FCC TEST REPORT

For

Shenzhen SEI Robotics Co., Ltd.

4K ATV STICK

Test Model: SN5B6AD

List Model No.: SN5B6AX(X=A to Z), BEAST, SET210

Prepared for	:	Shenzhen SEI Robotics Co., Ltd.
Address	:	3F(East), Block D, SDG Infoport, No.2 Kefeng Road, Nanshan District, Shenzhen, P.R. China
Prepared by	:	Shenzhen LCS Compliance Testing Laboratory Ltd.
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Date of receipt of test sample	:	March 1, 2018
Number of tested samples	:	1
Serial number	:	Prototype
Date of Test	:	March 1, 2018~March 24, 2018
Date of Report	:	March 27, 2018

FCC TEST REPORT
FCC CFR 47 PART 15 E(15.407)

Report Reference No.	**:**	**LCS171204015AE3**
Date of Issue	:	March 27, 2018
Testing Laboratory Name.....	**:**	**Shenzhen LCS Compliance Testing Laboratory Ltd.**
Address	:	1F., Xingyuan Industrial Park, Tongda Road, Bao'an Blvd., Bao'an District, Shenzhen, Guangdong, China
Testing Location/ Procedure.....	:	Full application of Harmonised standards ■ Partial application of Harmonised standards ☐ Other standard testing method ☐
Applicant's Name.....	**:**	**Shenzhen SEI Robotics Co., Ltd.**
Address	:	3F(East), Block D, SDG Infoport, No.2 Kefeng Road, Nanshan District, Shenzhen, P.R. China
Test Specification		
Standard	:	FCC CFR 47 PART 15 E(15.407)
Test Report Form No.....	**:**	LCSEMC-1.0
TRF Originator	:	Shenzhen LCS Compliance Testing Laboratory Ltd.
Master TRF.....	:	Dated 2011-03

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EUT Description.	**:**	**4K ATV STICK**
Trade Mark	:	N/A
Model/ Type reference.....	:	SN5B6AD
Ratings	:	DC 5V by adapter
Result	:	**Positive**

Compiled by:	**Supervised by:**	**Approved by:**
Linda He	Dick Su	Gavin Liang
Linda He/ File administrators	Dick Su / Technique principal	Gavin Liang/ Manager

FCC -- TEST REPORT

Test Report No. : LCS171204015AE3	March 27, 2018 Date of issue

EUT.....	: 4K ATV STICK
Type / Model.....	: SN5B6AD
Applicant.....	**: Shenzhen SEI Robotics Co., Ltd.**
Address.....	: 3F(East), Block D, SDG Infoport, No.2 Kefeng Road, Nanshan District, Shenzhen, P.R. China
Telephone.....	: /
Fax.....	: /
Manufacturer.....	**: Shenzhen SEI Robotics Co., Ltd.**
Address.....	: 3F(East), Block D, SDG Infoport, No.2 Kefeng Road, Nanshan District, Shenzhen, P.R. China
Telephone.....	: /
Fax.....	: /
Factory.....	**: Shenzhen SEI Robotics Co., Ltd.**
Address.....	: 3F(East), Block D, SDG Infoport, No.2 Kefeng Road, Nanshan District, Shenzhen, P.R. China
Telephone.....	: /
Fax.....	: /

Test Result:	**Positive**

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.

Revision History

Revision	Issue Date	Revisions	Revised By
000	March 27, 2018	Initial Issue	Gavin Liang

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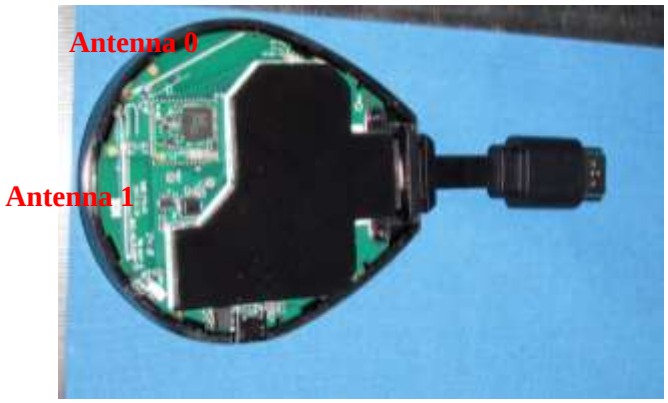
1. GENERAL INFORMATION

1.1. Description of Device (EUT)

EUT	:	4K ATV Stick
Model Number	:	SN5B6AX(X=A to Z), BEAST, SET210
Model Declaration	:	PCB board, structure and internal of these model(s) are the same, Only models name is different for these models.
Test Model	:	SN5B6AD
Power Supply	:	DC 5V by adapter
Hardware version	:	SMB.179.06
Software version	:	8.0.0
Bluetooth Version	:	V4.1
Channel Number	:	79 Channels for Bluetooth V3.0(DSS) 40 Channels for Bluetooth V4.1(DTS)
Modulation Technology	:	GFSK, π/4-DQPSK, 8-DPSK for Bluetooth V3.0(DSS) GFSK for Bluetooth V4.1(DTS)
Data Rates	:	Bluetooth V3.0(DSS): 1~3Mbps Bluetooth V4.1(DTS): 1Mbps
WLAN	:	Supported IEEE 802.11a/b/g/n/ac
WLAN FCC Operation Frequency	:	IEEE 802.11b:2412-2462MHz IEEE 802.11g:2412-2462MHz IEEE 802.11n HT20:2412-2462MHz / 5180-5240MHz / 5745-5825MHz IEEE 802.11n HT40:2422-2452MHz / 5190-5230MHz / 5755-5795MHz IEEE 802.11a: 5180-5240MHz / 5745-5825MHz IEEE 802.11ac VHT20: 5180-5240MHz / 5745-5825MHz IEEE 802.11ac VHT40: 5190-5230MHz / 5755-5795MHz IEEE 802.11ac VHT80: 5210MHz / 5775MHz
WLAN Channel Number	:	11 Channels for 2412-2462MHz(IEEE 802.11b/g/n HT20) 7 Channels for 2422-2452MHz(IEEE 802.11n HT40) 4 Channels for 5180-5240MHz (IEEE 802.11a/ac VHT20/n HT20) 2 Channels for 5190-5230MHz (IEEE 802.11ac VHT40/n HT40) 1 Channels for 5210MHz (IEEE 802.11ac VHT80) 5 Channels for 5745-5825MHz(IEEE 802.11a/ac VHT20/n HT20) 2 Channels for 5755-5795MHz(IEEE 802.11ac VHT40/n HT40) 1 Channels for 5775MHz(IEEE 802.11ac VHT80)
WLAN Modulation Technology	:	IEEE 802.11b: DSSS(CCK,DQPSK,DBPSK) IEEE 802.11g: OFDM (64QAM, 16QAM, QPSK, BPSK) IEEE 802.11n: OFDM (64QAM, 16QAM, QPSK, BPSK) IEEE 802.11a: OFDM (64QAM, 16QAM, QPSK, BPSK) IEEE 802.11ac: OFDM (256QAM, 64QAM, 16QAM, QPSK, BPSK)
Antenna Type And Gain	:	Two same Antenna: Internal Antenna 0, 2.15dBi(Max.), for TX/RX (Bluetooth and WLAN) Internal Antenna 1, 2.15dBi(Max.), for TX/RX (WLAN) 802.11n/ac support 2T2R.
Directional Gain	:	2.15 + 10log(2) = 5.16 dBi for MIMO 2.15 dBi for SISO



1.2. Host System Configuration List and Details

Manufacturer	Description	Model	Serial Number	Certificate
SUNUN	Adapter	SA69-050200U	A69-84	N/A

1.3. External I/O Port

I/O Port Description	Quantity	Cable
USB Port	1	1m, unshielded
HDMI Port	1	N/A

1.4. Description of Test Facility

FCC Registration Number. is 254912.
Industry Canada Registration Number. is 9642A-1.
ESMD Registration Number. is ARCB0108.
UL Registration Number. is 100571-492.
TUV SUD Registration Number. is SCN1081.
TUV RH Registration Number. is UA 50296516-001
NVLAP Registration Code is 600167-0

The 3m-Semi anechoic test site fulfils CISPR 16-1-4 according to ANSI C63.4:2014 and CISPR 16-1-4:2010 SVSWR requirement for radiated emission above 1GHz.

1.5. 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 LCS 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.

1.6. Measurement Uncertainty

Test Item		Frequency Range	Uncertainty	Note
Radiation Uncertainty	:	9KHz~30MHz	3.10dB	(1)
		30MHz~200MHz	2.96dB	(1)
		200MHz~1000MHz	3.10dB	(1)
		1GHz~26.5GHz	3.80dB	(1)
		26.5GHz~40GHz	3.90dB	(1)
Conduction Uncertainty	:	150kHz~30MHz	1.63dB	(1)
Power disturbance	:	30MHz~300MHz	1.60dB	(1)

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

1.7. Description of Test Modes

The EUT has been tested under operating condition.

This test was performed with EUT in X, Y, Z position and the worst case was found when EUT in X position.

Worst-case mode and channel used for 150 kHz-30 MHz power line conducted emissions was the mode and channel with the highest output power that was determined to be IEEE 802.11a mode (High Channel).

Worst-case mode and channel used for 9kHz-1000 MHz radiated emissions was the mode and channel with the highest output power, that was determined to be IEEE 802.11a mode(High Channel).

Worst-Case data rates were utilized from preliminary testing of the Chipset, worst-case data rates used during the testing are as follows:

IEEE 802.11a Mode : 6 Mbps, OFDM.
IEEE 802.11ac VHT20 Mode: MCS0
IEEE 802.11n HT20 Mode: MCS0, OFDM.
IEEE 802.11ac VHT40 Mode: MCS0, OFDM.
IEEE 802.11n HT40 Mode: MCS0, OFDM.
IEEE 802.11ac VHT80 Mode: MCS0, OFDM.

Antenna & Bandwidth

Antenna	Single (Port.1)			Two (Port.1 + Port.2)		
Bandwidth Mode	20MHz	40MHz	80MHz	20MHz	40MHz	80MHz
IEEE 802.11a	☐	☐	☐	☑	☐	☐
IEEE 802.11n	☐	☐	☐	☑	☑	☐
IEEE 802.11ac	☐	☐	☐	☑	☑	☑

2. TEST METHODOLOGY

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

The radiated testing was performed at an antenna-to-EUT distance of 3 meters. All radiated and conducted emissions measurement was performed at Shenzhen LCS Compliance Testing Laboratory Ltd.

2.1. EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

2.2. EUT Exercise

The EUT was operated in the engineering mode to fix the TX frequency that was for the purpose of the measurements.

According to FCC's request, Test Procedure 789033 D02 General UNII Test Procedures New Rules v01r02 and KDB 6622911 are required to be used for this kind of FCC 15.407 UII device.

According to its specifications, the EUT must comply with the requirements of the Section 15.203, 15.205, 15.207, 15.209 and 15.407 under the FCC Rules Part 15 Subpart E

2.3. General Test Procedures

2.3.1 Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 6.2.1 of ANSI C63.10-2013 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using Quasi-peak and average detector modes.

2.3.2 Radiated Emissions

The EUT is placed on a turn table, which is 0.8 m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 6.3 of ANSI C63.10-2013

3. SYSTEM TEST CONFIGURATION

3.1. Justification

The system was configured for testing in a continuous transmits condition.

3.2. EUT Exercise Software

The system was configured for testing in a continuous transmits condition and change test channels by software(MP Tool) provided by application.

3.3. Special Accessories

No.	Equipment	Manufacturer	Model No.	Serial No.	Length	shielded/ unshielded	Notes
1	TV	Skyworth	43M9	117413	/	/	DOC

3.4. Block Diagram/Schematics

Please refer to the related document

3.5. Equipment Modifications

Shenzhen LCS Compliance Testing Laboratory Ltd. has not done any modification on the EUT.

3.6. Test Setup

Please refer to the test setup photo.

4. SUMMARY OF TEST RESULTS

Applied Standard: FCC Part 15 Subpart E		
FCC Rules	**Description of Test**	**Result**
§15.407(a)	Maximum Conducted Output Power	Compliant
§15.407(a)	Power Spectral Density	Compliant
§15.407(e)	6dB Bandwidth	Compliant
§15.407(b)	Radiated Emissions	Compliant
§15.407(b)	Band edge Emissions	Compliant
§15.407(g)	Frequency Stability	Note
§15.207(a)	Line Conducted Emissions	Compliant
§15.203	Antenna Requirements	Compliant
§2.1093	RF Exposure	Compliant

Note: The customer declared frequency stability is better than 20ppm which ensures that the signal remains in the allocated bands under all operational conditions stated in the user manual.

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5. TEST RESULT

5.1. On Time and Duty Cycle

5.1.1. Standard Applicable

None; for reporting purpose only.

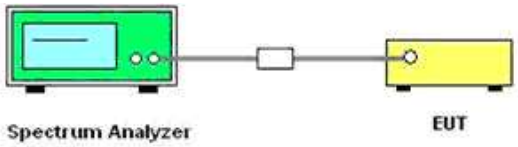
5.1.2. Measuring Instruments and Setting

Please refer to section 6 of equipment list in this report. The following table is the setting of the spectrum analyzer.

5.1.3. Test Procedures

1. Set the Centre frequency of the spectrum analyzer to the transmitting frequency;
2. Set the span=0MHz, RBW=8MHz, VBW=50MHz, Sweep time=5ms;
3. Detector = peak;
4. Trace mode = Single hold.

5.1.4. Test Setup Layout



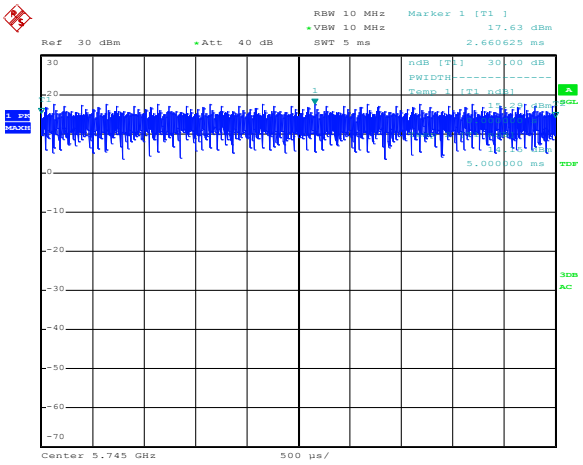
5.1.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

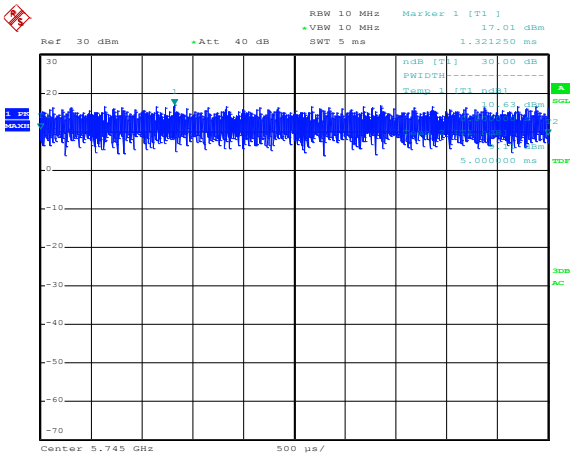
5.1.6. Test result

Mode	On Time B (ms)	Period (ms)	Duty Cycle x (Linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW(KHz)
IEEE 802.11a	5	5	1	100	0	0.010
IEEE 802.11n HT20	5	5	1	100	0	0.010
IEEE 802.11ac VHT20	5	5	1	100	0	0.010
IEEE 802.11n HT40	5	5	1	100	0	0.010
IEEE 802.11ac VHT40	5	5	1	100	0	0.010
IEEE 802.11ac VHT80	5	5	1	100	0	0.010

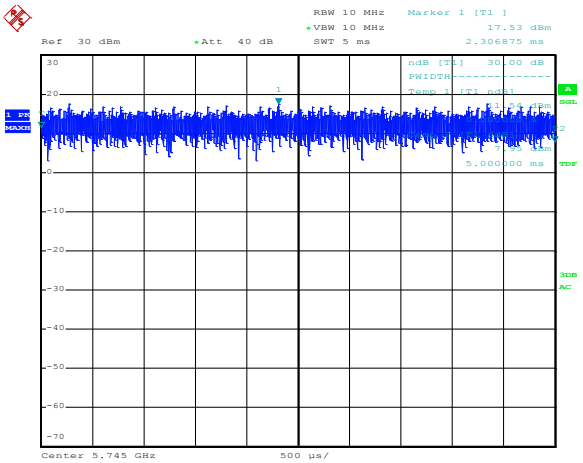
On Time and Duty Cycle



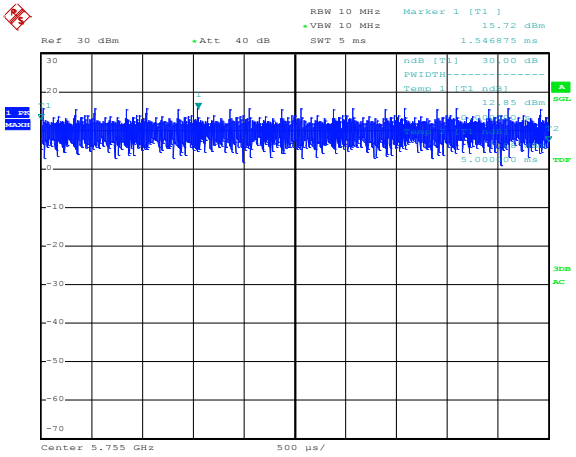
IEEE 802.11a



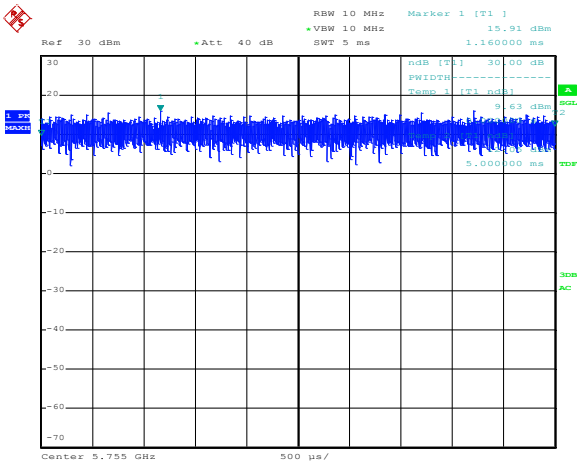
IEEE 802.11n HT20



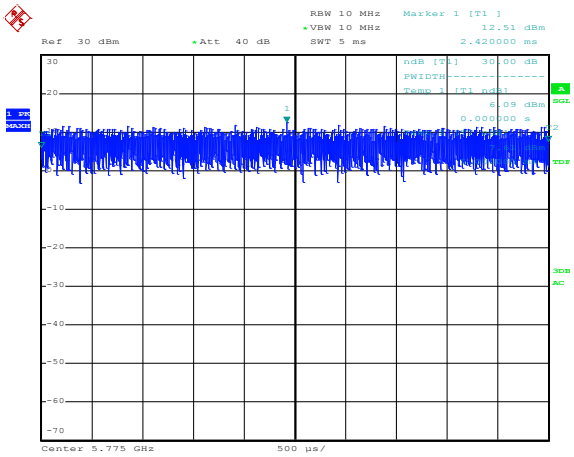
IEEE 802.11ac VHT20



IEEE 802.11n HT40



IEEE 802.11ac VHT40



IEEE 802.11ac VHT80

5.2. Maximum Conducted Output Power Measurement

5.2.1. Standard Applicable

For 5725~5850MHz

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

5.2.2. Measuring Instruments and Setting

Please refer to section 6 of equipment list in this report. The following table is the setting of the power meter.

5.2.3. Test Procedures

The transmitter output (antenna port) was connected to the power meter.

According to KDB 789033 D02 Section 3 (a) Method PM (Measurement using an RF average power meter):

(i) 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.

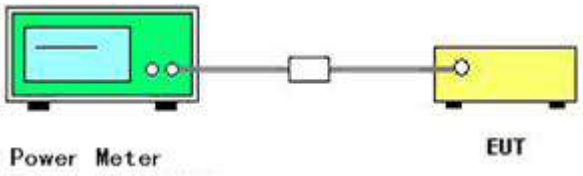
- The EUT is configured to transmit continuously or to transmit with a constant duty cycle.
- At all times when the EUT is transmitting, it must be transmitting at its maximum power control level.
- The integration period of the power meter exceeds the repetition period of the transmitted signal by at least a factor of five.

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

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

(iv) 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%).

5.2.4. Test Setup Layout



5.2.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

5.2.6. Test Result of Maximum Conducted Output Power

Temperature	25.1℃	Humidity	52.4%
Test Engineer	Tom Liu	Configurations	IEEE 802.11a/n/ac

Test Mode	Channel	Frequency (MHz)	Measured Conducted Average Power (dBm)			Duty Cycle factor (dB)	Report Conducted Average Power (dBm)			Limits (dBm)	Verdict
			Antenna 0	Antenna 1	Sum		Antenna 0	Antenna 1	Sum		
IEEE 802.11a	149	5745	10.67	11.54	/	0.00	10.67	11.54	/	30.00	PASS
	157	5785	11.56	12.02	/	0.00	11.56	12.02	/		
	165	5825	12.03	12.43	/	0.00	12.03	12.43	/		
IEEE 802.11n HT20	149	5745	12.42	11.53	15.01	0.00	12.42	11.53	15.01	30.00	PASS
	157	5785	11.54	12.23	14.91	0.00	11.54	12.23	14.91		
	165	5825	12.25	12.44	15.36	0.00	12.25	12.44	15.36		
IEEE 802.11ac VHT20	149	5745	12.44	11.12	14.84	0.00	12.44	11.12	14.84	30.00	PASS
	157	5785	11.14	12.01	14.61	0.00	11.14	12.01	14.61		
	165	5825	12.01	12.45	15.25	0.00	12.01	12.45	15.25		
IEEE 802.11n HT40	151	5755	12.44	11.18	14.87	0.00	12.44	11.18	14.87	30.00	PASS
	159	5795	11.18	12.08	14.66	0.00	11.18	12.08	14.66		
IEEE 802.11ac VHT40	151	5755	12.07	11.18	14.66	0.00	12.07	11.18	14.66	30.00	PASS
	159	5795	11.20	12.09	14.68	0.00	11.20	12.09	14.68		
IEEE 802.11ac VHT80	155	5775	12.09	12.08	15.10	0.00	12.09	12.08	15.10	30.00	PASS

Remark:

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, IEEE 802.11ac VHT40 and IEEE 802.11ac VHT80;*
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. *Directional Gain = 2.15 + 10log (2) = 5.16dBi < 6dBi; no need reduce power limit;*
6. *Report conducted average power = measured conducted average power + Duty Cycle factor;*

5.3. Power Spectral Density Measurement

5.3.1. Standard Applicable

For 5725~5850MHz

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

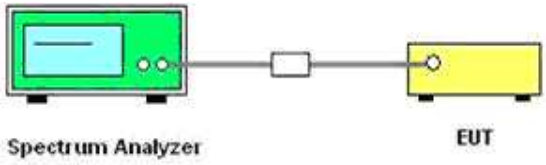
5.3.2. Measuring Instruments and Setting

Please refer to section 6 of equipments list in this report. The following table is the setting of Spectrum Analyzer.

5.3.3. Test Procedures

1. The transmitter was connected directly to a Spectrum Analyzer through a directional couple.
2. The power was monitored at the coupler port with a Spectrum Analyzer. The power level was set to the maximum level.
3. Set the RBW = 1 MHz.
4. Set the VBW ≥ 3*RBW
5. Span=Encompass the entire emissions bandwidth (EBW) of the signal
6. Detector = RMS.
7. Sweep time = auto couple.
8. Trace mode = max hold.
9. Allow trace to fully stabilize.
10. If measurement bandwidth of Maximum PSD is specified in 500 kHz, add 10 log (500 kHz/RBW) to the measured result, whereas RBW (<500 kHz) is the reduced resolution bandwidth of the spectrum analyzer set during measurement.
11. If measurement bandwidth of Maximum PSD is specified in 1 MHz, add 10 log (1MHz/RBW) to the measured result, whereas RBW (< 1 MHz) is the reduced resolution bandwidth of spectrum analyzer set during measurement.
12. Care must be taken to ensure that the measurements are performed during a period of continuous transmission or are corrected upward for duty cycle.

5.3.4. Test Setup Layout



5.3.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

5.3.6. Test Result of Power Spectral Density

Temperature	25.1℃	Humidity	52.4%
Test Engineer	Tom Liu	Configurations	802.11a/n/ac

Test Mode	Channel	Frequency (MHz)	Measured Conducted PSD (dBm/1MHz)			Duty Cycle factor (dB)	RBW factor (dB)	Report Conducted PSD (dBm/500KHz)			Limits (dBm/500KHz)	Verdict
			Antenna 0	Antenna 1	Sum			Antenna 0	Antenna 1	Sum		
IEEE 802.11a	149	5745	1.15	1.08	/	0.00	-3.01	-1.86	-1.93	/	30.00	PASS
	157	5785	1.72	1.70	/	0.00	-3.01	-1.29	-1.31	/		
	165	5825	2.14	2.14	/	0.00	-3.01	-0.87	-0.87	/		
IEEE 802.11n HT20	149	5745	0.97	0.92	3.96	0.00	-3.01	-2.04	-2.09	0.95	30.00	PASS
	157	5785	1.73	1.69	4.72	0.00	-3.01	-1.28	-1.32	1.71		
	165	5825	1.96	1.94	4.96	0.00	-3.01	-1.05	-1.07	1.95		
IEEE 802.11ac VHT20	149	5745	0.51	0.53	3.53	0.00	-3.01	-2.50	-2.48	0.52	30.00	PASS
	157	5785	1.47	1.49	4.49	0.00	-3.01	-1.54	-1.52	1.48		
	165	5825	2.00	1.98	5.00	0.00	-3.01	-1.01	-1.03	1.99		
IEEE 802.11n HT40	151	5755	-2.69	-2.72	0.31	0.00	-3.01	-5.70	-5.73	-2.70	30.00	PASS
	159	5795	-2.01	-2.02	1.00	0.00	-3.01	-5.02	-5.03	-2.01		
IEEE 802.11ac VHT40	151	5755	-2.70	-2.73	0.30	0.00	-3.01	-5.71	-5.74	-2.71	30.00	PASS
	159	5795	-1.99	-1.97	1.03	0.00	-3.01	-5.00	-4.98	-1.98		
IEEE 802.11ac VHT80	155	5775	-4.13	-3.75	-0.93	0.00	-3.01	-7.14	-6.76	-3.94	30.00	PASS

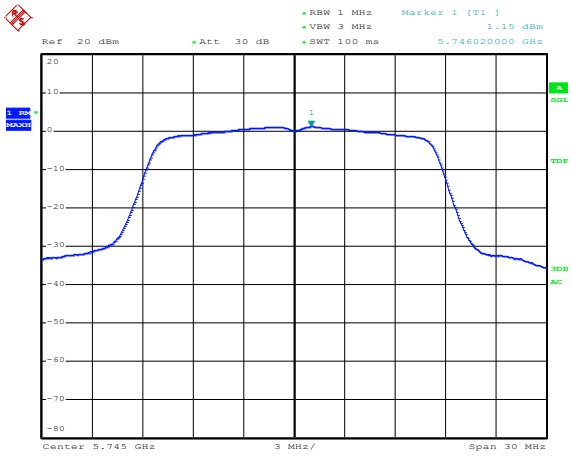
Remark:

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, IEEE 802.11ac VHT40 and IEEE 802.11ac VHT80;*
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. *Directional Gain = 2.15 + 10log (2) = 5.16 dBi < 6dBi; no need reduce power spectrum density limit;*
6. *Report conducted PSD = measured conducted PSD + Duty Cycle factor + RBW factor;*
7. *RBW factor = 10 log (500 KHz / 1000 KHz) = -3.01 dB;*
8. *Please refer to following test plots;*

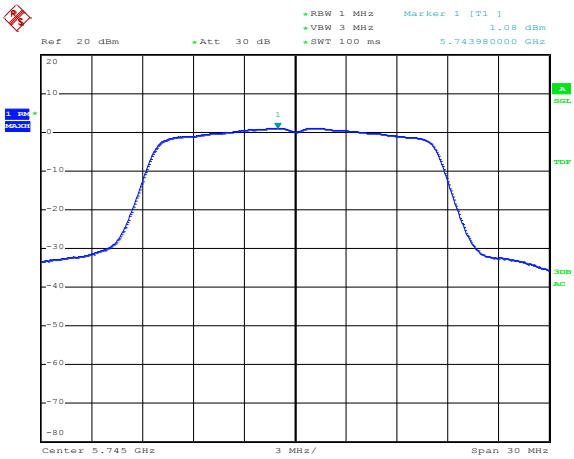
Power Spectral Density

IEEE 802.11a

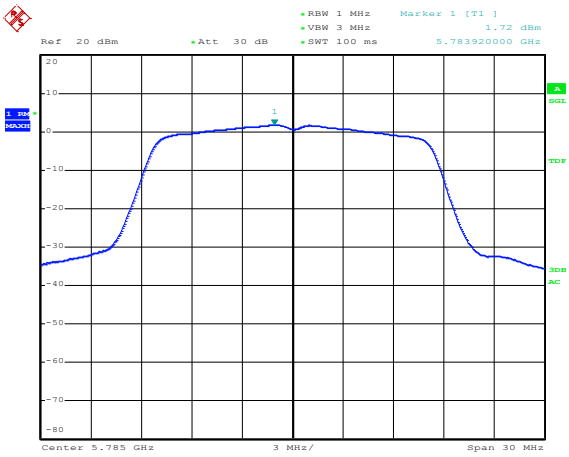
Antenna Chain 0



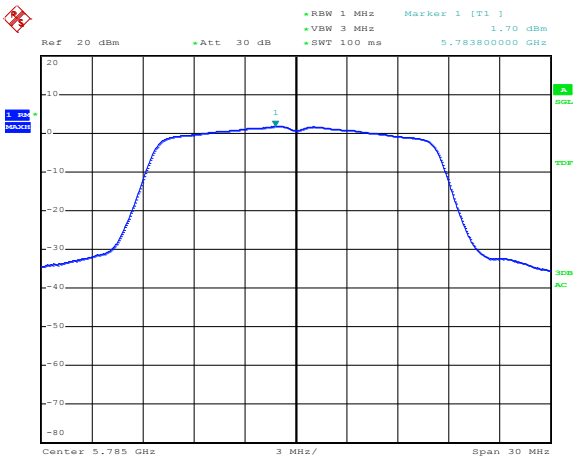
Antenna Chain 1



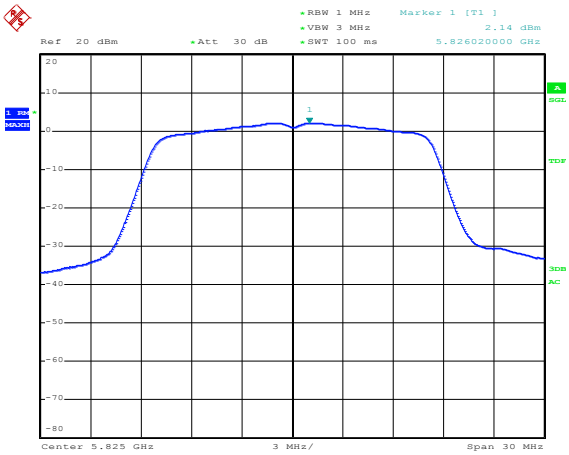
Channel 149 / 5745 MHz



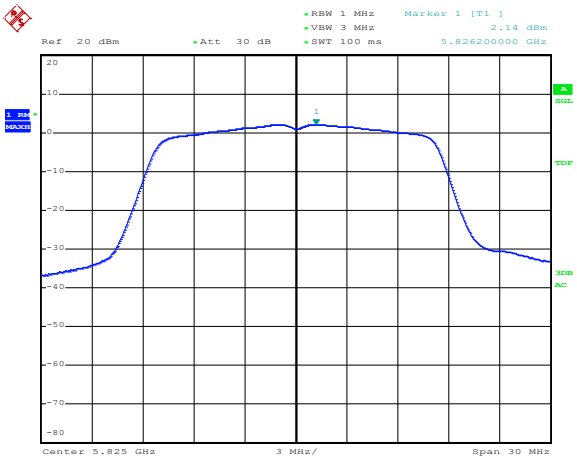
Channel 149 / 5745 MHz



Channel 157 / 5785 MHz



Channel 157 / 5785 MHz

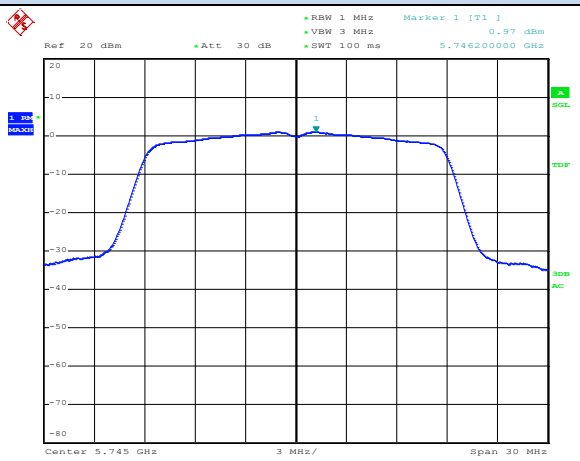
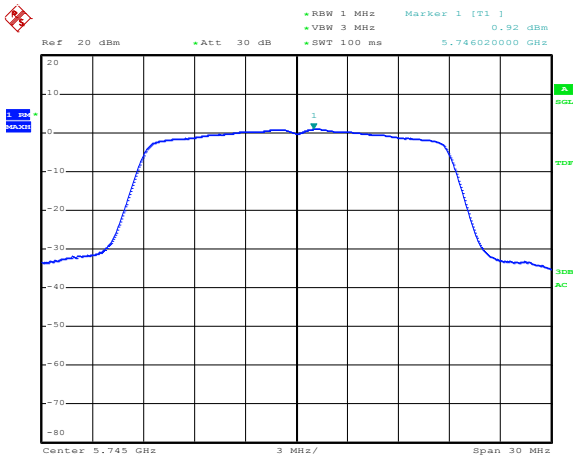
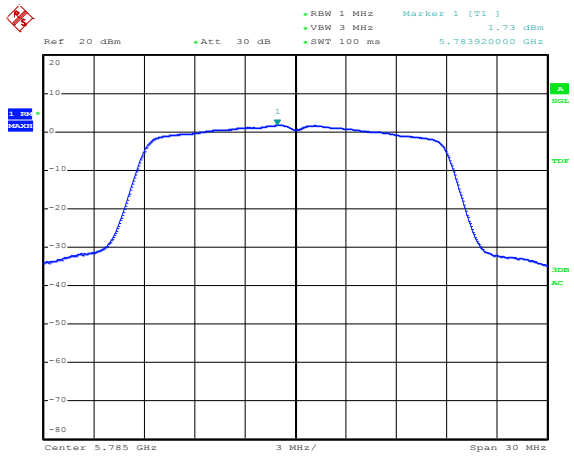
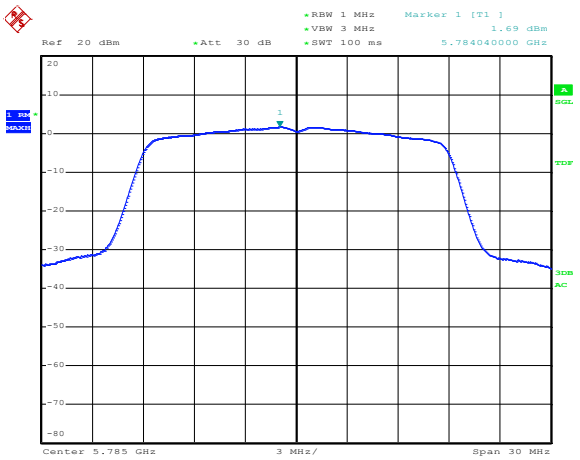
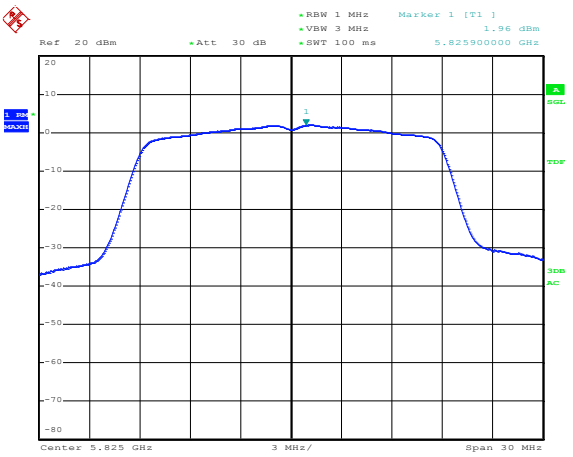
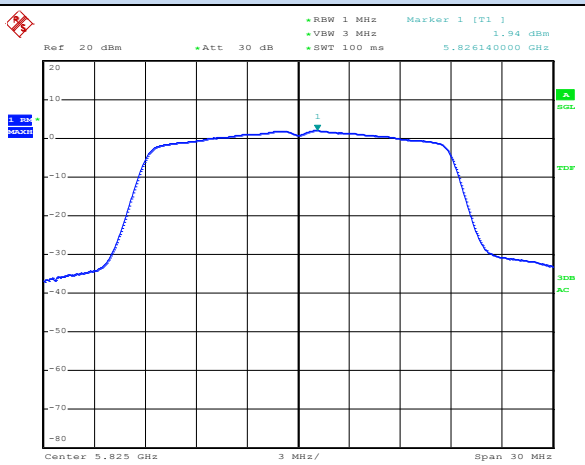


Channel 165 / 5825 MHz

Channel 165 / 5825 MHz

Power Spectral Density

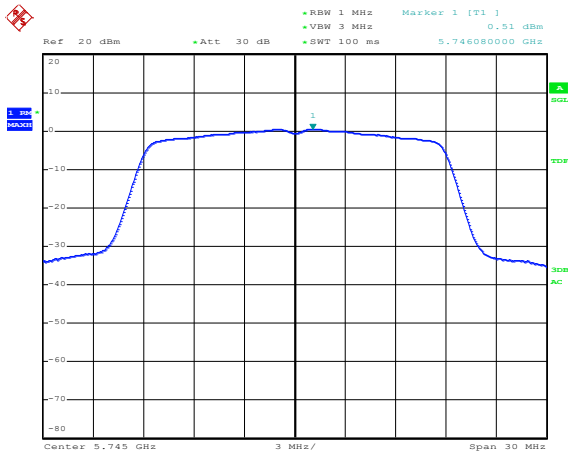
IEEE 802.11n HT20

Antenna Chain 0	Antenna Chain 1
	
Channel 149 / 5745 MHz	Channel 149 / 5745 MHz
	
Channel 157 / 5785 MHz	Channel 157 / 5785 MHz
	
Channel 165 / 5825 MHz	Channel 165 / 5825 MHz

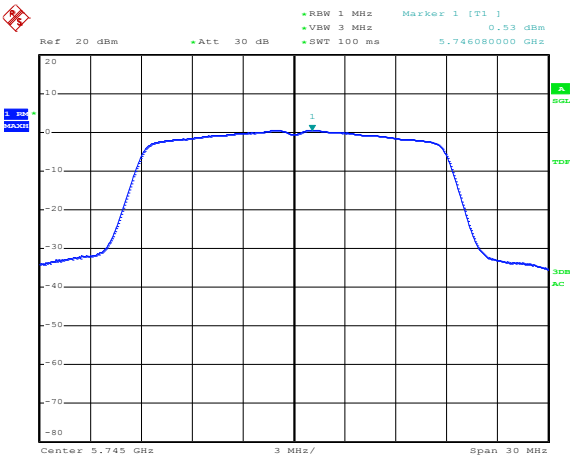
Power Spectral Density

IEEE 802.11ac VHT20

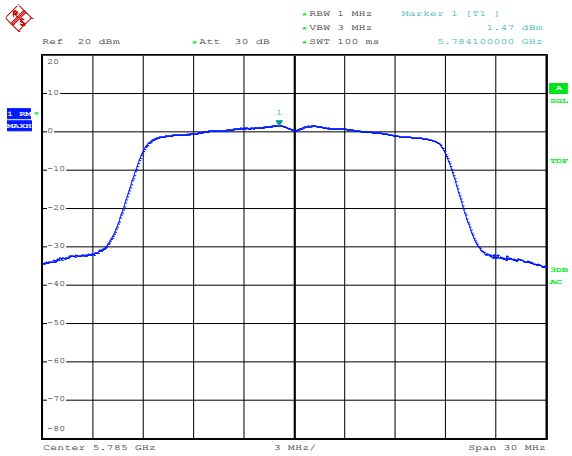
Antenna Chain 0



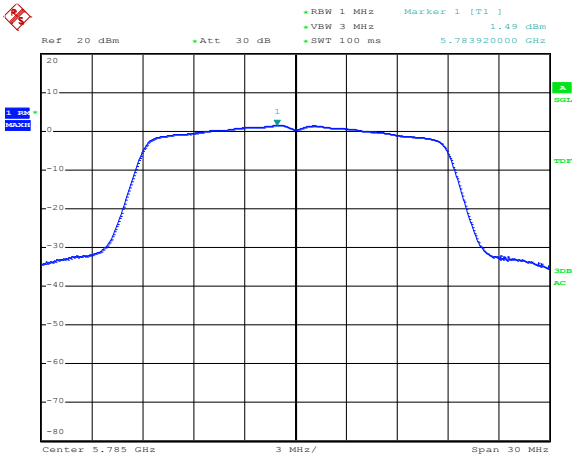
Antenna Chain 1



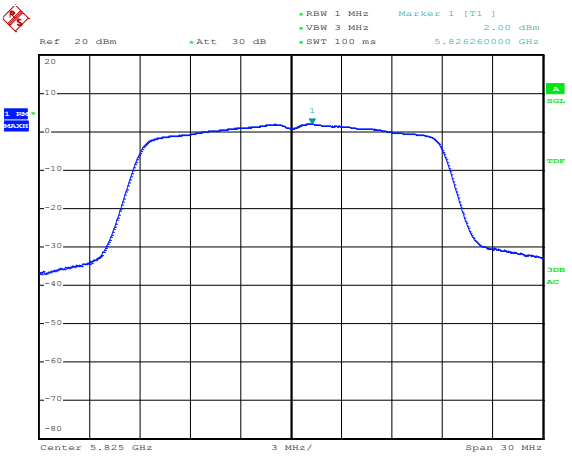
Channel 149 / 5745 MHz



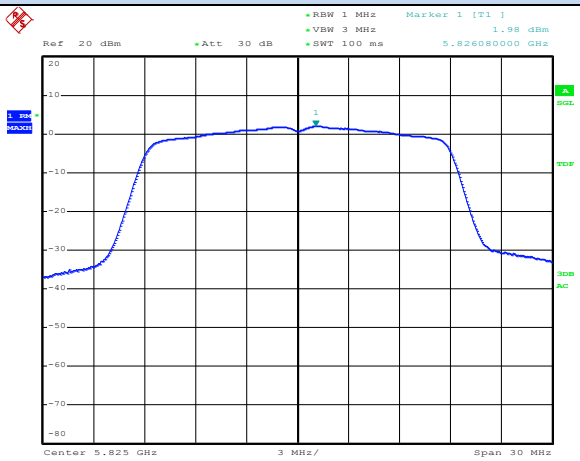
Channel 149 / 5745 MHz



Channel 157 / 5785 MHz



Channel 157 / 5785 MHz

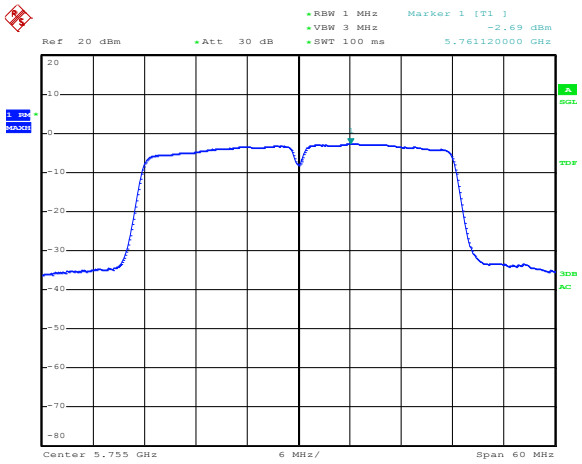
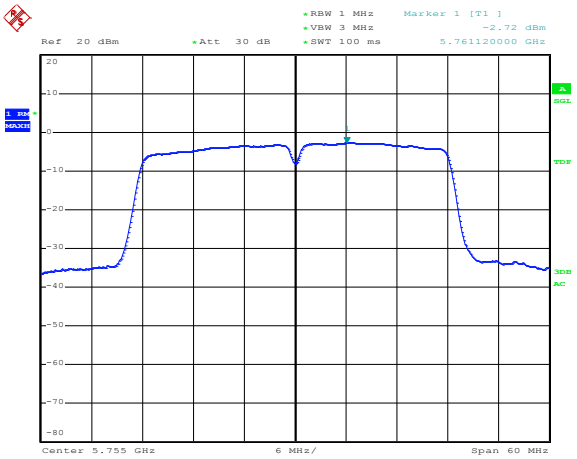
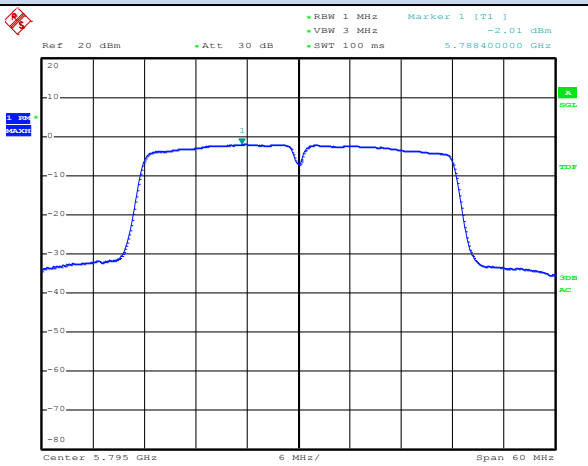
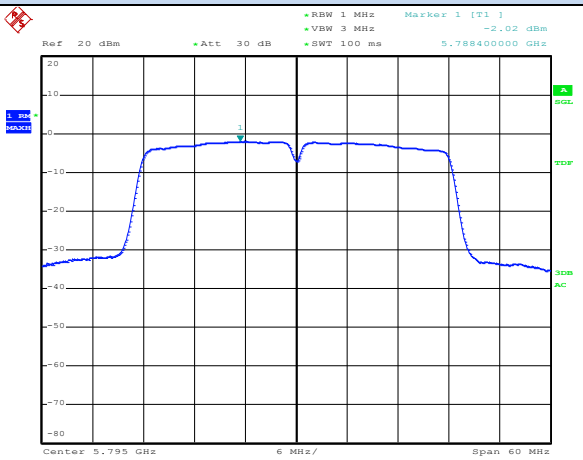


Channel 165 / 5825 MHz

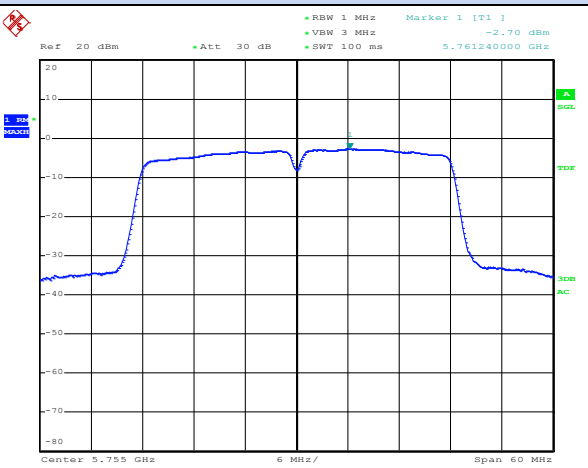
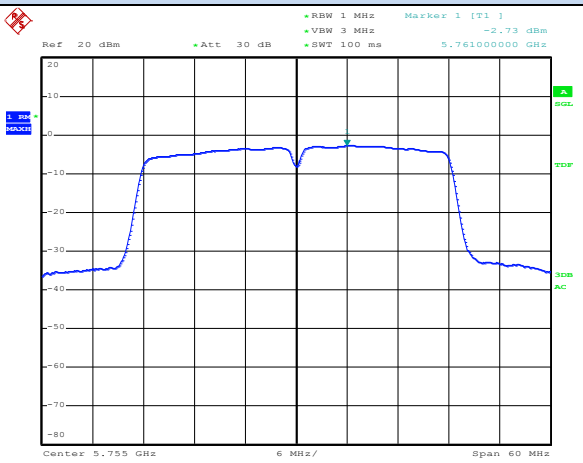
Channel 165 / 5825 MHz

Power Spectral Density

IEEE 802.11n HT40

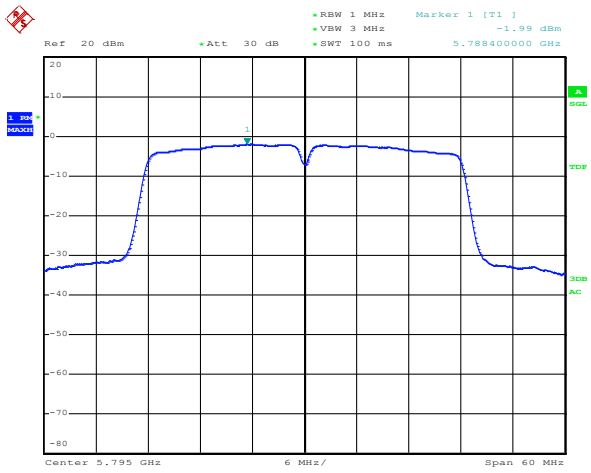
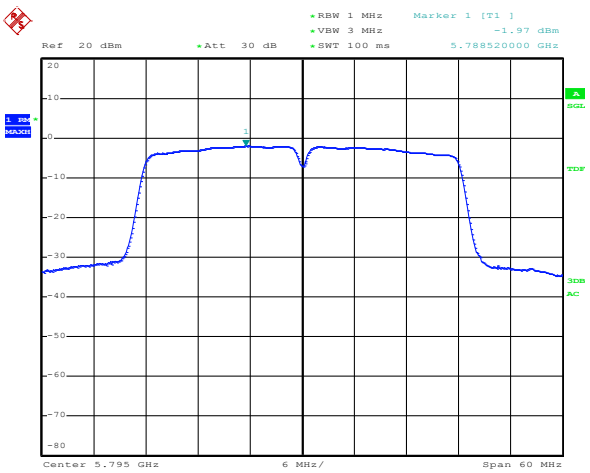
Antenna Chain 0	Antenna Chain 1
	
Channel 151 / 5755 MHz	Channel 151 / 5755 MHz
	
Channel 159 / 5795 MHz	Channel 159 / 5795 MHz

IEEE 802.11ac VHT40

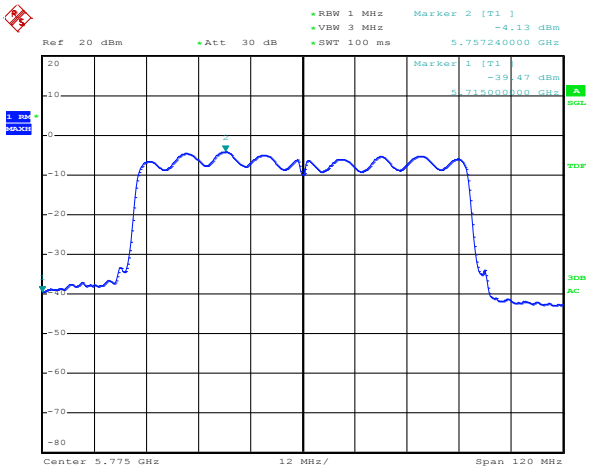
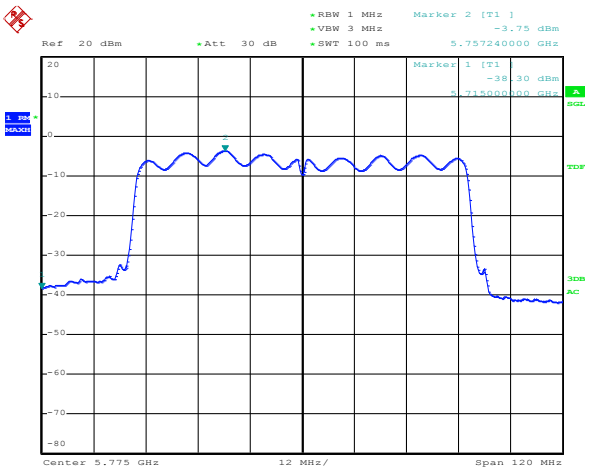
	
Channel 151 / 5755 MHz	Channel 151 / 5755 MHz

Power Spectral Density

IEEE 802.11ac VHT40

Antenna Chain 0	Antenna Chain 1
	
Channel 159 / 5795 MHz	Channel 159 / 5795 MHz

IEEE 802.11ac VHT80

	
Channel 155 / 5775 MHz	Channel 155 / 5775 MHz

5.4. 6dB Emission Bandwidth Measurement

5.4.1. Standard Applicable

Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

5.4.2. Measuring Instruments and Setting

Please refer to section 6 of equipment list in this report. The following table is the setting of the Spectrum Analyzer.

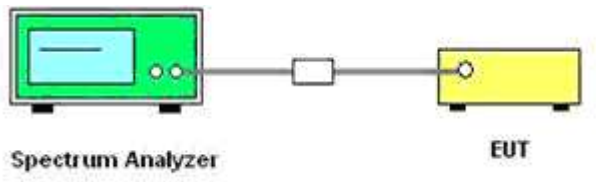
Spectrum Parameter	Setting
Attenuation	Auto
Span	> 26dB Bandwidth
Detector	Peak
Trace	Max Hold
Sweep Time	100ms

5

5.4.3. Test Procedures

1. The transmitter output (antenna port) was connected to the spectrum analyzer in peak hold mode.
2. Set the RBW = 100 KHz
3. Set the VBW > RBW
4. Measured the spectrum width with power higher than 6dB below carrier.

5.4.4. Test Setup Layout



5.4.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

5.4.6. Test Result of 6dB Occupied Bandwidth

Temperature	25.1℃	Humidity	52.4%
Test Engineer	Tom Liu	Configurations	IEEE 802.11a/n/ac

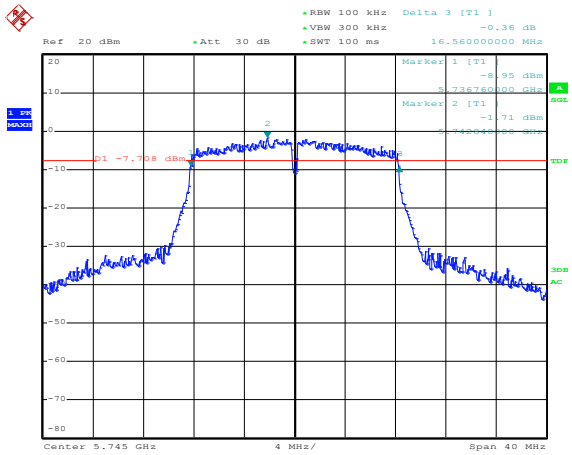
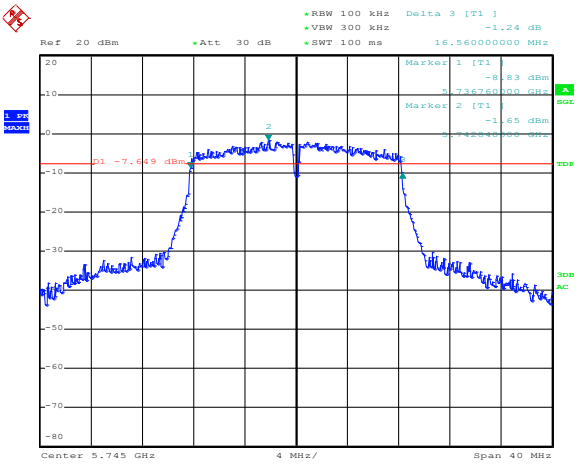
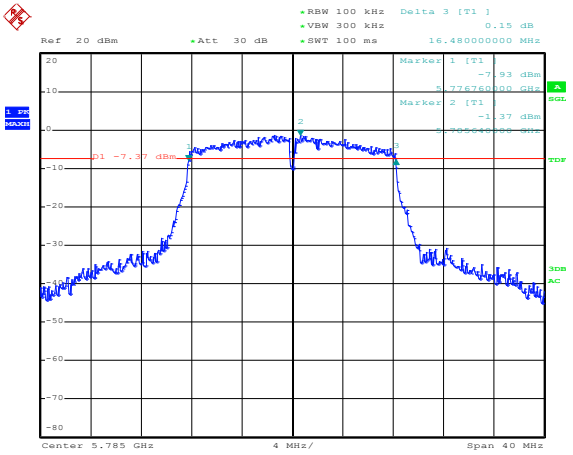
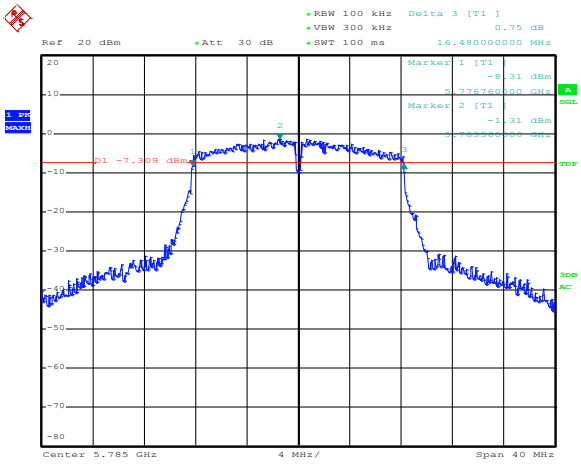
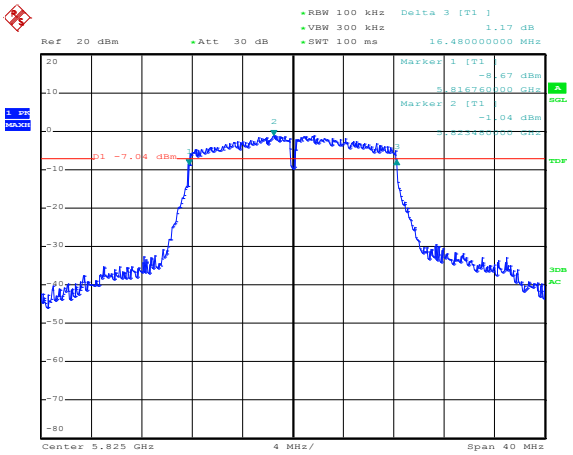
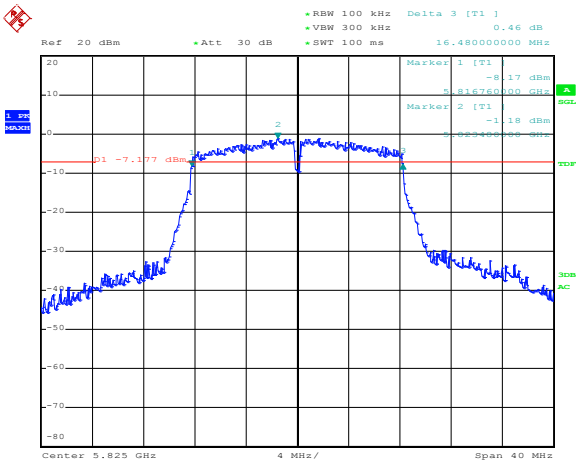
Test Mode	Channel	Frequency (MHz)	6dB Bandwidth (MHz)		Limits (MHz)	Verdict
			Antenna 0	Antenna 1		
IEEE 802.11a	149	5745	16.56	16.56	≥0.500	PASS
	157	5785	16.48	16.48		
	163	5825	16.48	16.48		
IEEE 802.11n HT20	149	5745	17.76	17.76	≥0.500	PASS
	157	5785	17.76	17.76		
	163	5825	17.76	17.76		
IEEE 802.11ac VHT20	149	5745	17.76	17.76	≥0.500	PASS
	157	5785	17.76	17.76		
	163	5825	17.76	17.76		
IEEE 802.11n HT40	151	5755	36.64	36.80	≥0.500	PASS
	159	5795	36.80	36.64		
IEEE 802.11ac VHT40	151	5755	36.64	36.64	≥0.500	PASS
	159	5795	36.80	36.64		
IEEE 802.11ac VHT80	155	5775	76.80	76.80	≥0.500	PASS

Remark:

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, IEEE 802.11ac VHT40 and IEEE 802.11ac VHT80;*
4. *Please refer to following test plots;*

6dB Bandwidth

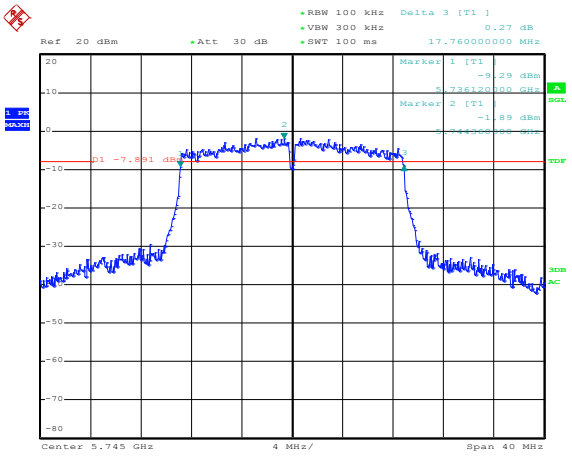
IEEE 802.11a

Antenna Chain 0	Antenna Chain 1
	
Channel 149 / 5745 MHz	Channel 149 / 5745 MHz
	
Channel 157 / 5785 MHz	Channel 157 / 5785 MHz
	
Channel 165 / 5825 MHz	Channel 165 / 5825 MHz

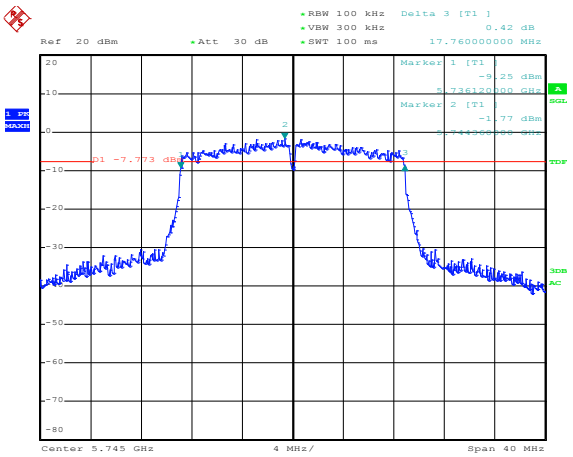
6dB Bandwidth

IEEE 802.11n HT20

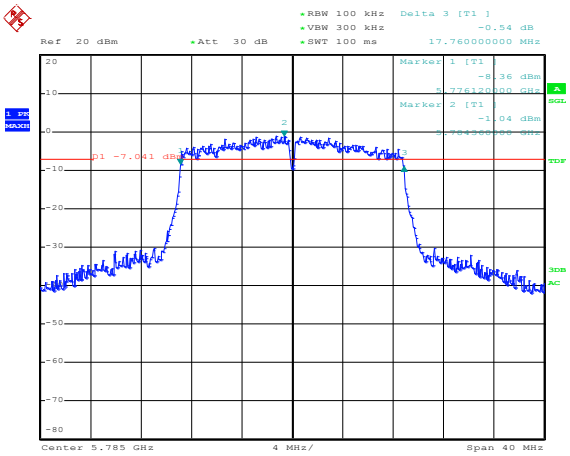
Antenna Chain 0



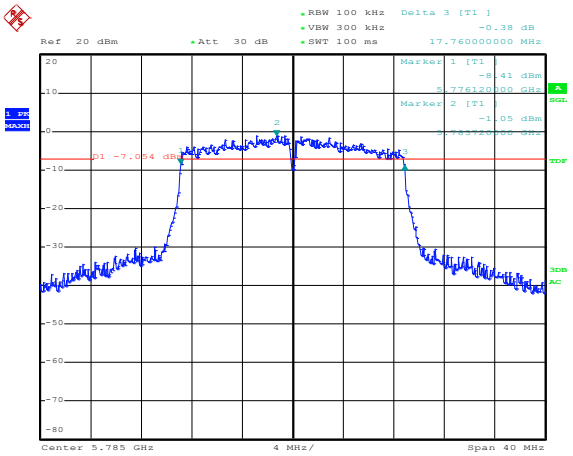
Antenna Chain 1



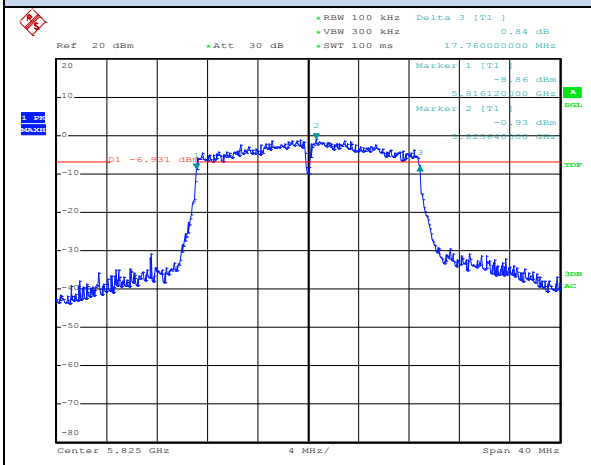
Channel 149 / 5745 MHz



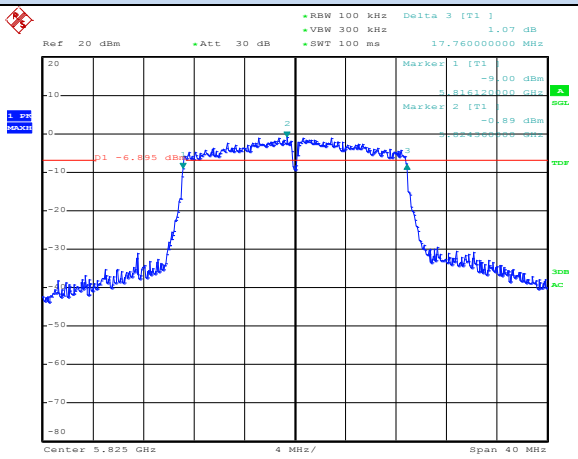
Channel 149 / 5745 MHz



Channel 157 / 5785 MHz



Channel 157 / 5785 MHz

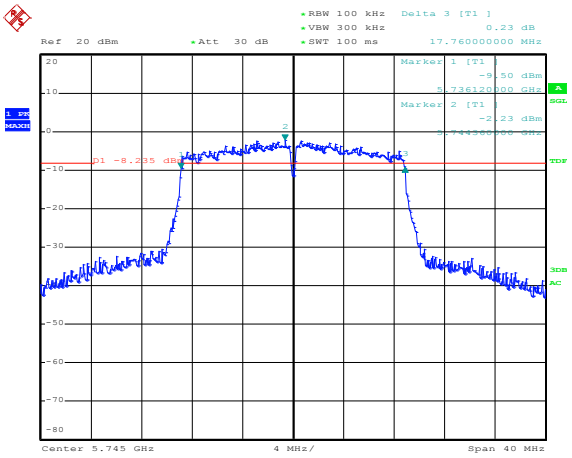
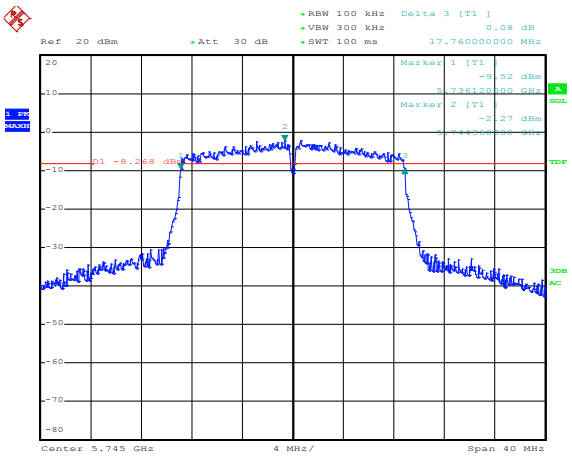
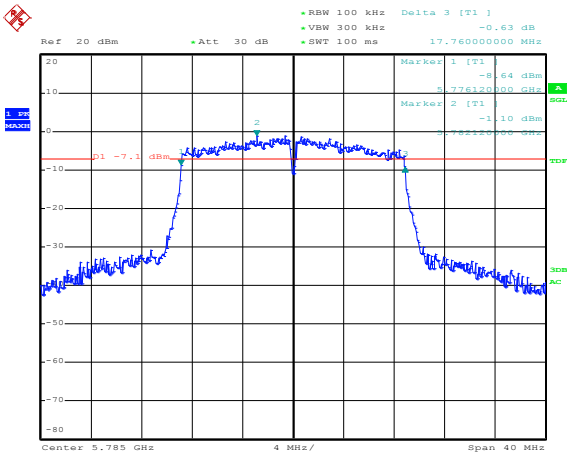
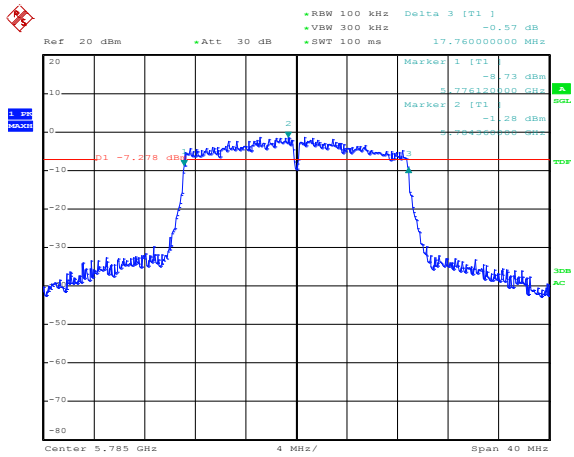
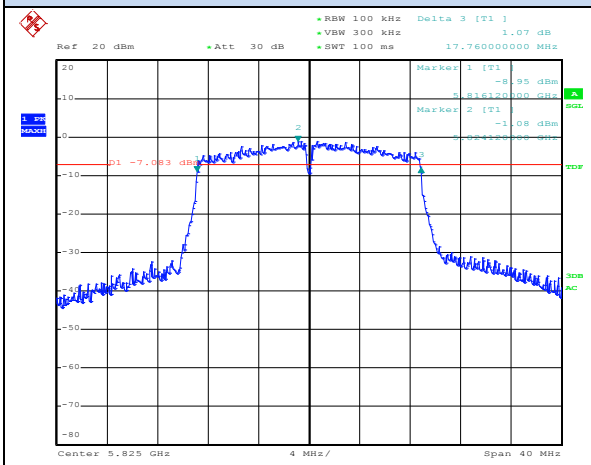
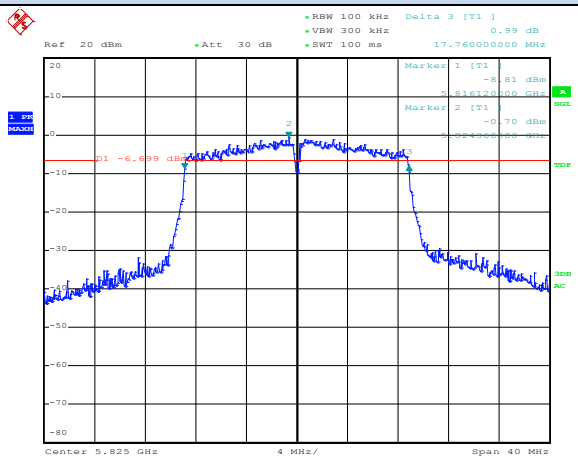


Channel 165 / 5825 MHz

Channel 165 / 5825 MHz

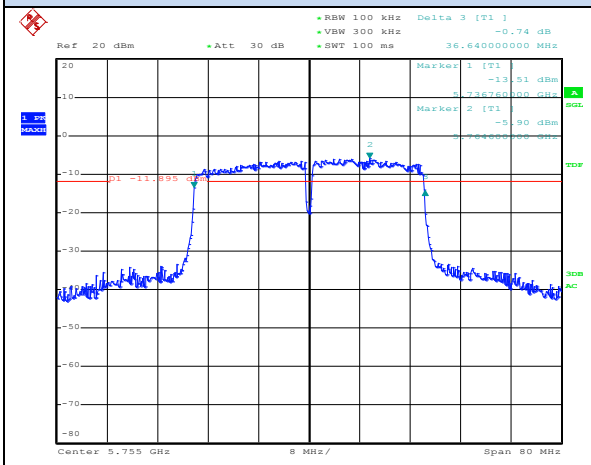
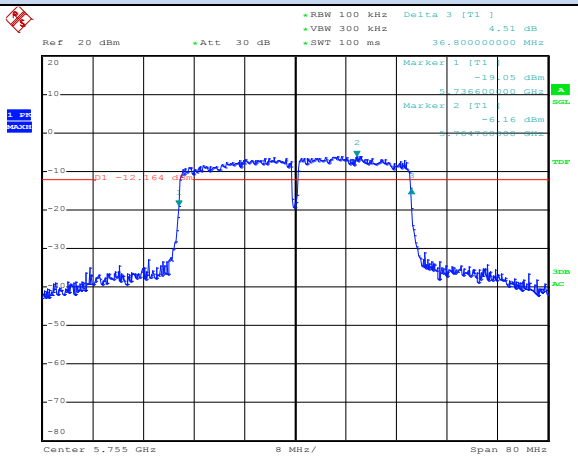
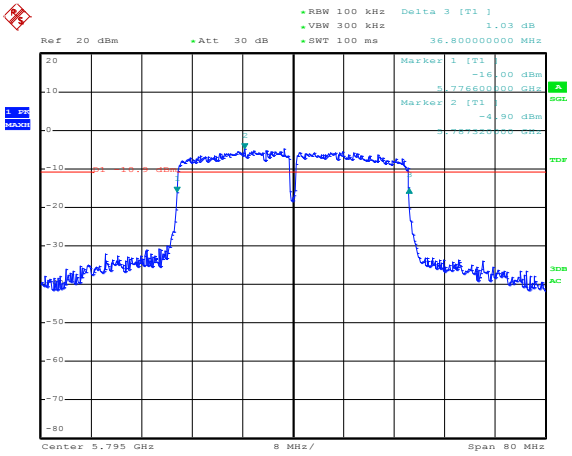
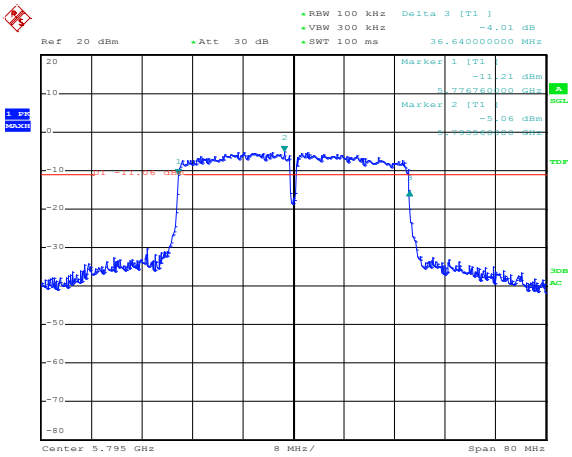
6dB Bandwidth

IEEE 802.11ac VHT20

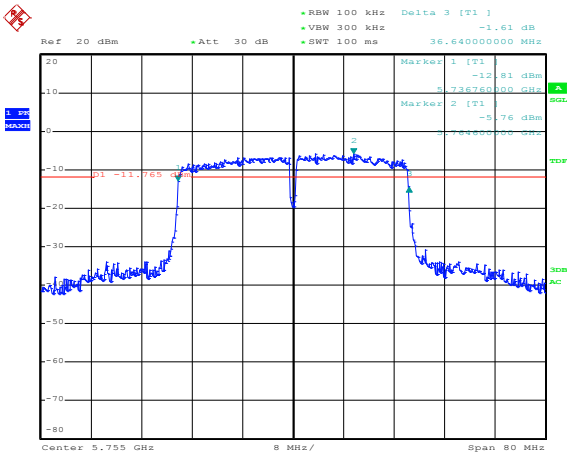
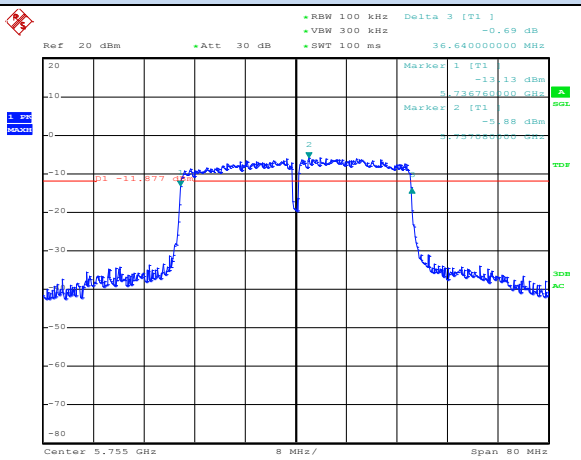
Antenna Chain 0	Antenna Chain 1
	
Channel 149 / 5745 MHz	Channel 149 / 5745 MHz
	
Channel 157 / 5785 MHz	Channel 157 / 5785 MHz
	
Channel 165 / 5825 MHz	Channel 165 / 5825 MHz

6dB Bandwidth

IEEE 802.11n HT40

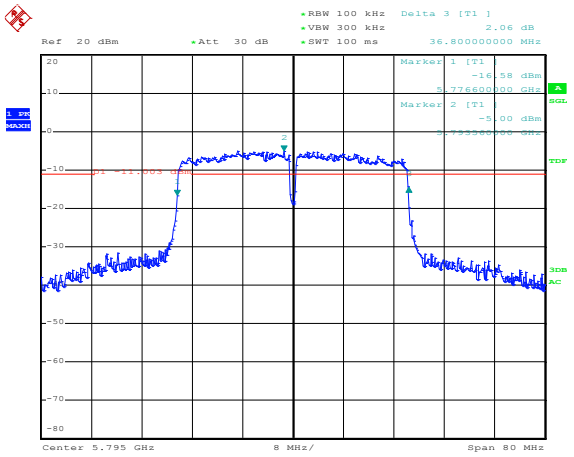
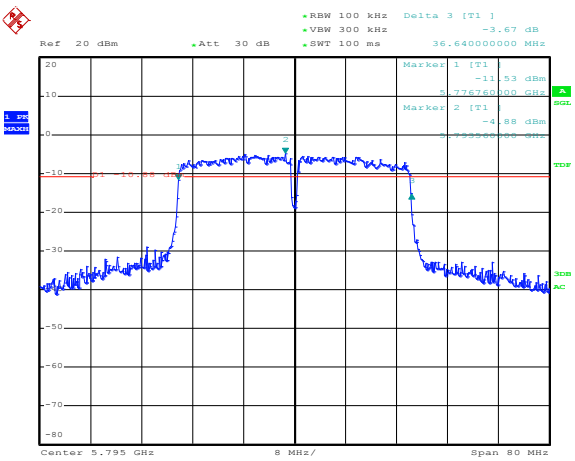
Antenna Chain 0	Antenna Chain 1
	
Channel 151 / 5755 MHz	Channel 151 / 5755 MHz
	
Channel 159 / 5795 MHz	Channel 159 / 5795 MHz

IEEE 802.11ac VHT40

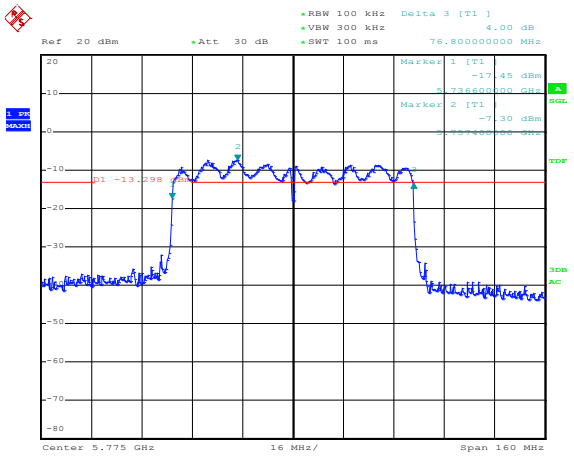
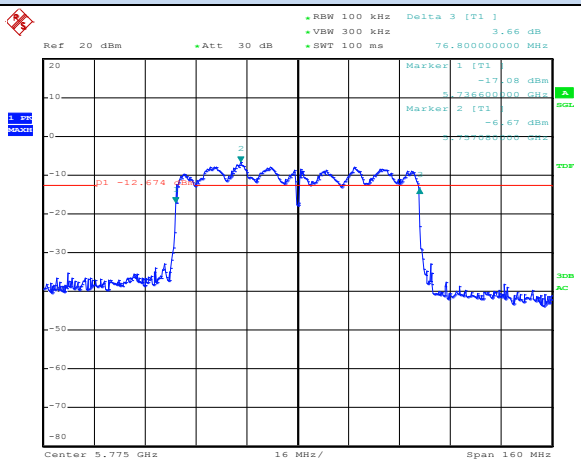
	
Channel 151 / 5755 MHz	Channel 151 / 5755 MHz

6dB Bandwidth

IEEE 802.11ac VHT40

Antenna Chain 0	Antenna Chain 1
	
Channel 159 / 5795 MHz	Channel 159 / 5795 MHz

IEEE 802.11ac VHT80

	
Channel 155 / 5775 MHz	Channel 155 / 5775 MHz

5.5. Radiated Emissions Measurement

5.5.1. Standard Applicable

15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
\1\ 0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293.	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	(\2\)
13.36-13.41			

\1\ Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.
\2\ Above 38.6

For transmitters operating in the 5.725-5.85 GHz band:

All emissions shall be limited to a level of −27 dBm/MHz(68.2dBuV/m at 3m) at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz(105.2dBuV/m at 3m) 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(110.8dBuV/m at 3m) 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(122.2dBuV/m at 3m) at the band edge.

In addition, 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.

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

5.5.2. Measuring Instruments and Setting

Please refer to section 6 of equipment list in this report. The following table is the setting of spectrum analyzer and receiver.

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RB / VB (Emission in restricted band)	1MHz / 1MHz for Peak, 1 MHz / 1/B kHz for Average
RB / VB (Emission in non-restricted band)	1MHz / 1MHz for Peak, 1 MHz / 1/B kHz for Average

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB/VB 200Hz/1KHz for QP/AVG
Start ~ Stop Frequency	150kHz~30MHz / RB/VB 9kHz/30KHz for QP/AVG
Start ~ Stop Frequency	30MHz~1000MHz / RB/VB 120kHz/1MHz for QP

5.5.3. Test Procedures

1) **Sequence of testing 9 kHz to 30 MHz**

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 0.8 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions.

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna height is 1.5 meter.

--- At each turntable position the analyzer sweeps with peak detection to find the maximum of all emissions

Final measurement:

--- Identified emissions during the premeasurement the software maximizes by rotating the turntable position (0° to 360°) and by rotating the elevation axes (0° to 360°).

--- The final measurement will be done in the position (turntable and elevation) causing the highest emissions with QPK detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

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2) **Sequence of testing 30 MHz to 1 GHz**

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna is polarized vertical and horizontal.

--- The antenna height changes from 1 to 3 meter.

--- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

Final measurement:

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position (± 45°) and antenna movement between 1 and 4 meter.

--- The final measurement will be done with QP detector with an EMI receiver.

--- The final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

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3) **Sequence of testing 1 GHz to 18 GHz**

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna is polarized vertical and horizontal.

--- The antenna height scan range is 1 meter to 2.5 meter.

--- At each turntable position and antenna polarization the analyzer sweeps with peak detection to find the maximum of all emissions.

Final measurement:

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position (± 45°) and antenna movement between 1 and 4 meter. This procedure is repeated for both antenna polarizations.

--- The final measurement will be done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and Average detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

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4) **Sequence of testing above 18 GHz**

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 1 meter.

--- The EUT was set into operation.

Premeasurement:

--- The antenna is moved spherical over the EUT in different polarizations of the antenna.

Final measurement:

--- The final measurement will be performed at the position and antenna orientation for all detected emissions that were found during the premeasurements with Peak and Average detector.

--- The final levels, frequency, measuring time, bandwidth, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

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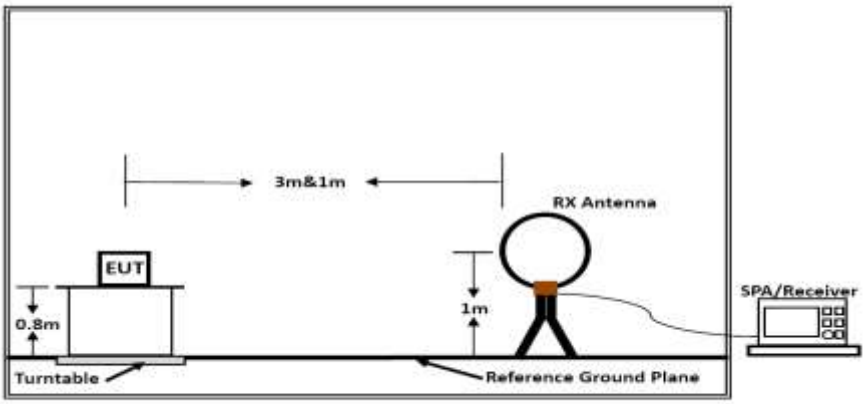
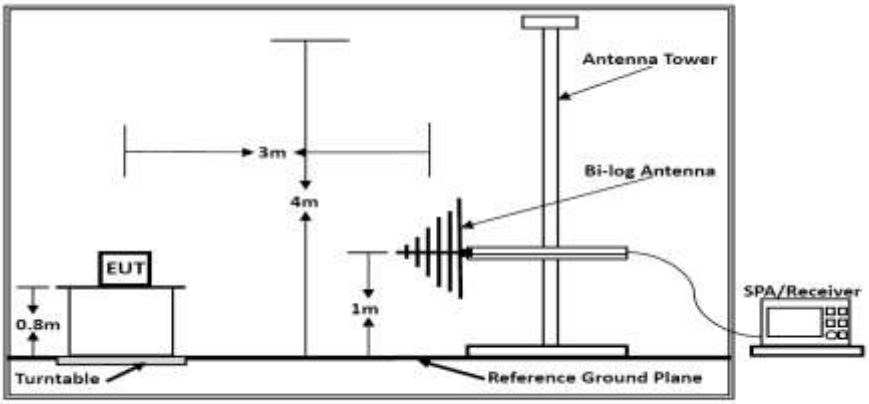
5.5.4. Test Setup Layout

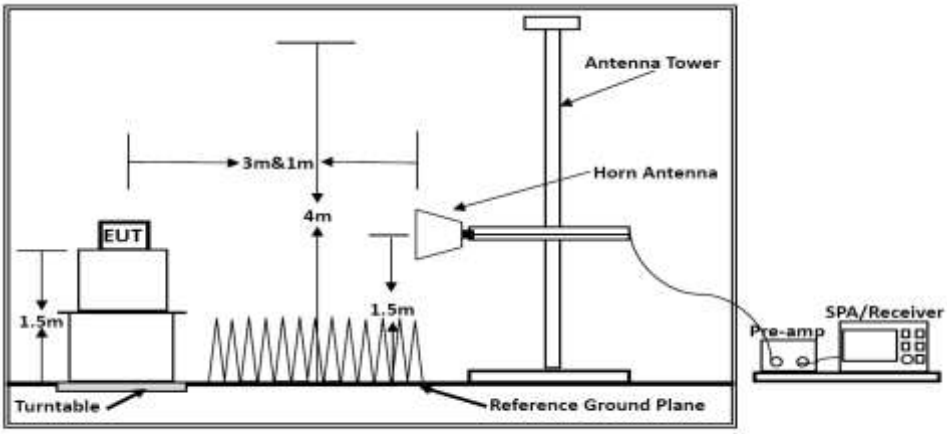
For radiated emissions below 30MHz



Below 30MHz



Below 1GHz



Above 1GHz

Above 18 GHz shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade form 3m to 1m.

Distance extrapolation factor = 20 log (specific distanc [3m] / test distance [1.5m]) (dB);

Limit line = specific limits (dBuV) + distance extrapolation factor [6 dB].

5.5.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

5.5.6. Results of Radiated Emissions (9 KHz~30MHz)

Temperature	24.5℃	Humidity	56.2%
Test Engineer	Tom Liu	Configurations	IEEE 802.11a/n/ac

Freq. (MHz)	Level (dBuV)	Over Limit (dB)	Over Limit (dBuV)	Remark
-	-	-	-	See Note

Note:

The amplitude of spurious emissions which are attenuated by more than 20 dB below the permissible value has no need to be reported.

Distance extrapolation factor = 40 log (specific distance / test distance) (dB);

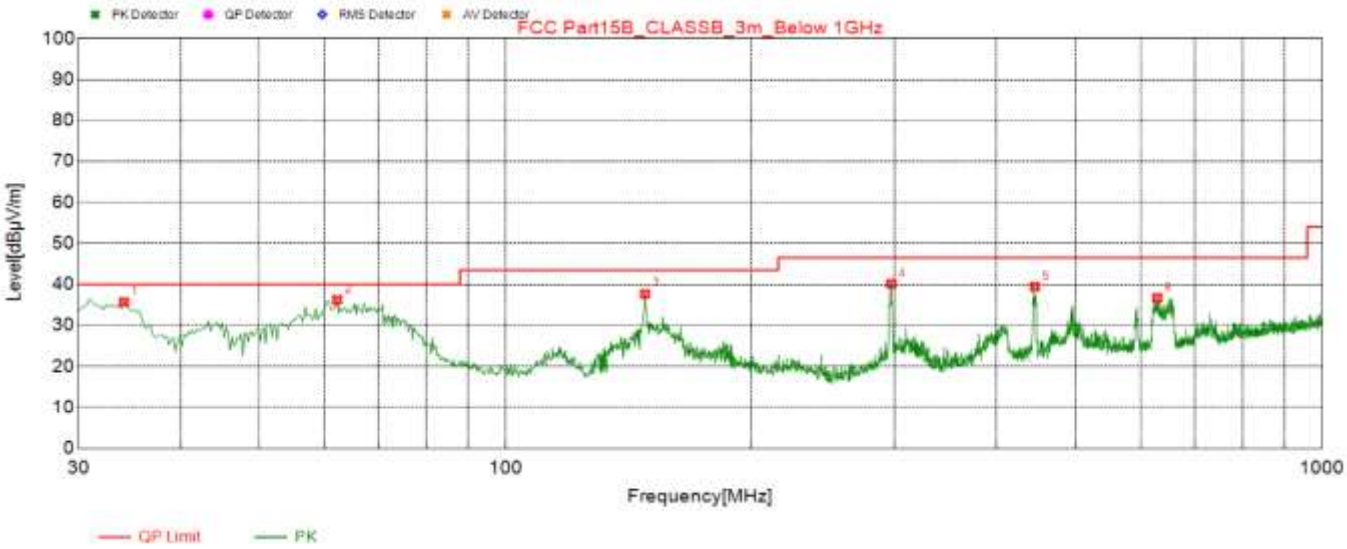
Limit line = specific limits (dBuV) + distance extrapolation factor.

5.5.7. Results of Radiated Emissions (30MHz~1GHz)

Temperature	24.5℃	Humidity	56.2%
Test Engineer	Tom Liu	Configurations	IEEE 802.11a, 5745MHz

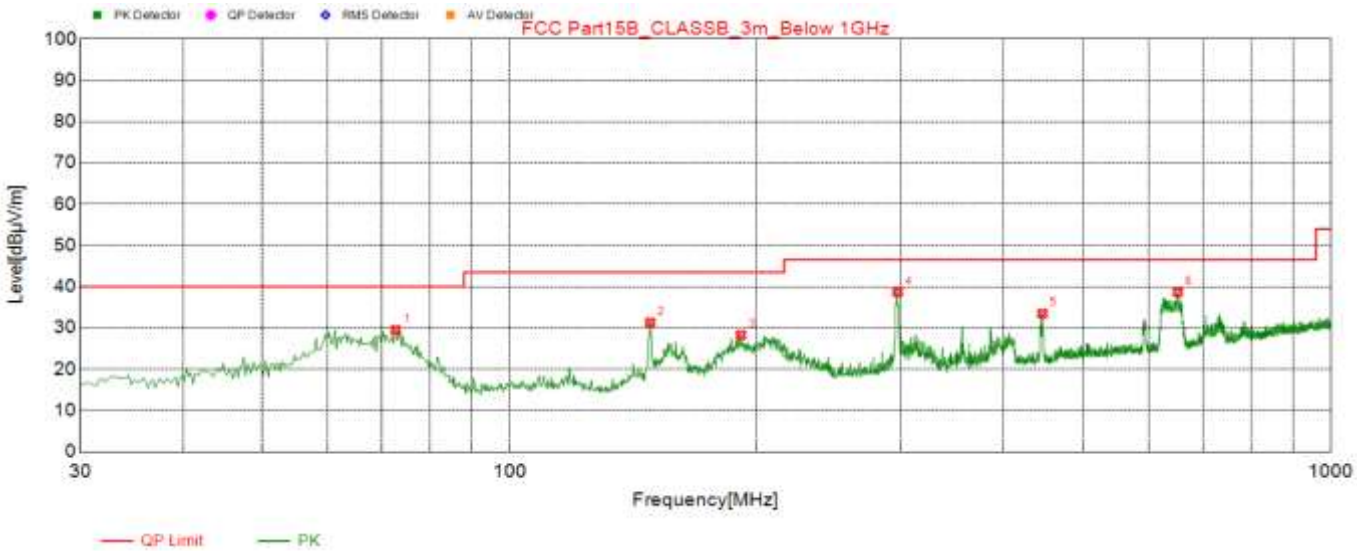
Test result for IEEE 802.11a-5745MHz@Chain 0

Vertical:



NO.	Freq. [MHz]	Result Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle[°]	Polarity
1	34.123	35.71	-16.11	40.00	4.29	100	257	Vertical
2	62.253	36.26	-16.23	40.00	3.74	100	117	Vertical
3	148.34	37.67	-19.16	43.50	5.83	100	0	Vertical
4	296.99	40.17	-12.88	46.50	6.33	100	161	Vertical
5	445.40	39.44	-9.14	46.50	7.06	100	128	Vertical
6	628.97	36.71	-5.23	46.50	9.79	100	311	Vertical

Horizontal:



NO.	Freq. [MHz]	Result Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle[°]	Polarity
1	72.680	29.49	-18.71	40.00	10.51	300	357	Horizontal
2	148.34	31.31	-19.16	43.50	12.19	300	336	Horizontal
3	191.26	28.21	-16.32	43.50	15.29	100	210	Horizontal
4	296.99	38.69	-12.88	46.50	7.81	100	49	Horizontal
5	445.64	33.51	-9.14	46.50	12.99	100	312	Horizontal
6	651.52	38.63	-4.95	46.50	7.87	100	279	Horizontal

Note:

Pre-scan all modes and recorded the worst case results in this report (IEEE 802.11a-5745MHz) @ Chain 0.

Emission level (dBuV/m) = 20 log Emission level (uV/m).

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

5.5.8. Results for Radiated Emissions (Above 1GHz)

Remark: Measured all modes and recorded worst case;

IEEE 802.11a/ Antenna Chain 0

Channel 149 / 5745 MHz

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit Line dBuV/m	Over limit dB	Remark	Pol/Phase
17.235	56.73	33.23	35.04	3.91	58.83	68.20	-9.37	Peak	Horizontal
17.235	44.56	33.23	35.04	3.91	46.66	54.00	-7.34	Average	Horizontal
17.235	55.93	33.23	35.04	3.91	58.03	68.20	-10.17	Peak	Vertical
17.235	41.32	33.23	35.04	3.91	43.42	54.00	-10.58	Average	Vertical

Channel 157 / 5785 MHz

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit Line dBuV/m	Over limit dB	Remark	Pol/Phase
17.355	58.00	33.27	35.15	3.93	60.05	68.20	-8.15	Peak	Horizontal
17.355	44.40	33.27	35.15	3.93	46.45	54.00	-7.55	Average	Horizontal
17.355	56.15	33.27	35.15	3.93	58.20	68.20	-10.00	Peak	Vertical
17.355	44.74	33.27	35.15	3.93	46.79	54.00	-7.21	Average	Vertical

Channel 163 / 5825 MHz

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit Line dBuV/m	Over limit dB	Remark	Pol/Phase
17.475	58.46	33.32	35.14	3.97	60.61	68.20	-7.59	Peak	Horizontal
17.475	44.14	33.32	35.14	3.97	46.29	54.00	-7.71	Average	Horizontal
17.475	55.60	33.32	35.14	3.97	57.75	68.20	-10.45	Peak	Vertical
17.475	40.92	33.32	35.14	3.97	43.07	54.00	-10.93	Average	Vertical

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IEEE 802.11n-HT20/Combined Antenna Chain 0 and Antenna Chain 1

Channel 149 / 5745 MHz

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit Line dBuV/m	Over limit dB	Remark	Pol/Phase
17.235	58.29	33.23	35.04	3.91	60.39	68.20	-7.81	Peak	Horizontal
17.235	40.05	33.23	35.04	3.91	42.15	54.00	-11.85	Average	Horizontal
17.235	58.68	33.23	35.04	3.91	60.78	68.20	-7.42	Peak	Vertical
17.235	41.35	33.23	35.04	3.91	43.45	54.00	-10.55	Average	Vertical

Channel 157 / 5785 MHz

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit Line dBuV/m	Over limit dB	Remark	Pol/Phase
17.355	55.62	33.27	35.15	3.93	57.67	68.20	-10.53	Peak	Horizontal
17.355	40.85	33.27	35.15	3.93	42.90	54.00	-11.10	Average	Horizontal
17.355	56.73	33.27	35.15	3.93	58.78	68.20	-9.42	Peak	Vertical
17.355	40.22	33.27	35.15	3.93	42.27	54.00	-11.73	Average	Vertical

Channel 163 / 5825 MHz

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit Line dBuV/m	Over limit dB	Remark	Pol/Phase
17.475	56.83	33.32	35.14	3.97	58.98	68.20	-9.22	Peak	Horizontal
17.475	41.88	33.32	35.14	3.97	44.03	54.00	-9.97	Average	Horizontal
17.475	54.26	33.32	35.14	3.97	56.41	68.20	-11.79	Peak	Vertical
17.475	40.54	33.32	35.14	3.97	42.69	54.00	-11.31	Average	Vertical

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IEEE 802.11ac VHT20/ Combined Antenna Chain 0 and Antenna Chain 1

Channel 149 / 5745 MHz

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit Line dBuV/m	Over limit dB	Remark	Pol/Phase
17.235	59.00	33.23	35.04	3.91	61.10	68.20	-7.10	Peak	Horizontal
17.235	44.18	33.23	35.04	3.91	46.28	54.00	-7.72	Average	Horizontal
17.235	58.95	33.23	35.04	3.91	61.05	68.20	-7.15	Peak	Vertical
17.235	40.83	33.23	35.04	3.91	42.93	54.00	-11.07	Average	Vertical

Channel 157 / 5785 MHz

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit Line dBuV/m	Over limit dB	Remark	Pol/Phase
17.355	58.01	33.27	35.15	3.93	60.06	68.20	-8.14	Peak	Horizontal
17.355	39.95	33.27	35.15	3.93	42.00	54.00	-12.00	Average	Horizontal
17.355	57.42	33.27	35.15	3.93	59.47	68.20	-8.73	Peak	Vertical
17.355	44.53	33.27	35.15	3.93	46.58	54.00	-7.42	Average	Vertical

Channel 163 / 5825 MHz

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit Line dBuV/m	Over limit dB	Remark	Pol/Phase
17.475	55.45	33.32	35.14	3.97	57.60	68.20	-10.60	Peak	Horizontal
17.475	41.72	33.32	35.14	3.97	43.87	54.00	-10.13	Average	Horizontal
17.475	55.00	33.32	35.14	3.97	57.15	68.20	-11.05	Peak	Vertical
17.475	43.01	33.32	35.14	3.97	45.16	54.00	-8.84	Average	Vertical

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IEEE 802.11n HT40 / Antenna Chain 0 and Antenna Chain 1

Channel 151 / 5755 MHz

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit Line dBuV/m	Over limit dB	Remark	Pol/Phase
17.265	54.86	33.23	35.04	3.91	56.96	68.20	-11.24	Peak	Horizontal
17.265	43.42	33.23	35.04	3.91	45.52	54.00	-8.48	Average	Horizontal
17.265	55.48	33.23	35.04	3.91	57.58	68.20	-10.62	Peak	Vertical
17.265	40.18	33.23	35.04	3.91	42.28	54.00	-11.72	Average	Vertical

Channel 159 / 5795 MHz

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit Line dBuV/m	Over limit dB	Remark	Pol/Phase
17.385	59.14	33.27	35.15	3.93	61.19	68.20	-7.01	Peak	Horizontal
17.385	41.46	33.27	35.15	3.93	43.51	54.00	-10.49	Average	Horizontal
17.385	54.73	33.27	35.15	3.93	56.78	68.20	-11.42	Peak	Vertical
17.385	42.67	33.27	35.15	3.93	44.72	54.00	-9.28	Average	Vertical

IEEE 802.11ac VHT40 / Antenna Chain 0 and Antenna Chain 1

Channel 151 / 5755 MHz

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit Line dBuV/m	Over limit dB	Remark	Pol/Phase
17.265	54.77	33.23	35.04	3.91	56.87	68.20	-11.33	Peak	Horizontal
17.265	41.68	33.23	35.04	3.91	43.78	54.00	-10.22	Average	Horizontal
17.265	54.18	33.23	35.04	3.91	56.28	68.20	-11.92	Peak	Vertical
17.265	42.43	33.23	35.04	3.91	44.53	54.00	-9.47	Average	Vertical

Channel 159 / 5795 MHz

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit Line dBuV/m	Over limit dB	Remark	Pol/Phase
17.385	55.71	33.27	35.15	3.93	57.76	68.20	-10.44	Peak	Horizontal
17.385	42.19	33.27	35.15	3.93	44.24	54.00	-9.76	Average	Horizontal
17.385	57.85	33.27	35.15	3.93	59.90	68.20	-8.30	Peak	Vertical
17.385	41.81	33.27	35.15	3.93	43.86	54.00	-10.14	Average	Vertical

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IEEE 802.11ac VHT80 / Antenna Chain 0 and Antenna Chain 1

Channel 155 / 5775 MHz

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit Line dBuV/m	Over limit dB	Remark	Pol/Phase
17.325	58.35	33.27	35.15	3.93	60.40	68.20	-7.80	Peak	Horizontal
17.325	42.83	33.27	35.15	3.93	44.88	54.00	-9.12	Average	Horizontal
17.325	57.38	33.27	35.15	3.93	59.43	68.20	-8.77	Peak	Vertical
17.325	43.14	33.27	35.15	3.93	45.19	54.00	-8.81	Average	Vertical

Notes:

1. *Measuring frequencies from 9 KHz ~40 GHz, No emission found between lowest internal used/generated frequencies to 30MHz.*
2. *Radiated emissions measured in frequency range from 9 KHz ~40GHz were made with an instrument using Peak detector mode.*
3. *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.*
4. *Worst case data at 6Mbps at IEEE 802.11a; MCS0 at IEEE 802.11n HT20, IEEE 802.11n HT40, IEEE 802.11a VHT20, IEEE 802.11ac VHT40 and IEEE 802.11ac VHT80;*

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5.6. Power line conducted emissions

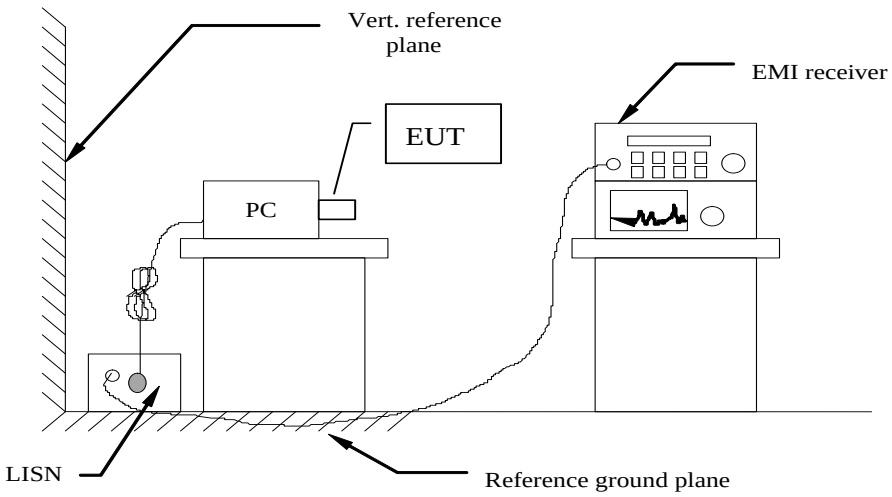
5.6.1 Standard Applicable

According to §15.207 (a): For an intentional radiator which is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed 250 microvolts (The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range are listed as follows:

Frequency Range (MHz)	Limits (dBμV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56*	56 to 46*
0.50 to 5	56	46
5 to 30	60	50

* Decreasing linearly with the logarithm of the frequency

5.6.2 Block Diagram of Test Setup

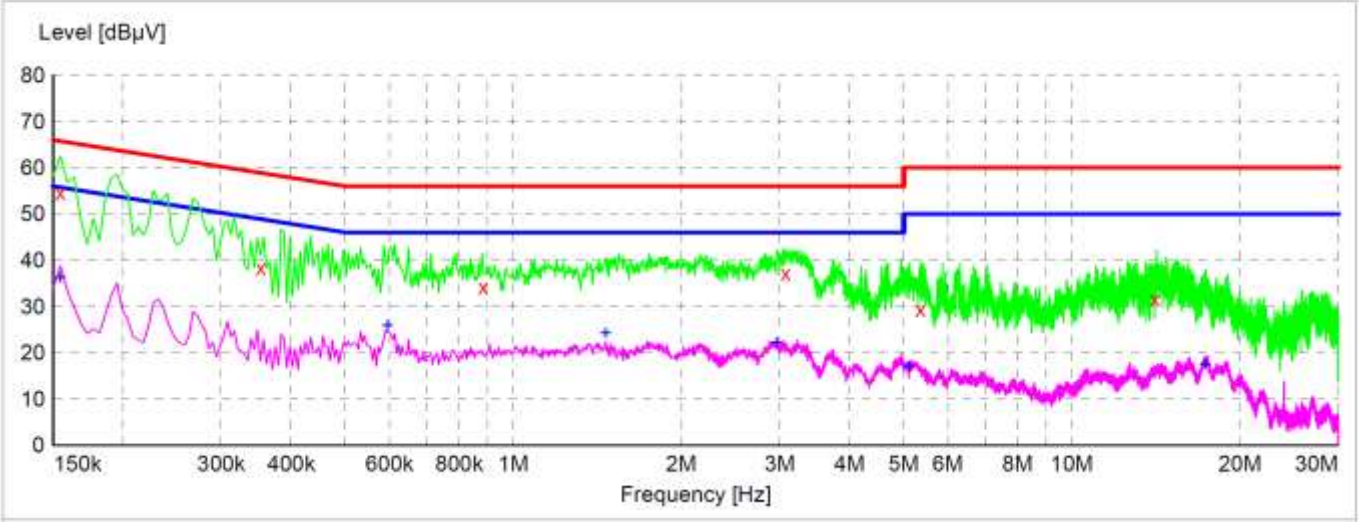


5.6.3 Test Results

PASS.

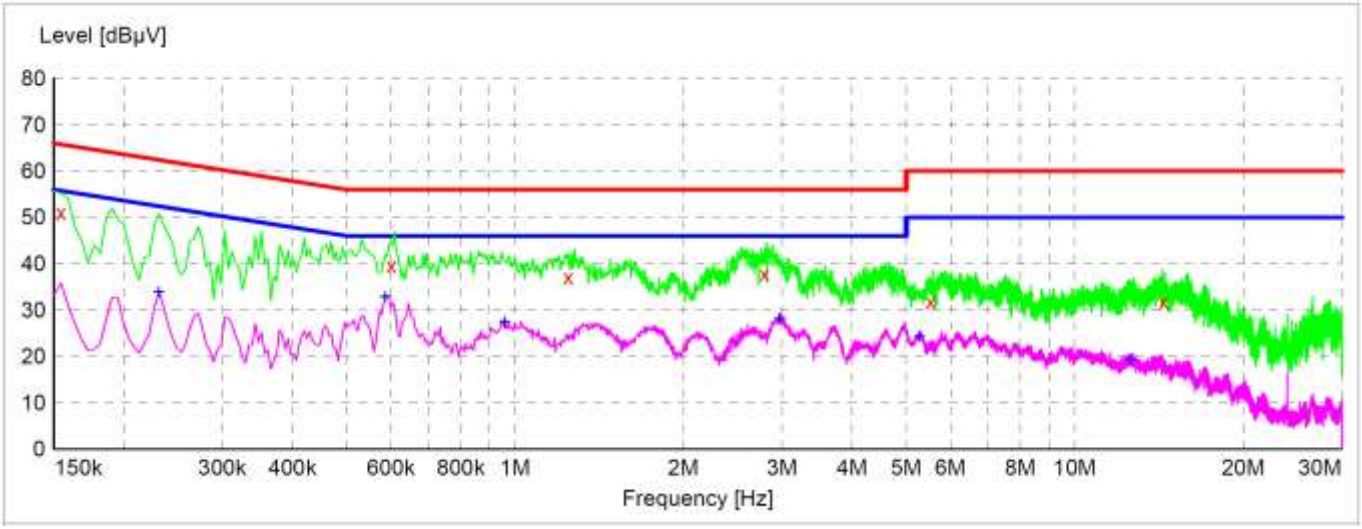
The test data please refer to following page.

The worst result for EEE 802.11a-5745MHz @Chain 0



Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.154500	54.60	9.9	66	11.2	QP	N	GND
0.352500	38.40	10.2	59	20.5	QP	N	GND
0.883500	34.20	9.9	56	21.8	QP	N	GND
3.070500	37.20	9.8	56	18.8	QP	N	GND
5.356500	29.30	9.8	60	30.7	QP	N	GND
14.068500	31.60	9.9	60	28.4	QP	N	GND

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.154500	36.30	9.9	56	19.5	AV	N	GND
0.595500	25.90	10.0	46	20.1	AV	N	GND
1.464000	24.30	9.8	46	21.7	AV	N	GND
2.958000	22.20	9.8	46	23.8	AV	N	GND
5.109000	17.10	9.8	50	32.9	AV	N	GND
17.349000	17.50	10.2	50	32.5	AV	N	GND



Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.154500	51.10	9.9	66	14.7	QP	L1	GND
0.600000	39.60	10.0	56	16.4	QP	L1	GND
1.243500	37.10	9.8	56	18.9	QP	L1	GND
2.787000	37.80	9.8	56	18.2	QP	L1	GND
5.527500	31.80	9.8	60	28.2	QP	L1	GND
14.401500	31.70	9.9	60	28.3	QP	L1	GND

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.231000	33.90	10.6	52	18.5	AV	L1	GND
0.586500	32.90	10.0	46	13.1	AV	L1	GND
0.960000	27.50	9.8	46	18.5	AV	L1	GND
2.967000	28.10	9.8	46	17.9	AV	L1	GND
5.280000	24.30	9.8	50	25.7	AV	L1	GND
12.556500	19.20	9.9	50	30.8	AV	L1	GND

****Note: Pre-scan all modes and recorded the worst case results in this report (IEEE 802.11a) @ Chain 0 for 120V/60Hz.*

5.7 Undesirable Emissions Measurement

5.7.1 LIMIT

According to ξ15.407 (b) Undesirable emission limits. 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:

(a) 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.

(b) 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.

(c) 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.

(d) For transmitters operating in the 5.725-5.85 GHz band:

(i) 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.

(ii) Devices certified before March 2, 2017 with antenna gain greater than 10 dBi may demonstrate compliance with the emission limits in §15.247(d), but manufacturing, marketing and importing of devices certified under this alternative must cease by March 2, 2018. Devices certified before March 2, 2018 with antenna gain of 10 dBi or less may demonstrate compliance with the emission limits in §15.247(d), but manufacturing, marketing and importing of devices certified under this alternative must cease before March 2, 2020.

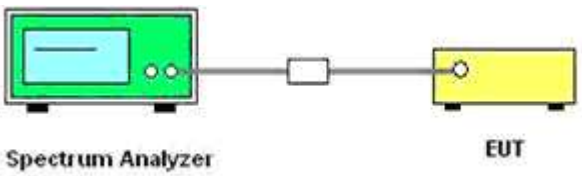
(e) The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.

(f) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209. Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in §15.207.

(g) The provisions of §15.205 apply to intentional radiators operating under this section.

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

5.7.2 TEST CONFIGURATION



5.7.3 TEST PROCEDURE

1. The power was monitored at the coupler port with a Spectrum Analyzer. The power level was set to the maximum level.

2. Set the RBW = 1MHz.

3. Set the VBW ≥ 3MHz

4. Number of points in sweep ≥ 2 × span / RBW. (This ensures that bin-to-bin spacing is ≤ RBW/2, so that narrowband signals are not lost between frequency bins.)

5. Manually set sweep time ≥ 10 × (number of points in sweep) × (total on/off period of the transmitted signal).

6. Set detector = power averaging (rms).

7. Sweep time = auto couple.

8. Trace mode = max hold.

9. Allow trace to fully stabilize.

5. 7.4 Test Results

For Antenna Chain 0

IEEE 802.11a							
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	EIRP (dBm/1MHz)	Detector	Limit (dBm/1MHz)	Over limit dB	Verdict
5650.00	-48.01	2.15	-45.86	Peak	-27.00	-18.86	PASS
5700.00	-43.35	2.15	-41.20	Peak	10.00	-51.20	PASS
5720.00	-36.70	2.15	-34.55	Peak	15.60	-50.15	PASS
5725.00	-27.45	2.15	-25.30	Peak	27.00	-52.30	PASS
5850.00	-34.90	2.15	-32.75	Peak	27.00	-59.75	PASS
5855.00	-38.39	2.15	-36.24	Peak	15.60	-51.84	PASS
5875.00	-42.07	2.15	-39.92	Peak	10.00	-49.92	PASS
5925.00	-45.63	2.15	-43.48	Peak	-27.00	-16.48	PASS

IEEE 802.11n HT20							
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	EIRP (dBm/1MHz)	Detector	Limit (dBm/1MHz)	Over limit dB	Verdict
5650.00	-47.34	2.15	-45.19	Peak	-27.00	-18.19	PASS
5700.00	-43.05	2.15	-40.90	Peak	10.00	-50.90	PASS
5720.00	-33.34	2.15	-31.19	Peak	15.60	-46.79	PASS
5725.00	-23.60	2.15	-21.45	Peak	27.00	-48.45	PASS
5850.00	-33.13	2.15	-30.98	Peak	27.00	-57.98	PASS
5855.00	-37.80	2.15	-35.65	Peak	15.60	-51.25	PASS
5875.00	-41.58	2.15	-39.43	Peak	10.00	-49.43	PASS
5925.00	-44.51	2.15	-42.36	Peak	-27.00	-15.36	PASS

IEEE 802.11ac VHT20							
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	EIRP (dBm/1MHz)	Detector	Limit (dBm/1MHz)	Over limit dB	Verdict
5650.00	-46.78	2.15	-44.63	Peak	-27.00	-17.63	PASS
5700.00	-42.92	2.15	-40.77	Peak	10.00	-50.77	PASS
5720.00	-34.48	2.15	-32.33	Peak	15.60	-47.93	PASS
5725.00	-24.84	2.15	-22.69	Peak	27.00	-49.69	PASS
5850.00	-31.49	2.15	-29.34	Peak	27.00	-56.34	PASS
5855.00	-38.15	2.15	-36.00	Peak	15.60	-51.60	PASS
5875.00	-41.98	2.15	-39.83	Peak	10.00	-49.83	PASS
5925.00	-44.87	2.15	-42.72	Peak	-27.00	-15.72	PASS

IEEE 802.11n HT40							
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	EIRP (dBm/1MHz)	Detector	Limit (dBm/1MHz)	Over limit dB	Verdict
5650.00	-48.70	2.15	-46.55	Peak	-27.00	-19.55	PASS
5700.00	-41.64	2.15	-39.49	Peak	10.00	-49.49	PASS
5720.00	-28.35	2.15	-26.20	Peak	15.60	-41.80	PASS
5725.00	-26.54	2.15	-24.39	Peak	27.00	-51.39	PASS
5850.00	-39.01	2.15	-36.86	Peak	27.00	-63.86	PASS
5855.00	-40.05	2.15	-37.90	Peak	15.60	-53.50	PASS
5875.00	-43.99	2.15	-41.84	Peak	10.00	-51.84	PASS
5925.00	-47.23	2.15	-45.08	Peak	-27.00	-18.08	PASS

IEEE 802.11ac VHT40							
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	EIRP (dBm/1MHz)	Detector	Limit (dBm/1MHz)	Over limit dB	Verdict
5650.00	-48.53	2.15	-46.38	Peak	-27.00	-19.38	PASS
5700.00	-41.23	2.15	-39.08	Peak	10.00	-49.08	PASS
5720.00	-27.33	2.15	-25.18	Peak	15.60	-40.78	PASS
5725.00	-25.51	2.15	-23.36	Peak	27.00	-50.36	PASS
5850.00	-39.08	2.15	-36.93	Peak	27.00	-63.93	PASS
5855.00	-39.71	2.15	-37.56	Peak	15.60	-53.16	PASS
5875.00	-42.36	2.15	-40.21	Peak	10.00	-50.21	PASS
5925.00	-46.25	2.15	-44.10	Peak	-27.00	-17.10	PASS

IEEE 802.11ac VHT80							
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	EIRP (dBm/1MHz)	Detector	Limit (dBm/1MHz)	Over limit dB	Verdict
5650.00	-41.64	2.15	-39.49	Peak	-27.00	-12.49	PASS
5700.00	-30.64	2.15	-28.49	Peak	10.00	-38.49	PASS
5720.00	-28.65	2.15	-26.50	Peak	15.60	-42.10	PASS
5725.00	-27.29	2.15	-25.14	Peak	27.00	-52.14	PASS
5850.00	-32.36	2.15	-30.21	Peak	27.00	-57.21	PASS
5855.00	-34.63	2.15	-32.48	Peak	15.60	-48.08	PASS
5875.00	-36.18	2.15	-34.03	Peak	10.00	-44.03	PASS
5925.00	-42.74	2.15	-40.59	Peak	-27.00	-13.59	PASS

For Antenna Chain 1

IEEE 802.11a							
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	EIRP (dBm/1MHz)	Detector	Limit (dBm/1MHz)	Over limit dB	Verdict
5650.00	-47.59	2.15	-45.44	Peak	-27.00	-18.44	PASS
5700.00	-43.38	2.15	-41.23	Peak	10.00	-51.23	PASS
5720.00	-36.53	2.15	-34.38	Peak	15.60	-49.98	PASS
5725.00	-27.20	2.15	-25.05	Peak	27.00	-52.05	PASS
5850.00	-35.11	2.15	-32.96	Peak	27.00	-59.96	PASS
5855.00	-39.47	2.15	-37.32	Peak	15.60	-52.92	PASS
5875.00	-43.18	2.15	-41.03	Peak	10.00	-51.03	PASS
5925.00	-45.36	2.15	-43.21	Peak	-27.00	-16.21	PASS

IEEE 802.11n HT20							
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	EIRP (dBm/1MHz)	Detector	Limit (dBm/1MHz)	Over limit dB	Verdict
5650.00	-46.43	2.15	-44.28	Peak	-27.00	-17.28	PASS
5700.00	-43.33	2.15	-41.18	Peak	10.00	-51.18	PASS
5720.00	-34.01	2.15	-31.86	Peak	15.60	-47.46	PASS
5725.00	-23.43	2.15	-21.28	Peak	27.00	-48.28	PASS
5850.00	-32.87	2.15	-30.72	Peak	27.00	-57.72	PASS
5855.00	-38.21	2.15	-36.06	Peak	15.60	-51.66	PASS
5875.00	-42.42	2.15	-40.27	Peak	10.00	-50.27	PASS
5925.00	-45.19	2.15	-43.04	Peak	-27.00	-16.04	PASS

IEEE 802.11ac VHT20							
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	EIRP (dBm/1MHz)	Detector	Limit (dBm/1MHz)	Over limit dB	Verdict
5650.00	-48.12	2.15	-45.97	Peak	-27.00	-18.97	PASS
5700.00	-43.32	2.15	-41.17	Peak	10.00	-51.17	PASS
5720.00	-34.23	2.15	-32.08	Peak	15.60	-47.68	PASS
5725.00	-24.90	2.15	-22.75	Peak	27.00	-49.75	PASS
5850.00	-31.70	2.15	-29.55	Peak	27.00	-56.55	PASS
5855.00	-35.76	2.15	-33.61	Peak	15.60	-49.21	PASS
5875.00	-40.06	2.15	-37.91	Peak	10.00	-47.91	PASS
5925.00	-45.35	2.15	-43.20	Peak	-27.00	-16.20	PASS

IEEE 802.11n HT40							
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	EIRP (dBm/1MHz)	Detector	Limit (dBm/1MHz)	Over limit dB	Verdict
5650.00	-48.70	2.15	-46.55	Peak	-27.00	-19.55	PASS
5700.00	-40.30	2.15	-38.15	Peak	10.00	-48.15	PASS
5720.00	-28.36	2.15	-26.21	Peak	15.60	-41.81	PASS
5725.00	-26.48	2.15	-24.33	Peak	27.00	-51.33	PASS
5850.00	-39.99	2.15	-37.84	Peak	27.00	-64.84	PASS
5855.00	-38.81	2.15	-36.66	Peak	15.60	-52.26	PASS
5875.00	-44.14	2.15	-41.99	Peak	10.00	-51.99	PASS
5925.00	-46.75	2.15	-44.60	Peak	-27.00	-17.60	PASS

IEEE 802.11ac VHT40							
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	EIRP (dBm/1MHz)	Detector	Limit (dBm/1MHz)	Over limit dB	Verdict
5650.00	-48.91	2.15	-46.76	Peak	-27.00	-19.76	PASS
5700.00	-40.10	2.15	-37.95	Peak	10.00	-47.95	PASS
5720.00	-28.79	2.15	-26.64	Peak	15.60	-42.24	PASS
5725.00	-25.89	2.15	-23.74	Peak	27.00	-50.74	PASS
5850.00	-38.37	2.15	-36.22	Peak	27.00	-63.22	PASS
5855.00	-39.90	2.15	-37.75	Peak	15.60	-53.35	PASS
5875.00	-43.02	2.15	-40.87	Peak	10.00	-50.87	PASS
5925.00	-46.17	2.15	-44.02	Peak	-27.00	-17.02	PASS

IEEE 802.11ac VHT80							
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	EIRP (dBm/1MHz)	Detector	Limit (dBm/1MHz)	Over limit dB	Verdict
5650.00	-42.05	2.15	-39.90	Peak	-27.00	-12.90	PASS
5700.00	-30.26	2.15	-28.11	Peak	10.00	-38.11	PASS
5720.00	-28.22	2.15	-26.07	Peak	15.60	-41.67	PASS
5725.00	-28.19	2.15	-26.04	Peak	27.00	-53.04	PASS
5850.00	-31.39	2.15	-29.24	Peak	27.00	-56.24	PASS
5855.00	-34.47	2.15	-32.32	Peak	15.60	-47.92	PASS
5875.00	-36.68	2.15	-34.53	Peak	10.00	-44.53	PASS
5925.00	-42.39	2.15	-40.24	Peak	-27.00	-13.24	PASS

For Combined Antenna Chain 0 and Antenna Chain 1

IEEE 802.11n HT20									
Frequency (MHz)	Conducted Power (dBm)			Directional Gain (dB)	EIRP (dBm/1MHz)	Detector	Limit (dBm/1MHz)	Over limit dB	Verdict
	Antenna 0	Antenna 1	Sum						
5650.00	-47.34	-46.43	-43.85	2.15	-41.70	Peak	-27.00	-14.70	PASS
5700.00	-43.05	-43.33	-40.18	2.15	-38.03	Peak	10.00	-48.03	PASS
5720.00	-33.34	-34.01	-30.65	2.15	-28.50	Peak	15.60	-44.10	PASS
5725.00	-23.60	-23.43	-20.50	2.15	-18.35	Peak	27.00	-45.35	PASS
5850.00	-33.13	-32.87	-29.99	2.15	-27.84	Peak	27.00	-54.84	PASS
5855.00	-37.80	-38.21	-34.99	2.15	-32.84	Peak	15.60	-48.44	PASS
5875.00	-41.58	-42.42	-38.97	2.15	-36.82	Peak	10.00	-46.82	PASS
5925.00	-44.51	-45.19	-41.83	2.15	-39.68	Peak	-27.00	-12.68	PASS

IEEE 802.11ac VHT20									
Frequency (MHz)	Conducted Power (dBm)			Directional Gain (dB)	EIRP (dBm/1MHz)	Detector	Limit (dBm/1MHz)	Over limit dB	Verdict
	Antenna 0	Antenna 1	Sum						
5650.00	-46.78	-48.12	-44.39	2.15	-42.24	Peak	-27.00	-15.24	PASS
5700.00	-42.92	-43.32	-40.11	2.15	-37.96	Peak	10.00	-47.96	PASS
5720.00	-34.48	-34.23	-31.34	2.15	-29.19	Peak	15.60	-44.79	PASS
5725.00	-24.84	-24.90	-21.86	2.15	-19.71	Peak	27.00	-46.71	PASS
5850.00	-31.49	-31.70	-28.58	2.15	-26.43	Peak	27.00	-53.43	PASS
5855.00	-38.15	-35.76	-33.78	2.15	-31.63	Peak	15.60	-47.23	PASS
5875.00	-41.98	-40.06	-37.90	2.15	-35.75	Peak	10.00	-45.75	PASS
5925.00	-44.87	-45.35	-42.09	2.15	-39.94	Peak	-27.00	-12.94	PASS

IEEE 802.11n HT40									
Frequency (MHz)	Conducted Power (dBm)			Directional Gain (dB)	EIRP (dBm/1MHz)	Detector	Limit (dBm/1MHz)	Over limit dB	Verdict
	Antenna 0	Antenna 1	Sum						
5650.00	-48.70	-48.70	-45.69	2.15	-43.54	Peak	-27.00	-16.54	PASS
5700.00	-41.64	-40.30	-37.91	2.15	-35.76	Peak	10.00	-45.76	PASS
5720.00	-28.35	-28.36	-25.34	2.15	-23.19	Peak	15.60	-38.79	PASS
5725.00	-26.54	-26.48	-23.50	2.15	-21.35	Peak	27.00	-48.35	PASS
5850.00	-39.01	-39.99	-36.46	2.15	-34.31	Peak	27.00	-61.31	PASS
5855.00	-40.05	-38.81	-36.38	2.15	-34.23	Peak	15.60	-49.83	PASS
5875.00	-43.99	-44.14	-41.05	2.15	-38.90	Peak	10.00	-48.90	PASS
5925.00	-47.23	-46.75	-43.97	2.15	-41.82	Peak	-27.00	-14.82	PASS

IEEE 802.11ac VHT40									
Frequency (MHz)	Conducted Power (dBm)			Directional Gain (dB)	EIRP (dBm/1MHz)	Detector	Limit (dBm/1MHz)	Over limit dB	Verdict
	Antenna 0	Antenna 1	Sum						
5650.00	-48.53	-48.91	-45.71	2.15	-43.56	Peak	-27.00	-16.56	PASS
5700.00	-41.23	-40.10	-37.62	2.15	-35.47	Peak	10.00	-45.47	PASS
5720.00	-27.33	-28.79	-24.99	2.15	-22.84	Peak	15.60	-38.44	PASS
5725.00	-25.51	-25.89	-22.69	2.15	-20.54	Peak	27.00	-47.54	PASS
5850.00	-39.08	-38.37	-35.70	2.15	-33.55	Peak	27.00	-60.55	PASS
5855.00	-39.71	-39.90	-36.79	2.15	-34.64	Peak	15.60	-50.24	PASS
5875.00	-42.36	-43.02	-39.67	2.15	-37.52	Peak	10.00	-47.52	PASS
5925.00	-46.25	-46.17	-43.20	2.15	-41.05	Peak	-27.00	-14.05	PASS

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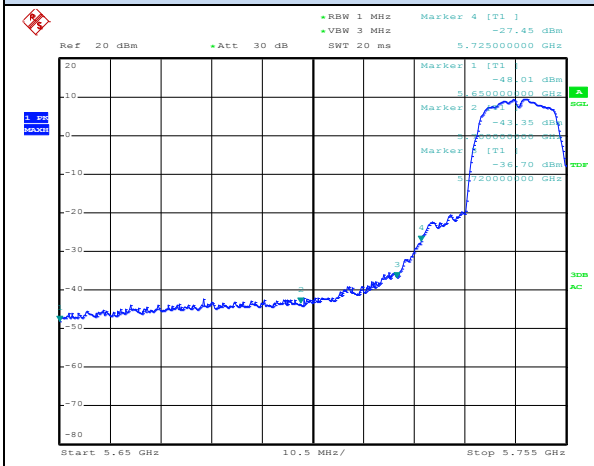
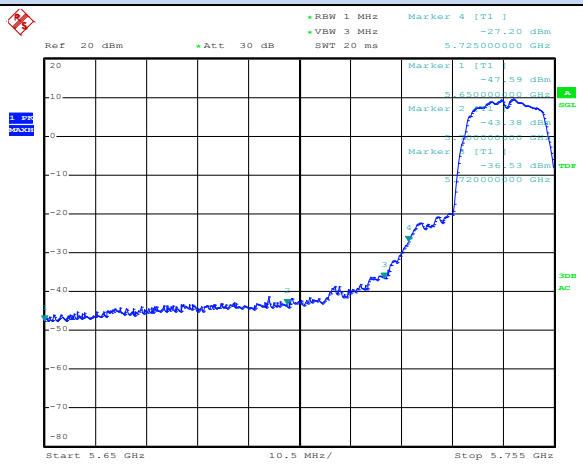
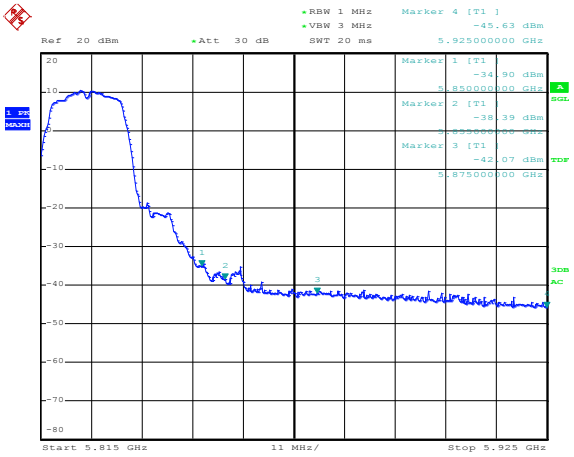
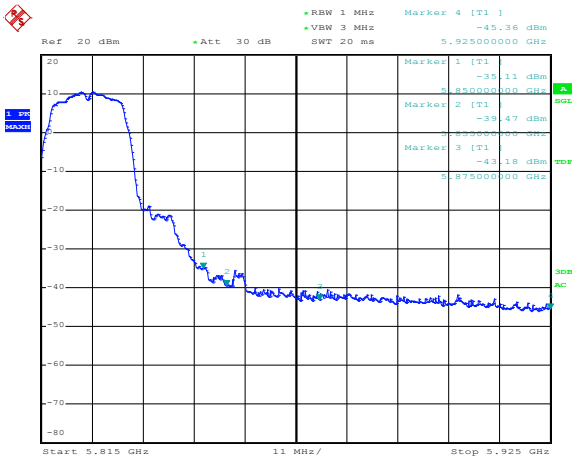
IEEE 802.11ac VHT80									
Frequency (MHz)	Conducted Power (dBm)			Directional Gain (dB)	EIRP (dBm/1MHz)	Detector	Limit (dBm/1MHz)	Over limit dB	Verdict
	Antenna 0	Antenna 1	Sum						
5650.00	-41.64	-42.05	-38.83	2.15	-36.68	Peak	-27.00	-9.68	PASS
5700.00	-30.64	-30.26	-27.44	2.15	-25.29	Peak	10.00	-35.29	PASS
5720.00	-28.65	-28.22	-25.42	2.15	-23.27	Peak	15.60	-38.87	PASS
5725.00	-27.29	-28.19	-24.71	2.15	-22.56	Peak	27.00	-49.56	PASS
5850.00	-32.36	-31.39	-28.84	2.15	-26.69	Peak	27.00	-53.69	PASS
5855.00	-34.63	-34.47	-31.54	2.15	-29.39	Peak	15.60	-44.99	PASS
5875.00	-36.18	-36.68	-33.41	2.15	-31.26	Peak	10.00	-41.26	PASS
5925.00	-42.74	-42.39	-39.55	2.15	-37.40	Peak	-27.00	-10.40	PASS

Remark:

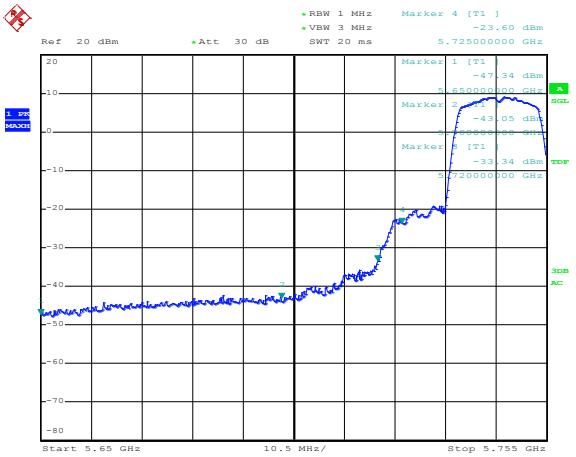
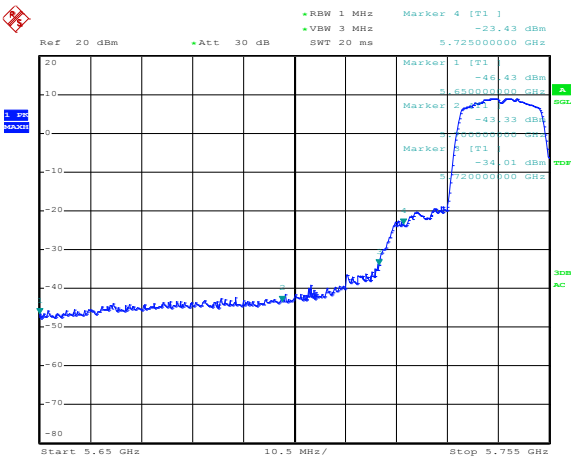
1. *Measured unwanted emission at difference data rate for each mode and recorded worst case for each mode.*
2. *Test results including cable loss;*
3. *Worst case data at 6Mbps at IEEE 802.11a; MCS0 at IEEE 802.11n HT20, IEEE 802.11n HT40, IEEE 802.11a VHT20, IEEE 802.11ac VHT40 and IEEE 802.11ac VHT80;*
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. *E.I.R.P = Conducted power + Directional Gain*
6. *Please refer to following test plots;*

Unwanted emission

IEEE 802.11a

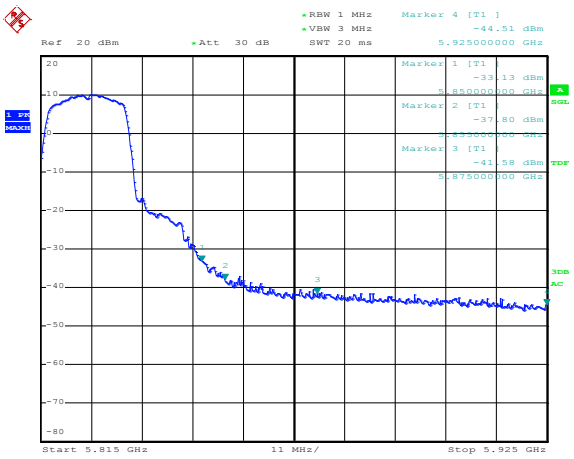
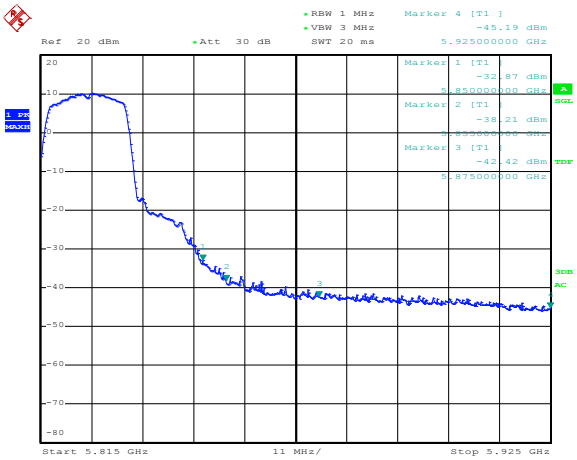
Antenna Chain 0	Antenna Chain 1
	
Channel 149 / 5745 MHz – Peak	Channel 149 / 5745 MHz – Peak
	
Channel 165 / 5825 MHz – Peak	Channel 165 / 5825 MHz – Peak

IEEE 802.11n HT20

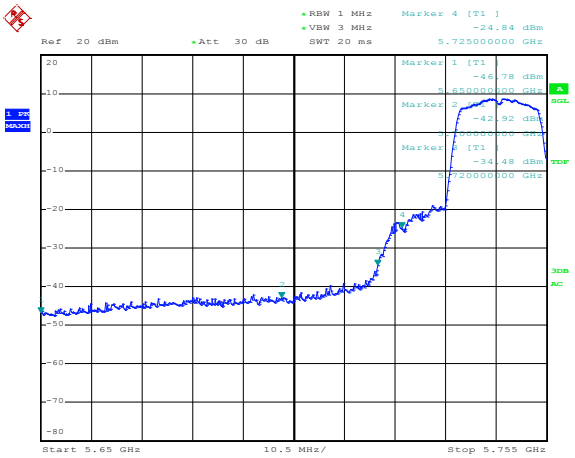
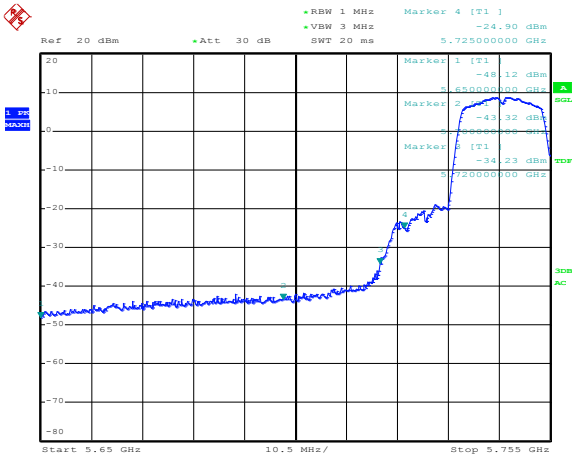
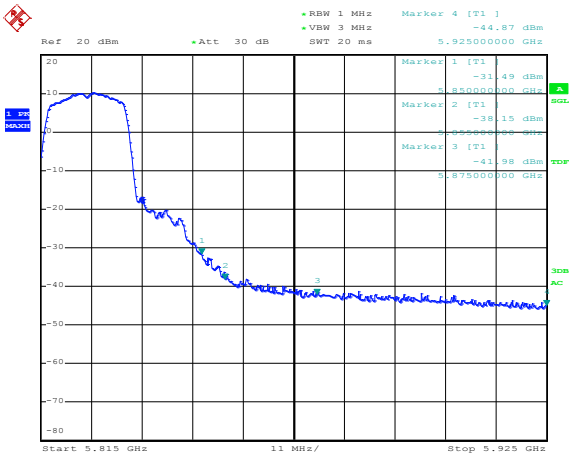
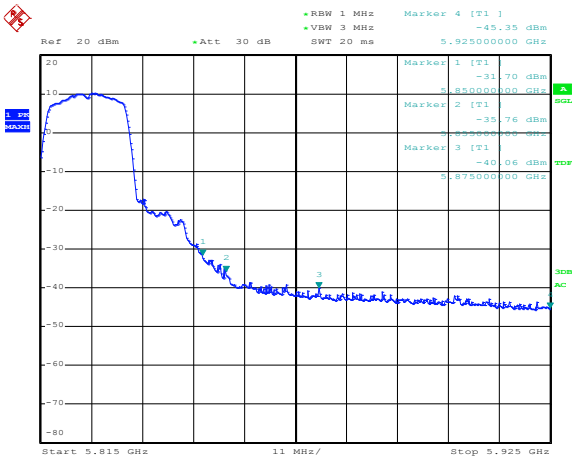
	
Channel 149 / 5745 MHz – Peak	Channel 149 / 5745 MHz – Peak

Unwanted emission

IEEE 802.11n HT20

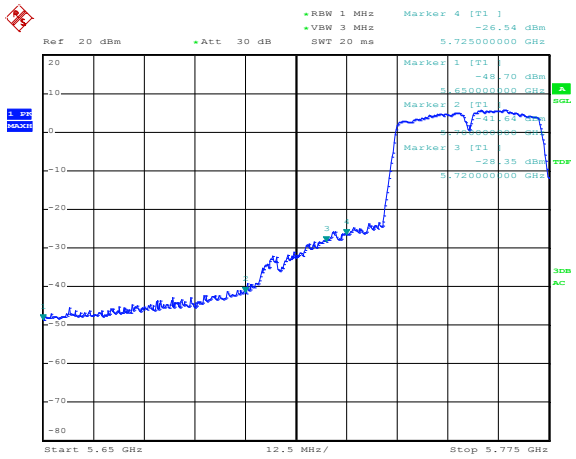
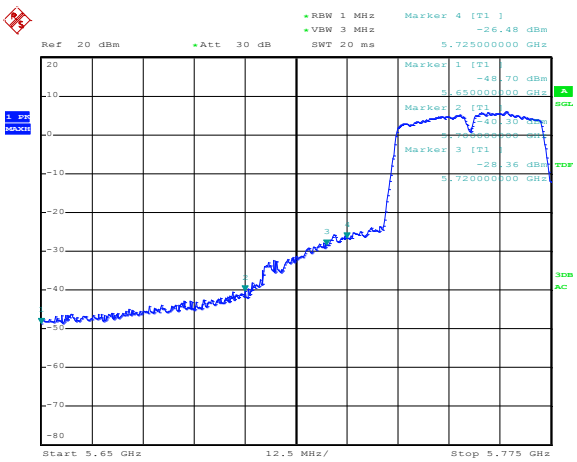
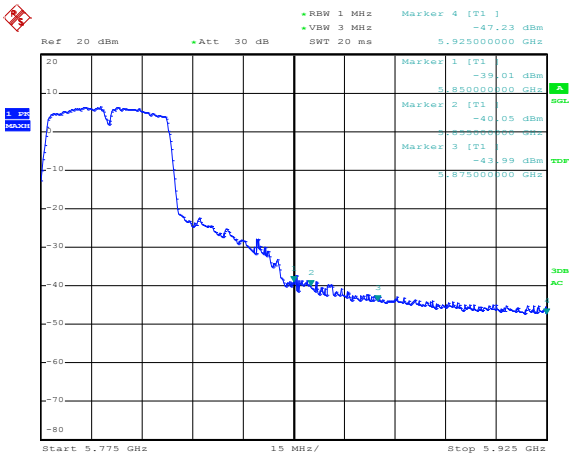
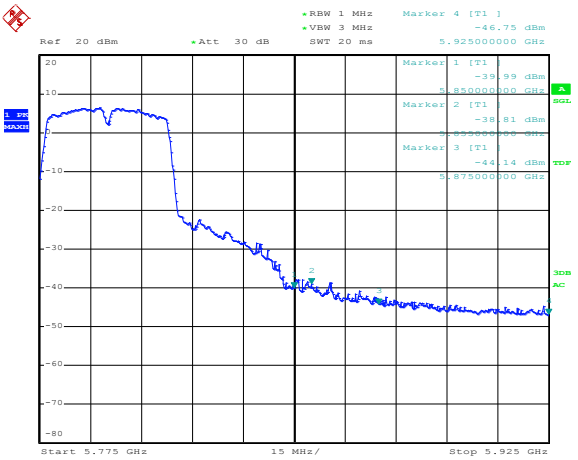
Antenna Chain 0	Antenna Chain 1
	
Channel 165 / 5825 MHz – Peak	Channel 165 / 5825 MHz – Peak

IEEE 802.11ac VHT20

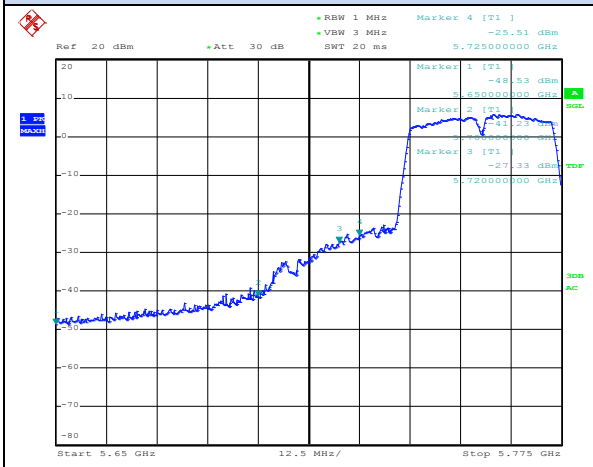
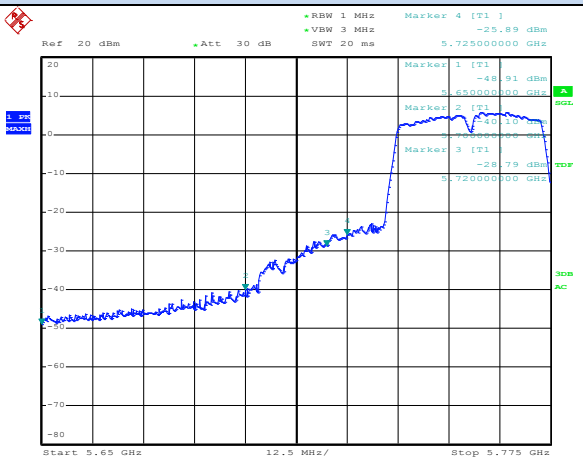
	
Channel 149 / 5745 MHz – Peak	Channel 149 / 5745 MHz – Peak
	
Channel 165 / 5825 MHz – Peak	Channel 165 / 5825 MHz – Peak

Unwanted emission

IEEE 802.11n HT40

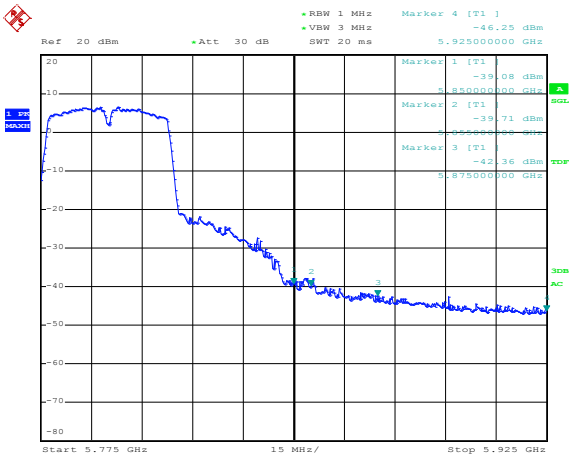
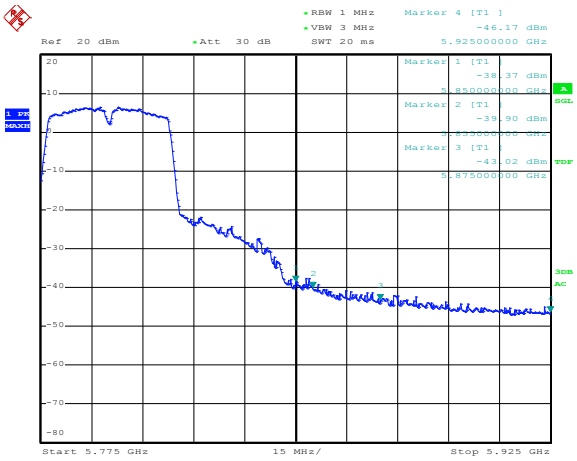
Antenna Chain 0	Antenna Chain 1
	
Channel 151 / 5755 MHz – Peak	Channel 151 / 5755 MHz – Peak
	
Channel 159 / 5795 MHz – Peak	Channel 159 / 5795 MHz – Peak

IEEE 802.11ac VHT40

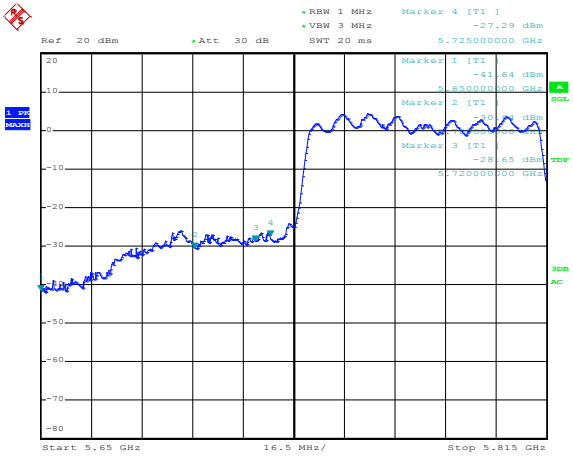
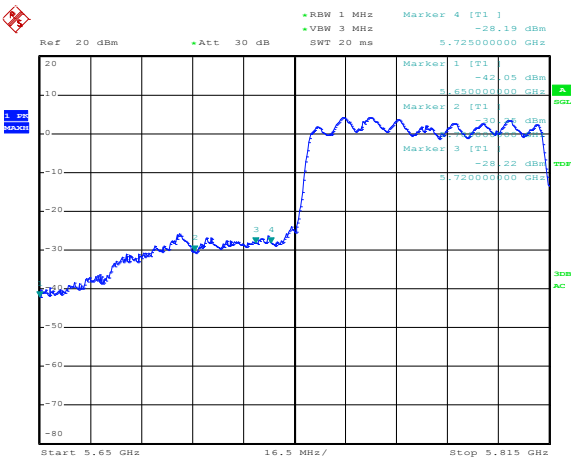
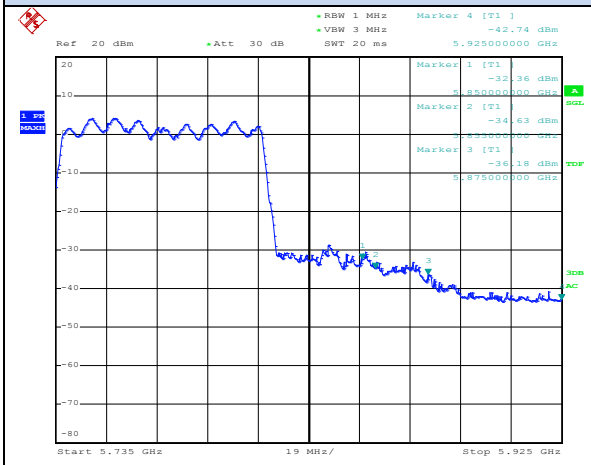
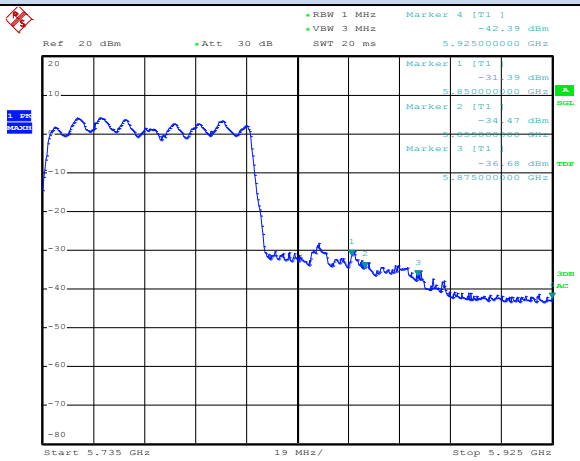
	
Channel 151 / 5755 MHz – Peak	Channel 151 / 5755 MHz – Peak

Unwanted emission

IEEE 802.11ac VHT40

Antenna Chain 0	Antenna Chain 1
	
Channel 159 / 5795 MHz – Peak	Channel 159 / 5795 MHz – Peak

IEEE 802.11ac VHT80

	
Channel 155 / 5775 MHz – Peak	Channel 155 / 5775 MHz – Peak
	
Channel 155 / 5775 MHz – Peak	Channel 155 / 5775 MHz – Peak

5.8. Antenna Requirements

5.8.1. 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. 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
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.

5.8.2. Antenna Connector Construction

The directional gains of antenna used for transmitting is 2.0dBi, and the antenna is an internal antenna connect to PCB board and no consideration of replacement. Please see EUT photo for details.

5.8.3. Results: Compliance.

Measurement

The antenna gain of the complete system is calculated by the difference of radiated power in EIRP and the conducted power of the module.

Conducted power refers ANSI C63.10:2013 Output power test procedure for UNII devices.

Radiated power refers to ANSI C63.10:2013 Radiated emissions tests.

Measurement parameters

Measurement parameter	
Detector:	Peak
Sweep Time:	Auto
Resolution bandwidth:	1MHz
Video bandwidth:	3MHz
Trace-Mode:	Max hold

Note: The antenna gain of the complete system is calculated by the difference of radiated power in EIRP and the conducted power of the module. For 5G WLAN devices, the IEEE 802.11a mode is used.

Limits

FCC	ISED
Antenna Gain	
6 dBi	

Antenna Chain 0

T_{nom}	V_{nom}	Lowest Channel 5745 MHz	Middle Channel 5785 MHz	Highest Channel 5825 MHz
Conducted power [dBm] Measured with OFDM modulation		10.67	11.56	12.03
Radiated power [dBm] Measured with OFDM modulation		12.31	12.85	13.87
Gain [dBi] Calculated		1.64	1.29	1.84
Measurement uncertainty			± 1.6 dB (cond.) / ± 3.8 dB (rad.)	

Antenna Chain 1

T_{nom}	V_{nom}	Lowest Channel 5745 MHz	Middle Channel 5785 MHz	Highest Channel 5825 MHz
Conducted power [dBm] Measured with OFDM modulation		11.54	12.02	12.43
Radiated power [dBm] Measured with OFDM modulation		12.96	13.73	14.35
Gain [dBi] Calculated		1.42	1.71	1.92
Measurement uncertainty			± 1.6 dB (cond.) / ± 3.8 dB (rad.)	

6. LIST OF MEASURING EQUIPMENTS

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
1	Power Meter	R&S	NRVS	100444	2017-06-17	2018-06-16
2	Power Sensor	R&S	NRV-Z81	100458	2017-06-17	2018-06-16
3	Power Sensor	R&S	NRV-Z32	10057	2017-06-17	2018-06-16
4	EPM Series Power Meter	Agilent	E4419B	MY45104493	2017-06-17	2018-06-16
5	E-SERIES AVG POWER SENSOR	Agilent	E9301H	MY41495234	2017-06-17	2018-06-16
6	ESA-E SERIES SPECTRUM ANALYZER	Agilent	E4407B	MY41440754	2017-11-18	2018-11-17
7	MXA Signal Analyzer	Agilent	N9020A	MY49100040	2017-06-17	2018-06-16
8	SPECTRUM ANALYZER	R&S	FSP	100503	2017-06-17	2018-06-16
9	3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	2017-06-17	2018-06-16
10	Positioning Controller	MF	MF-7082	/	2017-06-17	2018-06-16
11	EMI Test Software	AUDIX	E3	N/A	2017-06-17	2018-06-16
12	EMI Test Receiver	ROHDE & SCHWARZ	ESR 7	101181	2017-06-17	2018-06-16
13	AMPLIFIER	QuieTek	QTK-A2525G	CHM10809065	2017-11-18	2018-11-17
14	Active Loop Antenna	SCHWARZBECK	FMZB 1519B	00005	2017-06-23	2018-06-22
15	By-log Antenna	SCHWARZBECK	VULB9163	9163-470	2017-05-02	2018-05-01
16	Horn Antenna	EMCO	3115	6741	2017-06-23	2018-06-22
17	Horn Antenna	SCHWARZBECK	BBHA9170	BBHA9170154	2017-06-10	2018-06-09
18	RF Cable-R03m	Jye Bao	RG142	CB021	2017-06-17	2018-06-16
19	RF Cable-HIGH	SUHNER	SUCOFLEX 106	03CH03-HY	2017-06-17	2018-06-16
20	TEST RECEIVER	R&S	ESCI	101142	2017-06-17	2018-06-16
21	RF Cable-CON	UTIFLEX	3102-26886-4	CB049	2017-06-17	2018-06-16
22	10dB Attenuator	SCHWARZBECK	MTS-IMP136	261115-001-003 2	2017-06-17	2018-06-16
23	Artificial Mains	R&S	ENV216	101288	2017-06-17	2018-06-16

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