TEST REPORT

Applicant:	HONGKING INDUSTRIAL CO., LIMITED
Address of Applicant:	5 block,1#,Changkeng RD,Bantian,Buji Town,Longgang District, Shenzhen,China
Manufacturer:	HONGKING INDUSTRIAL CO., LIMITED
Address of Manufacturer	5 block,1#,Changkeng RD,Bantian,Buji Town,Longgang District, Shenzhen,China
Product Name:	Optical Network Unit
Model No.:	FV480D,FP580D,FV6600, F670L,F673
Trade Mark:	N/A
FCC ID:	2BNRH-FV480D
Applicable standards:	FCC CFR Title 47 Part 15 Subpart E Section 15.407
Date of Test:	Dec.17, 2024-Feb.16, 2025
Date of report issued:	Feb.17, 2025

Remark:

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

Prepared By

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Report Revision History		
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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	Jason Huang
Conducted Output Power	15.407 (a)(1)/(a)(3)	Pass	Kara Wu
26dB Bandwidth and 99% Occupied Bandwidth	15.407 (a)(12)	Pass	Kara Wu
6dB Bandwidth	15.407 (e)	Pass	Kara Wu
Power Spectral Density	15.407(a)(1)/(a)(3)	Pass	Kara Wu
Band Edge	15.407(b)(1)/(b)(4)	Pass	Kara Wu
Spurious Emission	15.205/15.209 15.407(b)(1)/(b)(4)/(b)(8)	Pass	Jason Huang
Frequency Stability	15.407(g)	Pass	Kara Wu

Remarks:

1. *Pass: The EUT complies with the essential requirements in the standard.*
2. *Test according to ANSI C63.10:2013*
3. *Note: Compliance determination rules*

1).The Compliance determination of test results does not take into account measurement uncertainty. Measurement results are determined based on regulatory limitations or requirements specified by the applicant/manufacturer. If measurement uncertainty is taken into account, the applicant/manufacturer will bear all possible risks of non-compliance.

2).The measurement uncertainty please refer to each test result in the "Measurement Uncertainty"

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	± 2.64 dB	(1)
Radiated emissions 9K-30MHz	±3.98dB	(1)
Radiated emissions 30M- 1GHz	±4.32dB	(1)
Radiated emissions 1GHz-18GHz	±4.56dB	(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:	Optical Network Unit
Model No.:	FV480D,FP580D,FV6600, F670L,F673
Difference of model(s)	All the model are the same circuit and RF module, except the model names and colour
Test Model:	FP480D
Hardware Version:	N/A
Software Version:	N/A
Sample(s) Status:	Engineer sample
Operation Frequency:	☒5745-5825 MHz for 802.11a/n(HT20)/ac20; 5755-5795 MHz for 802.11n(HT40)/ac40; 5775MHz for 802.11 ac80;
Channel numbers:	☒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:	4.32dBi (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 From Adapter
Adapter Model:	Model：RD1201500-C55-198GB Input：AC 100-240V 50/60Hz 0.6A Output: DC 12V 1.5A

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 ≥ 98%)

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.

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 ac80CH 155
Mode 4	/
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 ac80CH 155
Mode 4	/

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	Notebook computer	DELL	Vostro 3520	/

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	2024.3.12	2025.3.11
2	Artificial power network	schwarabeck	NSLK8127	8127483	2024.3.12	2025.3.11
3	Artificial power network	ETS	3186/2NM	1132	2024.3.12	2025.3.11
4	10dB attenuator	HUBER+SUHNER	10dB	/	2024.3.12	2025.3.11
5	Cable 4	HUBER SUNNER	3M	/	2024.3.12	2025.3.11
6	Absorbing Clamp	schwarabeck	MDS21	D69250	2024.3.12	2025.3.11

Radiated Emission &RF Conducted test:

Item	Equipment name	Manufacturer	Model	Serial No.	Calibration date	Due date
1	EMI Test Receiver	Rohde&schwarz	ESCI7	101032	2024.3.12	2025.3.11
2	Broadband antenna	schwarabeck	VULB9168	1064	2024.3.19	2026.3.21
3	Horn antenna	schwarabeck	BBHA9120D	9120D-1145	2024.3.19	2026.3.21
4	Amplifier	EMtrace	RP01A	50117	2024.3.12	2025.3.11
5	Amplifier	Space-Dtronics	EWLAN0118G-P40	19113001	2024.3.12	2025.3.11
6	Spectrum analyzer	KEYSIGHT	N9020A	MY55370280	2024.3.12	2025.3.11
7	Power detector meter	MWRFtest	MW100-PSB	MW201020JYT	2024.3.12	2025.3.11
8	Signal generator	Agilent	N5182A	MY49060455	2024.3.12	2025.3.11
9	Spectrum analyzer	Rohde&schwarz	FSU40	1166.1660K43	2024.3.12	2025.3.11
10	Amplifier	SKET	LNPA_1840-50	SK2019040302	2024.3.12	2025.3.11
11	Horn antenna	schwarabeck	BBHA 9170	946	2024.3.19	2026.3.21
12	Loop antenna	schwarabeck	FMZB 1519 B	1519	2024.3.19	2026.3.21
13	Cable 6	HUBER SUNNER	0.5M	/	2024.3.12	2025.3.11
14	Cable7	HUBER SUNNER	2.0M	/	2024.3.12	2025.3.11
15	Cable8	HUBER SUNNER	6.0M	/	2024.3.12	2025.3.11
16	Filter	Xin bo	XBLBQ-GTA29	210410-3-2	2024.3.12	2025.3.11
17	Power meter	Rohde&Schwarz	NRP-Z11	1138.3004.02-117725-vh	2024.3.12	2025.3.11
18	Temp. & Humidity Chamber	Jiecheng Instrument	QA-LP-80	20160705001	2024/4/23	2025/4/22

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
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.*	
E.U.T Antenna:	
The antennas are Integrated antenna, the best case gain of the antennas are 4.32 dBi, reference to the appendix II for details	

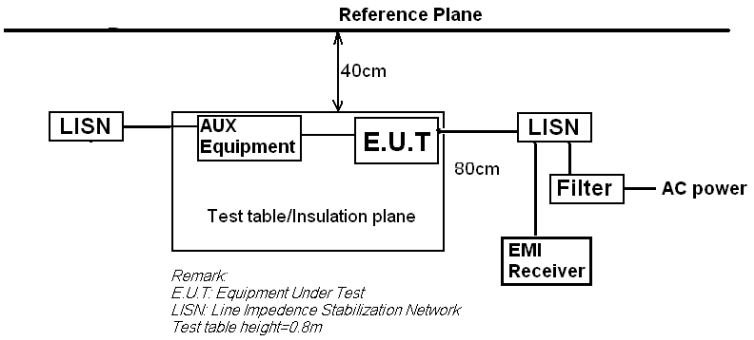
4.2 Conducted Emissions

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:



Test procedure:

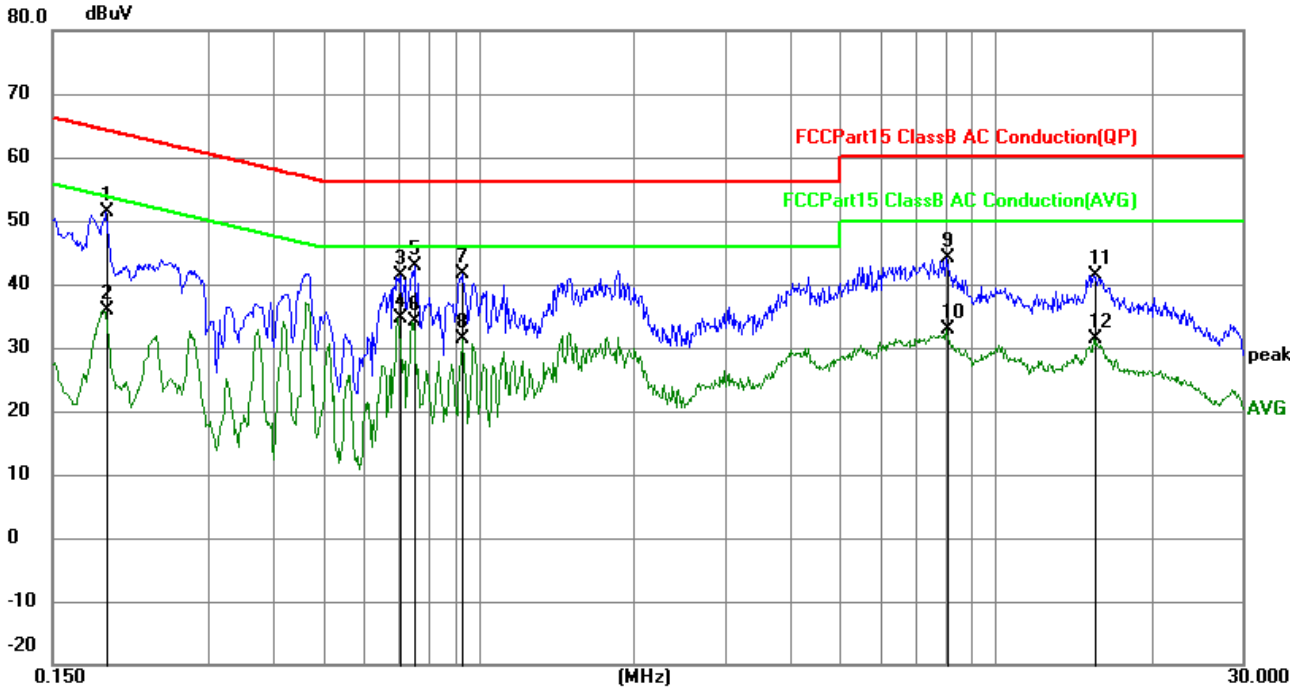
1. The E.U.T and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm/50uH coupling impedance for the measuring equipment.
2. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling 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.:	22.4°C	Humid.:	30%	Press.:	1012mbar
Test voltage:	DC 12V From Adapter					
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 (802.11a 5785MHz) of ANT2

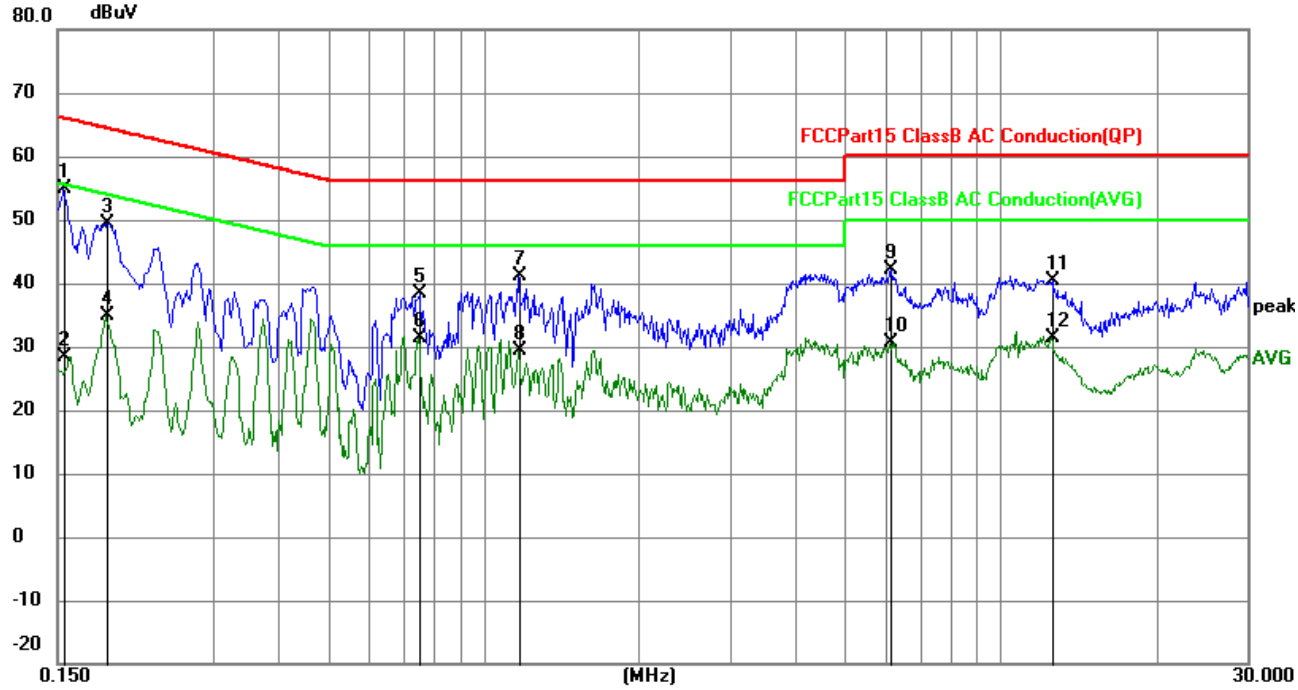
Measurement Result

Line:



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.1905	41.57	9.81	51.38	64.01	-12.63	QP
2	0.1905	26.01	9.81	35.82	54.01	-18.19	AVG
3	0.7075	31.32	9.94	41.26	56.00	-14.74	QP
4	0.7075	24.67	9.94	34.61	46.00	-11.39	AVG
5	0.7529	32.90	9.94	42.84	56.00	-13.16	QP
6	0.7529	24.12	9.94	34.06	46.00	-11.94	AVG
7	0.9284	31.60	9.96	41.56	56.00	-14.44	QP
8	0.9284	21.49	9.96	31.45	46.00	-14.55	AVG
9	8.0609	34.27	9.84	44.11	60.00	-15.89	QP
10	8.0609	23.08	9.84	32.92	50.00	-17.08	AVG
11	15.5129	31.60	9.74	41.34	60.00	-18.66	QP
12	15.5129	21.58	9.74	31.32	50.00	-18.68	AVG

Neutral:

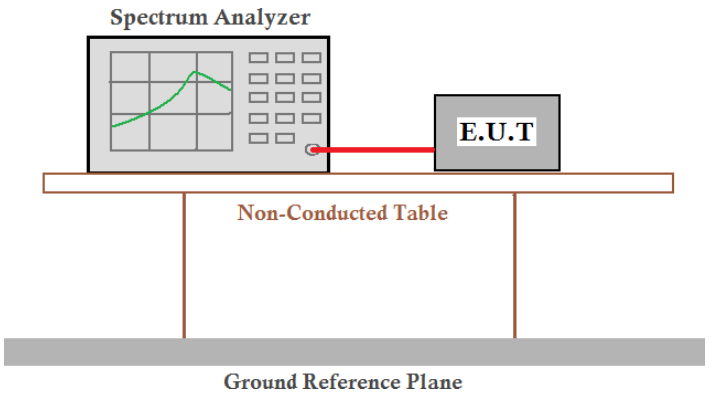


No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.1544	45.11	9.80	54.91	65.76	-10.85	QP
2	0.1544	18.63	9.80	28.43	55.76	-27.33	AVG
3	0.1872	39.47	9.81	49.28	64.16	-14.88	QP
4	0.1872	25.10	9.81	34.91	54.16	-19.25	AVG
5	0.7529	28.32	9.94	38.26	56.00	-17.74	QP
6	0.7529	21.42	9.94	31.36	46.00	-14.64	AVG
7	1.1713	31.19	9.94	41.13	56.00	-14.87	QP
8	1.1713	19.51	9.94	29.45	46.00	-16.55	AVG
9	6.1485	32.31	9.83	42.14	60.00	-17.86	QP
10	6.1485	20.90	9.83	30.73	50.00	-19.27	AVG
11	12.6195	30.52	9.80	40.32	60.00	-19.68	QP
12	12.6195	21.57	9.80	31.37	50.00	-18.63	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 Duty cycle

Test Method :	ANSI C63.10:2013	
Limit:	/	
Test setup:		
Test Instruments:	Refer to section 3.0 for details	
Test mode:	Refer to section 2.2 for details	
Test environment:	Temp.: 22.9°C	Humid.: 39%RH
Test voltage:	DC 12V From Adapter	
Test results:	Pass	

Measurement Result
ANT2
5745-5825 MHz

Mode	Duty cycle (%)	Correction Factor (dB)
TX 802.11a Mode	98.59	0.06
TX 802.11n20 Mode	95.12	0.22
TX 802.11ac20 Mode	95.00	0.22
TX 802.11n40 Mode	86.96	0.61
TX 802.11a40 Mode	86.96	0.61
TX 802.11ac80 Mode	91.67	0.38

ANT2

5745-5825 MHz

(802.11a) plot

(802.11 n20) plot

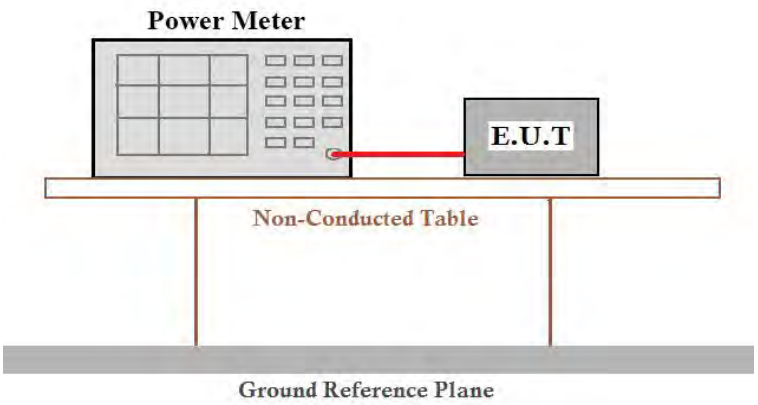
(802.11ac20) plot

(802.11 n40) plot

(802.11ac40) plot

(802.11ac80) plot

4.4 Conducted 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.: 22.9°C	Humid.: 39%RH
Test voltage:	DC 12V From Adapter	
Test results:	Pass	

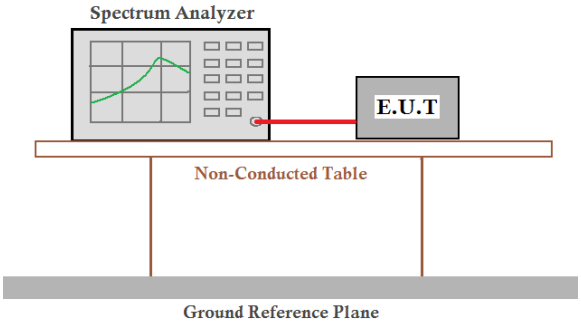
Measurement Result

ANT2

5745-5825 MHz

Test Channel	Frequency	Correction Factor	Maximum output power	Total Power	LIMIT	Result
	(MHz)	(dB)	(dBm)	(dBm)	dBm	
TX 802.11a Mode						
CH149	5745	0.06	12.80	12.86	30	Pass
CH157	5785	0.06	13.52	13.58	30	Pass
CH165	5825	0.06	12.41	12.47	30	Pass
TX 802.11 n20 Mode						
CH149	5745	0.22	12.56	12.78	30	Pass
CH157	5785	0.22	12.74	12.96	30	Pass
CH165	5825	0.22	12.59	12.81	30	Pass
TX 802.11 ac20 Mode						
CH149	5745	0.22	12.45	12.67	30	Pass
CH157	5785	0.22	12.76	12.98	30	Pass
CH165	5825	0.22	12.67	12.89	30	Pass
TX 802.11 n40 Mode						
CH151	5755	0.61	11.71	12.32	30	Pass
CH159	5795	0.61	11.88	12.49	30	Pass
TX 802.11 ac40 Mode						
CH151	5755	0.61	12.76	13.37	30	Pass
CH159	5795	0.61	12.80	13.41	30	Pass
TX 802.11 ac80 Mode						
CH155	5775	0.38	11.63	12.01	30	Pass

4.5 Bandwidth &99% Occupy 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.: 22.9°C	Humid.: 39%RH
Test voltage:	DC 12V From Adapter	
Test results:	Pass	

Measurement Result

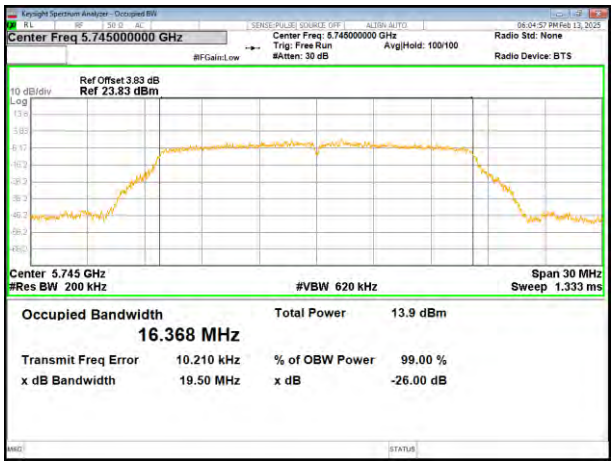
ANT2

Test CH	99% Occupy Bandwidth (MHz)						Result
	802.11a	802.11n (HT20)	802.11ac (HT20)	802.11n (HT40)	802.11ac (HT40)	802.11ac (HT80)	
Lowest	16.368	17.563	17.522	35.945	35.915	--	Pass
Middle	16.381	17.525	17.539	--	--	75.206	
Highest	16.409	17.546	17.545	35.956	35.970	--	

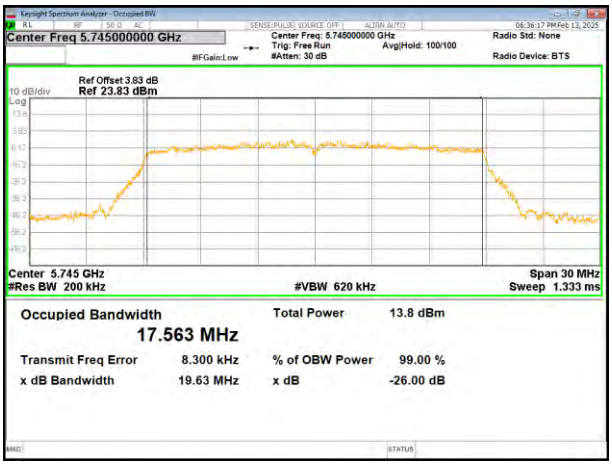
ANT2

Test plot 99% Occupy Bandwidth

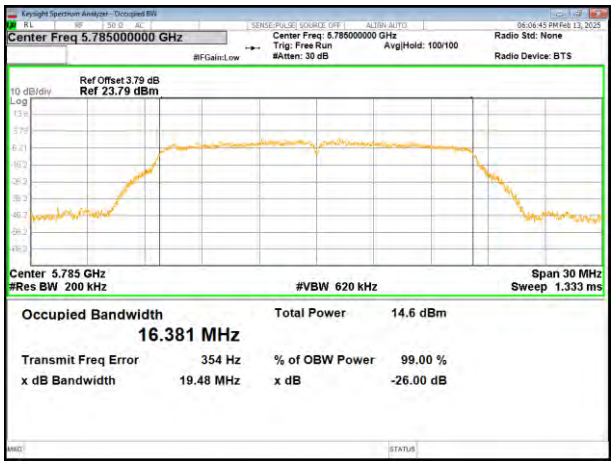
(802.11a) plot on channel 36



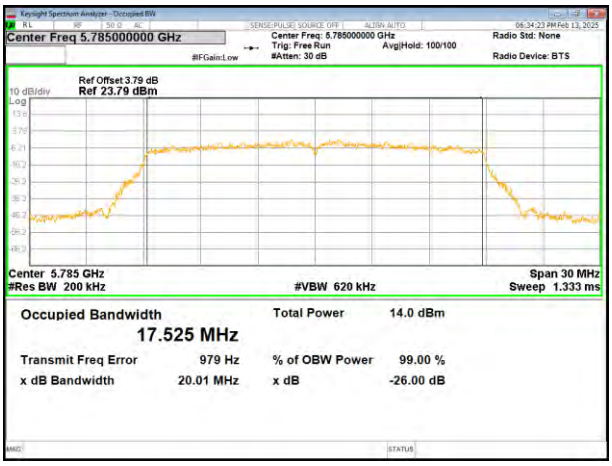
(802.11 n20) plot on channel 36



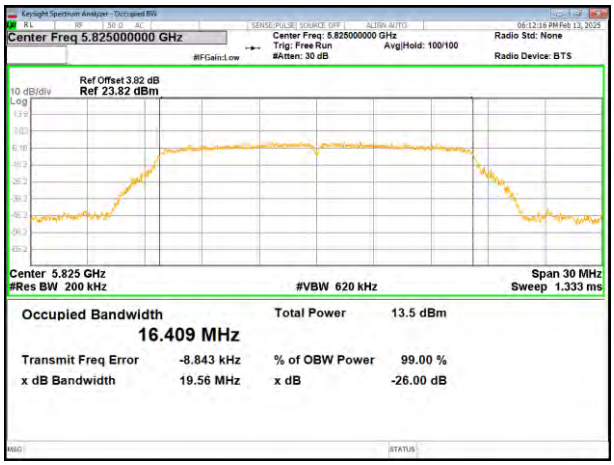
(802.11a) plot on channel 40



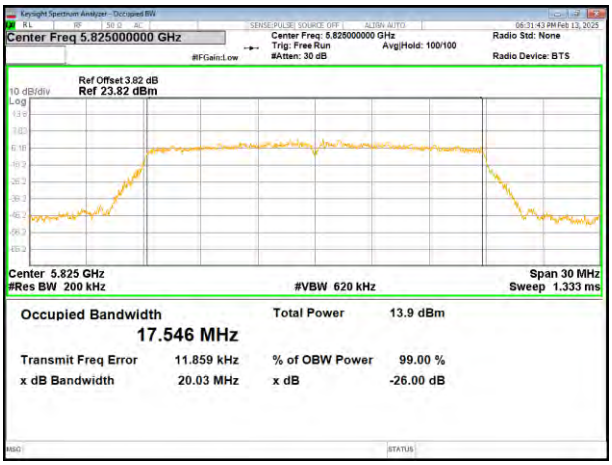
(802.11 n20) plot on channel 40



(802.11a) plot on channel 48

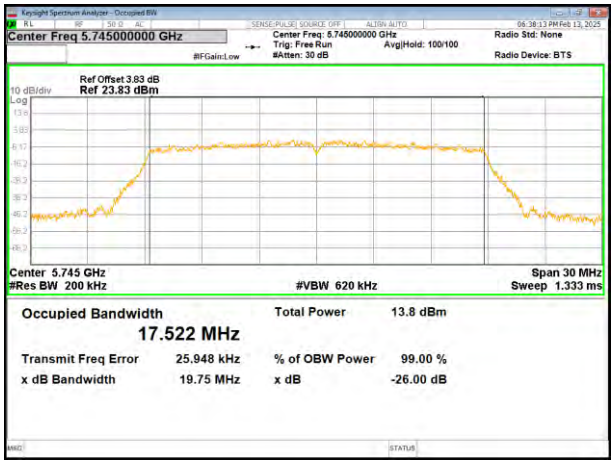


(802.11 n20) plot on channel 48

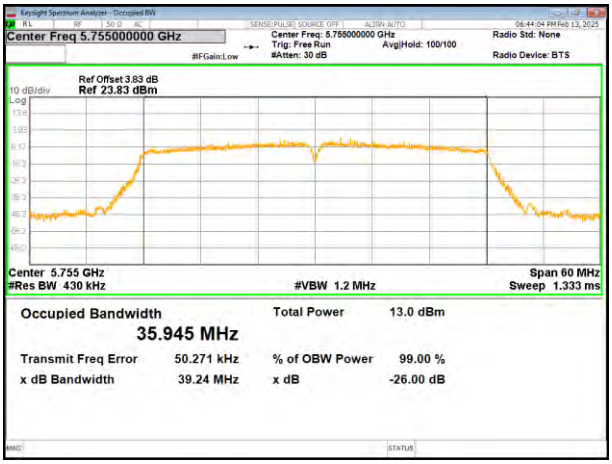


Test plot

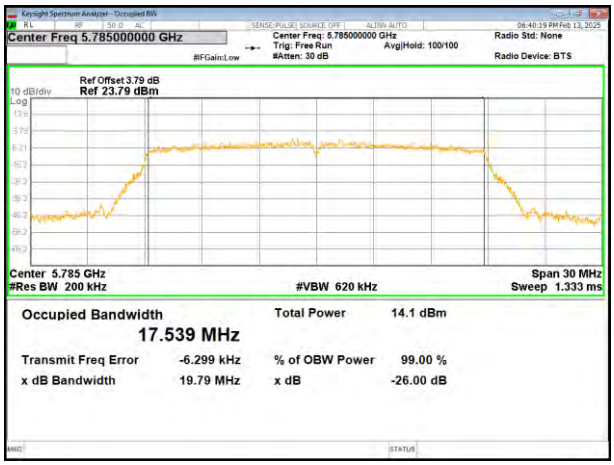
(802.11ac20) plot on channel 36



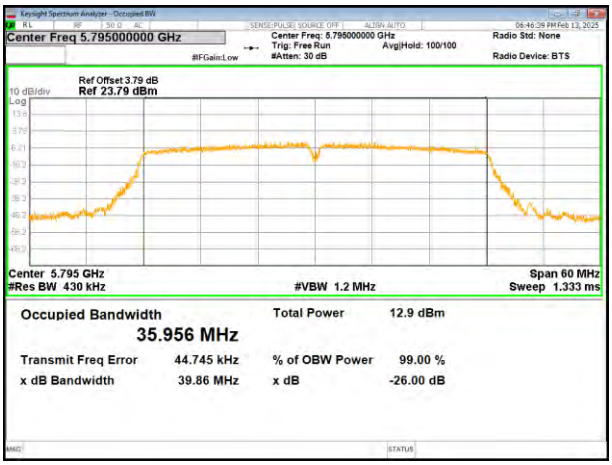
(802.11 n40) plot on channel 38



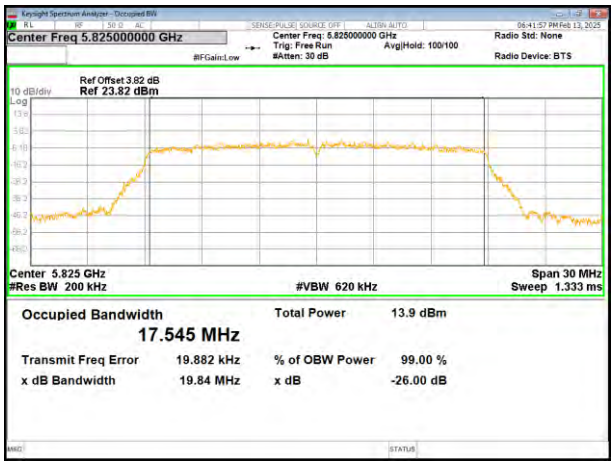
(802.11ac20) plot on channel 40



(802.11 n40) plot on channel 46

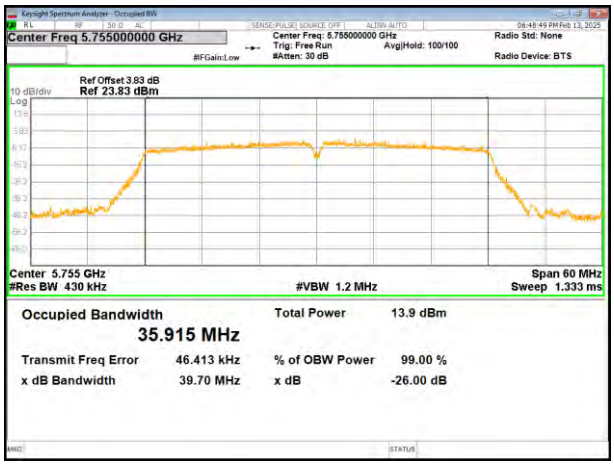


(802.11ac20) plot on channel 48

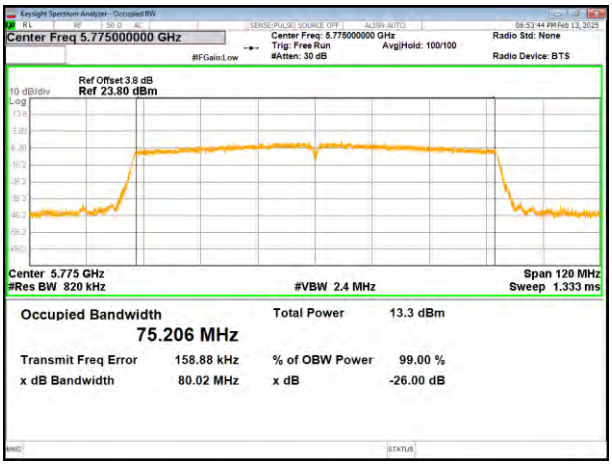


Test plot

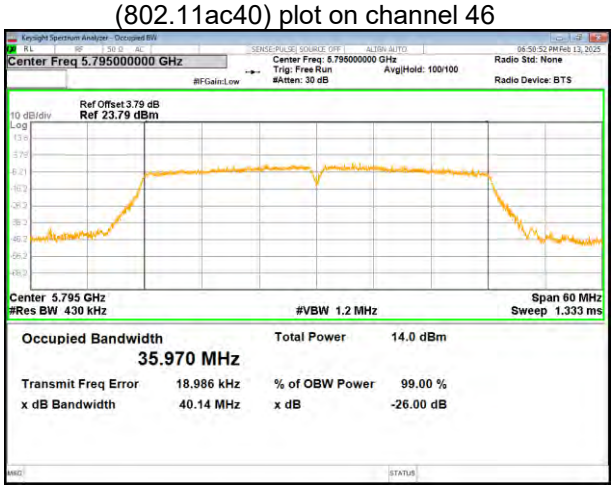
(802.11ac40) plot on channel 38



(802.11ac80) plot on channel 42



(802.11ac40) plot on channel 46



ANT2

5745-5825MHz

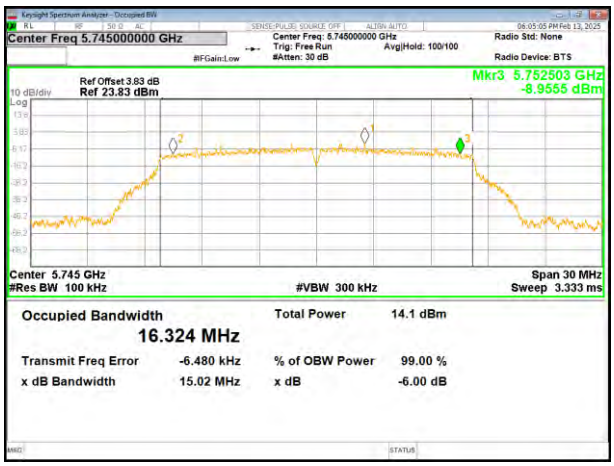
Test CH	-6dB Channel Bandwidth (MHz)						Limit (KHz)	Result
	802.11a	802.11n (HT20)	802.11ac (HT20)	802.11n (HT40)	802.11ac (HT40)	802.11ac (HT80)		
Lowest	15.02	15.10	16.55	35.07	35.08	--	>500	Pass
Middle	15.63	15.64	15.11	--	--	75.11		
Highest	14.83	16.66	15.13	35.11	35.08	--		

Remark: “---“is not applicable

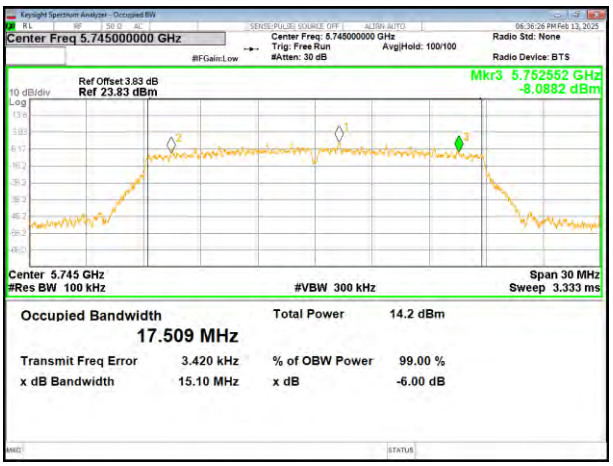
ANT2

Test plot

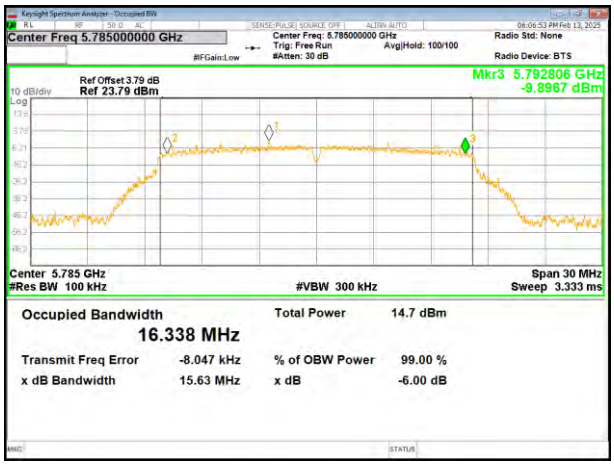
(802.11a) plot on channel 149



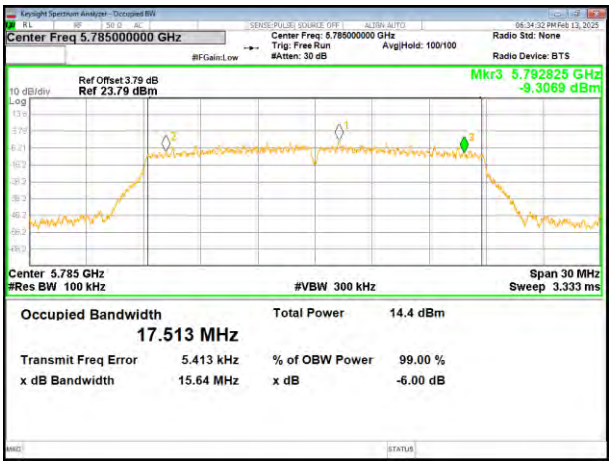
(802.11 n20) plot on channel 149



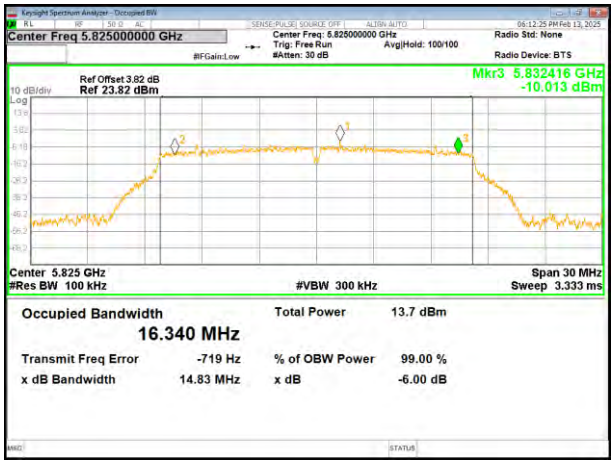
(802.11a) plot on channel 157



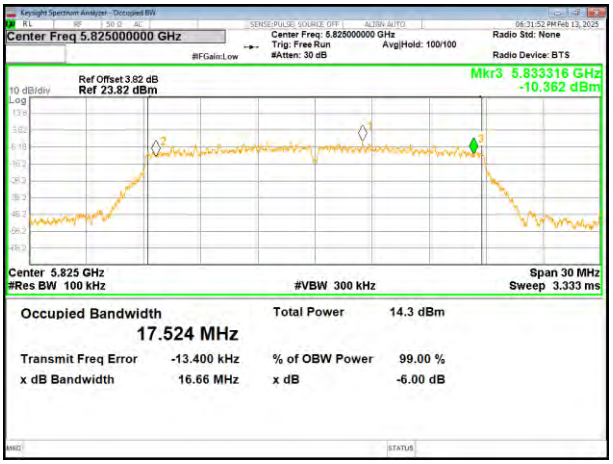
(802.11 n20) plot on channel 157



(802.11a) plot on channel 165

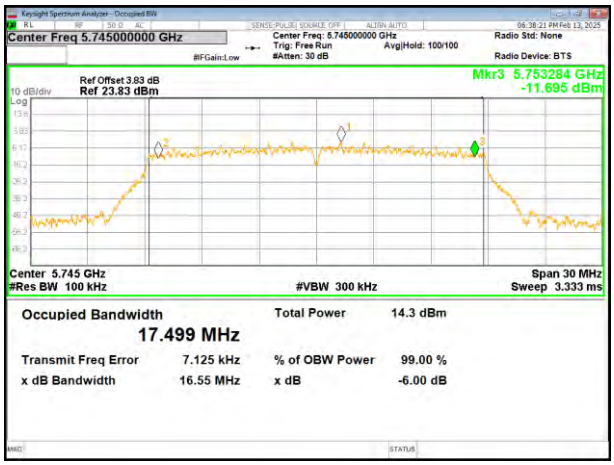


(802.11 n20) plot on channel 165

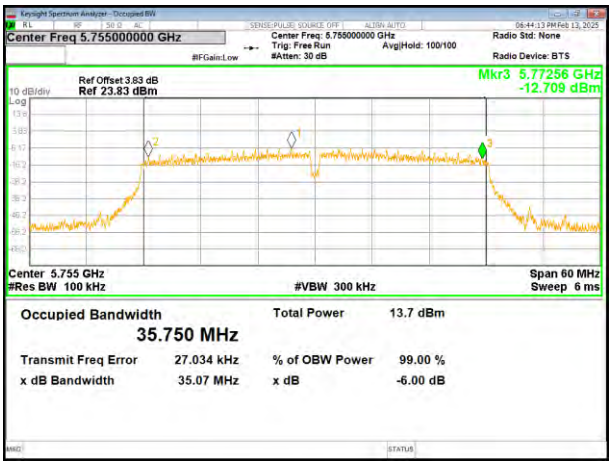


Test plot

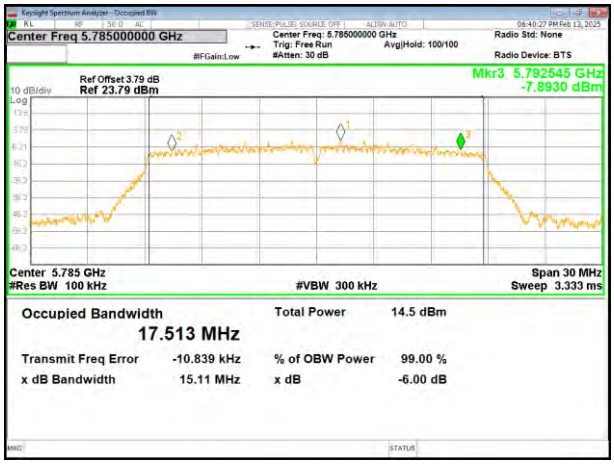
(802.11ac20) plot on channel 149



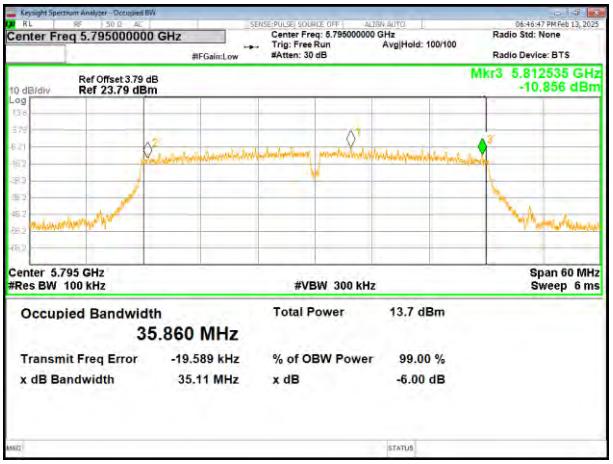
(802.11 n40) plot on channel 151



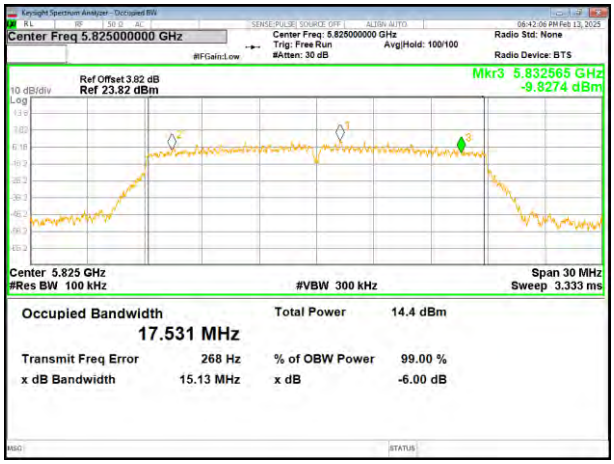
(802.11ac20) plot on channel 157



(802.11 n40) plot on channel 159

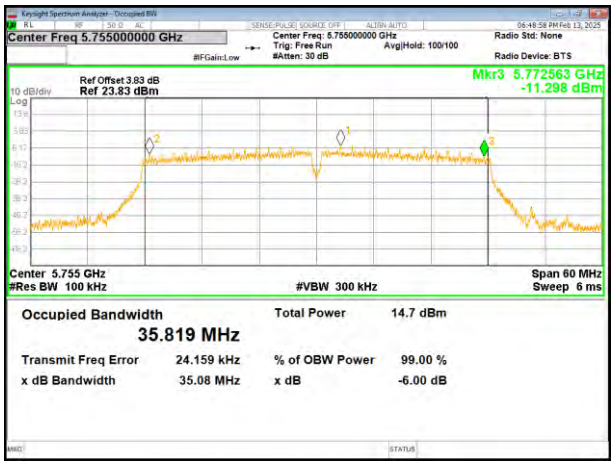


(802.11ac20) plot on channel 165

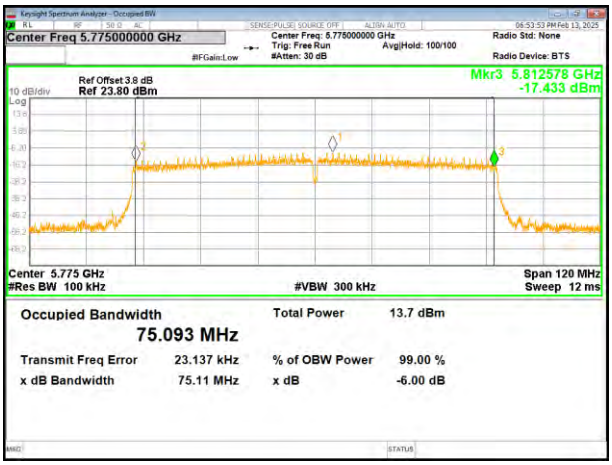


Test plot

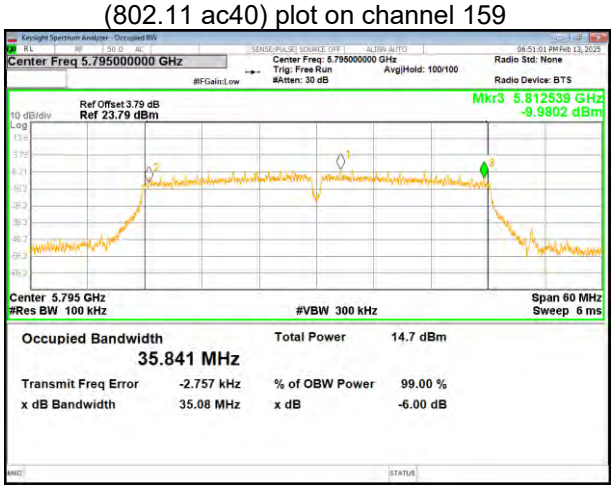
(802.11 ac40) plot on channel 151



(802.11 ac80) plot on channel 155



(802.11 ac40) plot on channel 159

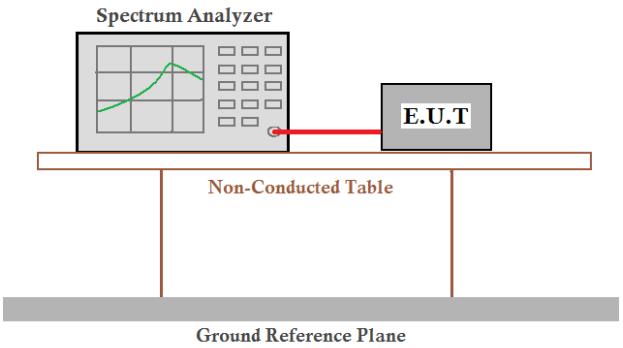


4.6 Power Spectral Density

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.: 22.9°C	Humid.: 39%RH
Test voltage:	DC 12V From Adapter	
Test results:	Pass	

Measurement Result ANT2

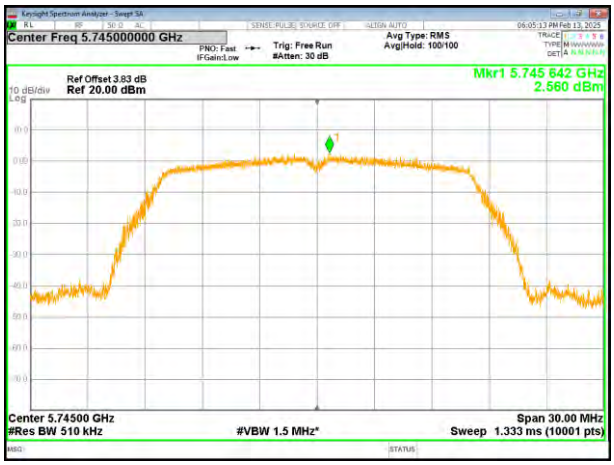
Mode	Frequency	Measured Power Density (dBm/510KHz)	Measured Power Density (dBm/500KHz)	Correction Factor (dB)	Total Measured Power Density (dBm/500KHz)	Limit (dBm/MHz)
802.11 a	5745 MHz	2.560	2.474	0.060	2.534	30
	5785 MHz	4.219	4.133	0.060	4.193	30
	5825 MHz	2.170	2.084	0.060	2.144	30
802.11 n20	5745 MHz	2.082	1.996	0.220	2.216	30
	5785 MHz	2.629	2.543	0.220	2.763	30
	5825 MHz	2.510	2.424	0.220	2.644	30
802.11ac20	5745 MHz	2.955	2.869	0.220	3.089	30
	5785 MHz	3.374	3.288	0.220	3.508	30
	5825 MHz	2.816	2.730	0.220	2.950	30
802.11 n40	5755 MHz	-1.187	-1.273	0.610	-0.663	30
	5795 MHz	-0.928	-1.014	0.610	-0.404	30
802.11ac40	5755 MHz	-0.360	-0.446	0.610	0.164	30
	5795 MHz	-0.561	-0.647	0.610	-0.037	30
802.11ac80	5775 MHz	-4.023	-4.109	0.380	-3.729	30

Note: 1. If the measurement is X dBm/510kHz, thus X dBm/510kHz = $(10^{X/10})$*(500 / 510) dBm/500kHz

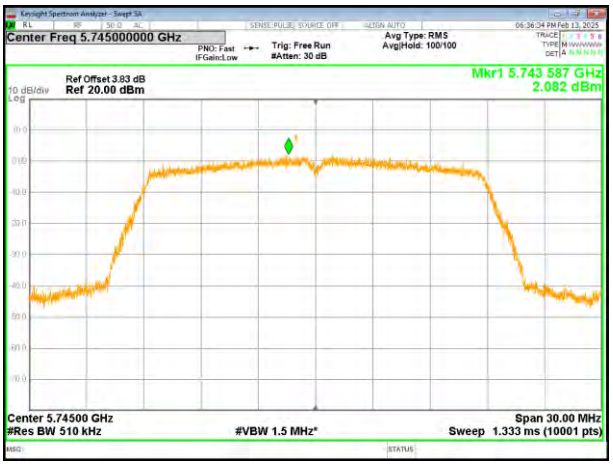
2. Correction Factor (dB)= duty cycle factor

ANT2

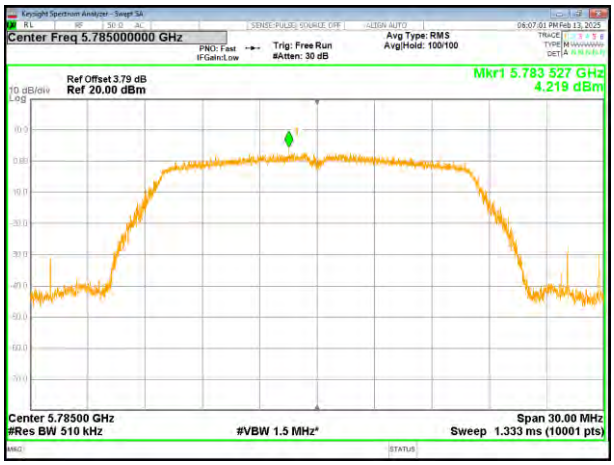
(802.11a) PSD plot on channel 149



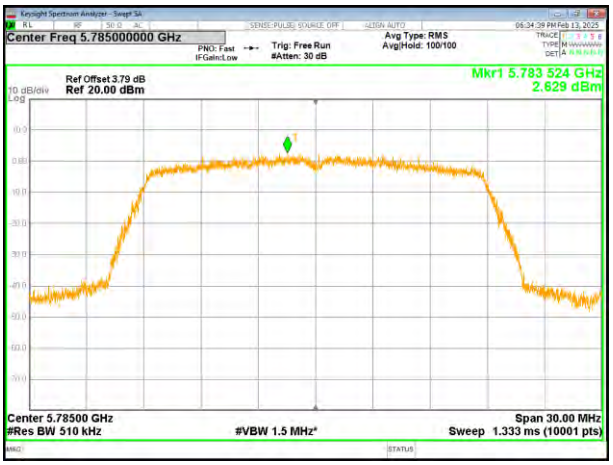
(802.11n20) PSD plot on channel 149



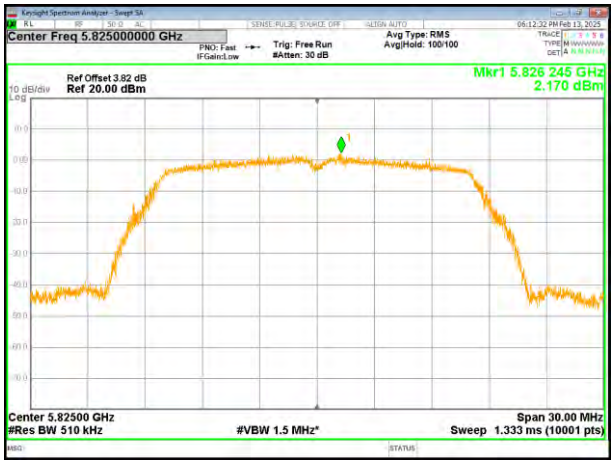
(802.11a) PSD plot on channel 157



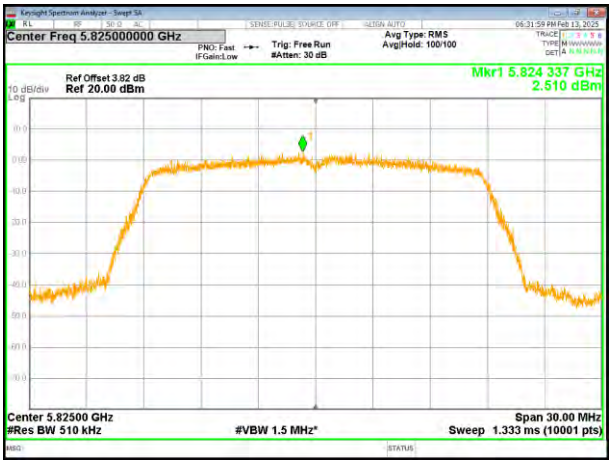
(802.11n20) PSD plot on channel 157



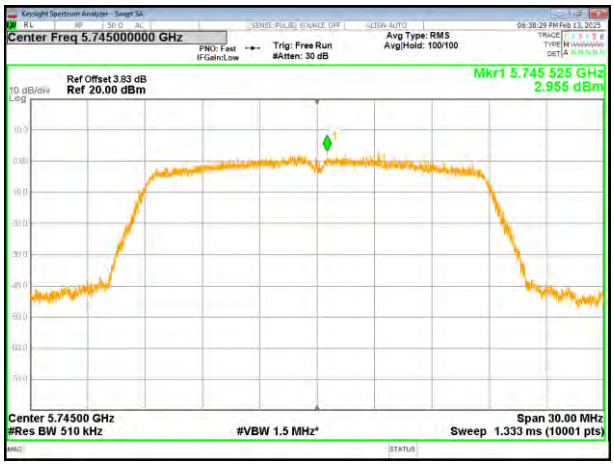
(802.11a) PSD plot on channel 165



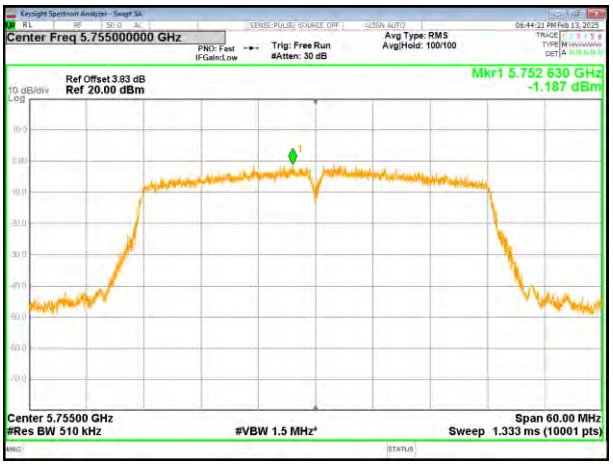
(802.11n20) PSD plot on channel 165



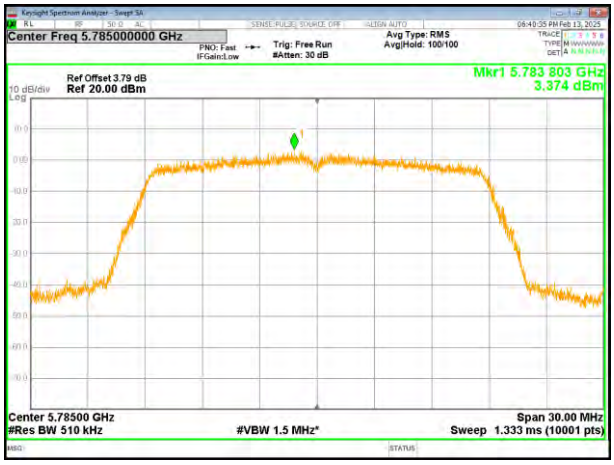
(802.11ac20) PSD plot on channel 149



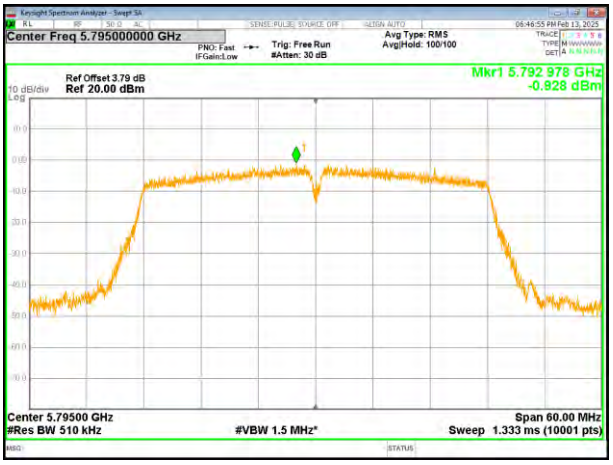
(802.11n40) PSD plot on channel 151



(802.11ac20) PSD plot on channel 157

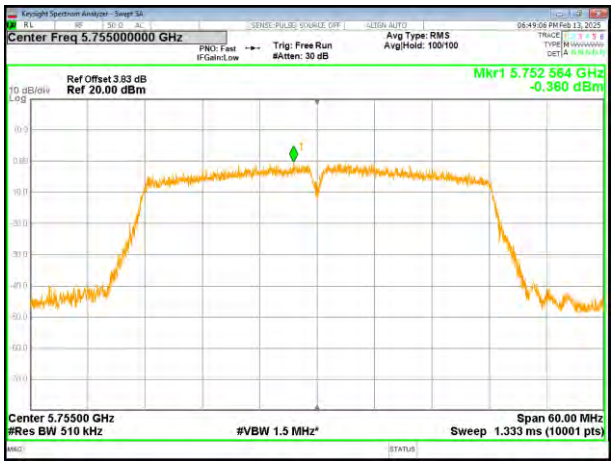


(802.11n40) PSD plot on channel 159



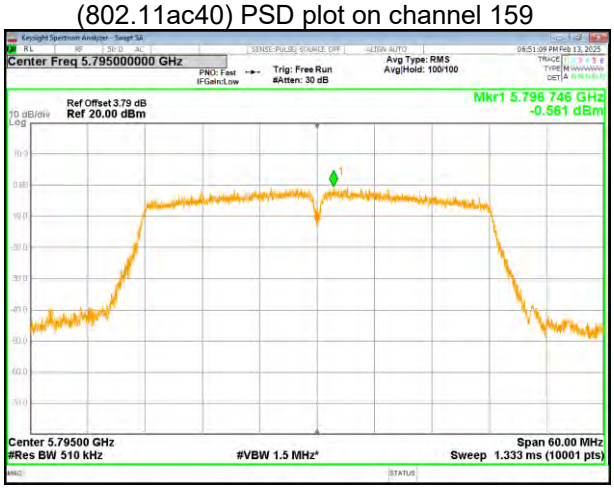
(802.11ac20) PSD plot on channel 165

(802.11ac40) PSD plot on channel 151



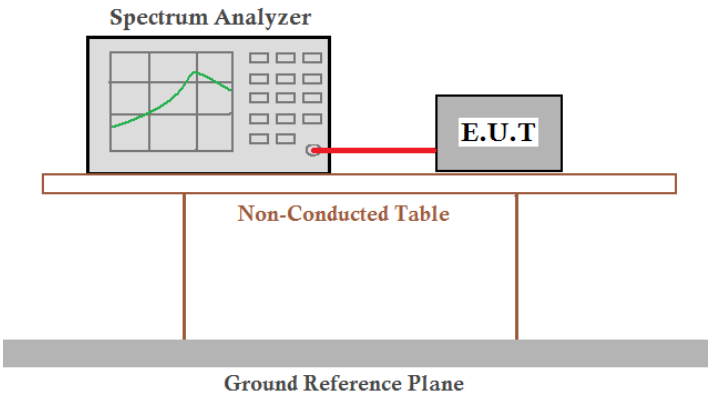
(802.11ac80) PSD plot on channel 155

(802.11ac40) PSD plot on channel 159



4.7 Band edge

4.7.1 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:		
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.: 22.9°C	Humid.: 39%RH
Test voltage:	DC 12V From Adapter	
Test results:	Pass	

Remark: Due to the margin value of the sideband test being greater than the antenna gain value, the test meets the requirements

ANT2

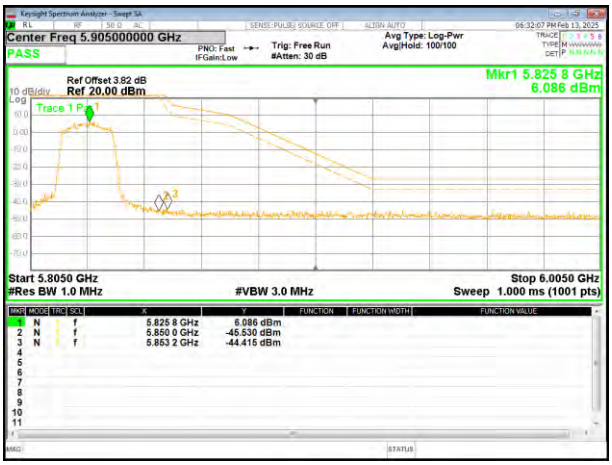
5.745~5.825 GHz

(802.11a) Band Edge, Left Side

(802.11n20) Band Edge, Left Side

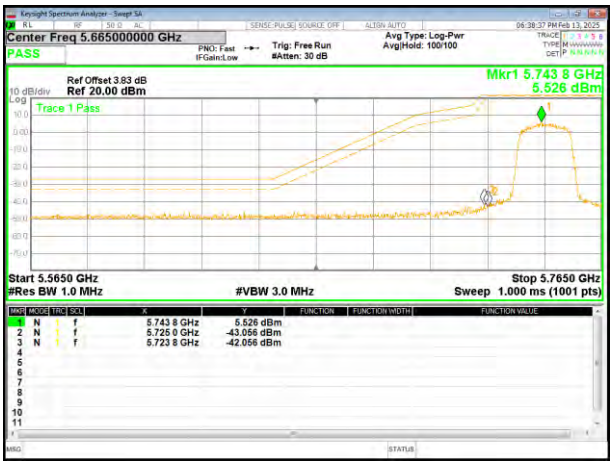
(802.11a) Band Edge, Right Side

(802.11n20) Band Edge, Right Side

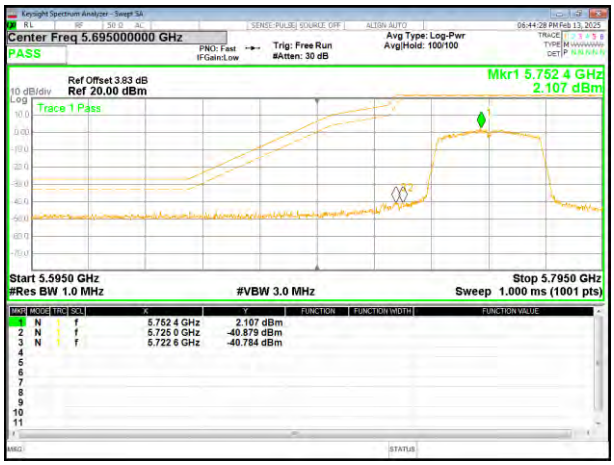


Remark: Antenna gain and cable loss data included in Offset.

(802.11ac20) Band Edge, Left Side

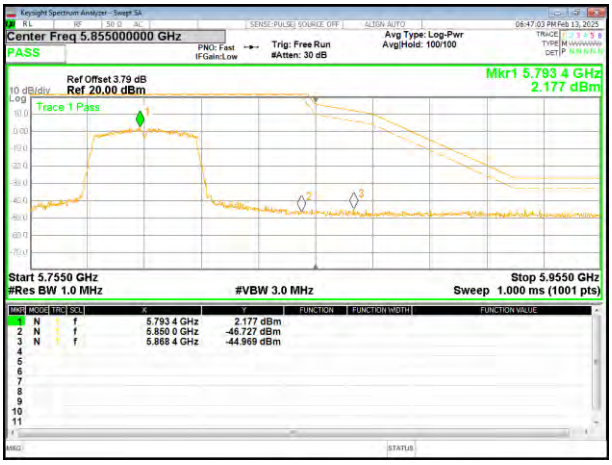


(802.11n40) Band Edge, Left Side



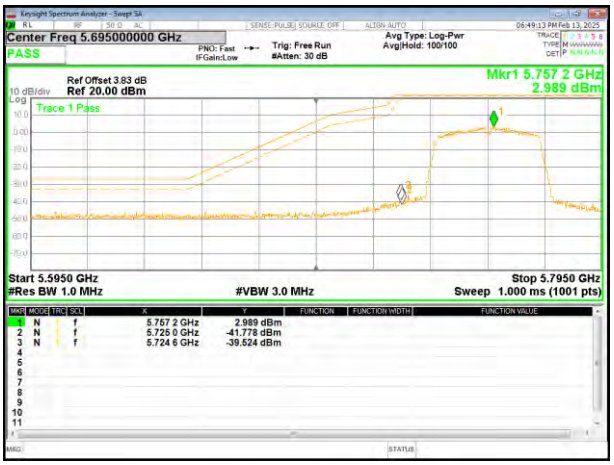
(802.11ac20) Band Edge, Right Side

(802.11n40) Band Edge, Right Side

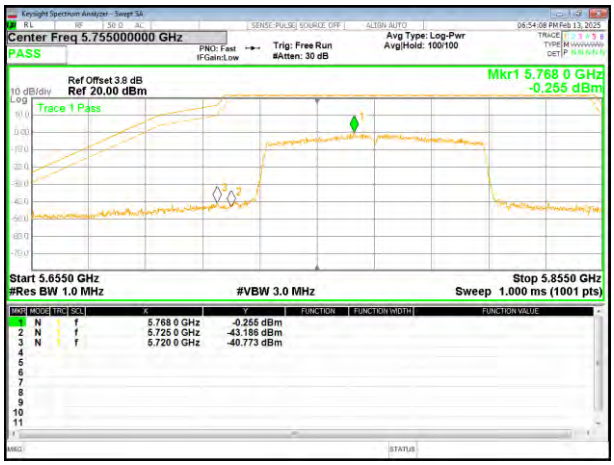


Remark: Antenna gain and cable loss data included in Offset.

(802.11ac40) Band Edge, Left Side



(802.11ac80) Band Edge



(802.11ac40) Band Edge, Right Side

Remark: Antenna gain and cable loss data included in Offset.

4.8 Spurious Emission

4.8.1 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

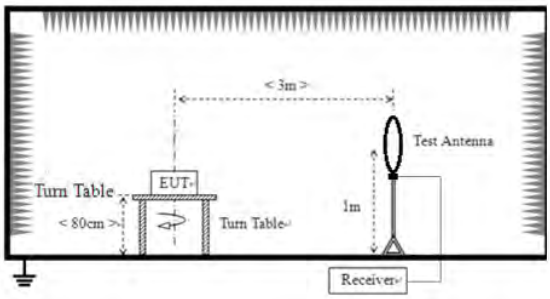
Limit:

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	

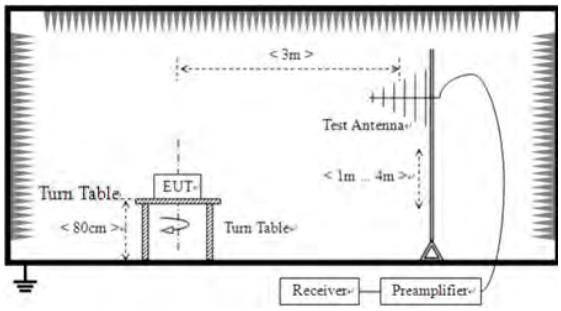
Frequency	Limit (dBm/MHz)	Remark
Above 1GHz	-27.0	Peak Value

Test setup:

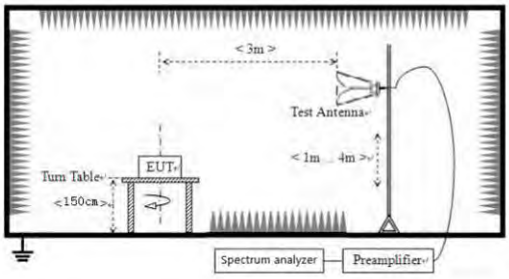
For radiated emissions from 9kHz to 30MHz



For radiated emissions from 30MHz to1GHz



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

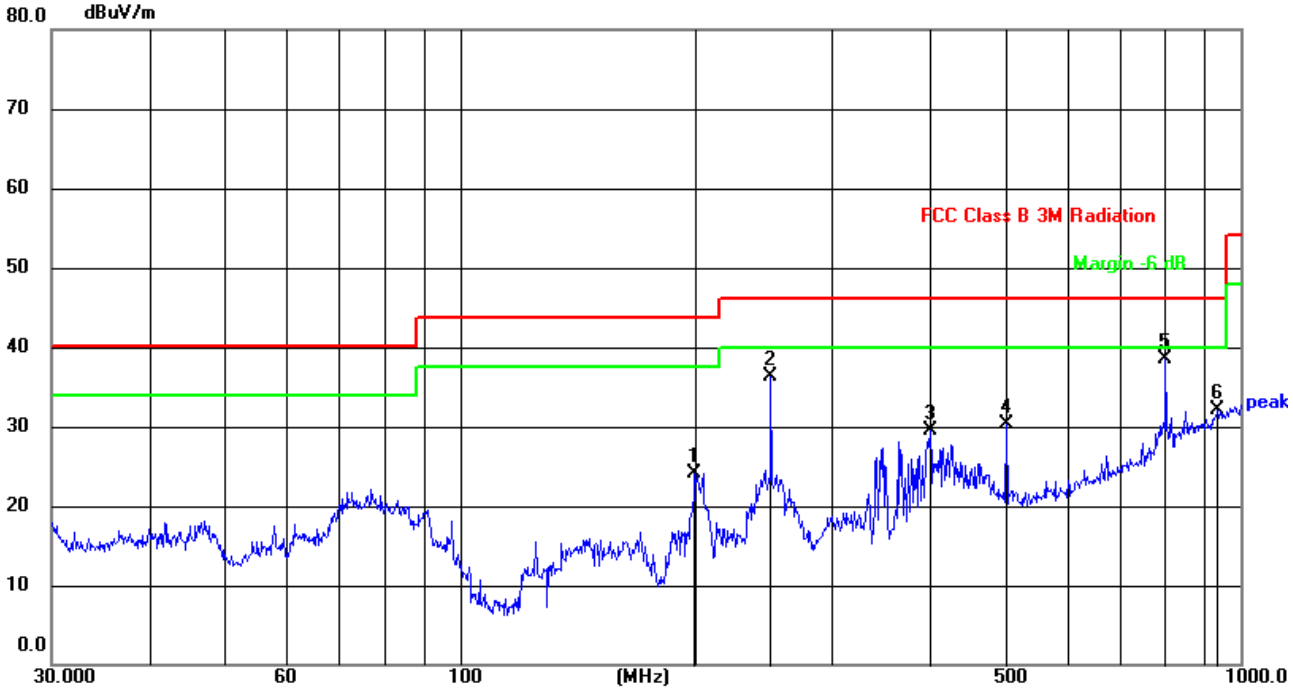
The emission from 9 kHz to 30MHz was pre-tested and found the result was 20dB lower than the limit, and according to 15.31(o) & RSS-Gen 6.13, the test result no need to reported.

Below 1GHz

Remark: The test data shows only the worst case 802.11a (5785MHz) of ANT2 mode.

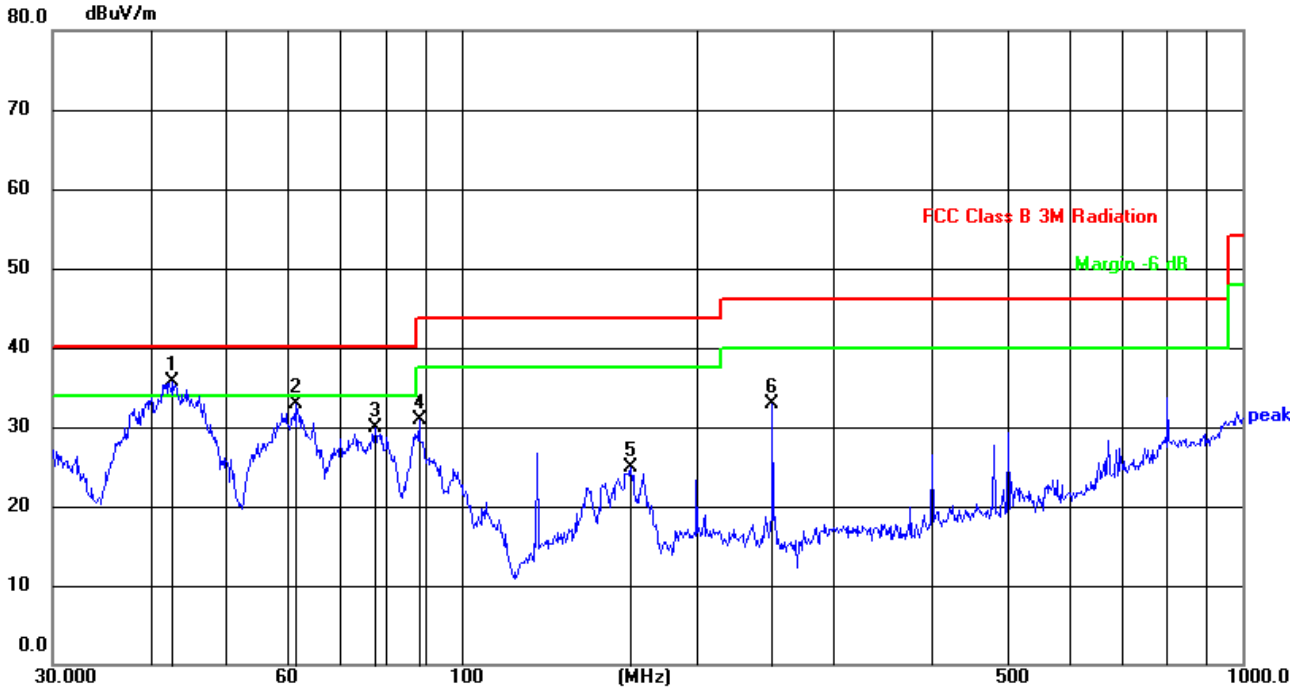
Temperature:	22.9℃	Relative Humidity:	39%
Pressure:	101.2kPar	Test Voltage :	DC 12V From Adapter
Test Mode :	5.8G TX- 802.11a (5785MHz)		

Horizontal:



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	199.9855	47.46	-23.38	24.08	43.50	-19.42	QP
2	250.3011	58.47	-22.25	36.22	46.00	-9.78	QP
3	400.4318	46.70	-17.28	29.42	46.00	-16.58	QP
4	501.1790	44.53	-14.17	30.36	46.00	-15.64	QP
5	801.7863	44.90	-6.49	38.41	46.00	-7.59	QP
6	935.5463	36.45	-4.29	32.16	46.00	-13.84	QP

Vertical:



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	42.7494	56.84	-21.08	35.76	40.00	-4.24	QP
2	61.5617	55.66	-22.79	32.87	40.00	-7.13	QP
3	77.5926	55.45	-25.62	29.83	40.00	-10.17	QP
4	88.3421	56.45	-25.52	30.93	43.50	-12.57	QP
5	164.9073	45.72	-20.76	24.96	43.50	-18.54	QP
6	250.3010	55.16	-22.25	32.91	46.00	-13.09	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 802.11a mode

Above 1GHz:

Remark: The test data shows only the worst case 802.11a mode.

Temperature:	22.9℃	Relative Humidity:	39%
Pressure:	101.2kPar	Test Voltage :	DC 12V From Adapter
Test Mode :	5.8G TX- 802.11a		

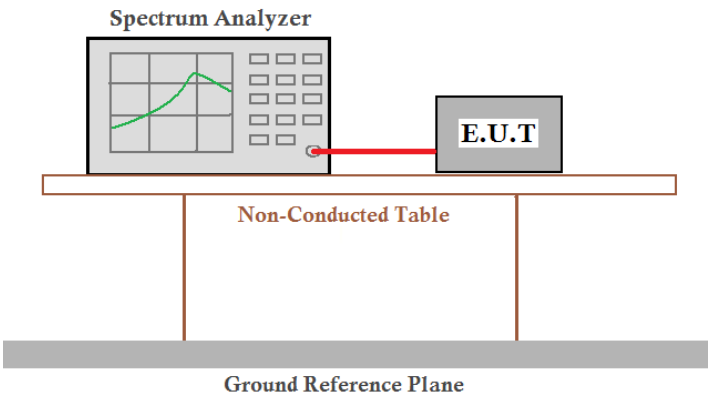
Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Pre-amplifier (dB)	Cable Loss (dB)	Antenn Factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Detector Typ
Low Channel:5745MHz									
V	11490.00	47.65	46.10	8.77	39.10	49.42	74.00	-24.58	PK
V	11490.00	35.58	46.10	8.77	39.10	37.35	54.00	-16.65	AV
V	17235.00	41.87	47.60	11.10	38.70	44.07	68.20	-24.13	PK
V	17235.00	34.26	47.60	11.10	38.70	36.46	54.00	-17.54	AV
V	22980.00	55.14	56.90	12.73	37.70	48.67	74.00	-25.33	PK
V	22980.00	42.13	56.90	12.73	37.70	35.66	54.00	-18.34	AV
V	28725.00	48.74	55.60	14.25	40.30	47.69	68.20	-20.51	PK
V	28725.00	42.11	55.60	14.25	40.30	41.06	54.00	-12.94	AV
V	34470.00	48.41	55.90	17.26	42.10	51.87	68.20	-16.33	PK
V	34470.00	40.56	55.90	17.26	42.10	44.02	54.00	-9.98	AV
H	11490.00	46.40	46.10	8.77	39.10	48.17	74.00	-25.83	PK
H	11490.00	35.27	46.10	8.77	39.10	37.04	54.00	-16.96	AV
H	17235.00	40.92	47.60	11.10	38.70	43.12	68.20	-25.08	PK
H	17235.00	34.54	47.60	11.10	38.70	36.74	54.00	-17.26	AV
H	22980.00	56.77	56.90	12.73	37.70	50.30	74.00	-23.70	PK
H	22980.00	47.13	56.90	12.73	37.70	40.66	54.00	-13.34	AV
H	28725.00	47.99	55.60	14.25	40.30	46.94	68.20	-21.26	PK
H	28725.00	42.48	55.60	14.25	40.30	41.43	54.00	-12.57	AV
H	34470.00	47.59	55.90	17.26	42.10	51.05	68.20	-17.15	PK
H	34470.00	40.79	55.90	17.26	42.10	44.25	54.00	-9.75	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)	Detector Type
Middle Channel:5785MHz									
V	11570.00	47.10	46.10	8.77	39.10	48.87	74.00	-25.13	PK
V	11570.00	35.77	46.10	8.77	39.10	37.54	54.00	-16.46	AV
V	17355.00	41.53	47.60	11.10	38.70	43.73	68.20	-24.47	PK
V	17355.00	35.95	47.60	11.10	38.70	38.15	54.00	-15.85	AV
V	23140.00	57.03	56.90	12.73	37.70	50.56	74.00	-23.44	PK
V	23140.00	46.09	56.90	12.73	37.70	39.62	54.00	-14.38	AV
V	28925.00	45.68	55.60	14.25	40.30	44.63	68.20	-23.57	PK
V	28925.00	41.76	55.60	14.25	40.30	40.71	54.00	-13.29	AV
V	34710.00	47.16	55.90	17.26	42.40	50.92	68.20	-17.28	PK
V	34710.00	41.12	55.90	17.26	42.40	44.88	54.00	-9.12	AV
H	11570.00	47.69	46.10	8.77	39.10	49.46	74.00	-24.54	PK
H	11570.00	36.66	46.10	8.77	39.10	38.43	54.00	-15.57	AV
H	17355.00	42.45	47.60	11.10	38.70	44.65	68.20	-23.55	PK
H	17355.00	35.70	47.60	11.10	38.70	37.90	54.00	-16.10	AV
H	23140.00	58.29	56.90	12.73	37.70	51.82	74.00	-22.18	PK
H	23140.00	46.93	56.90	12.73	37.70	40.46	54.00	-13.54	AV
H	28925.00	47.78	55.60	14.25	40.30	46.73	68.20	-21.47	PK
H	28925.00	41.42	55.60	14.25	40.30	40.37	54.00	-13.63	AV
H	34710.00	45.63	55.90	17.26	42.40	49.39	68.20	-18.81	PK
H	34710.00	41.03	55.90	17.26	42.40	44.79	54.00	-9.21	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)	Detector Type
High Channel:5825MHz									
V	11650.00	47.36	46.10	8.77	39.10	49.13	74.00	-24.87	PK
V	11650.00	35.58	46.10	8.77	39.10	37.35	54.00	-16.65	AV
V	17475.00	42.30	47.90	11.23	38.90	44.53	68.20	-23.67	PK
V	17475.00	37.33	47.90	11.23	38.90	39.56	54.00	-14.44	AV
V	23300.00	51.30	57.10	12.73	37.80	44.73	68.20	-23.47	PK
V	23300.00	46.17	57.10	12.73	37.80	39.60	54.00	-14.40	AV
V	29125.00	47.40	55.80	14.25	40.50	46.35	68.20	-21.85	PK
V	29125.00	42.62	55.80	14.25	40.50	41.57	54.00	-12.43	AV
V	34950.00	46.42	56.30	17.91	42.50	50.53	68.20	-17.67	PK
V	34950.00	40.76	56.30	17.91	42.50	44.87	54.00	-9.13	AV
H	11650.00	47.99	46.10	8.77	39.10	49.76	74.00	-24.24	PK
H	11650.00	34.21	46.10	8.77	39.10	35.98	54.00	-18.02	AV
H	17475.00	42.17	47.90	11.23	38.90	44.40	68.20	-23.80	PK
H	17475.00	37.09	47.90	11.23	38.90	39.32	54.00	-14.68	AV
H	23300.00	52.59	57.10	12.73	37.80	46.02	68.20	-22.18	PK
H	23300.00	46.93	57.10	12.73	37.80	40.36	54.00	-13.64	AV
H	29125.00	48.81	55.80	14.25	40.50	47.76	68.20	-20.44	PK
H	29125.00	42.68	55.80	14.25	40.50	41.63	54.00	-12.37	AV
H	34950.00	46.13	56.30	17.91	42.50	50.24	68.20	-17.96	PK
H	34950.00	40.60	56.30	17.91	42.50	44.71	54.00	-9.29	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.

4.8.2 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:		
Test Instruments:	Refer to section 3.0 for details	
Test mode:	Refer to section 2.2 for details	
Test environment:	Temp.: 22.9°C	Humid.: 39%RH
Test voltage:	DC 12V From Adapter	
Test results:	Pass	

Remark:

1. Antenna gain and cable loss data included in Offset.

2. We tested 30MHz-40GHz frequency and found 27GHz-40GHz test data was very lower (close to the noise of the spectrum analyzer). The test report only showed data for 30MHz-27GHz.

ANT2
5745-5825MHz

Test Plot

802.11a on channel 149

802.11a on channel 157

802.11a on channel 165

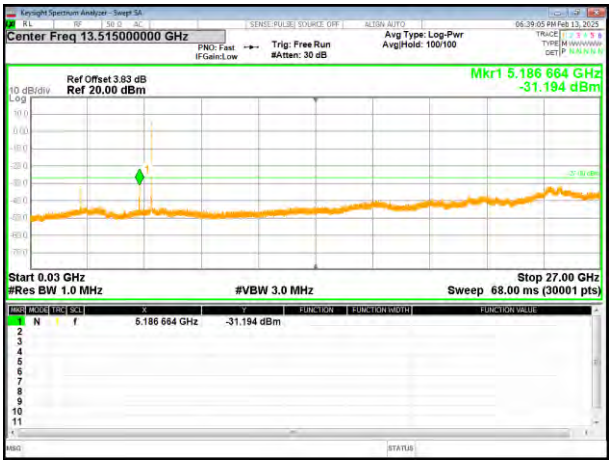
802.11n20 on channel 149

802.11n20 on channel 157

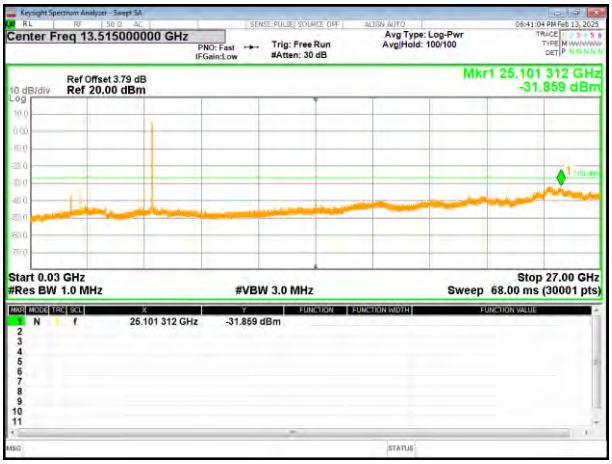
802.11n20 on channel 165

Test Plot

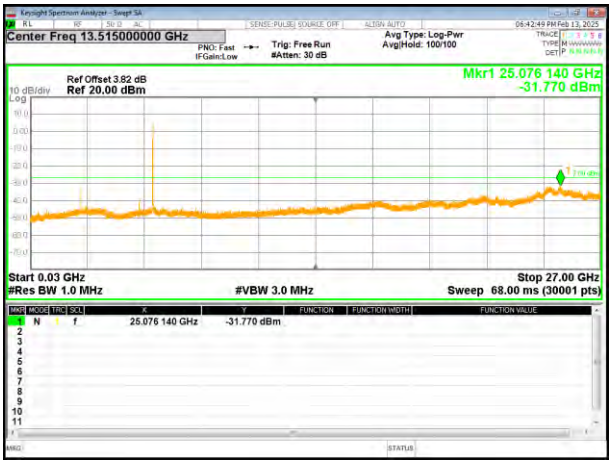
802.11ac20 on channel 149



802.11ac20 on channel 157



802.11ac20 on channel 165

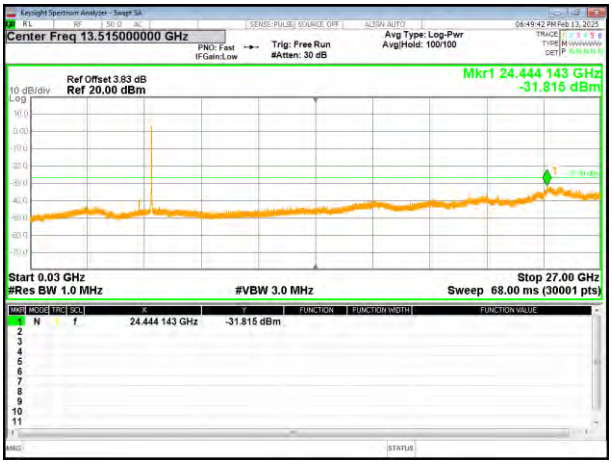


802.11n40 on channel 151

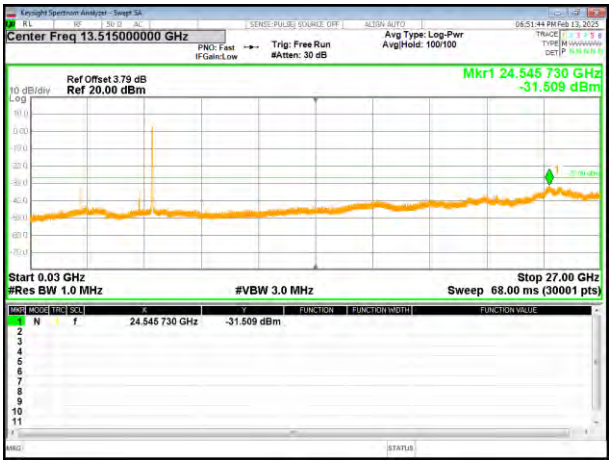
802.11n40 on channel 159

Test Plot

802.11ac40 on channel 151

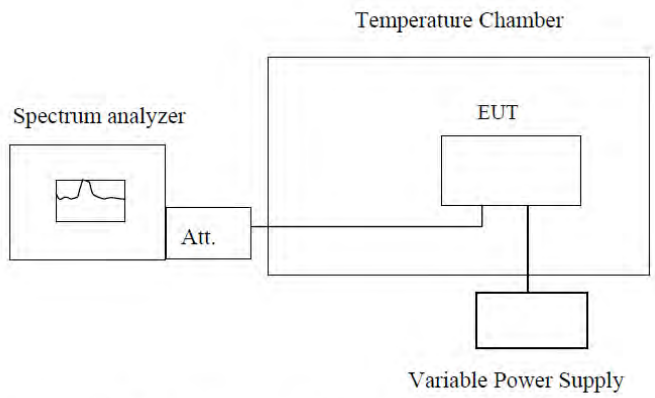


802.11ac40 on channel 159



802.11ac80 on channel 155

4.9 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	2 minute	5 minute	10 minute
		Measured Frequency (MHz)	Measured Frequency (MHz)	Measured Frequency (MHz)	Measured Frequency (MHz)
-30	5745	5745.022	5745.046	5744.989	5744.980
	5755	5755.040	5755.053	5755.006	5755.006
	5775	5775.039	5775.045	5775.007	5774.987
	5785	5785.042	5785.037	5784.989	5784.996
	5795	5795.053	5795.044	5795.007	5794.994
	5825	5825.034	5824.973	5825.004	5825.004
-20	5745	5745.022	5745.057	5744.984	5744.996
	5755	5755.040	5755.059	5755.009	5755.011
	5775	5775.039	5775.062	5774.990	5774.996
	5785	5785.042	5785.054	5784.999	5784.983
	5795	5795.049	5795.045	5794.997	5794.977
	5825	5825.034	5825.054	5825.007	5825.011
-10	5745	5745.043	5745.070	5745.000	5744.985
	5755	5755.059	5755.043	5755.014	5755.005
	5775	5775.044	5775.066	5774.999	5774.985
	5785	5785.031	5785.066	5784.986	5785.012
	5795	5795.025	5795.057	5794.980	5795.004
	5825	5825.059	5825.072	5825.014	5825.013
0	5745	5745.026	5745.046	5744.990	5744.985
	5755	5755.038	5755.053	5754.997	5754.975
	5775	5775.059	5775.045	5775.014	5774.986
	5785	5785.035	5785.037	5784.990	5784.993
	5795	5795.031	5795.044	5794.986	5795.011
	5825	5825.029	5824.973	5824.989	5825.003
10	5745	5745.023	5745.057	5744.984	5744.996
	5755	5755.040	5755.059	5755.009	5755.011
	5775	5775.039	5775.062	5774.990	5774.996
	5785	5785.042	5785.054	5784.999	5784.983
	5795	5795.052	5795.045	5794.997	5794.977
	5825	5825.034	5825.054	5825.007	5825.011
20	5745	5745.102	5745.047	5745.000	5744.616
	5755	5755.061	5755.054	5755.002	5755.000
	5775	5775.057	5775.071	5775.005	5775.001
	5785	5785.041	5785.047	5784.997	5785.004
	5795	5795.030	5795.043	5794.988	5794.987
	5825	5824.965	5825.045	5824.997	5824.983
30	5745	5745.023	5745.057	5744.984	5744.996
	5755	5755.040	5755.059	5755.009	5755.011
	5775	5775.039	5775.062	5774.990	5774.996
	5785	5785.042	5785.054	5784.999	5784.983
	5795	5795.052	5795.045	5794.997	5794.977
	5825	5825.034	5825.054	5825.007	5825.011
40	5745	5745.102	5745.047	5745.000	5744.616
	5755	5755.061	5755.054	5755.002	5755.000
	5775	5775.057	5775.071	5775.005	5775.001
	5785	5785.041	5785.047	5784.997	5785.004

	5795	5795.053	5795.044	5795.007	5794.994
	5825	5825.034	5824.973	5825.004	5825.004
50	5745	5745.026	5745.046	5744.990	5744.985
	5755	5755.038	5755.053	5754.997	5754.975
	5775	5775.059	5775.045	5775.014	5774.986
	5785	5785.035	5785.037	5784.990	5784.993
	5795	5795.031	5795.044	5794.986	5795.011
	5825	5825.029	5824.973	5824.989	5825.003

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)
DC 10.8V	5745	5745.027	5745.046	5744.989	5744.981
	5755	5755.054	5755.063	5754.996	5754.994
	5775	5775.035	5775.064	5774.988	5775.011
	5785	5785.044	5785.046	5784.980	5784.987
	5795	5795.042	5795.063	5794.987	5794.983
	5825	5825.052	5825.061	5824.916	5824.986
DC 12V	5745	5745.043	5745.071	5744.998	5744.985
	5755	5755.059	5755.043	5755.014	5755.005
	5775	5775.044	5775.066	5774.999	5774.985
	5785	5785.031	5785.066	5784.986	5785.012
	5795	5795.025	5795.057	5794.980	5795.004
	5825	5825.059	5825.072	5825.014	5825.013
DC 13.2V	5745	5745.033	5745.057	5744.983	5745.010
	5755	5755.042	5755.059	5755.006	5754.983
	5775	5775.059	5775.062	5775.007	5775.006
	5785	5785.035	5785.054	5784.989	5785.006
	5795	5795.031	5795.045	5795.006	5794.997
	5825	5825.034	5825.054	5825.004	5825.012

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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