

FCC Test Report

Client Name : Seeed Technology Co., Ltd.

Address : 9F, G3 Building, TCL International E City, Zhongshanyuan Road,
Nanshan District, Shenzhen, Guangdong Province, P.R.C

Product Name : RTL8720DN

Date : Apr. 29, 2020



Shenzhen Anbotech Compliance Laboratory Limited



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TEST REPORT

Applicant : Seeed Technology Co., Ltd.
Manufacturer : Seeed Technology Co., Ltd.
Product Name : RTL8720DN
Model No. : RTL8720DN
Trade Mark : Seeed Studio
Rating(s) : Input: DC 3.3V, 100mA
Test Standard(s) : FCC Part15 Subpart E, Paragraph 15.407
Test Method(s) : ANSI C63.10: 2013,
KDB 789033 D02 General UNII Test Procedures New Rules v02r01

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.

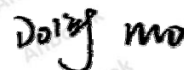
Date of Receipt

Apr. 01, 2020

Date of Test

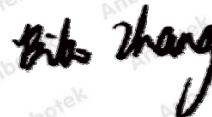
Apr. 01~24, 2020

Prepared By



(Engineer / Dolly Mo)

Reviewer



(Supervisor / Bibo Zhang)

Approved & Authorized Signer



(Manager / Tom Chen)



1. General Information

1.1. Client Information

Applicant	:	Seeed Technology Co., Ltd.
Address	:	9F, G3 Building, TCL International E City, Zhongshanyuan Road, Nanshan District, Shenzhen, Guangdong Province, P.R.C
Manufacturer	:	Seeed Technology Co., Ltd.
Address	:	9F, G3 Building, TCL International E City, Zhongshanyuan Road, Nanshan District, Shenzhen, Guangdong Province, P.R.C
Factory	:	Seeed Technology Co., Ltd.-
Address	:	F5, Building B17, Hengfeng Industrial City, No. 739 Zhoushi Rd, Baoan District, Shenzhen, Guangdong, P.R.C.

1.2. Description of Device (EUT)

Product Name	:	RTL8720DN
Model No.	:	RTL8720DN
Trade Mark	:	Seeed Studio
Test Power Supply	:	AC 120V, 60Hz for adapter
Test Sample No.	:	1-2-1(Normal Sample), 1-2-2(Engineering Sample)
Product Description	Operation Frequency:	WiFi 2.4G: 802.11b/ g/ n(HT20) 2412-2462MHz 802.11n(HT40) 2422-2452MHz BLE: 2402-2480MHz WiFi 5.1G: 5180MHz~5240MHz WiFi 5.8G: 5745MHz~5825MHz
	Number of Channel:	WiFi 2.4G: 11 Channels for 802.11b/ g/ n(HT20) 7 Channels for 802.11n(HT40) BLE: 40 Channels WiFi 5.1G: 4 Channels for 802.11a WiFi 5.8G: 5 Channels for 802.11a
	Modulation Type:	WiFi 2.4G: 802.11b CCK; 802.11g/n OFDM BLE: GFSK WiFi 5.1G: OFDM with BPSK/QPSK/16QAM/64QAM/256QAM WiFi 5.8G: OFDM with BPSK/QPSK/16QAM/64QAM/256QAM
	Antenna Type:	ANT A: PCB Antenna ANT B: Chip Antenna

	Antenna Gain(Peak):	WiFi 2.4G(ANT A): 4.1 dBi BLE(ANT A): 4.1 dBi WiFi 5.1G(ANT A): 3.6 dBi WiFi 5.8G(ANT A): 2.1 dBi WiFi 2.4G(ANT B): 1 dBi BLE(ANT B): 1 dBi WiFi 5.1G(ANT B): 4 dBi WiFi 5.8G(ANT B): 4 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 module. 3) Two antennas do not support MIMO.		

1.3. Auxiliary Equipment Used During Test

Adapter	:	Manufacturer: ZTE
		M/N: STC-A2050I1000USBA-C S/N: 201202102100876 Input: 100-240V~ 50/60Hz, 0.3A Output: DC 5V, 1000mA

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)	CH 149	5745MHz
	CH 157	5785MHz
	CH 165	5825MHz

Note:

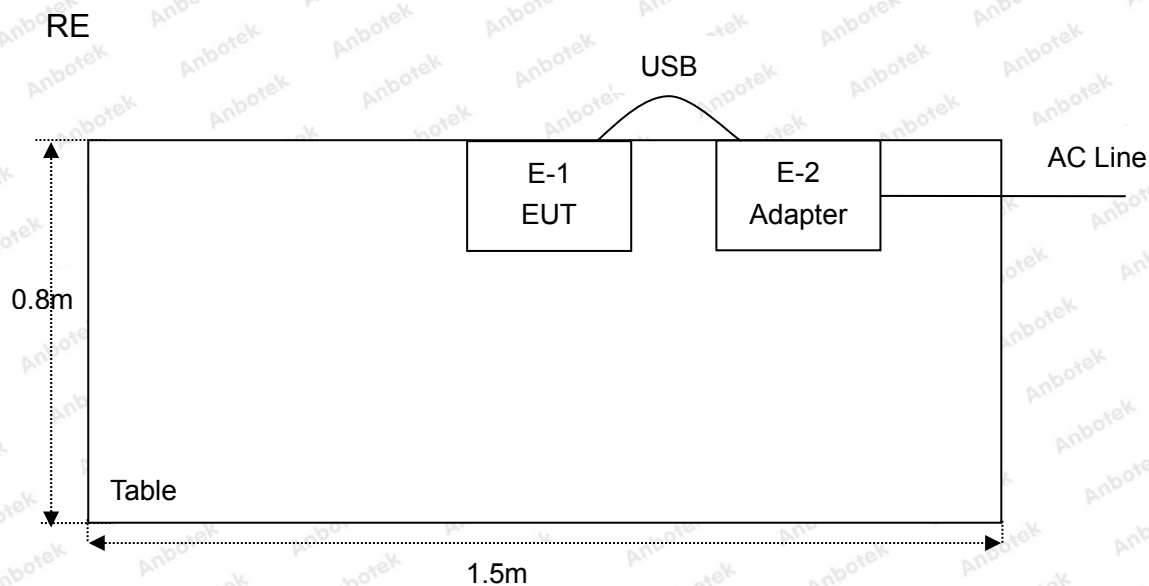
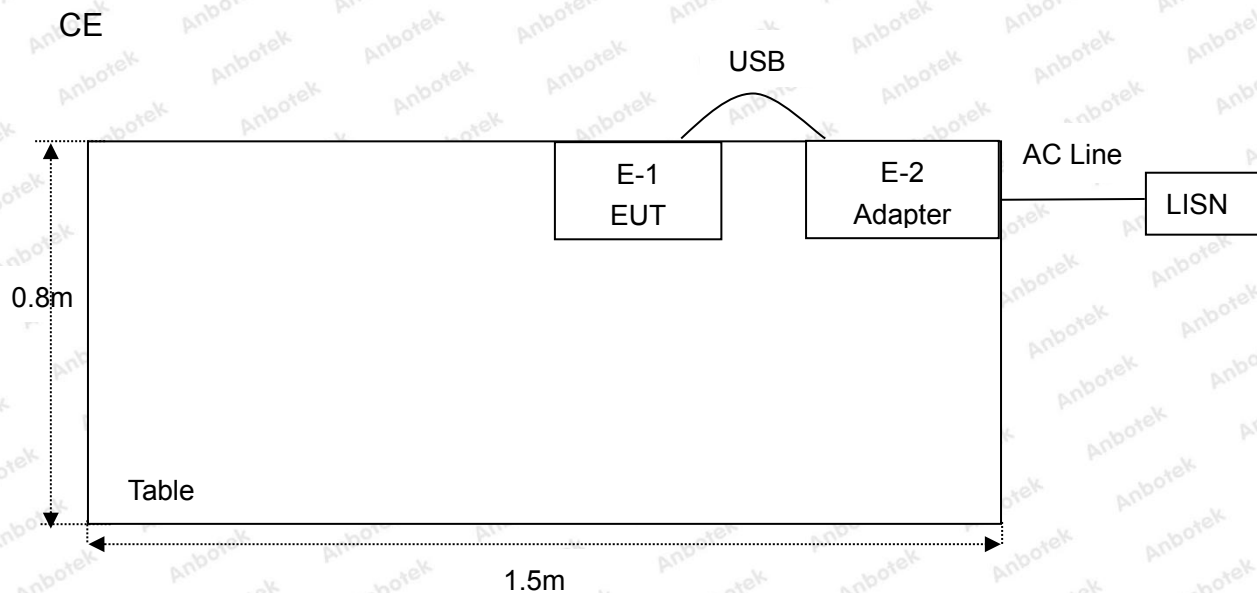
1. The measurements are performed at the highest, middle, lowest available channels.
2. The EUT has been tested as an independent unit. And Continual Transmitting in maximum power.
3. For the relevant Conducted Measurement, the temporary antenna connector is used during the measurement. Antenna Connector 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

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

1.6. Description Of Test Setup



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. 04, 2019	1 Year
2.	EMI Test Receiver	Rohde & Schwarz	ESPI3	101604	Nov. 04, 2019	1 Year
3.	RF Switching Unit	Compliance Direction	RSU-M2	38303	Nov. 04, 2019	1 Year
4.	MAX Spectrum Analysis	Agilent	N9020A	MY51170037	Nov. 04, 2019	1 Year
5.	Preamplifier	SKET Electronic	BK1G18G30 D	KD17503	Nov. 04, 2019	1 Year
6.	Double Ridged Horn Antenna	Instruments corporation	GTH-0118	351600	Nov. 01, 2019	1 Year
7.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	VULB 9163-289	Nov. 01, 2019	1 Year
8.	Loop Antenna	Schwarzbeck	FMZB1519B	00053	Nov. 01, 2019	1 Year
9.	Horn Antenna	A-INFO	LB-180400-K F	J211060628	Nov. 01, 2019	1 Year
10.	Pre-amplifier	SONOMA	310N	186860	Nov. 04, 2019	1 Year
11.	EMI Test Software EZ-EMC	SHURPLE	N/A	N/A	N/A	N/A
12.	RF Test Control System	YIHENG	YH3000	2017430	Nov. 04, 2019	1 Year
13.	Power Sensor	DAER	RPR3006W	15I00041SN045	Nov. 04, 2019	1 Year
14.	Power Sensor	DAER	RPR3006W	15I00041SN046	Nov. 04, 2019	1 Year
15.	MXA Spectrum Analysis	Agilent	N9020A	MY51170037	Nov. 04, 2019	1 Year
16.	MXG RF Vector Signal Generator	Agilent	N5182A	MY48180656	Nov. 04, 2019	1 Year
17.	Signal Generator	Agilent	E4421B	MY41000743	Nov. 04, 2019	1 Year
18.	DC Power Supply	LW	TPR-6420D	374470	Nov. 04, 2019	1 Year
19.	Constant Temperature Humidity Chamber	ZHONGJIAN	ZJ-KHWS80 B	N/A	Nov. 04, 2019	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 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. Registration No. 184111, September 27, 2019.

ISED-Registration No.: 8058A

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, March 07, 2019.

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

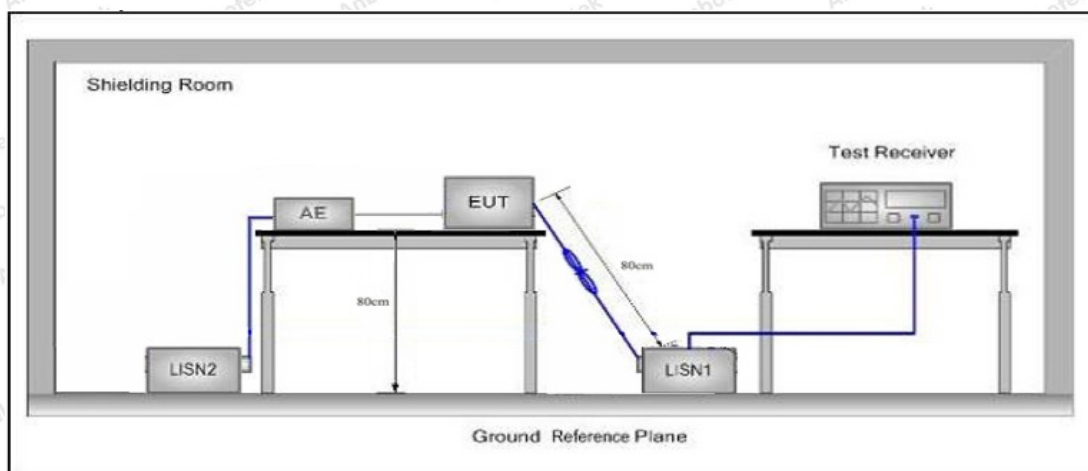
Standard	Test Type	Result
15.207 & 15.407	Conducted Emission	PASS
15.205/15.209	Spurious Emission	PASS
15.407(b)	Band Edge	PASS
15.407(a)(5)&15.407(e)	Occupy Bandwidth	PASS
15.407(a)(3)	Maximum Conducted Output Power	PASS
15.407(a)(3)	Peak Power Spectral Density	PASS
15.203	Antenna Requirement	PASS
15.407(g)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

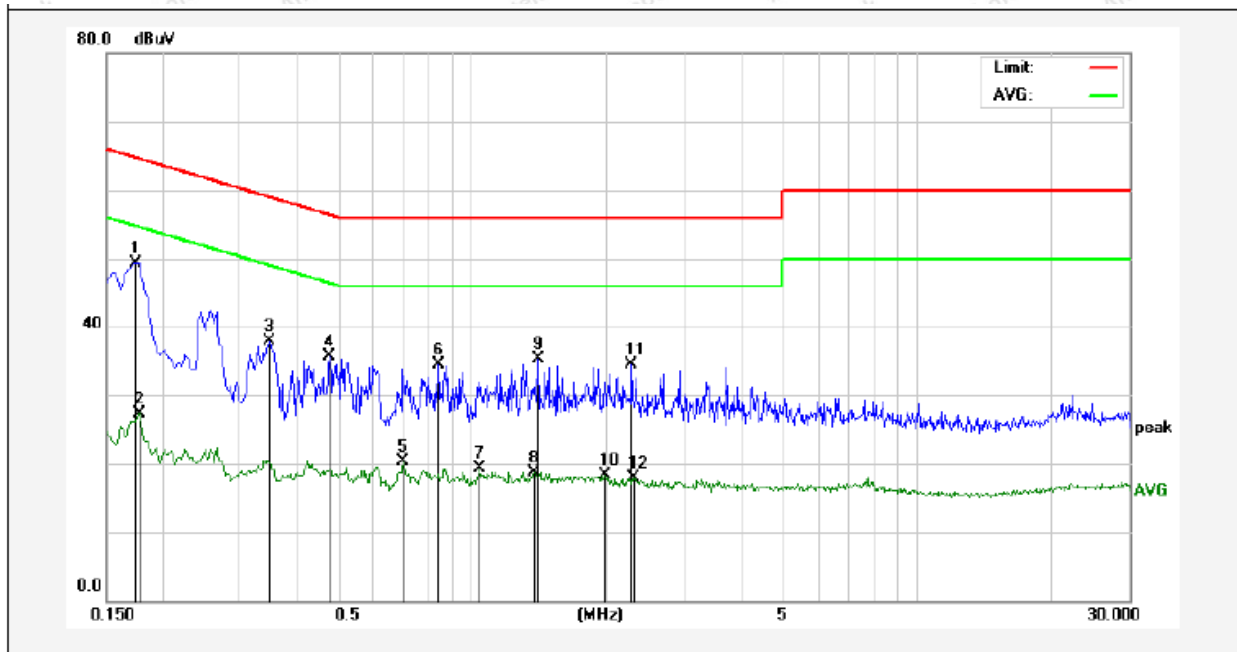
3.4. Test Data

During the test, pre-scan all modes, and found the 802.11a CH 149 which is the worst case, only the worst case is recorded in the report.

ANT A

Conducted Emission Test Data

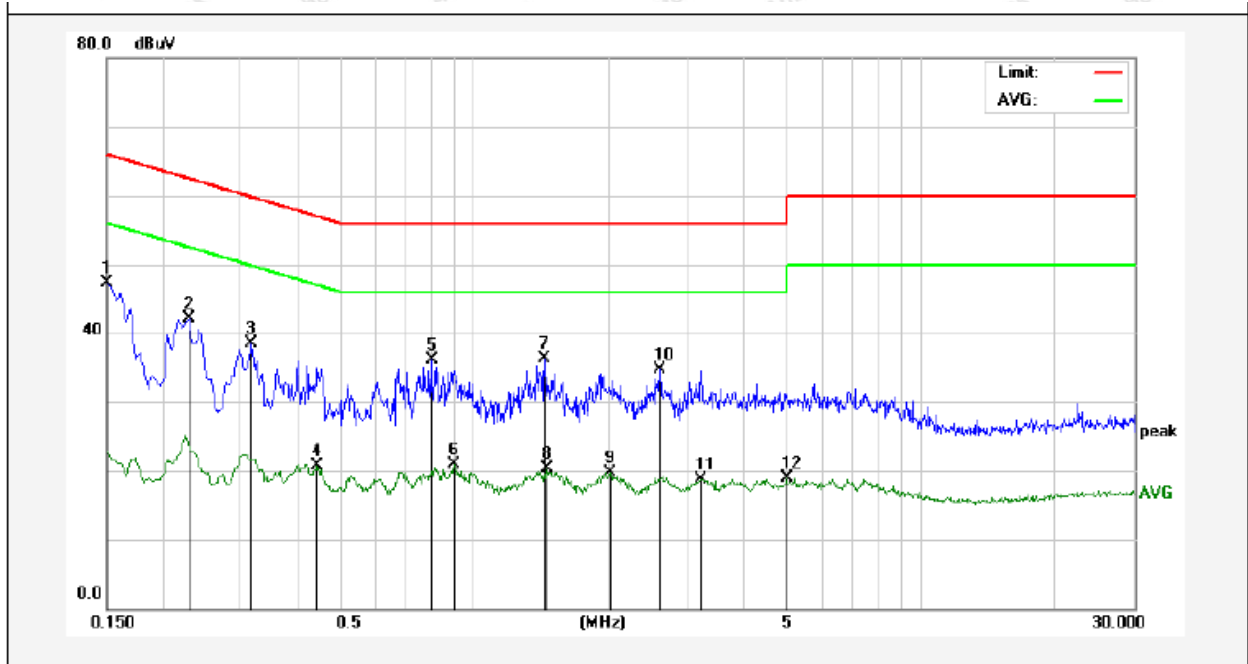
Test Site: 1# Shielded Room
Operating Condition: 802.11a CH 149
Test Specification: AC 120V, 60Hz for adapter
Comment: Live Line
Tem.: 22.5°C Hum.: 51%



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Over Limit (dB)	Detector	Remark
1	0.1740	29.45	19.90	49.35	64.76	-15.41	QP	
2	0.1780	7.50	19.90	27.40	54.57	-27.17	AVG	
3	0.3500	18.09	19.91	38.00	58.96	-20.96	QP	
4	0.4780	15.67	19.97	35.64	56.37	-20.73	QP	
5	0.6980	0.22	20.04	20.26	46.00	-25.74	AVG	
6	0.8380	14.51	20.08	34.59	56.00	-21.41	QP	
7	1.0380	-0.82	20.12	19.30	46.00	-26.70	AVG	
8	1.3779	-1.37	20.13	18.76	46.00	-27.24	AVG	
9	1.4060	15.11	20.13	35.24	56.00	-20.76	QP	
10	1.9900	-1.79	20.14	18.35	46.00	-27.65	AVG	
11	2.2740	14.29	20.15	34.44	56.00	-21.56	QP	
12	2.3060	-2.15	20.15	18.00	46.00	-28.00	AVG	

Conducted Emission Test Data

Test Site: 1# Shielded Room
 Operating Condition: 802.11a CH 149
 Test Specification: AC 120V, 60Hz for adapter
 Comment: Neutral Line
 Tem.: 22.5°C Hum.: 51%

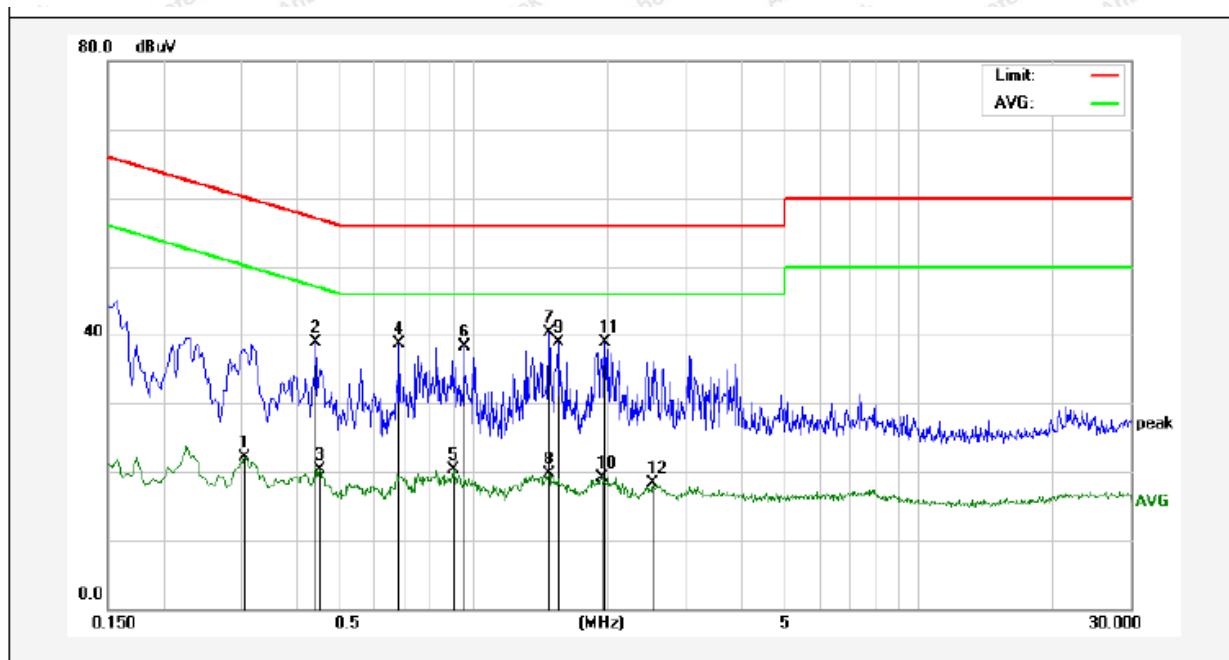


No.	Freq. (MHz)	Reading (dBμV)	Factor (dB)	Result (dBμV)	Limit dBμV	Over Limit (dB)	Detector	Remark
1	0.1500	27.50	19.90	47.40	65.99	-18.59	QP	
2	0.2300	22.26	19.89	42.15	62.45	-20.30	QP	
3	0.3180	18.67	19.90	38.57	59.76	-21.19	QP	
4	0.4460	0.71	19.96	20.67	46.95	-26.28	AVG	
5	0.8020	15.96	20.07	36.03	56.00	-19.97	QP	
6	0.9020	0.87	20.09	20.96	46.00	-25.04	AVG	
7	1.4380	16.08	20.13	36.21	56.00	-19.79	QP	
8	1.4420	0.09	20.13	20.22	46.00	-25.78	AVG	
9	2.0140	-0.48	20.14	19.66	46.00	-26.34	AVG	
10	2.6060	14.48	20.15	34.63	56.00	-21.37	QP	
11	3.2100	-1.36	20.16	18.80	46.00	-27.20	AVG	
12	4.9899	-1.38	20.21	18.83	46.00	-27.17	AVG	

ANT B

Conducted Emission Test Data

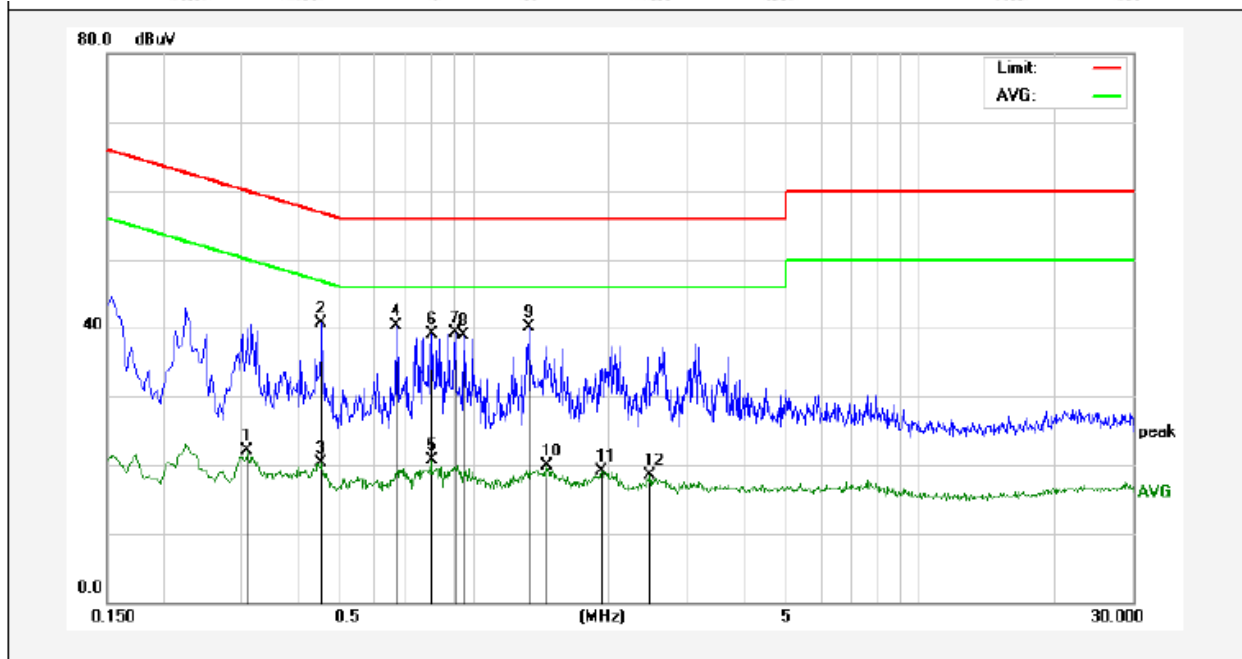
Test Site: 1# Shielded Room
Operating Condition: 802.11a CH 149
Test Specification: AC 240V, 60Hz for adapter
Comment: Live Line
Tem.: 22.5°C Hum.: 51%



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Over Limit (dB)	Detector	Remark
1	0.3060	2.27	19.89	22.16	50.08	-27.92	AVG	
2	0.4420	18.90	19.95	38.85	57.02	-18.17	QP	
3	0.4500	0.32	19.96	20.28	46.87	-26.59	AVG	
4	0.6820	18.74	20.03	38.77	56.00	-17.23	QP	
5	0.9020	0.18	20.09	20.27	46.00	-25.73	AVG	
6	0.9500	18.26	20.11	38.37	56.00	-17.63	QP	
7	1.4740	20.09	20.13	40.22	56.00	-15.78	QP	
8	1.4740	-0.49	20.13	19.64	46.00	-26.36	AVG	
9	1.5460	18.86	20.13	38.99	56.00	-17.01	QP	
10	1.9340	-0.98	20.14	19.16	46.00	-26.84	AVG	
11	1.9700	18.82	20.14	38.96	56.00	-17.04	QP	
12	2.5220	-1.84	20.15	18.31	46.00	-27.69	AVG	

Conducted Emission Test Data

Test Site: 1# Shielded Room
Operating Condition: 802.11a CH 149
Test Specification: AC 240V, 60Hz for adapter
Comment: Neutral Line
Tem.: 22.5°C Hum.: 51%



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Over Limit (dB)	Detector	Remark
1	0.3100	2.17	19.89	22.06	49.97	-27.91	AVG	
2	0.4540	20.70	19.96	40.66	56.80	-16.14	QP	
3	0.4540	0.29	19.96	20.25	46.80	-26.55	AVG	
4	0.6700	20.24	20.03	40.27	56.00	-15.73	QP	
5	0.8020	0.64	20.07	20.71	46.00	-25.29	AVG	
6	0.8059	19.05	20.07	39.12	56.00	-16.88	QP	
7	0.9060	19.25	20.09	39.34	56.00	-16.66	QP	
8	0.9460	18.89	20.11	39.00	56.00	-17.00	QP	
9	1.3300	19.91	20.13	40.04	56.00	-15.96	QP	
10	1.4500	-0.32	20.13	19.81	46.00	-26.19	AVG	
11	1.9340	-1.01	20.14	19.13	46.00	-26.87	AVG	
12	2.4780	-1.55	20.15	18.60	46.00	-27.40	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				
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 limit: $E[dBuV/m] = EIRP[dBm] + 95.2 = 68.2 dBuV/m$, for $EIPR[dBm] = -27dBm$.

4.2. Test Setup

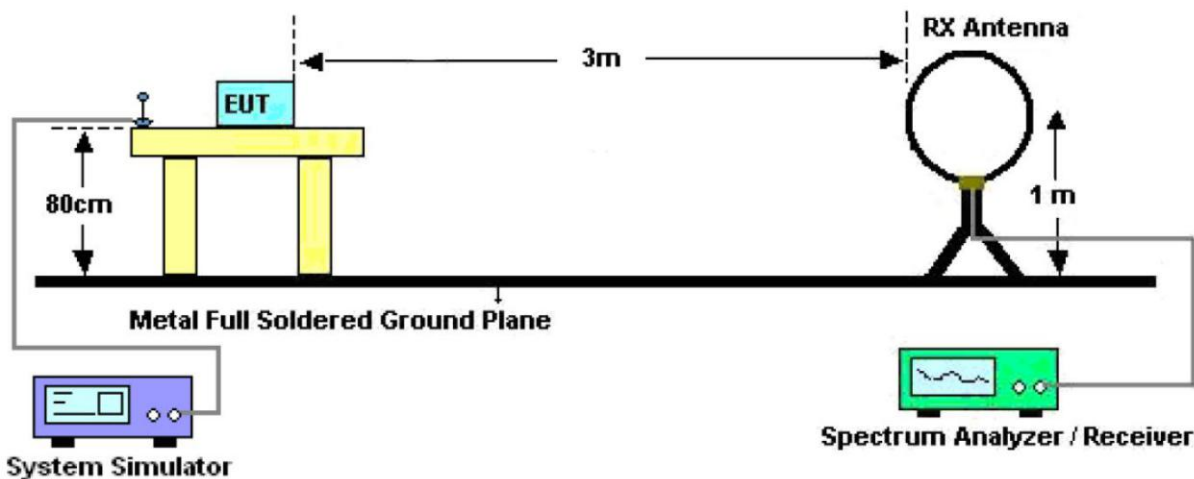


Figure 1. Below 30MHz

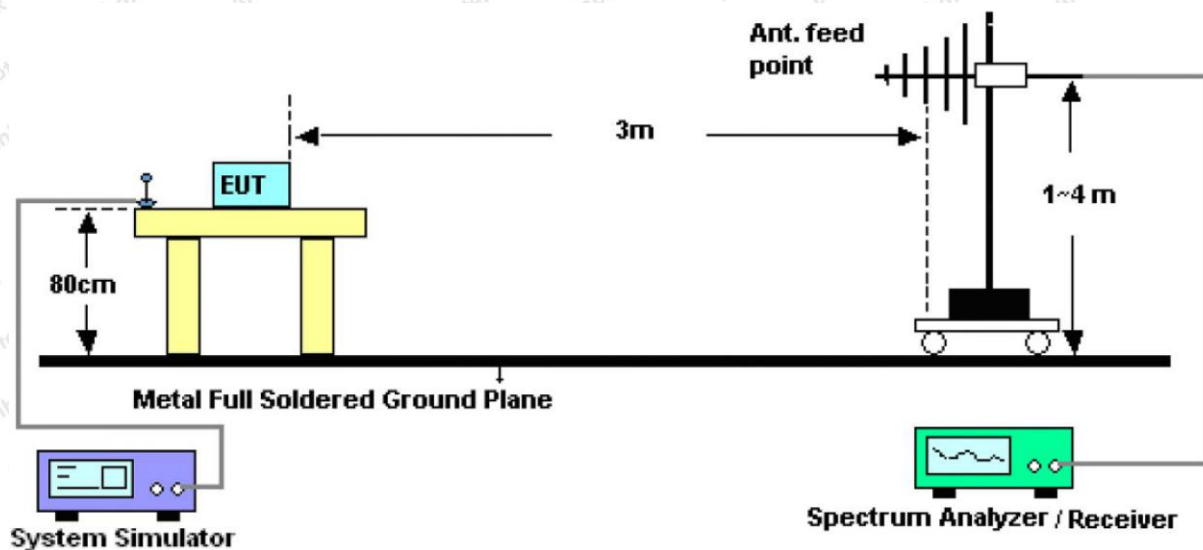


Figure 2. 30MHz to 1GHz

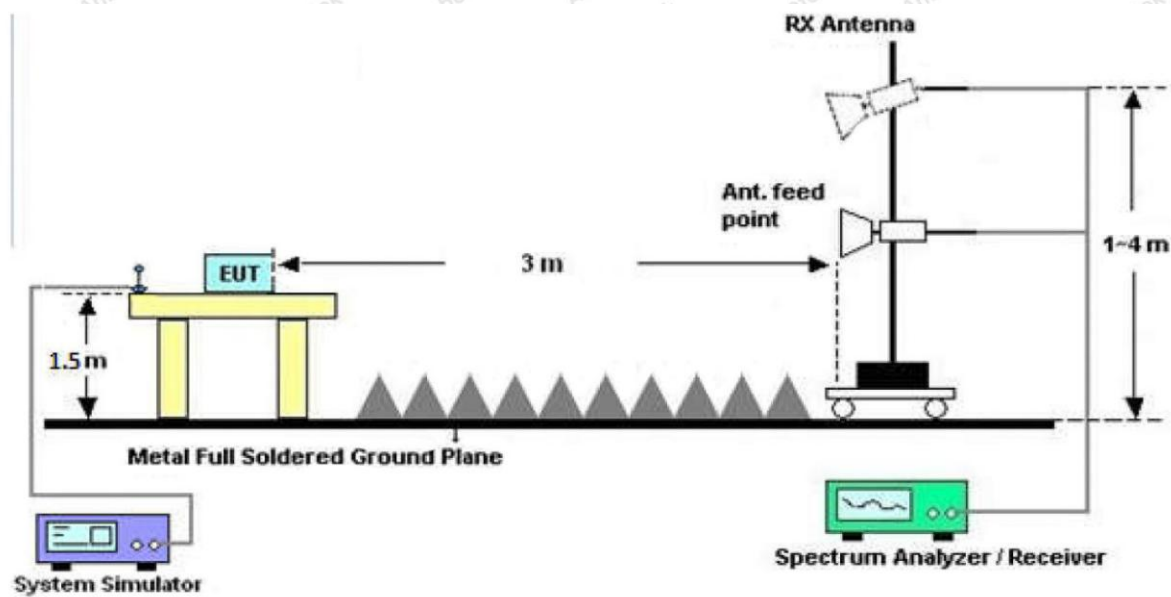


Figure 3. Above 1 GHz

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 the radiated emission test above 1GHz:

Shenzhen Anbotek Compliance Laboratory Limited

Code:AB-RF-05-a

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

Tel:(86) 755-26066440 Fax: (86) 755-26014772 Email: service@anbotek.com

Hotline
400-003-0500
www.anbotek.com

Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.

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 was attenuated more than 20dB below the permissible limits, so the results don't record in the report.

During the test, pre-scan all modes, and found the 802.11a CH 149 which is the worst case, only the worst case is recorded in the report.

Report No.: 18220WC00028704

FCC ID: Z4TSEED8720DN

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ANT A

Test Results (30~1000MHz)

Job No.: 18220WC000287-04

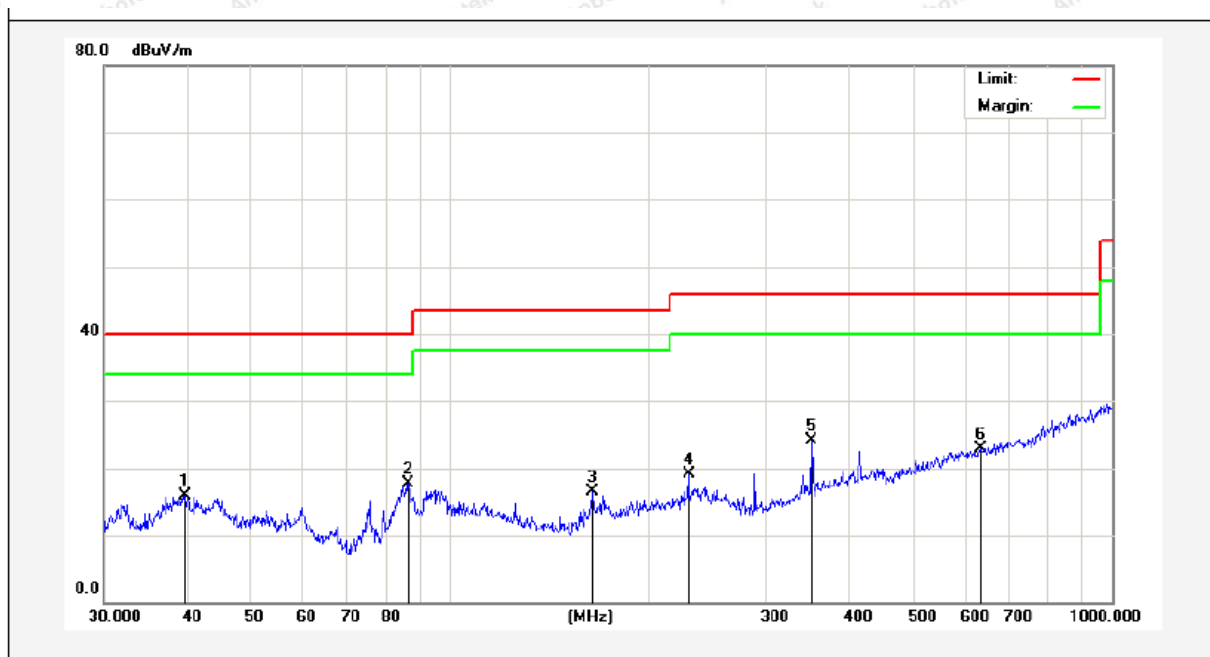
Temp.(°C)/Hum.(%RH): 23.4°C/51%RH

Standard: FCC PART 15C

Power Source: AC 120V, 60Hz for adapter

Test Mode: 802.11a CH 149

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	39.8542	30.35	-14.45	15.90	40.00	-24.10	QP	300	0	
2	86.5029	40.28	-22.64	17.64	40.00	-22.36	QP	300	74	
3	163.7550	37.91	-21.37	16.54	43.50	-26.96	QP	300	145	
4	229.2931	38.57	-19.46	19.11	46.00	-26.89	QP	300	211	
5	351.7079	38.54	-14.42	24.12	46.00	-21.88	QP	300	296	
6	633.9073	33.11	-10.30	22.81	46.00	-23.19	QP	300	360	

Test Results (30~1000MHz)

Job No.: 18220WC000287-04

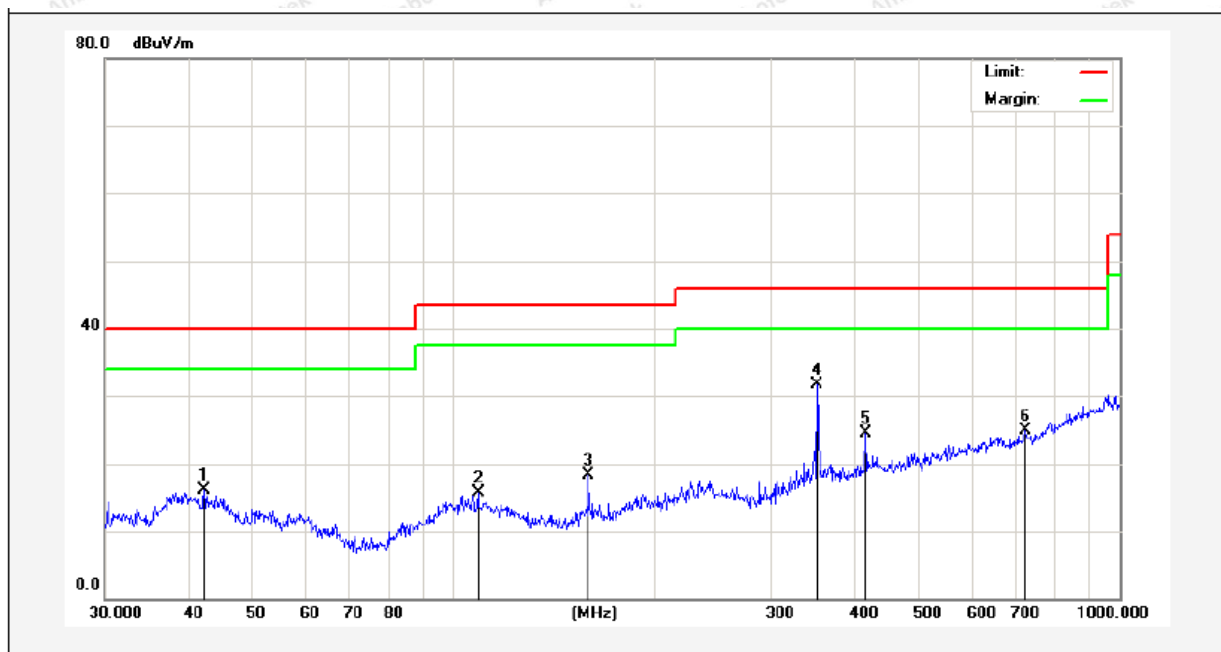
Temp.(°C)/Hum.(%RH): 23.4°C/51%RH

Standard: FCC PART 15C

Power Source: AC 120V, 60Hz for adapter

Test Mode: 802.11a CH 149

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	42.3022	31.09	-15.04	16.05	40.00	-23.95	QP	300	0	
2	109.0286	37.36	-21.63	15.73	43.50	-27.77	QP	300	74	
3	159.7844	40.18	-21.88	18.30	43.50	-25.20	QP	300	145	
4	351.7079	46.05	-14.42	31.63	46.00	-14.37	QP	300	211	
5	416.1791	36.90	-12.47	24.43	46.00	-21.57	QP	300	286	
6	721.7259	32.94	-8.05	24.89	46.00	-21.11	QP	300	360	

Report No.: 18220WC00028704

FCC ID: Z4TSEED8720DN

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ANT B

Test Results (30~1000MHz)

Job No.: 18220WC000287-04

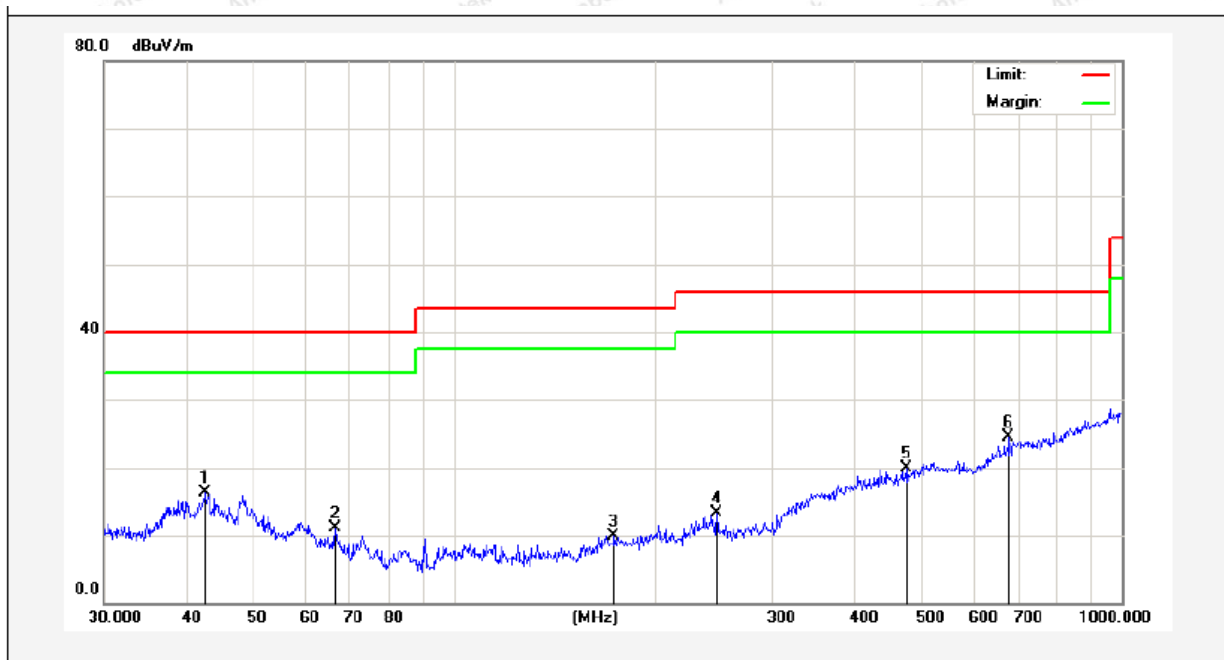
Temp.(°C)/Hum.(%RH): 23.4°C/51%RH

Standard: FCC PART 15C

Power Source: AC 120V, 60Hz for adapter

Test Mode: 802.11a CH 149

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	42.4508	30.31	-14.09	16.22	40.00	-23.78	QP	300	0	
2	66.4989	30.65	-19.46	11.19	40.00	-28.81	QP	300	74	
3	173.8135	27.15	-17.29	9.86	43.50	-33.64	QP	300	152	
4	247.6819	27.75	-14.54	13.21	46.00	-32.79	QP	300	217	
5	477.1694	31.43	-11.62	19.81	46.00	-26.19	QP	300	259	
6	677.5798	33.12	-8.65	24.47	46.00	-21.53	QP	300	360	

Report No.: 18220WC00028704

FCC ID: Z4TSEED8720DN

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Test Results (30~1000MHz)

Job No.: 18220WC000287-04

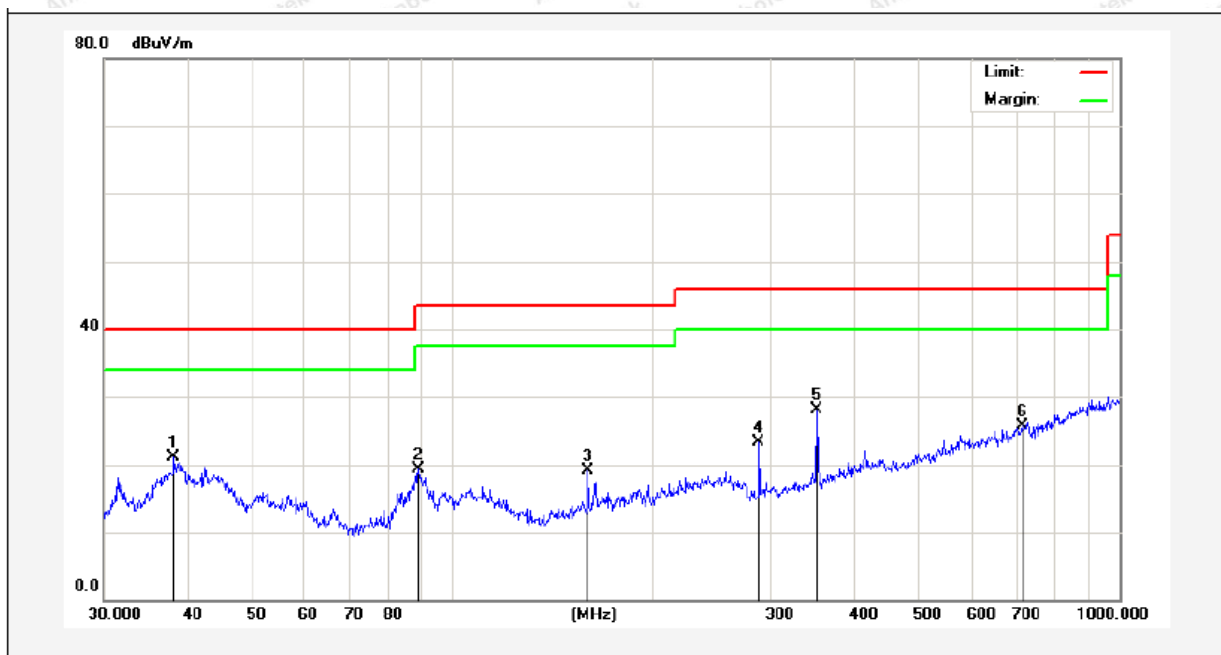
Temp.(°C)/Hum.(%RH): 23.4°C/51%RH

Standard: FCC PART 15C

Power Source: AC 120V, 60Hz for adapter

Test Mode: 802.11a CH 149

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	38.2120	36.49	-15.34	21.15	40.00	-18.85	QP	300	0	
2	88.9637	43.04	-23.80	19.24	43.50	-24.26	QP	300	74	
3	159.7844	41.02	-21.88	19.14	43.50	-24.36	QP	300	152	
4	287.9904	42.23	-18.89	23.34	46.00	-22.66	QP	300	209	
5	351.7078	42.51	-14.42	28.09	46.00	-17.91	QP	300	268	
6	714.1734	33.93	-8.20	25.73	46.00	-20.27	QP	300	360	

ANT A

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)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Pol.
11490.00	41.66	31.98	17.08	33.91	56.81	68.20	-11.39	V
17235.00	41.54	32.65	20.03	34.85	59.37	68.20	-8.83	V
11490.00	39.69	31.98	17.08	33.91	54.84	68.20	-13.36	H
17235.00	39.98	32.65	20.03	34.85	57.81	68.20	-10.39	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	29.07	31.98	17.08	33.91	44.22	54.00	-9.78	V
17235.00	28.14	32.65	20.03	34.85	45.97	54.00	-8.03	V
11490.00	27.16	31.98	17.08	33.91	42.31	54.00	-11.69	H
17235.00	27.10	32.65	20.03	34.85	44.93	54.00	-9.07	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)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Pol.
11570.00	40.11	32.44	17.18	33.91	55.82	68.20	-12.38	V
17355.00	41.22	32.78	20.12	34.86	59.26	68.20	-8.94	V
11570.00	39.26	32.44	17.18	33.91	54.97	68.20	-13.23	H
17355.00	39.05	32.78	20.12	34.86	57.09	68.20	-11.11	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	28.87	32.44	17.18	33.91	44.58	54.00	-9.42	V
17355.00	27.85	32.78	20.12	34.86	45.89	54.00	-8.11	V
11570.00	27.04	32.44	17.18	33.91	42.75	54.00	-11.25	H
17355.00	29.36	32.78	20.12	34.86	47.40	54.00	-6.60	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)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Pol.
11650.00	40.23	32.59	18.02	33.92	56.92	68.20	-11.28	V
17475.00	40.59	32.87	20.15	34.88	58.73	68.20	-9.47	V
11650.00	41.79	32.59	18.02	33.92	58.48	68.20	-9.72	H
17475.00	41.78	32.87	20.15	34.88	59.92	68.20	-8.28	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	27.49	32.59	18.02	33.92	44.18	54.00	-9.82	V
17475.00	27.43	32.87	20.15	34.88	45.57	54.00	-8.43	V
11650.00	27.74	32.59	18.02	33.92	44.43	54.00	-9.57	H
17475.00	29.44	32.87	20.15	34.88	47.58	54.00	-6.42	H

Note:

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

ANT B

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)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Pol.
11490.00	40.01	31.98	17.08	33.91	55.16	68.20	-13.04	V
17235.00	40.93	32.65	20.03	34.85	58.76	68.20	-9.44	V
11490.00	39.10	31.98	17.08	33.91	54.25	68.20	-13.95	H
17235.00	39.59	32.65	20.03	34.85	57.42	68.20	-10.78	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	27.49	31.98	17.08	33.91	42.64	54.00	-11.36	V
17235.00	27.81	32.65	20.03	34.85	45.64	54.00	-8.36	V
11490.00	28.75	31.98	17.08	33.91	43.90	54.00	-10.10	H
17235.00	29.56	32.65	20.03	34.85	47.39	54.00	-6.61	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)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Pol.
11570.00	40.43	32.44	17.18	33.91	56.14	68.20	-12.06	V
17355.00	40.08	32.78	20.12	34.86	58.12	68.20	-10.08	V
11570.00	40.76	32.44	17.18	33.91	56.47	68.20	-11.73	H
17355.00	41.31	32.78	20.12	34.86	59.35	68.20	-8.85	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.
11570.00	27.75	32.44	17.18	33.91	43.46	54.00	-10.54	V
17355.00	27.86	32.78	20.12	34.86	45.90	54.00	-8.10	V
11570.00	27.60	32.44	17.18	33.91	43.31	54.00	-10.69	H
17355.00	27.81	32.78	20.12	34.86	45.85	54.00	-8.15	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)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Pol.
11650.00	40.42	32.59	18.02	33.92	57.11	68.20	-11.09	V
17475.00	40.99	32.87	20.15	34.88	59.13	68.20	-9.07	V
11650.00	40.63	32.59	18.02	33.92	57.32	68.20	-10.88	H
17475.00	39.33	32.87	20.15	34.88	57.47	68.20	-10.73	H

Average value:

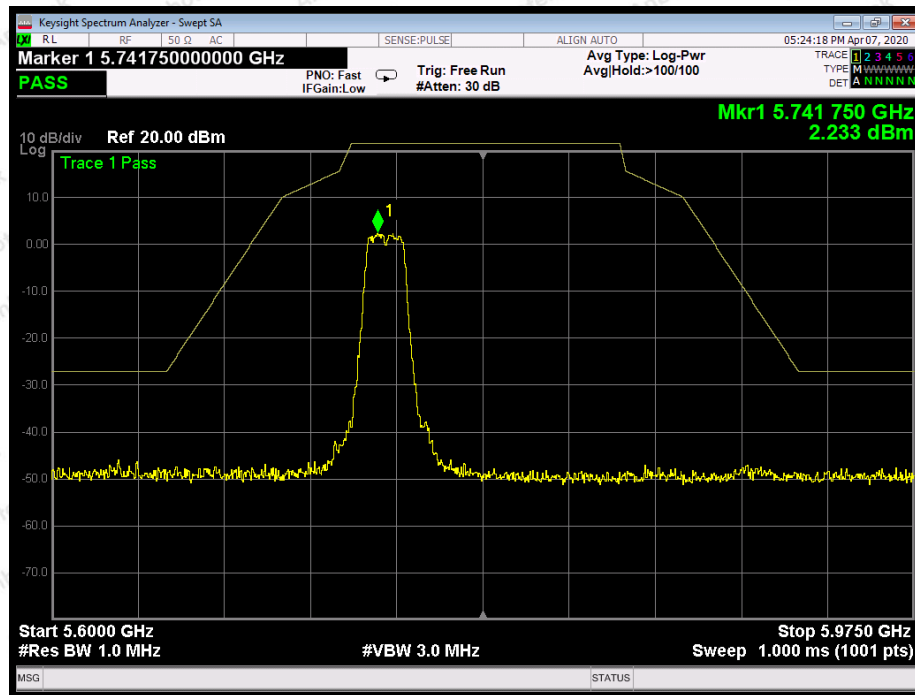
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Pol.
11650.00	28.42	32.59	18.02	33.92	45.11	54.00	-8.89	V
17475.00	29.53	32.87	20.15	34.88	47.67	54.00	-6.33	V
11650.00	28.58	32.59	18.02	33.92	45.27	54.00	-8.73	H
17475.00	29.04	32.87	20.15	34.88	47.18	54.00	-6.82	H

Note:

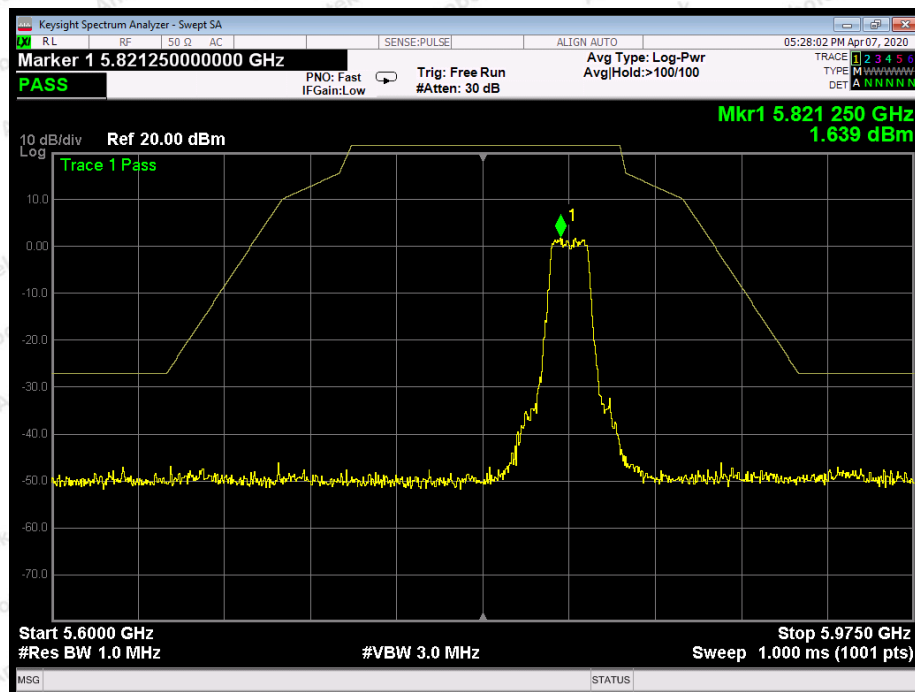
1. Final Level = Receiver Read level + Antenna Factor + Cable Loss - Preamplifier Factor

ANT A

Band Edge test:



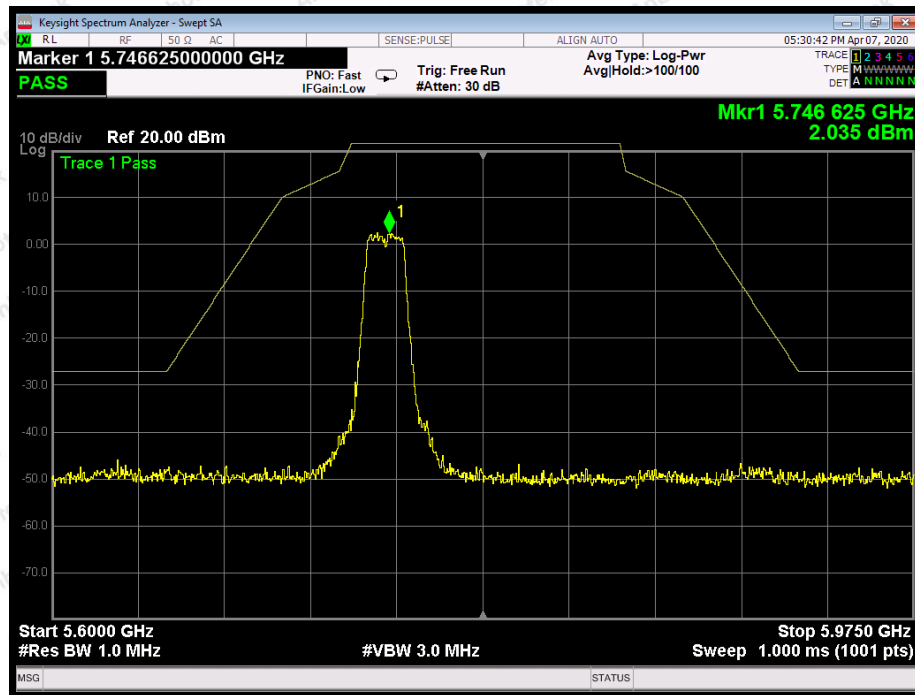
802.11a: Band Edge, Left Side



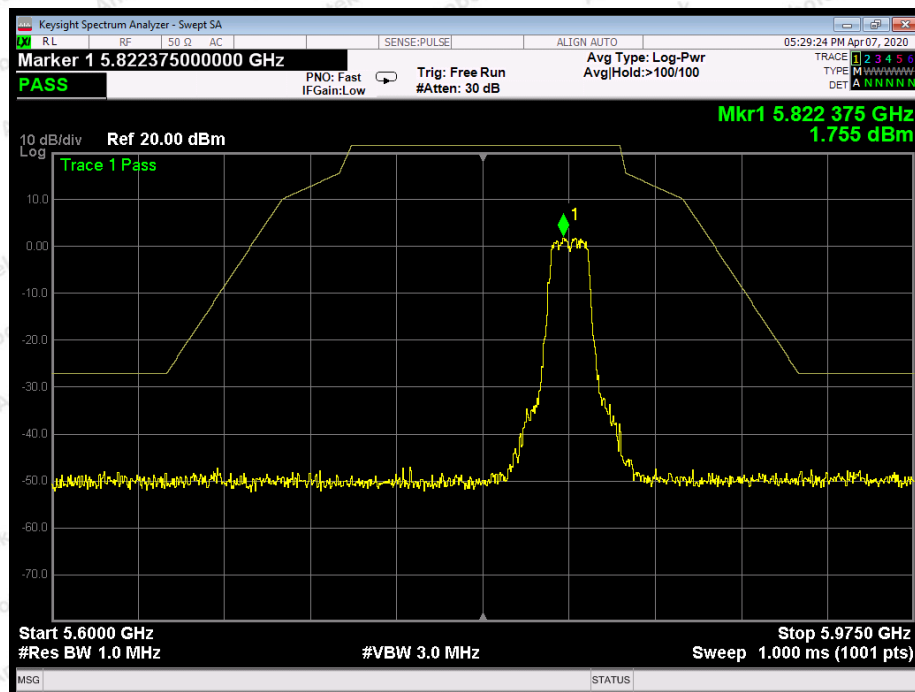
802.11a: Band Edge, Right Side

ANT B

Band Edge test:



802.11a: Band Edge, Left Side



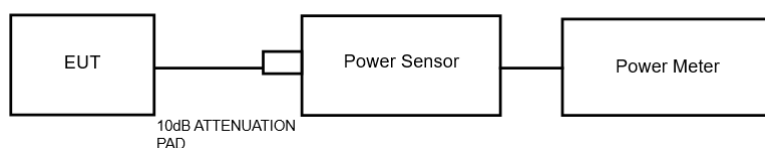
802.11a: Band Edge, Right Side

5. Maximum Peak Output Power Test

5.1. Test Standard and Limit

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

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 Voltage	:	AC 120V, 60Hz for adapter
Test Result	:	PASS

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

ANT A

Mode	Channel Frequency (MHz)	Peak Power output (dBm)	Correctional Limit (dBm)	Results
802.11a	5745	12.85	30	PASS
	5785	13.27	30	PASS
	5825	13.24	30	PASS

ANT B

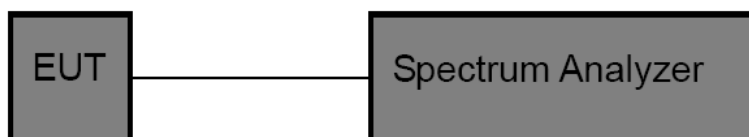
Mode	Channel Frequency (MHz)	Peak Power output (dBm)	Correctional Limit (dBm)	Results
802.11a	5745	12.49	30	PASS
	5785	12.52	30	PASS
	5825	13.18	30	PASS

6. Occupy Bandwidth Test

6.1. Test Standard

Test Standard	FCC Part15 C Section 15.407(a)(5)&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 : AC 120V, 60Hz for adapter
 Test Result : PASS

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

ANT A

Mode	Channel Frequency (MHz)	6dB BW(MHz)	Limit	Results
802.11a	5745	16.56	>0.5MHz	PASS
	5785	16.52		PASS
	5825	16.56		PASS

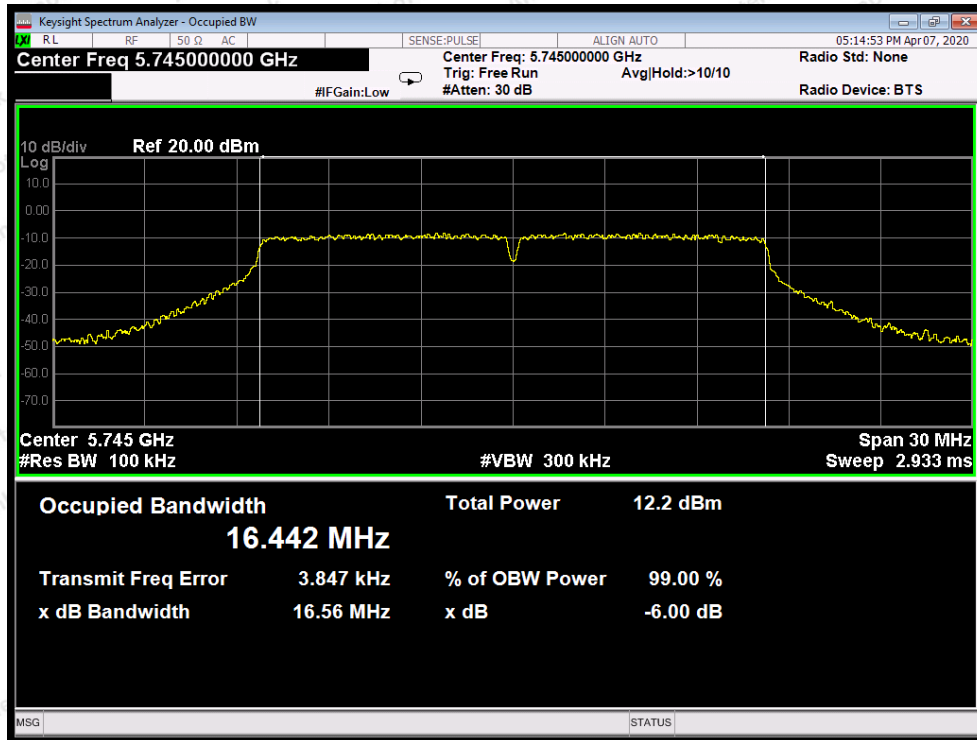
Mode	Channel Frequency (MHz)	26dB BW(MHz)	99% Bandwidth (MHz)
802.11a	5745	21.02	16.612
	5785	20.87	16.591
	5825	21.07	16.635

ANT B

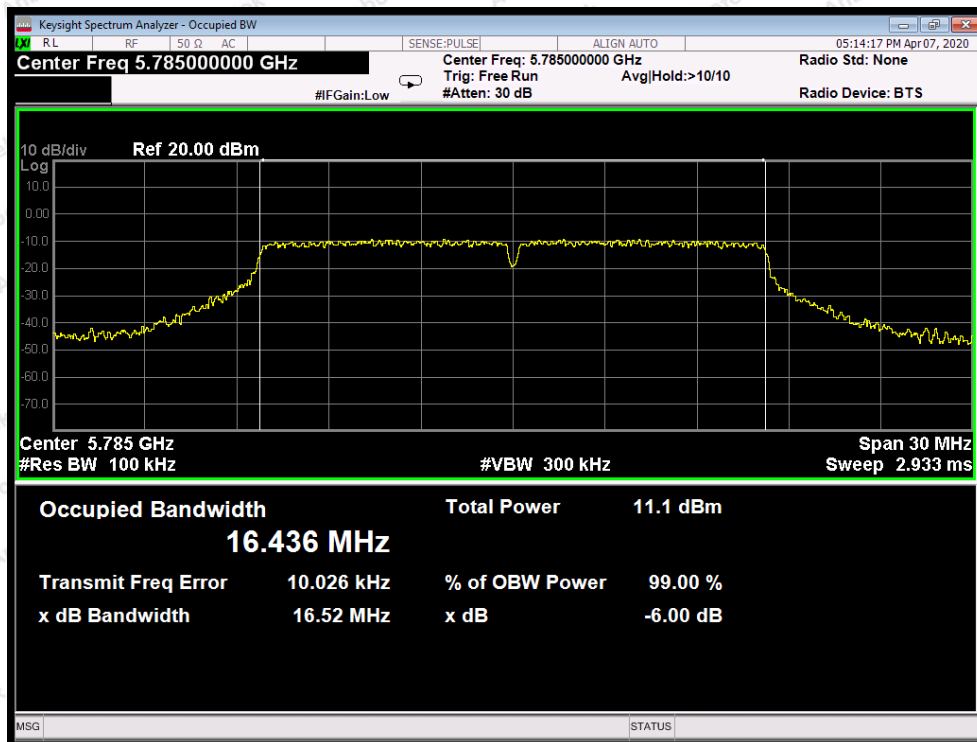
Mode	Channel Frequency (MHz)	6dB BW(MHz)	Limit	Results
802.11a	5745	16.55	>0.5MHz	PASS
	5785	16.56		PASS
	5825	16.56		PASS

Mode	Channel Frequency (MHz)	26dB BW(MHz)	99% Bandwidth (MHz)
802.11a	5745	20.87	16.595
	5785	20.97	16.619
	5825	20.89	16.587

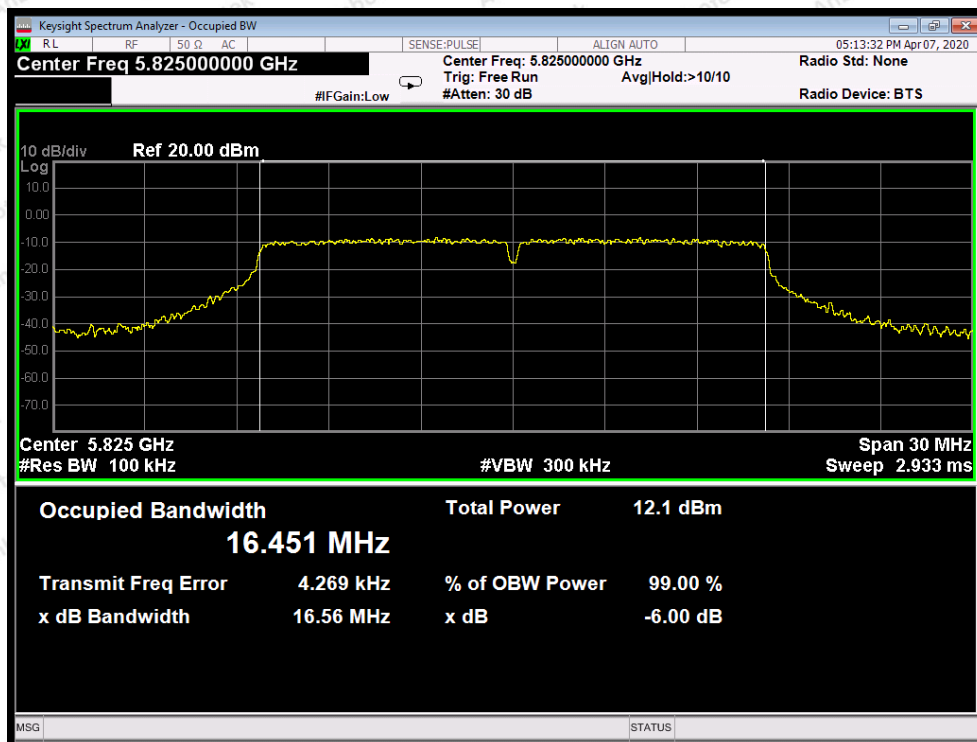
6dB Bandwidth



Test Mode: 802.11a--Low

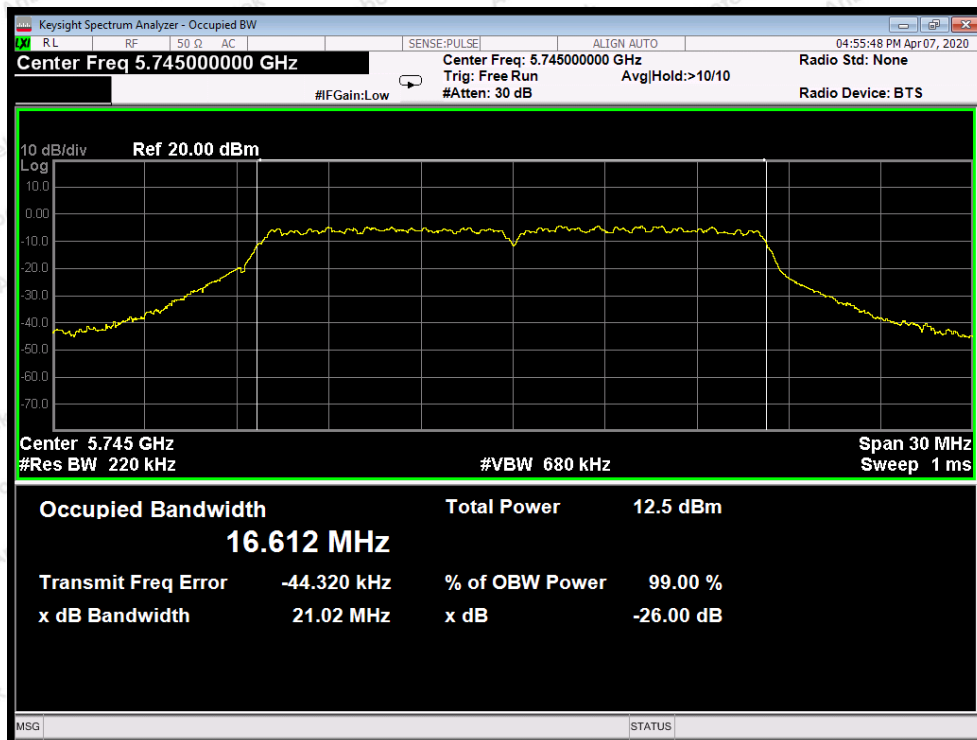


Test Mode: 802.11a---Middle

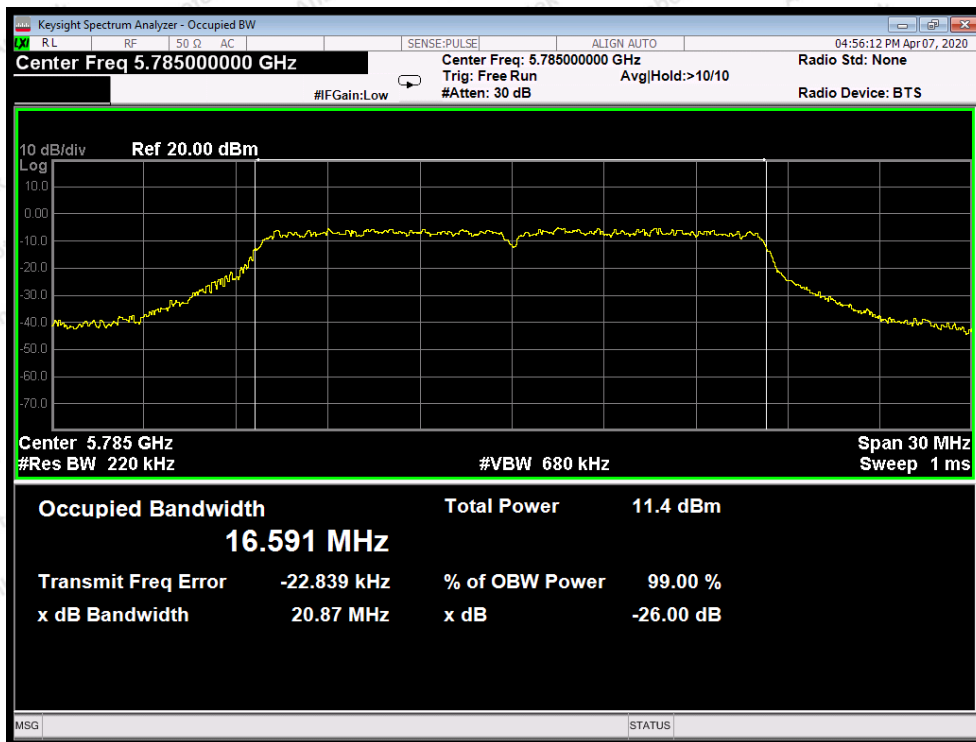


Test Mode: 802.11a---High

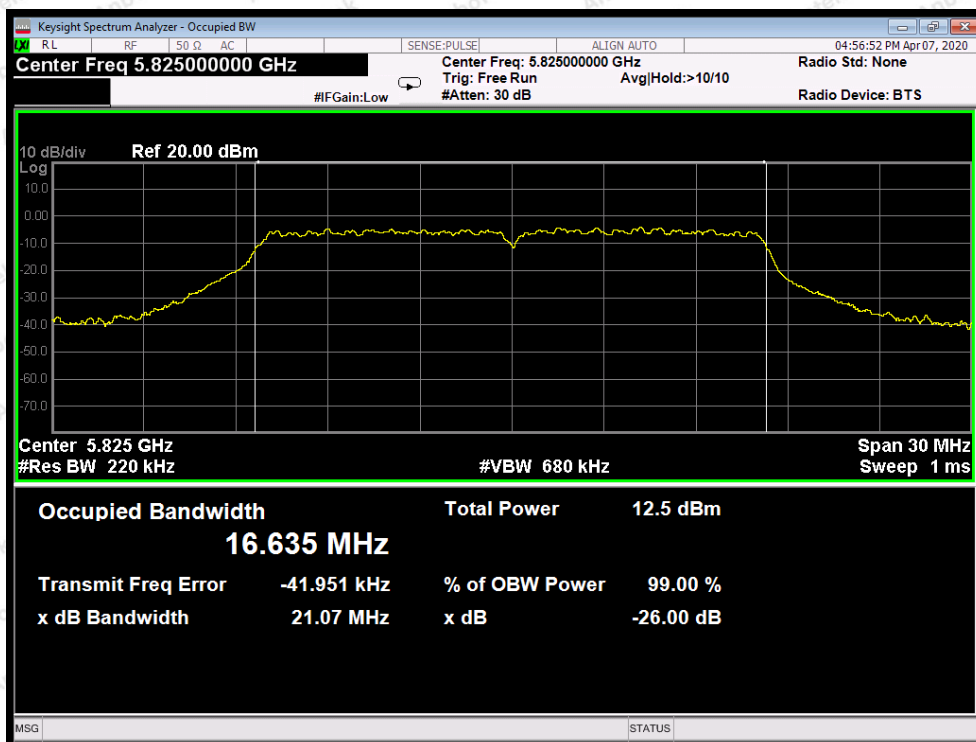
26dB & 99% Bandwidth



Test Mode: 802.11a--Low



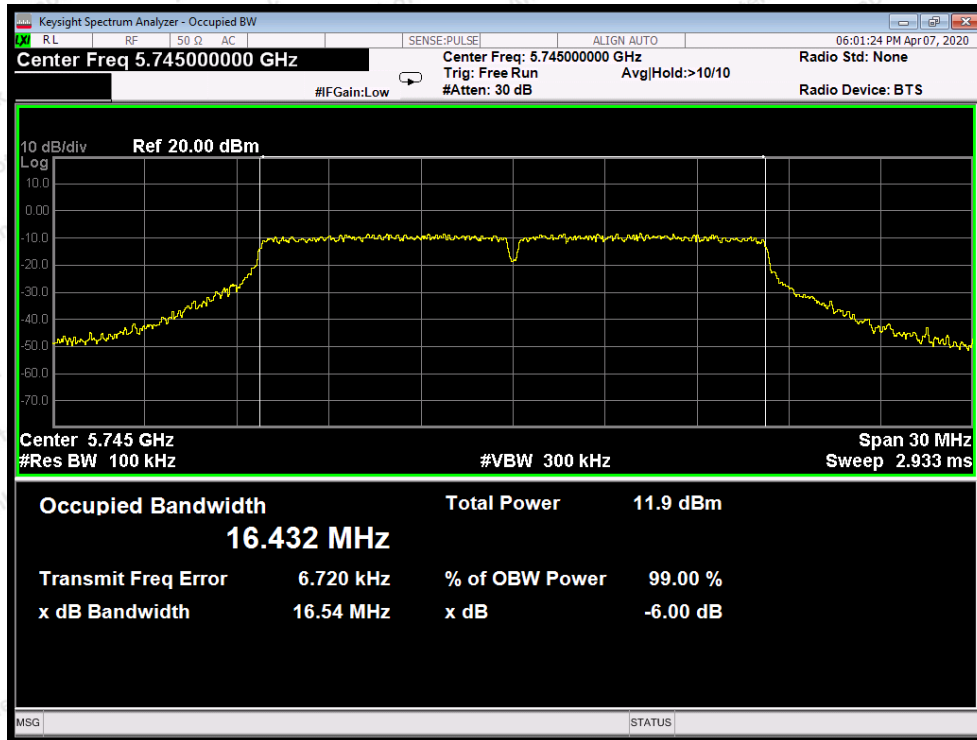
Test Mode: 802.11a---Middle



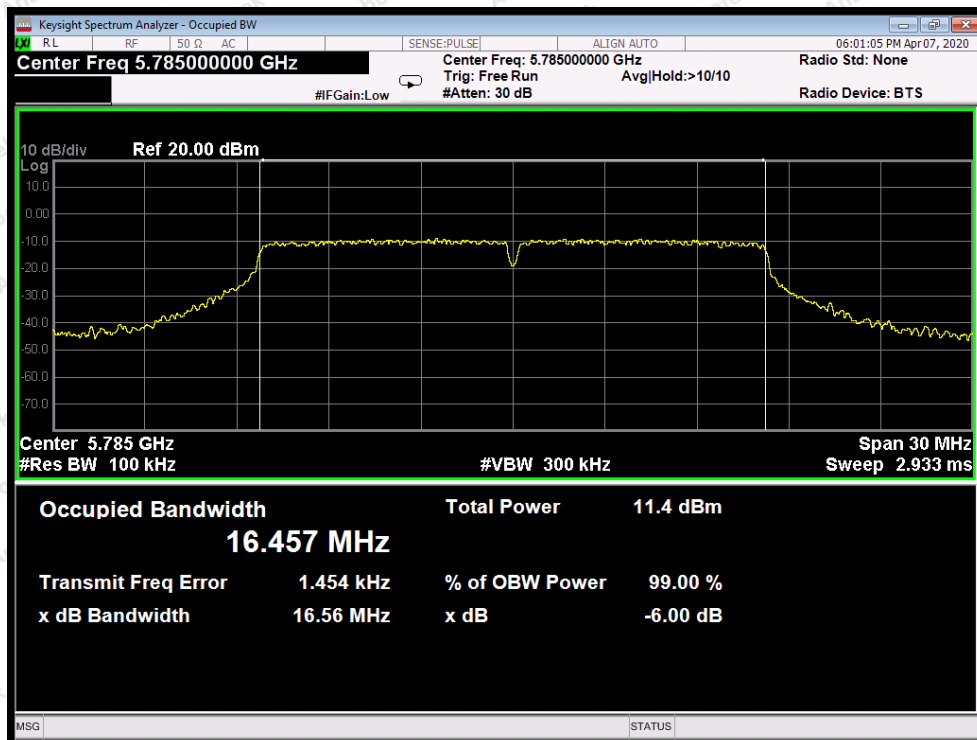
Test Mode: 802.11a---High

ANT B

6dB Bandwidth

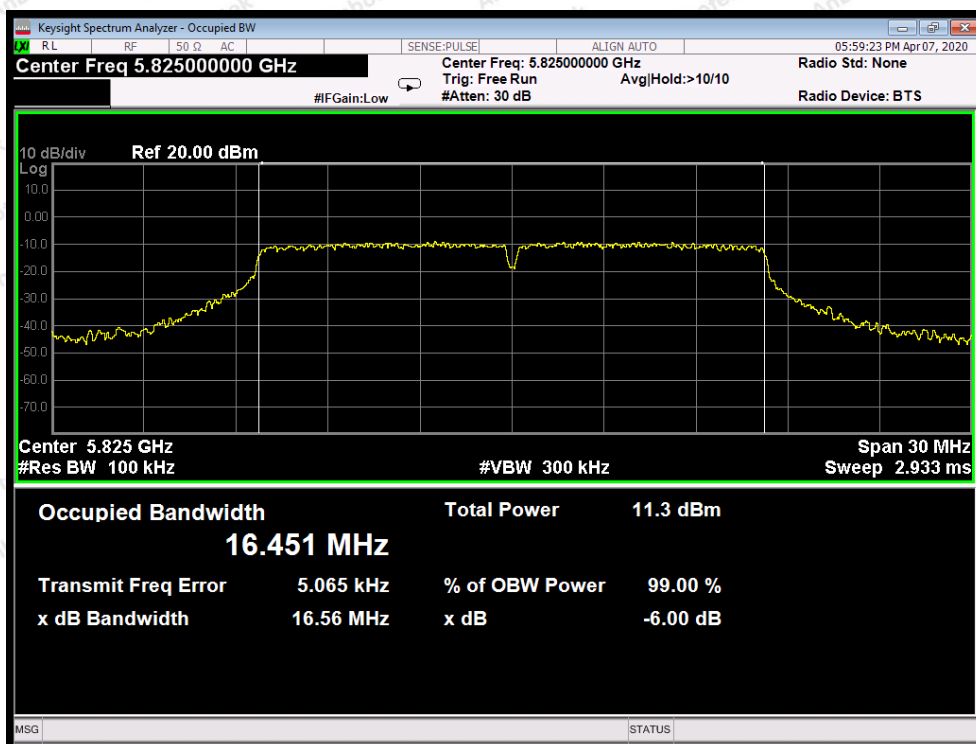


Test Mode: 802.11a--Low



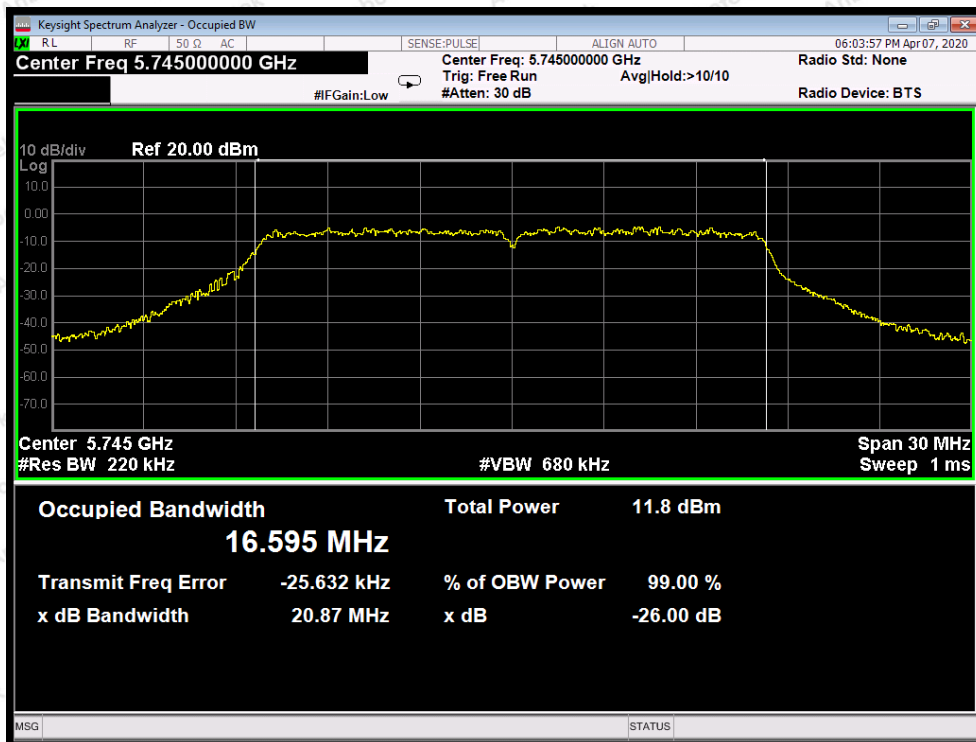
Test Mode: 802.11a---Middle



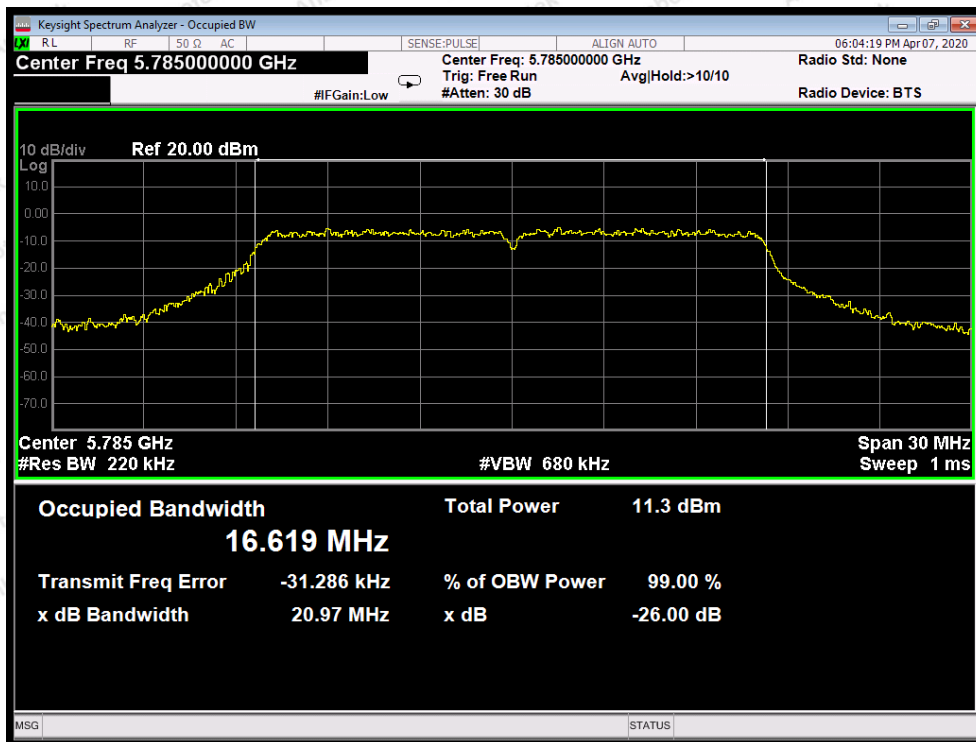


Test Mode: 802.11a---High

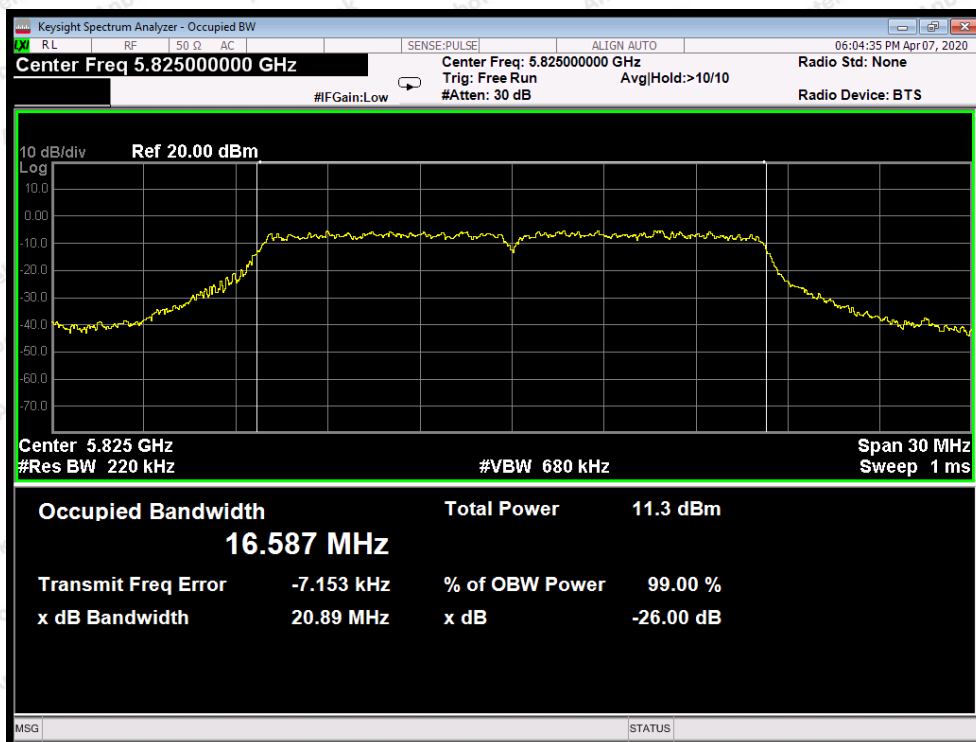
26dB & 99% Bandwidth



Test Mode: 802.11a--Low



Test Mode: 802.11a---Middle



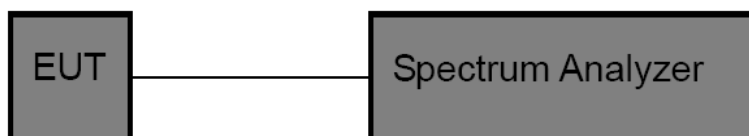
Test Mode: 802.11a---High

7. Power Spectral Density Test

7.1. Test Standard and Limit

Test Standard	FCC Part15 C Section 15.407 (a) (3)
Test Limit	30 dBm/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 =1MHz;
3. Set VBW $\geq$ 3 RBW=3MHz;
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 : AC 120V, 60Hz for adapter
Test Result : PASS

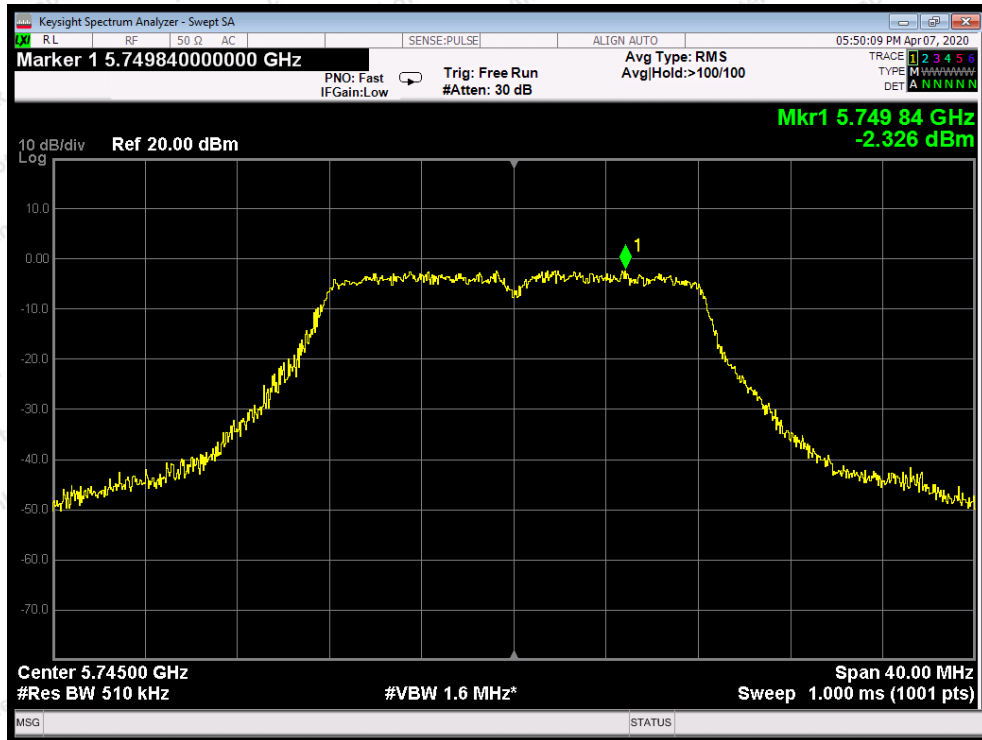
Test Mode : CH Low ~ CH High
Temperature : 24℃
Humidity : 55%RH

ANT A

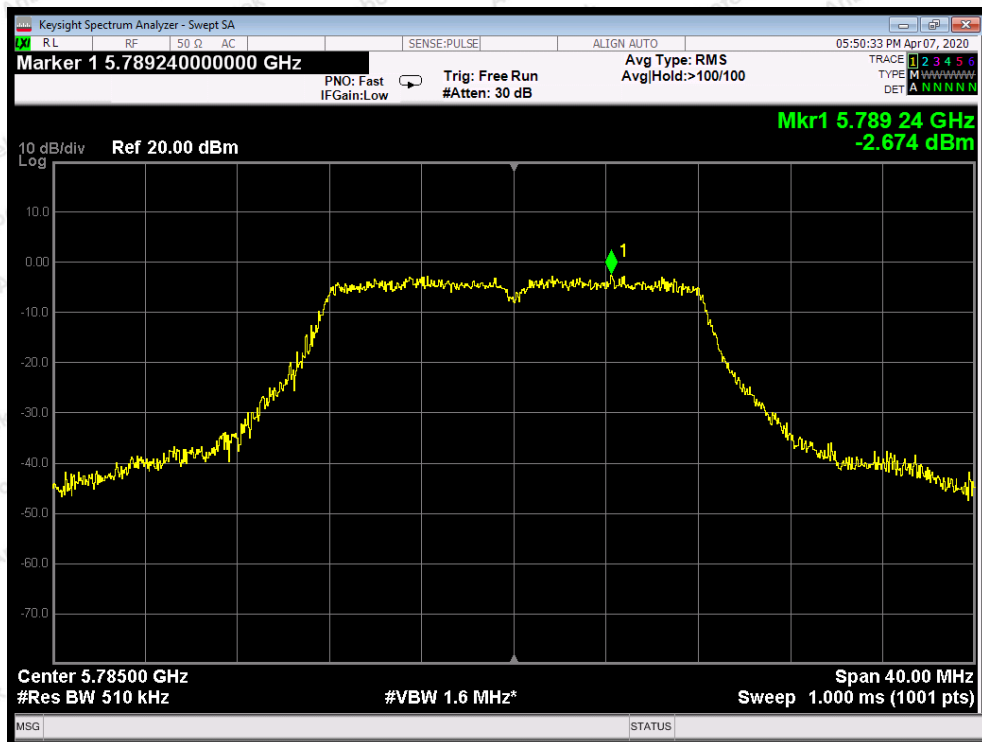
Mode	Channel Frequency (MHz)	Final Power Spectral Density (dBm/500KHz)	Limit	Results
802.11a	5745	-2.326	30	PASS
	5785	-2.674	30	PASS
	5825	-1.955	30	PASS

ANT B

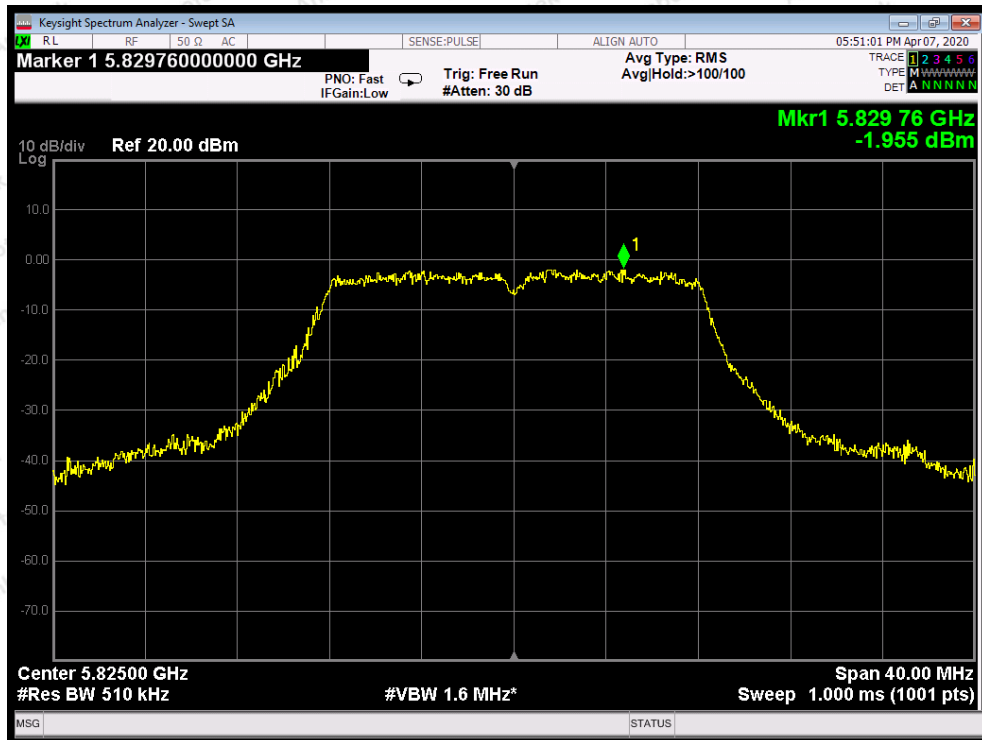
Mode	Channel Frequency (MHz)	Final Power Spectral Density (dBm/500KHz)	Limit	Results
802.11a	5745	-2.213	30	PASS
	5785	-2.507	30	PASS
	5825	-2.063	30	PASS



Test Mode: 802.11a--Low

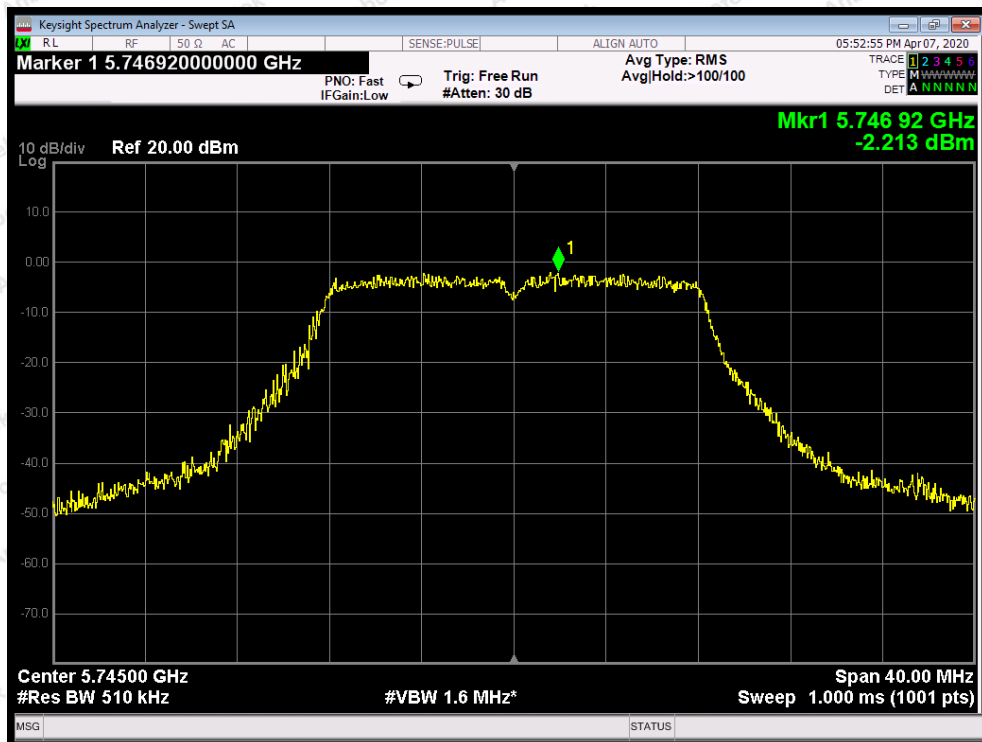


Test Mode: 802.11a---Middle

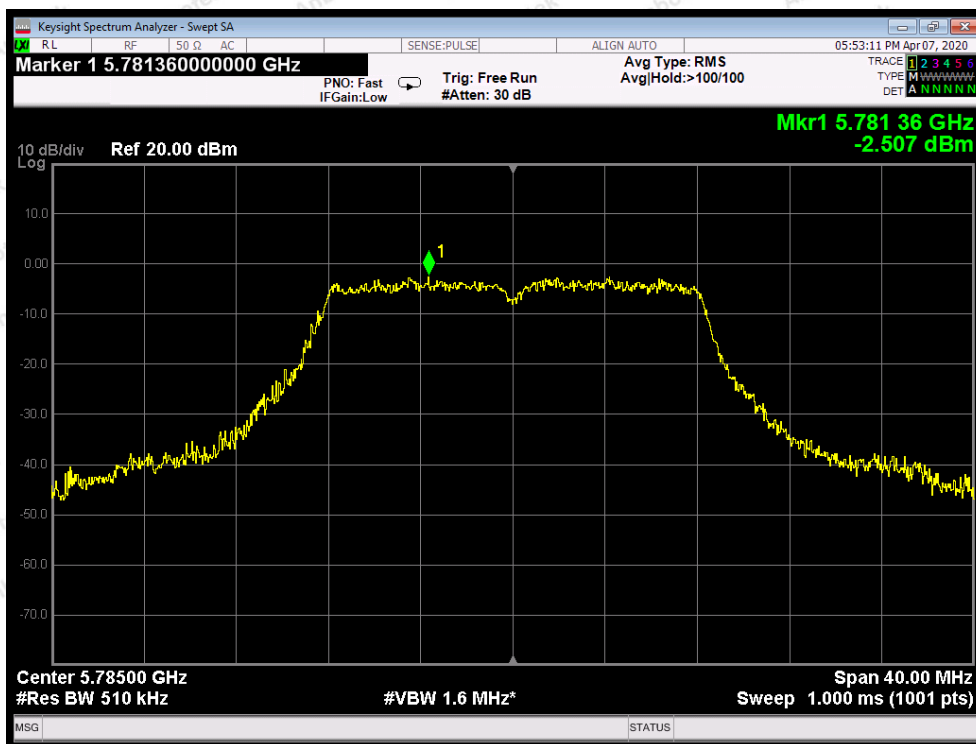


Test Mode: 802.11a---High

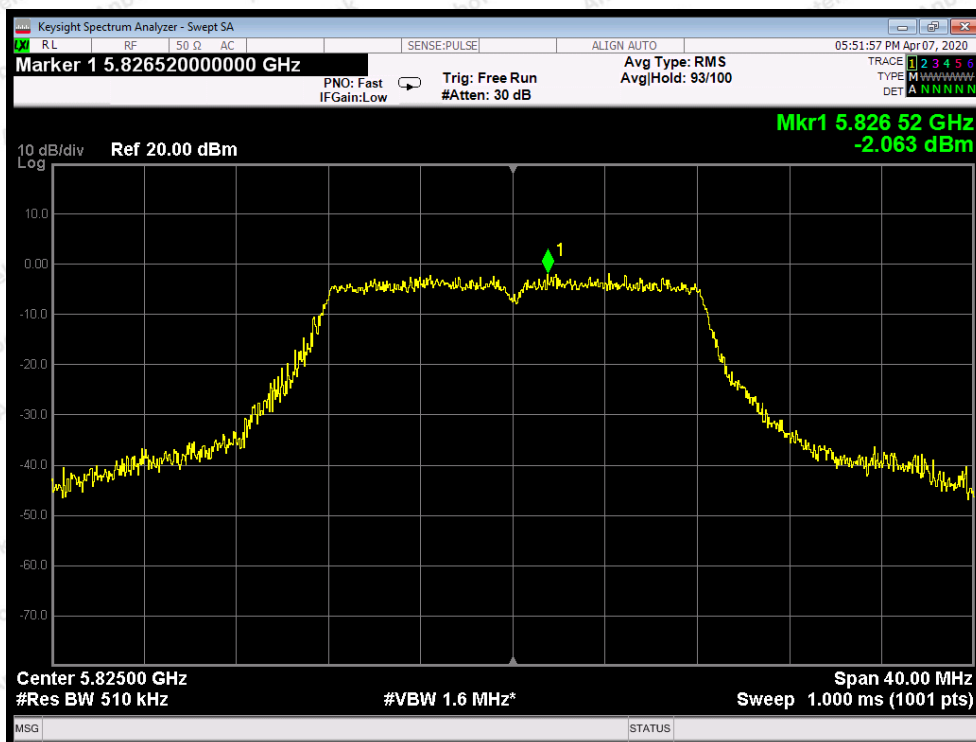
ANT B



Test Mode: 802.11a--Low



Test Mode: 802.11a---Middle



Test Mode: 802.11a---High

8. Antenna Requirement

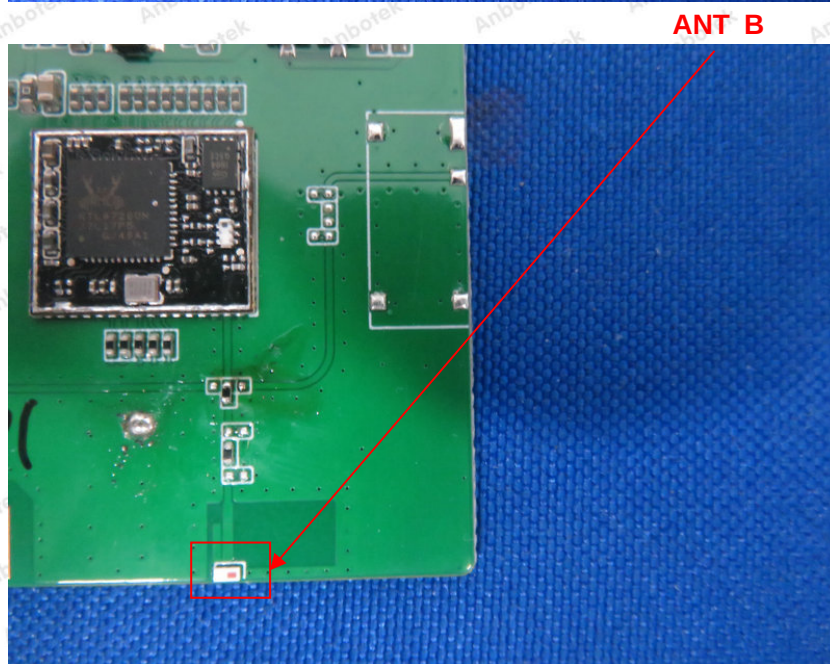
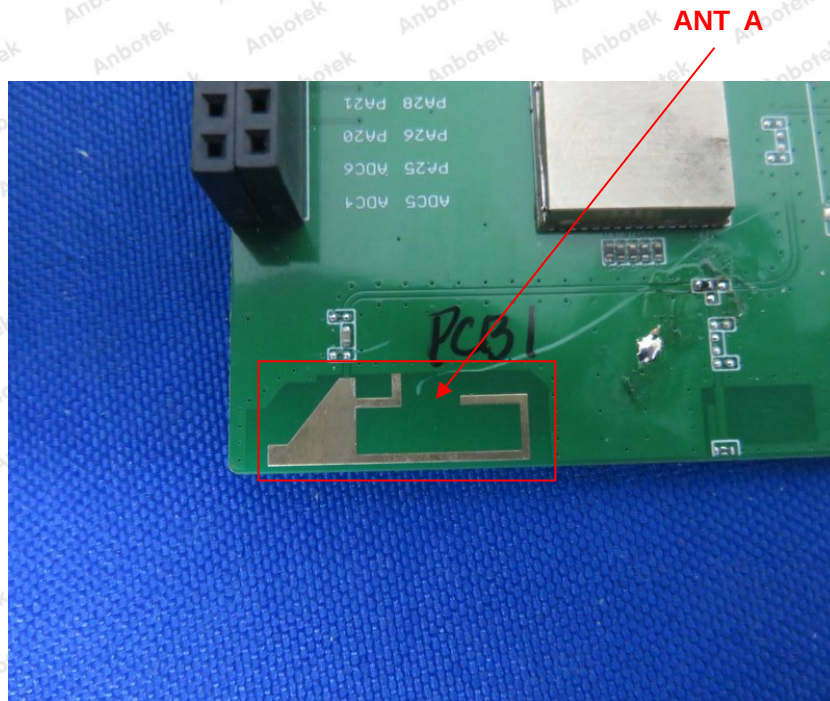
8.1. Test Standard and Requirement

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 A is a PCB Antenna which permanently attached, and the best case gain of the antenna is 2.1 dBi. It complies with the standard requirement.

The antenna B is a Chip Antenna which permanently attached, and the best case gain of the antenna is 4 dBi. It complies with the standard requirement.



9. Frequency Stability

According to the manufacturer, under any normal operating conditions, the working frequency of the product is in the range of 5725-5850MHz.



APPENDIX I -- PHOTOGRAPH

Reference to the test report 18220WC00028701.

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

