TEST REPORT

Product Name:	TV BOX
FCC ID:	2BBX3-R3
Trademark:	VONTAR
Model Number:	R3, RK3528, H1, H618, X2, X3, X4, X5, S905X5, DQ03, DQ06, DQ08
Prepared For:	Shenzhen Yojia Technology Co., Ltd.
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Prepared By:	Shenzhen CTB Testing Technology Co., Ltd.
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Sample Received Date:	Jun. 20, 2023
Sample tested Date:	Jun. 20, 2023 to Jun. 28, 2023
Issue Date:	Jun. 28, 2023
Report No.:	CTB230625009RFX
Test Standards	47 CFR Part 15 Subpart E KDB 789033 V02r01
Test Results	PASS
Remark:	This is WIFI-5GHz band radio test report.

Compiled by:	Reviewed by:	Approved by:
Chen Zheng	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.

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(NOTE: N/A MEANS NOT APPLICABLE)

1. VERSION

Report No.	Issue Date	Description	Approved
CTB230625009RFX	Jun. 28, 2023	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)(9)	ANSI C63.10-2013	PASS
Radiated Spurious emissions	47 CFR Part 15 Subpart E Section 15.205/15.407(b)	KDB789033v02r01	PASS
Band edge	47 CFR Part 15 Subpart E Section 15.205/15.407(b)	KDB789033v02r01	PASS
Conducted Peak Output Power	47 CFR Part 15 Subpart E Section 15.407 (a)	KDB789033v02r01	PASS
Emission Bandwidth & Occupied Bandwidth	47 CFR Part 15 Subpart E Section 15.407 (a)(e)	KDB789033v02r01	PASS
Power Spectral Density	47 CFR Part 15 Subpart E Section 15.407 (a)	KDB789033v02r01	PASS
Frequency stability	47 CFR Part 15 Subpart E Section 15.407 (g)	KDB789033v02r01	PASS
Operation in the absence of information to the transmit	47 CFR Part 15 Subpart E Section 15.407 (c)	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.

No.	Item	Uncertainty
1	Occupancy bandwidth	U=±54.3Hz
2	Adjacent channel power	U=±1.3dB
3	Conducted Adjacent channel power	U=±1.38dB
4	Conducted output power Above 1G	U=±1.0dB
5	Conducted output power below 1G	U=±0.9dB
6	Power Spectral Density , Conduction	U=±1.0dB
7	Conduction spurious emissions	U=±2.8dB
8	Out of band emission	U=±54Hz
9	3m camber Radiated spurious emission(30MHz-1GHz)	U=±4.3dB
10	3m chamber Radiated spurious emission(1GHz-18GHz)	U=±4.5dB
11	humidity uncertainty	U=±5.3%
12	Temperature uncertainty	U=±0.59℃
13	Supply volyages	U=±3%
14	Time	U=±5%
15	Conducted Emission (150KHz-30MHz)	3.2 dB
16	3m camber Radiated spurious emission(9KHz-30MHz)	4.8dB
17	3m chamber Radiated spurious emission(18GHz-40GHz)	3.4dB

4. PRODUCT INFORMATION AND TEST SETUP

4.1 Product Information

Model(s):	R3, RK3528, H1, H618, X2, X3, X4, X5, S905X5, DQ03, DQ06, DQ08
Model Description:	All the model are the same circuit and RF module, only for model name. Test sample model: R3
Wi-Fi Specification:	IEEE 802.11a/b/g/n/ac/ax
Hardware Version:	V1.0
Software Version:	V1.0
Operation Frequency:	IEEE 802.11a/n/ac/ax(20M): 5150MHz ~5250MHz/ 4 channel IEEE 802.11n/ac/ax(40M): 5150MHz ~5250MHz/ 2 channel IEEE 802.11ac/ax(80M): 5150MHz ~5250MHz/ 1 channel IEEE 802.11a/n/ac/ax(20M): 5725MHz ~5850MHz/ 5 channel IEEE 802.11n/ac/ax(40M): 5725MHz ~5850MHz/ 2 channel IEEE 802.11ac/ax(80M): 5725MHz ~5850MHz/ 1 channel
Max. RF output power:	WiFi (5G): 14.341dBm
Type of Modulation:	WiFi: DSSS, OFDM, CCK
Antenna installation:	Internal antenna
Antenna Gain:	5.2G: 1.9dBi 5.8G: -1.65dBi
Ratings:	POWER SUPPLY: 100-240VAC~0.33A 50/60Hz OUTPUT: 5V⎓2A

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	SWITCHING POWER SUPPLY	/	XY-050200	N/A	N/A
2	Monitor	DELL	SE2218HV	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/ax(20M) Operation in the 5180MHz ~5240 MHz band			
Channel	Frequency	Channel	Frequency
36	5180MHz	44	5220MHz
40	5200MHz	48	5240MHz
For 802.11a/n/ac/ax(20M) Operation in the 5745MHz ~5825 MHz band			
Channel	Frequency	Channel	Frequency
149	5745MHz	161	5805MHz
153	5765MHz	165	5825MHz
157	5785MHz	NA	NA

For 802.11n/ac/ax(40M) Operation in the 5190MHz ~5230 MHz band			
Channel	Frequency	Channel	Frequency
38	5190MHz	46	5230MHz
For 802.11n/ac/ax(40M) Operation in the 5755MHz ~5795 MHz band			
Channel	Frequency	Channel	Frequency
151	5755MHz	159	5795MHz

For 802.11ac/ax(80M) Operation in the 5210 MHz band			
Channel	Frequency	Channel	Frequency
42	5210MHz	NA	NA
For 802.11ac/ax(80M) Operation in the 5775 MHz band			
Channel	Frequency	NA	NA
155	5775MHz	NA	NA

NOTE: Dutycycle>98%.

Test mode	rate
802.11a	54M
802.11n	500M
802.11/ac/ax	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/ax(20M)	5180MHz ~5240 MHz	Channel 36	Channel 40	Channel 48
		5180MHz	5200MHz	5240MHz
802.11n/ac/ax(40M)		Channel 38	N/A	Channel 46
		5190MHz	N/A	5230MHz
802.11ac/ax(80M)		N/A	Channel 42	N/A
		N/A	5210MHz	N/A
802.11a/n/ac/ax(20M)	5745MHz ~5825MHz	Channel 149	Channel 157	Channel 165
		5745MHz	5785MHz	5825MHz
802.11n/ac/ax(40M)		Channel 151	N/A	Channel 159
		5755MHz	N/A	5795MHz
802.11ac/ax(80M)		N/A	Channel 155	N/A
		N/A	5775MHz	N/A

4.6 Test Environment

Humidity(%):	54
Atmospheric Pressure(kPa):	101
Normal Voltage(AC):NV	5V
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	2023.07.19
2	Power Sensor	Agilent	U2021XA	MY56120032	2023.07.19
3	Power Sensor	Agilent	U2021XA	MY56120034	2023.07.19
4	Communication test set	R&S	CMW500	108058	2023.07.19
5	Spectrum Analyzer	KEYSIGHT	N9020A	MY51289897	2023.07.19
6	Signal Generator	Agilent	N5181A	MY50140365	2023.07.19
7	Vector signal generator	Agilent	N5182A	MY47420195	2023.07.19
8	Communication test set	Agilent	E5515C	MY50102567	2023.07.19
9	2.4 GHz Filter	Shenxiang	MSF2400-2483.5MS-1154	20181015001	2023.07.19
10	5 GHz Filter	Shenxiang	MSF5150-5850 MS-1155	20181015001	2023.07.19
11	Filter	Xingbo	XBLBQ-DZA120	190821-1-1	2023.07.19
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	2023.10.30
14	Temperature humidity chamber	Hongjing	TH-80CH	DG-15174	2023.07.19
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	2023.07.19
18	Amplifier	HP	8447E	2945A02747	2023.07.19
19	Amplifier	Agilent	8449B	3008A01838	2023.07.19
20	TRILOG Broadband Antenna	Schwarzbeck	VULB 9168	00869	2023.07.22

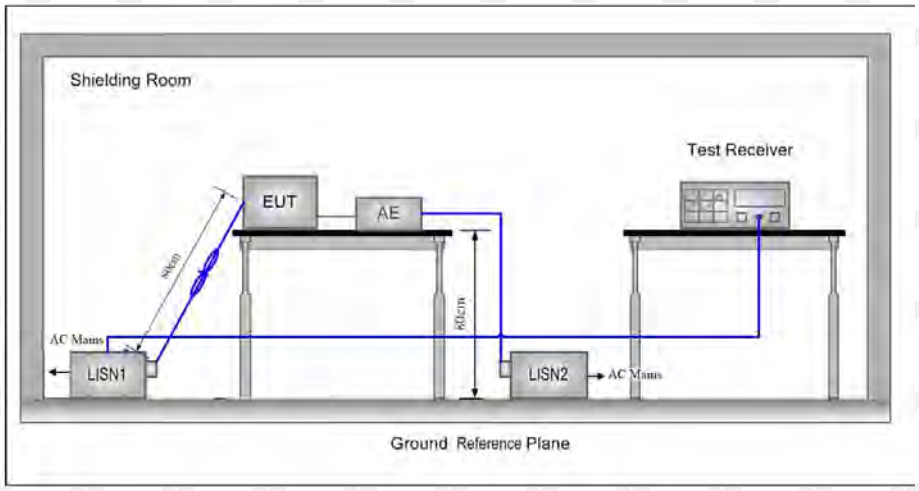
21	Double Ridged Broadband Horn Antenna	Schwarzbeck	BBHA9120D	01911	2023.07.22
22	EMI test software	Fala	EZ-EMC	FA-03A2 RE	/
23	Loop Antenna	Schwarzbeck	FMZB 1519B	1519B-224	2023.07.23
24	loop antenna	ZHINAN	ZN30900A	GTS534	/
25	40G Horn antenna	A/H/System	SAS-574	588	2024.10.30
26	Amplifier	AEROFLEX	Aeroflex	097	2024.10.30

Continuous disturbance					
No.	Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
1	LISN	ROHDE&SCHWARZ	ESH3-Z5	100318	2023.07.19
2	Pulse limiter	ROHDE&SCHWARZ	ESH3Z2	357881052	2023.07.19
3	EMI TEST RECEIVER	ROHDE&SCHWARZ	ESCI	100428/003	2023.07.19
4	Coaxial cable	ZDECL	Z302S-NJ-SMA J-12M	18091905	2023.07.19
5	ISN	Schwarzbeck	NTFM8158	183	2023.07.19
6	Communication test set	Agilent	E5515C	MY50102567	2023.07.19
7	Communication test set	R&S	CMW500	108058	2023.07.19
8	EZ-EMC	Frad	EMC-con3A1.1	/	/

Radiated emission					
No.	Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
1	Double Ridged Broadband Horn Antenna	Schwarzbeck	BBHA 9120 D	01911	2023.07.22
2	TRILOG Broadband Antenna	Schwarzbeck	VULB 9168	00869	2023.07.22
3	Amplifier	Agilent	8449B	3008A01838	2023.07.19
4	Amplifier	HP	8447E	2945A02747	2023.07.19
5	EMI TEST RECEIVER	ROHDE&SCHWARZ	ESCI	100428/003	2023.07.19
6	Coaxial cable	ETS	RFC-SNS-100-NMS-80 NI	/	2023.07.19
7	Coaxial cable	ETS	RFC-SNS-100-NMS-20 NI	/	2023.07.19
8	Coaxial cable	ETS	RFC-SNS-100-SMS-20 NI	/	2023.07.19
9	Coaxial cable	ETS	RFC-NNS-100 -NMS-300 NI	/	2023.07.19
10	Communication test set	Agilent	E5515C	MY50102567	2023.07.19
11	Communication test set	R&S	CMW500	108058	2023.07.19
12	EZ-EMC	Frad	EMC-con3A1.1	/	/

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,

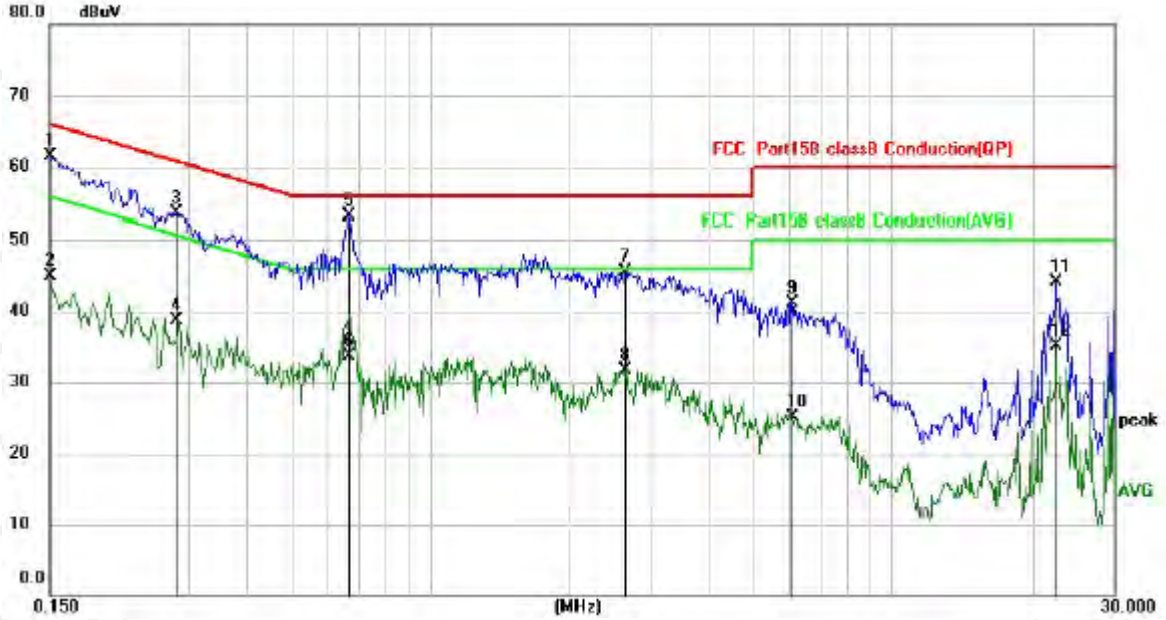
4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0,4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0,8 m from the boundary of the unit under

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.

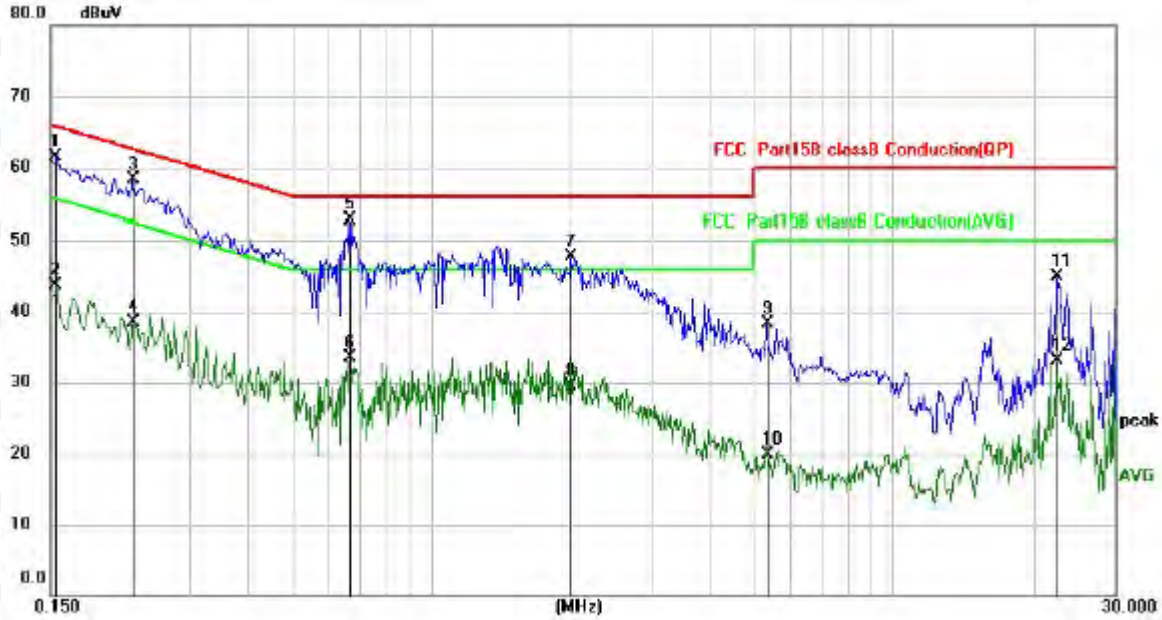
6.4 Test Result

Test Specification: Neutral



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		0.1500	51.57	10.01	61.58	66.00	-4.42	QP
2		0.1500	34.89	10.01	44.90	56.00	-11.10	AVG
3		0.2816	43.51	9.99	53.50	60.77	-7.27	QP
4		0.2816	28.80	9.99	38.79	50.77	-11.98	AVG
5	*	0.6660	43.23	9.97	53.20	56.00	-2.80	QP
6		0.6660	23.80	9.97	33.77	46.00	-12.23	AVG
7		2.6419	35.53	10.06	45.59	56.00	-10.41	QP
8		2.6419	21.59	10.06	31.65	46.00	-14.35	AVG
9		6.0658	30.93	10.21	41.14	60.00	-18.86	QP
10		6.0658	14.92	10.21	25.13	50.00	-24.87	AVG
11		22.4340	33.51	10.59	44.10	60.00	-15.90	QP
12		22.4340	24.45	10.59	35.04	50.00	-14.96	AVG

Test Specification: Line



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		0.1539	51.52	10.01	61.53	65.79	-4.26	QP
2		0.1539	33.77	10.01	43.78	55.79	-12.01	AVG
3		0.2260	48.38	10.00	58.38	62.60	-4.22	QP
4		0.2260	28.41	10.00	38.41	52.60	-14.19	AVG
5	*	0.6660	42.70	9.97	52.67	56.00	-3.33	QP
6		0.6660	23.52	9.97	33.49	46.00	-12.51	AVG
7		2.0059	37.60	10.03	47.63	56.00	-8.37	QP
8		2.0059	19.41	10.03	29.44	46.00	-16.56	AVG
9		5.3578	28.22	10.18	38.40	60.00	-21.60	QP
10		5.3578	9.70	10.18	19.88	50.00	-30.12	AVG
11		22.4460	34.29	10.59	44.88	60.00	-15.12	QP
12		22.4460	22.50	10.59	33.09	50.00	-16.91	AVG

Remark:
1. Factor = Cable loss + LISN factor, Margin = Limit – Level
2. All modes were tested at AC 120V and 240V, only the worst result of AC 120V 60Hz was reported.
3. All the test modes completed for test. Only the worst result of was reported.

7. RADIATED SPURIOUS EMISSIONS

7.1 Block Diagram Of Test Setup

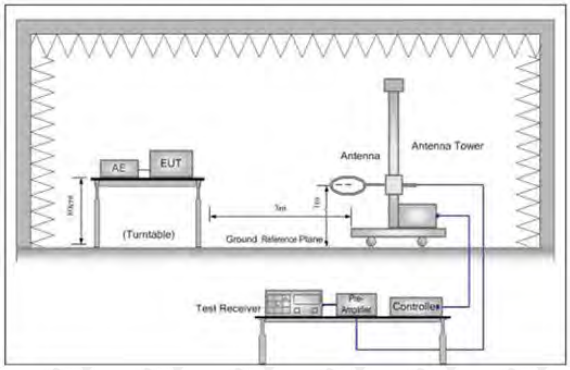


Figure 1. Below 30MHz

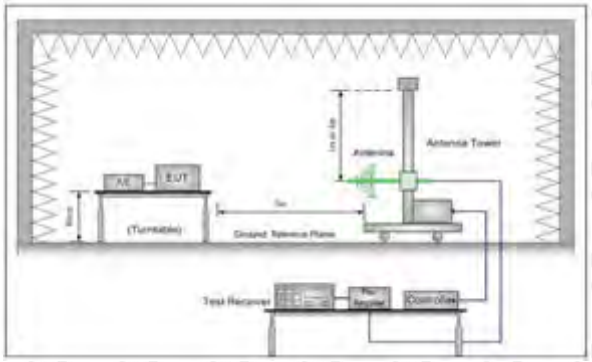


Figure 2. 30MHz to 1GHz

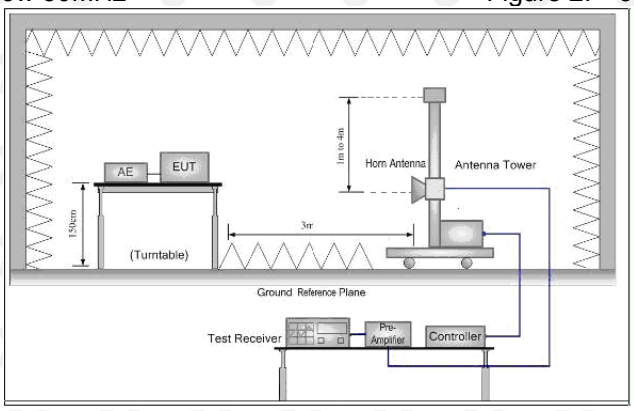


Figure 3. Above 1GHz

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

1. The EUT was pretested with 3 orientations placed on the table for the radiated emission measurement –X, Y, and Z-plane. The X-plane results were found as the worst case and were shown in this report.

7.4 Test Result

30MHz-1GHzTest Results:
Modulation : 802.11a (the worst data)
Test Channel : 5180MHz
Antenna polarity: H

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector
1		38.3462	32.97	-6.52	26.45	40.00	-13.55	QP
2		62.6505	35.85	-7.96	27.89	40.00	-12.11	QP
3	*	124.1329	42.91	-7.26	35.65	43.50	-7.85	QP
4		250.3009	37.62	-7.80	29.82	46.00	-16.18	QP
5		331.3546	37.21	-4.58	32.63	46.00	-13.37	QP
6		742.2586	32.38	4.67	37.05	46.00	-8.95	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		58.9217	39.82	-7.45	32.37	40.00	-7.63	QP
2		104.1701	44.61	-9.30	35.31	43.50	-8.19	QP
3	*	146.6303	45.37	-5.48	39.89	43.50	-3.61	QP
4		210.0481	43.87	-9.20	34.67	43.50	-8.83	QP
5		317.1444	34.78	-4.98	29.80	46.00	-16.20	QP
6	!	948.7608	32.38	7.63	40.01	46.00	-5.99	QP

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

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	41.83	16.39	58.22	74	-15.78	PK	1.31	60	H
10360	26.82	16.39	43.21	54	-10.79	AV	1.50	56	H
10360	39.27	16.39	55.66	74	-18.34	PK	1.53	99	V
10360	25.42	16.39	41.81	54	-12.19	AV	1.12	243	V
Channel:5240MHz									
10480	41.83	16.11	57.94	74	-16.06	PK	1.15	284	H
10480	27.63	16.11	43.74	54	-10.26	AV	1.05	169	H
10480	40.88	16.11	56.99	74	-17.01	PK	1.50	306	V
10480	27.97	16.11	44.08	54	-9.92	AV	1.49	70	V
Channel:5745MHz									
11490	40.75	17.46	58.21	74	-15.79	PK	1.65	92	H
11490	26.70	17.46	44.16	54	-9.84	AV	1.06	185	H
11490	39.71	17.46	57.17	74	-16.83	PK	1.27	221	V
11490	25.20	17.46	42.66	54	-11.34	AV	1.56	52	V
Channel:5825MHz									
11650	40.03	17.57	57.60	74	-16.40	PK	1.28	166	H
11650	26.71	17.57	44.28	54	-9.72	AV	1.85	51	H
11650	41.44	17.57	59.01	74	-14.99	PK	1.49	351	V
11650	26.59	17.57	44.16	54	-9.84	AV	1.70	217	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	39.21	16.34	55.55	74	-18.45	PK	1.80	294	H
10380	26.59	16.34	42.93	54	-11.07	AV	1.15	176	H
10380	41.46	16.34	57.80	74	-16.20	PK	1.63	19	V
10380	25.12	16.34	41.46	54	-12.54	AV	1.54	197	V
Channel:5230MHz									
10460	39.39	16.15	55.54	74	-18.46	PK	1.39	33	H
10460	25.17	16.15	41.32	54	-12.68	AV	1.26	239	H
10460	40.11	16.15	56.26	74	-17.74	PK	1.08	159	V
10460	27.72	16.15	43.87	54	-10.13	AV	1.68	187	V
Channel:5755MHz									
11510	40.78	17.49	58.27	74	-15.73	PK	1.48	90	H
11510	27.29	17.49	44.78	54	-9.22	AV	1.79	62	H
11510	39.96	17.49	57.45	74	-16.55	PK	1.70	347	V
11510	27.32	17.49	44.81	54	-9.19	AV	1.08	30	V
Channel:5795MHz									
11590	41.19	17.52	58.71	74	-16.48	PK	1.29	301	H
11590	27.67	17.52	45.19	54	-15.29	AV	1.73	261	H
11590	41.24	17.52	58.76	74	-15.24	PK	1.40	251	V
11590	25.64	17.52	43.16	54	-10.84	AV	1.43	24	V

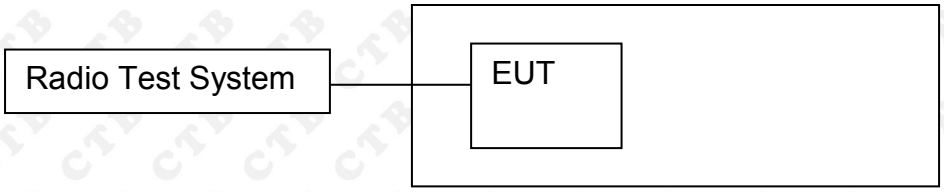
Modulation : 802.11(VH80) (the worst data)

Freq (MHz)	Rd_level (dBuV/m)	Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over (dB)	detector	Height	Degree	Antenna polarization
Channel:5210MHz									
10420	41.27	16.25	57.52	74	-16.48	PK	1.72	150	H
10420	27.82	16.25	44.07	54	-9.93	AV	1.10	347	H
10420	40.90	16.25	57.15	74	-16.85	PK	1.38	38	V
10420	25.67	16.25	41.92	54	-12.08	AV	1.43	303	V
Channel:5775MHz									
11550	41.64	17.50	59.14	74	-14.86	PK	1.18	120	H
11550	27.34	17.50	44.84	54	-9.16	AV	1.16	360	H
11550	41.83	17.50	59.33	74	-14.67	PK	1.55	59	V
11550	25.77	17.50	43.27	54	-10.73	AV	1.47	11	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

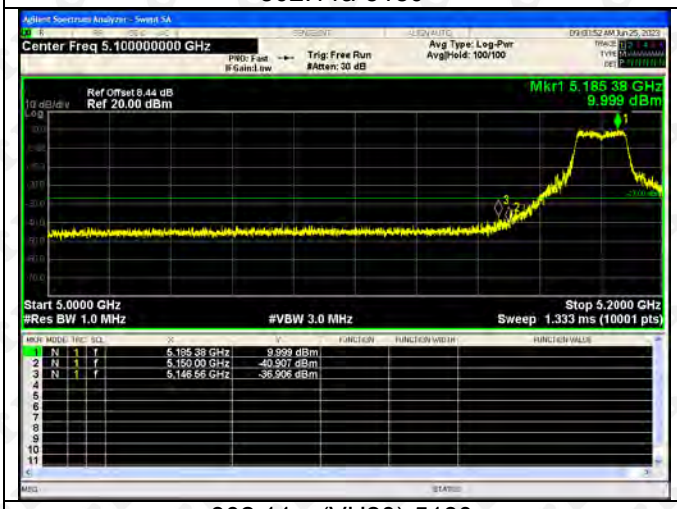
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then 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

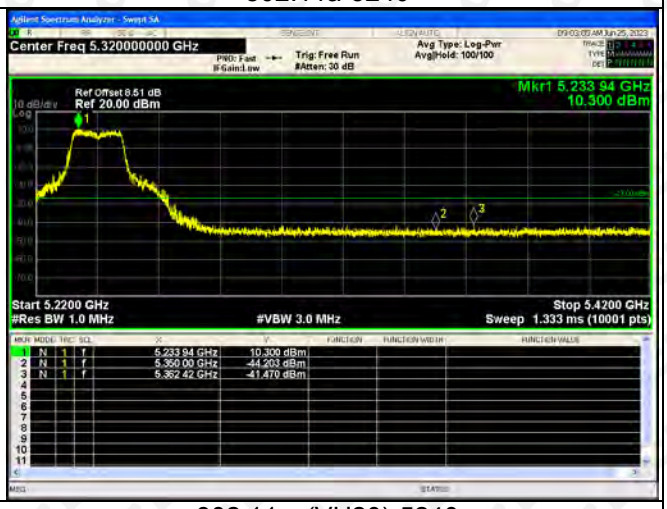
Test Graph

5180-5240MHz

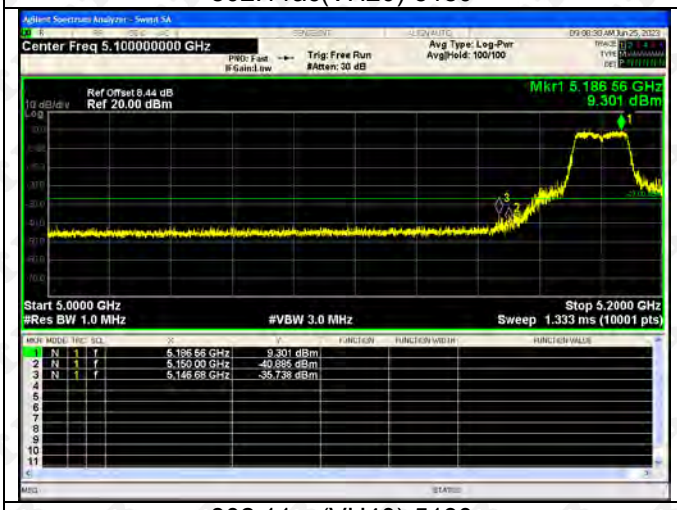
802.11a-5180



802.11a-5240

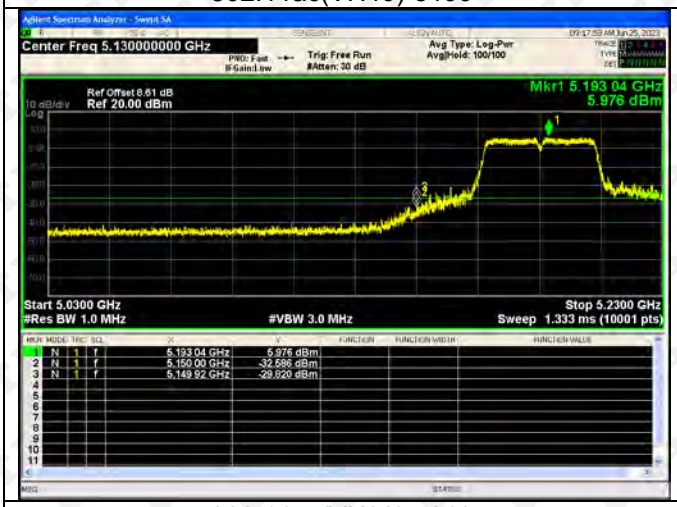


802.11ac(VH20)-5180



802.11ac(VH20)-5240

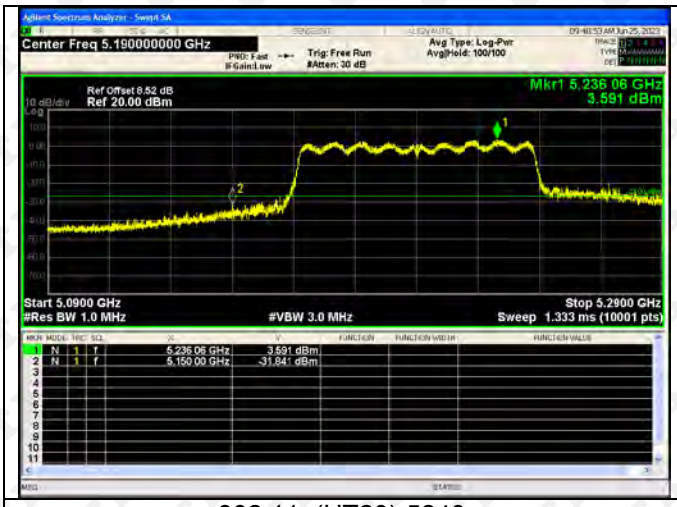
802.11ac(VH40)-5190



802.11ac(VH40)-5230

802.11ac(VH80)-5210

802.11n(HT20)-5180



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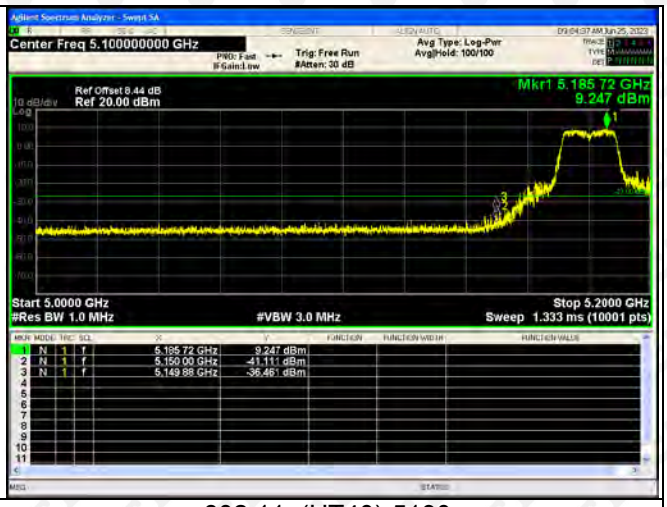

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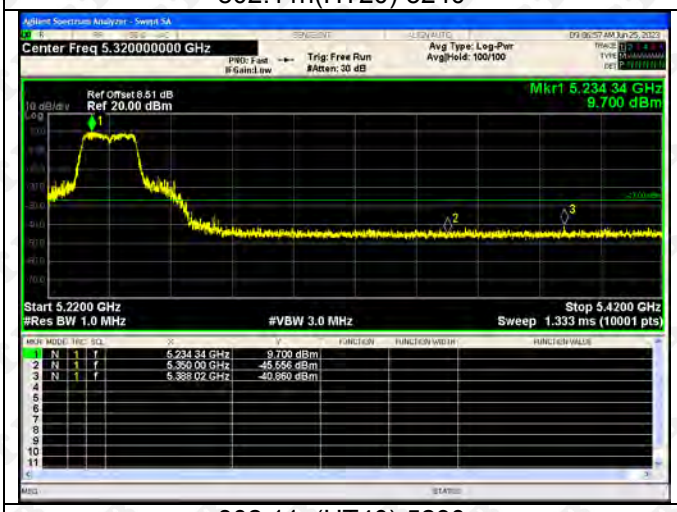
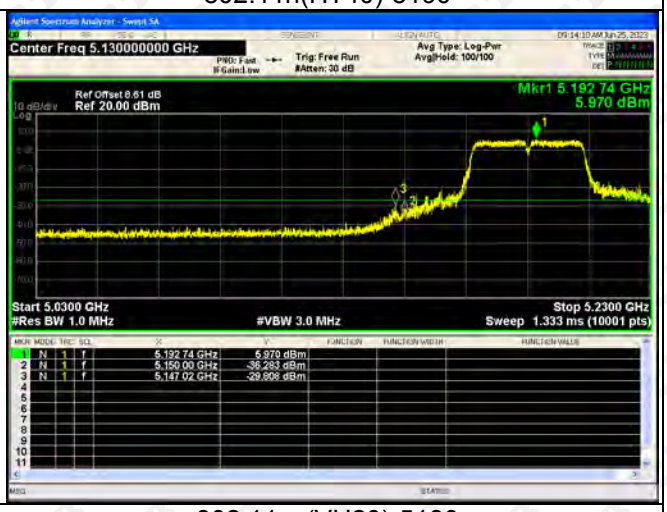
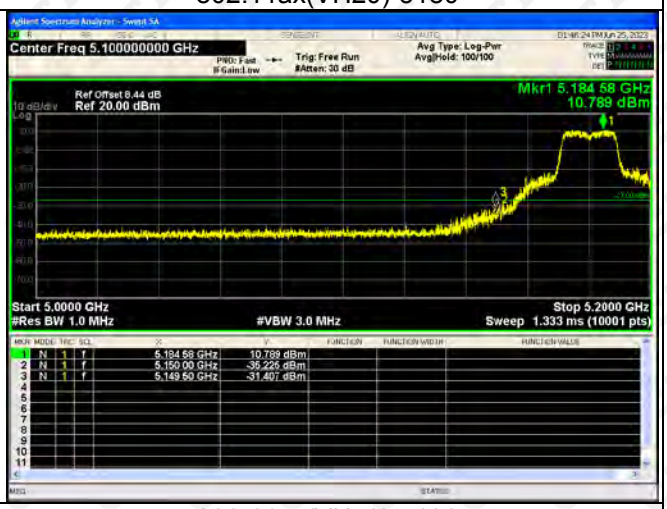


802.11n(HT40)-5230



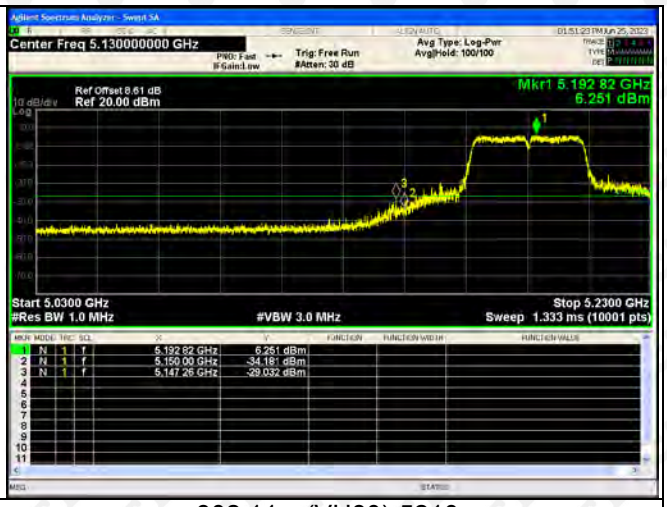
802.11ax(VH20)-5180

802.11ax(VH20)-5240

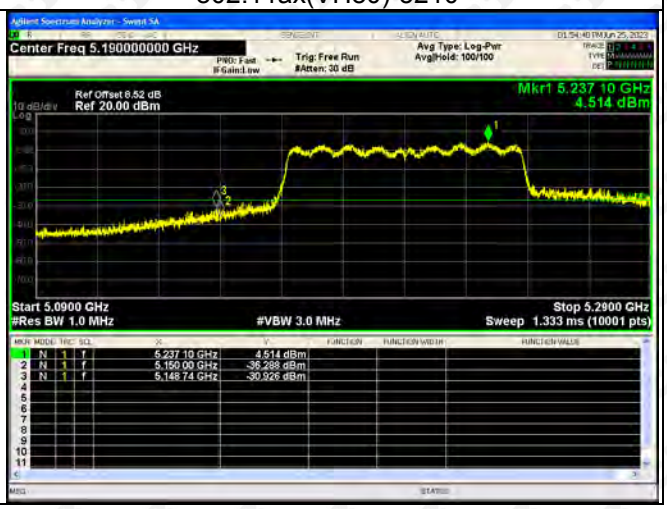


802.11ax(VH40)-5190

802.11ax(VH40)-5230

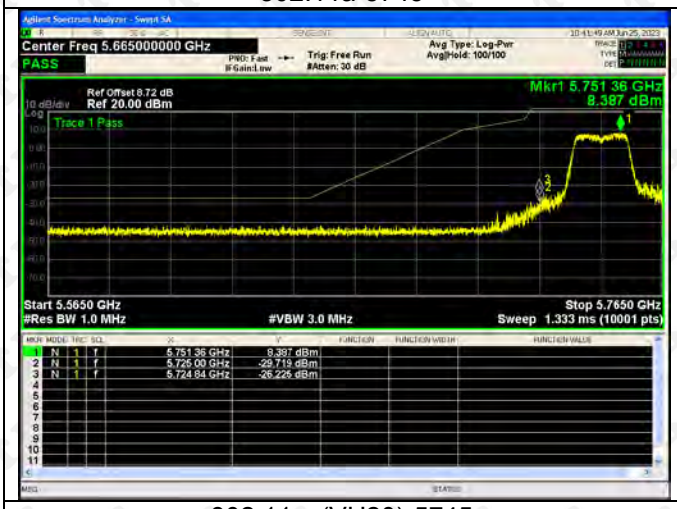


802.11ax(VH80)-5210



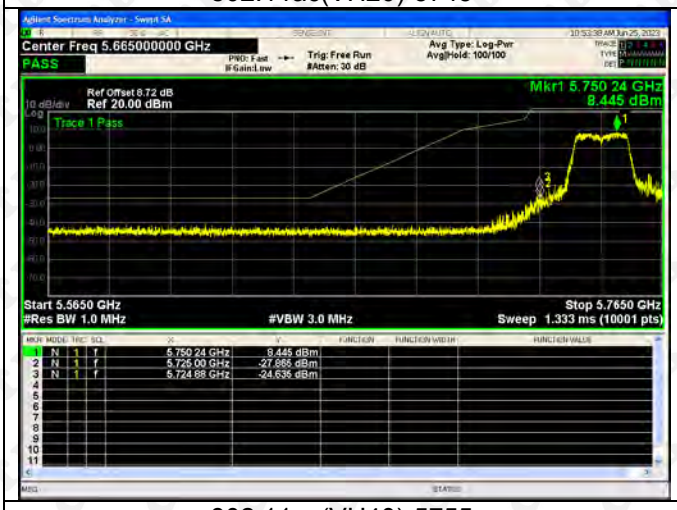
5745-5825MHz

802.11a-5745



802.11a-5825

802.11ac(VH20)-5745



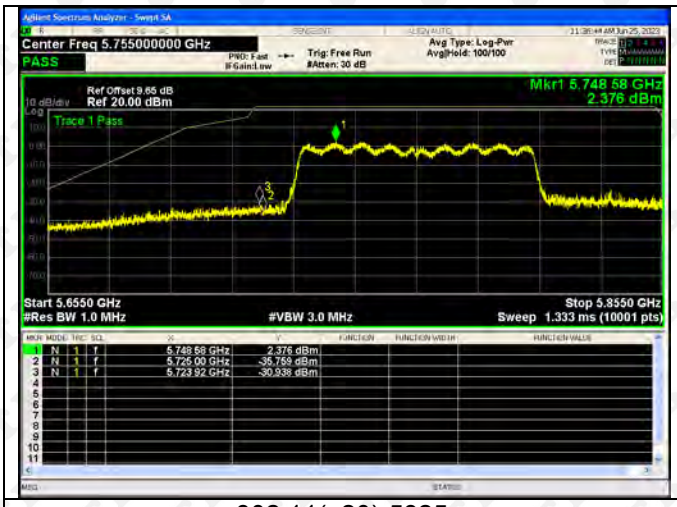
802.11ac(VH20)-5825

802.11ac(VH40)-5755

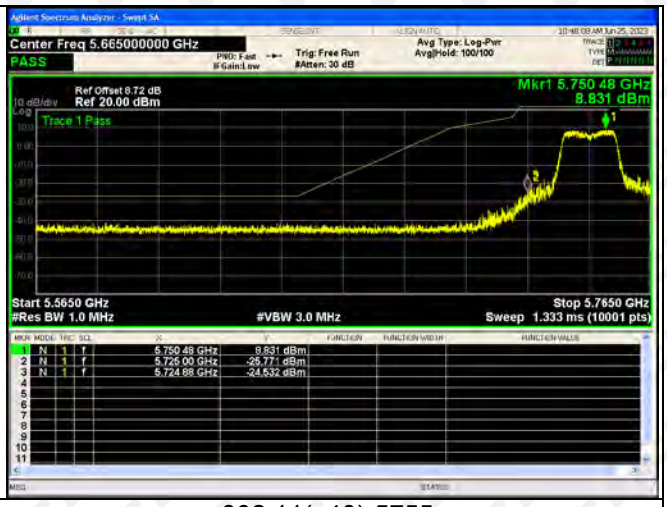
802.11ac(VH40)-5795

802.11ac(VH80)-5775

802.11(n20)-5745



802.11(n20)-5825

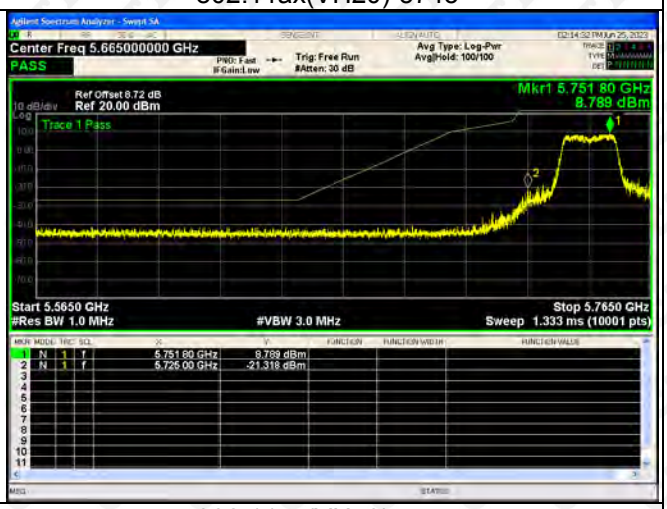


802.11(n40)-5755

802.11(n40)-5795

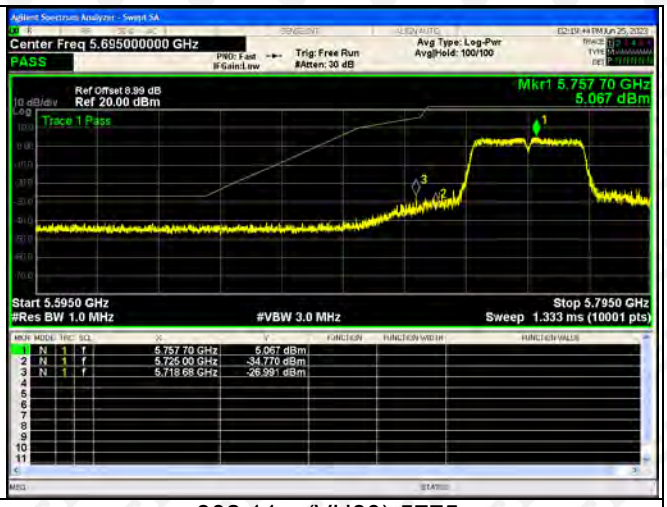
802.11ax(VH20)-5745

802.11ax(VH20)-5825

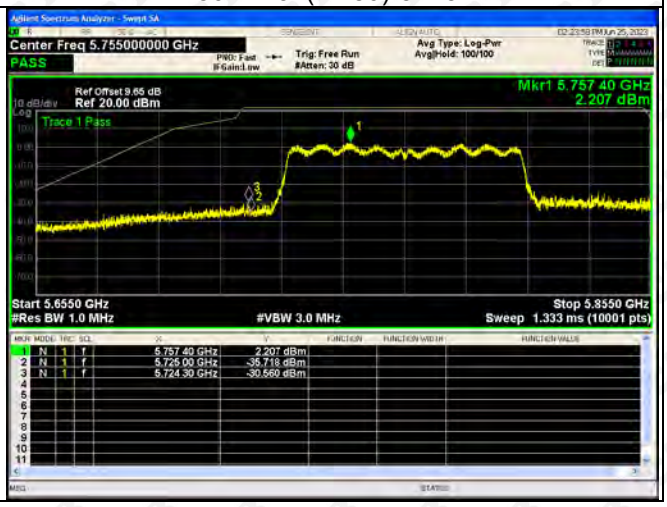


802.11ax(VH40)-5755

802.11ax(VH40)-5795

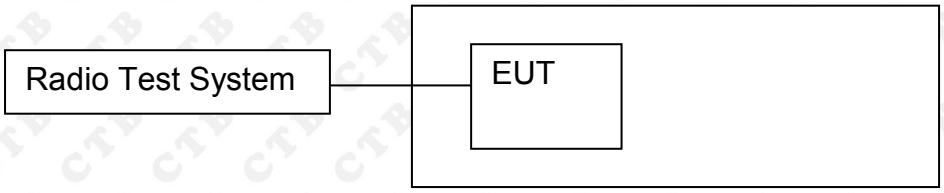


802.11ax(VH80)-5775



9. CONDUCTED PEAK 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.

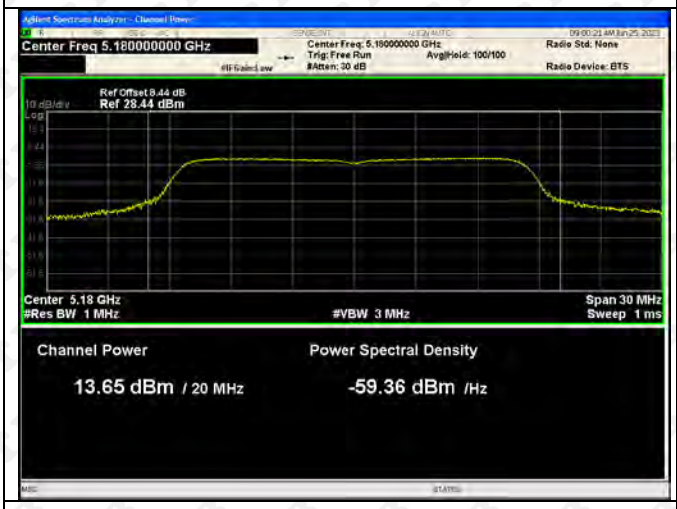
9.4 Test Result

Test mode1	Test Channel (MHz)	Output Power dBm	Limit dBm
802.11a20	5180	13.654	23.98
	5200	13.831	23.98
	5240	14.224	23.98
802.11ac20	5180	13.505	23.98
	5200	13.695	23.98
	5240	14.341	23.98
802.11ac40	5190	12.984	23.98
	5230	13.419	23.98
802.11ac80	5210	11.947	23.98
802.11n(HT20)	5180	13.105	23.98
	5200	13.154	23.98
	5240	13.733	23.98
802.11n(HT40)	5190	12.885	23.98
	5230	13.204	23.98
802.11ax20	5180	13.973	23.98
	5200	13.346	23.98
	5240	13.456	23.98
802.11ax40	5190	13.254	23.98
	5230	13.023	23.98
802.11ax80	5210	12.926	23.98

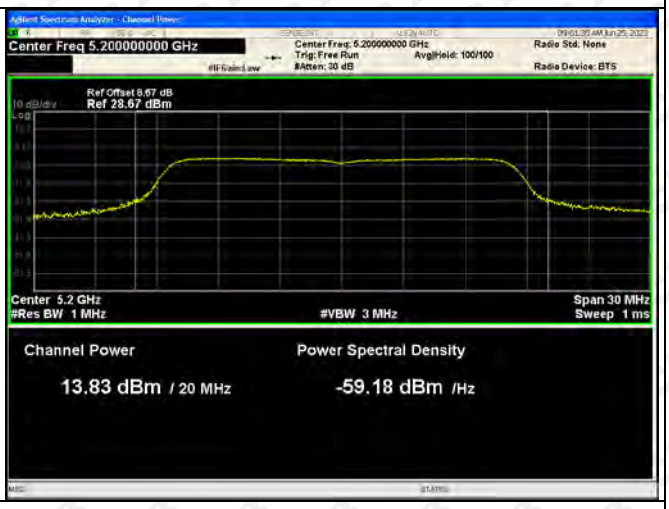
Test mode1	Test Channel (MHz)	Output Power dBm	Limit dBm
802.11a20	5745	12.128	30
	5785	11.763	30
	5825	12.278	30
802.11ac20	5745	12.268	30
	5785	13.255	30
	5825	12.879	30
802.11ac40	5755	11.983	30
	5795	11.411	30
802.11ac80	5775	11.352	30
802.11n(HT20)	5745	12.366	30
	5785	12.504	30
	5825	13.461	30
802.11n(HT40)	5755	12.086	30
	5795	11.441	30
802.11ax20	5745	12.569	30
	5785	12.498	30
	5825	13.309	30
802.11ax40	5755	11.407	30
	5795	11.937	30
802.11ax80	5775	11.267	30

5180-5240MHz-Power

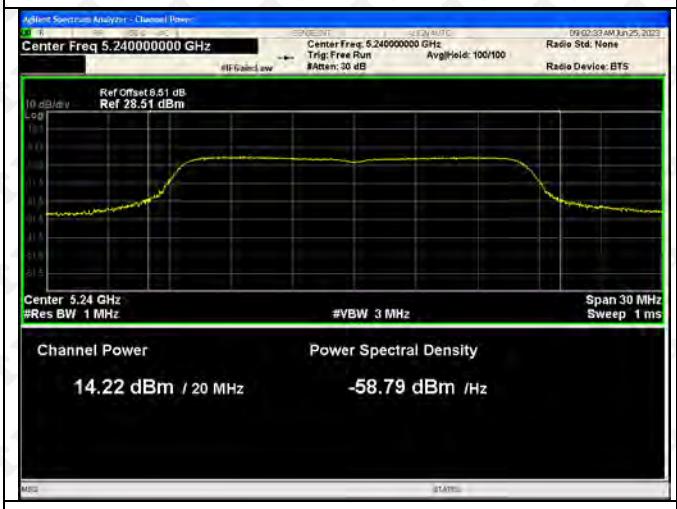
802.11a-5180



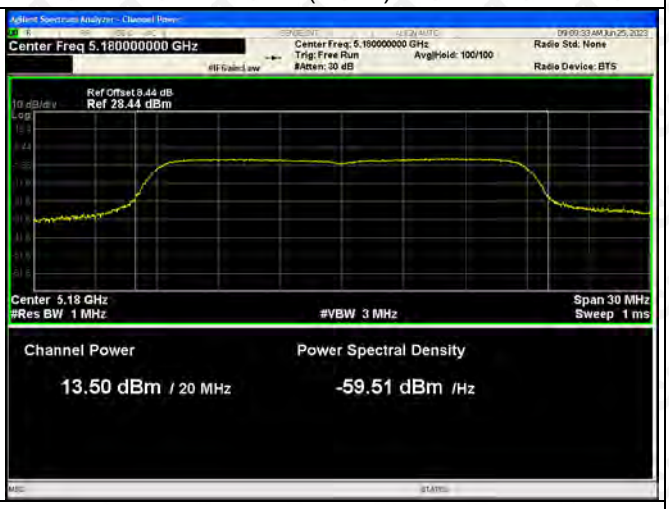
802.11a-5200



802.11a-5240

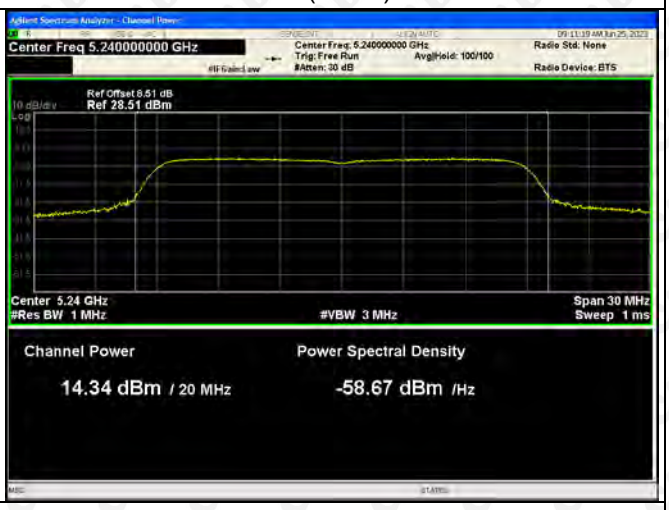


802.11ac(VH20)-5180



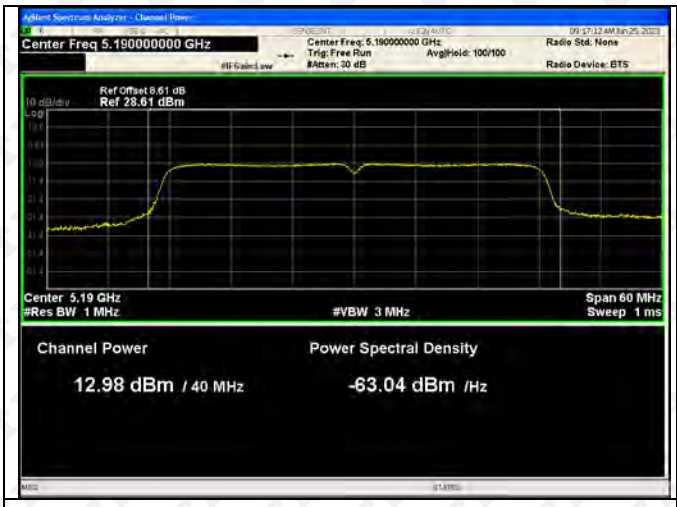
802.11ac(VH20)-5200

802.11ac(VH20)-5240

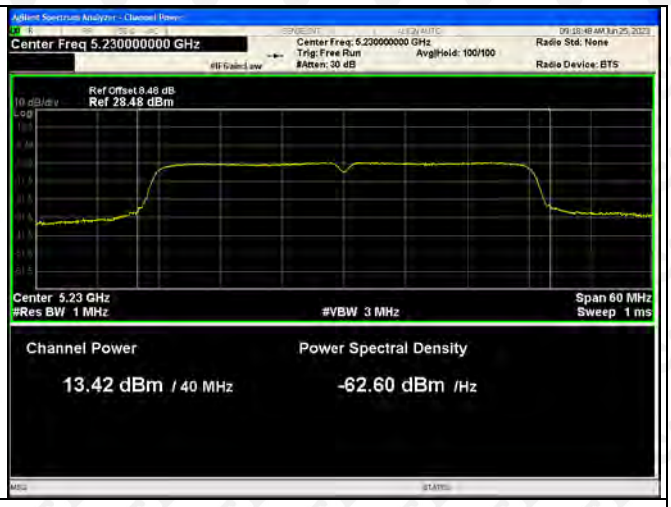


802.11ac(VH40)-5190

802.11ac(VH40)-5230

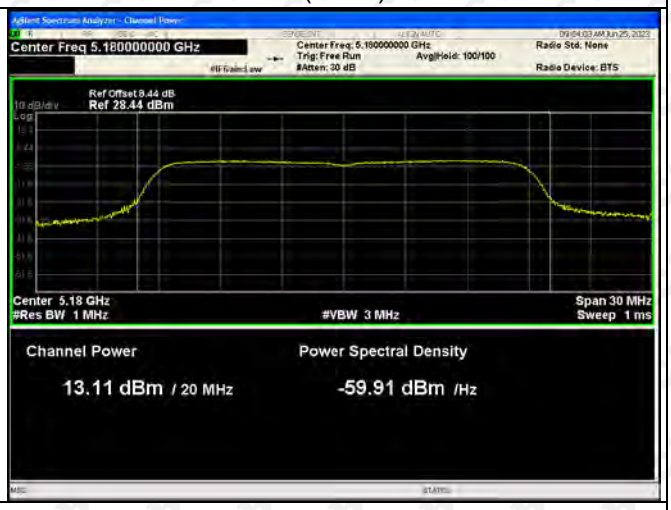


802.11ac(VH80)-5210



802.11n(HT20)-5180

802.11n(HT20)-5200



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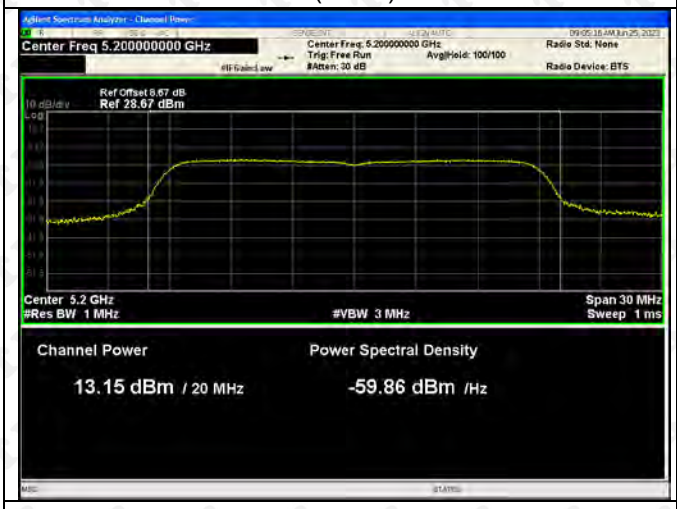
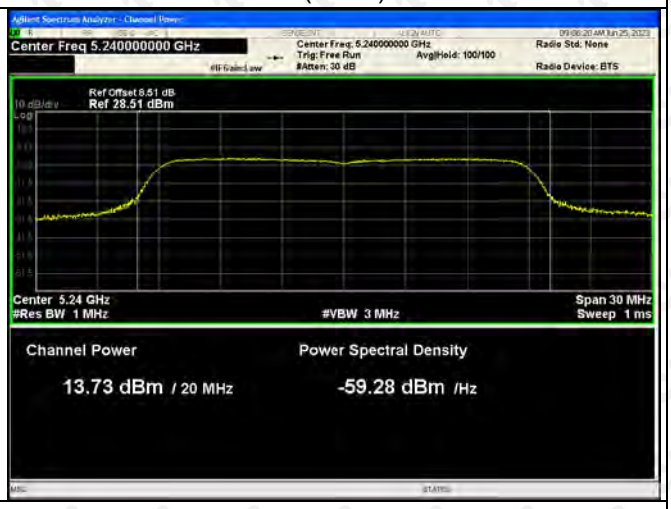
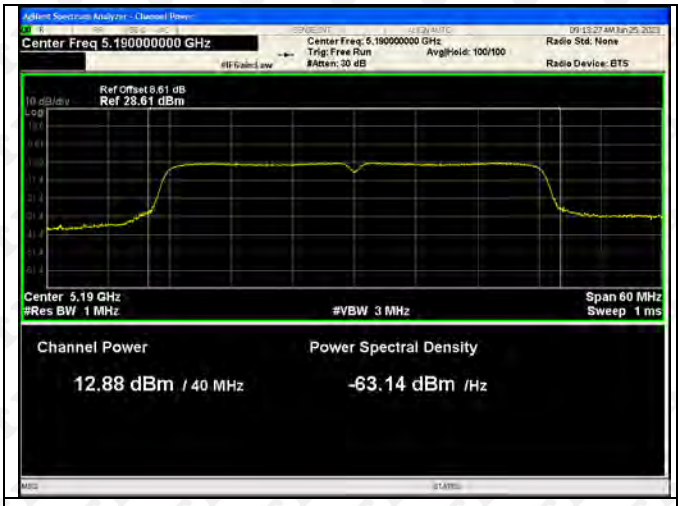


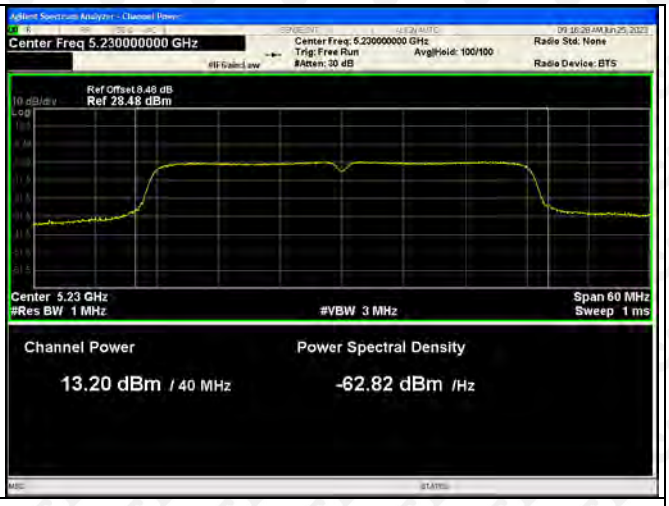
802.11n(HT40)-5190



802.11n(HT40)-5230



802.11ax(VH20)-5180



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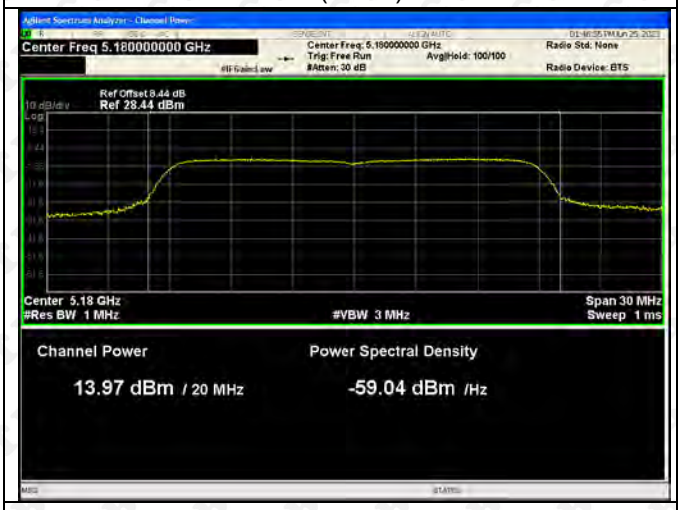
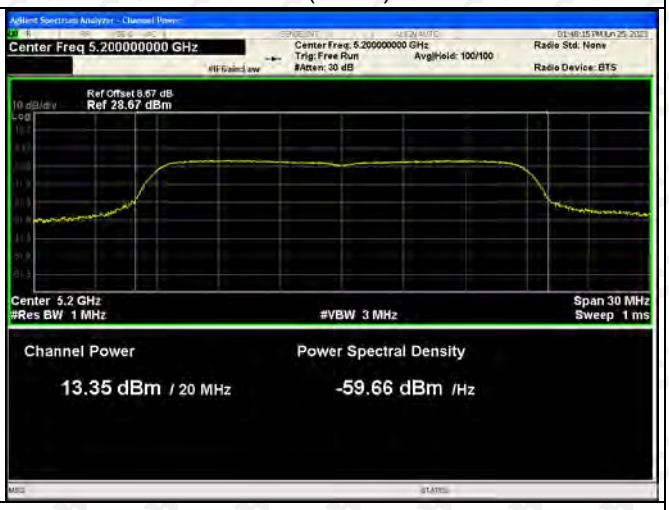


802.11ax(VH20)-5240



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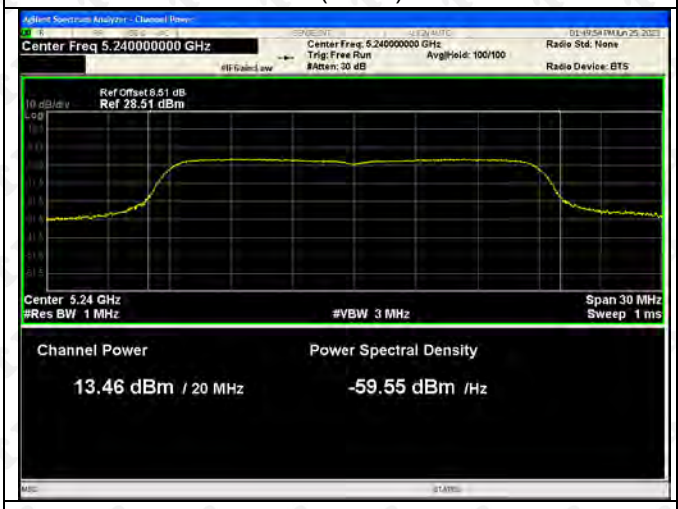
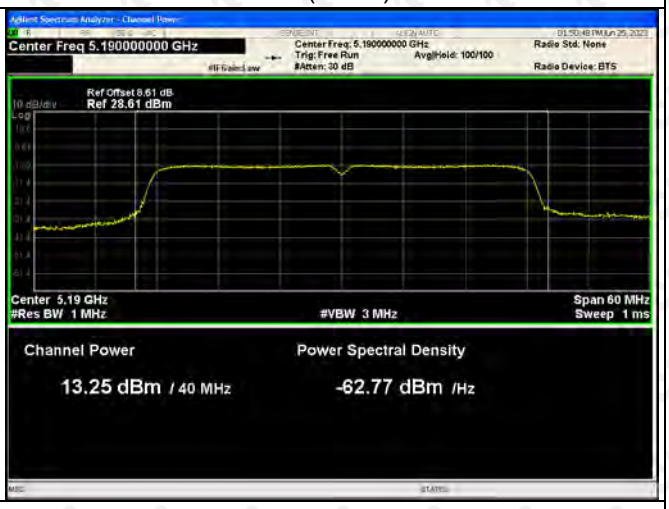
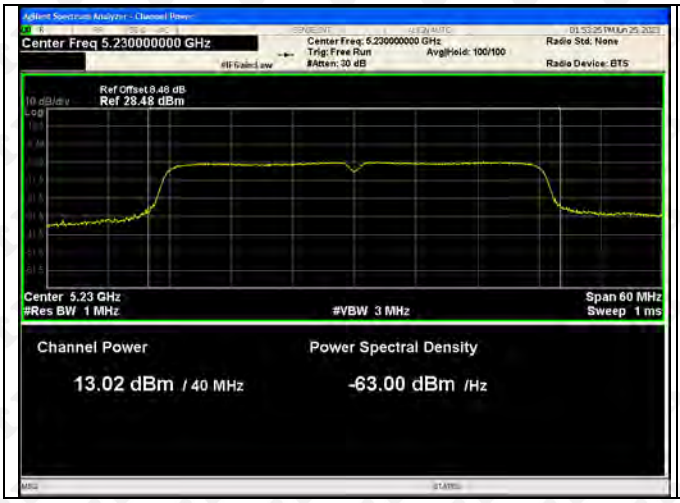
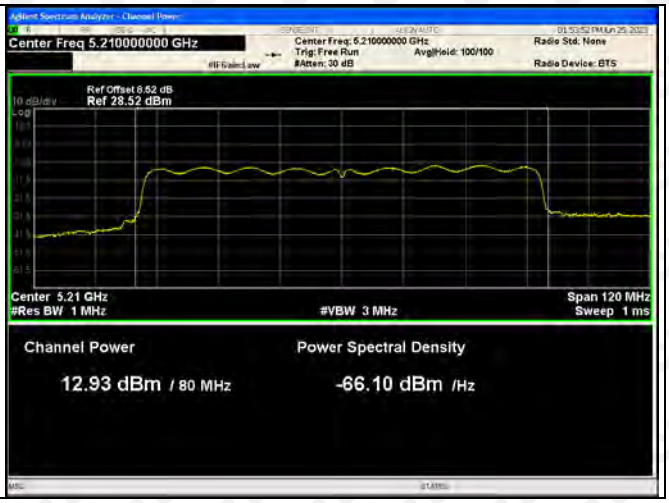


802.11ax(VH40)-5230



802.11ax(VH80)-5210

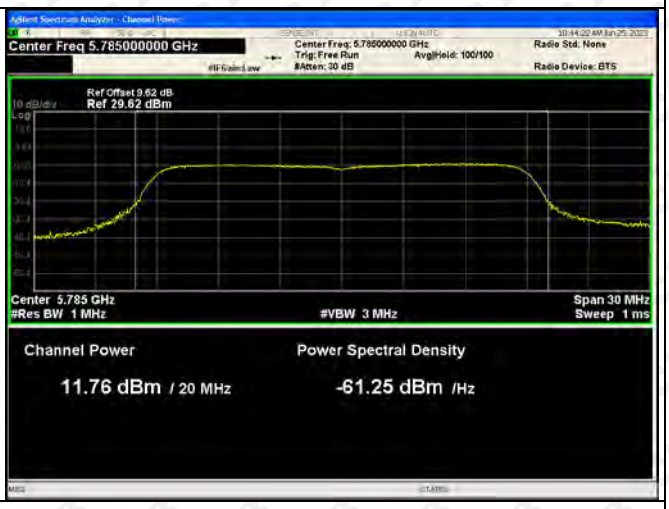

Agilent Spectrum Analyzer - Channel Power
Center Freq 5.230000000 GHz
Center Freq: 5.230000000 GHz
Trig: Free Run
#Atten: 30 dB
Avg|Hold: 100/100
Radio Std: None
Radio Device: BTS
Ref Offset 8.48 dB
10 dB/div
Ref 28.48 dBm
Center 5.23 GHz
#Res BW 1 MHz
#VBW 3 MHz
Span 60 MHz
Sweep 1 ms
Channel Power
13.02 dBm / 40 MHz
Power Spectral Density
-63.00 dBm /Hz


Agilent Spectrum Analyzer - Channel Power
Center Freq 5.210000000 GHz
Center Freq: 5.210000000 GHz
Trig: Free Run
#Atten: 30 dB
Avg|Hold: 100/100
Radio Std: None
Radio Device: BTS
Ref Offset 8.52 dB
10 dB/div
Ref 28.52 dBm
Center 5.21 GHz
#Res BW 1 MHz
#VBW 3 MHz
Span 120 MHz
Sweep 1 ms
Channel Power
12.93 dBm / 80 MHz
Power Spectral Density
-66.10 dBm /Hz

5745-5825MHz-Power

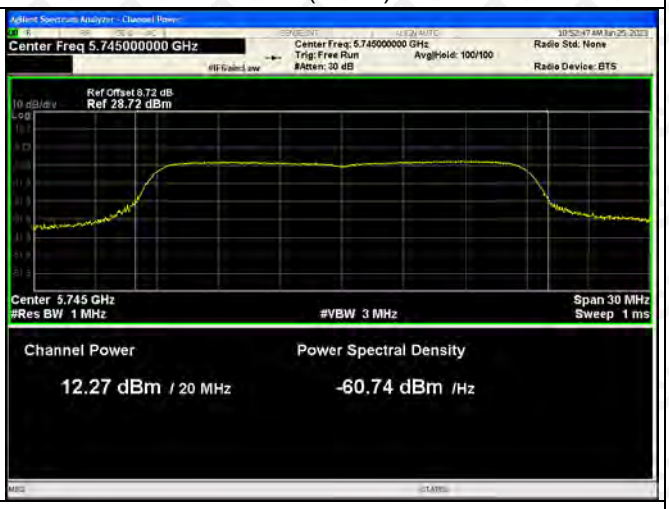
802.11a-5745

802.11a-5785

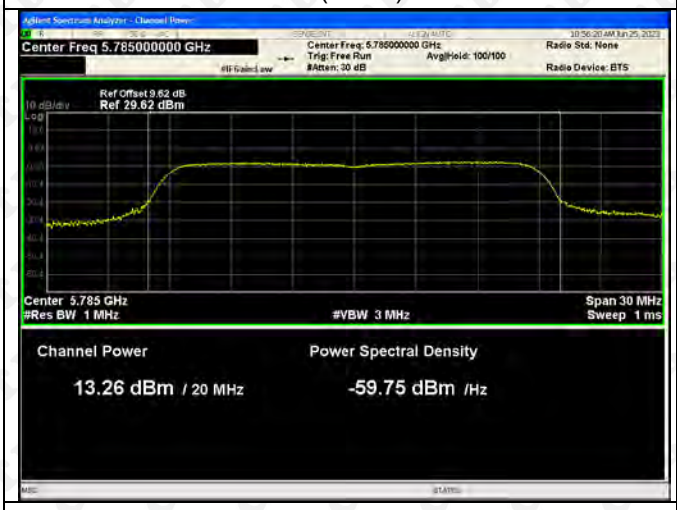


802.11a-5825

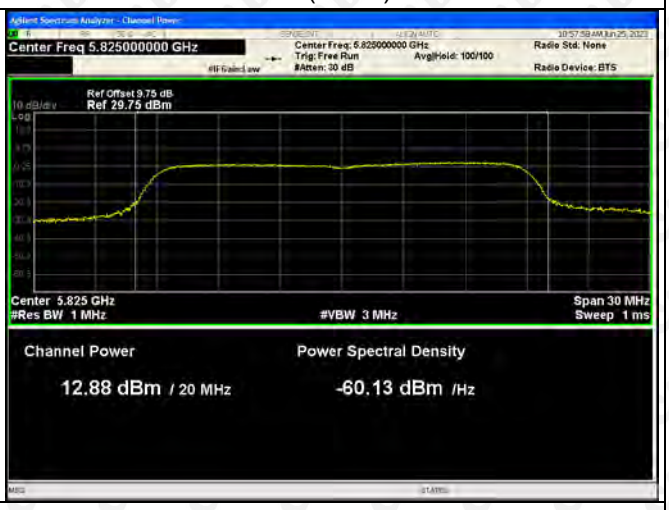
802.11ac(VH20)-5745



802.11ac(VH20)-5785

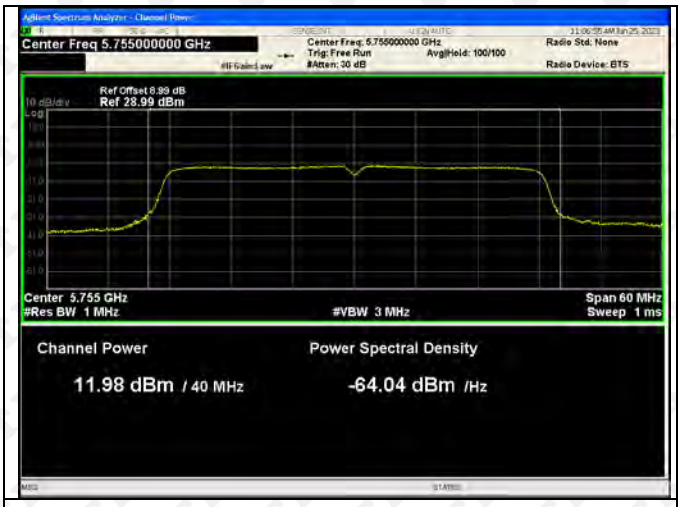


802.11ac(VH20)-5825

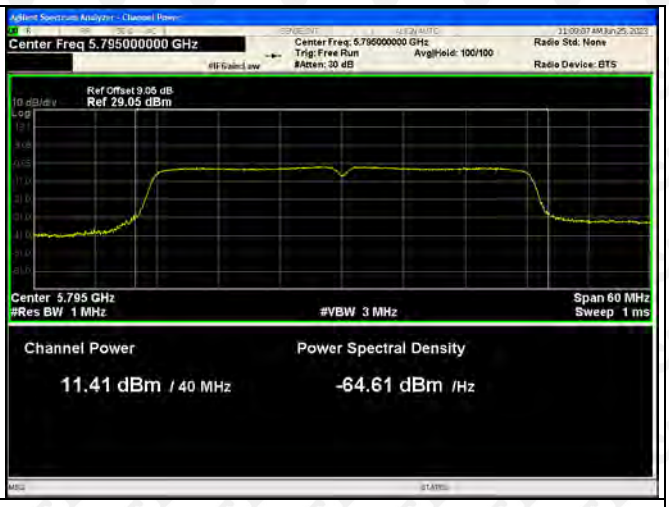


802.11ac(VH40)-5755

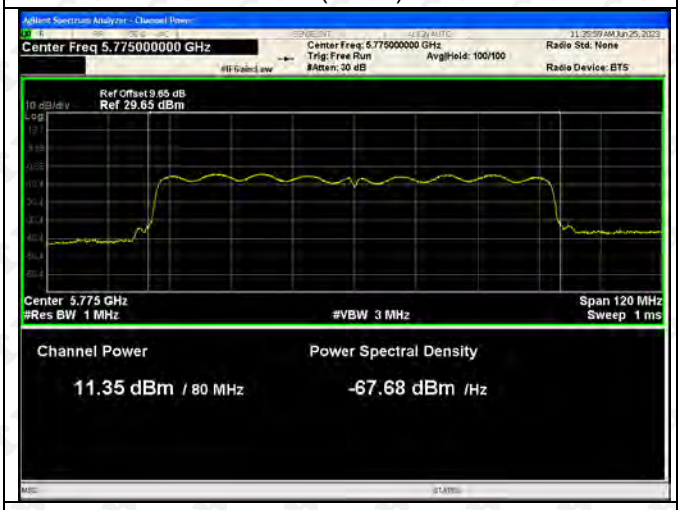
802.11ac(VH40)-5795



802.11ac(VH80)-5775



802.11n(HT20)-5745



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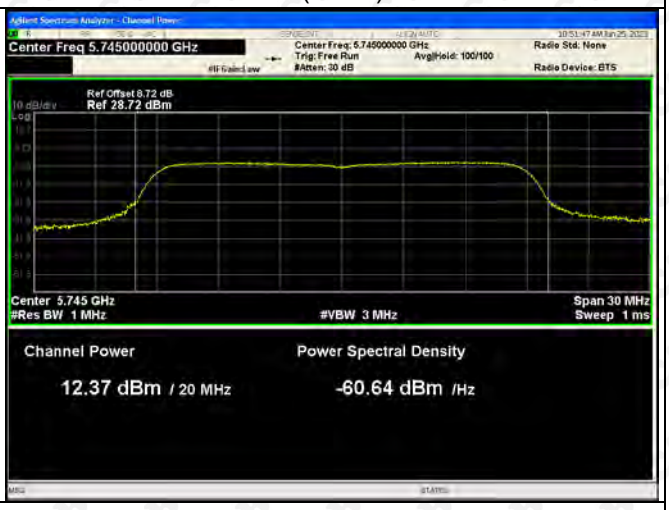

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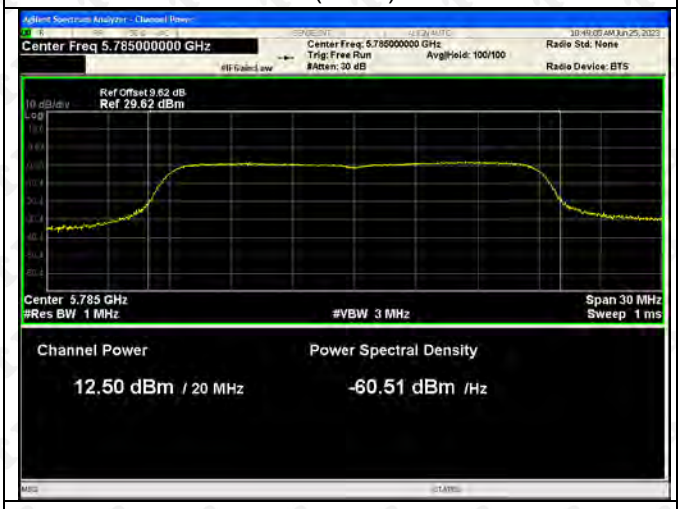
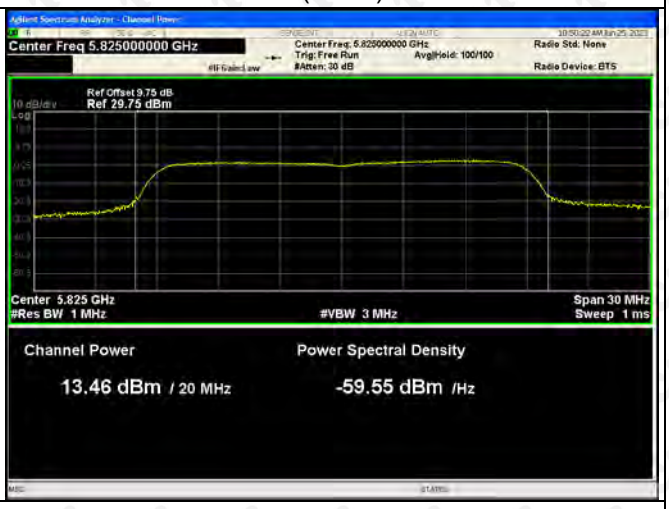
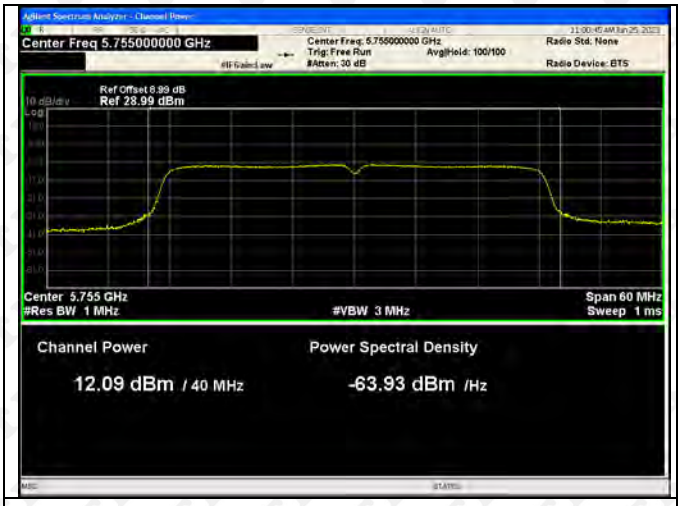


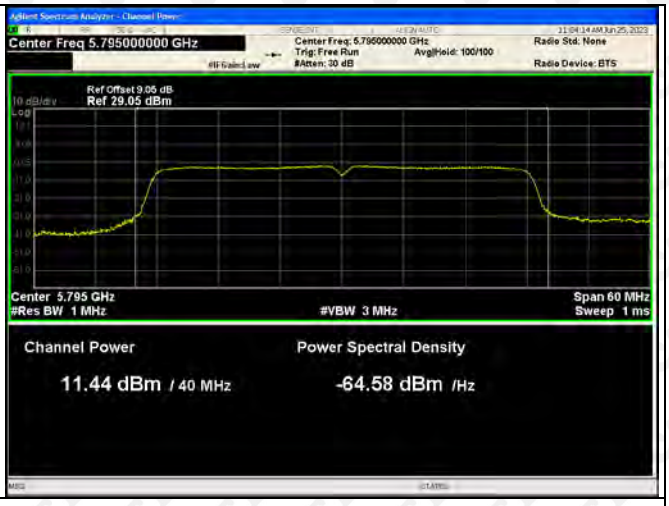
5802.11n(HT40)-5755



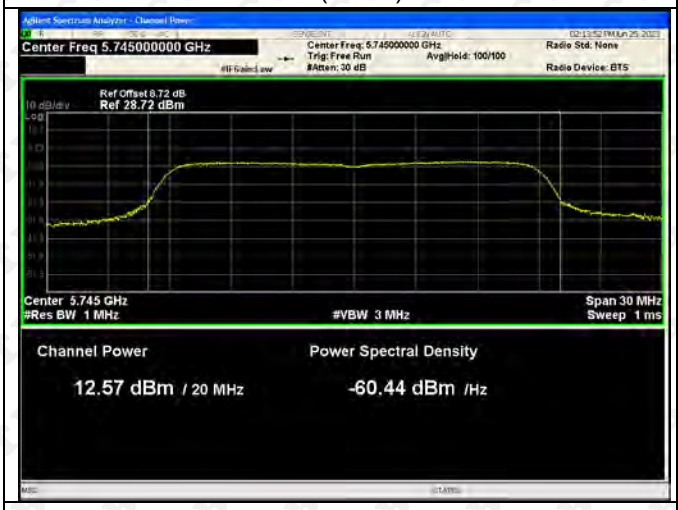
802.11n(HT40)-5795



802.11ax(VH20)-5745



802.11ax(VH20)-5785



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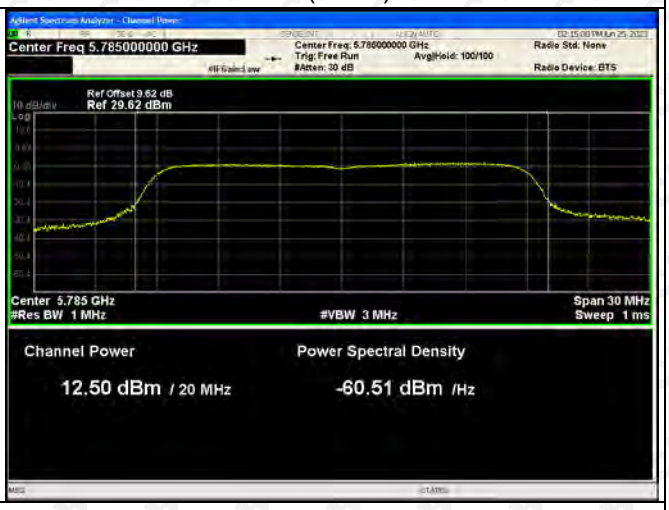
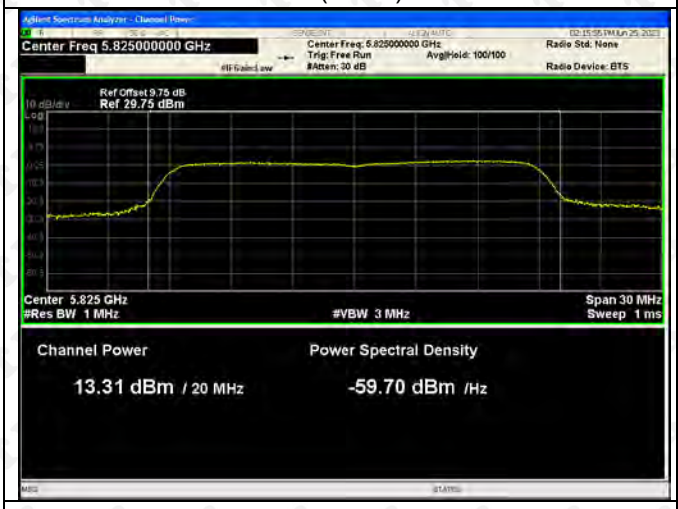
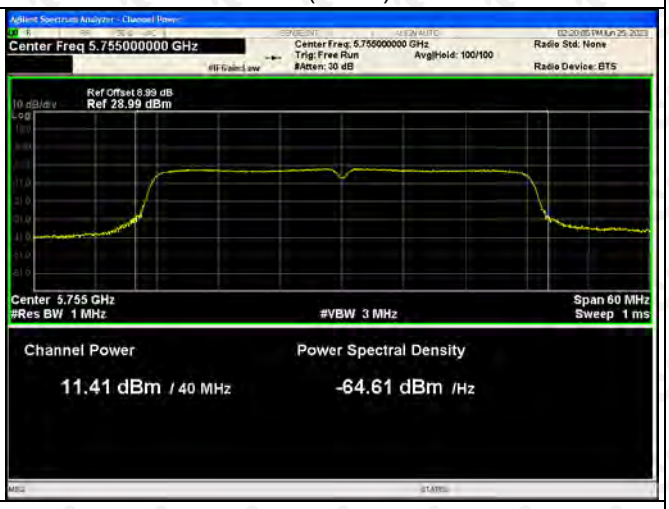


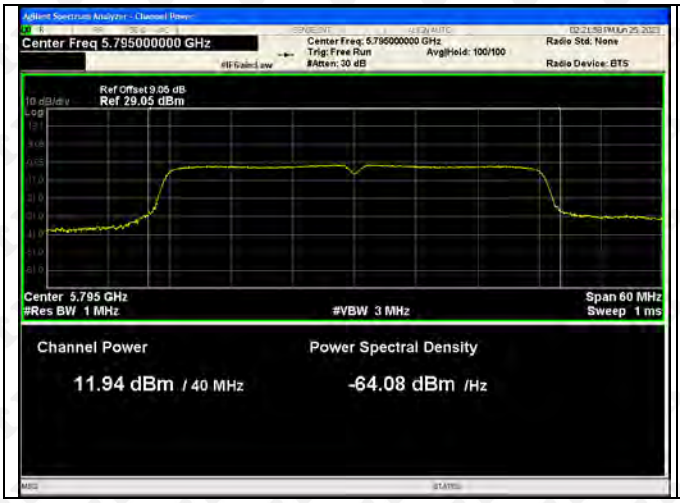
802.11ax(VH40)-5755

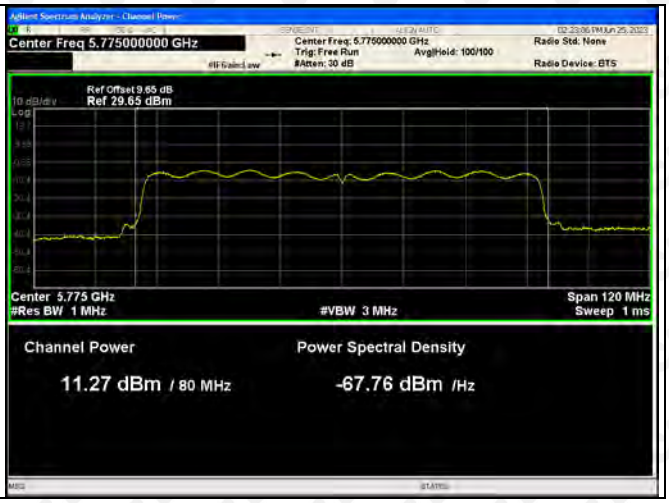


802.11ax(VH40)-5795



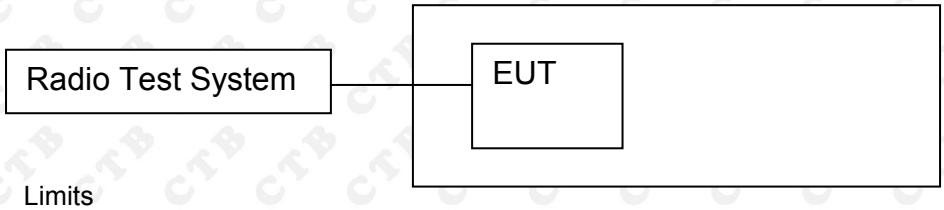
802.11ax(VH80)-5775


Agilent Spectrum Analyzer - Channel Power
Center Freq 5.795000000 GHz
Center Freq: 5.795000000 GHz
Trig: Free Run
Avg|Hold: 100/100
#Atten: 30 dB
Radio Std: None
Radio Device: BTS
Ref Offset 9.05 dB
10 dB/div
Ref 29.05 dBm
Center 5.795 GHz
#Res BW 1 MHz
#VBW 3 MHz
Span 60 MHz
Sweep 1 ms
Channel Power
11.94 dBm / 40 MHz
Power Spectral Density
-64.08 dBm /Hz


Agilent Spectrum Analyzer - Channel Power
Center Freq 5.775000000 GHz
Center Freq: 5.775000000 GHz
Trig: Free Run
Avg|Hold: 100/100
#Atten: 30 dB
Radio Std: None
Radio Device: BTS
Ref Offset 9.65 dB
10 dB/div
Ref 29.65 dBm
Center 5.775 GHz
#Res BW 1 MHz
#VBW 3 MHz
Span 120 MHz
Sweep 1 ms
Channel Power
11.27 dBm / 80 MHz
Power Spectral Density
-67.76 dBm /Hz

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

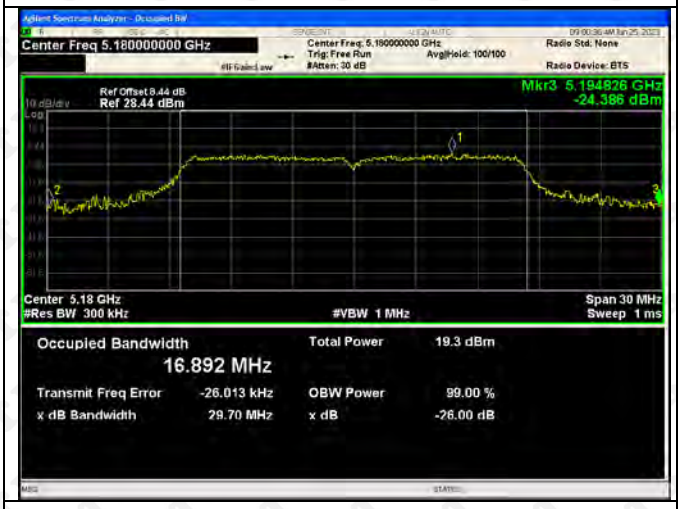
Test mode	Test Channel (MHz)	26dB Bandwidth (MHz)
802.11a	5180	29.704
	5200	28.182
	5240	25.126
802.11ac20	5180	25.844
	5200	25.146
	5240	25.261
802.11ac40	5190	43.17
	5230	44.075
802.11ac80	5210	89.38
802.11n(HT20)	5180	25.867
	5200	25.848
	5240	24.7
802.11n(HT40)	5190	43.147
	5230	50.509
802.11ax20	5180	29.913
	5200	27.426
	5240	26.02
802.11ax40	5190	50.74
	5230	46.98
802.11ax80	5210	91.958

Test mode	Test Channel (MHz)	6dB Bandwidth (MHz)
802.11a	5745	17.714
	5785	17.757
	5825	17.764
802.11ac20	5745	17.78
	5785	17.764
	5825	17.711
802.11ac40	5755	36.441
	5795	36.446
802.11ac80	5775	76.092
802.11n(HT20)	5745	17.737
	5785	17.69
	5825	17.743
802.11n(HT40)	5755	36.428
	5795	36.436
802.11ax20	5745	17.725
	5785	17.731
	5825	17.726
802.11ax40	5755	36.43
	5795	36.455
802.11ax80	5775	76.095

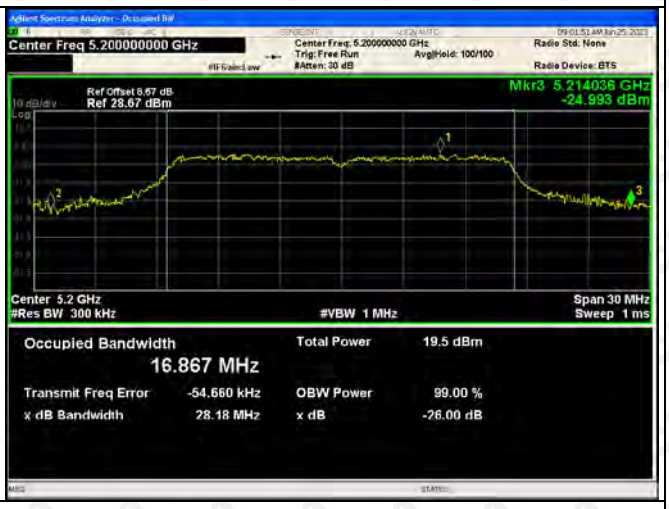
Test Graph

5180-5240MHz

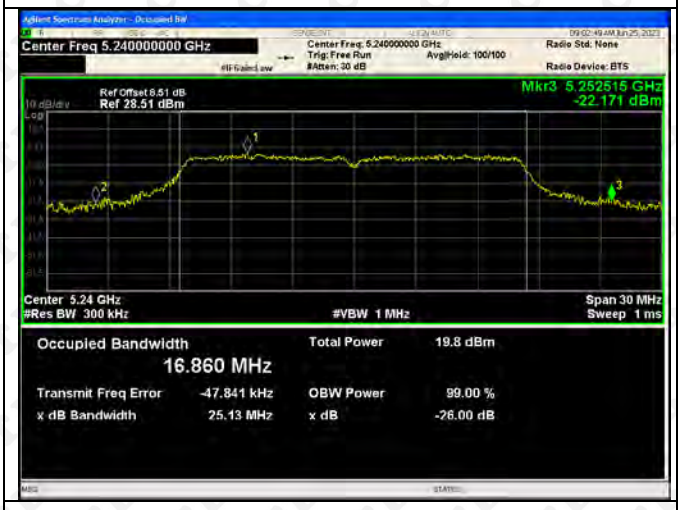
802.11a-5180



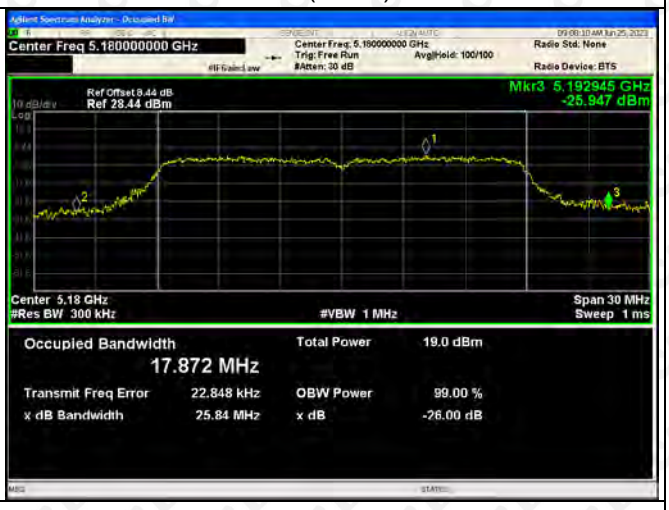
802.11a-5200



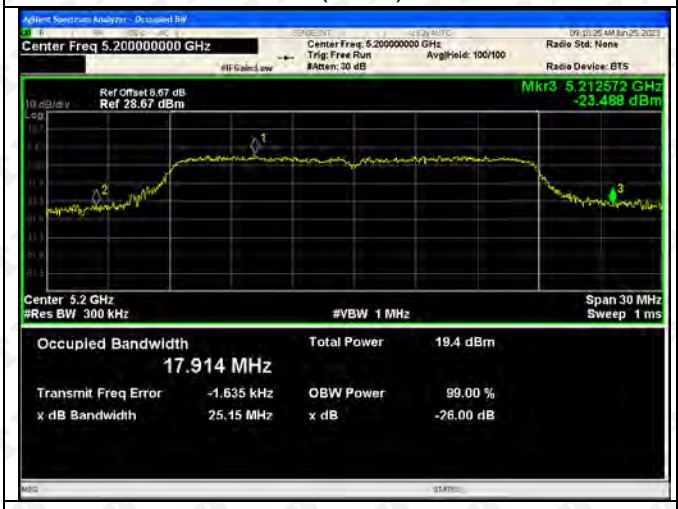
802.11a-5240



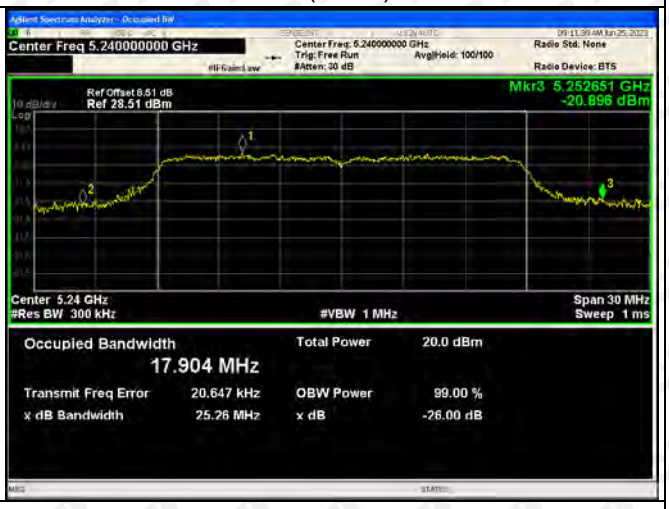
802.11ac(VH20)-5180



802.11ac(VH20)-5200

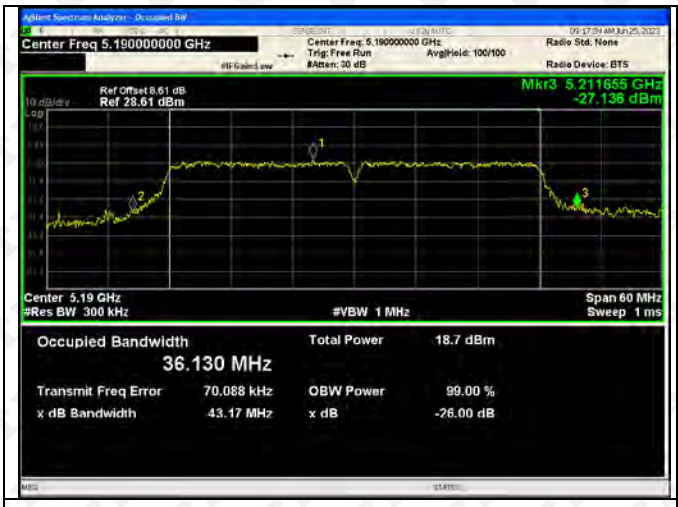


802.11ac(VH20)-5240

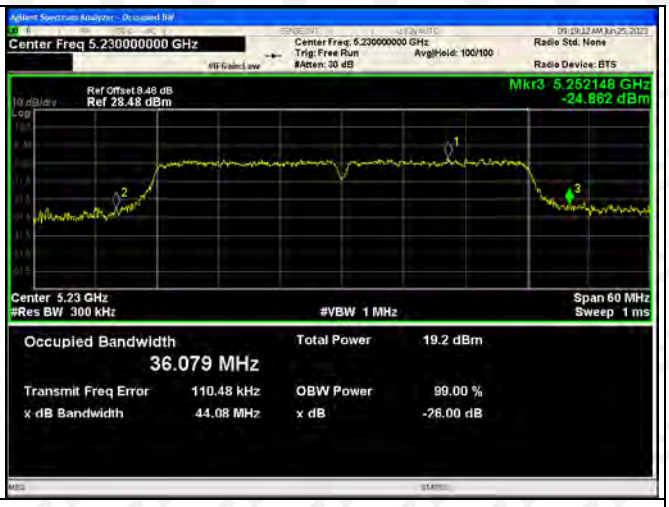


802.11ac(VH40)-5190

802.11ac(VH40)-5230

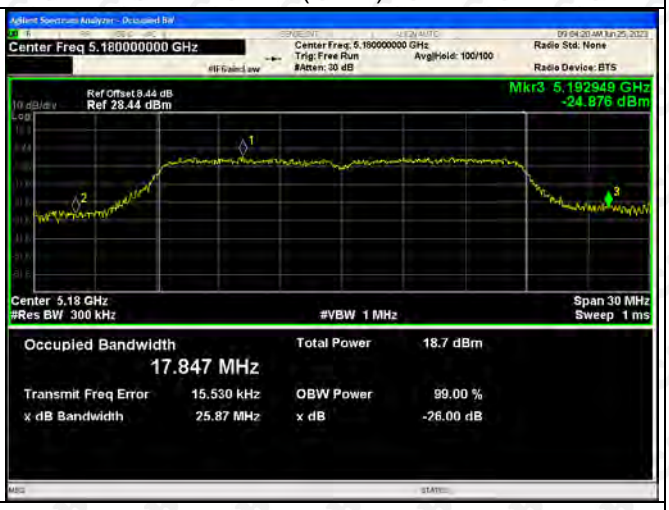


802.11ac(VH80)-5210

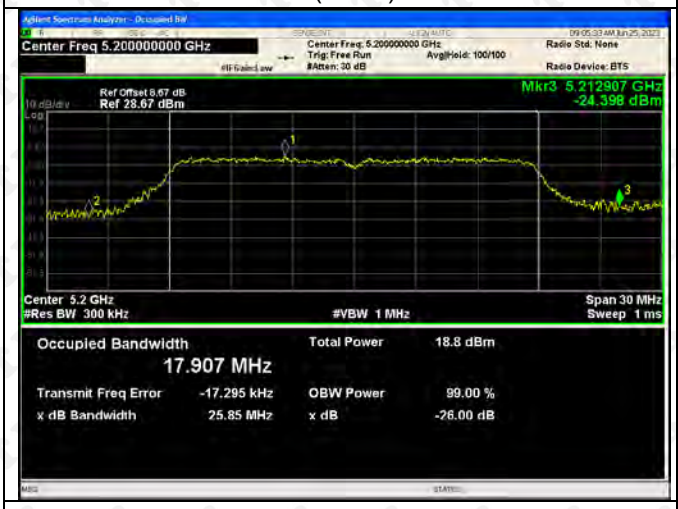


802.11n(HT20)-5180

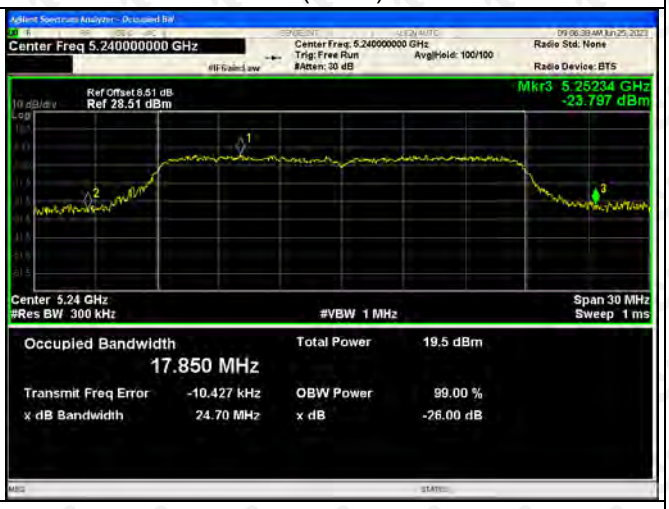
802.11n(HT20)-5200



802.11n(HT20)-5240

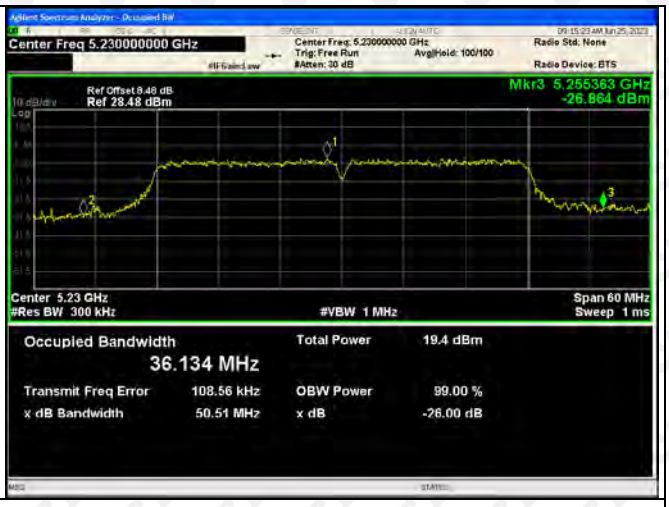


802.11n(HT40)-5190



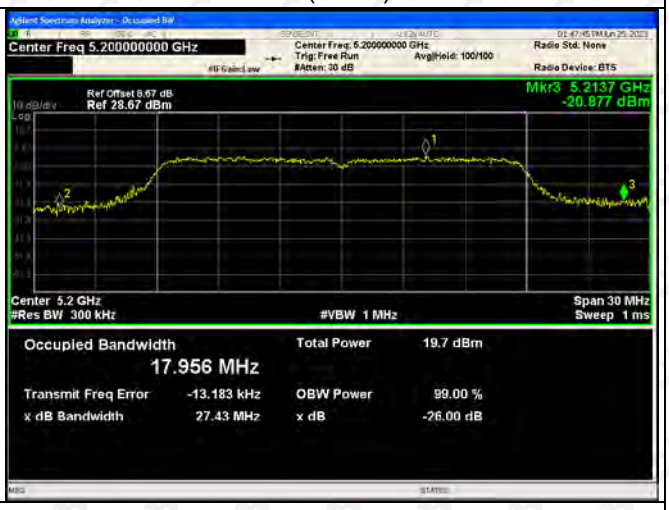
802.11n(HT40)-5230

802.11ax(VH20)-5180

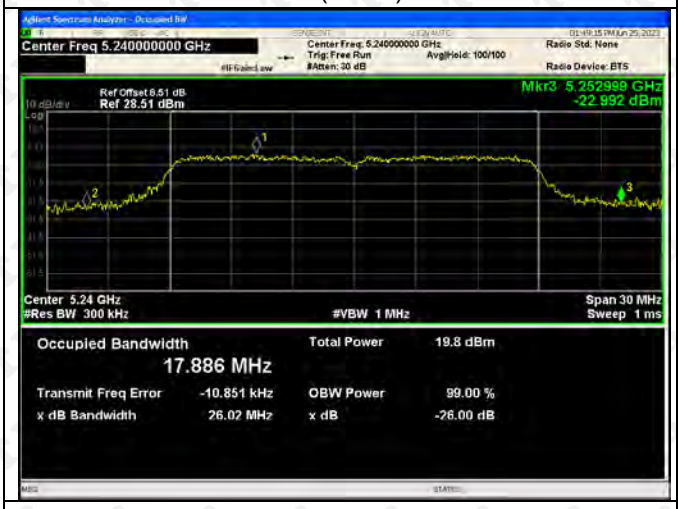


802.11ax(VH20)-5200

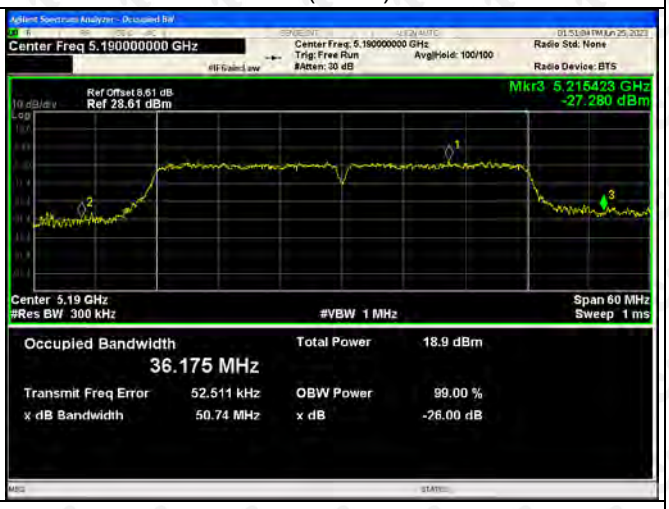
802.11ax(VH20)-5240



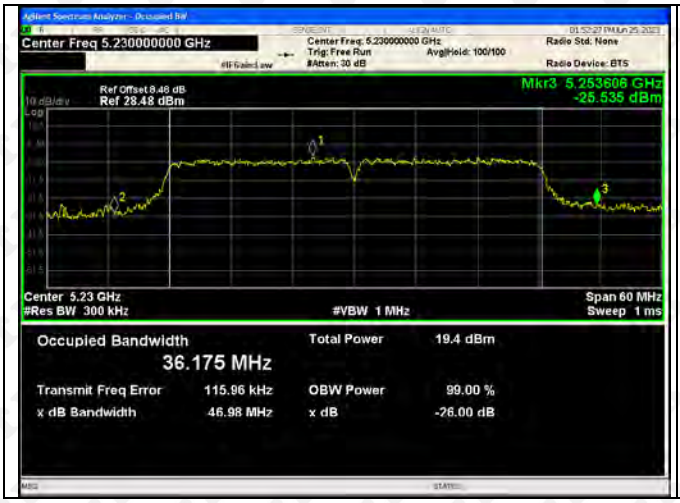
802.11ax(VH40)-5190



802.11ax(VH40)-5230



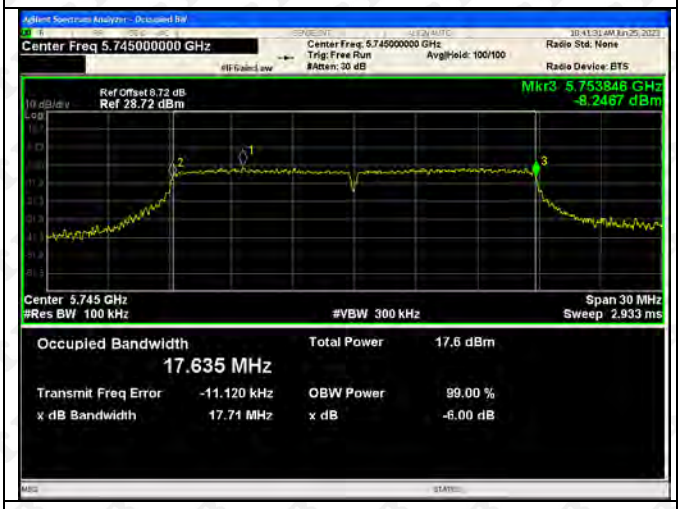
802.11ax(VH80)-5210


Agilent Spectrum Analyzer - Occupied BW
Center Freq 5.230000000 GHz
Center Freq: 5.230000000 GHz
Trig: Free Run
Avg|Hold: 100/100
#Atten: 30 dB
Radio Std: None
Radio Device: BTS
Ref Offset 8.46 dB
10 dB/div
Ref 28.48 dBm
Mkr3 5.253606 GHz
-25.535 dBm
Center 5.23 GHz
#Res BW 300 kHz
#VBW 1 MHz
Span 60 MHz
Sweep 1 ms
Occupied Bandwidth
36.175 MHz
Total Power 19.4 dBm
Transmit Freq Error 115.96 kHz
OBW Power 99.00 %
x dB Bandwidth 46.98 MHz
x dB -26.00 dB

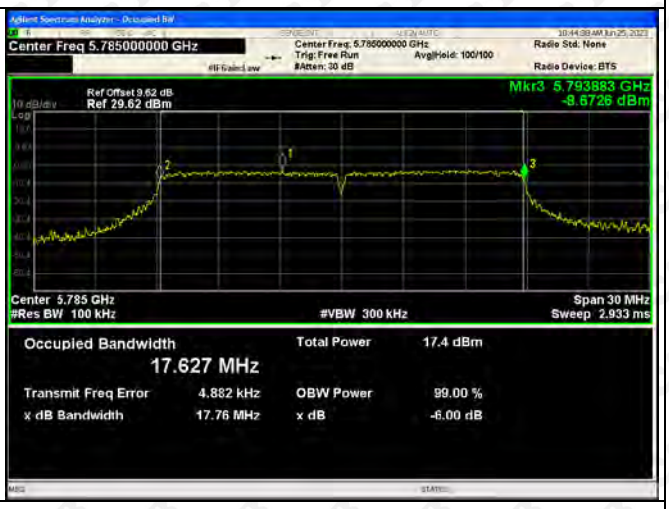
Agilent Spectrum Analyzer - Occupied BW
Center Freq 5.210000000 GHz
Center Freq: 5.210000000 GHz
Trig: Free Run
Avg|Hold: 100/100
#Atten: 30 dB
Radio Std: None
Radio Device: BTS
Ref Offset 8.52 dB
10 dB/div
Ref 28.52 dBm
Mkr3 5.256184 GHz
-27.850 dBm
Center 5.21 GHz
#Res BW 300 kHz
#VBW 1 MHz
Span 120 MHz
Sweep 1.267 ms
Occupied Bandwidth
75.565 MHz
Total Power 18.9 dBm
Transmit Freq Error 205.01 kHz
OBW Power 99.00 %
x dB Bandwidth 91.96 MHz
x dB -26.00 dB

5745-5825MHz

802.11a-5745



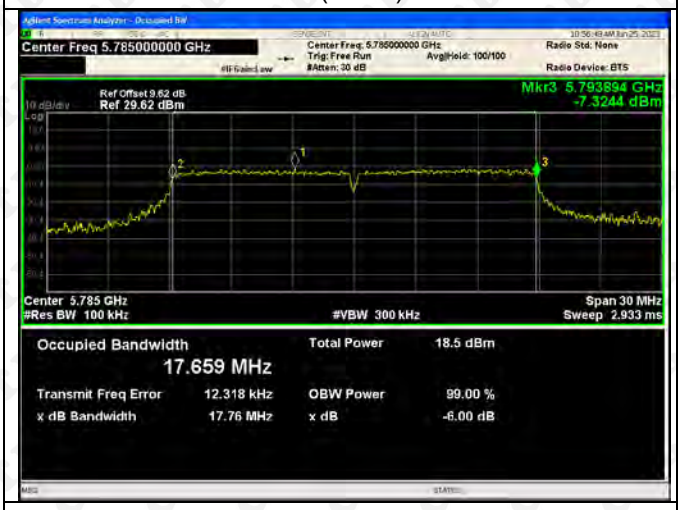
802.11a-5785



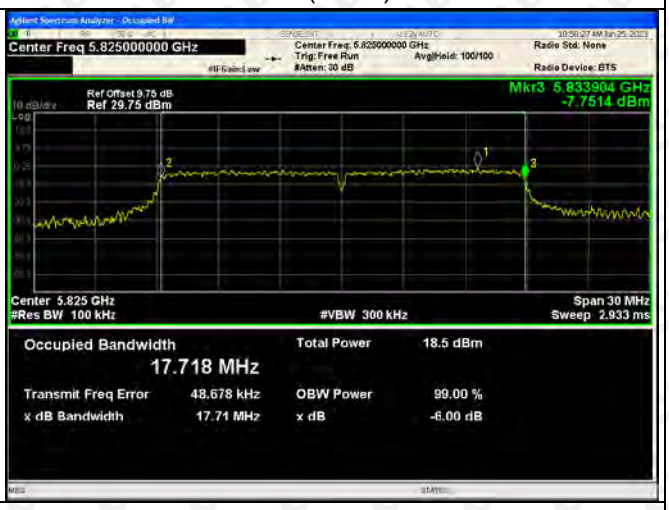
802.11a-5825

802.11ac(VH20)-5745

802.11ac(VH20)-5785

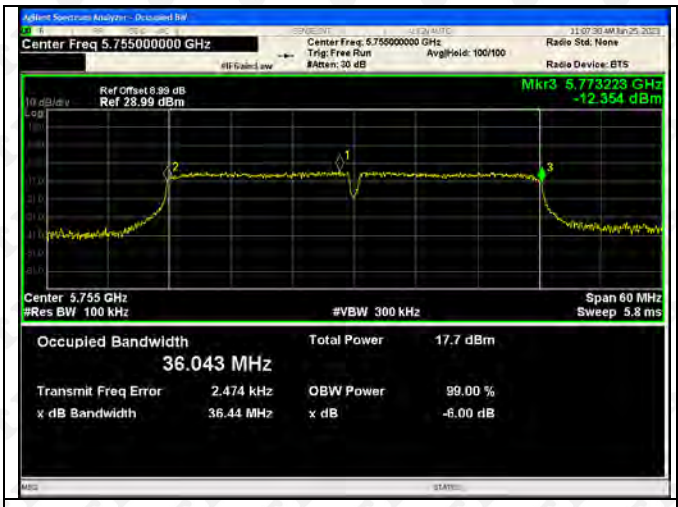


802.11ac(VH20)-5825

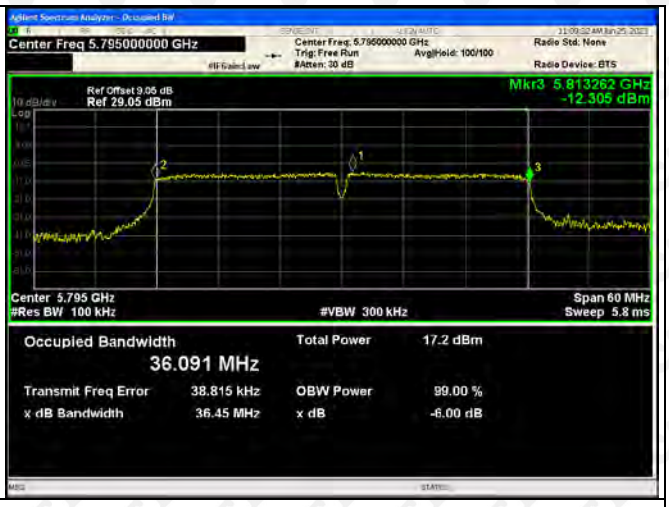


802.11ac(VH40)-5755

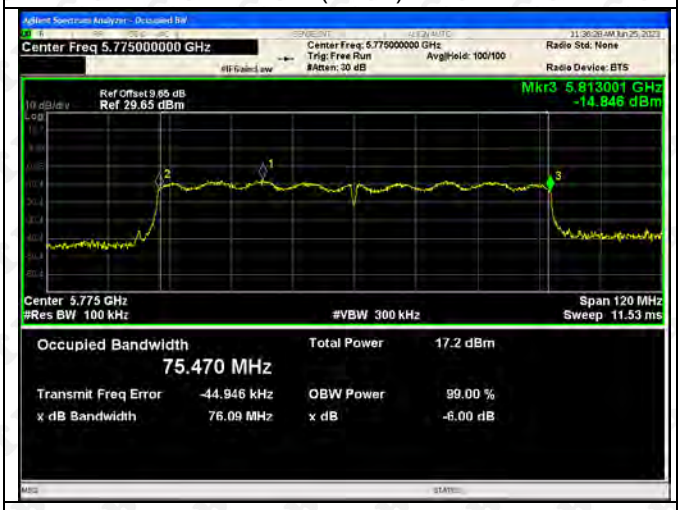
802.11ac(VH40)-5795



802.11ac(VH80)-5775

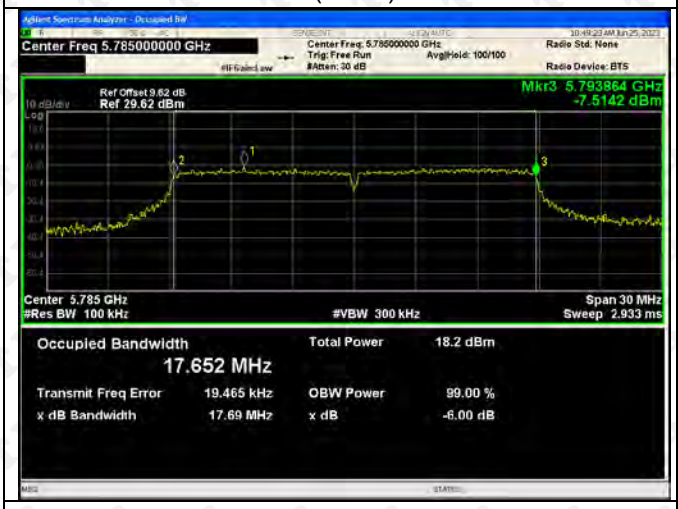


802.11n(HT20)-5745



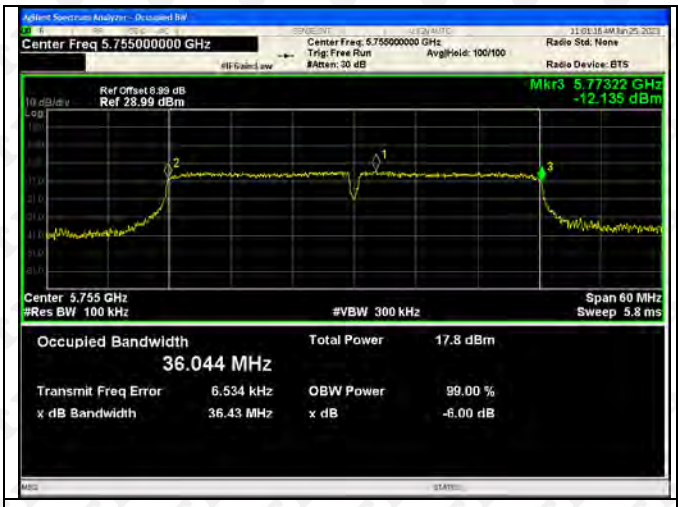
802.11n(HT20)-5785

802.11n(HT20)-5825

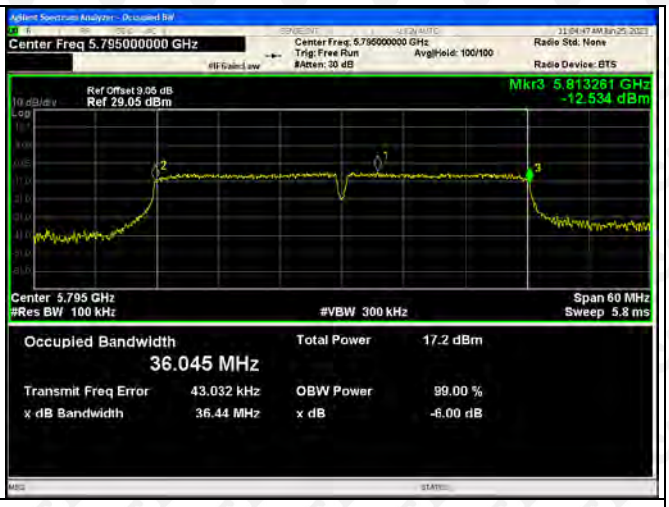


5802.11n(HT40)-5755

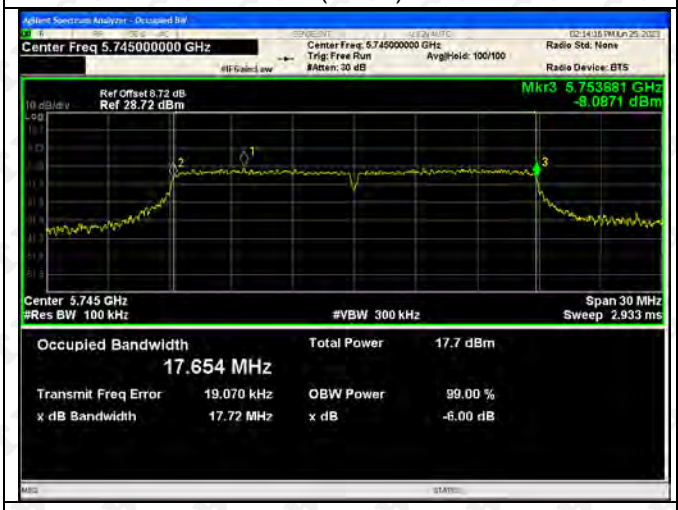
802.11n(HT40)-5795



802.11ax(VH20)-5745

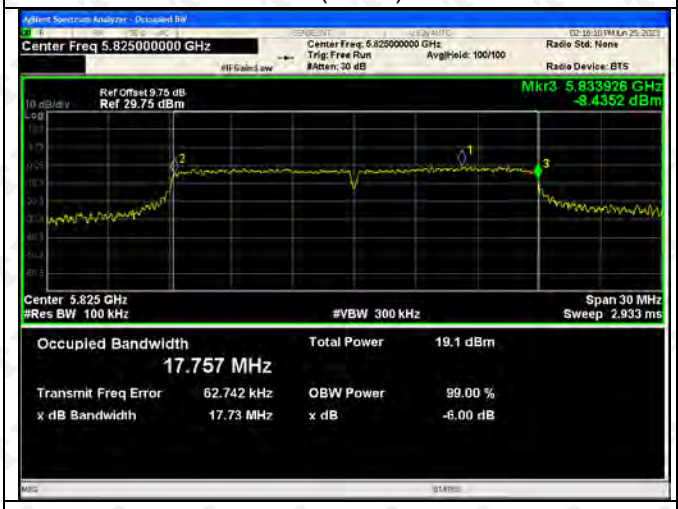


802.11ax(VH20)-5785

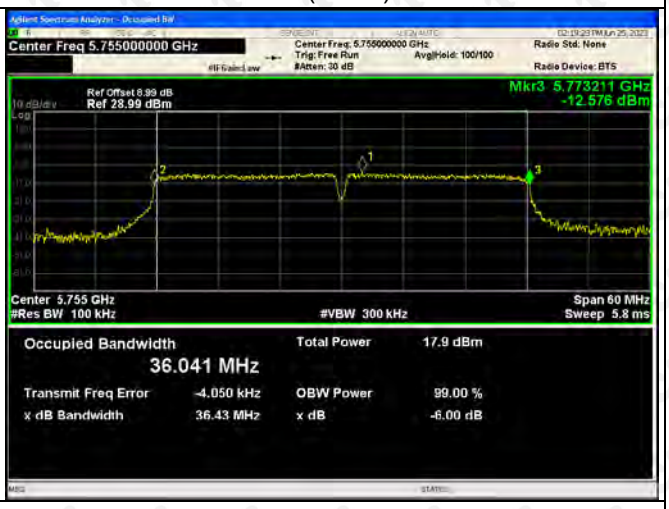


802.11ax(VH20)-5825

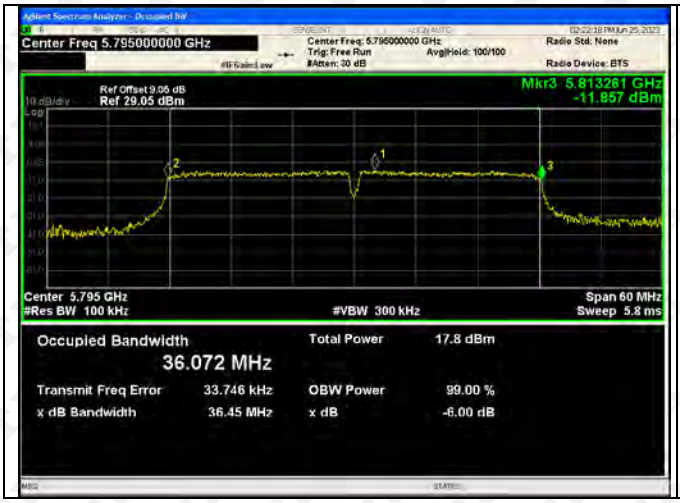
802.11ax(VH40)-5755

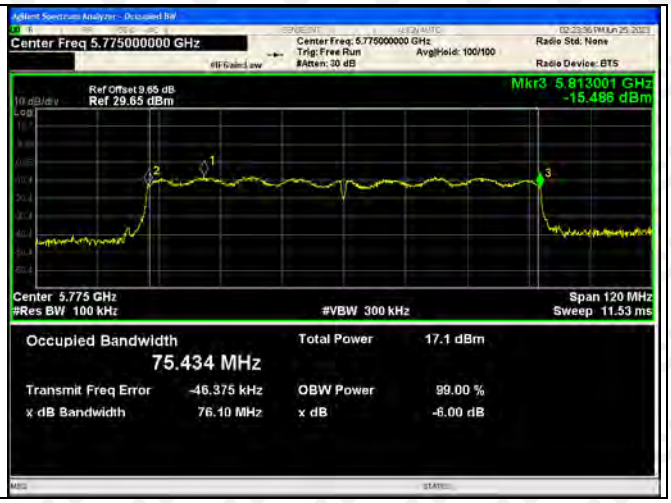


802.11ax(VH40)-5795



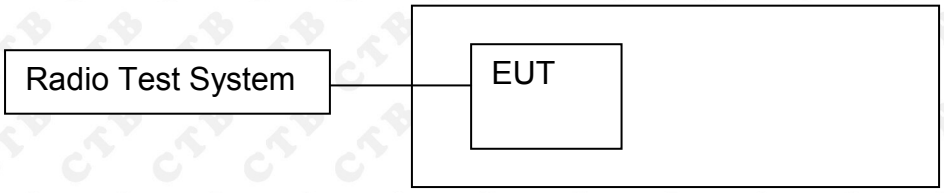
802.11ax(VH80)-5775


Agilent Spectrum Analyzer - Occupied BW
Center Freq 5.795000000 GHz
Center Freq: 5.795000000 GHz
Trig: Free Run
Avg|Hold: 100/100
#Atten: 30 dB
Radio Std: None
Radio Device: BTS
Ref Offset 9.05 dB
Ref 29.05 dBm
Mkr3 5.813261 GHz
-11.857 dBm
Center 5.795 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 60 MHz
Sweep 5.8 ms
Occupied Bandwidth
36.072 MHz
Total Power 17.8 dBm
Transmit Freq Error 33.746 kHz
OBW Power 99.00 %
x dB Bandwidth 36.45 MHz
x dB -6.00 dB


Agilent Spectrum Analyzer - Occupied BW
Center Freq 5.775000000 GHz
Center Freq: 5.775000000 GHz
Trig: Free Run
Avg|Hold: 100/100
#Atten: 30 dB
Radio Std: None
Radio Device: BTS
Ref Offset 9.65 dB
Ref 29.65 dBm
Mkr3 5.813001 GHz
-15.486 dBm
Center 5.775 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 120 MHz
Sweep 11.53 ms
Occupied Bandwidth
75.434 MHz
Total Power 17.1 dBm
Transmit Freq Error -46.375 kHz
OBW Power 99.00 %
x dB Bandwidth 76.10 MHz
x dB -6.00 dB

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

Test mode	Test Channel (MHz)	PSD [dBm/MHz]	Limit [dBm/MHz]	Result
802.11a	5180	2.633	11	Pass
	5200	2.584	11	Pass
	5240	2.95	11	Pass
802.11ac(VH20)	5180	1.977	11	Pass
	5200	2.526	11	Pass
	5240	3.091	11	Pass
802.11ac(VH40)	5190	-1.658	11	Pass
	5230	-1.025	11	Pass
802.11ac(VH80)	5210	-3.83	11	Pass
802.11n(HT20)	5180	1.652	11	Pass
	5200	1.839	11	Pass
	5240	2.522	11	Pass
802.11n(HT40)	5190	-1.605	11	Pass
	5230	-0.732	11	Pass
802.11ax(VH20)	5180	3.567	11	Pass
	5200	2.623	11	Pass
	5240	2.592	11	Pass
802.11ax(VH40)	5190	-1.461	11	Pass
	5230	-0.897	11	Pass
802.11ax(VH80)	5210	-3.385	11	Pass

Test mode	Test Channel (MHz)	PSD [dBm/500kHz]	Limit [dBm/MHz]	Result
802.11a	5745	-2.195	30	Pass
	5785	-2.313	30	Pass
	5825	-1.206	30	Pass
802.11ac(VH20)	5745	-1.833	30	Pass
	5785	-1.051	30	Pass
	5825	-0.878	30	Pass
802.11ac(VH40)	5755	-5.322	30	Pass
	5795	-5.599	30	Pass
802.11ac(VH80)	5775	-7.912	30	Pass
802.11n(HT20)	5745	-1.566	30	Pass
	5785	-1.324	30	Pass
	5825	-0.419	30	Pass
802.11n(HT40)	5755	-5.114	30	Pass
	5795	-5.431	30	Pass
802.11ax(VH20)	5745	-1.954	30	Pass
	5785	-1.387	30	Pass
	5825	-0.247	30	Pass
802.11ax(VH40)	5755	-5.152	30	Pass
	5795	-5.244	30	Pass
802.11ax(VH80)	5775	-7.982	30	Pass

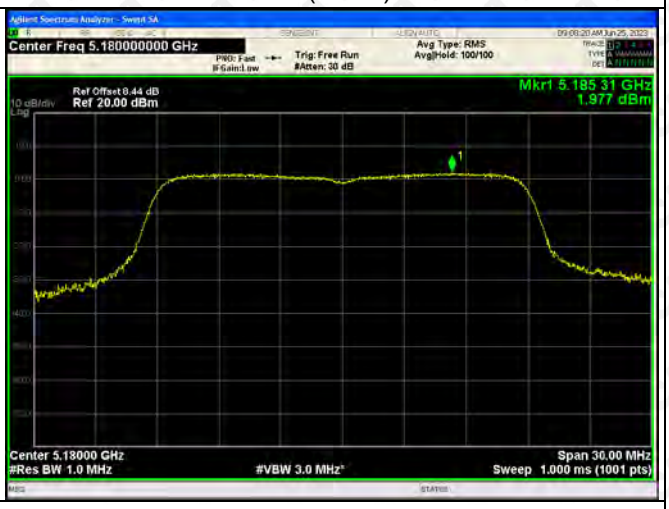
5180-5230MHz

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

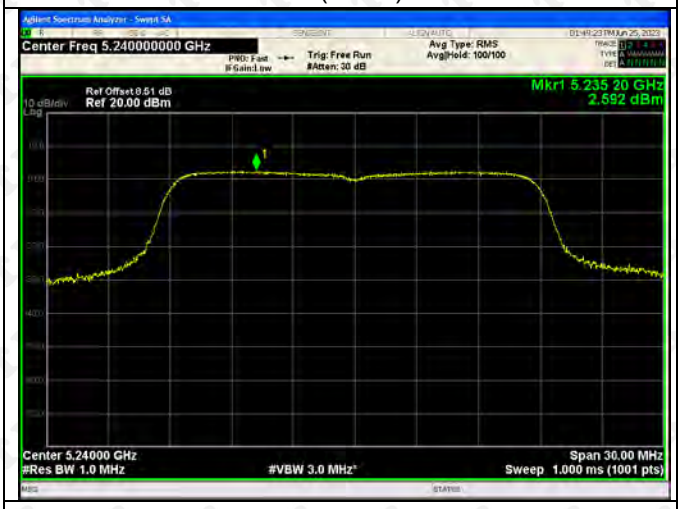
802.11n(HT40)-5230

802.11ax(VH20)-5180

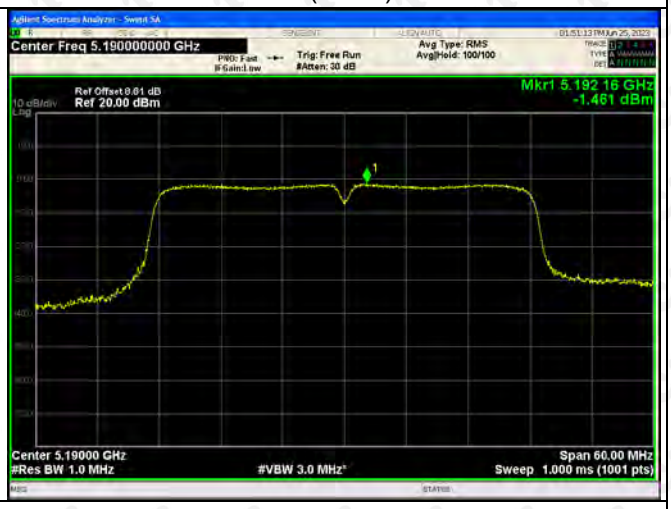
802.11ax(VH20)-5200

802.11ax(VH20)-5240

802.11ax(VH40)-5190



802.11ax(VH40)-5230



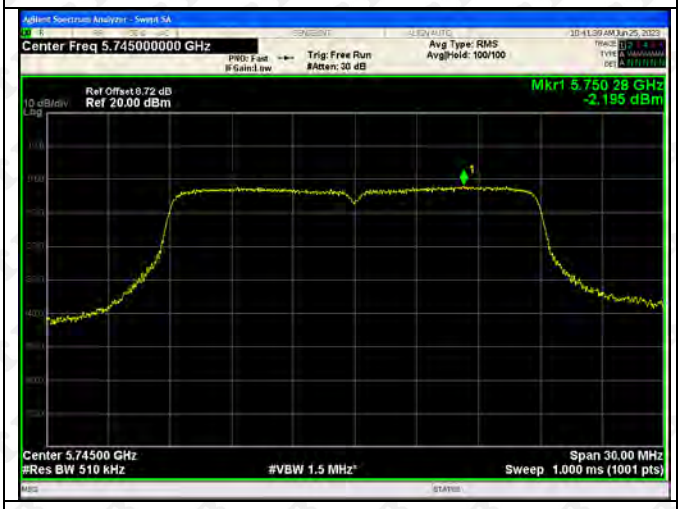
802.11ax(VH80)-5210

Agilent Spectrum Analyzer - Swept SA
Center Freq 5.230000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: RMS
Avg|Hold: 100/100
Ref Offset 8.49 dB
10 dB/div
Ref 20.00 dBm
Mkr1 5.233 60 GHz
-0.897 dBm
Center 5.23000 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz*
Span 60.00 MHz
Sweep 1.000 ms (1001 pts)

Agilent Spectrum Analyzer - Swept SA
Center Freq 5.210000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: RMS
Avg|Hold: 100/100
Ref Offset 8.52 dB
10 dB/div
Ref 20.00 dBm
Mkr1 5.236 88 GHz
-3.385 dBm
Center 5.21000 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz*
Span 120.0 MHz
Sweep 1.000 ms (1001 pts)

5745-5825MHz

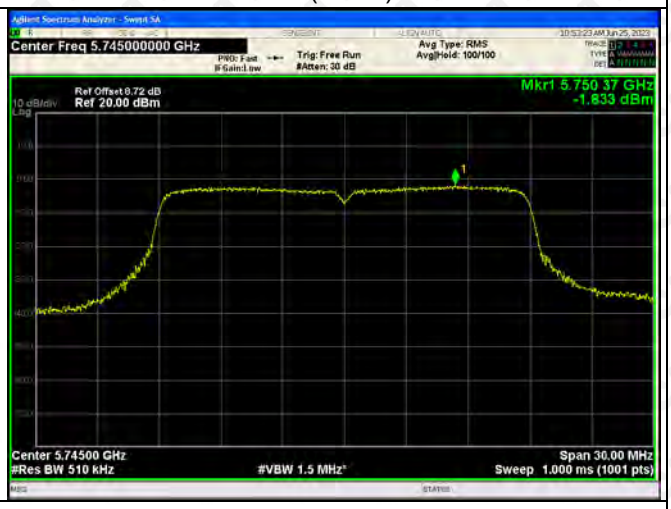
802.11a-5745



802.11a-5785

802.11a-5825

802.11ac(VH20)-5745



802.11ac(VH20)-5785

802.11ac(VH20)-5825

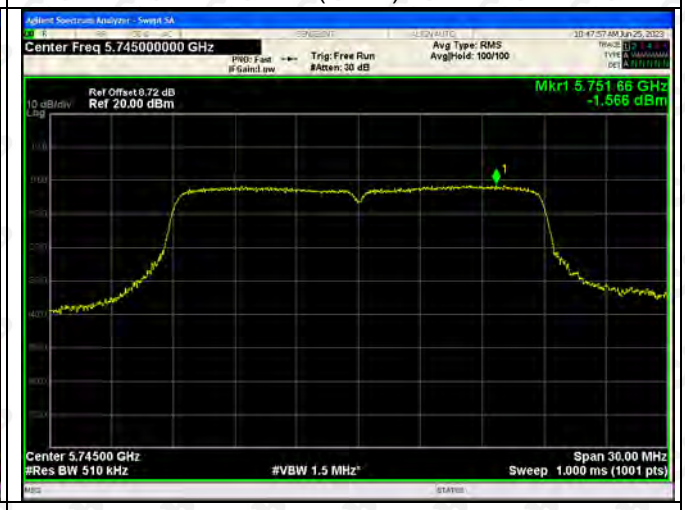
802.11ac(VH40)-5755

802.11ac(VH40)-5795

802.11ac(VH80)-5775

802.11n(HT20)-5745

802.11n(HT20)-5785



802.11n(HT20)-5825

5802.11n(HT40)-5755

802.11n(HT40)-5795

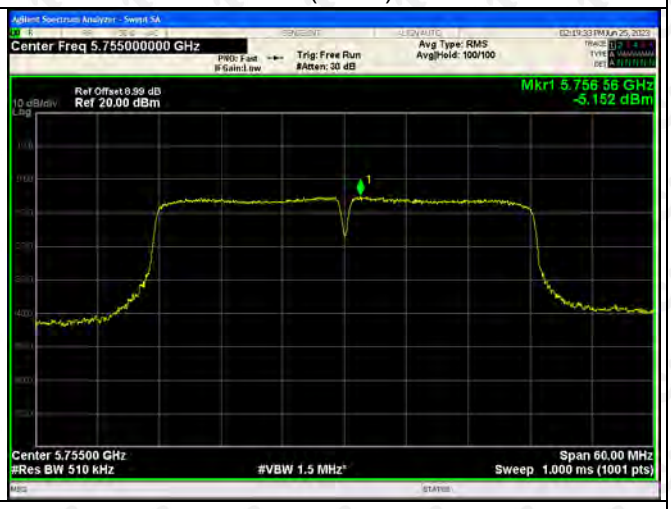
802.11ax(VH20)-5745

802.11ax(VH20)-5785

802.11ax(VH20)-5825

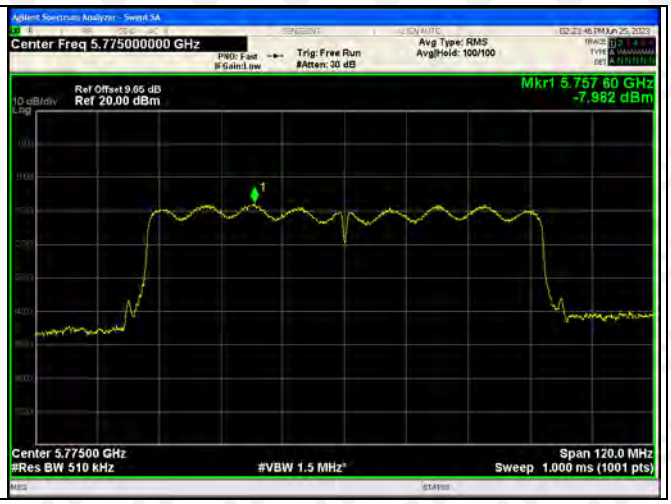
802.11ax(VH40)-5755

802.11ax(VH40)-5795



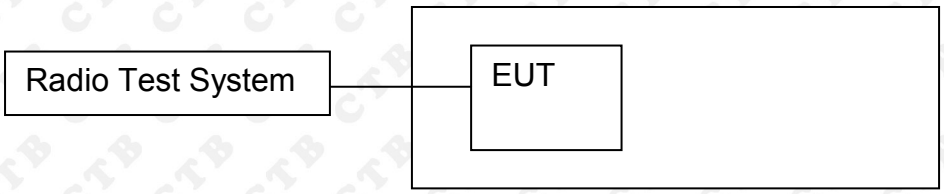
802.11ax(VH80)-5775

Agilent Spectrum Analyzer - Swept SA
Center Freq 5.795000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: RMS
Avg|Hold: 100/100
Ref Offset 9.06 dB
10 dB/div
Ref 20.00 dBm
Mkr1 5.793 50 GHz
-5.244 dBm
Center 5.79500 GHz
#Res BW 510 kHz
#VBW 1.5 MHz*
Span 60.00 MHz
Sweep 1.000 ms (1001 pts)


Agilent Spectrum Analyzer - Swept SA
Center Freq 5.775000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: RMS
Avg|Hold: 100/100
Ref Offset 9.06 dB
10 dB/div
Ref 20.00 dBm
Mkr1 5.757 60 GHz
-7.982 dBm
Center 5.77500 GHz
#Res BW 510 kHz
#VBW 1.5 MHz*
Span 120.0 MHz
Sweep 1.000 ms (1001 pts)

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

Pass

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 WLAN message transmitting from remote device and verify whether it shall reconnect. (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.

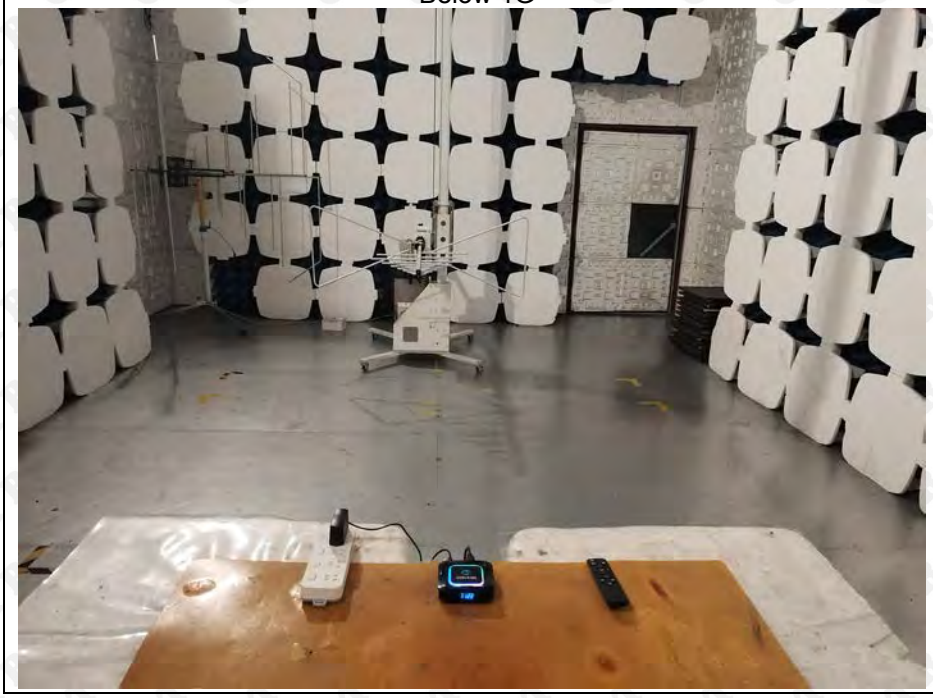
EUT Antenna:

The antenna is internal antenna and no consideration of replacement. The best case gain of the antenna is 5.2G: 1.9dBi, 5.8G: -1.65dBi.

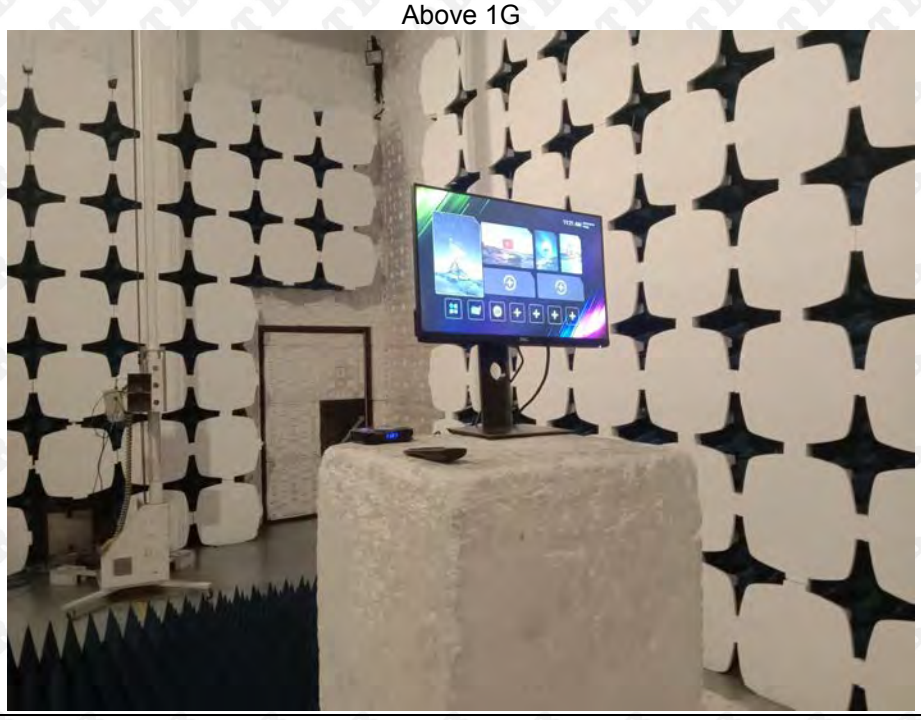
15. EUT TEST SETUP PHOTOGRAPHS

Radiated Emission

Below 1G



Above 1G



Conducted Emission

※※※※※ **END OF REPORT** ※※※※※