Shenzhen Global Test Service Co.,Ltd.
No.7-101 and 8A-104, Building 7 and 8, DCC Cultural and Creative Garden, No.98, Pingxin North Road, Shangmugu Community, Pinghu Street, Longgang District, Shenzhen, Guangdong

FCC PART 15 SUBPART C TEST REPORT

FCC PART 15.407

Report Reference No.....:	**GTSR18080197-WLAN02**
FCC ID..... :	**2AQ4K-M6**
Compiled by (position+printed name+signature)..:	File administrators Jimmy Wang
Supervised by (position+printed name+signature)..:	Test Engineer Aaron Tan
Approved by (position+printed name+signature)..:	Manager Jason Hu
Date of issue.....:	Sep.25, 2018
Representative Laboratory Name .:	**Shenzhen Global Test Service Co.,Ltd.**
Address.....:	No.7-101 and 8A-104, Building 7 and 8, DCC Cultural and Creative Garden, No.98, Pingxin North Road, Shangmugu Community, Pinghu Street, Longgang District, Shenzhen, Guangdong, China
Applicant's name.....:	**Shandong Praytech Optoelectronic Technology Co.,Ltd.**
Address .....:	F2,Blue Venture Valley,South of Keji Road,East of Longhai Road,Nanhai New District, Weihai City,Shandong Province, China
Test specification .....:	
Standard .....:	**FCC Part 15.407**
TRF Originator.....:	Shenzhen Global Test Service Co.,Ltd.
Master TRF.....:	Dated 2014-12

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Test item description .....:	Music projector
Trade Mark .....:	/
Manufacturer .....:	Shandong Praytech Optoelectronic Technology Co.,Ltd.
Model/Type reference.....:	M6
Listed Models .....:	H4
Difference .....:	All the same except the model number
Modulation Type.....:	IEEE 802.11a /802.11ac/ 802.11n
Operation Frequency.....:	From 5745-5825 MHz
Hardware Version .....:	V4
Software Version .....:	V017
Rating .....:	DC 7.4V from Battery or DC 5V from adapter
Result.....:	**PASS**

TEST REPORT

Test Report No. :	GTSR18080197-WLAN02	Sep. 25, 2018 Date of issue

Equipment under Test	:	**Music projector**
Model /Type	:	**M6**
Listed Models	:	**H4**
Applicant	:	**Shandong Praytech Optoelectronic Technology Co.,Ltd.**
Address	:	F2,Blue Venture Valley,South of Keji Road,East of Longhai Road,Nanhai New District, Weihai City,Shandong Province, China
Manufacturer	:	**Shandong Praytech Optoelectronic Technology Co.,Ltd.**
Address	:	F2,Blue Venture Valley,South of Keji Road,East of Longhai Road,Nanhai New District, Weihai City,Shandong Province, China

Test Result:	**PASS**

The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

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1. TEST STANDARDS

The tests were performed according to following standards:

FCC Rules Part 15.407: UNLICENSED NATIONAL INFORMATION INFRASTRUCTURE DEVICES.
ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices
KDB 789033 D02: GUIDELINES FOR COMPLIANCE TESTING OF UNLICENSED NATIONAL INFORAMTION INFRASTRUCTURE (U-NII) DEVICES PART 15, SUBPART E
KDB 662911 D01 Multiple Transmitter Output v02r01: Emissions Testing of Transmitters with Multiple Outputs in the Same Band

2. SUMMARY

2.1. General Remarks

Date of receipt of test sample	:	Sep. 19, 2018
Testing commenced on	:	Sep. 19, 2018
Testing concluded on	:	Sep. 25, 2018

2.2. Product Description

Name of EUT	**Music projector**
Trade Mark:	/
Model Number	**M6**
Listed Models	H4
Power Supply	DC 7.4V from Battery or DC 5V from adapter
WLAN	Supported 802.11a/ 802.11ac/802.11n
Modulation Type	IEEE 802.11ac: OFDM(64QAM, 16QAM, QPSK, BPSK) IEEE 802.11a: OFDM(64QAM, 16QAM, QPSK, BPSK) IEEE 802.11n HT20: OFDM (64QAM, 16QAM, QPSK,BPSK) IEEE 802.11n HT40: OFDM (64QAM, 16QAM, QPSK,BPSK)
Operation frequency	IEEE 802.11a/ac VHT20/ n HT20: 5745MHz-5825MHz IEEE 802.11n HT40 /ac CHT 40:2422-2452MHz/5755-5795 MHz
Directional gain	@2.4G GANT +10log(N)dbi =0.98+10log2=3.99dbi ＜ 6 dbi @5G GANT +10log(N)dbi =0.98+10log2=3.99dbi ＜ 6 dbi
Antenna Type	internal antenna
Antenna gain	0.98 dBi@2.4G&@5G for ANT1 , 0.82 dBi@2.4G&@5G for ANT2

2.3. Equipment Under Test

Power supply system utilised

Power supply voltage	:	○	230V / 50 Hz	○	120V / 60Hz
		○	12 V DC	○	24 V DC
		●	Other (specified in blank below)		

DC 7.4V

2.4. Short description of the Equipment under Test (EUT)

This is a Music projector.

For more details, refer to the user's manual of the EUT.

2.5. EUT operation mode

The application provider specific test software(Realtek MPtool) to control sample in continuous TX and RX.

IEEE 802.11a/IEEE 802.11ac(20MHz)/IEEE 802.11n(20MHz):

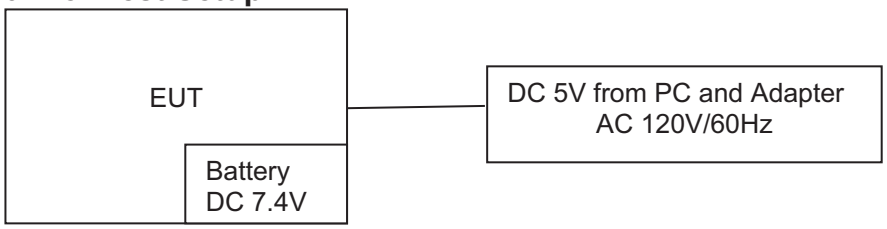
UNII-3	
Channel	Frequency (MHz)
149	**5745**
153	5765

157	**5785**
161	5805
165	**5825**

IEEE 802.11ac(40MHz)/IEEE 802.11n(40MHz):

UNII-3	
Channel	Frequency (MHz)
151	**5755**
159	5795

2.6. Block Diagram of Test Setup



2.7. Special Accessories

Manufacturer	Description	Model	Serial Number	Certificate
TOSHIBA	Tablet PC	Satellite S40Dt-A	D26T	DOC

2.8. Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for **FCC ID: 2AQ4K-M6** filing to comply with Section 15.407 of the FCC Part 15, Subpart E Rules.

2.9. Modifications

No modifications were implemented to meet testing criteria.

3. TEST ENVIRONMENT

3.1. Address of the test laboratory

Shenzhen Global Test Service Co.,Ltd.
1F, Building No. 13A, Zhonghaixin Science and Technology City, No.12,6 Road, Ganli Industrial Park, Buji Street, Longgang District, Shenzhen, Guangdong

3.2. Test Facility

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

FCC-Registration No.: 165725

Shenzhen Global Test Service Co.,Ltd 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.

A2LA-Lab Cert. No.: 4758.01

Shenzhen Global Test Service Co.,Ltd. EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

CNAS-Lab Code: L8169

Shenzhen Global Test Service Co.,Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC 17025: 2005 General Requirements) for the Competence of Testing and Calibration Laboratories. Date of Registration: Dec. 11, 2015. Valid time is until Dec. 10, 2018.

3.3. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature:	15-35 ° C
Humidity:	30-60 %
Atmospheric pressure:	950-1050mbar

3.4. Test Description

Test Specification clause	Test case	Test Mode	Test Channel	Recorded In Report		Pass	Fail	NA	NP	Remark
§15.203	Antenna gain	802.11ac	☒ Lowest ☒ Middle ☒ Highest	802.11a	☒ Lowest ☒ Middle ☒ Highest	☒	☐	☐	☐	complies
§15.407(a)	Power spectral density	802.11ac 802.11n HT20	☒ Lowest ☒ Middle ☒ Highest	802.11a 802.11ac 802.11n	☒ Lowest ☒ Middle ☒ Highest	☒	☐	☐	☐	complies
§15.407(a)	Spectrum bandwidth – 26 dB bandwidth	-/-	-/-	-/-	-/-	☐	☐	☒	☐	complies
§15.407(e)	Spectrum bandwidth – 6 dB bandwidth	802.11ac 802.11n HT20	☒ Lowest ☒ Middle ☒ Highest	802.11a 802.11ac 802.11n	☒ Lowest ☒ Middle ☒ Highest	☒ ☒	☐	☐	☐	complies
§15.407(a)	Maximum output power	802.11ac 802.11n HT20	☒ Lowest ☒ Middle ☒ Highest	802.11a 802.11ac 802.11n	☒ Lowest ☒ Middle ☒ Highest	☒ ☒ ☒	☐	☐	☐	complies
§15.407(b)	Band edge compliance conducted	802.11ac 802.11n HT20	☒ Lowest ☒ Highest	802.11a 802.11ac 802.11n	☒ Lowest ☒ Highest	☒ ☒	☐	☐	☐	complies
§15.407(b)	Band edge compliance radiated	802.11a 802.11ac 802.11n	☒ Lowest ☒ Highest	802.11a	☒ Lowest ☒ Highest	☒	☐	☐	☐	complies
§15.407(a)	TX spurious emissions conducted	-/-	-/-	-/-	-/-	☐	☐	☒	☐	complies
§15.407(a)	TX spurious emissions radiated	802.11a 802.11ac 802.11n	☒ Lowest ☒ Middle ☒ Highest	802.11a	☒ Lowest ☒ Middle ☒ Highest	☒	☐	☐	☐	complies
§15.407(g)	Frequency Stability	802.11a 802.11ac 802.11n	☒ Lowest ☒ Highest	802.11a	☒ Lowest	☒	☐	☐	☐	complies
§15.109	RX spurious emissions radiated	-/-	-/-	-/-	-/-	☐	☐	☒	☐	complies
§15.209(a)	TX spurious Emissions radiated < 30 MHz	802.11a 802.11ac 802.11n	-/-	802.11a	-/-	☒	☐	☐	☐	complies
§15.107(a) §15.207	Conducted Emissions < 30 MHz	802.11a 802.11ac 802.11n	-/-	802.11a	-/-	☒	☐	☐	☐	complies

Remark:
1. The measurement uncertainty is not included in the test result.
2. NA = Not Applicable; NP = Not Performed

Preliminary tests were performed in different data rate to find the worst radiated emission. The data rate shown in the table below is the worst-case rate with respect to the specific test item. Investigation has been done on all the possible configurations for searching the worst cases. The following table is a list of the test modes shown in this test report.

Test Items	Mode	Data Rate
Maximum Peak Conducted Output Power Power Spectral Density 6dB Bandwidth 26dB Bandwidth Spurious RF conducted emission Radiated Emission 9kHz~1GHz& Radiated Emission 1GHz~10th Harmonic	11ac/OFDM	6 Mbps
	11n/OFDM	6.5 Mbps
Band Edge	11ac/OFDM	6 Mbps
	11n/OFDM	6.5 Mbps

3.5. Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 „Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements“ and is documented in the Shenzhen Global Test Service Co.,Ltd quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for Shenzhen GTS laboratory is reported:

Test	Range	Measurement Uncertainty	Notes
Radiated Emission	30~1000MHz	4.10 dB	(1)
Radiated Emission	1~18GHz	4.32 dB	(1)
Radiated Emission	18-40GHz	5.54 dB	(1)
Conducted Disturbance	0.15~30MHz	3.12 dB	(1)

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

3.6. Equipments Used during the Test

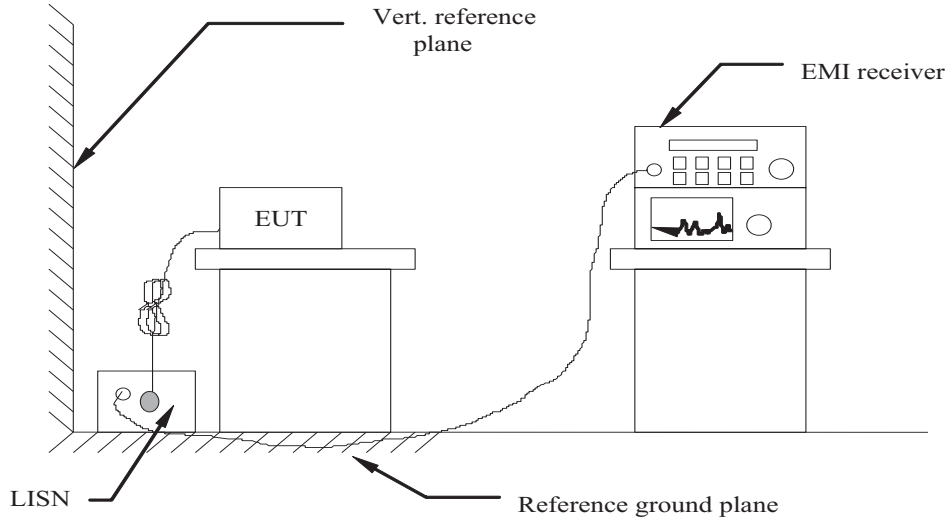
Test Equipment	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Due Date
LISN	R&S	ENV216	3560.6550.08	2017/09/20	2018/09/19
LISN	R&S	ESH2-Z5	893606/008	2017/09/20	2018/09/19
Bilog Antenna	Schwarzbeck	VULB9163	976	2016/09/20	2019/09/19
EMI Test Receiver	R&S	ESCI7	101102	2017/09/20	2018/09/19
Spectrum Analyzer	Agilent	N9020A	MY48010425	2017/09/20	2018/09/19
Spectrum Analyzer	R&S	FSP40	100019	2018/06/05	2019/06/04
Controller	EM Electronics	Controller EM 1000	N/A	N/A	N/A
Horn Antenna	Schwarzbeck	BBHA 9120D	01622	2016/09/20	2019/09/19
Active Loop Antenna	SCHWARZBECK	FMZB1519	1519-037	2016/09/20	2019/09/19
Broadband Horn Antenna	SCHWARZBECK	BBHA 9170	971	2016/09/20	2019/09/19
Amplifier	Schwarzbeck	BBV 9743	#202	2017/09/20	2018/09/19
Amplifier	EMCI	EMC051845B	980355	2017/09/20	2018/09/19
Temperature/Humidity Meter	Gangxing	CTH-608	02	2017/09/20	2018/09/19
High-Pass Filter	K&L	9SH10-2700/X12750-O/O	KL142031	2017/09/20	2018/09/19
High-Pass Filter	K&L	41H10-1375/U12750-O/O	KL142032	2017/09/20	2018/09/19
RF Cable(below 1GHz)	HUBER+SUHNER	RG214	RE01	2017/09/20	2018/09/19
RF Cable(above 1GHz)	HUBER+SUHNER	RG214	RE02	2017/09/20	2018/09/19
Data acquisition card	Agilent	U2531A	TW53323507	2017/09/20	2018/09/19
Power Sensor	Agilent	U2021XA	MY5365004	2017/09/20	2018/09/19
EMI Test Software	R&S	ES-K1	V1.7.1	2017/09/20	2018/09/19
EMI Test Software	JS Tonscend	JS32-RE	2.0.1.5	2017/09/20	2018/09/19

Note: The Cal.Interval was one year.

4. TEST CONDITIONS AND RESULTS

4.1. AC Power Conducted Emission

TEST CONFIGURATION



TEST PROCEDURE

1 The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. The EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10-2013.
2 Support equipment, if needed, was placed as per ANSI C63.10-2013
3 All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10-2013
4 The EUT received DC 5V power from adapter, the adapter received AC120V/60Hz and AC 240V/60Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.
5 All support equipments received AC power from a second LISN, if any.
6 The EUT test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT.The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
7 Analyzer / Receiver scanned from 150 KHz to 30MHz for emissions in each of the test modes.
8 During the above scans, the emissions were maximized by cable manipulation.

AC Power Conducted Emission Limit

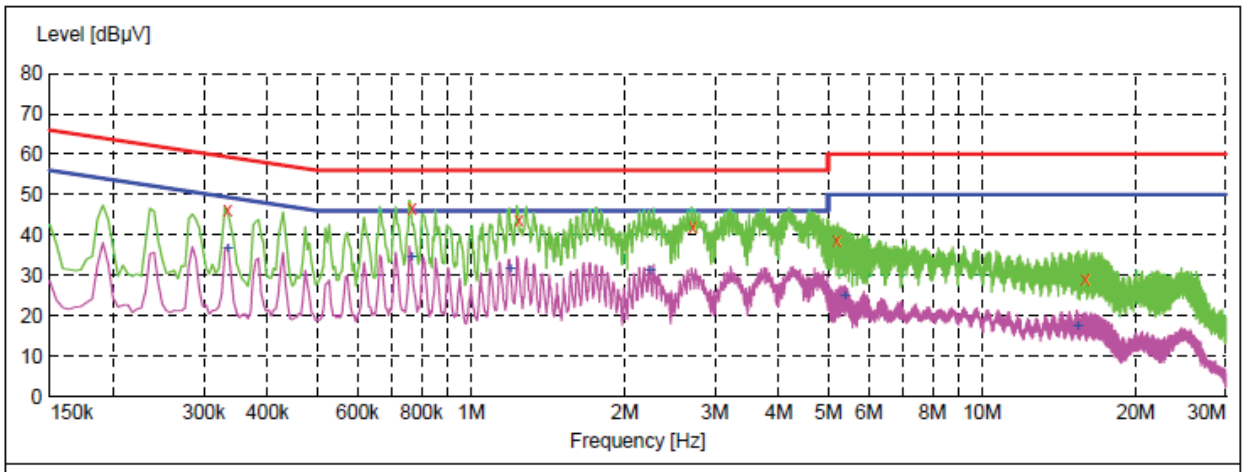
For intentional device, according to § 15.207(a) AC Power Conducted Emission Limits is as following：

Frequency range (MHz)	Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50
* Decreases with the logarithm of the frequency.		

TEST RESULTS

Remark: We measured Conducted Emission at 802.11a/802.11n/802.11ac mode in AC 120V/60Hz and AC 240V/50Hz, Pre-test AC conducted emission at power from AC mains mode and at charge from PC mode, recorded worst case..

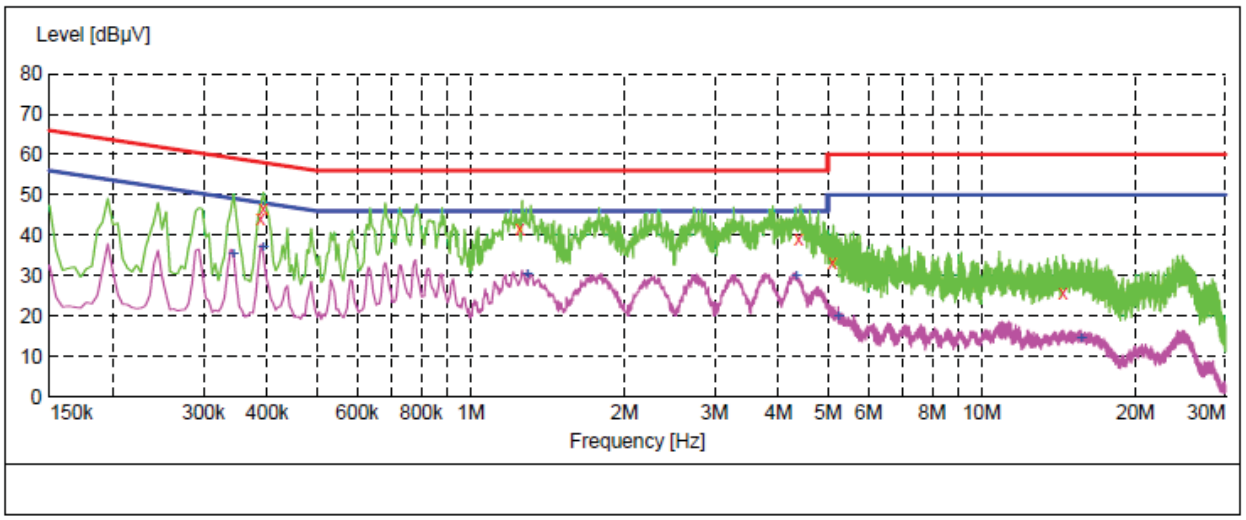
Power supply:	AC 120V/60Hz(adapter)	Polarization	L



Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.334500	46.40	9.9	59	12.9	QP	L1	GND
0.766500	46.60	9.7	56	9.4	QP	L1	GND
1.243500	43.60	9.6	56	12.4	QP	L1	GND
2.719500	41.90	9.5	56	14.1	QP	L1	GND
5.199000	38.50	9.3	60	21.5	QP	L1	GND
15.931500	29.10	8.4	60	30.9	QP	L1	GND

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.334500	36.70	9.9	49	12.6	AV	L1	GND
0.766500	34.70	9.7	46	11.3	AV	L1	GND
1.194000	31.70	9.6	46	14.3	AV	L1	GND
2.242500	31.30	9.5	46	14.7	AV	L1	GND
5.388000	24.90	9.3	50	25.1	AV	L1	GND
15.396000	17.30	8.3	50	32.7	AV	L1	GND

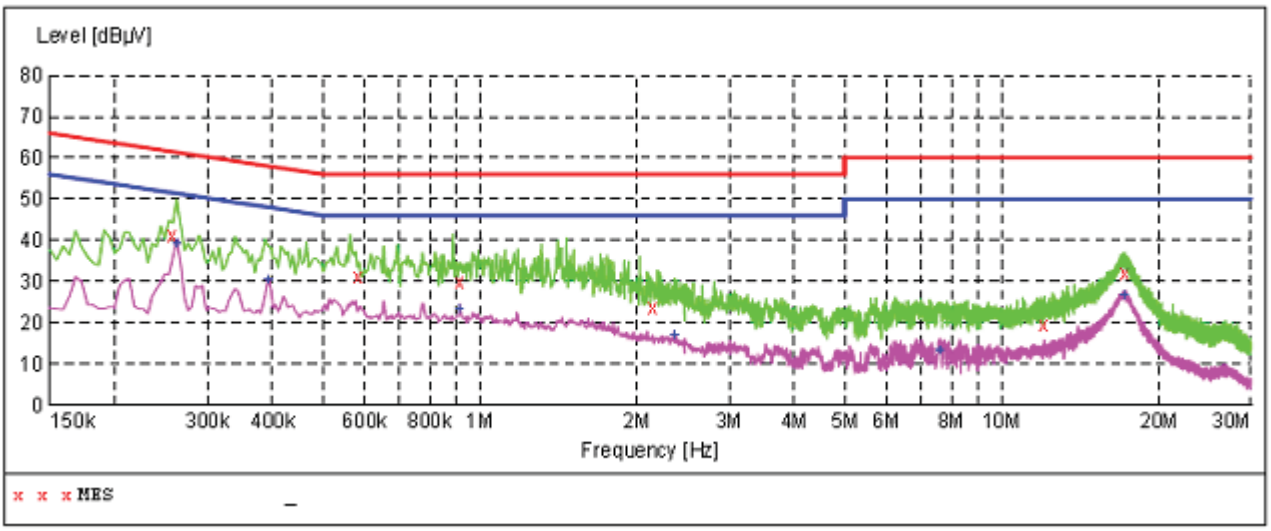
Power supply:	AC 120V/60Hz(adapter)	Polarization	N



Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.388500	44.20	9.8	58	13.9	QP	N	GND
0.393000	46.50	9.8	58	11.5	QP	N	GND
1.248000	41.50	9.6	56	14.5	QP	N	GND
4.393500	39.10	9.3	56	16.9	QP	N	GND
5.113500	33.30	9.3	60	26.7	QP	N	GND
14.428500	25.80	8.3	60	34.2	QP	N	GND

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.343500	35.50	9.9	49	13.6	AV	N	GND
0.393000	37.10	9.8	48	10.9	AV	N	GND
1.293000	30.40	9.6	46	15.6	AV	N	GND
4.330500	29.70	9.4	46	16.3	AV	N	GND
5.235000	20.00	9.3	50	30.0	AV	N	GND
15.648000	14.30	8.3	50	35.7	AV	N	GND

Power supply:	AC 240V/50Hz(adapter)	Polarization	L



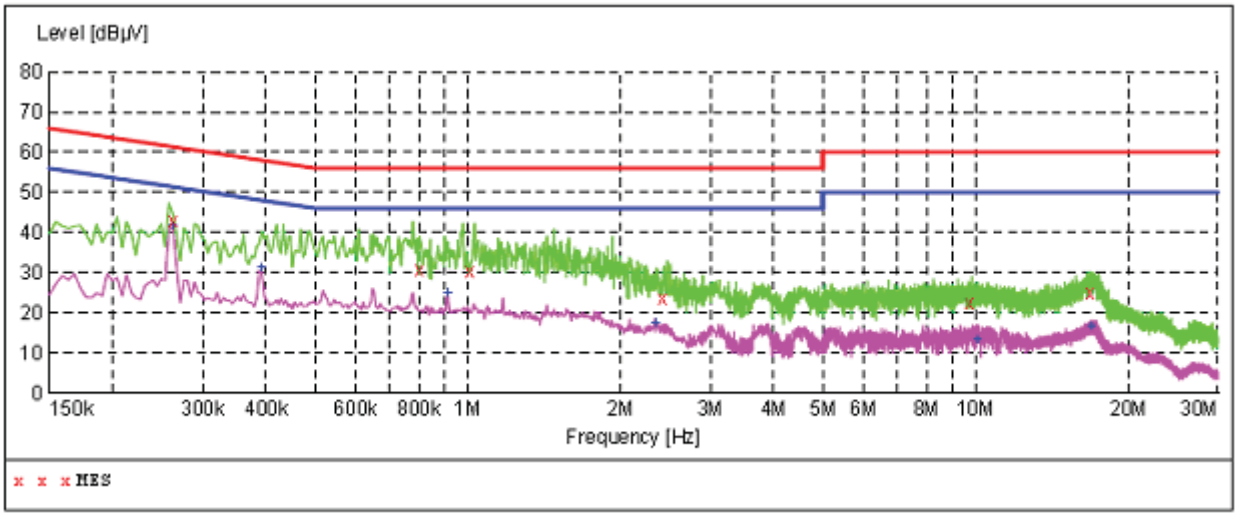
MEASUREMENT RESULT:

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.258000	41.30	9.9	62	20.2	QP	L1	GND
0.586500	31.30	9.7	56	24.7	QP	L1	GND
0.919500	29.90	9.6	56	26.1	QP	L1	GND
2.148000	23.60	9.5	56	32.4	QP	L1	GND
12.066000	19.60	8.6	60	40.4	QP	L1	GND
17.227500	31.80	7.6	60	28.2	QP	L1	GND

MEASUREMENT RESULT:

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.262500	39.30	9.9	51	12.1	AV	L1	GND
0.393000	30.20	9.8	48	17.8	AV	L1	GND
0.915000	23.10	9.6	46	22.9	AV	L1	GND
2.359500	17.00	9.5	46	29.0	AV	L1	GND
7.615500	13.40	9.1	50	36.6	AV	L1	GND
17.209500	26.70	7.6	50	23.3	AV	L1	GND

Power supply:	AC 240V/50Hz(adapter)	Polarization	N



MEASUREMENT RESULT:

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.262500	42.80	9.9	61	18.6	QP	N	GND
0.802500	30.60	9.7	56	25.4	QP	N	GND
1.009500	30.20	9.6	56	25.8	QP	N	GND
2.427000	23.50	9.5	56	32.5	QP	N	GND
9.780000	22.30	8.9	60	37.7	QP	N	GND
16.795500	24.90	7.7	60	35.1	QP	N	GND

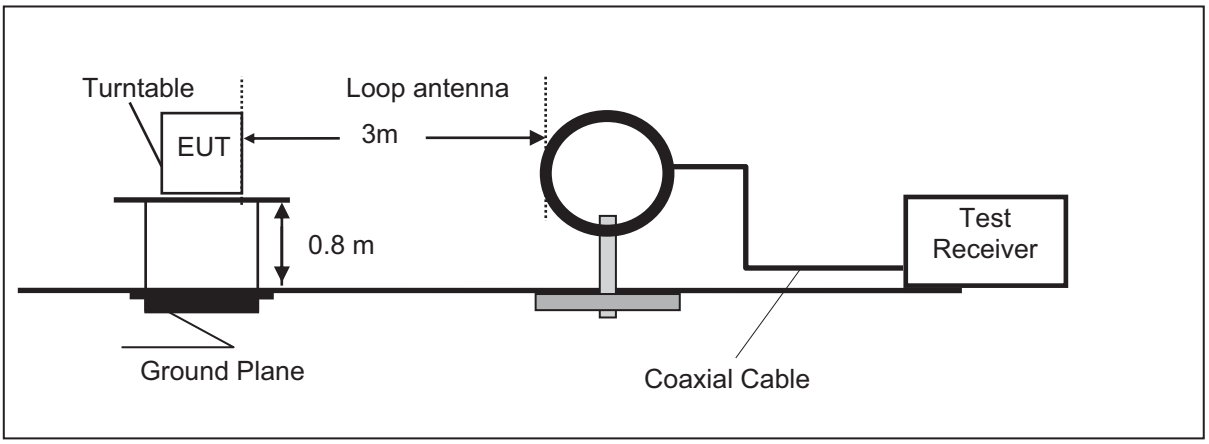
MEASUREMENT RESULT:

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.262500	41.70	9.9	51	9.7	AV	N	GND
0.393000	31.30	9.8	48	16.7	AV	N	GND
0.915000	24.90	9.6	46	21.1	AV	N	GND
2.350500	17.40	9.5	46	28.6	AV	N	GND
10.095000	13.10	8.9	50	36.9	AV	N	GND
16.957500	16.60	7.7	50	33.4	AV	N	GND

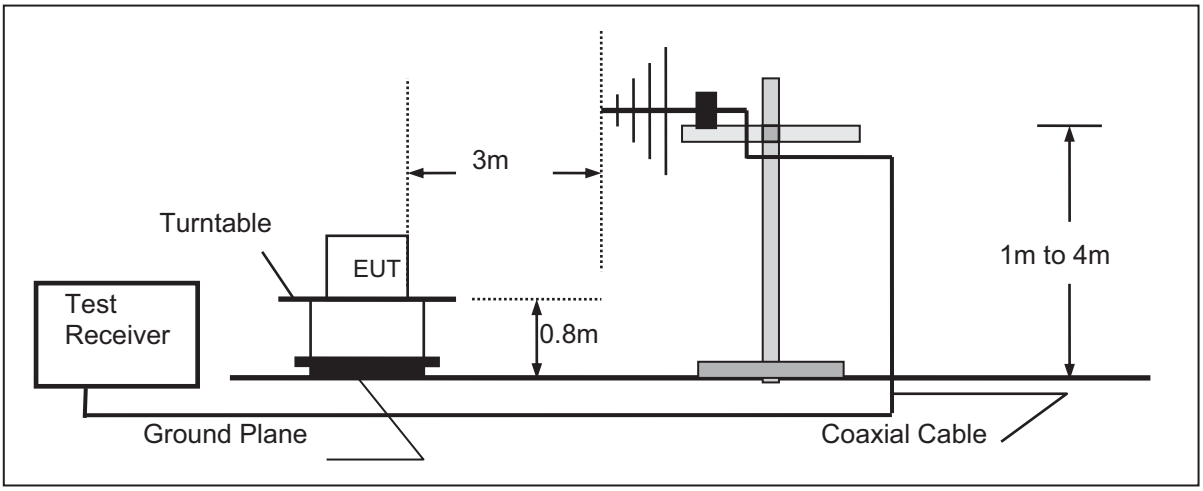
4.2. Radiated Emission

TEST CONFIGURATION

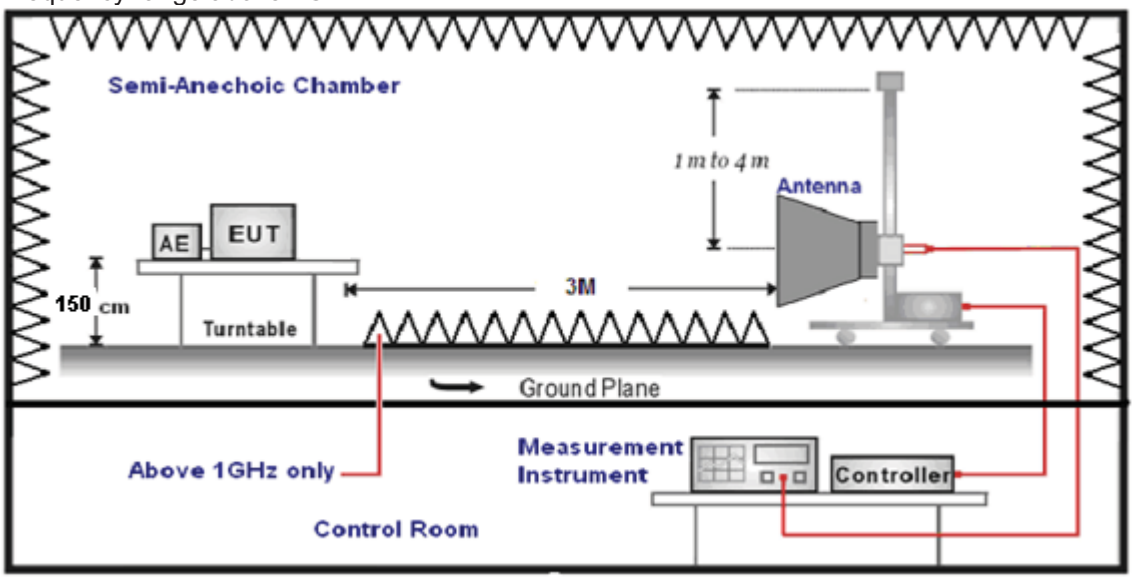
Frequency range 9 KHz – 30MHz



Frequency range 30MHz – 1000MHz



Frequency range above 1GHz



TEST PROCEDURE

1. The EUT was placed on a turn table which is 0.8m above ground plane when testing frequency range 9 KHz –1GHz;the EUT was placed on a turn table which is 1.5m above ground plane when testing above 1GHz.
2. Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0° to 360° to acquire the highest emissions from EUT.
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measurements have been completed.
5. The EUT minimum operation frequency was 24MHz and maximum operation frequency was 5825MHz.so radiated emission test frequency band from 9KHz to 40GHz.
6. The distance between test antenna and EUT as following table states:

Test Frequency range	Test Antenna Type	Test Distance
9KHz-30MHz	Active Loop Antenna	3
30MHz-1GHz	Ultra-Broadband Antenna	3
1GHz-18GHz	Double Ridged Horn Antenna	3
18GHz-25GHz	Horn Anternna	1

7. Setting test receiver/spectrum as following table states:

Test Frequency range	Test Receiver/Spectrum Setting	Detector
9KHz-150KHz	RBW=200Hz/VBW=3KHz,Sweep time=Auto	QP
150KHz-30MHz	RBW=9KHz/VBW=100KHz,Sweep time=Auto	QP
30MHz-1GHz	RBW=120KHz/VBW=1000KHz,Sweep time=Auto	QP
1GHz-40GHz	Peak Value: RBW=1MHz/VBW=3MHz, Sweep time=Auto Average Value: RBW=1MHz/VBW=10Hz, Sweep time=Auto	Peak

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor(if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CL - AG

Where FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
RA = Reading Amplitude	AG = Amplifier Gain
AF = Antenna Factor	

Transd=AF +CL-AG

RADIATION LIMIT

According to §15.407 (b): Except as shown in paragraph (b)(7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits

Frequency (MHz)	EIRP Limit (dBm)	Equivalent Field Strength at 3m (dBμV/m)
5150-5250	-27	68.3
5250-5350	-27	68.3
5470-5725	-27	68.3
5725-5850	-27 (beyond 10MHz of the bandedge)	68.3
	-17 (within 10 MHz of band edge)	78.3

Frequency (MHz)	Distance (Meters)	Radiated (dBμV/m)	Radiated (μV/m)
0.009-0.49	3	20log(2400/F(KHz))+40log(300/3)	2400/F(KHz)
0.49-1.705	3	20log(24000/F(KHz))+ 40log(30/3)	24000/F(KHz)
1.705-30	3	20log(30)+ 40log(30/3)	30
30-88	3	40.0	100
88-216	3	43.5	150
216-960	3	46.0	200
Above 960	3	54.0	500

TEST RESULTS

Remark: We tested at 802.11ac/802.11ac/802.11n mode at the antenna single transmitting mode and the Mimo mode in AC 120V/60Hz, and recored the worst data at the Mimo mode of the 802.11a Mode.

For 9 KHz-30MHz

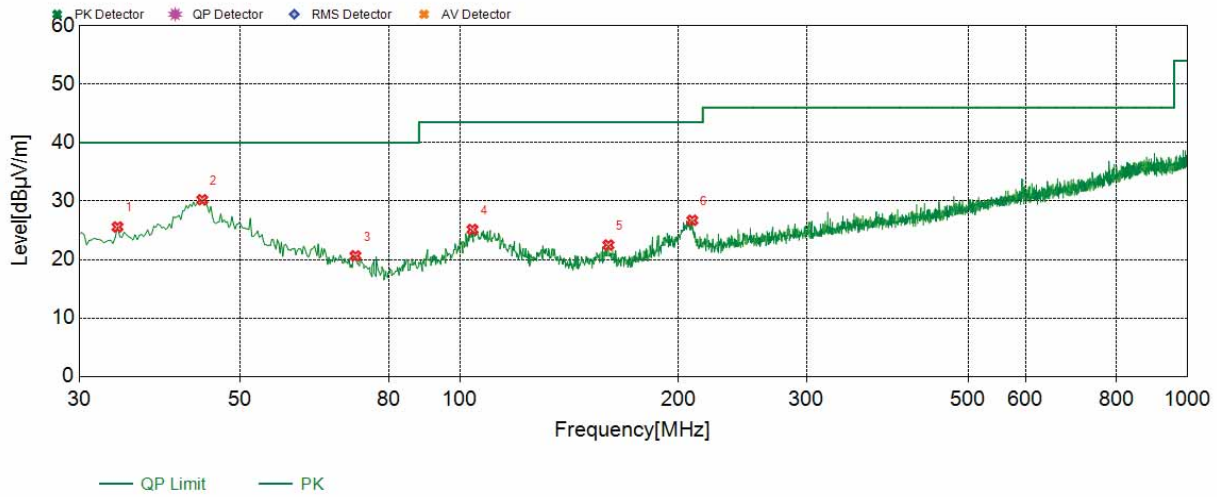
Freq.	Reading	Limit	Margin	State
(MHz)	(dBuV/m)	(dBuV/m)	(dB)	P/F
--	--	--	--	P
--	--	--	--	P

Note:

The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.
Distance extrapolation factor =40 log (specific distance/test distance)(dB);
Limit line = specific limits(dBuv) + distance extrapolation factor.

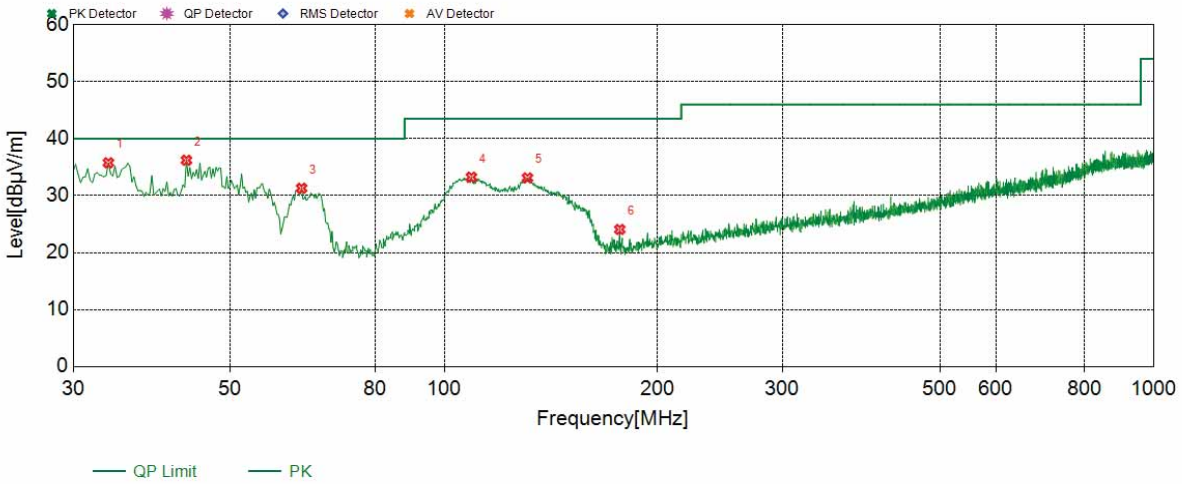
For 30MHz-1GHz

Horizontal



NO.	Freq. [MHz]	Reading [dBµV/m]	Result Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle[°]	Polarity
1	33.880	41.95	25.58	-16.37	40.00	14.42	100	201	Horizontal
2	44.308	44.34	30.23	-14.11	40.00	9.77	100	205	Horizontal
3	71.953	39.61	20.64	-18.97	40.00	19.36	100	243	Horizontal
4	104.205	42.18	25.15	-17.03	43.50	18.35	100	243	Horizontal
5	160.223	41.86	22.48	-19.38	43.50	21.02	100	196	Horizontal
6	208.965	42.91	26.71	-16.20	43.50	16.79	100	154	Horizontal

Vertical



NO.	Freq. [MHz]	Reading [dBµV/m]	Result Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle[°]	Polarity
1	33.638	52.14	35.76	-16.38	40.00	4.24	100	209	Vertical
2	43.338	50.47	36.2	-14.27	40.00	3.80	100	223	Vertical
3	62.980	48.63	31.29	-17.34	40.00	8.71	100	171	Vertical
4	109.298	50.30	33.24	-17.06	43.50	10.26	100	265	Vertical
5	131.123	53.32	33.11	-20.21	43.50	10.39	100	298	Vertical
6	176.955	42.73	24.07	-18.66	43.50	19.43	100	298	Vertical

Note:

1. Pre-scan all modes and recorded the worst case results in this report (IEEE 802.11ac VHT20 mode (Middle Channel, Combined Antenna Chain1 and Antenna Chain2)).
2. Emission level (dBuV/m) = Meter Reading+ antenna Factor+ cable loss- preamp factor
3. Margin value = Emission level-Limits

For 1GHz to 40GHz

802.11a Mode_Channel 149_ 5745 MHz

Item	Freq	Read Level	Antenna Factor	PRM	Cable Loss	Result Level	Limit Line	Margin	Detector	Polarization
(Mark)	(MHz)	(dBμV)	(dB/m)	Factor	(dB)	(dBμV/m)	(dBμV/m)	(dB)		
1	11490	35.32	38.46	33.92	11.59	51.45	74	-24.49	Peak	Horizontal
2	11490	23.96	38.46	33.92	11.59	40.09	54	-13.91	AV	Horizontal
3	17235	30.25	43.11	37.11	13.94	50.19	74	-23.81	Peak	Horizontal
4	17235	18.45	43.11	37.11	13.94	38.39	54	-15.61	AV	Horizontal

Item	Freq	Read Level	Antenna Factor	PRM	Cable Loss	Result Level	Limit Line	Margin	Detector	Polarization
(Mark)	(MHz)	(dBμV)	(dB/m)	Factor	(dB)	(dBμV/m)	(dBμV/m)	(dB)		
1	11490	35.62	38.46	33.92	11.59	51.75	74	-24.02	Peak	Vertical
2	11490	23.48	38.46	33.92	11.59	39.61	54	-14.39	AV	Vertical
3	17235	29.86	43.11	37.11	13.94	49.8	74	-24.2	Peak	Vertical
4	17235	20.74	43.11	37.11	13.94	40.68	54	-13.32	AV	Vertical

802.11a Mode_Channel 157_5785 MHz

Item	Freq	Read Level	Antenna Factor	PRM	Cable Loss	Result Level	Limit Line	Margin	Detector	Polarization
(Mark)	(MHz)	(dBμV)	(dB/m)	Factor	(dB)	(dBμV/m)	(dBμV/m)	(dB)		
1	11570	32.19	38.53	33.86	11.66	48.52	74	-26.2	Peak	Horizontal
2	11570	22.41	38.53	33.86	11.66	38.74	54	-15.26	AV	Horizontal
3	17355	27.49	43.2	37.15	14.02	47.56	74	-26.44	Peak	Horizontal
4	17355	18.69	43.2	37.15	14.02	38.76	54	-15.24	AV	Horizontal

Item	Freq	Read Level	Antenna Factor	PRM	Cable Loss	Result Level	Limit Line	Margin	Detector	Polarization
(Mark)	(MHz)	(dBμV)	(dB/m)	Factor	(dB)	(dBμV/m)	(dBμV/m)	(dB)		
1	11570	33.85	38.53	33.86	11.66	50.18	74	-25.58	Peak	Vertical
2	11570	23.51	38.53	33.86	11.66	39.84	54	-14.16	AV	Vertical
3	17355	29.84	43.2	37.15	14.02	49.91	74	-24.09	Peak	Vertical
4	17355	18.76	43.2	37.15	14.02	38.83	54	-15.17	AV	Vertical

802.11a Mode_Channel 165_5825 MHz

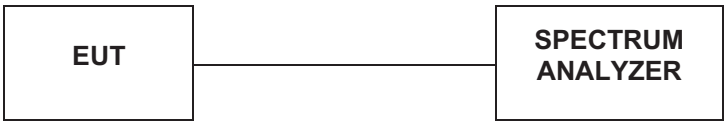
Item	Freq	Read Level	Antenna Factor	PRM	Cable Loss	Result Level	Limit Line	Margin	Detector	Polarization
(Mark)	(MHz)	(dBμV)	(dB/m)	Factor	(dB)	(dBμV/m)	(dBμV/m)	(dB)		
1	11650	32.05	38.56	33.84	11.71	48.48	74	-25.52	Peak	Horizontal
2	11650	22.16	38.56	33.84	11.71	38.59	54	-15.41	AV	Horizontal
3	17475	28.62	43.23	37.17	14.18	48.86	74	-25.14	Peak	Horizontal
4	17475	19.95	43.23	37.17	14.18	40.19	54	-13.81	AV	Horizontal

Item	Freq	Read Level	Antenna Factor	PRM	Cable Loss	Result Level	Limit Line	Margin	Detector	Polarization
(Mark)	(MHz)	(dBμV)	(dB/m)	Factor	(dB)	(dBμV/m)	(dBμV/m)	(dB)		
1	11650	32.96	38.56	33.84	11.71	49.39	74	-24.43	Peak	Vertical
2	11650	23.15	38.56	33.84	11.71	39.58	54	-14.42	AV	Vertical
3	17475	26.95	43.23	37.17	14.18	47.19	74	-26.81	Peak	Vertical
4	17475	17.15	43.23	37.17	14.18	37.39	54	-16.61	AV	Vertical

Note:
1). Measuring frequencies from 9 KHz ~ 40 GHz, No emission found between lowest internal used/generated frequency to 30MHz.
2). Radiated emissions measured in frequency range from 9 KHz ~ 40 GHz were made with an instrument using Peak detector mode.
3). 18~40GHz at least have 20dB margin. No recording in the test report.
4). Worst case data at 6Mbps at IEEE 802.11a; MCS0 at IEEE 802.11n HT20, IEEE 802.11n HT40, IEEE 802.11a VHT20 and IEEE 802.11ac VHT40;
5). Data of measurement within this frequency range shown “---” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
6). Pre-scan at Antenna1 and Antenna2 for IEEE 802.11a mode, pre-scan at Antenna1 and Antenna2 and Combined Antenna1 and Antenna2 for IEEE 802.11n and IEEE 802.11ac, recorded worst case.

4.3. Duty Cycle

TEST CONFIGURATION



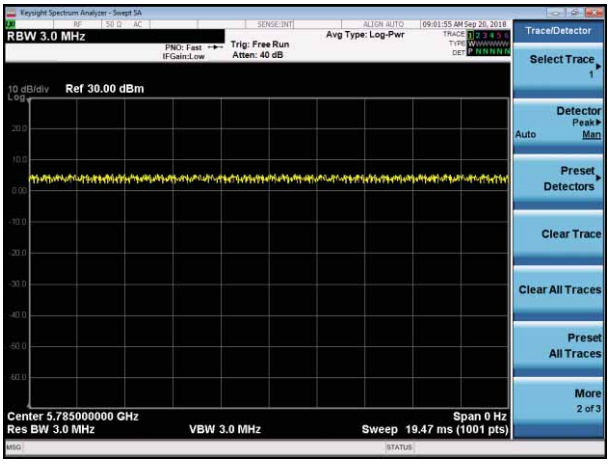
TEST PROCEDURE

According to KDB789033 D02 General UNII Test Procedures New Rules v01 B Duty Cycle (x), Transmission Duration (T):

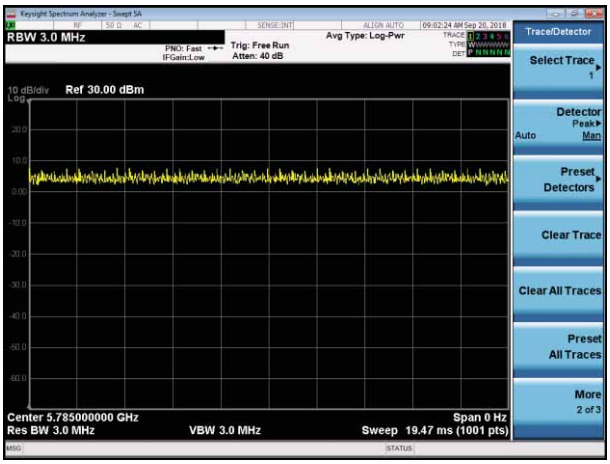
a. A diode detector and an oscilloscope that together have sufficiently short response time to permit accurate measurements of the on and off times of the transmitted signal
b. The zero-span mode on a spectrum analyzer or EMI receiver, if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on and off times of the transmitted signal. Set the center frequency of the instrument to the center frequency of the transmission. Set RBW ≥ EBW if possible; otherwise, set RBW to the largest available value. Set VBW ≥ RBW. Set detector = peak or average. The zerospan measurement method shall not be used unless both RBW and VBW are > 50/T, where T is defined in section II.B.1.a), and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if T ≤ 16.7 microseconds.)

The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator.
The path loss was compensated to the results for each measurement.
Set to the maximum power setting and enable the EUT transmit continuously.
The EUT was operating in controlled its channel.
Use the following spectrum analyzer settings:
Span = Zero Span
RBW = 1MHz
VBW = 1MHz
Number of points in Sweep >100
Detector function = peak
Trace = Clear writeMeasure Ttotal and Ton
Calculate Duty Cycle = Ton / Ttotal and Duty Cycle Factor=10*log(1/Duty Cycle)

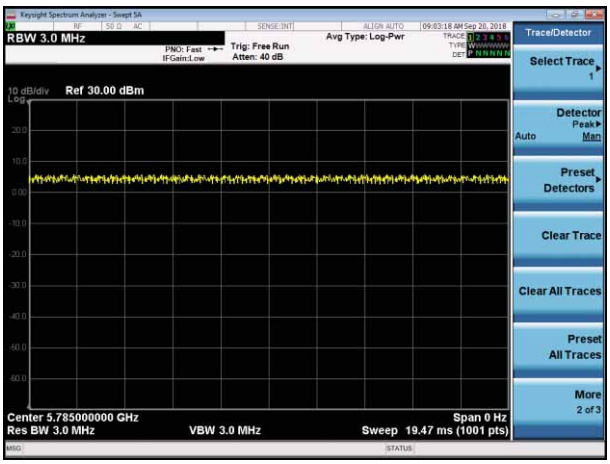
TEST RESULTS



802.11a 5785MHz



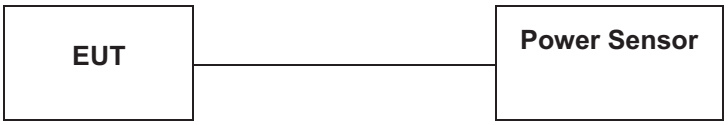
802.11n(HT20) 5785MHz



802.11ac(VHT20) 5785MHz

4.4. Maximum Average Output Power

TEST CONFIGURATION



TEST PROCEDURE

According to KDB789033 D02 General UNII Test Procedures New Rules v01 Section E3 Measurement using a Power Meter (PM):

a. Measurements may be performed using a wideband RF power meter with a thermocouple detector or equivalent if all of the conditions listed below are satisfied
   1. The EUT is configured to transmit continuously or to transmit with a constant duty cycle
   2. At all times when the EUT is transmitting, it must be transmitting at its maximum power control level.
   3. The integration period of the power meter exceeds the repetition period of the transmitted signal by at least a factor of five.

b. If the transmitter does not transmit continuously, measure the duty cycle, x, of the transmitter output signal as described in section II.B

c. Measure the average power of the transmitter. This measurement is an average over both the on and off periods of the transmitter.

Adjust the measurement in dBm by adding 10 log(1/x) where x is the duty cycle (e.g., 10 log(1/0.25) if the duty cycle is 25 percent).

LIMIT

According to §15.407(a): The maximum output power should be not exceed follow:

Frequency Range (MHz)	Limit
5150-5250	Fixed:1 Watt (30dBm) Mobile and portable: 250mW (24dBm)
5250-5350	250mW (24dBm)
5470-5725	250mW (24dBm)
5725-5850	1 Watt (30dBm)
Note: The maximum e.i.r.p at anyelevation angle above 30 degrees as measured from the horizon must not exceed 125mW(21dBm)	

TEST RESULTS

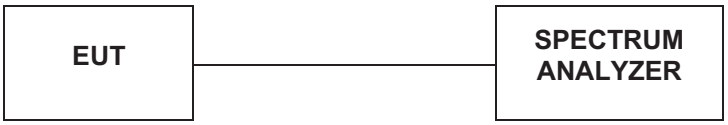
	Frequency (MHz)	ANT 1 Average Output Power (dBm)	ANT 2 Average Output Power (dBm)	Total Average Output Power (dBm)	FCC Limit (dBm)	Result
802.11a	5745	7.35	7.38	/	30	Pass
	5785	6.12	6.09	/	30	Pass
	5825	7.06	7.03	/	30	Pass
802.11n (HT20)	5745	6.83	6.32	9.59	30	Pass
	5785	6.59	6.26	9.44	30	Pass
	5825	6.76	6.03	9.42	30	Pass
802.11ac (VHT20)	5745	6.42	6.34	9.39	30	Pass
	5785	6.05	6.02	9.05	30	Pass
	5825	6.11	6.01	9.07	30	Pass
802.11n (HT40)	5755	5.56	5.61	8.60	30	Pass
	5795	5.14	5.17	8.16	30	Pass
802.11ac (VHT40)	5755	5.62	5.63	8.63	30	Pass
	5795	5.15	5.24	8.21	30	Pass

Note:

1. *Measured output power at difference data rate for each mode and recorded worst case for each mode.*
2. *Test results including cable loss;*
3. *Worst case data at 6Mbps at IEEE 802.11a; MCS0 at IEEE 802.11n HT20, IEEE 802.11n HT40, IEEE 802.11a VHT20 and IEEE 802.11ac VHT40;*
4. *Report conducted power = Measured conducted average power + Duty Cycle factor;*
5. *The EUT used two monopole antenna for WIFI TX/RX, the directional gain=0.98+10log2=3.99dbi＜6 dbi.*
   So the power limits of IEEE 802.11n HT20, IEEE 802.11 n HT40, IEEE 802.11 ac VHT20 and IEEE 802.11 ac VHT40 or MIMO with CDD technology should be reduced.

4.5. Power Spectral Density

TEST CONFIGURATION



TEST PROCEDURE

According to KDB 789033 D02 General UNII Test Procedures New Rules v01 F: The rules requires "maximum power spectral density" measurements where the intent is to measure the maximum value of the time average of the power spectral density measured during a period of continuous transmission

a. Create an average power spectrum for the EUT operating mode being tested by following the instructions in section II.E.2. for measuring maximum conducted output power using a spectrum analyzer or EMI receiver: select the appropriate test method (SA-1, SA-2, SA-3, or alternatives to each) and apply it up to, but not including, the step labeled, "Compute power…". (This procedure is required even if the maximum conducted output power measurement was performed using a power meter, method PM.)
b. Use the peak search function on the instrument to find the peak of the spectrum and record its value.
c. Make the following adjustments to the peak value of the spectrum, if applicable:
   1. If Method SA-2 or SA-2 Alternative was used, add 10 log(1/x), where x is the duty cycle, to the peak of the spectrum.
   2.) If Method SA-3 Alternative was used and the linear mode was used in step II.E.2.g)(viii), add 1 dB to the final result to compensate for the difference between linear averaging and power averaging.
d. The result is the Maximum PSD over 1 MHz reference bandwidth.
e. For devices operating in the bands 5.15-5.25 GHz, 5.25-5.35 GHz, and 5.47-5.725 GHz, the above procedures make use of 1 MHz RBW to satisfy directly the 1 MHz reference bandwidth specified in § 15.407(a)(5). For devices operating in the band 5.725-5.85 GHz, the rules specify a measurement bandwidth of 500 kHz. Many spectrum analyzers do not have 500 kHz RBW, thus a narrower RBW may need to be used. The rules permit the use of a RBWs less than 1 MHz, or 500 kHz, "provided that the measured power is integrated over the full reference bandwidth" to show the total power over the specified measurement bandwidth (i.e., 1 MHz, or 500 kHz). If measurements are performed using a reduced resolution bandwidth (< 1 MHz, or < 500 kHz) and integrated over 1 MHz, or 500 KHz bandwidth, the following adjustments to the procedures apply:
   1. Set RBW ≥ 1/T, where T is defined in section II.B.I.a).
   2. Set VBW ≥ 3 RBW.
   3. If measurement bandwidth of Maximum PSD is specified in 500 kHz, add 10log(500kHz/RBW) to the measured result, whereas RBW (< 500 KHz) is the reduced resolution bandwidth of the spectrum analyzer set during measurement.
   4. If measurement bandwidth of Maximum PSD is specified in 1 MHz, add 10log(1MHz/RBW) to the measured result, whereas RBW (< 1 MHz) is the reduced resolution bandwidth of spectrum analyzer set during measurement.
   5. Care must be taken to ensure that the measurements are performed during a period of continuous transmission or are corrected upward for duty cycle.

   Note: As a practical matter, it is recommended to use reduced RBW of 100 KHz for the sections 5.c) and 5.d) above, since RBW=100 KHz is available on nearly all spectrum analyzers.
f. Adjust the measurement in dBm by adding 10 log(1/x) where x is the duty cycle (e.g., 10 log(1/0.25) if the duty cycle is 25 percent).

LIMIT

According to §15.407(a): The maximum output power should be not exceed follow:

Frequency Range (MHz)	Limit
5150-5250	Other then Mobile and portable:17dBm/MHz Mobile and portable:11dBm/MHz
5250-5350	11dBm/MHz
5470-5725	11dBm/MHz
5725-5850	30dBm/500kHz

TEST RESULTS

5.8G

Mode	Frequency (MHz)	Power Density(dBm/300KHz)		Power Density(dBm/500KHz)		Total	FCC Limit (dBm/500KHz)
		Antenna 1	Antenna 2	Antenna 1	Antenna 2		
802.11a	5745	-3.521	-3.140	-1.303	-0.922	/	30
	5785	-6.430	-6.008	-4.212	-3.790	/	30
	5825	-5.431	-5.882	-3.213	-3.664	/	30
802.11n (HT20)	5745	-2.986	-3.734	-3.734	-1.516	1.885	30
	5785	-5.731	-4.764	-4.764	-2.546	0.008	30
	5825	-4.995	-6.826	-6.826	-4.608	-0.586	30
802.11n (HT40)	5755	-3.948	-4.528	-4.528	-2.310	1.000	30
	5795	-4.834	-5.931	-5.931	-3.713	-0.119	30
802.11ac (VHT20)	5745	-4.242	-6.665	-6.665	-4.447	-0.058	30
	5785	-9.122	-9.593	-9.593	-7.375	-4.122	30
	5825	-11.577	-11.631	-11.631	-9.413	-6.375	30
802.11ac (VHT40)	5755	-8.737	-8.795	-8.795	-6.577	-3.537	30
	5795	-11.164	-11.708	-11.708	-9.490	-6.199	30

Note:

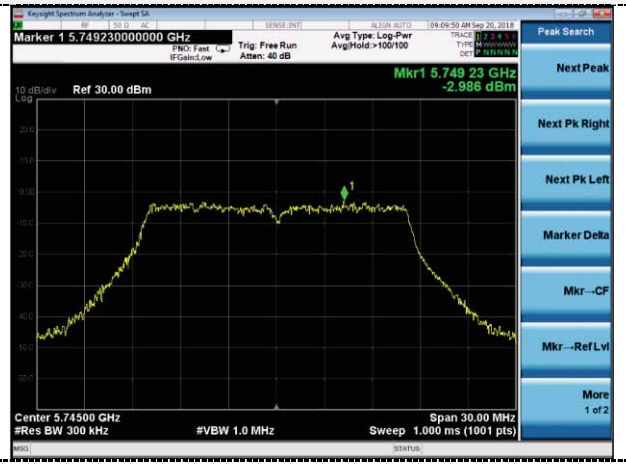
1. *Measured power spectrum density at difference data rate for each mode and recorded worst case for each mode.*
2. *Test results including cable loss;*
3. *Worst case data at 6Mbps at IEEE 802.11a; MCS0 at IEEE 802.11n HT20, IEEE 802.11n HT40, IEEE 802.11a VHT20 and IEEE 802.11ac VHT40;*
4. *The EUT used two monopole antenna for WIFI TX/RX, the directional gain=0.98+10log2=3.99dbi＜6 dbi.*
   So the power spectrum density limits of IEEE 802.11n HT20, IEEE 802.11 n HT40, IEEE 802.11 ac VHT20 and IEEE 802.11 ac VHT40 for MIMO with CDD technology should be reduced.
5. *Please refer to following test plots;*

5.8G Antenna 1

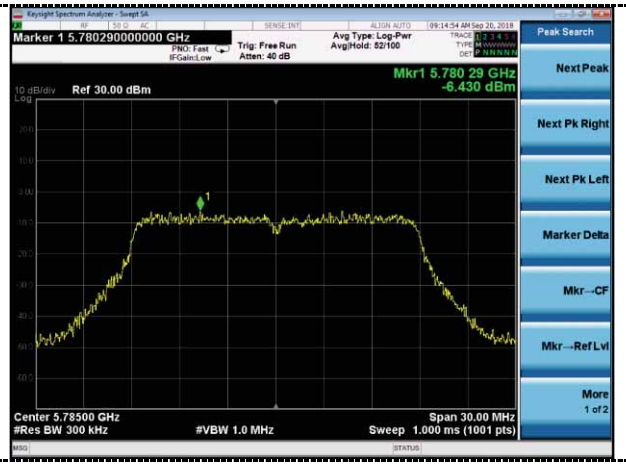
802.11a

CH 149

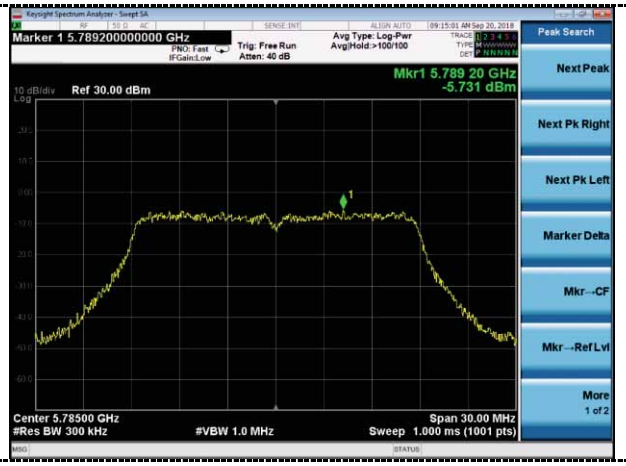
802.11n HT20



CH 149

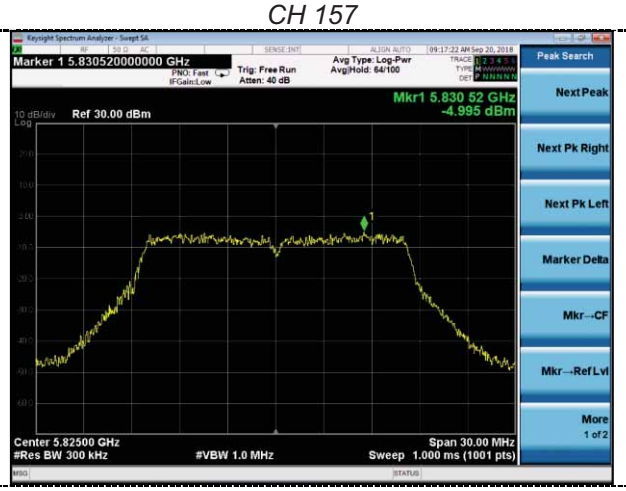


CH 157

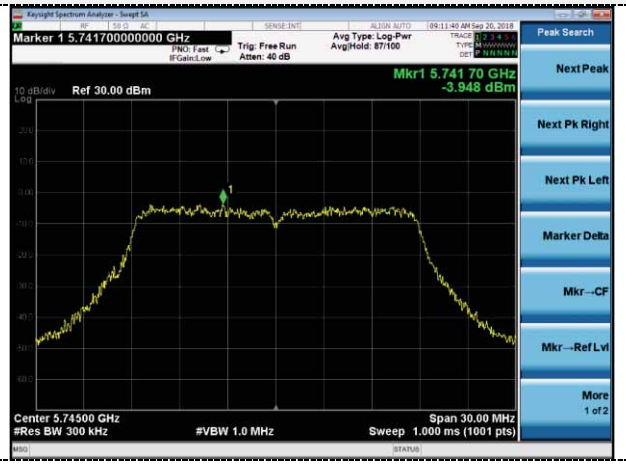
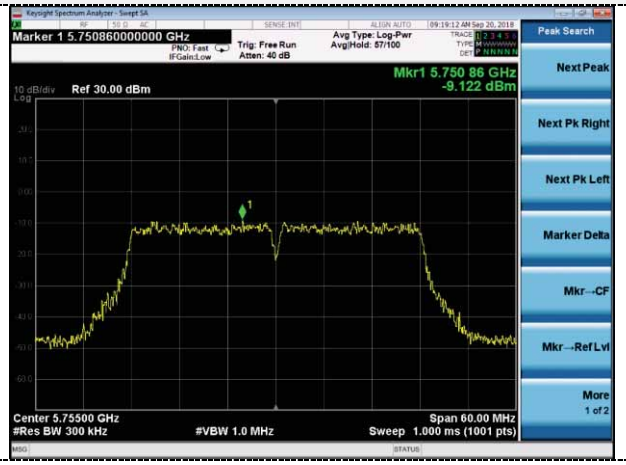
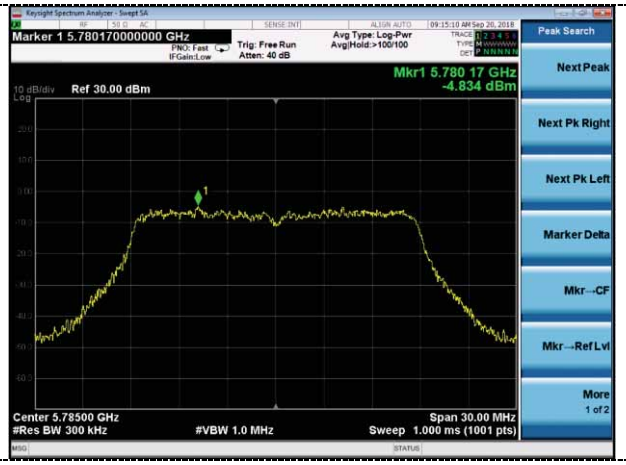
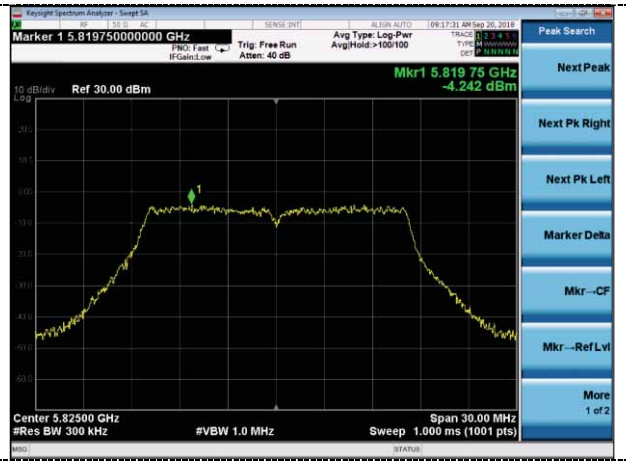


CH 157

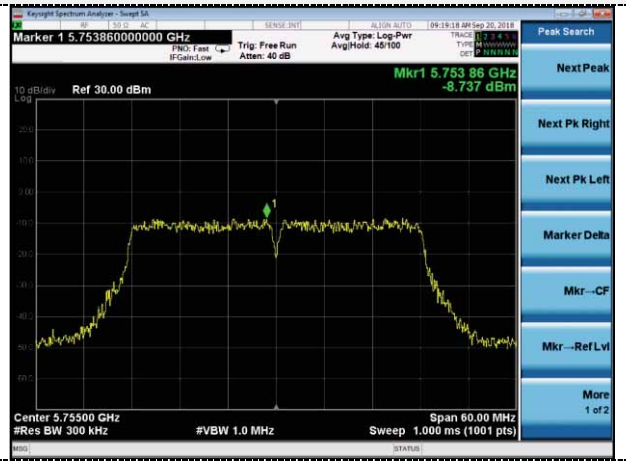
CH 165



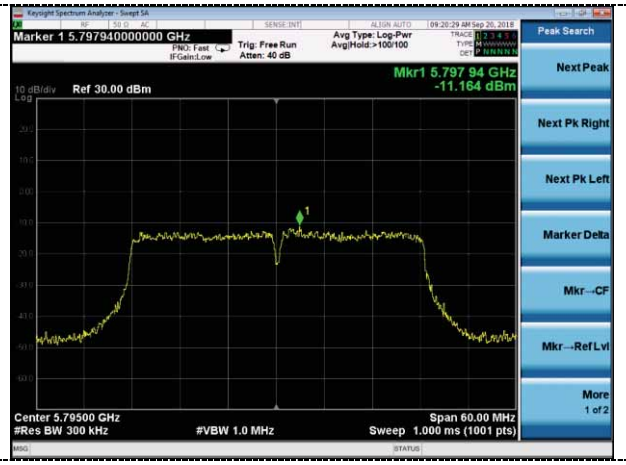
CH 165

802.11ac VHT20	802.11n HT40
	
CH 149	*CH 151*
	
CH 157	*CH 159*
	
CH 165	

802.11ac VHT40

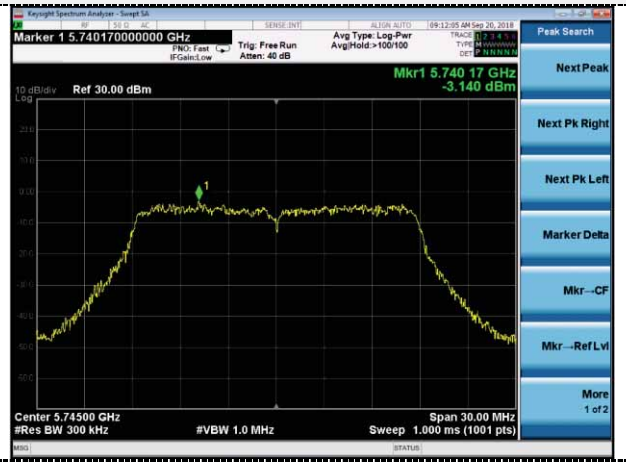
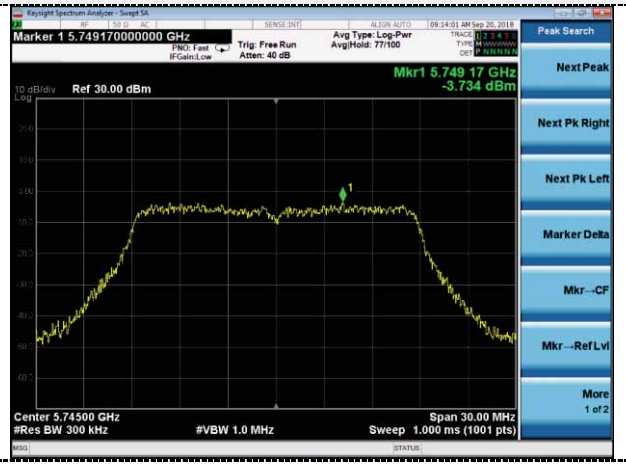
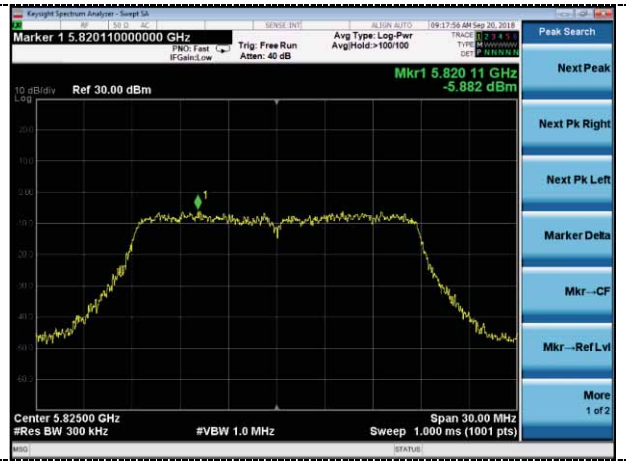


CH 151



CH 159

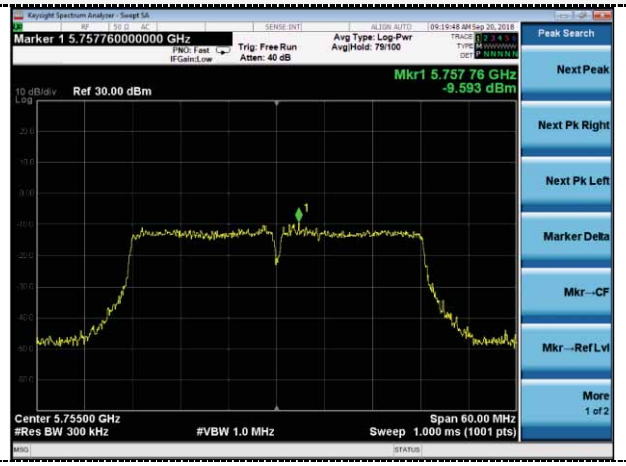
5.8G Antenna 2

802.11a	802.11n HT20
	
CH 149	*CH 149*
CH 157	*CH 157*
	
CH 165	*CH 165*

802.11ac VHT20

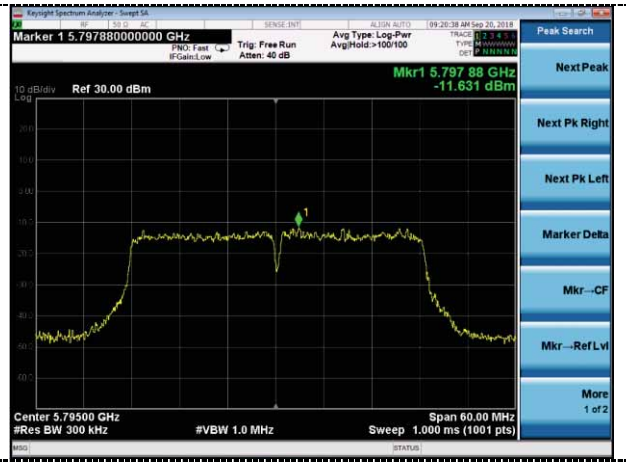
CH 149

802.11n HT40

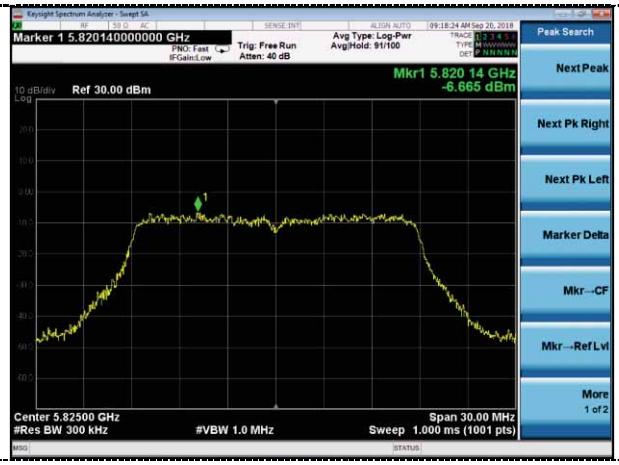


CH 151

CH 157

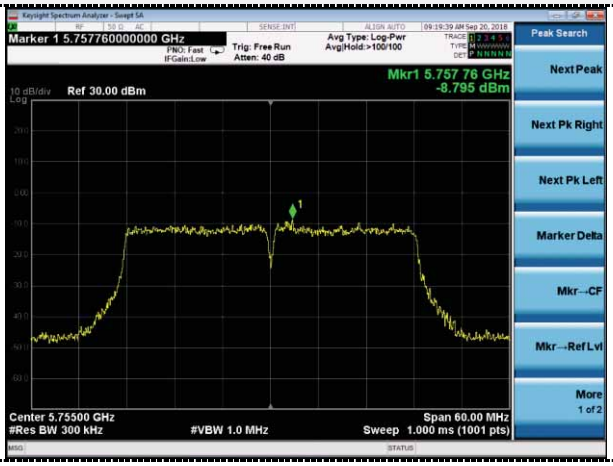


CH 159

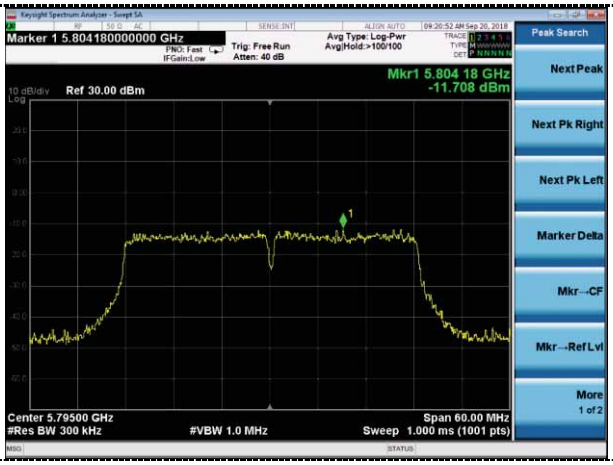


CH 165

802.11ac VHT40



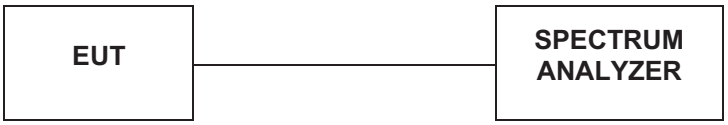
CH 151



CH 159

4.6. 6dB Bandwidth

TEST CONFIGURATION



TEST PROCEDURE

According to KDB789033 D02 General UNII Test Procedures New Rules v01 for one of the following procedures may be used for section 15.407(e) specifies the minimum 6 dB emission bandwidth of at least 500 KHz for the band 5.715-5.85 GHz. The following procedure shall be used for measuring this bandwidth:

a. Set RBW = 100 kHz.
b. Set the video bandwidth (VBW) ≥ 3 × RBW
c. Detector = Peak.
d. Trace mode = max hold.
e. Sweep = auto couple.
f. Allow the trace to stabilize
g. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

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

LIMIT

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

TEST RESULTS

Antenna 1

Type	Channel	6dB Bandwidth (MHz)	Limit (KHz)	Result
802.11ac	149	17.71	≥500	Pass
	157	17.74		
	165	16.56		
802.11n HT20	149	16.56	≥500	Pass
	157	17.77		
	165	16.57		
802.11ac VHT20	149	17.76	≥500	Pass
	157	17.72		
	165	16.54		
802.11n HT 40	151	36.54	≥500	Pass
	159	36.5		
802.11ac VHT40	151	36.57	≥500	Pass
	159	36.49		

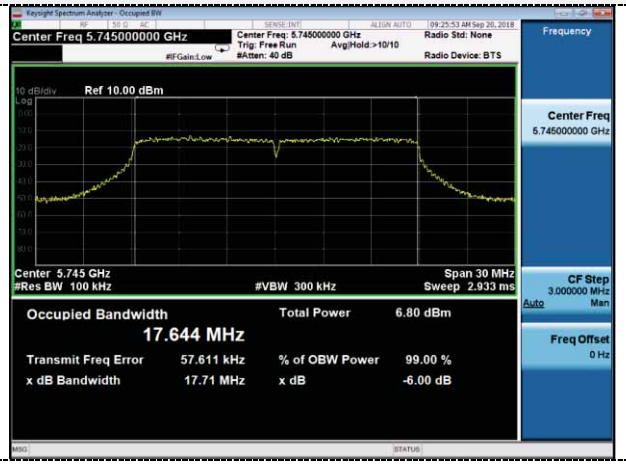
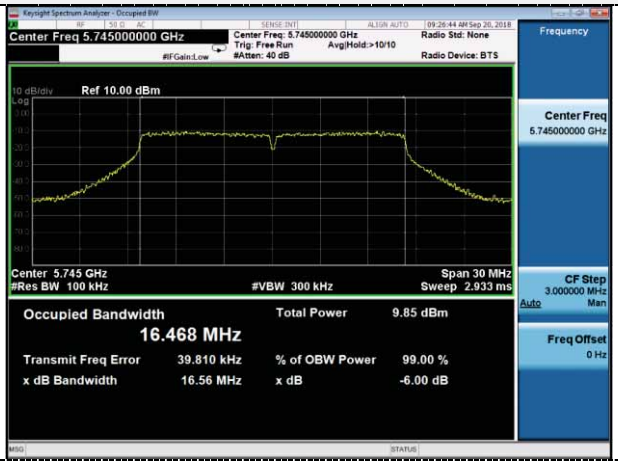
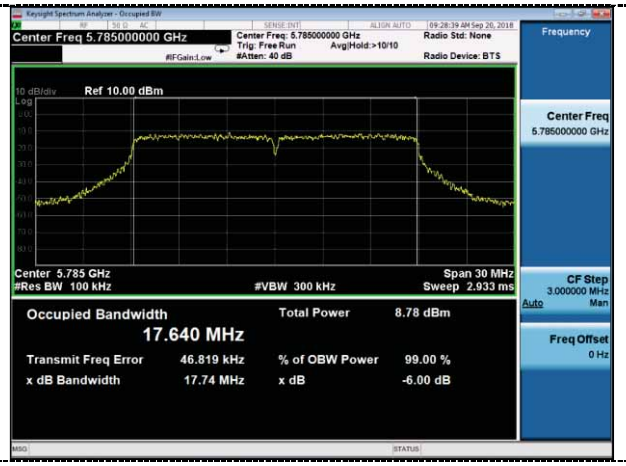
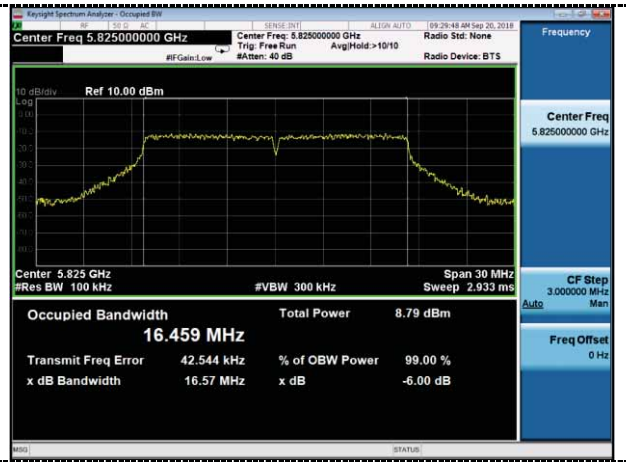
Antenna 2

Type	Channel	6dB Bandwidth (MHz)	Limit (KHz)	Result
802.11ac	149	17.75	≥500	Pass
	157	16.53		
	165	16.54		
802.11n HT20	149	16.56	≥500	Pass
	157	17.8		
	165	17.74		
802.11ac VHT20	149	16.55	≥500	Pass
	157	16.54		
	165	17.72		
802.11n HT 40	151	36.53	≥500	Pass
	159	36.47		
802.11ac VHT40	151	36.55	≥500	Pass
	159	36.47		

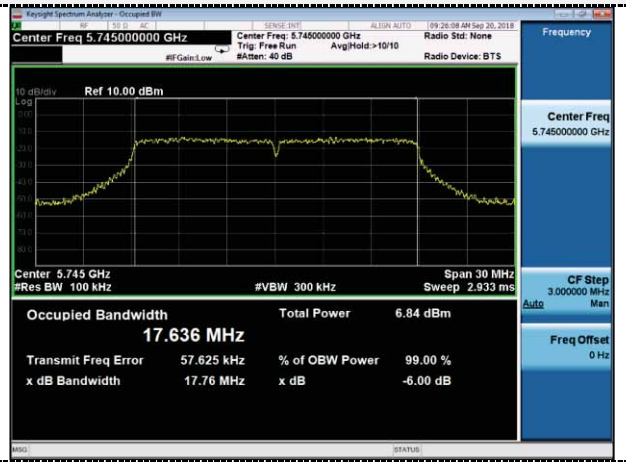
Note:

1. *Measured 6dB bandwidth at difference data rate for each mode and recorded worst case for each mode.*
2. *Test results including cable loss;*
3. *Worst case data at 6Mbps at IEEE 802.11a; MCS0 at IEEE 802.11n HT20, IEEE 802.11n HT40, IEEE 802.11a VHT20 and IEEE 802.11ac VHT40;*
4. *Please refer to following test plots;*

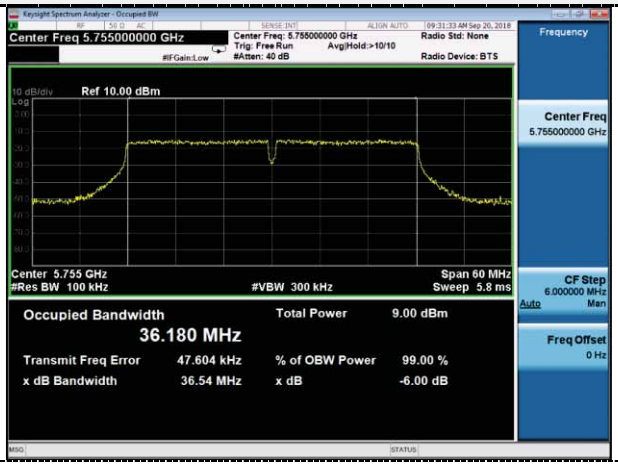
Antenna 1

802.11a	802.11n HT20
	
CH149	*CH149*
	
CH157	*CH157*
	
CH165	*CH165*

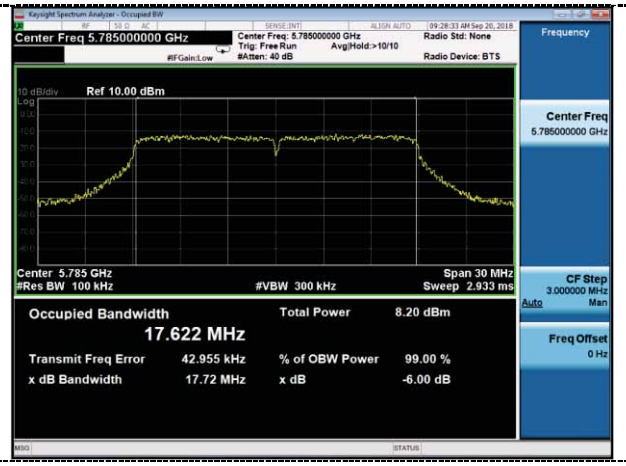
802.11ac *VHT20*



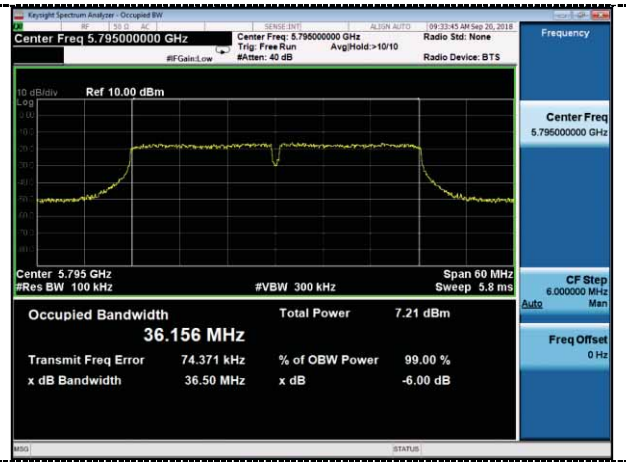
802.11n HT40



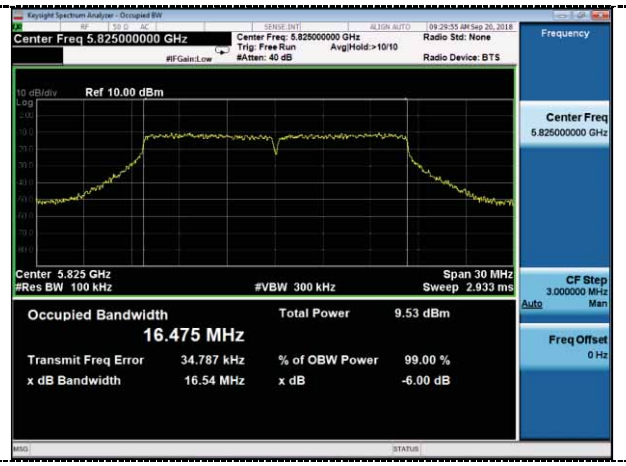
CH149



CH151



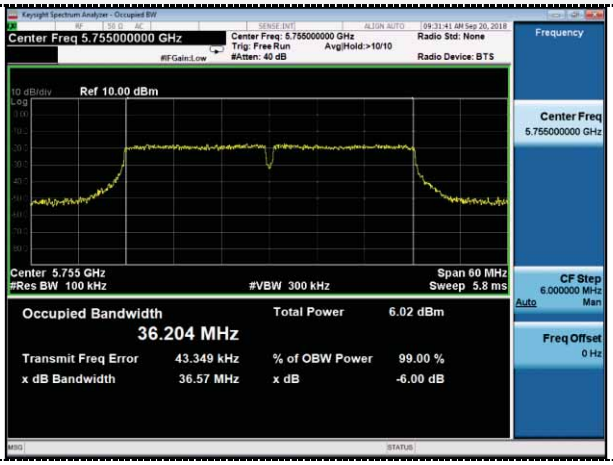
CH157



CH159

CH165

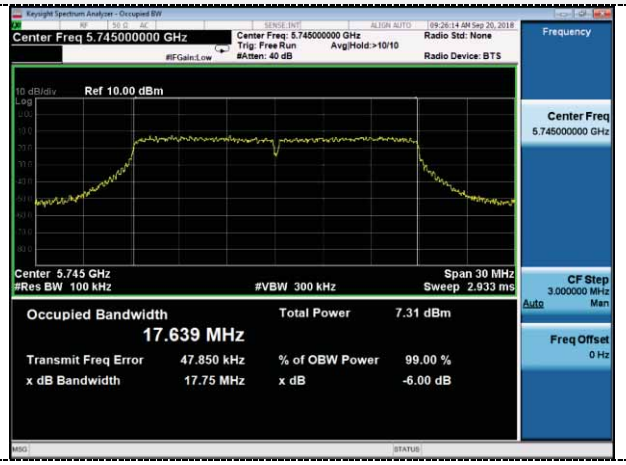
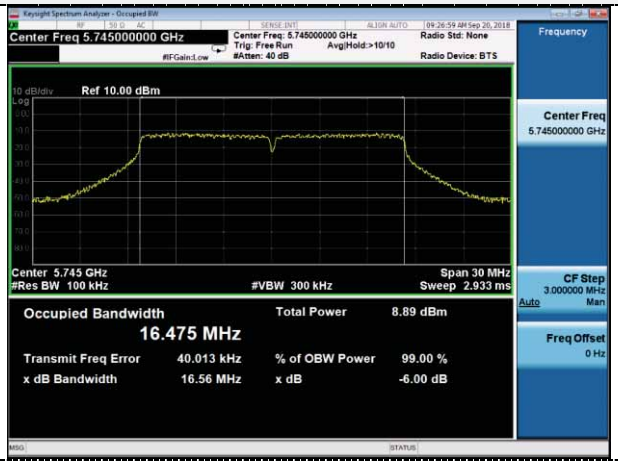
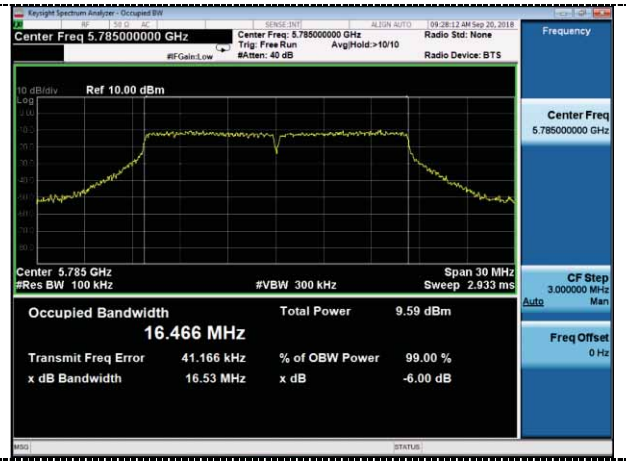
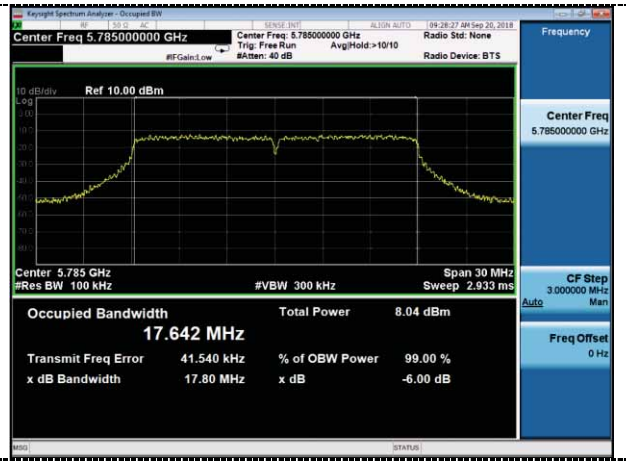
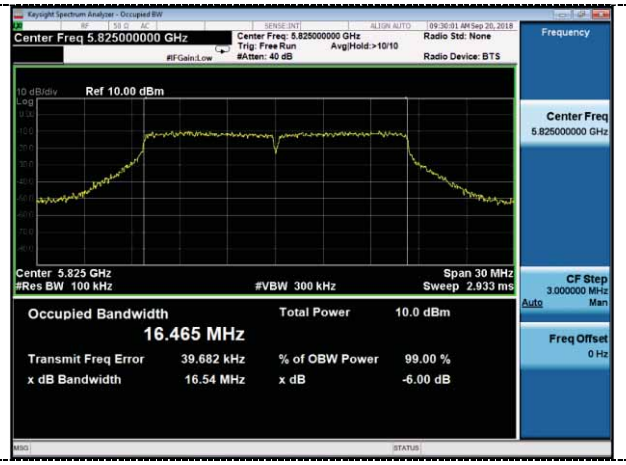
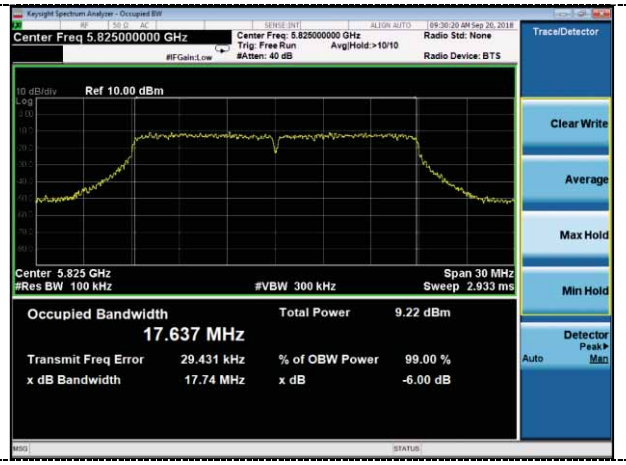
802.11ac VHT40



CH151

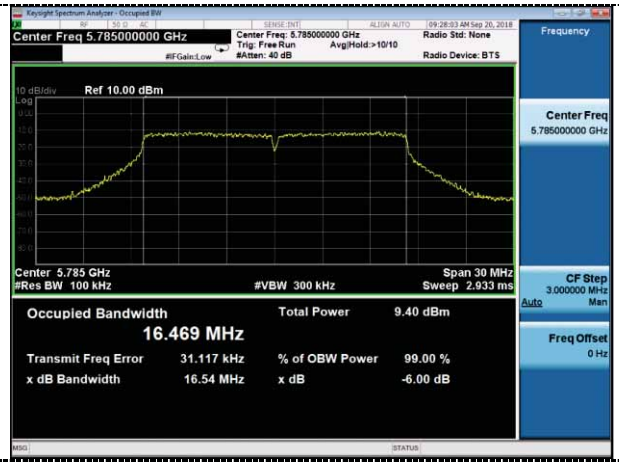
CH159

Antenna 2

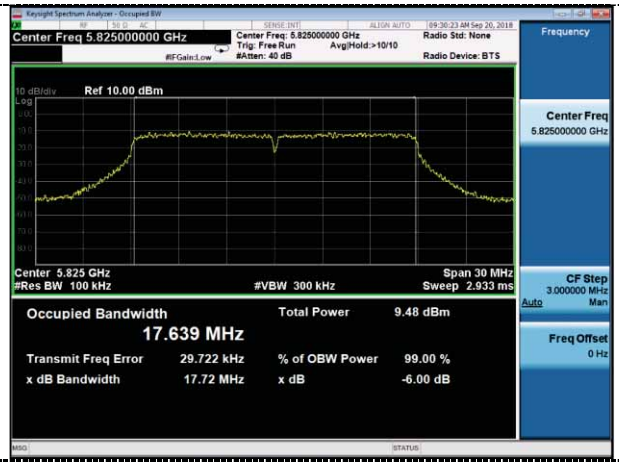
802.11a	*802.11n HT20*
	
CH149	*CH149*
	
CH157	*CH157*
	
CH165	*CH165*

802.11ac *VHT20*

CH149

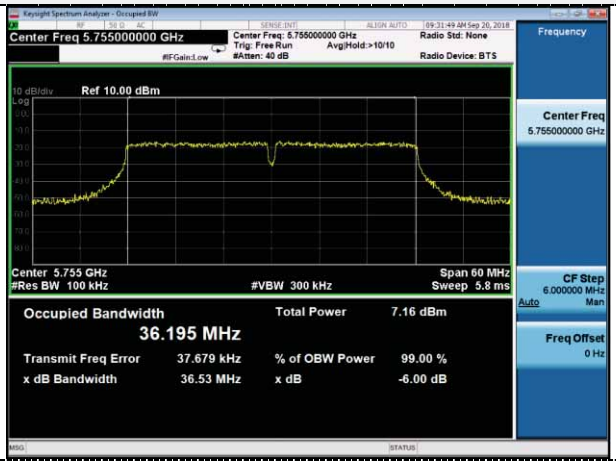


CH157



CH165

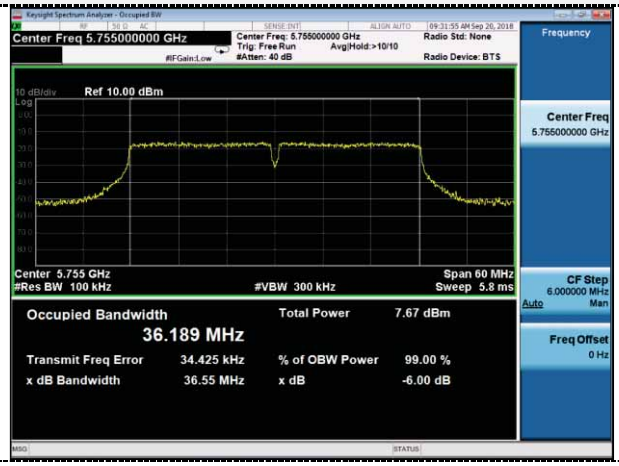
802.11n HT40



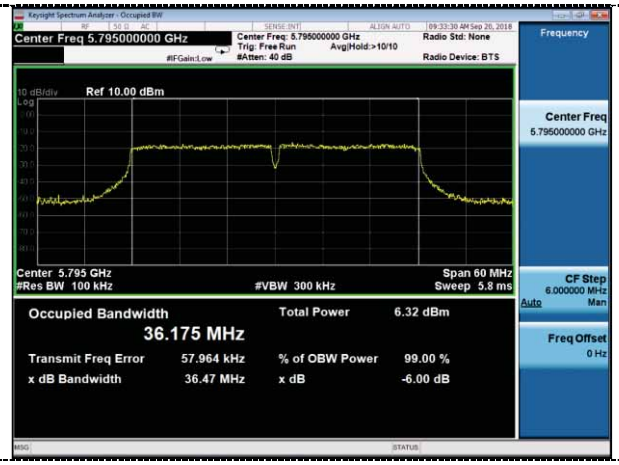
CH151

CH159

802.11ac VHT40



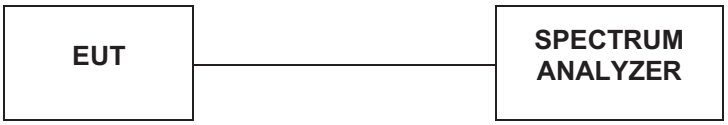
CH151



CH159

4.7. 26dBc Bandwidth

TEST CONFIGURATION



TEST PROCEDURE

Emission Bandwidth (EBW)

a) Set RBW = approximately 1% of the emission bandwidth.
b) Set the VBW > RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Measure the maximum width of the emission that is 26 dB down from the maximum of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

LIMIT

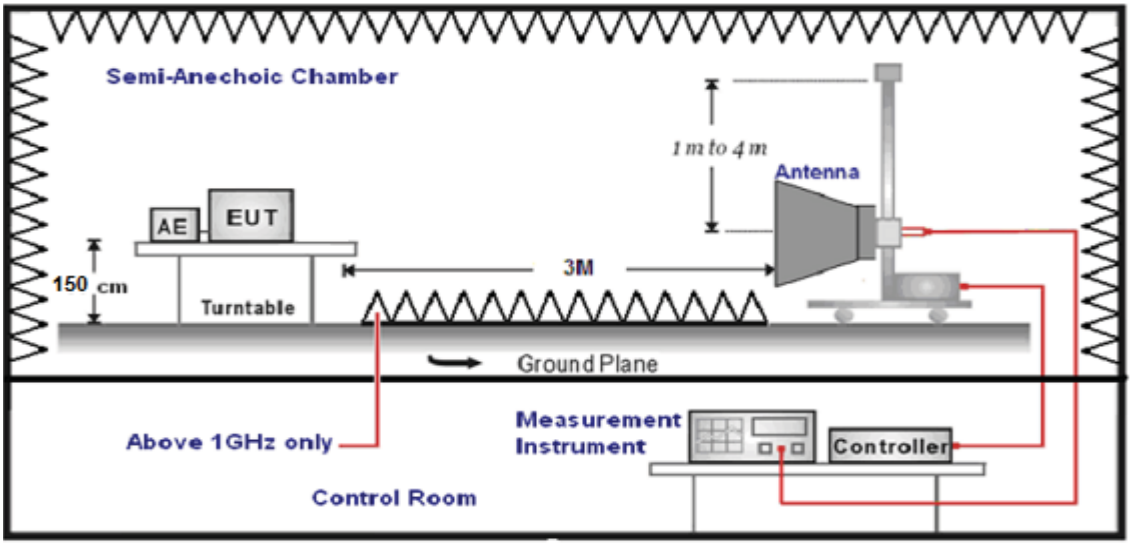
No Limits for 26dBc Bandwith

TEST RESULTS

This product is not applicable to this project.

4.8. Band Edge Compliance

TEST CONFIGURATION



LIMIT

20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

Frequency (MHz)	Distance (Meters)	Radiated (dBμV/m)	Radiated (μV/m)
0.009-0.49	3	20log(2400/F(KHz))+40log(300/3)	2400/F(KHz)
0.49-1.705	3	20log(24000/F(KHz))+ 40log(30/3)	24000/F(KHz)
1.705-30	3	20log(30)+ 40log(30/3)	30
30-88	3	40.0	100
88-216	3	43.5	150
216-960	3	46.0	200
Above 960	3	54.0	500

According to §15.407 (b):
For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.
For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.
For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.
For transmitters operating in the 5.725-5.85 GHz band:
All emissions shall be limited to a level of −27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

Frequency (MHz)		EIRP Limit (dBm)	Equivalent Field Strength at 3m (dBμV/m)
5150-5250		-27	68.3
5250-5350		-27	68.3
5470-5725		-27	68.3
5725-5850	Below 5650	-27	68.3
	5650-5700	-27~10	68.3~105.3
	5700-5720	10~15.6	105.3~110.9
	5720-5725	15.6~27	110.9~68.3
	5725-5850	27	122.3
	5850-5855	27~15.6	122.3~110.9
	5855-5875	15.6~10	110.9~105.3
	5875-5925	10~-27	105.3~68.3
	Above 5925	-27	68.3

TEST PROCEDURE

1. The EUT was placed on a turn table which is 1.5m above 1GHz.
2. Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0° to 360° to acquire the highest emissions from EUT.
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measurements have been completed..
5. The distance between test antenna and EUT as following table states:

Test Frequency range	Test Antenna Type	Test Distance
1GHz-18GHz	Double Ridged Horn Antenna	3

6. Setting test receiver/spectrum as following table states:

Test Frequency range	Test Receiver/Spectrum Setting	Detector
1GHz-18GHz	Peak Value: RBW=1MHz/VBW=3MHz, Sweep time=Auto Average Value: RBW=1MHz/VBW=10Hz, Sweep time=Auto	Peak

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor(if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CL - AG

Where FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
RA = Reading Amplitude	AG = Amplifier Gain
AF = Antenna Factor	

TEST RESULTS

Remark: We tested at all modes at the antenna single transmitting mode and the Mimo mode, and recored the worst data at the Mimo mode of the 802.11a Mode.

For Antenna 1

IEEE 802.11a							
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	EIRP (dBm/1MHz)	Detector	Limit (dBm/1MHz)	Over limit dB	Verdict
5650.000	-41.471	0.96	-40.511	Peak	-27	-13.511	PASS
5700.000	-41.519	0.96	-40.559	Peak	-27	-13.559	PASS
5720.000	-40.93	0.96	-39.97	Peak	-17	-22.97	PASS
5725.000	-42.593	0.96	-41.633	Peak	-17	-24.633	PASS
5850.000	-41.594	0.96	-40.634	Peak	-17	-23.634	PASS
5855.000	-42.573	0.96	-41.613	Peak	-17	-24.613	PASS
5875.000	-42.835	0.96	-41.875	Peak	-27	-14.875	PASS
5925.000	-43.635	0.96	-42.675	Peak	-27	-15.675	PASS

IEEE 802.11n HT20							
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	EIRP (dBm/1MHz)	Detector	Limit (dBm/1MHz)	Over limit dB	Verdict
5650.000	-42.097	0.96	-41.137	Peak	-27	-14.137	PASS
5700.000	-42.134	0.96	-41.174	Peak	-27	-14.174	PASS
5720.000	-41.346	0.96	-40.386	Peak	-17	-23.386	PASS
5725.000	-42.209	0.96	-41.249	Peak	-17	-24.249	PASS
5850.000	-41.397	0.96	-40.437	Peak	-17	-23.437	PASS
5855.000	-42.273	0.96	-41.313	Peak	-17	-24.313	PASS
5875.000	-41.354	0.96	-40.394	Peak	-27	-13.394	PASS
5925.000	-41.025	0.96	-40.065	Peak	-27	-13.065	PASS

IEEE 802.11ac20							
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	EIRP (dBm/1MHz)	Detector	Limit (dBm/1MHz)	Over limit dB	Verdict
5650.000	-42.88	0.96	-41.92	Peak	-27	-14.92	PASS
5700.000	-42.354	0.96	-41.394	Peak	-27	-14.394	PASS
5720.000	-42.847	0.96	-41.887	Peak	-17	-24.887	PASS
5725.000	-43.208	0.96	-42.248	Peak	-17	-25.248	PASS
5850.000	-40.286	0.96	-39.326	Peak	-17	-22.326	PASS
5855.000	-41.787	0.96	-40.827	Peak	-17	-23.827	PASS
5875.000	-43.402	0.96	-42.442	Peak	-27	-15.442	PASS
5925.000	-42.289	0.96	-41.329	Peak	-27	-14.329	PASS

IEEE 802.11n HT40							
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	EIRP (dBm/1MHz)	Detector	Limit (dBm/1MHz)	Over limit dB	Verdict
5650.000	-41.354	0.96	-40.394	Peak	-27	-13.394	PASS
5700.000	-41.766	0.96	-40.806	Peak	-27	-13.806	PASS
5720.000	-42.097	0.96	-41.137	Peak	-17	-24.137	PASS
5725.000	-40.421	0.96	-39.461	Peak	-17	-22.461	PASS
5850.000	-44.174	0.96	-43.214	Peak	-17	-26.214	PASS
5855.000	-42.227	0.96	-41.267	Peak	-17	-24.267	PASS
5875.000	-42.032	0.96	-41.072	Peak	-27	-14.072	PASS
5925.000	-43.607	0.96	-42.647	Peak	-27	-15.647	PASS

IEEE 802.11ac40							
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	EIRP (dBm/1MHz)	Detector	Limit (dBm/1MHz)	Over limit dB	Verdict
5650.000	-43.943	0.96	-42.983	Peak	-27	-15.983	PASS
5700.000	-42.355	0.96	-41.395	Peak	-27	-14.395	PASS
5720.000	-44.089	0.96	-43.129	Peak	-17	-26.129	PASS
5725.000	-41.916	0.96	-40.956	Peak	-17	-23.956	PASS
5850.000	-41.711	0.96	-40.751	Peak	-17	-23.751	PASS
5855.000	-42.203	0.96	-41.243	Peak	-17	-24.243	PASS
5875.000	-41.669	0.96	-40.709	Peak	-27	-13.709	PASS
5925.000	-40.574	0.96	-39.614	Peak	-27	-12.614	PASS

For Antenna 2

IEEE 802.11a							
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	EIRP (dBm/1MHz)	Detector	Limit (dBm/1MHz)	Over limit dB	Verdict
5650.000	-39.45	0.82	-38.63	Peak	-27	-11.63	PASS
5700.000	-42.602	0.82	-41.782	Peak	-27	-14.782	PASS
5720.000	-42.764	0.82	-41.944	Peak	-17	-24.944	PASS
5725.000	-42.233	0.82	-41.413	Peak	-17	-24.413	PASS
5850.000	-40.84	0.82	-40.02	Peak	-17	-23.02	PASS
5855.000	-41.106	0.82	-40.286	Peak	-17	-23.286	PASS
5875.000	-43.072	0.82	-42.252	Peak	-27	-15.252	PASS
5925.000	-41.532	0.82	-40.712	Peak	-27	-13.712	PASS

IEEE 802.11n 20							
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	EIRP (dBm/1MHz)	Detector	Limit (dBm/1MHz)	Over limit dB	Verdict
5650.000	-42.672	0.82	-41.852	Peak	-27	-14.852	PASS
5700.000	-42.198	0.82	-41.378	Peak	-27	-14.378	PASS
5720.000	-43.436	0.82	-42.616	Peak	-17	-25.616	PASS
5725.000	-43.337	0.82	-42.517	Peak	-17	-25.517	PASS
5850.000	-43.402	0.82	-42.582	Peak	-17	-25.582	PASS
5855.000	-43.531	0.82	-42.711	Peak	-17	-25.711	PASS
5875.000	-43.849	0.82	-43.029	Peak	-27	-16.029	PASS
5925.000	-41.839	0.82	-41.019	Peak	-27	-14.019	PASS

IEEE 802.11ac20							
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	EIRP (dBm/1MHz)	Detector	Limit (dBm/1MHz)	Over limit dB	Verdict
5650.000	-41.853	0.82	-41.033	Peak	-27	-14.033	PASS
5700.000	-42.094	0.82	-41.274	Peak	-27	-14.274	PASS
5720.000	-42.899	0.82	-42.079	Peak	-17	-25.079	PASS
5725.000	-41.642	0.82	-40.822	Peak	-17	-23.822	PASS
5850.000	-44.787	0.82	-43.967	Peak	-17	-26.967	PASS
5855.000	-43.003	0.82	-42.183	Peak	-17	-25.183	PASS
5875.000	-42.712	0.82	-41.892	Peak	-27	-14.892	PASS
5925.000	-42.107	0.82	-41.287	Peak	-27	-14.287	PASS

IEEE 802.11n40							
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	EIRP (dBm/1MHz)	Detector	Limit (dBm/1MHz)	Over limit dB	Verdict
5650.000	-42.968	0.82	-42.148	Peak	-27	-15.148	PASS
5700.000	-41.221	0.82	-40.401	Peak	-27	-13.401	PASS
5720.000	-41.448	0.82	-40.628	Peak	-17	-23.628	PASS
5725.000	-42.924	0.82	-42.104	Peak	-17	-25.104	PASS
5850.000	-42.553	0.82	-41.733	Peak	-17	-24.733	PASS
5855.000	-40.974	0.82	-40.154	Peak	-17	-23.154	PASS
5875.000	-41.791	0.82	-40.971	Peak	-27	-13.971	PASS
5925.000	-41.311	0.82	-40.491	Peak	-27	-13.491	PASS

IEEE 802.11ac40							
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	EIRP (dBm/1MHz)	Detector	Limit (dBm/1MHz)	Over limit dB	Verdict
5650.000	-42.654	0.82	-41.834	Peak	-27	-14.834	PASS
5700.000	-41.953	0.82	-41.133	Peak	-27	-14.133	PASS
5720.000	-41.717	0.82	-40.897	Peak	-17	-23.897	PASS
5725.000	-43.15	0.82	-42.33	Peak	-17	-25.33	PASS
5850.000	-39.384	0.82	-38.564	Peak	-17	-21.564	PASS
5855.000	-42.491	0.82	-41.671	Peak	-17	-24.671	PASS
5875.000	-42.304	0.82	-41.484	Peak	-27	-14.484	PASS
5925.000	-42.083	0.82	-41.263	Peak	-27	-14.263	PASS

For Combined Antenna 1 and Antenna 2

IEEE 802.11n20									
Frequency (MHz)	Conducted Power (dBm)			Directional Gain (dB)	EIRP (dBm/1MHz)	Detector	Limit (dBm/1MHz)	Over limit dB	Verdict
	Antenna 0	Antenna 1	Sum						
5650.000	-42.097	-42.672	-39.365	3.91	-35.455	Peak	-27	-8.455	PASS
5700.000	-42.134	-42.198	-39.156	3.91	-35.246	Peak	-27	-8.246	PASS
5720.000	-41.346	-43.436	-39.256	3.91	-35.346	Peak	-17	-18.346	PASS
5725.000	-42.209	-43.337	-39.726	3.91	-35.816	Peak	-17	-18.816	PASS
5850.000	-41.397	-43.402	-39.275	3.91	-35.365	Peak	-17	-18.365	PASS
5855.000	-42.273	-43.531	-39.846	3.91	-35.936	Peak	-17	-18.936	PASS
5875.000	-41.354	-43.849	-39.414	3.91	-35.504	Peak	-27	-8.504	PASS
5925.000	-41.025	-41.839	-38.403	3.91	-34.493	Peak	-27	-7.493	PASS

IEEE 802.11ac20									
Frequency (MHz)	Conducted Power (dBm)			Directional Gain (dB)	EIRP (dBm/1MHz)	Detector	Limit (dBm/1MHz)	Over limit dB	Verdict
	Antenna 0	Antenna 1	Sum						
5650.000	-42.88	-41.853	-39.326	3.91	-35.416	Peak	-27	-8.416	PASS
5700.000	-42.354	-42.094	-39.212	3.91	-35.302	Peak	-27	-8.302	PASS
5720.000	-42.847	-42.899	-39.863	3.91	-35.953	Peak	-17	-18.953	PASS
5725.000	-43.208	-41.642	-39.344	3.91	-35.434	Peak	-17	-18.434	PASS
5850.000	-40.286	-44.787	-38.967	3.91	-35.057	Peak	-17	-18.057	PASS
5855.000	-41.787	-43.003	-39.342	3.91	-35.432	Peak	-17	-18.432	PASS
5875.000	-43.402	-42.712	-40.033	3.91	-36.123	Peak	-27	-9.123	PASS
5925.000	-42.289	-42.107	-39.187	3.91	-35.277	Peak	-27	-8.277	PASS

IEEE 802.11n40									
Frequency (MHz)	Conducted Power (dBm)			Directional Gain (dB)	EIRP (dBm/1MHz)	Detector	Limit (dBm/1MHz)	Over limit dB	Verdict
	Antenna 0	Antenna 1	Sum						
5650.000	-41.354	-42.968	-39.076	3.91	-35.166	Peak	-27	-8.166	PASS
5700.000	-41.766	-41.221	-38.475	3.91	-34.565	Peak	-27	-7.565	PASS
5720.000	-42.097	-41.448	-38.750	3.91	-34.840	Peak	-17	-17.840	PASS
5725.000	-40.421	-42.924	-38.484	3.91	-34.574	Peak	-17	-17.574	PASS
5850.000	-44.174	-42.553	-40.278	3.91	-36.368	Peak	-17	-19.368	PASS
5855.000	-42.227	-40.974	-38.545	3.91	-34.635	Peak	-17	-17.635	PASS
5875.000	-42.032	-41.791	-38.900	3.91	-34.990	Peak	-27	-7.990	PASS
5925.000	-43.607	-41.311	-39.299	3.91	-35.389	Peak	-27	-8.389	PASS

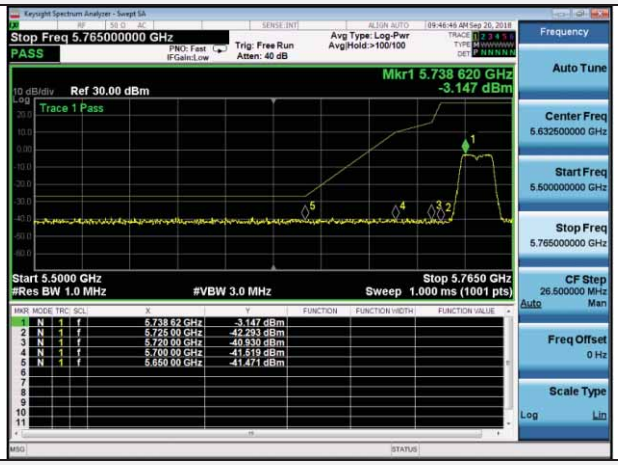
IEEE 802.11ac40									
Frequency (MHz)	Conducted Power (dBm)			Directional Gain (dB)	EIRP (dBm/1MHz)	Detector	Limit (dBm/1MHz)	Over limit dB	Verdict
	Antenna 0	Antenna 1	Sum						
5650.000	-43.943	-42.654	-40.241	3.91	-36.331	Peak	-27	-9.331	PASS
5700.000	-42.355	-41.953	-39.139	3.91	-35.229	Peak	-27	-8.229	PASS
5720.000	-44.089	-41.717	-39.733	3.91	-35.823	Peak	-17	-18.823	PASS
5725.000	-41.916	-43.15	-39.479	3.91	-35.569	Peak	-17	-18.569	PASS
5850.000	-41.711	-39.384	-37.383	3.91	-33.473	Peak	-17	-16.473	PASS
5855.000	-42.203	-42.491	-39.334	3.91	-35.424	Peak	-17	-18.424	PASS
5875.000	-41.669	-42.304	-38.965	3.91	-35.055	Peak	-27	-8.055	PASS
5925.000	-40.574	-42.083	-38.253	3.91	-34.343	Peak	-27	-7.343	PASS

Remark:

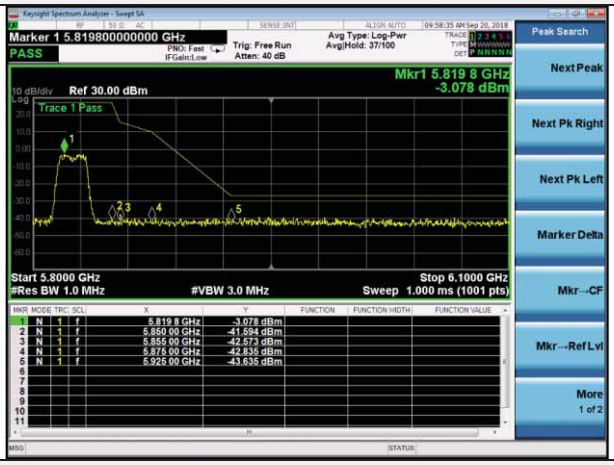
1. *Measured unwanted emission at difference data rate for each mode and recorded worst case for each mode.*
2. *Test results including cable loss;*
3. *Worst case data at 6Mbps at IEEE 802.11a; MCS0 at IEEE 802.11n HT20, IEEE 802.11n HT40;*
4. *For MIMO with CCD technology device, The Directional Gain= Gain of individual transmit antennas (dBi) + Array gain;*
   Array gain = 10 log (N_{ant}), where N_{ant} is the number of transmit antennas.
5. *3.99=0.98+10*log(2), 3.83=0.82+10*log(2).*
6. *E.I.R.P = Conducted power + Directional Gain*
7. *Please refer to following test plots;*

5.8G Antenna 1

802.11a

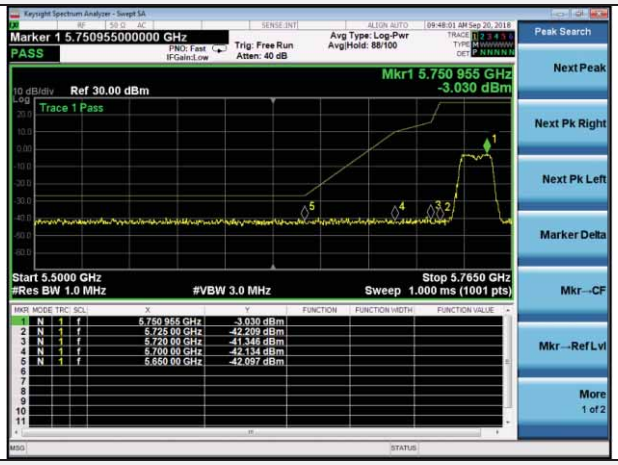


5745



5825

802.11n HT20



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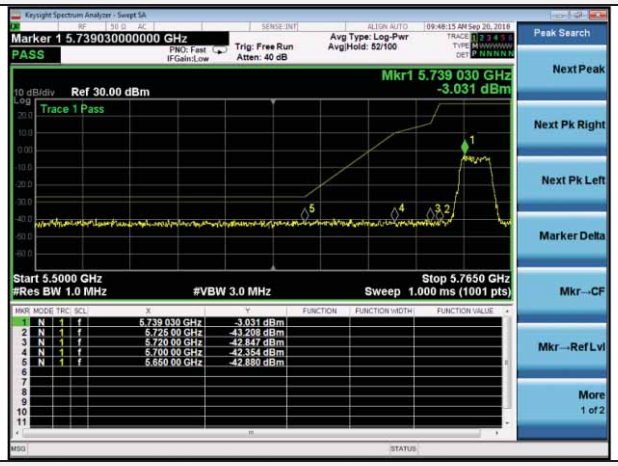
5825

802.11ac VHT20



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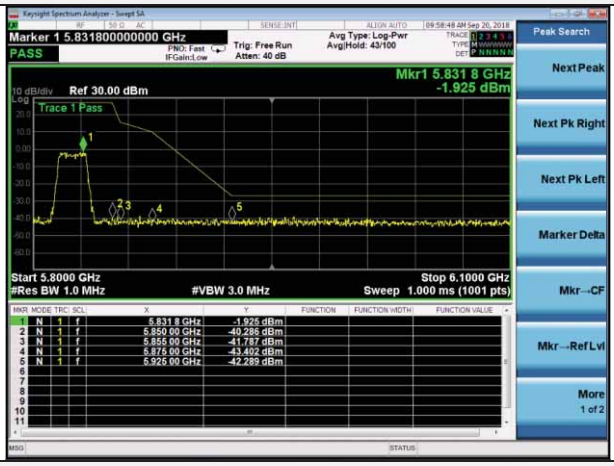


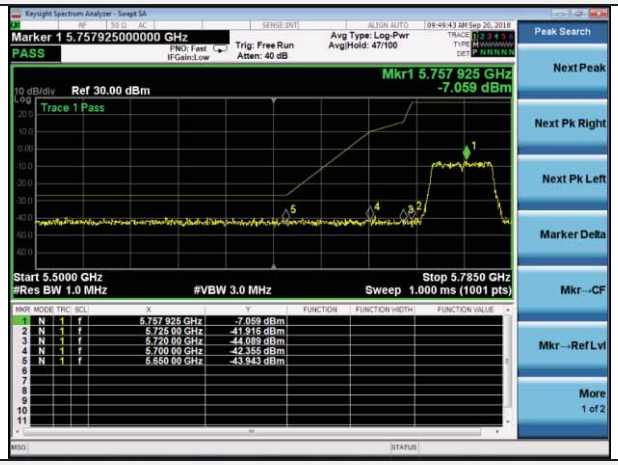
5825

802.11n HT40

5755

5795

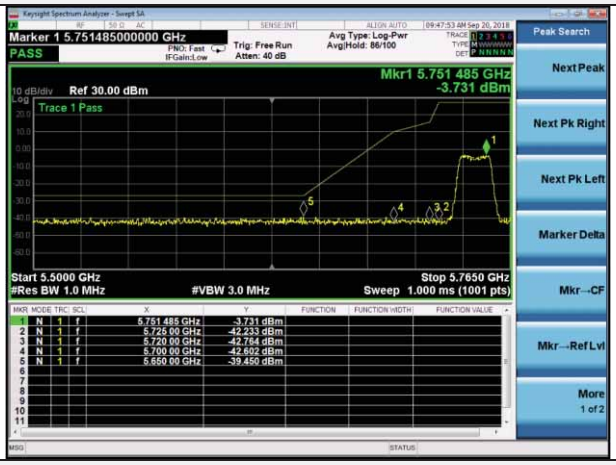
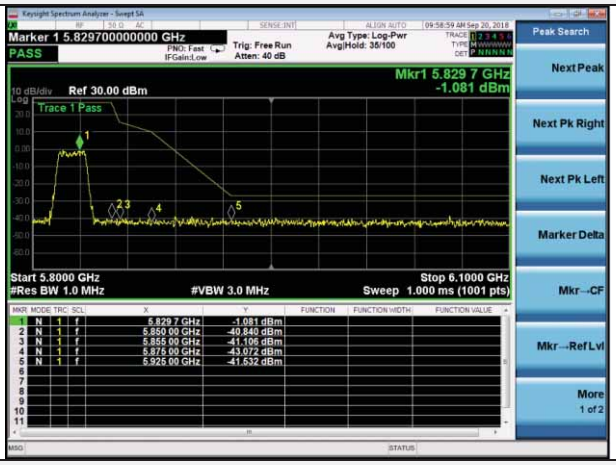
802.11ac VHT40



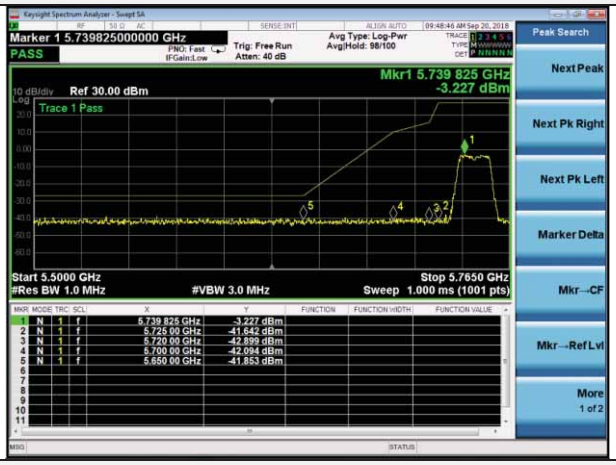
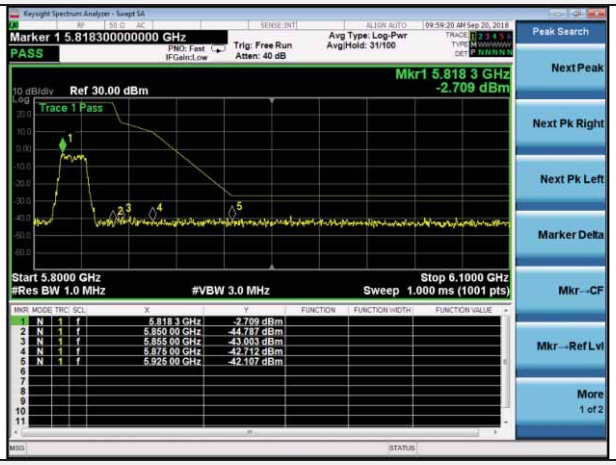
5755

5795

5.8G Antenna 2

802.11a	
	
5745	5825

802.11n HT20	
5745	5825

802.11ac VHT20	
	
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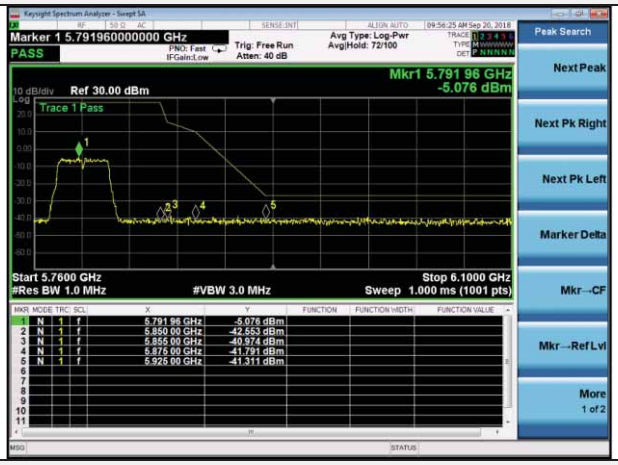
802.11n HT40

5755



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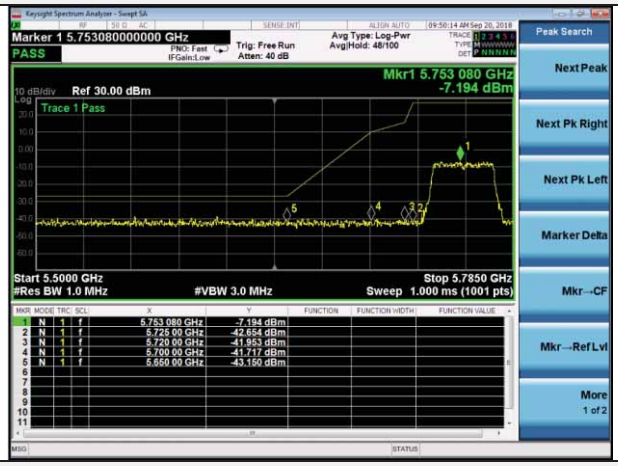
802.11ac VHT40



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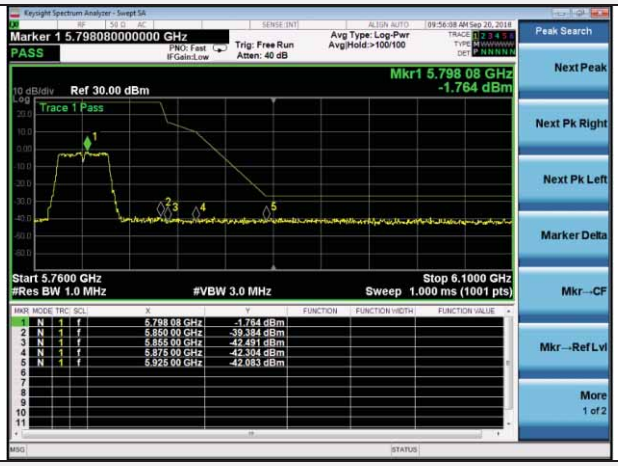
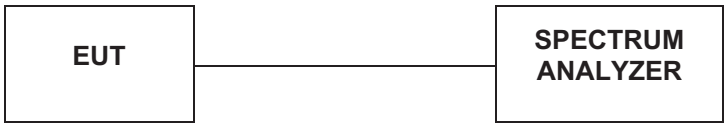


5795

4.9. Frequency Stability

TEST CONFIGURATION



TEST PROCEDURE

a. The EUT was directly connected to the spectrum analyzer and antenna output port
b. Spectrum setting as follows:
   RBW=10KHz
   VBW=30KHz
   Span= Entire absence of modulation emissionsbandwidth
   Sweep Time= Auto
   Attenuation= Auto
c. The test extreme voltage is to change the primary supply voltage from 85 to 115 percent of the nominal value.

LIMIT

Frequency Range (MHz)	Limit
5150-5250	Specifiedin the user's manual
5250-5350	
5470-5725	
5725-5850	

TEST RESULTS

Antenna 1

802.11 a/ Channel 149: 5745MHz

Voltage. Frequency Stability

Voltage (V)	Measurement Frequency (MHz)
7.8	5745.005
8.6	5745.006
7.2	5745.005
Maximum Deviation (MHz)	0.006
Maximum Deviation (ppm)	1.04

Temperature. Frequency Stability

Temperature (℃)	Measurement Frequency (MHz)
-10	5745.005
5	5745.004
15	5745.005
25	5745.006
35	5745.005
45	5745.006
55	5745.005
Maximum Deviation (MHz)	0.006
Maximum Deviation (ppm)	1.04

Antenna 2

802.11 a/ Channel 149: 5745MHz

Voltage. Frequency Stability

Voltage (V)	Measurement Frequency (MHz)
7.8	5745.006
8.6	5745.005
7.2	5745.006
Maximum Deviation (MHz)	0.006
Maximum Deviation (ppm)	1.04

Temperature. Frequency Stability

Temperature (℃)	Measurement Frequency (MHz)
-10	5745.005
5	5745.006
15	5745.005
25	5745.006
35	5745.004
45	5745.006
55	5745.006
Maximum Deviation (MHz)	0.006
Maximum Deviation (ppm)	1.04

4.10. Antenna Requirement

Standard Applicable

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

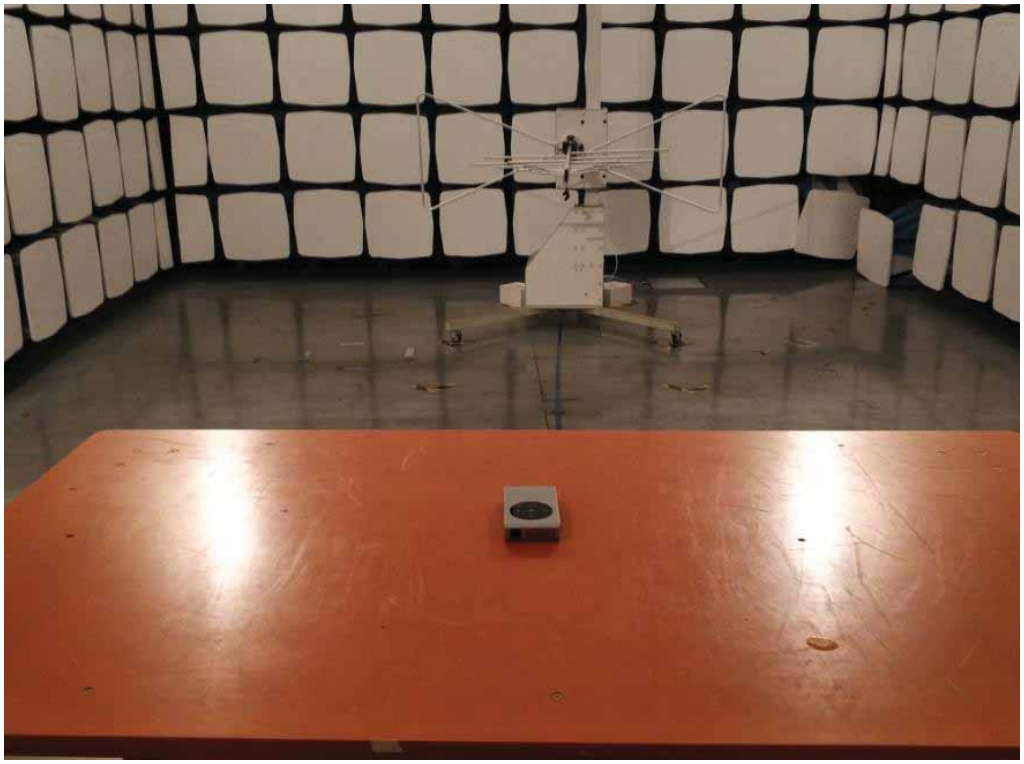
And according to FCC 47 CFR Section 15.407 (a), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

Test Result

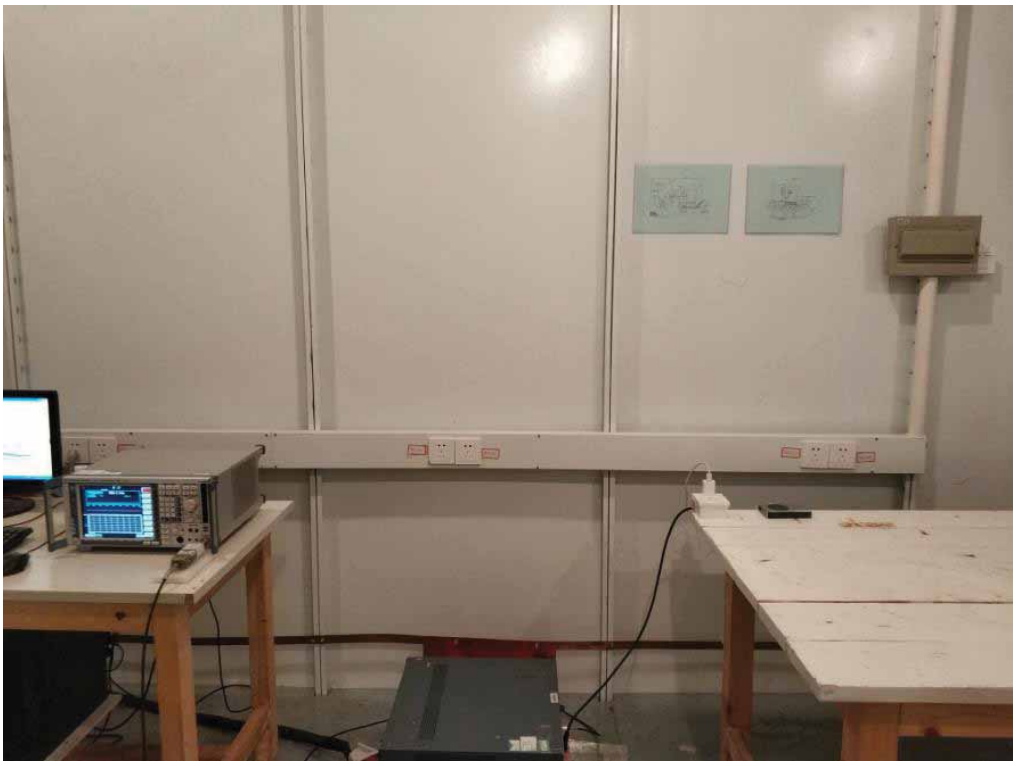
The antenna used for this product is internal Antenna and that no antenna other than that furnished by the responsible party shall be used with the device, the maximum peak gain of the transmit antenna is only 0.98dB for ANT 1 and 0.82 dB for ANT 2.

5. Test Setup Photos of the EUT

Radiated Emission Test



Conducted Emission



6. External and Internal Photos of the EUT

Reference to the test report No. GTSR18080197-WLAN01.

.....End of Report.....