FCC TEST REPORT

Test report
On Behalf of
CE Labs, LLC.
For
Media Players
Model No.: CE440, CE640, CE420, CE220
FCC ID: 2AO9Q-2GCA6B

Prepared for :	**CE Labs, LLC.** **3209 Wood Drive Garland TX US 75041**
Prepared By :	**Shenzhen HUAK Testing Technology Co., Ltd.** **1-2/F., Building B2, Junfeng Zhongcheng Zhizao Innovation Park, Heping, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China**

Date of Test:	**Jan. 04, 2022 ~ Jan. 11, 2022**
Date of Report:	**Jan. 11, 2022**
Report Number:	**HK2201060061-2E**

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TEST RESULT CERTIFICATION

Applicant's name.....: CE Labs, LLC.

Address .....: 3209 Wood Drive Garland TX US 75041

Manufacture's Name.....: CE Labs, LLC.

Address .....: 3209 Wood Drive Garland TX US 75041

Product description

Trade Mark: N/A

Product name ..... : Media Players

Model and/or type reference .: CE440, CE640, CE420, CE220

Standards .....: FCC Rules and Regulations Part 15 Subpart E Section 15.407
ANSI C63.10: 2013

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Date of Test.....:

Date (s) of performance of tests .....: **Jan. 04, 2022 ~ Jan. 11, 2022**

Date of Issue.....: **Jan. 11, 2022**

Test Result .....: Pass

Testing Engineer : Gary Qian
(Gary Qian)

Technical Manager : Eden Hu
(Eden Hu)

Authorized Signatory : Jason Zhou
(Jason Zhou)

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TABLE OF CONTENTS

1. Test Result Summary 5
1.1. TEST PROCEDURES AND RESULTS 5
1.2. INFORMATION OF THE TEST LABORATORY 5
1.3. MEASUREMENT UNCERTAINTY 6
2. EUT Description 7
2.1. GENERAL DESCRIPTION OF EUT 7
2.2. OPERATION FREQUENCY EACH OF CHANNEL 8
2.3. OPERATION OF EUT DURING TESTING 8
2.4. DESCRIPTION OF TEST SETUP 9
3. Genera Information 10
3.1. TEST ENVIRONMENT AND MODE 10
3.2. DESCRIPTION OF SUPPORT UNITS 11
4. Test Results and Measurement Data 12
4.1. CONDUCTED EMISSION 12
4.2. MAXIMUM CONDUCTED OUTPUT POWER 16
4.3. 6DB EMISSION BANDWIDTH 19
4.4. 26DB BANDWIDTH AND 99% OCCUPIED BANDWIDTH 32
4.5. POWER SPECTRAL DENSITY 33
4.6. BAND EDGE 47
4.7. SPURIOUS EMISSION 62
4.8. FREQUENCY STABILITY MEASUREMENT 81
4.9. ANTENNA REQUIREMENT 83
4.10. PHOTOGRAPHS OF TEST SETUP 84
4.11. PHOTOS OF THE EUT 86

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** Modified History **

Revision	Description	Issued Data	Remark
Revision 1.0	Initial Test Report Release	Jan. 11, 2022	Jason Zhou

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1-2/F., Building B2, Junfeng Zhongcheng Zhizao Innovation Park, Heping, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China

1. Test Result Summary

1.1. TEST PROCEDURES AND RESULTS

Requirement	CFR 47 Section	Result
Antenna requirement	§15.203	PASS
AC Power Line Conducted Emission	§15.207	PASS
Maximum Conducted Output Power	§15.407(a)	PASS
6dB Emission Bandwidth	§15.407(e)	PASS
26dB Emission Bandwidth& 99% Occupied Bandwidth	§15.407(a)	N/A
Power Spectral Density	§15.407(a)	PASS
Band edge	§15.407(b)/15.209/15.205	PASS
Radiated Emission	§15.407(b)/15.209/15.205	PASS
Frequency Stability	§15.407(g)	PASS

Note:

1. PASS: Test item meets the requirement.

2. Fail: Test item does not meet the requirement.

3. N/A: Test case does not apply to the test object.

4. The test result judgment is decided by the limit of test standard.

1.2. INFORMATION OF THE TEST LABORATORY

Shenzhen HUAK Testing Technology Co., Ltd.
Add.: 1-2/F., Building B2, Junfeng Zhongcheng Zhizao Innovation Park, Heping, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China

Testing Laboratory Authorization：

A2LA Accreditation Code is 4781.01.
FCC Designation Number is CN1229.
Canada IC CAB identifier is CN0045.
CNAS Registration Number is L9589.

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1.3. Measurement Uncertainty

The reported uncertainty of measurement y ± U, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95 %.

No.	Item	MU
1	Conducted Emission	±2.56dB
2	RF power, conducted	±0.12dB
3	Spurious emissions, conducted	±0.11dB
4	All emissions, radiated(<1G)	±3.92dB
5	All emissions, radiated(>1G)	±4.28dB
6	Temperature	±0.1°C
7	Humidity	±1.0%

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2. EUT Description

2.1. GENERAL DESCRIPTION OF EUT

Equipment	Media Players
Model Name	CE440
Serial No.	CE640, CE420, CE220
Trade Mark	N/A
Model Difference	All model's the function, software and electric circuit are the same, only with a product color and model named different. Test sample model: CE440
FCC ID	2AO9Q-2GCA6B
Operation Frequency:	IEEE 802.11a/n/ac(HT20)5.745GHz-5.825GHz IEEE 802.11n/ac(HT40)5.755GHz-5.795GHz IEEE 802.11ac(HT80) 5.775GHz
Modulation Technology:	IEEE 802.11a/n/ac
Modulation Type	OFDM
Antenna Type	External Antenna
Antenna Gain	Antenna 1:3dBi Antenna 2:3dBi MIMO: 6.010dBi
Power Source	DC 12V from adapter
Power Supply:	DC 12V from adapter
Hardware Version:	V1.0
Software Version:	V1.0
Note: The EUT incorporates a MIMO function. Physically, it provides two completed transmitt ers and receivers(2T2R), two transmit signals are completely correlated, then, Direction gain= GANT + Array Gain(Array Gain=10 log(2) dB for power spectral density; Array Gain=0 for power measurement)	

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2.2. Operation Frequency each of channel

802.11a/802.11n(HT20) 802.11ac(HT20)		802.11n(HT40)/ 802.11ac(HT40)		802.11ac(HT80)	
Channel	Frequency	Channel	Frequency	Channel	Frequency
149	5745	151	5755	155	5775
153	5765	159	5790		
157	5785				
161	5805				
165	5825				

Note:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

2.3. Operation of EUT during testing

Band IV (5725 - 5850 MHz)		
For 802.11a/n (HT20)/ac(HT20)		
Channel Number	Channel	Frequency (MHz)
149	Low	5745
157	Mid	5785
165	High	5825

For 802.11n (HT40)/ ac(HT40)		
Channel Number	Channel	Frequency (MHz)
151	Low	5755
159	High	5795

For 802.11ac(HT80)		
Channel Number	Channel	Frequency (MHz)
155	/	5775

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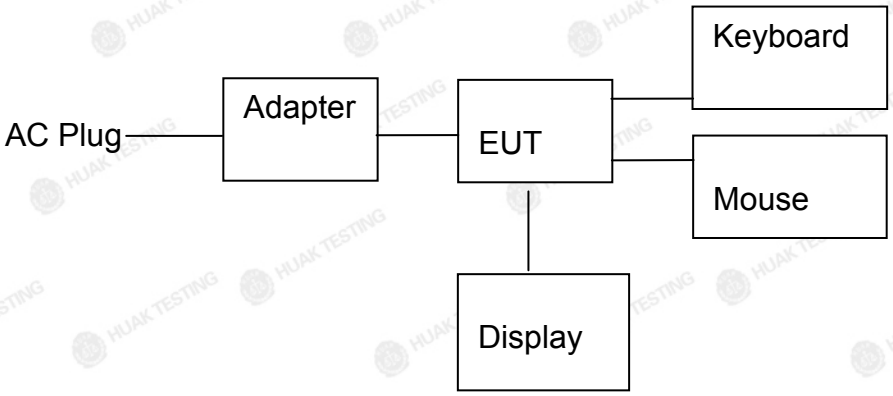
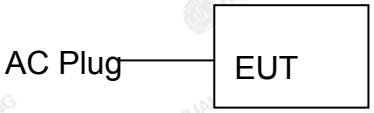
2.4. DESCRIPTION OF TEST SETUP

Operation of EUT during conducted testing and below 1GHz Radiation testing:



Operation of EUT during Above1GHz Radiation testing:



- Display information
  Model: 24PFF3661/T3
  Input: AC 120V/60Hz

  Adapter information
  Model: FJ-SW126G1201500N
  Input: 100-240V ~ 50/60Hz 0.6A Max
  Output: 12V 1.5A, 18.0W

  Mouse information
  Model: OP-300
  Input: DC 5V

  Keyboard information
  Model: KB-202
  Input: DC 5V

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3. Genera Information

3.1. Test environment and mode

Operating Environment:	
Temperature:	25.0 °C
Humidity:	56 % RH
Atmospheric Pressure:	1010 mbar
Test Mode:	
Engineering mode:	Keep the EUT in continuous transmitting by select channel and modulations(The value of duty cycle is 100%)
The sample was placed 0.8m/1.5m for blow/above 1GHz above the ground plane of 3m chamber. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating the turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages.	

We have verified the construction and function in typical operation. All the test modes were carried out with the EUT in transmitting operation, which was shown in this test report and defined as follows:	
Per-scan all kind of data rate in lowest channel, and found the follow list which it was worst case.	
Mode	Data rate
802.11a	6 Mbps
802.11n(HT20)	MCS0
802.11n(HT40)	MCS0
802.11ac(HT20)/ac(HT40)/ac(HT80)	MCS0
Final Test Mode:	
Operation mode:	Keep the EUT in continuous transmitting with modulation

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3.2. Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Equipment	Model No.	Serial No.	FCC ID	Trade Name
/	/	/	/	/

Note:

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.

2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

3. For conducted measurements (Output Power, Emission Bandwidth, Power Spectral Density, Spurious Emissions), the antenna of EUT is connected to the test equipment via temporary antenna connector, the antenna connector is soldered on the antenna port of EUT, and the temporary antenna connector is listed in the Test Instruments.

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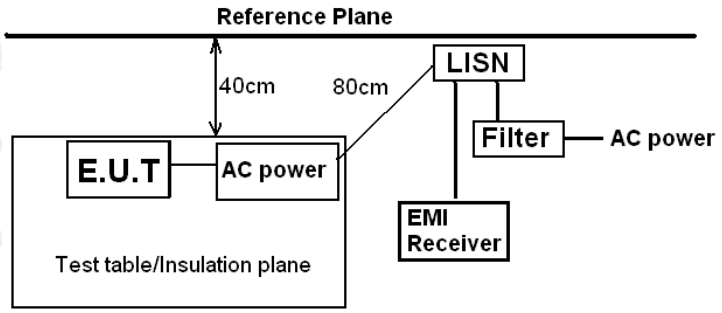
4. Test Results and Measurement Data

4.1. Conducted Emission

4.1.1. Test Specification

<table>
<tr><td>Test Requirement:</td><td>FCC Part15 C Section 15.207</td></tr>
<tr><td>Test Method:</td><td>ANSI C63.10:2013</td></tr>
<tr><td>Frequency Range:</td><td>150 kHz to 30 MHz</td></tr>
<tr><td>Receiver setup:</td><td>RBW=9 kHz, VBW=30 kHz, Sweep time=auto</td></tr>
<tr><td>Limits:</td><td>
<table>
<tr><td rowspan="2">Frequency range (MHz)</td><td colspan="2">Limit (dBuV)</td></tr>
<tr><td>Quasi-peak</td><td>Average</td></tr>
<tr><td>0.15-0.5</td><td>66 to 56*</td><td>56 to 46*</td></tr>
<tr><td>0.5-5</td><td>56</td><td>46</td></tr>
<tr><td>5-30</td><td>60</td><td>50</td></tr>
</table>
</td></tr>
<tr><td>Test Setup:</td><td>


Remark:
E.U.T: Equipment Under Test
LISN: Line Impedence Stabilization Network
Test table height=0.8m
</td></tr>
<tr><td>Test Mode:</td><td>Tx Mode</td></tr>
<tr><td>Test Procedure:</td><td>1. The E.U.T and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm/50uH coupling impedance for the measuring equipment.
2. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs).
3. Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10: 2013 on conducted measurement.</td></tr>
<tr><td>Test Result:</td><td>N/A</td></tr>
</table>

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4.1.2. Test Instruments

Conducted Emission Shielding Room Test Site (843)					
Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Date**	**Calibration Due**
Receiver	R&S	ESR-7	HKE-010	Dec. 09, 2021	Dec. 08, 2022
LISN	R&S	ENV216	HKE-002	Dec. 09, 2021	Dec. 08, 2022
Coax cable (9KHz-30MHz)	Times	381806-002	N/A	Dec. 09, 2021	Dec. 08, 2022
Conducted test software	Tonscend	TS+ Rev 2.5.0.0	HKE-081	N/A	N/A

Note: *The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).*

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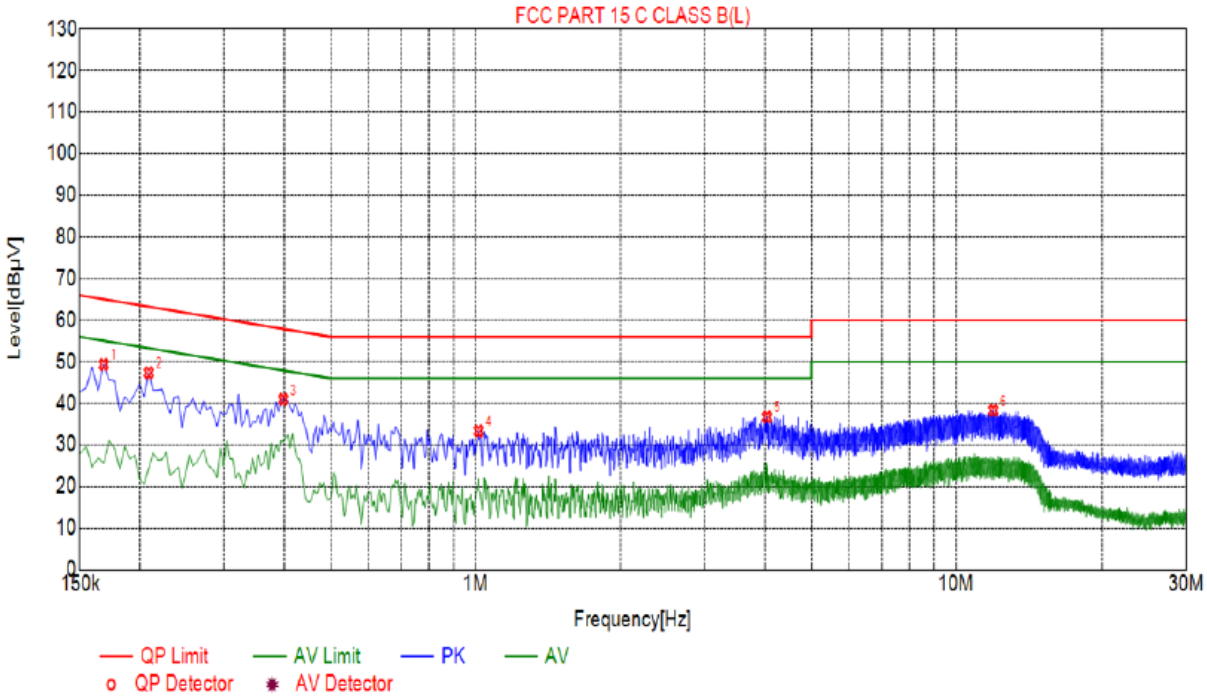
4.1.3. Test data

Test Specification: Line



Suspected List								
NO.	Freq. [MHz]	Level [dBμV]	Factor [dB]	Limit [dBμV]	Margin [dB]	Reading [dBμV]	Detector	Type
1	0.1680	49.34	20.01	65.06	15.72	29.33	PK	L
2	0.2085	47.33	20.04	63.26	15.93	27.29	PK	L
3	0.3975	40.94	20.04	57.91	16.97	20.90	PK	L
4	1.0140	33.33	20.06	56.00	22.67	13.27	PK	L
5	4.0425	36.70	20.25	56.00	19.30	16.45	PK	L
6	11.9625	38.29	19.99	60.00	21.71	18.30	PK	L

Remark: Margin = Limit – Level
Correction factor = Cable lose + LISN insertion loss
Level=Test receiver reading + correction factor

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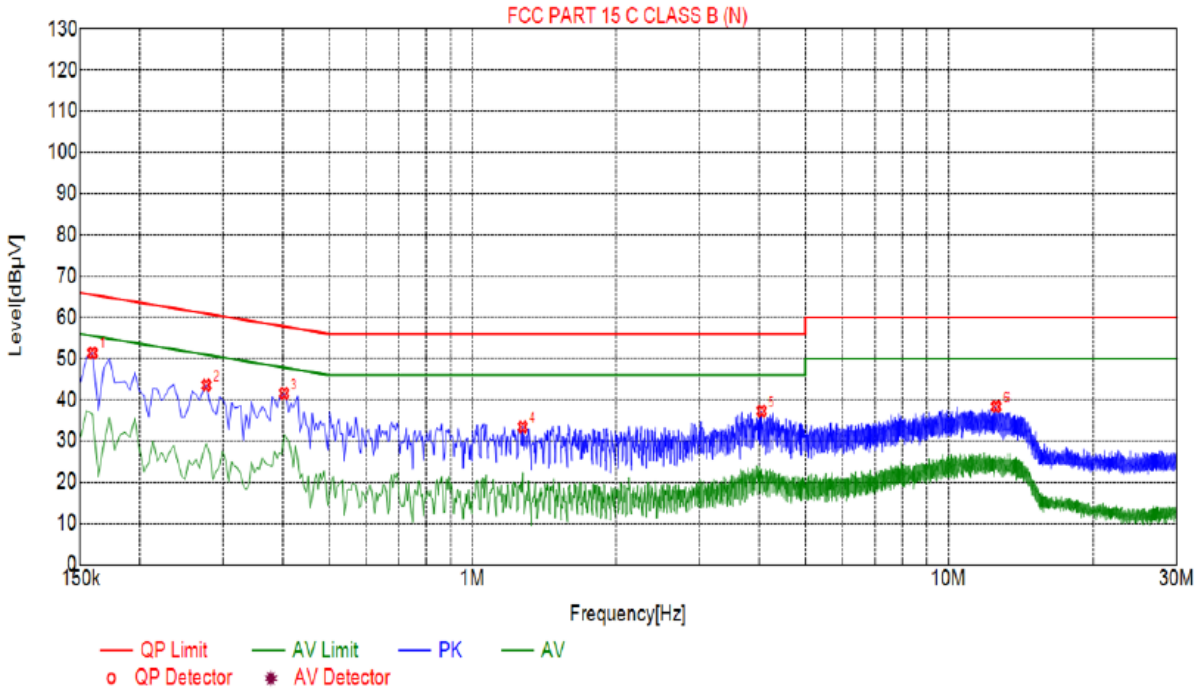
Test Specification: Neutral



Suspected List								
NO.	Freq. [MHz]	Level [dBμV]	Factor [dB]	Limit [dBμV]	Margin [dB]	Reading [dBμV]	Detector	Type
1	0.1590	51.36	20.01	65.52	14.16	31.35	PK	N
2	0.2760	43.55	20.04	60.94	17.39	23.51	PK	N
3	0.4020	41.55	20.04	57.81	16.26	21.51	PK	N
4	1.2750	33.39	20.09	56.00	22.61	13.30	PK	N
5	4.0515	37.25	20.25	56.00	18.75	17.00	PK	N
6	12.5970	38.35	19.98	60.00	21.65	18.37	PK	N

Remark: Margin = Limit – Level
Correction factor = Cable lose + LISN insertion loss

Level=Test receiver reading + correction factor

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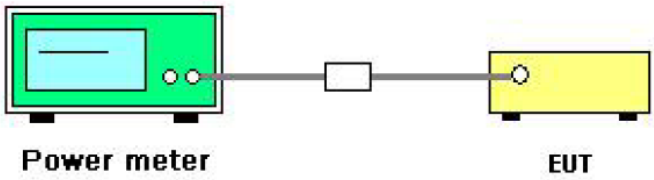
4.2. Maximum Conducted Output Power

4.2.1. Test Specification

Test Requirement:	FCC Part15 E Section 15.407(a)
Test Method:	KDB789033 D02 General UNII Test Procedures New Rules v02.r01 Section E
Limit:	Frequency Band (MHz): Limit 5725-5850: 1 W
Test Setup:	
Test Mode:	Transmitting mode with modulation
Test Procedure:	1. The testing follows the Measurement Procedure of KDB789033 D02 General UNII Test Procedures New Rules v02r01 Section E, 3, a 2. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement. 3. Set to the maximum power setting and enable the EUT transmit continuously. 5. Measure the conducted output power and record the results in the test report.
Test Result:	PASS
Remark:	Conducted output power= measurement power +10log(1/x) X is duty cycle=1, so 10log(1/1)=0 Conducted output power= measurement power

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4.2.2. Test Instruments

RF Test Room					
Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Date**	**Calibration Due**
Spectrum analyzer	Agilent	N9020A	HKE-048	Dec. 09, 2021	Dec. 08, 2022
Power meter	Agilent	E4419B	HKE-085	Dec. 09, 2021	Dec. 08, 2022
Power Sensor	Agilent	E9300A	HKE-086	Dec. 09, 2021	Dec. 08, 2022
RF cable	Times	1-40G	HKE-034	Dec. 09, 2021	Dec. 08, 2022
RF automatic control unit	Tonscend	JS0806-2	HKE-060	Dec. 09, 2021	Dec. 08, 2022

Note: *The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).*

Test Data

Configuration Band IV (5725 - 5850 MHz)					
Mode	Test channel	Maximum Conducted Output Power (dBm)		FCC Limit (dBm)	Result
		Antenna port 1	Antenna port 2		
11a	CH149	15.38	15.15	30	PASS
11a	CH157	15.85	14.28	30	PASS
11a	CH165	16.05	14.42	30	PASS
11n(HT20)	CH149	15.93	14.45	30	PASS
11n(HT20)	CH157	15.73	14.31	30	PASS
11n(HT20)	CH165	15.95	14.81	30	PASS
11n(HT40)	CH151	14.04	13.68	30	PASS
11n(HT40)	CH159	13.48	13.56	30	PASS
11ac(HT20)	CH149	16.04	14.70	30	PASS
11ac(HT20)	CH157	14.35	14.48	30	PASS
11ac(HT20)	CH165	14.49	14.70	30	PASS
11ac(HT40)	CH151	13.51	13.34	30	PASS
11ac(HT40)	CH159	13.50	12.90	30	PASS
11ac(HT80)	CH155	13.92	13.98	30	PASS

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Configuration Band IV (5725 - 5850 MHz)				
Mode	Test channel	Maximum Conducted Output Power (dBm)	FCC Limit (dBm)	Result
		MIMO		
11n(HT20)	CH149	18.26	30	PASS
11n(HT20)	CH157	18.09	30	PASS
11n(HT20)	CH165	18.43	30	PASS
11n(HT40)	CH151	16.87	30	PASS
11n(HT40)	CH159	16.53	30	PASS
11ac(HT20)	CH149	18.43	30	PASS
11ac(HT20)	CH157	17.43	30	PASS
11ac(HT20)	CH165	17.61	30	PASS
11ac(HT40)	CH151	16.44	30	PASS
11ac(HT40)	CH159	16.22	30	PASS
11ac(HT80)	CH155	16.96	30	PASS

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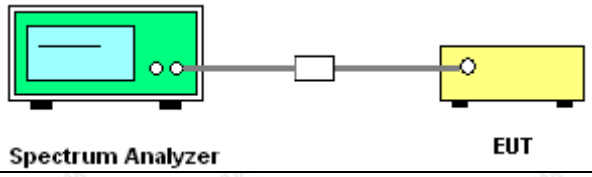
4.3. 6dB Emission Bandwidth

4.3.1. Test Specification

Test Requirement:	FCC CFR47 Part 15 Section 15.407(e)
Test Method:	KDB789033 D02 General UNII Test Procedures New Rules v01r04 Section C
Limit:	>500kHz
Test Setup:	
Test Mode:	Transmitting mode with modulation
Test Procedure:	1. KDB789033 D02 General UNII Test Procedures New Rules v02r01 Section C 2. Set to the maximum power setting and enable the EUT transmit continuously. 3. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6dB bandwidth must be greater than 500 kHz. 4. Measure and record the results in the test report.
Test Result:	PASS

4.3.2. Test Instruments

RF Test Room					
Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Date**	**Calibration Due**
Spectrum analyzer	Agilent	N9020A	HKE-048	Dec. 09, 2021	Dec. 08, 2022
RF cable	Times	1-40G	HKE-034	Dec. 09, 2021	Dec. 08, 2022
RF automatic control unit	Tonscend	JS0806-2	HKE-060	Dec. 09, 2021	Dec. 08, 2022

Note: *The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).*

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4.3.3. Test data

ANT 1

Band IV (5725 - 5850 MHz)					
Mode	Test channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Limit (MHz)	Result
11a	CH149	5745	16.280	0.5	PASS
11a	CH157	5785	16.320	0.5	PASS
11a	CH165	5825	16.320	0.5	PASS
11n(HT20)	CH149	5745	16.960	0.5	PASS
11n(HT20)	CH157	5785	17.000	0.5	PASS
11n(HT20)	CH165	5825	17.080	0.5	PASS
11n(HT40)	CH151	5755	35.680	0.5	PASS
11n(HT40)	CH159	5795	35.840	0.5	PASS
11ac(HT20)	CH149	5745	16.920	0.5	PASS
11ac(HT20)	CH157	5785	16.960	0.5	PASS
11ac(HT20)	CH165	5825	16.760	0.5	PASS
11ac(HT40)	CH151	5755	35.840	0.5	PASS
11ac(HT40)	CH159	5795	35.440	0.5	PASS
11ac(HT80)	CH155	5775	75.200	0.5	PASS

Test plots as follows:

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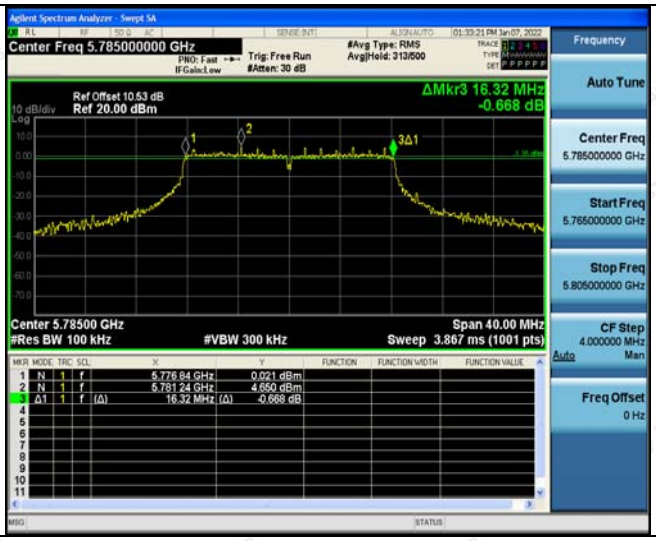
Band IV (5725 – 5850 MHz)

802.11a

Low



Mid

High

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802.11n(HT20)

Low

Mid

High

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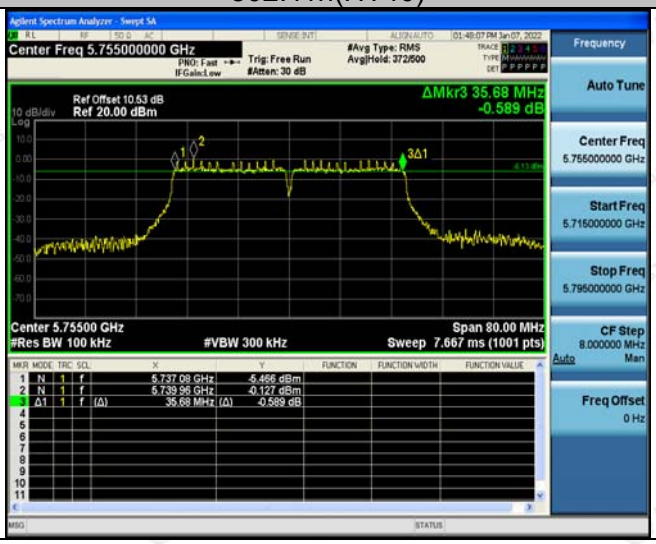
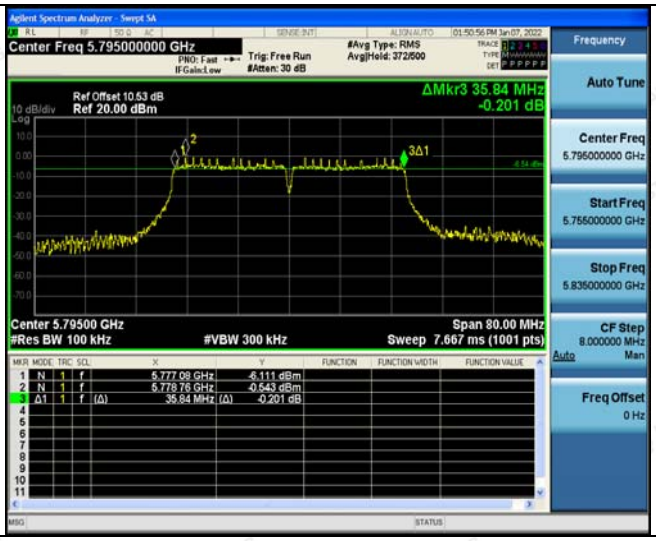
802.11n(HT40)



Low



High

802.11ac(HT20)

Low

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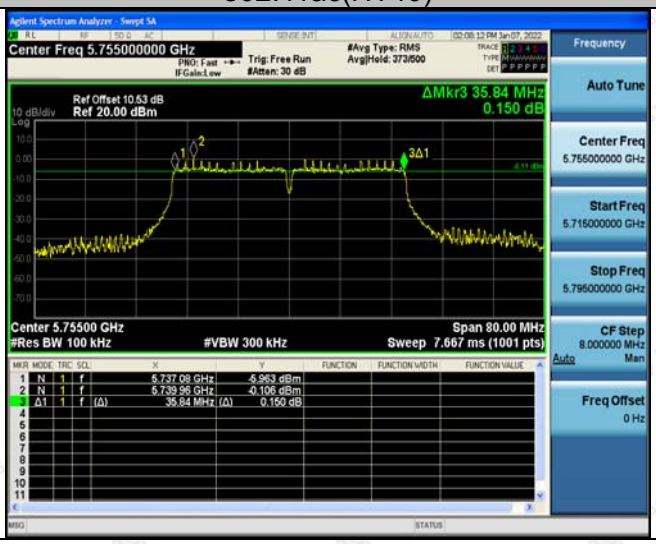
Mid

High

802.11ac(HT40)



Low

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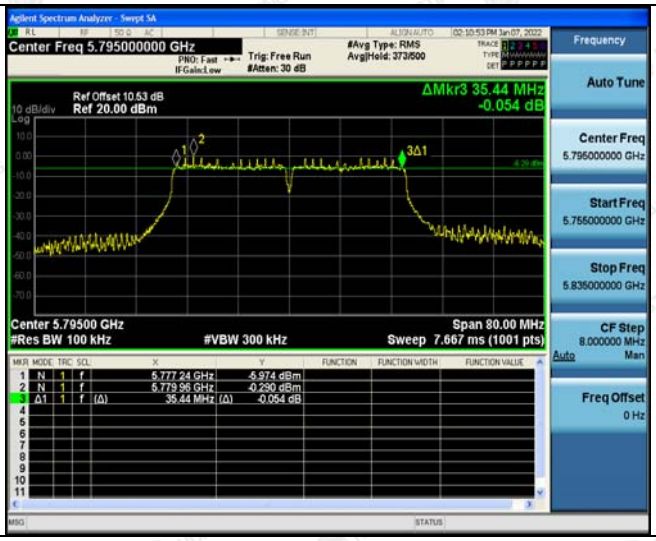
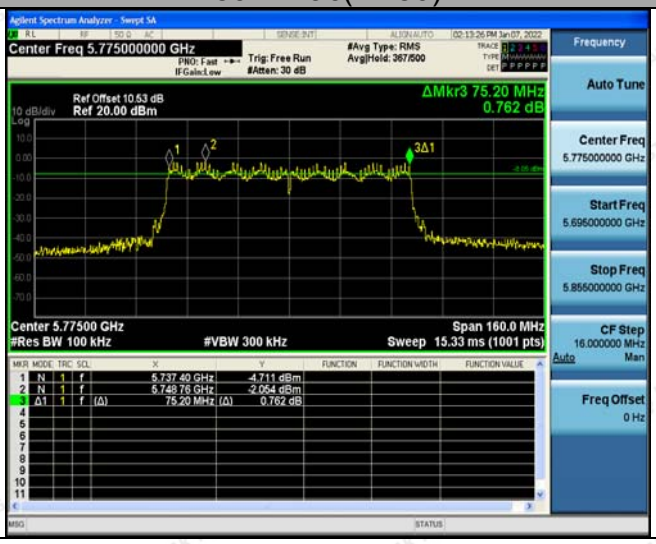


High

802.11ac(HT80)



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ANT 2

Band IV (5725 - 5850 MHz)					
Mode	Test channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Limit (MHz)	Result
11a	CH149	5745	16.320	0.5	PASS
11a	CH157	5785	16.320	0.5	PASS
11a	CH161	5825	16.320	0.5	PASS
11n(HT20)	CH149	5745	17.000	0.5	PASS
11n(HT20)	CH157	5785	16.960	0.5	PASS
11n(HT20)	CH161	5825	17.520	0.5	PASS
11n(HT40)	CH151	5755	35.600	0.5	PASS
11n(HT40)	CH159	5795	35.680	0.5	PASS
11ac(HT20)	CH149	5745	17.320	0.5	PASS
11ac(HT20)	CH157	5785	17.280	0.5	PASS
11ac(HT20)	CH165	5825	17.320	0.5	PASS
11ac(HT40)	CH151	5755	35.680	0.5	PASS
11ac(HT40)	CH159	5795	35.600	0.5	PASS
11ac(HT80)	CH155	5755	75.200	0.5	PASS

Test plots as follows:

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Band IV (5725 – 5850 MHz)

802.11a

Low

Mid

High

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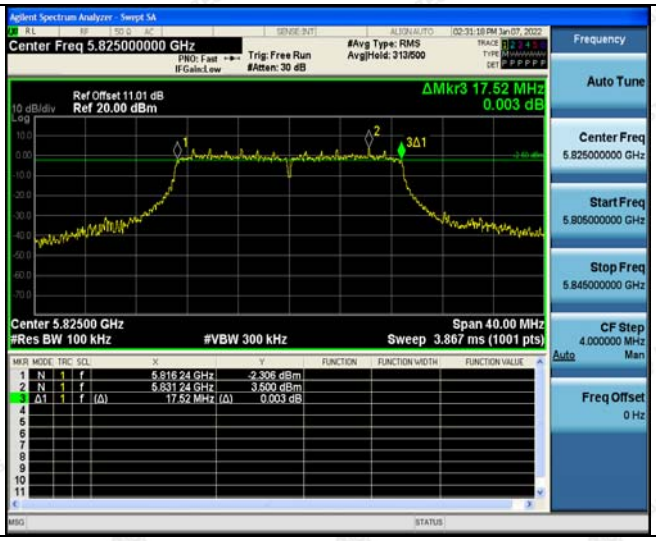
802.11n(HT20)

Low

Mid



High

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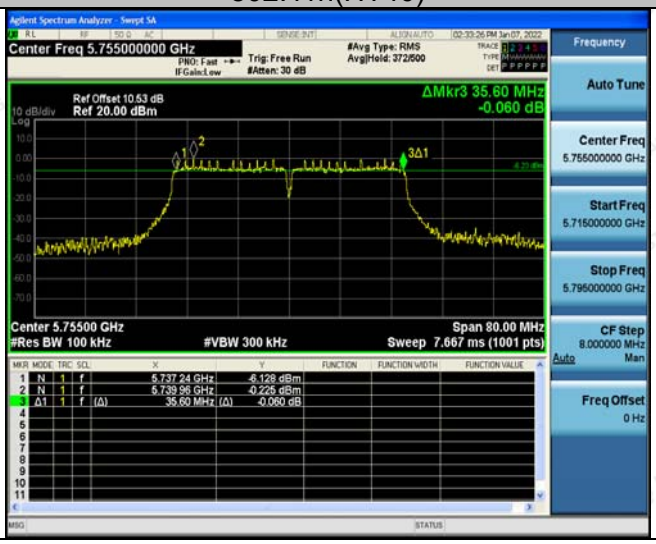
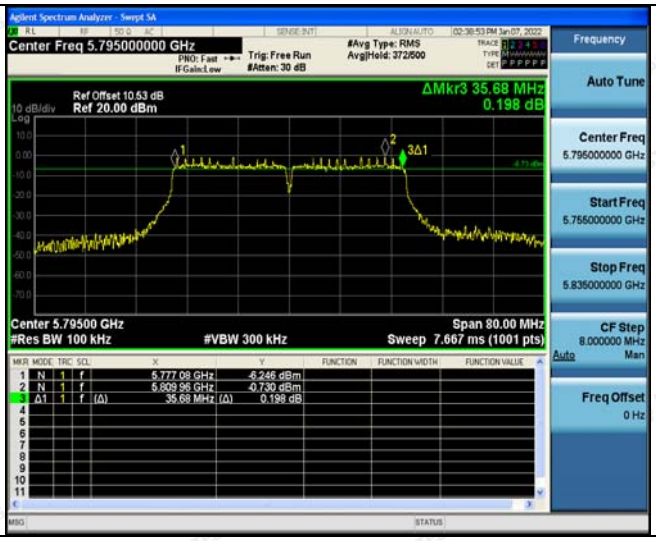
802.11n(HT40)



Low



High

802.11ac(HT20)

Low

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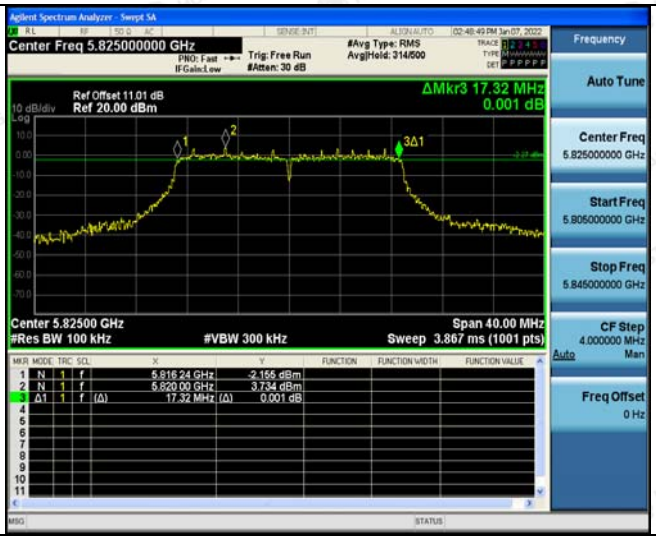
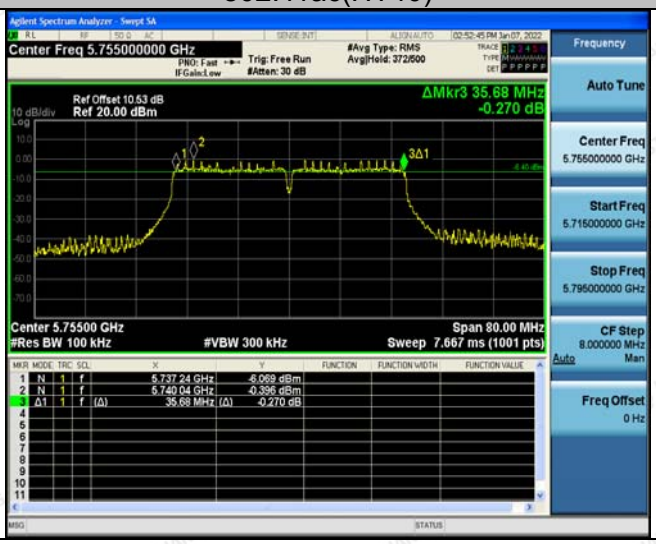
Mid



High

802.11ac(HT40)



Low

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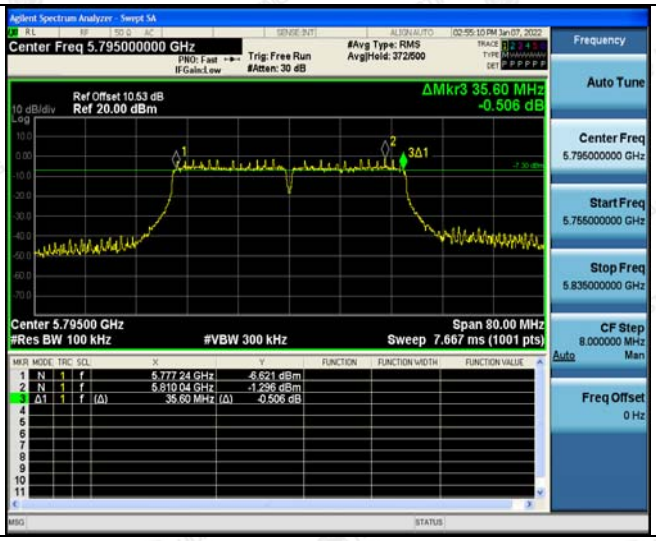
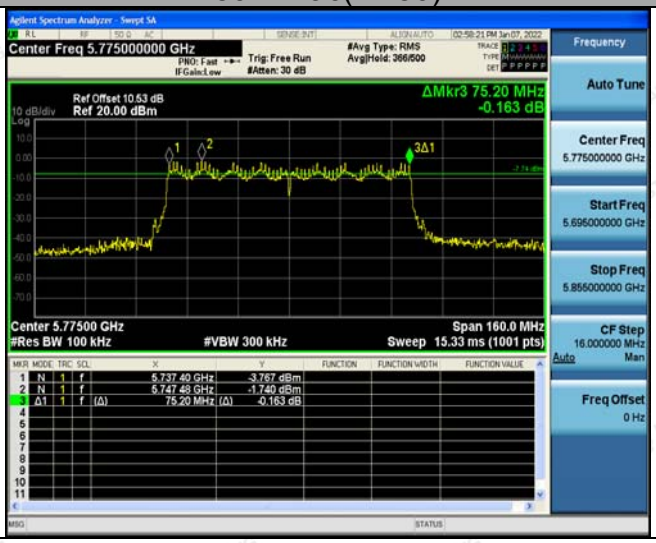


High

802.11ac(HT80)



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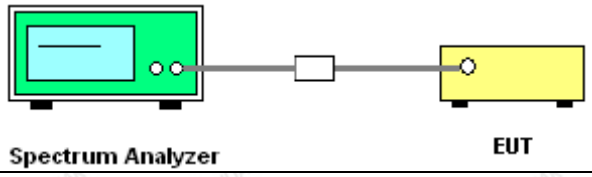
4.4. 26dB Bandwidth and 99% Occupied Bandwidth

4.4.1. Test Specification

Test Requirement:	47 CFR Part 15C Section 15.407 (a)
Test Method:	KDB789033 D02 General UNII Test Procedures New Rules v02r01 Section C
Limit:	No restriction limits
Test Setup:	
Test Mode:	Transmitting mode with modulation
Test Procedure:	1. KDB789033 D02 General UNII Test Procedures New Rules v02r01 Section C 2. Set to the maximum power setting and enable the EUT transmit continuously. 3. Make the measurement with the spectrum analyzer's resolution bandwidth RBW = 1% EBW, VBW≥3RBW, In order to make an accurate measurement. 4. Measure and record the results in the test report.
Test Result:	N/A

4.4.2. Test Instruments

RF Test Room					
Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Date**	**Calibration Due**
Spectrum analyzer	Agilent	N9020A	HKE-048	Dec. 09, 2021	Dec. 08, 2022
RF cable	Times	1-40G	HKE-034	Dec. 09, 2021	Dec. 08, 2022
RF automatic control unit	Tonscend	JS0806-2	HKE-060	Dec. 09, 2021	Dec. 08, 2022

Note: *The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).*

4.4.3. Test Result

N/A

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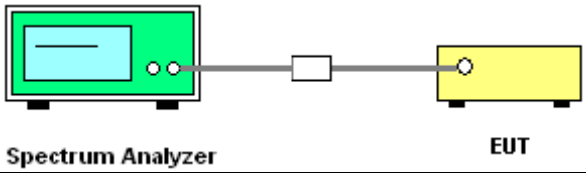
4.5. Power Spectral Density

4.5.1. Test Specification

Test Requirement:	FCC Part15 E Section 15.407 (a)
Test Method:	KDB789033 D02 General UNII Test Procedures New Rules v02r01 Section F
Limit:	≤30.00dBm/500KHz for Band IV 5725MHz-5850MHz
Test Setup:	
Test Mode:	Transmitting mode with modulation
Test Procedure:	1. Set the spectrum analyzer or EMI receiver span to view the entire emission bandwidth. 1. Set RBW = 510 kHz/1 MHz, VBW ≥ 3*RBW, Sweep time = Auto, Detector = RMS. 2. Allow the sweeps to continue until the trace stabilizes. 3. Use the peak marker function to determine the maximum amplitude level. 4. The E.I.R.P spectral density used radiated test method. At a test site that has been validated using the procedures of ANSI C63.4 or the latest CISPR 16-1-4 for measurements above 1 GHz, so as to simulate a near free-space environment.
Test Result:	PASS

4.5.2. Test Instruments

RF Test Room					
Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Date**	**Calibration Due**
Spectrum analyzer	Agilent	N9020A	HKE-048	Dec. 09, 2021	Dec. 08, 2022
RF cable	Times	1-40G	HKE-034	Dec. 09, 2021	Dec. 08, 2022
RF automatic control unit	Tonscend	JS0806-2	HKE-060	Dec. 09, 2021	Dec. 08, 2022

Note: *The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).*

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4.5.3. Test data

ANT 1

Configuration Band IV (5725 - 5850 MHz)						
Mode	Test channel	Level [dBm/510kHz]	10log(500/510)	Power Spectral Density	Limit (dBm/500kHz)	Result
11a	CH149	9.57	-0.086	9.484	30	PASS
11a	CH157	10.75	-0.086	10.664	30	PASS
11a	CH165	10.97	-0.086	10.884	30	PASS
11n HT20	CH149	10.37	-0.086	10.284	30	PASS
11n HT20	CH157	10.24	-0.086	10.154	30	PASS
11n HT20	CH165	10.66	-0.086	10.574	30	PASS
11n HT40	CH151	6.31	-0.086	6.224	30	PASS
11n HT40	CH159	6.35	-0.086	6.264	30	PASS
11ac HT20	CH149	10.6	-0.086	10.514	30	PASS
11ac HT20	CH157	9.08	-0.086	8.994	30	PASS
11ac HT20	CH165	9.21	-0.086	9.124	30	PASS
11ac HT40	CH151	6.94	-0.086	6.854	30	PASS
11ac HT40	CH159	6.68	-0.086	6.594	30	PASS
11ac HT80	CH155	6.43	-0.086	6.344	30	PASS

Test plots as follows:

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Band IV (5725 – 5850 MHz)

802.11a

Low

Mid

High

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802.11n(HT20)
Low
Mid
High

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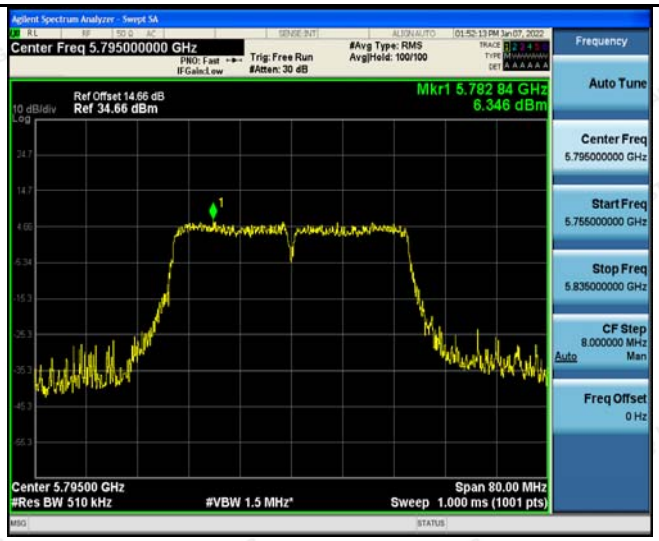
802.11n(HT40)

Low



High

802.11ac(HT20)

Low

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Mid

High

802.11ac(HT40)

Low

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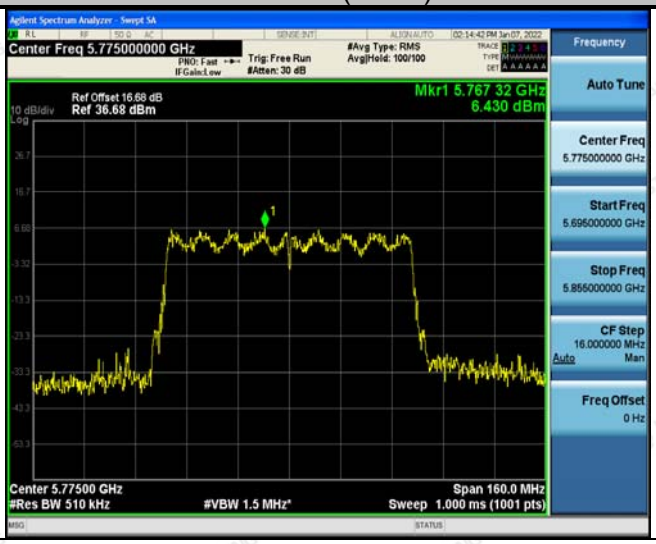
High

802.11ac(HT80)



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ANT 2

Configuration Band IV (5725 - 5850 MHz)						
Mode	Test channel	Level [dBm/510kHz]	10log(500/510)	Power Spectral Density	Limit (dBm/500kHz)	Result
11a	CH149	9.29	-0.086	9.204	30	PASS
11a	CH157	9.98	-0.086	9.894	30	PASS
11a	CH161	9.45	-0.086	9.364	30	PASS
11n(HT20)	CH149	9.42	-0.086	9.334	30	PASS
11n(HT20)	CH157	9.17	-0.086	9.084	30	PASS
11n(HT20)	CH161	9.48	-0.086	9.394	30	PASS
11n(HT40)	CH151	6.56	-0.086	6.474	30	PASS
11n(HT40)	CH159	6.25	-0.086	6.164	30	PASS
11ac(HT20)	CH149	9.34	-0.086	9.254	30	PASS
11ac(HT20)	CH157	8.98	-0.086	8.894	30	PASS
11ac(HT20)	CH161	9.48	-0.086	9.394	30	PASS
11ac(HT40)	CH151	6.82	-0.086	6.734	30	PASS
11ac(HT40)	CH159	6.65	-0.086	6.564	30	PASS
11ac(HT80)	CH155	6.91	-0.086	6.824	30	PASS

Test plots as follows:

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Band IV (5725 – 5850 MHz)

802.11a

Low

Mid

High

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802.11n(HT20)

Low

Mid

High

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802.11n(HT40)

Low

High

802.11ac(HT20)

Low

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Mid

High

802.11ac(HT40)

Low

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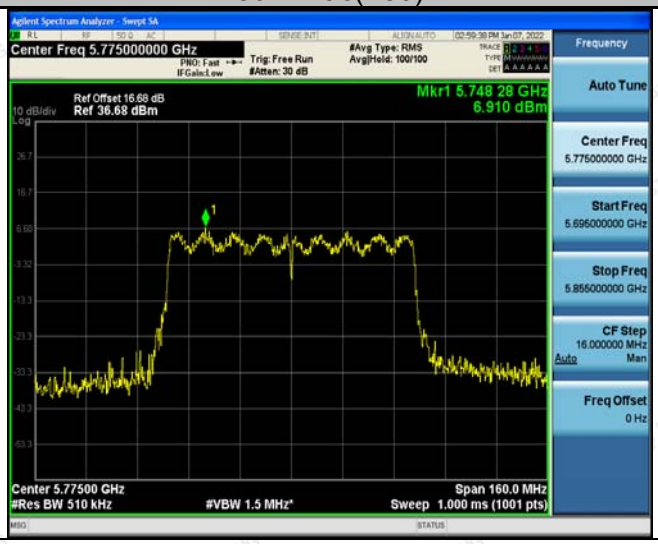
High

802.11ac(T80)



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For MIMO antenna port 1+antenna port 2

Configuration Band IV (5725 - 5850 MHz)				
Mode	Test channel	**Power Density (dBm)**	**Limit (dBm)**	**Result**
11a	CH149	/	30	/
11a	CH157	/	30	/
11a	CH161	/	30	/
11n(HT20)	CH149	12.93	29.99	**PASS**
11n(HT20)	CH157	12.75	29.99	**PASS**
11n(HT20)	CH161	13.12	29.99	**PASS**
11n(HT40)	CH151	9.45	29.99	**PASS**
11n(HT40)	CH159	9.31	29.99	**PASS**
11ac(HT20)	CH149	13.03	29.99	**PASS**
11ac(HT20)	CH157	12.04	29.99	**PASS**
11ac(HT20)	CH161	12.36	29.99	**PASS**
11ac(HT40)	CH151	9.89	29.99	**PASS**
11ac(HT40)	CH159	9.68	29.99	**PASS**
11ac(HT80)	CH155	9.69	29.99	**PASS**
	Note: 1 Result unit: W, The end result is converted to units of dBm. limit=30dBm-(direction gain-6dBi)=30-(3+10log2-6)=29.99dBm			

Note: This product supports antenna 1 and antenna 2 launch, but only support 802.11 n/ac for MIMO mode, not support 802.11 a for MIMO mode.

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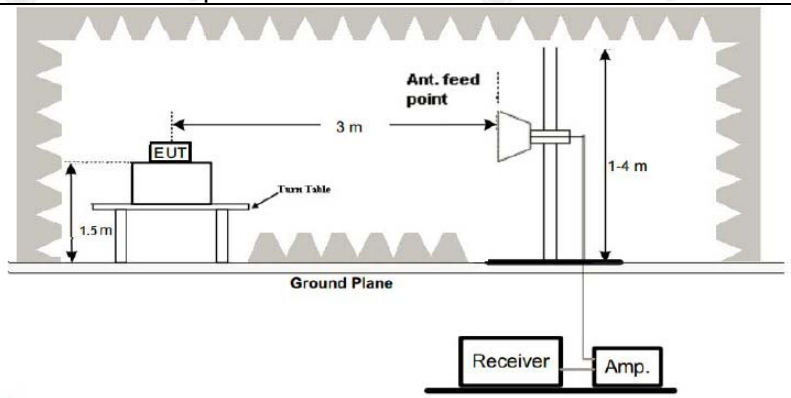
4.6. Band edge

4.6.1. Test Specification

Test Requirement:	FCC CFR47 Part 15E Section 15.407
Test Method:	ANSI C63.10 2013
Limit:	(1)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. The limit of frequency below 1GHz and which fall in restricted ba nds should complies 15.209.
Test Setup:	
Test Mode:	Transmitting mode with modulation
Test Procedure:	1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation. 2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. 3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. 4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading.

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	5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. 6. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasipeak or average method as specified and then reported in a data sheet.
Test Result:	PASS

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4.6.2. Test Instruments

Radiated Emission Test Site (966)					
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Date**	**Calibration Due**
Receiver	R&S	ESRP3	HKE-005	Dec. 09, 2021	Dec. 08, 2022
Spectrum analyzer	Agilent	N9020A	HKE-048	Dec. 09, 2021	Dec. 08, 2022
Preamplifier	EMCI	EMC051845SE	HKE-015	Dec. 09, 2021	Dec. 08, 2022
Preamplifier	Agilent	83051A	HKE-016	Dec. 09, 2021	Dec. 08, 2022
Loop antenna	Schwarzbeck	FMZB 1519 B	HKE-014	Dec. 09, 2021	Dec. 08, 2022
Broadband antenna	Schwarzbeck	VULB 9163	HKE-012	Dec. 09, 2021	Dec. 08, 2022
Horn antenna	Schwarzbeck	9120D	HKE-013	Dec. 09, 2021	Dec. 08, 2022
Antenna Mast	Keleto	CC-A-4M	N/A	N/A	N/A
Position controller	Taiwan MF	MF7802	HKE-011	Dec. 09, 2021	Dec. 08, 2022
Radiated test software	Tonscend	TS+ Rev 2.5.0.0	HKE-082	N/A	N/A
RF cable (9KHz-1GHz)	Times	381806-001	N/A	N/A	N/A
Hf antenna	Schwarzbeck	LB-180400-KF	HKE-031	Dec. 09, 2021	Dec. 08, 2022
RF cable	Tonscend	1-18G	HKE-099	Dec. 09, 2021	Dec. 08, 2022
RF cable	Times	1-40G	HKE-034	Dec. 09, 2021	Dec. 08, 2022
Horn Antenna	Schewarzbeck	BBHA 9170	HKE-017	Dec. 09, 2021	Dec. 08, 2022
Spectrum analyzer	R&S	FSP40	HKE-025	Dec. 09, 2021	Dec. 08, 2022

Note: *The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).*

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4.6.3. Test Data

All modes of operation were investigated and the worst-case emissions of ANT.1 are reported.
Operation Mode: 802.11a Mode with 5.8G TX CH Low

Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
5650	51.33	-2.06	49.27	68.2	-18.93	peak
5700	90.74	-1.96	88.78	105.2	-16.42	peak
5720	95.68	-2.87	92.81	110.8	-17.99	peak
5725	110.25	-2.14	108.11	122.2	-14.09	peak
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
5650	52.17	-2.06	50.11	68.2	-18.09	peak
5700	95.13	-1.96	93.17	105.2	-12.03	peak
5720	96.39	-2.87	93.52	110.8	-17.28	peak
5725	115.72	-2.14	113.58	122.2	-8.62	peak
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

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Operation Mode: TX CH High with 5.8G

Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
5850	111.64	-1.97	109.67	122.2	-12.53	peak
5855	96.34	-2.13	94.21	110.8	-16.59	peak
5875	89.34	-2.65	86.69	105.2	-18.51	peak
5925	57	-2.28	54.72	68.2	-13.48	peak
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
5850	105.34	-1.97	103.37	122.2	-18.83	peak
5855	93.67	-2.13	91.54	110.8	-19.26	peak
5875	88.24	-2.65	85.59	105.2	-19.61	peak
5925	54.54	-2.28	52.26	68.2	-15.94	peak
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

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Operation Mode: 802.11n20 Mode with 5.8G TX CH Low

Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
5650	57.41	-2.06	55.35	68.2	-12.85	peak
5700	92.35	-1.96	90.39	105.2	-14.81	peak
5720	96.35	-2.87	93.48	110.8	-17.32	peak
5725	112.34	-2.14	110.2	122.2	-12	peak
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
5650	61.35	-2.06	59.29	68.2	-8.91	peak
5700	96.34	-1.96	94.38	105.2	-10.82	peak
5720	94.68	-2.87	91.81	110.8	-18.99	peak
5725	112.34	-2.14	110.2	122.2	-12	peak
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

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Operation Mode: TX CH High with 5.8G
Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
5850	111.25	-1.97	109.28	122.2	-12.92	peak
5855	95.68	-2.13	93.55	110.8	-17.25	peak
5875	89.89	-2.65	87.24	105.2	-17.96	peak
5925	54.16	-2.28	51.88	68.2	-16.32	peak
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
5850	107.98	-1.97	106.01	122.2	-16.19	peak
5855	94.35	-2.13	92.22	110.8	-18.58	peak
5875	88.25	-2.65	85.6	105.2	-19.6	peak
5925	57.66	-2.28	55.38	68.2	-12.82	peak
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

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Operation Mode: 802.11n40 Mode with 5.8G TX CH Low

Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
5650	57.49	-2.06	55.43	68.2	-12.77	peak
5700	93.25	-1.96	91.29	105.2	-13.91	peak
5720	94.94	-2.87	92.07	110.8	-18.73	peak
5725	112.06	-2.14	109.92	122.2	-12.28	peak
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
5650	52.01	-2.06	49.95	68.2	-18.25	peak
5700	96.17	-1.96	94.21	105.2	-10.99	peak
5720	96.33	-2.87	93.46	110.8	-17.34	peak
5725	112.76	-2.14	110.62	122.2	-11.58	peak
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

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Operation Mode: TX CH High with 5.8G
Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
5850	106.35	-1.97	104.38	122.2	-17.82	peak
5855	95.25	-2.13	93.12	110.8	-17.68	peak
5875	88.74	-2.65	86.09	105.2	-19.11	peak
5925	54.21	-2.28	51.93	68.2	-16.27	peak
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
5850	107.25	-1.97	105.28	122.2	-16.92	peak
5855	95.34	-2.13	93.21	110.8	-17.59	peak
5875	88.77	-2.65	86.12	105.2	-19.08	peak
5925	54.35	-2.28	52.07	68.2	-16.13	peak
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

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Operation Mode: 802.11ac20 Mode with 5.8G TX CH Low

Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
5650	57.14	-2.06	55.08	68.2	-13.12	peak
5700	88.32	-1.96	86.36	105.2	-18.84	peak
5720	95.34	-2.87	92.47	110.8	-18.33	peak
5725	110.25	-2.14	108.11	122.2	-14.09	peak
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
5650	58.17	-2.06	56.11	68.2	-12.09	peak
5700	91.35	-1.96	89.39	105.2	-15.81	peak
5720	95.36	-2.87	92.49	110.8	-18.31	peak
5725	110.25	-2.14	108.11	122.2	-14.09	peak
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

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Operation Mode: TX CH High with 5.8G

Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
5850	112.35	-1.97	110.38	122.2	-11.82	peak
5855	95.72	-2.13	93.59	110.8	-17.21	peak
5875	89.56	-2.65	86.91	105.2	-18.29	peak
5925	54.21	-2.28	51.93	68.2	-16.27	peak
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
5850	111.39	-1.97	109.42	122.2	-12.78	peak
5855	93.25	-2.13	91.12	110.8	-19.68	peak
5875	92.34	-2.65	89.69	105.2	-15.51	peak
5925	56.23	-2.28	53.95	68.2	-14.25	peak
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

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Operation Mode: 802.11ac40 Mode with 5.8G TX CH Low

Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
5650	58.14	-2.06	56.08	68.2	-12.12	peak
5700	89.65	-1.96	87.69	105.2	-17.51	peak
5720	94.94	-2.87	92.07	110.8	-18.73	peak
5725	112.37	-2.14	110.23	122.2	-11.97	peak
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
5650	57.24	-2.06	55.18	68.2	-13.02	peak
5700	89.32	-1.96	87.36	105.2	-17.84	peak
5720	94.35	-2.87	91.48	110.8	-19.32	peak
5725	111.02	-2.14	108.88	122.2	-13.32	peak
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

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Operation Mode: TX CH High with 5.8G

Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
5850	110.25	-1.97	108.28	122.2	-13.92	peak
5855	95.34	-2.13	93.21	110.8	-17.59	peak
5875	89.37	-2.65	86.72	105.2	-18.48	peak
5925	56.28	-2.28	54	68.2	-14.2	peak
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
5850	112.36	-1.97	110.39	122.2	-11.81	peak
5855	93.14	-2.13	91.01	110.8	-19.79	peak
5875	89.27	-2.65	86.62	105.2	-18.58	peak
5925	60.25	-2.28	57.97	68.2	-10.23	peak
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

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Operation Mode: 802.11ac80 Mode with 5.8G TX CH Low

Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
5650	57.19	-2.06	55.13	68.2	-13.07	peak
5700	89.16	-1.96	87.2	105.2	-18	peak
5720	94.25	-2.87	91.38	110.8	-19.42	peak
5725	112.35	-2.14	110.21	122.2	-11.99	peak
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
5650	57.84	-2.06	55.78	68.2	-12.42	peak
5700	91.34	-1.96	89.38	105.2	-15.82	peak
5720	97.25	-2.87	94.38	110.8	-16.42	peak
5725	111.11	-2.14	108.97	122.2	-13.23	peak
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

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Operation Mode: TX CH High with 5.8G

Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
5850	112.02	-1.97	110.05	122.2	-12.15	peak
5855	95.34	-2.13	93.21	110.8	-17.59	peak
5875	89.89	-2.65	87.24	105.2	-17.96	peak
5925	52.33	-2.28	50.05	68.2	-18.15	peak
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
5850	110.25	-1.97	108.28	122.2	-13.92	peak
5855	95.34	-2.13	93.21	110.8	-17.59	peak
5875	89.34	-2.65	86.69	105.2	-18.51	peak
5925	56.02	-2.28	53.74	68.2	-14.46	peak
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

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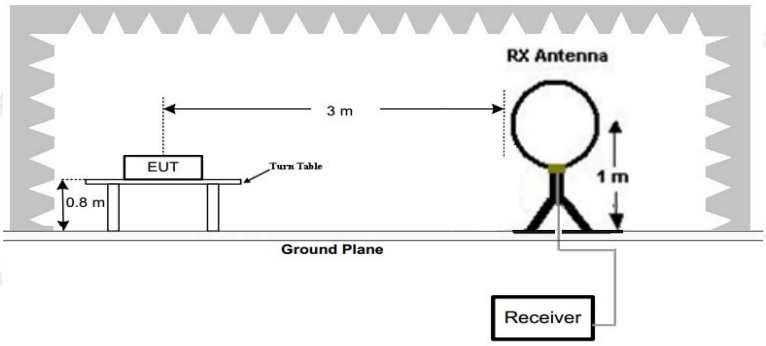
4.7. Spurious Emission

4.7.1.1. Test Specification

<table>
<tr><td>Test Requirement:</td><td>FCC CFR47 Part 15 Section 15.407 & 15.209 & 15.205</td></tr>
<tr><td>Test Method:</td><td>KDB 789033 D02 v02r01</td></tr>
<tr><td>Frequency Range:</td><td>9kHz to 40GHz</td></tr>
<tr><td>Measurement Distance:</td><td>3 m</td></tr>
<tr><td>Antenna Polarization:</td><td>Horizontal & Vertical</td></tr>
<tr><td>Operation mode:</td><td>Transmitting mode with modulation</td></tr>
<tr><td>Receiver Setup:</td><td>
<table>
<tr><td>Frequency</td><td>Detector</td><td>RBW</td><td>VBW</td><td>Remark</td></tr>
<tr><td>9kHz- 150kHz</td><td>Quasi-peak</td><td>200Hz</td><td>1kHz</td><td>Quasi-peak Value</td></tr>
<tr><td>150kHz-30MHz</td><td>Quasi-peak</td><td>9kHz</td><td>30kHz</td><td>Quasi-peak Value</td></tr>
<tr><td>30MHz-1GHz</td><td>Quasi-peak</td><td>120KHz</td><td>300KHz</td><td>Quasi-peak Value</td></tr>
<tr><td rowspan="2">Above 1GHz</td><td>Peak</td><td>1MHz</td><td>3MHz</td><td>Peak Value</td></tr>
<tr><td>Peak</td><td>1MHz</td><td>10Hz</td><td>Average Value</td></tr>
</table>
</td></tr>
<tr><td>Limit:</td><td>(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:
(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.
The limit of frequency below 1GHz and which fall in restricted b ands should complies 15.209.</td></tr>
<tr><td>Test setup:</td><td>For radiated emissions below 30MHz
 

30MHz to 1GHz</td></tr>
</table>

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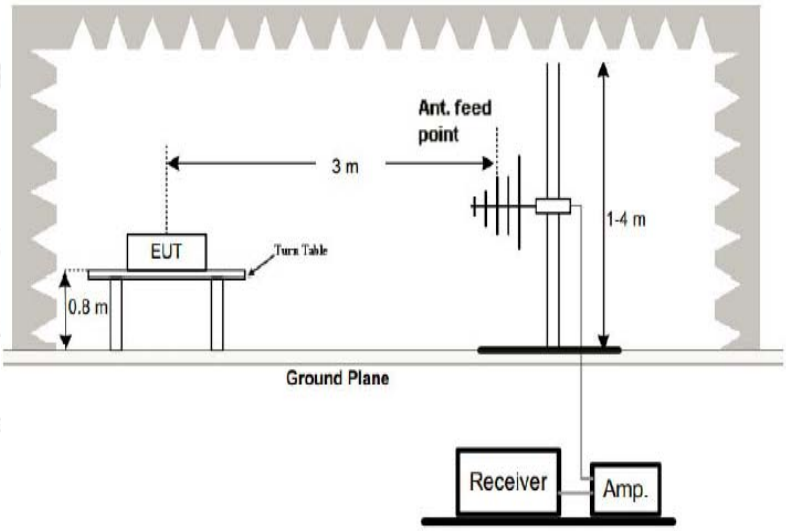
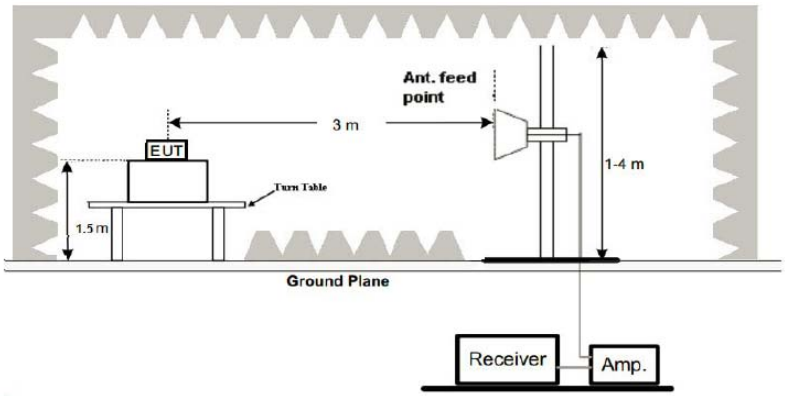


Above 1GHz



Test Procedure:

1. The EUT was placed on the top of a rotating table 0.8 meters above the groundat a 3 meter camber. The table was rotated 360 degrees todetermine the position of the highest radiation.
2. The EUT was set 3 meters away from the interference-receiving antenna, whichwas mounted on the top of a variable-height antenna tower.
3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and thenthe antenna was tuned to heights from 1 meter to 4 meters and the rotatablewas turned from 0 degrees to 360 degrees to find the maximum reading.
5. The test-receiver system was set to Peak Detect Function and SpecifiedBandwidth with Maximum Hold Mode.
6. If the emission level of the EUT in peak mode was 10dB lower than the limitspecified, then testing could be stopped and the peak values of the EUT wouldbe reported. Otherwise the emissions that did not have

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	10dB margin would bere-tested one by one using peak, quasi-peak or average method as specified andthen reported in a data sheet.
Test results:	PASS

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4.7.2. Test Data

test mode: TX 802.11a 5745MHz

All the test modes completed for test. The worst case of Radiated Emission; the test data of this mode was reported.

Below 1GHz

Horizontal

Suspected List									
NO.	Freq. [MHz]	Factor [dB]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	130.0100	-18.57	41.78	23.21	43.50	20.29	100	338	Horizontal
2	192.1522	-15.81	46.96	31.15	43.50	12.35	100	317	Horizontal
3	274.6847	-13.47	47.90	34.43	46.00	11.57	100	314	Horizontal
4	445.5756	-9.18	39.34	30.16	46.00	15.84	100	29	Horizontal
5	593.1632	-6.57	40.37	33.80	46.00	12.20	100	275	Horizontal
6	742.6927	-4.02	41.88	37.86	46.00	8.14	100	246	Horizontal

Remark: Factor = Cable loss + Antenna factor – Preamplifier; Level = Reading + Factor; Margin = Limit – Level

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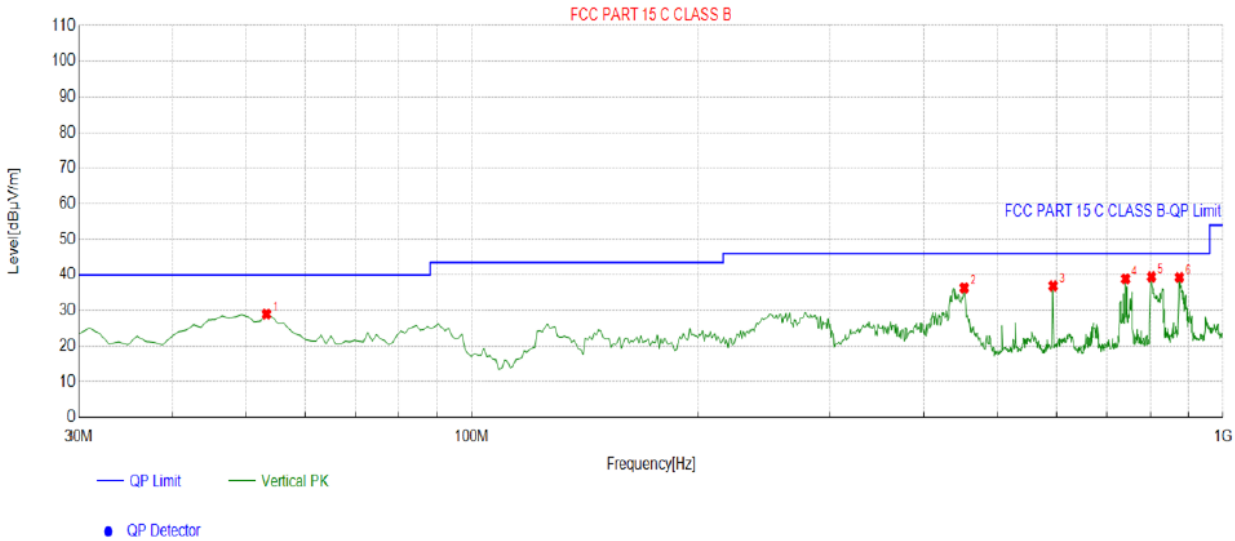
Vertical



Suspected List									
NO.	Freq. [MHz]	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	53.3033	-14.15	43.10	28.95	40.00	11.05	100	167	Vertical
2	452.3724	-8.91	45.23	36.32	46.00	9.68	100	347	Vertical
3	594.1341	-6.50	43.39	36.89	46.00	9.11	100	318	Vertical
4	741.7217	-4.06	42.93	38.87	46.00	7.13	100	326	Vertical
5	802.8929	-3.07	42.54	39.47	46.00	6.53	100	328	Vertical
6	874.7447	-2.16	41.48	39.32	46.00	6.68	100	331	Vertical

Remark: Factor = Cable loss + Antenna factor – Preamplifier; Level = Reading + Factor; Margin = Limit – Level

Harmonics and Spurious Emissions

Frequency Range (9 kHz-30MHz)

Frequency (MHz)	Level@3m (dBμV/m)	Limit@3m (dBμV/m)
--	--	--
--	--	--
--	--	--
--	--	--

Note: *1. Emission Level=Reading+ Cable loss-Antenna factor-Amp factor*

2. The emission levels are 20 dB below the limit value, which are not reported. It is deemed to comply with the requirement

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Above 1GHz

All modes of operation were investigated and the worst-case of Ant 1 are reported.

LOW CH 149 (802.11 a Mode with 5.8G)/5745

Horizontal:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
3368	56.38	-4.59	51.79	68.2	-16.41	peak
11096	50.25	4.21	54.46	74	-19.54	peak
11096	38.69	4.21	42.9	54	-11.1	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
3368	59.32	-4.59	54.73	68.2	-13.47	peak
11096	54.14	4.21	58.35	74	-15.65	peak
11096	37.28	4.21	41.49	54	-12.51	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

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MID CH157 (802.11 a Mode with 5.8G)/5785

Horizontal:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
3172	58.69	-4.59	54.1	68.2	-14.1	peak
10523	54.21	4.21	58.42	68.2	-9.78	peak
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
3172	57.64	-4.59	53.05	68.2	-15.15	peak
10523	56.32	4.21	60.53	68.2	-7.67	peak
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

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HIGH CH 165 (802.11a Mode with 5.8G)/5825

Horizontal:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2705	59.34	-4.59	54.75	74	-19.25	peak
2705	48.17	-4.59	43.58	54	-10.42	AVG
11717	54.21	4.84	59.05	74	-14.95	peak
11717	37.69	4.84	42.53	54	-11.47	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2705	60.32	-4.59	55.73	74	-18.27	peak
2705	45.12	-4.59	40.53	54	-13.47	AVG
11717	51.24	4.84	56.08	74	-17.92	peak
11717	39.87	4.84	44.71	54	-9.29	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Remark：
(1) Measuring frequencies from 1 GHz to the 40 GHz。
(2) “F” denotes fundamental frequency; “H” denotes spurious frequency. “E” denotes band edge frequency.
(3) * denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.
(4) The emissions are attenuated more than 20dB below the permissible limits are not record in the report.
(5) The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120KHz, 1 MHz for measuring above 1 GHz, below 30MHz was 10KHz.
(6) When the test results of Peak Detected below the limits of Average Detected, the Average Detected is not need completed. For example: Top Channel at Fundamental 73.16dBuV/m(PK Value) <93.98(AV Limit), at harmonic 53.20 dBuV/m(PK Value) <54 dBuV/m(AV Limit), the Average Detected not need to completed.

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5.8G 802.11n20 Mode

LOW CH 149

Horizontal:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
3368	58.39	-4.59	53.8	68.2	-14.4	peak
11096	57.57	4.21	61.78	74	-12.22	peak
11096	40.33	4.21	44.54	54	-9.46	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
3368	54.38	-4.59	49.79	68.2	-18.41	peak
11096	56.24	4.21	60.45	74	-13.55	peak
11096	38.17	4.21	42.38	54	-11.62	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

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MID CH157

Horizontal:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
3172	60.35	-4.59	55.76	68.2	-12.44	peak
10523	49.27	4.21	53.48	68.2	-14.72	peak
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
3172	55.25	-4.59	50.66	68.2	-17.54	peak
10523	52.14	4.21	56.35	68.2	-11.85	peak
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

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HIGH CH165

Horizontal:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2705	60.28	-4.59	55.69	74	-18.31	peak
2705	45.16	-4.59	40.57	54	-13.43	AVG
11717	56.34	4.84	61.18	74	-12.82	peak
11717	39.28	4.84	44.12	54	-9.88	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2705	60.28	-4.59	55.69	74	-18.31	peak
2705	49.22	-4.59	44.63	54	-9.37	AVG
11717	53.35	4.84	58.19	74	-15.81	peak
11717	38.74	4.84	43.58	54	-10.42	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Remark：
(1) Measuring frequencies from 1 GHz to the 40 GHz。
(2) “F” denotes fundamental frequency; “H” denotes spurious frequency. “E” denotes band edge frequency.
(3) * denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.
(4) The emissions are attenuated more than 20dB below the permissible limits are not record in the report.
(5) The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120KHz, 1 MHz for measuring above 1 GHz, below 30MHz was 10KHz.
(6) When the test results of Peak Detected below the limits of Average Detected, the Average Detected is not need completed. For example: Top Channel at Fundamental 73.16dBuV/m(PK Value) <93.98(AV Limit), at harmonic 53.20 dBuV/m(PK Value) <54 dBuV/m(AV Limit), the Average Detected not need to completed.

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5.8G 802.11n40 Mode

LOW CH 151

Horizontal:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
3368	60.28	-4.59	55.69	68.2	-12.51	peak
11096	57.14	4.21	61.35	74	-12.65	peak
11096	39.25	4.21	43.46	54	-10.54	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
3368	58.17	-4.59	53.58	68.2	-14.62	peak
11096	59.33	4.21	63.54	74	-10.46	peak
11096	38.69	4.21	42.9	54	-11.1	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

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MID CH159

Horizontal:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
3172	58.14	-4.59	53.55	68.2	-14.65	peak
10523	54.32	4.21	58.53	68.2	-9.67	peak
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
3172	57.14	-4.59	52.55	68.2	-15.65	peak
10523	52.69	4.21	56.9	68.2	-11.3	peak
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Remark：
(1) Measuring frequencies from 1 GHz to the 40 GHz。
(2) “F” denotes fundamental frequency; “H” denotes spurious frequency. “E” denotes band edge frequency.
(3) * denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.
(4) The emissions are attenuated more than 20dB below the permissible limits are not record in the report.
(5) The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120KHz, 1 MHz for measuring above 1 GHz, below 30MHz was 10KHz.
(6) When the test results of Peak Detected below the limits of Average Detected, the Average Detected is not need completed. For example: Top Channel at Fundamental 73.16dBuV/m(PK Value) <93.98(AV Limit), at harmonic 53.20 dBuV/m(PK Value) <54 dBuV/m(AV Limit), the Average Detected not need to completed.

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5.8G 802.11ac20 Mode

LOW CH 149

Horizontal:

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
3368	62.35	-4.59	57.76	68.2	-10.44	peak
11096	52.14	4.21	56.35	74	-17.65	peak
11096	38.47	4.21	42.68	54	-11.32	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
3368	62.35	-4.59	57.76	68.2	-10.44	peak
11096	57.14	4.21	61.35	74	-12.65	peak
11096	38.22	4.21	42.43	54	-11.57	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

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MID CH157

Horizontal:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
3172	57.69	-4.59	53.1	68.2	-15.1	peak
10523	55.03	4.21	59.24	68.2	-8.96	peak
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
3172	55.17	-4.59	50.58	68.2	-17.62	peak
10523	50.22	4.21	54.43	68.2	-13.77	peak
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

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HIGH CH165

Horizontal:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2705	61.34	-4.59	56.75	74	-17.25	peak
2705	45.65	-4.59	41.06	54	-12.94	AVG
11717	52.28	4.84	57.12	74	-16.88	peak
11717	37.16	4.84	42	54	-12	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2705	59.34	-4.59	54.75	74	-19.25	peak
2705	47.14	-4.59	42.55	54	-11.45	AVG
11717	53.69	4.84	58.53	74	-15.47	peak
11717	37.19	4.84	42.03	54	-11.97	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Remark：
(1) Measuring frequencies from 1 GHz to the 40 GHz。
(2) “F” denotes fundamental frequency; “H” denotes spurious frequency. “E” denotes band edge frequency.
(3) * denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.
(4) The emissions are attenuated more than 20dB below the permissible limits are not record in the report.
(5) The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120KHz, 1 MHz for measuring above 1 GHz, below 30MHz was 10KHz.
(6) When the test results of Peak Detected below the limits of Average Detected, the Average Detected is not need completed. For example: Top Channel at Fundamental 73.16dBuV/m(PK Value) <93.98(AV Limit), at harmonic 53.20 dBuV/m(PK Value) <54 dBuV/m(AV Limit), the Average Detected not need to completed.

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5.8G 802.11ac40 Mode

LOW CH 151

Horizontal:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
3368	62.38	-4.59	57.79	68.2	-10.41	peak
11096	59.17	4.21	63.38	74	-10.62	peak
11096	38.22	4.21	42.43	54	-11.57	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
3368	64.27	-4.59	59.68	68.2	-8.52	peak
11096	57.18	4.21	61.39	74	-12.61	peak
11096	36.99	4.21	41.2	54	-12.8	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

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MID CH159

Horizontal:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
3172	63.36	-4.59	58.77	68.2	-9.43	peak
10523	54.22	4.21	58.43	68.2	-9.77	peak
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
3172	61.24	-4.59	56.65	68.2	-11.55	peak
10523	52.72	4.21	56.93	68.2	-11.27	peak
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Remark：
(1) Measuring frequencies from 1 GHz to the 40 GHz。
(2) “F” denotes fundamental frequency; “H” denotes spurious frequency. “E” denotes band edge frequency.
(3) * denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.
(4) The emissions are attenuated more than 20dB below the permissible limits are not record in the report.
(5) The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120KHz, 1 MHz for measuring above 1 GHz, below 30MHz was 10KHz.
(6) When the test results of Peak Detected below the limits of Average Detected, the Average Detected is not need completed. For example: Top Channel at Fundamental 73.16dBuV/m(PK Value) <93.98(AV Limit), at harmonic 53.20 dBuV/m(PK Value) <54 dBuV/m(AV Limit), the Average Detected not need to completed.

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5.8G 802.11ac80 Mode

CH 155

Horizontal:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
3368	61.22	-4.59	56.63	68.2	-11.57	peak
11096	56.89	4.21	61.1	74	-12.9	peak
11096	37.18	4.21	41.39	54	-12.61	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
3368	62.38	-4.59	57.79	68.2	-10.41	peak
11096	55.26	4.21	59.47	74	-14.53	peak
11096	39.17	4.21	43.38	54	-10.62	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Remark：
(1) Measuring frequencies from 1 GHz to the 40 GHz。
(2) “F” denotes fundamental frequency; “H” denotes spurious frequency. “E” denotes band edge frequency.
(3) * denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.
(4) The emissions are attenuated more than 20dB below the permissible limits are not record in the report.
(5) The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120KHz, 1 MHz for measuring above 1 GHz, below 30MHz was 10KHz.
(6) When the test results of Peak Detected below the limits of Average Detected, the Average Detected is not need completed. For example: Top Channel at Fundamental 73.16dBuV/m(PK Value) <93.98(AV Limit), at harmonic 53.20 dBuV/m(PK Value) <54 dBuV/m(AV Limit), the Average Detected not need to completed.

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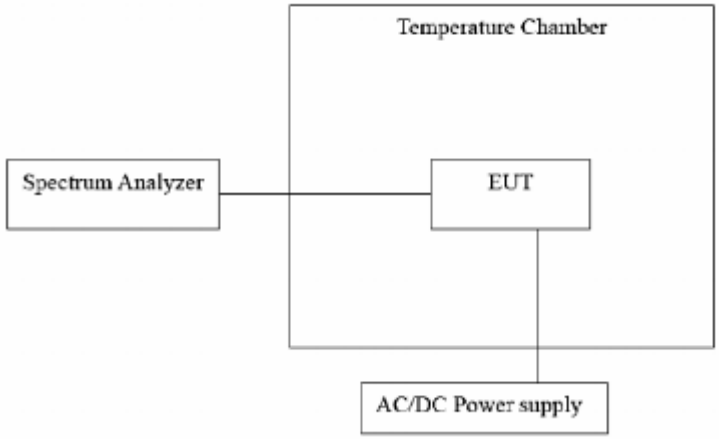
4.8. Frequency Stability Measurement

4.8.1. Test Specification

Test Requirement:	FCC Part15 Section 15.407(g)
Test Method:	ANSI C63.10: 2013
Limit:	The frequency tolerance shall be maintained within the band of operation frequency over a temperature variation of 0 degrees to 35 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C.
Test Setup:	
Test Procedure:	The EUT was placed inside the environmental test chamber and powered by nominal AC/DC voltage. b. Turn the EUT on and couple its output to a spectrum analyzer. c. Turn the EUT off and set the chamber to the highest temperature specified. d. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize. e. Repeat step 2 and 3 with the temperature chamber set to the lowest temperature. f. The test chamber was allowed to stabilize at +20 degree C for a minimum of 30 minutes. The supply voltage was then adjusted on the EUT from 85% to 115% and the frequency record.
Test Result:	PASS
Remark:	N/A

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Test Result as follows:

Mode	Voltage (V)	FHL (5745MHz)	Deviation (KHz)	FHH (5825MHz)	Deviation (KHz)
5.8G Band	10.8V	5744.953	-47	5824.973	-27
	12.0V	5745.017	17	2824.960	-40
	13.2V	5745.025	25	5825.021	21

Mode	Temperature (℃)	FHL (5745MHz)	Deviation (KHz)	FHH (5825MHz)	Deviation (KHz)
5.8G Band	-30	5744.967	-33	2824.973	-27
	-20	5744.990	-10	5825.030	30
	-10	5745.021	21	2824.960	-40
	0	5745.005	5	5825.008	8
	10	5745.048	48	2825.006	6
	20	5745.002	2	5825.009	9
	30	5745.032	32	2824.972	-28
	40	5744.956	-44	5824.951	-49
	50	5745.028	28	2824.969	-31

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4.9. ANTENNA REQUIREMENT

Standard Applicable
For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section 15.249, 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.

Refer to statement below for compliance.
The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed.

Antenna Connected Construction
The antenna used in this product is a External Antenna which professional installation is required and cannot be dismantled easily, and the best case gain of the antenna is Antenna port 1:3dBi and Antenna port 2:3dBi.

ANTENNA

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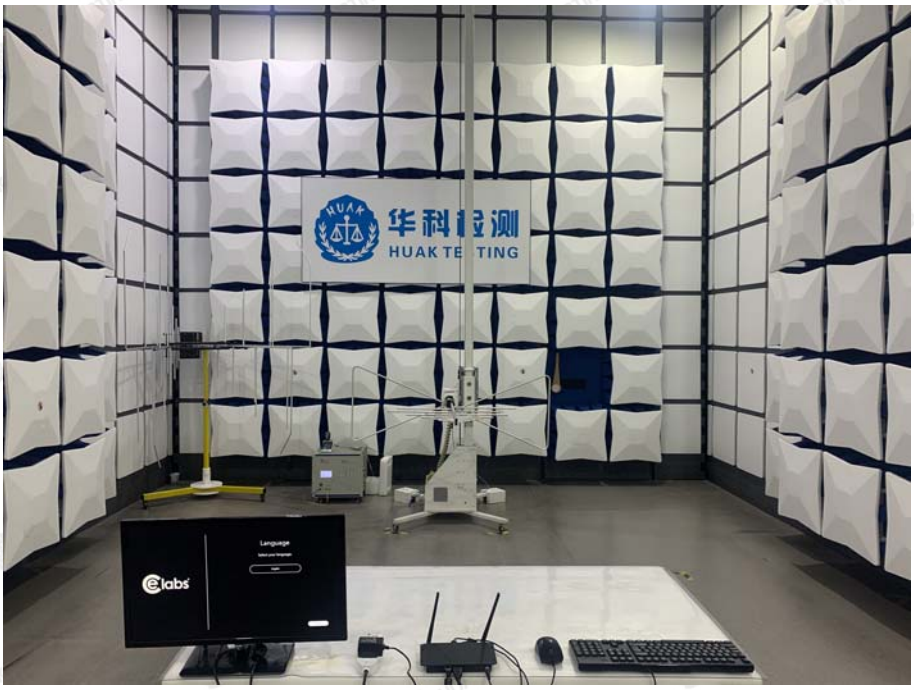
4.10. Photographs of Test Setup

Radiated Emission



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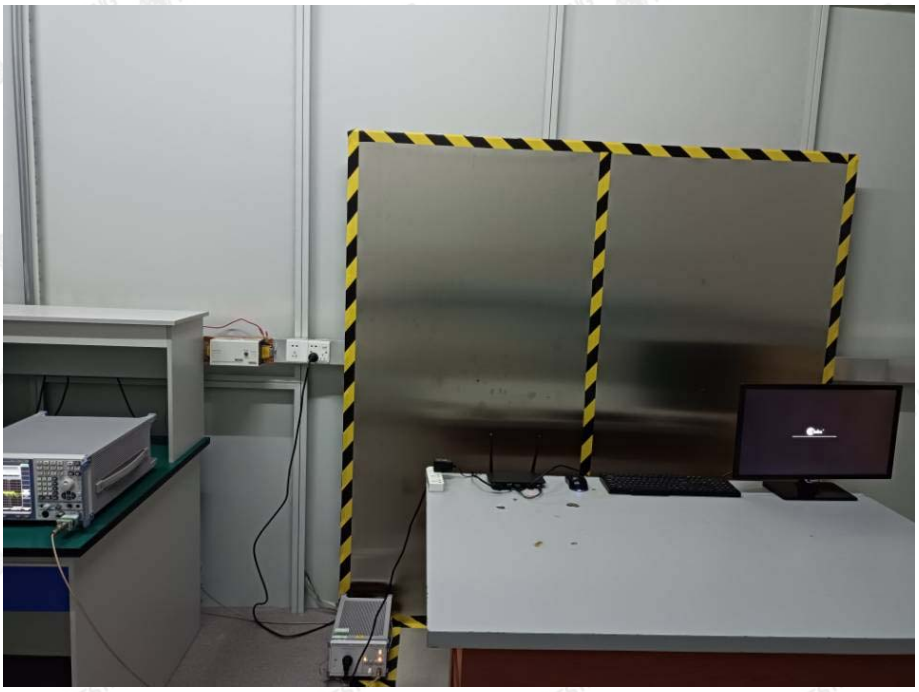

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4.11. PHOTOS OF THE EUT

Reference to the report: ANNEX A of external photos and ANNEX B of internal photos

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