TEST REPORT

Product Name:	OneScreen OPS LF Powered by Android
FCC ID:	2BEW9-OPSLFA
Trademark:	OneScreen
Model Number:	OPSLFA
Prepared For:	NZS Inc. DBA OneScreen
Address:	12335 World Trade Drive, Suite 9, San Diego, CA 92128
Manufacturer:	NZS Inc. DBA OneScreen
Address:	12335 World Trade Drive, Suite 9, San Diego, CA 92128
Name of Factory:	Guangdong Huazhuang Technology Co., Ltd
Address:	No. 1, Taoyuan 1st Road, Hengli Town, Dongguan City, Guangdong, P.R. China
Prepared By:	Shenzhen CTB Testing Technology Co., Ltd.
Address:	1&2/F., Building A, No.26, Xinhe Road, Xinqiao, Xinqiao Street, Bao'an District, Shenzhen, Guangdong, China
Sample Received Date:	Jan. 02, 2024
Sample tested Date:	Jan. 02, 2024 to Jan. 18, 2024
Issue Date:	Jan. 18, 2024
Report No.:	CTB240117016RF
Test Standards	47 CFR Part 15 Subpart E
Test Results	PASS
Remark:	This is WIFI-5GHz band radio test report.

Compiled by:	Reviewed by:	Approved by:
Zhou Kui	Arron Liu	Bin Mei / Director

Note: If there is any objection to the inspection results in this report, please submit a written report to the company within 15 days from the date of receiving the report. The test report is effective only with both signature and specialized stamp. This result(s) shown in this report refer only to the sample(s) tested. Without written approval of Shenzhen CTB Testing Technology Co., Ltd. this report can't be reproduced except in full. The tested sample(s) and the sample information are provided by the client. "*" indicates the testing items were fulfilled by subcontracted lab. "#" indicates the items are not in CNAS accreditation scope.

TABLE OF CONTENT

(Note: N/A means not applicable)

1. VERSION

Report No.	Issue Date	Description	Approved
CTB240117016RF	Jan. 18, 2024	Original	Valid

2. TEST SUMMARY

The Product has been tested according to the following specifications:

Test Item	Test Requirement	Test method	Result
AC Power Line Conducted Emission	47 CFR Part 15 Subpart E Section 15.407 (b)(6)	ANSI C63.10-2013	PASS
Radiated Spurious emissions	47 CFR Part 15 Subpart E Section 15.205/15.407(b)	KDB789033	PASS
Band edge	47 CFR Part 15 Subpart E Section 15.205/15.407(b)	KDB789033	PASS
Conducted Peak Output Power	47 CFR Part 15 Subpart E Section 15.407 (a)	KDB789033	PASS
Emission Bandwidth & Occupied Bandwidth	47 CFR Part 15 Subpart E Section 15.407 (a)(e)	KDB789033	PASS
Power Spectral Density	47 CFR Part 15 Subpart E Section 15.407 (a)	KDB789033	PASS
Frequency stability	47 CFR Part 15 Subpart E Section 15.407 (g)	KDB789033	PASS
Operation in the absence of information to the transmit	47 CFR Part 15 Subpart E Section 15.407 (b)	47 CFR Part 15 Subpart E	PASS
Antenna Requirement	47 CFR Part 15 Subpart E Section 15.203	/	PASS

Remark:
Test according to ANSI C63.10-2013.

3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the Product as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

Item	Uncertainty
Occupancy bandwidth	U=±54.3Hz
Adjacent channel power	U=±1.3dB
Conducted Adjacent channel power	U=±1.38dB
Conducted output power Above 1G	U=±1.0dB
Conducted output power below 1G	U=±0.9dB
Power Spectral Density , Conduction	U=±1.0dB
Conduction spurious emissions	U=±2.8dB
Out of band emission	U=±54Hz
3m camber Radiated spurious emission(9KHz-30MHz)	U=±4.8dB
3m camber Radiated spurious emission(30MHz-1GHz)	U=±4.3dB
3m chamber Radiated spurious emission(1GHz-18GHz)	U=±4.5dB
3m chamber Radiated spurious emission(18GHz-40GHz)	U=±3.4dB
humidity uncertainty	U=±5.3%
Temperature uncertainty	U=±0.59℃
Supply voltages	U=±3%
Time	U=±5%
Conducted emission(150K-30MHz)	3.2dB

4. PRODUCT INFORMATION AND TEST SETUP

4.1 Product Information

Model(s):	OPSLFA
Model Description:	N/A
Wi-Fi Specification:	IEEE 802.11a/n/ac
Hardware Version:	V1.0
Software Version:	V1.0
Operation Frequency:	IEEE 802.11a/n/ac(20M): 5150MHz ~5250MHz/ 4 channel IEEE 802.11n/ac(40M): 5150MHz ~5250MHz/ 2 channel IEEE 802.11ac(80M): 5150MHz ~5250MHz/ 1 channel IEEE 802.11a/n/ac(20M): 5250MHz ~5350 MHz/ 4 channel IEEE802.11n/ac(40M): 5250MHz ~5350 MHz/ 2 channel IEEE802.11ac(80M): 5250MHz ~5350 MHz/ 1 channel
Max. RF output power:	WiFi (5G): 15.739dBm
Type of Modulation:	WiFi (5G): OFDM
Antenna installation:	WiFi (5G): Glue stick antenna
Antenna Gain:	WiFi (5.2G): ANT1: 4.04dBi ANT2: 4.04dBi WiFi (5.3G): ANT1: 4.21dBi ANT2: 4.21dBi
Ratings:	DC 12-19V by DC power

4.2 Test Setup Configuration

See test photographs attached in EUT TEST SETUP PHOTOGRAPHS for the actual connections between Product and support equipment.

4.3 Support Equipment

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Note
1	DC power	LONGWEI	TPR-12002D	N/A	N/A

Notes:

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

4.4 Channel List

For 802.11a/n/ac(20M) Operation in the 5150MHz ~5250 MHz band			
Channel	Frequency	Channel	Frequency
36	5180MHz	44	5220MHz
40	5200MHz	48	5240MHz
For 802.11a/n/ac(20M) Operation in the 5250MHz ~5350 MHz band			
Channel	Frequency	Channel	Frequency
52	5260MHz	60	5300MHz
56	5280MHz	64	5320MHz

For 802.11n/ac(40M) Operation in the 5150MHz ~5250 MHz band			
Channel	Frequency	Channel	Frequency
38	5190MHz	46	5230MHz
For 802.11n/ac(40M) Operation in the 5250MHz ~5350 MHz band			
Channel	Frequency	Channel	Frequency
54	5270MHz	62	5310MHz

For 802.11ac(80M) Operation in the 5150MHz ~5250 MHz band			
Channel	Frequency	Channel	Frequency
42	5210MHz	NA	NA
For 802.11ac(80M) Operation in the 5250MHz ~5350 MHz band			
Channel	Frequency	Channel	Frequency
58	5290MHz	NA	NA

NOTE: Dutycycle>98%.

Test mode	rate
802.11a	54M
802.11n	500M
802.11/ac	500M

4.5 Test Mode

All test mode(s) and condition(s) mentioned were considered and evaluated respectively by performing full tests, the worst data were recorded and reported.

Test Mode	Tx/Rx	RF Channel		
		Low(L)	Middle(M)	High(H)
802.11a/n/ac(20M)	5150MHz ~5250 MHz	Channel 36	Channel 40	Channel 48
		5180MHz	5200MHz	5240MHz
802.11n/ac(40M)		Channel 38	N/A	Channel 46
		5190MHz	N/A	5230MHz
802.11ac(80M)		N/A	Channel 42	N/A
		N/A	5210MHz	N/A
802.11a/n/ac(20M)	5250MHz ~5350 MHz	Channel 52	Channel 56	Channel 64
		5260MHz	5280MHz	5320MHz
802.11n/ac(40M)		Channel 54	N/A	Channel 62
		5270MHz	N/A	5310MHz
802.11ac(80M)		N/A	Channel 58	N/A
		N/A	5290MHz	N/A

4.6 Test Environment

Humidity(%):	54
Atmospheric Pressure(kPa):	101
Normal Voltage(DC):	12V
Normal Temperature(℃):NT	23
Low Temperature(℃):LT	0
High Temperature(℃):HT	40

5. TEST FACILITY AND TEST INSTRUMENT USED

5.1 Test Facility

All measurement facilities used to collect the measurement data are located at 1&2F., Building A, No. 26, Xinhe Road, Xinqiao, Xinqiao Street, Bao'an District, Shenzhen, Guangdong, China. The site and apparatus are constructed in conformance with the requirements of ANSI C63.4 and CISPR 16-1-1 other equivalent standards.

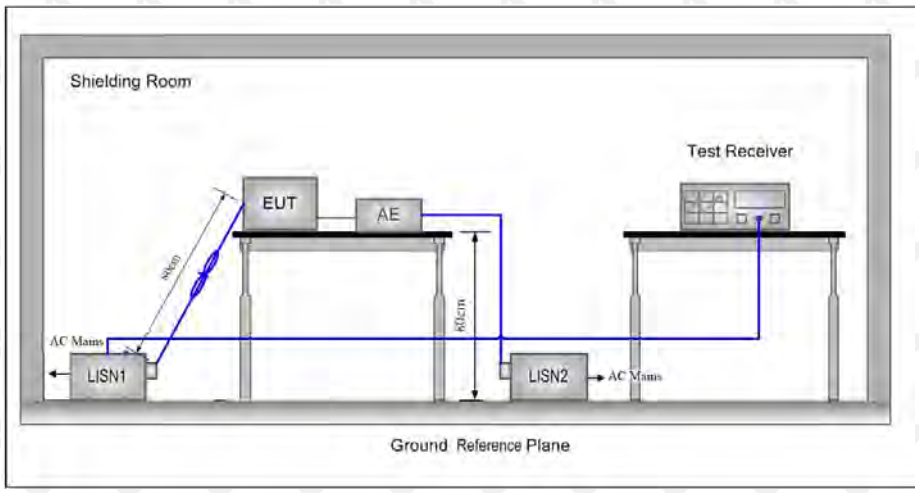
5.2 Test Instrument Used

Item	Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	Agilent	N9020A	MY52090073	2024.07.05
2	Power Sensor	Agilent	U2021XA	MY56120032	2024.07.05
3	Power Sensor	Agilent	U2021XA	MY56120034	2024.07.05
4	Communication test set	R&S	CMW500	108058	2024.07.05
5	Spectrum Analyzer	KEYSIGHT	N9020A	MY51289897	2024.07.05
6	Signal Generator	Agilent	N5181A	MY50140365	2024.07.05
7	Vector signal generator	Agilent	N5182A	MY47420195	2024.07.05
8	Communication test set	Agilent	E5515C	MY50102567	2024.07.06
9	2.4 GHz Filter	Shenxiang	MSF2400-2483.5MS-1154	20181015001	2024.07.05
10	5 GHz Filter	Shenxiang	MSF5150-5850 MS-1155	20181015001	2024.07.06
11	Filter	Xingbo	XBLBQ-DZA120	190821-1-1	2024.07.06
12	BT&WI-FI Automatic test software	Micowave	MTS8000	Ver. 2.0.0.0	/
13	Rohde & Schwarz SFU Broadcast Test System	R&S	SFU	101017	2024.10.30
14	Temperature humidity chamber	Hongjing	TH-80CH	DG-15174	2024.07.05
15	234G Automatic test software	Micowave	MTS8200	Ver. 2.0.0.0	/
16	966 chamber	C.R.T.	966	/	2024.08.11
17	Receiver	R&S	ESPI	100362	2024.07.05
18	Amplifier	HP	8447E	2945A02747	2024.07.05
19	Amplifier	Agilent	8449B	3008A01838	2024.07.05
20	TRILOG Broadband Antenna	Schwarzbeck	VULB 9168	00869	2024.07.08

21	Double Ridged Broadband Horn Antenna	Schwarzbeck	BBHA9120D	01911	2024.07.08
22	EMI test software	Fala	EZ-EMC	FA-03A2 RE	/
23	Loop Antenna	Schwarzbeck	FMZB 1519B	1519B-224	2024.07.08
24	loop antenna	ZHINAN	ZN30900A	GTS534	/
25	40G Horn antenna	A/H/System	SAS-574	588	2024.10.30
26	Amplifier	AEROFLEX	Aeroflex	097	2024.07.05

6. AC POWER LINE CONDUCTED EMISSION

6.1 Block Diagram Of Test Setup



6.2 Limit

Table 4 – AC power-line conducted emissions limits

Frequency (MHz)	Conducted limit (dBµV)	
	Quasi-peak	Average
0.15 - 0.5	66 to 56[Note 1]	56 to 46[Note 1]
0.5 – 5	56	46
5 – 30	60	50

Note 1: The level decreases linearly with the logarithm of the frequency.

* Decreasing linearly with the logarithm of the frequency

6.3 Test procedure

1) The mains terminal disturbance voltage test was conducted in a shielded room.

2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50Ω/50µH + 5Ω linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.

3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane,

4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0,4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0,8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane.

This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0,8 m from the LISN 2.

5) 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 on conducted measurement.

6.4 Test Result

N/A

NOTE: This EUT is powered by DC power only, this test item is not applicable.

7. RADIATED SPURIOUS EMISSIONS

7.1 Block Diagram Of Test Setup

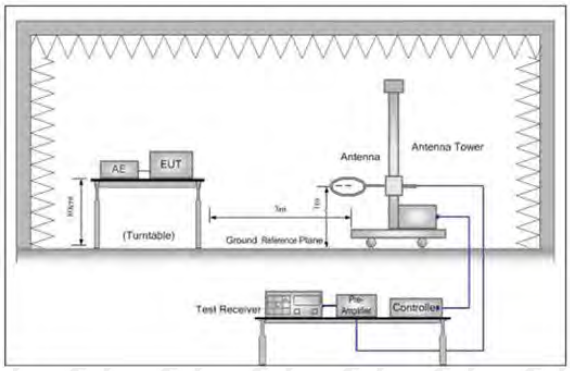


Figure 1. Below 30MHz

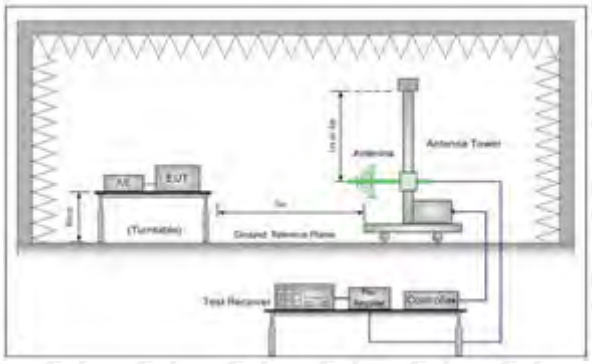


Figure 2. 30MHz to 1GHz

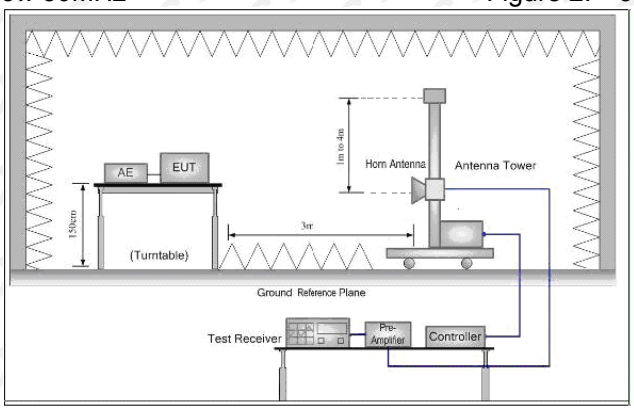


Figure 3. Above 1GHz

7.2 Limit

Spurious Emissions:

Frequency	Field strength (dBμV/m)	Remark	Measurement distance (m)
0.009MHz-0.490MHz	20log 2400/F (kHz) + 80	Quasi-peak	3
0.490MHz-1.705MHz	20log 24000/F (kHz) + 40	Quasi-peak	3
1.705MHz-30MHz	20log 30 + 40	Quasi-peak	3
30MHz-88MHz	40.0	Quasi-peak	3
88MHz-216MHz	43.5	Quasi-peak	3
216MHz-960MHz	46.0	Quasi-peak	3
960MHz-1GHz	54.0	Quasi-peak	3
Above 1GHz	54.0	Average	3

Note: 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.

If radiated measurements are performed, field strength is then converted to EIRP as follows:
(i) EIRP = ((E*d)^2) / 30
where:
• E is the field strength in V/m;
• d is the measurement distance in meters;
• EIRP is the equivalent isotropically radiated power in watts.
(ii) Working in dB units, the above equation is equivalent to:
EIRP[dBm] = E[dBμV/m] + 20 log(d[meters]) - 104.77
(iii) Or, if d is 3 meters:
EIRP[dBm] = E[dBμV/m] - 95.2

7.3 Test procedure

Below 1GHz test procedure as below:
a.The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.
b.The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
c.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.
d.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 (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rota table table was turned from 0 degrees to 360 degrees to find the maximum reading.
e.The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
f.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.
Above 1GHz test procedure as below:
g.Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber and change form table 0.8 meter to 1.5 meter(Above 18GHz the distance is 1 meter and table is 1.5 meter).
h.Test the EUT in the lowest channel ,the middle channel ,the Highest channel
j.Repeat above procedures until all frequencies measured was complete.

Receiver set:

Frequency	Detector	RBW	VBW	Remark
0.009MHz-0.090MHz	Peak	10kHz	30KHz	Peak
0.009MHz-0.090MHz	Average	10kHz	30KHz	Average
0.090MHz-0.110MHz	Quasi-peak	10kHz	30KHz	Quasi-peak
0.110MHz-0.490MHz	Peak	10kHz	30KHz	Peak
0.110MHz-0.490MHz	Average	10kHz	30KHz	Average
0.490MHz -30MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
30MHz-1GHz	Quasi-peak	120 kHz	300KHz	Quasi-peak
Above 1GHz	Peak	1MHz	3MHz	Peak
	Peak	1MHz	10Hz	Average

7.4 Test Result

30MHz-1GHzTest Results:
Modulation : 802.11a (the worst data)
Test Channel : 5780MHz
Antenna polarity: H

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector
1		44.9004	29.55	-5.69	23.86	40.00	-16.14	QP
2		98.8324	35.24	-9.03	26.21	43.50	-17.29	QP
3	*	147.9214	34.12	-3.42	30.70	43.50	-12.80	QP
4		190.7390	36.10	-7.56	28.54	43.50	-14.96	QP
5		306.2162	37.39	-4.58	32.81	46.00	-13.19	QP
6		704.2259	28.48	4.63	33.11	46.00	-12.89	QP

Antenna polarity: V

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector
1	*	43.7351	35.27	-5.47	29.80	40.00	-10.20	QP
2		81.4967	33.39	-9.22	24.17	40.00	-15.83	QP
3		147.9214	34.40	-3.42	30.98	43.50	-12.52	QP
4		285.4768	39.43	-5.37	34.06	46.00	-11.94	QP
5		412.5466	32.85	-1.88	30.97	46.00	-15.03	QP
6		768.7481	28.83	5.84	34.67	46.00	-11.33	QP

Remark: Factor = Cable lose + Antenna factor - Pre-amplifier; Margin = Limit – Level

1. The margin of 9K-30MH measurement exceeds 20dB, so the test chart is not included. Test Mode: 802.11a20 (the worst)

Radiated Spurious Emission (Above 1GHz):
Modulation : 802.11(a) (the worst data)

Freq (MHz)	Rd_level (dBuV/m)	Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over (dB)	detector	Height	Degree	Antenna polarization
Channel:5180MHz									
10360	41.09	16.39	57.48	74	-16.52	PK	1.37	36	H
10360	26.87	16.39	43.26	54	-10.74	AV	1.60	334	H
10360	39.80	16.39	56.19	74	-17.81	PK	1.36	327	V
10360	26.82	16.39	43.21	54	-10.79	AV	1.57	312	V
Channel:5240MHz									
10480	41.09	16.11	57.20	74	-16.80	PK	1.67	162	H
10480	27.25	16.11	43.36	54	-10.64	AV	1.33	169	H
10480	40.23	16.11	56.34	74	-17.66	PK	1.04	302	V
10480	25.24	16.11	41.35	54	-12.65	AV	1.42	306	V
Channel:5260MHz									
10520	39.21	16.39	55.60	74	-18.40	PK	1.26	52	H
10520	27.14	16.39	43.53	54	-10.47	AV	1.43	151	H
10520	41.34	16.39	57.73	74	-16.27	PK	1.21	256	V
10520	26.74	16.39	43.13	54	-10.87	AV	1.07	23	V
Channel:5320MHz									
10640	39.43	16.39	55.82	74	-18.18	PK	1.33	212	H
10640	26.72	16.39	43.11	54	-10.89	AV	1.42	35	H
10640	39.85	16.39	56.24	74	-17.76	PK	1.18	72	V
10640	27.99	16.39	44.38	54	-9.62	AV	1.15	103	V

Modulation : 802.11(n40) (the worst data)

Freq (MHz)	Rd_level (dBuV/m)	Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over (dB)	detector	Height	Degree	Antenna polarization
Channel:5190MHz									
10380	40.16	16.34	56.50	74	-17.50	PK	1.06	65	H
10380	27.52	16.34	43.86	54	-10.14	AV	1.48	110	H
10380	40.92	16.34	57.26	74	-16.74	PK	1.03	91	V
10380	27.07	16.34	43.41	54	-10.59	AV	1.73	174	V
Channel:5230MHz									
10460	40.17	16.15	56.32	74	-17.68	PK	1.84	216	H
10460	27.21	16.15	43.36	54	-10.64	AV	1.34	318	H
10460	39.31	16.15	55.46	74	-18.54	PK	1.21	343	V
10460	26.32	16.15	42.47	54	-11.53	AV	1.10	207	V
Channel:5270MHz									
10540	41.17	16.34	57.51	74	-16.49	PK	1.71	2	H
10540	25.82	16.34	42.16	54	-11.84	AV	1.41	156	H
10540	41.83	16.34	58.17	74	-15.83	PK	1.72	269	V
10540	25.94	16.34	42.28	54	-11.72	AV	1.61	295	V
Channel:5310MHz									
10620	39.18	16.34	55.52	74	-18.48	PK	1.32	7	H
10620	25.24	16.34	41.58	54	-12.42	AV	1.23	14	H
10620	41.48	16.34	57.82	74	-16.18	PK	1.67	187	V
10620	27.62	16.34	43.96	54	-10.04	AV	1.56	278	V

Modulation : 802.11(VH80) (the worst data)

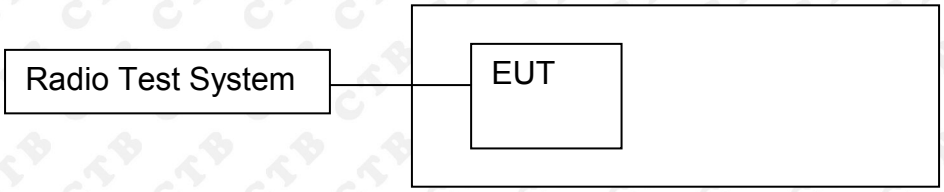
Freq (MHz)	Rd_level (dBuV/m)	Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over (dB)	detector	Height	Degree	Antenna polarization
Channel:5210MHz									
10420	41.63	16.25	57.88	74	-16.12	PK	1.50	164	H
10420	26.51	16.25	42.76	54	-11.24	AV	1.50	267	H
10420	39.81	16.25	56.06	74	-17.94	PK	1.59	268	V
10420	26.79	16.25	43.04	54	-10.96	AV	1.27	75	V

Channel:5290MHz									
10580	39.05	16.25	55.30	74	-18.70	PK	1.12	133	H
10580	25.55	16.25	41.80	54	-12.20	AV	1.22	322	H
10580	39.13	16.25	55.38	74	-18.62	PK	1.01	129	V
10580	27.12	16.25	43.37	54	-10.63	AV	1.15	197	V

Remark:
1.Factor = Antenna Factor + Cable Loss – Pre-amplifier. Emission level = Reading Result + Factor, Margin = Emission level - Limits
2.The EUT was tested in the low, high channel and the worst case position data was reported.
3.Testing is carried out with frequency rang 9kHz to the tenth harmonics, other than listed in the table above are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

8. BAND EDGE

8.1 Block Diagram Of Test Setup



8.2 Limit

(1) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.
(2) For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.
(3) For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.
(4) For transmitters operating in the 5.725-5.85 GHz band: All emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an e.i.r.p. of −17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an e.i.r.p. of −27 dBm/MHz.
(5) The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.
(6) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209. Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in §15.207.

8.3 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.

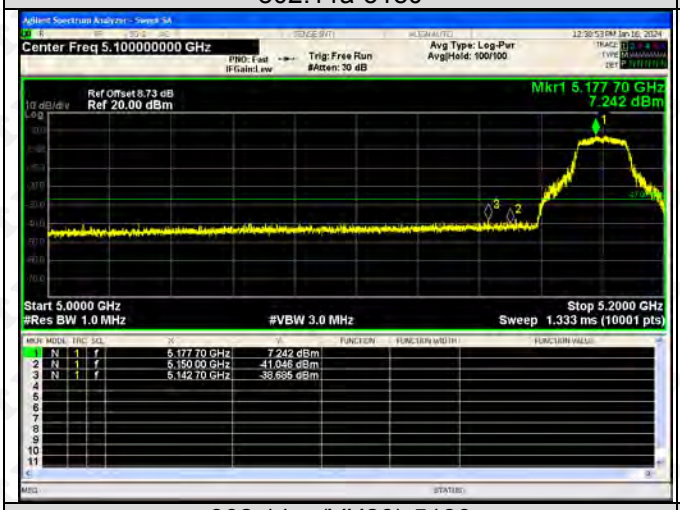
8.4 Test Result

Test Graph

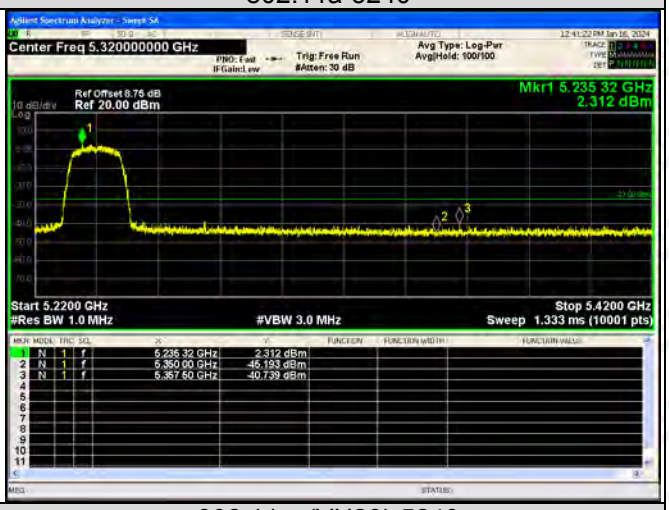
5150-5250MHz:

ANT 1

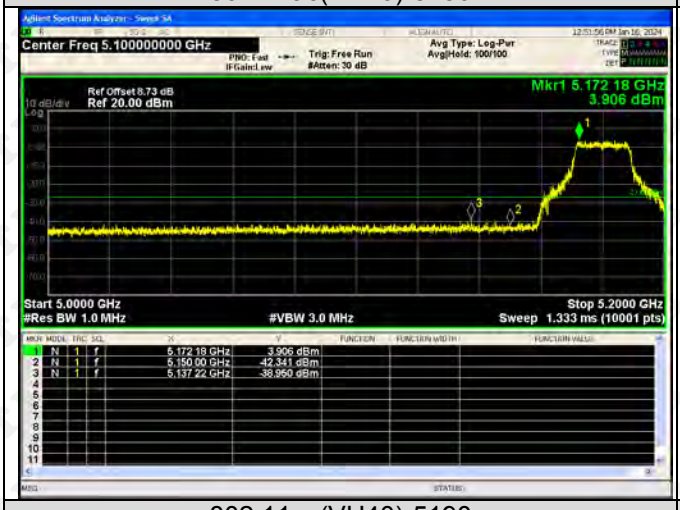
802.11a-5180



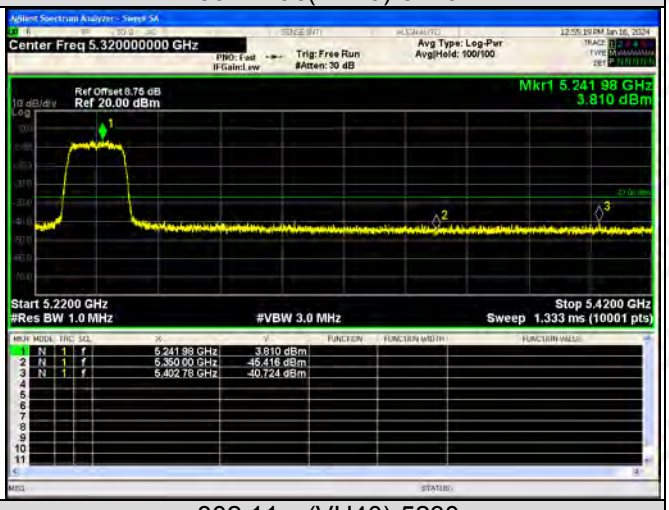
802.11a-5240



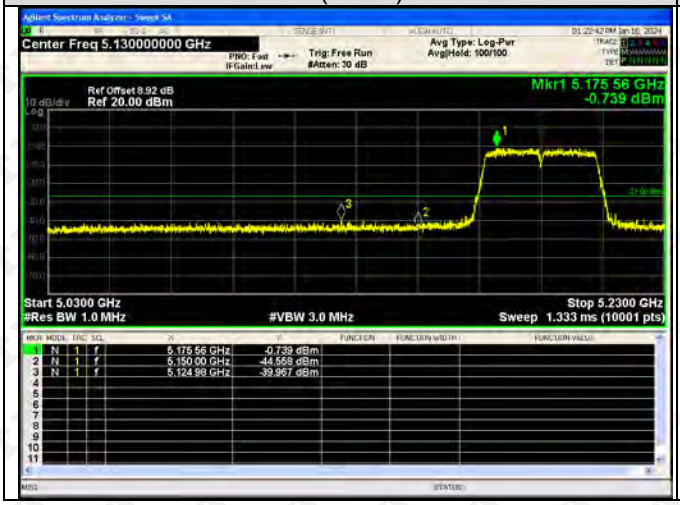
802.11ac(VH20)-5180



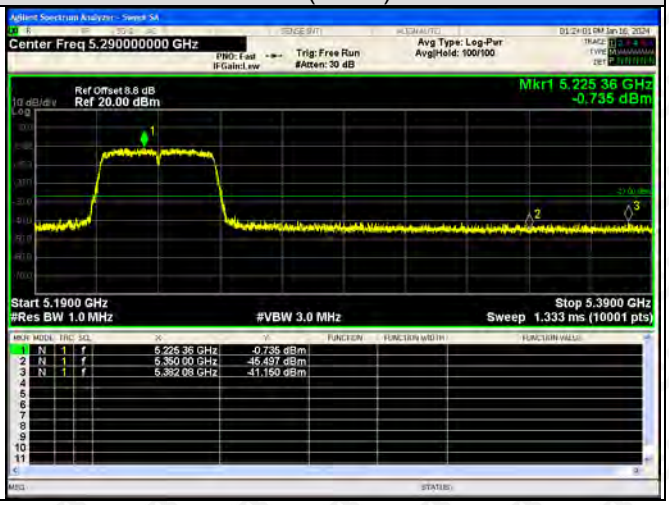
802.11ac(VH20)-5240



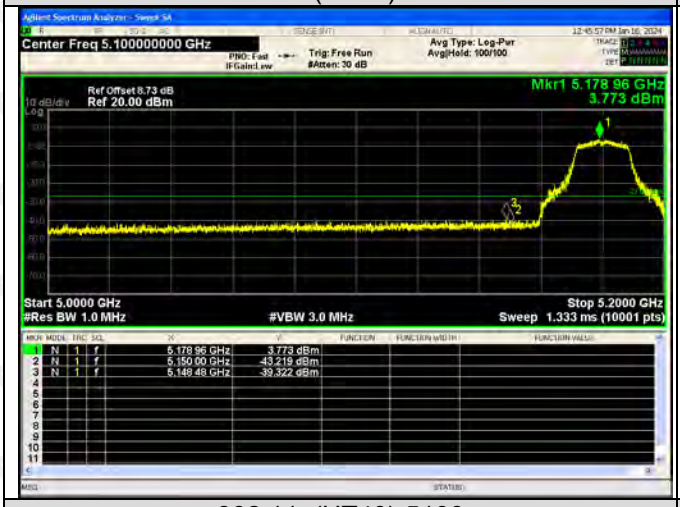
802.11ac(VH40)-5190



802.11ac(VH40)-5230



802.11n(HT20)-5180



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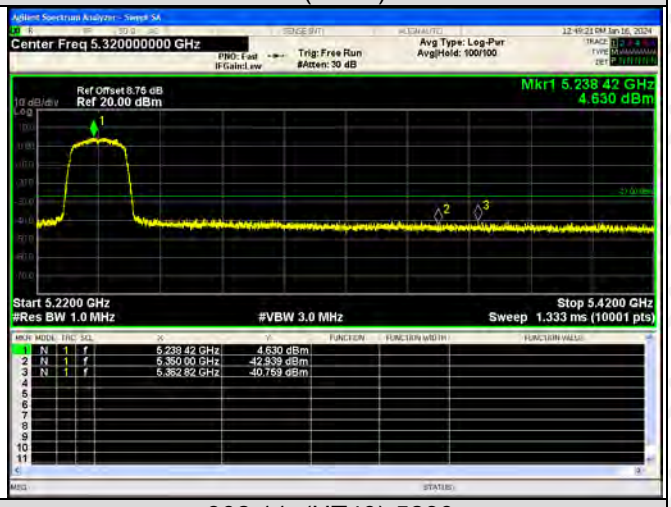
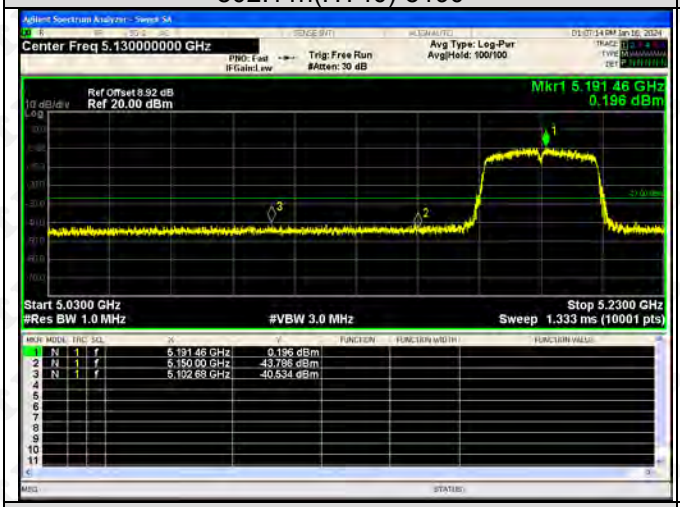
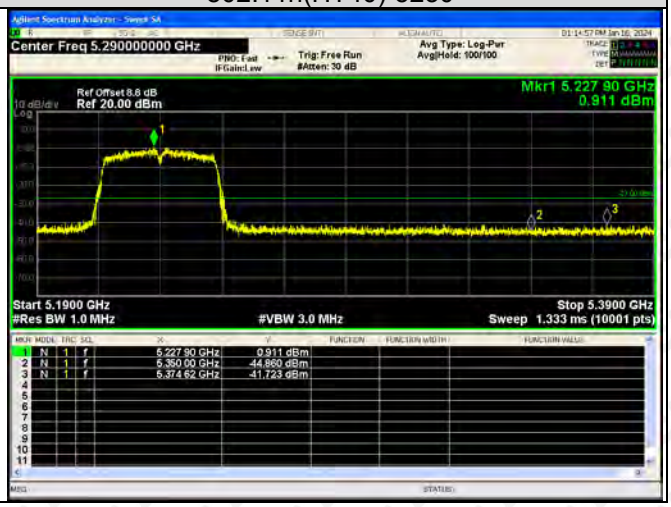


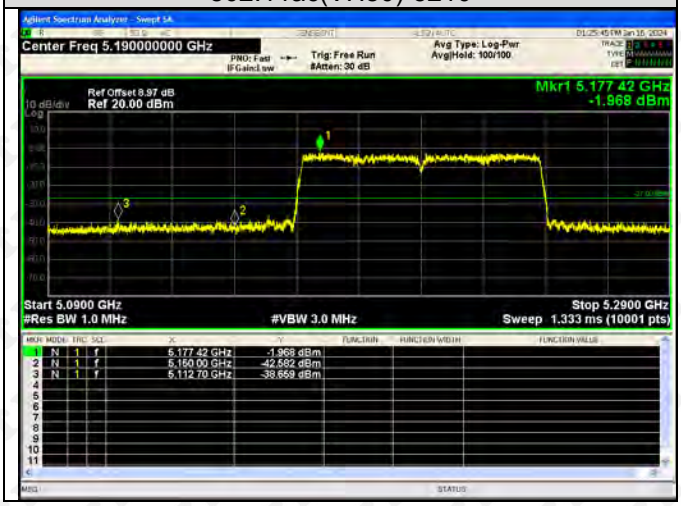
802.11n(HT40)-5190



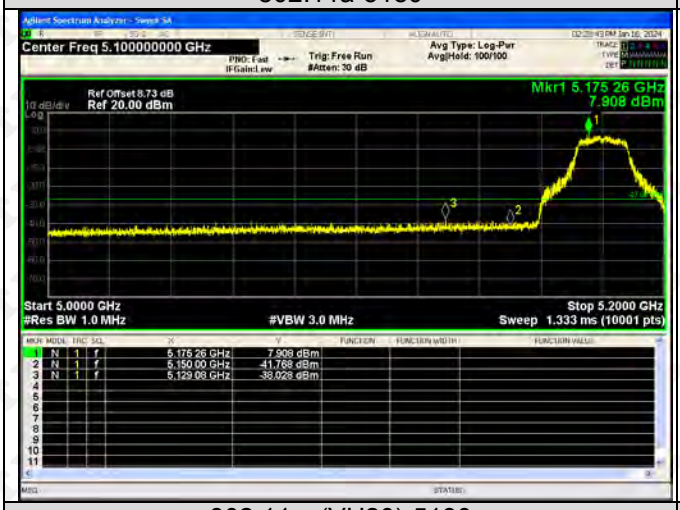
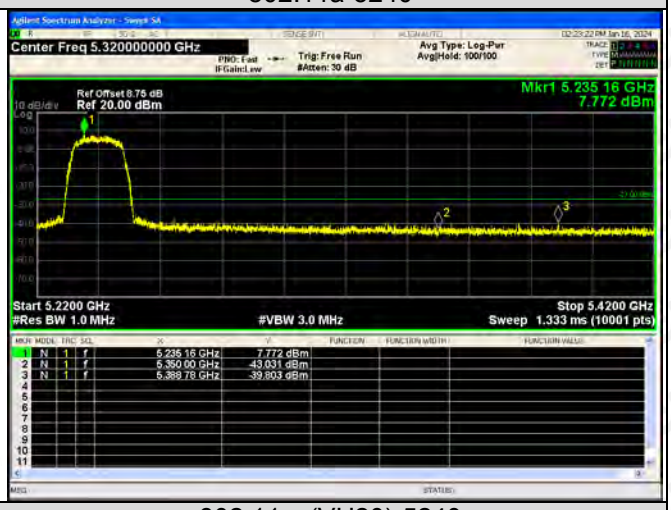
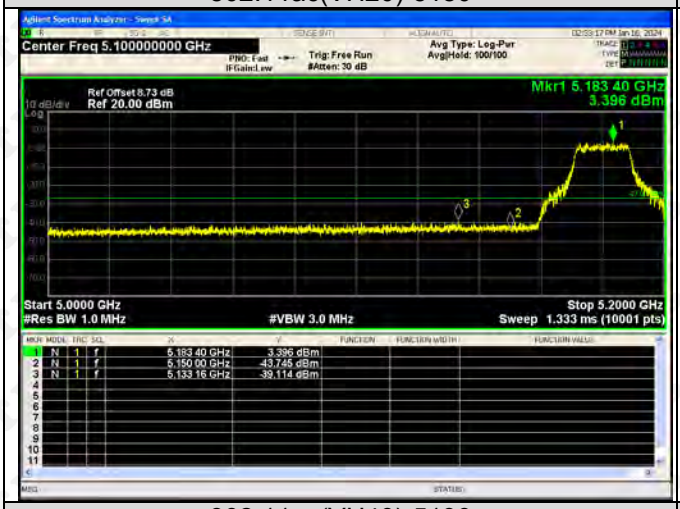
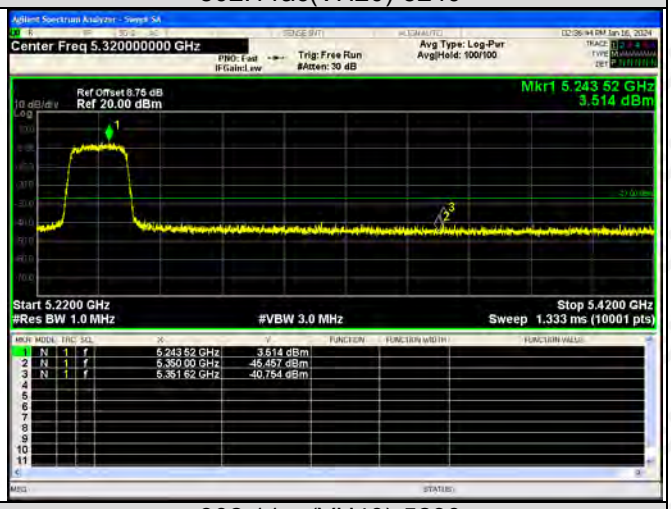
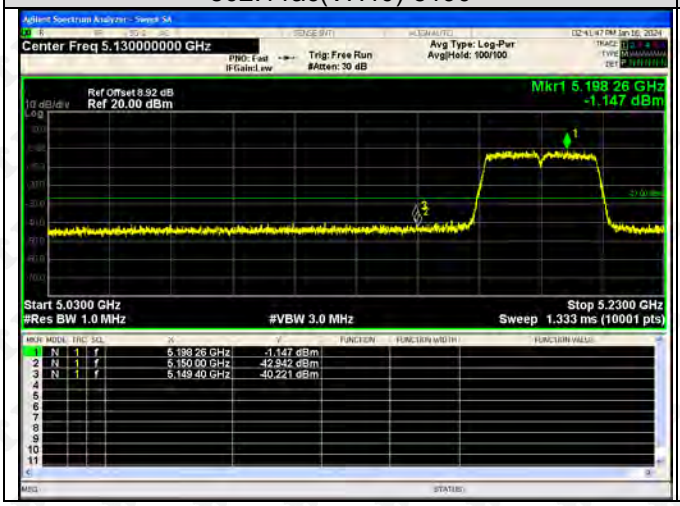
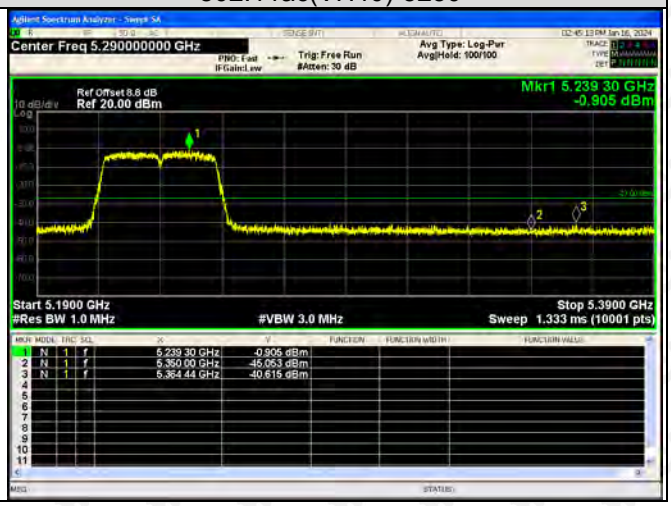
802.11n(HT40)-5230



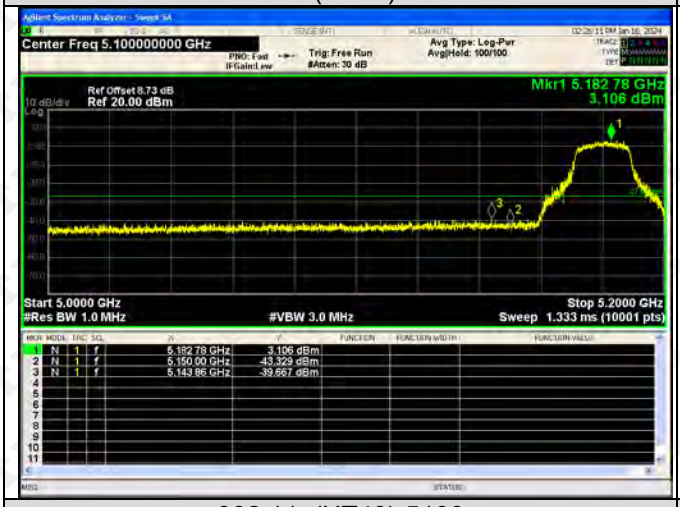
802.11ac(VH80)-5210



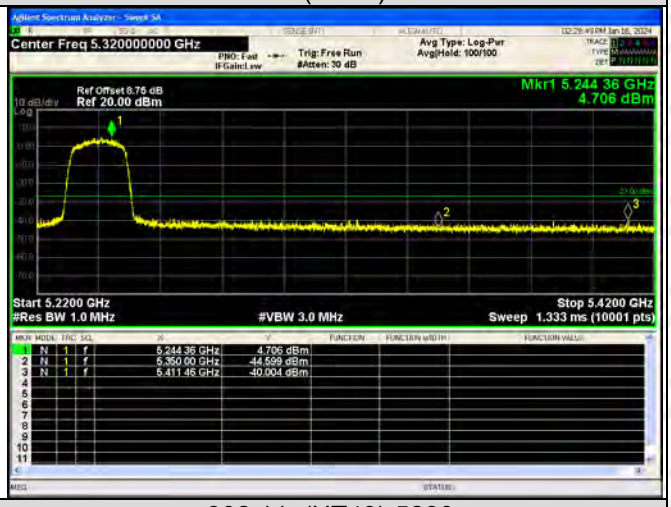
ANT 2

802.11a-5180	802.11a-5240
	
802.11ac(VH20)-5180	802.11ac(VH20)-5240
	
802.11ac(VH40)-5190	802.11ac(VH40)-5230
	

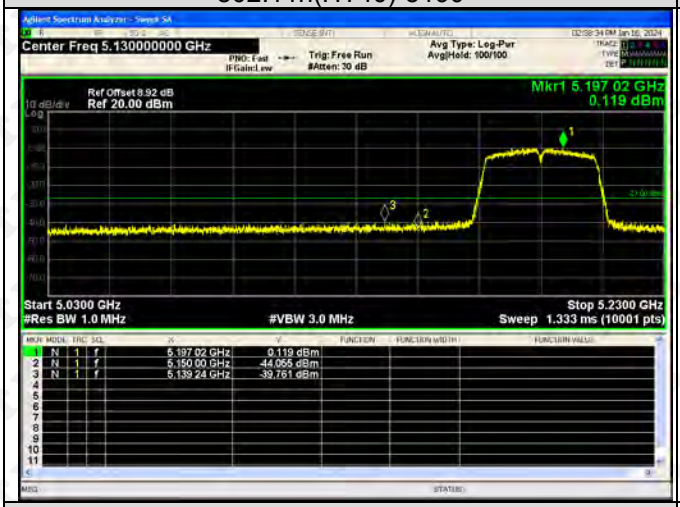
802.11n(HT20)-5180



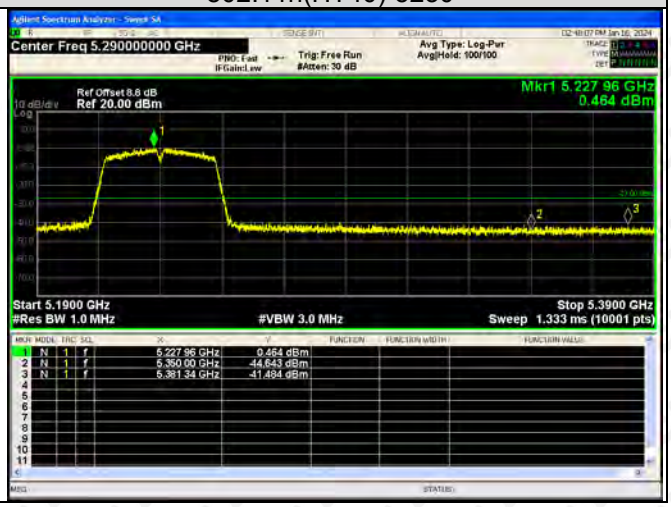
802.11n(HT20)-5240



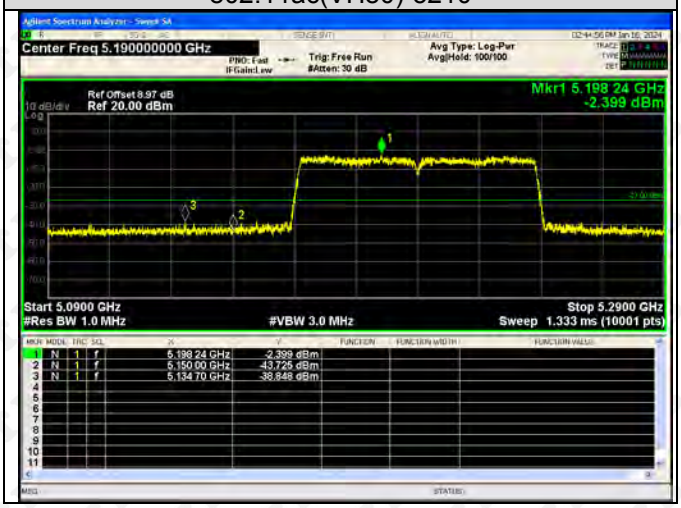
802.11n(HT40)-5190



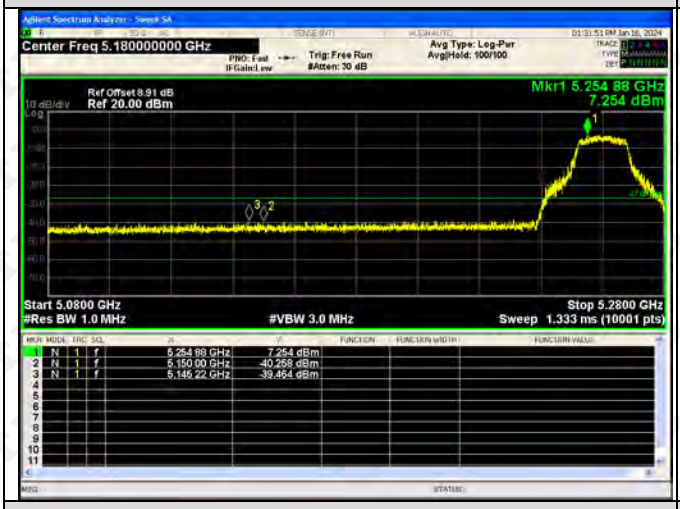
802.11n(HT40)-5230



802.11ac(VH80)-5210



5250-5350MHz:
ANT1

802.11a-5260	802.11a-5320
	
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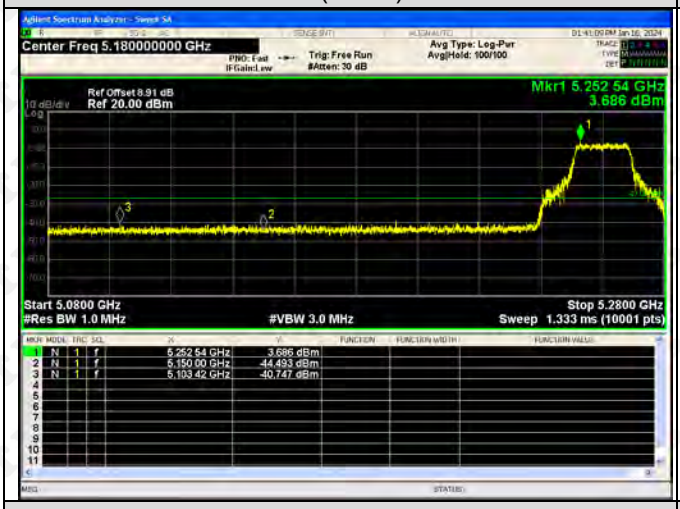
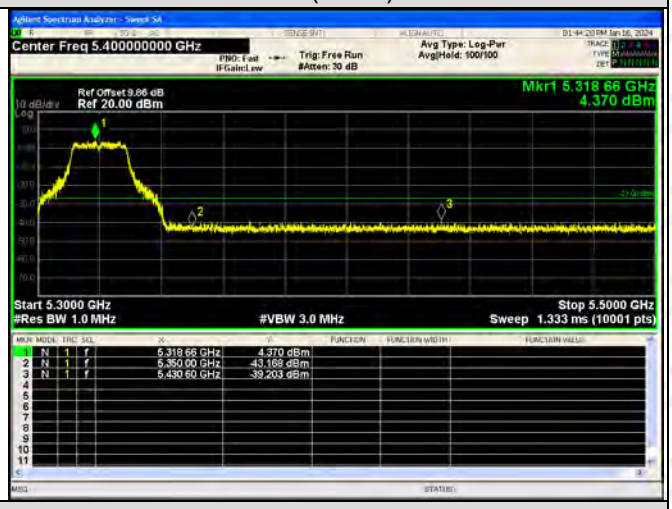
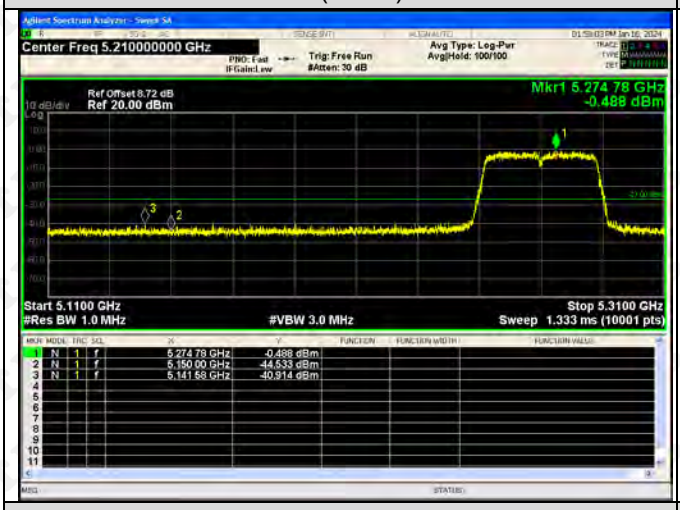
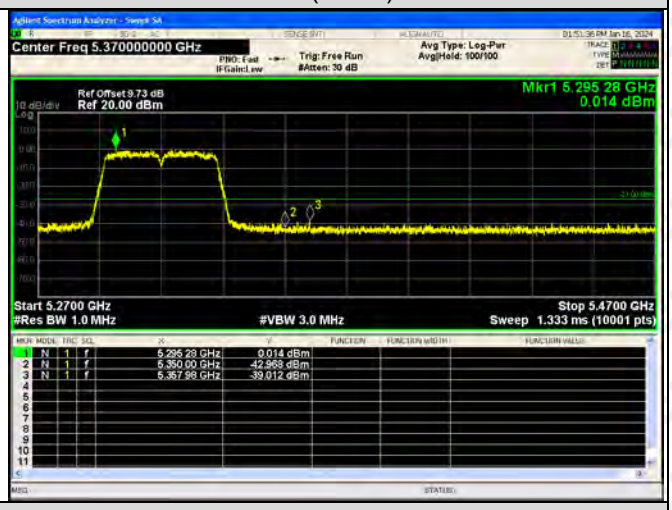
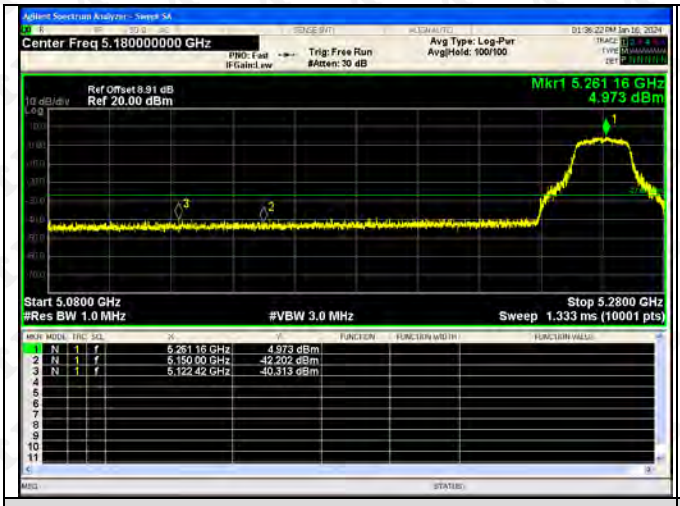
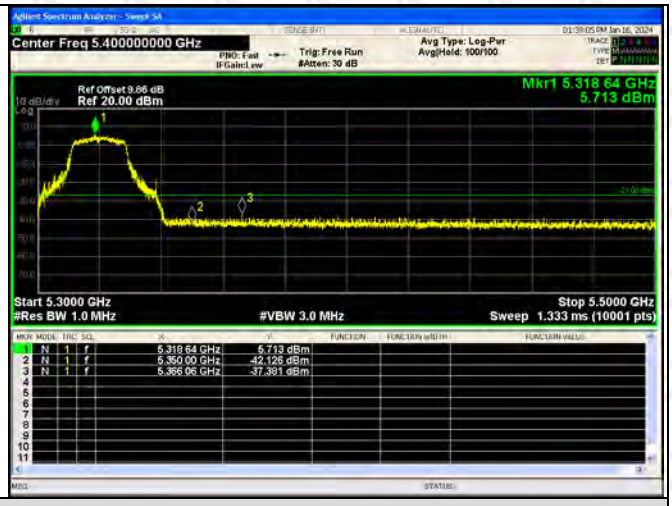
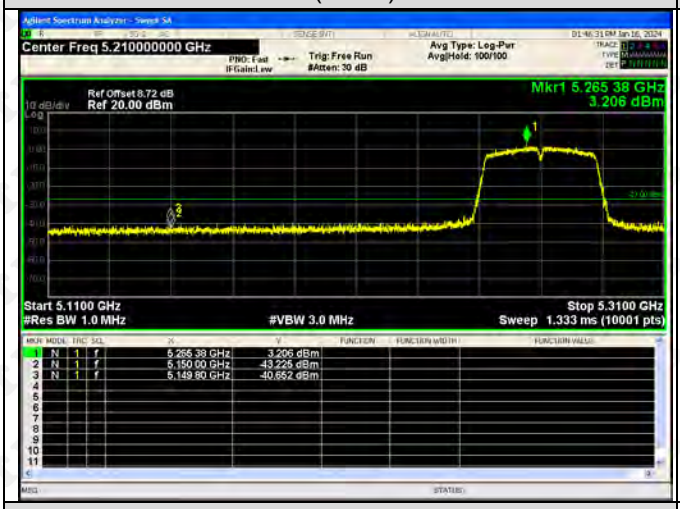
	
802.11ac(VH40)-5270	802.11ac(VH40)-5310
	
802.11n(HT20)-5260	802.11n(HT20)-5320



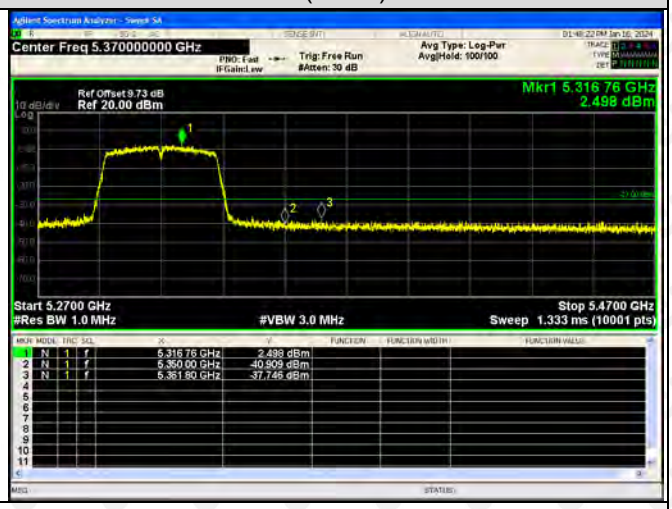
802.11n(HT40)-5270

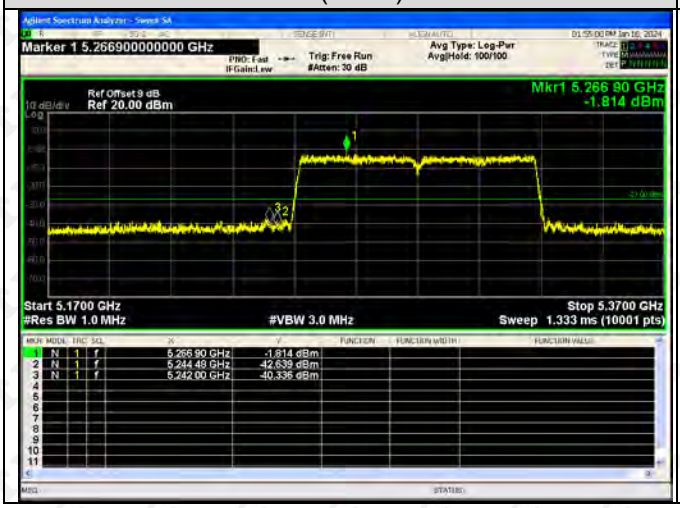


802.11n(HT40)-5310

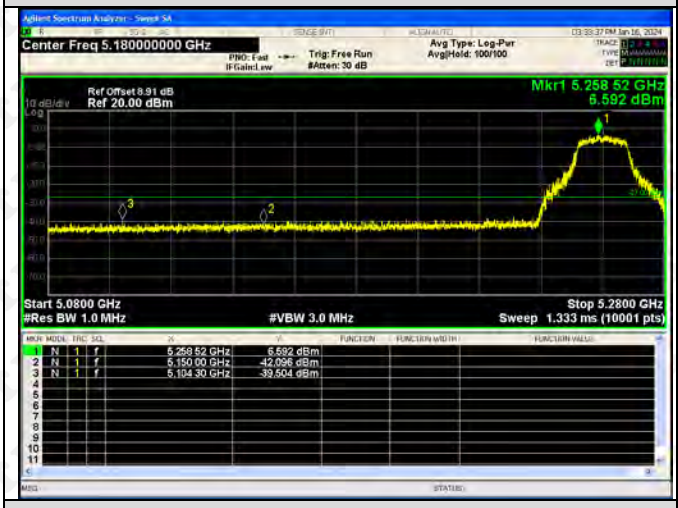
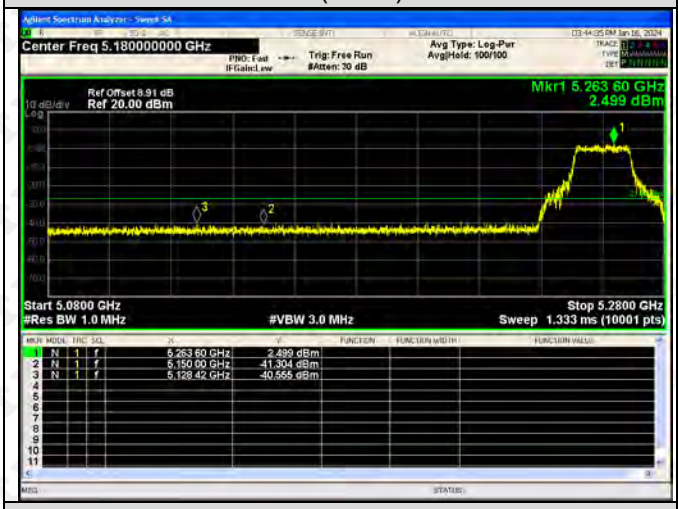
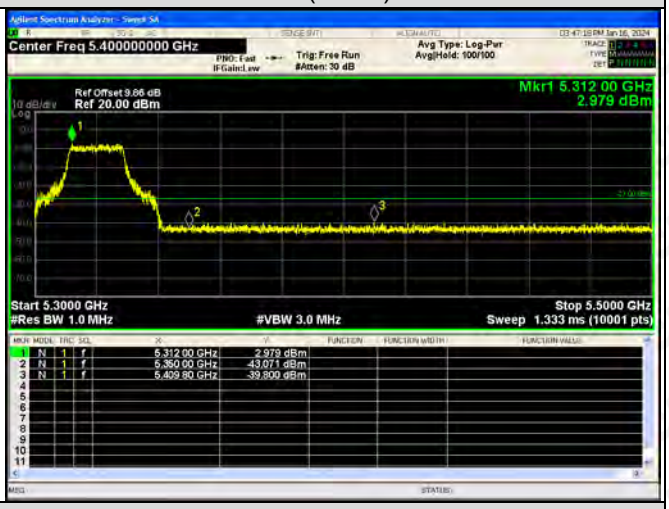
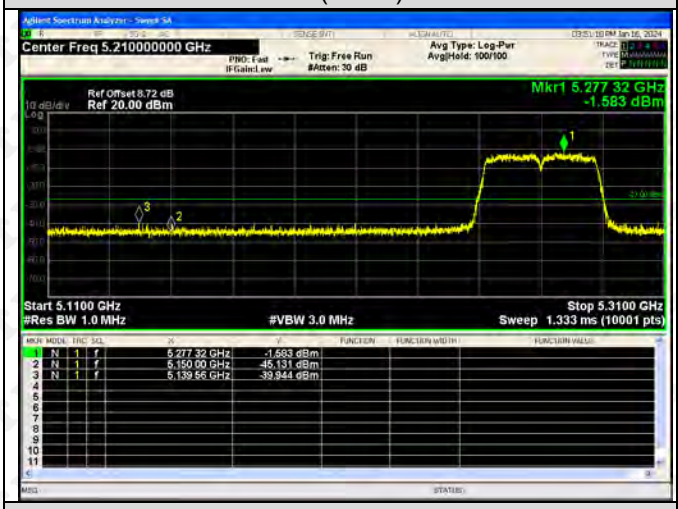
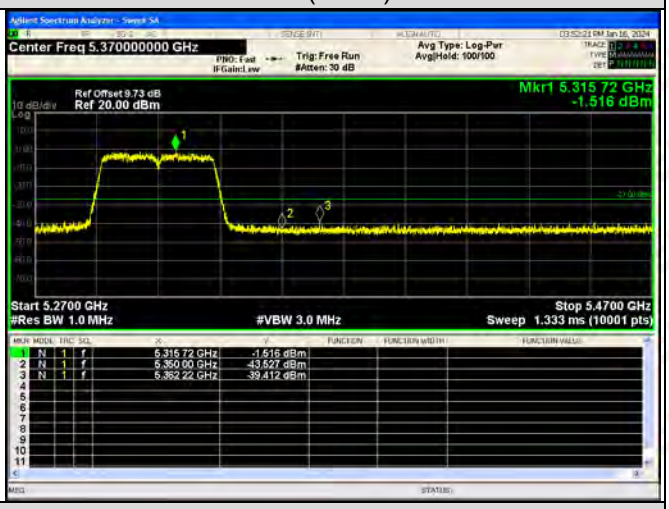


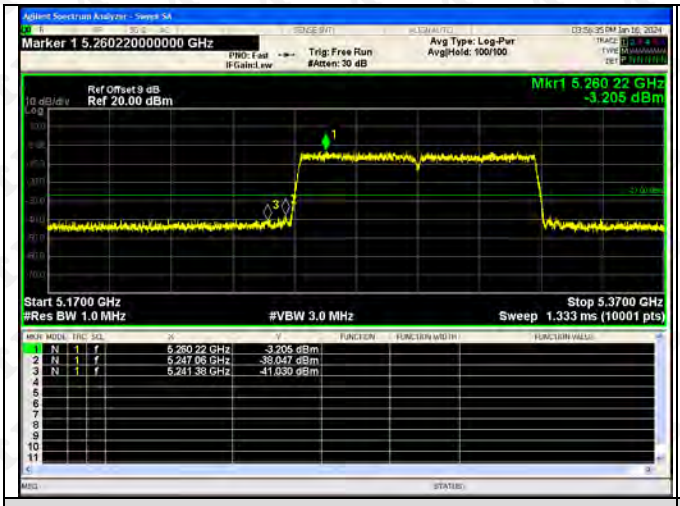
802.11ac(VH80)-5290



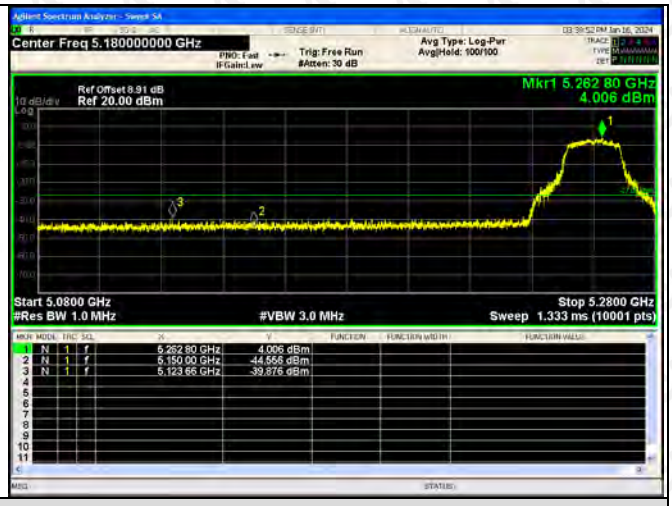


ANT2

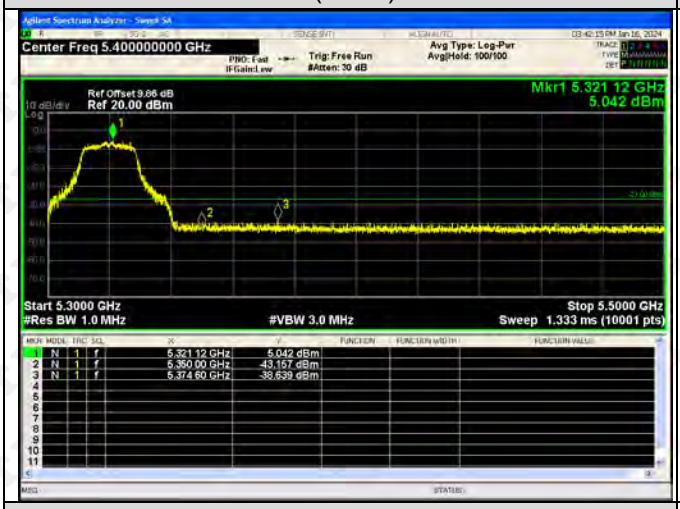
802.11a-5260	802.11a-5320
	
802.11ac(VH20)-5260	802.11ac(VH20)-5320
	
802.11ac(VH40)-5270	802.11ac(VH40)-5310
	
802.11n(HT20)-5260	802.11n(HT20)-5320



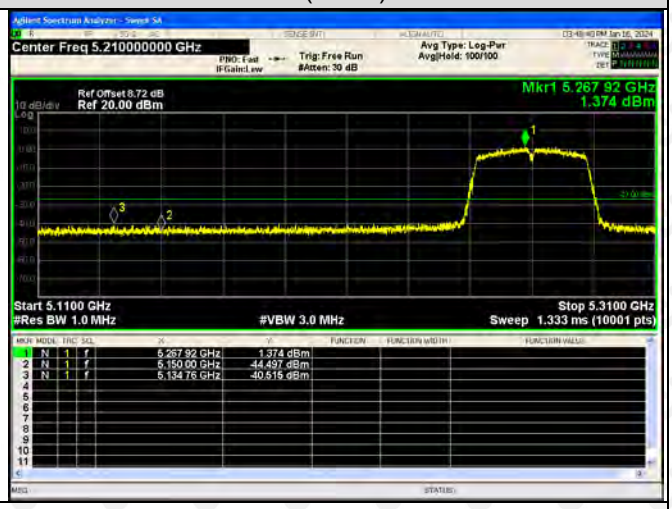
802.11n(HT40)-5270

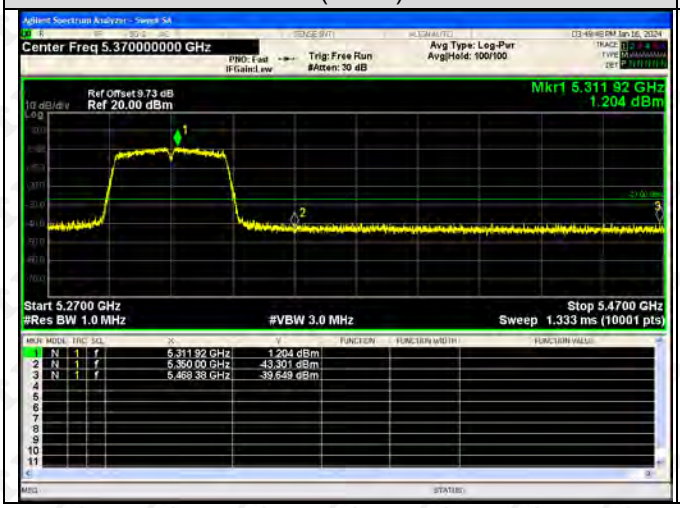


802.11n(HT40)-5310



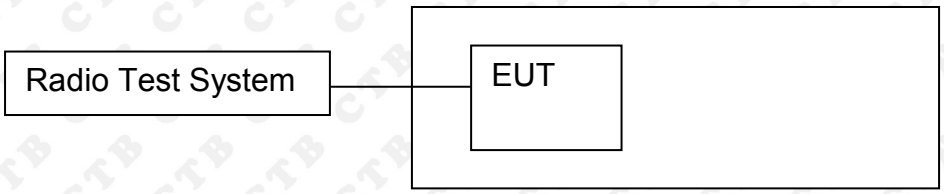
802.11ac(VH80)-5290





9. CONDUCTED OUTPUT POWER

9.1 Block Diagram Of Test Setup



9.2 Limit

(1) For the band 5.15-5.25 GHz.
(i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p.
at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).
(ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition,the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.
(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.
(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.
(2) For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.
(4) The maximum conducted output power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage.
(5) The maximum power spectral density is measured as a conducted emission by direct connection of a calibrated test instrument to the equipment under test. If the device cannot be connected directly, alternative techniques acceptable to the Commission may be used. Measurements in the 5.725-5.85 GHz band are made over a reference bandwidth of 500 kHz or the 26 dB emission bandwidth of the device, whichever is less. 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.

(h) Transmit Power Control (TPC) and Dynamic Frequency Selection (DFS).
(1) Transmit power control (TPC). U-NII devices operating in the 5.25-5.35 GHz band and the 5.47-5.725 GHz band shall employ a TPC mechanism. The U-NII device is required to have the capability to operate at least 6 dB below the mean EIRP value of 30 dBm. A TPC mechanism is not required for systems with an e.i.r.p. of less than 500 mW.

9.3 Test procedure

According to KDB789033 D02v02r01 sectionE, the following is the measurement procedure.

(i) Set span to encompass the entire emission bandwidth (EBW) (or, alternatively, the entire 99% occupied bandwidth) of the signal.

(ii) Set RBW = 1 MHz.

(iii) Set VBW ≥ 3 MHz.

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

(v) Sweep time = auto.

(vi) Detector = power averaging (rms), if available. Otherwise, use sample detector mode.

(vii) If transmit duty cycle < 98%, use a video trigger with the trigger level set to enable triggering only on full power pulses. Transmitter must operate at maximum power control level for the entire duration of every sweep. If the EUT transmits continuously (i.e., with no off intervals) or at duty cycle ≥ 98%, and if each transmission is entirely at the maximum power control level, then the trigger shall be set to “free run.”

(viii) Trace average at least 100 traces in power averaging (rms) mode.

(ix) Compute power by integrating the spectrum across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal using the instrument’s band power measurement function with band limits set equal to the EBW (or occupied bandwidth) band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at 1 MHz intervals extending across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the spectrum.

9.4 Test Result

5150-5250MHz:

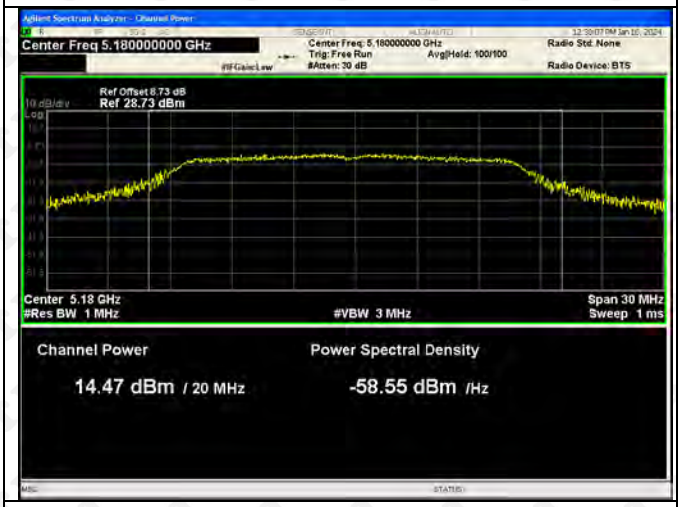
Test mode1	Test Channel (MHz)	Output Power dBm ANT1	Output Power dBm ANT2	Output Power dBm Total	Limit dBm
802.11a	5180	14.465	14.353	/	23.98
	5200	14.764	14.418	/	23.98
	5240	14.53	14.326	/	23.98
802.11ac20	5180	11.502	10.771	14.162	23.98
	5200	11.516	10.893	14.226	23.98
	5240	11.355	10.599	14.004	23.98
802.11ac40	5190	10.224	9.732	12.995	23.98
	5230	10.15	9.41	12.806	23.98
802.11ac80	5210	11.773	11.449	14.624	23.98
802.11n(HT20)	5180	11.301	10.451	13.907	23.98
	5200	11.386	10.573	14.009	23.98
	5240	12.337	11.774	15.075	23.98
802.11n(HT40)	5190	10.271	10.758	13.532	23.98
	5230	10.304	10.669	13.501	23.98

5250-5350MHz:

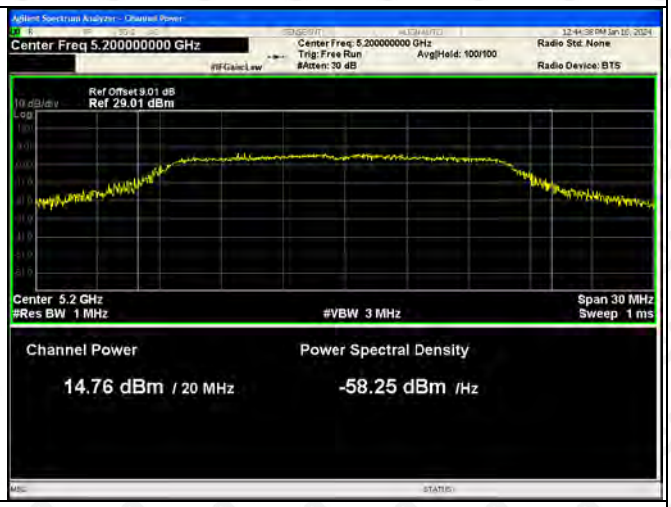
Test mode1	Test Channel (MHz)	Output Power dBm ANT1	Output Power dBm ANT2	Output Power dBm Total	Limit dBm
802.11a	5260	14.485	13.585	/	23.98
	5280	14.428	13.652	/	23.98
	5320	13.298	14.443	/	23.98
802.11ac20	5260	11.577	10.489	14.077	23.98
	5280	11.439	10.46	13.987	23.98
	5320	12.279	11.07	14.727	23.98
802.11ac40	5270	10.152	9.188	12.707	23.98
	5310	10.743	9.596	13.218	23.98
802.11ac80	5290	11.555	10.746	14.180	23.98
802.11n(HT20)	5260	12.384	11.571	15.007	23.98
	5280	12.416	11.553	15.016	23.98
	5320	13.208	12.165	15.728	23.98
802.11n(HT40)	5270	12.492	11.596	15.077	23.98
	5310	13.218	12.178	15.739	23.98

Test Graph:
5150-5250MHz-Power
ANT1

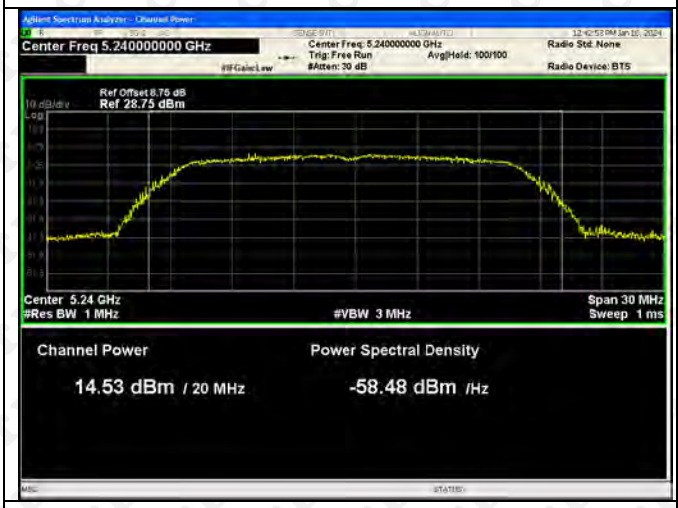
802.11a-5180



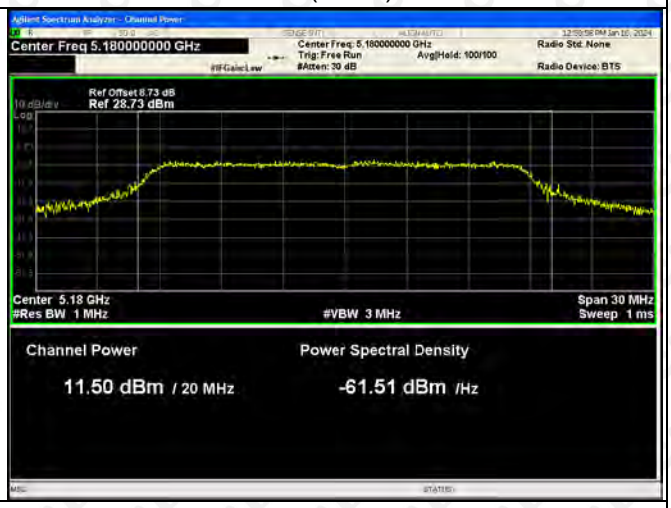
802.11a-5200



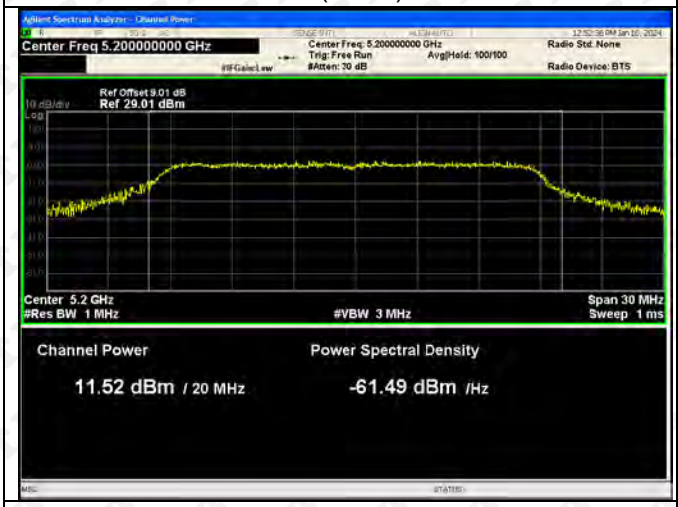
802.11a-5240



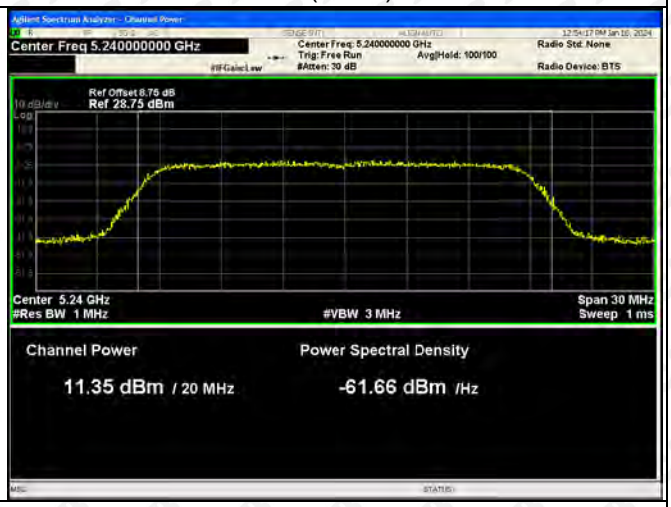
802.11ac(VH20)-5180



802.11ac(VH20)-5200

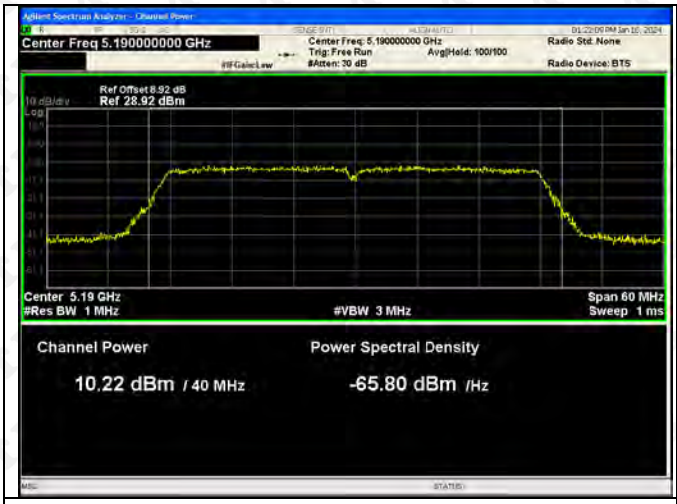


802.11ac(VH20)-5240

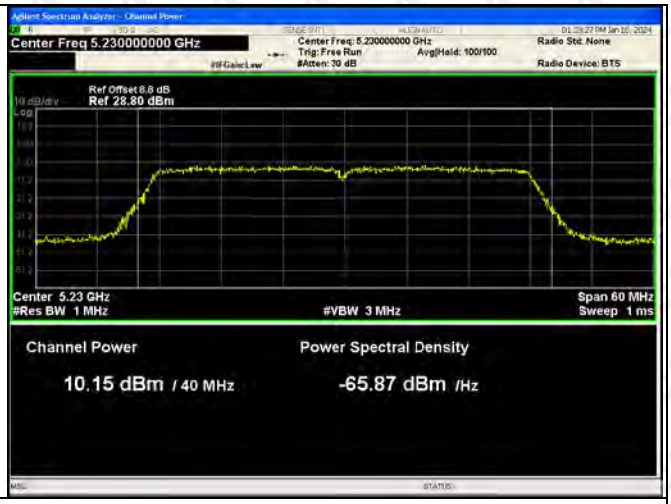


802.11ac(VH40)-5190

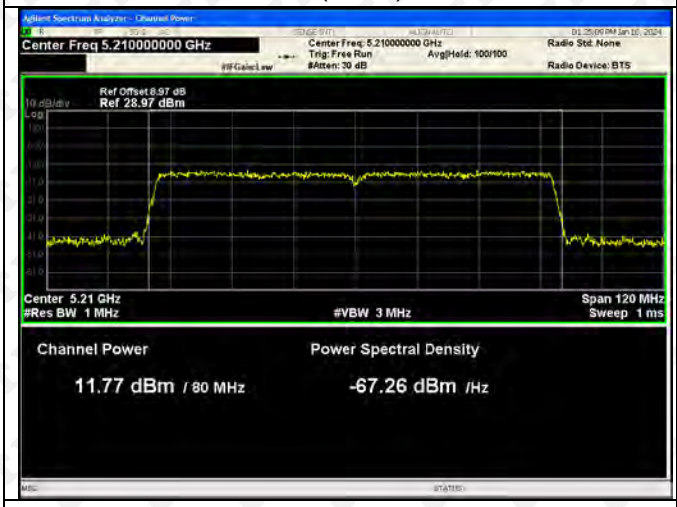
802.11ac(VH40)-5230



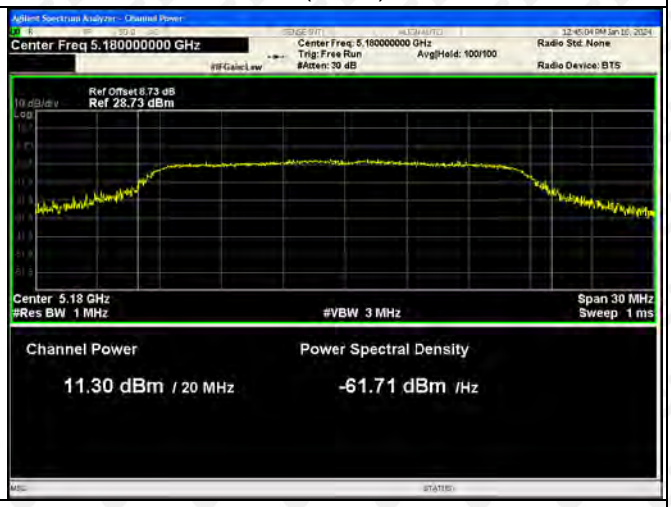
802.11ac(VH80)-5210



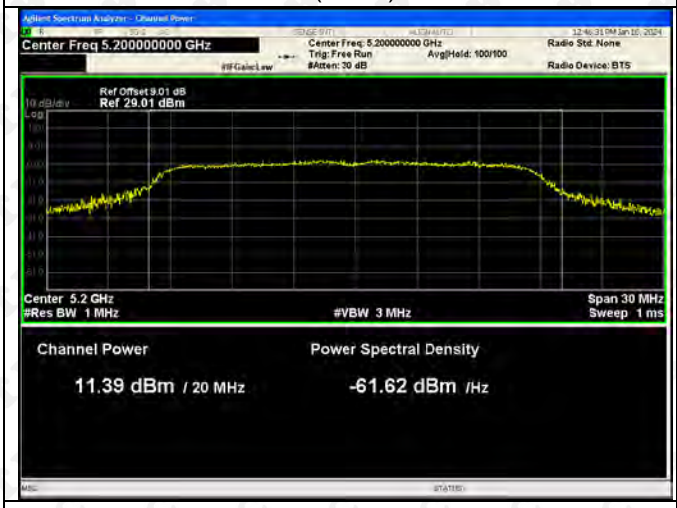
802.11n(HT20)-5180



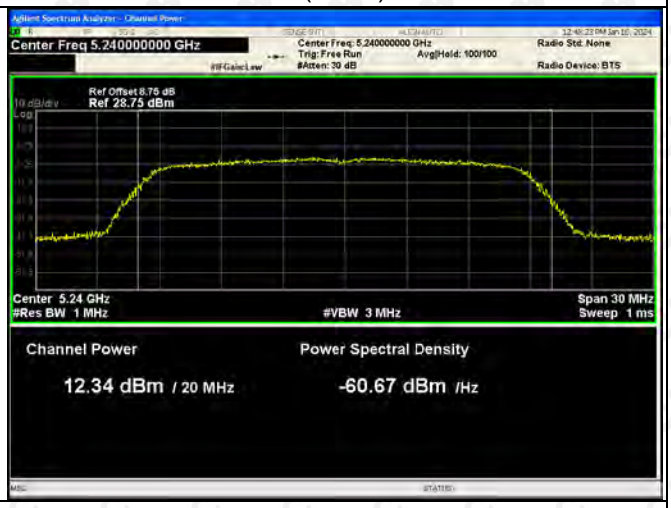
802.11n(HT20)-5200



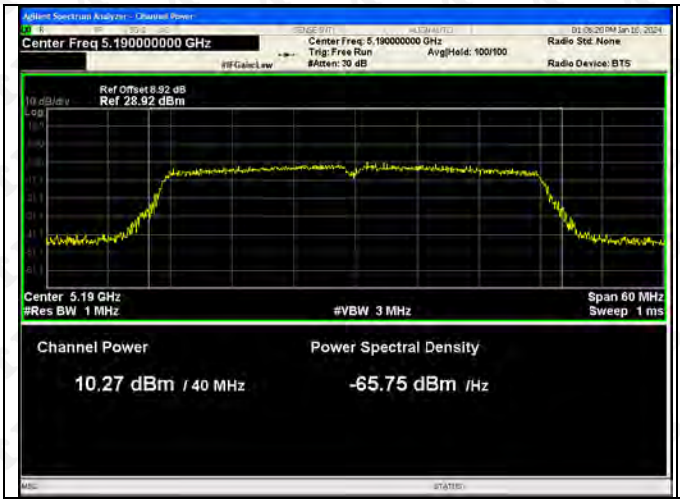
802.11n(HT20)-5240

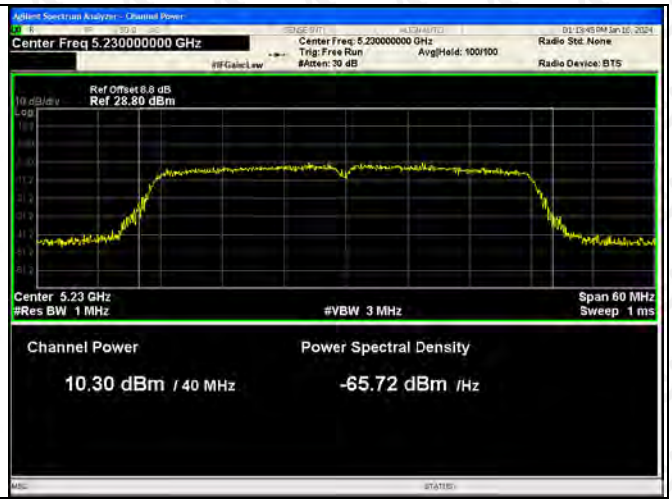


802.11n(HT40)-5190

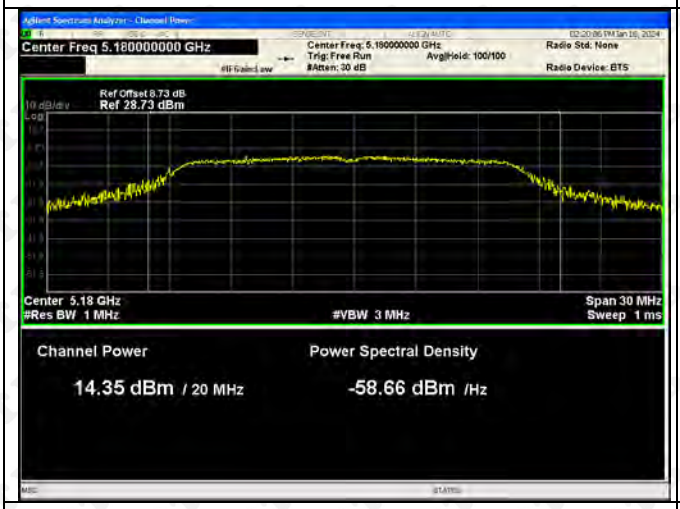
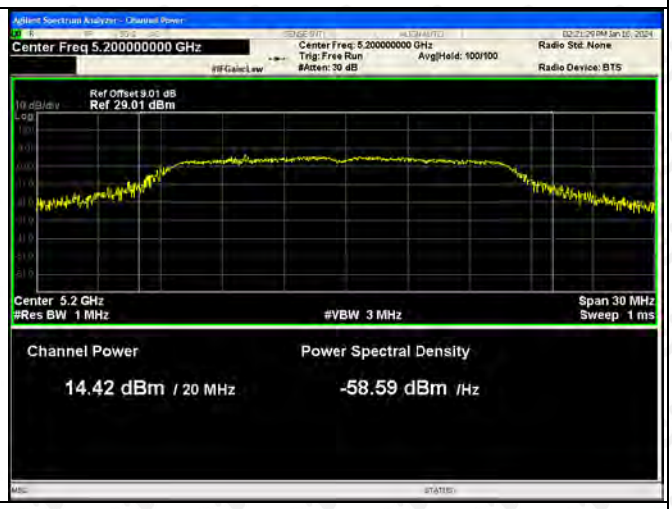
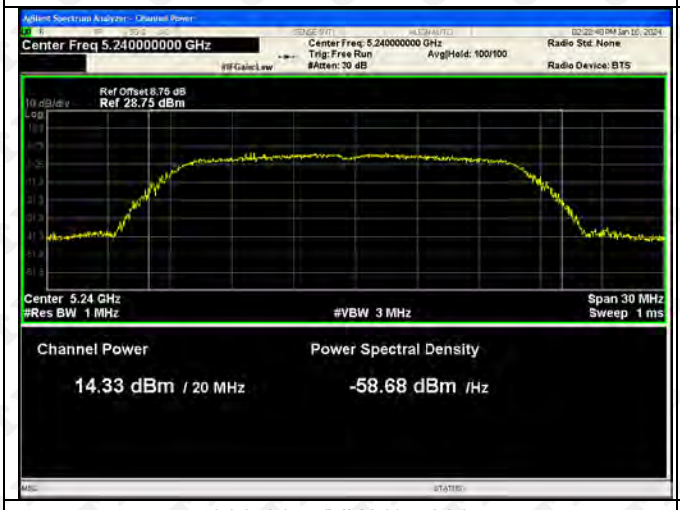
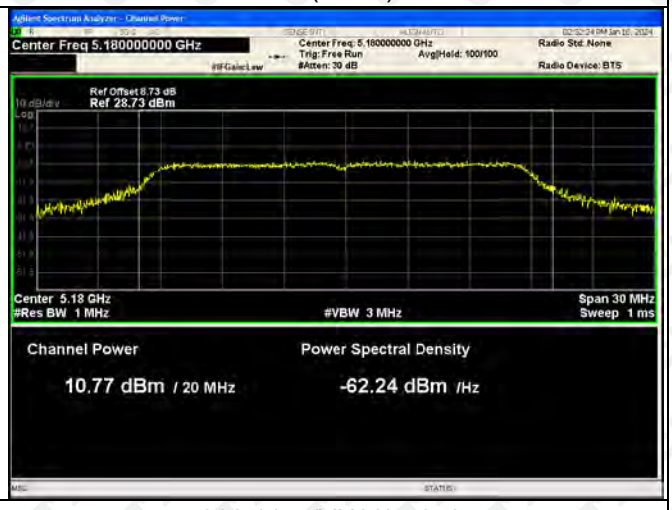


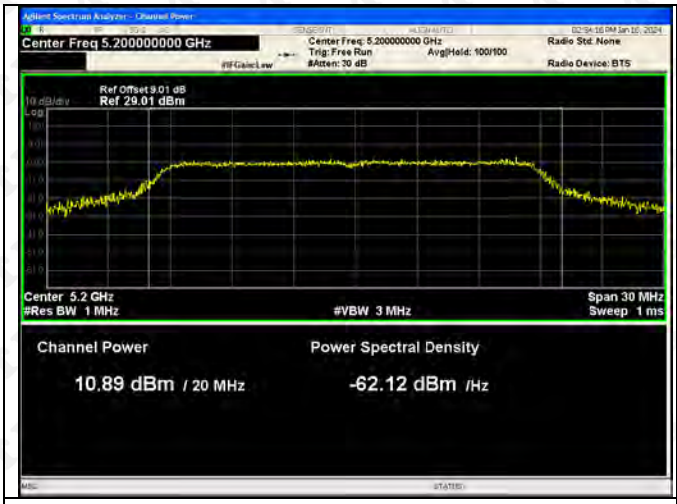
802.11n(HT40)-5230



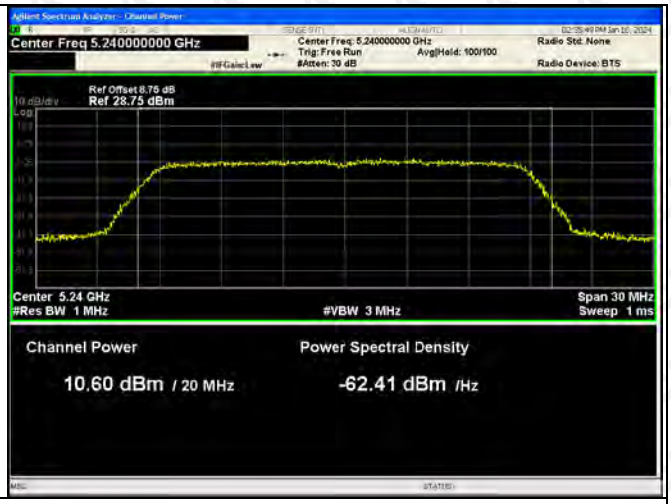


ANT2

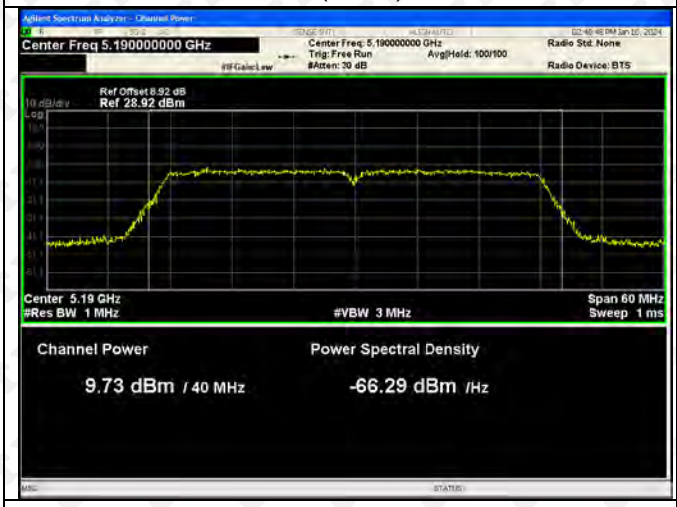
802.11a-5180	802.11a-5200
	
802.11a-5240	802.11ac(VH20)-5180
	
802.11ac(VH20)-5200	802.11ac(VH20)-5240



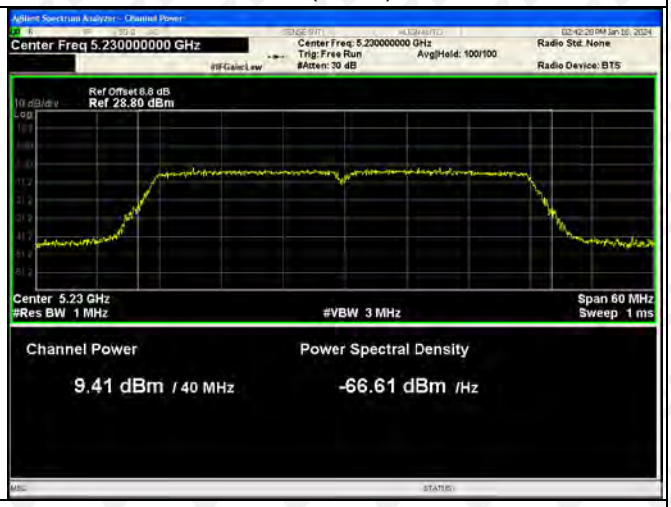
802.11ac(VH40)-5190



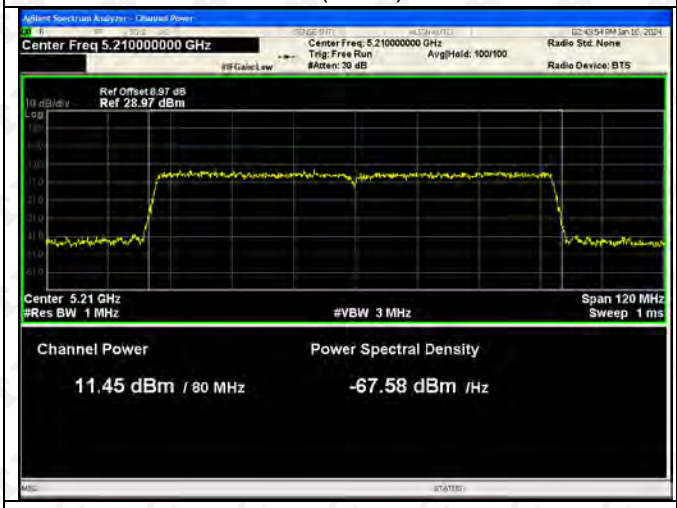
802.11ac(VH40)-5230



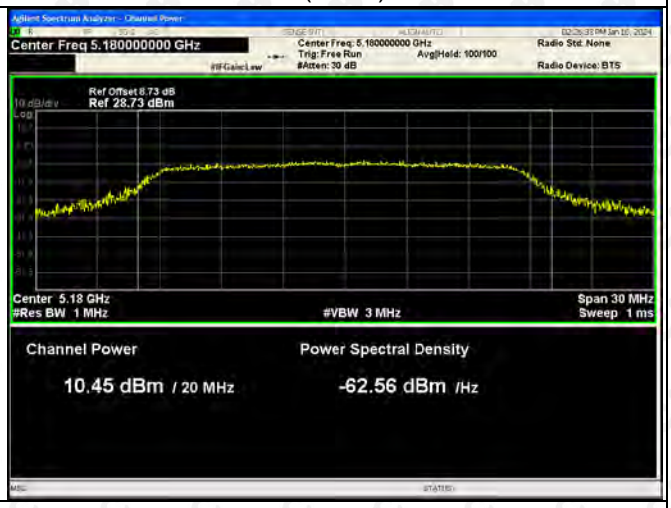
802.11ac(VH80)-5210



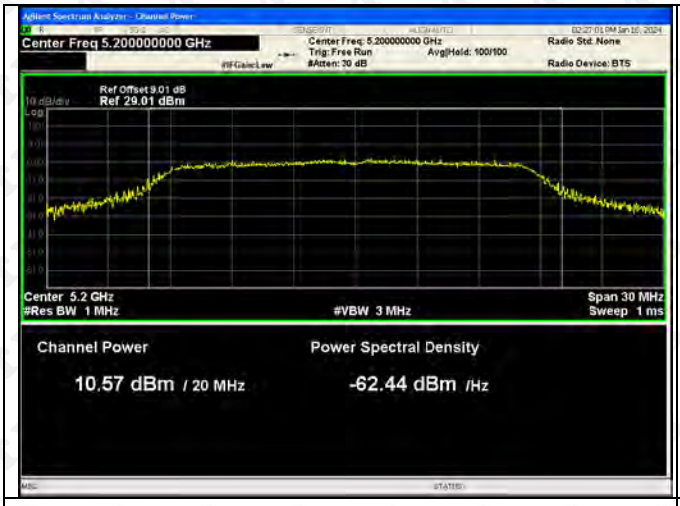
802.11n(HT20)-5180



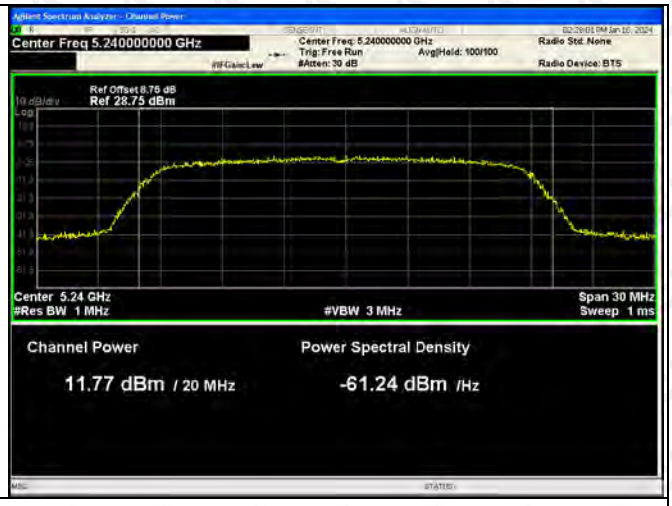
802.11n(HT20)-5200



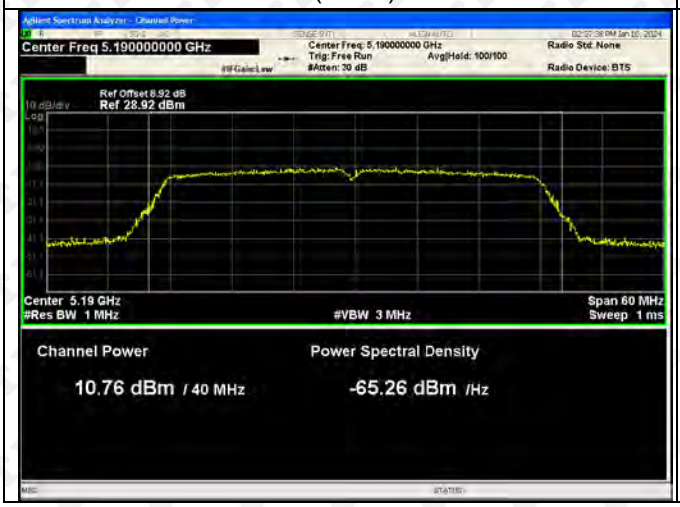
802.11n(HT20)-5240

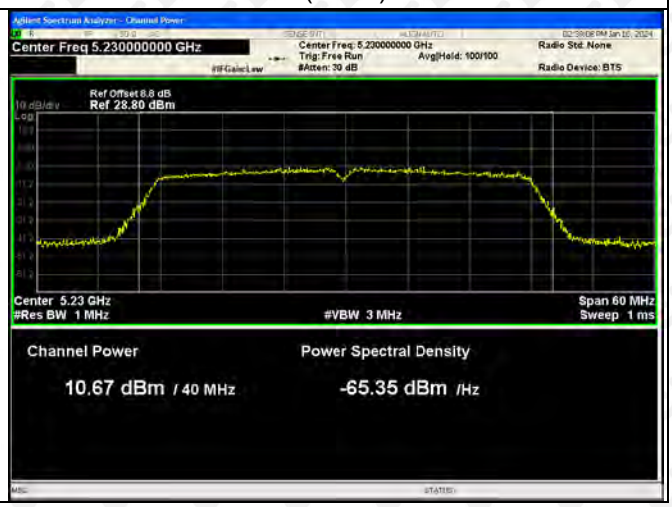


802.11n(HT40)-5190

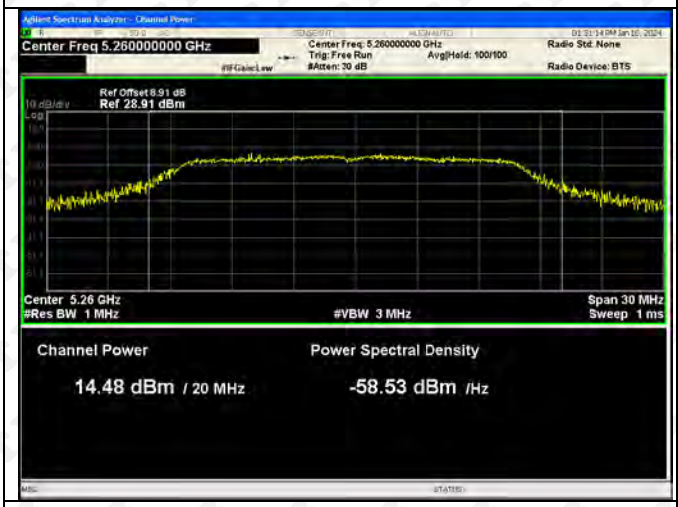
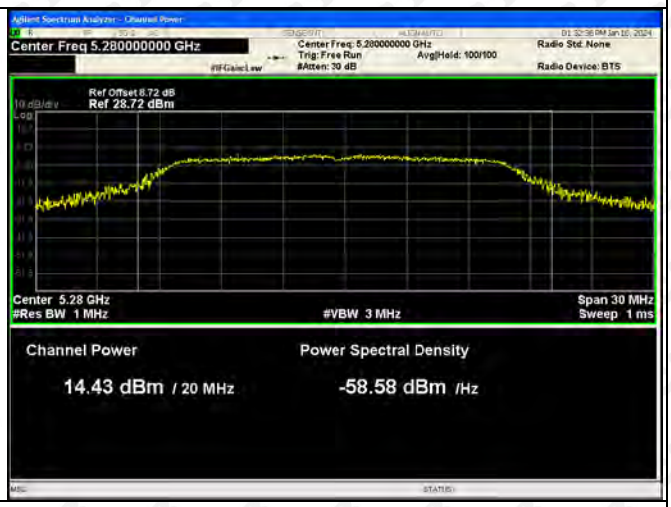
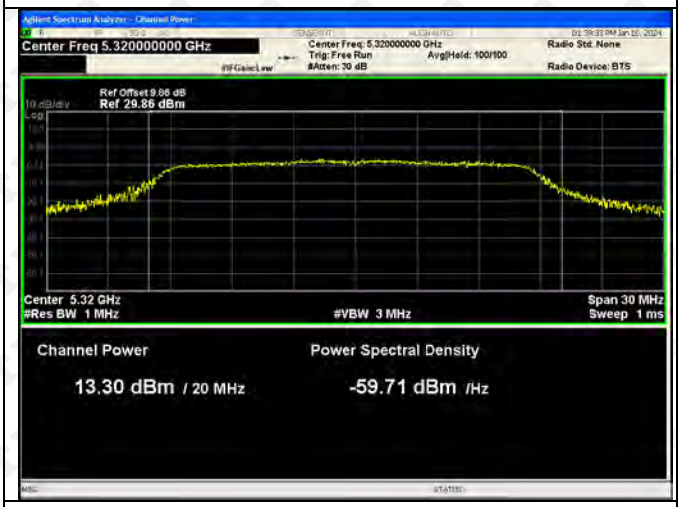
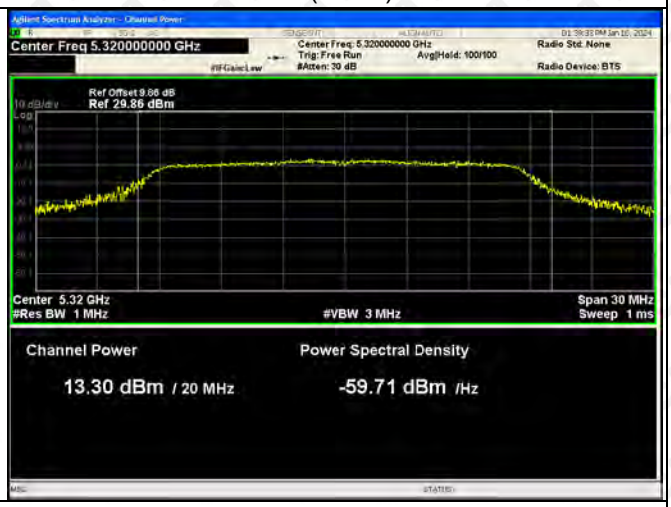
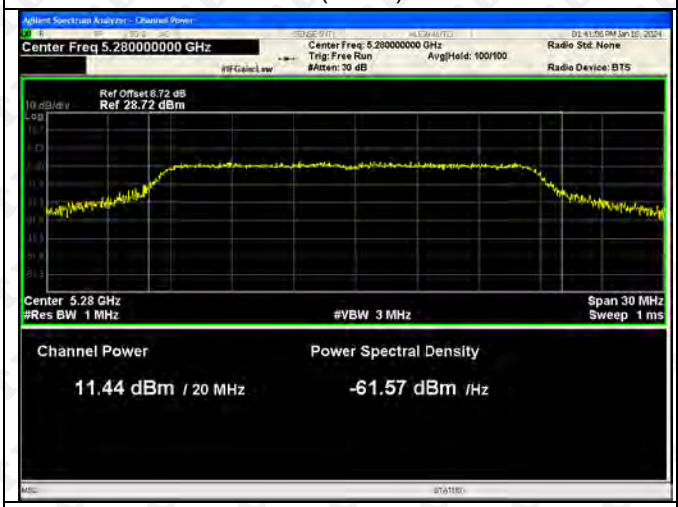
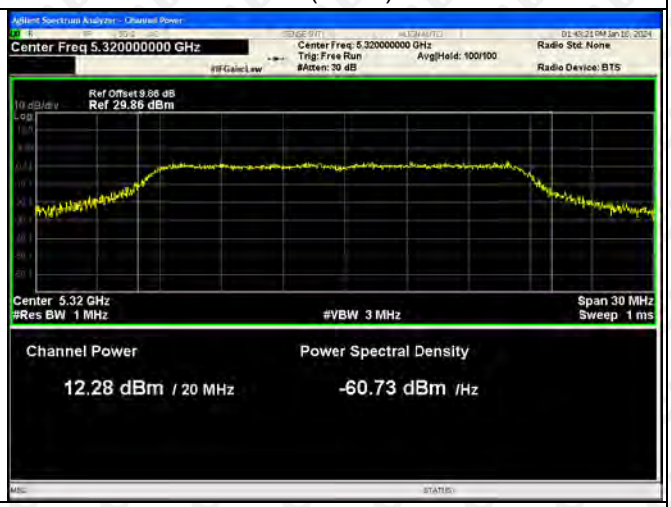


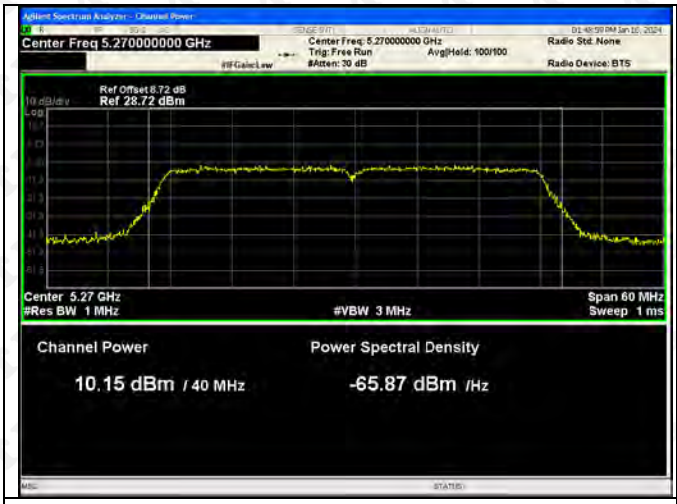
802.11n(HT40)-5230



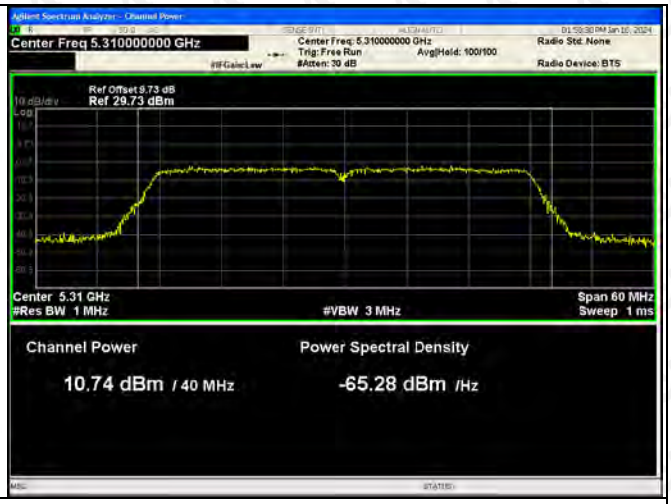


5250-5350MHz-Power
ANT1

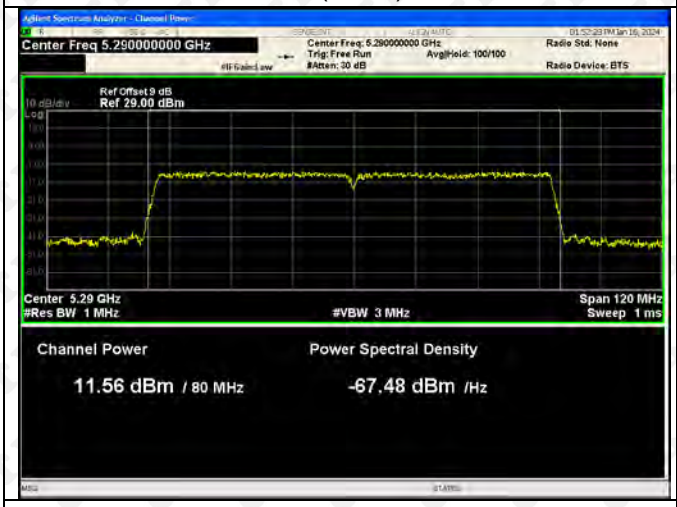
802.11a-5260	802.11a-5280
	
802.11a-5320	802.11ac(VH20)-5260
	
802.11ac(VH20)-5280	802.11ac(VH20)-5320
	
802.11ac(VH40)-5270	802.11ac(VH40)-5310



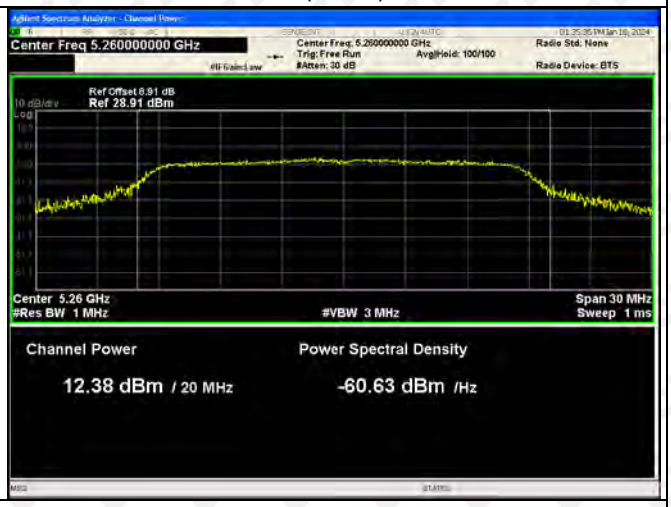
802.11ac(VH80)-5290



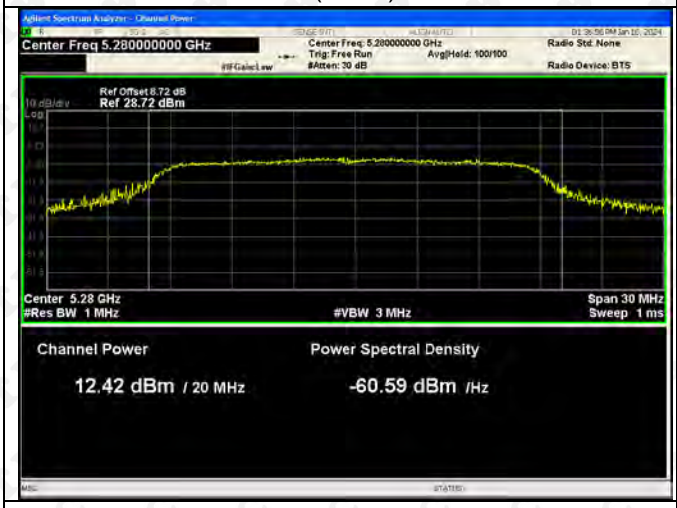
802.11n(HT20)-5260



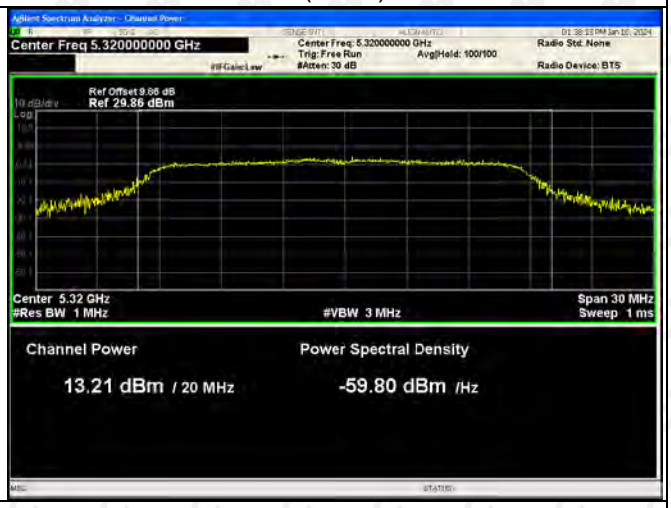
802.11n(HT20)-5280



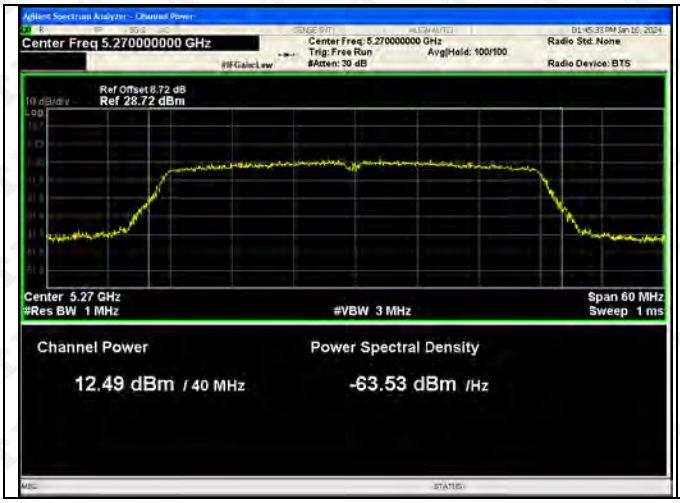
802.11n(HT20)-5320

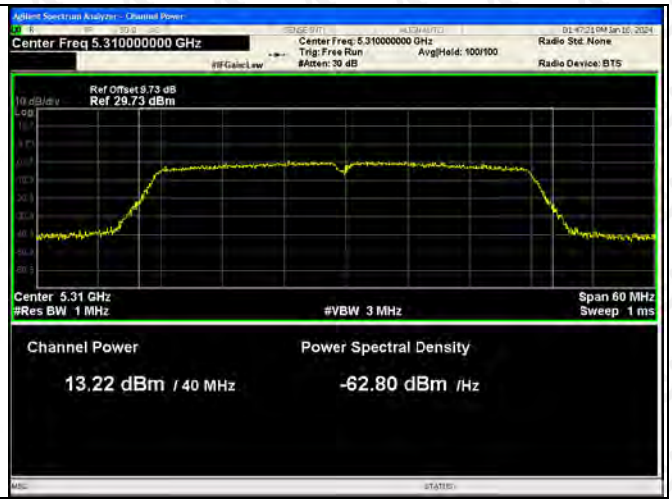


802.11n(HT40)-5270



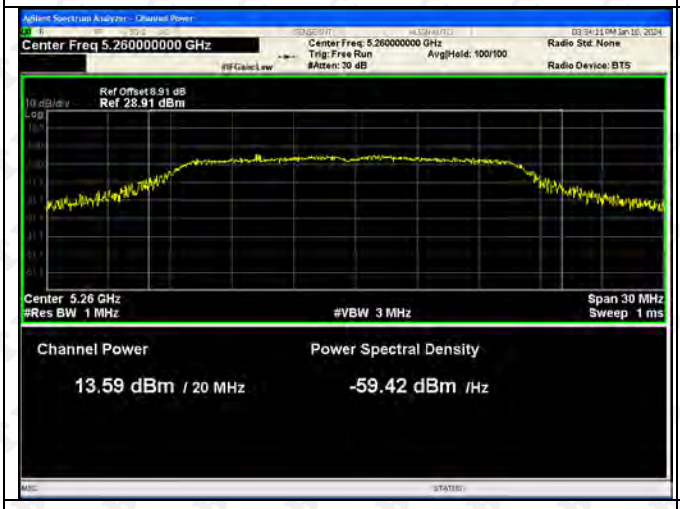
802.11n(HT40)-5310

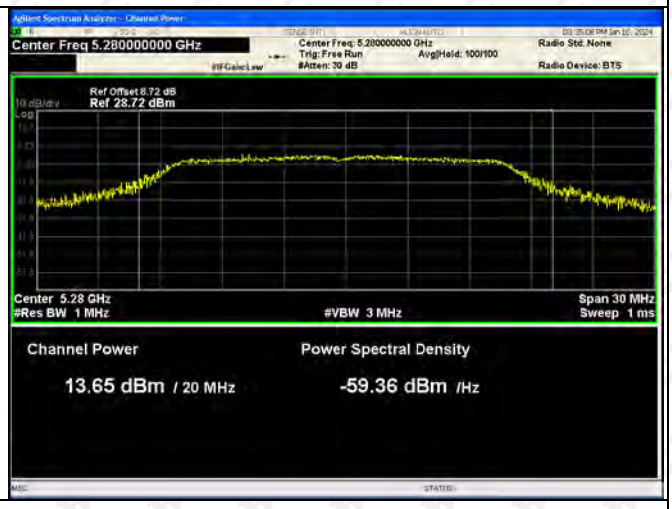




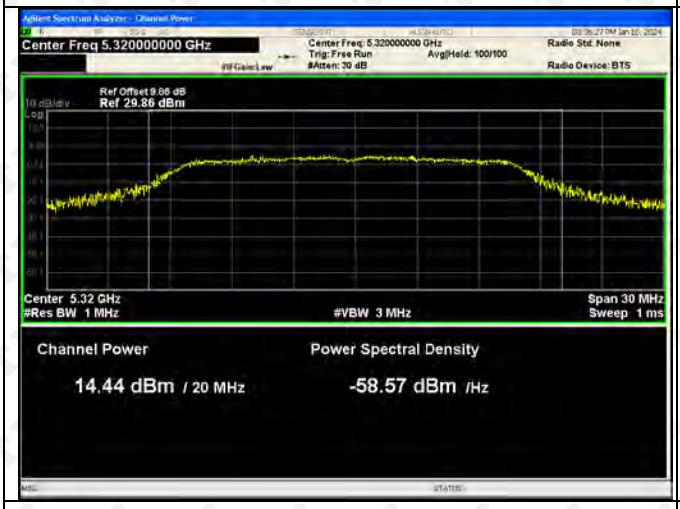
ANT2

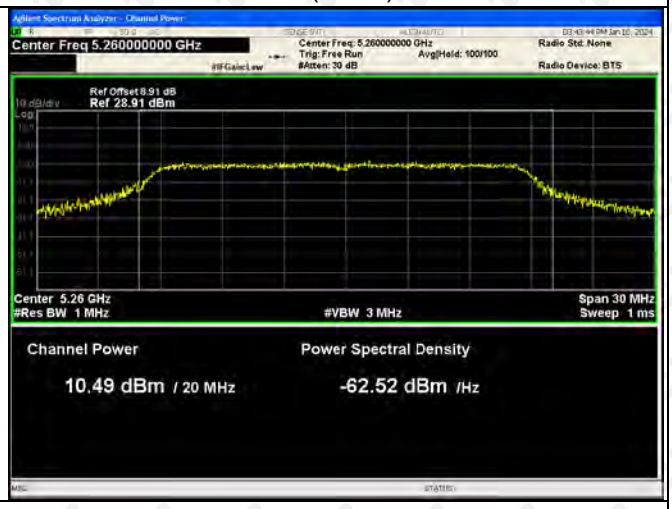
802.11a-5260	802.11a-5280



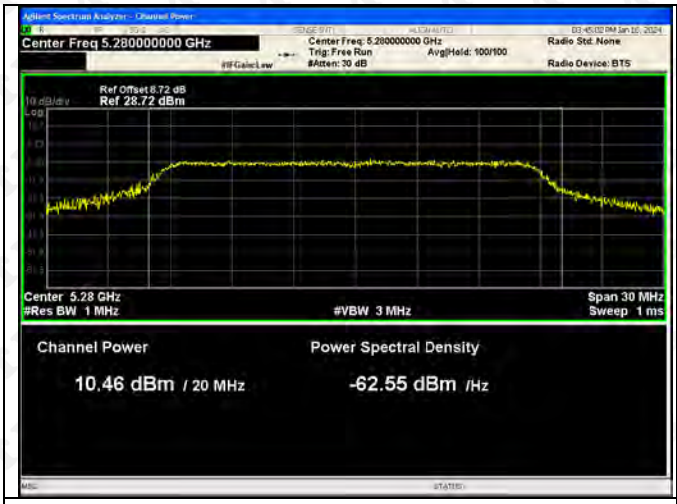


802.11a-5320	802.11ac(VH20)-5260

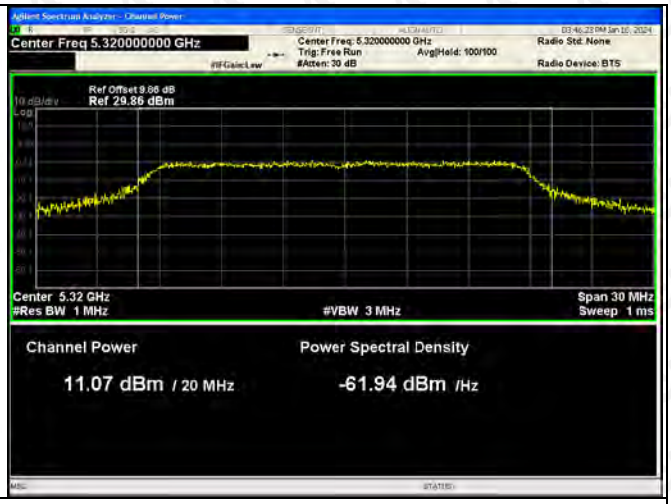




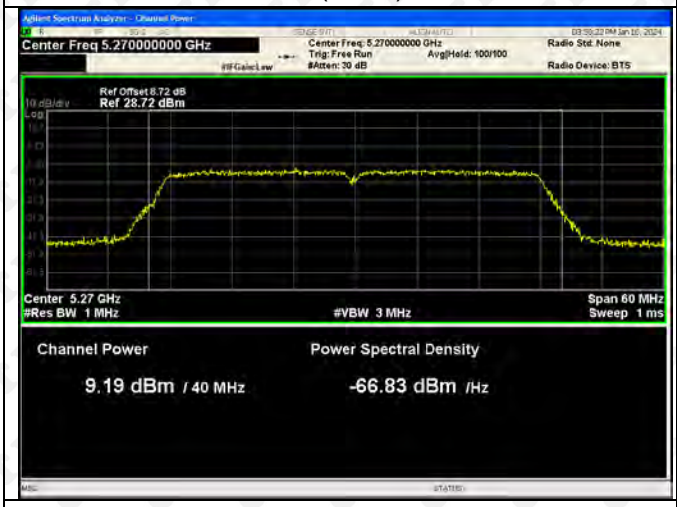
802.11ac(VH20)-5280	802.11ac(VH20)-5320



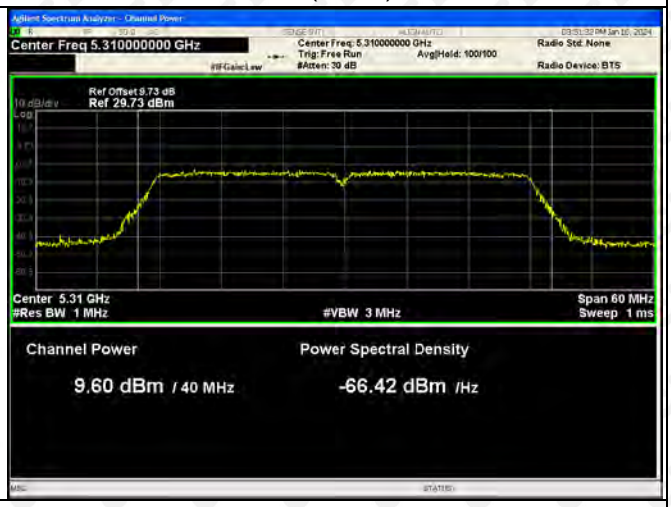
802.11ac(VH40)-5270



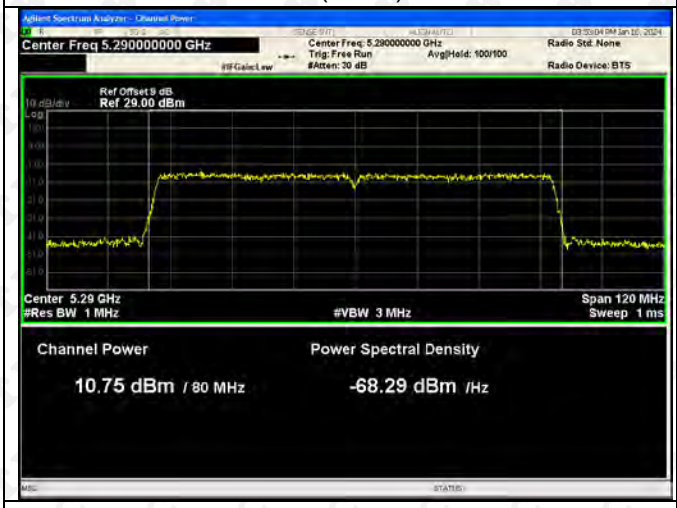
802.11ac(VH40)-5310



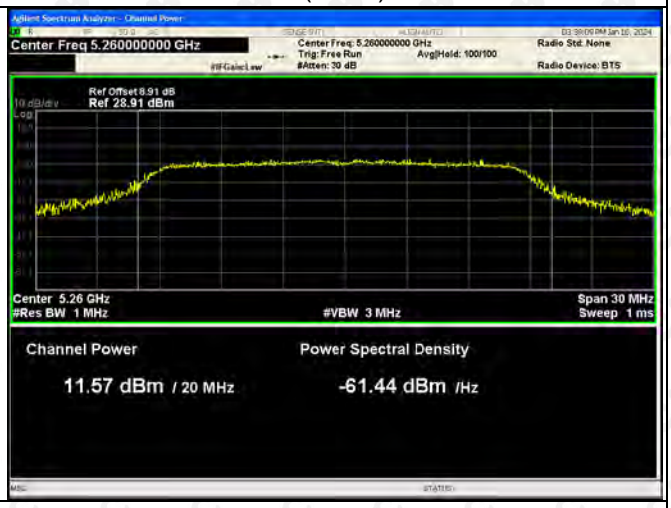
802.11ac(VH80)-5290



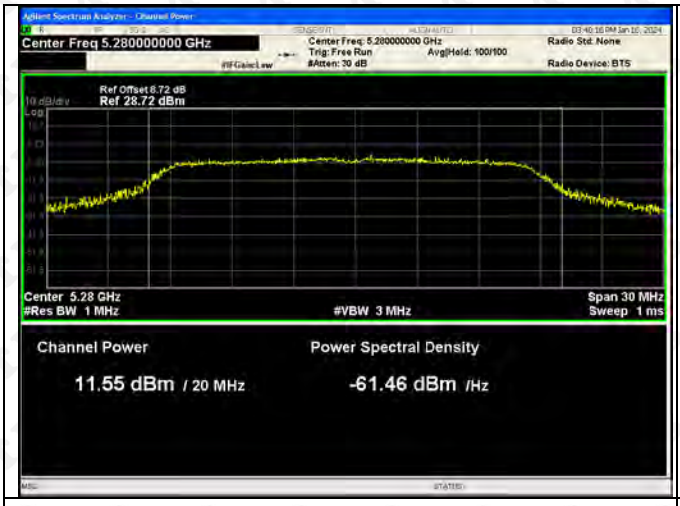
802.11n(HT20)-5260



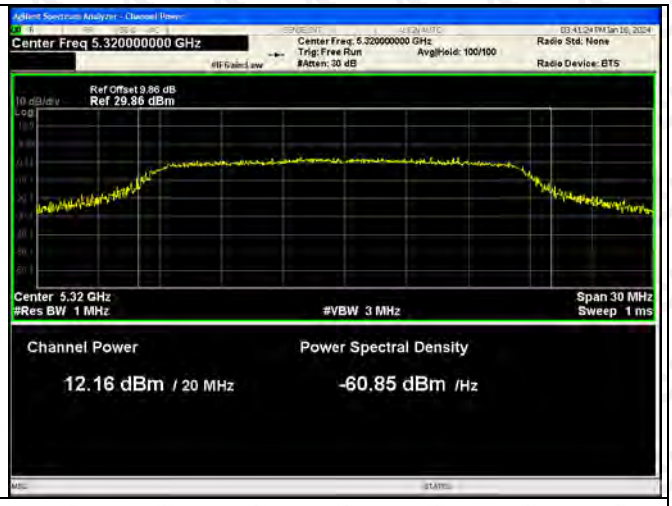
802.11n(HT20)-5280



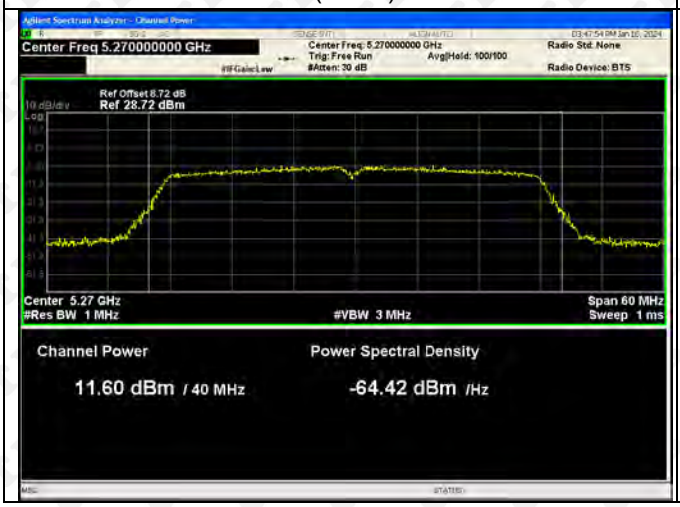
802.11n(HT20)-5320

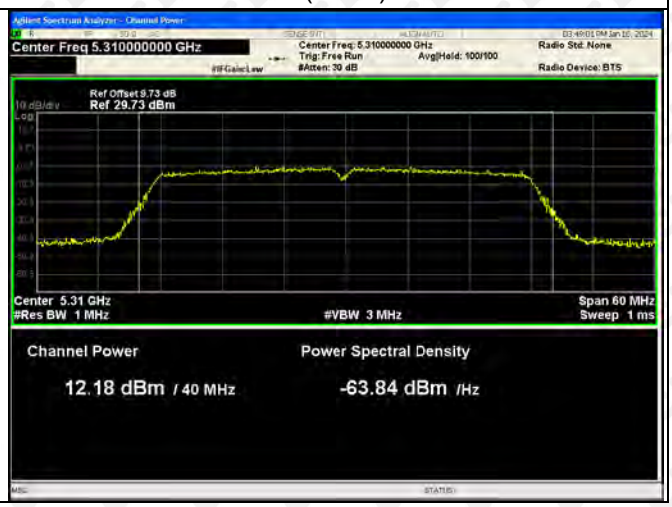


802.11n(HT40)-5270



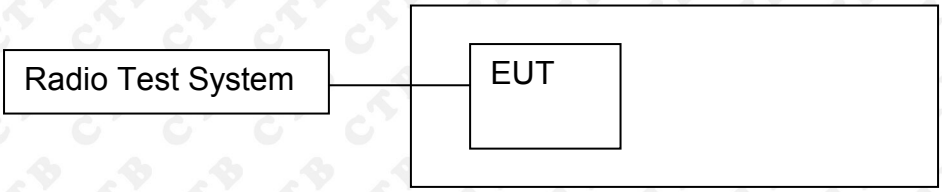
802.11n(HT40)-5310





10. EMISSION BANDWIDTH& OCCUPIED BANDWIDTH

10.1 Block Diagram Of Test Setup



10.2 Limits

(1) For the band 5.15-5.25 GHz.

(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.
(2) For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

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

10.3 Test Procedure

According to KDB789033 D02v02r01 sectionE, the following is the measurement procedure.

1. Emission Bandwidth (EBW)
a) Set RBW = approximately 1% of the emission bandwidth.
b) Set the VBW > RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Measure the maximum width of the emission that is 26 dB down from the maximum of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.
2. Minimum Emission Bandwidth for the band 5.725−5.85 GHz
Section 15.407(e) specifies the minimum 6 dB emission bandwidth of at least 500 kHz for the band 5.725−5.85 GHz. The following procedure shall be used for measuring this bandwidth:
a) Set RBW = 100 kHz.
b) Set the video bandwidth (VBW) ≥ 3 * RBW.
c) Detector = Peak.

d) Trace mode = max hold.
e) Sweep = auto couple.
f) Allow the trace to stabilize.
g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.
Note: The automatic bandwidth measurement capability of a spectrum analyzer or EMI receiver may be employed if it implements the functionality described in this section. For devices that use channel aggregation refer to III.A and III.C for determining emission bandwidth.

D. 99% Occupied Bandwidth

The 99% occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission. Measurement of the 99% occupied bandwidth is *required* only as a condition for using the optional band-edge measurement techniques described in II.G.3.d). Measurements of 99% occupied bandwidth may also optionally be used in lieu of the EBW to define the minimum frequency range over which the 789033 D02 General UNII Test Procedures New Rules v02r01 Page 4 spectrum is integrated when measuring maximum conducted output power as described in II.E. However, the EBW must be measured to determine bandwidth dependent limits on maximum conducted output power in accordance with Section 15.407(a).
The following procedure shall be used for measuring (99%) power bandwidth:
1. Set center frequency to the nominal EUT channel center frequency.

2. Set span = 1.5 times to 5.0 times the OBW.

3. Set RBW = 1% to 5% of the OBW

4. Set VBW ≥ 3 * RBW

5. Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.

6. Use the 99% power bandwidth function of the instrument (if available).

7. If the instrument does not have a 99% power bandwidth function, the trace data points are recovered and directly summed in power units. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5% of the total is reached; that frequency is recorded as the upper frequency. The 99% occupied bandwidth is the difference between these two frequencies.

10.4 Test Results

5150-5250MHz:

Test mode	Test Channel (MHz)	26dB Bandwidth (MHz)&ANT1	26dB Bandwidth (MHz)&ANT2
802.11a	5180	26.06	25.179
	5200	25.699	25.532
	5240	19.959	19.969
802.11ac20	5180	25.320	24.934
	5200	24.774	25.237
	5240	20.292	20.265
802.11ac40	5190	40.378	40.403
	5230	40.170	40.329
802.11ac80	5210	79.425	79.501
802.11n(HT20)	5180	24.130	24.346
	5200	25.348	24.815
	5240	20.002	19.869
802.11n(HT40)	5190	39.350	39.895
	5230	39.621	39.428

5250-5350 MHz:

Test mode	Test Channel (MHz)	26dB Bandwidth (MHz)&ANT1	26dB Bandwidth (MHz)&ANT2
802.11a	5260	25.840	25.991
	5280	25.457	25.278
	5320	25.250	25.346
802.11ac20	5260	25.893	25.946
	5280	25.981	25.139
	5320	25.168	26.924
802.11ac40	5270	40.187	40.249
	5310	40.386	40.350
802.11ac80	5290	79.597	79.408
802.11n(HT20)	5260	25.066	24.255
	5280	24.468	23.976
	5320	25.118	24.76
802.11n(HT40)	5270	39.469	39.583
	5310	39.663	40.040

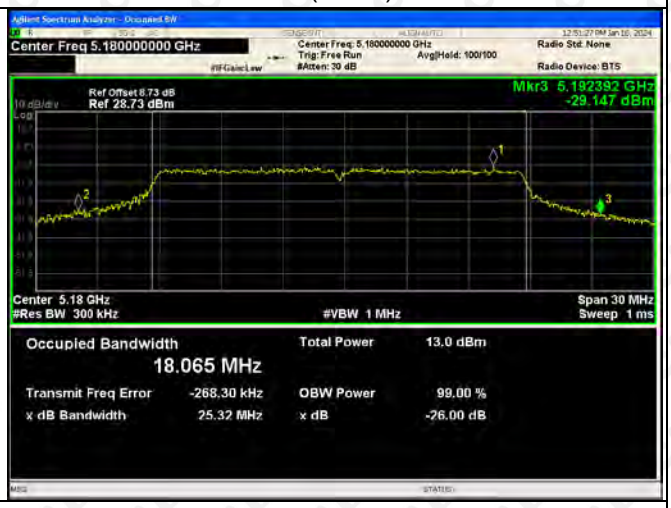
Test Graph:
5150-5250MHz-Power
ANT1

802.11a-5180

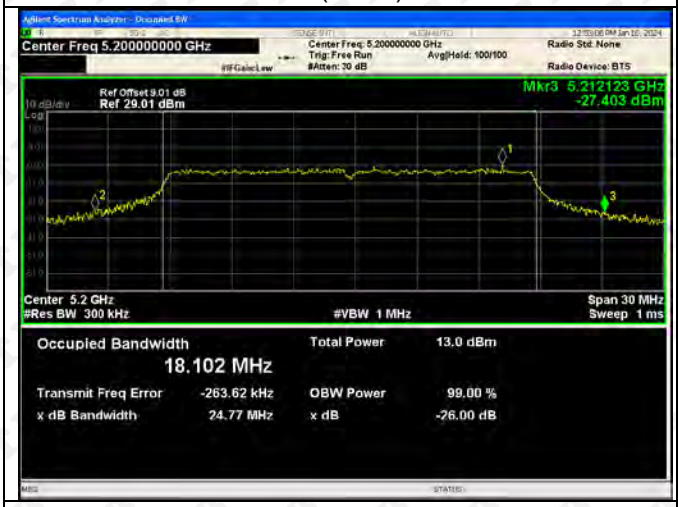
802.11a-5200

802.11a-5240

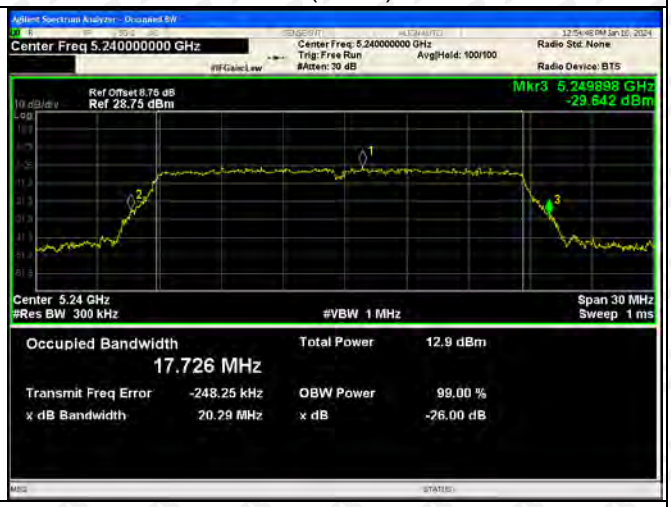
802.11ac(VH20)-5180



802.11ac(VH20)-5200



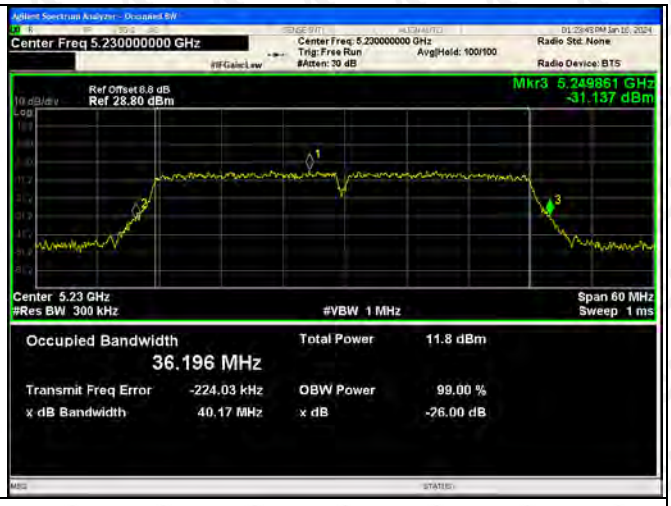
802.11ac(VH20)-5240



802.11ac(VH40)-5190

802.11ac(VH40)-5230

802.11ac(VH80)-5210



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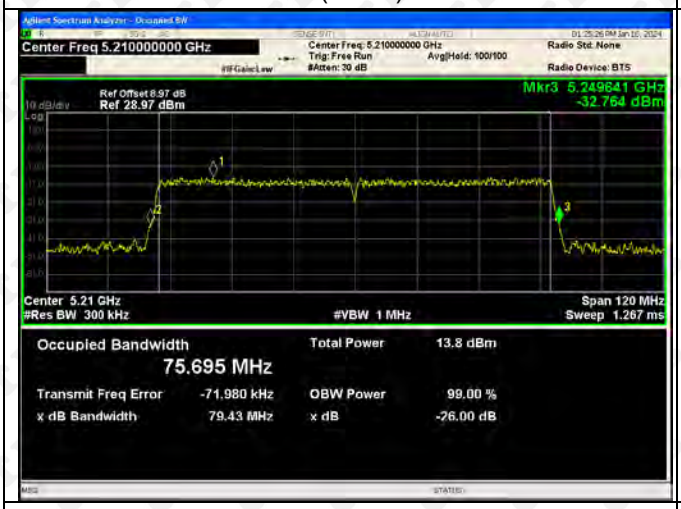

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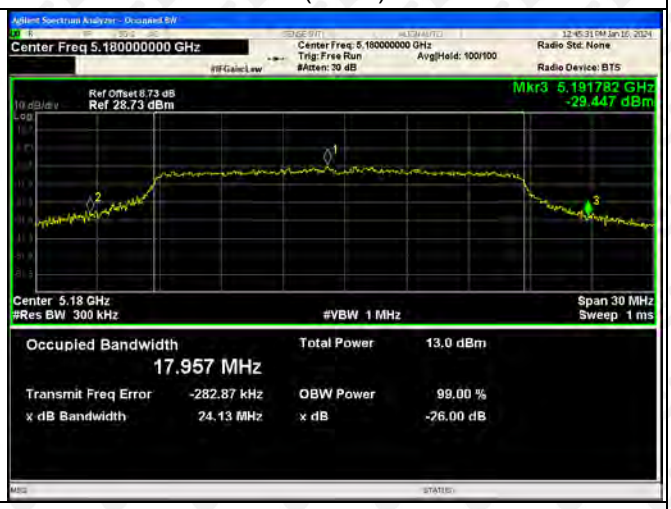


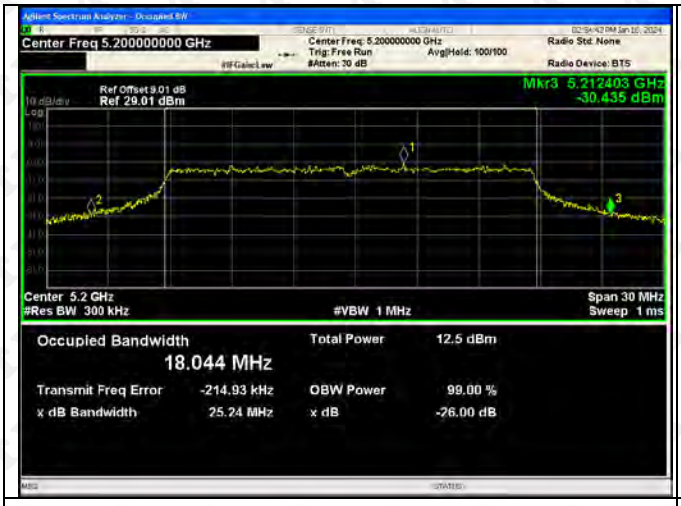
802.11n(HT20)-5240

802.11n(HT40)-5190

802.11n(HT40)-5230

ANT2

802.11a-5180	802.11a-5200
	
802.11a-5240	802.11ac(VH20)-5180
	
802.11ac(VH20)-5200	802.11ac(VH20)-5240



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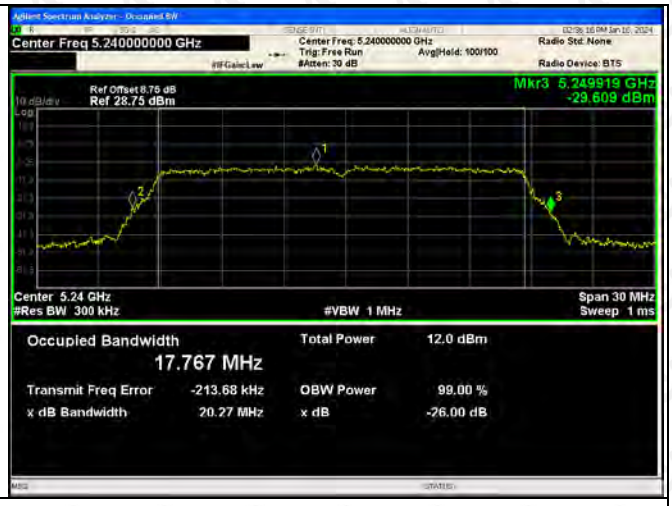
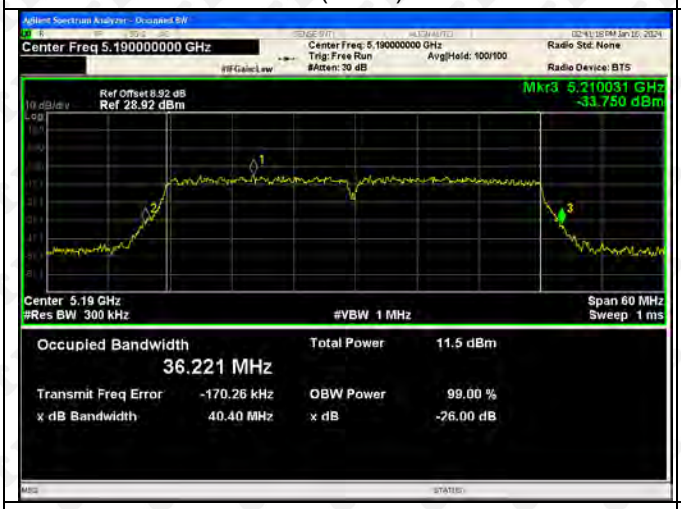
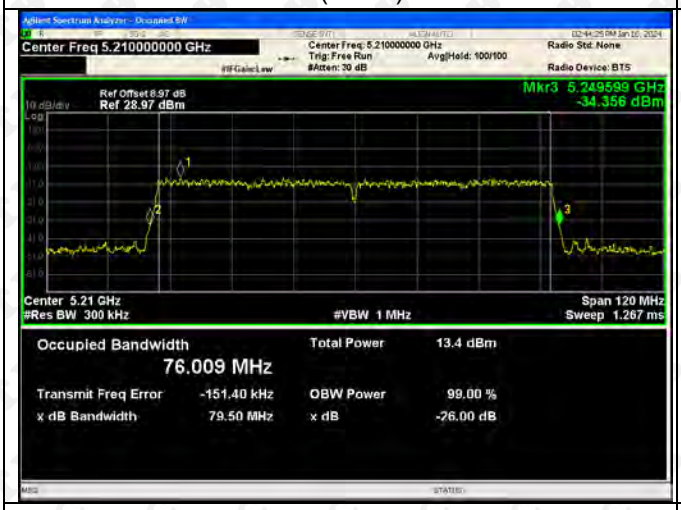


802.11ac(VH40)-5230



802.11ac(VH80)-5210

802.11n(HT20)-5180



802.11n(HT20)-5200

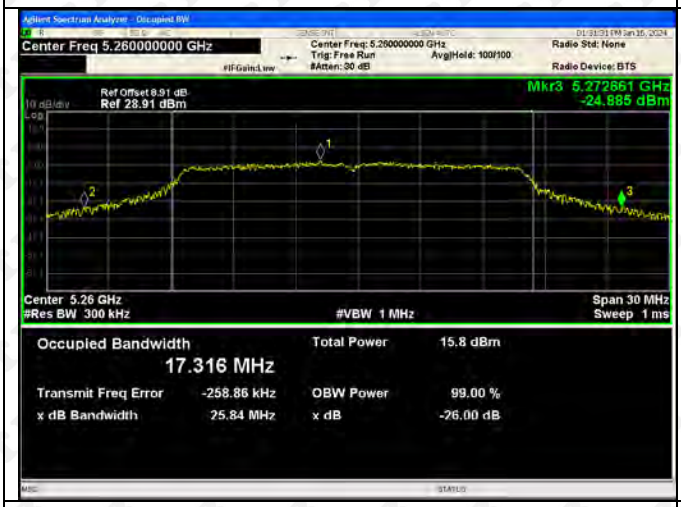
802.11n(HT20)-5240

802.11n(HT40)-5190

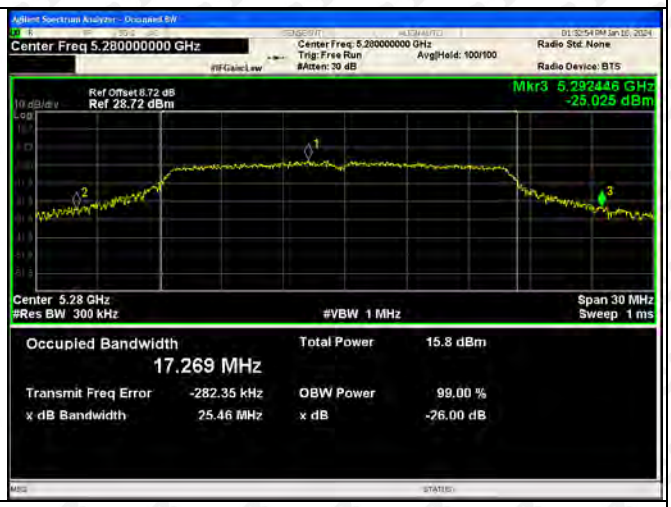
802.11n(HT40)-5230

5250-5350MHz-Power
ANT1

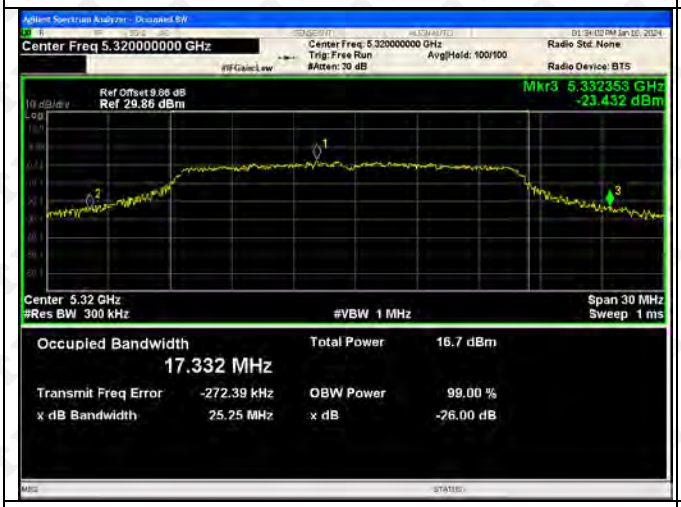
802.11a-5260



802.11a-5280



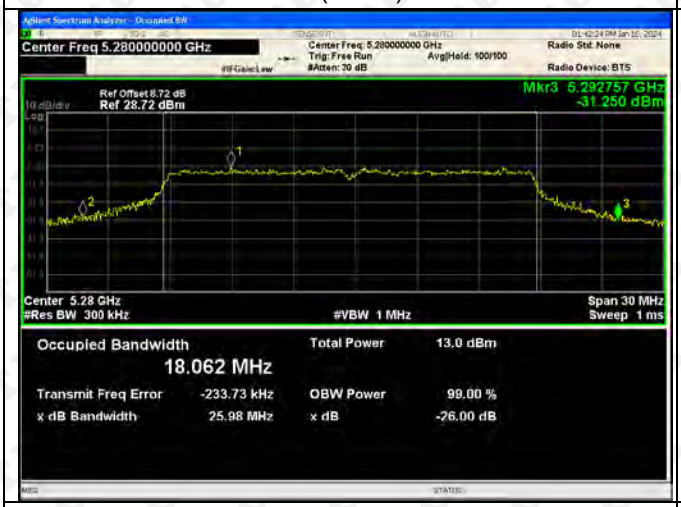
802.11a-5320



802.11ac(VH20)-5260

802.11ac(VH20)-5280

802.11ac(VH20)-5320



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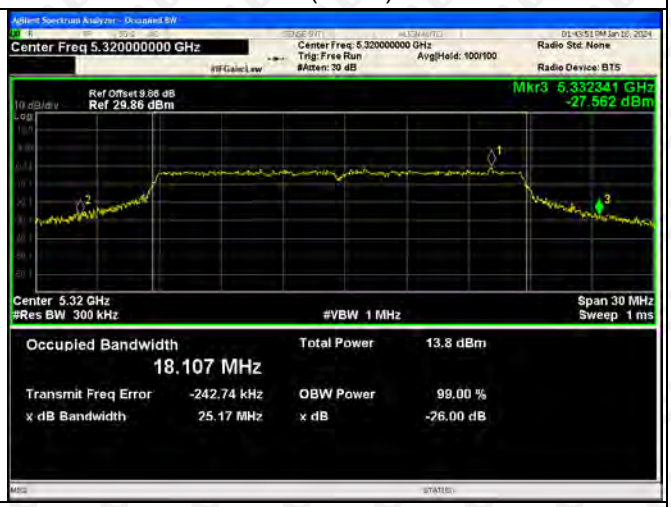
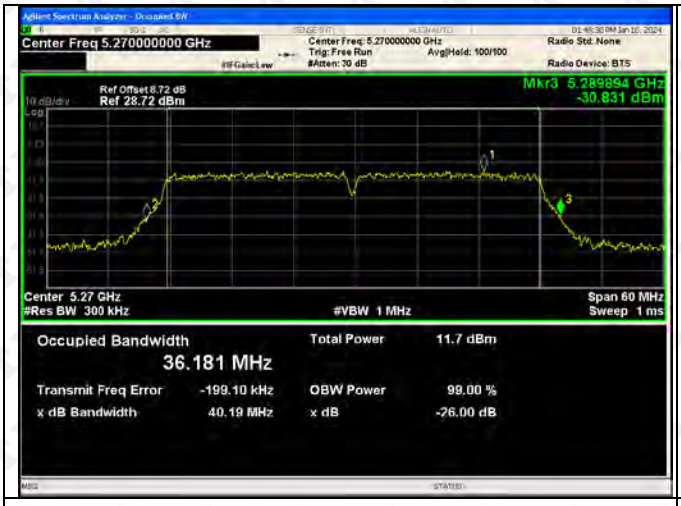


802.11ac(VH40)-5310



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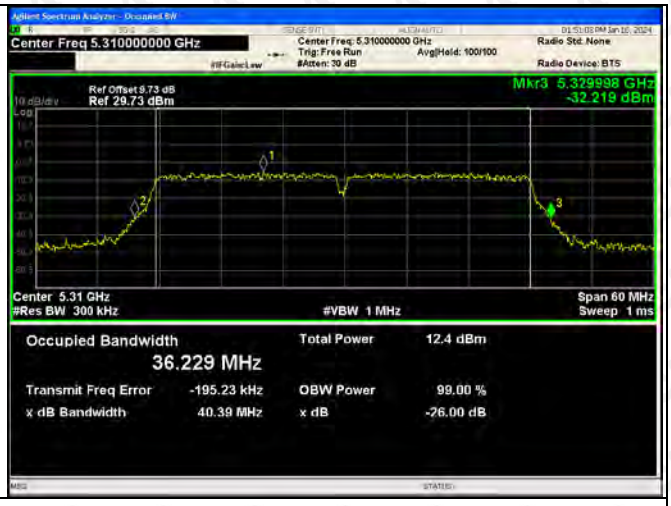
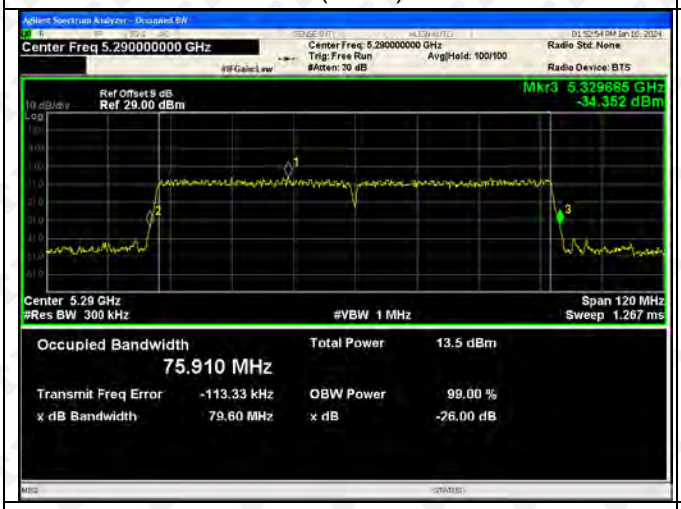
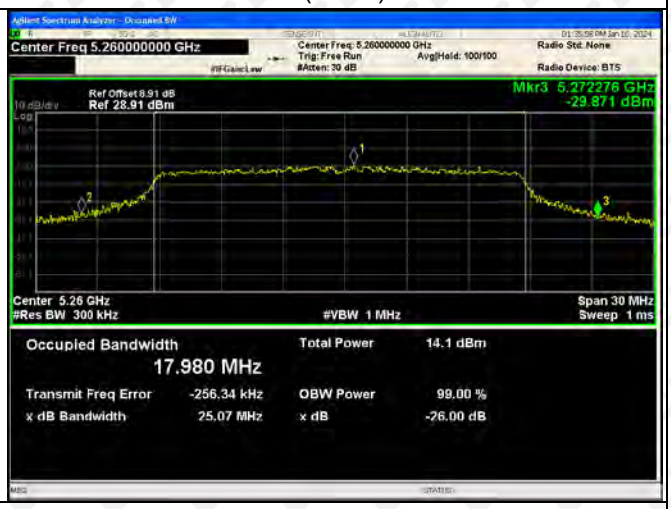


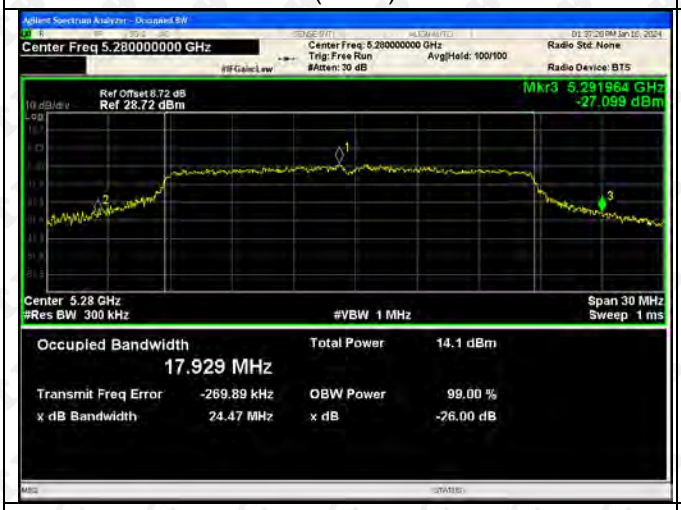
802.11n(HT20)-5260



802.11n(HT20)-5280



802.11n(HT20)-5320

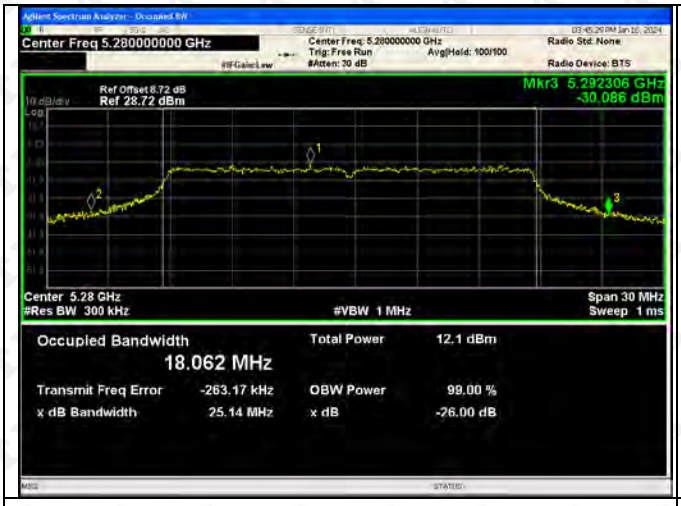


802.11n(HT40)-5270

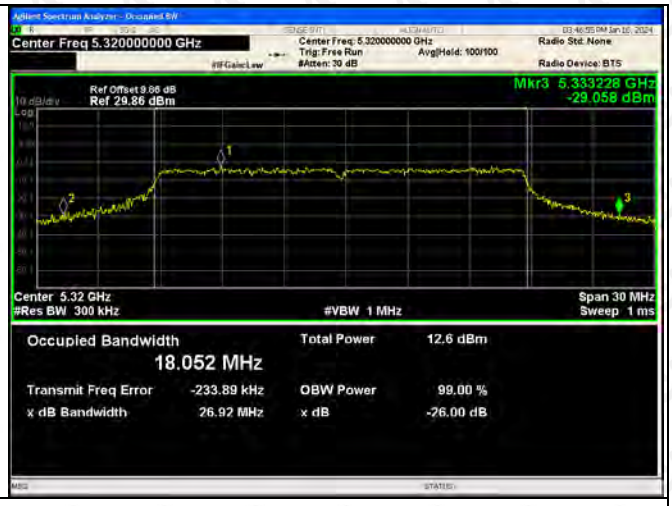
802.11n(HT40)-5310

ANT2

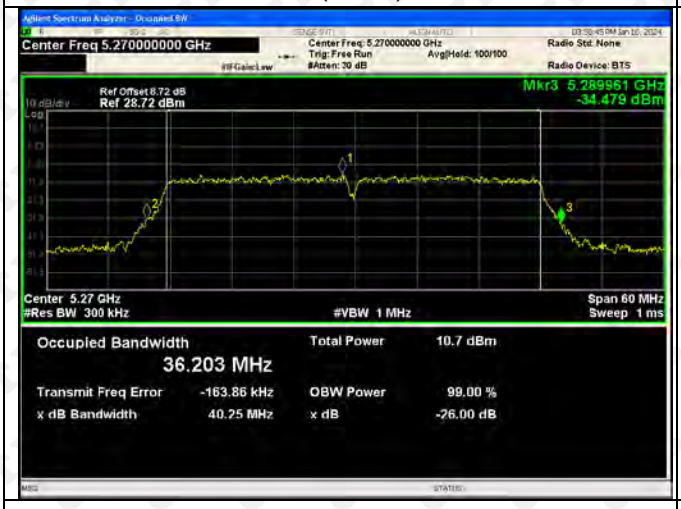
802.11a-5260	802.11a-5280
	
802.11a-5320	802.11ac(VH20)-5260
	
802.11ac(VH20)-5280	802.11ac(VH20)-5320



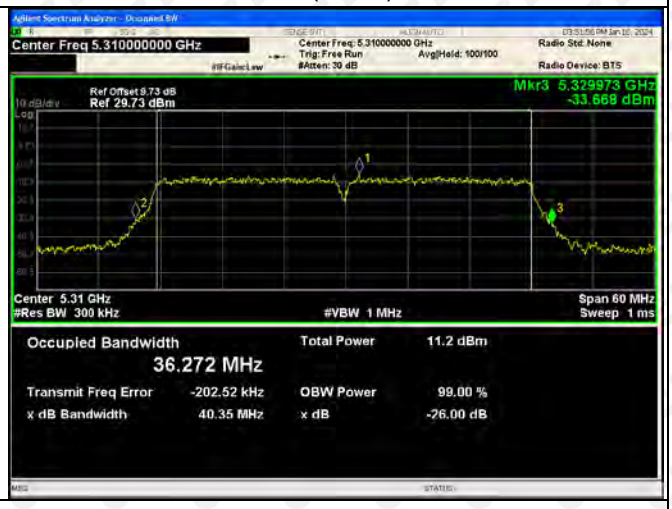
802.11ac(VH40)-5270



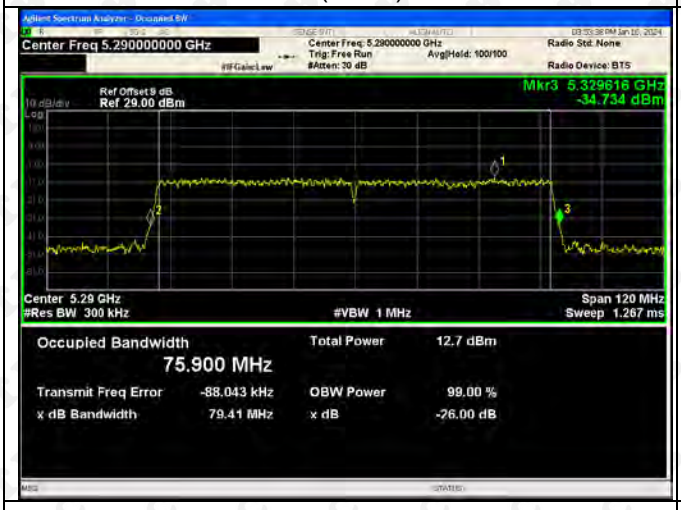
802.11ac(VH40)-5310



802.11ac(VH80)-5290



802.11n(HT20)-5260



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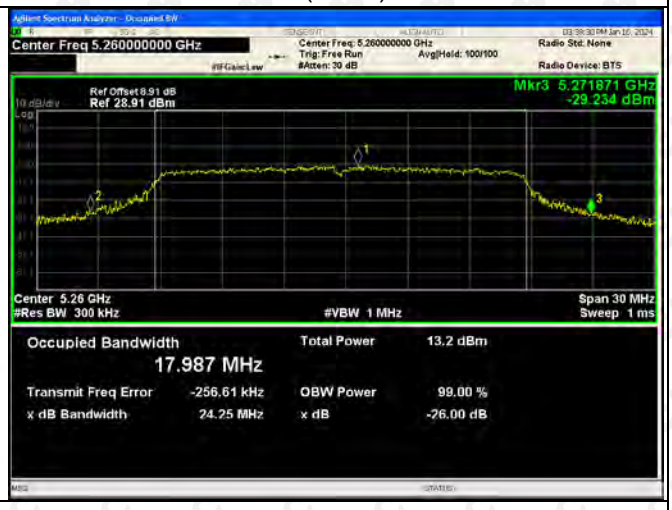
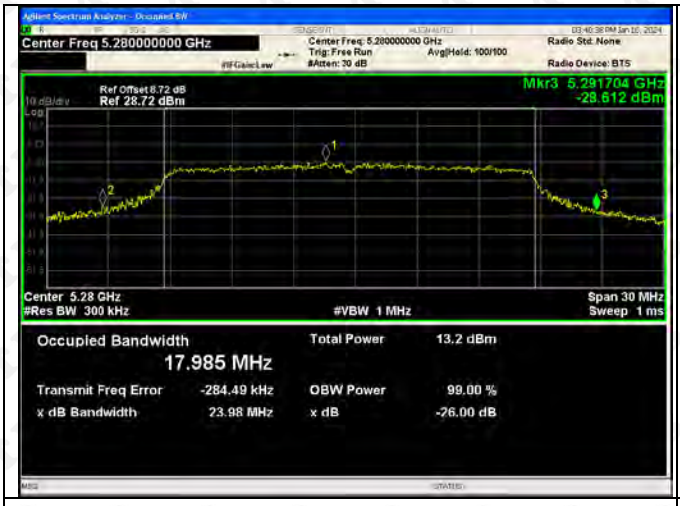
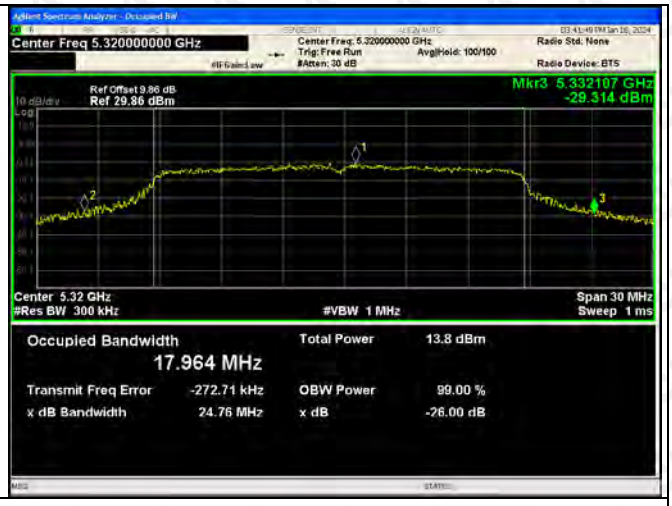


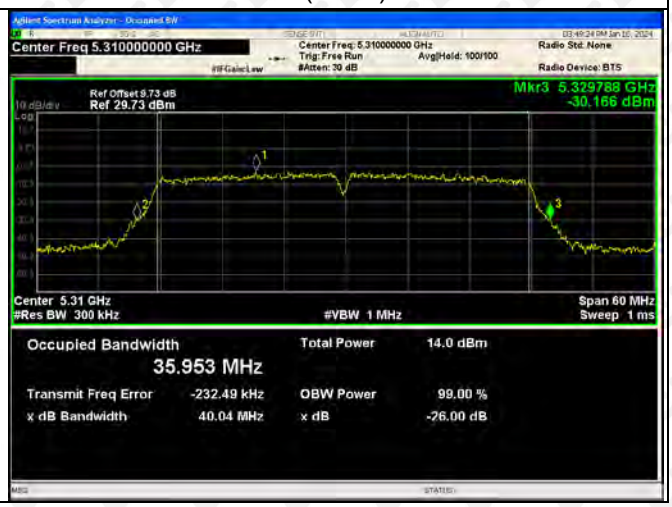
802.11n(HT20)-5320



802.11n(HT40)-5270

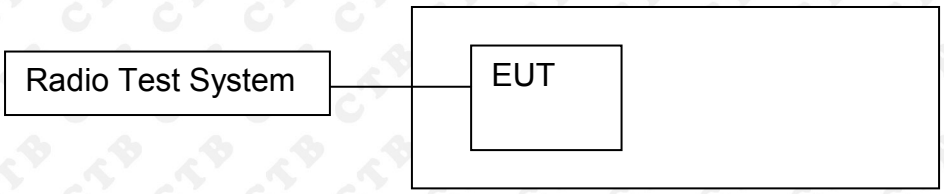


802.11n(HT40)-5310



11. POWER SPECTRAL DENSITY

11.1 Block Diagram Of Test Setup



11.2 Limit

(1) For the band 5.15-5.25 GHz.

(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.
(2) For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

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

11.3 Test procedure

According to KDB789033 D02v02r01 sectionE, the following is the measurement procedure.

For devices operating in the bands 5.15−5.25 GHz, 5.25−5.35 GHz, and 5.47−5.725 GHz, the preceding procedures make use of 1 MHz RBW to satisfy directly the 1 MHz reference bandwidth specified in Section 15.407(a)(5). For devices operating in the band 5.725−5.85 GHz, the rules specify a measurement bandwidth of 500 kHz. Many spectrum analyzers do not have 500 kHz RBW, thus a narrower RBW may need to be used. The rules permit the use of RBWs less than 1 MHz, or 500 kHz, “provided that the measured power is integrated over the full reference bandwidth” to show the total power over the specified measurement bandwidth (i.e., 1 MHz, or 500 kHz). If measurements are performed using a reduced resolution bandwidth (< 1 MHz, or < 500 kHz) and integrated over 1 MHz, or 500 kHz bandwidth, the following adjustments to the procedures apply:
a) Set RBW ≥ 1/*T*, where *T* is defined in II.B.I.a).

b) Set VBW ≥ 3 RBW.

c) If measurement bandwidth of Maximum PSD is specified in 500 kHz, add 10 log (500 kHz/RBW) to the

measured result, whereas RBW (<500 kHz) is the reduced resolution bandwidth of the spectrum analyzer set during measurement.

d) If measurement bandwidth of Maximum PSD is specified in 1 MHz, add 10 log (1MHz/RBW) to the measured result, whereas RBW (< 1 MHz) is the reduced resolution bandwidth of spectrum analyzer set during measurement.

e) Care must be taken to ensure that the measurements are performed during a period of continuous transmission or are corrected upward for duty cycle.
Note: As a practical matter, it is recommended to use reduced RBW of 100 kHz for the II.F.5.c) and II.F.5.d), since RBW=100 kHz is available on nearly all spectrum analyzers.

11.4 Test Result

5150-5250MHz:MHz
ANT1+ANT2

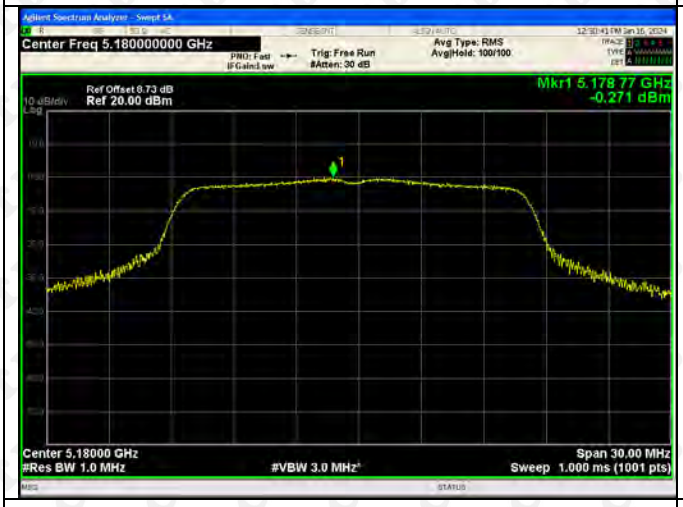
Test mode	Test Channel (MHz)	PSD [dBm/MHz] ANT 1	PSD [dBm/MHz] ANT 2	PSD [dBm/MHz] Total	Limit (dBm)	Result
802.11a	5180	-0.271	-0.466	/	11	Pass
	5200	-0.227	-0.411	/	11	Pass
	5240	-5.280	-0.139	/	11	Pass
802.11n(HT20)	5180	-5.164	-5.891	-2.502	11	Pass
	5200	-4.892	-5.490	-2.170	11	Pass
	5240	-5.141	-5.798	-2.447	11	Pass
802.11n(HT40)	5190	-10.626	-10.617	-7.611	11	Pass
	5230	-10.407	-10.614	-7.499	11	Pass
802.11ac(VH20)	5210	-12.828	-13.194	-9.997	11	Pass
	5180	-3.466	-4.457	-0.923	11	Pass
	5200	-3.787	-4.403	-1.074	11	Pass
802.11ac(VH40)	5240	-2.302	-2.979	0.383	11	Pass
	5190	-11.784	-7.513	-6.133	11	Pass
802.11ac(VH80)	5230	-11.678	-0.466	-0.149	11	Pass

5250-5350 MHzMHz
ANT1+ANT2

Test mode	Test Channel (MHz)	PSD [dBm/MHz] ANT 1	PSD [dBm/MHz] ANT 2	PSD [dBm/MHz] Total	Limit (dBm)	Result
802.11a	5260	-0.324	-1.070	/	11	Pass
	5280	-0.236	-1.208	/	11	Pass
	5320	0.467	-0.394	/	11	Pass
802.11n(HT20)	5260	-5.118	-6.253	-2.638	11	Pass
	5280	-5.398	-6.041	-2.697	11	Pass
	5320	-4.652	-5.586	-2.084	11	Pass
802.11n(HT40)	5270	-10.207	-11.275	-7.698	11	Pass
	5310	-9.666	-10.899	-7.229	11	Pass
802.11ac(VH20)	5260	-13.154	-13.817	-10.463	11	Pass
	5280	-2.619	-3.362	0.036	11	Pass
	5320	-2.681	-3.691	-0.146	11	Pass
802.11ac(VH40)	5270	-1.802	-2.900	0.694	11	Pass
	5310	-5.898	-6.476	-3.167	11	Pass
802.11ac(VH80)	5290	-5.093	-6.476	-2.719	11	Pass

Test Graph:
5150-5250MHz
ANT1

802.11a-5180



802.11a-5200

802.11a-5240

802.11ac(VH20)-5180

802.11ac(VH20)-5200

802.11ac(VH20)-5240

802.11ac(VH40)-5190

802.11ac(VH40)-5230

802.11ac(VH80)-5210

802.11n(HT20)-5180

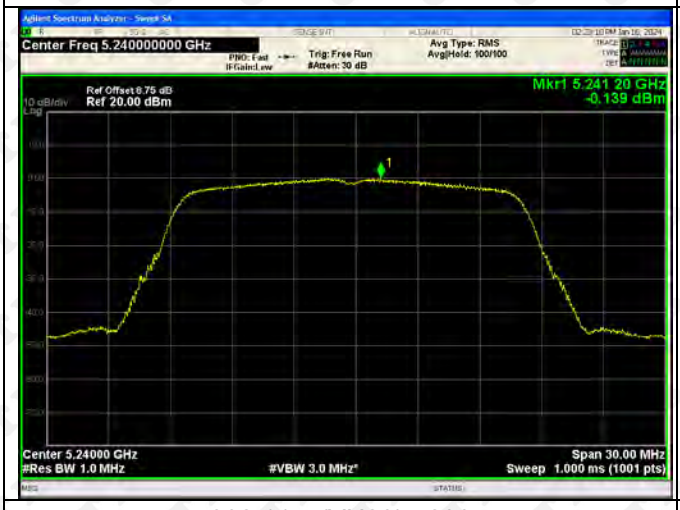
802.11n(HT20)-5200

802.11n(HT20)-5240

802.11n(HT40)-5190

802.11n(HT40)-5230

ANT2

802.11a-5180	802.11a-5200
	
802.11a-5240	802.11ac(VH20)-5180
	
802.11ac(VH20)-5200	802.11ac(VH20)-5240

802.11ac(VH40)-5190

802.11ac(VH40)-5230

802.11ac(VH80)-5210

802.11n(HT20)-5180

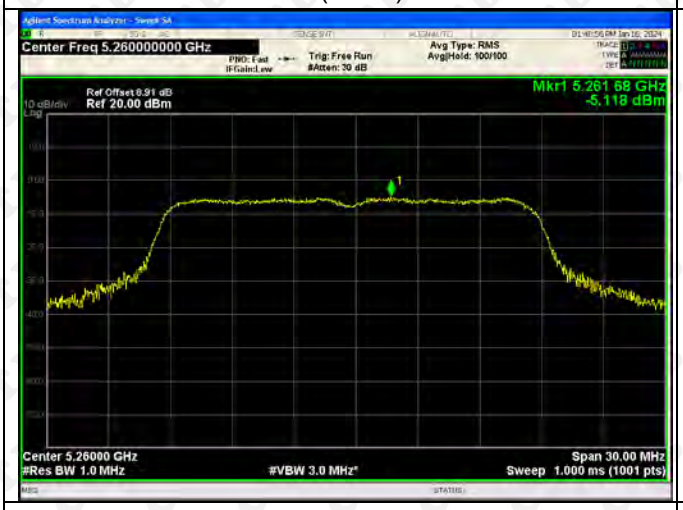
802.11n(HT20)-5200

802.11n(HT20)-5240

802.11n(HT40)-5190

802.11n(HT40)-5230

5250-5350MHz
ANT1

802.11a-5260	802.11a-5280
	
802.11a-5320	802.11ac(VH20)-5260
	
802.11ac(VH20)-5280	802.11ac(VH20)-5320
	
802.11ac(VH40)-5270	802.11ac(VH40)-5310

802.11ac(VH80)-5290

802.11n(HT20)-5260

802.11n(HT20)-5280

802.11n(HT20)-5320

802.11n(HT40)-5270

802.11n(HT40)-5310

ANT2

802.11a-5260	802.11a-5280
	
802.11a-5320	802.11ac(VH20)-5260
	
802.11ac(VH20)-5280	802.11ac(VH20)-5320

802.11ac(VH40)-5270

802.11ac(VH40)-5310

802.11ac(VH80)-5290

802.11n(HT20)-5260

802.11n(HT20)-5280

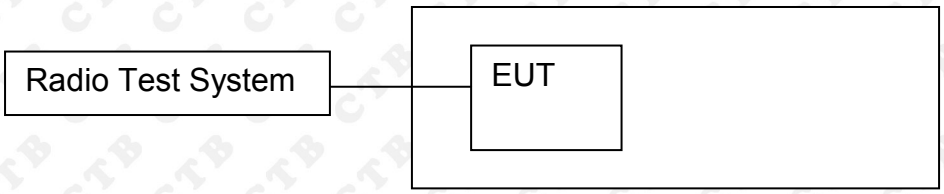
802.11n(HT20)-5320

802.11n(HT40)-5270

802.11n(HT40)-5310

12. FREQUENCY STABILITY

12.1 Block Diagram Of Test Setup



12.2 Limit

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

12.3 Test procedure

1. The EUT was placed inside temperature chamber and powered and powered by nominal DC voltage.

2. Set EUT as normal operation.

3. Turn the EUT on and couple its output to spectrum.

4. Turn the EUT off and set the chamber to the highest temperature specified.

5. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize, turn the EUT and measure the operating frequency.

6. Repeat step with the temperature chamber set to the lowest temperature.

12.4 Test Result

TX Frequency (5150-5250MHz)

ANT1

Voltage vs. Frequency Stability

TEST CONDITIONS				Reference Frequency：5180MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
T nom (°C)	20	V nom (V)	12.0	5180.0727	5180	0.0727	14.0424
		V max (V)	13.2	5180.0859	5180	0.0859	16.5896
		V min (V)	10.8	5180.0171	5180	0.0171	3.3087
Limits				±20ppm			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency：5180MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	12	T (°C)	0	5180.0290	5180	0.0290	5.5999
		T (°C)	10	5180.0037	5180	0.0037	0.7152
		T (°C)	20	5180.0507	5180	0.0507	9.7859
		T (°C)	30	5180.0154	5180	0.0154	2.9728
		T (°C)	40	5180.0097	5180	0.0097	1.8672
Limits				±20ppm			
Result				Complies			

Voltage vs. Frequency Stability

TEST CONDITIONS				Reference Frequency：5200MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
T nom (°C)	20	V nom (V)	12.0	5200.0182	5200	0.0182	3.5016
		V max (V)	13.2	5200.0133	5200	0.0133	2.5502
		V min (V)	10.8	5200.0198	5200	0.0198	3.8056
Limits				±20ppm			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency：5200MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	12	T (°C)	0	5200.0190	5200	0.0190	3.6629
		T (°C)	10	5200.0298	5200	0.0298	5.7336
		T (°C)	20	5200.0421	5200	0.0421	8.0954
		T (°C)	30	5200.0144	5200	0.0144	2.7637
		T (°C)	40	5200.0325	5200	0.0325	6.2412
Limits				±20ppm			
Result				Complies			

Voltage vs. Frequency Stability

TEST CONDITIONS				Reference Frequency：5240MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
T nom (°C)	20	V nom (V)	12.0	5240.0210	5240	0.0210	4.0137
		V max (V)	13.2	5240.0171	5240	0.0171	3.2657
		V min (V)	10.8	5240.0183	5240	0.0183	3.4981
Limits				±20ppm			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency：5240MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	12	T (°C)	0	5240.0373	5240	0.0373	7.1268
		T (°C)	10	5240.0520	5240	0.0520	9.9293
		T (°C)	20	5240.0301	5240	0.0301	5.7531
		T (°C)	30	5240.0410	5240	0.0410	7.8268
		T (°C)	40	5240.0127	5240	0.0127	2.4198
Limits				±20ppm			
Result				Complies			

TX Frequency (5250-5350MHz)

Voltage vs. Frequency Stability

TEST CONDITIONS				Reference Frequency：5260MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
T nom (°C)	20	V nom (V)	12.0	5260.0149	5260	0.0149	2.8304
		V max (V)	13.2	5260.0082	5260	0.0082	1.5517
		V min (V)	10.8	5260.0089	5260	0.0089	1.6917
Limits				±20ppm			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency：5260MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	12	T (°C)	0	5260.0111	5260	0.0111	2.1192
		T (°C)	10	5260.0262	5260	0.0262	4.9794
		T (°C)	20	5260.0884	5260	0.0884	16.8062
		T (°C)	30	5260.0544	5260	0.0544	10.3393
		T (°C)	40	5260.0040	5260	0.0040	0.7645
Limits				±20ppm			
Result				Complies			

Voltage vs. Frequency Stability

TEST CONDITIONS				Reference Frequency：5280MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
T nom (°C)	20	V nom (V)	12.0	5280.0024	5280	0.0024	0.4489
		V max (V)	13.2	5280.0824	5280	0.0824	15.5992
		V min (V)	10.8	5280.0081	5280	0.0081	1.5286
Limits				±20ppm			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency：5280MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	12	T (°C)	0	5280.0026	5280	0.0026	0.4920
		T (°C)	10	5280.0264	5280	0.0264	4.9979
		T (°C)	20	5280.0207	5280	0.0207	3.9219
		T (°C)	30	5280.0362	5280	0.0362	6.8476
		T (°C)	40	5280.0509	5280	0.0509	9.6388
Limits				±20ppm			
Result				Complies			

Voltage vs. Frequency Stability

TEST CONDITIONS				Reference Frequency：5320MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
T nom (°C)	20	V nom (V)	12.0	5320.0466	5320	0.0466	8.7669
		V max (V)	13.2	5320.0173	5320	0.0173	3.2505
		V min (V)	10.8	5320.0911	5320	0.0911	17.1266
Limits				±20ppm			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency：5320MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	12	T (°C)	0	5320.0508	5320	0.0508	9.5416
		T (°C)	10	5320.0082	5320	0.0082	1.5363
		T (°C)	20	5320.0264	5320	0.0264	4.9645
		T (°C)	30	5320.0131	5320	0.0131	2.4578
		T (°C)	40	5320.0676	5320	0.0676	12.6990
Limits				±20ppm			
Result				Complies			

13. OPERATION IN THE ABSENCE OF INFORMATION TO THE TRANSMIT

13.1 Requirement

15.407(c) requirement:
The device shall automatically discontinue transmission in case of either absence of information to transmit or operational failure. These provisions are not intended to preclude the transmission of control or signal ling information or the use of repetitive codes used by certain digital technologies to complete frame or burst intervals. Applicants shall include in their application for equipment authorization a description of how this requirement is met.

13.2 Test Results

Operation in the absence of information to the transmit:

While the EUT is not transmitting any information, the EUT can automatically discontinue transmission and become standby mode for power saving. The EUT can detect the controlling
signal of ASK message transmitting from remote device and verify whether it shall resend or
discontinue transmission. (manufacturer declare)

14. ANTENNA REQUIREMENT

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.
15.247(b) (4) requirement:
The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

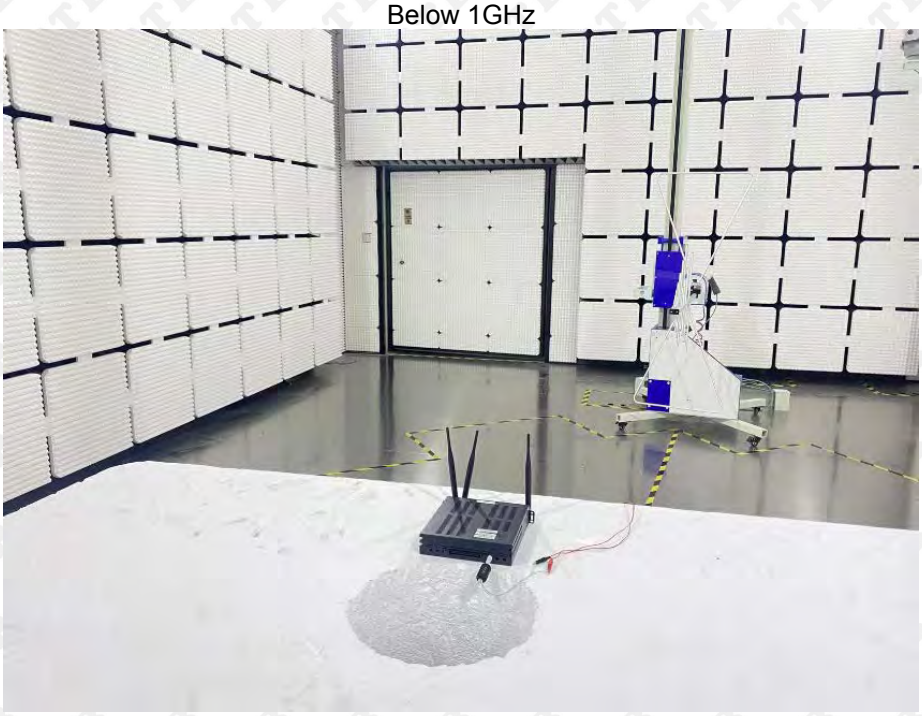
EUT Antenna:

The antenna is glue stick antenna and no consideration of replacement. The best case gain of the antenna is WiFi (5.2G): ANT1: 4.04dBi, ANT2: 4.04dBi; WiFi (5.3G): ANT1: 4.21dBi, ANT2: 4.21dBi dBi.

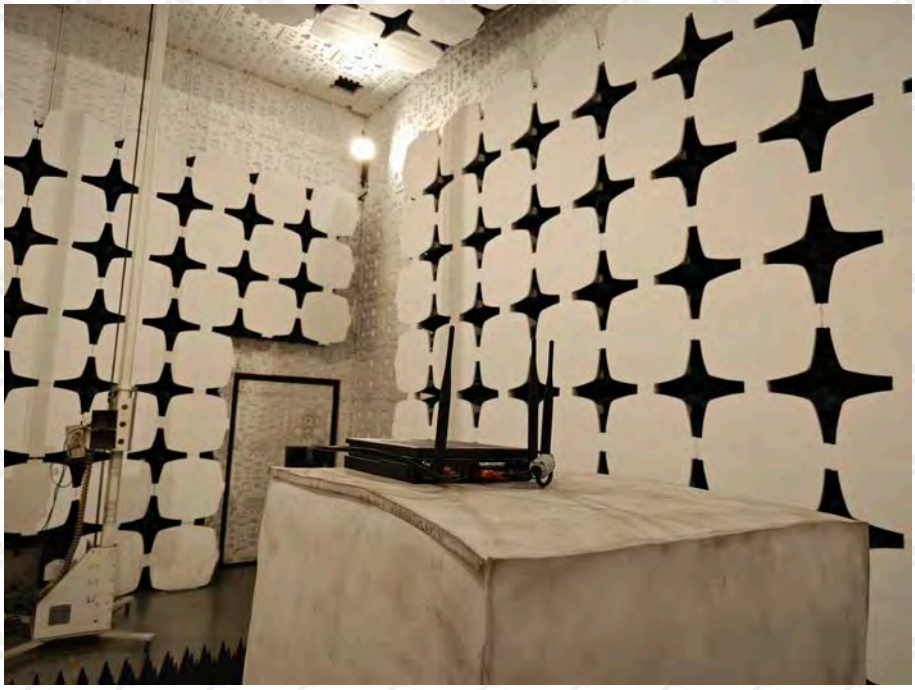
15. EUT TEST SETUP PHOTOGRAPHS

Spurious emissions

Below 1GHz



Above 1GHz



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