ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

EUT Description	Wearable Camera 210
Applicant:	Oracle America, Inc. 500 Oracle Parkway, Redwood City, CA 94065, USA
Manufacturer:	Microtips Technology Inc. 31, LANE 169, KANG-NING ST, 12F, HSI CHIH DISTRICT, TAIWAN, 221
Brand Name:	Wearable Camera 210
Model No.:	WCS210
Report Number:	TERF2504001490E2
FCC ID	A4H532CB
Date of EUT Received:	April 24, 2025
Date of Test:	May 5, 2025～May 28, 2025
Issue Date:	June 9, 2025

Approved By _____
Jay Lin

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
TERF2504001490E2	00	Original	Jun. 9, 2025	Candice Li	

Note:

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

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1 GENERAL INFORMATION

1.1 Product Description

EUT Description	Wearable Camera 210
Brand Name:	Wearable Camera 210
Model No.:	WCS210
Hardware Version:	N/A
Firmware Version:	N/A
EUT Series No.:	N/A
Power Supply:	3.85 Vdc from Rechargeable Li-ion Battery 5 / 9 /12 Vdc from AC/DC Adapter with 100-240V AC input.
Test Software (Name/Version)	Tera term 5.3

1.2 Modulation & Data Rate

Modulation type:	64QAM, 16QAM, QPSK, BPSK for OFDM in 802.11a,11n
	256QAM, 64QAM, 16QAM, QPSK, BPSK for OFDM in 802.11ac
Transition Rate:	802.11 a: 6 - 54 Mbps
	802.11 n_HT20: up to 72.2 Mbps
	802.11 n_HT40: up to 150 Mbps
	802.11 ac_VHT20: up to 86.7 Mbps
	802.11 ac_VHT40: up to 200 Mbps
	802.11 ac_VHT80: up to 433.3 Mbps

1.3 Antenna Designation

Ant. Type	Brand	Part No.	Freq.(MHz) / Peak Gain (dBi)	
			5150~5250	5725~5850
FPC	Amphenol	MT540A-12-001-C	2.2	2.2

Note: The antenna information is provided by the applicant, and the laboratory shall not be held liable for the accuracy, completeness, or reliability of any applicant-supplied data.

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1.4 FCC

Wi-Fi	Frequency Range	Channels	EIRP/Avg	Rated Power(EIRP/Avg) (dBm) (Worst Case)	Modulation Technology
802.11a/ 802.11n_HT20/ 802.11ac_VHT20	5180~5240	4	Avg	13.70 dBm	OFDM
	5745-5825	5	Avg	13.73 dBm	OFDM
802.11n_HT40/ 802.11ac_VHT40	5190~5230	2	Avg	10.84 dBm	OFDM
	5755-5795	2	Avg	10.59 dBm	OFDM
802.11ac_VHT80	5210	1	Avg	10.93 dBm	OFDM
	5775	1	Avg	10.97 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
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 2		
		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.				

Temperature:	20~26	°C	Relative Humidity:	60~66	%
Test site	Conducted D		Test Start:	05/14/2025	
Test Engineer:	Charlie		Test Done:	05/28/2025	

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.

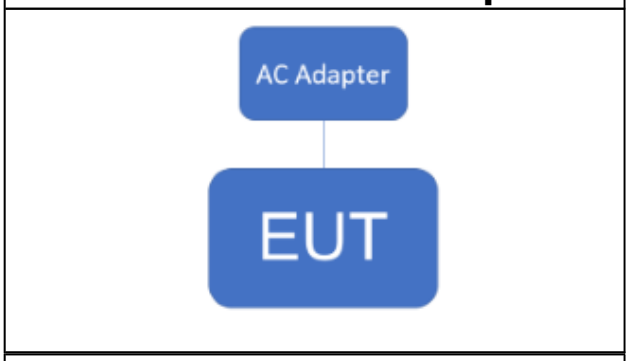
There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

2.4.2 For all conducted test items:

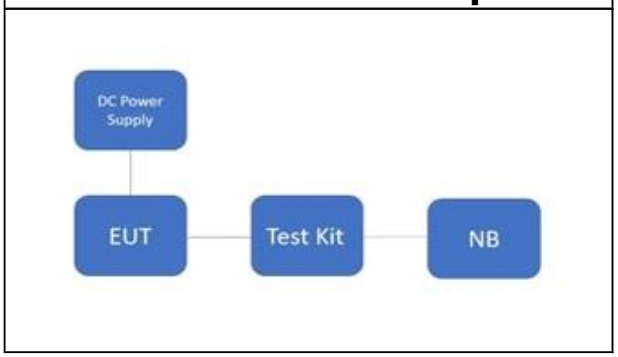
The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuation factor between EUT conducted port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly EUT RF output level.

2.5 Test Configuration

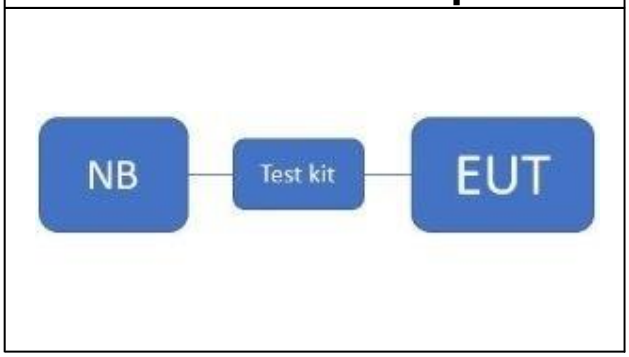
Conduction Setup



Conducted Setup



Radiated Setup



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2.6 Control Unit(s)

AC Power-Line Conducted Emission Test Site: Conduction C					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL. (mm/dd/yyyy)	CAL DUE. (mm/dd/yyyy)
USB cable	JAWSSTECH	25-450-H001	N/A	N/A	N/A
USB cable	SUNCA	1Q19002251-WD	N/A	N/A	N/A
Adapter	PowerEric	PD0202UC	ABPS240023	N/A	N/A

Conducted Emission Test Site: Conducted D					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL. (mm/dd/yyyy)	CAL DUE. (mm/dd/yyyy)
Notebook	Lenovo	T14	P0003332	N/A	N/A
Test Kit	Microtips	739-RS2320S7	N/A	N/A	N/A

Radiated Emission Test Site: SAC C					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL. (mm/dd/yyyy)	CAL DUE. (mm/dd/yyyy)
Notebook	HP	HSN-Q35C-4	P0004691	N/A	N/A
Test Kit	Microtips	739-RS2320S7	N/A	N/A	N/A
USB Cable	DIKE	SH-USB 3M	N/A	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

UNII-1 5150 MHz ~ 5250MHz

20MHz	
CH	Freq. (MHz)
36	5180
40	5200
44	5220
48	5240

40MHz	
CH	Freq. (MHz)
38	5190
46	5230

80MHz	
CH	Freq. (MHz)
42	5210

UNII-3 5725 MHz ~ 5850MHz

20MHz	
CH	Freq. (MHz)
149	5745
153	5765
157	5785
161	5805
165	5825

40MHz	
CH	Freq. (MHz)
151	5755
159	5795

80MHz	
CH	Freq. (MHz)
155	5775

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	
V	802.11 a	V	Ch0		Ch1		Ch2		Ch3	V	1TX		1TX
V	802.11 n	V	Ch0		Ch1		Ch2		Ch3	V	1TX		1TX
V	802.11 ac	V	Ch0		Ch1		Ch2		Ch3	V	1TX		1TX
	802.11 ax		Ch0		Ch1		Ch2		Ch3		1TX		1TX
	802.11 be		Ch0		Ch1		Ch2		Ch3		1TX		1TX

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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.

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	Ch0
	5745~5825	149 to 165	149,157,165			
802.11n_HT20	5180~5240	36 to 48	36,44,48	OFDM	MCS0	Ch0
	5745~5825	149 to 165	149,157,165			
802.11n_HT40	5190~5230	38 to 46	38,46	OFDM	MCS0	Ch0
	5755~5795	151 to 159	151,159			
802.11ac_VHT80	5210	42	42	OFDM	MCS0	Ch0
	5775	155	155			
TRANSMIT 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	Ch0
	5745~5825	149 to 165	157	OFDM		
TRANSMIT 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	Ch0
	5745~5825	149 to 165	149,157,165	OFDM		
802.11n20	5180~5240	36 to 48	36,44,48	OFDM	MCS0	Ch0
	5745~5825	149 to 165	149,157,165	OFDM		
802.11n40	5190~5230	38 to 46	38,46	OFDM	MCS0	Ch0
	5755~5795	151 to 159	151,159	OFDM		
802.11ac80	5210	42	42	OFDM	MCS0	Ch0
	5775	155	155	OFDM		

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	+/-	1.54	dB
Emission Bandwidth	+/-	1.38	Hz
Output Power measurement	+/-	0.97	dB
Peak Power Spectral Density Measurement	+/-	0.61	dB
Frequency Stability	+/-	1.48	Hz
Temperature	+/-	0.6	°C
Humidity	+/-	3	%
DC / AC Power Source	+/-	1	%

Radiated Spurious Emission Measurement Uncertainty				
Polarization: Vertical	**+/-**	**1.89**	**dB**	9kHz~30MHz
	+/-	**4.1**	**dB**	30MHz - 1000MHz
	+/-	**3.37**	**dB**	1GHz - 18GHz
	+/-	**3.83**	**dB**	18GHz - 40GHz
Polarization: Horizontal	**+/-**	**1.89**	**dB**	9kHz~30MHz
	+/-	**4.1**	**dB**	30MHz - 1000MHz
	+/-	**3.37**	**dB**	1GHz - 18GHz
	+/-	**3.83**	**dB**	18GHz - 40GHz
Radiated Spurious Emission	**+/-**	**2**	**dB**	33GHz-50GHz
	+/-	**1.59**	**dB**	50GHz-60GHz
	+/-	**1.71**	**dB**	60GHz-90GHz
	+/-	**1.64**	**dB**	90GHz-140GHz
	+/-	**3.84**	**dB**	140GHz-220GHz

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

AC Power-Line Conducted Emission Test Site: Conduction C					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL. (mm/dd/yyyy)	CAL DUE. (mm/dd/yyyy)
Coaxial Cable	EC Lab	RF-HY-CAB-250	RF-HY-CAB-250-01	03/27/2025	03/26/2026
EMI Test Receiver	R&S	ESCI	101342	04/23/2025	04/22/2026
LISN	SCHWARZBECK Mess-Elektronik	NSLK8127	974	06/26/2024	06/25/2025
Pulse Limiter	EC Lab	VTSD 9561F-N	485	03/27/2025	03/26/2026
Test Software	audix	e3	E3 20923 SGS Ver.9 (C)	N.C.R	N.C.R

6.2 Condcuted Measurement

Conducted Emission Test Site: Conducted D					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL. (mm/dd/yyyy)	CAL DUE. (mm/dd/yyyy)
Attenuator	Marvelous	MVE2213-10	RF08	11/14/2024	11/13/2025
Attenuator	Woken	WATT-218FS-10	RF17	11/14/2024	11/13/2025
DC Block	Marvelous	MVE6114	RF39	11/14/2024	11/13/2025
DC Power Supply	Agilent	E3640A	MY53130054	10/01/2024	09/30/2025
Power Meter	Anritsu	ML2496A	2138002	08/28/2024	08/27/2025
Power Sensor	Anritsu	MA2411B	1911390	08/28/2024	08/27/2025
Power Sensor	Anritsu	MA2411B	1911398	08/28/2024	08/27/2025
Spectrum Analyzer	KEYSIGHT	N9010A	MY51440113	09/18/2024	09/17/2025
Spectrum Analyzer	Keysight	N9010B	MY60240548	01/06/2025	01/05/2026
Test Software	SGS Taiwan	Radio Test Software	Ver.21	N.C.R	N.C.R

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6.3 Radiated Measurement

Radiated Emission Test Site: SAC C					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL. (mm/dd/yyyy)	CAL DUE. (mm/dd/yyyy)
3m Site NSA	SGS	966 chamber C	N/A	03/02/2025	03/01/2026
Active Loop Antenna	COM-POWER	AL-130R	10160105	12/11/2024	12/10/2025
Attenuator	Woken	WATT-218FS-10	RF17	11/14/2024	11/13/2025
Broadband Antenna	SCHWARZBECK	VULB 9168	9168-300	11/06/2024	11/05/2025
Coaxial Cable	EMCI+Huber Suhner	RG 214/U+EMC104-SM-SM-6000+EMC105-SM-SM-12000+15	W13.01+150813+2310002+15	11/14/2024	11/13/2025
EMI Test Receiver	R&S	ESU 40	100363	05/06/2025	05/05/2026
Highpass Filter	R&S	HPF7.0	RF168	11/14/2024	11/13/2025
Horn Antenna	Schwarzbeck	BBHA9120D	1187	02/05/2025	02/04/2026
Horn Antenna	Schwarzbeck	BBHA9170	184	12/20/2024	12/19/2025
Lowpass Filter	Woken	EWT-56-0019	RF163	11/14/2024	11/13/2025
Notch Filter	Woken	EWT-14-0251	RF195	11/14/2024	11/13/2025
Notch Filter	Woken	EWT-14-0251	RF196	11/14/2024	11/13/2025
Notch Filter	Woken	EWT-14-0275	RF194	11/14/2024	11/13/2025
Pre-Amplifier	EMC Instruments	EMC118A45SE	980789	11/14/2024	11/13/2025
Pre-Amplifier	EMC Instruments	EMC184045SEE	980881	11/14/2024	11/13/2025
Pre-Amplifier	EMC Instruments	EMC330	980091	11/14/2024	11/13/2025
Spectrum Analyzer	KEYSIGHT	N9010B	MY63440390	02/13/2025	02/12/2026
Test Software	audix	e3	E3 20923 SGS Ver.9 (C)	N.C.R	N.C.R

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

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7 CONDUCTED EMISSION TEST

7.1 Standard Applicable

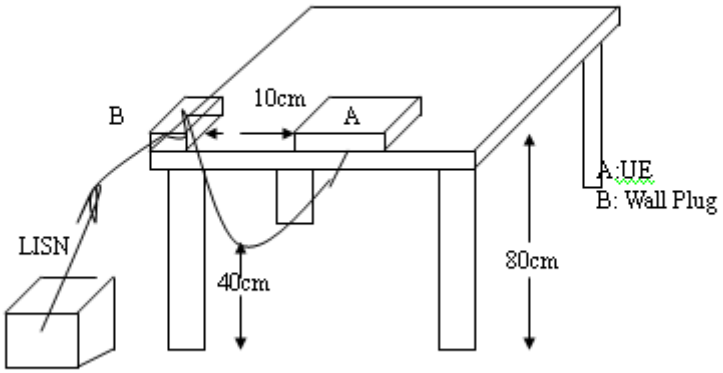
Frequency range within 150 kHz to 30 MHz shall not exceed the Limit table as below.

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 EUT was placed flushed with the rear of the table.
3. The LISN was connected with 120-240Vac/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

Level = Read Level + Factor
Factor = (LISN, ISN, or current probe)Factor + Cable Loss +Attenuator

Note: Refer to next page for measurement data and plots.
Note2: The * reveals the worst-case results that closest to the limit.

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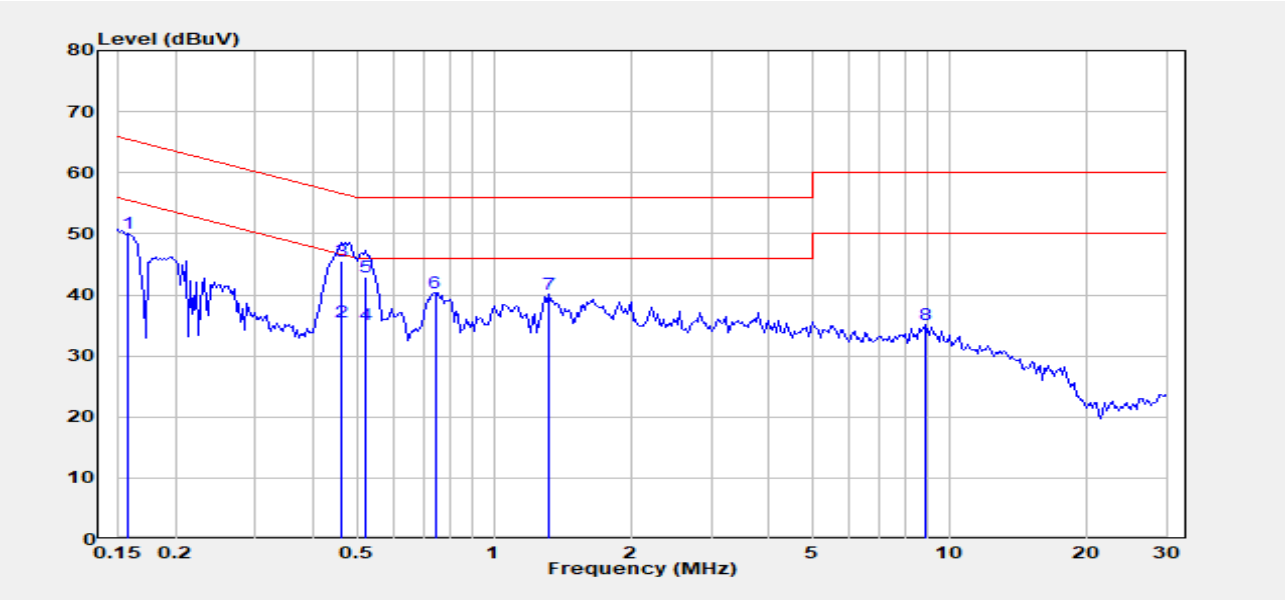
AC POWER LINE CONDUCTED EMISSION TEST DATA

Report Number	:TERF2504001490E2	Test Site	:Conduction C
Test Mode	:802.11a	Test Date	:2025-05-27
Power	:120V/60Hz	Temp./Humi	:26.3℃/61%
Probe	:L1	Engineer	:Alex Li
Note:	:SUNCA		



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV	Limit dBμV	Margin dB
0.156	Peak	39.34	10.65	49.99	65.65	-15.66
0.461	Average	24.90	10.62	35.52	46.67	-11.15
0.461	QP	34.90	10.62	45.52	56.67	-11.15
0.524	Average	24.50	10.62	35.12	46.00	-10.88
0.524	QP	32.40	10.62	43.02	56.00	-12.98
0.743	Peak	29.63	10.66	40.29	56.00	-15.71
1.317	Peak	29.46	10.72	40.18	56.00	-15.82
8.869	Peak	24.11	10.96	35.07	60.00	-24.93

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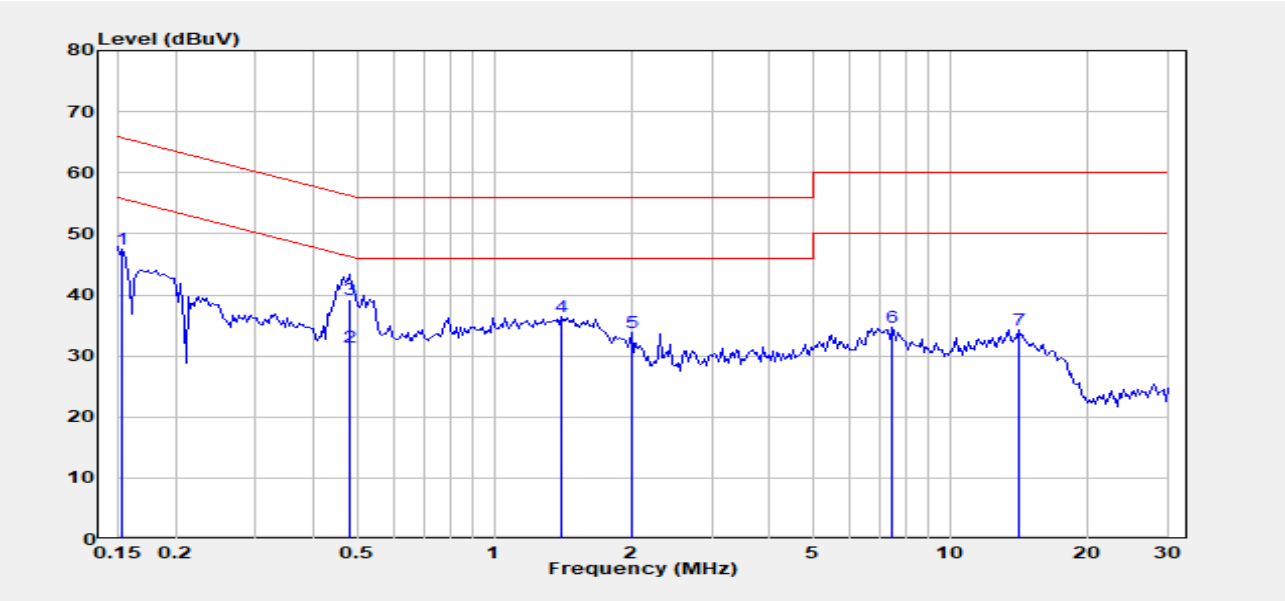
Probe	:N	Engineer	:Alex Li
Note:	:SUNCA		



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV	Limit dBμV	Margin dB
0.153	Peak	36.78	10.66	47.44	65.82	-18.39
0.481	Average	20.80	10.60	31.40	46.32	-14.91
0.481	QP	28.70	10.60	39.30	56.32	-17.01
1.403	Peak	25.64	10.71	36.34	56.00	-19.66
2.012	Peak	23.00	10.75	33.76	56.00	-22.24
7.486	Peak	23.65	10.94	34.59	60.00	-25.41
14.138	Peak	23.28	11.05	34.33	60.00	-25.67

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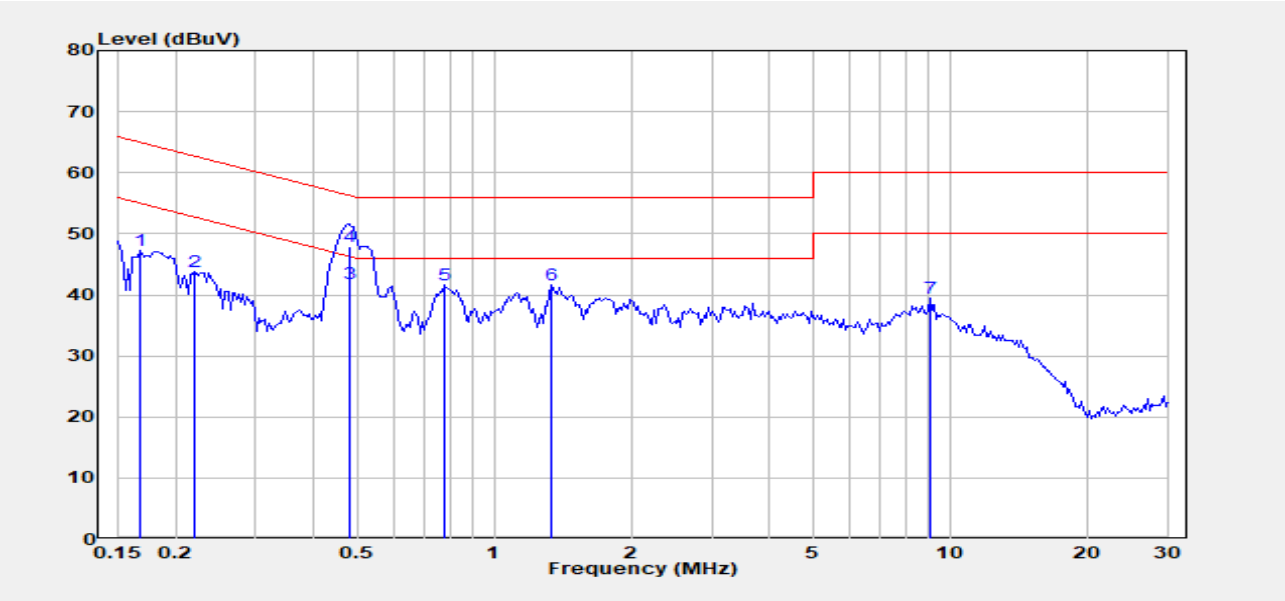
Power	:120V/60Hz	Temp./Humi	:26.3℃/61%
Probe	:L1	Engineer	:Alex Li
Note:	:JAWSSTECH		



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV	Limit dBμV	Margin dB
0.167	Peak	36.58	10.65	47.23	65.12	-17.89
0.220	Peak	33.08	10.65	43.73	62.83	-19.10
0.481	Average	31.20	10.62	41.82	46.32	-4.50
0.481	QP	37.20	10.62	47.82	56.32	-8.50
0.775	Peak	30.92	10.66	41.59	56.00	-14.41
1.331	Peak	30.87	10.72	41.59	56.00	-14.41
9.059	Peak	28.42	10.96	39.38	60.00	-20.62

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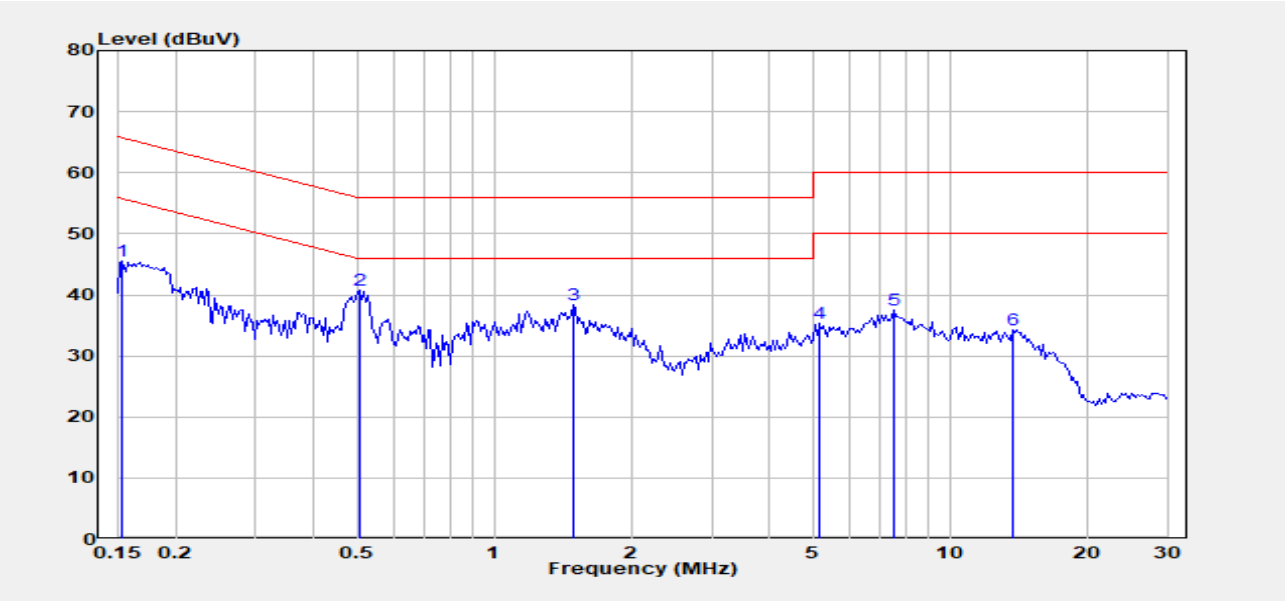
Probe	:N	Engineer	:Alex Li
Note:	:JAWSSTECH		



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV	Limit dBμV	Margin dB
0.153	Peak	34.86	10.66	45.52	65.82	-20.30
0.507	Peak	30.19	10.60	40.80	56.00	-15.20
1.495	Peak	27.59	10.72	38.31	56.00	-17.69
5.166	Peak	24.31	10.94	35.25	60.00	-24.75
7.566	Peak	26.52	10.94	37.46	60.00	-22.54
13.695	Peak	23.31	11.05	34.36	60.00	-25.64

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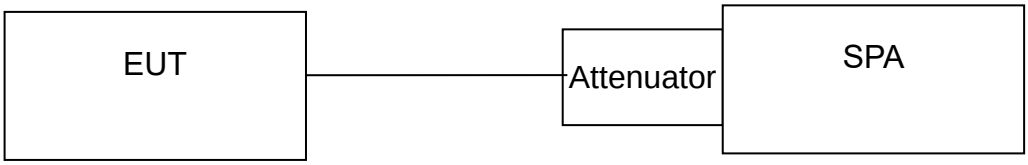
8 EMISSION BANDWIDTH MEASUREMENT

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. For 99% Bandwidth: Set the spectrum analyzer as
   RBW = 1%,
   VBW = 3*RBW,
   Span = large enough to capture all products of the modulation process,
   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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9. For 26dB BW and OBW of straddle channels, the results were calculated as below.
   straddle channel emission BW in U-NII 2C = (emission BW/2) + (5725-straddle channel)
   straddle channel emission bandwidth in U-NII 3 = emission BW- emission BW_U-NII 2C

8.4 Measurement Result

8.4.1 FCC Occupied Bandwidth

802.11a_Ch0

Freq. (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5180	25.15	14.010
5220	21.58	13.340
5240	22.75	13.570

802.11n_HT20_Ch0

Freq. (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5180	21.03	13.230
5220	21.00	13.220
5240	20.71	13.160

802.11a_Ch0

Freq. (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5745	16.37	12.140
5785	16.35	12.140
5825	16.28	12.120

802.11n_HT20_Ch0

Freq. (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5745	16.96	12.290
5785	17.06	12.320
5825	17.02	12.310

802.11a_Ch0

Freq. (MHz)	Measured Freq. (MHz)	Limit (MHz)
5240	5248.28	< 5250
5745	5736.76	> 5725

802.11n_HT20_Ch0

Freq. (MHz)	Measured Freq. (MHz)	Limit (MHz)
5240	5248.81	< 5250
5745	5736.16	> 5725

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802.11n_HT40_Ch0

Freq. (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5190	48.64	16.870
5230	53.55	17.290

802.11n_HT40_Ch0

Freq. (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5755	35.53	15.510
5795	35.71	15.530

802.11n_HT40_Ch0

Freq. (MHz)	Measured Freq. (MHz)	Limit (MHz)
5230	5248.08	< 5250
5755	5736.95	> 5725

802.11ac_VHT80_Ch0

Freq. (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5210	82.00	19.140

802.11ac_VHT80_Ch0

Freq. (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5775	74.76	18.740

802.11ac_VHT80_Ch0

Freq. (MHz)	Measured Freq. (MHz)	Limit (MHz)
5210	5247.78	< 5250
5775	5737.30	> 5725

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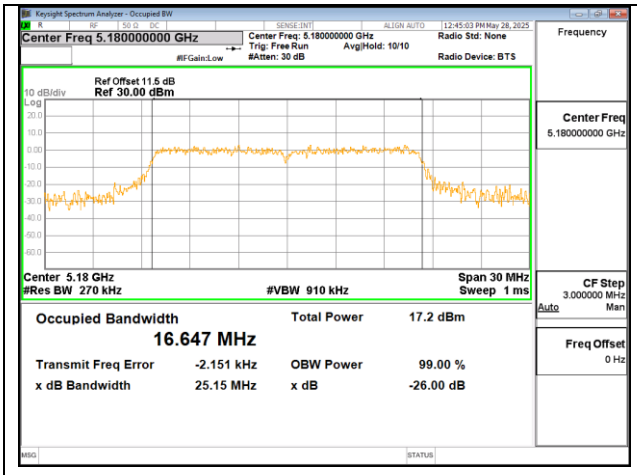
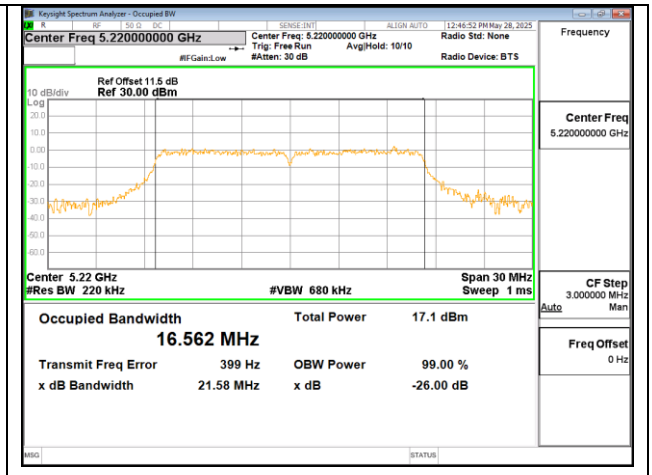
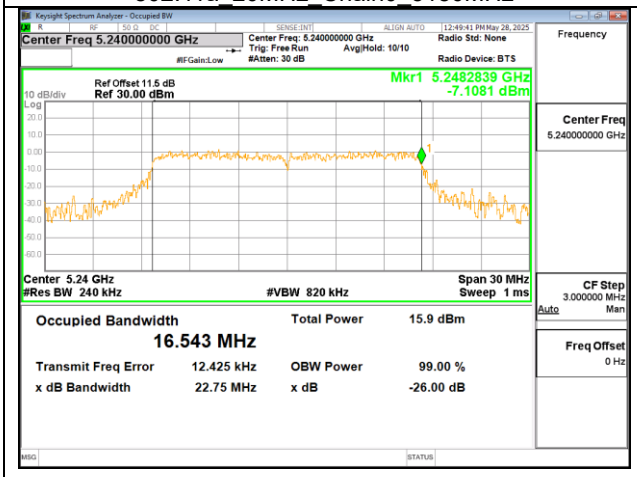


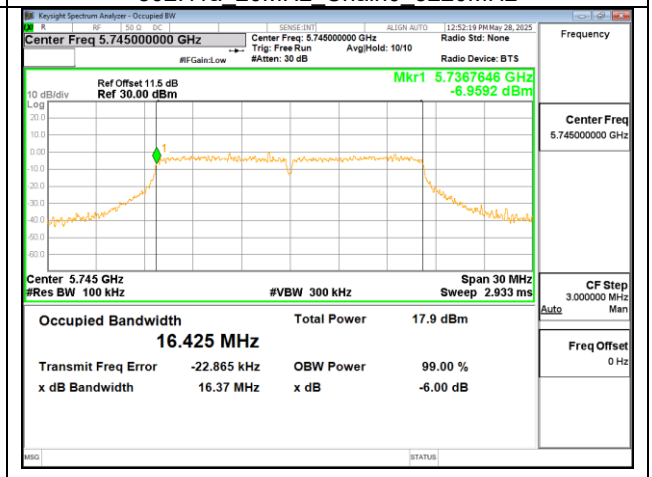
802.11a_20MHz_Chain0_5180MHz



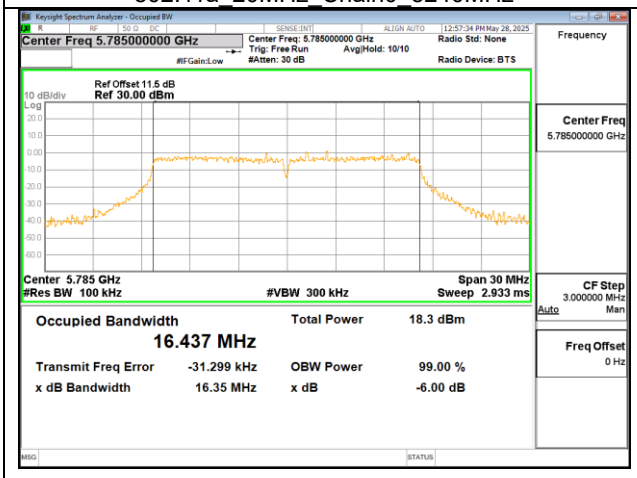
802.11a_20MHz_Chain0_5220MHz



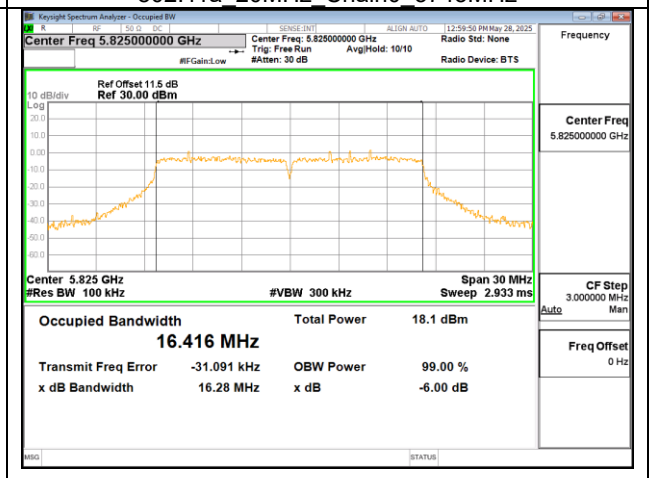
802.11a_20MHz_Chain0_5240MHz



802.11a_20MHz_Chain0_5745MHz



802.11a_20MHz_Chain0_5785MHz



802.11a_20MHz_Chain0_5825MHz

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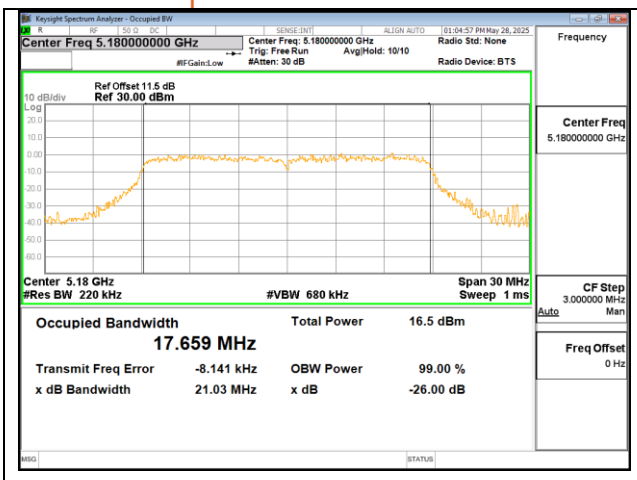
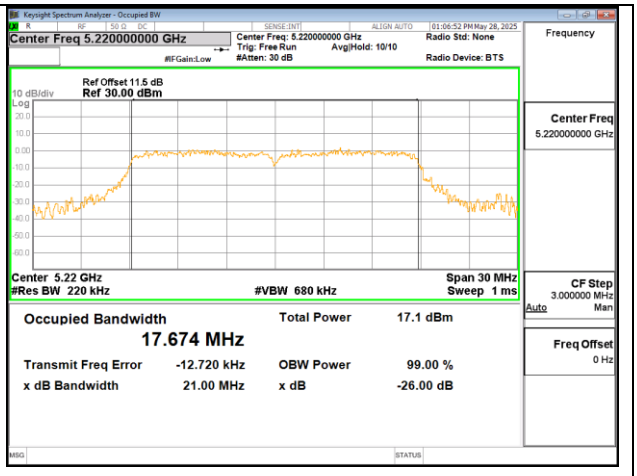
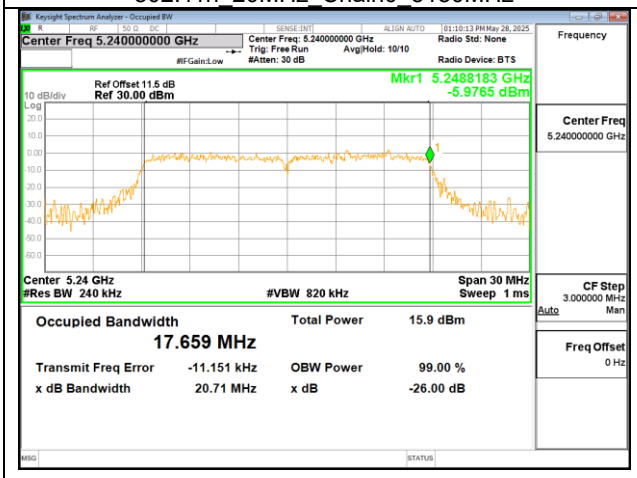


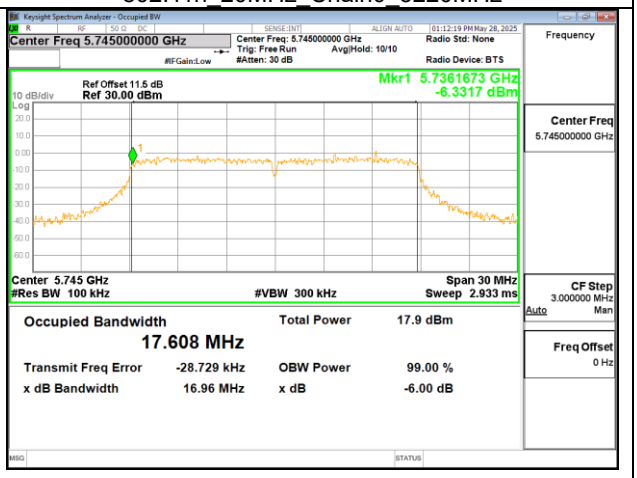
802.11n_20MHz_Chain0_5180MHz



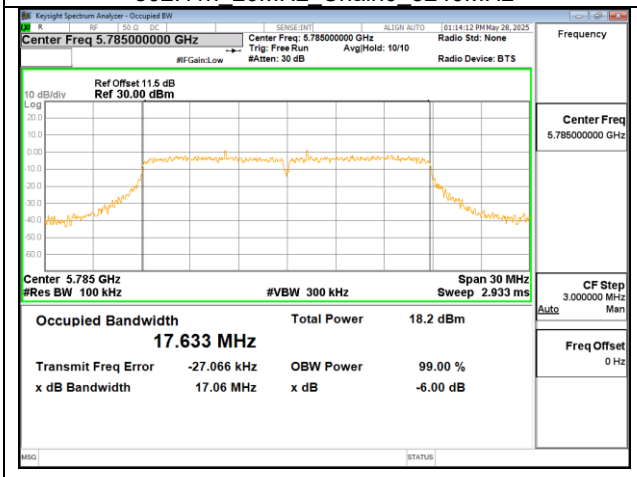
802.11n_20MHz_Chain0_5220MHz



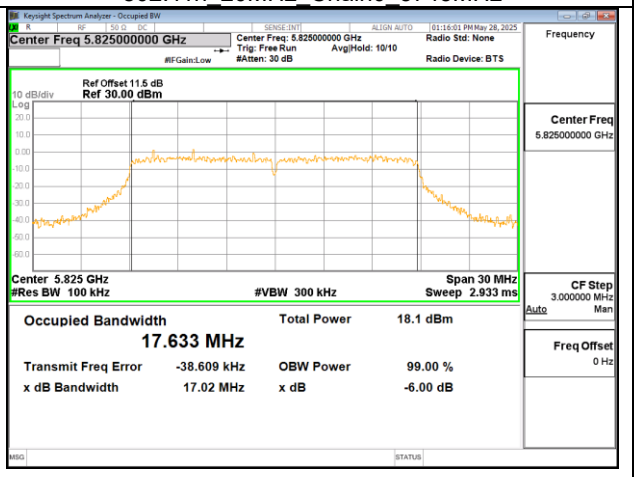
802.11n_20MHz_Chain0_5240MHz



802.11n_20MHz_Chain0_5745MHz



802.11n_20MHz_Chain0_5785MHz



802.11n_20MHz_Chain0_5825MHz

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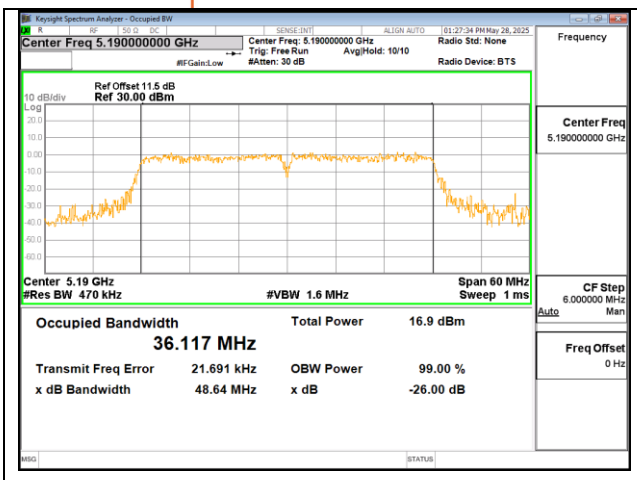
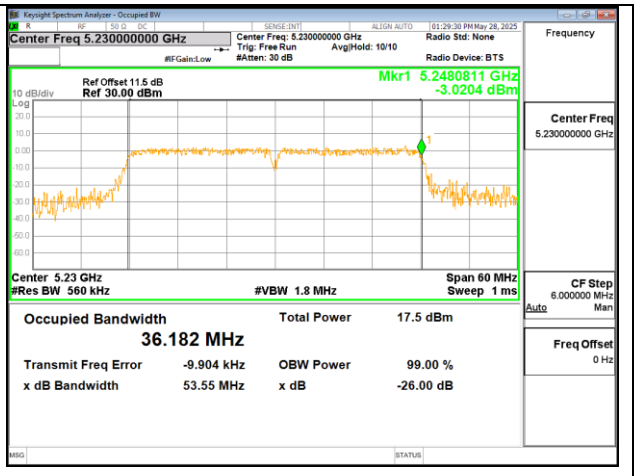
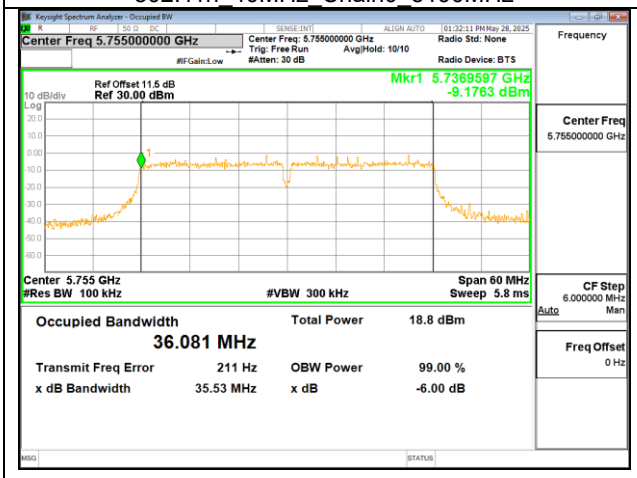


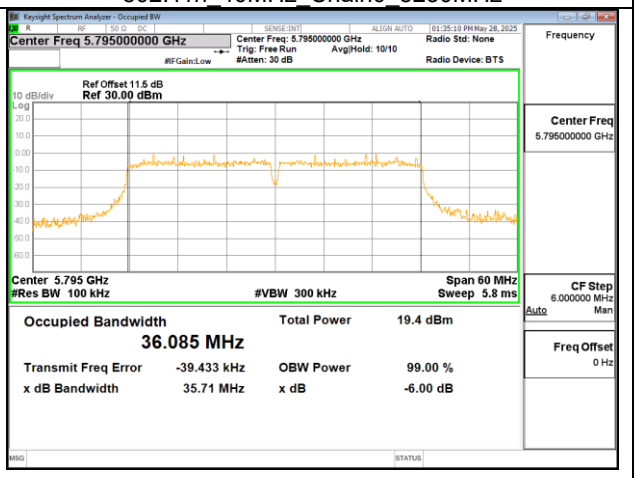
802.11n_40MHz_Chain0_5190MHz



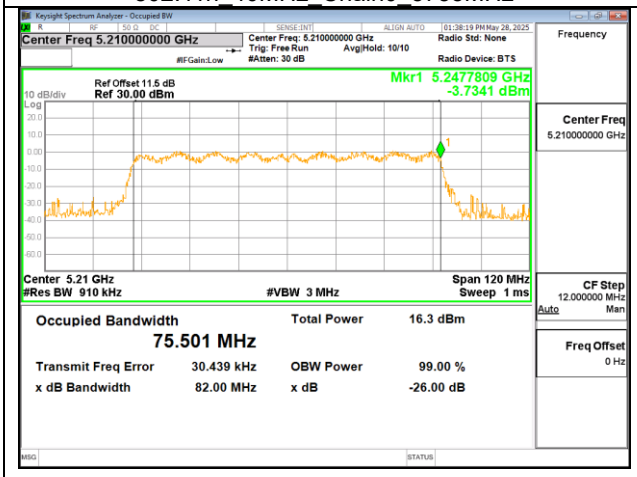
802.11n_40MHz_Chain0_5230MHz



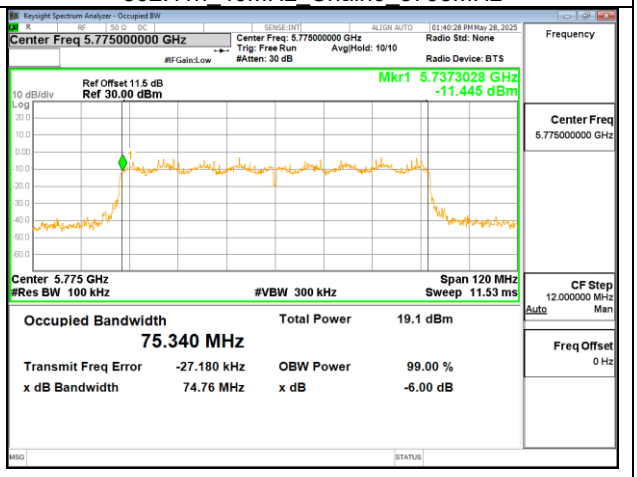
802.11n_40MHz_Chain0_5755MHz



802.11n_40MHz_Chain0_5795MHz



802.11ac_80MHz_Chain0_5210MHz



802.11ac_80MHz_Chain0_5775MHz

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8.4.2 99% Occupied Bandwidth

802.11a_Ch0

Frequency (MHz)	99% BW (MHz)	10 Log (B) (dB)
5180	16.623	12.210
5220	16.583	12.200
5240	16.571	12.190

802.11a_Ch0

Frequency (MHz)	99% BW (MHz)	6dB BW (MHz)
5745	16.545	16.37
5785	16.538	16.35
5825	16.510	16.28

802.11n_HT20_Ch0

Frequency (MHz)	99% BW (MHz)	10 Log (B) (dB)
5180	17.659	12.470
5220	17.668	12.470
5240	17.692	12.480

802.11n_HT20_Ch0

Frequency (MHz)	99% BW (MHz)	6dB BW (MHz)
5745	17.660	16.96
5785	17.632	17.06
5825	17.662	17.02

802.11n_HT40_Ch0

Frequency (MHz)	99% BW (MHz)	10 Log (B) (dB)
5190	36.099	15.570
5230	36.186	15.590

802.11n_HT40_Ch0

Frequency (MHz)	99% BW (MHz)	6dB BW (MHz)
5755	36.039	35.53
5795	36.117	35.71

802.11ac_VHT80_Ch0

Frequency (MHz)	99% BW (MHz)	10 Log (B) (dB)
5210	75.485	18.780

802.11ac_VHT80_Ch0

Frequency (MHz)	99% BW (MHz)	6dB BW (MHz)
5775	75.570	74.46

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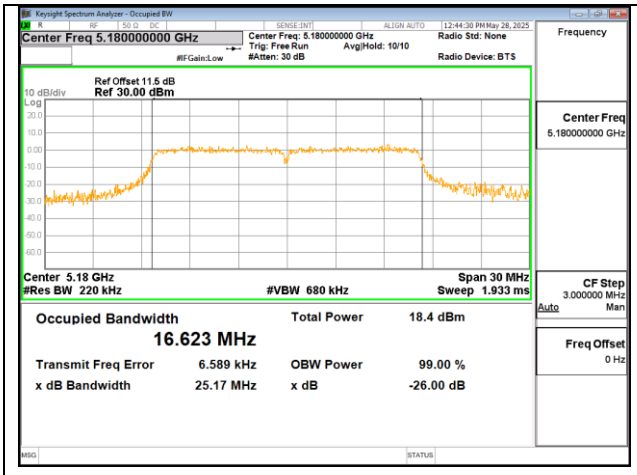
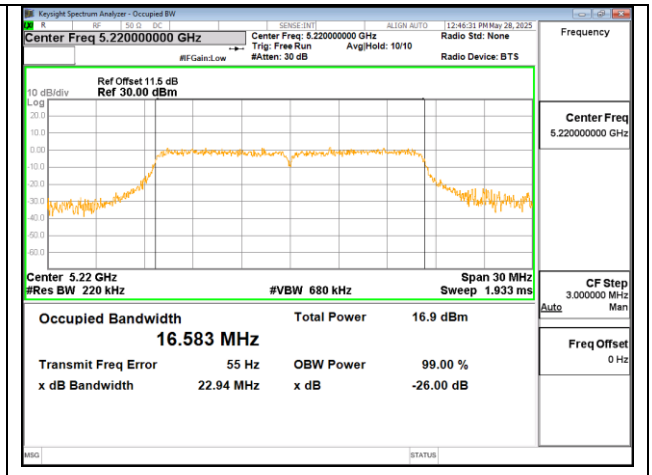
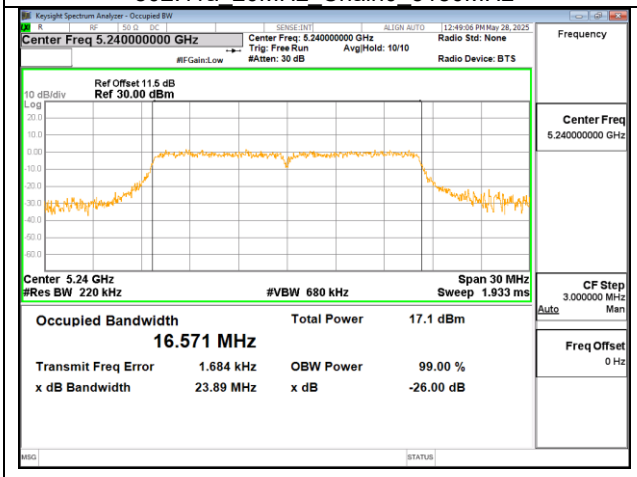


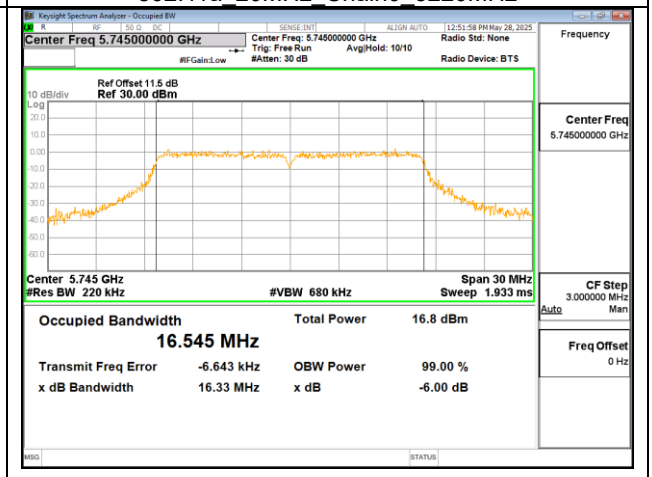
802.11a_20MHz_Chain0_5180MHz



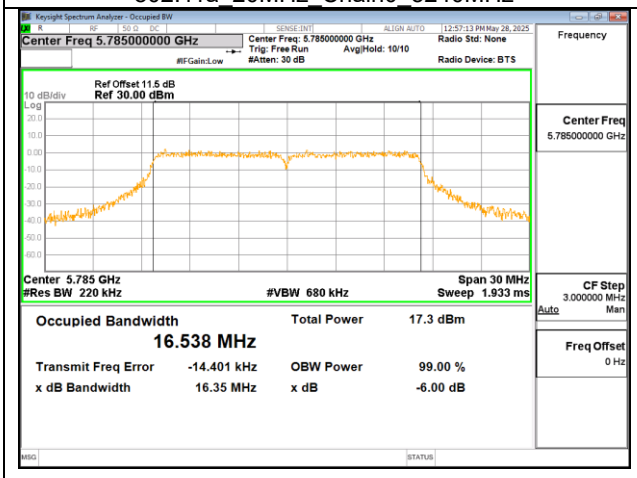
802.11a_20MHz_Chain0_5220MHz



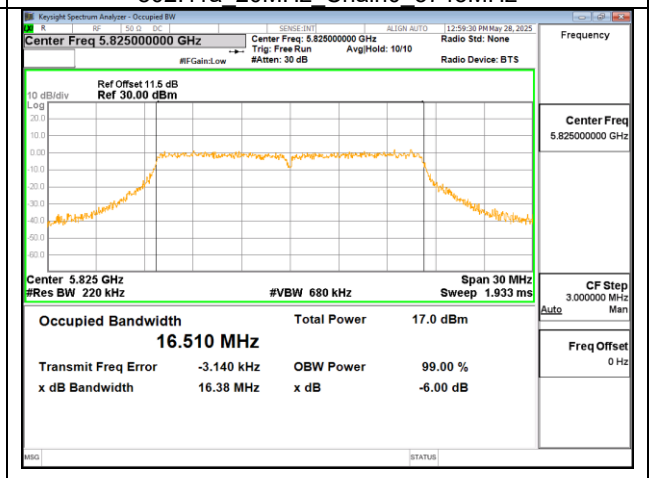
802.11a_20MHz_Chain0_5240MHz



802.11a_20MHz_Chain0_5745MHz



802.11a_20MHz_Chain0_5785MHz



802.11a_20MHz_Chain0_5825MHz

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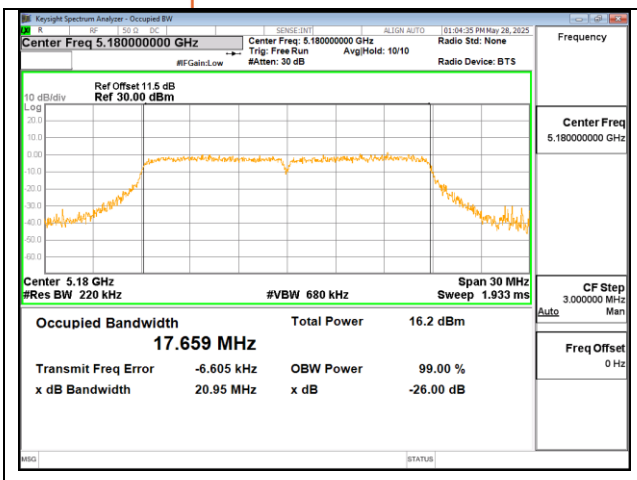
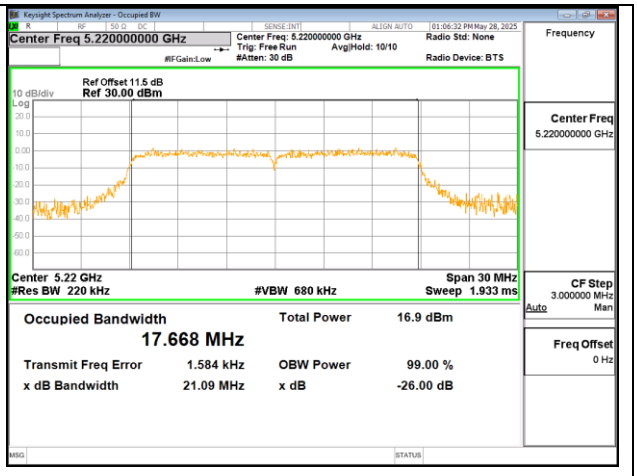
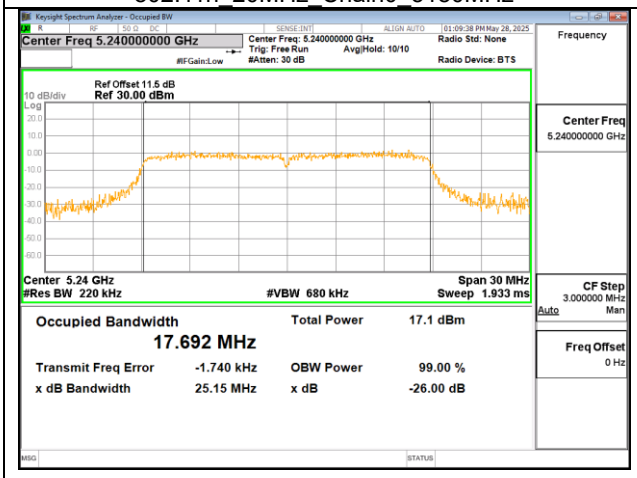


802.11n_20MHz_Chain0_5180MHz



802.11n_20MHz_Chain0_5220MHz



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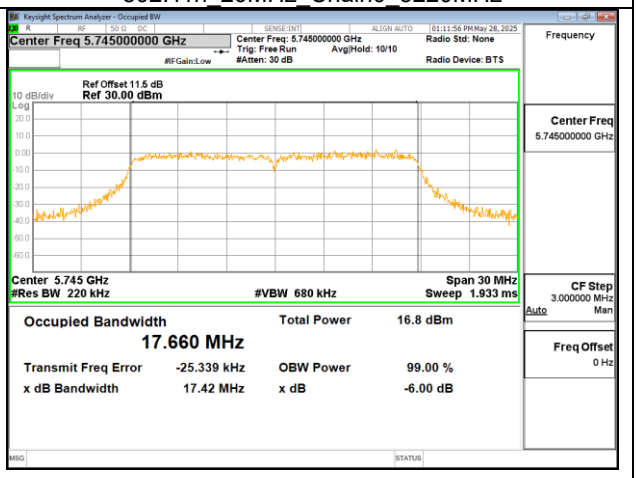

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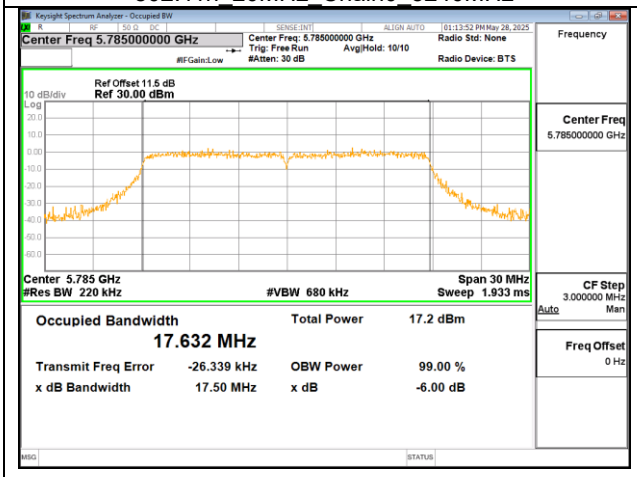

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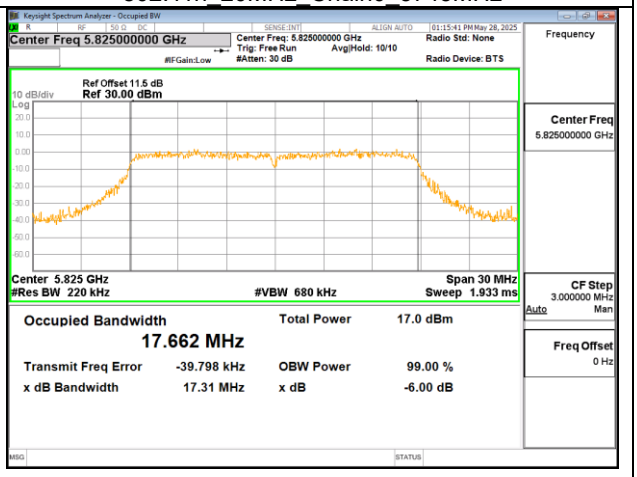

802.11n_20MHz_Chain0_5825MHz

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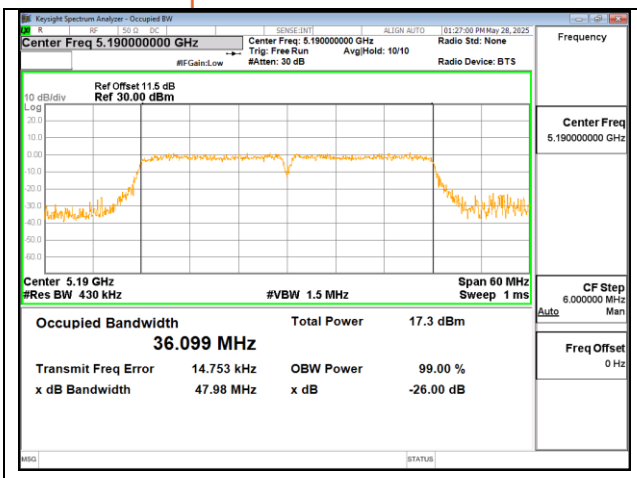
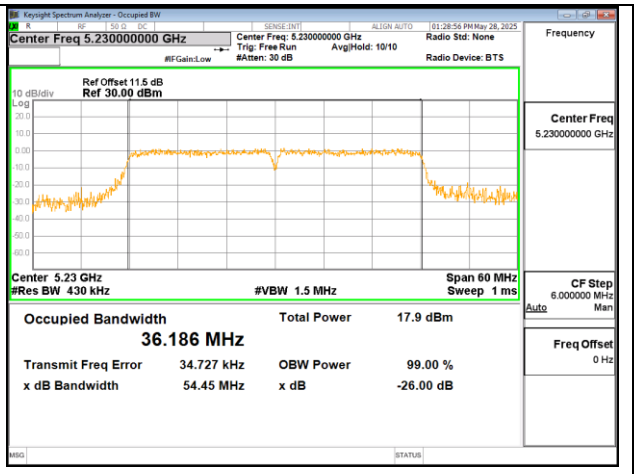


802.11n_40MHz_Chain0_5190MHz



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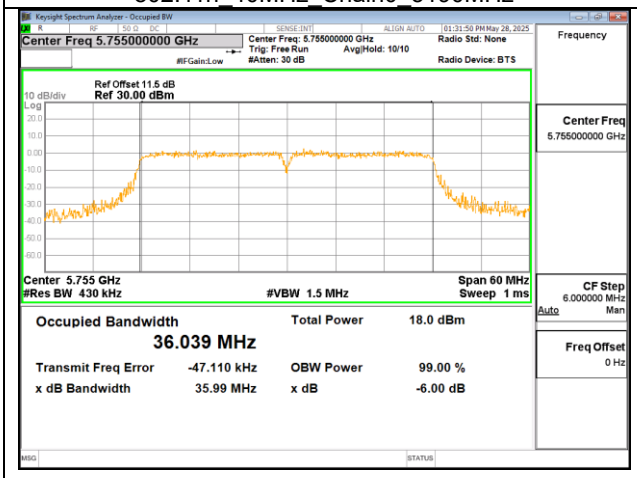

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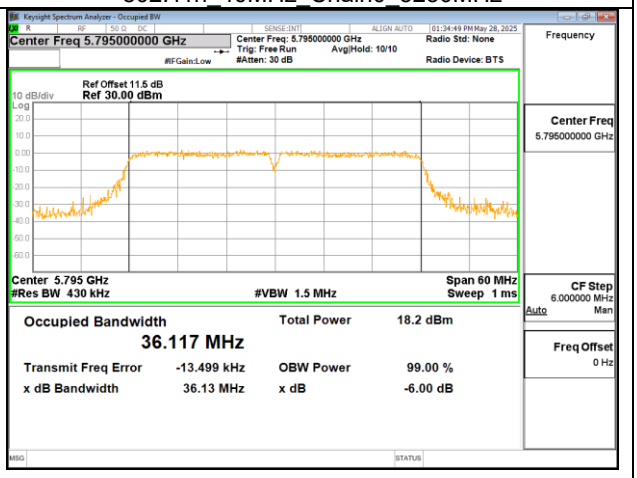
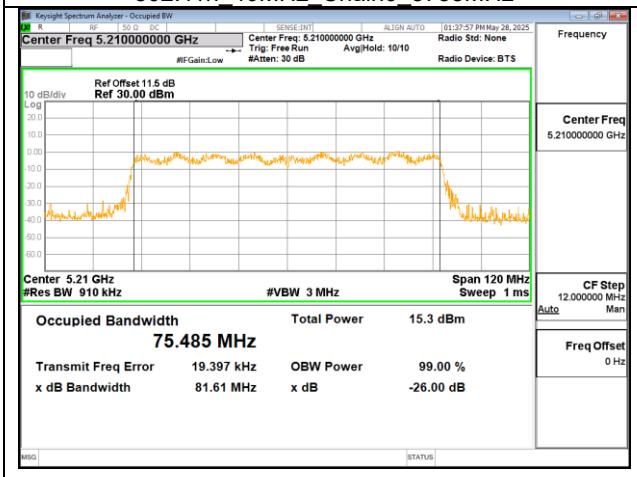
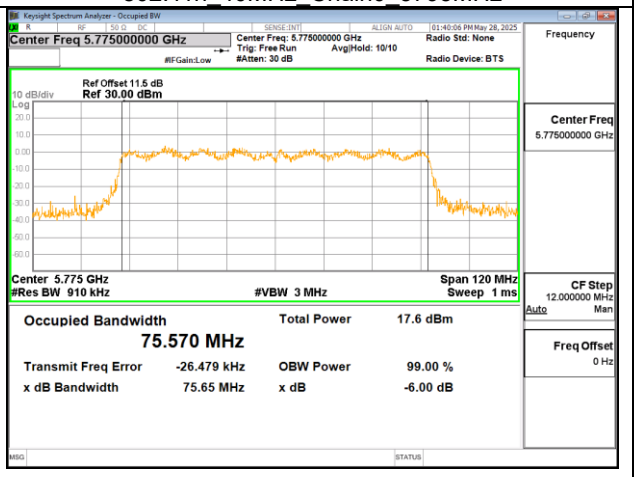


802.11n_40MHz_Chain0_5795MHz



802.11ac_80MHz_Chain0_5210MHz



802.11ac_80MHz_Chain0_5775MHz

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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 FCC

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
		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
	V	Other	250mW(23.98dBm)	Not required	Not required	6dBi
U-NII-2A		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		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
U-NII-4		Indoor AP (a channel spans 5725~5850 and 5850~5895MHz)	Not required	36dBm	Not required	Not required
		Indoor client (a channel spans 5725~5850 and 5850~5895MHz)	Not required	30dBm	Not required	Not required
		Subordinate device	Not required	36dBm	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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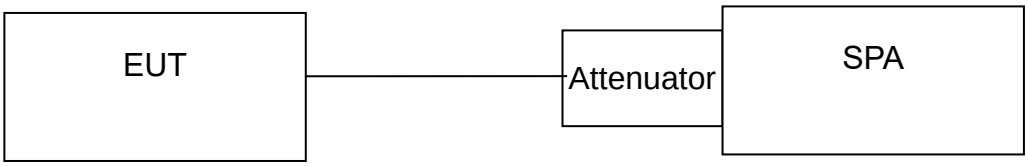
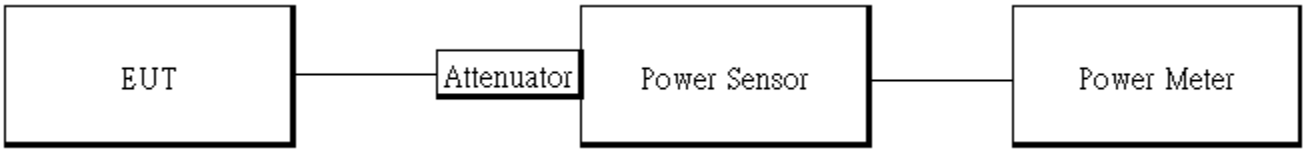
9.2 Test Setup

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/duty cycle).
6. Repeat above procedures until all frequency (low, middle, and high channel) measured were complete.

Note:

For U-NII1, 2A, 2C and 3 Bands, when the antenna gain is greater than 6 dBi, the power limit attenuated accordingly.

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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)
802.11a	80.06	0.97	0.49	1.00
802.11n_20	78.86	1.03	0.53	1.00
802.11ac_20	78.90	1.03	0.53	1.00
802.11n_40	64.80	1.88	1.08	2.00
802.11ac_40	64.81	1.88	1.07	2.00
802.11ac_80	47.28	3.25	2.21	3.00

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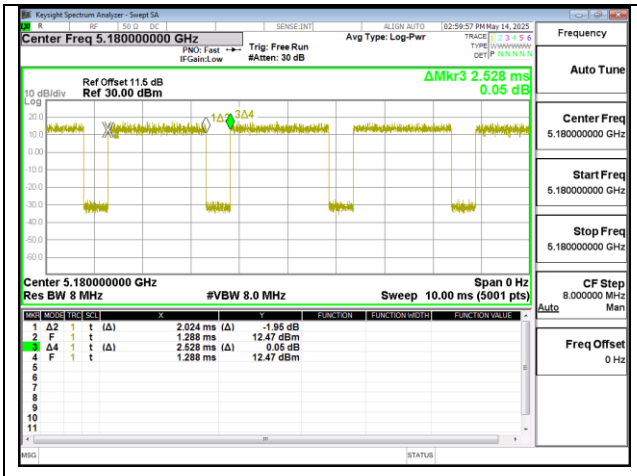
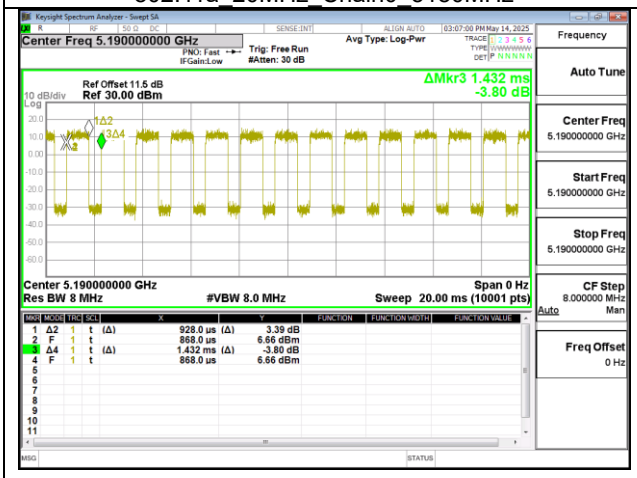


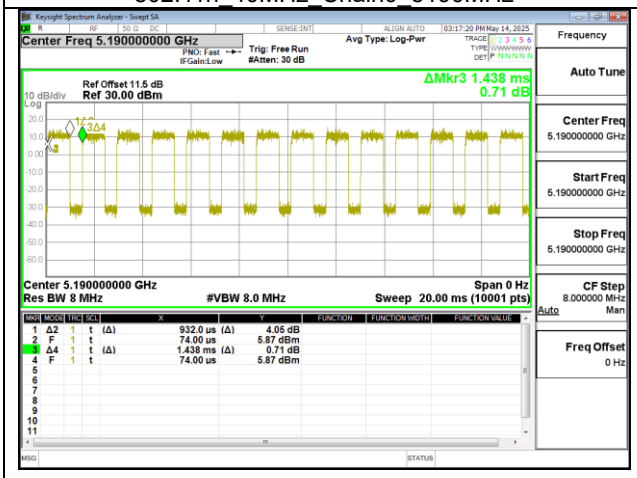
802.11a_20MHz_Chain0_5180MHz

802.11n_20MHz_Chain0_5180MHz



802.11n_40MHz_Chain0_5190MHz

802.11ac_20MHz_Chain0_5180MHz



802.11ac_40MHz_Chain0_5190MHz

802.11ac_80MHz_Chain0_5210MHz

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9.5 Output Power Measurement Result

9.5.1 FCC Output power

Note: *For all straddle channels, full bandwidth power is reported in the UNII Band 2C because the combined UNII Band 2C and UNII Band 3 power already passed the worst-case UNII Band 2C limit.*

802.11a_Ch0

CH	Frequency (MHz)	Data Rate	Power Setting	TOTAL POWER (mW)	TOTAL POWER (dBm)	REQUIRED LIMIT (dBm)	RESULT
36	5180	6	53	23.420	**13.70**	23.98	PASS
44	5220	6	52	23.152	13.65	23.98	PASS
48	5240	6	52	22.573	13.54	23.98	PASS
149	5745	6	40	23.582	**13.73**	30	PASS
157	5785	6	40	22.992	13.62	30	PASS
165	5825	6	40	22.782	13.58	30	PASS

802.11n_HT20_Ch0

CH	Frequency (MHz)	Data Rate	Power Setting	TOTAL POWER (mW)	TOTAL POWER (dBm)	REQUIRED LIMIT (dBm)	RESULT
36	5180	MCS0	47	12.138	**10.84**	23.98	PASS
44	5220	MCS0	46	11.753	10.70	23.98	PASS
48	5240	MCS0	46	11.328	10.54	23.98	PASS
149	5745	MCS0	34	12.364	**10.92**	30	PASS
157	5785	MCS0	34	12.166	10.85	30	PASS
165	5825	MCS0	34	12.027	10.80	30	PASS

802.11n_HT40_Ch0

CH	Frequency (MHz)	Data Rate	Power Setting	TOTAL POWER (mW)	TOTAL POWER (dBm)	REQUIRED LIMIT (dBm)	RESULT
38	5190	MCS0	46	12.146	**10.84**	23.98	PASS
46	5230	MCS0	45	11.952	10.77	23.98	PASS
151	5755	MCS0	34	11.466	**10.59**	30	PASS
159	5795	MCS0	34	11.283	10.52	30	PASS

802.11ac_VHT20_Ch0

CH	Frequency (MHz)	Data Rate	Power Setting	TOTAL POWER (mW)	TOTAL POWER (dBm)	REQUIRED LIMIT (dBm)	RESULT
36	5180	MCS0	47	12.132	**10.84**	23.98	PASS
44	5220	MCS0	46	11.532	10.62	23.98	PASS
48	5240	MCS0	46	11.374	10.56	23.98	PASS
149	5745	MCS0	34	11.993	**10.79**	30	PASS
157	5785	MCS0	34	11.774	10.71	30	PASS
165	5825	MCS0	34	11.559	10.63	30	PASS

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802.11ac_VHT40_Ch0

CH	Frequency (MHz)	Data Rate	Power Setting	TOTAL POWER (mW)	TOTAL POWER (dBm)	REQUIRED LIMIT (dBm)	RESULT
38	5190	MCS0	46	12.033	**10.80**	23.98	PASS
46	5230	MCS0	45	11.786	10.71	23.98	PASS
151	5755	MCS0	34	11.412	**10.57**	30	PASS
159	5795	MCS0	34	11.386	10.56	30	PASS

802.11ac_VHT80_Ch0

CH	Frequency (MHz)	Data Rate	Power Setting	TOTAL POWER (mW)	TOTAL POWER (dBm)	REQUIRED LIMIT (dBm)	RESULT
42	5210	MCS0	44	12.397	**10.93**	23.98	PASS
155	5775	MCS0	32	12.512	**10.97**	30	PASS

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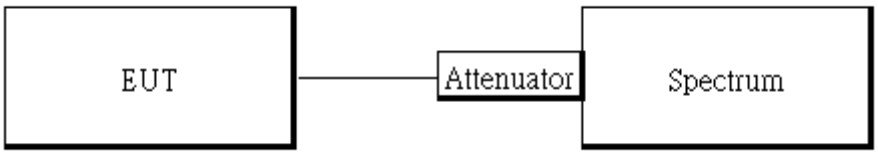
10 MAXIMUM POWER SPECTRAL DENSITY

10.1 FCC Standard

Operation Bands	EUT CATEGORY		e-CRF Title 47 §15.407 Power Spectral Density	Antenna Directional Gain Requirements
U-NII-1		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 Ponit	17dBm / MHz	23dBi
	V	Client device	11dBm / MHz	6dBi
U-NII-2A		All	11dBm / MHz	6dBi
U-NII-2C		All	11dBm / MHz	6dBi
U-NII-3	V	All	30dBm / 500kHz	6dBi
U-NII-4		Indoor AP	20dBm / MHz e.i.r.p.	Not required
		Indoor client	14dBm / MHz e.i.r.p.	Not required
		Subordinate device	20dBm / MHz e.i.r.p.	Not required
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.				

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. User the cursor on spectrum to peak search the highest level of trace
6. (1)Duty cycle ≥ 98%：Record the max. reading.

   (2)Duty cycle < 98%：Record the max. reading and add 10 log(1/duty cycle).
7. Repeat above procedures until all default test channel (low, middle, and high) was complete.

Note:

For U-NII1, 2A, 2C and 3 Bands, when the antenna gain is greater than 6 dBi, the power spectral density limit attenuated accordingly.

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10.4 Measurement Result

POWER DENSITY 802.11a MODE						
Frequency (MHz)	Ch0 meas PSD (dBm/MHz)	Duty Factor (dB)	Maxmum Corr'd PSD(dBm/MHz)		Limit	Margin (dB)
5180	2.913	0.97	3.88		11.00 dBm/MHz	-7.12
5220	0.377	0.97	1.35		11.00 dBm/MHz	-9.65
5240	0.524	0.97	1.49		11.00 dBm/MHz	-9.51
Frequency (MHz)	Ch0 meas PSD (dBm/300kHz)	Duty Factor (dB)	10log (500kHz/RBW) Factor(dB)	Maxmum Corr'd PSD (dBm/500kHz)	Limit	Margin (dB)
5745	-3.891	0.97	2.22	3.19	30.00 dBm/500kHz	-26.81
5785	-4.017	0.97	2.22	3.19	30.00 dBm/500kHz	-26.81
5825	-4.295	0.97	2.22	3.19	30.00 dBm/500kHz	-26.81
POWER DENSITY 802.11n HT20 MODE						
Frequency (MHz)	Ch0 meas PSD (dBm/MHz)	Duty Factor (dB)	Maxmum Corr'd PSD(dBm/MHz)		Limit	Margin (dB)
5180	-0.077	1.03	1.03		11.00 dBm/MHz	-9.97
5220	0.515	1.03	1.55		11.00 dBm/MHz	-9.46
5240	0.663	1.03	1.69		11.00 dBm/MHz	-9.31
Frequency (MHz)	Ch0 meas PSD (dBm/300kHz)	Duty Factor (dB)	10log (500kHz/RBW) Factor(dB)	Maxmum Corr'd PSD (dBm/500kHz)	Limit	Margin (dB)
5745	-4.332	1.03	2.22	3.25	30.00 dBm/500kHz	-26.75
5785	-4.201	1.03	2.22	3.25	30.00 dBm/500kHz	-26.75
5825	-4.758	1.03	2.22	3.25	30.00 dBm/500kHz	-26.75
POWER DENSITY 802.11n HT40 MODE						
Frequency (MHz)	Ch0 meas PSD (dBm/MHz)	Duty Factor (dB)	Maxmum Corr'd PSD(dBm/MHz)		Limit	Margin (dB)
5190	-3.476	1.88	1.88		11.00 dBm/MHz	-9.12
5230	-2.806	1.88	1.88		11.00 dBm/MHz	-9.12
Frequency (MHz)	Ch0 meas PSD (dBm/300kHz)	Duty Factor (dB)	10log (500kHz/RBW) Factor(dB)	Maxmum Corr'd PSD (dBm/500kHz)	Limit	Margin (dB)
5755	-6.957	1.88	2.22	4.10	30.00 dBm/500kHz	-25.90
5795	-7.324	1.88	2.22	4.10	30.00 dBm/500kHz	-25.90

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POWER DENSITY 802.11ac VHT80 MODE						
Frequency (MHz)	Ch0 meas PSD (dBm/MHz)	Duty Factor (dB)	Maxmum Corr'd PSD(dBm/MHz)		Limit	Margin (dB)
5210	-8.497	3.25	3.25		11.00 dBm/MHz	-7.75
Frequency (MHz)	Ch0 meas PSD (dBm/300kHz)	Duty Factor (dB)	10log (500kHz/RBW) Factor(dB)	Maxmum Corr'd PSD (dBm/500kHz)	Limit	Margin (dB)
5775	-10.616	3.25	2.22	5.47	30.00 dBm/500kHz	-24.53

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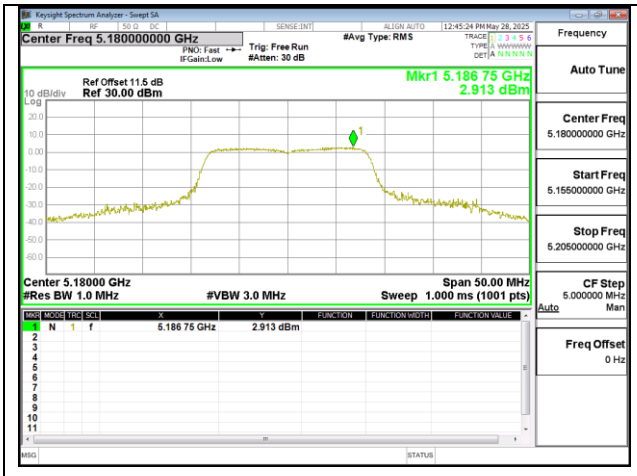
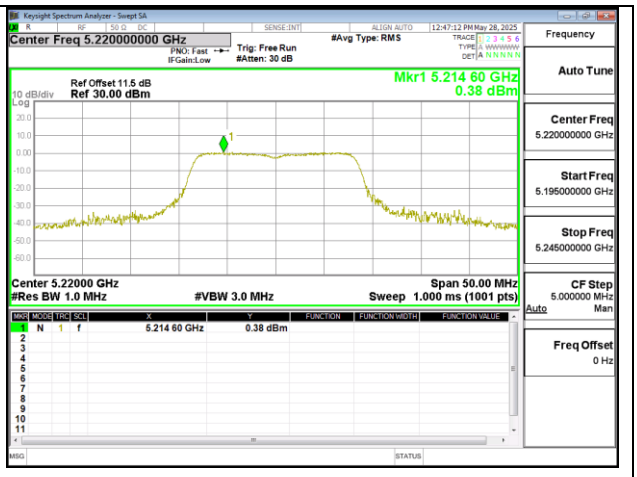


802.11a_20MHz_Chain0_5180MHz



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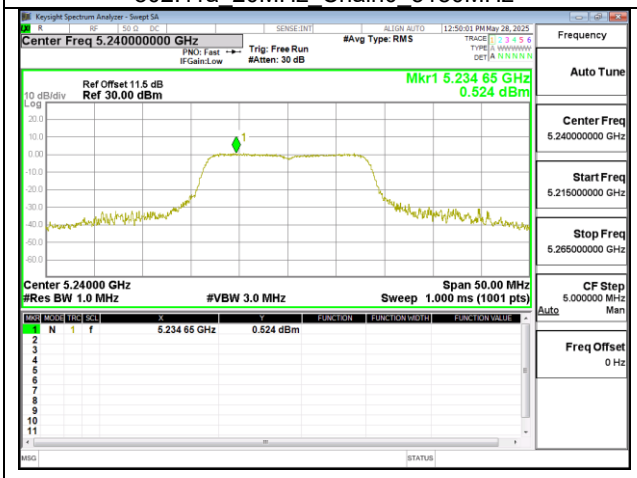
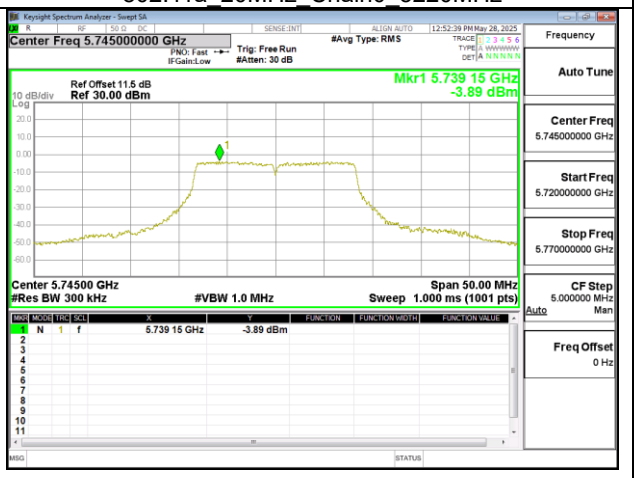
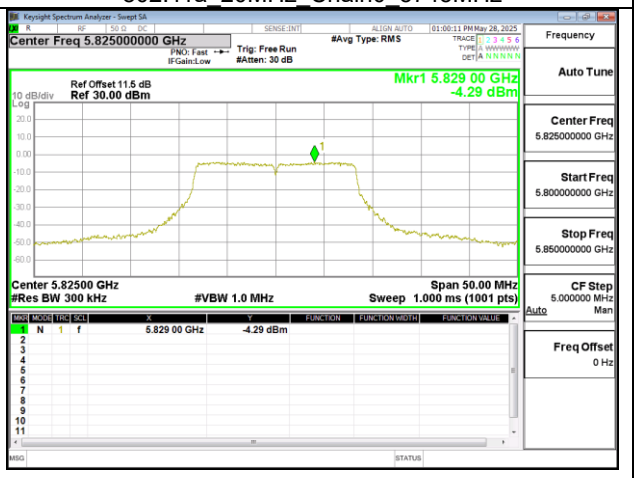


802.11a_20MHz_Chain0_5240MHz



802.11a_20MHz_Chain0_5745MHz

802.11a_20MHz_Chain0_5785MHz



802.11a_20MHz_Chain0_5825MHz

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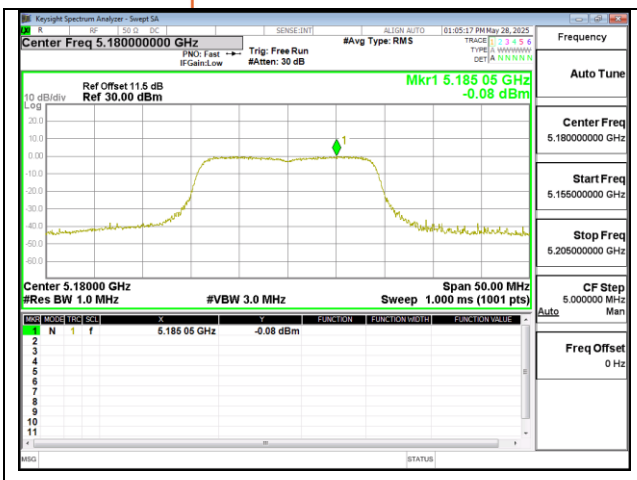
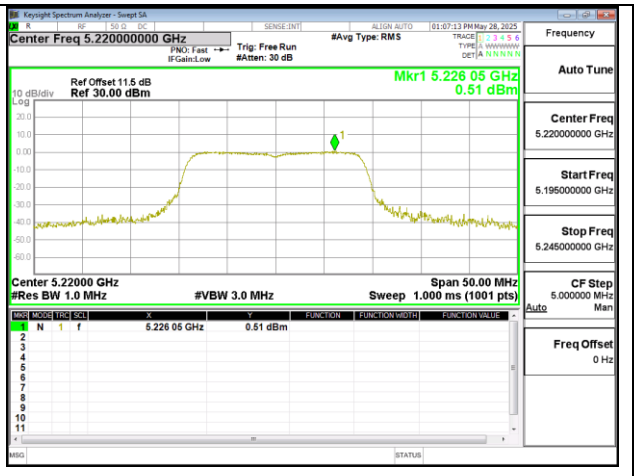


802.11n_20MHz_Chain0_5180MHz



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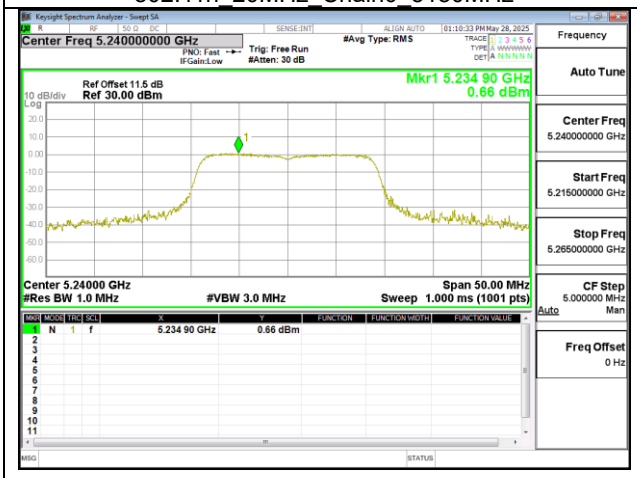
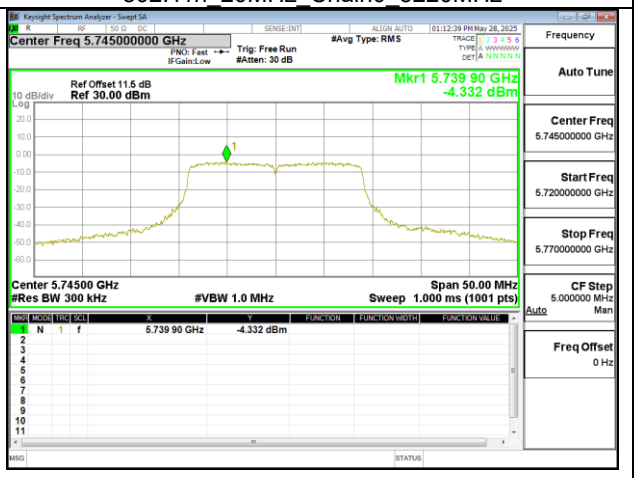
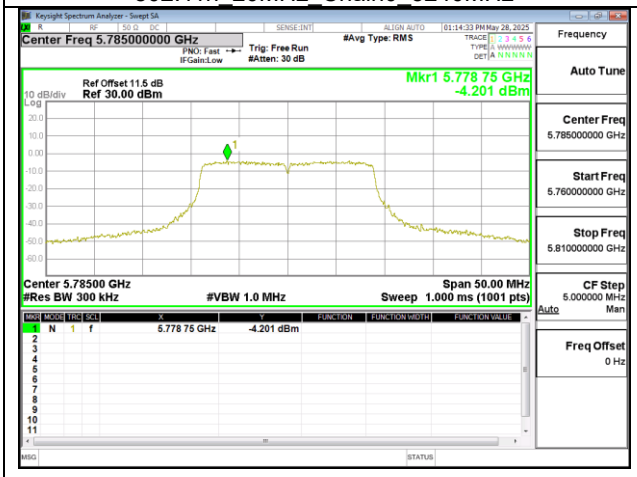


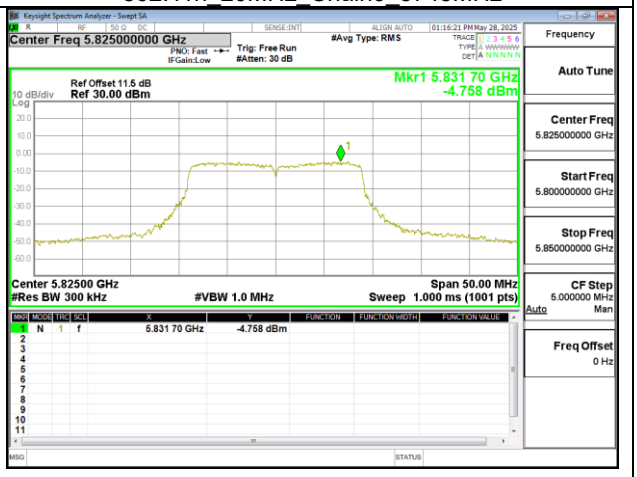
802.11n_20MHz_Chain0_5240MHz



802.11n_20MHz_Chain0_5745MHz



802.11n_20MHz_Chain0_5785MHz



802.11n_20MHz_Chain0_5825MHz

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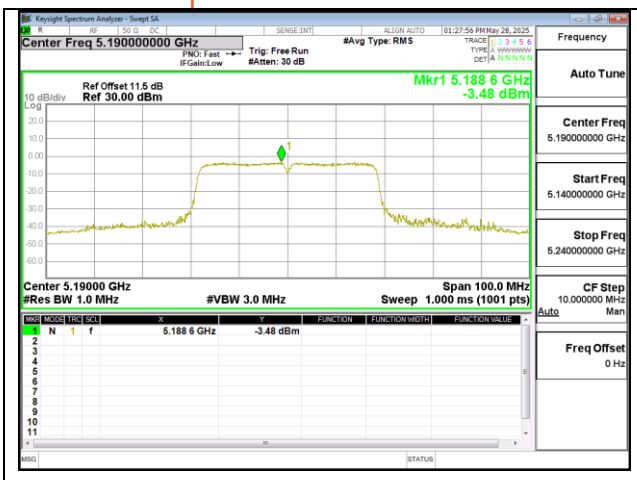
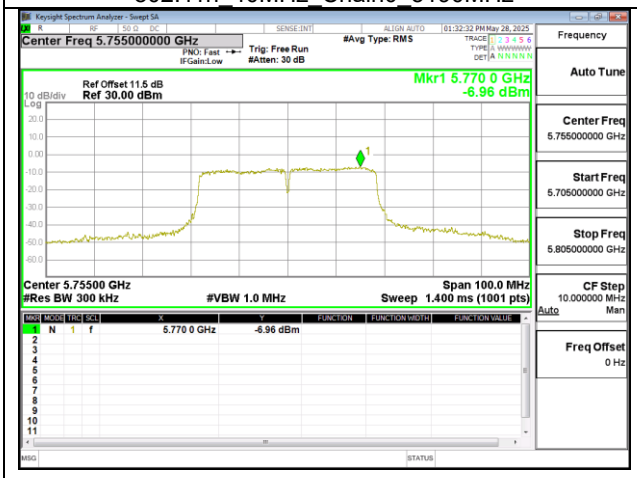
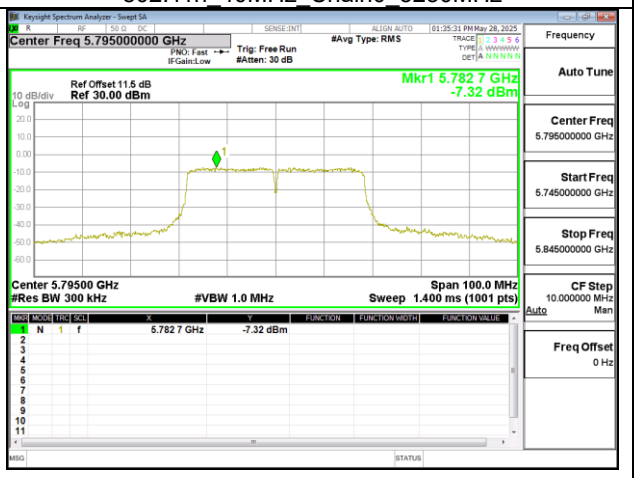


802.11n_40MHz_Chain0_5190MHz

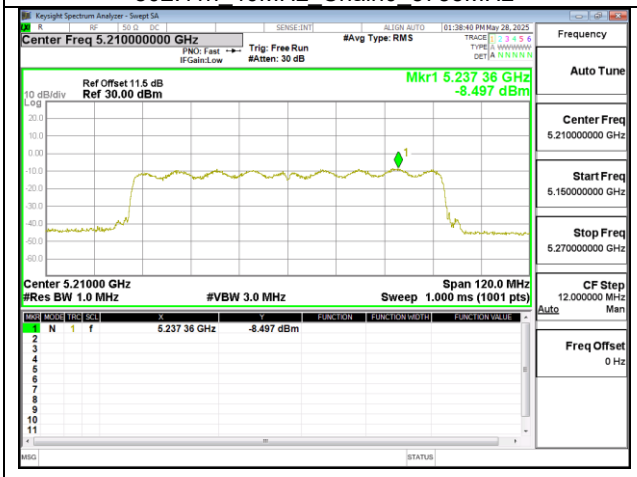
802.11n_40MHz_Chain0_5230MHz



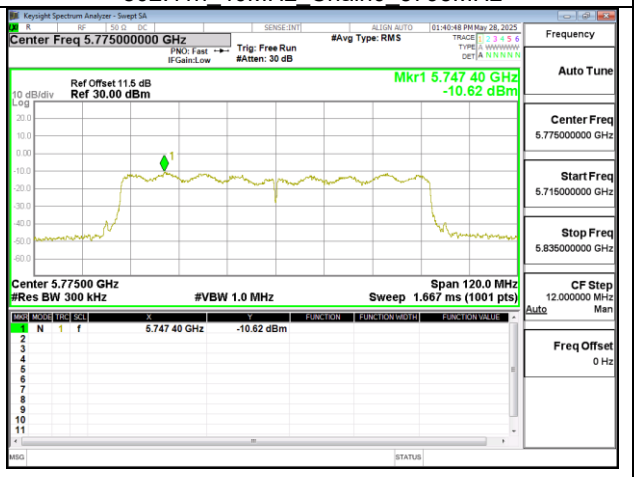
802.11n_40MHz_Chain0_5755MHz



802.11n_40MHz_Chain0_5795MHz



802.11ac_80MHz_Chain0_5210MHz



802.11ac_80MHz_Chain0_5775MHz

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