ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

Applicant:	Murata Manufacturing Co., Ltd. 10-1, Higashikotari 1-chome Nagaokakyo-shi, Kyoto 617-8555 Japan
Manufacturer:	Murata Manufacturing Co., Ltd. 10-1, Higashikotari 1-chome Nagaokakyo-shi, Kyoto 617-8555 Japan
Product Name:	Communication Module
Brand Name:	muRata
Model No.:	For FCC: LBEE5XV2EA, LBEE5XV2EB For ISED: LBEE5XV2EA_SANT, LBEE5XV2EA_DANT, LBEE5XV2EB_SANT, LBEE5XV2EB_DANT
Model Difference:	Refer to section 1.8
Report Number:	TERF2211002258ER
FCC ID	VPYLBEE5XV2EA
IC:	772C-LBEE5XV2EA
Date of EUT Received:	November 08, 2022
Date of Test:	November 25, 2022～March 17, 2023
Issue Date:	June 13, 2023

CHUN-CHIEH, CHEN

Approved By _____

CHUN-CHIEH, CHEN

We hereby certify that:

The above equipment was tested by SGS Taiwan Ltd. Central RF Lab The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10:2013 and the energy emitted by the sample EUT comply with FCC rule part §15.247, ISED RSS-247.

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

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.
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Revision History

Report Number	Revision	Description	Issue Date	Revised By	Remark
TERF2211002258ER	00	Original	May 04, 2023	Violetta Tang	
TERF2211002258ER	01	Remove HMN information from page 9	June 02, 2023	Violetta Tang	
TERF2211002258ER	02	Correct firmware information on page 4	June 13, 2023	Violetta Tang	

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.

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1 GENERAL INFORMATION

1.1 Product Description

Product Name:	Communication Module
Brand Name:	muRata
Model No.:	For FCC: LBEE5XV2EA, LBEE5XV2EB For ISED: LBEE5XV2EA_SANT, LBEE5XV2EA_DANT, LBEE5XV2EB_SANT, LBEE5XV2EB_DANT
Model Difference:	Refer to section 1.8
Hardware Version:	1.0
Firmware Version:	1.1.1.1 1.1.2.1 1.1.1.2 1.1.2.2
EUT Series No.:	SA2022019000001046
Power Supply:	3.3Vdc, 1.8Vdc
Test Software (Name/Version)	Tera Term / 4.71

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1.2 RF Specification

SISO

WLAN 2.4GHz

WLAN	Frequency Range (MHz)	Channels	Rated Power (dBm)		Modulation Technology
			Peak	Avg.	
802.11b	2412~2462	11	22.53	19.99	DSSS
802.11g	2412~2462	11	24.27	18.67	OFDM
802.11n20	2412~2462	11	24.03	17.96	OFDM
802.11ax20	2412~2462	11	25.08	15.91	OFDMA
Modulation type:		CCK, DQPSK, DBPSK for DSSS			
		64QAM, 16QAM, QPSK, BPSK for OFDM			
		1024 QAM, 256 QAM , 64QAM, 16QAM, QPSK, BPSK for OFDMA			
Data Rate:		802.11 b: 1/2/5.5/11 Mbps			
		802.11 g: 6/9/12/18/24/36/48/54 Mbps			
		802.11 n_20MHz:up to 72.2Mbps			
		802.11 ax_20MHz:up to 143.4Mbps			

WLAN 2.4GHz for IC

WLAN	Frequency Range (MHz)	Channels	Rated Power (dBm)		Rated Power in dBm (EIRP)	Modulation Technology
			Peak	Avg.		
802.11b	2412~2462	11	22.53	19.99	23.19	DSSS
802.11g	2412~2462	11	24.27	18.67	21.87	OFDM
802.11n20	2412~2462	11	24.03	17.96	21.16	OFDM
802.11ax20	2412~2462	11	25.08	15.91	19.11	OFDMA
Modulation type:		CCK, DQPSK, DBPSK for DSSS				
		64QAM, 16QAM, QPSK, BPSK for OFDM				
		1024 QAM, 256 QAM , 64QAM, 16QAM, QPSK, BPSK for OFDMA				
Data Rate:		802.11 b: 1/2/5.5/11 Mbps				
		802.11 g: 6/9/12/18/24/36/48/54 Mbps				
		802.11 n_20MHz:up to 72.2Mbps				
		802.11 ax_20MHz:up to 143.4Mbps				

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MIMO

WLAN 2.4GHz

WLAN	Frequency Range (MHz)	Channels	Rated Power (dBm)		Modulation Technology
			Peak	Avg.	
802.11g	2412~2462	11	25.44	18.88	OFDM
802.11n20	2412~2462	11	25.00	17.99	OFDM
802.11ax20	2412~2462	11	26.96	15.99	OFDMA
Modulation type:		64QAM, 16QAM, QPSK, BPSK for OFDM			
		1024 QAM, 256 QAM , 64QAM, 16QAM, QPSK, BPSK for OFDMA			
Data Rate:		802.11 g: 6/9/12/18/24/36/48/54 Mbps			
		802.11 n_20MHz:up to 144.4Mbps			
		802.11 ax_20MHz:up to 286.8Mbps			

WLAN 2.4GHz for IC

WLAN	Frequency Range (MHz)	Channels	Rated Power (dBm)		Rated Power in dBm (EIRP)	Modulation Technology
			Peak	Avg.		
802.11g	2412~2462	11	25.44	18.88	22.08	OFDM
802.11n20	2412~2462	11	25.00	17.99	21.19	OFDM
802.11ax20	2412~2462	11	26.96	15.99	19.19	OFDMA
Modulation type:		64QAM, 16QAM, QPSK, BPSK for OFDM				
		1024 QAM, 256 QAM , 64QAM, 16QAM, QPSK, BPSK for OFDMA				
Data Rate:		802.11 g: 6/9/12/18/24/36/48/54 Mbps				
		802.11 n_20MHz:up to 144.4Mbps				
		802.11 ax_20MHz:up to 286.8Mbps				

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1.3 Antenna Designation

SISO

Antenna Type	Supplier	Antenna Part No.	Freq. (MHz)	Peak Antenna Gain (dBi)
Dipole	Molex	146153	2400~2500	3.2
	Molex	219611	2400~2500	2.67
	Unictron	WT32D1-KX	2400~2500	3
	Inventek	W24P-U	2400~2500	3.2
Monopole	Murata	Type2EA_Antenna	2400~2500	2.9

MIMO

Antenna Type	Supplier	Antenna Part No.	Freq. (MHz)	Peak Antenna Gain (dBi)
Dipole	Molex	219611	2400~2500	2.67
	Unictron	WT32D1-KX	2400~2500	3
	Inventek	W24P-U	2400~2500	3.2

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 Test Methodology of Applied Standards

FCC Part 15, Subpart C §15.247
FCC KDB 558074 D01 15.247 Meas Guidance v05r02
FCC KDB 662911 D01 Multiple Transmitter Output v02r01
RSS-247 issue 2 Feb. 2017
RSS-Gen,issue 5 April, 2018
ANSI C63.10:2013

1.5 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.

1.6 Special Accessories

There are no special accessories used while test was conducted.

1.7 Equipment Modifications

There was no modification incorporated into the EUT.

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1.8 Model Variants

The LBEE5XV2EA_SANT and LBEE5XV2EA_DANT are electrically identical.

Model For ISED	Model For FCC	Chip on C101	RF functions
LBEE5XV2EA_SANT	LBEE5XV2EA	CYW55573	2x2 WLAN2.4GHz,5GHz, 6GHz +BT/ BLE
LBEE5XV2EA_DANT			

The LBEE5XV2EB_SANT and LBEE5XV2EB_DANT are electrically identical.

Model For ISED	Model For FCC	Chip on C101	RF functions
LBEE5XV2EB_SANT	LBEE5XV2EB	CYW55572	2x2 WLAN2.4GHz,5GHz +BT/ BLE
LBEE5XV2EB_DANT			

In addition, the differences of firmware versions are

Model	Firmware versions	Antenna connector(s)	WLAN	BT	BLE
LBEE5XV2EA_DANT	1.1.2.1	3 (ANT0, ANT1, BT_ANT)	ANT0, ANT1	BT_ANT	BT_ANT
LBEE5XV2EB_DANT	1.1.2.2				
LBEE5XV2EA_SANT	1.1.1.1	2 (ANT0, ANT1)	ANT0, ANT1	ANT0	ANT0
LBEE5XV2EB_SANT	1.1.1.2				

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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 a 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 a placed on a turn table. For emissions testing at or below 1 GHz, the table height shall be 0.8 m above the reference ground plane. For emission measurements above 1 GHz, the table height shall be 1.5 m. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this transmitter (EUT) was rotated through three orthogonal axes and measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made “while keeping the antenna in the ‘cone of radiation’ from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response.” is still within the 3dB illumination BW of the measurement antenna.

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2.4 Measurement Results Explanation Example

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

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

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

2.4.2 For all conducted test items:

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

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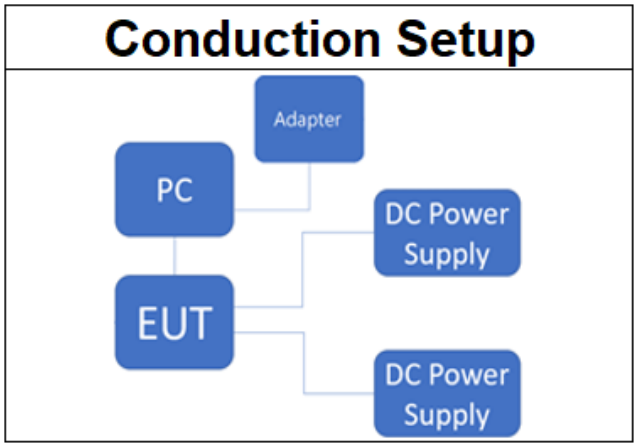
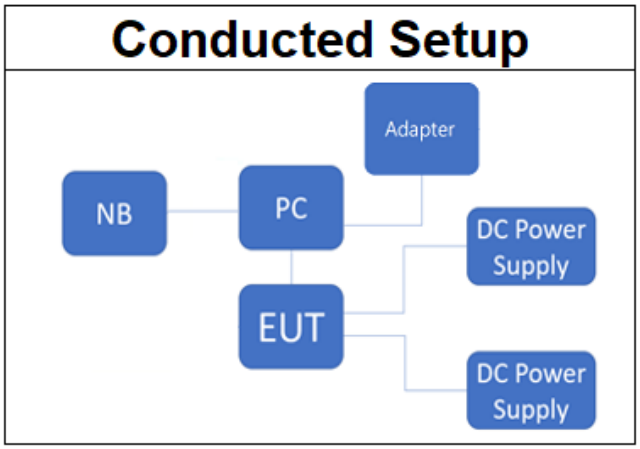
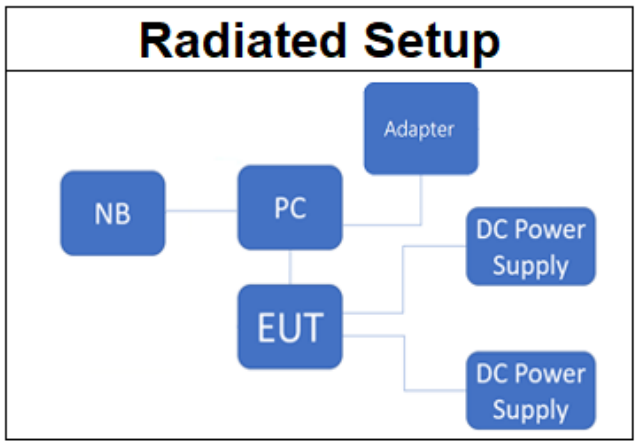
2.5 Test Configuration







2.6 Control Unit(s)

AC Power-Line Conducted Emission Test Site: Conduction 1					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
PC	GIGABYTE	GB-BXI7H-4500	N/A	N/A	N/A
Adapter	FSP GROUP INC.	FSP065-REB	N/A	N/A	N/A

Conducted Emission Test Site: Conducted 2					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
PC	GIGABYTE	GB-BXI7H-4500	N/A	N/A	N/A
Adapter	FSP GROUP INC.	FSP065-REB	N/A	N/A	N/A
Notebook	Lenovo	T440P	PC-014TAK	N/A	N/A

Radiated Emission Test Site: SAC 2					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
PC	GIGABYTE	GB-BXI7H-4500	N/A	N/A	N/A
Adapter	FSP GROUP INC.	FSP065-REB	N/A	N/A	N/A
Notebook	Lenovo	T440P	PC-06L5W6	N/A	N/A

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3 SUMMARY OF TEST RESULTS

FCC Rules	ISED Rules	Description Of Test	Result
§15.207(a)	RSS-Gen §8.8	AC Power Line Conducted Emission	Compliant
§15.247(b)(3)	RSS-247 §5.4 d	Peak Output Power	Compliant
§15.247(a)(2)	RSS-247 §5.2 a RSS-Gen §6.7	Emission Bandwidth	Compliant
§15.205 §15.209 §15.247(d)	RSS-247 §5.5 RSS-Gen §8.9 RSS-Gen §8.10 RSS-Gen §6.13	Radiated & Conducted Band Edge and Spurious Emission	Compliant
§15.247(e)	RSS-247 §5.2 b	Power Spectral Density	Compliant
§15.203	N/A	Antenna Requirement	Compliant

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4 DESCRIPTION OF TEST MODES

4.1 Operating Frequencies

Modulation of BW 20MHz	
CHANNEL	FREQUENCY (MHz)
1	2412
2	2417
3	2422
4	2427
5	2432
6	2437
7	2442
8	2447
9	2452
10	2457
11	2462

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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 and receiving mode is programmed.
3. Investigation has been done on all the possible configurations for searching the worst case.

   The given UE is pre-scanned among below modes.

Modulation	Transmission Chain				Single Transmission Spatial	Multiple Transmission Spatial
☒ 802.11 b	☒ Ch0	☒ Ch1	☐ Ch2	☐ Ch3	☒ 1TX	☐ 2TX
☒ 802.11 g	☒ Ch0	☒ Ch1	☐ Ch2	☐ Ch3	☒ 1TX	☒ 2TX
☒ 802.11 n	☒ Ch0	☒ Ch1	☐ Ch2	☐ Ch3	☒ 1TX	☒ MIMO
☒ 802.11 ax	☒ Ch0	☒ Ch1	☐ Ch2	☐ Ch3	☒ 1TX	☒ MIMO

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

5. Observations have been done for 802.11 ax available RU configurations below and found that the lowest, highest and Full RU results higher emissions.
   Only one RU can be enabled at any given time.

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802.11ax	20MHz			
RU type	26-tone RU		52-tone RU	
RU index and subcarrier range	RU0	[-121: -96]	RU37	[-121: -70]
	RU1	[-95: -70]	RU38	[-68: -17]
	RU2	[-68: -43]	RU39	[17: 68]
	RU3	[-42: -17]	RU40	[70: 121]
	RU4	[-16: -4, 4: 16]	RU41	N/A
	RU5	[17: 42]	RU42	N/A
	RU6	[43: 68]	RU43	N/A
	RU7	[70: 95]	RU44	N/A
	RU8	[96: 121]	RU45	N/A
	RU9	N/A	RU46	N/A
	RU10	N/A	RU47	N/A
	RU11	N/A	RU48	N/A
	RU12	N/A	RU49	N/A
	RU13	N/A	RU50	N/A
	RU14	N/A	RU51	N/A
	RU15	N/A	RU52	N/A
	RU16	N/A		
	RU17	N/A	106-tone RU	
	RU18	N/A	RU53	[-122: -17]
	RU19	N/A	RU54	[17: 122]
	RU20	N/A	RU55	N/A
	RU21	N/A	RU56	N/A
	RU22	N/A	RU57	N/A
	RU23	N/A	RU58	N/A
	RU24	N/A	RU59	N/A
	RU25	N/A	RU60	N/A
	RU26	N/A		
	RU27	N/A	242-tone RU	
	RU28	N/A	RU61	[-122: -2, 2:122]
	RU29	N/A	RU62	N/A
	RU30	N/A	RU63	N/A
	RU31	N/A	RU64	N/A
	RU32	N/A		
	RU33	N/A		
	RU34	N/A		
	RU35	N/A		
	RU36	N/A		

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Conducted					
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT
802.11b	1 to 11	1,3,6,9,11	DSSS	1	Ch0
802.11g	1 to 11	1,3,4,5,6,7,8,9,11	OFDM	6	Ch0/2TX
802.11n (HT20)	1 to 11	1,3,4,5,6,7,8,9,11	OFDM	MCS0	Ch0/2TX
802.11ax (HE20)	1 to 11	1,3,6,9,11	OFDMA	MCS0	Ch0/2TX

RADIATED EMISSION TEST (BELOW 1 GHz)					
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT
802.11g	1 to 11	6	OFDM	6	Ch0/2TX

RADIATED EMISSION TEST (ABOVE 1 GHz)					
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT
802.11b	1 to 11	1,3,6,9,11	DSSS	1	Ch0
802.11g	1 to 11	1,3,4,5,6,7,8,9,11	OFDM	6	Ch0/2TX
802.11n (HT20)	1 to 11	1,3,4,5,6,7,8,9,11	OFDM	MCS0	Ch0/2TX
802.11ax (HE20)	1 to 11	1,3,6,9,11	OFDMA	MCS0	Ch0/2TX

Note:

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

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5 MEASUREMENT UNCERTAINTY

Test Items	Uncertainty		
AC Power Line Conducted Emission	+/-	2.32	dB
Output Power measurement	+/-	1	dB
Emission Bandwidth	+/-	1.53	Hz
Undesignable radiated emission measurement	+/-	1.68	dB
Peak Power Density	+/-	2.16	dB
Temperature	+/-	0.7	°C
Humidity	+/-	3	%
DC / AC Power Source	+/-	1	%

Radiated Spurious Emission Measurement Uncertainty				
Polarization: Vertical	**+/-**	**2.8**	**dB**	9kHz~30MHz
	+/-	**4.82**	**dB**	30MHz - 1000MHz
	+/-	**4.37**	**dB**	1GHz - 18GHz
	+/-	**4.21**	**dB**	18GHz - 40GHz
Polarization: Horizontal	**+/-**	**2.8**	**dB**	9kHz~30MHz
	+/-	**4.54**	**dB**	30MHz - 1000MHz
	+/-	**4.37**	**dB**	1GHz - 18GHz
	+/-	**4.21**	**dB**	18GHz - 40GHz

Note:

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

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6 MEASUREMENT EQUIPMENT USED

6.1 Emission from AC power line

AC Power-Line Conducted Emission Test Site: Conduction 1					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EMI Test Receiver	R&S	ESR 7	102525	02/18/2023	02/17/2024
Pulse Limiter	SCHWARZBECK	VTSD 9561F-N	793	06/22/2022	06/21/2023
LISN	SCHWARZBECK	NSLK 8127	01040	08/23/2022	08/22/2023
LISN	SCHWARZBECK	NSLK 8127	01041	10/25/2022	10/24/2023
Coaxial Cables	EMC Instruments Corp.	EMCCFD300-BM-BM-3000	161207	06/22/2022	06/21/2023
DC Power Supply	Agilent	E3640A	MY40005907	10/07/2022	10/06/2023
DC Power Supply	Agilent	E3640A	KR93300208	09/08/2022	09/07/2023
Test Software	audix	e3	Ver. 9 210322	N.C.R	N.C.R

6.2 Conducted Measurement

Conducted Emission Test Site: Conducted 2					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EXA Spectrum Analyzer	KEYSIGHT	N9010B	MY59071541	07/14/2022	07/13/2023
Test Software	SGS	Radio Test Software	Ver. 21	N.C.R	N.C.R
Power Meter	Anritsu	ML2496A	2132007	09/21/2022	09/20/2023
Power Sensor	Anritsu	MA2411B	1911391	09/21/2022	09/20/2023
Power Sensor	Anritsu	MA2411B	1911392	09/21/2022	09/20/2023
DC Power Supply	Agilent	E3640A	MY40005907	10/07/2022	10/06/2023
DC Power Supply	Gwinstek	SPS-3610	GEV856761	09/13/2022	09/12/2023
Attenuator	KEYSIGHT	8494B	TH60073121	12/14/2021	12/13/2022
Attenuator	KEYSIGHT	8494B	TH60073121	12/13/2022	12/12/2023
DC Block	Mini-Circuits	BLK-18-S+	1	12/14/2021	12/13/2022
DC Block	Mini-Circuits	BLK-18-S+	1	12/13/2022	12/12/2023

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6.3 Radiated Measurement

Radiated Emission Test Site: SAC 2					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Horn Antenna	RF SPIN	DRH18-E	210303A18-ES	02/24/2022	02/23/2023
Bi-log Antenna	SCHWARZBECK	VULB9168	9168-1278	02/25/2022	02/24/2023
Loop Antenna	ETS.LINDGREN	6502	148045	10/05/2022	10/04/2023
Horn Antenna	SCHWARZBECK	BBHA9170	184	12/30/2022	12/29/2023
EXA Spectrum	KEYSIGHT	N9010B	MY59071541	07/14/2022	07/13/2023
Test Software	Audix	e3	Ver. 9.210322	N.C.R	N.C.R
DC Power Supply	Agilent	E3640A	MY40005907	10/07/2022	10/06/2023
DC Power Supply	Agilent	E3640A	KR93300208	09/08/2022	09/07/2023
EMI Test Receiver	R&S	ESCI 7	100759	08/22/2022	08/21/2023
Pre-Amplifier	EMCI	EMC330N	980826	08/31/2022	08/30/2023
Pre-Amplifier	EMCI	EMC118A45SEE	980867	08/31/2022	08/30/2023
Pre-Amplifier	EMCI	EMC184045B	980135	10/27/2022	10/26/2023
Attenuator	Mini-Circuit	BW-S10W2+	2	12/13/2022	12/12/2023
Bandreject Filter	EWT	EWT-14-0166	M1	12/13/2022	12/12/2023
4GHz High Pass Filter	WI	WHKX4.0/18G-10SS	22	12/13/2022	12/12/2023
Coaxial Cables	EMCI	EMCCFD400-NM-NM-	RX Cable below 1G	08/31/2022	08/30/2023
Coaxial Cables	EMCI	EMC104-SM-SM-600	RX Cable below 1G	08/31/2022	08/30/2023
Coaxial Cables	EMCI	EMC105-SM-SM-2000	RX Cable below 1G	08/31/2022	08/30/2023
Coaxial Cables	EMCI	EMC104-SM-SM-10000	RX Cable above 1G	08/31/2022	08/30/2023
Coaxial Cables	EMCI	EMC105-SM-SM-1000	RX Cable above 1G	08/31/2022	08/30/2023
Coaxial Cables	EMCI	EMC105-SM-SM-1500	RX Cable above 1G	08/31/2022	08/30/2023
Coaxial Cables	EMCI	EMC105-SM-SM-2000	RX Cable above 1G	08/31/2022	08/30/2023
Coaxial Cables	EMCI	EMCCFD400-NM-NM-	RX Cable below 30M	08/31/2022	08/30/2023
Coaxial Cables	EMCI	EMC105-SM-SM-2000	RX Cable below 30M	08/31/2022	08/30/2023
Site Cal	SGS	SAC 2	N/A	08/31/2022	08/30/2023

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

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7 CONDUCTED EMISSION TEST

7.1 Standard Applicable

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

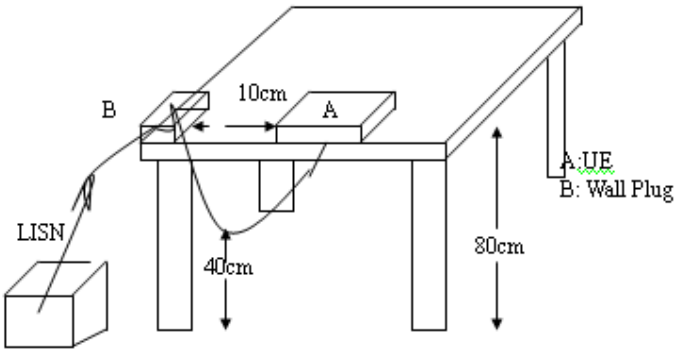
Frequency range MHz	Limits (dBuV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

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 120Vac/60Hz power source.

7.3 Test Setup



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

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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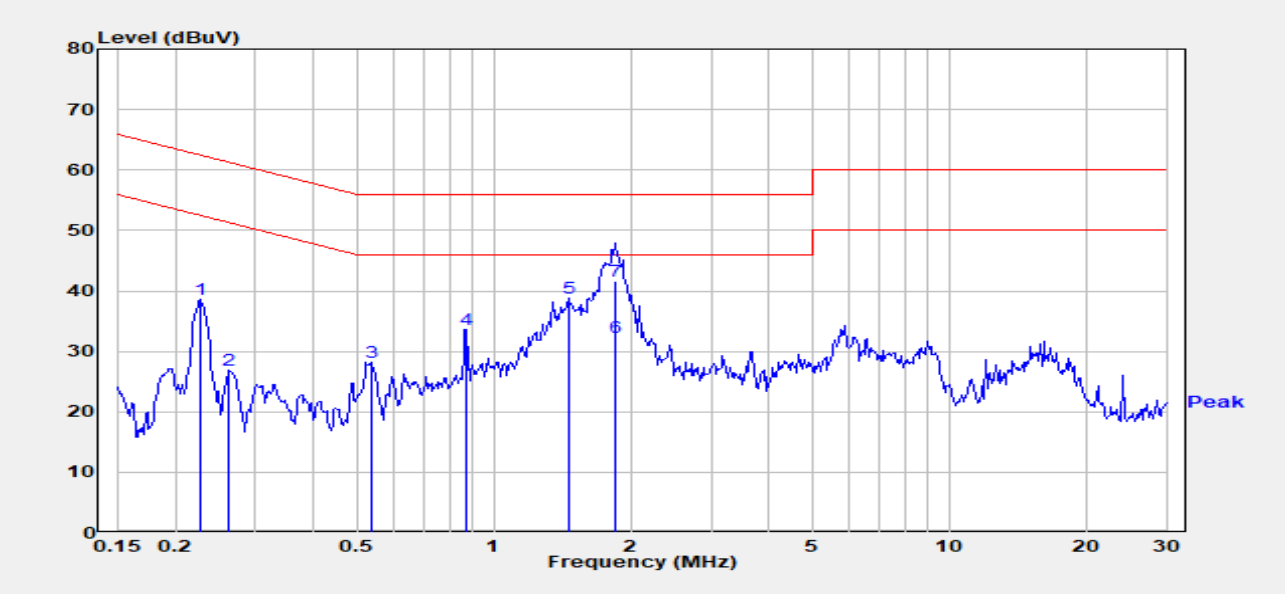
AC POWER LINE CONDUCTED EMISSION TEST DATA

Report Number	:TERF2211002258ER	Test Site	:Conduction 1
Test Mode	:Operation (2.4G)	Test Date	:2023-03-02
Power	:120V/60Hz	Temp./Humi.	:23.8/52
Probe	:L	Engineer	:Ricky Chen



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV	Limit dBμV	Margin dB
0.227	Peak	28.25	10.25	38.50	62.56	-24.05
0.263	Peak	16.65	10.25	26.90	61.34	-34.44
0.537	Peak	17.99	10.26	28.25	56.00	-27.75
0.870	Peak	23.35	10.34	33.69	56.00	-22.31
1.456	Peak	27.96	10.75	38.71	56.00	-17.29
1.847	Average	21.36	11.00	32.36	46.00	-13.64
1.847	QP	30.61	11.00	41.61	56.00	-14.39

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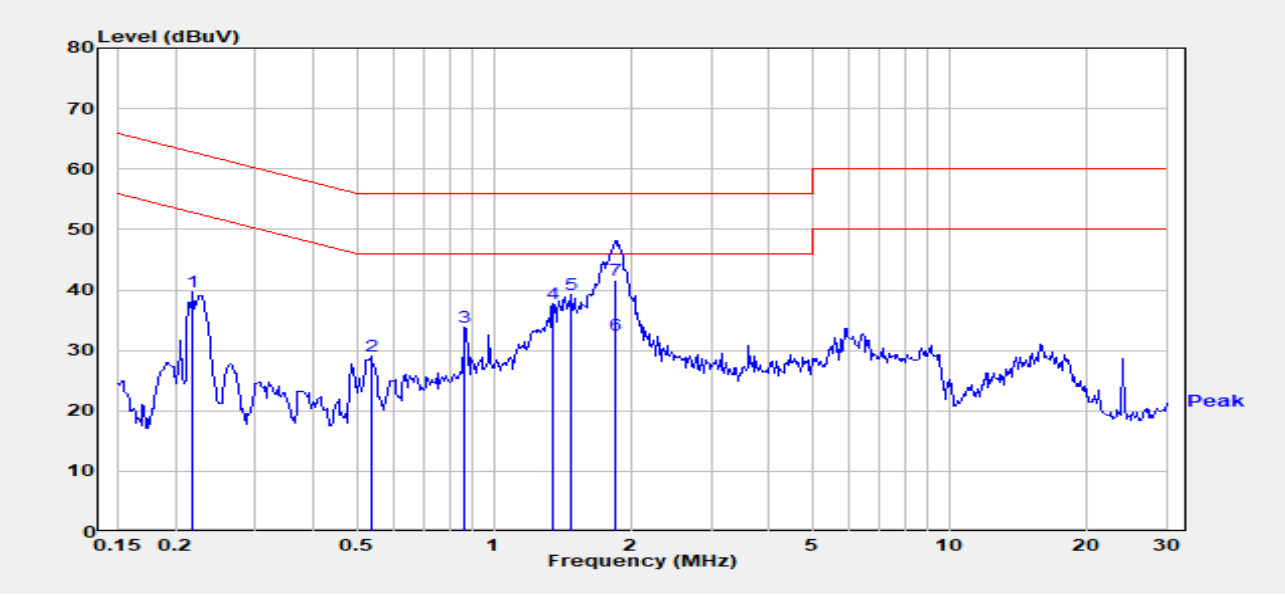
Report Number	:TERF2211002258ER	Test Site	:Conduction 1
Test Mode	:Operation (2.4G)	Test Date	:2023-03-02
Power	:120V/60Hz	Temp./Humi.	:23.8/52
Probe	:N	Engineer	:Ricky Chen



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV	Limit dBμV	Margin dB
0.219	Peak	29.40	10.25	39.65	62.87	-23.22
0.537	Peak	18.71	10.26	28.97	56.00	-27.03
0.864	Peak	23.53	10.34	33.86	56.00	-22.14
1.349	Peak	27.14	10.67	37.81	56.00	-18.19
1.479	Peak	28.40	10.77	39.16	56.00	-16.84
1.847	Average	21.63	11.00	32.63	46.00	-13.37
1.847	QP	30.56	11.00	41.56	56.00	-14.44

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8 PEAK OUTPUT POWER MEASUREMENT

8.1 Standard Applicable

8.2 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.

8.3 Output Power

For systems using digital modulation in the 2400-2483.5 MHz bands, the limit for peak output power is 1Watt and the e.i.r.p. shall not exceed 4 W.

If the transmitting antenna of directional gain greater than 6dBi are used the peak output power form the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the Antenna exceeds 6dBi.

In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of Antenna exceeds 6dBi.

Note:

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

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

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

where

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

NSS = the number of independent spatial streams of data;

NANT = the total number of antennas

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

G_k is the gain in dBi of the kth antenna.

The antenna gain is not greater than 6 dBi. Therefore, reduction of power is not required.

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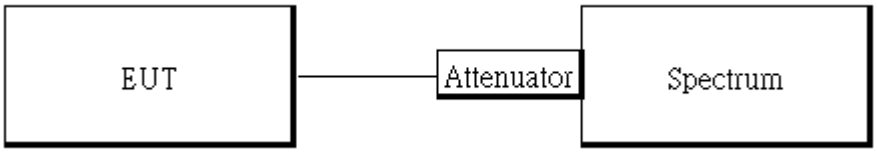
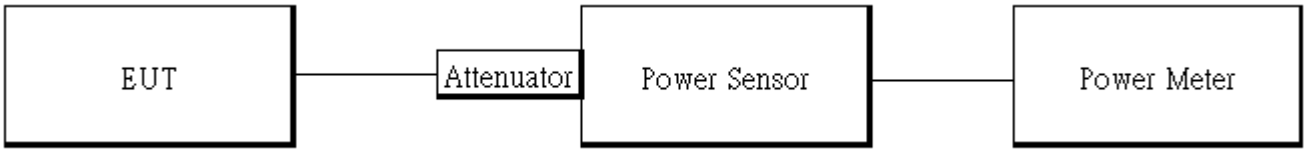
8.4 Test Setup

8.4.1 Duty Cycle



8.4.2 Output Power:



8.5 Measurement Procedure

8.5.1 Duty Cycle:

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

8.5.2 Output Power

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance .
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power meter.
   Power Meter:
   It is used as the auxiliary test equipment to conduct the output power measurement.
4. Record the max. Reading as observed from Spectrum or Power Meter.
5. MIMO mode: offset is set with “measure and add 10 Log (N)” to measurement for MIMO mode. Offset = cable loss + 10 log (N), where N is number of transmitting antenna.

**** Note: The duty cycle factor** and below **is compensated to obtain the maximum value of measurement in average.***

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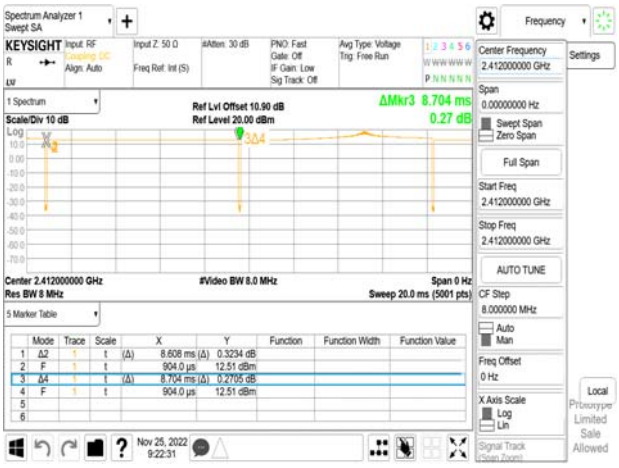
8.6 Measurement Result

8.6.1 Duty Cycle:

	Duty Cycle (%) = Ton / (Ton+Toff)	Duty Factor (dB) =10*log (1/Duty Cycle)	1/T (kHz)	VBW setting (kHz)
802.11b	98.90	0.05	0.12	0.01
802.11g	93.39	0.30	0.70	1.00
802.11n_20	92.97	0.32	0.75	1.00
802.11ax_20	97.89	0.09	1.03	2.00

8.6.2 Duty Cycle test plots

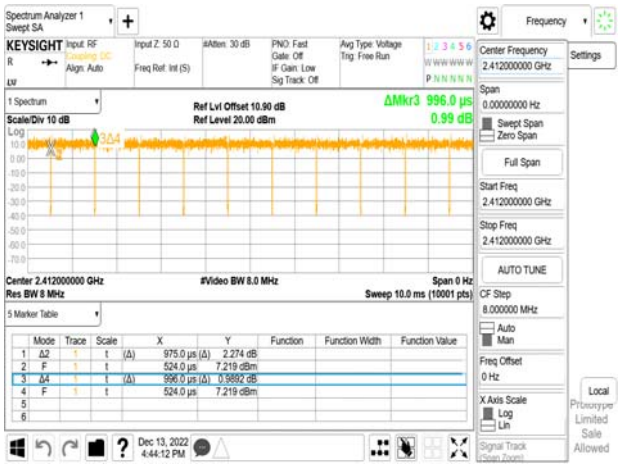
802.11b_20MHz_Chain0_2412MHz



802.11n_20MHz_Chain0_2412MHz

802.11g_20MHz_Chain0_2412MHz

802.11ax_20MHz_Chain0_2412MHz



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8.6.3 Output Power

SISO

802.11b Ch0						
CH	Freq. (MHz)	Data Rate	Power set	Peak Output Power (dBm)	Limit (dBm)	RESULT
1	2412	1	69	19.44	30.00	PASS
3	2422	1	80	22.43	30.00	PASS
6	2437	1	80	22.45	30.00	PASS
9	2452	1	80	22.53	30.00	PASS
11	2462	1	69	19.52	30.00	PASS

802.11b Ch0						
CH	Freq. (MHz)	Data Rate	Power set	Avg. Output Power (dBm)	Limit (dBm)	RESULT
1	2412	1	69	16.76	30.00	PASS
3	2422	1	80	19.99	30.00	PASS
6	2437	1	80	19.98	30.00	PASS
9	2452	1	80	19.96	30.00	PASS
11	2462	1	69	16.59	30.00	PASS

802.11b Ch1						
CH	Freq. (MHz)	Data Rate	Power set	Peak Output Power (dBm)	Limit (dBm)	RESULT
1	2412	1	70	19.23	30.00	PASS
3	2422	1	80	21.65	30.00	PASS
6	2437	1	80	21.72	30.00	PASS
9	2452	1	80	21.63	30.00	PASS
11	2462	1	73	19.31	30.00	PASS

802.11b Ch1						
CH	Freq. (MHz)	Data Rate	Power set	Avg. Output Power (dBm)	Limit (dBm)	RESULT
1	2412	1	70	16.51	30.00	PASS
3	2422	1	80	19.55	30.00	PASS
6	2437	1	80	19.53	30.00	PASS
9	2452	1	80	19.51	30.00	PASS
11	2462	1	73	16.58	30.00	PASS

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802.11g Ch0						
CH	Freq. (MHz)	Data Rate	Power set	Peak Output Power (dBm)	Limit (dBm)	RESULT
1	2412	6	62	21.49	30.00	PASS
3	2422	6	67	22.58	30.00	PASS
4	2427	6	70	23.46	30.00	PASS
5	2432	6	70	23.51	30.00	PASS
6	2437	6	77	24.23	30.00	PASS
7	2442	6	73	24.27	30.00	PASS
8	2447	6	69	23.54	30.00	PASS
9	2452	6	67	22.73	30.00	PASS
11	2462	6	63	21.78	30.00	PASS

802.11g Ch0						
CH	Freq. (MHz)	Data Rate	Power set	Avg. Output Power (dBm)	Limit (dBm)	RESULT
1	2412	6	62	14.77	30.00	PASS
3	2422	6	67	15.80	30.00	PASS
4	2427	6	70	16.93	30.00	PASS
5	2432	6	70	16.95	30.00	PASS
6	2437	6	77	18.67	30.00	PASS
7	2442	6	73	17.89	30.00	PASS
8	2447	6	69	16.82	30.00	PASS
9	2452	6	67	15.87	30.00	PASS
11	2462	6	63	14.84	30.00	PASS

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802.11g Ch1						
CH	Freq. (MHz)	Data Rate	Power set	Peak Output Power (dBm)	Limit (dBm)	RESULT
1	2412	6	62	21.31	30.00	PASS
3	2422	6	67	21.98	30.00	PASS
4	2427	6	72	23.19	30.00	PASS
5	2432	6	71	23.08	30.00	PASS
6	2437	6	78	23.19	30.00	PASS
7	2442	6	74	24.03	30.00	PASS
8	2447	6	72	22.98	30.00	PASS
9	2452	6	68	22.03	30.00	PASS
11	2462	6	63	21.31	30.00	PASS
802.11g Ch1						
CH	Freq. (MHz)	Data Rate	Power set	Avg. Output Power (dBm)	Limit (dBm)	RESULT
1	2412	6	62	14.72	30.00	PASS
3	2422	6	67	15.55	30.00	PASS
4	2427	6	72	16.88	30.00	PASS
5	2432	6	71	16.77	30.00	PASS
6	2437	6	78	18.56	30.00	PASS
7	2442	6	74	17.83	30.00	PASS
8	2447	6	72	16.78	30.00	PASS
9	2452	6	68	15.73	30.00	PASS
11	2462	6	63	14.64	30.00	PASS

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802.11n_HT_20M Ch0						
CH	Freq. (MHz)	Data Rate	Power set	Peak Output Power (dBm)	Limit (dBm)	RESULT
1	2412	MCS0	62	21.47	30.00	PASS
3	2422	MCS0	68	23.31	30.00	PASS
4	2427	MCS0	71	23.28	30.00	PASS
5	2432	MCS0	70	23.47	30.00	PASS
6	2437	MCS0	75	23.97	30.00	PASS
7	2442	MCS0	75	24.03	30.00	PASS
8	2447	MCS0	70	23.68	30.00	PASS
9	2452	MCS0	68	22.74	30.00	PASS
11	2462	MCS0	59	21.04	30.00	PASS

802.11n_HT_20M Ch0						
CH	Freq. (MHz)	Data Rate	Power set	Avg. Output Power (dBm)	Limit (dBm)	RESULT
1	2412	MCS0	62	14.64	30.00	PASS
3	2422	MCS0	68	15.95	30.00	PASS
4	2427	MCS0	71	16.80	30.00	PASS
5	2432	MCS0	70	16.78	30.00	PASS
6	2437	MCS0	75	17.96	30.00	PASS
7	2442	MCS0	75	17.82	30.00	PASS
8	2447	MCS0	70	16.95	30.00	PASS
9	2452	MCS0	68	15.98	30.00	PASS
11	2462	MCS0	59	13.81	30.00	PASS

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802.11n_HT_20M Ch1						
CH	Freq. (MHz)	Data Rate	Power set	Peak Output Power (dBm)	Limit (dBm)	RESULT
1	2412	MCS0	62	21.35	30.00	PASS
3	2422	MCS0	68	22.41	30.00	PASS
4	2427	MCS0	71	22.79	30.00	PASS
5	2432	MCS0	72	22.73	30.00	PASS
6	2437	MCS0	75	22.80	30.00	PASS
7	2442	MCS0	75	22.94	30.00	PASS
8	2447	MCS0	72	22.61	30.00	PASS
9	2452	MCS0	69	22.22	30.00	PASS
11	2462	MCS0	59	20.87	30.00	PASS
802.11n_HT_20M Ch1						
CH	Freq. (MHz)	Data Rate	Power set	Avg. Output Power (dBm)	Limit (dBm)	RESULT
1	2412	MCS0	62	14.55	30.00	PASS
3	2422	MCS0	68	15.84	30.00	PASS
4	2427	MCS0	71	16.59	30.00	PASS
5	2432	MCS0	72	16.75	30.00	PASS
6	2437	MCS0	75	17.57	30.00	PASS
7	2442	MCS0	75	17.53	30.00	PASS
8	2447	MCS0	72	16.78	30.00	PASS
9	2452	MCS0	69	15.94	30.00	PASS
11	2462	MCS0	59	13.69	30.00	PASS

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802.11ax_HE_20M Ch0							
CH	Freq. (MHz)	Data Rate	RU Config	Power set	Peak Output Power (dBm)	Limit (dBm)	RESULT
1	2412	MCS0	full	53	24.43	30.00	PASS
			26/0	54	24.56	30.00	PASS
			52/37	55	24.58	30.00	PASS
			106/53	53	24.37	30.00	PASS
3	2422	MCS0	full	64	25.08	30.00	PASS
6	2437	MCS0	full	65	25.08	30.00	PASS
9	2452	MCS0	full	65	24.98	30.00	PASS
11	2462	MCS0	full	53	24.27	30.00	PASS
			26/8	54	24.25	30.00	PASS
			52/40	55	24.34	30.00	PASS
			106/54	54	24.26	30.00	PASS

802.11ax_HE_20M Ch0							
CH	Freq. (MHz)	Data Rate	RU Config	Power set	Avg. Output Power (dBm)	Limit (dBm)	RESULT
1	2412	MCS0	full	53	12.78	30.00	PASS
			26/0	54	12.98	30.00	PASS
			52/37	55	12.99	30.00	PASS
			106/53	53	12.83	30.00	PASS
3	2422	MCS0	full	64	15.90	30.00	PASS
6	2437	MCS0	full	65	15.82	30.00	PASS
9	2452	MCS0	full	65	15.91	30.00	PASS
11	2462	MCS0	full	53	12.82	30.00	PASS
			26/8	54	12.87	30.00	PASS
			52/40	55	12.96	30.00	PASS
			106/54	54	12.88	30.00	PASS

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802.11ax_HE_20M Ch1							
CH	Freq. (MHz)	Data Rate	RU Config	Power set	Peak Output Power (dBm)	Limit (dBm)	RESULT
1	2412	MCS0	full	53	23.76	30.00	PASS
			26/0	53	23.72	30.00	PASS
			52/37	54	23.80	30.00	PASS
			106/53	53	23.73	30.00	PASS
3	2422	MCS0	full	64	24.23	30.00	PASS
6	2437	MCS0	full	65	24.30	30.00	PASS
9	2452	MCS0	full	65	24.26	30.00	PASS
11	2462	MCS0	full	53	23.60	30.00	PASS
			26/8	54	23.63	30.00	PASS
			52/40	55	23.59	30.00	PASS
			106/54	54	23.43	30.00	PASS

802.11ax_HE_20M Ch1							
CH	Freq. (MHz)	Data Rate	RU Config	Power set	Avg. Output Power (dBm)	Limit (dBm)	RESULT
1	2412	MCS0	full	53	12.75	30.00	PASS
			26/0	53	12.67	30.00	PASS
			52/37	54	12.91	30.00	PASS
			106/53	53	12.75	30.00	PASS
3	2422	MCS0	full	64	15.87	30.00	PASS
6	2437	MCS0	full	65	15.78	30.00	PASS
9	2452	MCS0	full	65	15.70	30.00	PASS
11	2462	MCS0	full	53	12.57	30.00	PASS
			26/8	54	12.61	30.00	PASS
			52/40	55	12.89	30.00	PASS
			106/54	54	12.62	30.00	PASS

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802.11g_2TX

CH	Freq. (MHz)	Data Rate	Power set	Peak Output Power		Total Peak Output Power (dBm)	Limit (dBm)	RESULT
				Ch0	Ch1			
1	2412	6	53	18.59	18.54	21.58	30.00	PASS
3	2422	6	67	22.86	21.96	25.44	30.00	PASS
6	2437	6	67	22.82	21.75	25.33	30.00	PASS
9	2452	6	67	22.89	21.83	25.40	30.00	PASS
11	2462	6	53	18.57	18.21	21.40	30.00	PASS

802.11g_2TX

CH	Freq. (MHz)	Data Rate	Power set	Avg. Output Power		Total Avg. Output Power (dBm)	Limit (dBm)	RESULT
				Ch0	Ch1			
1	2412	6	53	11.81	11.78	14.80	30.00	PASS
3	2422	6	67	15.92	15.83	18.88	30.00	PASS
6	2437	6	67	15.93	15.69	18.82	30.00	PASS
9	2452	6	67	16.05	15.56	18.82	30.00	PASS
11	2462	6	53	11.89	11.46	14.69	30.00	PASS

802.11n_HT_20M_2TX

CH	Freq. (MHz)	Data Rate	Power set	Peak Output Power		Total Peak Output Power (dBm)	Limit (dBm)	RESULT
				Ch0	Ch1			
1	2412	MCS0	52	18.11	18.23	21.18	30.00	PASS
3	2422	MCS0	64	21.92	21.77	24.86	30.00	PASS
6	2437	MCS0	64	22.11	21.87	25.00	30.00	PASS
9	2452	MCS0	64	22.29	21.59	24.96	30.00	PASS
11	2462	MCS0	51	18.39	18.21	21.31	30.00	PASS

802.11n_HT_20M_2TX

CH	Freq. (MHz)	Data Rate	Power set	Avg. Output Power		Total Avg. Output Power (dBm)	Limit (dBm)	RESULT
				Ch0	Ch1			
1	2412	MCS0	52	11.61	11.78	14.70	30.00	PASS
3	2422	MCS0	64	14.92	15.04	17.99	30.00	PASS
6	2437	MCS0	64	14.97	14.96	17.97	30.00	PASS
9	2452	MCS0	64	15.08	14.73	17.92	30.00	PASS
11	2462	MCS0	51	11.06	10.55	13.82	30.00	PASS

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802.11ax_HE_20M_2TX									
CH	Freq. (MHz)	Data Rate	RU Config	Power set	Peak Output Power		Total Peak Output Power (dBm)	Limit (dBm)	RESULT
					Ch0	Ch1			
1	2412	MCS0	full	40	22.01	22.19	25.11	30.00	PASS
			26/0	41	22.08	22.35	25.23	30.00	PASS
			52/37	41	22.05	22.28	25.18	30.00	PASS
			106/53	41	22.06	22.33	25.21	30.00	PASS
3	2422	MCS0	full	53	24.28	23.60	26.96	30.00	PASS
6	2437	MCS0	full	53	24.13	23.55	26.86	30.00	PASS
9	2452	MCS0	full	54	24.30	23.57	26.96	30.00	PASS
11	2462	MCS0	full	41	22.06	22.03	25.06	30.00	PASS
			26/8	42	22.20	22.29	25.26	30.00	PASS
			52/40	42	22.04	22.11	25.09	30.00	PASS
			106/54	42	22.13	22.31	25.23	30.00	PASS

802.11ax_HE_20M_2TX									
CH	Freq. (MHz)	Data Rate	RU Config	Power set	Avg. Output Power		Total Avg. Output Power (dBm)	Limit (dBm)	RESULT
					Ch0	Ch1			
1	2412	MCS0	full	40	9.53	9.99	12.78	30.00	PASS
			26/0	41	9.66	10.07	12.88	30.00	PASS
			52/37	41	9.65	10.02	12.85	30.00	PASS
			106/53	41	9.64	10.04	12.86	30.00	PASS
3	2422	MCS0	full	53	12.83	12.95	15.90	30.00	PASS
6	2437	MCS0	full	53	12.71	12.61	15.67	30.00	PASS
9	2452	MCS0	full	54	13.02	12.94	15.99	30.00	PASS
11	2462	MCS0	full	41	9.69	9.70	12.71	30.00	PASS
			26/8	42	9.78	9.88	12.84	30.00	PASS
			52/40	42	9.78	9.72	12.76	30.00	PASS
			106/54	42	9.83	10.03	12.94	30.00	PASS

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802.11b Ch0							
CH	Freq. (MHz)	Data Rate	Avg. Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	RESULT
1	2412	1	16.76	3.20	19.96	36	PASS
3	2422	1	19.99	3.20	23.19	36	PASS
6	2437	1	19.98	3.20	23.18	36	PASS
9	2452	1	19.96	3.20	23.16	36	PASS
11	2462	1	16.59	3.20	19.79	36	PASS

802.11b Ch1							
CH	Freq. (MHz)	Data Rate	Avg. Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	RESULT
1	2412	1	16.51	3.20	19.71	36	PASS
3	2422	1	19.55	3.20	22.75	36	PASS
6	2437	1	19.53	3.20	22.73	36	PASS
9	2452	1	19.51	3.20	22.71	36	PASS
11	2462	1	16.58	3.20	19.78	36	PASS

802.11g Ch0							
CH	Freq. (MHz)	Data Rate	Avg. Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	RESULT
1	2412	6	14.77	3.20	17.97	36	PASS
3	2422	6	15.80	3.20	19.00	36	PASS
4	2427	6	16.93	3.20	20.13	36	PASS
5	2432	6	16.95	3.20	20.15	36	PASS
6	2437	6	18.67	3.20	21.87	36	PASS
7	2442	6	17.89	3.20	21.09	36	PASS
8	2447	6	16.82	3.20	20.02	36	PASS
9	2452	6	15.87	3.20	19.07	36	PASS
11	2462	6	14.84	3.20	18.04	36	PASS

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802.11g Ch1							
CH	Freq. (MHz)	Data Rate	Avg. Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	RESULT
1	2412	6	14.72	3.20	17.92	36	PASS
3	2422	6	15.55	3.20	18.75	36	PASS
4	2427	6	16.88	3.20	20.08	36	PASS
5	2432	6	16.77	3.20	19.97	36	PASS
6	2437	6	18.56	3.20	21.76	36	PASS
7	2442	6	17.83	3.20	21.03	36	PASS
8	2447	6	16.78	3.20	19.98	36	PASS
9	2452	6	15.73	3.20	18.93	36	PASS
11	2462	6	14.64	3.20	17.84	36	PASS

802.11n_HT_20M Ch0							
CH	Freq. (MHz)	Data Rate	Avg. Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	RESULT
1	2412	MCS0	14.64	3.20	17.84	36	PASS
3	2422	MCS0	15.95	3.20	19.15	36	PASS
4	2427	MCS0	16.80	3.20	20.00	36	PASS
5	2432	MCS0	16.78	3.20	19.98	36	PASS
6	2437	MCS0	17.96	3.20	21.16	36	PASS
7	2442	MCS0	17.82	3.20	21.02	36	PASS
8	2447	MCS0	16.95	3.20	20.15	36	PASS
9	2452	MCS0	15.98	3.20	19.18	36	PASS
11	2462	MCS0	13.81	3.20	17.01	36	PASS

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802.11n_HT_20M Ch1							
CH	Freq. (MHz)	Data Rate	Avg. Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	RESULT
1	2412	MCS0	14.55	3.20	17.75	36	PASS
3	2422	MCS0	15.84	3.20	19.04	36	PASS
4	2427	MCS0	16.59	3.20	19.79	36	PASS
5	2432	MCS0	16.75	3.20	19.95	36	PASS
6	2437	MCS0	17.57	3.20	20.77	36	PASS
7	2442	MCS0	17.53	3.20	20.73	36	PASS
8	2447	MCS0	16.78	3.20	19.98	36	PASS
9	2452	MCS0	15.94	3.20	19.14	36	PASS
11	2462	MCS0	13.69	3.20	16.89	36	PASS

802.11ax_HE_20M Ch0								
CH	Freq. (MHz)	Data Rate	RU Config	Avg. Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit	RESULT
1	2412	MCS0	full	12.78	3.20	15.98	36	PASS
			26/0	12.98	3.20	16.18	36	PASS
			52/37	12.99	3.20	16.19	36	PASS
			106/53	12.83	3.20	16.03	36	PASS
3	2422	MCS0	full	15.90	3.20	19.10	36	PASS
6	2437	MCS0	full	15.82	3.20	19.02	36	PASS
9	2452	MCS0	full	15.91	3.20	19.11	36	PASS
11	2462	MCS0	full	12.82	3.20	16.02	36	PASS
			26/8	12.87	3.20	16.07	36	PASS
			52/40	12.96	3.20	16.16	36	PASS
			106/54	12.88	3.20	16.08	36	PASS

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802.11ax_HE_20M Ch1								
CH	Freq. (MHz)	Data Rate	RU Config	Avg. Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit	RESULT
1	2412	MCS0	full	12.75	3.20	15.95	36	PASS
			26/0	12.67	3.20	15.87	36	PASS
			52/37	12.91	3.20	16.11	36	PASS
			106/53	12.75	3.20	15.95	36	PASS
3	2422	MCS0	full	15.87	3.20	19.07	36	PASS
6	2437	MCS0	full	15.78	3.20	18.98	36	PASS
9	2452	MCS0	full	15.70	3.20	18.90	36	PASS
11	2462	MCS0	full	12.57	3.20	15.77	36	PASS
			26/8	12.61	3.20	15.81	36	PASS
			52/40	12.89	3.20	16.09	36	PASS
			106/54	12.62	3.20	15.82	36	PASS

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802.11g_2TX									
CH	Freq. (MHz)	Data Rate	Avg. Output Power		Total Avg. Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	RESULT
			Ch0	Ch1					
1	2412	6	11.81	11.78	14.80	3.20	18.00	36	PASS
3	2422	6	15.92	15.83	18.88	3.20	22.08	36	PASS
6	2437	6	15.93	15.69	18.82	3.20	22.02	36	PASS
9	2452	6	16.05	15.56	18.82	3.20	22.02	36	PASS
11	2462	6	11.89	11.46	14.69	3.20	17.89	36	PASS

802.11n_HT_20M_2TX									
CH	Freq. (MHz)	Data Rate	Avg. Output Power		Total Avg. Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	RESULT
			Ch0	Ch1					
1	2412	MCS0	11.61	11.78	14.70	3.20	17.90	36	PASS
3	2422	MCS0	14.92	9.70	17.99	3.20	21.19	36	PASS
6	2437	MCS0	14.97	14.96	17.97	3.20	21.17	36	PASS
9	2452	MCS0	15.08	14.73	17.92	3.20	21.12	36	PASS
11	2462	MCS0	11.06	10.55	13.82	3.20	17.02	36	PASS

802.11ax_HE_20M_2TX										
CH	Freq. (MHz)	Data Rate	RU Config	Avg. Output Power		Total Avg. Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit	RESULT
				Ch0	Ch1					
1	2412	MCS0	full	9.53	9.99	12.78	3.20	15.98	36	PASS
			26/0	9.66	10.07	12.88	3.20	16.08	36	PASS
			52/37	9.65	10.02	12.85	3.20	16.05	36	PASS
			106/53	9.64	10.04	12.86	3.20	16.06	36	PASS
3	2422	MCS0	full	12.83	12.95	15.90	3.20	19.10	36	PASS
6	2437	MCS0	full	12.71	12.61	15.67	3.20	18.87	36	PASS
9	2452	MCS0	full	13.02	12.94	15.99	3.20	19.19	36	PASS
11	2462	MCS0	full	9.69	9.70	12.71	3.20	15.91	36	PASS
			26/8	9.78	9.88	12.84	3.20	16.04	36	PASS
			52/40	9.78	9.72	12.76	3.20	15.96	36	PASS
			106/54	9.83	10.03	12.94	3.20	16.14	36	PASS

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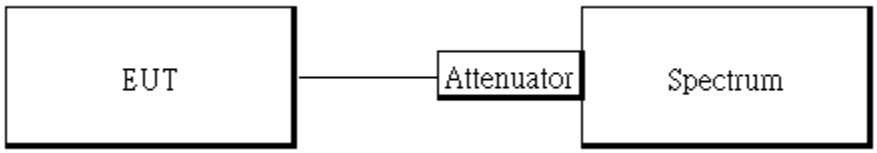
9 EMISSION BANDWIDTH MEASUREMENT

9.1 Standard Applicable

The minimum 6 dB bandwidth shall be at least 500 kHz.

9.2 Test Setup



9.3 Measurement Procedure:

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.

9.3.1 FCC measurements

1. The testing follows the Measurement Procedure of the KDB 558074 D01.
2. Set the spectrum analyzer as
   RBW= 100 kHz ,
   VBW = 3 X RBW,
   Span= 2 to 5 times of the OBW,
   Sweep=auto, Detector = Peak, and Max hold.
3. Mark the upper and lower frequencies of -6dB.
4. Repeat above procedures until all test default channel is completed.

9.3.2 ISED measurements

1. The testing follows the Measurement Procedure of the RSS-Gen section 6.7.
2. Set the spectrum analyzer as
   RBW= 1 % to 5% of 99% and -6dB Bandwidth ,
   VBW ≥ 3 X RBW,
   Span= large enough to capture all products of the modulation process
   Sweep=auto, Detector = Peak, and Max hold.
3. Mark the upper and lower frequencies of 99% and -6dB.
4. Repeat above procedures until all test default channel is completed.

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9.4 6dB Bandwidth

SISO

802.11b Ch0

Freq. (MHz)	6dB BW (kHz)	Limit (kHz)	Result
2412	9092	≥ 500	PASS
2437	**9106**	≥ 500	PASS
2462	9099	≥ 500	PASS

802.11g Ch0

Freq. (MHz)	6dB BW (kHz)	Limit (kHz)	Result
2412	**16340**	≥ 500	PASS
2437	16320	≥ 500	PASS
2462	16330	≥ 500	PASS

802.11n_HT_20M Ch0

Freq. (MHz)	6dB BW (kHz)	Limit (kHz)	Result
2412	**17570**	≥ 500	PASS
2437	**17570**	≥ 500	PASS
2462	**17570**	≥ 500	PASS

802.11ax_HE_20M Ch0

Freq. (MHz)	RU Config	6dB BW (kHz)	Limit (kHz)	Result
2412	full	19110	≥ 500	PASS
2437	full	19070	≥ 500	PASS
2462	full	**19140**	≥ 500	PASS

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MIMO

802.11g Ch0

Freq. (MHz)	6dB BW (kHz)	Limit (kHz)	Result
2412	16330	≧ 500	PASS
2437	16350	≧ 500	PASS
2462	**16370**	≧ 500	PASS

802.11g Ch1

Freq. (MHz)	6dB BW (kHz)	Limit (kHz)	Result
2412	16370	≧ 500	PASS
2437	16370	≧ 500	PASS
2462	**16380**	≧ 500	PASS

802.11n_HT_20M Ch0

Freq. (MHz)	6dB BW (kHz)	Limit (kHz)	Result
2412	17340	≧ 500	PASS
2437	**17580**	≧ 500	PASS
2462	17570	≧ 500	PASS

802.11n_HT_20M Ch1

Freq. (MHz)	6dB BW (kHz)	Limit (kHz)	Result
2412	17620	≧ 500	PASS
2437	17610	≧ 500	PASS
2462	**17630**	≧ 500	PASS

802.11ax_HE_20M Ch0

Freq. (MHz)	RU Config	6dB BW (kHz)	Limit (kHz)	Result
2412	full	19110	≧ 500	PASS
2437	full	19080	≧ 500	PASS
2462	full	**19130**	≧ 500	PASS

802.11ax_HE_20M Ch1

Freq. (MHz)	RU Config	6dB BW (kHz)	Limit (kHz)	Result
2412	full	19140	≧ 500	PASS
2437	full	19140	≧ 500	PASS
2462	full	**19150**	≧ 500	PASS

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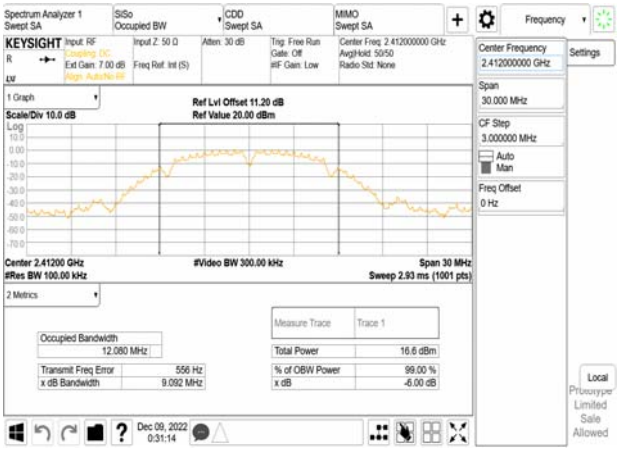
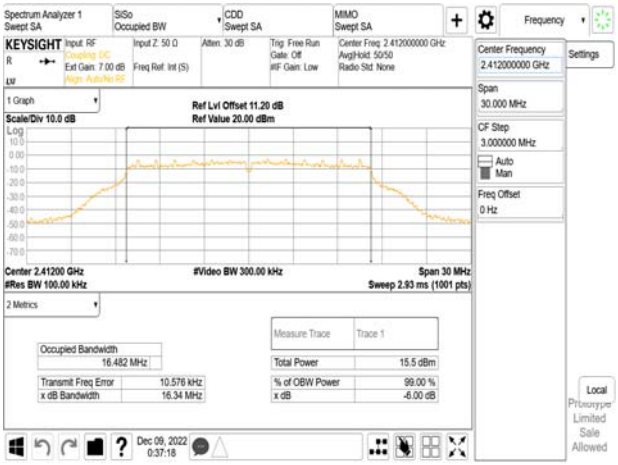
SISO

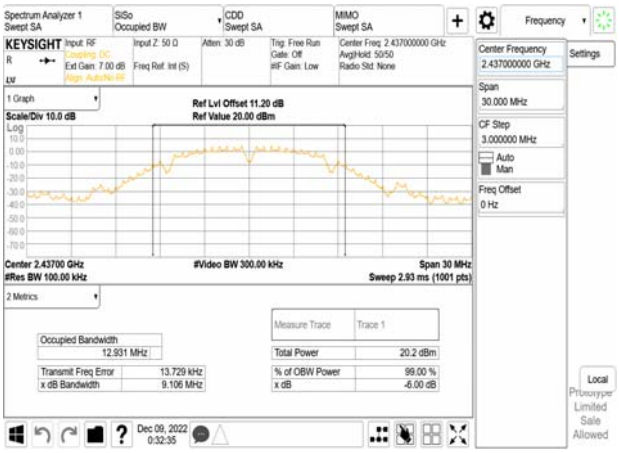
802.11b_20MHz_Chain0_2412MHz



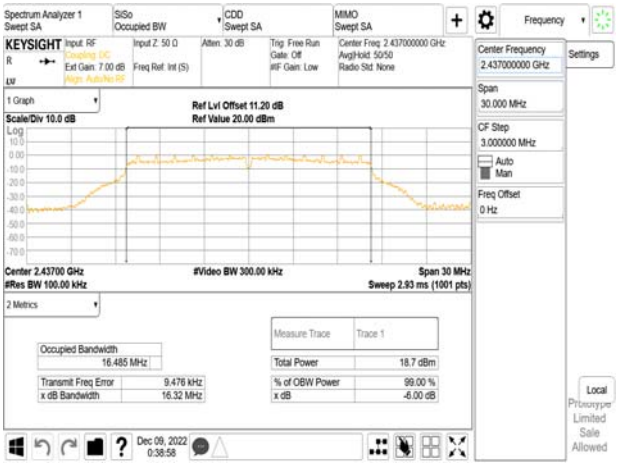
802.11g_20MHz_Chain0_2412MHz



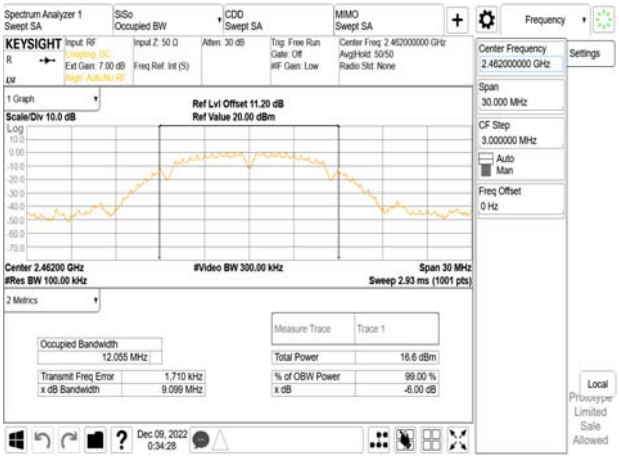
802.11b_20MHz_Chain0_2437MHz



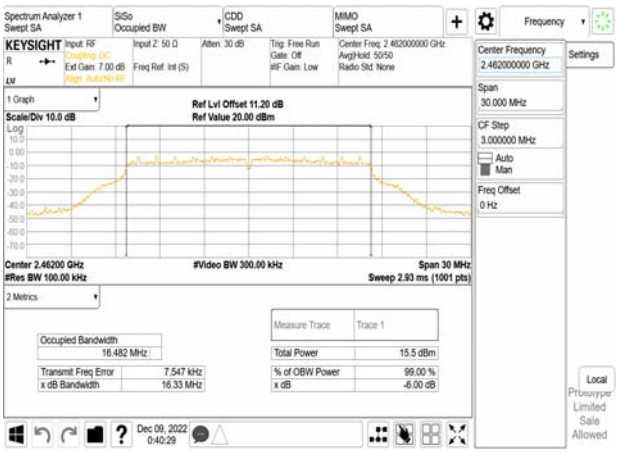
802.11g_20MHz_Chain0_2437MHz



802.11b_20MHz_Chain0_2462MHz



802.11g_20MHz_Chain0_2462MHz



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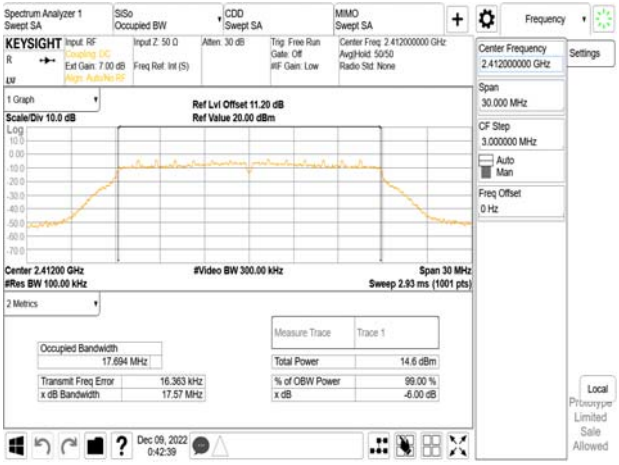
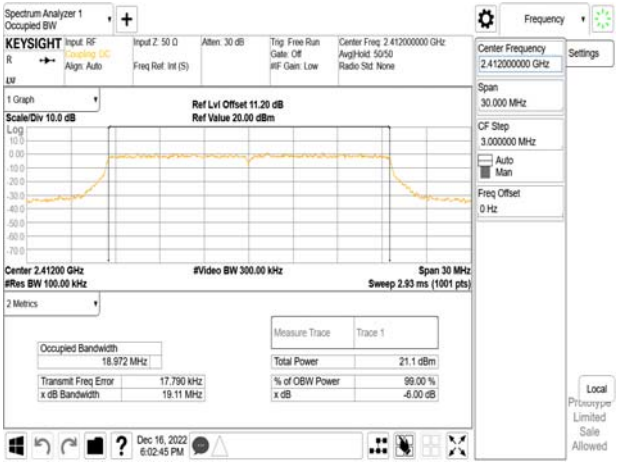
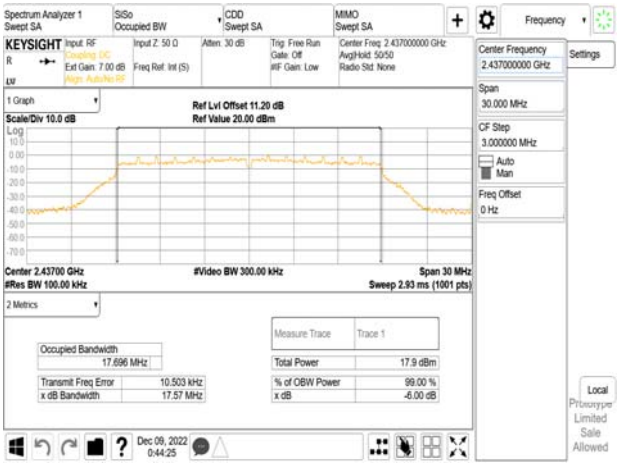
802.11n_20MHz_Chain0_2412MHz



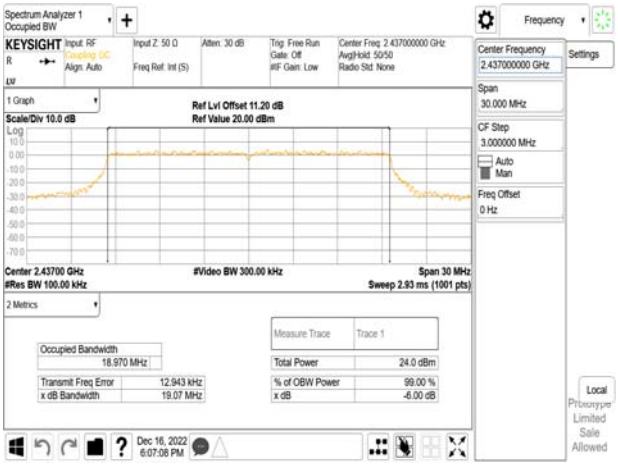
802.11ax_20MHz_Chain0_2412MHz



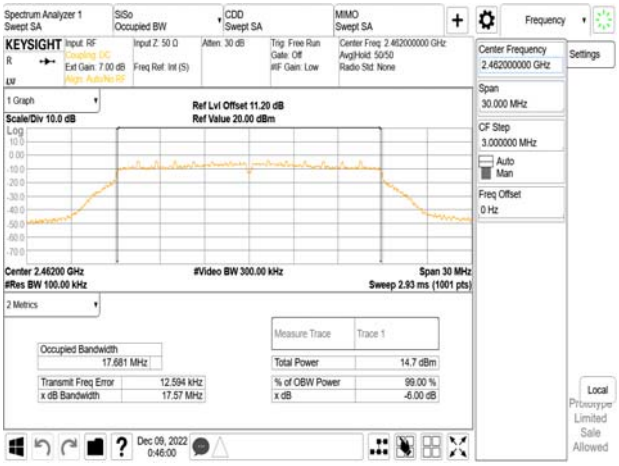
802.11n_20MHz_Chain0_2437MHz



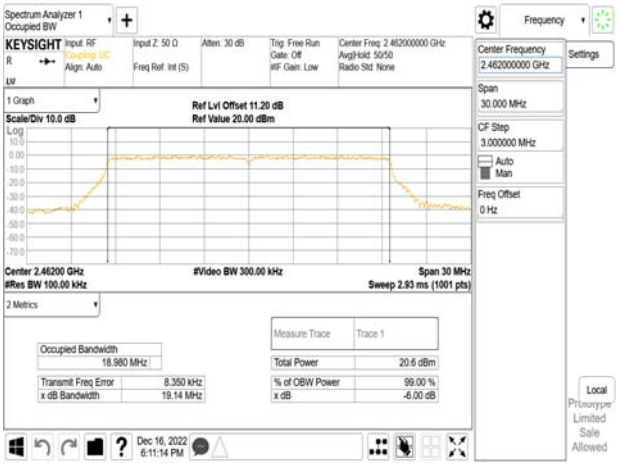
802.11ax_20MHz_Chain0_2437MHz



802.11n_20MHz_Chain0_2462MHz



802.11ax_20MHz_Chain0_2462MHz



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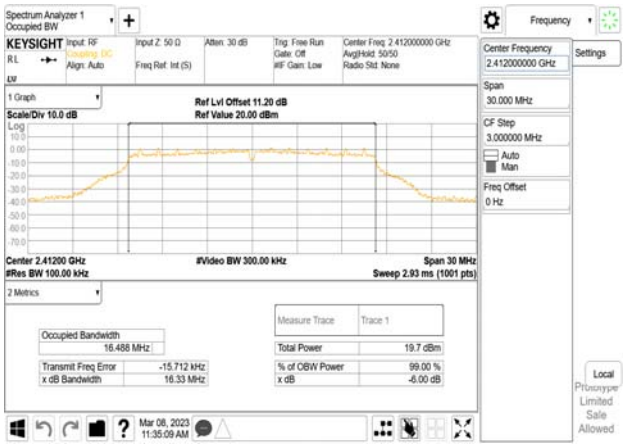
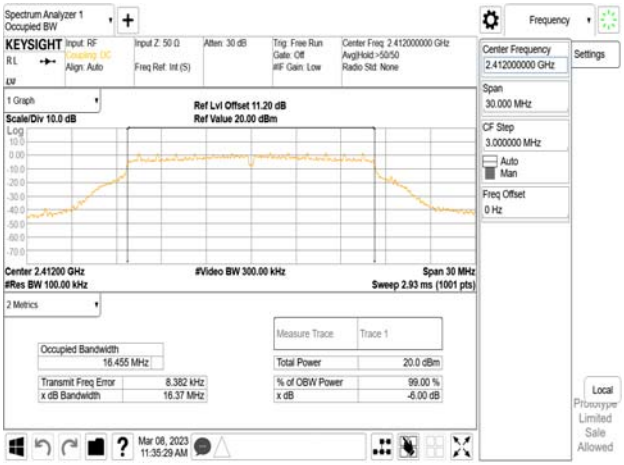
MIMO

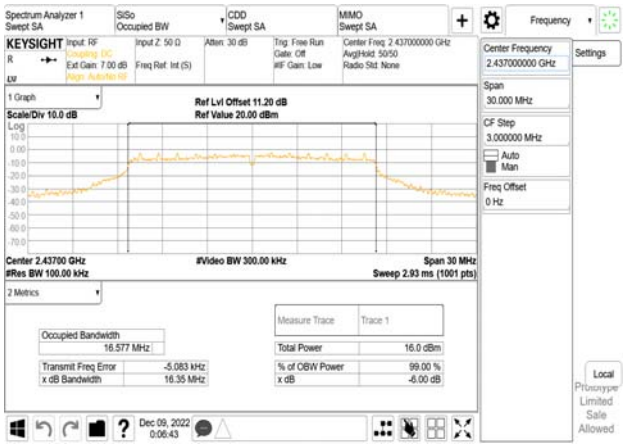
802.11g_20MHz_Chain0_2412MHz



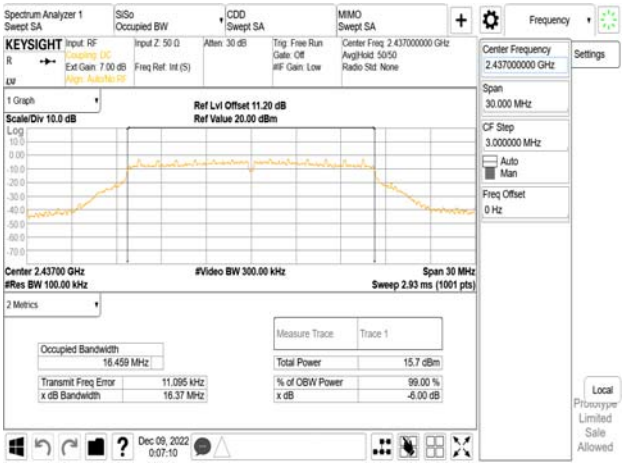
802.11g_20MHz_Chain1_2412MHz



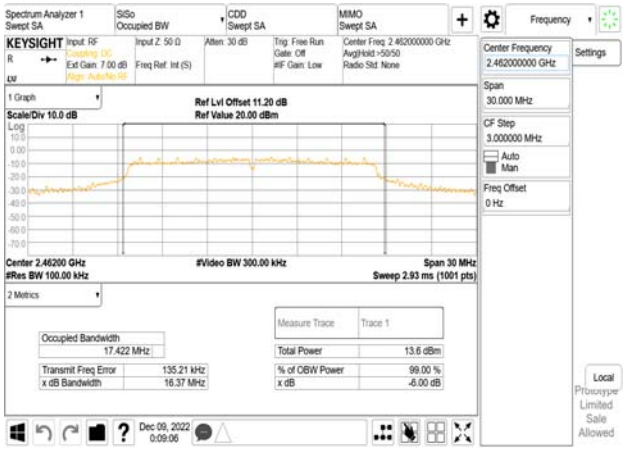
802.11g_20MHz_Chain0_2437MHz



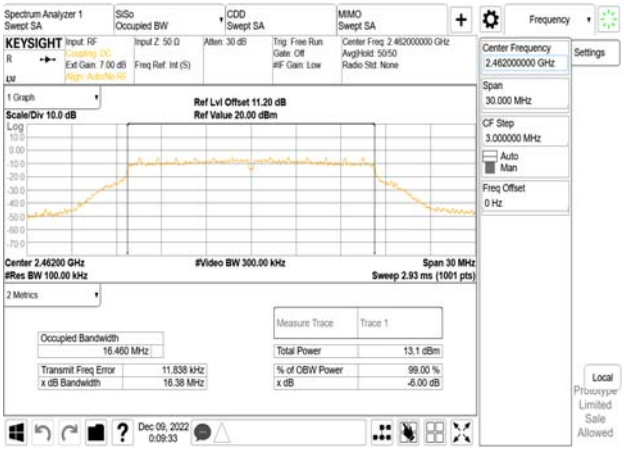
802.11g_20MHz_Chain1_2437MHz



802.11g_20MHz_Chain0_2462MHz



802.11g_20MHz_Chain1_2462MHz



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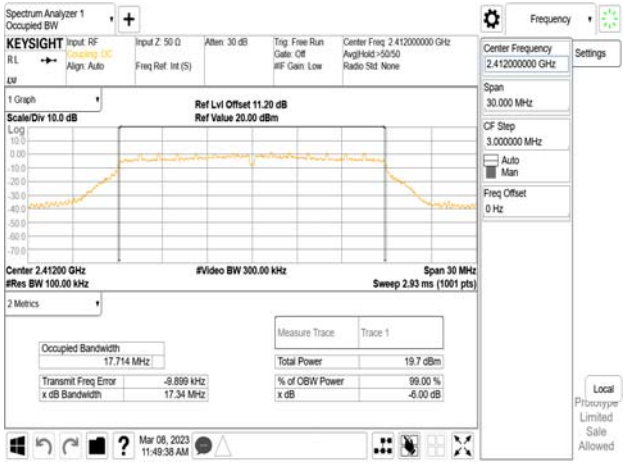
802.11n_20MHz_Chain0_2412MHz



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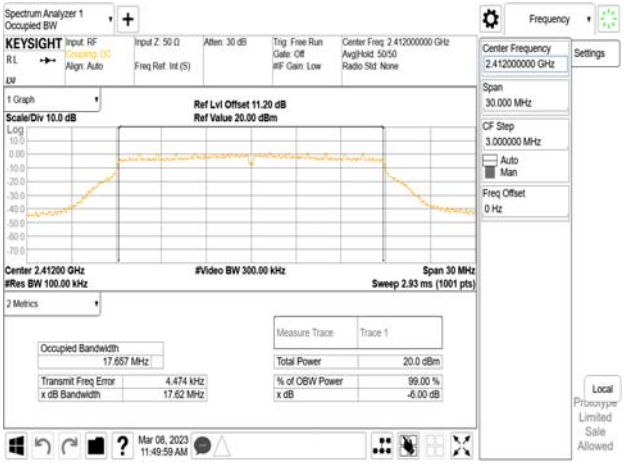

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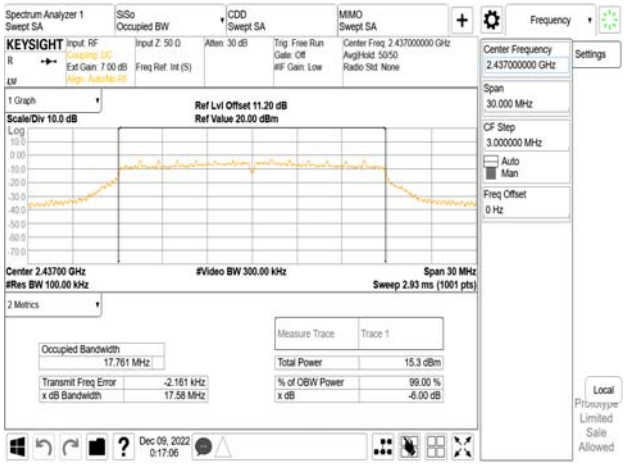
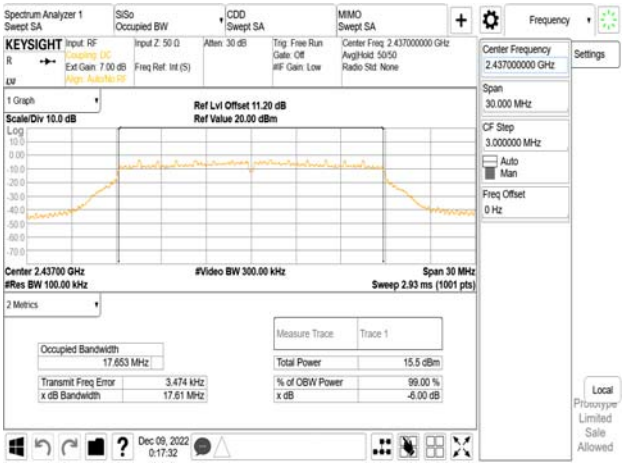
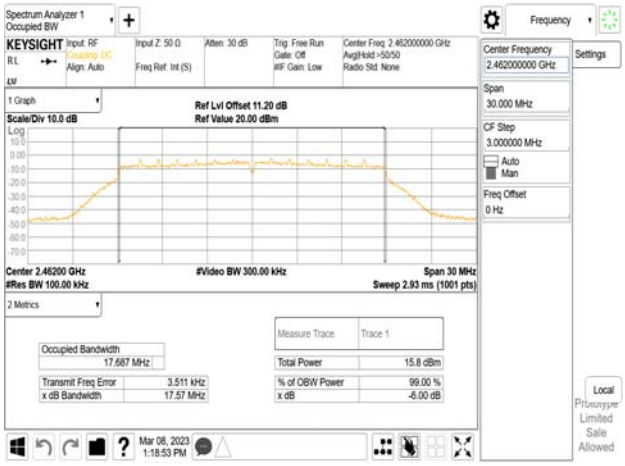


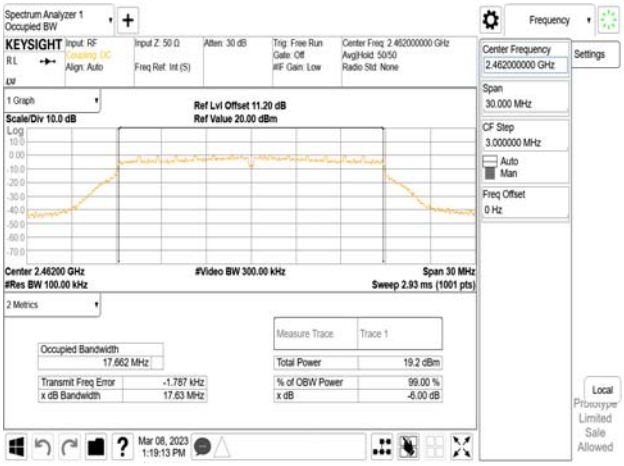
802.11n_20MHz_Chain1_2437MHz



802.11n_20MHz_Chain0_2462MHz



802.11n_20MHz_Chain1_2462MHz



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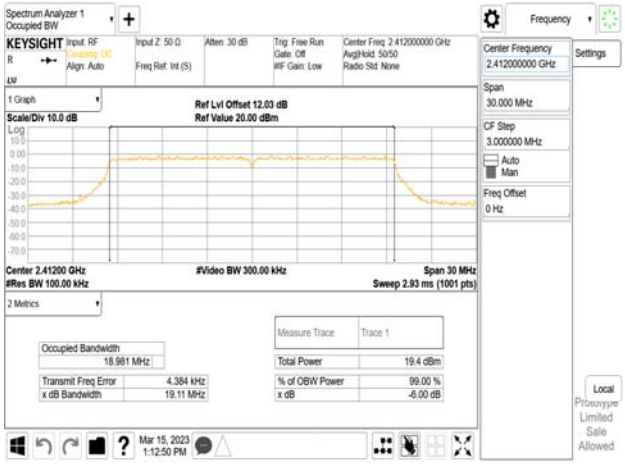
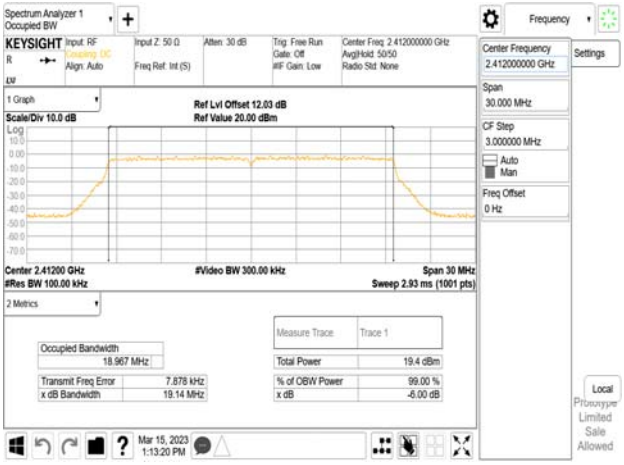
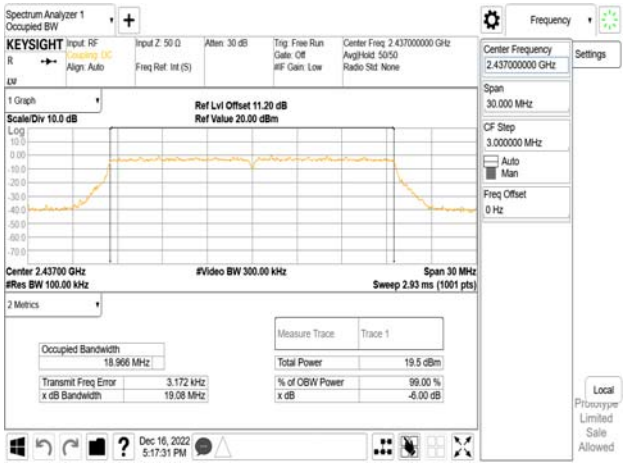
802.11ax_20MHz_Chain0_2412MHz



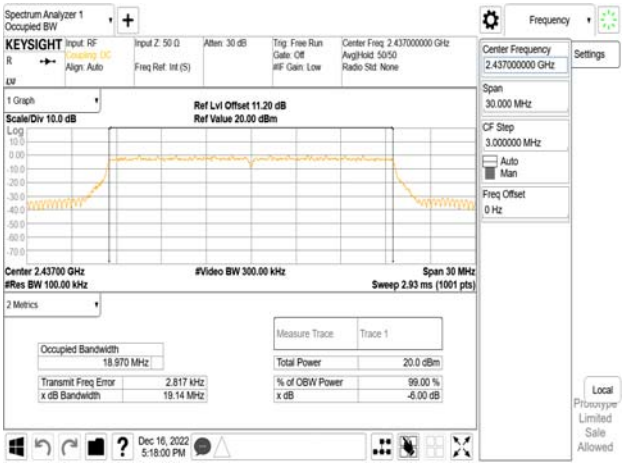
802.11ax_20MHz_Chain1_2412MHz



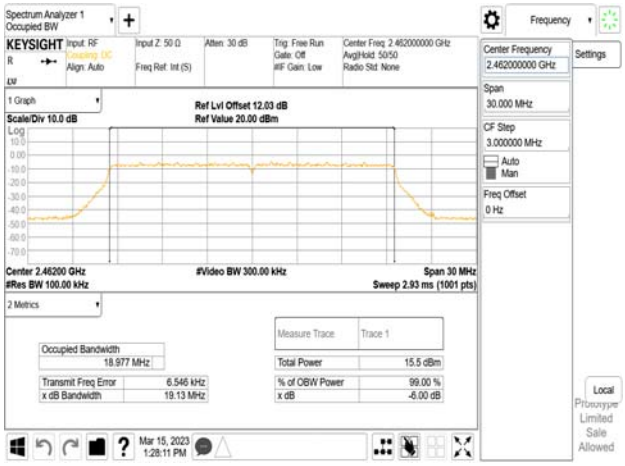
802.11ax_20MHz_Chain0_2437MHz



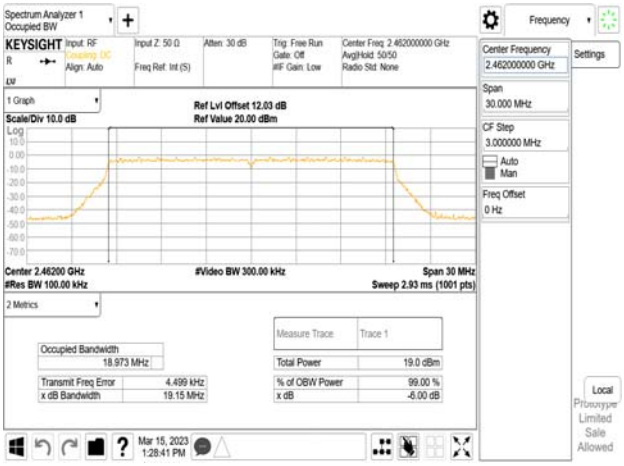
802.11ax_20MHz_Chain1_2437MHz



802.11ax_20MHz_Chain0_2462MHz



802.11ax_20MHz_Chain1_2462MHz



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9.5 99% Bandwidth

SISO

802.11b Ch0

Freq. (MHz)	99% BW (MHz)
2412	12.104
2437	12.94
2462	12.078

802.11g Ch0

Freq. (MHz)	99% BW (MHz)
2412	17
2437	17.024
2462	17.003

802.11n_HT20M Ch0

Freq. (MHz)	99% BW (MHz)
2412	18.079
2437	18.102
2462	18.083

802.11ax_HE20M Ch0

Freq. (MHz)	RU Config	99% BW (MHz)
2412	full	19.15
2437	full	19.152
2462	full	19.155

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MIMO

802.11g Ch0 802.11g Ch1

Freq. (MHz)	99% BW (MHz)	Freq. (MHz)	99% BW (MHz)
2412	17.004	2412	16.79
2437	17.205	2437	16.774
2462	17.012	2462	16.774

802.11n_HT20M Ch0 802.11n_HT20M Ch1

Freq. (MHz)	99% BW (MHz)	Freq. (MHz)	99% BW (MHz)
2412	18.074	2412	17.881
2437	18.183	2437	17.864
2462	18.094	2462	17.874

802.11ax_HE20M Ch0 802.11ax_HE20M Ch1

Freq. (MHz)	RU Config	99% BW (MHz)	Freq. (MHz)	RU Config	99% BW (MHz)
2412	full	19.154	2412	full	19.119
2437	full	19.167	2437	full	19.088
2462	full	19.13	2462	full	19.119

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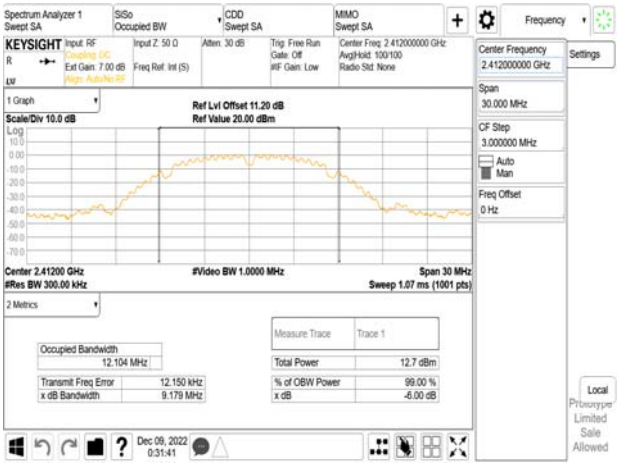
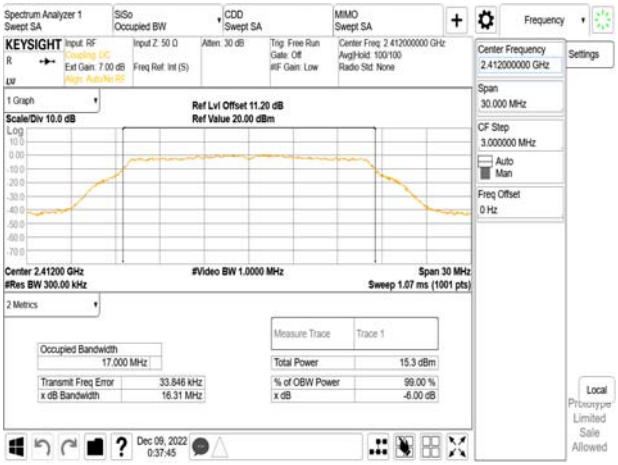
SISO

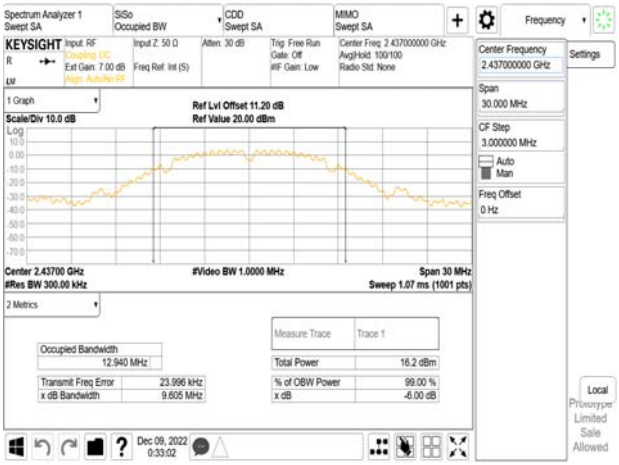
802.11b_20MHz_Chain0_2412MHz



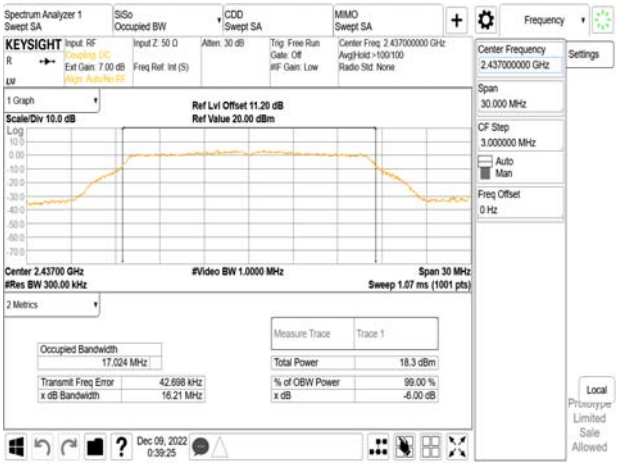
802.11g_20MHz_Chain0_2412MHz



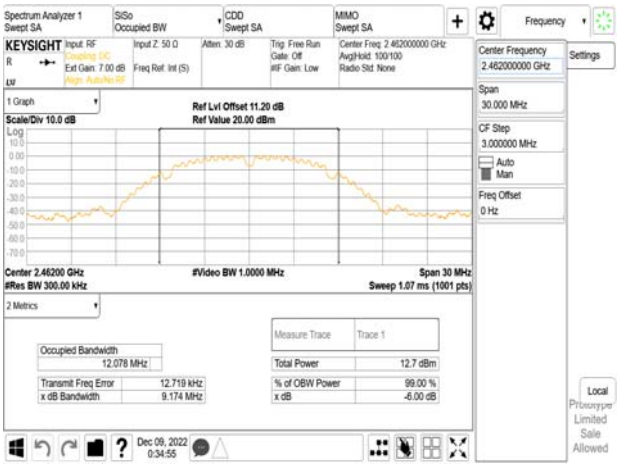
802.11b_20MHz_Chain0_2437MHz



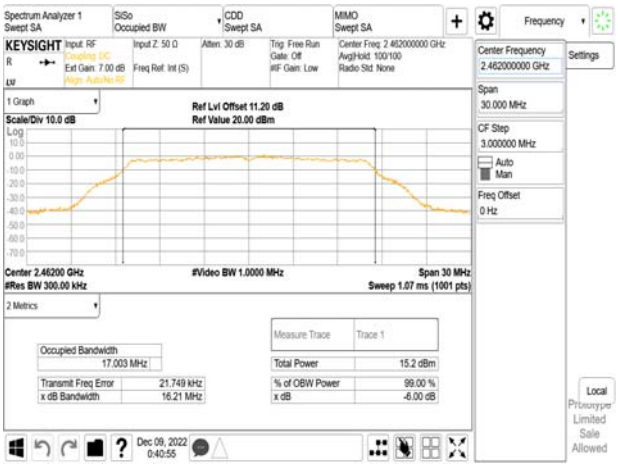
802.11g_20MHz_Chain0_2437MHz



802.11b_20MHz_Chain0_2462MHz



802.11g_20MHz_Chain0_2462MHz



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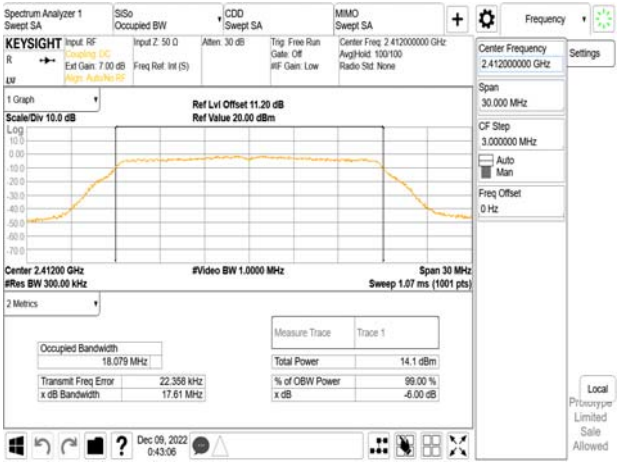
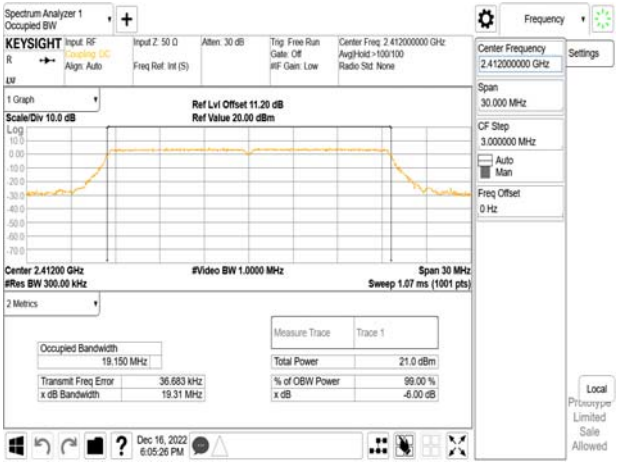
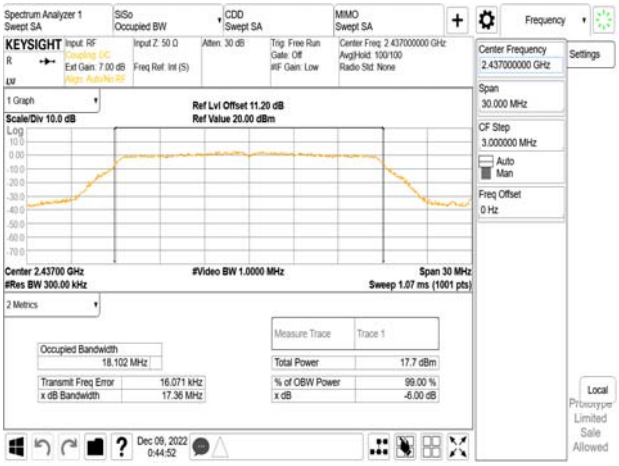
802.11n_20MHz_Chain0_2412MHz



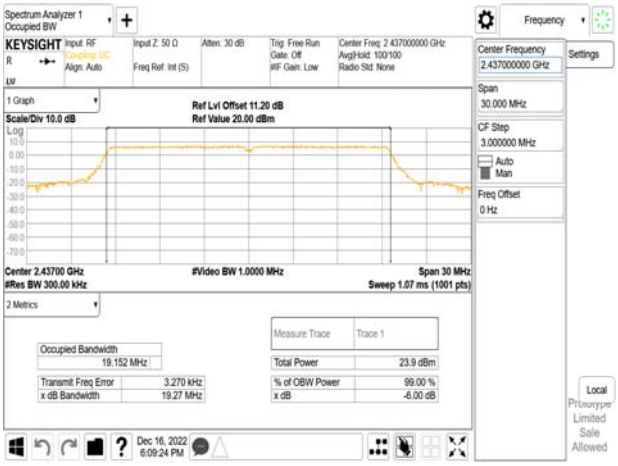
802.11ax_20MHz_Chain0_2412MHz



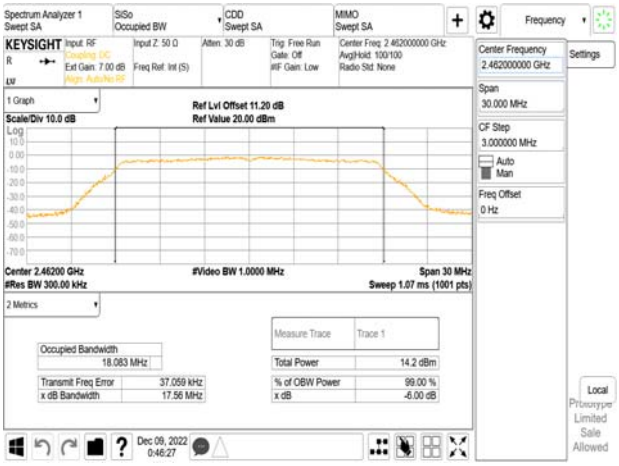
802.11n_20MHz_Chain0_2437MHz



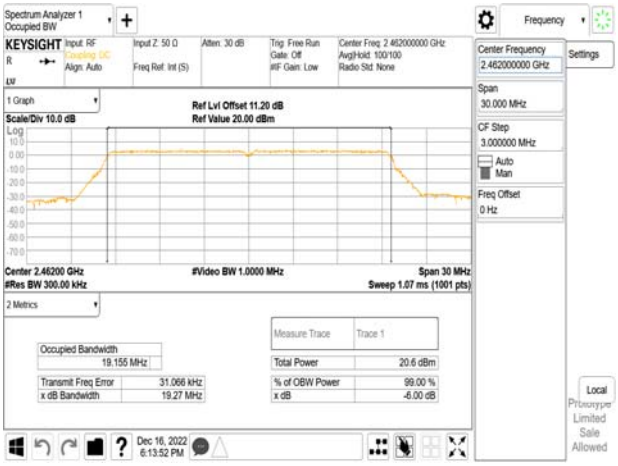
802.11ax_20MHz_Chain0_2437MHz



802.11n_20MHz_Chain0_2462MHz



802.11ax_20MHz_Chain0_2462MHz



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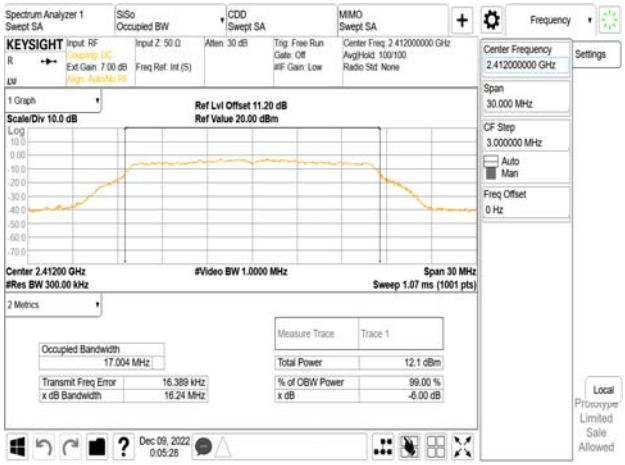
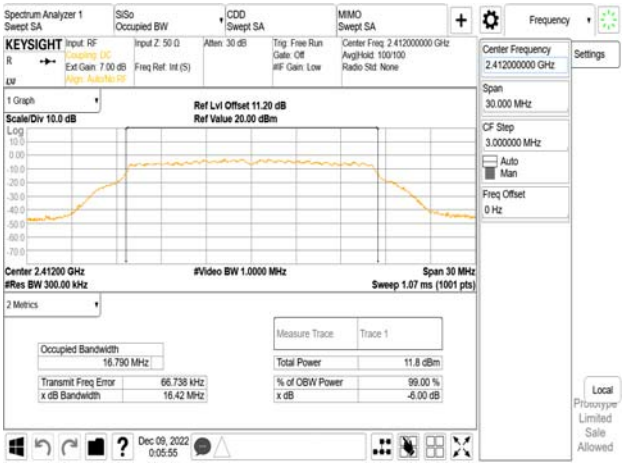
MIMO

802.11g_20MHz_Chain0_2412MHz



802.11g_20MHz_Chain1_2412MHz



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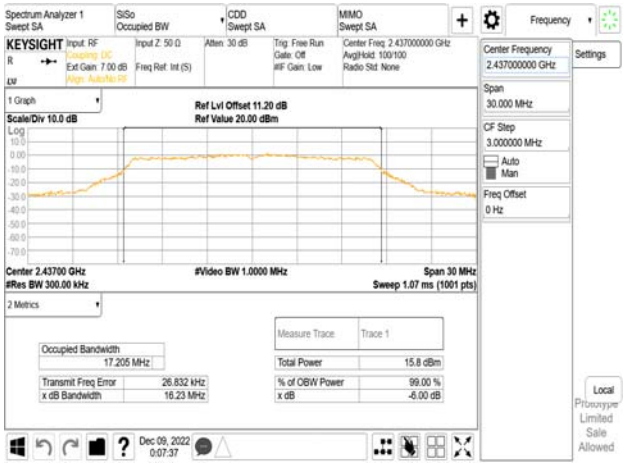
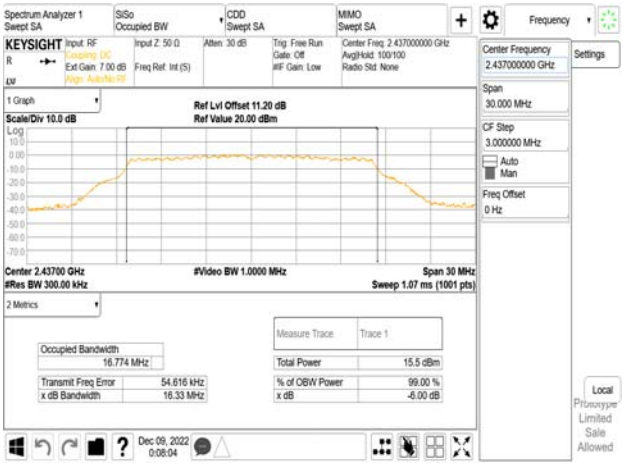
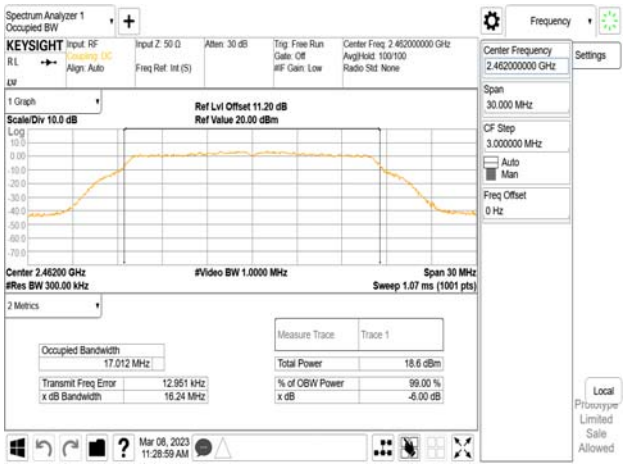


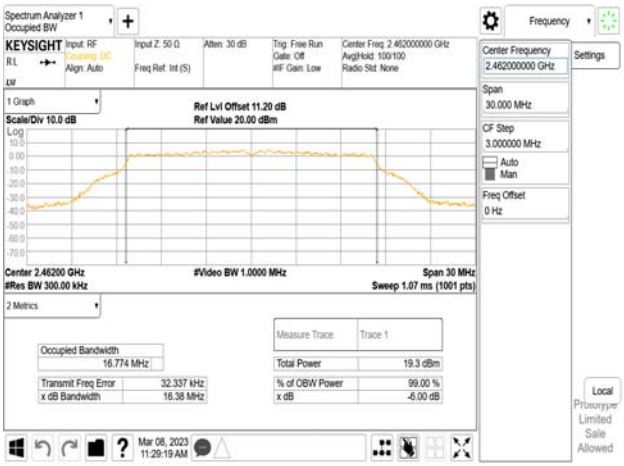
802.11g_20MHz_Chain1_2437MHz



802.11g_20MHz_Chain0_2462MHz



802.11g_20MHz_Chain1_2462MHz



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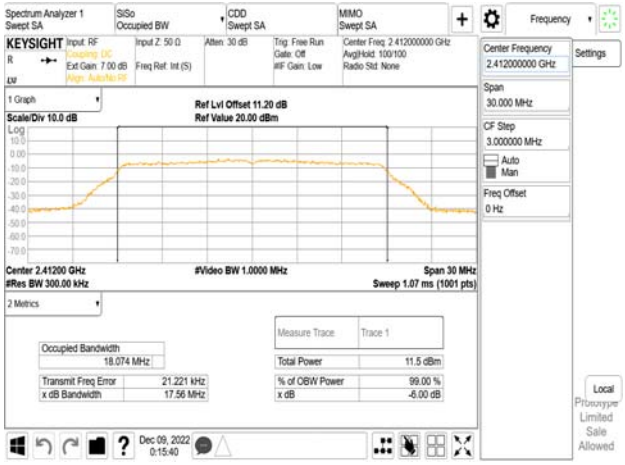
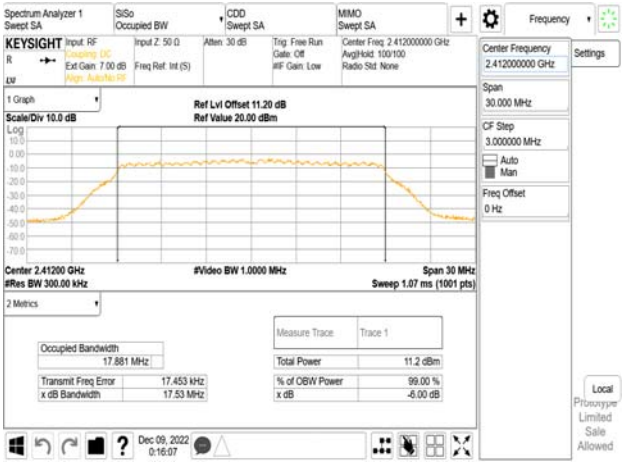
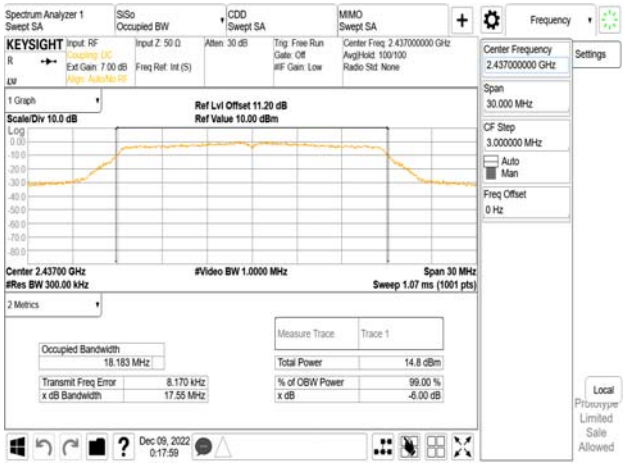
802.11n_20MHz_Chain0_2412MHz



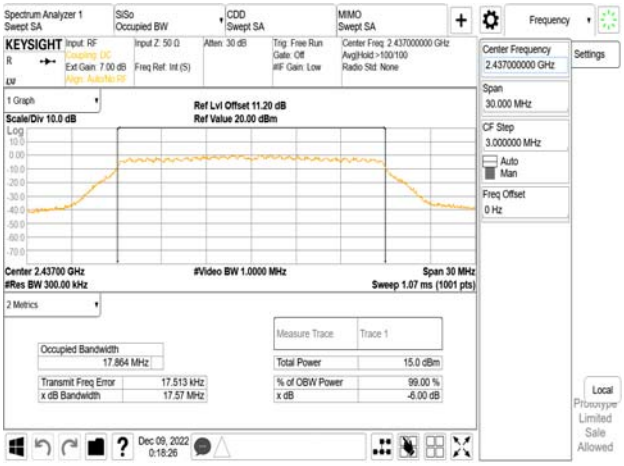
802.11n_20MHz_Chain1_2412MHz



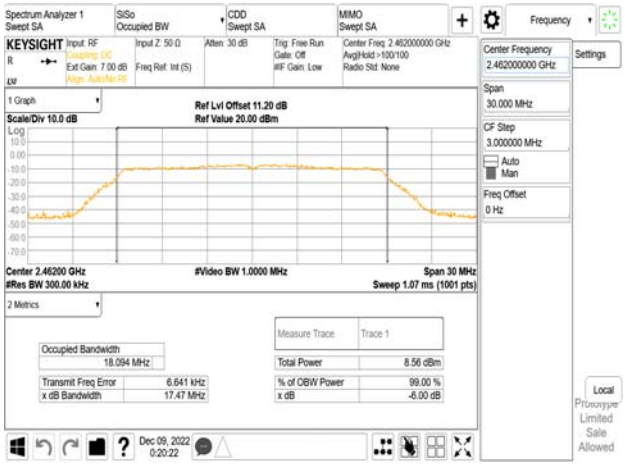
802.11n_20MHz_Chain0_2437MHz



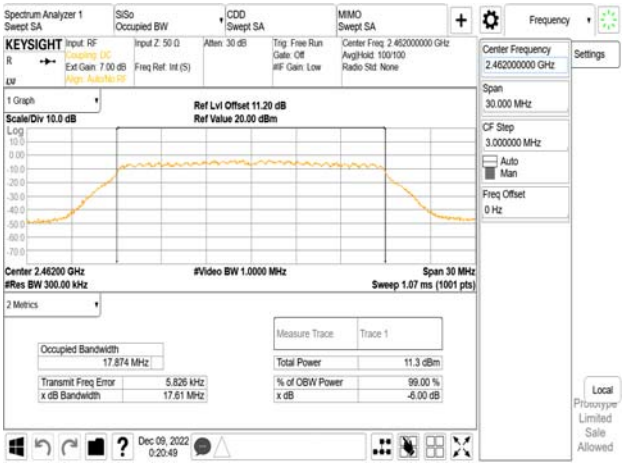
802.11n_20MHz_Chain1_2437MHz



802.11n_20MHz_Chain0_2462MHz



802.11n_20MHz_Chain1_2462MHz



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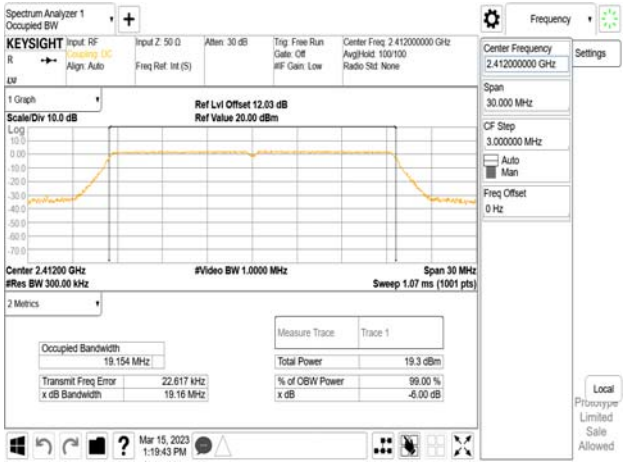
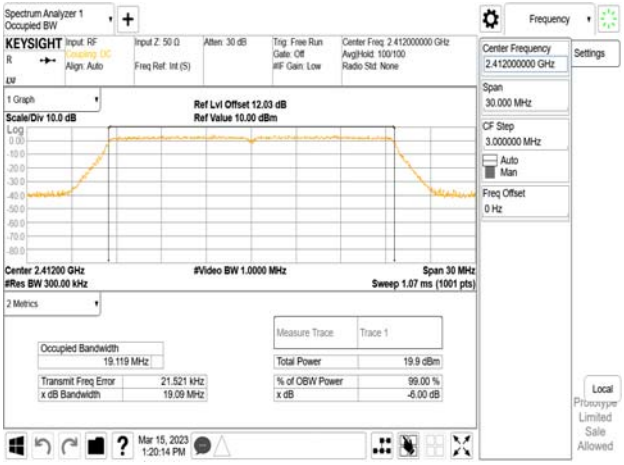
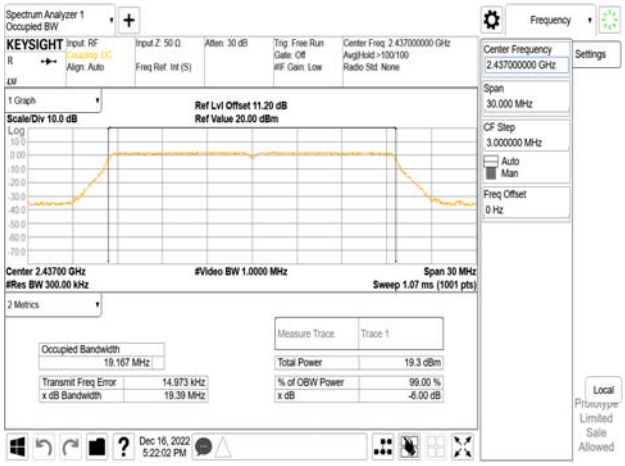
802.11ax_20MHz_Chain0_2412MHz



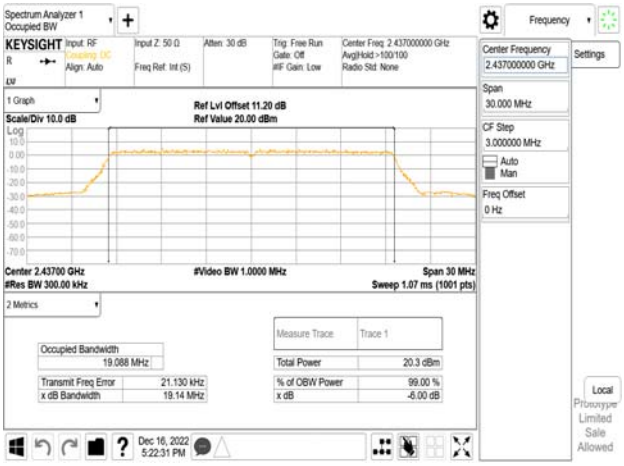
802.11ax_20MHz_Chain1_2412MHz



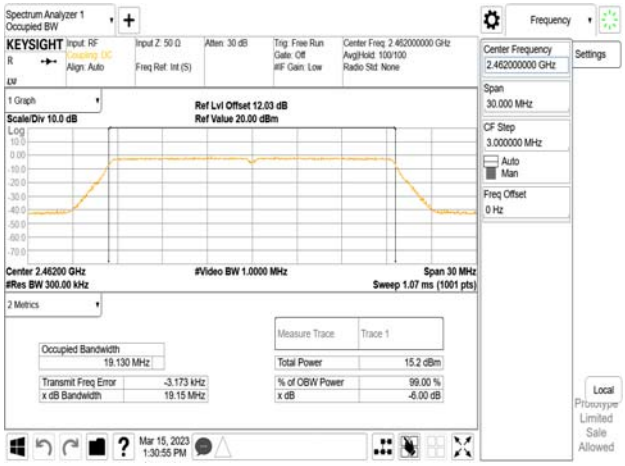
802.11ax_20MHz_Chain0_2437MHz



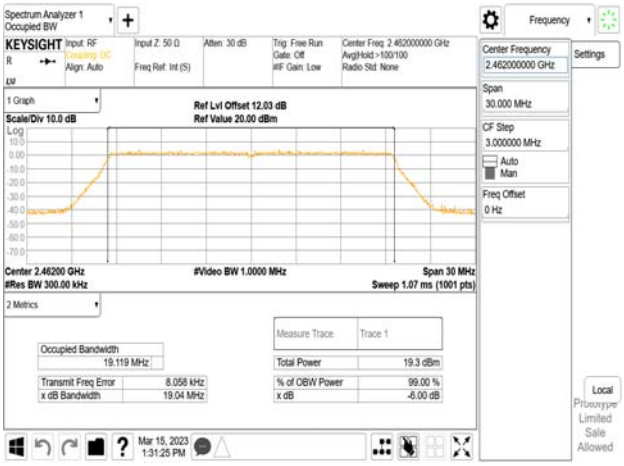
802.11ax_20MHz_Chain1_2437MHz



802.11ax_20MHz_Chain0_2462MHz



802.11ax_20MHz_Chain1_2462MHz



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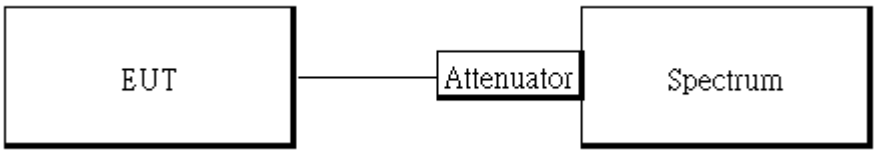
10 CONDUCTED BAND EDGES AND SPURIOUS EMISSION MEASUREMENT

10.1 Standard Applicable

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.
In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a) & RSS-Gen §8.10, must also comply with the radiated emission limits specified in §15.209(a) & RSS-Gen §8.9.

10.2 Test Setup



10.3 Measurement Procedure

10.3.1 Reference Level of Emission Limit:

1. Set analyzer center frequency to DTS channel center frequency.
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance .
3. Set the span to 1.5 times the DTS channel bandwidth.
4. Set the RBW = 100kHz & VBW = 300 kHz.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level.
10. MIMO mode: offset is set following “measure and add 10 Log (N)” on spectrum to measure for MIMO mode. Offset = cable loss + 10 log (N), where N is number of transmitting antenna.

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10.3.2 Conducted Band Edge:

1. To connect Antenna Port of EUT to Spectrum.
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance .
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
4. Set start to edge frequency, and stop frequency of spectrum analyzer so as to encompass the spectrum to be examined.
5. Set the spectrum analyzer as RBW=100 kHz, VBW=300 kHz, Detector = Peak, Sweep = auto
6. Mark the highest reading of the emission as the reference level measurement.
7. Set DL as the limit = reading on marker of reference level measurement – 20dBm
8. Mark the highest readings of the emissions outside of 2400MHz~2483.5MHz.
9. Repeat above procedures until all default test channel (low, middle, and high) was complete.
10. MIMO mode: offset is set following “measure and add 10 Log (N)” on spectrum to measure for MIMO mode. Offset = cable loss + 10 log (N), where N is number of transmitting antenna.

10.3.3 Conducted Spurious Emission:

1. To connect Antenna Port of EUT to Spectrum
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance .
3. Set RBW = 100 kHz & VBW= 300 kHz, Detector =Peak, Sweep = Auto.
4. Allow trace to fully stabilize.
5. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.
6. Repeat above procedures until all default test channel measured were complete.
7. MIMO mode: offset is set following “measure and add 10 Log (N)” on spectrum to measure for MIMO mode. Offset = cable loss + 10 log (N), where N is number of transmitting antenna.

Note:

For test of MIMO mode, the highest emission of worst case employing Measure and add 10 log (N) technical is reported on this report after the comparison between Main Antenna at single transmitting mode and Aux that yields the higher value. The MIMO transmitting mode produces higher value of outcome.

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10.4 Measurement Result

SISO

802.11b Ch0

Reference Level of Limit		
Freq. (MHz)	PSD (dBm)	Reference Level of Limit (dBm)
2412	7.59	-12.41
2437	11.13	-8.87
2462	7.44	-12.56

802.11g Ch0

Reference Level of Limit 802.11g mode		
Freq. (MHz)	PSD (dBm)	Reference Level of Limit (dBm)
2412	4.33	-15.67
2437	7.43	-12.57
2462	4.26	-15.74

802.11n_HT_20M Ch0

Reference Level of Limit 802.11n20 MODE		
Freq. (MHz)	PSD (dBm)	Reference Level of Limit (dBm)
2412	3.31	-16.69
2437	6.71	-13.29
2462	3.25	-16.75

802.11ax_HE_20M Ch0

Reference Level of Limit 802.11ax20 mode		
Freq. (MHz)	PSD (dBm)	Reference Level of Limit (dBm)
2412	7.37	-12.63
2437	3.88	-16.12
2462	7.23	-12.77

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MIMO

802.11g Ch0

Reference Level of Limit 802.11g mode		
Freq. (MHz)	PSD (dBm)	Reference Level of Limit (dBm)
2412	1.52	-18.48
2437	4.54	-15.46
2462	1.87	-18.13

802.11g Ch1

Reference Level of Limit 802.11g mode		
Freq. (MHz)	PSD (dBm)	Reference Level of Limit (dBm)
2412	1.59	-18.41
2437	4.43	-15.57
2462	1.57	-18.43

802.11n_HT_20M Ch0

Reference Level of Limit 802.11n20 MODE		
Freq. (MHz)	PSD (dBm)	Reference Level of Limit (dBm)
2412	1.34	-18.66
2437	3.66	-16.34
2462	-0.16	-20.16

802.11n_HT_20M Ch1

Reference Level of Limit 802.11ac20 MODE		
Freq. (MHz)	PSD (dBm)	Reference Level of Limit (dBm)
2412	1.10	-18.90
2437	3.58	-16.42
2462	0.21	-19.79

802.11ax_HE_20M Ch0

Reference Level of Limit 802.11ax20 mode		
Freq. (MHz)	PSD (dBm)	Reference Level of Limit (dBm)
2412	7.73	-12.27
2437	-0.60	-20.60
2462	1.31	-18.69

802.11ax_HE_20M Ch1

Reference Level of Limit 802.11ax20 mode		
Freq. (MHz)	PSD (dBm)	Reference Level of Limit (dBm)
2412	7.33	-12.67
2437	-0.01	-20.01
2462	2.08	-17.92

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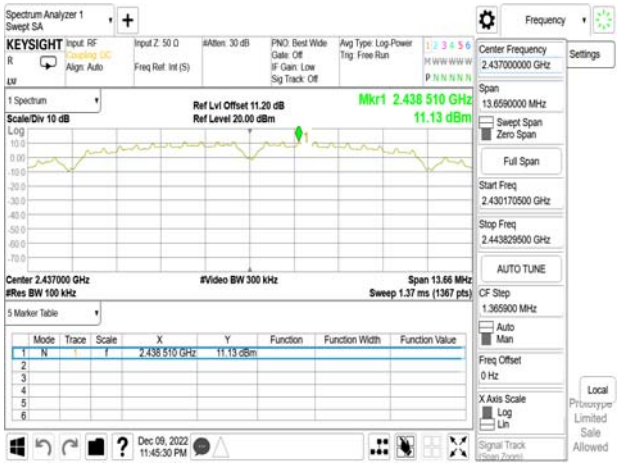
SISO

802.11b_20MHz_Chain0_2412MHz

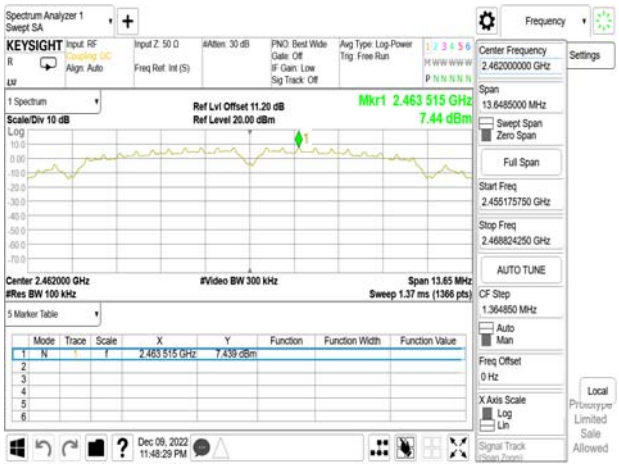
802.11g_20MHz_Chain0_2412MHz

802.11b_20MHz_Chain0_2437MHz



802.11g_20MHz_Chain0_2437MHz

802.11b_20MHz_Chain0_2462MHz



802.11g_20MHz_Chain0_2462MHz

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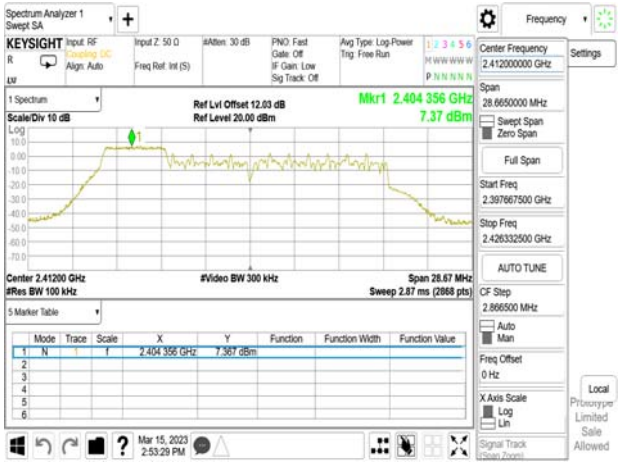
802.11n_20MHz_Chain0_2412MHz

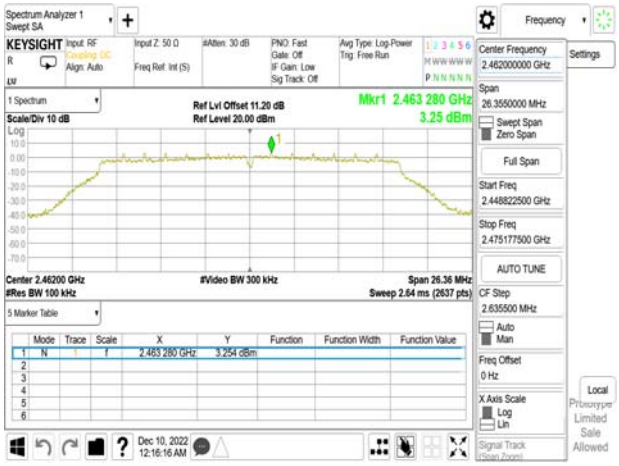
802.11ax_20MHz_Chain0_2412MHz



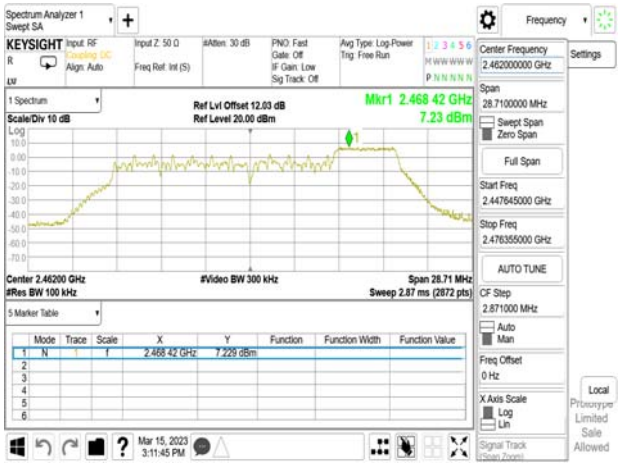
802.11n_20MHz_Chain0_2437MHz

802.11ax_20MHz_Chain0_2437MHz

802.11n_20MHz_Chain0_2462MHz



802.11ax_20MHz_Chain0_2462MHz



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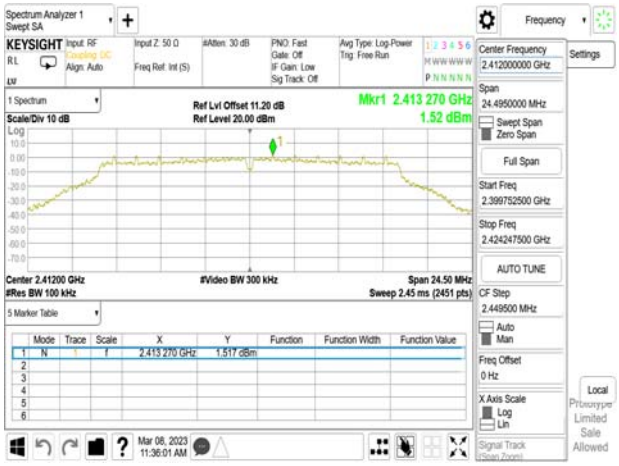
MIMO

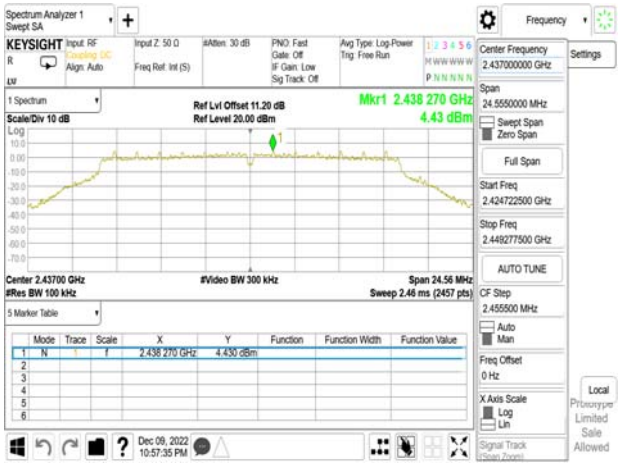
802.11g_20MHz_Chain0_2412MHz



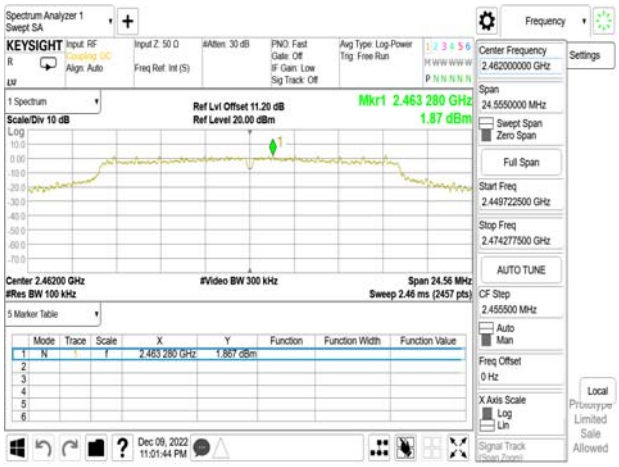
802.11g_20MHz_Chain1_2412MHz

802.11g_20MHz_Chain0_2437MHz

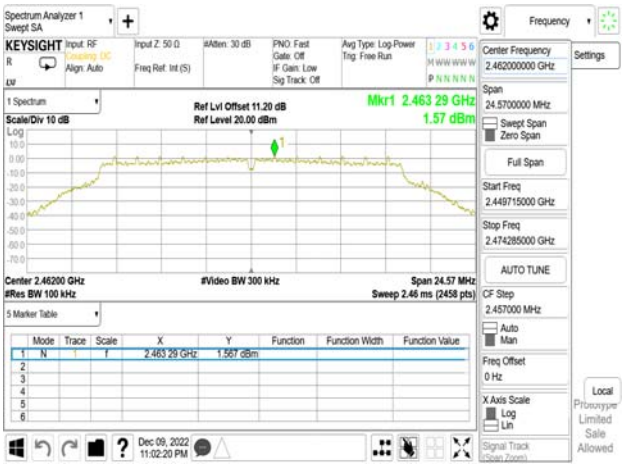
802.11g_20MHz_Chain1_2437MHz



802.11g_20MHz_Chain0_2462MHz



802.11g_20MHz_Chain1_2462MHz



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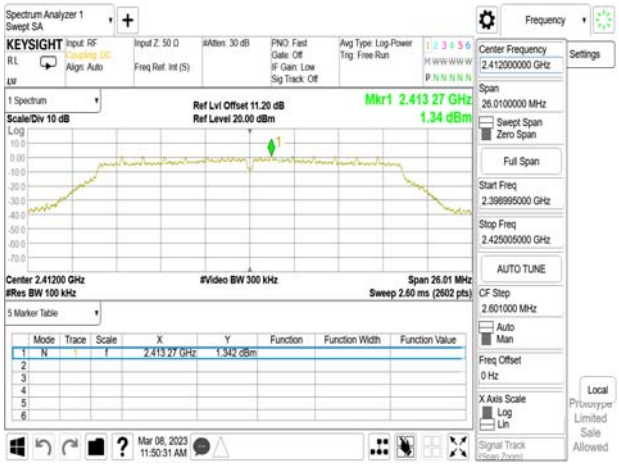
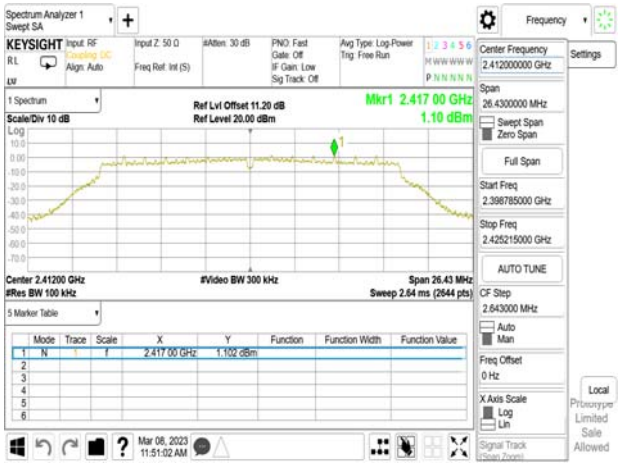
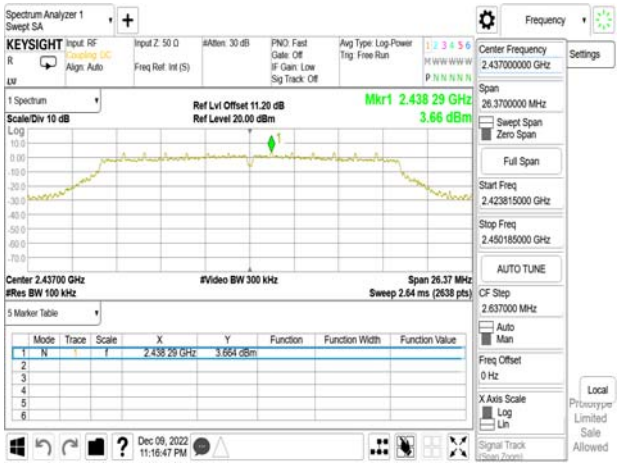
802.11n_20MHz_Chain0_2412MHz



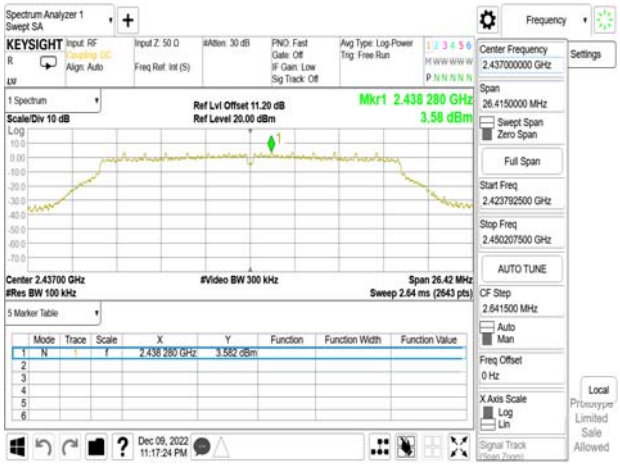
802.11n_20MHz_Chain1_2412MHz



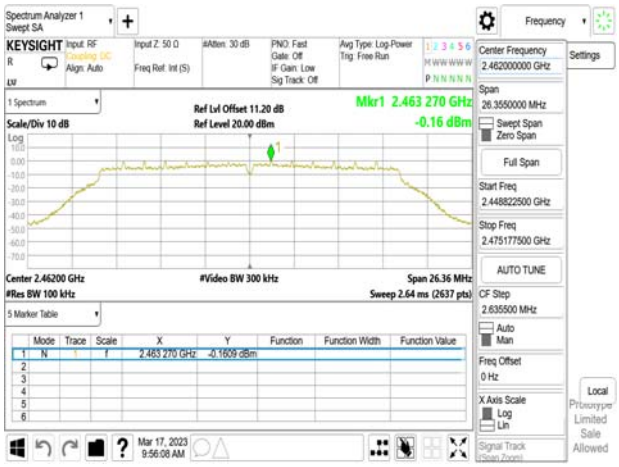
802.11n_20MHz_Chain0_2437MHz



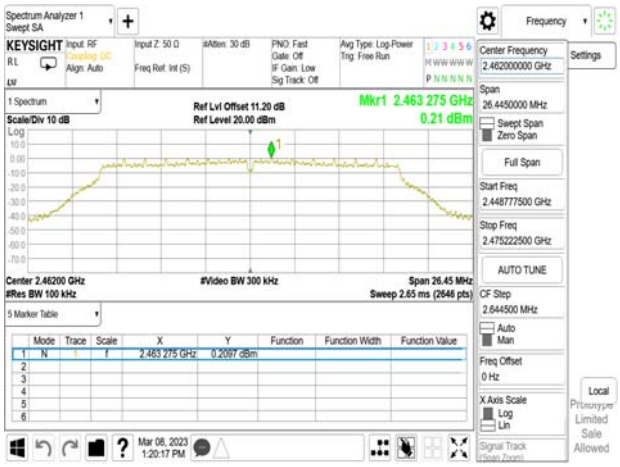
802.11n_20MHz_Chain1_2437MHz



802.11n_20MHz_Chain0_2462MHz



802.11n_20MHz_Chain1_2462MHz



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