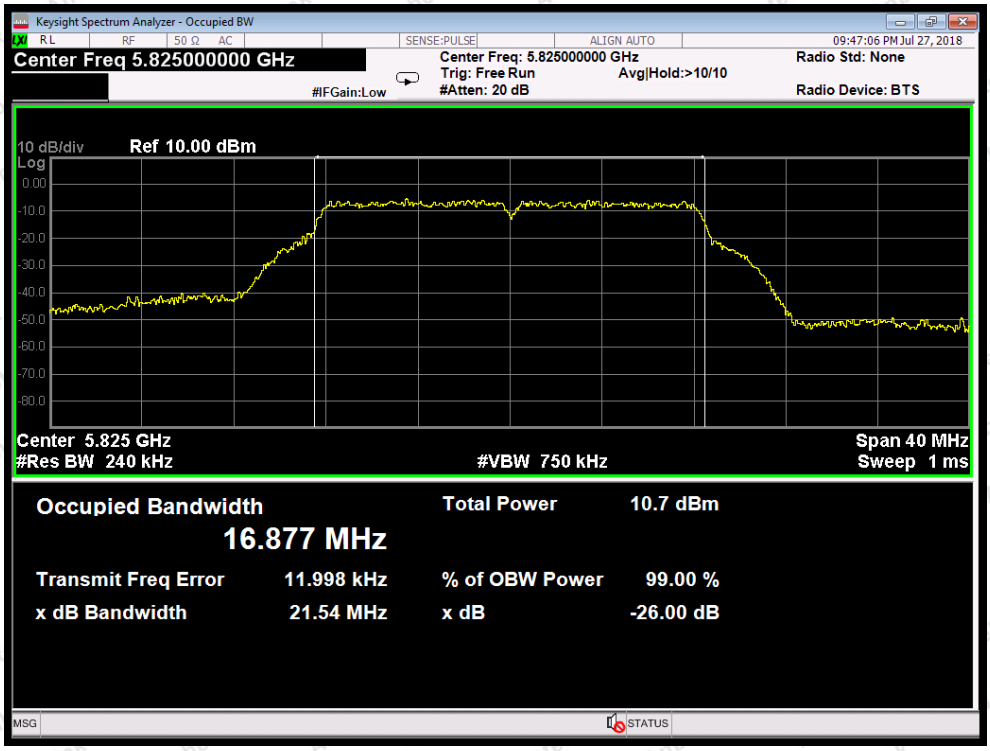
26dB & 99% Bandwidth



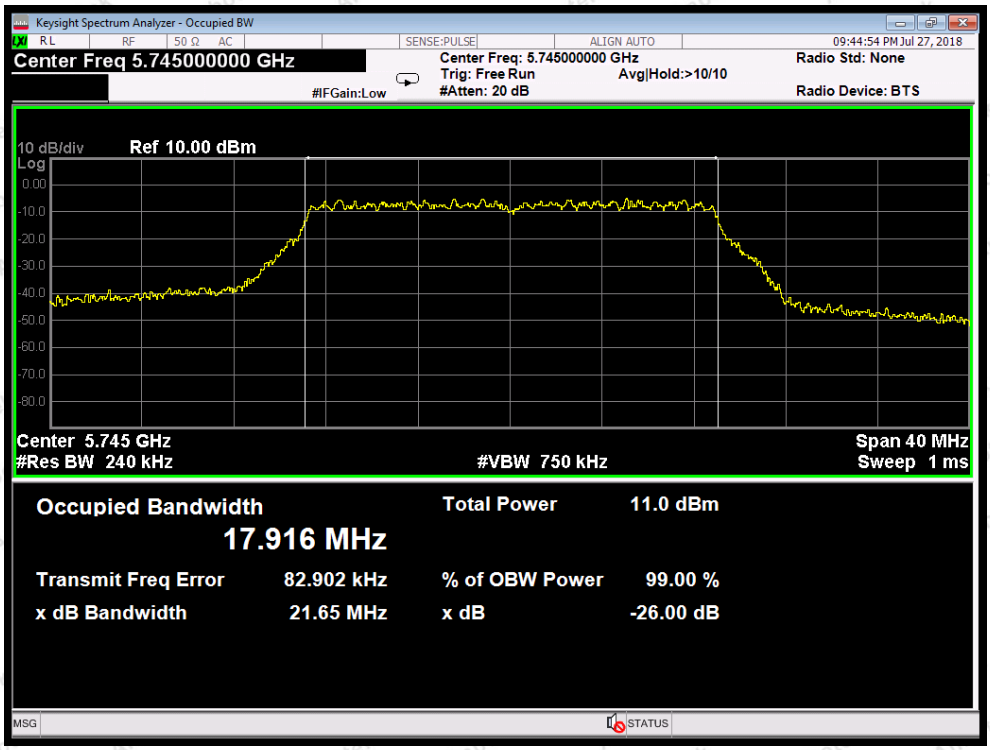
Test Mode: 802.11a--Low



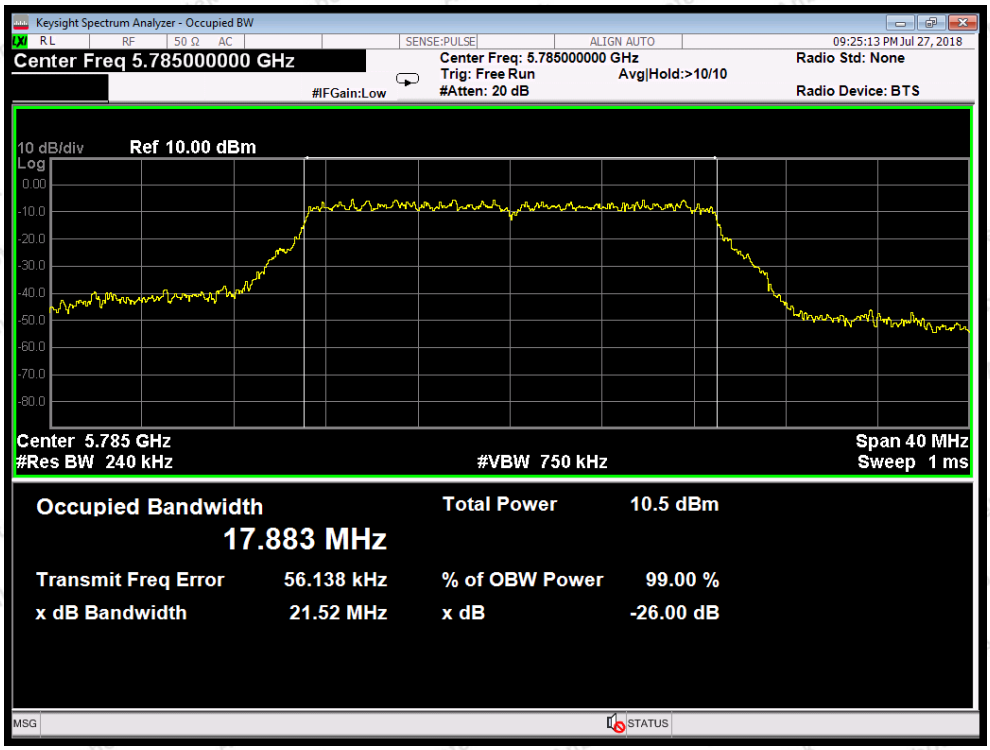
Test Mode: 802.11a---Middle



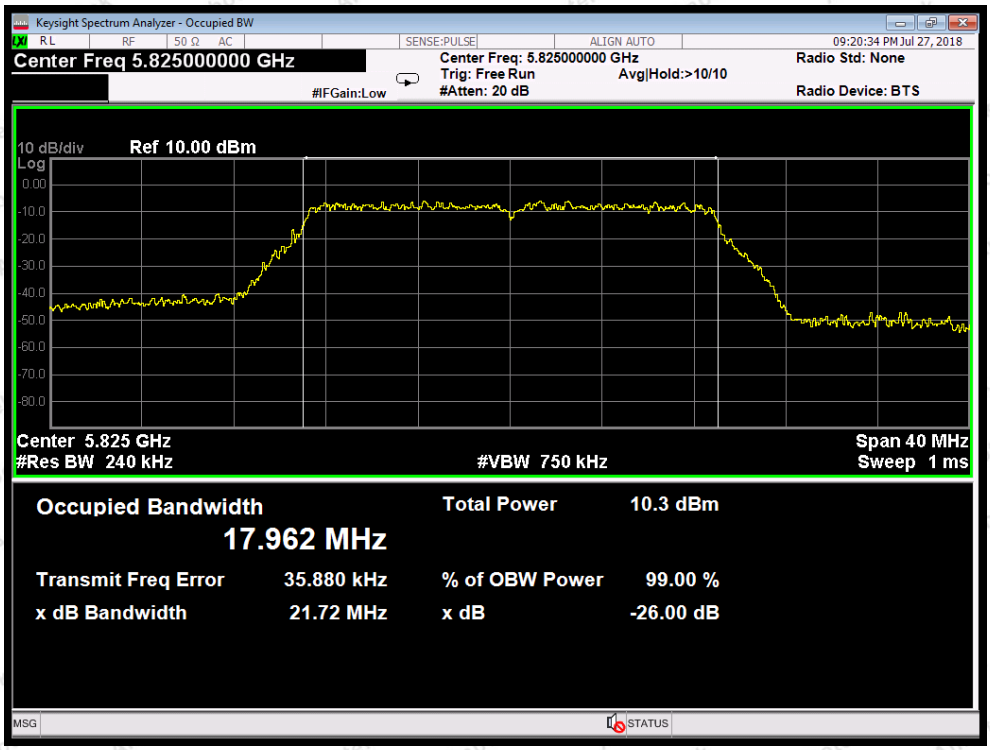
Test Mode: 802.11a---High



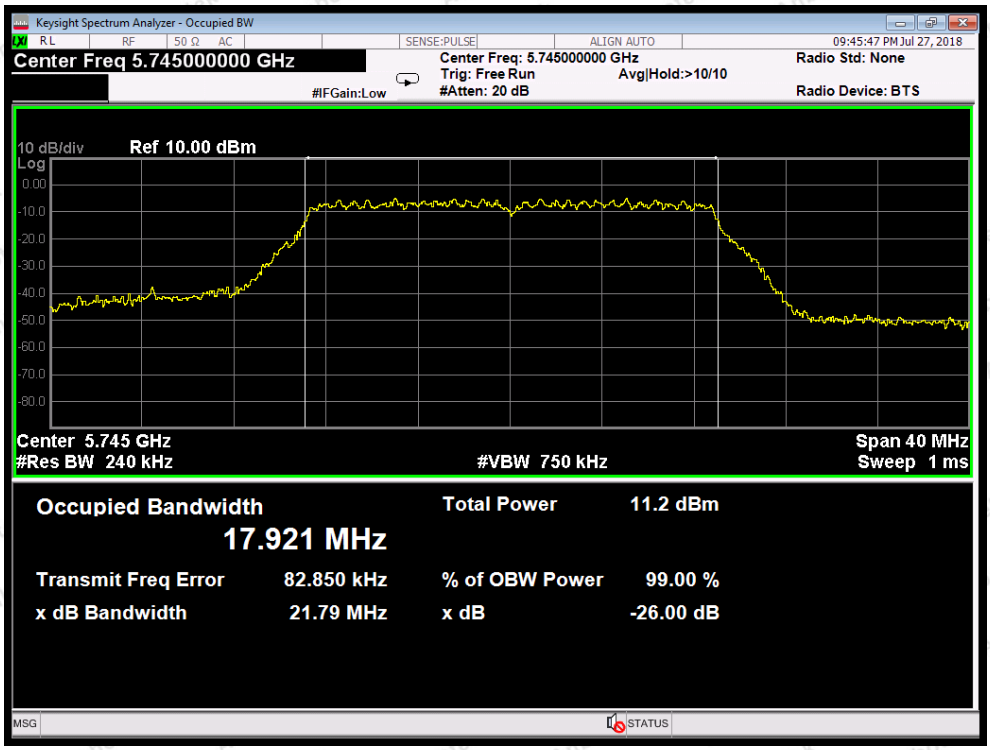
Test Mode: 802.11n20---Low



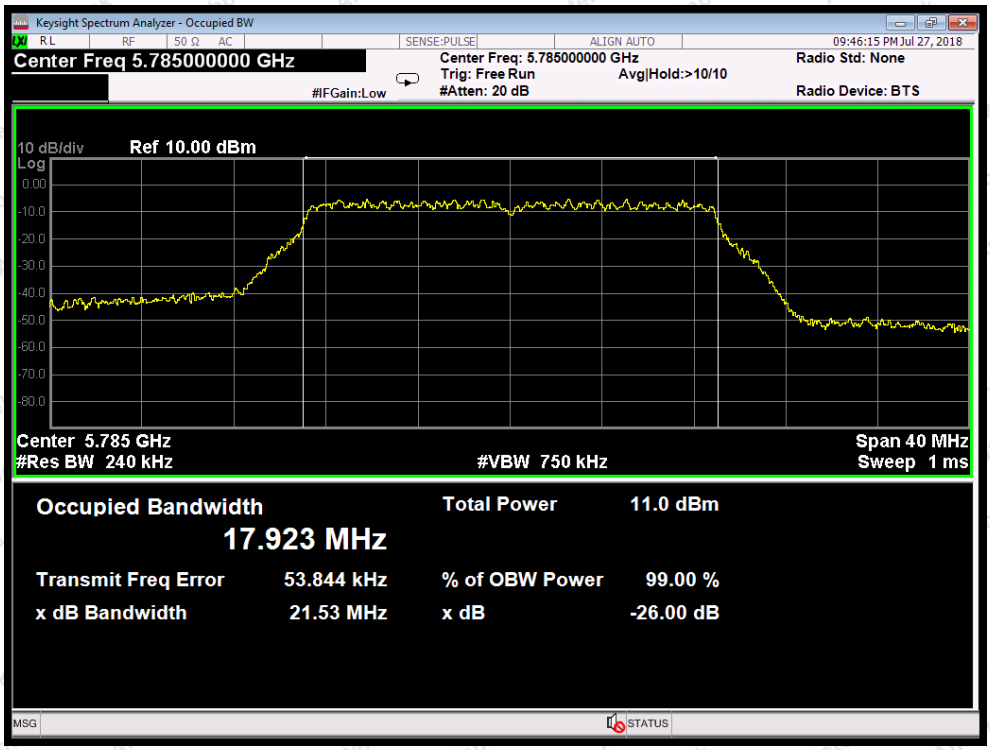
Test Mode: 802.11n20---Middle



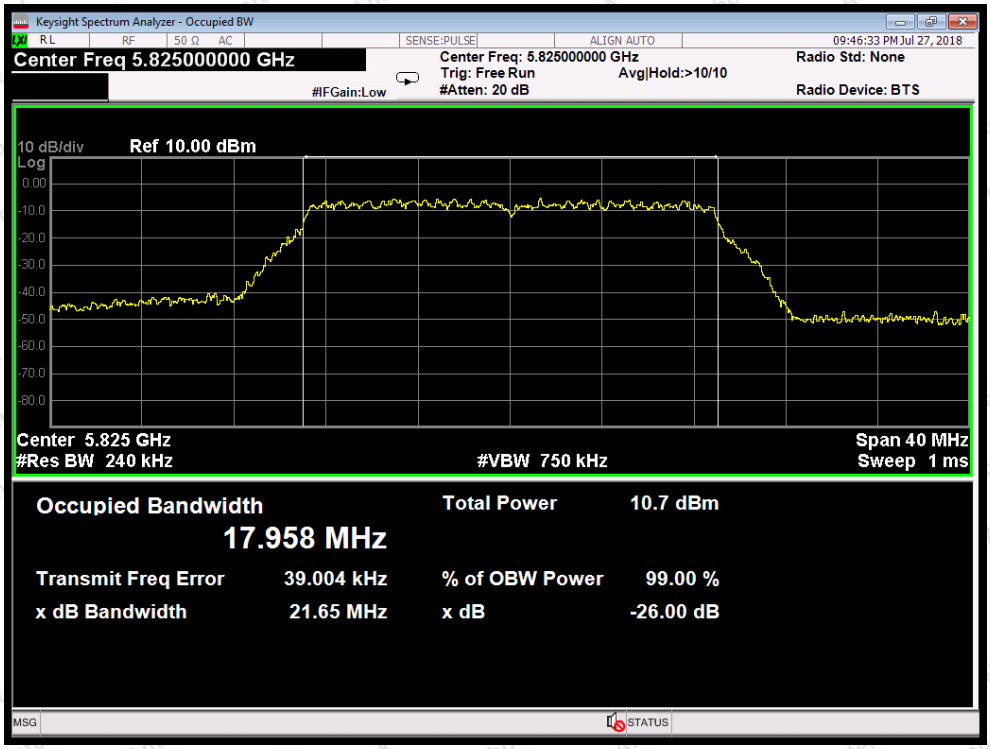
Test Mode: 802.11n20---High



Test Mode: 802.11ac20--Low



Test Mode: 802.11ac20---Middle



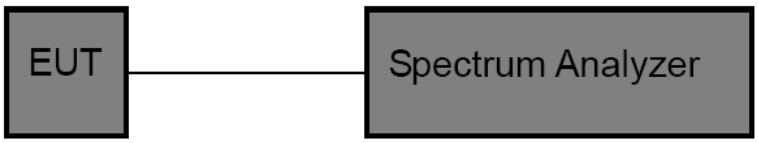
Test Mode: 802.11ac20---High

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 Mode	:	CH Low ~ CH High
Test Voltage	:	DC 3.8V battery inside	Temperature	:	24℃
Test Result	:	PASS	Humidity	:	55%RH

ANT A:

Test Mode	Channel Frequency (MHz)	Final Power Spectral Density (dBm/500KHz)	Correctional Limit (dBm/500KHz)	Results
802.11a	5745	-3.710	30	PASS
	5785	-3.473	30	PASS
	5825	-4.259	30	PASS
802.11n20	5745	-2.884	30	PASS
	5785	-2.807	30	PASS
	5825	-2.674	30	PASS
802.11ac20	5745	-1.613	30	PASS
	5785	-2.019	30	PASS
	5825	-2.281	30	PASS

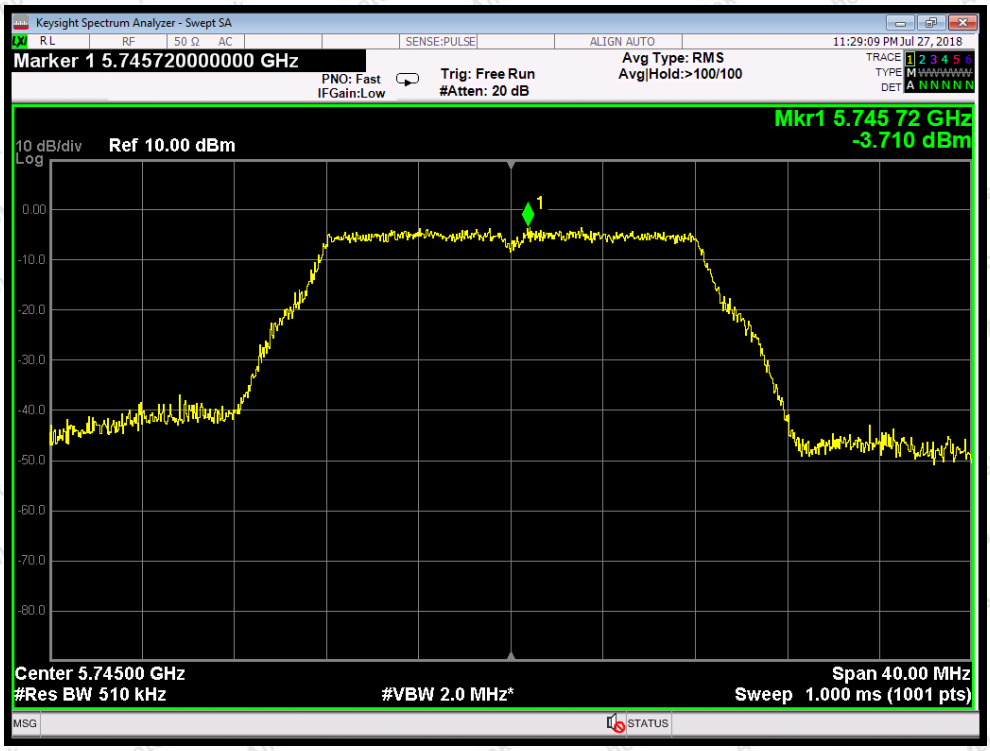
ANT B:

Test Mode	Channel Frequency (MHz)	Final Power Spectral Density (dBm/500KHz)	Correctional Limit (dBm/500KHz)	Results
802.11a	5745	-3.079	30	PASS
	5785	-4.096	30	PASS
	5825	-4.519	30	PASS
802.11n20	5745	-1.648	30	PASS
	5785	-2.704	30	PASS
	5825	-2.528	30	PASS
802.11ac20	5745	-1.540	30	PASS
	5785	-1.647	30	PASS
	5825	-3.393	30	PASS

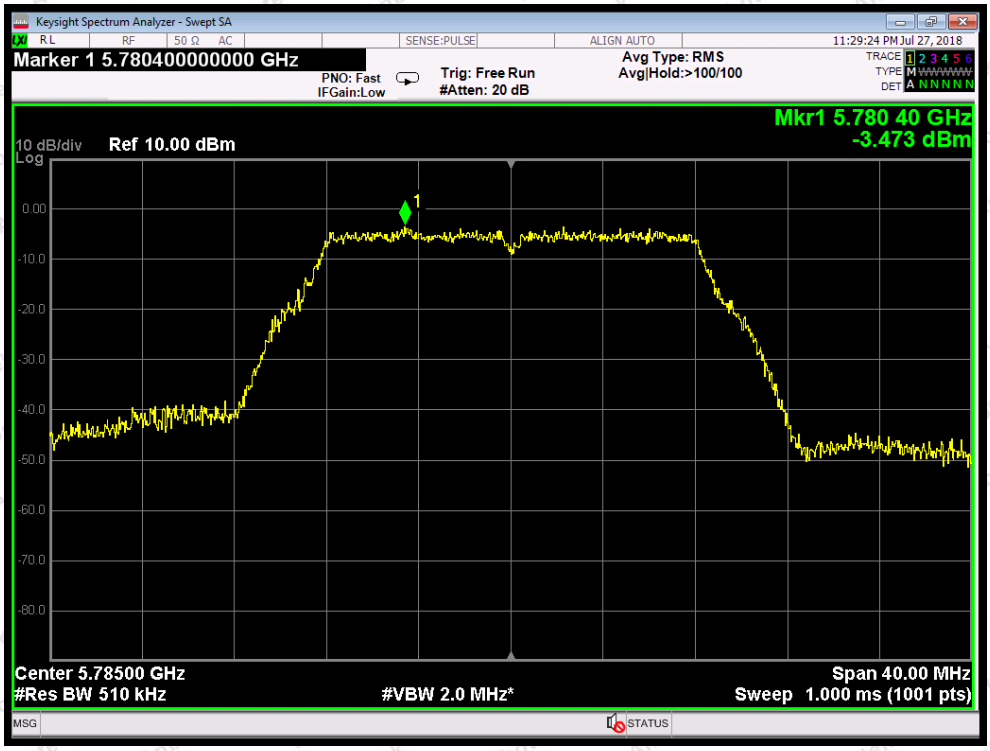
ANT A+B:

Test Mode	Channel Frequency (MHz)	Final Power Spectral Density (dBm/500KHz)	Correctional Limit (dBm/500KHz)	Results
802.11a	5745	-0.373	30	PASS
	5785	-0.763	30	PASS
	5825	-1.377	30	PASS
802.11n20	5745	0.79	30	PASS
	5785	0.26	30	PASS
	5825	0.41	30	PASS
802.11ac20	5745	**1.43**	30	PASS
	5785	1.18	30	PASS
	5825	0.21	30	PASS

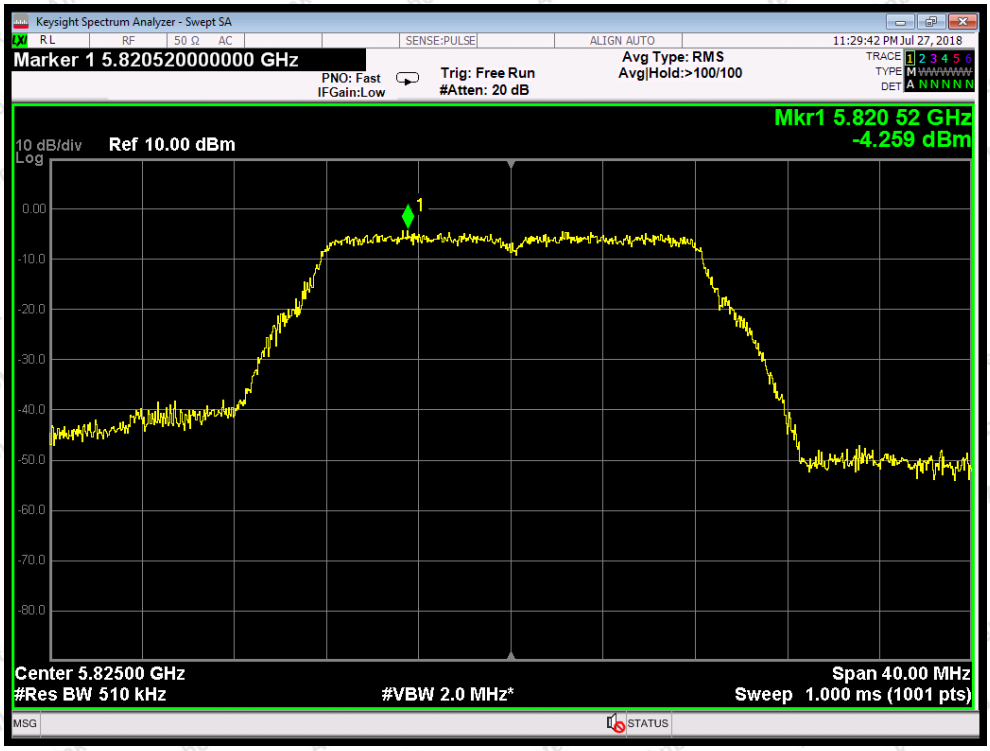
ANT A:



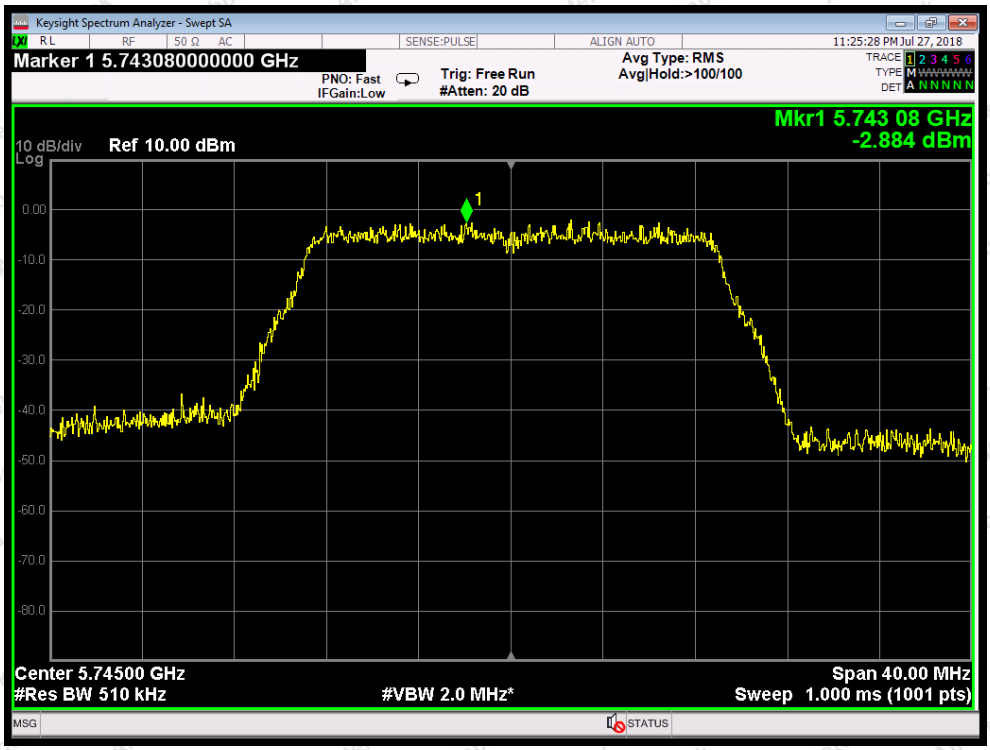
Test Mode: 802.11a--Low



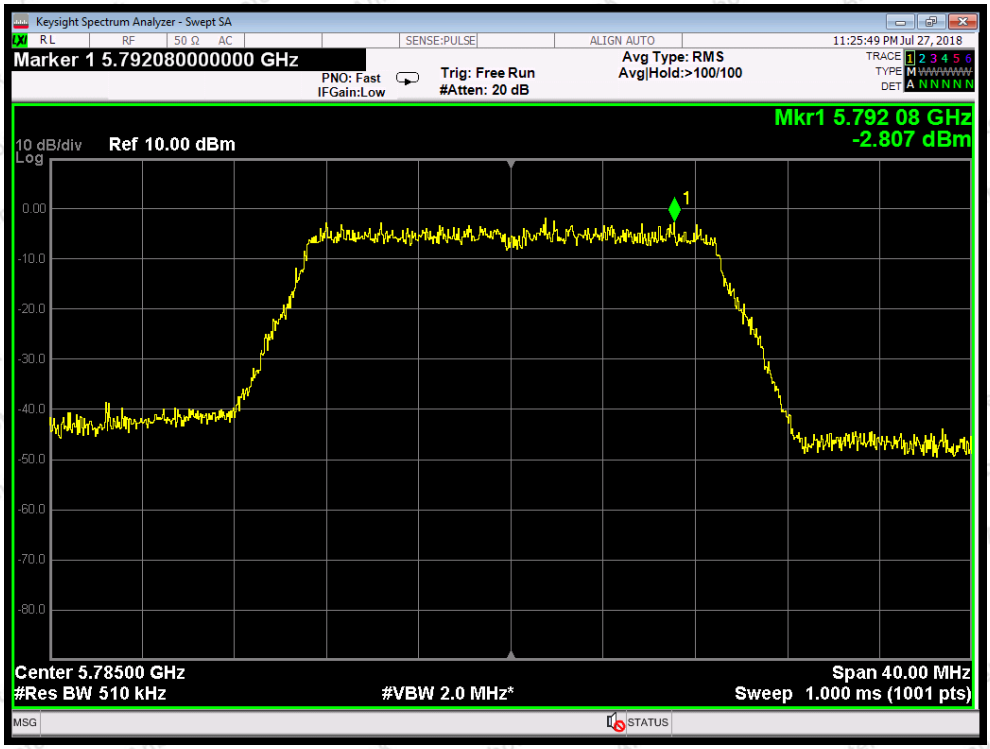
Test Mode: 802.11a---Middle



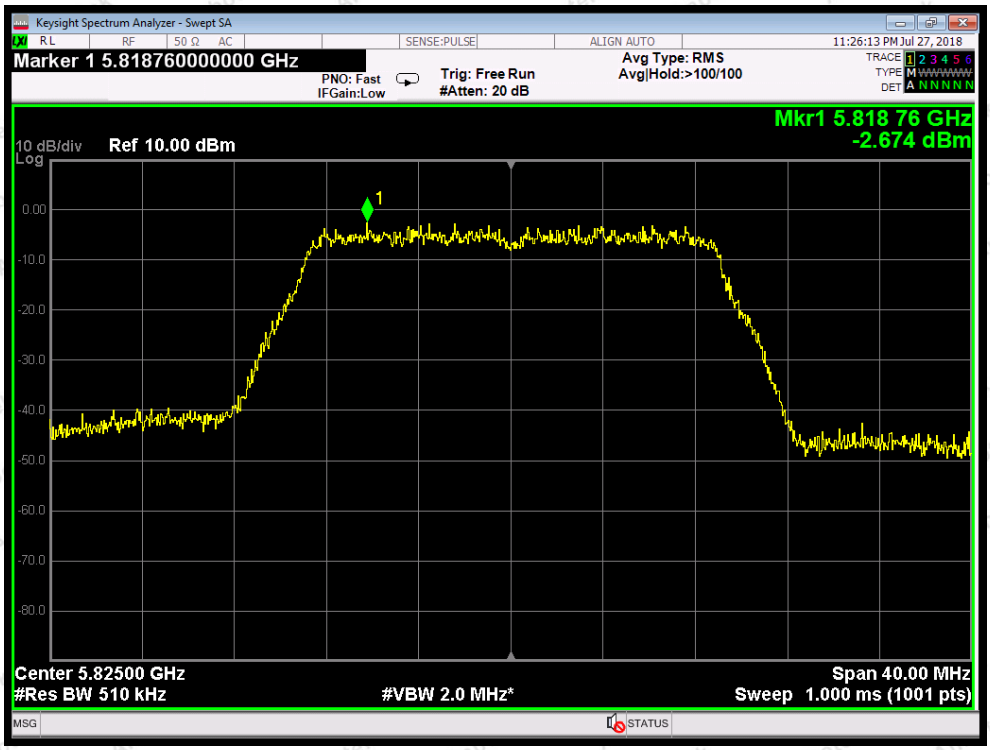
Test Mode: 802.11a---High



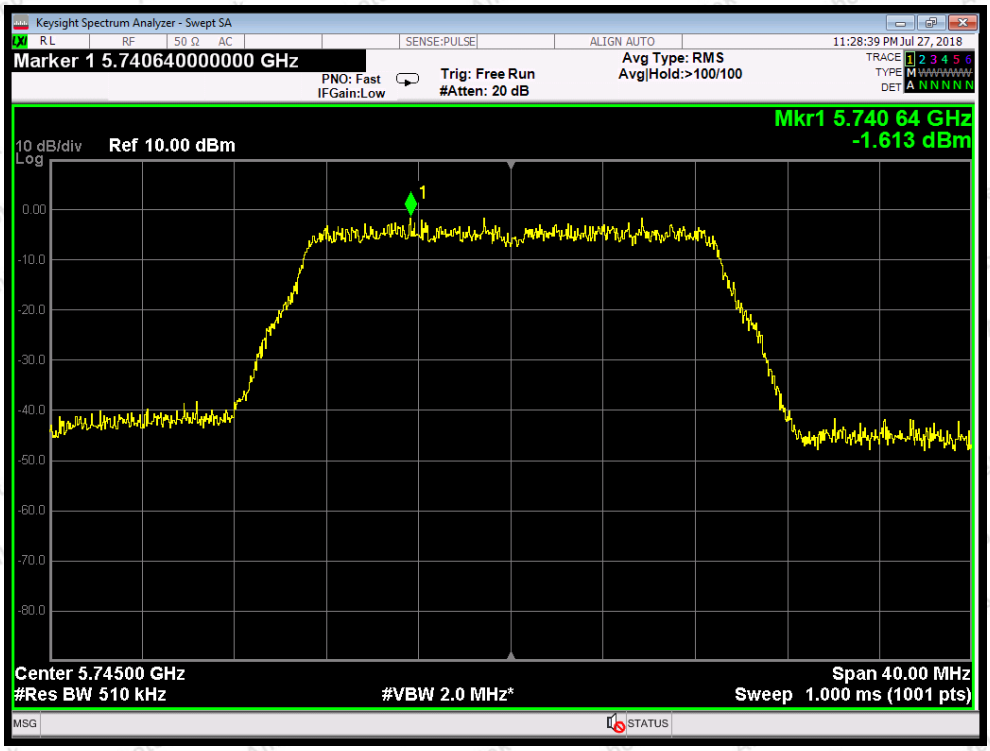
Test Mode: 802.11n20---Low



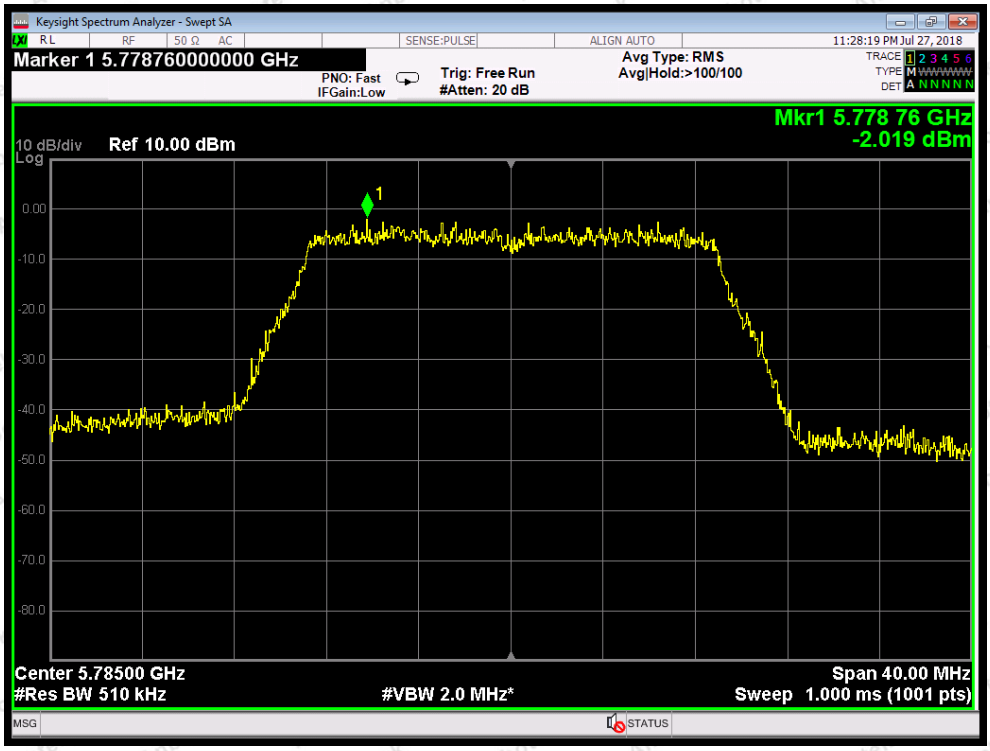
Test Mode: 802.11n20---Middle



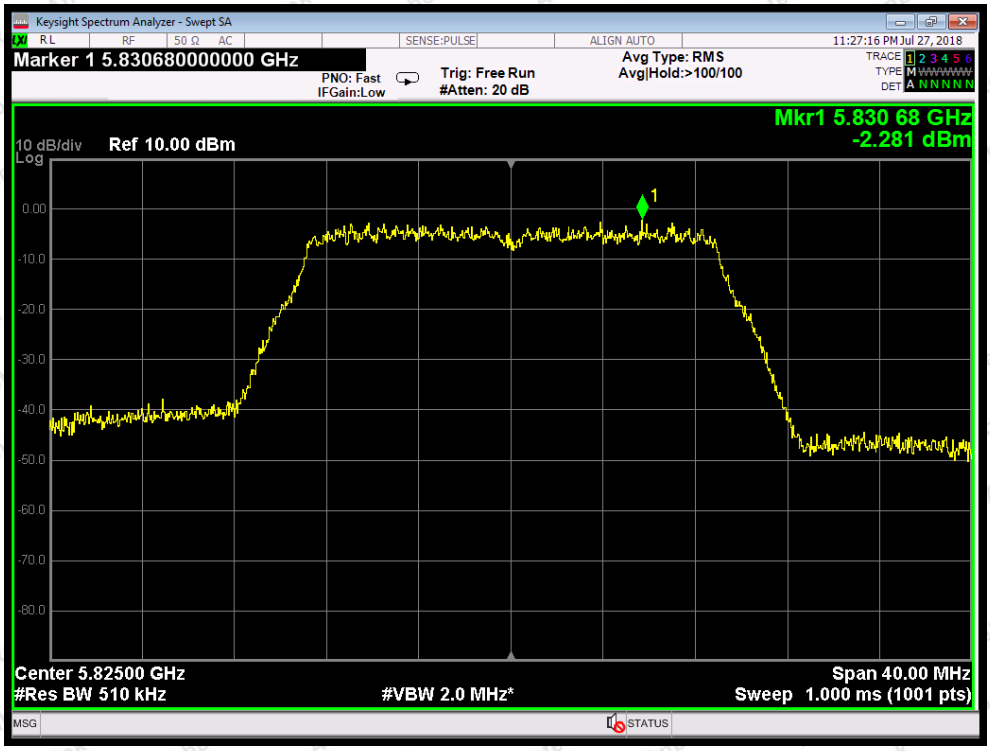
Test Mode: 802.11n20---High



Test Mode: 802.11ac20--Low

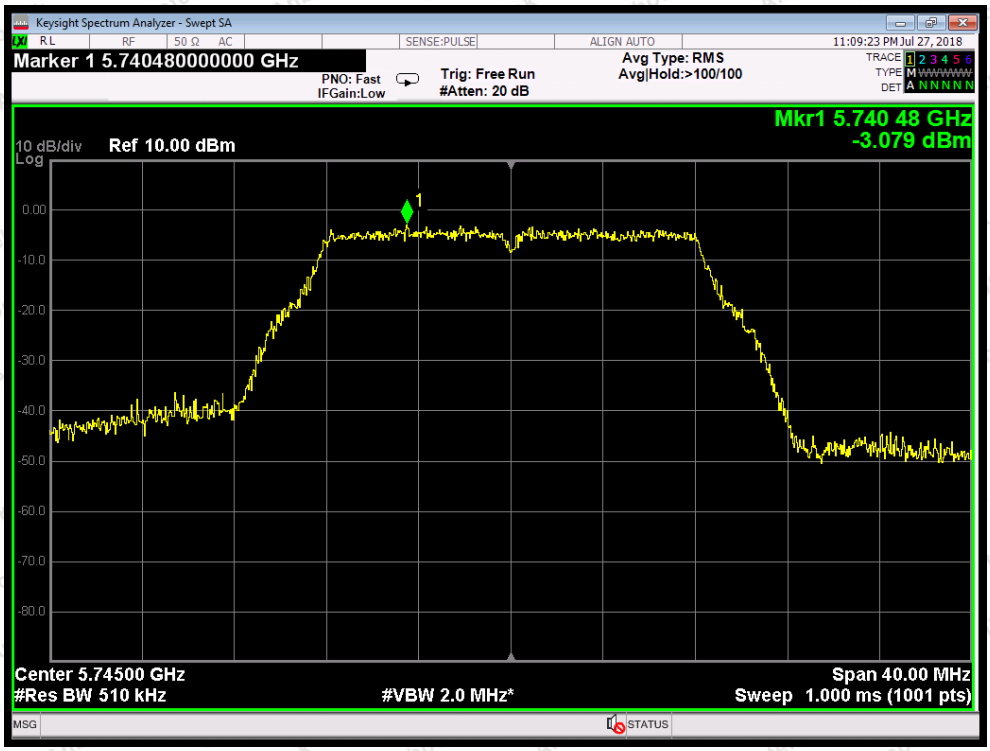


Test Mode: 802.11ac20---Middle

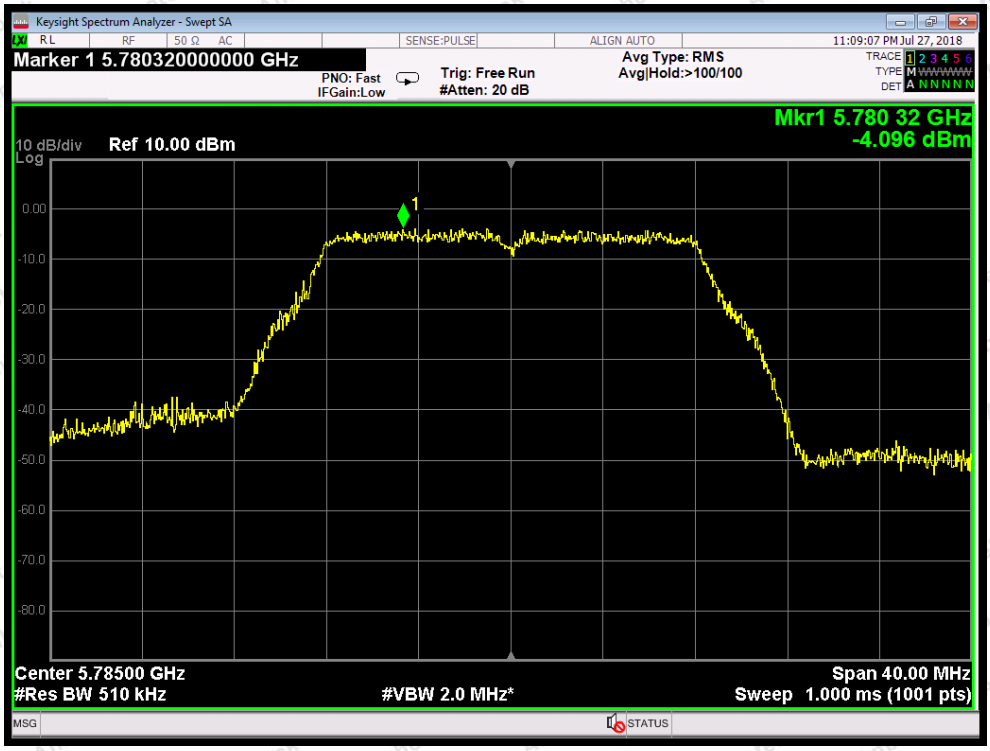


Test Mode: 802.11ac20---High

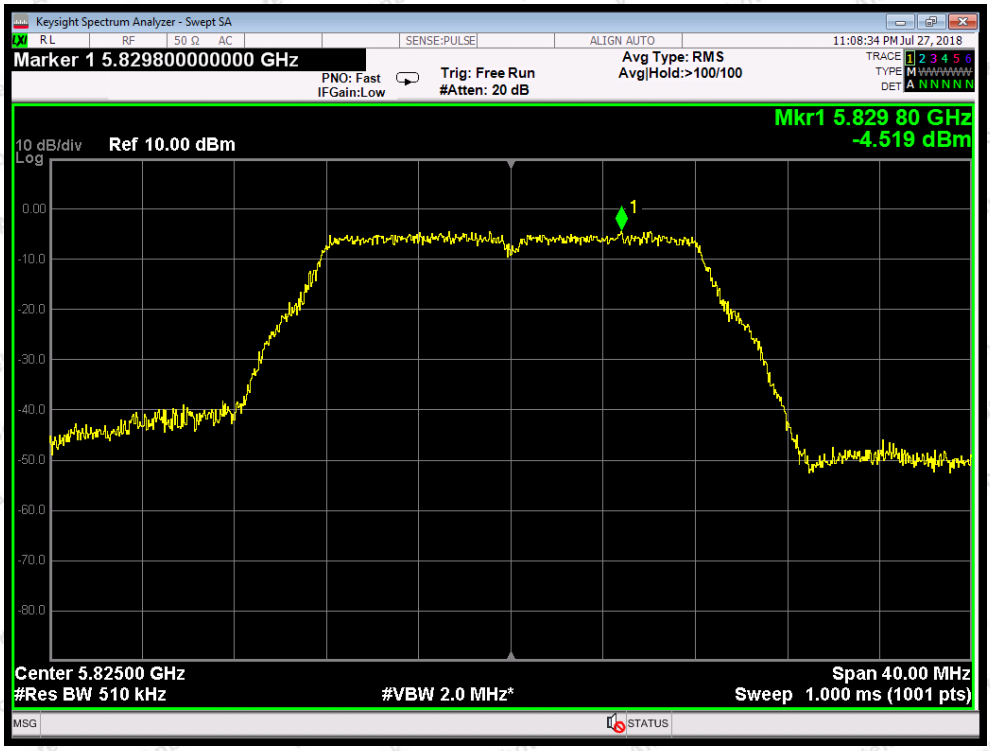
ANT B:



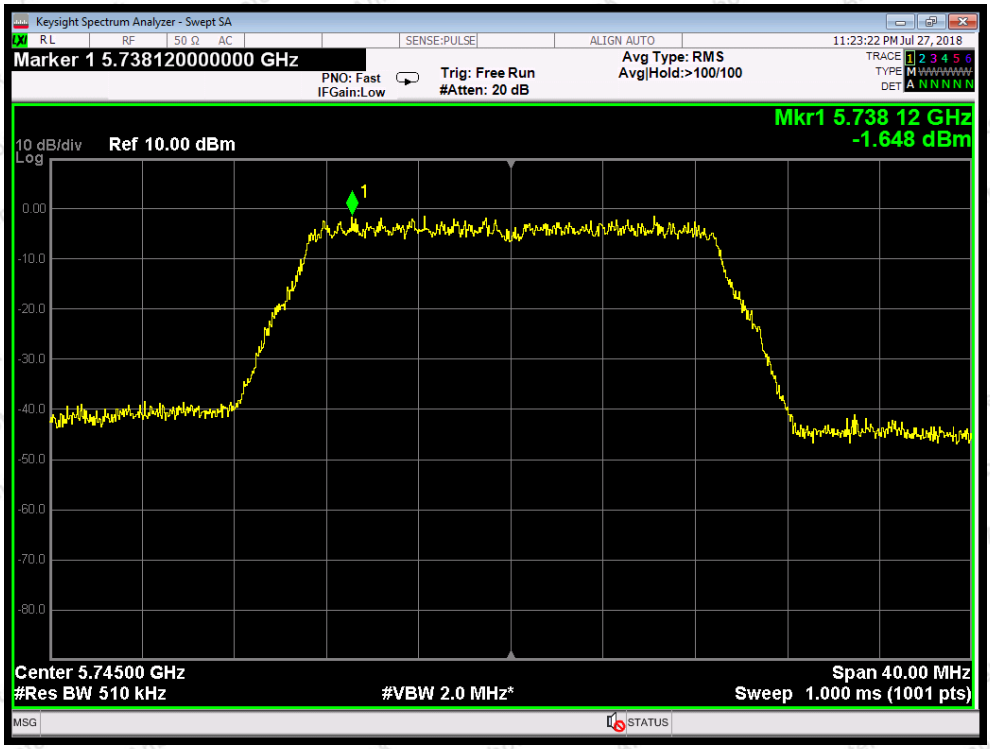
Test Mode: 802.11a--Low



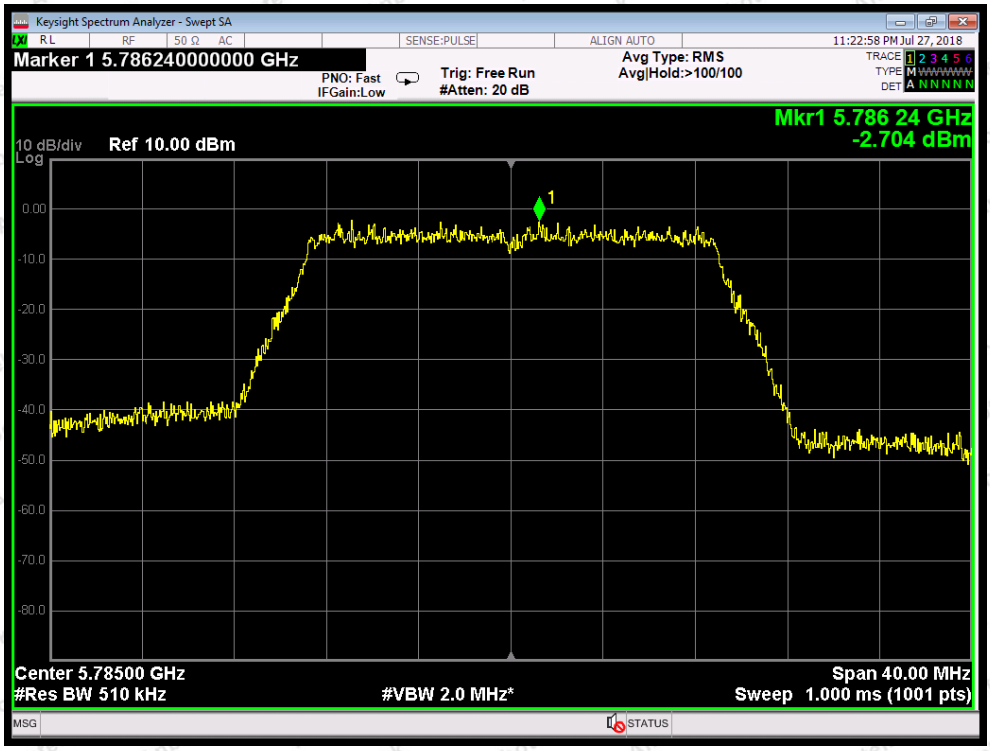
Test Mode: 802.11a---Middle



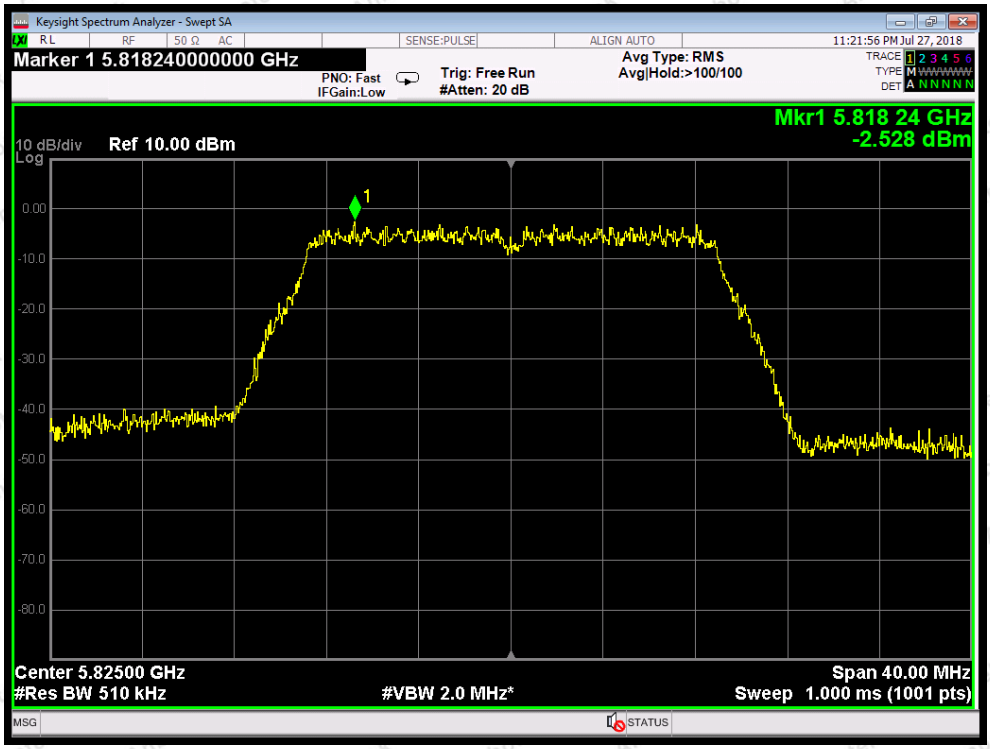
Test Mode: 802.11a---High



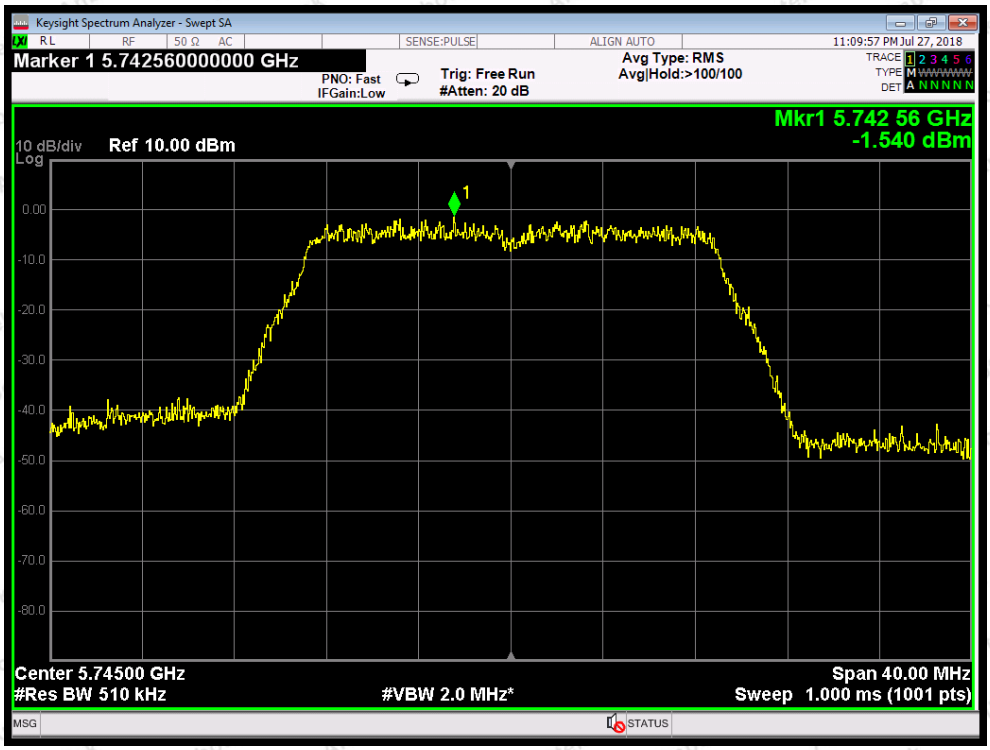
Test Mode: 802.11n20---Low



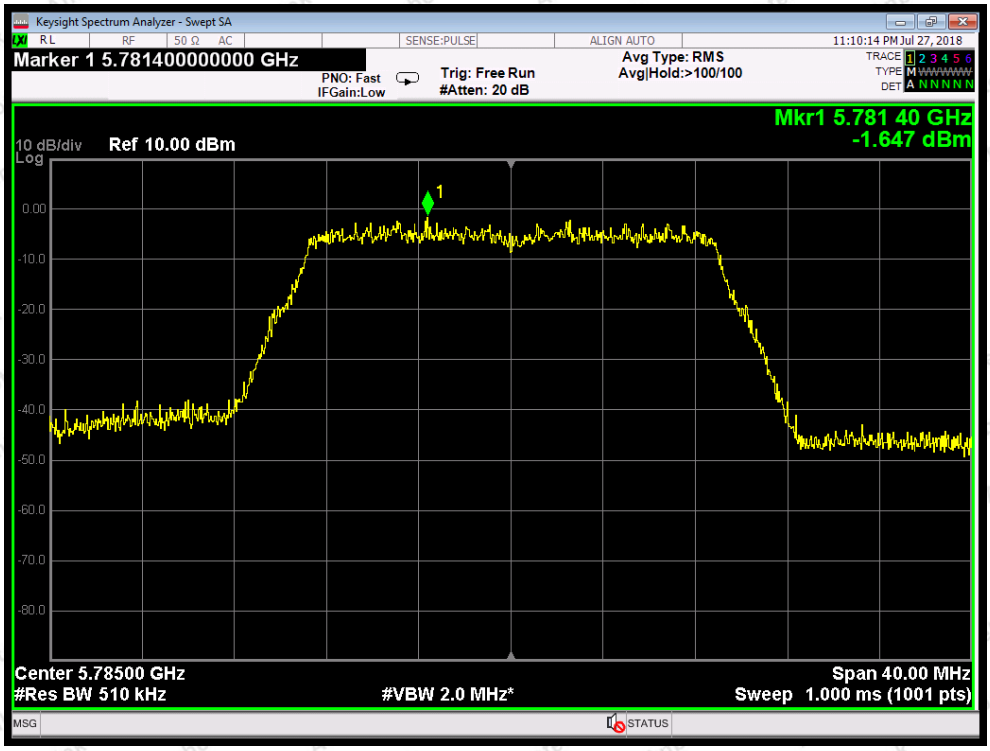
Test Mode: 802.11n20---Middle



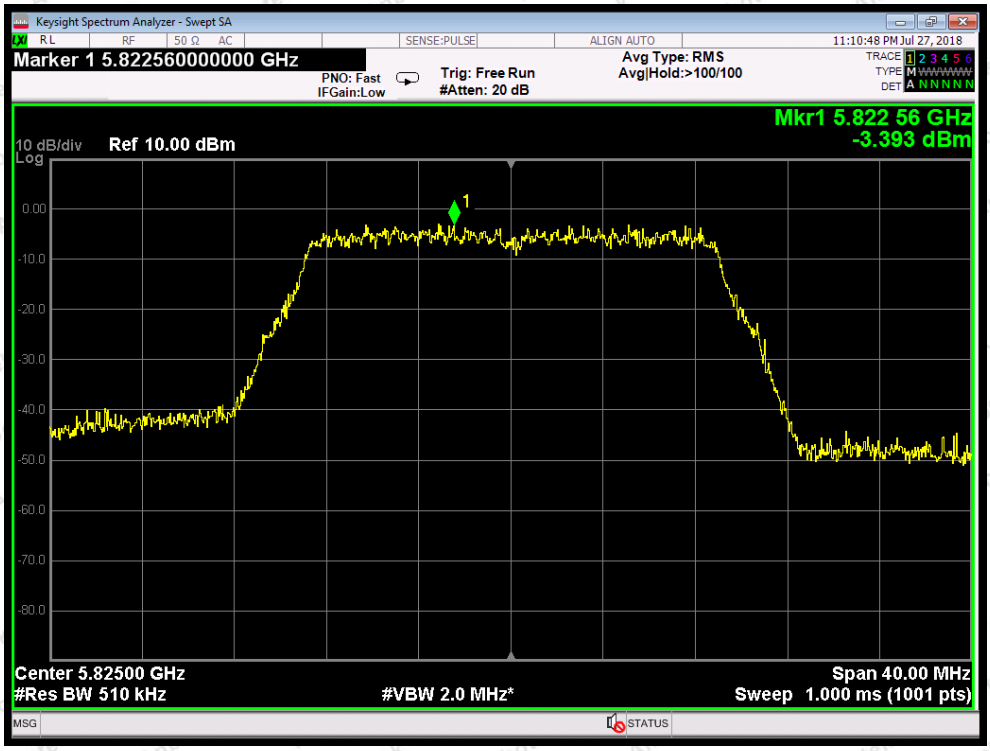
Test Mode: 802.11n20---High



Test Mode: 802.11ac20--Low



Test Mode: 802.11ac20---Middle



Test Mode: 802.11ac20---High

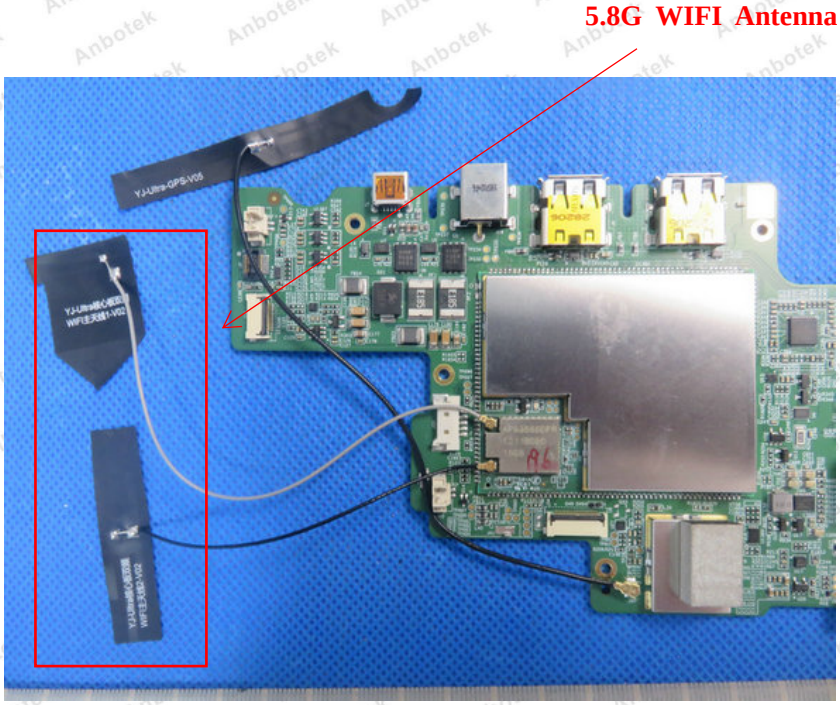
8. Antenna Requirement

8.1. Test Standard and Requirement

Test Standard	FCC Part15 Section 15.203 /15.407
Requirement	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. 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.

8.2. Antenna Connected Construction

The antenna is an PIFA Antenna which permanently attached, and the best case gain of the antenna is 1 dBi each antenna (It is reduced power treatment). It complies with the standard requirement.



APPENDIX I -- TEST SETUP PHOTOGRAPH

Please refer to the test report SZAWW180702011-01.

APPENDIX II -- EXTERNAL PHOTOGRAPH

Please refer to the test report SZAWW180702011-01.

APPENDIX III -- INTERNAL PHOTOGRAPH

Please refer to the test report SZAWW180702011-01.

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