RF TEST REPORT

Applicant	Huawei Technologies Co., Ltd.
FCC ID	QISAP4050DN-E
Product	Wireless LAN Access Point
Model	AP4050DN-E
Report No.	R1805A0265-R1V1
Issue Date	June 27, 2018

TA Technology (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in **FCC CFR47 Part 15E (2017)**. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Performed by: Zhengqiang Zhou *Approved by: Kai Xu*

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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: June 1, 2018 ~ June 10, 2018			

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.

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 (Designation number: CN1179, Test Firm Registration Number: 446626)

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-10766)

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
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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	AP4050DN-E
SN	21500829442SJ5601554
Hardware Version	VER.F
Software Version	V200
Power Supply	DC adapter
Antenna Type	Internal Antenna
Antenna Gain	Antenna 1: 4.0 dBi Antenna 2: 4.0dBi
Directional Gain	4.0 dBi
additional beamforming gain	3 dB
Test Mode(s)	U-NII-1(5150MHz-5250MHz) U-NII-3(5725MHz-5850MHz)
Modulation Type	802.11a/n (HT20/HT40) : OFDM 802.11ac (VHT20/VHT40/VHT80): OFDM
Max. Conducted Power	23.30dBm
Operating Frequency Range(s)	U-NII-1: 5150-5250MHz U-NII-3: 5725-5850MHz
Operating temperature range:	-10 ° C to 50° C
Operating voltage range:	DC: 12 V POE: 37 V to 57 V
State AC voltage:	48V
EUT Accessory	
DC Adapter	Manufacturer: Shenzhen Honor Electronics Co.,Ltd.

	Model: HW-560107D0D
POE	Model: AC6005-8-PWR
Current meter	Model: Tesgine
Note: 1. The information of the EUT is declared by the manufacturer. 2. The EUT don't have standard Adapter. The adapter used for testing in this report is the after-market accessory.	

3. Applied Standards

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

FCC CFR47 Part 15E (2017) Unlicensed National Information Infrastructure Devices

ANSI C63.10 (2013)

KDB 789033 D02 General UNII Test Procedures New Rules v02r01

KDB 662911 D01 Multiple Transmitter Output v02r01

4. Test Configuration

Test Mode

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 lie-down position (X 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	
	MIMO Antenna 1	MIMO Antenna 2
802.11a	6 Mbps	6 Mbps
802.11n HT20	MCS0	MCS0
802.11n HT40	MCS0	MCS0
802.11ac VHT20	MCS0	MCS0
802.11ac VHT40	MCS0	MCS0
802.11ac VHT80	MCS0	MCS0
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	MIMO Antenna 1	MIMO Antenna 2
Average conducted output power	O	O
Occupied bandwidth	-	O
Frequency stability	-	O
Power Spectral Density	O	O
Unwanted Emissions	-	O
Conducted Emissions	-	O
Note：“O”: test all bands		

Wireless Technology and Frequency Range

Wireless Technology		Bandwidth	Channel	Frequency
Wi-Fi	U-NII-1	20 MHz	36	5180MHz
			40	5200MHz
			44	5220MHz
			48	5240MHz
		40 MHz	38	5190MHz
			46	5230MHz
		80 MHz	42	5210MHz
	U-NII-3	20 MHz	149	5745MHz
			153	5765MHz
			157	5785MHz
			161	5805MHz
			165	5825MHz
		40 MHz	151	5755MHz
			159	5795MHz
		80 MHz	155	5775MHz
Does this device support TPC Function? ☒Yes ☐No				
Does this device support TDWR Band? ☐Yes ☒No				

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 ≈1% OCB kHz, VBW ≥ 3 × 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 ≥ 3 × 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(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:

U-NII-1

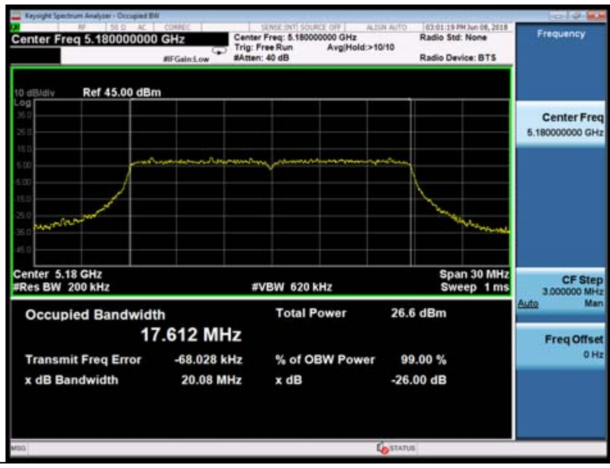
Network Standards	Carrier frequency (MHz)	99% bandwidth (MHz)	Minimum 26 dB bandwidth (MHz)	Conclusion
802.11a	5180	16.400	19.05	PASS
	5200	16.392	18.91	PASS
	5240	16.388	18.81	PASS
802.11n HT20	5180	17.612	20.08	PASS
	5200	17.614	19.83	PASS
	5240	17.600	19.93	PASS
802.11n HT40	5190	35.881	39.05	PASS
	5230	35.893	38.67	PASS
802.11ac VHT20	5180	17.615	20.08	PASS
	5200	17.621	20.20	PASS
	5240	17.601	20.08	PASS
802.11ac VHT40	5190	35.870	38.96	PASS
	5230	35.871	38.79	PASS
802.11ac VHT80	5210	75.536	82.58	PASS

U-NII-3

Network Standards	Carrier frequency (MHz)	99% bandwidth (MHz)	Minimum 6 dB bandwidth (MHz)	Limit (kHz)	Conclusion
802.11a	5745	16.394	16.38	500	PASS
	5785	16.408	16.37	500	PASS
	5825	16.404	16.37	500	PASS
802.11n HT20	5745	17.625	17.61	500	PASS
	5785	17.602	17.61	500	PASS
	5825	17.601	17.60	500	PASS
802.11n HT40	5755	35.915	35.07	500	PASS
	5795	35.916	35.47	500	PASS
802.11ac VHT20	5745	17.631	17.60	500	PASS
	5785	17.609	17.61	500	PASS
	5825	17.608	17.60	500	PASS
802.11ac VHT40	5755	35.896	34.45	500	PASS
	5795	35.920	35.66	500	PASS
802.11ac VHT80	5775	75.666	75.82	500	PASS

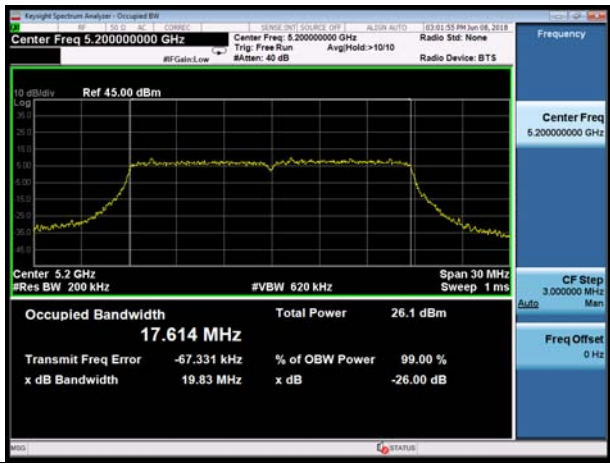
U-NII-1, 802.11a
Carrier frequency (MHz): 5180

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

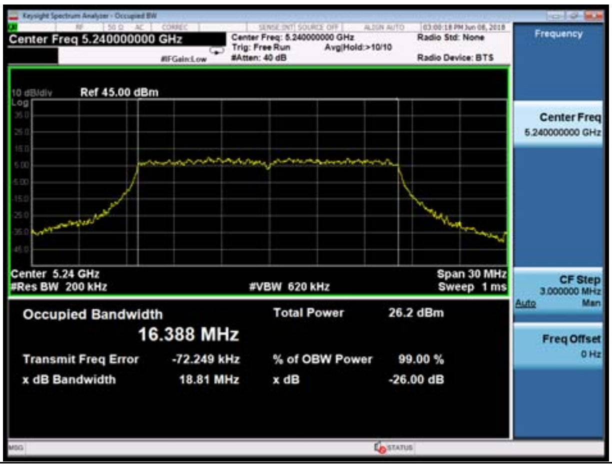


U-NII-1, 802.11a
Carrier frequency (MHz): 5200

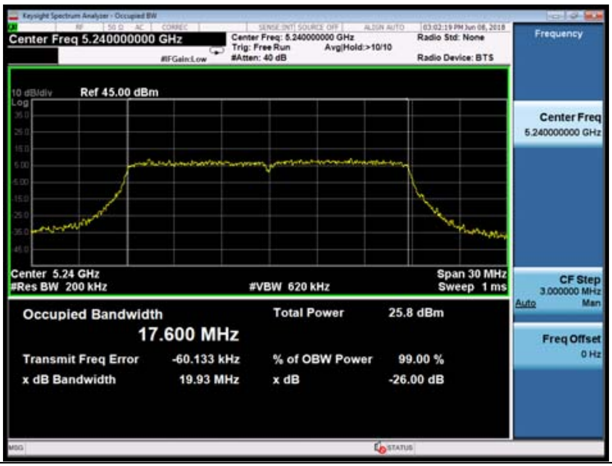
U-NII-1, 802.11n HT20
Carrier frequency (MHz): 5200



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

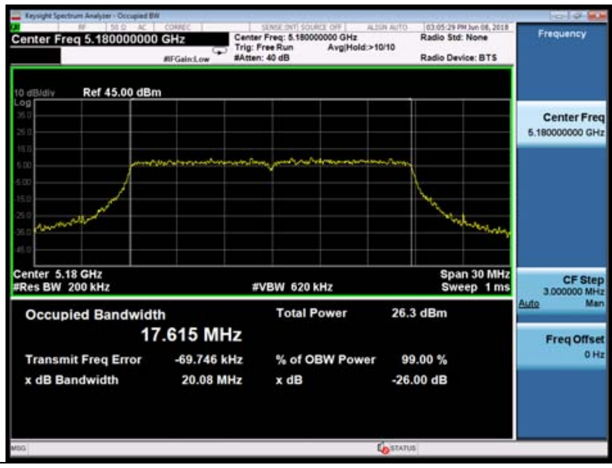


U-NII-1, 802.11n HT20
Carrier frequency (MHz):5240



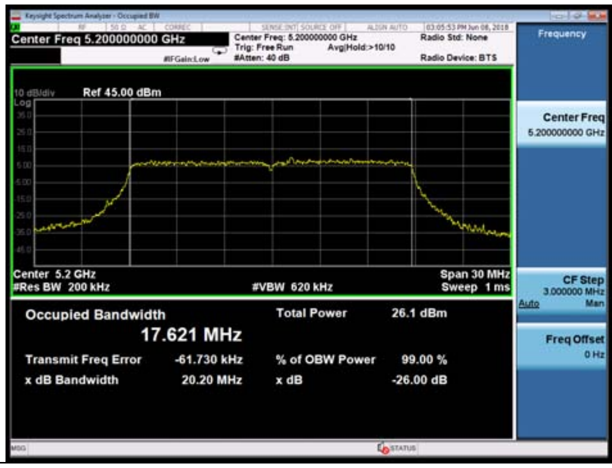
U-NII-1, 802.11n HT40
Carrier frequency (MHz): 5190

U-NII-1, 802.11ac VHT20
Carrier frequency (MHz): 5180



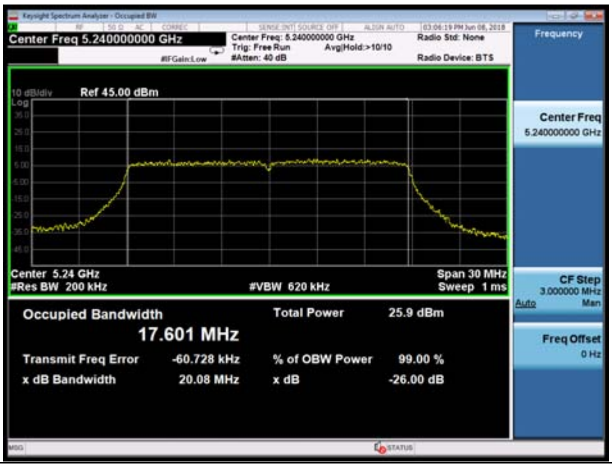
U-NII-1, 802.11n HT40
Carrier frequency (MHz): 5230

U-NII-1, 802.11ac VHT20
Carrier frequency (MHz): 5200



U-NII-1, 802.11ac VHT40
Carrier frequency (MHz): 5190

U-NII-1, 802.11ac VHT20
Carrier frequency (MHz):5240



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Carrier frequency (MHz): 5230</td>
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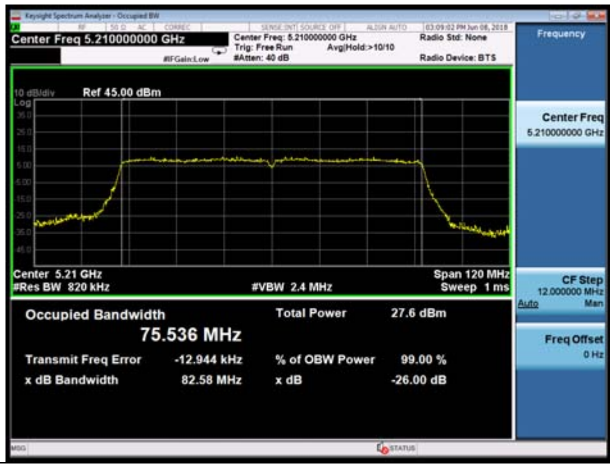

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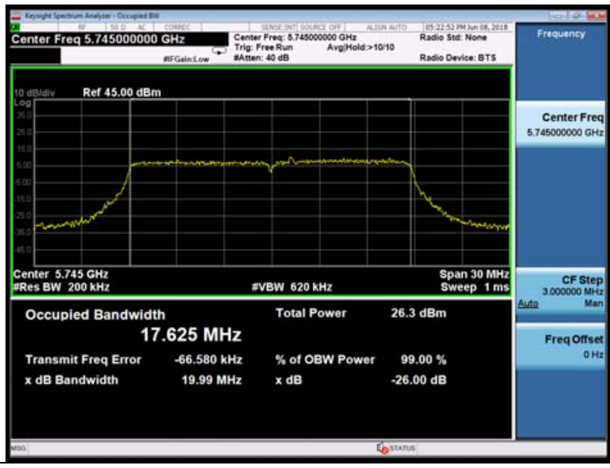
99% bandwidth

U-NII-3, 802.11a

Carrier frequency (MHz): 5745

U-NII-3, 802.11n HT20

Carrier frequency (MHz): 5745

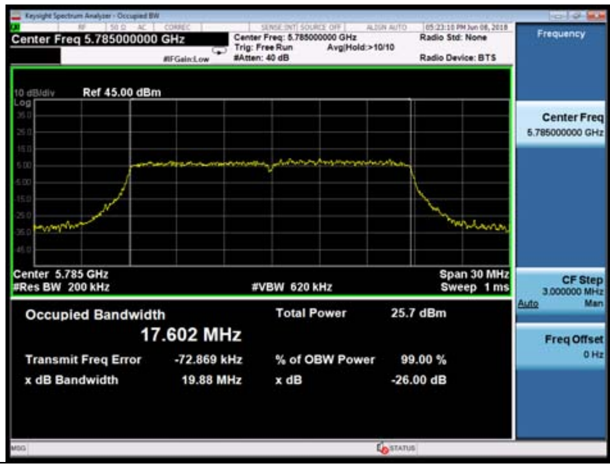


U-NII-3, 802.11a

Carrier frequency (MHz): 5785

U-NII-3, 802.11n HT20

Carrier frequency (MHz): 5785



U-NII-3, 802.11a

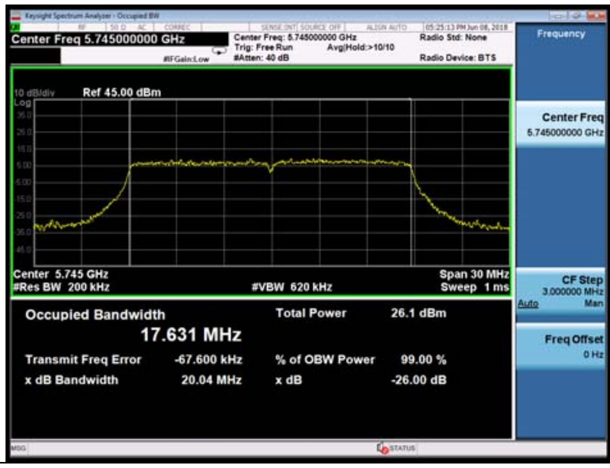
Carrier frequency (MHz): 5825

U-NII-3, 802.11n HT20

Carrier frequency (MHz): 5825

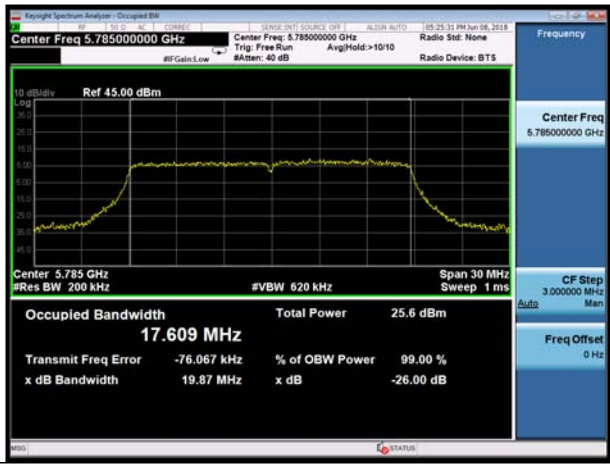
U-NII-3, 802.11n HT40
Carrier frequency (MHz): 5755

U-NII-3, 802.11ac VHT20
Carrier frequency (MHz): 5745



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

U-NII-3, 802.11ac VHT20
Carrier frequency (MHz): 5785

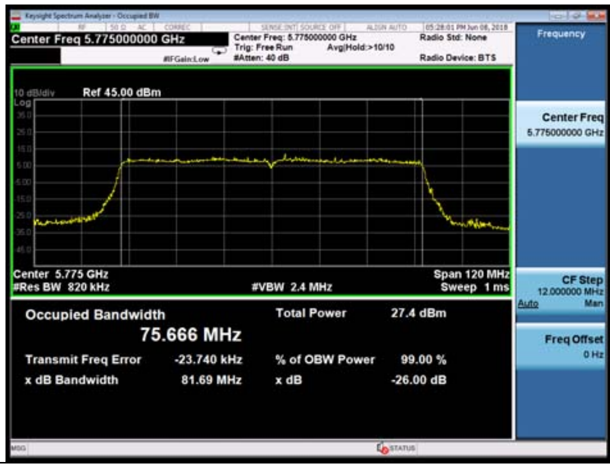


U-NII-3, 802.11ac VHT40
Carrier frequency (MHz): 5755

U-NII-3, 802.11ac VHT20
Carrier frequency (MHz): 5825

U-NII-3, 802.11ac VHT40
Carrier frequency (MHz): 5795

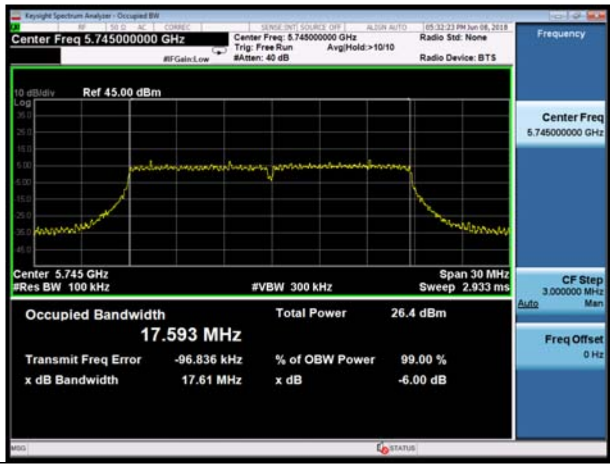
U-NII-3, 802.11ac VHT80
Carrier frequency (MHz): 5775



Minimum 6 dB bandwidth

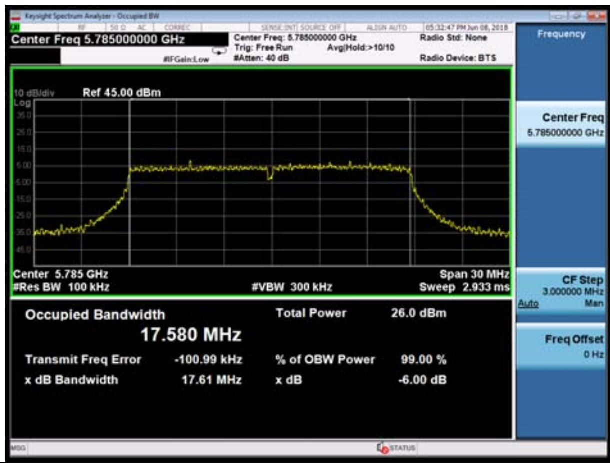
U-NII-3, 802.11a
Carrier frequency (MHz): 5745

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

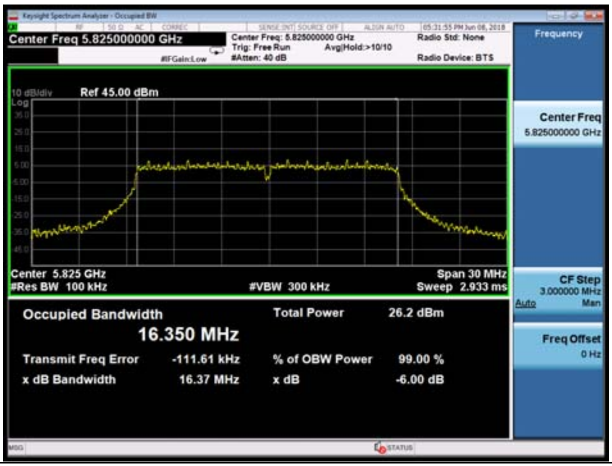


U-NII-3, 802.11a
Carrier frequency (MHz): 5785

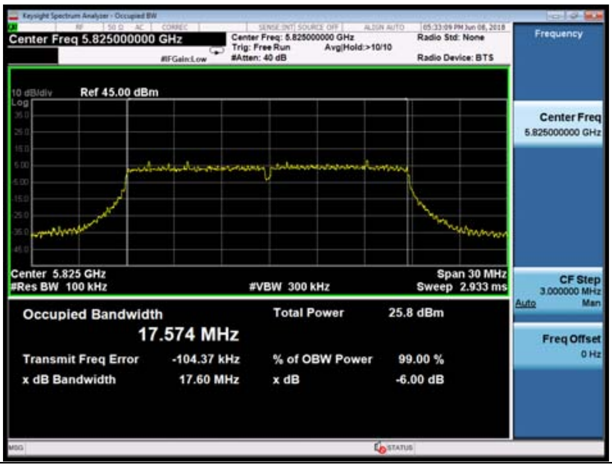
U-NII-3, 802.11n HT20
Carrier frequency (MHz): 5785



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

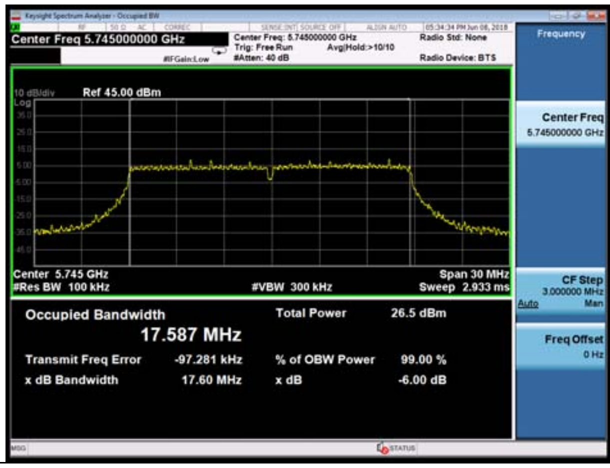


U-NII-3, 802.11n HT20
Carrier frequency (MHz): 5825



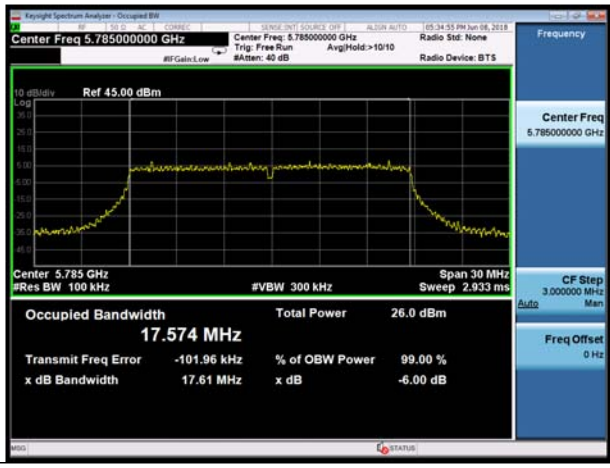
U-NII-3, 802.11n HT40
Carrier frequency (MHz): 5755

U-NII-3, 802.11ac VHT20
Carrier frequency (MHz): 5745



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

U-NII-3, 802.11ac VHT20
Carrier frequency (MHz): 5785



U-NII-3, 802.11ac VHT40
Carrier frequency (MHz): 5755

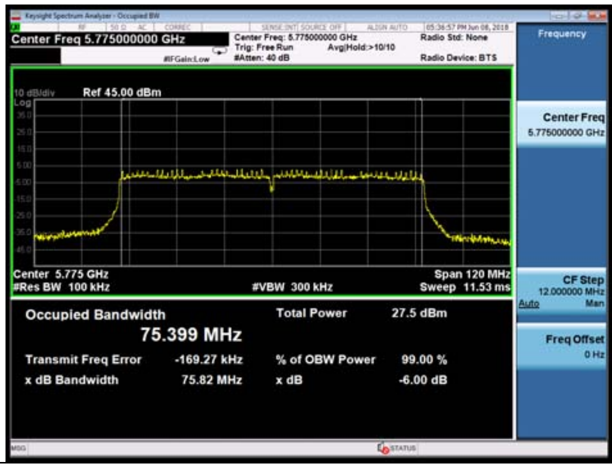
U-NII-3, 802.11ac VHT20
Carrier frequency (MHz): 5825

U-NII-3, 802.11ac VHT40

Carrier frequency (MHz): 5795

U-NII-3, 802.11ac VHT80

Carrier frequency (MHz): 5775



5.2. Average Power Output –Conducted

Ambient condition

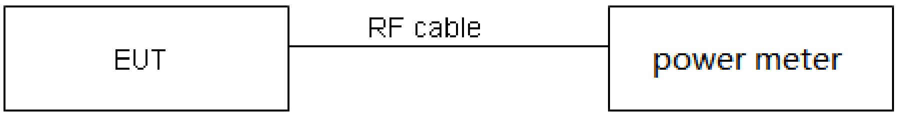
Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

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

Band	T_{on} (ms)	$T_{(on+off)}$ (ms)	Duty cycle	Duty cycle correction Factor(dB)
802.11a	2.03	2.10	0.97	0.15
802.11n HT20	4.96	5.03	0.99	N/A
802.11n HT40	2.41	2.48	0.97	0.13
802.11ac VHT20	4.97	5.05	0.98	N/A
802.11ac VHT40	2.42	2.49	0.97	0.13
802.11ac VHT80	1.14	1.21	0.94	0.27
Note: when Duty cycle>0.98, Duty cycle correction Factor not required.				

MIMO Antenna 1&2 without Beamforming

MIMO Antenna 1&2 Power Index						
Packet Type	CH36	CH40	CH48	CH149	CH157	CH165
802.11a	20	20	20	20	20	20
802.11n HT20	20	20	20	20	20	20
802.11ac VHT20	20	20	20	20	20	20
Packet Type	CH38	CH46	CH151	CH159	/	/
802.11n HT40	20	20	20	20	/	/
802.11ac VHT40	20	20	20	20	/	/
Packet Type	CH42	CH155	/	/	/	/
802.11ac VHT80	20	20	/	/	/	/

MIMO Antenna 1&2 with Beamforming

MIMO Antenna 1&2 Power Index						
Packet Type	CH36	CH40	CH48	CH149	CH157	CH165
802.11a	20	20	20	20	20	20
802.11n HT20	20	20	20	20	20	20
802.11ac VHT20	20	20	20	20	20	20
Packet Type	CH38	CH46	CH151	CH159	/	/
802.11n HT40	20	20	20	20	/	/
802.11ac VHT40	20	20	20	20	/	/
Packet Type	CH42	CH155	/	/	/	/
802.11ac VHT80	20	20	/	/	/	/

Test results

Note: Output Power=Read Value+Duty cycle correction factor

MIMO Antenna 1&2 without Beamforming

U-NII-1

Network Standards	Channel/ Frequency (MHz)	MIMO Antenna 1		MIMO Antenna 2		Total Power (dBm)	Limit (dBm)	Conclusion
		Read Value (dBm)	Output Power (dBm)	Read Value (dBm)	Output Power (dBm)			
U-NII-1 802.11a	36/5180	19.78	19.93	20.15	20.30	23.13	30.00	PASS
	44/5220	19.66	19.81	20.08	20.23	23.04	30.00	PASS
	48/5240	19.67	19.82	19.94	20.09	22.97	30.00	PASS
802.11n HT20	36/5180	19.74	19.74	20.07	20.07	22.92	30.00	PASS
	44/5220	19.65	19.65	20.01	20.01	22.84	30.00	PASS
	48/5240	19.59	19.59	19.96	19.96	22.79	30.00	PASS
802.11n HT40	38/5190	19.82	19.95	20.34	20.47	23.23	30.00	PASS
	46/5230	19.85	19.98	20.11	20.24	23.12	30.00	PASS
802.11ac VHT20	36/5180	19.69	19.69	20.16	20.16	22.94	30.00	PASS
	44/5220	19.58	19.58	20.07	20.07	22.84	30.00	PASS
	48/5240	19.61	19.61	19.99	19.99	22.81	30.00	PASS
802.11ac VHT40	38/5190	19.89	20.02	20.33	20.46	23.25	30.00	PASS
	46/5230	19.92	20.05	20.14	20.27	23.17	30.00	PASS
802.11ac VHT80	42/5210	19.55	19.82	20.05	20.32	23.08	30.00	PASS

Note: 1. For Total Power, according to KDB 662911 D01 Multiple Transmitter Output v02r01 1),

The Total Power =10log($10^{(\text{Power antenna1 in dBm}/10)}+10^{(\text{Power antenna2 in dBm}/10)}$).

2. The manufacturer declared the transmitter output signals is CDD mode And N_{ss}=2 According to KDB 662911 D01 Multiple Transmitter Output v02r01 2)f)(i): If all antennas have the same gain, Directional gain = G_{ANT} + Array Gain,

For power measurements on IEEE 802.11 devices,

Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$;

Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 40 MHz for any N_{ANT};

Array Gain = 5 log(N_{ANT}/N_{SS}) dB or 3 dB, whichever is less, for 20-MHz channel widths with $N_{ANT} \geq 5$.

So directional gain = G_{ANT} + Array Gain =4+0=4 dBi<6dBi. So the power limt is 30dBm.

U-NII-3

Network Standards	Channel/ Frequency (MHz)	MIMO Antenna 1		MIMO Antenna 2		Total Power (dBm)	Limit (dBm)	Conclusion
		Read Value (dBm)	Output Power (dBm)	Read Value (dBm)	Output Power (dBm)			
802.11a	149/5745	19.82	19.97	19.86	20.01	23.00	30.00	PASS
	157/5785	19.76	19.91	19.66	19.81	22.87	30.00	PASS
	165/5825	19.95	20.10	19.72	19.87	23.00	30.00	PASS
802.11n HT20	149/5745	19.86	19.86	19.78	19.78	22.83	30.00	PASS
	157/5785	19.81	19.81	19.68	19.68	22.76	30.00	PASS
	165/5825	19.99	19.99	19.74	19.74	22.88	30.00	PASS
802.11n HT40	151/5755	20.08	20.21	20.01	20.14	23.18	30.00	PASS
	159/5795	19.97	20.10	19.82	19.95	23.03	30.00	PASS
802.11ac VHT20	149/5745	19.73	19.73	19.76	19.76	22.76	30.00	PASS
	157/5785	19.85	19.85	19.64	19.64	22.76	30.00	PASS
	165/5825	19.98	19.98	19.71	19.71	22.86	30.00	PASS
802.11ac VHT40	151/5755	20.09	20.22	20.01	20.14	23.19	30.00	PASS
	159/5795	19.93	20.06	19.85	19.98	23.03	30.00	PASS
802.11ac VHT80	155/5775	19.77	20.04	19.69	19.96	23.01	30.00	PASS

Note: 1. For Total Power, according to KDB 662911 D01 Multiple Transmitter Output v02r01 1),

The Total Power =10log(10$^{(\text{Power antenna1 in dBm}/10)}$+10$^{(\text{Power antenna2 in dBm}/10)}$.

2. The manufacturer declared the transmitter output signals is CDD mode And N_{ss}=2 According to KDB 662911 D01 Multiple Transmitter Output v02r01 2)f)(i): If all antennas have the same gain, Directional gain = G_{ANT} + Array Gain,

For power measurements on IEEE 802.11 devices,

Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$;

Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 40 MHz for any N_{ANT};

Array Gain = 5 log(N_{ANT}/N_{SS}) dB or 3 dB, whichever is less, for 20-MHz channel widths with $N_{ANT} \geq 5$.

So directional gain = G_{ANT} + Array Gain =4+0=4 dBi<6dBi. So the power limt is 30dBm.

MIMO Antenna 1&2 with Beamforming

U-NII-1

Network Standards	Channel/ Frequency (MHz)	MIMO Antenna 1		MIMO Antenna 2		Total Power (dBm)	Limit (dBm)	Conclusion
		Read Value (dBm)	Output Power (dBm)	Read Value (dBm)	Output Power (dBm)			
802.11n HT20	36/5180	19.66	19.66	20.13	20.13	22.91	30.00	PASS
	40/5200	19.69	19.69	20.08	20.08	22.90	30.00	PASS
	48/5240	19.64	19.64	19.84	19.84	22.75	30.00	PASS
802.11n HT40	38/5190	19.79	19.92	20.31	20.44	23.20	30.00	PASS
	46/5230	19.81	19.94	20.08	20.21	23.09	30.00	PASS
802.11ac VHT20	36/5180	19.75	19.75	20.09	20.09	22.93	30.00	PASS
	40/5200	19.66	19.66	20.11	20.11	22.90	30.00	PASS
	48/5240	19.74	19.74	19.94	19.94	22.85	30.00	PASS
802.11ac VHT40	38/5190	19.81	19.94	20.29	20.42	23.19	30.00	PASS
	46/5230	19.89	20.02	20.22	20.35	23.20	30.00	PASS
802.11ac VHT80	42/5210	19.58	19.85	20.12	20.39	23.14	30.00	PASS

Note: 1. For Total Power, according to KDB 662911 D01 Multiple Transmitter Output v02r01 1),
The Total Power =10log ($10^{(\text{Power antenna1 in dBm}/10)}+10^{(\text{Power antenna2 in dBm}/10)}$).
2. Direction gain calculation according to KDB662911 D01 Multiple Transmitter Output v02r01 F) 2) e）(i),If all antennas have the same gain, directional gain = GANT + 10 log(NANT/NSS)=4+10log（2/2）=4 dBi/（ii）If antenna gains are not equal，directional gain = GANTMAX + 10 log(NANT/NSS)=4+10log（2/2）=4 dBi< 6dBi. So the limt is 30dBm.

U-NII-3

Network Standards	Channel/ Frequency (MHz)	MIMO Antenna 1		MIMO Antenna 2		Total Power (dBm)	Limit (dBm)	Conclusion
		Read Value (dBm)	Output Power (dBm)	Read Value (dBm)	Output Power (dBm)			
802.11n HT20	149/5745	19.82	19.82	19.74	19.74	22.79	30.00	PASS
	157/5785	19.96	19.96	19.76	19.76	22.87	30.00	PASS
	165/5825	19.91	19.91	19.65	19.65	22.79	30.00	PASS
802.11n HT40	151/5755	20.02	20.15	20.11	20.24	23.20	30.00	PASS
	159/5795	19.88	20.01	19.72	19.85	22.94	30.00	PASS
802.11ac VHT20	149/5745	19.89	19.89	19.69	19.69	22.80	30.00	PASS
	157/5785	19.94	19.94	19.55	19.55	22.76	30.00	PASS
	165/5825	19.87	19.87	19.79	19.79	22.84	30.00	PASS
802.11ac VHT40	151/5755	20.16	20.29	20.16	20.29	23.30	30.00	PASS
	159/5795	19.83	19.96	19.74	19.87	22.92	30.00	PASS
802.11ac VHT80	155/5775	19.72	19.99	19.83	20.10	23.05	30.00	PASS

Note: 1. For Total Power, according to KDB 662911 D01 Multiple Transmitter Output v02r01 1),
The Total Power =10log $(10^{(\text{Power antenna1 in dBm}/10)}+10^{(\text{Power antenna2 in dBm}/10)})$.
2. Direction gain calculation according to KDB662911 D01 Multiple Transmitter Output v02r01 F) 2) e）(i),If all antennas have the same gain, directional gain = GANT + 10 log(NANT/NSS)=4+10log（2/2）=4 dBi/（ii）If antenna gains are not equal，directional gain = GANTMAX + 10 log(NANT/NSS)=4+10log （2/2） =4 dBi< 6dBi. So the limt is 30dBm.

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 that 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*= 936Hz

Test Results

Voltage (V)	Temperature (°C)	U-NII-1 Test Results			
		5200MHz			
		1min	2min	5min	10min
12V	25	5199.993376	5199.989522	5199.986855	5199.979028
12V	25	5199.995848	5199.981444	5199.981573	5199.976376
12V	25	5199.991876	5199.977442	5199.981439	5199.972302
12V	25	5199.983991	5199.970197	5199.975772	5199.966866
12V	25	5199.975439	5199.969513	5199.973402	5199.962892
12V	25	5199.970220	5199.959767	5199.973394	5199.955288
12V	25	5199.963582	5199.951443	5199.966242	5199.951587
12V	25	5199.954943	5199.942279	5199.965631	5199.949000
11.4V	-10	5199.950827	5199.936822	5199.959069	5199.945011
12.6V	50	5199.942975	5199.931942	5199.950702	5199.943955
MHz		-0.057025	-0.068058	-0.049298	-0.056045
PPM		-10.966302	-13.088050	-9.480347	-10.777900

Voltage (V)	Temperature (°C)	U-NII-3 Test Results			
		5785MHz			
		1min	2min	5min	10min
12V	25	5784.997177	5784.993316	5784.990865	5784.982536
12V	25	5784.991277	5784.992598	5784.989995	5784.975931
12V	25	5784.987607	5784.984406	5784.989394	5784.973945
12V	25	5784.984517	5784.984335	5784.980192	5784.973632
12V	25	5784.977738	5784.982839	5784.973852	5784.968998
12V	25	5784.974203	5784.975379	5784.971357	5784.966163
12V	25	5784.969591	5784.970184	5784.962670	5784.957276
12V	25	5784.963459	5784.964720	5784.961091	5784.947974
11.4V	-10	5784.955618	5784.961410	5784.954693	5784.941836
12.6V	50	5784.946573	5784.954736	5784.947516	5784.936414
MHz		-0.053427	-0.045264	-0.052484	-0.063586
PPM		-9.235460	-7.824370	-9.072458	-10.991503

5.4. Power Spectral Density

Ambient condition

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

Method of Measurement

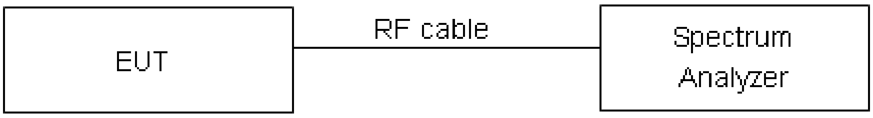
The EUT was connected to the spectrum analyzer through an external attenuator (20dB) and a known loss cable.

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 transmittingantennas 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	17MHz
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= 0.75dB.

Test Results:

Note: Power Spectral Density =Read Value+Duty cycle correction factor

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MIMO without Beamforming

Network Standards	Channel/ Frequency (MHz)	Power Spectral Density					Limit (dBm /MHz)	Conclusion
		Antenna 1		Antenna 2		Total Power (dBm /MHz)		
		Read Value (dBm/MHz)	PSD (dBm /MHz)	Read Value (dBm/MHz)	PSD (dBm /MHz)			
802.11a	36/5180	8.55	8.70	9.22	9.37	12.06	17.00	PASS
	40/5200	8.18	8.33	9.00	9.15	11.77	17.00	PASS
	48/5240	8.37	8.52	8.71	8.86	11.70	17.00	PASS
802.11n HT20	36/5180	7.95	7.95	8.66	8.66	11.33	17.00	PASS
	40/5200	7.67	7.67	8.67	8.67	11.21	17.00	PASS
	48/5240	7.62	7.62	8.56	8.56	11.13	17.00	PASS
802.11n HT40	38/5190	5.32	5.45	6.25	6.38	8.95	17.00	PASS
	46/5230	5.79	5.92	6.01	6.14	9.04	17.00	PASS
802.11ac VHT20	36/5180	7.87	7.87	8.24	8.24	11.07	17.00	PASS
	40/5200	7.82	7.82	8.54	8.54	11.20	17.00	PASS
	48/5240	7.53	7.53	8.88	8.88	11.26	17.00	PASS
802.11ac VHT40	38/5190	5.54	5.66	5.99	6.12	8.91	17.00	PASS
	46/5230	5.63	5.76	6.21	6.34	9.07	17.00	PASS
802.11ac VHT80	42/5210	1.34	1.61	2.43	2.70	5.20	17.00	PASS

Note: 1. Power Spectral Density =Read Value+Duty cycle correction factor

2. For Total PSD, according to KDB 662911 D01 Multiple Transmitter Output v02r01 2)a),the power spectral density=$10\log(10^{(\text{PSD antenna1 in dBm}/10)}+10^{(\text{PSD antenna2 in dBm}/10)})$

3. The manufacturer declared the transmitter output signals is CDD mode And Nss=2. According to KDB 662911 D01 Multiple Transmitter Output v02r01 2)f)(i): If all antennas have the same gain, Directional gain = GANT + Array Gain, For PSD measurements on all devices,Array Gain=10log(Nant/Nss)dB,so directional gain=GANT+Array Gain=4+10log(2/2)=4<6 dBi. So the power limt is 17dBm

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Network Standards	Channel/ Frequency (MHz)	Power Spectral Density					Limit (dBm /MHz)	Conclusion
		Antenna 1		Antenna 2		Total Power (dBm /MHz)		
		Read Value (dBm/MHz)	PSD (dBm /MHz)	Read Value (dBm/MHz)	PSD (dBm /MHz)			
802.11a	149/5745	6.05	6.20	6.47	6.62	9.42	30.00	PASS
	157/5785	5.68	5.83	6.08	6.23	9.05	30.00	PASS
	165/5825	5.52	5.67	5.70	5.85	8.77	30.00	PASS
802.11n HT20	149/5745	5.22	5.22	6.44	6.44	8.88	30.00	PASS
	157/5785	5.14	5.14	5.40	5.40	8.29	30.00	PASS
	165/5825	5.59	5.59	5.55	5.55	8.58	30.00	PASS
802.11n HT40	151/5755	3.16	3.29	3.44	3.57	6.44	30.00	PASS
	159/5795	2.74	2.87	3.26	3.39	6.15	30.00	PASS
802.11ac VHT20	149/5745	5.27	5.27	5.73	5.73	8.52	30.00	PASS
	157/5785	5.53	5.53	5.55	5.55	8.55	30.00	PASS
	165/5825	5.40	5.40	5.73	5.73	8.58	30.00	PASS
802.11ac VHT40	151/5755	3.31	3.43	3.14	3.26	6.36	30.00	PASS
	159/5795	2.89	3.02	3.05	3.18	6.11	30.00	PASS
802.11ac VHT80	155/5775	-0.30	-0.03	-0.40	-0.13	2.93	30.00	PASS

Note: 1. Power Spectral Density =Read Value+Duty cycle correction factor

2. For Total PSD, according to KDB 662911 D01 Multiple Transmitter Output v02r01 2)a),the power spectral density=10log($10^{(\text{PSD antenna1 in dBm}/10)}+10^{(\text{PSD antenna2 in dBm}/10)}$)

3. The manufacturer declared the transmitter output signals is CDD mode And Nss=2. According to KDB 662911 D01 Multiple Transmitter Output v02r01 2)f)(i): If all antennas have the same gain, Directional gain = GANT + Array Gain, For PSD measurements on all devices,Array Gain=10log(Nant/Nss)dB,so directional gain=GANT+Array Gain=4+10log(2/2)=4<6 dBi. So the power limt is 30dBm

MIMO with Beamforming

U-NII-1

Network Standards	Channel/ Frequency (MHz)	Power Spectral Density					Limit (dBm /MHz)	Conclusion
		Antenna 1		Antenna 2		Total		
		Read Value (dBm/MHz)	PSD (dBm /MHz)	Read Value (dBm/MHz)	PSD (dBm /MHz)	Power (dBm /MHz)		
802.11n HT20	36/5180	8.00	8.00	8.19	8.19	11.11	17.00	PASS
	40/5200	7.64	7.64	8.06	8.06	10.87	17.00	PASS
	48/5240	8.05	8.05	8.37	8.37	11.23	17.00	PASS
802.11n HT40	38/5190	5.55	5.68	5.94	6.06	8.89	17.00	PASS
	46/5230	5.66	5.79	6.32	6.45	9.14	17.00	PASS
802.11ac VHT20	36/5180	8.21	8.21	8.78	8.78	11.51	17.00	PASS
	40/5200	7.78	7.78	8.71	8.71	11.28	17.00	PASS
	48/5240	7.72	7.72	8.53	8.53	11.15	17.00	PASS
802.11ac VHT40	38/5190	5.15	5.28	5.98	6.11	8.72	17.00	PASS
	46/5230	5.67	5.79	5.96	6.09	8.95	17.00	PASS
802.11ac VHT80	42/5210	2.05	2.31	2.26	2.53	5.43	17.00	PASS

Note: 1. Power Spectral Density =Read Value+Duty cycle correction factor

2. For Total PSD, according to KDB 662911 D01 Multiple Transmitter Output v02r01 2)a),the power spectral density=10log($10^{(\text{PSD antenna1 in dBm}/10)}+10^{(\text{PSD antenna2 in dBm}/10)}$

3. The manufacturer declared the transmitter output signals is CDD mode And Nss=2. According to KDB 662911 D01 Multiple Transmitter Output v02r01 2)f)(i): If all antennas have the same gain, Directional gain = GANT + Array Gain, For PSD measurements on all devices,Array Gain=10log(Nant/Nss)dB,so directional gain=GANT+Array Gain=4+10log(2/2)=4<6 dBi. So the power limt is 17dBm

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Network Standards	Channel/ Frequency (MHz)	Power Spectral Density					Limit (dBm /MHz)	Conclusion
		Antenna 1		Antenna 2		Total Power (dBm /MHz)		
		Read Value (dBm/MHz)	PSD (dBm /MHz)	Read Value (dBm/MHz)	PSD (dBm /MHz)			
802.11n HT20	149/5745	5.41	5.41	5.92	5.92	8.68	30.00	PASS
	157/5785	5.51	5.51	5.45	5.45	8.49	30.00	PASS
	165/5825	5.43	5.43	5.78	5.78	8.62	30.00	PASS
802.11n HT40	151/5755	3.10	3.23	3.73	3.86	6.57	30.00	PASS
	159/5795	3.37	3.50	2.95	3.08	6.30	30.00	PASS
802.11ac VHT20	149/5745	4.82	4.82	5.80	5.80	8.35	30.00	PASS
	157/5785	5.18	5.18	5.33	5.33	8.26	30.00	PASS
	165/5825	5.85	5.85	5.33	5.33	8.61	30.00	PASS
802.11ac VHT40	151/5755	3.06	3.19	3.74	3.87	6.55	30.00	PASS
	159/5795	2.94	3.07	2.91	3.04	6.06	30.00	PASS
802.11ac VHT80	155/5775	-0.28	-0.01	-0.30	-0.03	2.99	30.00	PASS

Note: 1. Power Spectral Density =Read Value+Duty cycle correction factor

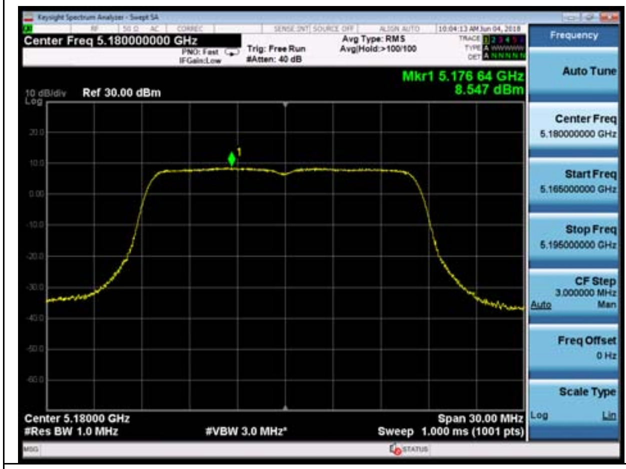
2. For Total PSD, according to KDB 662911 D01 Multiple Transmitter Output v02r01 2)a),the power spectral density=10log($10^{(\text{PSD antenna1 in dBm/10})}+10^{(\text{PSD antenna2 in dBm/10})}$)

3. The manufacturer declared the transmitter output signals is CDD mode And Nss=2. According to KDB 662911 D01 Multiple Transmitter Output v02r01 2)f)(i): If all antennas have the same gain, Directional gain = GANT + Array Gain, For PSD measurements on all devices,Array Gain=10log(Nant/Nss)dB,so directional gain=GANT+Array Gain=4+10log(2/2)=4<6 dBi. So the power limt is 30dBm

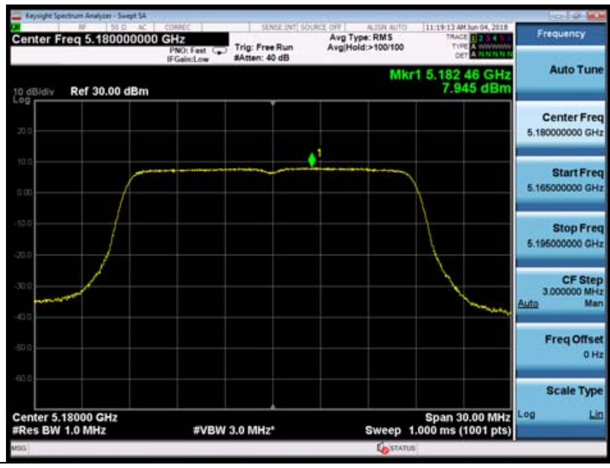
MIMO without Beamforming

Antenna 1

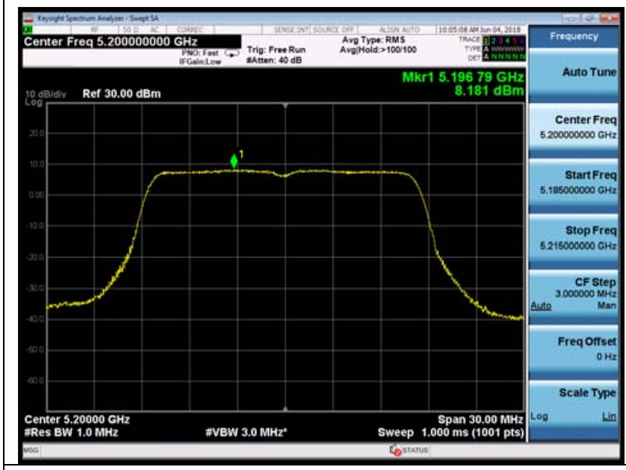
U-NII-1, 802.11a, Channel No.: 36



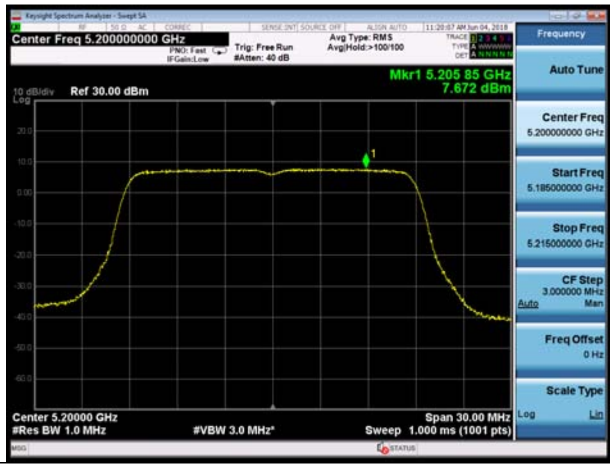
U-NII-1, 802.11n HT20, Channel No.: 36



U-NII-1, 802.11a, Channel No.: 40

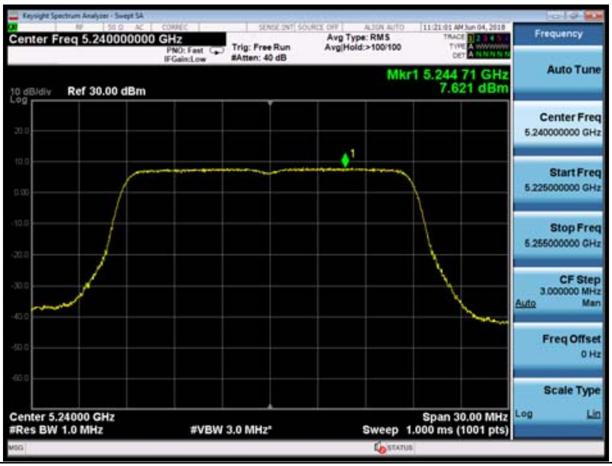


U-NII-1, 802.11n HT20, Channel No.: 40



U-NII-1, 802.11a, Channel No.: 48

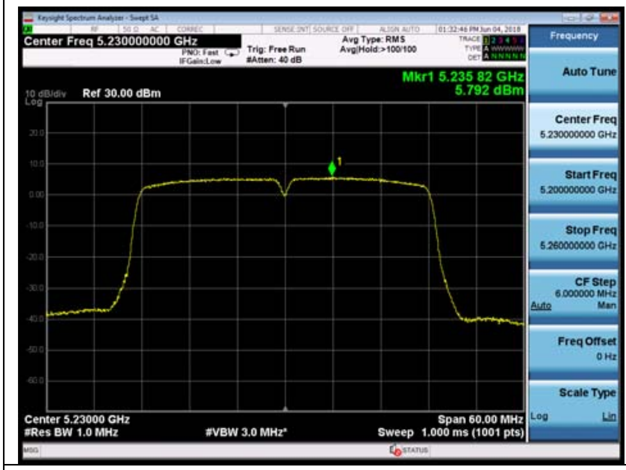
U-NII-1, 802.11n HT20, Channel No.: 48



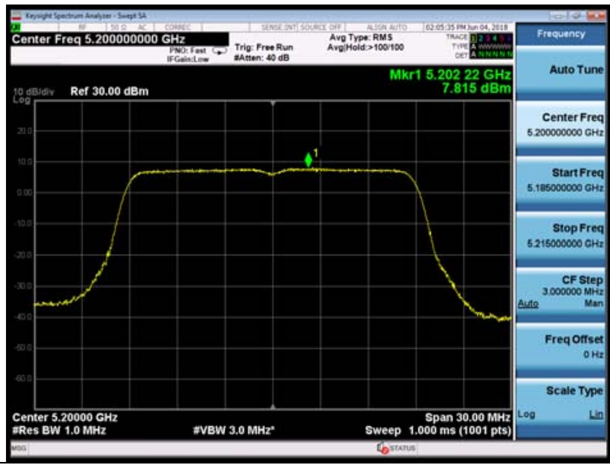
U-NII-1, 802.11n HT40, Channel No.: 38

U-NII-1, 802.11ac VHT20, Channel No.: 36

U-NII-1, 802.11n HT40, Channel No.: 46

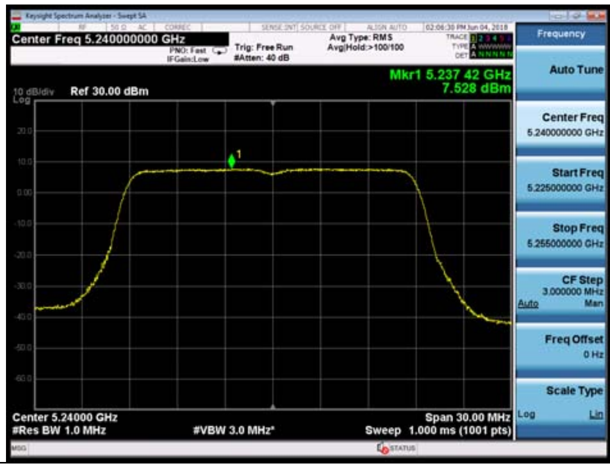


U-NII-1, 802.11ac VHT20, Channel No.: 40



U-NII-1, 802.11ac VHT40, Channel No.: 38

U-NII-1, 802.11ac VHT20, Channel No.: 48



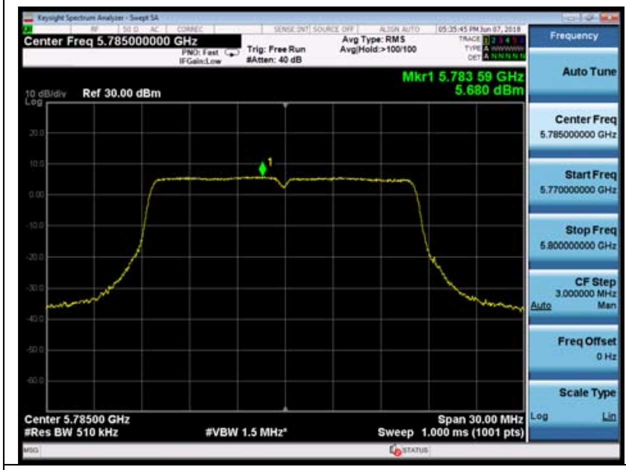
U-NII-1, 802.11ac VHT40, Channel No.: 46

U-NII-1, 802.11ac VHT80, Channel No.: 42

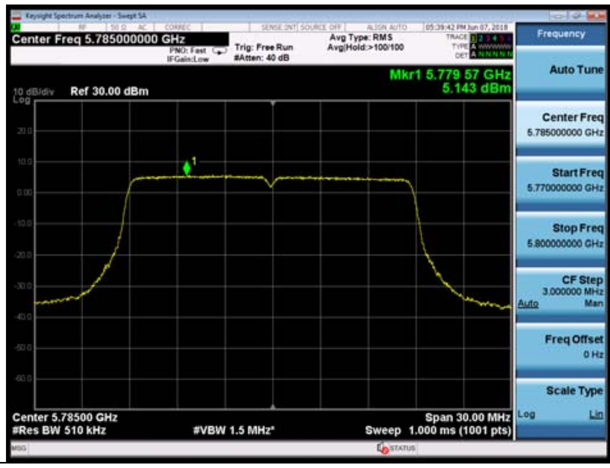
U-NII-3, 802.11a, Channel No.: 149

U-NII-3, 802.11n HT20, Channel No.: 149

U-NII-3, 802.11a, Channel No.: 157

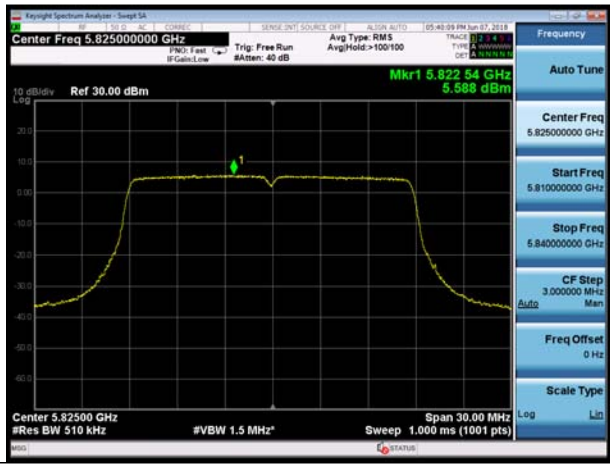


U-NII-3, 802.11n HT20, Channel No.: 157



U-NII-3, 802.11a, Channel No.: 165

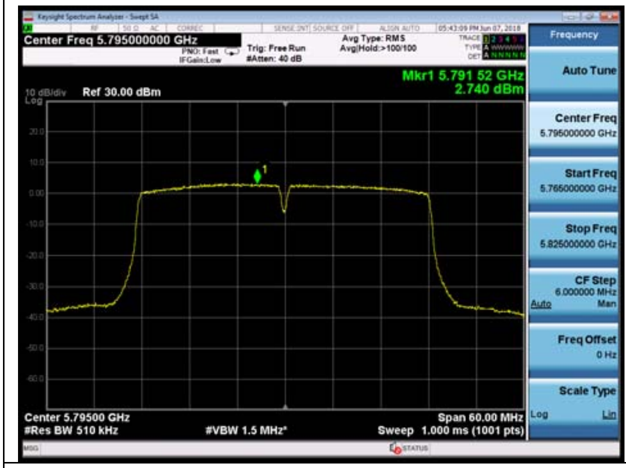
U-NII-3, 802.11n HT20, Channel No.: 165



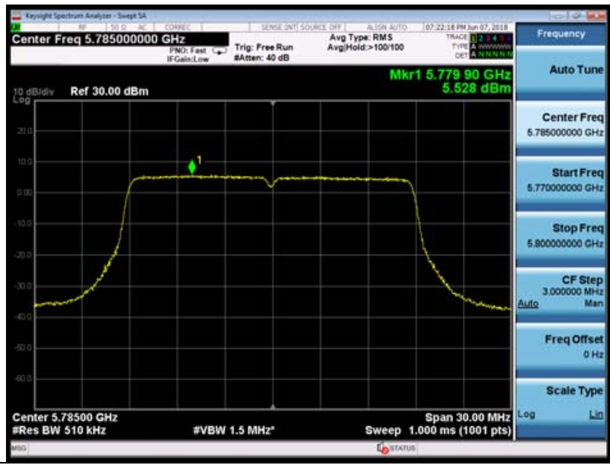
U-NII-3, 802.11n HT40, Channel No.: 151

U-NII-3, 802.11ac VHT20, Channel No.: 149

U-NII-3, 802.11n HT40, Channel No.: 159

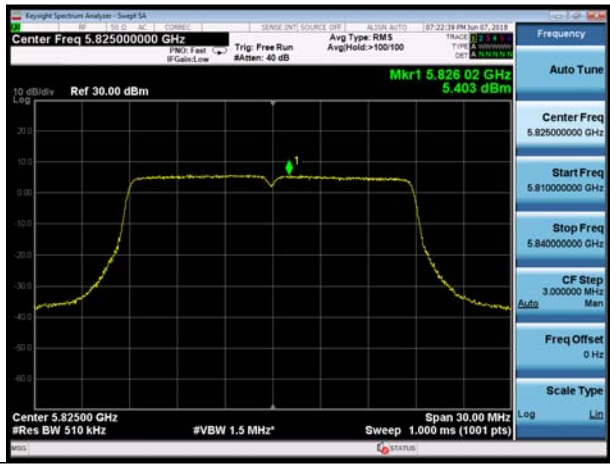


U-NII-3, 802.11ac VHT20, Channel No.: 157



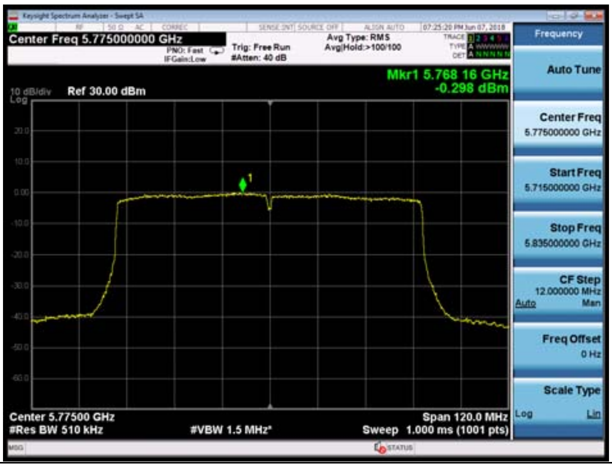
U-NII-3, 802.11ac VHT40, Channel No.: 151

U-NII-3, 802.11ac VHT20, Channel No.: 165

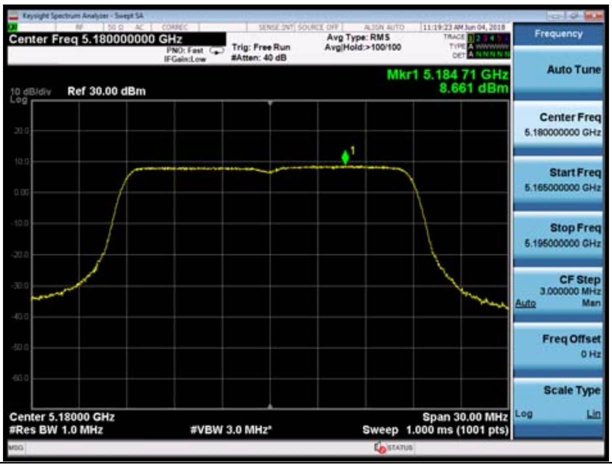
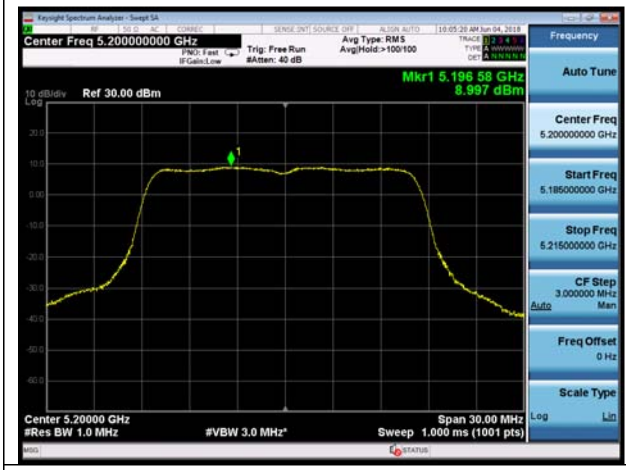
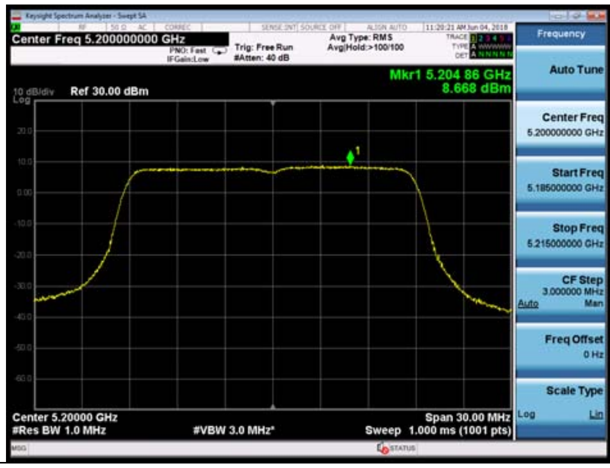
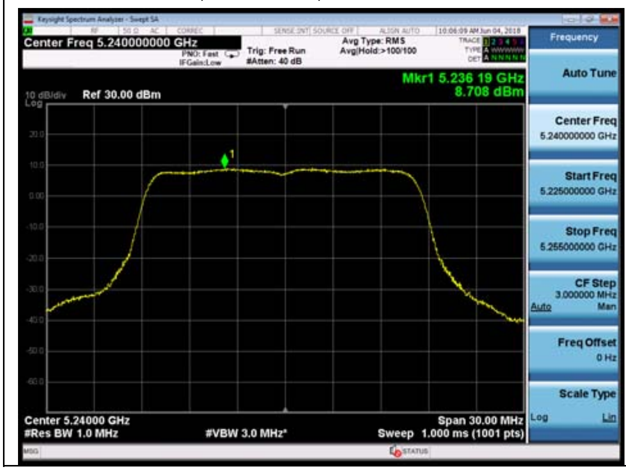
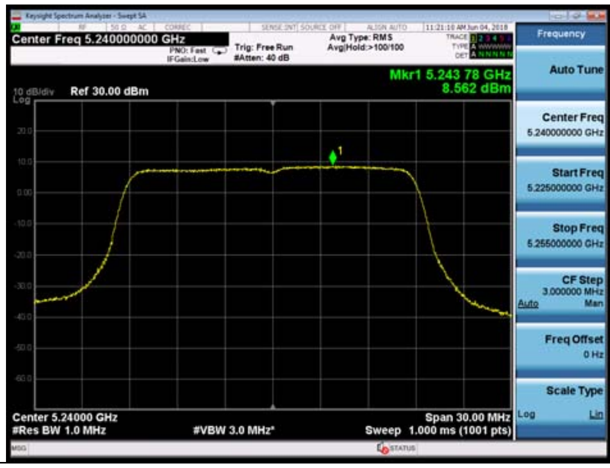


U-NII-3, 802.11ac VHT40, Channel No.: 159

U-NII-3, 802.11ac VHT80, Channel No.: 155



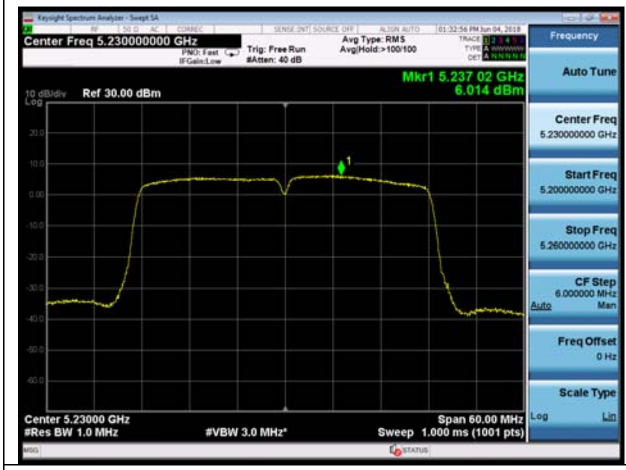
Antenna 2

U-NII-1, 802.11a, Channel No.: 36	U-NII-1, 802.11n HT20, Channel No.: 36
	
U-NII-1, 802.11a, Channel No.: 40	U-NII-1, 802.11n HT20, Channel No.: 40
	
U-NII-1, 802.11a, Channel No.: 48	U-NII-1, 802.11n HT20, Channel No.: 48
	

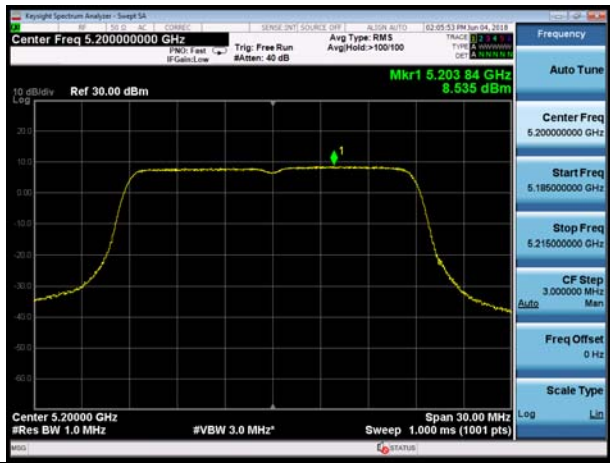
U-NII-1, 802.11n HT40, Channel No.: 38

U-NII-1, 802.11ac VHT20, Channel No.: 36

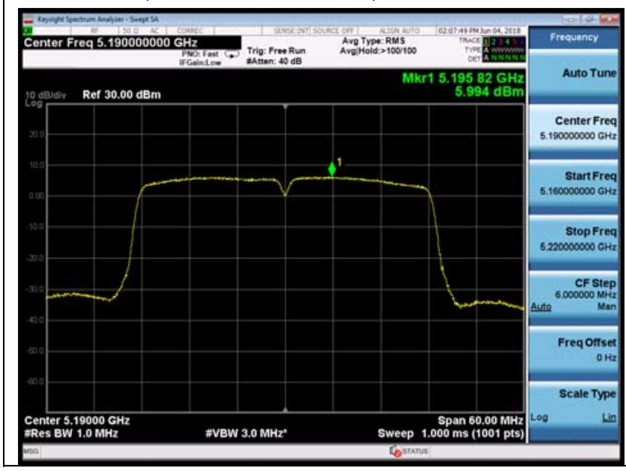
U-NII-1, 802.11n HT40, Channel No.: 46



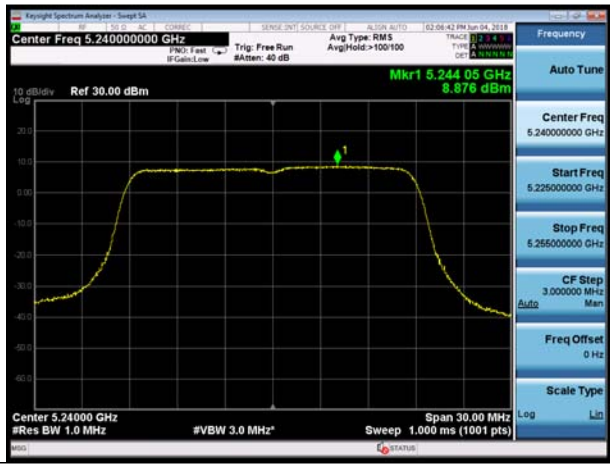
U-NII-1, 802.11ac VHT20, Channel No.: 40



U-NII-1, 802.11ac VHT40, Channel No.: 38

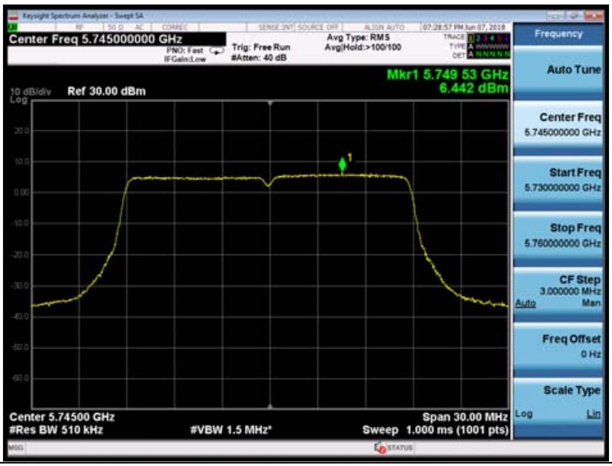
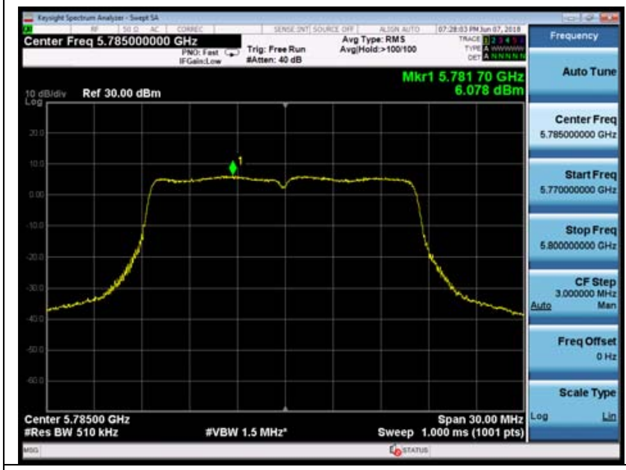
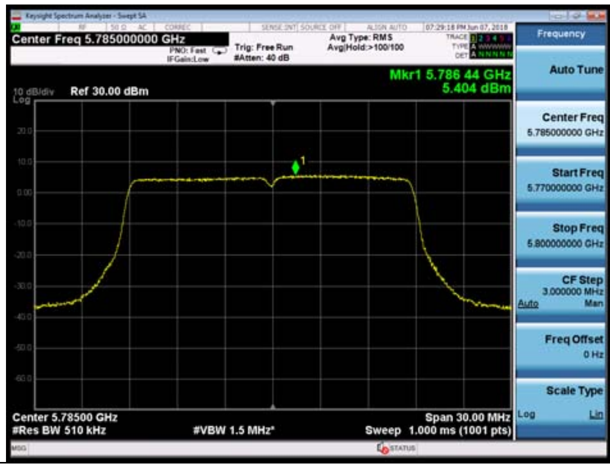
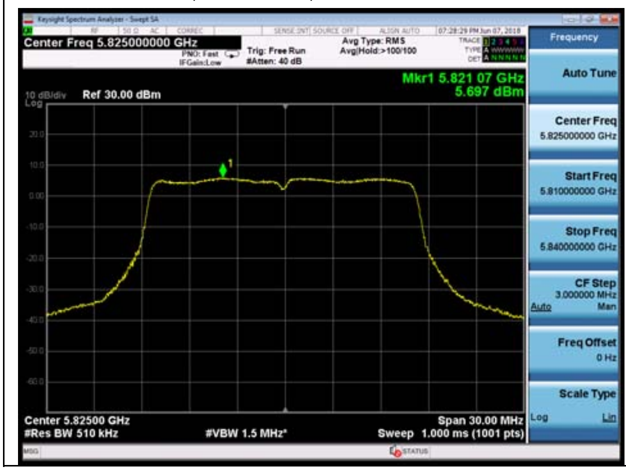
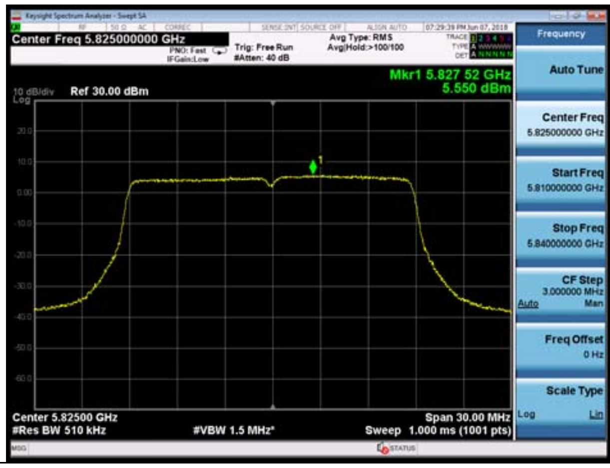


U-NII-1, 802.11ac VHT20, Channel No.: 48



U-NII-1, 802.11ac VHT40, Channel No.: 46

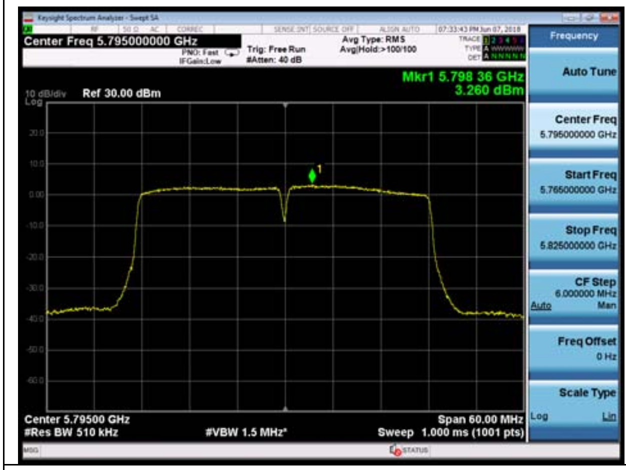
U-NII-1, 802.11ac VHT80, Channel No.: 42

U-NII-3, 802.11a, Channel No.: 149	U-NII-3, 802.11n HT20, Channel No.: 149
	
U-NII-3, 802.11a, Channel No.: 157	U-NII-3, 802.11n HT20, Channel No.: 157
	
U-NII-3, 802.11a, Channel No.: 165	U-NII-3, 802.11n HT20, Channel No.: 165
	

U-NII-3, 802.11n HT40, Channel No.: 151

U-NII-3, 802.11ac VHT20, Channel No.: 149

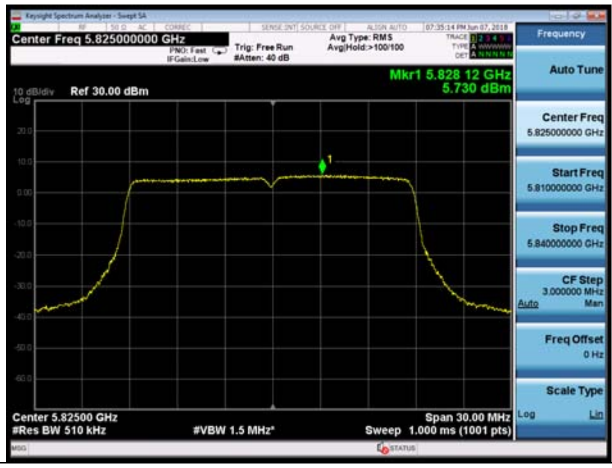
U-NII-3, 802.11n HT40, Channel No.: 159



U-NII-3, 802.11ac VHT20, Channel No.: 157

U-NII-3, 802.11ac VHT40, Channel No.: 151

U-NII-3, 802.11ac VHT20, Channel No.: 165



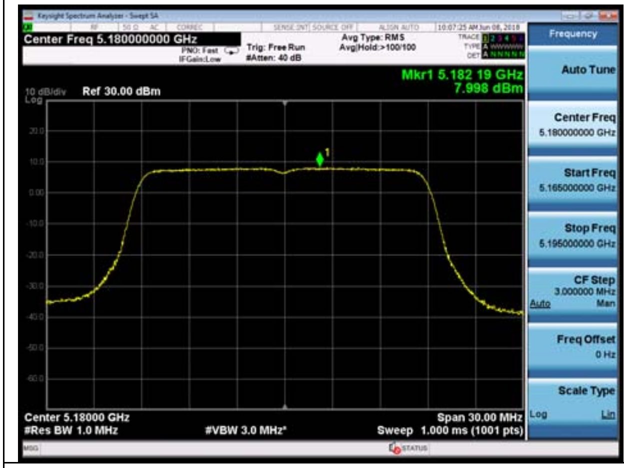
U-NII-3, 802.11ac VHT40, Channel No.: 159

U-NII-3, 802.11ac VHT80, Channel No.: 155

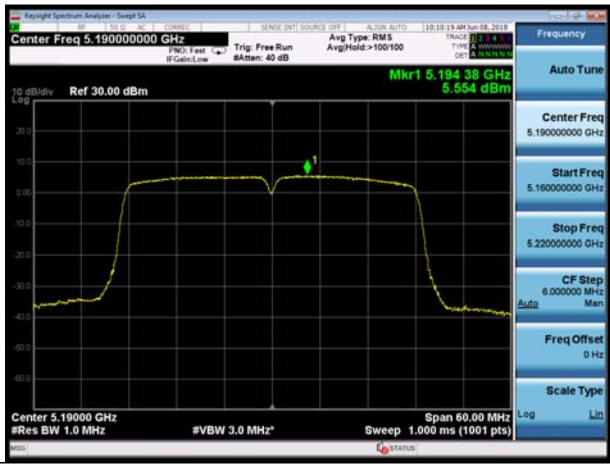
MIMO with Beamforming

Antenna 1

U-NII-1, 802.11n HT20, Channel No.: 36

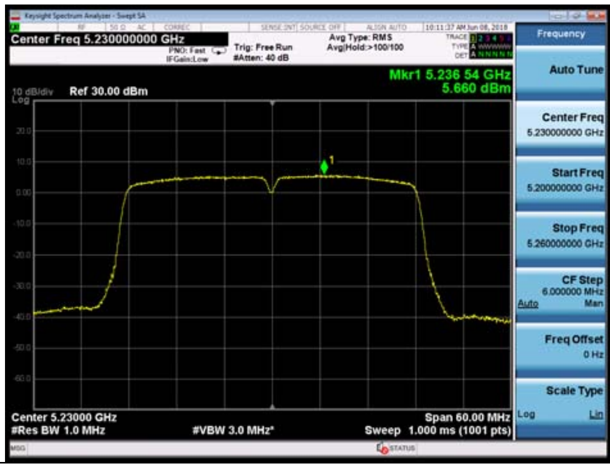


U-NII-1, 802.11n HT40, Channel No.: 38

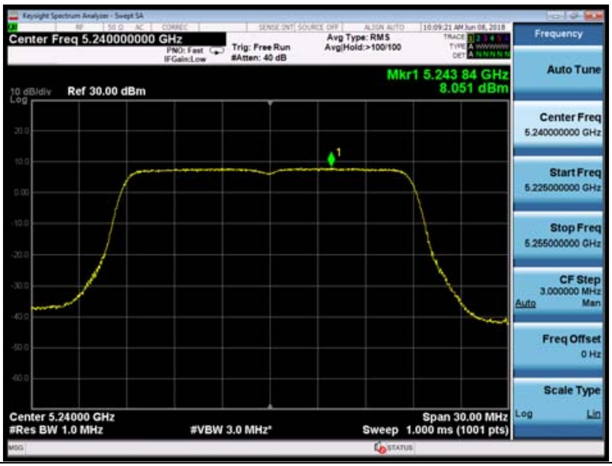


U-NII-1, 802.11n HT20, Channel No.: 40

U-NII-1, 802.11n HT40, Channel No.: 46



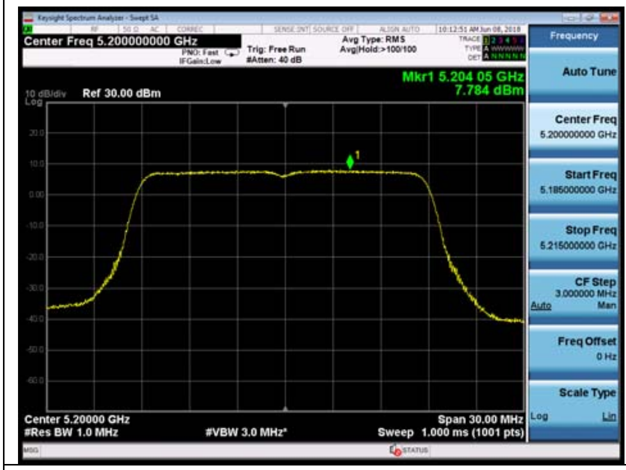
U-NII-1, 802.11n HT20, Channel No.: 48



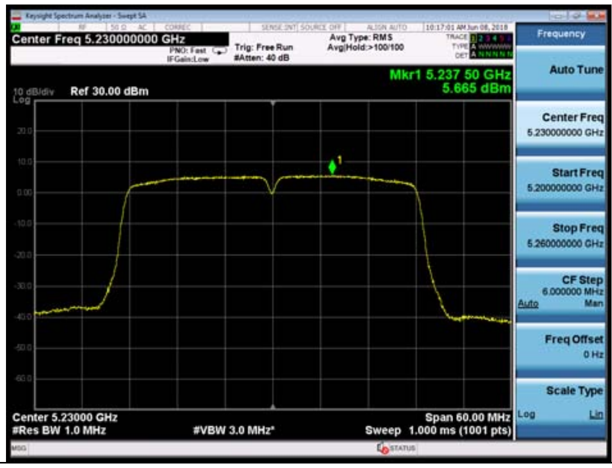
U-NII-1, 802.11ac VHT20, Channel No.: 36

U-NII-1, 802.11ac VHT40, Channel No.: 38

U-NII-1, 802.11ac VHT20, Channel No.: 40

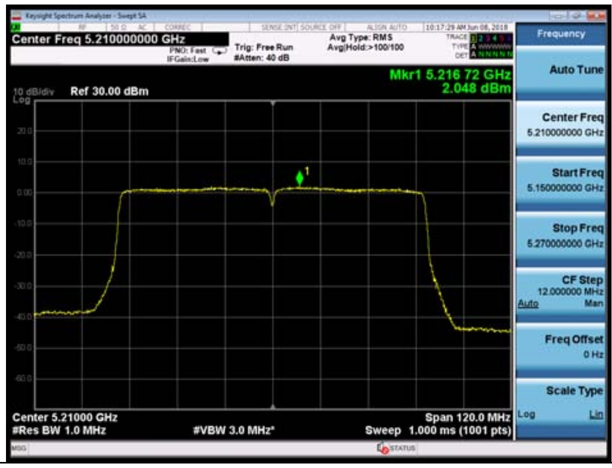


U-NII-1, 802.11ac VHT40, Channel No.: 46



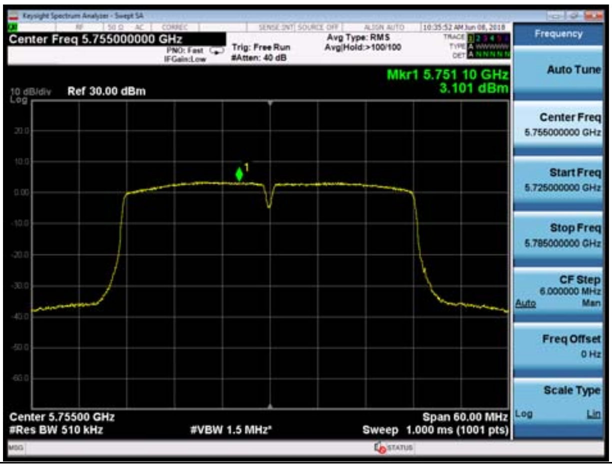
U-NII-1, 802.11ac VHT20, Channel No.: 48

U-NII-1, 802.11ac VHT80, Channel No.: 42

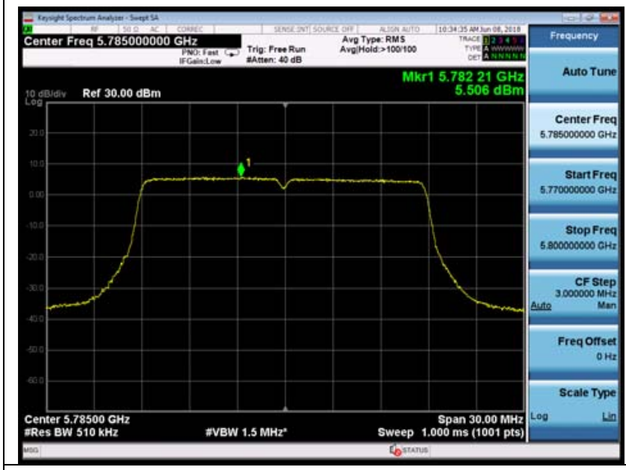


U-NII-3, 802.11n HT20, Channel No.: 149

U-NII-3, 802.11n HT40, Channel No.: 151



U-NII-3, 802.11n HT20, Channel No.: 157



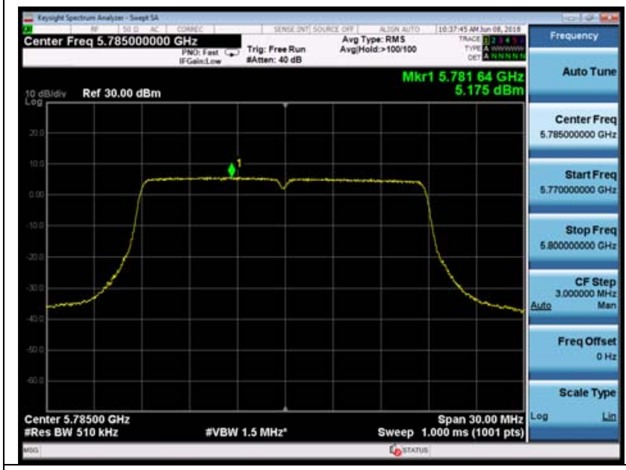
U-NII-3, 802.11n HT40, Channel No.: 159

U-NII-3, 802.11n HT20, Channel No.: 165

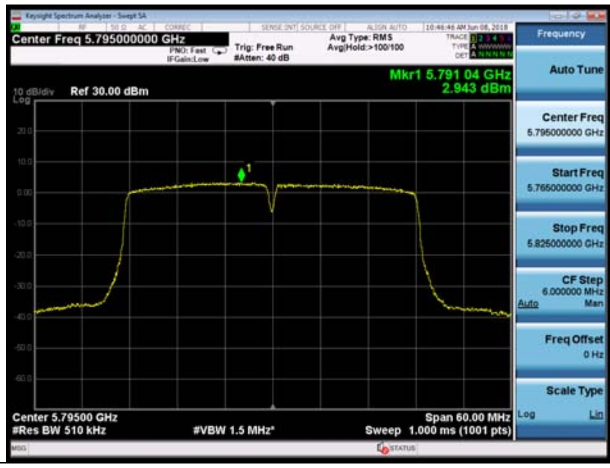
U-NII-3, 802.11ac VHT20, Channel No.: 149

U-NII-3, 802.11ac VHT40, Channel No.: 151

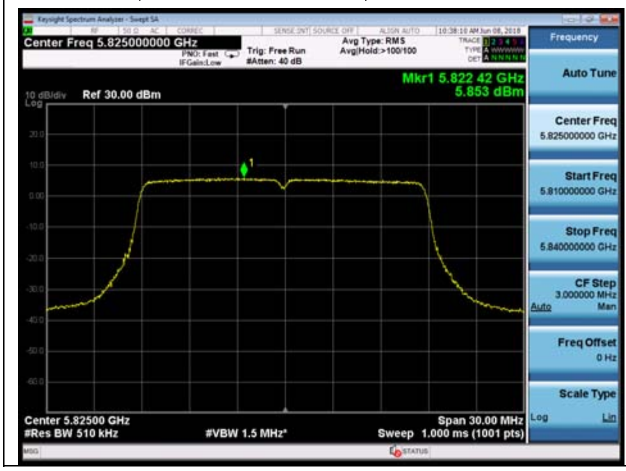
U-NII-3, 802.11ac VHT20, Channel No.: 157



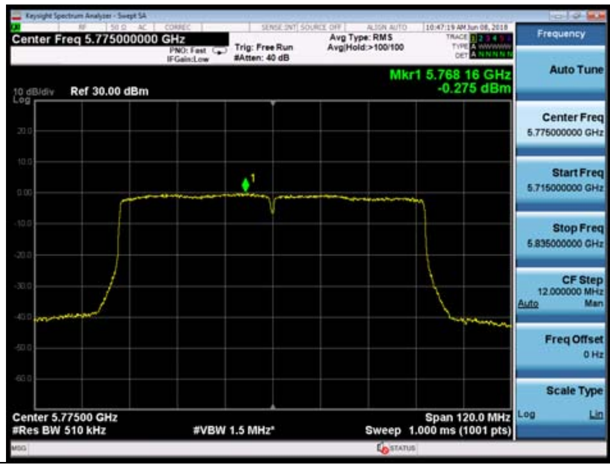
U-NII-3, 802.11ac VHT40, Channel No.: 159



U-NII-3, 802.11ac VHT20, Channel No.: 165



U-NII-3, 802.11ac VHT80, Channel No.: 155

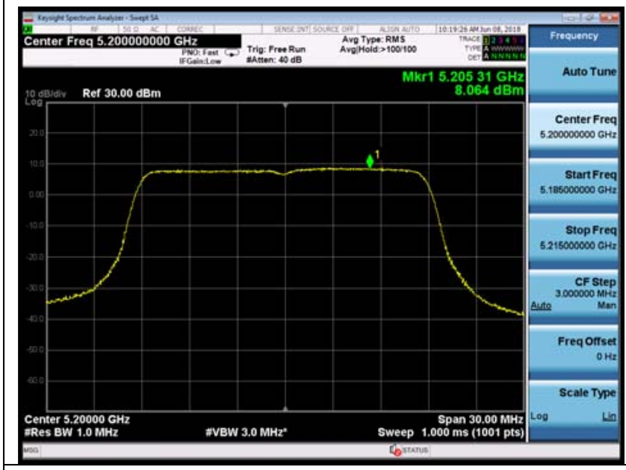


Antenna 2

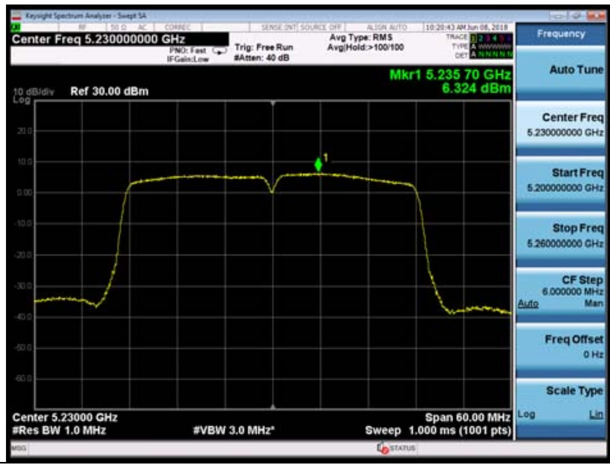
U-NII-1, 802.11n HT20, Channel No.: 36

U-NII-1, 802.11n HT40, Channel No.: 38

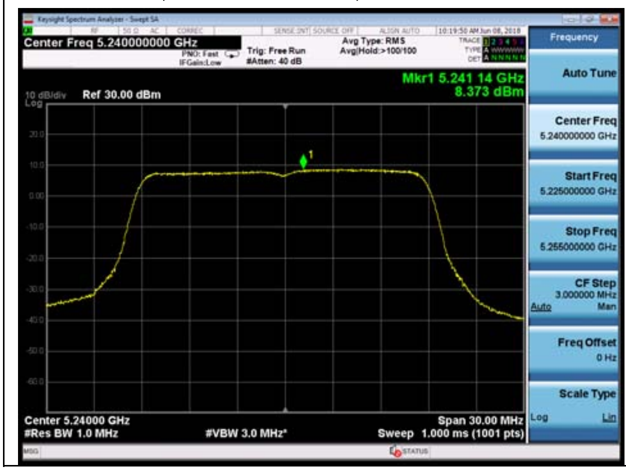
U-NII-1, 802.11n HT20, Channel No.: 40



U-NII-1, 802.11n HT40, Channel No.: 46



U-NII-1, 802.11n HT20, Channel No.: 48

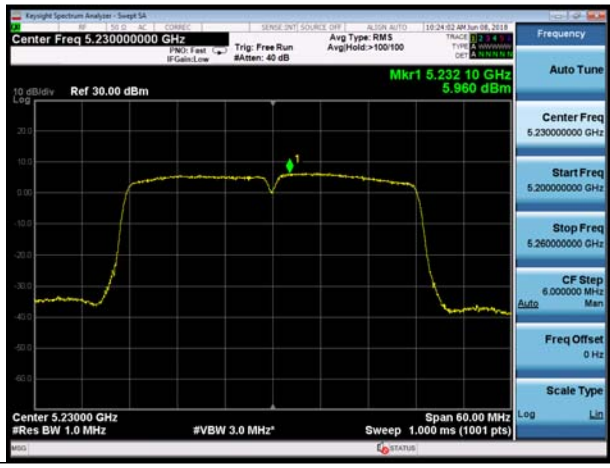


U-NII-1, 802.11ac VHT20, Channel No.: 36

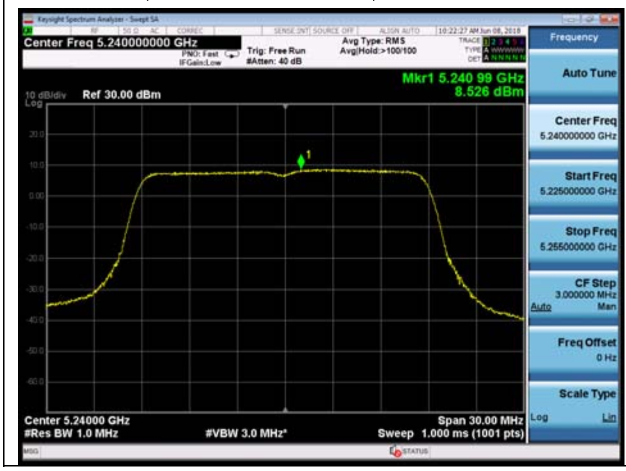
U-NII-1, 802.11ac VHT40, Channel No.: 38

U-NII-1, 802.11ac VHT20, Channel No.: 40

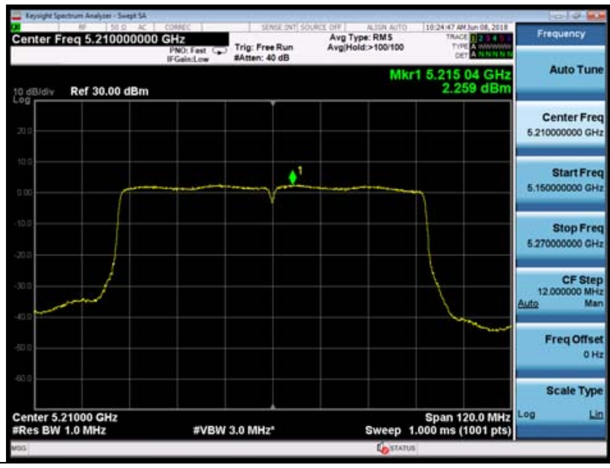
U-NII-1, 802.11ac VHT40, Channel No.: 46



U-NII-1, 802.11ac VHT20, Channel No.: 48



U-NII-1, 802.11ac VHT80, Channel No.: 42

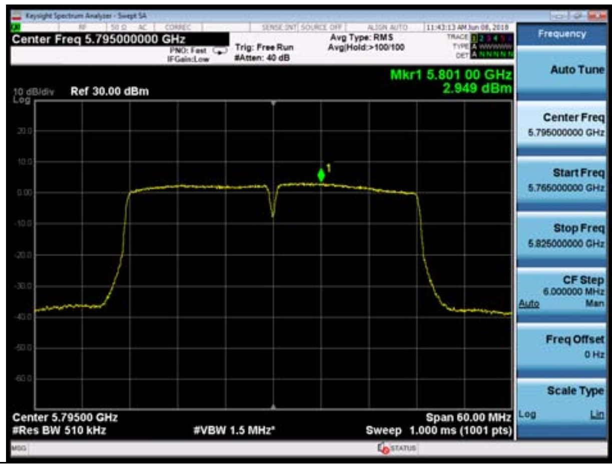


U-NII-3, 802.11n HT20, Channel No.: 149

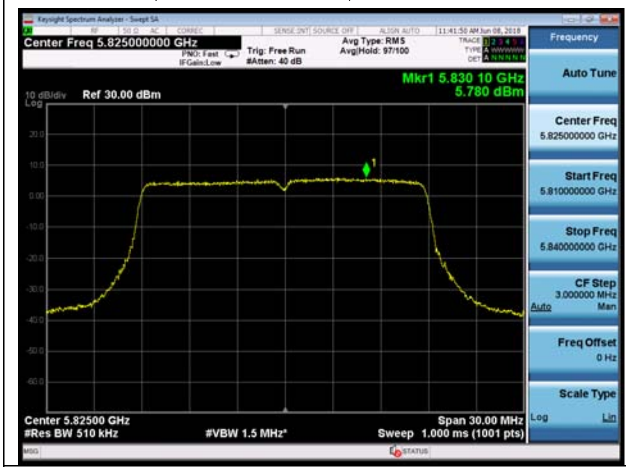
U-NII-3, 802.11n HT40, Channel No.: 151

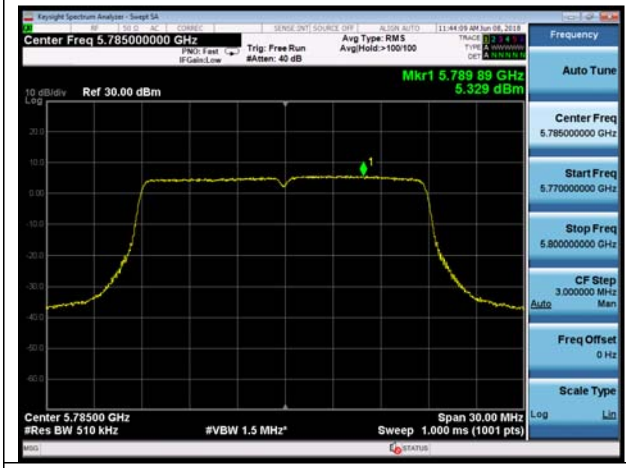
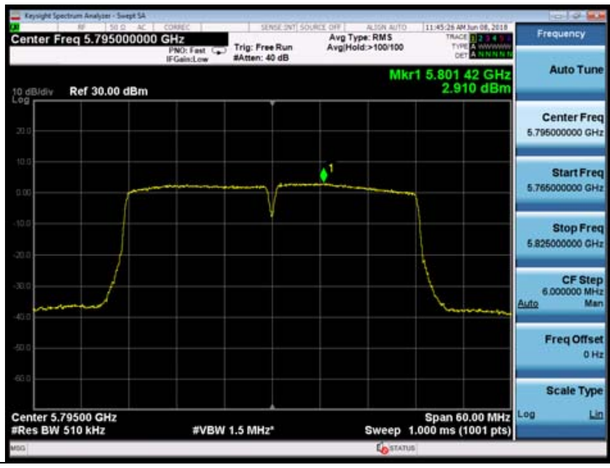
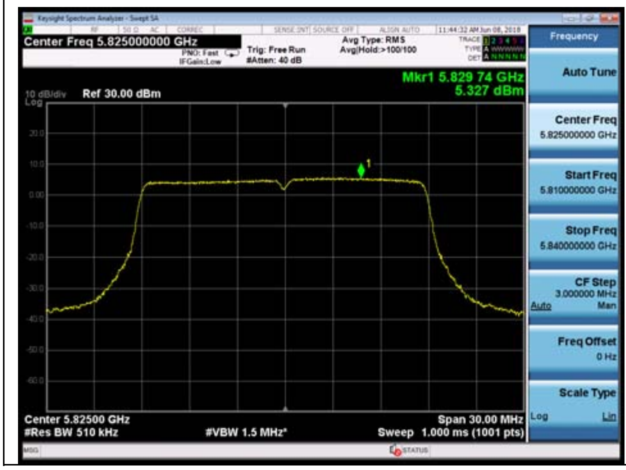
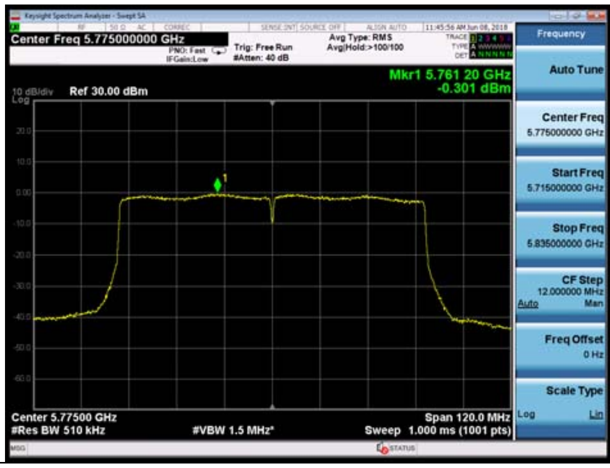
U-NII-3, 802.11n HT20, Channel No.: 157

U-NII-3, 802.11n HT40, Channel No.: 159



U-NII-3, 802.11n HT20, Channel No.: 165



U-NII-3, 802.11ac VHT20, Channel No.: 149	U-NII-3, 802.11ac VHT40, Channel No.: 151
	
U-NII-3, 802.11ac VHT20, Channel No.: 157	U-NII-3, 802.11ac VHT40, Channel No.: 159
	
U-NII-3, 802.11ac VHT20, Channel No.: 165	U-NII-3, 802.11ac VHT80, Channel No.: 155
	

5.5. Unwanted Emission

Ambient condition

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

Method of Measurement

The test set-up was made in accordance to the general provisions of ANSI C63.10-2013. The Equipment Under Test (EUT) was set up on a non-conductive table in the semi-anechoic chamber. The test was performed at the distance of 3 m between the EUT and the receiving antenna. The radiated emissions measurements were made in a typical installation configuration.
Sweep the whole frequency band range from 9kHz to the 10th harmonic of the carrier, and the emissions less than 20 dB below the permissible value are reported.

During the test, the height of receive antenna shall be moved from 1 to 4 meters, and the antenna shall be performed under horizontal and vertical polarization. The turntable shall be rotated from 0 to 360 degrees for detecting the maximum of radiated spurious signal level. The measurements shall be repeated with orthogonal polarization of the test antenna. The data of cable loss and antenna factor has been calibrated in full testing frequency range before the testing.
Set the spectrum analyzer in the following:
Below 1GHz (detector: Peak and Quasi-Peak)
RBW=100kHz / VBW=300kHz / Sweep=AUTO
Above 1GHz (detector: Peak):
I) Peak emission levels are measured by setting the instrument as follows:
1) RBW = 1 MHz.
2) VBW ≥ [3 × RBW]
3) Detector = peak.
4) Sweep time = auto.
5) Trace mode = max hold.
6) Allow sweeps to continue until the trace stabilizes. Note that if the transmission is not continuous, then the time required for the trace to stabilize will increase by a factor of approximately 1 / D, where D is the duty cycle.

II) Average emission levels are measured by setting the instrument as follows:
a) RBW = 1 MHz.
b) VBW ≥ [3 × RBW].
c) Detector = RMS (power averaging), if [span / (# of points in sweep)] ≤ RBW / 2. Satisfying this condition can require increasing the number of points in the sweep or reducing the span. If the condition is not satisfied, then the detector mode shall be set to peak.
d) Averaging type = power (i.e., rms) (As an alternative, the detector and averaging type may be set for linear voltage averaging. Some instruments require linear display mode to use linear voltage averaging. Log or dB averaging shall not be used.)

e) Sweep time = auto.

f) Perform a trace average of at least 100 traces if the transmission is continuous. If the transmission is not continuous, then the number of traces shall be increased by a factor of 1 / D, where D is the duty cycle. For example, with 50% duty cycle, at least 200 traces shall be averaged. (If a specific emission is demonstrated to be continuous—i.e., 100% duty cycle—then rather than turning ON and OFF with the transmit cycle, at least 100 traces shall be averaged.)

g) If tests are performed with the EUT transmitting at a duty cycle less than 98%, then a correction factor shall be added to the measurement results prior to comparing with the emission limit, to compute the emission level that would have been measured had the test been performed at 100% duty cycle. The correction factor is computed as follows:

1) If power averaging (rms) mode was used in the preceding step e), then the correction factor is [10 log (1 / D)], where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 3 dB shall be added to the measured emission levels.

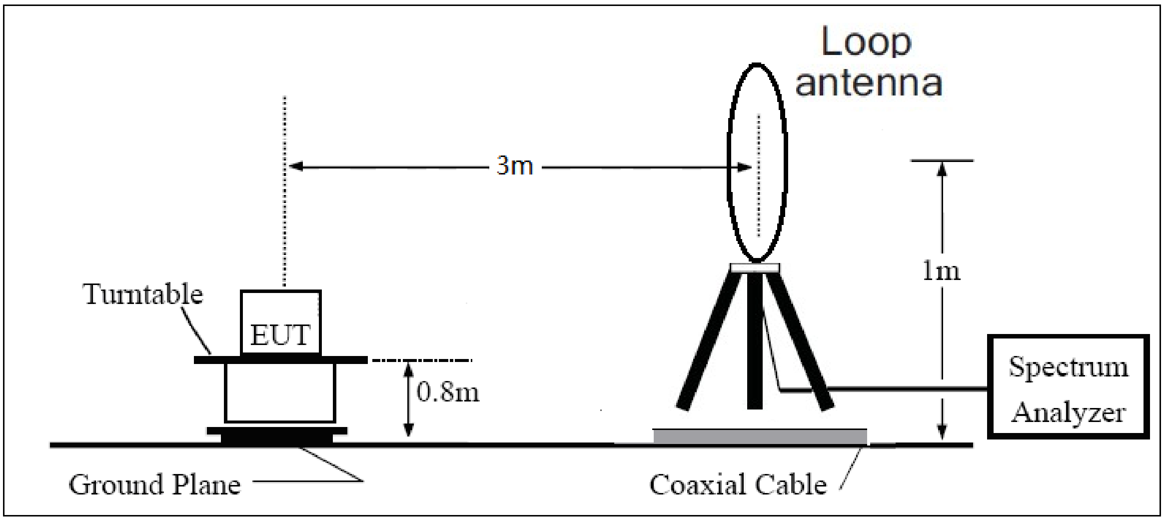
2) If linear voltage averaging mode was used in the preceding step e), then the correction factor is [20 log (1 / D)], where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 6 dB shall be added to the measured emission levels.

3) If a specific emission is demonstrated to be continuous (100% duty cycle) rather than turning ON and OFF with the transmit cycle, then no duty cycle correction is required for that emission.

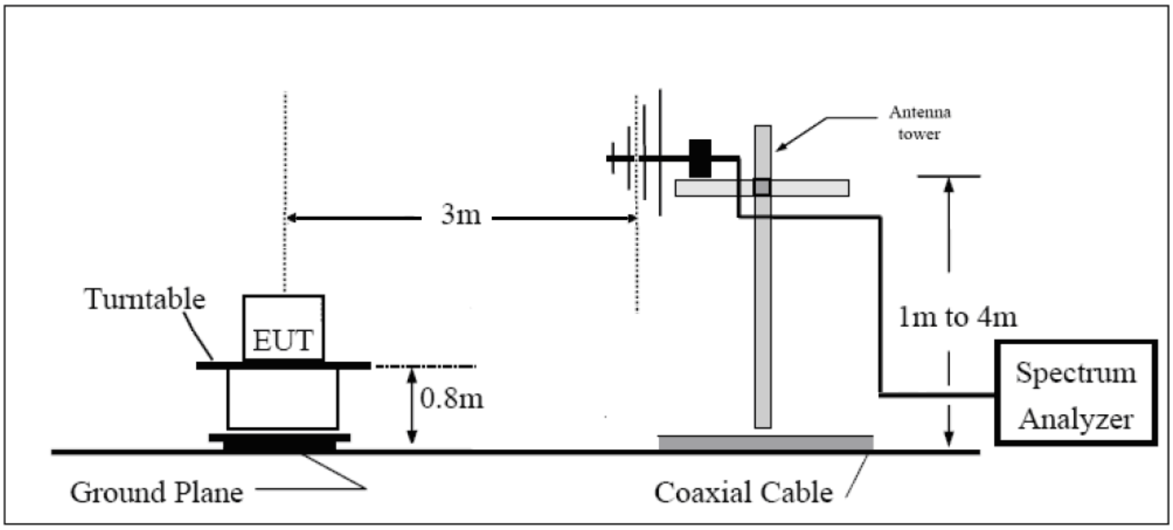
The field strength of spurious emission was measured in the following position: EUT stand-up position (Z axis), lie-down position (X, Y axis). The worst emission was found in stand-up position (Z axis) and the antenna is vertical.

The test is in transmitting mode.

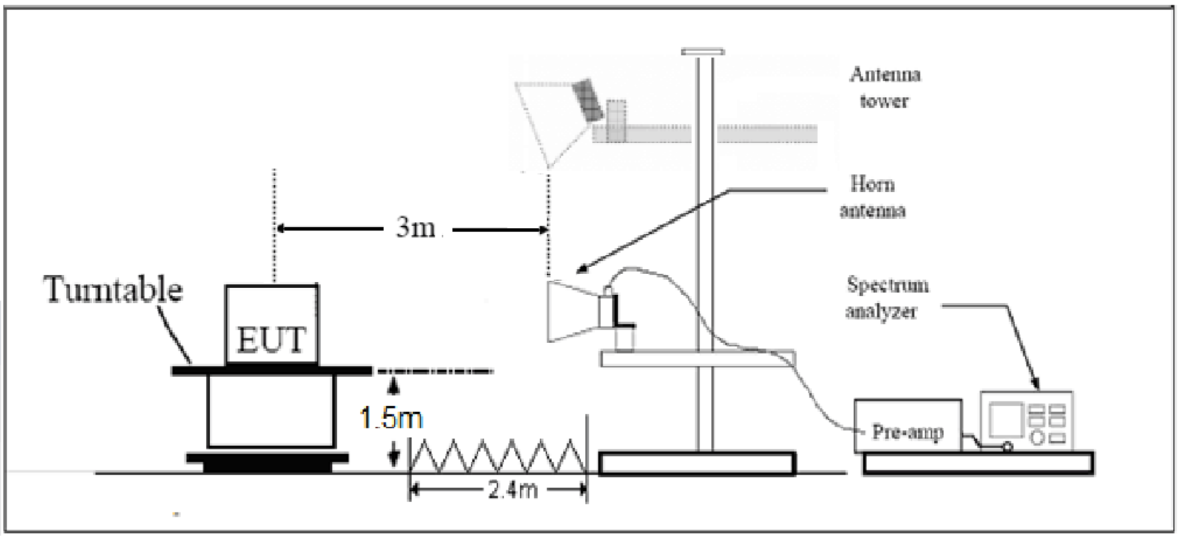
9KHz~~~30MHz



30MHz~~~ 1GHz



Above 1GHz



Note: Area side:2.4mX3.6m

Limits

(1) For transmitters operating in the 5725-5850 MHz band: All emissions shall be limited to a level of −27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

(2) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz(68.2dBμV/m).

(3) For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz(68.2dBμV/m).

(4) For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz(68.2dBμV/m).

Note: the following formula is used to convert the EIRP to field strength

§1、E[dBμV/m] = EIRP[dBm] - 20 log(d[meters]) + 104.77, where E = field strength and

d = distance at which field strength limit is specified in the rules;

§2、E[dBμV/m] = EIRP[dBm] + 95.2, for d = 3 meters

(5) Unwanted spurious emissions fallen in restricted bands per FCC Part15.205 shall comply with the general field strength limits set forth in § 15.209 as below table.

Frequency of emission (MHz)	Field strength(uV/m)	Field strength(dBuV/m)
0.009–0.490	2400/F(kHz)	/
0.490–1.705	24000/F(kHz)	/
1.705–30.0	30	/
30-88	100	40
88-216	150	43.5
216-960	200	46
Above960	500	54

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1]0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	([2])
13.36 - 13.41			

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor *k* = 1.96.

Frequency	Uncertainty
9KHz-30MHz	3.55 dB
30MHz-200MHz	4.19 dB
200MHz-1GHz	3.63 dB
1GHz-26.5G	3.68 dB
26.5G-40GHz	4.76dB