



TEST REPORT

Product Name: WiSmart3E dual band wireless router
FCC ID: 2BHJC-WISMART3E
Trademark: Wiwide
Model Number: WiSmart3E
Prepared For: Shanghai WiWide Network Technology Co., Ltd
Address: 808A, B, Building C, Zhongjin International, No. 375, Caoxi North Road, Xuhui District, China
Manufacturer: Shanghai WiWide Network Technology Co., Ltd
Address: 808A, B, Building C, Zhongjin International, No. 375, Caoxi North Road, Xuhui District, 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: Jun. 03, 2024
Sample tested Date: Jun. 03, 2024 to Jul. 01, 2024
Issue Date: Jul. 01, 2024
Report No.: CTB240701024RF
Test Standards: FCC CFR Title 47 Part 15 Subpart E Section 15.407
Test Results: PASS
Remark: This is WIFI-5GHz band radio test report.

Compiled by:

Reviewed by:

Approved by:

Zhou kui

Arron Liu



Zhou Kui

Arron Liu

Bin Mei / Director

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

TABLE OF CONTENT

Test Report Declaration	Page
1. VERSION	4
2. TEST SUMMARY	5
3. MEASUREMENT UNCERTAINTY	6
4. PRODUCT INFORMATION AND TEST SETUP	7
4.1 Product Information	7
4.2 Test Setup Configuration	7
4.3 Support Equipment	7
4.5 Test Mode	8
4.6 Test Environment	9
5. TEST FACILITY AND TEST INSTRUMENT USED	10
5.1 Test Facility	10
5.2 Test Instrument Used	10
6. AC POWER LINE CONDUCTED EMISSION	12
6.1 Block Diagram Of Test Setup	12
6.2 Limit	12
6.3 Test procedure	12
6.4 Test Result	14
7. RADIATED SPURIOUS EMISSIONS	16
7.1 Block Diagram Of Test Setup	16
7.2 Limit	16
7.3 Test procedure	17
7.4 Test Result	18
8. BAND EDGE	23
8.1 Block Diagram Of Test Setup	23
8.2 Limit	23
8.3 Test procedure	23
8.4 Test Result	24
9. CONDUCTED OUTPUT POWER	32
9.1 Block Diagram Of Test Setup	32
9.2 Limit	32
9.3 Test procedure	33
9.4 Test Result	34
10. EMISSION BANDWIDTH& OCCUPIED BANDWIDTH	45
10.1 Block Diagram Of Test Setup	45
10.2 Limits	45
10.3 Test Procedure	45
10.4 Test Results	47
11. POWER SPECTRAL DENSITY	59
11.1 Block Diagram Of Test Setup	59
11.2 Limit	59
11.3 Test procedure	59

11.4	Test Result	61
12.	FREQUENCY STABILITY	72
12.1	Block Diagram Of Test Setup	72
12.2	Limit	72
12.3	Test procedure	72
12.4	Test Result	72
13.	OPERATION IN THE ABSENCE OF INFORMATION TO THE TRANSMIT ...	85
13.1	Requirement	85
13.2	Test Results	85
14.	ANTENNA REQUIREMENT	86
15.	EUT TEST SETUP PHOTOGRAPHS	87

(Note: N/A means not applicable)

1. VERSION

Report No.	Issue Date	Description	Approved
CTB240701024RF	Jul. 01, 2024	Original	Valid

2. TEST SUMMARY

The Product has been tested according to the following specifications:

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

Remark:

Test according to ANSI C63.10-2013.

3. MEASUREMENT UNCERTAINTY

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

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

4. PRODUCT INFORMATION AND TEST SETUP

4.1 Product Information

Model(s):	WiSmart3E
Model Description:	N/A
Wi-Fi Specification:	IEEE 802.11a/n/ac
Hardware Version:	A1
Software Version:	v6.0.0.30
Operation Frequency:	IEEE 802.11a/n/ac(20M): 5150MHz ~5250MHz/ 4 channel IEEE 802.11n/ac(40M): 5150MHz ~5250MHz/ 2 channel IEEE 802.11ac(80M): 5150MHz ~5250MHz/ 1 channel IEEE 802.11a/n/ac(20M): 5725MHz ~5850MHz/ 5 channel IEEE 802.11n/ac(40M): 5725MHz ~5850MHz/ 2 channel IEEE 802.11ac(80M): 5725MHz ~5850MHz/ 1 channel
Max. RF output power:	WiFi (5G): 17.898dBm
Type of Modulation:	WiFi: OFDM
Antenna installation:	WiFi: Internal antenna
Antenna Gain:	WiFi (5.2G):Ant1: 2.9dBi Ant2: 2.9dBi WiFi (5.8G):Ant1: 3.7dBi Ant2: 3.7dBi
Ratings:	POE: DC 48V=0.5A DC 12V=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	Laptop	DELL	Vostro 5490	N/A	N/A

Notes:

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

4.4 Channel List

For 802.11a/n/ac(20M) Operation in the 5180MHz ~5240 MHz band			
Channel	Frequency	Channel	Frequency
36	5180MHz	44	5220MHz
40	5200MHz	48	5240MHz
For 802.11a/n/ac(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(40M) Operation in the 5190MHz ~5230 MHz band			
Channel	Frequency	Channel	Frequency
38	5190MHz	46	5230MHz
For 802.11n/ac(40M) Operation in the 5755MHz ~5795 MHz band			
Channel	Frequency	Channel	Frequency
151	5755MHz	159	5795MHz

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

NOTE: Dutycycle>98%.

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

4.5 Test Mode

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

Test Mode	Tx/Rx	RF Channel		
		Low(L)	Middle(M)	High(H)
802.11a/n/ac(20M)	5180MHz ~5240 MHz	Channel 36	Channel 40	Channel 48
		5180MHz	5200MHz	5240MHz
802.11n/ac(40M)		Channel 38	N/A	Channel 46
		5190MHz	N/A	5230MHz
802.11ac(80M)	5745MHz ~5825MHz	N/A	Channel 42	N/A
		N/A	5210MHz	N/A
802.11a/n/ac(20M)		Channel 149	Channel 157	Channel 165
		5745MHz	5785MHz	5825MHz
802.11n/ac(40M)		Channel 151	N/A	Channel 159
		5755MHz	N/A	5795MHz
802.11ac(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	120V
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, Xinhua 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.

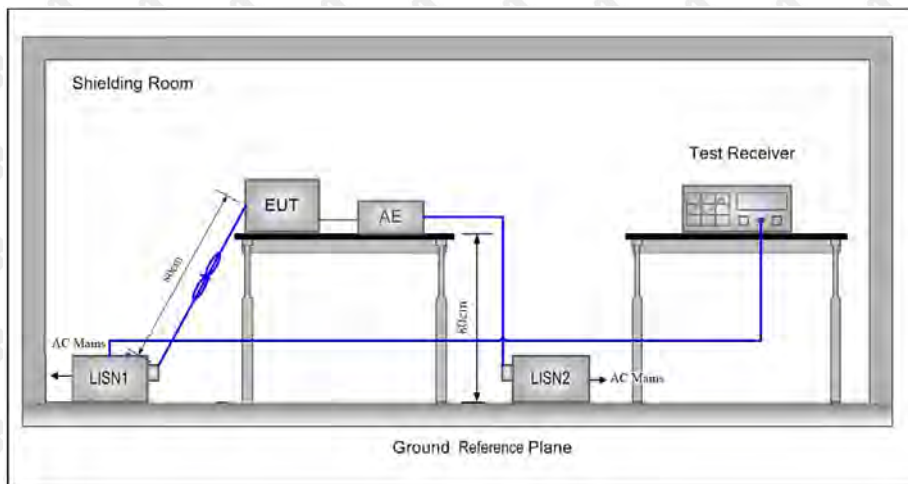
5.2 Test Instrument Used

No.	Equipment	Manufacturer	Type No.	Serial No.	Firmware Version	Calibrated until
1	Spectrum Analyzer	Agilent	N9020A	MY52090073	A.14.16	2024.07.05
2	Power Sensor	Agilent	U2021XA	MY56120032	/	2024.07.05
3	Power Sensor	Agilent	U2021XA	MY56120034	/	2024.07.05
4	Communication test set	R&S	CMW500	108058	V3.5.80	2024.07.05
5	Spectrum Analyzer	KEYSIGHT	N9020A	MY51289897	A.14.16	2024.07.05
6	Signal Generator	Agilent	N5181A	MY50140365	A.01.60	2024.07.05
7	Vector signal generator	Agilent	N5182A	MY47420195	A.01.87	2024.07.05
8	Communication test set	Agilent	E5515C	MY50102567	B.19.07 (E1962B)	2024.07.06
9	2.4 GHz Filter	Shenxiang	MSF2400-24 83.5MS-1154	20181015001	/	2024.07.05
10	5 GHz Filter	Shenxiang	MSF5150-58 50MS-1155	20181015001	/	2024.07.06
11	Filter	Xingbo	XBLBQ-DZA 120	190821-1-1	/	2024.07.06
12	BT&WI-FI Automatic test software	Microwave	MTS8000	Ver. 2.0.0.0	/	/
13	Rohde & Schwarz SFU Broadcast Test System	R&S	SFU	101017	/	2024.10.30
14	Temperature humidity chamber	Hongjing	TH-80CH	DG-15174	/	2024.07.05
15	234G Automatic test software	Microwave	MTS8200	Ver. 2.0.0.0	/	/
16	966 chamber	C.R.T.	966	/	/	2024.08.11
17	Receiver	R&S	ESPI	100362	RF_ATTEN_7 (104489/003)	2024.07.05
18	Amplifier	HP	8447E	2945A02747	/	2024.07.05
19	Amplifier	Agilent	8449B	3008A01838	/	2024.07.05
20	TRILOG Broadband Antenna	Schwarzbeck	VULB 9168	00869	/	2024.07.08
21	Double Ridged Broadband Horn Antenna	Schwarzbeck	BBHA9120D	01911	/	2024.07.08

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

6. AC POWER LINE CONDUCTED EMISSION

6.1 Block Diagram Of Test Setup



6.2 Limit

Table 4 – AC power-line conducted emissions limits

Frequency (MHz)	Conducted limit (dB μ V)	
	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 Ω /50 μ H + 5 Ω 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.

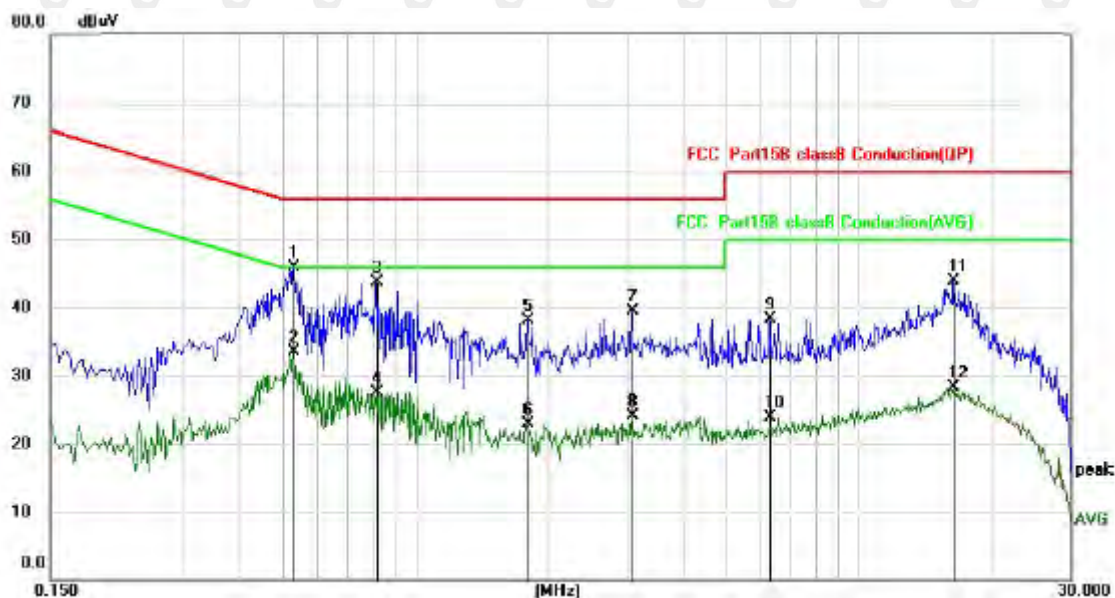
This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0,8 m from the LISN 2.

- 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

Modulation : 802.11a (the worst data)

L:

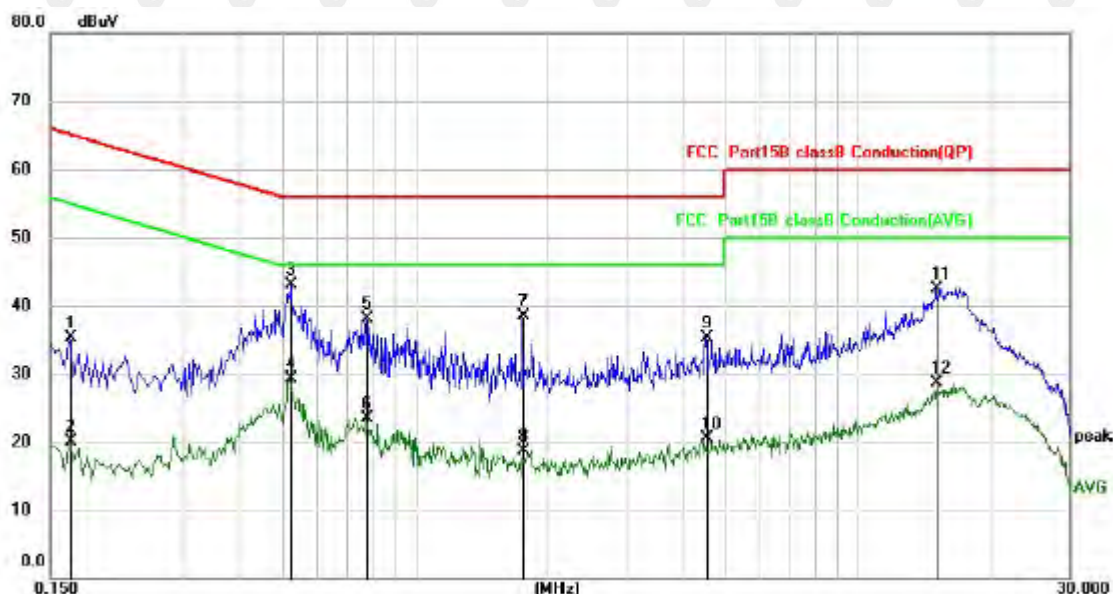


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector
1	*	0.5299	35.88	9.99	45.87	56.00	-10.13	QP
2		0.5299	23.56	9.99	33.55	46.00	-12.45	AVG
3		0.8139	33.77	10.02	43.79	56.00	-12.21	QP
4		0.8139	17.53	10.02	27.55	46.00	-18.45	AVG
5		1.7860	28.00	10.07	38.07	56.00	-17.93	QP
6		1.7860	12.92	10.07	22.99	46.00	-23.01	AVG
7		3.0740	29.38	10.19	39.57	56.00	-16.43	QP
8		3.0740	13.90	10.19	24.09	46.00	-21.91	AVG
9		6.3100	27.75	10.47	38.22	60.00	-21.78	QP
10		6.3100	13.47	10.47	23.94	50.00	-26.06	AVG
11		16.3939	33.15	10.76	43.91	60.00	-16.09	QP
12		16.3939	17.46	10.76	28.22	50.00	-21.78	AVG

Remark:

Factor = Cable loss + LISN factor, Margin = Measurement – Limit

N:



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector
1		0.1660	25.32	9.95	35.27	65.16	-29.89	QP
2		0.1660	10.25	9.95	20.20	55.16	-34.96	AVG
3	*	0.5260	33.17	9.99	43.16	56.00	-12.84	QP
4		0.5260	19.31	9.99	29.30	46.00	-16.70	AVG
5		0.7780	28.18	10.02	38.20	56.00	-17.80	QP
6		0.7780	13.57	10.02	23.59	46.00	-22.41	AVG
7		1.7460	28.40	10.07	38.47	56.00	-17.53	QP
8		1.7460	8.69	10.07	18.76	46.00	-27.24	AVG
9		4.5420	24.94	10.34	35.28	56.00	-20.72	QP
10		4.5420	10.09	10.34	20.43	46.00	-25.57	AVG
11		15.0540	31.81	10.73	42.54	60.00	-17.46	QP
12		15.0540	18.02	10.73	28.75	50.00	-21.25	AVG

Remark:

Factor = Cable loss + LISN factor, Margin = Measurement – Limit

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

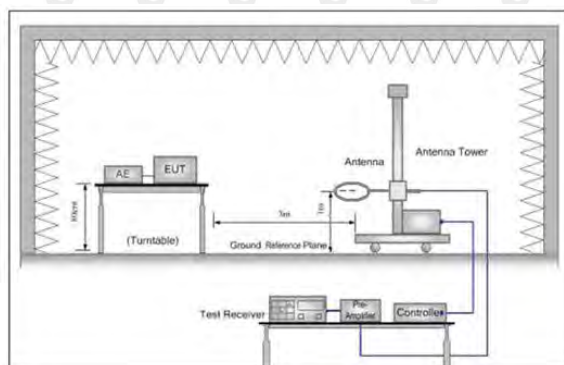


Figure 1. Below 30MHz

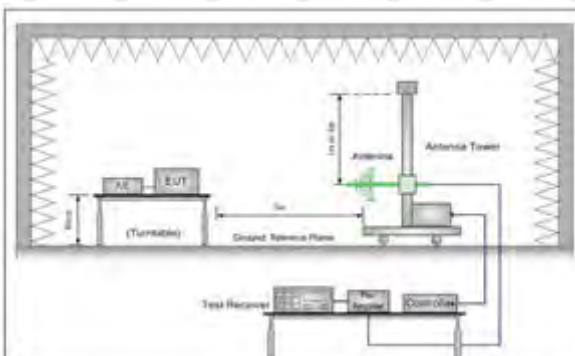


Figure 2. 30MHz to 1GHz

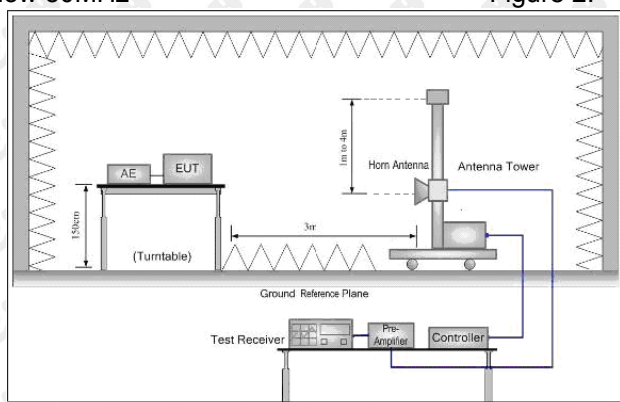


Figure 3. Above 1GHz

7.2 Limit

Spurious Emissions:

Frequency	Field strength (dBμV/m)	Remark	Measurement distance (m)
0.009MHz-0.490MHz	$20\log 2400/F \text{ (kHz)} + 80$	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:

- a. 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.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rota table table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

Above 1GHz test procedure as below:

- g. Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber and change form table 0.8 meter to 1.5 meter(Above 18GHz the distance is 1 meter and table is 1.5 meter).
- h. Test the EUT in the lowest channel ,the middle channel ,the Highest channel
- j. Repeat above procedures until all frequencies measured was complete.

Receiver set:

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

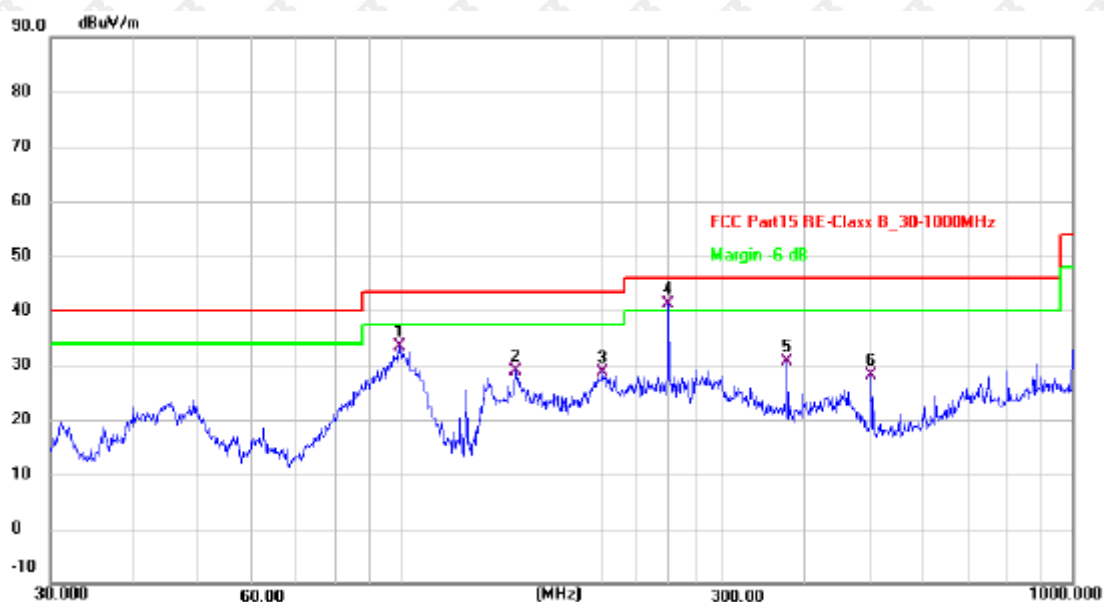
7.4 Test Result

30MHz-1GHzTest Results:

Modulation : 802.11a (the worst data)

Test Channel : 5780MHz

Antenna polarity: H



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	99.5281	50.96	-17.58	33.38	43.50	-10.12	QP
2	147.9214	41.73	-12.80	28.93	43.50	-14.57	QP
3	199.2855	44.95	-16.32	28.63	43.50	-14.87	QP
4 *	250.3010	56.70	-15.64	41.06	46.00	-4.94	QP
5	375.9385	42.48	-11.87	30.61	46.00	-15.39	QP
6	501.1790	36.26	-8.23	28.03	46.00	-17.97	QP

Antenna polarity: V



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1 !	39.8542	48.65	-13.57	35.08	40.00	-4.92	QP
2 *	47.6584	50.10	-14.94	35.16	40.00	-4.84	QP
3	99.1797	52.53	-17.61	34.92	43.50	-8.58	QP
4	133.1511	45.81	-14.30	31.51	43.50	-11.99	QP
5 !	250.3012	56.40	-15.64	40.76	46.00	-5.24	QP
6	426.5210	38.29	-10.65	27.64	46.00	-18.36	QP

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

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	39.97	16.39	56.36	74	-17.64	PK	1.35	298	H
10360	26.70	16.39	43.09	54	-10.91	AV	1.06	321	H
10360	41.51	16.39	57.90	74	-16.10	PK	1.31	36	V
10360	26.19	16.39	42.58	54	-11.42	AV	1.48	50	V
Channel:5240MHz									
10480	39.97	16.11	56.08	74	-17.92	PK	1.39	184	H
10480	26.84	16.11	42.95	54	-11.05	AV	1.69	136	H
10480	39.17	16.11	55.28	74	-18.72	PK	1.40	208	V
10480	27.11	16.11	43.22	54	-10.78	AV	1.89	343	V
Channel:5745MHz									
11490	39.83	17.46	57.29	74	-16.71	PK	1.16	39	H
11490	27.92	17.46	45.38	54	-8.62	AV	1.78	263	H
11490	39.84	17.46	57.30	74	-16.70	PK	1.34	159	V
11490	25.02	17.46	42.48	54	-11.52	AV	1.41	156	V
Channel:5825MHz									
11650	39.93	17.57	57.50	74	-16.50	PK	1.90	303	H
11650	27.82	17.57	45.39	54	-8.61	AV	1.34	47	H
11650	39.45	17.57	57.02	74	-16.98	PK	1.56	31	V
11650	27.24	17.57	44.81	54	-9.19	AV	1.31	344	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	40.34	16.34	56.68	74	-17.32	PK	1.19	276	H
10380	27.05	16.34	43.39	54	-10.61	AV	1.34	269	H
10380	41.14	16.34	57.48	74	-16.52	PK	1.69	354	V
10380	27.99	16.34	44.33	54	-9.67	AV	1.18	175	V
Channel:5230MHz									
10460	40.53	16.15	56.68	74	-17.32	PK	1.56	209	H
10460	26.98	16.15	43.13	54	-10.87	AV	1.16	180	H
10460	40.77	16.15	56.92	74	-17.08	PK	1.90	303	V
10460	25.53	16.15	41.68	54	-12.32	AV	1.62	271	V
Channel:5755MHz									
11510	41.27	17.49	58.76	74	-15.24	PK	1.33	350	H
11510	25.39	17.49	42.88	54	-11.12	AV	1.20	69	H
11510	40.19	17.49	57.68	74	-16.32	PK	1.68	358	V
11510	26.62	17.49	44.11	54	-9.89	AV	1.70	113	V
Channel:5795MHz									
11590	39.19	17.52	56.71	74	-18.16	PK	1.68	330	H
11590	27.44	17.52	44.96	54	-17.29	AV	1.69	168	H
11590	41.03	17.52	58.55	74	-15.45	PK	1.76	100	V
11590	26.50	17.52	44.02	54	-9.98	AV	1.87	16	V

Modulation : 802.11(VH80) (the worst data)

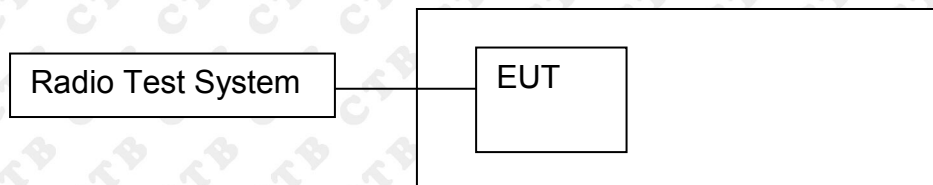
Freq (MHz)	Rd_level (dBuV/m)	Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over (dB)	detector	Height	Degree	Antenna polarization
Channel:5210MHz									
10420	39.59	16.25	55.84	74	-18.16	PK	1.14	250	H
10420	27.56	16.25	43.81	54	-10.19	AV	1.39	105	H
10420	41.41	16.25	57.66	74	-16.34	PK	1.11	160	V
10420	25.93	16.25	42.18	54	-11.82	AV	1.24	280	V
Channel:5775MHz									
11550	39.61	17.50	57.11	74	-16.89	PK	1.81	57	H
11550	26.87	17.50	44.37	54	-9.63	AV	1.52	256	H
11550	41.80	17.50	59.30	74	-14.70	PK	1.69	76	V
11550	25.68	17.50	43.18	54	-10.82	AV	1.90	166	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.

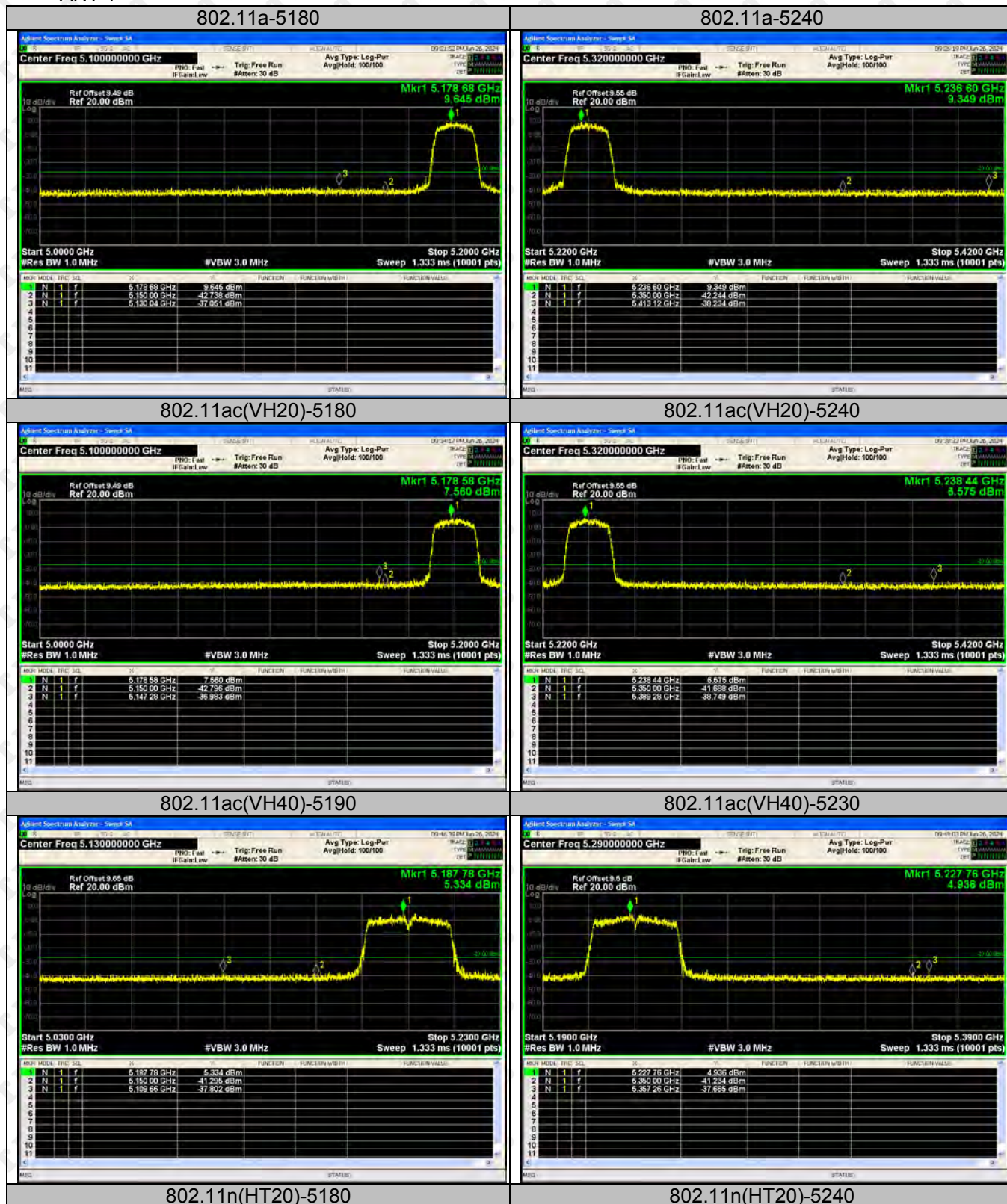
8.3 Test procedure

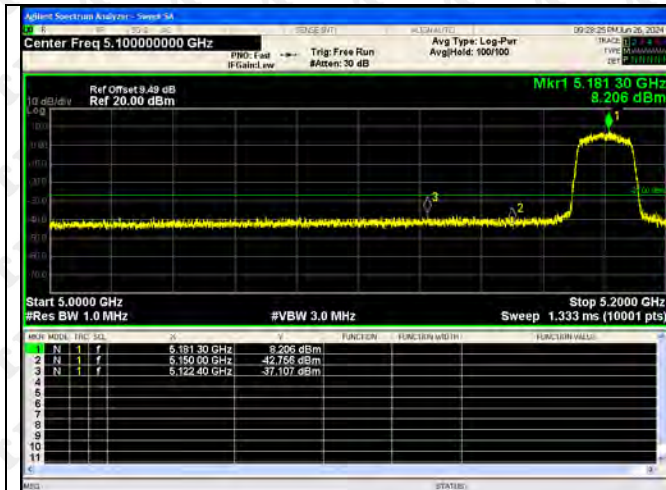
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then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

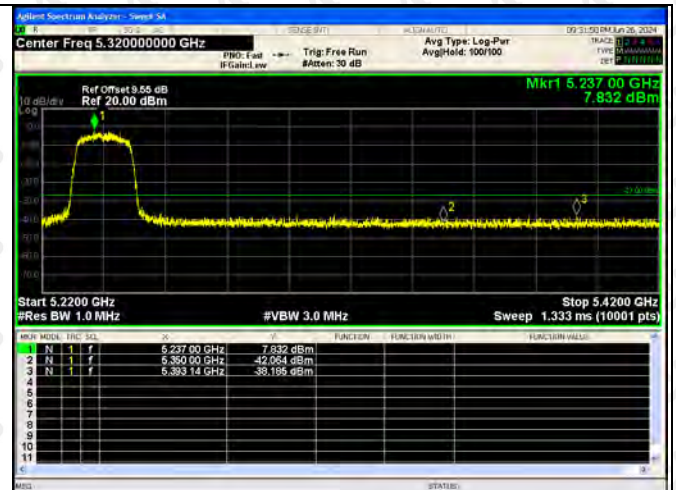
Test Graph

ANT 1

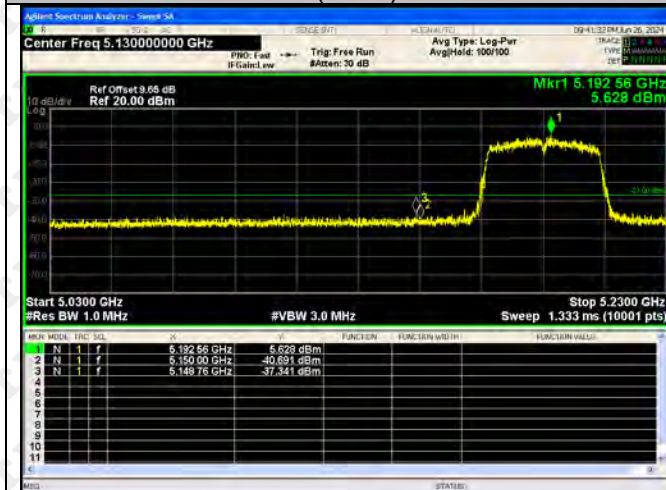




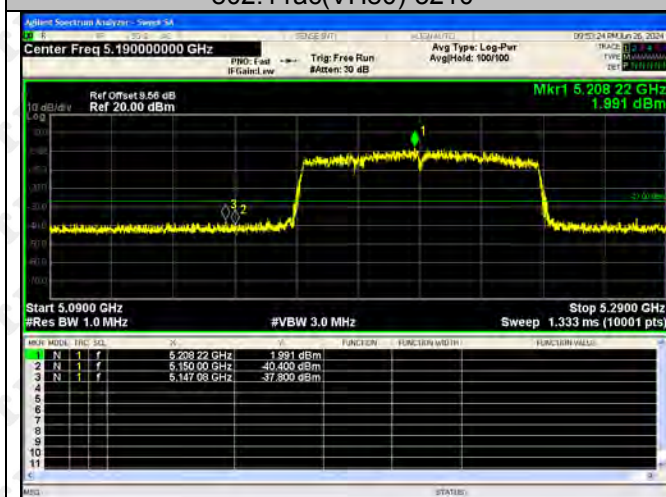
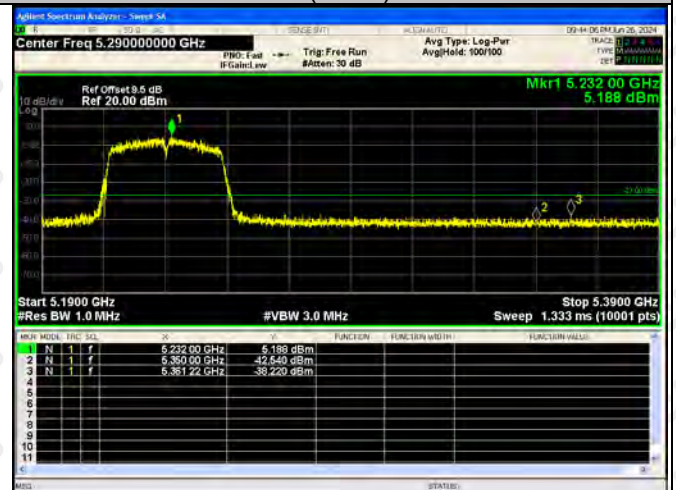
802.11n(HT40)-5190



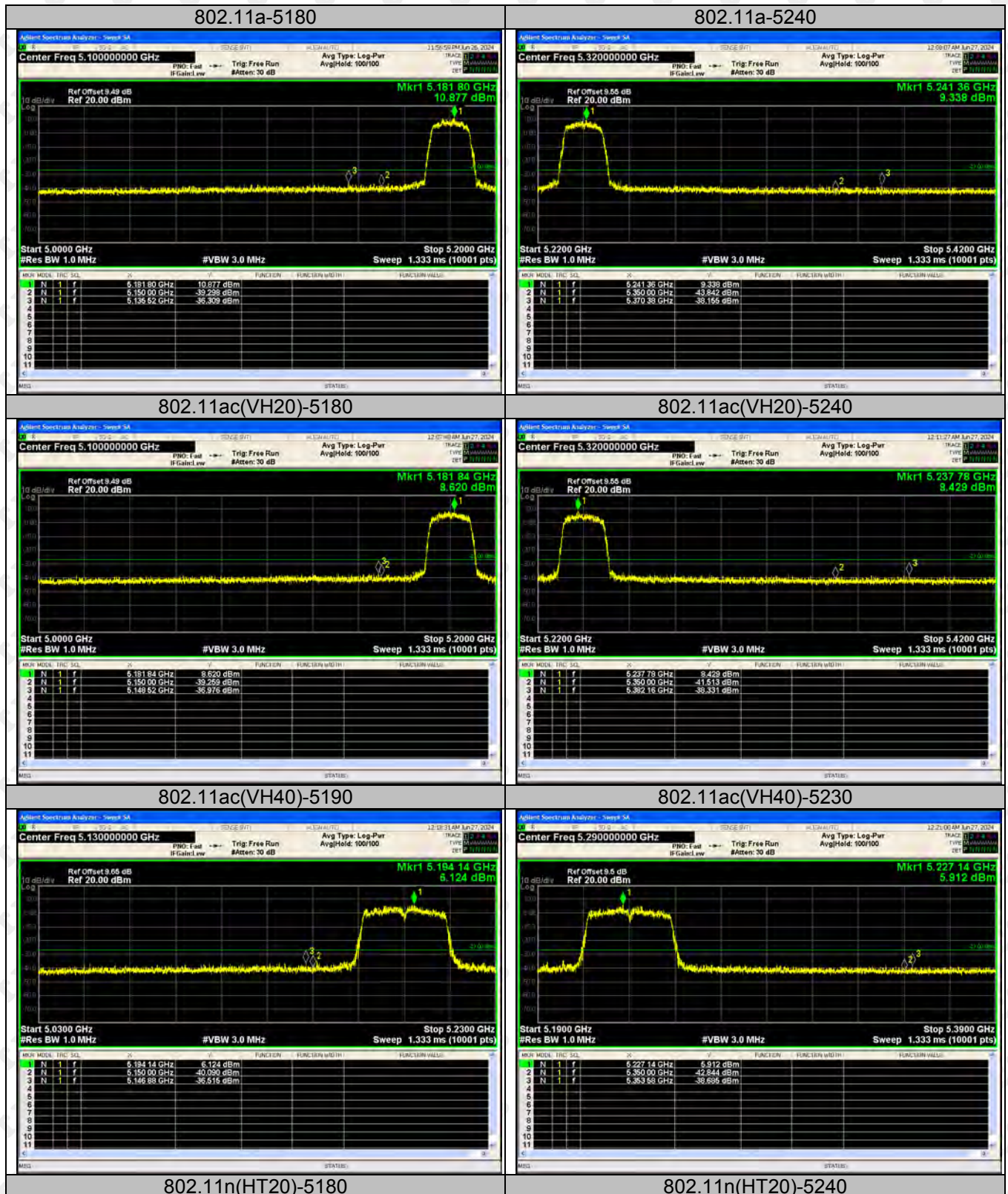
802.11n(HT40)-5230

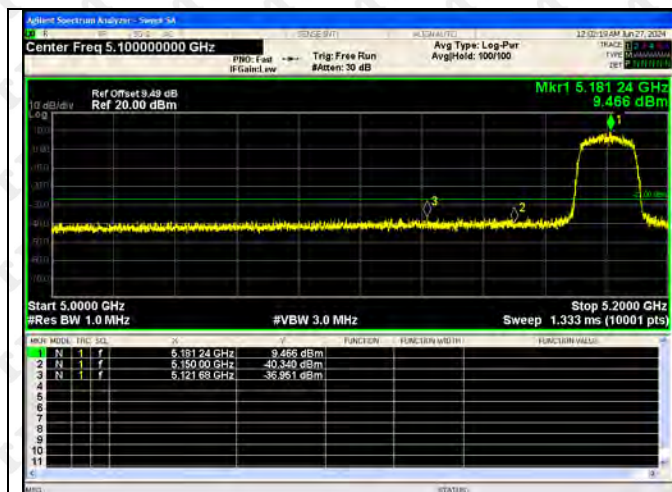


802.11ac(VH80)-5210

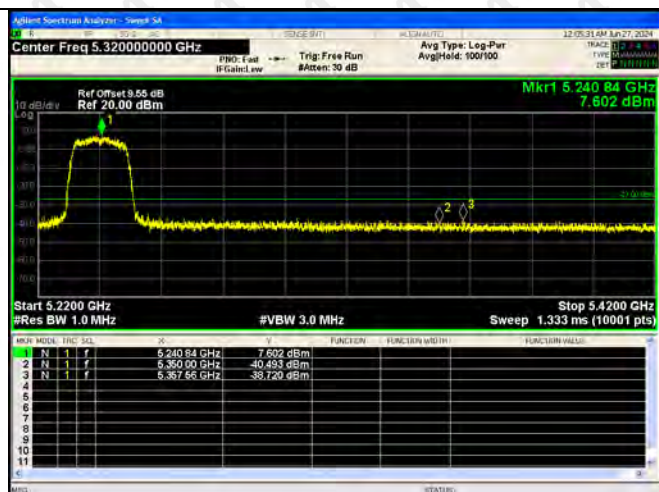


ANT2:

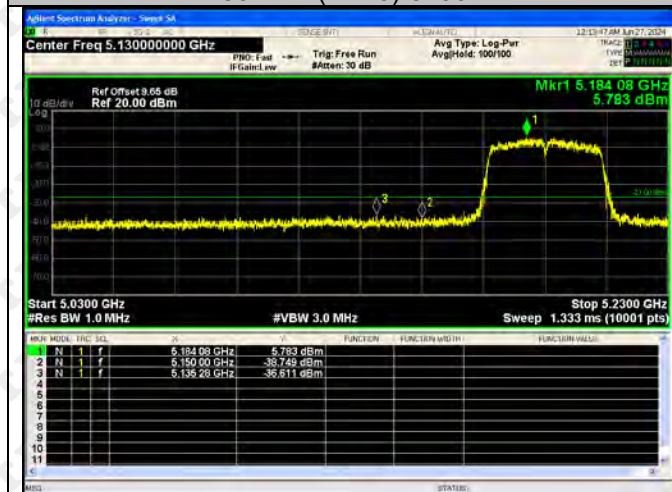




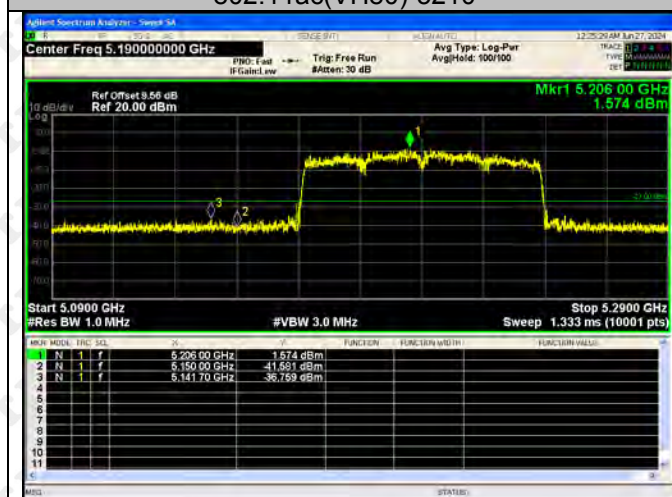
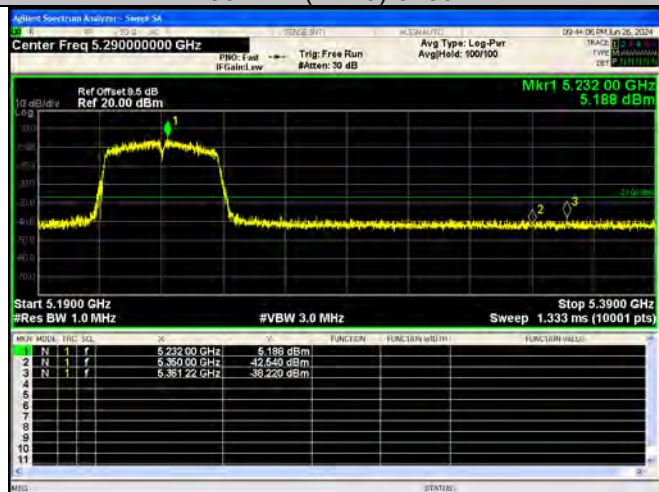
802.11n(HT40)-5190



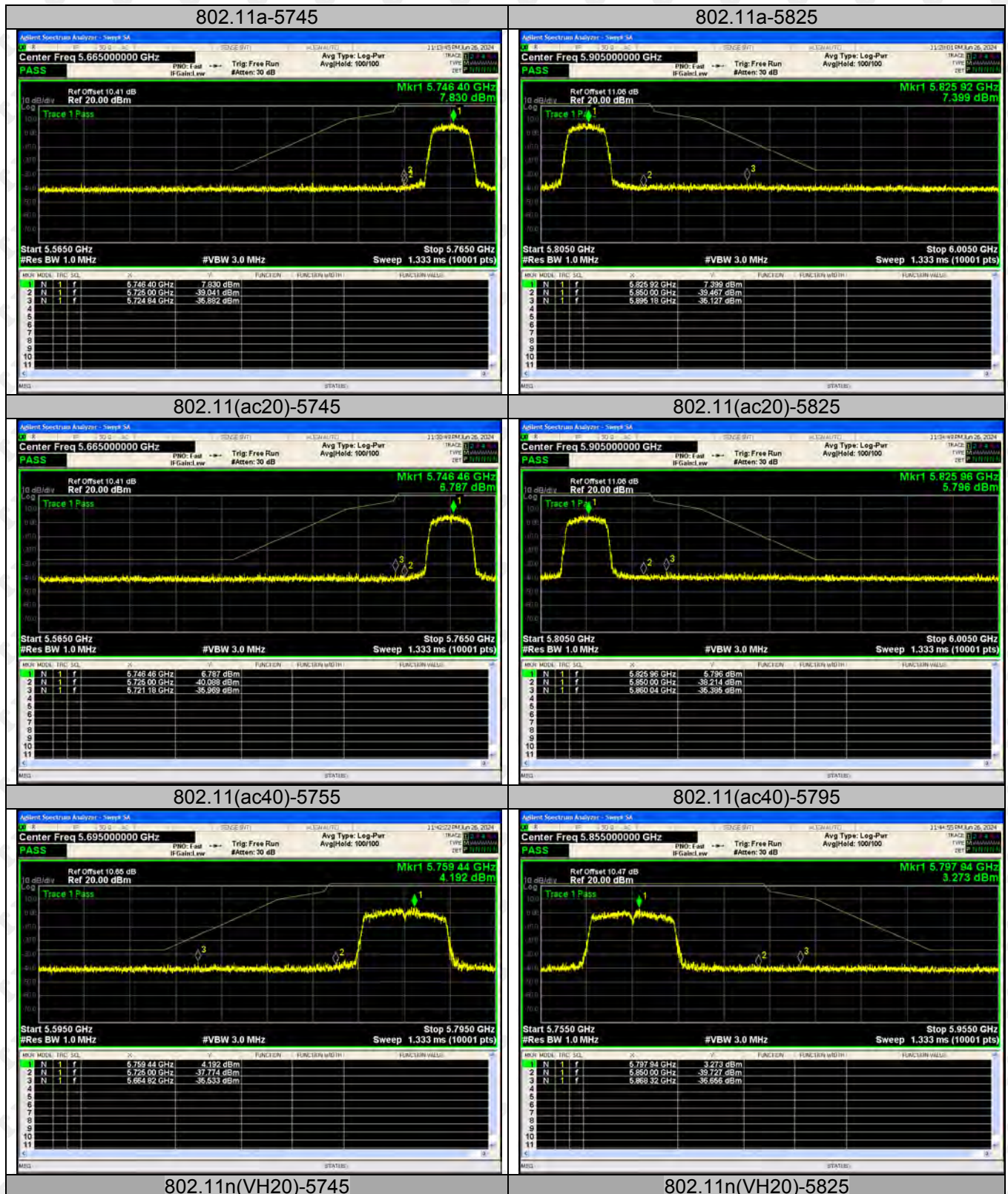
802.11n(HT40)-5230

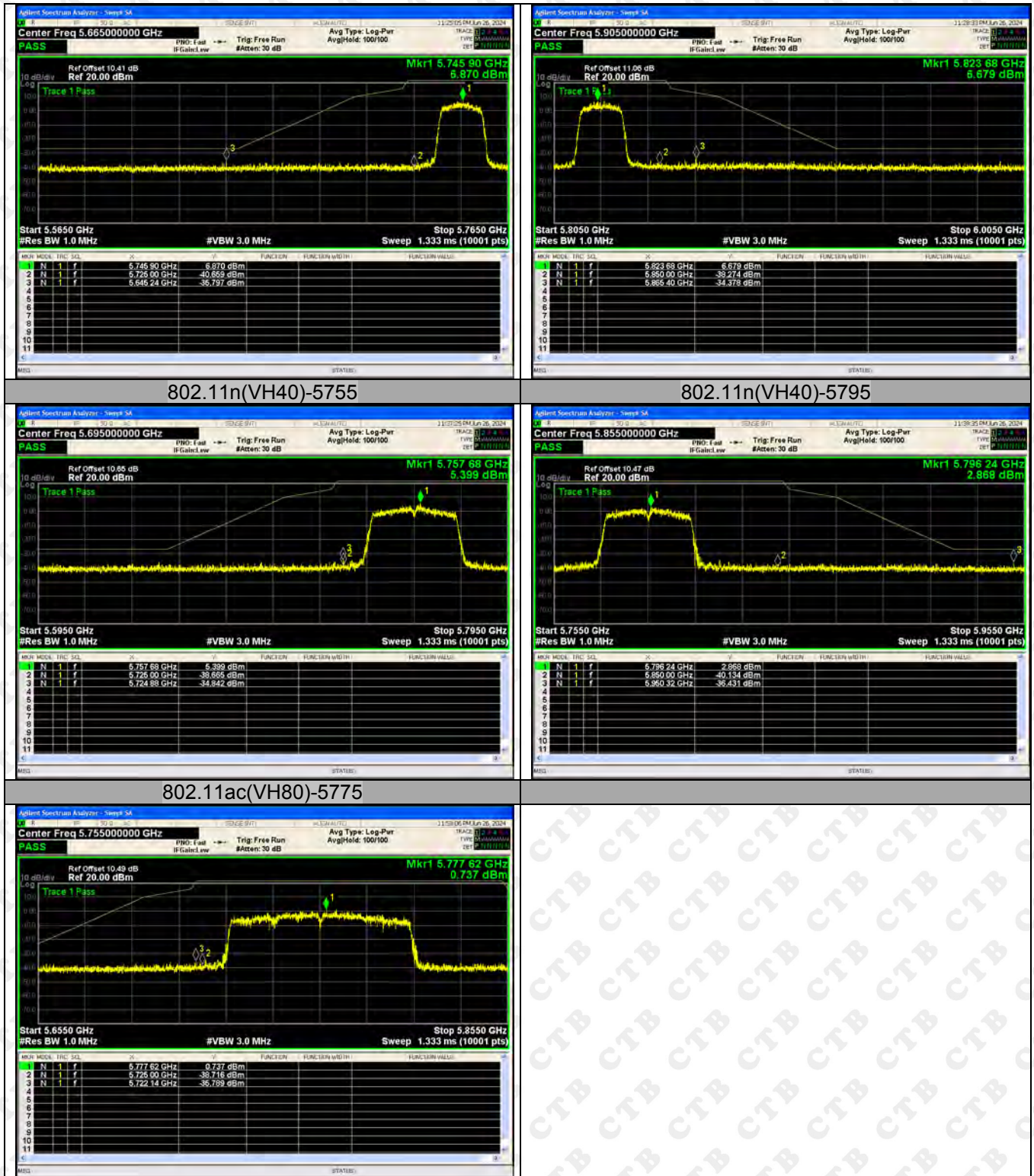


802.11ac(VH80)-5210

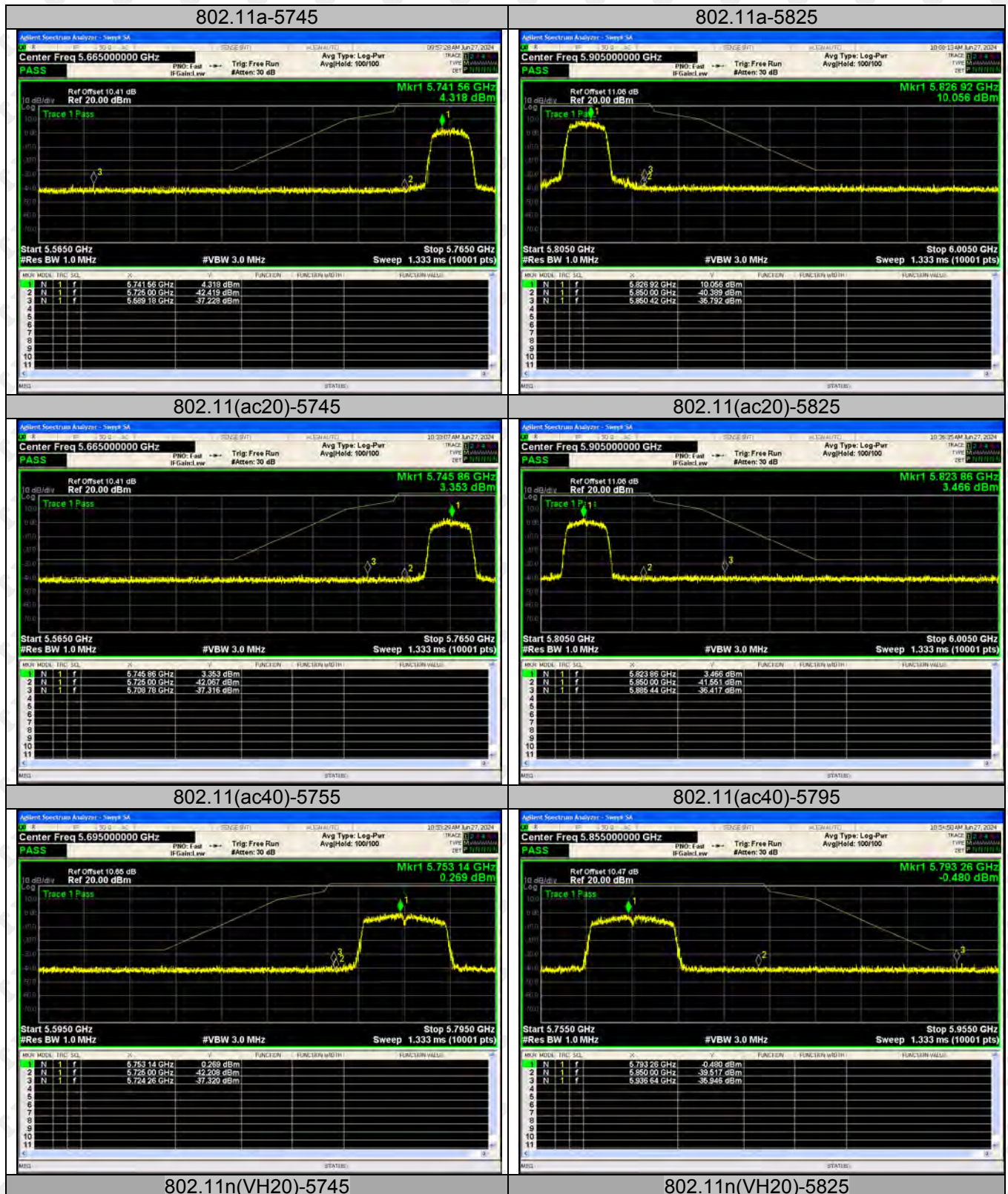


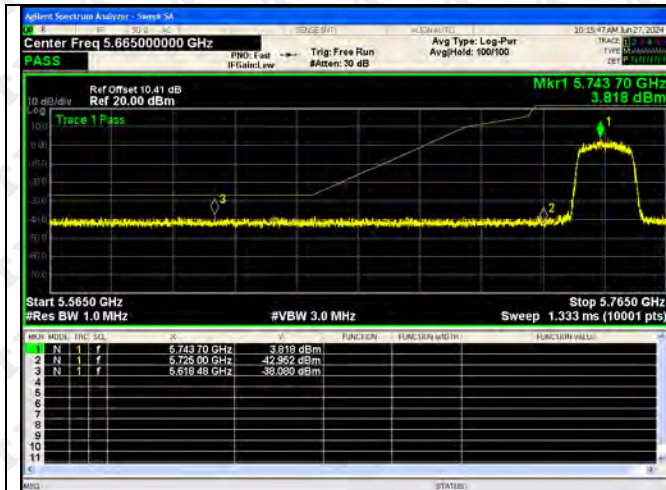
ANT1:



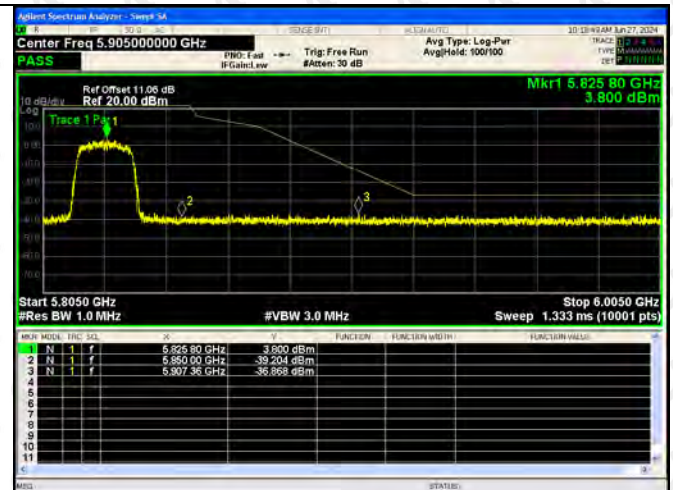


ANT2:





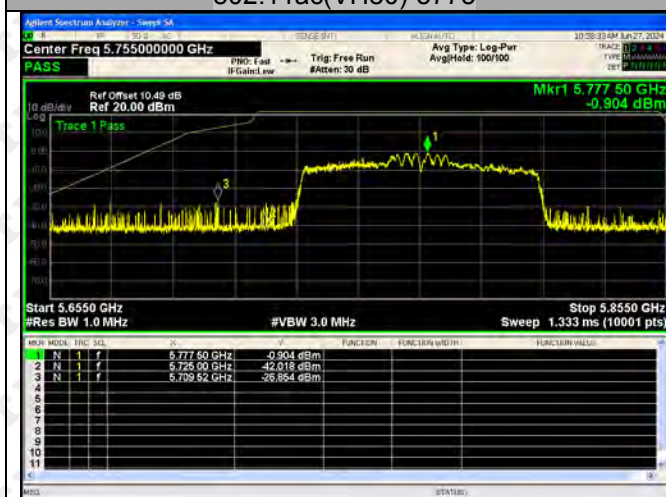
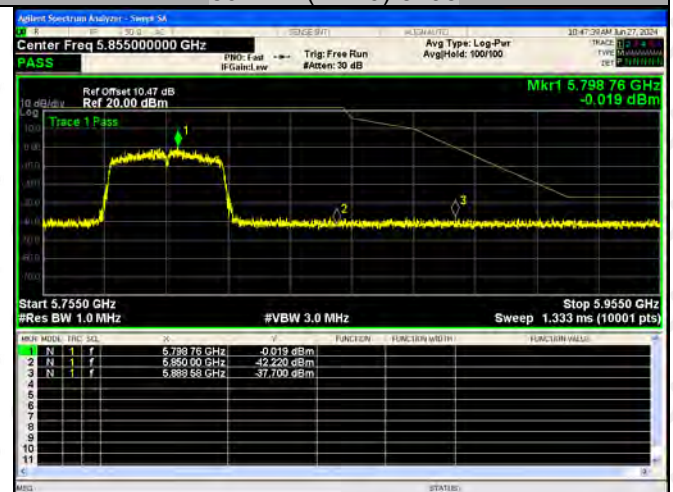
802.11n(VH40)-5755



802.11n(VH40)-5795

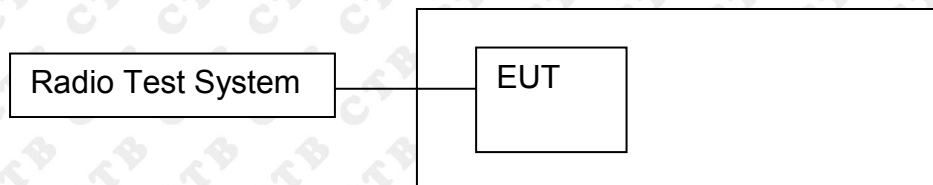


802.11ac(VH80)-5775



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

ANT 1+ANT 2

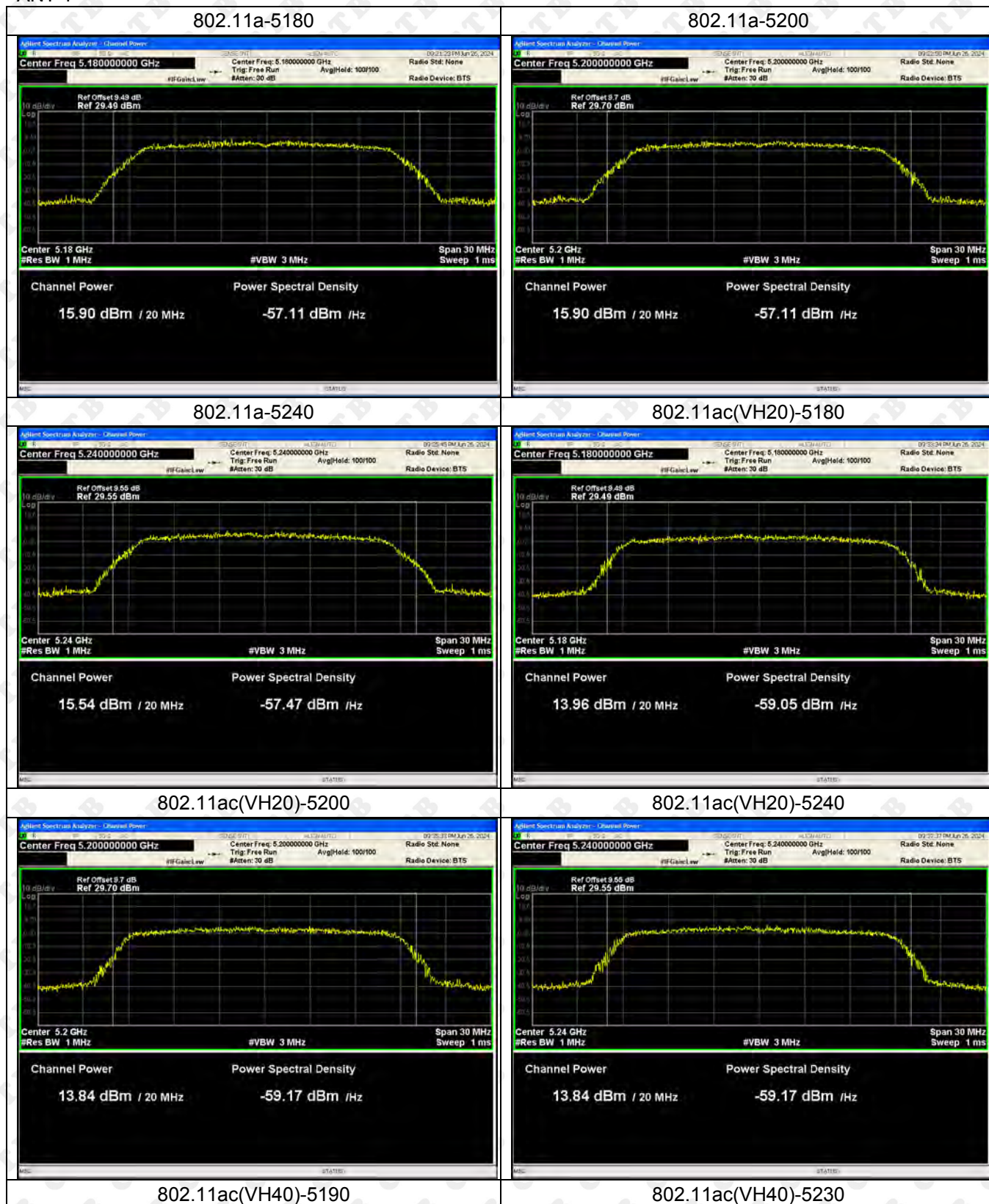
Test mode1	Test Channel (MHz)	Output Power dBm ANT1	Output Power dBm ANT2	Output Power dBm Total	Limit dBm
802.11a	5180	15.896	16.705	/	23.98
	5200	15.898	16.503	/	23.98
	5240	15.536	15.92	/	23.98
802.11ac20	5180	13.965	15.083	17.570	23.98
	5200	13.837	14.924	17.425	23.98
	5240	13.835	14.212	17.038	23.98
802.11ac40	5190	13.665	15.112	17.459	23.98
	5230	13.644	14.313	17.002	23.98
802.11ac80	5210	13.686	13.329	16.521	23.98
802.11n(HT20)	5180	14.169	15.429	17.855	23.98
	5200	14.288	15.415	17.898	23.98
	5240	14.325	14.602	17.476	23.98
802.11n(HT40)	5190	14.013	15.169	17.640	23.98
	5230	14.181	14.181	17.191	23.98

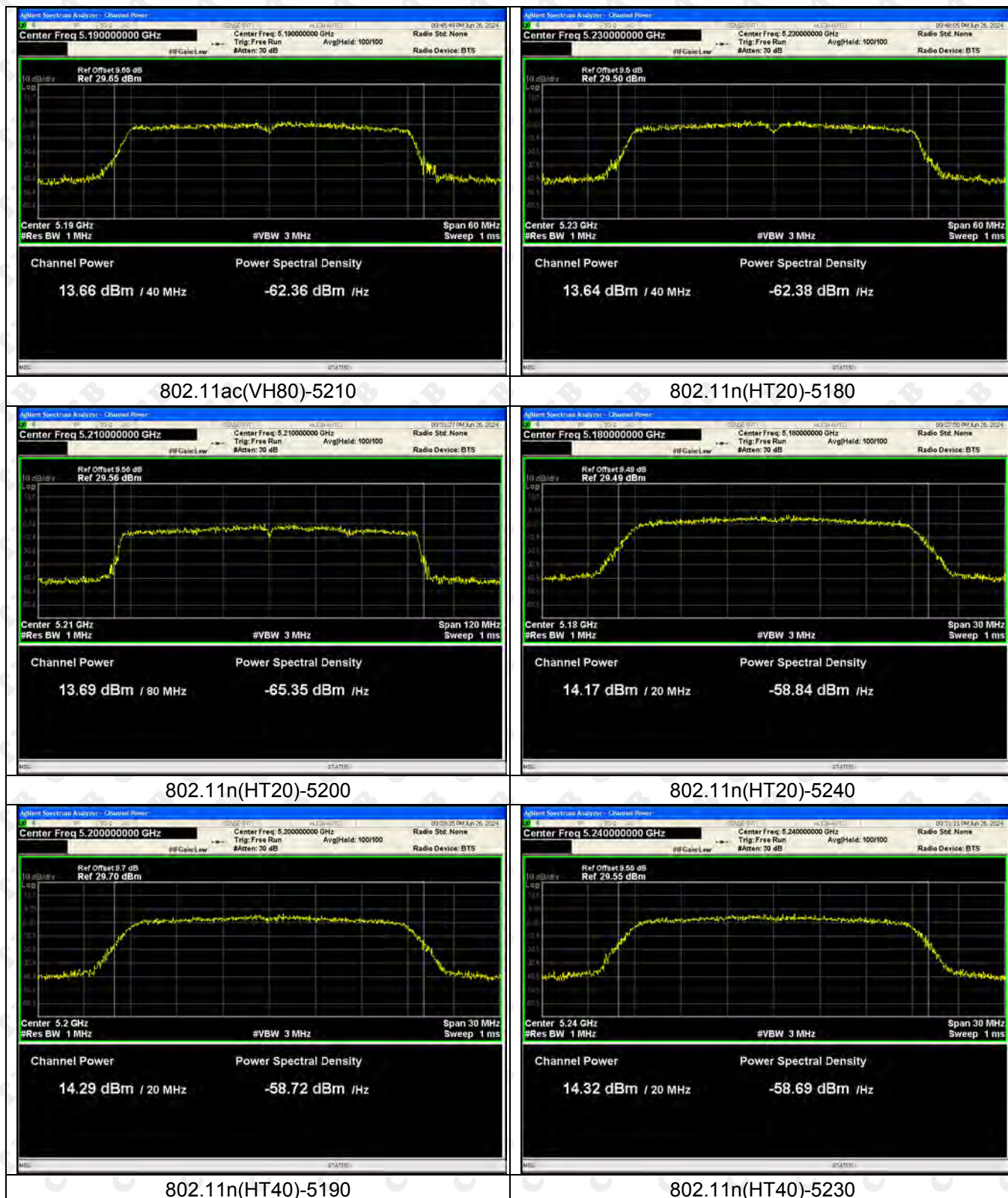
ANT 1+ANT 2

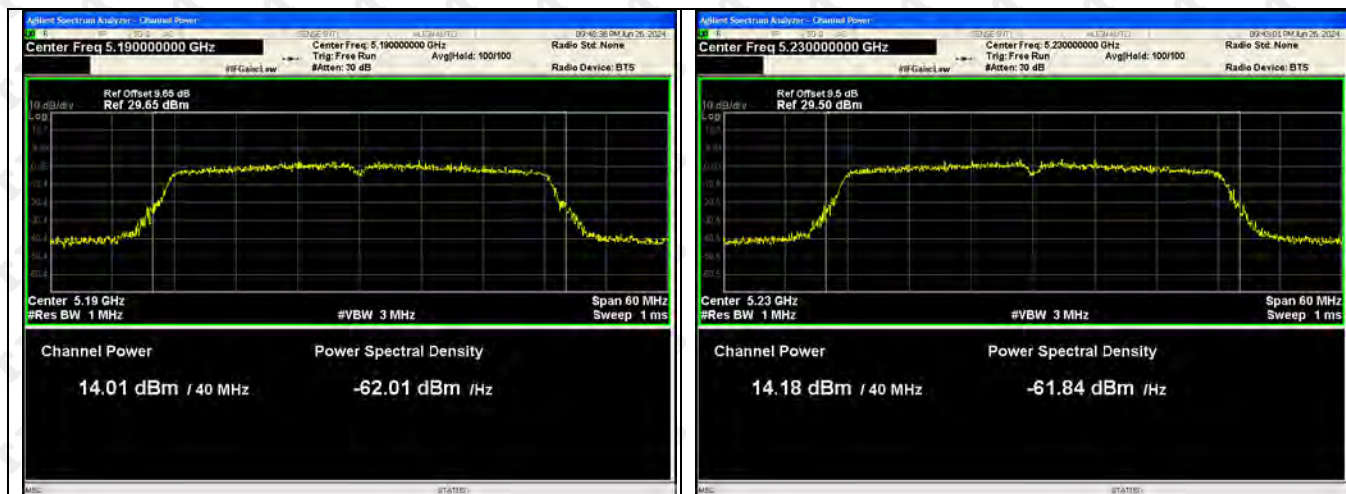
Test mode1	Test Channel (MHz)	Output Power dBm ANT1	Output Power dBm ANT2	Output Power dBm Total	Limit dBm
802.11a	5745	13.813	10.3	/	30
	5785	13.68	9.283	/	30
	5825	14.259	10.441	/	30
802.11ac20	5745	12.674	9.513	14.385	30
	5785	11.997	8.696	13.663	30
	5825	13.247	10.466	15.086	30
802.11ac40	5755	13.184	9.991	14.885	30
	5795	12.482	9.182	14.148	30
802.11ac80	5775	12.74	10.715	14.855	30
802.11n(HT20)	5745	13.271	9.56	14.811	30
	5785	12.492	8.528	13.958	30
	5825	13.088	10.346	14.940	30
802.11n(HT40)	5755	12.995	10.095	14.793	30
	5795	12.913	9.227	14.460	30

5180-5240MHz

ANT 1

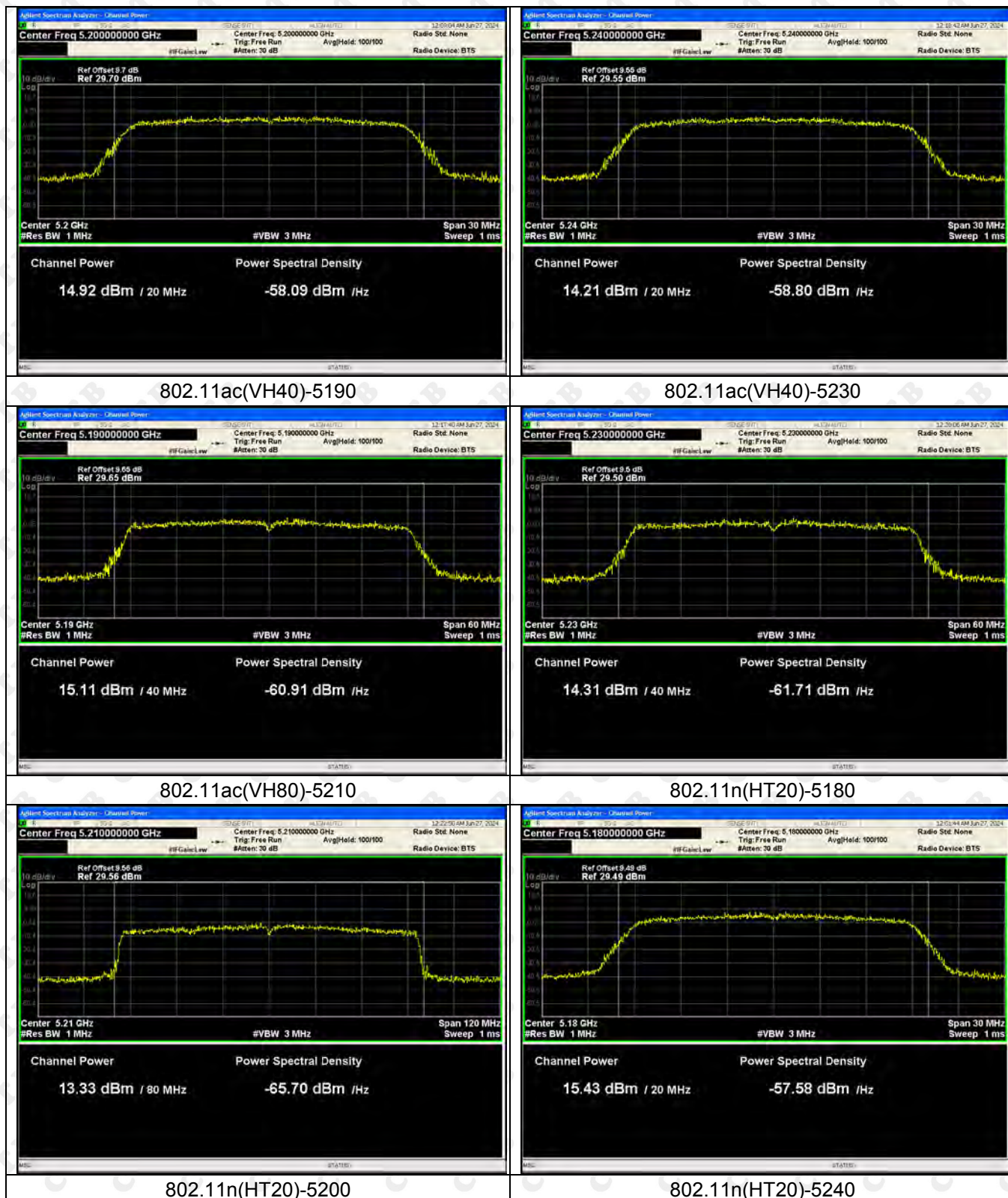






ANT2

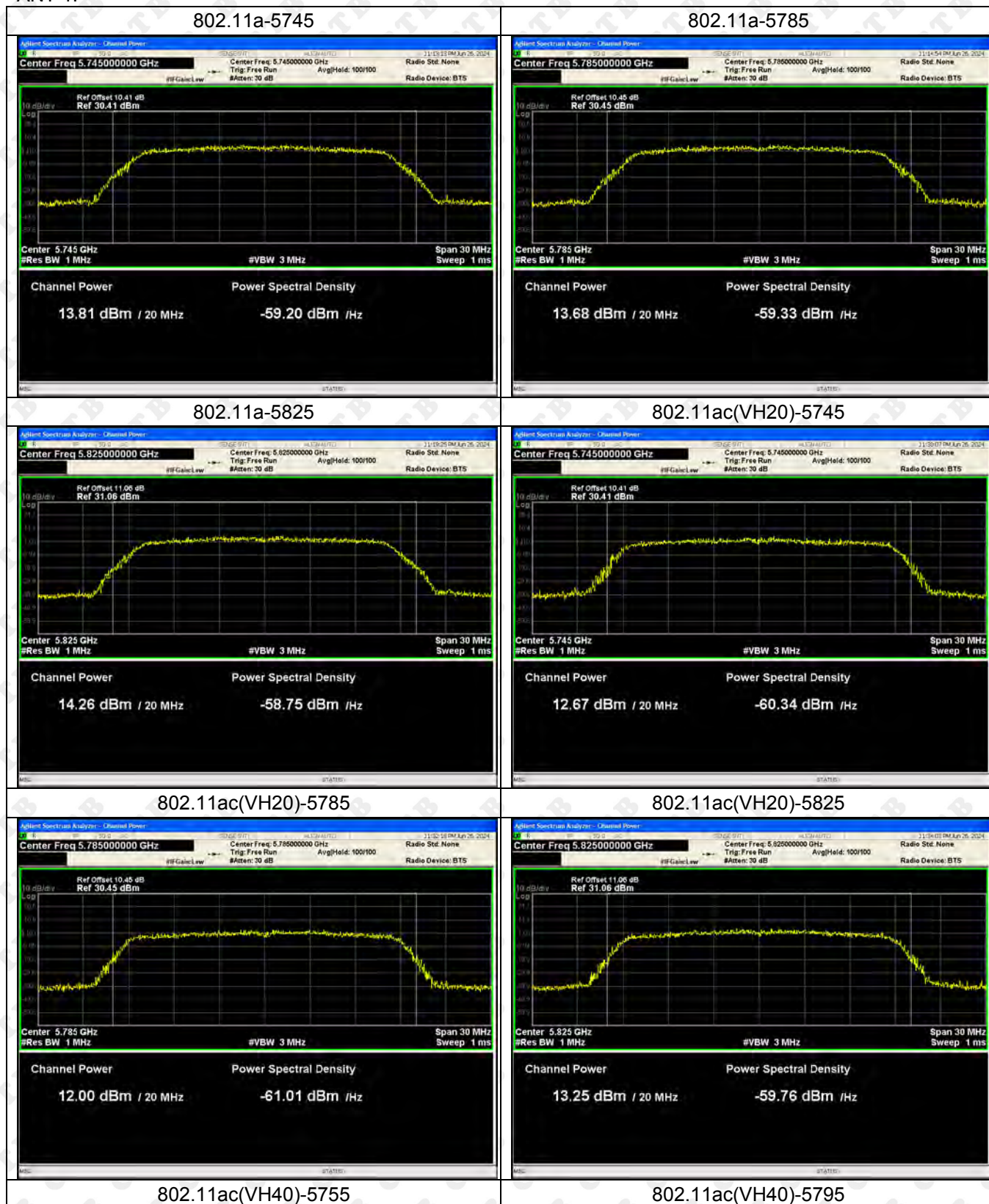


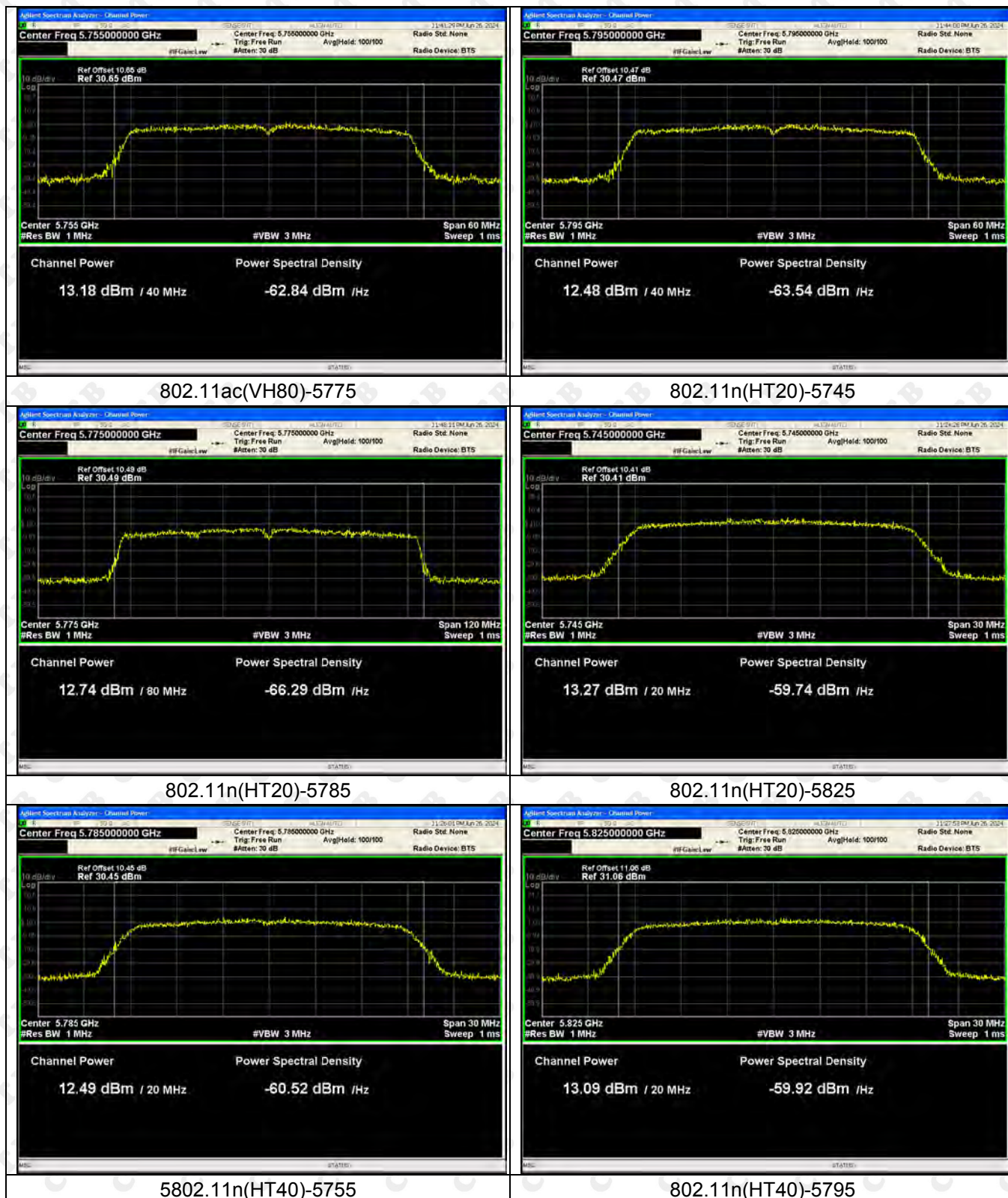


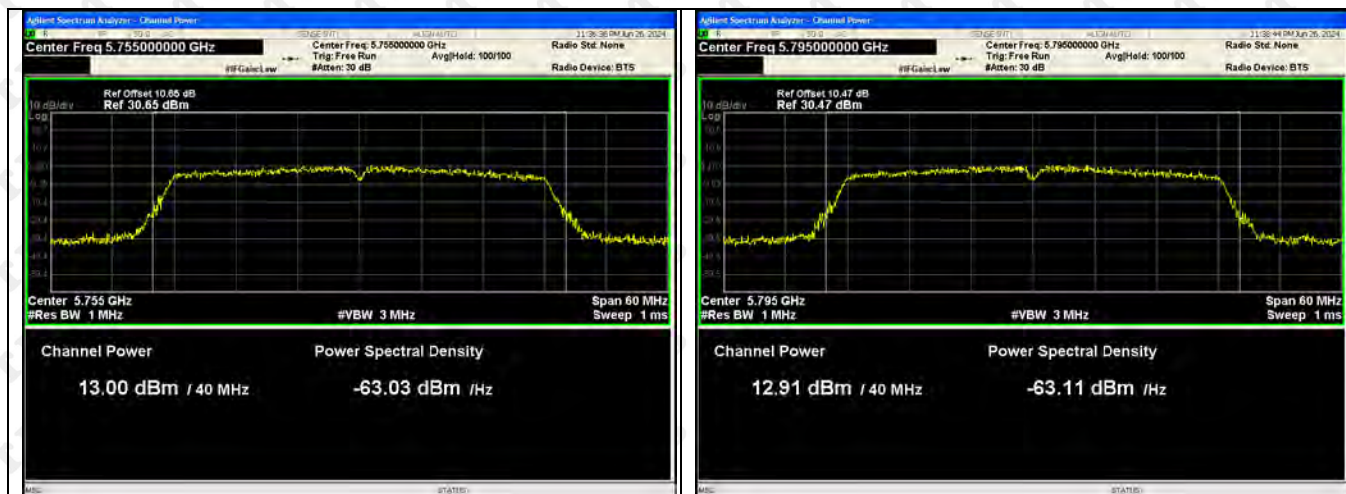


5745-5825MHz

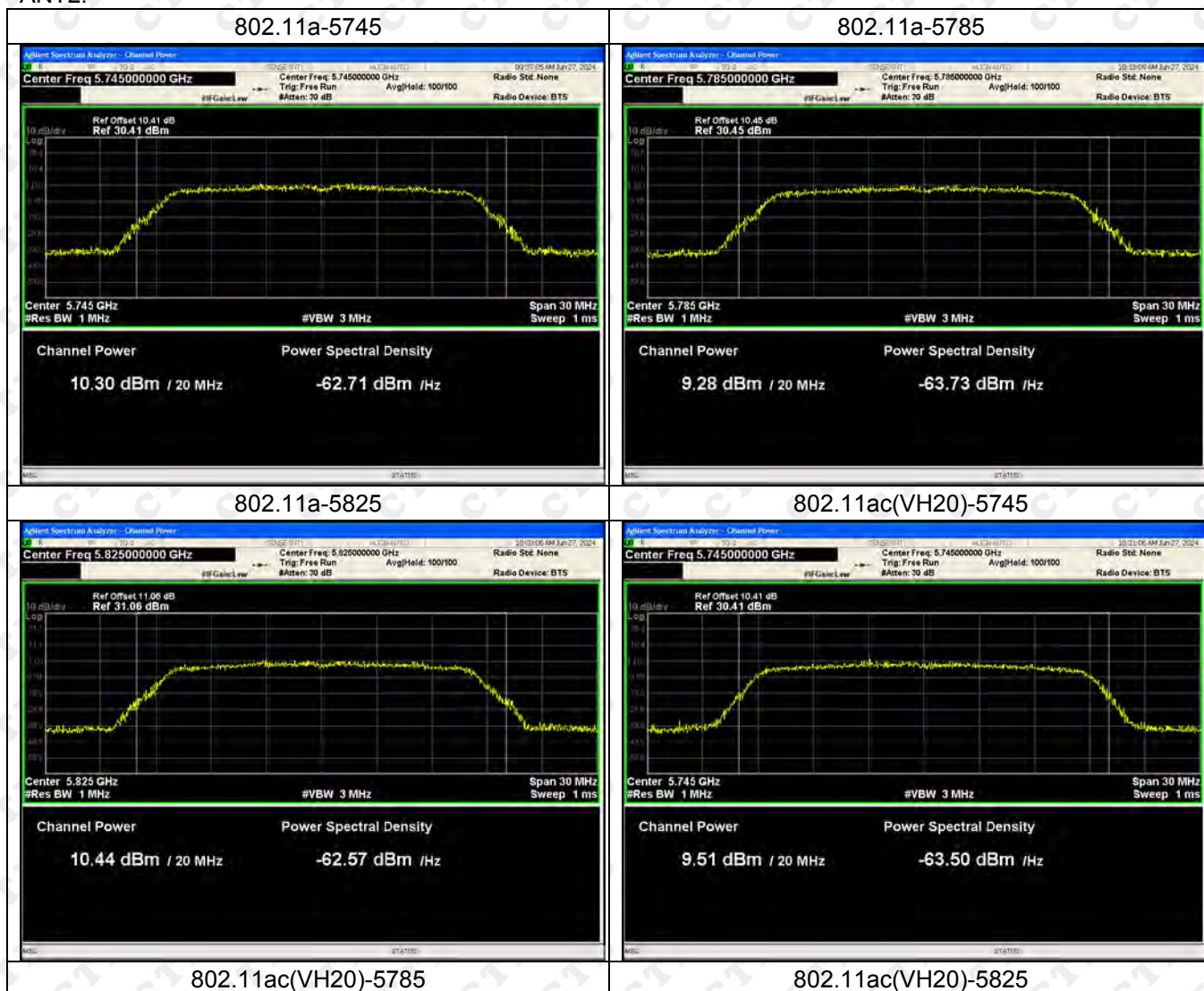
ANT 1:

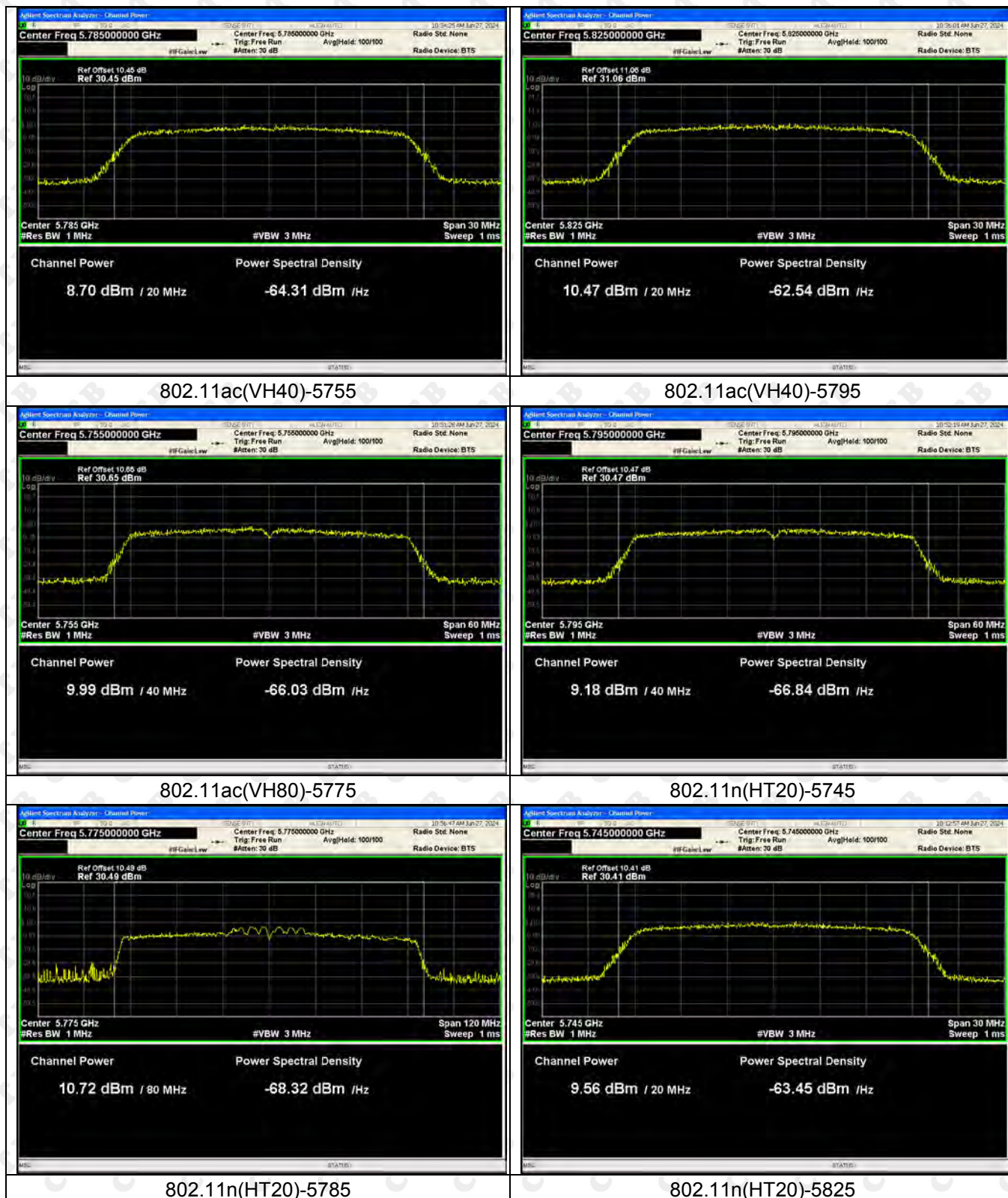


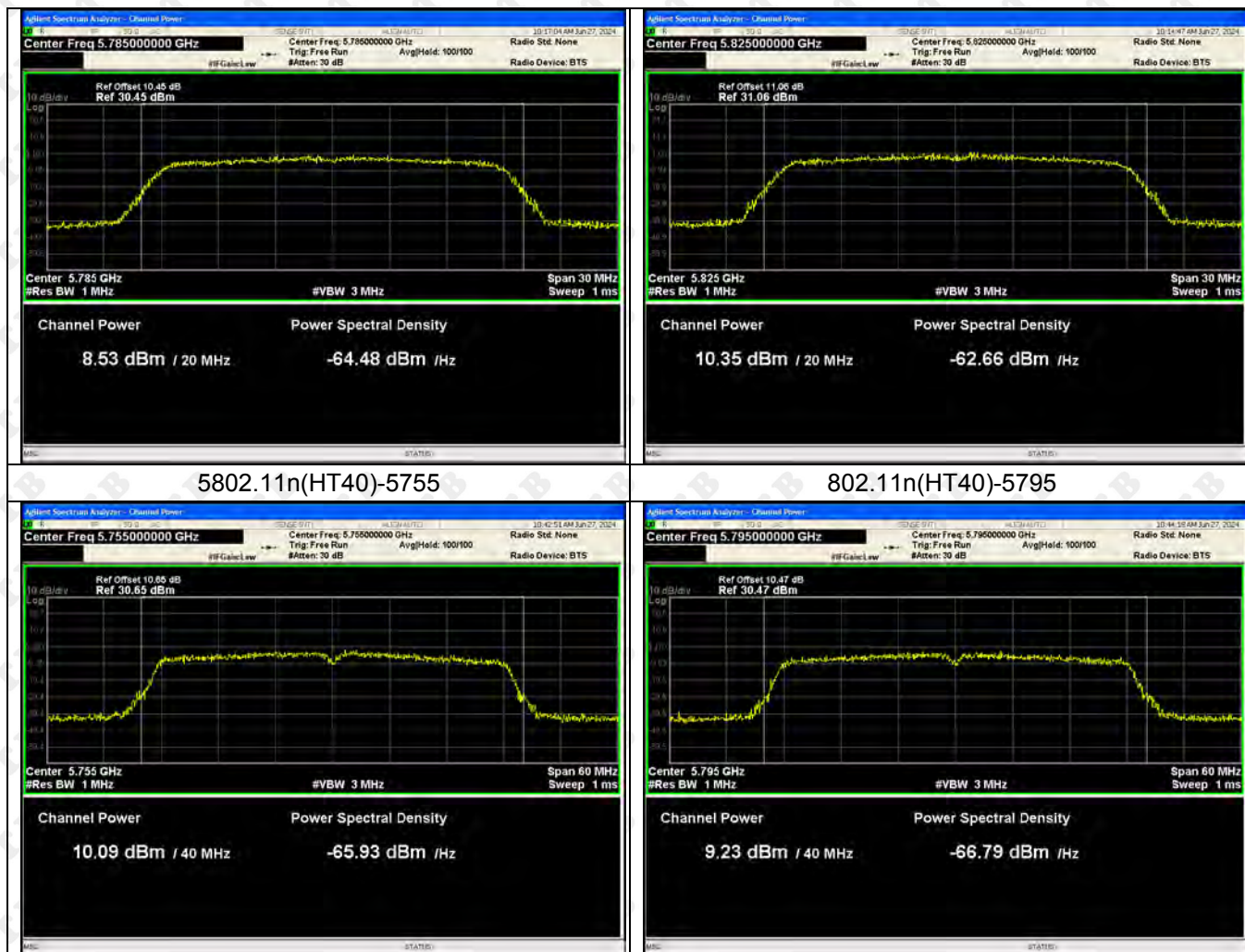




ANT2:

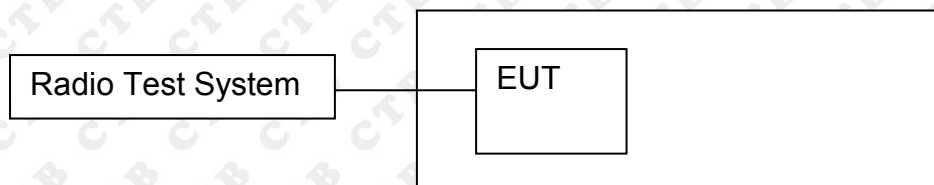






10. EMISSION BANDWIDTH& OCCUPIED BANDWIDTH

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) $\geq 3 * \text{RBW}$.
- Detector = Peak.
- 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 $\geq 3 * \text{RBW}$
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 ANT 1	Test Channel (MHz)	26dB Bandwidth (MHz)
802.11a	5180	19.545
	5200	19.622
	5240	19.559
802.11ac20	5180	20.208
	5200	20.05
	5240	19.967
802.11ac40	5190	39.725
	5230	38.829
802.11ac80	5210	79.453
802.11n(HT20)	5180	19.938
	5200	20.029
	5240	19.719
802.11n(HT40)	5190	38.691
	5230	39.049

Test mode ANT 2	Test Channel (MHz)	26dB Bandwidth (MHz)
802.11a	5180	19.693
	5200	19.239
	5240	19.401
802.11ac20	5180	20.05
	5200	19.943
	5240	20.241
802.11ac40	5190	40.046
	5230	38.942
802.11ac80	5210	77.858
802.11n(HT20)	5180	19.757
	5200	20.029
	5240	19.931
802.11n(HT40)	5190	39.737
	5230	39.049

5725-5850 MHz

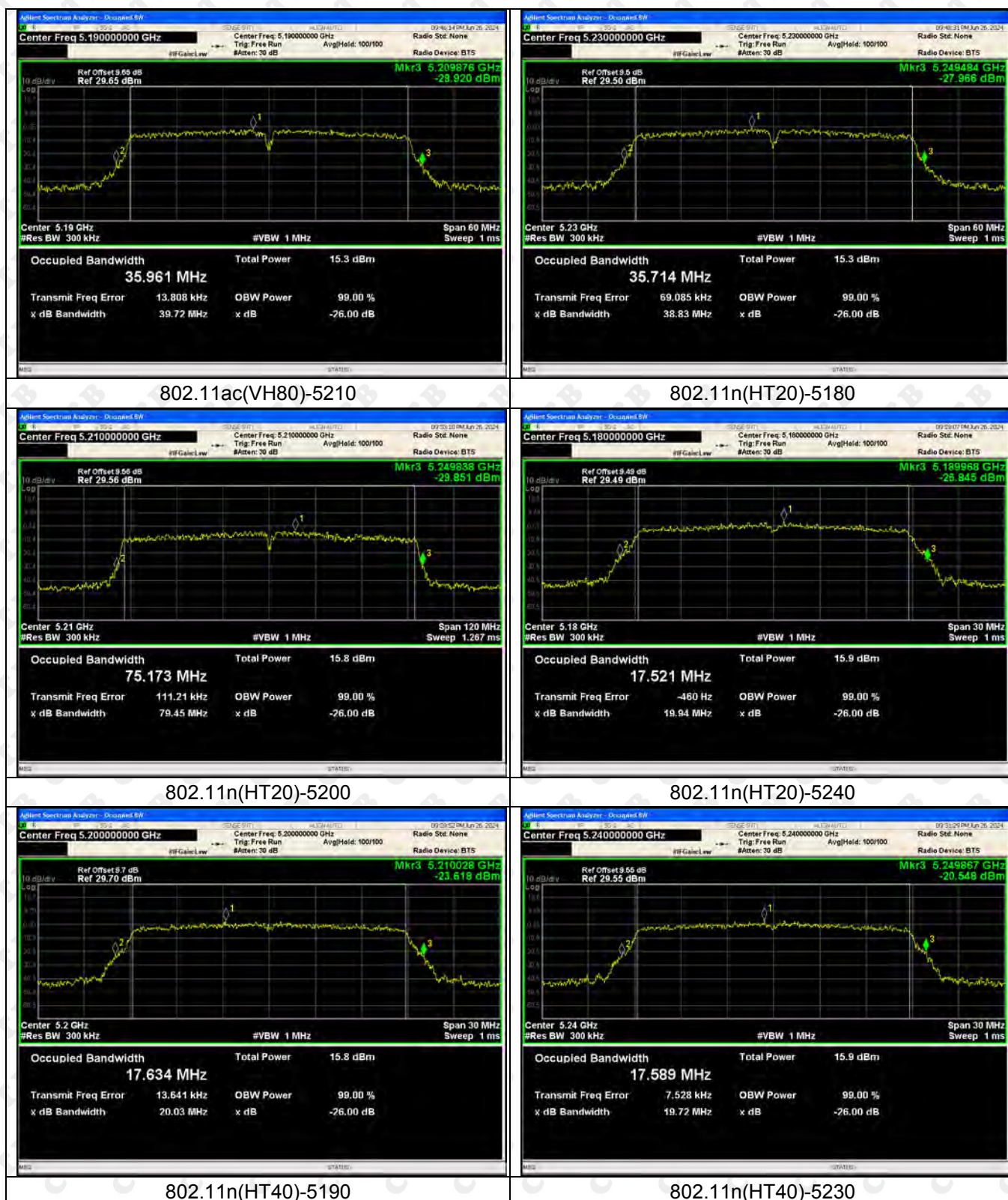
Test mode Ant 1	Test Channel (MHz)	6dB Bandwidth (MHz)	Result
802.11a	5745	15.733	Pass
	5785	16.351	Pass
	5825	14.707	Pass
802.11ac(VH20)	5745	15.445	Pass
	5785	15.036	Pass
	5825	15.114	Pass
802.11ac(VH40)	5755	35.145	Pass
	5795	35.1	Pass
802.11ac(VH80)	5775	75.096	Pass
802.11n(VH20)	5745	16.006	Pass
	5785	15.357	Pass
	5825	16.187	Pass
802.11n(VH40)	5755	35.378	Pass
	5795	35.113	Pass

Test mode Ant 2	Test Channel (MHz)	6dB Bandwidth (MHz)	Result
802.11a	5745	15.748	Pass
	5785	16.035	Pass
	5825	15.394	Pass
802.11ac(VH20)	5745	17.283	Pass
	5785	16.067	Pass
	5825	15.118	Pass
802.11ac(VH40)	5755	35.122	Pass
	5795	33.907	Pass
802.11ac(VH80)	5775	75.17	Pass
802.11n(VH20)	5745	17.25	Pass
	5785	16.885	Pass
	5825	16.629	Pass
802.11n(VH40)	5755	35.135	Pass
	5795	35.417	Pass

5180-5240MHz

ANT 1

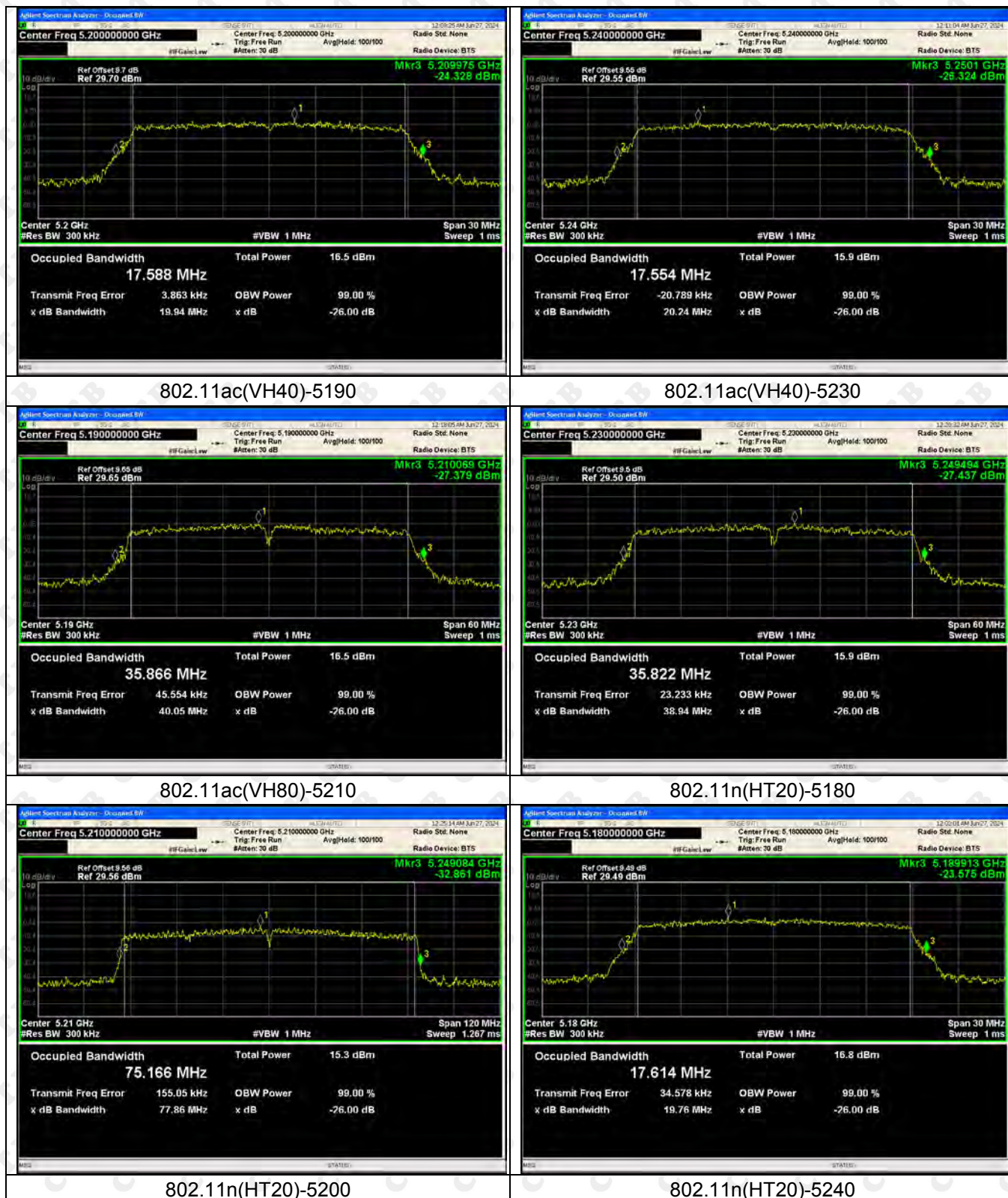






ANT2







802.11n(HT40)-5190

802.11n(HT40)-5230

5745-5825MHz

ANT 1:

802.11a-5745



802.11a-5785



802.11a-5825



802.11ac(VH20)-5745



802.11ac(VH20)-5785



802.11ac(VH20)-5825

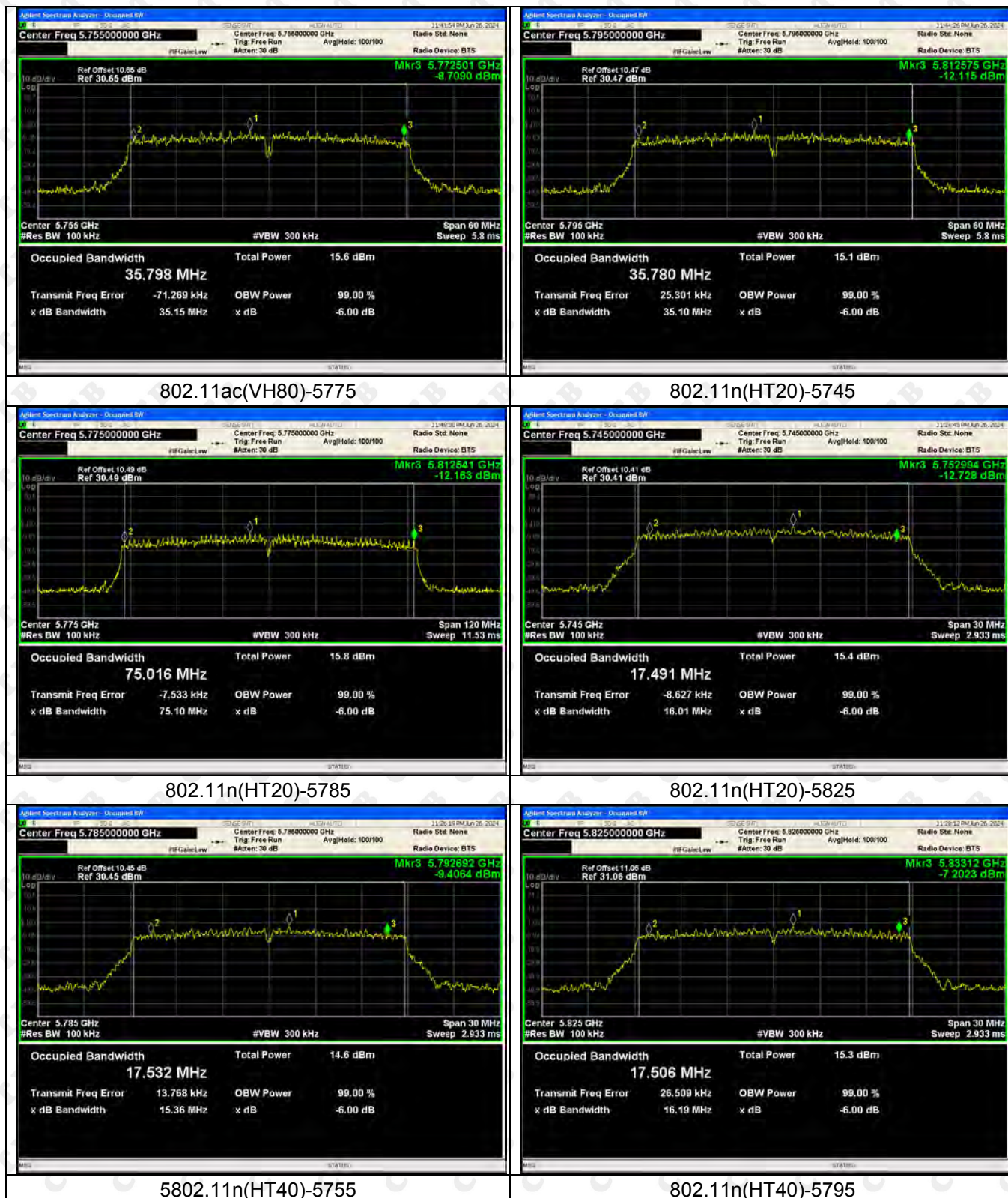


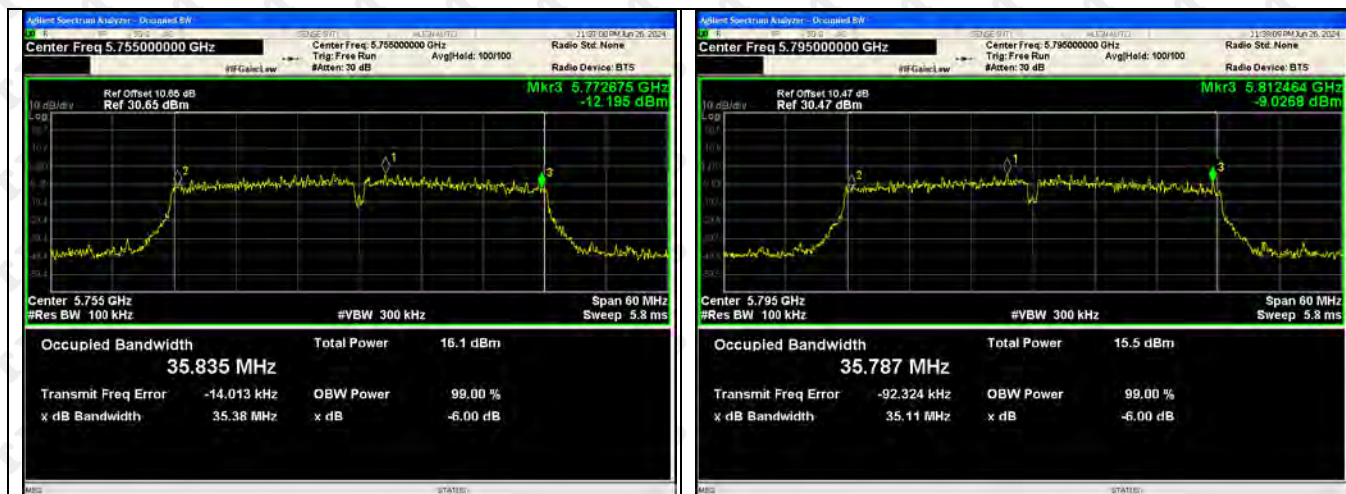
802.11ac(VH40)-5755



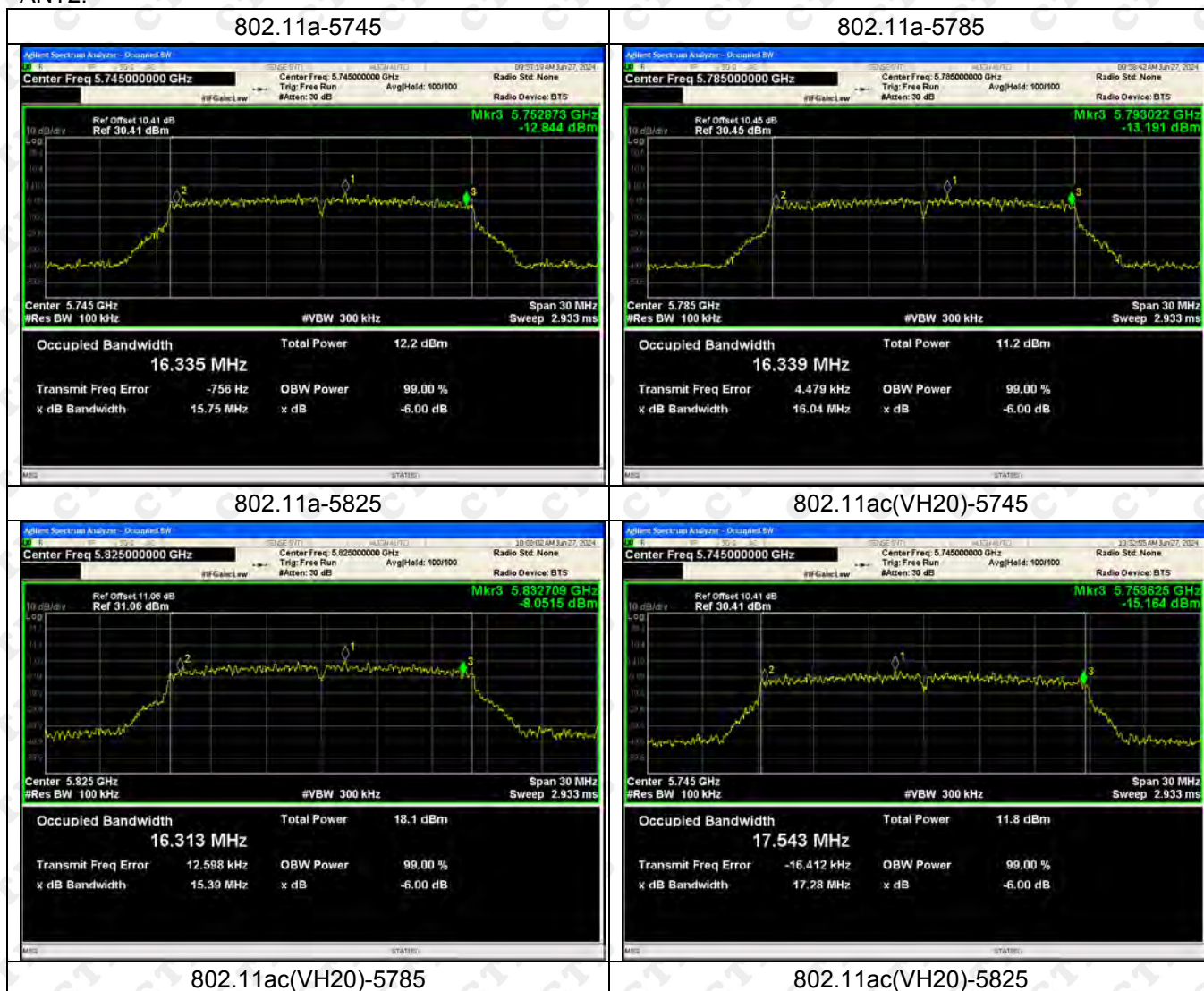
802.11ac(VH40)-5795

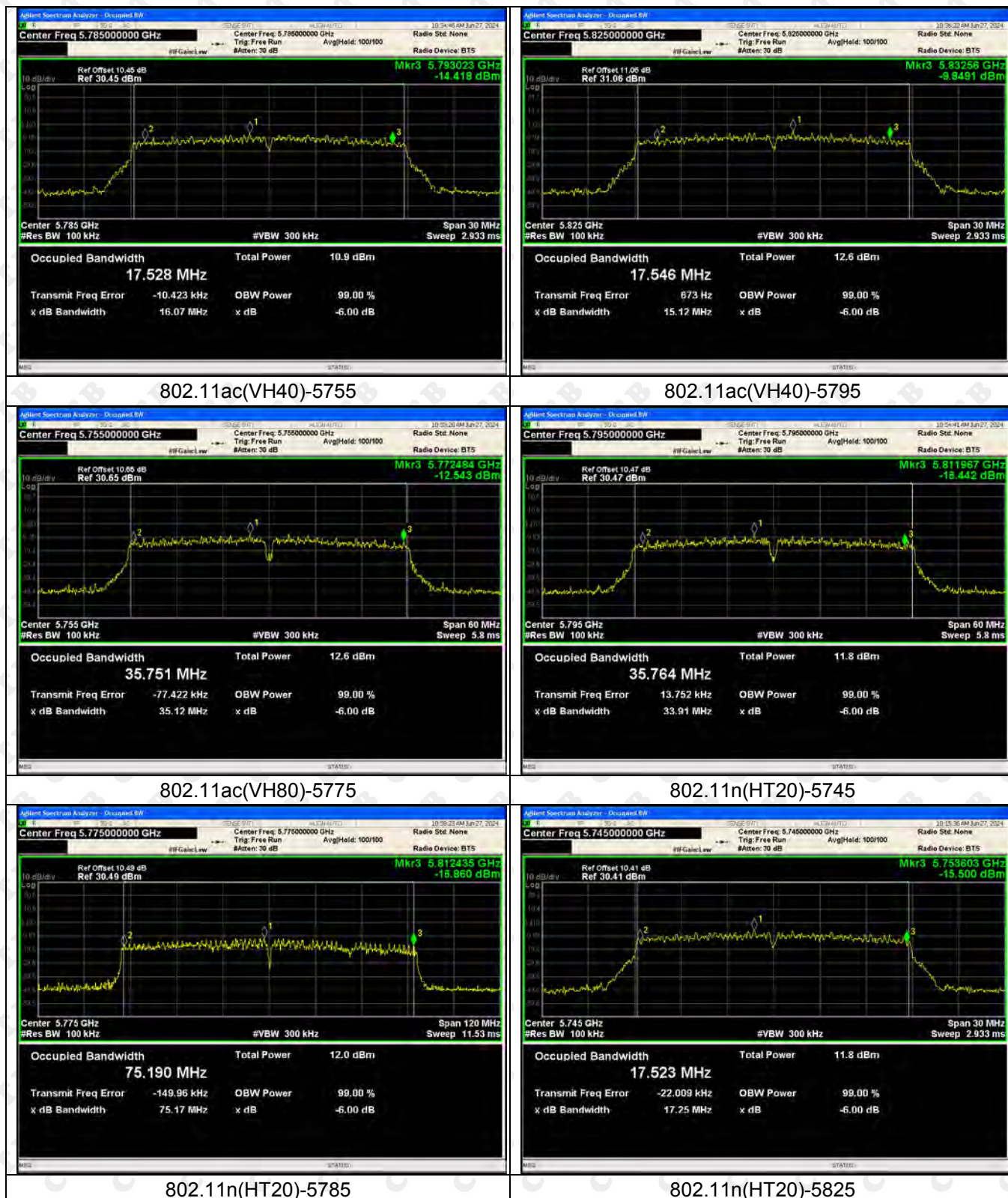






ANT2:

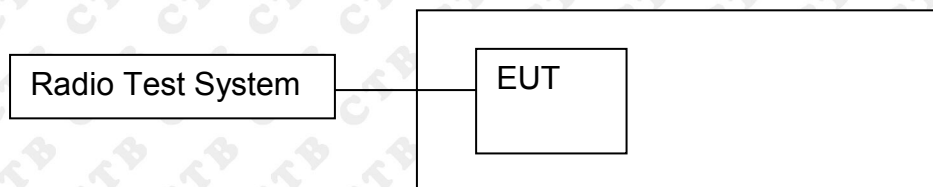






11. POWER SPECTRAL DENSITY

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 MHz, or < 500 kHz) and integrated over 1 MHz, or 500 kHz bandwidth, the following adjustments to the procedures apply:

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

b) Set $\text{VBW} \geq 3 \text{ RBW}$.

c) If measurement bandwidth of Maximum PSD is specified in 500 kHz, add $10 \log (500 \text{ kHz}/\text{RBW})$ 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 $10 \log(1\text{MHz}/\text{RBW})$ 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

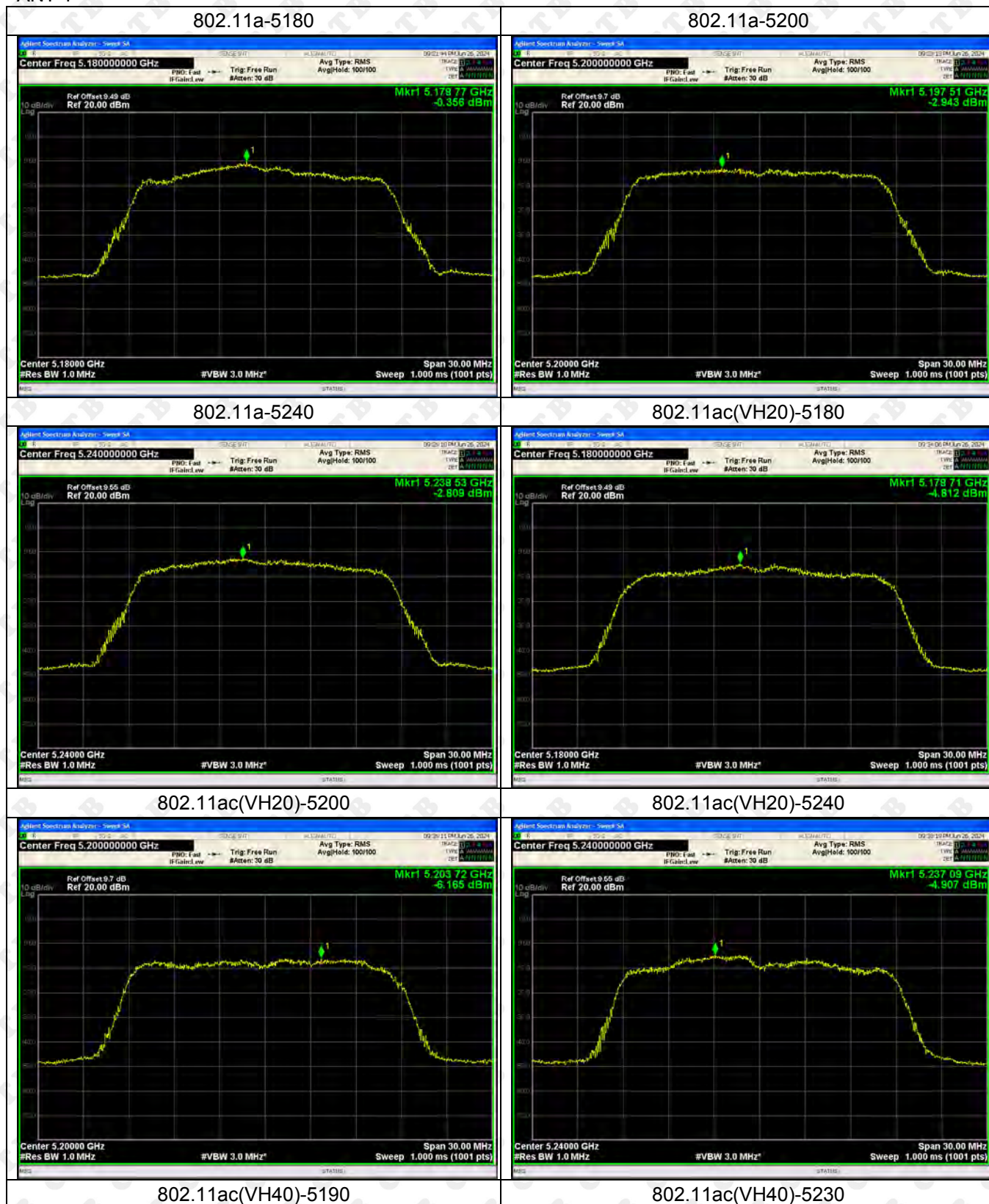
ANT 1+ANT2

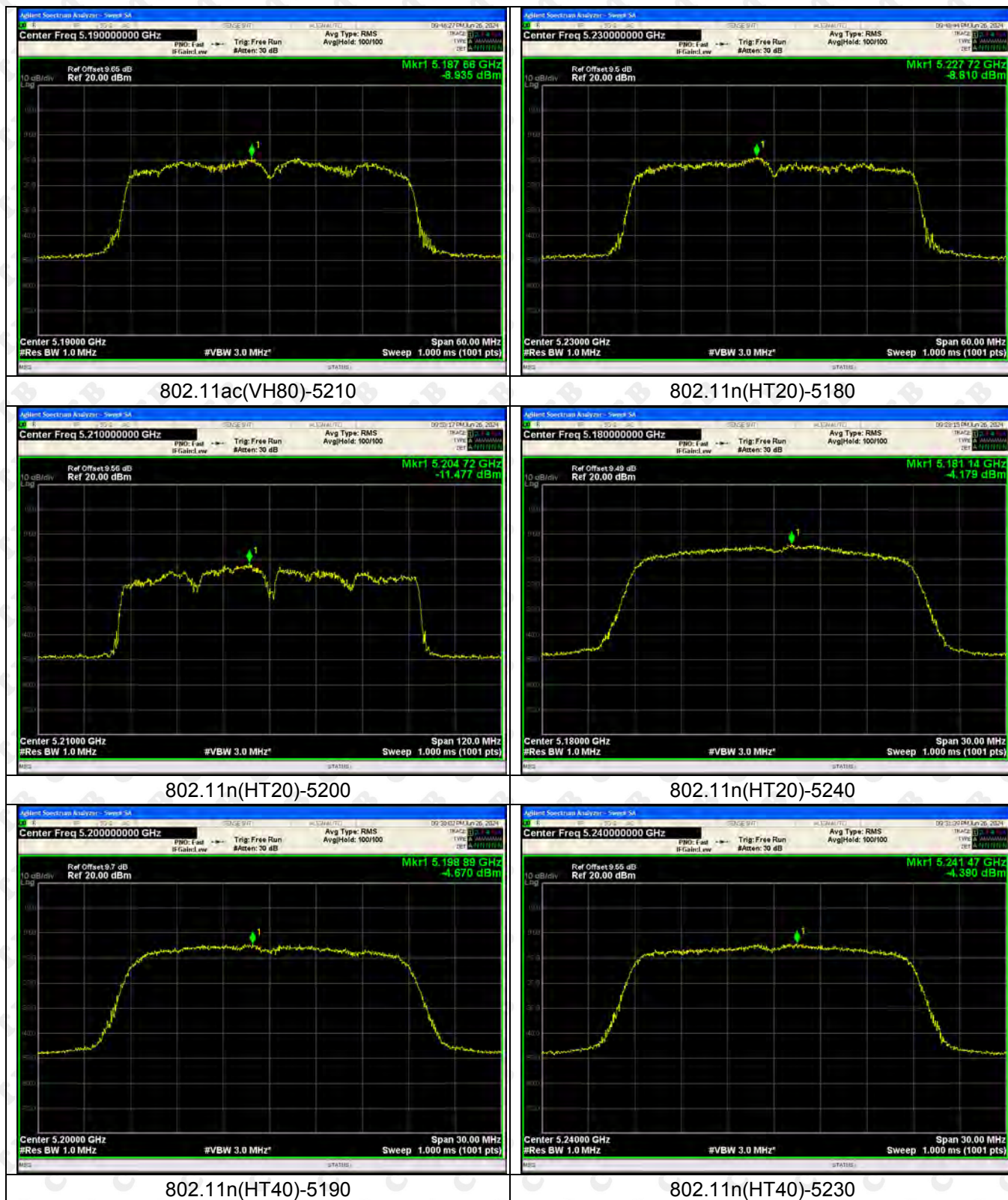
Test mode	Test Channel (MHz)	PSD [dBm/MHz] ANT 1	PSD [dBm/MHz] ANT 2	PSD [dBm/MHz] Total	Limit (dBm/MHz)	Result
802.11a	5180	-0.356	-1.078	/	11	Pass
	5200	-2.943	-2.052	/	11	Pass
	5240	-2.809	-2.624	/	11	Pass
802.11ac(VH20)	5180	-4.812	-3.754	-1.241	11	Pass
	5200	-6.165	-4.719	-2.372	11	Pass
	5240	-4.907	-4.129	-1.490	11	Pass
802.11ac(VH40)	5190	-8.935	-7.622	-5.219	11	Pass
	5230	-8.81	-8.274	-5.523	11	Pass
802.11n(VH20)	5180	-11.477	-12.908	-9.124	11	Pass
	5200	-4.179	-3.302	-0.708	11	Pass
	5240	-4.67	-2.675	-0.549	11	Pass
802.11n(VH40)	5190	-4.39	-3.832	-1.092	11	Pass
	5230	-7.768	-7.107	-4.415	11	Pass
802.11ac(VH80)	5230	-7.801	-7.801	-4.791	11	Pass

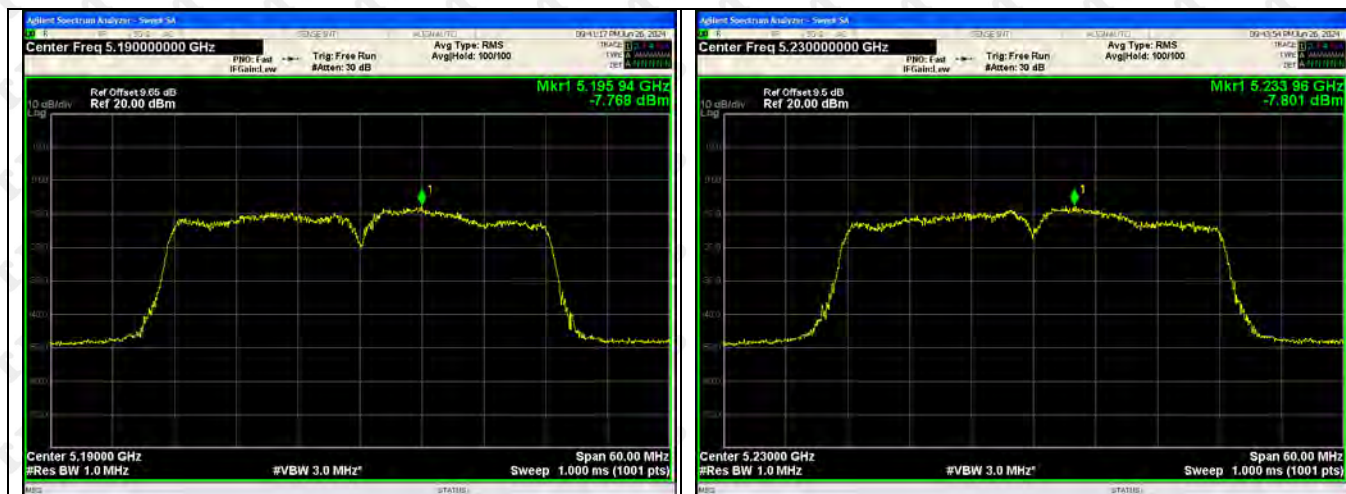
Test mode	Test Channel (MHz)	PSD [dBm/MHz] ANT 1	PSD [dBm/MHz] ANT 2	PSD [dBm/MHz] Total	Limit (dBm)	Result
802.11a	5745	-6.819	-10.827	/	30	Pass
	5785	-6.669	-10.609	/	30	Pass
	5825	-6.924	-5.188	/	30	Pass
802.11ac(VH20)	5745	-9.534	-12.083	-7.614	30	Pass
	5785	-10.064	-12.828	-8.219	30	Pass
	5825	-8.798	-10.707	-6.638	30	Pass
802.11ac(VH40)	5755	-12.421	-14.472	-10.316	30	Pass
	5795	-12.747	-15.645	-10.948	30	Pass
802.11n(VH20)	5775	-16.169	-11.763	-10.419	30	Pass
	5745	-8.009	-11.493	-6.400	30	Pass
	5785	-8.461	-12.927	-7.133	30	Pass
802.11n(VH40)	5825	-8.363	-8.354	-5.348	30	Pass
	5755	-10.71	-14.254	-9.120	30	Pass
802.11ac(VH80)	5795	-12.294	-16.032	-10.762	30	Pass

5180-5240MHz

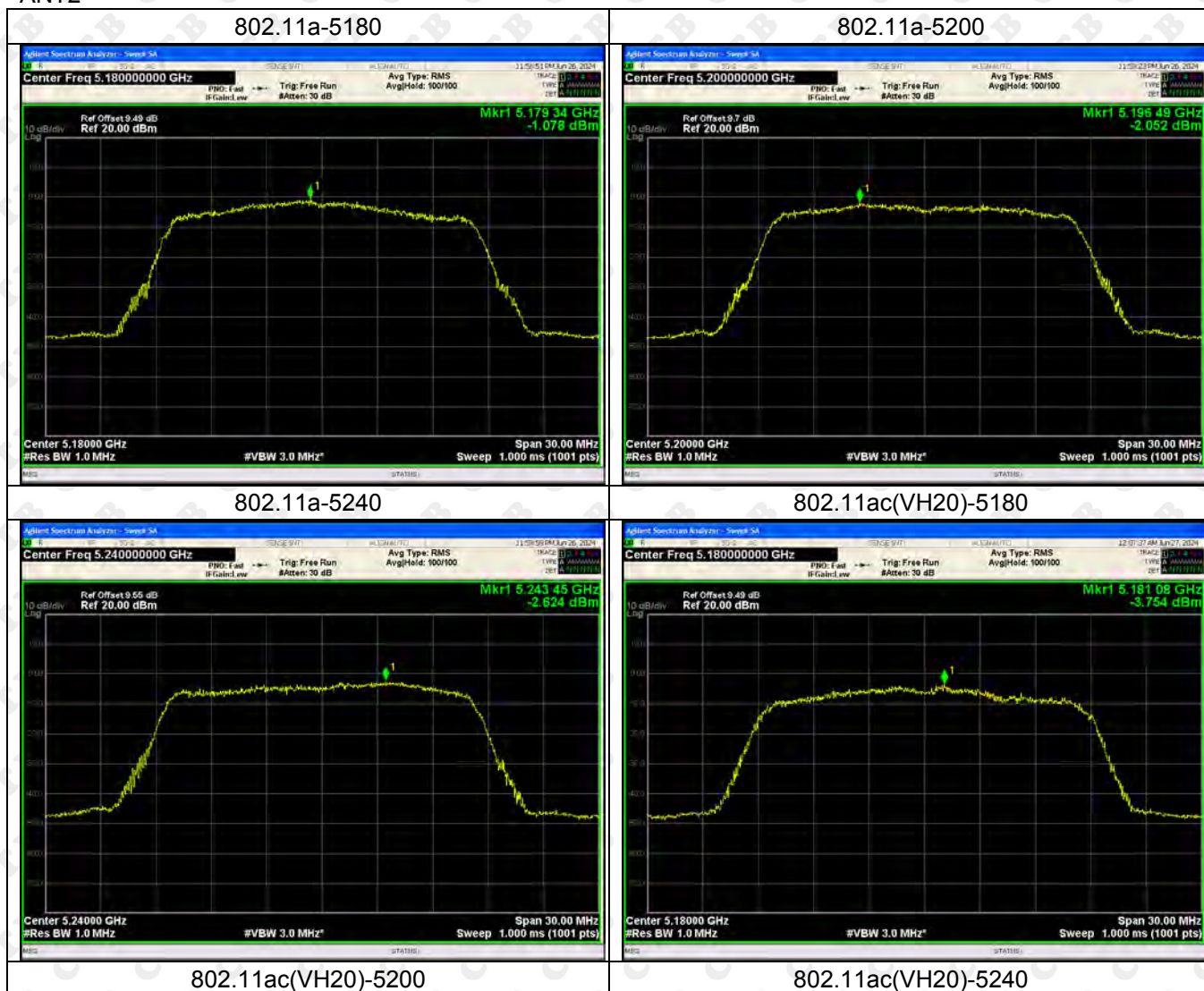
ANT 1

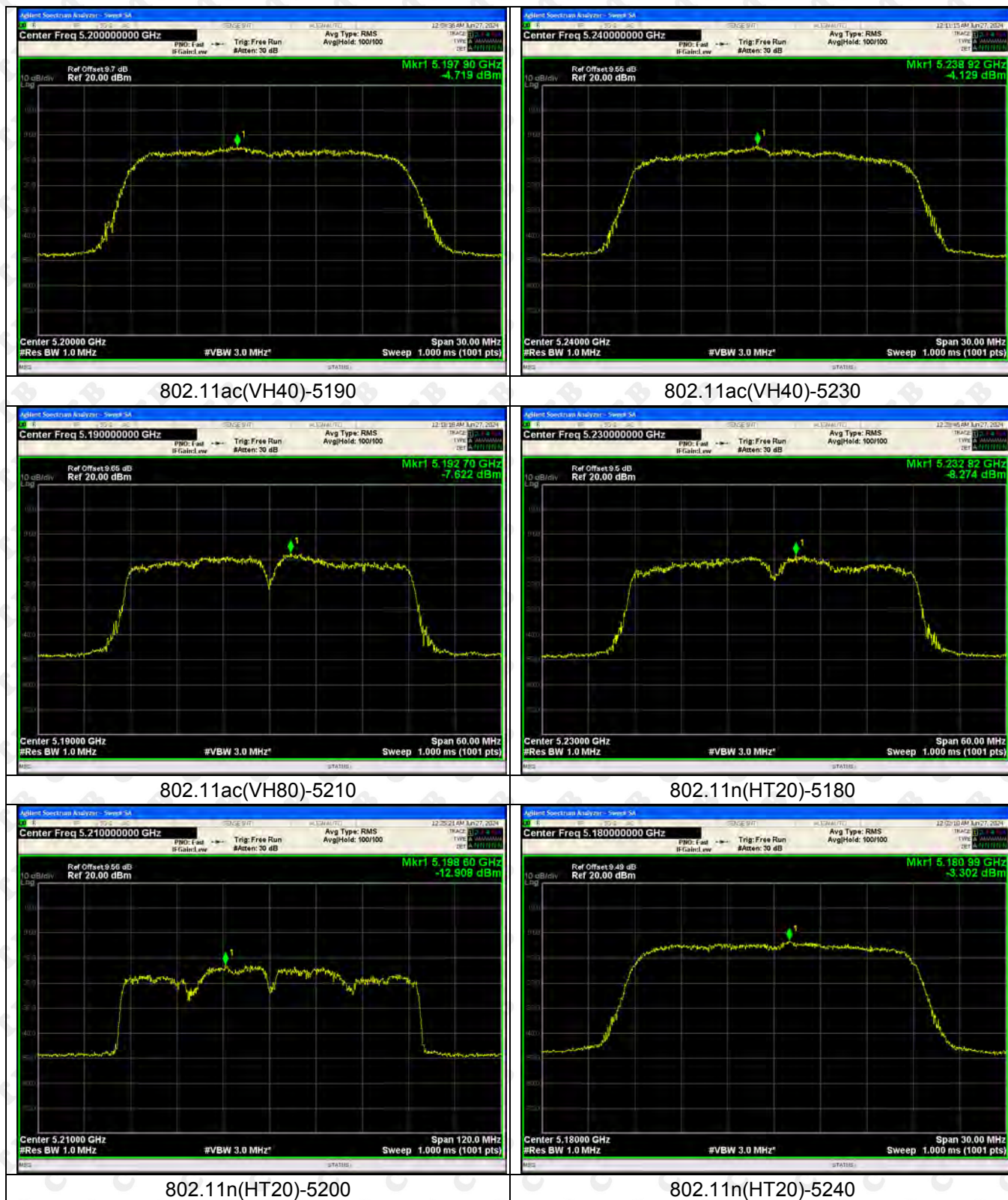






ANT2







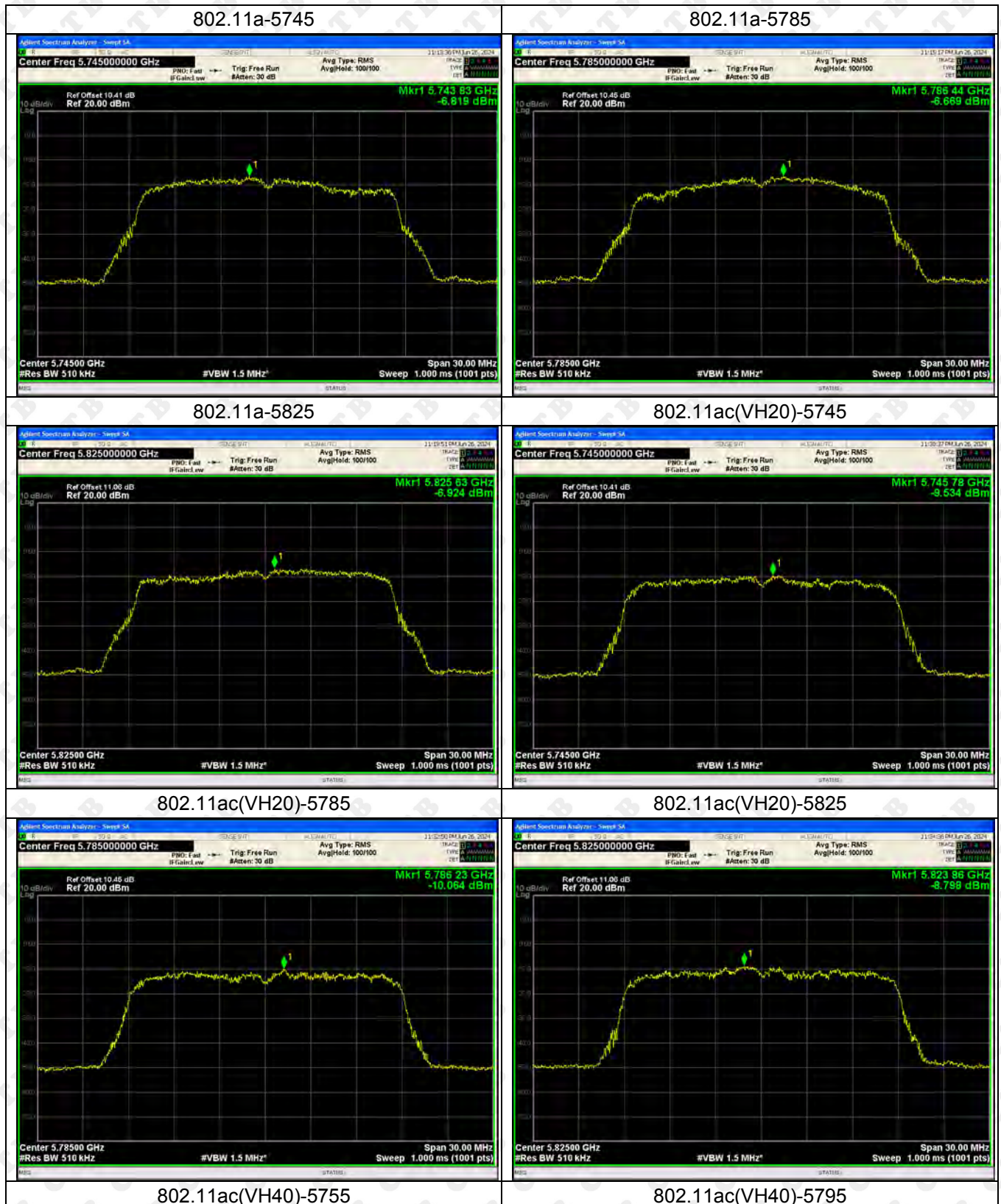
802.11n(HT40)-5190

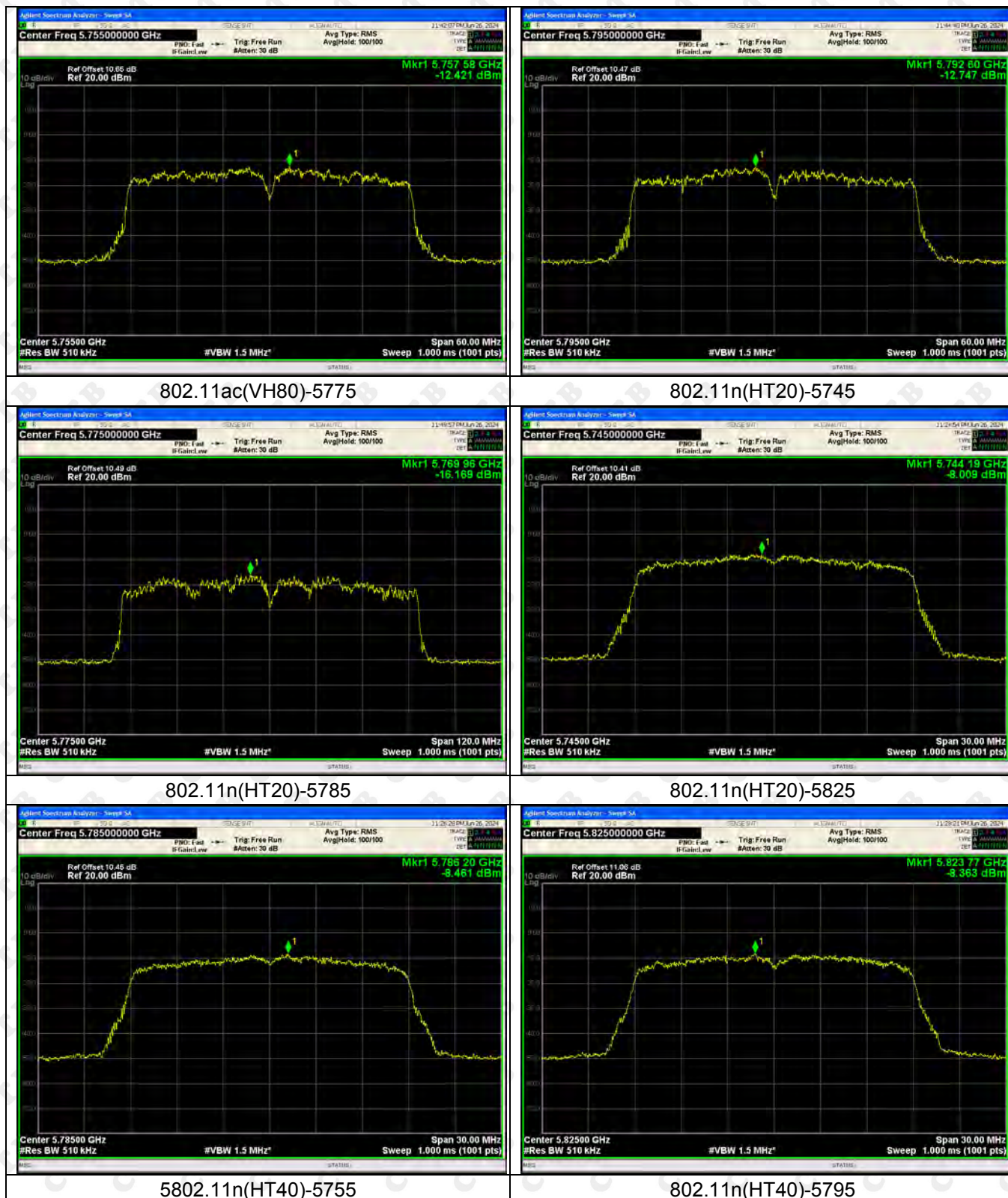


802.11n(HT40)-5230



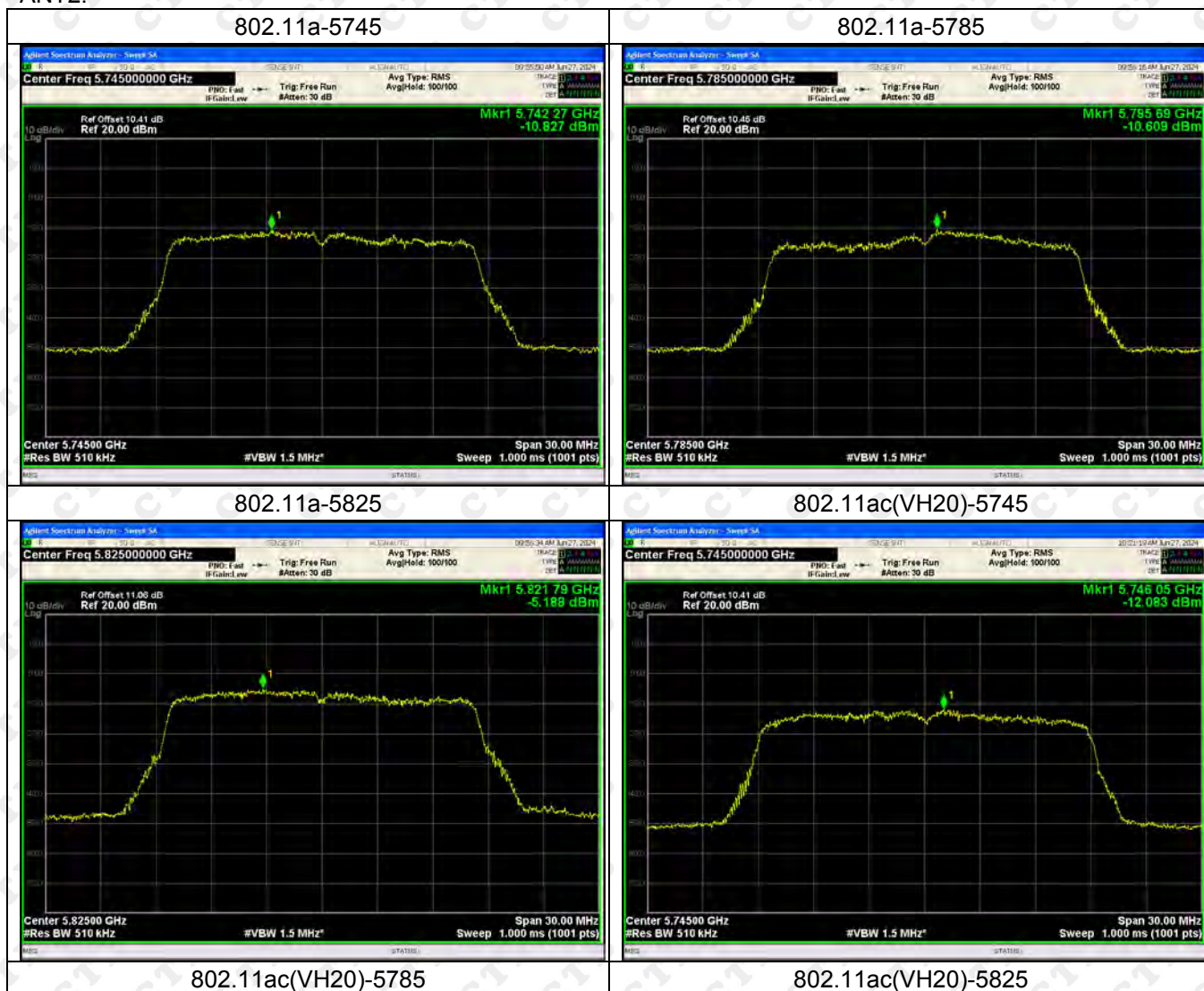
5745-5825MHz
ANT 1:







ANT2:





802.11ac(VH40)-5755



802.11ac(VH40)-5795



802.11ac(VH80)-5775



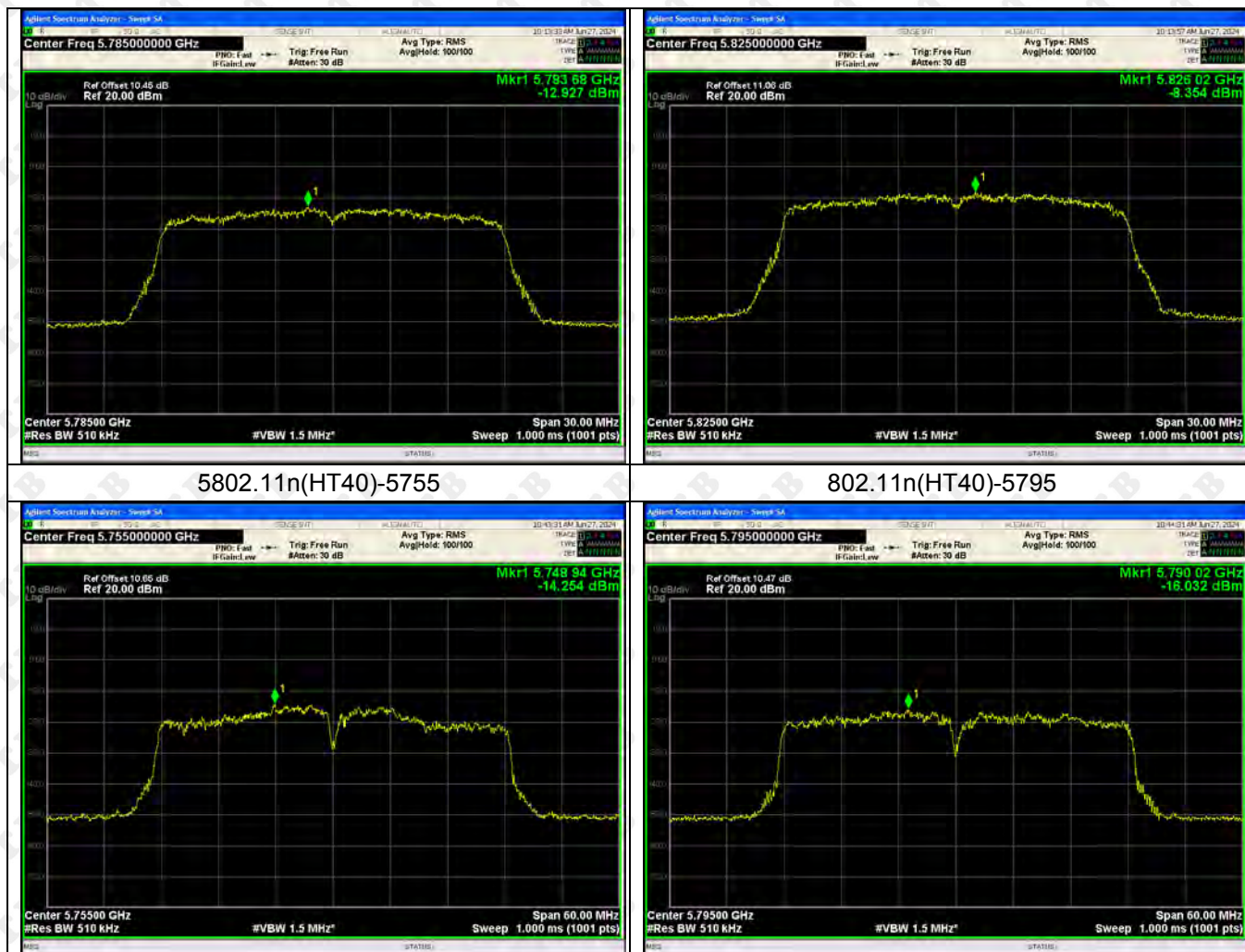
802.11n(HT20)-5745



802.11n(HT20)-5785

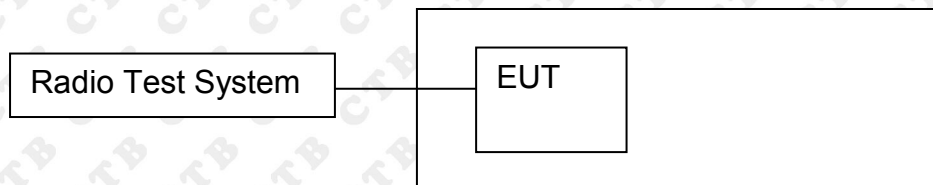


802.11n(HT20)-5825



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

ANT1:

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)	120	5180.0119	5180	0.0119	2.2997
		V max (V)	132	5180.1099	5180	0.1099	21.2066
		V min (V)	108	5180.0415	5180	0.0415	8.0144
Limits				±20ppm			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency: 5180MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	120	T (°C)	0	5180.0140	5180	0.0140	2.6969
		T (°C)	10	5180.0393	5180	0.0393	7.5913
		T (°C)	20	5180.0023	5180	0.0023	0.4465
		T (°C)	30	5180.0501	5180	0.0501	9.6684
		T (°C)	40	5180.0433	5180	0.0433	8.3574
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)	120	5200.0443	5200	0.0443	8.5227
		V max (V)	132	5200.0132	5200	0.0132	2.5417
		V min (V)	108	5200.0454	5200	0.0454	8.7240
Limits				±20ppm			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency: 5200MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	120	T (°C)	0	5200.0085	5200	0.0085	1.6317
		T (°C)	10	5200.0113	5200	0.0113	2.1733
		T (°C)	20	5200.0387	5200	0.0387	7.4352
		T (°C)	30	5200.0209	5200	0.0209	4.0112
		T (°C)	40	5200.0045	5200	0.0045	0.8742
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)	120	5240.0248	5240	0.0248	4.7347
		V max (V)	132	5240.0308	5240	0.0308	5.8793
		V min (V)	108	5240.0456	5240	0.0456	8.7106
Limits				±20ppm			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency: 5240MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	120	T (°C)	0	5240.0458	5240	0.0458	8.7409
		T (°C)	10	5240.0150	5240	0.0150	2.8712
		T (°C)	20	5240.0230	5240	0.0230	4.3849
		T (°C)	30	5240.0159	5240	0.0159	3.0254
		T (°C)	40	5240.0036	5240	0.0036	0.6864
Limits				±20ppm			
Result				Complies			

ANT2:

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)	120	5180.0129	5180	0.0129	2.4904
		V max (V)	132	5180.0687	5180	0.0687	13.2706
		V min (V)	108	5180.0768	5180	0.0768	14.8280
Limits				±20ppm			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency: 5180MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	120	T (°C)	0	5180.0590	5180	0.0590	11.3929
		T (°C)	10	5180.0255	5180	0.0255	4.9147
		T (°C)	20	5180.0160	5180	0.0160	3.0942
		T (°C)	30	5180.0283	5180	0.0283	5.4617
		T (°C)	40	5180.0010	5180	0.0010	0.1910
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)	120	5200.0251	5200	0.0251	4.8232
		V max (V)	132	5200.0429	5200	0.0429	8.2566
		V min (V)	108	5200.0796	5200	0.0796	15.3159
Limits				±20ppm			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency: 5200MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	120	T (°C)	0	5200.0133	5200	0.0133	2.5528
		T (°C)	10	5200.0273	5200	0.0273	5.2480
		T (°C)	20	5200.0478	5200	0.0478	9.1900
		T (°C)	30	5200.0374	5200	0.0374	7.1952
		T (°C)	40	5200.0728	5200	0.0728	13.9919
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)	120	5240.0780	5240	0.0780	14.8788
		V max (V)	132	5240.0367	5240	0.0367	6.9996
		V min (V)	108	5240.0191	5240	0.0191	3.6422
Limits				±20ppm			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency: 5240MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	120	T (°C)	0	5240.0520	5240	0.0520	9.9292
		T (°C)	10	5240.0699	5240	0.0699	13.3460
		T (°C)	20	5240.0815	5240	0.0815	15.5523
		T (°C)	30	5240.0075	5240	0.0075	1.4232
		T (°C)	40	5240.0054	5240	0.0054	1.0270
Limits				±20ppm			
Result				Complies			

ANT1:

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)	120	5745.0617	5745	0.0617	10.7479
		V max (V)	132	5745.0114	5745	0.0114	1.9783
		V min (V)	108	5745.0617	5745	0.0617	10.7479
Limits				±20ppm			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency: 5745MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	120	T (°C)	0	5745.0446	5745	0.0446	7.7695
		T (°C)	10	5745.0670	5745	0.0670	11.6645
		T (°C)	20	5745.0268	5745	0.0268	4.6591
		T (°C)	30	5745.0347	5745	0.0347	6.0458
		T (°C)	40	5745.0224	5745	0.0224	3.8968
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)	120	5785.0834	5785	0.0834	14.4190
		V max (V)	132	5785.0088	5785	0.0088	1.5228
		V min (V)	108	5785.0793	5785	0.0793	13.7092
Limits				±20ppm			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency: 5785MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	120	T (°C)	0	5785.0192	5785	0.0192	3.3239
		T (°C)	10	5785.0050	5785	0.0050	0.8565
		T (°C)	20	5785.0544	5785	0.0544	9.3995
		T (°C)	30	5785.0718	5785	0.0718	12.4175
		T (°C)	40	5785.0178	5785	0.0178	3.0764
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)	120	5825.0855	5825	0.0855	14.6704
		V max (V)	132	5825.0722	5825	0.0722	12.3895
		V min (V)	108	5825.0212	5825	0.0212	3.6395
Limits				±20ppm			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency: 5825MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	120	T (°C)	0	5825.0697	5825	0.0697	11.9656
		T (°C)	10	5825.0674	5825	0.0674	11.5701
		T (°C)	20	5825.0083	5825	0.0083	1.4307
		T (°C)	30	5825.0934	5825	0.0934	16.0407
		T (°C)	40	5825.0470	5825	0.0470	8.0612
Limits				±20ppm			
Result				Complies			

ANT2:

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)	120	5745.0281	5745	0.0281	4.8841
		V max (V)	132	5745.0692	5745	0.0692	12.0512
		V min (V)	108	5745.0818	5745	0.0818	14.2363
Limits				±20ppm			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency: 5745MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	120	T (°C)	0	5745.0295	5745	0.0295	5.1405
		T (°C)	10	5745.0656	5745	0.0656	11.4122
		T (°C)	20	5745.0759	5745	0.0759	13.2176
		T (°C)	30	5745.0103	5745	0.0103	1.7973
		T (°C)	40	5745.0709	5745	0.0709	12.3442
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)	120	5785.0546	5785	0.0546	9.4403
		V max (V)	132	5785.0069	5785	0.0069	1.1964
		V min (V)	108	5785.0339	5785	0.0339	5.8686
Limits				±20ppm			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency: 5785MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	120	T (°C)	0	5785.0506	5785	0.0506	8.7462
		T (°C)	10	5785.0472	5785	0.0472	8.1663
		T (°C)	20	5785.0212	5785	0.0212	3.6574
		T (°C)	30	5785.0612	5785	0.0612	10.5750
		T (°C)	40	5785.0361	5785	0.0361	6.2391
		T (°C)	50	5785.0512	5785	0.0512	8.8548
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)	120	5825.0858	5825	0.0858	14.7320
		V max (V)	132	5825.0758	5825	0.0758	13.0062
		V min (V)	108	5825.0119	5825	0.0119	2.0363
Limits				±20ppm			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency: 5825MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	120	T (°C)	0	5825.0012	5825	0.0012	0.2078
		T (°C)	10	5825.0434	5825	0.0434	7.4425
		T (°C)	20	5825.0101	5825	0.0101	1.7363
		T (°C)	30	5825.0152	5825	0.0152	2.6150
		T (°C)	40	5825.0402	5825	0.0402	6.9013
Limits				±20ppm			
Result				Complies			

13. OPERATION IN THE ABSENCE OF INFORMATION TO THE TRANSMIT

13.1 Requirement

15.407(c) requirement:

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

13.2 Test Results

Operation in the absence of information to the transmit:

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

14. ANTENNA REQUIREMENT

15.203 requirement:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

15.247(b) (4) requirement:

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

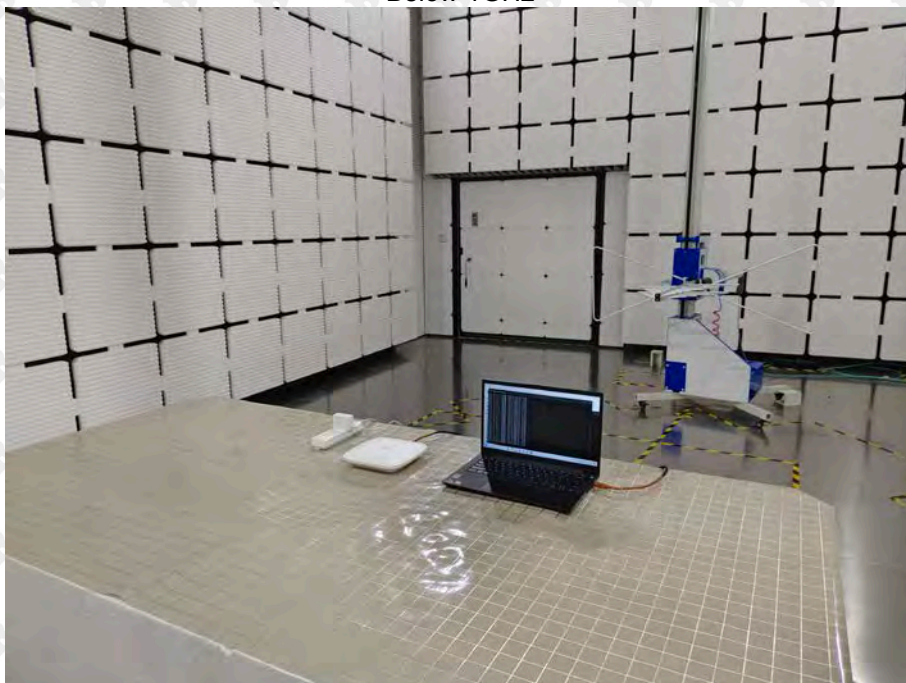
EUT Antenna:

The antenna is Internal antenna and no consideration of replacement. The best case gain of the antenna is WiFi (5.2G):Ant1: 2.9dBi, Ant2: 2.9dBi, WiFi (5.8G):Ant1: 3.7dBi, Ant2: 3.7dBi.

15. EUT TEST SETUP PHOTOGRAPHS

Spurious emissions

Below 1GHz



Above 1GHz



Conducted Emission



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