



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: TERF2410002917E2

FCC ID VPYLBES0ZZ2LL

IC: 772C-LBES0ZZ2LL

Date of EUT Received: September 24, 2024

Date of Test: October 4, 2024 ~ November 19, 2024

Issue Date: December 18, 2024

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 §15.247, 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
TERF2410002917E2	00	Original	Dec. 6, 2024	Candice Li	
TERF2410002917E2	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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Table of Contents

1	GENERAL INFORMATION	4
2	SYSTEM TEST CONFIGURATION	8
3	SUMMARY OF TEST RESULTS	11
4	DESCRIPTION OF TEST MODES	12
5	MEASUREMENT UNCERTAINTY	15
6	MEASUREMENT EQUIPMENT USED	16
7	CONDUCTED EMISSION TEST	18
8	PEAK OUTPUT POWER MEASUREMENT	22
9	EMISSION BANDWIDTH MEASUREMENT	32
10	CONDUCTED BAND EDGES AND SPURIOUS EMISSION MEASUREMENT	39
11	RADIATED BANDEDGE AND SPURIOUS EMISSION MEASUREMENT	48
12	POWER SPECTRAL DENSITY	276
13	ANTENNA REQUIREMENT	284

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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, Radiated)
Power Supply:	3.3 Vdc, 1.8 Vdc
Test Software (Name/Version)	DUT Labtool Version 2.0.0.17

1.2 RF Specification

WLAN 2.4GHz

Wi-Fi	Frequency Range	Channels	Rated Power (dBm)		Modulation Technology
			Peak	Avg.	
802.11b	2412~2462	11	21.31	18.73	DSSS
802.11g	2412~2462	11	23.21	17.69	OFDM
802.11n_HT20	2412~2462	11	23.03	16.99	OFDM
802.11ac_VHT20	2412~2462	11	22.97	16.70	OFDM
802.11ax_HE20	2412~2462	11	24.04	16.76	OFDMA
Modulation type:	CCK, DQPSK, DBPSK for DSSS in 802.11b				
	64QAM, 16QAM, QPSK, BPSK for OFDM in 802.11g, 11n				
	256QAM, 64QAM, 16QAM, QPSK, BPSK for OFDM in 802.11ac				
	1024QAM, 256QAM, 64QAM, 16QAM, QPSK, BPSK for OFDMA in 802.11ax				
Data Rate:	802.11b: 1/2/5.5/11 Mbps				
	802.11g: 6/9/12/18/24/36/48/54 Mbps				
	802.11n_HT20: up to 72.2Mbps				
	802.11ac_VHT20: up to 86.7Mbps				
	802.11ax_HE20: up to 143.4Mbps				

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WLAN 2.4GHz for IC

Wi-Fi	Frequency Range	Channels	Rated Power (dBm)		Rated Power in dBm (EIRP)	Modulation Technology
			Peak	Avg.		
802.11b	2412~2462	11	21.31	18.73	22.46	DSSS
802.11g	2412~2462	11	23.21	17.69	21.42	OFDM
802.11n_HT20	2412~2462	11	23.03	16.99	20.72	OFDM
802.11ac_VHT20	2412~2462	11	22.97	16.70	20.43	OFDM
802.11ax_HE20	2412~2462	11	24.04	16.76	20.49	OFDMA
Modulation type:		CCK, DQPSK, DBPSK for DSSS in 802.11b				
		64QAM, 16QAM, QPSK, BPSK for OFDM in 802.11g,11n				
		256QAM, 64QAM, 16QAM, QPSK, BPSK for OFDM in 802.11ac				
		1024QAM, 256QAM, 64QAM, 16QAM, QPSK, BPSK for OFDMA in 802.11ax				
Data Rate:		802.11b: 1/2/5.5/11 Mbps				
		802.11g: 6/9/12/18/24/36/48/54 Mbps				
		802.11n_HT20:up to 72.2Mbps				
		802.11ac_VHT20:up to 86.7Mbps				
		802.11ax_HE20:up to 143.4Mbps				

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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	2412-2462	3.2
	Molex	145153	2412-2462	3.2
	Molex	219611	2412-2462	2.67
	Unictron	WT32D1-KX	2412-2462	3
	Unictron	AA258	2412-2462	0.9
	Taoglas	FXP830.07.0100C	2412-2462	2.5
	Antenova	SRF2W012	2412-2462	3
	Sansei	STDANTEMD-013	2412-2462	1.9
	Laird	EMF2471A3S	2412-2462	2.2
	Kyocera AVX (KAVX)	1001932FT	2412-2462	2.5
	Kyocera AVX (KAVX)	1001932PT	2412-2462	2.03
	Kyocera AVX (KAVX)	W3P35x8W04	2412-2462	2.3
	Inventek	W2.4-5P-U	2412-2462	3.73

Internal Antenna

Antenna Type	Supplier	Antenna Part No.	Freq. (MHz)	Peak Antenna Gain (dBi)
Monopole	Murata	Type2LL_Antenna	2412-2462	3.6

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 Test Methodology of Applied Standards

FCC Part 15, Subpart C §15.247

FCC KDB 558074 D01 15.247 Meas Guidance v05r02

RSS-247 issue 3 Aug. 2023

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

ANSI C63.10:2013

1.5 Test Facility

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

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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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

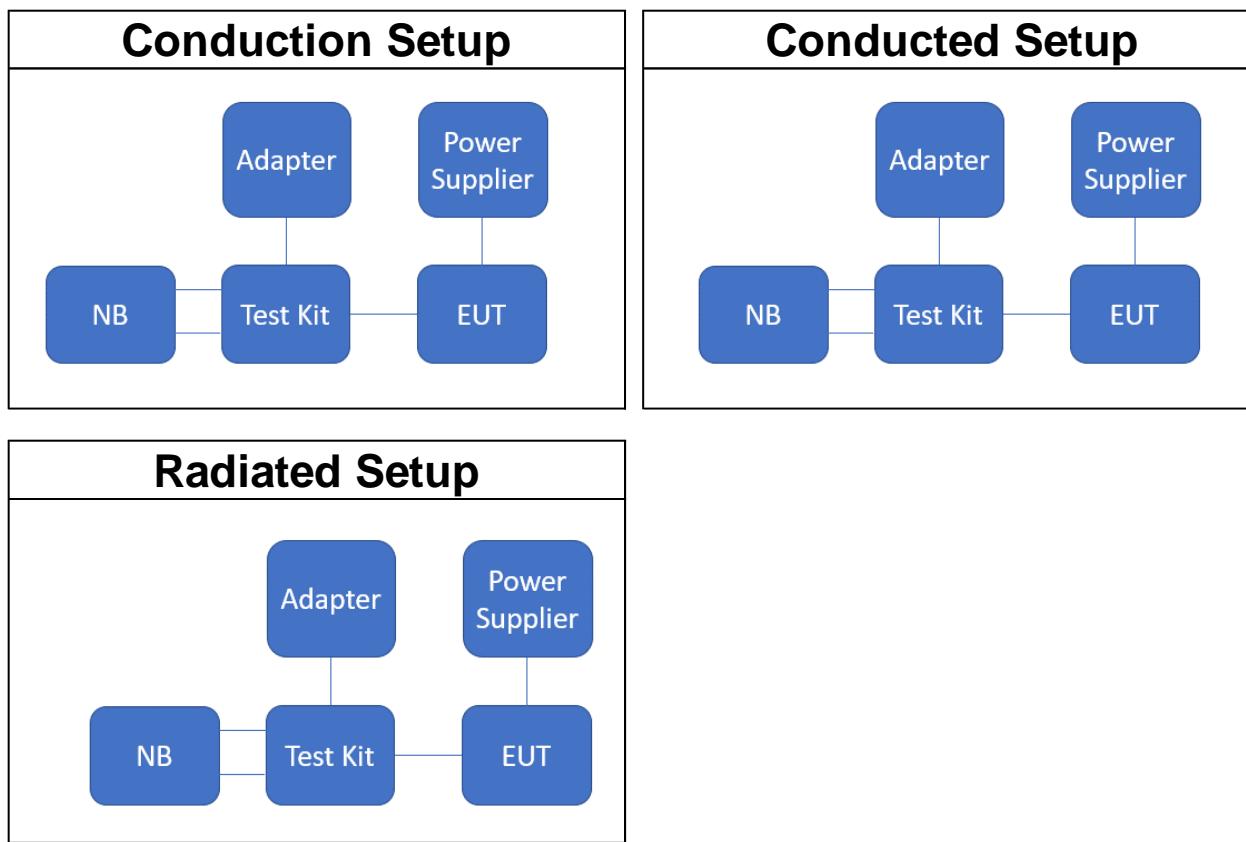
Radiated emission below 30MHz is measured in a 9m*6m*6m semi-anechoic chamber, the measurements correspond to those obtained at an open-field test site.

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

Radiated Emission Test Site: SAC G					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
LAN Cable	AMP	AMP-6e	4719862256612	N/A	N/A
USB cable	ZHUANG SHAN	2725	N/A	N/A	N/A
USB cable	ANKER	N/A	N/A	N/A	N/A
Adapter	ANKER	A2664	N/A	N/A	N/A
Notebook	Lenovo	T470	P0001293	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
§15.209 §15.247(d)	RSS-247 §5.5	Conducted Band Edge and Spurious Emission	Compliant
§15.209 §15.247(d)	RSS-247 §5.5	Radiated Band Edge and Spurious Emission	Compliant
§15.205	RSS-Gen § 8.10	Restricted Bands	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

2400~2483.5 MHz

20MHz	
CH	Freq. (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		Multi Transmission Spatial		
V	802.11 b	V	Ch0		Ch1		Ch2		Ch3	V	1TX	2TX
V	802.11 g	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	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT
802.11b	1 to 11	1,2,3,6,9,10,11	DSSS	1	ch0
802.11g	1 to 11	1,2,3,6,10,11	OFDM	6	ch0
802.11n_HT20	1 to 11	1,2,6,10,11	OFDM	MCS0	ch0

CONDUCTED TEST						
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	RU CONFIGURATION	DATA RATE (Mbps)	ANTENNA PORT
802.11ax_HE20	1 to 11	1,2,3,6,9,10,11	OFDMA	FULL RU 26/0,26/8 52/37,52/40 106/53,106/54	MCS0	ch0

TRANSMIT 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	

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TRANSMIT RADIATED EMISSION TEST (ABOVE 1 GHz)					
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT
802.11b	1 to 11	1,2,3,6,9,10,11	DSSS	1	ch0
802.11g	1 to 11	1,2,3,6,10,11	OFDM	6	ch0
802.11n_HT20	1 to 11	1,2,6,10,11	OFDM	MCS0	ch0

TRANSMIT RADIATED EMISSION TEST (ABOVE 1 GHz)						
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	RU CONFIGURATION	DATA RATE (Mbps)	ANTENNA PORT
802.11ax_HE20	1 to 11	1,2,3,6,9,10,11	OFDMA	FULL RU 26/0,26/8 52/37,52/40 106/53,106/54	MCS0	ch0

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	PASTERNACK	PE8210	RF155	11/15/2023	11/14/2024
DC Block	PASTERNACK	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 G					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
3m Site NSA	SGS	966 chamber G	N/A	03/30/2024	03/29/2025
Active Loop Antenna	COM-POWER	AL-130R	10160105	12/04/2023	12/03/2024
Broadband Antenna	SCHWARZBECK	VULB 9168	1208	07/17/2024	07/16/2025
Coaxial Cable	EMC Instruments	EMC104-SM-SM-8000-5000-5000	210219 、 210220 、 210221	03/13/2024	03/12/2025
Coaxial Cable	EMC Instruments	EMCCFD400-NM-NM-8000-5000-2000	210216 、 210217 、 210218	03/13/2024	03/12/2025
DC Power Supply	Agilent	E3640A	MY53140006	05/17/2024	05/16/2025
High Pass Filter	WI	WHKX10-2624-3200-18000-80SS	RF210	11/15/2023	11/14/2024
Horn Antenna	RF SPIN	DRH18-E	210105A18E	04/12/2024	04/11/2025
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	EMC118A45SE	980815	05/08/2024	05/07/2025
Pre-Amplifier	EMC Instruments	EMC18405SEE	980881	11/15/2023	11/14/2024
Pre-Amplifier	EMC Instruments	EMC330N	980781	03/13/2024	03/12/2025
Spectrum Analyzer	KEYSIGHT	N9010B	MY63440390	02/16/2024	02/15/2025
Test Software	audix	e3	E3 20923 SGS Ver.9 (C)	N.C.R	N.C.R

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

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7 CONDUCTED EMISSION TEST

7.1 Standard Applicable

Frequency range within 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

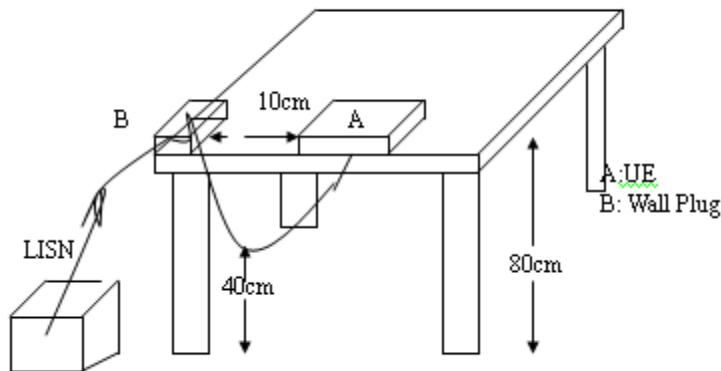
Note

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 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

Note: 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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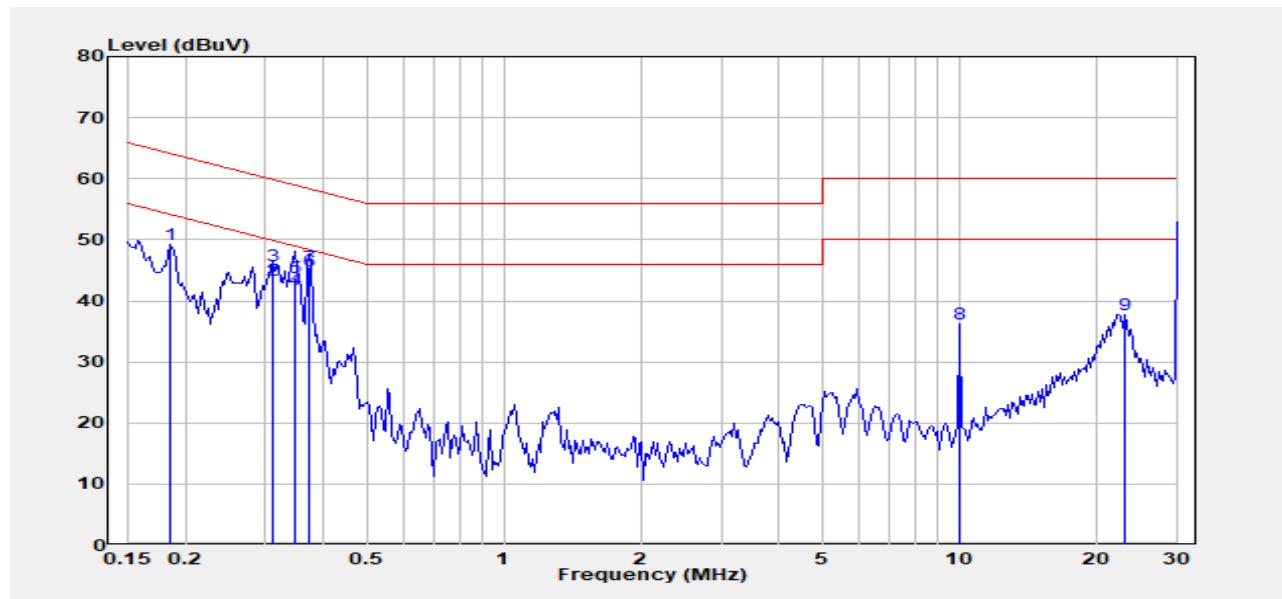
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AC POWER LINE CONDUCTED EMISSION TEST DATA

Report Number :TERF2410002917E2
 Test Mode :2.4G
 Power :120V/60Hz
 Probe :L1

Test Site :Conduction C
 Test Date :2024-10-18
 Temp./Humi :23.4°C/60%
 Engineer :Howard Huang



Freq. MHz	Detector Mode	Spectrum Reading Level dB μ V	Factor dB	Actual	Limit	Margin
				FS dB μ V	dB μ V	dB
0.185	Peak	38.49	10.65	49.14	64.24	-15.10
0.312	Average	32.70	10.63	43.33	49.93	-6.59
0.312	QP	35.20	10.63	45.83	59.93	-14.09
0.346	Average	31.20	10.63	41.83	49.05	-7.22
0.346	QP	33.10	10.63	43.73	59.05	-15.32
0.373	Average	34.20	10.62	44.82	48.43	-3.61
0.373	QP	35.00	10.62	45.62	58.43	-12.81
10.072	Peak	25.34	10.96	36.30	60.00	-23.70
23.018	Peak	26.48	11.23	37.71	60.00	-22.29

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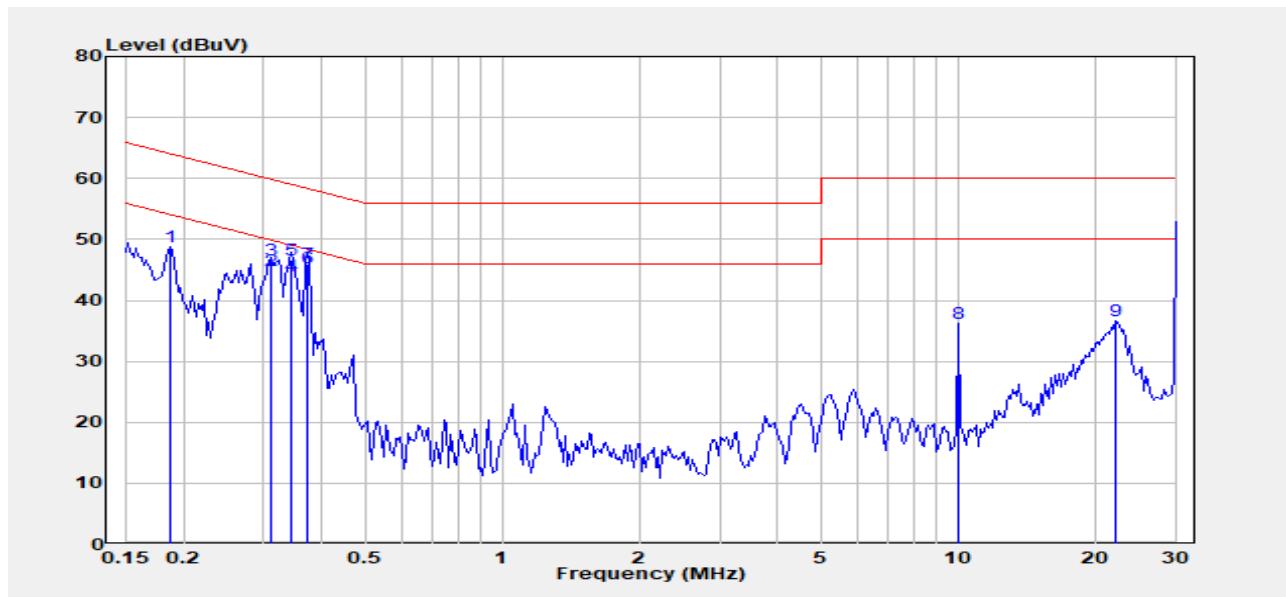
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Report Number :TERF2410002917E2
 Test Mode :2.4G
 Power :120V/60Hz
 Probe :N

Test Site :Conduction C
 Test Date :2024-10-18
 Temp./Humi :23.4°C/60%
 Engineer :Howard Huang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual	Limit dB μ V	Margin dB
				FS dB μ V		
0.187	Peak	38.08	10.65	48.73	64.15	-15.42
0.312	Average	34.20	10.63	44.83	49.93	-5.10
0.312	QP	36.00	10.63	46.63	59.93	-13.30
0.343	Average	33.40	10.62	44.02	49.13	-5.11
0.343	QP	36.10	10.62	46.72	59.13	-12.41
0.373	Average	34.80	10.62	45.42	48.43	-3.01
0.373	QP	35.40	10.62	46.02	58.43	-12.41
10.072	Peak	25.18	10.95	36.13	60.00	-23.87
22.298	Peak	25.35	11.22	36.57	60.00	-23.43

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8 PEAK OUTPUT POWER MEASUREMENT

8.1 Standard Applicable

8.1.1 Duty Cycle

Pre-analysis Check: While conducting average power measurement, duty cycle of each mode shall be checked to ensure its duty cycle in order to compensate for the loss due to insufficient ratio of duty cycle.

All duty cycle is pre-scanned, and result as obtained below shows only the most representative ones where duty cycle is conducted as the given transmission with given virtual operation that expresses the percentage.

8.1.2 FCC

For systems using digital modulation in the 2400-2483.5 MHz bands, the limit for peak output power is 1Watt.

If the transmitting antenna of directional gain greater than 6dBi are used the peak output power from 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.

8.1.3 ISED

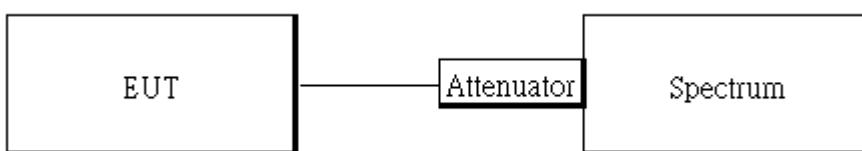
For systems using digital modulation in the 2400-2483.5 MHz bands, the limit for peak output power is 1Watt and the e.i.r.p. shall not exceed 4 W (ISED only).

Note:

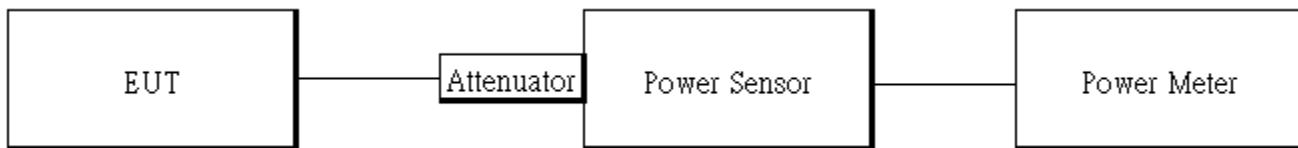
When the antenna gain is greater than 6 dBi, the power limit attenuated accordingly.

8.2 Test Setup

8.2.1 Duty Cycle



8.2.2 Output Power:



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8.3 Measurement Procedure

8.3.1 Duty Cycle:

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

8.3.2 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.

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

8.4 Measurement Result

8.4.1 Duty Cycle:

Mode	Duty Cycle (%) = Ton / (Ton+Toff)		Duty Factor (dB) =10*log (1/Duty Cycle)	1/T (kHz)	VBW setting (kHz)
802.11b	99.77		0.01	0.12	0.01
802.11g	99.38		0.03	0.70	0.01
802.11n_20	99.41		0.03	0.75	0.01
802.11ac_20	99.33		0.03	0.74	0.01
Mode	RU Config	Duty Cycle (%) = Ton / (Ton+Toff)	Duty Factor (dB) =10*log (1/Duty Cycle)	1/T (kHz)	VBW setting (kHz)
802.11ax_20	SU	99.15	0.04	0.96	0.01
	RU	95.49	0.20	0.74	1.00
	26 RU	99.34	0.03	0.74	0.01
	52 RU	95.50	0.20	0.74	1.00
	106 RU	95.50	0.20	0.74	1.00

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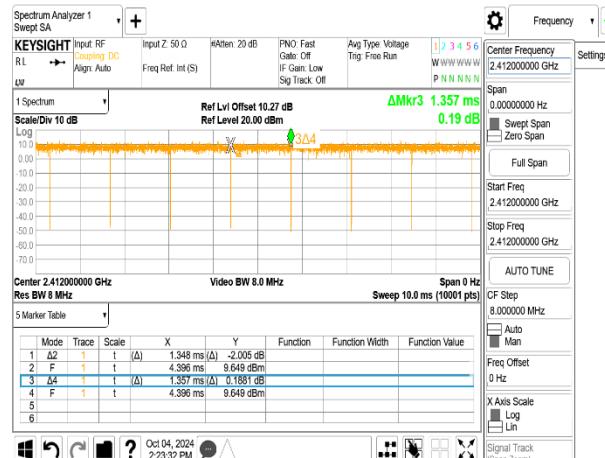


8.4.2 Duty Cycle test plots

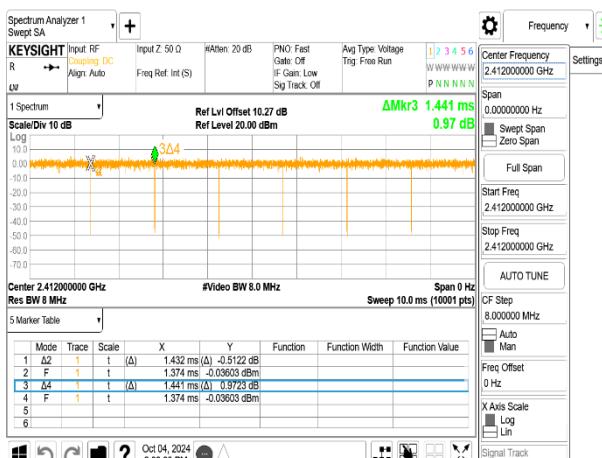
802.11b_20MHz_Chain0_2412MHz



802.11ac_20MHz_Chain0_2412MHz



802.11g_20MHz_Chain0_2412MHz



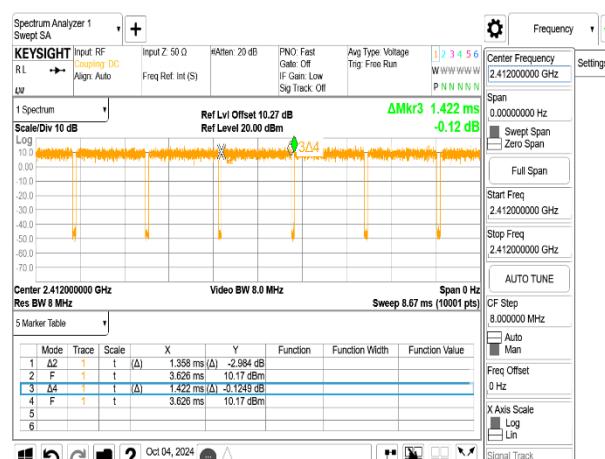
802.11ax_20MHz_Chain0_2412MHz_SU



802.11n_20MHz_Chain0_2412MHz



802.11ax_20MHz_Chain0_2412MHz_RU



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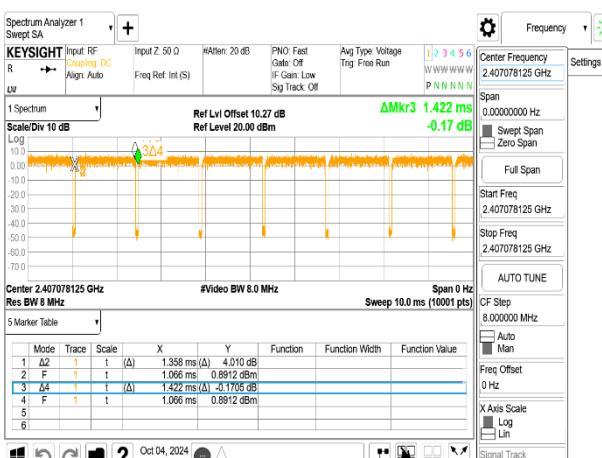
802.11ax_20MHz_Chain0_2412MHz_RU26_0



802.11ax_20MHz_Chain0_2412MHz_RU52_37



802.11ax_20MHz_Chain0_2412MHz_RU106_53



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8.4.3 Output Power

802.11b Ch0

CH	Freq. (MHz)	Data Rate	Power Setting	Peak Output Power (mW)	Peak Output Power (dBm)	Limit (dBm)	RESULT
1	2412	1	17.5	104.95	20.21	30.00	PASS
2	2417	1	18	117.22	20.69	30.00	PASS
3	2422	1	18.5	129.12	21.11	30.00	PASS
6	2437	1	18.5	135.21	21.31	30.00	PASS
9	2452	1	18.5	133.66	21.26	30.00	PASS
10	2457	1	17	84.53	19.27	30.00	PASS
11	2462	1	16.5	87.50	19.42	30.00	PASS

802.11b Ch0

CH	Freq. (MHz)	Data Rate	Power Setting	Avg. Output Power (mW)	Avg. Output Power (dBm)	Limit (dBm)	RESULT
1	2412	1	17.5	56.62	17.53	30.00	PASS
2	2417	1	18	62.37	17.95	30.00	PASS
3	2422	1	18.5	71.94	18.57	30.00	PASS
6	2437	1	18.5	74.64	18.73	30.00	PASS
9	2452	1	18.5	73.45	18.66	30.00	PASS
10	2457	1	17	47.53	16.77	30.00	PASS
11	2462	1	16.5	47.21	16.74	30.00	PASS

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802.11g Ch0

CH	Freq. (MHz)	Data Rate	Power Setting	Peak Output Power (mW)	Peak Output Power (dBm)	Limit (dBm)	RESULT
1	2412	6	14.5	76.03	18.81	30.00	PASS
2	2417	6	17	148.59	21.72	30.00	PASS
3	2422	6	18.5	205.12	23.12	30.00	PASS
6	2437	6	18.5	209.41	23.21	30.00	PASS
10	2457	6	18.5	208.45	23.19	30.00	PASS
11	2462	6	14.5	77.09	18.87	30.00	PASS

802.11g Ch0

CH	Freq. (MHz)	Data Rate	Power Setting	Avg. Output Power (mW)	Avg. Output Power (dBm)	Limit (dBm)	RESULT
1	2412	6	14.5	19.67	12.94	30.00	PASS
2	2417	6	17	39.60	15.98	30.00	PASS
3	2422	6	18.5	57.50	17.60	30.00	PASS
6	2437	6	18.5	58.71	17.69	30.00	PASS
10	2457	6	18.5	58.17	17.65	30.00	PASS
11	2462	6	14.5	19.94	13.00	30.00	PASS

802.11n_HT_20M Ch0

CH	Freq. (MHz)	Data Rate	Power Setting	Peak Output Power (mW)	Peak Output Power (dBm)	Limit (dBm)	RESULT
1	2412	MCS0	11	31.12	14.93	30.00	PASS
2	2417	MCS0	15.5	134.59	21.29	30.00	PASS
6	2437	MCS0	18	200.91	23.03	30.00	PASS
10	2457	MCS0	16.5	151.36	21.80	30.00	PASS
11	2462	MCS0	13	52.97	17.24	30.00	PASS

802.11n_HT_20M Ch0

CH	Freq. (MHz)	Data Rate	Power Setting	Avg. Output Power (mW)	Avg. Output Power (dBm)	Limit (dBm)	RESULT
1	2412	MCS0	11	9.74	9.89	30.00	PASS
2	2417	MCS0	15.5	30.24	14.81	30.00	PASS
6	2437	MCS0	18	49.95	16.99	30.00	PASS
10	2457	MCS0	16.5	37.89	15.79	30.00	PASS
11	2462	MCS0	13	14.37	11.58	30.00	PASS

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802.11ac_VHT_20M Ch0

CH	Freq. (MHz)	Data Rate	Power Setting	Peak Output Power (mW)	Peak Output Power (dBm)	Limit (dBm)	RESULT
1	2412	MCS0	11	30.55	14.85	30.00	PASS
2	2417	MCS0	15.5	133.05	21.24	30.00	PASS
6	2437	MCS0	18	198.15	22.97	30.00	PASS
10	2457	MCS0	16.5	149.62	21.75	30.00	PASS
11	2462	MCS0	13	52.12	17.17	30.00	PASS

802.11ac_VHT_20M Ch0

CH	Freq. (MHz)	Data Rate	Power Setting	Avg. Output Power (mW)	Avg. Output Power (dBm)	Limit (dBm)	RESULT
1	2412	MCS0	11	9.66	9.85	30.00	PASS
2	2417	MCS0	15.5	29.99	14.77	30.00	PASS
6	2437	MCS0	18	46.76	16.70	30.00	PASS
10	2457	MCS0	16.5	37.49	15.74	30.00	PASS
11	2462	MCS0	13	14.22	11.53	30.00	PASS

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802.11ax_HE_20M Ch0								
CH	Freq. (MHz)	Data Rate	RU Config	Power Setting	Peak Output Power (mW)	Peak Output Power (dBm)	Limit (dBm)	RESULT
1	2412	MCS0	SU	11.5	36.90	15.67	30.00	PASS
			RU	10.5	36.31	15.60	30.00	PASS
			26/0	10.5	35.32	15.48	30.00	PASS
			26/8	10.5	35.89	15.55	30.00	PASS
			52/37	10.5	33.34	15.23	30.00	PASS
			52/40	10.5	33.04	15.19	30.00	PASS
			106/53	10.5	32.58	15.13	30.00	PASS
			106/54	15.5	33.57	15.26	30.00	PASS
2	2417	MCS0	SU	15.5	136.46	21.35	30.00	PASS
			RU	15.5	134.59	21.29	30.00	PASS
3	2422	MCS0	SU	16.5	166.72	22.22	30.00	PASS
			RU	16.5	164.44	22.16	30.00	PASS
6	2437	MCS0	SU	17.5	253.51	24.04	30.00	PASS
			RU	17.5	228.03	23.58	30.00	PASS
9	2452	MCS0	SU	16.5	169.43	22.29	30.00	PASS
			RU	16.5	167.11	22.23	30.00	PASS
10	2457	MCS0	SU	16.5	153.11	21.85	30.00	PASS
			RU	16.5	150.31	21.77	30.00	PASS
11	2462	MCS0	SU	13	55.59	17.45	30.00	PASS
			RU	13	54.70	17.38	30.00	PASS
			26/0	13	53.46	17.28	30.00	PASS
			26/8	13	53.95	17.32	30.00	PASS
			52/37	13	52.60	17.21	30.00	PASS
			52/40	13	53.21	17.26	30.00	PASS
			106/53	13	54.33	17.35	30.00	PASS
			106/54	13	53.70	17.30	30.00	PASS
802.11ax_HE_20M Ch0								
CH	Freq. (MHz)	Data Rate	RU Config	Power Setting	Avg. Output Power (mW)	Avg. Output Power (dBm)	Limit (dBm)	RESULT
1	2412	MCS0	SU	11.5	9.88	9.95	30.00	PASS
			RU	10.5	9.77	9.90	30.00	PASS
			26/0	10.5	9.57	9.81	30.00	PASS
			26/8	10.5	9.68	9.86	30.00	PASS
			52/37	10.5	9.66	9.85	30.00	PASS
			52/40	10.5	9.55	9.80	30.00	PASS
			106/53	10.5	9.53	9.79	30.00	PASS
			106/54	10.5	9.62	9.83	30.00	PASS
2	2417	MCS0	SU	15.5	30.81	14.89	30.00	PASS
			RU	15.5	30.53	14.85	30.00	PASS
3	2422	MCS0	SU	16.5	39.24	15.94	30.00	PASS
			RU	16.5	38.88	15.90	30.00	PASS
6	2437	MCS0	SU	17.5	47.39	16.76	30.00	PASS
			RU	17.5	47.10	16.73	30.00	PASS
9	2452	MCS0	SU	16.5	38.79	15.89	30.00	PASS
			RU	16.5	38.17	15.82	30.00	PASS
10	2457	MCS0	SU	16.5	38.43	15.85	30.00	PASS
			RU	16.5	37.91	15.79	30.00	PASS
11	2462	MCS0	SU	13	14.99	11.76	30.00	PASS
			RU	13	14.86	11.72	30.00	PASS
			26/0	13	14.65	11.66	30.00	PASS
			26/8	13	14.78	11.70	30.00	PASS
			52/37	13	14.55	11.63	30.00	PASS
			52/40	13	14.62	11.65	30.00	PASS
			106/53	13	14.83	11.71	30.00	PASS
			106/54	13	14.69	11.67	30.00	PASS

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8.4.4 EIRP

802.11b Ch0

CH	Freq. (MHz)	Data Rate	Avg. Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	RESULT
1	2412	1	17.53	3.73	21.26	36	PASS
2	2417	1	17.95	3.73	21.68	36	PASS
3	2422	1	18.57	3.73	22.30	36	PASS
6	2437	1	18.73	3.73	22.46	36	PASS
9	2452	1	18.66	3.73	22.39	36	PASS
10	2457	1	16.77	3.73	20.50	36	PASS
11	2462	1	16.74	3.73	20.47	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	12.94	3.73	16.67	36	PASS
2	2417	6	15.98	3.73	19.71	36	PASS
3	2422	6	17.60	3.73	21.33	36	PASS
6	2437	6	17.69	3.73	21.42	36	PASS
10	2457	6	17.65	3.73	21.38	36	PASS
11	2462	6	13.00	3.73	16.73	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	9.89	3.73	13.62	36	PASS
2	2417	MCS0	14.81	3.73	18.54	36	PASS
6	2437	MCS0	16.99	3.73	20.72	36	PASS
10	2457	MCS0	15.79	3.73	19.52	36	PASS
11	2462	MCS0	11.58	3.73	15.31	36	PASS

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802.11ac_VHT_20M Ch0

CH	Freq. (MHz)	Data Rate	Avg. Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	RESULT
1	2412	MCS0	9.85	3.73	13.58	36	PASS
2	2417	MCS0	14.77	3.73	18.50	36	PASS
6	2437	MCS0	16.70	3.73	20.43	36	PASS
10	2457	MCS0	15.74	3.73	19.47	36	PASS
11	2462	MCS0	11.53	3.73	15.26	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	SU	9.95	3.73	13.68	36	PASS
			RU	9.90	3.73	13.63	36	PASS
			26/0	9.81	3.73	13.54	36	PASS
			26/8	9.86	3.73	13.59	36	PASS
			52/37	9.85	3.73	13.58	36	PASS
			52/40	9.80	3.73	13.53	36	PASS
			106/53	9.79	3.73	13.52	36	PASS
			106/54	9.83	3.73	13.56	36	PASS
2	2417	MCS0	SU	14.89	3.73	18.62	36	PASS
			RU	14.85	3.73	18.58	36	PASS
3	2422	MCS0	SU	15.94	3.73	19.67	36	PASS
			RU	15.90	3.73	19.63	36	PASS
6	2437	MCS0	SU	16.76	3.73	20.49	36	PASS
			RU	16.73	3.73	20.46	36	PASS
9	2452	MCS0	SU	15.89	3.73	19.62	36	PASS
			RU	15.82	3.73	19.55	36	PASS
10	2457	MCS0	SU	15.85	3.73	19.58	36	PASS
			RU	15.79	3.73	19.52	36	PASS
11	2462	MCS0	SU	11.76	3.73	15.49	36	PASS
			RU	11.72	3.73	15.45	36	PASS
			26/0	11.66	3.73	15.39	36	PASS
			26/8	11.70	3.73	15.43	36	PASS
			52/37	11.63	3.73	15.36	36	PASS
			52/40	11.65	3.73	15.38	36	PASS
			106/53	11.71	3.73	15.44	36	PASS
			106/54	11.67	3.73	15.40	36	PASS

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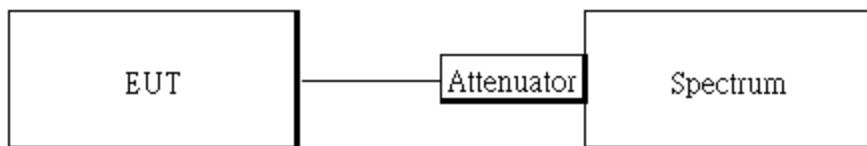
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9 EMISSION BANDWIDTH MEASUREMENT

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 6dB BW 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 99% BW 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%,
 VBW \geq 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%.
4. Repeat above procedures until all test default channel is completed.

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9.4 Measurement Result:

9.4.1 6dB BW measurements

802.11b Ch0

Freq. (MHz)	6dB BW (kHz)	Limit (kHz)	Result
2412	10110.00	≥ 500	PASS
2437	10110.00	≥ 500	PASS
2462	10100.00	≥ 500	PASS

802.11g Ch0

Freq. (MHz)	6dB BW (kHz)	Limit (kHz)	Result
2412	16420.00	≥ 500	PASS
2437	16440.00	≥ 500	PASS
2462	16430.00	≥ 500	PASS

802.11n_HT_20M Ch0

Freq. (MHz)	6dB BW (kHz)	Limit (kHz)	Result
2412	17610.00	≥ 500	PASS
2437	17610.00	≥ 500	PASS
2462	17610.00	≥ 500	PASS

802.11ax_HE_20M Ch0

Freq. (MHz)	RU Config	6dB BW (kHz)	Limit (kHz)	Result
2412	full	18500.00	≥ 500	PASS
2437	full	18420.00	≥ 500	PASS
2462	full	18430.00	≥ 500	PASS

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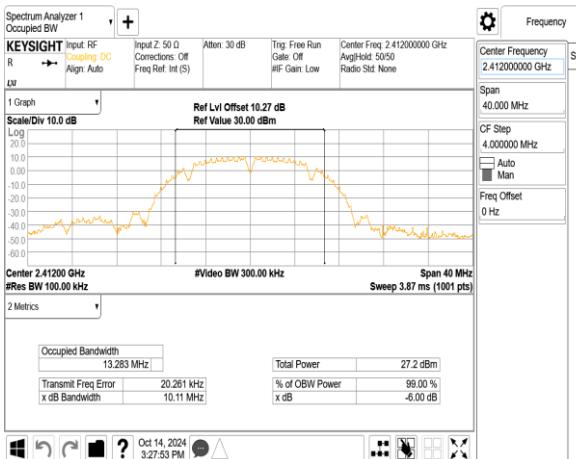
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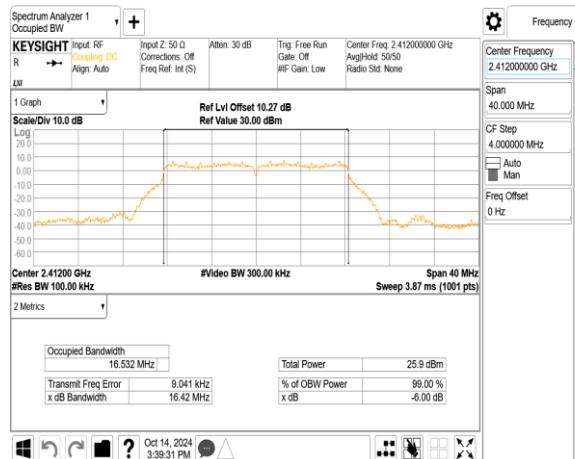
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802.11b_20MHz_Chain0_2412MHz



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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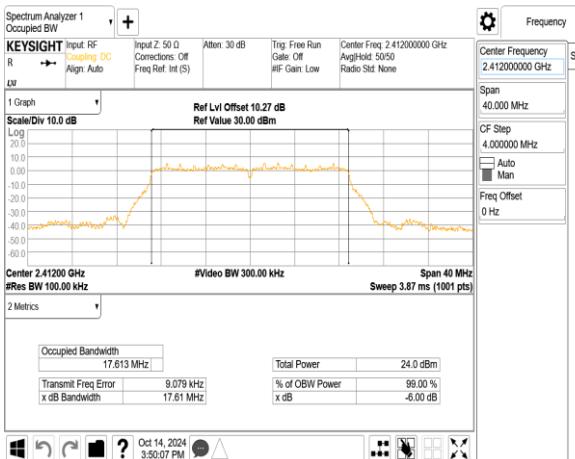
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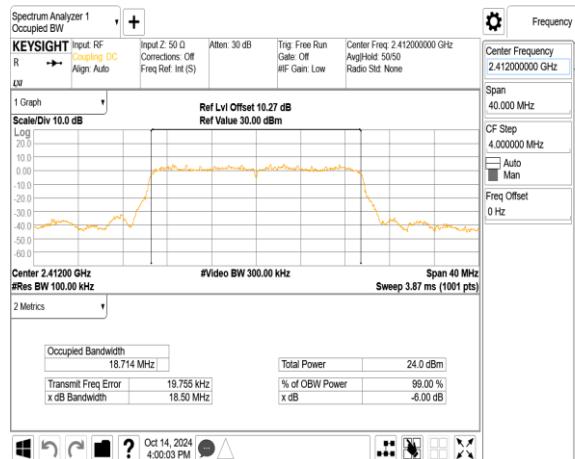
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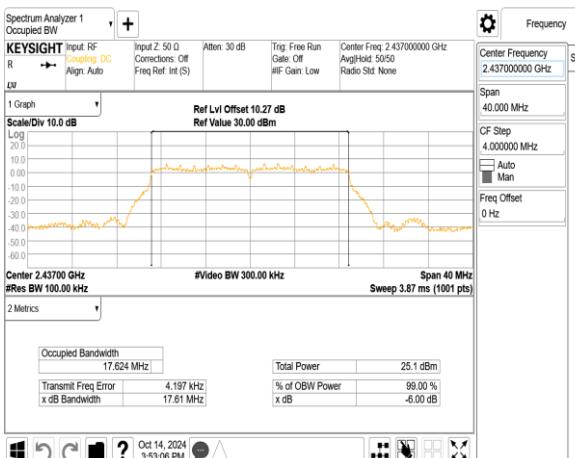
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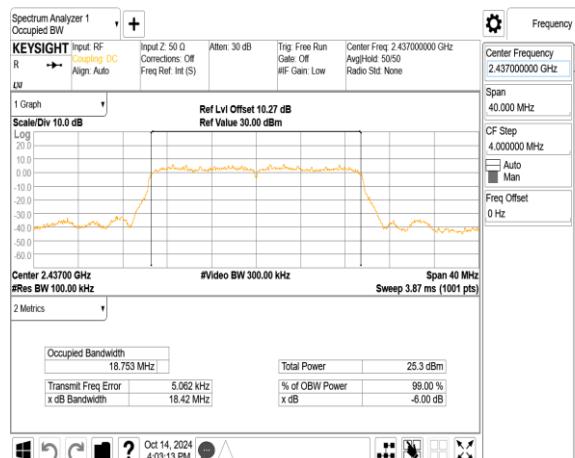
802.11ax_20MHz_Chain0_2412MHz



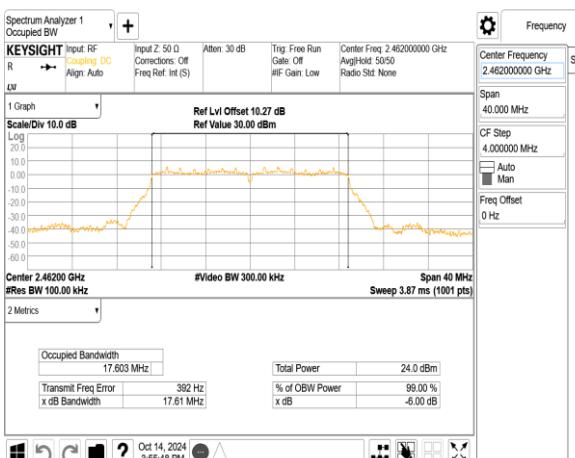
802.11n_20MHz_Chain0_2437MHz



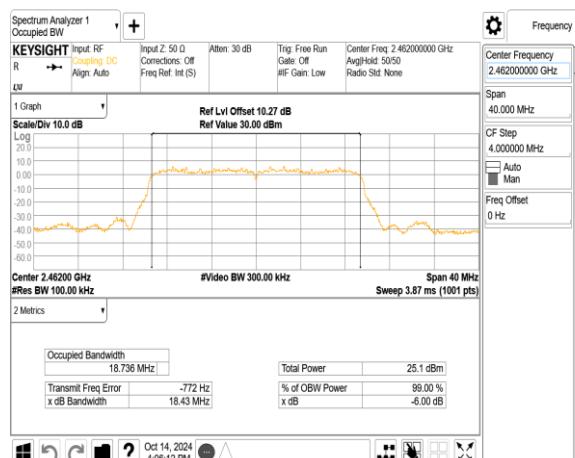
802.11ax_20MHz_Chain0_2437MHz



802.11n_20MHz_Chain0_2462MHz



802.11ax_20MHz_Chain0_2462MHz



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9.4.2 99% Bandwidth

802.11b Ch0

Freq. (MHz)	99% BW (MHz)
2412	13.34
2437	13.34
2462	13.323

802.11g Ch0

Freq. (MHz)	99% BW (MHz)
2412	16.821
2437	16.828
2462	16.86

802.11n_HT20M Ch0

Freq. (MHz)	99% BW (MHz)
2412	17.69
2437	17.696
2462	17.693

802.11ax_HE20M Ch0

Freq. (MHz)	RU Config	99% BW (MHz)
2412	full	18.788
2437	full	18.796
2462	full	18.791

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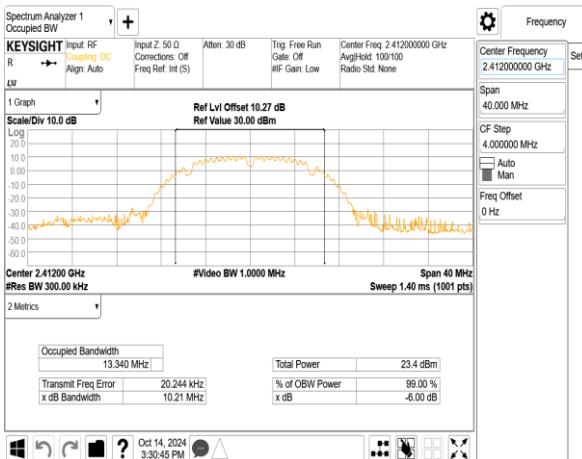
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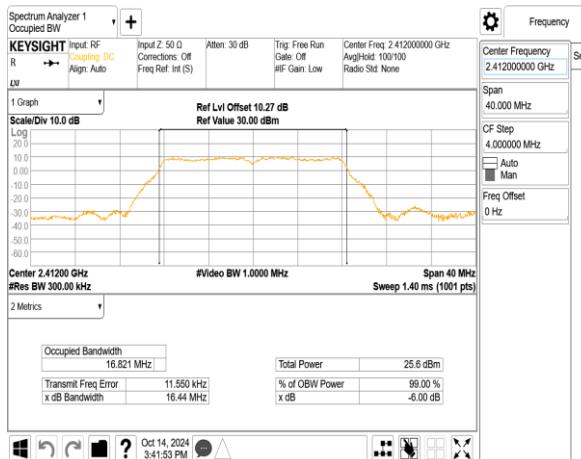
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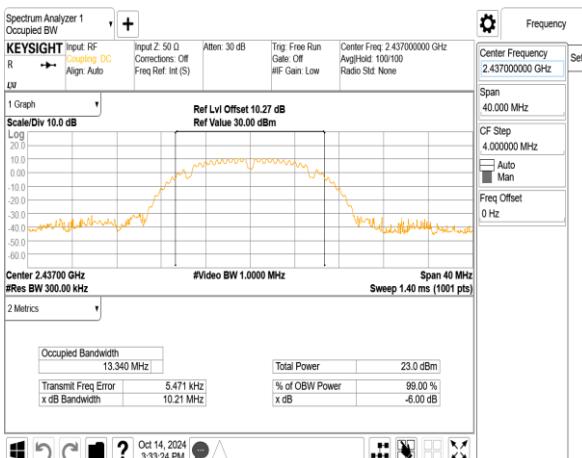
802.11b_20MHz_Chain0_2412MHz



802.11g_20MHz_Chain0_2412MHz



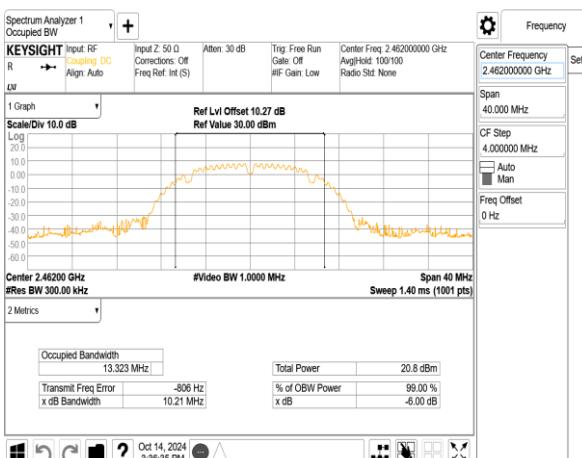
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802.11b_20MHz_Chain0_2462MHz



802.11g_20MHz_Chain0_2462MHz



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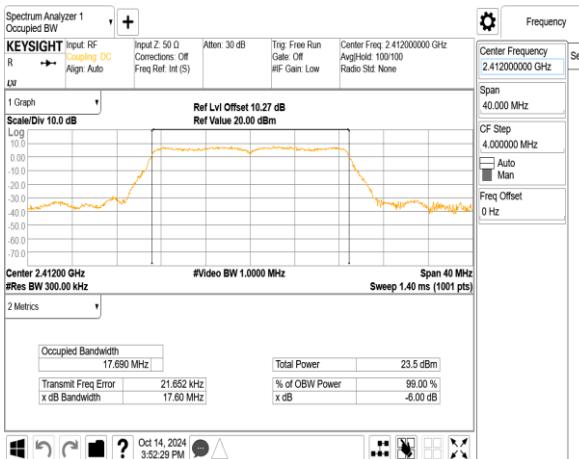
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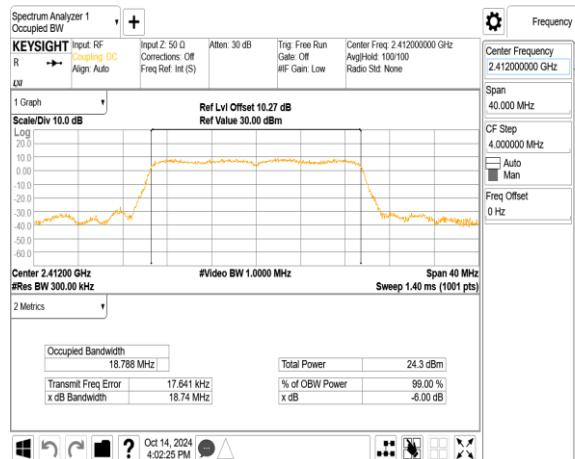
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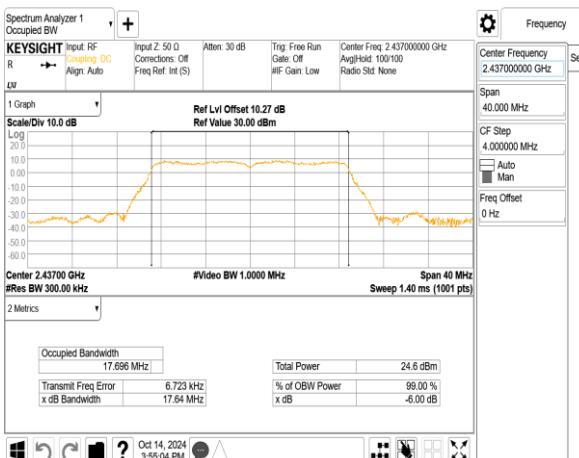
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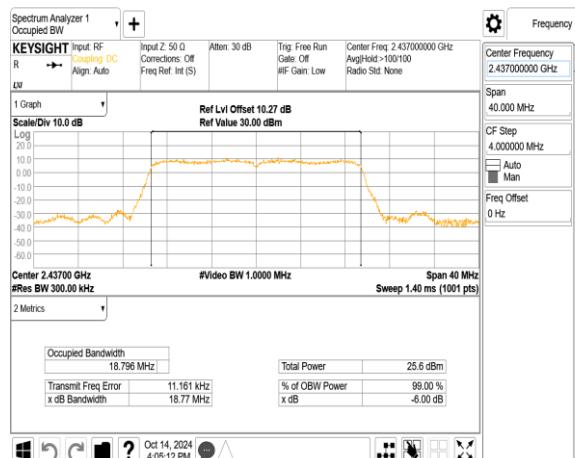
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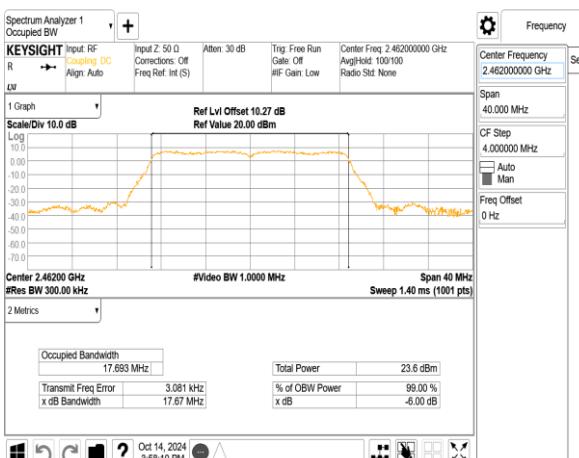
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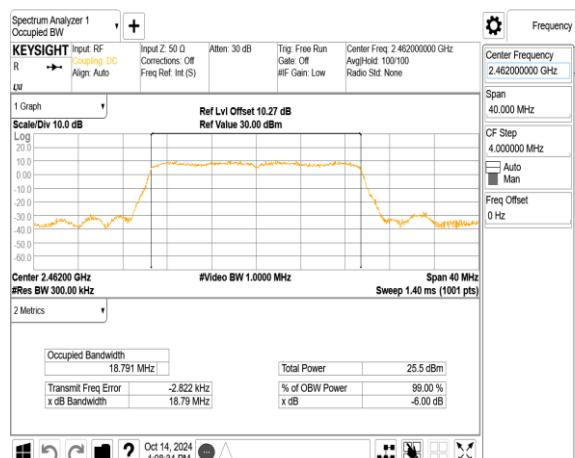
802.11ax_20MHz_Chain0_2437MHz



802.11n_20MHz_Chain0_2462MHz



802.11ax_20MHz_Chain0_2462MHz



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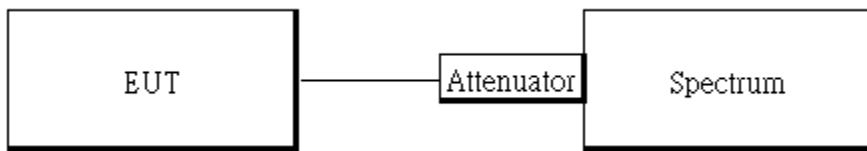
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10 CONDUCTED BAND EDGES AND SPURIOUS EMISSION MEASUREMENT

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.

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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.

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.

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10.4 Measurement Result

802.11b Ch0

Reference Level of Limit		
Freq. (MHz)	PSD (dBm)	Reference Level of Limit (dBm)
2412	10.40	-9.60
2437	10.21	-9.79
2462	8.02	-11.98

802.11g Ch0

Reference Level of Limit		
Freq. (MHz)	PSD (dBm)	Reference Level of Limit (dBm)
2412	7.42	-12.58
2437	7.21	-12.79
2462	7.58	-12.42

802.11n HT 20M Ch0

Reference Level of Limit		
Freq. (MHz)	PSD (dBm)	Reference Level of Limit (dBm)
2412	5.76	-14.24
2437	6.81	-13.19
2462	5.65	-14.35

802.11ax HE 20M Ch0

Reference Level of Limit		
Freq. (MHz)	PSD (dBm)	Reference Level of Limit (dBm)
2412	4.93	-15.07
2437	6.17	-13.83
2462	6.03	-13.97

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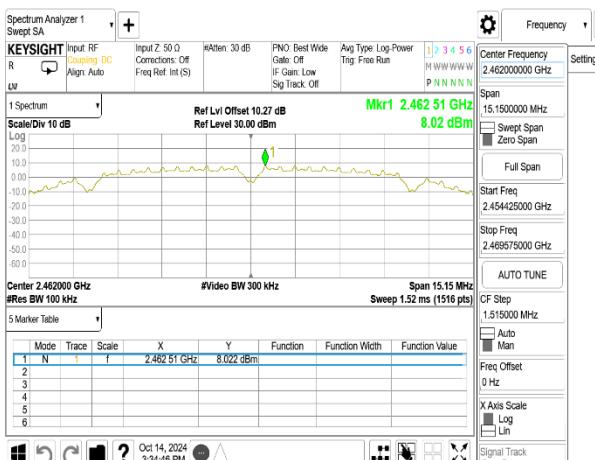
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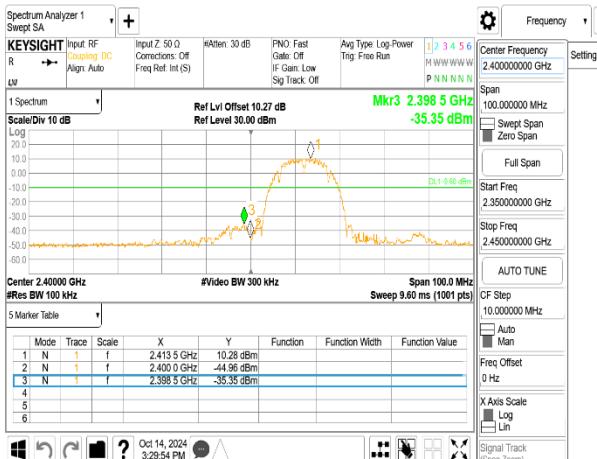
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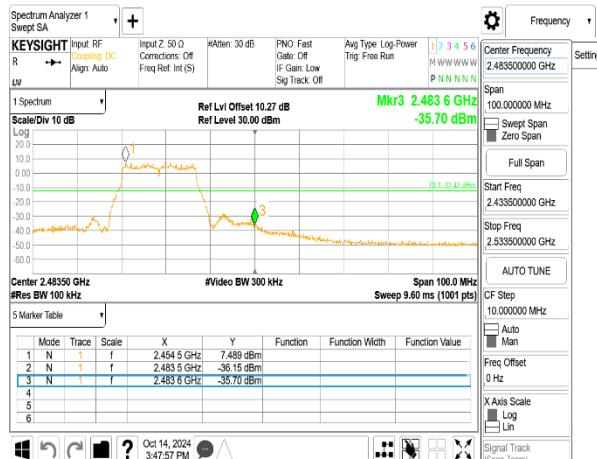
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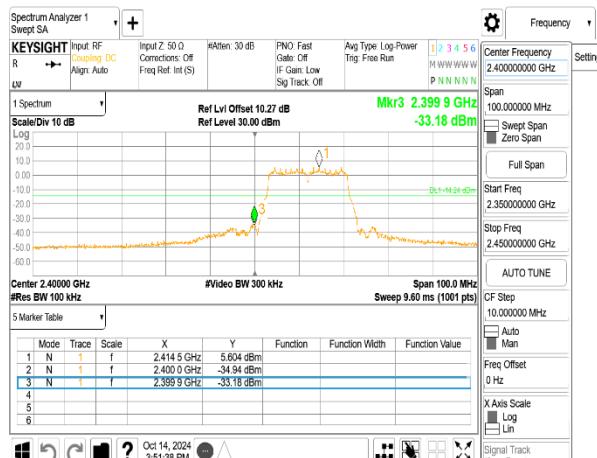
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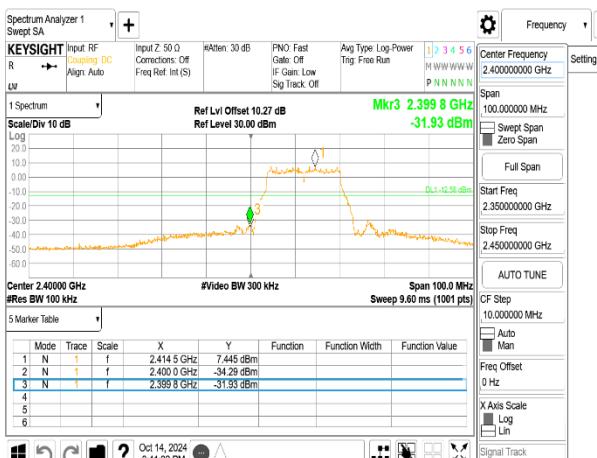
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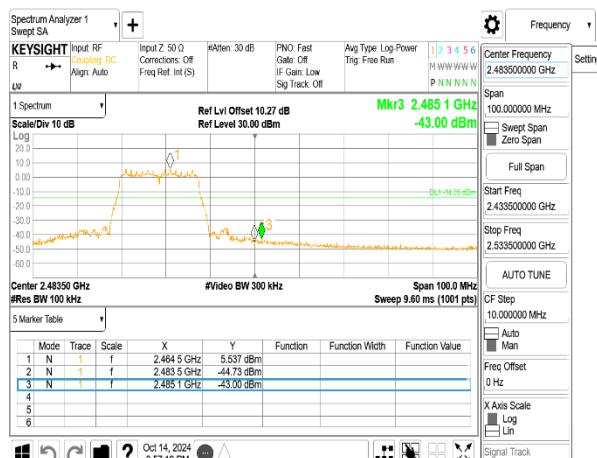
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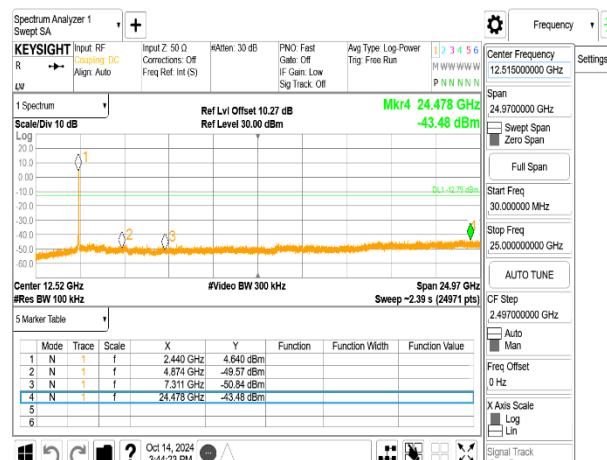
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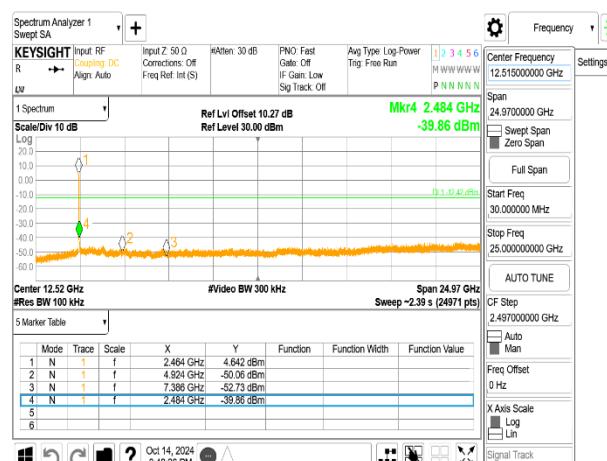
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