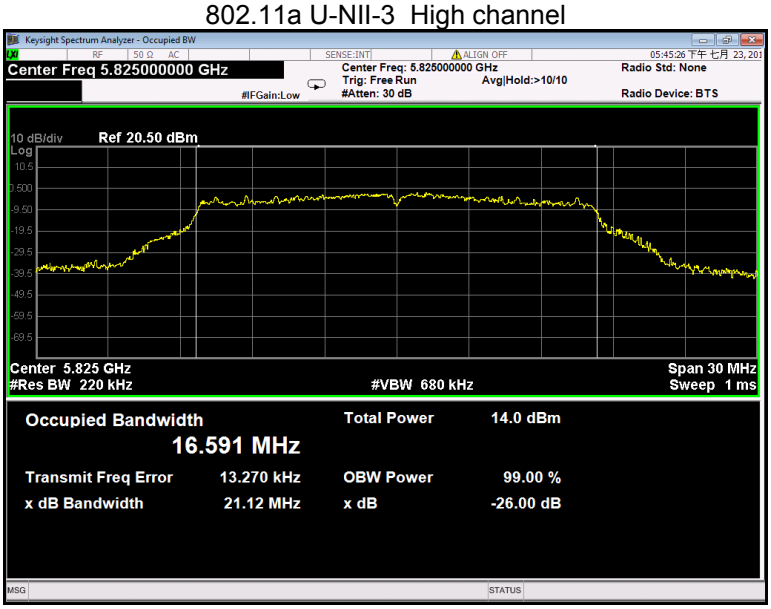
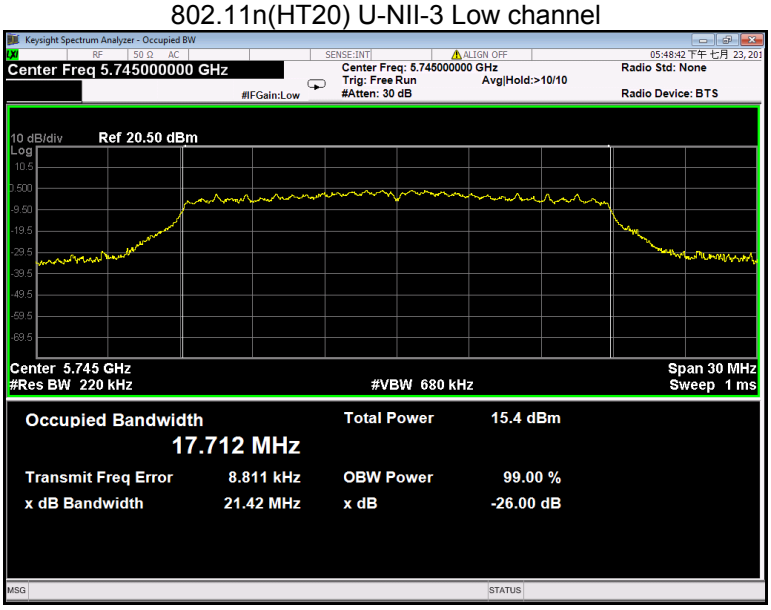
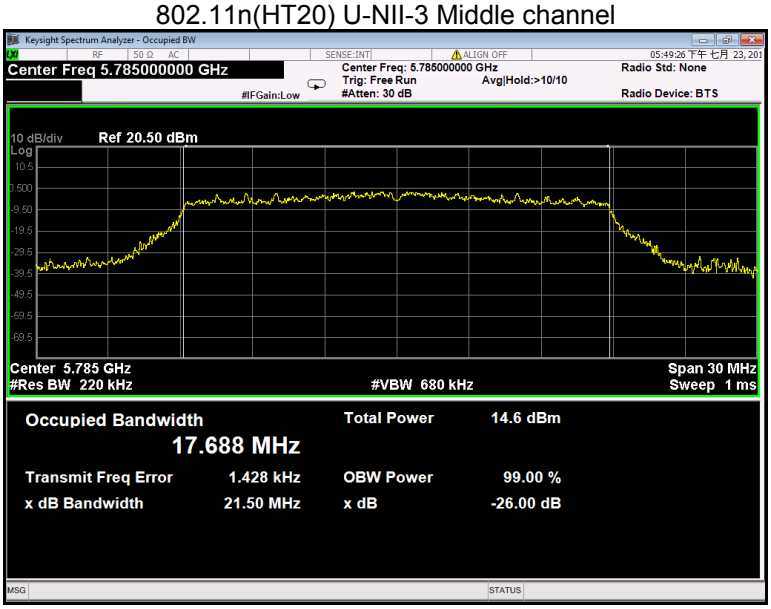
802.11a U-NII-3 High channel



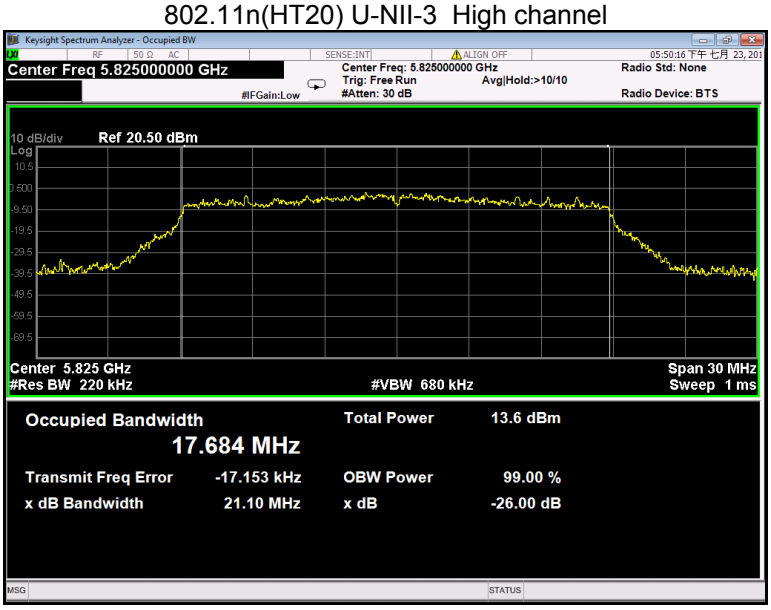
802.11n(HT20) U-NII-3 Low channel



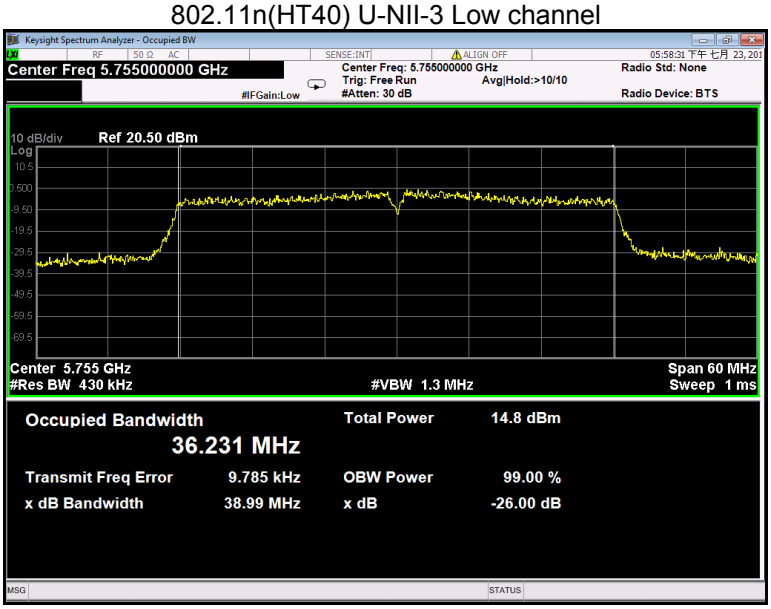
802.11n(HT20) U-NII-3 Middle channel



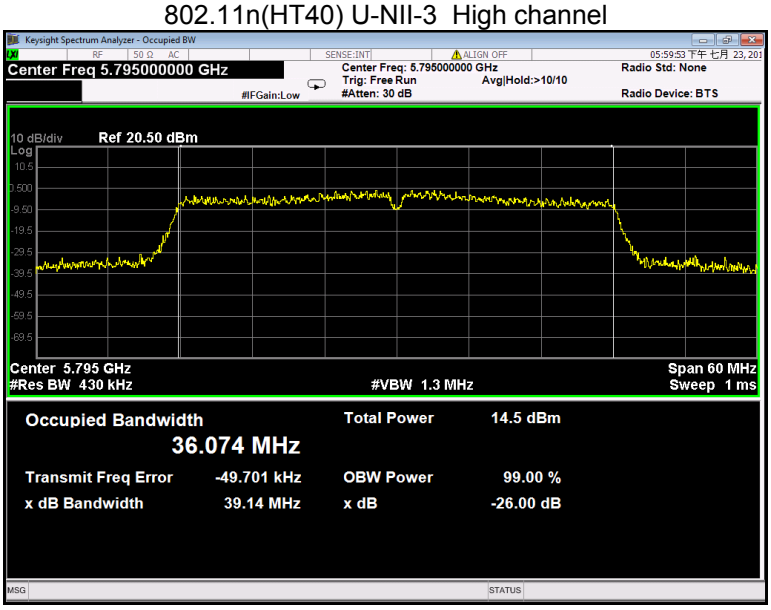
802.11n(HT20) U-NII-3 High channel



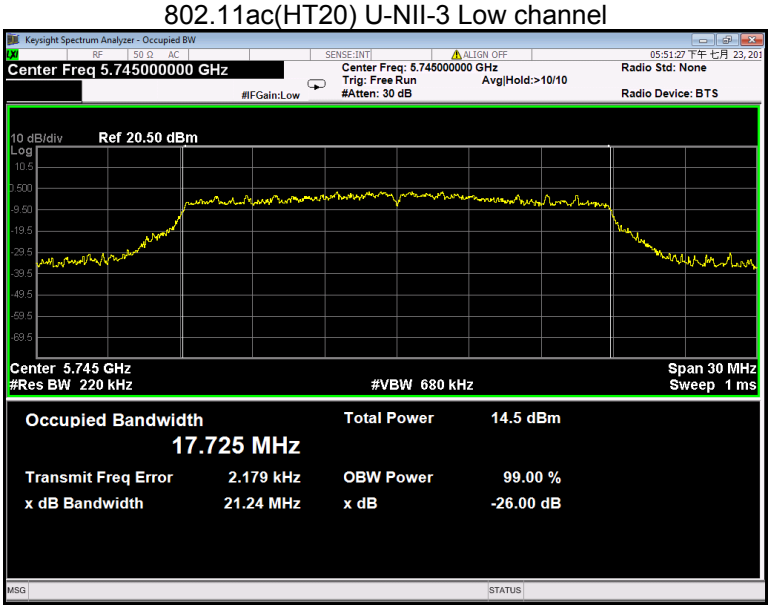
802.11n(HT40) U-NII-3 Low channel



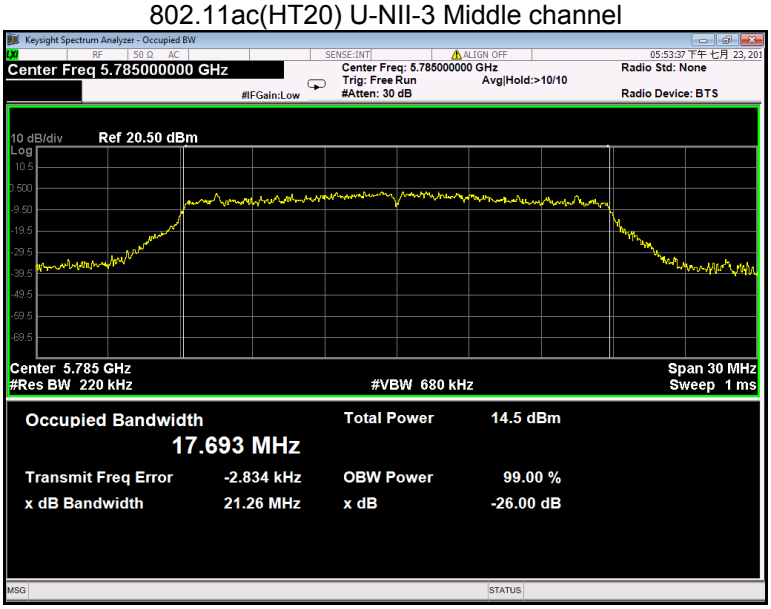
802.11n(HT40) U-NII-3 High channel



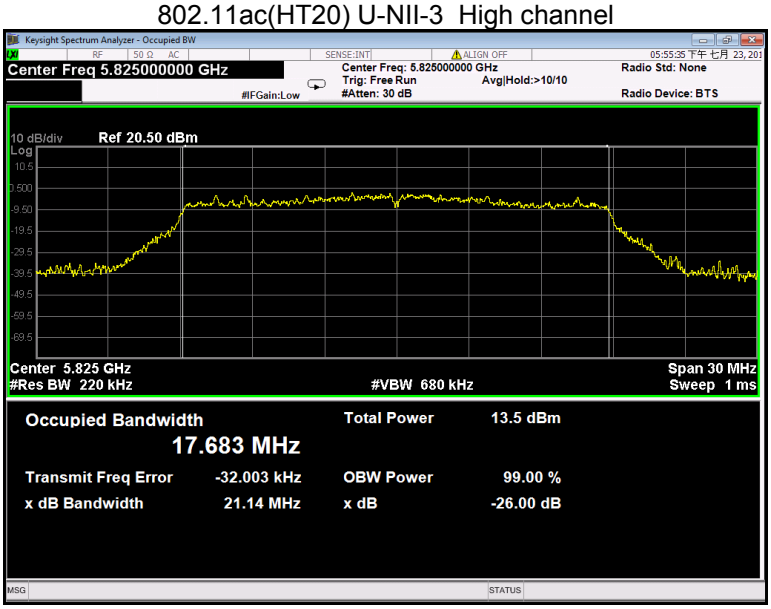
802.11ac(HT20) U-NII-3 Low channel



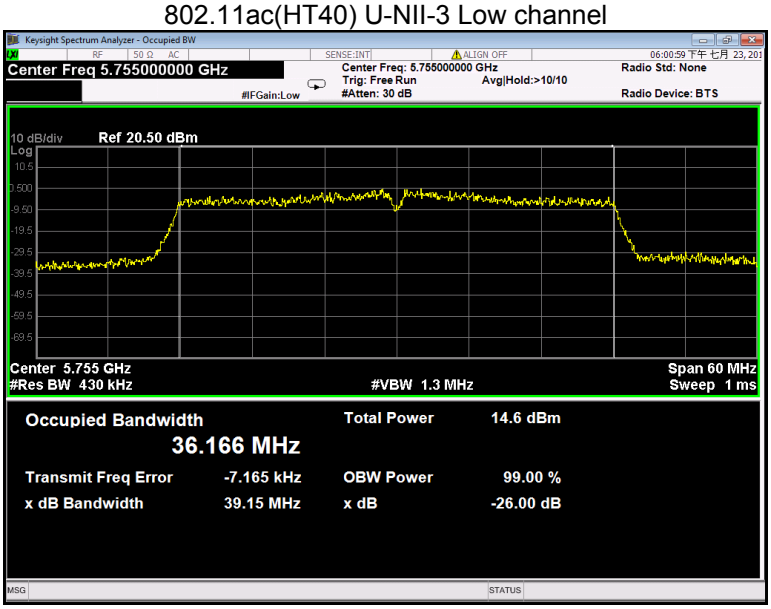
802.11ac(HT20) U-NII-3 Middle channel



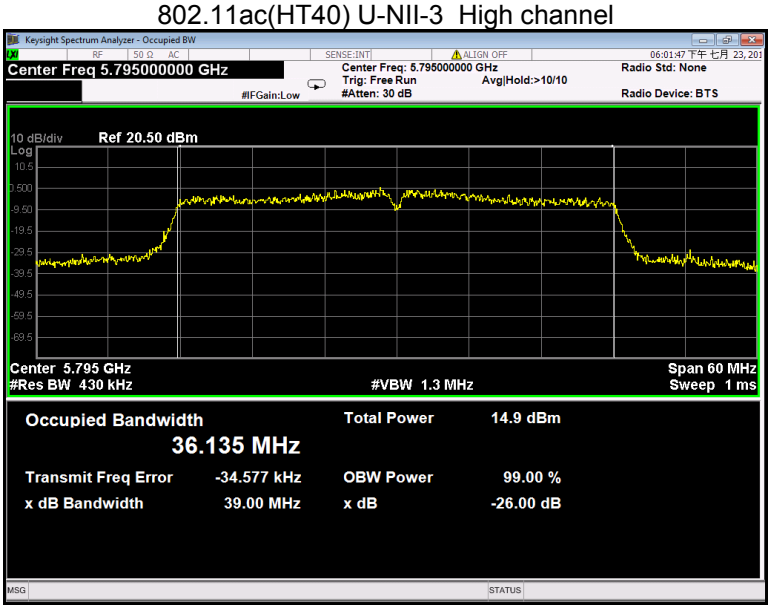
802.11ac(HT20) U-NII-3 High channel



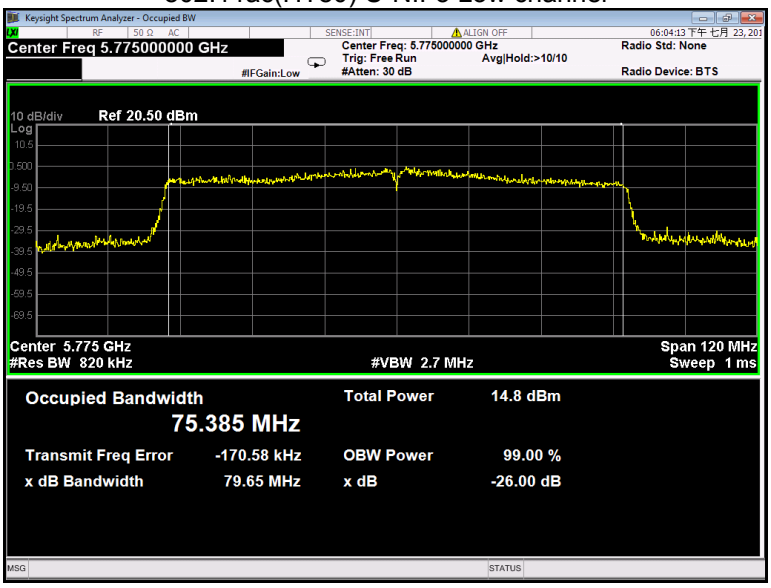
802.11ac(HT40) U-NII-3 Low channel



802.11ac(HT40) U-NII-3 High channel



802.11ac(HT80) U-NII-3 Low channel



12 Conducted Output Power

Test Requirement:	FCC 47CFR Part 15 Section 15.407(a)
Test Method:	KDB662911 D01 Multiple Transmitter Output v02r01 KDB789033 D02 General U-NII Test Procedures New Rules v02r01 Section E
Test Limit:	U-NII-1 250mW(24dBm) U-NII-2A 250mW(24dBm) U-NII-2C 250mW(24dBm) U-NII-3 1W(30dBm)
Test Result:	PASS
Remark:	Conducted output power= measurement power+10log(1/x) X is duty cycle=1, so 10log(1/1)=0 Conducted output power= measurement power

12.1 Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 1 MHz. VBW = 3 MHz. Sweep = auto; Detector Function = Peak, Set the span to fully encompass the DTS bandwidth.
3. Keep the EUT in transmitting at lowest, medium and highest channel individually. Record the max value.

12.2 Test Result

Ant0

Band	Operation mode	Channel	Measurements (dBm)	Duty Cycle Factor (dB)	Conducted Output Power (dBm)
U-NII-1	802.11a	Low	14.48	0.14	14.62
		Middle	14.90		15.04
		High	14.48		14.62
	802.11n(HT20)	Low	14.63	0.18	14.81
		Middle	15.06		15.24
		High	14.59		14.77
	802.11n(HT40)	Low	14.26	0.31	14.57
		High	14.29		14.60
	802.11ac(HT20)	Low	14.78	0.20	14.98
		Middle	14.88		15.08
		High	15.01		15.21
	802.11ac(HT40)	Low	14.21	0.35	14.56
		High	13.68		14.03
	802.11ac(HT80)	Low	15.32	0.55	**15.87**

Band	Operation mode	Channel	Measurements (dBm)	Duty Cycle Factor (dB)	Conducted Output Power (dBm)
U-NII-3	802.11a	Low	13.24	0.18	13.42
		Middle	13.55		13.73
		High	12.76		12.94
	802.11n(HT20)	Low	13.34	0.20	13.54
		Middle	13.78		**13.98**
		High	12.81		13.01
	802.11n(HT40)	Low	13.62	0.31	13.78
		High	13.65		13.81
	802.11ac(HT20)	Low	13.28	0.16	13.44
		Middle	13.77		13.93
		High	12.76		12.92
	802.11ac(HT40)	Low	13.56	0.34	13.90
		High	13.91		14.25
	802.11ac(HT80)	Low	12.66	0.56	13.22

Ant1

Band	Operation mode	Channel	Measurements (dBm)	Duty Cycle Factor (dB)	Conducted Output Power (dBm)
U-NII-1	802.11a	Low	14.69	0.17	14.86
		Middle	14.40		14.57
		High	14.60		14.77
	802.11n(HT20)	Low	14.68	0.20	14.88
		Middle	15.01		15.21
		High	14.43		14.63
	802.11n(HT40)	Low	14.24	0.34	14.58
		High	14.41		14.75
	802.11ac(HT20)	Low	14.82	0.36	15.18
		Middle	14.58		14.94
		High	15.52		15.88
	802.11ac(HT40)	Low	14.49	0.31	14.80
		High	13.67		13.98
	802.11ac(HT80)	Low	15.41	0.57	**15.98**

Band	Operation mode	Channel	Measurements (dBm)	Duty Cycle Factor (dB)	Conducted Output Power (dBm)
U-NII-3	802.11a	Low	13.29	0.19	13.48
		Middle	13.67		13.86
		High	12.71		12.90
	802.11n(HT20)	Low	13.30	0.19	13.49
		Middle	13.76		**13.95**
		High	12.56		12.75
	802.11n(HT40)	Low	13.60	0.34	13.94
		High	13.79		14.13
	802.11ac(HT20)	Low	13.20	0.19	13.39
		Middle	12.63		12.82
		High	12.77		12.96
	802.11ac(HT40)	Low	13.69	0.31	14.00
		High	13.61		13.92
	802.11ac(HT80)	Low	12.38	0.54	12.92

Simultaneous Transmission

Band	Operation mode	Channel	Conducted Output Power (dBm)		
			Ant. 0	Ant. 1	SUM
U-NII-1	802.11a	Low	14.62	14.86	/
		Middle	15.04	14.57	/
		High	14.62	14.77	/
	802.11n(HT20)	Low	14.81	14.88	17.86
		Middle	15.24	15.21	18.24
		High	14.77	14.63	17.71
	802.11ac (HT20)	Low	14.57	14.58	17.59
		Middle	14.6	14.75	17.69
		High	14.98	15.18	18.09
	802.11n(HT40)	Low	15.08	14.94	18.02
		High	15.21	15.88	18.57
	802.11ac (HT40)	Low	14.56	14.8	17.69
		High	14.03	13.98	17.02
	802.11ac (HT80)	Middle	15.87	15.98	**18.94**

Band	Operation mode	Channel	Conducted Output Power (dBm)		
			Ant. 0	Ant. 1	SUM
U-NII-3	802.11a	Low	13.42	13.48	/
		Middle	13.73	13.86	/
		High	12.94	12.90	/
	802.11n(HT20)	Low	13.54	13.49	16.53
		Middle	13.98	13.95	16.98
		High	13.01	12.75	15.89
	802.11ac (HT20)	Low	13.78	13.94	16.87
		Middle	13.81	14.13	16.98
		High	13.44	13.39	16.43
	802.11n(HT40)	Low	13.93	12.82	16.42
		High	12.92	12.96	15.95
	802.11ac (HT40)	Low	13.90	14.00	16.96
		High	14.25	13.92	17.10
	802.11ac (HT80)	Middle	13.22	12.92	16.08

Note:

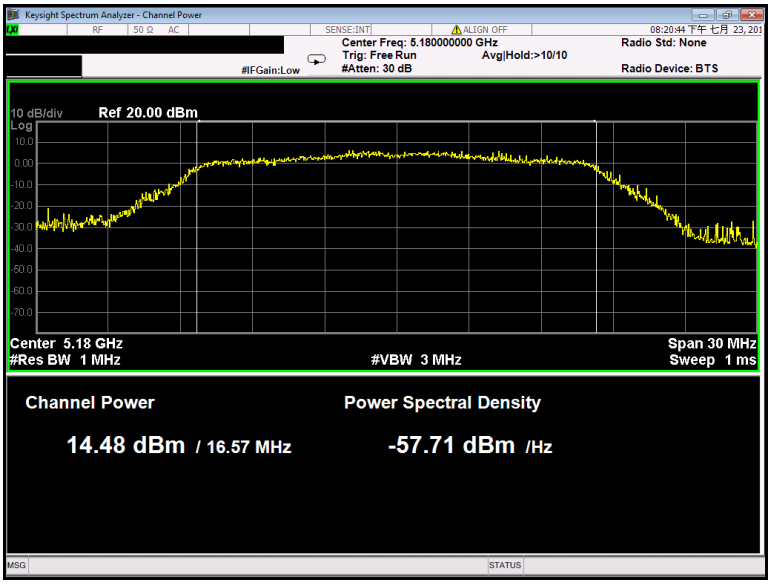
1. Conducted Output Power = Measurements + Duty Cycle Factor

* All transmit signals are completely uncorrelated with each other, Directional gain = G_{ANT} which is less than 6dBi. So the limit does not be reduced.

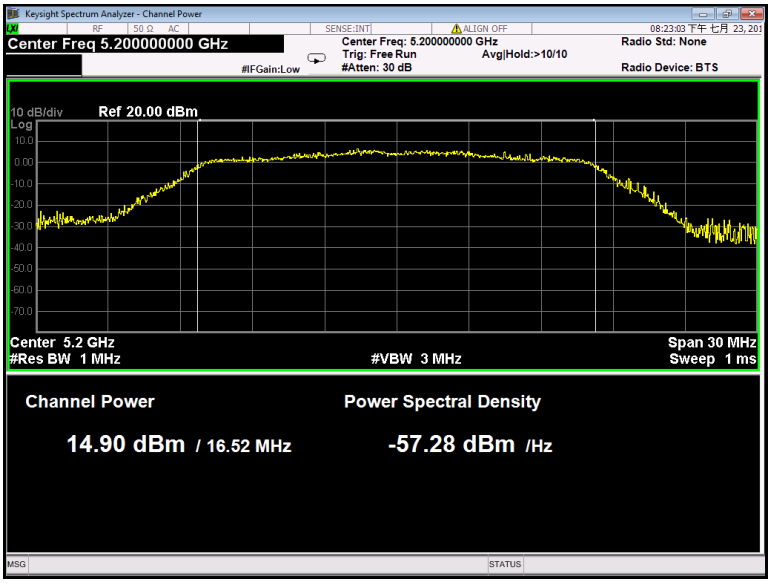
Test result plots shown as follows:

Ant0

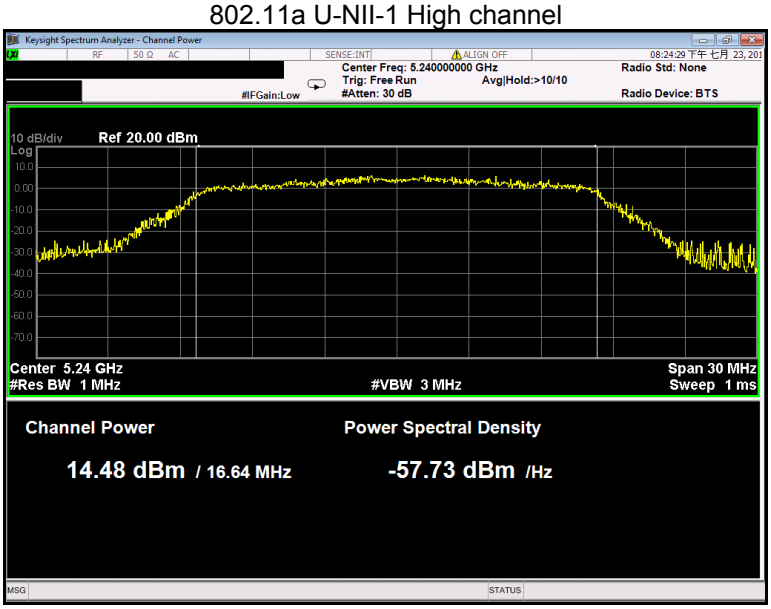
802.11a U-NII-1 Low channel



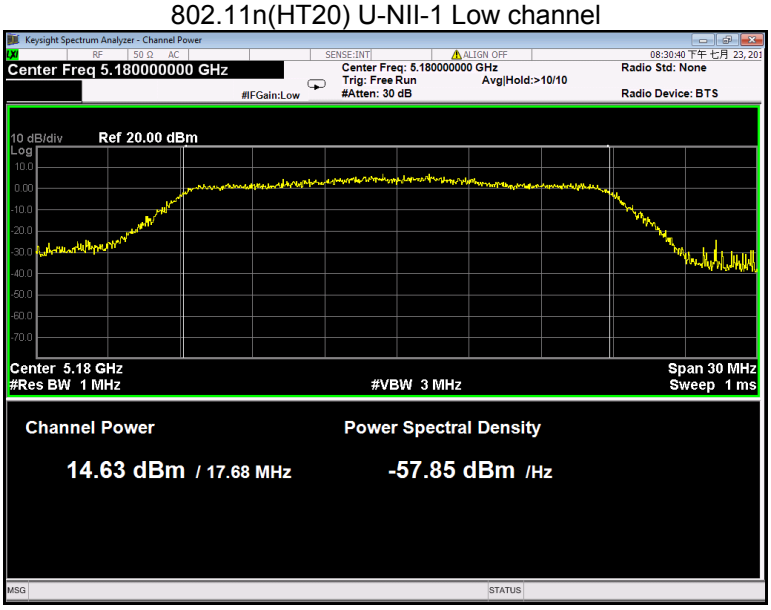
802.11a U-NII-1 Middle channel



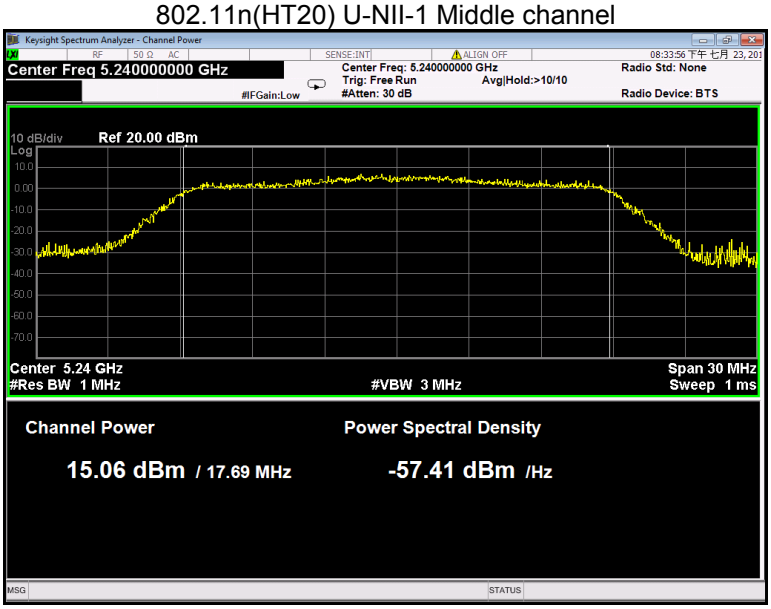
802.11a U-NII-1 High channel



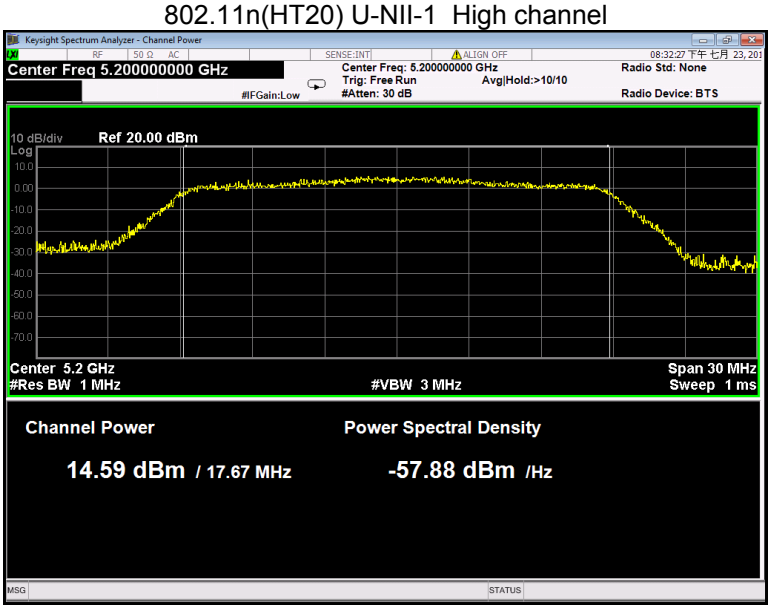
802.11n(HT20) U-NII-1 Low channel



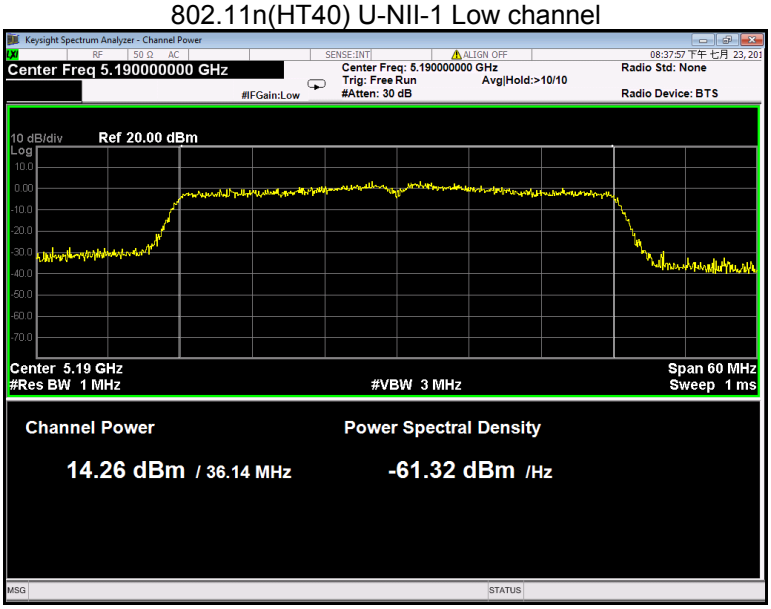
802.11n(HT20) U-NII-1 Middle channel



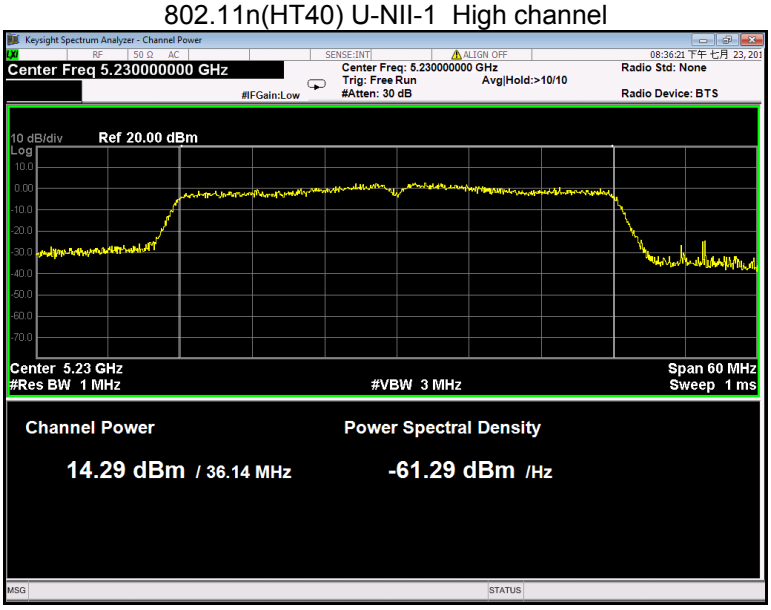
802.11n(HT20) U-NII-1 High channel



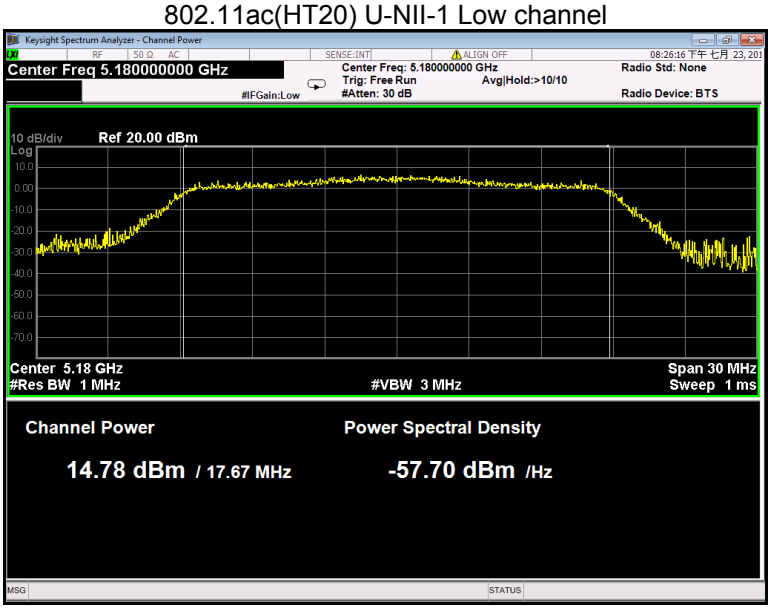
802.11n(HT40) U-NII-1 Low channel



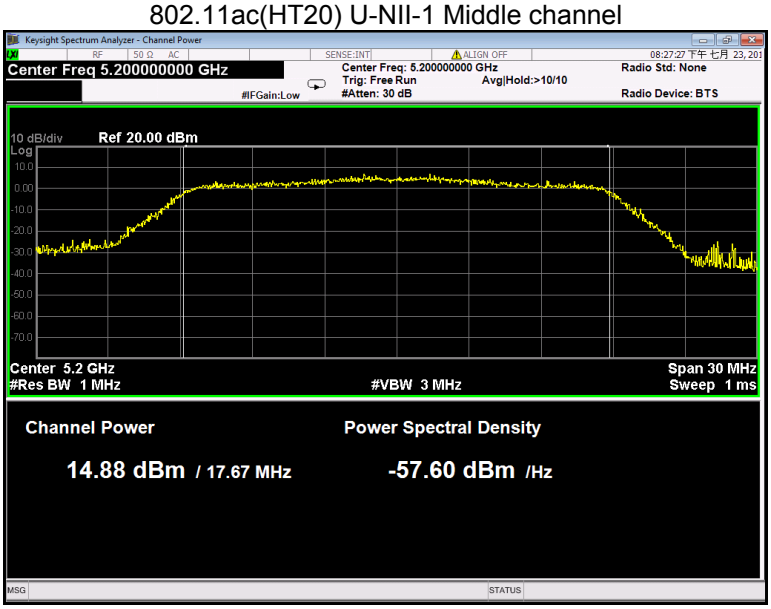
802.11n(HT40) U-NII-1 High channel



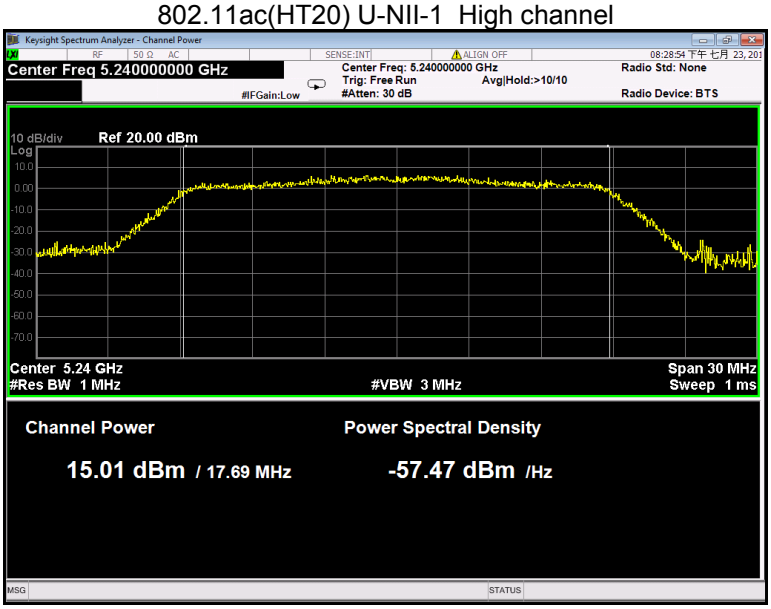
802.11ac(HT20) U-NII-1 Low channel



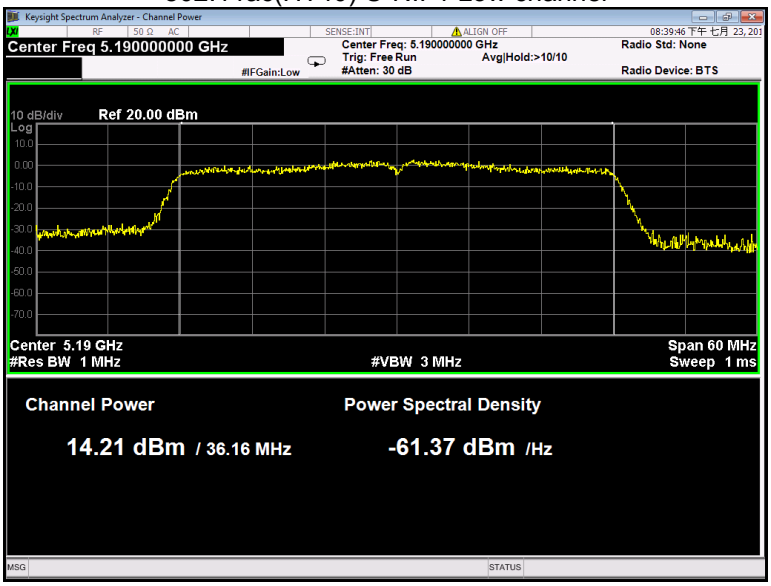
802.11ac(HT20) U-NII-1 Middle channel



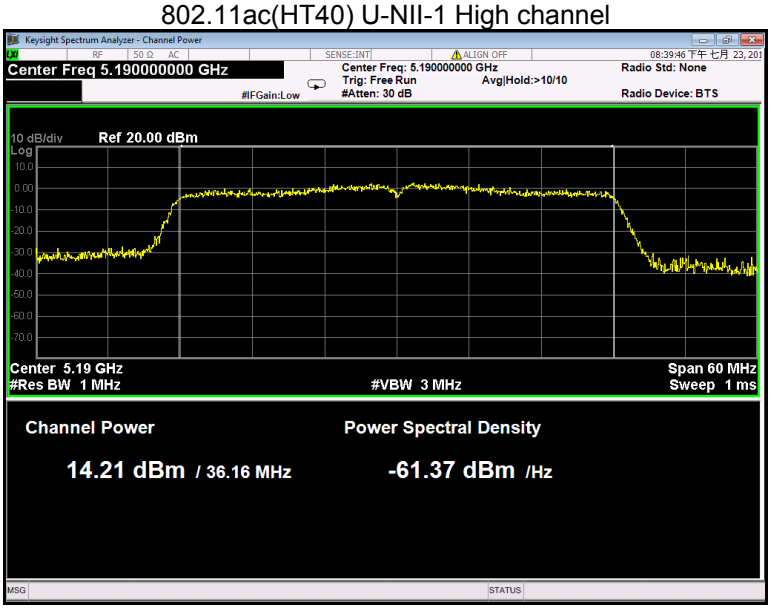
802.11ac(HT20) U-NII-1 High channel



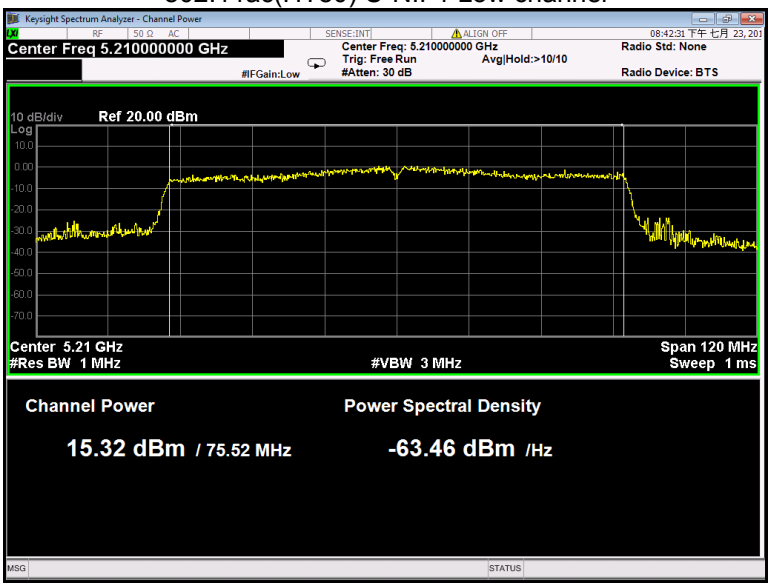
802.11ac(HT40) U-NII-1 Low channel



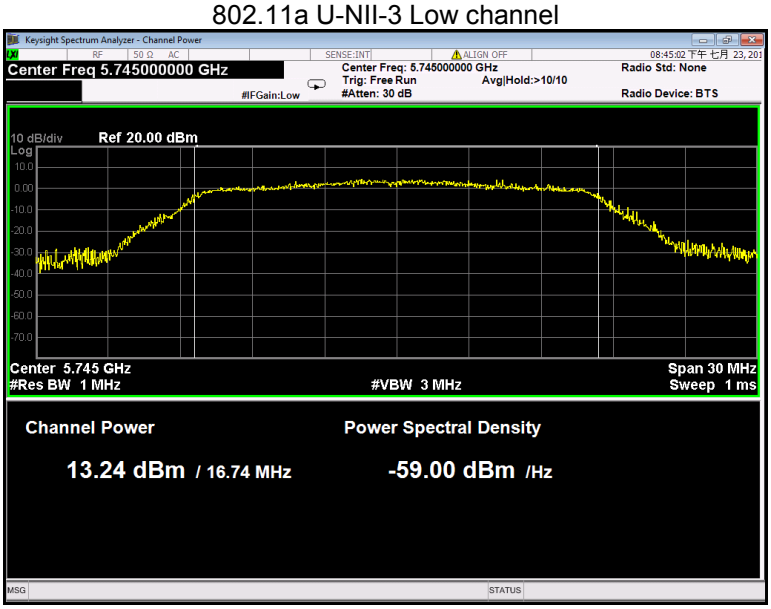
802.11ac(HT40) U-NII-1 High channel



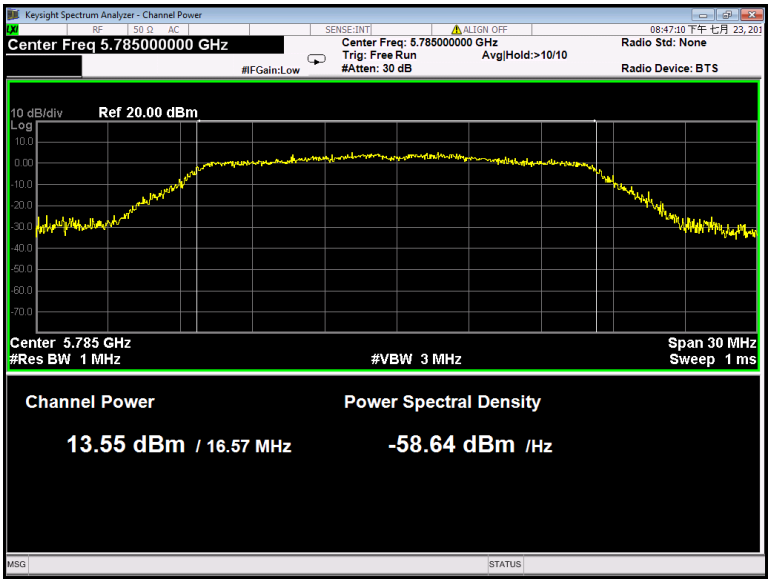
802.11ac(HT80) U-NII-1 Low channel



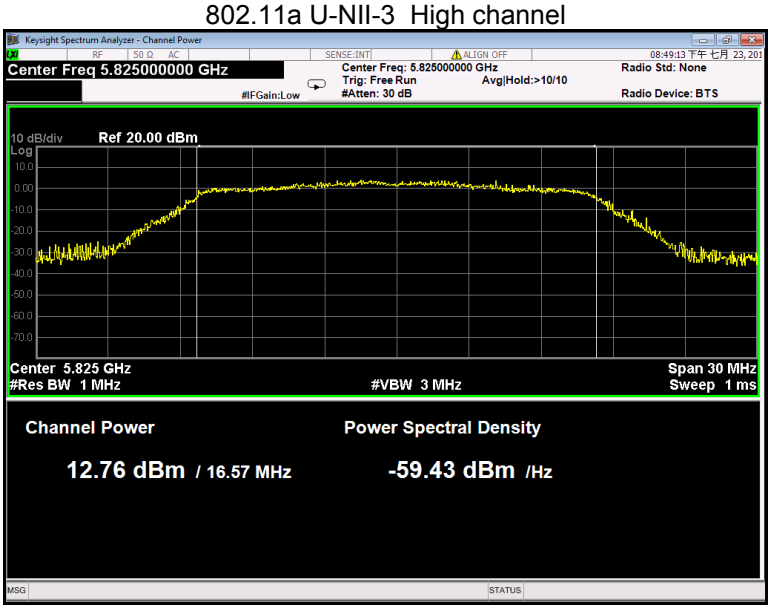
802.11a U-NII-3 Low channel



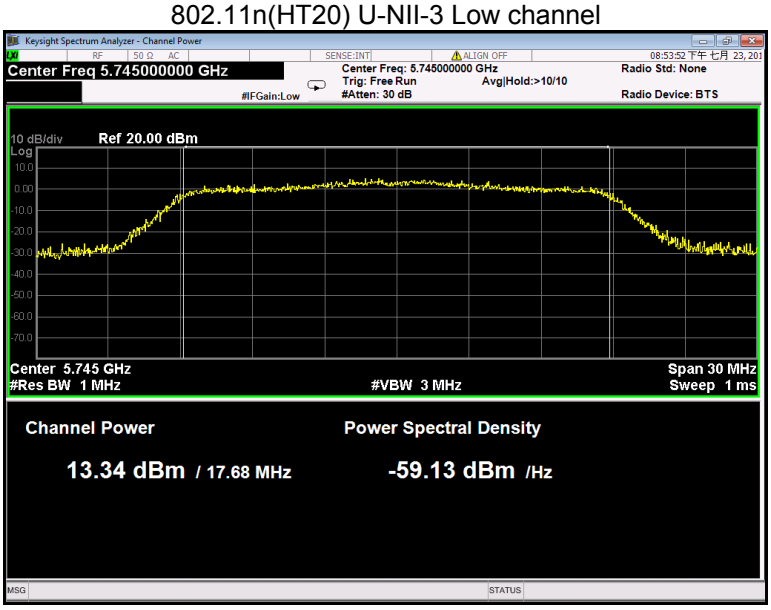
802.11a U-NII-3 Middle channel



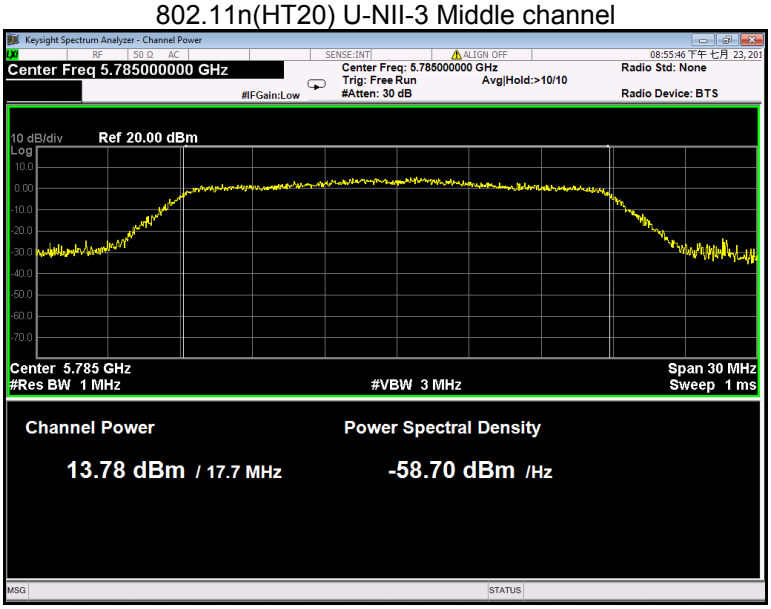
802.11a U-NII-3 High channel



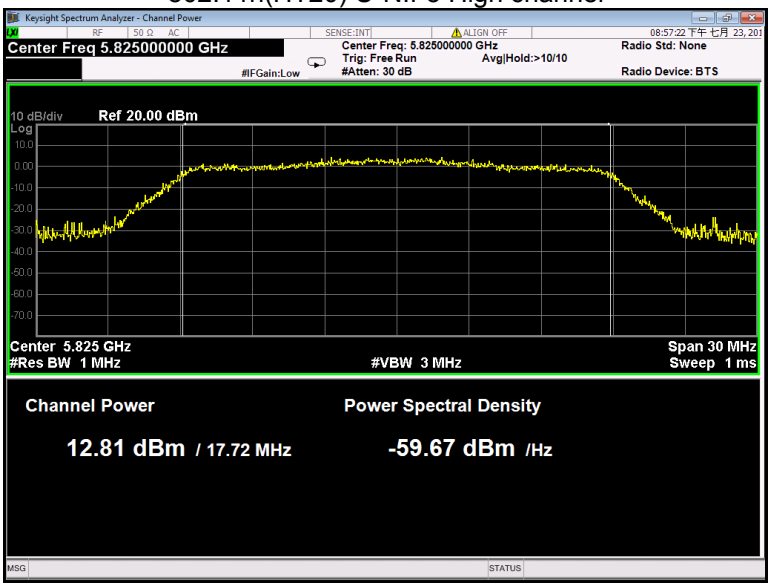
802.11n(HT20) U-NII-3 Low channel



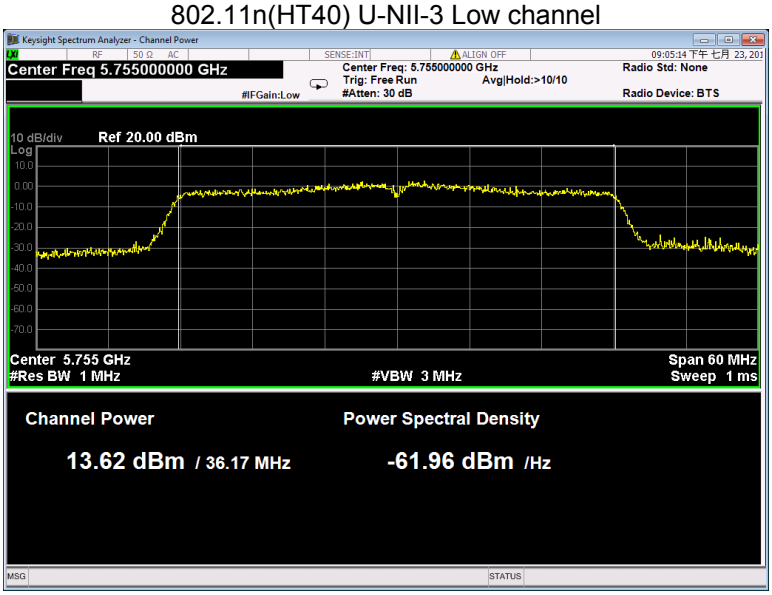
802.11n(HT20) U-NII-3 Middle channel



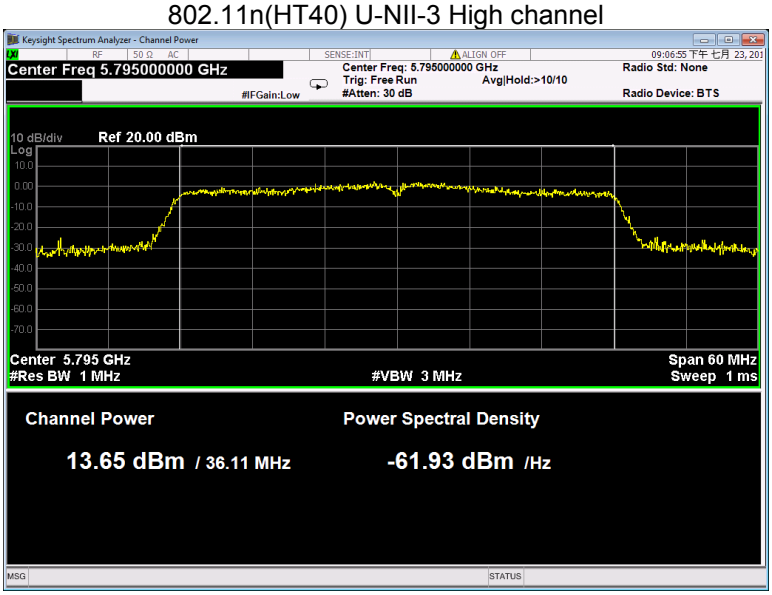
802.11n(HT20) U-NII-3 High channel



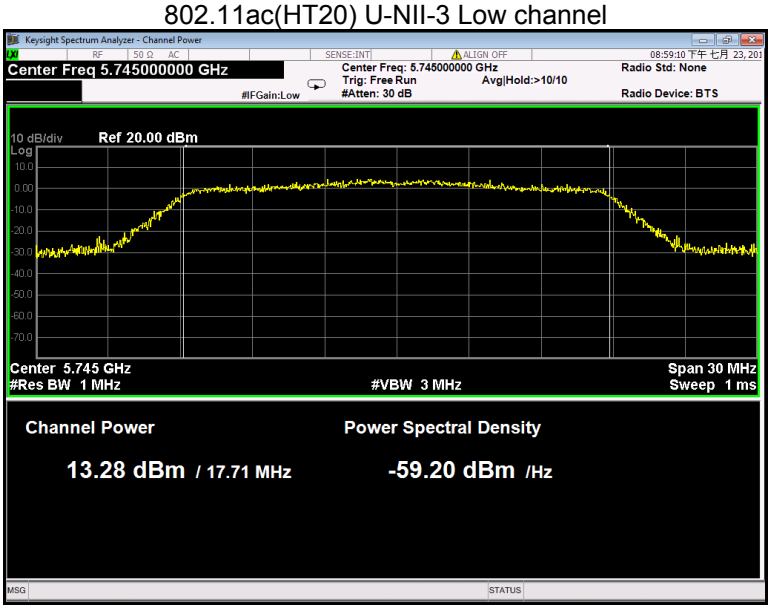
802.11n(HT40) U-NII-3 Low channel



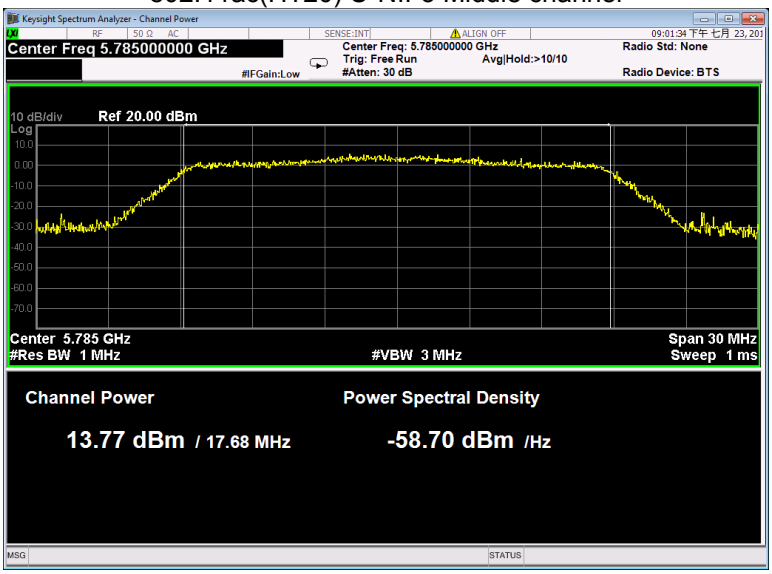
802.11n(HT40) U-NII-3 High channel



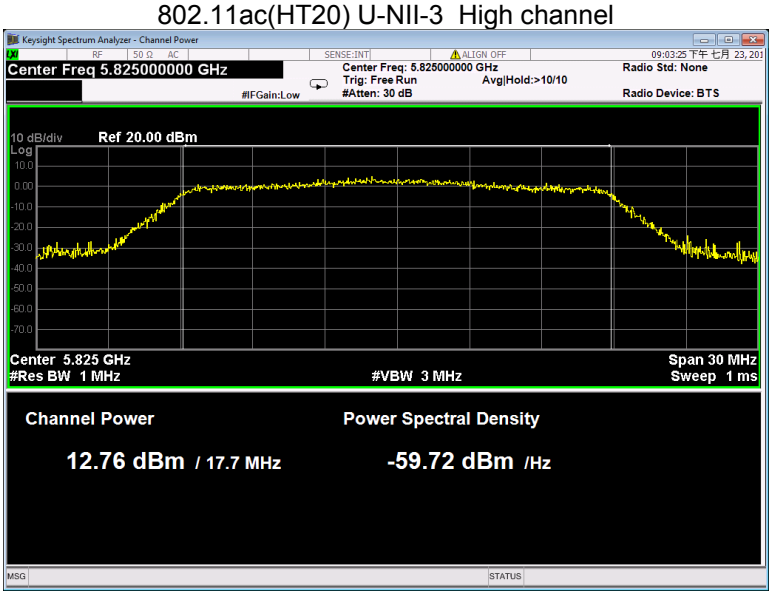
802.11ac(HT20) U-NII-3 Low channel



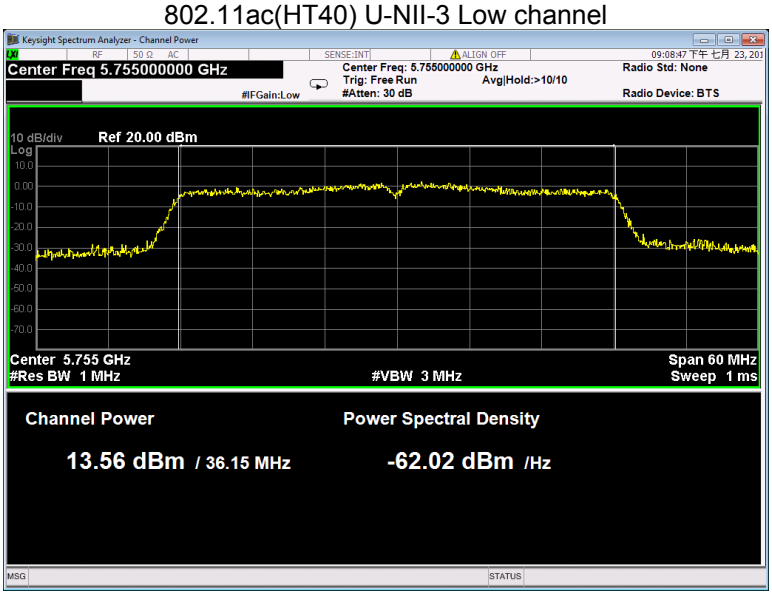
802.11ac(HT20) U-NII-3 Middle channel



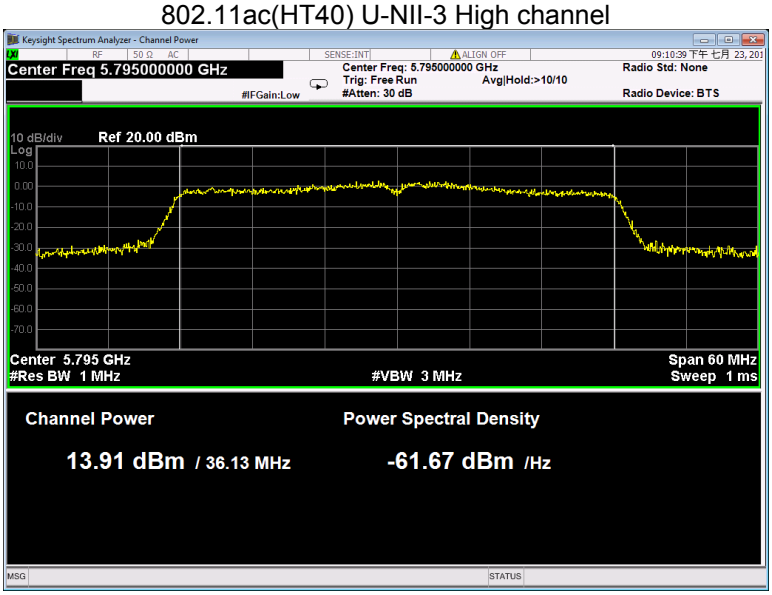
802.11ac(HT20) U-NII-3 High channel



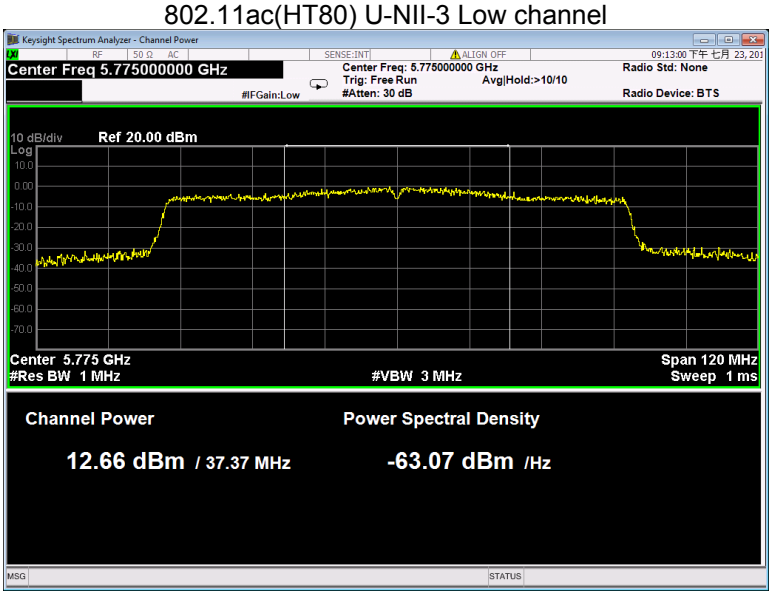
802.11ac(HT40) U-NII-3 Low channel



802.11ac(HT40) U-NII-3 High channel

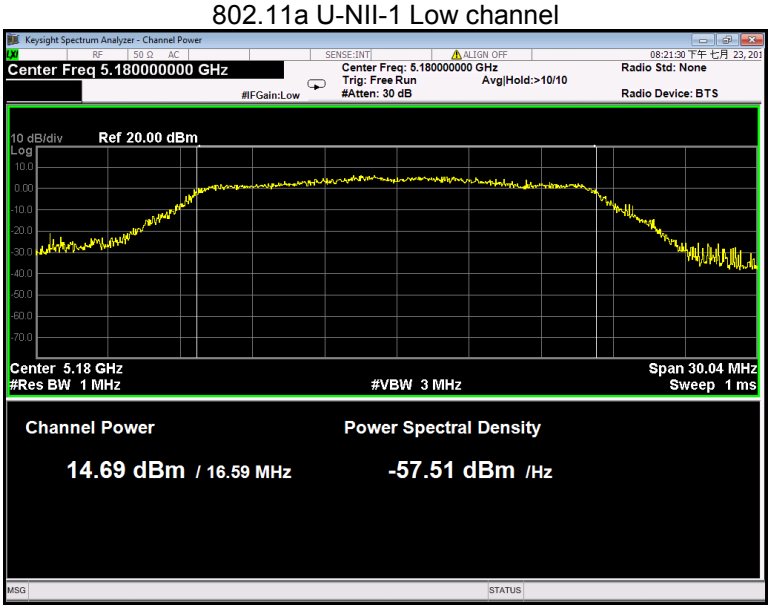


802.11ac(HT80) U-NII-3 Low channel

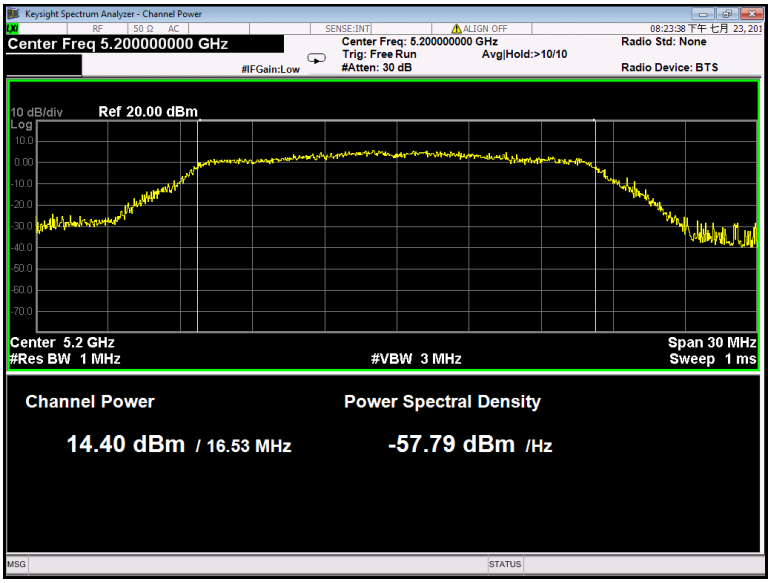


Ant1

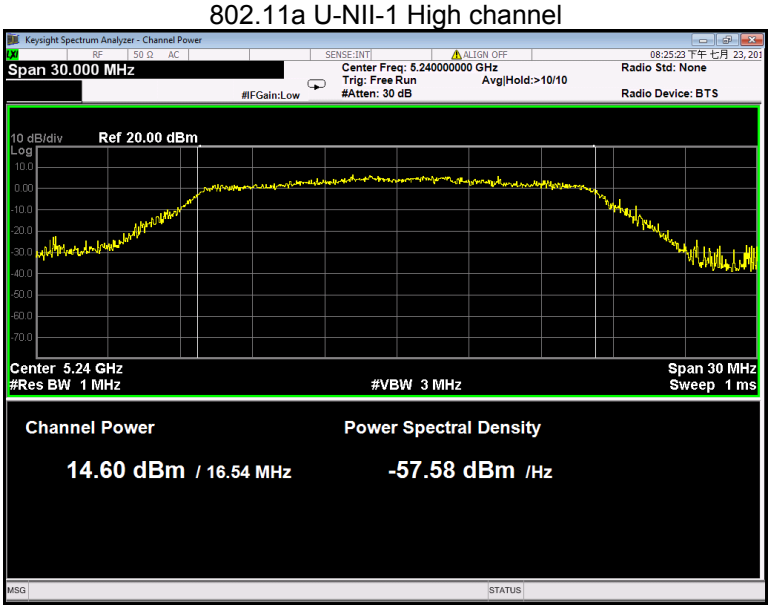
802.11a U-NII-1 Low channel



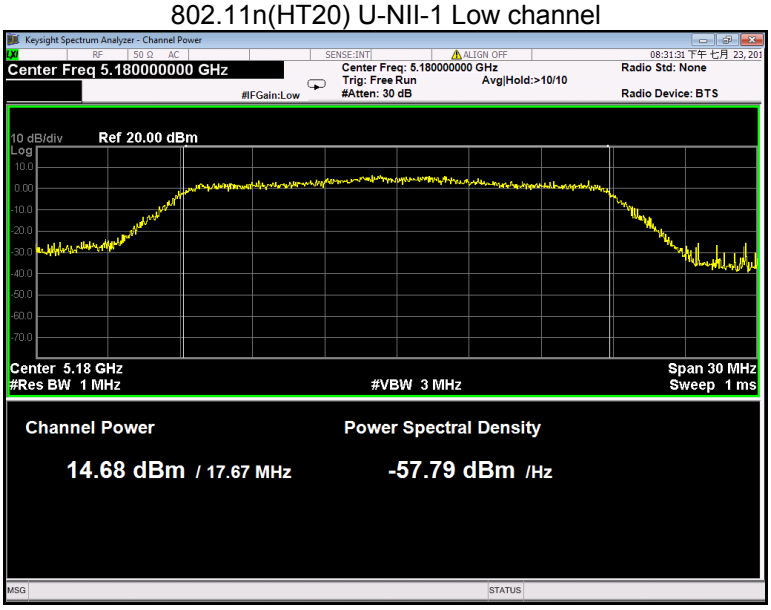
802.11a U-NII-1 Middle channel



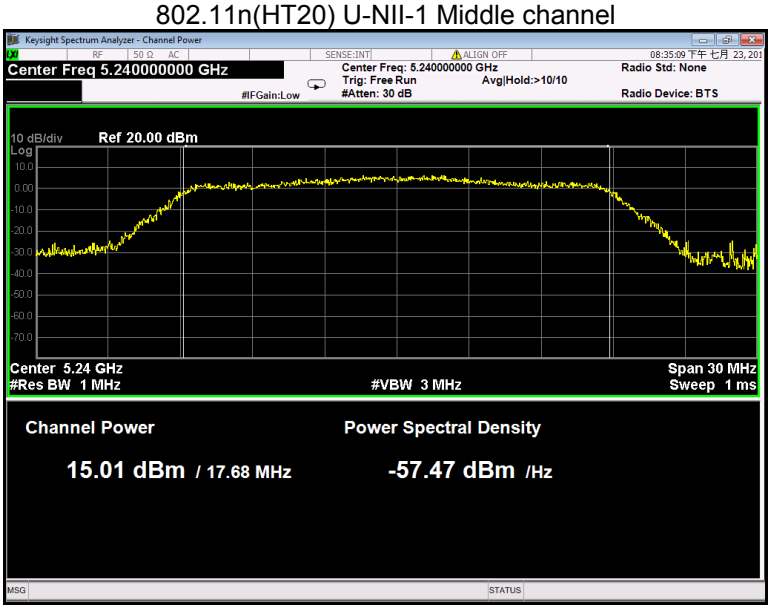
802.11a U-NII-1 High channel



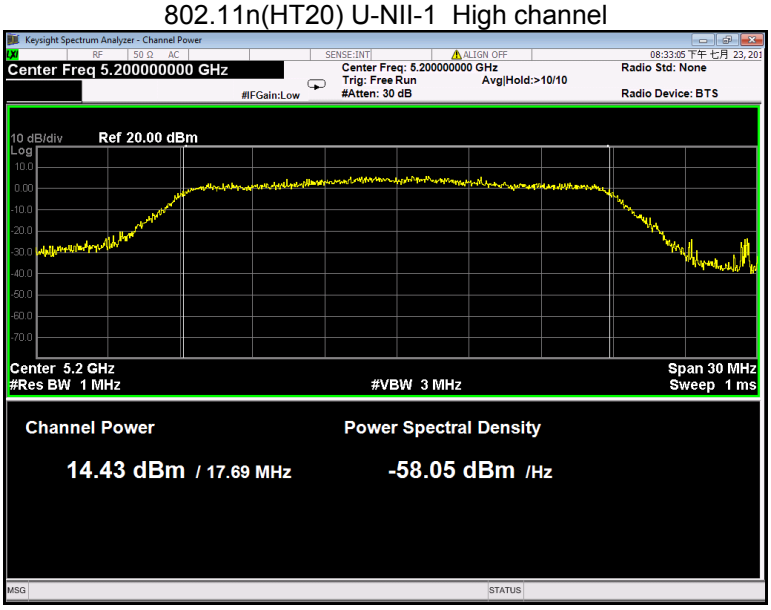
802.11n(HT20) U-NII-1 Low channel



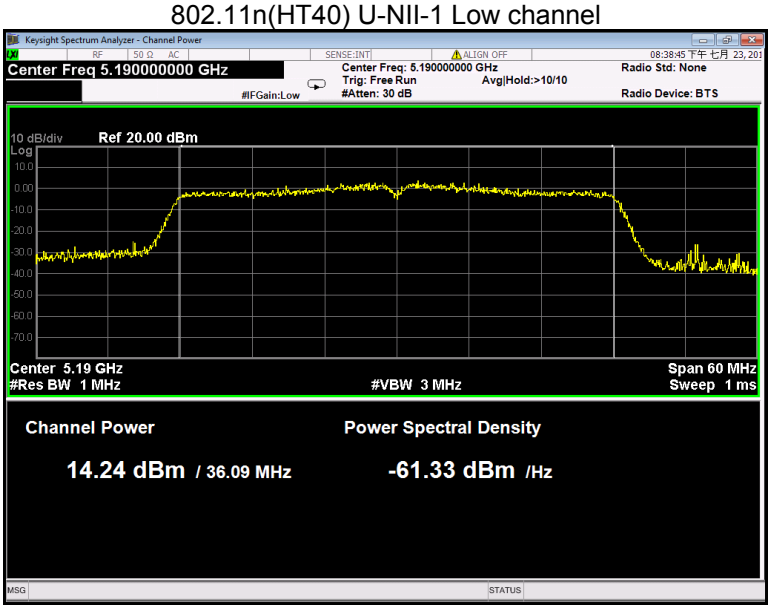
802.11n(HT20) U-NII-1 Middle channel



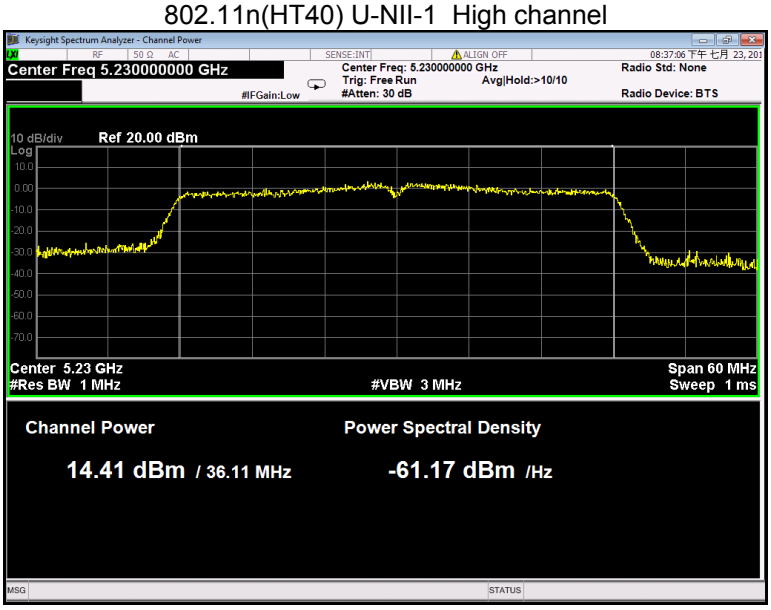
802.11n(HT20) U-NII-1 High channel



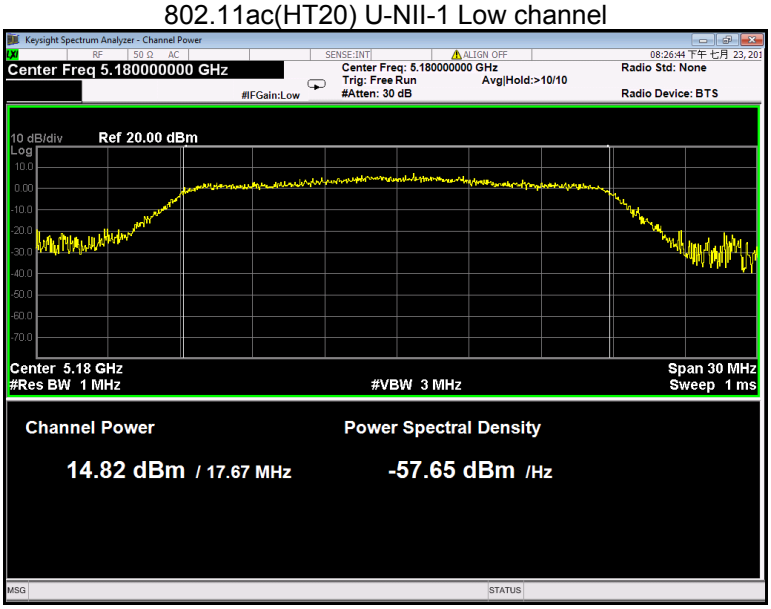
802.11n(HT40) U-NII-1 Low channel



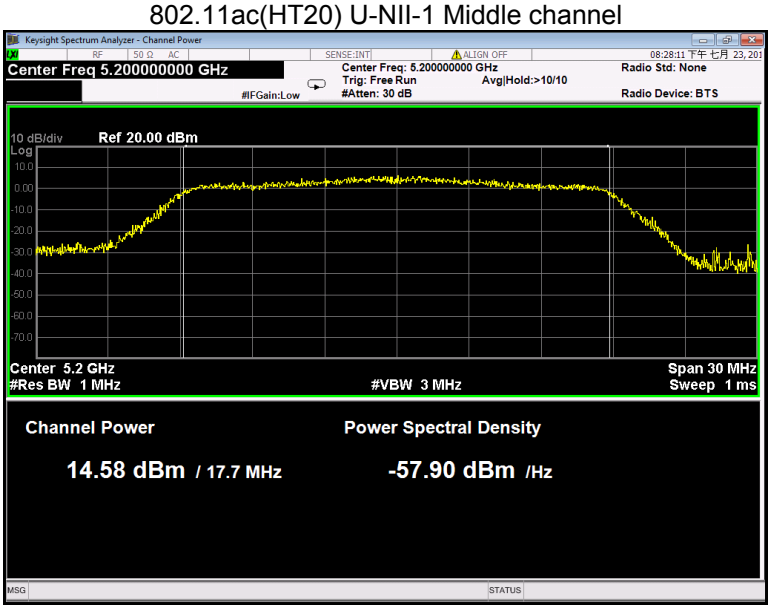
802.11n(HT40) U-NII-1 High channel



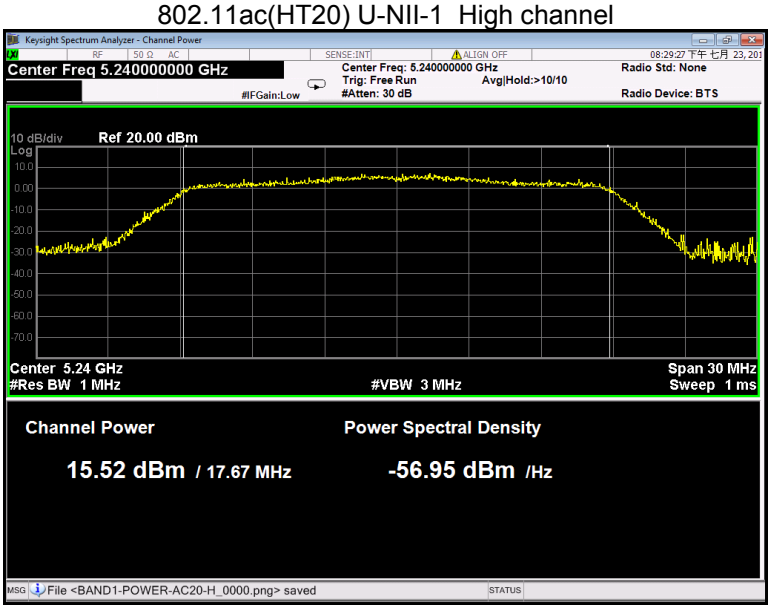
802.11ac(HT20) U-NII-1 Low channel



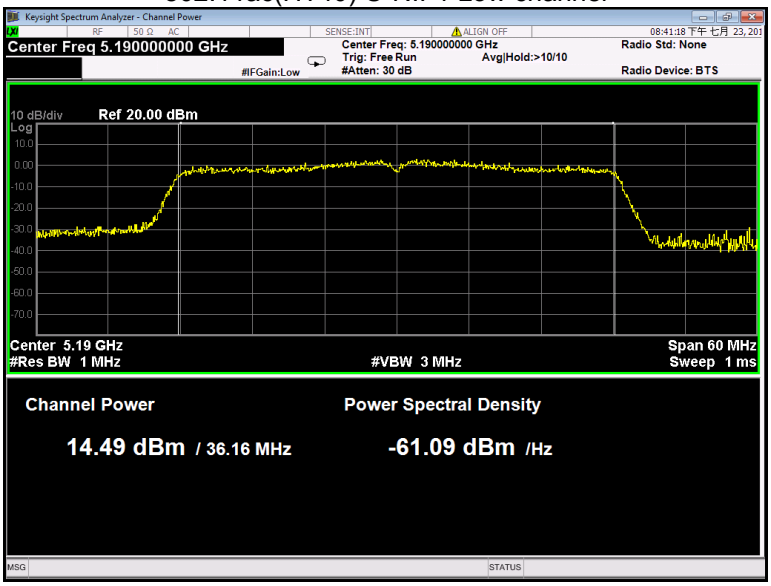
802.11ac(HT20) U-NII-1 Middle channel



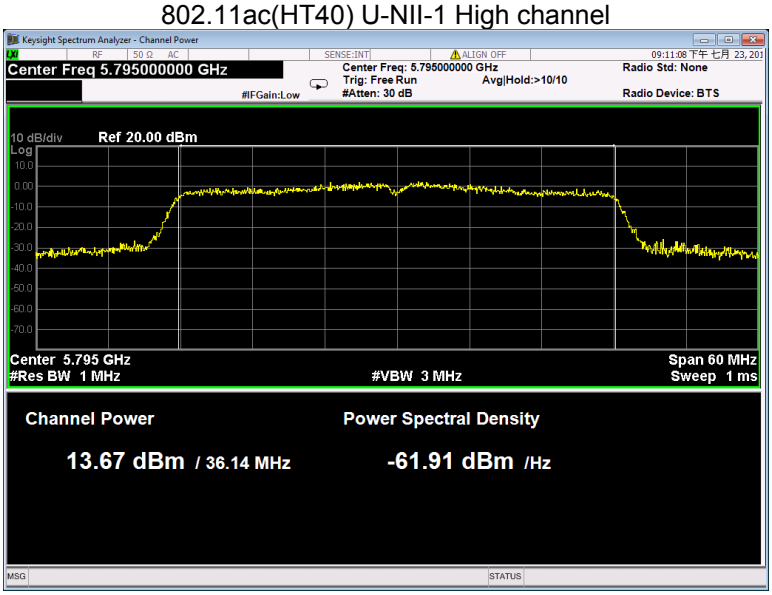
802.11ac(HT20) U-NII-1 High channel



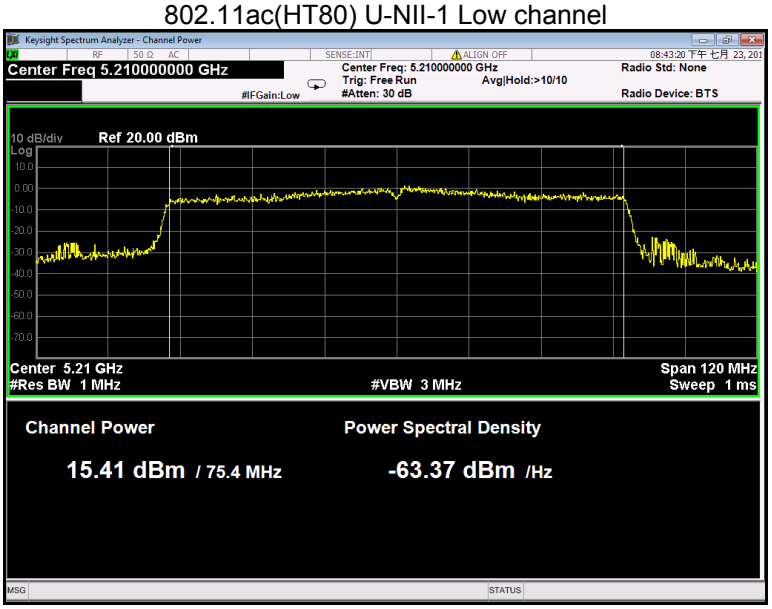
802.11ac(HT40) U-NII-1 Low channel



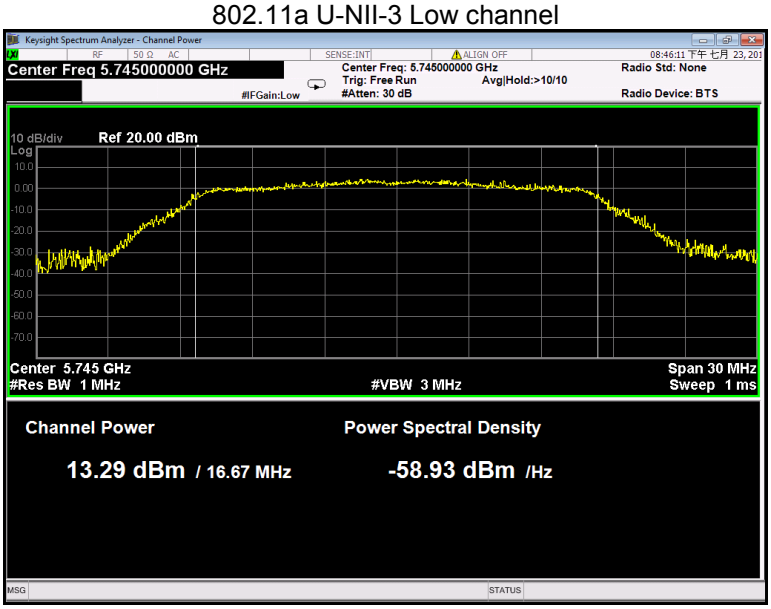
802.11ac(HT40) U-NII-1 High channel



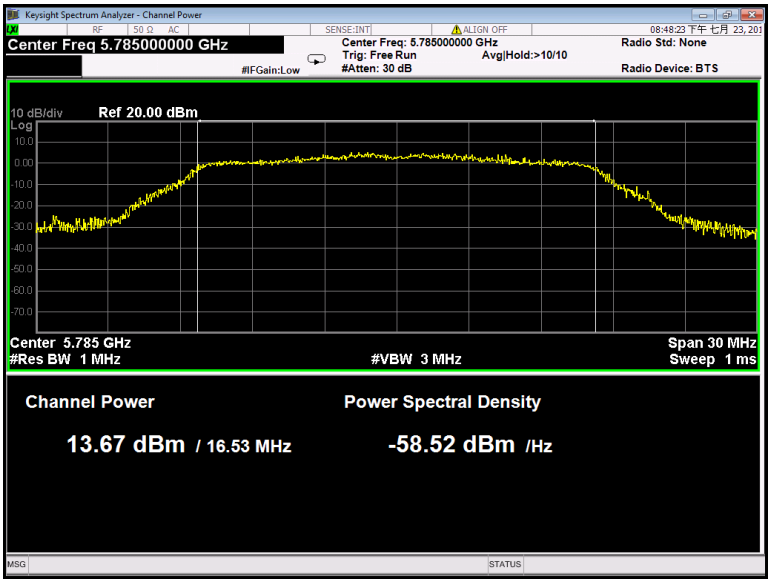
802.11ac(HT80) U-NII-1 Low channel



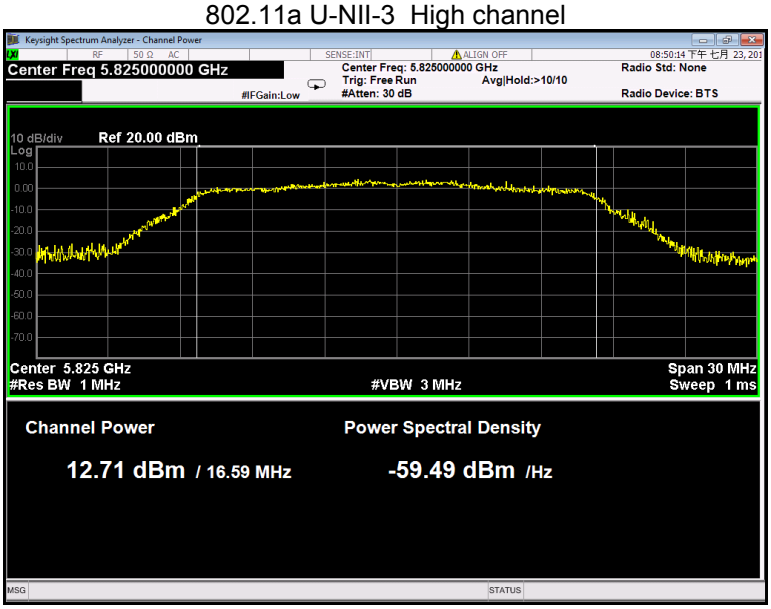
802.11a U-NII-3 Low channel



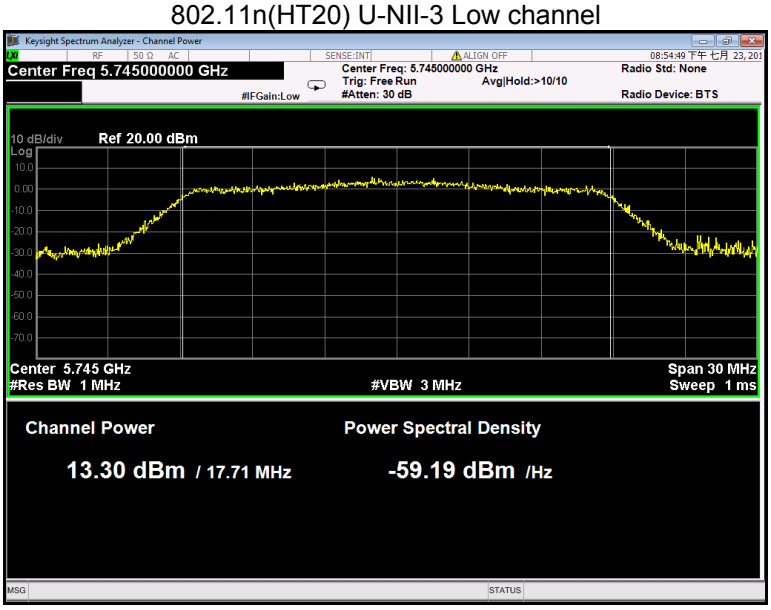
802.11a U-NII-3 Middle channel



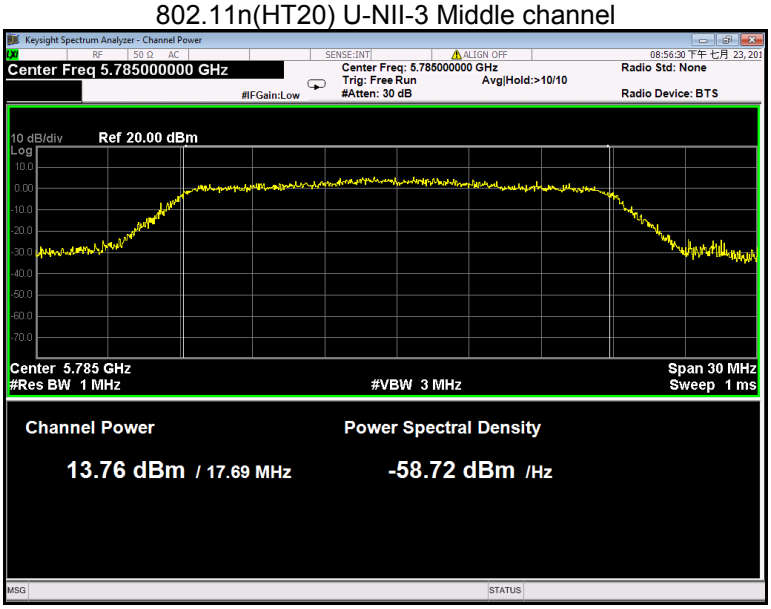
802.11a U-NII-3 High channel



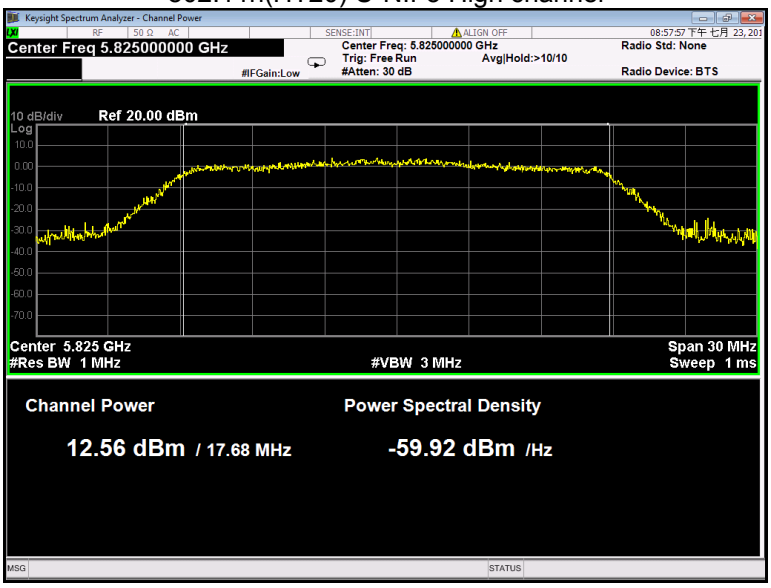
802.11n(HT20) U-NII-3 Low channel



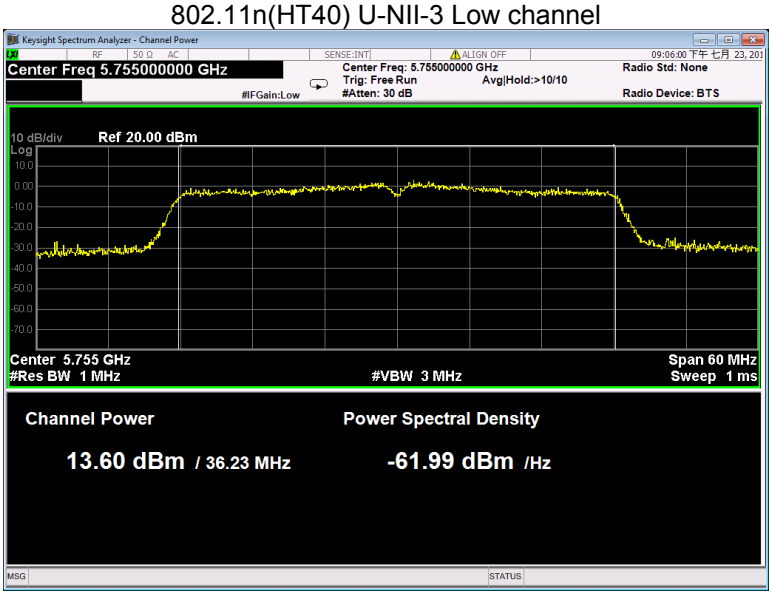
802.11n(HT20) U-NII-3 Middle channel



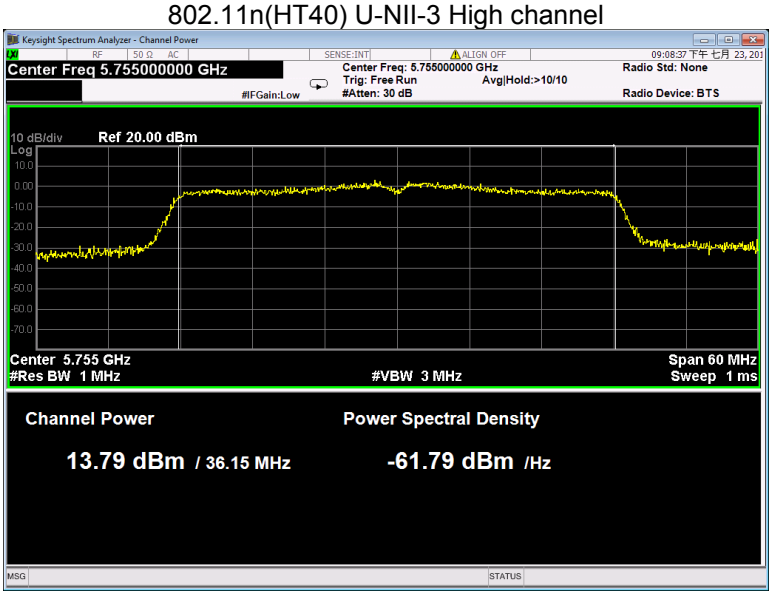
802.11n(HT20) U-NII-3 High channel



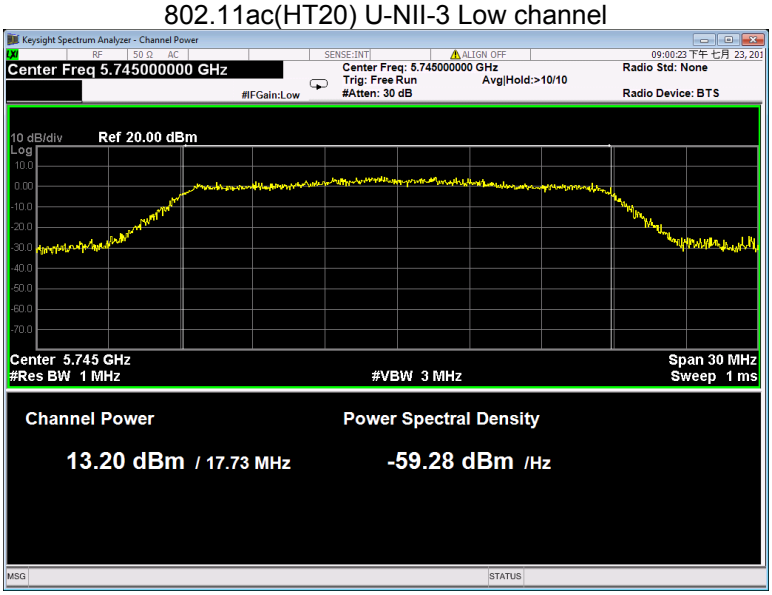
802.11n(HT40) U-NII-3 Low channel



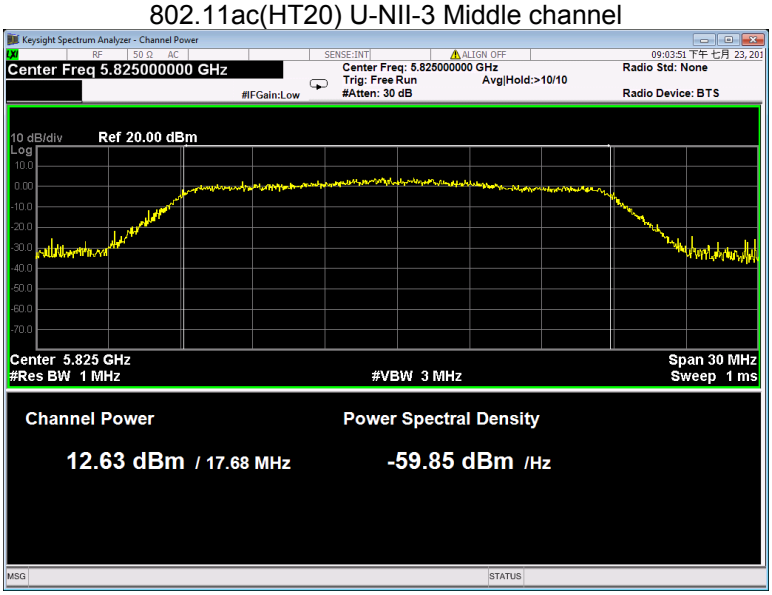
802.11n(HT40) U-NII-3 High channel



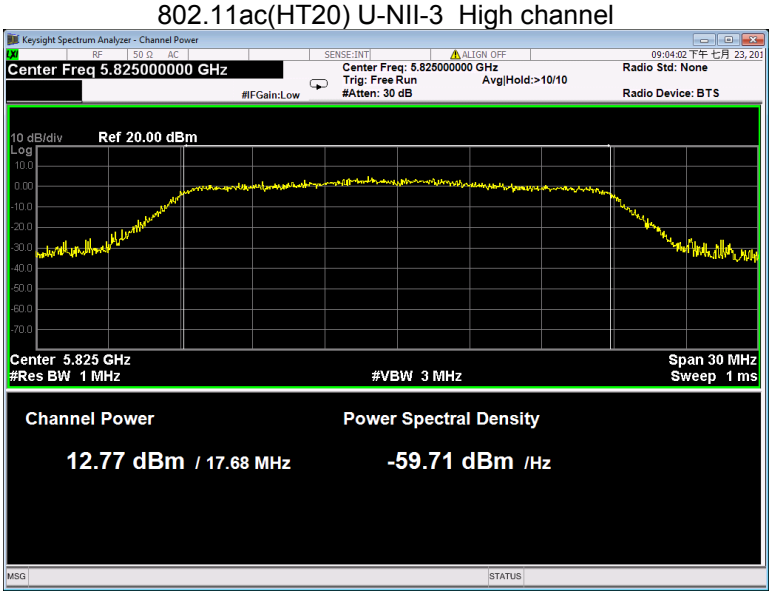
802.11ac(HT20) U-NII-3 Low channel



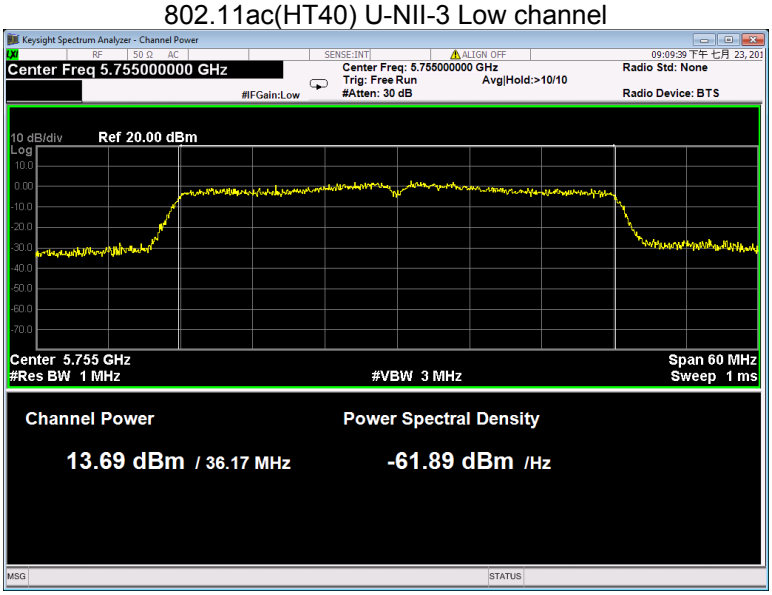
802.11ac(HT20) U-NII-3 Middle channel



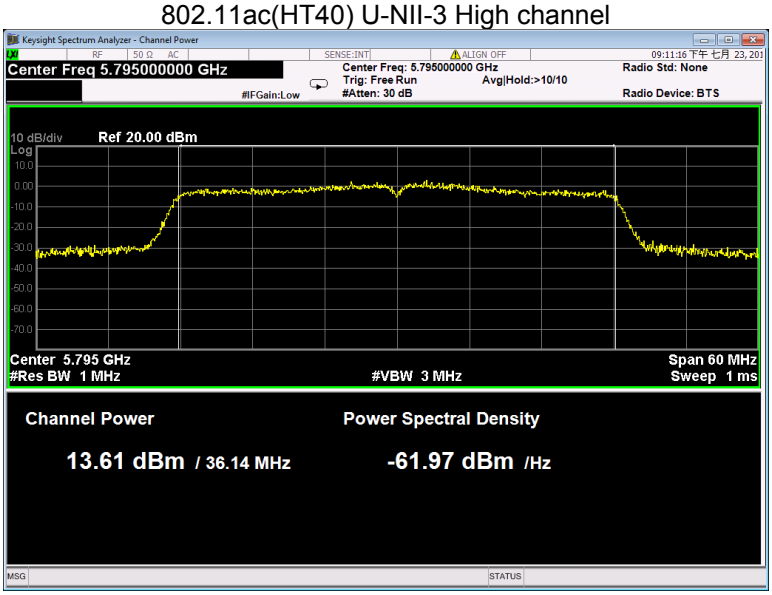
802.11ac(HT20) U-NII-3 High channel



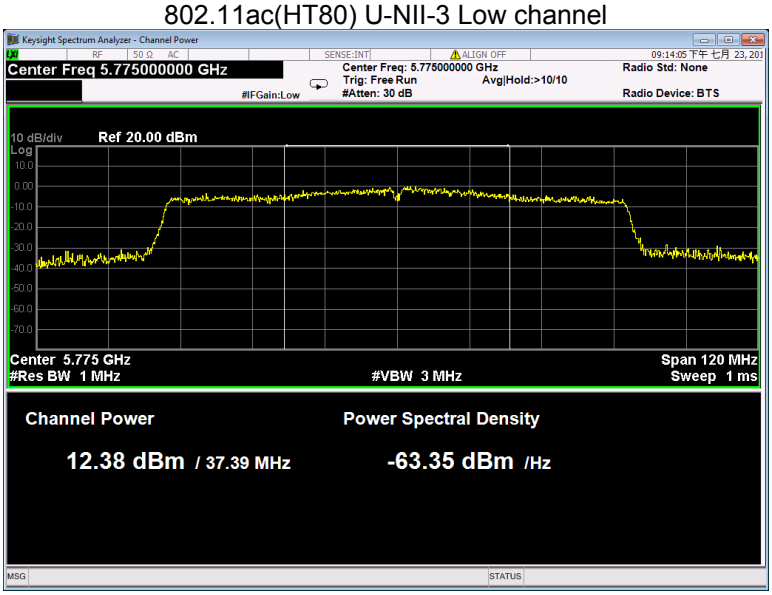
802.11ac(HT40) U-NII-3 Low channel



802.11ac(HT40) U-NII-3 High channel



802.11ac(HT80) U-NII-3 Low channel



13 Power Spectral density

Test Requirement:	FCC 47CFR Part 15 Section 15.407(a)
Test Method:	KDB 789033 D02 General U-NII Test Procedures New Rules v02r01
Test Limit:	≤11dBm/MHz for Operation in the U-NII-1(5150MHz-5250MHz,5250-5350MHz and 5470-5725MHz)of device; ≤30dBm/500kHz for Operation in the U-NII-3(5725MHz-5850MHz)of device
Test Result:	PASS

13.1 Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.

2. Set the spectrum analyzer:

U-NII-1

RBW = 1MHz, VBW ≥3* RBW Sweep = auto; Detector Function = Peak. Trace = Max hold.

U-NII-3

RBW = 510KHz, VBW ≥3* RBW Sweep = auto; Detector Function = Peak. Trace = Max hold.

3. Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section Submit this plot.

13.2 Test Result

Ant0

Band	Operation mode	Channel	Measurements (dBm)	Duty Cycle Factor (dB)	Power Spectral density (dBm)
U-NII-1	802.11a	Low	6.881	0.14	7.02
		Middle	6.814		6.95
		High	6.604		6.74
	802.11n(HT20)	Low	7.370	0.18	7.55
		Middle	6.876		7.06
		High	7.196		7.38
	802.11n(HT40)	Low	3.449	0.31	3.76
		High	3.354		3.66
	802.11ac(HT20)	Low	7.058	0.20	7.26
		Middle	7.107		7.31
		High	7.515		7.72
	802.11ac(HT40)	Low	3.859	0.35	4.21
		High	3.413		3.76
	802.11ac(HT80)	Middle	1.958	0.55	2.51

Band	Operation mode	Channel	Measurements (dBm)	Duty Cycle Factor (dB)	Power Spectral density (dBm)
U-NII-3	802.11a	Low	3.090	0.18	3.27
		Middle	3.137		3.32
		High	2.682		2.86
	802.11n(HT20)	Low	3.316	0.20	3.52
		High	3.102		3.30
	802.11n(HT40)	Low	0.904	0.31	1.21
		High	0.790		1.10
	802.11ac(HT20)	Low	4.443	0.16	4.60
		Middle	3.778		3.91
		High	3.312		3.47
	802.11ac(HT40)	Low	1.057	0.34	1.40
		High	1.246		1.59
	802.11ac(HT80)	Low	-0.41	0.56	0.15

Ant1

Band	Operation mode	Channel	Measurements (dBm)	Duty Cycle Factor (dB)	Power Spectral density (dBm)
U-NII-1	802.11a	Low	6.793	0.17	6.96
		Middle	6.814		6.98
		High	6.537		6.71
	802.11n(HT20)	Low	6.994	0.20	7.19
		Middle	7.078		7.28
		High	7.263		7.46
	802.11n(HT40)	Low	3.268	0.34	3.61
		High	3.577		3.92
	802.11ac(HT20)	Low	7.121	0.36	7.48
		Middle	7.410		7.77
		High	6.810		7.17
	802.11ac(HT40)	Low	3.522	0.31	3.83
		High	3.388		3.70
	802.11ac(HT80)	Middle	1.525	0.57	2.10

Band	Operation mode	Channel	Measurements (dBm)	Duty Cycle Factor (dB)	Power Spectral density (dBm)
U-NII-3	802.11a	Low	2.998	0.19	3.19
		Middle	3.338		3.53
		High	2.946		3.14
	802.11n(HT20)	Low	3.630	0.19	3.82
		High	2.727		2.92
	802.11n(HT40)	Low	0.804	0.34	1.14
		High	1.498		1.84
	802.11ac(HT20)	Low	3.247	0.19	3.44
		Middle	3.978		4.17
		High	3.258		3.45
	802.11ac(HT40)	Low	1.225	0.31	1.54
		High	0.921		1.23
	802.11ac(HT80)	Low	-1.403	0.54	-0.86

Simultaneous Transmission

Band	Operation mode	Channel	Power Spectral density (dBm)		
			Ant. 0	Ant. 1	SUM
U-NII-1	802.11a	Low	7.02	6.96	/
		Middle	6.95	6.98	/
		High	6.74	6.71	/
	802.11n(HT20)	Low	7.55	7.19	10.38
		Middle	7.06	7.28	10.18
		High	7.38	7.46	10.43
	802.11ac (HT20)	Low	3.76	3.61	6.70
		Middle	3.66	3.92	6.80
		High	7.26	7.48	10.38
	802.11n(HT40)	Low	7.31	7.77	10.56
		High	7.72	7.17	10.46
	802.11ac (HT40)	Low	4.21	3.83	7.03
		High	3.76	3.7	6.74
	802.11ac (HT80)	Middle	2.51	2.1	5.32

Band	Operation mode	Channel	Power Spectral density (dBm)		
			Ant. 0	Ant. 1	SUM
U-NII-3	802.11a	Low	3.27	3.19	/
		Middle	3.32	3.53	/
		High	2.86	3.14	/
	802.11n(HT20)	Low	3.52	3.82	6.68
		High	3.3	2.92	6.12
	802.11ac (HT20)	Low	1.21	1.14	4.19
		Middle	1.1	1.84	4.50
		High	4.6	3.44	7.07
	802.11n(HT40)	Low	3.91	4.17	7.05
		High	3.47	3.45	6.47
	802.11ac (HT40)	Low	1.4	1.54	4.48
		High	1.59	1.23	4.42
	802.11ac (HT80)	Middle	0.15	-0.86	2.68

Note:

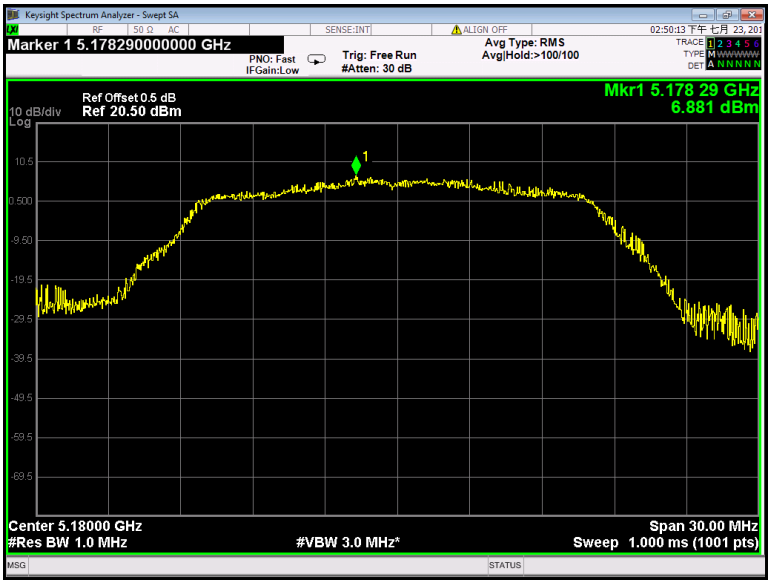
1. Conducted Output Power Spectral Density = Measurements + Duty Cycle Factor

* All transmit signals are completely uncorrelated with each other, Directional gain = G_{ANT} which is less than 6dBi. So the limit does not be reduced.

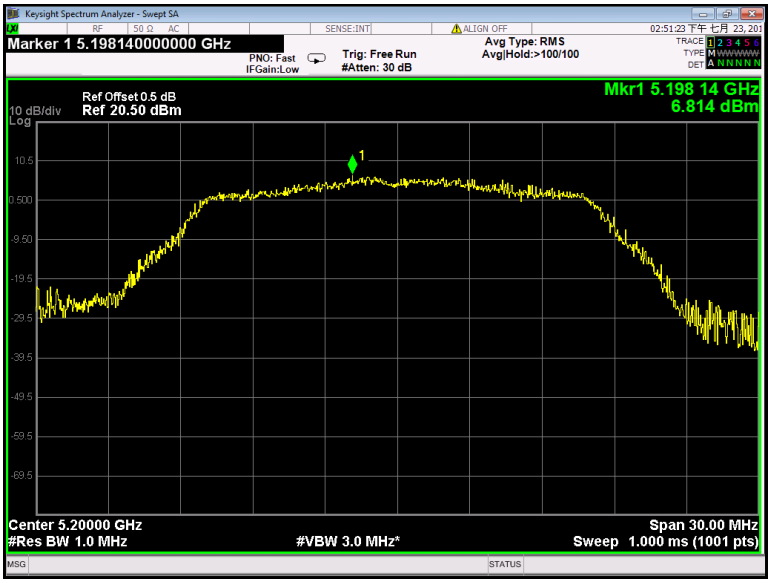
Test result plots shown as follows:

Ant0

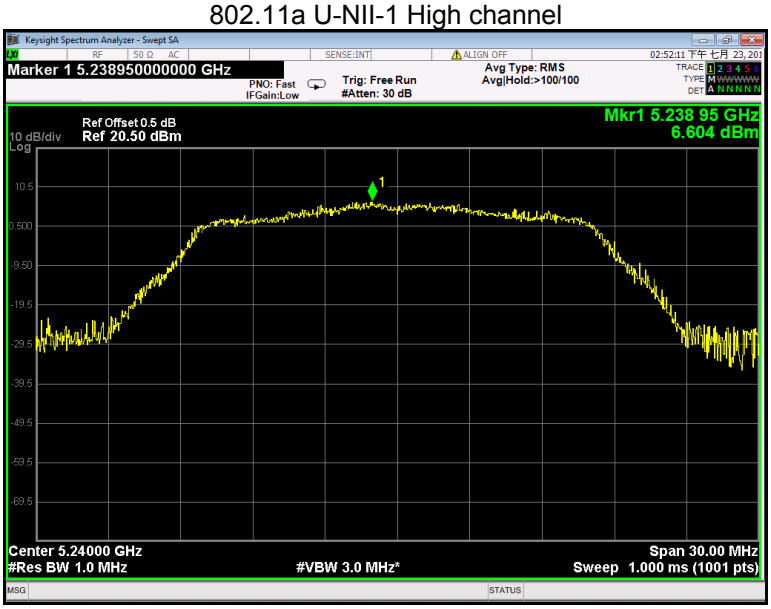
802.11a U-NII-1 Low channel



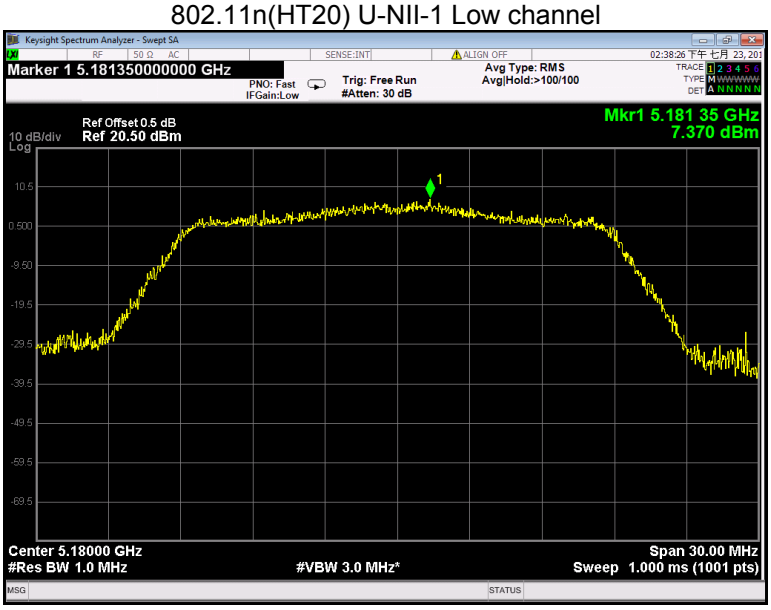
802.11a U-NII-1 Middle channel



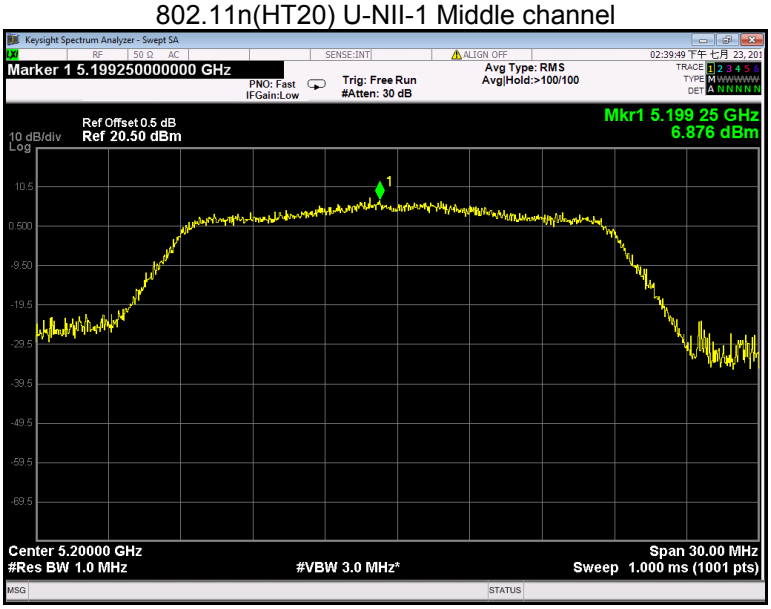
802.11a U-NII-1 High channel



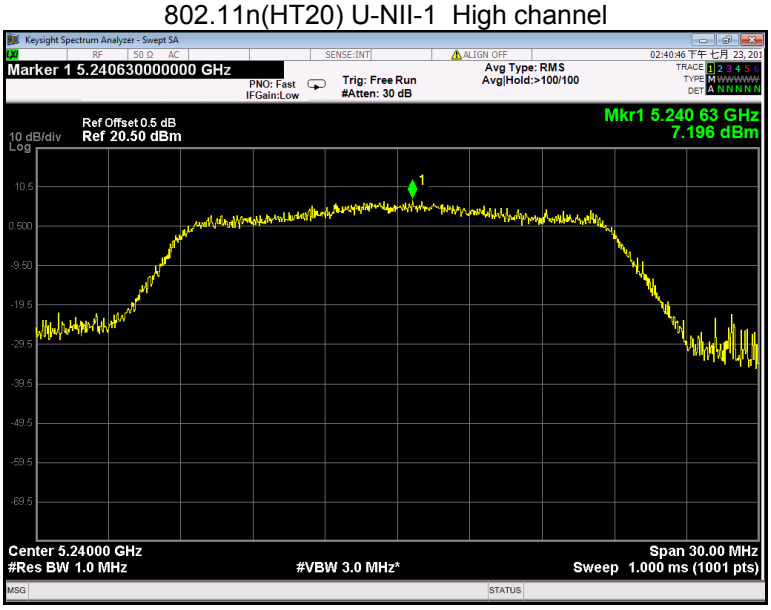
802.11n(HT20) U-NII-1 Low channel



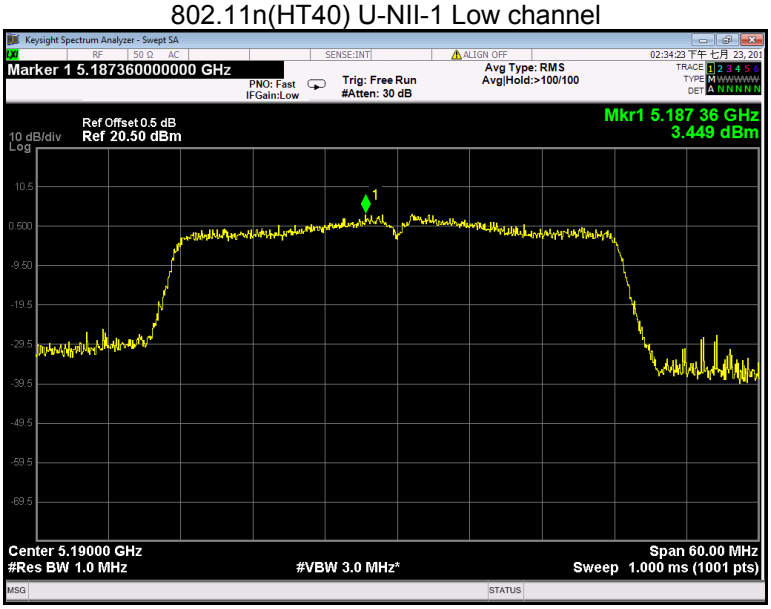
802.11n(HT20) U-NII-1 Middle channel



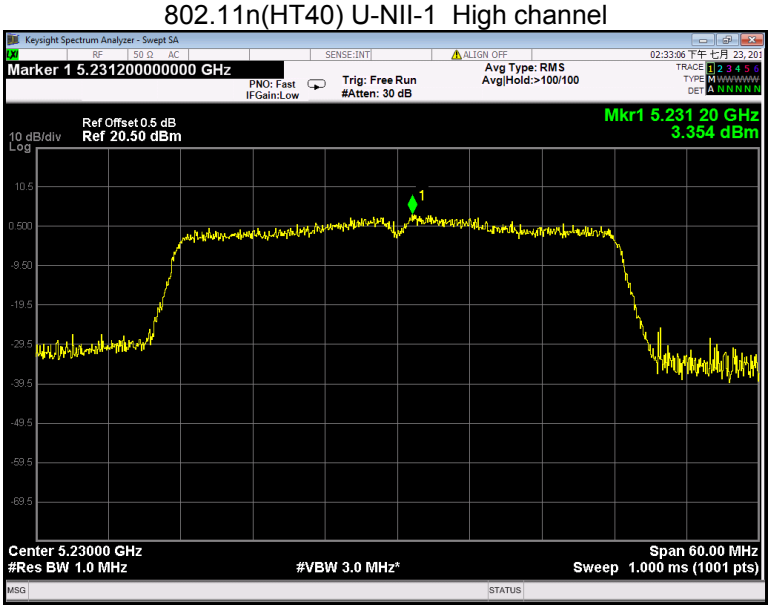
802.11n(HT20) U-NII-1 High channel



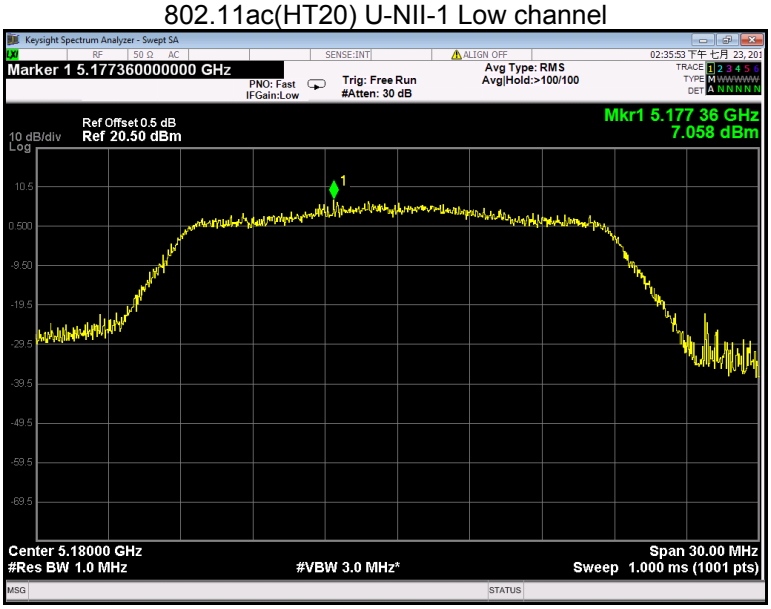
802.11n(HT40) U-NII-1 Low channel



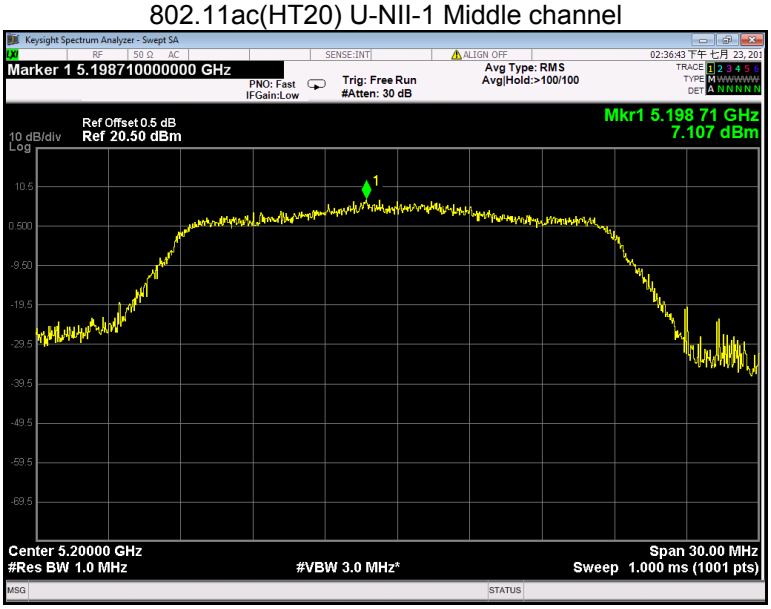
802.11n(HT40) U-NII-1 High channel



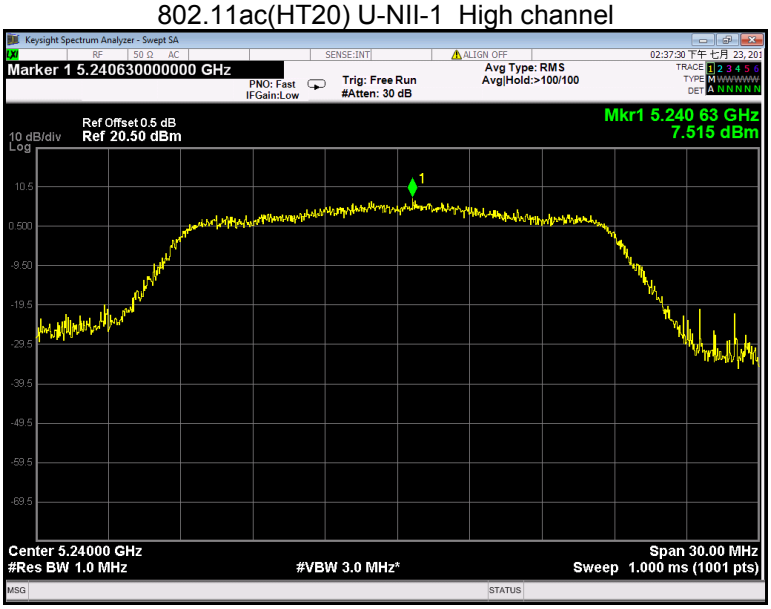
802.11ac(HT20) U-NII-1 Low channel



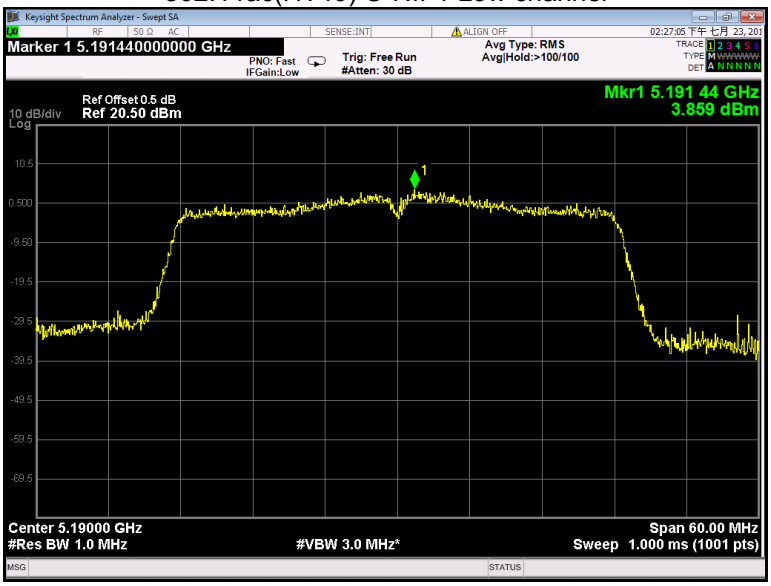
802.11ac(HT20) U-NII-1 Middle channel



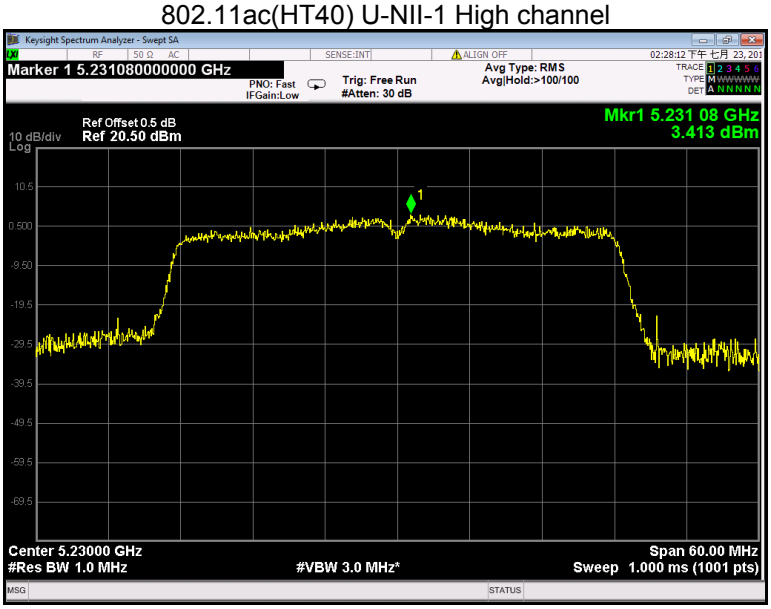
802.11ac(HT20) U-NII-1 High channel



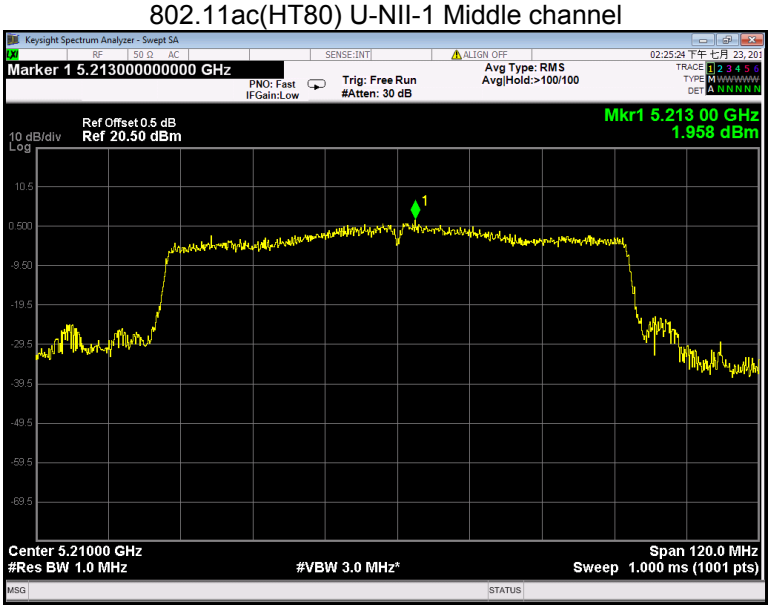
802.11ac(HT40) U-NII-1 Low channel



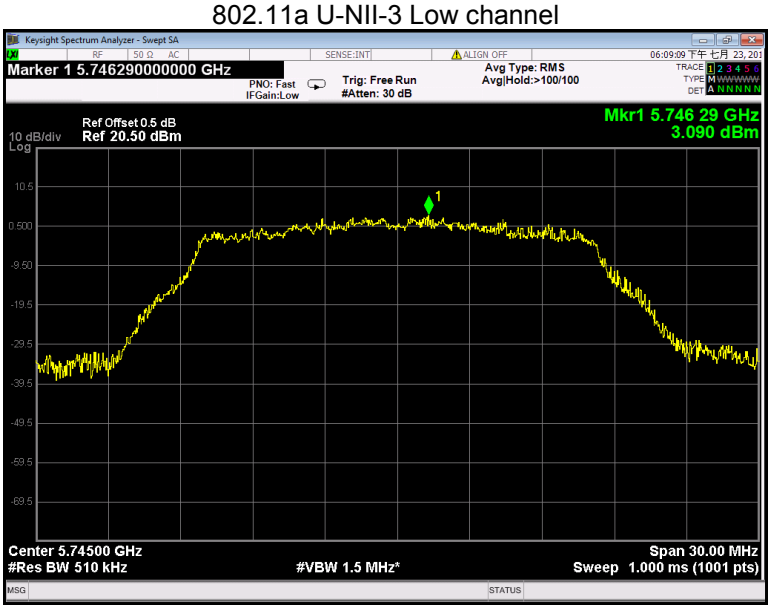
802.11ac(HT40) U-NII-1 High channel



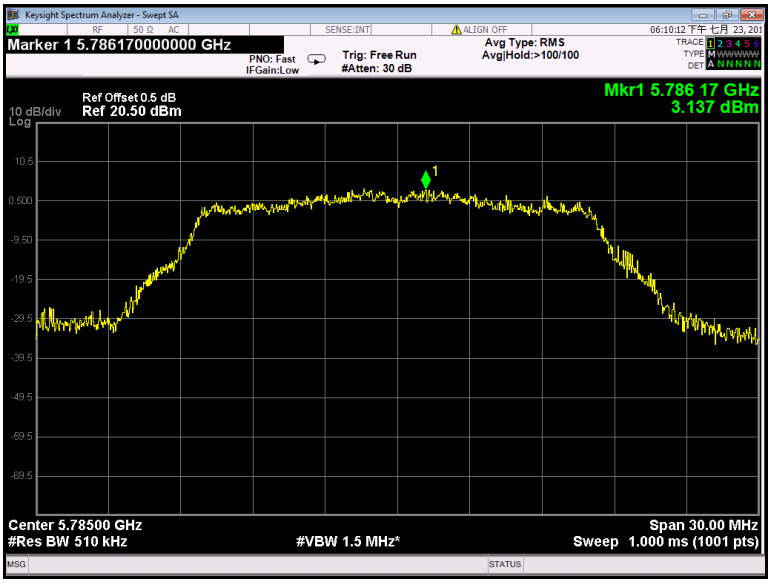
802.11ac(HT80) U-NII-1 Middle channel



802.11a U-NII-3 Low channel



802.11a U-NII-3 Middle channel



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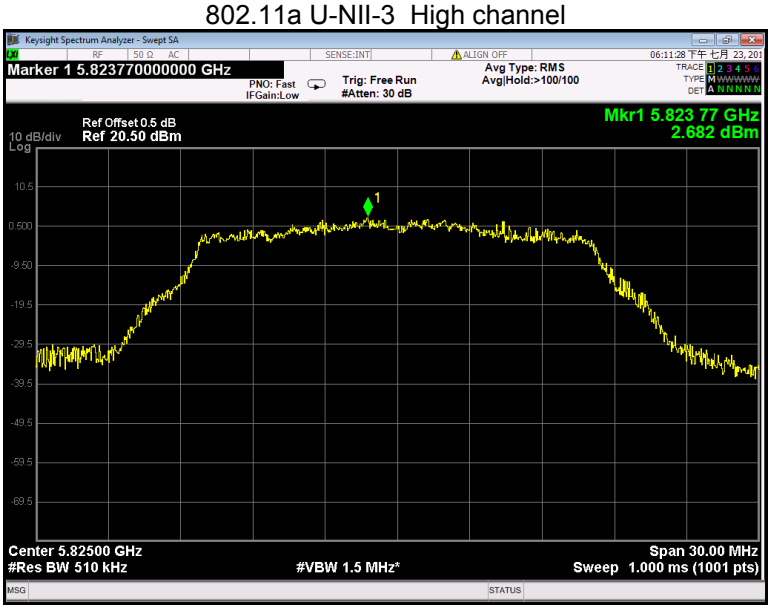
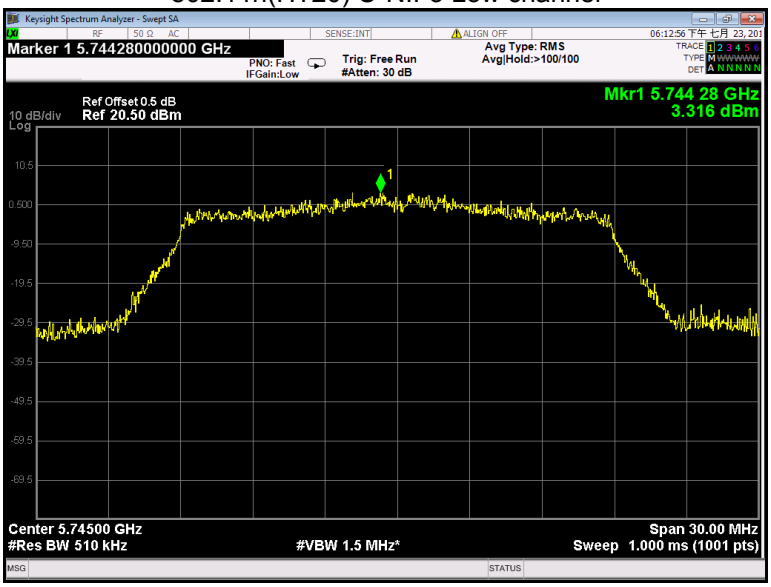
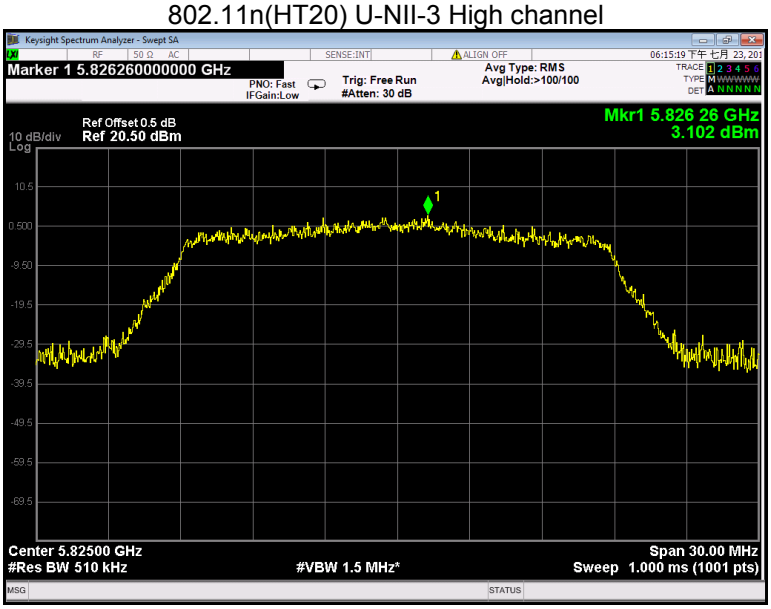


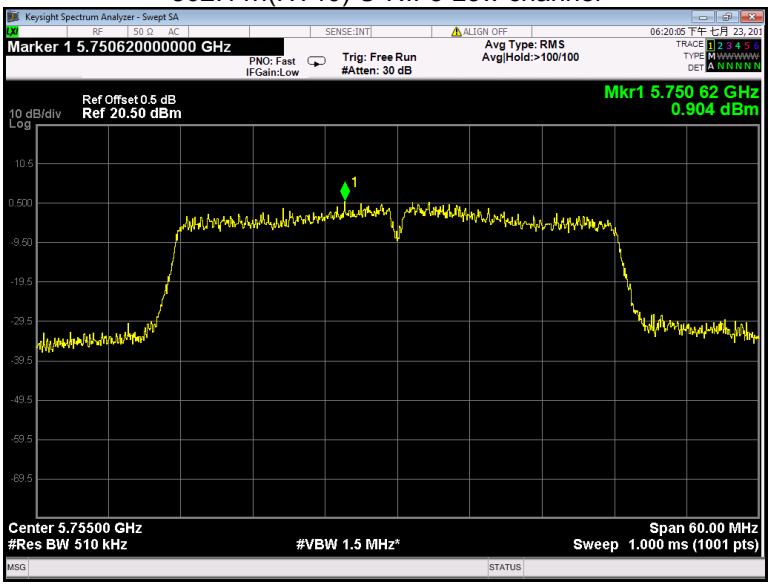
802.11n(HT20) U-NII-3 Low channel



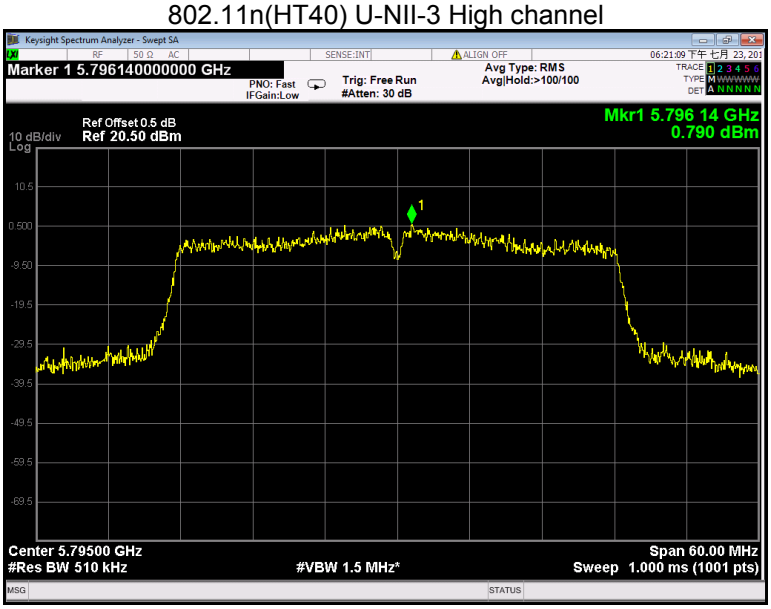
802.11n(HT20) U-NII-3 High channel



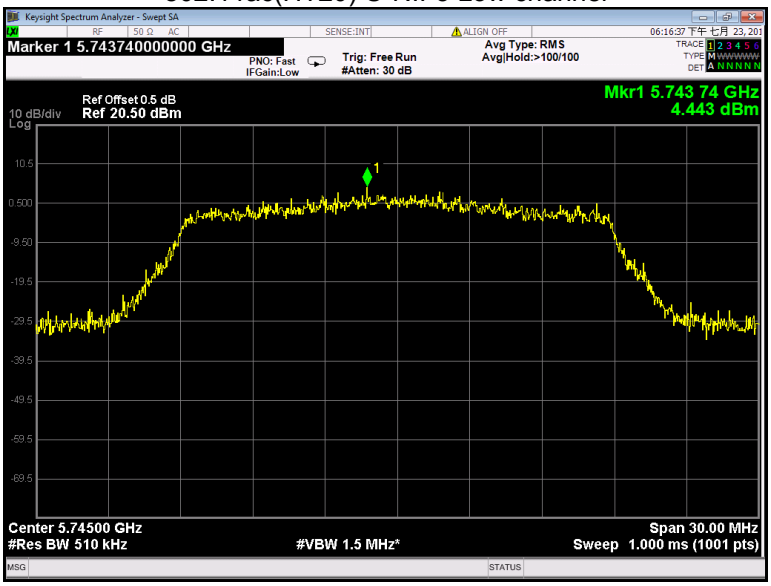
802.11n(HT40) U-NII-3 Low channel



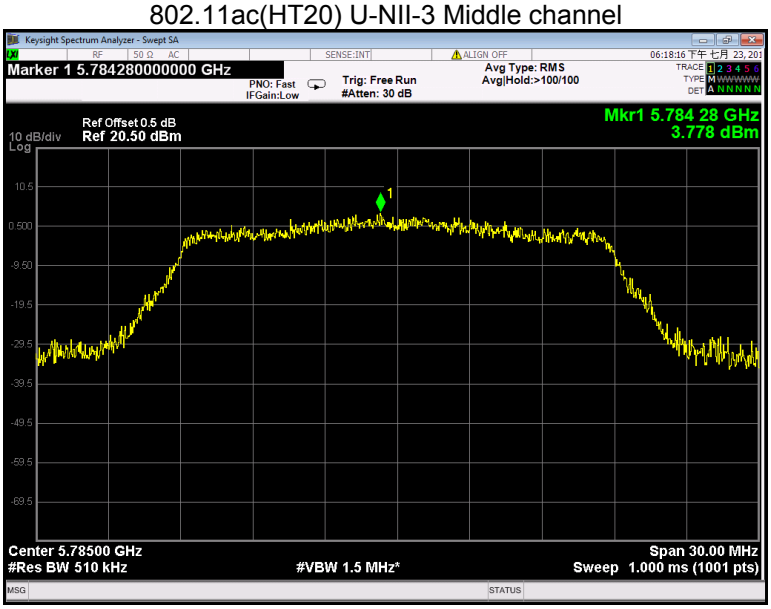
802.11n(HT40) U-NII-3 High channel



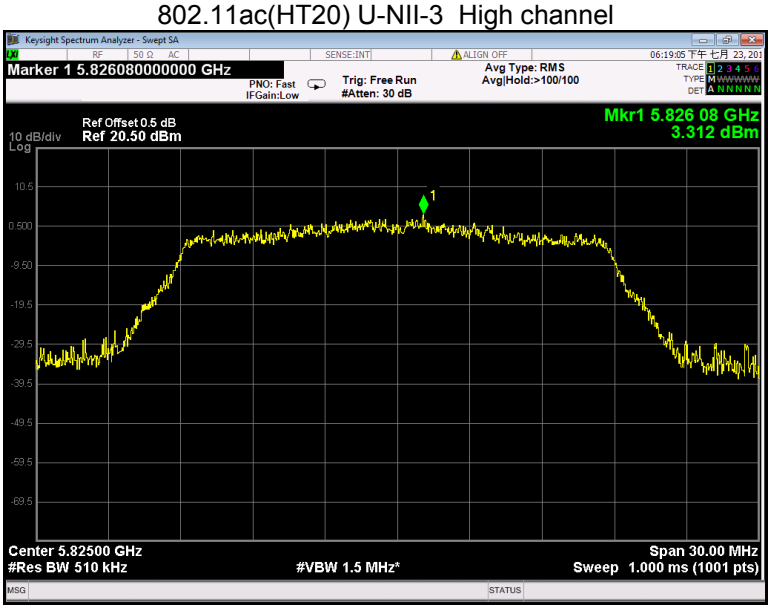
802.11ac(HT20) U-NII-3 Low channel



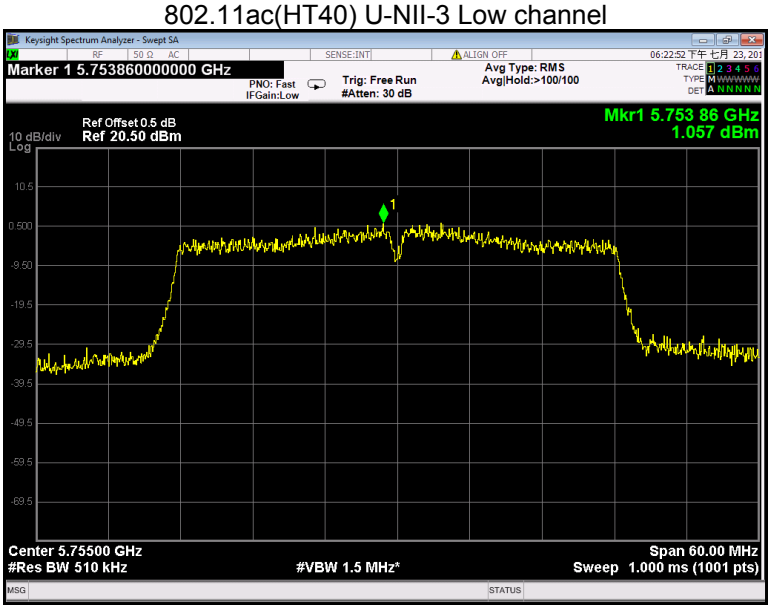
802.11ac(HT20) U-NII-3 Middle channel



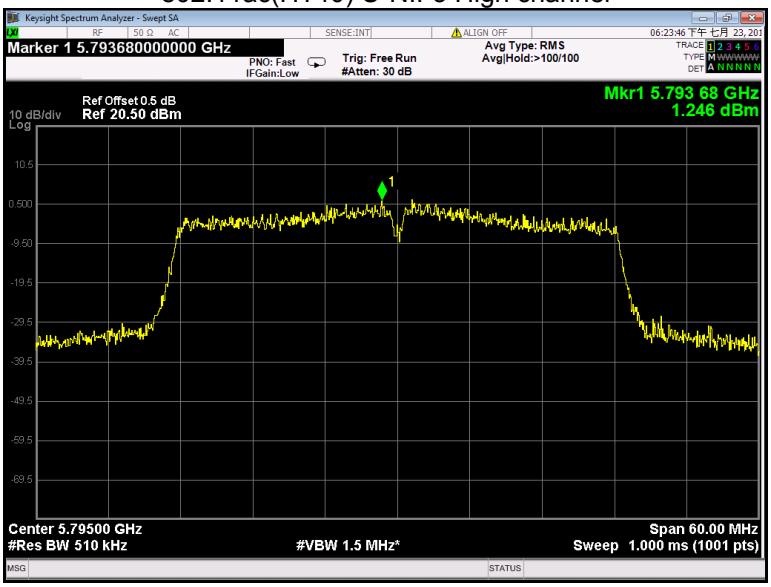
802.11ac(HT20) U-NII-3 High channel



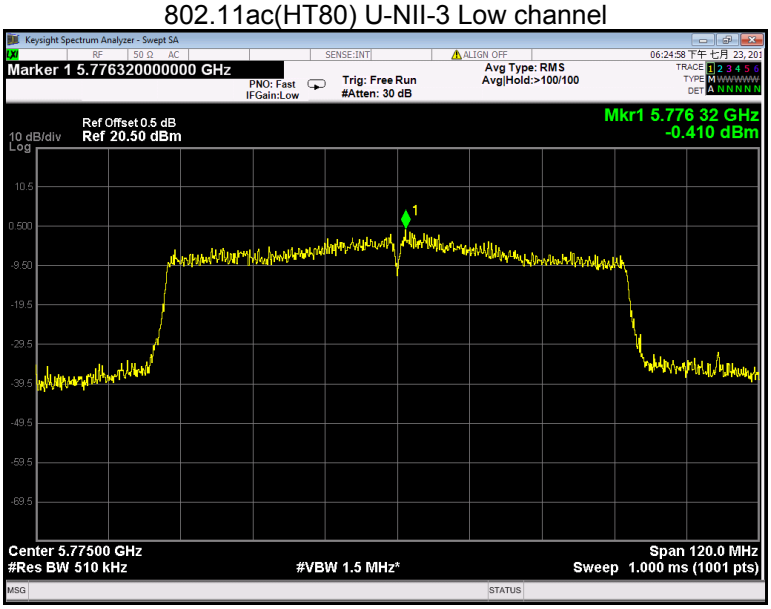
802.11ac(HT40) U-NII-3 Low channel



802.11ac(HT40) U-NII-3 High channel

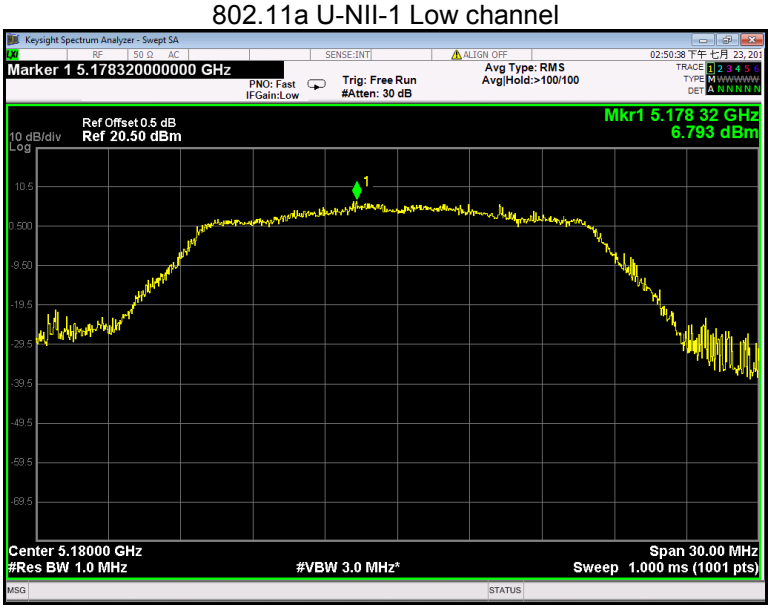


802.11ac(HT80) U-NII-3 Low channel

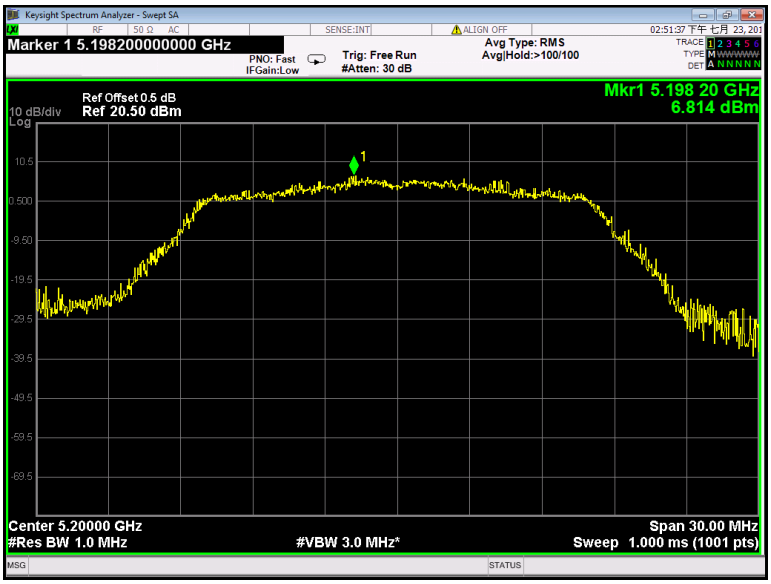


Ant1

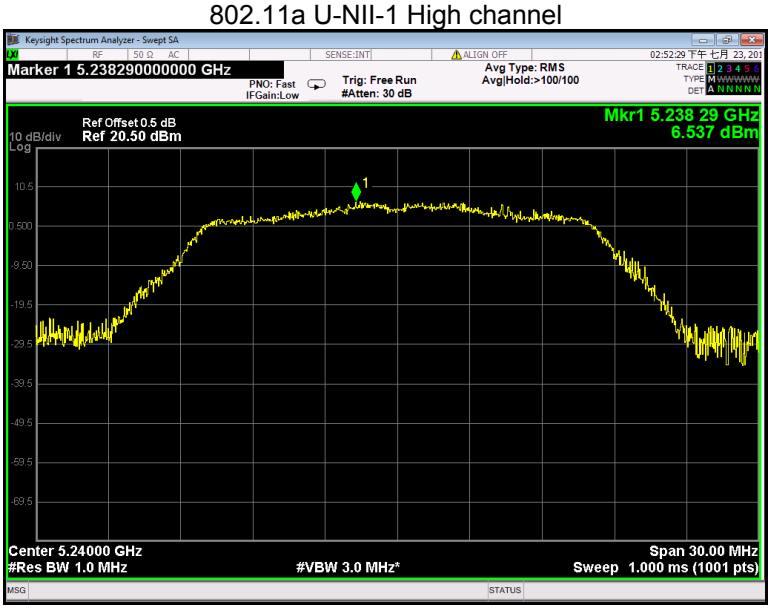
802.11a U-NII-1 Low channel



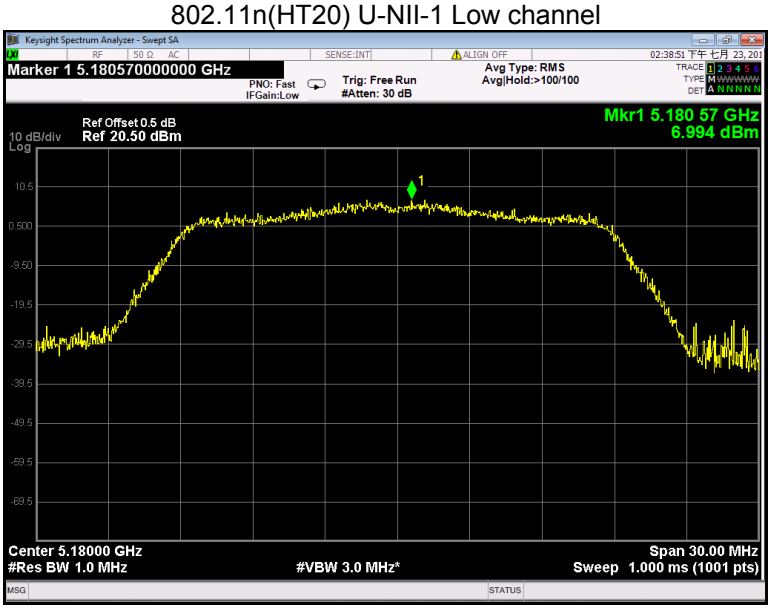
802.11a U-NII-1 Middle channel



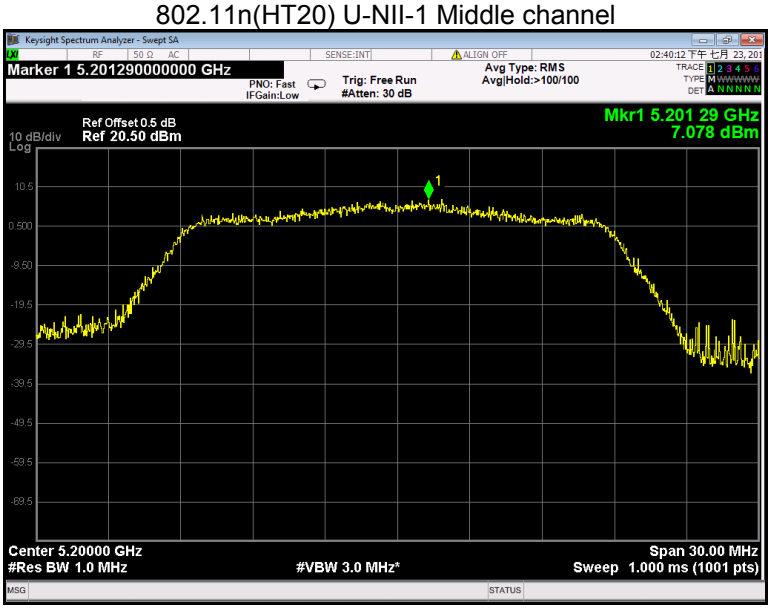
802.11a U-NII-1 High channel



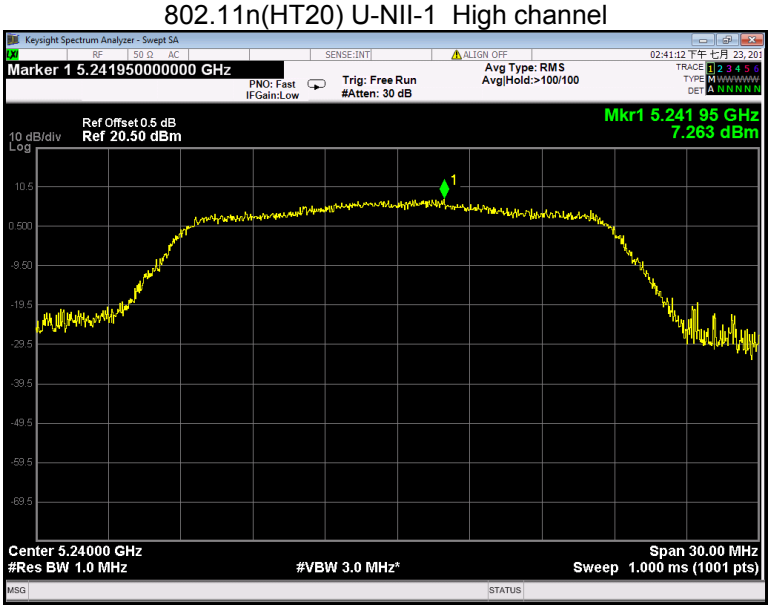
802.11n(HT20) U-NII-1 Low channel



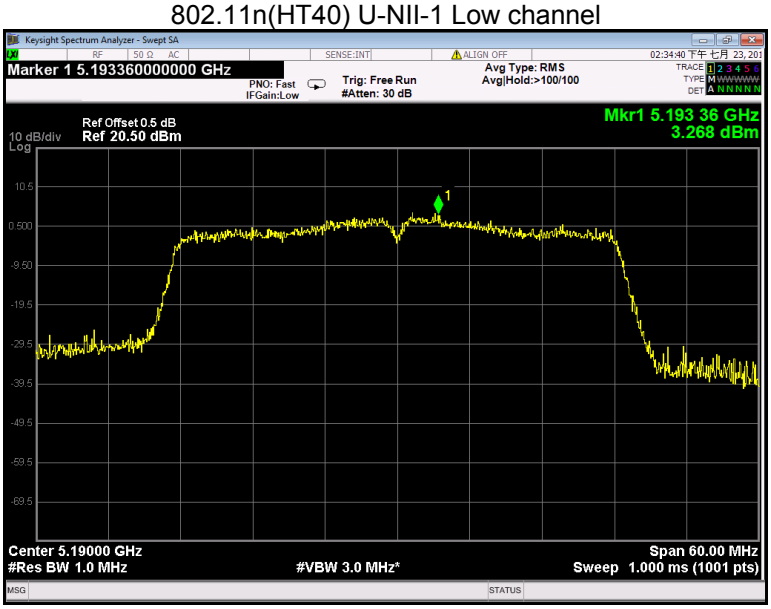
802.11n(HT20) U-NII-1 Middle channel



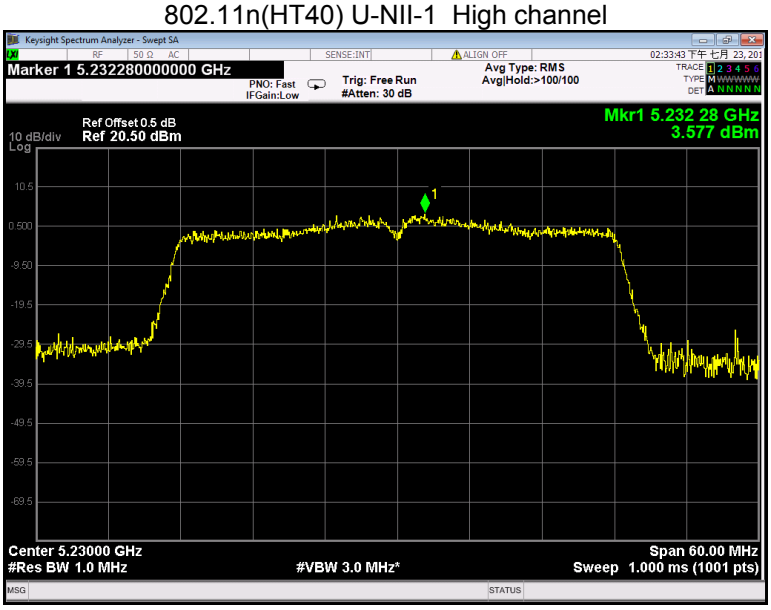
802.11n(HT20) U-NII-1 High channel



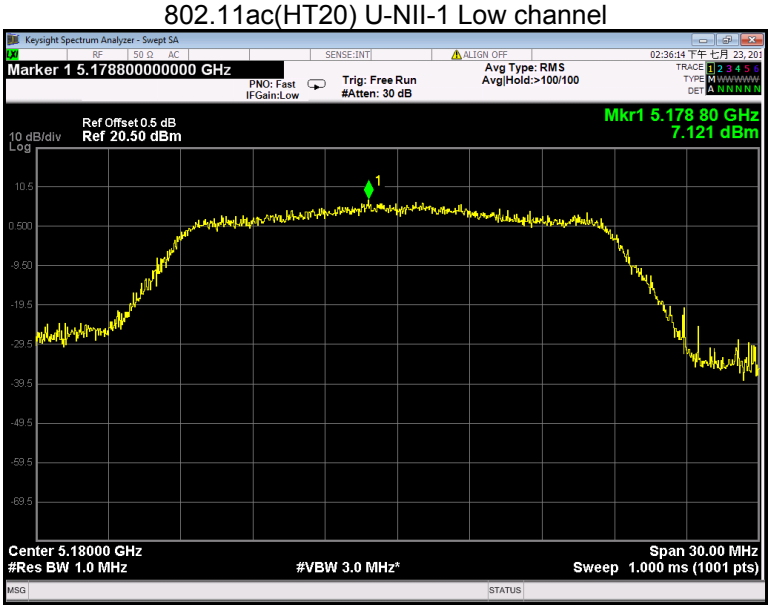
802.11n(HT40) U-NII-1 Low channel



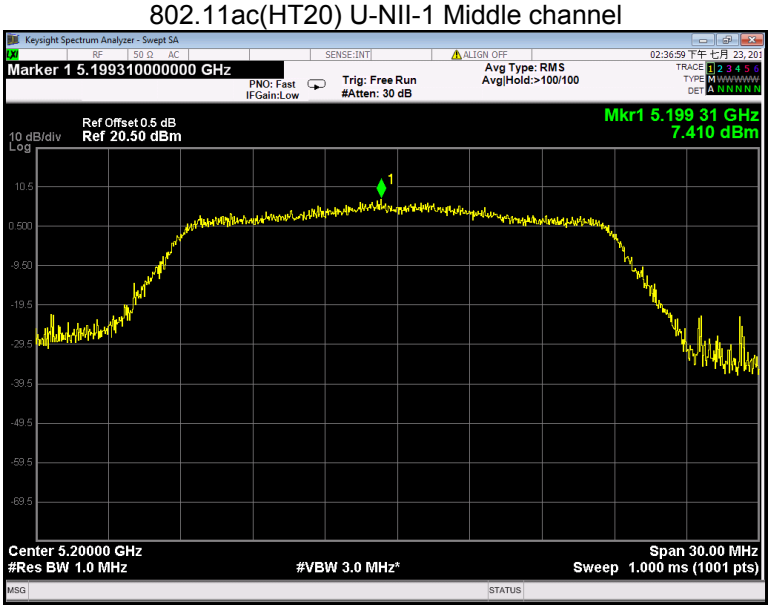
802.11n(HT40) U-NII-1 High channel



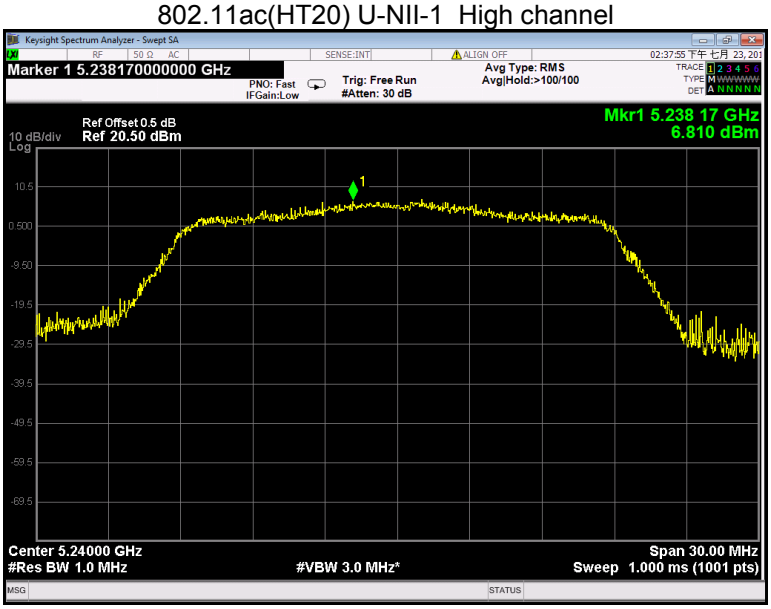
802.11ac(HT20) U-NII-1 Low channel



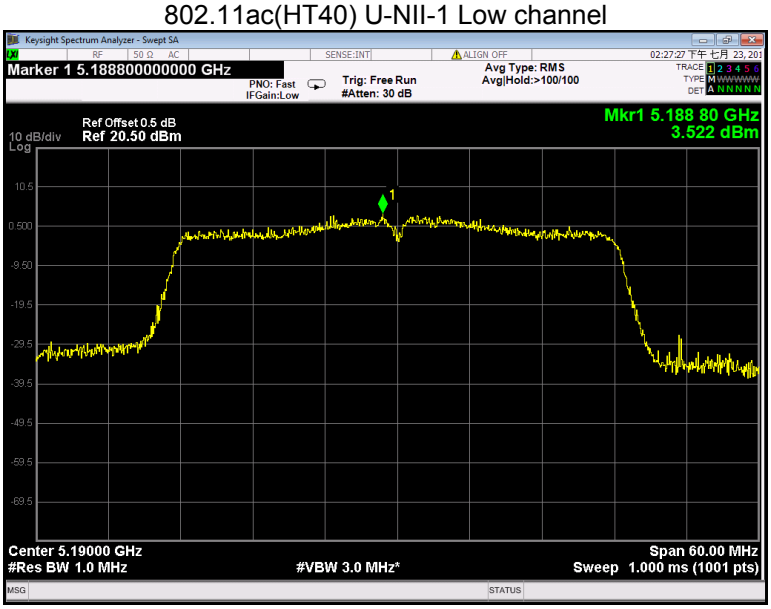
802.11ac(HT20) U-NII-1 Middle channel



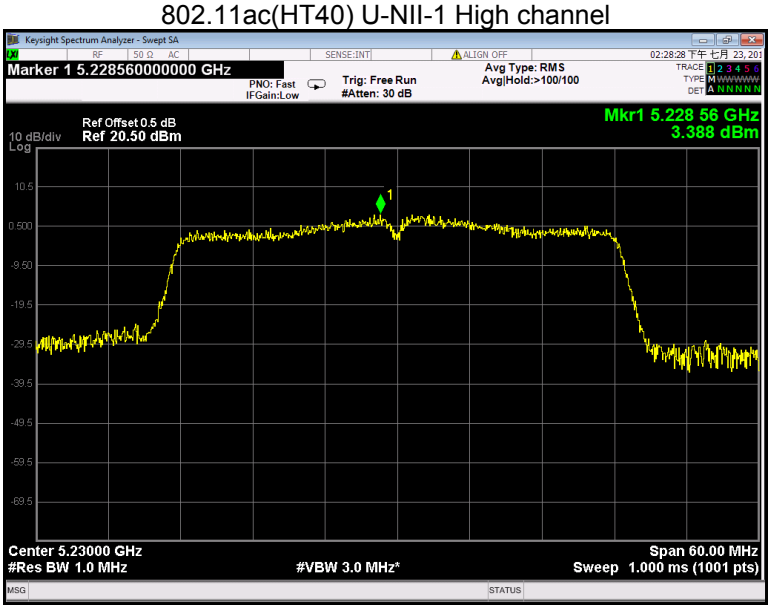
802.11ac(HT20) U-NII-1 High channel



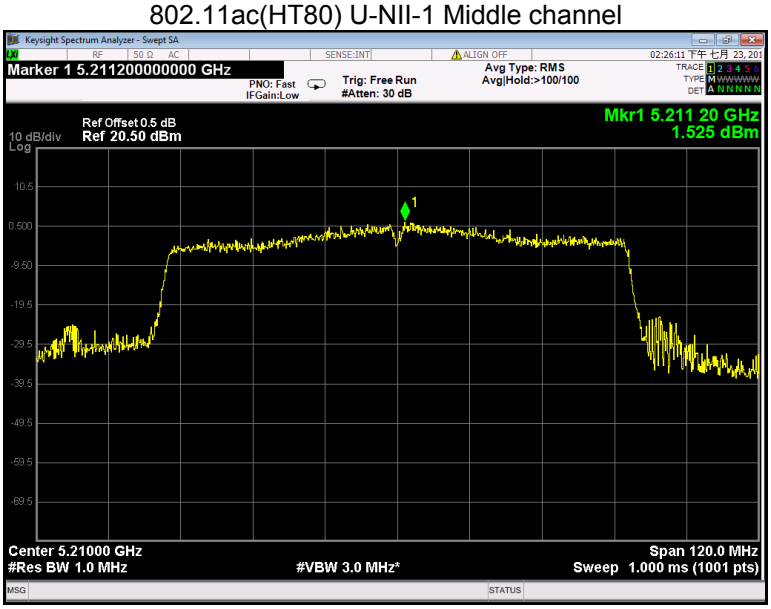
802.11ac(HT40) U-NII-1 Low channel



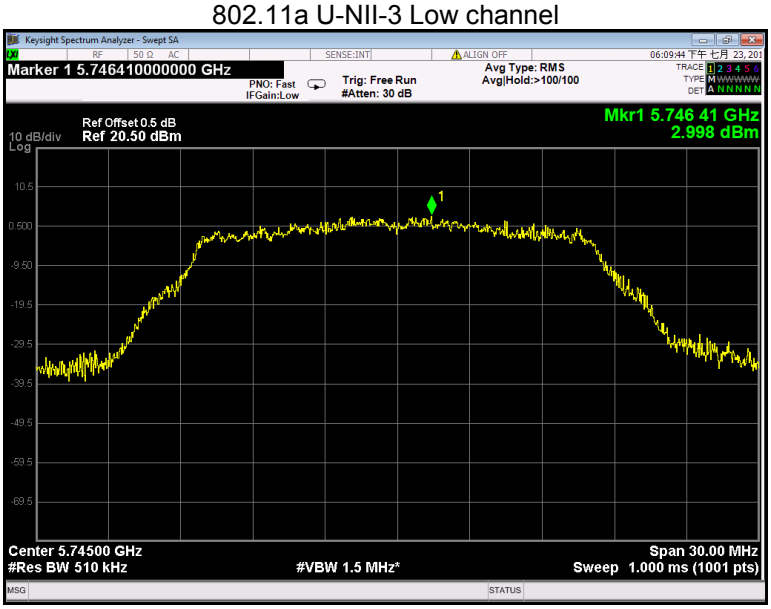
802.11ac(HT40) U-NII-1 High channel



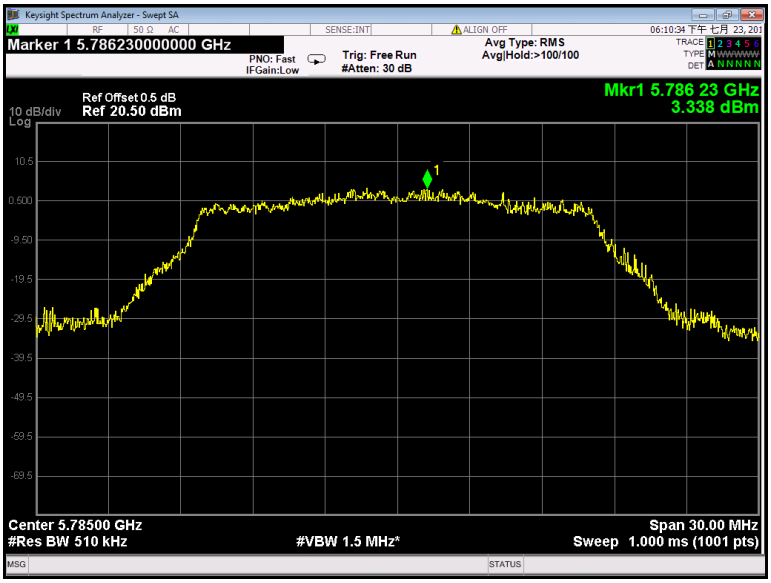
802.11ac(HT80) U-NII-1 Middle channel



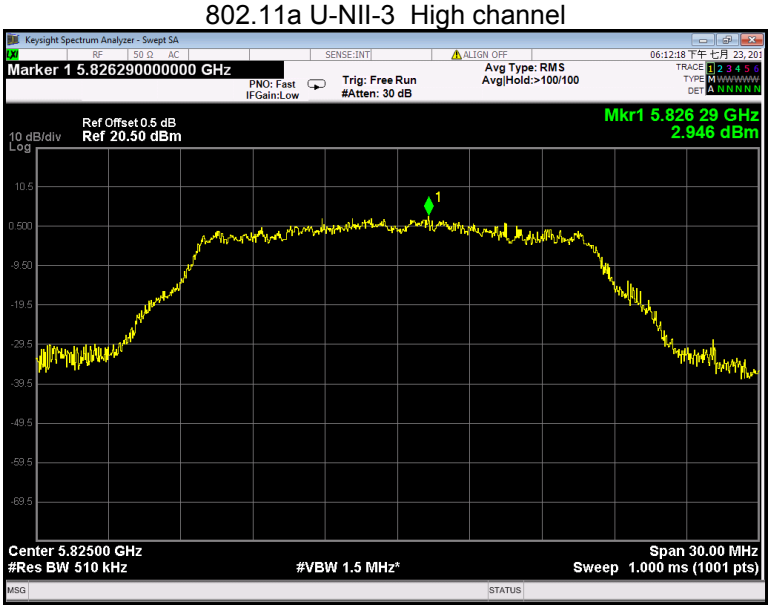
802.11a U-NII-3 Low channel



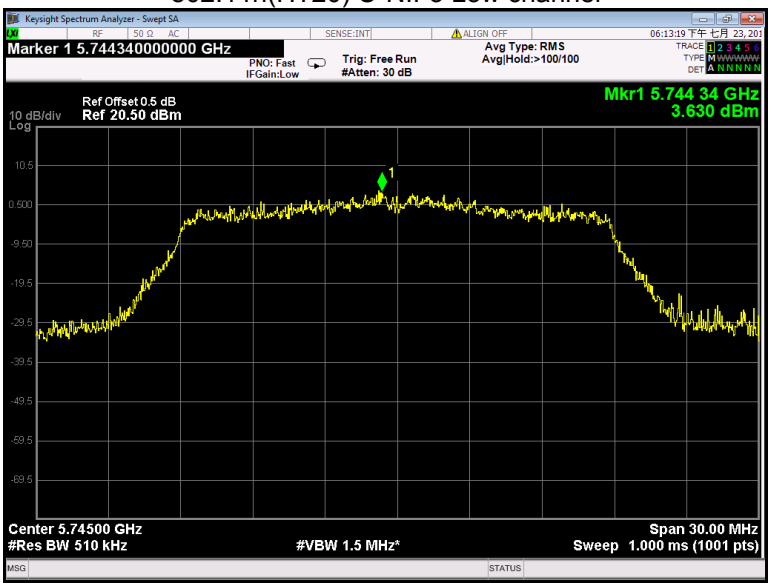
802.11a U-NII-3 Middle channel



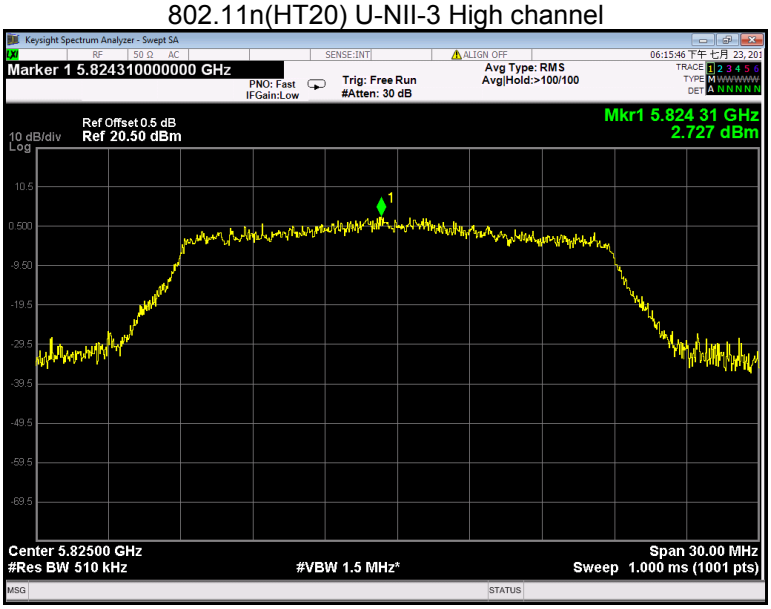
802.11a U-NII-3 High channel



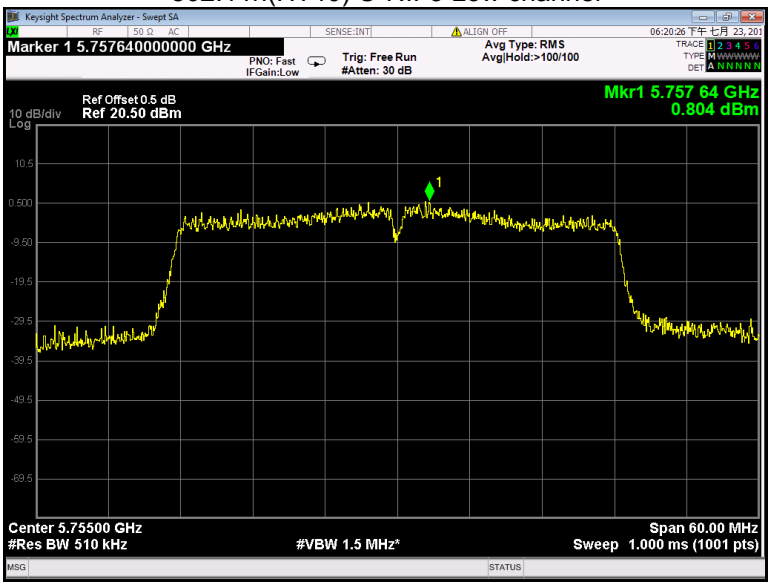
802.11n(HT20) U-NII-3 Low channel



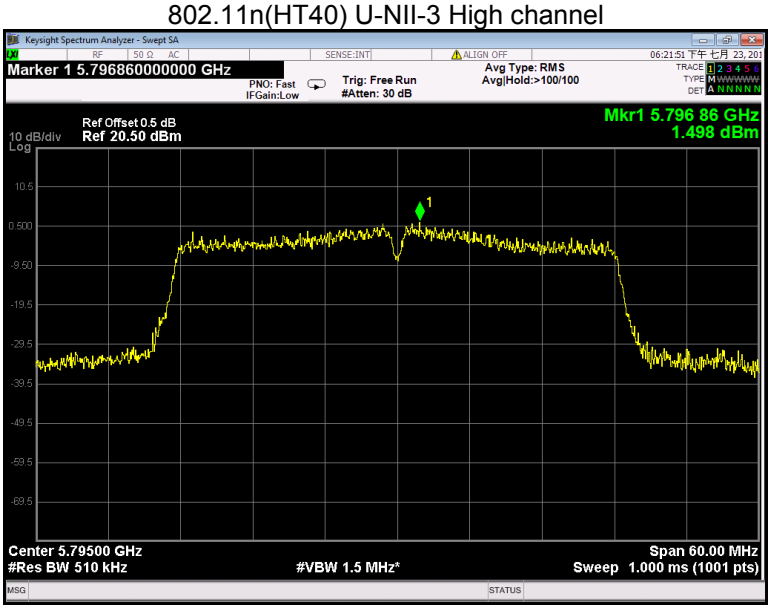
802.11n(HT20) U-NII-3 High channel



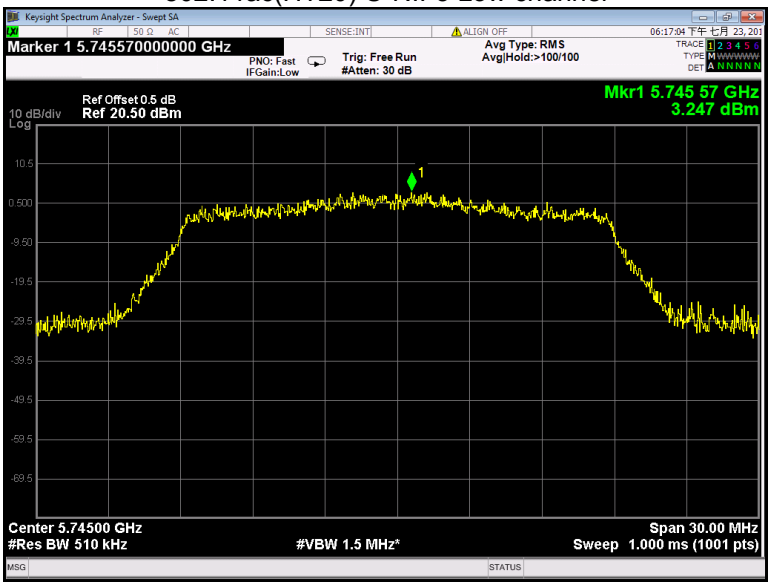
802.11n(HT40) U-NII-3 Low channel



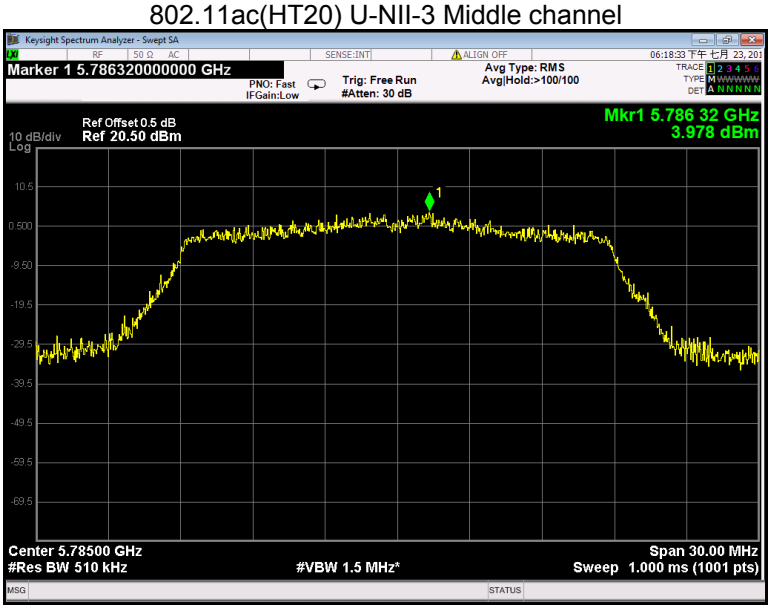
802.11n(HT40) U-NII-3 High channel



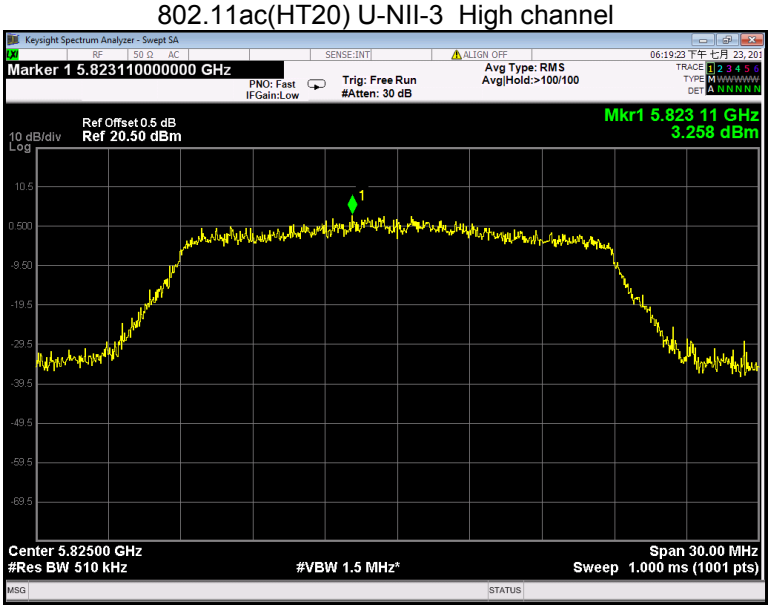
802.11ac(HT20) U-NII-3 Low channel



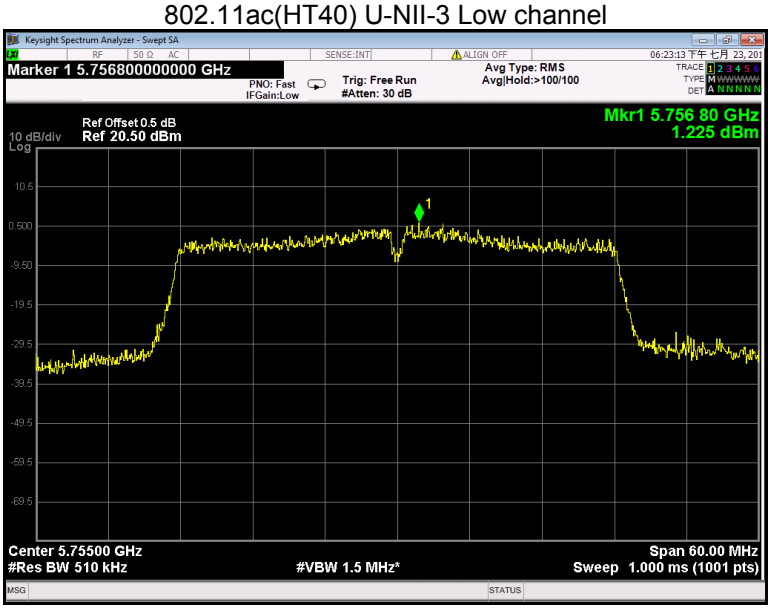
802.11ac(HT20) U-NII-3 Middle channel



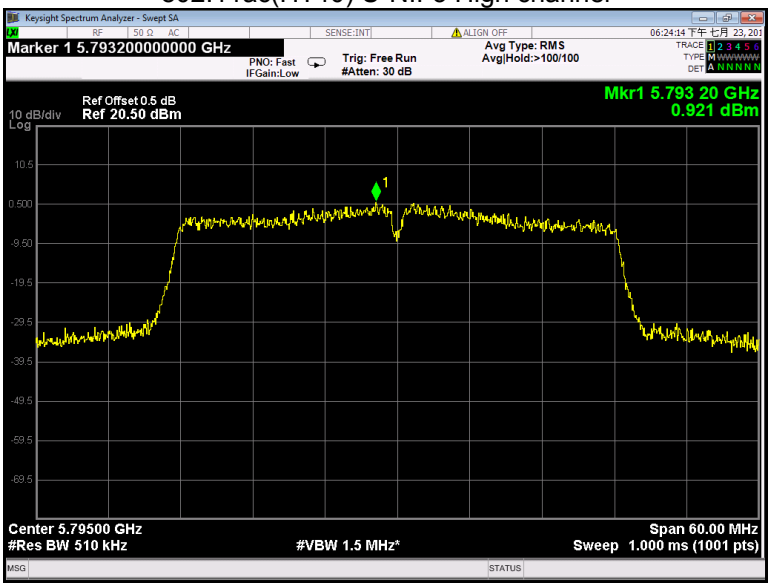
802.11ac(HT20) U-NII-3 High channel



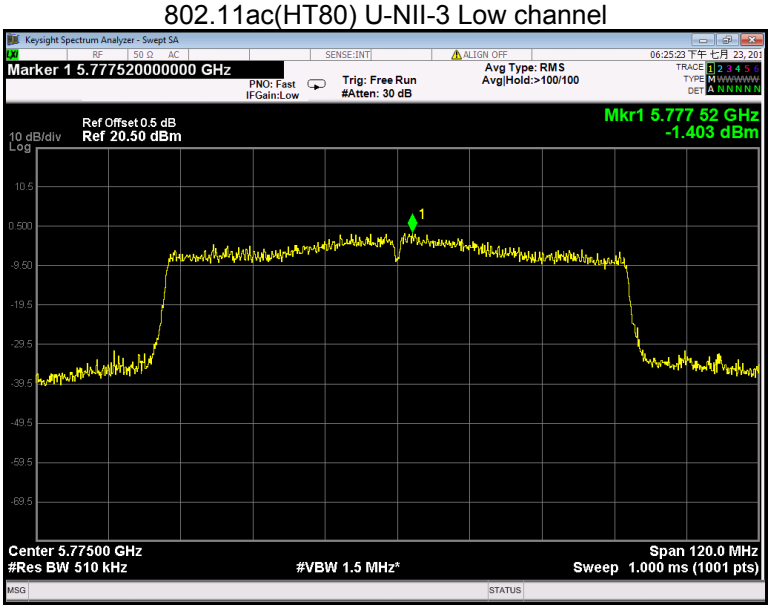
802.11ac(HT40) U-NII-3 Low channel



802.11ac(HT40) U-NII-3 High channel



802.11ac(HT80) U-NII-3 Low channel



14 Frequency Stability

Test Requirement:	FCC 47CFR Part 15 Section 15.407(g)
Test Method:	ANSI C63.10:2013
Test 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 users manual or 20ppm.
Test Result:	PASS

14.1 Test Procedure

1. The transmitter output (antenna port) was connected to the spectrum analyzer. EUT have transmitted absence of unmodulation signal and fixed channelise. Set the spectrum analyzer span to view the entire absence of modulation emissions bandwidth. Set RBW = 10 kHz, VBW = 10 kHz with peak detector and maxhold settings. fc is declaring of channel frequency. Then the frequency error formula is (fc-f)/fc × 106 ppm and the limit is less than ±20ppm The test extreme voltage is to change the primary supply voltage from 85 to 115 percent of the nominal value.

2. Extreme temperature rule is -30°C~ 75°C.

14.2 Test Result

U-NII-1 Test Frequency:5180MHz				
Temperature (℃)	Power Supply (VDC)	Frequency Error (MHz)	Frequency Error (ppm)	Limit (ppm)
75	3.3	0.0001	0.03	20
70		0.0057	1.09	20
60		-0.0037	-0.71	20
50		0.0000	0.00	20
40		-0.0036	-0.69	20
30		0.0083	1.60	20
20		-0.0011	-0.22	20
10		-0.0038	-0.73	20
0		-0.0035	-0.68	20
-10		-0.0014	-0.27	20
-20		-0.0020	-0.38	20
20	2.8	0.0059	1.14	20
-20	3.6	0.0041	0.80	20

U-NII-3 Test Frequency:5785MHz				
Temperature (℃)	Power Supply (VDC)	Frequency Error (MHz)	Frequency Error (ppm)	Limit (ppm)
75	3.3	0.0040	0.69	20
70		-0.0015	-0.26	20
60		-0.0031	-0.54	20
50		0.0000	0.00	20
40		0.0008	0.14	20
30		0.0046	0.80	20
20		-0.0045	-0.78	20
10		0.0004	0.07	20
0		-0.0052	-0.90	20
-10		-0.0045	-0.78	20
-20		0.0058	1.00	20
-30		-0.0041	-0.71	20
20	2.8	-0.0027	-0.47	20
20	3.6	-0.0001	-0.02	20

15 Antenna 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 shall be considered sufficient to comply with the provisions of this section. 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. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

This product has two integrated antennas fulfil the requirement of this section.

Note: Please refer to EUT photos for more details.

16 RF Exposure

Remark: refer to MPE test report: WTD24D03066052W003.

17 Photographs of test setup and EUT.

Note: Please refer to appendix: Appendix-ALXC29-Photos.

======End of Report======