

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART E REQUIREMENT

OF

Applicant: ASKEY COMPUTER CORP.
10F, NO.119, JIANKANG RD.,
ZHONGHE DIST., NEW TAIPEI CITY 23585,
TAIWAN, R.O.C.

Product Name: Wireless module

Brand Name: Panasonic

Model No.: WLU5540B-D81(RoHS)

Model Difference: N/A

FCC ID: H8N-WLU5540B

Report Number: E2/2018/70034

FCC Rule Part: §15.407, Cat: NII

Issue Date: Apr. 07, 2018

Date of Test: Jul. 09, 2018~ Aug. 03, 2018

Date of EUT Received: Jul. 09, 2018

We hereby certify that:

The above equipment was tested by SGS Taiwan Ltd. Electronics & Communication Laboratory. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10: 2013 and the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits. The test results of this report relate only to the tested sample identified in this report.

Tested By:

Aken Huang

Aken Huang / Engineer

Approved By:

Jim Chang

Jim Chang / Manager



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Revision History

Report Number	Revision	Description	Effected Page	Issue Date	Revised By
E2/2018/70034	Rev.00	Initial creation of document	All	Apr. 07, 2018	Stefanie Yu / Clerk

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1 GENERAL INFORMATION

1.1 Product Description

General:

Product Name:	Wireless module
Brand Name:	Panasonic
Model No.:	WLU5540B-D81(RoHS)
Model Difference:	N/A
Hardware Version (Product):	REV5
Operation system:	Ubuntu 12.04.1
QA tool version:	v.63770
WLAN driver Version:	V 2.0.1
MTK BT Driver Version:	V6.1.17060901
Power Supply:	5Vdc from USB Port

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WLAN 5GHz:

WLAN 802.11	Frequency Range	Channels	Rated Power (Avg.) (dBm)	Modulation Technology
a	5180~5240	4	18.29	OFDM
	5260~5320	4	18.69	
	5500~5720	12	18.79	
	5745-5825	5	23.41	
n_HT ac_VHT 20M	5180~5240	4	HT: 18.88 (Worst case)	OFDM
	5260~5320	4	HT: 18.80 (Worst case)	
	5500~5720	11	HT: 18.93 (Worst case)	
	5745-5825	5	HT: 24.41 (Worst case)	
n_HT ac_VHT 40M	5190~5230	2	HT: 18.60 (Worst case)	OFDM
	5270~5310	2	HT: 18.77 (Worst case)	
	5510~5710	5	HT: 18.95 (Worst case)	
	5755~5795	2	HT: 24.53 (Worst case)	
ac_VHT 80M	5210	1	16.15	OFDM
	5290	1	15.55	
	5530~5690	2	18.82	
	5775	1	19.86	
Modulation type		64QAM, 16QAM, QPSK, BPSK for OFDM 256QAM for OFDM in 802.11ac only		
Transition Rate:s		802.11 a: 6/9/12/18/24/36/48/54 Mbps 802.11 n_20MHz: 6.5 – 144.4Mbps 802.11 n_40MHz: 13.5 – 300.0Mbps 802.11 ac_20MHz: 6.5 –173.3Mbps 802.11 ac_40MHz: 13.5 –400.0Mbps 802.11 ac_80MHz: 29.3 – 866.7Mbps		

Vendor	Ant. Type	Main / Aux	Part No.	Freq.(MHz)	Peak Gain (dBi)
ASKEY	Internal	Main	N/A	5150~5250	8.01
				5250~5350	8.01
				5470~5725	8.01
				5725~5850	8.01
	Internal	Aux	N/A	5150~5250	8.01
				5250~5350	8.01
				5470~5725	8.01
				5725~5850	8.01

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1.2 Test Methodology of Applied Standards

FCC Part 15, Subpart E §15.407

FCC KDB 789033 D02 General UNII Test Procedures New Rules V02r01

FCC KDB 662911 D01 Multiple Transmitter Output v02r01

ANSI C63.10:2013

Note:

All test items have been performed and record as per the above standards.

1.3 Test Facility

SGS Taiwan Ltd. Electronics & Communication Laboratory No.2, Keji 1st Rd.,
Guishan District, Taoyuan City, Taiwan 333 (TAF code 0513)

FCC Registration Numbers are: 735305 / TW0002

1.4 Special Accessories

There are no special accessories used while test was conducted.

1.5 Equipment Modifications

There was no modification incorporated into the EUT.

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2 SYSTEM TEST CONFIGURATION

2.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

2.2 EUT Exercise

An engineering test mode (software/firmware) that applicant provided was utilized to manipulate the EUT into transmit, selection of the test channel, and modulation scheme.

2.3 Test Procedure

2.3.1 Conducted Emissions

The EUT is placed on a turn table which is 0.8 m above ground plane. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30 MHz. The CISPR Quasi-Peak and Average detector mode is employed according to §15.207. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

2.3.2 Radiated Emissions

The EUT is placed on a turn table. For emissions testing at or below 1 GHz, the table height shall be 0.8 m above the reference ground plan. For emission measurements above 1 GHz, the table height shall be 1.5 m. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this transmitter (EUT) was rotated through three orthogonal axes and measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made "while keeping the antenna in the 'cone of radiation' from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response." is still within the 3dB illumination BW of the measurement antenna.

2.4 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuation factor between EUT conducted port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly EUT RF output level.

Note:

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

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2.5 Configuration of Tested System

Fig. 2-1 Conducted (Antenna Port) Emission Configuration

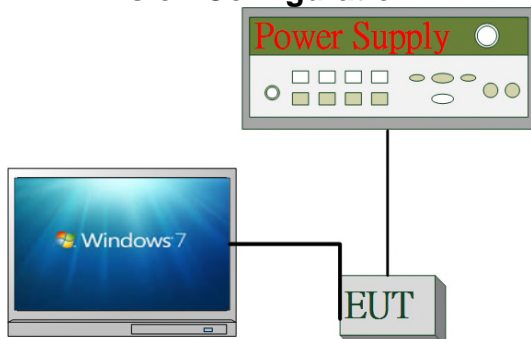


Fig 2-3 Conduction (AC Power Line) Radiated Emission



Fig 2-2 Radiated Emission



Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Data Cable	Power Cord
1.	Bluetooth Test Software	N/A	N/A	N/A	N/A	N/A
2.	Notebook	Lenovo	T420	S0012599	Shielded	Unshielded
3.	DC Power Supply	Agilent	E3640A	MY53130054	N/A	Unshielded

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3 SUMMARY OF TEST RESULT

FCC Rules	Description Of Test	Result
§15.207	AC Power Line Conducted Emission	Compliant
§15.403(i) §15.407(e)	26 dB & 6dB & 99% Emission Bandwidth	Compliant
§15.407(a)	Maximum Conducted Output Power	Compliant
§15.407(a)	Power Spectral Density	Compliant
§15.407(b)	Undesirable Radiated Emissions	Compliant
§15.407(c)	Transmission in case of Absence of Information	Compliant
§15.407(g)	Frequency Stability	Compliant
§15.203 §15.407(a)	Antenna Requirement	Compliant

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4 DESCRIPTION OF TEST MODES

4.1 Operated in U-NII Bands

Operated band in 5150 MHz ~5250 MHz:

802.11a / n HT20 Mode, 802.11ac VHT20 Mode	
Channel	Frequency
36	5180
44	5220
48	5240

802.11 n HT40 Mode, 802.11ac VHT40 Mode	
channel	Frequency
38	5190
46	5230

802.11ac VHT80 Mode	
channel	Frequency
42	5210

Operated band in 5250 MHz ~5350 MHz:

802.11a / n HT20 Mode, 802.11ac VHT20 Mode	
channel	Frequency
52	5260
60	5300
64	5320

802.11 n HT40 Mode, 802.11ac VHT40 Mode	
channel	Frequency
54	5270
62	5310

802.11ac VHT80 Mode	
Channel	Frequency
58	5290

Operated band in 5470 MHz ~5725 MHz:

802.11a / n HT20 Mode,	
Channel	Frequency
100	5500
116	5580
140	5700
142	5720

802.11 n HT40 Mode,	
channel	Frequency
102	5510
110	5550
134	5670
142	5710

802.11ac VHT80 Mode	
channel	Frequency
106	5530
122	5610
138	5690

Operated band in 5745 MHz ~5850 MHz:

802.11a / n HT20 Mode,	
Channel	Frequency
149	5745
157	5785
165	5825

802.11 n HT40 Mode,	
channel	Frequency
151	5755
159	5795

802.11ac VHT80 Mode	
channel	Frequency
155	5775

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4.2 The Worst Test Modes and Channel Details

1. The EUT has been tested under operating condition.
2. Test program used to control the EUT for staying in continuous transmitting mode is programmed.
3. Investigation has been done on all the possible configurations for searching the worst case.

RADIATED EMISSION TEST:

MODE	FREQUENCY BAND (MHz)	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT
RADIATED EMISSION TEST (BELOW 1 GHz)						
802.11a	5180~5240	36 to 48	36,44,48	OFDM	6	2TX
802.11ac_VHT80	5210	42	42	OFDM	MCS8	MIMO
802.11a	5260~5320	52 to 64	52,60,64	OFDM	6	2TX
802.11ac_VHT80	5290	58	58	OFDM	MCS8	MIMO
802.11a	5500~5720	100 to 140	100,116,140	OFDM	6	2TX
802.11ac_VHT80	5530~5690	106 to 138	106,122,138	OFDM	MCS8	MIMO
802.11a	5745~5825	149 to 165	149,157,165	OFDM	6	2TX
802.11ac_VHT80	5775	155	155	OFDM	MCS8	MIMO
RADIATED EMISSION TEST (ABOVE 1 GHz)						
802.11a	5180~5240	36 to 48	36,44,48	OFDM	6	2TX
802.11n_HT20				OFDM	MCS8	MIMO
802.11n_HT40	5190~5230	38 to 46	38,46	OFDM	MCS8	MIMO
802.11ac_VHT80	5210	42	42	OFDM	MCS8	MIMO
802.11a	5260~5320	52 to 64	52,60,64	OFDM	6	2TX
802.11n_HT20				OFDM	MCS8	MIMO
802.11n_HT40	5270~5310	54 to 62	54,62	OFDM	MCS8	MIMO
802.11ac_VHT80	5290	58	58	OFDM	MCS8	MIMO
802.11a	5500~5720	100 to 144	100,116,140	OFDM	6	2TX
802.11n_HT20				OFDM	MCS8	MIMO
802.11n_HT40	5510~5710	102 to 142	102,110,134	OFDM	MCS8	MIMO
802.11ac_VHT80	5530~5610	106 to 122	106,122	OFDM	MCS8	MIMO
802.11a	5745~5825	149 to 165	149,157,165	OFDM	6	2TX
802.11n_HT20				OFDM	MCS8	MIMO
802.11n_HT40	5755~5795	151 to 159	151,159	OFDM	MCS8	MIMO
802.11ac_VHT80	5775	155	155	OFDM	MCS8	MIMO

Note: The field strength of radiation emission was measured as EUT stand-up position (H mode) and lie down position (E1, E2 mode) for 802.11a/n/ac WLAN Transmitter for channel Low, Mid and High, the worst case H position was reported

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ANTENNA PORT CONDUCTED MEASUREMENT:

CONDUCTED TEST						
MODE	FREQUENCY BAND (MHz)	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT
802.11a	5180~5240	36 to 48	36,44,48	OFDM	6	2TX
802.11n_HT20 802.11ac_VHT20				OFDM	MCS8	MIMO
802.11n_HT40 802.11ac_VHT40	5190~5230	38 to 46	38,46	OFDM	MCS8	MIMO
802.11ac_VHT80	5210	42	42	OFDM	MCS8	MIMO
802.11a	5260~5320	52 to 64	52,60,64	OFDM	6	2TX
802.11n_HT20 802.11ac_VHT20				OFDM	MCS8	MIMO
802.11n_HT40 802.11ac_VHT40	5270~5310	54 to 62	54,62	OFDM	MCS8	MIMO
802.11ac_VHT80	5290	58	58	OFDM	MCS8	MIMO
802.11a	5500~5700	100 to 140	100,116,140	OFDM	6	2TX
802.11n_HT20 802.11ac_VHT20				OFDM	MCS8	MIMO
802.11n_HT40 802.11ac_VHT40	5510~5670	102 to 134	102,110,134	OFDM	MCS8	MIMO
802.11ac_VHT80	5530~5610	106 to 122	106,122	OFDM	MCS8	MIMO
802.11a	5745~5825	149 to 165	149,157,165	OFDM	6	2TX
802.11n_HT20 802.11ac_VHT20				OFDM	MCS8	MIMO
802.11n_HT40 802.11ac_VHT40	5755~5795	151 to 159	151,159	OFDM	MCS8	MIMO
802.11ac_VHT80	5775	155	155	OFDM	MCS8	MIMO

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5 MEASUREMENT UNCERTAINTY

Test Items	Uncertainty
AC Power Line Conducted Emission	+/- 2.586 dB
26dB & 6dB Emission Bandwidth	+/- 123.36 Hz
The Maximum Output Power Measurement	+/- 0.96 dB
Maximum Power Spectral Density Measurement	+/- 1.67 dB
Frequency Stability	+/- 123.36 Hz
Temperature	+/- 0.65 °C
Humidity	+/- 4.6 %
DC / AC Power Source	DC= +/- 0.13%, AC=+/- 0.2%

Radiated Spurious Emission:

Measurement uncertainty (Polarization : Vertical)	9kHz-30MHz: +/-2.87dB
	30MHz - 180MHz: +/- 3.37dB
	180MHz -417MHz: +/- 3.19dB
	0.417GHz-1GHz: +/- 3.19dB
	1GHz - 18GHz: +/- 4.04dB
	18GHz - 40GHz: +/- 4.04dB

Measurement uncertainty (Polarization : Horizontal)	9kHz-30MHz: +/-2.87dB
	30MHz - 167MHz: +/- 4.22dB
	167MHz -500MHz: +/- 3.44dB
	0.5GHz-1GHz: +/- 3.39dB
	1GHz - 18GHz: +/- 4.08dB
	18GHz - 40GHz: +/- 4.08dB

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

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6 CONDUCTED EMISSION TEST

6.1. Standard Applicable

Frequency range within 150 kHz to 30 MHz shall not exceed the Limit table as below.

Frequency range MHz	Limits dB(μV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50
Note 1.The lower limit shall apply at the transition frequencies 2.The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.		

6.2. Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EMI Test Receiver	R&S	ESCI 7	100950	12/24/2017	12/23/2018
Coaxial Cables	N/A	N30N30-1042-1 50cm	N/A	08/30/2017	08/29/2018
LISN	Schwarzbeck	NSLK 8127	8127-648	06/18/2018	06/17/2019
Test Software	Farad	EZ-EMC	Ver. SGS-03A2	N.C.R.	N.C.R.

6.3. EUT Setup

1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.10:2013.
2. The AC/DC Power adaptor of EUT was plug-in LISN. The rear of the EUT and peripherals were placed flushed with the rear of the table top.
3. The LISN was connected with 120Vac/60Hz power source.

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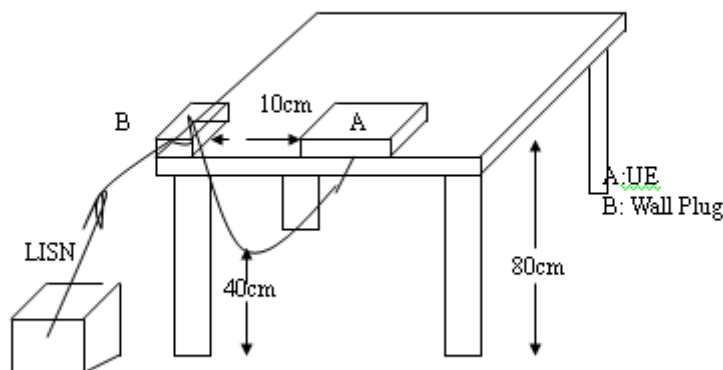
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6.4. Test SET-UP



6.5. Measurement Procedure

1. The EUT was placed on a table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all phases of power being supplied by given UE are completed.

6.6. Measurement Result

Note: Refer to next page for measurement data and plots.

Note2: The * reveals the worst-case results that closet to the limit

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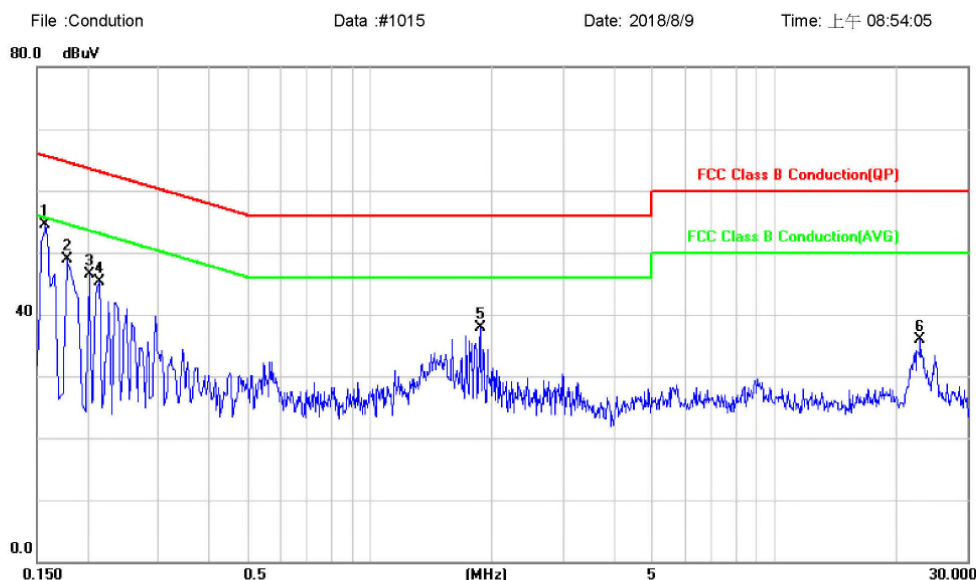
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Site : Conduction Room
Limit: FCC Class B Conduction(QP)
Mode:
Note:

Phase: **L1**
Power: AC 120V/60Hz

Temperature: 23 °C
Humidity: 69 %

Conducted Emission



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1	*	0.1580	34.91	19.67	54.58	65.57	-10.99	peak	
2		0.1780	29.14	19.70	48.84	64.58	-15.74	peak	
3		0.2020	26.67	19.74	46.41	63.53	-17.12	peak	
4		0.2140	25.57	19.76	45.33	63.05	-17.72	peak	
5		1.8700	17.34	20.47	37.81	56.00	-18.19	peak	
6		22.9340	15.84	20.10	35.94	60.00	-24.06	peak	

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Site : Conduction Room

Phase: **N**

Temperature: 23 °C

Limit: FCC Class B Conduction(QP)

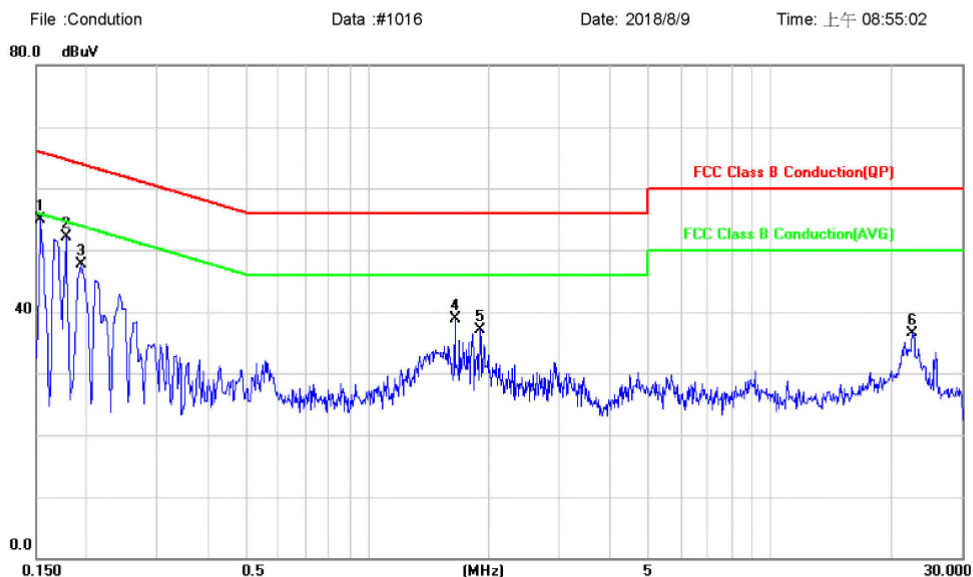
Power: AC 120V/60Hz

Humidity: 69 %

Mode:

Note:

Conducted Emission



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB		
1	*	0.1540	35.17	19.65	54.82	65.78	-10.96	peak	
2		0.1780	32.40	19.69	52.09	64.58	-12.49	peak	
3		0.1940	27.97	19.71	47.68	63.86	-16.18	peak	
4		1.6500	18.60	20.29	38.89	56.00	-17.11	peak	
5		1.8980	16.61	20.47	37.08	56.00	-18.92	peak	
6		22.6260	16.29	20.12	36.41	60.00	-23.59	peak	

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7 DUTY CYCLE TEST SIGNAL

Pre-analysis Check: While conducting average power measurement, duty cycle of each mode shall be checked to ensure its duty cycle in order to compensate for the loss due to insufficient ratio of duty cycle.

All duty cycle is pre-scanned, and result as obtained below shows only the most representative ones where duty cycle is conducted as the given transmission with given virtual operation that expresses the percentage.

Formula:

$$\text{Duty Cycle} = \text{Ton} / (\text{Ton} + \text{Toff})$$

Measurement Procedure:

1. Set span = Zero
2. RBW = 8MHz
3. VBW = 8MHz,
4. Detector = Peak

Duty Cycle:

Mode	Duty Cycle (%)	Duty Factor (dB) =10*log (1/Duty Cycle)	1/T (kHz)	VBW setting (kHz)
802.11a	97.48	0.11	0.72	1.00
802.11n_20	94.91	0.23	1.49	2.00
802.11ac_20	78.25	1.07	0.32	1.00
802.11n_40	90.86	0.42	2.87	3.00
802.11ac_40	75.64	1.21	0.29	1.00
802.11ac_80	73.52	1.34	0.77	1.00

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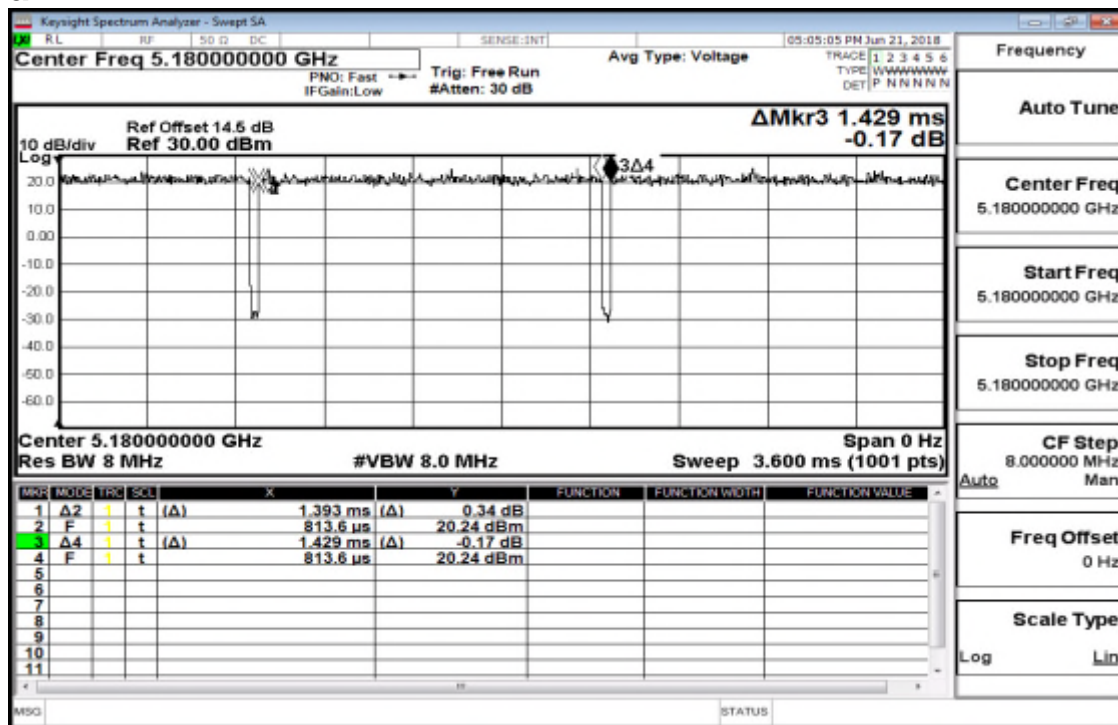
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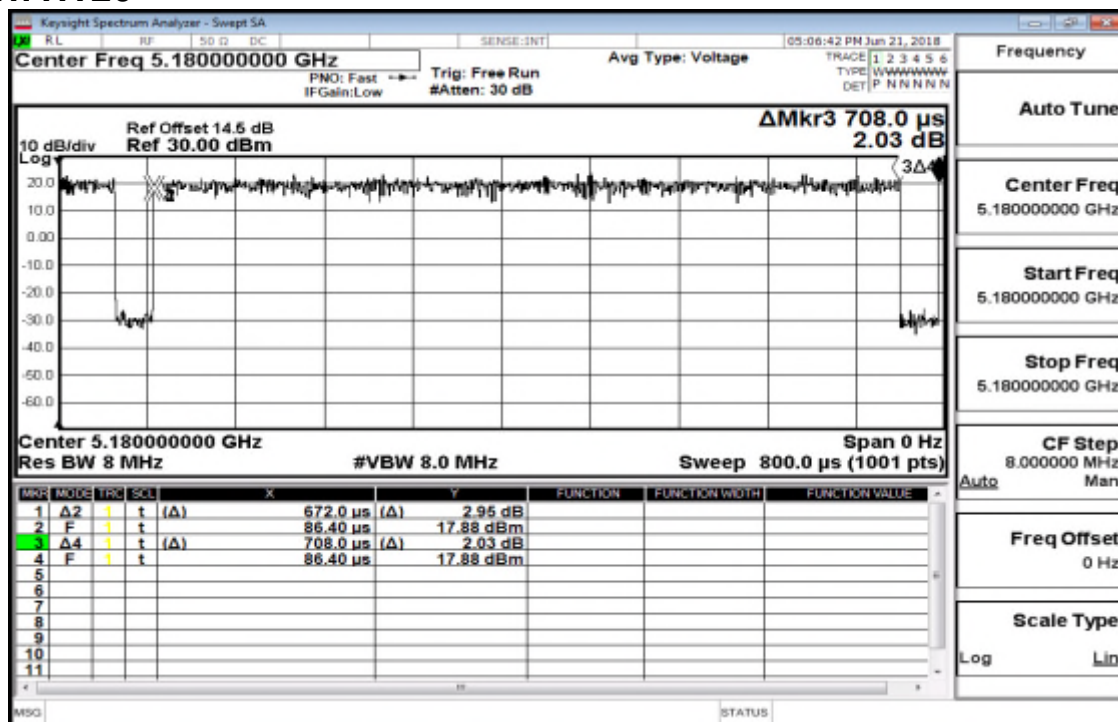
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DUTY CYCLE TEST SIGNAL Measurement Result

802.11a



802.11n HT20



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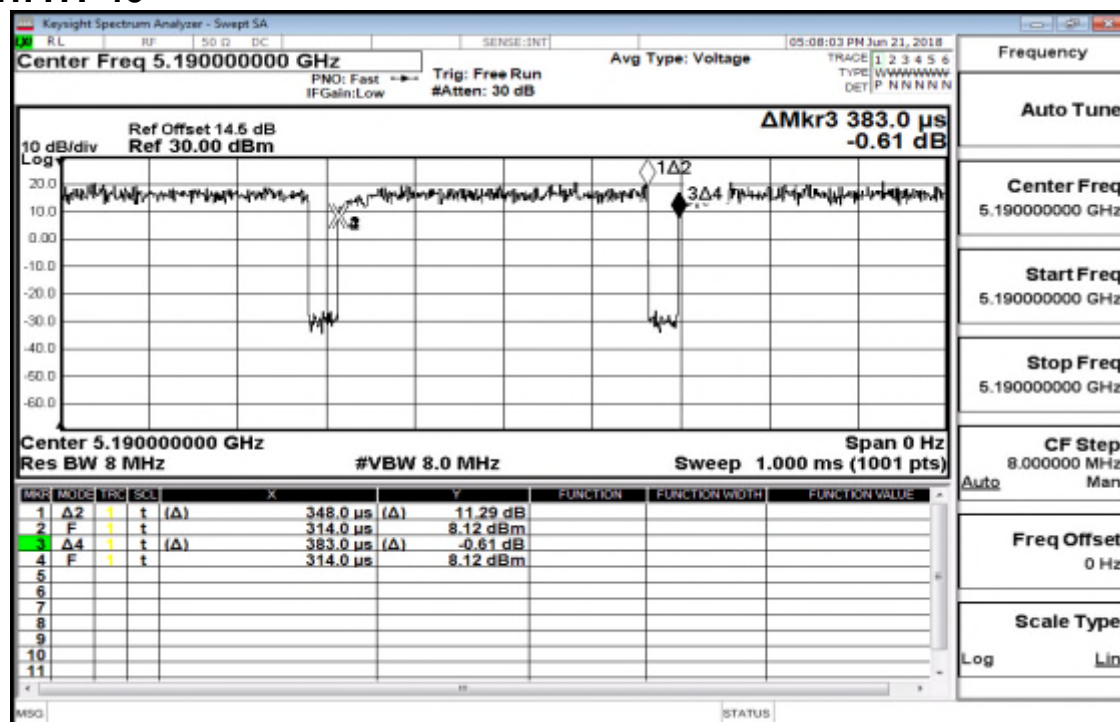
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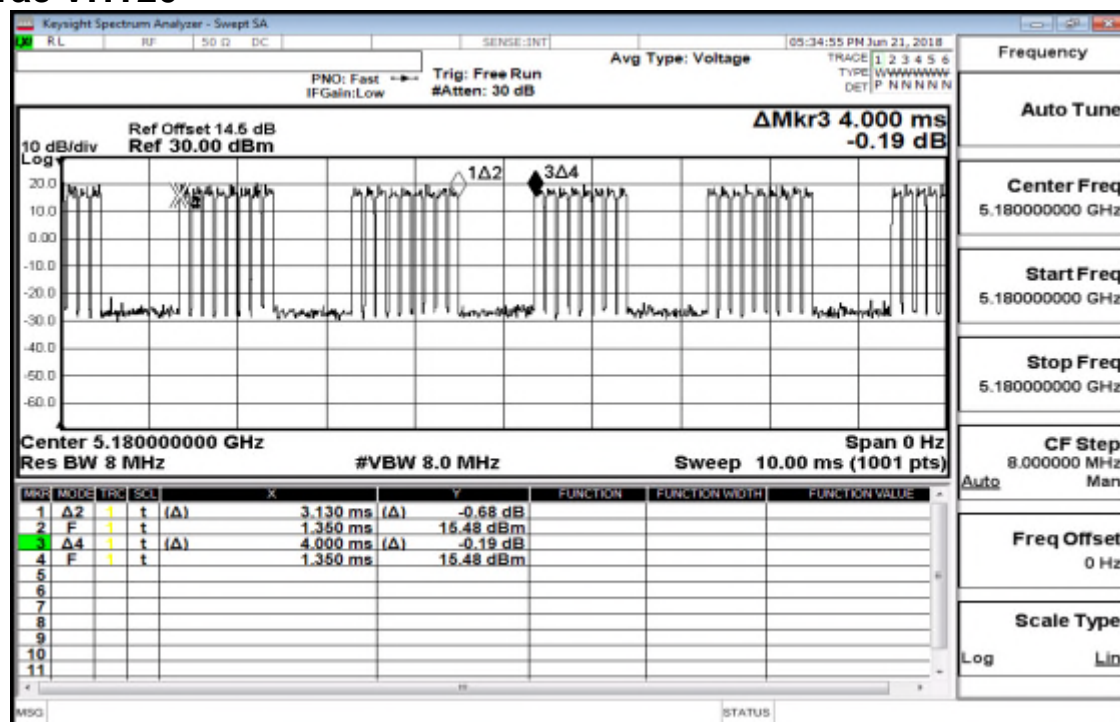
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802.11n HT 40



802.11ac VHT20



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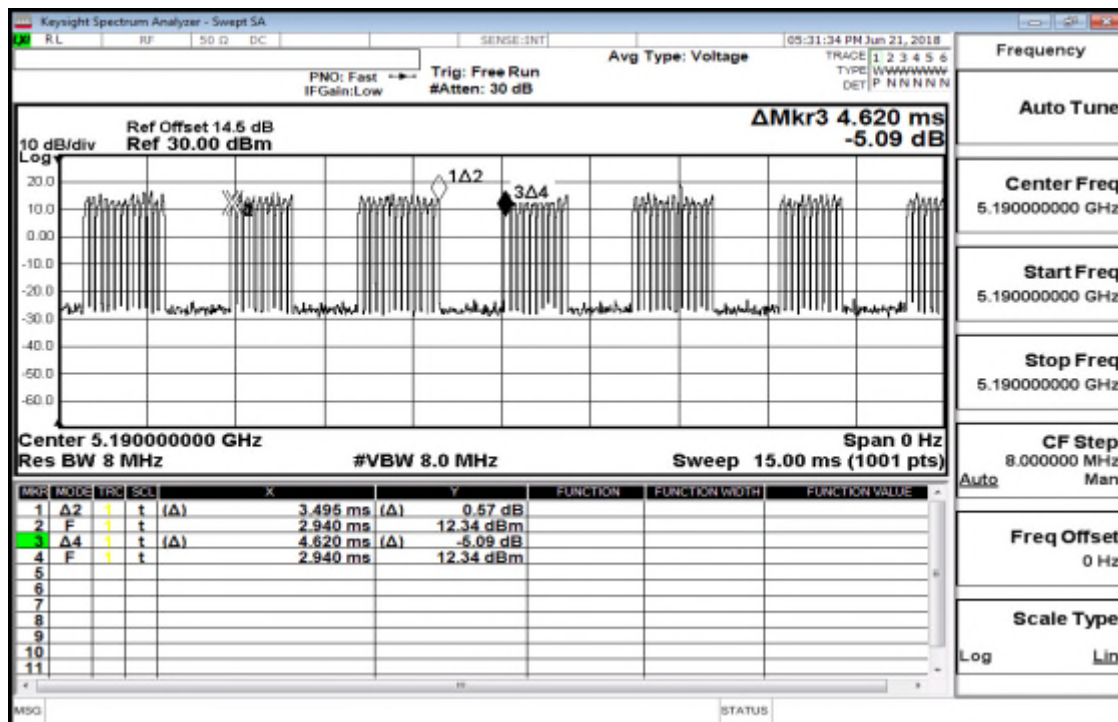
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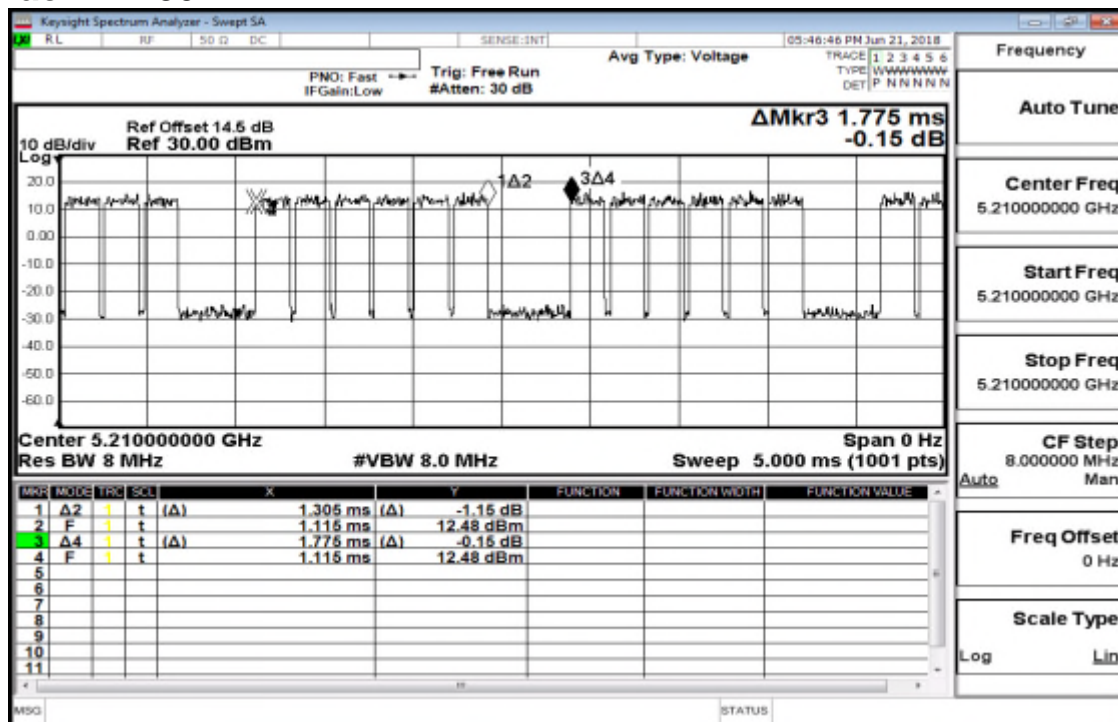
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802.11ac VHT 40



802.11 ac VHT 80



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8 26DB & 6DB EMISSION BANDWIDTH MEASUREMENT

8.1 Standard Applicable

There is no limit bandwidth for U-NII-1, U-NII-2-A and U-NII-2-C.

The minimum of 6dB Bandwidth measurement is 0.5 MHz for U-NII-3

8.2 Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the Antenna port to the spectrum analyzer.
 - a. 26dB Band width Measurement: Set the spectrum analyzer as 1% of emission BW Sweep=auto, Detector = Peak, Trace Mode = Max Hold, Manually readjust RBW until the RBW/EBW ratio is 1% based on EBW as observed on the result of pre-sequence measurement.
 - b. Mark the peak frequency and -26dB (upper and lower) frequency.
4. Repeat the procedures as list above until all test default channels (low, middle, and high) are completed.
5. Minimum Emission Bandwidth for the band 5.725-5.850GHz.
 - a. Set the spectrum analyzer as RBW = 100 kHz, VBW = 3*RBW, Span = 30M/50MHz, Detector=Peak, Sweep=auto
 - b. Mark the peak frequency and -6dB (upper and lower) frequency.
6. For 99% Bandwidth:

Set the spectrum analyzer as RBW=1%, VBW = 3*RBW, Span = 30M/50MHz, Detector=Sample, Sweep=auto.
7. Turn on the 99% bandwidth function, max reading.
8. Repeat above procedures until all frequency of interest measured was complete.

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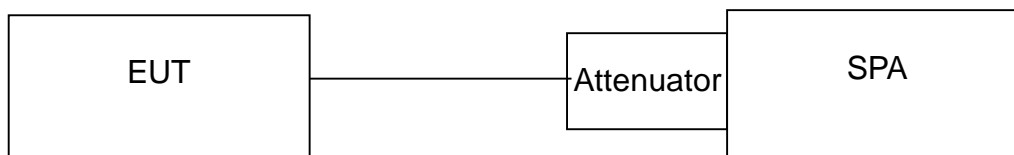
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8.3 Measurement Equipment Used

SGS Conducted Room					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Spectrum Analyzer	Agilent	N9010A	MY51440113	2018/06/20	2019/06/19
DC Power Supply	Agilent	E3640A	MY53130054	2017/09/04	2018/09/03
DC Power Supply	Agilent	E3640A	MY53130054	2018/09/02	2019/09/01
DC Block	PASTERNAK	PE8210	RF29	2017/12/26	2018/12/25
Attenuator	Marvelous	MVE2213-10	RF30	2017/12/26	2018/12/25
Notebook	Lenovo	T420	S0012599	N/A	N/A

8.4 Test Set-up



8.5 Measurement Result

26dB Bandwidth

802.11a_Main			802.11a_Aux1		
Frequency (MHz)	26dB BW (MHz)	10 Log (B) (dB)	Frequency (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5180	18.83	12.749	5180	18.65	12.707
5220	18.77	12.735	5220	18.43	12.655
5240	19.12	12.815	5240	18.74	12.728
5260	18.98	12.783	5260	19.32	12.860
5300	18.79	12.739	5300	18.79	12.739
5320	19.03	12.794	5320	18.80	12.742
5500	19.00	12.788	5500	18.77	12.735
5580	18.97	12.781	5580	19.04	12.797
5700	19.13	12.817	5700	19.04	12.797
5720(U-NII 2C)	12.98	11.133	5720(U-NII 2C)	12.56	10.990
5720 (U-NII 3)	3.68	5.658	5720 (U-NII 3)	3.56	5.514

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802.11n_HT20_Main

Frequency (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5180	19.57	12.916
5220	19.32	12.860
5240	19.34	12.865
5260	19.44	12.887
5300	19.36	12.869
5320	19.38	12.874
5500	19.62	12.927
5580	19.39	12.876
5700	19.52	12.905
5720(U-NII 2C)	11.58	10.637
5720 (U-NII 3)	3.55	5.502

802.11n_HT20_Aux1

Frequency (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5180	19.32	12.860
5220	19.31	12.858
5240	19.32	12.860
5260	19.32	12.860
5300	19.33	12.862
5320	19.34	12.865
5500	19.54	12.909
5580	19.30	12.856
5700	19.31	12.858
5720(U-NII 2C)	10.75	10.314
5720 (U-NII 3)	3.30	5.185

802.11n_HT40_Main

Frequency (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5190	39.07	15.918
5230	39.07	15.918
5270	38.58	15.864
5310	39.06	15.917
5510	39.78	15.997
5550	39.31	15.945
5670	44.75	16.508
5710 (U-NII 2C)	30.57	14.853
5710 (U-NII 3)	3.66	5.635

802.11n_HT40_Aux1

Frequency (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5190	38.61	15.867
5230	38.84	15.893
5270	38.64	15.870
5310	38.81	15.889
5510	38.88	15.897
5550	38.93	15.903
5670	40.10	16.031
5710 (U-NII 2C)	30.26	14.809
5710 (U-NII 3)	3.63	5.599

802.11ac_VHT80_Main

Frequency (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5210	77.67	18.903
5290	78.06	18.924
5530	78.32	18.939
5610	78.27	18.936
5690 (U-NII 2C)	73.61	18.669
5690 (U-NII 3)	4.44	6.474

802.11ac_VHT80_Aux1

Frequency (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5210	77.76	18.908
5290	77.97	18.919
5530	78.11	18.927
5610	78.19	18.932
5690 (U-NII 2C)	73.50	18.663
5690 (U-NII 3)	4.43	6.464

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802.11a_Main

Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5745	15.76	11.976
5785	16.10	12.068
5825	16.31	12.125

802.11a_Aux1

Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5745	15.73	11.967
5785	15.71	11.962
5825	16.30	12.122

802.11n_HT20_Main

Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5745	15.93	12.022
5785	16.05	12.055
5825	16.32	12.127

802.11n_HT20_Aux1

Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5745	15.60	11.931
5785	15.13	11.798
5825	16.04	12.052

802.11n_HT40_Main

Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5755	35.15	15.459
5795	35.08	15.451

802.11n_HT40_Aux1

Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5755	34.71	15.405
5795	35.15	15.459

802.11ac_VHT80_Main

Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5775	75.79	18.796

802.11ac_VHT80_Aux1

Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5775	75.24	18.764

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99% BW Verification of DFS Function

802.11a_Main

Frequency (MHz)	Measured Frequency (MHz)	Limit (MHz)
5240	5248.10	< 5250
5745	5736.42	> 5725

802.11a_Aux1

Frequency (MHz)	Measured Frequency (MHz)	Limit (MHz)
5240	5248.10	< 5250
5745	5736.45	> 5725

802.11n_HT20_Main

Frequency (MHz)	Measured Frequency (MHz)	Limit (MHz)
5240	5248.67	< 5250
5745	5735.79	> 5725

802.11n_HT20_Aux1

Frequency (MHz)	Measured Frequency (MHz)	Limit (MHz)
5240	5248.67	< 5250
5745	5735.94	> 5725

802.11n_HT40_Main

Frequency (MHz)	Measured Frequency (MHz)	Limit (MHz)
5230	5247.95	< 5250
5755	5736.80	> 5725

802.11n_HT40_Aux1

Frequency (MHz)	Measured Frequency (MHz)	Limit (MHz)
5230	5247.90	< 5250
5755	5736.80	> 5725

802.11ac_VHT80_Main

Frequency (MHz)	Measured Frequency (MHz)	Limit (MHz)
5210	5247.80	< 5250
5775	5736.80	> 5725

802.11n_HT80_Aux1

Frequency (MHz)	Measured Frequency (MHz)	Limit (MHz)
5210	5247.80	< 5250
5775	5737.10	> 5725

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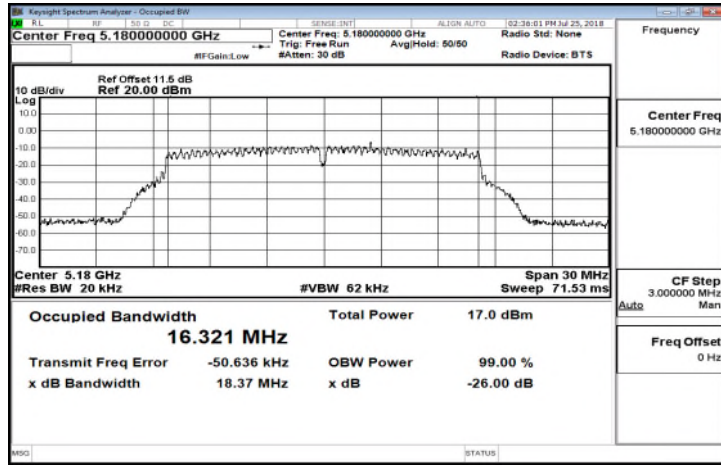
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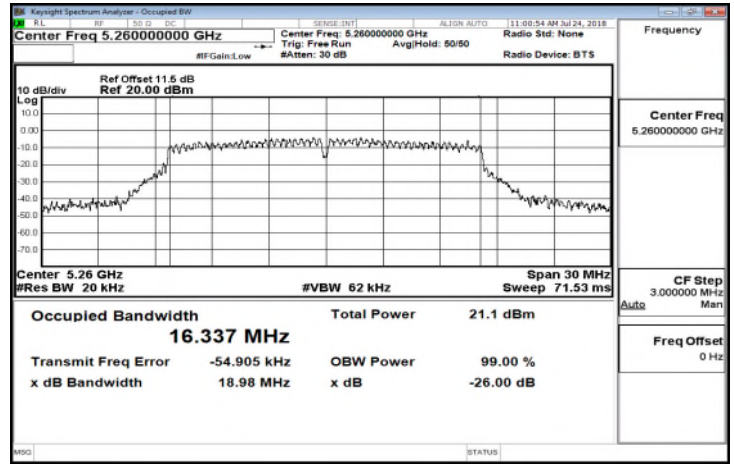
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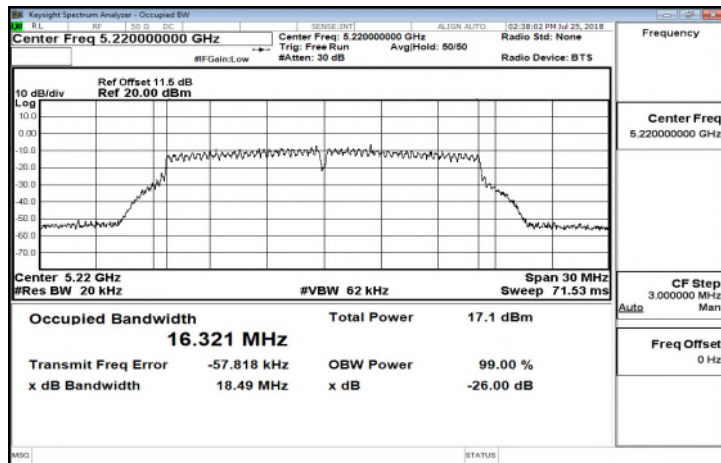
802.11a (Main) 5180MHz



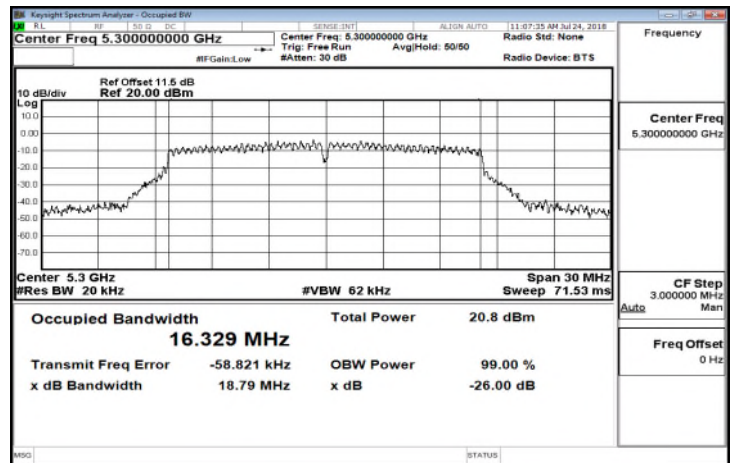
5260MHz



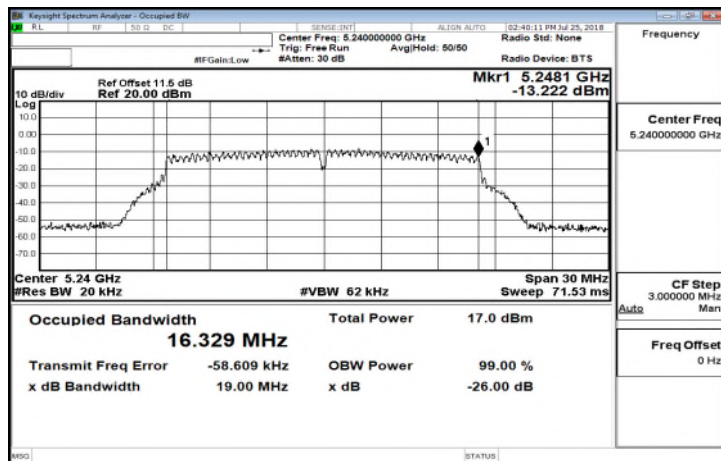
5220MHz



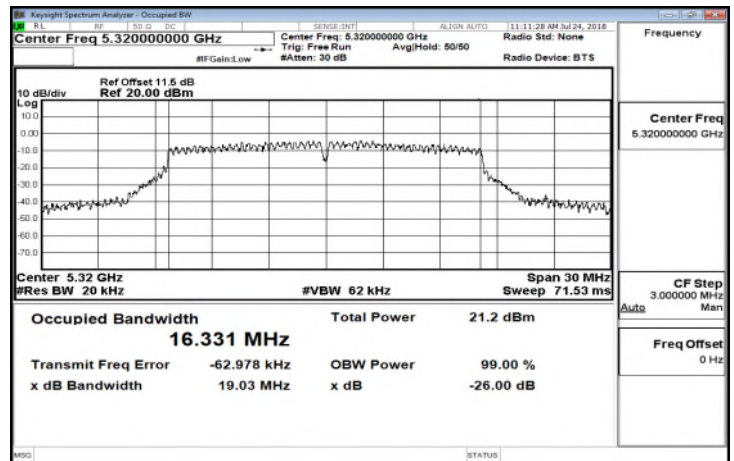
5300MHz



5240MHz



5320MHz

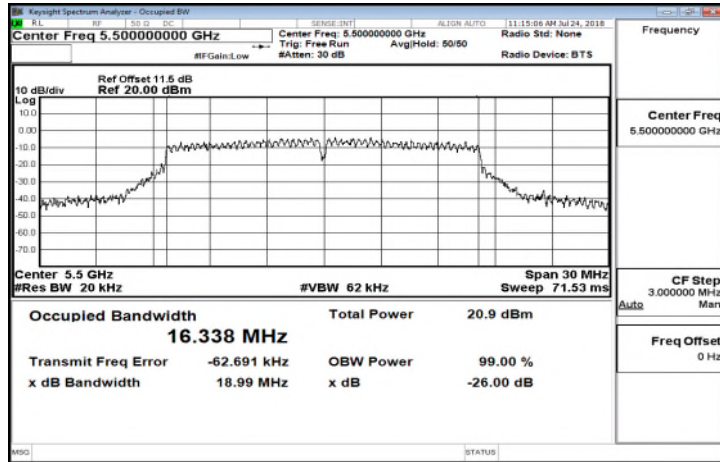


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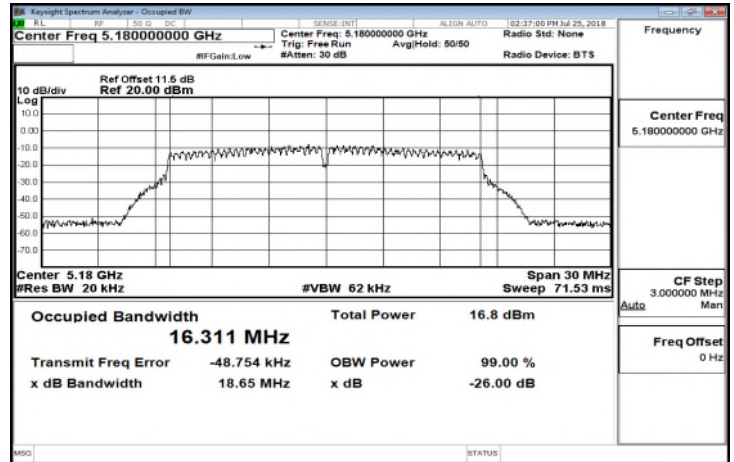
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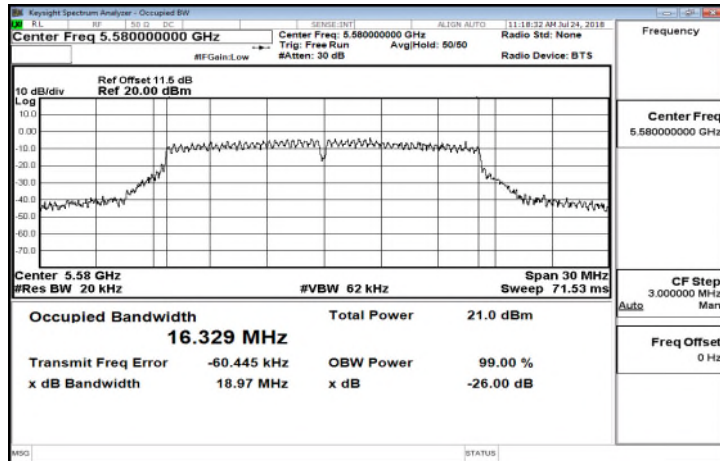
5500MHz



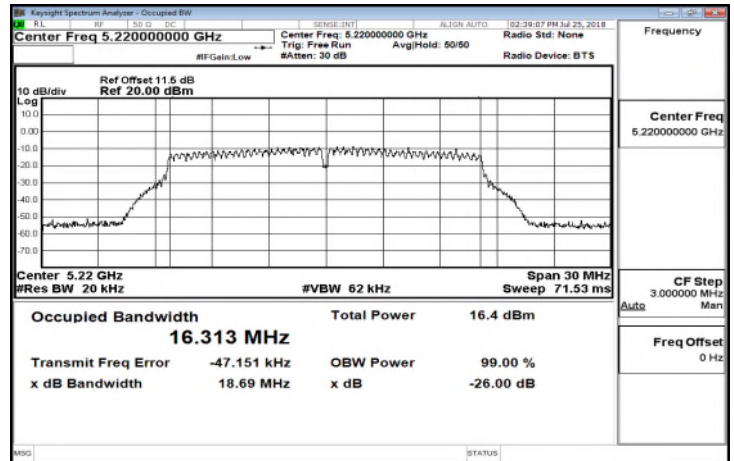
802.11a (Aux1) 5180MHz



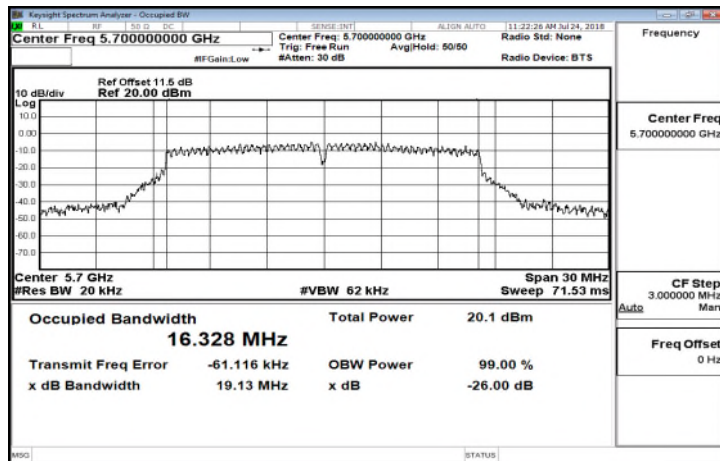
5580MHz



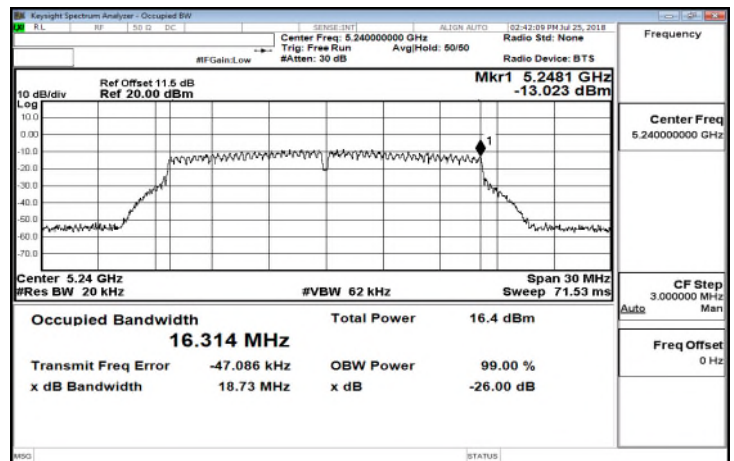
5220MHz



5700MHz



5240MHz

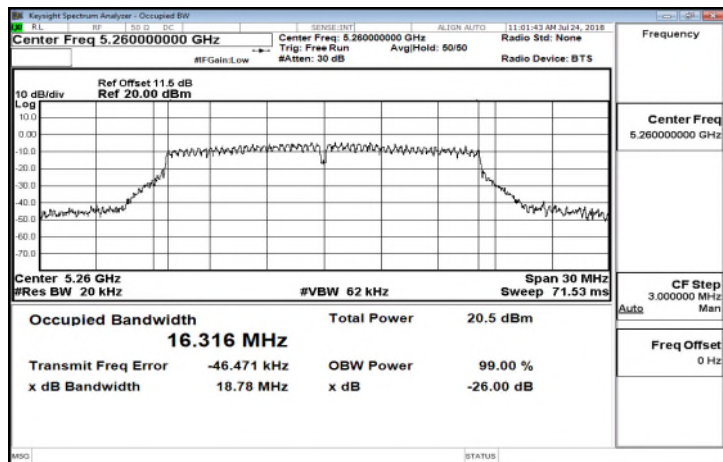


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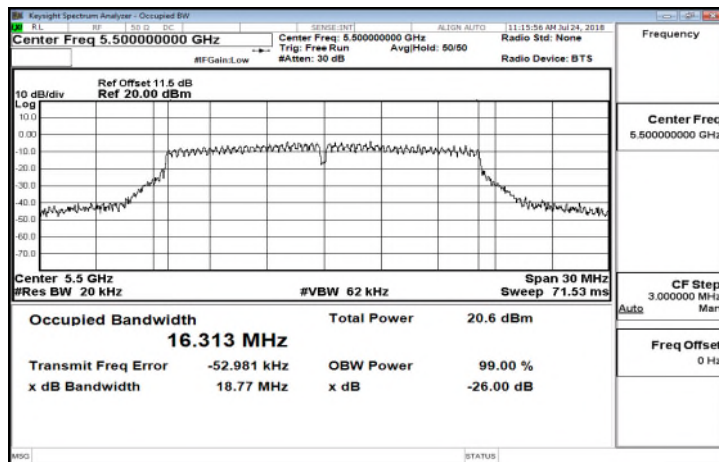
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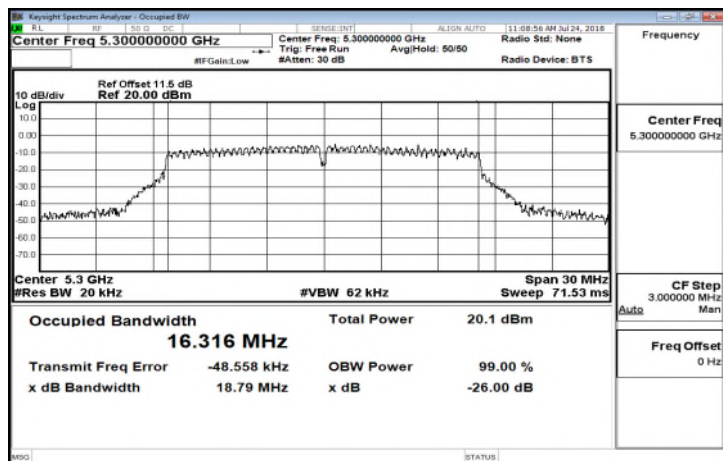
5260MHz



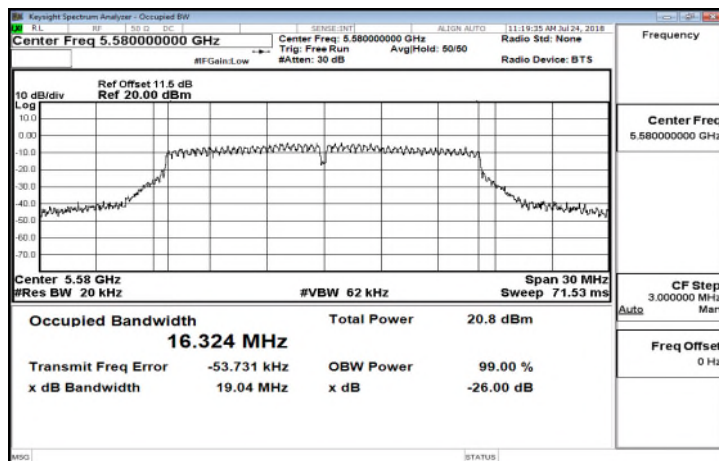
5500MHz



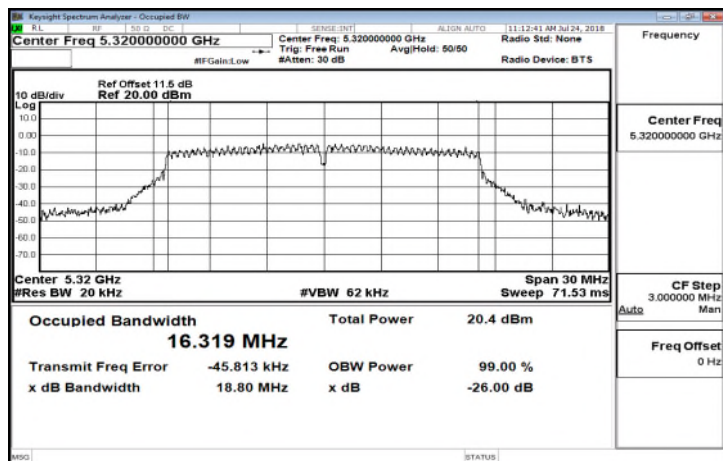
5300MHz



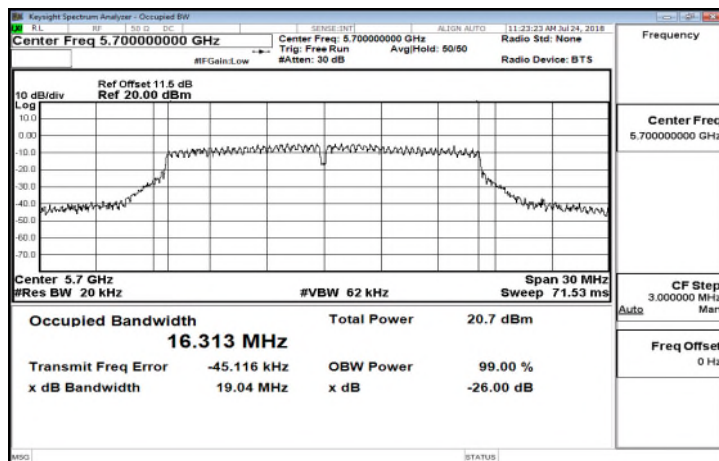
5580MHz



5320MHz



5700MHz

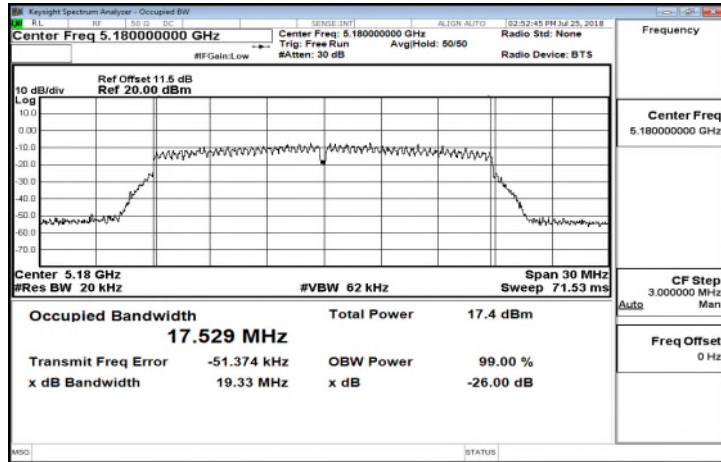


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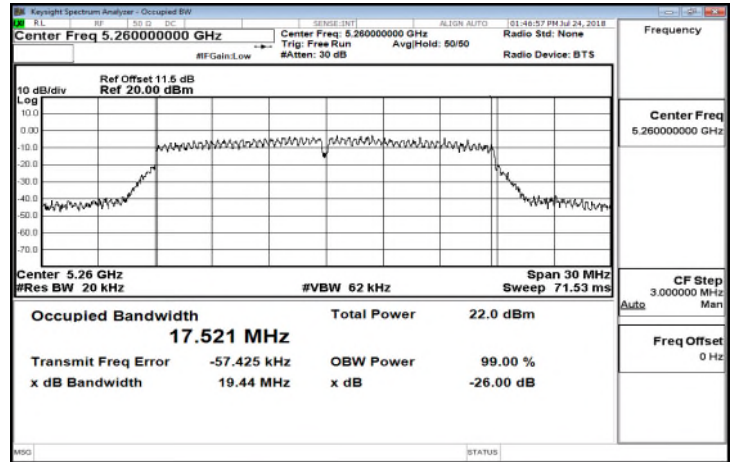
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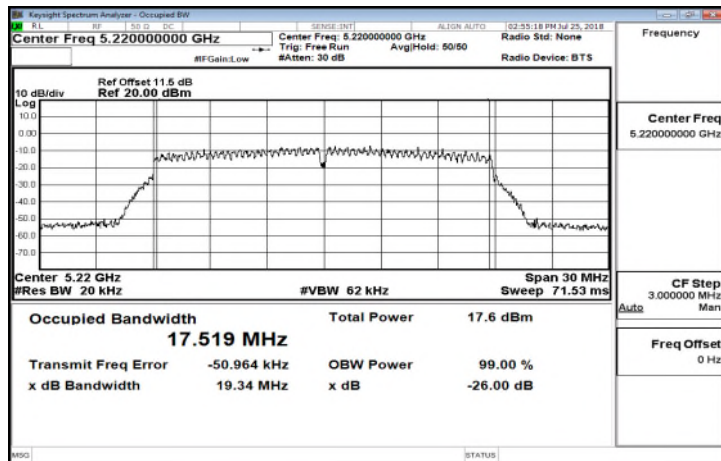
802.11n HT20 (Main) 5180 MHz



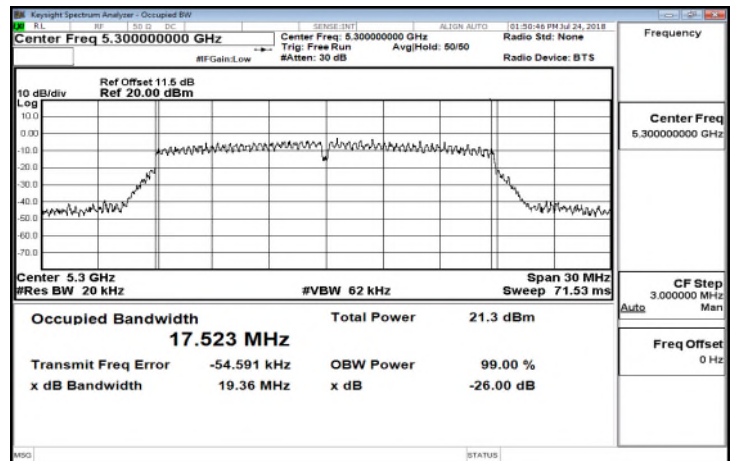
5260 MHz



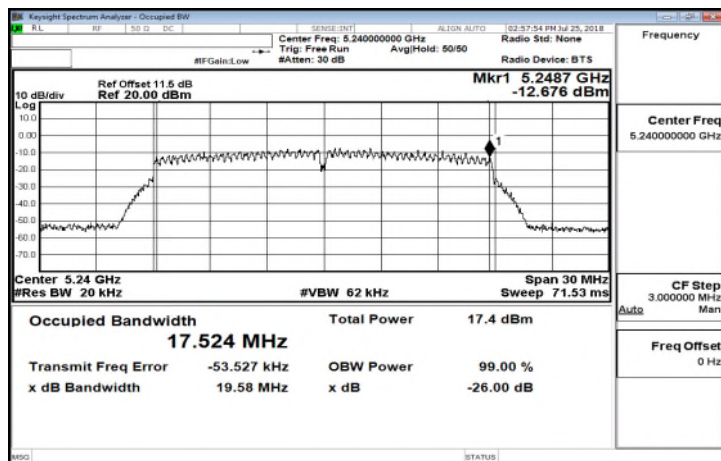
5220 MHz



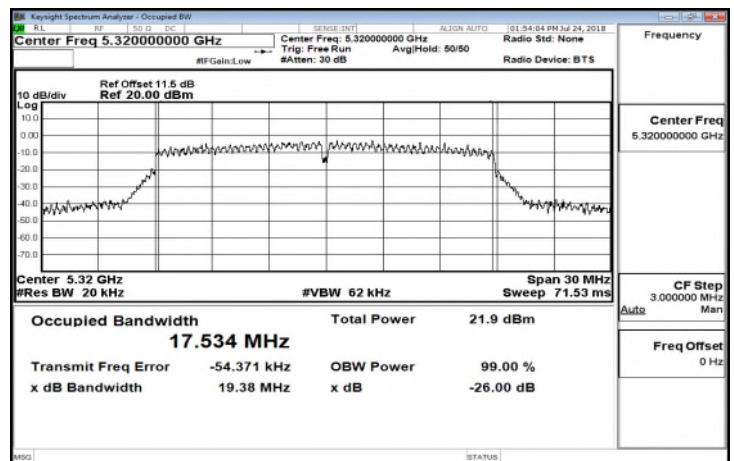
5300 MHz



5240 MHz



5320 MHz

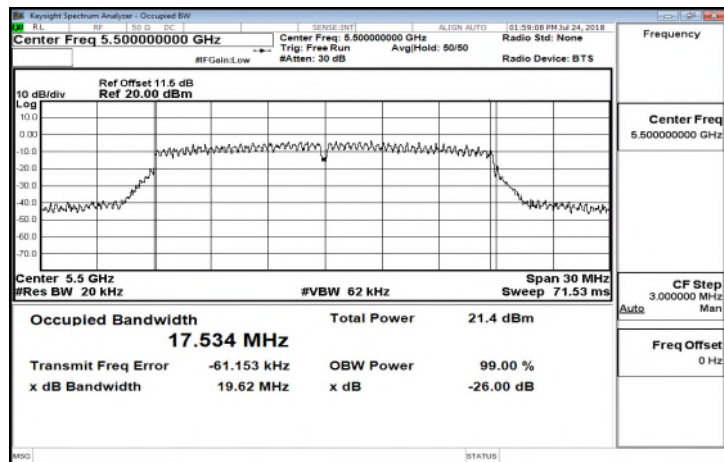


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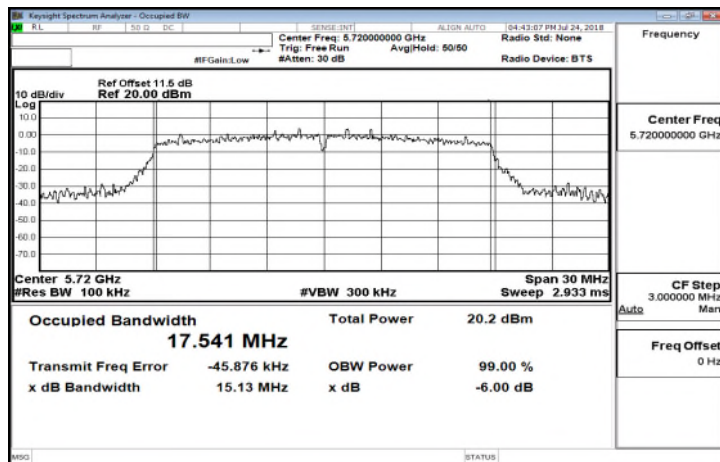
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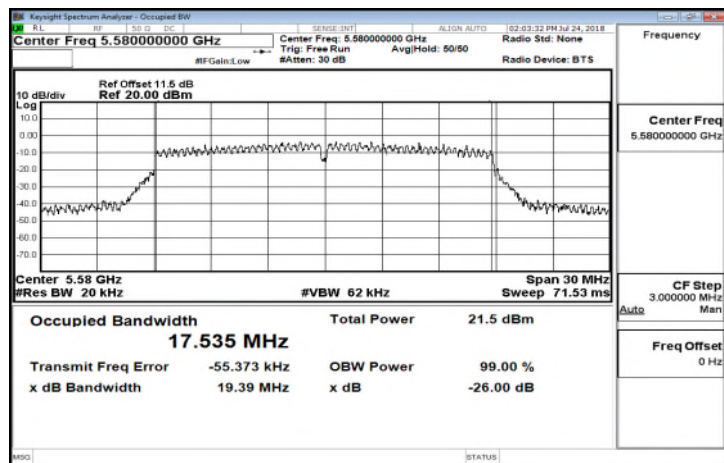
5500 MHz



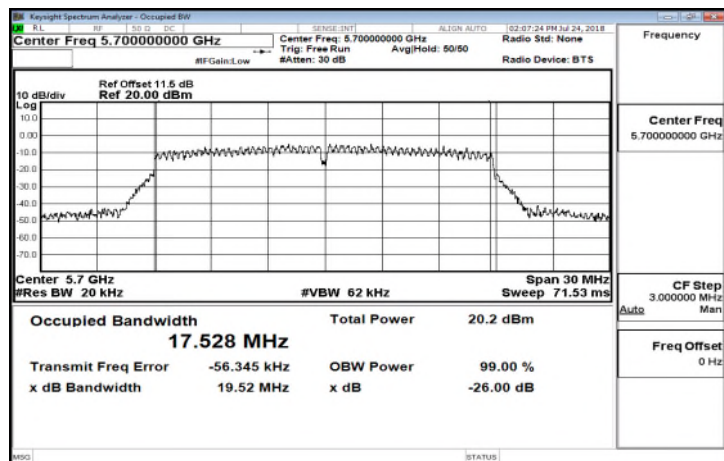
5720 MHz



5580 MHz



5700 MHz

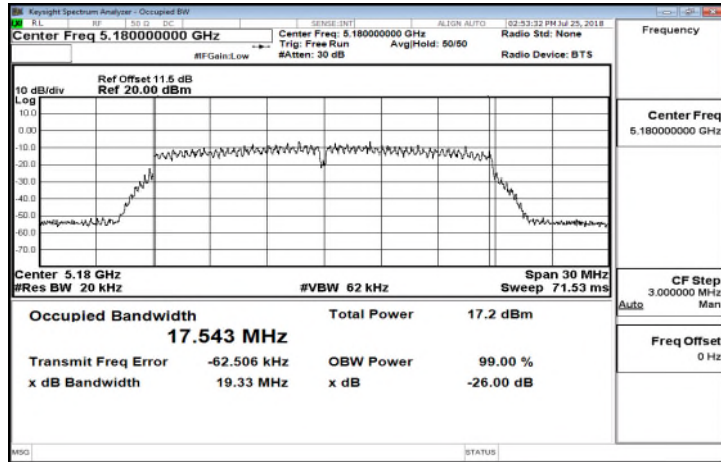


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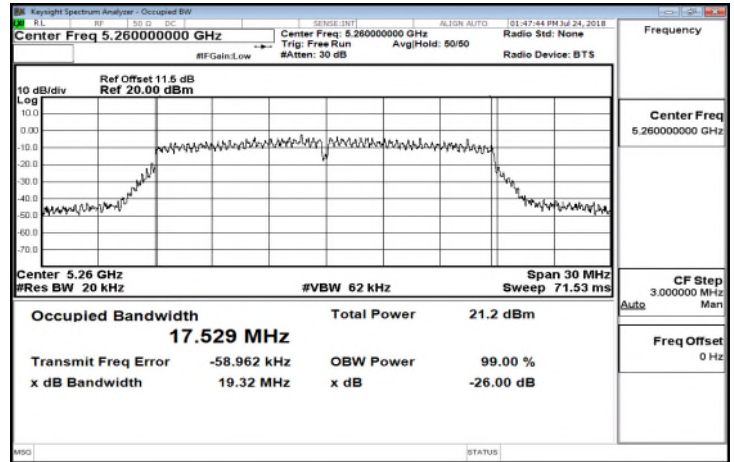
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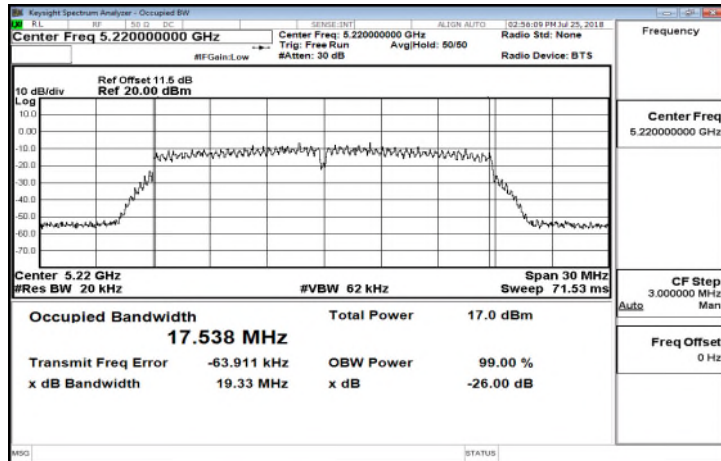
802.11n HT20 (Aux1) 5180 MHz



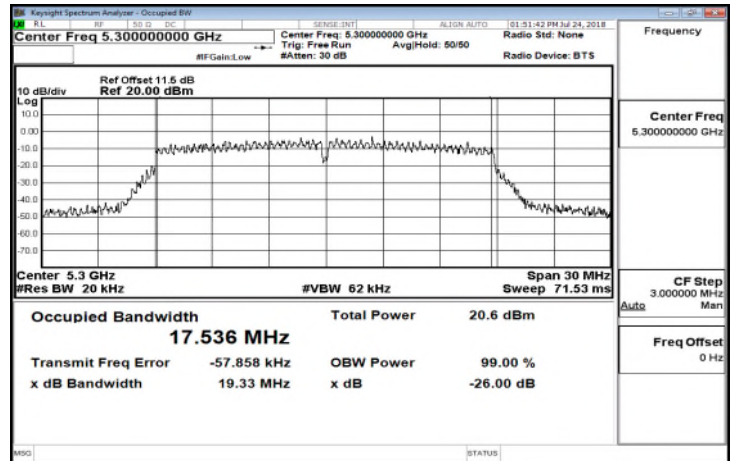
5260 MHz



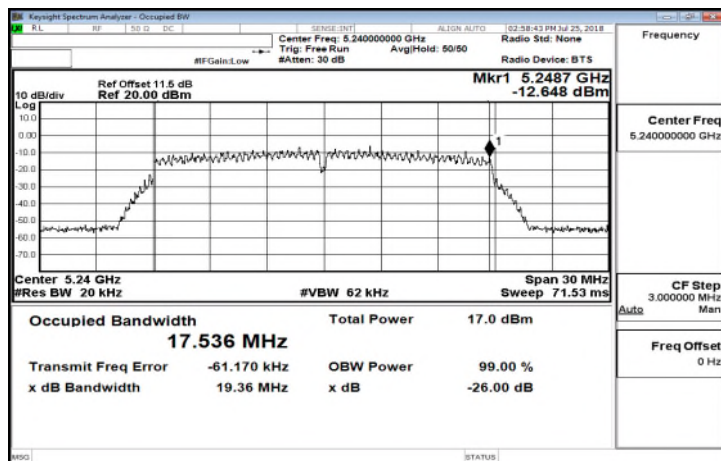
5220 MHz



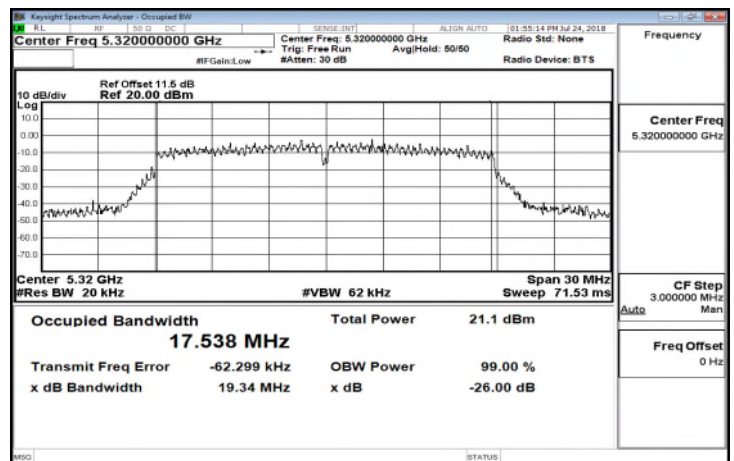
5300 MHz



5240 MHz



5320 MHz

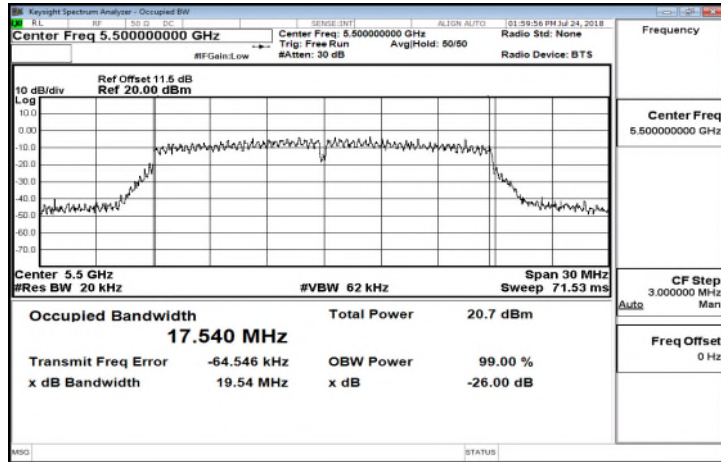


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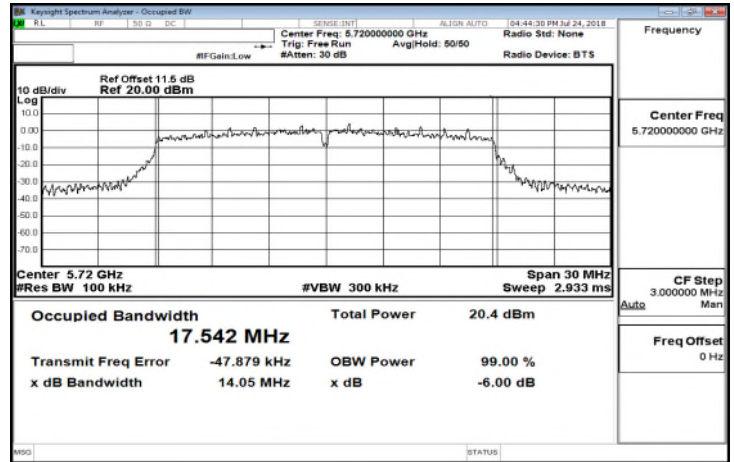
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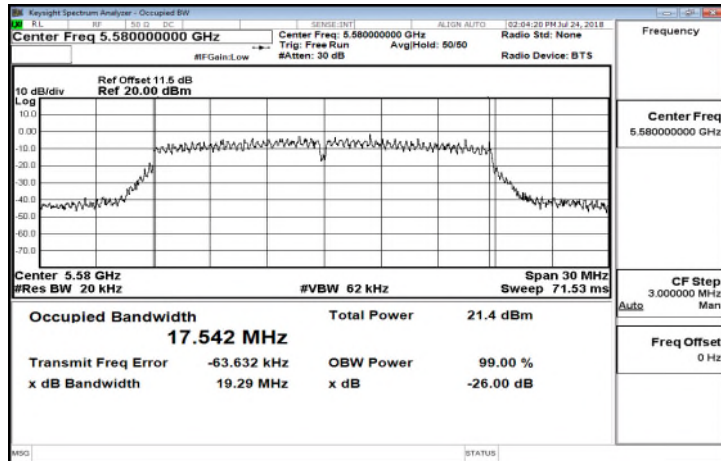
5500 MHz



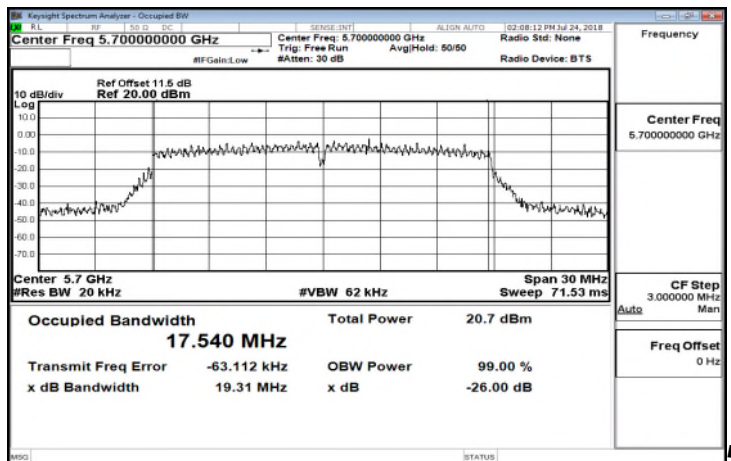
5720 MHz



5580 MHz



5700 MHz



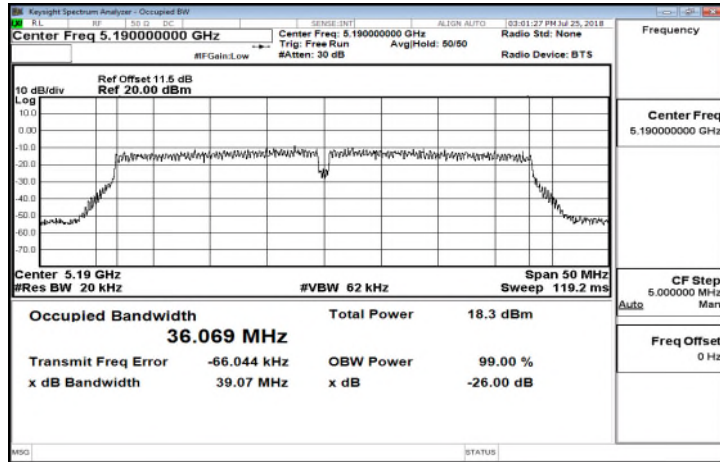
5

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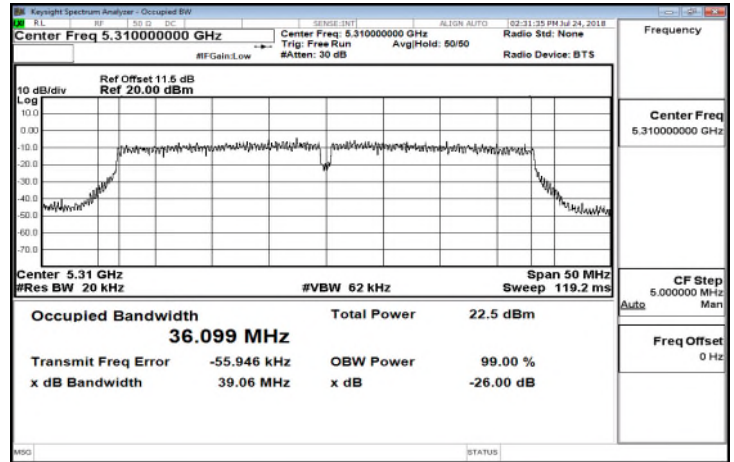
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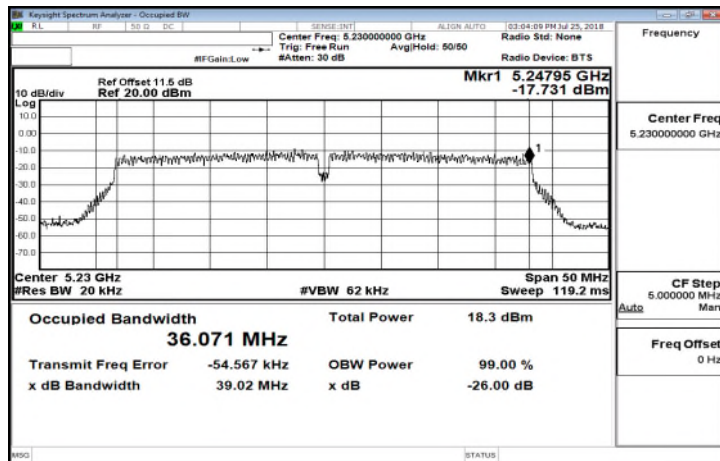
802.11n HT40 (Main) 5190 MHz



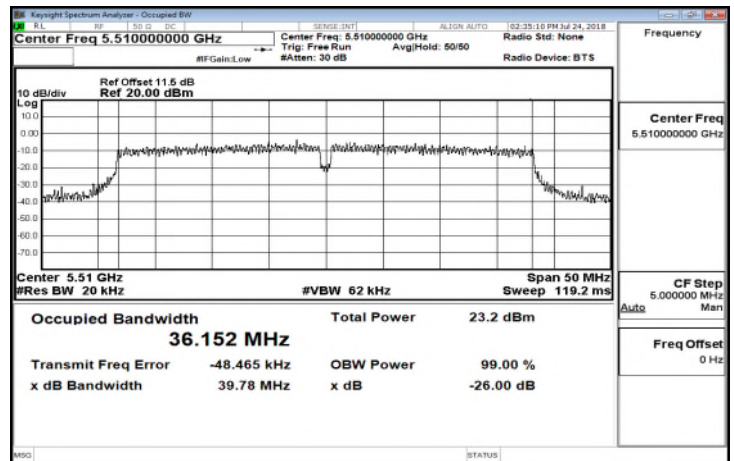
5310MHz



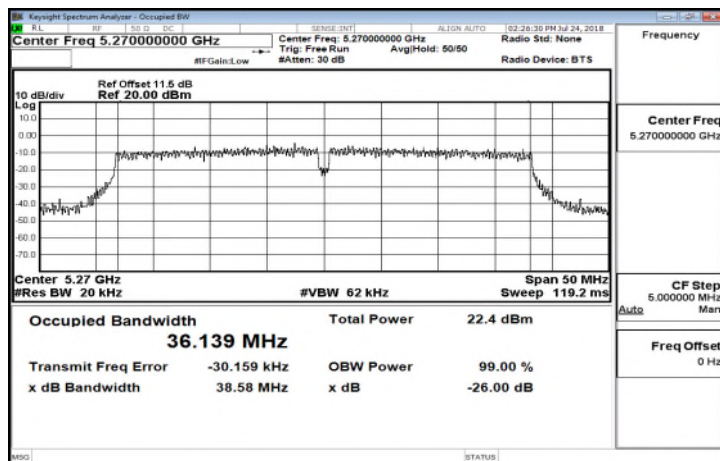
5230 MHz



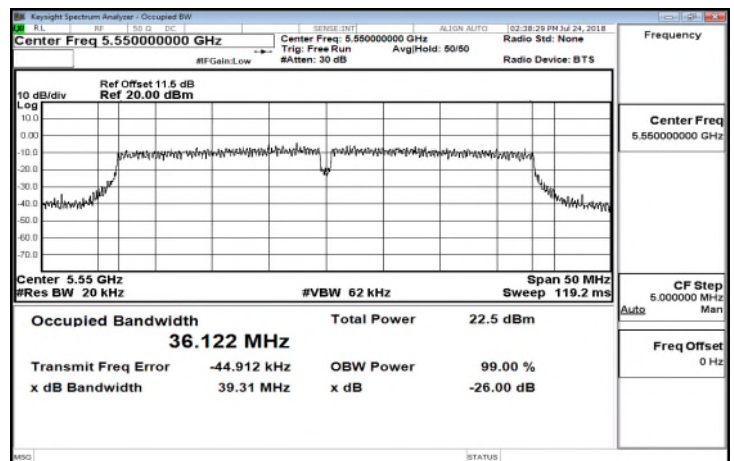
5510 MHz



5270 MHz



5550 MHz

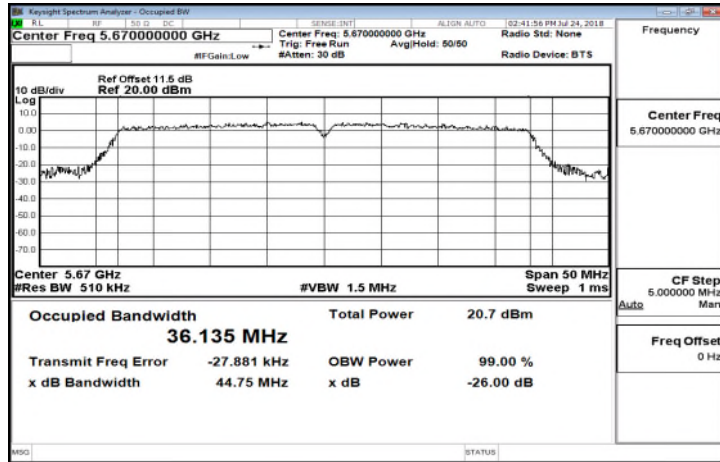


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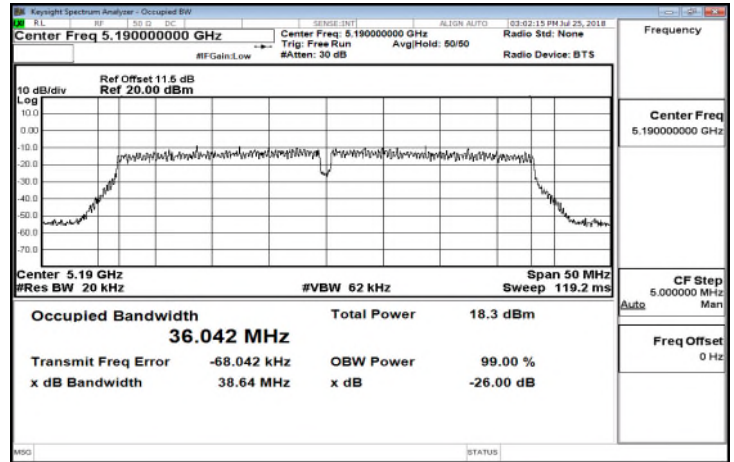
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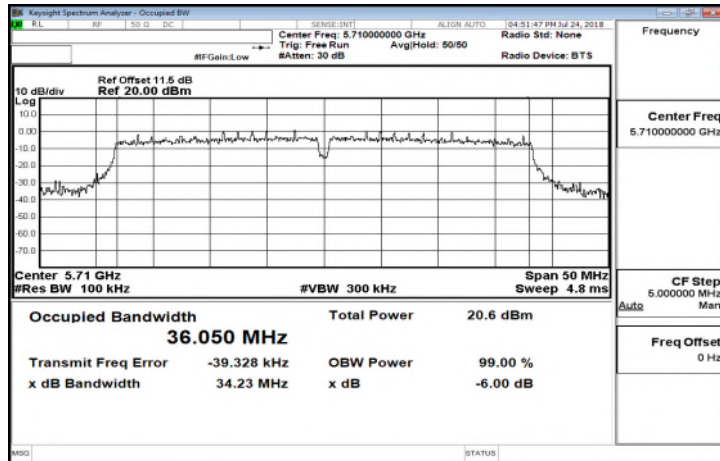
5670 MHz



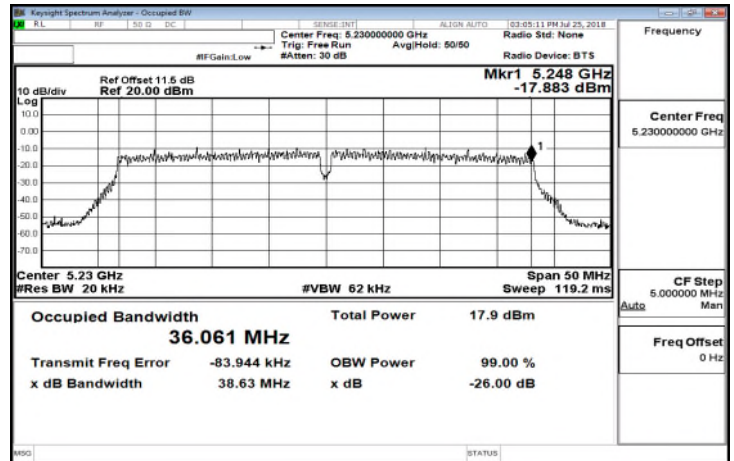
802.11n HT40 (Aux1) 5190 MHz



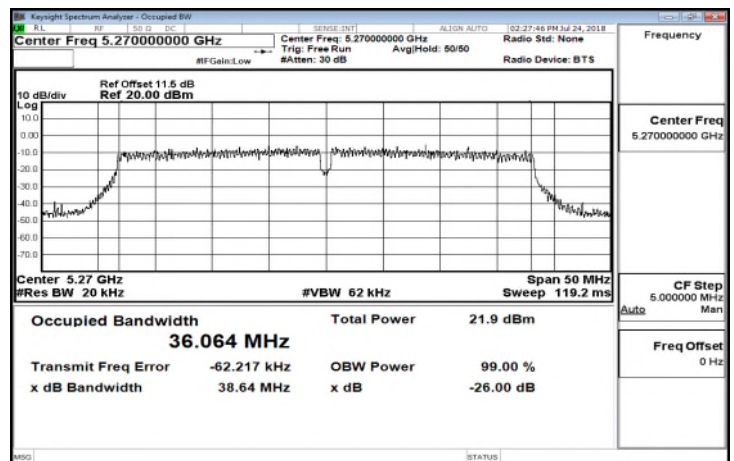
5710 MHz



5230 MHz



5270 MHz

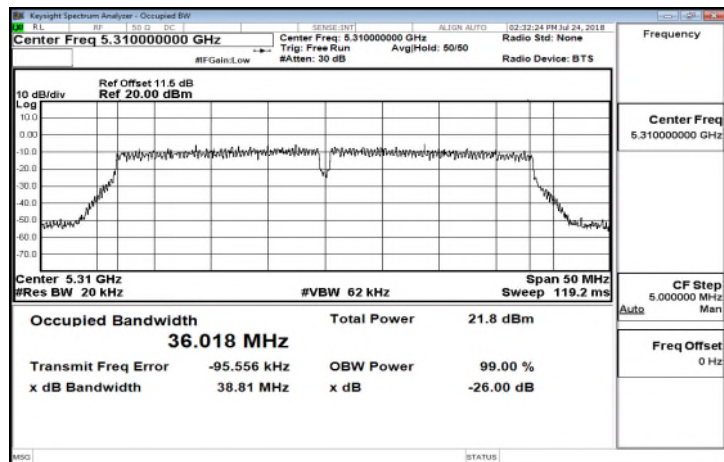


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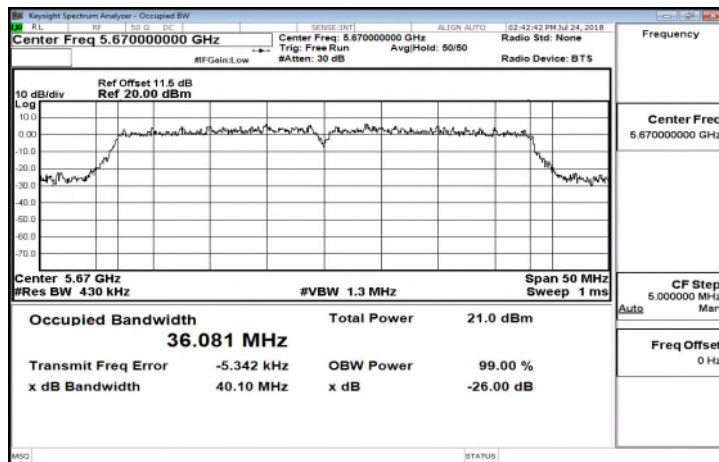
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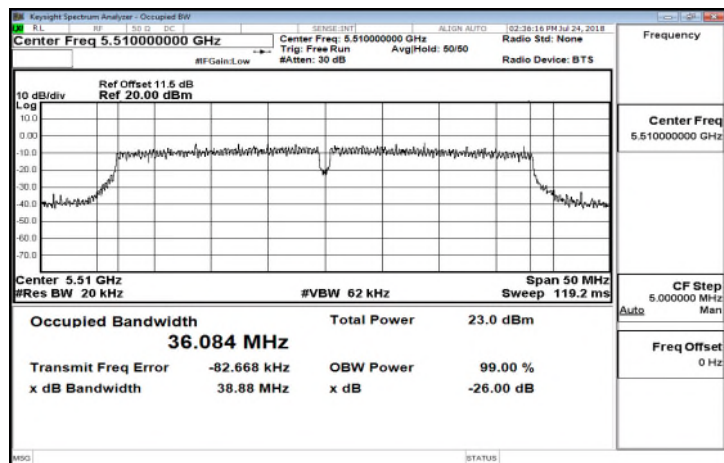
5310MHz



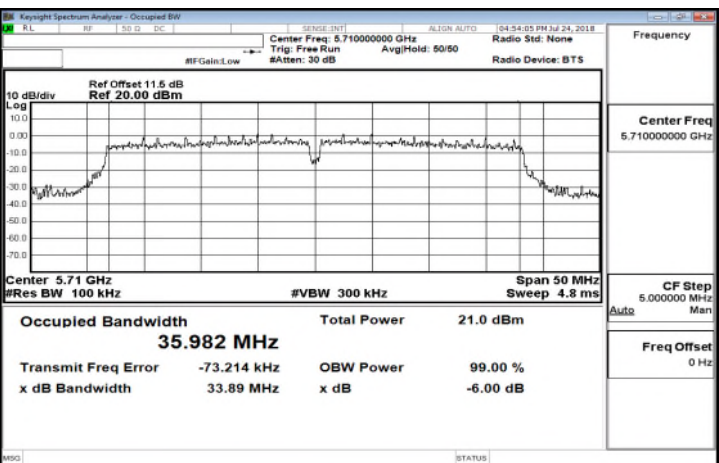
5670 MHz



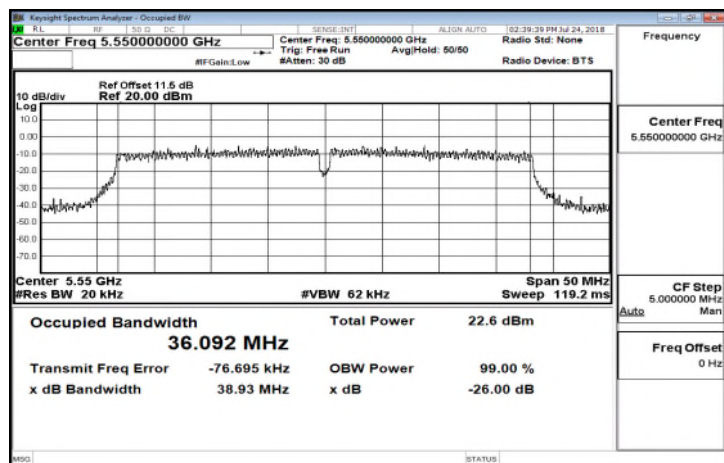
5510 MHz



5710 MHz



5550 MHz

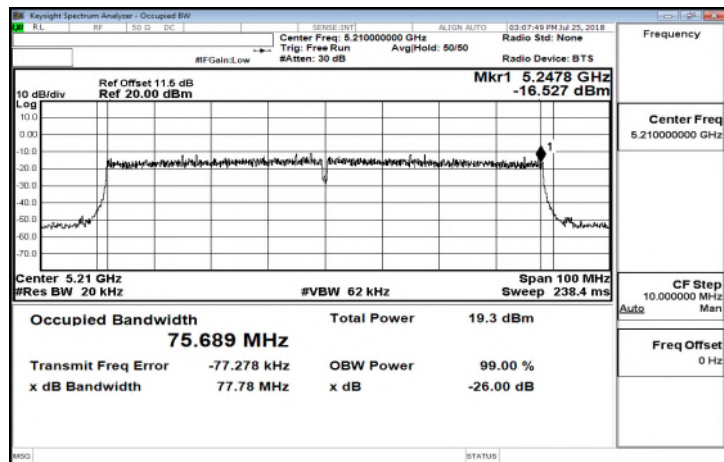


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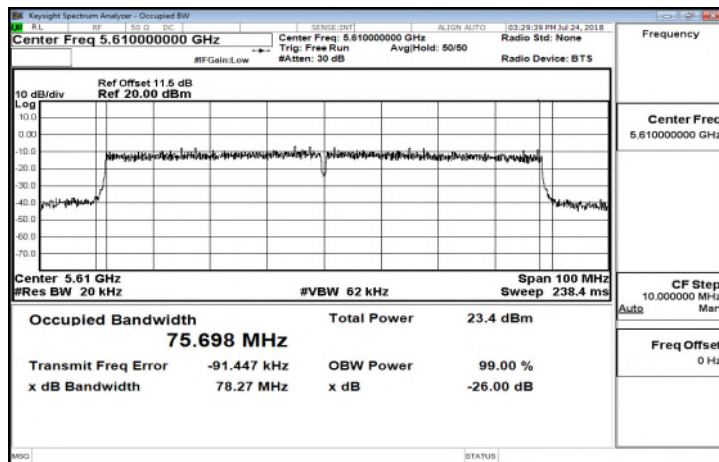
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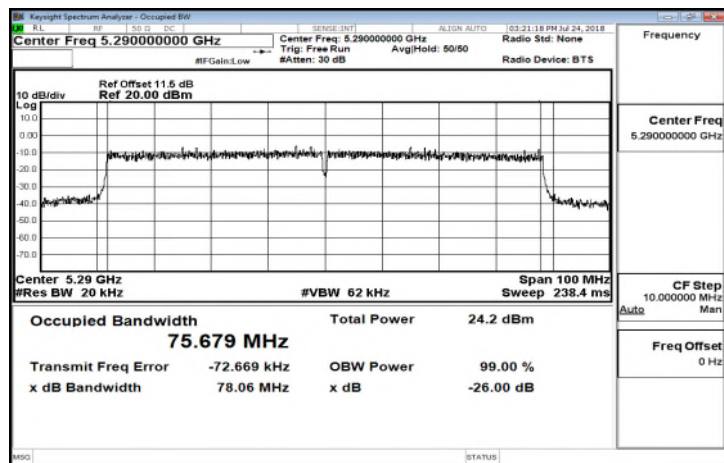
802.11ac VHT80 (Main) 5210 MHz



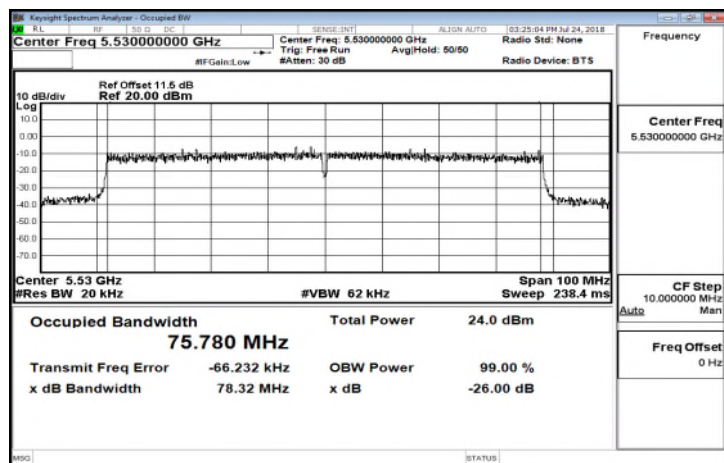
5610 MHz



5290 MHz



5530 MHz

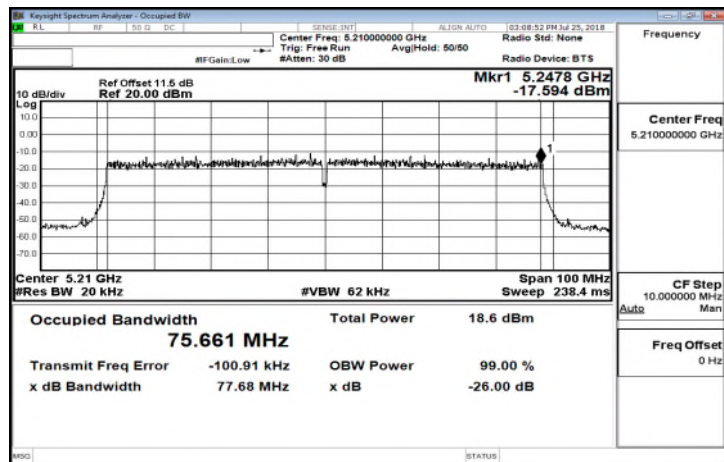


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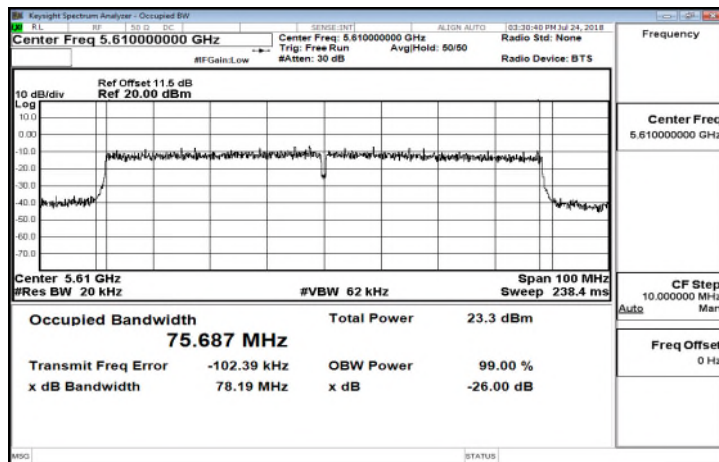
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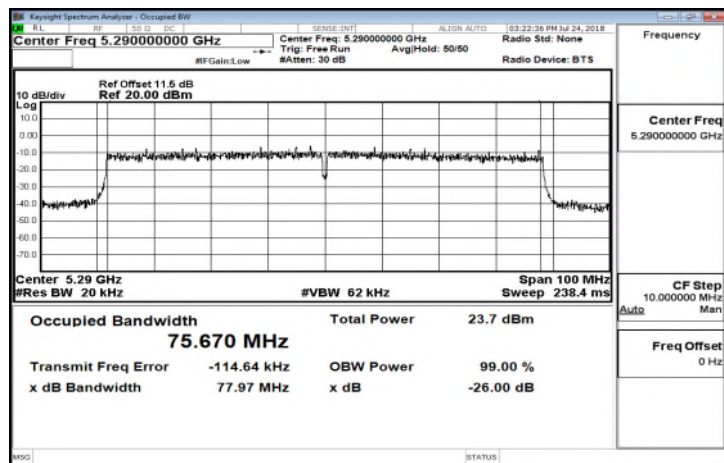
802.11ac VHT80 (Aux1) 5210 MHz



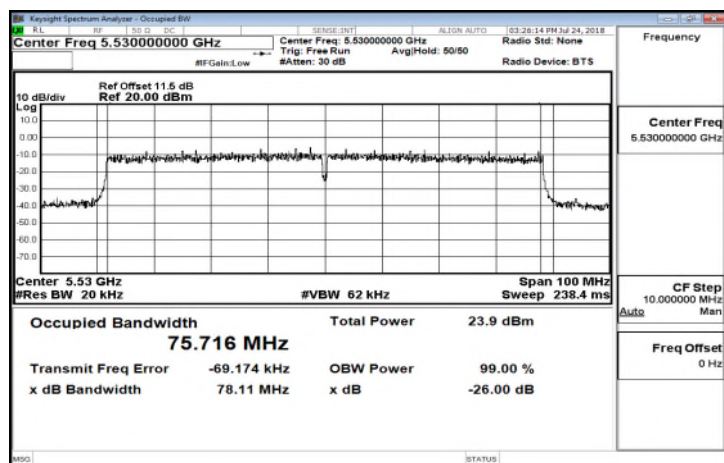
5610 MHz



5290 MHz



5530 MHz

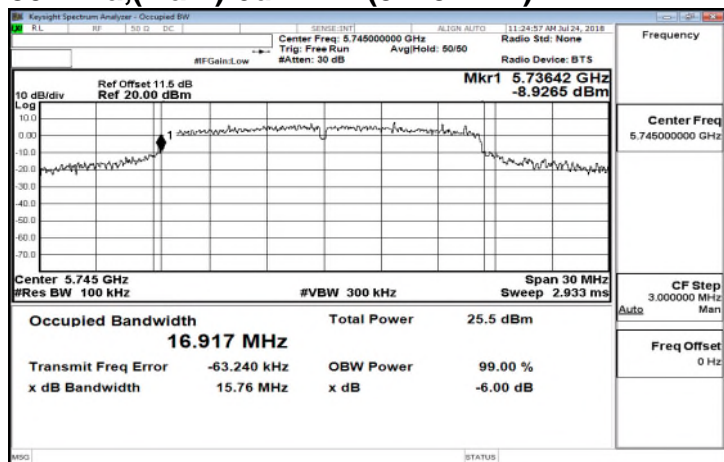


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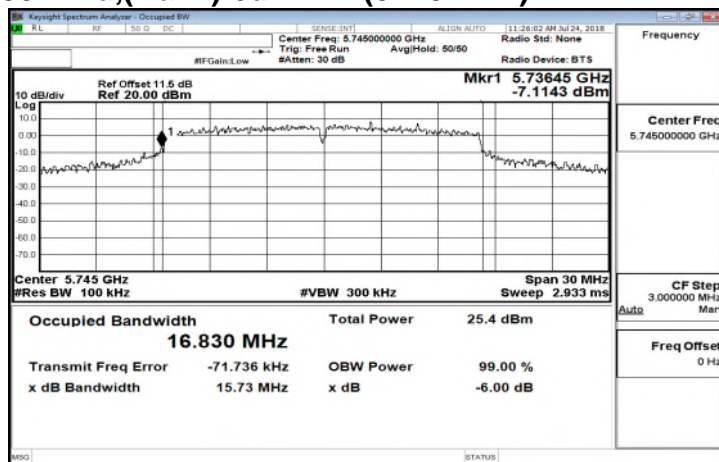
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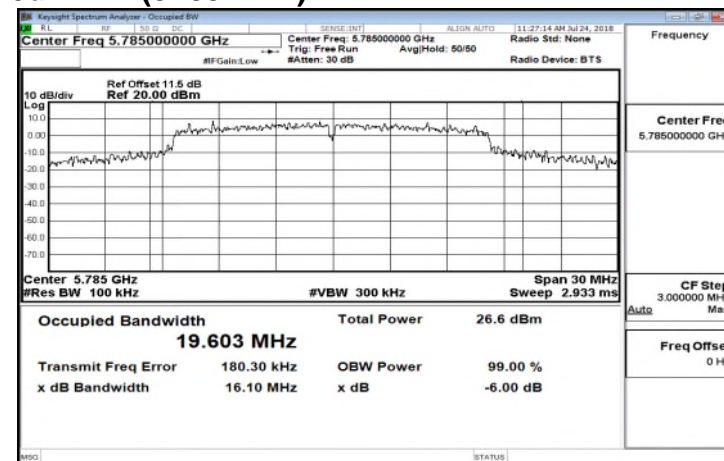
6dB Band Width measure with Peak detector for FCC 802.11a,(Main) 6dB BW (5745 MHz)



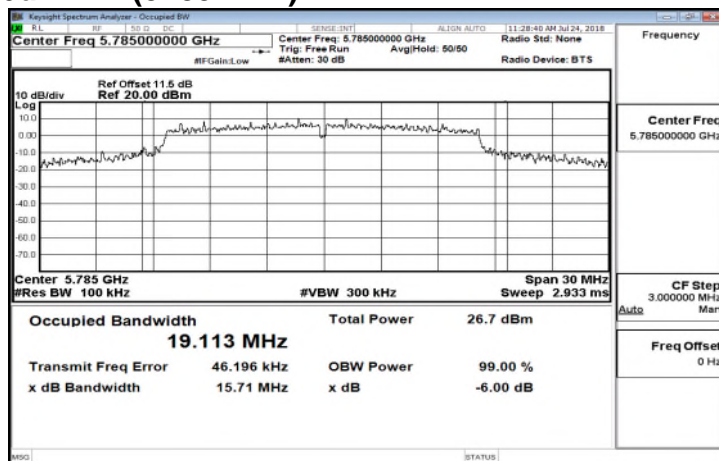
802.11a,(Aux1) 6dB BW (5745 MHz)



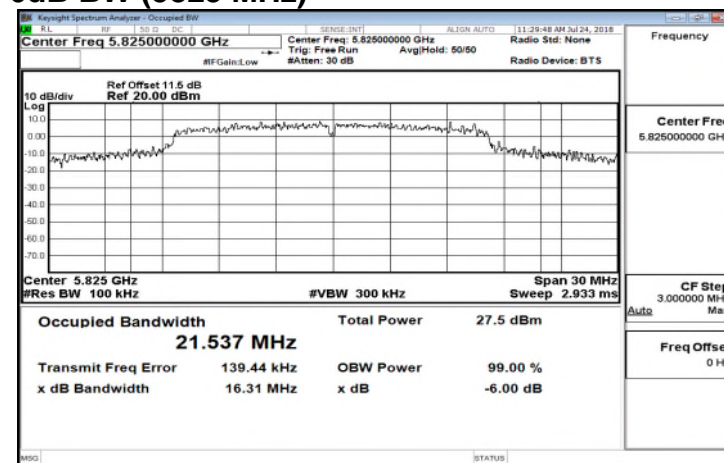
6dB BW (5785 MHz)



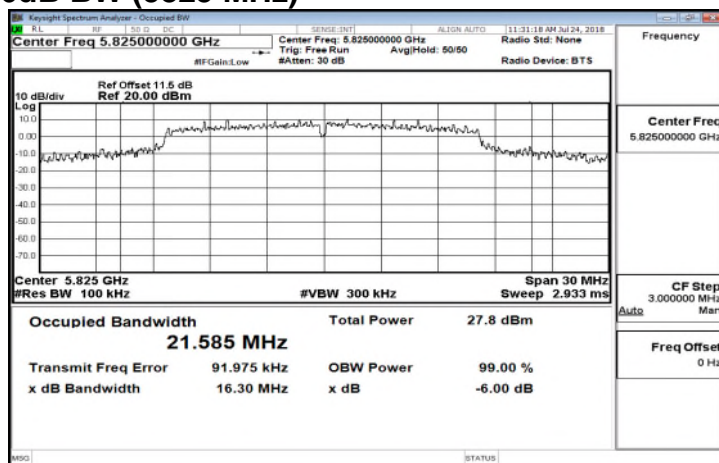
6dB BW (5785 MHz)



6dB BW (5825 MHz)



6dB BW (5825 MHz)

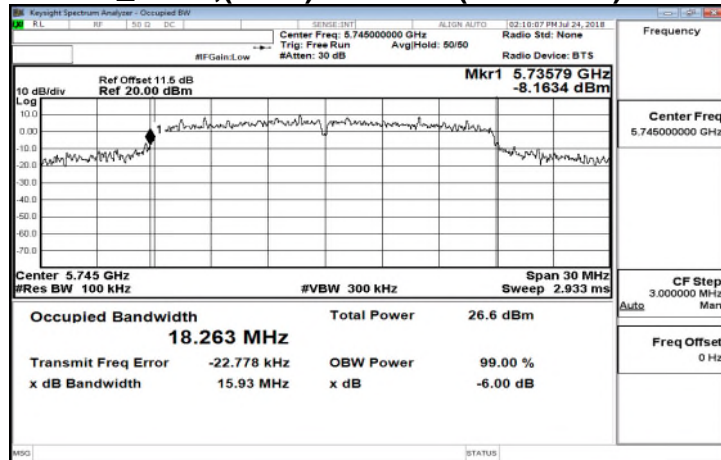


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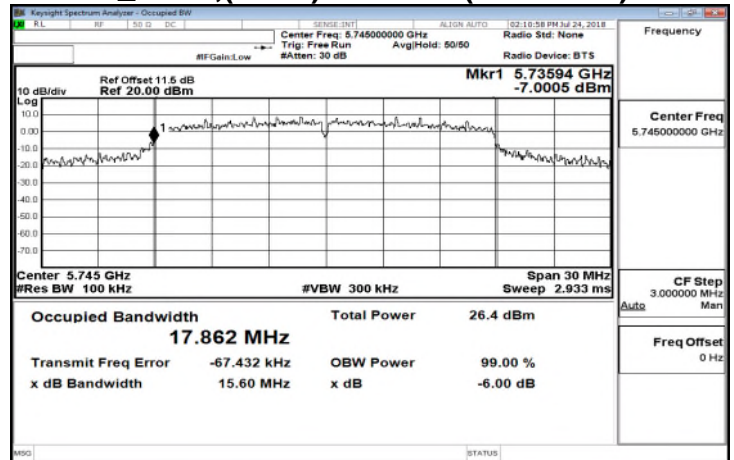
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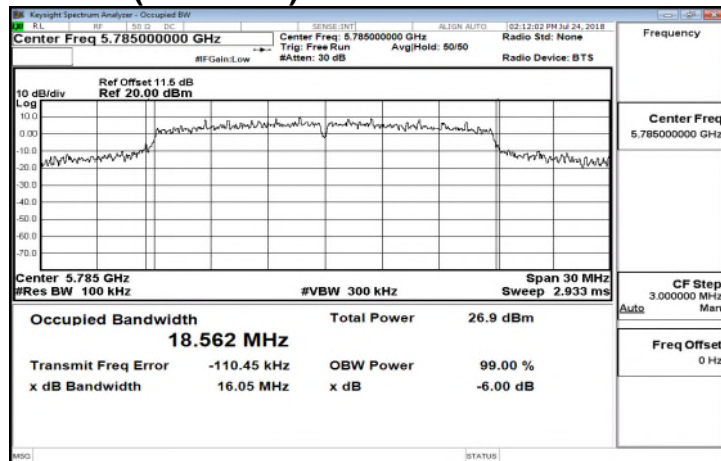
802.11n_HT20,(Main) 6dB BW (5745 MHz)



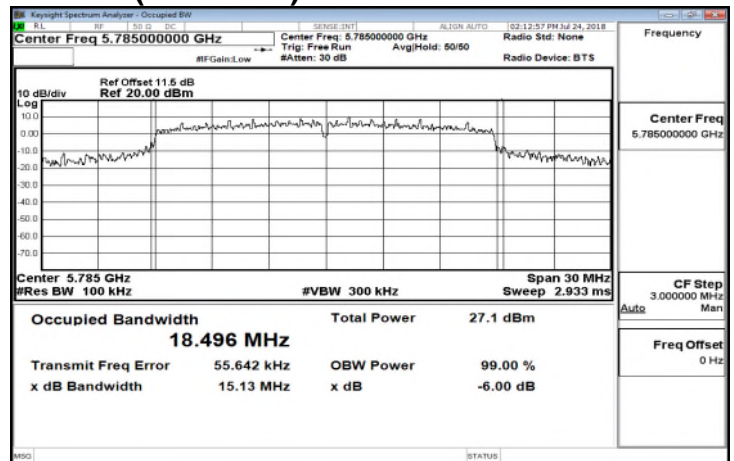
802.11n_HT20,(Aux1) 6dB BW (5745 MHz)



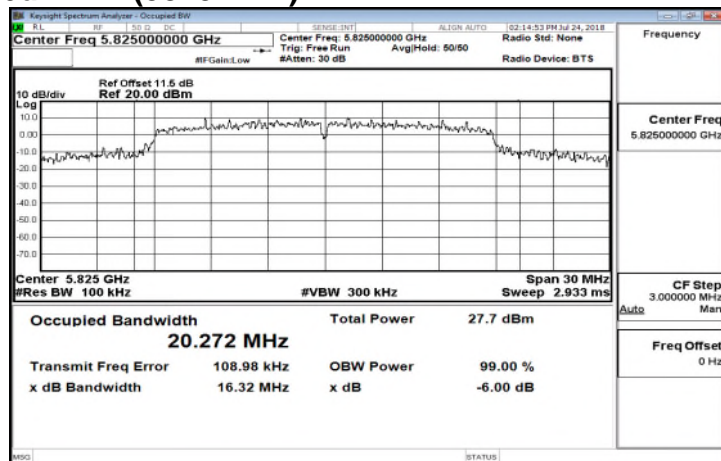
6dB BW (5785 MHz)



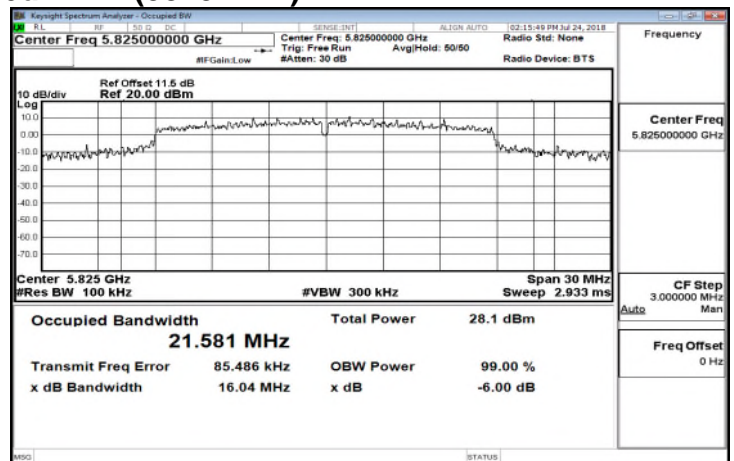
6dB BW (5785 MHz)



6dB BW (5825 MHz)



6dB BW (5825 MHz)

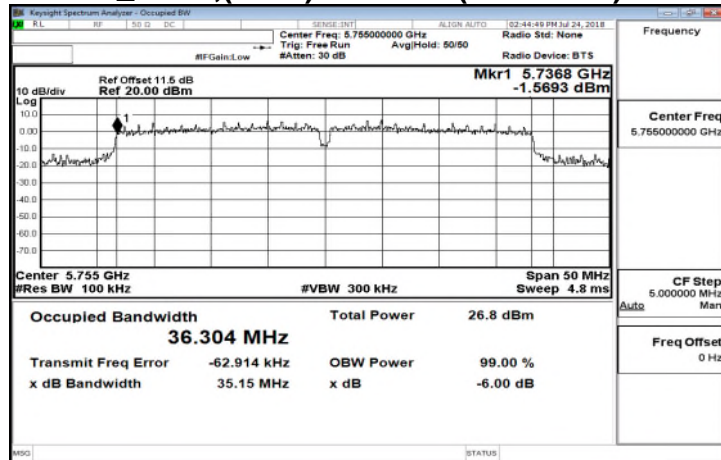


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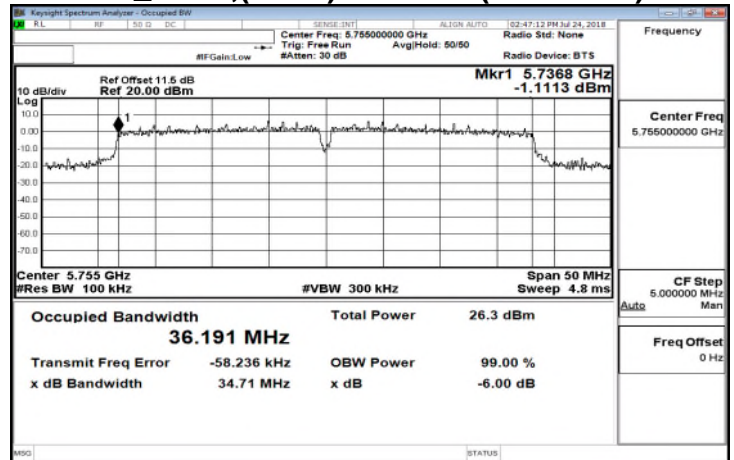
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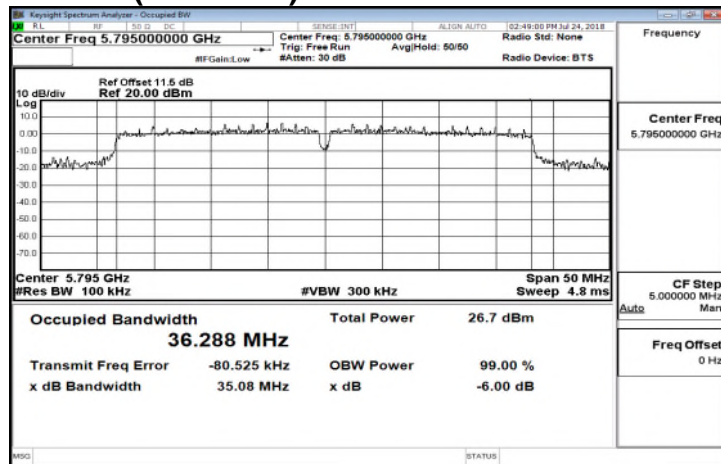
802.11n_HT40,(Main) 6dB BW (5755 MHz)



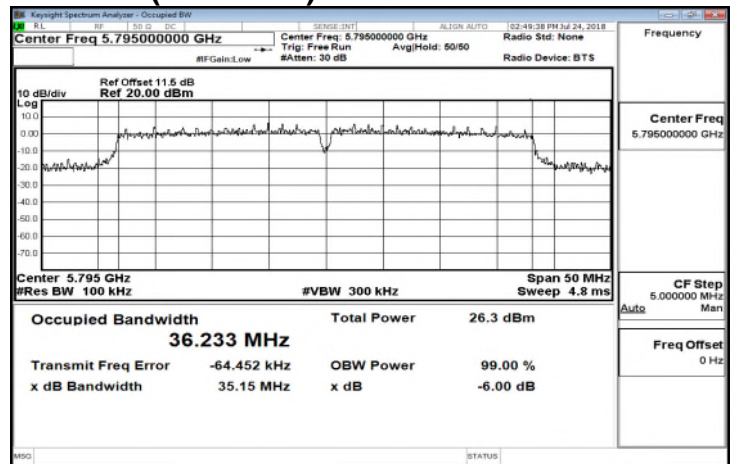
802.11n_HT40,(Aux1) 6dB BW (5755 MHz)



6dB BW (5795 MHz)



6dB BW (5795 MHz)

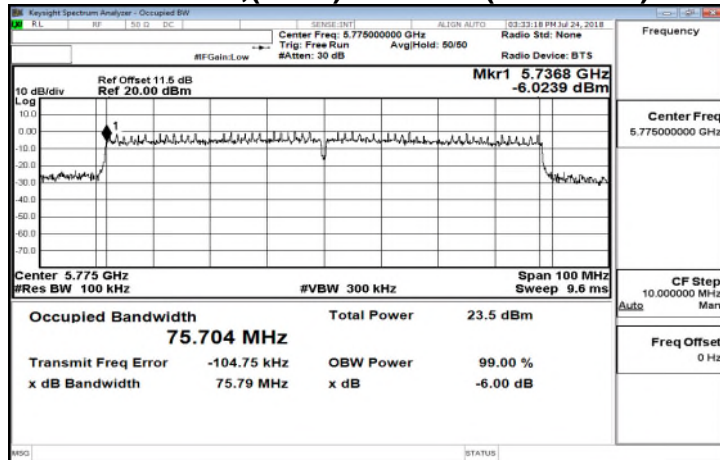


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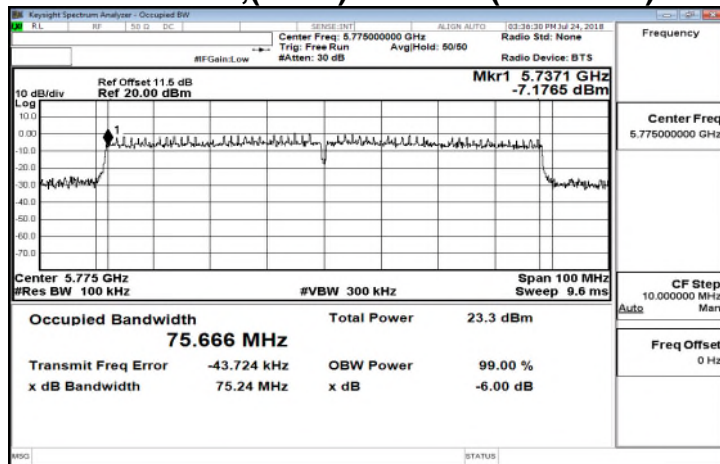
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802.11ac VHT80,(Main) 6dB BW (5775 MHz)



802.11ac VHT80,(Aux1) 6dB BW (5775 MHz)

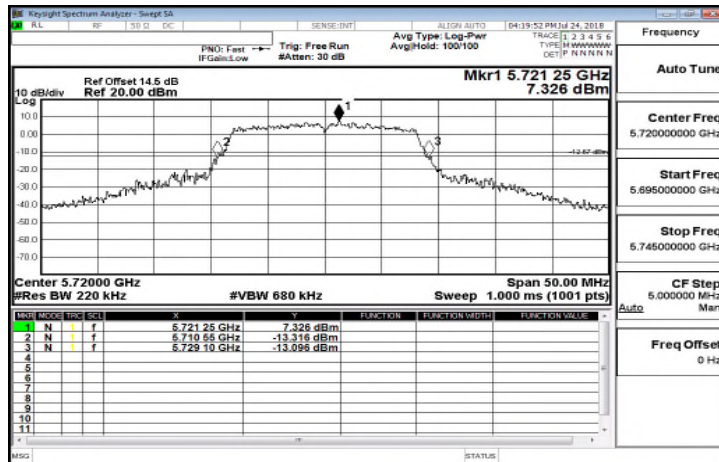


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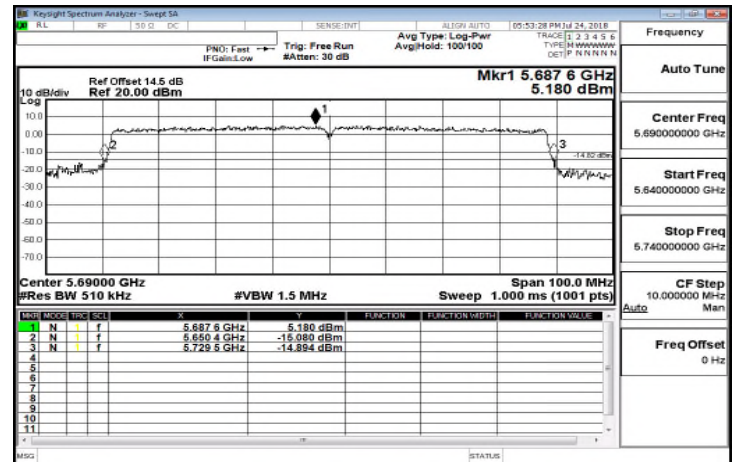
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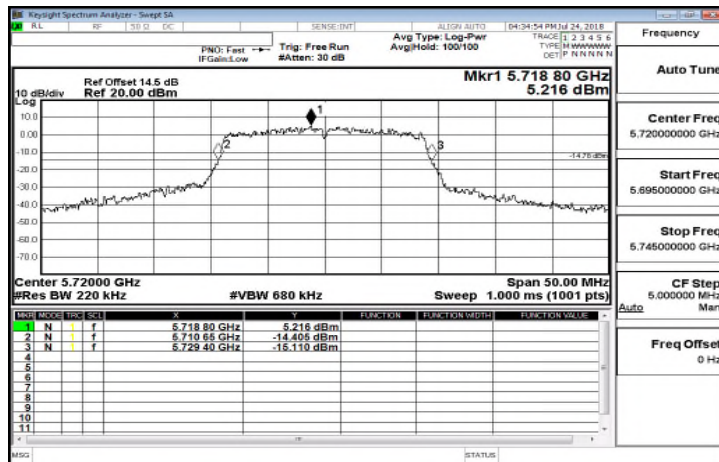
Band-Crossing Signals_802.11a_20MHz_5720MHz



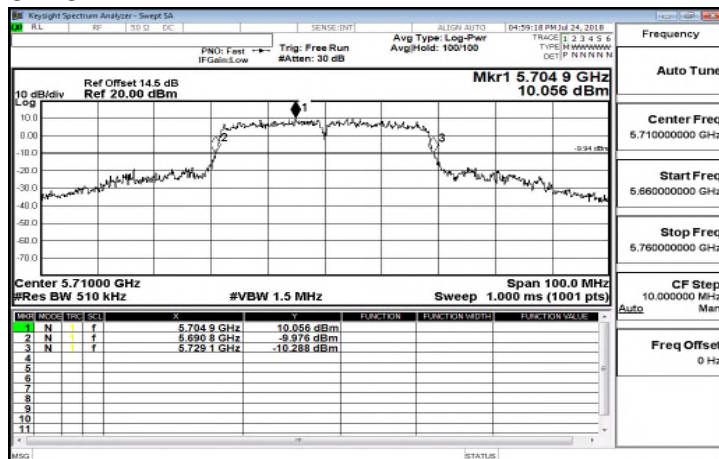
Band-Crossing Signals_802.11ac_80MHz_5690MHz



Band-Crossing Signals_802.11n_20MHz_5720MHz



Band-Crossing Signals_802.11n_40MHz_5710MHz



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9 MAXIMUM CONDUCTED OUTPUT POWER MEASUREMENT

9.1 Standard Applicable

OPERZTION Band	EUT CATEGORY		LIMIT
U-NII-1		Access Point (Mater device)	1 Watt(30dBm)
		Fixed point-to-point Acess Ponit	1 Watt(30dBm)
	√	Mobile and portable clinet device	250mW(23.98dBm)
U-NII-2A	√		250mW(23.98dBm) or 11dBm+10 log B
U-NII-2C	√		250mW(23.98dBm) or 11dBm+10 log B
U-NII-3	√		1 Watt(30dBm)

If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the Maximum Power Spectral Density shall be reduced by the amount in dB that the direction-al gain of the antenna exceeds 6 dBi.

Note:

As per FCC KDB 662911 D01

Unequal antenna gains, with equal transmit powers. For antenna gains given by G1, G2, ..., GN dBi.

(i) If transmit signals are correlated, then Directional gain

$$= 10 \log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2 / N_{ANT}] \text{ dBi}$$

[Note the “20”s in the denominator of each exponent and the square of the sum of terms; the object is to combine the signal levels coherently.]

The antenna gain is granter than 6 dBi in MIMO mode the limit reduce as below:

	Effective Legacy Gain (dBi)	Conducted Power Limit (dBm)
UNII-1	11.02	18.96 dBm
UNII-2A	11.02	18.96 dBm
U-NII-2C	11.02	18.96 dBm
U-NII-3	11.02	24.98 dBm

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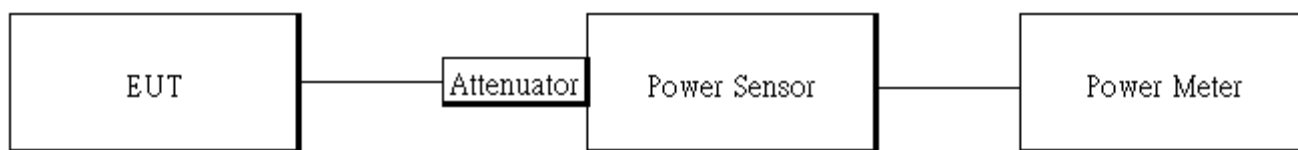
9.2 Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules .
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power meter
4. Power Meter is used as the auxiliary test equipment to conduct the output power measurement.
5. Record the max. reading and add $10 \log(1/\text{duty cycle})$.
6. Repeat above procedures until all frequency (low, middle, and high channel) measured were complete.

9.3 Measurement Equipment Used

SGS Conducted Room					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Power Meter	Anritsu	ML2496A	1804001	2018/02/01	2019/01/31
Power Sensor	Anritsu	MA2411B	1726104	2018/02/01	2019/01/31
Power Sensor	Anritsu	MA2411B	1726107	2018/02/01	2019/01/31
DC Power Supply	Agilent	E3640A	MY53130054	2017/09/04	2018/09/03
DC Power Supply	Agilent	E3640A	MY53130054	2018/09/02	2019/09/01
Attenuator	Marvelous	MVE2213-10	RF30	2017/12/26	2018/12/25
Notebook	Lenovo	T420	S0012599	N/A	N/A

9.4 Test Set-up



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9.5 Measurement Result

Conducted output power (FCC)

802.11a_Main

CH	Frequency (MHz)	Data Rate	TOTAL POWER (dBm)	TOTAL POWER (mW)	REQUIRED LIMIT (dBm)	RESULT
36	5180	6	18.02	63.387	21.97	PASS
44	5220	6	17.63	57.943	21.97	PASS
48	5240	6	18.11	64.714	21.97	PASS
52	5260	6	18.50	70.795	21.97 or $11+10\log(B) = 23.78$	PASS
60	5300	6	18.54	71.450	21.97 or $11+10\log(B) = 23.74$	PASS
64	5320	6	18.36	68.549	21.97 or $11+10\log(B) = 23.79$	PASS
100	5500	6	18.64	73.114	21.97 or $11+10\log(B) = 23.79$	PASS
116	5580	6	18.63	72.946	21.97 or $11+10\log(B) = 23.78$	PASS
140	5700	6	17.83	60.674	21.97 or $11+10\log(B) = 23.82$	PASS
144	5720(U-NII 2C)	6	14.0941297	25.669	21.97 or $11+10\log(B) = 22.13$	PASS
144	5720 (U-NII 3)	6	3.99587035	2.509	27.99	PASS
149	5745	6	22.29	169.434	27.99	PASS
157	5785	6	23.16	207.014	27.99	PASS
165	5825	6	23.21	209.411	27.99	PASS

802.11a_Aux1

CH	Frequency (MHz)	Data Rate	TOTAL POWER (dBm)	TOTAL POWER (mW)	REQUIRED LIMIT (dBm)	RESULT
36	5180	6	17.87	61.235	21.97	PASS
44	5220	6	17.51	56.364	21.97	PASS
48	5240	6	17.96	62.517	21.97	PASS
52	5260	6	18.36	68.549	21.97 or $11+10\log(B) = 23.86$	PASS
60	5300	6	18.35	68.391	21.97 or $11+10\log(B) = 23.74$	PASS
64	5320	6	18.21	66.222	21.97 or $11+10\log(B) = 23.74$	PASS
100	5500	6	18.45	69.984	21.97 or $11+10\log(B) = 23.74$	PASS
116	5580	6	18.44	69.823	21.97 or $11+10\log(B) = 23.80$	PASS
140	5700	6	17.65	58.210	21.97 or $11+10\log(B) = 23.80$	PASS
144	5720(U-NII 2C)	6	13.9468983	24.814	21.97 or $11+10\log(B) = 21.99$	PASS
144	5720 (U-NII 3)	6	3.95	2.483	27.99	PASS
149	5745	6	22.08	161.436	27.99	PASS
157	5785	6	22.97	198.153	27.99	PASS
165	5825	6	23.08	203.236	27.99	PASS

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802.11a_MIMO

CH	Frequency (MHz)	Data Rate	Avg. POWER (dBm)		TOTAL POWER (dBm)	TOTAL POWER (mW)	REQUIRED LIMIT (dBm)	RESULT
			CH 0	CH 1				
36	5180	6	15.27	14.85	18.19	64.200	18.98	PASS
44	5220	6	15.04	14.31	17.81	58.893	18.98	PASS
48	5240	6	15.47	14.84	18.29	65.716	18.98	PASS
52	5260	6	15.92	15.18	18.69	72.045	18.98 or 11+10log(B) = 23.78	PASS
60	5300	6	16.01	15.07	18.69	72.039	18.98 or 11+10log(B) = 23.74	PASS
64	5320	6	15.84	14.94	18.53	69.560	18.98 or 11+10log(B) = 23.74	PASS
100	5500	6	15.86	15.47	18.79	73.785	18.98 or 11+10log(B) = 23.74	PASS
116	5580	6	15.76	15.54	18.77	73.480	18.98 or 11+10log(B) = 23.78	PASS
140	5700	6	14.77	14.96	17.99	61.324	18.98 or 11+10log(B) = 23.80	PASS
144	5720(U-NII 2C)	6	11.8035414	11.7418859	14.20	30.082	18.98 or 11+10log(B) = 21.99	PASS
144	5720 (U-NII 3)	6	3.34645858	3.32811414	4.03	4.313	25	PASS
149	5745	6	19.37	19.25	22.43	170.636	25	PASS
157	5785	6	20.24	20.16	23.32	209.435	25	PASS
165	5825	6	20.31	20.26	23.41	213.568	25	PASS

802.11n_HT20_Main

CH	Frequency (MHz)	Data Rate	TOTAL POWER (dBm)	TOTAL POWER (mW)	REQUIRED LIMIT (dBm)	RESULT
36	5180	MCS0	18.77	75.336	21.97	PASS
44	5220	MCS0	18.39	69.024	21.97	PASS
48	5240	MCS0	18.42	69.502	21.97	PASS
52	5260	MCS0	18.68	73.790	21.97 or 11+10log(B) = 23.89	PASS
60	5300	MCS0	18.25	66.834	21.97 or 11+10log(B) = 23.87	PASS
64	5320	MCS0	18.66	73.451	21.97 or 11+10log(B) = 23.87	PASS
100	5500	MCS0	18.30	67.608	21.97 or 11+10log(B) = 23.93	PASS
116	5580	MCS0	18.83	76.384	21.97 or 11+10log(B) = 23.88	PASS
140	5700	MCS0	17.33	54.075	21.97 or 11+10log(B) = 23.91	PASS
144	5720(U-NII 2C)	MCS0	14.19	26.242	21.97 or 11+10log(B) = 21.64	PASS
144	5720 (U-NII 3)	MCS0	4.35	2.723	27.99	PASS
149	5745	MCS0	23.32	214.783	27.99	PASS
157	5785	MCS0	23.59	228.560	27.99	PASS
165	5825	MCS0	24.26	266.686	27.99	PASS

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802.11n_HT20_Aux1

CH	Frequency (MHz)	Data Rate	TOTAL POWER (dBm)	TOTAL POWER (mW)	REQUIRED LIMIT (dBm)	RESULT
36	5180	MCS0	18.62	72.778	21.97	PASS
44	5220	MCS0	18.26	66.988	21.97	PASS
48	5240	MCS0	18.30	67.608	21.97	PASS
52	5260	MCS0	18.57	71.945	21.97 or $11+10\log(B) = 23.86$	PASS
60	5300	MCS0	18.11	64.714	21.97 or $11+10\log(B) = 23.86$	PASS
64	5320	MCS0	18.54	71.450	21.97 or $11+10\log(B) = 23.87$	PASS
100	5500	MCS0	18.19	65.917	21.97 or $11+10\log(B) = 23.91$	PASS
116	5580	MCS0	18.66	73.451	21.97 or $11+10\log(B) = 23.86$	PASS
140	5700	MCS0	17.19	52.360	21.97 or $11+10\log(B) = 23.86$	PASS
144	5720(U-NII 2C)	MCS0	14.10	25.704	21.97 or $11+10\log(B) = 21.31$	PASS
144	5720 (U-NII 3)	MCS0	4.33	2.710	27.99	PASS
149	5745	MCS0	23.15	206.538	27.99	PASS
157	5785	MCS0	23.44	220.800	27.99	PASS
165	5825	MCS0	24.13	258.821	27.99	PASS

802.11n_HT20_MIMO

CH	Frequency (MHz)	Data Rate	Avg. POWER (dBm)		TOTAL POWER (dBm)	TOTAL POWER (mW)	REQUIRED LIMIT (dBm)	RESULT
			CH 0	CH 1				
36	5180	MCS8	15.85	15.43	18.89	73.373	18.98	PASS
44	5220	MCS8	15.64	14.89	18.52	67.476	18.98	PASS
48	5240	MCS8	15.57	15.03	18.55	67.900	18.98	PASS
52	5260	MCS8	15.93	15.16	18.80	71.984	18.98 or $11+10\log(B) = 23.86$	PASS
60	5300	MCS8	15.61	14.56	18.36	64.967	18.98 or $11+10\log(B) = 23.86$	PASS
64	5320	MCS8	15.93	15.16	18.80	71.984	18.98 or $11+10\log(B) = 23.87$	PASS
100	5500	MCS8	15.41	15.01	18.45	66.449	18.98 or $11+10\log(B) = 23.91$	PASS
116	5580	MCS8	15.83	15.55	18.93	74.175	18.98 or $11+10\log(B) = 23.86$	PASS
140	5700	MCS8	14.25	14.21	17.47	52.971	18.98 or $11+10\log(B) = 23.86$	PASS
144	5720(U-NII 2C)	MCS8	11.8249174	11.7599644	14.27	30.219	18.98 or $11+10\log(B) = 21.31$	PASS
144	5720 (U-NII 3)	MCS8	3.62508262	3.61003559	4.38	4.600	25	PASS
149	5745	MCS8	20.21	20.17	23.43	208.946	25	PASS
157	5785	MCS8	20.51	20.45	23.72	223.378	25	PASS
165	5825	MCS8	21.21	21.13	24.41	261.847	25	PASS

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802.11n_HT40_Main

CH	Frequency (MHz)	Data Rate	TOTAL POWER (dBm)	TOTAL POWER (mW)	REQUIRED LIMIT (dBm)			RESULT
38	5190	MCS0	16.86	48.529	21.97			PASS
46	5230	MCS0	18.51	70.958	21.97			PASS
54	5270	MCS0	18.69	73.961	21.97	or 11+10log(B) =	26.86	PASS
62	5310	MCS0	18.64	73.114	21.97	or 11+10log(B) =	26.92	PASS
102	5510	MCS0	16.24	42.073	21.97	or 11+10log(B) =	27.00	PASS
110	5550	MCS0	18.74	74.817	21.97	or 11+10log(B) =	26.95	PASS
134	5670	MCS0	18.85	76.736	21.97	or 11+10log(B) =	27.51	PASS
142	5710(U-NII 2C)	MCS0	16.52	44.875	21.97	or 11+10log(B) =	25.85	PASS
142	5710 (U-NII 3)	MCS0	1.98	1.578	27.99			PASS
151	5755	MCS0	24.45	278.612	27.99			PASS
159	5795	MCS0	24.21	263.633	27.99			PASS

802.11n_HT40_Aux1

CH	Frequency (MHz)	Data Rate	TOTAL POWER (dBm)	TOTAL POWER (mW)	REQUIRED LIMIT (dBm)			RESULT
38	5190	MCS0	16.83	48.195	21.97			PASS
46	5230	MCS0	18.37	68.707	21.97			PASS
54	5270	MCS0	18.58	72.111	21.97	or 11+10log(B) =	26.87	PASS
62	5310	MCS0	18.57	71.945	21.97	or 11+10log(B) =	26.89	PASS
102	5510	MCS0	16.17	41.400	21.97	or 11+10log(B) =	26.90	PASS
110	5550	MCS0	18.62	72.778	21.97	or 11+10log(B) =	26.90	PASS
134	5670	MCS0	18.75	74.989	21.97	or 11+10log(B) =	27.03	PASS
142	5710(U-NII 2C)	MCS0	16.43	43.954	21.97	or 11+10log(B) =	25.81	PASS
142	5710 (U-NII 3)	MCS0	1.97	1.574	27.99			PASS
151	5755	MCS0	24.33	271.019	27.99			PASS
159	5795	MCS0	24.11	257.632	27.99			PASS

802.11n_HT40_MIMO

CH	Frequency (MHz)	Data Rate	Avg. POWER (dBm)		TOTAL POWER (dBm)	TOTAL POWER (mW)	REQUIRED LIMIT (dBm)		RESULT
			CH 0	CH 1					
38	5190	MCS8	14.07	13.79	17.36	49.460	18.98		PASS
46	5230	MCS8	15.31	15.03	18.60	65.805	18.98		PASS
54	5270	MCS8	15.77	14.87	18.77	68.447	18.98	or 11+10log(B) = 26.86	PASS
62	5310	MCS8	15.74	14.86	18.75	68.117	18.98	or 11+10log(B) = 26.89	PASS
102	5510	MCS8	13.53	13.17	16.78	43.292	18.98	or 11+10log(B) = 26.90	PASS
110	5550	MCS8	15.51	15.28	18.83	69.292	18.98	or 11+10log(B) = 26.90	PASS
134	5670	MCS8	15.54	15.5	18.95	71.291	18.98	or 11+10log(B) = 27.03	PASS
142	5710(U-NII 2C)	MCS8	13.5836897	13.5272647	16.62	45.351	18.98	or 11+10log(B) = 25.81	PASS
142	5720 (U-NII 3)	MCS8	1.62631025	1.62273532	1.99	2.907	25		PASS
151	5755	MCS8	21.31	20.87	24.53	257.387	25		PASS
159	5795	MCS8	20.96	20.81	24.32	245.242	25		PASS

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802.11ac_VHT80_Main

CH	Frequency (MHz)	Data Rate	TOTAL POWER (dBm)	TOTAL POWER (mW)	REQUIRED LIMIT (dBm)	RESULT
42	5210	MCS0	14.76	29.923	21.97	PASS
58	5290	MCS0	14.15	26.002	21.97 or 11+10log(B) = 29.92	PASS
106	5530	MCS0	14.73	29.717	21.97 or 11+10log(B) = 29.94	PASS
122	5610	MCS0	18.69	73.961	21.97 or 11+10log(B) = 29.94	PASS
138	5690(U-NII 2C)	MCS0	17.49	56.105	21.97 or 11+10log(B) = 29.67	PASS
138	5690 (U-NII 3)	MCS0	1.05	1.274	27.99	PASS
155	5775	MCS0	19.75	94.406	27.99	PASS

802.11ac_VHT80_Aux1

CH	Frequency (MHz)	Data Rate	TOTAL POWER (dBm)	TOTAL POWER (mW)	REQUIRED LIMIT (dBm)	RESULT
42	5210	MCS0	14.71	29.580	21.97	PASS
58	5290	MCS0	14.10	25.704	21.97 or 11+10log(B) = 29.92	PASS
106	5530	MCS0	14.67	29.309	21.97 or 11+10log(B) = 29.93	PASS
122	5610	MCS0	18.59	72.277	21.97 or 11+10log(B) = 29.93	PASS
138	5690(U-NII 2C)	MCS0	17.34	54.200	21.97 or 11+10log(B) = 29.66	PASS
138	5690 (U-NII 3)	MCS0	1.05	1.274	27.99	PASS
155	5775	MCS0	19.62	91.622	27.99	PASS

802.11ac_VHT80_MIMO

CH	Frequency (MHz)	Data Rate	Avg. POWER (dBm)		TOTAL POWER (dBm)	TOTAL POWER (mW)	REQUIRED LIMIT (dBm)	RESULT
			CH 0	CH 1				
42	5210	MCS0	12.19	11.38	16.15	30.298	18.98	PASS
58	5290	MCS0	11.79	10.53	15.56	26.399	18.98 or 11+10log(B) = 29.92	PASS
106	5530	MCS0	12.13	11.48	16.17	30.391	18.98 or 11+10log(B) = 29.93	PASS
122	5610	MCS0	14.72	14.22	18.83	56.072	18.98 or 11+10log(B) = 29.93	PASS
138	5690(U-NII 2C)	MCS0	13.6562819	13.3079045	17.59	44.626	18.98 or 11+10log(B) = 29.66	PASS
138	5690 (U-NII 3)	MCS0	0.82371813	0.80209547	1.06	2.412	25	PASS
155	5775	MCS0	15.58	15.44	19.86	71.136	25	PASS

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10 MAXIMUM POWER SPECTRAL DENSITY

10.1 Standard Applicable

OPERZTION Band	EUT CATEGORY		LIMIT
U-NII-1		Access Point (Mater device)	17dBm/ MHz
		Fixed point-to-point Acess Ponit	
	√	Mobile and portable clinet device	11dBm/ MHz
U-NII-2A	√		11dBm/ MHz
U-NII-2C	√		11dBm/ MHz
U-NII-3	√		30dBm/ 500kHz

If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit 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.

Note:

As per FCC KDB 662911 D01

Unequal antenna gains, with equal transmit powers. For antenna gains given by G1, G2, ..., GN dBi.

(i) If transmit signals are correlated, then Directional gain

$$= 10 \log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2 / N_{ANT}] \text{ dBi}$$

[Note the “20”s in the denominator of each exponent and the square of the sum of terms; the object is to combine the signal levels coherently.]

The antenna gain is granter than 6 dBi in MIMO mode the limit reduce as below:

	Effective Legacy Gain (dBi)	Limit (dBm / MHz)
UNII-1	8.01+3.01=11.02dBi	5.98 dBm
UNII-2A	8.01+3.01=11.02dBi	5.98 dBm
U-NII-2C	8.01+3.01=11.02dBi	5.98 dBm
U-NII-3	8.01+3.01=11.02dBi	24.98 dBm

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10.2 Measurement Procedure

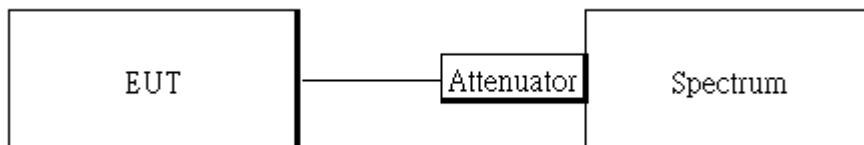
1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules .
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to Spectrum.
4. **For U-NII1, U-NII-2A, U-NII-2C Band:**
Set RBW=1MHz, VBW=3MHz, where span is enough to capture the entire bandwidth, Sweep time = Auto (601 pts), detector = sample, traces 100 sweeps of video averaging. (SA-2 with the omission of procedure x, the integration with 26dB EBW bandwidth)
For U-NII-3 Band:
Set RBW=500 kHz, VBW \geq 3RBW, where span is enough to capture the entire bandwidth, Sweep time = Auto (601 pts), detector = sample, traces 100 sweeps of video averaging. (SA-2 with the omission of procedure x, the integration with 26dB EBW bandwidth)
5. Use the cursor on spectrum to peak search the highest level of trace
6. Record the max. reading and add 10 log(1/duty cycle).
7. Repeat above procedures until all default test channel (low, middle, and high) was complete.

Note: For the test of PSD at MIMO mode, the highest emission of worst case employing Measure and add 10 log (N) technical is reported on this report after the comparison between Main Antenna at single transmitting mode and Aux that yields the higher value. The MIMO transmitting mode produces higher value of outcome

10.3 Measurement Equipment Used

SGS Conducted Room					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Spectrum Analyzer	Agilent	N9010A	MY51440113	2018/06/20	2019/06/19
DC Power Supply	Agilent	E3640A	MY53130054	2017/09/04	2018/09/03
DC Power Supply	Agilent	E3640A	MY53130054	2018/09/02	2019/09/01
DC Block	PASTERNAK	PE8210	RF29	2017/12/26	2018/12/25
Attenuator	Marvelous	MVE2213-10	RF30	2017/12/26	2018/12/25
Notebook	Lenovo	T420	S0012599	N/A	N/A

10.4 Test Set-up



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10.5 Measurement Result

POWER DENSITY 802.11a MODE						
Frequency (MHz)	PPSD W/O Duty Factor (dBm)	Offset	Duty Factor	PPSD With Duty Factor (dBm)	Limit (dBm)	Margin (dB)
5180	4.21	14.50	0.11	4.32	5.98	-1.66
5220	4.58	14.50	0.11	4.69	5.98	-1.29
5240	4.62	14.50	0.11	4.73	5.98	-1.25
5260	4.85	14.50	0.11	4.96	5.98	-1.02
5300	4.63	14.50	0.11	4.74	5.98	-1.24
5320	4.52	14.50	0.11	4.63	5.98	-1.35
5500	4.56	14.50	0.11	4.67	5.98	-1.31
5580	4.48	14.50	0.11	4.59	5.98	-1.39
5700	4.55	14.50	0.11	4.66	5.98	-1.32
5720 (U-NII 2C)	3.57	14.50	0.11	3.68	5.98	-2.30
5720 (U-NII 3)	-2.34	14.50	0.11	-2.23	24.98	-27.21
5745	16.21	14.50	0.11	16.21	24.98	-8.77
5785	17.20	14.50	0.11	17.20	24.98	-7.78
5825	17.77	14.50	0.11	17.77	24.98	-7.21
POWER DENSITY 802.11n HT20 MODE						
Frequency (MHz)	PPSD W/O Duty Factor (dBm)	Offset	Duty Factor	PPSD With Duty Factor (dBm)	Limit (dBm)	Margin (dB)
5180	4.72	14.50	0.23	4.95	5.9797	-1.03
5220	4.12	14.50	0.23	4.35	5.9797	-1.63
5240	4.42	14.50	0.23	4.65	5.9797	-1.33
5260	4.36	14.50	0.23	4.59	5.9797	-1.39
5300	4.14	14.50	0.23	4.37	5.9797	-1.61
5320	4.74	14.50	0.23	4.97	5.9797	-1.01
5500	4.10	14.50	0.23	4.33	5.9797	-1.65
5580	4.46	14.50	0.23	4.69	5.9797	-1.29
5700	3.73	14.50	0.23	3.96	5.9797	-2.02
5720 (U-NII 2C)	2.93	14.50	0.23	3.16	5.9797	-2.82
5720 (U-NII 3)	-3.28	14.50	0.23	-3.05	24.98	-28.03
5745	16.89	14.50	0.23	16.89	24.98	-8.09
5785	17.43	14.50	0.23	17.43	24.98	-7.55
5825	17.85	14.50	0.23	17.85	24.98	-7.13

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POWER DENSITY 802.11n HT40 MODE						
Frequency (MHz)	PPSD W/O Duty Factor (dBm)	Offset	Duty Factor	PPSD With Duty Factor (dBm)	Limit (dBm)	Margin (dB)
5190	0.97	14.50	0.42	1.39	5.9797	-4.59
5230	-0.63	14.50	0.42	-0.21	5.9797	-6.19
5270	1.79	14.50	0.42	2.21	5.9797	-3.77
5310	0.76	14.50	0.42	1.18	5.9797	-4.80
5510	0.77	14.50	0.42	1.19	5.9797	-4.79
5550	-0.2	14.50	0.42	0.22	5.9797	-5.76
5670	0.83	14.50	0.42	1.25	5.9797	-4.73
5710 (U-NII 2C)	-1.76	14.50	0.42	-1.34	5.9797	-7.32
5710 (U-NII 3)	-7.73	14.50	0.42	-7.31	24.98	-32.29
5755	14.06	14.50	0.42	14.06	24.98	-10.92
5795	13.41	14.50	0.42	13.41	24.98	-11.57
POWER DENSITY 802.11ac VHT80 MODE						
Frequency (MHz)	PPSD W/O Duty Factor (dBm)	Offset	Duty Factor	PPSD With Duty Factor (dBm)	Limit (dBm)	Margin (dB)
5210	-8.77	14.50	1.34	-7.43	5.9797	-13.41
5290	-9.52	14.50	1.34	-8.18	5.9797	-14.16
5530	-11.19	14.50	1.34	-9.85	5.9797	-15.83
5610	-7.69	14.50	1.34	-6.35	5.9797	-12.33
5690 (U-NII 2C)	-14.49	14.50	1.34	-13.15	5.9797	-19.13
5690 (U-NII 3)	-17.63	14.50	1.34	-16.29	24.98	-41.27
5775	6.46	14.50	1.34	6.46	24.98	-18.52

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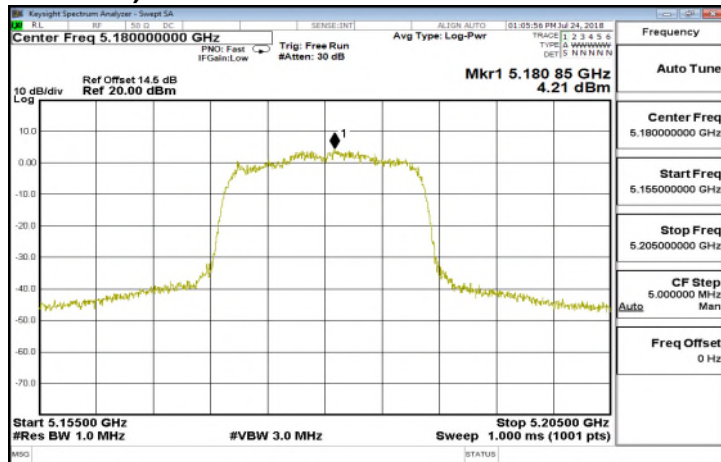
f (886-2) 2298-0488

www.tw.sgs.com

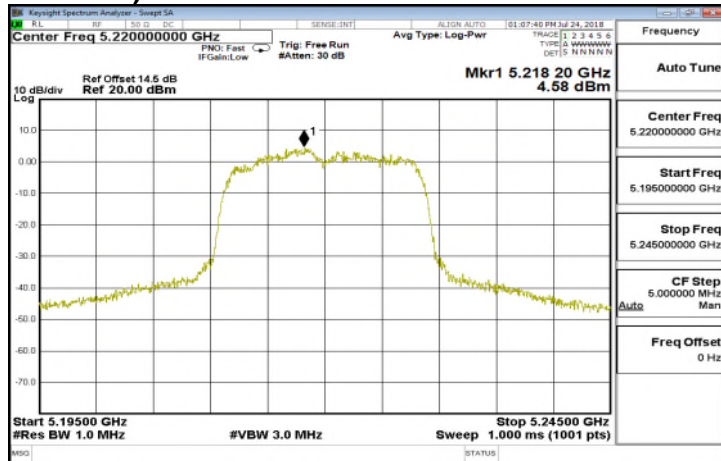
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802.11a 5150~5250 MHz

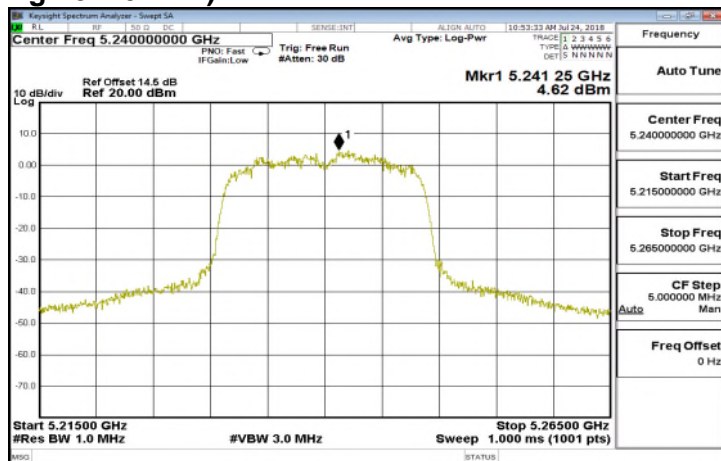
Maximum Power Spectral Density Data Plot (CH Low 5180 MHz)



Maximum Power Spectral Density Data Plot (CH Mid 5220 MHz)

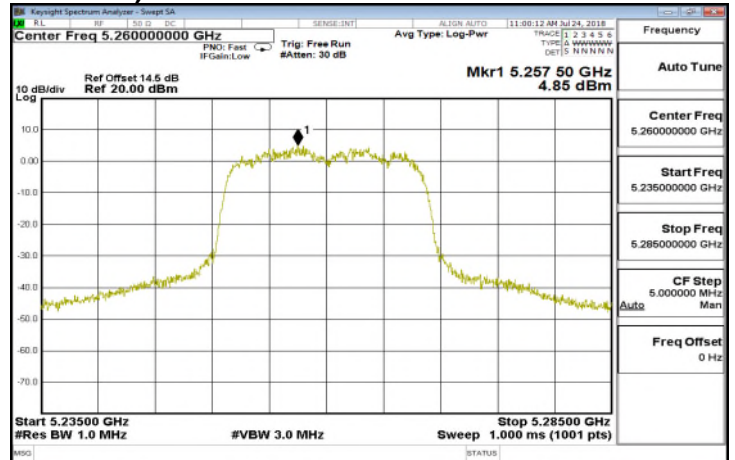


Maximum Power Spectral Density Data Plot (CH High 5240 MHz)

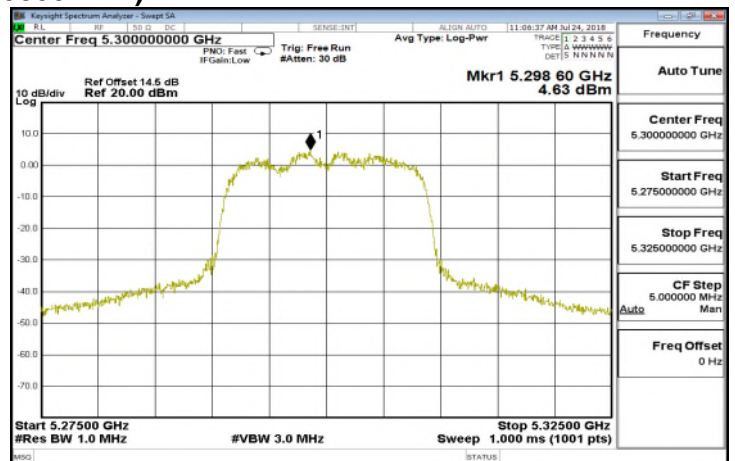


802.11a 5250~5350 MHz

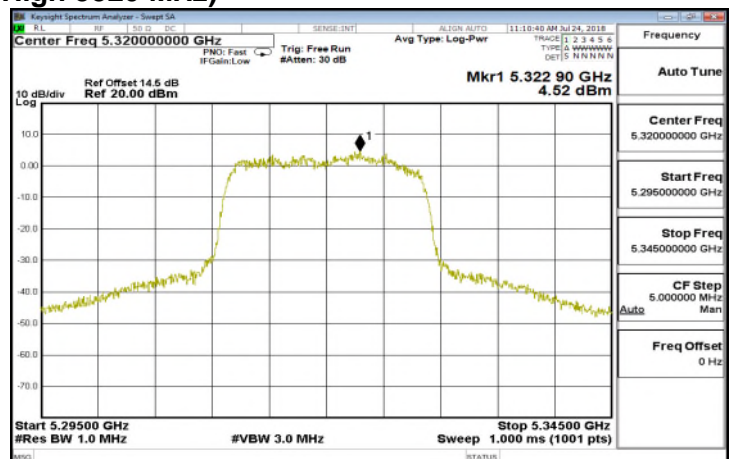
Maximum Power Spectral Density Data Plot (CH Low 5260 MHz)



Maximum Power Spectral Density Data Plot (CH Mid 5300 MHz)



Maximum Power Spectral Density Data Plot (CH High 5320 MHz)



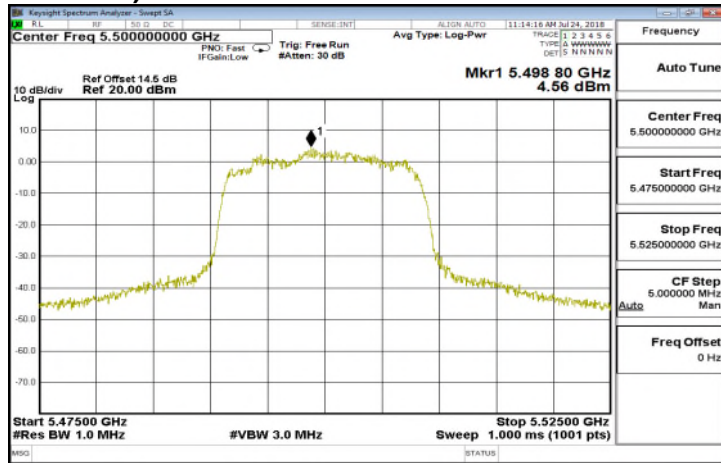
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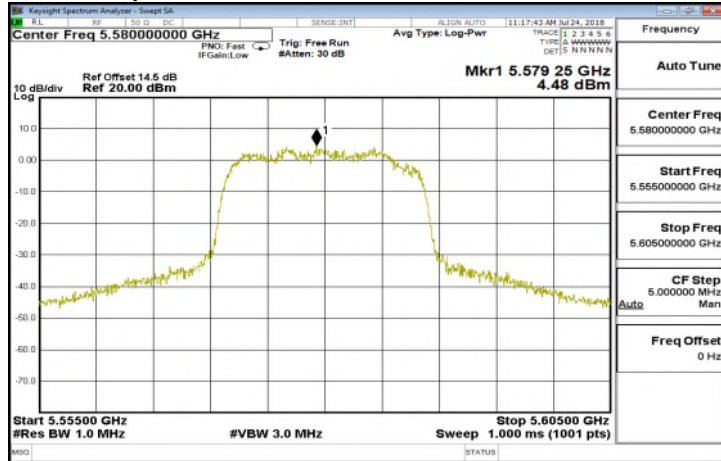
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802.11a 5470~5725 MHz

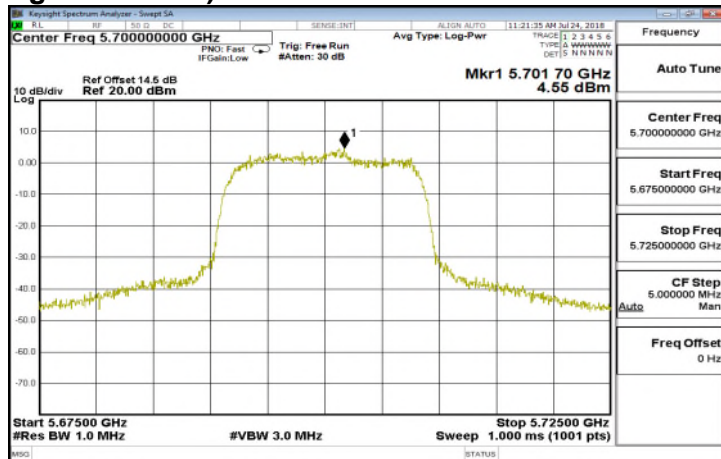
Maximum Power Spectral Density Data Plot (CH Low 5500 MHz)



Maximum Power Spectral Density Data Plot (CH Mid 5580 MHz)

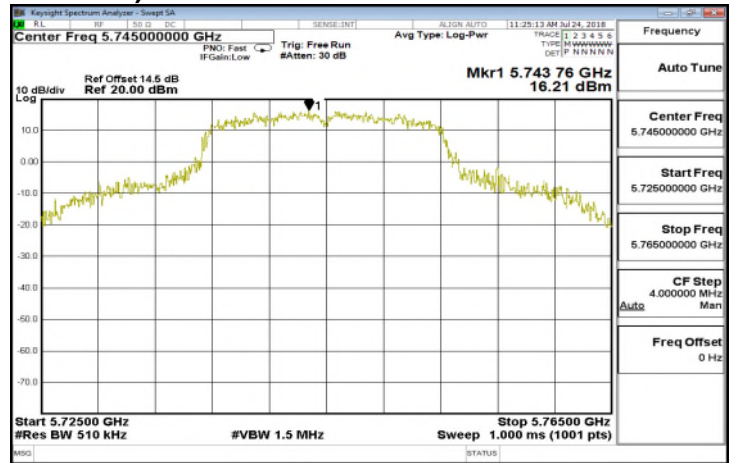


Maximum Power Spectral Density Data Plot (CH High 5700 MHz)

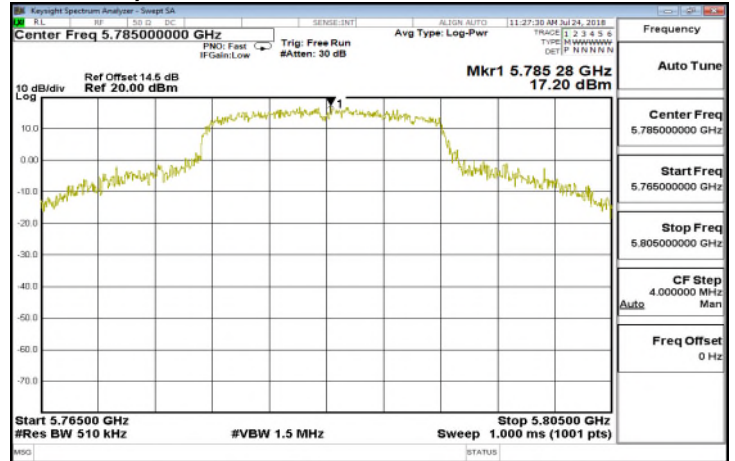


802.11a 5725~5850 MHz

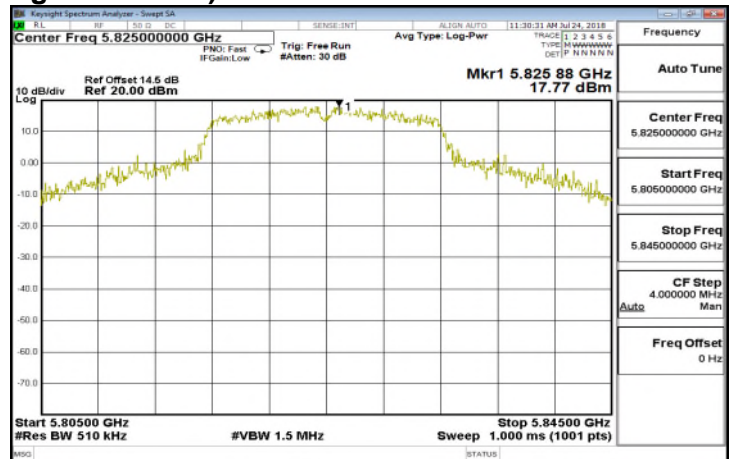
Maximum Power Spectral Density Data Plot (CH Low 5745 MHz)



Maximum Power Spectral Density Data Plot (CH Mid 5785 MHz)



Maximum Power Spectral Density Data Plot (CH High 5825 MHz)

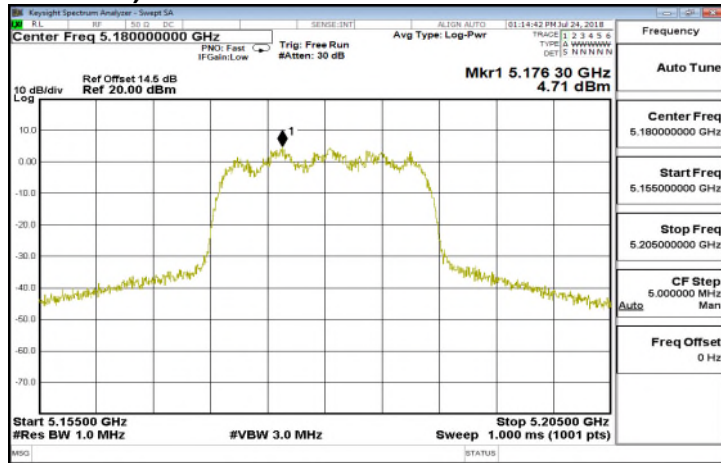


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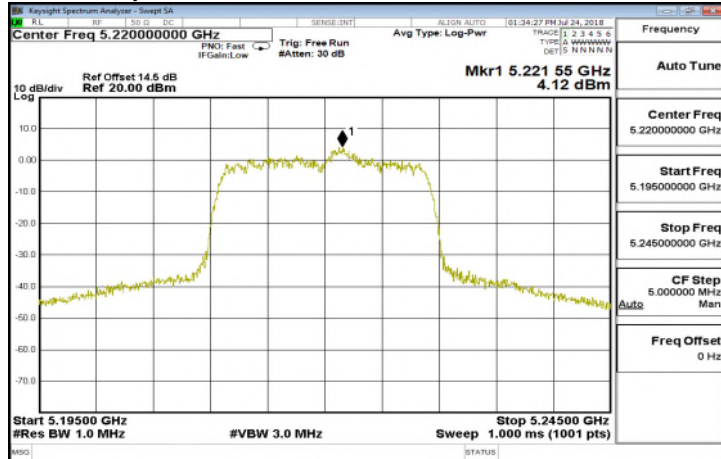
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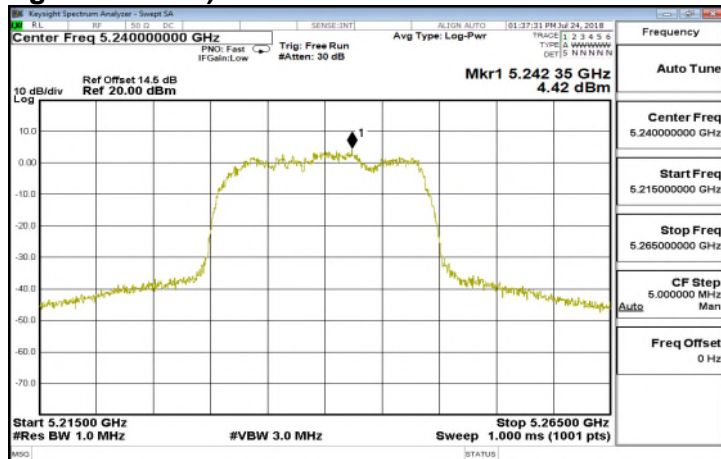
802.11n HT20, 5150~5250 MHz
Maximum Power Spectral Density Data Plot (CH Low 5180 MHz)



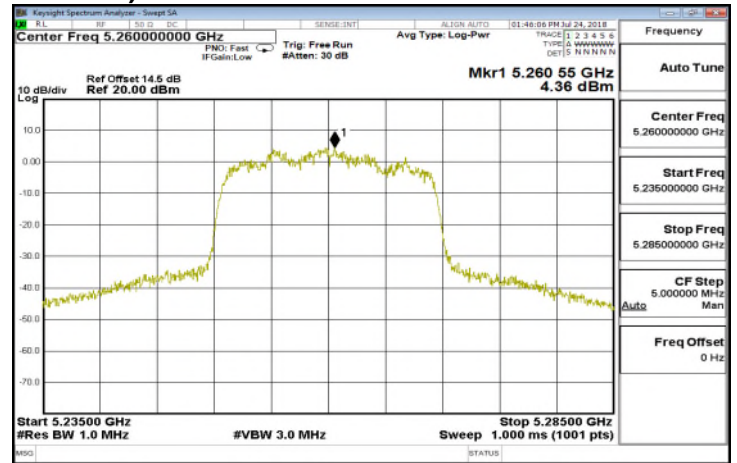
Maximum Power Spectral Density Data Plot (CH Mid 5220 MHz)



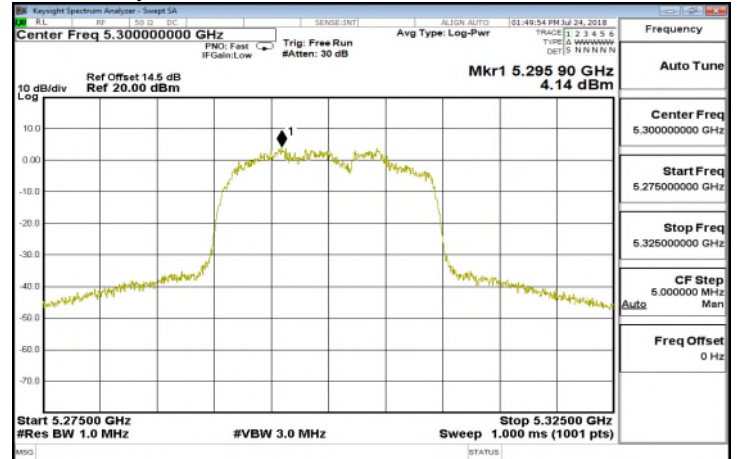
Maximum Power Spectral Density Data Plot (CH High 5240 MHz)



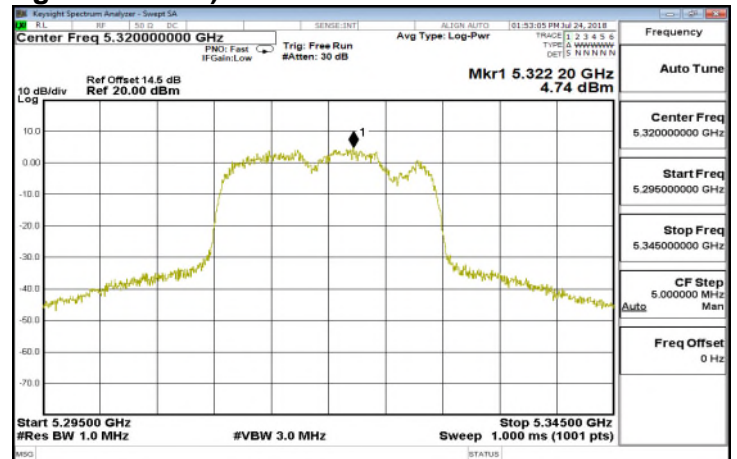
802.11n HT20, 5250~5350 MHz
Maximum Power Spectral Density Data Plot (CH Low 5260MHz)



Maximum Power Spectral Density Data Plot (CH Mid 5300 MHz)



Maximum Power Spectral Density Data Plot (CH High 5320 MHz)



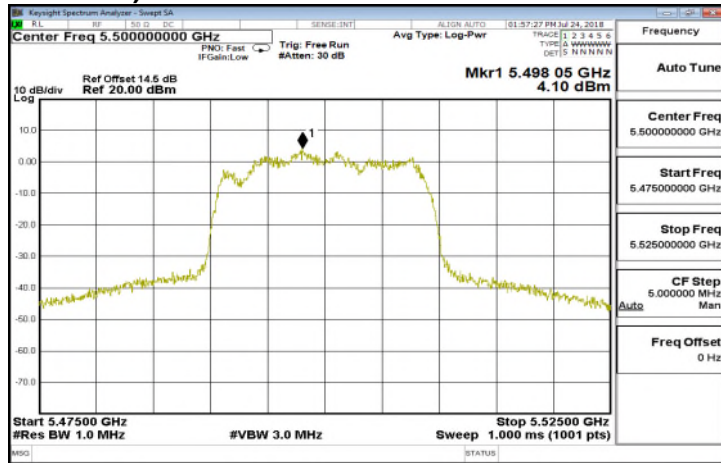
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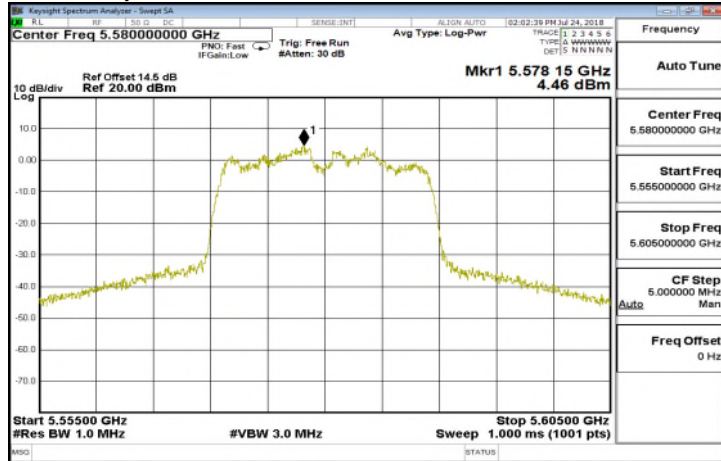
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802.11n HT20, 5470~5725 MHz

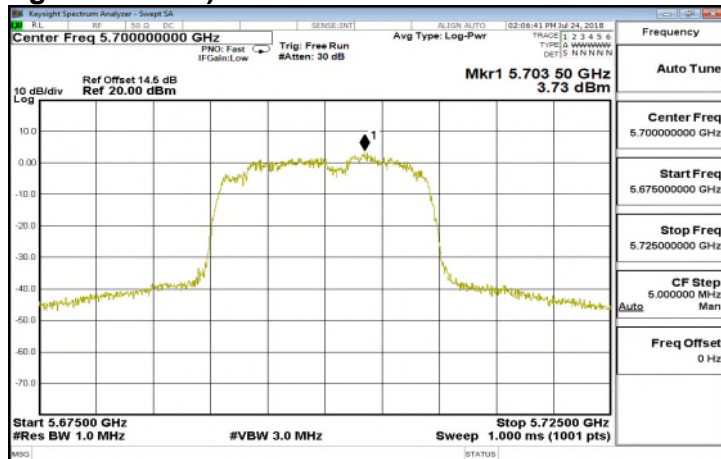
Maximum Power Spectral Density Data Plot (CH Low 5500 MHz)



Maximum Power Spectral Density Data Plot (CH Mid 5580MHz)

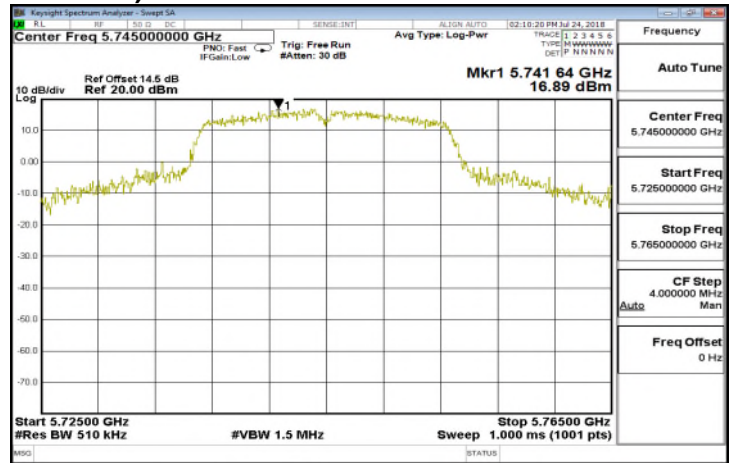


Maximum Power Spectral Density Data Plot (CH High 5700 MHz)

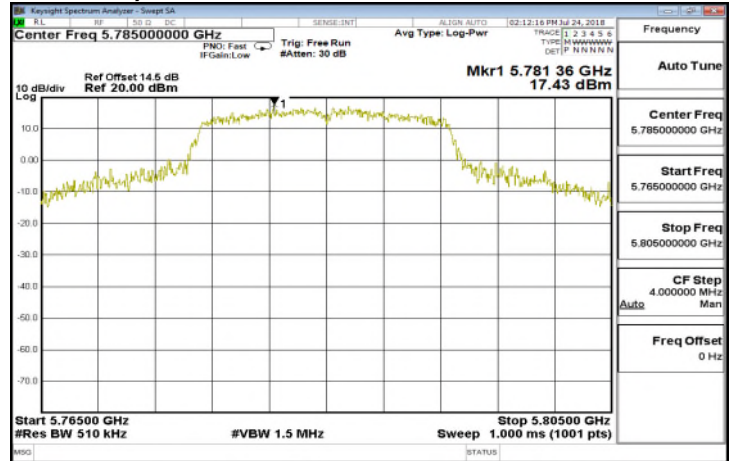


802.11n HT20, 5725~5850 MHz

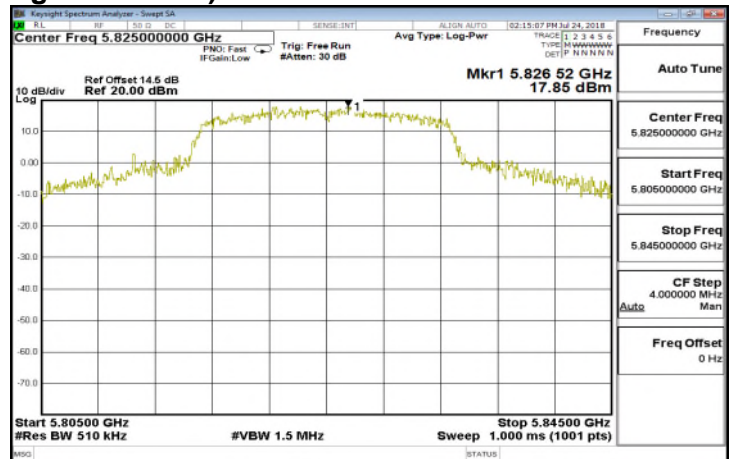
Maximum Power Spectral Density Data Plot (CH Low 5745 MHz)



Maximum Power Spectral Density Data Plot (CH Mid 5785 MHz)



Maximum Power Spectral Density Data Plot (CH High 5825 MHz)

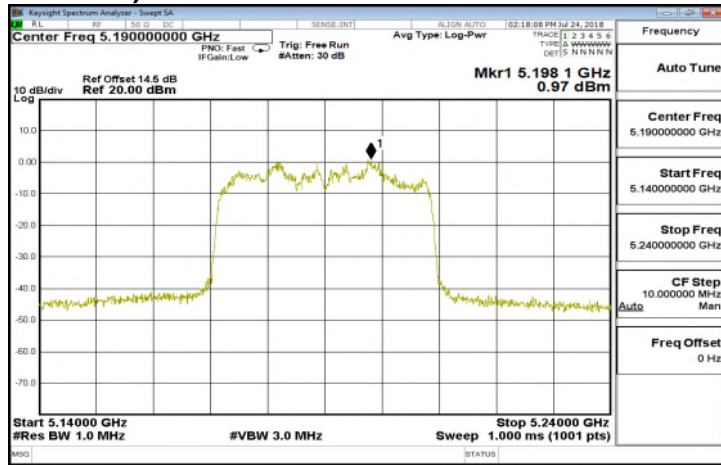


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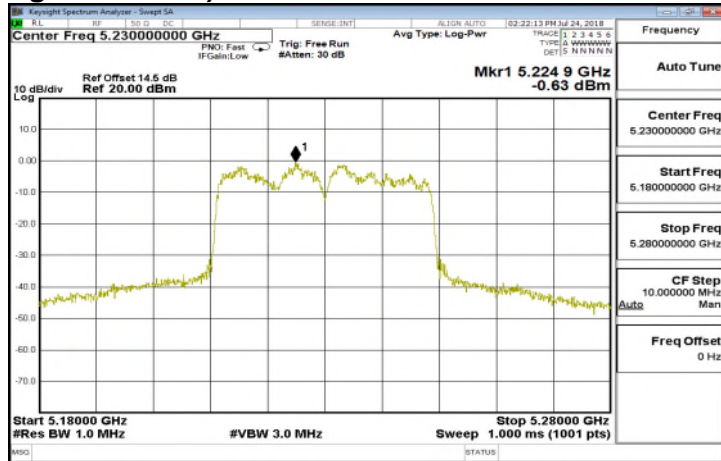
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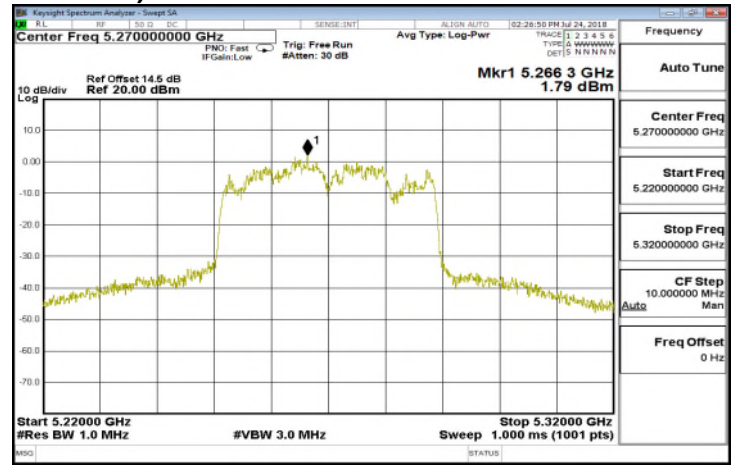
802.11n HT40, 5150~5250 MHz
Maximum Power Spectral Density Data Plot (CH Low 5190 MHz)



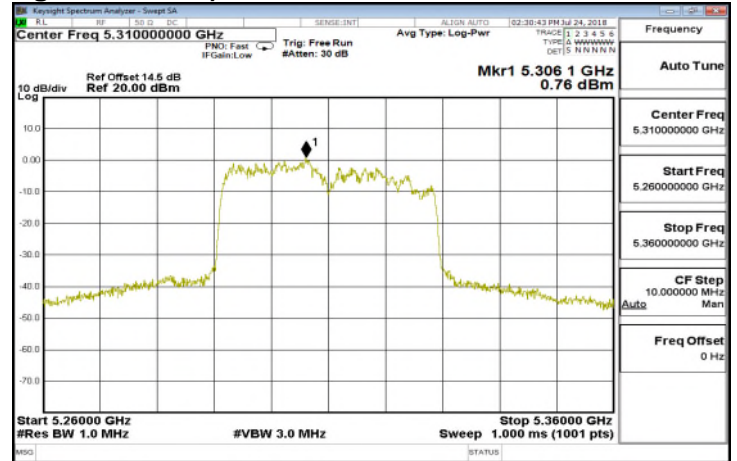
Maximum Power Spectral Density Data Plot (CH High 5230 MHz)



802.11n HT40, 5250~5350 MHz
Maximum Power Spectral Density Data Plot (CH Low 5270 MHz)



Maximum Power Spectral Density Data Plot (CH High 5310 MHz)



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