

**ELECTROMAGNETIC EMISSIONS
COMPLIANCE REPORT**

FCC Applicant: Cisco Systems Inc.
125 West Tasman Dr, Bldg. P, San Jose, California, 95134
USA
Product Name: FM4500FIBER-HW
Brand Name: Cisco Fluidmesh FM4500 FIBER
Model No.: FM4500F
Model Difference: N/A
Report Number: ER/2021/A0117
FCC ID R5SX500F
Issue Date: March 29, 2022
Date of Test: November 30, 2021~February 24, 2022
Date of EUT Received: October 28, 2021

JJ Chen

Approved By

JJ Chen

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 comply with FCC rule part §15.407.

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

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Revision History

Report Number	Revision	Description	Issue Date	Revised By	Remark
ER/2021/A0117	00	Original.	March 29, 2022	Karen Huang	

Note:

- 1、The remark "*" indicates modification of the report upon requests from certification body.

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Contents

1	GENERAL INFORMATION	4
2	SYSTEM TEST CONFIGURATION	8
3	SUMMARY OF TEST RESULT	11
4	DESCRIPTION OF TEST MODES	12
5	MEASUREMENT UNCERTAINTY	15
6	MEASUREMENT EQUIPMENT USED	16
7	CONDUCTED EMISSION TEST	17
8	EMISSION BANDWIDTH MEASUREMENT	23
9	MAXIMUM CONDUCTED OUTPUT POWER MEASUREMENT	39
10	MAXIMUM POWER SPECTRAL DENSITY	47
11	UNDESIRABLE RADIATED EMISSION MEASUREMENT	60
12	TRANSMISSION IN THE ABSENCE OF DATA.....	260
13	ANTENNA REQUIREMENT	261

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1 GENERAL INFORMATION

1.1 Product Description

Product Name:	FM4500FIBER-HW
Brand Name:	Cisco Fluidmesh FM4500 FIBER
Model No.:	FM4500F
Model Difference:	N/A
Hardware Version:	N/A
Firmware Version:	N/A
EUT Series No.:	4501170639
Power Supply:	56Vdc

1.2 Modulation & Data Rate

Modulation type:	64QAM, 16QAM, QPSK, BPSK for OFDM
	256QAM for OFDM in 802.11ac only
Transition Rate:	802.11 n_20MHz: 6.5 - 144.4 Mbps
	802.11 n_40MHz: 13.5 - 300 Mbps
	802.11 ac_20MHz: 6.5 - 173.4 Mbps
	802.11 ac_40MHz: 13.5 - 400 Mbps
	802.11 ac_80MHz: 29.3 - 866.6 Mbps

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1.3 Antenna Designation

Antenna Type	Supplier	Antenna Part No.	Freq. (MHz)	Peak Antenna Gain (dBi)	Directional Gain (dBi)
Omni-direction	Fluidmesh	FM-OMNI-5-V	5150~5250	4.0	7.52
			5250~5350	4.0	7.52
			5470~5725	4.0	7.52
			5725~5850	4.0	7.52
Omni-direction	Fluidmesh	FM-OMNI-5-H	5150~5250	5.0	7.52
			5250~5350	5.0	7.52
			5470~5725	5.0	7.52
			5725~5850	5.0	7.52
Omni-direction	Fluidmesh	FM-SHARK-DUAL	5150~5250	13.0	16.01
			5250~5350	13.0	16.01
			5470~5725	13.0	16.01
			5725~5850	13.0	16.01
Directional	Fluidmesh	FM-TUBE	5150~5250	14.6	17.61
			5250~5350	14.6	17.61
			5470~5725	14.6	17.61
			5725~5850	14.6	17.61

Note:

1. Pre-scanned was done on the above antennas, measurements were demonstrated by using the antenna with the highest gain as the worst case scenarios.
2. Antenna information is provided by the applicant.

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1.4 FCC

Wi-Fi	Frequency Range	Channels	Rated Power(Avg) (dBm) (Worst Case)	Modulation Technology
n_HT/ ac_VHT 20M	5180~5240	4	9.90 dBm	OFDM
	5260~5320	4	10.53 dBm	OFDM
	5500~5700	11	10.31 dBm	OFDM
	5745~5825	5	18.03 dBm	OFDM
n_HT/ ac_VHT 40M	5190~5230	2	9.96 dBm	OFDM
	5270~5310	2	12.31 dBm	OFDM
	5510~5670	5	12.33 dBm	OFDM
	5755~5795	2	17.59 dBm	OFDM
ac_VHT 80M	5210	1	7.29 dBm	OFDM
	5290	1	0.13 dBm	OFDM
	5530~5610	2	12.01 dBm	OFDM
	5775	1	15.92 dBm	OFDM

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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

ANSI C63.10:2013

1.6 Test Facility

Laboratory	Test Site Address	Test Site Name	FCC Designation number	IC CAB identifier
SGS Taiwan Ltd. Central RF Lab. (TAF code 3702)	No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan.	SAC 1	TW0027	TW3702
		SAC 3		
		Conduction 1		
		Conducted 1		
		Conducted 2		
		Conducted 3		
		Conducted 4		
		Conducted 5		
		Conducted 6		
	No.2, Keji 1st Rd., Guishan District, Taoyuan City, Taiwan 333	Conduction C	TW0028	
		SAC C		
		SAC D		
		SAC G		
		Conducted A		
		Conducted B		
		Conducted C		
		Conducted D		
		Conducted E		
		Conducted F		
		Conducted G		

Note: Test site name is remarked on the equipment list in each section of this report as an indication where measurements occurred in specific test site and address.

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 30MHz. The CISPR Quasi-Peak and Average detector mode is employed. The two LISNs provide 50uH/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.

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2.4 Measurement Results Explanation Example

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

Radiated emission below 30MHz is measured in a 9m*6m*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:

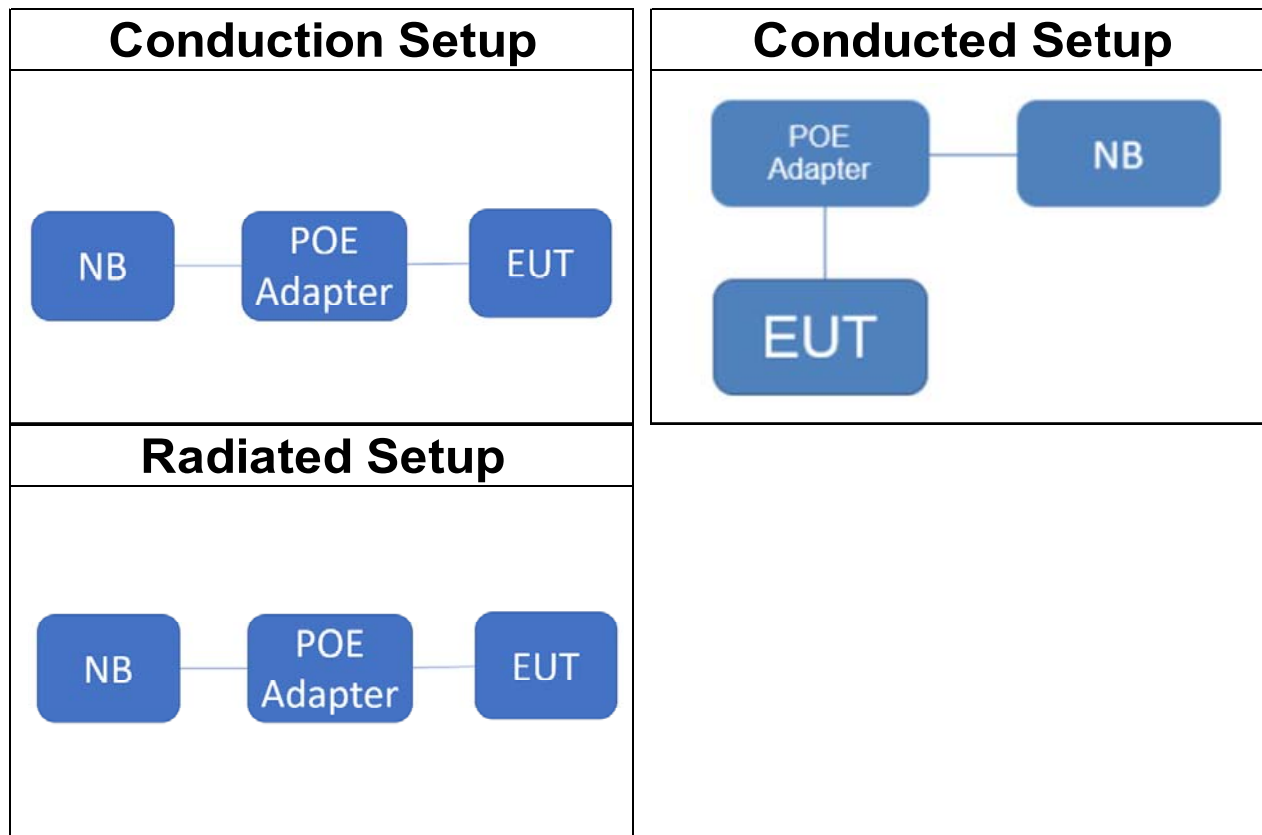
The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuation factor between EUT conducted port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly EUT RF output level.

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2.5 Test Configuration



2.6 Control Unit(s)

Conducted Emission Test Site: Conduction 1					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Test Software	audix	e3	Ver. 9 210322	N.C.R	N.C.R
Notebook	Lenovo	L430	R9-WGNK5 13/01	N/A	N/A
POE Adapter	PHIHONG	POE29U1AT(PL)	PHI242904KM	N/A	N/A

Conducted Emission Test Site: Conducted 2					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
POE Adapter	Fluidmesh	POE29U-1AT(PL)	PHI242904KX	N/A	N/A
Notebook	Lenovo	T440P	PC-089AH5	N/A	N/A

Radiated Emission Test Site: SAC 3					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Test Software	audix	e3	Ver. 9 210322	N.C.R	N.C.R
Notebook	Lenovo	L430	R9-WGNK5 13/01	N/A	N/A
POE Adapter	PHIHONG	POE29U1AT(PL)	PHI242904KM	N/A	N/A

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3 SUMMARY OF TEST RESULT

FCC Rules	Description Of Test	Result
§15.207	AC Power Line Conducted Emission	Compliant
§15.407(e)	Emission Bandwidth	Compliant
§15.407(a)	Maximum Conducted Output Power	Compliant
§15.407(a)	Power Spectral Density	Compliant
§15.205 §15.209 §15.407(b)	Undesirable Radiated Emissions	Compliant
§15.407(c)	Transmission in case of Absence of Information	Compliant
§15.203	Antenna Requirement	Compliant

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4 DESCRIPTION OF TEST MODES

4.1 Operating Frequencies

Operated band in 5150 MHz ~5250 MHz:

20 M		40 M		80 M	
CH	Freq (MHz)	CH	Freq (MHz)	CH	Freq (MHz)
36	5180	38	5190	42	5210
40	5200	46	5230		
44	5220				
48	5240				

Operated band in 5250 MHz ~5350 MHz:

20 M		40 M		80 M	
CH	Freq (MHz)	CH	Freq (MHz)	CH	Freq (MHz)
52	5260	54	5270	58	5290
56	5280	62	5310		
60	5300				
64	5320				

Operated band in 5470 MHz ~5725 MHz:

20 M		40 M		80 M	
CH	Freq (MHz)	CH	Freq (MHz)	CH	Freq (MHz)
100	5500	102	5510	106	5530
104	5520	110	5550	122	5610
108	5540	118	5590		
112	5560	126	5630		
116	5580	134	5670		
120	5600				
124	5620				
128	5640				
132	5660				
136	5680				
140	5700				

Operated band in 5725 MHz ~5850 MHz:

20 M		40 M		80 M	
CH	Freq (MHz)	CH	Freq (MHz)	CH	Freq (MHz)
149	5745	151	5755	155	5775
153	5765	159	5795		
157	5785				
161	5805				
165	5825				

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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
☐ 802.11 a	☐ Ch0	☐ Ch1	☐ Ch2	☐ Ch3	☐ 1TX	☐ 2TX
☒ 802.11 n	☒ Ch0	☒ Ch1	☐ Ch2	☐ Ch3	☐ SISO	☒ MIMO
☒ 802.11 ac	☒ Ch0	☒ Ch1	☐ Ch2	☐ Ch3	☐ SISO	☒ MIMO
☐ 802.11 ax	☐ Ch0	☐ Ch1	☐ Ch2	☐ Ch3	☐ SISO	☐ 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.

RADIATED EMISSION TEST (BELOW 1 GHz)						
MODE	FREQUENCY BAND (MHz)	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT
802.11_HT20	5180~5240	36 to 48	44	OFDM	MCS8	MIMO
	5260~5320	52 to 64	60			
	5500~5700	100 to 140	116			
	5745~5825	149 to 165	157			
RADIATED EMISSION TEST (ABOVE 1 GHz)						
MODE	FREQUENCY BAND (MHz)	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT
802.11n_HT20	5180~5240	36 to 48	36,44,48	OFDM	MCS8	MIMO
	5260~5320	52 to 64	52,60,64			
	5500~5700	100 to 140	100,116,140			
	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			
	5510~5670	102 to 134	102,110,134			
	5755~5795	151 to 159	151,159			
802.11ac_VHT80	5210	42	42	OFDM	MCS0	MIMO
	5290	58	58			
	5530~5610	106 to 122	106,122			
	5775	155	155			

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CONDUCTED TEST						
MODE	FREQUENCY BAND (MHz)	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT
802.11n_HT20	5180~5240	36 to 48	36,44,48	OFDM	MCS8	MIMO
	5260~5320	52 to 64	52,60,64			
	5500~5700	100 to 140	100,116,140			
	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			
	5510~5670	102 to 134	102,110,134			
	5755~5795	151 to 159	151,159			
802.11ac_VHT80	5210	42	42	OFDM	MCS0	MIMO
	5290	58	58			
	5530~5610	106 to 122	106,122			
	5775	155	155			

Note:

The field strength of radiated emission was measured as the EUT positioned in different orthogonal planes (E1/E2/H) based on actual usage of the EUT to pre-scan the emissions for determining the worst case scenario.

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5 MEASUREMENT UNCERTAINTY

Test Items	Uncertainty
AC Power Line Conducted Emission	+/- 2.34 dB
Output Power measurement	+/- 1 dB
Emission Bandwidth	+/- 1.53 Hz
Undesignable radiated emission measurement	+/- 1.68 dB
Peak Power Density	+/- 1.62 dB
Temperature	+/- 0.4 °C
Humidity	+/- 3.5 %
DC / AC Power Source	+/- 1 %

Radiated Spurious Emission Measurement Uncertainty			
Polarization: Vertical	+/-	2.57 dB	9kHz~30MHz
	+/-	4.85 dB	30MHz - 1000MHz
	+/-	4.45 dB	1GHz - 18GHz
	+/-	4.24 dB	18GHz - 40GHz
Polarization: Horizontal	+/-	2.57 dB	9kHz~30MHz
	+/-	4.37 dB	30MHz - 1000MHz
	+/-	4.45 dB	1GHz - 18GHz
	+/-	4.24 dB	18GHz - 40GHz

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 MEASUREMENT EQUIPMENT USED

6.1 Emission from AC power line

Conducted Emission Test Site: Conduction 1					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EMI Test Receiver	R&S	ESCI 7	100759	08/26/2021	08/25/2022
LISN	SCHWARZBECK	NSLK 8127	01040	08/10/2021	08/09/2022
LISN	SCHWARZBECK	NSLK 8127	01041	10/25/2021	10/24/2022
Coaxial Cables	N/A	Coaxial Cable	161207	12/07/2021	12/06/2022

6.2 Conducted Measurement

Conducted Emission Test Site: Conducted 2					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EXA Spectrum Analyzer	KEYSIGHT	N9010B	MY60240503	12/09/2021	12/08/2022
Power Meter	Anritsu	ML2496A	1804001	03/02/2021	03/01/2022
Power Sensor	Anritsu	MA2411B	1726104	03/02/2021	03/01/2022
Power Sensor	Anritsu	MA2411B	1726107	03/02/2021	03/01/2022
Attenuator	Mini-Circuit	BW-S10W2+	4	12/14/2021	12/13/2022
DC Block	Mini-Circuits	BLK-18-S+	1	12/14/2021	12/13/2022

6.3 Radiated Measurement

Radiated Emission Test Site: SAC 3					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Horn Antenna	SCHWARZBECK	BBHA9170	184	12/16/2021	12/15/2022
Horn Antenna	SCHWARZBECK	BBHA9120D	1441	09/27/2021	09/26/2022
Bi-log Antenna	SCHWARZBECK	VULB9168	378	08/20/2021	08/19/2022
Loop Antenna	ETS.LINDGREN	6502	148045	09/29/2021	09/28/2022
PXA Spectrum Analyzer	Agilent	N9030A	MY53120760	04/27/2021	04/26/2022
EMI Test Receiver	R&S	ESCI 7	100759	08/26/2021	08/25/2022
Pre-Amplifier	HP	8449B	3008A00578	12/16/2021	12/15/2022
Pre-Amplifier	EMC Instruments	EMC184045B	980135	10/27/2021	10/26/2022
Pre-Amplifier	HP	8447D	2944A07676	12/16/2021	12/15/2022
Attenuator	Mini-Circuit	BW-S10W2+	4	12/14/2021	12/13/2022
Filter 5150-5350 MHz	Micro-Tronics	BRM50703	1	12/14/2021	12/13/2022
Filter 5470-5725 MHz	Micro-Tronics	BRM50704	1	12/14/2021	12/13/2022
Filter 5725-5875 MHz	Micro-Tronics	BRM50705	1	12/14/2021	12/13/2022
High Pass Filter	WI	WHKX7.0/18G-8SS	45	12/14/2021	12/13/2022
Coaxial Cable	Huber Suhner	SUCOFLEX 102	MY2636/2	12/16/2021	12/15/2022
Coaxial Cable	Huber Suhner	SUCOFLEX 104	340057/4	12/16/2021	12/15/2022
Coaxial Cable	Huber Suhner	SUCOFLEX 104PEA	800052/2	12/16/2021	12/15/2022
Coaxial Cable	Huber Suhner	SUCOFLEX 102	MY2621/2	12/16/2021	12/15/2022
Coaxial Cable	Huber Suhner	SUCOFLEX 102	MY2617/2	12/16/2021	12/15/2022
Site Cal	SGS	SAC 3	N/A	01/01/2022	12/31/2022

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

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7 CONDUCTED EMISSION TEST

7.1 Standard Applicable

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

Frequency range MHz	Limits (dBuV)	
	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

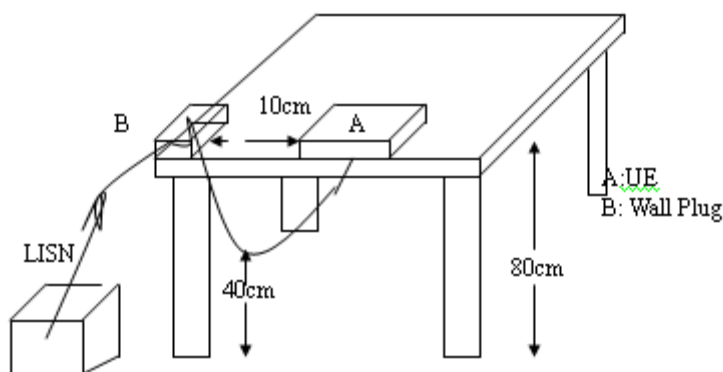
Note

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.

7.2 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.

7.3 Test SET-UP



7.4 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.

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7.5 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

7.5.1 FM4500F connect FM-SHARK-DUAL antenna

Report Number :ER/2021/A0017

Test Site :Conduction 1

Test Mode :WLAN 5G

Test Date :2022-02-24

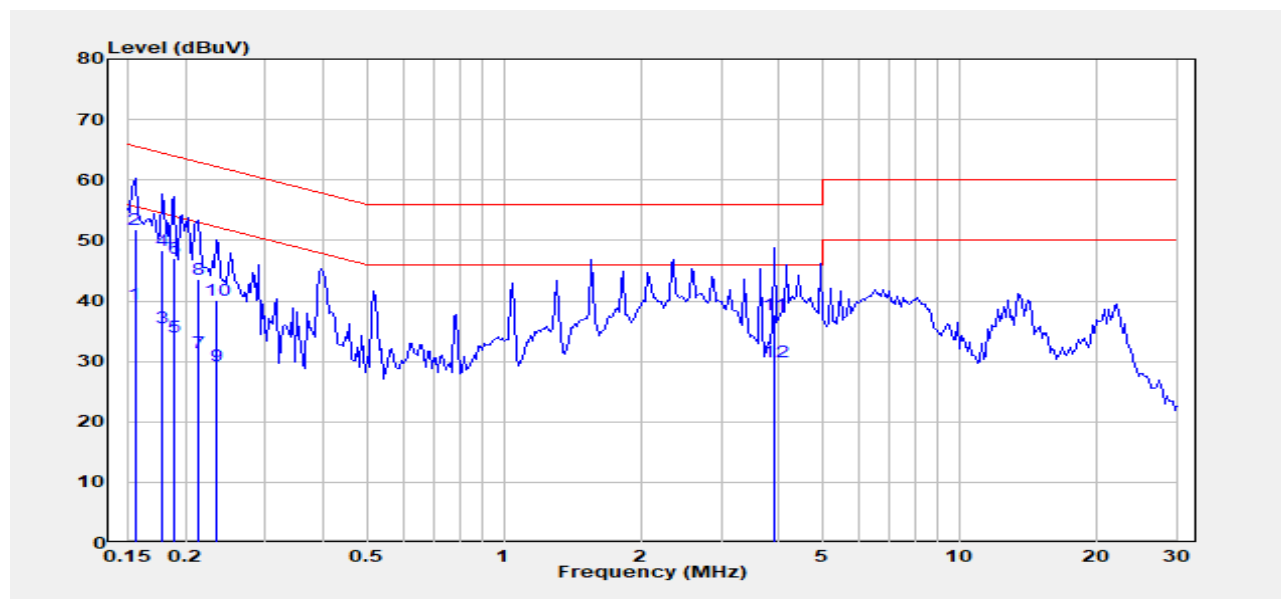
Power :120V/60Hz

Temp./Humi. :20.5/52

Probe :L

Engineer :Ricky Chen

Note: :



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV	Limit dBμV	Margin dB
0.155	Average	37.42	2.12	39.54	55.74	-16.20
0.155	QP	49.62	2.12	51.74	65.74	-14.00
0.178	Average	33.52	2.12	35.64	54.59	-18.95
0.178	QP	46.15	2.12	48.27	64.59	-16.32
0.189	Average	31.92	2.12	34.04	54.06	-20.02
0.189	QP	45.02	2.12	47.14	64.06	-16.92
0.213	Average	29.34	2.12	31.46	53.10	-21.64
0.213	QP	41.49	2.12	43.61	63.10	-19.49
0.234	Average	27.25	2.12	29.37	52.30	-22.93
0.234	QP	38.06	2.12	40.18	62.30	-22.12
3.922	Average	34.87	2.78	37.65	46.00	-8.35
3.922	QP	27.23	2.78	30.01	56.00	-25.99

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Report Number :ER/2021/A0017

Test Site :Conduction 1

Test Mode :WLAN 5G

Test Date :2022-02-24

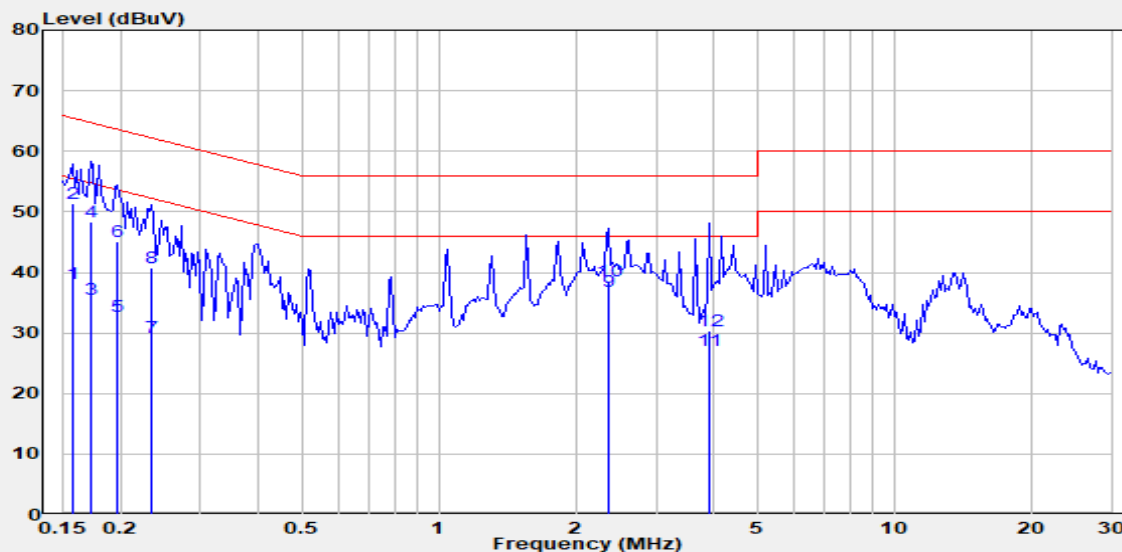
Power :120V/60Hz

Temp./Humi. :20.5/52

Probe :N

Engineer :Ricky Chen

Note: :



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV	Limit dBμV	Margin dB
0.156	Average	35.98	2.15	38.13	55.65	-17.52
0.156	QP	49.22	2.15	51.37	65.65	-14.28
0.172	Average	33.38	2.21	35.59	54.86	-19.27
0.172	QP	46.05	2.21	48.26	64.86	-16.60
0.198	Average	30.36	2.29	32.65	53.71	-21.06
0.198	QP	42.91	2.29	45.20	63.71	-18.51
0.234	Average	26.93	2.26	29.19	52.30	-23.11
0.234	QP	38.52	2.26	40.78	62.30	-21.52
2.358	Average	34.75	2.16	36.91	46.00	-9.09
2.358	QP	36.42	2.16	38.58	56.00	-17.42
3.922	Average	24.83	2.18	27.01	46.00	-18.99
3.922	QP	28.15	2.18	30.33	56.00	-25.67

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7.5.2 FM4500F connect FM-TUBE antenna

Report Number :ER/2021/A0017

Test Site :Conduction 1

Test Mode :WLAN 5G

Test Date :2022-02-24

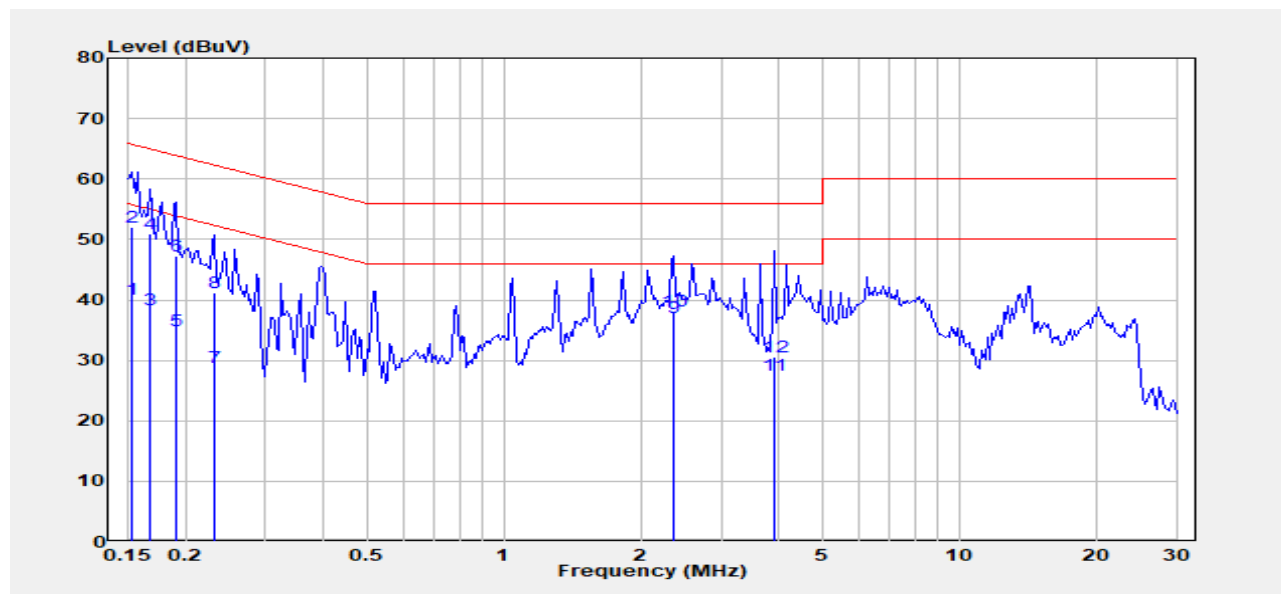
Power :120V/60Hz

Temp./Humi. :20.5/52

Probe :L

Engineer :Ricky Chen

Note :



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV	Limit dBμV	Margin dB
0.153	Average	37.91	2.12	40.03	55.82	-15.79
0.153	QP	49.92	2.12	52.04	65.82	-13.78
0.167	Average	36.35	2.12	38.47	55.12	-16.65
0.167	QP	48.93	2.12	51.05	65.12	-14.07
0.191	Average	32.83	2.12	34.95	53.98	-19.03
0.191	QP	45.16	2.12	47.28	63.98	-16.70
0.232	Average	26.73	2.12	28.85	52.39	-23.54
0.232	QP	39.17	2.12	41.29	62.39	-21.10
2.358	Average	34.86	2.30	37.16	46.00	-8.84
2.358	QP	35.92	2.30	38.22	56.00	-17.78
3.922	Average	24.75	2.78	27.53	46.00	-18.47
3.922	QP	27.68	2.78	30.46	56.00	-25.54

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Report Number :ER/2021/A0017

Test Site :Conduction 1

Test Mode :WLAN 5G

Test Date :2022-02-24

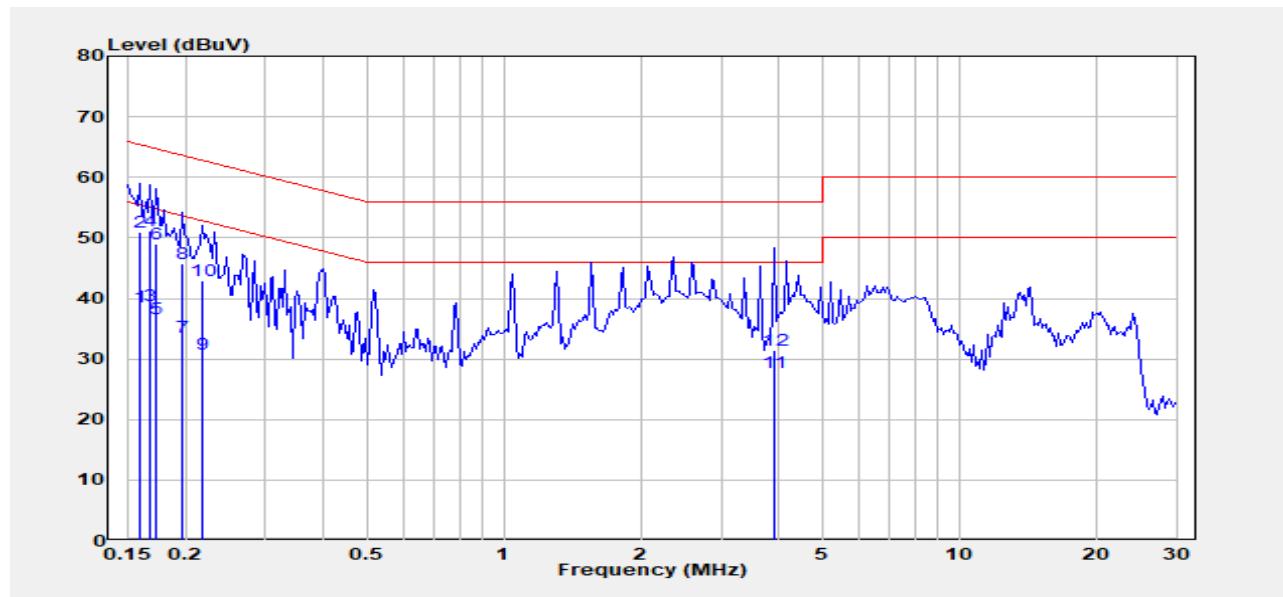
Power :120V/60Hz

Temp./Humi. :20.5/52

Probe :N

Engineer :Ricky Chen

Note: :



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV	Limit dBμV	Margin dB
0.158	Average	36.45	2.15	38.60	55.56	-16.96
0.158	QP	48.83	2.15	50.98	65.56	-14.58
0.167	Average	36.53	2.19	38.72	55.12	-16.40
0.167	QP	48.92	2.19	51.11	65.12	-14.01
0.172	Average	34.41	2.21	36.62	54.86	-18.24
0.172	QP	46.75	2.21	48.96	64.86	-15.90
0.198	Average	31.22	2.29	33.51	53.71	-20.20
0.198	QP	43.38	2.29	45.67	63.71	-18.04
0.217	Average	28.57	2.28	30.85	52.92	-22.07
0.217	QP	40.55	2.28	42.83	62.92	-20.09
3.922	Average	25.62	2.18	27.80	46.00	-18.20
3.922	QP	29.36	2.18	31.54	56.00	-24.46

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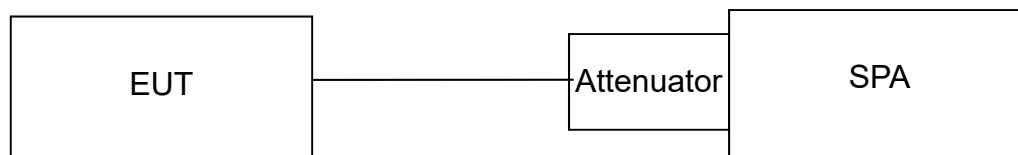
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8 EMISSION BANDWIDTH MEASUREMENT

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 Test Setup



8.3 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 = large enough to capture all products of the modulation process,
Detector=Peak,
Sweep=auto
 - b. Mark the peak frequency and -6dB (upper and lower) frequency.
6. Repeat above procedures until all frequency of interest measured was complete.

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8.4 Measurement Result

8.4.1 FCC Occupied Bandwidth

802.11n_HT20_Ch0

Freq. (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5180	20.04	13.020
5220	19.85	12.980
5240	19.79	12.960
5260	20.15	13.040
5300	20.12	13.040
5320	20.05	13.020
5500	20.08	13.030
5580	20.27	13.070
5700	20.03	13.020

802.11n_HT20_Ch0

Freq. (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5745	17.65	12.470
5785	17.70	12.480
5825	17.65	12.470

802.11n_HT20_Ch0

Freq. (MHz)	Measured Freq. (MHz)	Limit (MHz)
5240	5248.81	< 5250
5745	5736.21	> 5725

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802.11n_HT20_Ch1

Freq. (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5180	19.87	12.980
5220	20.00	13.010
5240	20.06	13.020
5260	20.04	13.020
5300	19.95	13.000
5320	19.99	13.010
5500	19.82	12.970
5580	19.88	12.980
5700	20.01	13.010

802.11n_HT20_Ch1

Freq. (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5745	17.69	12.480
5785	17.61	12.460
5825	17.65	12.470

802.11n_HT20_Ch1

Freq. (MHz)	Measured Freq. (MHz)	Limit (MHz)
5240	5248.82	< 5250
5745	5736.20	> 5725

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802.11n_HT40_Ch0

Freq. (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5190	40.56	16.080
5230	40.26	16.050
5270	40.49	16.070
5310	40.13	16.030
5510	40.01	16.020
5550	40.12	16.030
5670	40.42	16.070

802.11n_HT40_Ch0

Freq. (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5755	36.42	15.610
5795	36.37	15.610

802.11n_HT40_Ch0

Freq. (MHz)	Measured Freq. (MHz)	Limit (MHz)
5230	5248.06	< 5250
5755	5736.96	> 5725

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802.11n_HT40_Ch1

Freq. (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5190	40.67	16.090
5230	40.33	16.060
5270	40.24	16.050
5310	40.21	16.040
5510	40.43	16.070
5550	40.54	16.080
5670	40.08	16.030

802.11n_HT40_Ch1

Freq. (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5755	36.39	15.610
5795	36.37	15.610

802.11n_HT40_Ch1

Freq. (MHz)	Measured Freq. (MHz)	Limit (MHz)
5230	5248.06	< 5250
5755	5737.02	> 5725

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802.11ac_VHT80_Ch0

Freq. (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5210	81.14	19.090
5290	95.21	19.790
5530	80.79	19.070
5610	80.55	19.060

802.11ac_VHT80_Ch0

Freq. (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5775	74.16	18.700

802.11ac_VHT80_Ch0

Freq. (MHz)	Measured Freq. (MHz)	Limit (MHz)
5210	5247.51	< 5250
5775	5737.04	> 5725

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802.11ac_VHT80_Ch1

Freq. (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5210	80.69	19.070
5290	82.11	19.140
5530	80.42	19.050
5610	79.77	19.020

802.11ac_VHT80_Ch1

Freq. (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5775	73.05	18.640

802.11ac_VHT80_Ch1

Freq. (MHz)	Measured Freq. (MHz)	Limit (MHz)
5210	5247.45	< 5250
5775	5737.16	> 5725

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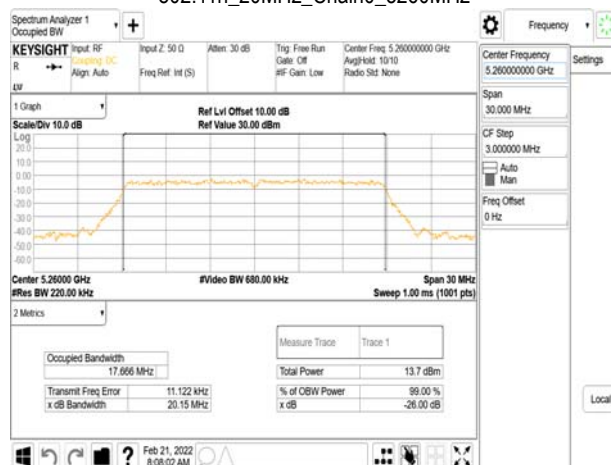
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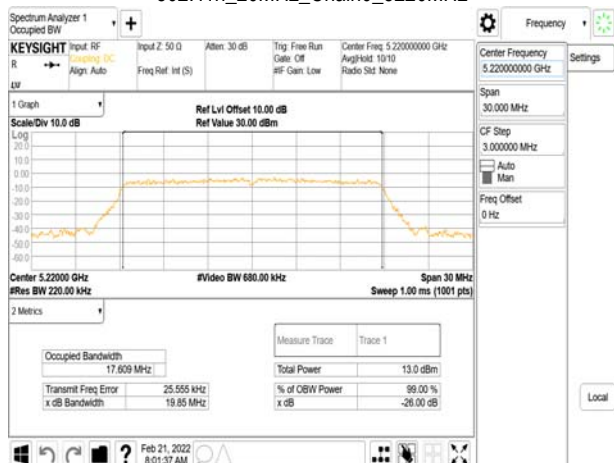
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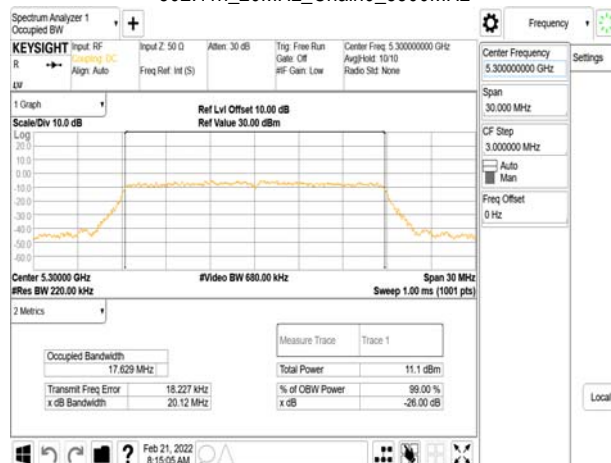
802.11n_20MHz_Chain0_5260MHz



802.11n_20MHz_Chain0_5220MHz



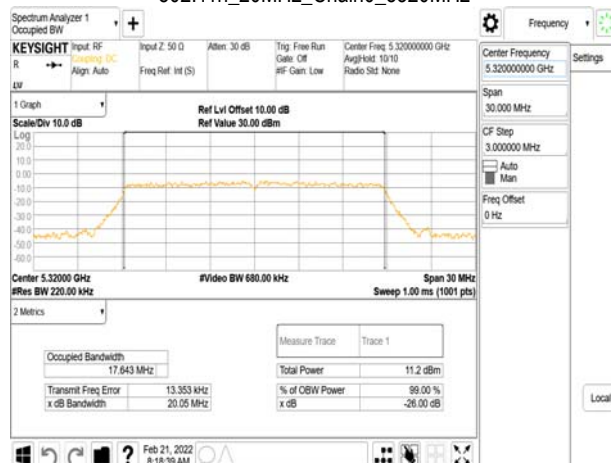
802.11n_20MHz_Chain0_5300MHz



802.11n_20MHz_Chain0_5240MHz



802.11n_20MHz_Chain0_5320MHz



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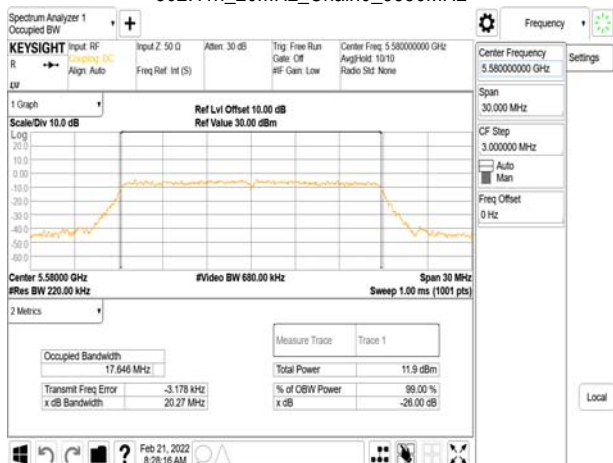
802.11n_20MHz_Chain0_5500MHz



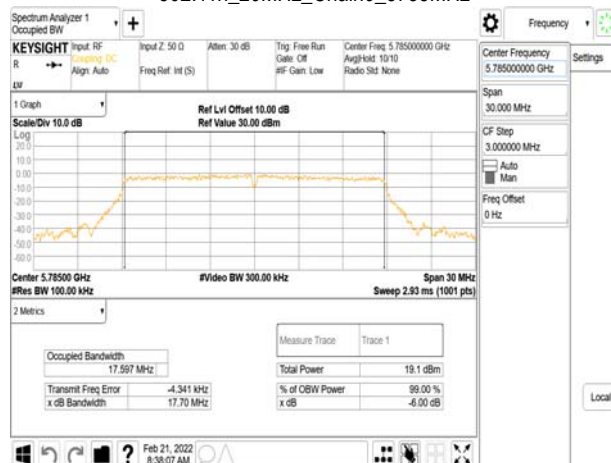
802.11n_20MHz_Chain0_5745MHz



802.11n_20MHz_Chain0_5580MHz



802.11n_20MHz_Chain0_5785MHz



802.11n_20MHz_Chain0_5700MHz



802.11n_20MHz_Chain0_5825MHz



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802.11n_20MHz_Chain1_5180MHz



802.11n_20MHz_Chain1_5260MHz



802.11n_20MHz_Chain1_5220MHz



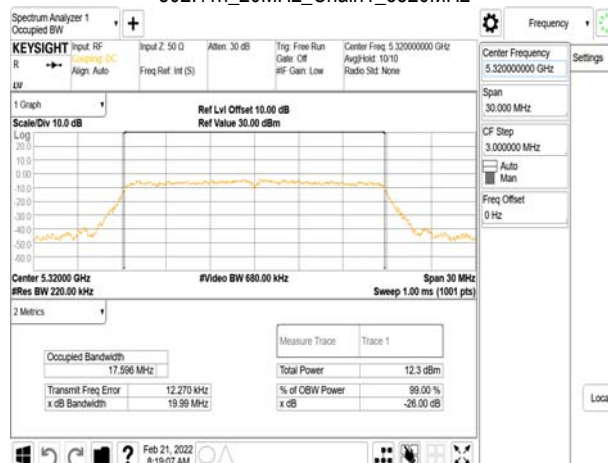
802.11n_20MHz_Chain1_5300MHz



802.11n_20MHz_Chain1_5240MHz



802.11n_20MHz_Chain1_5320MHz



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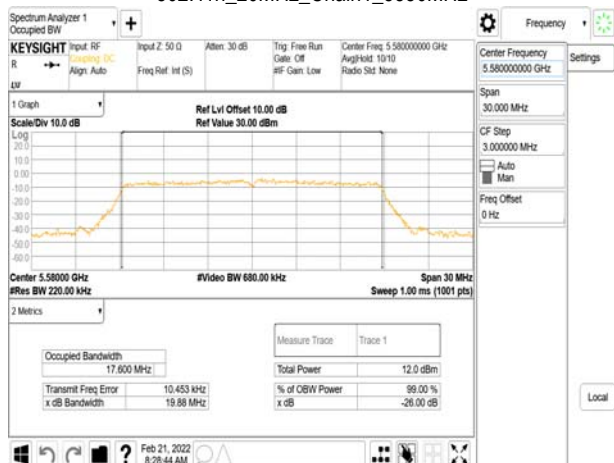
802.11n_20MHz_Chain1_5500MHz



802.11n_20MHz_Chain1_5745MHz



802.11n_20MHz_Chain1_5580MHz



802.11n_20MHz_Chain1_5785MHz



802.11n_20MHz_Chain1_5700MHz



802.11n_20MHz_Chain1_5825MHz



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802.11n_40MHz_Chain0_5190MHz



802.11n_40MHz_Chain0_5310MHz



802.11n_40MHz_Chain0_5230MHz



802.11n_40MHz_Chain0_5510MHz



802.11n_40MHz_Chain0_5270MHz



802.11n_40MHz_Chain0_5550MHz



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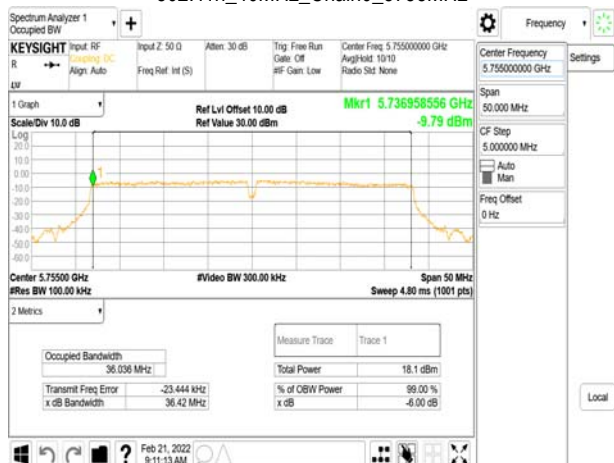
802.11n_40MHz_Chain0_5670MHz



802.11n_40MHz_Chain1_5190MHz



802.11n_40MHz_Chain0_5755MHz



802.11n_40MHz_Chain1_5230MHz



802.11n_40MHz_Chain0_5795MHz



802.11n_40MHz_Chain1_5270MHz

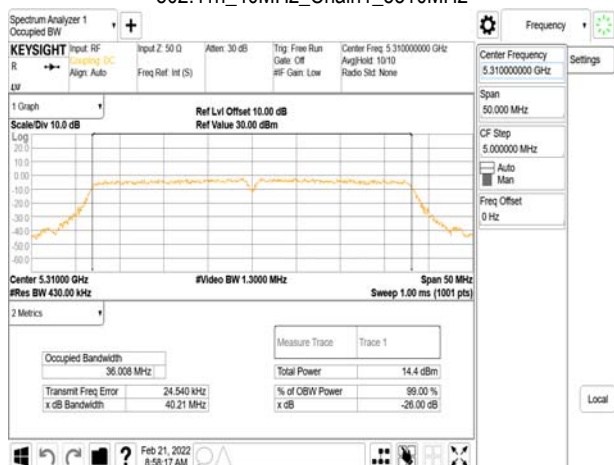


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802.11n_40MHz_Chain1_5310MHz



802.11n_40MHz_Chain1_5670MHz



802.11n_40MHz_Chain1_5510MHz



802.11n_40MHz_Chain1_5755MHz



802.11n_40MHz_Chain1_5550MHz



802.11n_40MHz_Chain1_5795MHz



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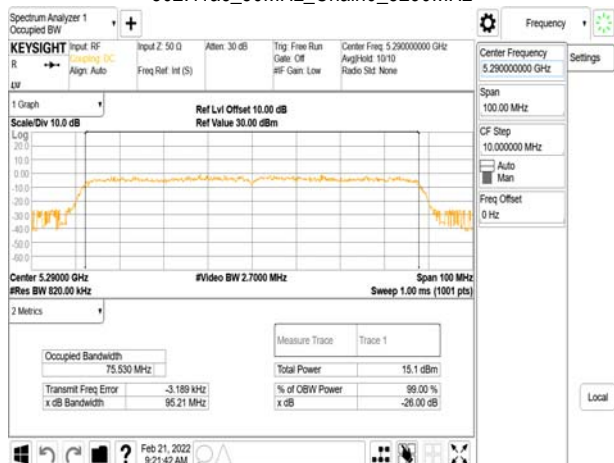
802.11ac_80MHz_Chain0_5210MHz



802.11ac_80MHz_Chain0_5610MHz



802.11ac_80MHz_Chain0_5290MHz



802.11ac_80MHz_Chain0_5775MHz



802.11ac_80MHz_Chain0_5530MHz



802.11ac_80MHz_Chain1_5210MHz



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802.11ac_80MHz_Chain1_5290MHz



802.11ac_80MHz_Chain1_5775MHz



802.11ac_80MHz_Chain1_5530MHz



802.11ac_80MHz_Chain1_5610MHz



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9 MAXIMUM CONDUCTED OUTPUT POWER MEASUREMENT

9.1 Standard Applicable

9.1.1 Duty Cycle

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.

9.1.2 Output Power

Band	EUT CATEGORY		e-CRF Title 47 §15.407			
			Conducted Output Power	EIRP	TPC	Antenna Directional Gain Requirements
U-NII-1		Fixed point-to-point	1 Watt(30dBm)	Not required	Not required	23dBi
	V	Outdoor AP	1 Watt(30dBm)	Elevation angle above 30 degrees 125mW (21dBm)	Not required	6dBi
		Indoor AP	1 Watt(30dBm)	Not required	Not required	6dBi
		Other	250mW(23.98dBm)	Not required	Not required	6dBi
U-NII-2A	V	Other	250mW(23.98dBm) or 11dBm+10 log B	Not required	When EIRP >500mW At least 6dB below EIRP 1W (30dBm)	6dBi
U-NII-2C	V	Other	250mW(23.98dBm) or 11dBm+10 log B	Not required		6dBi
U-NII-3	V	Other	1 Watt(30dBm)	Not required	Not required	6dBi
		Fixed point-to-point	1 Watt(30dBm)	Not required	Not required	Not required

1. If transmitting antennas of directional gain greater than the antenna requirements column, the Maximum transmit power shall be reduced by the amount in dB that the direction-al gain of the antenna.

2. For the 10 log B, B is the 26 dB emission bandwidth.

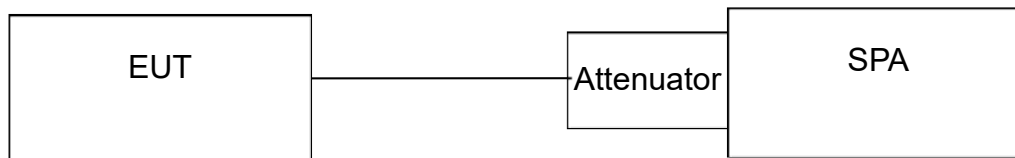
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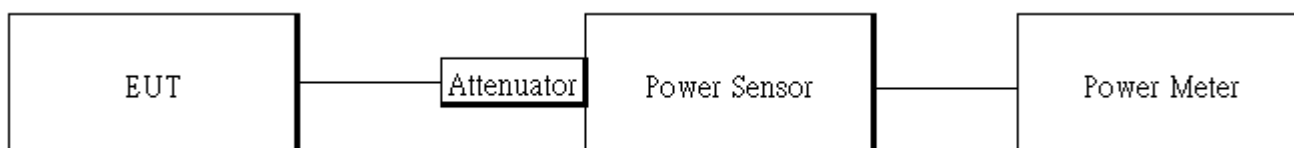
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9.2 Test Setup

9.2.1 Duty Cycle



9.2.2 Output Power



9.3 Measurement Procedure

9.3.1 Duty Cycle Measurements

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

9.3.2 Output Power Measurements

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.
7. MIMO mode: offset is set with "measure and add 10 Log (N)" to measurement for MIMO mode. Offset = cable loss + $10 \log (N)$, where N is number of transmitting antenna, cable loss is specified below.

Cable Loss Offset (dB)
11.25

Note:

As per section F. 2). e). (ii) of FCC KDB 662911 D01

If antenna gains are not equal and each transmit antenna is driven by only one spatial stream, directional gain may be calculated by either of the following formulas.

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$$\bullet \quad DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{SS}} \left\{ \sum_{k=1}^{N_{ANT}} g_{j,k} \right\}^2}{N_{ANT}} \right]$$

where

Each antenna is driven by no more than one spatial stream;

NSS = the number of independent spatial streams of data;

NANT = the total number of antennas

$g_{j,k}$ = / 20 10Gk if the kth antenna is being fed by spatial stream j, or zero if it is not;

G_k is the gain in dBi of the kth antenna.

The antenna gain is grater than 6 dBi in MIMO mode, therefore the the power density limit auten-
uation has been applied in the test results.

9.4 Duty Cycle Measurement Result

Mode	Duty Cycle (%) =Ton / (Ton+Toff)	Duty Factor (dB) =10*log (1/Duty Cycle)	1/T (kHz)	VBW setting (kHz)
802.11n_20	100.00	0.00	0.00	0.01
802.11ac_20	100.00	0.00	0.00	0.01
802.11n_40	100.00	0.00	0.00	0.01
802.11ac_40	100.00	0.00	0.00	0.01
802.11ac_80	100.00	0.00	0.00	0.01

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802.11n_20MHz_Chain0_5180MHz



802.11ac_40MHz_Chain0_5190MHz



802.11n_40MHz_Chain0_5190MHz



802.11ac_80MHz_Chain0_5210MHz



802.11ac_20MHz_Chain0_5180MHz



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9.5 Output Power Measurement Result

9.5.1 FCC Output power

802.11n_HT20_MIMO

CH	Frequency (MHz)	Data Rate	Power set	Avg. POWER (dBm)		TOTAL POWER (dBm)	TOTAL POWER (mW)	REQUIRED LIMIT (dBm)	RESULT
				Ch0	Ch1				
36	5180	MCS8	3	7.53	5.73	9.73	9.397	18.39	PASS
44	5220	MCS8	2	7.69	5.67	9.81	9.572	18.39	PASS
48	5240	MCS8	2	7.81	5.72	9.90	9.772	18.39	PASS
52	5260	MCS8	1	6.45	7.46	9.99	9.977	12.37	PASS
60	5300	MCS8	3	6.99	7.85	10.45	11.092	12.37	PASS
64	5320	MCS8	3	6.89	8.07	10.53	11.298	12.37	PASS
100	5500	MCS8	1	7.78	6.76	10.31	10.740	12.37	PASS
116	5580	MCS8	1	7.42	7.06	10.25	10.593	12.37	PASS
140	5700	MCS8	1	7.37	5.82	9.67	9.268	12.37	PASS
149	5745	MCS8	10	13.72	15.07	17.46	55.719	18.39	PASS
157	5785	MCS8	7	14.7	15.31	18.03	63.533	18.39	PASS
165	5825	MCS8	8	14.78	15.16	17.98	62.806	18.39	PASS

802.11n_HT40_MIMO

CH	Frequency (MHz)	Data Rate	Power set	Avg. POWER (dBm)		TOTAL POWER (dBm)	TOTAL POWER (mW)	REQUIRED LIMIT (dBm)	RESULT
				Ch0	Ch1				
38	5190	MCS8	3	7.75	5.93	9.94	9.863	18.39	PASS
46	5230	MCS8	2	7.85	5.81	9.96	9.908	18.39	PASS
54	5270	MCS8	4	8.72	9.81	12.31	17.022	12.37	PASS
62	5310	MCS8	1	4.18	5.36	7.82	6.053	12.37	PASS
102	5510	MCS8	3	9.75	8.85	12.33	17.100	12.37	PASS
110	5550	MCS8	3	9.62	8.26	12.00	15.849	12.37	PASS
134	5670	MCS8	3	9.21	8.15	11.72	14.859	12.37	PASS
151	5755	MCS8	10	13.63	14.61	17.16	52.000	18.39	PASS
159	5795	MCS8	7	14.58	14.57	17.59	57.412	18.39	PASS

802.11ac_VHT20_MIMO

CH	Frequency (MHz)	Data Rate	Power set	Avg. POWER (dBm)		TOTAL POWER (dBm)	TOTAL POWER (mW)	REQUIRED LIMIT (dBm)	RESULT
				Ch0	Ch1				
36	5180	MCS0	3	7.45	5.71	9.68	9.290	18.39	PASS
44	5220	MCS0	2	7.64	5.61	9.75	9.441	18.39	PASS
48	5240	MCS0	2	7.79	5.69	9.88	9.727	18.39	PASS
52	5260	MCS0	1	6.41	7.42	9.95	9.886	12.37	PASS
60	5300	MCS0	3	6.96	7.81	10.42	11.015	12.37	PASS
64	5320	MCS0	3	6.87	8.05	10.51	11.246	12.37	PASS
100	5500	MCS0	1	7.74	6.72	10.27	10.641	12.37	PASS
116	5580	MCS0	1	7.38	7.01	10.21	10.495	12.37	PASS
140	5700	MCS0	1	7.34	5.8	9.65	9.226	12.37	PASS
149	5745	MCS0	10	13.46	15.02	17.32	53.951	18.39	PASS
157	5785	MCS0	7	14.51	15.19	17.87	61.235	18.39	PASS
165	5825	MCS0	8	14.51	15.07	17.81	60.395	18.39	PASS

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802.11ac_VHT40_MIMO

CH	Frequency (MHz)	Data Rate	Power set	Avg. POWER (dBm)		TOTAL POWER (dBm)	TOTAL POWER (mW)	REQUIRED LIMIT (dBm)	RESULT
				Ch0	Ch1				
38	5190	MCS0	3	7.71	5.89	9.90	9.772	18.39	PASS
46	5230	MCS0	2	7.82	5.79	9.93	9.840	18.39	PASS
54	5270	MCS0	4	8.66	9.75	12.25	16.788	12.37	PASS
62	5310	MCS0	1	4.16	5.32	7.79	6.012	12.37	PASS
102	5510	MCS0	3	9.71	8.82	12.30	16.982	12.37	PASS
110	5550	MCS0	3	9.42	8.07	11.81	15.171	12.37	PASS
134	5670	MCS0	3	9.16	8.09	11.67	14.689	12.37	PASS
151	5755	MCS0	10	13.43	14.51	17.01	50.234	18.39	PASS
159	5795	MCS0	7	14.51	14.48	17.51	56.364	18.39	PASS

802.11ac_VHT80_MIMO

CH	Frequency (MHz)	Data Rate	Power set	Avg. POWER (dBm)		TOTAL POWER (dBm)	TOTAL POWER (mW)	REQUIRED LIMIT (dBm)	RESULT
				Ch0	Ch1				
42	5210	MCS0	1	5.03	3.36	7.29	5.358	18.39	PASS
58	5290	MCS0	-1	-2.14	-3.77	0.13	1.030	12.37	PASS
106	5530	MCS0	-1	-0.26	0.79	3.31	2.143	12.37	PASS
122	5610	MCS0	3	9.08	8.92	12.01	15.885	12.37	PASS
155	5775	MCS0	10	12.53	13.25	15.92	39.084	18.39	PASS

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Transmit Power Control (TPC) Power

802.11n_HT20_MIMO

CH	Frequency (MHz)	Data Rate	Power set	Avg. POWER (dBm)		TOTAL POWER (dBm)	TOTAL POWER (mW)	REQUIRED LIMIT (dBm)	RESULT
				Ch0	Ch1				
52	5260	MCS8	-1	-2.81	-4.79	-0.68	0.855	12.37	PASS
60	5300	MCS8	-1	-2.65	-4.21	-0.35	0.923	12.37	PASS
64	5320	MCS8	-1	-2.63	-4.04	-0.27	0.940	12.37	PASS
100	5500	MCS8	-1	-0.35	0.15	2.92	1.959	12.37	PASS
116	5580	MCS8	-1	-1.43	0.06	2.39	1.734	12.37	PASS
140	5700	MCS8	-1	-2.33	-1.63	1.04	1.271	12.37	PASS

802.11n_HT40_MIMO

CH	Frequency (MHz)	Data Rate	Power set	Avg. POWER (dBm)		TOTAL POWER (dBm)	TOTAL POWER (mW)	REQUIRED LIMIT (dBm)	RESULT
				Ch0	Ch1				
54	5270	MCS8	-1	-2.86	-4.67	-0.66	0.859	12.37	PASS
102	5510	MCS8	-1	-0.55	0.14	2.82	1.914	12.37	PASS
110	5550	MCS8	-1	-1.01	0.25	2.68	1.854	12.37	PASS
134	5670	MCS8	-1	-1.76	-0.61	1.86	1.535	12.37	PASS

802.11ac_VHT20_MIMO

CH	Frequency (MHz)	Data Rate	Power set	Avg. POWER (dBm)		TOTAL POWER (dBm)	TOTAL POWER (mW)	REQUIRED LIMIT (dBm)	RESULT
				Ch0	Ch1				
52	5260	MCS0	-1	-2.85	-4.83	-0.72	0.847	12.37	PASS
60	5300	MCS0	-1	-2.69	-4.24	-0.39	0.914	12.37	PASS
64	5320	MCS0	-1	-2.66	-4.08	-0.30	0.933	12.37	PASS
100	5500	MCS0	-1	-0.39	0.11	2.88	1.941	12.37	PASS
116	5580	MCS0	-1	-1.45	-0.02	2.33	1.710	12.37	PASS
140	5700	MCS0	-1	-2.37	-1.66	1.01	1.262	12.37	PASS

802.11ac_VHT40_MIMO

CH	Frequency (MHz)	Data Rate	Power set	Avg. POWER (dBm)		TOTAL POWER (dBm)	TOTAL POWER (mW)	REQUIRED LIMIT (dBm)	RESULT
				Ch0	Ch1				
54	5270	MCS0	-1	-2.91	-4.69	-0.70	0.851	12.37	PASS
102	5510	MCS0	-1	-0.58	0.11	2.79	1.901	12.37	PASS
110	5550	MCS0	-1	-1.13	0.22	2.61	1.824	12.37	PASS
134	5670	MCS0	-1	-1.79	-0.64	1.83	1.524	12.37	PASS

802.11ac_VHT80_MIMO

CH	Frequency (MHz)	Data Rate	Power set	Avg. POWER (dBm)		TOTAL POWER (dBm)	TOTAL POWER (mW)	REQUIRED LIMIT (dBm)	RESULT
				Ch0	Ch1				
122	5610	MCS0	-1	-0.44	1.28	3.51	2.244	12.37	PASS

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Outdoor AP U-NII-1 EIRP

802.11n_HT20_MIMO

CH	Frequency (MHz)	TOTAL POWER (dBm)	ELEVATION ABOVE 30° MAX GAIN (dBi)	ELEVATION ABOVE 30° MAX EIRP (dBm)	EIRP LIMIT (dBm)	RESULT
36	5180	9.73	11.01	20.74	21.00	PASS
44	5220	9.81	11.01	20.82	21.00	PASS
48	5240	9.90	11.01	20.91	21.00	PASS

802.11n_HT40_MIMO

CH	Frequency (MHz)	TOTAL POWER (dBm)	ELEVATION ABOVE 30° MAX GAIN (dBi)	ELEVATION ABOVE 30° MAX EIRP (dBm)	EIRP LIMIT (dBm)	RESULT
38	5190	9.94	11.01	20.95	21.00	PASS
46	5210	9.96	11.01	20.97	21.00	PASS

802.11ac_VHT20_MIMO

CH	Frequency (MHz)	TOTAL POWER (dBm)	ELEVATION ABOVE 30° MAX GAIN (dBi)	ELEVATION ABOVE 30° MAX EIRP (dBm)	EIRP LIMIT (dBm)	RESULT
36	5180	9.68	11.01	20.69	21.00	PASS
44	5220	9.75	11.01	20.76	21.00	PASS
48	5240	9.88	11.01	20.89	21.00	PASS

802.11ac_VHT40_MIMO

CH	Frequency (MHz)	TOTAL POWER (dBm)	ELEVATION ABOVE 30° MAX GAIN (dBi)	ELEVATION ABOVE 30° MAX EIRP (dBm)	EIRP LIMIT (dBm)	RESULT
38	5190	9.90	11.01	20.91	21.00	PASS
46	5210	9.93	11.01	20.94	21.00	PASS

802.11ac_VHT80_MIMO

CH	Frequency (MHz)	TOTAL POWER (dBm)	ELEVATION ABOVE 30° MAX GAIN (dBi)	ELEVATION ABOVE 30° MAX EIRP (dBm)	EIRP LIMIT (dBm)	RESULT
42	5210	7.29	11.01	18.30	21.00	PASS

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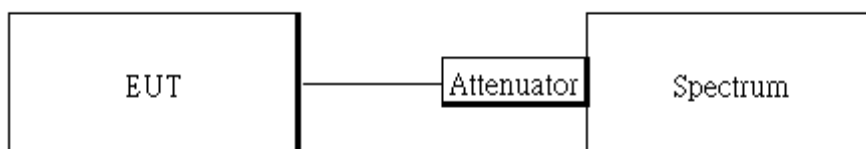
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10 MAXIMUM POWER SPECTRAL DENSITY

10.1 Standard Applicable

Operation Bands	EUT CATEGORY		e-CRF Title 47 §15.407 Power Spectral Density	Antenna Directional Gain Requirements
U-NII-1	V	Outdoor Access Point (Master)	1. 17dBm/ MHz 2. EIRP<=125mW(21dBm) at any elevation angle > 30°	6dBi
		Indoor Access Point (Master)	17dBm/ MHz	6dBi
		Fixed point-to-point Access Point	17dBm/ MHz	23dBi
		Client device	11dBm/ MHz	6dBi
U-NII-2A	V	All	11dBm/ MHz	6dBi
U-NII-2C	V	All	11dBm/ MHz	6dBi
U-NII-3	V	All	30dBm/ 500kHz	6dBi
If transmitting antennas of directional gain greater than the antenna requirements column, the Maximum transmit power shall be reduced by the amount in dB that the directional gain of the antenna.				

10.2 Test Setup



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10.3 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 (1001 pts), Detector = power averaging (rms), if available. Otherwise, use sample detector mode, 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=300kHz, VBW=1MHz, where span is enough to capture the entire bandwidth, Sweep time = Auto, detector = RMS or sample, traces 100 sweeps of video averaging.
In addition, measurement bandwidth of Maximum PSD is specified in 500 kHz, add 10 log (500 kHz/RBW) to the measured result.
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.
8. MIMO mode: offset is set with "measure and add 10 Log (N)" to measurement for MIMO mode. Offset = cable loss + 10 log (N), where N is number of transmitting antenna, cable loss is specified below.

Cable Loss Offset (dB)
11.25

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 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.

Note:

As per section F. 2). e). (ii) of FCC KDB 662911 D01

If antenna gains are not equal and each transmit antenna is driven by only one spatial stream, directional gain may be calculated by either of the following formulas.

$$DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{SS}} \left\{ \sum_{k=1}^{N_{ANT}} g_{j,k} \right\}^2}{N_{ANT}} \right]$$

where

Each antenna is driven by no more than one spatial stream;

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NSS = the number of independent spatial streams of data;

NANT = the total number of antennas

$g_{j,k} = 1/20$ 10Gk if the kth antenna is being fed by spatial stream j, or zero if it is not;

G_k is the gain in dBi of the kth antenna.

The antenna gain is greater than 6 dBi in MIMO mode, therefore the power density limit attenuation has been applied in the test results.

10.4 Measurement Result

POWER DENSITY 802.11n HT20 MODE							
Frequency (MHz)	Ch0 meas PSD (dBm/MHz)	Ch1 meas PSD (dBm/MHz)	Duty Factor (dB)	Maximum Corr'd PSD(dBm/MHz)		Limit	Margin (dB)
5180	-2.597	-4.306	0.00	-0.36		5.39 dBm/MHz	-5.75
5220	-2.338	-4.596	0.00	-0.31		5.39 dBm/MHz	-5.70
5240	-2.593	-4.687	0.00	-0.50		5.39 dBm/MHz	-5.89
5260	-4.185	-3.689	0.00	-0.92		-0.61 dBm/MHz	-0.31
5300	-4.652	-3.702	0.00	-1.14		-0.61 dBm/MHz	-0.53
5320	-5.019	-3.425	0.00	-1.14		-0.61 dBm/MHz	-0.53
5500	-3.621	-4.253	0.00	-0.92		-0.61 dBm/MHz	-0.31
5580	-4.271	-4.017	0.00	-1.13		-0.61 dBm/MHz	-0.52
5700	-3.105	-5.138	0.00	-0.99		-0.61 dBm/MHz	-0.38
Frequency (MHz)	Ch0 meas PSD (dBm/300kHz)	Ch1 meas PSD (dBm/300kHz)	Duty Factor (dB)	10log (500kHz/RBW) Factor(dB)	Maximum Corr'd PSD(dBm/500kHz)	Limit	Margin (dB)
5745	-2.079	-0.888	0.00	2.22	3.79	18.39 dBm/500kHz	-14.60
5785	-1.170	-0.367	0.00	2.22	4.48	18.39 dBm/500kHz	-13.91
5825	-1.018	-1.114	0.00	2.22	4.16	18.39 dBm/500kHz	-14.23
POWER DENSITY 802.11n HT40 MODE							
Frequency (MHz)	Ch0 meas PSD (dBm/MHz)	Ch1 meas PSD (dBm/MHz)	Duty Factor (dB)	Maximum Corr'd PSD(dBm/MHz)		Limit	Margin (dB)
5190	-5.674	-8.000	0.00	-3.67		5.39 dBm/MHz	-9.06
5230	-5.780	-8.132	0.00	-3.79		5.39 dBm/MHz	-9.18
5270	-4.805	-3.807	0.00	-1.27		-0.61 dBm/MHz	-0.66
5310	-9.020	-8.380	0.00	-5.68		-0.61 dBm/MHz	-5.07
5510	-4.060	-5.189	0.00	-1.58		-0.61 dBm/MHz	-0.97
5550	-4.670	-5.830	0.00	-2.20		-0.61 dBm/MHz	-1.59
5670	-3.544	-4.423	0.00	-0.95		-0.61 dBm/MHz	-0.34
Frequency (MHz)	Ch0 meas PSD (dBm/300kHz)	Ch1 meas PSD (dBm/300kHz)	Duty Factor (dB)	10log (500kHz/RBW) Factor(dB)	Maximum Corr'd PSD(dBm/500kHz)	Limit	Margin (dB)
5755	-5.202	-4.294	0.00	2.22	0.51	18.39 dBm/500kHz	-17.88
5795	-4.562	-3.691	0.00	2.22	1.13	18.39 dBm/500kHz	-17.26

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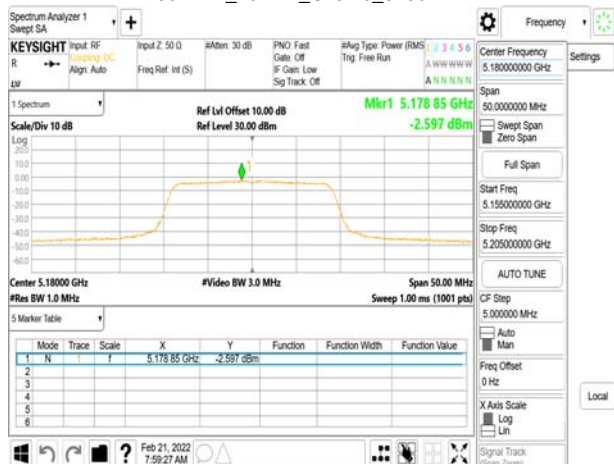
POWER DENSITY 802.11ac VHT80 MODE							
Frequency (MHz)	Ch0 meas PSD (dBm/MHz)	Ch1 meas PSD (dBm/MHz)	Duty Factor (dB)	Maximum Corr'd PSD(dBm/MHz)		Limit	Margin (dB)
5210	-11.465	-13.248	0.00	-9.26		5.39 dBm/MHz	-14.65
5290	-19.010	-21.010	0.00	-16.89		-0.61 dBm/MHz	-16.28
5530	-17.711	-16.384	0.00	-13.99		-0.61 dBm/MHz	-13.38
5610	-7.661	-7.477	0.00	-4.56		-0.61 dBm/MHz	-3.95
Frequency (MHz)	Ch0 meas PSD (dBm/300kHz)	Ch1 meas PSD (dBm/300kHz)	Duty Factor (dB)	10log (500kHz/RBW) Factor(dB)	Maximum Corr'd PSD(dBm/500kHz)	Limit	Margin (dB)
5775	-9.677	-8.112	0.00	2.22	-3.59	18.39 dBm/500kHz	-21.98

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802.11n_20MHz_Chain0_5180MHz



802.11n_20MHz_Chain0_5260MHz



802.11n_20MHz_Chain0_5220MHz



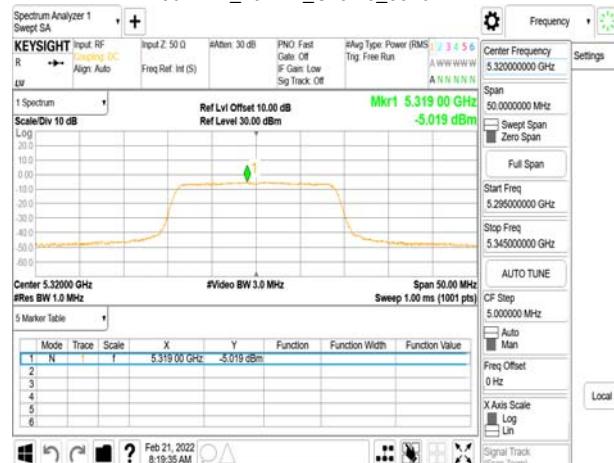
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802.11n_20MHz_Chain0_5240MHz



802.11n_20MHz_Chain0_5320MHz

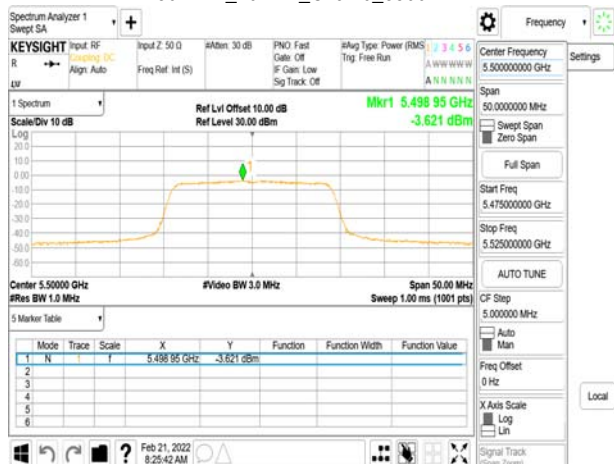


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802.11n_20MHz_Chain0_5500MHz



802.11n_20MHz_Chain0_5745MHz



802.11n_20MHz_Chain0_5580MHz



802.11n_20MHz_Chain0_5785MHz



802.11n_20MHz_Chain0_5700MHz



802.11n_20MHz_Chain0_5825MHz

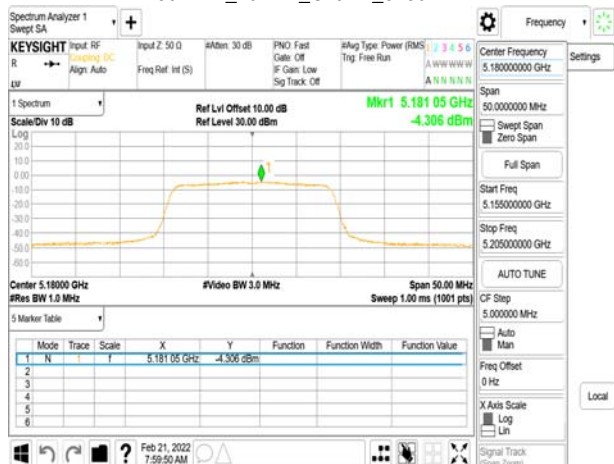


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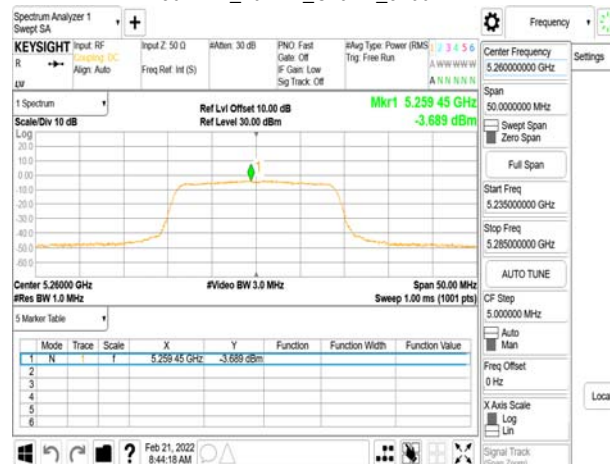
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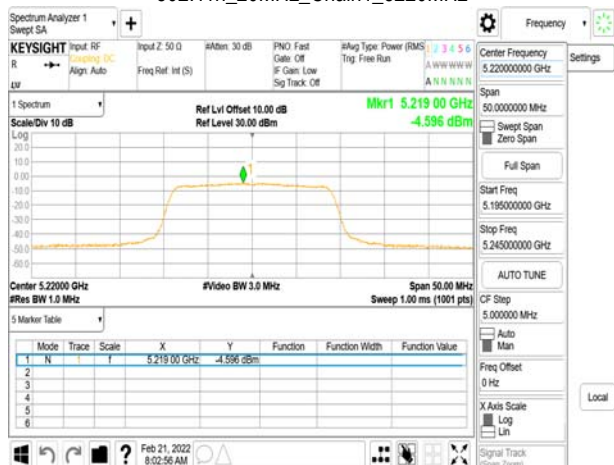
802.11n_20MHz_Chain1_5180MHz



802.11n_20MHz_Chain1_5260MHz



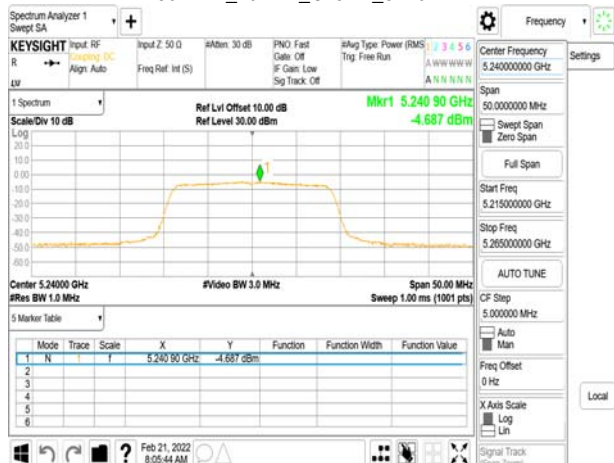
802.11n_20MHz_Chain1_5220MHz



802.11n_20MHz_Chain1_5300MHz



802.11n_20MHz_Chain1_5240MHz



802.11n_20MHz_Chain1_5320MHz



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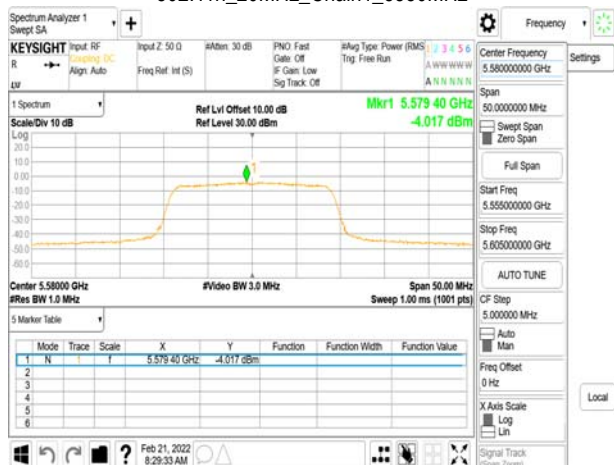
802.11n_20MHz_Chain1_5500MHz



802.11n_20MHz_Chain1_5745MHz



802.11n_20MHz_Chain1_5580MHz



802.11n_20MHz_Chain1_5785MHz



802.11n_20MHz_Chain1_5700MHz



802.11n_20MHz_Chain1_5825MHz

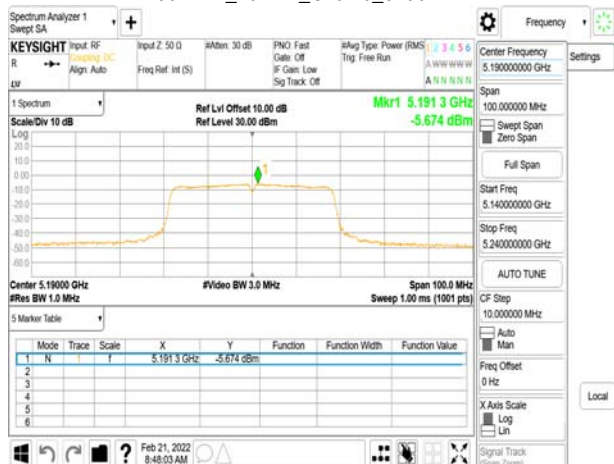


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802.11n_40MHz_Chain0_5190MHz



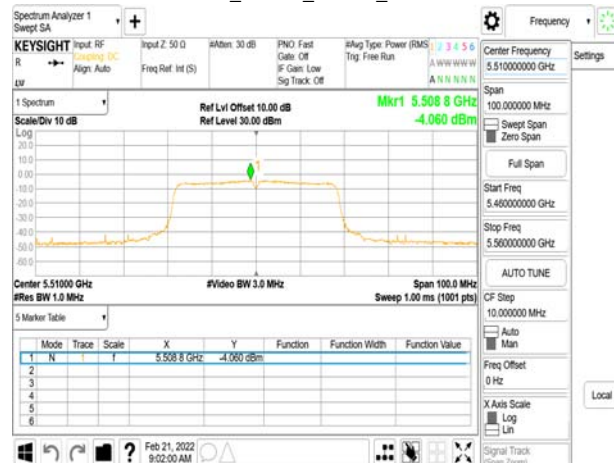
802.11n_40MHz_Chain0_5310MHz



802.11n_40MHz_Chain0_5230MHz



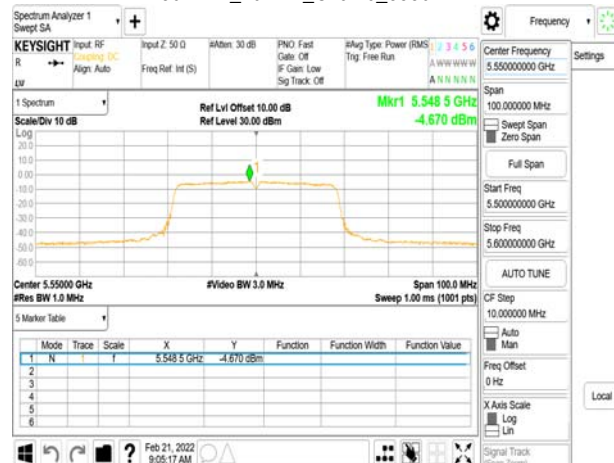
802.11n_40MHz_Chain0_5510MHz



802.11n_40MHz_Chain0_5270MHz



802.11n_40MHz_Chain0_5550MHz



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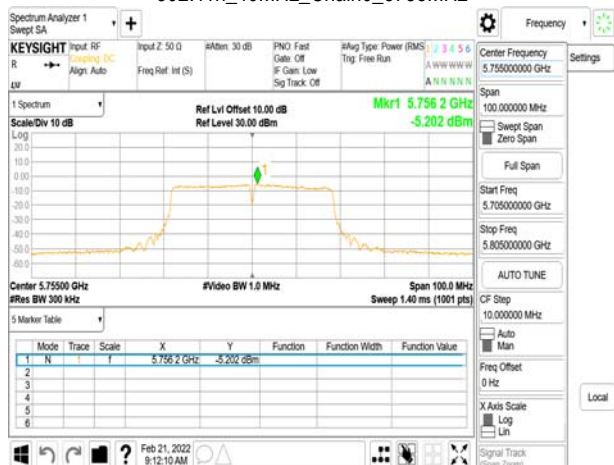
802.11n_40MHz_Chain0_5670MHz



802.11n_40MHz_Chain1_5190MHz



802.11n_40MHz_Chain0_5755MHz



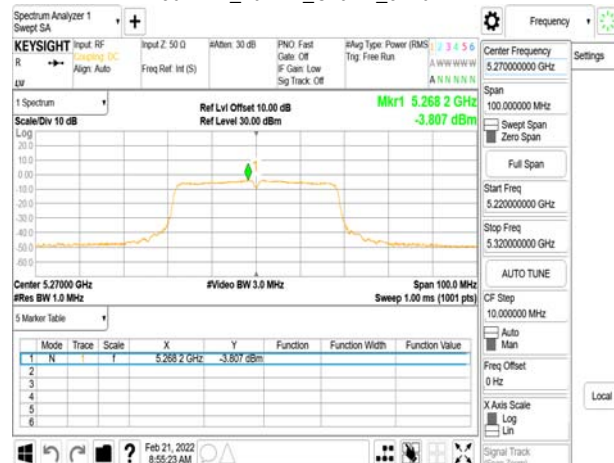
802.11n_40MHz_Chain1_5230MHz



802.11n_40MHz_Chain0_5795MHz



802.11n_40MHz_Chain1_5270MHz

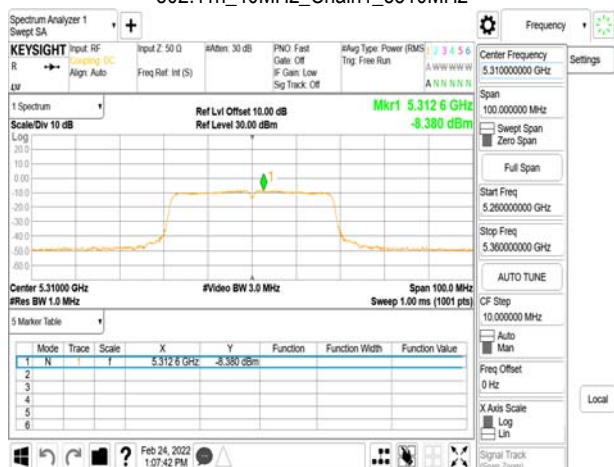


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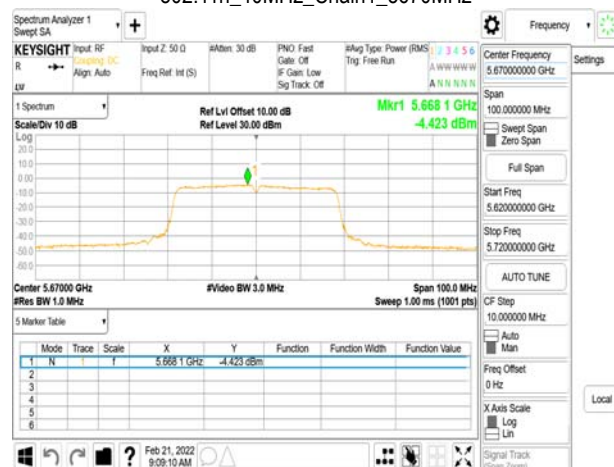
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802.11n_40MHz_Chain1_5310MHz



802.11n_40MHz_Chain1_5670MHz



802.11n_40MHz_Chain1_5510MHz



802.11n_40MHz_Chain1_5755MHz



802.11n_40MHz_Chain1_5550MHz



802.11n_40MHz_Chain1_5795MHz



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