

TEST REPORT

Report No.: SHE19110011-02DE

Date: 2020-1-19

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Applicant : PCD, LLC
Address of Applicant : 7651 Southland Blvd. Orlando, FL 32809

Product Name : Router
Model No. : R402
Sample No. : E19110011-05#04
E19110011-05#02
FCC ID : 2ALJJR402

Standards : FCC CFR47 Part 15, Subpart C

Date of Receipt : 2020-1-2
Date of Test : 2020-1-8 ~ 2020-1-19
Date of Issue : 2020-1-19

Remark:

This report details the results of the testing carried out on one sample, the results contained in this report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

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(Jennifer Zhou)

Reviewed by: jesse
(jesse)

Approved by: Guoyou Chi
(Authorized signatory: Guoyou Chi)

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Revision Record			
Version	Date	Revisions	Revised By
1.0	2020-1-19	Original	--

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1 General Information

1.1 Testing Laboratory

Company Name	ICAS Testing Technology Services (Shanghai) Co., Ltd.
Address	155 Pingbei Rd, Minhang District, Shanghai, China
Telephone	0086 21-51682999
Fax	0086 21-54711112
Homepage	www.icasiso.com

1.2 Details of Application

Company Name	PCD, LLC
Address	7651 Southland Blvd. Orlando, FL 32809
Contact Person	Mauricio Velasco
Telephone	+1.631.495.7537
Email	mvelasco@pcdatam.com

1.3 Details of EUT

Product Name	Router
Brand Name	PCD
Model No.	R402
FCC ID	2ALJJR402
Mode of Operation	WLAN 802.11a/n(HT20/40)/ac(HT20/40/80)
Frequency Range	Band I: 5150 MHz ~ 5250 MHz Band IV: 5725 MHz ~ 5850 MHz
Modulation Type	256QAM, 64QAM, 16QAM, BPSK, QPSK
Channel Bandwidth	802.11a: 20MHz 802.11n: 20MHz, 40MHz 802.11ac: 20MHz, 40MHz, 80MHz
Antenna Type	internal antenna
Antenna Gain	1 dBi
Extreme Temperature Range	-10°C ~ +55°C
Test Voltage	AC 100~240V
Extreme Voltage	Low Voltage: DC 12.0V High Voltage: DC 13.2V
Product Type	Fixed

1.4 Test Methodology

47 CFR Part 15, Subpart C (10-1-16 Edition)	Miscellaneous Wireless Communications Services
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KDB Publication 789033 D02 v02r01	Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E
KDB Publication 662911 D01 v02r01	Emissions Testing of Transmitters with Multiple Outputs in the Same Band (e.g., MIMO, Smart Antenna, etc)
RSS-Gen (Issue 5, March 2019)	General Requirements for Compliance of Radio Apparatus
RSS-247 (Issue 2, February 2017)	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
ANSI C63.10-2013	American National Standard for Testing Unlicensed Wireless Devices

Note(s):

All test items were verified and recorded according to the standards and without any addition/deviation/exclusion during the test.

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2 Test Condition

2.1 Environmental conditions

Temperature (°C)	18-25
Humidity (%RH)	40-65
Barometric Pressure (mbar)	960-1060

2.2 Equipment List

Name of Equipment	Manufacturer	Model	Serial No.	Cal. Due Date
Spectrum Analyzer	Keysight	N9020B	MY59260184	2020-07-28
Spectrum Analyzer	Rohde & Schwarz	FSV40N	101450	2020-06-24
EMI Test Receiver	Rohde & Schwarz	ESPI3	100173	2020-06-19
EMI Test Receiver	Rohde & Schwarz	ESR 7	101911	2020-06-19
V-network	SCHWARZBECK	NSLK 8127	8127-902	2020-02-20
Wideband Radio Communication Tester	Rohde & Schwarz	CMW 500	100687	2020-08-22
DC Power Supply	ACPOWER	ADC-0800025-15	D215010003	2020-03-15
Temperature Chamber	Muni	M/THP400L	M/161227-01	2020-05-08
Broadband Antenna	SCHWARZBECK	VULB9163	9163-1037	2020-06-06
Horn Antenna-18G	SCHWARZBECK	BBHA9120D	9120D-1775	2020-06-06
Loop Antenna	SCHWARZBECK	FMZB 1513	N/A	2021-03-19
Horn Antenna-18~40G	YINGLIAN	LB-180400-KF	N/A	2020-07-26
EMC chamber 9*6*6 (L*W*H)	CHANGNING	966	N/A	2020-06-26
Shielded Enclosure 8*5*4 (L*W*H)	CHANGNING	854	N/A	2020-08-28
Test Software	BL	BL410_E	N/A	N/A
Test Software	BL	BL410_R	N/A	N/A
Amplifier and Filter group	BL	BL410_E	N/A	2020-11-01
Amplifier and Filter group and Power meter	BL	BL410_R	N/A	2020-11-01

2.3 Measurement Uncertainty

Parameter	Frequency	Uncertainty
Antenna Port Conducted Emission	< 1GHz	± 1.5 dB
	> 1GHz	± 1.5 dB
Radiated Emission	30 MHz – 1 GHz	± 3 dB
	> 1GHz	± 3 dB

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3 Test Set-up and Operation Modes

3.1 Details of Test Mode

Using test software was control EUT work in continuous transmitter and receiver mode. Select test channel as below:

For 802.11a/n(HT20), 802.11ac(VHT20)

Band I (5150 – 5250 MHz)		Band IV (5725 – 5850 MHz)	
Channel	Frequency	Channel	Frequency
The lowest channel(CH36)	5180MHz	The lowest channel(CH149)	5745MHz
The middle channel(CH44)	5220MHz	The middle channel(CH157)	5785MHz
The highest channel(CH48)	5240MHz	The highest channel(CH165)	5825MHz

For 802.11n(HT40), 802.11ac(VHT40)

Band I (5150 – 5250 MHz)		Band IV (5725 – 5850 MHz)	
Channel	Frequency	Channel	Frequency
The lowest channel(CH38)	5190MHz	The lowest channel(CH151)	5755MHz
The highest channel(CH46)	5230MHz	The highest channel(CH159)	5795MHz

For 802.11ac(VHT80)

Band I (5150 – 5250 MHz)		Band IV (5725 – 5850 MHz)	
Channel	Frequency	Channel	Frequency
The lowest channel(CH42)	5210MHz	The lowest channel(CH155)	5775MHz

Through Pre-scan under all rate at lowest channel, the data rate as below table described is the worst case, so we choose these data rate for test.

Type	Data rate (For Chain 1)	Data rate (For Chain 2)
802.11a	24Mbps	24Mbps
802.11n(HT20), 802.11ac(VHT20)	MCS6	MCS6
802.11n(HT40), 802.11ac(VHT40)	MCS4	MCS6
802.11ac(VHT80)	MCS3	MCS3

Type	Data rate (For MIMO)
802.11a	36Mbps
802.11n(HT20), 802.11ac(VHT20)	MCS6
802.11n(HT40), 802.11ac(VHT40)	MCS4
802.11ac(VHT80)	MCS3

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The basic operation modes are:

- A. On
 - 1. WLAN mode
 - a. Transmitting
 - b. Receiving
- B. Standby
- C. Off

3.2 Special Accessories and Auxiliary Equipment

Description	Manufacturer	Model No.	Serial No.
N/A	N/A	N/A	N/A

3.3 Support Software

Description	Manufacturer	Software Name
N/A	N/A	N/A

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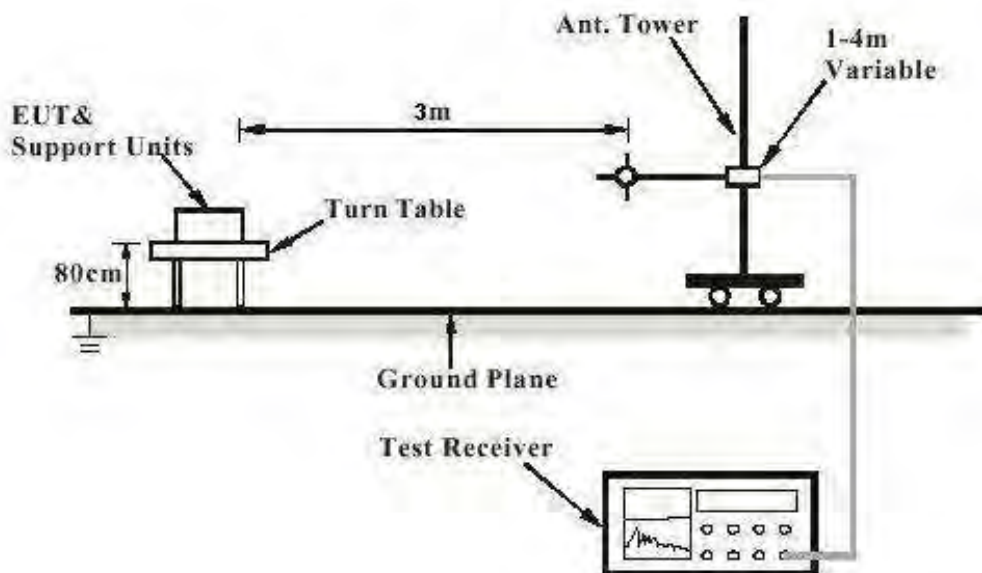
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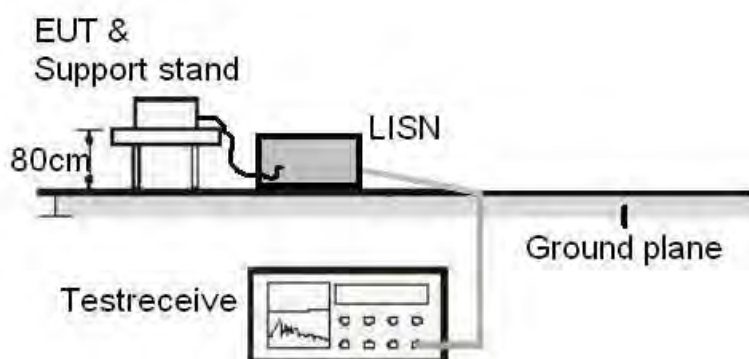
3.4 Test Setup Diagram

Diagram of Measurement Configuration for Radiation Test



Note: Measurements above 1GHz are done with a table height of 1.5m. In addition, there is RF absorbing material on the floor of the test site for above 1GHz measurement.

Diagram of Measurement Equipment Configuration for Conduction Measurement



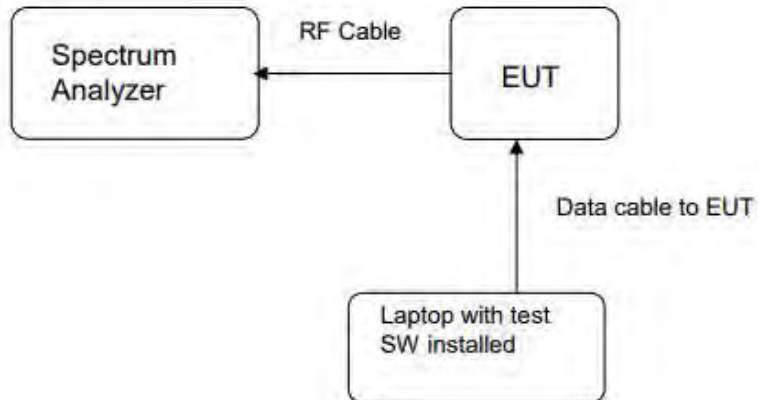
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Diagram of Measurement Equipment Configuration for Transmitter Measurement



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4 Test Results

4.1 Transmitter Requirement & Test Suites

4.1.1 Antenna Requirement

RESULT:

PASS

Test standard : FCC Part 15.407(a), 15.203
RSS-247 6.2

Requirement : The use of approved antennas only with directional
gains that do not exceed 6 dBi

According to the manufacturer declaration, the EUT has an antenna with a directional gain of 1dBi. The antenna is an internal antenna with no possibility of replacement with a non-approved antenna by the end-user.

Therefore, the EUT is considered to comply with this provision.

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4.1.2 Peak Output Power

RESULT:

PASS

Test standard : FCC Part 15.407(a)
RSS-247 6.2
Requirement : ANSI C63.10-2013, KDB 789033
Kind of test site : Shielded room

Test setup

Test Channel : Low/Middle/High
Operation Mode : A.1.a
Ambient temperature : 25C
Relative humidity : 52%

Table 1: Peak Output Power

Band I (5150 – 5250 MHz)

Test Mode	Test Channel (MHz)	Measured Peak Output Power				FCC Limit (mW)
		Chain 1		Chain 2		
		(dBm)	(mW)	(dBm)	(mW)	
802.11a	5180	11.28	13.43	12.11	16.26	250
	5220	11.26	13.37	12.46	17.62	
	5240	11.15	13.03	12.63	18.32	
802.11n(HT20)	5180	11.43	13.90	12.28	16.90	
	5220	11.48	14.06	12.69	18.58	
	5240	11.46	14.00	12.86	19.32	
802.11ac(VHT20)	5180	11.57	14.35	12.25	16.79	
	5220	11.44	13.93	12.66	18.45	
	5240	11.42	13.87	12.81	19.10	
802.11n(HT40)	5190	11.17	13.09	11.98	15.78	
	5230	11.08	12.82	12.42	17.46	
802.11ac(VHT40)	5190	11.12	12.94	11.93	15.60	
	5230	11.02	12.65	12.39	17.34	
802.11ac(VHT80)	5210	11.10	12.88	12.17	16.48	

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Band I (5150 – 5250 MHz)

Test Mode	Test Channel (MHz)	Measured Peak Output Power		FCC Limit (mW)
		MIMO		
		(dBm)	(mW)	
802.11a	5180	11.86	15.35	250
	5220	11.56	14.32	
	5240	11.46	14.00	
802.11n(HT20)	5180	12.00	15.85	
	5220	11.73	14.89	
	5240	11.62	14.52	
802.11ac(VHT20)	5180	12.32	17.06	
	5220	12.03	15.96	
	5240	11.93	15.60	
802.11n(HT40)	5190	11.68	14.72	
	5230	11.46	14.00	
802.11ac(VHT40)	5190	11.62	14.52	
	5230	10.89	12.27	
802.11ac(VHT80)	5210	11.96	15.70	

Band IV (5725 – 5850 MHz)

Test Mode	Test Channel (MHz)	Measured Peak Output Power				FCC Limit (W)
		Chain 1		Chain 2		
		(dBm)	(mW)	(dBm)	(mW)	
802.11a	5745	11.26	13.37	13.04	20.14	1
	5785	11.63	14.55	12.93	19.63	
	5825	11.52	14.19	12.52	17.86	
802.11n(HT20)	5745	11.43	13.90	13.25	21.13	
	5785	11.84	15.28	13.05	20.18	
	5825	11.71	14.83	12.65	18.41	
802.11ac(VHT20)	5745	11.58	14.39	13.34	21.58	
	5785	11.87	15.38	13.12	20.51	
	5825	11.75	14.96	12.51	17.82	
802.11n(HT40)	5755	11.21	13.21	12.85	19.28	
	5795	11.60	14.45	12.72	18.71	
802.11ac(VHT40)	5755	11.31	13.52	12.84	19.23	
	5795	11.70	14.79	12.74	18.79	
802.11ac(VHT80)	5775	11.41	13.84	12.60	18.20	

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Band IV (5725 – 5850 MHz)

Test Mode	Test Channel (MHz)	Measured Peak Output Power		FCC Limit (W)
		MIMO		
		(dBm)	(mW)	
802.11a	5745	10.83	12.11	1
	5785	10.49	11.19	
	5825	10.12	10.28	
802.11n(HT20)	5745	11.79	15.10	
	5785	11.47	14.03	
	5825	11.04	12.71	
802.11ac(VHT20)	5745	13.12	20.51	
	5785	12.91	19.54	
	5825	12.36	17.22	
802.11n(HT40)	5755	12.91	19.54	
	5795	12.79	19.01	
802.11ac(VHT40)	5755	12.46	17.62	
	5795	12.32	17.06	
802.11ac(VHT80)	5775	12.50	17.78	

Note:

B is the 99% emissions bandwidth in MHz.

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4.1.3 26dB Bandwidth and 99% Bandwidth

RESULT:

PASS

Test standard : FCC Part 15.407(a)
RSS-247 6.2
Requirement : ANSI C63.10-2013, KDB 789033
Kind of test site : Shielded room

Test setup

Test Channel : Low/Middle/High
Operation Mode : A.1.a
Ambient temperature : 25C
Relative humidity : 52%

Table 2: Chain 2 26dB Bandwidth and 99% Bandwidth
Band I (5150 – 5250 MHz)

Test Mode	Test Channel (MHz)	26dB Bandwidth (MHz)	99% Bandwidth (MHz)
802.11a	5180	19.11	16.431
	5220	19.28	16.446
	5240	19.12	16.439
802.11n(HT20)	5180	20.25	17.641
	5220	20.20	17.673
	5240	20.24	17.670
802.11ac(VHT20)	5180	20.20	17.660
	5220	20.18	17.673
	5240	20.34	17.674
802.11n(HT40)	5190	39.03	36.150
	5230	38.60	36.179
802.11ac(VHT40)	5190	39.01	36.194
	5230	39.02	36.210
802.11ac(VHT80)	5210	79.62	75.661

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Band IV (5725 – 5850 MHz)

Test Mode	Test Channel (MHz)	26dB Bandwidth (MHz)	99% Bandwidth (MHz)
802.11a	5745	19.38	16.407
	5785	18.79	16.405
	5825	19.01	16.415
802.11n(HT20)	5745	20.47	17.672
	5785	20.46	17.670
	5825	20.26	17.679
802.11ac(VHT20)	5745	20.42	17.658
	5785	20.55	17.664
	5825	20.10	17.663
802.11n(HT40)	5755	38.91	36.123
	5795	39.34	36.088
802.11ac(VHT40)	5755	39.17	36.199
	5795	38.89	36.176
802.11ac(VHT80)	5775	79.66	75.640

Table 3: MIMO 26dB Bandwidth and 99% Bandwidth

Band I (5150 – 5250 MHz)

Test Mode	Test Channel (MHz)	26dB Bandwidth (MHz)	99% Bandwidth (MHz)
802.11a	5180	18.67	16.422
	5220	18.65	16.439
	5240	18.51	16.400
802.11n(HT20)	5180	19.83	17.642
	5220	19.90	17.621
	5240	20.01	17.653
802.11ac(VHT20)	5180	19.94	17.680
	5220	20.16	17.661
	5240	19.94	20.211
802.11n(HT40)	5190	38.71	36.142
	5230	38.54	36.109
802.11ac(VHT40)	5190	38.96	36.104
	5230	38.81	36.218
802.11ac(VHT80)	5210	79.93	75.693

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Band IV (5725 – 5850 MHz)

Test Mode	Test Channel (MHz)	26dB Bandwidth (MHz)	99% Bandwidth (MHz)
802.11a	5745	18.56	16.442
	5785	18.63	16.427
	5825	18.46	16.448
802.11n(HT20)	5745	19.93	17.692
	5785	19.80	17.688
	5825	20.17	17.685
802.11ac(VHT20)	5745	20.24	17.768
	5785	21.43	17.777
	5825	21.74	17.752
802.11n(HT40)	5755	38.12	35.802
	5795	37.59	35.746
802.11ac(VHT40)	5755	37.64	35.893
	5795	38.66	36.272
802.11ac(VHT80)	5775	80.29	75.707

Table 4: Chain 1 26dB Bandwidth and 99% Bandwidth

Band I (5150 – 5250 MHz)

Test Mode	Test Channel (MHz)	26dB Bandwidth (MHz)	99% Bandwidth (MHz)
802.11a	5180	19.07	16.445
	5220	19.05	16.444
	5240	18.95	16.430
802.11n(HT20)	5180	20.15	17.686
	5220	20.20	17.658
	5240	20.47	17.653
802.11ac(VHT20)	5180	20.15	17.640
	5220	20.10	17.639
	5240	20.26	17.658
802.11n(HT40)	5190	37.84	35.701
	5230	38.75	36.207
802.11ac(VHT40)	5190	38.98	36.166
	5230	39.53	36.170
802.11ac(VHT80)	5210	79.58	75.720

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Band IV (5725 – 5850 MHz)

Test Mode	Test Channel (MHz)	26dB Bandwidth (MHz)	99% Bandwidth (MHz)
802.11a	5745	19.050	16.470
	5785	19.210	16.461
	5825	19.450	16.442
802.11n(HT20)	5745	20.090	17.677
	5785	20.660	17.658
	5825	20.110	17.676
802.11ac(VHT20)	5745	20.470	17.657
	5785	20.250	17.671
	5825	20.250	17.670
802.11n(HT40)	5755	39.63	36.185
	5795	39.68	36.173
802.11ac(VHT40)	5755	38.95	36.127
	5795	39.35	36.191
802.11ac(VHT80)	5775	79.52	75.609

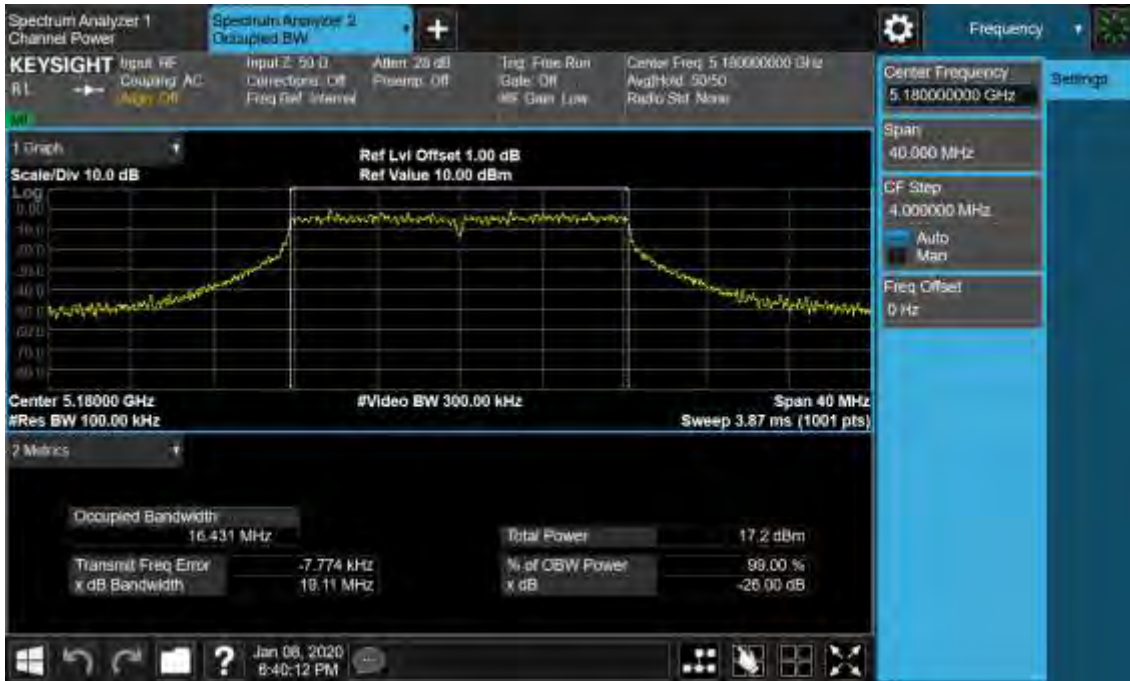
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Chain 2 26dB Bandwidth and 99% Bandwidth, 802.11a, 5180MHz



MIMO 26dB Bandwidth and 99% Bandwidth, 802.11a, 5180MHz



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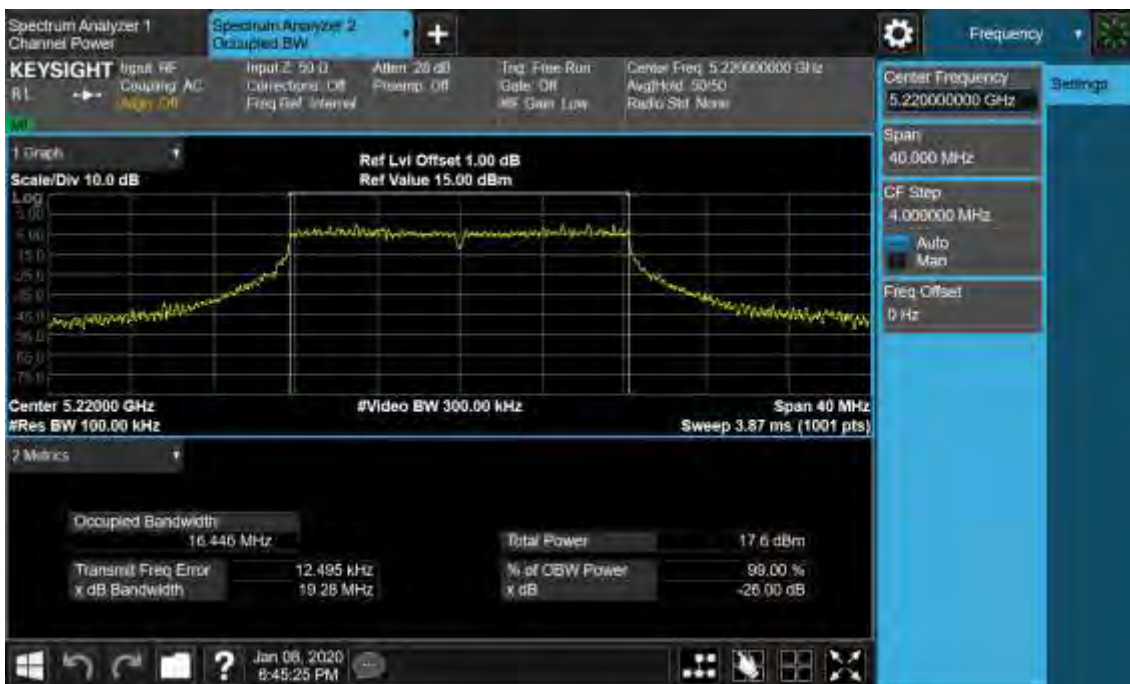
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Chain 1 26dB Bandwidth and 99% Bandwidth, 802.11a, 5180MHz



Chain 2 26dB Bandwidth and 99% Bandwidth, 802.11a, 5220MHz



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MIMO 26dB Bandwidth and 99% Bandwidth, 802.11a, 5220MHz



Chain 1 26dB Bandwidth and 99% Bandwidth, 802.11a, 5220MHz



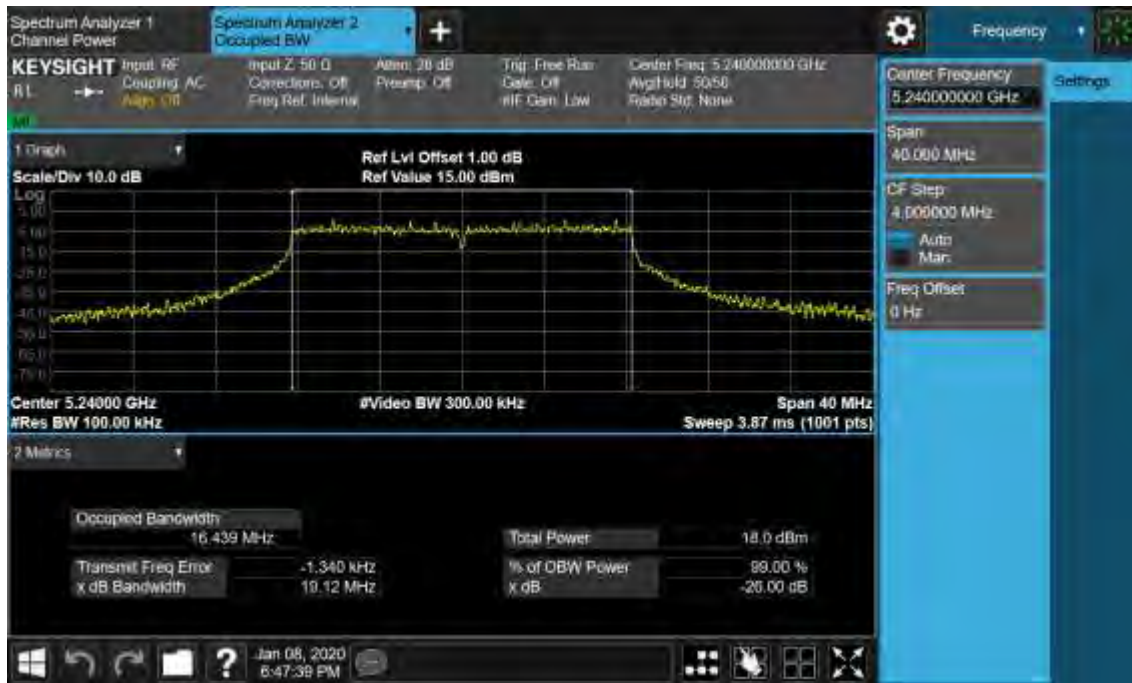
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Chain 2 26dB Bandwidth and 99% Bandwidth, 802.11a, 5240MHz



MIMO 26dB Bandwidth and 99% Bandwidth, 802.11a, 5240MHz



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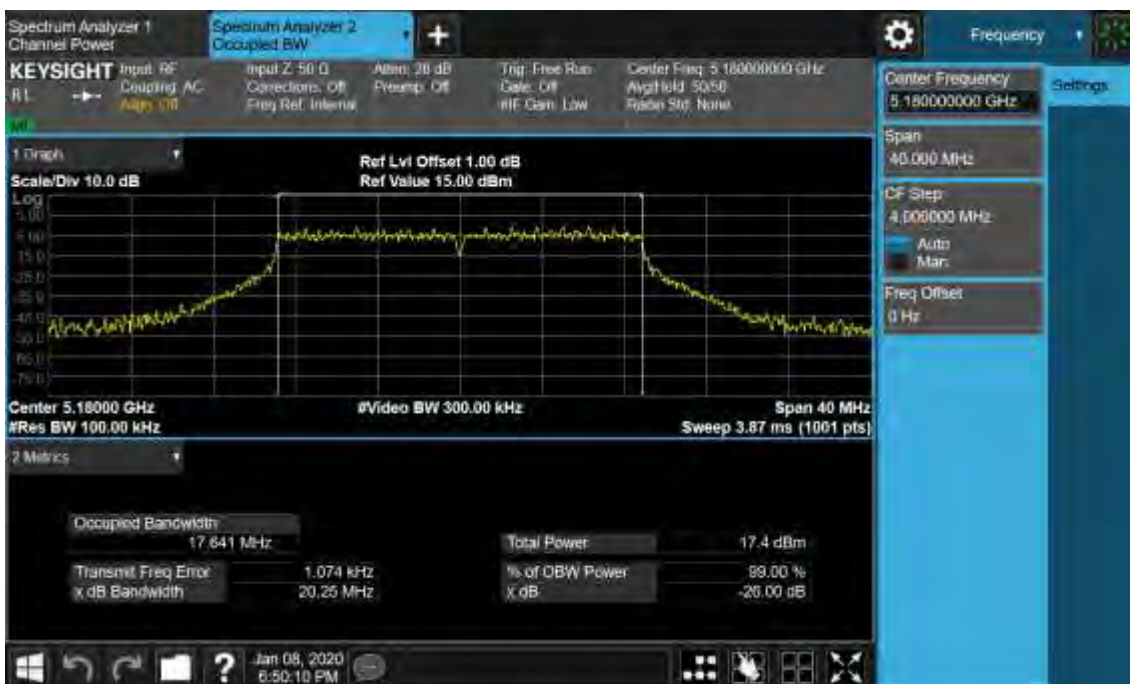
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Chain 1 26dB Bandwidth and 99% Bandwidth, 802.11a, 5240MHz



Chain 2 26dB Bandwidth and 99% Bandwidth, 802.11n(HT20), 5180MHz



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MIMO 26dB Bandwidth and 99% Bandwidth, 802.11n(HT20), 5180MHz



Chain 1 26dB Bandwidth and 99% Bandwidth, 802.11n(HT20), 5180MHz



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Chain 2 26dB Bandwidth and 99% Bandwidth, 802.11n(HT20), 5220MHz



MIMO 26dB Bandwidth and 99% Bandwidth, 802.11n(HT20), 5220MHz



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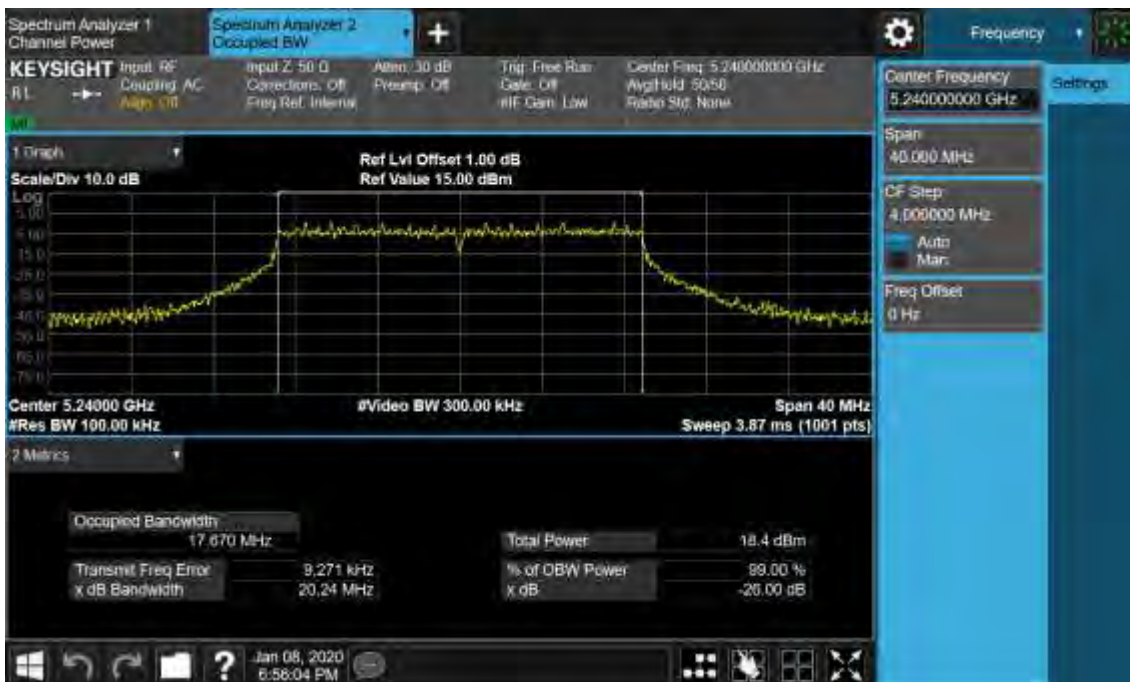
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Chain 1 26dB Bandwidth and 99% Bandwidth, 802.11n(HT20), 5220MHz



Chain 2 26dB Bandwidth and 99% Bandwidth, 802.11n(HT20), 5240MHz



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MIMO 26dB Bandwidth and 99% Bandwidth, 802.11n(HT20), 5240MHz



Chain 1 26dB Bandwidth and 99% Bandwidth, 802.11n(HT20), 5240MHz



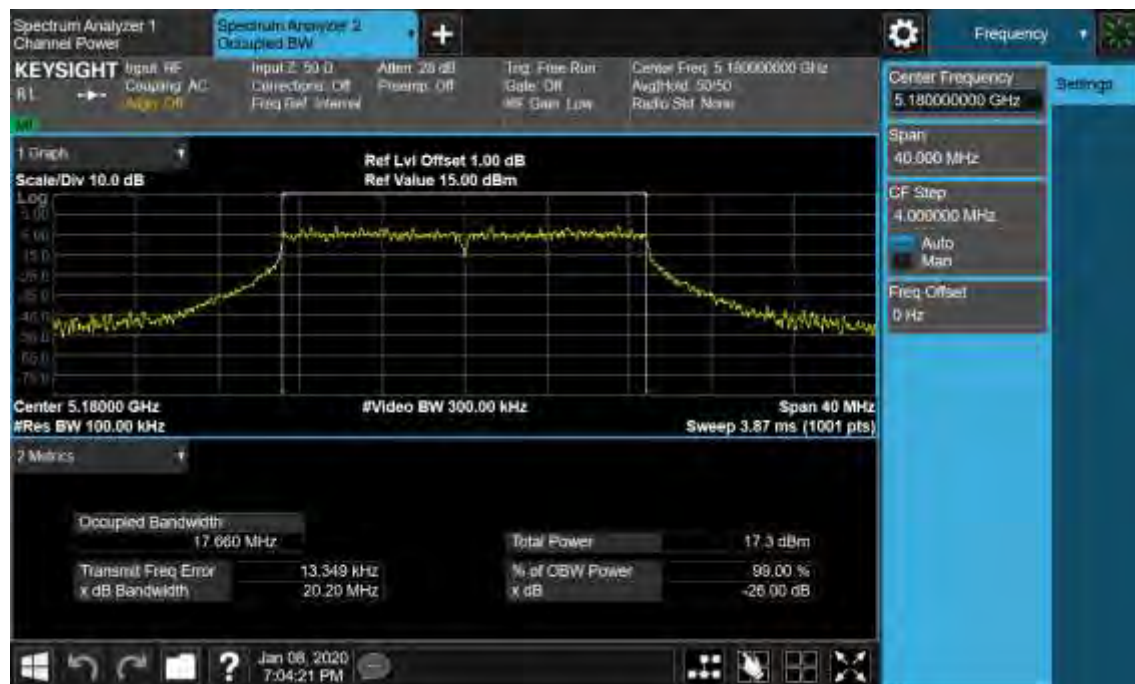
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Chain 2 26dB Bandwidth and 99% Bandwidth, 802.11ac(VHT20), 5180MHz



MIMO 26dB Bandwidth and 99% Bandwidth, 802.11ac(VHT20), 5180MHz



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Chain 1 26dB Bandwidth and 99% Bandwidth, 802.11ac(VHT20), 5180MHz



Chain 2 26dB Bandwidth and 99% Bandwidth, 802.11ac(VHT20), 5220MHz



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MIMO 26dB Bandwidth and 99% Bandwidth, 802.11ac(VHT20), 5220MHz



Chain 1 26dB Bandwidth and 99% Bandwidth, 802.11ac(VHT20), 5220MHz



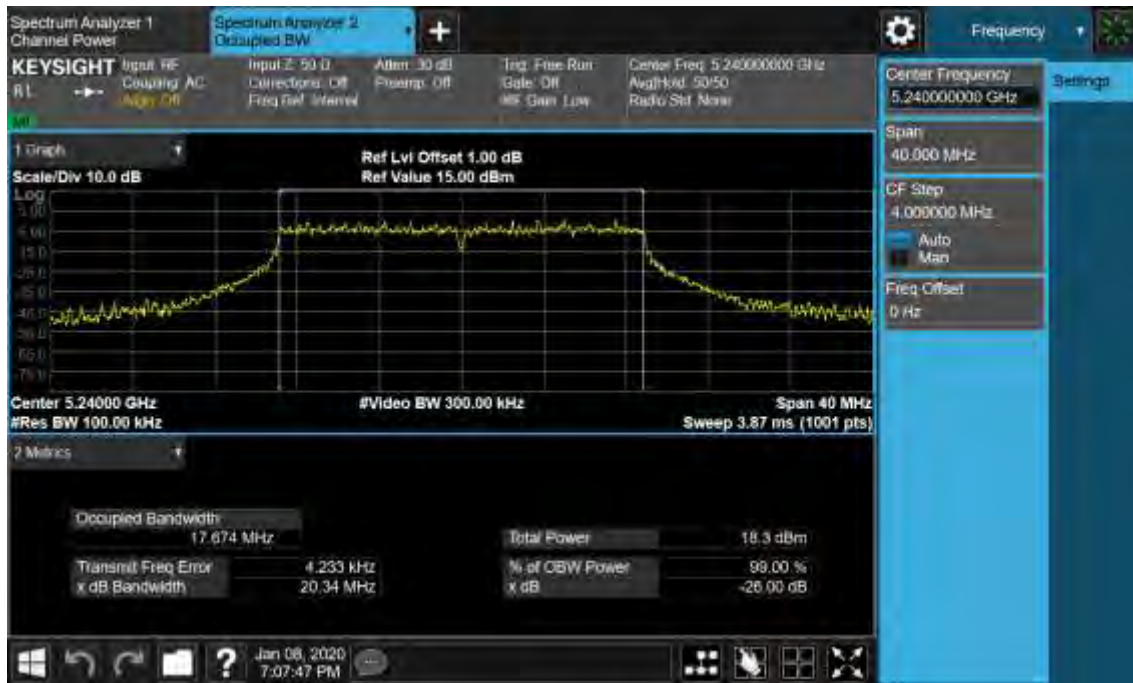
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Chain 2 26dB Bandwidth and 99% Bandwidth, 802.11ac(VHT20), 5240MHz



MIMO 26dB Bandwidth and 99% Bandwidth, 802.11ac(VHT20), 5240MHz



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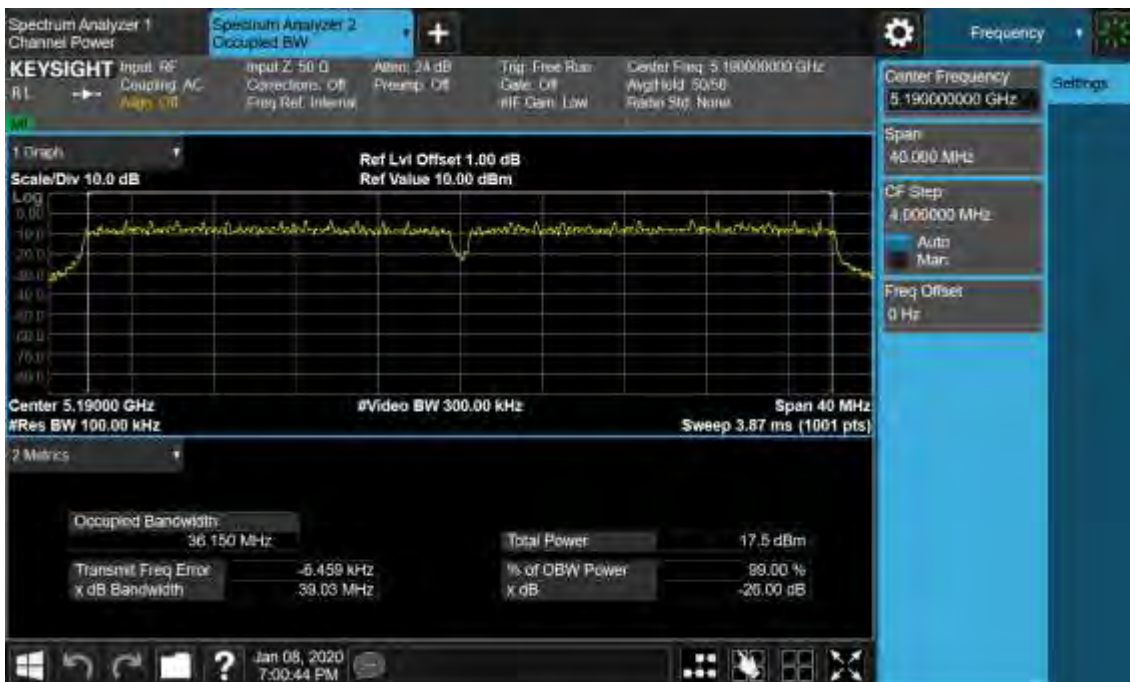
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Chain 1 26dB Bandwidth and 99% Bandwidth, 802.11ac(VHT20), 5240MHz



Chain 2 26dB Bandwidth and 99% Bandwidth, 802.11n(HT40), 5190MHz



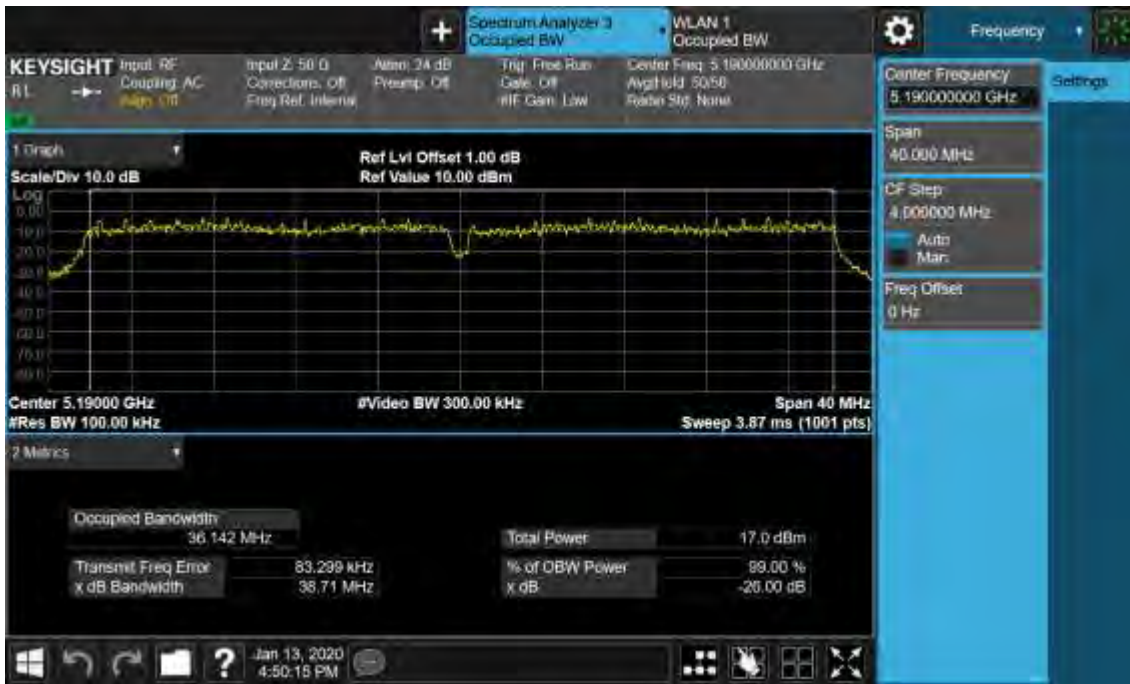
TEST REPORT

Report No.: SHE19110011-02DE

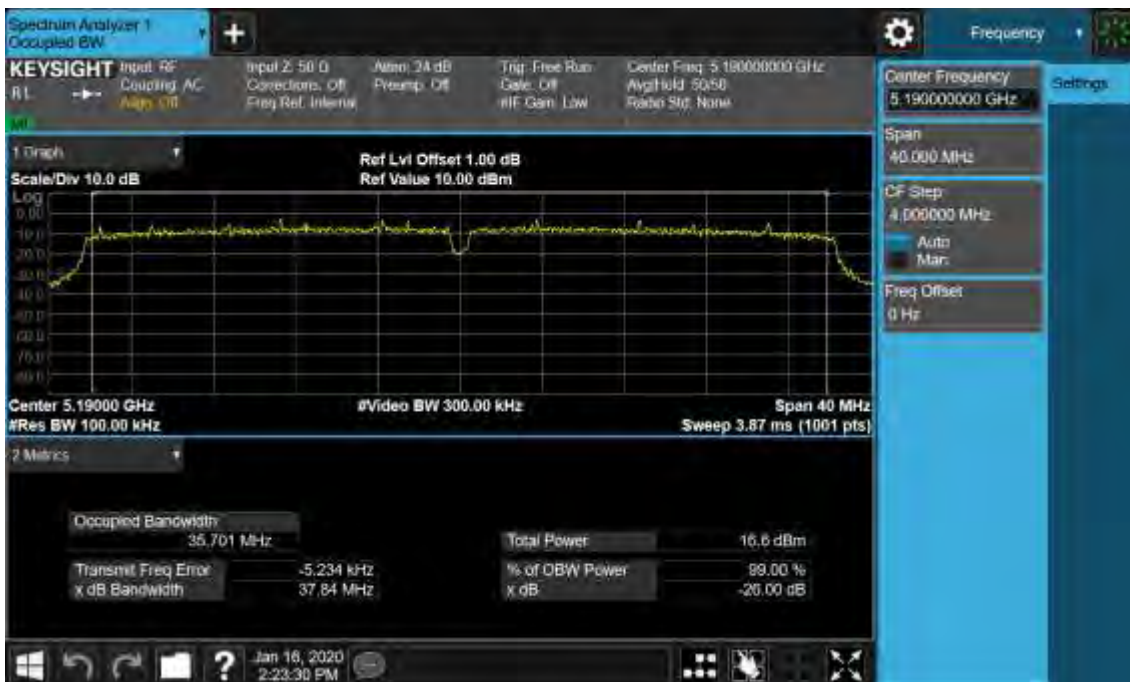
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MIMO 26dB Bandwidth and 99% Bandwidth, 802.11n(HT40), 5190MHz



Chain 1 26dB Bandwidth and 99% Bandwidth, 802.11n(HT40), 5190MHz



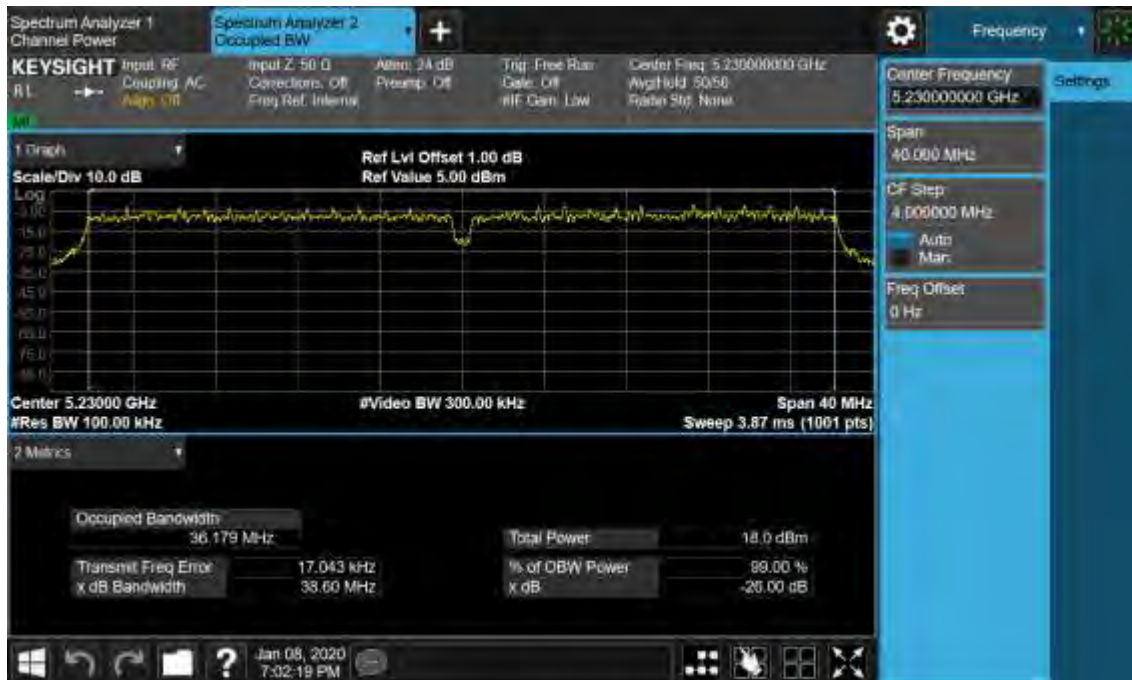
TEST REPORT

Report No.: SHE19110011-02DE

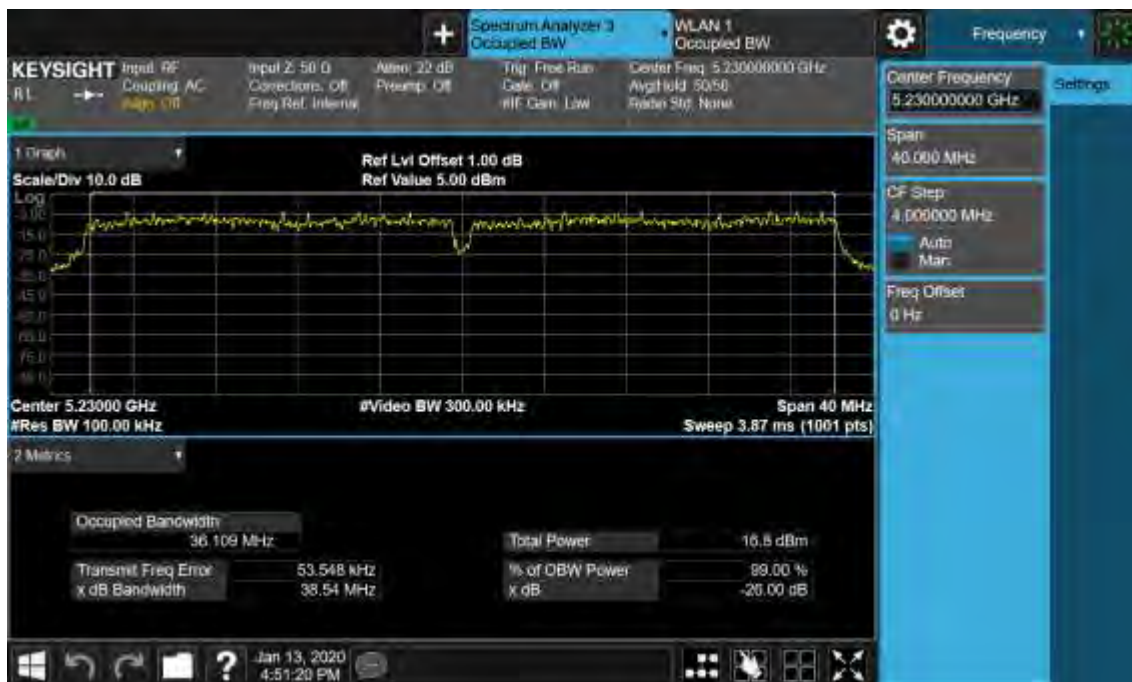
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Chain 2 26dB Bandwidth and 99% Bandwidth, 802.11n(HT40), 5230MHz



MIMO 26dB Bandwidth and 99% Bandwidth, 802.11n(HT40), 5230MHz



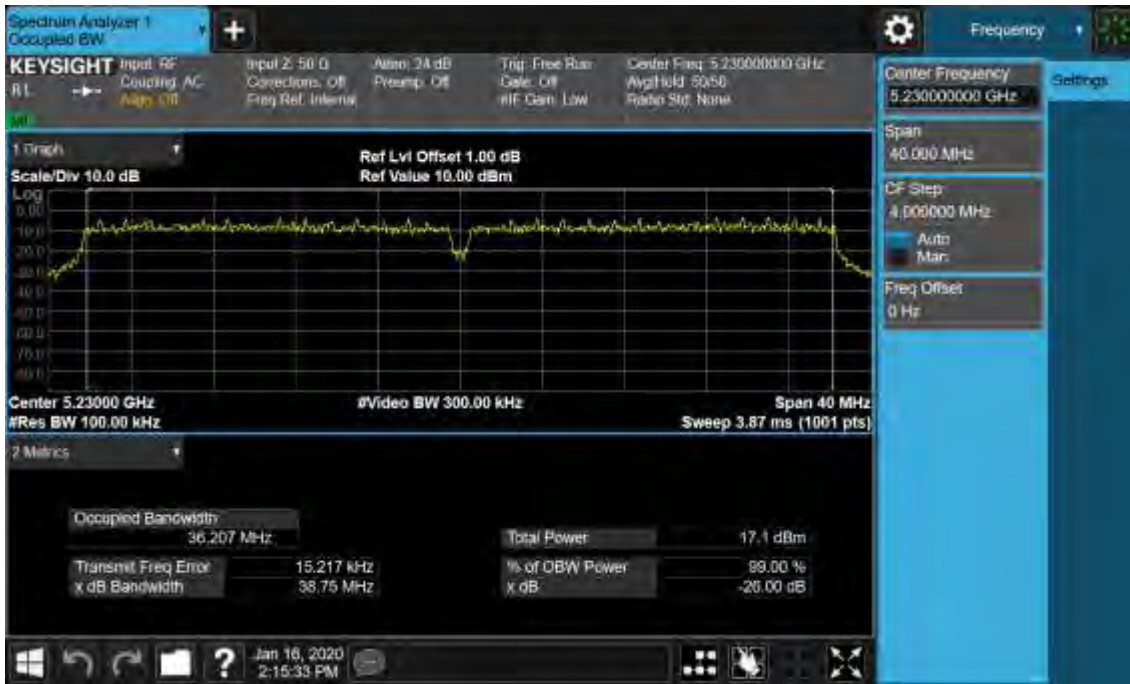
TEST REPORT

Report No.: SHE19110011-02DE

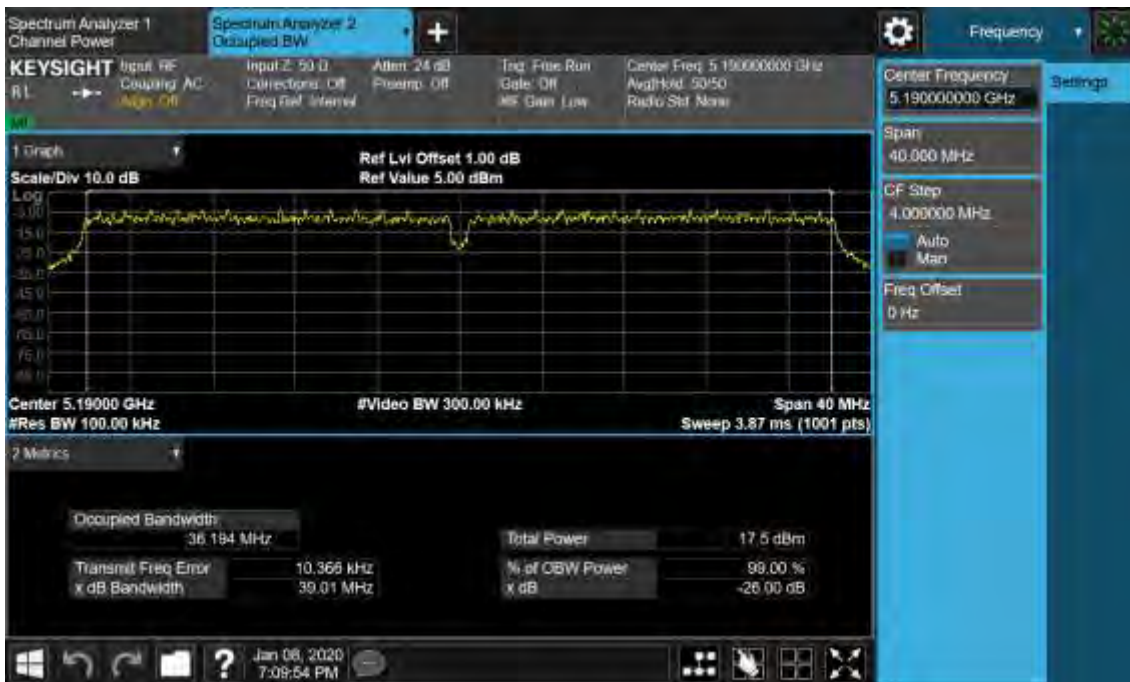
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Chain 1 26dB Bandwidth and 99% Bandwidth, 802.11n(HT40), 5230MHz



Chain 2 26dB Bandwidth and 99% Bandwidth, 802.11ac(VHT40), 5190MHz



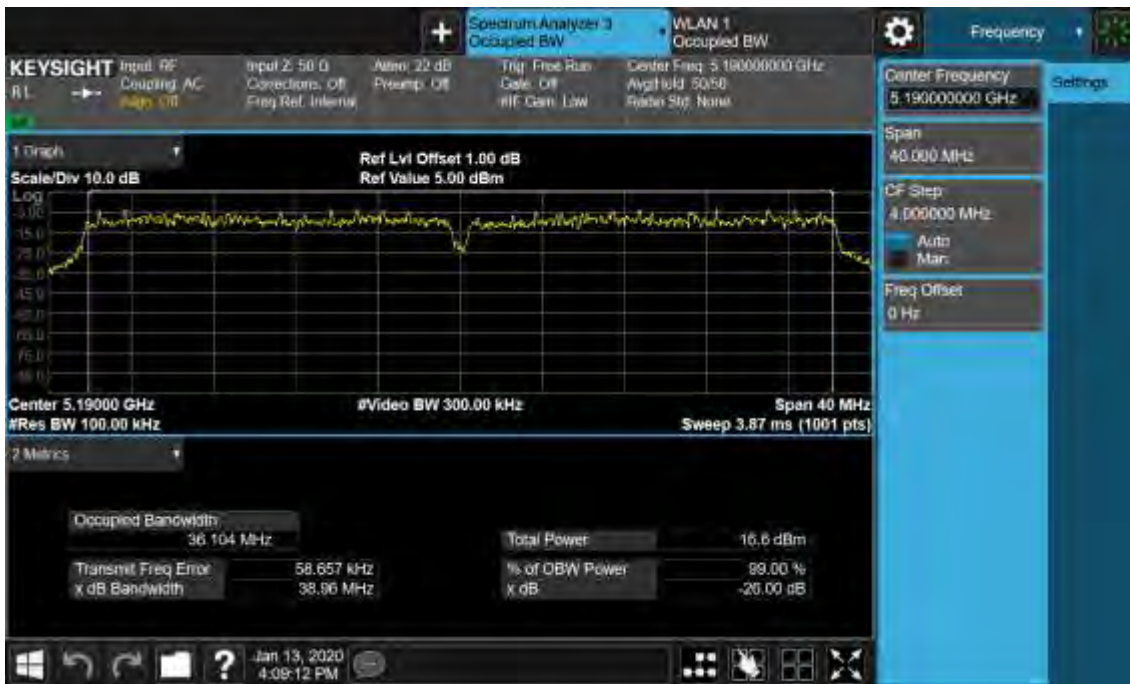
TEST REPORT

Report No.: SHE19110011-02DE

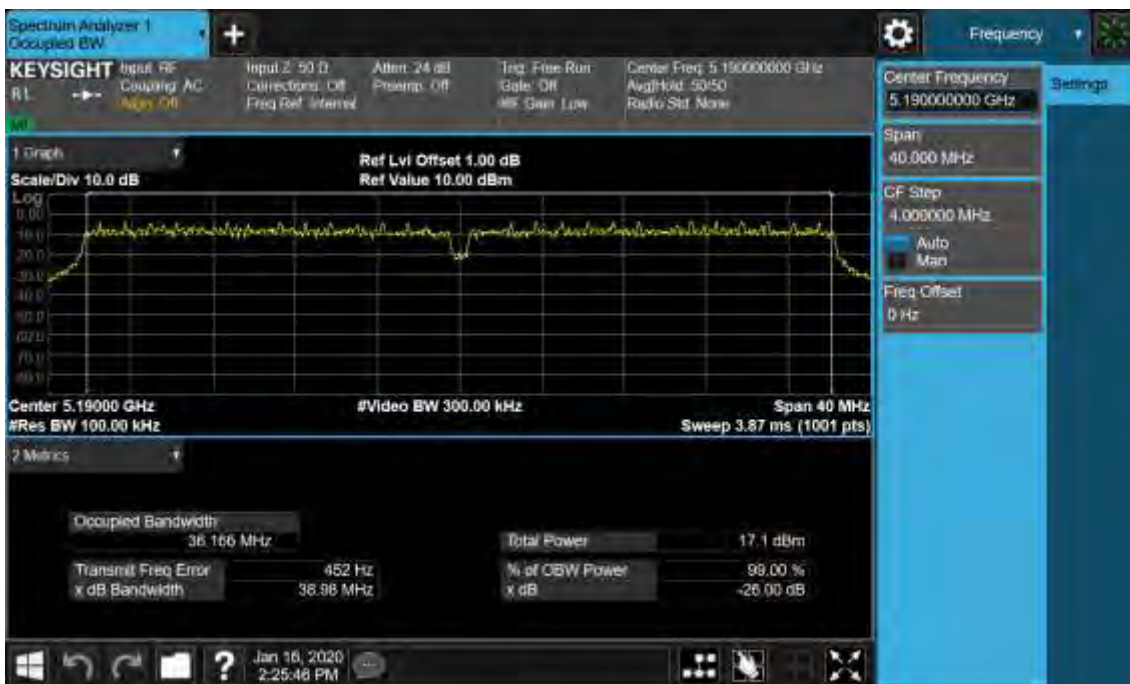
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MIMO 26dB Bandwidth and 99% Bandwidth, 802.11ac(VHT40), 5190MHz



Chain 1 26dB Bandwidth and 99% Bandwidth, 802.11ac(VHT40), 5190MHz



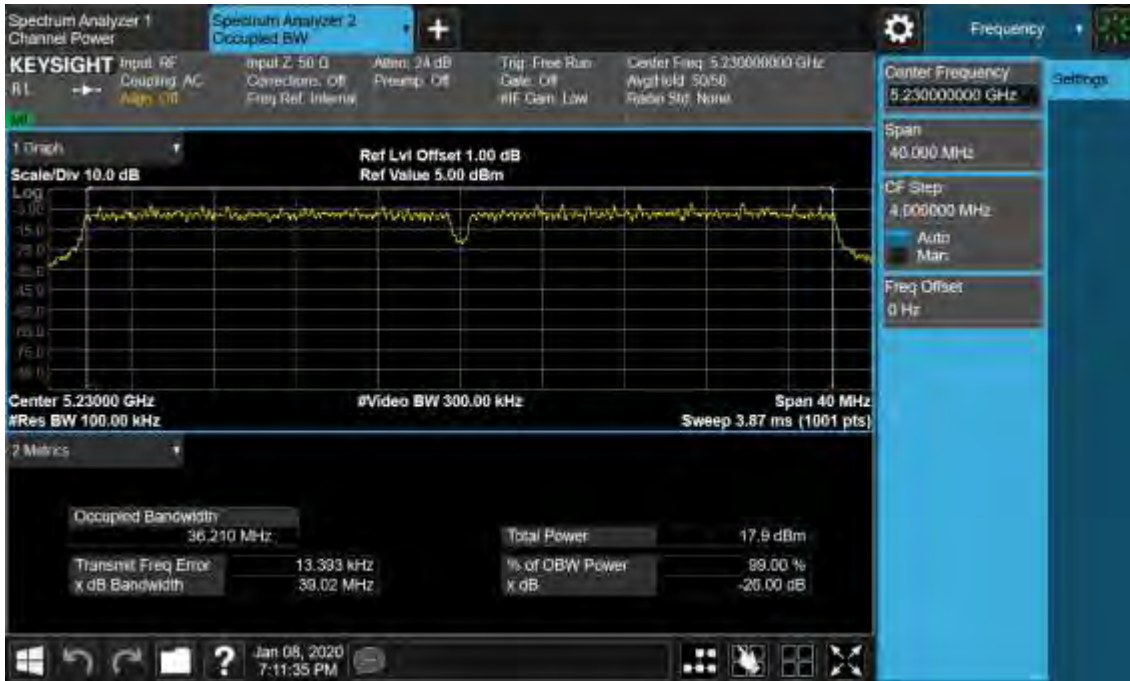
TEST REPORT

Report No.: SHE19110011-02DE

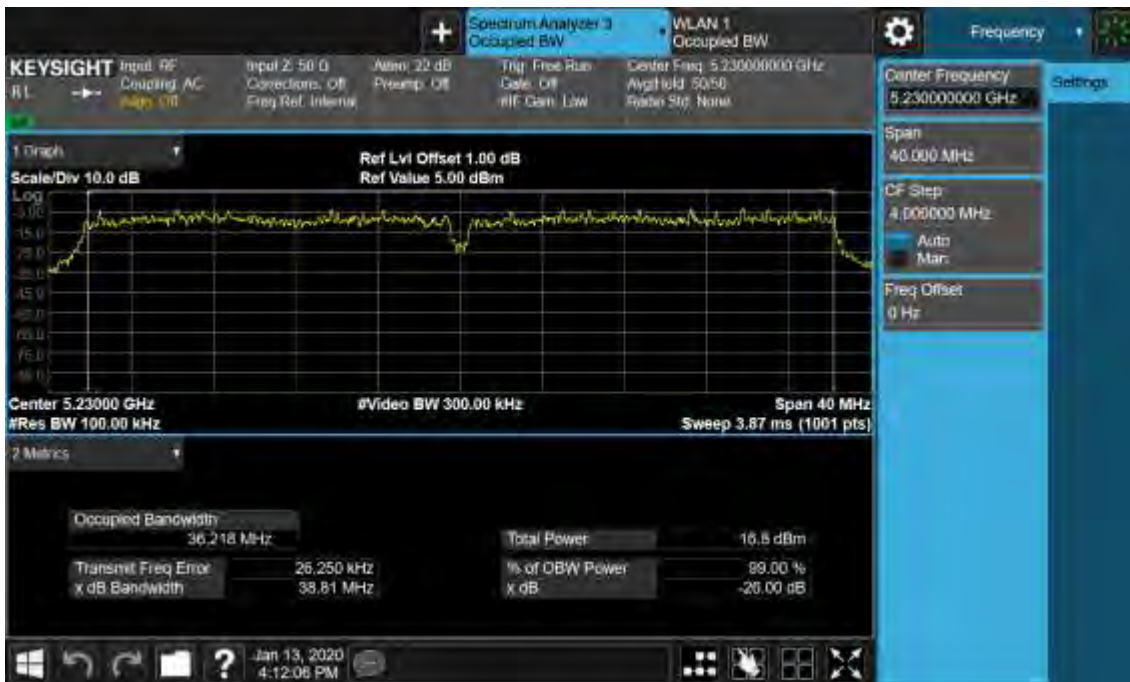
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Chain 2 26dB Bandwidth and 99% Bandwidth, 802.11ac(VHT40), 5230MHz



MIMO 26dB Bandwidth and 99% Bandwidth, 802.11ac(VHT40), 5230MHz



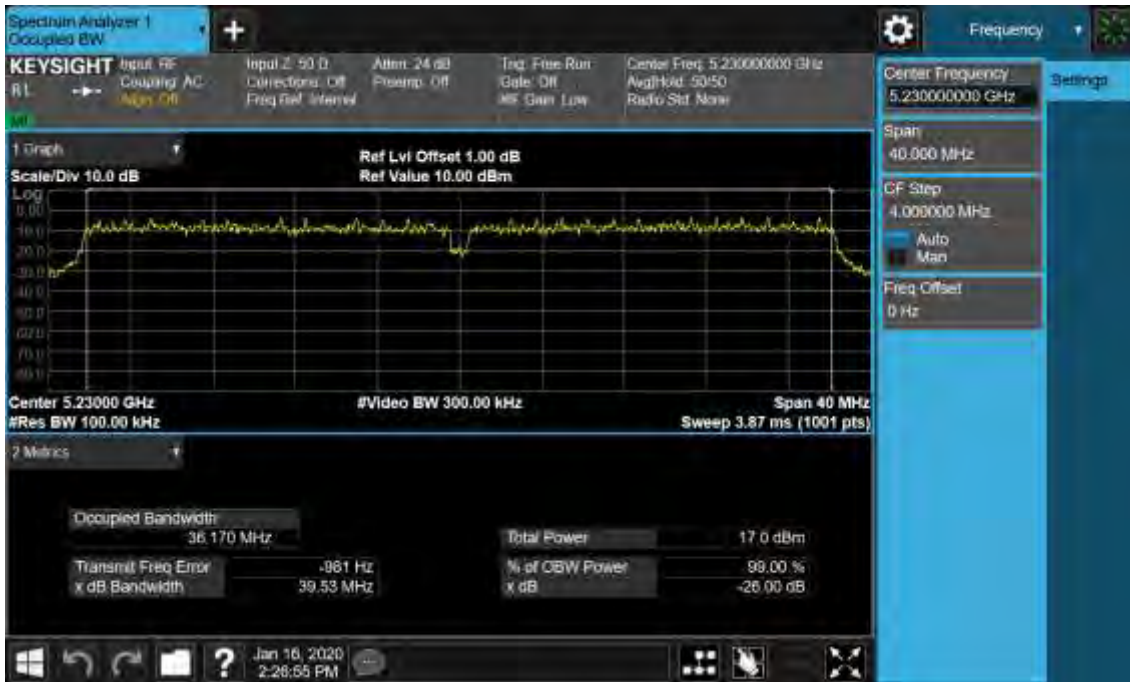
TEST REPORT

Report No.: SHE19110011-02DE

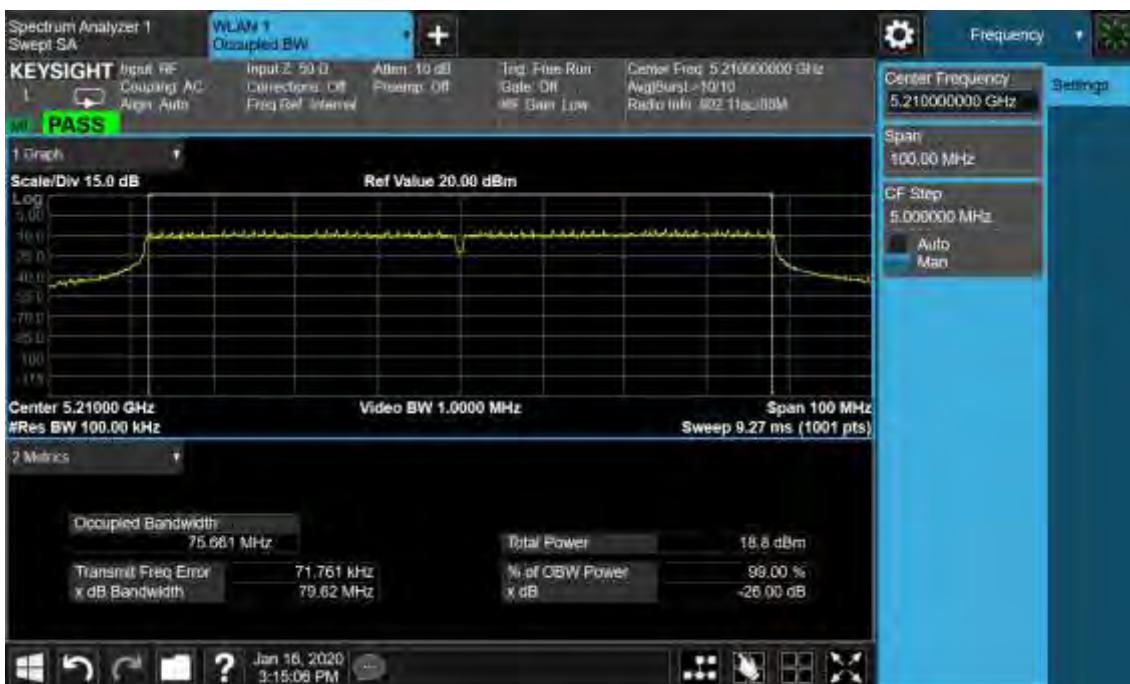
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Chain 1 26dB Bandwidth and 99% Bandwidth, 802.11ac(VHT40), 5230MHz



Chain 2 26dB Bandwidth and 99% Bandwidth, 802.11ac(VHT80), 5210MHz



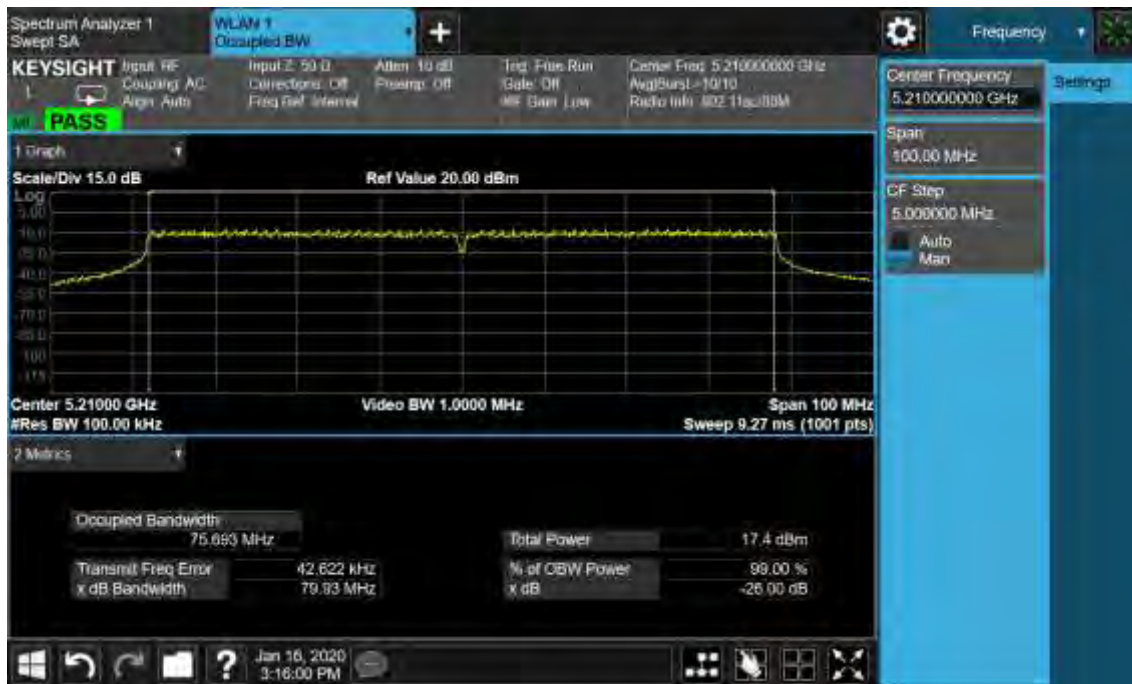
TEST REPORT

Report No.: SHE19110011-02DE

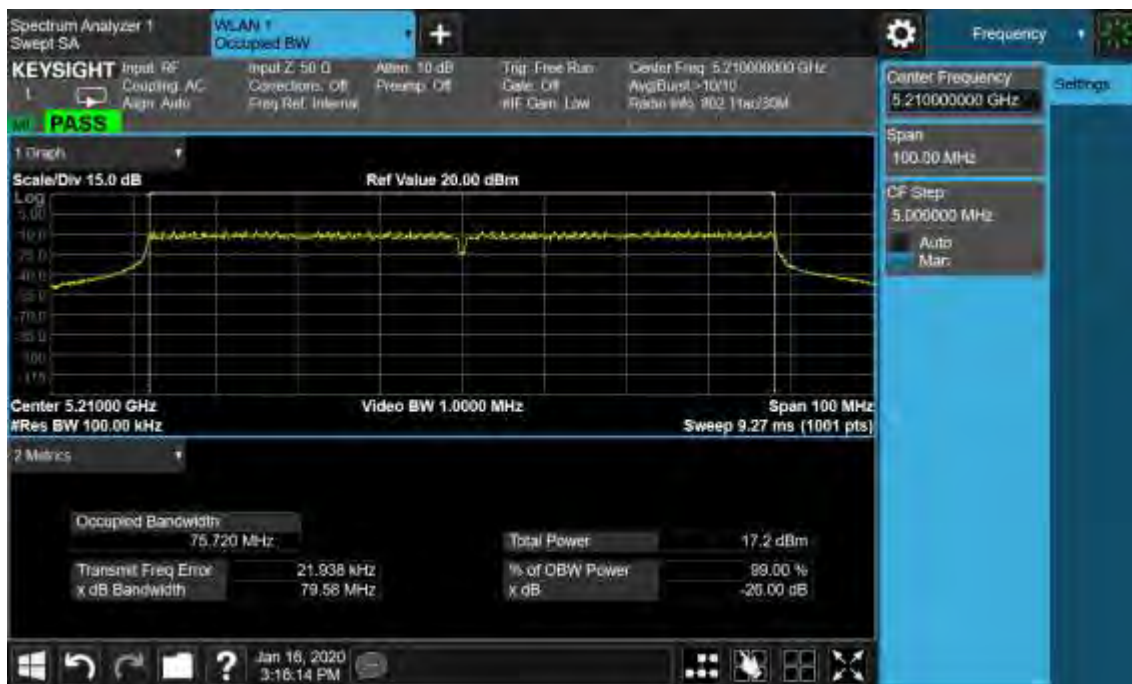
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MIMO 26dB Bandwidth and 99% Bandwidth, 802.11ac(VHT80), 5210MHz



Chain 1 26dB Bandwidth and 99% Bandwidth, 802.11ac(VHT80), 5210MHz



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Chain 2 26dB Bandwidth and 99% Bandwidth, 802.11a, 5745MHz



MIMO 26dB Bandwidth and 99% Bandwidth, 802.11a, 5745MHz



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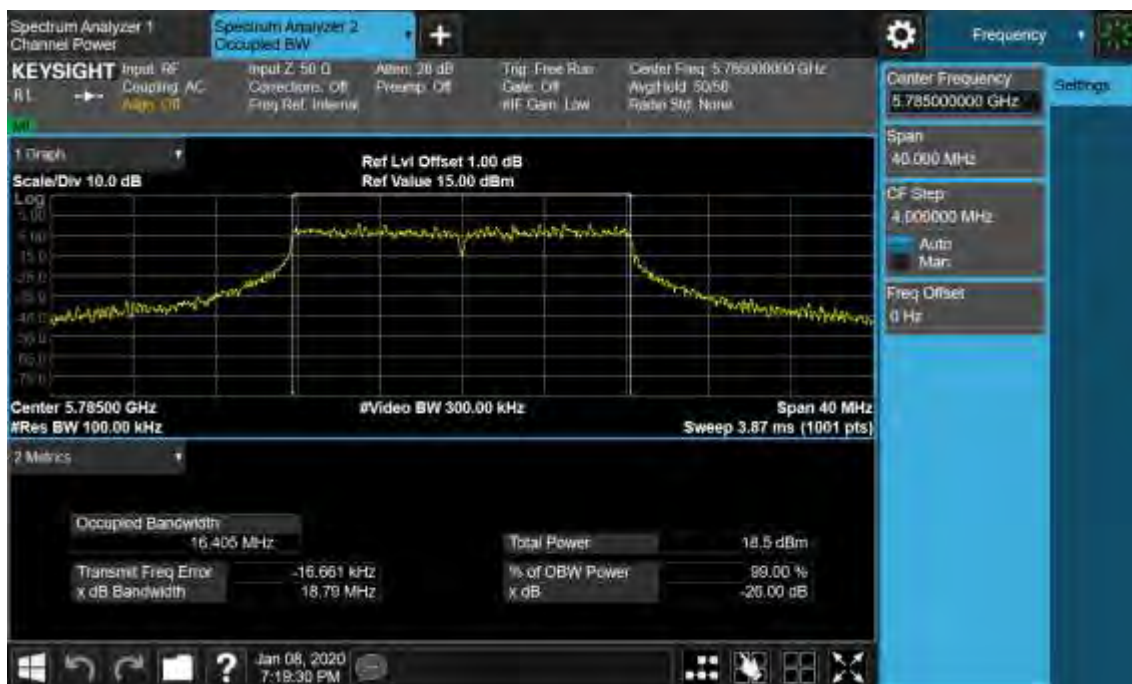
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Chain 1 26dB Bandwidth and 99% Bandwidth, 802.11a, 5745MHz



Chain 2 26dB Bandwidth and 99% Bandwidth, 802.11a, 5785MHz



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MIMO 26dB Bandwidth and 99% Bandwidth, 802.11a, 5785MHz



Chain 1 26dB Bandwidth and 99% Bandwidth, 802.11a, 5785MHz



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Chain 2 26dB Bandwidth and 99% Bandwidth, 802.11a, 5825MHz



MIMO 26dB Bandwidth and 99% Bandwidth, 802.11a, 5825MHz



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Chain 1 26dB Bandwidth and 99% Bandwidth, 802.11a, 5825MHz



Chain 2 26dB Bandwidth and 99% Bandwidth, 802.11n(HT20), 5745MHz



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MIMO 26dB Bandwidth and 99% Bandwidth, 802.11n(HT20), 5745MHz



Chain 1 26dB Bandwidth and 99% Bandwidth, 802.11n(HT20), 5745MHz



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Chain 2 26dB Bandwidth and 99% Bandwidth, 802.11n(HT20), 5785MHz



MIMO 26dB Bandwidth and 99% Bandwidth, 802.11n(HT20), 5785MHz



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Chain 1 26dB Bandwidth and 99% Bandwidth, 802.11n(HT20), 5785MHz



Chain 2 26dB Bandwidth and 99% Bandwidth, 802.11n(HT20), 5825MHz



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MIMO 26dB Bandwidth and 99% Bandwidth, 802.11n(HT20), 5825MHz



Chain 1 26dB Bandwidth and 99% Bandwidth, 802.11n(HT20), 5825MHz



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Chain 2 26dB Bandwidth and 99% Bandwidth, 802.11ac(VHT20), 5745MHz



MIMO 26dB Bandwidth and 99% Bandwidth, 802.11ac(VHT20), 5745MHz



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Chain 1 26dB Bandwidth and 99% Bandwidth, 802.11ac(VHT20), 5745MHz



Chain 2 26dB Bandwidth and 99% Bandwidth, 802.11ac(VHT20), 5785MHz



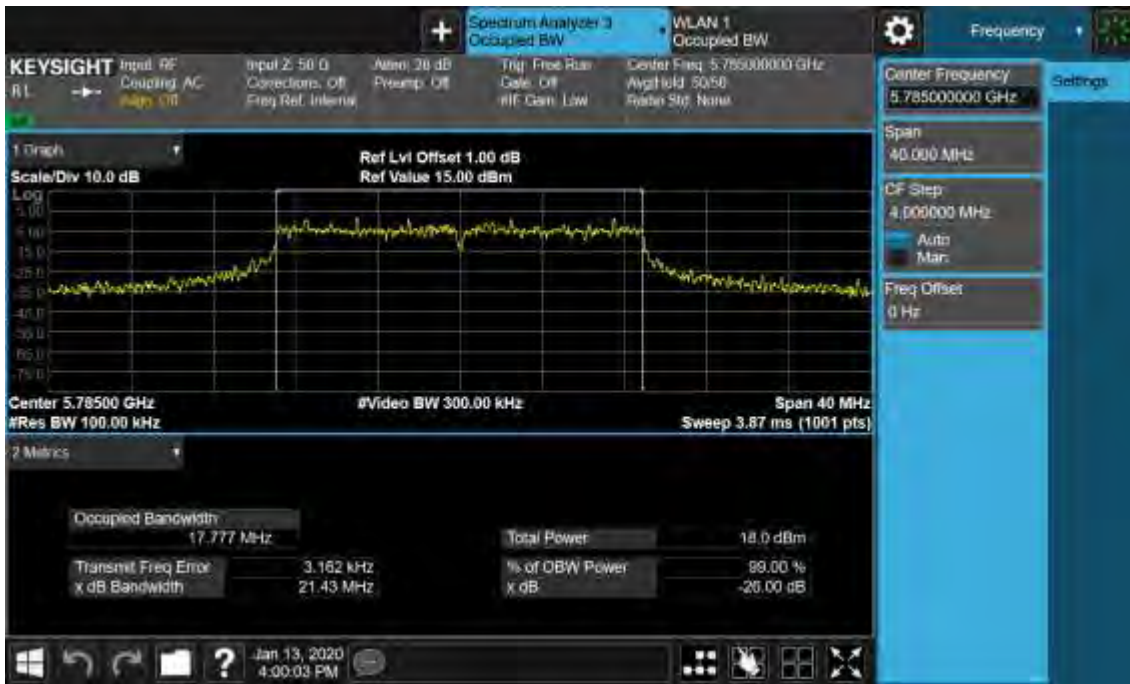
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MIMO 26dB Bandwidth and 99% Bandwidth, 802.11ac(VHT20), 5785MHz



Chain 1 26dB Bandwidth and 99% Bandwidth, 802.11ac(VHT20), 5785MHz



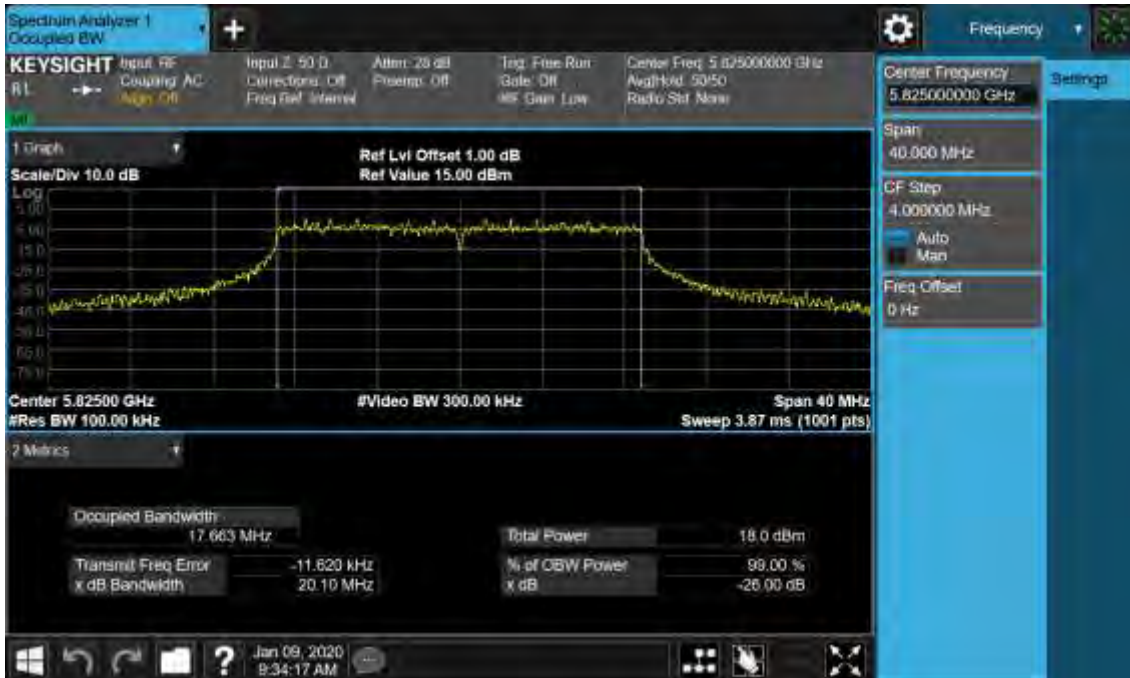
TEST REPORT

Report No.: SHE19110011-02DE

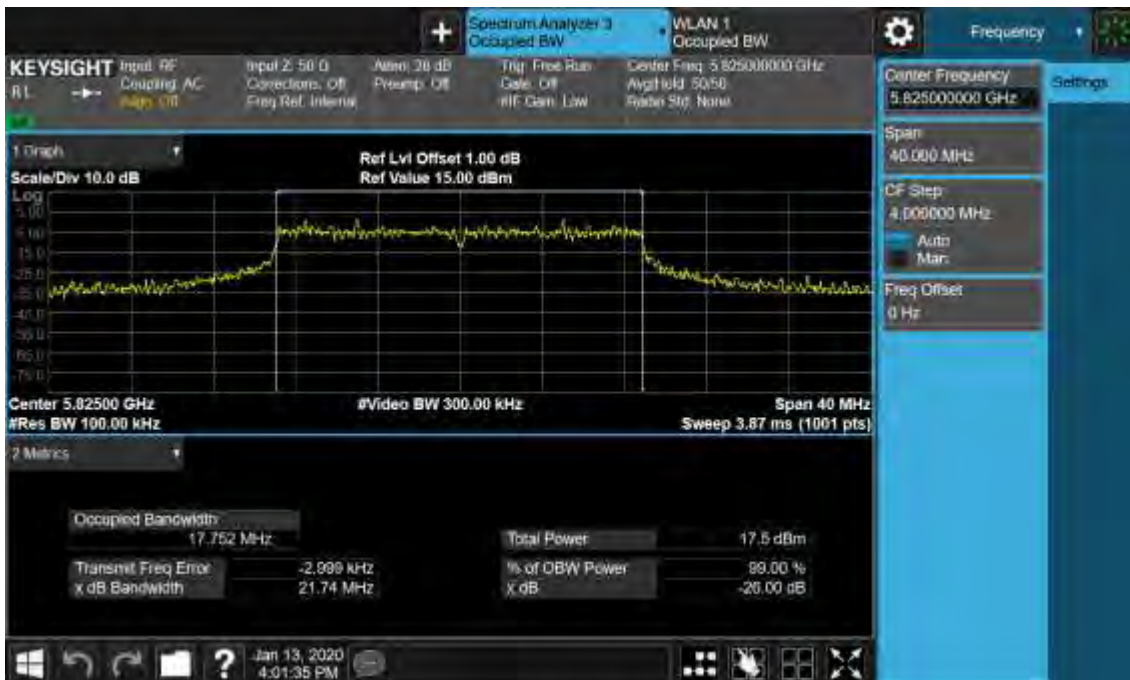
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Chain 2 26dB Bandwidth and 99% Bandwidth, 802.11ac(VHT20), 5825MHz



MIMO 26dB Bandwidth and 99% Bandwidth, 802.11ac(VHT20), 5825MHz



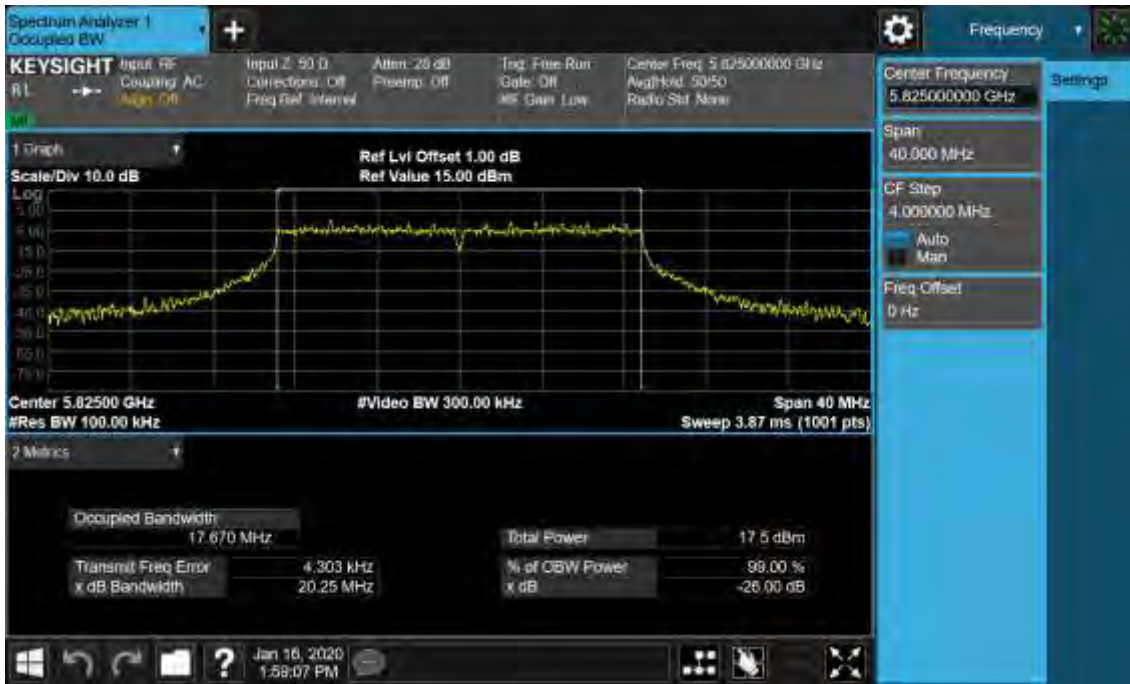
TEST REPORT

Report No.: SHE19110011-02DE

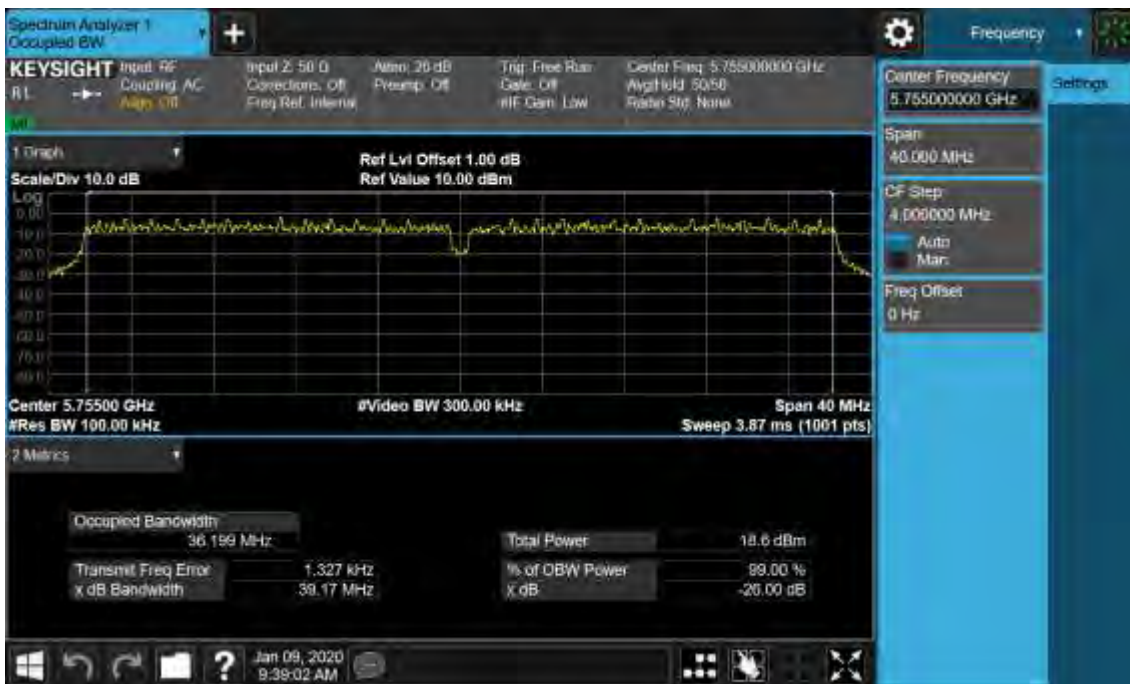
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Chain 2 26dB Bandwidth and 99% Bandwidth, 802.11ac(VHT20), 5825MHz



Chain 2 26dB Bandwidth and 99% Bandwidth, 802.11n(HT40), 5755MHz



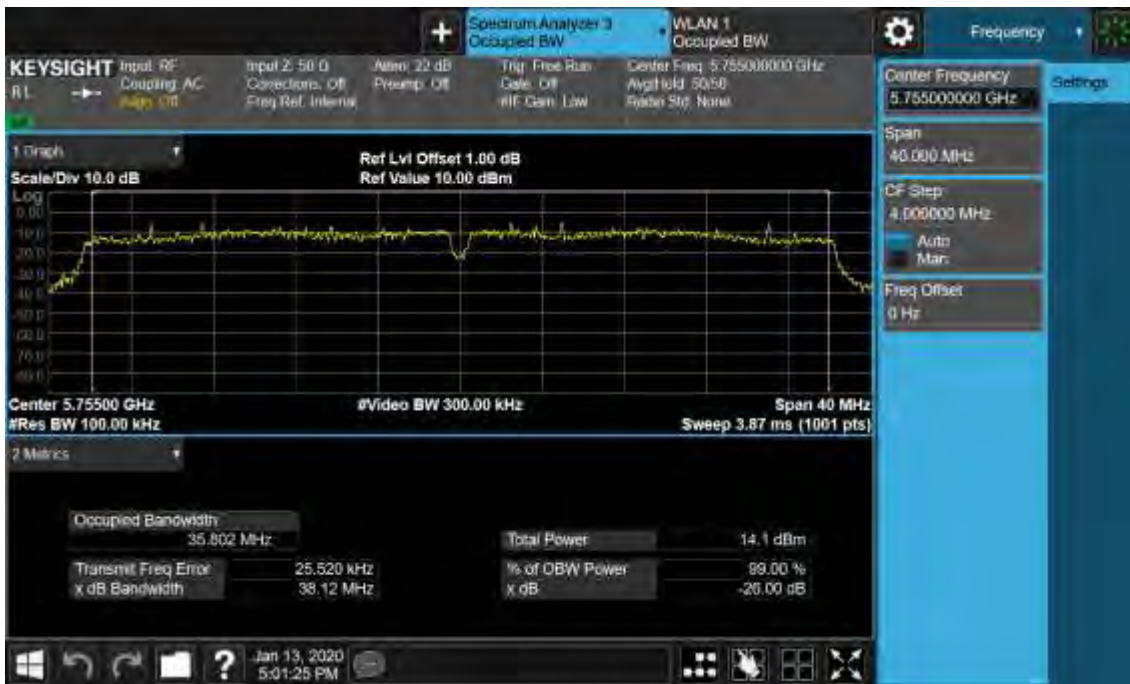
TEST REPORT

Report No.: SHE19110011-02DE

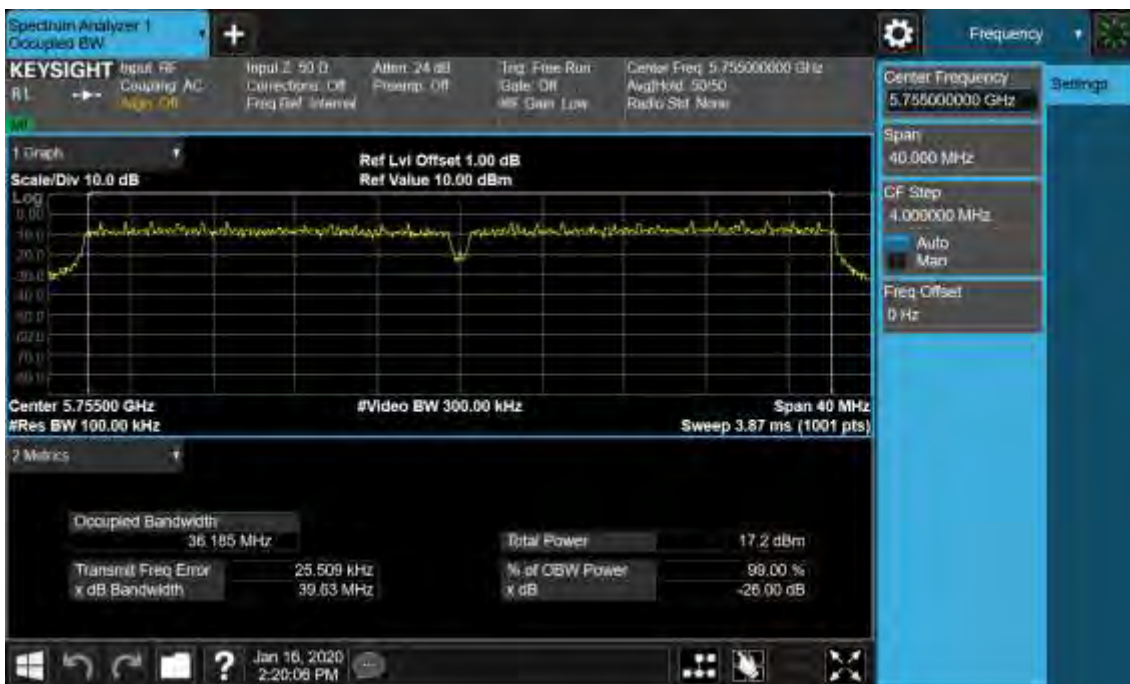
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MIMO 26dB Bandwidth and 99% Bandwidth, 802.11n(HT40), 5755MHz



Chain 1 26dB Bandwidth and 99% Bandwidth, 802.11n(HT40), 5755MHz



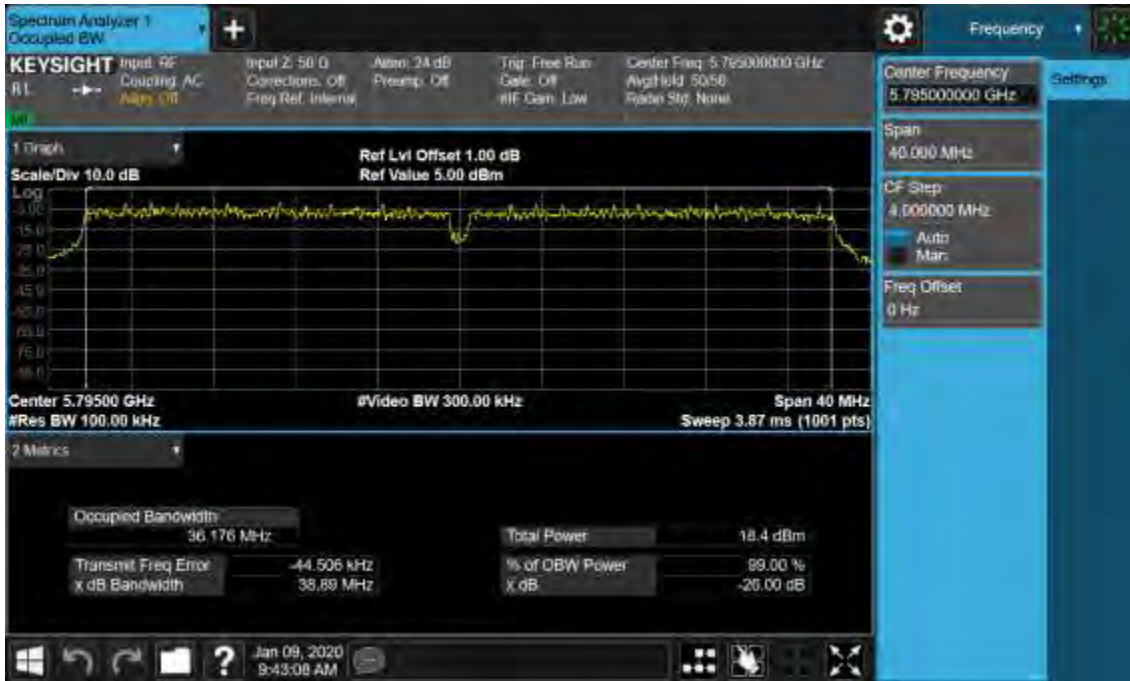
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Chain 2 26dB Bandwidth and 99% Bandwidth, 802.11n(HT40), 5795MHz



MIMO 26dB Bandwidth and 99% Bandwidth, 802.11n(HT40), 5795MHz



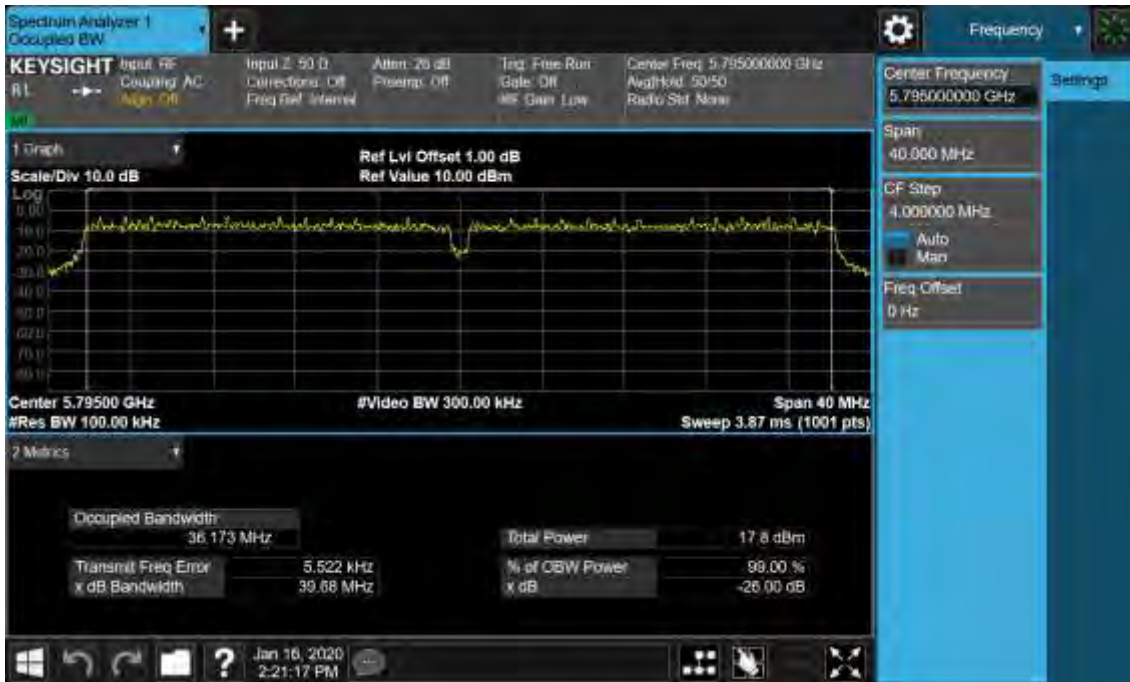
TEST REPORT

Report No.: SHE19110011-02DE

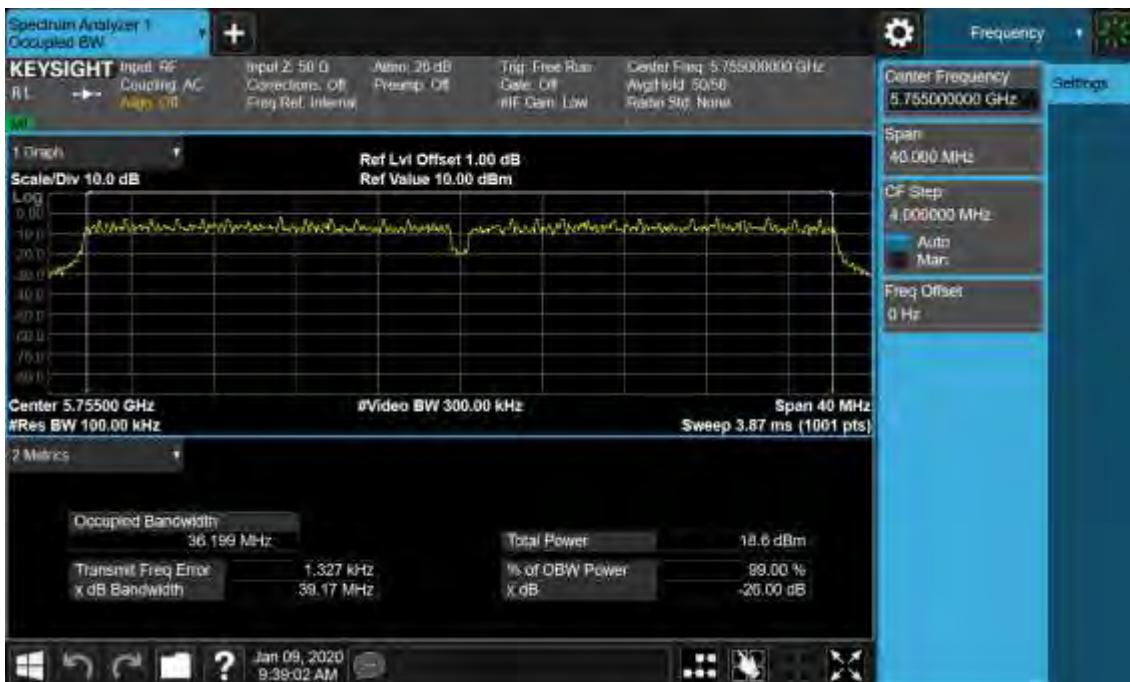
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Chain 1 26dB Bandwidth and 99% Bandwidth, 802.11n(HT40), 5795MHz



Chain 2 26dB Bandwidth and 99% Bandwidth, 802.11ac(VHT40), 5755MHz



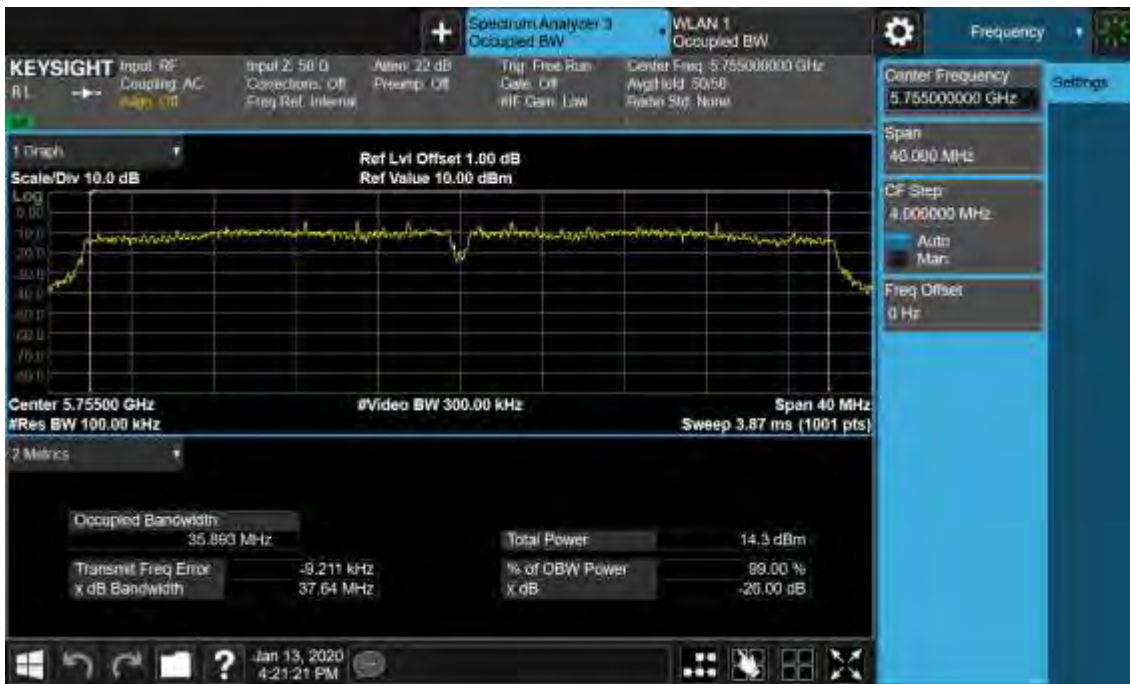
TEST REPORT

Report No.: SHE19110011-02DE

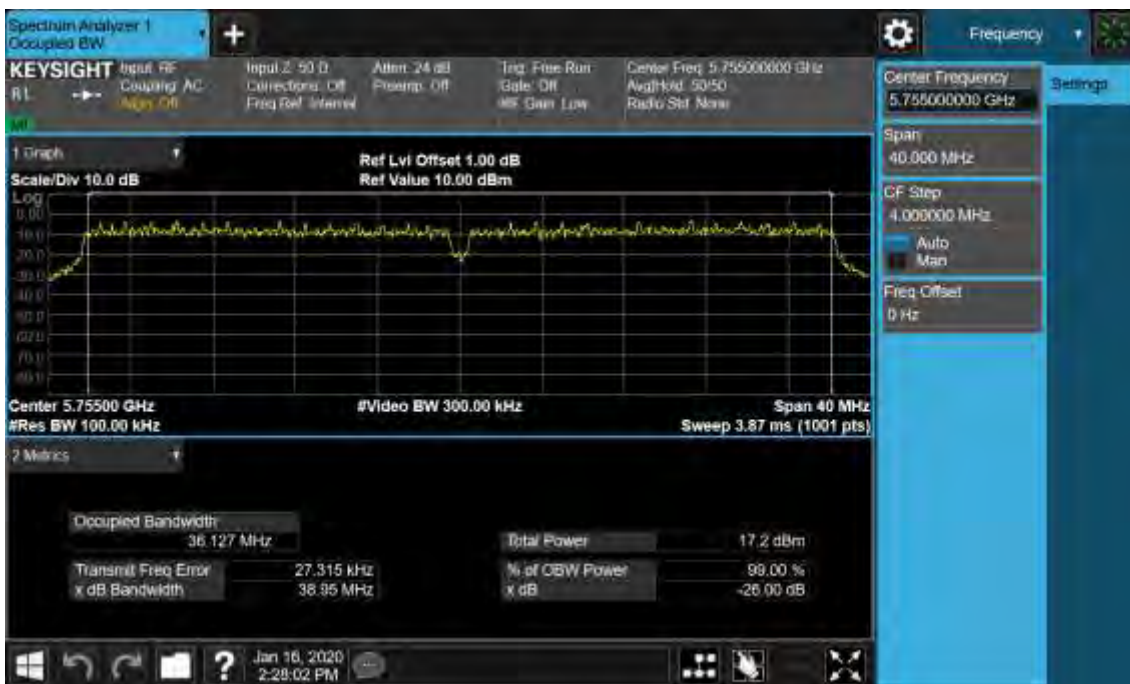
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MIMO 26dB Bandwidth and 99% Bandwidth, 802.11ac(VHT40), 5755MHz



Chain 1 26dB Bandwidth and 99% Bandwidth, 802.11ac(VHT40), 5755MHz



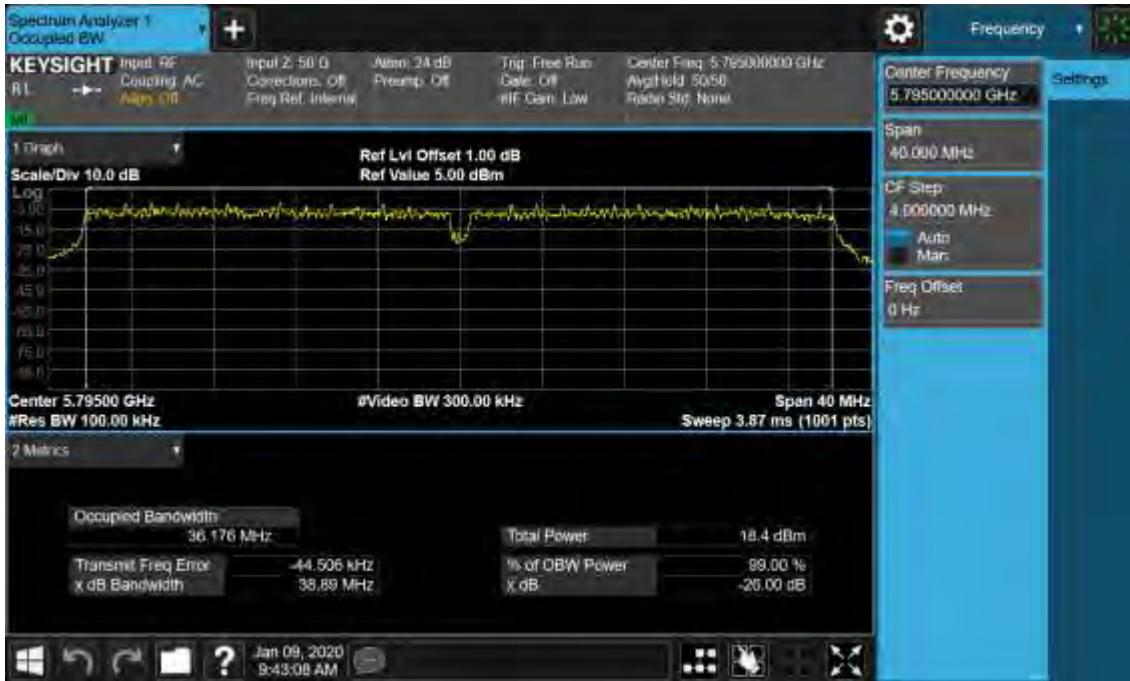
TEST REPORT

Report No.: SHE19110011-02DE

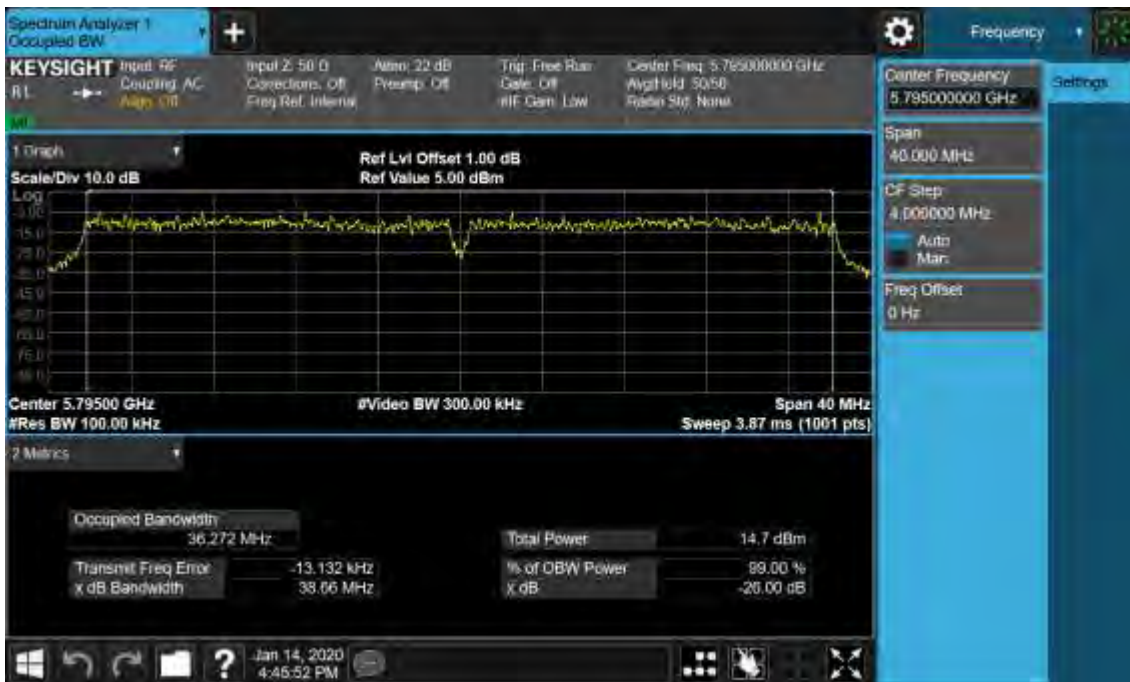
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Chain 2 26dB Bandwidth and 99% Bandwidth, 802.11ac(VHT40), 5795MHz



MIMO 26dB Bandwidth and 99% Bandwidth, 802.11ac(VHT40), 5795MHz



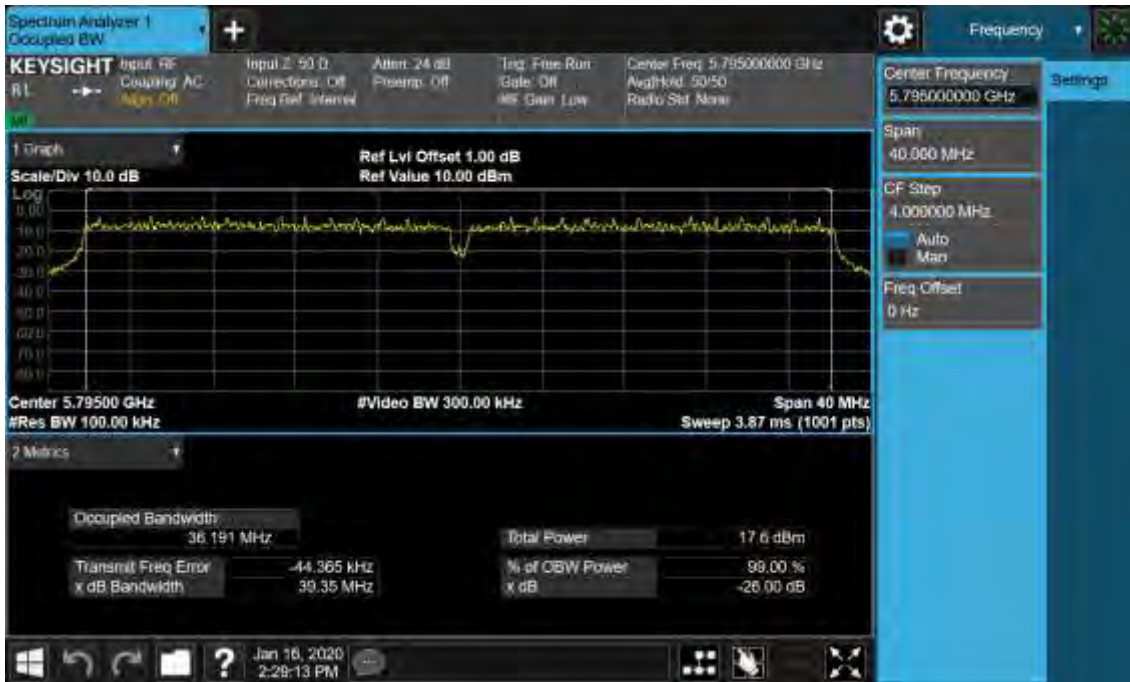
TEST REPORT

Report No.: SHE19110011-02DE

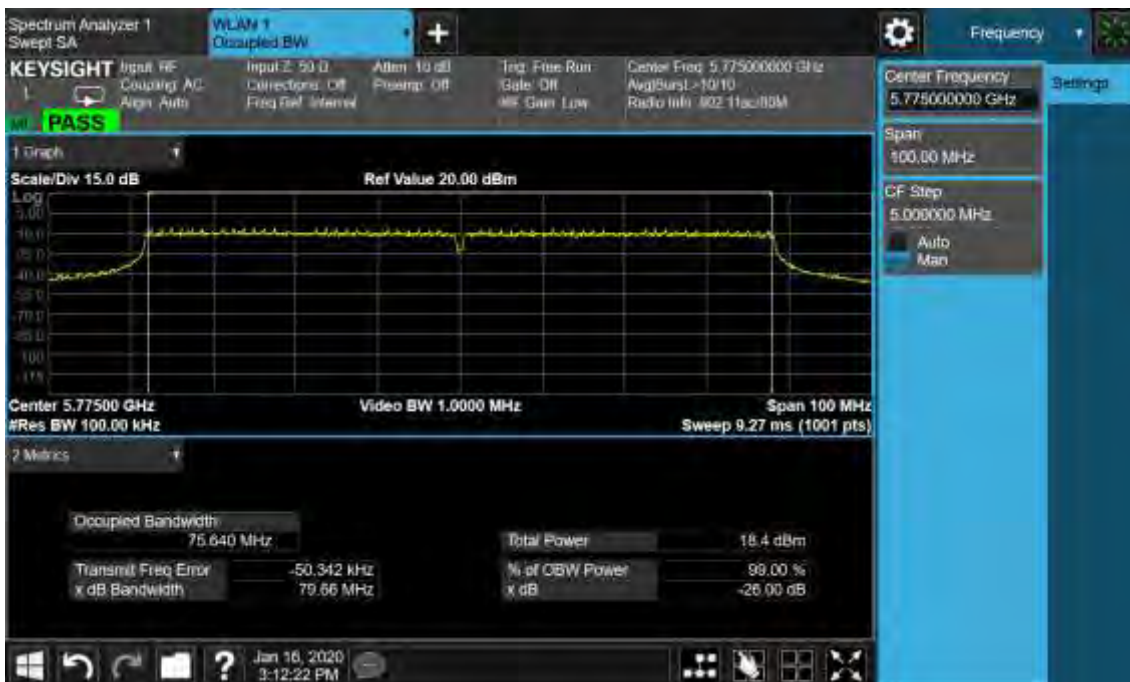
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Chain 1 26dB Bandwidth and 99% Bandwidth, 802.11ac(VHT40), 5795MHz



Chain 2 26dB Bandwidth and 99% Bandwidth, 802.11ac(VHT80), 5775MHz



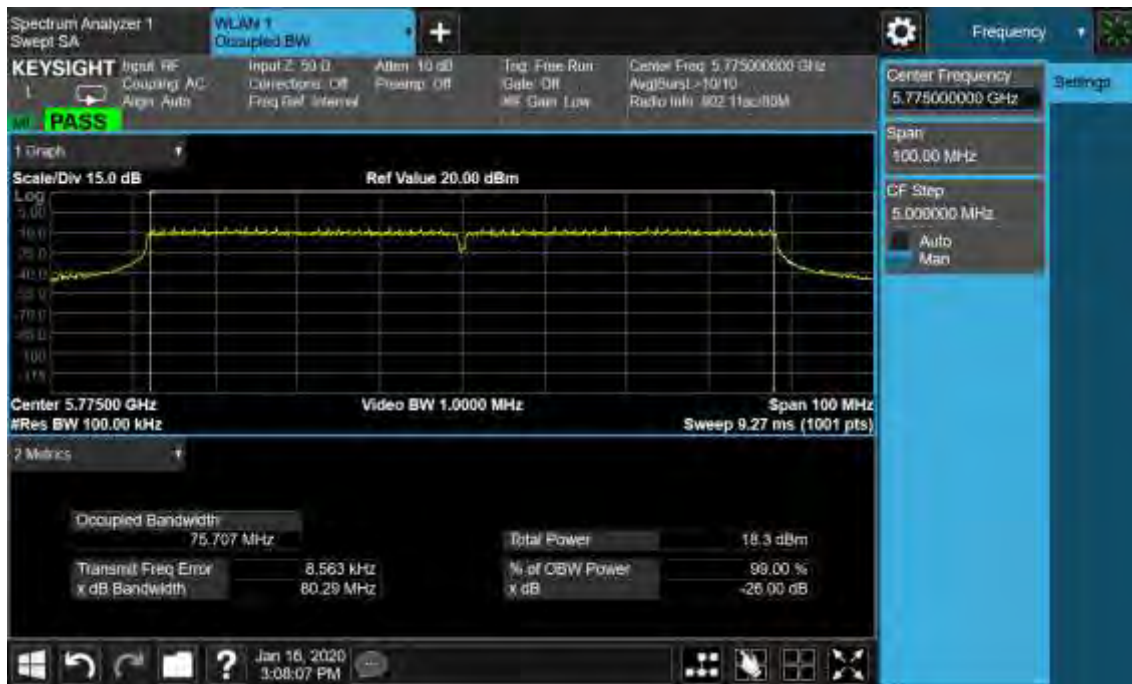
TEST REPORT

Report No.: SHE19110011-02DE

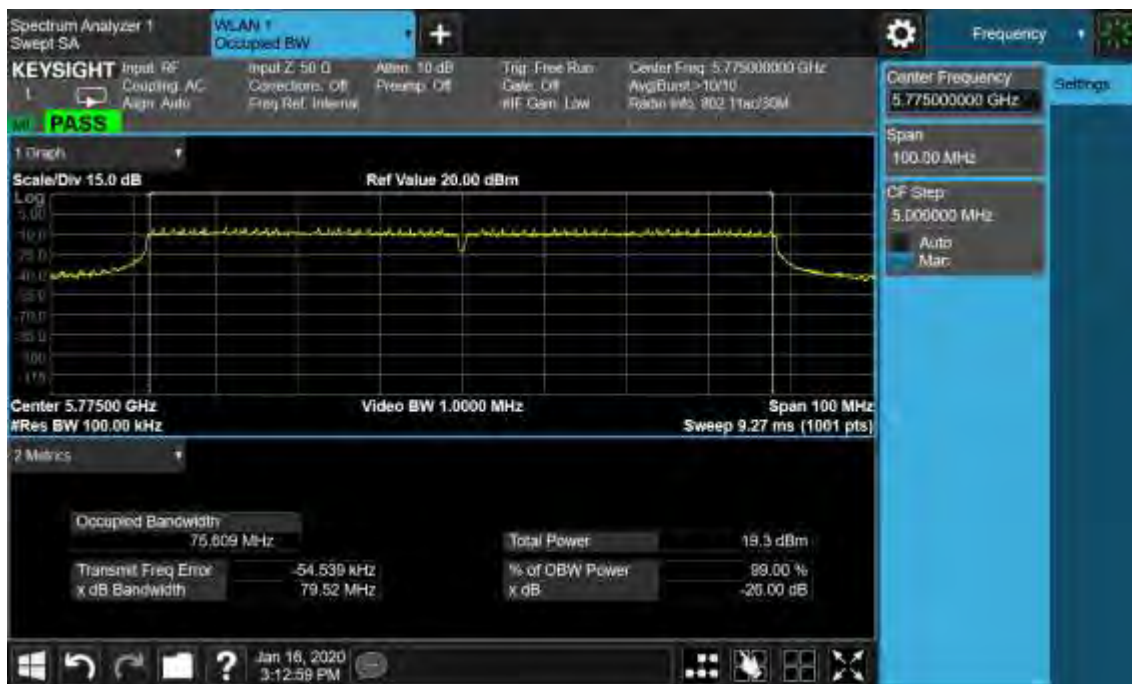
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Chain 2 26dB Bandwidth and 99% Bandwidth, 802.11ac(VHT80), 5775MHz



Chain 1 26dB Bandwidth and 99% Bandwidth, 802.11ac(VHT80), 5775MHz



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4.1.4 6dB Bandwidth

RESULT:

PASS

Test standard : FCC Part 15.407(e)
RSS-247 6.2
Requirement : ANSI C63.10-2013, KDB 789033
Kind of test site : Shielded room

Test setup

Test Channel : Low/Middle/High
Operation Mode : A.1.a
Ambient temperature : 25C
Relative humidity : 52%

Table 5: Chain 2 6dB Bandwidth

Band IV (5725 – 5850 MHz)

Test Mode	Test Channel (MHz)	6dB Bandwidth (MHz)	Limit (MHz)
802.11a	5745	16.47	0.5
	5785	16.52	
	5825	16.47	
802.11n(HT20)	5745	17.77	
	5785	17.77	
	5825	17.77	
802.11ac(VHT20)	5745	17.77	
	5785	17.72	
	5825	17.42	
802.11n(HT40)	5755	36.52	
	5795	36.12	
802.11ac(VHT40)	5755	36.37	
	5795	36.57	
802.11ac(VHT80)	5775	76.42	

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Table 6: MIMO 6dB Bandwidth

Band IV (5725 – 5850 MHz)

Test Mode	Test Channel (MHz)	6dB Bandwidth (MHz)	Limit (MHz)
802.11a	5745	16.57	0.5
	5785	16.62	
	5825	16.47	
802.11n(HT20)	5745	17.77	
	5785	17.57	
	5825	17.67	
802.11ac(VHT20)	5745	17.82	
	5785	17.72	
	5825	17.42	
802.11n(HT40)	5755	28.87	
	5795	31.37	
802.11ac(VHT40)	5755	35.12	
	5795	35.77	
802.11ac(VHT80)	5775	75.72	

Table 7: MIMO 6dB Bandwidth

Band IV (5725 – 5850 MHz)

Test Mode	Test Channel (MHz)	6dB Bandwidth (MHz)	Limit (MHz)
802.11a	5745	16.52	0.5
	5785	16.52	
	5825	16.57	
802.11n(HT20)	5745	17.77	
	5785	17.67	
	5825	17.77	
802.11ac(VHT20)	5745	17.72	
	5785	17.67	
	5825	17.72	
802.11n(HT40)	5755	36.47	
	5795	36.47	
802.11ac(VHT40)	5755	36.47	
	5795	36.32	
802.11ac(VHT80)	5775	76.42	

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Chain 2 6dB Bandwidth, 802.11a, 5745MHz



MIMO 6dB Bandwidth, 802.11a, 5745MHz



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Chain 1 6dB Bandwidth, 802.11a, 5745MHz



Chain 2 6dB Bandwidth, 802.11a, 5785MHz



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MIMO 6dB Bandwidth, 802.11a, 5785MHz



Chain 1 6dB Bandwidth, 802.11a, 5785MHz



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Chain 2 6dB Bandwidth, 802.11a, 5825MHz



MIMO 6dB Bandwidth, 802.11a, 5825MHz



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Chain 1 6dB Bandwidth, 802.11a, 5825MHz



Chain 2 6dB Bandwidth, 802.11n(HT20), 5745MHz



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MIMO 6dB Bandwidth, 802.11n(HT20), 5745MHz



Chain 1 6dB Bandwidth, 802.11n(HT20), 5745MHz



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Chain 2 6dB Bandwidth, 802.11n(HT20), 5785MHz



MIMO 6dB Bandwidth, 802.11n(HT20), 5785MHz



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Chain 1 6dB Bandwidth, 802.11n(HT20), 5785MHz



Chain 2 6dB Bandwidth, 802.11n(HT20), 5825MHz



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MIMO 6dB Bandwidth, 802.11n(HT20), 5825MHz



Chain 1 6dB Bandwidth, 802.11n(HT20), 5825MHz



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Chain 2 6dB Bandwidth, 802.11ac(VHT20), 5745MHz



MIMO 6dB Bandwidth, 802.11ac(VHT20), 5745MHz



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Chain 1 6dB Bandwidth, 802.11ac(VHT20), 5745MHz



Chain 2 6dB Bandwidth, 802.11ac(VHT20), 5785MHz



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MIMO 6dB Bandwidth, 802.11ac(VHT20), 5785MHz



Chain 1 6dB Bandwidth, 802.11ac(VHT20), 5785MHz



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Chain 2 6dB Bandwidth, 802.11ac(VHT20), 5825MHz



MIMO 6dB Bandwidth, 802.11ac(VHT20), 5825MHz



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Chain 1 6dB Bandwidth, 802.11ac(VHT20), 5825MHz



Chain 2 6dB Bandwidth, 802.11n(HT40), 5755MHz



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MIMO 6dB Bandwidth, 802.11n(HT40), 5755MHz



Chain 1 6dB Bandwidth, 802.11n(HT40), 5755MHz



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Chain 2 6dB Bandwidth, 802.11n(HT40), 5795MHz



MIMO 6dB Bandwidth, 802.11n(HT40), 5795MHz



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Chain 1 6dB Bandwidth, 802.11n(HT40), 5795MHz



Chain 2 6dB Bandwidth, 802.11ac(VHT40), 5755MHz



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MIMO 6dB Bandwidth, 802.11ac(VHT40), 5755MHz



Chain 1 6dB Bandwidth, 802.11ac(VHT40), 5755MHz



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Chain 2 6dB Bandwidth, 802.11ac(VHT40), 5795MHz



MIMO 6dB Bandwidth, 802.11ac(VHT40), 5795MHz



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Chain 1 6dB Bandwidth, 802.11ac(VHT40), 5795MHz



Chain 2 6dB Bandwidth, 802.11ac(VHT80), 5775MHz



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MIMO 6dB Bandwidth, 802.11ac(VHT80), 5775MHz



Chain 1 6dB Bandwidth, 802.11ac(VHT80), 5775MHz



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4.1.5 Power Spectral Density

RESULT:

PASS

Test standard : FCC Part 15.407(a)
RSS-247 6.2
Requirement : ANSI C63.10-2013, KDB 789033
Kind of test site : Shielded room

Test setup

Test Channel : Low/Middle/High
Operation Mode : A.1.a
Ambient temperature : 25C
Relative humidity : 52%

Table 8: Chain 2 Power Spectral Density

Band I (5150 – 5250 MHz)

Test Mode	Test Channel (MHz)	PSD (dBm/MHz)	FCC Limit (dBm/MHz)
802.11a	5180	7.64	11
	5220	8.94	
	5240	9.13	
802.11n(HT20)	5180	6.07	
	5220	7.70	
	5240	8.11	
802.11ac(VHT20)	5180	6.55	
	5220	8.06	
	5240	8.27	
802.11n(HT40)	5190	3.93	
	5230	4.68	
802.11ac(VHT40)	5190	4.51	
	5230	5.10	
802.11ac(VHT80)*	5210	-1.2	

*Note :

$PSD(dBm/MHz) = P(dBm/510kHz) + 10 \cdot \log(1MHz/0.51MHz)$.

So $RBW=510kHz$ to $RBW=1MHz$ $PSD(dBm/MHz) = -1.5 + 0.292 = -1.2$

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Band IV (5725 – 5850 MHz)

Test Mode	Test Channel (MHz)	PSD (dBm/MHz)	FCC Limit (dBm/MHz)
802.11a	5745	9.37	30
	5785	8.49	
	5825	7.90	
802.11n(HT20)	5745	7.80	
	5785	7.50	
	5825	7.40	
802.11ac(VHT20)	5745	7.68	
	5785	7.34	
	5825	7.56	
802.11n(HT40)	5755	4.80	
	5795	4.91	
802.11ac(VHT40)	5755	5.92	
	5795	5.81	
802.11ac(VHT80)	5775	-0.30	

Table 9: MIMO Power Spectral Density

Band I (5150 – 5250 MHz)

Test Mode	Test Channel (MHz)	PSD (dBm/MHz)	FCC Limit (dBm/MHz)
802.11a	5180	8.112	11
	5220	7.792	
	5240	7.863	
802.11n(HT20)	5180	8.193	
	5220	8.273	
	5240	8.128	
802.11ac(VHT20)	5180	8.403	
	5220	8.317	
	5240	8.308	
802.11n(HT40)	5190	5.177	
	5230	4.835	
802.11ac(VHT40)	5190	4.265	
	5230	4.712	
802.11ac(VHT80)	5210	-0.73	

*Note :

$PSD(dBm/MHz)=P(dBm/510kHz)+10*\log(1MHz/0.51MHz).$

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So $RBW=510kHz$ to $RBW=1MHz$ $PSD(dBm/MHz)=-1.03+0.292=-0.73$

Band IV (5725 – 5850 MHz)

Test Mode	Test Channel (MHz)	PSD (dBm/MHz)	FCC Limit (dBm/MHz)
802.11a	5745	8.02	30
	5785	7.71	
	5825	7.33	
802.11n(HT20)	5745	8.19	
	5785	8.37	
	5825	7.96	
802.11ac(VHT20)	5745	8.28	
	5785	7.95	
	5825	7.51	
802.11n(HT40)	5755	5.46	
	5795	5.69	
802.11ac(VHT40)	5755	6.05	
	5795	6.52	
802.11ac(VHT80)	5775	0.56	

Table 10: Chain 1 Power Spectral Density

Band I (5150 – 5250 MHz)

Test Mode	Test Channel (MHz)	PSD (dBm/MHz)	FCC Limit (dBm/MHz)
802.11a	5180	8.302	11
	5220	8.438	
	5240	8.306	
802.11n(HT20)	5180	7.563	
	5220	7.453	
	5240	7.503	
802.11ac(VHT20)	5180	7.266	
	5220	7.109	
	5240	7.486	
802.11n(HT40)	5190	4.517	
	5230	4.746	
802.11ac(VHT40)	5190	4.365	
	5230	4.394	
802.11ac(VHT80)	5210	-0.708	

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*Note :

$PSD(dBm/MHz) = P(dBm/510kHz) + 10 \cdot \log(1MHz/0.51MHz)$.

So $RBW=510kHz$ to $RBW=1MHz$ $PSD(dBm/MHz) = -1.00 + 0.292 = -0.708$

Band IV (5725 – 5850 MHz)

Test Mode	Test Channel (MHz)	PSD (dBm/MHz)	FCC Limit (dBm/MHz)
802.11a	5745	8.307	30
	5785	8.781	
	5825	8.379	
802.11n(HT20)	5745	7.326	
	5785	8.160	
	5825	7.491	
802.11ac(VHT20)	5745	6.987	
	5785	8.279	
	5825	7.685	
802.11n(HT40)	5755	4.684	
	5795	4.963	
802.11ac(VHT40)	5755	4.451	
	5795	5.144	
802.11ac(VHT80)	5775	-0.495	

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Chain 2 Power Spectral Density, 802.11a, 5180MHz



MIMO Power Spectral Density, 802.11a, 5180MHz



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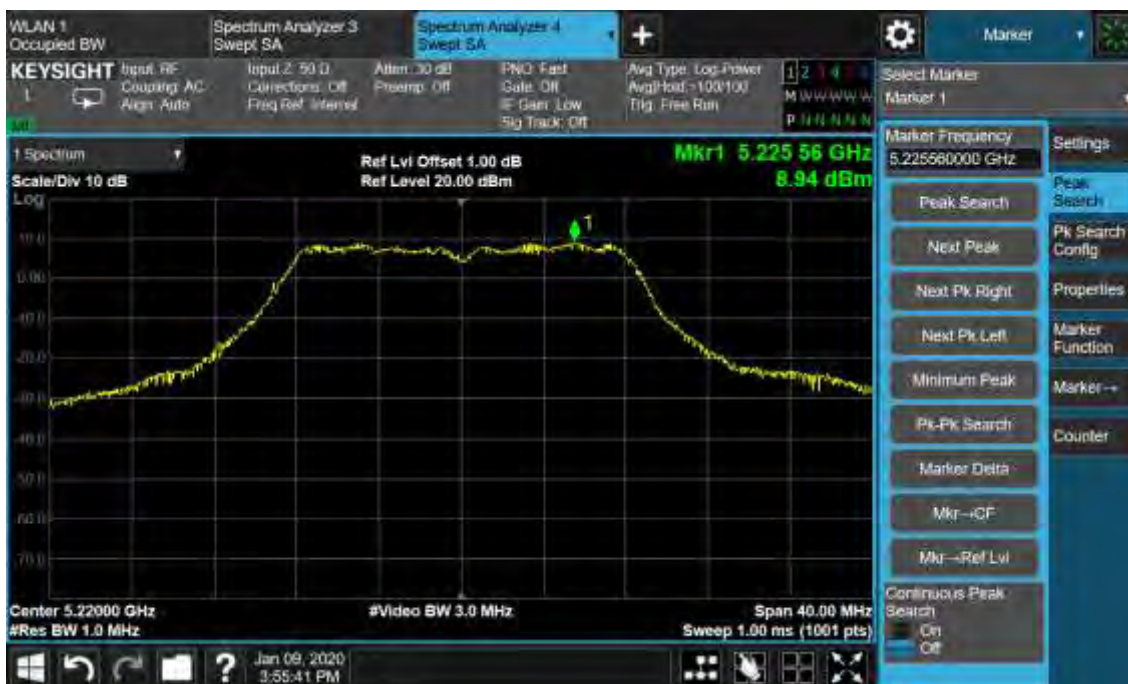
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Chain 1 Power Spectral Density, 802.11a, 5180MHz



Chain 2 Power Spectral Density, 802.11a, 5220MHz



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MIMO Power Spectral Density, 802.11a, 5220MHz



Chain 1 Power Spectral Density, 802.11a, 5220MHz



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Chain 2 Power Spectral Density, 802.11a, 5240MHz



MIMO Power Spectral Density, 802.11a, 5240MHz



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Chain 1 Power Spectral Density, 802.11a, 5240MHz



Chain 2 Power Spectral Density, 802.11n(HT20), 5180MHz



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MIMO Power Spectral Density, 802.11n(HT20), 5180MHz



Chain 1 Power Spectral Density, 802.11n(HT20), 5180MHz



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Keysight Spectrum Analyzer 3

WLAN 1 Occupied BW

Center Frequency: 5.22000000 GHz

Span: 40.000000 MHz

Start Freq: 5.20000000 GHz

Stop Freq: 5.24000000 GHz

AUTO TUNE

CF Step: 4.000000 MHz

Freq Offset: 0 Hz

X Axis Scale: Log

Signal Track (Span Zoom)

1 Spectrum

Scale/Div 10 dB

Log

Ref Lvl Offset 1.00 dB

Ref Level 21.00 dBm

Mkr1 5.22713 GHz

8.273 dBm

Center 5.22000 GHz

#Res BW 1.0 MHz

#Video BW 3.0 MHz

Span 40.00 MHz

Sweep 1.00 ms / 601 pts

Jan 13, 2020 3:11:03 PM

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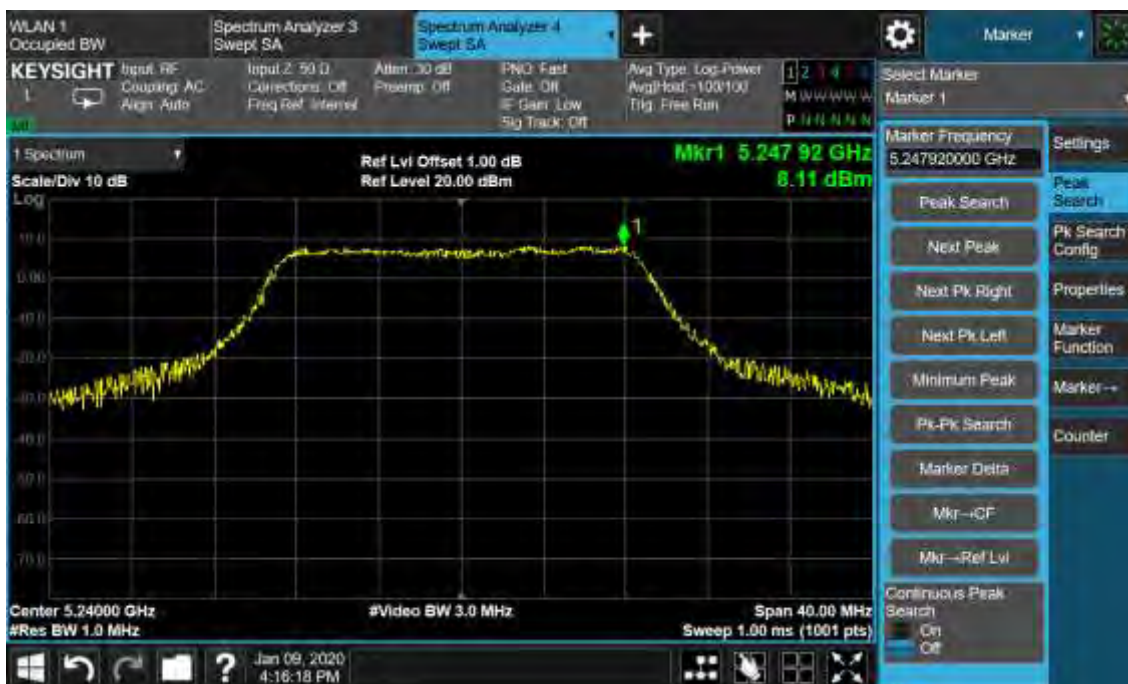
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Chain 1 Power Spectral Density, 802.11n(HT20), 5220MHz



Chain 2 Power Spectral Density, 802.11n(HT20), 5240MHz



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MIMO Power Spectral Density, 802.11n(HT20), 5240MHz



Chain 1 Power Spectral Density, 802.11n(HT20), 5240MHz



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Chain 2 Power Spectral Density, 802.11ac(VHT20), 5180MHz



MIMO Power Spectral Density, 802.11ac(VHT20), 5180MHz



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Chain 1 Power Spectral Density, 802.11ac(VHT20), 5180MHz



Chain 2 Power Spectral Density, 802.11ac(VHT20), 5220MHz



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MIMO Power Spectral Density, 802.11ac(VHT20), 5220MHz



Chain 1 Power Spectral Density, 802.11ac(VHT20), 5220MHz



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Chain 2 Power Spectral Density, 802.11ac(VHT20), 5240MHz



MIMO Power Spectral Density, 802.11ac(VHT20), 5240MHz



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Chain 1 Power Spectral Density, 802.11ac(VHT20), 5240MHz



Chain 2 Power Spectral Density, 802.11n(HT40), 5190MHz



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MIMO Power Spectral Density, 802.11n(HT40), 5190MHz



Chain 1 Power Spectral Density, 802.11n(HT40), 5190MHz



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MIMO Power Spectral Density, 802.11n(HT40), 5230MHz



MIMO Power Spectral Density, 802.11n(HT40), 5230MHz



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Chain 1 Power Spectral Density, 802.11n(HT40), 5230MHz



Chain 2 Power Spectral Density, 802.11ac(VHT40), 5190MHz



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MIMO Power Spectral Density, 802.11ac(VHT40), 5190MHz



Chain 1 Power Spectral Density, 802.11ac(VHT40), 5190MHz



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Chain 2 Power Spectral Density, 802.11ac(VHT40), 5230MHz



MIMO Power Spectral Density, 802.11ac(VHT40), 5230MHz



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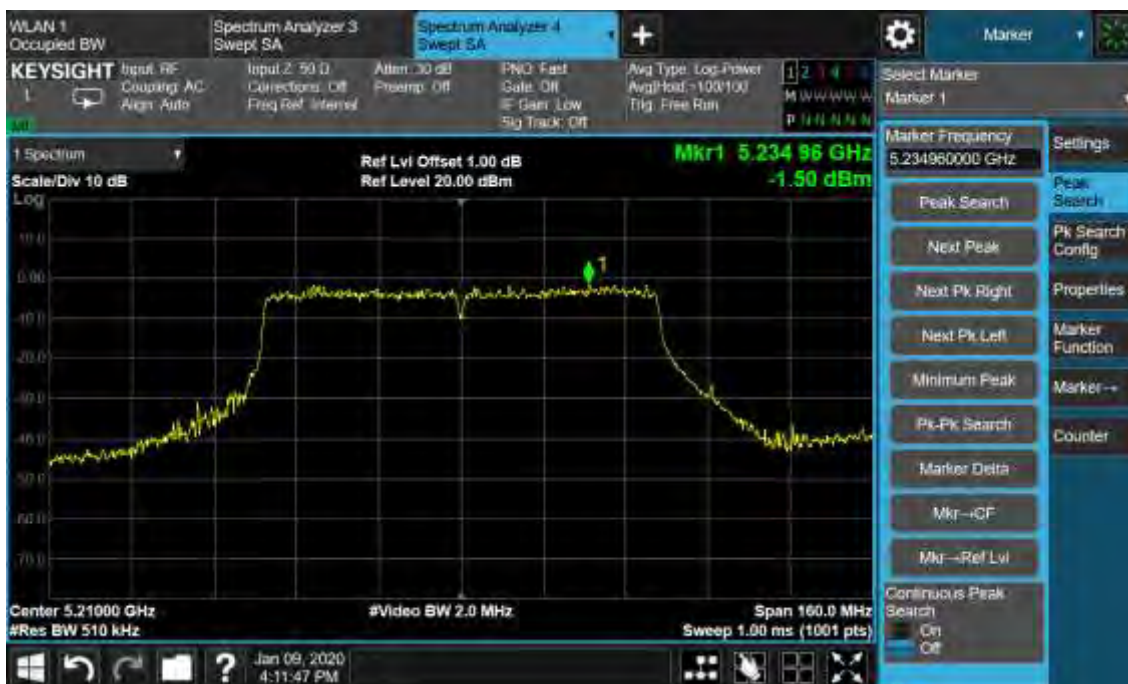
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Chain 1 Power Spectral Density, 802.11ac(VHT40), 5230MHz



Chain 2 Power Spectral Density, 802.11ac(VHT80), 5210MHz



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MIMO Power Spectral Density, 802.11ac(VHT80), 5210MHz



Chain 1 Power Spectral Density, 802.11ac(VHT80), 5210MHz



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Chain 2 Power Spectral Density, 802.11a, 5745MHz



MIMO Power Spectral Density, 802.11a, 5745MHz



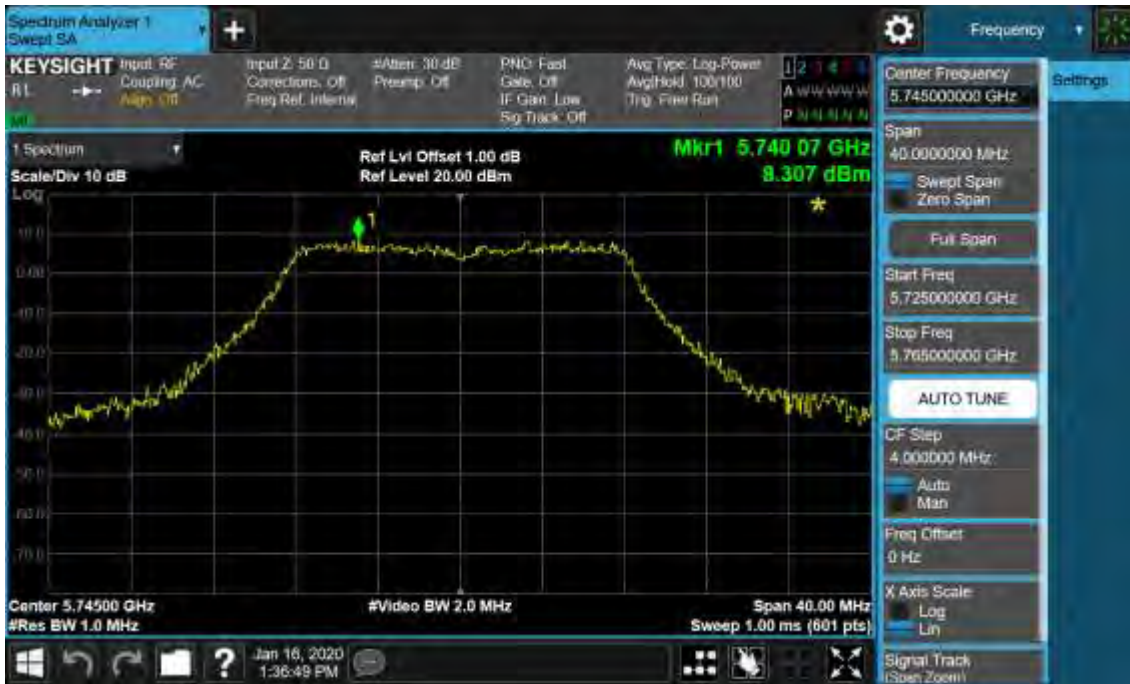
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Chain 1 Power Spectral Density, 802.11a, 5745MHz



Chain 2 Power Spectral Density, 802.11a, 5785MHz



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MIMO Power Spectral Density, 802.11a, 5785MHz



Chain 1 Power Spectral Density, 802.11a, 5785MHz



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Chain 2 Power Spectral Density, 802.11a, 5825MHz



MIMO Power Spectral Density, 802.11a, 5825MHz



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Chain 1 Power Spectral Density, 802.11a, 5825MHz



Chain 2 Power Spectral Density, 802.11n(HT20), 5745MHz



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MIMO Power Spectral Density, 802.11n(HT20), 5745MHz



Chain 1 Power Spectral Density, 802.11n(HT20), 5745MHz



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Chain 2 Power Spectral Density, 802.11n(HT20), 5785MHz



MIMO Power Spectral Density, 802.11n(HT20), 5785MHz



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Chain 1 Power Spectral Density, 802.11n(HT20), 5785MHz



Chain 2 Power Spectral Density, 802.11n(HT20), 5825MHz



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MIMO Power Spectral Density, 802.11n(HT20), 5825MHz



Chain 1 Power Spectral Density, 802.11n(HT20), 5825MHz



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Chain 2 Power Spectral Density, 802.11ac(VHT20), 5745MHz



MIMO Power Spectral Density, 802.11ac(VHT20), 5745MHz



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Chain 1 Power Spectral Density, 802.11ac(VHT20), 5745MHz



Chain 2 Power Spectral Density, 802.11ac(VHT20), 5785MHz



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MIMO Power Spectral Density, 802.11ac(VHT20), 5785MHz



Chain 1 Power Spectral Density, 802.11ac(VHT20), 5785MHz



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Chain 2 Power Spectral Density, 802.11ac(VHT20), 5825MHz



MIMO Power Spectral Density, 802.11ac(VHT20), 5825MHz



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Chain 1 Power Spectral Density, 802.11ac(VHT20), 5825MHz



Chain 2 Power Spectral Density, 802.11n(HT40), 5755MHz



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MIMO Power Spectral Density, 802.11n(HT40), 5755MHz



Chain 1 Power Spectral Density, 802.11n(HT40), 5755MHz



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Chain 2 Power Spectral Density, 802.11n(HT40), 5795MHz



MIMO Power Spectral Density, 802.11n(HT40), 5795MHz



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Chain 1 Power Spectral Density, 802.11n(HT40), 5795MHz



Chain 2 Power Spectral Density, 802.11ac(VHT40), 5755MHz



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MIMO Power Spectral Density, 802.11ac(VHT40), 5755MHz



Chain 1 Power Spectral Density, 802.11ac(VHT40), 5755MHz



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Chain 2 Power Spectral Density, 802.11ac(VHT40), 5795MHz



MIMO Power Spectral Density, 802.11ac(VHT40), 5795MHz



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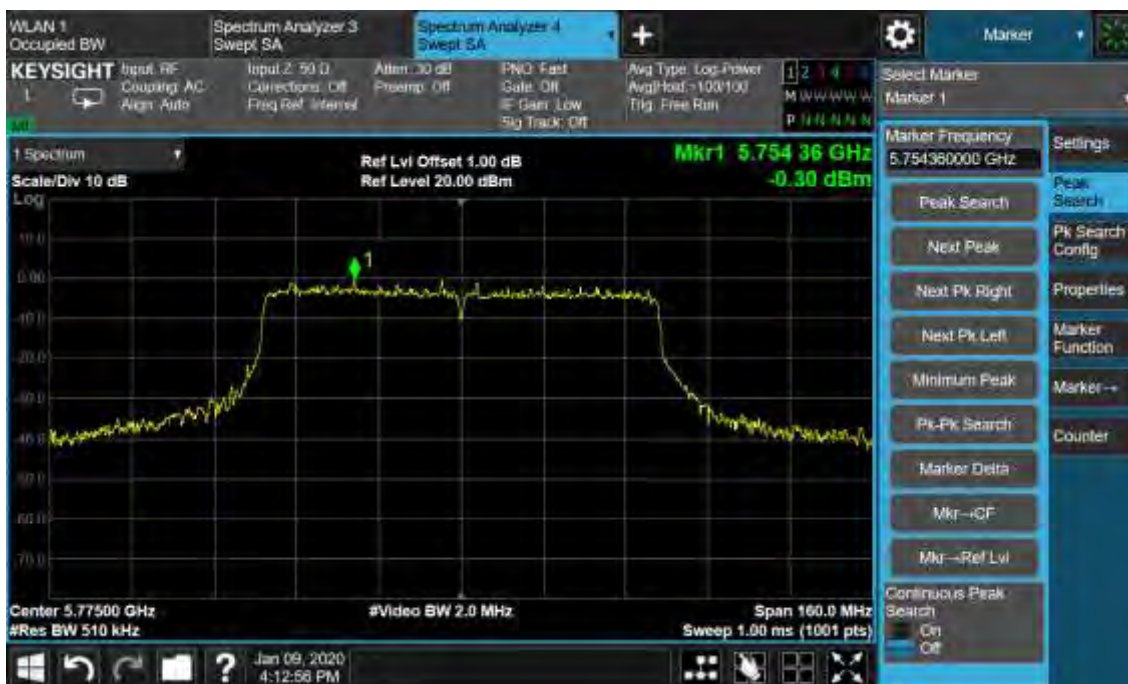
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Chain 1 Power Spectral Density, 802.11ac(VHT40), 5795MHz



Chain 2 Power Spectral Density, 802.11ac(VHT80), 5775MHz



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MIMO Power Spectral Density, 802.11ac(VHT80), 5775MHz



Chain 1 Power Spectral Density, 802.11ac(VHT80), 5775MHz



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4.1.6 Undesirable Emission

RESULT:

PASS

Test standard	: FCC Part 15.407(b), 15.209 RSS-247 6.2
Requirement	: ANSI C63.10-2013, KDB 789033
Kind of test site	: Shielded room

Test setup

Test Channel	: Low/Middle/High
Operation Mode	: A.1.a
Ambient temperature	: 25C
Relative humidity	: 52%

For details refer to following test plot.