

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART E AND INDUSTRY CANADA RSS 247 REQUIREMENT

OF

Product Name: HiMirror
Brand Name: HiMirror
Model No.: BM618
Model Difference: N/A
FCC ID: 2AJTF-BM618
IC: 21978-BM618
Report No.: E2/2016/A0021
Issue Date: Nov. 01, 2016
FCC Rule Part: §15.407
IC Rule Part: RSS-247 issue 1 May 2015
Prepared for: Cal-Comp Big Data, Inc.
No. 147, Sec. 3, Beishen Rd., Shenkeng
Dist., New Taipei City 222, Taiwan (R.O.C.)
Prepared by: SGS Taiwan Ltd.
Electronics & Communication Laboratory
No.2, Keji 1st Rd., Guishan District,
Taoyuan City, Taiwan 333



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VERIFICATION OF COMPLIANCE

Applicant: Cal-Comp Big Data, Inc.
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Taiwan (R.O.C.)

Product Name: HiMirror

Brand Name: HiMirror

Model No.: BM618

Model Difference: N/A

FCC ID: 2AJTF-BM618

IC: 21978-BM618

File Number: E2/2016/A0021

Date of Test: Oct. 04, 2016 ~ Oct. 27, 2016

Date of EUT Received: Oct. 04, 2016

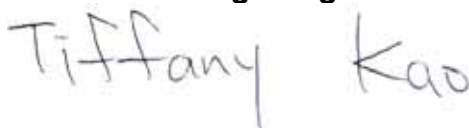
We hereby certify that:

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.

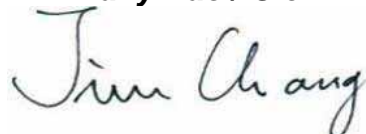
The test results of this report relate only to the tested sample identified in this report.

Test By:**Date:**

Nov. 01, 2016

Aken Huang / Engineer**Prepared By:****Date:**

Nov. 01, 2016

Tiffany Kao / Clerk**Approved By:****Date:**

Nov. 01, 2016

Jim Chang / Asst. Manager

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Revision History

Report Number	Revision	Description	Issue Date
E2/2016/A0021	Rev.00	Initial creation of document	Nov. 01, 2016

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1. GENERAL INFORMATION

1.1 Product Description

General:

Product Name:	HiMirror	
Brand Name:	HiMirror	
Model No.:	BM618	
Model Difference:	N/A	
Product SW/HW version:	N/A / N/A	
Radio SW/HW version:	N/A / N/A	
Test SW Version:	N/A	
RF power setting in TEST SW:	N/A	
Power Supply:	12Vdc from AC/DC adapter	
	Adapter:	<ol style="list-style-type: none"> 1. Model No.: 2ABN036F, Supplier: Channel Well Technology 2. Model No.: KSAS0361200300HU Supplier: Kuantech (Shenzhen) Co., Ltd. 3. Model No.: WA-36A12FU, Supplier: Asian Power Devices Inc. 4. Model No.: WAG007, Supplier: Acbel Polytech Inc.

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WLAN 5GHz:

Wi-Fi	Frequency Range	Channels	Rated Power (Avg.) / (EIRP)	Modulation Technology	Type of Emission
11a	5150~5250	4	13.95 dBm (Avg.) / 18.45 dBm (EIRP)	OFDM	16M5D1D
11n_20M	HT20 5150~5250	4	HT: 14.20 dBm (Avg.) / 21.71 dBm (EIRP) (Worst Case)	OFDM	17M6D1D
11n_40M	HT40 5150~5250	2	HT: 14.93dBm (Avg.) / 22.44 dBm (EIRP) (Worst Case)	OFDM	36M3D1D
Antenna Designation			PCB Antenna, 1. Main 5GHz Gain: 4.13dBi (5150MHz-5250MHz) 2. Aux 5GHz Gain: 4.5dBi (5150MHz-5250MHz)		
Modulation type			64QAM, 16QAM, QPSK, BPSK for OFDM		
Transition Rate:			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 – 300Mbps		

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1.2 Product Feature of Equipment Under Test

The equipment under Test (Hereafter Called: EUT) is supporting Wi-Fi 802.11a/b/g/n, Bluetooth features, and below is details of information.

Product Feature	
Product Name:	HiMirror
Brand Name:	HiMirror
Model No.:	BM618
Model Difference:	N/A
FCC ID:	2AJTF-BM618
IC :	21978-BM618
Bluetooth Version	V4.1 single mode
Wi-Fi- Specification	802.11a/b/g/n

Note: The above EUT information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

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1.3 Test Methodology of Applied Standards

FCC Part 15, Subpart E §15.407

FCC KDB 789033 D02 General UNII Test Procedures New Rules

FCC KDB 662911 D01 Multiple Transmitter Output

FCC KDB 644545 D03 Guidance for IEEE 802.11ac v01

RSS-247 issue 1 May 2015

RSS-Gen issue 4 Nov. 2014

ANSI C63.10:2013

Note:

1. All test items have been performed and record as per the above standards.
2. The composite system is compliance with FCC Subpart B is authorized under the certification procedure.

1.4 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

Canada Registration Number: 4620A-5.

1.5 Special Accessories

There are no special accessories used while test was conducted.

1.6 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 30MHz. 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 hand-held 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.

Following shows an offset computation example with cable loss 1.4dB, and 10dB attenuator (SISO) and cable loss 4.4dB, and 10dB attenuator (MIMO).

SISO mode offset = RF cable loss (dB)+ attenuation factor(dB) =11.4(dB)

MIMO mode offset = RF cable loss (dB)+ attenuation factor(dB)+ 10 log(N_{ANT}) dB =14.4(dB)

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2.5 Configuration of Tested System

Fig. 2-1 Radiated Emission & AC Power Line Conducted Emission

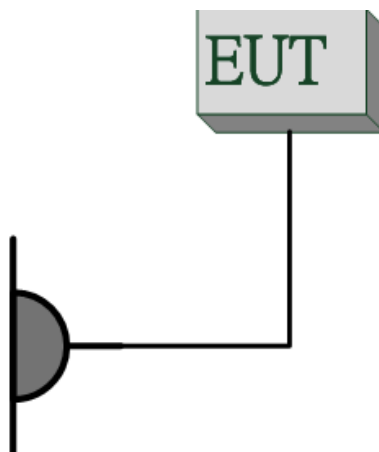


Fig. 2-2 Conducted (Antenna Port) Emission



Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Data Cable	Power Cord
1.	WLAN Test Software	N/A	N/A	N/A	N/A	N/A
2.	Notebook	Lenovo	L430	R9-YYG88	Shielded	Un-shielded
3.	DC Power Supply	Agilent	E3640A	MY52410006	N/A	Un-Shielded

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3. SUMMARY OF TEST RESULT

FCC Rules	IC Rules	Description Of Test	Result
§15.207	RSS-Gen §8.8	AC Power Line Conducted Emission	Compliant
§15.403(i) §15.407(e)	RSS-247 §6.2.1~ 4 (1) RSS-Gen §6.6	26 dB & 6dB & 99% Emission Bandwidth	Compliant
§15.407(a)	RSS-247 §6.2.1~ 4 (1)	Maximum Conducted Output Power	Compliant
§15.407(a)	RSS-247 §6.2.1~ 4 (1)	Power Spectral Density	Compliant
§15.407(b)	RSS-247 §6.2.1~ 4 (2)	Undesirable Radiated Emissions	Compliant
§15.407(c)	RSS-247 §6.4	Transmission in case of Absence of Information	Compliant
§15.407(g)	RSS-Gen §6.11	Frequency Stability	Compliant
§15.203 §15.407(a)	RSS- Gen §6.7 RSS- Gen §8.3	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:

4 channels are provided for 802.11a, 802.11n_HT20

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
36	5180 MHz	44	5220 MHz
40	5200 MHz	48	5240 MHz

2 channels are provided for 802.11n_HT40

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
38	5190 MHz	46	5230 MHz

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.

Note: Pre-scanned was done on Antenna Main and Antenna Aux, and Antenna Aux results higher emission at 5GHz. Therefore, the completed set of measurement was done on Antenna Main (5GHz) to be presented on this test report.

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RADIATED EMISSION TEST:

RADIATED EMISSION TEST (BELOW 1 GHz)						
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	1	MAIN
RADIATED EMISSION TEST (ABOVE 1 GHz)						
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	1	MAIN
802.11n_HT20				OFDM	MCS8	MIMO
802.11n_HT40	5190~5230	38 to 46	38,46	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 WLAN Transmitter for channel Low, Mid and High, the worst case E2 position was reported.

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	1	MAIN
802.11n_HT20				OFDM	MCS8	MIMO
802.11n_HT40	5190~5230	38 to 46	38,46	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
Peak 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(uV)	
	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	12/12/2015	12/11/2016
Coaxial Cables	N/A	N30N30-1042-150 cm	N/A	02/07/2016	02/06/2017
LISN	Schwarzbeck	NSLK 8127	8127-648	03/11/2016	03/10/2017
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 tabletop.
3. The LISN was connected with 120Vac/60Hz power source.

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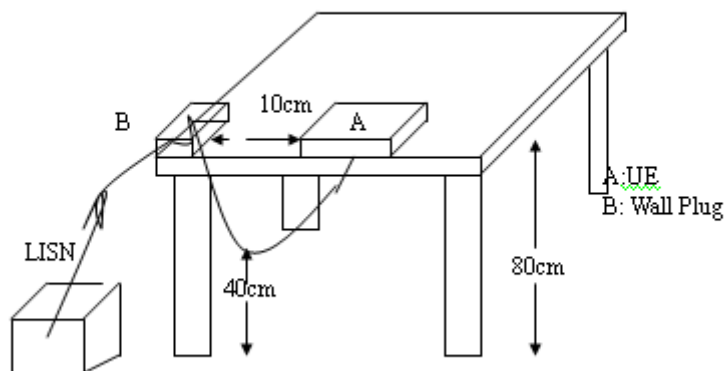
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6.4. Test SET-UP



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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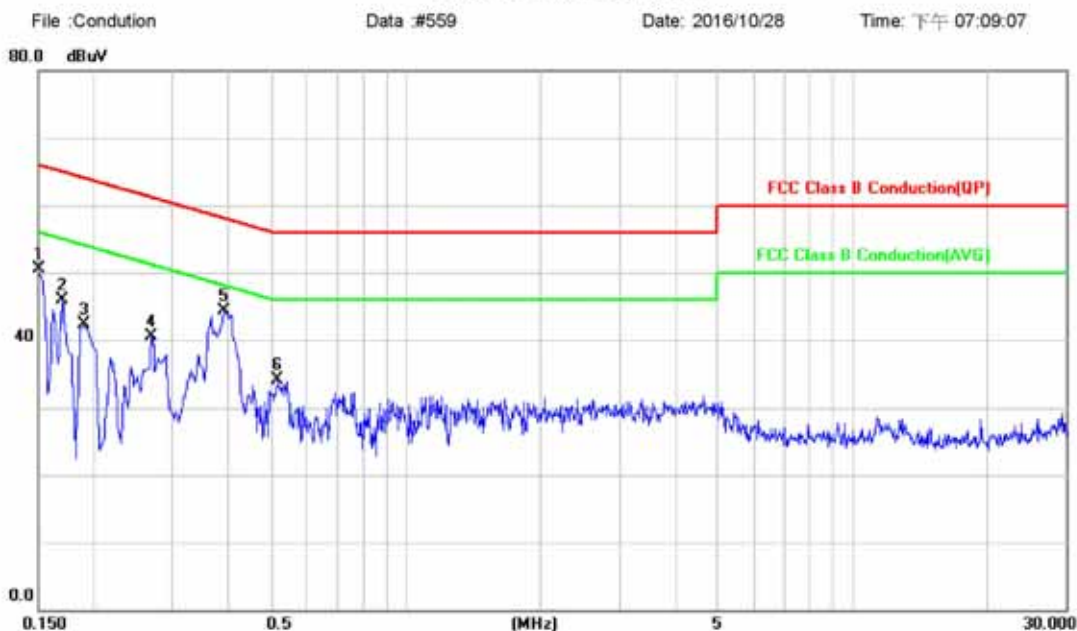
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AC POWER LINE CONDUCTED EMISSION TEST DATA

Operation Mode:	Operation mode			Test Date:	Oct. 07, 2016
Temperature:	20	Humidity:	58 %	Test By:	Aken
Model No.:	2ABN036F			Phase:	L1

Site : Conduction Room Phase: **L1** Temperature: 25 °C
 Limit: FCC Class B Conduction(QP) Power: AC 120V/60Hz Humidity: 56 %
 Mode: 2ABN036F
 Note:

Conducted Emission



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1		0.1500	30.78	19.72	50.50	66.00	-15.50	peak	
2		0.1700	26.15	19.72	45.87	64.96	-19.09	peak	
3		0.1900	22.54	19.71	42.25	64.04	-21.79	peak	
4		0.2700	20.76	19.76	40.52	61.12	-20.60	peak	
5 *		0.3900	24.52	19.83	44.35	58.06	-13.71	peak	
6		0.5140	14.14	19.90	34.04	56.00	-21.96	peak	

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Site : Conduction Room Phase: **N** Temperature: 25 °C
 Limit: FCC Class B Conduction(QP) Power: AC 120V/60Hz Humidity: 56 %
 Mode: 2ABN036F
 Note:

Conducted Emission



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB		
1		0.1780	22.60	19.72	42.32	64.58	-22.26	peak	
2		0.1980	20.07	19.72	39.79	63.69	-23.90	peak	
3	*	0.3940	22.12	19.84	41.96	57.98	-16.02	peak	
4		0.6980	11.74	19.91	31.65	56.00	-24.35	peak	
5		1.1740	11.58	19.92	31.50	56.00	-24.50	peak	
6		1.6420	11.53	19.93	31.46	56.00	-24.54	peak	

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AC POWER LINE CONDUCTED EMISSION TEST DATA

Operation Mode:	Operation mode			Test Date:	Oct. 07, 2016
Temperature:	20	Humidity:	58 %	Test By:	Aken
Model No.:	KSAS0361200300HU			Phase:	L1

Site : Conduction Room

Phase: L1

Temperature: 25 °C

Limit: FCC Class B Conduction(QP)

Power: AC 120V/60Hz

Humidity: 56 %

Mode: KSAS0361200300HU

Note:

Conducted Emission



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB		
1		0.1500	30.66	19.72	50.38	66.00	-15.62	peak	
2 *		0.1700	30.37	19.72	50.09	64.96	-14.87	peak	
3		0.1780	27.88	19.71	47.59	64.58	-16.99	peak	
4		0.2020	26.15	19.71	45.86	63.53	-17.67	peak	
5		0.2260	24.83	19.73	44.56	62.60	-18.04	peak	
6		0.6020	17.52	19.90	37.42	56.00	-18.58	peak	

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Site : Conduction Room Phase: **N** Temperature: 25 °C
 Limit: FCC Class B Conduction(QP) Power: AC 120V/60Hz Humidity: 56 %
 Mode: KSAS0361200300HU
 Note:

Conducted Emission



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB		
1		0.1500	29.01	19.73	48.74	66.00	-17.26	peak	
2		0.1660	26.49	19.73	46.22	65.16	-18.94	peak	
3 *		0.1740	31.27	19.73	51.00	64.77	-13.77	peak	
4		0.1980	28.00	19.72	47.72	63.69	-15.97	peak	
5		0.2300	24.28	19.74	44.02	62.45	-18.43	peak	
6		0.5980	18.42	19.91	38.33	56.00	-17.67	peak	

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AC POWER LINE CONDUCTED EMISSION TEST DATA

Operation Mode:	Operation mode			Test Date:	Oct. 07, 2016
Temperature:	20	Humidity:	58 %	Test By:	Aken
Model No.:	WA-36A12FU			Phase:	L1

Site : Conduction Room Phase: **L1** Temperature: 25 ℃
 Limit: FCC Class B Conduction(QP) Power: AC 120V/60Hz Humidity: 56 %
 Mode: WA-36A12FU
 Note:

Conducted Emission



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1500	25.33	19.72	45.05	66.00	-20.95	peak	
2		0.1700	20.72	19.72	40.44	64.96	-24.52	peak	
3 *		0.4740	17.66	19.88	37.54	56.44	-18.90	peak	
4		0.7260	16.06	19.91	35.97	56.00	-20.03	peak	
5		0.8260	16.74	19.91	36.65	56.00	-19.35	peak	
6		3.9460	9.59	19.96	29.55	56.00	-26.45	peak	

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Site : Conduction Room

Phase: **N**

Temperature: 25 ℃

Limit: FCC Class B Conduction(QP)

Power: AC 120V/60Hz

Humidity: 56 %

Mode: WA-36A12FU

Note:

Conducted Emission



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1		0.1580	21.45	19.73	41.18	65.57	-24.39	peak	
2		0.4780	13.58	19.90	33.48	56.37	-22.89	peak	
3	*	0.7260	15.00	19.92	34.92	56.00	-21.08	peak	
4		0.8300	13.41	19.92	33.33	56.00	-22.67	peak	
5		1.2740	9.93	19.93	29.86	56.00	-26.14	peak	
6		3.9740	7.97	19.97	27.94	56.00	-28.06	peak	

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AC POWER LINE CONDUCTED EMISSION TEST DATA

Operation Mode:	Operation mode			Test Date:	Oct. 07, 2016
Temperature:	20	Humidity:	58 %	Test By:	Aken
Model No.:	WAG007			Phase:	L1

Site : Conduction Room

Phase: L1

Temperature: 25 °C

Limit: FCC Class B Conduction(QP)

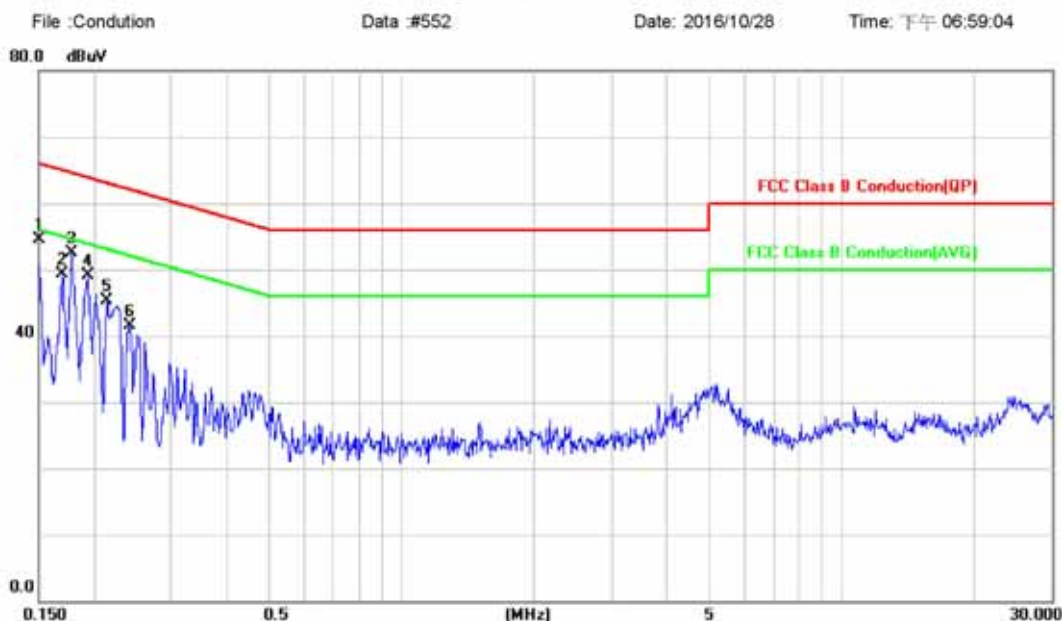
Power: AC 120V/60Hz

Humidity: 56 %

Mode: WAG007

Note:

Conducted Emission



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB		
1	*	0.1500	34.78	19.72	54.50	66.00	-11.50	peak	
2		0.1700	29.57	19.72	49.29	64.96	-15.67	peak	
3		0.1780	32.79	19.71	52.50	64.58	-12.08	peak	
4		0.1940	29.41	19.71	49.12	63.86	-14.74	peak	
5		0.2140	25.59	19.72	45.31	63.05	-17.74	peak	
6		0.2420	21.81	19.74	41.55	62.03	-20.48	peak	

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Site : Conduction Room Phase: **N** Temperature: 25 ℃
Limit: FCC Class B Conduction(QP) Power: AC 120V/60Hz Humidity: 56 %
Mode: WAG007
Note:

Conducted Emission



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1 *		0.1540	34.70	19.73	54.43	65.78	-11.35	QP	
2		0.1540	16.30	19.73	36.03	55.78	-19.75	AVG	
3		0.1900	28.05	19.72	47.77	64.04	-16.27	peak	
4		0.1980	28.23	19.72	47.95	63.69	-15.74	peak	
5		0.2380	22.44	19.75	42.19	62.17	-19.98	peak	
6		0.2780	21.14	19.77	40.91	60.88	-19.97	peak	
7		0.3220	18.26	19.79	38.05	59.66	-21.61	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
802.11a	97.46	0.11
802.11n_20	94.53	0.24
802.11n_40	90.00	0.46

Duty Cycle Factor: $10 * \log(1/0.9746) = 0.11$

Duty Cycle Factor: $10 * \log(1/0.9453) = 0.24$

Duty Cycle Factor: $10 * \log(1/0.9) = 0.46$

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DUTY CYCLE TEST SIGNAL Measurement Result 802.11a



802.11n HT20



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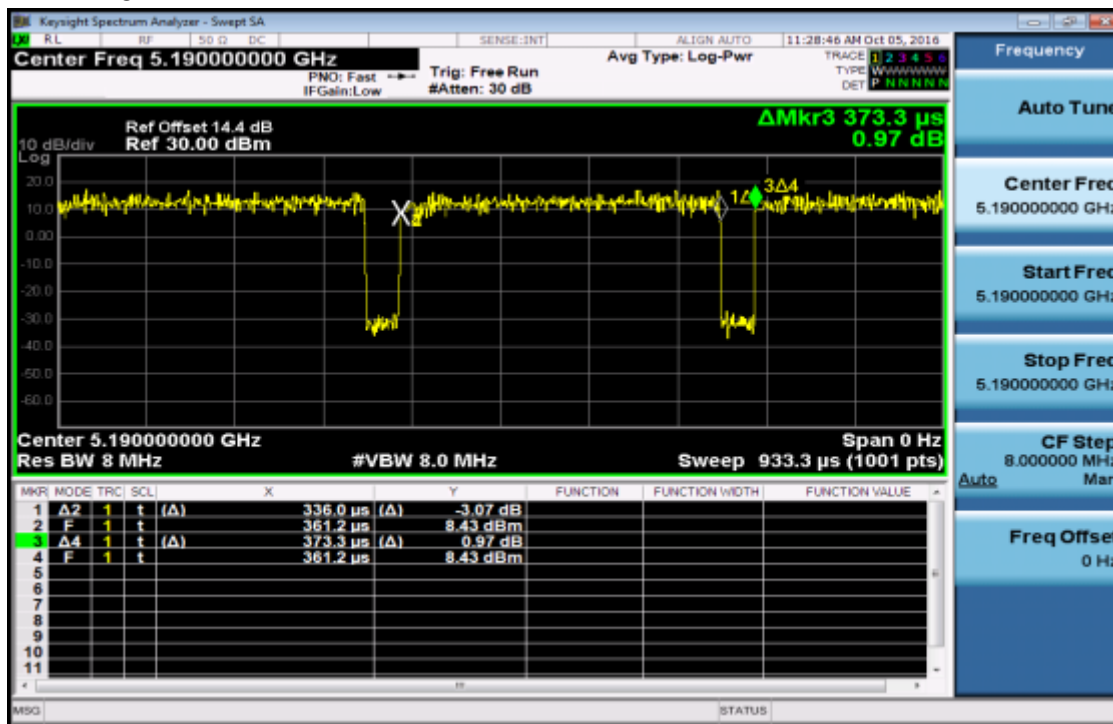
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802.11n HT 40



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8. 26dB & 99% 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. Repeat above procedures until all test default channel measured were complete.

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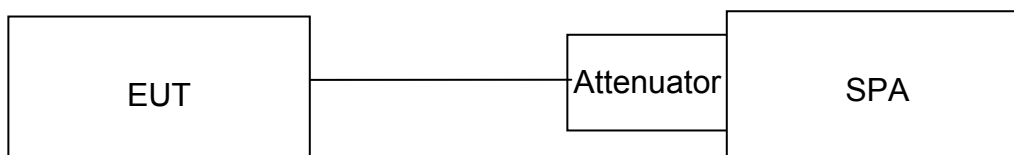
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8.3 Measurement Equipment Used

SGS Conducted Room					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Spectrum Analyzer	KEYSIGHT	N9010A	MY54510568	04/14/2016	04/13/2017
Power Meter	Anritsu	ML2496A	1326001	06/23/2016	06/22/2017
Power Sensor	Anritsu	MA2411B	1315048	06/23/2016	06/22/2017
Power Sensor	Anritsu	MA2411B	1315049	06/23/2016	06/22/2017
Coaxial Cable 30cm	WOKEN	00100A1F1A195C	RF01	12/12/2015	12/11/2016
DC Block	PASTERNAK	PE8210	RF29	12/12/2015	12/11/2016
Splitter	RF-LAMBDA	RFLT2W1G18G	RF35	12/12/2015	12/11/2016
Attenuator	WOKEN	218FS-10	RF23	12/12/2015	12/11/2016
DC Power Supply	Agilent	E3640A	MY53140006	05/04/2016	05/03/2017

8.4 Test Set-up



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8.5 Measurement Result

26dB Bandwidth

802.11a_Main

Frequency (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5180	19.95	12.998
5220	18.57	12.689
5240	19.76	12.957

802.11a_Aux1

Frequency (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5180	18.77	12.735
5220	27.28	14.359
5240	18.53	12.679

802.11n_HT20_Main

Frequency (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5180	22.49	13.519
5220	20.67	13.154
5240	22.54	13.530

802.11n_HT20_Aux1

Frequency (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5180	19.05	12.798
5220	18.93	12.772
5240	18.84	12.752

802.11n_HT40_Main

Frequency (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5190	46.63	16.686
5230	46.59	16.683

802.11n_HT40_Aux1

Frequency (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5190	45.62	16.592
5230	49.81	16.973

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99% Emission Bandwidth

(5150~5250 MHz)

802.11a

Main

Frequency (MHz)	Measured Frequency (MHz)	Limit (MHz)
5240	5248.07	< 5250

Aux

Frequency (MHz)	Measured Frequency (MHz)	Limit (MHz)
5240	5248.07	< 5250

802.11n HT20

Main

Frequency (MHz)	Measured Frequency (MHz)	Limit (MHz)
5240	5248.64	< 5250

Aux

Frequency (MHz)	Measured Frequency (MHz)	Limit (MHz)
5240	5248.64	< 5250

802.11n HT40

Main

Frequency (MHz)	Measured Frequency (MHz)	Limit (MHz)
5230	5248.05	< 5250

Aux

Frequency (MHz)	Measured Frequency (MHz)	Limit (MHz)
5230	5248.05	< 5250

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99% Bandwidth

802.11a_Main

Frequency (MHz)	99% BW (MHz)	10 Log (B) (dB)
5180	16.415	12.152
5220	16.367	12.140
5240	16.456	12.163

802.11a_Aux1

Frequency (MHz)	99% BW (MHz)	10 Log (B) (dB)
5180	16.209	12.098
5220	16.413	12.152
5240	16.324	12.128

802.11n_HT20_Main

Frequency (MHz)	99% BW (MHz)	10 Log (B) (dB)
5180	17.557	12.445
5220	17.513	12.434
5240	17.559	12.445

802.11n_HT20_Aux1

Frequency (MHz)	99% BW (MHz)	10 Log (B) (dB)
5180	17.543	12.441
5220	17.378	12.400
5240	17.491	12.428

802.11n_HT40_Main

Frequency (MHz)	99% BW (MHz)	10 Log (B) (dB)
5190	36.261	15.594
5230	36.312	15.601

802.11n_HT40_Aux1

Frequency (MHz)	99% BW (MHz)	10 Log (B) (dB)
5190	36.168	15.583
5230	36.299	15.599

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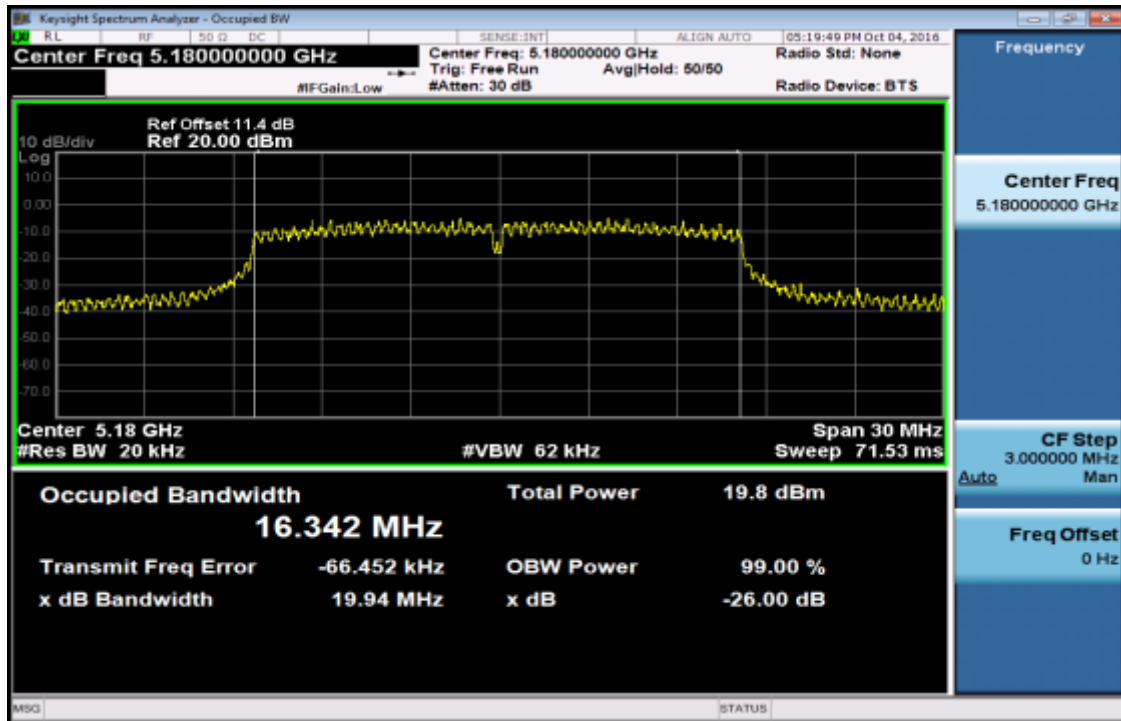
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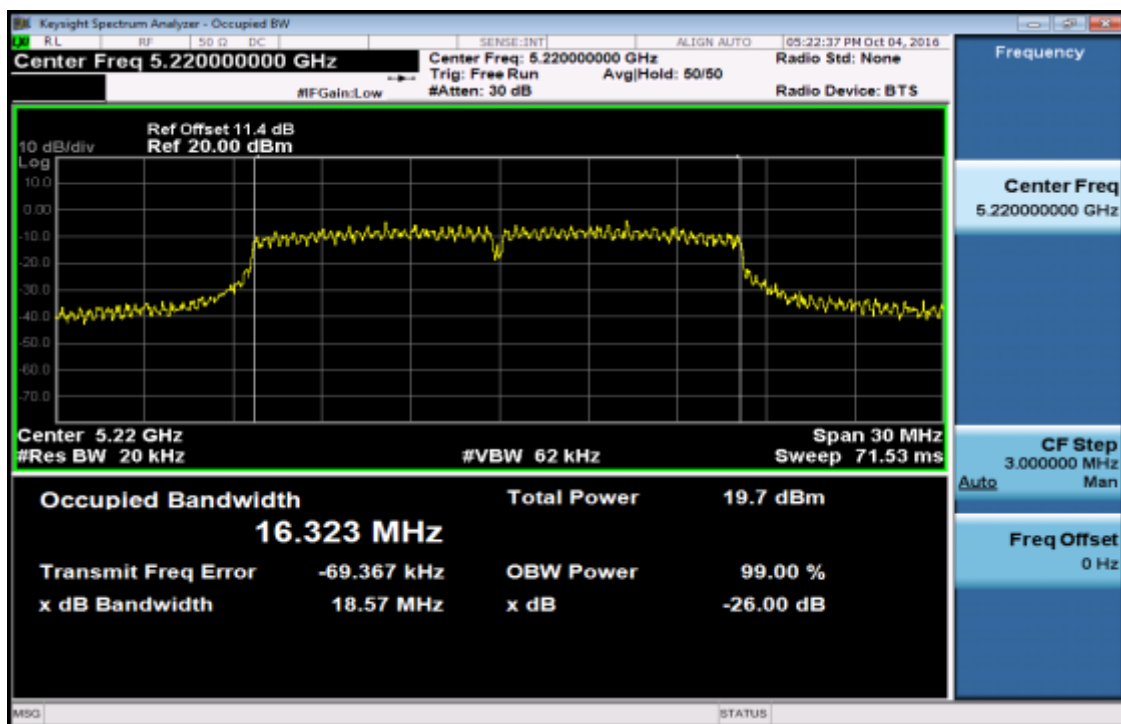
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802.11a, 5150~5250 MHz (Main) 26dB Band Width Test Data CH-Low (5180MHz)



26dB Band Width Test Data CH-Mid (5220MHz)



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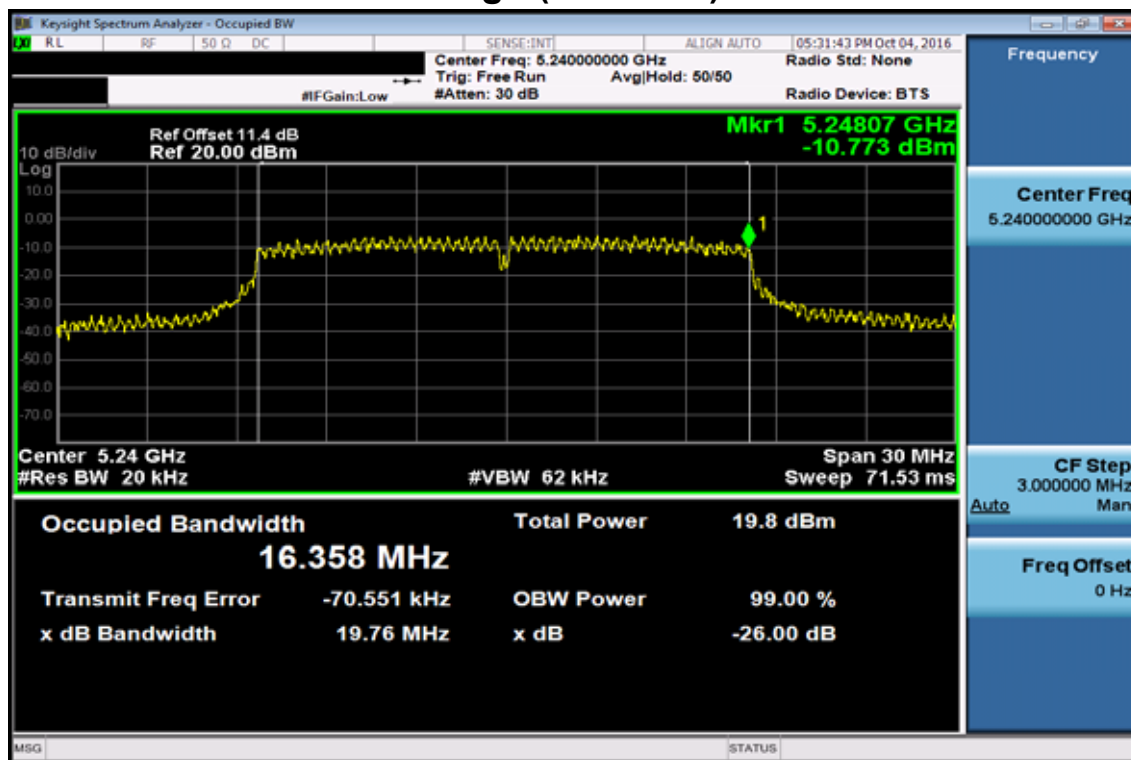
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26dB Band Width Test Data CH-High (5240MHz)



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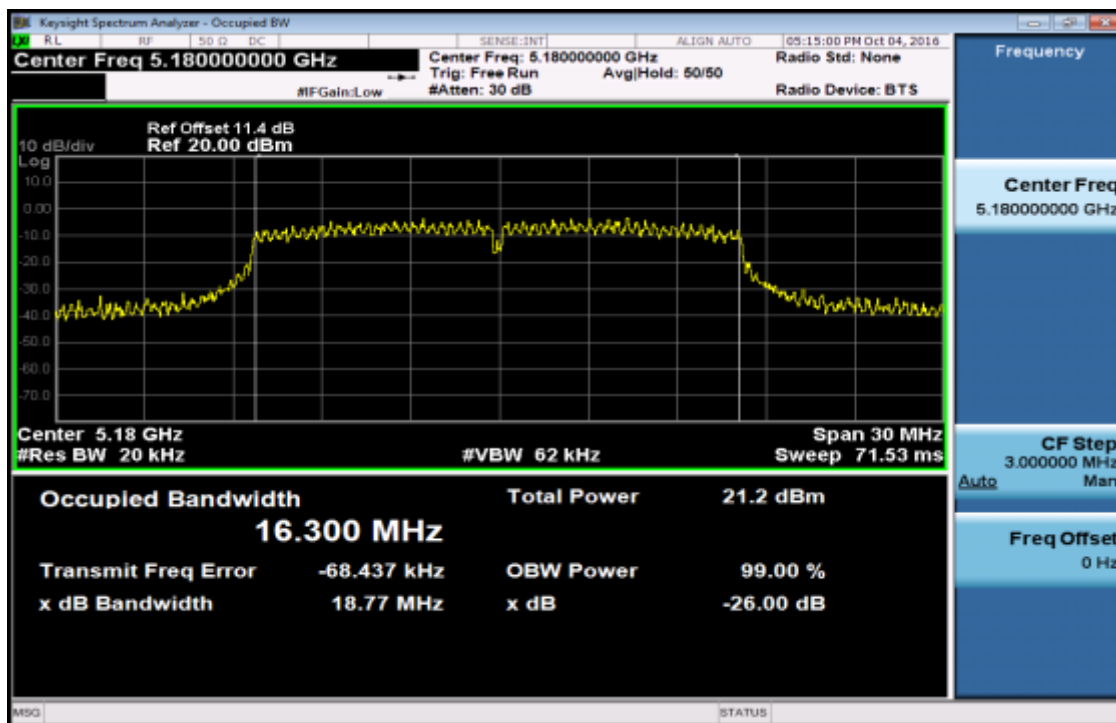
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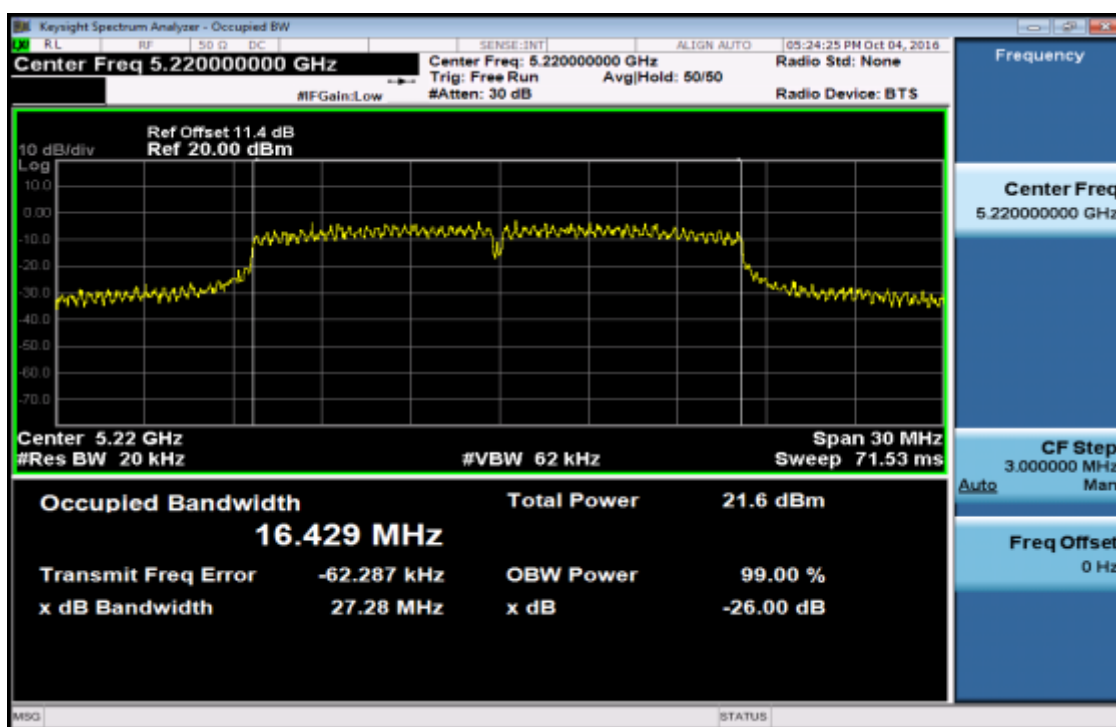
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802.11a, 5150~5250 MHz (Aux) 26dB Band Width Test Data CH-Low (5180MHz)



26dB Band Width Test Data CH-Mid (5220MHz)



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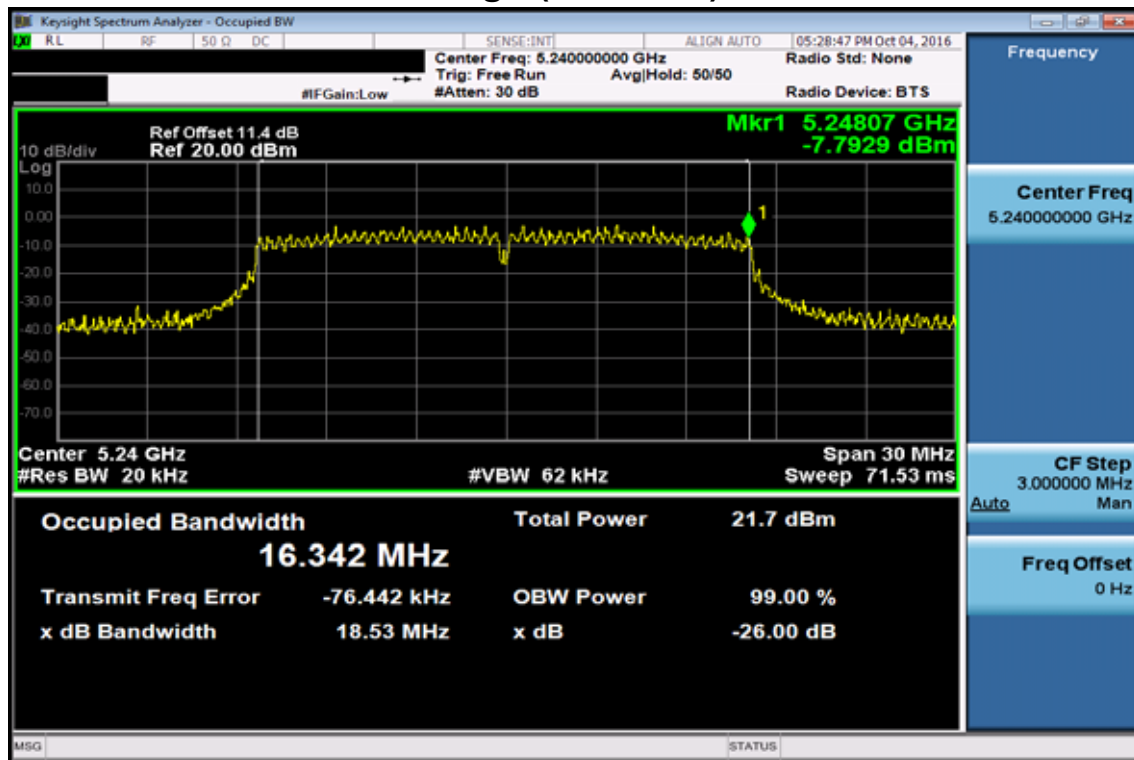
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26dB Band Width Test Data CH-High (5240MHz)



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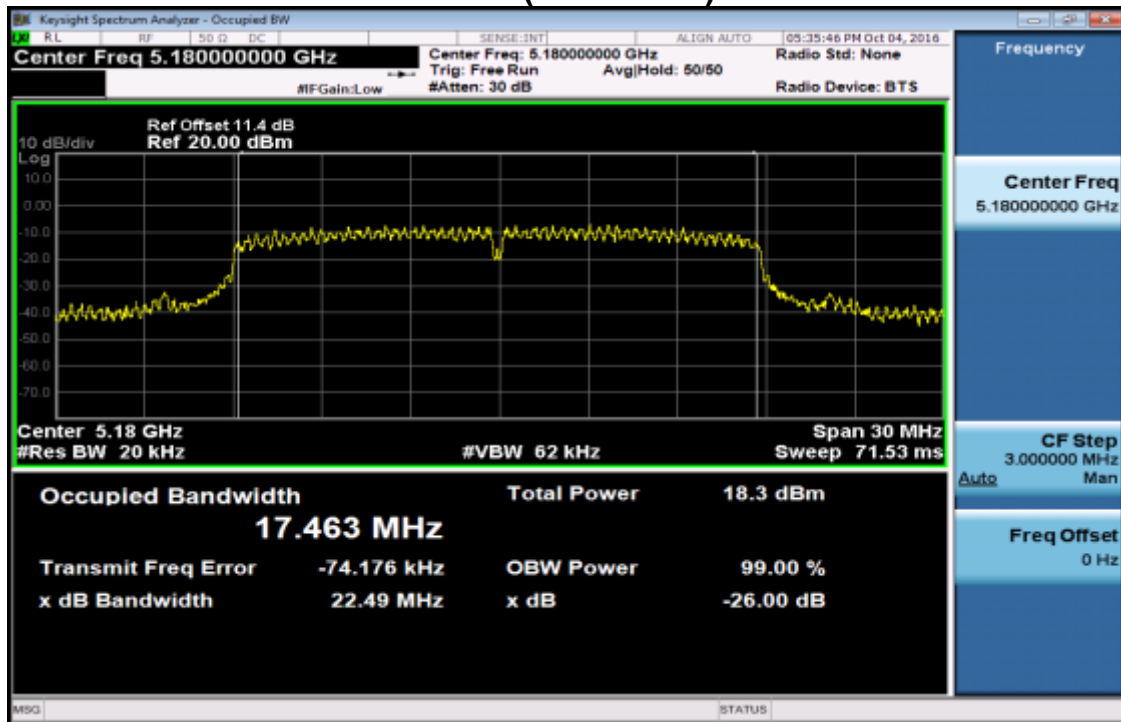
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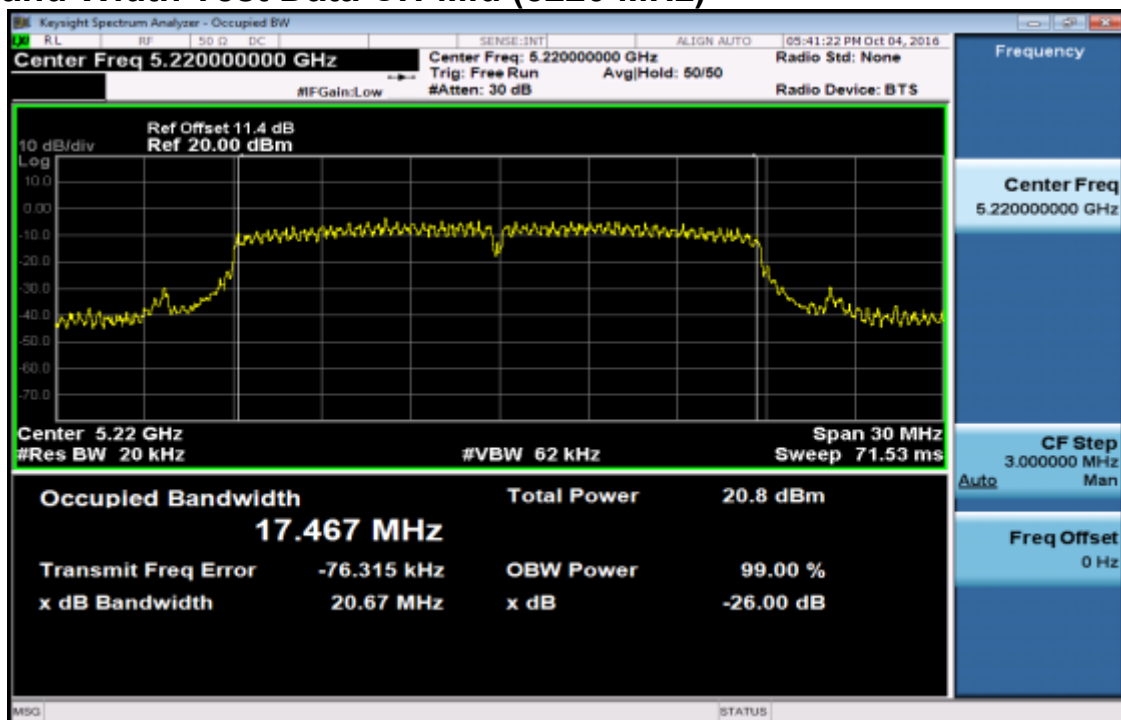
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802.11n HT20, 5150~5250 MHz (Main) 26dB Band Width Test Data CH-Low (5180 MHz)



26dB Band Width Test Data CH-Mid (5220 MHz)



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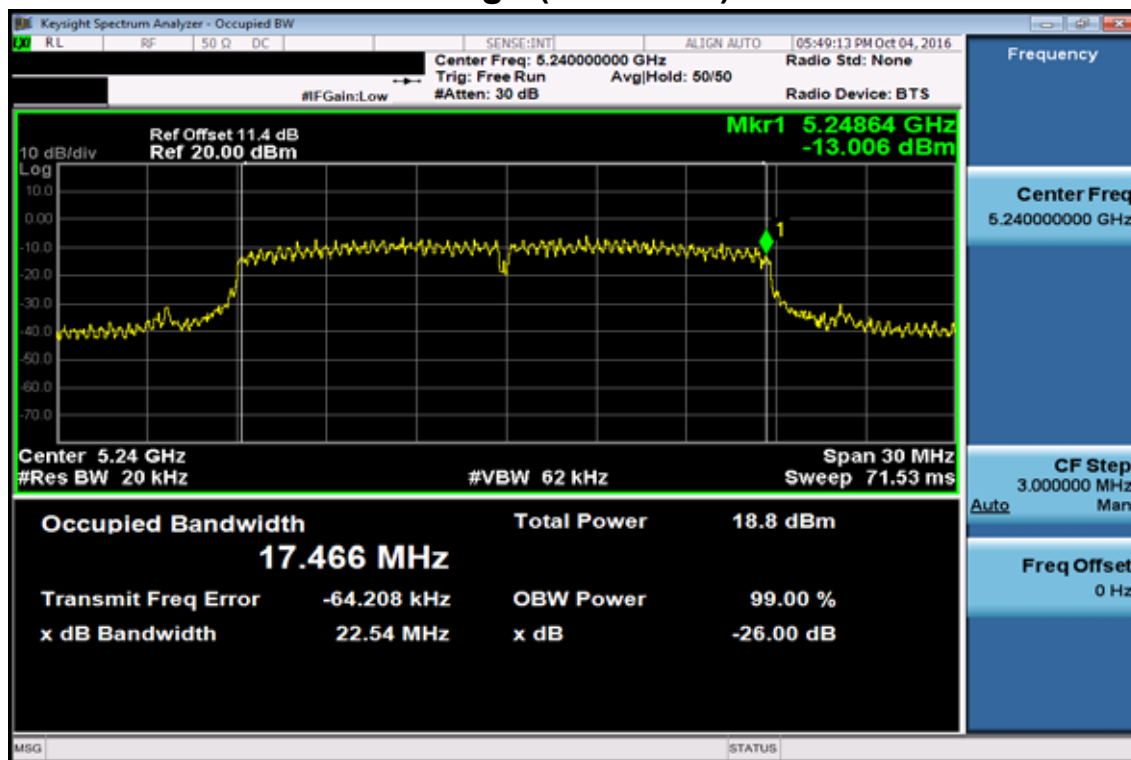
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26dB Band Width Test Data CH-High (5240 MHz)



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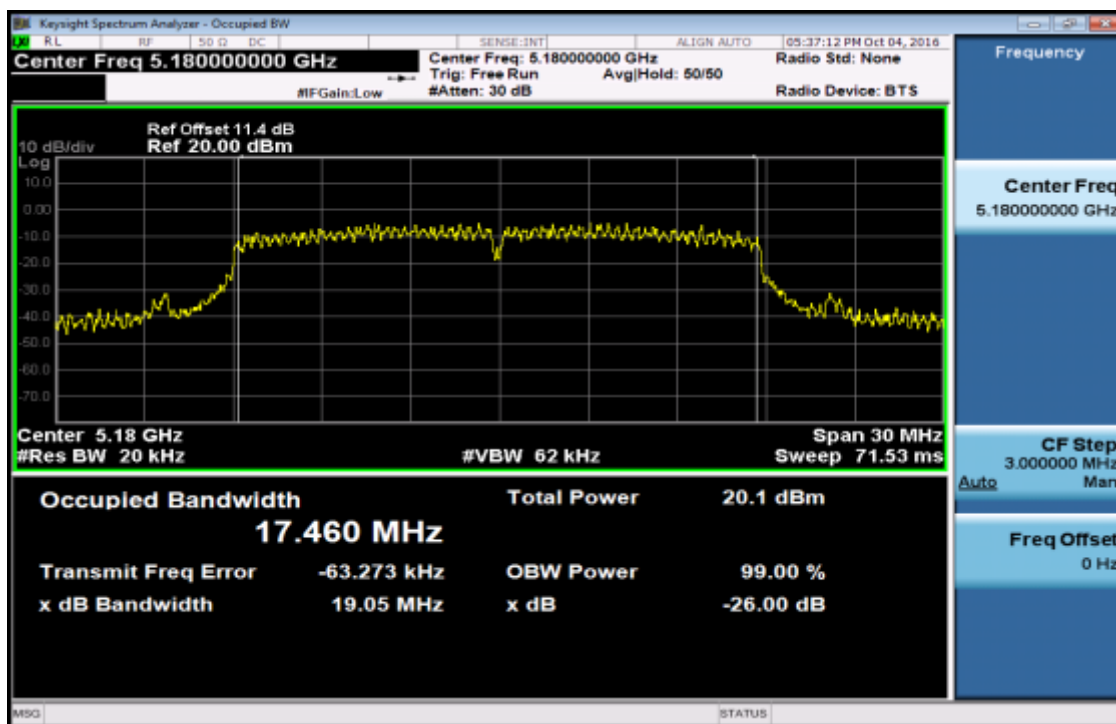
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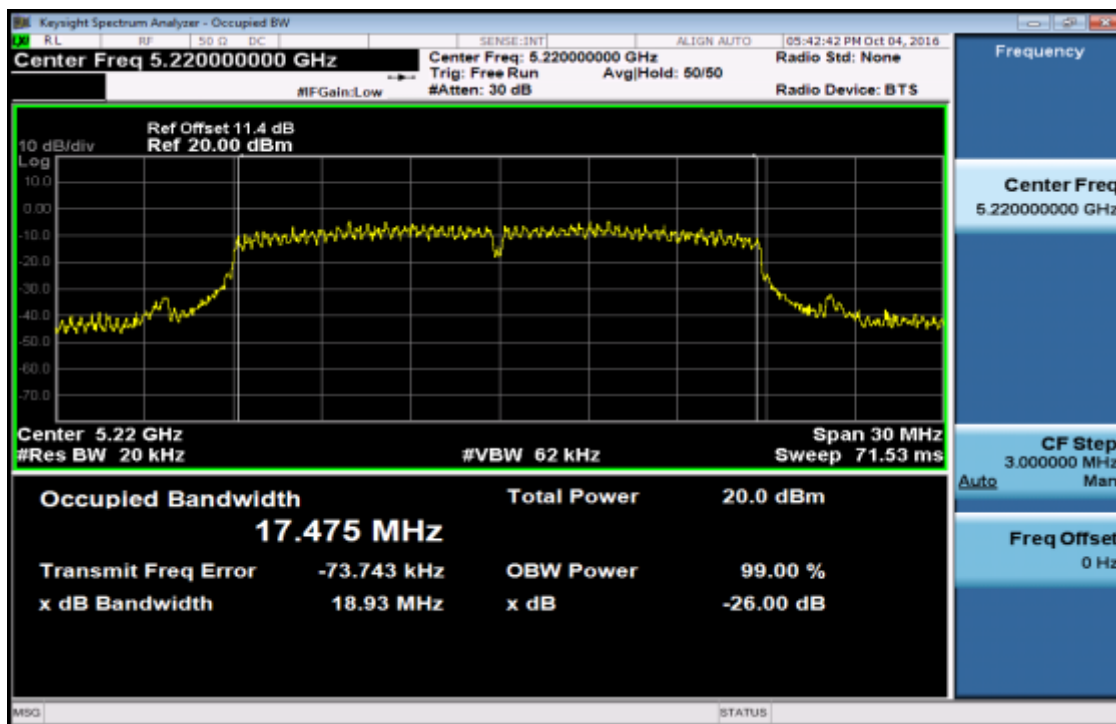
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802.11n HT20, 5150~5250 MHz (Aux1) 26dB Band Width Test Data CH-Low (5180 MHz)



26dB Band Width Test Data CH-Mid (5220 MHz)



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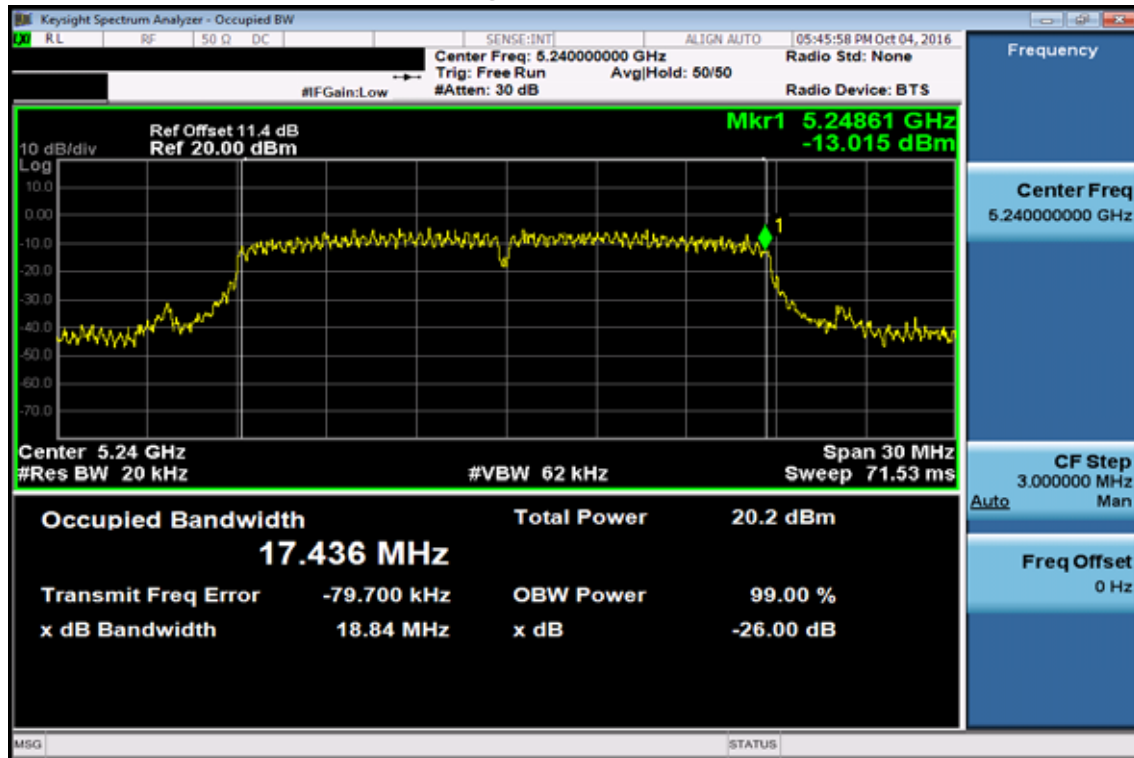
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26dB Band Width Test Data CH-High (5240 MHz)



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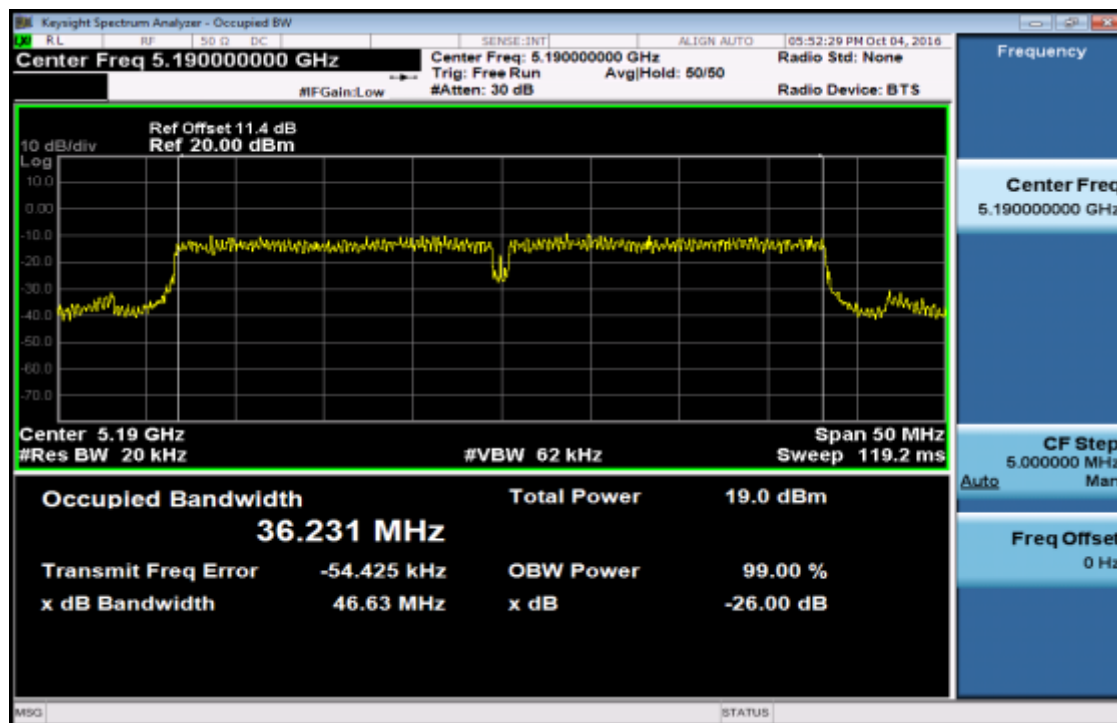
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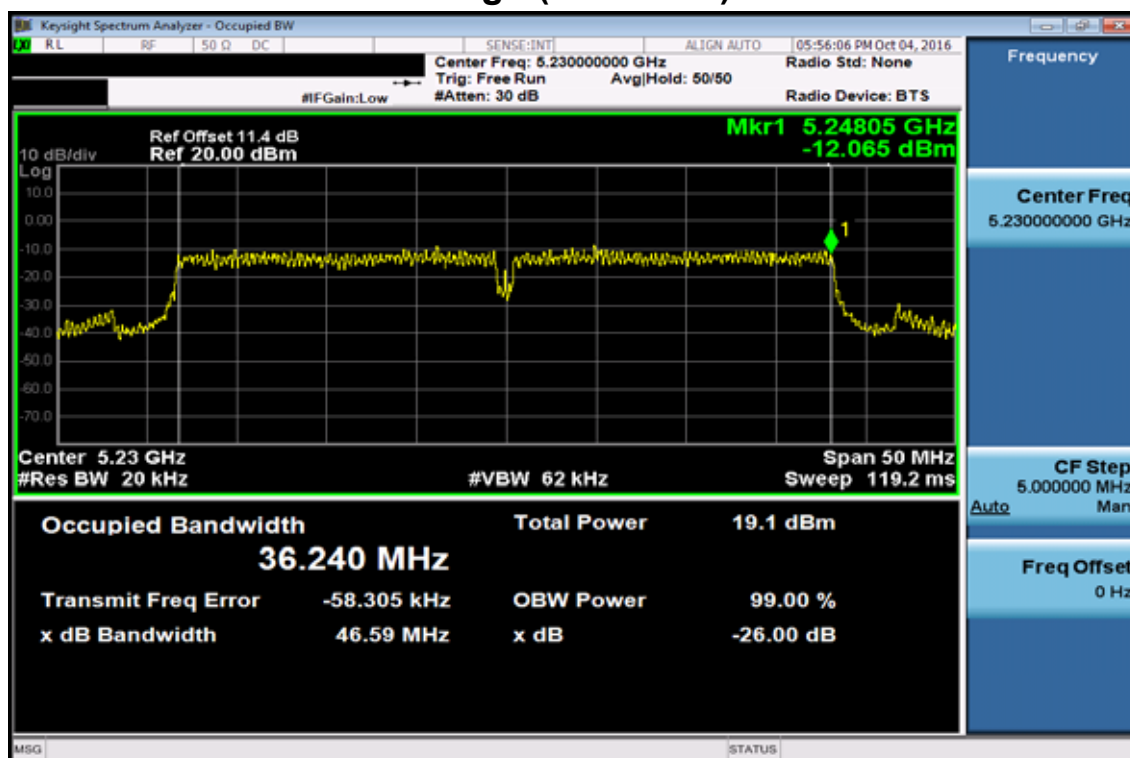
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802.11n HT40, 5150~5250 MHz (Main)

26dB Band Width Test Data CH-Low (5190 MHz)



26dB Band Width Test Data CH-High (5230 MHz)



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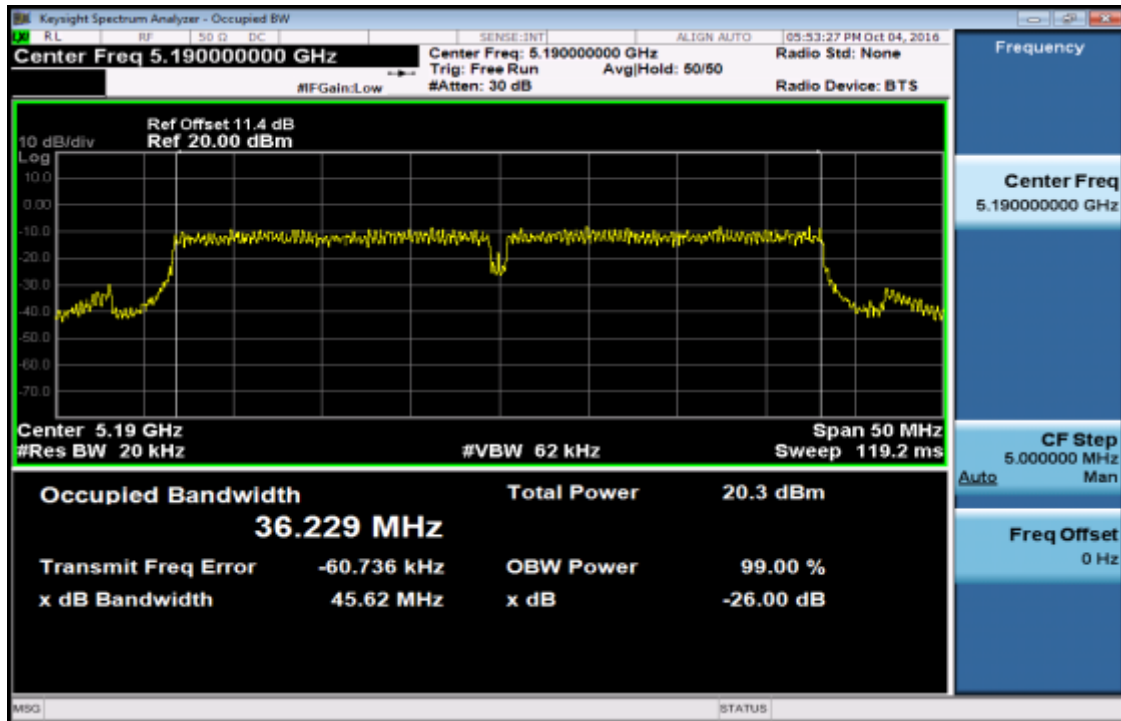
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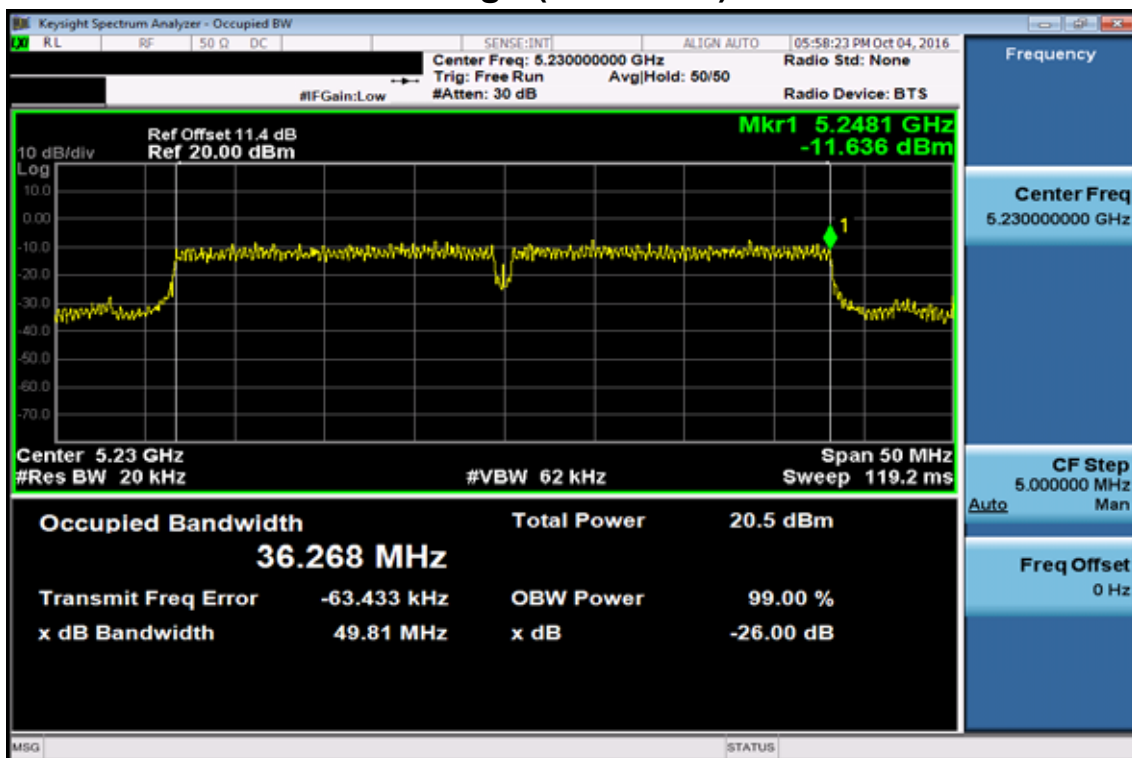
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802.11n HT40, 5150~5250 MHz (Aux1) 26dB Band Width Test Data CH-Low (5190 MHz)



26dB Band Width Test Data CH-High (5230 MHz)



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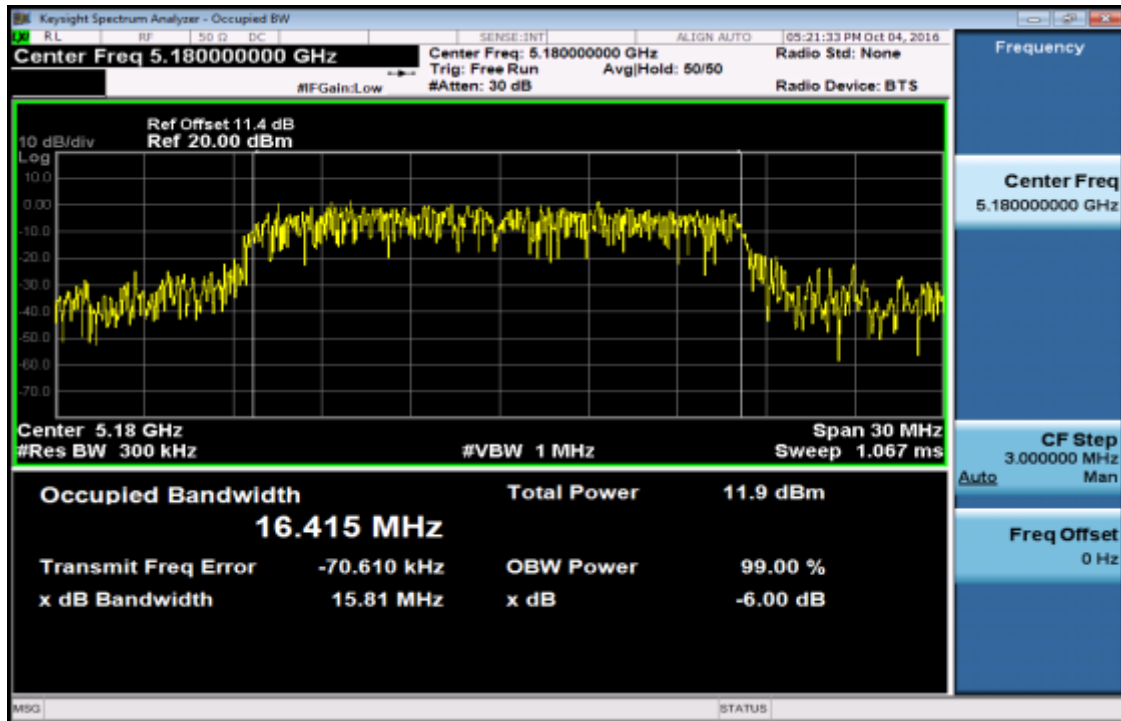
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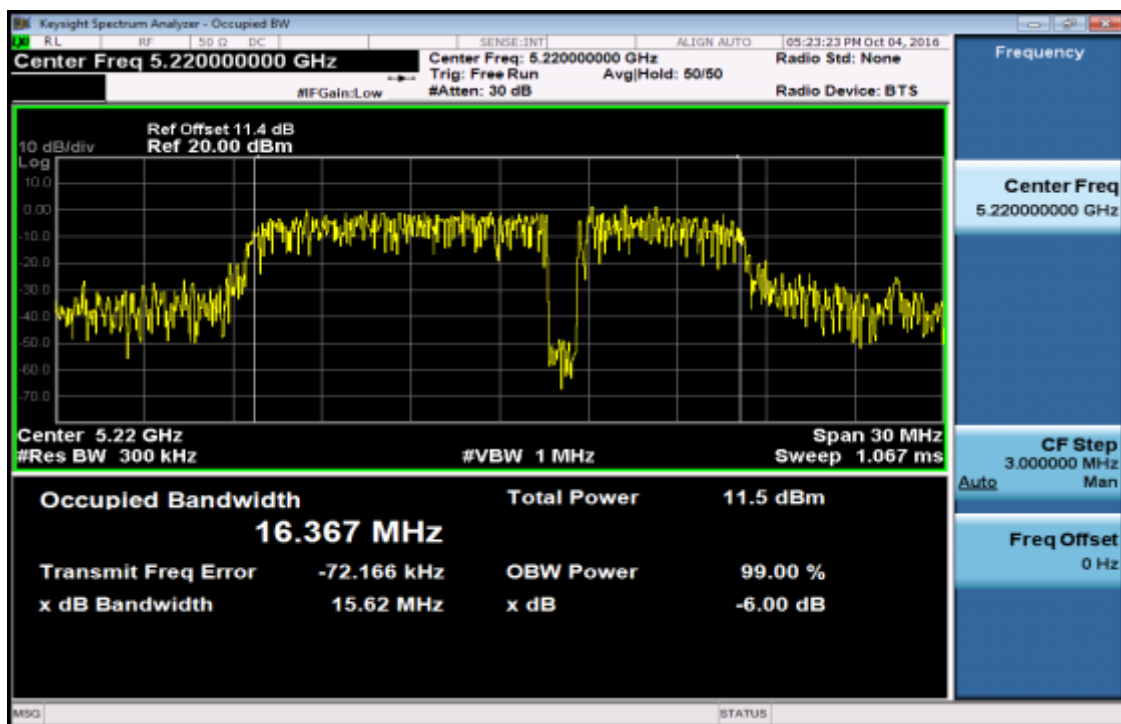
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802.11a, 5150~5250 MHz (Main)

99% Band Width Test Data CH-Low (5180MHz)



99% Band Width Test Data CH-Mid (5220MHz)



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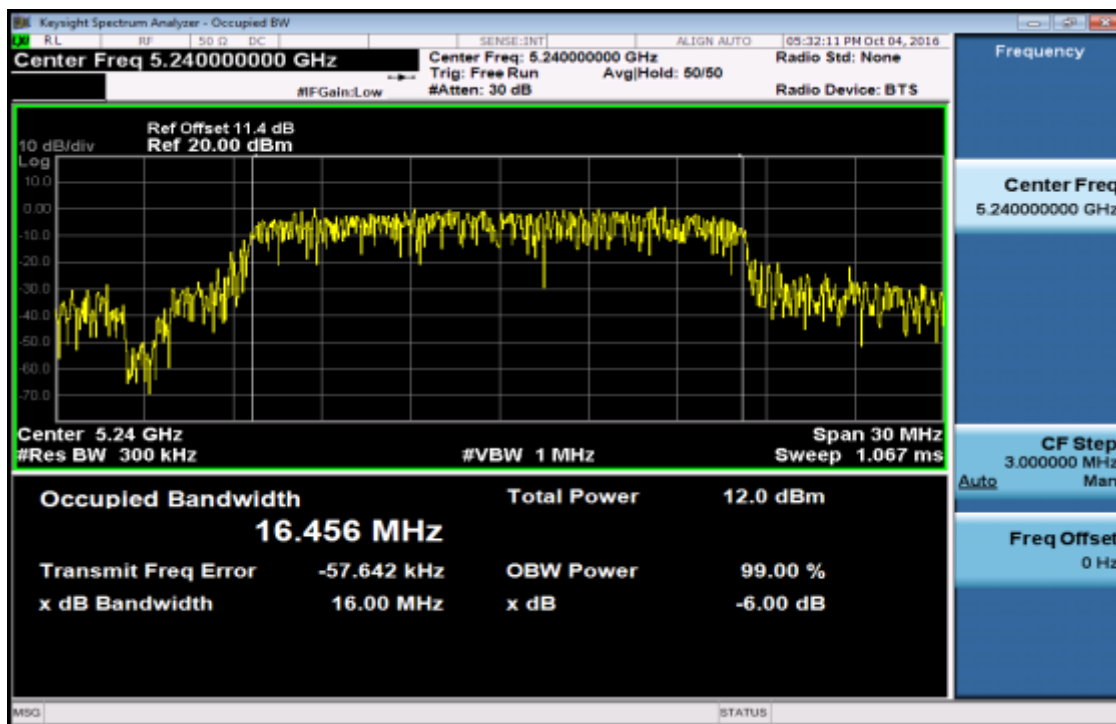
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99% Band Width Test Data CH-High (5240MHz)



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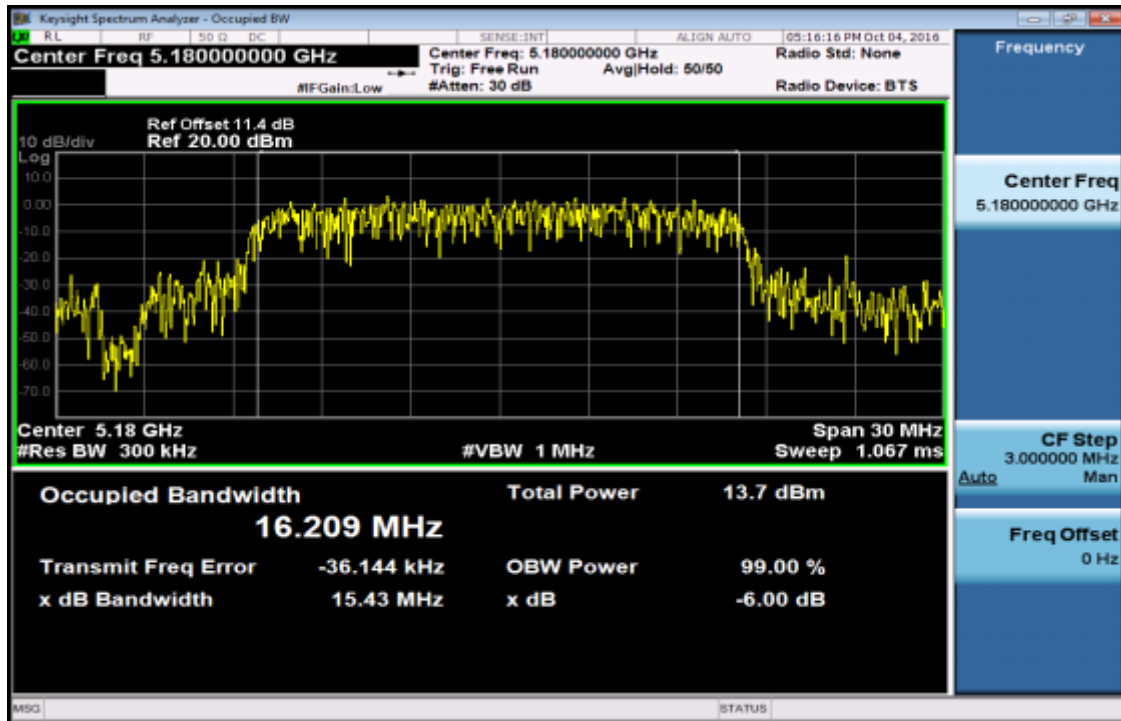
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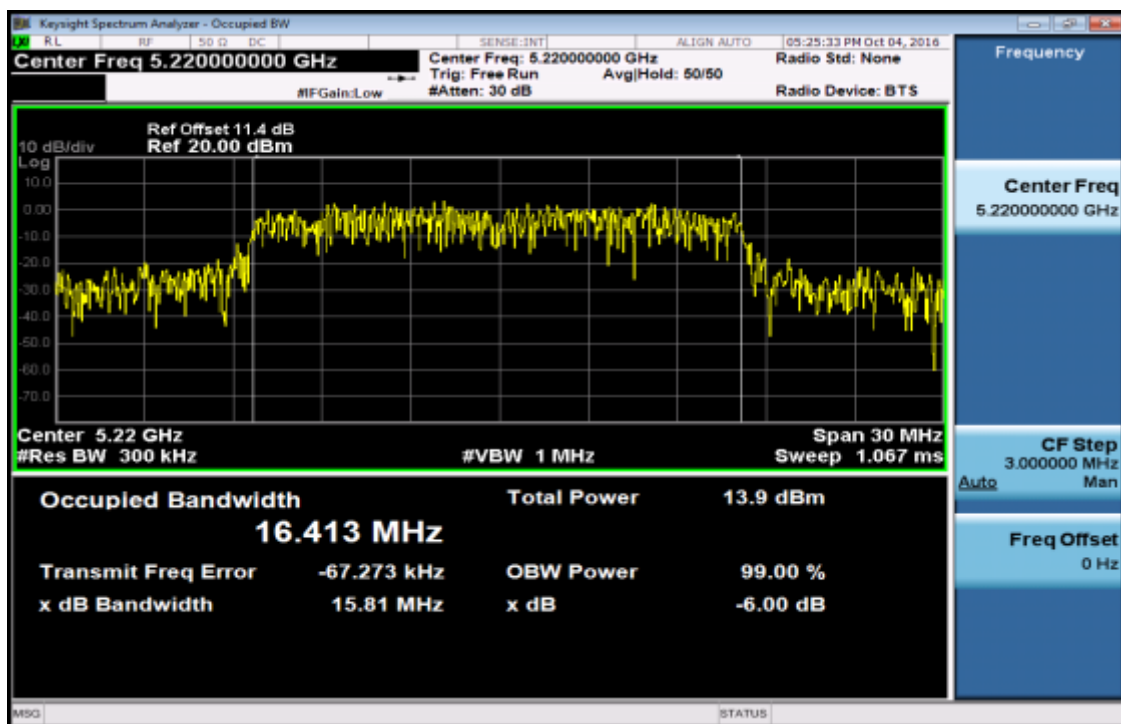
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802.11a, 5150~5250 MHz (Aux)

99% Band Width Test Data CH-Low (5180MHz)



99% Band Width Test Data CH-Mid (5220MHz)



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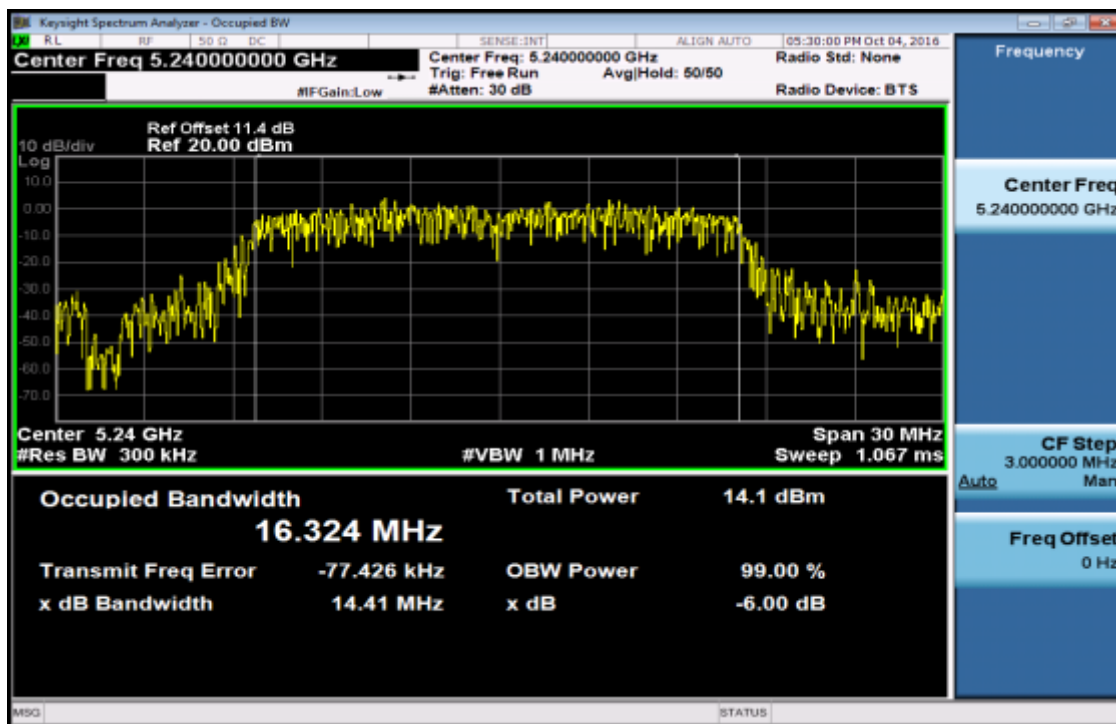
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99% Band Width Test Data CH-High (5240MHz)



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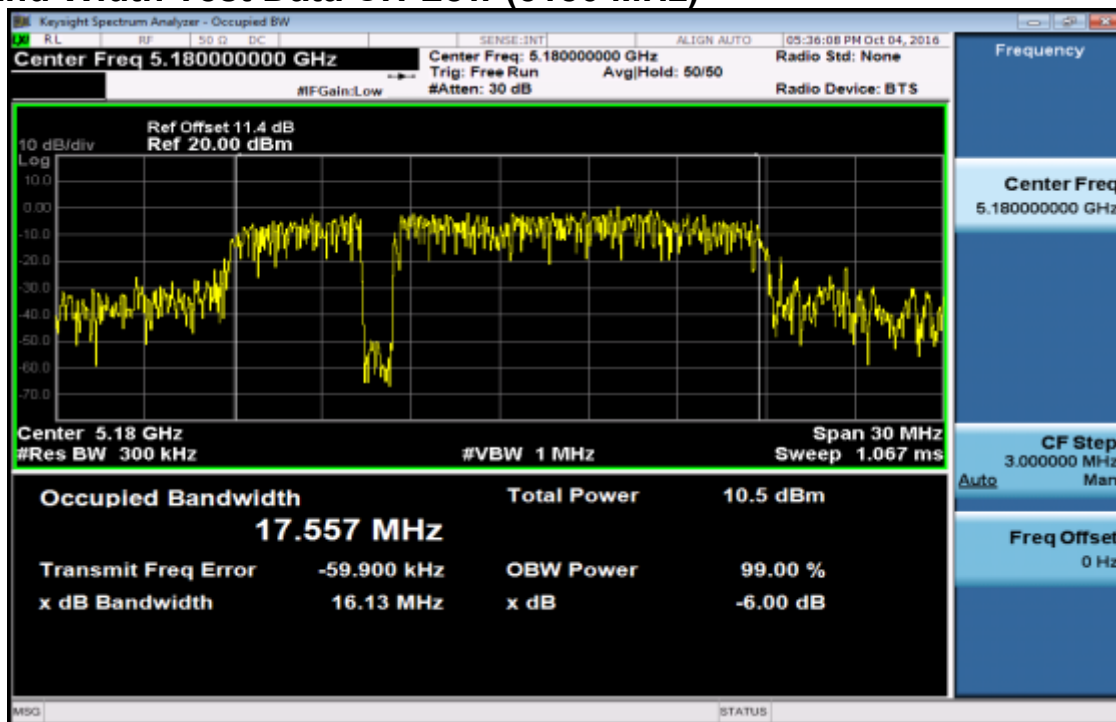
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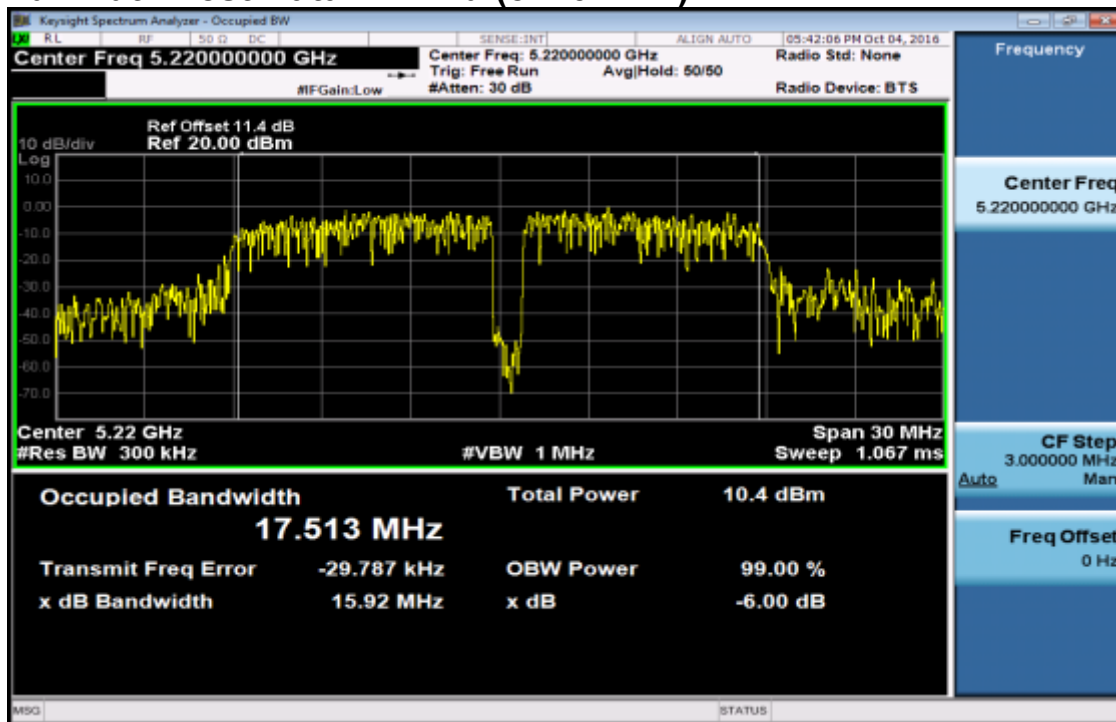
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802.11n HT20, 5150~5250 MHz (Main)

99% Band Width Test Data CH-Low (5180 MHz)



99% Band Width Test Data CH-Mid (5220 MHz)



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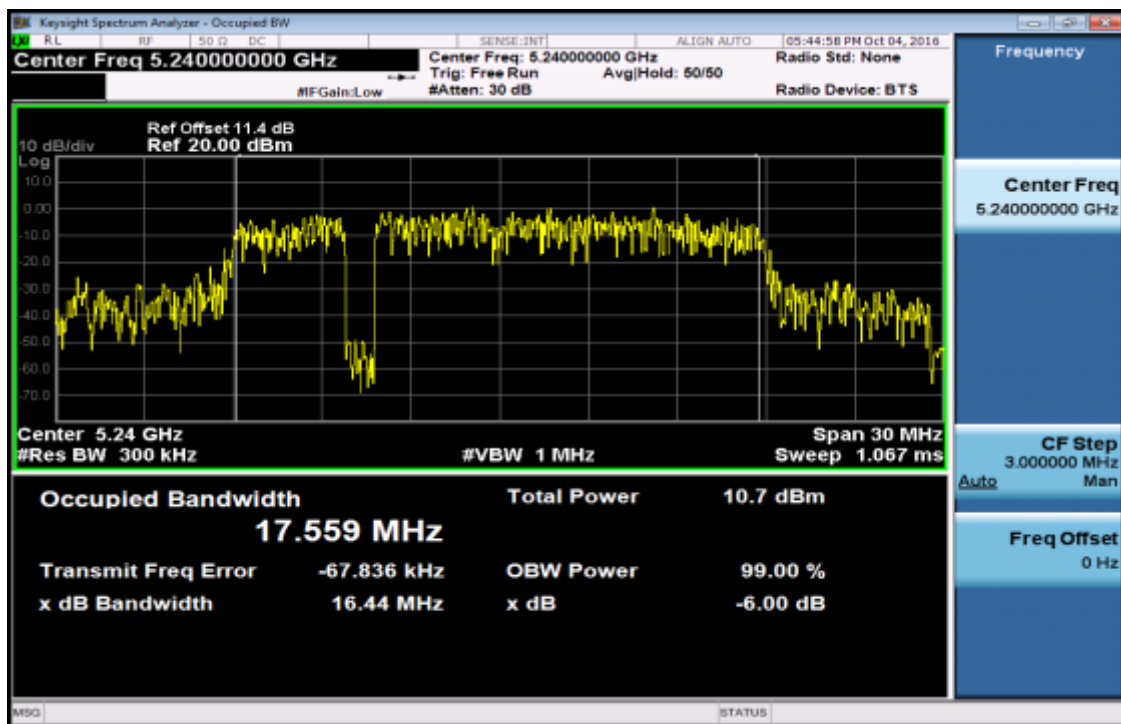
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99% Band Width Test Data CH-High (5240 MHz)



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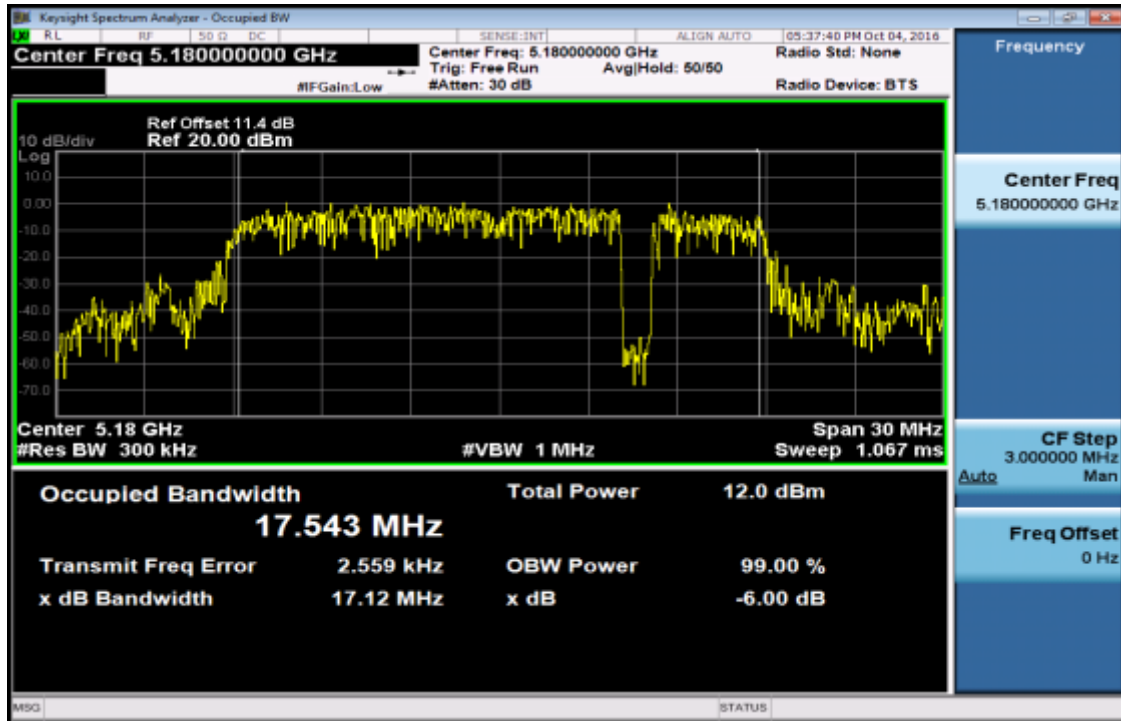
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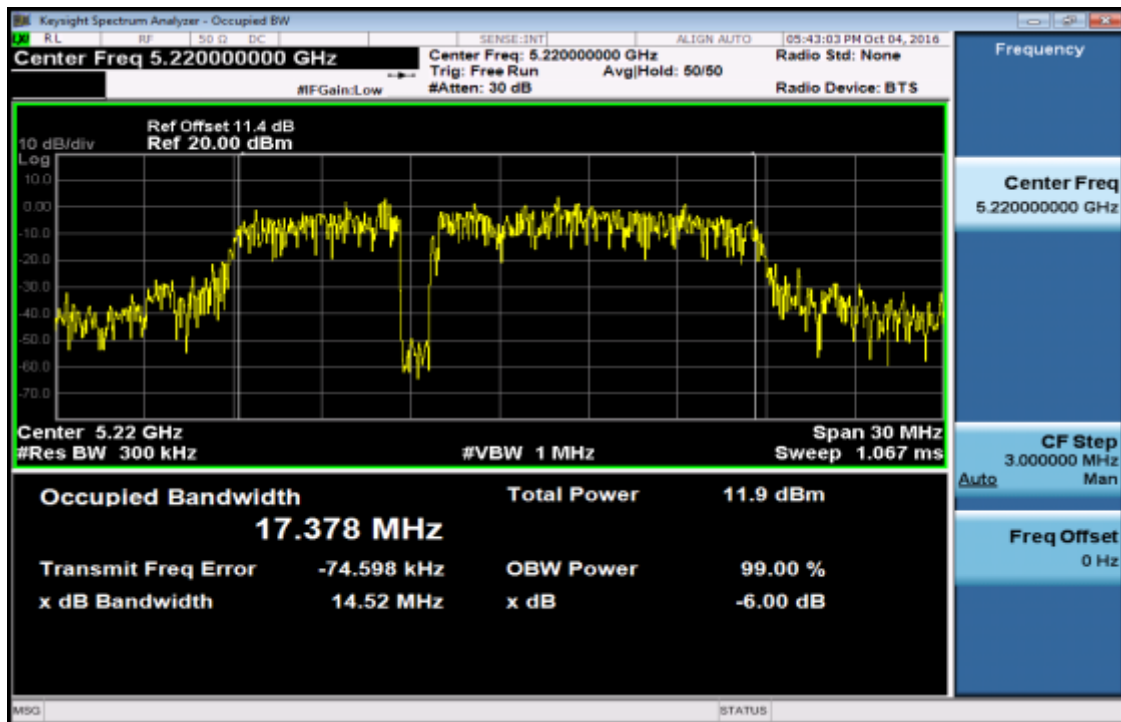
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802.11n HT20, 5150~5250 MHz (Aux1) 99% Band Width Test Data CH-Low (5180 MHz)



99% Band Width Test Data CH-Mid (5220 MHz)



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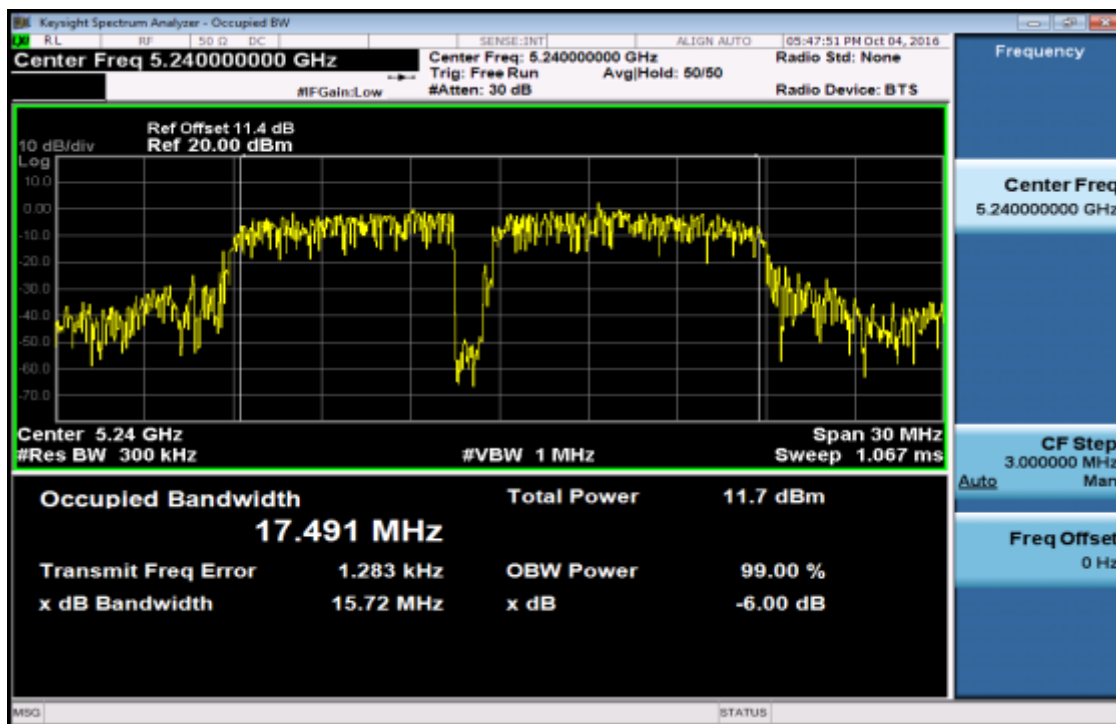
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99% Band Width Test Data CH-High (5240 MHz)



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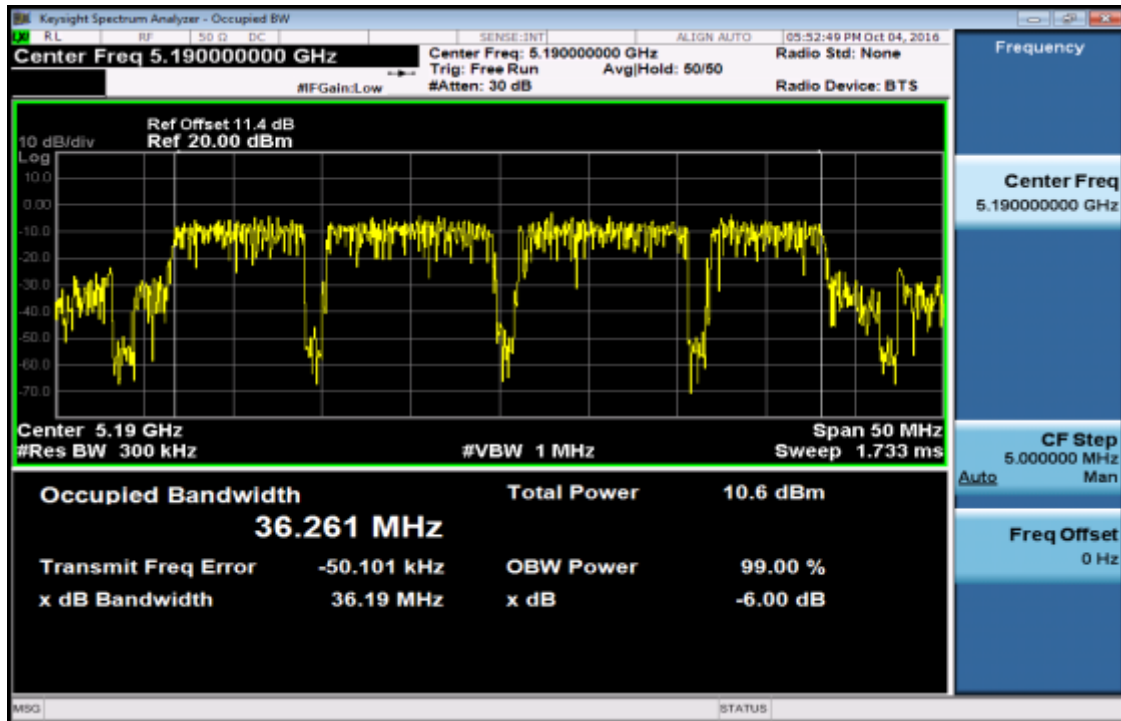
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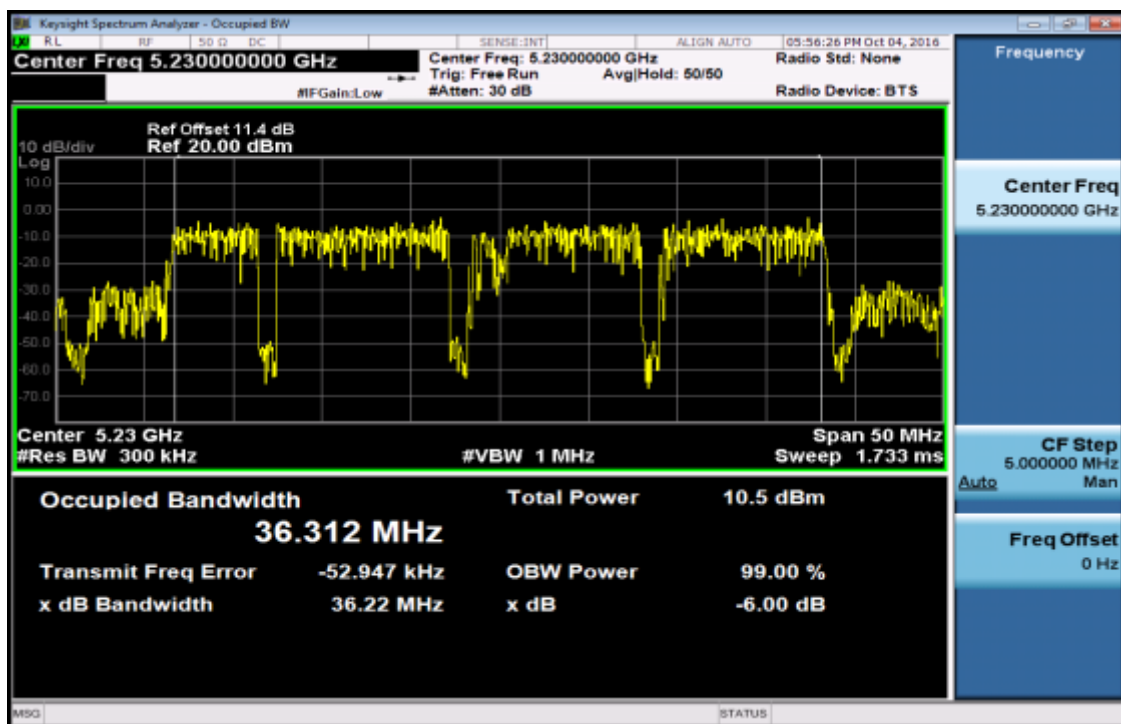
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802.11n HT40, 5150~5250 MHz (Main)

99% Band Width Test Data CH-Low (5190 MHz)



99% Band Width Test Data CH-High (5230 MHz)



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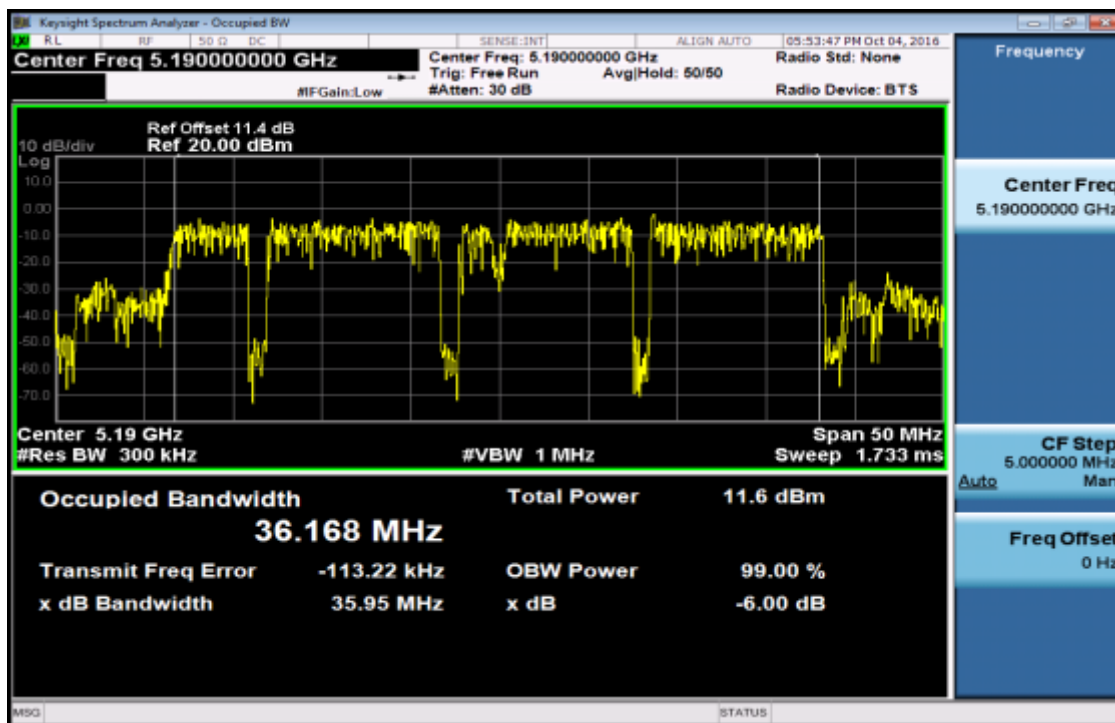
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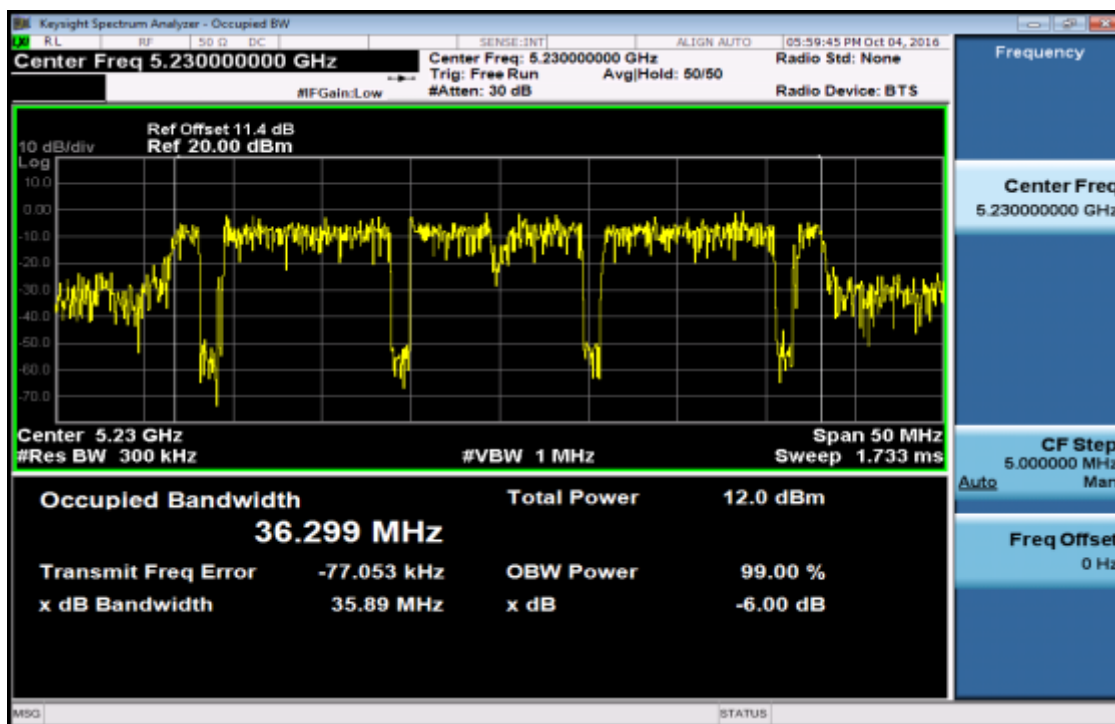
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802.11n HT40, 5150~5250 MHz (Aux)

99% Band Width Test Data CH-Low (5190 MHz)



99% Band Width Test Data CH-High (5230 MHz)



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9. MAXIMUM CONDUCTED OUTPUT POWER MEASUREMENT

9.1 Standard Applicable

FCC

OPERZTION Band	EUT CATEGORY		LIMIT
U-NII-1		Access Point (Mater device)	1 Watt(30dBm)
		Fixed point-to-point Acess Ponit	1 Watt(30dBm)
	√	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)

IC

OPERZTION FREQUENCY BAND	LIMIT
5150~5250 MHz	EIRP shall not exceed 200 mW or 10 + 10 log ₁₀ B, dBm
5250~5350 MHz	Conducted output power shall not exceed 250 mW or 11 +10 log ₁₀ B EIRP shall not exceed 1.0 W or 17 + 10 log ₁₀ B, dBm
5470-5600 MHz and 5650-5725 MHz	Conducted output power shall not exceed 250 mW or 11 +10 log ₁₀ B EIRP shall not exceed 1.0 W or 17 + 10 log ₁₀ B, dBm
5725~5850 MHz	Conducted output power shall not exceed 1 W

If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Note: 5.15-5.25G

Antenna1 Gain: 4.13 dBi

Antenna2 Gain: 4.50 dBi

Number Antenna: 2 pcs

Directional gain = gain of antenna element + 10 log (# of TX antenna elements)

Effective Legacy Gain (dBi) = 4.5+3.01=7.51dBi

Limit: 23.98dBm – (7.51 – 6 dBi) = 22.47dBm

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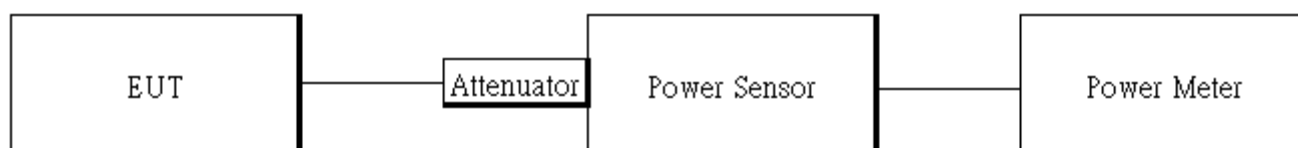
9.2 Measurement Procedure

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
Spectrum Analyzer	KEYSIGHT	N9010A	MY54510568	04/14/2016	04/13/2017
Power Meter	Anritsu	ML2496A	1326001	06/23/2016	06/22/2017
Power Sensor	Anritsu	MA2411B	1315048	06/23/2016	06/22/2017
Power Sensor	Anritsu	MA2411B	1315049	06/23/2016	06/22/2017
Coaxial Cable 30cm	WOKEN	00100A1F1A195C	RF01	12/12/2015	12/11/2016
DC Block	PASTERNAK	PE8210	RF29	12/12/2015	12/11/2016
Splitter	RF-LAMBAD	RFLT2W1G18G	RF35	12/12/2015	12/11/2016
Attenuator	WOKEN	218FS-10	RF23	12/12/2015	12/11/2016
DC Power Supply	Agilent	E3640A	MY53140006	05/04/2016	05/03/2017

9.4 Test Set-up



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9.5 Measurement Result

Conducted output power (FCC)

802.11a_Aux1

CH	Frequency (MHz)	Data Rate	TOTAL POWER (dBm)	TOTAL POWER (mW)	REQUIRED LIMIT (dBm)	RESULT
36	5180	MCS0	13.95	24.831	23.98	PASS
44	5220	MCS0	13.93	24.717	23.98	PASS
48	5240	MCS0	13.69	23.388	23.98	PASS

802.11n_HT20_MIMO

CH	Frequency (MHz)	Data Rate	AVERAGE POWER (dBm)		TOTAL POWER (dBm)	TOTAL POWER (mW)	REQUIRED LIMIT (dBm)	RESULT
			CH 0	CH 1				
36	5180	MCS8	11.04	11.33	14.20	26.289	22.47	PASS
44	5220	MCS8	10.56	11.52	14.08	25.567	22.47	PASS
48	5240	MCS8	10.86	11.4	14.15	25.994	22.47	PASS

802.11n_HT40_MIMO

CH	Frequency (MHz)	Data Rate	AVERAGE POWER (dBm)		TOTAL POWER (dBm)	TOTAL POWER (mW)	REQUIRED LIMIT (dBm)	RESULT
			CH 0	CH 1				
38	5190	MCS8	11.91	11.48	14.71	29.584	22.47	PASS
46	5230	MCS8	11.51	12.29	14.93	31.101	22.47	PASS

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EIRP

802.11a_Aux1

CH	Frequency (MHz)	TOTAL POWER (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP (mW)	REQUIRED LIMIT (dBm)	RESULT
36	5180	13.95	4.500	18.45	69.984	23.01 or $10+10\log(B)=22.10$	PASS
44	5220	13.93	4.500	18.43	69.663	23.01 or $10+10\log(B)=22.15$	PASS
48	5240	13.69	4.500	18.19	65.917	23.01 or $10+10\log(B)=22.13$	PASS

802.11n_HT20_MIMO

CH	Frequency (MHz)	TOTAL POWER (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP (mW)	REQUIRED LIMIT (dBm)	RESULT
36	5180	14.20	7.510	21.71	148.174	23.01 or $10+10\log(B)=22.44$	PASS
44	5220	14.08	7.510	21.59	144.104	23.01 or $10+10\log(B)=22.40$	PASS
48	5240	14.15	7.510	21.66	146.510	23.01 or $10+10\log(B)=22.43$	PASS

802.11n_HT40_MIMO

CH	Frequency (MHz)	TOTAL POWER (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP (mW)	REQUIRED LIMIT (dBm)	RESULT
38	5190	14.71	7.510	22.22	166.749	23.01 or $10+10\log(B)=25.58$	PASS
46	5230	14.93	7.510	22.44	175.299	23.01 or $10+10\log(B)=25.60$	PASS

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10. PEAK POWER SPECTRAL DENSITY

10.1 Standard Applicable

FCC

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

IC

OPERZTION FREQUENCY BAND	LIMIT
5150~5250 MHz	EIRP spectral density 10 dBm / MHz
5250~5350 MHz	11dBm / MHz
5470-5600 MHz and 5650-5725 MHz	11dBm / MHz
5725~5850 MHz	30dBm / 500 kHz

If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Note: 5.15-5.25G

Antenna1 Gain: 4.13 dBi

Antenna2 Gain: 4.50 dBi

Number Antenna: 2 pcs

Directional gain = gain of antenna element + 10 log (# of TX antenna elements)

Effective Legacy Gain (dBi) = 4.5+3.01=7.51dBi

Limit: 11dBm – (7.51 – 6 dBi) = 9.49dBm

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10.2 Measurement Procedure

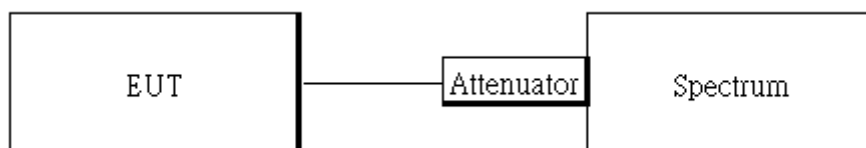
1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to Spectrum.
4. **For U-NII1, U-NII-2A, U-NII-2C Band:**
Set RBW=1MHz, 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	KEYSIGHT	N9010A	MY54510568	04/14/2016	04/13/2017
DC Block	PASTERNAK	PE8210	RF29	12/12/2015	12/11/2016
Attenuator	WOKEN	218FS-10	RF23	12/12/2015	12/11/2016

10.4 Test Set-up



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10.5 Measurement Result

POWER DENSITY 802.11a MODE			
Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
5180	0.57	11	-10.43
5220	0.04	11	-10.96
5240	-3.58	11	-14.58

POWER DENSITY 802.11n HT20 MODE			
Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
5180	-0.38	9.49	-9.87
5220	0.51	9.49	-8.98
5240	-1.21	9.49	-10.70

POWER DENSITY 802.11n HT40 MODE			
Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
5190	-5.9	9.49	-15.39
5230	-10.36	9.49	-19.85

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EIRP Power Density

EIRP spectral density 802.11a MODE					
Freq. (MHz)	PPSD (dBm)	Ant. Gain (dBi)	EIRP SD (dBm)	Limit (dBm)	Margin (dB)
5180	0.57	4.50	5.07	10	-9.43
5220	0.04	4.50	4.54	10	-9.96
5240	-3.58	4.50	0.92	10	-13.58

EIRP spectral density 802.11n HT20 MODE					
Freq. (MHz)	PPSD (dBm)	Ant. Gain (dBi)	EIRP SD (dBm)	Limit (dBm)	Margin (dB)
5180	-0.38	7.51	7.13	10	-10.38
5220	0.51	7.51	8.02	10	-9.49
5240	-1.21	7.51	6.30	10	-11.21

EIRP spectral density 802.11n HT40 MODE					
Freq. (MHz)	PPSD (dBm)	Ant. Gain (dBi)	EIRP SD (dBm)	Limit (dBm)	Margin (dB)
5180	-5.90	7.51	1.61	10	-15.90
5220	-10.36	7.51	-2.85	10	-20.36

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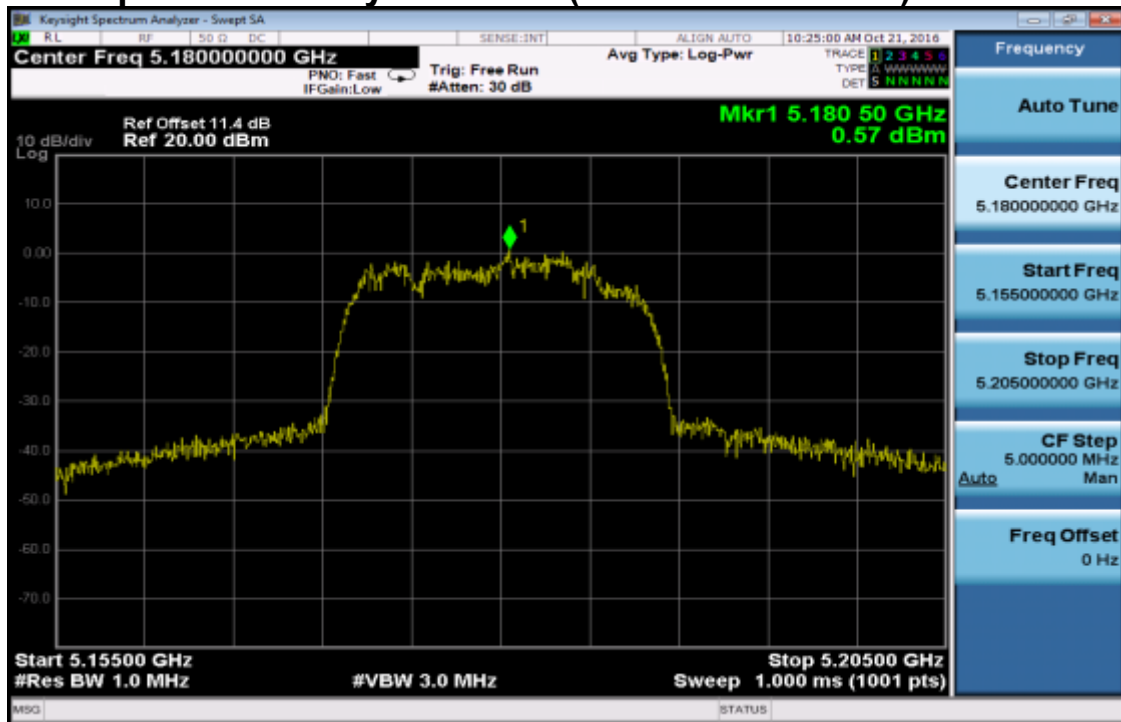
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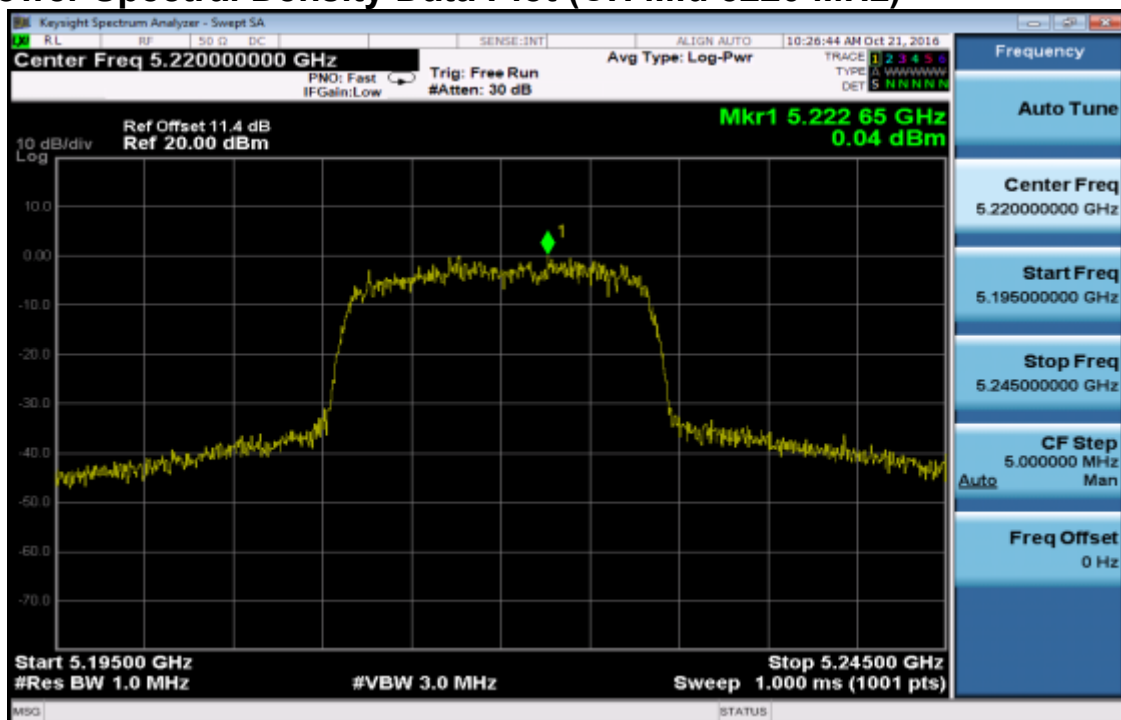
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802.11a 5150~5250 MHz

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



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



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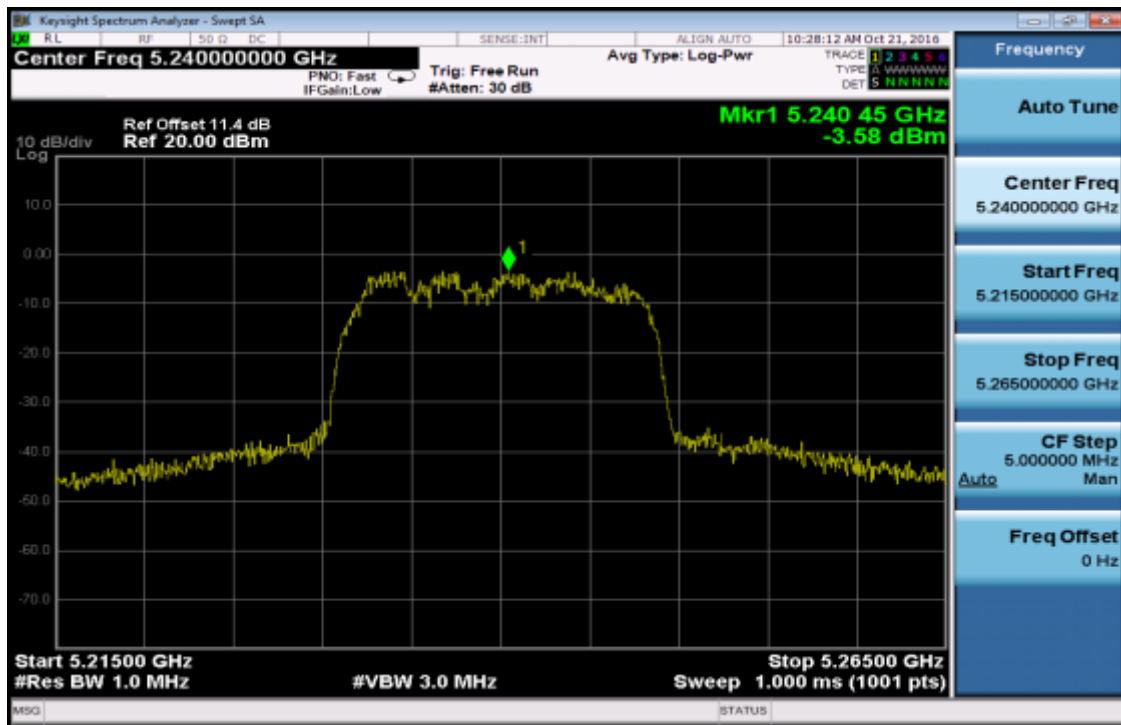
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Peak Power Spectral Density Data Plot (CH High 5240 MHz)



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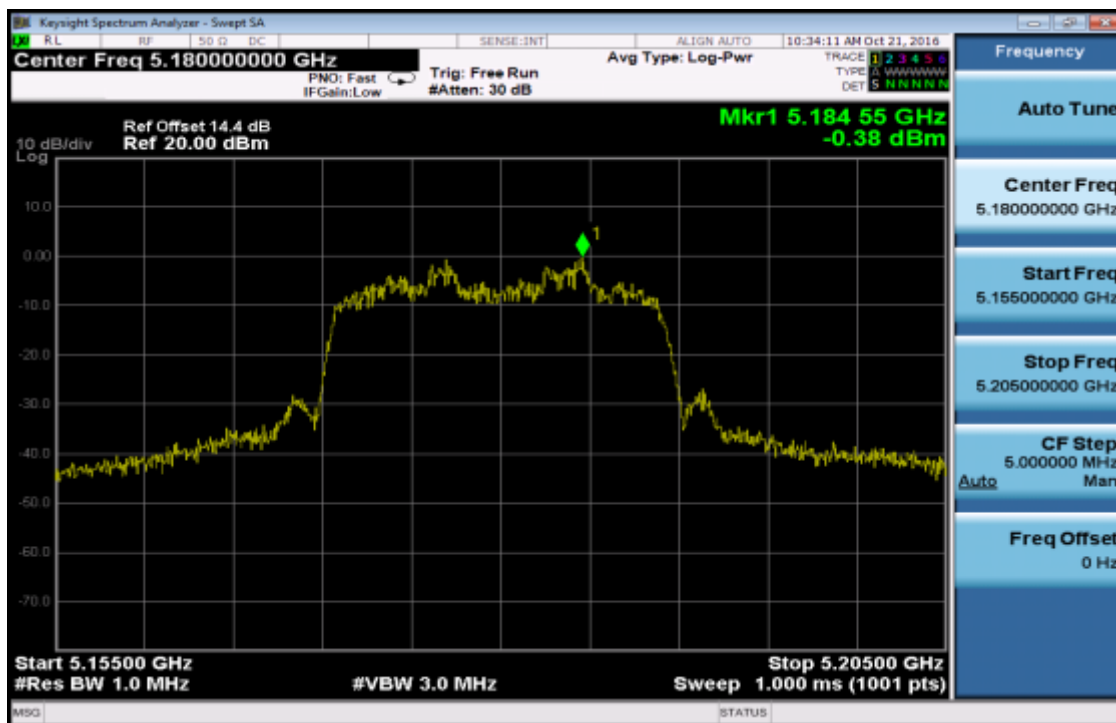
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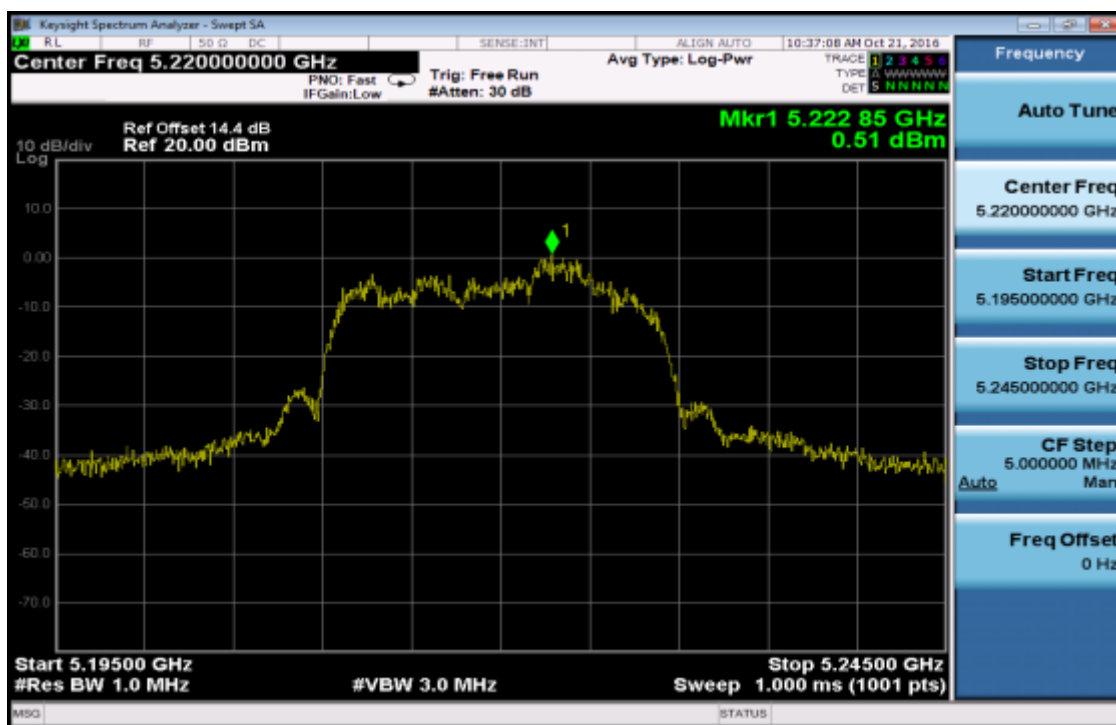
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802.11n HT20, 5150~5250 MHz

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



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



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



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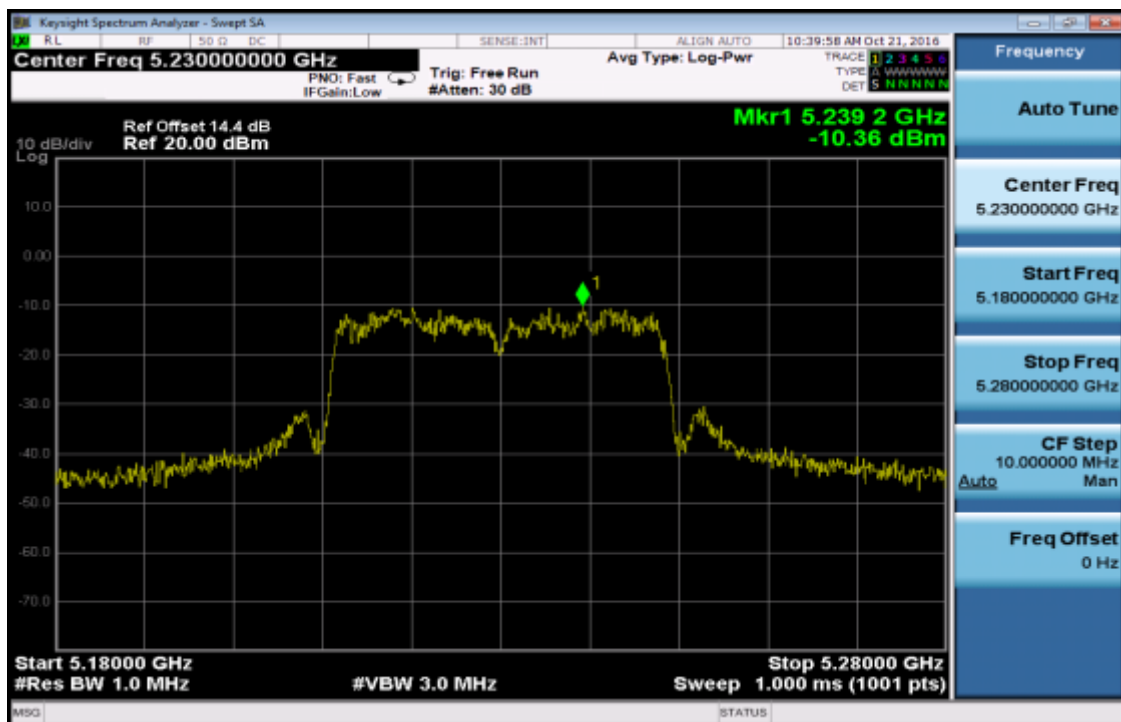
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802.11n HT40, 5150~5250 MHz Peak Power Spectral Density Data Plot (CH Low 5190 MHz)



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



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11. UNDESIRABLE RADIATED EMISSION MEASUREMENT1

11.1 Standard Applicable

The maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

1. For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.
2. For transmitters operating in the 5.725-5.85 GHz 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.

APPLICABLE TO	LIMIT	
FCC KDB 789033 D02 General UNII Test Procedures New Rules	FIELD STRENGTH AT 3m	
	PK: 74 (dBμV/m)	AV 54 (dBμV/m)
APPLICABLE TO	EIRP LIMIT	FIELD STRENGTH AT 3m
15.407(b)(1)	PK: -27 (dBm/MHz)	PK: 68.3 (dBμV/m)
15.407(b)(2)		
15.407(b)(3)		
15.407(b)(4)(i)	PK:-27 (dBm/MHz) *1 PK:10 (dBm/MHz) *2 PK:15.6 (dBm/MHz) *3 PK:27 (dBm/MHz) *4	PK: 68.2(dBμV/m) *1 PK:105.2 (dBμV/m) *2 PK: 110.8(dBμV/m) *3 PK:122.2 (dBμV/m) *4
RSS-247 6.2.4 (2)	PK: -27 (dBm/MHz)	PK: 68.3 (dBμV/m)
	PK: -17 (dBm/MHz)	PK: 78.2 (dBμV/m)
*1 beyond 75 MHz or more above of the bandedge. *2 below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above. *3 below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above. *4 from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.		

$EIRP = (E \cdot d)^2 / 30$, where E is the field in V/m, d is the measurement distance (3m), EIRP is the equivalent isotropically radiated power in Watts..

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Unwanted spurious emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table:

Frequency (MHz)	Field strength (microvolts/meter)	Distance (meters)
0.009-0.490	2400/F(KHz)	300
0.490-1.705	24000/F(KHz)	30
1.705-30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Note:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBμV/m) = 20 log Emission level (dBμV/m)

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11.2 Measurement Equipment Used

SGS SAC-III					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
EMI Test Receiver	R&S	ESU 40	100363	04/12/2016	04/11/2017
Loop Antenna	ETS-Lindgren	6502	00143303	12/23/2015	12/22/2016
Broadband Antenna	TESEQ	CBL 6112D	35240	10/28/2015	10/27/2016
Horn Antenna	ETS-Lindgren	3117	00143272	12/16/2015	12/15/2016
Horn Antenna	Schwarzbeck	BBHA9170	185	07/18/2016	07/17/2017
Pre Amplifier	EMC Instruments	EMC330	980096	12/12/2015	12/11/2016
Pre Amplifier	EMC Instruments	EMC0011830	980199	12/12/2015	12/11/2016
Pre Amplifier	R&S	SCU-18	10204	12/12/2015	12/11/2016
Pre Amplifier	EMC Instruments	EMC184045B	980135	12/12/2015	12/11/2016
Coaxial Cable	Huber+Suhner	RG 214/U	966Rx 9K-30M	12/12/2015	12/11/2016
Coaxial Cable	Huber+Suhner	RG 214/U SUCOFLEX 104	966Rx 30M-3G	12/12/2015	12/11/2016
Coaxial Cable	Huber+Suhner	SUCOFLEX 104	966Rx 1G-18G	12/12/2015	12/11/2016
Coaxial Cable	Huber+Suhner	mini 141-12 SUCOFLEX 104	966Rx 18G-40G	12/12/2015	12/11/2016
Coaxial Cable	Huber+Suhner	SUCOFLEX 104	966Tx 30M-18G	12/12/2015	12/11/2016
Coaxial Cable	Huber+Suhner	SUCOFLEX 102	966Tx 18G-40G	12/12/2015	12/11/2016
Attenuator	WOKEN	218FS-10	RF27	12/12/2015	12/11/2016
Site NSA	SGS	966 Chamber C	SAC-C	03/04/2016	03/03/2017
Site VSWR	SGS	966 Chamber C	SAC-C	03/04/2016	03/03/2017
DC Power Supply	HOLA	DP-3003	D7070035	05/04/2016	05/03/2017
Controller	MF	MF-7802	N/A	N.C.R.	N.C.R.
Antenna Master	MF	N/A	N/A	N.C.R.	N.C.R.
Turn Table	MF	N/A	N/A	N.C.R.	N.C.R.
Test Software	World-Pallas	Dr. E	V 3.0 Lite	N.C.R.	N.C.R.

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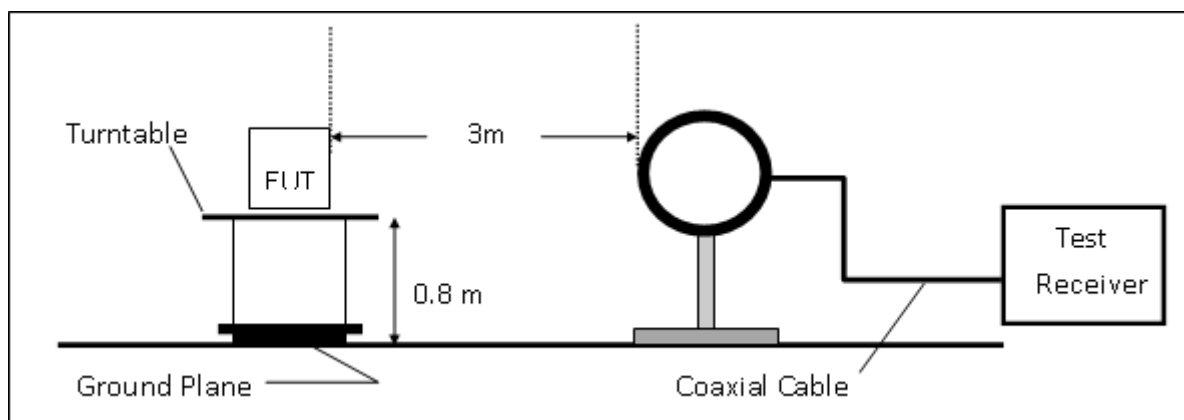
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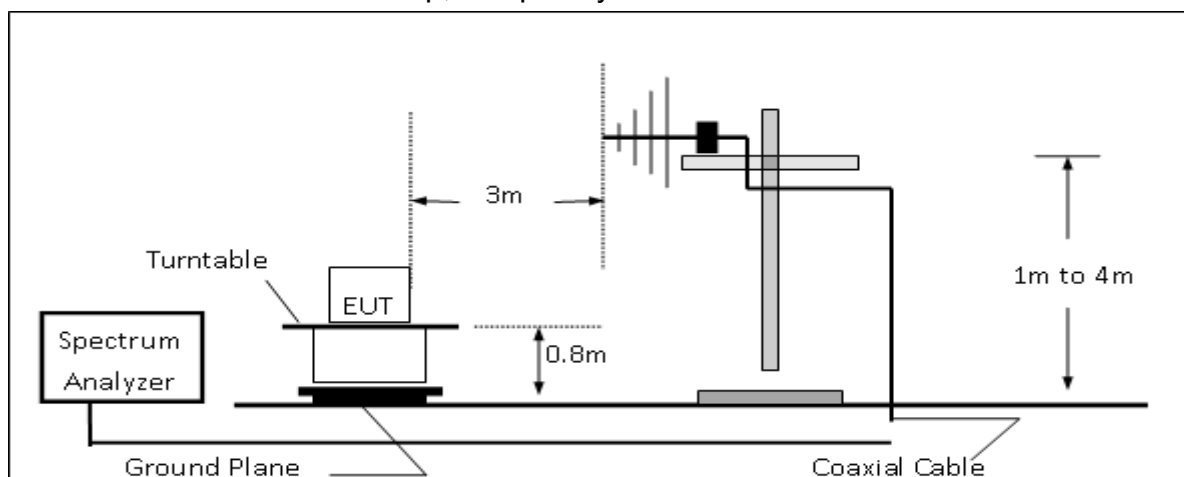
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11.3 Test SET-UP

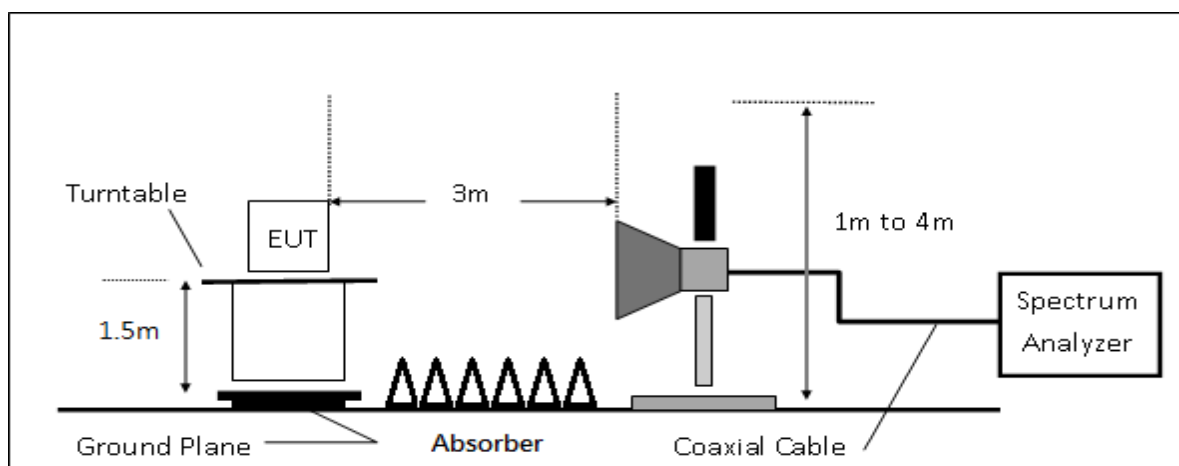
(A) Radiated Emission Test Set-UP Frequency Below 30MHz.



(B) Radiated Emission Test Set-UP, Frequency form 30MHz to 1000MHz



(C) Radiated Emission Test Set-UP Frequency Over 1 GHz



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11.4 Measurement Procedure

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules.
3. The EUT was placed on a turn table with 0.8m for frequency < 1GHz and 1.5m for frequency > 1GHz above ground plane.
4. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
5. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
6. Set the spectrum analyzer as RBW=120 kHz and VBW=300 kHz for Peak Detector (PK) and Quasi-peak (QP) at frequency below 1 GHz.
7. Set the spectrum analyzer as RBW=1 MHz, VBW=3 MHz for Peak Detector at frequency above 1 GHz.
8. Set the spectrum analyzer as RBW=1 MHz, VBW=10 Hz (Duty cycle > 98%) or VBW ≥ 1/T (Duty cycle < 98%) for Average Detector at frequency above 1 GHz.
9. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
10. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
11. Repeat above procedures until all frequency measured were complete.

11.5 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

Where	FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
	RA = Reading Amplitude	AG = Amplifier Gain
	AF = Antenna Factor	

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

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Note :

“F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

11.6 Test Results of Radiated Spurious Emissions form 9 KHz to 30 MHz

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit per 15.31(o) was not reported.

11.7 Measurement Result

Note: Refer to next page spectrum analyzer data chart and tabular data sheets.

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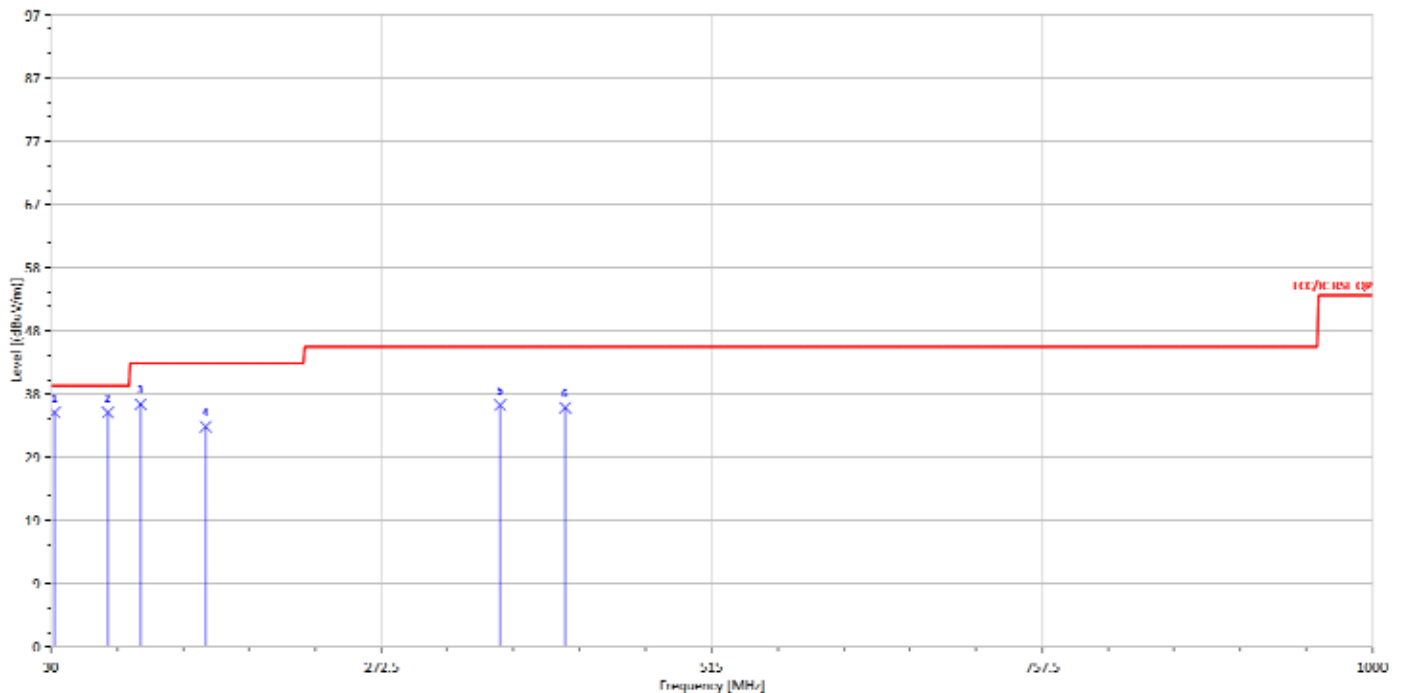
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Radiated Spurious Emission Measurement Result

Below 1GHz Worst-Case Data:

802.11a 5150~5250 MHz

Operation Mode :	802.11a	Test Date :	2016/10/21
Fundamental Frequency :	5220 MHz	Temp. / Humi. :	22.7deg_C/57RH
Operation Band :	Tx CH Mid	Test Engineer :	Pony
EUT Pol. :	E2	Measurement Antenna Pol. :	Vertical



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level		FS	@3m	
		PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
32.91	S	QP	44.70	-8.75	35.95	40	-4.05
71.71	S	QP	57.60	-21.65	35.95	40	-4.05
95.96	S	Peak	55.68	-18.44	37.24	43.5	-6.26
143.49	S	Peak	50.08	-16.32	33.76	43.5	-9.74
359.80	S	Peak	48.32	-11.20	37.12	46	-8.88
407.33	S	Peak	45.88	-9.16	36.71	46	-9.29

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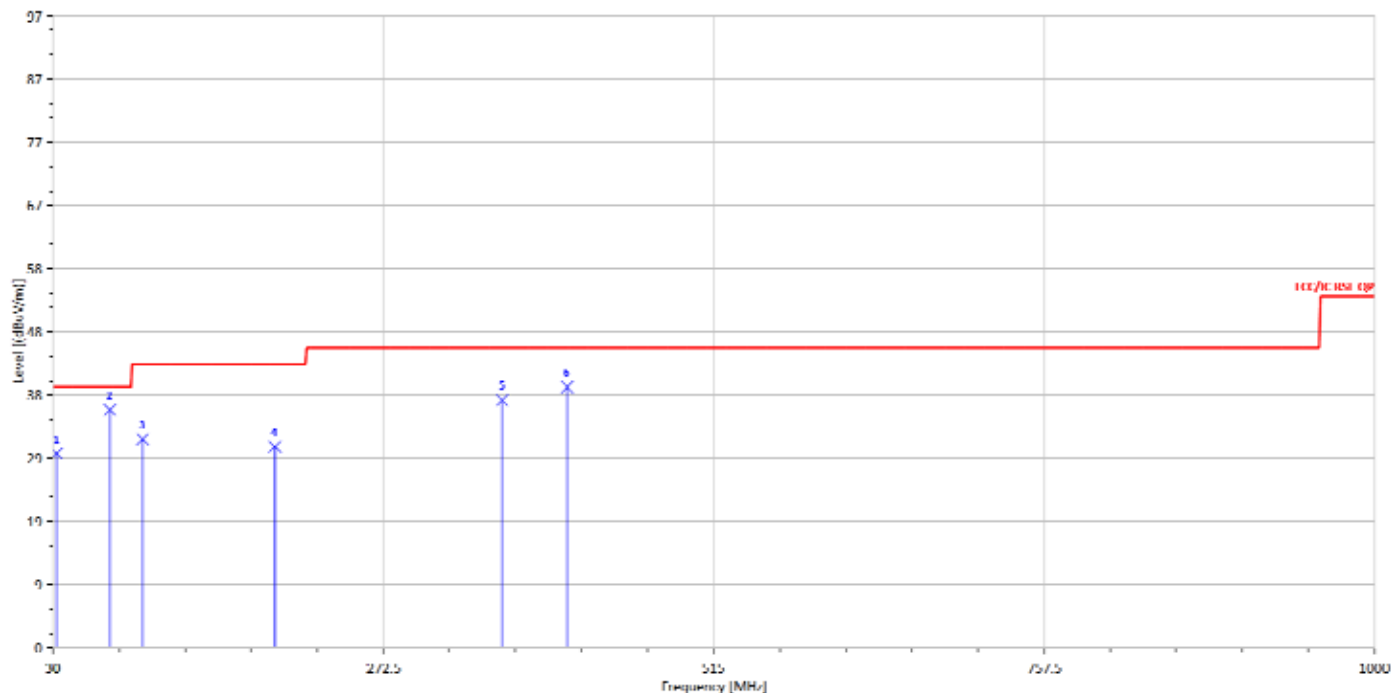
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Operation Mode : 802.11a Test Date : 2016/10/21
 Fundamental Frequency : 5220 MHz Temp. / Humi. : 22.7deg_C/57RH
 Operation Band : Tx CH Mid Test Engineer : Pony
 EUT Pol. : E2 Measurement Antenna Pol. : Horizontal



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
32.91	S	Peak	38.51	-8.75	29.76	40	-10.24
71.71	S	Peak	58.18	-21.65	36.53	40	-3.47
95.96	S	Peak	50.41	-18.44	31.97	43.5	-11.53
192.96	S	Peak	48.86	-18.05	30.81	43.5	-12.69
359.80	S	Peak	49.22	-11.20	38.02	46	-7.98
407.33	S	Peak	49.16	-9.16	39.99	46	-6.01

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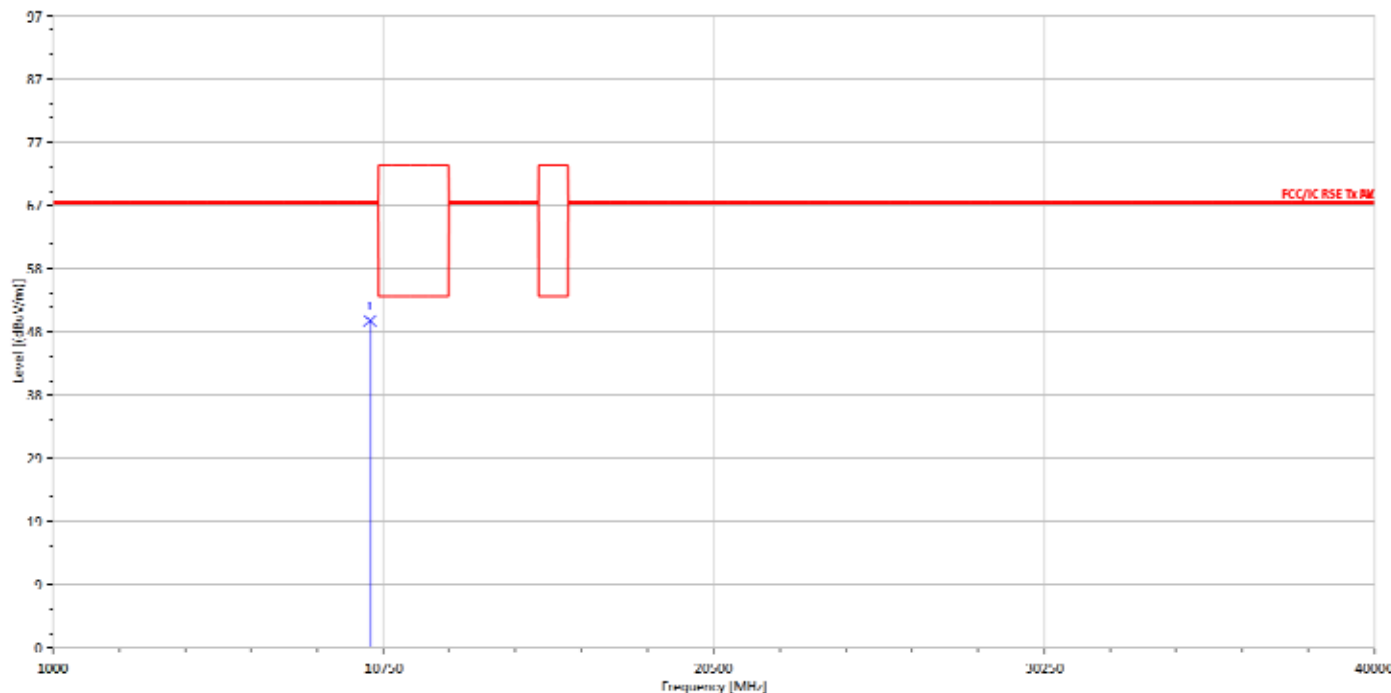
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Above 1GHz Worst-Case Data:

Radiated Spurious Emission Measurement Result 802.11a, 5150~5250 MHz

Operation Mode :	802.11a	Test Date :	2016/10/21
Fundamental Frequency :	5180 MHz	Temp. / Humi. :	22.7deg_C/57RH
Operation Band :	Tx CH Low	Test Engineer :	Ashton
EUT Pol. :	E2	Measurement Antenna Pol. :	Vertical



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level		FS	@3m	
		PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
10360.00	H	Peak	30.03	20.18	50.21	68.3	-18.09

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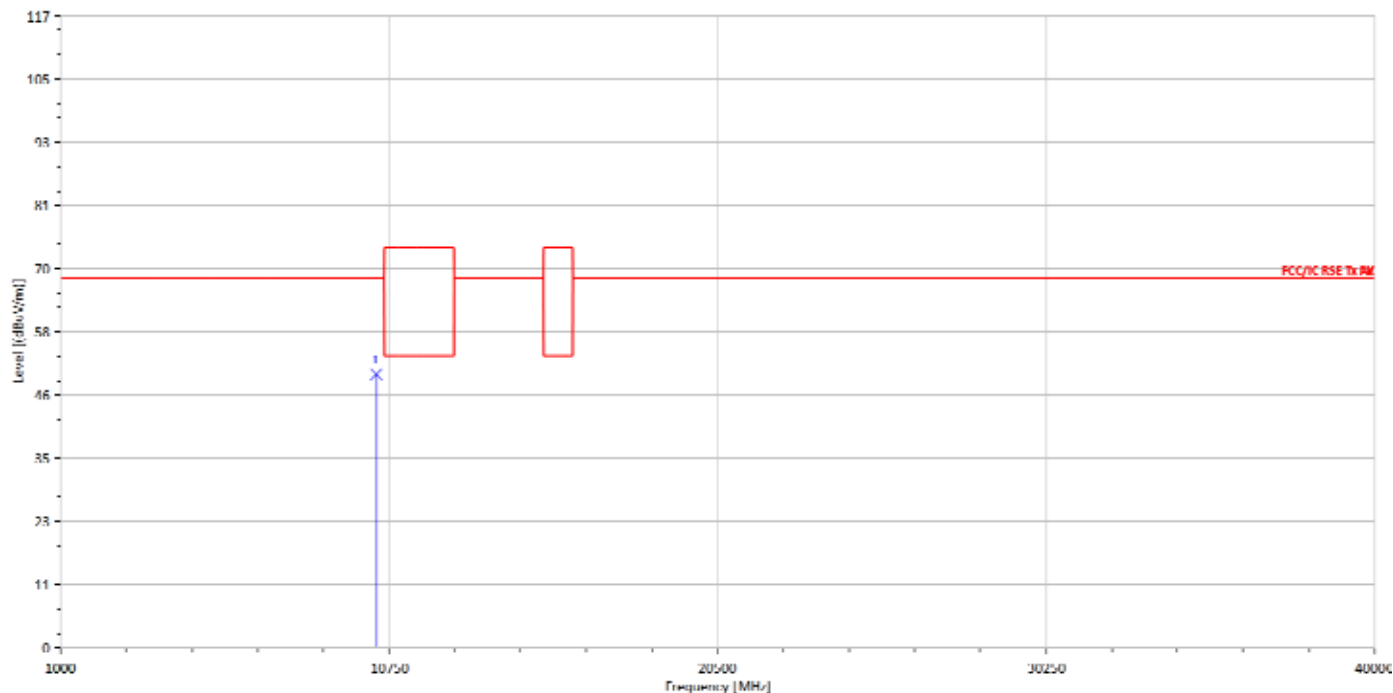
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Operation Mode : 802.11a Test Date : 2016/10/21
 Fundamental Frequency : 5180 MHz Temp. / Humi. : 22.7deg_C/57RH
 Operation Band : Tx CH Low Test Engineer : Ashton
 EUT Pol. : E2 Measurement Antenna Pol. : Horizontal



Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
10360.00	H	Peak	30.37	20.18	50.54	68.3	-17.76

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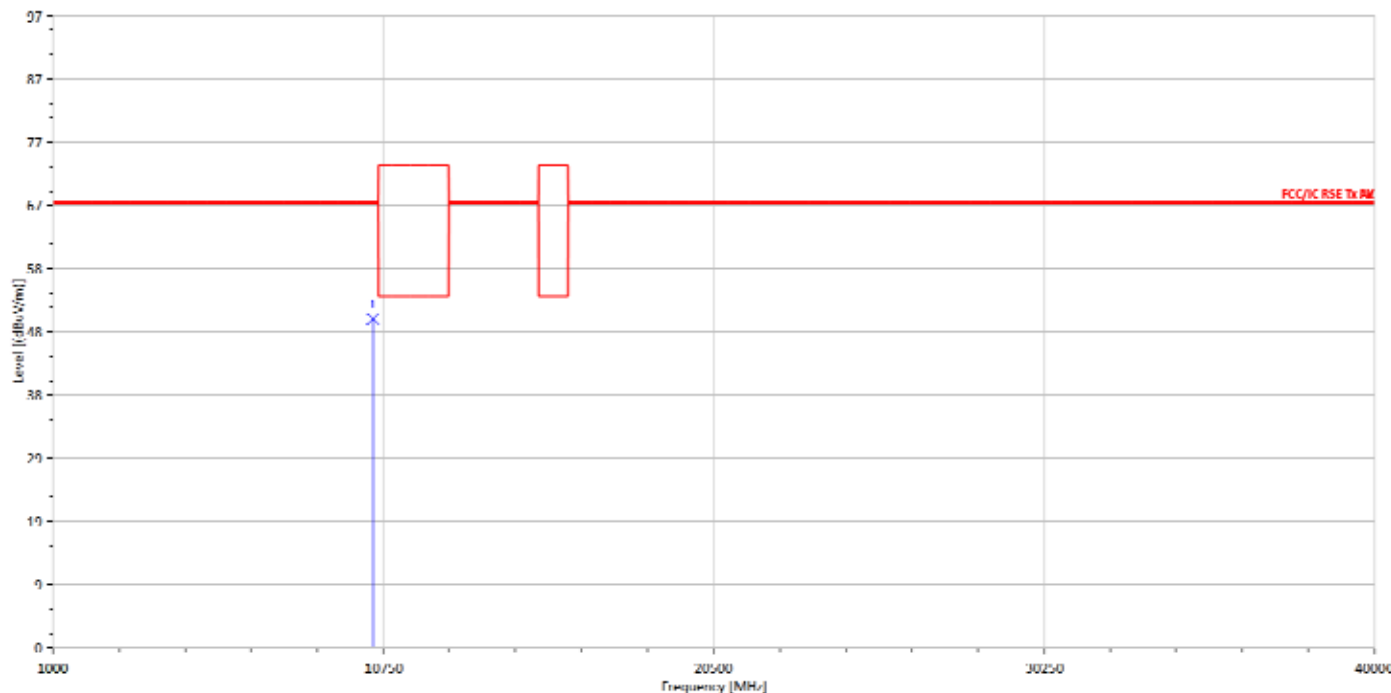
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Operation Mode : 802.11a Test Date : 2016/10/21
 Fundamental Frequency : 5220 MHz Temp. / Humi. : 22.7deg_C/57RH
 Operation Band : Tx CH Mid Test Engineer : Ashton
 EUT Pol. : E2 Measurement Antenna Pol. : Vertical



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level		FS	@3m	
		PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
10440.00	H	Peak	30.20	20.29	50.49	68.3	-17.81

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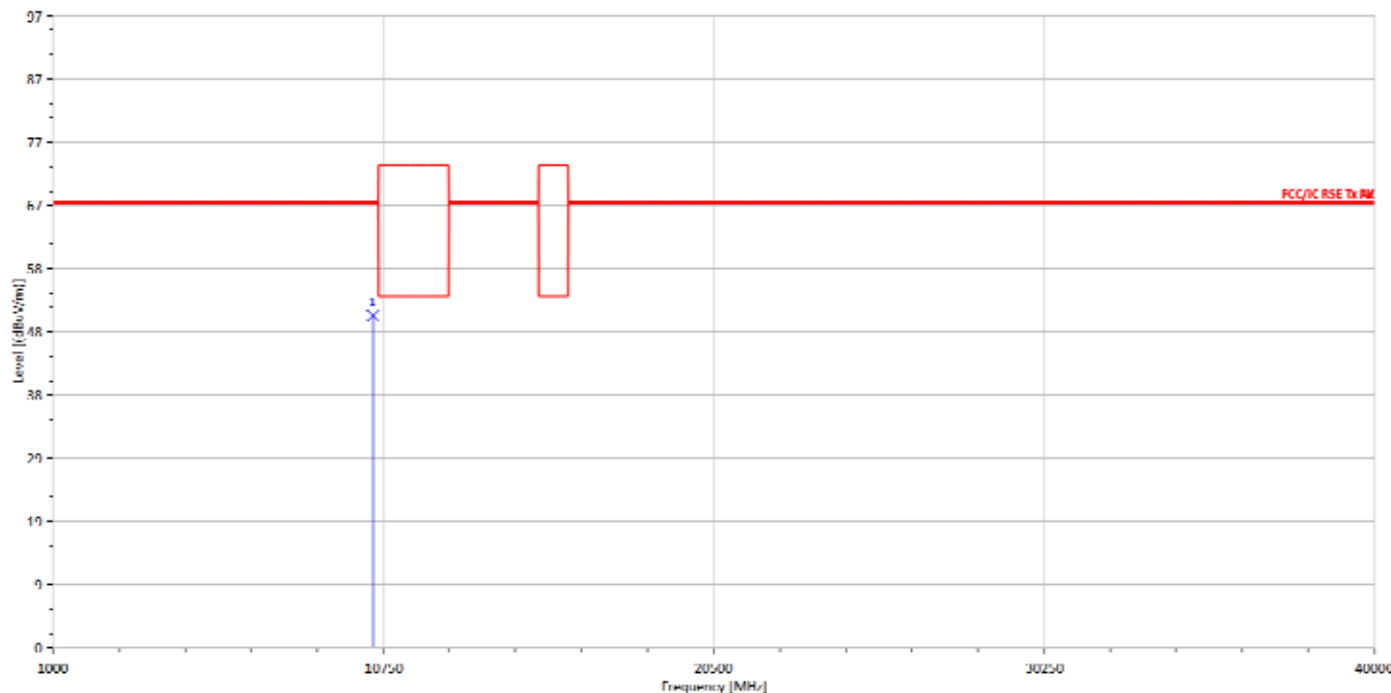
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Operation Mode :	802.11a	Test Date :	2016/10/21
Fundamental Frequency :	5220 MHz	Temp. / Humi. :	22.7deg_C/57RH
Operation Band :	Tx CH Mid	Test Engineer :	Ashton
EUT Pol. :	E2	Measurement Antenna Pol. :	Horizontal



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	
		PK/QP/AV	dBμV		dBμV/m	dBμV/m	dB
10440.00	H	Peak	30.71	20.29	51.00	68.3	-17.30

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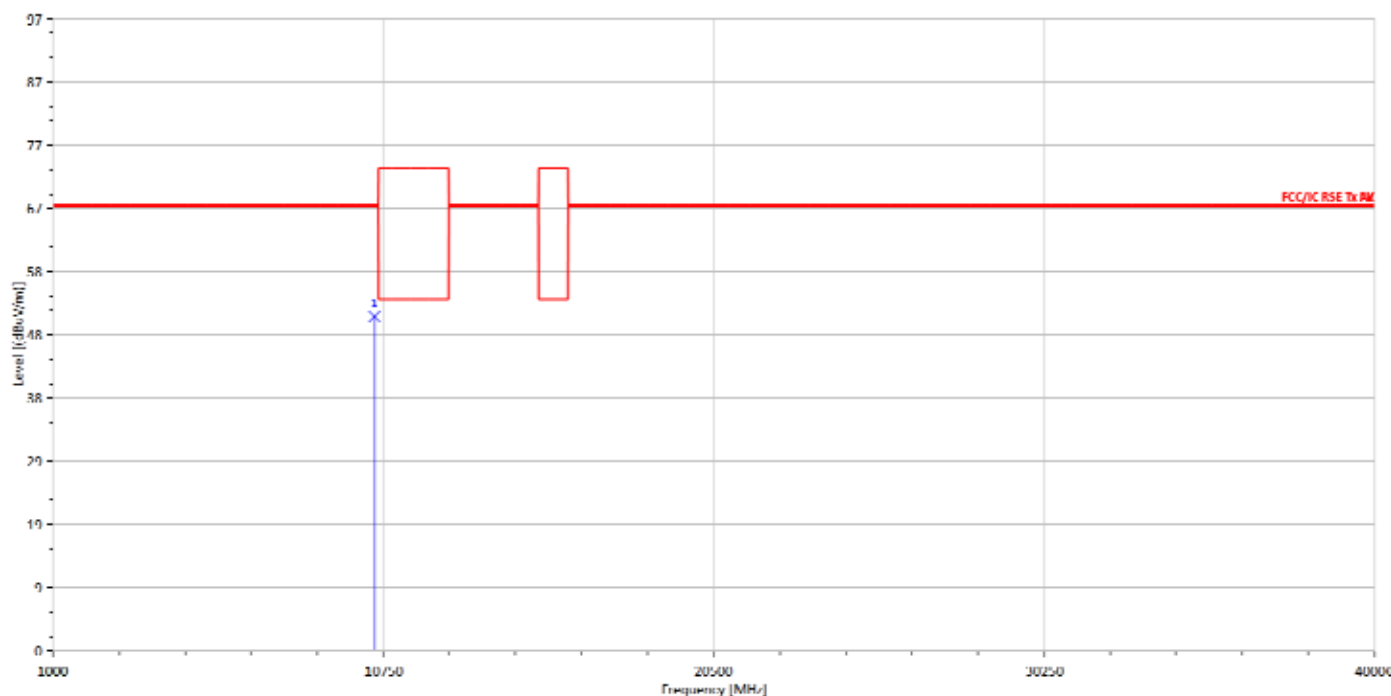
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Operation Mode : 802.11a Test Date : 2016/10/21
Fundamental Frequency : 5240 MHz Temp. / Humi. : 22.7deg_C/57RH
Operation Band : Tx CH High Test Engineer : Ashton
EUT Pol. : E2 Measurement Antenna Pol. : Vertical



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	
		PK/QP/AV	dBμV		dBμV/m	dBμV/m	dB
10480.00	H	Peak	30.64	20.68	51.32	68.3	-16.98

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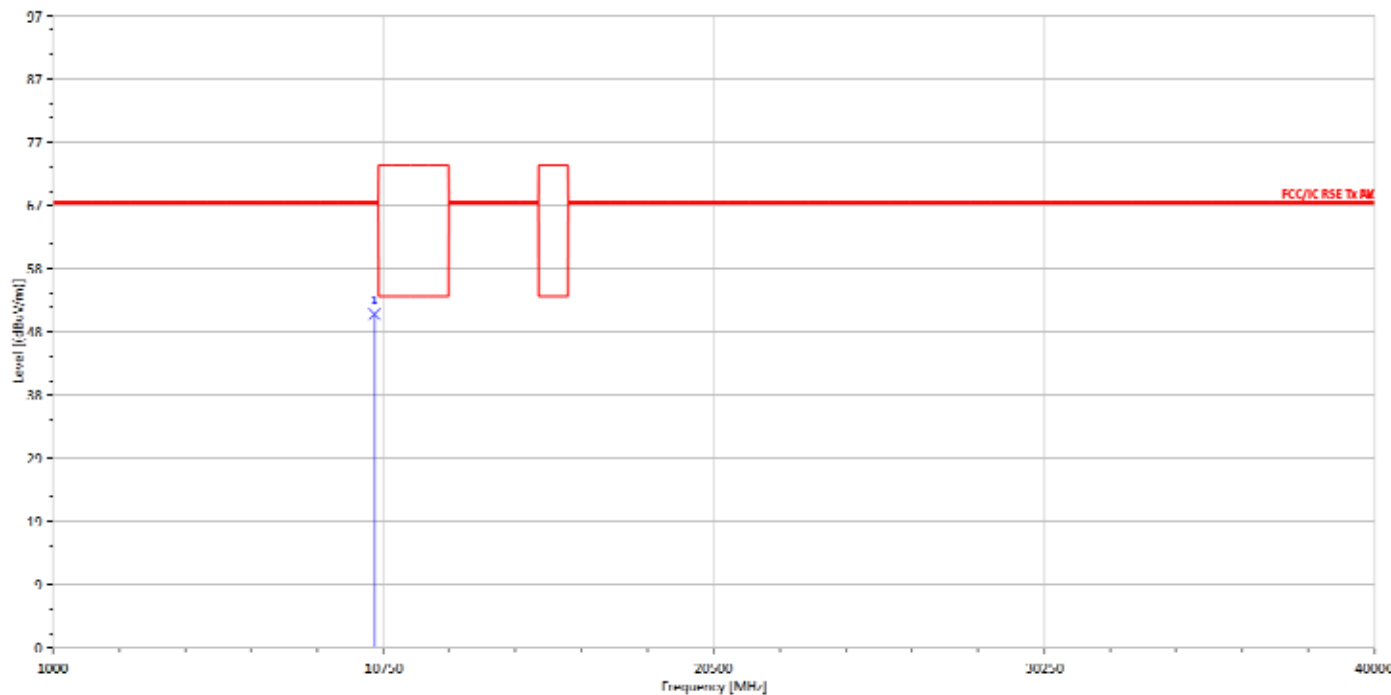
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Operation Mode :	802.11a	Test Date :	2016/10/21
Fundamental Frequency :	5240 MHz	Temp. / Humi. :	22.7deg_C/57RH
Operation Band :	Tx CH High	Test Engineer :	Ashton
EUT Pol. :	E2	Measurement Antenna Pol. :	Horizontal



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level		FS	@3m	
		PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
10480.00	H	Peak	30.55	20.68	51.23	68.3	-17.07

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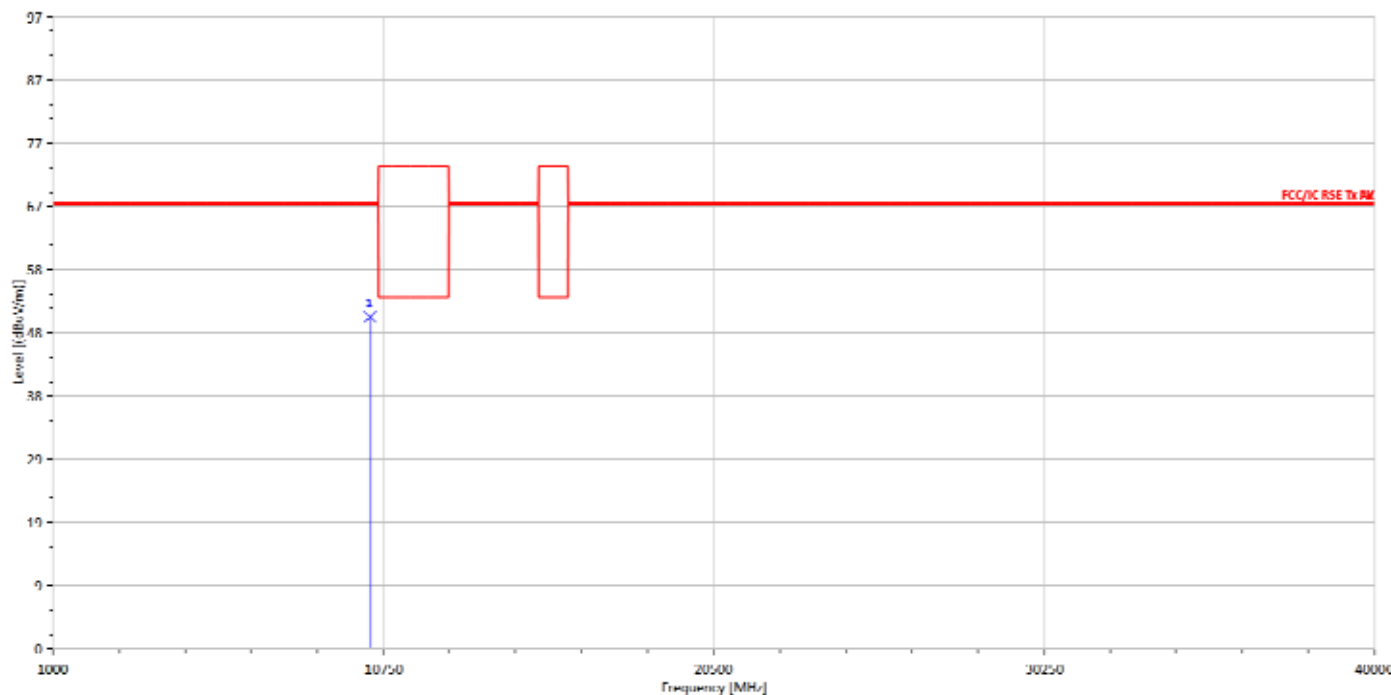
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Radiated Spurious Emission Measurement Result 802.11n HT20, 5150~5250 MHz

Operation Mode :	802.11n20	Test Date :	2016/10/21
Fundamental Frequency :	5180 MHz	Temp. / Humi. :	22.7 deg_C/57RH
Operation Band :	Tx CH Low	Test Engineer :	Ashton
EUT Pol. :	E2	Measurement Antenna Pol. :	Vertical



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	dB
		PK/QP/AV	dBμV		dBμV/m	dBμV/m	
10360.00	H	Peak	30.78	20.18	50.95	68.3	-17.35

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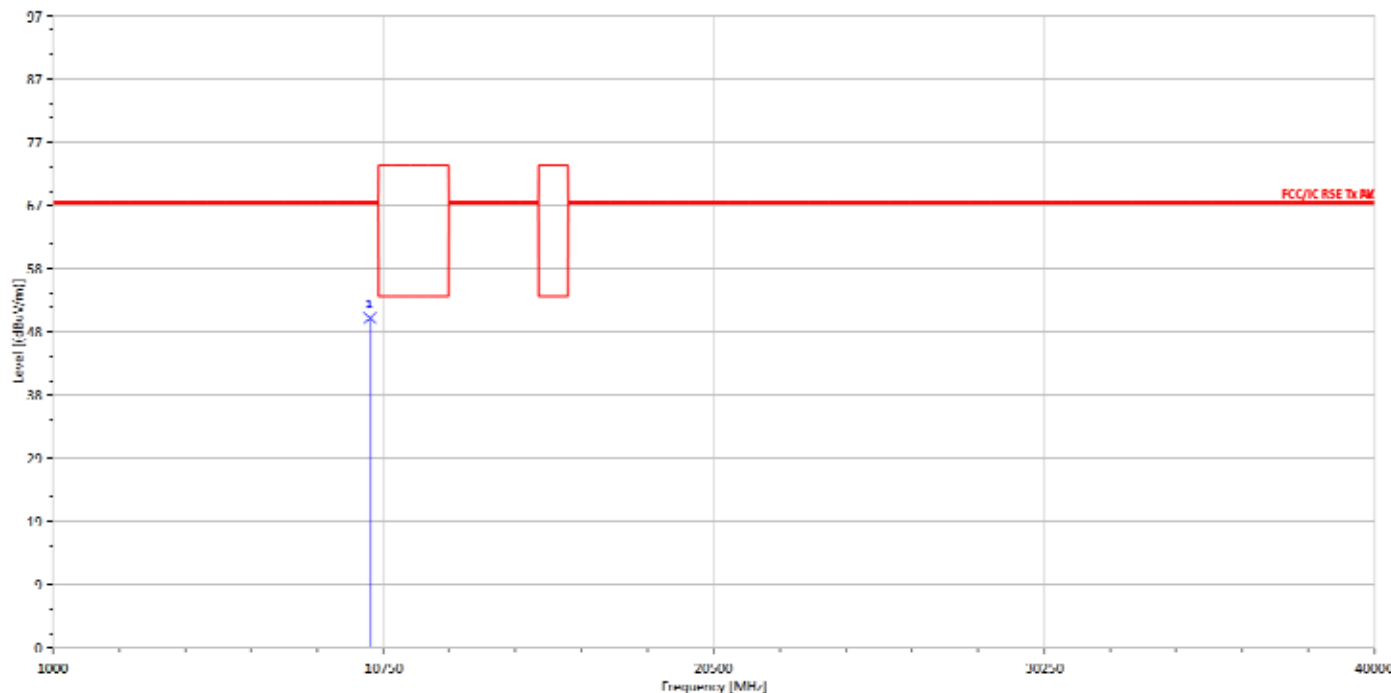
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Operation Mode : 802.11n20 Test Date : 2016/10/21
 Fundamental Frequency : 5180 MHz Temp. / Humi. : 22.7 deg_C/57RH
 Operation Band : Tx CH Low Test Engineer : Ashton
 EUT Pol. : E2 Measurement Antenna Pol. : Horizontal



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level		FS	@3m	
		PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
10360.00	H	Peak	30.46	20.18	50.63	68.3	-17.67

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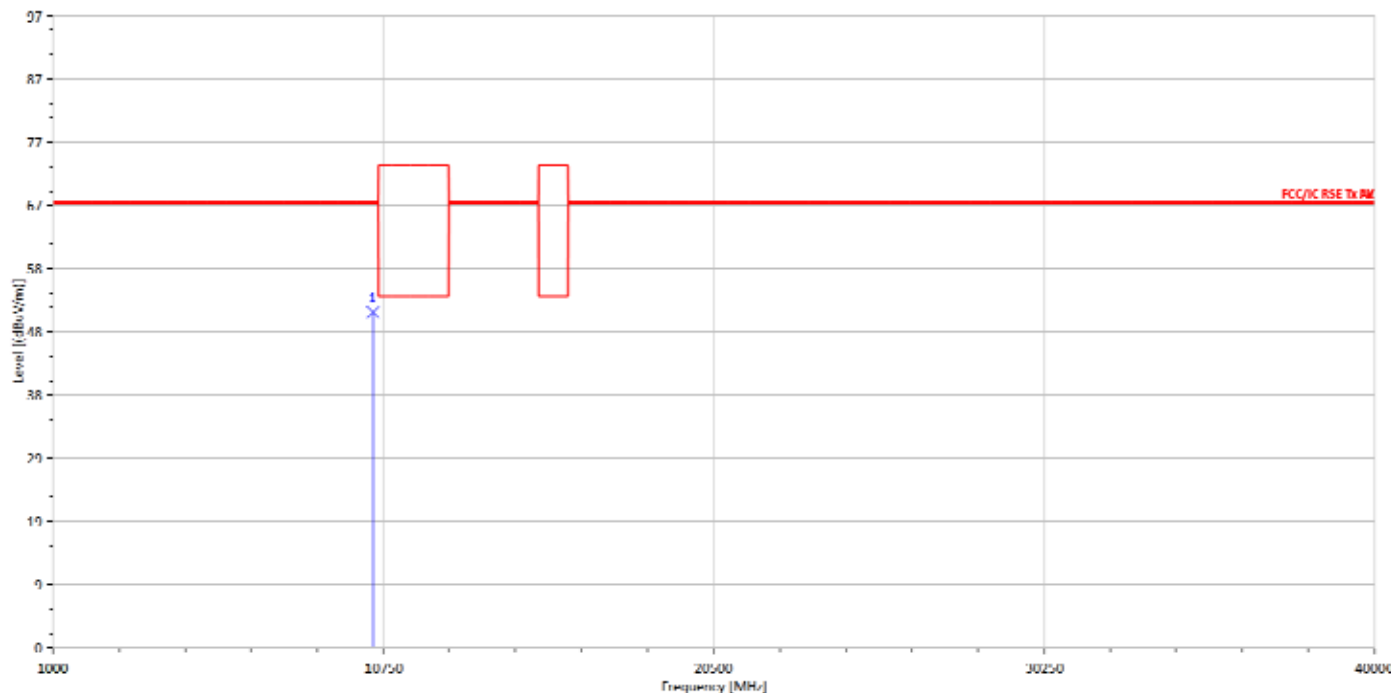
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Operation Mode :	802.11n20	Test Date :	2016/10/21
Fundamental Frequency :	5220 MHz	Temp. / Humi. :	22.7deg_C/57RH
Operation Band :	Tx CH Mid	Test Engineer :	Ashton
EUT Pol. :	E2	Measurement Antenna Pol. :	Vertical



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level		FS	@3m	
		PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
10440.00	H	Peak	31.23	20.29	51.52	68.3	-16.78

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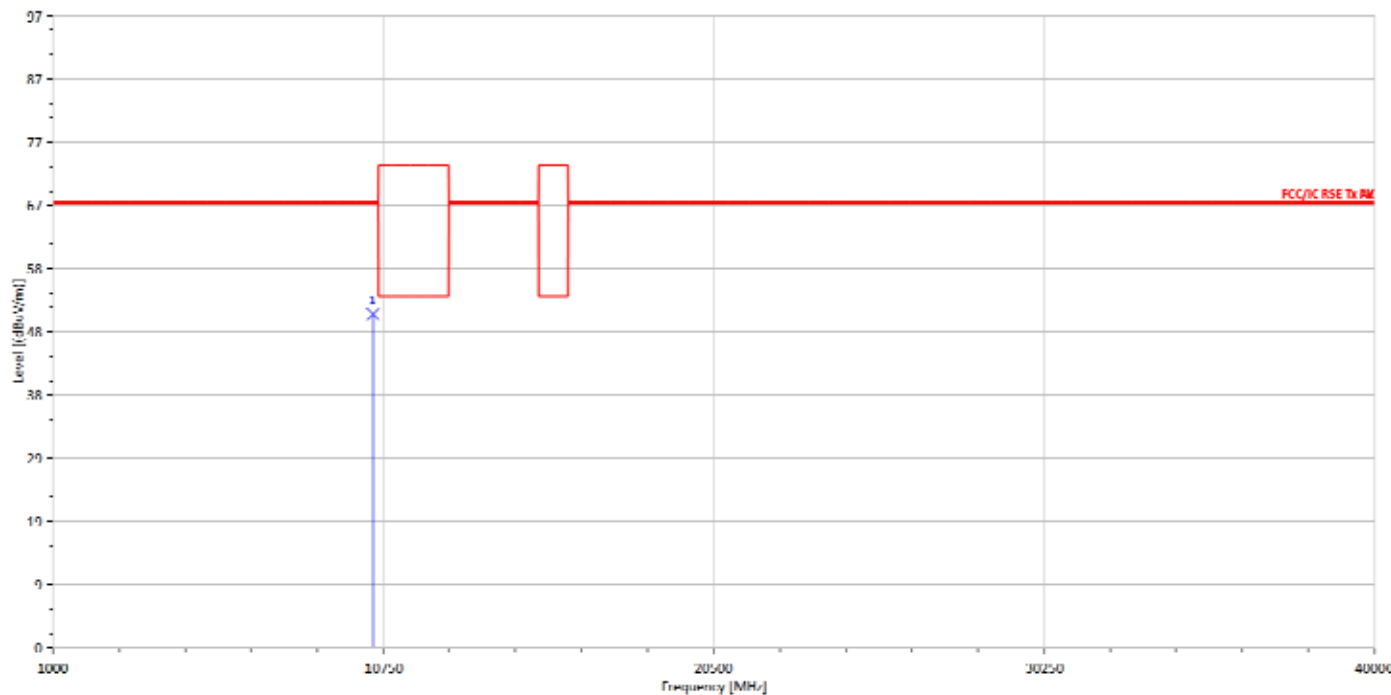
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Operation Mode :	802.11n20	Test Date :	2016/10/21
Fundamental Frequency :	5220 MHz	Temp. / Humi. :	22.7 deg_C/57RH
Operation Band :	Tx CH Mid	Test Engineer :	Ashton
EUT Pol. :	E2	Measurement Antenna Pol. :	Horizontal



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	
		PK/QP/AV	dBμV		dBμV/m	dBμV/m	dB
10440.00	H	Peak	30.93	20.29	51.22	68.3	-17.08

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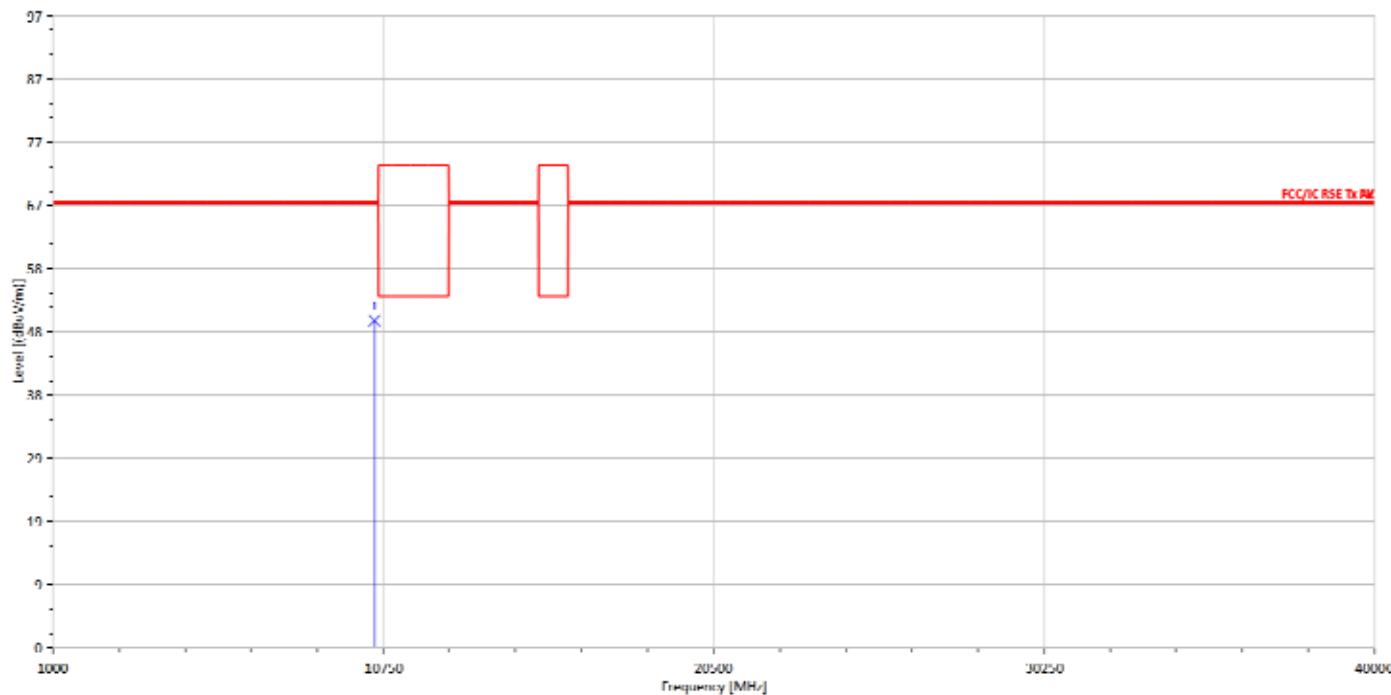
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Operation Mode : 802.11n20 Test Date : 2016/10/21
Fundamental Frequency : 5240 MHz Temp. / Humi. : 22.7deg_C/57RH
Operation Band : Tx CH High Test Engineer : Ashton
EUT Pol. : E2 Measurement Antenna Pol. : Vertical



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level		FS	@3m	
		PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
10480.00	H	Peak	29.56	20.68	50.24	68.3	-18.06

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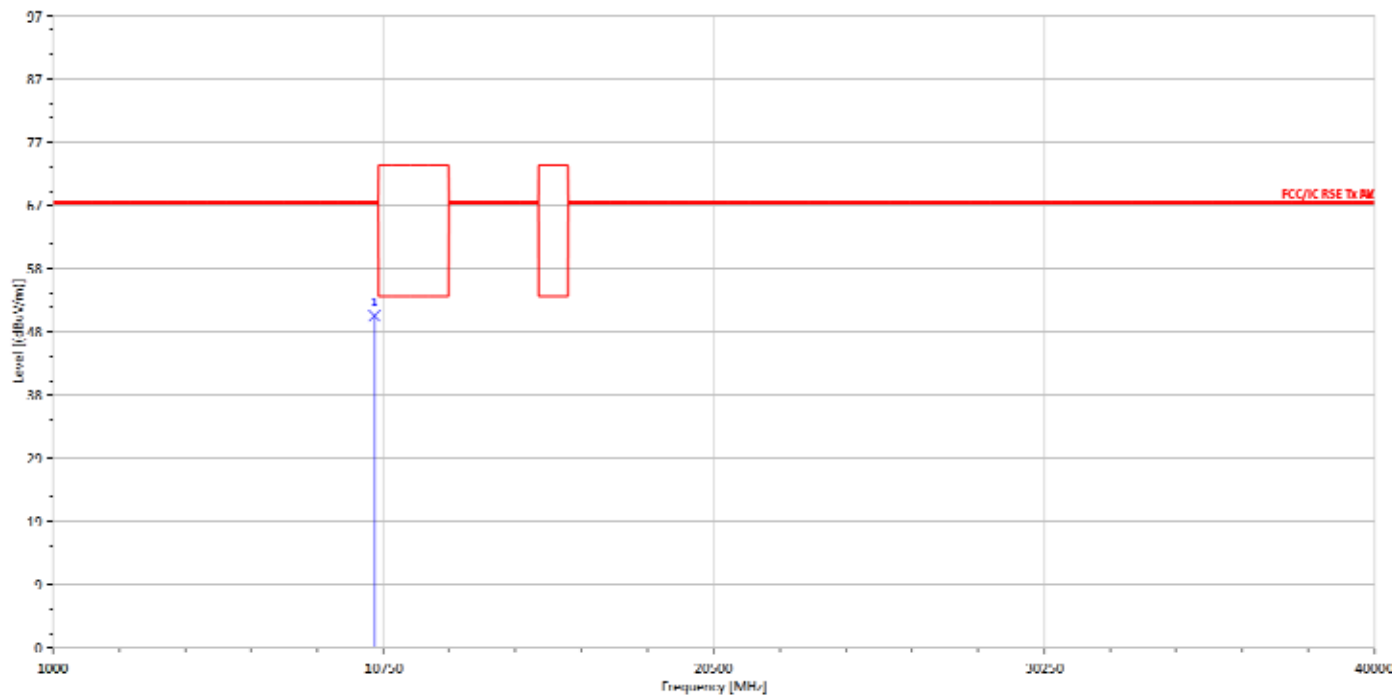
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Operation Mode : 802.11n20 Test Date : 2016/10/21
 Fundamental Frequency : 5240 MHz Temp. / Humi. : 22.7 deg_C/57RH
 Operation Band : Tx CH High Test Engineer : Ashton
 EUT Pol. : E2 Measurement Antenna Pol. : Horizontal



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level		FS	@3m	
		PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
10480.00	H	Peak	30.29	20.68	50.96	68.3	-17.34

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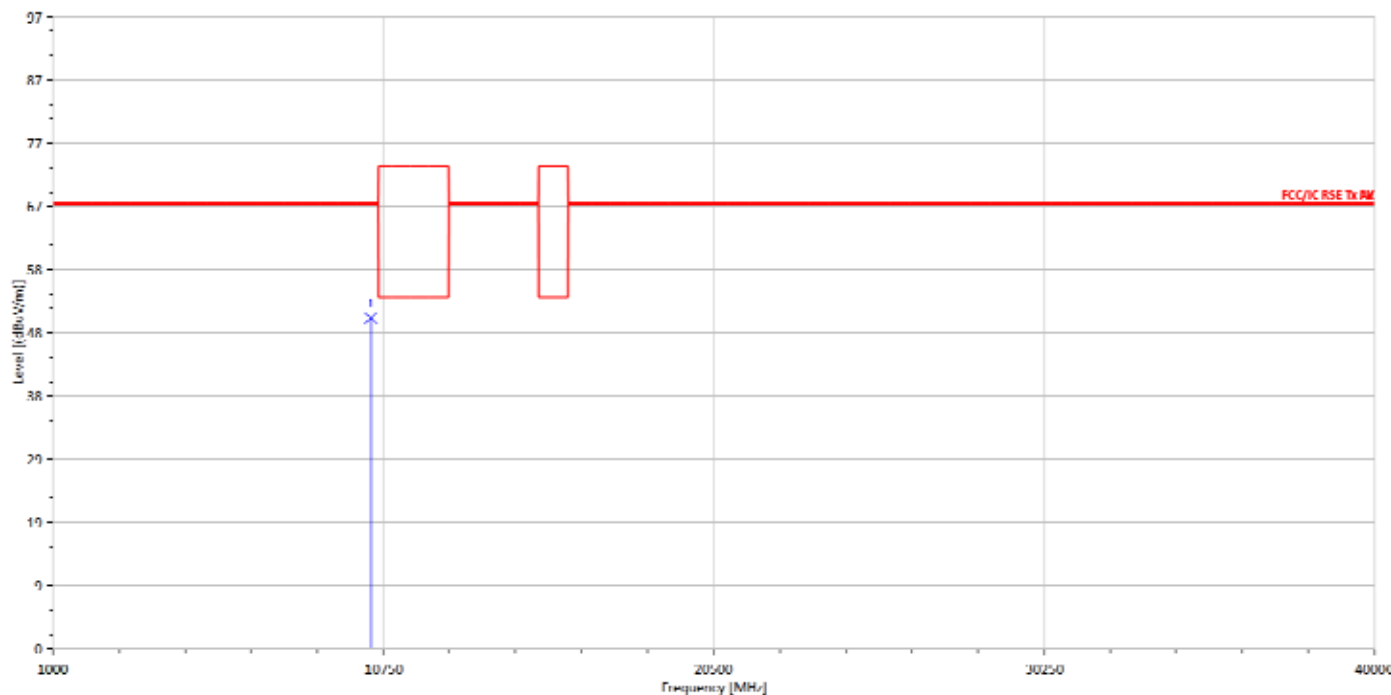
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Radiated Spurious Emission Measurement Result 802.11n HT40, 5150~5250 MHz

Operation Mode :	802.11n40	Test Date :	2016/10/21
Fundamental Frequency :	5190 MHz	Temp. / Humi. :	22.7 deg_C/57RH
Operation Band :	Tx CH Low	Test Engineer :	Ashton
EUT Pol. :	E2	Measurement Antenna Pol. :	Vertical



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	dB
		PK/QP/AV	dBμV		dBμV/m	dBμV/m	
10380.00	H	Peak	29.84	20.95	50.79	68.3	-17.51

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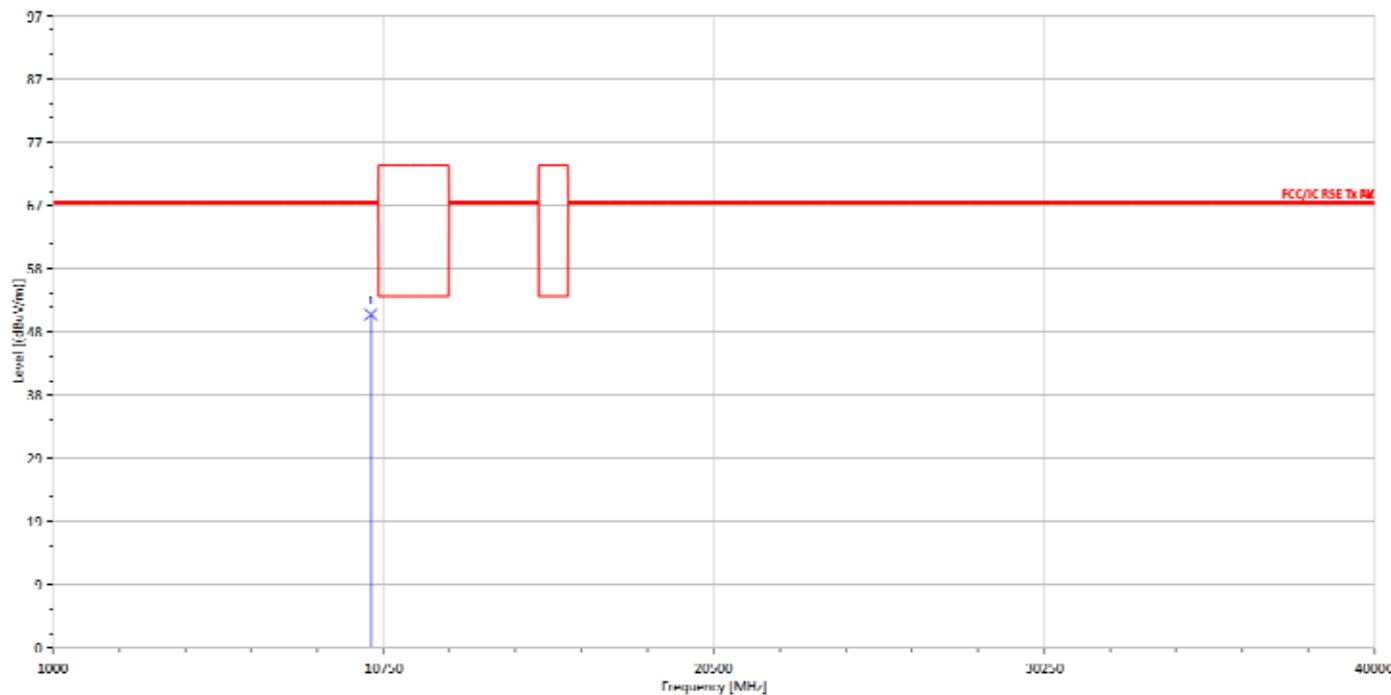
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Operation Mode : 802.11n40 Test Date : 2016/10/21
 Fundamental Frequency : 5190 MHz Temp. / Humi. : 22.7 deg_C/57RH
 Operation Band : Tx CH Low Test Engineer : Ashton
 EUT Pol. : E2 Measurement Antenna Pol. : Horizontal



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level		FS	@3m	
		PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
10380.00	H	Peak	30.22	20.95	51.17	68.3	-17.13

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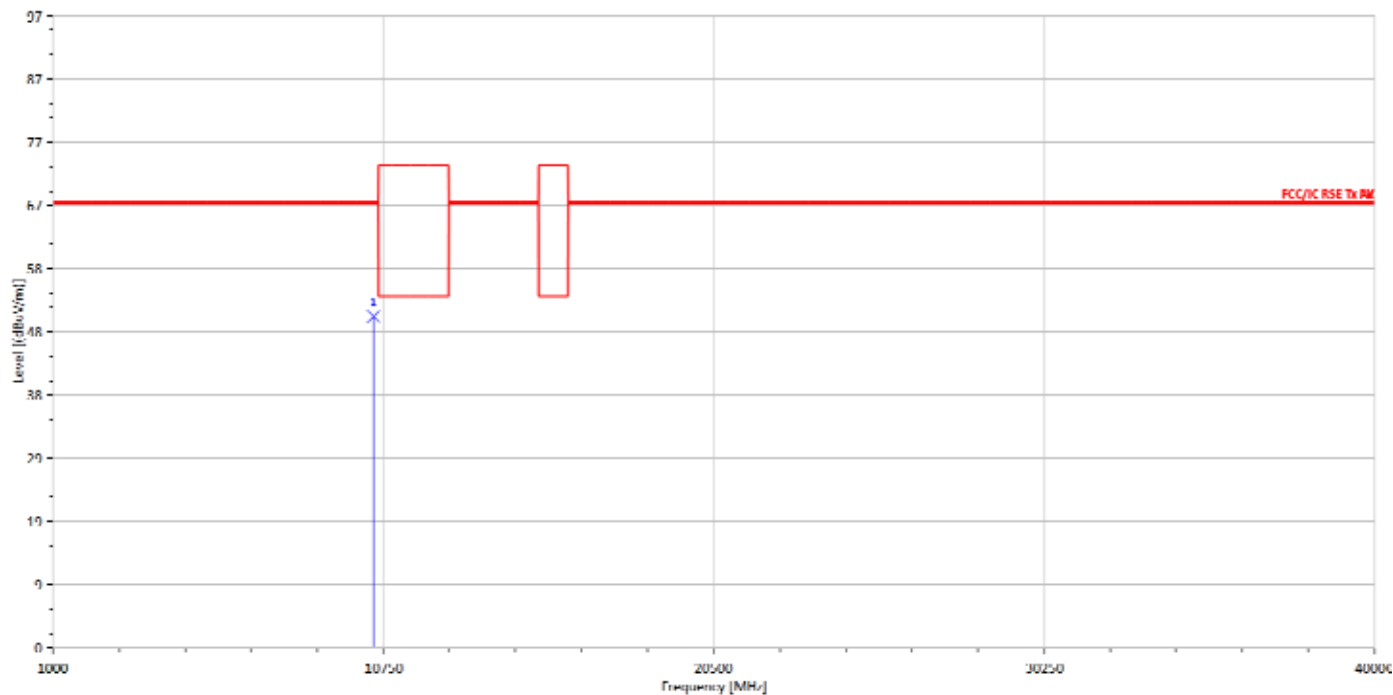
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Operation Mode : 802.11n40 Test Date : 2016/10/21
 Fundamental Frequency : 5230 MHz Temp. / Humi. : 22.7 deg_C/57RH
 Operation Band : Tx CH High Test Engineer : Ashton
 EUT Pol. : E2 Measurement Antenna Pol. : Vertical



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level		FS	@3m	
		PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
10460.00	H	Peak	29.93	20.95	50.88	68.3	-17.42

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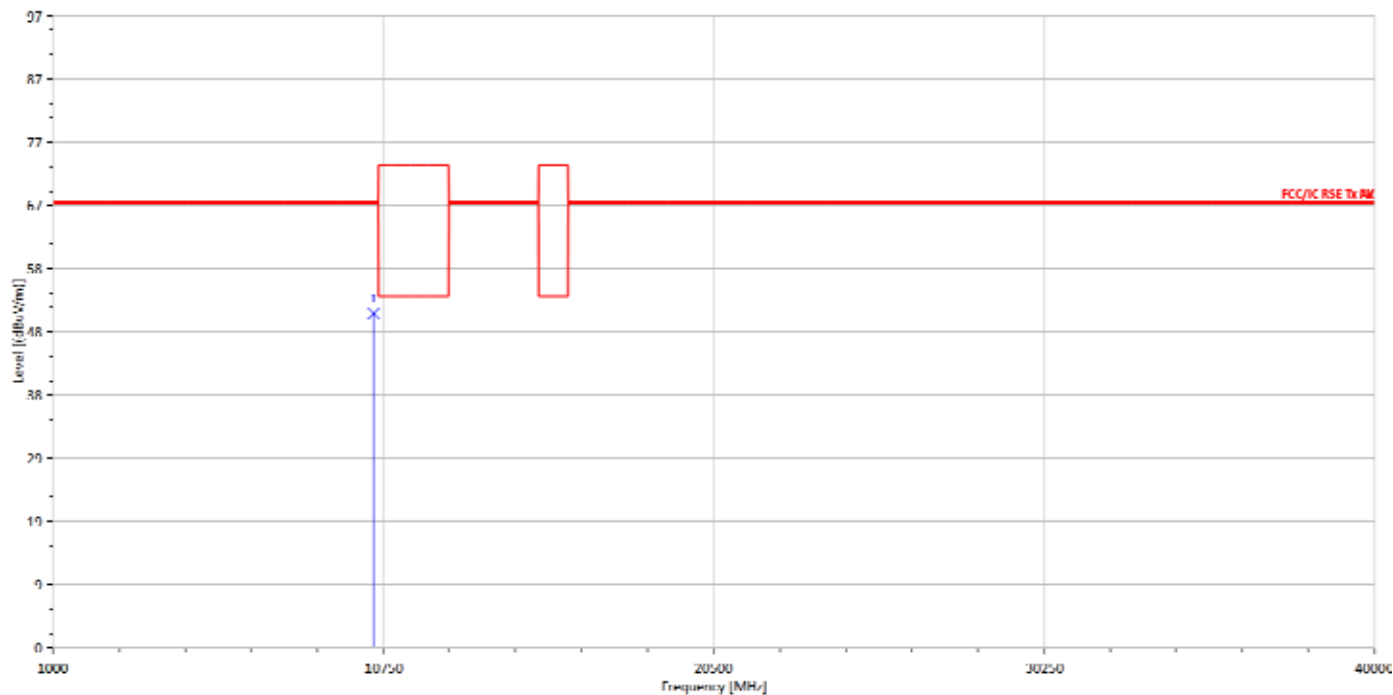
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Operation Mode : 802.11n40 Test Date : 2016/10/21
 Fundamental Frequency : 5230 MHz Temp. / Humi. : 22.7 deg_C/57RH
 Operation Band : Tx CH High Test Engineer : Ashton
 EUT Pol. : E2 Measurement Antenna Pol. : Horizontal



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level		FS	@3m	
		PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
10460.00	H	Peak	30.37	20.95	51.33	68.3	-16.97

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Band edge falling to restricted band

802.11a mode

Operation Mode : 802.11a Test Date : 2016/10/21
 Fundamental Frequency : 5180 MHz Temp. / Humi. : 22.7deg_C/57RH
 Operation Band : BE CH Low Test Engineer : Ashton
 EUT Pol. : E2 Measurement Antenna Pol. : Vertical

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
5149.36	S	Peak	53.48	8.19	61.67	74	-12.33
5149.36	S	Average	32.53	8.19	40.72	54	-13.28
5150.00	E	Peak	52.92	8.19	61.11	74	-12.89
5150.00	E	Average	32.58	8.19	40.77	54	-13.23

Operation Mode : 802.11a Test Date : 2016/10/21
 Fundamental Frequency : 5180 MHz Temp. / Humi. : 22.7deg_C/57RH
 Operation Band : BE CH Low Test Engineer : Ashton
 EUT Pol. : E2 Measurement Antenna Pol. : Horizontal

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
5150.00	E	Peak	64.93	8.19	73.12	74	-0.88
5150.00	E	Average	37.19	8.19	45.38	54	-8.62

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802.11n HT20 mode

Operation Mode : 802.11n20 Test Date : 2016/10/21
 Fundamental Frequency : 5180 MHz Temp. / Humi. : 22.7deg_C/57RH
 Operation Band : BE CH Low Test Engineer : Ashton
 EUT Pol. : E2 Measurement Antenna Pol. : Vertical

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
5150.00	E	Peak	53.39	8.19	61.58	74	-12.42
5150.00	E	Average	31.76	8.19	39.95	54	-14.05

Operation Mode : 802.11n20 Test Date : 2016/10/21
 Fundamental Frequency : 5180 MHz Temp. / Humi. : 22.7deg_C/57RH
 Operation Band : BE CH Low Test Engineer : Ashton
 EUT Pol. : E2 Measurement Antenna Pol. : Horizontal

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
5150.00	E	Peak	62.48	8.19	70.67	74	-3.33
5150.00	E	Average	34.95	8.19	43.14	54	-10.86

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802.11n HT40 mode

Operation Mode : 802.11n40 Test Date : 2016/10/21
 Fundamental Frequency : 5190 MHz Temp. / Humi. : 22.7deg_C/57RH
 Operation Band : BE CH Low Test Engineer : Ashton
 EUT Pol. : E2 Measurement Antenna Pol. : Vertical

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
5148.64	S	Peak	55.89	8.18	64.07	74	-9.93
5148.64	S	Average	34.92	8.18	43.10	54	-10.90
5150.00	E	Peak	54.93	8.19	63.13	74	-10.87
5150.00	E	Average	35.22	8.19	43.41	54	-10.59

Operation Mode : 802.11n40 Test Date : 2016/10/21
 Fundamental Frequency : 5190 MHz Temp. / Humi. : 22.7deg_C/57RH
 Operation Band : BE CH Low Test Engineer : Ashton
 EUT Pol. : E2 Measurement Antenna Pol. : Horizontal

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
5146.24	S	Peak	62.78	8.17	70.95	74	-3.05
5146.24	S	Average	39.55	8.17	47.72	54	-6.28
5150.00	E	Peak	61.76	8.19	69.95	74	-4.05
5150.00	E	Average	40.66	8.19	48.85	54	-5.15

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12. TRANSMISSION IN THE ABSENCE OF DATA

12.1 Standard Applicable

According to §15.407(c)

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

12.2 Result

No non-compliance noted:

Refer to the theory of operation.

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13. FREQUENCY STABILITY

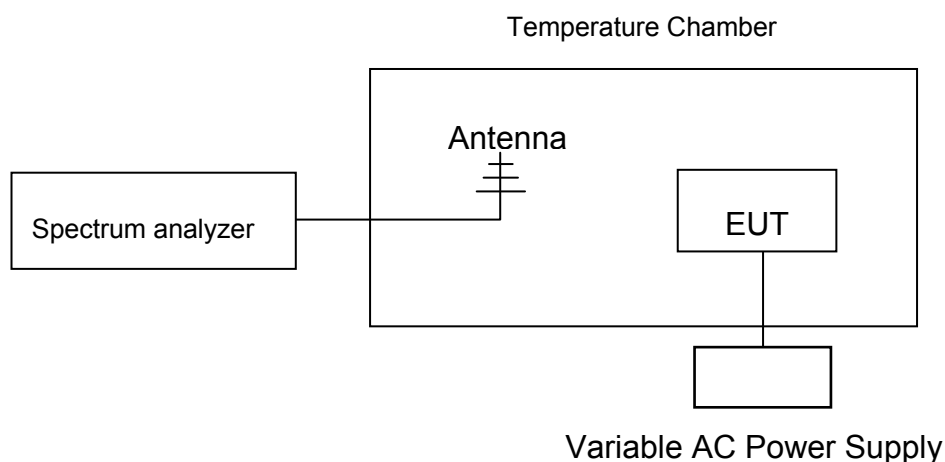
13.1 Standard Applicable

Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

13.2 Measurement Procedure

1. The EUT was placed inside temperature chamber and powered and powered by nominal DC voltage.
2. Set EUT as normal operation.
3. Turn the EUT on and couple its output to spectrum.
4. Turn the EUT off and set the chamber to the highest temperature specified.
5. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize, turn the EUT and measure the operating frequency.
6. Repeat step with the temperature chamber set to the lowest temperature.

13.3 Test SET-UP



13.4 Measurement Equipment Used:

SGS Conducted Room					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Spectrum Analyzer	KEYSIGHT	N9010A	MY54510568	04/14/2016	04/13/2017
DC Power Supply	Agilent	E3640A	MY53140006	05/04/2016	05/03/2017
Temperature Chamber	TERCHY	MHK-120LK	1020582	06/16/2016	06/15/2017

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13.5 Measurement Result

Operation Mode	802.11 a	Test Date	2016.10.21
Temperature	:24	Test By	Henry
Humidity	:66 %		

Test Temp.	Test Voltage	Channel	Measured Frequency (MHz)	Spectrum Frequency (MHz)	ΔFrequency (MHz)
0	13.8V	36	5180	5,179.92321	0.00001482
		44	5220	5,219.92249	0.00001485
		48	5240	5,239.92232	0.00001482
	10.8V	36	5180	5,179.92389	0.00001469
		44	5220	5,219.92327	0.00001470
		48	5240	5,239.92296	0.00001470
25	12V	36	5180	5,179.92398	0.00001468
		44	5220	5,219.92334	0.00001469
		48	5240	5,239.92305	0.00001469
40	13.8V	36	5180	5,179.92320	0.00001483
		44	5220	5,219.92249	0.00001485
		48	5240	5,239.92305	0.00001469
	10.8V	36	5180	5,179.92337	0.00001479
		44	5220	5,219.92318	0.00001472
		48	5240	5,239.92287	0.00001472

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Operation Mode	802.11 n_HT40	Test Date	2016.10.21
Temperature	:24	Test By	Henry
Humidity	:66 %		

Test Temp.	Test Voltage	Channel	Measured Frequency (MHz)	Spectrum Frequency (MHz)	ΔFrequency (MHz)
0	13.8V	38	5190	5,189.92304	0.00001483
		46	5230	5,229.92276	0.00001477
	10.8V	38	5190	5,189.92304	0.00001483
		46	5230	5,229.92276	0.00001477
25	12V	38	5190	5,189.92385	0.00001467
		46	5230	5,229.92329	0.00001467
40	13.8V	38	5190	5,189.92345	0.00001475
		46	5230	5,229.92254	0.00001481
	10.8V	38	5190	5,189.92350	0.00001474
		46	5230	5,229.92236	0.00001485

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14. ANTENNA REQUIREMENT

14.1 Standard Applicable

According to §15.203, an intentional radiator shall be designed to ensure that no antenna other than furnished by the responsible party shall be used with the device.

According to §15.407, 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.

14.2 Antenna Connected Construction

PIFA antenna designs are used.

The antenna is designed with permanent attached and no consideration of replacement. Please see EUT photo and antenna spec. for details.

The antenna gain is less than 6dBi. Therefore, it is not necessary to reduce maximum output power limit.

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15. MAXIMUM PERMISSIBLE EXPOSURE (MPE)

15.1 Standard Applicable

According to §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

This is a Mobile device, the MPE is required.

According to §1.1310 and §2.1093 RF exposure is calculated.

Limits for Maximum Permissive Exposure (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (minute)
Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f ²)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	F/1500	30
1500-15000	/	/	1.0	30

F = frequency in MHz

* = Plane-wave equipment power density

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = PG/4\pi R^2$$

Where: S = Power density

P = Power input to antenna

G = Power gain of the antenna in the direction of interest relative to an isotropic radiator

R = Distance to the center of radiation of the antenna

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802.11a Max. output power**802.11a_Aux1**

CH	Frequency (MHz)	Data Rate	TOTAL POWER (dBm)	TOTAL POWER (mW)	REQUIRED LIMIT (dBm)	RESULT
36	5180	MCS0	13.95	24.831	23.98	PASS
44	5220	MCS0	13.93	24.717	23.98	PASS
48	5240	MCS0	13.69	23.388	23.98	PASS

MPE Prediction (802.11a 5150~5250)

Average output power at antenna input terminal:	13.95	(dBm)
Average output power at antenna input terminal:	24.831331	(mW)
Duty cycle:	97.46	(%)
Maximum Pav :	24.200615	(mW)
Peak Antenna gain (Maximum):	4.5	(dBi)
Peak Antenna gain (linear):	2.8183829	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	5180	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm ²)
Power density at predication frequency at 20 (cm)	0.014	(mW/cm ²)
Measurement Result		
The predicted power density level at 20 cm is 0.014 mW/cm ² .		
This is below the uncontrolled exposure limit of 1 mW/cm ² at 5180MHz.		

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802.11n_HT20M Max. output power

802.11n_HT20_MIMO

CH	Frequency (MHz)	Data Rate	AVERAGE POWER (dBm)		TOTAL POWER (dBm)	TOTAL POWER (mW)	REQUIRED LIMIT (dBm)	RESULT
			CH 0	CH 1				
36	5180	MCS8	11.04	11.33	14.20	26.289	22.47	PASS
44	5220	MCS8	10.56	11.52	14.08	25.567	22.47	PASS
48	5240	MCS8	10.86	11.4	14.15	25.994	22.47	PASS

MPE Prediction (802.11n_HT20 5150~5250)

MIMO gain= $G+(10 \log N)=4.5+3.01=7.51\text{dBm}$

Average output power at antenna input terminal:	14.20	(dBm)
Average output power at antenna input terminal:	26.30268	(mW)
Duty cycle:	94.53	(%)
Maximum Pav :	24.863923	(mW)
Peak Antenna gain (Maximum):	7.51	(dBi)
Peak Antenna gain (linear):	5.6363766	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	5180	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm ²)
Power density at predication frequency at 20 (cm)	0.028	(mW/cm ²)

Measurement Result

The predicted power density level at 20 cm is 0.028 mW/cm².

This is below the uncontrolled exposure limit of 1 mW/cm² at 5180MHz.

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802.11n_HT40M Max. output power

802.11n_HT40_MIMO

CH	Frequency (MHz)	Data Rate	AVERAGE POWER (dBm)		TOTAL POWER (dBm)	TOTAL POWER (mW)	REQUIRED LIMIT (dBm)	RESULT
			CH 0	CH 1				
38	5190	MCS8	11.91	11.48	14.71	29.584	22.47	PASS
46	5230	MCS8	11.51	12.29	14.93	31.101	22.47	PASS

MPE Prediction (802.11n_HT40 5150~5250)

MIMO gain= $G+(10 \log N)= 4.5+3.01= 7.51\text{dBm}$

Average output power at antenna input terminal:	14.93	(dBm)
Average output power at antenna input terminal:	31.117163	(mW)
Duty cycle:	90	(%)
Maximum Pav :	28.005447	(mW)
Peak Antenna gain (Maximum):	7.51	(dBi)
Peak Antenna gain (linear):	5.6363766	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	5230	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm ²)
Power density at predication frequency at 20 (cm)	0.031	(mW/cm ²)
Measurement Result		
The predicted power density level at 20 cm is 0.031 mW/cm ² .		
This is below the uncontrolled exposure limit of 1 mW/cm ² at 5230MHz.		

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16. MAXIMUM PERMISSIBLE EXPOSURE (MPE)

16.1 Standard Applicable

According to RSS 102 March 19,2015 issue 5 §2.5.2 RF Exposure Evaluation

RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:

below 20 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance);

at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $22.48/f^{0.5}W$ (adjusted for tune-up tolerance), where f is in MHz;

at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);

at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $1.31 \times 10^{-2} f^{0.6834} W$ (adjusted for tune-up tolerance), where f is in MHz;

This is a Mobile device, at which separation distance between the user and the device's antenna is 20cm. Therefore, section 2.5.2 shall be complied with

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Maximum Permissible Exposure (MPE) Evaluation

802.11a 5150~5250:

Maximum average output power at antenna input	13.95	(dBm)
Maximum average output power at antenna input	24.831331	(mW)
Antenna gain (Peak):	4.5	(dBi)
Maximum antenna gain:	2.8183829	(numeric)
Frequency	5180	MHz
Limit	4.5253	W

Evaluation Result

The radiated power is $13.95 + 4.5 = 18.45$ dBm(EIRP) = 69.984mW = 0.069984W that is less than or equal to 4.525W. Hence, following section 2.5.2 of RSS102 issue RF exposure evaluation is no longer required.

802.11 n_HT20 MIMO 5150~5250:

Maximum average output power at antenna input	14.2	(dBm)
Maximum average output power at antenna input	26.30268	(mW)
Antenna gain (Peak):	0.51	(dBi)
Maximum antenna gain:	1.124605	(numeric)
Frequency	5180	MHz
Limit	4.5253	W

Evaluation Result

The radiated power is $14.2 + 0.51 = 14.71$ dBm(EIRP) = 29.58mW = 0.02958W that is less than or equal to 4.525W. Hence, following section 2.5.2 of RSS102 issue RF exposure evaluation is no longer required.

802.11 n_HT40 MIMO 5150~5250:

Maximum average output power at antenna input	14.93	(dBm)
Maximum average output power at antenna input	31.117163	(mW)
Antenna gain (Peak):	7.51	(dBi)
Maximum antenna gain:	5.6363766	(numeric)
Frequency	5230	MHz
Limit	4.5551	W

Evaluation Result

The radiated power is $14.93 + 7.51 = 22.44$ dBm(EIRP) = 175.388mW = 0.175388W that is less than or equal to 4.555W. Hence, following section 2.5.2 of RSS102 issue RF exposure evaluation is no longer required.

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