



TEST REPORT

Product Name: Wi-Fi + BT SoC Module
FCC ID: 2ATPO-BW21
Trademark:   安信可科技
Model Number: BW21-CBV
Prepared For: Shenzhen Ai-Thinker Technology Co., Ltd
Address: 410, Block C, Huafeng Smart Innovation Port. Gushu 2nd Road, Gushu Community, Xixiang Street, Baoan District, Shenzhen, China
Manufacturer: Shenzhen Ai-Thinker Technology Co., Ltd
Address: 410, Block C, Huafeng Smart Innovation Port. Gushu 2nd Road, Gushu Community, Xixiang Street, Baoan District, Shenzhen, 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: Feb. 11, 2025
Sample tested Date: Feb. 11, 2025 to Feb. 25, 2025
Issue Date: Feb. 25, 2025
Report No.: CTB25021104203RF03
Test Standards: FCC CFR Title 47 Part 15 Subpart E Section 15.407
KDB 789033 V02r01
Test Results: PASS
Remark: This is WIFI-5GHz band radio test report.

Compiled by:

Zhou kui

Zhou Kui

Reviewed by:

Arron Liu

Arron Liu

Approved by:

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
CTB25021104203RF03	Feb. 25, 2025	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	ANSI C63.10-2013	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	$U=\pm 54.3\text{Hz}$
2	Adjacent channel power	$U=\pm 1.3\text{dB}$
3	Conducted Adjacent channel power	$U=\pm 1.38\text{dB}$
4	Conducted output power Above 1G	$U=\pm 1.0\text{dB}$
5	Conducted output power below 1G	$U=\pm 0.9\text{dB}$
6	Power Spectral Density , Conduction	$U=\pm 1.0\text{dB}$
7	Conduction spurious emissions	$U=\pm 2.8\text{dB}$
8	Out of band emission	$U=\pm 54\text{Hz}$
9	3m camber Radiated spurious emission(30MHz-1GHz)	$U=\pm 4.3\text{dB}$
10	3m chamber Radiated spurious emission(1GHz-18GHz)	$U=\pm 4.5\text{dB}$
11	humidity uncertainty	$U=\pm 5.3\%$
12	Temperature uncertainty	$U=\pm 0.59^{\circ}\text{C}$
13	Supply volyages	$U=\pm 3\%$
14	Time	$U=\pm 5\%$
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):	BW21-CBV
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/(40M): 5150MHz ~5250MHz/ 2 channel IEEE 802.11a/n/ac(20M): 5250MHz ~5350 MHz/ 4 channel IEEE 802.11n(40M): 5250MHz ~5350 MHz/ 2 channel IEEE 802.11a/n/ac(20M): 5470MHz ~5725 MHz/ 11 channel IEEE 802.11n/(40M): 5470MHz ~5725 MHz/ 5 channel IEEE 802.11a/n/ac(20M): 5725MHz ~5850MHz/ 5 channel IEEE 802.11n(40M): 5725MHz ~5850MHz/ 2 channel
Max. RF output power:	WiFi (5G): 24.775dBm
Type of Modulation:	WiFi (5G): OFDM
Antenna installation:	WiFi (5G): External antenna
Antenna Gain:	WiFi (5.2G): 3.17dBi WiFi (5.3G): 3.42dBi WiFi (5.6G): 2.66dBi WiFi (5.8G): 3.03dBi
Ratings:	1.8V/ 3.3V/ 5V=1A

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.	Adapter	JIYIN	JY-05100C	/	AE
2.	Laptop	DELL	Vostro 5490	N/A	AE

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 5150MHz ~5250 MHz band			
Channel	Frequency	Channel	Frequency
36	5180MHz	44	5220MHz
40	5200MHz	48	5240MHz
For 802.11a/n/ac/ax(20M) Operation in the 5250MHz ~5350 MHz band			
Channel	Frequency	Channel	Frequency
52	5260MHz	60	5300MHz
56	5280MHz	64	5320MHz
For 802.11a/n/ac/ax(20M) Operation in the 5470MHz ~5725 MHz band			
Channel	Frequency	Channel	Frequency
100	5500MHz	124	5620 MHz
104	5520MHz	128	5640 MHz
108	5540MHz	132	5660 MHz
112	5560MHz	136	5680MHz
116	5580MHz	140	5700MHz
120	5600 MHz		
For 802.11a/n/ac/ax(20M) Operation in the 5725MHz ~5850 MHz band			
Channel	Frequency	Channel	Frequency
149	5745MHz	161	5805MHz
153	5765MHz	165	5825MHz
157	5785MHz	NA	NA

For 802.11n(40M) Operation in the 5150MHz ~5250 MHz band			
Channel	Frequency	Channel	Frequency
38	5190MHz	46	5230MHz
For 802.11n(40M) Operation in the 5250MHz ~5350 MHz band			
Channel	Frequency	Channel	Frequency
54	5270MHz	62	5310MHz
For 802.11n(40M) Operation in the 5470MHz ~5725 MHz band			
Channel	Frequency	Channel	Frequency
102	5510MHz	126	5630MHz
110	5550MHz	134	5670MHz
118	5590MHz		
For 802.11n(40M) Operation in the 5725MHz ~5850 MHz band			
Channel	Frequency	Channel	Frequency
151	5755MHz	159	5795MHz

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)	5150MHz ~5250 MHz	Channel 36	Channel 40	Channel 48
		5180MHz	5200MHz	5240MHz
802.11n(40M)	5150MHz ~5250 MHz	Channel 38	N/A	Channel 46
		5190MHz	N/A	5230MHz
802.11a/n/ac/ax(20M)	5250MHz ~5350 MHz	Channel 52	Channel 56	Channel 64
		5260MHz	5280MHz	5320MHz
802.11n(40M)	5250MHz ~5350 MHz	Channel 54	N/A	Channel 62
		5270MHz	N/A	5310MHz
802.11a/n/ac/ax(20M)	5470MHz ~5725 MHz	Channel 100	Channel 116	Channel 140
		5500MHz	5580MHz	5700MHz
802.11n(40M)	5470MHz ~5725 MHz	Channel 102	N/A	Channel 134
		5510MHz	N/A	5670MHz
802.11a/n/ac/ax(20M)	5725MHz ~5850 MHz	Channel 149	Channel 157	Channel 165
		5745MHz	5785MHz	5825MHz
802.11n(40M)	5725MHz ~5850 MHz	Channel 151	N/A	Channel 159
		5755MHz	N/A	5795MHz

4.6 Test Environment

Humidity(%):	54
Atmospheric Pressure(kPa):	101
Normal Voltage(DC):NV	3.3V
Normal Temperature(°C):NT	23
Low Temperature(°C):LT	0
High Temperature(°C):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, Xinghe 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

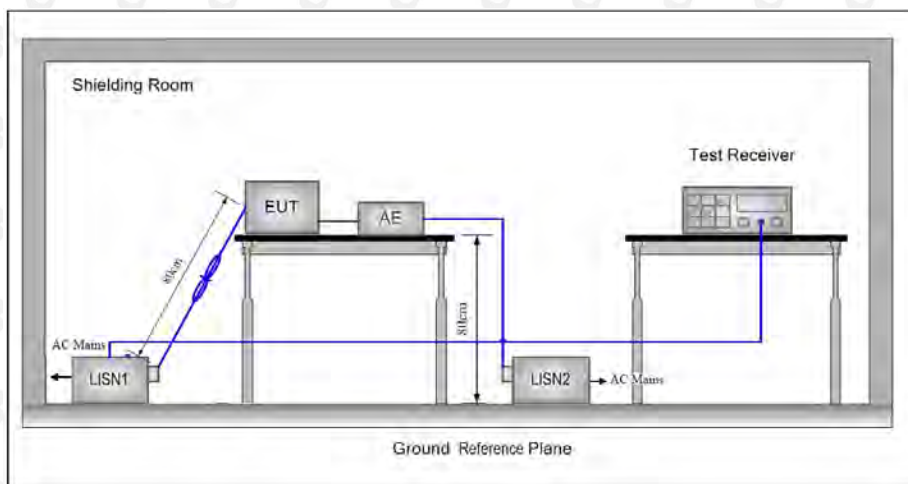
No.	Equipment	Manufacturer	Type No.	Serial No.	Firmware Version	Calibrated until
1	Spectrum Analyzer	Agilent	N9020A	MY52090073	A.14.16	2025/6/28
2	Power Sensor	Agilent	U2021XA	MY56120032	/	2025/6/28
3	Power Sensor	Agilent	U2021XA	MY56120034	/	2025/6/28
4	Communication test set	R&S	CMW500	108058	V3.5.80	2025/6/28
5	Spectrum Analyzer	KEYSIGHT	N9020A	MY51289897	A.14.16	2025/6/28
6	Signal Generator	Agilent	N5181A	MY50140365	A.01.60	2025/6/28
7	Vector signal generator	Agilent	N5182A	MY47420195	A.01.87	2025/6/28
8	Communication test set	Agilent	E5515C	MY50102567	B.19.07 (E1962B)	2025/6/28
9	2.4 GHz Filter	Shenxiang	MSF2400-2483.5MS-1154	20181015001	/	2025/6/30
10	5 GHz Filter	Shenxiang	MSF5150-5850MS-1155	20181015001	/	2025/6/30
11	Filter	Xingbo	XBLBQ-DZA120	190821-1-1	/	2025/6/30
12	BT&WI-FI Automatic test software	Microwave	MTS8310	Ver. 2.0.0.0	/	/
13	Rohde & Schwarz SFU Broadcast Test System	R&S	SFU	101017	/	2025/6/28
14	Temperature humidity chamber	Hongjing	TH-80CH	DG-15174	/	2025/6/28
15	234G Automatic test software	Microwave	MTS8200	Ver. 2.0.0.0	/	/
16	966 chamber	C.R.T.	966	/	/	2027/6/21
17	Receiver	R&S	ESPI	100362	RF_ATTEN_7 (104489/003)	2025/6/28
18	Amplifier	HP	8447E	2945A02747	/	2025/6/28
19	Amplifier	Agilent	8449B	3008A01838	/	2025/6/28
20	TRILOG Broadband Antenna	Schwarzbeck	VULB 9168	00869	/	2025/6/28
21	Double Ridged Broadband Horn Antenna	Schwarzbeck	BBHA9120D	01911	/	2025/6/28

22	EMI test software	Fala	EZ-EMC	FA-03A2 RE	/	/
23	Loop Antenna	Schwarzbeck	FMZB 1519B	1519B-224	/	2025/6/28
24	loop antenna	ZHINAN	ZN30900A	GTS534	/	/
25	40G Horn antenna	A/H/System	SAS-574	588	/	2025/6/28
26	Amplifier	AEROFLEX	Aeroflex	097	/	2025/6/28
27	Power Metter	KEYSIGHT	N1912AP	N/A	A.05.00	2025/6/28

Continuous disturbance						
No.	Equipment	Manufacturer	Model No.	Serial No.	Firmware version	Calibrated until
1	843 Shield Room	C/ R/ T	843	/	/	2027/6/21
2	AMN	ROHDE&SCHWARZ	ESH3-Z5	831551852	/	2025/6/30
3	Pulse limiter	ROHDE&SCHWARZ	ESH3Z2	357881052	/	2025/6/28
4	EMI TEST RECEIVER	ROHDE&SCHWARZ	ESCI	100428	V4.42.SP3	2025/6/30
5	Coaxial cable	ZDECL	Z302S	18091904	/	2025/6/30
6	ISN	Schwarzbeck	NTFM8158	183	/	2025/6/30
7	Voltage sensor	Schwarzbeck	TK 9420	01189	/	2025/10/25
8	EZ-EMC	Frad	EMC-con3A1.1	/	/	/
9	Current Probe	FCC	F-52B	199453	/	2025/5/27
10	Communication test set	R&S	CMW500	108058	B.19.07 (E1962B)	2025/6/28
11	Communication test set	Agilent	E5515C	MY50102567	V3.5.80	2025/6/28

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

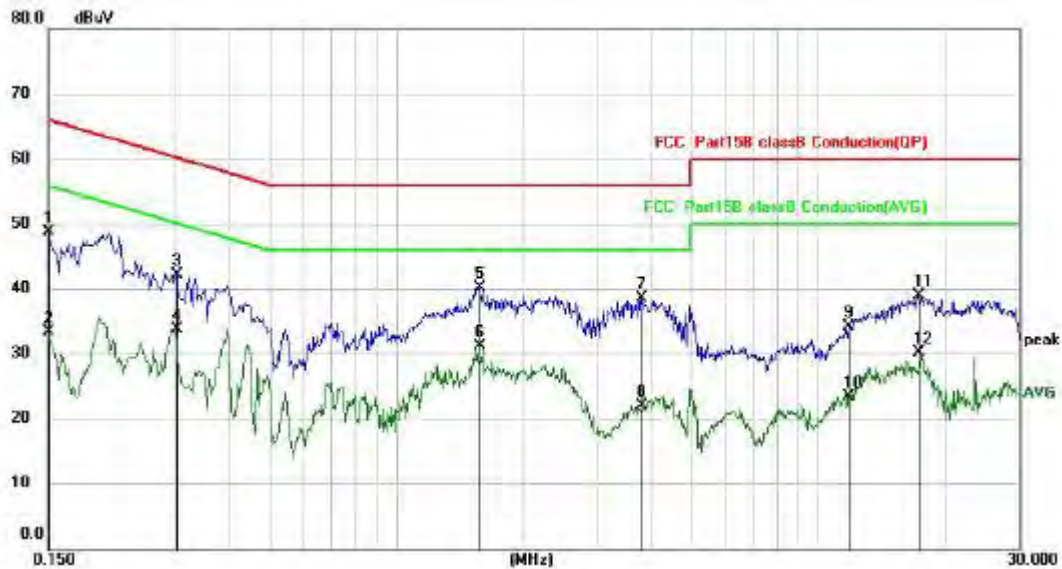
- 1) The mains terminal disturbance voltage test was conducted in a shielded room.
- 2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a $50\Omega/50\mu\text{H} + 5\Omega$ linear impedance. The power cables of all other units of the EUT 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.

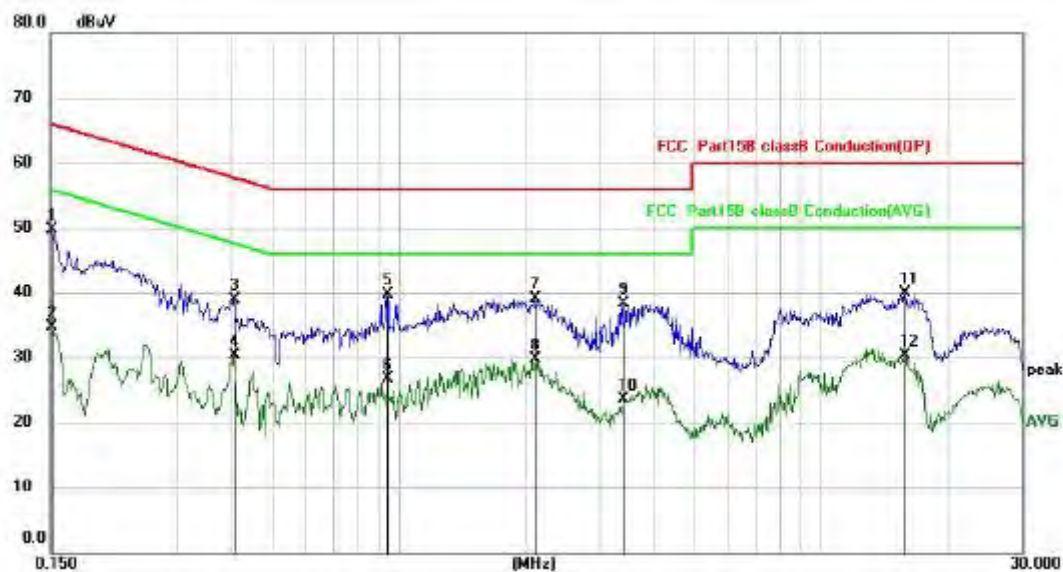
6.4 Test Result

Test Specification: Neutral



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector
1		0.1500	37.79	10.89	48.68	66.00	-17.32	QP
2		0.1500	22.35	10.89	33.24	56.00	-22.76	AVG
3		0.3019	31.54	10.64	42.18	60.19	-18.01	QP
4		0.3019	23.05	10.64	33.69	50.19	-16.50	AVG
5		1.5820	28.85	11.32	40.17	56.00	-15.83	QP
6	*	1.5820	19.70	11.32	31.02	46.00	-14.98	AVG
7		3.8140	26.43	11.98	38.41	56.00	-17.59	QP
8		3.8140	9.92	11.98	21.90	46.00	-24.10	AVG
9		11.8338	20.78	13.28	34.06	60.00	-25.94	QP
10		11.8338	10.11	13.28	23.39	50.00	-26.61	AVG
11		17.2337	25.39	13.45	38.84	60.00	-21.16	QP
12		17.2337	16.75	13.45	30.20	50.00	-19.80	AVG

Test Specification: Line



No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Over	
		MHz	Level	Factor	ment			Detector
			dBuV	dB	dBuV	dBuV	dB	
1	*	0.1516	38.80	10.88	49.68	65.91	-16.23	QP
2		0.1516	23.84	10.88	34.72	55.91	-21.19	AVG
3		0.4100	28.37	10.56	38.93	57.65	-18.72	QP
4		0.4100	19.70	10.56	30.26	47.65	-17.39	AVG
5		0.9419	28.71	10.91	39.62	56.00	-16.38	QP
6		0.9419	15.82	10.91	26.73	46.00	-19.27	AVG
7		2.1018	27.48	11.60	39.08	56.00	-16.92	QP
8		2.1018	18.14	11.60	29.74	46.00	-16.26	AVG
9		3.4080	26.33	11.89	38.22	56.00	-17.78	QP
10		3.4080	11.60	11.89	23.49	46.00	-22.51	AVG
11		15.7418	26.44	13.38	39.82	60.00	-20.18	QP
12		15.7418	16.83	13.38	30.21	50.00	-19.79	AVG

Remark:

- Factor = Cable loss + LISN factor, Margin = Limit – Level
- All modes were tested at AC 120V and 240V, only the worst result of AC 120V 60Hz was reported.
- 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

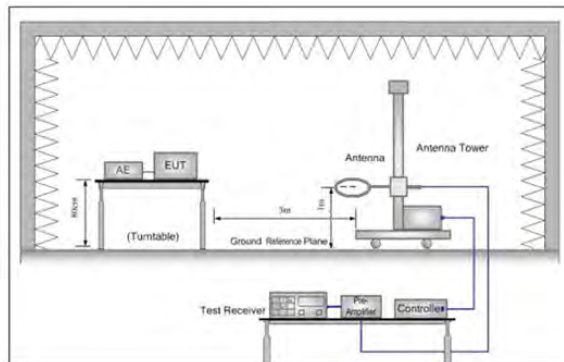


Figure 1. Below 30MHz

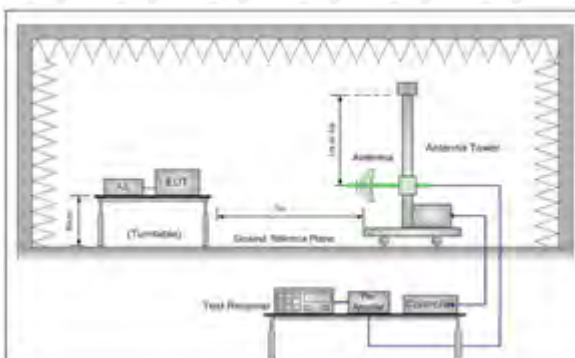


Figure 2. 30MHz to 1GHz

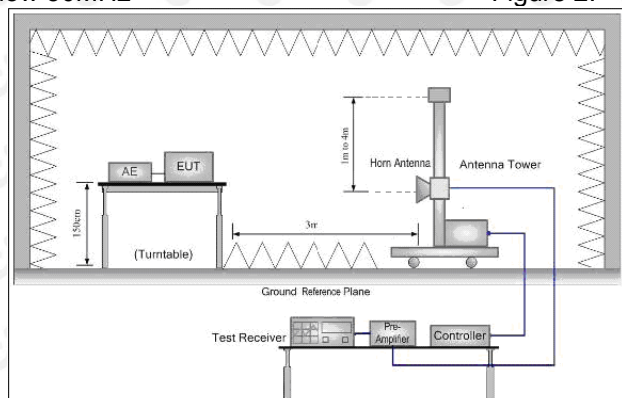


Figure 3. Above 1GHz

7.2 Limit

Spurious Emissions:

Frequency	Field strength (dBμV/m)	Remark	Measurement distance (m)
0.009MHz-0.490MHz	$20\log 2400/F \text{ (kHz)} + 80$	Quasi-peak	3
0.490MHz-1.705MHz	$20\log 24000/F \text{ (kHz)} + 40$	Quasi-peak	3
1.705MHz-30MHz	$20\log 30 + 40$	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) $EIRP = ((E \cdot d)^2) / 30$

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:

$$EIRP[dBm] = E[dB\mu V/m] + 20 \log(d[meters]) - 104.77$$

(iii) Or, if d is 3 meters:

$$EIRP[dBm] = E[dB\mu V/m] - 95.2$$

7.3 Test procedure

Below 1GHz test procedure as below:

- The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- 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.
- 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.
- The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- 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:

- 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).
- Test the EUT in the lowest channel ,the middle channel ,the Highest channel
- 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.

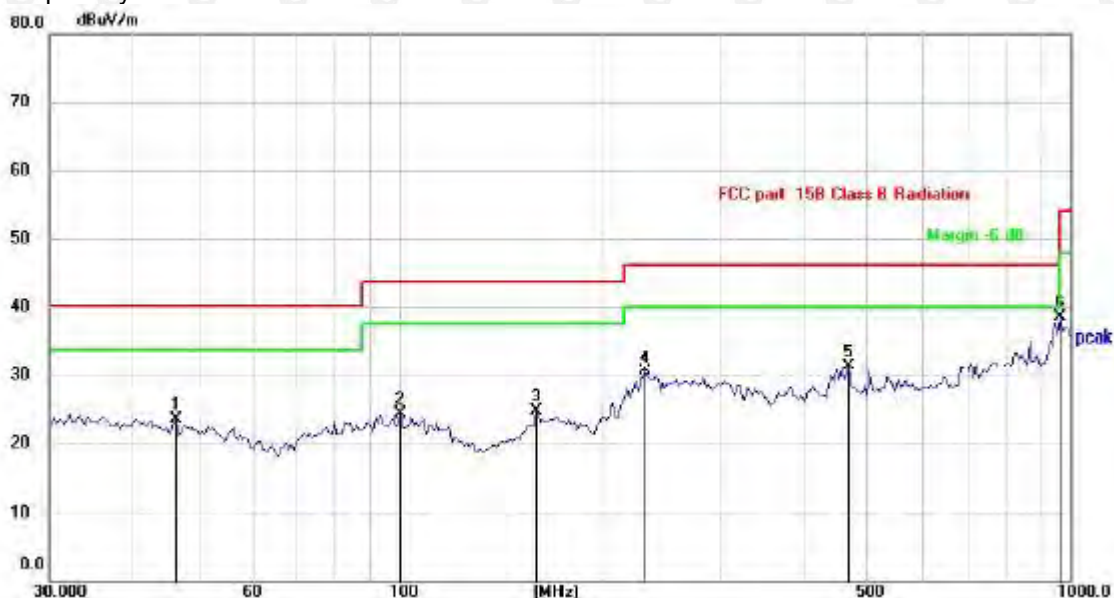
7.4 Test Result

30MHz-1GHz Test Results:

Modulation : 802.11a (the worst data)

Test Channel : 5180MHz

Antenna polarity: H



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dB/m	Over dB	Detector
1		46.5030	30.17	-6.72	23.45	40.00	-16.55	QP
2		100.5806	33.66	-9.44	24.22	43.50	-19.28	QP
3		160.0646	25.48	-0.84	24.64	43.50	-18.86	QP
4		233.3486	34.77	-4.15	30.62	46.00	-15.38	QP
5	*	470.5231	30.21	1.30	31.51	46.00	-14.49	QP
6		965.5420	29.80	8.72	38.52	54.00	-15.48	QP

Antenna polarity: V



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dB/m	Over dB	Detector
1		41.8594	28.22	-6.85	21.37	40.00	-18.63	QP
2		139.1170	35.04	-4.40	30.64	43.50	-12.86	QP
3		176.2685	33.56	-3.04	30.52	43.50	-12.98	QP
4		250.3010	36.55	-3.80	32.75	46.00	-13.25	QP
5		458.3100	30.79	0.95	31.74	46.00	-14.26	QP
6	*	846.5706	26.55	7.80	34.35	46.00	-11.65	QP

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

- 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	40.47	16.39	56.86	74	-17.14	PK	1.46	82	H
10360	27.65	16.39	44.04	54	-9.96	AV	1.04	305	H
10360	40.70	16.39	57.09	74	-16.91	PK	1.49	4	V
10360	26.97	16.39	43.36	54	-10.64	AV	1.58	46	V
Channel:5240MHz									
10480	40.47	16.11	56.58	74	-17.42	PK	1.29	225	H
10480	27.72	16.11	43.83	54	-10.17	AV	1.45	183	H
10480	39.51	16.11	55.62	74	-18.38	PK	1.32	87	V
10480	25.41	16.11	41.52	54	-12.48	AV	1.59	261	V
Channel:5260MHz									
10520	39.38	16.39	55.77	74	-18.23	PK	1.53	293	H
10520	27.85	16.39	44.24	54	-9.76	AV	1.43	272	H
10520	41.57	16.39	57.96	74	-16.04	PK	1.21	209	V
10520	26.40	16.39	42.79	54	-11.21	AV	1.31	242	V
Channel:5320MHz									
10640	39.40	16.39	55.79	74	-18.21	PK	1.02	209	H
10640	25.97	16.39	42.36	54	-11.64	AV	1.26	333	H
10640	41.54	16.39	57.93	74	-16.07	PK	1.08	80	V
10640	26.51	16.39	42.90	54	-11.10	AV	1.39	80	V
Channel:5500MHz									
11000	40.48	16.39	56.87	74	-17.13	PK	1.01	61	H
11000	25.37	16.39	41.76	54	-12.24	AV	1.47	76	H
11000	40.14	16.39	56.53	74	-17.47	PK	1.53	357	V
11000	27.79	16.39	44.18	54	-9.82	AV	1.31	162	V

Channel:5700MHz									
11400	40.56	16.39	56.95	74	-17.05	PK	1.17	80	H
11400	26.87	16.39	43.26	54	-10.74	AV	1.36	265	H
11400	39.93	16.39	56.32	74	-17.68	PK	1.06	117	V
11400	26.20	16.39	42.59	54	-11.41	AV	1.13	330	V
Channel:5745MHz									
11490	40.13	17.46	57.59	74	-16.41	PK	1.64	346	H
11490	25.88	17.46	43.34	54	-10.66	AV	1.88	153	H
11490	39.47	17.46	56.93	74	-17.07	PK	1.33	280	V
11490	27.60	17.46	45.06	54	-8.94	AV	1.83	77	V
Channel:5825MHz									
11650	39.86	17.57	57.43	74	-16.57	PK	1.53	280	H
11650	26.36	17.57	43.93	54	-10.07	AV	1.32	148	H
11650	39.56	17.57	57.13	74	-16.87	PK	1.63	150	V
11650	27.37	17.57	44.94	54	-9.06	AV	1.38	256	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	40.75	16.34	57.09	74	-16.91	PK	1.61	301	H
10380	25.22	16.34	41.56	54	-12.44	AV	1.09	342	H
10380	41.21	16.34	57.55	74	-16.45	PK	1.81	26	V
10380	25.78	16.34	42.12	54	-11.88	AV	1.10	351	V
Channel:5230MHz									
10460	41.94	16.15	58.09	74	-15.91	PK	1.85	29	H
10460	27.21	16.15	43.36	54	-10.64	AV	1.14	41	H
10460	39.17	16.15	55.32	74	-18.68	PK	1.66	150	V
10460	27.33	16.15	43.48	54	-10.52	AV	1.08	10	V
Channel:5270MHz									
10540	41.05	16.34	57.39	74	-16.61	PK	1.65	153	H
10540	26.94	16.34	43.28	54	-10.72	AV	1.40	190	H
10540	41.84	16.34	58.18	74	-15.82	PK	1.46	145	V
10540	26.75	16.34	43.09	54	-10.91	AV	1.21	195	V
Channel:5310MHz									
10620	40.03	16.34	56.37	74	-17.63	PK	1.09	257	H
10620	27.05	16.34	43.39	54	-10.61	AV	1.30	243	H
10620	40.32	16.34	56.66	74	-17.34	PK	1.46	202	V
10620	27.12	16.34	43.46	54	-10.54	AV	1.36	208	V
Channel:5510MHz									
11020	40.25	16.34	56.59	74	-17.41	PK	1.23	61	H
11020	26.75	16.34	43.09	54	-10.91	AV	1.27	11	H
11020	39.53	16.34	55.87	74	-18.13	PK	1.85	60	V
11020	25.05	16.34	41.39	54	-12.61	AV	1.71	245	V

Channel:5670MHz									
11340	39.30	16.34	55.64	74	-18.36	PK	1.03	119	H
11340	27.55	16.34	43.89	54	-10.11	AV	1.10	105	H
11340	41.57	16.34	57.91	74	-16.09	PK	1.21	242	V
11340	27.60	16.34	43.94	54	-10.06	AV	1.63	347	V

Channel:5755MHz									
11510	41.34	17.49	58.83	74	-15.17	PK	1.56	54	H
11510	26.08	17.49	43.57	54	-10.43	AV	1.43	264	H
11510	40.22	17.49	57.71	74	-16.29	PK	1.13	287	V
11510	27.22	17.49	44.71	54	-9.29	AV	1.36	303	V

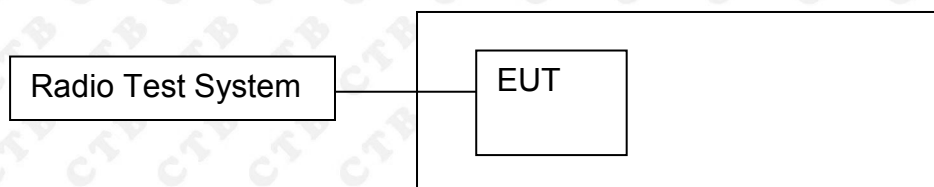
Channel:5795MHz									
11590	39.91	17.52	57.43	74	-18.48	PK	1.41	207	H
11590	27.92	17.52	45.44	54	-16.57	AV	1.78	322	H
11590	39.87	17.52	57.39	74	-16.61	PK	1.47	12	V
11590	27.89	17.52	45.41	54	-8.59	AV	1.82	129	V

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.

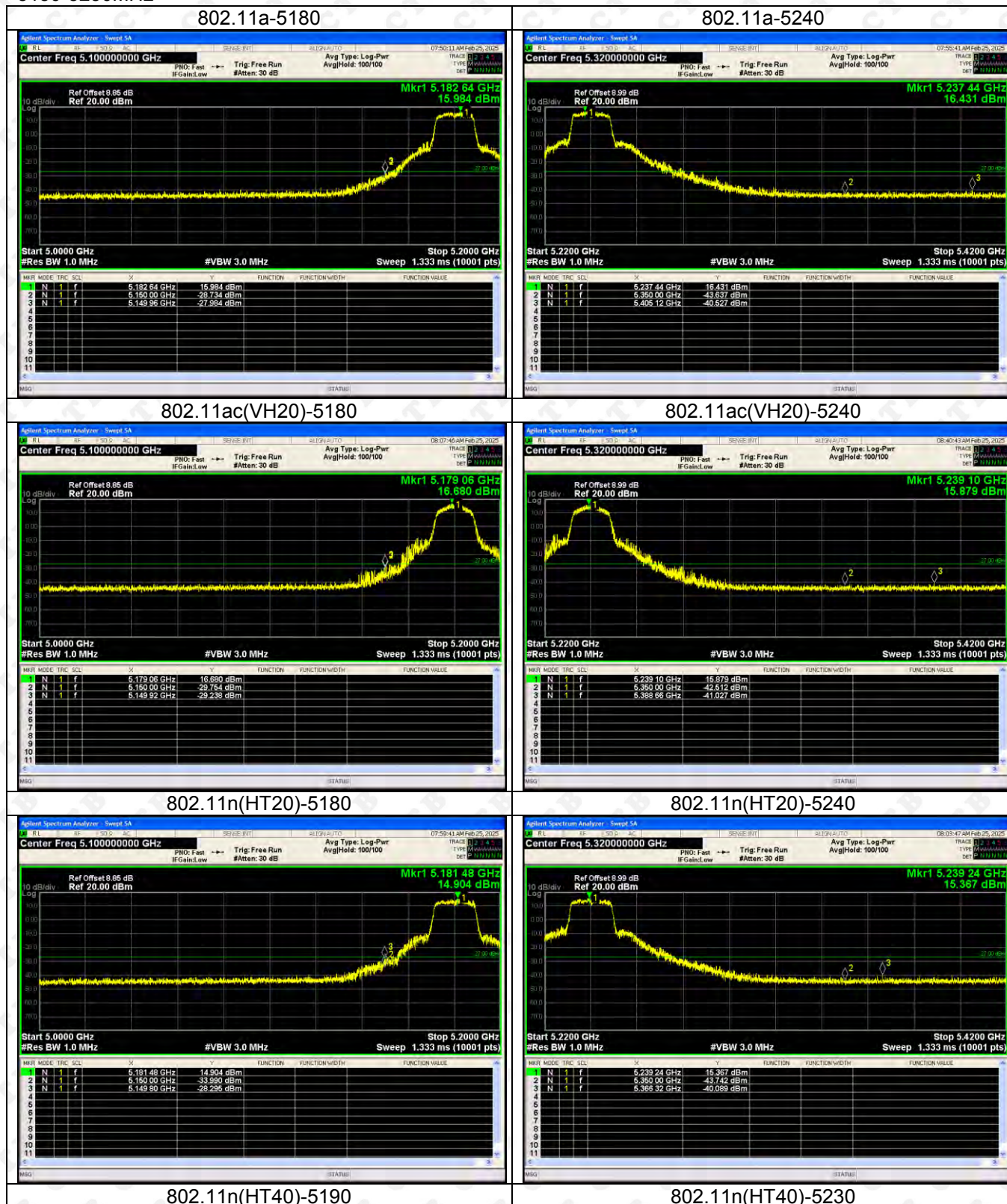
8.3 Test procedure

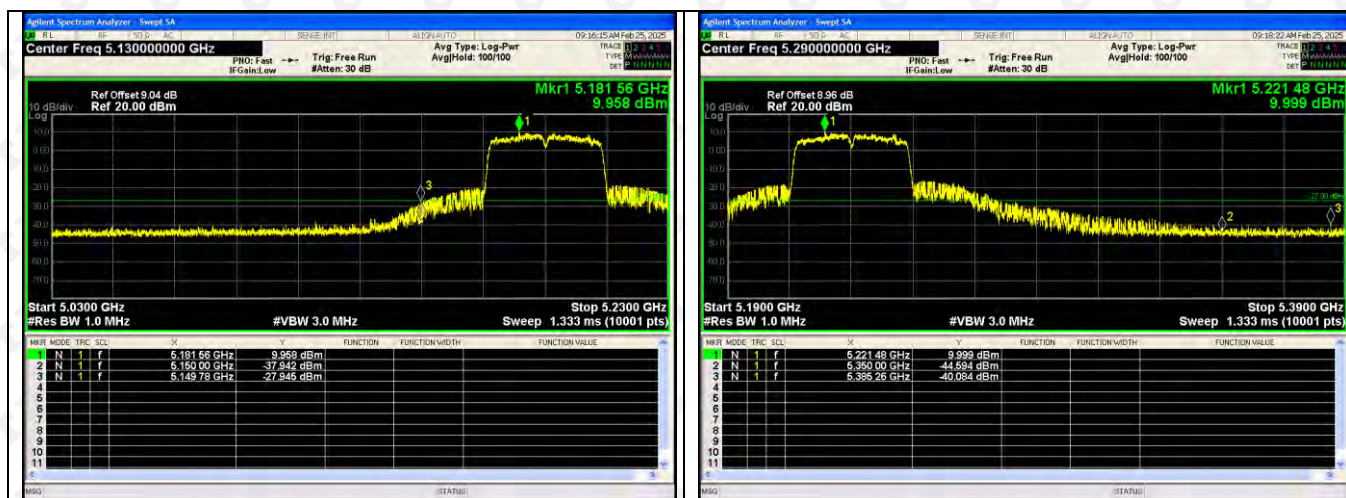
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then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

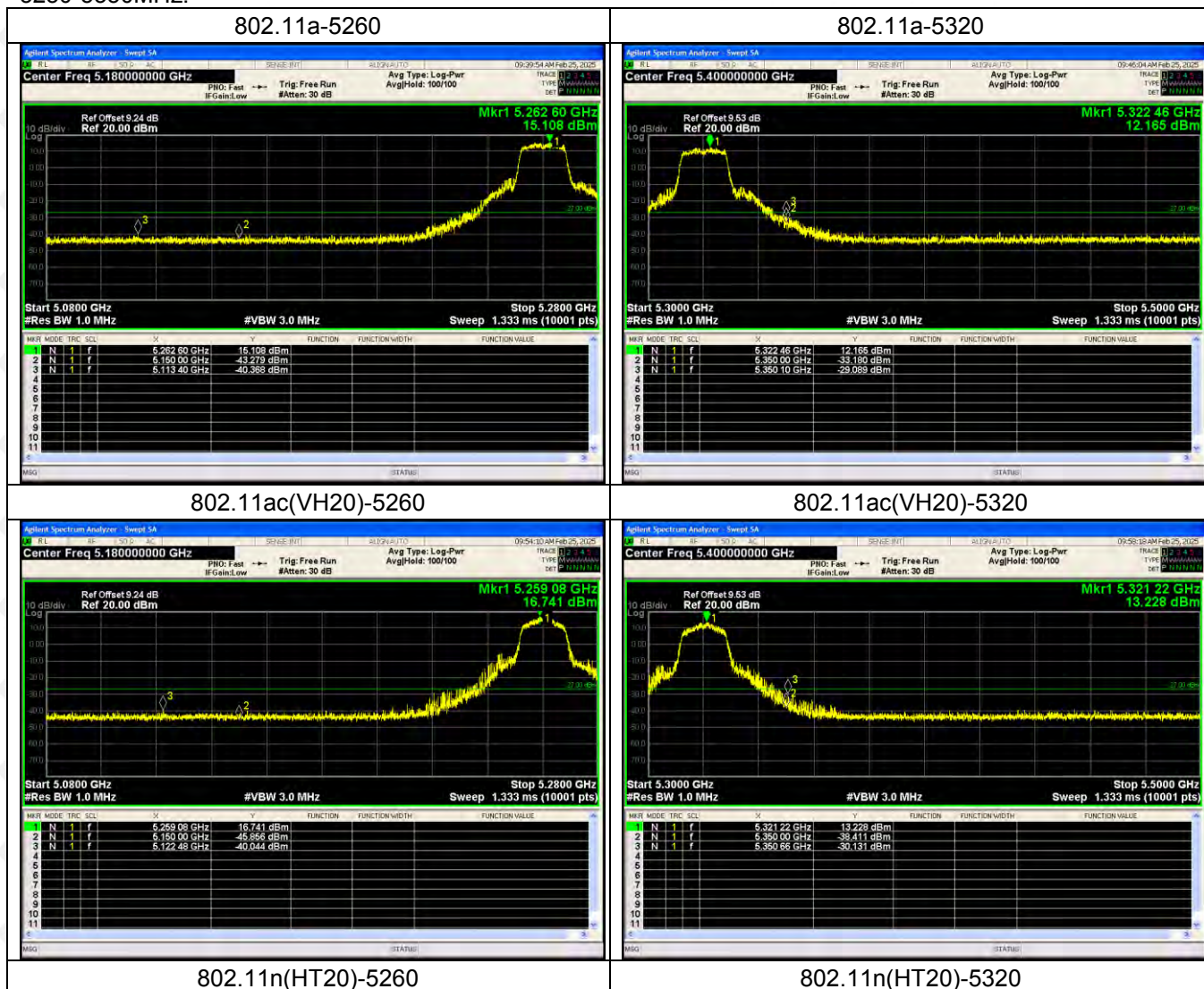
Test Graph

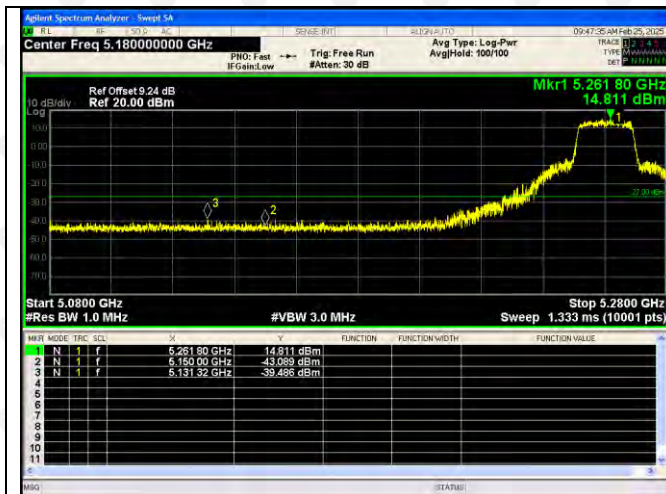
5150-5250MHz



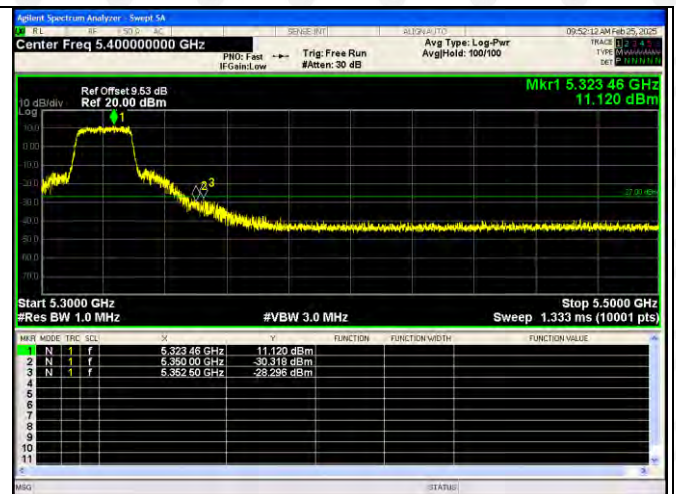


5250-5350MHz:

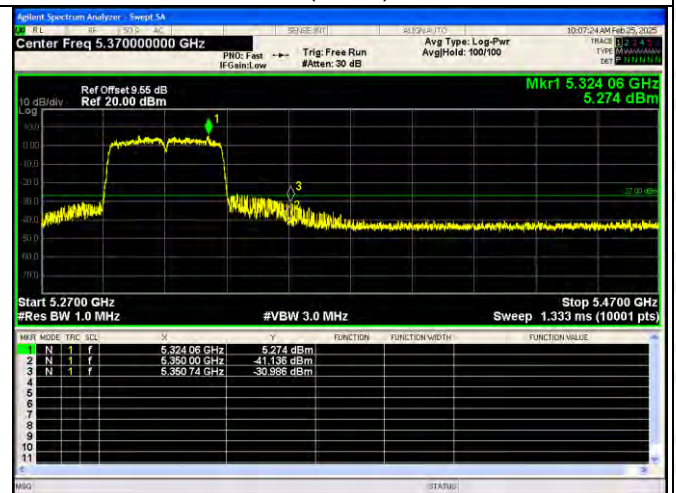
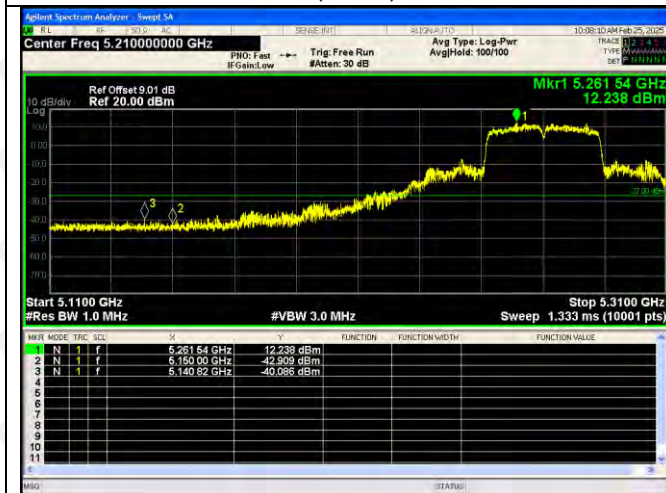




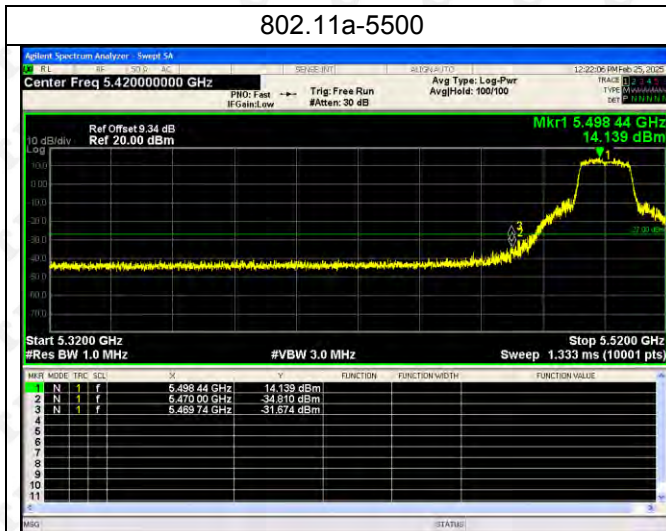
802.11n(HT40)-5270



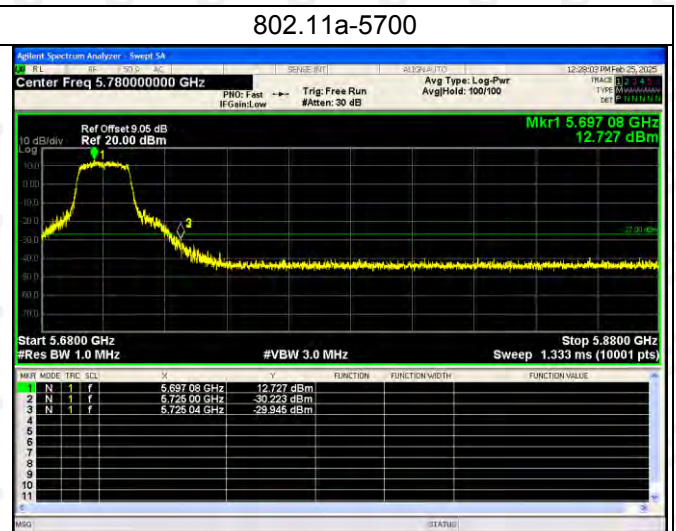
802.11n(HT40)-5310



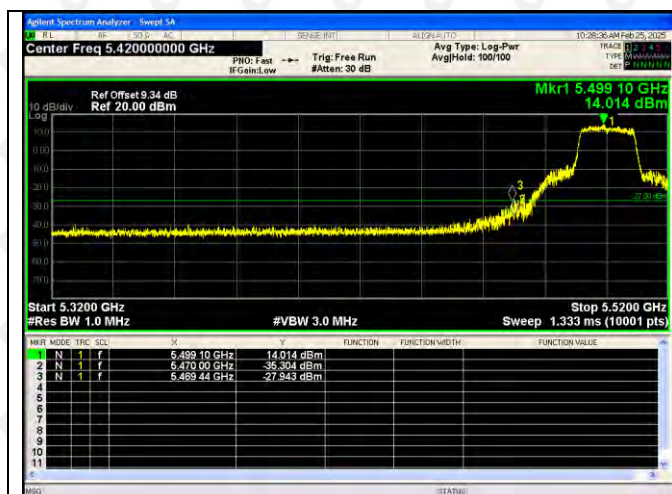
5470-5725MHz:



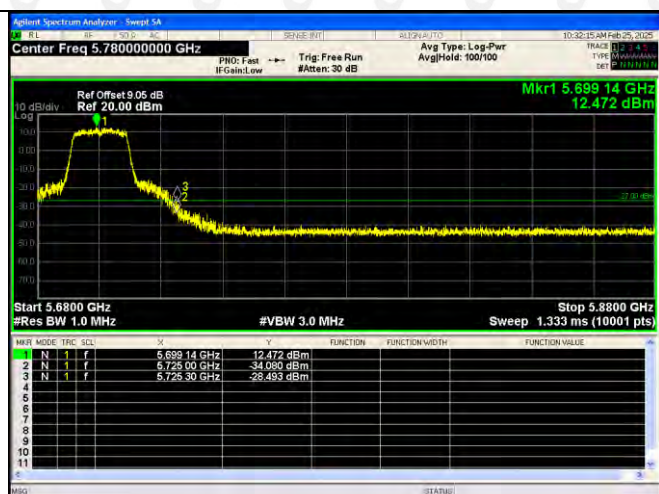
802.11ac(VH20)-5500



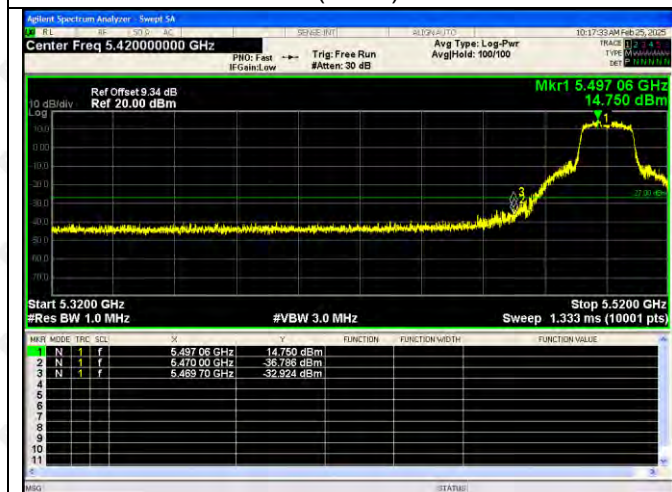
802.11ac(VH20)-5700



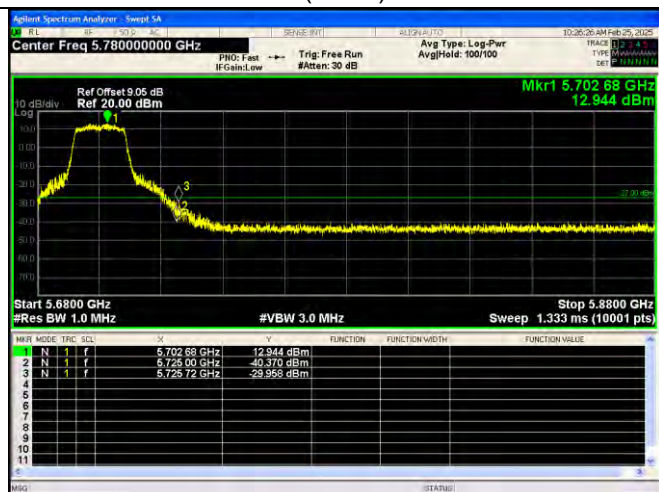
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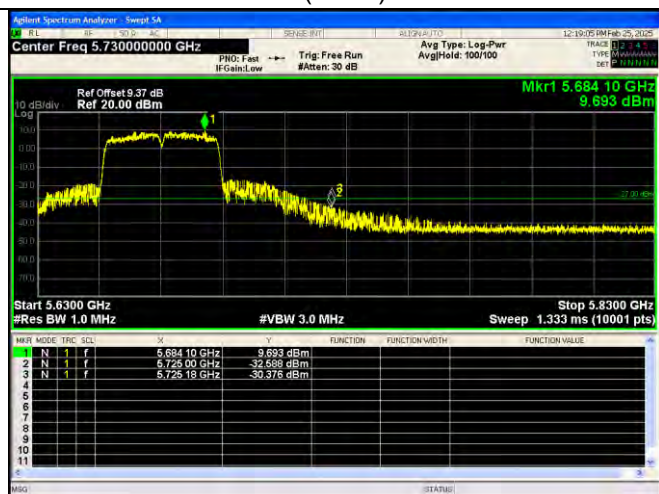
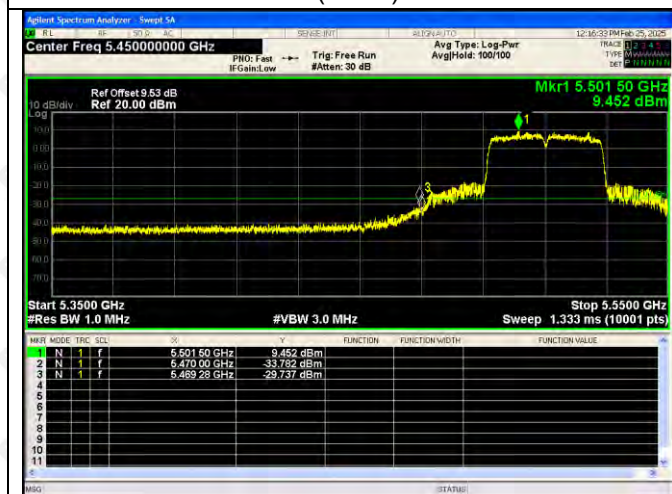
802.11n(HT20)-5700



802.11n(HT40)-5510

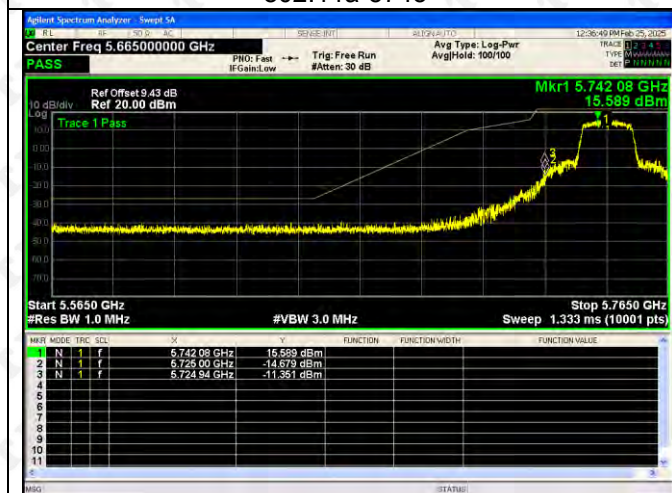


802.11n(HT40)-5670

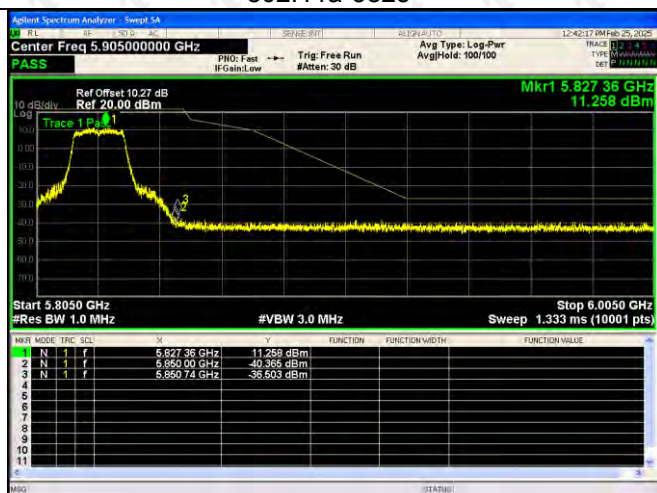


5725-5850MHz

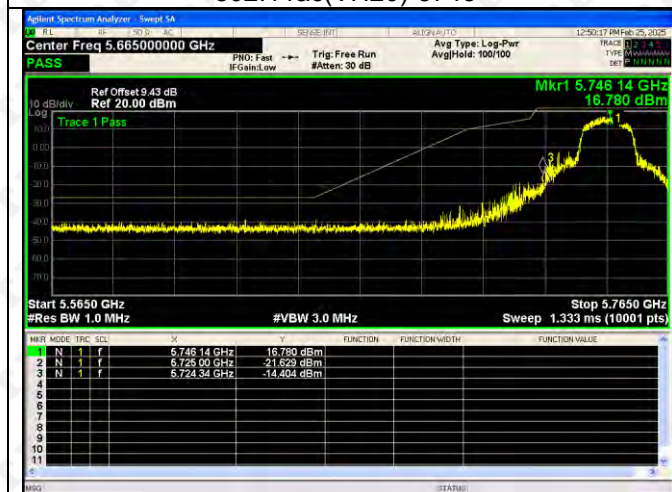
802.11a-5745



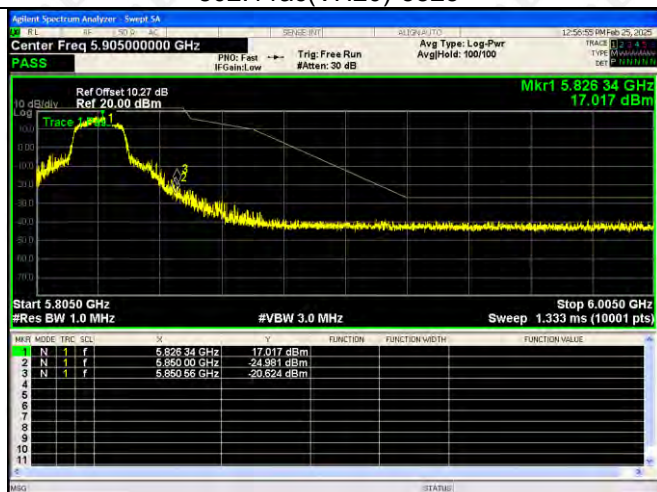
802.11a-5825



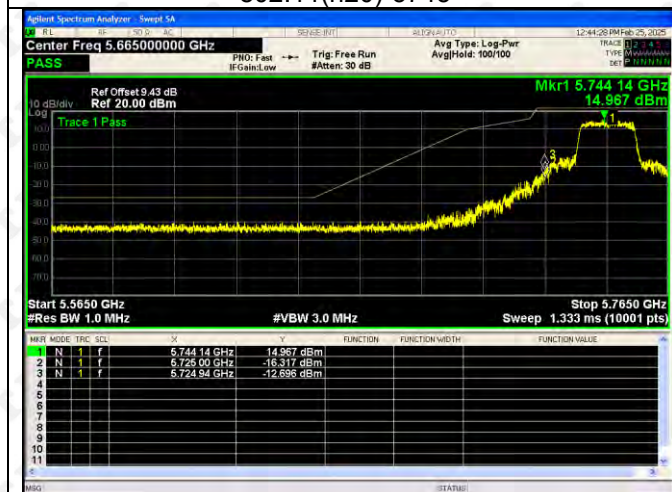
802.11ac(VH20)-5745



802.11ac(VH20)-5825



802.11(n20)-5745



802.11(n20)-5825



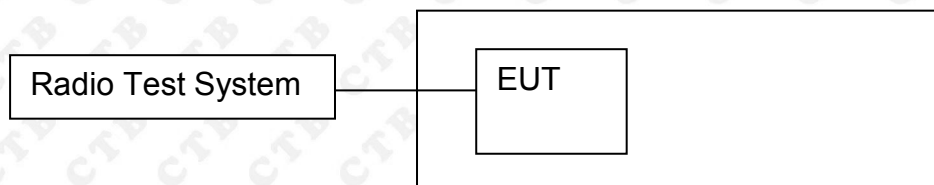
802.11(n40)-5755

802.11(n40)-5795



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 $11 \text{ dBm} + 10 \log B$, 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 $\geq$ 3 MHz.

(iv) Number of points in sweep $\geq 2 \times \text{span} / \text{RBW}$. (This ensures that bin-to-bin spacing is $\leq \text{RBW}/2$, 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 $\geq 98\%$, 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	Limit dBm
802.11a20	5180	23.963	23.98
	5200	23.844	23.98
	5240	23.611	23.98
802.11ac20	5180	23.037	23.98
	5200	22.774	23.98
	5240	22.514	23.98
802.11n20	5180	23.66	23.98
	5200	22.765	23.98
	5240	23.52	23.98
802.11n40	5190	19.98	23.98
	5230	20.209	23.98

5250-5350MHz:

Test mode1	Test Channel (MHz)	Output Power dBm	Limit dBm
802.11a20	5260	22.925	23.98
	5280	22.343	23.98
	5320	19.882	23.98
802.11ac20	5260	22.808	23.98
	5280	22.161	23.98
	5320	19.796	23.98
802.11n20	5270	22.882	23.98
	5310	22.252	23.98
	5260	19.723	23.98
802.11n40	5280	21.911	23.98
	5320	15.644	23.98

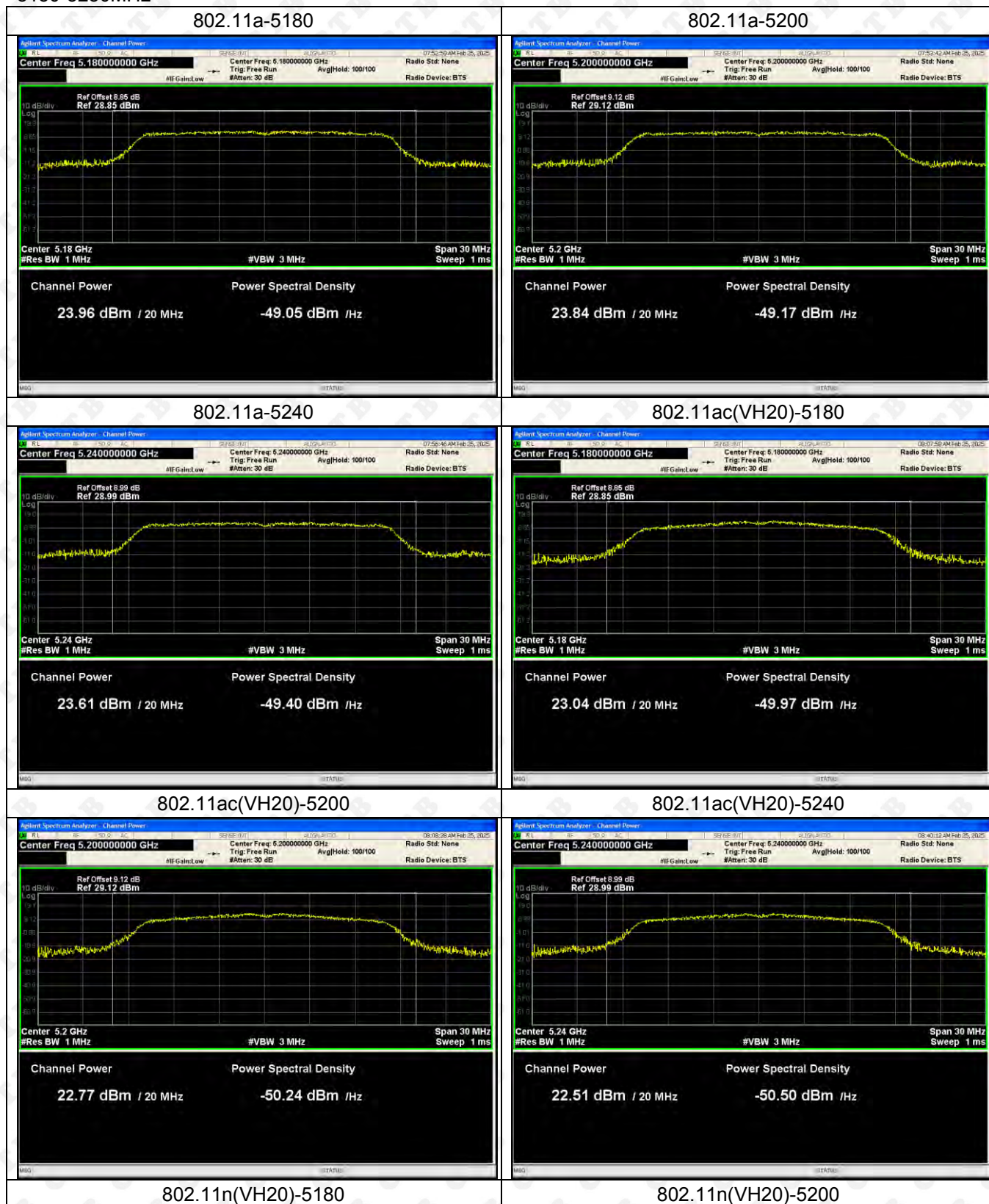
5470-5725MHz:

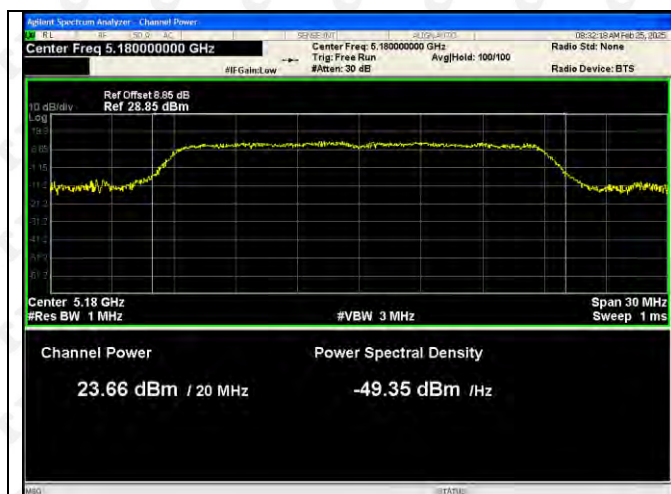
Test mode1	Test Channel (MHz)	Output Power dBm	Limit dBm
802.11a20	5500	21.989	23.98
	5580	21.86	23.98
	5700	20.45	23.98
802.11ac20	5500	21.699	23.98
	5580	21.532	23.98
	5700	20.113	23.98
802.11n20	5500	22.009	23.98
	5580	21.675	23.98
	5700	20.143	23.98
802.11n40	5510	19.61	23.98
	5670	19.766	23.98

5725-5850MHz:

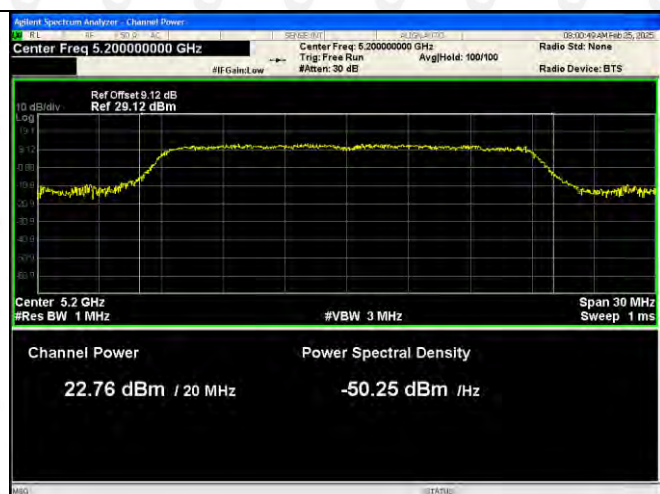
Test mode1	Test Channel (MHz)	Output Power dBm	Limit dBm
802.11a20	5745	23.057	30
	5785	22.131	30
	5825	23.568	30
802.11ac20	5745	22.962	30
	5785	22.02	30
	5825	22.333	30
802.11n20	5745	23.098	30
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	5825	23.311	30
802.11n40	5755	24.775	30
	5795	23.512	30

5150-5250MHz

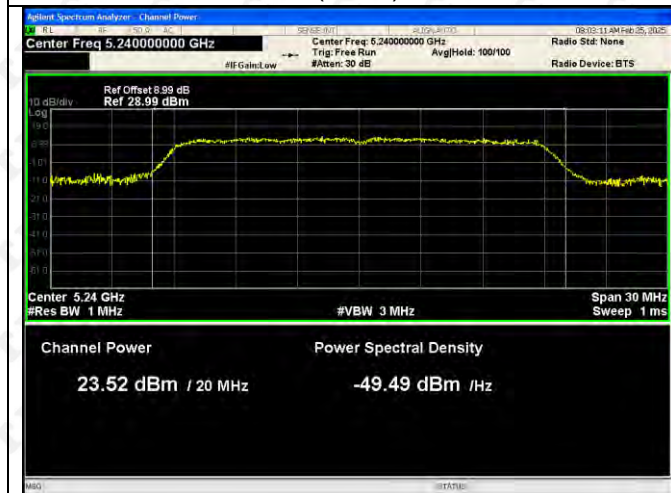




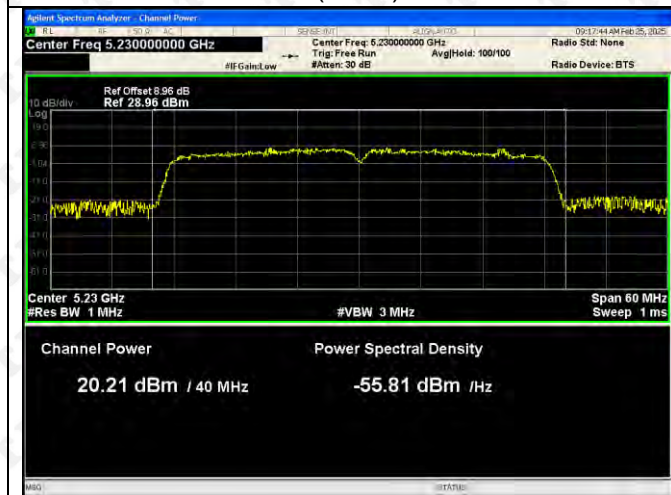
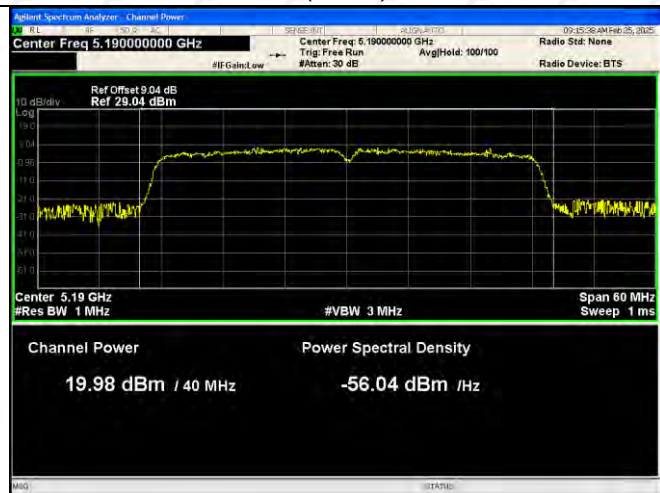
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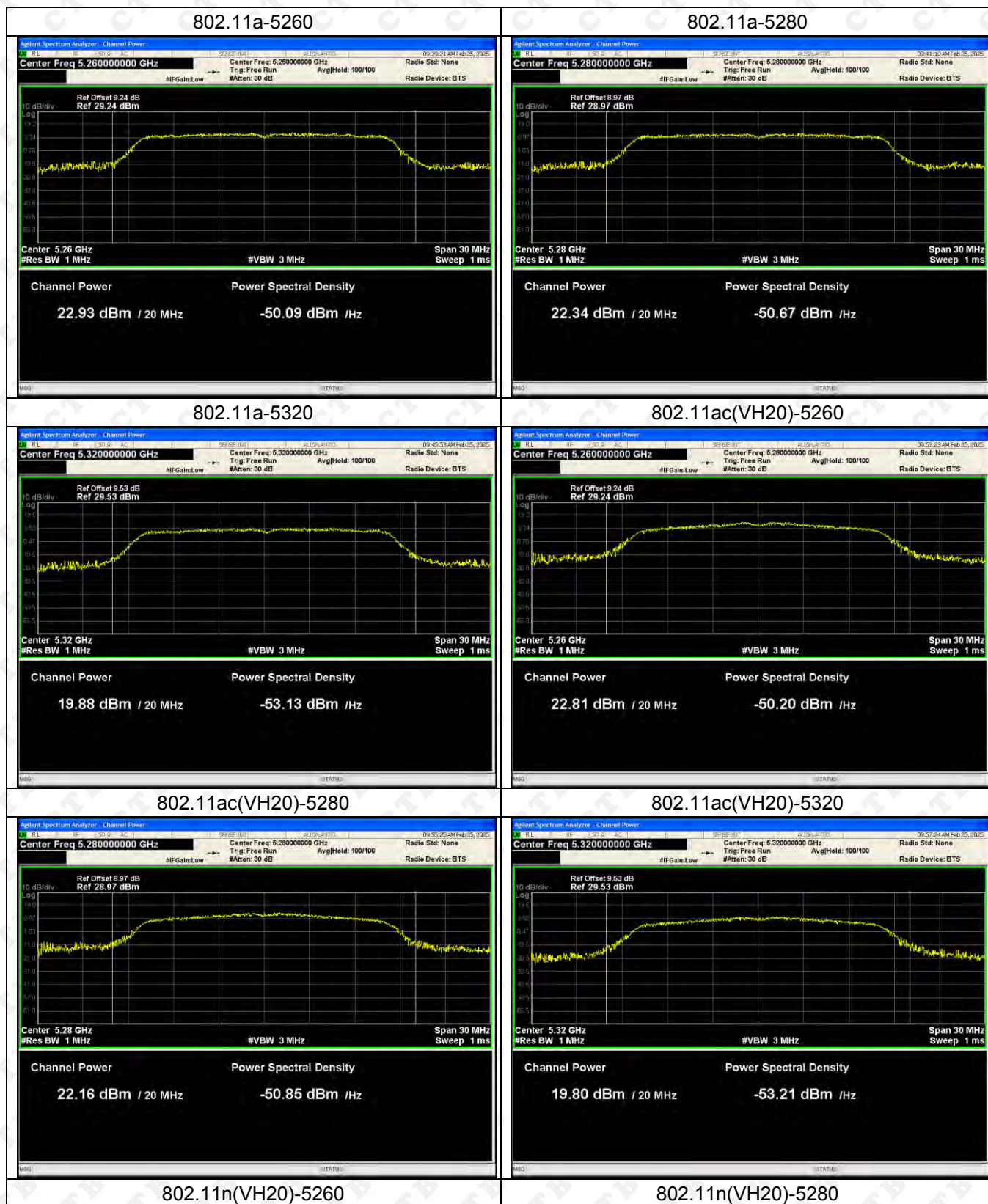
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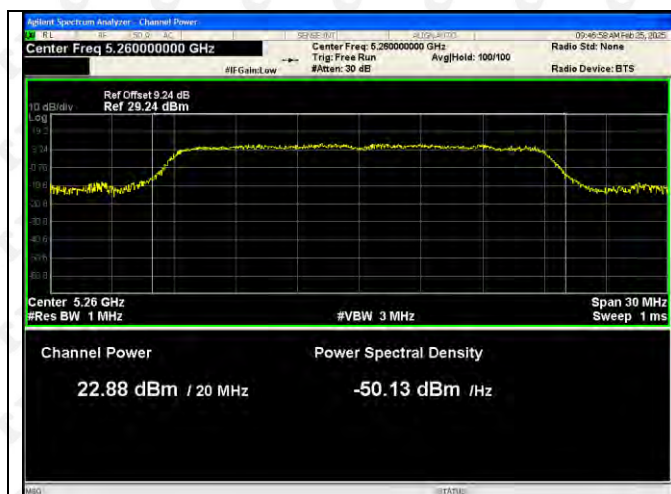


802.11n(VH40)-5230



5250-5350MHz





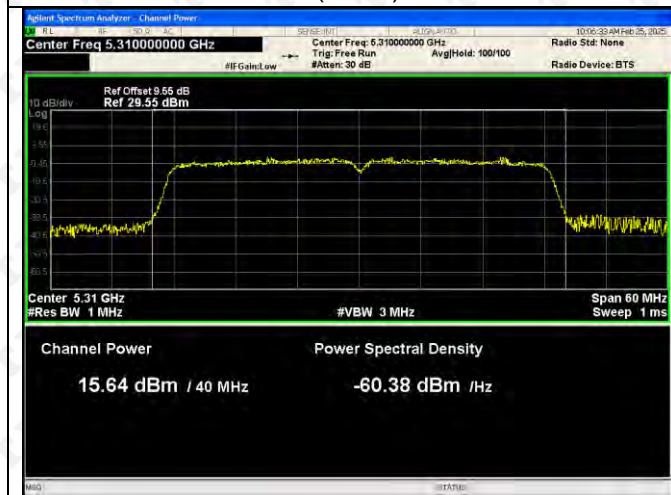
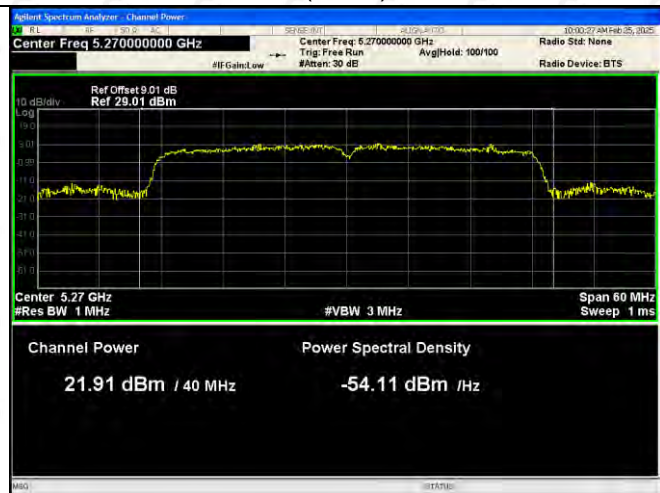
8802.11n(VH20)-5320



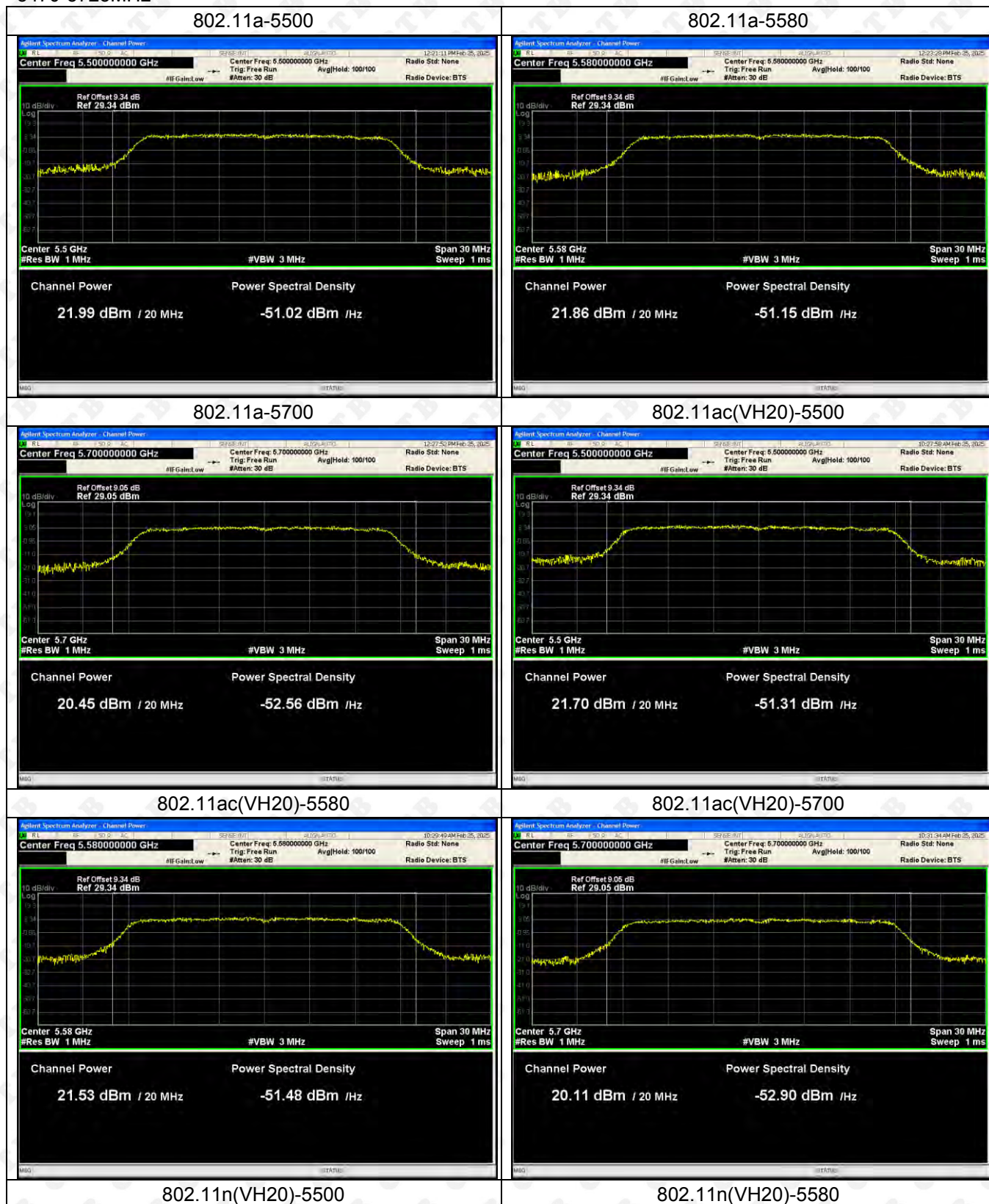
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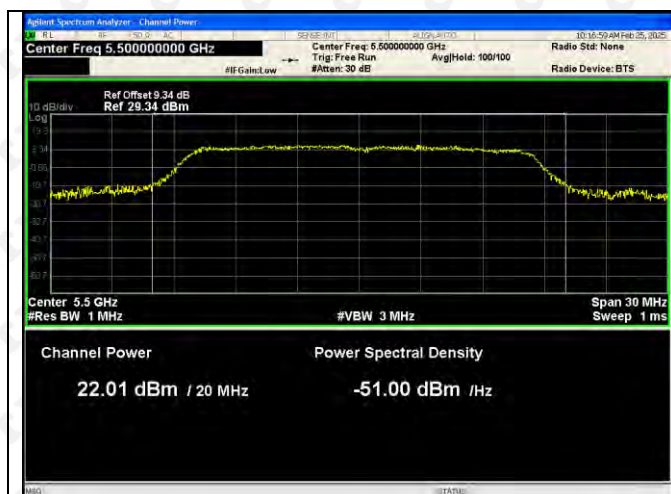


802.11n(VH40)-5310



5470-5725MHz

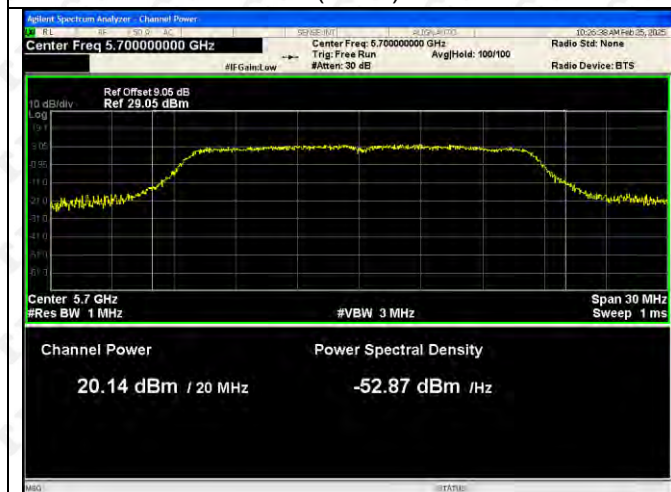




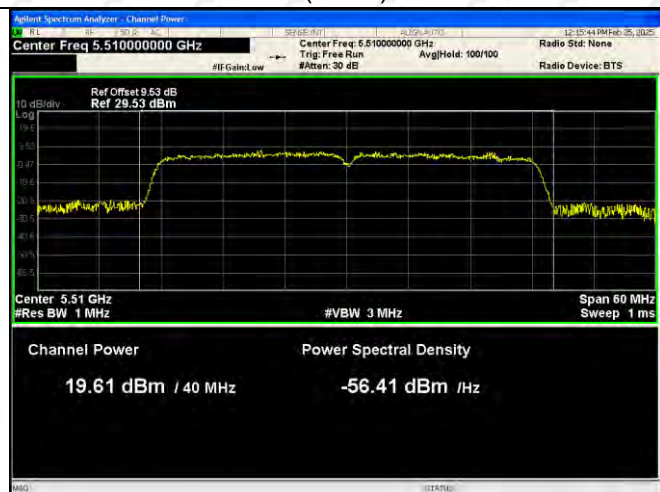
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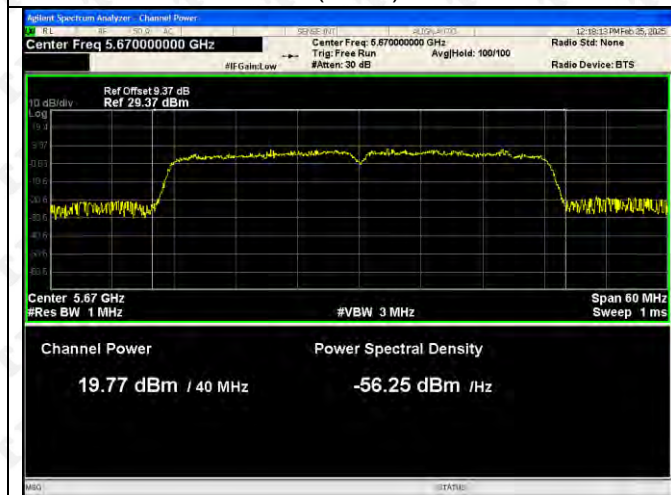
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802.11n(VH40)-5670

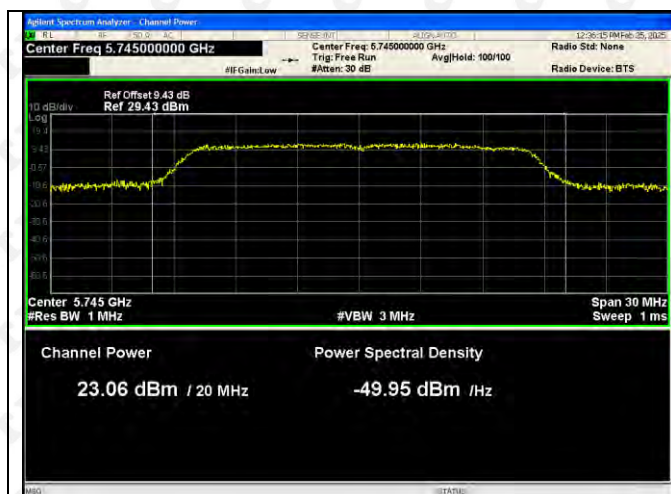


802.11a-5785



802.11a-5745

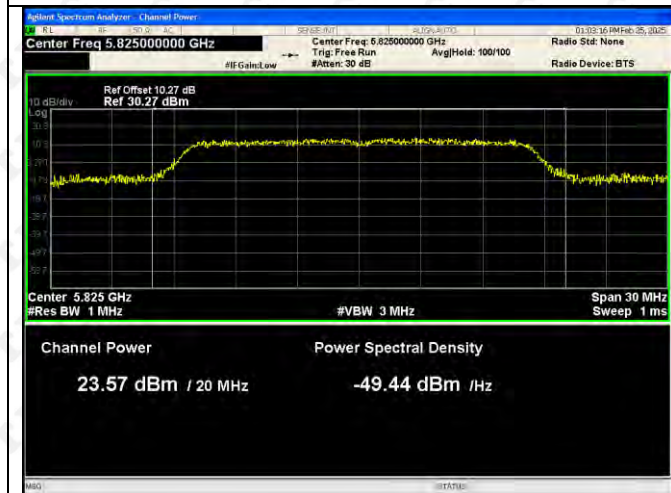
5725-5850MHz



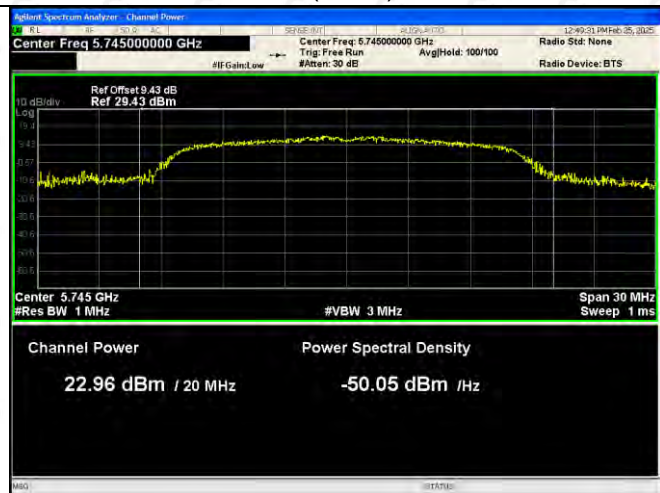
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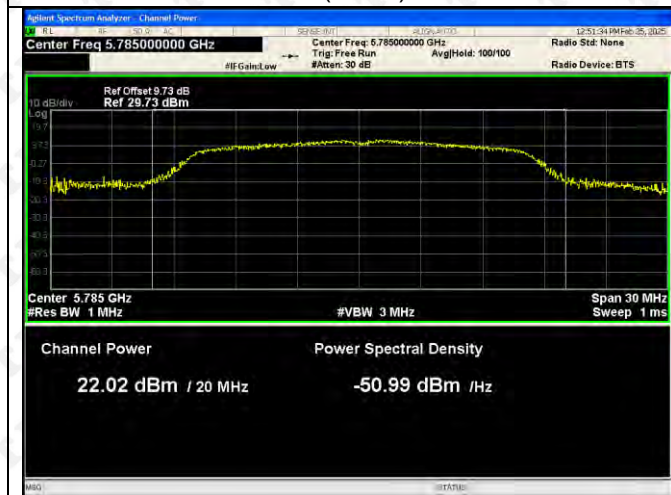
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802.11ac(VH20)-5785



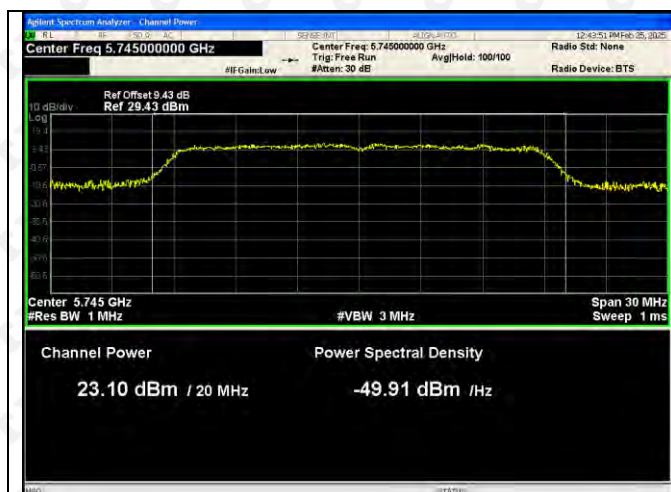
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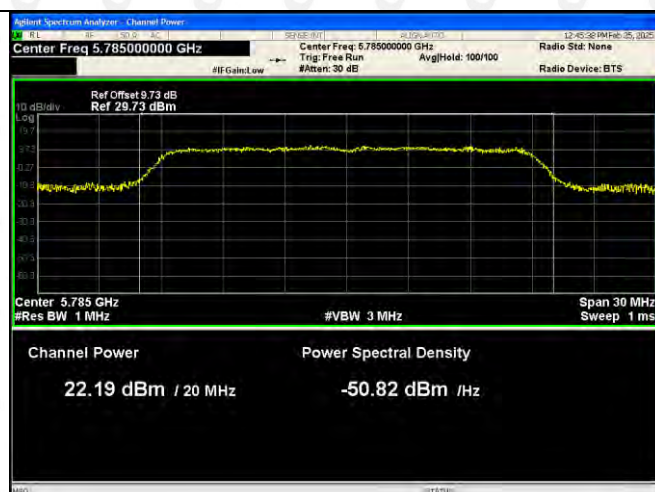
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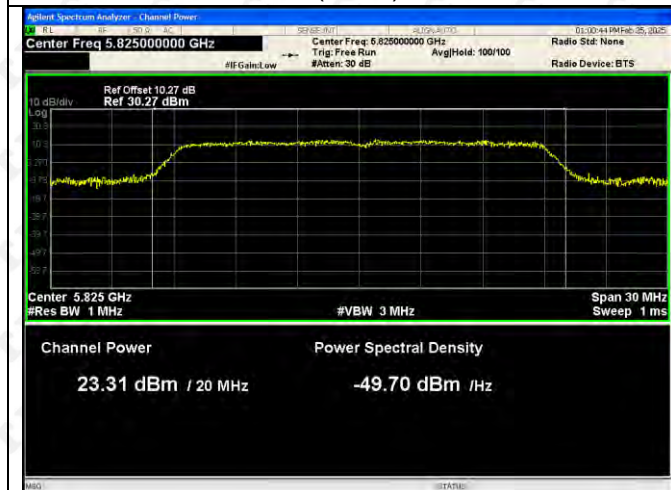
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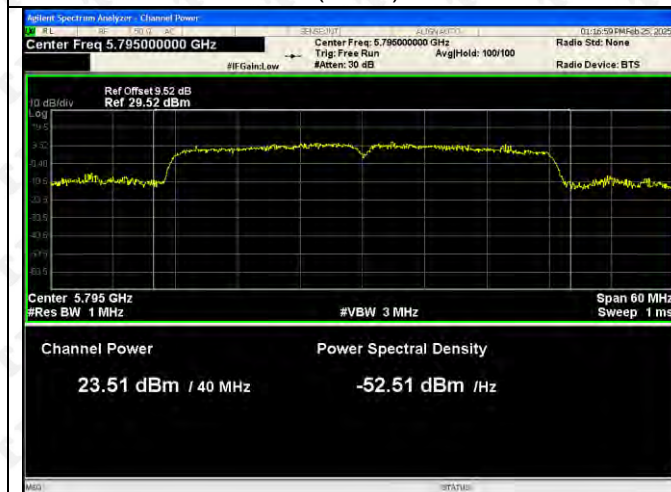
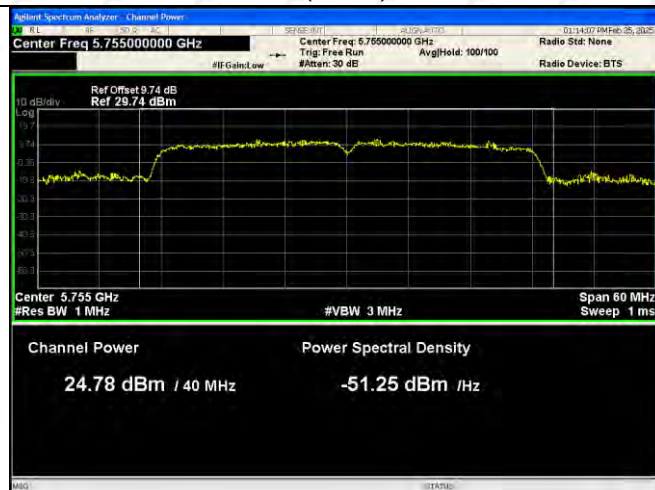
802.11n(VH20)-5825



802.11n(VH40)-5755

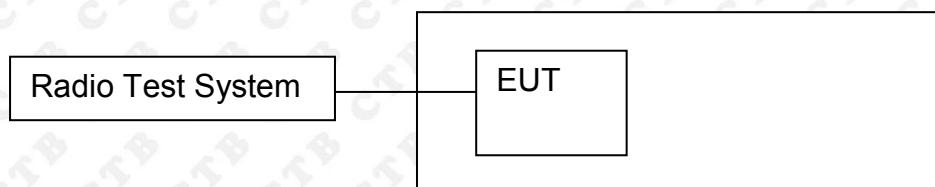


802.11n(VH40)-5795



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 $11 \text{ dBm} + 10 \log B$, 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)

- Set RBW = approximately 1% of the emission bandwidth.
- Set the VBW > RBW.
- Detector = Peak.
- Trace mode = max hold.
- 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:

- Set RBW = 100 kHz.
- Set the video bandwidth (VBW) $\geq 3 * \text{RBW}$.

- 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 $\geq 3 * RBW$
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)
802.11a	5180	25.744
	5200	29.12
	5240	29.339
802.11ac20	5180	20.238
	5200	19.969
	5240	21.194
802.11n20	5180	26.782
	5200	26.47
	5240	29.594
802.11n40	5190	37.92
	5230	37.855

5250-5350 MHz:

Test mode	Test Channel (MHz)	26dB Bandwidth (MHz)
802.11a	5260	26.332
	5280	28.188
	5320	29.359
802.11ac20	5260	20.392
	5280	26.132
	5320	19.997
802.11n(HT20)	5260	29.583
	5280	29.57
	5320	30
802.11n(HT40)	5270	55.449
	5310	59.614

5470-5725MHz:

Test mode	Test Channel (MHz)	26dB Bandwidth (MHz)
802.11a	5500	25.152
	5580	19.901
	5700	20.413
802.11ac20	5500	26.678
	5580	21.05
	5700	21.051
802.11n(HT20)	5500	27.069
	5580	20.475
	5700	20.369
802.11n(HT40)	5510	37.993
	5670	37.914

5725-5850MHz:

Test mode	Test Channel (MHz)	6dB Bandwidth (MHz)
802.11a	5745	16.439
	5785	16.435
	5825	16.391
802.11ac20	5745	15.449
	5785	13.826
	5825	12.624
802.11n20	5745	17.609
	5785	17.623
	5825	17.529
802.11n40	5755	35.171
	5795	35.158

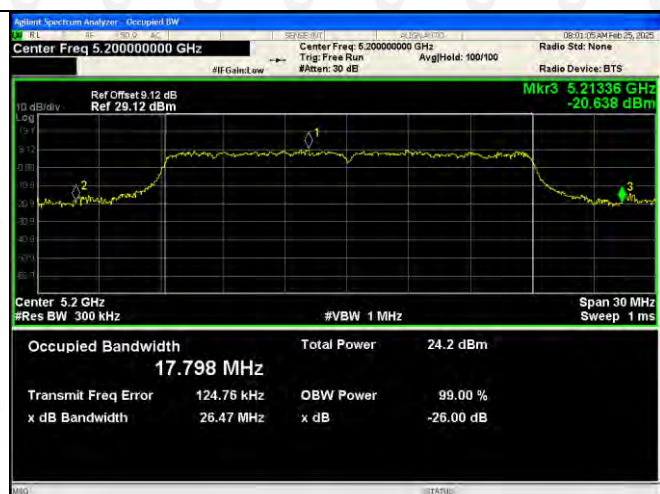
Test Graph

5150-5250MHz

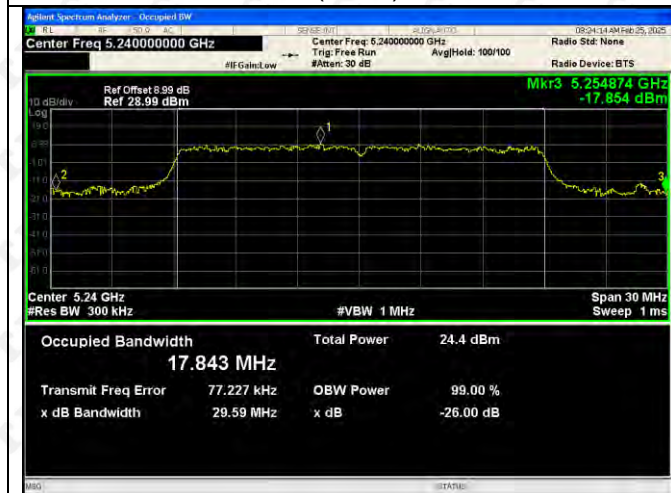




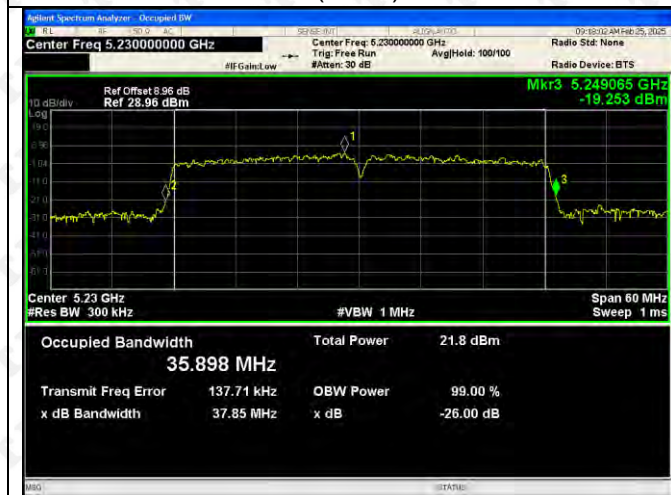
802.11n(VH20)-5240



802.11n(VH40)-5190

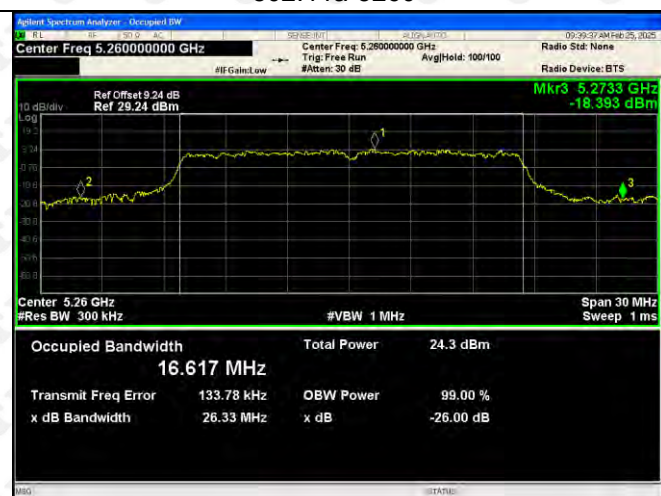


802.11n(VH40)-5230

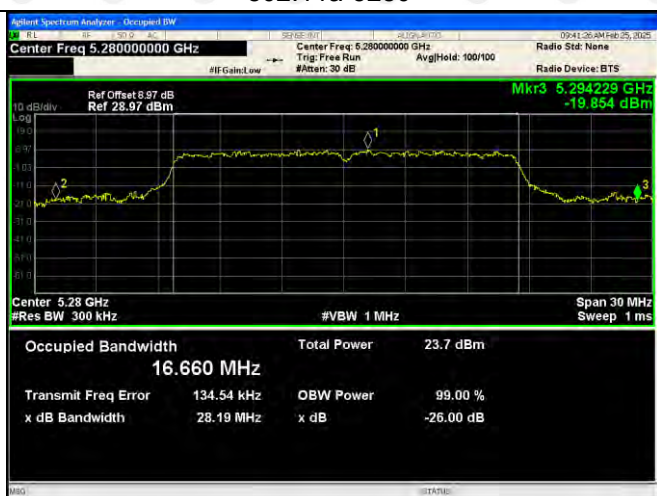


5250-5350MHz

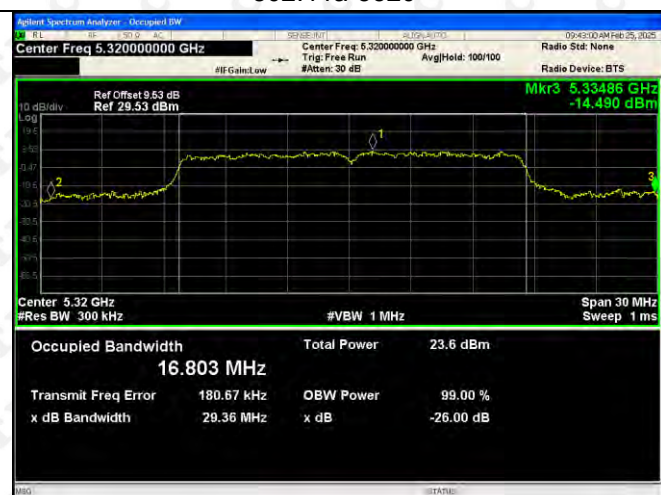
802.11a-5260



802.11a-5280



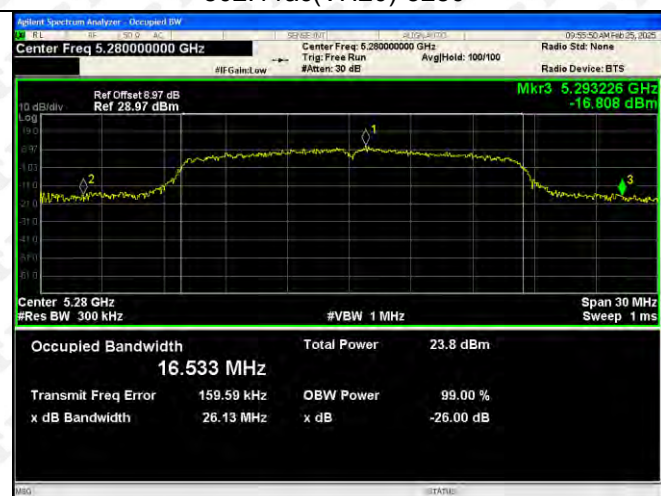
802.11a-5320



802.11ac(VH20)-5260



802.11ac(VH20)-5280



802.11ac(VH20)-5320

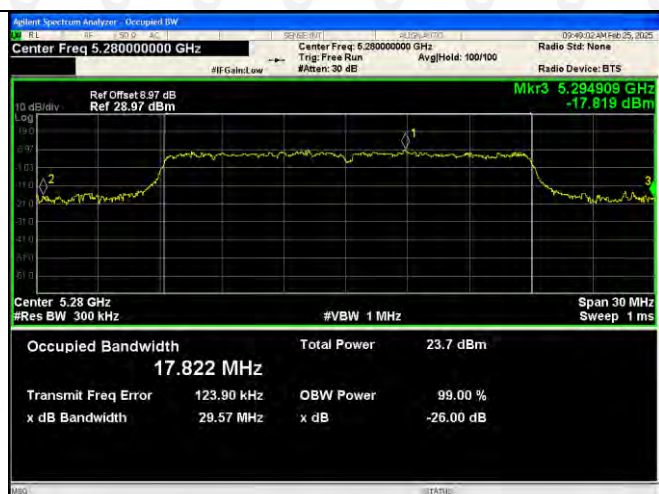


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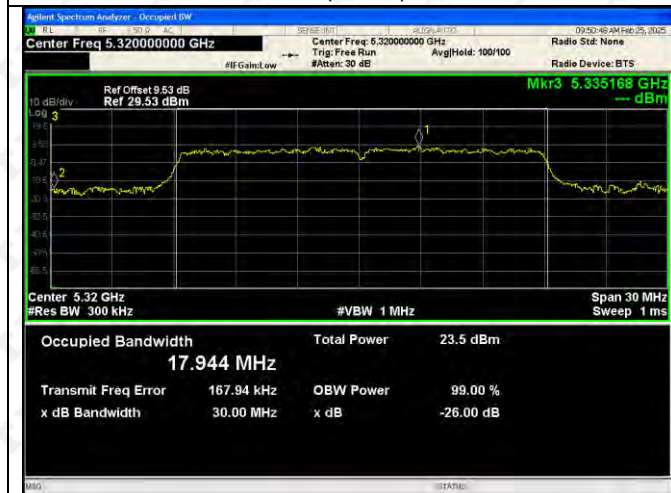
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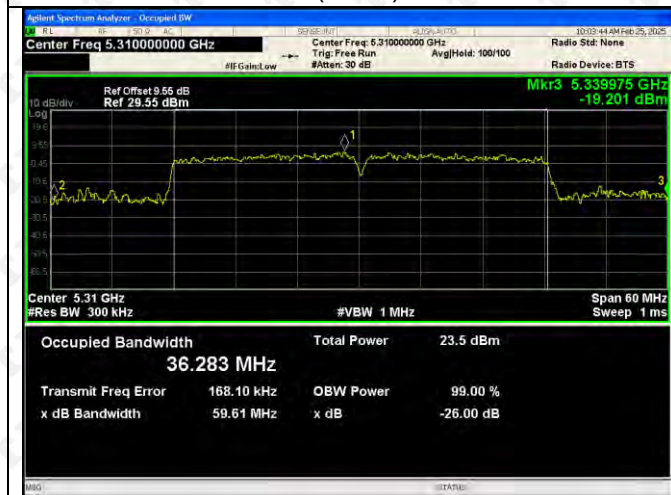
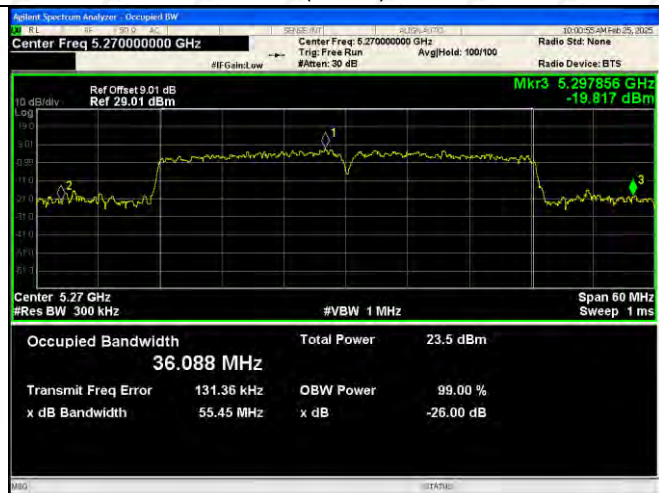
8802.11n(VH20)-5320



802.11n(VH40)-5270

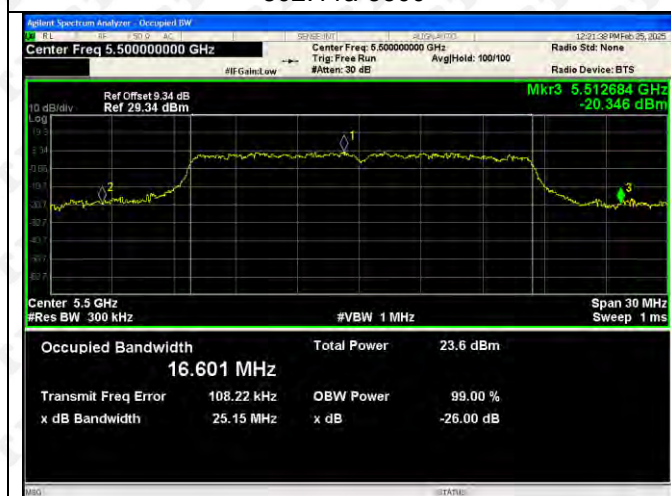


8802.11n(VH40)-5310

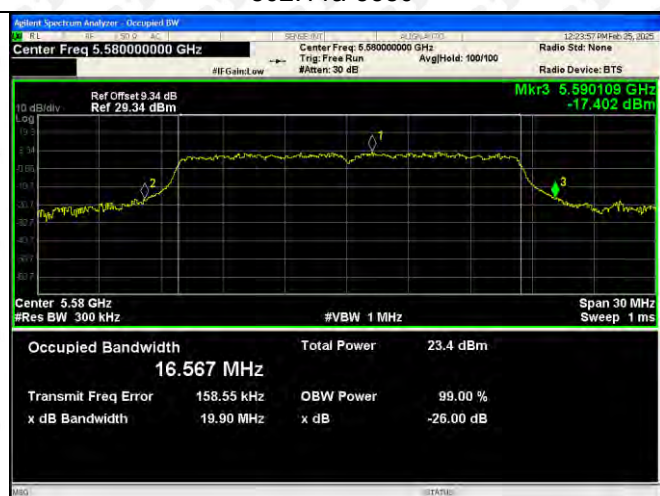


5470-5725MHz

802.11a-5500



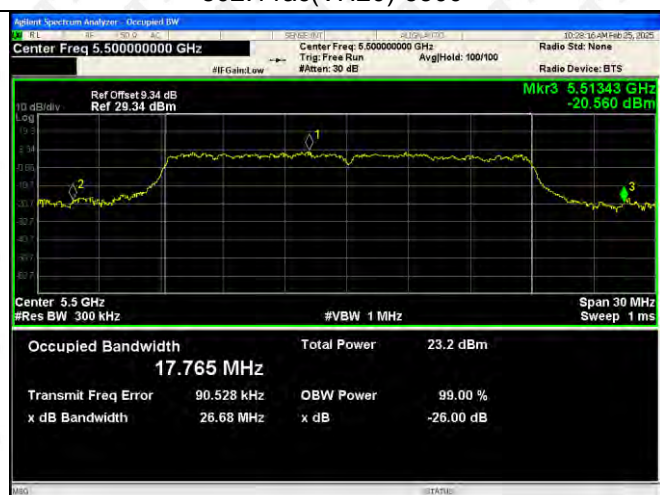
802.11a-5580



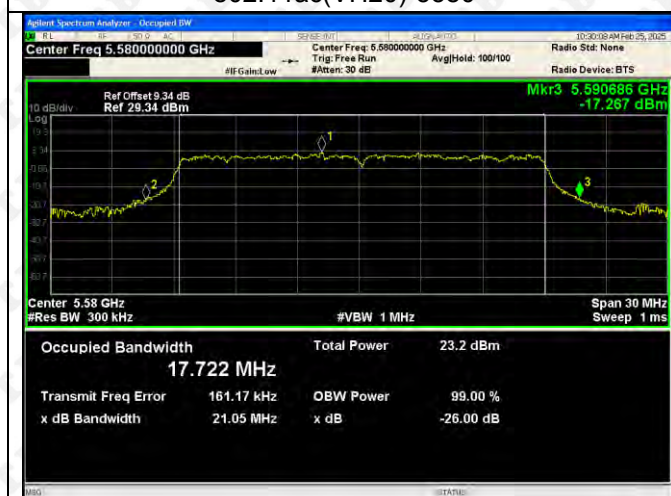
802.11a-5700



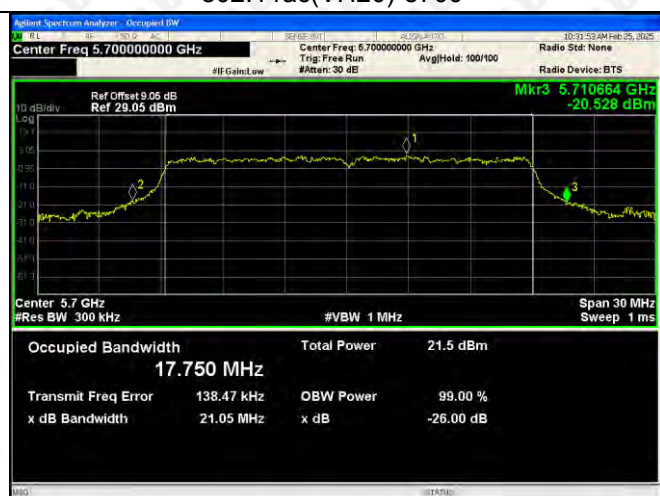
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802.11ac(VH20)-5580



802.11ac(VH20)-5700

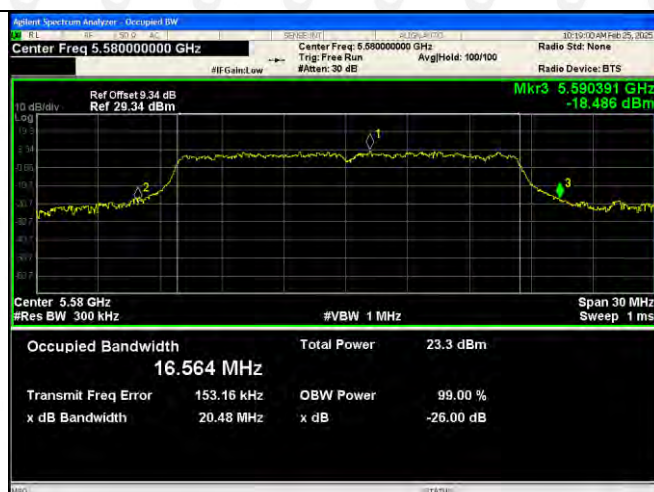


802.11n(VH20)-5500

802.11n(VH20)-5580



802.11n(VH20)-5700



802.11n(VH40)-5510



802.11n(VH40)-5670

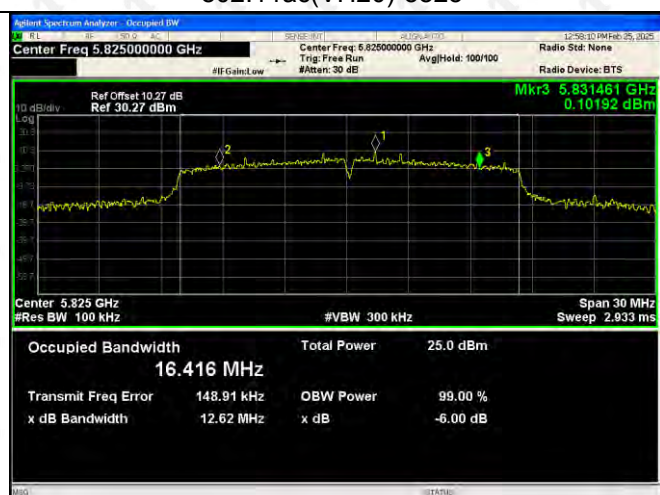
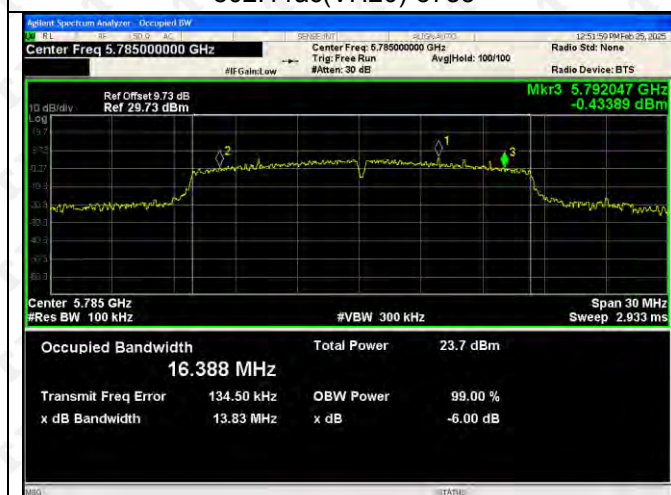
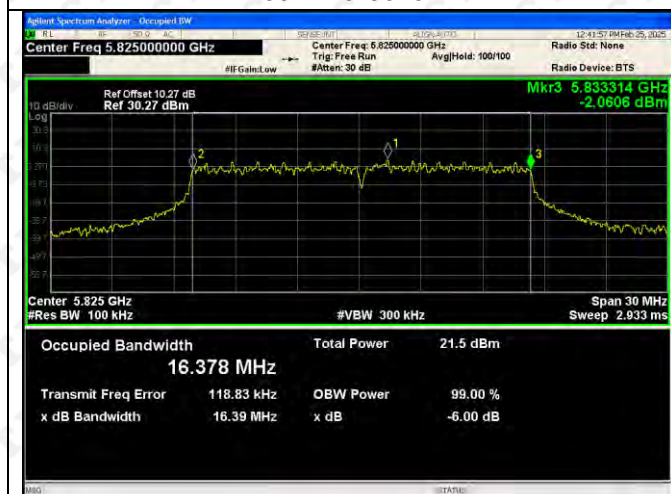
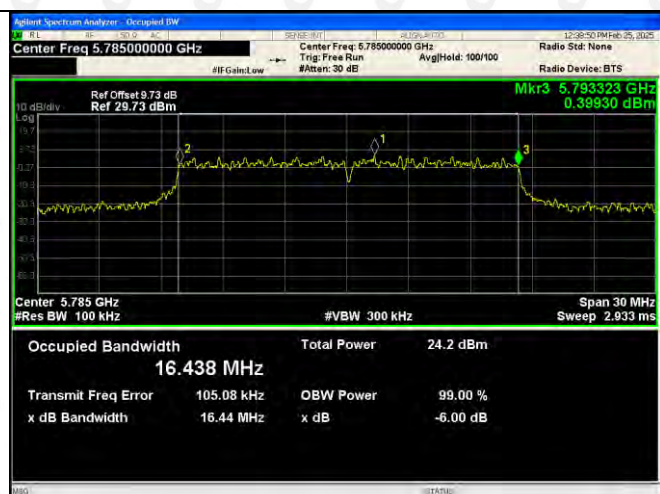
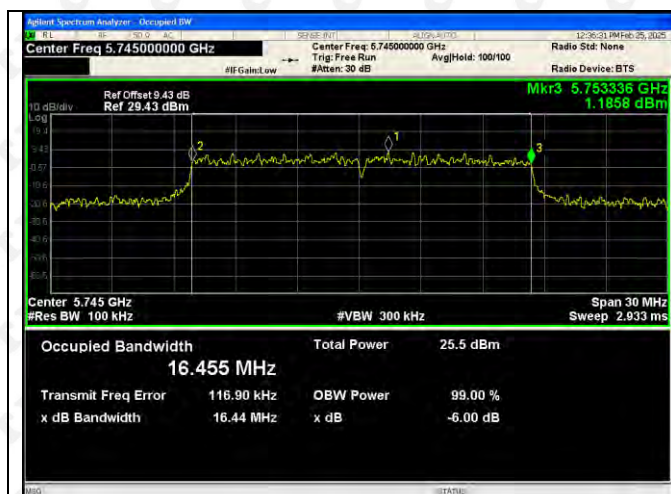


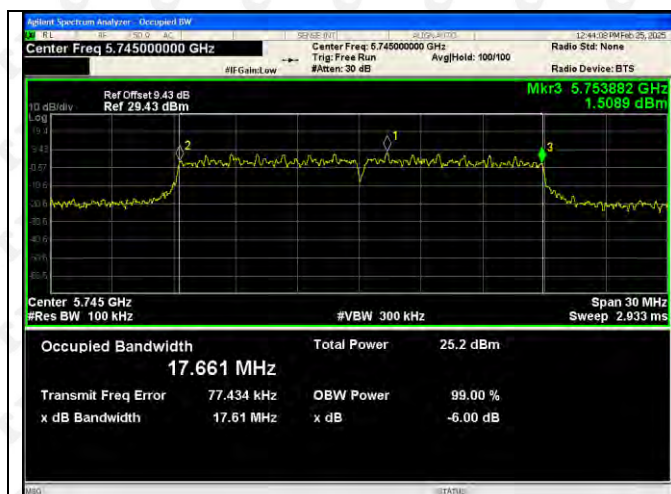
802.11a-5785



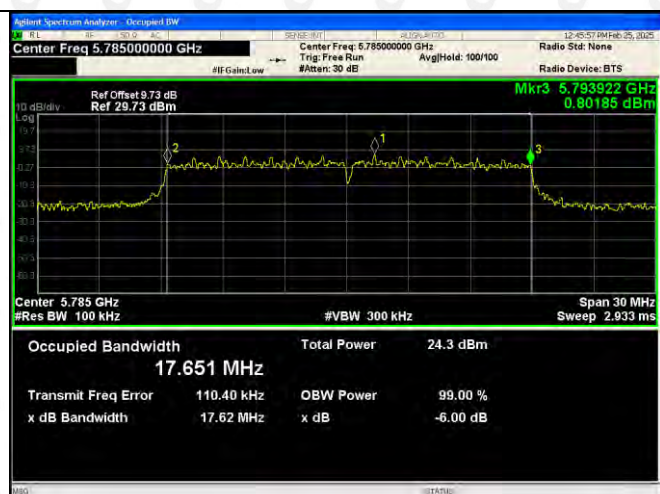
802.11a-5745

5725-5850MHz

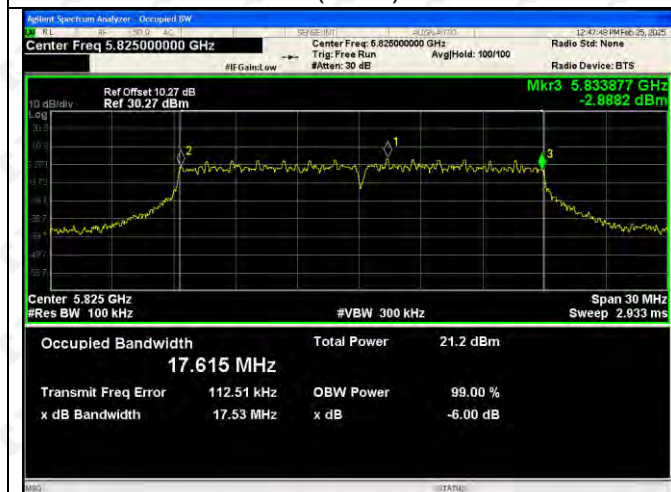




802.11n(VH20)-5825



802.11n(VH40)-5755

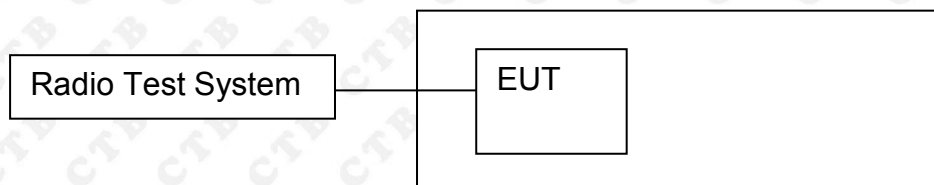


802.11n(VH40)-5795



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 $11 \text{ dBm} + 10 \log B$, 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 ($< 1 \text{ MHz}$, or $< 500 \text{ kHz}$) and integrated over 1 MHz, or 500 kHz bandwidth, the following adjustments to the procedures apply:

- Set $\text{RBW} \geq 1/T$, where T is defined in II.B.I.a).
- Set $\text{VBW} \geq 3 \text{ RBW}$.

c) If measurement bandwidth of Maximum PSD is specified in 500 kHz, add $10 \log (500 \text{ kHz/RBW})$ to the measured result, whereas RBW ($< 500 \text{ kHz}$) 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 $10 \log (1 \text{ MHz/RBW})$ to the measured result, whereas RBW ($< 1 \text{ MHz}$) 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:

Test mode	Test Channel (MHz)	PSD [dBm/MHz]	Limit [dBm/MHz]	Result
802.11a	5180	7.965	11	Pass
	5200	8.159	11	Pass
	5240	8.368	11	Pass
802.11ac(VH20)	5180	9.852	11	Pass
	5200	9.155	11	Pass
	5240	8.678	11	Pass
802.11n(VH20)	5180	8.132	11	Pass
	5200	6.569	11	Pass
	5240	7.371	11	Pass
802.11n (VH40)	5190	1.243	11	Pass
	5230	2.176	11	Pass

5250-5350 MHz:

Test mode	Test Channel (MHz)	PSD [dBm/MHz]	Limit (dBm)	Result
802.11a	5260	7.039	11	Pass
	5280	6.255	11	Pass
	5320	6.483	11	Pass
802.11ac(HT20)	5260	9.022	11	Pass
	5280	8.542	11	Pass
	5320	5.923	11	Pass
802.11n(VH20)	5260	6.815	11	Pass
	5280	6.228	11	Pass
	5320	5.986	11	Pass
802.11n(VH40)	5270	3.548	11	Pass
	5310	2.946	11	Pass

5470-5725MHz:

Test mode	Test Channel (MHz)	PSD [dBm/MHz]	Limit (dBm)	Result
802.11a	5500	6.189	30	Pass
	5580	6.361	30	Pass
	5700	4.424	30	Pass
802.11ac(VH20)	5530	5.466	30	Pass
	5500	5.831	30	Pass
	5580	4.006	30	Pass
802.11n(HT20)	5500	6.37	30	Pass
	5580	6.089	30	Pass
	5700	7.012	30	Pass
802.11n(HT40)	5510	1.01	30	Pass
	5670	1.07	30	Pass

5725-5850MHz:

Test mode	Test Channel (MHz)	PSD [dBm/500kHz]	Limit [dBm/MHz]	Result
802.11a	5745	4.084	30	Pass
	5785	3.888	30	Pass
	5825	0.707	30	Pass
802.11ac(VH20)	5745	4.996	30	Pass
	5785	5.583	30	Pass
	5825	6.732	30	Pass
802.11n(HT20)	5745	4.414	30	Pass
	5785	3.365	30	Pass
	5825	0.395	30	Pass
802.11n(HT40)	5755	3.588	30	Pass
	5795	3.024	30	Pass

5150-5250MHz

802.11a-5180



802.11a-5200



802.11a-5240



802.11ac(VH20)-5180



802.11ac(VH20)-5200



802.11ac(VH20)-5240



802.11n(VH20)-5180

802.11n(VH20)-5200



802.11n(VH20)-5240



802.11n(VH40)-5190

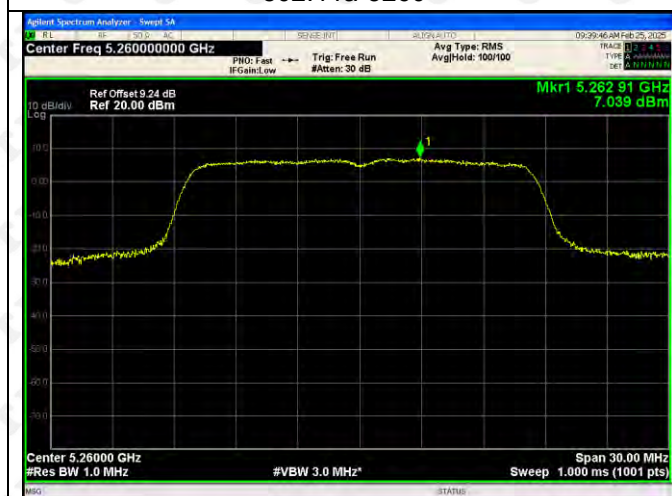


802.11n(VH40)-5230



5250-5350MHz

802.11a-5260



802.11a-5280



802.11a-5320



802.11ac(VH20)-5260



802.11ac(VH20)-5280



802.11ac(VH20)-5320



802.11n(VH20)-5260

802.11n(VH20)-5280



8802.11n(VH20)-5320



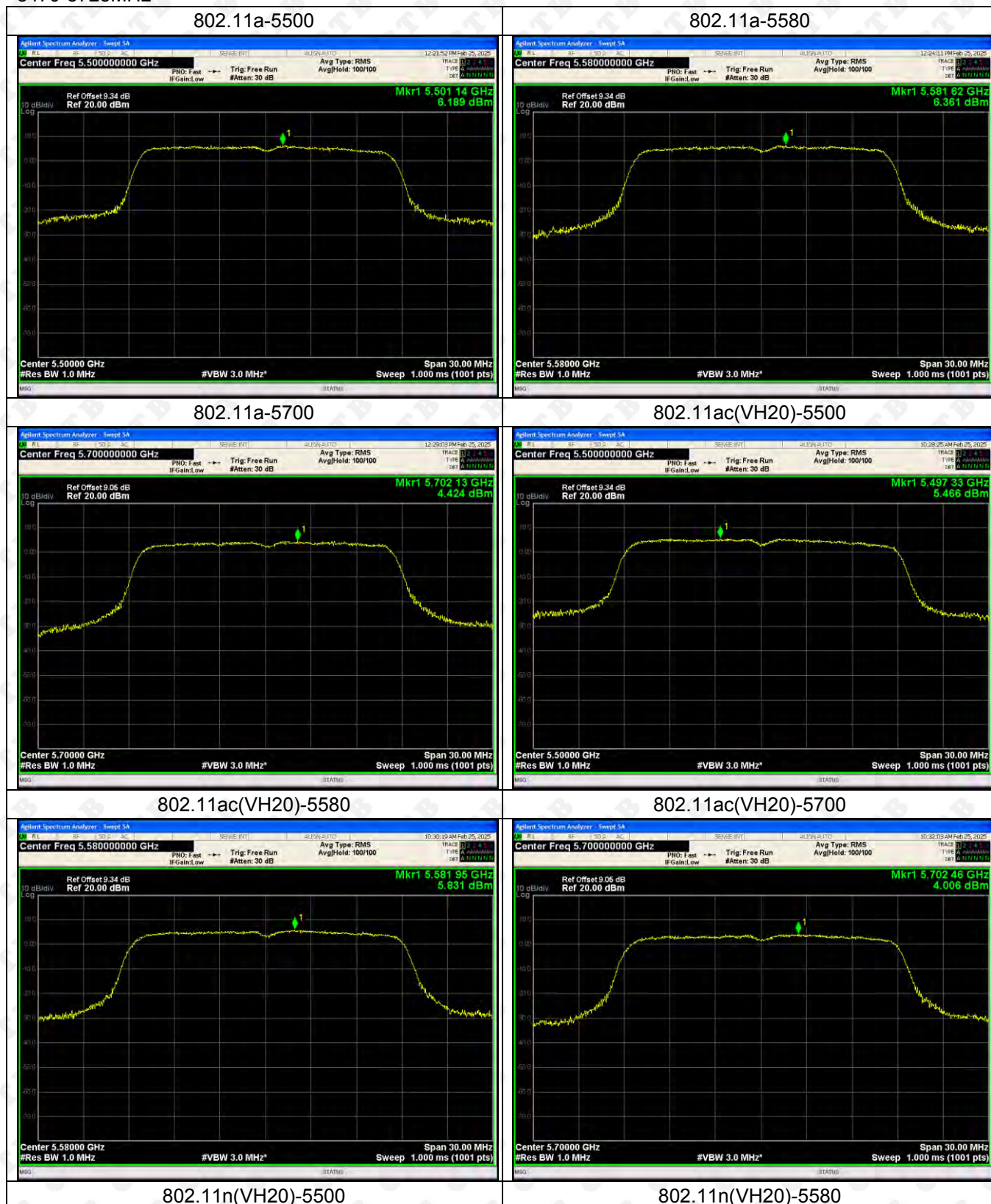
802.11n(VH40)-5270



802.11n(VH40)-5310



5470-5725MHz





802.11n(VH20)-5700



802.11n(VH40)-5510



802.11n(VH40)-5670



5725-5850MHz

802.11a-5745

802.11a-5785



802.11a-5825



802.11ac(VH20)-5745



802.11ac(VH20)-5785



802.11ac(VH20)-5825



802.11n(VH20)-5745



802.11n(VH20)-5785



802.11n(VH20)-5825



802.11n(VH40)-5755

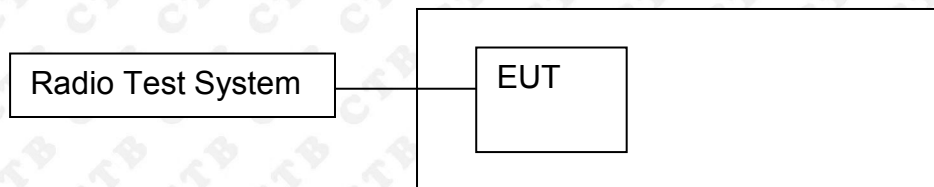


802.11n(VH40)-5795



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)

Voltage vs. Frequency Stability

TEST CONDITIONS				Reference Frequency: 5180MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
T nom (°C)	20	V nom (V)	3.3	5180.0278	5180	0.0278	5.3655
		V max (V)	3.6	5180.0097	5180	0.0097	1.8714
		V min (V)	3.0	5180.0654	5180	0.0654	12.6291
Limits				±20ppm			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency: 5180MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	3.3	T (°C)	0	5180.0057	5180	0.0057	1.1090
		T (°C)	10	5180.0532	5180	0.0532	10.2719
		T (°C)	20	5180.0144	5180	0.0144	2.7789
		T (°C)	30	5180.0178	5180	0.0178	3.4273
		T (°C)	40	5180.0253	5180	0.0253	4.8852
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)	3.3	5200.0216	5200	0.0216	4.1573
		V max (V)	3.6	5200.0176	5200	0.0176	3.3786
		V min (V)	3.0	5200.0137	5200	0.0137	2.6393
Limits				±20ppm			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency: 5200MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	3.3	T (°C)	0	5200.0171	5200	0.0171	3.2877
		T (°C)	10	5200.0070	5200	0.0070	1.3498
		T (°C)	20	5200.0366	5200	0.0366	7.0374
		T (°C)	30	5200.0089	5200	0.0089	1.7116
		T (°C)	40	5200.0180	5200	0.0180	3.4669
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)	3.3	5240.0353	5240	0.0353	6.7438
		V max (V)	3.6	5240.0433	5240	0.0433	8.2702
		V min (V)	3.0	5240.0306	5240	0.0306	5.8307
Limits				±20ppm			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency: 5240MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	3.3	T (°C)	0	5240.0085	5240	0.0085	1.6144
		T (°C)	10	5240.0511	5240	0.0511	9.7548
		T (°C)	20	5240.0414	5240	0.0414	7.9029
		T (°C)	30	5240.0424	5240	0.0424	8.0921
		T (°C)	40	5240.0293	5240	0.0293	5.5908
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)	3.3	5260.0001	5260	0.0001	0.0125
		V max (V)	3.6	5260.0496	5260	0.0496	9.4363
		V min (V)	3.0	5260.0354	5260	0.0354	6.7352
Limits				±20ppm			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency: 5260MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	3.3	T (°C)	0	5260.0506	5260	0.0506	9.6266
		T (°C)	10	5260.0171	5260	0.0171	3.2453
		T (°C)	20	5260.0484	5260	0.0484	9.1941
		T (°C)	30	5260.0871	5260	0.0871	16.5612
		T (°C)	40	5260.0798	5260	0.0798	15.1745
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)	3.3	5280.0439	5280	0.0439	8.3199
		V max (V)	3.6	5280.0593	5280	0.0593	11.2336
		V min (V)	3.0	5280.0659	5280	0.0659	12.4876
Limits				±20ppm			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency: 5280MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	3.3	T (°C)	0	5280.0616	5280	0.0616	11.6695
		T (°C)	10	5280.0681	5280	0.0681	12.8951
		T (°C)	20	5280.0932	5280	0.0932	17.6558
		T (°C)	30	5280.0504	5280	0.0504	9.5433
		T (°C)	40	5280.0174	5280	0.0174	3.2972
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)	3.3	5320.0636	5320	0.0636	11.9538
		V max (V)	3.6	5320.0916	5320	0.0916	17.2216
		V min (V)	3.0	5320.0483	5320	0.0483	9.0727
Limits				±20ppm			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency: 5320MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	3.3	T (°C)	0	5320.0858	5320	0.0858	16.1303
		T (°C)	10	5320.0868	5320	0.0868	16.3119
		T (°C)	20	5320.0853	5320	0.0853	16.0316
		T (°C)	30	5320.0543	5320	0.0543	10.2018
		T (°C)	40	5320.0309	5320	0.0309	5.8126
Limits				±20ppm			
Result				Complies			

TX Frequency (5470-5725MHz)

Voltage vs. Frequency Stability

TEST CONDITIONS				Reference Frequency: 5500MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
T nom (°C)	20	V nom (V)	3.3	5500.0018	5500	0.0018	0.3267
		V max (V)	3.6	5500.0186	5500	0.0186	3.3814
		V min (V)	3.0	5550.0055	5500	50.0055	9091.9168
Limits				±20ppm			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency: 5500MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	3.3	T (°C)	0	5500.0739	5500	0.0739	13.4355
		T (°C)	10	5500.0007	5500	0.0007	0.1185
		T (°C)	20	5500.0542	5500	0.0542	9.8555
		T (°C)	30	5500.0232	5500	0.0232	4.2171
		T (°C)	40	5500.0663	5500	0.0663	12.0605
Limits				±20ppm			
Result				Complies			

Voltage vs. Frequency Stability

TEST CONDITIONS				Reference Frequency: 5580MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
T nom (°C)	20	V nom (V)	3.3	5580.0321	5580	0.0321	5.7509
		V max (V)	3.6	5580.0282	5580	0.0282	5.0601
		V min (V)	3.0	5580.0417	5580	0.0417	7.4664
Limits				±20ppm			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency: 5580MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	3.3	T (°C)	0	5580.0031	5580	0.0031	0.5517
		T (°C)	10	5580.0007	5580	0.0007	0.1169
		T (°C)	20	5580.0253	5580	0.0253	4.5392
		T (°C)	30	5580.0091	5580	0.0091	1.6397
		T (°C)	40	5580.0740	5580	0.0740	13.2536
Limits				±20ppm			
Result				Complies			

Voltage vs. Frequency Stability

TEST CONDITIONS				Reference Frequency: 5700MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
T nom (°C)	20	V nom (V)	3.3	5700.0299	5700	0.0299	5.2449
		V max (V)	3.6	5700.0103	5700	0.0103	1.8118
		V min (V)	3.0	5700.0029	5700	0.0029	0.5004
Limits				±20ppm			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency: 5700MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	3.3	T (°C)	0	5700.0454	5700	0.0454	7.9700
		T (°C)	10	5700.0287	5700	0.0287	5.0332
		T (°C)	20	5700.0303	5700	0.0303	5.3160
		T (°C)	30	5700.0702	5700	0.0702	12.3241
		T (°C)	40	5700.0250	5700	0.0250	4.3790
Limits				±20ppm			
Result				Complies			

TX Frequency (5725-5850MHz)

Voltage vs. Frequency Stability

TEST CONDITIONS				Reference Frequency: 5745MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
T nom (°C)	20	V nom (V)	3.3	5745.0045	5745	0.0045	0.7880
		V max (V)	3.6	5745.0411	5745	0.0411	7.1473
		V min (V)	3.0	5745.0045	5745	0.0045	0.7880
Limits				±20ppm			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency: 5745MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	3.3	T (°C)	0	5745.0793	5745	0.0793	13.8106
		T (°C)	10	5745.0445	5745	0.0445	7.7532
		T (°C)	20	5745.0367	5745	0.0367	6.3838
		T (°C)	30	5745.0846	5745	0.0846	14.7193
		T (°C)	40	5745.0007	5745	0.0007	0.1278
Limits				±20ppm			
Result				Complies			

Voltage vs. Frequency Stability

TEST CONDITIONS				Reference Frequency: 5785MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
T nom (° C)	20	V nom (V)	3.3	5785.0869	5785	0.0869	15.0135
		V max (V)	3.6	5785.0625	5785	0.0625	10.8072
		V min (V)	3.0	5785.0081	5785	0.0081	1.3969
Limits				±20ppm			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency: 5785MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	3.3	T (°C)	0	5785.0304	5785	0.0304	5.2484
		T (°C)	10	5785.0776	5785	0.0776	13.4070
		T (°C)	20	5785.0052	5785	0.0052	0.8981
		T (°C)	30	5785.0314	5785	0.0314	5.4286
		T (°C)	40	5785.0585	5785	0.0585	10.1124
Limits				±20ppm			
Result				Complies			

Voltage vs. Frequency Stability

TEST CONDITIONS				Reference Frequency: 5825MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
T nom (° C)	20	V nom (V)	3.3	5825.0364	5825	0.0364	6.2565
		V max (V)	3.6	5825.0764	5825	0.0764	13.1203
		V min (V)	3.0	5825.0191	5825	0.0191	3.2725
Limits				±20ppm			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency: 5825MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	3.3	T (°C)	0	5825.0210	5825	0.0210	3.6135
		T (°C)	10	5825.0158	5825	0.0158	2.7120
		T (°C)	20	5825.0274	5825	0.0274	4.6987
		T (°C)	30	5825.0554	5825	0.0554	9.5070
		T (°C)	40	5825.0212	5825	0.0212	3.6390
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 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.

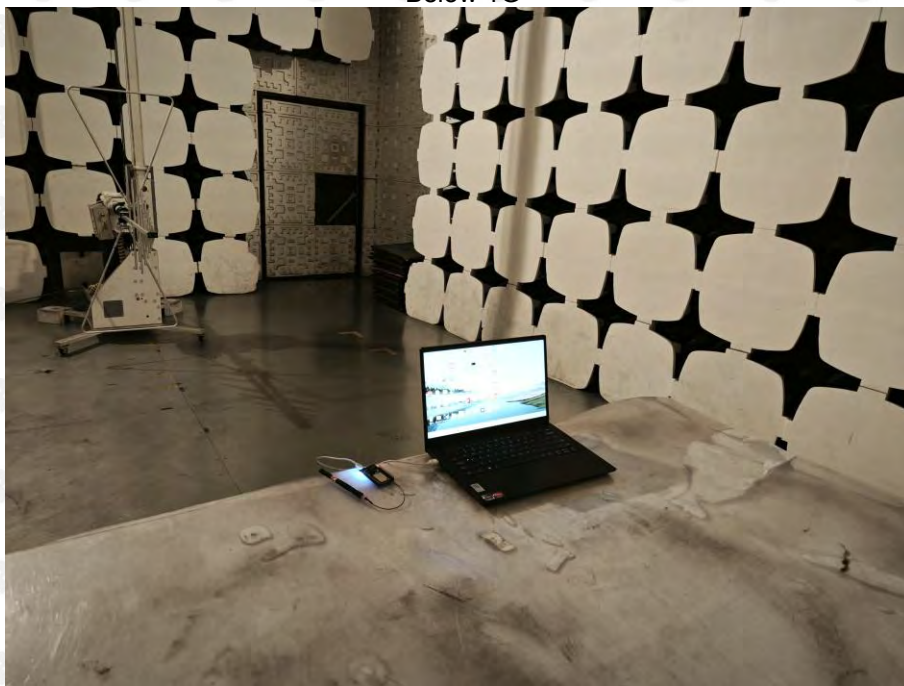
EUT Antenna:

The antenna is internal antenna and no consideration of replacement. The best case gain of the antenna is WiFi (5.2G): 3.17dBi, WiFi (5.3G): 3.42dBi, WiFi (5.6G):2.66dBi, WiFi (5.8G): 3.03dBi.

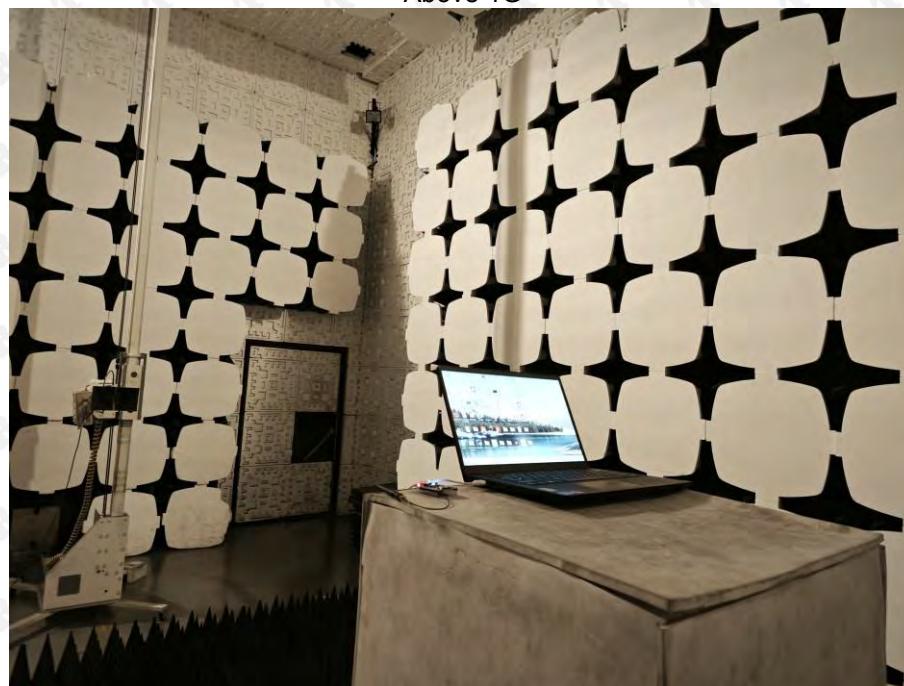
15. EUT TEST SETUP PHOTOGRAPHS

Radiated Emission

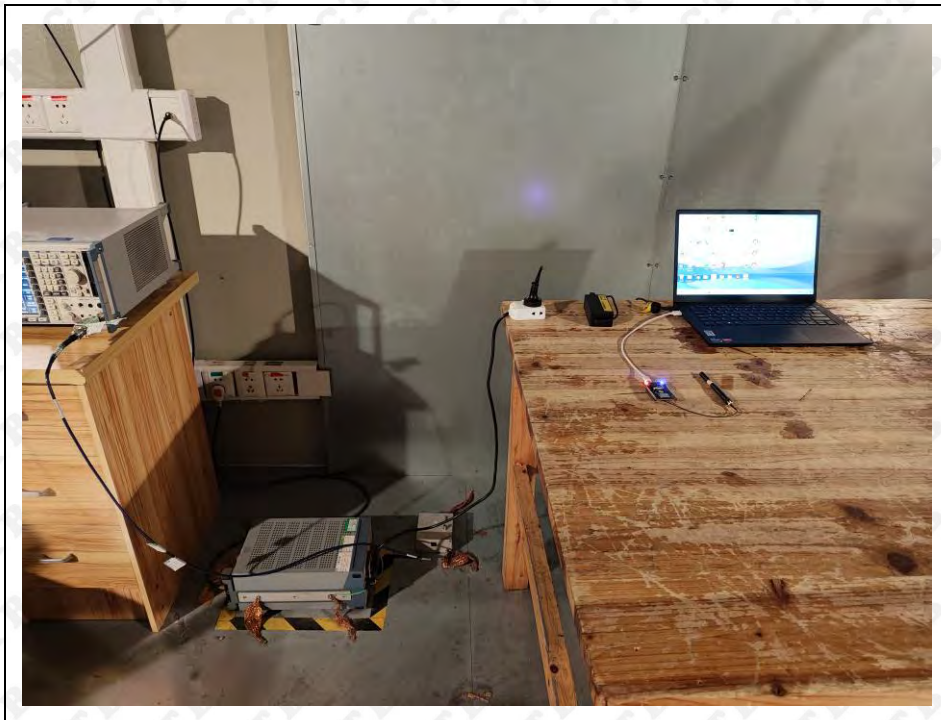
Below 1G



Above 1G



Conducted Emission



***** END OF REPORT *****