

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT



Applicant: Murata Manufacturing Co., Ltd.
1-10-1 Higashikotari, Nagaokakyo-shi, Kyoto 617-8555 Japan
Manufacturer: Murata Manufacturing Co., Ltd.
1-10-1 Higashikotari, Nagaokakyo-shi, Kyoto 617-8555 Japan
Product Name: Communication Module
Brand Name: Murata Manufacturing Co., Ltd.
Model No.: LBES0ZZ2LL
/ISED HVIN:
Family Model No.: LBEE0ZZ2KL
/ Family ISED HVIN:
Model Difference: Different functions: LBES0ZZ2LL includes IEEE802.15.4. functionality.
ISED PMN: LBES0ZZ2LL, LBEE0ZZ2KL
Report Number: TERF2410002919E2
FCC ID VPLYLBES0ZZ2LL
IC: 772C-LBES0ZZ2LL
Date of EUT Received: September 24, 2024
Date of Test: October 4, 2024 ~ November 19, 2024
Issue Date: December 18, 2024

Aken Huang

Approved By

Aken Huang

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, ISED RSS-247.

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
TERF2410002919E2	00	Original	Dec. 10, 2024	Candice Li	
TERF2410002919E2	01	Modify FVIN of section 1.1	Dec. 18, 2024	Candice Li	*

Note:

- 1、The remark "*" indicates modification of the report upon requests from certification body.
- 2、Variant information of model numbers is provided by the applicant, test results of this report are applicable to the sample EUT(s) received.
Only the main model LBES0ZZ2LL has IEEE802.15.4. functionality and has been independently tested for this feature. The variants are assessed as electrically identical in RF characteristics, therefore, no further assessment required for the variant(s).

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1 GENERAL INFORMATION

1.1 Product Description

Product Name:	Communication Module
Brand Name:	Murata Manufacturing Co., Ltd.
Model No.: /ISED HVIN:	LBES0ZZ2LL
Family Model No.: / Family ISED HVIN:	LBEE0ZZ2KL
Model Difference:	Different functions: LBES0ZZ2LL includes IEEE802.15.4. functionality.
Hardware Version:	1.0
Firmware Version:	1.1.1.1
EUT Series No.:	2LL #116 (Conducted, Conduction) 2LL #116 / 2LL #82 (Radiated)
Power Supply:	3.3 Vdc, 1.8 Vdc
Test Software (Name/Version)	DUT Labtool Version 2.0.0.17

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
	1024QAM, 256QAM, 64QAM, 16QAM, QPSK, BPSK for OFDMA in 802.11ax
Transition Rate:	802.11 a: 6 - 54 Mbps
	802.11 n_HT20: up to 144.4 Mbps
	802.11 ac_VHT20: up to 173.4 Mbps
	802.11 ax_HE20: up to 286.8 Mbps

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1.3 Antenna Designation

External Antenna

Antenna Type	Supplier	Antenna Part No.	Freq. (MHz)	Peak Antenna Gain (dBi)
Dipole	Molex	146187	5150~5850	4.25
	Molex	145153	5150~5850	4.25
	Molex	219611	5150~5850	3.67
	Unictron	WT32D1-KX	5150~5850	4
	Unictron	AA258	5150~5850	3.8
	Taoglas	FXP830.07.0100C	5150~5850	4.7
	Antenova	SRF2W012	5150~5850	4
	Sansei	STDANTEMMD-013	5150~5850	2.8
	Laird	EMF2471A3S	5150~5850	4.4
	Kyocera AVX (KAVX)	1001932FT	5150~5850	4.4
	Kyocera AVX (KAVX)	1001932PT	5150~5850	4.45
	Kyocera AVX (KAVX)	W3P35x8W04	5150~5850	5
	Inventek	W2.4-5P-U	5150~5850	5.18

Internal Antenna

Antenna Type	Supplier	Antenna Part No.	Freq. (MHz)	Peak Antenna Gain (dBi)
Monopole	Murata	Type2LL _Antenna	5150~5850	4.6

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
802.11a/ 802.11n_HT20/ 802.11ac_VHT20/ 802.11ax_HE20	5180~5240	4	17.95 dBm	OFDM
	5260~5320	4	17.77 dBm	OFDM
	5500~5720	12	17.73 dBm	OFDM
	5745-5825	5	17.91 dBm	OFDM

1.5 ISED

WLAN 5 GHz for ISED (Slave)

Wi-Fi	Frequency Range	Channels	EIRP/Avg	Rated Power(EIRP/Avg) (dBm) (Worst Case)	Modulation Technology
802.11a/ 802.11n_HT20/ 802.11ac_VHT20/ 802.11ax_HE20	5180~5240	4	EIRP	20.14 dBm	OFDMA
	5260~5320	4	Avg	17.77 dBm	OFDM
	5500~5700	11	Avg	17.73 dBm	OFDM
	5720 (U-NII 2C)	1	Avg	16.73 dBm	OFDM
	5720 (U-NII 3)	1	Avg	11.89 dBm	OFDM
	5745-5825	5	Avg	17.91 dBm	OFDM

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1.6 Test Methodology of Applied Standards

FCC Part 15, Subpart E §15.407

FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01

RSS-247 issue 3 Aug. 2023

RSS-Gen, Issue 5 April 2018, Amendment 2 (February 2021)

ANSI C63.10:2013

1.7 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.

1.8 Special Accessories

There are no special accessories used while test was conducted.

1.9 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

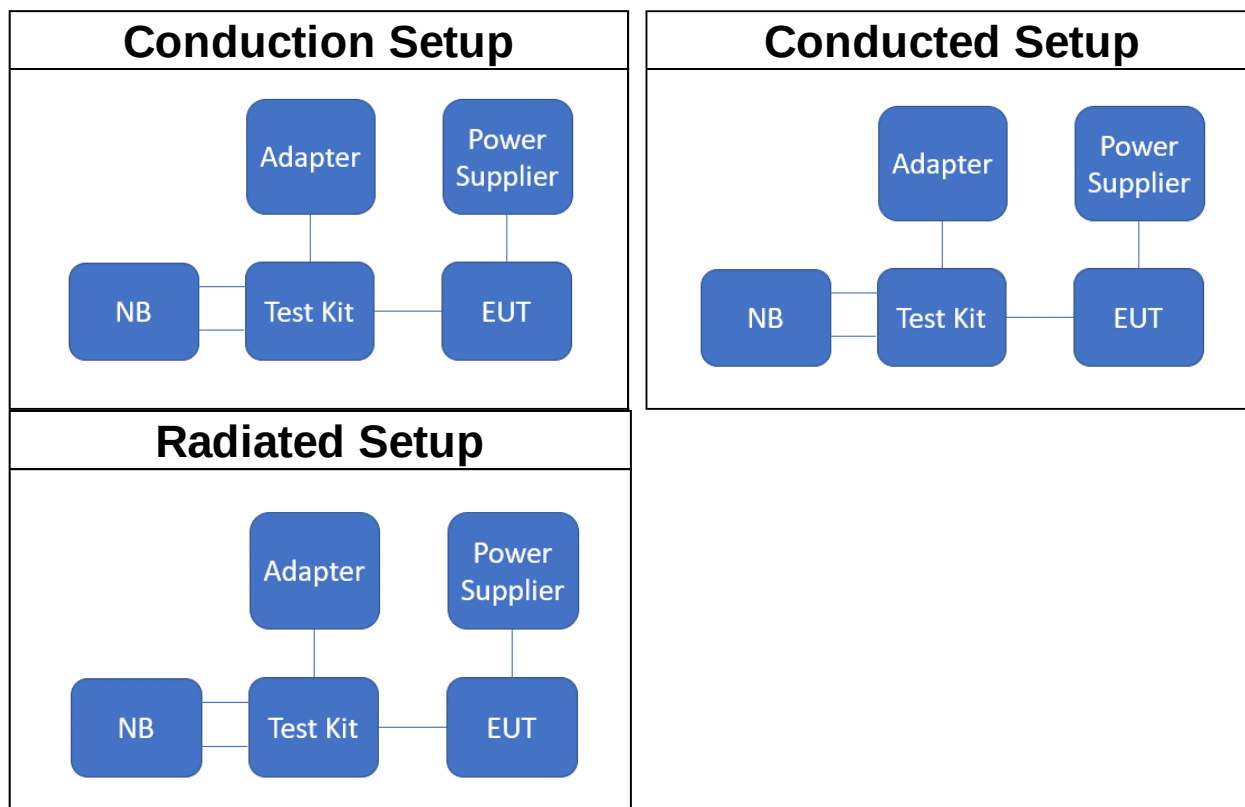
Radiated emission below 30MHz is measured in a 9m*6m*6m semi-anechoic chamber, the measurements correspond to those obtained at an open-field test site.

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



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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.	CAL DUE.
LAN Cable	BUFFALO	BSLS6NU30BL	N/A	N/A	N/A
USB cable	ZHUANG SHAN	2725	N/A	N/A	N/A
USB cable	ANKER	A8852011	N/A	N/A	N/A
Adapter	ANKER	A2664	N/A	N/A	N/A
Notebook	Lenovo	T470	P0001293	N/A	N/A

Conducted Emission Test Site: Conducted C					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Adapter	ANKER	A2664	N/A	N/A	N/A
LAN Cable	TATUNG	IMG_5283	N/A	N/A	N/A
USB cable	ANKER	A8852011	N/A	N/A	N/A
USB cable	ZHUANG SHAN CHUAN	2725	N/A	N/A	N/A
Notebook	Lenovo	T14	P0003332	N/A	N/A

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Notebook	Lenovo	T470	P0001293	N/A	N/A
LAN Cable	BUFFALO	BSLS6NU30BL	N/A	N/A	N/A
USB cable	ZHUANG SHAN CHUAN	2725	N/A	N/A	N/A
USB cable	ANKER	A8852011	N/A	N/A	N/A
Adapter	ANKER	A2664	N/A	N/A	N/A

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3 SUMMARY OF TEST RESULT

FCC Rules	ISED Rules	Description Of Test	Result
§15.207	RSS-Gen §8.8	AC Power Line Conducted Emission	Compliant
§15.407(e)	RSS-Gen §6.7	Emission Bandwidth	Compliant
§15.407(a)	RSS-247 §6.2.1~4 (1) RSS-247 §6.2.5 (2)	Maximum Conducted Output Power	Compliant
§15.407(a)	RSS-247 §6.2.1~ 4 (1) RSS-247 §6.2.5 (2)	Power Spectral Density	Compliant
§15.205 §15.209 §15.407(b)	RSS-Gen 8.10 RSS-247 §6.2.1~3 (2) §6.2.4 (3) RSS-247 §6.2.5 (3)	Undesirable Radiated Emissions	Compliant
§15.407(c)	RSS-247 §6.4	Transmission in case of Absence of Information	Compliant
§15.203	N/A	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

UNII-2A 5250 MHz ~ 5350MHz

20MHz	
CH	Freq. (MHz)
52	5260
56	5280
60	5300
64	5320

UNII-2C 5470 MHz ~ 5725MHz

20MHz	
CH	Freq. (MHz)
100	5500
104	5520
108	5540
112	5560
116	5580
120	5600
124	5620
128	5640
132	5660
136	5680
140	5700
144	5720

UNII-3 5725 MHz ~ 5850MHz

20MHz	
CH	Freq. (MHz)
149	5745
153	5765
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	
V	802.11 a	V	Ch0		Ch1		Ch2		Ch3	V	1TX	2TX
V	802.11 n	V	Ch0		Ch1		Ch2		Ch3	V	1TX	2TX
V	802.11 ac	V	Ch0		Ch1		Ch2		Ch3	V	1TX	2TX
V	802.11 ax	V	Ch0		Ch1		Ch2		Ch3	V	1TX	2TX
	802.11 be		Ch0		Ch1		Ch2		Ch3		1TX	2TX

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
	5260~5320	52 to 64	52,60,64				
	5500~5720	100 to 144	100,116,140,144				
	5745~5825	149 to 165	149,157,165				
802.11ac_VHT20	5180~5240	36 to 48	36,44,48	OFDM	MCS0		ch0
	5260~5320	52 to 64	52,60,64				
	5500~5720	100 to 144	100,116,140,144				
	5745~5825	149 to 165	149,157,165				
CONDUCTED TEST							
MODE	FREQUENCY BAND (MHz)	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	RU CONFIGURATION	DATA RATE (Mbps)	ANTENNA PORT
802.11ax_HE20	5180~5240	36 to 48	36,44,48	OFDMA	FULL RU 26/0,26/8 52/37,52/40 106/53,106/54	MCS0	ch0
	5260~5320	52 to 64	52,60,64				
	5500~5720	100 to 144	100,116,140,144				
	5745~5825	149 to 165	149,157,165				
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
	5260~5320	52 to 64	60				
	5500~5720	100 to 144	116				
	5745~5825	149 to 165	157				

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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
	5260~5320	52 to 64	52,60,64				
	5500~5720	100 to 144	100,116,140,144				
	5745~5825	149 to 165	149,157,165				
802.11ac_VHT20	5180~5240	36 to 48	36,44,48	OFDM	MCS0		ch0
	5260~5320	52 to 64	52,60,64				
	5500~5720	100 to 144	100,116,140,144				
	5745~5825	149 to 165	149,157,165				
TRANSMIT RADIATED EMISSION TEST (ABOVE 1 GHz)							
MODE	FREQUENCY BAND (MHz)	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	RU CONFIGURATION	DATA RATE (Mbps)	ANTENNA PORT
802.11ax_HE20	5180~5240	36 to 48	36,44,48	OFDMA	FULL RU 26/0,26/8 52/37,52/40 106/53,106/54	MCS0	ch0
	5260~5320	52 to 64	52,60,64				
	5500~5720	100 to 144	100,116,140,144				
	5745~5825	149 to 165	149,157,165				

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
Output Power measurement	+/- 0.97 dB
Emission Bandwidth	+/- 1.38 Hz
Conducted emission measurement	+/- 0.77 dB
Peak Power Density	+/- 0.61 dB
Temperature	+/- 0.6 °C
Humidity	+/- 3 %
DC / AC Power Source	+/- 1 %

Radiated Spurious Emission Measurement Uncertainty			
Polarization: Vertical	+/-	1.89 dB	9kHz~30MHz
	+/-	4.15 dB	30MHz - 1000MHz
	+/-	3.43 dB	1GHz - 18GHz
	+/-	3.86 dB	18GHz - 40GHz
Polarization: Horizontal	+/-	1.89 dB	9kHz~30MHz
	+/-	4.02 dB	30MHz - 1000MHz
	+/-	3.43 dB	1GHz - 18GHz
	+/-	3.86 dB	18GHz - 40GHz
Radiated Spurious Emission	+/-	2 dB	33GHz-50GHz
	+/-	1.59 dB	50GHz-60GHz
	+/-	1.7 dB	60GHz-90GHz
	+/-	1.64 dB	90GHz-140GHz
	+/-	3.83 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.	CAL DUE.
Coaxial Cable	EC Lab	RF-HY-CAB-250	RF-HY-CAB-250-01	03/27/2024	03/26/2025
EMI Test Receiver	R&S	ESCI	101342	04/29/2024	04/28/2025
LISN	SCHWARZBECK Mess-Elektronik	NSLK8127	973	04/22/2024	04/21/2025
Pulse Limiter	EC Lab	VTSD 9561F-N	485	03/27/2024	03/26/2025
Test Software	audix	e3	E3 20923 SGS Ver.9 (C)	N.C.R	N.C.R

6.2 Conducted Measurement

Conducted Emission Test Site: Conducted C					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Attenuator	Woken	WATT-218FS-10	RF18	11/15/2023	11/14/2024
Attenuator	Woken	WATT-218FS-10	RF18	11/14/2024	11/13/2025
Attenuator	Woken	WATT-218FS-10	RF19	11/15/2023	11/14/2024
Attenuator	Woken	WATT-218FS-10	RF19	11/14/2024	11/13/2025
DC Block	PASTERNAK	PE8210	RF155	11/15/2023	11/14/2024
DC Block	PASTERNAK	PE8210	RF155	11/14/2024	11/13/2025
DC Power Supply	HOLA	DP-3003	D7070035	06/14/2024	06/13/2025
Power Meter	Anritsu	ML2496A	2138005	09/25/2024	09/24/2025
Power Sensor	Anritsu	MA2411B	1911395	09/25/2024	09/24/2025
Power Sensor	Anritsu	MA2411B	1911396	09/25/2024	09/24/2025
Spectrum Analyzer	KEYSIGHT	N9010B	MY59071573	05/24/2024	05/23/2025
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 D					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
3m Site NSA	SGS	966 chamber D	N/A	04/30/2024	04/29/2025
Active Loop Antenna	COM-POWER	AL-130R	10160105	12/04/2023	12/03/2024
Attenuator	Woken	WATT-218FS-10	RF17	11/15/2023	11/14/2024
Band Rejection Filter	Micro-Tronics	G015	RF198	11/15/2023	11/14/2024
Band Rejection Filter	Micro-Tronics	G016	RF199	11/15/2023	11/14/2024
Band Rejection Filter	Micro-Tronics	G021	RF200	11/15/2023	11/14/2024
Broadband Antenna	SCHWARZBECK	VULB 9168	9168-617	12/14/2023	12/13/2024
Coaxial Cable	Huber+Suhner	EMC106-SM-SM-7200	150703	11/15/2023	11/14/2024
Coaxial Cable	Huber+Suhner	RG 214/U	W21.01	11/15/2023	11/14/2024
Highpass Filter	R&S	HPF7.0	RF174	11/15/2023	11/14/2024
Horn Antenna	Schwarzbeck	BBHA9120D	1341	05/30/2024	05/29/2025
DC Power Supply	Gwinstek	SPS-3610	GEV856769	08/14/2024	08/13/2025
Horn Antenna	Schwarzbeck	BBHA9170	184	12/28/2023	12/27/2024
Lowpass Filter	Woken	EWT-56-0019	RF173	11/15/2023	11/14/2024
Pre-Amplifier	EMC Instruments	EMC12630SE	980273	11/15/2023	11/14/2024
Pre-Amplifier	EMC Instruments	EMC18405SEE	980881	11/15/2023	11/14/2024
Spectrum Analyzer	KEYSIGHT	N9010A	MY57120200	04/03/2024	04/02/2025
Test Software	audix	e3	E3 20923 SGS Ver.9 (C)	N.C.R	N.C.R
Pre-Amplifier	EMC Instruments	EMC9135	980234	11/15/2023	11/14/2024

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

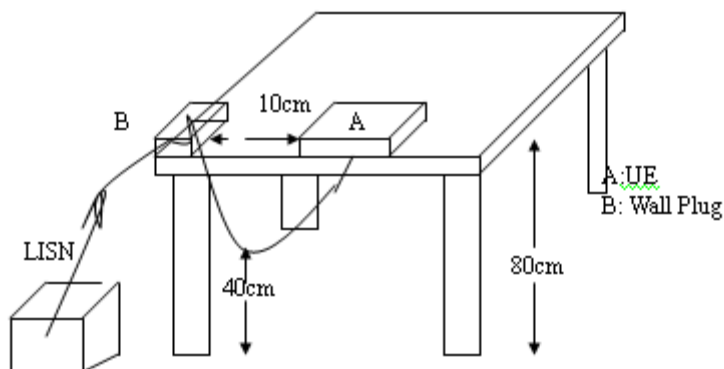
Note

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 Setup



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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.

7.5 Measurement Result

Note1: Refer to next page for measurement data and plots.

Note2: The test data reveals the worst-case results that closest to the limit.

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AC POWER LINE CONDUCTED EMISSION TEST DATA

Report Number :TERF2410002919E2

Test Site :Conduction C

Test Mode :5G

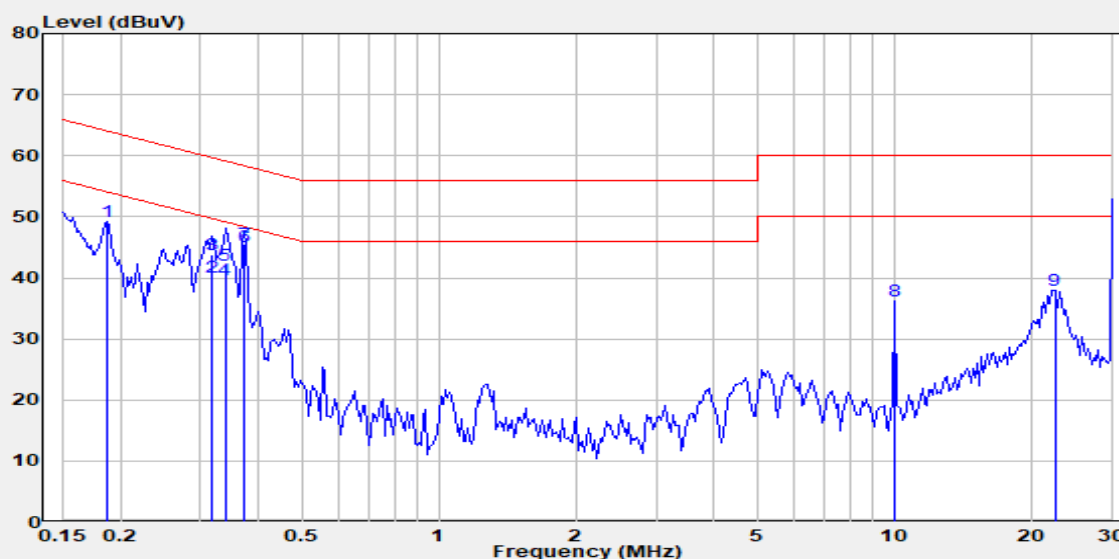
Test Date :2024-10-18

Power :120V/60Hz

Temp./Humi :23.4°C/60%

Probe :L1

Engineer :Howard Huang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV	Limit dBμV	Margin dB
0.187	Peak	38.57	10.65	49.22	64.15	-14.93
0.318	Average	29.50	10.63	40.13	49.75	-9.62
0.318	QP	33.20	10.63	43.83	59.75	-15.92
0.339	Average	29.10	10.63	39.73	49.22	-9.49
0.339	QP	31.40	10.63	42.03	59.22	-17.19
0.373	Average	34.50	10.62	45.12	48.43	-3.31
0.373	QP	35.00	10.62	45.62	58.43	-12.81
10.072	Peak	25.33	10.96	36.30	60.00	-23.70
22.535	Peak	26.71	11.22	37.93	60.00	-22.07

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Report Number :TERF2410002919E2

Test Mode :5G

Power :120V/60Hz

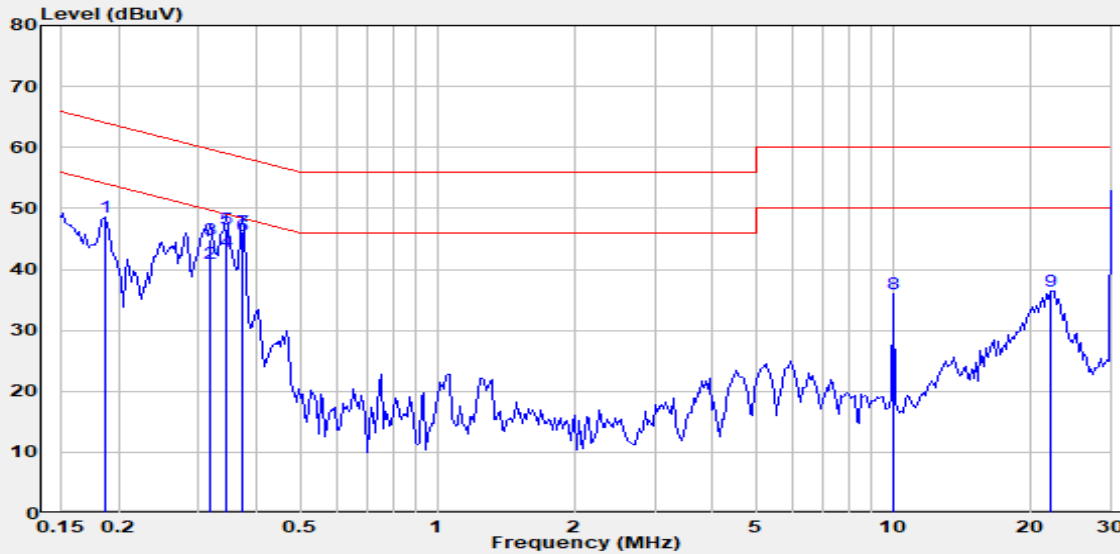
Probe :N

Test Site :Conduction C

Test Date :2024-10-18

Temp./Humi :23.4℃/60%

Engineer :Howard Huang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV	Limit dBμV	Margin dB
0.187	Peak	37.80	10.65	48.46	64.15	-15.69
0.318	Average	30.40	10.62	41.02	49.75	-8.73
0.318	QP	34.30	10.62	44.92	59.75	-14.83
0.343	Average	32.20	10.62	42.82	49.13	-6.31
0.343	QP	36.00	10.62	46.62	59.13	-12.51
0.373	Average	34.90	10.62	45.52	48.43	-2.91
0.373	QP	35.60	10.62	46.22	58.43	-12.21
10.072	Peak	25.01	10.95	35.96	60.00	-24.04
22.298	Peak	25.16	11.22	36.38	60.00	-23.62

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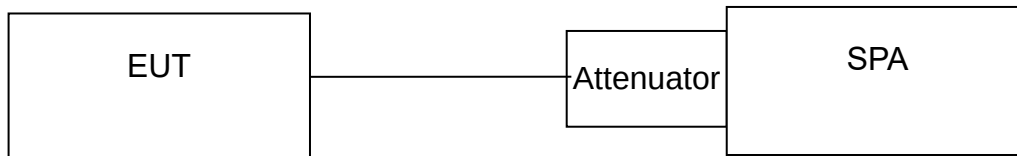
8 EMISSION BANDWIDTH MEASUREMENT

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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8.4 Measurement Result

8.4.1 FCC Occupied Bandwidth

802.11a_Ch0

Freq. (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5180	20.12	13.040
5220	20.27	13.070
5240	19.99	13.010
5260	20.24	13.060
5300	20.26	13.070
5320	20.62	13.140
5500	20.18	13.050
5580	20.20	13.050
5700	19.93	13.000
5720(U-NII 2C)	14.90	11.730
5720(U-NII 3)	4.90	6.900

802.11a_Ch0

Freq. (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5745	16.40	12.150
5785	16.36	12.140
5825	16.37	12.140

802.11a_Ch0

Freq. (MHz)	Measured Freq. (MHz)	Limit (MHz)
5240	5248.301512	< 5250
5745	5736.720940	> 5725

802.11ac_VHT20_Ch0

Freq. (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5180	20.19	13.050
5220	20.25	13.060
5240	20.29	13.070
5260	20.57	13.130
5300	20.38	13.090
5320	20.06	13.020
5500	20.10	13.030
5580	20.23	13.060
5700	19.90	12.990
5720(U-NII 2C)	15.02	11.770
5720(U-NII 3)	5.02	7.010

802.11ac_VHT20_Ch0

Freq. (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5745	17.31	12.380
5785	16.96	12.290
5825	17.19	12.350

802.11ac_VHT20_Ch0

Freq. (MHz)	Measured Freq. (MHz)	Limit (MHz)
5240	5248.819383	< 5250
5745	5736.184767	> 5725

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802.11ax_HE20_Ch0

Freq. (MHz)	RU config	26dB BW (MHz)	10 Log (B) (dB)
5180	full	20.53	13.120
5220	full	20.28	13.070
5240	full	20.18	13.050
5260	full	20.44	13.100
5300	full	20.32	13.080
5320	full	20.37	13.090
5500	full	20.42	13.100
5580	full	20.42	13.100
5700	full	20.06	13.020
5720 (U-NII 2C)	full	15.18	11.810
5720 (U-NII 3)	full	5.18	7.140

802.11ax_HE20_Ch0

Freq. (MHz)	RU config	6dB BW (MHz)	10 Log (B) (dB)
5745	full	17.40	12.410
5785	full	17.69	12.480
5825	full	17.94	12.540

802.11ax_HE20_Ch0

Freq. (MHz)	Measured Freq. (MHz)	Limit (MHz)
5240	5249.355477	< 5250
5745	5735.604914	> 5725

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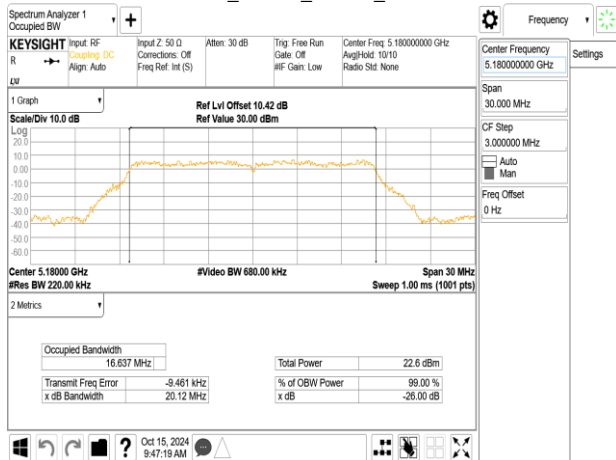
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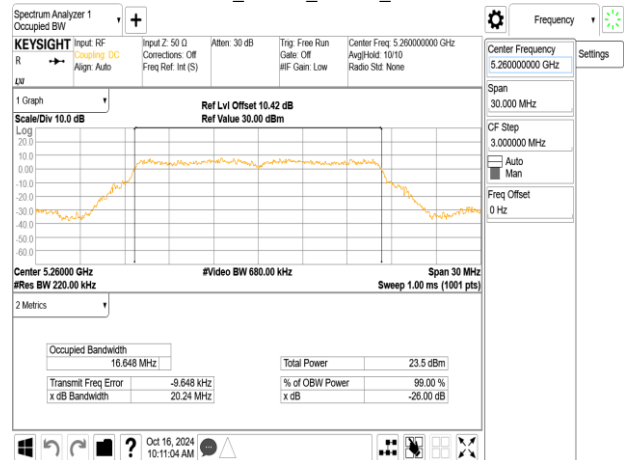
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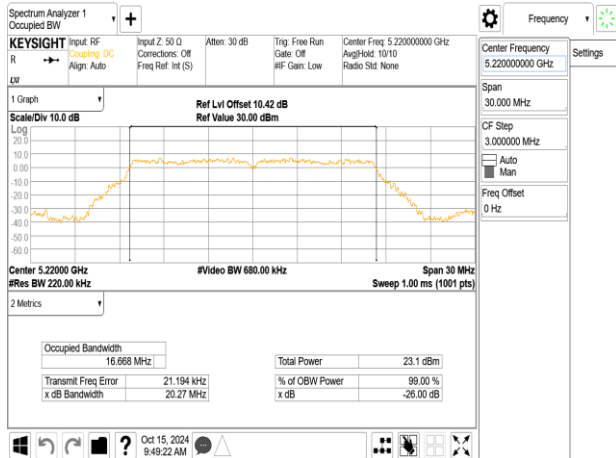
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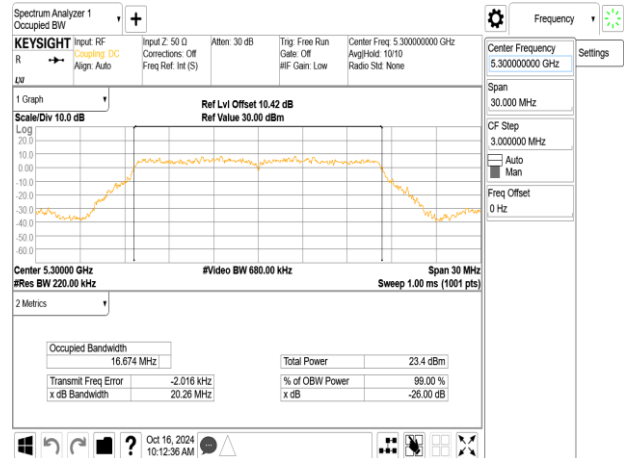
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802.11a_20MHz_Chain0_5220MHz



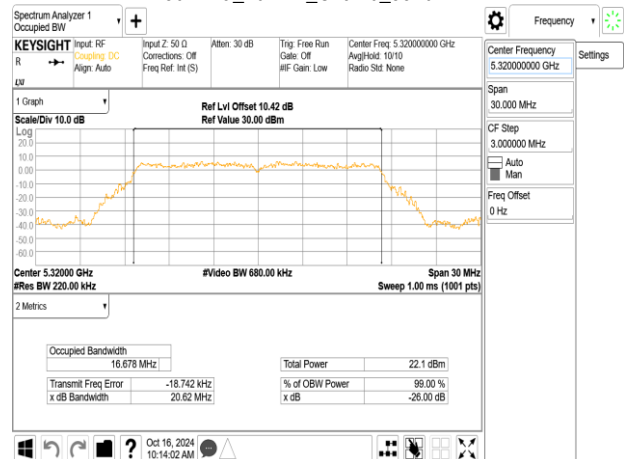
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802.11a_20MHz_Chain0_5240MHz



802.11a_20MHz_Chain0_5320MHz

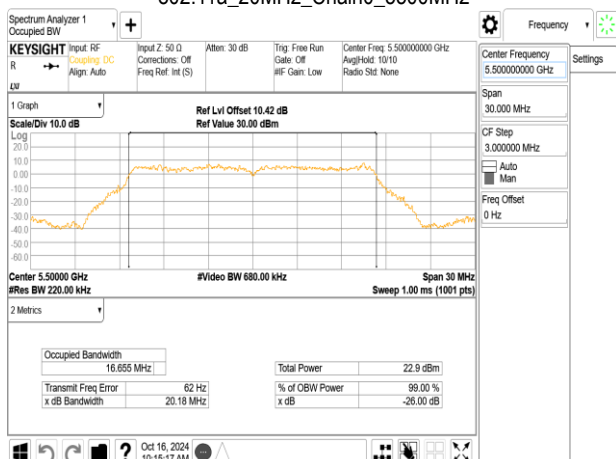


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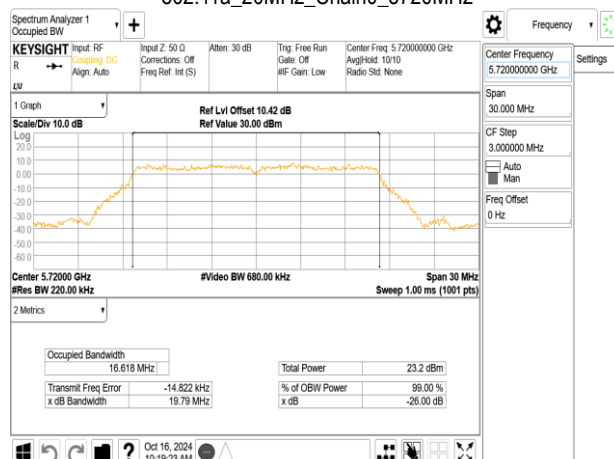
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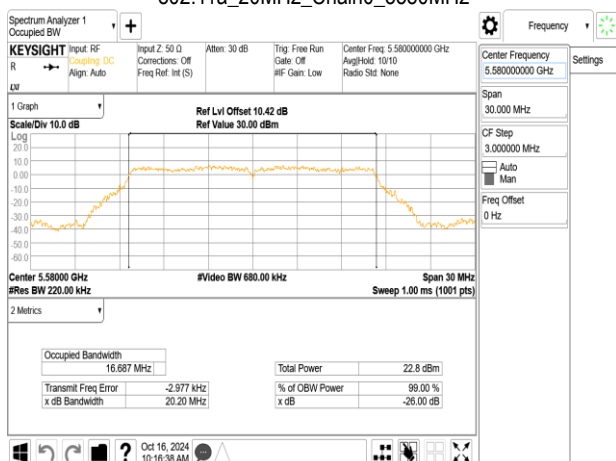
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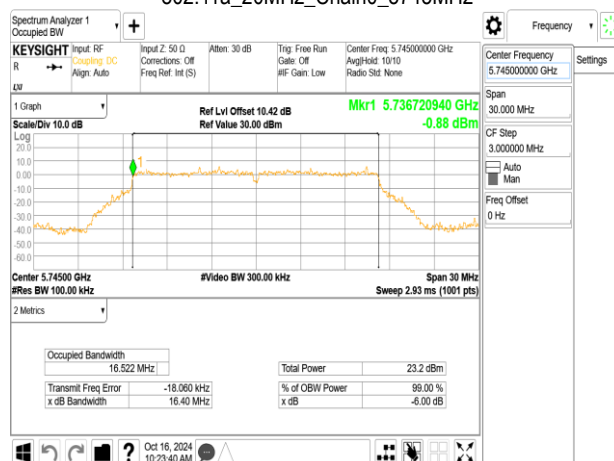
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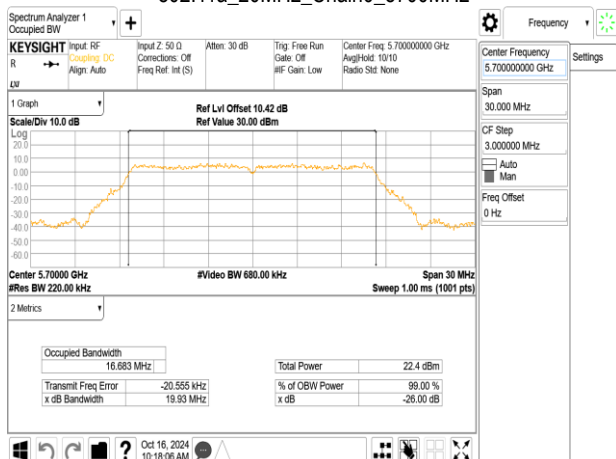
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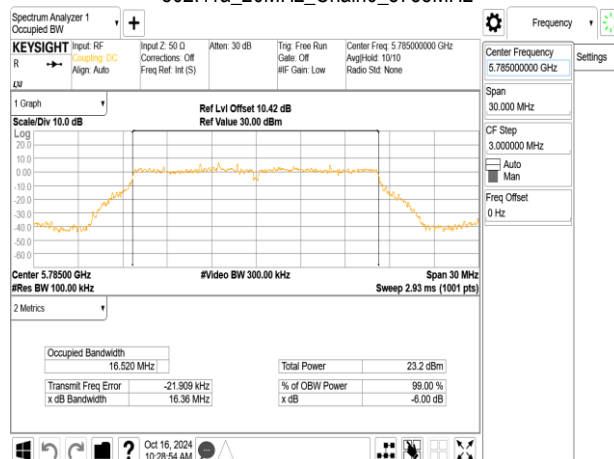
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802.11a_20MHz_Chain0_5700MHz



802.11a_20MHz_Chain0_5785MHz

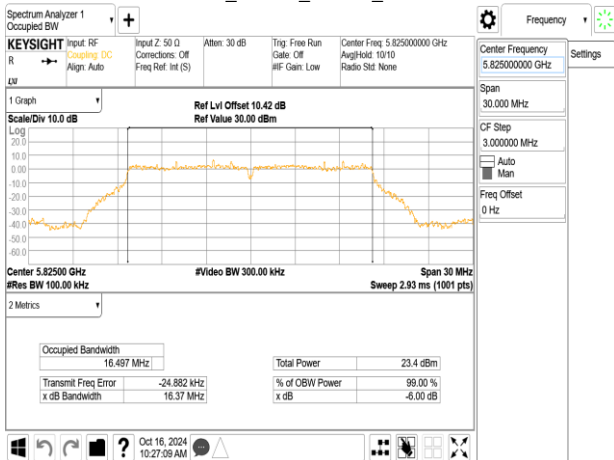


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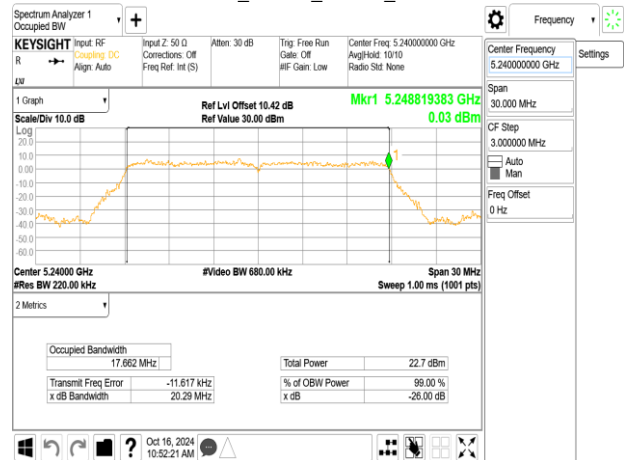
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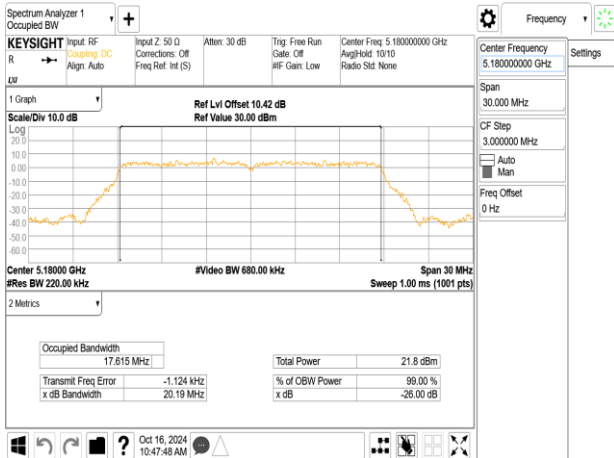
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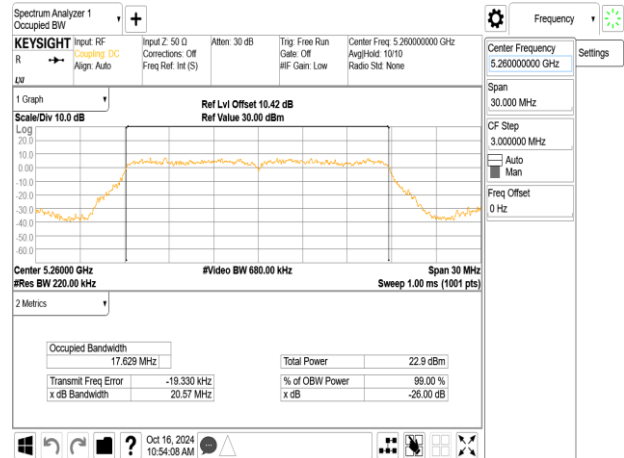
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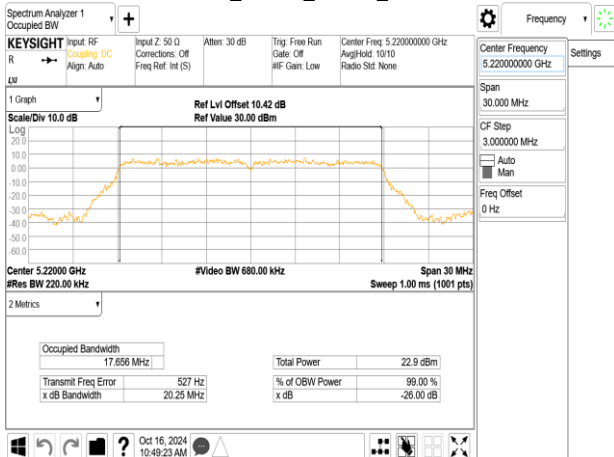
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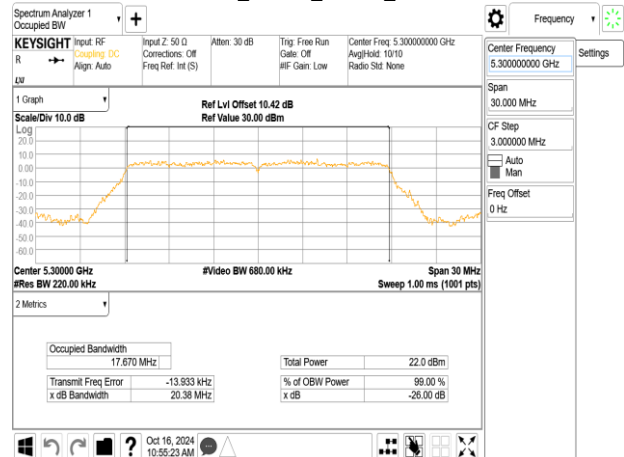
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802.11ac_20MHz_Chain0_5220MHz



802.11ac_20MHz_Chain0_5300MHz

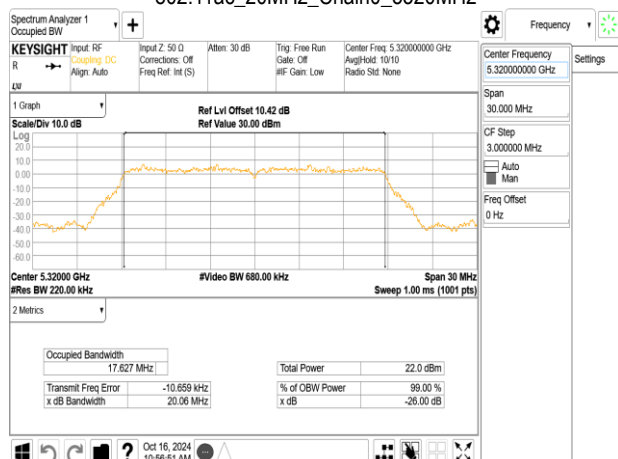


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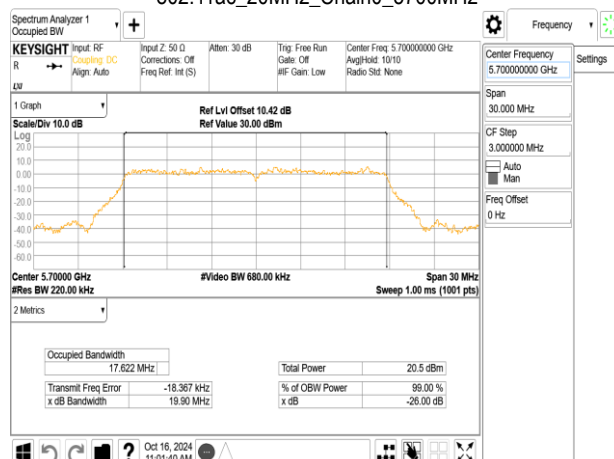
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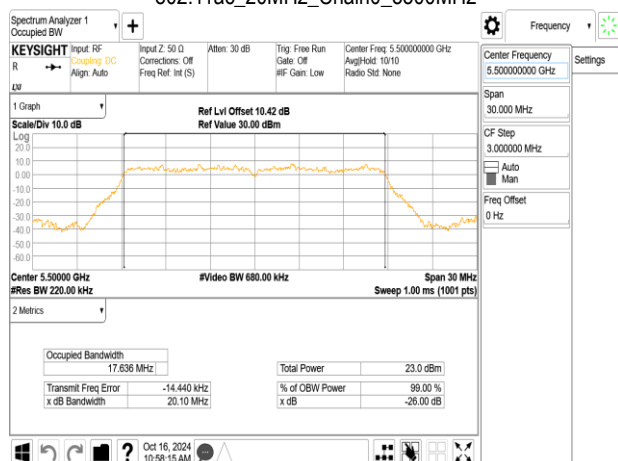
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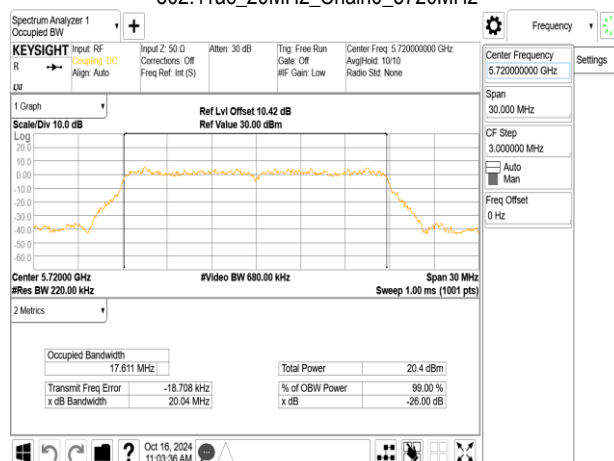
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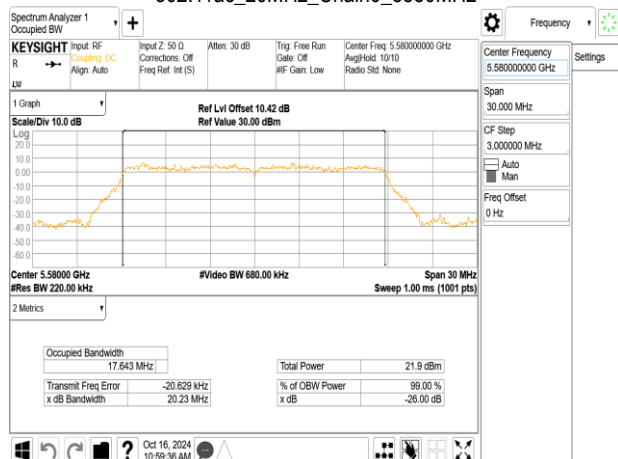
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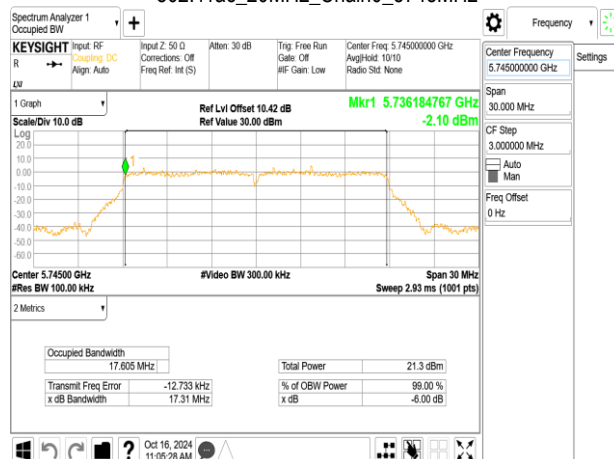
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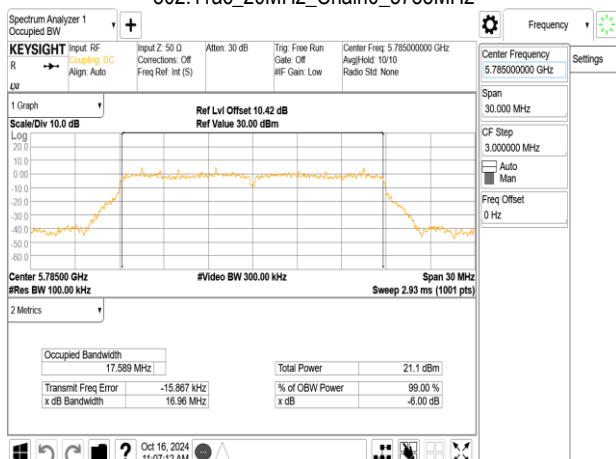


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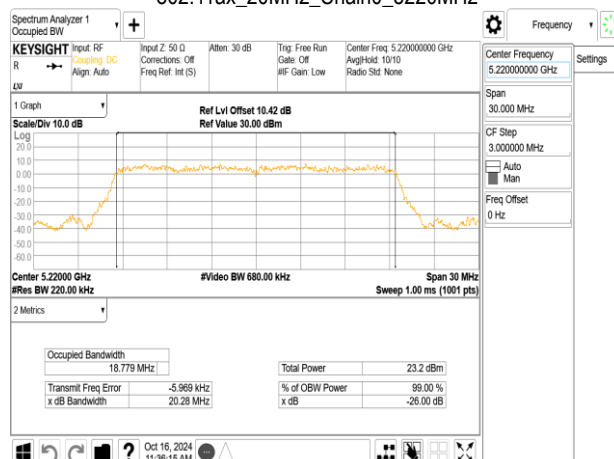
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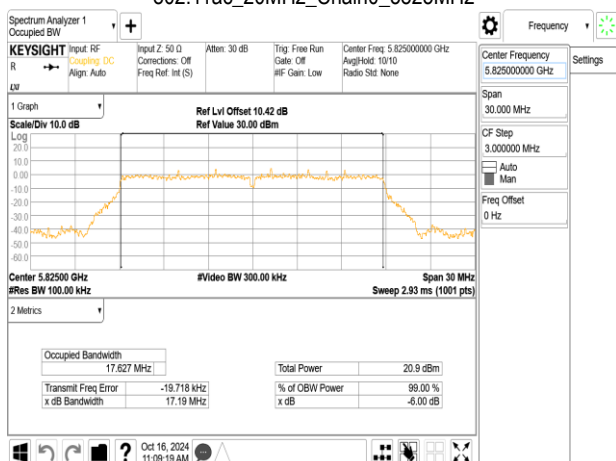
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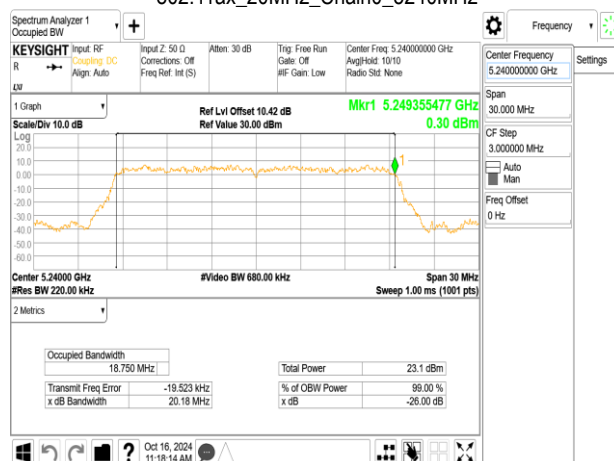
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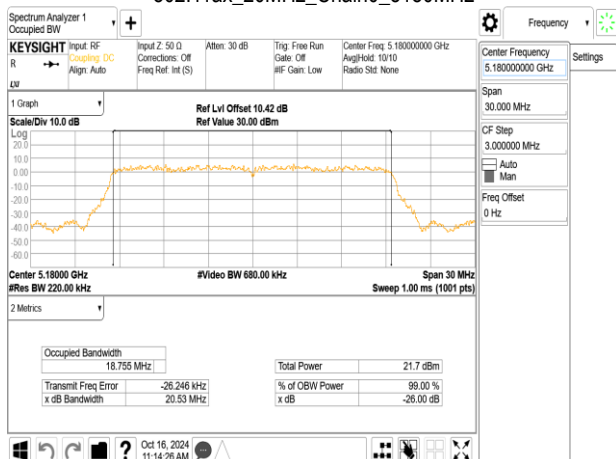
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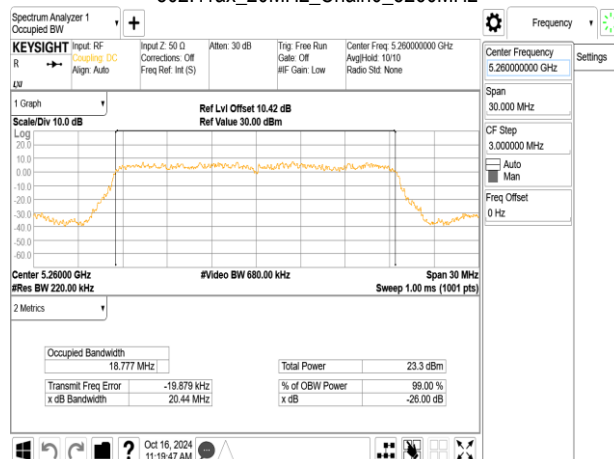
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802.11ax_20MHz_Chain0_5180MHz



802.11ax_20MHz_Chain0_5260MHz

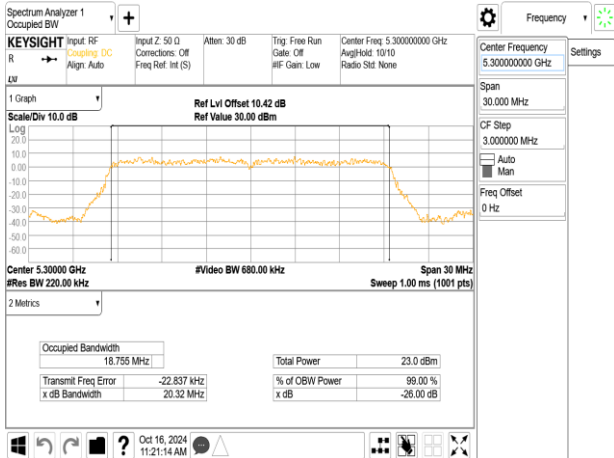


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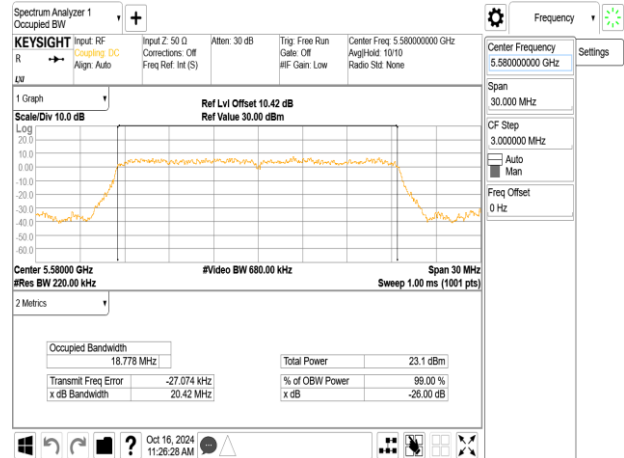
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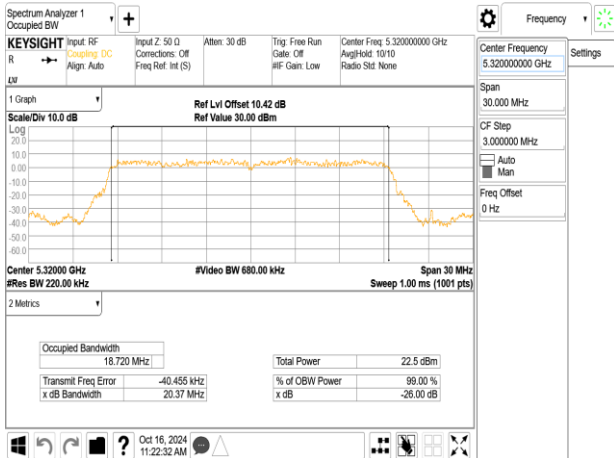
802.11ax_20MHz_Chain0_5300MHz



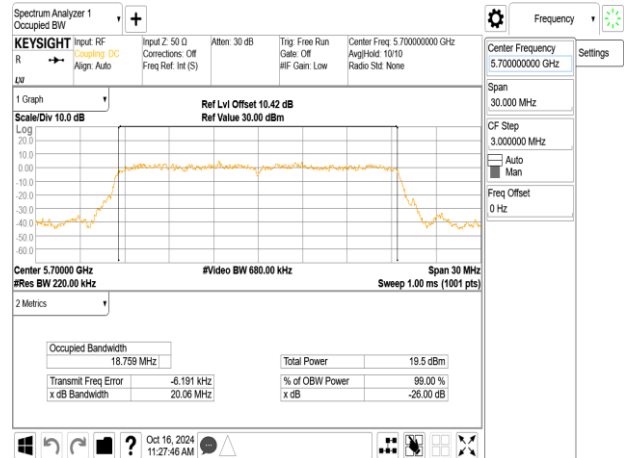
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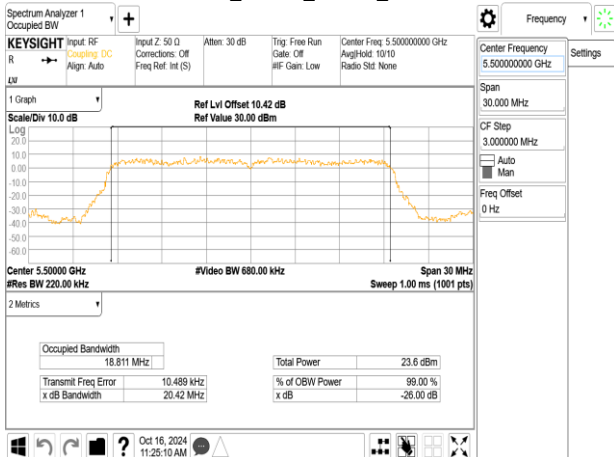
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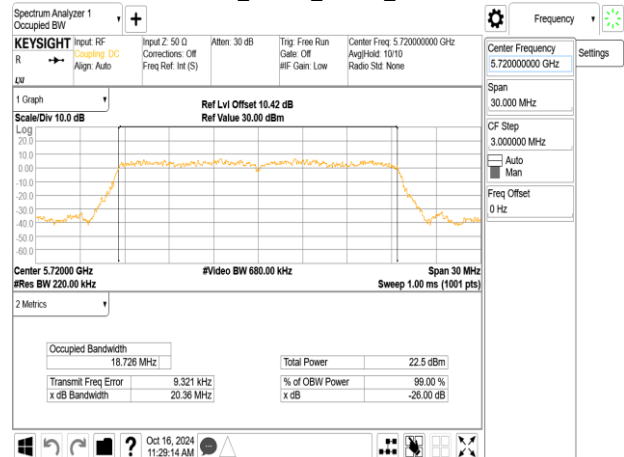
802.11ax_20MHz_Chain0_5700MHz



802.11ax_20MHz_Chain0_5500MHz



802.11ax_20MHz_Chain0_5720MHz



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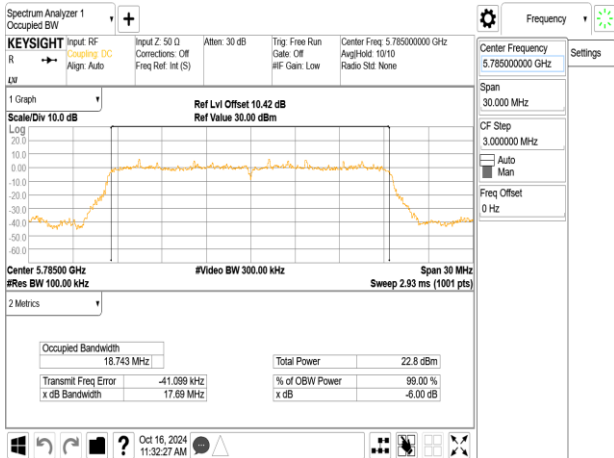
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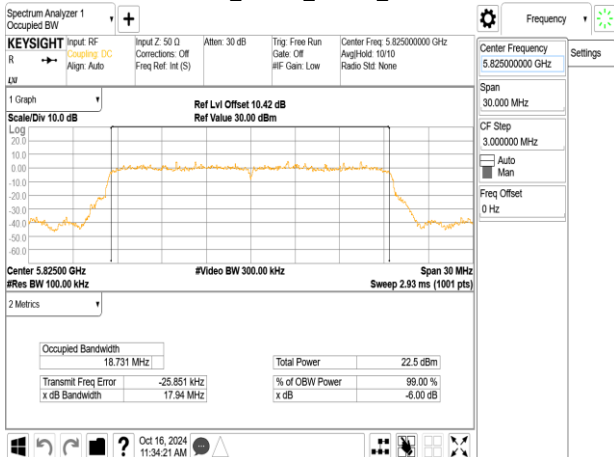
802.11ax_20MHz_Chain0_5745MHz



802.11ax_20MHz_Chain0_5785MHz



802.11ax_20MHz_Chain0_5825MHz



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8.4.2 ISED Occupied Bandwidth

802.11a_Ch0

Frequency (MHz)	99% BW (MHz)	10 Log (B) (dB)
5180	16.603	12.200
5220	16.596	12.200
5240	16.613	12.200
5260	16.623	12.210
5300	16.636	12.210
5320	16.624	12.210
5500	16.599	12.200
5580	16.621	12.210
5700	16.595	12.200
5720(U-NII 2C)	13.297	11.240
5720(U-NII 3)	3.297	5.180

802.11ac_VHT20_Ch0

Frequency (MHz)	99% BW (MHz)	10 Log (B) (dB)
5180	17.633	12.460
5220	17.633	12.460
5240	17.633	12.460
5260	17.643	12.470
5300	17.644	12.470
5320	17.642	12.470
5500	17.642	12.470
5580	17.634	12.460
5700	17.656	12.470
5720(U-NII 2C)	13.820	11.410
5720(U-NII 3)	3.820	5.820

802.11a_Ch0

Frequency (MHz)	99% BW (MHz)	6dB BW (MHz)
5745	16.597	16.40
5785	16.608	16.38
5825	16.641	16.36

802.11ac_VHT20_Ch0

Frequency (MHz)	99% BW (MHz)	6dB BW (MHz)
5745	17.643	17.59
5785	17.629	17.53
5825	17.638	17.43

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802.11ax_HE20_Ch0

Frequency (MHz)	RU config	99% BW (MHz)	10 Log (B) (dB)
5180	full	18.760	12.730
5220	full	18.720	12.720
5240	full	18.744	12.730
5260	full	18.802	12.740
5300	full	18.747	12.730
5320	full	18.758	12.730
5500	full	18.729	12.730
5580	full	18.754	12.730
5700	full	18.776	12.740
5720(U-NII 2C)	full	14.395	11.580
5720(U-NII 3)	full	4.395	6.430

802.11ax_HE20_Ch0

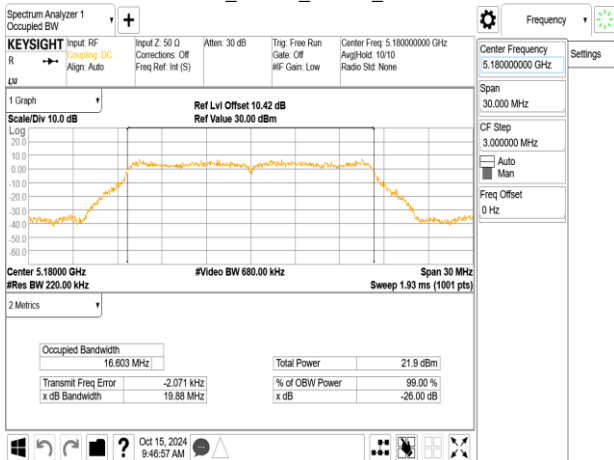
Frequency (MHz)	RU config	99% BW (MHz)	6dB BW (MHz)
5745	full	18.777	18.65
5785	full	18.785	18.66
5825	full	18.728	18.38

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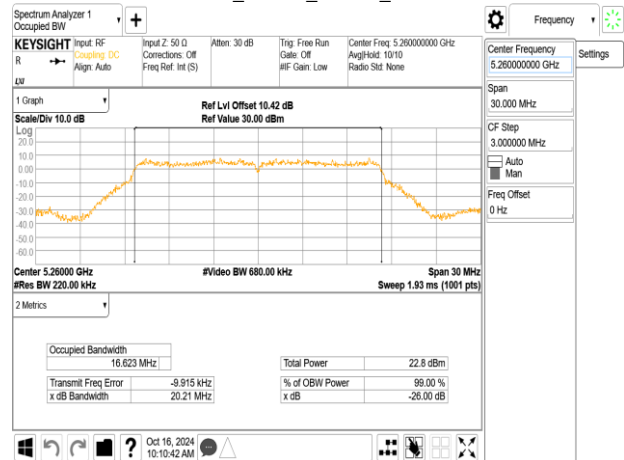
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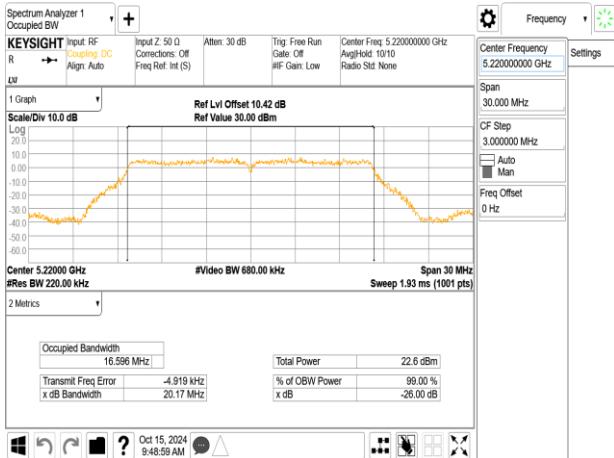
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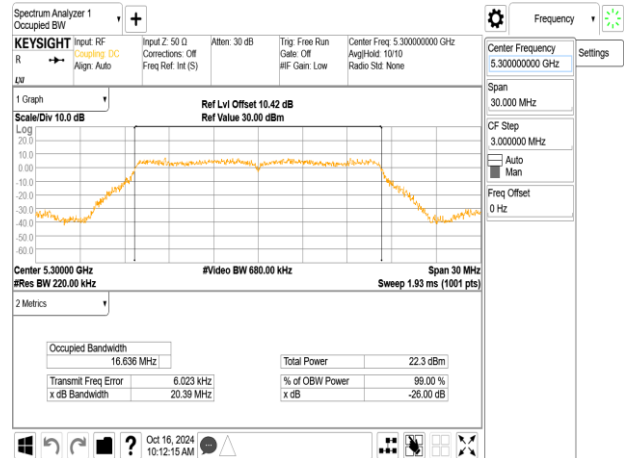
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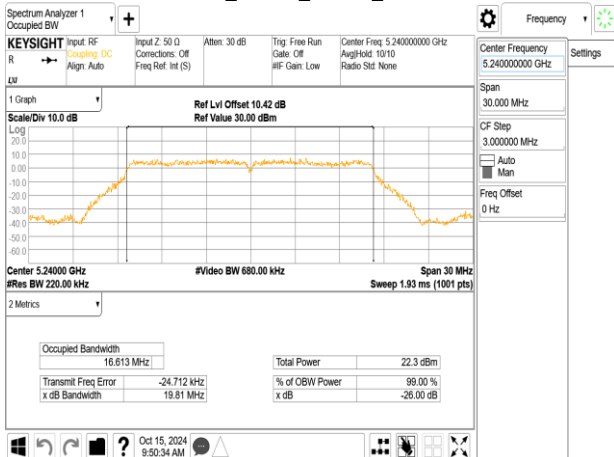
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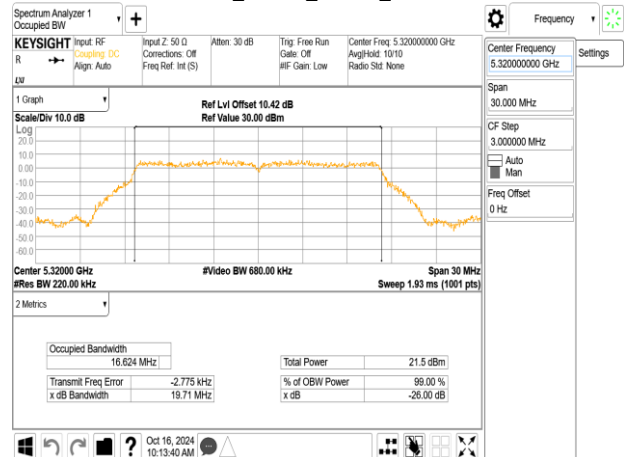
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802.11a_20MHz_Chain0_5240MHz



802.11a_20MHz_Chain0_5320MHz

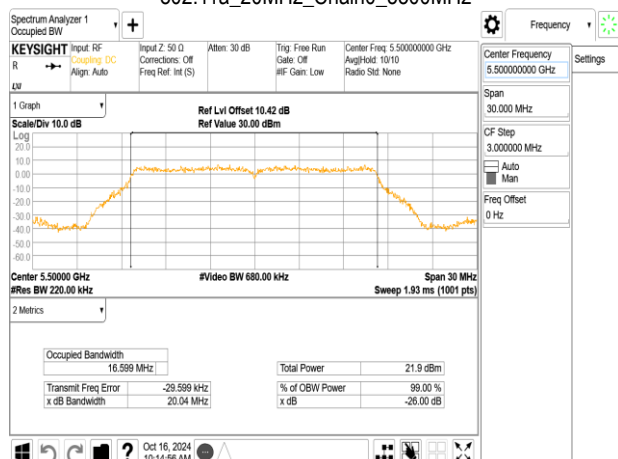


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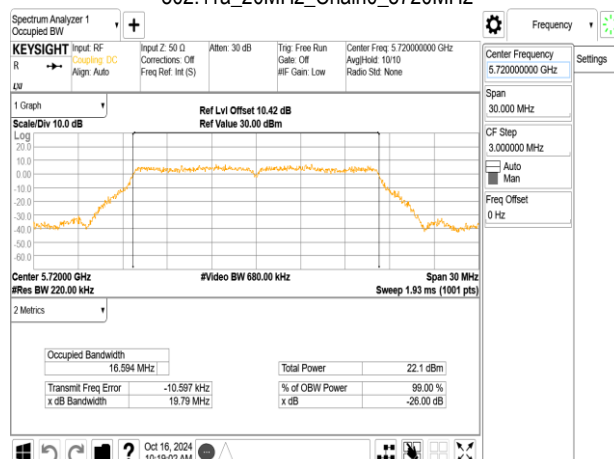
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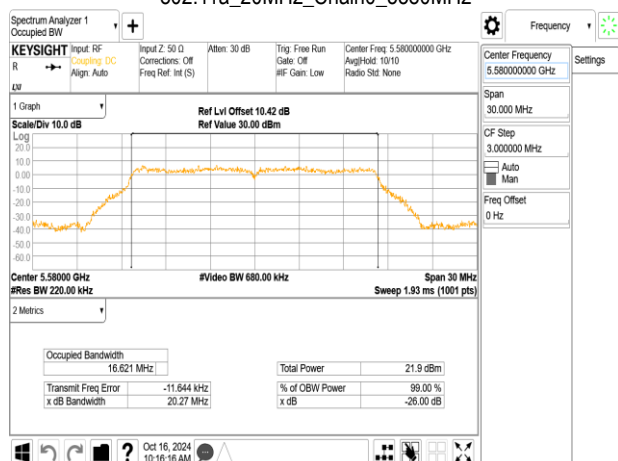
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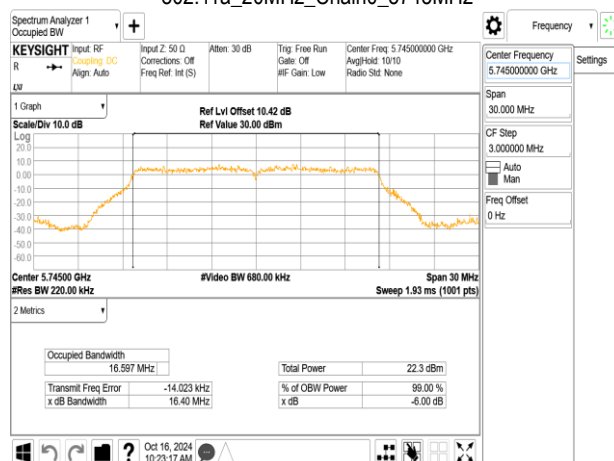
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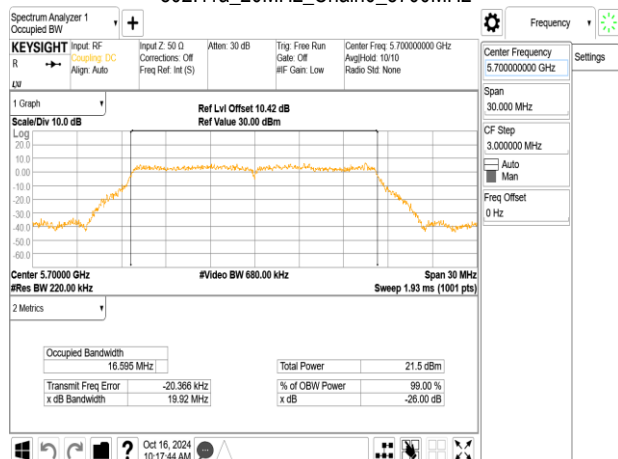
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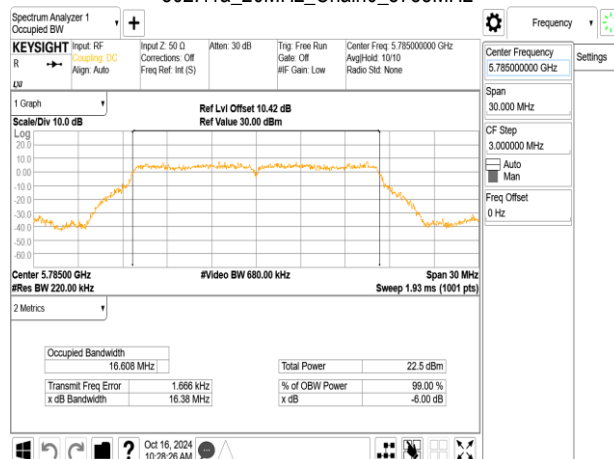
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802.11a_20MHz_Chain0_5700MHz



802.11a_20MHz_Chain0_5785MHz

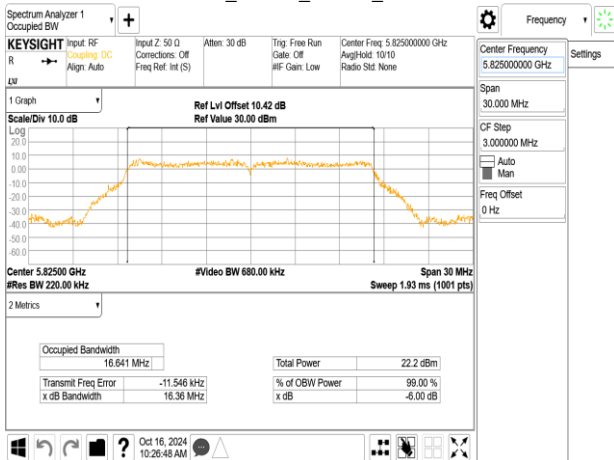


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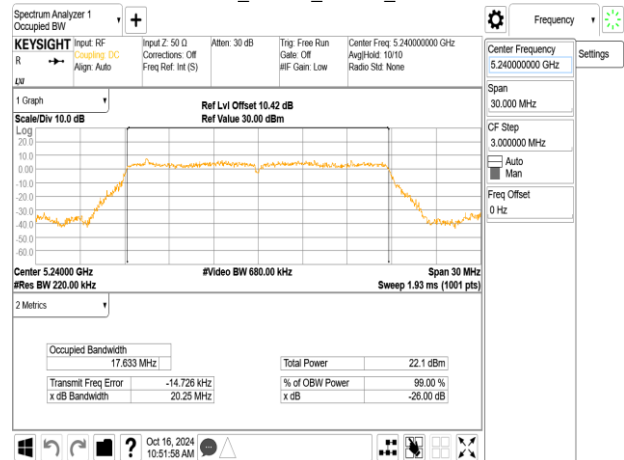
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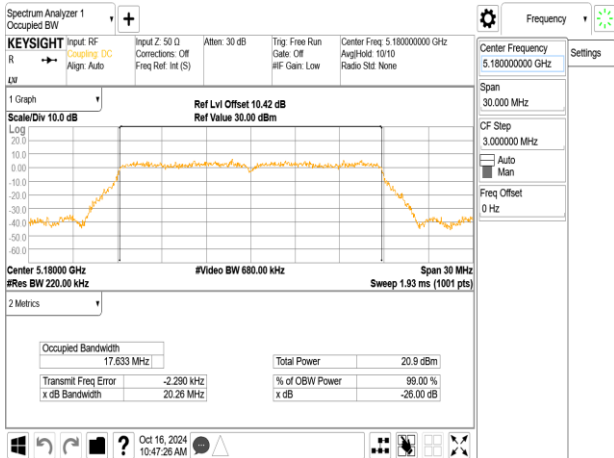
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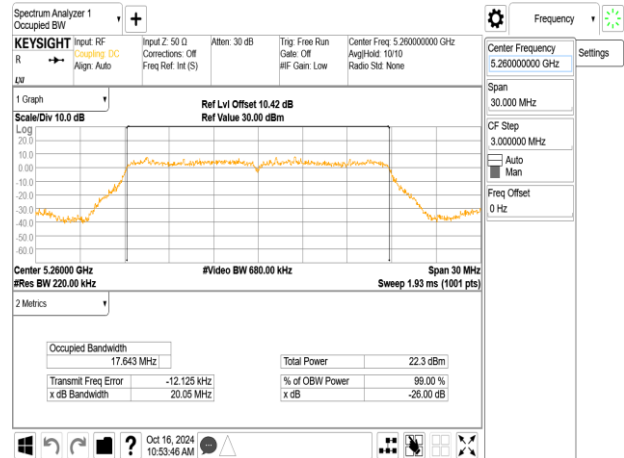
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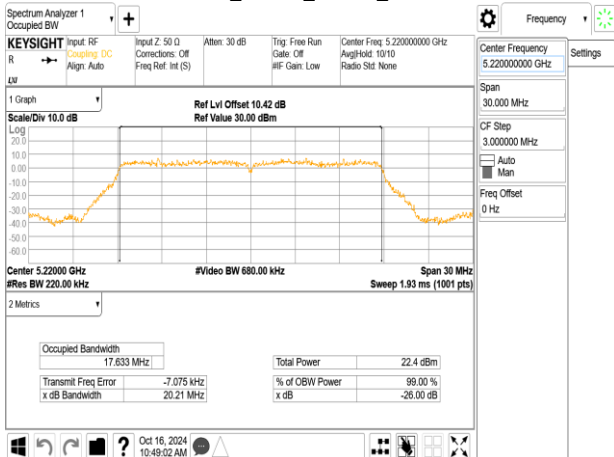
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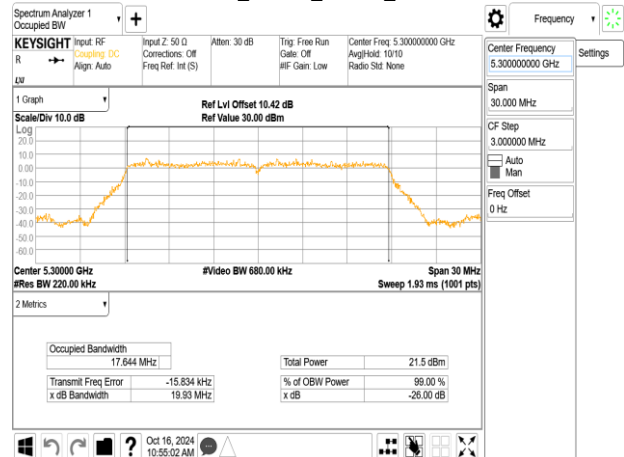
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802.11ac_20MHz_Chain0_5220MHz



802.11ac_20MHz_Chain0_5300MHz

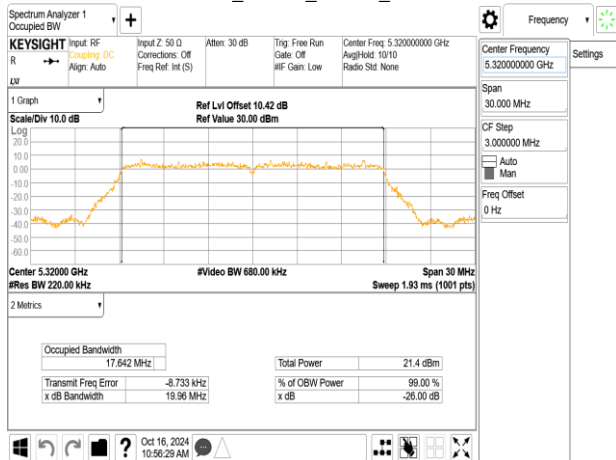


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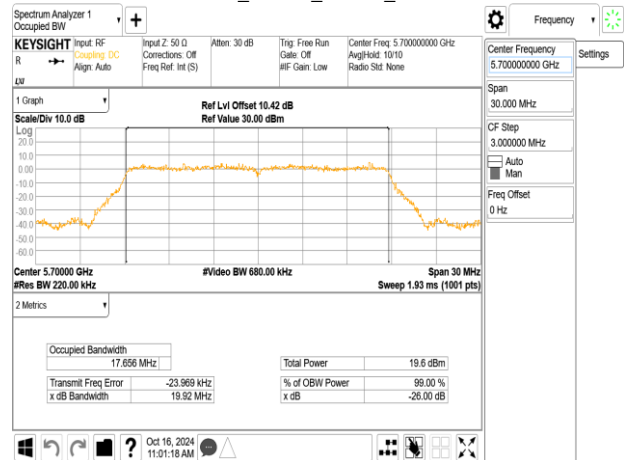
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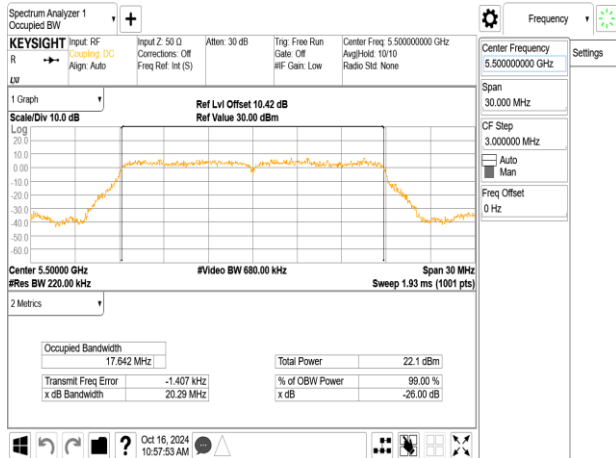
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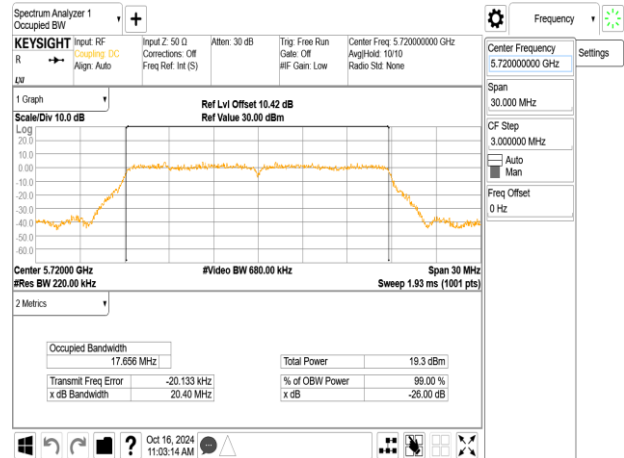
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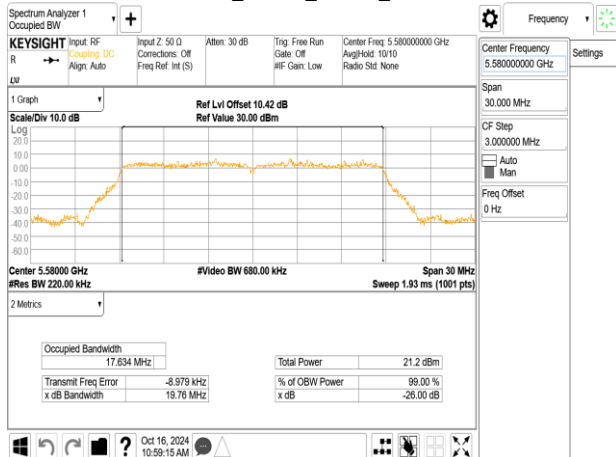
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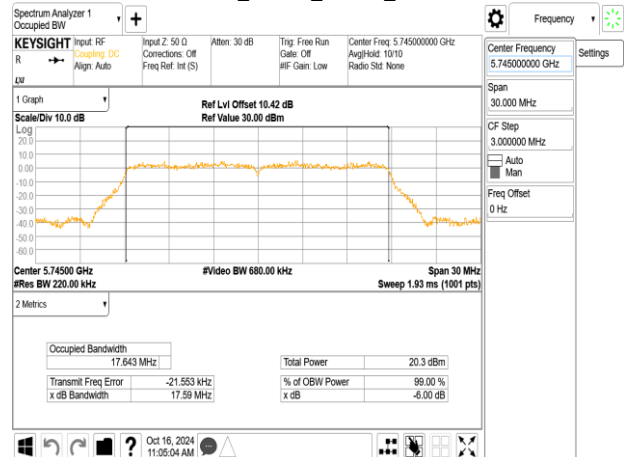
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802.11ac_20MHz_Chain0_5580MHz



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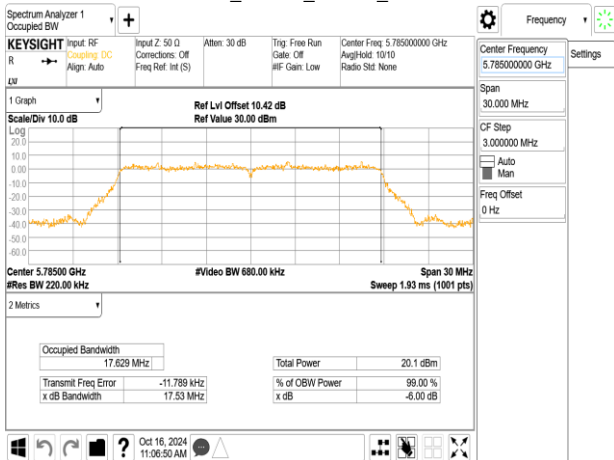


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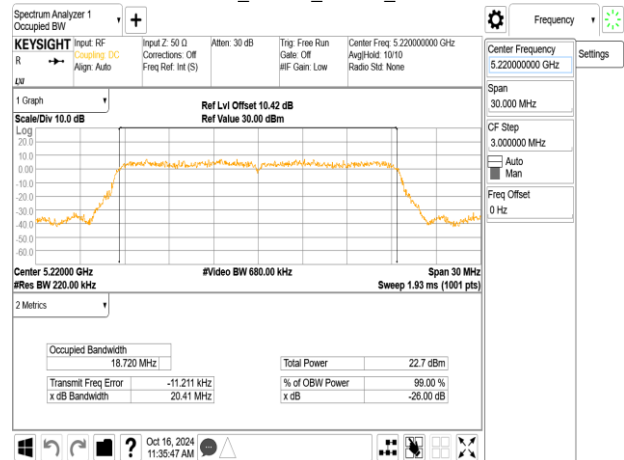
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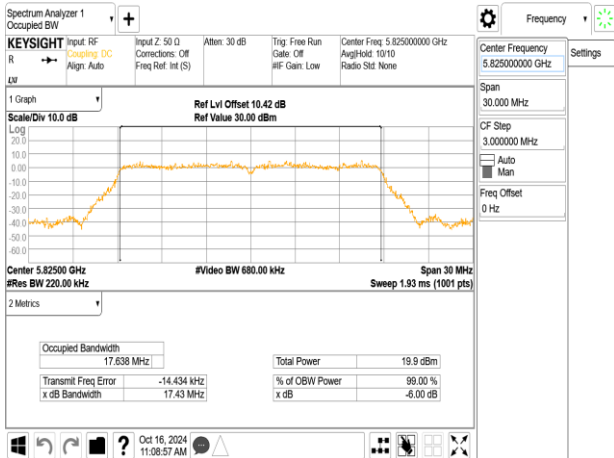
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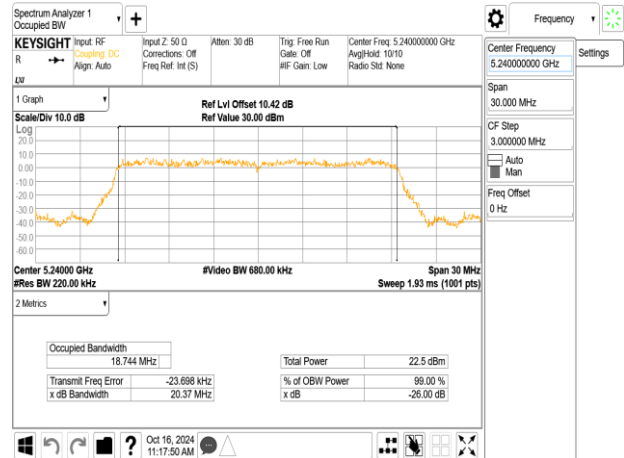
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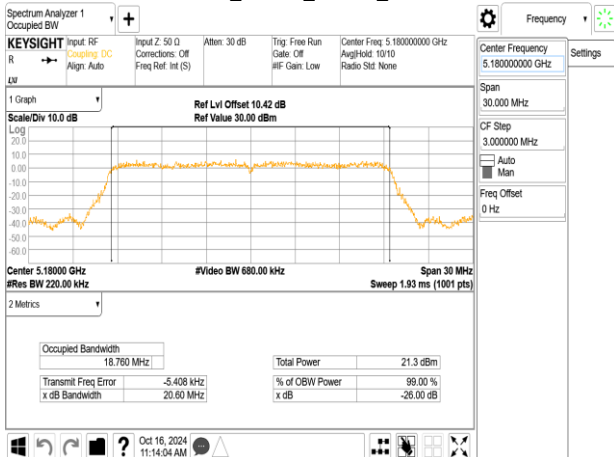
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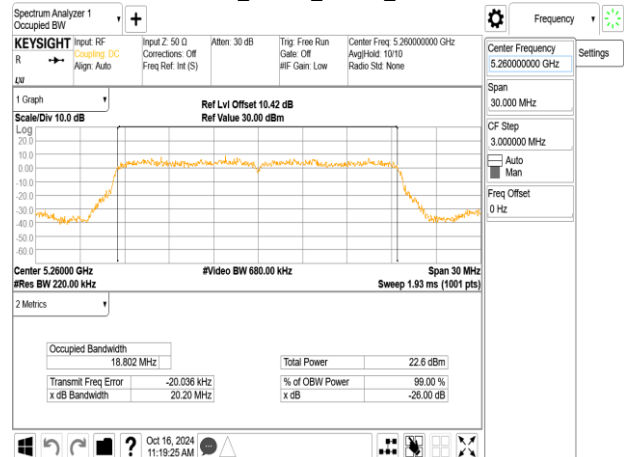
802.11ax_20MHz_Chain0_5240MHz



802.11ax_20MHz_Chain0_5180MHz



802.11ax_20MHz_Chain0_5260MHz



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