Shenzhen GUOREN Certification Technology Service Co., Ltd.

101#, Building K & Building T, The Second Industrial Zone, Jiazitang Community, Fenghuang Street, Guangming District, Shenzhen, China

FCC PART 15 SUBPART C TEST REPORT

FCC PART 15 SUBPART E 15.407
RSS-247 Issue 2 February 2017
RSS-Gen Issue 5 March 2019

Report Reference No......:	**GRCTR211102001-02**
FCC ID..... **:**	**2A3RN-SIR01**
IC . ..... **:**	**27961-SIR01**
Compiled by (position+printed name+signature)..:	Testing Engineer Jimmy Wang
Supervised by (position+printed name+signature)..:	Project Engineer Kelley Zhang
Approved by (position+printed name+signature)..:	Manager Sam Wang
Date of issue.....:	Nov. 30, 2021
Testing Laboratory Name .....:	**Shenzhen GUOREN Certification Technology Service Co., Ltd.**
Address.....**:**	101#, Building K & Building T, The Second Industrial Zone, Jiazitang Community, Fenghuang Street, Guangming District, Shenzhen, China
Applicant's name.....:	**Apkudo, Inc.**
Address .....:	3500 Boston St #210, Baltimore, MD 21224
Test specification .....**:**	
Standard .....:	**FCC Part 15 Subpart E 15.407** **RSS-247 Issue 2 February 2017** **RSS-Gen Issue 5 March 2019**

Test item description .....:	**Package Station**
Trade Mark .....:	/
Manufacturer .....:	Shenzhen Ai Rui Intelligent Manufacturing Co., Ltd
Model/Type reference.....:	SIR01
Listed Models .....:	/
Modulation .....:	OFDM
Frequency.....	From 5180MHz-5240MHz, 5745MHz-5825MHz
Ratings .....:	DC 12.0V From external circuit
Result.....:	**PASS**

TEST REPORT

Equipment under Test	:	Package Station
Model /Type	:	SIR01
Listed Models	:	/
Applicant	:	Apkudo, Inc.
Address	:	3500 Boston St #210, Baltimore, MD 21224
Manufacturer	:	Shenzhen Ai Rui Intelligent Manufacturing Co., Ltd
Address	:	603, building 2, Welld Industrial Park, No. 24, Qinglan Third Road, Pingshan District, Shenzhen, Guangdong, 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:
Radio Standards Specification RSS-247, Issue 2: Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices, replaces RSS-247, Issue 1, dated May 2015.
Radio Standards Specification RSS-Gen: issue 5, General Requirements for Compliance of Radio Apparatus replaces RSS-Gen, issue 4, dated November 2014.
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

2 SUMMARY

2.1 General Remarks

Date of receipt of test sample	:	Nov. 05, 2021
Testing commenced on	:	Nov. 05, 2021
Testing concluded on	:	Nov. 30, 2021

2.2 Product Description

Product Description:	Package Station			
Model:	SIR01			
HVIN:	SIR01			
Power supply:	DC 12.0V From external circuit			
Adapter：	Model:WTB48-1203000-T Input:AC 100-240V 50/60Hz 1.6A Output:DC 12V/3.0A. 36.0W			
Sample ID:	GRCTS211102001-1# (Engineer sample), GRCTS211102001-2# (Normal sample)			
Hardware version:	SIR_V100R001			
Software version:	V1.0			
WIFI				
Supported type:	20MHz system	40MHz system	80MHz system	160MHz system
	802.11n 802.11ac	802.11n 802.11ac	802.11ac	N/A
Operation frequency:	5180MHz-5240MHz 5745MHz-5825MHz	5190MHz-5230MHz 5755MHz-5795MHz	5210MHz 5775MHz	N/A
Modulation:	OFDM	OFDM	OFDM	N/A
Channel number:	9	4	2	N/A
Channel separation:	20MHz	40MHz	80MHz	N/A
Antenna type:	PCB antenna			
Antenna gain*（Supplied by the customer）:	2.0 dBi			
Remark:*When the information provided by the customer was used to calculate test results, if the information provided by the customer is not accurate, shenzhen GUOREN Certification Technology Service Co., Ltd. does not assume any responsibility.				

2.3 Short description of the Equipment under Test (EUT)

This is a Package Station.
For more details, refer to the user's manual of the EUT.

2.4 EUT operation mode

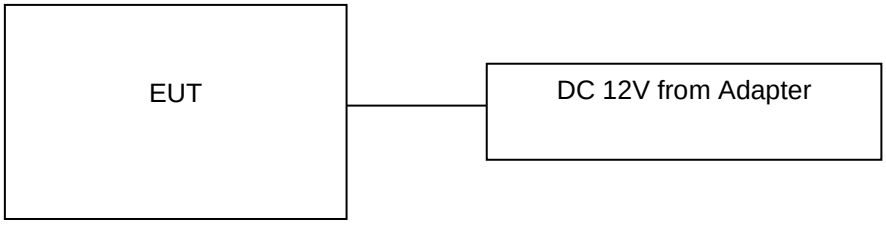
The Applicant provides communication tools software (AT command) to control the EUT for staying in continuous transmitting (Duty Cycle more than 98%) and receiving mode for testing.
All test performed at the low, middle and high of operational frequency range of each mode.

Operation Frequency List WIFI on 5G Band：

Operating band	20MHz		40MHz		80MHz	
	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
U-NII 1 (5150MHz-5250MHz)	36	5180	38	5190	42	5210
	40	5200				
	44	5220	46	5230		
	48	5240				
U-NII 3 (5725MHz-5850MHz)	149	5745	151	5755	155	5775
	153	5765				
	157	5785	159	5795		
	161	5805				
	165	5825	--	--	--	--

Note: The line display in grey is those Channels/Frequencies select to test in this report for each operation mode.

2.5 Block Diagram of Test Setup



2.6 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended to comply with Section 15.407 of the FCC Part 15 Subpart E and RSS-247 Rules.

2.7 Modifications

No modifications were implemented to meet testing criteria.

3 TEST ENVIRONMENT

3.1 Address of the test laboratory

Shenzhen GUOREN Certification Technology Service Co., Ltd.
101#, Building K & Building T, The Second Industrial Zone, Jiazitang Community, Fenghuang Street, Guangming District, Shenzhen, China

3.2 Test Facility

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

FCC-Registration No.: 920798 Designation Number: CN1304

Shenzhen GUOREN Certification Technology Service Co., Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform electromagnetic emissions measurements.

A2LA-Lab Cert. No.: 6202.01

Shenzhen GUOREN Certification Technology Service Co., Ltd. has been listed by American Association for Laboratory Accreditation to perform electromagnetic emission measurement.

ISED#: 27264 CAB identifier: CN0115
Shenzhen GUOREN Certification Technology Service Co., Ltd. has been listed by Innovation, Science and Economic Development Canada to perform electromagnetic emission measurement.

The 3m-Semi anechoic test site fulfils CISPR 16-1-4 according to ANSI C63.10 and CISPR 16-1-4:2010.

3.3 Environmental conditions

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

Normal Temperature:	15-35 ℃
Relative Humidity	30-60 %
Air Pressure	950-1050mbar

3.4 Test Description

FCC Requirement		
FCC Part 15.207 RSS-Gen 8.8	AC Power Conducted Emission	PASS
FCC Part 15.407(a) RSS-247 6.2.1.2	Emission Bandwidth(26dBm Bandwidth)	PASS Note1
FCC Part 15.407(e) RSS-247 6.2.4.1	Minimum Emission Bandwidth(6dBm Bandwidth)	PASS Note2
RSS-Gen 6.7	Occupied Bandwidth(99%)	PASS
FCC Part 15.407(a) RSS-247 6.2.1.1 RSS-247 6.2.4.1	Maximum Conducted Output Power	PASS
FCC Part 15.407(a) RSS-247 6.2.1.1 RSS-247 6.2.4.1	Peak Power Spectral Density	PASS
FCC Part 15.407(g) RSS-Gen 8.11	Frequency Stability	PASS
FCC 15.407(b)&15.205 RSS-Gen 8.10& RSS-247 6.2.4.2 & RSS-247 6.2.1.2	Restricted Bands Requirement	PASS
FCC 15.209 &15.407(b) RSS-Gen 8.9 & RSS-247 6.2.1.2 & RSS-247 6.2.4.2	Radiated Emissions	PASS
FCC Part 15.407(h) RSS 247 6.3.1	Dynamic Frequency Selection	N/A Note 3
FCC Part 15.203 RSS-Gen 6.8	Antenna Requirement	PASS

Note 1: Apply to U-NII 1, U-NII 2A, and U-NII 2C band.
Note 2: Apply to U-NII 3 band only.
Note 3: This device not work in DFS band.

Data Rate Used:
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 Conducted Output Power Power Spectral Density Emission Bandwidth(26dBm Bandwidth) Minimum Emission Bandwidth(6dBm Bandwidth) Radiated Emissions and Restricted Bands Requirement Frequency Stability	11n(20MHz),11ac(20MHz)/OFDM	7.2 Mbps
	11n(40MHz),11ac(40MHz)/OFDM	15.0Mbps
	11ac(80MHz)/OFDM	65.0Mbps

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 TR-100028-01" Electromagnetic compatibility and Radio spectrum Matters (ERM);Uncertainties in the measurement of mobile radio equipment characteristics; Part 1" and TR-100028-02 "Electromagnetic compatibility and Radio spectrum Matters (ERM);Uncertainties in the measurement of mobile radio equipment characteristics; Part 2 " and is documented in the Shenzhen GUOREN Certification Technology 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 GUOREN Certification Technology Service Co., Ltd.:

Test	Range	Measurement Uncertainty	Notes
Radiated Emission	30~1000MHz	4.06 dB	(1)
Radiated Emission	1~18GHz	5.14 dB	(1)
Radiated Emission	18-40GHz	5.38 dB	(1)
Conducted Disturbance	0.15~30MHz	2.14 dB	(1)

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

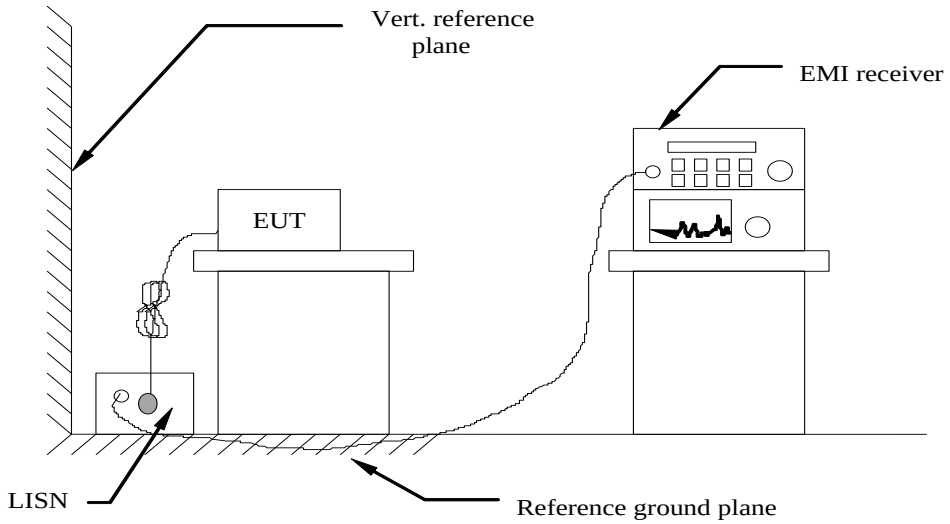
3.6 Equipments Used during the Test

Test Equipment	Manufacturer	Model No.	Equipment No.	Calibration Date	Calibration Due Date
LISN	R&S	ENV216	GRCTEE009	2021/10/30	2022/10/29
LISN	R&S	ENV216	GRCTEE010	2021/10/30	2022/10/29
EMI Test Receiver	R&S	ESPI	GRCTEE017	2021/10/30	2022/10/29
EMI Test Receiver	R&S	ESCI	GRCTEE008	2021/10/30	2022/10/29
Spectrum Analyzer	Agilent	N9020A	GRCTEE002	2021/10/30	2022/10/29
Spectrum Analyzer	R&S	FSP	GRCTEE003	2021/10/20	2022/10/19
Vector Signal generator	Agilent	N5181A	GRCTEE007	2021/10/30	2022/10/29
Analog Signal Generator	R&S	SML03	GRCTEE006	2021/10/30	2022/10/29
Climate Chamber	QIYA	LCD-9530	GRCTES016	2021/10/30	2022/10/29
Ultra-Broadband Antenna	Schwarzbeck	VULB9163	GRCTEE018	2020/10/25	2023/10/24
Horn Antenna	Schwarzbeck	BBHA 9120D	GRCTEE019	2020/10/25	2023/10/24
Loop Antenna	Zhinan	ZN30900C	GRCTEE020	2020/10/25	2023/10/24
Horn Antenna	Beijing Hangwei Dayang	OBH100400	GRCTEE049	2021/1/18	2024/1/17
Amplifier	Schwarzbeck	BBV 9745	GRCTEE021	2021/10/30	2022/10/29
Amplifier	Taiwan chengyi	EMC051845B	GRCTEE022	2021/10/30	2022/10/29
Temperature/Humidity Meter	Huaguan	HG-308	GRCTES037	2021/10/30	2022/10/29
Directional coupler	NARDA	4226-10	GRCTEE004	2021/10/30	2022/10/29
High-Pass Filter	XingBo	XBLBQ-GTA18	GRCTEE053	2021/10/30	2022/10/29
High-Pass Filter	XingBo	XBLBQ-GTA27	GRCTEE054	2021/10/30	2022/10/29
Automated filter bank	Tonscend	JS0806-F	GRCTEE055	2021/10/30	2022/10/29
Power Sensor	Agilent	U2021XA	GRCTEE070	2021/10/30	2022/10/29
EMI Test Software	ROHDE & SCHWARZ	ESK1-V1.71	GRCTEE060	N/A	N/A
EMI Test Software	Fera	EZ-EMC	GRCTEE061	N/A	N/A

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 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：

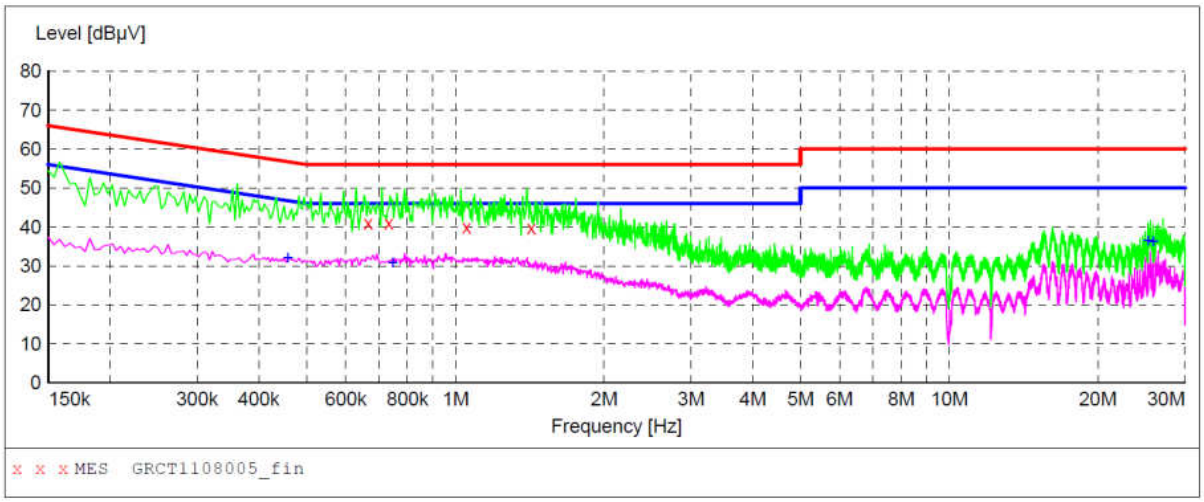
Frequency range (MHz)	Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50
* Decreases with the logarithm of the frequency.		

TEST RESULTS

Remark:

1. All modes of 802.11ac/n were tested at Low, Middle, and High channel; only the worst result of 802.11n (HT20) CH36 was reported as below:
2. Both 120 VAC, 50/60 Hz and 240 VAC, 50/60 Hz power supply have been tested, only the worst result of 120 VAC, 60 Hz was reported as below:

Power supply:	DC 12V from Adapter AC 120V/60Hz	Polarization	L



MEASUREMENT RESULT: "GRCT1108005_fin"

11/8/2021 1:09PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.666000	41.00	10.3	56	15.0	QP	L1	GND
0.734000	41.00	10.3	56	15.0	QP	L1	GND
1.054000	40.00	10.4	56	16.0	QP	L1	GND
1.426000	39.70	10.4	56	16.3	QP	L1	GND

MEASUREMENT RESULT: "GRCT1108005_fin2"

11/8/2021 1:09PM

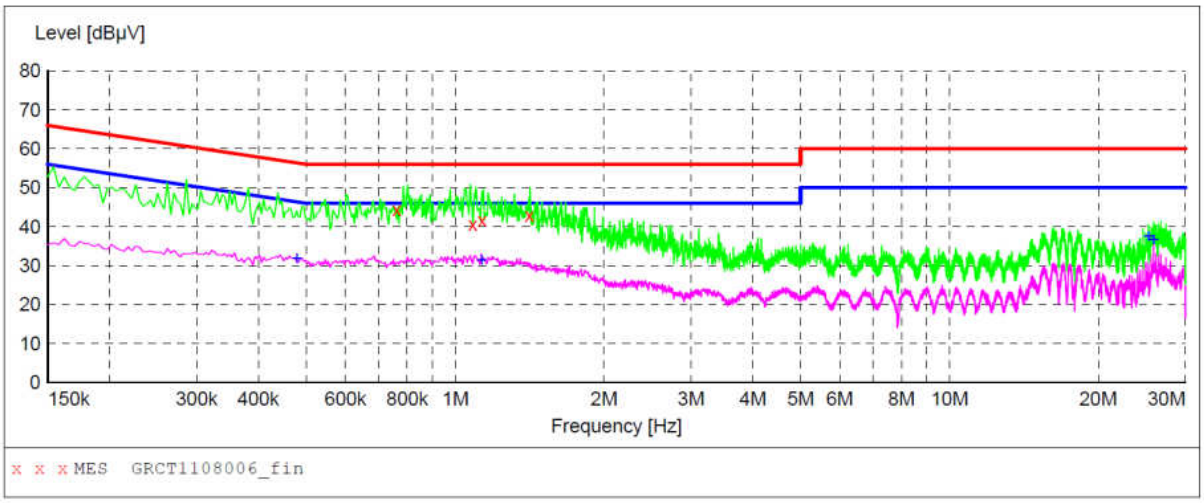
Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.458000	32.20	10.3	47	14.5	AV	L1	GND
0.746000	31.00	10.3	46	15.0	AV	L1	GND
25.262000	36.60	11.1	50	13.4	AV	L1	GND
25.870000	36.30	11.1	50	13.7	AV	L1	GND

Note:1).Level (dBµV)= Reading (dBµV)+ Transducer (dB)

2). Transducer (dB)=insertion loss of LISN (dB) + Cable loss (dB)

3). Margin(dB) = Limit (dBµV) - Level (dBµV)

Power supply:	DC 12V from Adapter AC 120V/60Hz	Polarization	N



MEASUREMENT RESULT: "GRCT1108006_fin"

11/8/2021 1:13PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.762000	44.40	10.3	56	11.6	QP	N	GND
1.086000	40.60	10.4	56	15.4	QP	N	GND
1.134000	41.60	10.4	56	14.4	QP	N	GND
1.414000	42.80	10.4	56	13.2	QP	N	GND

MEASUREMENT RESULT: "GRCT1108006_fin2"

11/8/2021 1:13PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.478000	32.00	10.3	46	14.0	AV	N	GND
1.130000	31.50	10.4	46	14.5	AV	N	GND
25.266000	37.60	11.1	50	12.4	AV	N	GND
25.874000	36.70	11.1	50	13.3	AV	N	GND

Note:1).Level (dBµV)= Reading (dBµV)+ Transducer (dB)

2). Transducer (dB)=insertion loss of LISN (dB) + Cable loss (dB)

3). Margin(dB) = Limit (dBµV) - Level (dBµV)

4.2 Radiated Emissions and Restricted Bands Requirement

Limit

The maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

(1) 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.
(2) 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.
(3) 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.
(4) 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.

Restricted Bands Requirement

Requirement	Limit(EIRP)	Limit (Field strength at 3m) Note1
15.407(b)(1)	PK:-27(dBm/MHz)	PK:68.2(dBμV/m)
15.407(b)(2)		
15.407(b)(3)		
15.407(b)(4)		

Note1: The following formula is used to convert the equipment isotropic radiated power (eirp) to field strength:

$$E = \frac{1000000\sqrt{30P}}{3}$$ μV/m, where P is the eirp (Watts)

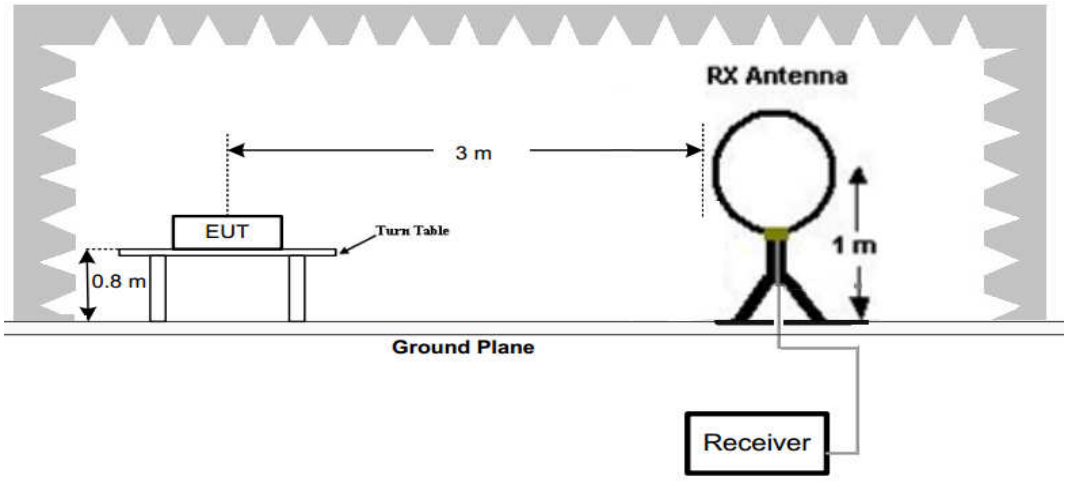
(5) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209
(6)In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a)

Radiated emission limits

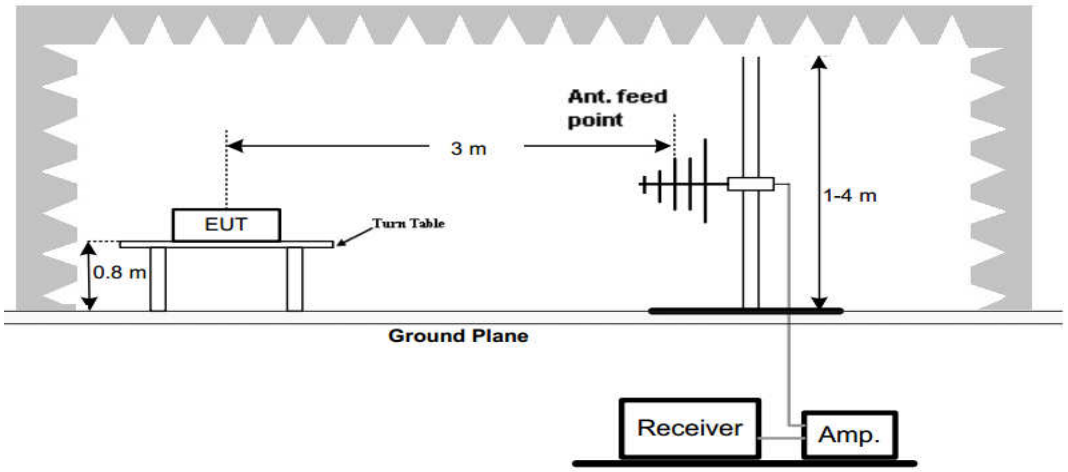
Frequency (MHz)	Distance (Meters)	Radiated (dBμV/m)	Radiated (μV/m)
0.009-0.49	3	20log(2400/F(KHz))+40log(300/3)	2400/F(KHz)
0.49-1.705	3	20log(24000/F(KHz))+ 40log(30/3)	24000/F(KHz)
1.705-30	3	20log(30)+ 40log(30/3)	30
30-88	3	40.0	100
88-216	3	43.5	150
216-960	3	46.0	200
Above 960	3	54.0	500

TEST CONFIGURATION

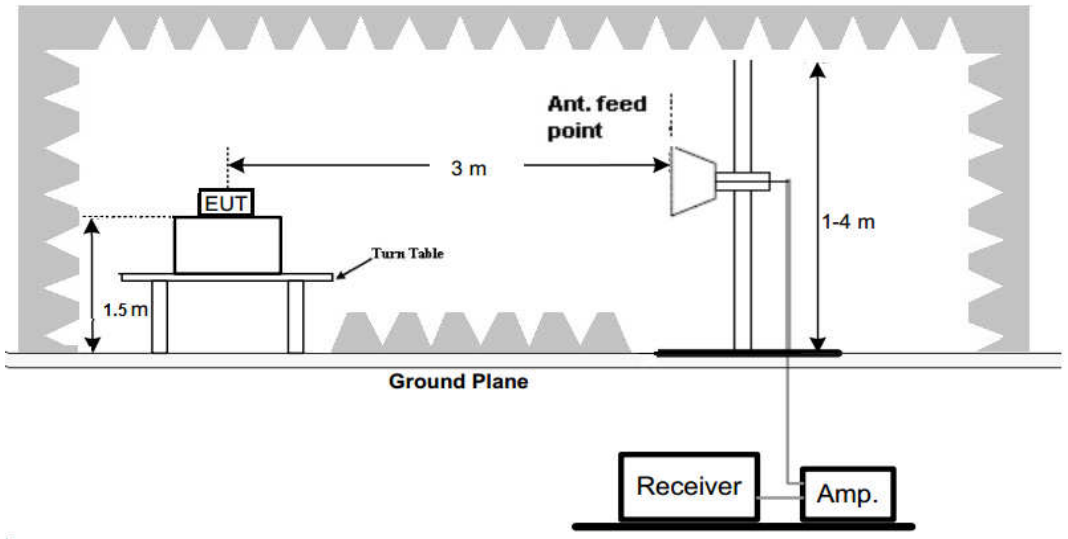
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz



(B) Radiated Emission Test Set-Up, Frequency below 1000MHz



(C) Radiated Emission Test Set-Up, Frequency above 1000MHz



Test Procedure

1. Below 1GHz measurement the EUT is placed on a turntable which is 0.8m above ground plane, and above 1GHz measurement EUT was placed on a low permittivity and low loss tangent turn table which is 1.5m above ground plane.
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. 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	Bilog Antenna	3
1GHz-18GHz	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

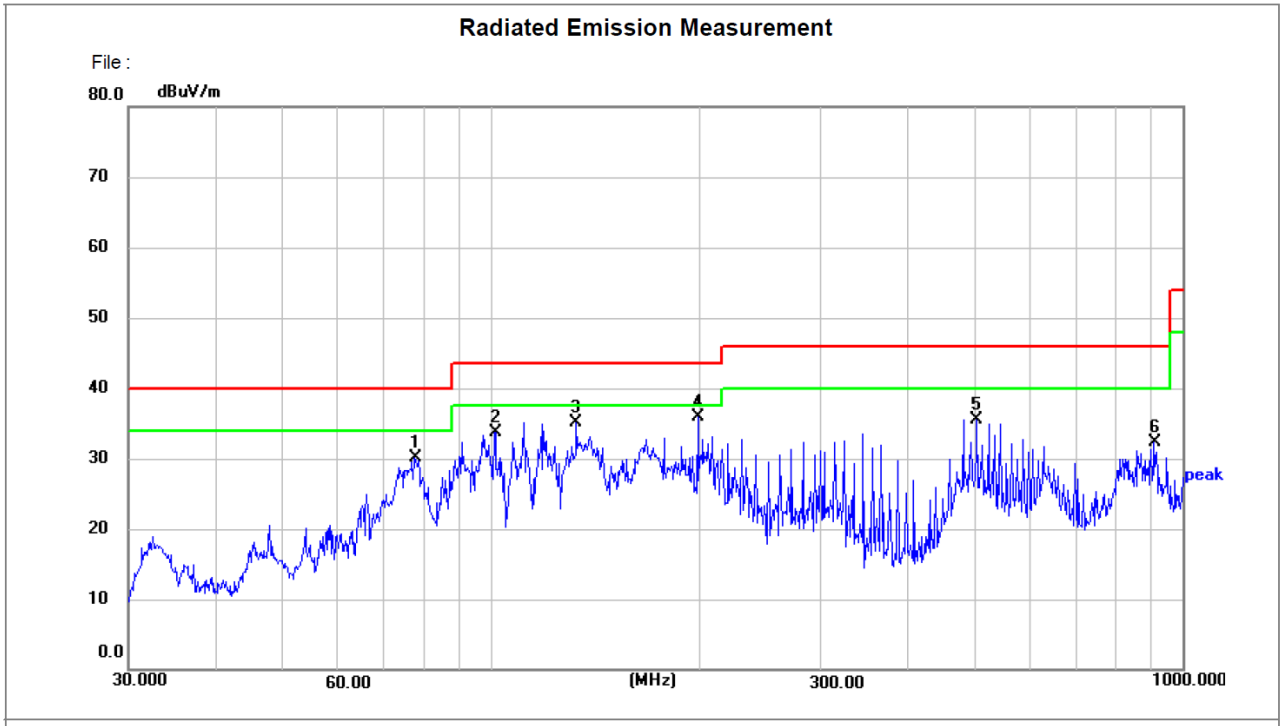
TEST RESULTS

Remark:

1. This test was performed with EUT in X, Y, Z position and the worse case was found when EUT in X position.
1. All 802.11ac / 802.11n (HT20) / 802.11n (HT40) modes have been tested for below 1GHz test, only the worst case 802.11n (HT20) low channel of U-NII 1 band was recorded.
2. All 802.11ac / 802.11n (HT20) / 802.11n (HT40) modes have been tested for above 1GHz test, only the worst case 802.11n (HT20) was recorded.
3. Radiated emission test from 9 KHz to 10th harmonic of fundamental was verified, and no emission found except system noise floor in 9 KHz to 30MHz and not recorded in this report.

For 30MHz-1GHz

Horizontal



Site LAB
Limit: FCC Part15 RE-Class B_30-1000MHz
EUT:
M/N:
Mode:
Note:

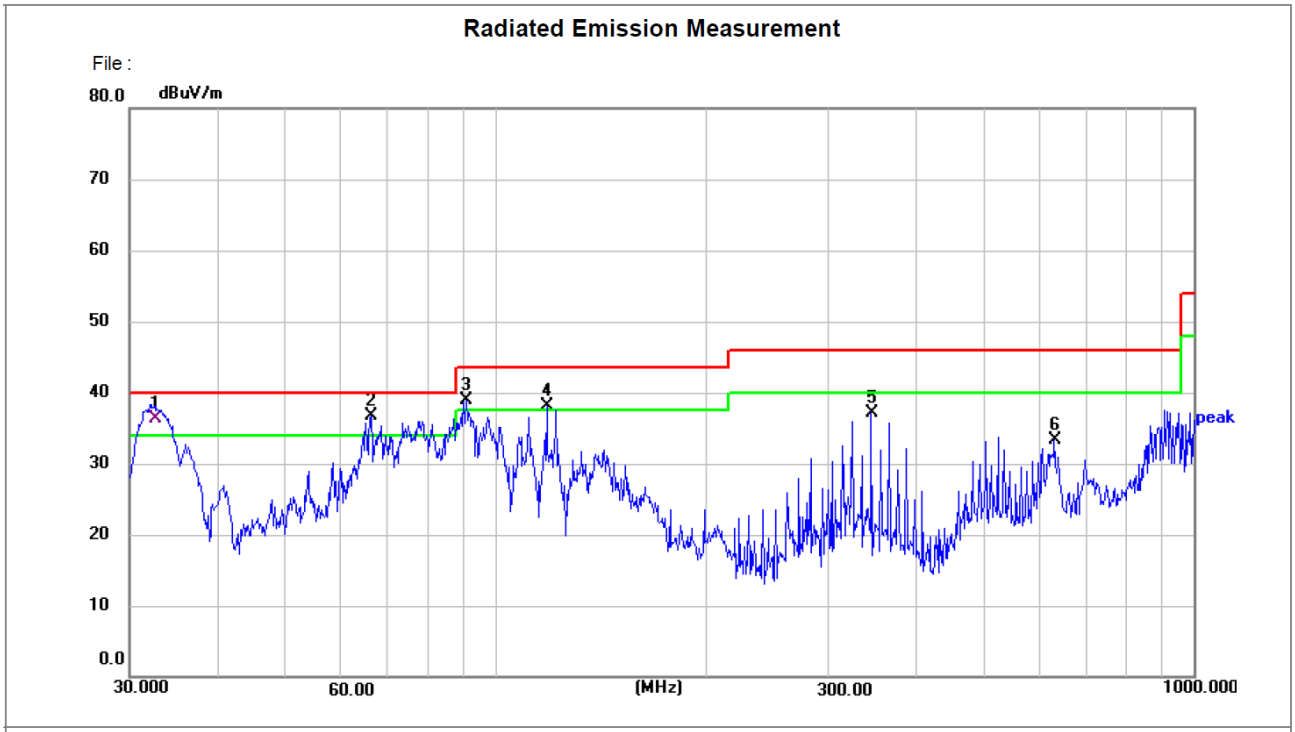
Polarization: ***Horizontal***
Power: AC120V/60Hz
Distance: 3m

Temperature: 24.5(C)
Humidity: 52 %

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F	Remark
1	77.5928	52.61	-22.47	30.14	40.00	-9.86	peak	200	48	P	
2	101.6443	52.75	-18.98	33.77	43.50	-9.73	peak	200	272	P	
3	133.1510	57.51	-22.36	35.15	43.50	-8.35	peak	200	86	P	
4 *	199.2855	55.00	-19.03	35.97	43.50	-7.53	peak	100	272	P	
5	504.7062	49.06	-13.62	35.44	46.00	-10.56	peak	100	141	P	
6	909.6667	39.47	-7.09	32.38	46.00	-13.62	peak	100	265	P	

Note:1).Level (dBμV/m)= Reading (dBμV/m)+ Factor (dB/m)
2). Factor(dB/m)=Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB)
3). Margin(dB) = Limit (dBμV/m) - Level (dBμV/m)

Vertical



Site LAB
Limit: FCC Part15 RE-Class B_30-1000MHz
EUT:
M/N:
Mode:
Note:

Polarization: ***Vertical***
Power: AC 120V/60Hz
Distance: 3m

Temperature: 24.5(C)
Humidity: 52 %

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F	Remark
1 !	32.5962	56.37	-19.98	36.39	40.00	-3.61	QP	116	54	P	
2 *	66.4989	57.23	-20.47	36.76	40.00	-3.24	peak	100	360	P	
3 !	90.8554	59.45	-20.51	38.94	43.50	-4.56	peak	200	126	P	
4 !	118.6014	57.87	-19.80	38.07	43.50	-5.43	peak	100	9	P	
5	345.5952	53.61	-16.43	37.18	46.00	-8.82	peak	200	209	P	
6	631.6884	43.95	-10.55	33.40	46.00	-12.60	peak	100	353	P	

Note:1).Level (dBμV/m)= Reading (dBμV/m)+ Factor (dB/m)
2). Factor(dB/m)=Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB)
3). Margin(dB) = Limit (dBμV/m) - Level (dBμV/m)

For 1GHz to 40GHz

Note: All 802.11ac / 802.11n (HT20) /802.11n (HT40) modes have been tested for above 1GHz test, only the worst case 802.11n (HT20) was recorded.

U-NII 1 & 802.11n (HT20) Mode (above 1GHz)

Tested Channel	Frequency (MHz)	Emission Level (dBuV/m)	Detector Mode	ANT Pol	Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre amplifier (dB)	Correction Factor (dB/m)
	5150.00	57.28	PK	H	68.20	10.92	76.18	29.91	5.87	54.68	-18.90
36.00	5150.00	43.54	AV	H	54.00	10.46	62.44	29.91	5.87	54.68	-18.90
(5180MHz)	10360.00	51.08	PK	H	68.20	17.12	58.00	37.62	10.02	54.56	-6.92
	--	--	--	--	--	--	--	--	--	--	--
40.00	10400.00	50.65	PK	H	68.20	17.55	57.07	37.81	10.14	54.37	-6.42
(5200MHz)	--	--	--	--	--	--	--	--	--	--	--
48.00	5350.50	45.16	PK	H	68.20	23.04	63.73	30.24	5.93	54.74	-18.57
(5240MHz)	10480.00	51.35	PK	H	68.20	16.85	57.87	37.95	10.17	54.64	-6.52
	--	--	--	--	--	--	--	--	--	--	--

Tested Channel	Frequency (MHz)	Emission Level (dBuV/m)	Detector Mode	ANT Pol	Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre amplifier (dB)	Correction Factor (dB/m)
	5150.00	54.58	PK	V	68.20	13.62	73.48	29.91	5.87	54.68	-18.90
36.00	5150.00	45.24	AV	V	54.00	8.76	64.14	29.91	5.87	54.68	-18.90
(5180MHz)	10360.00	51.71	PK	V	68.20	16.49	58.63	37.62	10.02	54.56	-6.92
	--	--	--	--	--	--	--	--	--	--	--
40.00	10400.00	50.35	PK	V	68.20	17.85	56.77	37.81	10.14	54.37	-6.42
(5200MHz)	--	--	--	--	--	--	--	--	--	--	--
48.00	5350.50	51.27	PK	V	68.20	16.93	69.84	30.24	5.93	54.74	-18.57
(5240MHz)	10480.00	50.63	PK	V	68.20	17.57	57.15	37.95	10.17	54.64	-6.52
	--	--	--	--	--	--	--	--	--	--	--

U-NII 3 & 802.11n (HT20) Mode (above 1GHz)

Tested Channel	Frequency (MHz)	Emission Level (dBuV/m)	Detector Mode	ANT Pol	Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre amplifier (dB)	Correction Factor (dB/m)
	5720.00	52.42	PK	H	68.20	15.78	70.29	30.82	6.02	54.71	-17.87
149.00	5720.00	45.81	AV	H	54.00	8.19	63.68	30.82	6.02	54.71	-17.87
(5745MHz)	11490.00	50.15	PK	H	68.20	18.05	54.90	39.23	10.83	54.81	-4.75
	--	--	--	--	--	--		--	--	--	--
157.00	11570.00	49.48	PK	H	68.20	18.72	53.93	39.34	10.96	54.75	-4.45
(5785MHz)	--	--	--	--	--	--	--	--	--	--	--
165.00	5855.00	49.52	PK	H	68.20	18.68	67.06	30.94	6.15	54.63	-17.54
(5825MHz)	11650.00	51.74	PK	H	68.20	16.46	55.45	39.42	11.15	54.28	-3.71
	--	--	--	--	--	--	--	--	--	--	--

Tested Channel	Frequency (MHz)	Emission Level (dBuV/m)	Detector Mode	ANT Pol	Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre amplifier (dB)	Correction Factor (dB/m)
	5720.00	53.14	PK	V	68.20	15.06	71.01	30.82	6.02	54.71	-17.87
149.00	5720.00	47.82	AV	V	54.00	6.18	65.69	30.82	6.02	54.71	-17.87
(5745MHz)	11490.00	50.21	PK	V	68.20	17.99	54.96	39.23	10.83	54.81	-4.75
	--	--	--	--	--	--	--	--	--	--	--
157.00	11570.00	51.64	PK	V	68.20	16.56	56.09	39.34	10.96	54.75	-4.45
(5785MHz)	--	--	--	--	--	--	--	--	--	--	--
165.00	5855.00	51.82	PK	V	68.20	16.38	69.36	30.94	6.15	54.63	-17.54
(5825MHz)	11650.00	50.34	PK	V	68.20	17.86	54.05	39.42	11.15	54.28	-3.71
	--	--	--	--	--	--	--	--	--	--	--

REMARKS:

1. Emission level (dBuV/m) =Raw Value (dBuV)+Correction Factor (dB/m)
2. Correction Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
3. Margin value = Limit value- Emission level.
4. -- Mean the other emission levels were very low against the limit.
5. RBW1MHz VBW3MHz Peak detector is for PK value; RBW 1MHz VBW10Hz Peak detector is for AV value.
6. Worst case data MCS0 at IEEE 802.11n HT20, IEEE 802.11n HT40, IEEE 802.11ac VHT20 ,IEEE 802.11ac VHT40 and IEEE 802.11ac VHT80;

4.3 Maximum Conducted Average Output Power

Limit

For the band 5.15-5.25 GHz.
(i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi.

(ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi.

(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W.

(iv) For client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi.

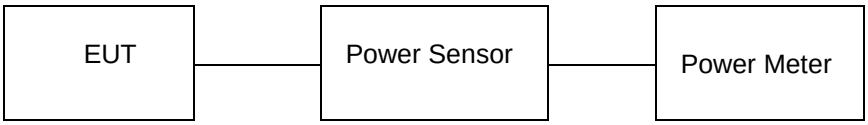
For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz.

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W

Test Procedure

Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power sensor.

Test Configuration



Test Results

U-NII 1

Type	Channel	Output power (dBm)	E.I.R.P power (dBm)	Limit (dBm)	Result
802.11n(HT20)	36	14.62	16.62	23.98/23.0(ISED)	Pass
	40	14.58	16.58		
	48	14.36	16.36		
802.11n(HT40)	38	14.73	16.73	23.98/23.0(ISED)	Pass
	46	14.52	16.52		
802.11ac(HT20)	36	14.18	16.18	23.98/23.0(ISED)	Pass
	40	14.46	16.46		
	48	14.27	16.27		
802.11ac(HT40)	38	14.43	16.43	23.98/23.0(ISED)	Pass
	46	14.37	16.37		
802.11ac(HT80)	42	14.52	16.52	23.98/23.0(ISED)	Pass

U-NII 3

Type	Channel	Output power (dBm)	Limit (dBm)	Result
802.11n(HT20)	149	14.56	30.00	Pass
	157	14.41		
	165	14.23		
802.11n(HT40)	151	14.17	30.00	Pass
	159	14.39		
802.11ac(HT20)	149	14.25	30.00	Pass
	157	14.38		
	165	14.16		
802.11ac(HT40)	151	14.42	30.00	Pass
	159	14.67		
802.11ac(HT80)	155	14.56	30.00	Pass

4.4 Power Spectral Density

Limit

(1) For the band 5.15 - 5.25 GHz.

(i) For an outdoor access point operating in the band 5.15 - 5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 MHz band.note1

(ii) For an indoor access point operating in the band 5.15 - 5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 MHz band.note1

(iii) For fixed point-to-point access points operating in the band 5.15 - 5.25 GHz, transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi.

(iv) For mobile and portable client devices in the 5.15 - 5.25 GHz band, the maximum power spectral density shall not exceed 11 dBm in any 1 MHz band. note1

(2) For the 5.25 - 5.35 GHz and 5.47 - 5.725 GHz bands, the peak power spectral density shall not exceed 11 dBm in any 1 MHz band. note1

(3) For the band 5.725 - 5.85 GHz, the maximum power spectral density shall not exceed 30 dBm in any 500 kHz band. note1, note2

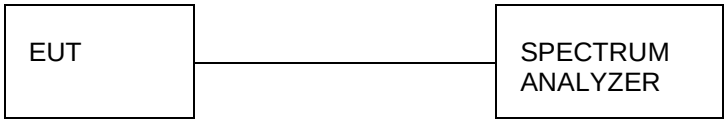
Note1: If transmitting antennas of directional gain greater than 6 dBi are used, the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Note2: 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.

Test Procedure

1. Use this procedure when the maximum peak conducted output power in the fundamental emission is used to demonstrate compliance.
2. Set the RBW = 1MHz for U-NII 1, U-NII 2A, U-NII C band and 510KHz for U-NII 3 band.
3. Set the VBW ≥ 3× RBW.
4. Set the span to encompass the entire EBW.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum power level.

Test Configuration



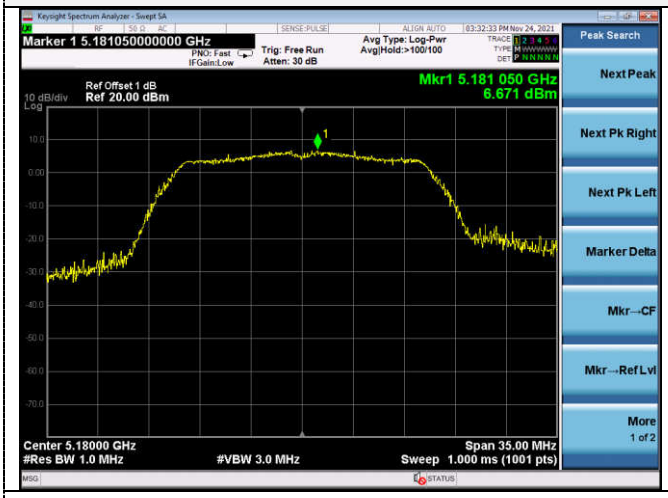
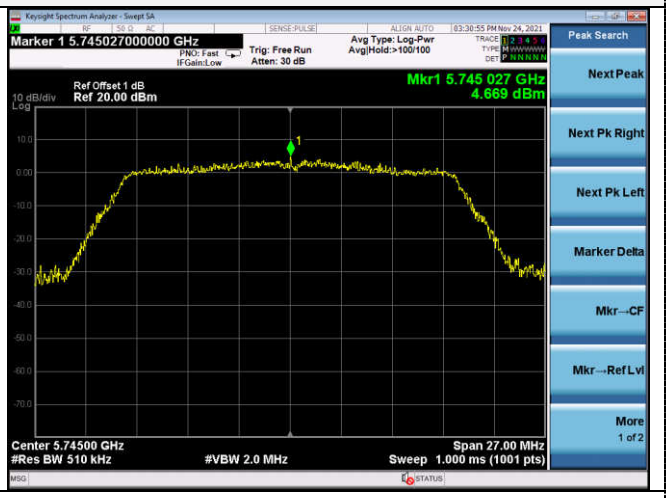
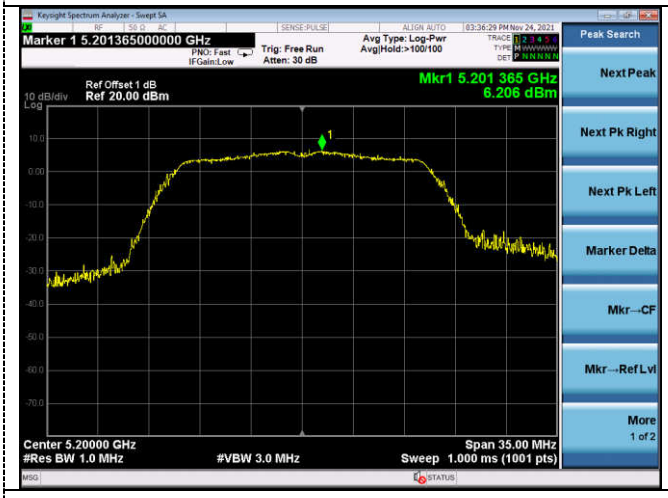
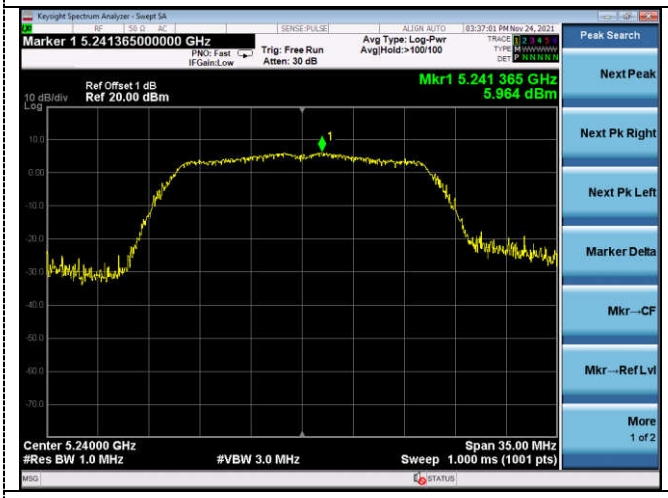
Test Results

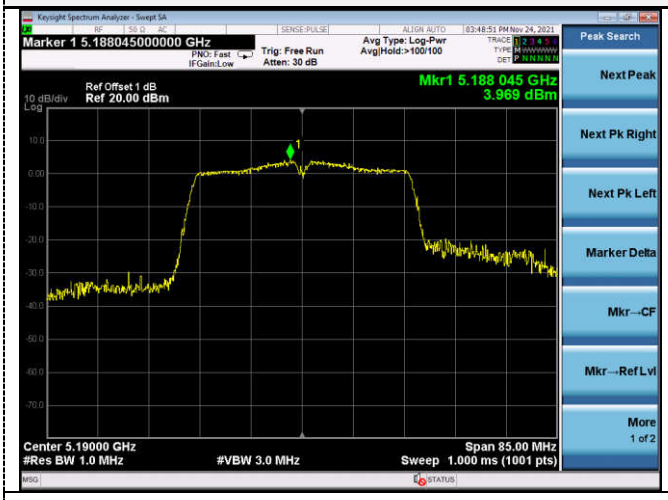
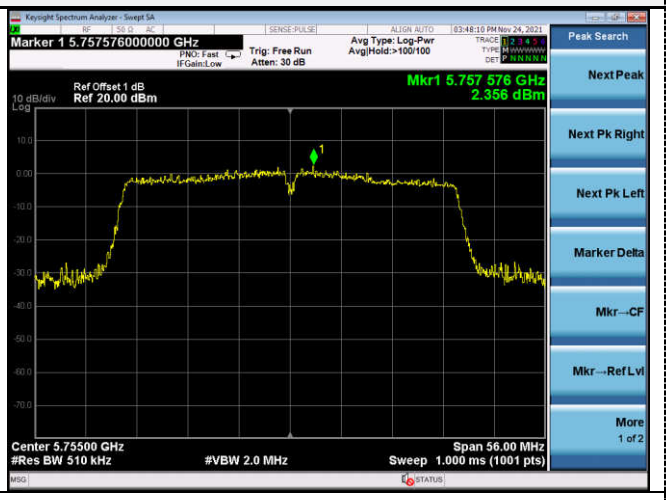
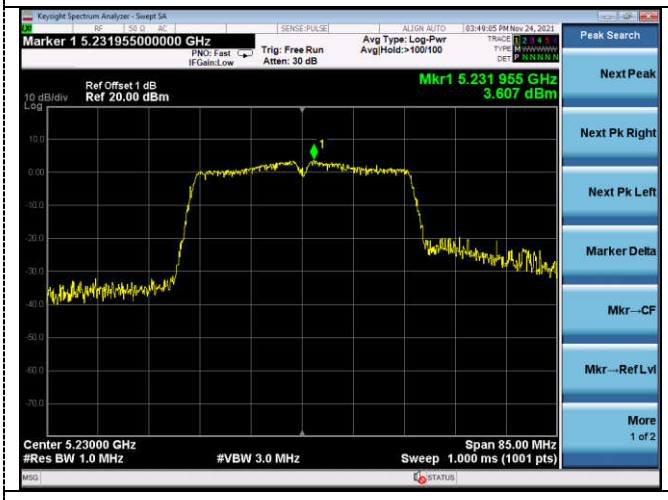
Type	Bands	Channel	Power Spectral Density (dBm/MHz)	E.I.R.P Power Spectral Density (dBm/MHz)	Limit (dBm/MHz)	Result
802.11n (HT20)	U-NII 1	36	6.671	8.671	11/10((ISED))	Pass
		40	6.206	8.206		
		48	5.964	7.964		
802.11n (HT40)	U-NII 1	38	3.969	5.969		
		46	3.607	5.607		
802.11ac (HT20)	U-NII 1	36	6.739	8.739		
		40	6.694	8.694		
		48	6.003	8.003		
802.11ac (HT40)	U-NII 1	38	4.063	6.063		
		46	3.714	5.714		
802.11ac (HT80)	U-NII 1	42	1.264	3.264		

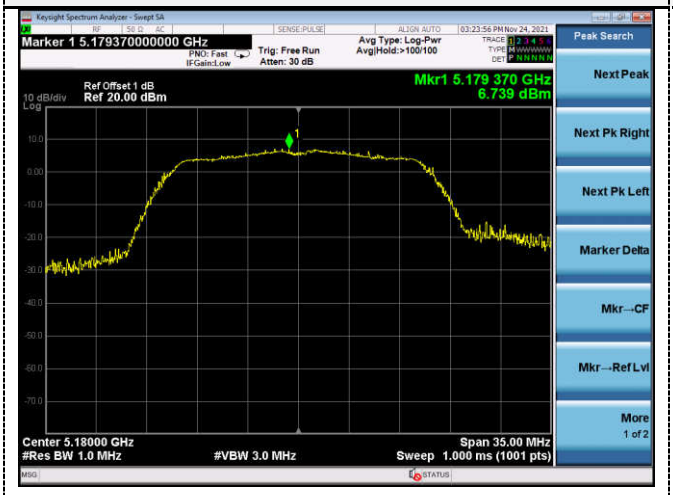
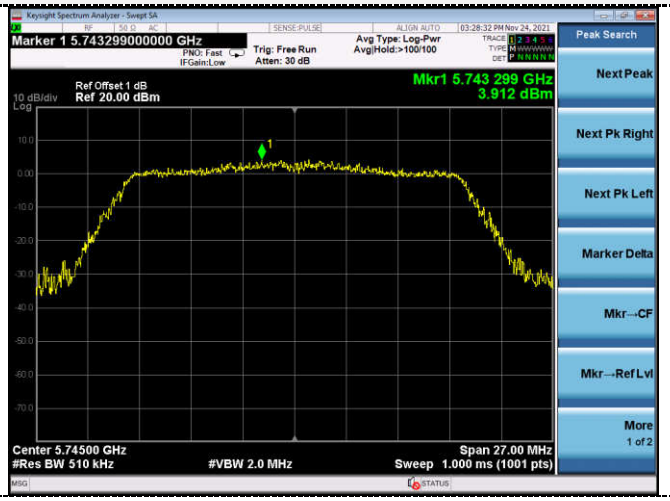
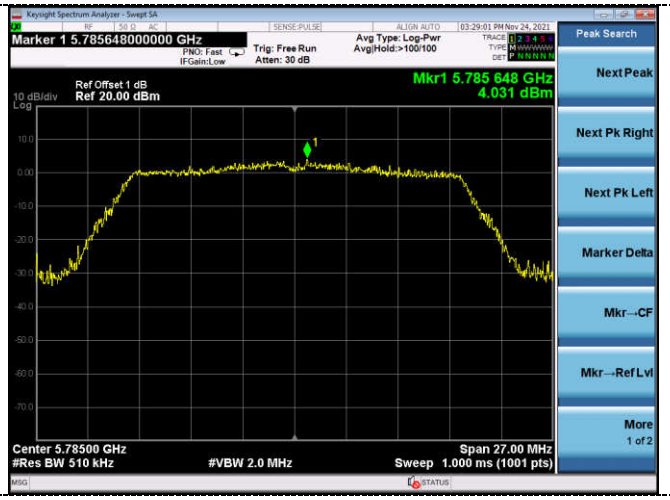
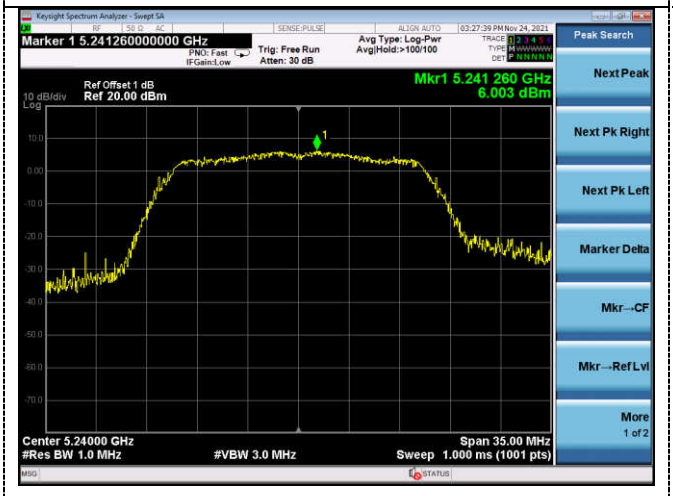
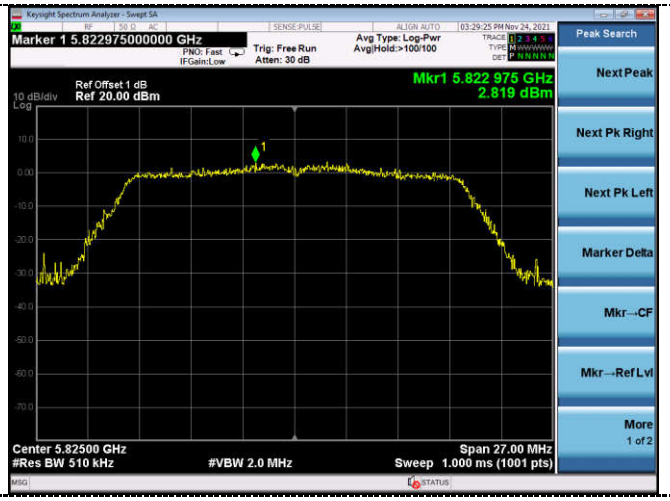
Type	Bands	Channel	Power Spectral Density (dBm/510KHz)	Power Spectral Density (dBm/500KHz)	Limit (dBm/500KHz)	Result
802.11n (HT20)	U-NII 3	149	4.669	4.583	30	Pass
		157	3.389	3.303		
		165	3.508	3.422		
802.11n (HT40)	U-NII 3	151	2.356	2.270		
		159	0.941	0.855		
802.11ac (HT20)	U-NII 3	149	3.912	3.826		
		157	4.031	3.945		
		165	2.819	2.733		
802.11ac (HT40)	U-NII 3	151	2.113	2.027		
		159	0.874	0.788		
802.11ac (HT80)	U-NII 3	155	-1.676	-1.762		

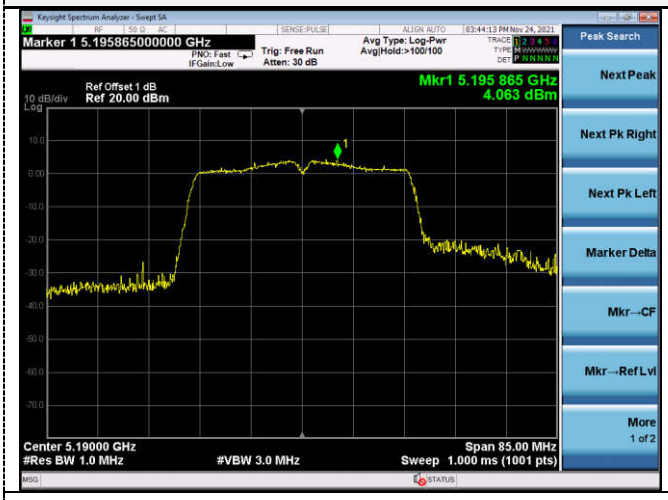
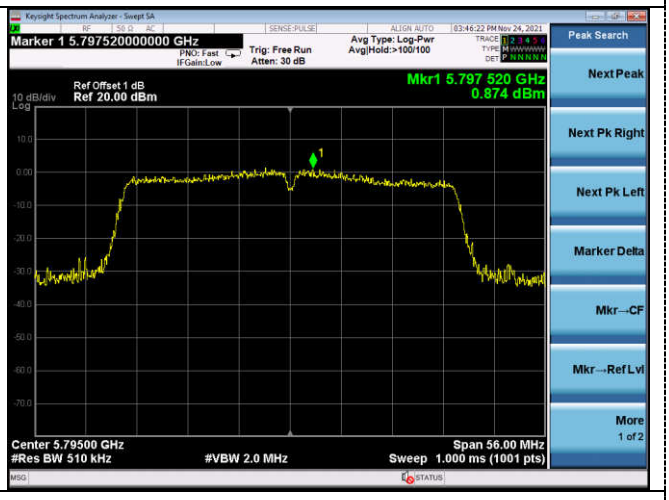
Remark: P.S.D(dBm/500KHz)= P.S.D(dBm/510KHz)+10 log (500 kHz/510KHz).

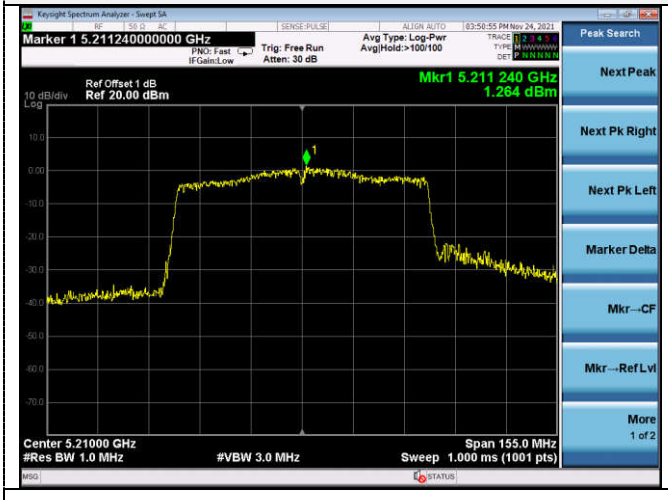
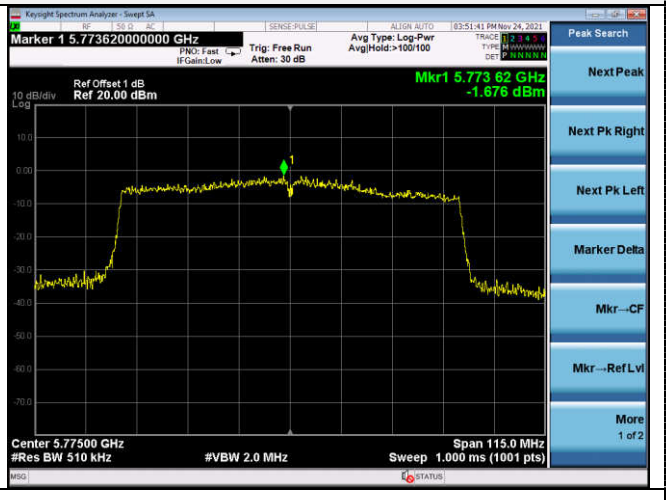
Test plot as follows

802.11n(HT20)	
U-NII 1	*U-NII 3*
	
CH36	*CH149*
	
CH40	*CH157*
	
CH48	*CH165*

802.11n(HT40)	
U-NII 1	*U-NII 3*
	
CH38	*CH151*
	
CH46	*CH159*

802.11ac(HT20)	
U-NII 1	*U-NII 3*
	
CH36	*CH149*
	
CH40	*CH157*
	
CH48	*CH165*

802.11ac(HT40)	
U-NII 1	U-NII 3
	
CH38	CH151
	
CH46	CH159

802.11ac(HT80)	
U-NII 1	U-NII 3
	
CH42	CH155

4.5 Emission Bandwidth (26dB Bandwidth&99%Bandwidth)

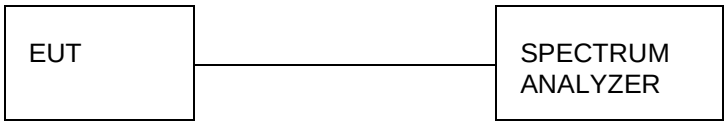
Limit

N/A

Test Procedure

1. Set resolution bandwidth (RBW) = approximately 1 % of the EBW.
2. Set the video bandwidth (VBW) > RBW.
3. Detector = Peak.
4. Trace mode = Max hold.
5. Measure the maximum width of the emission that is 26 dB down from the peak 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 %.

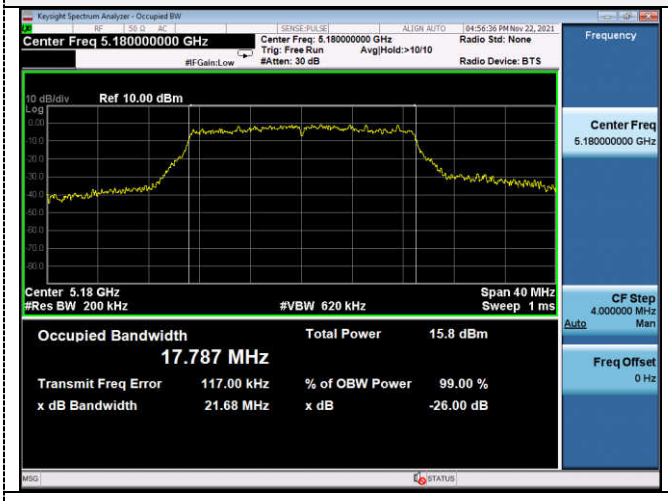
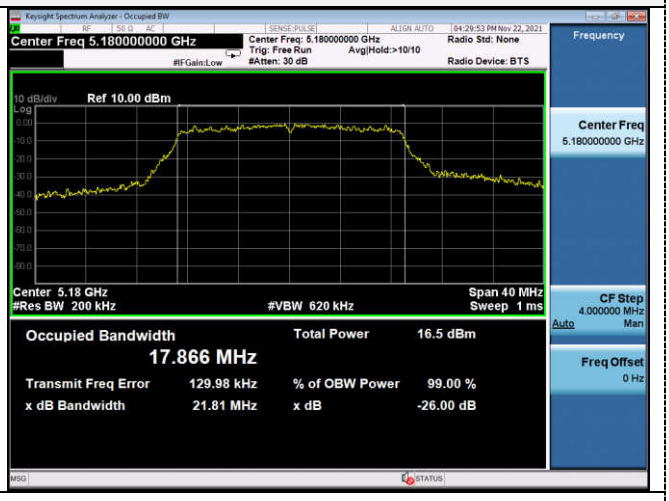
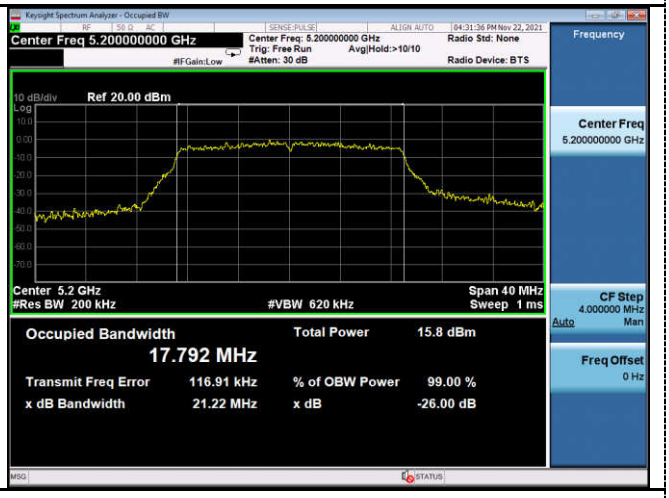
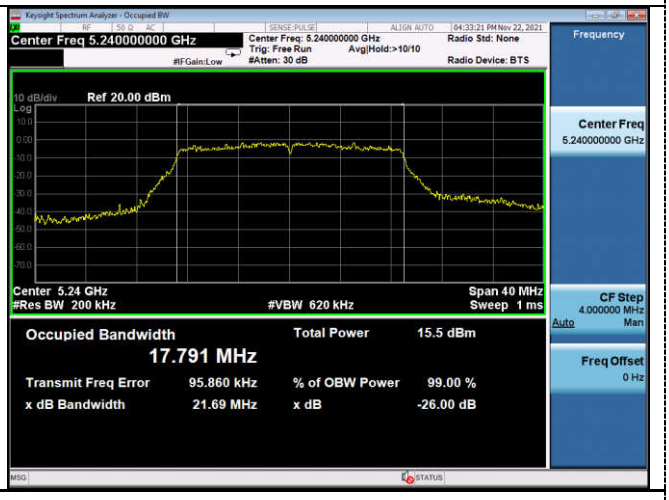
Test Configuration

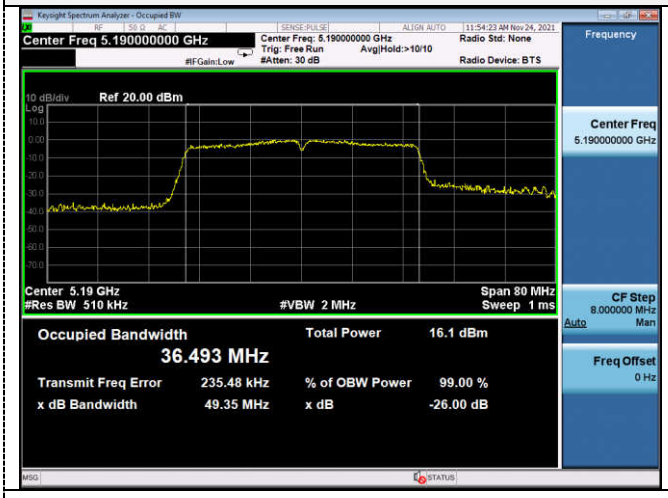
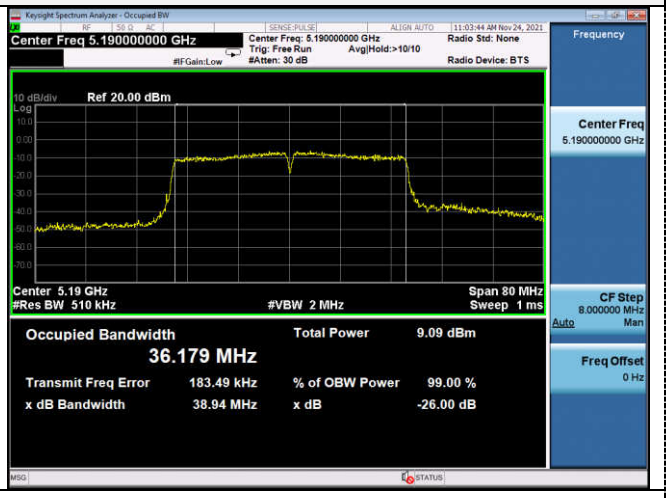


Test Results

Type	Bands	Channel	26dB Bandwidth (MHz)	99%Bandwidth (MHz)	Limit (MHz)	Result
802.11n(HT20)	U-NII 1	36	21.68	17.787	N/A	Pass
		40	21.61	17.822		
		48	21.57	17.794		
802.11n(HT40)	U-NII 1	38	49.35	36.493		
		46	56.60	36.454		
802.11ac(HT20)	U-NII 1	36	21.81	17.866		
		40	21.22	17.792		
		48	21.69	17.791		
802.11ac(HT40)	U-NII 1	38	38.94	36.179		
		46	38.85	36.198		
802.11ac(HT80)	U-NII 1	42	101.3	75.695		

Test plot as follows:

802.11n(HT20)	*802.11ac*(HT20)
	
CH36	*CH36*
	
CH40	*CH40*
	
CH48	*CH48*

802.11n(HT40)	*802.11ac*(HT40)
	
CH38	*CH38*
	
CH46	*CH46*
	802.11ac(HT80)
	
	CH42

4.6 Minimum Emission Bandwidth (6dB Bandwidth&99%Bandwidth)

Limit

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

Test Procedure

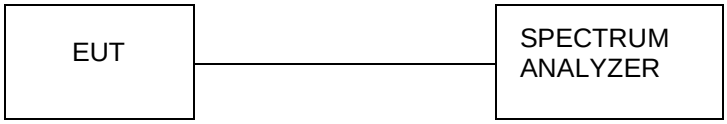
6dB Bandwidth

1. Set resolution bandwidth (RBW) = 100 kHz
2. Set the video bandwidth > RBW.
3. Detector = Peak.
4. Trace mode = Max hold.
5. 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.

99%Bandwidth

1. Set resolution bandwidth (RBW) = approximately 1 % of the EBW
2. Set the video bandwidth 3 x RBW.
3. Detector = Peak.
4. Trace mode = Max hold.

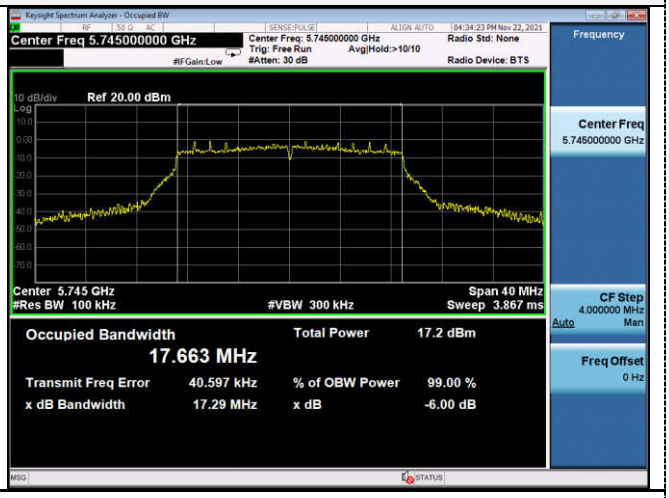
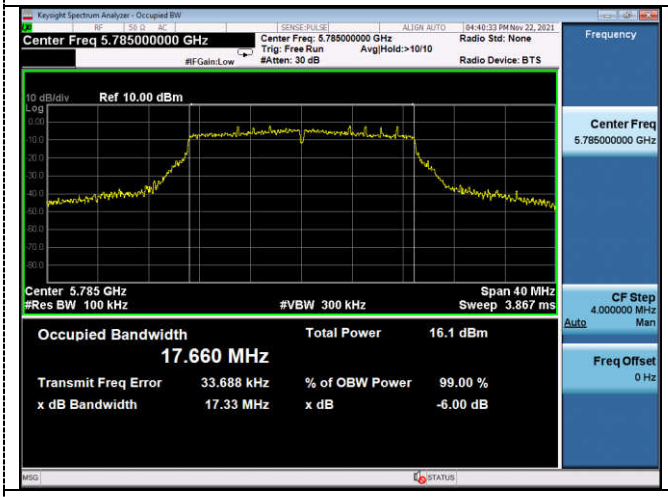
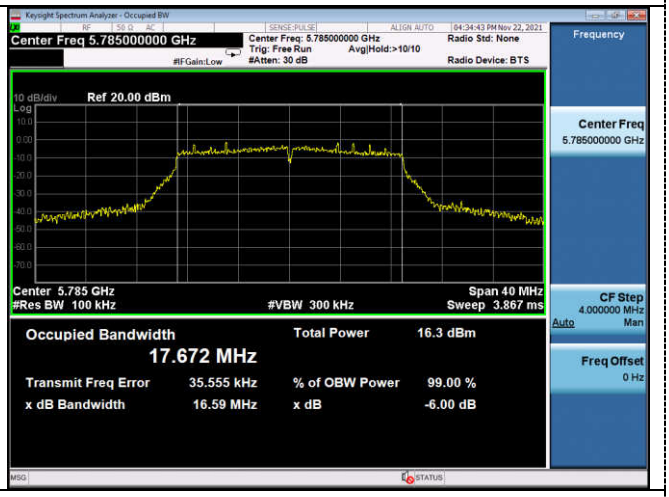
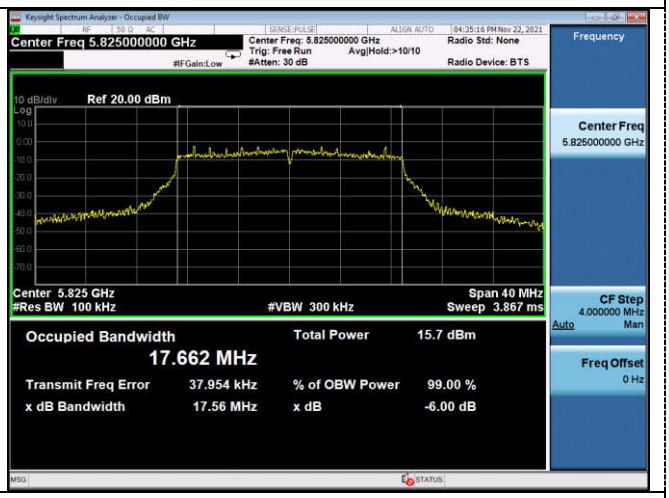
Test Configuration



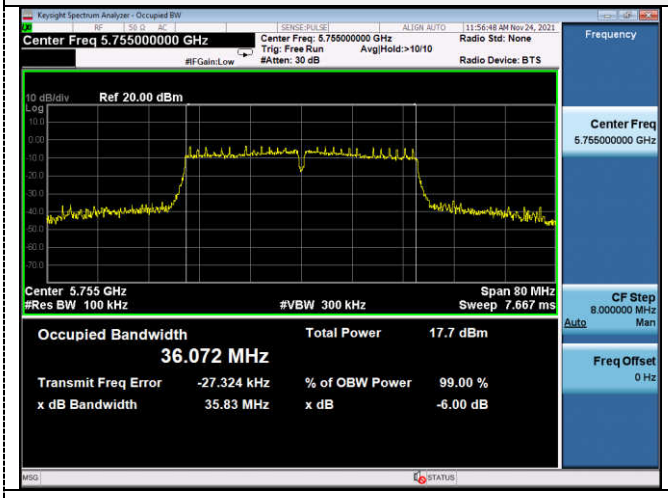
Test Results

Type	Bands	Channel	6dB Bandwidth (MHz)	99%Bandwidth (MHz)	Limit (KHz)	Result
802.11n(HT20)	U-NII 3	149	17.31	17.906	≥500KHz	Pass
		157	17.33	17.87		
		165	16.97	17.894		
802.11n(HT40)	U-NII 3	151	35.83	36.513		
		159	35.63	36.473		
802.11ac(HT20)	U-NII 3	149	17.29	17.847		
		157	16.59	17.892		
		165	17.56	17.901		
802.11ac(HT40)	U-NII 3	151	36.38	36.449		
		159	36.40	36.446		
802.11ac(HT80)	U-NII 3	155	75.60	75.753		

6dB Bandwidth
Test plot as follows:

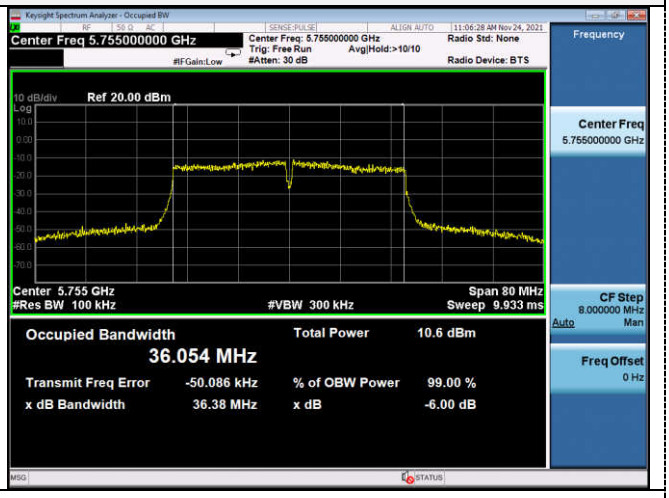
802.11n(HT20)	*802.11ac*(HT20)
	
CH149	*CH149*
	
CH157	*CH157*
	
CH165	*CH165*

802.11n(HT40)



CH151

802.11ac(HT40)



CH151

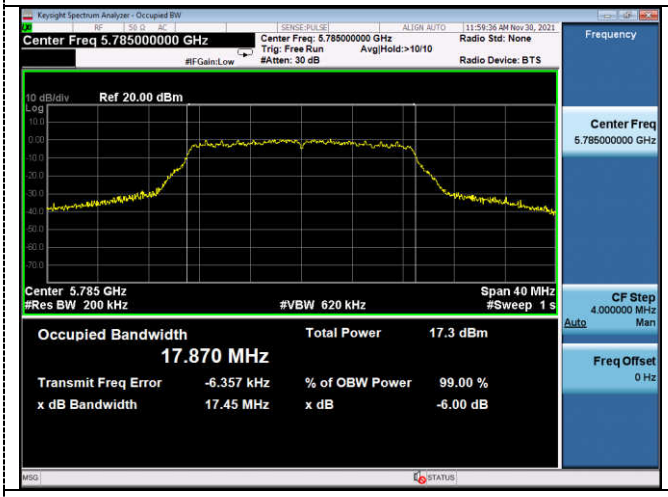
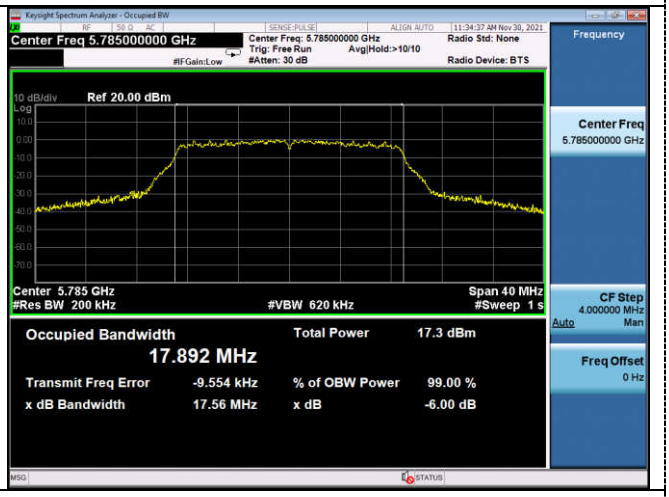
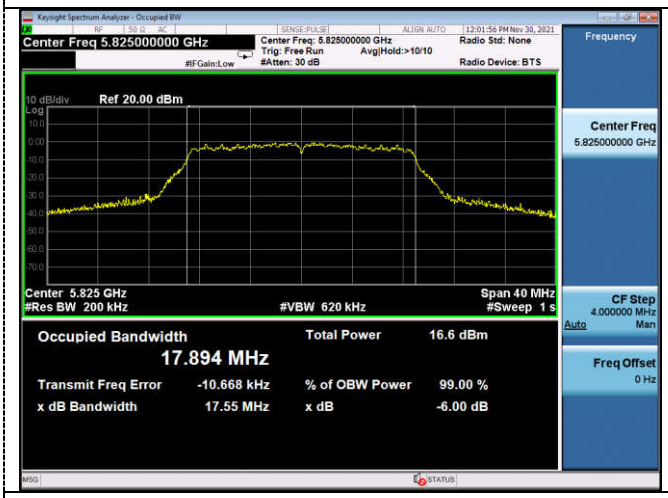
CH159

CH159

802.11ac(HT80)

CH155

99%Bandwidth
Test plot as follows:

802.11n(HT20)	*802.11ac*(HT20)
	
CH149	*CH149*
	
CH157	*CH157*
	
CH165	*CH165*

802.11n(HT40)

CH151

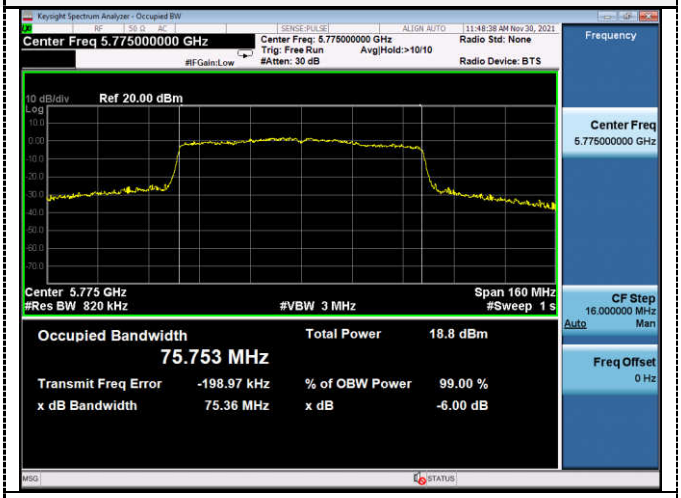
802.11ac(HT40)

CH151

CH159

CH159

802.11ac(HT80)



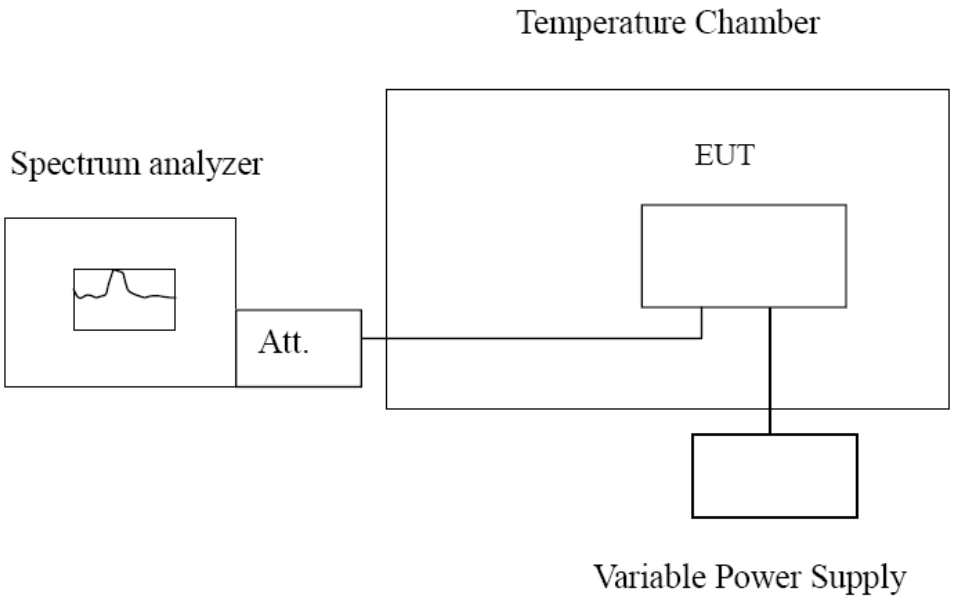
CH155

4.7 Frequency Stability

LIMIT

Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the users manual.

TEST CONFIGURATION



TEST PROCEDURE

Frequency Stability under Temperature Variations:
The equipment under test was connected to an external AC or DC power supply and input rated voltage. RF output was connected to a frequency counter or spectrum analyzer via feed through attenuators. The EUT was placed inside the temperature chamber. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and measure EUT 20℃ operating frequency as reference frequency. Turn EUT off and set the chamber temperature to -30℃. After the temperature stabilized for approximately 30 minutes recorded the frequency. Repeat step measure with 10℃ increased per stage until the highest temperature of +50℃ reached.

Frequency Stability under Voltage Variations:
Set chamber temperature to 20℃. Use a variable AC power supply / DC power source to power the EUT and set the voltage to rated voltage. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and recorded the frequency.
Reduce the input voltage to specify extreme voltage variation (±15%) and endpoint, record the maximum frequency change.

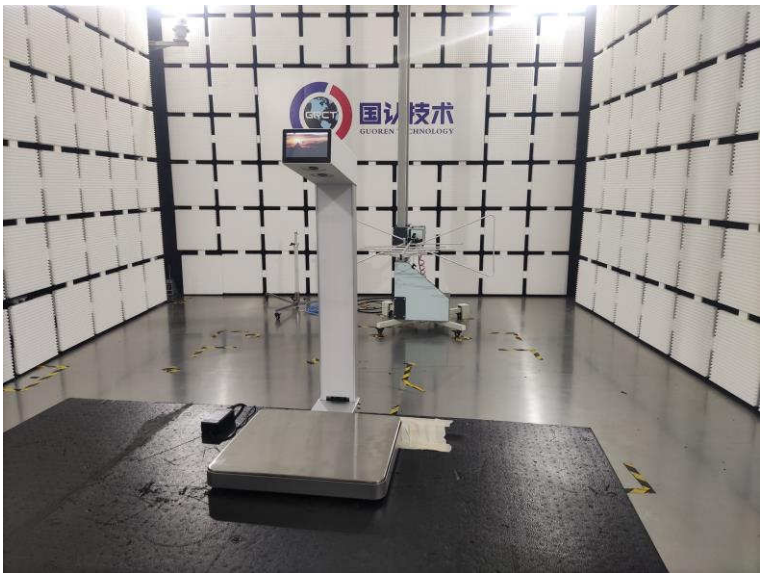
TEST RESULTS

Record worst case as below:

Reference Frequency: 802.11ac channel=36 frequency=5180MHz					
Voltage (V)	Temperature (℃)	Frequency error		Limit (ppm)	Result
		Hz	ppm		
12.00	-30	102.74	0.0198	Within the band of operation	Pass
	-20	168.37	0.0325		
	-10	129.45	0.0250		
	0	105.81	0.0204		
	10	127.42	0.0246		
	20	98.72	0.0191		
	30	167.28	0.0323		
	40	102.15	0.0197		
	50	115.46	0.0223		
13.2	25	176.83	0.0341		
10.8	25	115.64	0.0223		

Reference Frequency: 802.11ac channel=149 frequency=5745MHz					
Voltage (V)	Temperature (℃)	Frequency error		Limit (ppm)	Result
		Hz	ppm		
12.00	-30	130.41	0.0227	Within the band of operation	Pass
	-20	124.83	0.02177		
	-10	160.51	0.02797		
	0	162.94	0.0284		
	10	130.85	0.0228		
	20	138.72	0.0241		
	30	102.45	0.0178		
	40	162.87	0.0283		
	50	148.54	0.0259		
13.2	25	142.63	0.0248		
10.8	25	117.38	0.0204		

5 Test Setup Photos of the EUT



6 Photos of the EUT

Reference to the test report No. **GRCTR211102001-01.**

********** End of Report **********