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检测
TESTING
CNAS L2264

RF TEST REPORT

Applicant	Huawei Technologies Co., Ltd.
FCC ID	QISR227H
Product	Mobile WiFi
Brand	HUAWEI
Model	R227h
Report No.	RHA1705-0046RF05R2
Issue Date	July 4, 2017

TA Technology (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in **FCC CFR47 Part 15E (2016)**. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Performed by: Xianqing Li

Approved by: Kai Xu

TA Technology (Shanghai) Co., Ltd.

No.145, Jintang Rd, Tangzhen Industry Park, Pudong Shanghai, China

TEL: +86-021-50791141/2/3

FAX: +86-021-50791141/2/3-8000



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Summary of measurement results

Number	Summary of measurements of results	Clause in FCC rules	Verdict
1	Average conducted output power	15.407(a)	PASS
2	Occupied bandwidth	15.407(e)	PASS
3	Frequency stability	15.407(g)	PASS
4	Maximum power spectral density	15.407(a)	PASS
5	Unwanted Emissions	15.407(b)	PASS
6	Conducted Emissions	15.207	PASS
Date of Testing: May 9, 2017~ June 28, 2017			



1. Test Laboratory

1.1. Notes of the test report

This report shall not be reproduced in full or partial, without the written approval of **TA technology (shanghai) co., Ltd.** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. Measurement Uncertainties were not taken into account and are published for informational purposes only. This report is written to support regulatory compliance of the applicable standards stated above. This report must not be used by the client to claim product certification, approval, or endorsement by any government agencies.

1.2. Test facility

CNAS (accreditation number: L2264)

TA Technology (Shanghai) Co., Ltd. has obtained the accreditation of China National Accreditation Service for Conformity Assessment (CNAS).

FCC (recognition number is 428261)

TA Technology (Shanghai) Co., Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform electromagnetic emissions measurements.

IC (recognition number is 8510A)

TA Technology (Shanghai) Co., Ltd. has been listed by industry Canada to perform electromagnetic emission measurement.

VCCI (recognition number is C-4595, T-2154, R-4113, G-766)

TA Technology (Shanghai) Co., Ltd. has been listed by industry Japan to perform electromagnetic emission measurement.

A2LA (Certificate Number: 3857.01)

TA Technology (Shanghai) Co., Ltd. has been listed by American Association for Laboratory Accreditation to perform electromagnetic emission measurement.



1.3. Testing Location

Company: TA Technology (Shanghai) Co., Ltd.
Address: No.145, Jintang Rd, Tangzhen Industry Park, Pudong
City: Shanghai
Post code: 201201
Country: P. R. China
Contact: Xu Kai
Telephone: +86-021-50791141/2/3
Fax: +86-021-50791141/2/3-8000
Website: <http://www.ta-shanghai.com>
E-mail: xukai@ta-shanghai.com

2. General Description of Equipment under Test

Client Information

Applicant	Huawei Technologies Co., Ltd.
Applicant address	Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District, Shenzhen, 518129, P.R.China.
Manufacturer	Huawei Technologies Co., Ltd.
Manufacturer address	Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District, Shenzhen, 518129, P.R.China.

General information

EUT Description	
Model:	R227h
SN:	/
Hardware Version:	CL1E5785SM06
Software Version:	21.130.00.00.00
Power Supply:	Battery/AC adapter
Antenna Type:	Internal Antenna
Antenna Gain:	Antenna 1: 1.55 dBi Antenna 2: 1.55 dBi
Directional Gain:	1.55 dBi
additional beamforming gain:	0 dB
Test Mode:	U-NII-1(5150MHz-5250MHz) U-NII-3(5725MHz-5850MHz)
Modulation Type:	802.11a/n (HT20/HT40) : OFDM 802.11ac (HT20/HT40/HT80): OFDM
Max. Conducted Power	802.11a: 11.45 dBm 802.11n: 11.59 dBm 802.11ac: 10.95 dBm
Operating Frequency Range(s)	U-NII-1: 5150-5250MHz U-NII-3: 5725-5850MHz
Operating temperature range:	0 ° C to 35° C
Operating voltage range:	3.6 V to 4.2 V
State AC voltage:	3.8V
EUT Accessory	



Adapter 1	Manufacturer: Huizhou BYD Electronic Co., Ltd Model: HW-050200E01
Adapter 2	Manufacturer: Shenzhen Huntkey Electronic Co., Ltd Model: HW-050200E01
Adapter 3	Manufacturer: Huizhou BYD Electronic Co., Ltd Model: HW-050200U01
Adapter 4	Manufacturer: Shenzhen Huntkey Electronic Co., Ltd Model: HW-050200U01
Adapter 5	Manufacturer: Dongguan Phitek Electronic Co., Ltd Model: HW-050200U01
Adapter 6	Manufacturer: Huizhou BYD Electronic Co., Ltd Model: HW-050200B01
Adapter 7	Manufacturer: Shenzhen Huntkey Electronic Co., Ltd Model: HW-050200B01
Adapter 8	Manufacturer: Dongguan Phitek Electronic Co., Ltd Model: HW-050200B01
Adapter 9	Manufacturer: Huizhou BYD Electronic Co., Ltd Model: HW-050200A01
Adapter 10	Manufacturer: Shenzhen Huntkey Electronic Co., Ltd Model: HW-050200A01
Adapter 11	Manufacturer: Dongguan Phitek Electronic Co., Ltd Model: HW-050200A01
Battery	Manufacturer: Huawei Technologies Co., Ltd. Model: HB824666RBC Power Rating: DC 3.8V, 3000mAh, Li-ion
USB Extend Cable	100m Cable, Shielded
Note: The information of the EUT is declared by the manufacturer. Please refer to the specifications or user manual for details.	



3. Test Information

According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

FCC CFR47 Part 15E (2016) Unlicensed National Information Infrastructure Devices

ANSI C63.10 (2013)

789033 D02 General UNII Test Procedures New Rules v01r04

KDB 662911 D01 Multiple Transmitter Output v02r01

4. Test Configuration

Test Mode

The EUT was programmed to be in continuously transmitting mode and the transmit duty cycle is not less than 98%.

The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application.

The radiated emission was measured in the following position: EUT stand-up position (Z axis), lie-down position (X, Y axis). The worst emission was found in stand-up position (Z axis) and the worst case was recorded.

In order to find the worst case condition, Pre-tests are needed at the presence of different data rate. Preliminary tests have been done on all the configuration for confirming worst case. Data rate below means worst-case rate of each test item.

Worst-case data rates are shown as following table.

Band	Data Rate		
	Antenna 1	Antenna 2	MIMO
802.11a	6 Mbps	6 Mbps	/
802.11n HT20	MCS0	MCS0	MCS8
802.11n HT40	MCS0	MCS0	MCS8
802.11ac HT20	MCS0	MCS0	MCS8
802.11ac HT40	MCS0	MCS0	MCS8
802.11ac HT80	MCS0	MCS0	MCS8

The device supports non-beamforming and beamforming function in 802.11n/ac, after pre-testing, beamforming mode has the worst emission value, so the worst case was recorded.

The worst case Antenna mode for each of the following tests for Wi-Fi:

Test Cases	Antenna 1	Antenna 2	MIMO
Average conducted output power	O	O	802.11n HT20/40 802.11ac HT20/40/80
Occupied bandwidth	802.11a	--	802.11n HT20/40 802.11ac HT20/40/80
Frequency stability	802.11a	--	--
Power Spectral Density	O	O	802.11n HT20/40 802.11ac HT20/40/80
Unwanted Emissions	802.11a	--	802.11n HT20/40 802.11ac HT20/40/80
Conducted Emissions	802.11a	--	802.11n HT20/40 802.11ac HT20/40/80
Note: "O": test all bands			

5. Test Case Results

5.1. Occupied Bandwidth

Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement

The EUT was connected to the spectrum analyzer through an external attenuator (20dB) and a known loss cable.

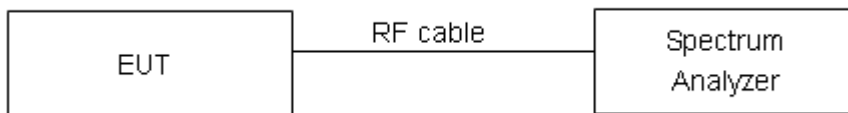
For U-NII-1, set RBW \approx 1% OCB kHz, VBW \geq 3 \times RBW, measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 26 dB relative to the maximum level measured in the fundamental emission.

For U-NII-3, Set RBW = 100 kHz, VBW \geq 3 \times RBW, 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 above.

Use the 99 % power bandwidth function of the instrument

Test Setup



Limits

Rule FCC Part 15.407(a)(5)/15.407(e)

Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$, $U = 936$ Hz.



Test Results:

Network Standards			Carrier frequency (MHz)	99% bandwidth (MHz)	Minimum 26 dB bandwidth (MHz)	Limit (kHz)	Conclusion
U-NII-1	SISO Antenna 1	802.11a	5180	16.513	20.96	500	PASS
			5220	16.516	20.94	500	PASS
			5240	16.507	20.89	500	PASS
	MIMO	802.11n HT20	5180	17.796	21.46	500	PASS
			5220	17.808	21.21	500	PASS
			5240	17.772	21.40	500	PASS
		802.11n HT40	5190	36.296	39.60	500	PASS
			5230	36.302	39.41	500	PASS
		802.11ac HT20	5180	17.764	21.46	500	PASS
			5220	17.766	21.33	500	PASS
			5240	17.791	21.23	500	PASS
		802.11ac HT40	5190	36.293	39.31	500	PASS
			5230	36.258	39.07	500	PASS
		802.11ac HT80	5210	75.754	80.92	500	PASS
		U-NII-3	SISO Antenna 1	802.11a	5745	16.511	16.32
5220	16.507				16.39	500	PASS
5825	16.522				16.37	500	PASS
MIMO	802.11n HT20		5745	17.786	17.70	500	PASS
			5785	17.796	17.73	500	PASS
			5825	17.811	17.73	500	PASS
	802.11n HT40		5755	36.348	36.47	500	PASS
			5795	36.296	36.44	500	PASS
	802.11ac HT20		5745	17.771	17.70	500	PASS
			5785	17.790	17.70	500	PASS
			5825	17.822	17.73	500	PASS
	802.11ac HT40		5755	36.320	36.42	500	PASS
			5795	36.315	36.45	500	PASS
	802.11ac HT80		5775	75.660	75.94	500	PASS



SISO Antenna 1

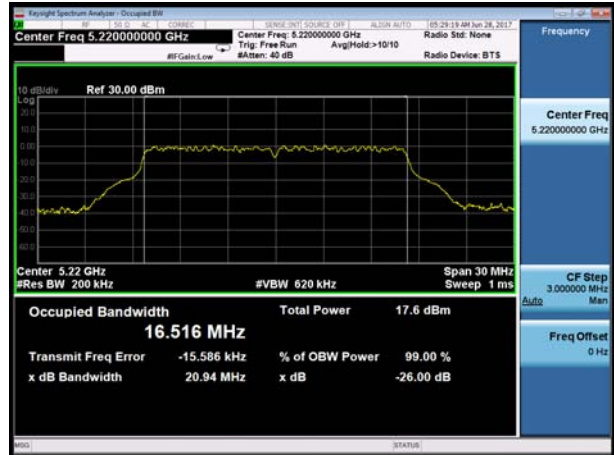
U-NII-1, 802.11a

Carrier frequency (MHz): 5180



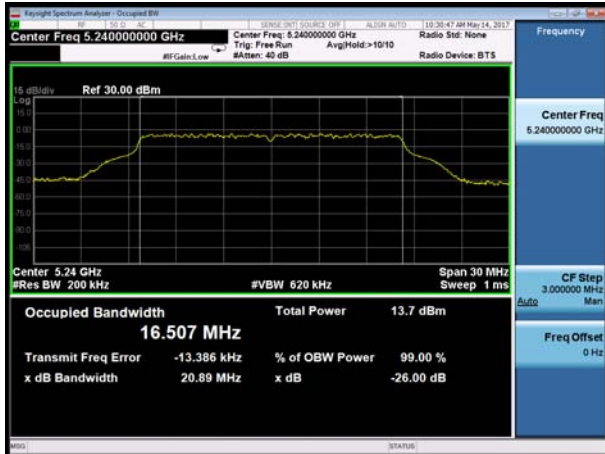
U-NII-1, 802.11a

Carrier frequency (MHz): 5220



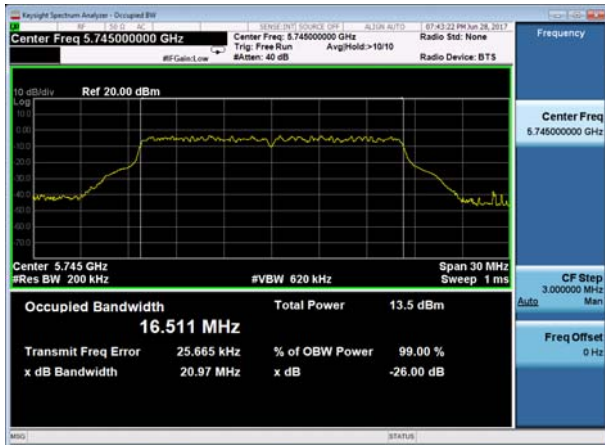
U-NII-1, 802.11a

Carrier frequency (MHz): 5240

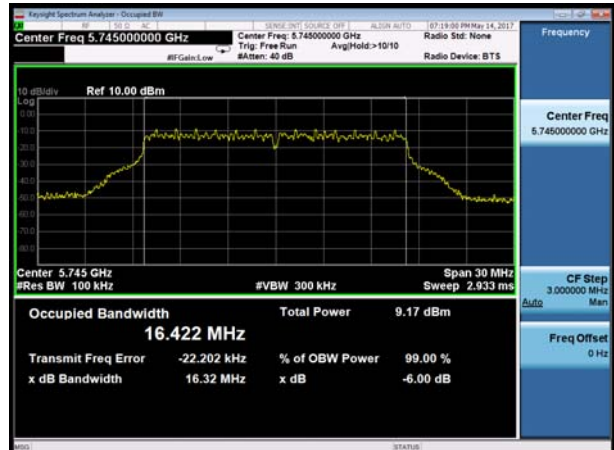




U-NII-3, 802.11a, 99% bandwidth
Carrier frequency (MHz): 5745



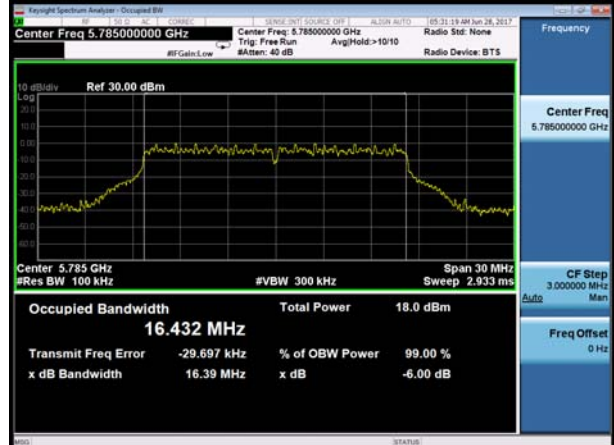
U-NII-3, 802.11a, 6 dB bandwidth
Carrier frequency (MHz): 5745



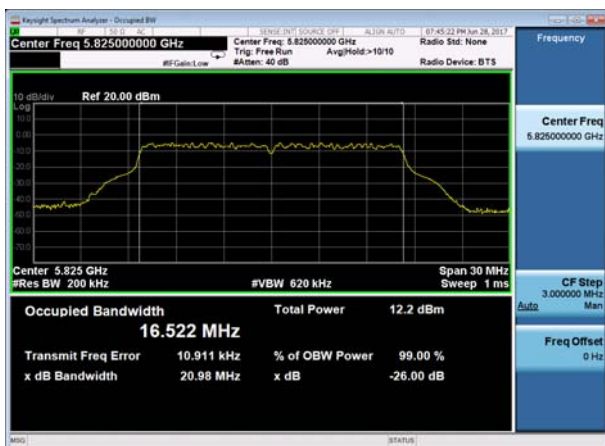
U-NII-3, 802.11a, 99% bandwidth
Carrier frequency (MHz): 5785



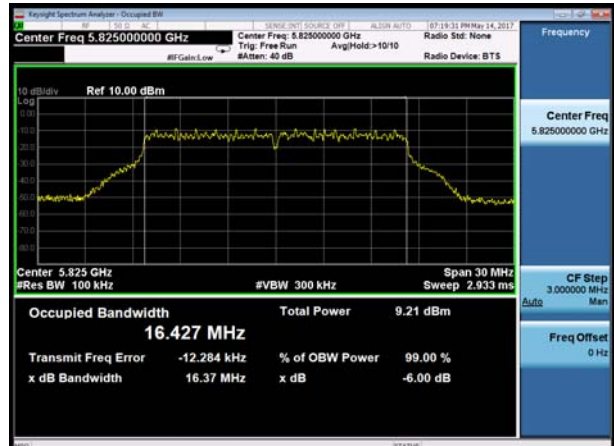
U-NII-3, 802.11a, 6 dB bandwidth
Carrier frequency (MHz): 5785



U-NII-3, 802.11a, 99% bandwidth
Carrier frequency (MHz): 5825



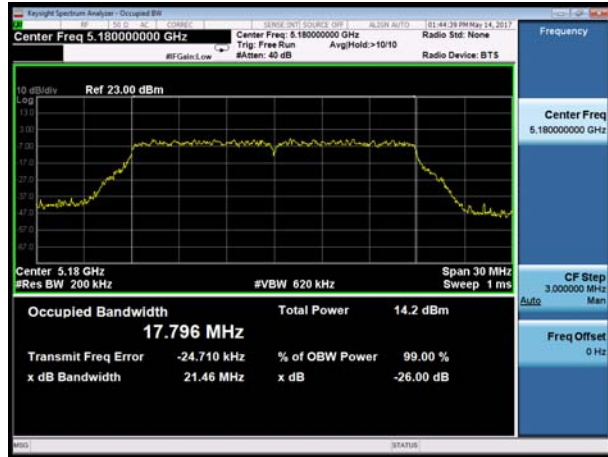
U-NII-3, 802.11a, 6 dB bandwidth
Carrier frequency (MHz): 5825



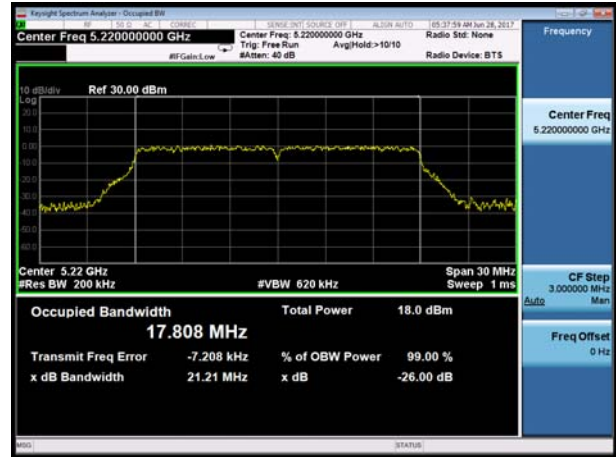


MIMO

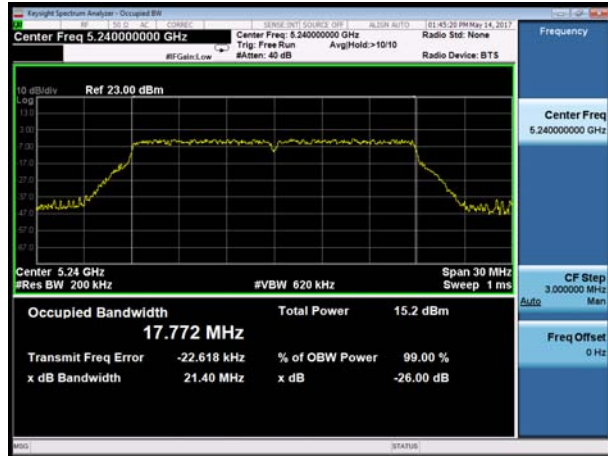
U-NII-1, 802.11n HT20
Carrier frequency (MHz): 5180



U-NII-1, 802.11n HT20
Carrier frequency (MHz):5220



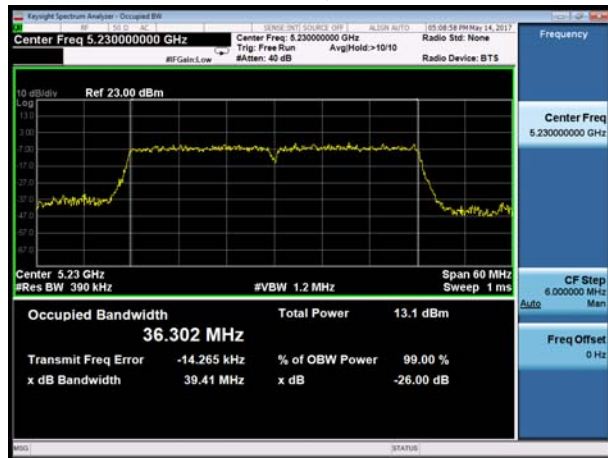
U-NII-1, 802.11n HT20
Carrier frequency (MHz):5240



U-NII-1, 802.11n HT40
Carrier frequency (MHz): 5190



U-NII-1, 802.11n HT40
Carrier frequency (MHz): 5230

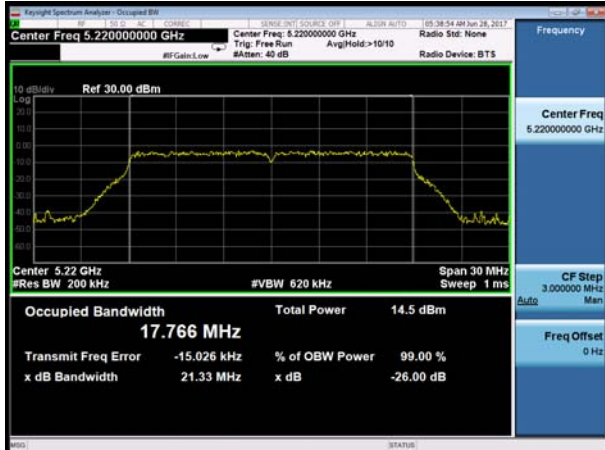


U-NII-1, 802.11ac HT20
Carrier frequency (MHz): 5180

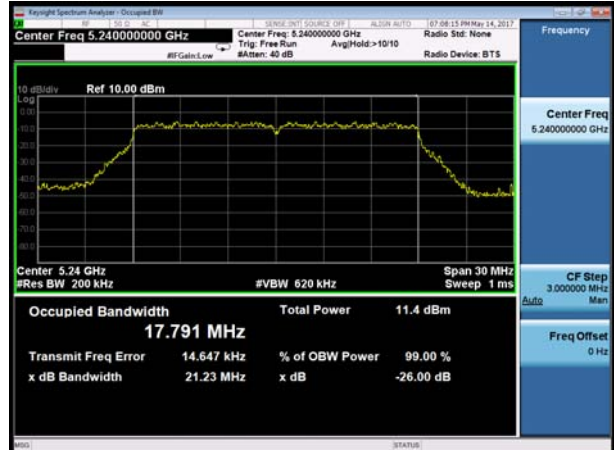




U-NII-1, 802.11ac HT20
Carrier frequency (MHz): 5220



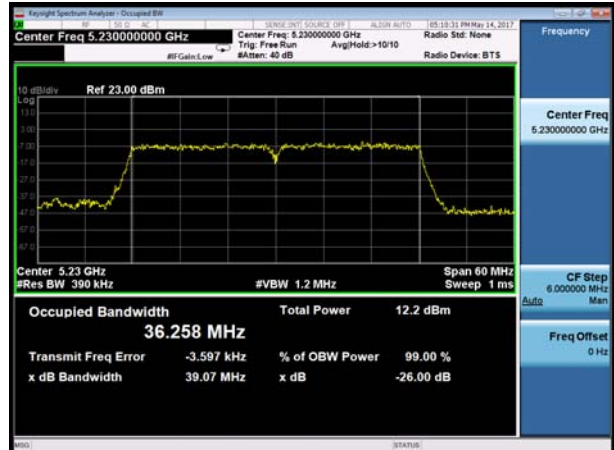
U-NII-1, 802.11ac HT20
Carrier frequency (MHz):5240



U-NII-1, 802.11ac HT40
Carrier frequency (MHz): 5190



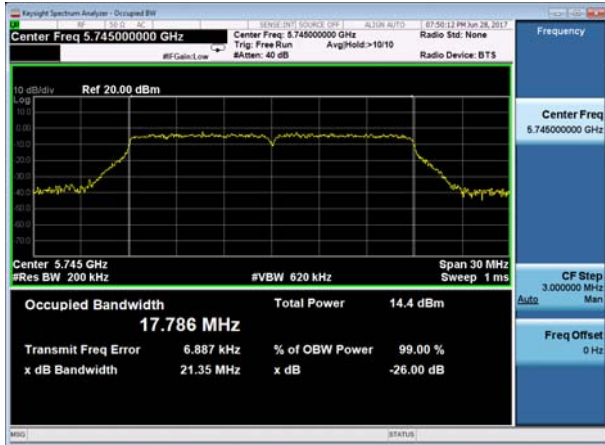
U-NII-1, 802.11ac HT40
Carrier frequency (MHz): 5230



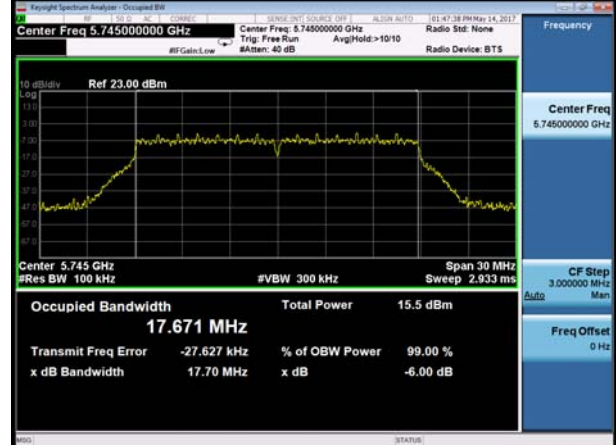
U-NII-1, 802.11ac HT80
Carrier frequency (MHz): 5210



U-NII-3, 802.11n HT20, 99% bandwidth
Carrier frequency (MHz): 5745



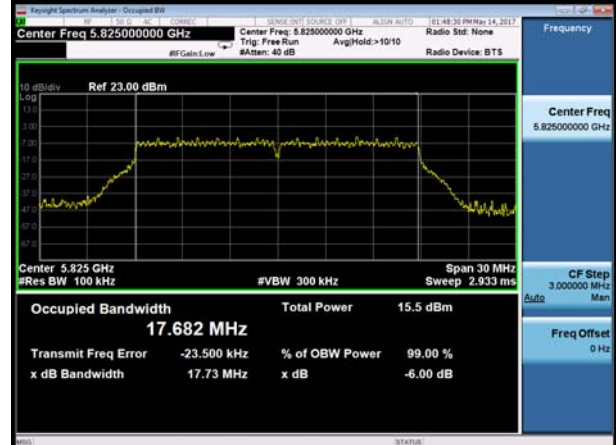
U-NII-3, 802.11n HT20, 6 dB bandwidth
Carrier frequency (MHz): 5745



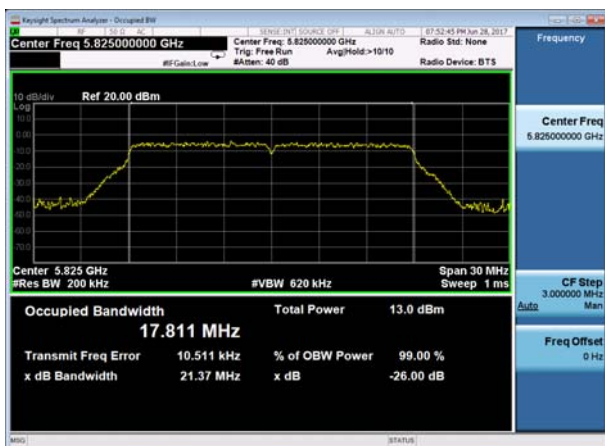
U-NII-3, 802.11n HT20, 99% bandwidth
Carrier frequency (MHz): 5785



U-NII-3, 802.11n HT20, 6 dB bandwidth
Carrier frequency (MHz): 5785



U-NII-3, 802.11n HT20, 99% bandwidth
Carrier frequency (MHz): 5825



U-NII-3, 802.11n HT20, 6 dB bandwidth
Carrier frequency (MHz): 5825

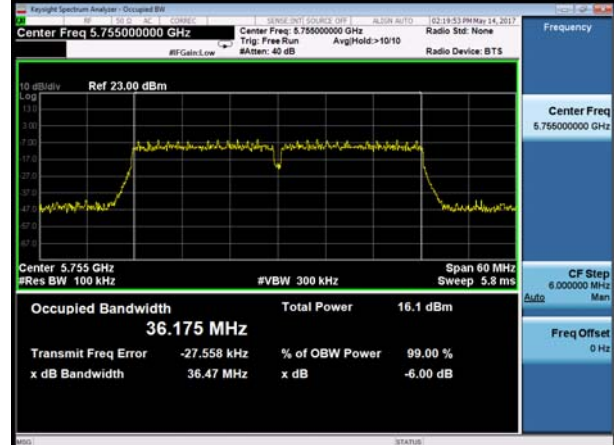




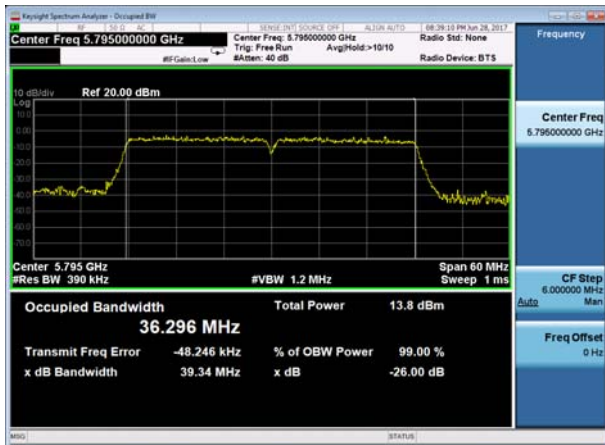
U-NII-3, 802.11n HT40, 99% bandwidth
Carrier frequency (MHz): 5755



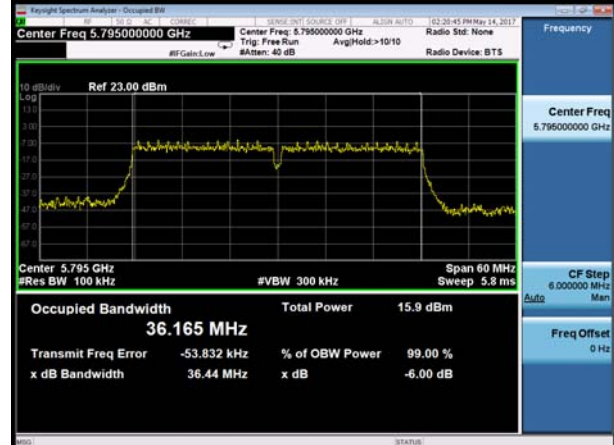
U-NII-3, 802.11n HT40, 6 dB bandwidth
Carrier frequency (MHz): 5755



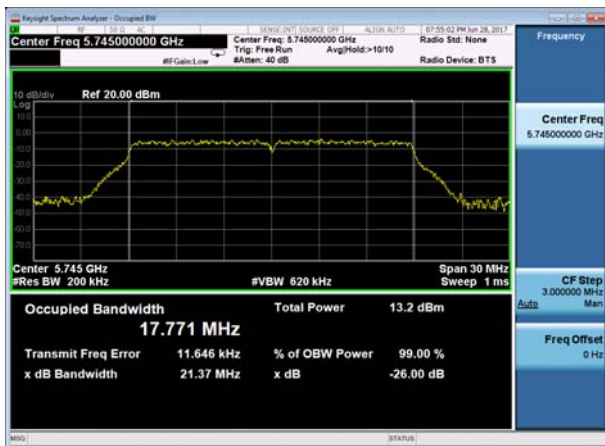
U-NII-3, 802.11n HT40, 99% bandwidth
Carrier frequency (MHz): 5795



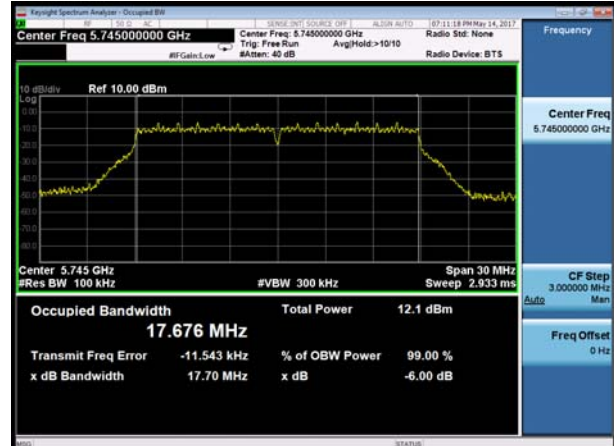
U-NII-3, 802.11n HT40, 6 dB bandwidth
Carrier frequency (MHz): 5795



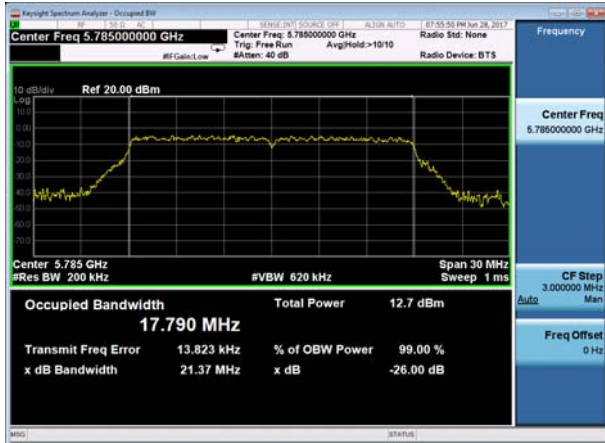
U-NII-3, 802.11ac HT20, 99% bandwidth
Carrier frequency (MHz): 5745



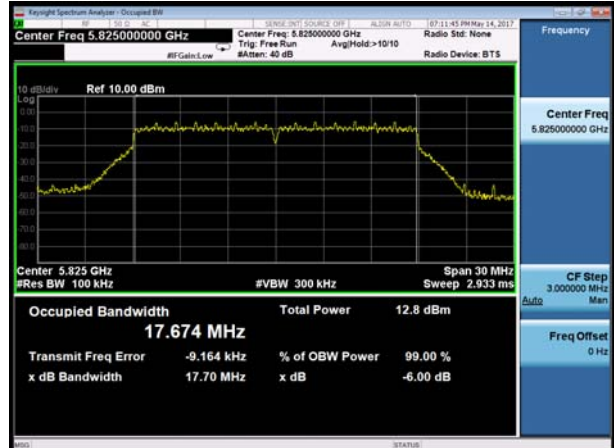
U-NII-3, 802.11ac HT20, 6 dB bandwidth
Carrier frequency (MHz): 5745



U-NII-3, 802.11ac HT20, 99% bandwidth
Carrier frequency (MHz): 5785



U-NII-3, 802.11ac HT20, 6 dB bandwidth
Carrier frequency (MHz): 5785



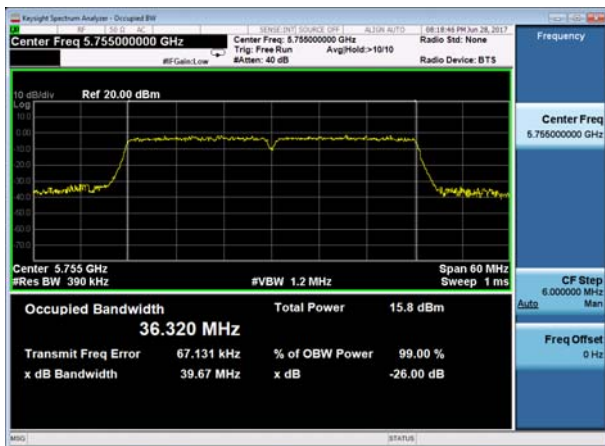
U-NII-3, 802.11ac HT20, 99% bandwidth
Carrier frequency (MHz): 5825



U-NII-3, 802.11ac HT20, 6 dB bandwidth
Carrier frequency (MHz): 5825



U-NII-3, 802.11ac HT40, 99% bandwidth
Carrier frequency (MHz): 5755

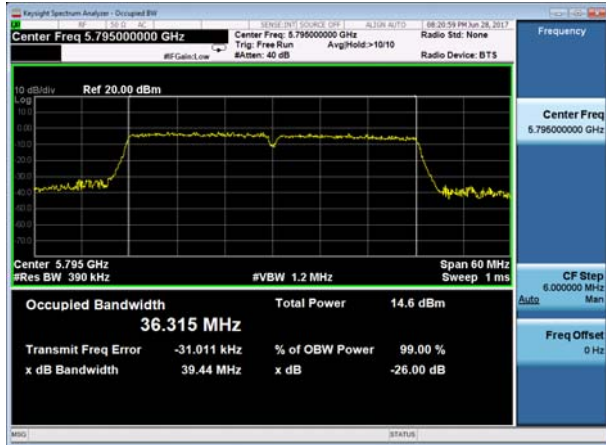


U-NII-3, 802.11ac HT40, 6 dB bandwidth
Carrier frequency (MHz): 5755

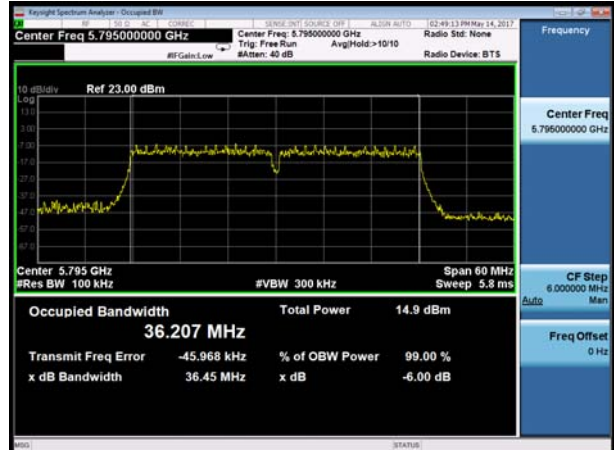




U-NII-3, 802.11ac HT40, 99% bandwidth
Carrier frequency (MHz): 5795



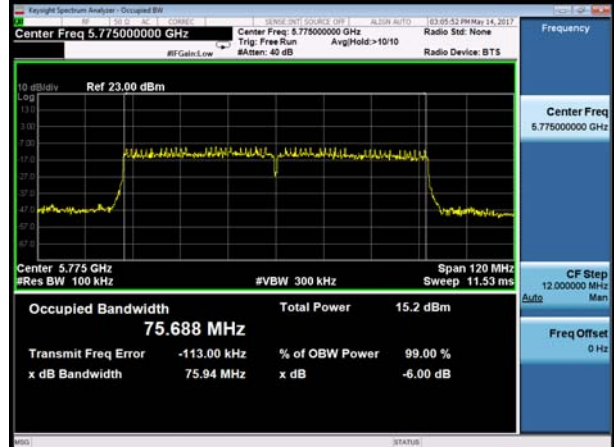
U-NII-3, 802.11ac HT40, 6 dB bandwidth
Carrier frequency (MHz): 5795



U-NII-3, 802.11ac HT80, 99% bandwidth
Carrier frequency (MHz): 5775



U-NII-3, 802.11ac HT80, 6 dB bandwidth
Carrier frequency (MHz): 5775



5.2. Average Power Output –Conducted

Ambient condition

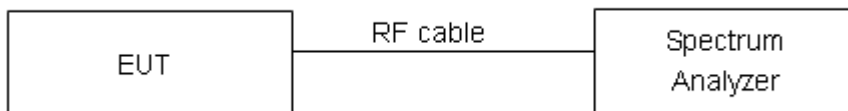
Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Methods of Measurement

During the process of the testing, The EUT was connected to the average power meter through an external attenuator and a known loss cable. The EUT is max power transmission with proper modulation. We use Maximum average Conducted Output Power Level Method in KDB789033 for this test

The conducted Power is measured at each antenna port. The measured results at the various antenna ports are then summed mathematically.

Test Setup



Limits

Rule FCC Part 15.407(a)(1)(2)(3)

For 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.

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

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.

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$, $U = 0.44$ dB.



Test Results

Packet Type	Single Antenna 1 Power Index						Single Antenna 2 Power Index					
	CH36	CH44	CH48	CH149	CH157	CH165	CH36	CH44	CH48	CH149	CH157	CH165
802.11a	13	13	13	13	13	13	13	13	13	13	13	13
802.11n HT20	10	10	10	10	10	10	10	10	10	10	10	10
802.11ac HT20	9	9	9	9	9	9	9	9	9	9	9	9
Packet Type	CH38	CH46	CH151	CH159	/	/	CH38	CH46	CH151	CH159	/	/
802.11n HT40	10	10	10	10	/	/	10	10	10	10	/	/
802.11ac HT40	9	9	9	9	/	/	9	9	9	9	/	/
Packet Type	CH42	CH155	/	/	/	/	CH42	CH155	/	/	/	/
802.11ac HT80	9	9	/	/	/	/	9	9	/	/	/	/
Packet Type	MIMO Antenna 1 Power Index						MIMO Antenna 2 Power Index					
	CH36	CH44	CH48	CH149	CH157	CH165	CH36	CH44	CH48	CH149	CH157	CH165
802.11n HT20	10	10	10	10	10	10	10	10	10	10	10	10
802.11ac HT20	9	9	9	9	9	9	9	9	9	9	9	9
Packet Type	CH38	CH46	CH151	CH159	/	/	CH38	CH46	CH151	CH159	/	/
802.11n HT40	10	10	10	10	/	/	10	10	10	10	/	/
802.11ac HT40	9	9	9	9	/	/	9	9	9	9	/	/
Packet Type	CH42	CH155	/	/	/	/	CH42	CH155	/	/	/	/
802.11ac HT80	9	9	/	/	/	/	9	9	/	/	/	/



SISO Antenna 1

Network Standards		Channel/ Frequency(MHz)	Output Power (dBm)	Limit (dBm)	Conclusion
U-NII-1	802.11a	36/5180	10.81	30	PASS
		44/5220	11.25	30	PASS
		48/5240	11.45	30	PASS
	802.11n HT20	36/5180	9.44	30	PASS
		44/5220	8.08	30	PASS
		48/5240	9.94	30	PASS
	802.11n HT40	38/5190	9.58	30	PASS
		46/5230	7.26	30	PASS
	802.11ac HT20	36/5180	8.62	30	PASS
		44/5220	7.30	30	PASS
		48/5240	9.13	30	PASS
	802.11ac HT40	38/5190	5.73	30	PASS
46/5230		6.30	30	PASS	
802.11ac HT80	42/5210	5.62	30	PASS	
U-NII-3	802.11a	149/5745	10.72	30	PASS
		157/5785	11.12	30	PASS
		165/5825	11.00	30	PASS
	802.11n HT20	149/5745	9.82	30	PASS
		157/5785	7.39	30	PASS
		165/5825	9.27	30	PASS
	802.11n HT40	151/5755	7.61	30	PASS
		159/5795	6.78	30	PASS
	802.11ac HT20	149/5745	8.98	30	PASS
		157/5785	6.65	30	PASS
		165/5825	8.55	30	PASS
	802.11ac HT40	151/5755	6.53	30	PASS
		159/5795	5.67	30	PASS
	802.11ac HT80	155/5775	5.97	30	PASS



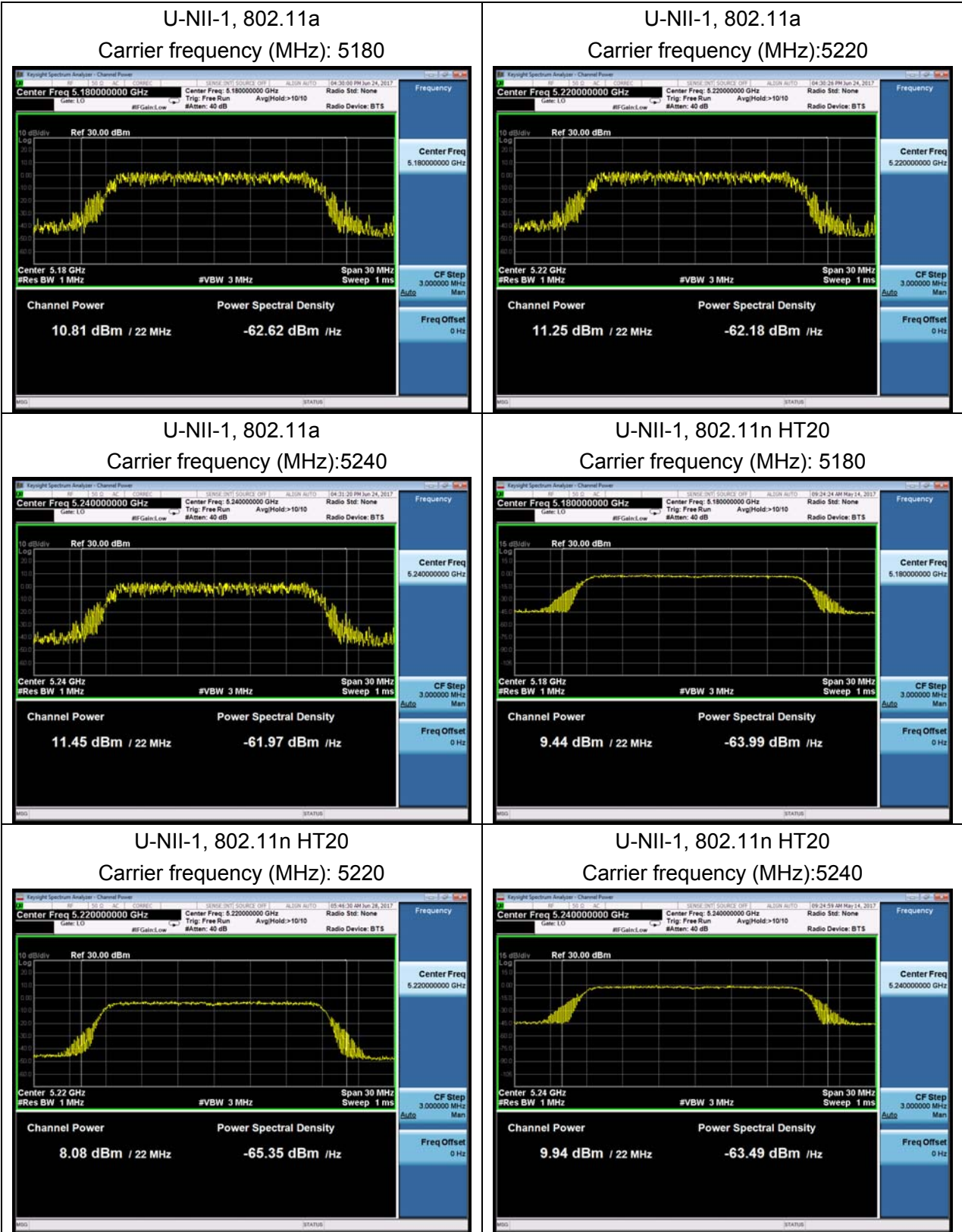
SISO Antenna 2

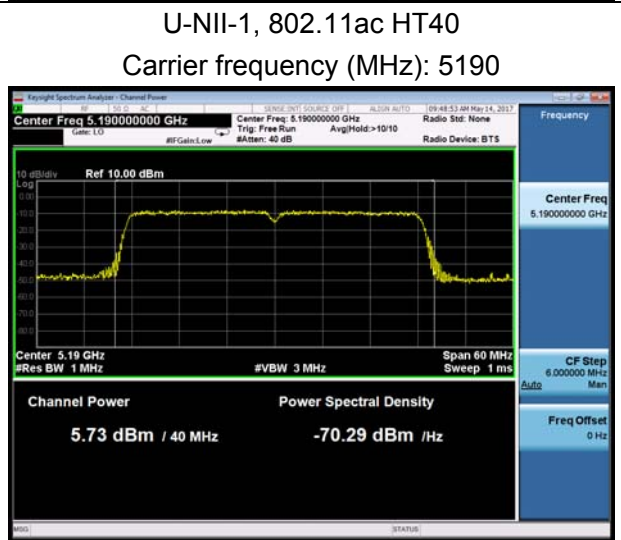
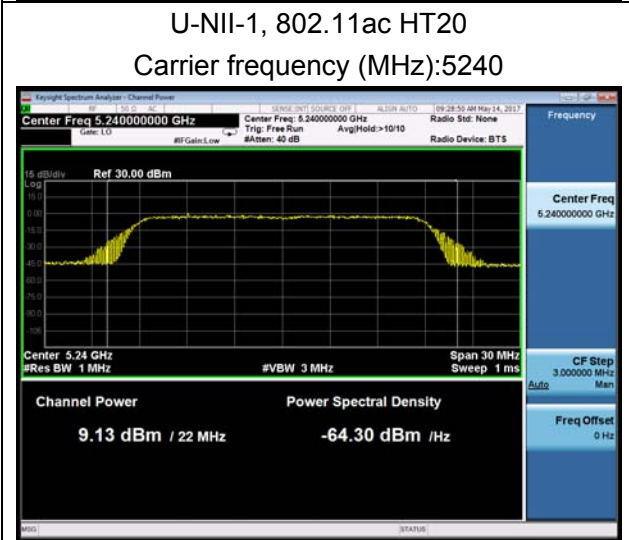
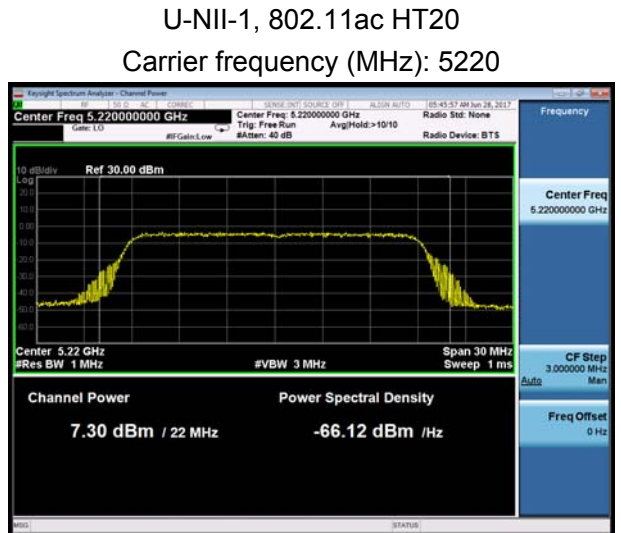
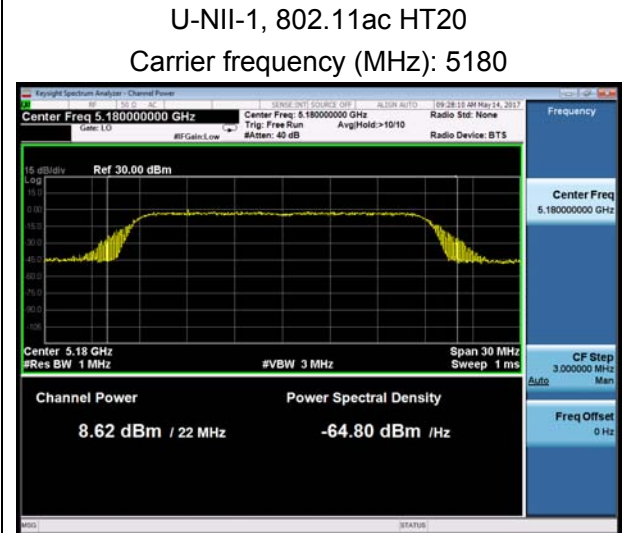
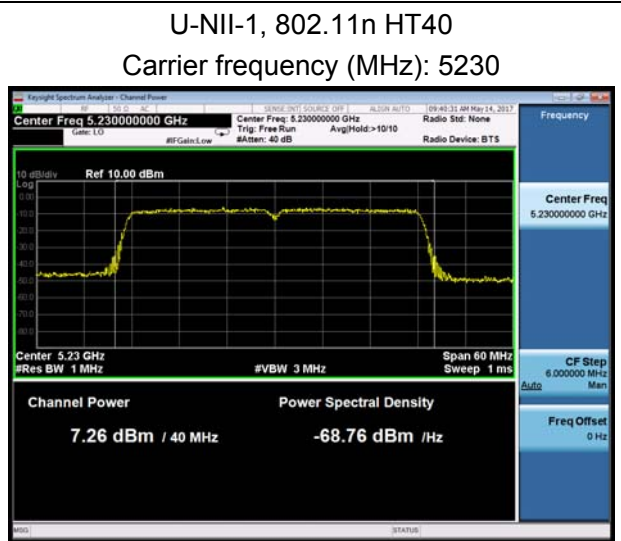
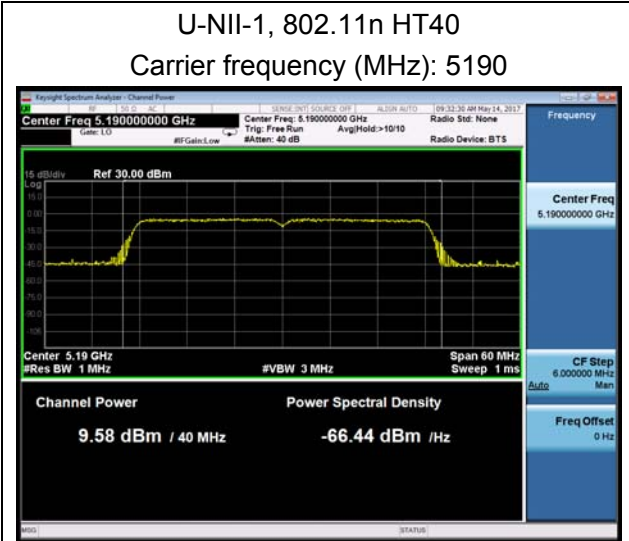
Network Standards		Channel/ Frequency(MHz)	Output Power (dBm)	Limit (dBm)	Conclusion
U-NII-1	802.11a	36/5180	10.93	30	PASS
		44/5220	11.24	30	PASS
		48/5240	11.32	30	PASS
	802.11n HT20	36/5180	6.50	30	PASS
		44/5220	8.22	30	PASS
		48/5240	7.24	30	PASS
	802.11n HT40	38/5190	6.42	30	PASS
		46/5230	7.16	30	PASS
	802.11ac HT20	36/5180	5.39	30	PASS
		44/5220	7.22	30	PASS
		48/5240	6.29	30	PASS
	802.11ac HT40	38/5190	5.85	30	PASS
46/5230		6.30	30	PASS	
802.11ac HT80	42/5210	5.51	30	PASS	
U-NII-3	802.11a	149/5745	10.06	30	PASS
		157/5785	10.47	30	PASS
		165/5825	10.20	30	PASS
	802.11n HT20	149/5745	7.58	30	PASS
		157/5785	8.49	30	PASS
		165/5825	7.25	30	PASS
	802.11n HT40	151/5755	8.20	30	PASS
		159/5795	7.37	30	PASS
	802.11ac HT20	149/5745	6.88	30	PASS
		157/5785	7.79	30	PASS
		165/5825	6.43	30	PASS
	802.11ac HT40	151/5755	7.25	30	PASS
		159/5795	6.77	30	PASS
	802.11ac HT80	155/5775	6.66	30	PASS

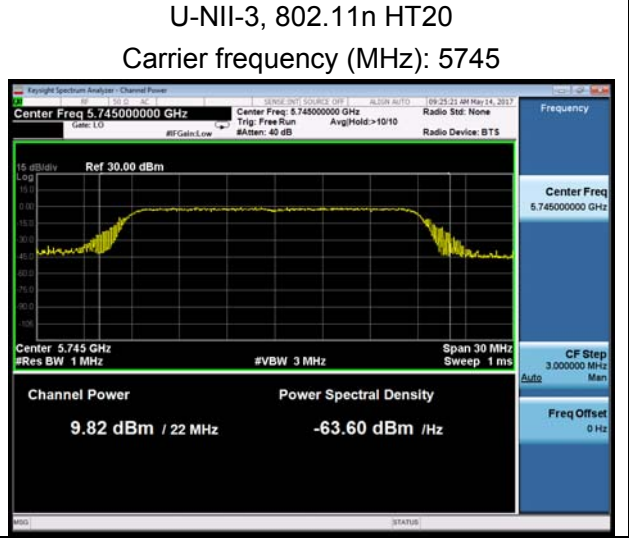
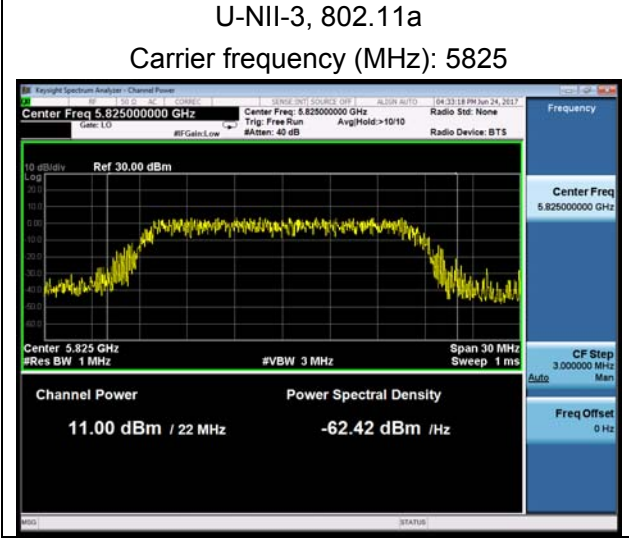
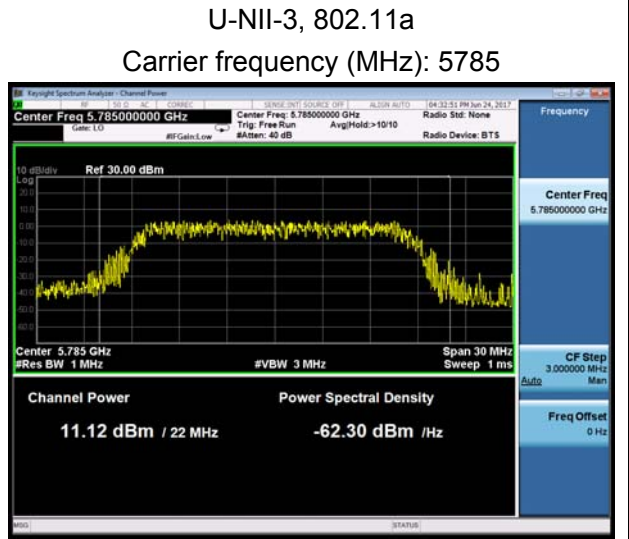
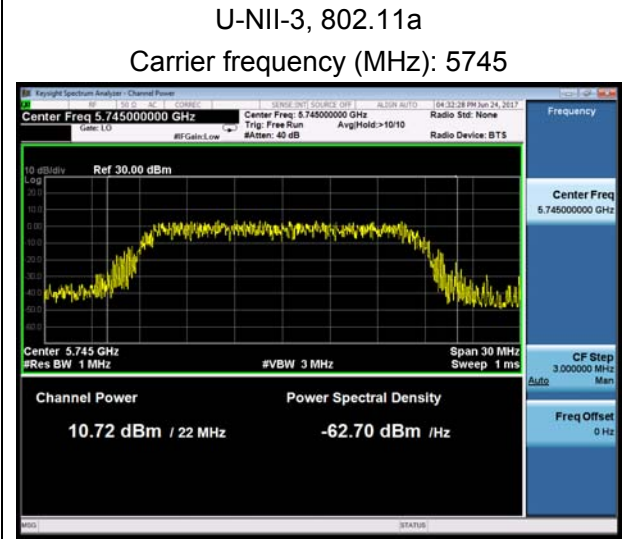
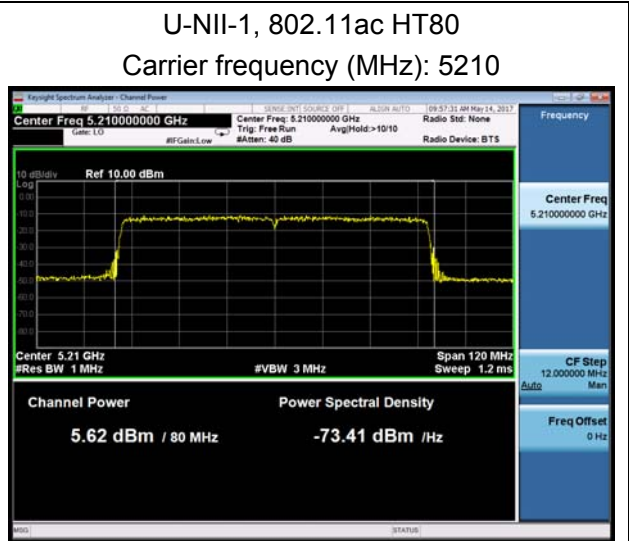
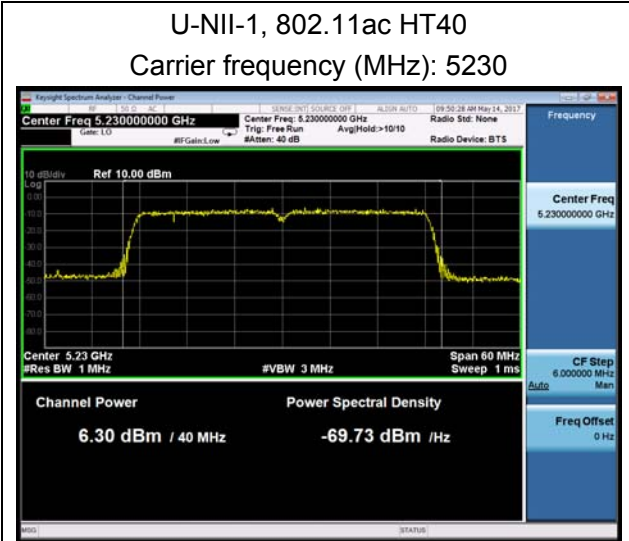
MIMO Antenna

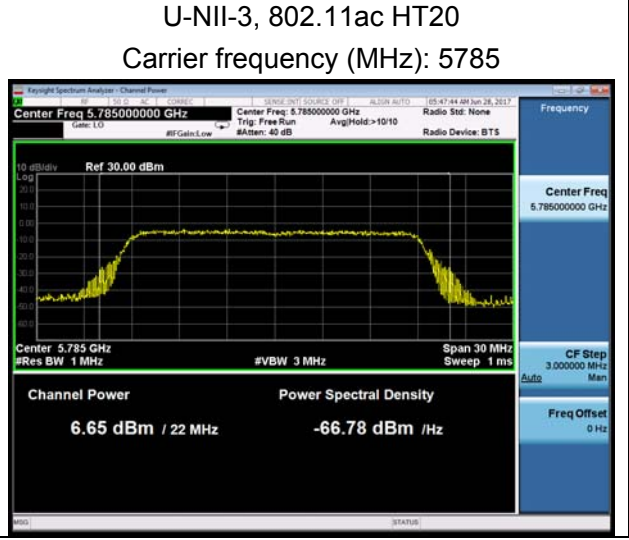
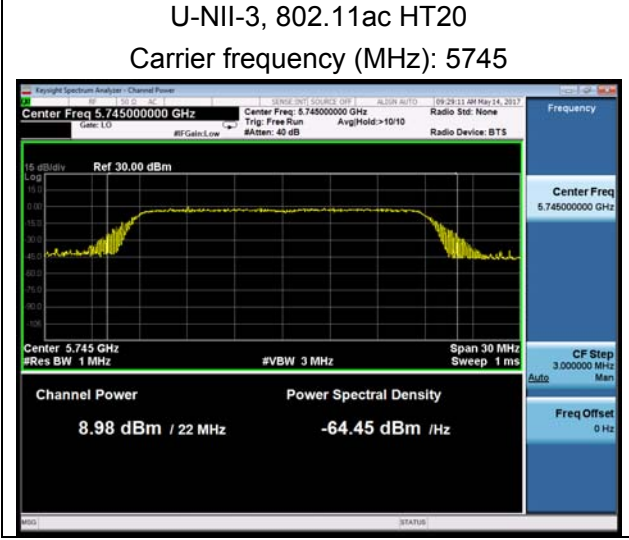
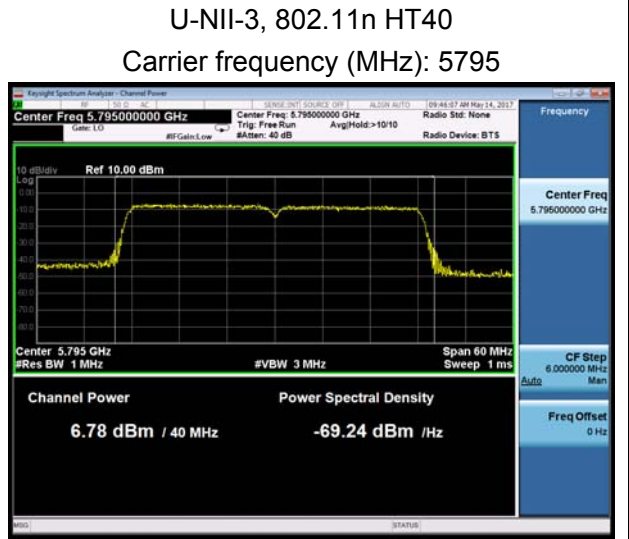
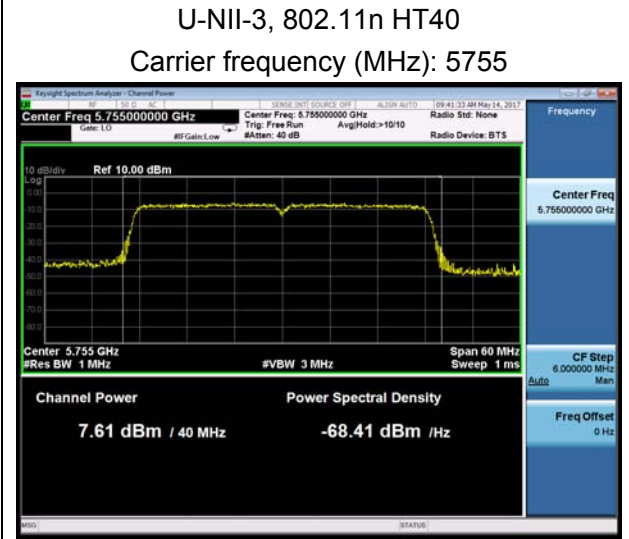
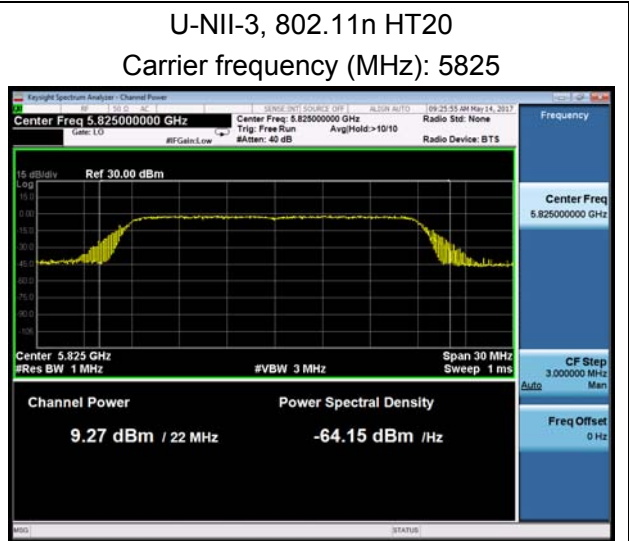
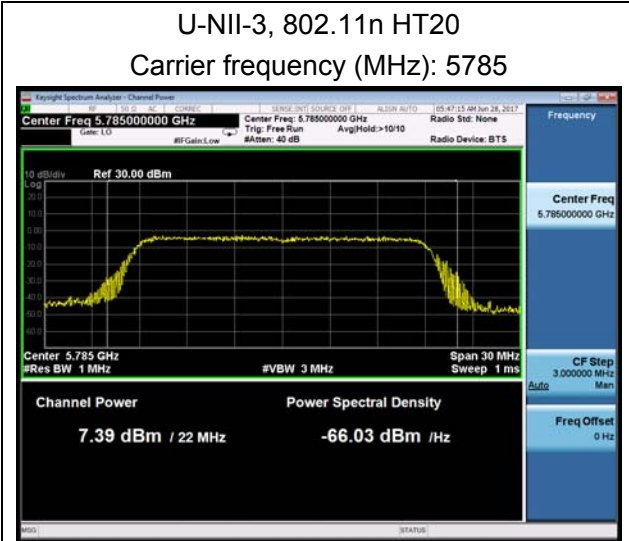
Network Standards		Channel/ Frequency (MHz)	Output Power (dBm)			Limit (dBm)	Conclusion
			ANT1	ANT2	MIMO		
802.11n HT20	U-NII-1	36/5180	7.29	7.25	10.28	30.00	PASS
		44/5220	8.07	8.22	11.16	30.00	PASS
		48/5240	7.66	7.71	10.70	30.00	PASS
	U-NII-3	149/5745	7.99	8.52	11.27	30.00	PASS
		157/5785	7.26	8.50	10.93	30.00	PASS
		165/5825	7.11	8.12	10.65	30.00	PASS
802.11n HT40	U-NII-1	38/5190	7.85	7.72	10.80	30.00	PASS
		46/5230	8.09	8.29	11.20	30.00	PASS
	U-NII-3	151/5755	8.18	8.95	11.59	30.00	PASS
		159/5795	7.88	8.77	11.36	30.00	PASS
802.11ac HT20	U-NII-1	36/5180	7.95	6.36	10.24	30.00	PASS
		44/5220	7.15	7.30	10.24	30.00	PASS
		48/5240	6.75	7.41	10.10	30.00	PASS
	U-NII-3	149/5745	5.99	5.59	8.80	30.00	PASS
		157/5785	6.68	7.62	10.19	30.00	PASS
		165/5825	5.35	5.89	8.64	30.00	PASS
802.11ac HT40	U-NII-1	38/5190	6.80	6.69	9.76	30.00	PASS
		46/5230	7.04	7.05	10.06	30.00	PASS
	U-NII-3	151/5755	7.49	8.35	10.95	30.00	PASS
		159/5795	6.76	7.88	10.37	30.00	PASS
802.11ac HT80	U-NII-1	42/5210	6.62	6.68	9.66	30.00	PASS
	U-NII-3	155/5775	6.69	7.79	10.29	30.00	PASS

SISO Antenna 1



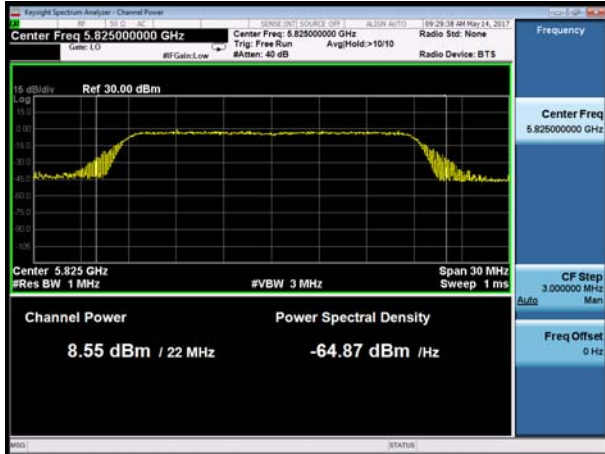




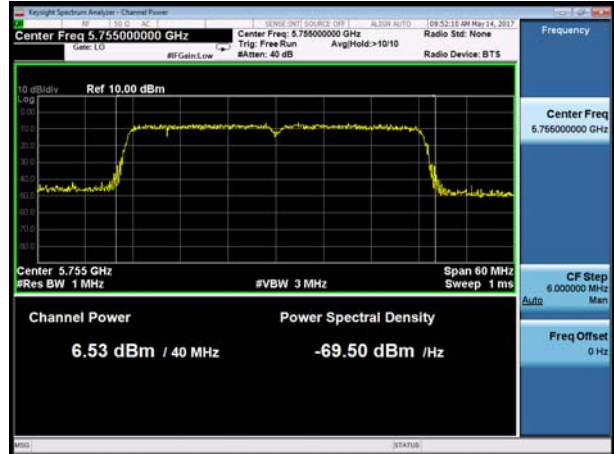




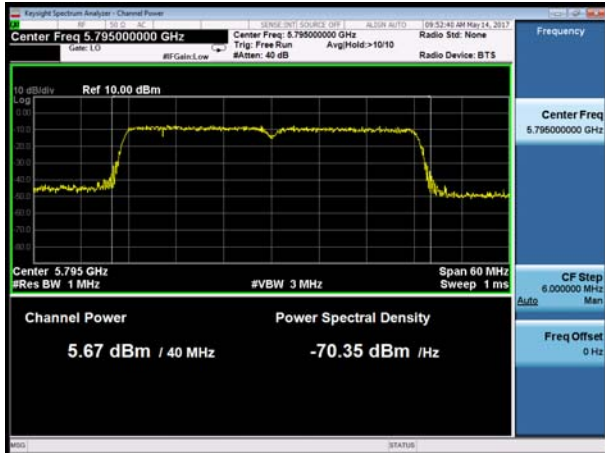
U-NII-3, 802.11ac HT20
Carrier frequency (MHz): 5825



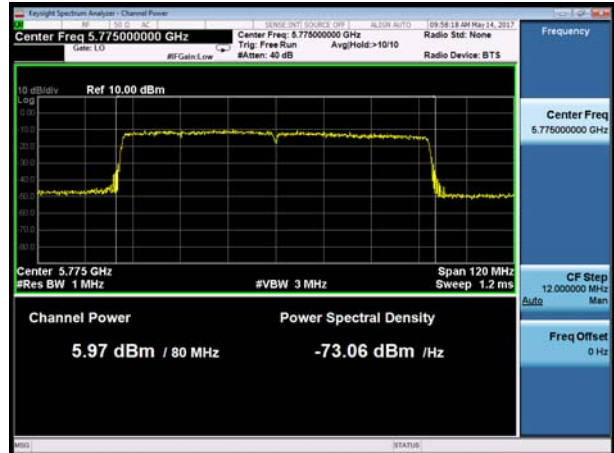
U-NII-3, 802.11ac HT40
Carrier frequency (MHz): 5755



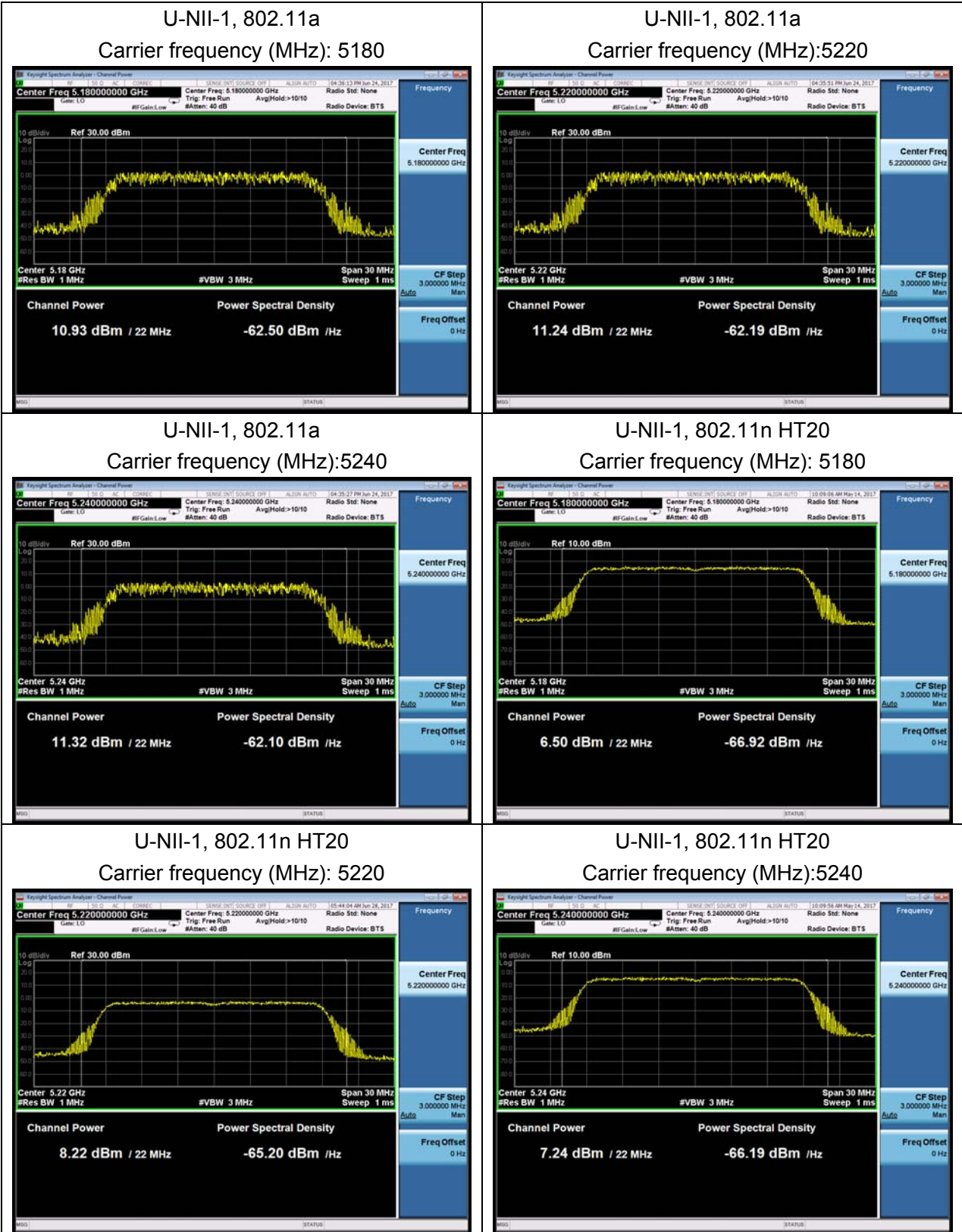
U-NII-3, 802.11ac HT40
Carrier frequency (MHz): 5795

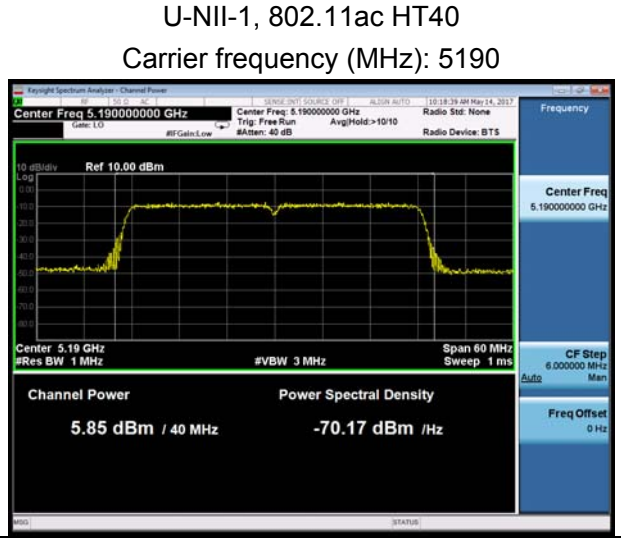
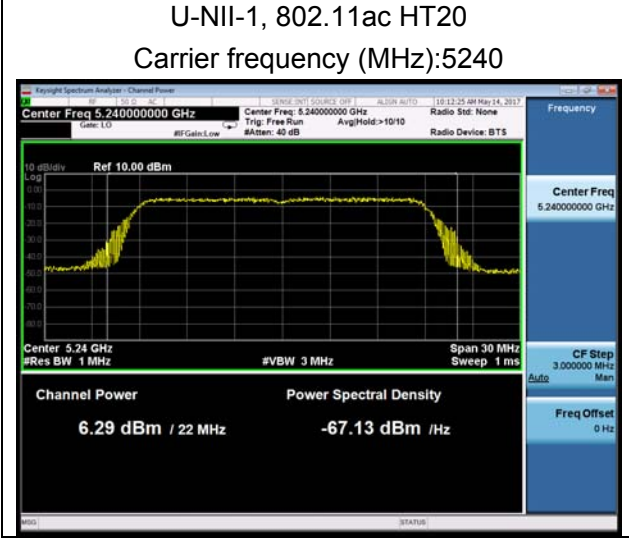
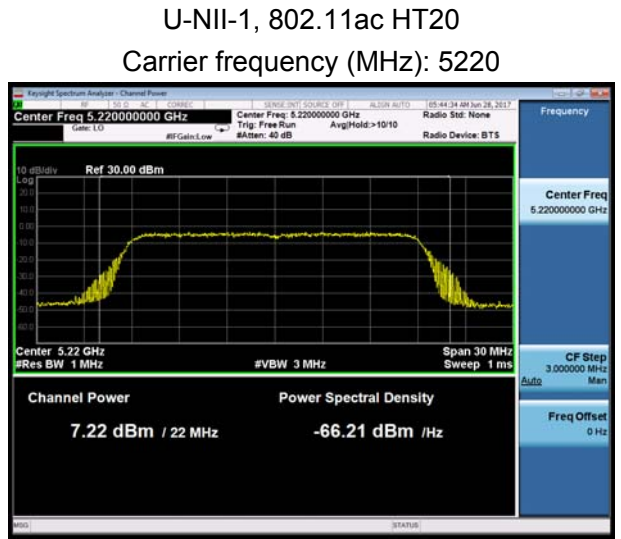
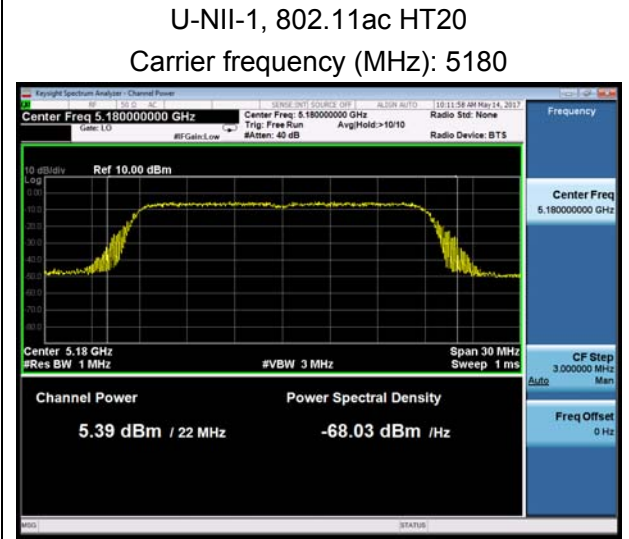
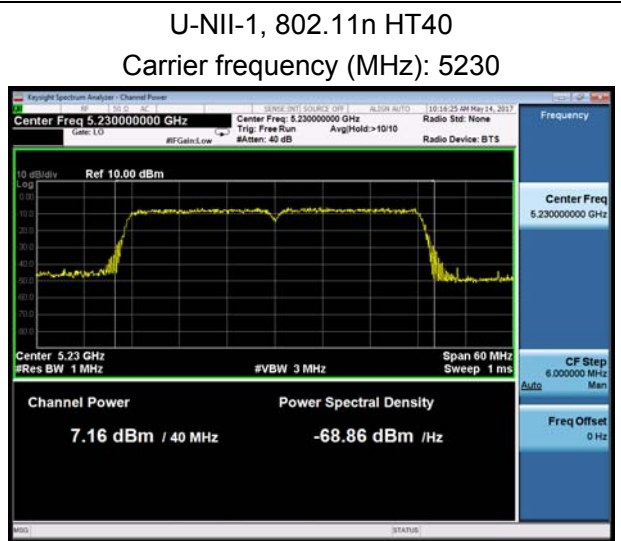
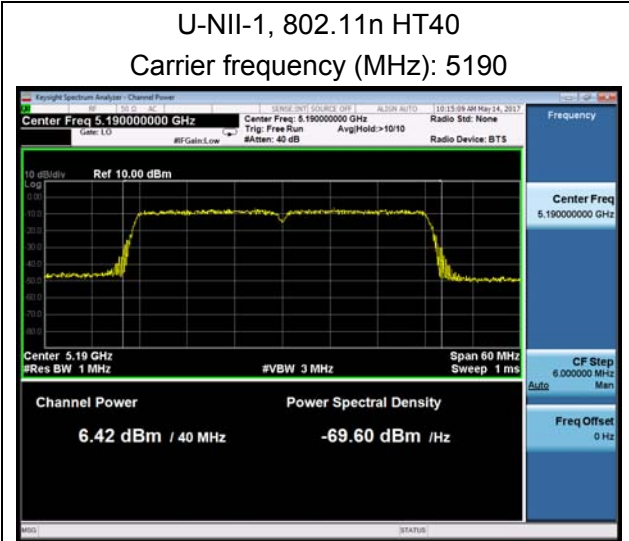


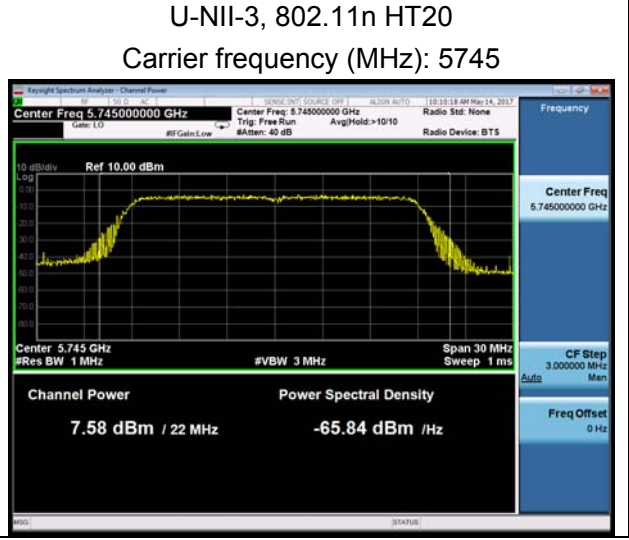
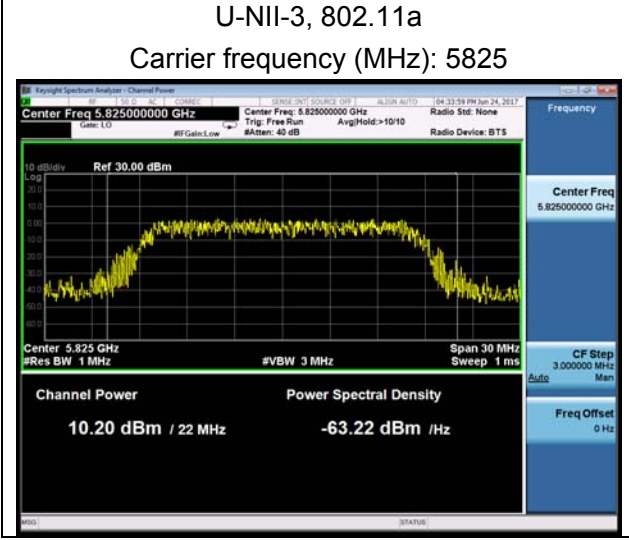
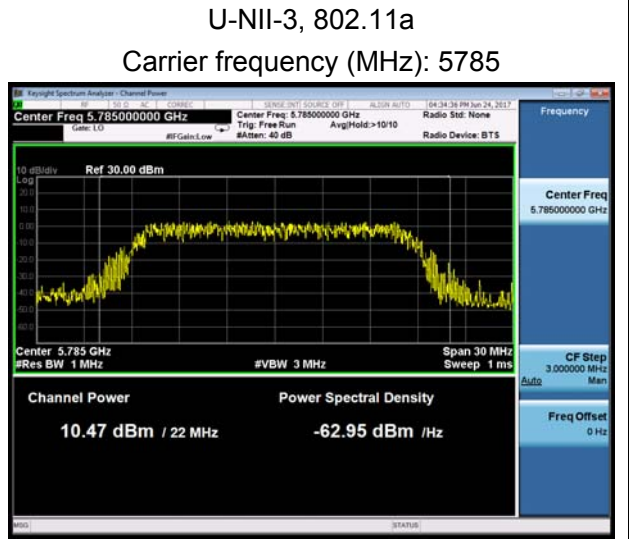
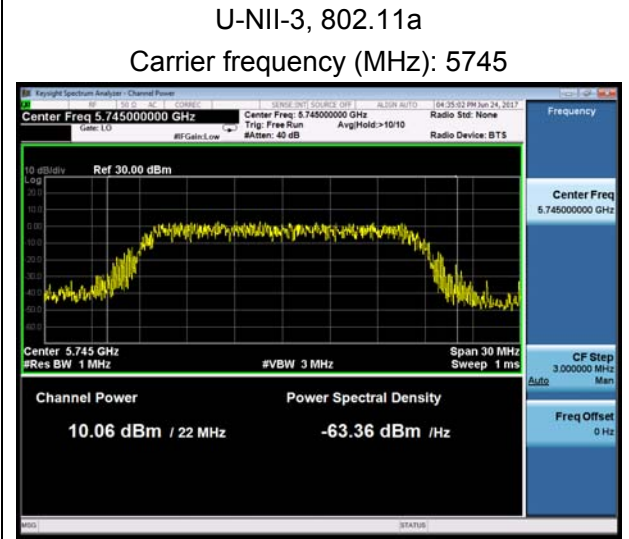
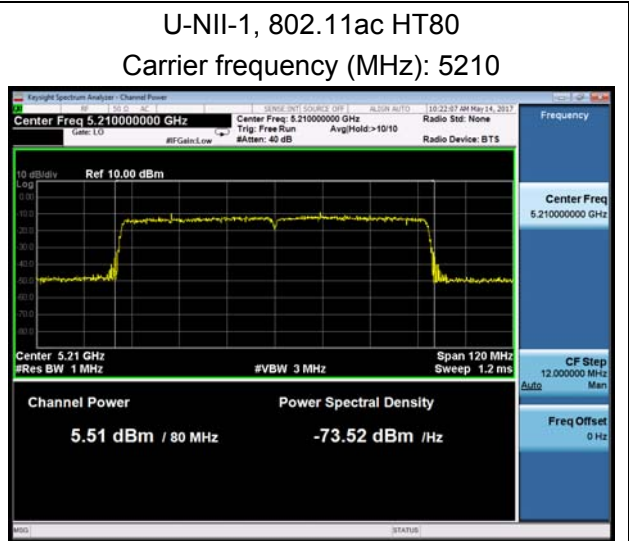
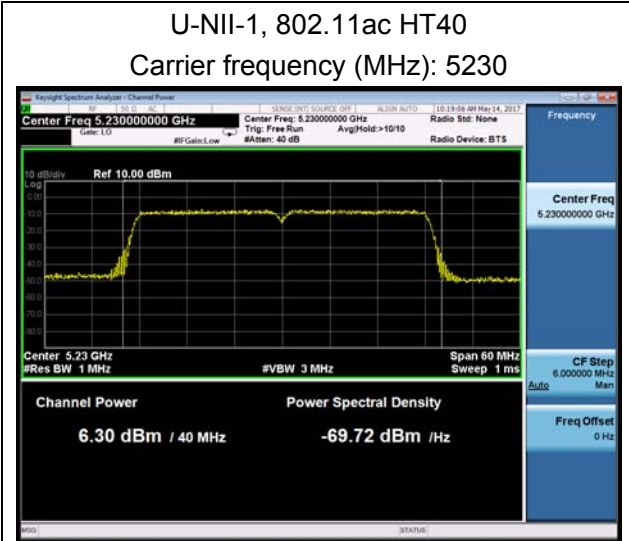
U-NII-3, 802.11ac HT80
Carrier frequency (MHz): 5775

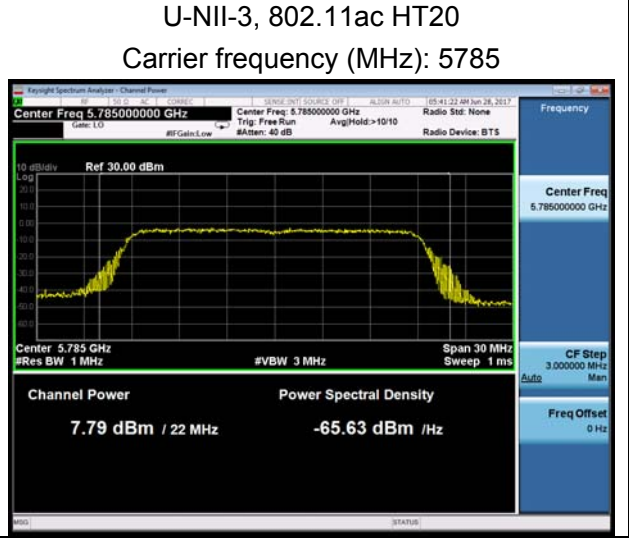
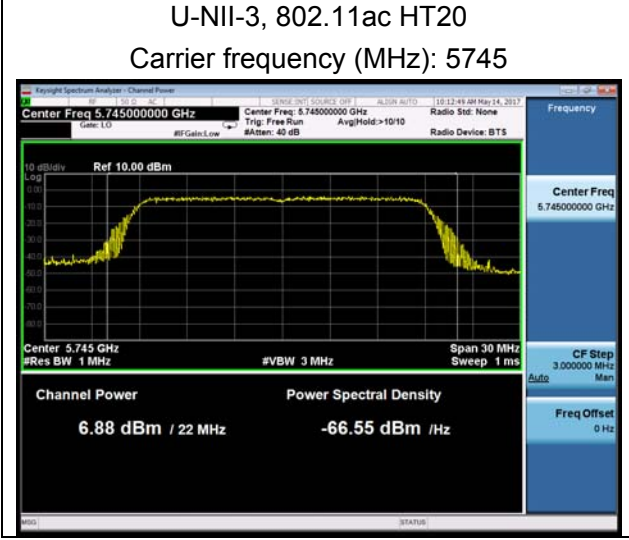
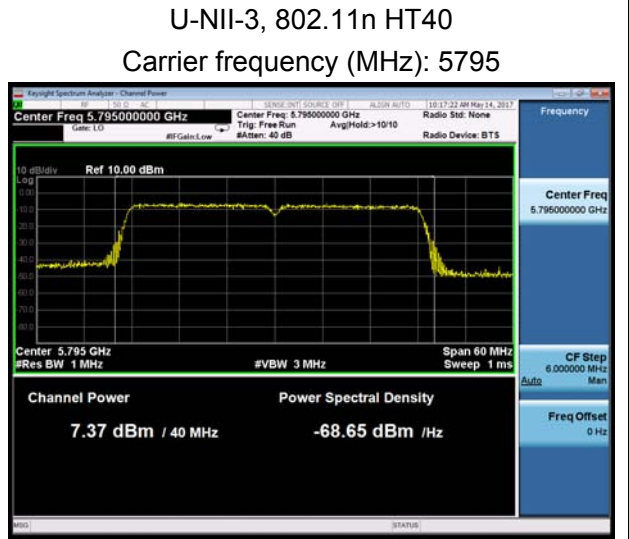
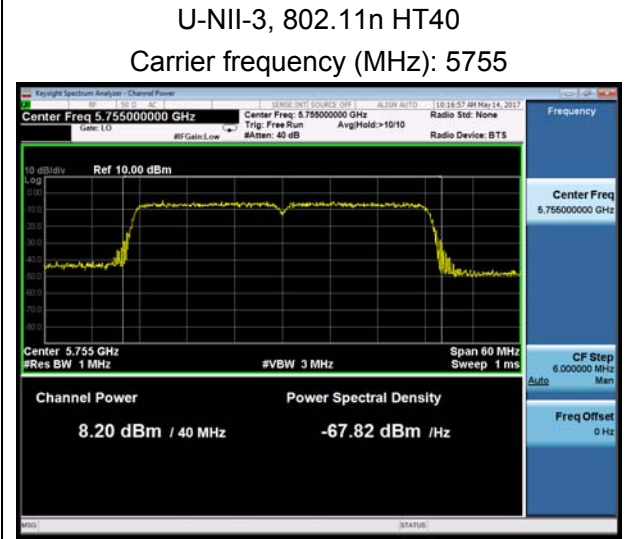
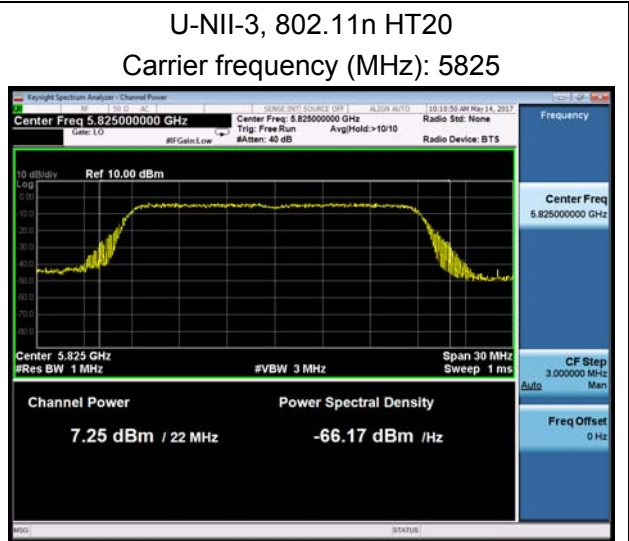
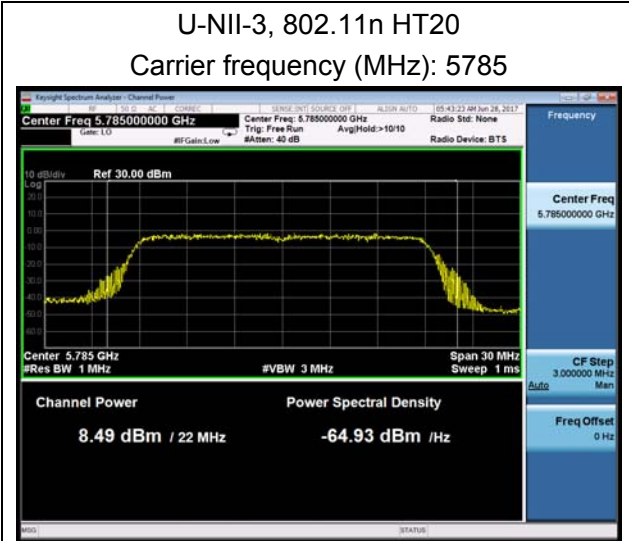


SISO Antenna 2





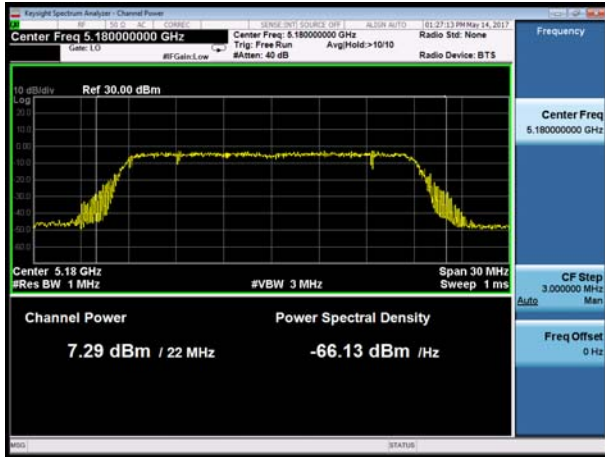




MIMO Antenna 1

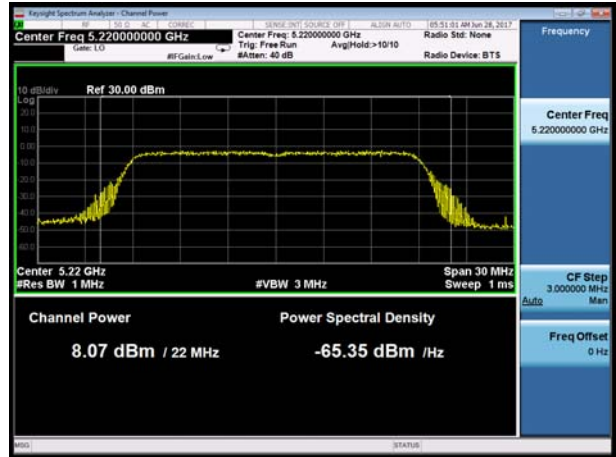
U-NII-1, 802.11n HT20

Carrier frequency (MHz): 5180



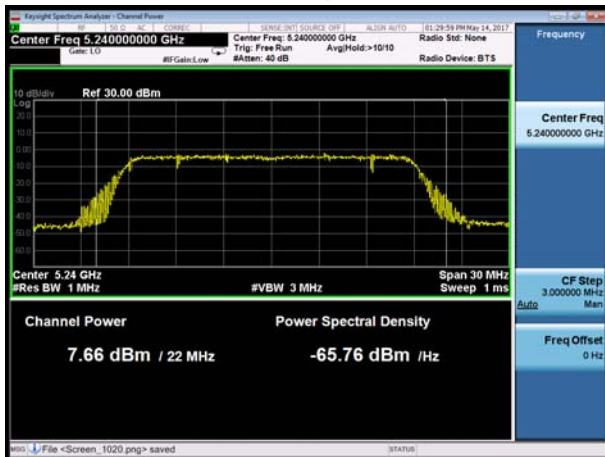
U-NII-1, 802.11n HT20

Carrier frequency (MHz): 5220



U-NII-1, 802.11n HT20

Carrier frequency (MHz): 5240



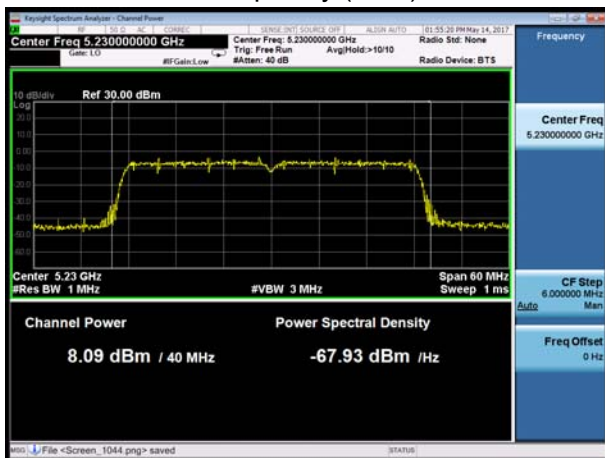
U-NII-1, 802.11n HT40

Carrier frequency (MHz): 5190



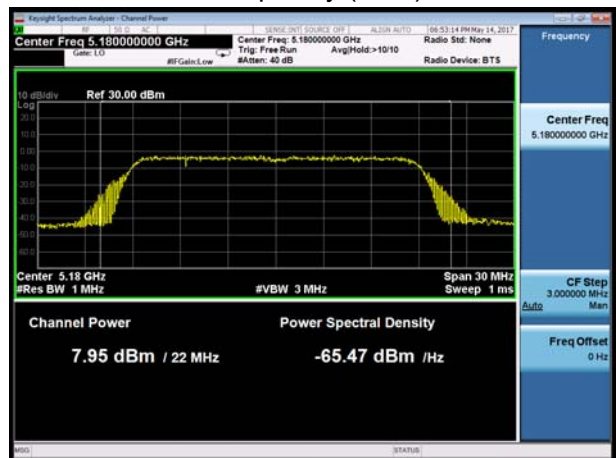
U-NII-1, 802.11n HT40

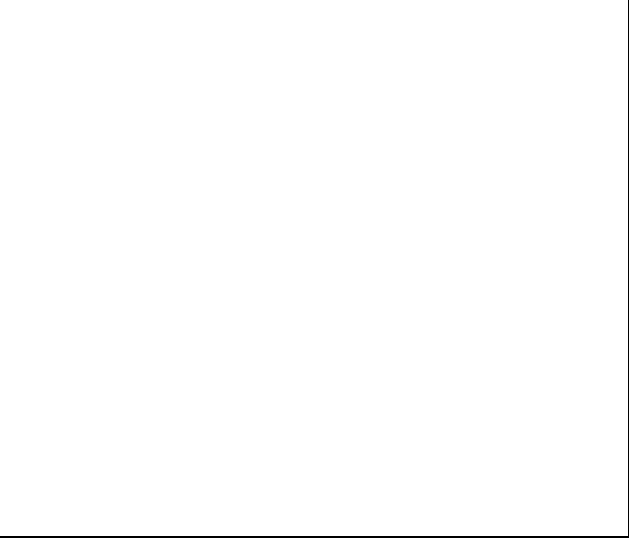
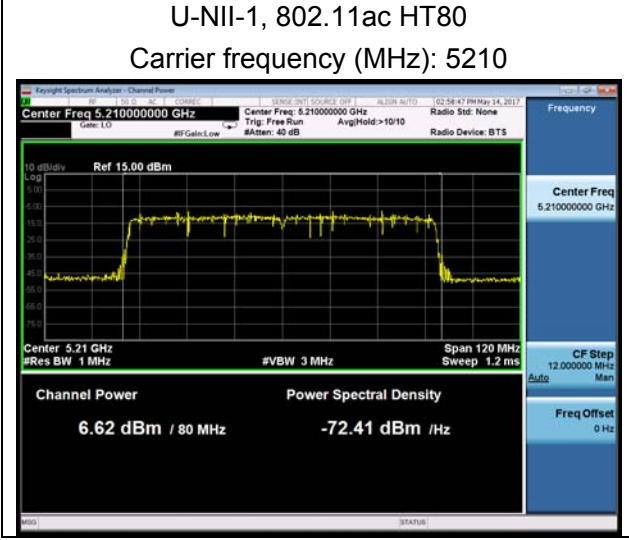
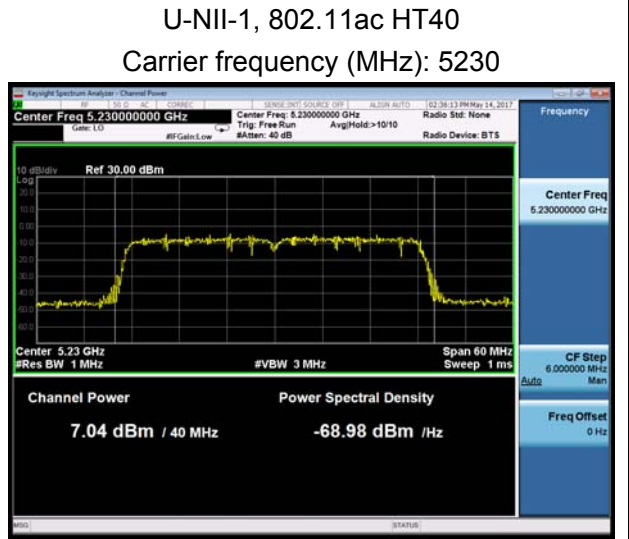
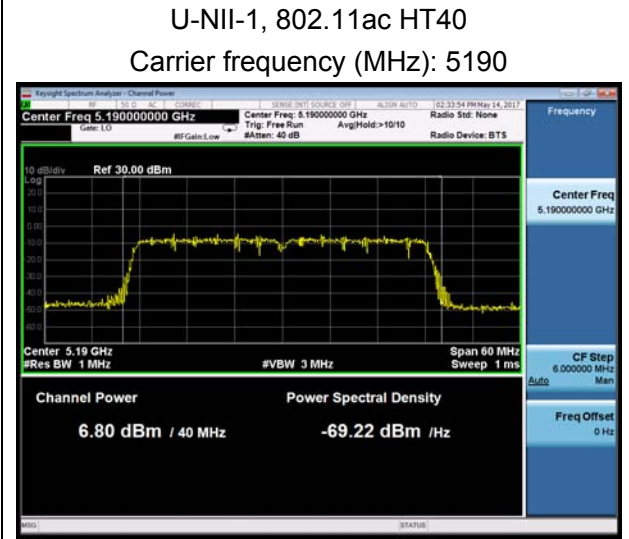
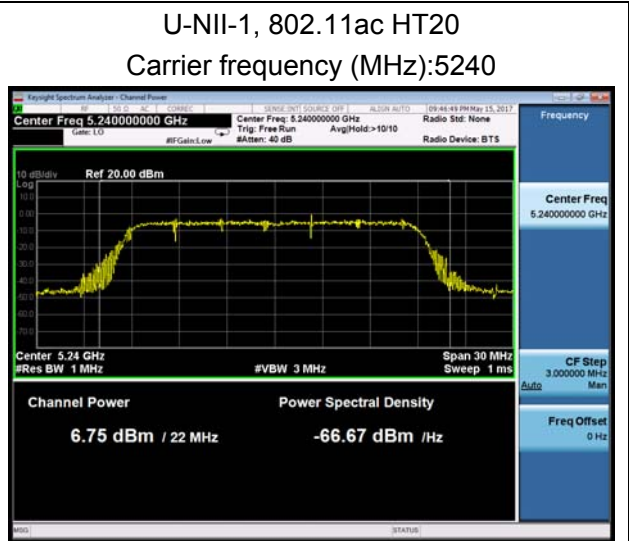
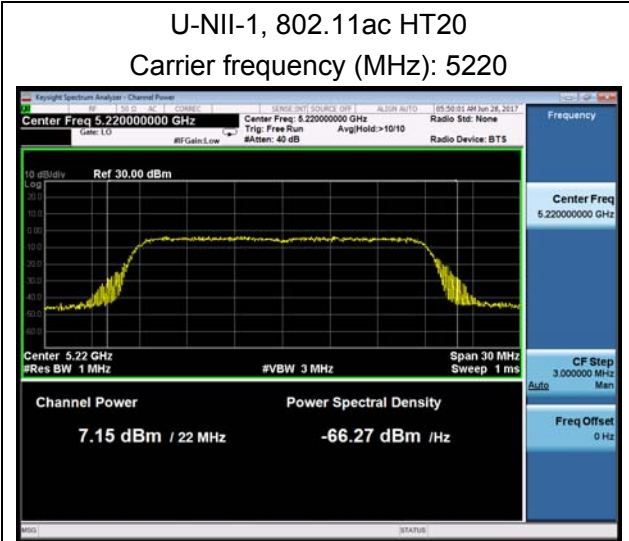
Carrier frequency (MHz): 5230

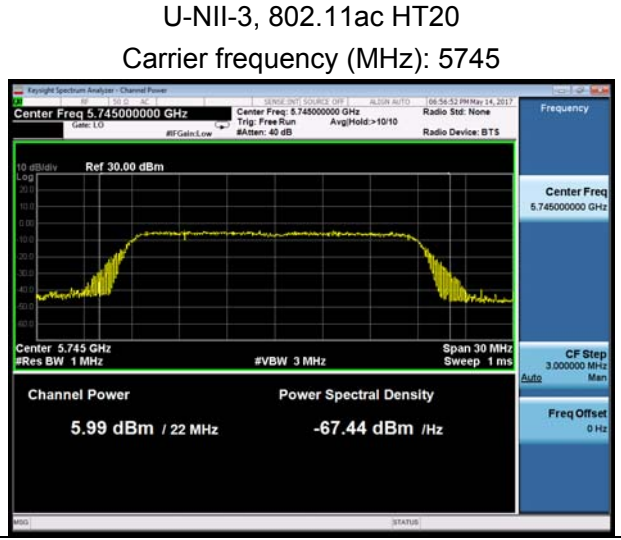
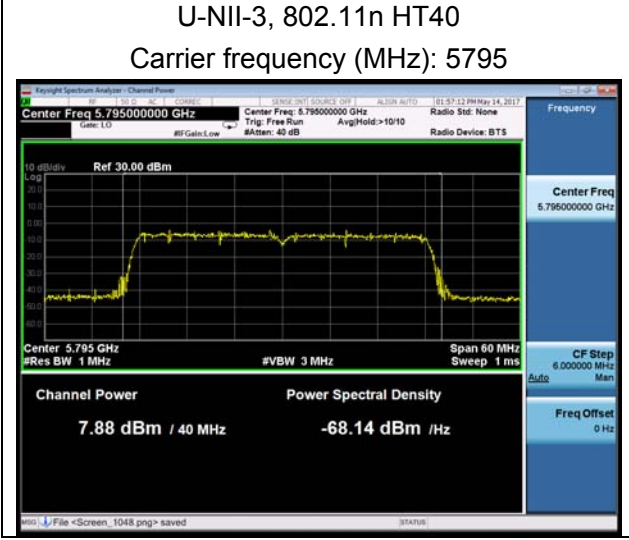
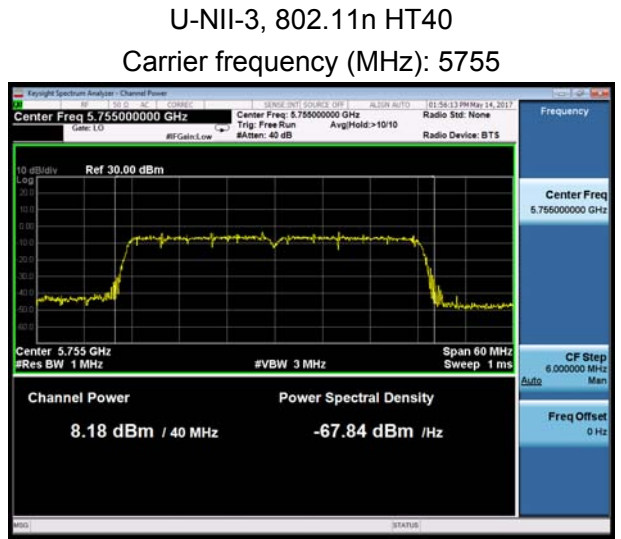
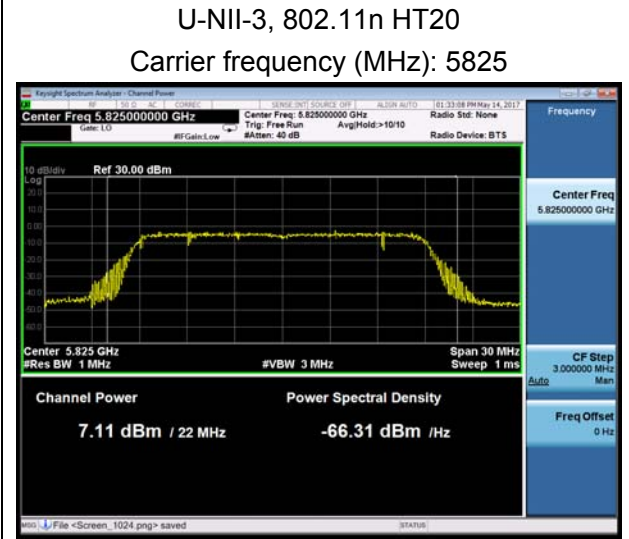
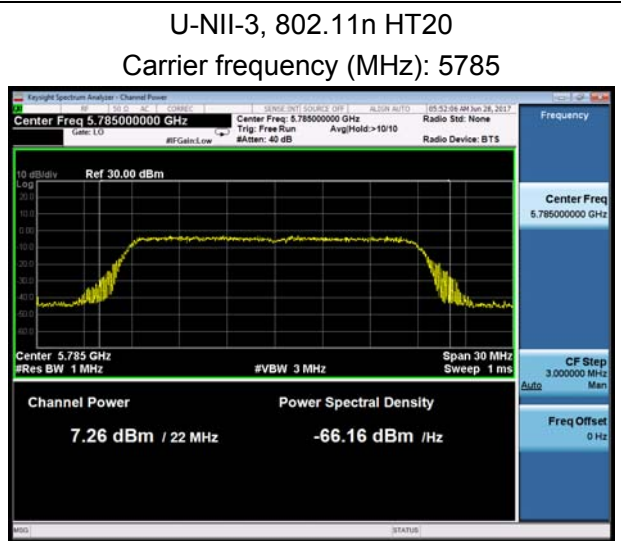
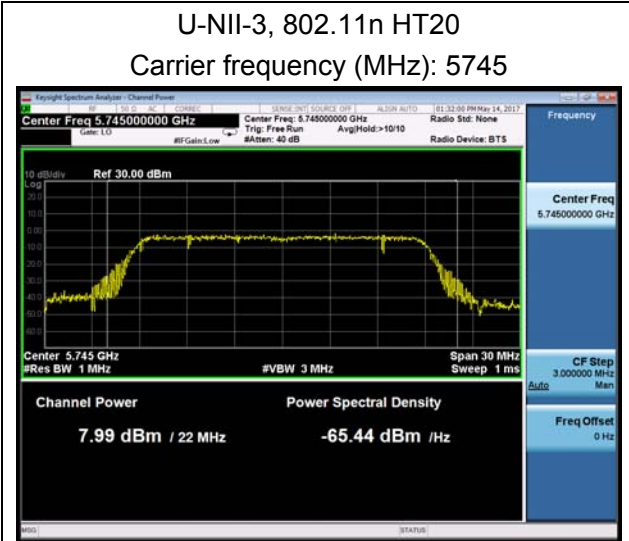


U-NII-1, 802.11ac HT20

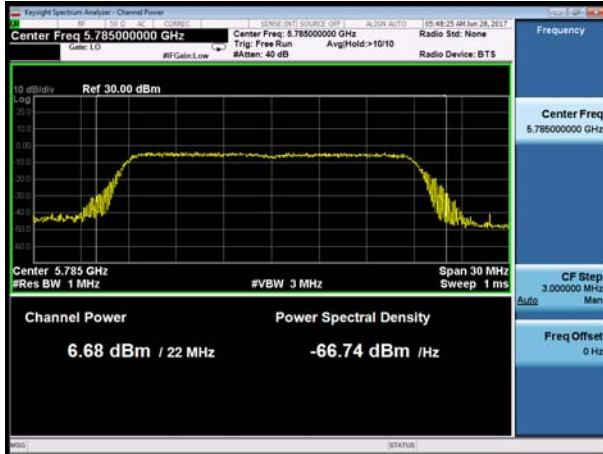
Carrier frequency (MHz): 5180



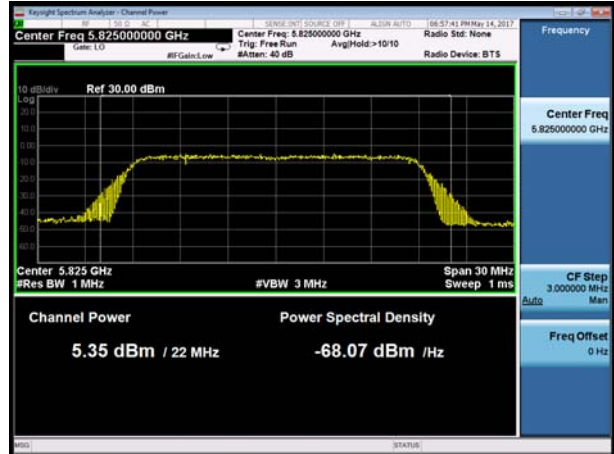




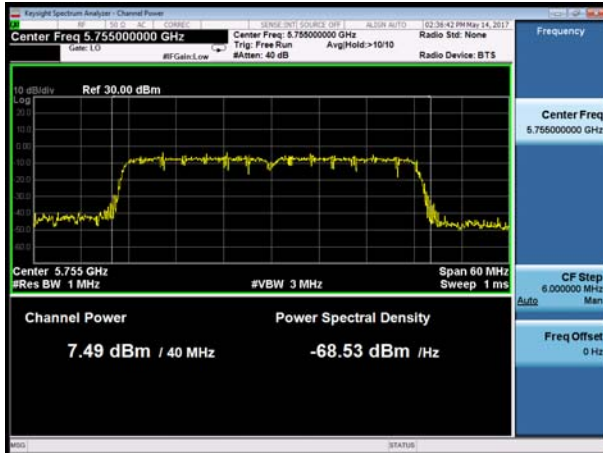
U-NII-3, 802.11ac HT20
Carrier frequency (MHz): 5785



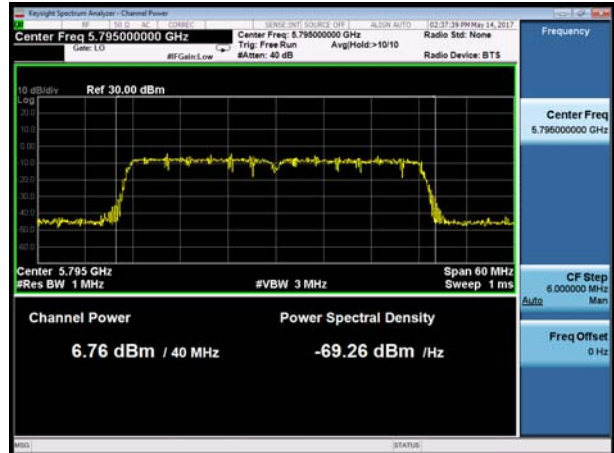
U-NII-3, 802.11ac HT20
Carrier frequency (MHz): 5825



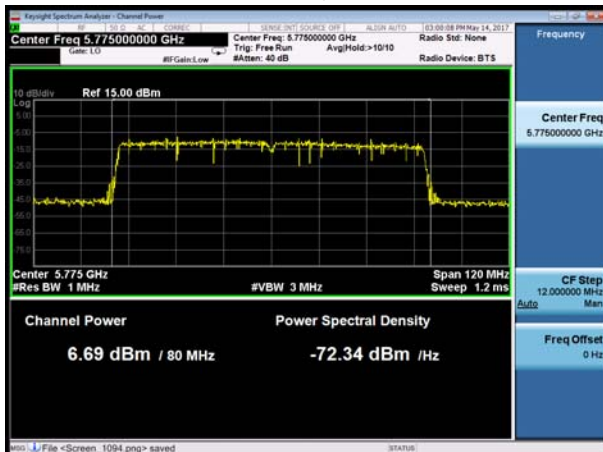
U-NII-3, 802.11ac HT40
Carrier frequency (MHz): 5755



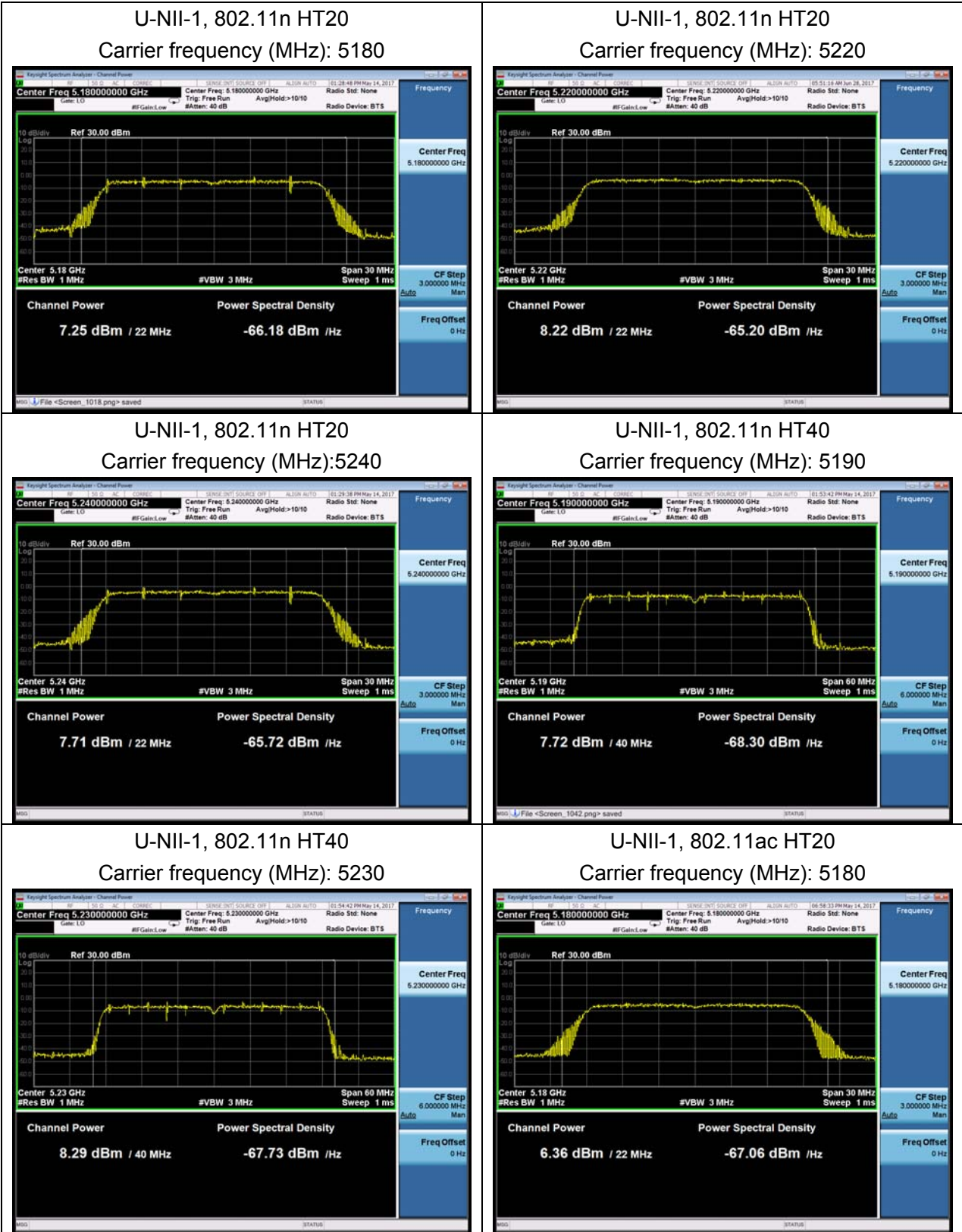
U-NII-3, 802.11ac HT40
Carrier frequency (MHz): 5795

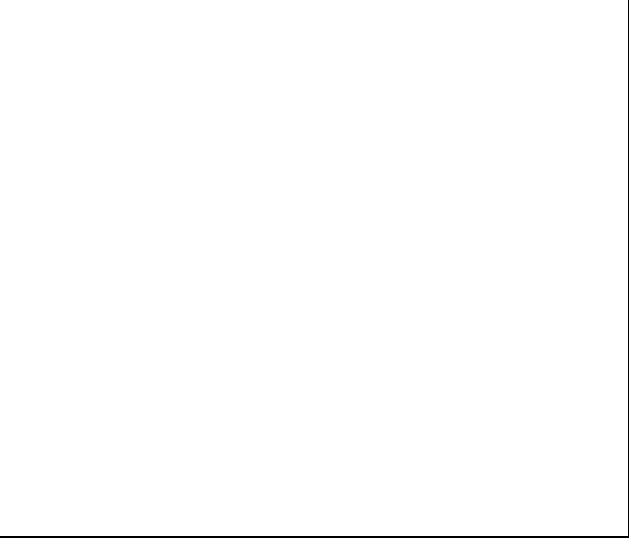
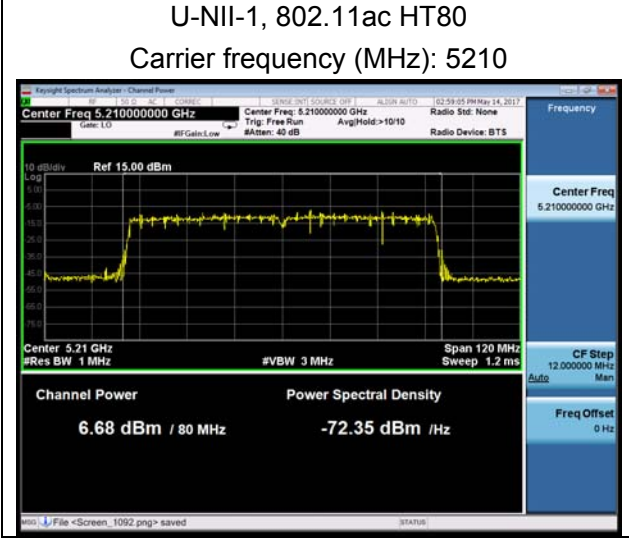
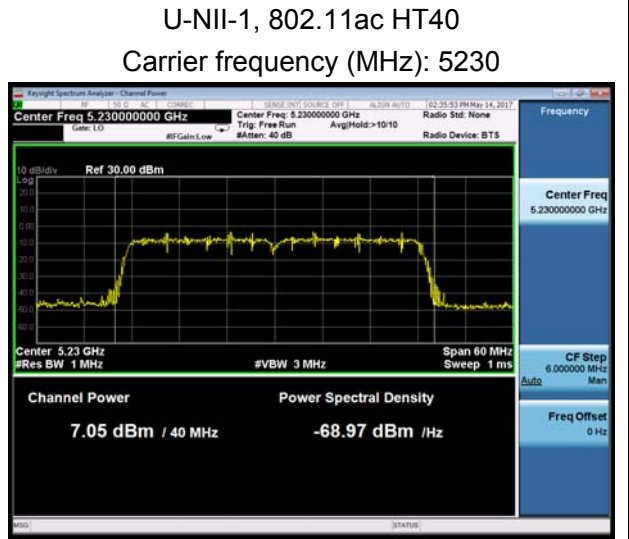
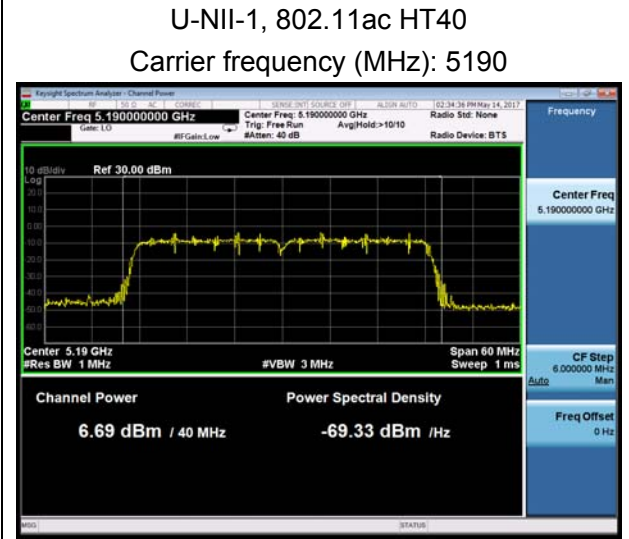
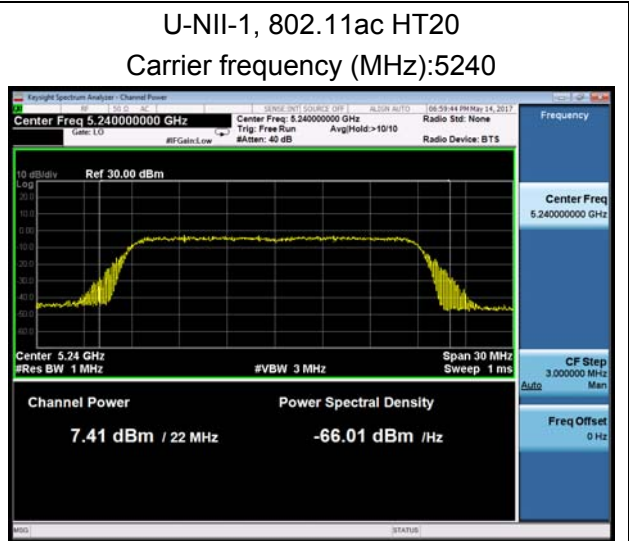
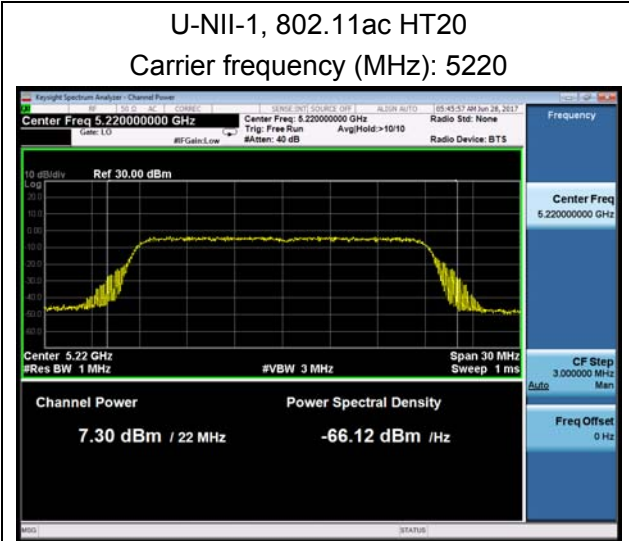


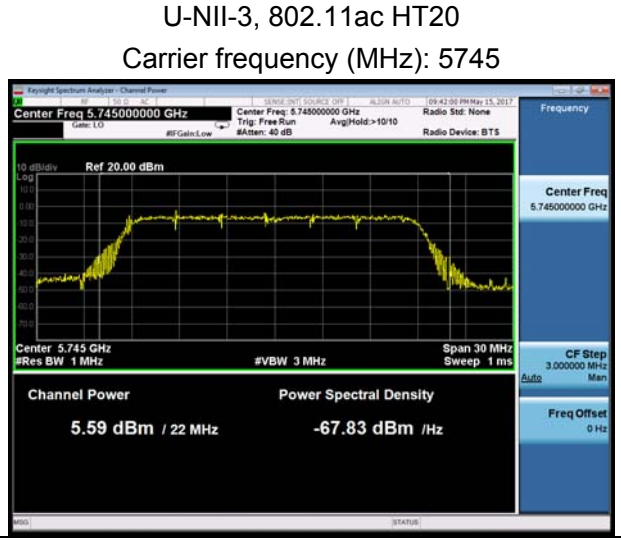
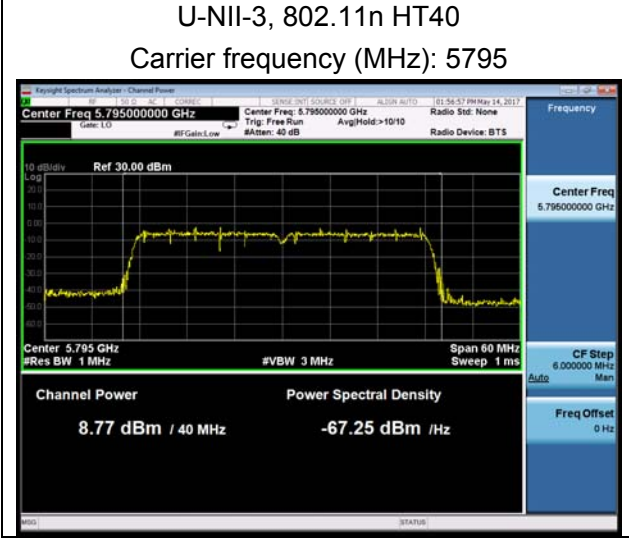
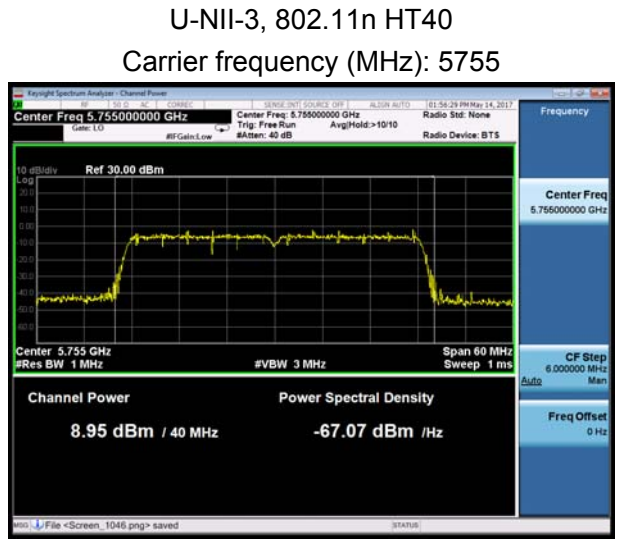
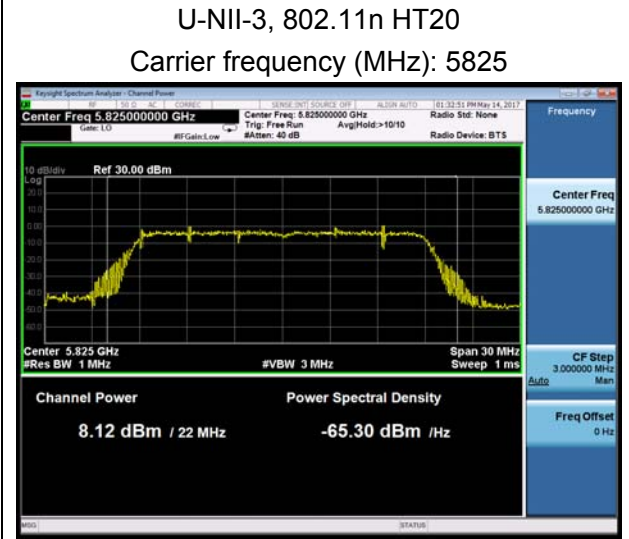
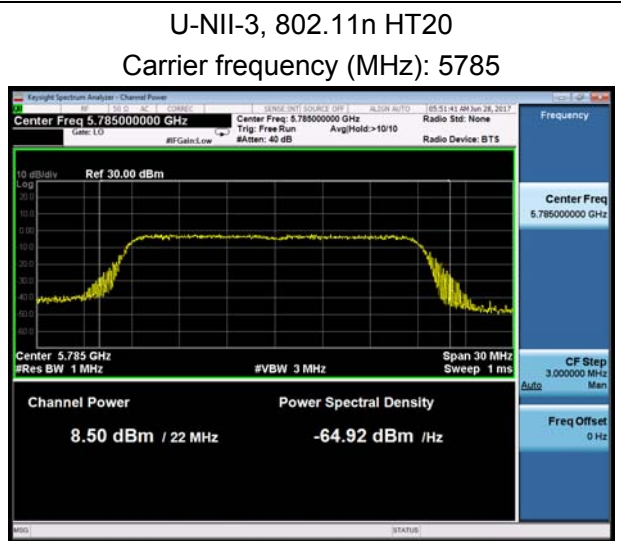
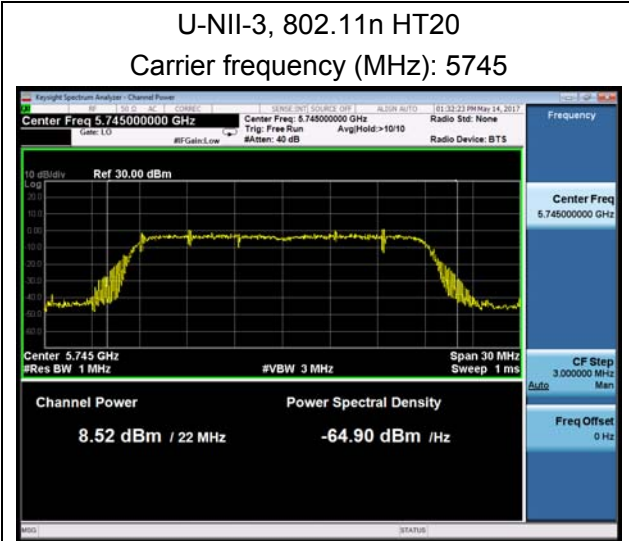
U-NII-3, 802.11ac HT80
Carrier frequency (MHz): 5775

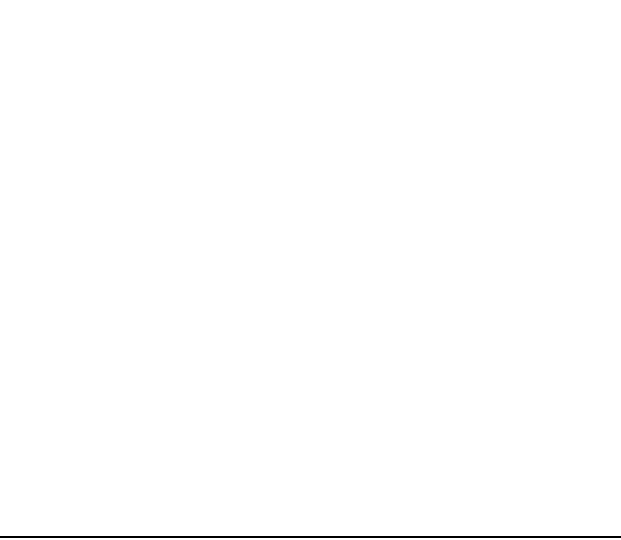
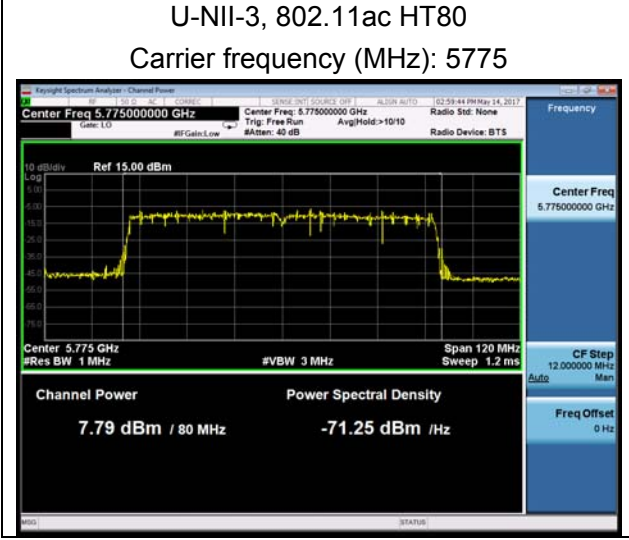
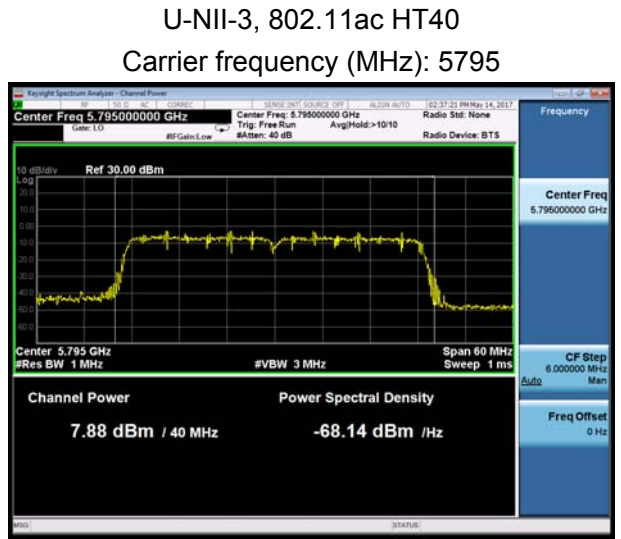
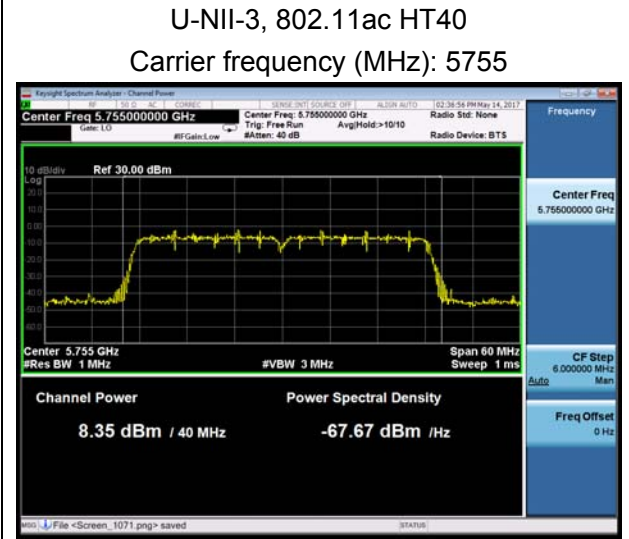
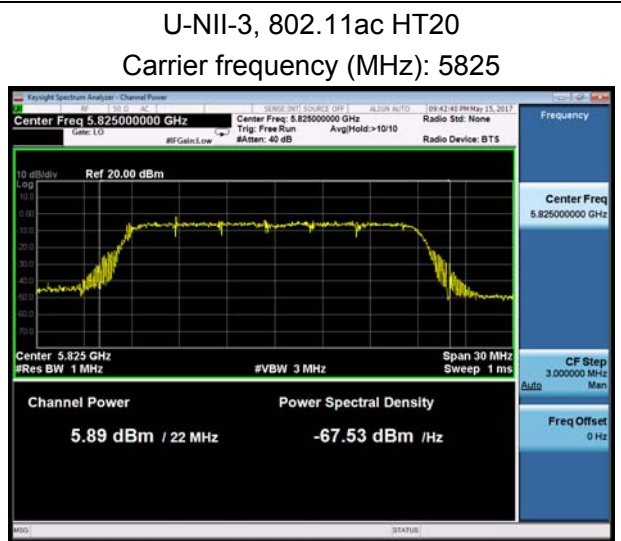
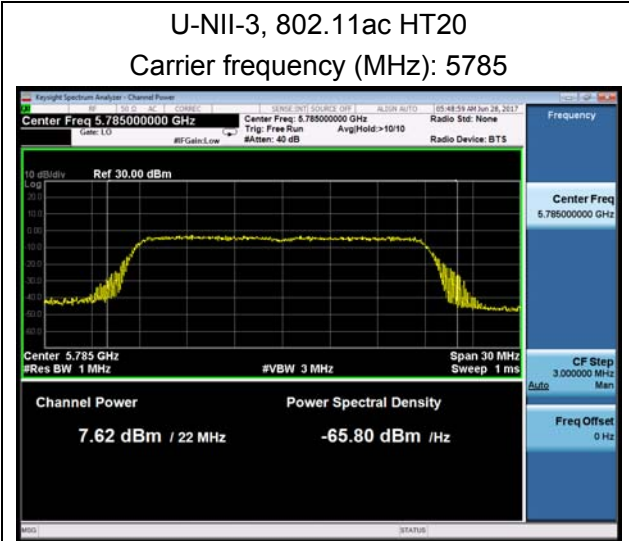


MIMO Antenna 2









5.3. Frequency Stability

Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement

1. Frequency stability with respect to ambient temperature

a) Supply the EUT with a nominal ac voltage or install a new or fully charged battery in the EUT. If possible, a dummy load shall be connected to the EUT because an antenna near the metallic walls of an environmental test chamber could affect the output frequency of the EUT. If the EUT is equipped with a permanently attached, adjustable-length antenna, then the EUT shall be placed in the center of the chamber with the antenna adjusted to the shortest length possible. Turn ON the EUT and tune it to one of the number of frequencies shown in 5.6.

b) Couple the unlicensed wireless device output to the measuring instrument by connecting an antenna to the measuring instrument with a suitable length of coaxial cable and placing the measuring antenna near the EUT (e.g., 15 cm away), or by connecting a dummy load to the measuring instrument, through an attenuator if necessary.

c) Adjust the location of the measurement antenna and the controls on the measurement instrument to obtain a suitable signal level (i.e., a level that will not overload the measurement instrument but is strong enough to allow measurement of the operating or fundamental frequency of the EUT).

d) Turn the EUT OFF and place it inside the environmental temperature chamber. For devices that have oscillator heaters, energize only the heater circuit.

e) Set the temperature control on the chamber to the highest specified in the regulatory requirements for the type of device and allow the oscillator heater and the chamber temperature to stabilize.

f) While maintaining a constant temperature inside the environmental chamber, turn the EUT ON and record the operating frequency at startup, and at 2 minutes, 5 minutes, and 10 minutes after the EUT is energized. Four measurements in total are made.

g) Measure the frequency at each of frequencies specified in 5.6.

h) Switch OFF the EUT but do not switch OFF the oscillator heater.

i) Lower the chamber temperature by not more than 10 C, and allow the temperature inside the chamber to stabilize.

j) Repeat step f) through step i) down to the lowest specified temperature.

2. Frequency stability when varying supply voltage

Unless otherwise specified, these tests shall be made at ambient room temperature (+15 C to +25

C). An antenna shall be connected to the antenna output terminals of the EUT if possible. If the EUT is equipped with or uses an adjustable-length antenna, then it shall be fully extended.

a) Supply the EUT with nominal voltage or install a new or fully charged battery in the EUT. Turn ON the EUT and couple its output to a frequency counter or other frequency-measuring instrument.

- b) Tune the EUT to one of the number of frequencies required in 5.6. Adjust the location of the measurement antenna and the controls on the measurement instrument to obtain a suitable signal level (i.e., a level that will not overload the measurement instrument but is strong enough to allow measurement of the operating or fundamental frequency of the EUT).
- c) Measure the frequency at each of the frequencies specified in 5.6.
- d) Repeat the above procedure at 85% and 115% of the nominal supply voltage.

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.

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$, $U = 936\text{Hz}$

**Test Results****SISO Antenna 1**

Voltage (V)	Temperature (°C)	U-NII-1 Test Results			
		5200MHz			
		1min	2min	5min	10min
3.8	-20	5200.007716	5200.003546	5199.997160	5199.992008
3.8	-10	5200.007310	5199.994718	5199.994384	5199.989441
3.8	0	5200.001325	5199.993653	5199.991787	5199.986468
3.8	10	5199.997964	5199.987707	5199.983033	5199.983849
3.8	20	5199.990748	5199.986200	5199.980130	5199.978877
3.8	30	5199.985196	5199.977774	5199.975409	5199.975970
3.8	40	5199.980927	5199.969722	5199.972689	5199.966480
3.8	50	5199.979894	5199.960318	5199.966612	5199.958204
3.6	20	5199.978790	5199.953983	5199.959831	5199.957115
4.2	20	5199.977684	5199.950973	5199.956302	5199.949072
MHz		-0.022316	-0.049027	-0.043698	-0.050928
PPM		-4.291530	-9.428354	-8.403382	-9.793879

Voltage (V)	Temperature (°C)	U-NII-3 Test Results			
		5785MHz			
		1min	2min	5min	10min
3.8	-20	5784.997746	5784.994716	5784.987007	5784.979515
3.8	-10	5784.990253	5784.985931	5784.978806	5784.976617
3.8	0	5784.985780	5784.983305	5784.972910	5784.974706
3.8	10	5784.983301	5784.976276	5784.972697	5784.970123
3.8	20	5784.975953	5784.968745	5784.967192	5784.969941
3.8	30	5784.966057	5784.966489	5784.958544	5784.967931
3.8	40	5784.961342	5784.963369	5784.949225	5784.964418
3.8	50	5784.958962	5784.962346	5784.941952	5784.955375
3.6	20	5784.949943	5784.960071	5784.937017	5784.948958
4.2	20	5784.945996	5784.957246	5784.927698	5784.948872
MHz		-0.054004	-0.042754	-0.072302	-0.051128
PPM		-9.335130	-7.390413	-12.498155	-8.838007

5.4. Power Spectral Density

Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement

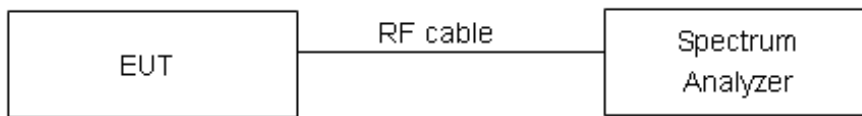
The EUT was connected to the spectrum analyzer through an external attenuator (20dB) and a known loss cable.

Set RBW = 500 kHz, VBW =1.5MHz for the band 5.725-5.85 GHz

Set RBW = 1 MHz, VBW =3MHz for the band 5.150-5.250 GHz

The conducted PSD is measured at each antenna port. The measured results at the various antenna ports are then summed mathematically.

Test setup



Limits

Rule FCC Part 15.407(a)(1)/ Part 15.407(a)(2) / Part 15.407(a)(3)

For an indoor access point operating in the band 5.15-5.25 GHz, 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.

For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, 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.

For the band 5.725-5.85 GHz, 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.

Frequency Bands/MHz	Limits
5150-5250	17dBm/MHz
5.25-5.35 GHz and 5.47-5.725 GHz	11dBm/MHz
5725-5850	30dBm/500kHz



Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$, $U = 0.75\text{dB}$.

**Test Results:****SISO Antenna 1****U-NII-1**

Network Standards	Channel Number	Power Spectral Density (dBm /MHz)	Limit (dBm /MHz)	Conclusion
802.11a	36	-1.545	17	PASS
	44	-1.356	17	PASS
	48	-1.662	17	PASS
802.11n HT20	36	-5.097	17	PASS
	44	-4.910	17	PASS
	48	-4.977	17	PASS
802.11n HT40	38	-8.080	17	PASS
	46	-7.777	17	PASS
802.11ac HT20	36	-6.464	17	PASS
	44	-5.936	17	PASS
	48	-5.680	17	PASS
802.11ac HT40	38	-9.379	17	PASS
	46	-9.505	17	PASS
802.11ac HT80	42	-14.034	17	PASS

U-NII-3

Network Standards	Channel Number	Power Spectral Density (dBm/500kHz)	Limit (dBm/500kHz)	Conclusion
802.11a	149	-3.732	30	PASS
	157	-4.811	30	PASS
	165	-4.796	30	PASS
802.11n HT20	149	-9.979	30	PASS
	157	-8.222	30	PASS
	165	-8.779	30	PASS
802.11n HT40	151	-14.172	30	PASS
	159	-13.748	30	PASS
802.11ac HT20	149	-10.732	30	PASS
	157	-8.997	30	PASS
	165	-10.529	30	PASS
802.11ac HT40	151	-15.743	30	PASS
	159	-14.325	30	PASS
802.11ac HT80	155	-18.675	30	PASS

**SISO Antenna 2****U-NII-1**

Network Standards	Channel Number	Power Spectral Density (dBm /MHz)	Limit (dBm /MHz)	Conclusion
802.11a	36	-1.633	17	PASS
	44	-2.661	17	PASS
	48	-1.219	17	PASS
802.11n HT20	36	-4.851	17	PASS
	44	-4.556	17	PASS
	48	-5.474	17	PASS
802.11n HT40	38	-9.220	17	PASS
	46	-8.250	17	PASS
802.11ac HT20	36	-6.282	17	PASS
	44	-5.454	17	PASS
	48	-5.701	17	PASS
802.11ac HT40	38	-10.358	17	PASS
	46	-9.530	17	PASS
802.11ac HT80	42	-13.611	17	PASS

U-NII-3

Network Standards	Channel Number	Power Spectral Density (dBm/500kHz)	Limit (dBm/500kHz)	Conclusion
802.11a	149	-3.668	30	PASS
	157	-3.783	30	PASS
	165	-3.607	30	PASS
802.11n HT20	149	-8.736	30	PASS
	157	-7.213	30	PASS
	165	-9.360	30	PASS
802.11n HT40	151	-11.375	30	PASS
	159	-11.996	30	PASS
802.11ac HT20	149	-9.219	30	PASS
	157	-7.942	30	PASS
	165	-9.317	30	PASS
802.11ac HT40	151	-12.332	30	PASS
	159	-11.831	30	PASS
802.11ac HT80	155	-16.123	30	PASS

**MIMO****U-NII-1**

Network Standards	Channel Number	Power Spectral Density (dBm /MHz)			Limit (dBm /MHz)	Conclusion
		ANT1	ANT2	MIMO		
802.11n HT20	36	-5.652	-6.185	-2.900	17	PASS
	44	-5.064	-5.038	-2.041	17	PASS
	48	-6.155	-5.787	-2.957	17	PASS
802.11n HT40	38	-10.077	-9.847	-6.950	17	PASS
	46	-10.751	-8.856	-6.691	17	PASS
802.11ac HT20	36	-7.757	-9.677	-5.601	17	PASS
	44	-5.934	-5.727	-2.819	17	PASS
	48	-7.083	-8.472	-4.712	17	PASS
802.11ac HT40	38	-10.818	-11.047	-7.921	17	PASS
	46	-10.606	-9.770	-7.158	17	PASS
802.11ac HT80	42	-13.214	-14.073	-10.612	17	PASS

U-NII-3

Network Standards	Channel Number	Power Spectral Density (dBm/500kHz)			Limit (dBm/500kHz)	Conclusion
		ANT1	ANT2	MIMO		
802.11n HT20	149	-8.705	-7.764	-5.199	30	PASS
	157	-8.799	-7.049	-4.826	30	PASS
	165	-9.631	-8.781	-6.175	30	PASS
802.11n HT40	151	-12.156	-10.118	-8.008	30	PASS
	159	-12.001	-11.441	-8.702	30	PASS
802.11ac HT20	149	-12.378	-10.210	-8.150	30	PASS
	157	-9.179	-7.497	-5.247	30	PASS
	165	-13.017	-11.294	-9.060	30	PASS
802.11ac HT40	151	-12.685	-11.248	-8.897	30	PASS
	159	-12.596	-11.893	-9.220	30	PASS
802.11ac HT80	155	-15.770	-14.956	-12.334	30	PASS



SISO Antenna 1

U-NII-1, 802.11a
Carrier frequency (MHz): 5180



U-NII-1, 802.11a
Carrier frequency (MHz):5220



U-NII-1, 802.11a
Carrier frequency (MHz):5240



U-NII-1, 802.11n HT20
Carrier frequency (MHz): 5180



U-NII-1, 802.11n HT20
Carrier frequency (MHz):5220



U-NII-1, 802.11n HT20
Carrier frequency (MHz):5240





U-NII-1, 802.11n HT40
Carrier frequency (MHz): 5190



U-NII-1, 802.11n HT40
Carrier frequency (MHz): 5230



U-NII-1, 802.11ac HT20
Carrier frequency (MHz): 5180



U-NII-1, 802.11ac HT20
Carrier frequency (MHz): 5220



U-NII-1, 802.11ac HT20
Carrier frequency (MHz): 5240

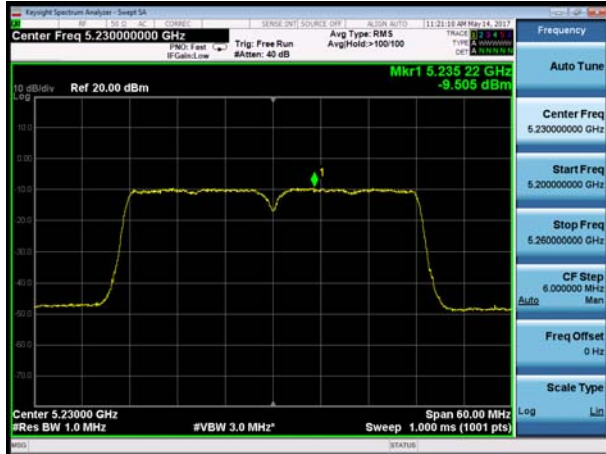


U-NII-1, 802.11ac HT40
Carrier frequency (MHz): 5190





U-NII-1, 802.11ac HT40
Carrier frequency (MHz): 5230



U-NII-1, 802.11ac HT80
Carrier frequency (MHz): 5210



U-NII-3, 802.11a
Carrier frequency (MHz): 5745



U-NII-3, 802.11a
Carrier frequency (MHz): 5785

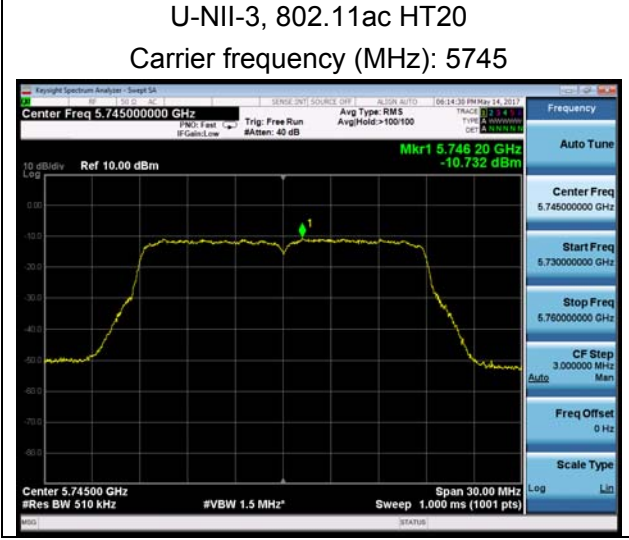
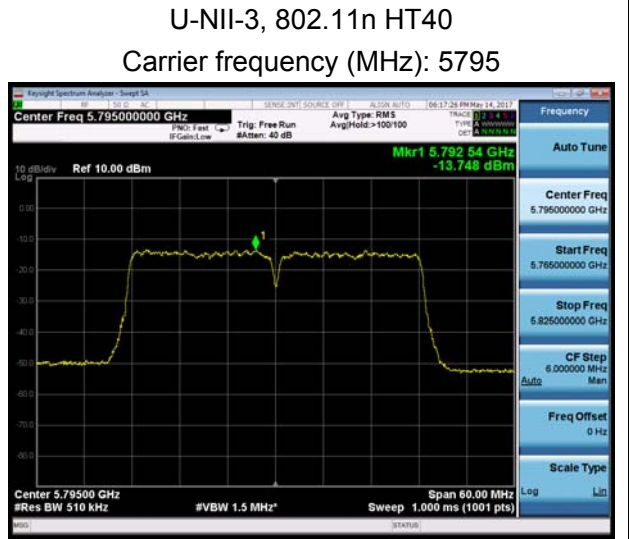
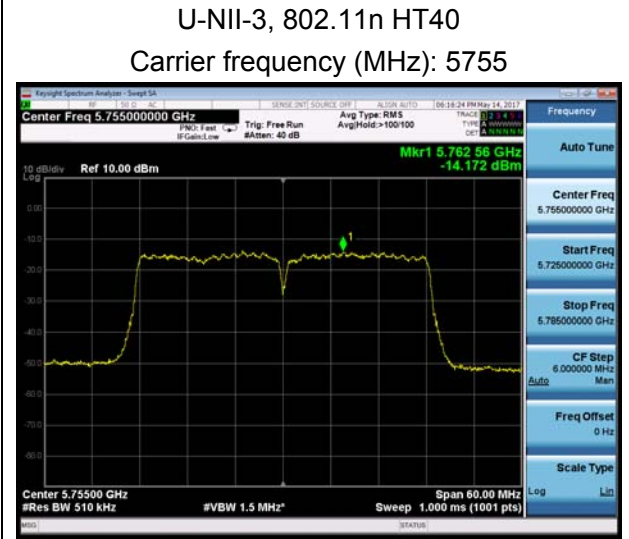
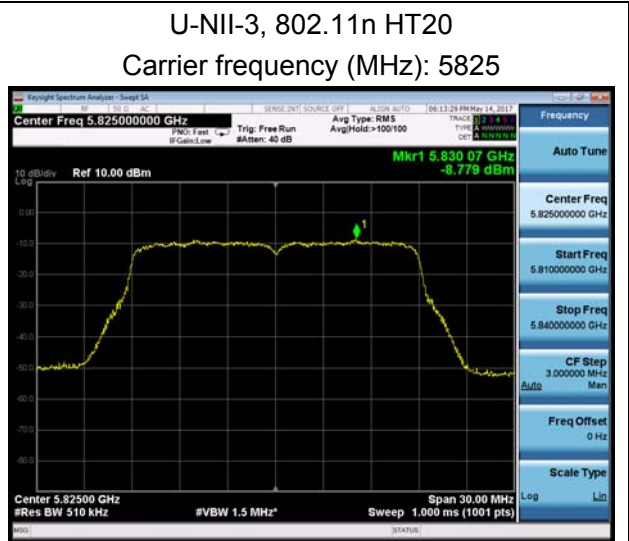
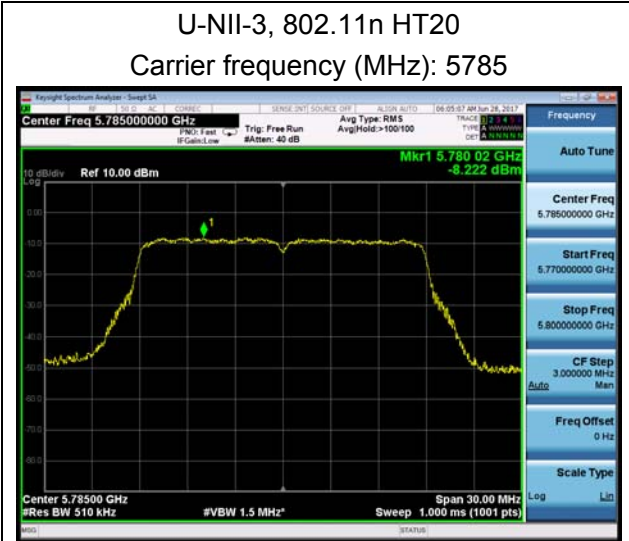


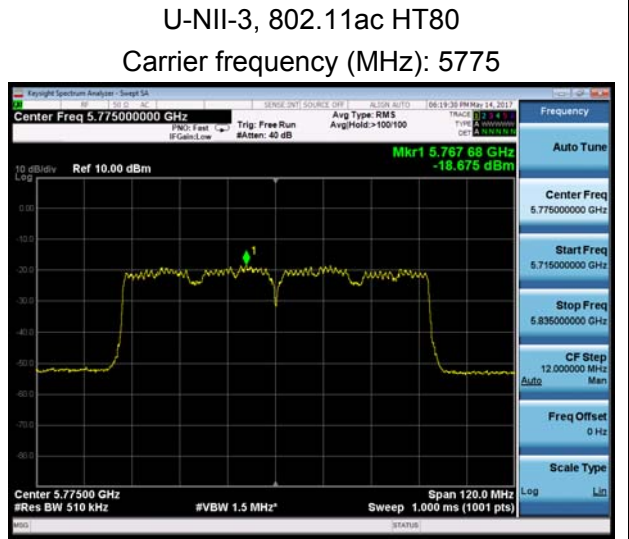
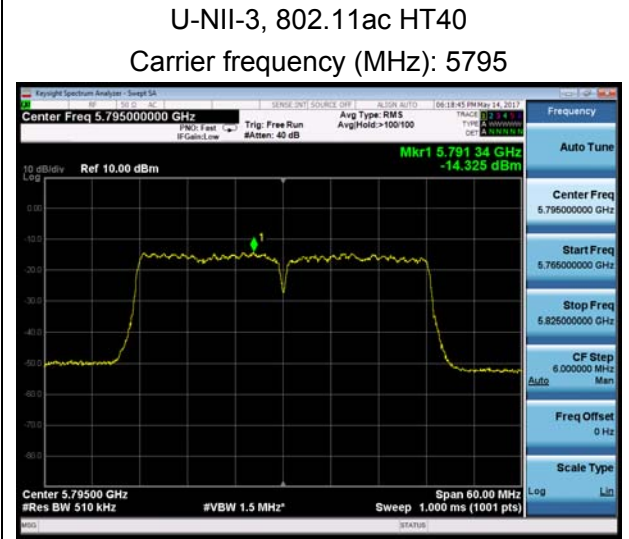
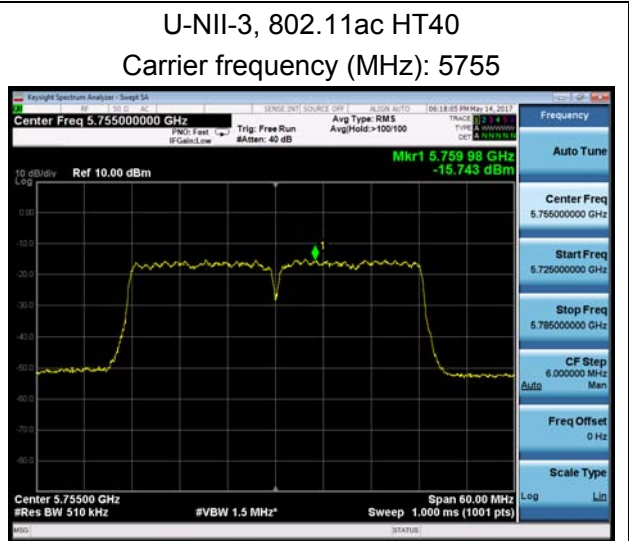
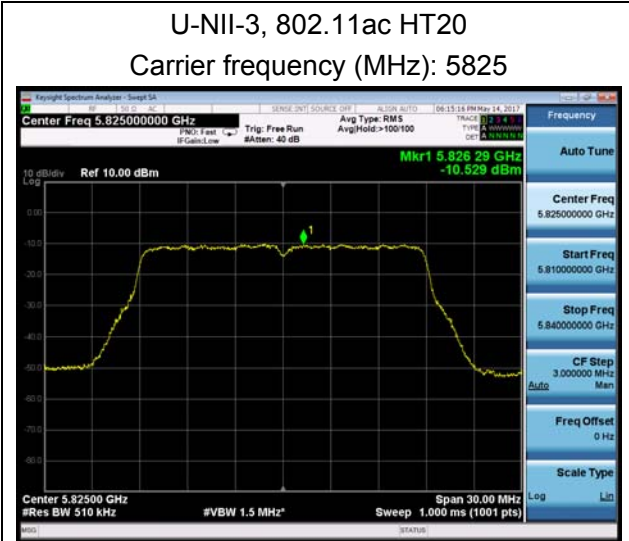
U-NII-3, 802.11a
Carrier frequency (MHz): 5825



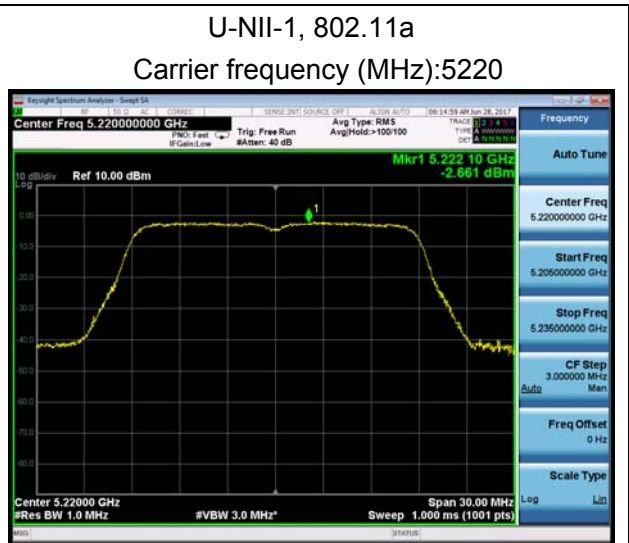
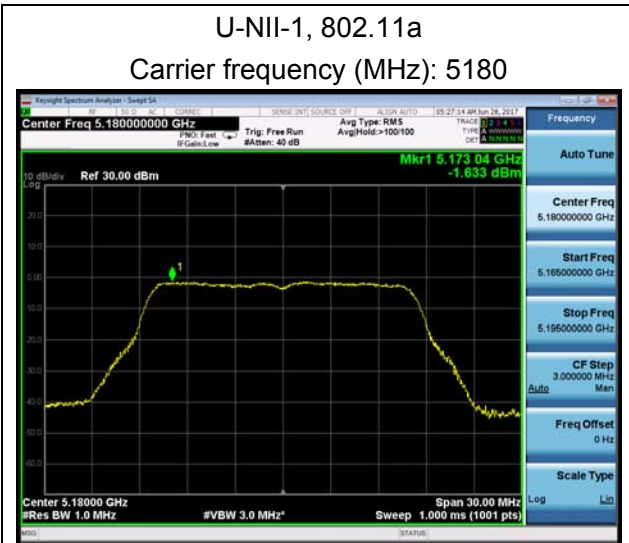
U-NII-3, 802.11n HT20
Carrier frequency (MHz): 5745







SISO Antenna 2





U-NII-1, 802.11a
Carrier frequency (MHz):5240



U-NII-1, 802.11n HT20
Carrier frequency (MHz): 5180



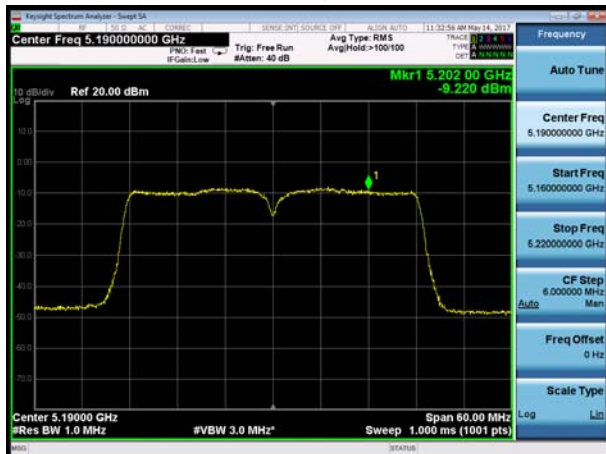
U-NII-1, 802.11n HT20
Carrier frequency (MHz):5220



U-NII-1, 802.11n HT20
Carrier frequency (MHz):5240



U-NII-1, 802.11n HT40
Carrier frequency (MHz): 5190



U-NII-1, 802.11n HT40
Carrier frequency (MHz): 5230

