



TEST REPORT

Applicant: Shenzhen Huasifei Technology Co., Ltd.
Address of Applicant: 11203, No.1 Langrong Road, Xinshi Community, Dalang Street, Longhua District, Shenzhen, China
Manufacturer/Factory: Shenzhen Huasifei Technology Co., Ltd.
Address of Manufacturer: 1203, No.1 Langrong Road, Xinshi Community, Dalang Street, Longhua District, Shenzhen, China
Product Name: WiFi Router
Model No.: WS1208V2, WS1218, WS1688, WS1209, WS1698, WS1699
Trade Mark: HUASIFEI
FCC ID: 2BBLF-WS1208V2
Applicable standards: FCC CFR Title 47 Part 15 Subpart E Section 15.407
Date of Test: May.24, 2023-Jun.06, 2023
Date of report issued: Jun.15, 2023
Test Result : PASS *

Remark:

* In the configuration tested, the EUT complied with the standards specified above.

The results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full without prior written permission of the company.

The report would be invalid without specific stamp of test institute and the signatures of compiler and approver

Prepared By

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1 Test Summary

Test Item	Section in CFR 47	Result	Test by
Antenna requirement	15.203	Pass	/
AC Power Line Conducted Emission	15.207	Pass	Carr Kang
Conducted Output Power	15.407 (a)(1)/(a)(3)	Pass	Yvan Fan
26dB Bandwidth and 99% Occupied Bandwidth	15.407 (a)(12)	Pass	Yvan Fan
6dB Bandwidth	15.407 (e)	Pass	Yvan Fan
Power Spectral Density	15.407(a)(1)/(a)(3)	Pass	Yvan Fan
Band Edge	15.407(b)(1)/(b)(4)	Pass	Yvan Fan
Spurious Emission	15.205/15.209 15.407(b)(1)/(b)(4)/(b)(8)	Pass	Qiao Li
Frequency Stability	15.407(g)	Pass	Yvan Fan

Remarks:

1. Pass: The EUT complies with the essential requirements in the standard.
2. Test according to ANSI C63.10:2013.

1.1 Measurement Uncertainty

Test Item	Measurement Uncertainty	Notes
Occupied Channel Bandwidth	±0.55%	(1)
RF output power, conducted	±0.99dB	(1)
Power Spectral Density, conducted	±0.61dB	(1)
Unwanted Emissions, conducted	±0.64dB	(1)
AC Power Line Conducted Emission	± 3.02dB	(1)
Radiated emissions 9K-30MHz	±3.98dB	(1)
Radiated emissions 30M- 1GHz	±4.30dB	(1)
Radiated emissions 1GHz-18GHz	±4.35dB	(1)
Radiated emissions 18GHz-40GHz	±4.59 dB	(1)

Note (1): The measurement uncertainty is for coverage factor of k=2 and a level of confidence of 95%.

2 General Information

2.1 General Description of EUT

Product Name:	WiFi Router
Model No.:	WS1208V2, WS1218, WS1688, WS1209, WS1698, WS1699
Difference of model(s)	All the model are the same circuit and RF module, except the model names and colors
Test Model:	WS1208V2
Hardware Version:	N/A
Software Version:	N/A
Sample(s) Status:	Engineer sample
Operation Frequency:	☐ 5180-5240MHz for 802.11a/n(HT20)/ac20; 5190-5230MHz for 802.11n(HT40)/ac40; 5210MHz for 802.11 ac80; ☒ 5745-5825 MHz for 802.11a/n(HT20)/ac20; 5755-5795 MHz for 802.11n(HT40)/ac40; 5775MHz for 802.11 ac80;
Channel numbers:	☐ 4 channels for 802.11a/n20/ac20 in the 5180-5240MHz band; 2 channels for 802.11 n40/ac40 in the 5190-5230MHz band ; 1 channels for 802.11 ac80 in the 5210MHz band ; ☒ 5 channels for 802.11a/n20/ac20 in the 5745-5825MHz band ; 2 channels for 802.11 n40/ac40 in the 5755-5795MHz band ; 1 channels for 802.11 ac80 in the 5775MHz band
Channel bandwidth:	802.11a/802.11n(HT20)/ 802.11ac(HT20): 20MHz 802.11n(HT40)/ 802.11ac(HT40) : 40MHz 802.11ac(HT80) : 80MHz
Data Rate	802.11a: 6,9,12,18,24,36,48,54Mbps; 802.11n(HT20/HT40):MCS0-MCS15; 802.11ac(VHT/20/40/80):NSS1, MCS0-MCS9
Modulation technology:	Orthogonal Frequency Division Multiplexing (OFDM) with BPSK/QPSK/16QAM/64QAM/256QAM
Antenna Type:	Integrated antenna
Antenna gain:	4.32 dBi (Note: Antenna information is provided by applicant, Testing lab is not responsible for the accuracy of the information.)
Battery	N/A
Power supply:	DC 12V

Operation Frequency each of channel							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
149	5745MHz	151	5755MHz	153	5765MHz	155	5775MHz
157	5785MHz	159	5795MHz	161	5805MHz	/	/
165	5825MHz	/					

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:

Test channel	Frequency (MHz)		
	802.11 a /n(HT20)/ac(HT20)	802.11 n(HT40)/ac(HT40)	802.11ac(HT80)
Lowest channel	5745	5755	5775
Middle channel	5785		
Highest channel	5825	5795	

2.2 Test mode

Transmitting mode	Keep the EUT in continuously transmitting mode(or with a duty cycle $\geq 98\%$)
<i>Remark: During the test, the test voltage was tuned from 85% to 115% of the nominal rated supply voltage, and found that the worst case was under the nominal rated supply condition. So the report just shows that condition's data.</i>	

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:

Pretest Mode	Description
Mode 1	802.11a /n 20 CH149/ CH157/ CH 165
Mode 2	802.11n 40 CH 151 / CH 159
Mode 3	802.11 ac80 CH 155
Mode 4	802.11a /n 20 CH149/ CH157/ CH 165
Mode 5	Link Mode

Conducted Emission	
Final Test Mode	Description
Mode 5	Link Mode

For Radiated Emission	
Final Test Mode	Description
Mode 1	802.11a /n 20 CH149/ CH157/ CH 165
Mode 2	802.11n 40 CH 151 / CH 159
Mode 3	802.11 ac80 CH 155
Mode 4	802.11a /n 20 CH149/ CH157/ CH 165

Note:

(1) The measurements are performed at all Bit Rate of Transmitter, the worst data was reported.

2.3 Description of Support Units

No.	Description	Manufacturer	Model	Serial Number
1	adapter	Guoaotong Technology	GA-0481204000C	/

2.4 Deviation from Standards

None.

2.5 Abnormalities from Standard Conditions

None.

2.6 Test Facility

Test laboratory:	Shenzhen ETR Standard Technology Co., Ltd.
CNAS Registration Number:	L11864
A2LA Certificate Number:	6640.01
FCC Designation Number:	CN1326
FCC Test Firm Registration:	183064

2.7 Test Location

All tests were performed at:

Laboratory location:	No.103, No.10, Phase I, Zone 3, Xinxing Industrial Park, Xinhe, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China
Telephone:	+86 755 85259392

2.8 Additional Instructions

Test Software	QATool_Dbg
Power level setup	Default

3 Test Instruments list

Conducted Emission

Item	Equipment name	Manufacturer	Model	Serial No.	Calibration date	Due date
1	EMI Test Receiver	Rohde&schwarz	ESCI3	100605	2023.3.02	2024.3.01
2	Artificial power network	schwarabeck	NSLK8127	8127483	2023.3.02	2024.3.01
3	Artificial power network	ETS	3186/2NM	1132	2023.3.02	2024.3.01
4	10dB attenuator	HUBER+SUHNER	10dB	/	2023.3.02	2024.3.01
5	Cable 4	HUBER SUNNER	3M	/	2023.3.02	2024.3.01
6	Absorbing Clamp	schwarabeck	MDS21	D69250	2023.3.06	2024.3.05

Radiated Emission & RF Conducted test:

Item	Equipment name	Manufacturer	Model	Serial No.	Calibration date	Due date
1	EMI Test Receiver	Rohde&schwarz	ESCI7	101032	2023.3.02	2024.3.01
2	Broadband antenna	schwarabeck	VULB9168	1064	2022.3.11	2024.3.10
3	Horn antenna	schwarabeck	BBHA9120D	9120D-1145	2022.3.11	2024.3.10
4	Amplifier	EMtrace	RP01A	50117	2023.3.02	2024.3.01
5	Amplifier	Space-Dtronics	EWLAN0118G-P40	19113001	2023.3.02	2024.3.01
6	Spectrum analyzer	KEYSIGHT	N9020A	MY55370280	2023.3.02	2024.3.01
7	Power detector meter	MWRFtest	MW100-PSB	MW201020JYT	2022.11.09	2023.11.08
8	Signal generator	Agilent	N5182A	MY49060455	2022.11.09	2023.11.08
9	Spectrum analyzer	Rohde&schwarz	FSV40	102137	2023.3.02	2024.3.01
10	Amplifier	SKET	LNPA_1840-50	SK2019040302	2023.3.02	2024.3.01
11	Horn antenna	schwarabeck	BBHA 9170	946	2022.3.11	2024.3.10
12	Loop antenna	schwarabeck	FMZB 1519 B	1519	2022.3.11	2024.3.10
13	Cable 6	HUBER SUNNER	0.5M	/	2023.3.02	2024.3.01
14	Cable7	HUBER SUNNER	2.0M	/	2023.3.02	2024.3.01
15	Cable8	HUBER SUNNER	6.0M	/	2023.3.02	2024.3.01
16	Filter	Xin bo	XBLBQ-GTA29	210410-3-2	2023.3.06	2024.3.05
17	Power meter	Rohde&Schwarz	NRP-Z11	1138.3004.02-117725-vh	2023.03.30	2024.03.29

Note: the calibration interval of the above test instruments is 12 or 24 months and the calibrations are traceable to international system unit (SI).

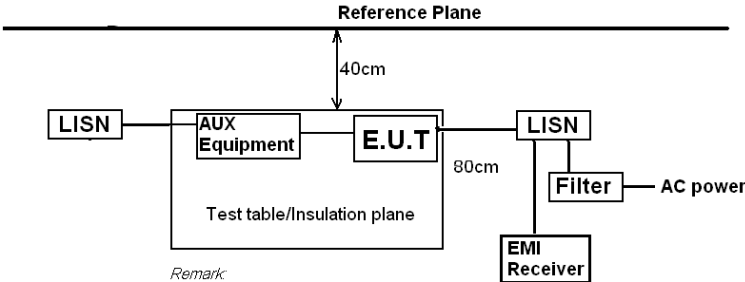
Software Name	Manufacturer	Model	Version
RF test software	MWRFtest	MTS 8310	V2.0.0.0
Conducted test software	EZ-EMC	Farad	Ver.EMC-CON 3A1.1
Radiated test software	EZ-EMC	Farad	Ver.FA-03A2 RE

4 Test results and Measurement Data

4.1 Antenna requirement

Standard requirement:	FCC Part15 C Section 15.203
<i>15.203 requirement: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.</i>	
E.U.T Antenna:	
<i>The antennas are Integrated antenna, the best case gain of the antennas are 4.32 dBi, reference to the appendix II for details</i>	

4.2 Conducted Emissions

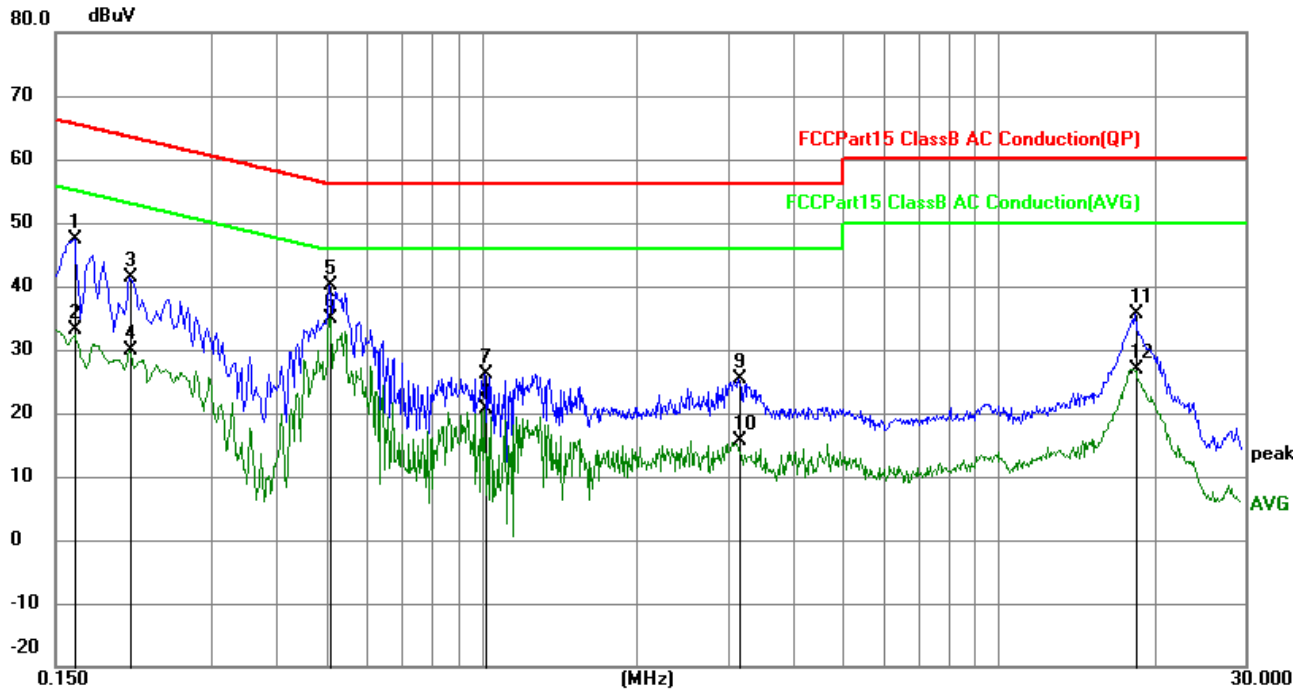
Test Requirement:	FCC Part15 C Section 15.207						
Test Method:	ANSI C63.10:2013						
Test Frequency Range:	150KHz to 30MHz						
Class / Severity:	Class B						
Receiver setup:	RBW=9KHz, VBW=30KHz, Sweep time=auto						
Limit:	Frequency range (MHz)		Limit (dBUV)				
			Quasi-peak		Average		
	0.15-0.5		66 to 56*		56 to 46*		
	0.5-5		56		46		
	5-30		60		50		
* Decreases with the logarithm of the frequency.							
Test setup:	Reference Plane  Test table/Insulation plane Remark: E.U.T: Equipment Under Test LISN: Line Impedance Stabilization Network Test table height=0.8m						
Test procedure:	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.						
Test Instruments:	Refer to section 3.0 for details						
Test mode:	Refer to section 2.2 for details						
Test environment:	Temp.:	24.5°C	Humid.:	51%	Press.:	1012mbar	
Test voltage:	AC 120V, 60Hz						
Test results:	Pass						

Remark:

1. Both high voltage and low voltage have been tested, and the report only shows the worst case data with AC 120V/60Hz.
2. All mode have been tested, the report only shows the worst mode TX 802.11 ac20 (5825MHz) mode.

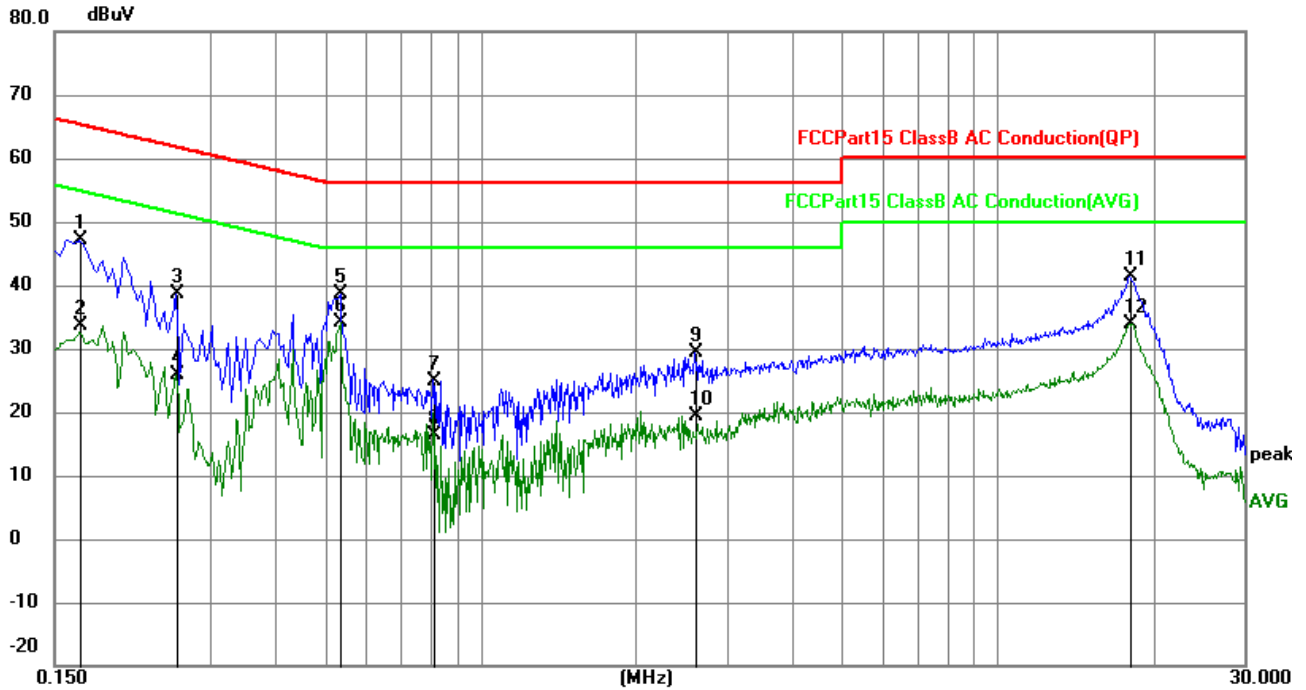
Measurement data

Line:



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.1635	37.69	9.80	47.49	65.28	-17.79	QP
2	0.1635	23.45	9.80	33.25	55.28	-22.03	AVG
3	0.2084	31.55	9.81	41.36	63.27	-21.91	QP
4	0.2084	19.95	9.81	29.76	53.27	-23.51	AVG
5	0.5100	30.09	9.94	40.03	56.00	-15.97	QP
6	0.5100	24.97	9.94	34.91	46.00	-11.09	AVG
7	1.0181	16.28	9.96	26.24	56.00	-29.76	QP
8	1.0181	10.78	9.96	20.74	46.00	-25.26	AVG
9	3.1469	15.47	9.84	25.31	56.00	-30.69	QP
10	3.1469	5.74	9.84	15.58	46.00	-30.42	AVG
11	18.3840	25.89	9.70	35.59	60.00	-24.41	QP
12	18.3840	17.29	9.70	26.99	50.00	-23.01	AVG

Neutral:

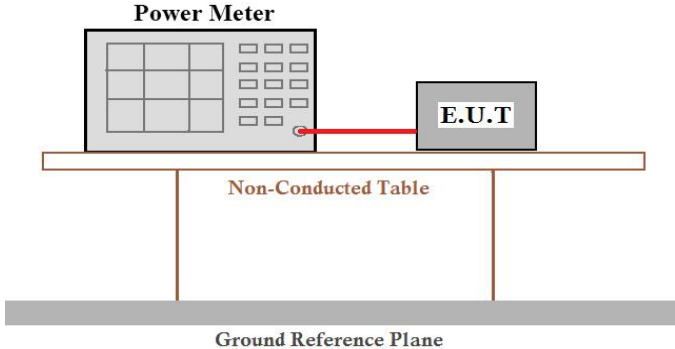


No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.1680	37.24	9.81	47.05	65.06	-18.01	QP
2	0.1680	23.72	9.81	33.53	55.06	-21.53	AVG
3	0.2580	28.74	9.83	38.57	61.50	-22.93	QP
4	0.2580	16.15	9.83	25.98	51.50	-25.52	AVG
5	0.5369	28.76	9.94	38.70	56.00	-17.30	QP
6	0.5369	24.13	9.94	34.07	46.00	-11.93	AVG
7	0.8114	15.04	9.96	25.00	56.00	-31.00	QP
8	0.8114	6.42	9.96	16.38	46.00	-29.62	AVG
9	2.5979	19.57	9.85	29.42	56.00	-26.58	QP
10	2.5979	9.43	9.85	19.28	46.00	-26.72	AVG
11	17.9520	31.74	9.70	41.44	60.00	-18.56	QP
12	17.9520	24.27	9.70	33.97	50.00	-16.03	AVG

Notes:

1. An initial pre-scan was performed on the line and neutral lines with peak detector.
2. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
3. Final Level = Receiver Read level + LISN Factor + Cable Loss
4. If the average limit is met when using a quasi-peak detector receiver, the EUT shall be deemed to meet both limits and measurement with the average detector receiver is unnecessary.

4.3 Conducted Peak Output Power

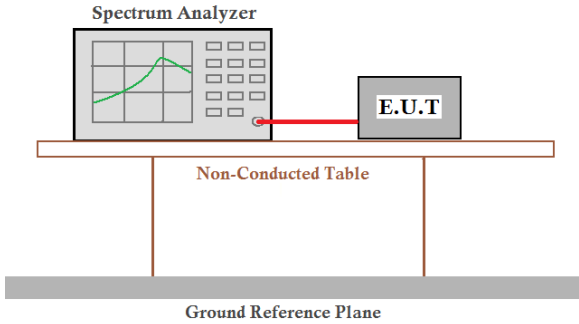
Test Requirement:	FCC Part15 E Section 15.407 (a)(1)/(a)(3)	
Test Method:	ANSI C63.10:2013 and KDB 789033 D02 General U-NII Test Procedures New Rules v02r01	
Limit:	5150-5250MHz : 250mW 5725~5850MHz : 1W	
Test setup:		
Test Instruments:	Refer to section 3.0 for details	
Test mode:	Refer to section 2.2 for details	
Test environment:	Temp.: 22.2°C	Humid.: 56%RH
Test voltage:	DC 12V	
Test results:	Pass	

Measurement Result

ANT 2

Test Channel	Frequency (MHz)	Maximum output power. (dBm)	LIMIT dBm	Result
TX 802.11a Mode				
CH149	5745	11.25	30	Pass
CH157	5785	11.30	30	Pass
CH165	5825	11.49	30	Pass
TX 802.11 n20 Mode				
CH149	5745	11.30	30	Pass
CH157	5785	11.19	30	Pass
CH165	5825	11.35	30	Pass
TX 802.11 ac20 Mode				
CH149	5745	11.21	30	Pass
CH157	5785	11.22	30	Pass
CH165	5825	11.60	30	Pass
TX 802.11 n40 Mode				
CH151	5755	10.46	30	Pass
CH159	5795	10.57	30	Pass
TX 802.11 ac40 Mode				
CH151	5755	10.47	30	Pass
CH159	5795	10.53	30	Pass
TX 802.11 ac80 Mode				
CH155	5775	8.32	30	Pass

4.4 26dB Bandwidth

Test Requirement:	FCC Part15 E Section 15.407(a)(12)&15.407(e)	
Test Method:	ANSI C63.10:2013 and KDB 789033 D02 General U-NII Test Procedures New Rules v02r01	
Limit:	Measurements in the 5.725-5.85 GHz band, the minimum bandwidth 6 dB bandwidth of U-NII devices shall be at least 500KHz. Measurements in the 5.15-5.25 GHz, 5.25-5.35 GHz, and the 5.47-5.725 GHz bands are made over a bandwidth of 1 MHz or the 26 dB emission bandwidth of the device, whichever is less. A narrower resolution bandwidth can be used, provided that the measured power is integrated over the full reference bandwidth.	
Test setup:		
Test Instruments:	Refer to section 3.0 for details	
Test mode:	Refer to section 2.2 for details	
Test environment:	Temp.: 22.2°C	Humid.: 56%RH
Test voltage:	DC 12V	
Test results:	Pass	

Measurement Result

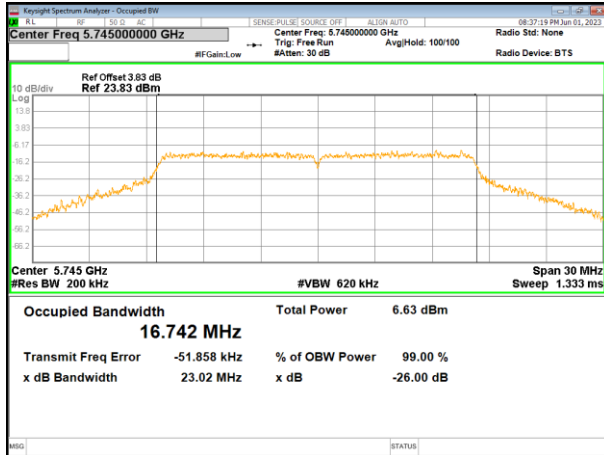
ANT 2

Test CH	99% Occupancy Bandwidth (MHz)						Result
	802.11a	802.11n (HT20)	802.11ac (HT20)	802.11n (HT40)	802.11ac (HT40)	802.11ac (HT80)	
Lowest	16.742	17.849	17.875	36.377	36.396	--	Pass
Middle	16.711	17.821	17.849	--	--	75.079	
Highest	16.659	17.820	17.816	36.344	36.330	--	

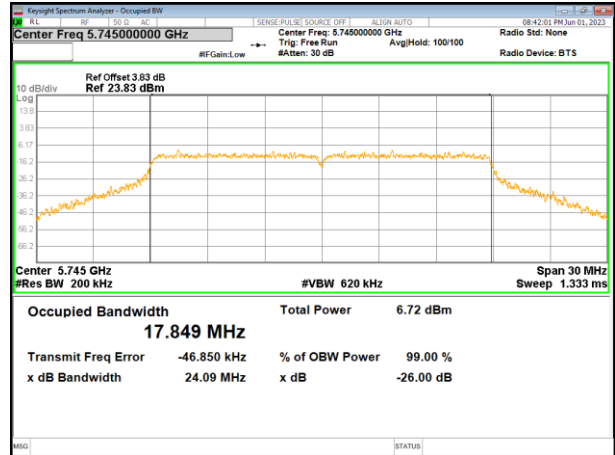
ANT 2

Test plot

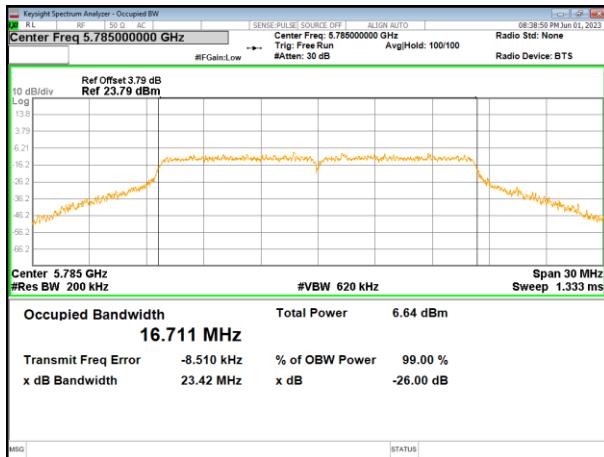
(802.11a) plot on channel 149



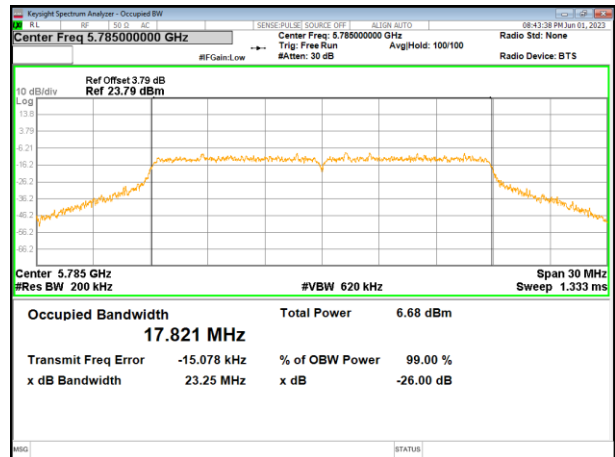
(802.11 n20) plot on channel 149



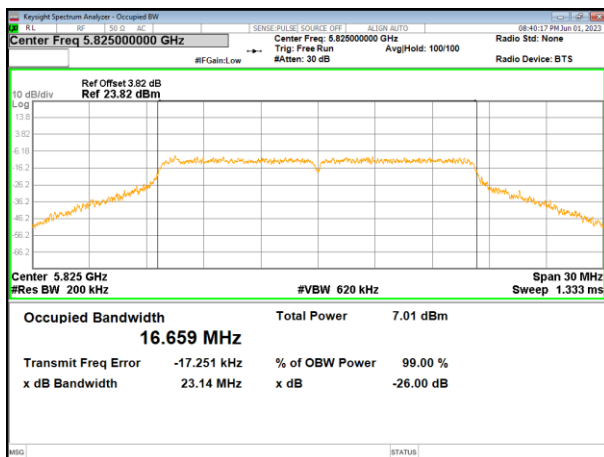
(802.11a) plot on channel 157



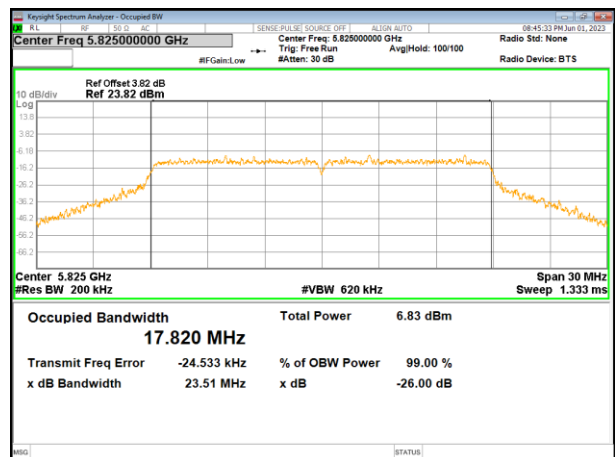
(802.11 n20) plot on channel 157



(802.11a) plot on channel 165

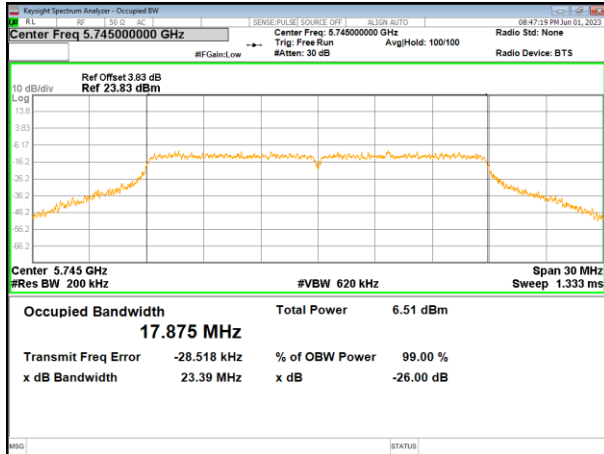


(802.11 n20) plot on channel 165

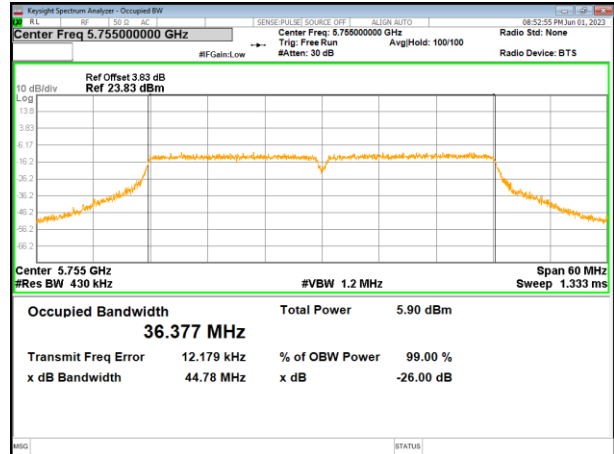


Test plot

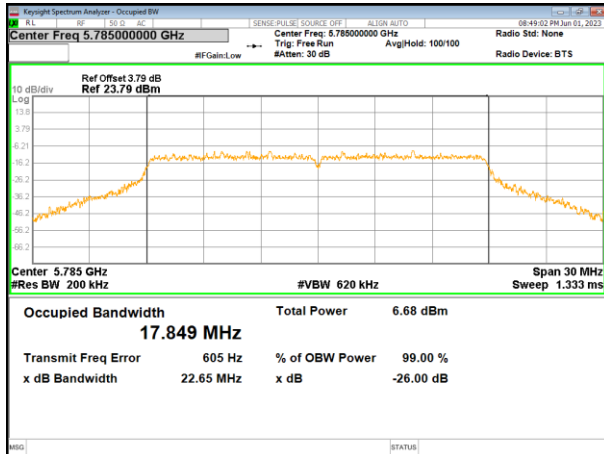
(802.11ac20) plot on channel 149



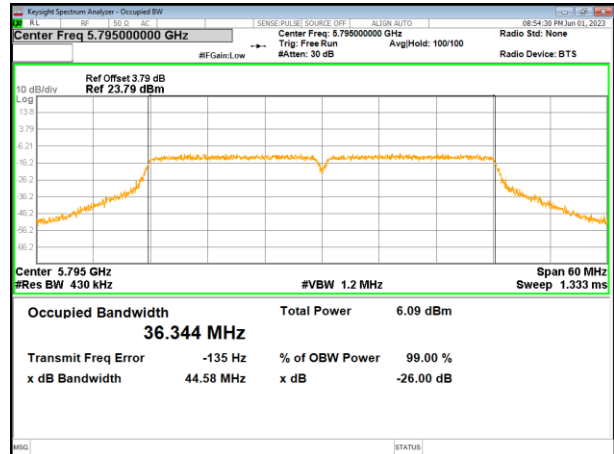
(802.11 n40) plot on channel 151



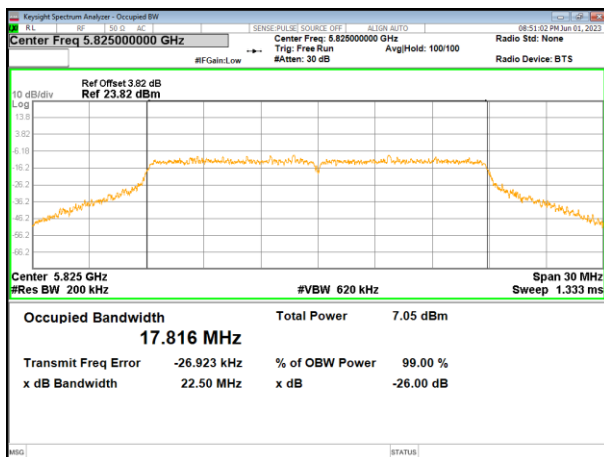
(802.11ac20) plot on channel 157



(802.11 n40) plot on channel 159

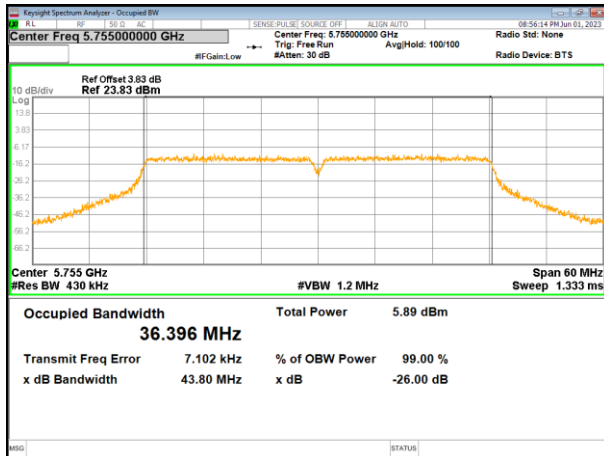


(802.11ac20) plot on channel 165

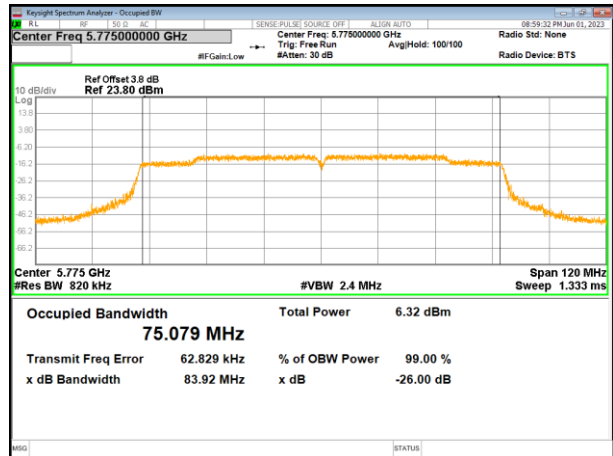


Test plot

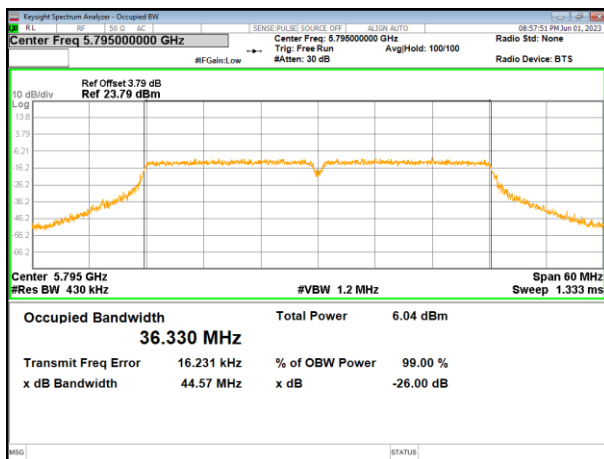
(802.11 ac40) plot on channel 151



(802.11 ac80) plot on channel 155



(802.11 ac40) plot on channel 159





ANT 2

Test CH	-6dB Channel Bandwidth (MHz)						Limit (KHz)	Result
	802.11a	802.11n (HT20)	802.11ac (HT20)	802.11n (HT40)	802.11ac (HT40)	802.11ac (HT80)		
Lowest	16.31	17.58	17.57	36.32	36.34	--	>500	Pass
Middle	16.34	17.57	17.58	--	--	75.08		
Highest	16.33	17.56	17.56	36.03	36.29	--		

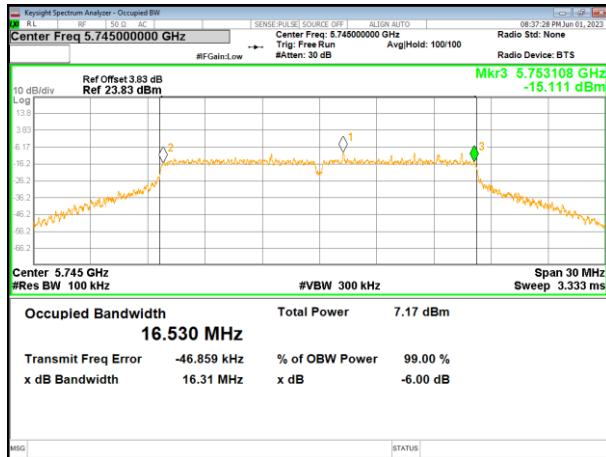
Remark:

“--”is no applicable

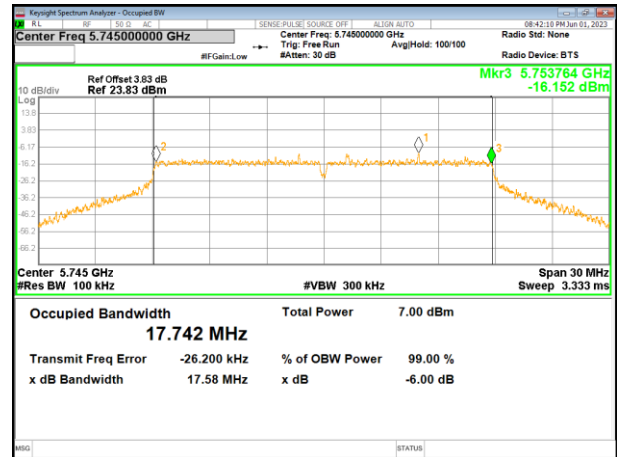
ANT 2

Test plot

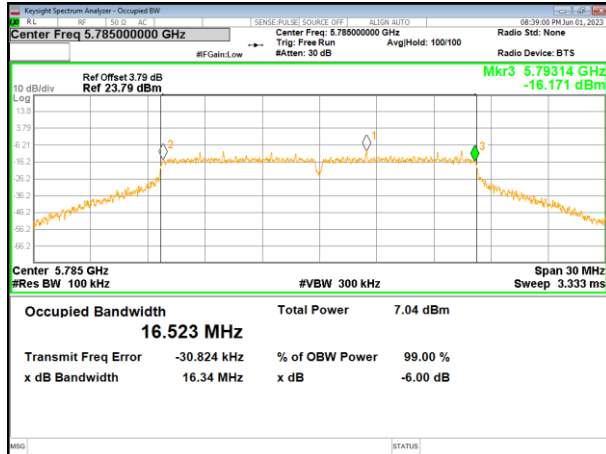
(802.11a) plot on channel 149



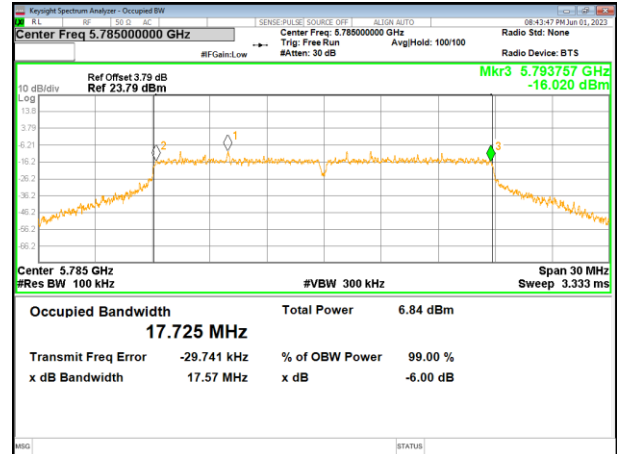
(802.11 n20) plot on channel 149



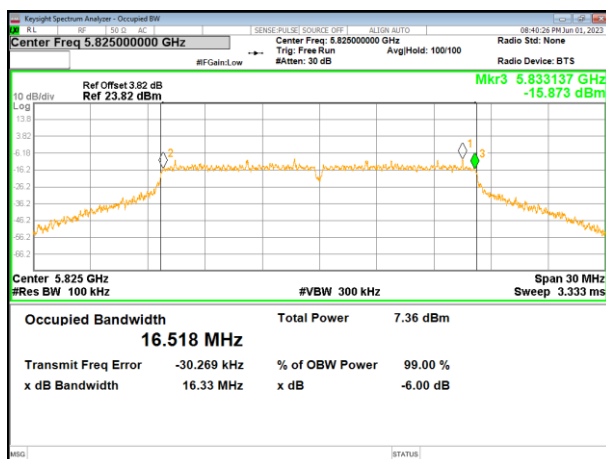
(802.11a) plot on channel 157



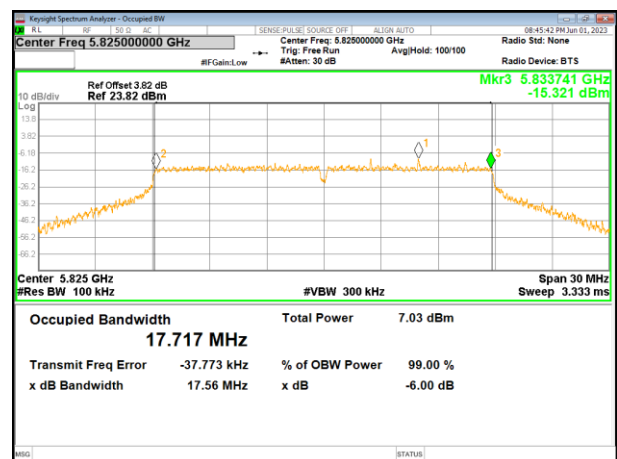
(802.11 n20) plot on channel 157



(802.11a) plot on channel 165

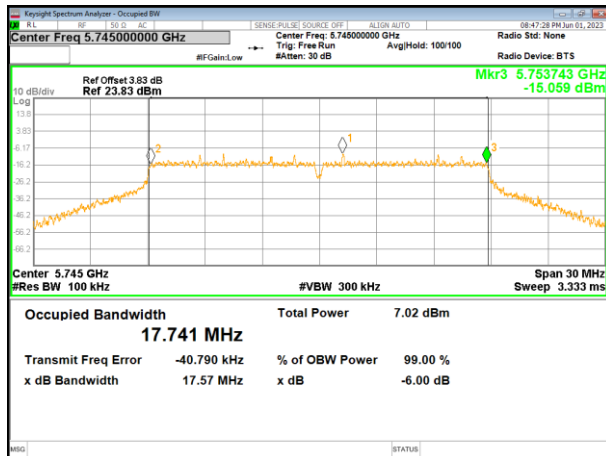


(802.11 n20) plot on channel 165

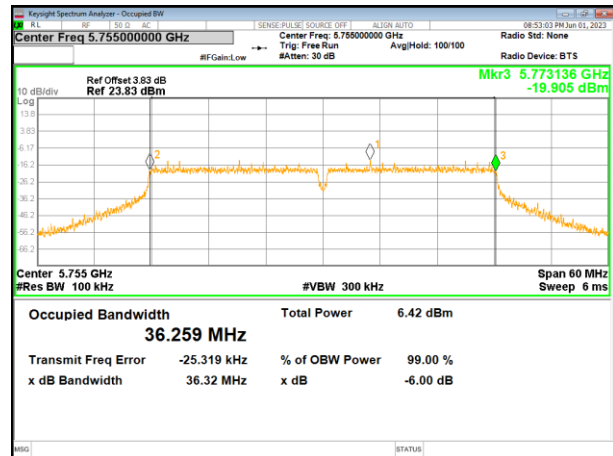


Test plot

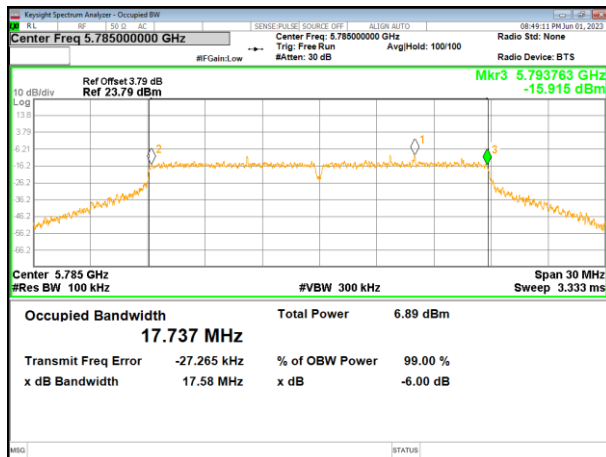
(802.11ac20) plot on channel 149



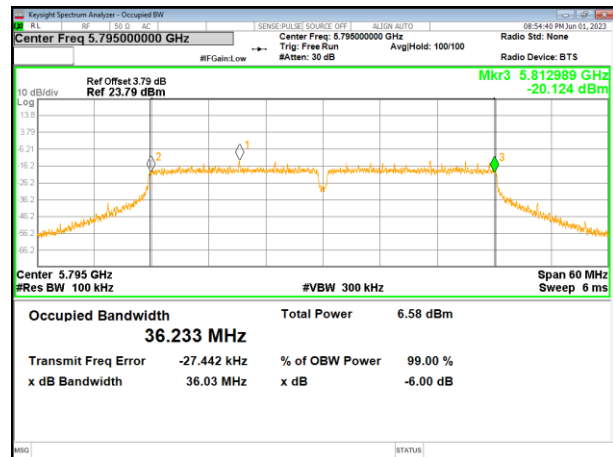
(802.11 n40) plot on channel 151



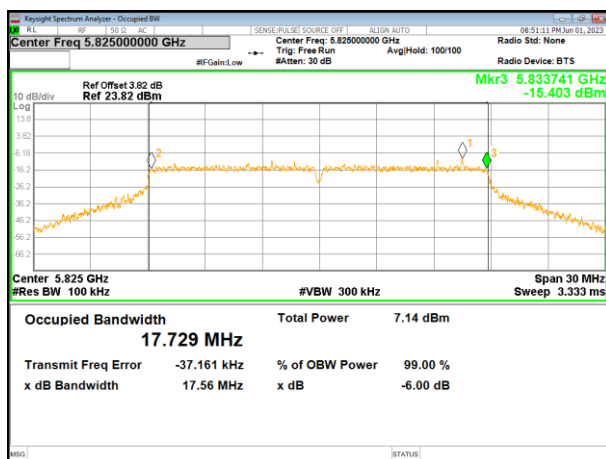
(802.11ac20) plot on channel 157



(802.11 n40) plot on channel 159

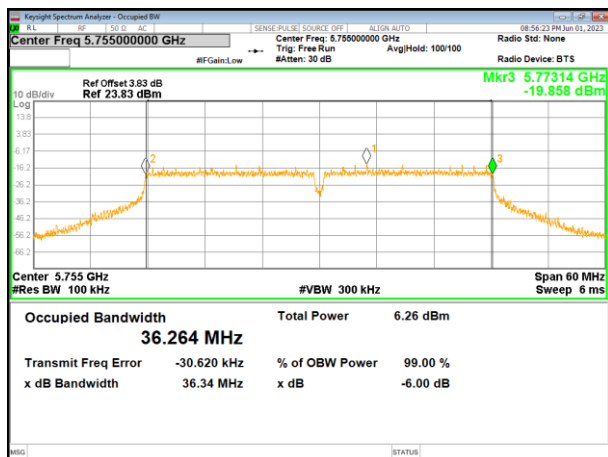


(802.11ac20) plot on channel 165

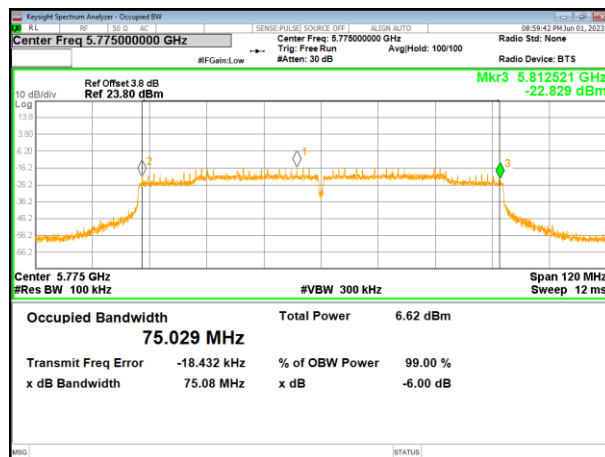


Test plot

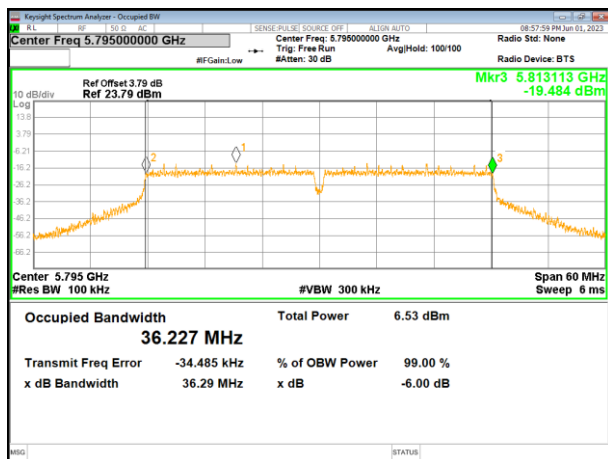
(802.11 ac40) plot on channel 151



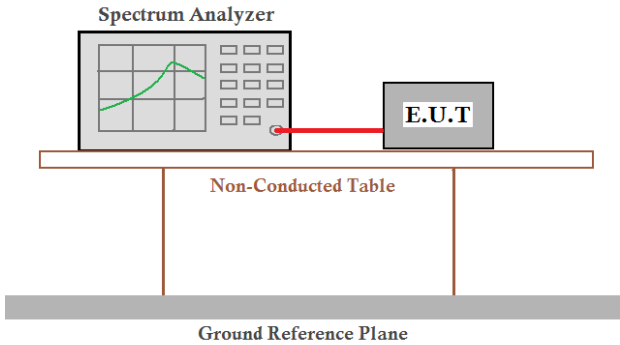
(802.11 ac80) plot on channel 155



(802.11 ac40) plot on channel 159



4.5 Power Spectral Density

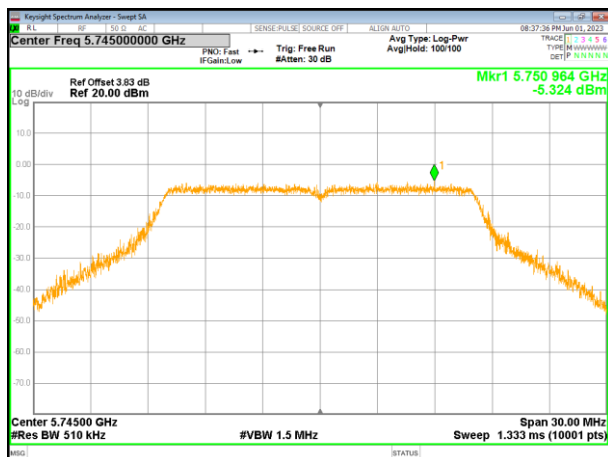
Test Requirement:	FCC Part15 E Section 15.407(a)(1)/ (a)(3)	
Test Method:	ANSI C63.10:2013 and KDB 789033 D02 General U-NII Test Procedures New Rules v02r01	
Limit:	Frequency band (MHz)	Limit
	5150-5250	≤17dBm/1MHz for master device
		≤11dBm/1MHz for client device
	5250-5350	≤11dBm/1MHz for client device
	5470-5725	≤11dBm/1MHz for client device
	5725-5850	≤30dBm/500kHz
Test setup:		
Test Instruments:	Refer to section 3.0 for details	
Test mode:	Refer to section 2.2 for details	
Test environment:	Temp.: 22.2°C	Humid.: 56%RH
Test voltage:	DC 12V	
Test results:	Pass	

Measurement Result

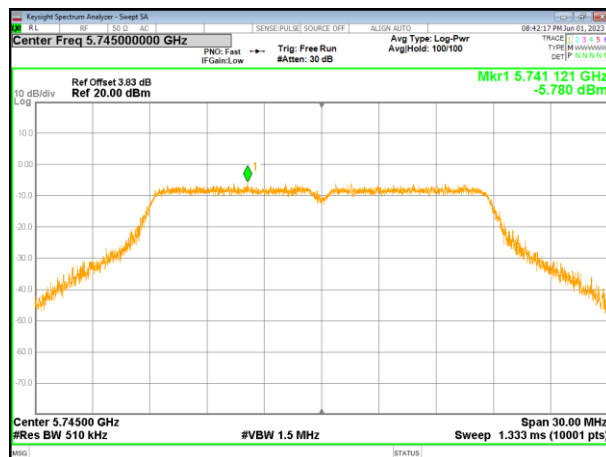
Mode	Frequency	Measured Power Density (dBm/510KHz)	Measured Power Density (dBm/500KHz)	Limit (dBm/500KHz)
802.11 a	5745 MHz	-5.324	-5.410	30
	5785 MHz	-5.308	-5.394	30
	5825 MHz	-5.337	-5.423	30
802.11 n20	5745 MHz	-5.780	-5.866	30
	5785 MHz	-6.084	-6.170	30
	5825 MHz	-6.100	-6.186	30
802.11 ac20	5745 MHz	-9.327	-9.413	30
	5785 MHz	-9.184	-9.270	30
	5825 MHz	-5.592	-5.678	30
802.11 n40	5755 MHz	-5.916	-6.002	30
	5795 MHz	-4.850	-4.936	30
802.11 ac40	5755 MHz	-9.344	-9.430	30
	5795 MHz	-9.489	-9.575	30
802.11 ac80	5775 MHz	-12.045	-12.131	30

Note: If the measurement is X dBm/510kHz, thus $X \text{ dBm/510kHz} = (10^{X/10}) * (500 / 510) \text{ dBm/500kHz}$

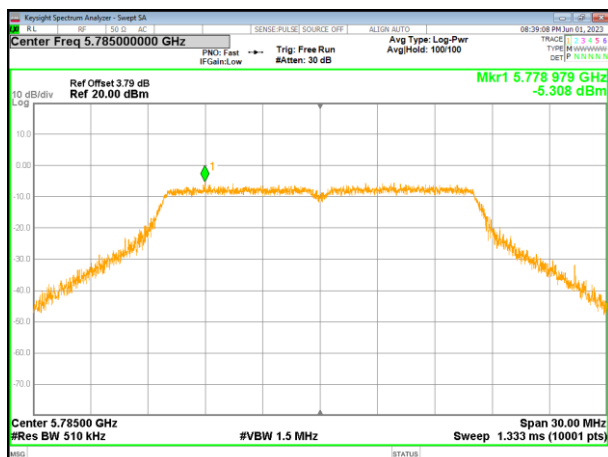
(802.11a) PSD plot on channel 149



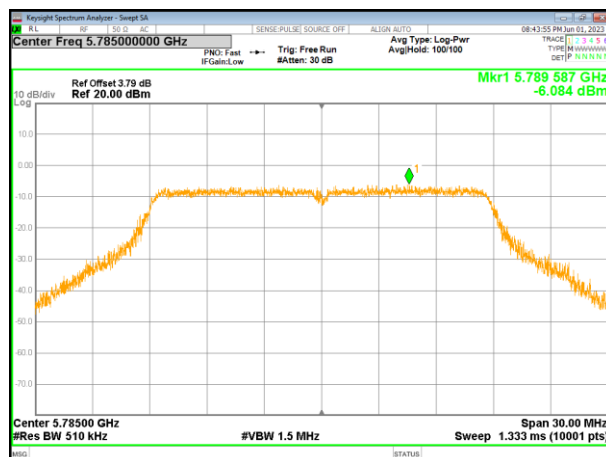
(802.11n20) PSD plot on channel 149



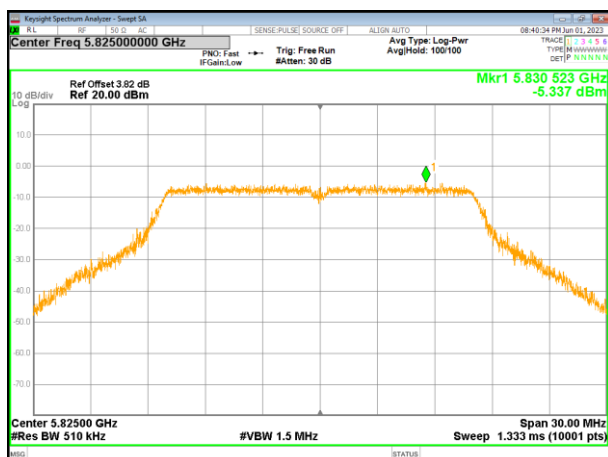
(802.11a) PSD plot on channel 157



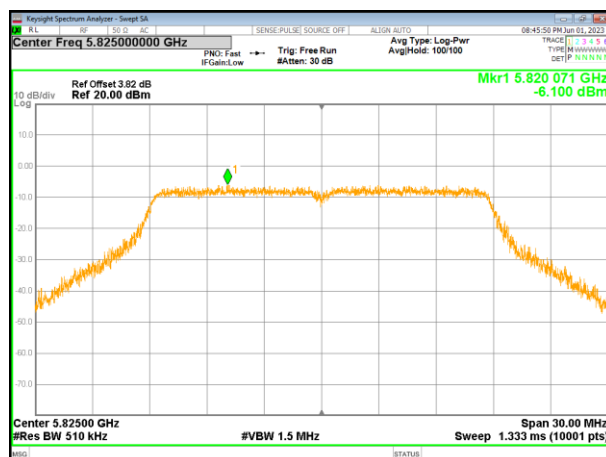
(802.11n20) PSD plot on channel 157



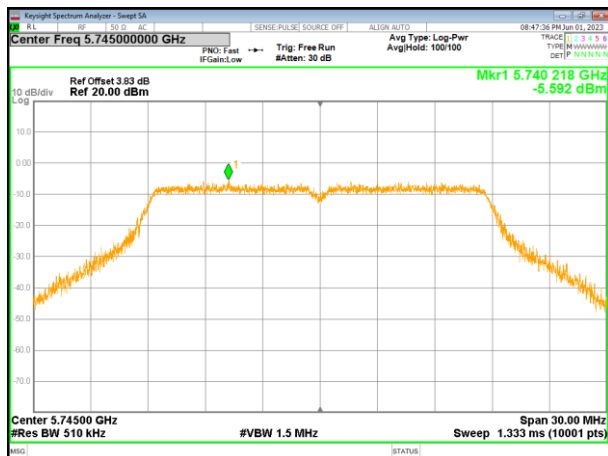
(802.11a) PSD plot on channel 165



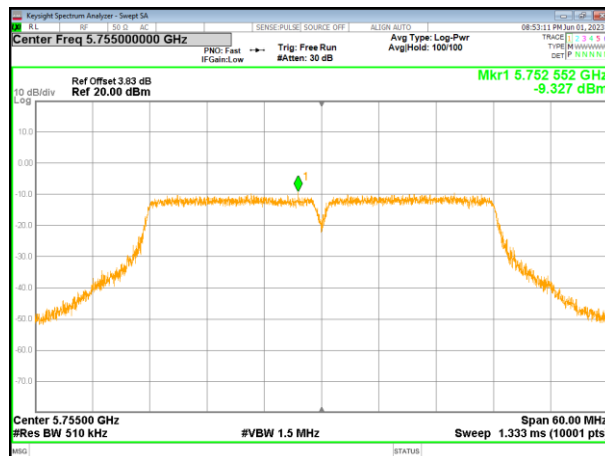
(802.11n20) PSD plot on channel 165



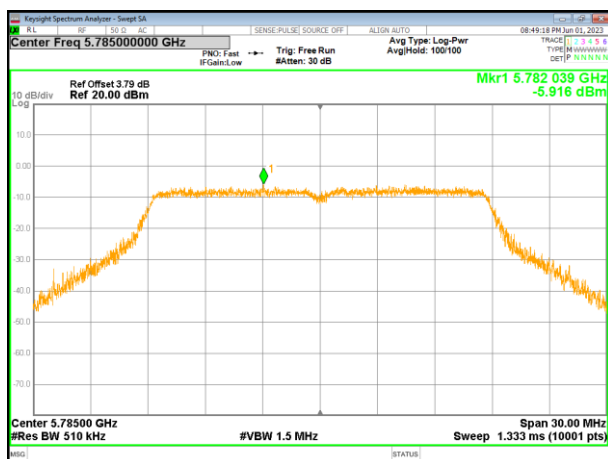
(802.11ac20) PSD plot on channel 149



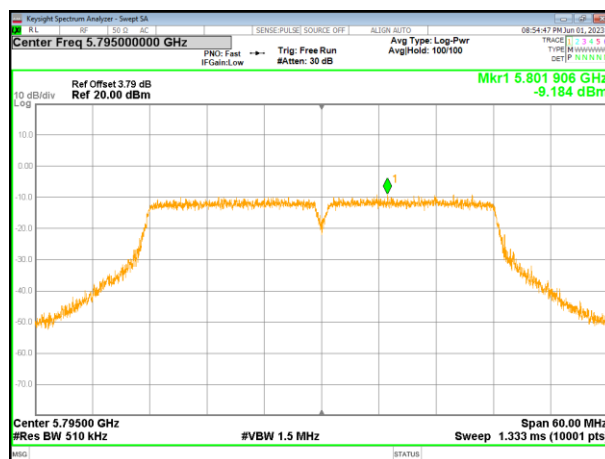
(802.11n40) PSD plot on channel 151



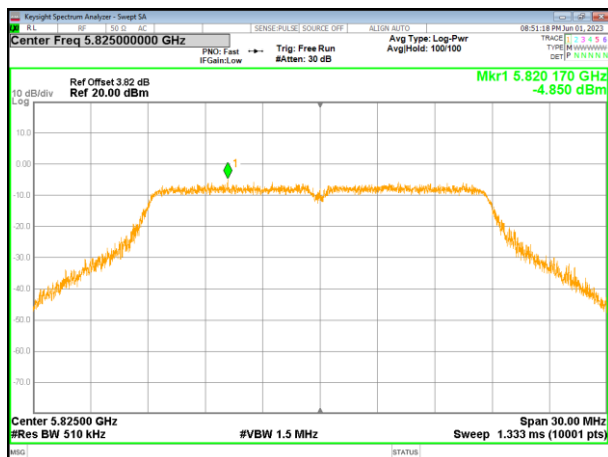
(802.11ac20) PSD plot on channel 157



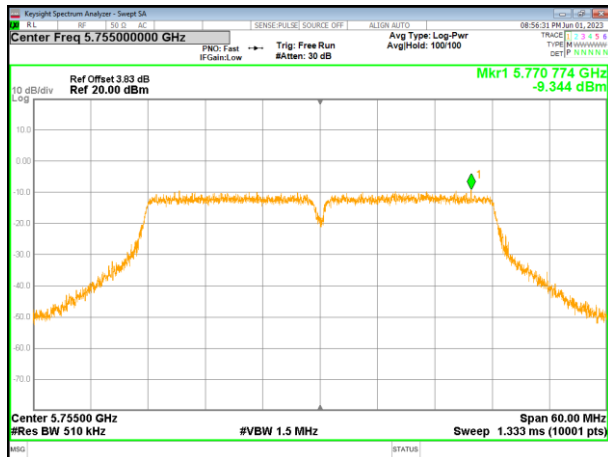
(802.11n40) PSD plot on channel 159



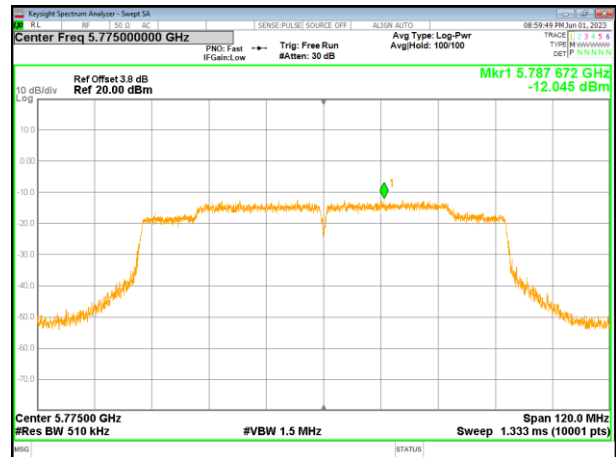
(802.11ac20) PSD plot on channel 165



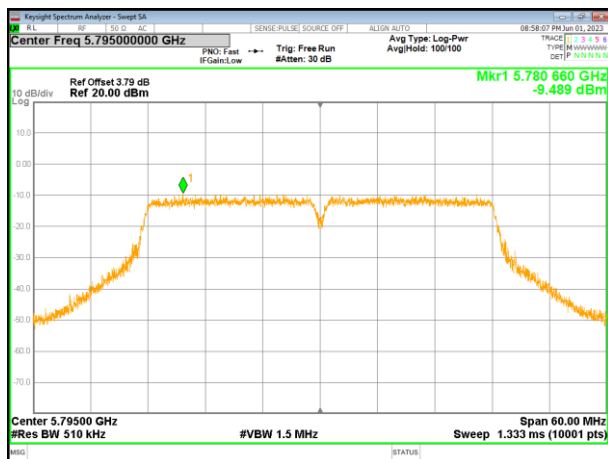
(802.11ac40) PSD plot on channel 151



(802.11ac80) PSD plot on channel 155

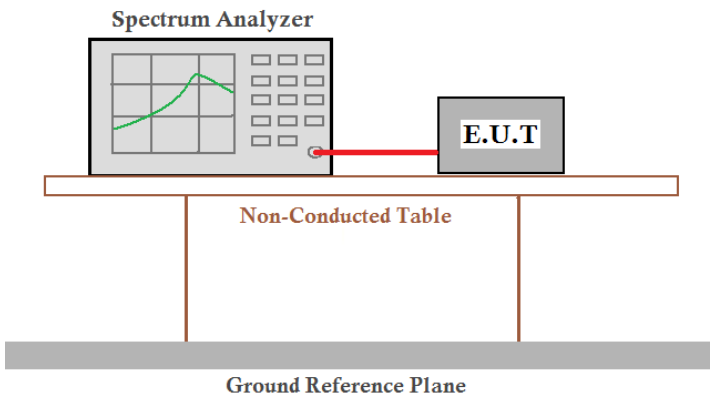


(802.11ac40) PSD plot on channel 159



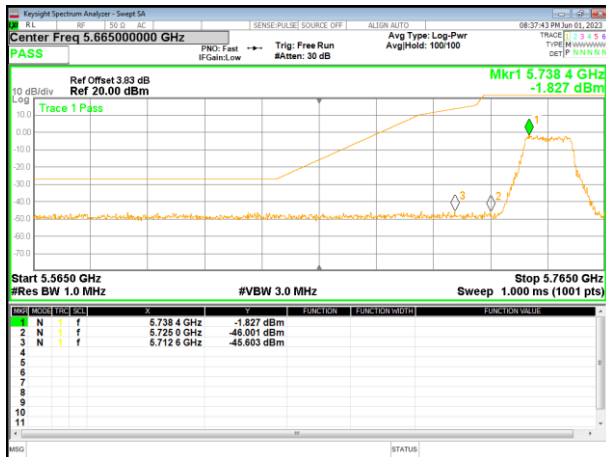
4.6 Band edge

4.6.1 Conducted test Method

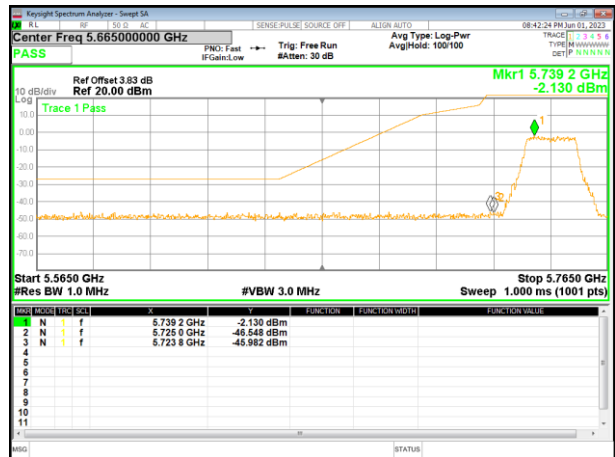
Test Requirement:	FCC Part15 C Section 15.209 and 15.205	
Test Method:	ANSI C63.10: 2013	
Limit:	All emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below 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.	
Test setup:	 The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T. (Equipment Under Test) via a red cable. Both are placed on a Non-Conducted Table, which is supported by a Ground Reference Plane.	
Test Procedure:	1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator. 2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range. 3. Set RBW of spectrum analyzer to 1 MHz with a convenient frequency span. 4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency. 5. Repeat above procedures until all measured frequencies were complete..	
Test Instruments:	Refer to section 3.0 for details	
Test mode:	Refer to section 2.2 for details	
Test environment:	Temp.: 22.2°C	Humid.: 56%RH
Test voltage:	DC 12V	
Test results:	Pass	

5.745~5.825 GHz

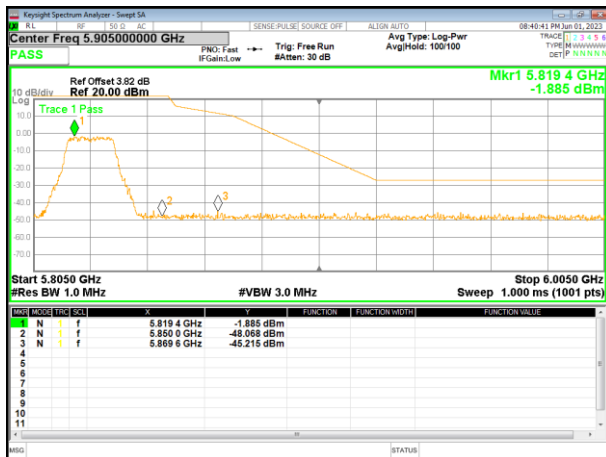
(802.11a) Band Edge, Left Side



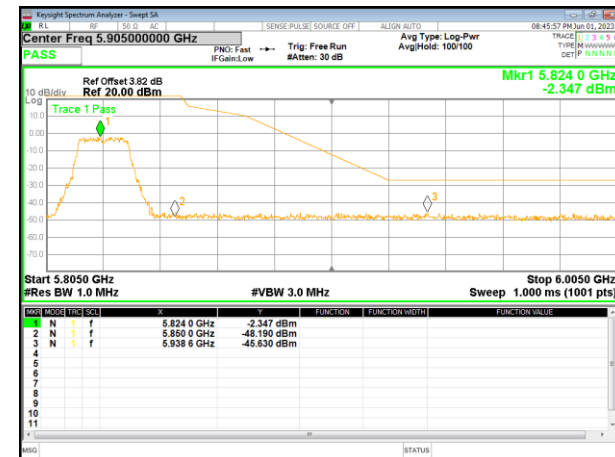
(802.11n20) Band Edge, Left Side



(802.11a) Band Edge, Right Side

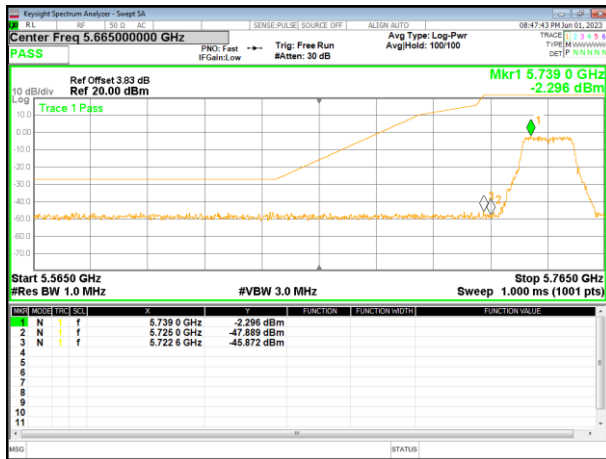


(802.11n20) Band Edge, Right Side

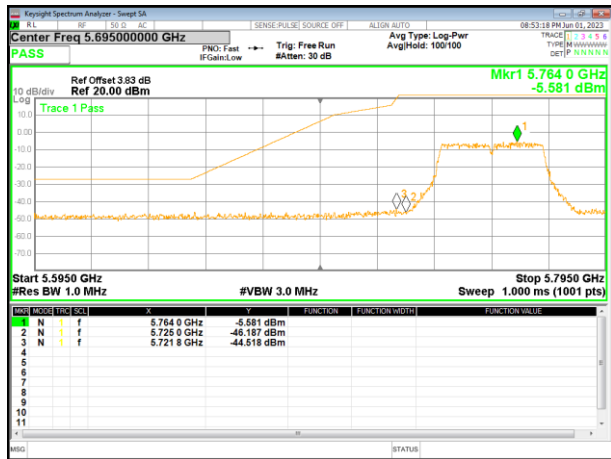


5.745~5.825 GHz

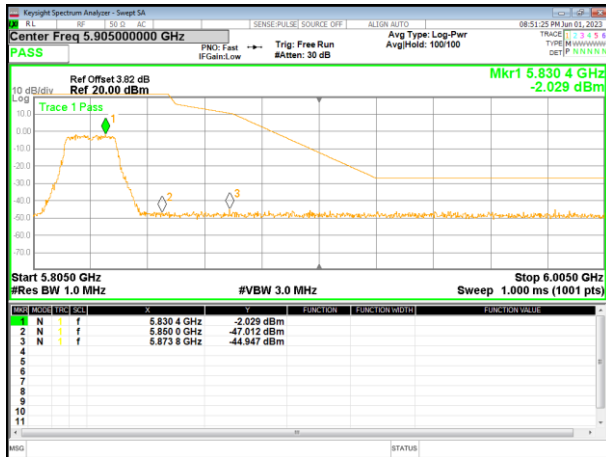
(802.11ac20) Band Edge, Left Side



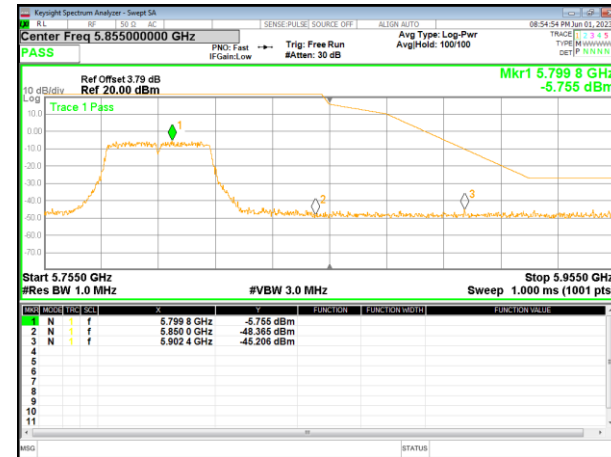
(802.11n40) Band Edge, Left Side



(802.11ac20) Band Edge, Right Side



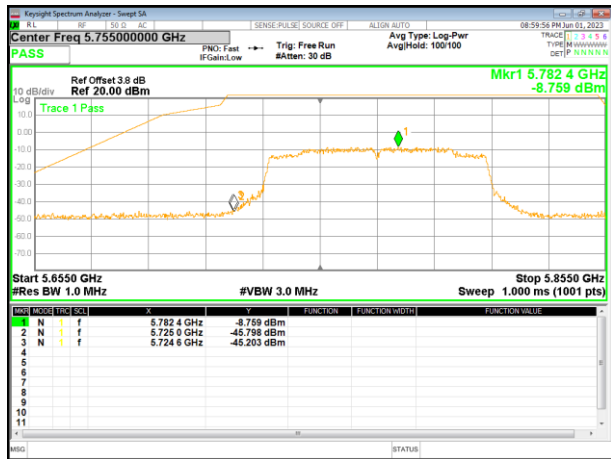
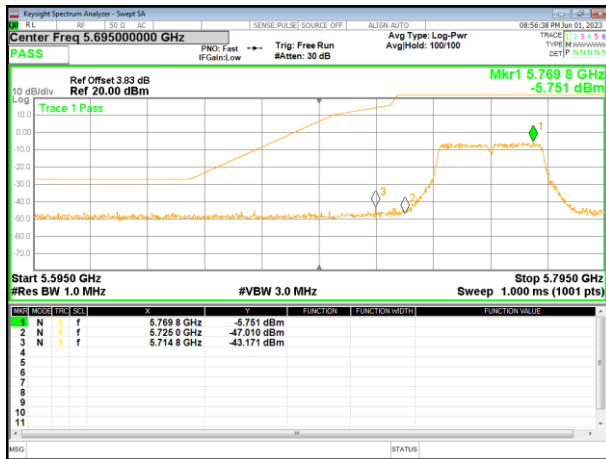
(802.11n40) Band Edge, Right Side



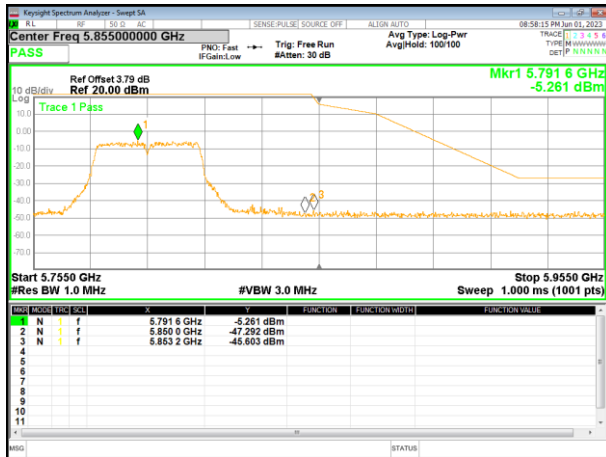
5.745~5.825 GHz

(802.11ac40) Band Edge, Left Side

(802.11ac80) Band Edge

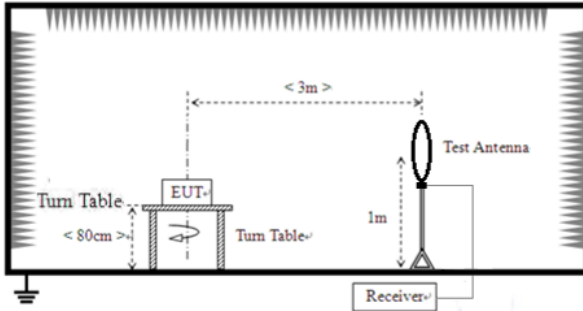
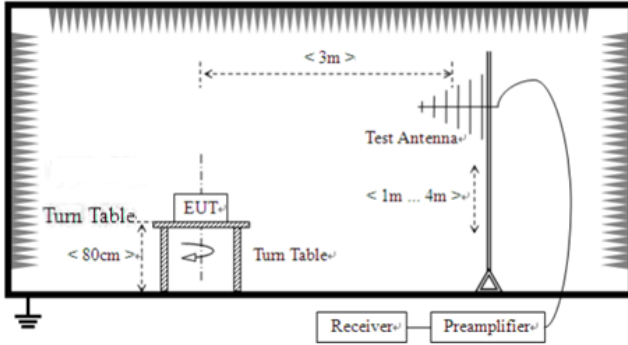


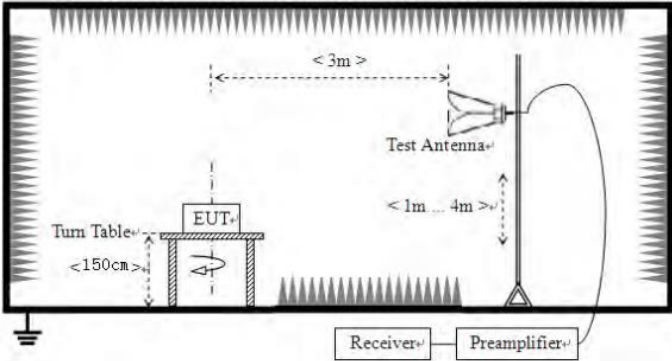
(802.11ac40) Band Edge, Right Side



4.7 Spurious Emission

4.7.1 Radiated Emission Method

Test Requirement:	FCC Part15 C Section 15.209, Part 15E Section 15.407(b)(4)				
Test Method:	ANSI C63.10:2013				
Test Frequency Range:	9kHz to 40GHz				
Test site:	Measurement Distance: 3m				
Receiver setup:	Frequency	Detector	RBW	VBW	Value
	9kHz-150KHz	Quasi-peak	200Hz	1kHz	Quasi-peak Value
	150kHz-30MHz	Quasi-peak	9kHz	30kHz	Quasi-peak Value
	30MHz-1GHz	Quasi-peak	120KHz	300KHz	Quasi-peak Value
	Above 1GHz	Peak	1MHz	3MHz	Peak Value
		AV	1MHz	3MHz	Average Value
Limit:	Frequency	Limit (uV/m)	Value	Measurement Distance	
	0.009MHz-0.490MHz	2400/F(KHz)	QP	300m	
	0.490MHz-1.705MHz	24000/F(KHz)	QP	300m	
	1.705MHz-30MHz	30	QP	30m	
	30MHz-88MHz	100	QP	3m	
	88MHz-216MHz	150	QP		
	216MHz-960MHz	200	QP		
	960MHz-1GHz	500	QP		
	Frequency	Limit (dBm/MHz)	Remark		
	Above 1GHz	-27.0	Peak Value		
Test setup:	For radiated emissions from 9kHz to 30MHz				
					
	For radiated emissions from 30MHz to 1GHz				
					

	For radiated emissions above 1GHz 
Test Procedure:	1. The EUT was placed on the top of a rotating table (0.8m for below 1GHz and 1.5 meters for above 1GHz) 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. 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, quasi-peak or average method as specified and then reported in a data sheet. The radiation measurements are performed in X, Y, Z axis positioning. And found the X axis positioning which it is worse case, only the test worst case mode is recorded in the report.
Test Instruments:	Refer to section 3.0 for details
Test mode:	Refer to section 2.2 for details
Test results:	Pass

Remarks:

1. The report only shows the worst mode.
2. Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the Y-axis which it is worse case.



Measurement Data:

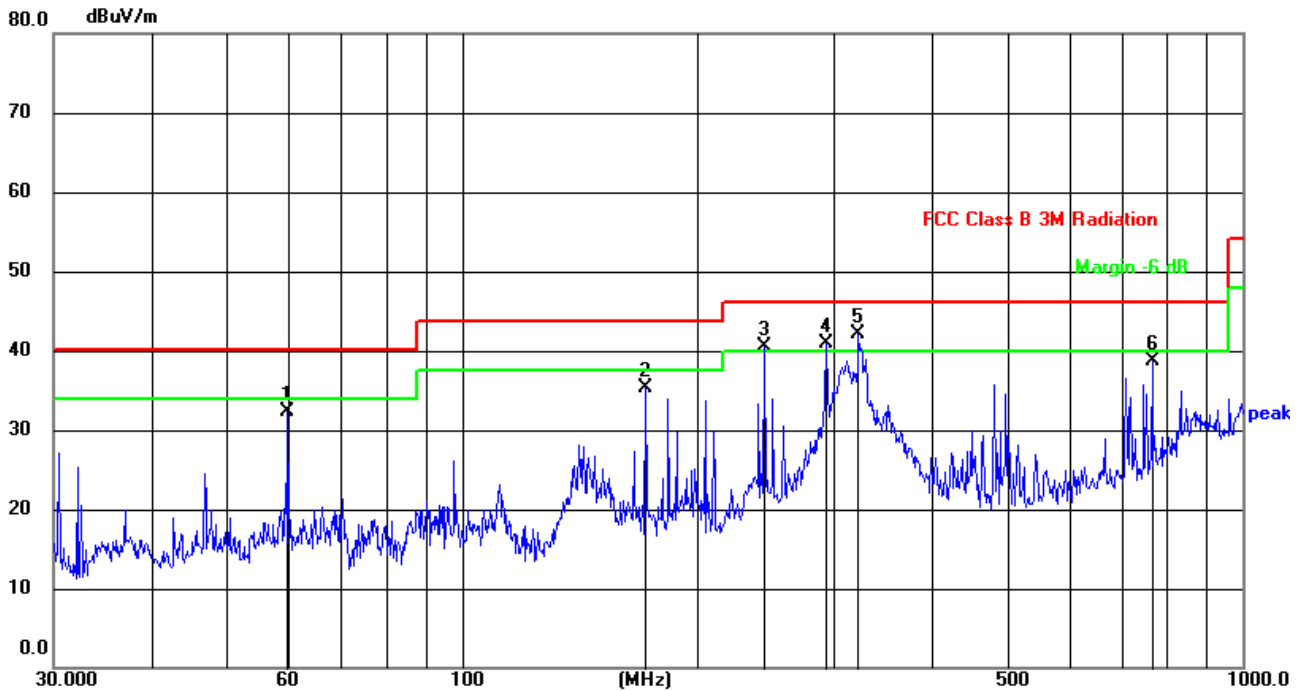
9 kHz ~ 30 MHz

The emission from 9 kHz to 30MHz was pre-tested and found the result was 20dB lower than the limit, and according to 15.31(o) & RSS-Gen 6.13, the test result no need to reported.

Below 1GHz

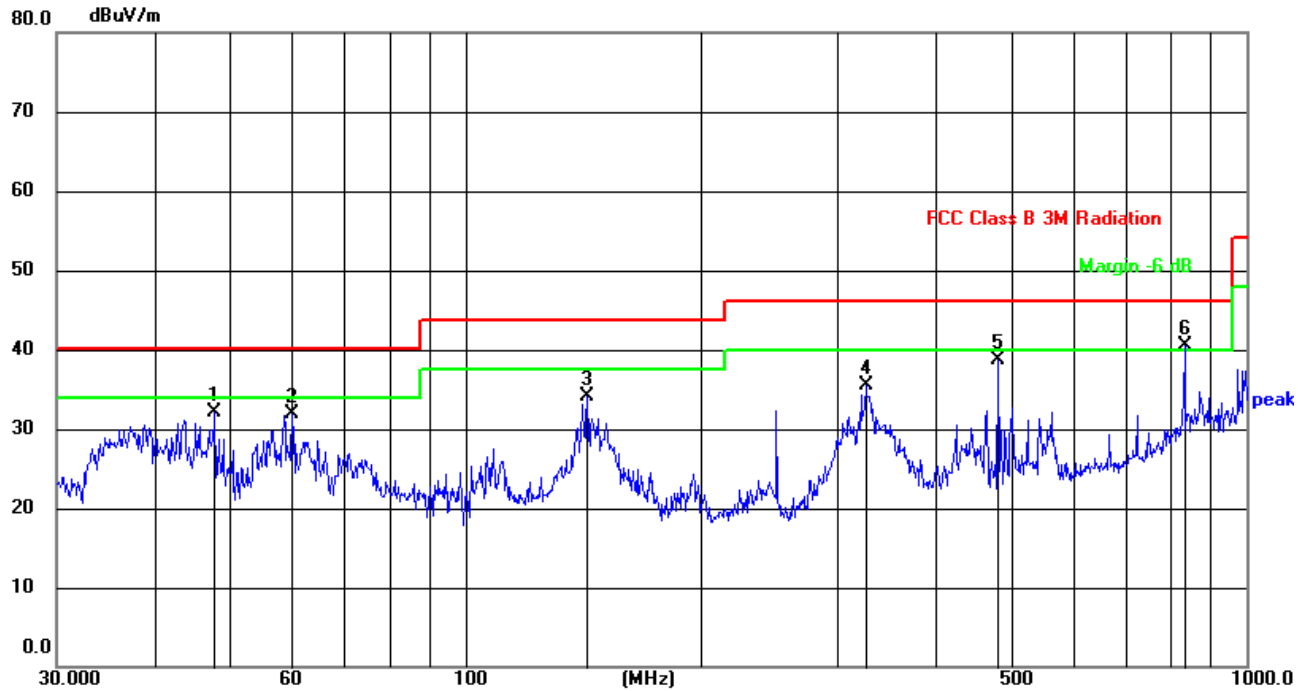
Temperature:	22.2°C	Relative Humidity:	56%
Pressure:	1010 hPa	Test Voltage :	DC 12V
Test Mode :	TX 802.11 ac20 (5825Mhz)		

Horizontal:



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	59.8588	54.89	-22.53	32.36	40.00	-7.64	QP
2	171.9944	56.61	-21.26	35.35	43.50	-8.15	QP
3	244.2321	62.94	-22.39	40.55	46.00	-5.45	QP
4	293.0842	61.59	-20.63	40.96	46.00	-5.04	QP
5	322.1884	61.48	-19.39	42.09	46.00	-3.91	QP
6	766.0570	46.35	-7.59	38.76	46.00	-7.24	QP

Vertical:



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	47.8260	53.56	-21.54	32.02	40.00	-7.98	QP
2	60.0690	54.46	-22.55	31.91	40.00	-8.09	QP
3	143.3257	55.30	-21.25	34.05	43.50	-9.45	QP
4	325.5957	54.78	-19.29	35.49	46.00	-10.51	QP
5	480.5276	53.97	-15.24	38.73	46.00	-7.27	QP
6	833.3170	46.93	-6.35	40.58	46.00	-5.42	QP

Remarks:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
2. The emission levels of other frequencies are very lower than the limit and not show in test report.
3. The test data shows only the worst case TX 802.11 ac20 (5825Mhz) mode

**Above 1GHz:**

Temperature:	23.7℃	Relative Humidity:	46%
Pressure:	1010 hPa	Test Voltage :	DC 12V
Test Mode :	TX 802.11 ac20		

Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Pre- amplifier (dB)	Cable Loss (dB)	Antenna Factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Detect or Type
Low Channel:5745MHz									
V	11490.00	48.11	46.10	8.77	39.10	49.88	74.00	-24.12	PK
V	11490.00	39.98	46.10	8.77	39.10	41.75	54.00	-12.25	AV
V	17235.00	45.70	47.60	11.10	38.70	47.90	68.20	-20.30	PK
V	17235.00	38.42	47.60	11.10	38.70	40.62	54.00	-13.38	AV
V	22980.00	54.40	56.90	12.73	37.70	47.93	74.00	-26.07	PK
V	22980.00	46.42	56.90	12.73	37.70	39.95	54.00	-14.05	AV
V	28725.00	51.22	55.60	14.25	40.30	50.17	68.20	-18.03	PK
V	28725.00	42.74	55.60	14.25	40.30	41.69	54.00	-12.31	AV
H	11490.00	48.59	46.10	8.77	39.10	50.36	74.00	-23.64	PK
H	11490.00	39.81	46.10	8.77	39.10	41.58	54.00	-12.42	AV
H	17235.00	46.72	47.60	11.10	38.70	48.92	68.20	-19.28	PK
H	17235.00	38.84	47.60	11.10	38.70	41.04	54.00	-12.96	AV
H	22980.00	56.61	56.90	12.73	37.70	50.14	74.00	-23.86	PK
H	22980.00	46.19	56.90	12.73	37.70	39.72	54.00	-14.28	AV
H	28725.00	53.18	55.60	14.25	40.30	52.13	68.20	-16.07	PK
H	28725.00	43.36	55.60	14.25	40.30	42.31	54.00	-11.69	AV

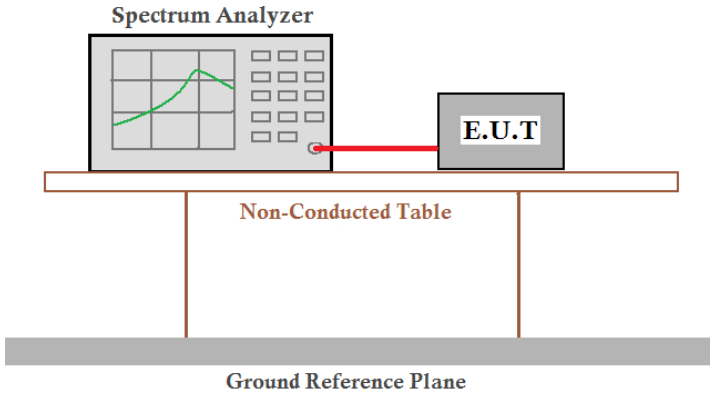
Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Pre- amplifier (dB)	Cable Loss (dB)	Antenna Factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Detect or Type
Middle Channel:5785MHz									
V	11570.00	47.93	46.10	8.77	39.10	49.70	74.00	-24.30	PK
V	11570.00	39.80	46.10	8.77	39.10	41.57	54.00	-12.43	AV
V	17355.00	45.51	47.60	11.10	38.70	47.71	68.20	-20.49	PK
V	17355.00	38.22	47.60	11.10	38.70	40.42	54.00	-13.58	AV
V	23140.00	54.22	56.90	12.73	37.70	47.75	74.00	-26.25	PK
V	23140.00	46.22	56.90	12.73	37.70	39.75	54.00	-14.25	AV
V	28925.00	51.02	55.60	14.25	40.30	49.97	68.20	-18.23	PK
V	28925.00	42.55	55.60	14.25	40.30	41.50	54.00	-12.50	AV
H	11570.00	48.40	46.10	8.77	39.10	50.17	74.00	-23.83	PK
H	11570.00	39.60	46.10	8.77	39.10	41.37	54.00	-12.63	AV
H	17355.00	46.53	47.60	11.10	38.70	48.73	68.20	-19.47	PK
H	17355.00	38.64	47.60	11.10	38.70	40.84	54.00	-13.16	AV
H	23140.00	56.42	56.90	12.73	37.70	49.95	74.00	-24.05	PK
H	23140.00	46.00	56.90	12.73	37.70	39.53	54.00	-14.47	AV
H	28925.00	52.99	55.60	14.25	40.30	51.94	68.20	-16.26	PK
H	28925.00	43.17	55.60	14.25	40.30	42.12	54.00	-11.88	AV

Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Pre- amplifier (dB)	Cable Loss (dB)	Antenna Factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Detect or Type
High Channel:5825MHz									
V	11650.00	49.01	46.10	8.77	39.10	50.78	74.00	-23.22	PK
V	11650.00	39.97	46.10	8.77	39.10	41.74	54.00	-12.26	AV
V	17475.00	46.89	47.90	11.23	38.90	49.12	68.20	-19.08	PK
V	17475.00	39.24	47.90	11.23	38.90	41.47	54.00	-12.53	AV
V	23300.00	56.53	57.10	12.73	37.80	49.96	68.20	-18.24	PK
V	23300.00	47.16	57.10	12.73	37.80	40.59	54.00	-13.41	AV
V	29125.00	53.27	55.80	14.25	40.50	52.22	68.20	-15.98	PK
V	29125.00	44.42	55.80	14.25	40.50	43.37	54.00	-10.63	AV
H	11650.00	51.01	46.10	8.77	39.10	52.78	74.00	-21.22	PK
H	11650.00	42.36	46.10	8.77	39.10	44.13	54.00	-9.87	AV
H	17475.00	48.10	47.90	11.23	38.90	50.33	68.20	-17.87	PK
H	17475.00	40.52	47.90	11.23	38.90	42.75	54.00	-11.25	AV
H	23300.00	57.93	57.10	12.73	37.80	51.36	68.20	-16.84	PK
H	23300.00	48.61	57.10	12.73	37.80	42.04	54.00	-11.96	AV
H	29125.00	54.32	55.80	14.25	40.50	53.27	68.20	-14.93	PK
H	29125.00	45.15	55.80	14.25	40.50	44.10	54.00	-9.90	AV

Remark:

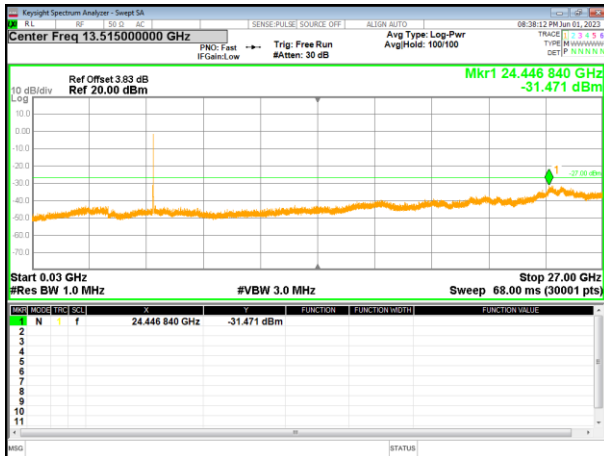
1. Emission Level = Meter Reading + Antenna Factor + Cable Loss – Pre-amplifier,
Margin= Emission Level - Limit
2. If peak below the average limit, the average emission was no test.
3. The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.
4. The worst mode is TX 802.11 ac20, only the worst data is recorded.

4.7.2 Conducted Emission Method

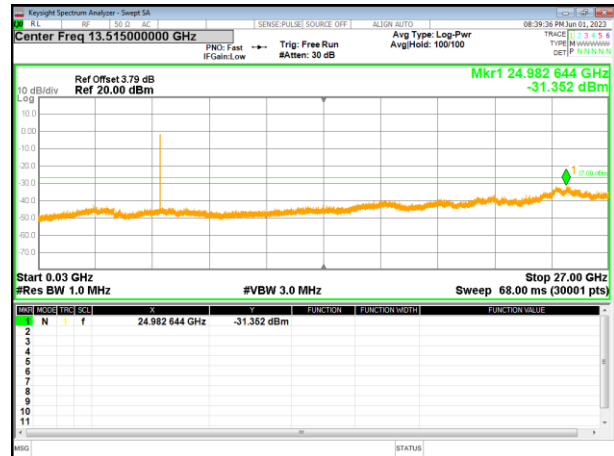
Test Requirement:	FCC Part15 C Section 15.209, Part 15E Section 15.407(b)(4)	
Test Method:	ANSI C63.10:2013	
Limit:	-27dBm/MHz	
Test setup:	 The diagram illustrates the test setup for conducted emissions. A Spectrum Analyzer is connected to an Equipment Under Test (E.U.T.) via a red cable. Both the Spectrum Analyzer and the E.U.T. are placed on a Non-Conducted Table. The table is supported by two vertical legs and sits on a Ground Reference Plane.	
Test Instruments:	Refer to section 3.0 for details	
Test mode:	Refer to section 2.2 for details	
Test environment:	Temp.: 22.2°C	Humid.: 56%RH
Test voltage:	DC 12V	
Test results:	Pass	

Test Plot

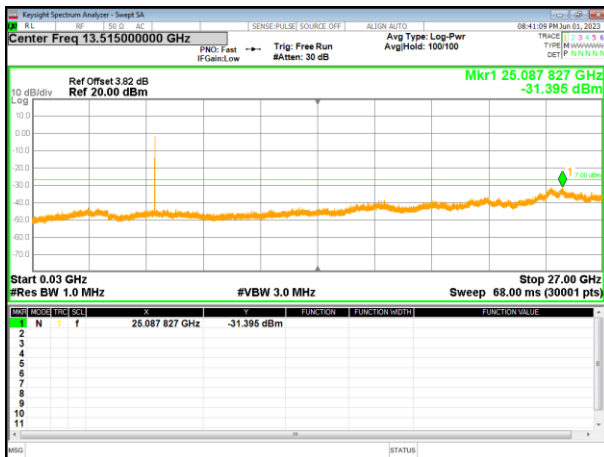
802.11a on channel 149



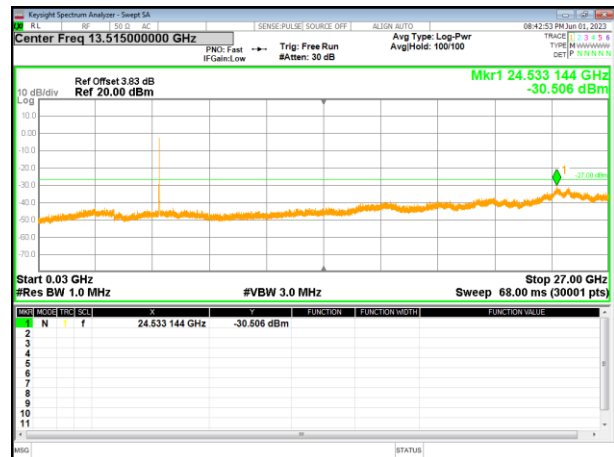
802.11a on channel 157



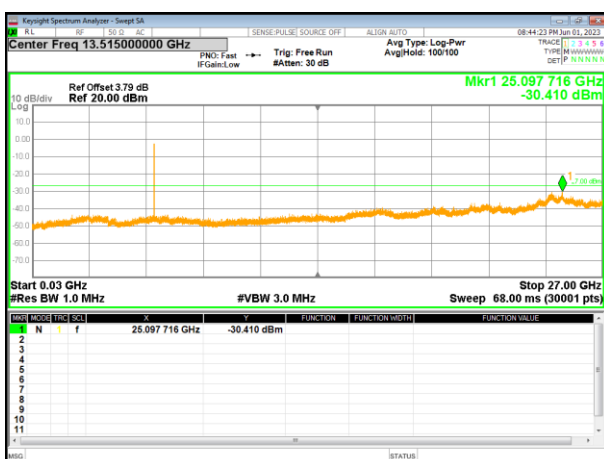
802.11a on channel 165



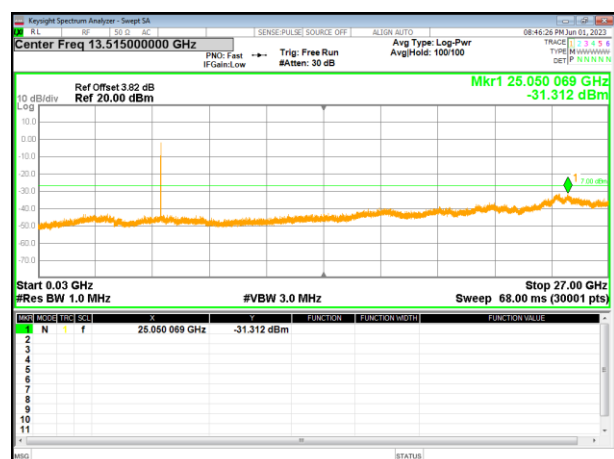
802.11n20 on channel 149



802.11n20 on channel 157

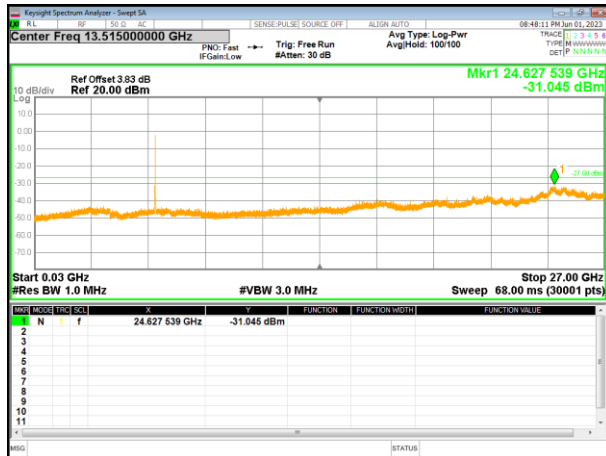


802.11n20 on channel 165

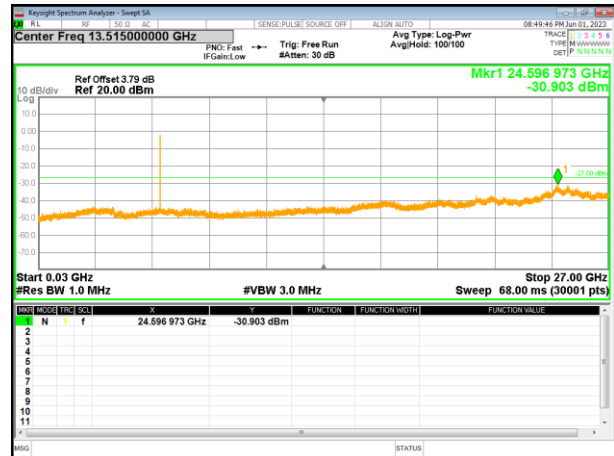


Test Plot

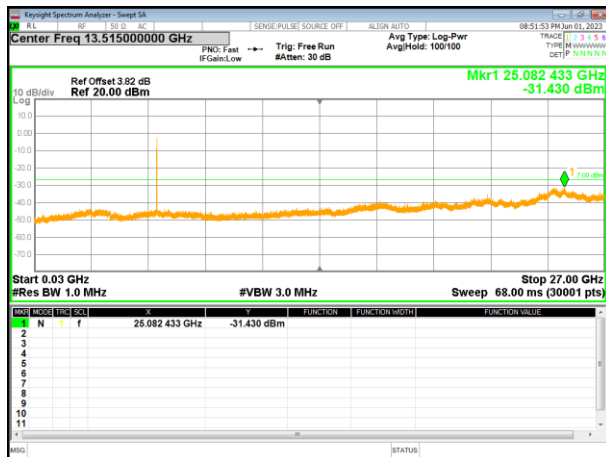
802.11ac20 on channel 149



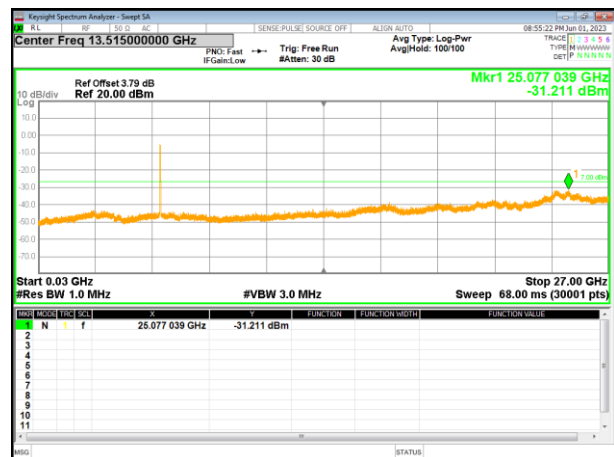
802.11ac20 on channel 157



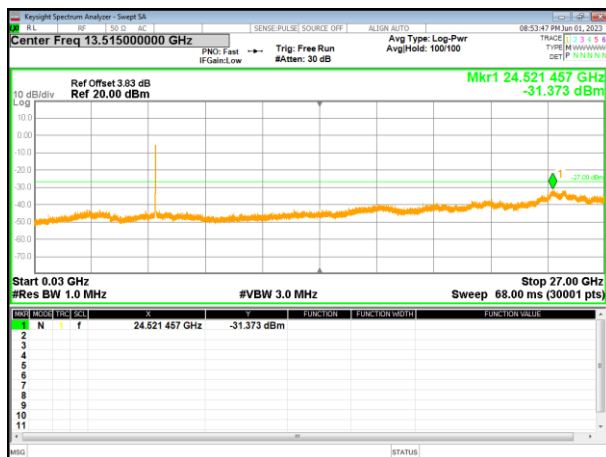
802.11ac20 on channel 165



802.11n40 on channel 159

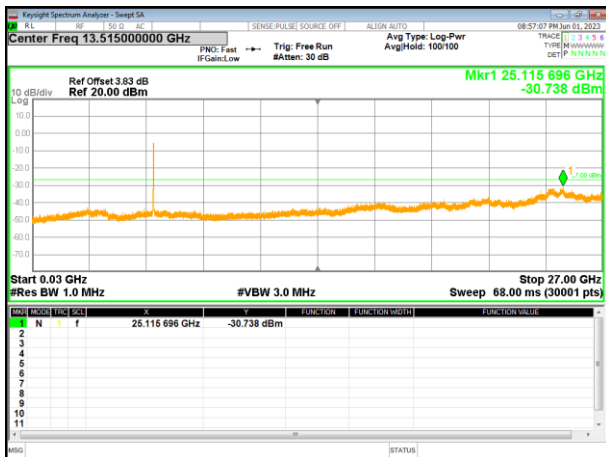


802.11n40 on channel 151

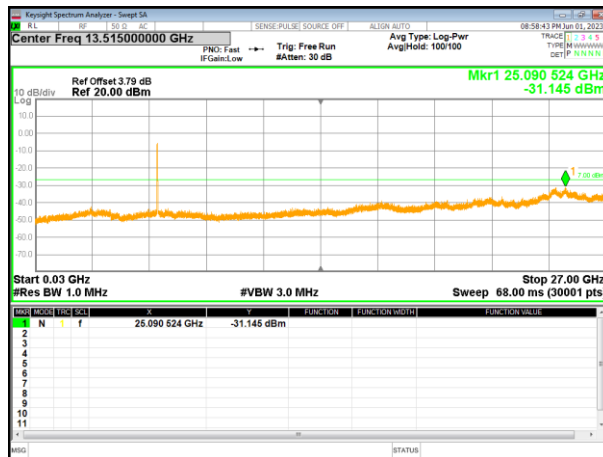


Test Plot

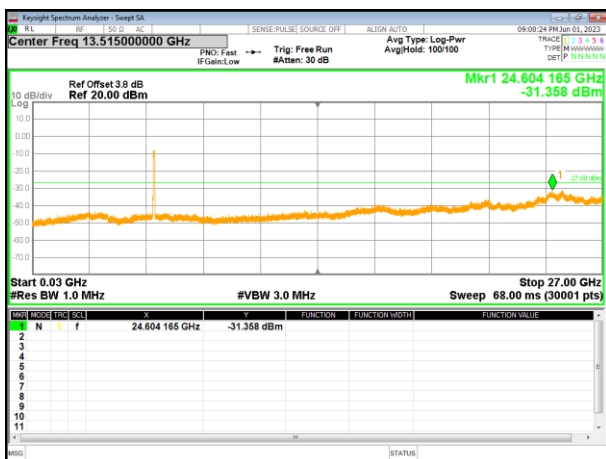
802.11ac40 on channel 151



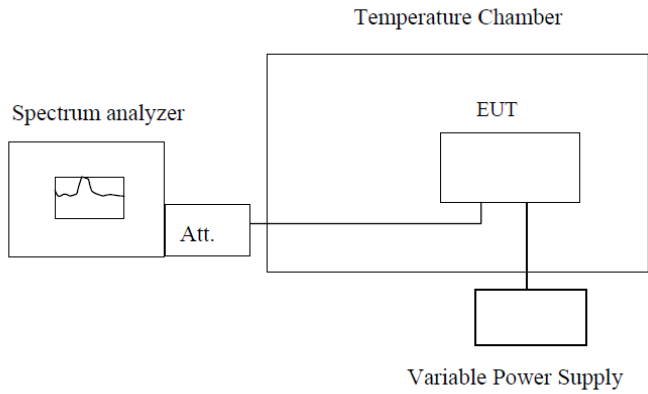
802.11ac40 on channel 159



802.11ac80 on channel 155



4.8 Frequency stability

Test Requirement:	FCC Part15 C Section 15.407(g)
Test Method:	ANSI C63.10:2013, FCC Part 2.1055
Limit:	Manufactures 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
Test Procedure:	a. The EUT was placed inside the environmental test chamber and powered by nominal 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, turn the EUT on and measure the operating frequency after 2, 5, and 10 Minutes. 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 Minute s. The supply voltage was then adjusted on the EUT from 85% to 115% and the frequency record.
Test setup:	 Note : Measurement setup for testing on Antenna connector
Test Instruments:	Refer to section 3.0 for details
Test mode:	Refer to section 2.2 for details
Test results:	Pass

Remark: Set the EUT transmits at un-modulation mode to test frequency stability.



Measurement data:

Frequency stability versus Temp.					
Power Supply: DC 12V					
Temp. (°C)	Operating Frequency (MHz)	0 minute Measured Frequency (MHz)	2 minute Measured Frequency (MHz)	5 minute Measured Frequency (MHz)	10 minute Measured Frequency (MHz)
-30	5745	5744.965	5744.313	5745.369	5744.571
	5755	5754.972	5754.318	5755.377	5754.559
	5775	5774.987	5774.309	5775.395	5774.570
	5785	5784.963	5784.300	5785.371	5784.576
	5795	5794.959	5794.306	5795.368	5794.594
	5825	5824.962	5824.231	5825.374	5824.585
-20	5745	5744.954	5744.324	5745.363	5744.582
	5755	5754.970	5754.324	5755.389	5754.595
	5775	5774.967	5774.326	5775.371	5774.580
	5785	5784.970	5784.317	5785.380	5784.566
	5795	5794.981	5794.307	5795.379	5794.560
	5825	5824.962	5824.312	5825.392	5824.593
-10	5745	5744.965	5744.314	5745.379	5744.202
	5755	5754.991	5754.319	5755.382	5754.584
	5775	5774.985	5774.335	5775.386	5774.585
	5785	5784.969	5784.310	5785.378	5784.587
	5795	5794.958	5794.305	5795.370	5794.570
	5825	5824.893	5824.304	5825.382	5824.565
0	5745	5744.959	5744.303	5745.379	5742.607
	5755	5754.984	5754.317	5755.382	5754.597
	5775	5774.964	5774.315	5775.386	5774.593
	5785	5784.972	5784.317	5785.378	5784.576
	5795	5794.970	5794.327	5795.370	5794.565
	5825	5824.979	5824.304	5825.382	5824.499
10	5745	5744.959	5744.313	5745.368	5744.572
	5755	5754.984	5754.328	5755.376	5754.578
	5775	5774.964	5774.328	5775.369	5774.595
	5785	5784.972	5784.309	5785.361	5784.570
	5795	5794.970	5794.325	5795.369	5794.566
	5825	5824.979	5824.319	5825.301	5824.568
20	5745	5744.975	5744.338	5745.379	5744.571
	5755	5754.989	5754.308	5755.394	5754.589
	5775	5774.972	5774.330	5775.380	5774.569
	5785	5784.959	5784.329	5785.367	5784.595
	5795	5794.953	5794.319	5795.362	5794.587
	5825	5824.986	5824.330	5825.399	5824.595
30	5745	5744.965	5744.324	5745.368	5744.596
	5755	5754.972	5754.324	5755.386	5754.567
	5775	5774.987	5774.326	5775.388	5774.590
	5785	5784.963	5784.317	5785.370	5784.589
	5795	5794.959	5794.307	5795.388	5794.580
	5825	5824.962	5824.312	5825.389	5824.594
40	5745	5744.975	5744.308	5745.379	5742.607
	5755	5754.989	5754.331	5755.382	5754.597
	5775	5774.972	5774.311	5775.386	5774.593



	5785	5784.959	5784.319	5785.378	5784.576
	5795	5794.953	5794.316	5795.370	5794.565
	5825	5824.986	5824.322	5825.382	5824.499
50	5745	5744.975	5744.338	5745.379	5744.571
	5755	5754.989	5754.308	5755.394	5754.589
	5775	5774.972	5774.330	5775.380	5774.569
	5785	5784.959	5784.329	5785.367	5784.595
	5795	5794.953	5794.319	5795.362	5794.587
	5825	5824.986	5824.330	5825.399	5824.595

Frequency stability versus Voltage					
Temperature: 25°C					
Power Supply (VAC)	Operating Frequency (MHz)	0 minute Measured Frequency (MHz)	2 minute Measured Frequency (MHz)	5 minute Measured Frequency (MHz)	10 minute Measured Frequency (MHz)
13.80	5745	5744.954	5744.313	5745.368	5744.566
	5755	5754.970	5754.318	5755.386	5754.590
	5775	5774.967	5774.309	5775.388	5774.571
	5785	5784.970	5784.300	5785.370	5784.579
	5795	5794.981	5794.306	5795.388	5794.577
	5825	5824.962	5824.231	5825.389	5824.586
12.00	5745	5744.954	5744.324	5745.363	5744.582
	5755	5754.970	5754.324	5755.389	5754.595
	5775	5774.967	5774.326	5775.371	5774.580
	5785	5784.970	5784.317	5785.380	5784.566
	5795	5794.981	5794.307	5795.379	5794.560
	5825	5824.962	5824.312	5825.392	5824.593
10.20	5745	5744.975	5744.338	5745.379	5744.571
	5755	5754.989	5754.308	5755.394	5754.589
	5775	5774.972	5774.330	5775.380	5774.569
	5785	5784.959	5784.329	5785.367	5784.595
	5795	5794.953	5794.319	5795.362	5794.587
	5825	5824.986	5824.330	5825.399	5824.595

5 Test Setup Photo

Reference to the **appendix I** for details.

6 EUT Constructional Details

Reference to the **appendix II** for details.

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