

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

Applicant: Murata Manufacturing Co., Ltd.
10-1, Higashikotari 1-chome, Nagaokakyo-shi, Kyoto 617-8555 Japan

Product Name: Communication Module

Brand Name: muRata

FCC Model No.: LBEE5XV1XA, LBEE5XV2BA, LBEE5XV1ZA
LBEE5XV1XA_3ANT, LBEE5XV1XA_2ANT,
LBEE5XV2BA_3ANT, LBEE5XV2BA_2ANT,
LBEE5XV1ZA_3ANT, LBEE5XV1ZA_2ANT

IC Model No.:

Model Difference: Please refer to the tables on page 5 for further details.

Report Number: ER/2020/90109

FCC ID: VPYLBEE5XV1XA

IC: 772C-LBEE5XV1XA

FCC Rule Part: §15.407, Cat: NII

ISED RSS: RSS-247 issue 2 Feb. 2017

Issue Date: Jan. 07, 2021

Date of Test: Sep. 22, 2020 ~ Nov. 30, 2020

Date of EUT Received: Sep. 22, 2020

We hereby certify that:

The above equipment was tested by SGS Taiwan Ltd. Central RF Lab. 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.

Approved By: _____



Jim Chang / Manager



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Revision History

Report Number	Revision	Description	Issue Date	Remark
ER/2020/90109	Rev.00	Original.	Jan. 07, 2021	Revised By: Violetta Tang

Note:

1、Multiple Model numbers or Trademarks

The variant model numbers are assessed as identical in hardware and software to each other, hence all variants are fully covered by the test results in this test report without further verification test.

2、Disclaimer

Variant information among model numbers is provided by the applicant, test results of this report are applicable to the sample EUT received.

3、Disclaimer

Antenna information is provided by the applicant, test results of this report are applicable to the sample EUT received.

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1 GENERAL INFORMATION

1.1 Product Description

Product Name:	Communication Module
Brand Name:	muRata
FCC Model No.:	LBEE5XV1XA, LBEE5XV2BA, LBEE5XV1ZA
IC Model No.:	LBEE5XV1XA_3ANT, LBEE5XV1XA_2ANT, LBEE5XV2BA_3ANT, LBEE5XV2BA_2ANT, LBEE5XV1ZA_3ANT, LBEE5XV1ZA_2ANT
Model Difference:	Please refer to the tables on page 5 for further details.
Hardware Version:	1.0
Software Version:	CYW4359D0_004.001.016.0200.0000_Generic_UART_37_4MHz_wlbg BU_dLNA_test_build_20200910.hcd CYW4359D0_004.001.016.0200.0000_Generic_UART_37_4MHz_wlbg BU_sLNA_test_build_20200909.hcd
EUT Series No.:	63_3A (Conducted) / 50 (Radiated)
Power Supply:	3.3Vdc
Modulation type	64QAM, 16QAM, QPSK, BPSK for OFDM 256QAM for OFDM in 802.11ac only
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 – 300.0Mbps 802.11 ac_80MHz: 29.3 – 866.7Mbps

1.2 Antenna Designation

Antenna Type	Supplier	Antenna Part No.	Freq. (MHz)	Peak Antenna Gain (dBi)	Worst Antenna Gain
Dipole	Molex	146153	5150~5250	4.25	
			5250~5350	4.25	
			5470~5725	4.25	
			5725~5850	4.25	
	Molex	146187	5150~5250	4.75	V
			5250~5350	4.75	V
			5470~5725	4.75	V
			5725~5850	4.75	V

Note: Pre-scanned was done on the above 2 antennas, the 146187 results higher emission at 5GHz. Therefore, the completed set of measurement was done on the antenna to be presented on this test report.

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Product Diversity Description Table

Difference for module

Number	Main model 1	2	5	6	9	10
Model Name	LBEE5XV1XA_3 ANT	LBEE5XV1XA_2 ANT	LBEE5XV2BA_3 ANT	LBEE5XV2BA_2 ANT	LBEE5XV1ZA_3 ANT	LBEE5XV1ZA_2 ANT
IC P/N	CYW54591	CYW54591	CYW54590	CYW54590	CYW88459	CYW88459
WiFi I/F	PCIe	PCIe	PCIe	PCIe	PCIe	PCIe
Antenna type/Gain	Dipole type	Same as 1XA_3ANT	Same as 1XA_3ANT	Same as 1XA_3ANT	Same as 1XA_3ANT	Same as 1XA_3ANT
Circuit Diagram	1XA	Same as 1XA_3ANT	Same as 1XA_3ANT	Same as 1XA_3ANT	Same as 1XA_3ANT	Same as 1XA_3ANT
Module PCB layout	1XA	Same as 1XA_3ANT	Same as 1XA_3ANT	Same as 1XA_3ANT	Same as 1XA_3ANT	Same as 1XA_3ANT
Internal Component	1XA	Same as 1XA_3ANT	Same as 1XA_3ANT	Same as 1XA_3ANT	Same as 1XA_3ANT	Same as 1XA_3ANT
Appearance Print	1XA	Same as 1XA_3ANT	Difference 1XA ->2BA	Difference 1XA ->2BA	Difference 1XA ->1ZA	Difference 1XA ->1ZA
Function/ Capability	1XA	Same as 1XA_3ANT	RSDB is de-sabled from 1XA_3ANT	RSDB is de-sabled from 1XA_3ANT	Same as 1XA_3ANT	Same as 1XA_3ANT
Other						

Difference for WLAN IC

Number	CYW54591	CYW54590	CYW88459
IC Size	5.155x7.698	Same as CYW54591	Same as CYW54591
Ball Number	194	Same as CYW54591	Same as CYW54591
Circuit Diagram	CYW54591	Same as CYW54591	Same as CYW54591
RF performance	CYW54591	Same as CYW54591	Same as CYW54591
Appearance	CYW54591	Difference ->Marking : CYW54590	Difference ->Marking : CYW88459
Function/Capability	CYW54591	RSDB doesn't support by Software	Same as CYW54591
Other	Consumer Grade	Same as CYW54591	Industrial Grade*

*IC vendor just want to control P/N for Consumer and Industrial. But IF for Hardware/Software from point of view it is same.

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1.3 FCC worst power

Wi-Fi 802.11	Frequency Range(MHz)	Channels	Rated Power (Avg.) (dBm) (Worst case)	Modulation Technology
a	5150~5250	4	15.98	OFDM
	5250~5350	4	17.40	
	5470~5725	12	17.38	
	5725~5850	5	17.50	
n_HT20M	5150~5250	4	15.89	OFDM
	5250~5350	4	19.28	
	5470~5725	12	19.98	
	5725~5850	5	20.48	
n_HT40M	5150~5250	2	15.20	OFDM
	5250~5350	2	19.38	
	5470~5725	5	19.22	
	5725~5850	2	19.42	
ac_VHT 80M	5150~5250	1	11.23	OFDM
	5250~5350	1	9.39	
	5470~5725	2	19.44	
	5725~5850	1	15.93	

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1.4 ISED worst power

Wi-Fi 802.11	Frequency Range (MHz)	Channels	Avg. or EIRP	Rated Power (dBm) (Worst Case)	Modulation Technology
11a	5150~5250	4	EIRP	20.73	OFDM
	5250~5350	4	Avg.	17.40	
	5470~5725	12	Avg.	17.38	
	5725~5850	5	Avg.	17.50	
n_HT20M	5150~5250	4	EIRP	20.64	OFDM
	5250~5350	4	Avg.	19.28	
	5470~5725	12	Avg.	19.98	
	5725~5850	5	Avg.	20.48	
n_HT40M	5150~5250	2	EIRP	19.95	OFDM
	5250~5350	2	Avg.	19.38	
	5470~5725	6	Avg.	19.22	
	5725~5850	2	Avg.	19.42	
ac_VHT 80M	5150~5250	1	EIRP	15.98	OFDM
	5250~5350	1	Avg.	9.39	
	5470~5725	2	Avg.	19.44	
	5725~5850	1	Avg.	15.93	

Note:

As per guidance in presentation 2018-04-10-03 IC Certification updates of April 2018 TCB workshop, Client (Slave mode) devices without active scanning function, but with the capability of operating in 5600-5650 MHz solely under the control of a certified master device meeting the requirement of RSS-247, are allowed in Canada.

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1.5 Test Methodology of Applied Standards

FCC Part 15, Subpart E §15.407
FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01
FCC KDB 662911 D01 Multiple Transmitter Output v02r01
RSS-247 issue 2 Feb. 2017
RSS-Gen. issue 5, Amendment 1, March 2019
ANSI C63.10:2013

1.6 Test Facility

SGS Taiwan Ltd. Central RF Lab (TAF code 3702)
No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan 24803
FCC Designation number: TW0027
ISED CAB identifier: TW3702

1.7 Special Accessories

There are no special accessories used while test was conducted.

1.8 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 table which is 0.8 m above ground plane. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30 MHz. The CISPR Quasi-Peak and Average detector mode is employed. The two LISNs provide 50 μ H/50 ohm 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 Conducted Test (RF)

The active antenna port of the unlicensed wireless device is connected to the spectrum analyzer with attenuator to protect the instrumentation. If a second antenna port is available, it is tested at one operating frequency, with other port(s) appropriately terminated, to verify it has similar output characteristics as the fully tested port.

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

2.4 Measurement Results Explanation Example

2.4.1 Radiated Emission Test Sites For Measurements From 9 kHz To 30 MHz

Radiated emission below 30 MHz is measured in a 9m*9m*6m semi-anechoic chamber, the measurements correspond to those obtained at an open-field test site.

There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

2.4.2 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.

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2.5 Configuration of Tested System

Fig. 2-1 Radiated Emission

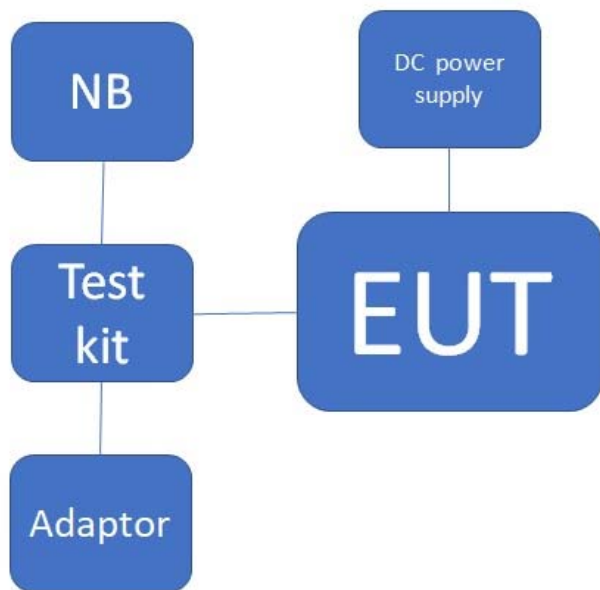


Fig. 2-2 Conducted Emission (AC Power Line)

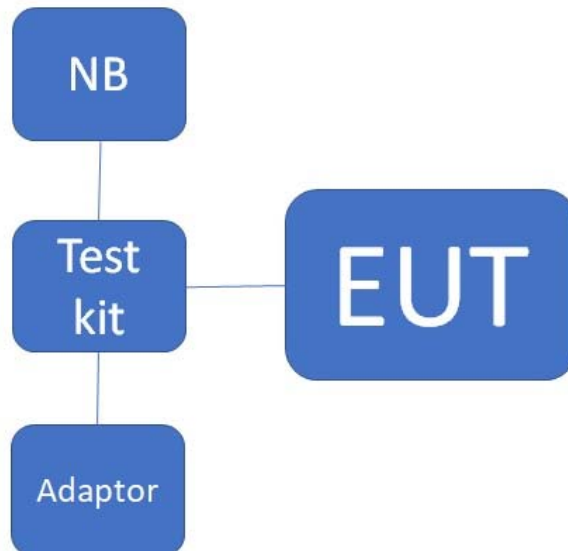


Fig. 2-2 Conducted (Antenna Port)

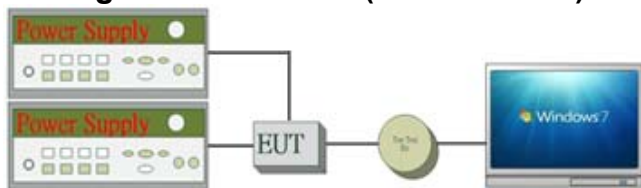


Table 2-1 Equipment Used in Tested System

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	X240	PF-00UH6D	N/A	N/A
3	Notebook	Lenovo	T440P	PB-02Y6RK	N/A	N/A
4	DC Power Supply	Agilent	E3640A	MY40000811	N/A	N/A
5	DC Power Supply	Agilent	E3640A	MY52410006	N/A	N/A
6	Test Kit	N/A	N/A	N/A	N/A	N/A

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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-Gen §6.7 RSS-247 §6.2.4.1	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
§15.205 §15.209 §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)	N/A	Antenna Requirement	Compliant

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4.2 The Worst Test Modes and Channel Details

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

Modulation	Transmission Chain				Single Transmission Spatial	Multiple Transmission Spatial
<input checked="" type="checkbox"/> 802.11 a	<input checked="" type="checkbox"/> Ch0	<input checked="" type="checkbox"/> Ch1	<input type="checkbox"/> Ch2	<input type="checkbox"/> Ch3	<input checked="" type="checkbox"/> 1TX	<input type="checkbox"/> 2TX
<input checked="" type="checkbox"/> 802.11 n	<input checked="" type="checkbox"/> Ch0	<input checked="" type="checkbox"/> Ch1	<input type="checkbox"/> Ch2	<input type="checkbox"/> Ch3	<input checked="" type="checkbox"/> SISO	<input checked="" type="checkbox"/> MIMO
<input checked="" type="checkbox"/> 802.11 ac	<input checked="" type="checkbox"/> Ch0	<input checked="" type="checkbox"/> Ch1	<input type="checkbox"/> Ch2	<input type="checkbox"/> Ch3	<input type="checkbox"/> SISO	<input checked="" type="checkbox"/> MIMO

4. Therefore, below summary is the modes of test configuration that yield the highest reading and generate the highest emission chosen to carry out the relevantly mandatory test items.

4.2.1 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	44	OFDM	6	ch1
	5260~5320	52 to 64	60			
	5500~5720	100 to 144	116			
	5745~5825	149 to 165	157			
802.11ac_VHT80	5190~5230	42	42	OFDM	MCS0	MIMO
	5270~5310	58	58			
	5530~5690	106 to 138	122			
	5775	155	155			

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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	6	ch1
	5260~5320	52 to 64	52,60,64			
	5500~5720	100 to 144	100,116,140,144			
	5745~5825	149 to 165	149,157,165			
802.11n_HT20	5180~5240	36 to 48	36,44,48	OFDM	MCS8	MIMO
	5260~5320	52 to 64	52,60,64			
	5500~5720	100 to 144	100,116,140,144			
	5745~5825	149 to 165	149,157,165			
802.11n_HT40	5190~5230	38 to 46	38,46	OFDM	MCS8	MIMO
	5270~5310	54 to 62	54,62			
	5510~5710	102 to 142	102,110,134,142			
	5755~5795	151 to 159	151,159			
802.11ac_VHT80	5210	42	42	OFDM	MCS0	MIMO
	5290	58	58			
	5530~5690	106 to 138	106,122,138			
	5775	155	155			

Note:

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

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4.2.2 ANTENNA PORT CONDUCTED MEASUREMENT:

CONDUCTED TEST						
MODE	FREQUENCY BAND (MHz)	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT
802.11a	5180~5240	36 to 48	36,44,48	OFDM	6	ch1
	5260~5320	52 to 64	52,60,64			
	5500~5720	100 to 144	100,116,140,144			
	5745~5825	149 to 165	149,157,165			
802.11n_HT20	5180~5240	36 to 48	36,44,48	OFDM	MCS8	MIMO
	5260~5320	52 to 64	52,60,64			
	5500~5720	100 to 144	100,116,144		MCS0	SISO
	5500~5720	100 to 144	140			
	5745~5825	149 to 165	149,157,165			
802.11n_HT40	5190~5230	38 to 46	38,46	OFDM	MCS8	MIMO
	5270~5310	54 to 62	54,62			
	5510~5710	102 to 142	102,110,134,142			
	5755~5795	151 to 159	151,159			
802.11ac_VHT80	5210	42	42	OFDM	MCS0	MIMO
	5290	58	58			
	5530~5690	106 to 138	106,122,138			
	5775	155	155			

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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: +2.3dB
	30MHz - 180MHz: +/- 3.37dB
	180MHz -417MHz: +/- 3.19dB
	0.417GHz-1GHz: +/- 3.19dB
	1GHz - 18GHz: +/- 4.04dB
	18GHz - 40GHz: +/- 4.04dB
Polarization: Horizontal	9kHz~30MHz: +2.3dB
	30MHz - 167MHz: +/- 4.22dB
	167MHz -500MHz: +/- 3.44dB
	0.5GHz-1GHz: +/- 3.39dB
	1GHz - 18GHz: +/- 4.08dB
	18GHz - 40GHz: +/- 4.08dB

Note:

1. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.
2. The conformity assessment statement in this report is based solely on the test results, measurement uncertainty is excluded.

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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.
PXA Spectrum Analyzer	Agilent	N9030A	MY53120760	04/21/2020	04/20/2021
EMI Test Receiver	R&S	ESCI 7	100759	07/13/2020	07/12/2021
LISN	SCHWARZBECK	NSLK 8127	8127-465	04/09/2020	04/08/2021
Coaxial Cables	N/A	Coaxial Cable	161207	12/07/2019	12/06/2020
Test Software	audix	e3	Ver. 6.11-20180413	N.C.R	N.C.R

NOTE: N.C.R refers to Not Calibrated Required.

6.3 EUT Setup

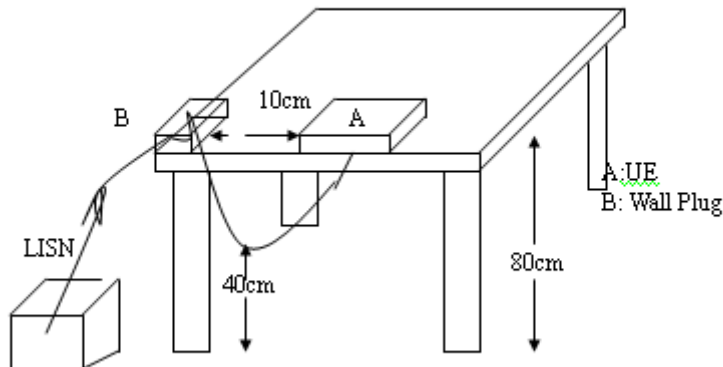
1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.10:2013.
2. The AC/DC Power adaptor of EUT was plug-in LISN. The rear of the EUT and peripherals were placed flushed with the rear of the tabletop.
3. The LISN was connected with 120Vac/60Hz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

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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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AC POWER LINE CONDUCTED EMISSION TEST DATA

Report Number :ER-2020-90109

Test Site :Conduction 6F

Test Mode :WLAN 5G

Test Date :2020-10-28

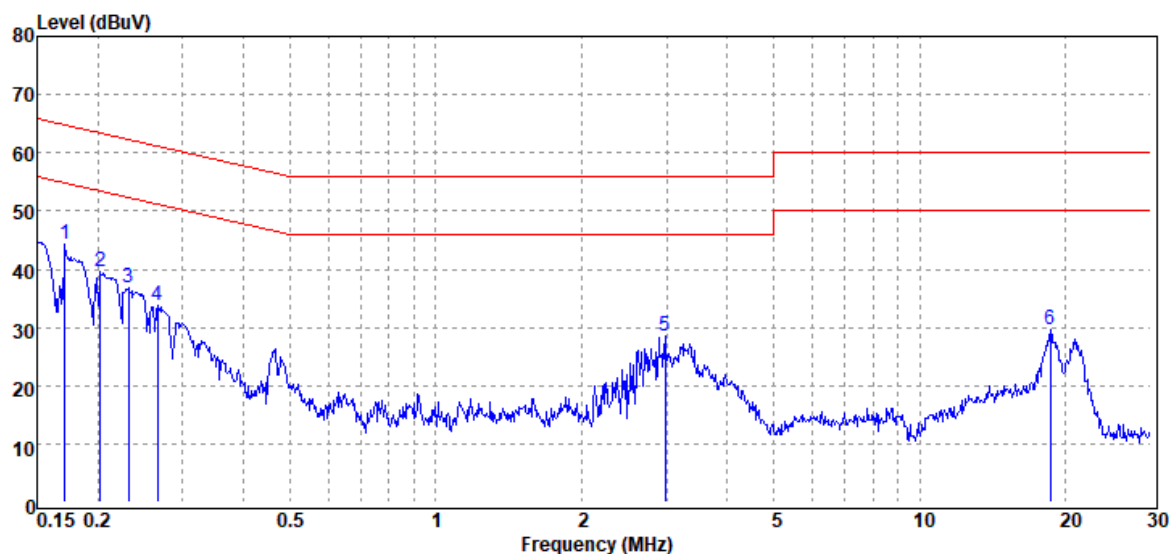
Power :AC 120V/60Hz

Temp./Humi. :24.0/57

Probe :L

Engineer :Neo

Note :



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV	Limit dBμV	Margin dB
0.17	Peak	42.10	2.14	44.24	64.90	-20.66
0.20	Peak	37.36	2.14	39.50	63.49	-23.99
0.23	Peak	34.59	2.14	36.73	62.39	-25.66
0.27	Peak	31.74	2.14	33.88	61.25	-27.37
2.98	Peak	26.15	2.37	28.52	56.00	-27.48
18.62	Peak	26.69	3.05	29.74	60.00	-30.26

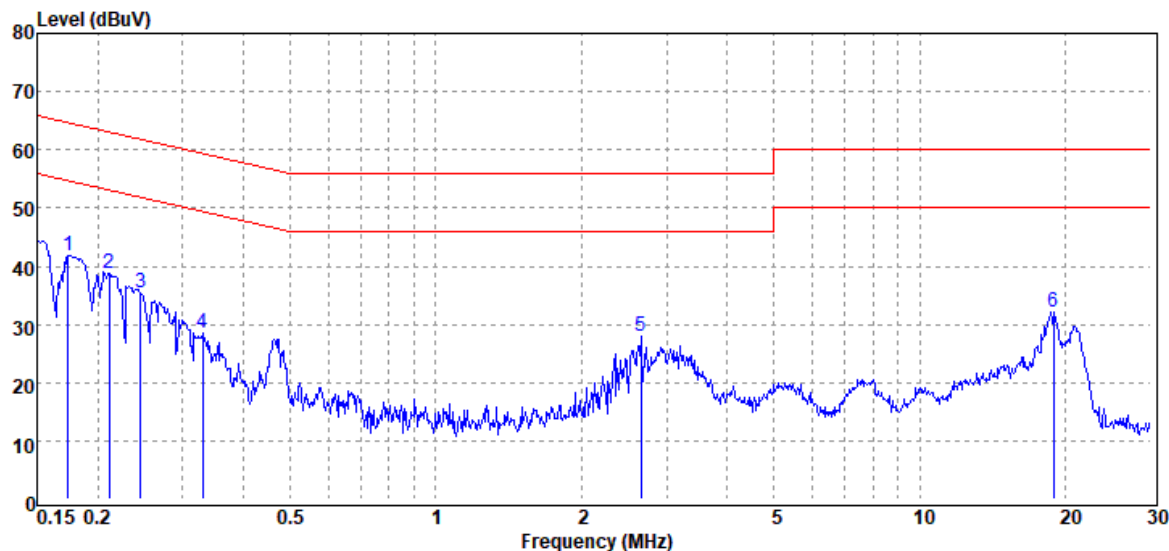
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Report Number :ER-2020-90109
 Test Mode :WLAN 5G
 Power :AC 120V/60Hz
 Probe :N
 Note: :

Test Site :Conduction 6F
 Test Date :2020-10-28
 Temp./Humi. :24.0/57
 Engineer :Neo



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV	Limit dBμV	Margin dB
0.17	Peak	39.66	2.21	41.87	64.77	-22.90
0.21	Peak	36.43	2.21	38.64	63.14	-24.50
0.25	Peak	33.25	2.21	35.46	61.91	-26.45
0.33	Peak	26.17	2.21	28.38	59.44	-31.06
2.65	Peak	25.74	2.34	28.08	56.00	-27.92
18.92	Peak	29.12	3.04	32.16	60.00	-27.84

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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.

7.1 Measurement Procedure:

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

Duty Cycle:

Mode	Duty Cycle (%) =Ton / (Ton+Toff)	Duty Factor (dB) =10*log (1/Duty Cycle)	1/T (kHz)	VBW setting (kHz)
802.11a	93.30	0.30	0.70	1.00
802.11n_20	92.98	0.32	0.75	1.00
802.11ac_20	92.99	0.32	0.74	1.00
802.11n_40	86.68	0.62	1.51	2.00
802.11ac_40	86.75	0.62	1.50	2.00
802.11ac_80	76.70	1.15	3.02	4.00

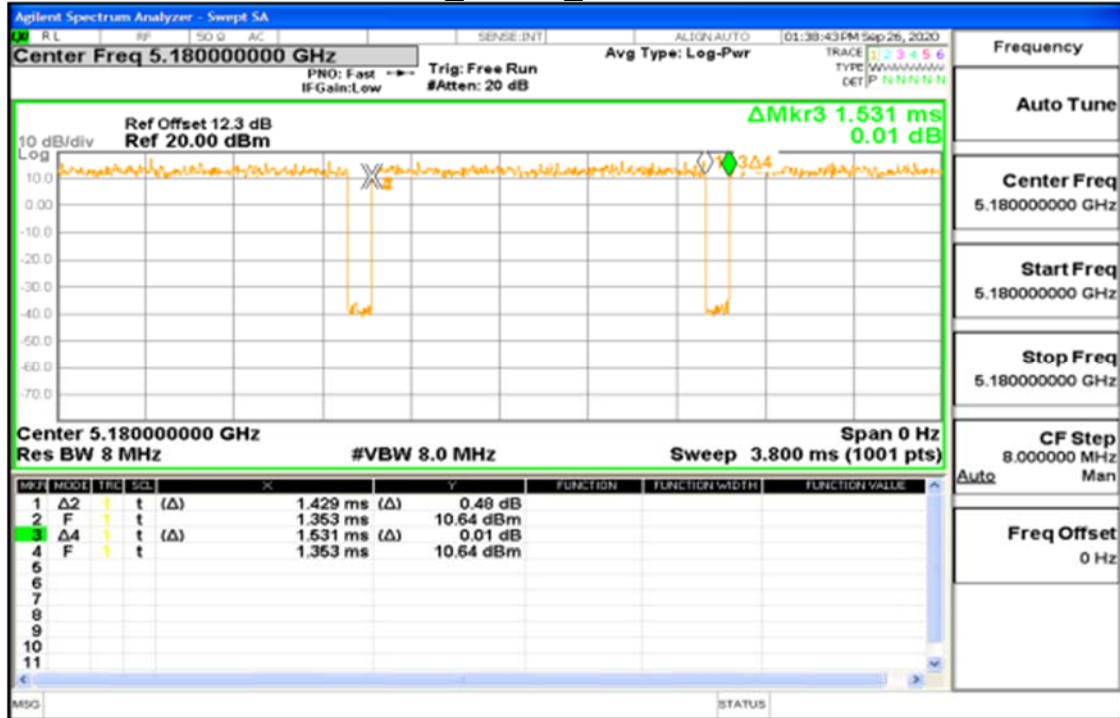
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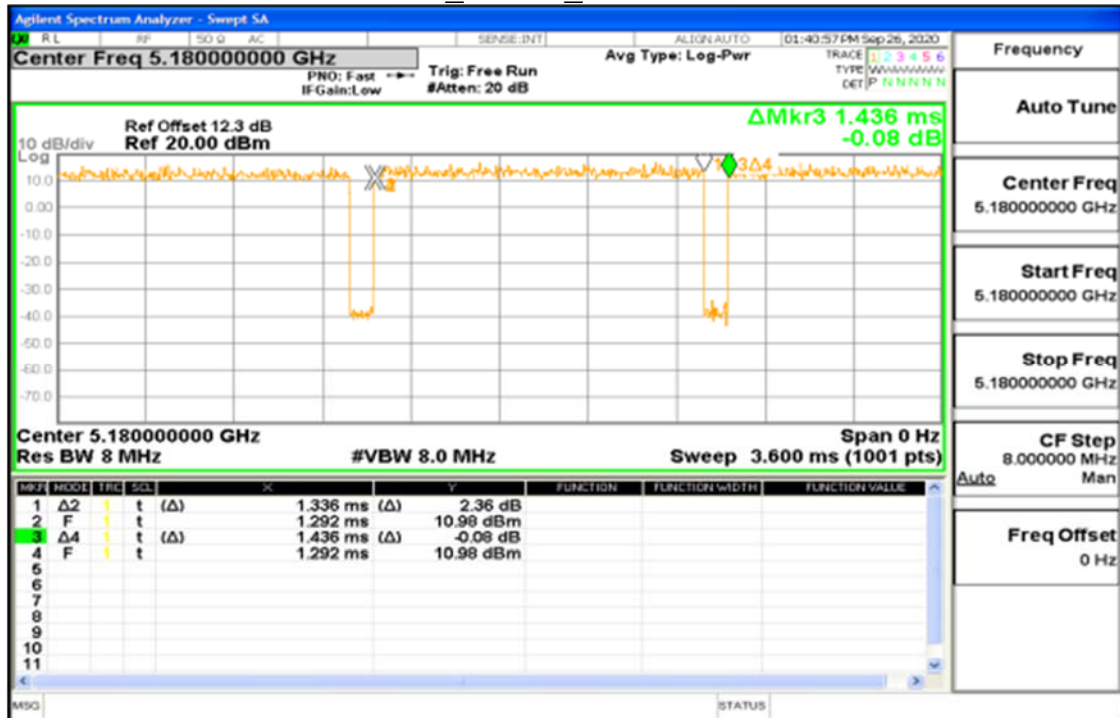
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7.2 DUTY CYCLE TEST SIGNAL MEASUREMENT RESULT

802.11a_20MHz_5180MHz-5180



802.11n_20MHz_5180MHz-5180

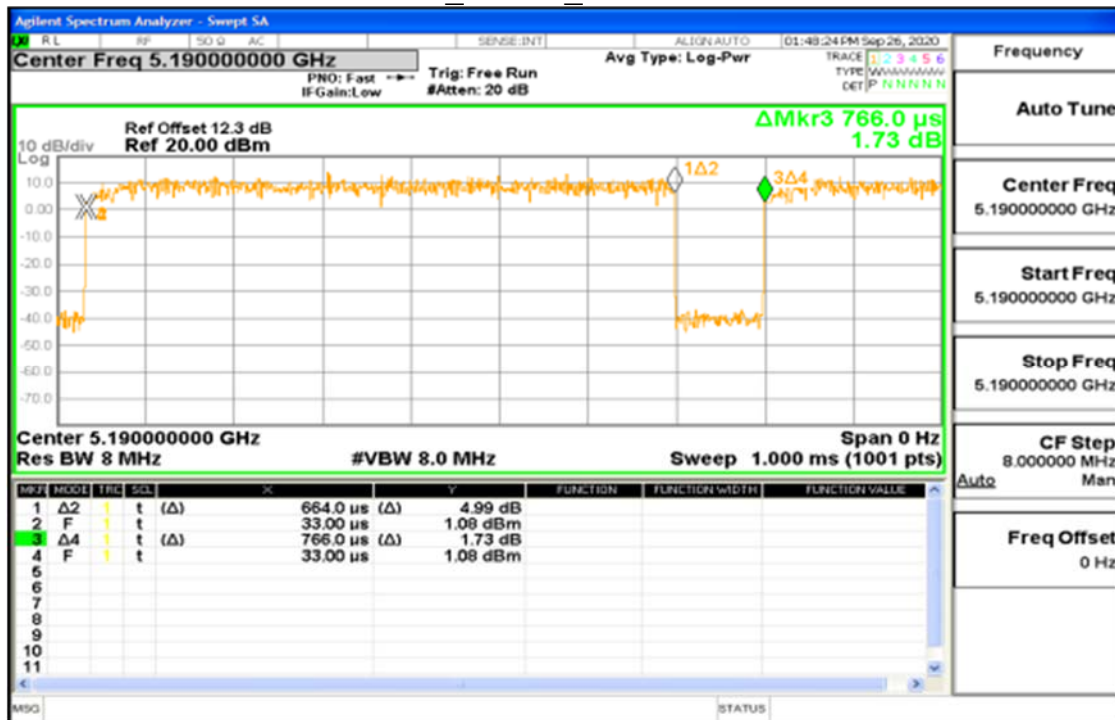


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802.11n_40MHz_5190MHz-5190



802.11ac_80MHz_5210MHz-5210



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8 26DB, 99% & 6DB EMISSION BANDWIDTH MEASUREMENT

8.1 Standard Applicable

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

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

8.2 Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the Antenna port to the spectrum analyzer.
 - 3.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.
 - 3.b. Mark the peak frequency and -26dB (upper and lower) frequency.
4. Repeat the procedures as list above until all test default channels (low, middle, and high) are completed.
5. Minimum Emission Bandwidth for the band 5.725-5.850GHz.
 - a. Set the spectrum analyzer as
RBW = 100 kHz,
VBW = 3*RBW,
Span = 30M/50MHz,
Detector=Peak,
Sweep=auto
 - b. Mark the peak frequency and -6dB (upper and lower) frequency.
6. For 99% Bandwidth: Set the spectrum analyzer as
RBW=1%,
VBW = 3*RBW,
Span = 30M/50MHz,
Detector=Sample,
Sweep=auto.
7. Turn on the 99% bandwidth function, max reading.
8. Repeat above procedures until all frequency of interest measured was complete.

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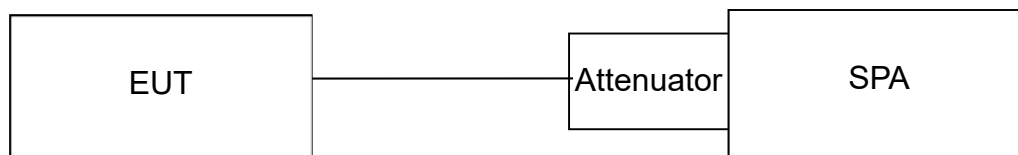
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8.3 Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EXA Spectrum Analyzer	Agilent	N9010A	MY50420195	05/06/2020	05/05/2021
DC Power Supply	Agilent	E3640A	MY40000811	12/23/2019	12/22/2020
DC Power Supply	Agilent	E3640A	MY52410006	12/10/2019	12/09/2020
Attenuator	Mini-Circuit	BW-S10W2+	2	01/02/2020	01/01/2021
DC Block	Mini-Circuits	BLK-18-S+	1	01/02/2020	01/01/2021

8.4 Test Set-up



8.5 Measurement Result

8.5.1 FCC 26dB Bandwidth

802.11a_Ch1

Freq. (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5180	20.95	13.210
5220	21.25	13.270
5240	21.28	13.280
5260	22.88	13.590
5300	22.55	13.530
5320	20.79	13.180
5500	21.12	13.250
5580	25.61	14.080
5700	21.14	13.250
5720	23.37	13.690

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802.11n_HT20_Ch0			802.11n_HT20_Ch1		
Freq. (MHz)	26dB BW (MHz)	10 Log (B) (dB)	Freq. (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5180	21.55	13.330	5180	20.92	13.210
5220	21.67	13.360	5220	20.96	13.210
5240	21.26	13.280	5240	21.31	13.290
5260	30.00	14.770	5260	23.65	13.740
5300	26.47	14.230	5300	30.00	14.770
5320	21.15	13.250	5320	21.18	13.260
5500	21.07	13.240	5500	21.03	13.230
5580	30.00	14.770	5580	23.32	13.680
5720	30.00	14.770	5700	21.49	13.320
			5720	24.11	13.820

802.11n_HT40_Ch0			802.11n_HT40_Ch1		
Freq. (MHz)	26dB BW (MHz)	10 Log (B) (dB)	Freq. (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5190	39.14	15.930	5190	38.93	15.900
5230	39.34	15.950	5230	38.98	15.910
5270	50.00	16.990	5270	42.96	16.330
5310	39.64	15.980	5310	38.74	15.880
5510	39.29	15.940	5510	39.17	15.930
5550	49.68	16.960	5550	39.08	15.920
5670	39.55	15.970	5670	39.22	15.940
5710	50.00	16.990	5710	43.92	16.430

802.11ac_VHT80_Ch0			802.11ac_VHT80_Ch1		
Freq. (MHz)	26dB BW (MHz)	10 Log (B) (dB)	Freq. (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5210	80.18	19.040	5210	80.02	19.030
5290	100.00	20.000	5290	80.21	19.040
5530	80.27	19.050	5530	80.31	19.050
5610	99.81	19.990	5610	99.76	19.990
5690	100.00	20.000	5690	99.58	19.980

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8.5.2 6dB Bandwidth (5725 MHz~ 5850 MHz) measure with Peak detector for FCC

802.11a_Ch1

Freq. (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5745	16.34	12.130
5785	16.33	12.130
5825	16.34	12.130

802.11n_HT20_Ch0

Freq. (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5745	17.58	12.450
5785	17.58	12.450
5825	17.28	12.380

802.11n_HT20_Ch1

Freq. (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5745	17.60	12.460
5785	17.59	12.450
5825	17.57	12.450

802.11n_HT40_Ch0

Freq. (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5755	35.74	15.530
5795	35.03	15.440

802.11n_HT40_Ch1

Freq. (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5755	35.18	15.460
5795	35.16	15.460

802.11ac_VHT80_Ch0

Freq. (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5775	75.31	18.770

802.11ac_VHT80_Ch1

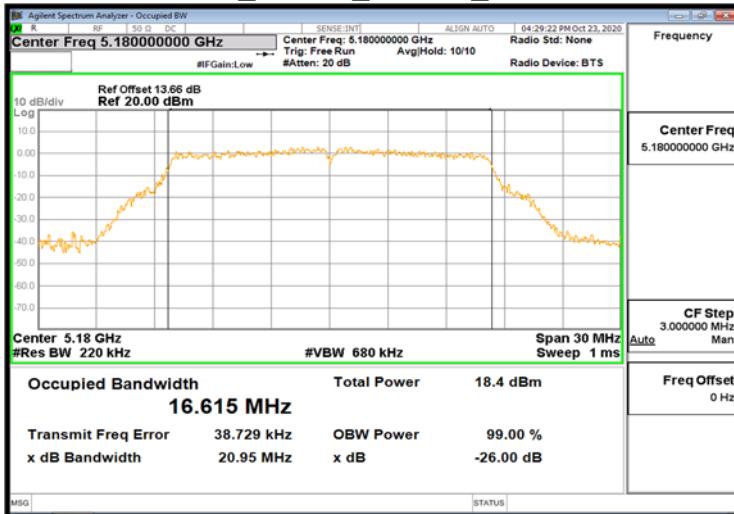
Freq. (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5775	75.55	18.780

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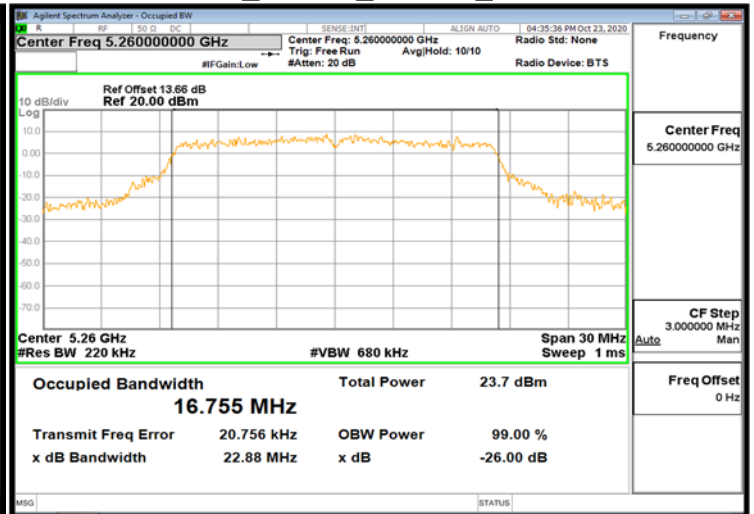
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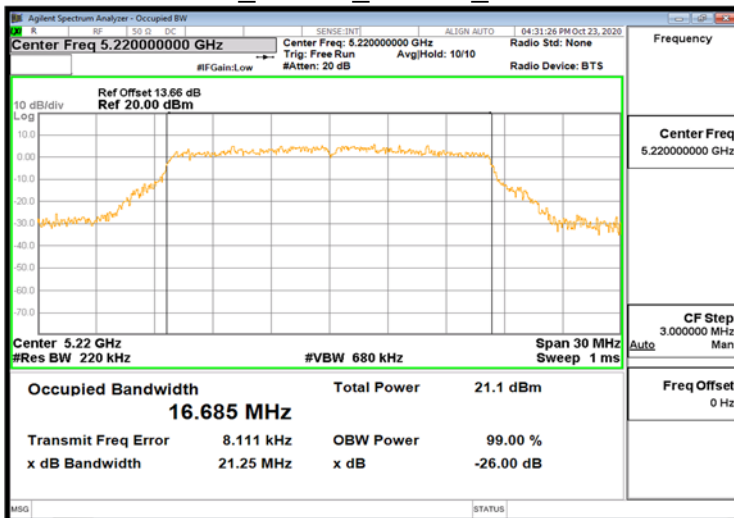
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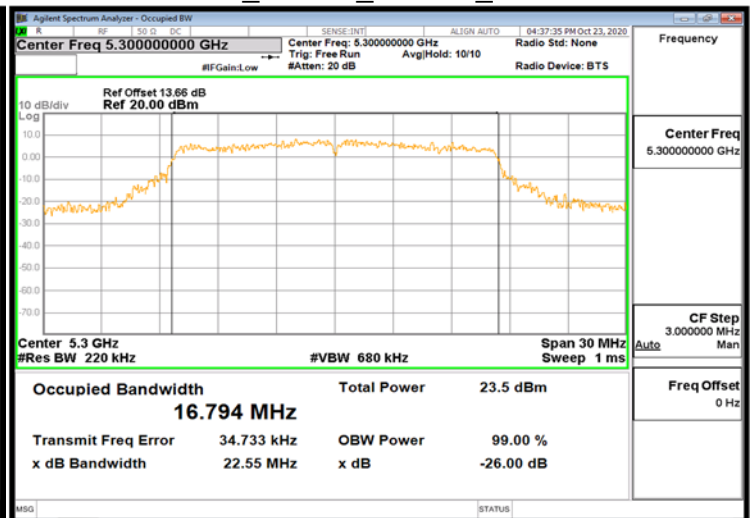
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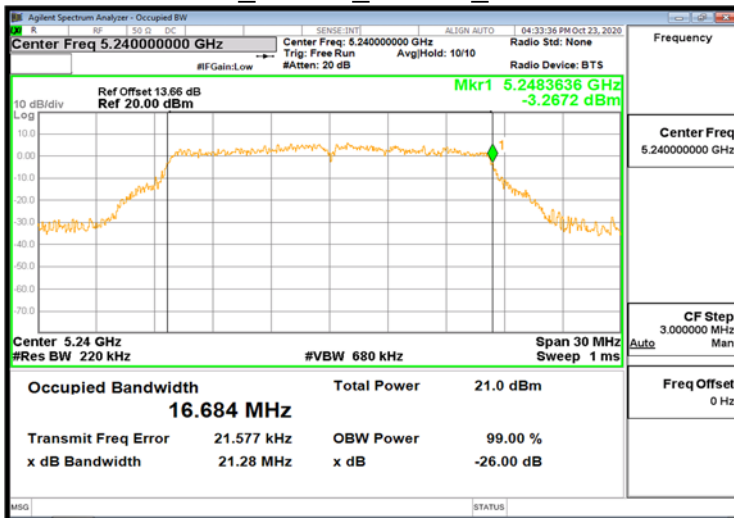
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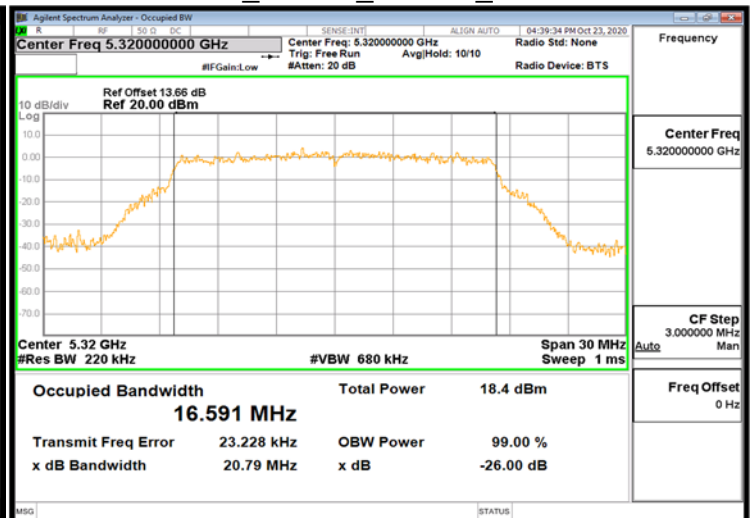
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802.11a_20MHz_Chain1_5240MHz



802.11a_20MHz_Chain1_5320MHz

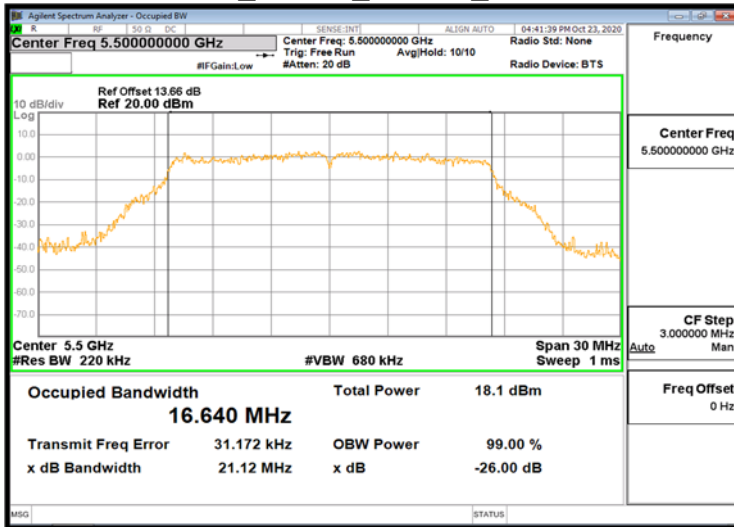


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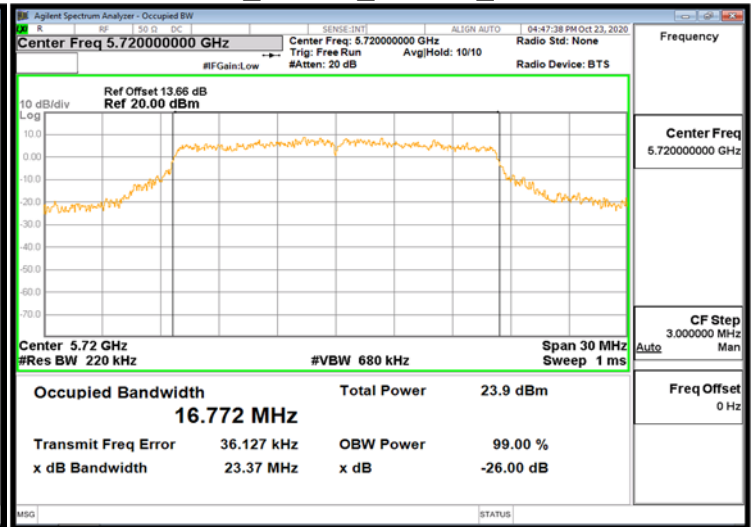
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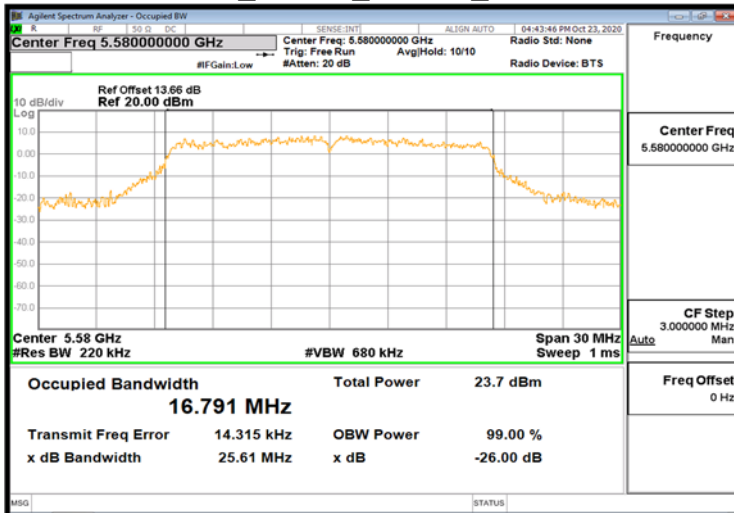
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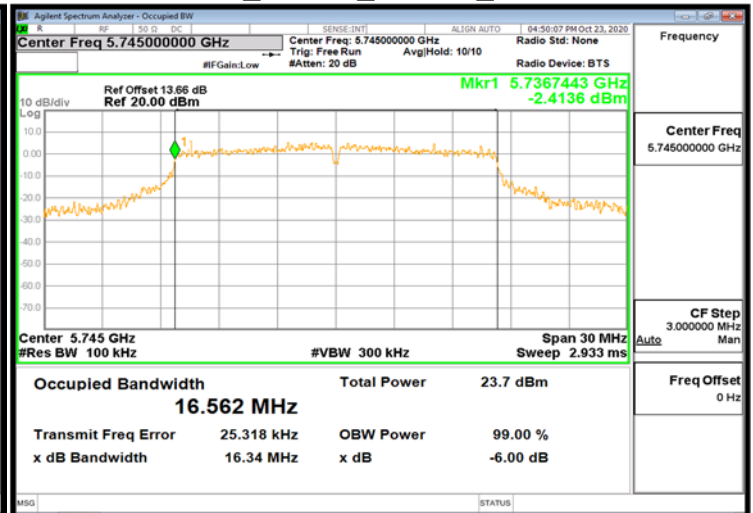
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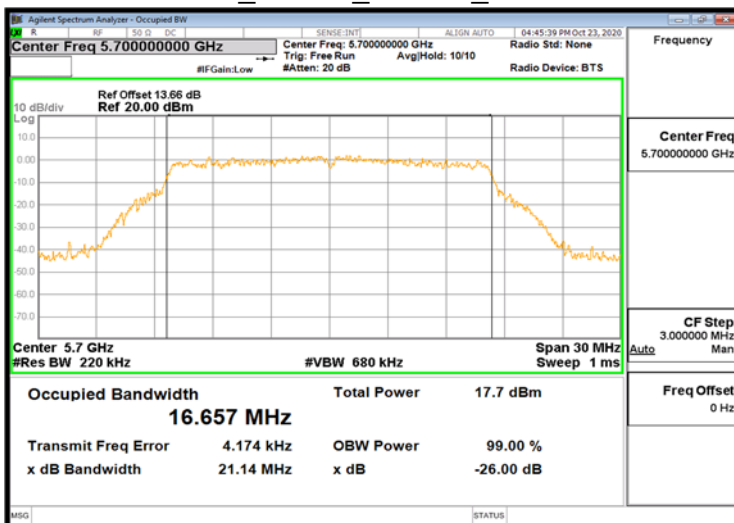
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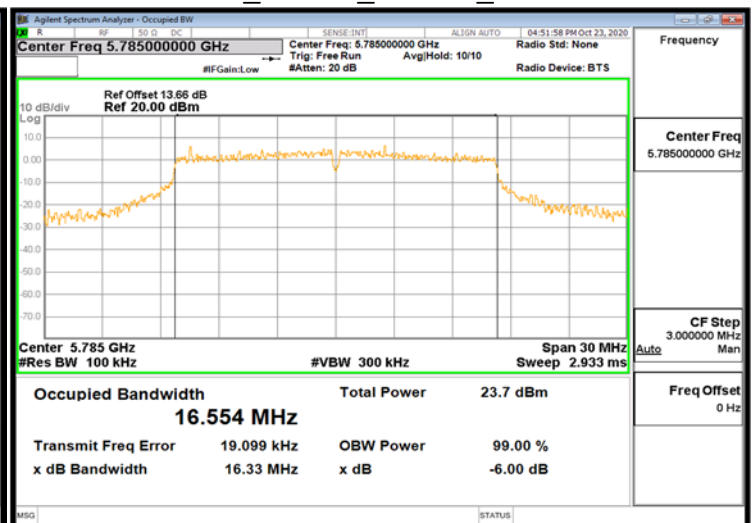
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802.11a_20MHz_Chain1_5700MHz



802.11a_20MHz_Chain1_5785MHz

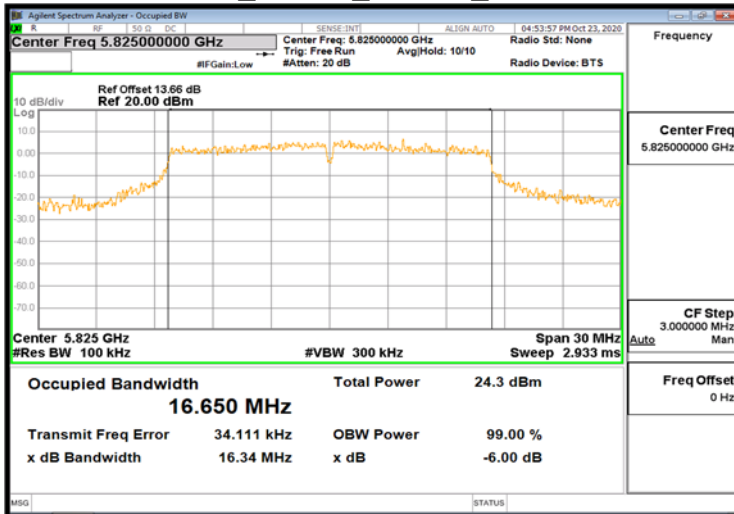


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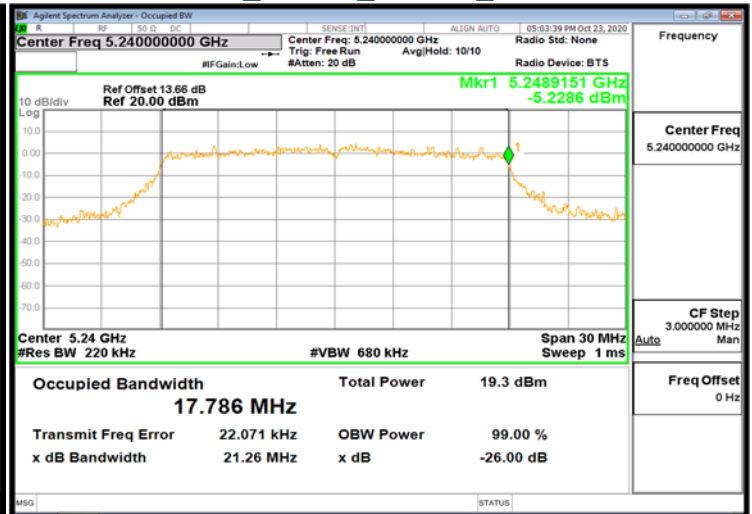
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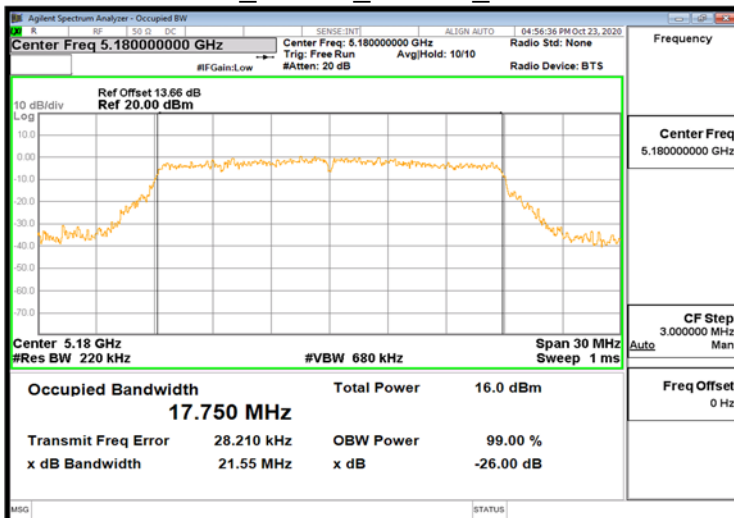
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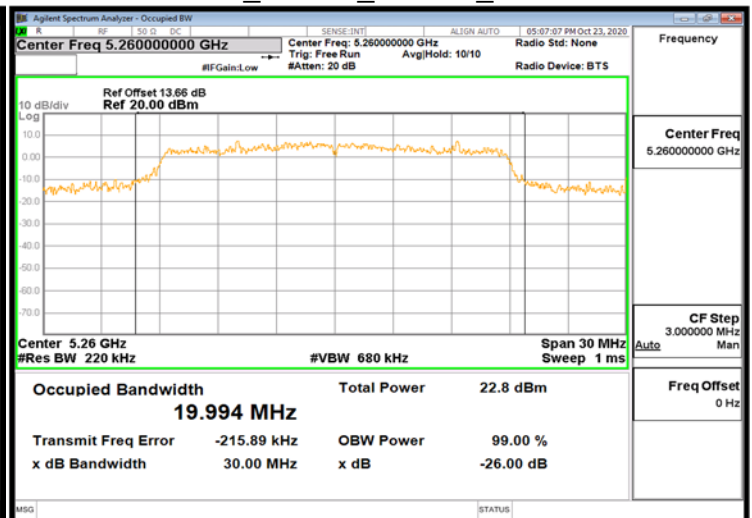
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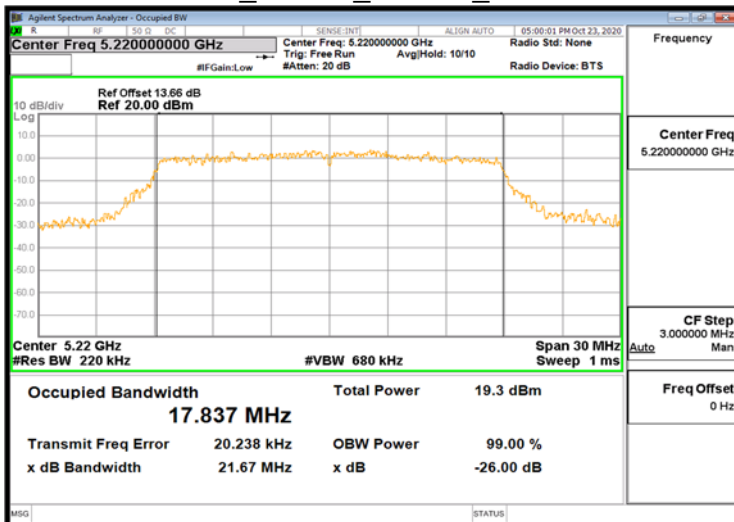
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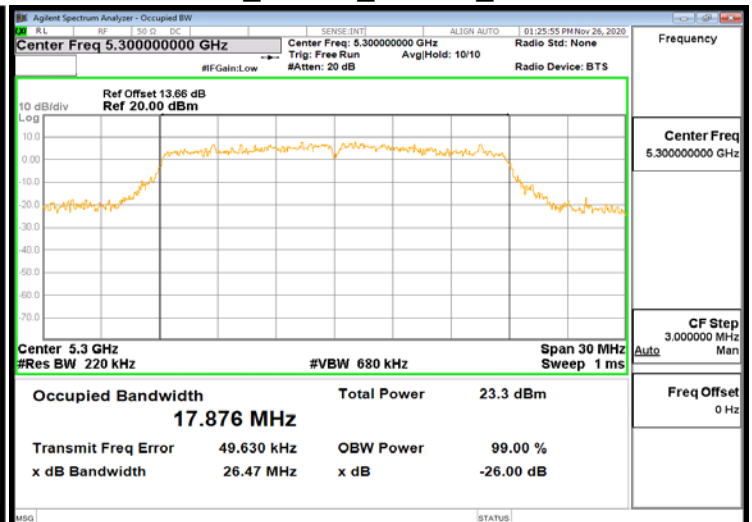
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802.11n_20MHz_Chain0_5220MHz



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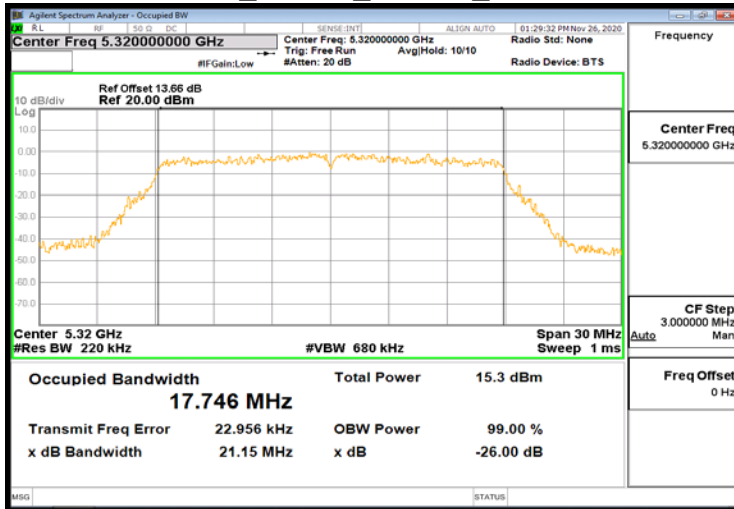


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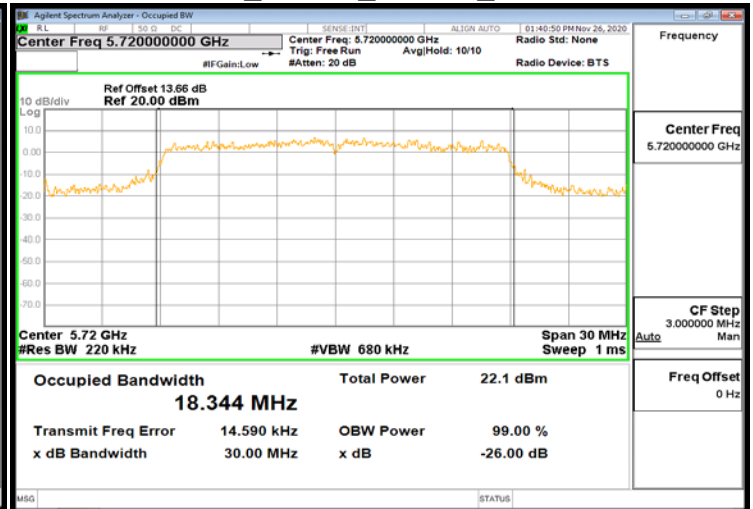
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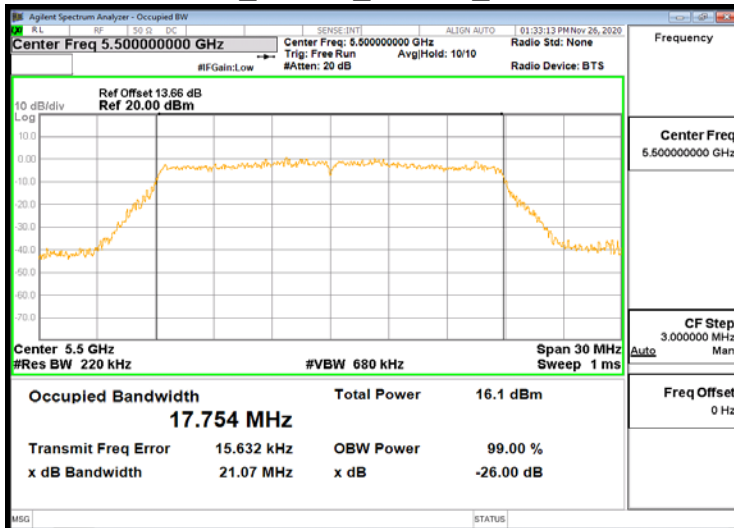
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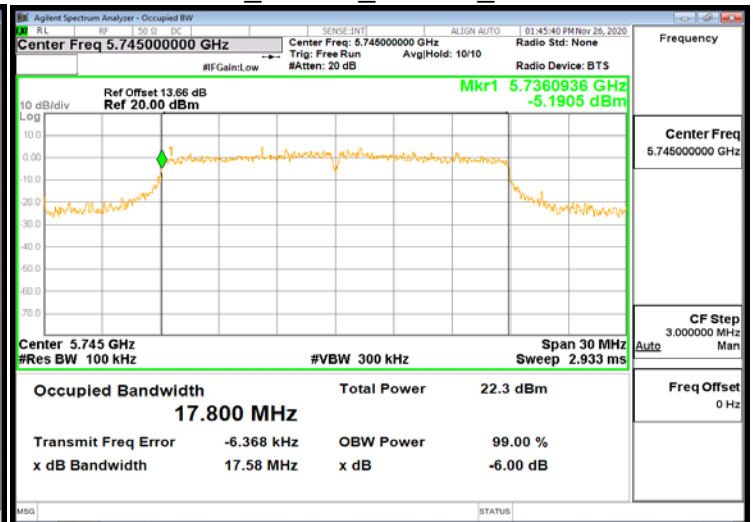
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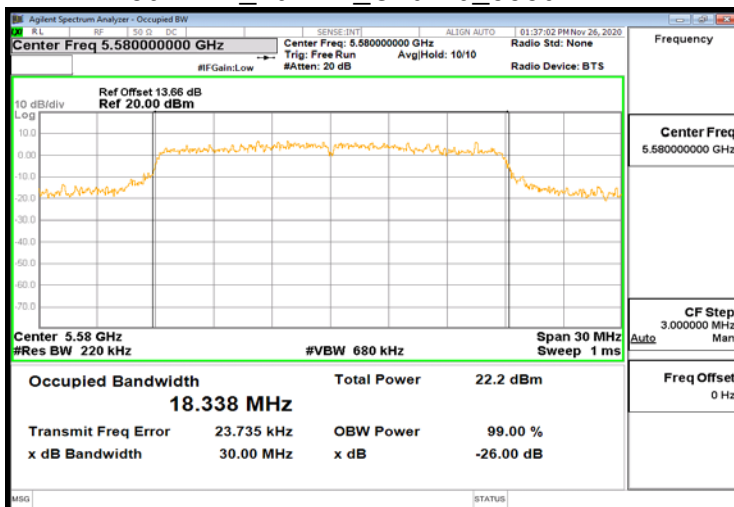
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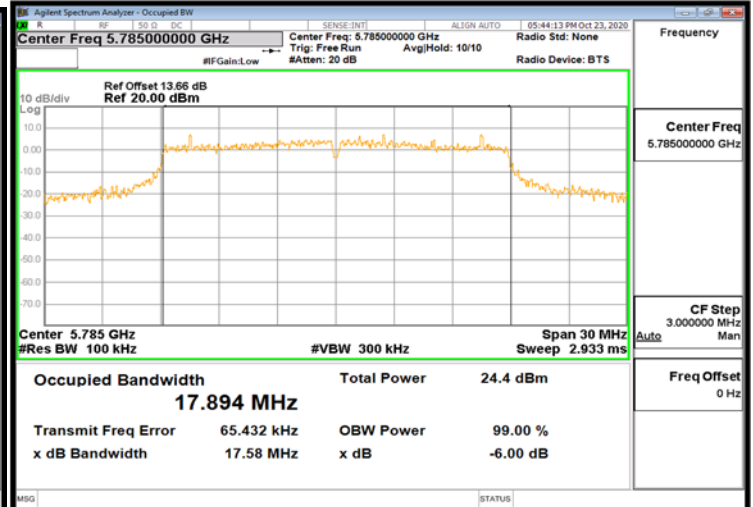
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802.11n_20MHz_Chain0_5580MHz



802.11n_20MHz_Chain0_5785MHz

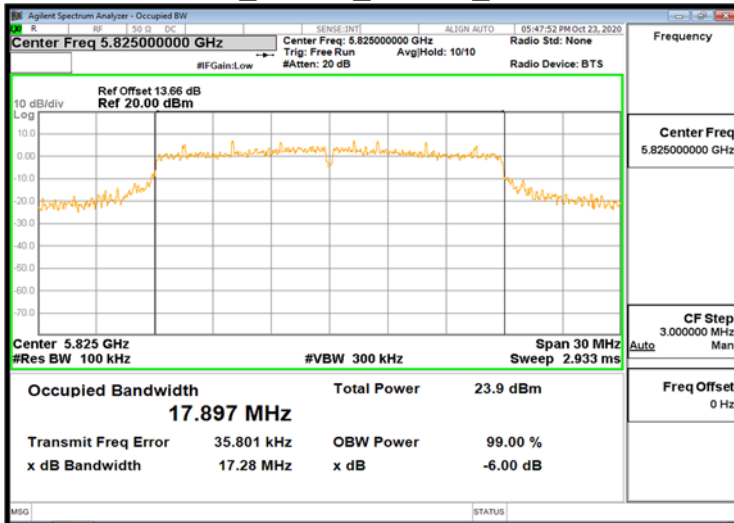


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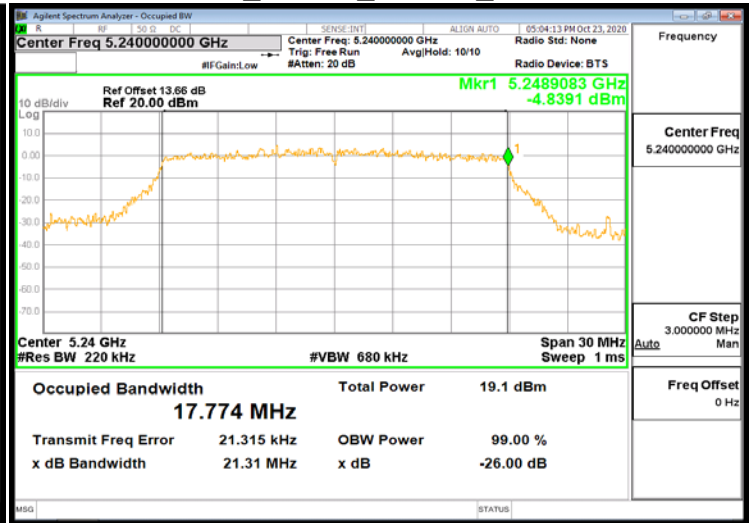
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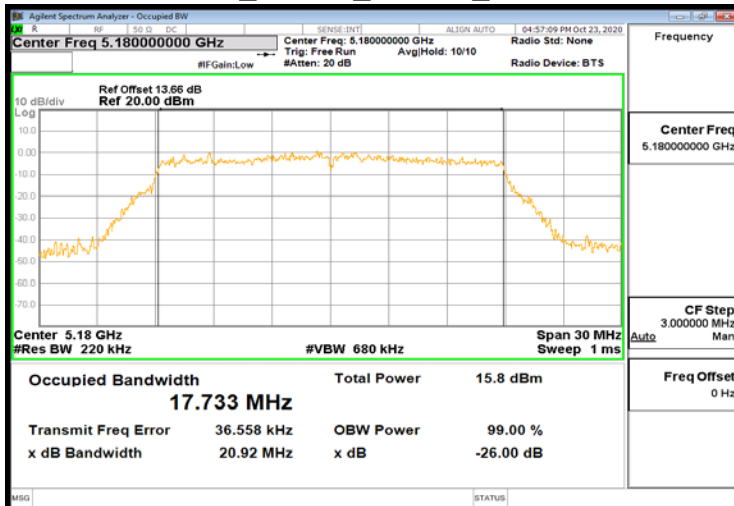
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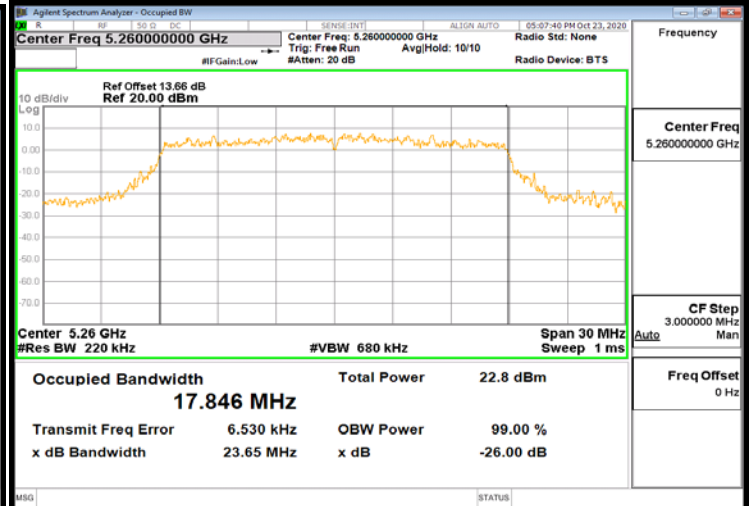
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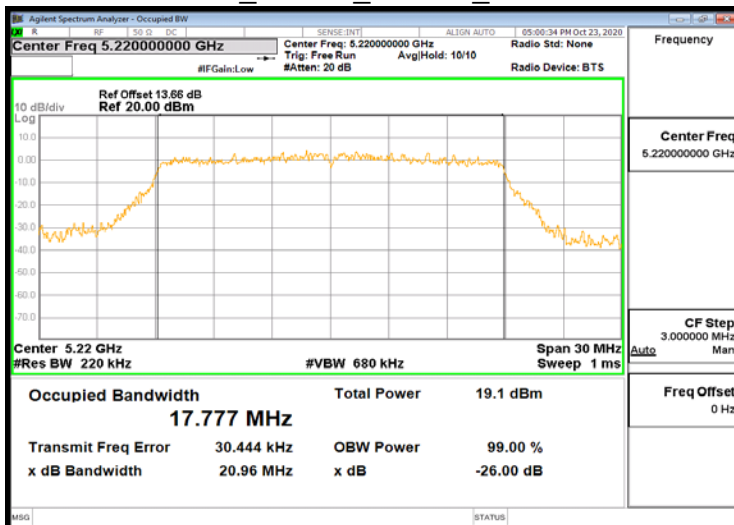
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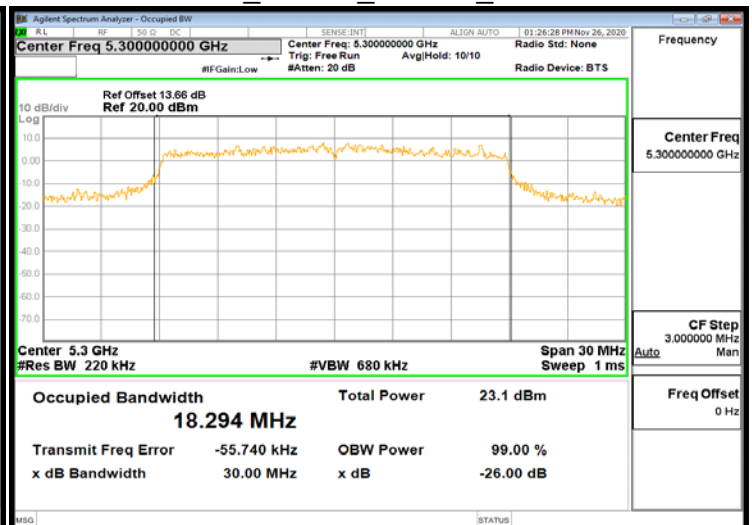
802.11n_20MHz_Chain1_5260MHz



802.11n_20MHz_Chain1_5220MHz



802.11n_20MHz_Chain1_5300MHz

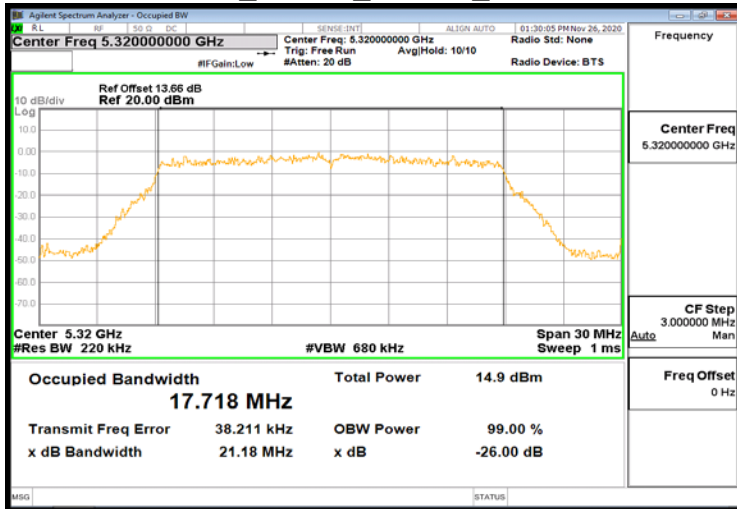


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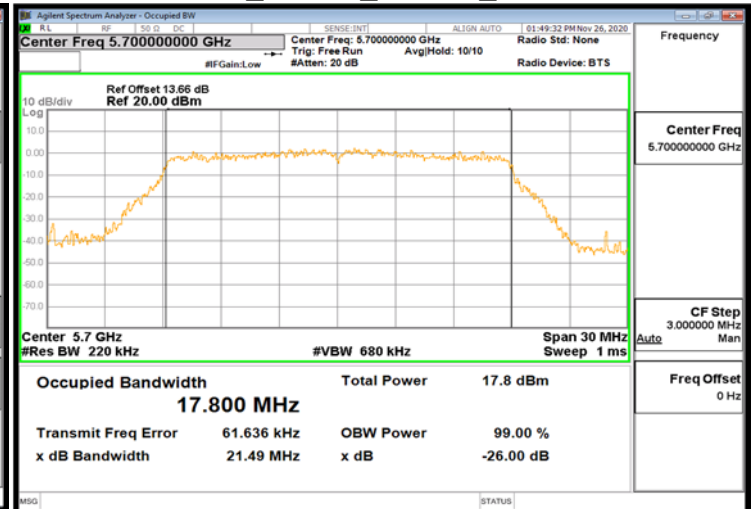
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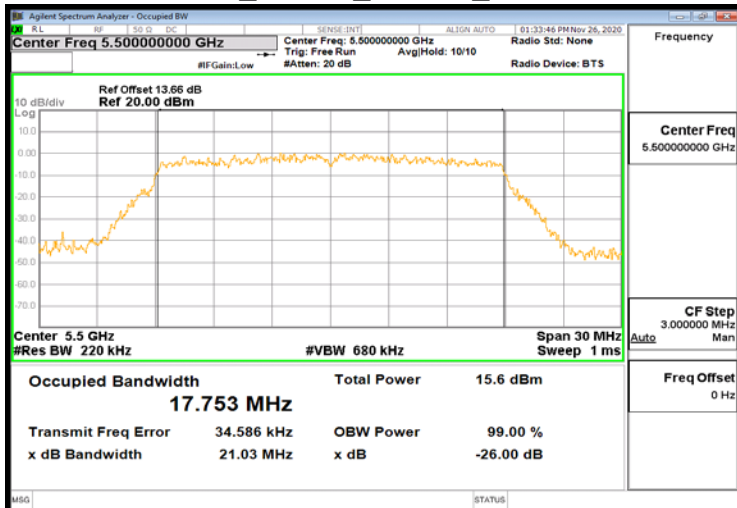
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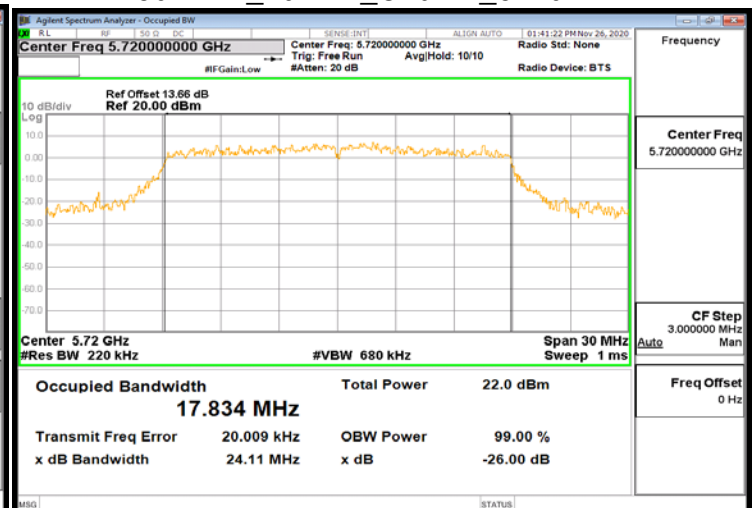
802.11n_20MHz_Chain1_5700MHz



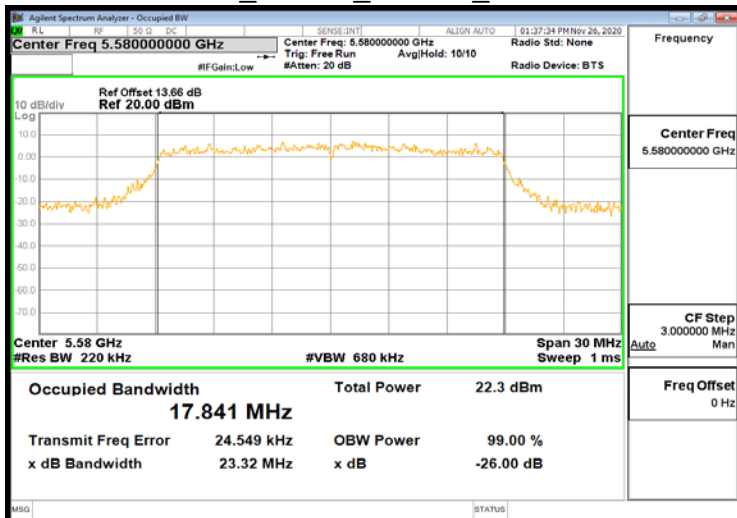
802.11n_20MHz_Chain1_5500MHz



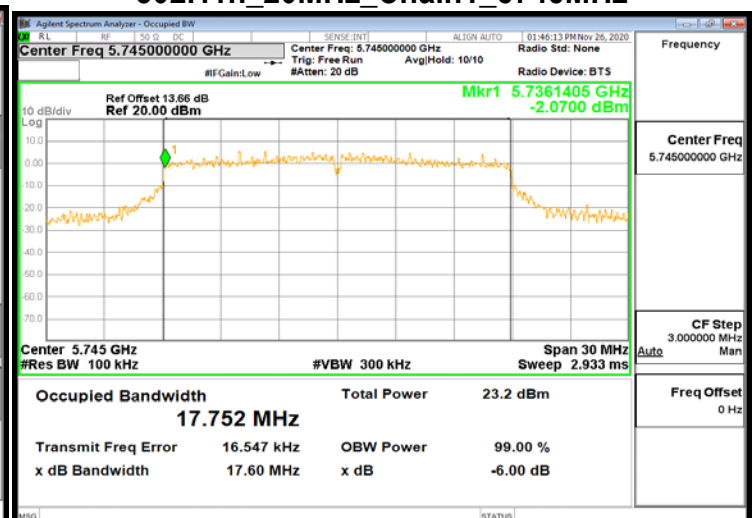
802.11n_20MHz_Chain1_5720MHz



802.11n_20MHz_Chain1_5580MHz



802.11n_20MHz_Chain1_5745MHz

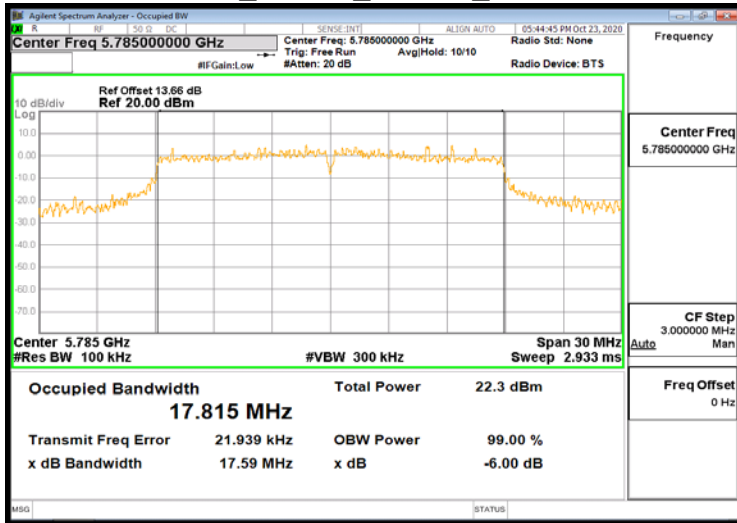


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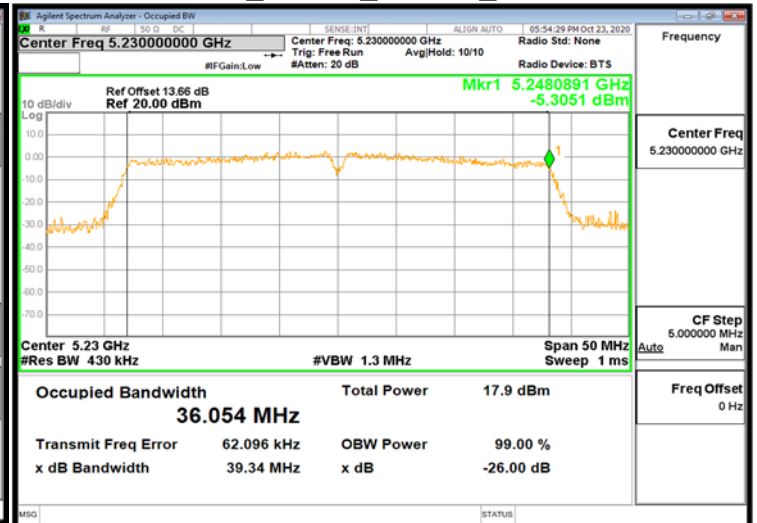
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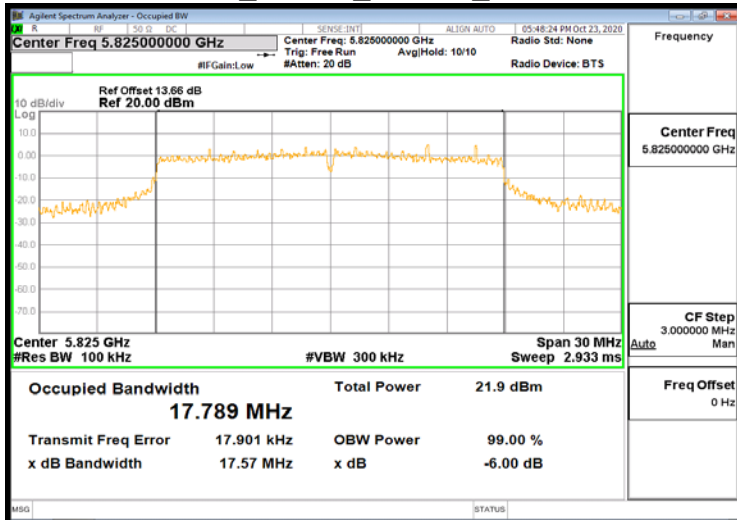
802.11n_20MHz_Chain1_5785MHz



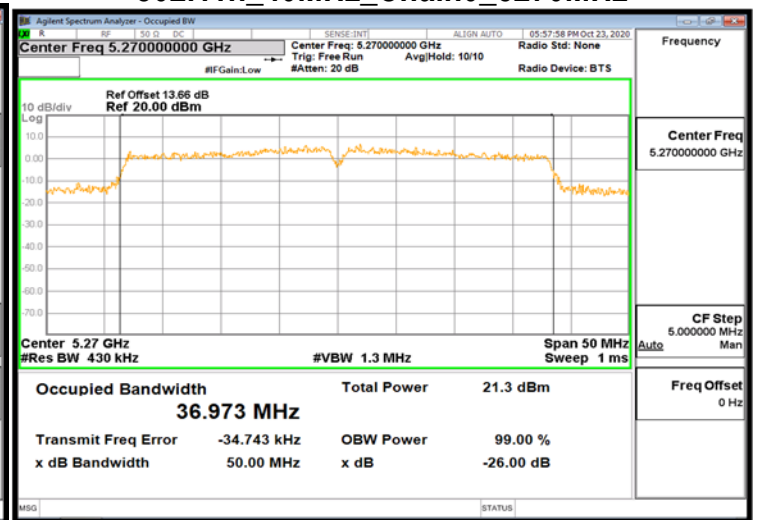
802.11n_40MHz_Chain0_5230MHz



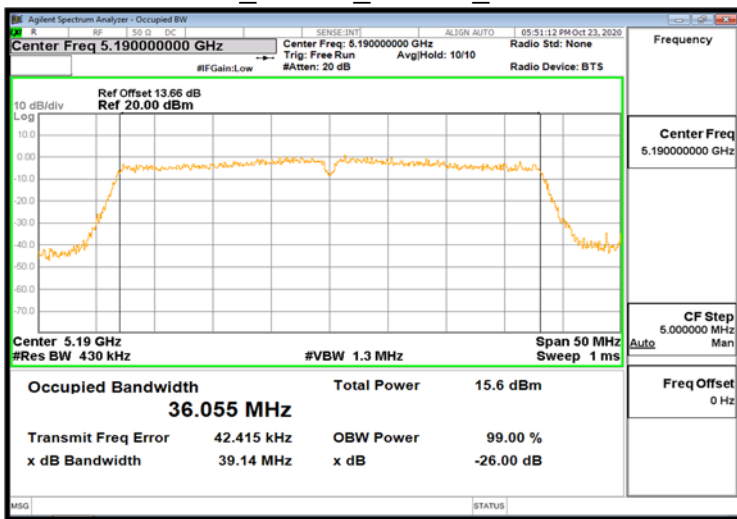
802.11n_20MHz_Chain1_5825MHz



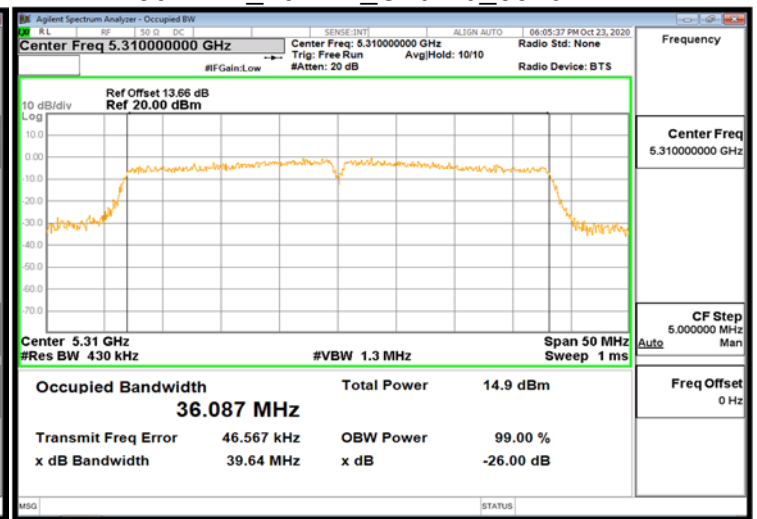
802.11n_40MHz_Chain0_5270MHz



802.11n_40MHz_Chain0_5190MHz



802.11n_40MHz_Chain0_5310MHz

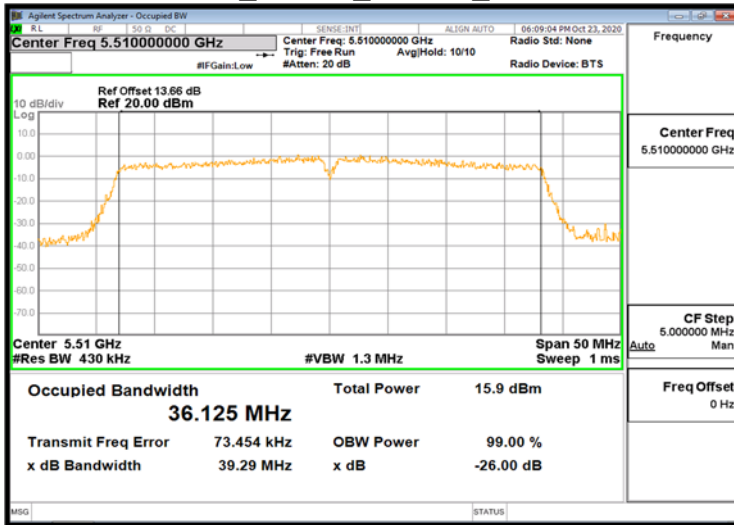


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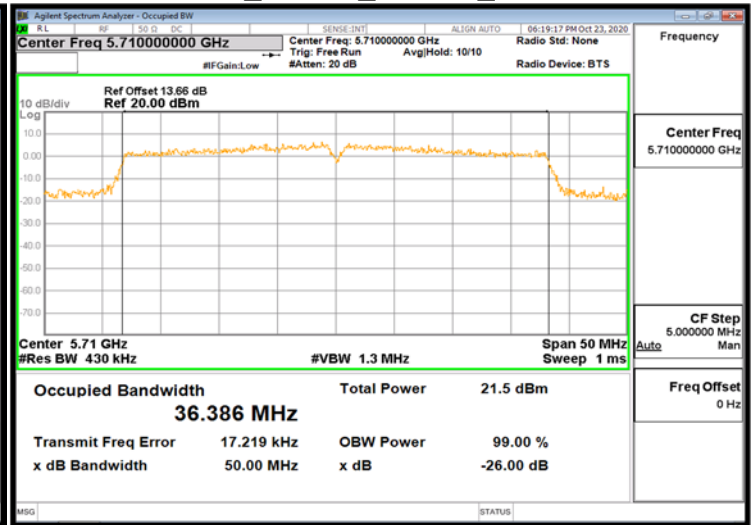
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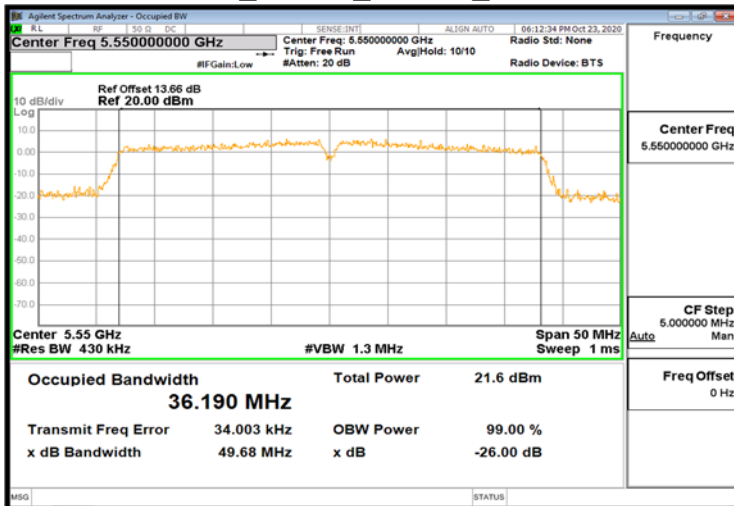
802.11n_40MHz_Chain0_5510MHz



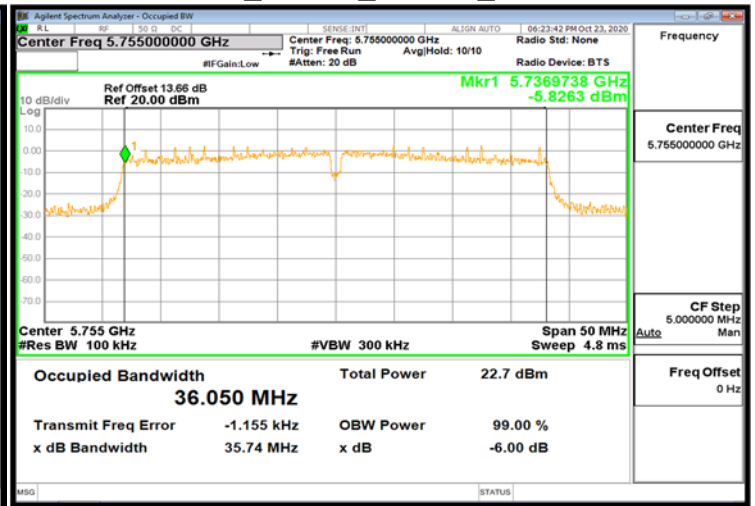
802.11n_40MHz_Chain0_5710MHz



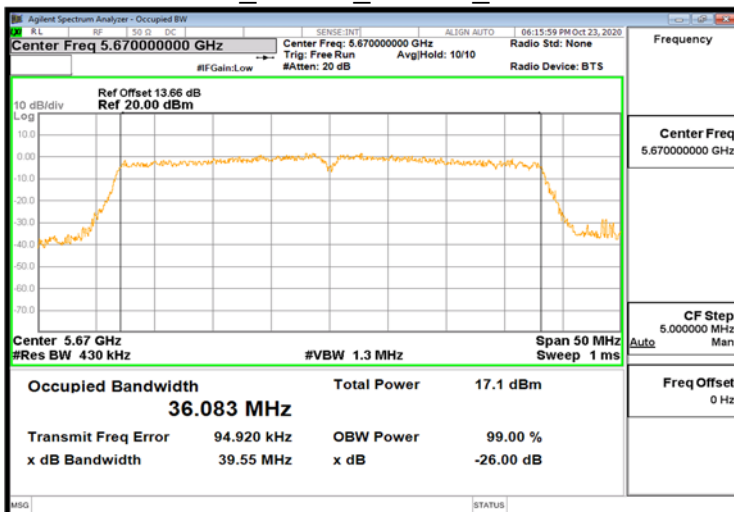
802.11n_40MHz_Chain0_5550MHz



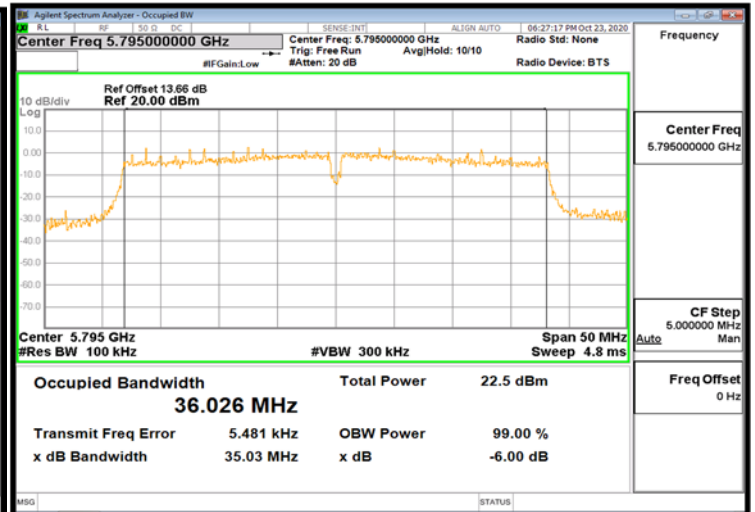
802.11n_40MHz_Chain0_5755MHz



802.11n_40MHz_Chain0_5670MHz



802.11n_40MHz_Chain0_5795MHz



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