

**ELECTROMAGNETIC EMISSIONS
COMPLIANCE REPORT**

Applicant: Quanta Computer Inc.
No. 188, Wenhua 2nd Road, Guishan District, Taoyuan City
33377, Taiwan

Manufacturer: Quanta Computer Inc.
No. 188, Wenhua 2nd Road, Guishan District, Taoyuan City
33377, Taiwan

Product Name: Clover Mini

Brand Name: Clover

Model No.: C305

Model Difference: N/A

Report Number: E2/2022/20119

FCC ID HFS-C305

IC: 1787B-C305

Issue Date: April 14, 2022

Date of Test: March 9, 2022 ~ March 21, 2022

Date of EUT Received: February 22, 2022

Approved By _____

Jay Lin

We hereby certify that:

The above equipment was tested by SGS Taiwan Ltd. Central RF Lab The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10:2013 and the energy emitted by the sample EUT comply with FCC rule part §15.247, 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
E2/2022/20119	00	Original	April 14, 2022	Yuri Tsai	

Note:

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

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1 GENERAL INFORMATION

1.1 Product Description

Product Name:	Clover Mini
Brand Name:	Clover
Model No.:	C305
Model Difference:	N/A
Hardware Version:	N/A
Firmware Version:	N/A
EUT Series No.:	C035UT20430016
Power Supply:	12V from Adapter
Test Software (Name/Version)	QRCT / 4.0.00163.0

1.2 RF Specification

WLAN 2.4GHz				
Wi-Fi	Frequency Range	Channels	Rated Power in dBm (Peak)	Modulation Technology
802.11b	2412~2462	11	19.64	DSSS
802.11g	2412~2462	11	21.26	OFDM
802.11n20	2412~2462	11	24.41	OFDM
802.11n40	2422~2452	7	25.41	OFDM
Modulation type:		CCK, DQPSK, DBPSK for DSSS 256 QAM, 64QAM, 16QAM, QPSK, BPSK for OFDM		
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:6.5 - 72.2Mbps 802.11 n_40MHz:13.5 - 150Mbps		

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WLAN 2.4GHz for IC

Wi-Fi	Frequency Range	Channels	Rated Power in dBm (Peak)	Rated Power in dBm (EIRP)	Modulation Technology
802.11b	2412~2462	11	19.64	19.57	DSSS
802.11g	2412~2462	11	21.26	18.60	OFDM
802.11n20	2412~2462	11	24.41	24.89	OFDM
802.11n40	2422~2452	7	25.41	23.94	OFDM
Modulation type:		CCK, DQPSK, DBPSK for DSSS			
		256 QAM, 64QAM, 16QAM, QPSK, BPSK for OFDM			
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:6.5 - 144.4Mbps			
		802.11 n_40MHz:13.5 - 300Mbps			

1.3 Antenna Designation

Antenna Type	Freq. (MHz)	Main / Aux	Peak Antenna Gain (dBi)	Directional Gain (dBi)
PIFA	2412-2462	Main	2.12	1.95
	2412-2462	Aux	1.78	1.95

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 (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. Central RF Lab. (TAF code 3702)	No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan.	SAC 1	TW0027	TW3702
		SAC 3		
		Conduction 1		
		Conducted 1		
		Conducted 2		
		Conducted 3		
		Conducted 4		
		Conducted 5		
	Conducted 6			
	No.2, Keji 1st Rd., Guishan District, Taoyuan City, Taiwan 333	Conduction C	TW0028	
		SAC C		
		SAC D		
		SAC G		
		Conducted A		
		Conducted B		
		Conducted C		
		Conducted D		
		Conducted E		
		Conducted F		
		Conducted G		
Note: Test site name is remarked on the equipment list in each section of this report as an indication where measurements occurred in specific test site and address.				

1.6 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 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:

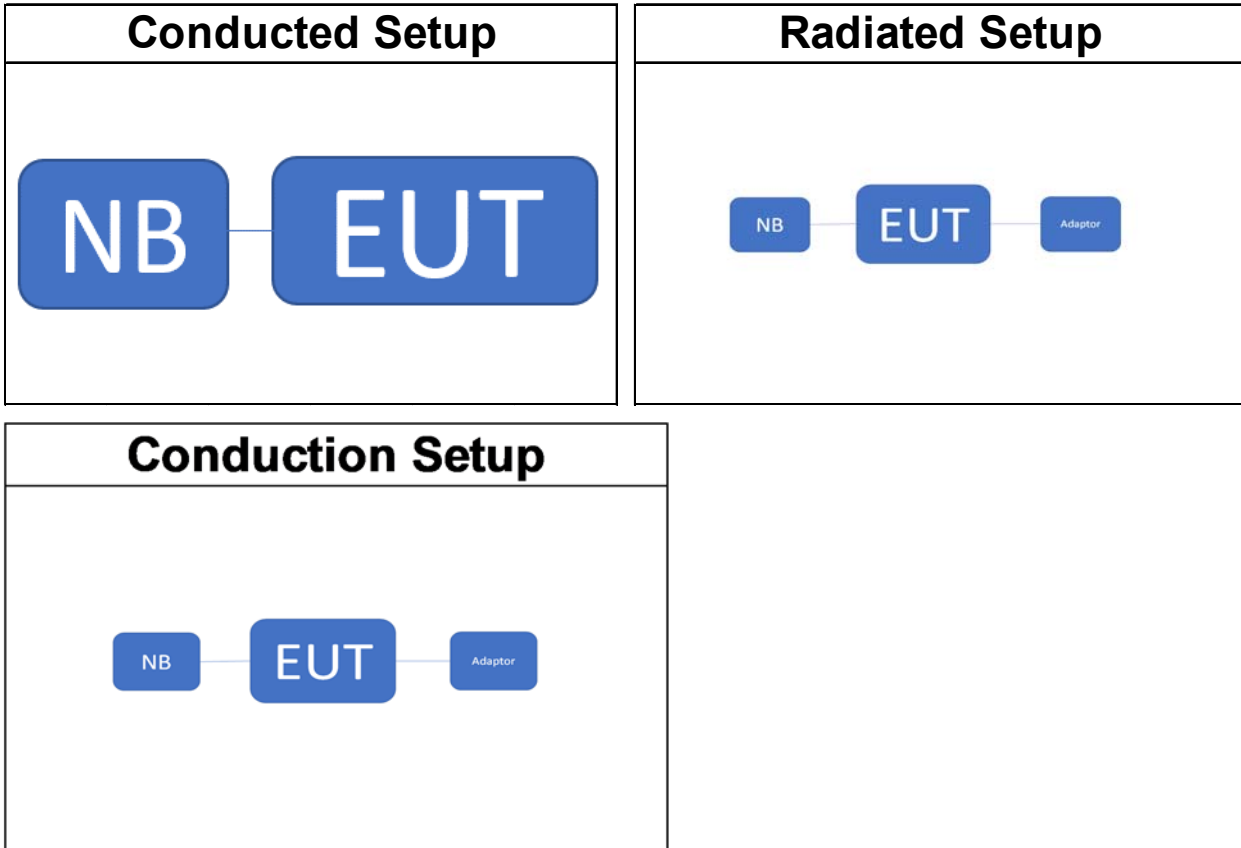
The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuation factor between EUT conducted port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly EUT RF output level.

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2.5 Test Configuration



2.6 Control Unit(s)

Radiated Emission Test Site: SAC D					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Adapter	Clover	FSP040-RHBN3	N/A	N/A	N/A
Notebook	Lenovo	T470	P0001293	N/A	N/A
AC Power-Line Conducted Emission Test Site: Conduction C					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Adapter	Clover	FSP040-RHBN3	N/A	N/A	N/A
Notebook	Lenovo	T470	P0001293	N/A	N/A
Conducted Emission Test Site: Conducted A					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Notebook	Lenovo	L480	PF-1PG38Y	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 Operatin Frequencies

Modulation of 20MHz nominal bandwidth

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

Modulation of 40MHz nominal bandwidth

CHANNEL	FREQUENCY (MHz)
3	2422
4	2427
5	2432
6	2437
7	2442
8	2447
9	2452

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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 gevin UE is pre-scanned among below modes.

Modulation		Transmission Chain							Single Transmission Spatial		Multi Transmission Spatial		
v	802.11 b	v	Ch0	v	Ch1		Ch2		Ch3	v	1TX		2TX
v	802.11 g	v	Ch0	v	Ch1		Ch2		Ch3	v	1TX		2TX
v	802.11 n	v	Ch0	v	Ch1		Ch2		Ch3		SISO	v	MIMO
	802.11 ax		Ch0		Ch1		Ch2		Ch3		SISO		MIMO

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

Conducted					
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT
802.11b	1 to 11	1,6,11	DSSS	1	ch0
802.11g	1 to 11	1,6,11	OFDM	6	ch0
802.11n (HT20)	1 to 11	1,6,11	OFDM	HT8	MIMO
802.11n (HT40)	3 to 9	3,6,9	OFDM	HT8	MIMO

RADIATED EMISSION TEST (BELOW 1 GHz)					
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT
802.11g	1 to 11	1,6,11	OFDM	6	ch0
802.11n (HT40)	3 to 9	3,6,9	OFDM	HT8	MIMO

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RADIATED EMISSION TEST (ABOVE 1 GHz)					
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT
802.11b	1 to 11	1,6,11	DSSS	1	ch0
802.11g	1 to 11	1,6,11	OFDM	6	ch0
802.11n (HT20)	1 to 11	1,6,11	OFDM	HT8	MIMO
802.11n (HT40)	3 to 9	3,6,9	OFDM	HT8	MIMO

Note:

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

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5 MEASUREMENT UNCERTAINTY

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

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

Note:

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

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6 MEASUREMENT EQUIPMENT USED

6.1 Emission from AC power line

AC Power-Line Conducted Emission Test Site: Conduction C					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
LISN	SCHWARZBECK Mess- Elektronik	NSLK8127	974	04/19/2021	04/18/2022
EMI Test Receiver	R&S	ESCI	101342	04/28/2021	04/27/2022
Coaxial Cable	EC Lab	RF-HY-CAB- 250	RF-HY-CAB- 250-01	03/27/2021	03/26/2022
Pulse Limiter	EC Lab	VTSD 9561F- N	485	03/27/2021	03/26/2022
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 A					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Power Meter	Anritsu	ML2496A	1326001	08/12/2021	08/11/2022
Power Sensor	Anritsu	MA2411B	1315048	08/12/2021	08/11/2022
Power Sensor	Anritsu	MA2411B	1315049	08/12/2021	08/11/2022
Spectrum Analyzer	KEYSIGHT	N9010A	MY57120290	04/06/2021	04/05/2022
Test Software	SGS Taiwan	Radio Test Software	Ver.21	N.C.R	N.C.R
Attenuator	Marvelous	MVE2213-10	RF13	11/18/2021	11/17/2022
Attenuator	Marvelous	MVE2213-10	RF14	11/18/2021	11/17/2022
Attenuator	Marvelous	MVE2213-10	RF12	11/18/2021	11/17/2022
DC Block	PASTERNAK	PE8210	RF151	11/18/2021	11/17/2022

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6.3 Radiated Measurement

Radiated Emission Test Site: SAC D					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Broadband Antenna	SCHWARZBECK	VULB 9168	9168-617	11/12/2021	11/11/2022
Horn Antenna	Schwarzbeck	BBHA9170	185	08/06/2021	08/05/2022
Horn Antenna	Schwarzbeck	BBHA9120D	1341	06/04/2021	06/03/2022
Loop Antenna	ETS.LINDGREN	6502	143303	05/07/2021	05/06/2022
3m Site NSA	SGS	966 chamber D	N/A	07/12/2021	07/11/2022
Test Software	audix	e3	E3 20923 SGS Ver.9 (C)	N.C.R	N.C.R
Spectrum Analyzer	KEYSIGHT	N9010B	MY59071570	06/01/2021	05/31/2022
Pre-Amplifier	EMC Instruments	EMC184045B	980135	10/27/2021	10/26/2022
Pre-Amplifier	EMC Instruments	EMC9135	980234	11/18/2021	11/17/2022
Pre-Amplifier	EMC Instruments	EMC12630SE	980273	11/18/2021	11/17/2022
Coaxial Cable	Huber+Suhner	RG 214/U	W21.01	11/18/2021	11/17/2022
Coaxial Cable	Huber Suhner	EMC106-SM-SM-7200	150703	11/18/2021	11/17/2022
Coaxial Cable	Huber Suhner	SUCOFLEX 104	MY17413/4	11/18/2021	11/17/2022
Attenuator	Marvelous	WATT-218FS-10	RF17	11/18/2021	11/17/2022
Lowpass Filter	Woken	EWT-56-0019	RF173	11/18/2021	11/17/2022
High Pass Filter	R&S	F13 HPF 3GHz	RF175	11/18/2021	11/17/2022
Band Rejection Filter	Micro-Tronics	BRM50701-01	RF201	11/18/2021	11/17/2022

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

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7 CONDUCTED EMISSION TEST

7.1 Standard Applicable

Frequency range within 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

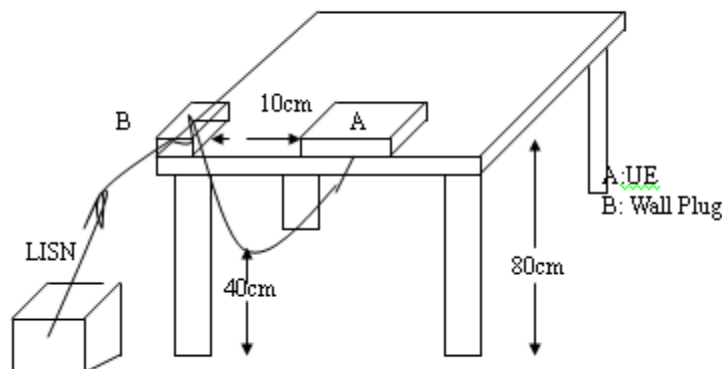
Note

- The lower limit shall apply at the transition frequencies
- The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

7.2 EUT Setup

- The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.10:2013.
- The AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.
- The LISN was connected with 120Vac/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 * reveals the worst-case results that closet to the limit.

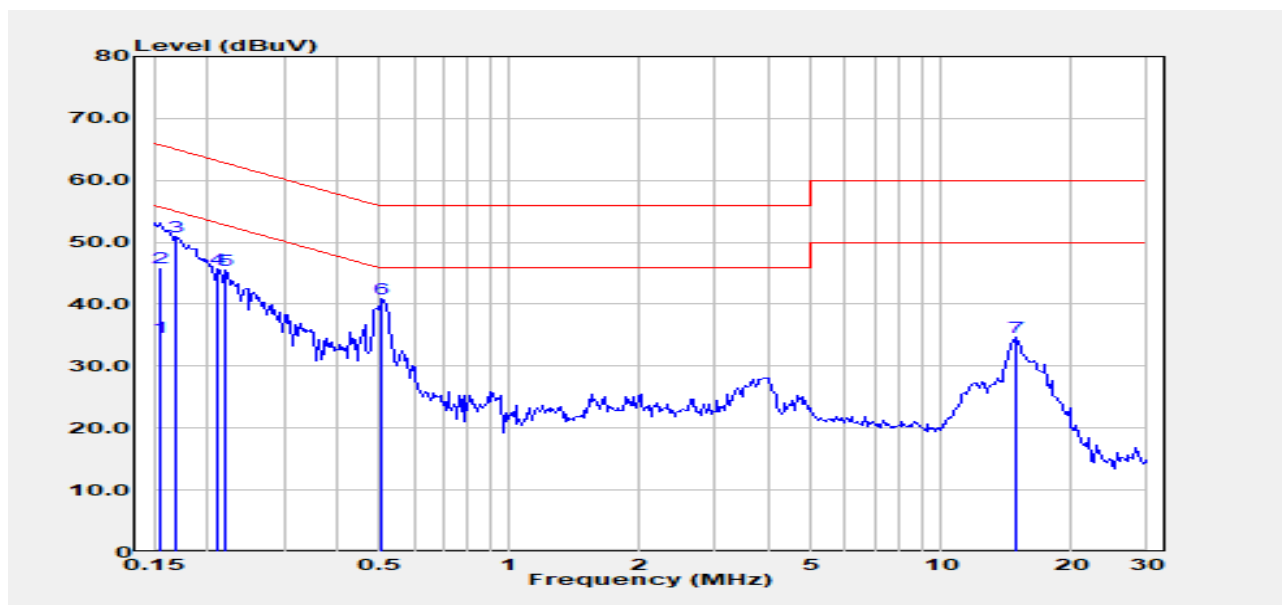
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AC POWER LINE CONDUCTED EMISSION TEST DATA

Report Number	:E2/2022/20119	Test Site	:Conduction C
Test Mode	:2.4G	Test Date	:2022-03-21
Power	:120V/60Hz	Temp./Humi.	:21.3/66
Probe	:L1	Engineer	:Andy Wang
Note:	: Adapter:FSP040-RHBN3		



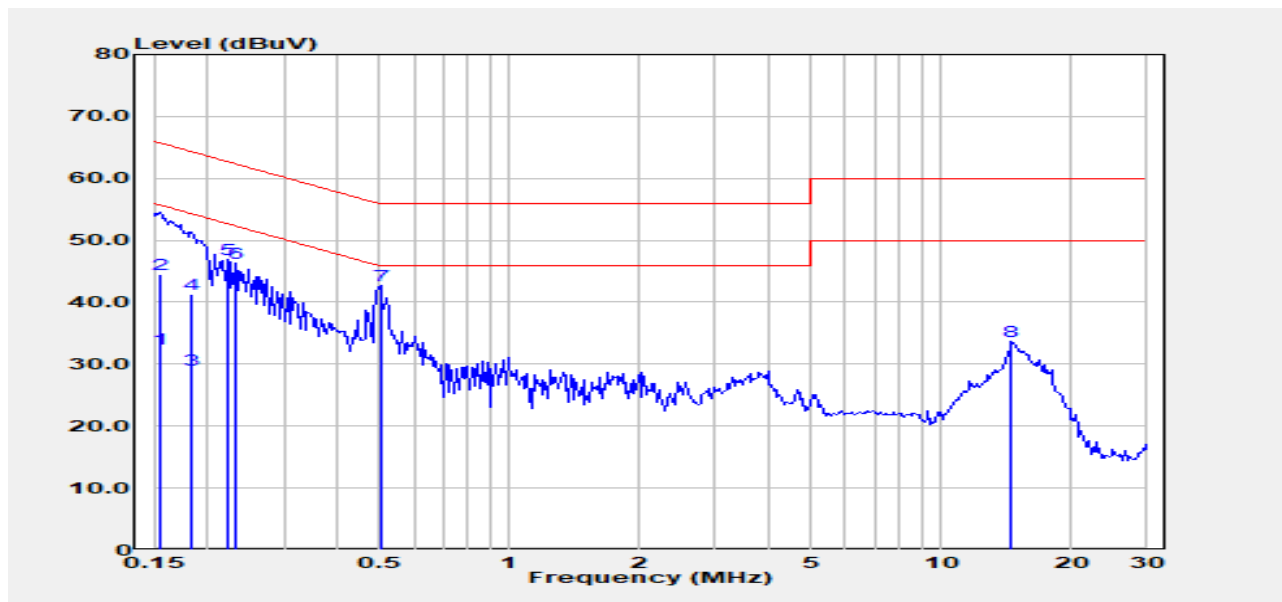
Freq. MHz	Detector Mode	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V	Limit dB μ V	Margin dB
0.155	Average	24.30	10.30	34.60	55.74	-21.14
0.155	QP	35.70	10.30	46.00	65.74	-19.74
0.169	Peak	40.66	10.30	50.96	65.03	-14.07
0.211	Peak	35.34	10.30	45.64	63.18	-17.54
0.220	Peak	35.19	10.30	45.50	62.83	-17.34
0.507	Peak	30.62	10.31	40.93	56.00	-15.07
14.907	Peak	24.00	10.78	34.78	60.00	-25.22

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Report Number	:E2/2022/20119	Test Site	:Conduction C
Test Mode	:2.4G	Test Date	:2022-03-21
Power	:120V/60Hz	Temp./Humi.	:21.3/66
Probe	:N	Engineer	:Andy Wang
Note:	: Adapter:FSP040-RHBN3		



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V	Limit dB μ V	Margin dB
0.155	Average	22.20	10.31	32.51	55.74	-23.23
0.155	QP	34.30	10.31	44.61	65.74	-21.13
0.183	Average	18.80	10.30	29.10	54.33	-25.22
0.183	QP	31.10	10.30	41.40	64.33	-22.92
0.222	Peak	36.63	10.30	46.93	62.74	-15.81
0.232	Peak	36.02	10.30	46.32	62.39	-16.07
0.502	Peak	32.48	10.32	42.80	56.00	-13.20
14.594	Peak	22.91	10.86	33.77	60.00	-26.23

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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.

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

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;

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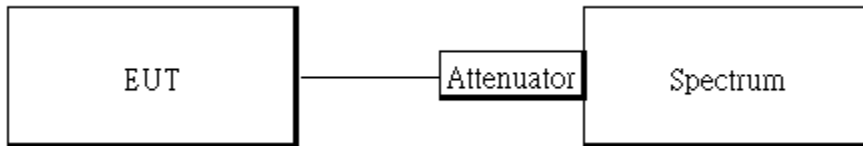
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G_k is the gain in dBi of the kth antenna.

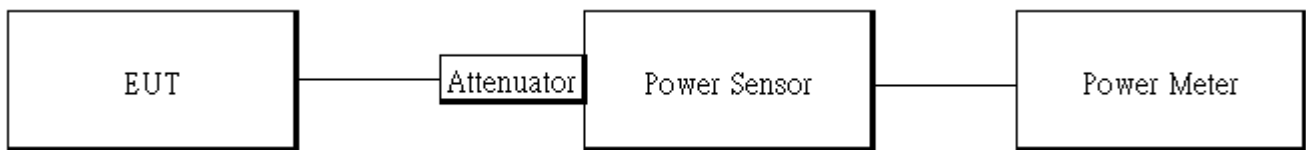
The antenna gain is not greater than 6 dBi. Therefore, reduction of power is not required.

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, cable loss is specified below.

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

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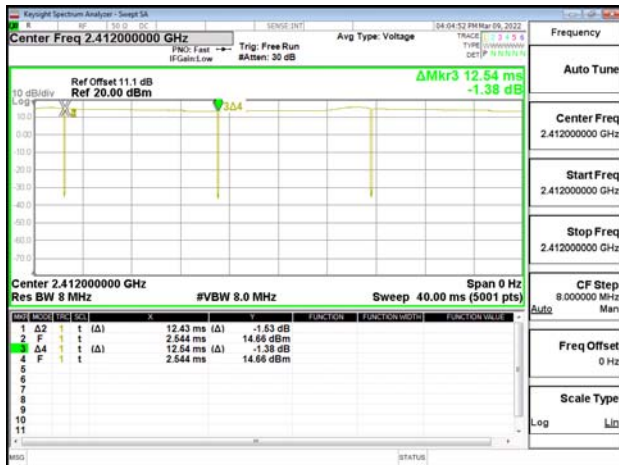
8.6 Measurement Result

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	99.11	0.04	0.08	0.01
802.11g	98.24	0.08	0.48	0.01
802.11n_20	98.11	0.08	0.52	0.01
802.11n_40	94.89	0.23	1.05	2.00

8.6.2 Duty Cycle test plots

802.11b_20MHz_Chain0_2412MHz



802.11n_20MHz_Chain0_2412MHz



802.11g_20MHz_Chain0_2412MHz



802.11n_40MHz_Chain0_2422MHz



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8.6.3 Output Power

802.11b Ch0						
CH	Freq. (MHz)	Data Rate	Power set	Peak Output Power (dBm)	Limit (dBm)	RESULT
1	2412	1	17.5	19.42	30.00	PASS
6	2437	1	17.5	19.48	30.00	PASS
11	2462	1	17.5	19.60	30.00	PASS

802.11b Ch0						
CH	Freq. (MHz)	Data Rate	Power set	Max. Avg. Output include tune up tolerance Power (dBm)	Limit (dBm)	RESULT
1	2412	1	17.5	17.41	30.00	PASS
6	2437	1	17.5	17.42	30.00	PASS
11	2462	1	17.5	17.45	30.00	PASS

802.11b Ch1						
CH	Freq. (MHz)	Data Rate	Power set	Peak Output Power (dBm)	Limit (dBm)	RESULT
1	2412	1	17.5	19.48	30.00	PASS
6	2437	1	17.5	19.52	30.00	PASS
11	2462	1	17.5	19.64	30.00	PASS

802.11b Ch1						
CH	Freq. (MHz)	Data Rate	Power set	Max. Avg. Output include tune up tolerance Power (dBm)	Limit (dBm)	RESULT
1	2412	1	17.5	17.33	30.00	PASS
6	2437	1	17.5	17.36	30.00	PASS
11	2462	1	17.5	17.39	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	16.5	21.22	30.00	PASS
6	2437	6	16.5	21.26	30.00	PASS
11	2462	6	16.5	21.24	30.00	PASS

802.11g Ch0						
CH	Freq. (MHz)	Data Rate	Power set	Max. Avg. Output include tune up tolerance Power (dBm)	Limit (dBm)	RESULT
1	2412	6	16.5	16.46	30.00	PASS
6	2437	6	16.5	16.48	30.00	PASS
11	2462	6	16.5	16.47	30.00	PASS

802.11g Ch1						
CH	Freq. (MHz)	Data Rate	Power set	Peak Output Power (dBm)	Limit (dBm)	RESULT
1	2412	6	16.5	21.18	30.00	PASS
6	2437	6	16.5	21.24	30.00	PASS
11	2462	6	16.5	21.21	30.00	PASS

802.11g Ch1						
CH	Freq. (MHz)	Data Rate	Power set	Max. Avg. Output include tune up tolerance Power (dBm)	Limit (dBm)	RESULT
1	2412	6	16.5	16.43	30.00	PASS
6	2437	6	16.5	16.47	30.00	PASS
11	2462	6	16.5	16.44	30.00	PASS

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802.11nHT_20M Ch0						
CH	Freq. (MHz)	Data Rate	Power set	Peak Output Power (dBm)	Limit (dBm)	RESULT
1	2412	HT0	17	21.31	30.00	PASS
6	2437	HT0	17	21.28	30.00	PASS
11	2462	HT0	17	21.22	30.00	PASS

802.11nHT_20M Ch0						
CH	Freq. (MHz)	Data Rate	Power set	Max. Avg. Output include tune up tolerance Power (dBm)	Limit (dBm)	RESULT
1	2412	HT0	17	16.97	30.00	PASS
6	2437	HT0	17	16.92	30.00	PASS
11	2462	HT0	17	16.89	30.00	PASS

802.11nHT_20M Ch1						
CH	Freq. (MHz)	Data Rate	Power set	Peak Output Power (dBm)	Limit (dBm)	RESULT
1	2412	HT0	17	21.14	30.00	PASS
6	2437	HT0	17	21.27	30.00	PASS
11	2462	HT0	17	21.19	30.00	PASS

802.11nHT_20M Ch1						
CH	Freq. (MHz)	Data Rate	Power set	Max. Avg. Output include tune up tolerance Power (dBm)	Limit (dBm)	RESULT
1	2412	HT0	17	16.95	30.00	PASS
6	2437	HT0	17	16.90	30.00	PASS
11	2462	HT0	17	16.87	30.00	PASS

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802.11n_HT20M MIMO								
CH	Freq. (MHz)	Data Rate	Power set	Peak Output Power		Total Peak Output Power (dBm)	Limit (dBm)	RESULT
				CH 0	CH 1			
1	2412	HT8	17	21.20	21.17	24.20	30.00	PASS
6	2437	HT8	17	21.24	21.18	24.22	30.00	PASS
11	2462	HT8	17	21.45	21.35	24.41	30.00	PASS

802.11n_HT20M MIMO								
CH	Freq. (MHz)	Data Rate	Power set	Avg. Output Power (dBm)		Max. Avg. Output include tune up tolerance Power (dBm)	Limit (dBm)	RESULT
				CH 0	CH 1			
1	2412	HT8	17	16.89	16.78	19.93	30.00	PASS
6	2437	HT8	17	16.87	16.64	19.85	30.00	PASS
11	2462	HT8	17	16.85	16.56	19.80	30.00	PASS

802.11nHT_40M Ch0							
CH	Freq. (MHz)	Data Rate	Power set	Peak Output Power (dBm)		Limit (dBm)	RESULT
3	2422	HT0	16.5	22.42		30.00	PASS
6	2437	HT0	16.5	22.31		30.00	PASS
9	2452	HT0	16.5	22.24		30.00	PASS

802.11nHT_40M Ch0							
CH	Freq. (MHz)	Data Rate	Power set	Max. Avg. Output include tune up tolerance Power (dBm)		Limit (dBm)	RESULT
3	2422	HT0	16.5	15.94		30.00	PASS
6	2437	HT0	16.5	15.92		30.00	PASS
9	2452	HT0	16.5	15.89		30.00	PASS

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802.11nHT_40M Ch1						
CH	Freq. (MHz)	Data Rate	Power set	Peak Output Power (dBm)	Limit (dBm)	RESULT
3	2422	HT0	16.5	22.30	30.00	PASS
6	2437	HT0	16.5	22.68	30.00	PASS
9	2452	HT0	16.5	22.21	30.00	PASS
802.11nHT_40M Ch1						
CH	Freq. (MHz)	Data Rate	Power set	Max. Avg. Output include tune up tolerance Power (dBm)	Limit (dBm)	RESULT
3	2422	HT0	16.5	15.93	30.00	PASS
6	2437	HT0	16.5	15.89	30.00	PASS
9	2452	HT0	16.5	15.86	30.00	PASS

802.11n_HT40M MIMO								
CH	Freq. (MHz)	Data Rate	Power set	Peak Output Power		Total Peak Output Power (dBm)	Limit (dBm)	RESULT
				CH 0	CH 1			
3	2422	HT8	16.5	22.35	22.26	25.32	30.00	PASS
6	2437	HT8	16.5	22.44	22.36	25.41	30.00	PASS
9	2452	HT8	16.5	22.38	22.21	25.31	30.00	PASS
802.11n_HT40M MIMO								
CH	Freq. (MHz)	Data Rate	Power set	Avg. Output Power (dBm)		Max. Avg. Output include tune up tolerance Power (dBm)	Limit (dBm)	RESULT
				CH 0	CH 1			
3	2422	HT8	16.5	15.70	15.64	18.91	30.00	PASS
6	2437	HT8	16.5	15.76	15.71	18.98	30.00	PASS
9	2452	HT8	16.5	15.74	15.69	18.96	30.00	PASS

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EIRP

802.11b Ch0							
CH	Freq. (MHz)	Data Rate	Avg. Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	RESULT
1	2412	1	17.41	2.12	19.53	36	PASS
6	2437	1	17.42	2.12	19.54	36	PASS
11	2462	1	17.45	2.12	19.57	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	17.33	1.78	19.11	36	PASS
6	2437	1	17.36	1.78	19.14	36	PASS
11	2462	1	17.39	1.78	19.17	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	16.46	2.12	18.58	36	PASS
6	2437	6	16.48	2.12	18.60	36	PASS
11	2462	6	16.47	2.12	18.59	36	PASS

802.11g Ch1							
CH	Freq. (MHz)	Data Rate	Avg. Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	RESULT
1	2412	6	16.43	1.78	18.21	36	PASS
6	2437	6	16.47	1.78	18.25	36	PASS
11	2462	6	16.44	1.78	18.22	36	PASS

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802.11nHT_20M Ch0							
CH	Freq. (MHz)	Data Rate	Avg. Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	RESULT
1	2412	HT0	16.97	2.12	19.09	36	PASS
6	2437	HT0	16.92	2.12	19.04	36	PASS
11	2462	HT0	16.89	2.12	19.01	36	PASS

802.11nHT_20M Ch1							
CH	Freq. (MHz)	Data Rate	Avg. Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	RESULT
1	2412	HT0	16.95	1.78	18.73	36	PASS
6	2437	HT0	16.90	1.78	18.68	36	PASS
11	2462	HT0	16.87	1.78	18.65	36	PASS

802.11n_HT20M MIMO									
CH	Freq. (MHz)	Data Rate	Avg. Output Power		Total Avg. Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	RESULT
			CH 0	CH 1					
1	2412	HT8	16.89	16.78	19.93	4.96	24.89	36	PASS
6	2437	HT8	16.87	16.64	19.85	4.96	24.81	36	PASS
11	2462	HT8	16.85	16.56	19.80	4.96	24.76	36	PASS

802.11nHT_40M Ch0							
CH	Freq. (MHz)	Data Rate	Avg. Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	RESULT
3	2422	HT0	15.94	2.12	18.06	36	PASS
6	2437	HT0	15.92	2.12	18.04	36	PASS
9	2452	HT0	15.89	2.12	18.01	36	PASS

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802.11nHT_40M Ch1							
CH	Freq. (MHz)	Data Rate	Avg. Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	RESULT
3	2422	HT0	15.93	1.78	17.71	36	PASS
6	2437	HT0	15.89	1.78	17.67	36	PASS
9	2452	HT0	15.86	1.78	17.64	36	PASS

802.11n_HT40M MIMO									
CH	Freq. (MHz)	Data Rate	Avg. Output Power		Total Avg. Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	RESULT
			CH 0	CH 1					
3	2422	HT8	15.70	15.64	18.91	4.96	23.87	36	PASS
6	2437	HT8	15.76	15.71	18.98	4.96	23.94	36	PASS
9	2452	HT8	15.74	15.69	18.96	4.96	23.92	36	PASS

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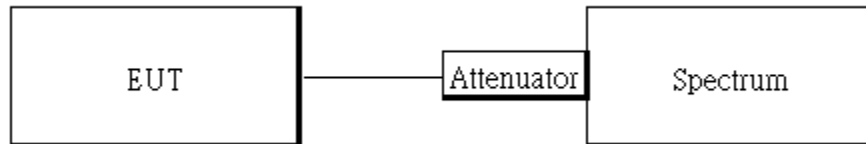
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9 EMISSION BANDWIDTH MEASUREMENT

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. 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 the spectrum analyzer as
RBW= 100kHz ,
VBW = 3 X RBW,
Span= 2 to 5 times of the OBW,
Sweep=auto,
Detector = Peak, and Max hold for -6dB Bandwidth test.
5. Set the spectrum analyzer as
RBW= 1 % to 5% of 99% Bandwidth ,
VBW \geq 3 X RBW,
Span= large enough to capture all products of the modulation process,
Sweep=auto,
Detector = Peak, and Max hold for 99% Bandwidth test.
6. Turn on the 99% bandwidth function, max reading.
7. Repeat above procedures until all test default channel is completed

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9.4 6dB Bandwidth

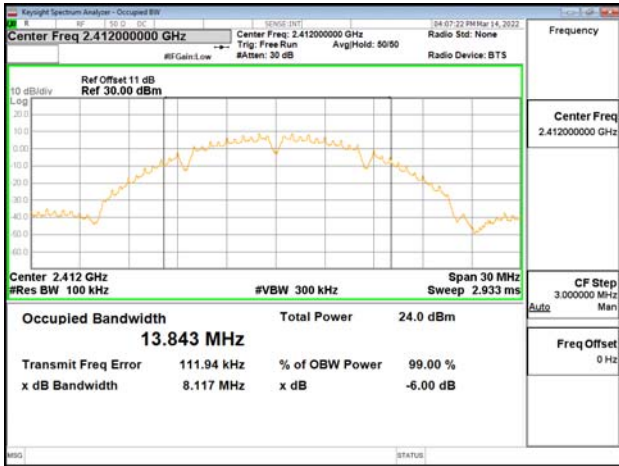
802.11b Ch0			
Freq. (MHz)	6dB BW (kHz)	Limit (kHz)	Result
2412	8117.00	≥ 500	PASS
2437	8118.00	≥ 500	PASS
2462	8120.00	≥ 500	PASS
802.11g Ch0			
Freq. (MHz)	6dB BW (kHz)	Limit (kHz)	Result
2412	15300.00	≥ 500	PASS
2437	15360.00	≥ 500	PASS
2462	15390.00	≥ 500	PASS
802.11nHT_20M Ch0			
Freq. (MHz)	6dB BW (kHz)	Limit (kHz)	Result
2412	15480.00	≥ 500	PASS
2437	16300.00	≥ 500	PASS
2462	16910.00	≥ 500	PASS
802.11nHT_20M Ch1			
Freq. (MHz)	6dB BW (kHz)	Limit (kHz)	Result
2412	16020.00	≥ 500	PASS
2437	15490.00	≥ 500	PASS
2462	16110.00	≥ 500	PASS
802.11nHT_40M Ch0			
Freq. (MHz)	6dB BW (kHz)	Limit (kHz)	Result
2422	35180.00	≥ 500	PASS
2437	35740.00	≥ 500	PASS
2452	35730.00	≥ 500	PASS
802.11nHT_40M Ch1			
Freq. (MHz)	6dB BW (kHz)	Limit (kHz)	Result
2422	35170.00	≥ 500	PASS
2437	35180.00	≥ 500	PASS
2452	35170.00	≥ 500	PASS

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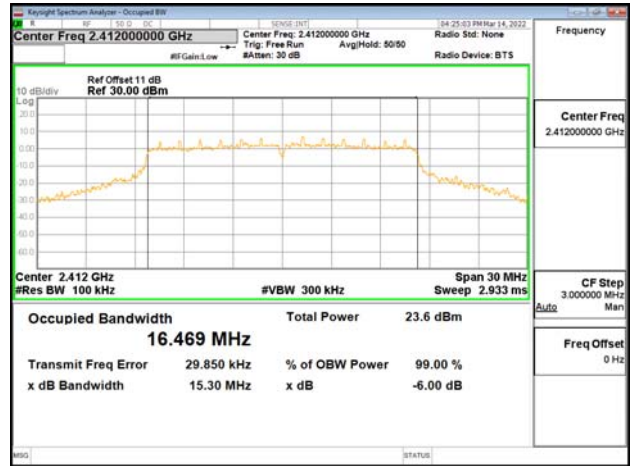
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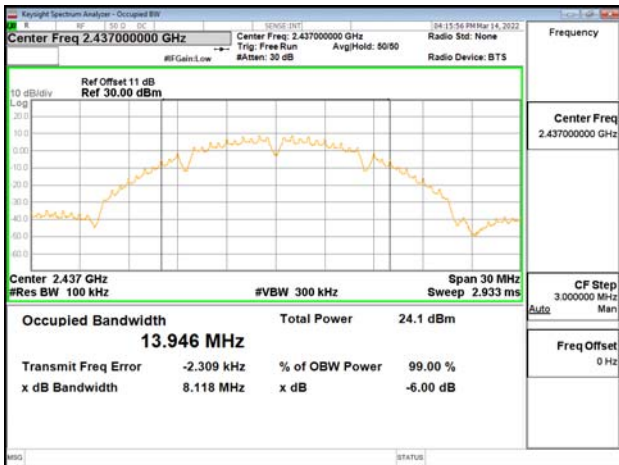
802.11b_20MHz_Chain0_2412MHz



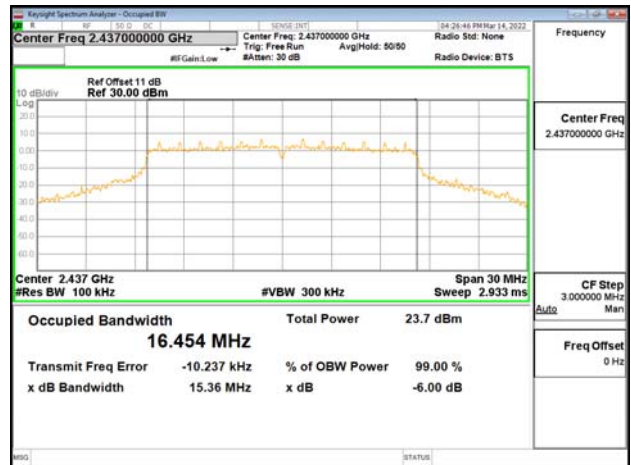
802.11g_20MHz_Chain0_2412MHz



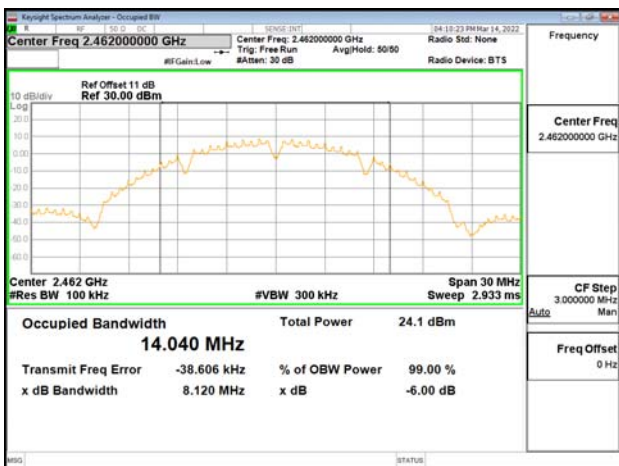
802.11b_20MHz_Chain0_2437MHz



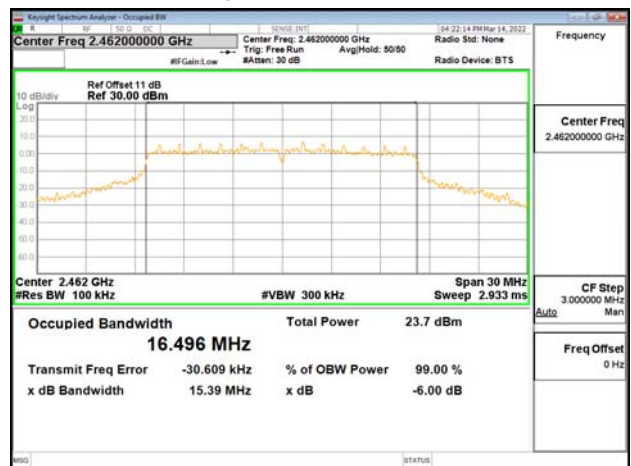
802.11g_20MHz_Chain0_2437MHz



802.11b_20MHz_Chain0_2462MHz



802.11g_20MHz_Chain0_2462MHz

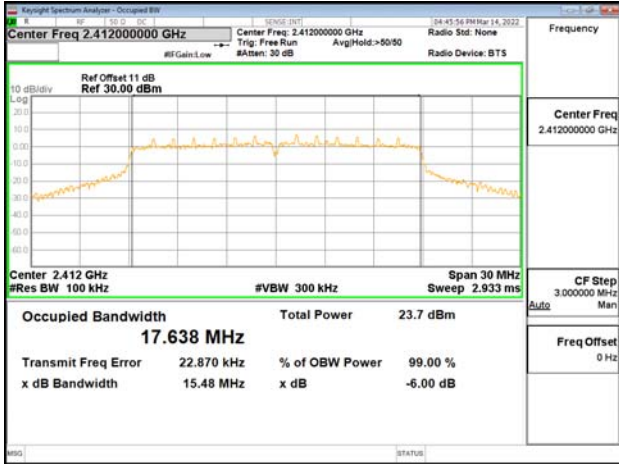


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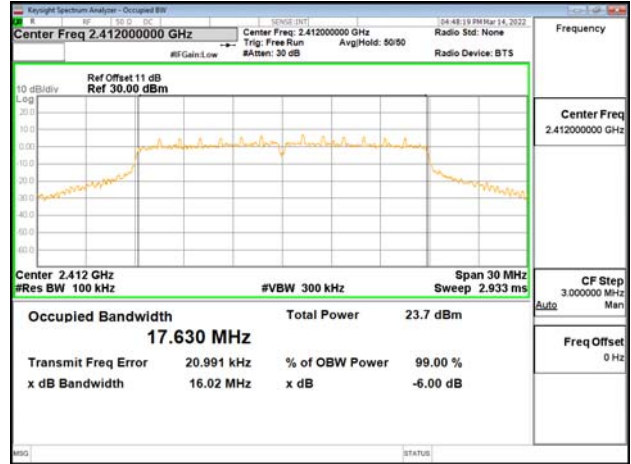
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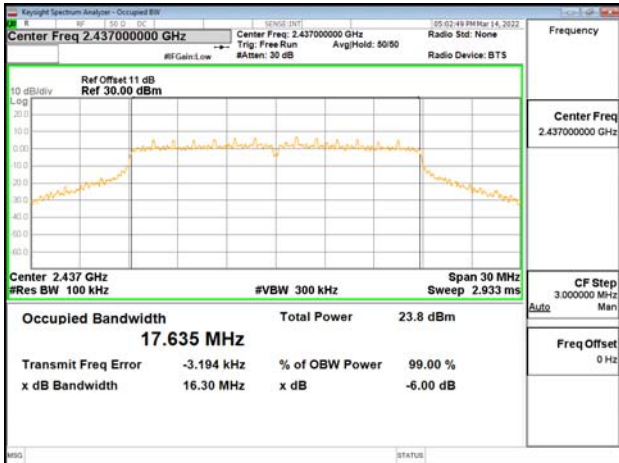
802.11n_20MHz_Chain0_2412MHz



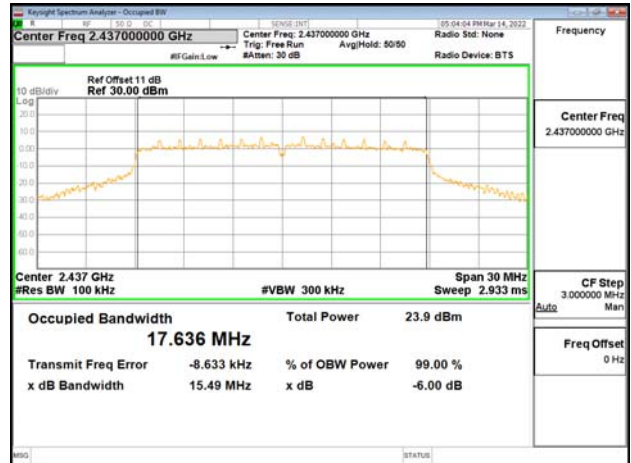
802.11n_20MHz_Chain1_2412MHz



802.11n_20MHz_Chain0_2437MHz



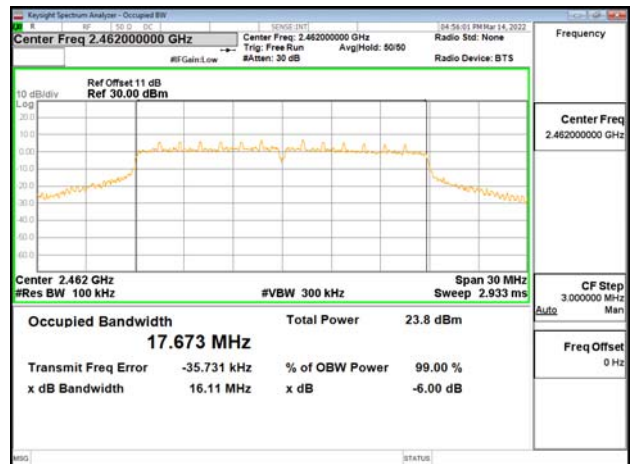
802.11n_20MHz_Chain1_2437MHz



802.11n_20MHz_Chain0_2462MHz



802.11n_20MHz_Chain1_2462MHz

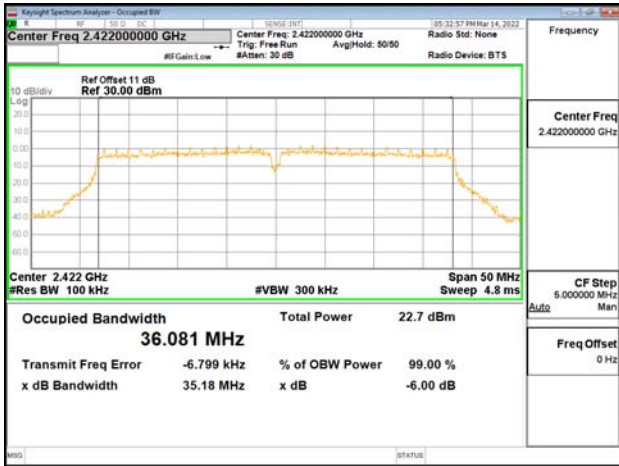


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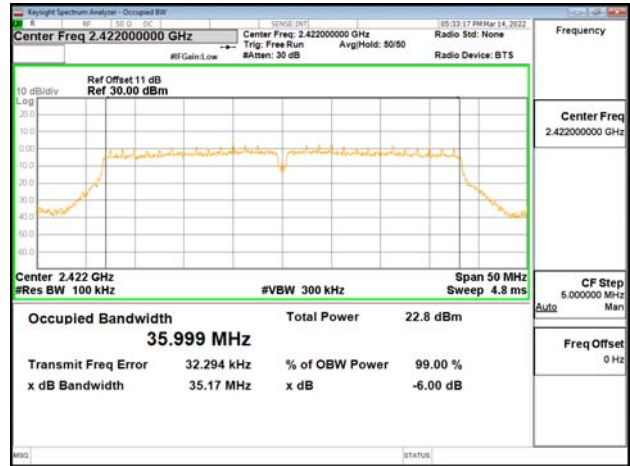
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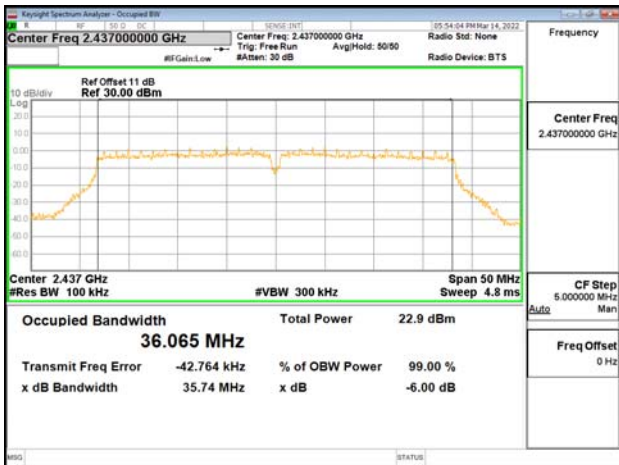
802.11n_40MHz_Chain0_2422MHz



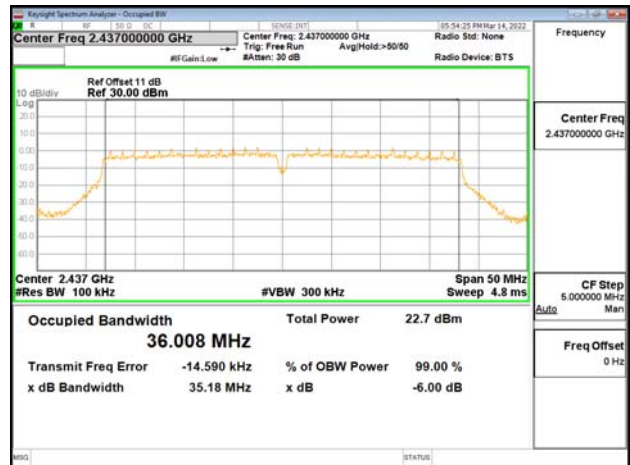
802.11n_40MHz_Chain1_2422MHz



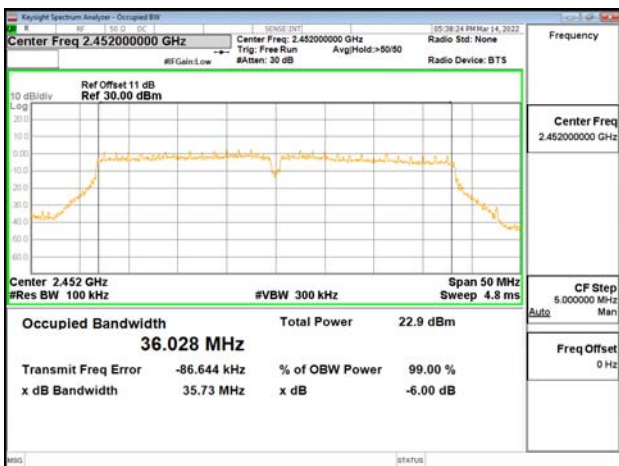
802.11n_40MHz_Chain0_2437MHz



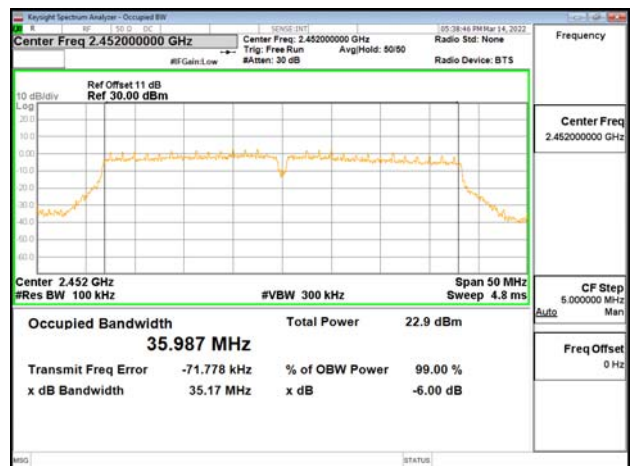
802.11n_40MHz_Chain1_2437MHz



802.11n_40MHz_Chain0_2452MHz



802.11n_40MHz_Chain1_2452MHz



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9.5 99% Bandwidth

802.11b Ch0

Freq. (MHz)	99% BW (MHz)
2412	13.817
2437	13.908
2462	14.055

802.11g Ch0

Freq. (MHz)	99% BW (MHz)
2412	16.727
2437	16.742
2462	16.845

802.11n_HT20M Ch0

Freq. (MHz)	99% BW (MHz)
2412	17.785
2437	17.783
2462	17.812

802.11n_HT20M Ch1

Freq. (MHz)	99% BW (MHz)
2412	17.888
2437	17.891
2462	17.979

802.11n_HT40M Ch0

Freq. (MHz)	99% BW (MHz)
2422	36.162
2437	36.146
2452	36.114

802.11n_HT40M Ch1

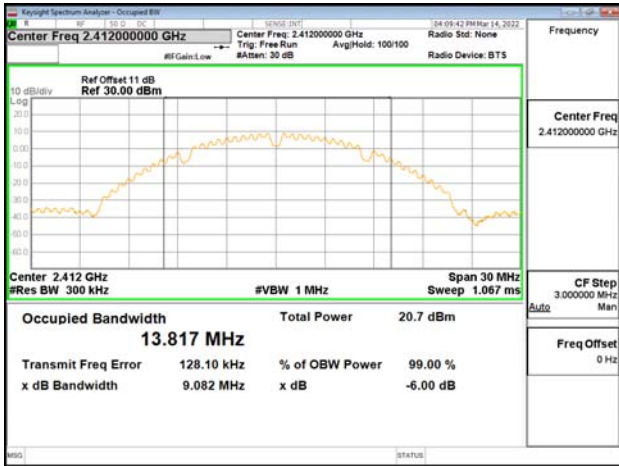
Freq. (MHz)	99% BW (MHz)
2422	36.143
2437	36.172
2452	36.198

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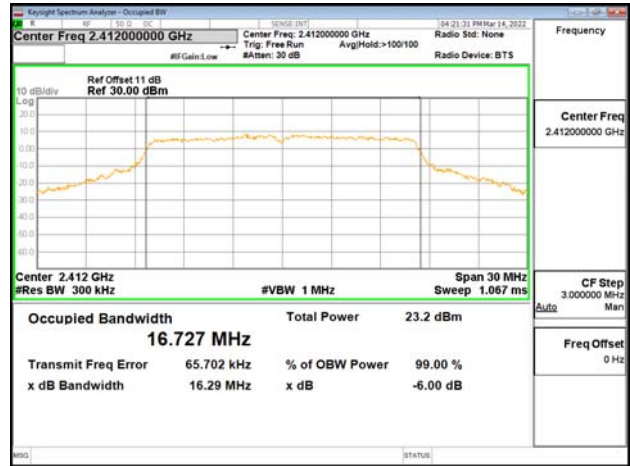
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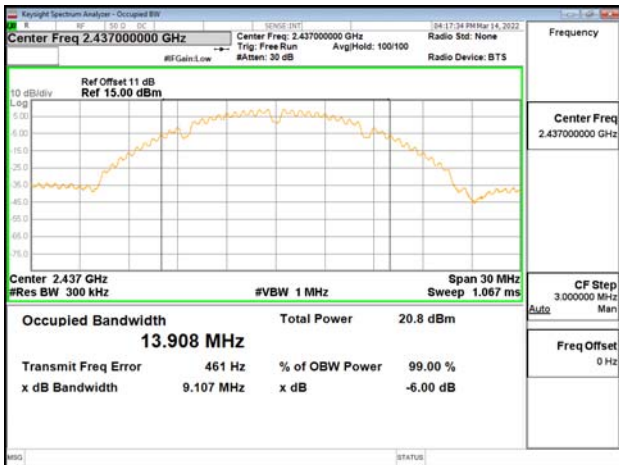
802.11b_20MHz_Chain0_2412MHz



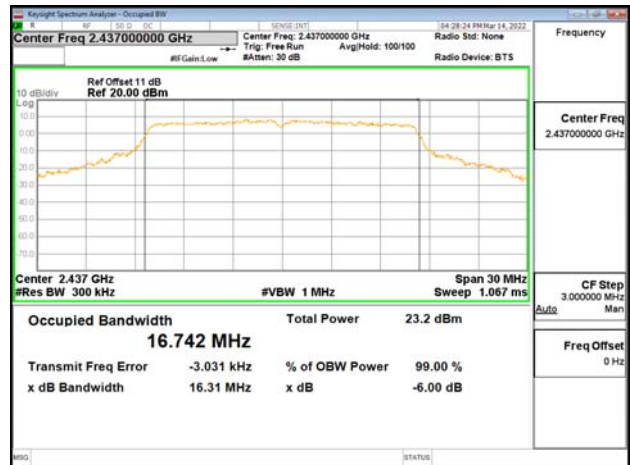
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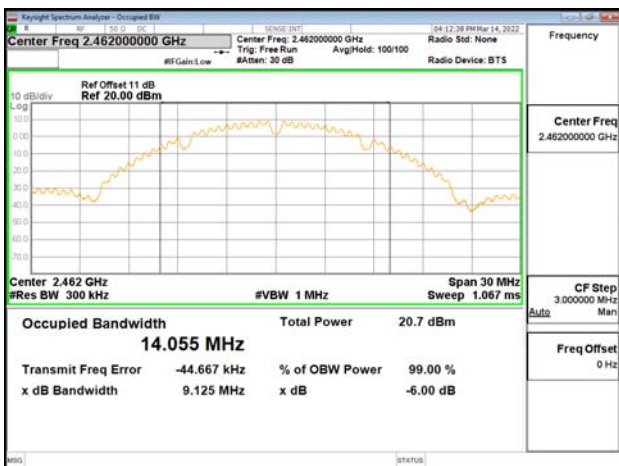
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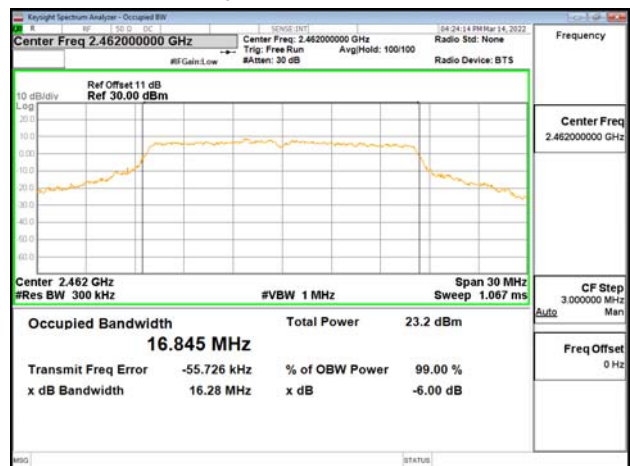
802.11g_20MHz_Chain0_2437MHz



802.11b_20MHz_Chain0_2462MHz



802.11g_20MHz_Chain0_2462MHz

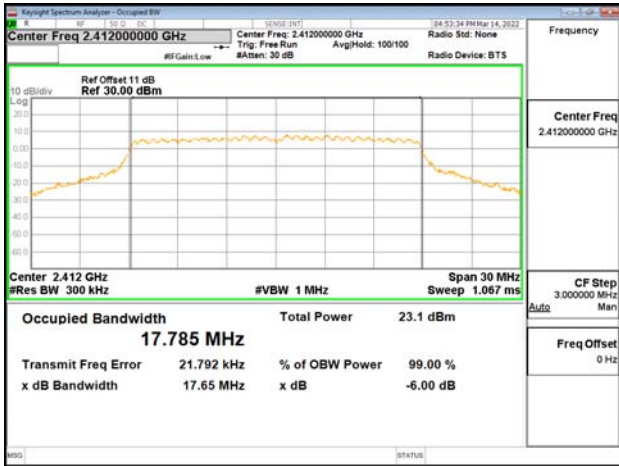


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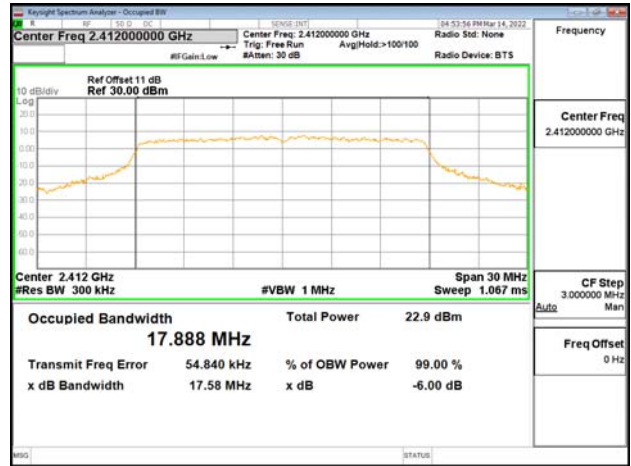
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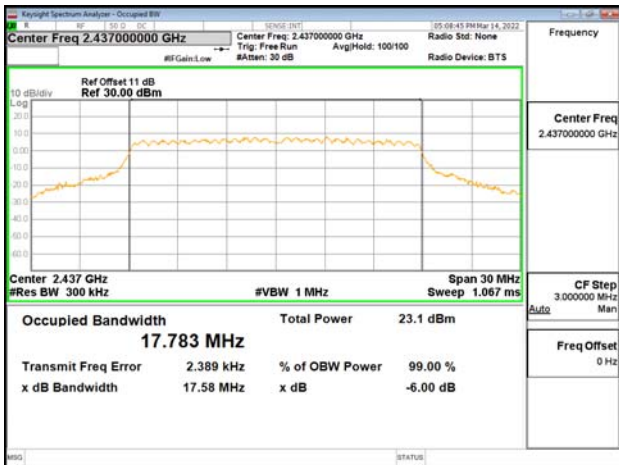
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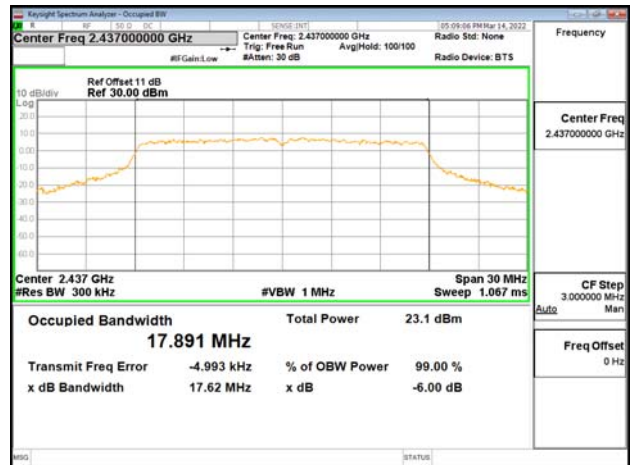
802.11n_20MHz_Chain1_2412MHz



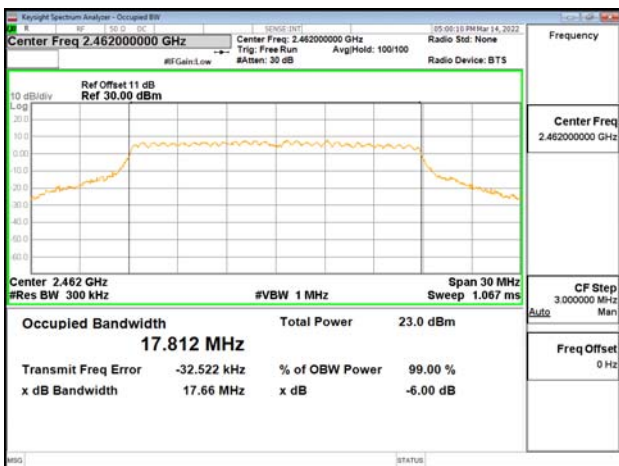
802.11n_20MHz_Chain0_2437MHz



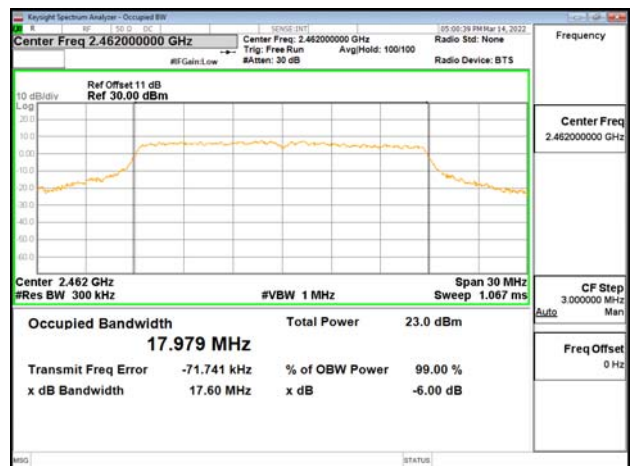
802.11n_20MHz_Chain1_2437MHz



802.11n_20MHz_Chain0_2462MHz



802.11n_20MHz_Chain1_2462MHz

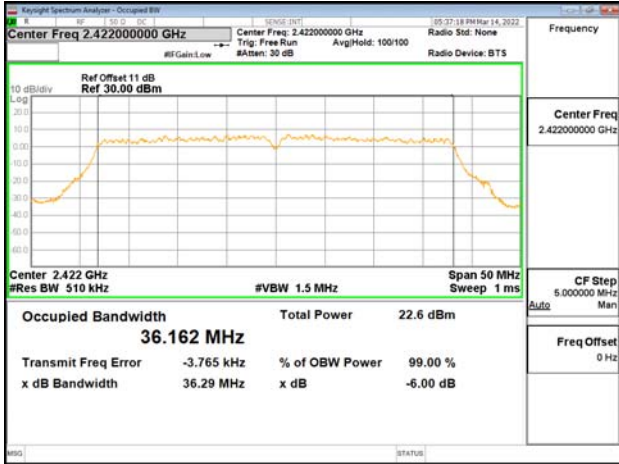


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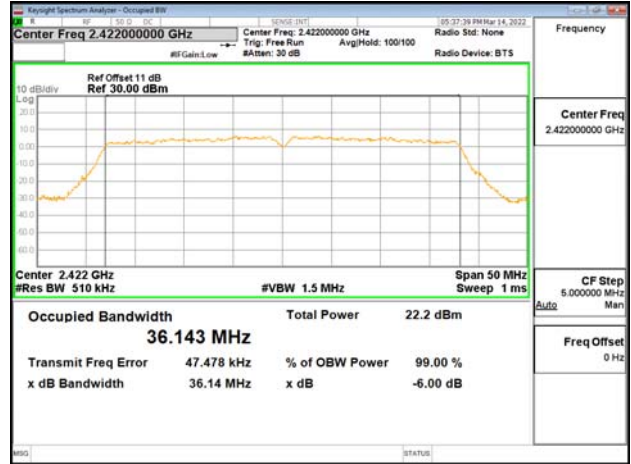
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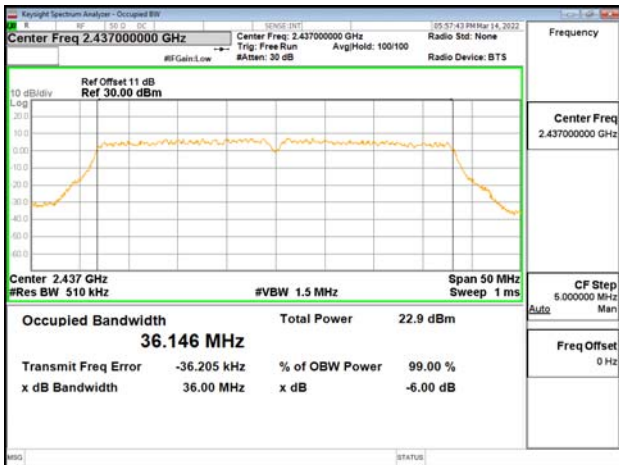
802.11n_40MHz_Chain0_2422MHz



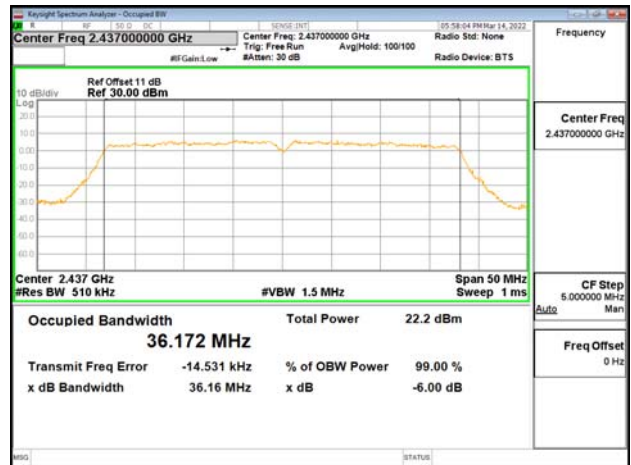
802.11n_40MHz_Chain1_2422MHz



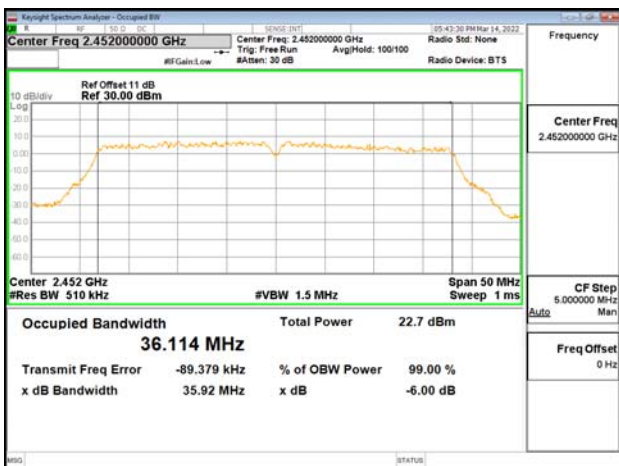
802.11n_40MHz_Chain0_2437MHz



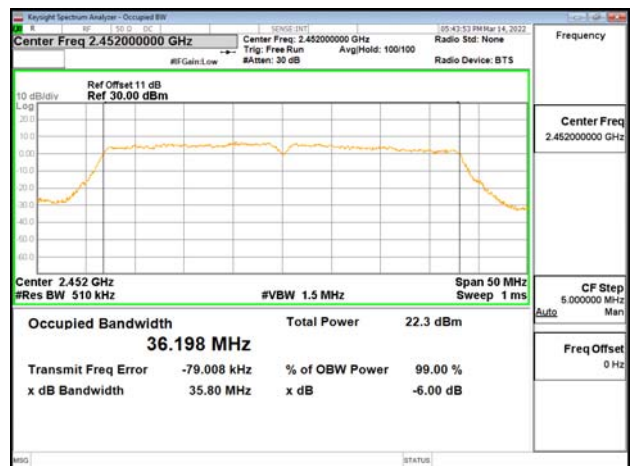
802.11n_40MHz_Chain1_2437MHz



802.11n_40MHz_Chain0_2452MHz



802.11n_40MHz_Chain1_2452MHz



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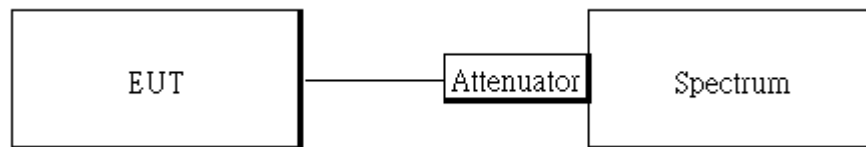
10 CONDUCTED BAND EDGES AND SPURIOUS EMISSION MEASUREMENT

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.

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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

802.11b Ch0			802.11g Ch0		
Reference Level of Limit			Reference Level of Limit 802.11g mode		
Freq. (MHz)	PSD (dBm)	Reference Level of Limit (dBm)	Freq. (MHz)	PSD (dBm)	Reference Level of Limit (dBm)
2412	8.76	-11.24	2412	7.23	-12.77
2437	8.85	-11.15	2437	7.02	-12.98
2462	8.94	-11.06	2462	6.77	-13.23

802.11nHT_20M Ch0			802.11nHT_20M Ch1		
Reference Level of Limit 802.11n20 MODE			Reference Level of Limit 802.11ac20 MODE		
Freq. (MHz)	PSD (dBm)	Reference Level of Limit (dBm)	Freq. (MHz)	PSD (dBm)	Reference Level of Limit (dBm)
2412	6.94	-13.06	2412	7.15	-12.85
2437	6.79	-13.21	2437	7.03	-12.97
2462	6.45	-13.55	2462	6.51	-13.49

802.11nHT_40M Ch0			802.11nHT_40M Ch1		
Reference Level of Limit 802.11n40 MODE			Reference Level of Limit 802.11ac40 MODE		
Freq. (MHz)	PSD (dBm)	Reference Level of Limit (dBm)	Freq. (MHz)	PSD (dBm)	Reference Level of Limit (dBm)
2422	2.05	-17.95	2422	2.36	-17.64
2437	2.64	-17.36	2437	2.16	-17.84
2452	2.54	-17.46	2452	2.8	-17.20

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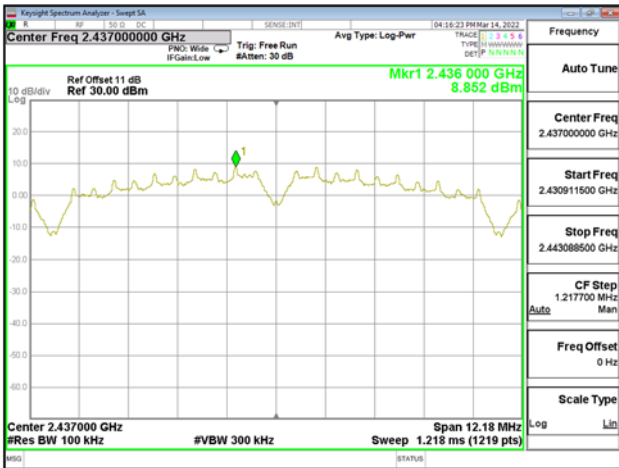
802.11b_20MHz_Chain0_2412MHz



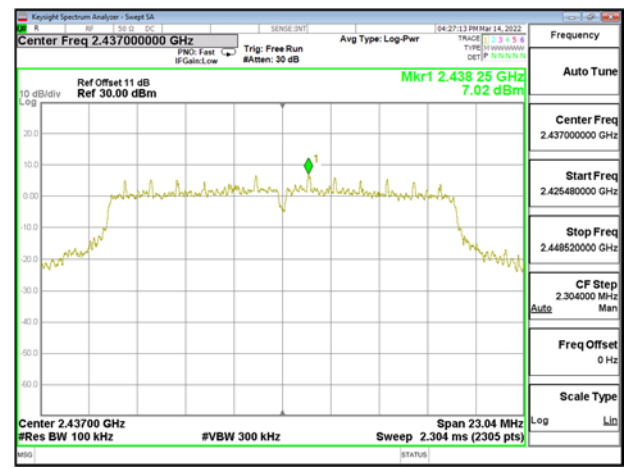
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802.11b_20MHz_Chain0_2437MHz



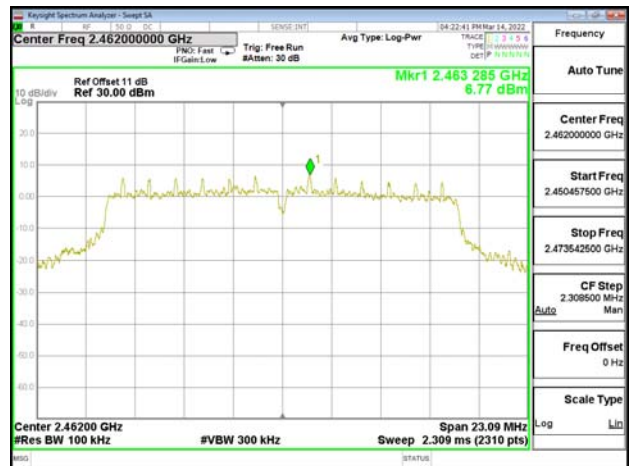
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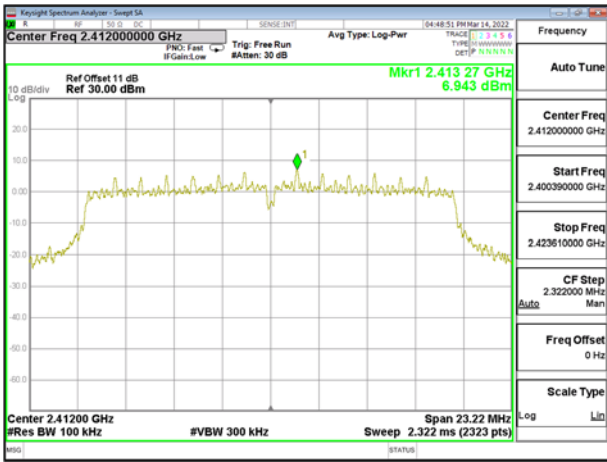


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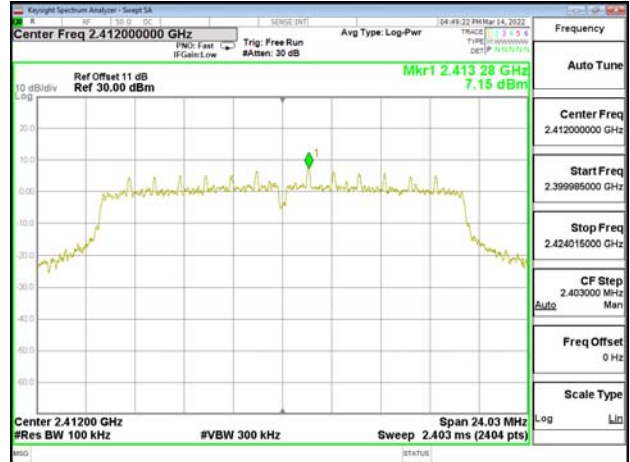
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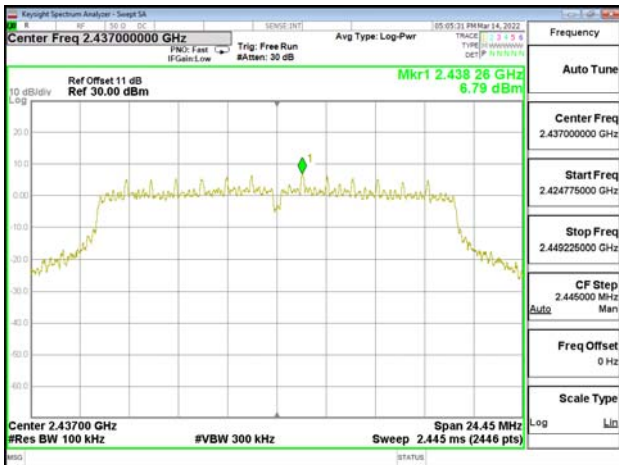
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802.11n_20MHz_Chain1_2412MHz



802.11n_20MHz_Chain0_2437MHz



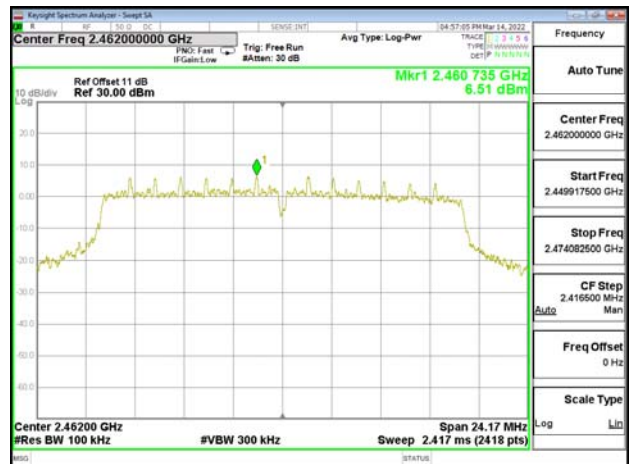
802.11n_20MHz_Chain1_2437MHz



802.11n_20MHz_Chain0_2462MHz



802.11n_20MHz_Chain1_2462MHz



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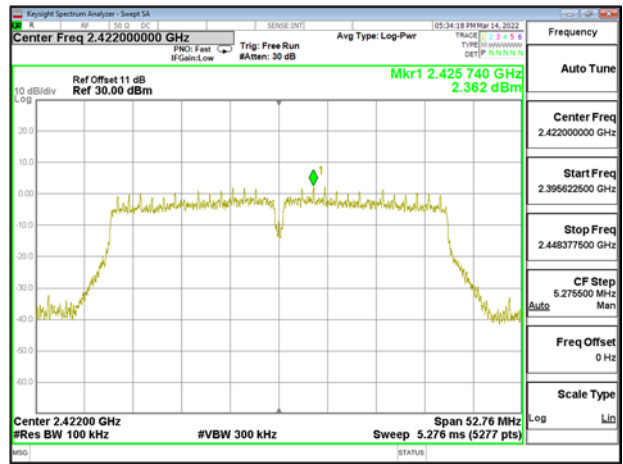
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802.11n_40MHz_Chain0_2422MHz



802.11n_40MHz_Chain1_2422MHz



802.11n_40MHz_Chain0_2437MHz



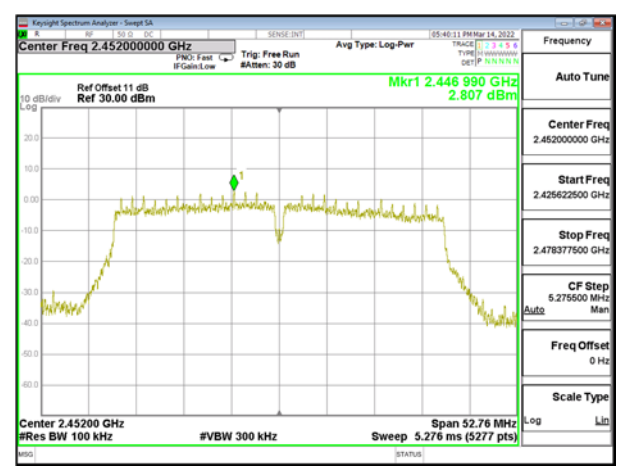
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802.11n_40MHz_Chain0_2452MHz



802.11n_40MHz_Chain1_2452MHz

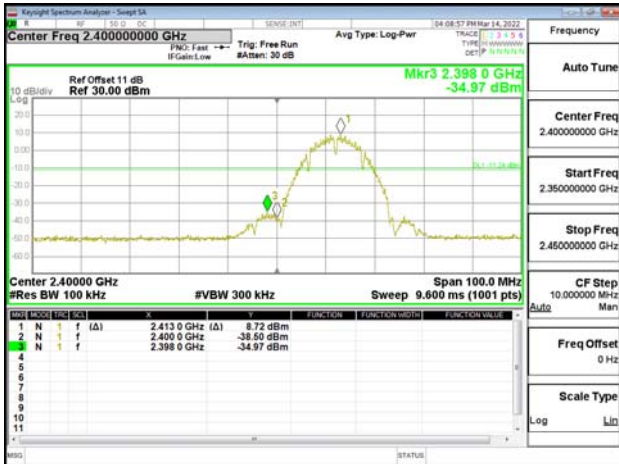


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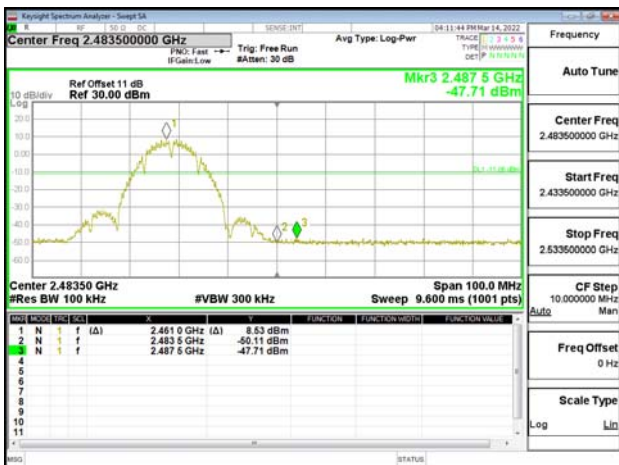
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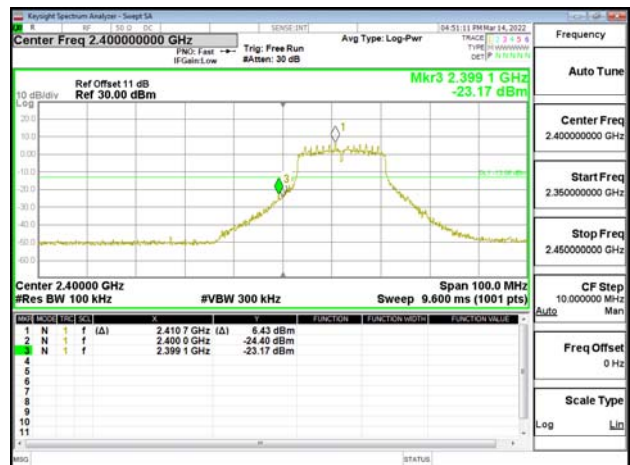
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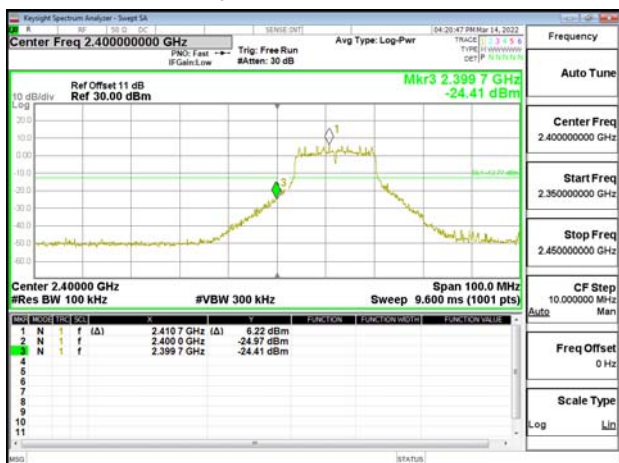
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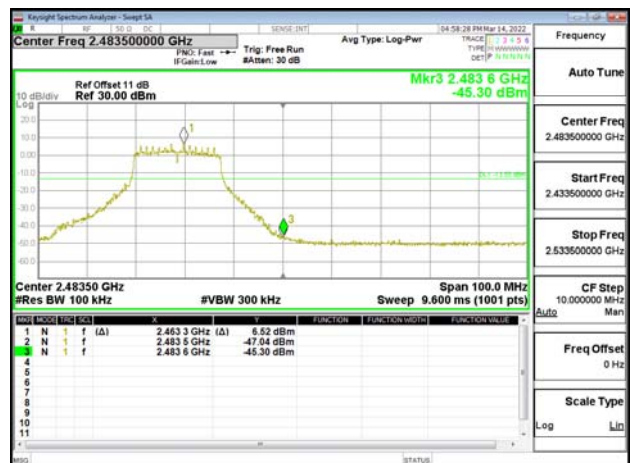
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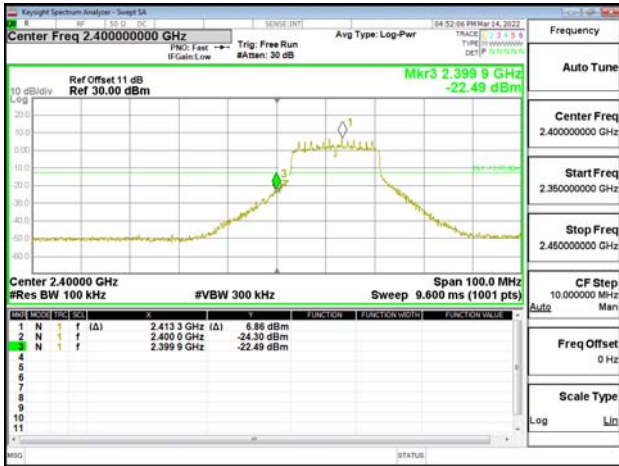


802.11n_20MHz_Chain0_2462MHz



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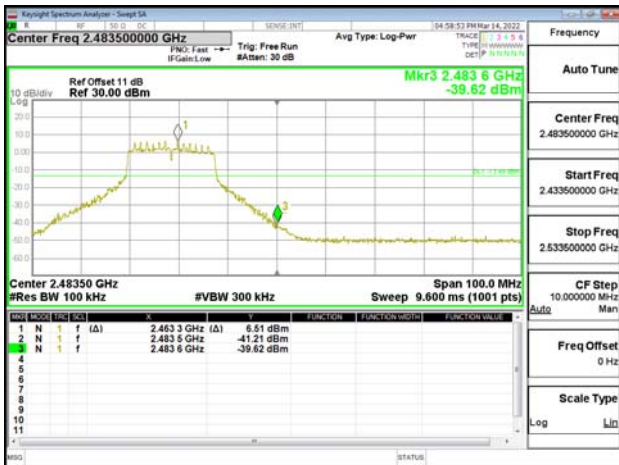
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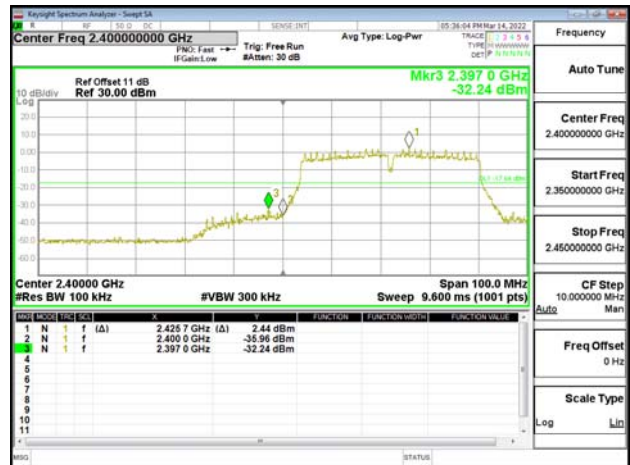
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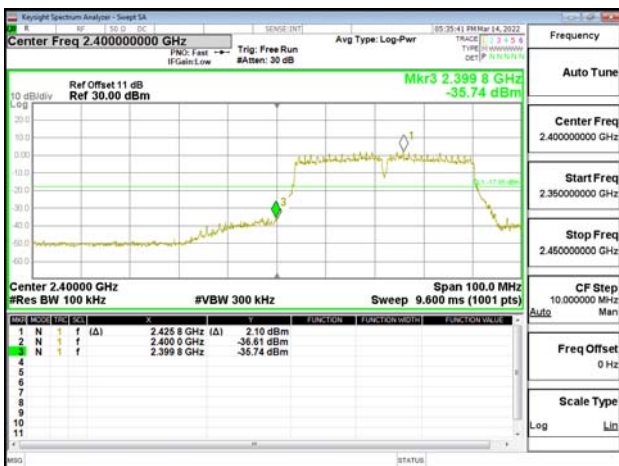
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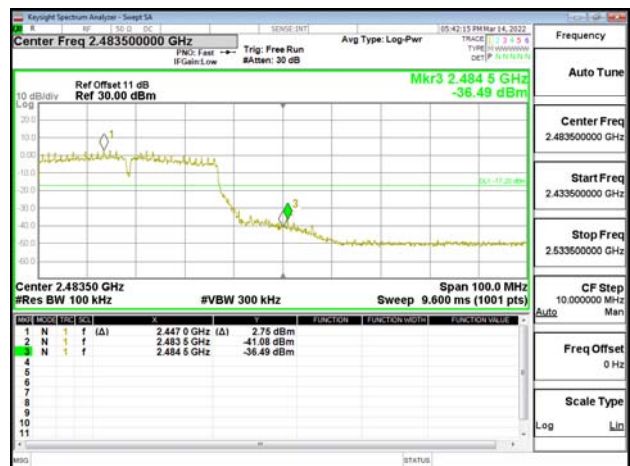
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802.11n_40MHz_Chain0_2422MHz



802.11n_40MHz_Chain1_2452MHz

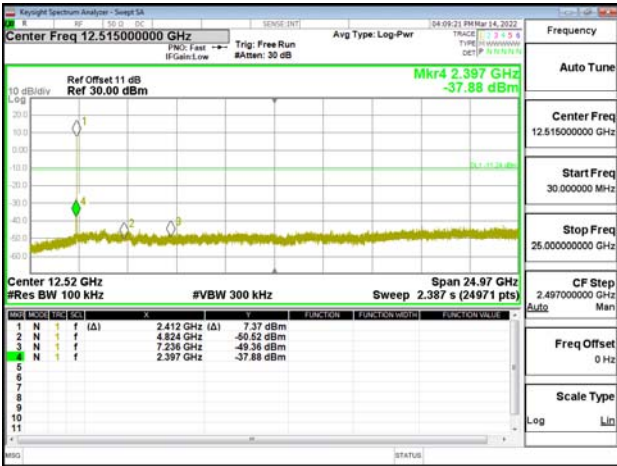


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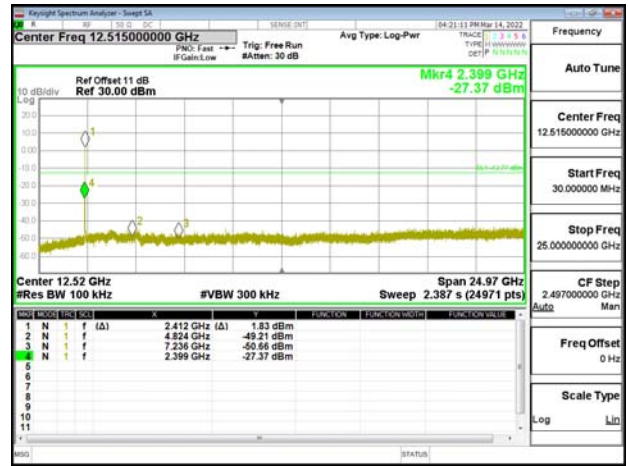
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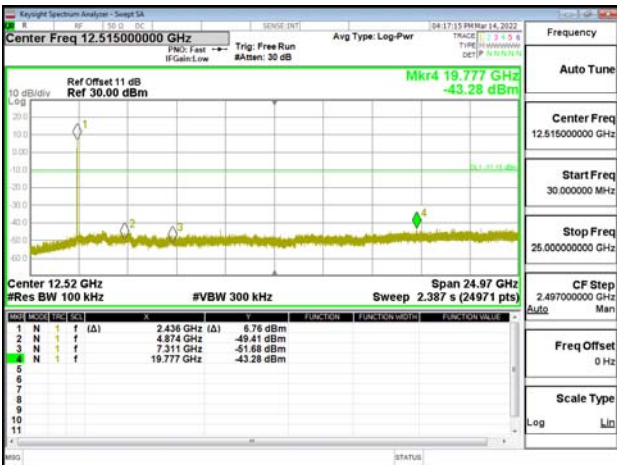
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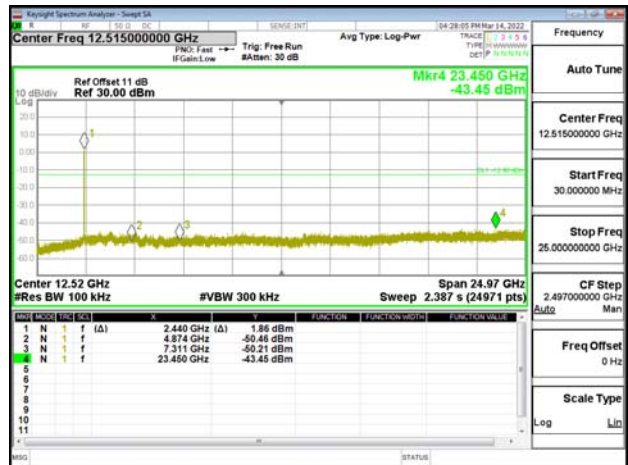
802.11g_20MHz_Chain0_2412MHz



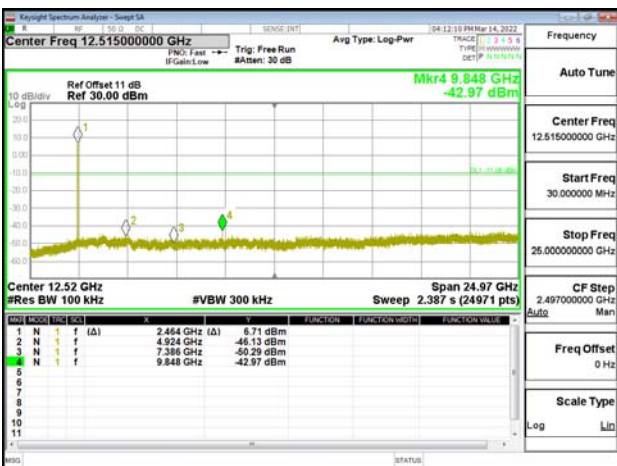
802.11b_20MHz_Chain0_2437MHz



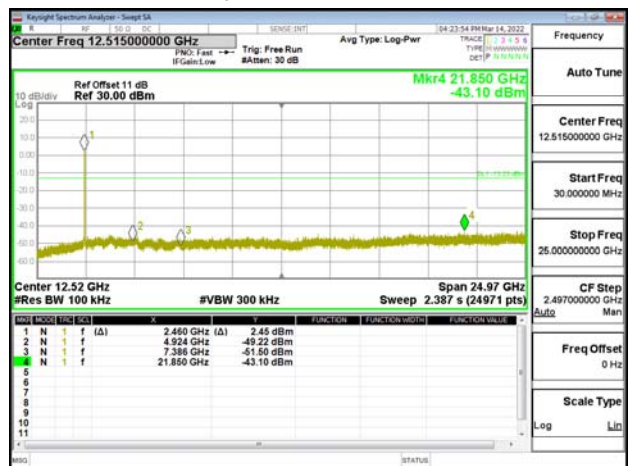
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802.11b_20MHz_Chain0_2462MHz

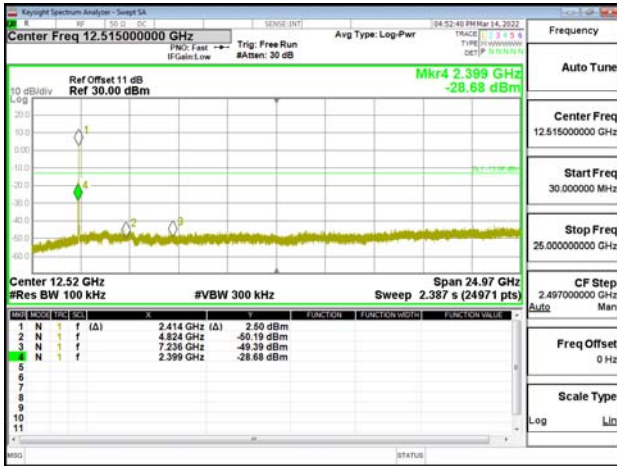


802.11g_20MHz_Chain0_2462MHz

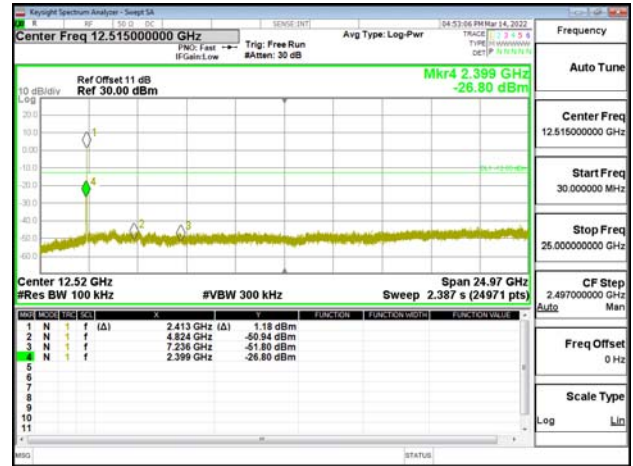


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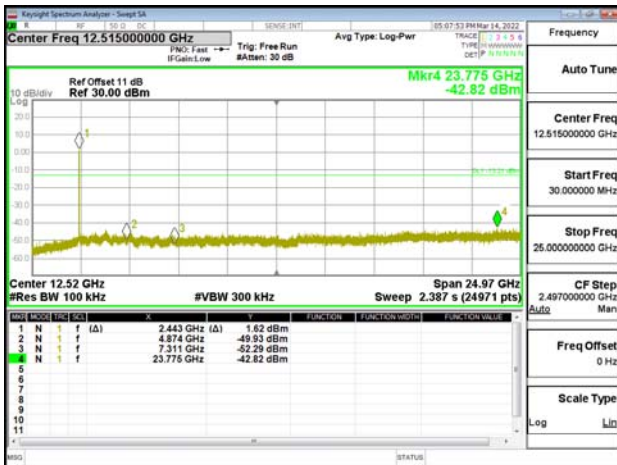
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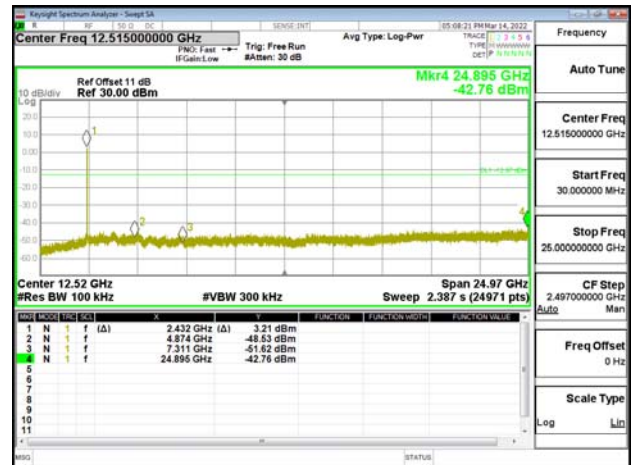
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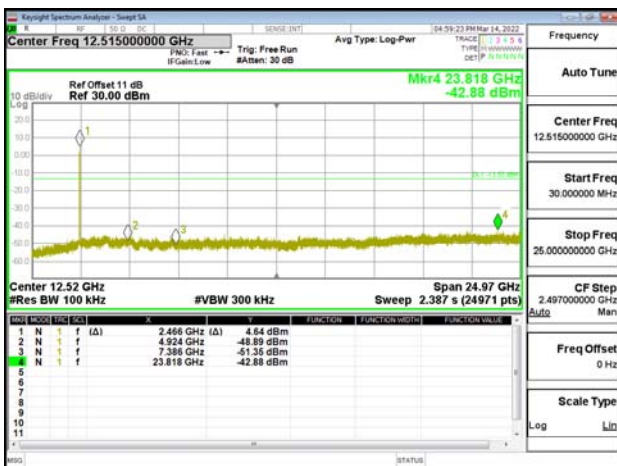
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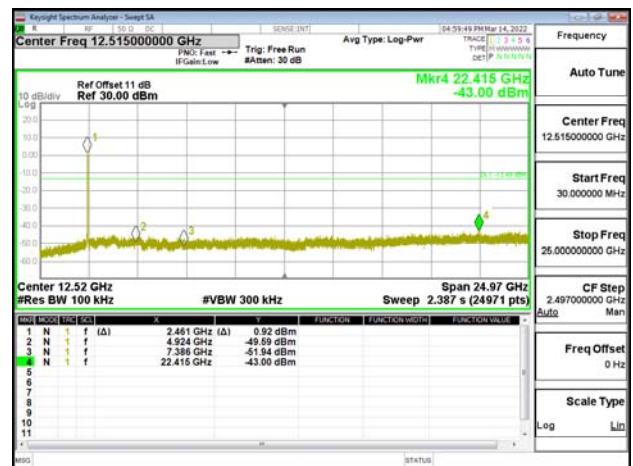
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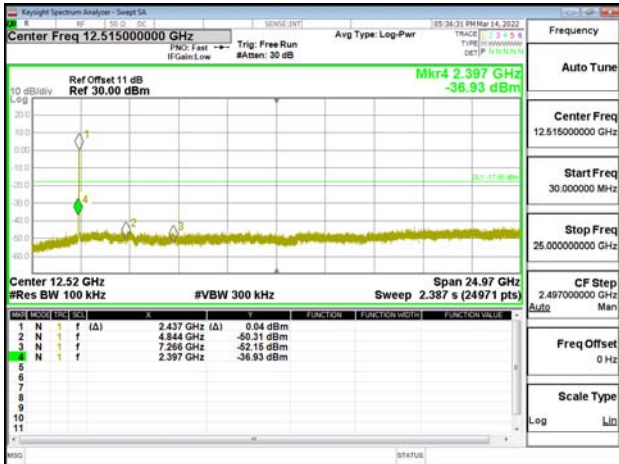


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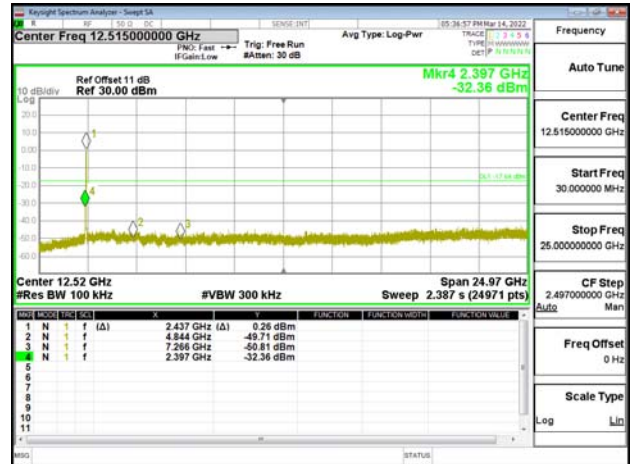


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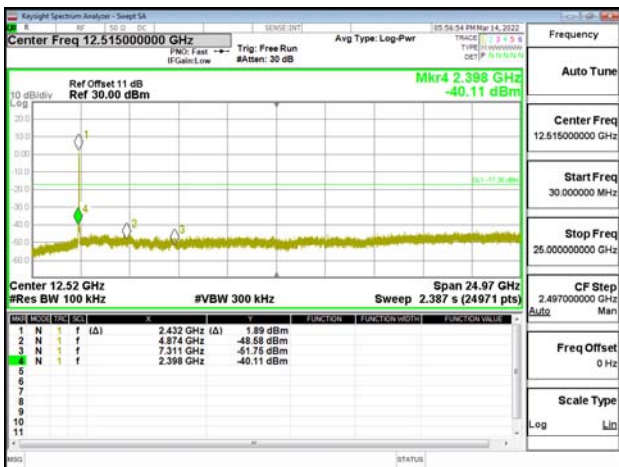
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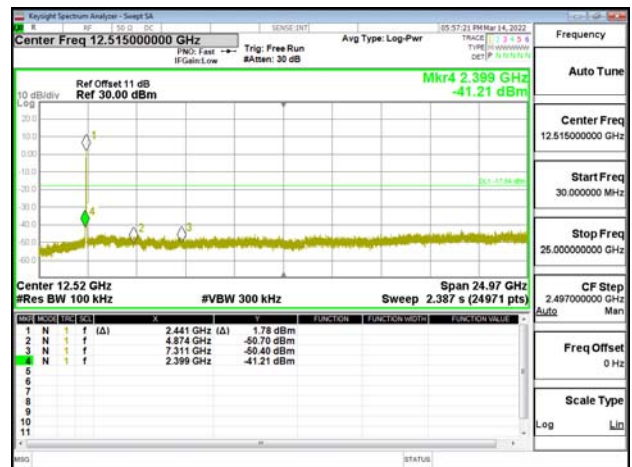
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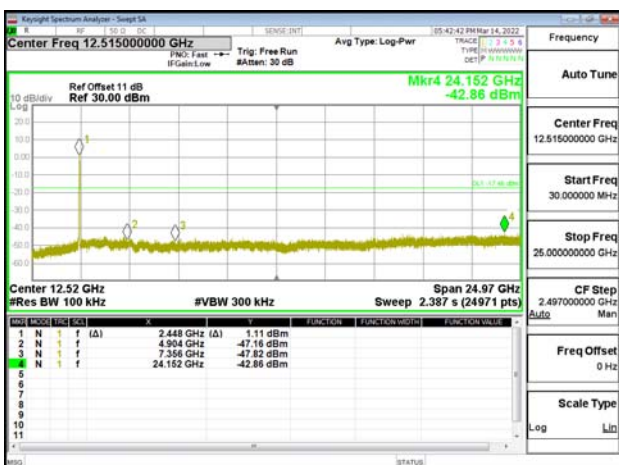
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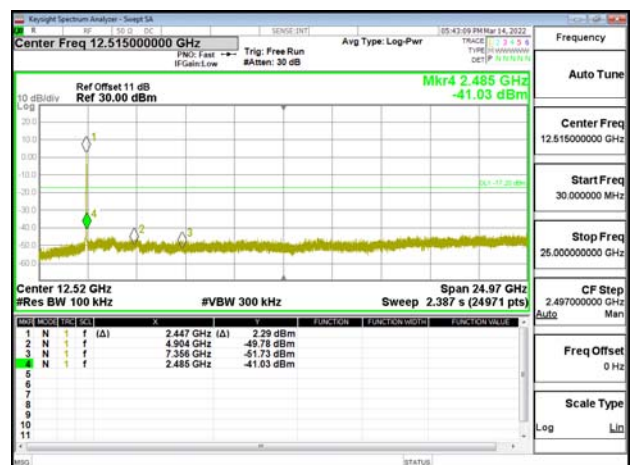
802.11n_40MHz_Chain1_2437MHz



802.11n_40MHz_Chain0_2452MHz



802.11n_40MHz_Chain1_2452MHz



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11 RADIATED BANDEDGE AND SPURIOUS EMISSION MEASUREMENT

11.1 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 must also comply with the §15.209 and RSS-Gen §8.9 Table 5 and 6 limit as below.

And according to §15.33(a) (1) & RSS-Gen §6.13.2.a, for an intentional radiator operates below 10GHz, the frequency range of measurements: to the tenth harmonic of the highest fundamental frequency or to 40GHz, whichever is lower.

Frequency (MHz)	Field strength (microvolts/meter)	Distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Note:

1. The lower limit shall apply at the transition frequencies.

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

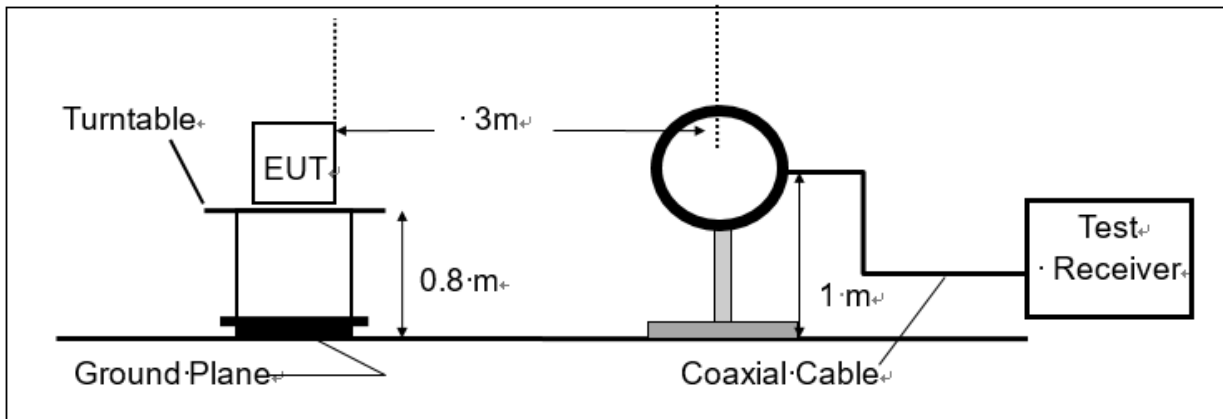
11.2 Test Setup

(A) Radiated Emission Test Set-Up, Frequency Below 30MHz.

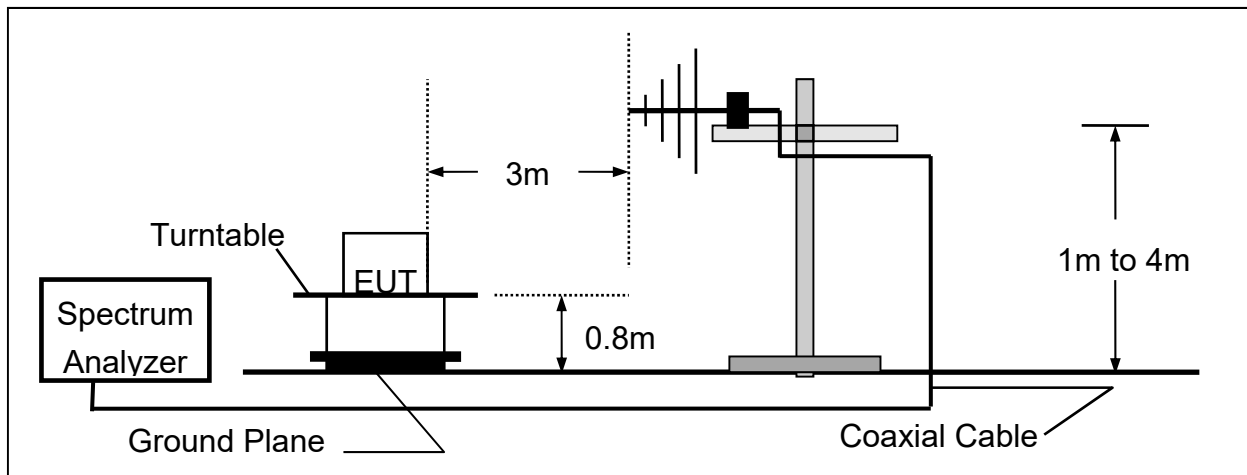
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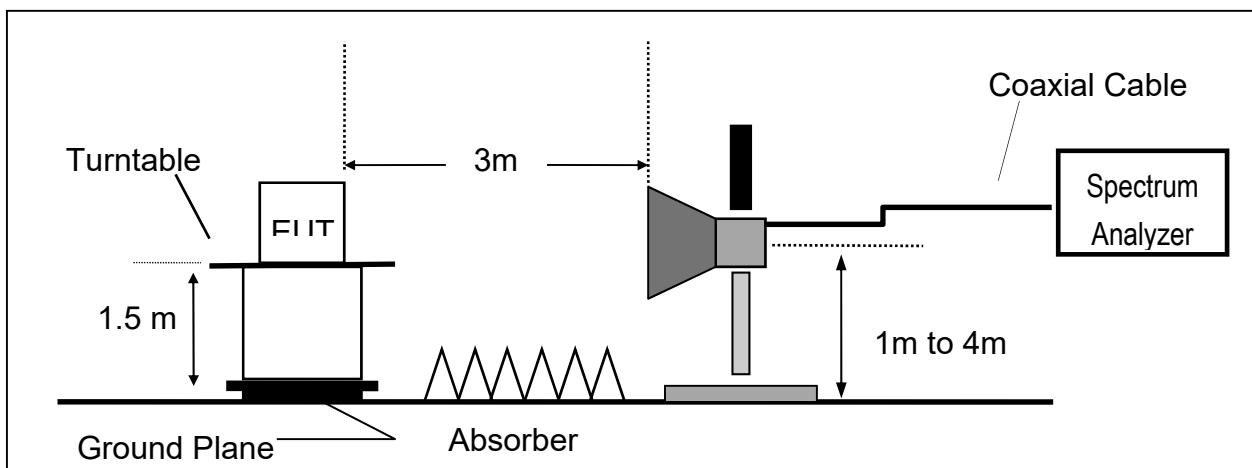
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(B) Radiated Emission Test Set-Up, Frequency From 30MHz to 1000MHz



(C) Radiated Emission Test Set-Up, Frequency Above 1GHz



11.3 Measurement Procedure

1. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance .

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2. The EUT was placed on a turn table with 0.8m for frequency < 1GHz and 1.5m for frequency > 1GHz above ground plane.
3. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
4. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
5. Set the spectrum analyzer as RBW=100 kHz and VBW=300 kHz for Peak Detector (PK) at frequency between 30MHz and 1 GHz.
6. Use receiver mode as RBW=120 kHz for Quasi-peak (QP) at frequency between 30MHz and 1 GHz.
7. Set the spectrum analyzer as RBW=1 MHz, VBW=3 MHz for Maximum Emission Measurements at frequency above 1 GHz.
8. Set the spectrum analyzer as RBW=1 MHz, VBW=10 Hz (Duty cycle > 98%) or VBW ≥ 1/T (Duty cycle < 98%) for Average Emission Measurements at frequency above 1 GHz.
9. When 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.
10. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
11. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
12. Repeat above procedures until all default test channel measured were complete.

11.4 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

Where *FS = Field Strength*

CL = Cable Attenuation Factor (Cable Loss)

RA = Reading Amplitude

AG = Amplifier Gain

AF = Antenna Factor

*The limit of the emission level is expressed in dBuV/m, which converts 20*log(uV/m)*

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

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11.5 Test Results of Radiated Spurious Emissions from 9 kHz to 30 MHz

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit per 15.31(o) & RSS-GEN §6.13.2 was not reported.

11.6 Measurement Result

Note:

1. *Refer to next page spectrum analyzer data chart and tabular data sheets.*
2. *Measurements are completed at peak and average level, the mark of average is the highest emission in restricted bands*

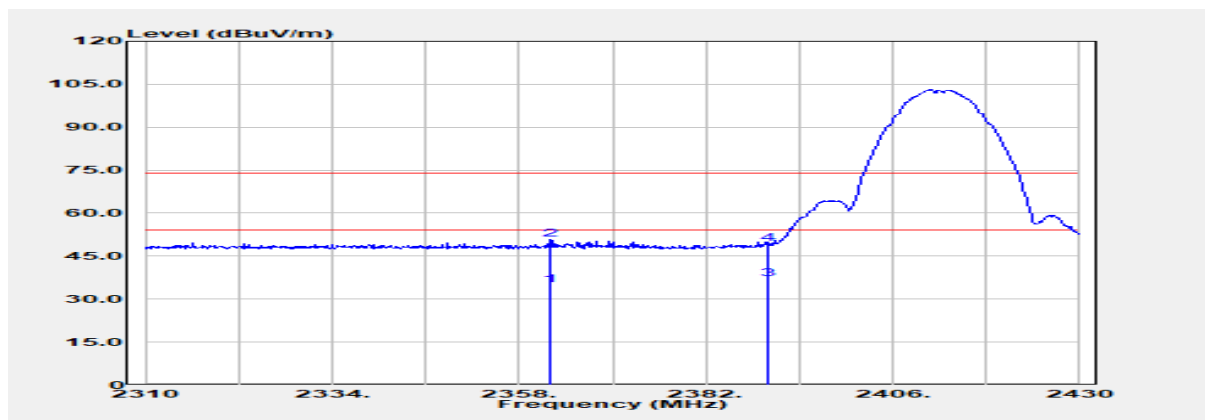
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11.6.1 Radiated Band Edge Measurement Result

Report Number	:E2/2022/20119	Test Site	:SAC D
Operation Mode	:802.11b	Test Date	:2022-03-15
Test Frequency	:2412 MHz	Temp./Humi.	:22.1/63
Test Mode	:BE CH LOW	Antenna Pol.	:Vertical
EUT Pol	:E2 Plane	Engineer	:Andy Wang
Ant	:CHAIN 0		



Freq. MHz	Detector Mode	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
2362.080	Average	40.52	-5.58	34.93	54.00	-19.07
2362.080	Peak	56.49	-5.58	50.91	74.00	-23.09
2390.000	Average	42.55	-5.69	36.86	54.00	-17.14
2390.000	Peak	55.03	-5.69	49.34	74.00	-24.66

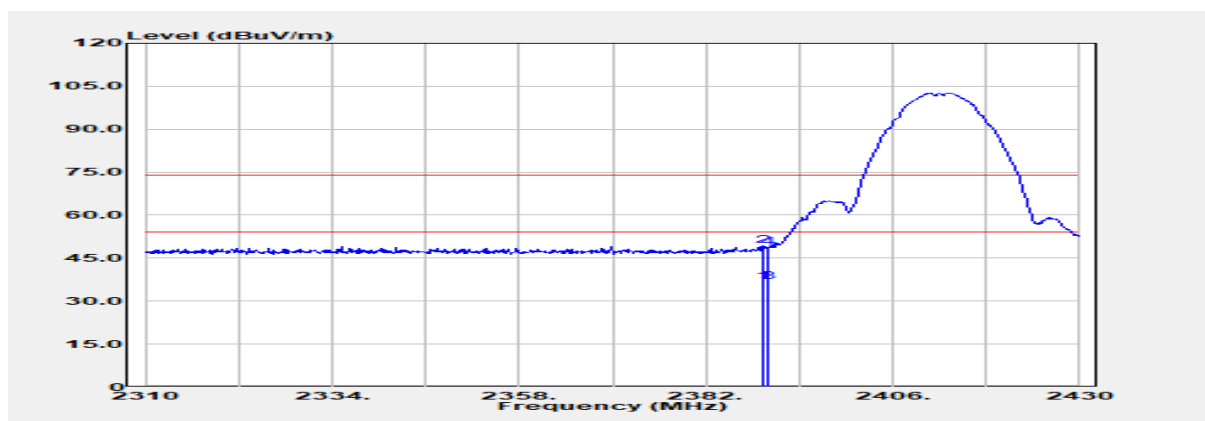
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Report Number :E2/2022/20119
Operation Mode :802.11b
Test Frequency :2412 MHz
Test Mode :BE CH LOW
EUT Pol :E2 Plane
Ant :CHAIN 0

Test Site :SAC D
Test Date :2022-03-15
Temp./Humi. :22.1/63
Antenna Pol. :Horizontal
Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
2389.440	Average	42.27	-5.69	36.58	54.00	-17.42
2389.440	Peak	54.94	-5.69	49.26	74.00	-24.74
2390.000	Average	42.51	-5.69	36.81	54.00	-17.19
2390.000	Peak	54.32	-5.69	48.63	74.00	-25.37

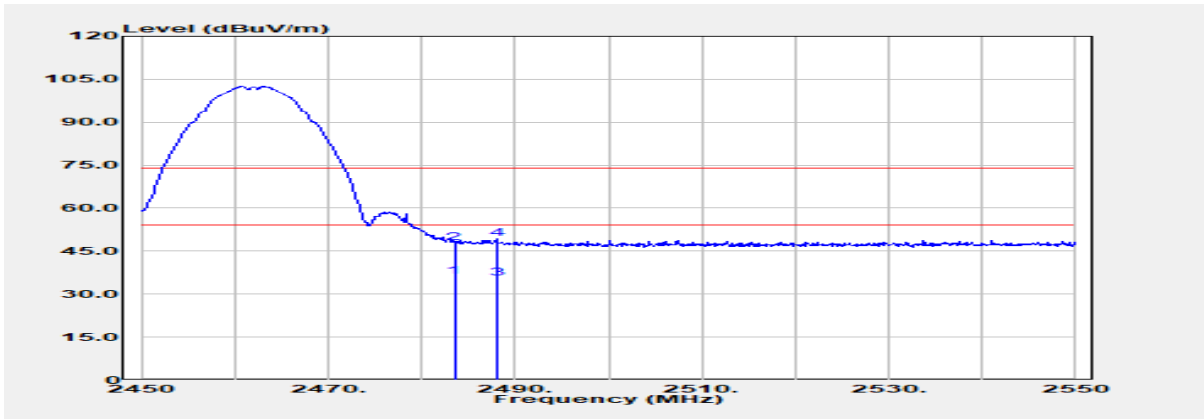
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Report Number :E2/2022/20119
Operation Mode :802.11b
Test Frequency :2462 MHz
Test Mode :BE CH HIGH
EUT Pol :E2 Plane
Ant :CHAIN 0

Test Site :SAC D
Test Date :2022-03-15
Temp./Humi. :22.1/63
Antenna Pol. :Vertical
Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
2483.500	Average	42.01	-5.94	36.07	54.00	-17.93
2483.500	Peak	53.83	-5.94	47.89	74.00	-26.11
2488.000	Average	41.56	-5.95	35.61	54.00	-18.39
2488.000	Peak	55.42	-5.95	49.47	74.00	-24.53

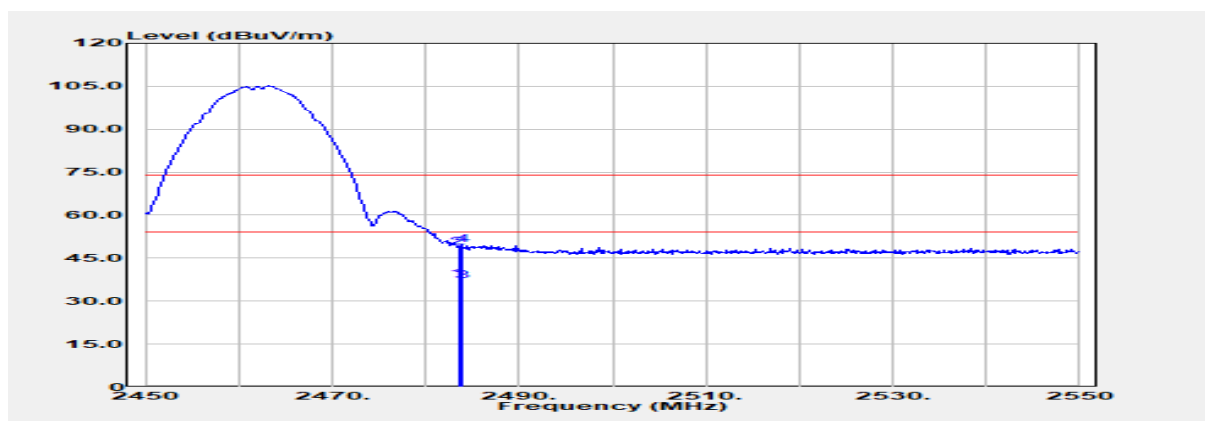
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Report Number :E2/2022/20119
Operation Mode :802.11b
Test Frequency :2462 MHz
Test Mode :BE CH HIGH
EUT Pol :E2 Plane
Ant :CHAIN 0

Test Site :SAC D
Test Date :2022-03-15
Temp./Humi. :22.1/63
Antenna Pol. :Horizontal
Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
2483.500	Average	43.41	-5.94	37.47	54.00	-16.53
2483.500	Peak	54.60	-5.94	48.66	74.00	-25.34
2483.900	Average	42.93	-5.94	36.99	54.00	-17.01
2483.900	Peak	55.65	-5.94	49.71	74.00	-24.29

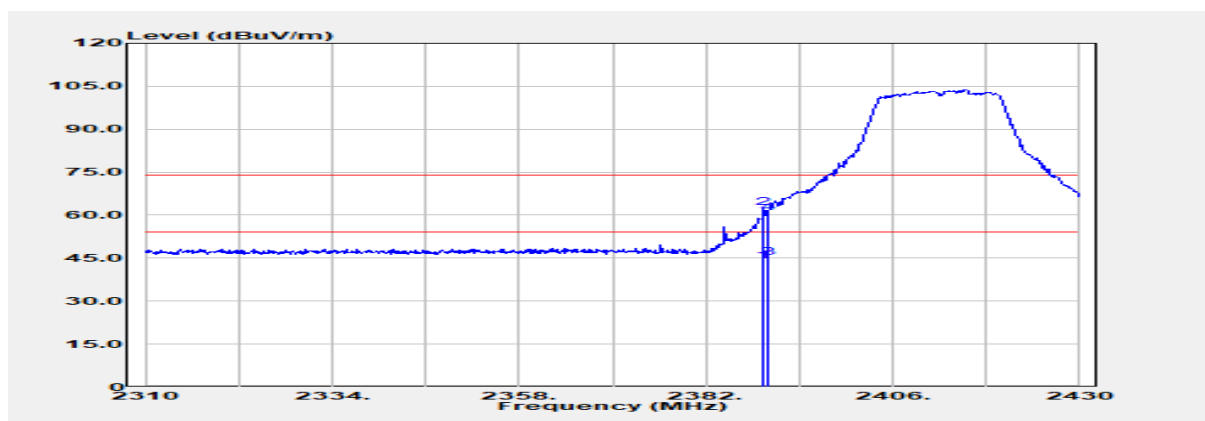
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Report Number :E2/2022/20119
Operation Mode :802.11g
Test Frequency :2412 MHz
Test Mode :BE CH LOW
EUT Pol :E2 Plane
Ant :CHAIN 0

Test Site :SAC D
Test Date :2022-03-15
Temp./Humi. :22.1/63
Antenna Pol. :Vertical
Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
2389.440	Average	49.71	-5.69	44.02	54.00	-9.98
2389.440	Peak	68.13	-5.69	62.44	74.00	-11.56
2390.000	Average	50.67	-5.69	44.97	54.00	-9.03
2390.000	Peak	66.52	-5.69	60.83	74.00	-13.17

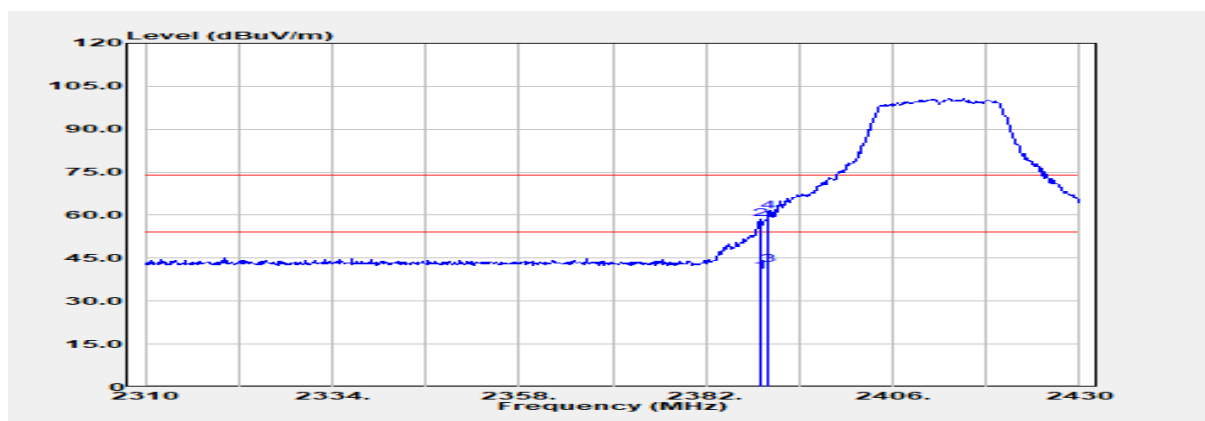
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Report Number :E2/2022/20119
Operation Mode :802.11g
Test Frequency :2412 MHz
Test Mode :BE CH LOW
EUT Pol :E2 Plane
Ant :CHAIN 0

Test Site :SAC D
Test Date :2022-03-15
Temp./Humi. :22.1/63
Antenna Pol. :Horizontal
Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
2388.960	Average	50.04	-9.79	40.25	54.00	-13.75
2388.960	Peak	68.49	-9.79	58.70	74.00	-15.30
2390.000	Average	52.55	-9.80	42.75	54.00	-11.25
2390.000	Peak	71.00	-9.80	61.20	74.00	-12.80

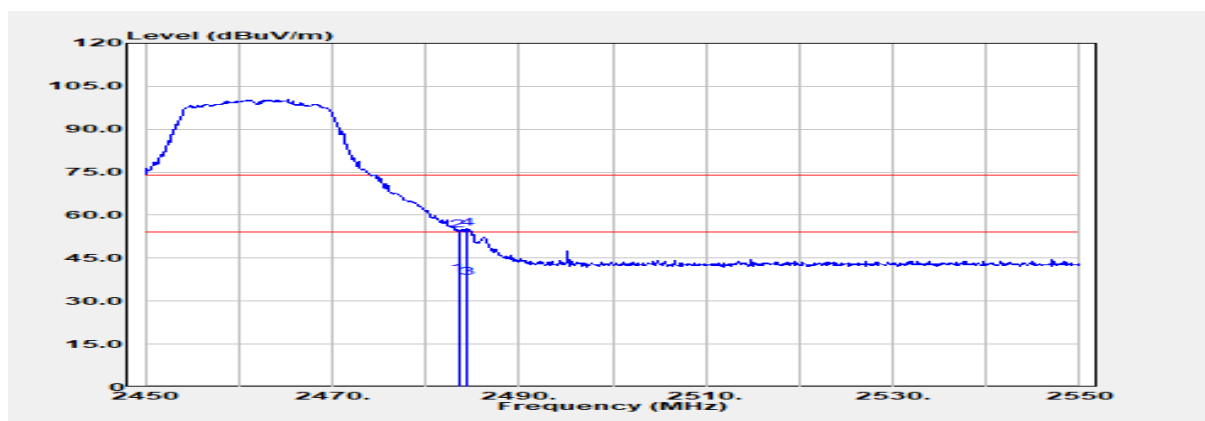
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Report Number :E2/2022/20119
 Operation Mode :802.11g
 Test Frequency :2462 MHz
 Test Mode :BE CH HIGH
 EUT Pol :E2 Plane
 Ant :CHAIN 0

Test Site :SAC D
 Test Date :2022-03-15
 Temp./Humi. :22.1/63
 Antenna Pol. :Vertical
 Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
2483.500	Average	49.72	-10.17	39.55	54.00	-14.45
2483.500	Peak	64.78	-10.17	54.61	74.00	-19.39
2484.300	Average	48.30	-10.17	38.13	54.00	-15.87
2484.300	Peak	65.39	-10.17	55.22	74.00	-18.78

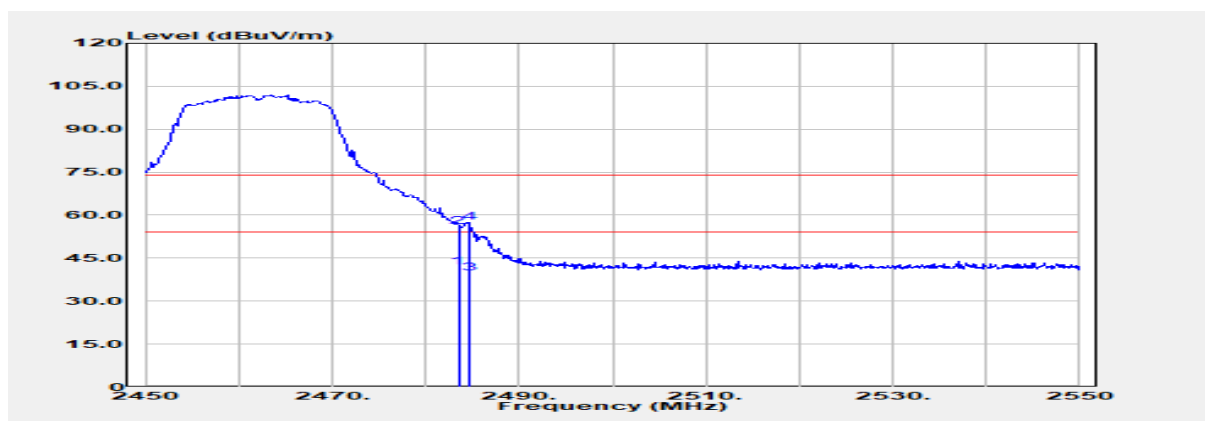
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Report Number :E2/2022/20119
Operation Mode :802.11g
Test Frequency :2462 MHz
Test Mode :BE CH HIGH
EUT Pol :E2 Plane
Ant :CHAIN 0

Test Site :SAC D
Test Date :2022-03-15
Temp./Humi. :22.1/63
Antenna Pol. :Horizontal
Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
2483.500	Average	52.04	-10.17	41.87	54.00	-12.13
2483.500	Peak	66.23	-10.17	56.06	74.00	-17.94
2484.600	Average	49.81	-10.17	39.63	54.00	-14.37
2484.600	Peak	67.62	-10.17	57.45	74.00	-16.55

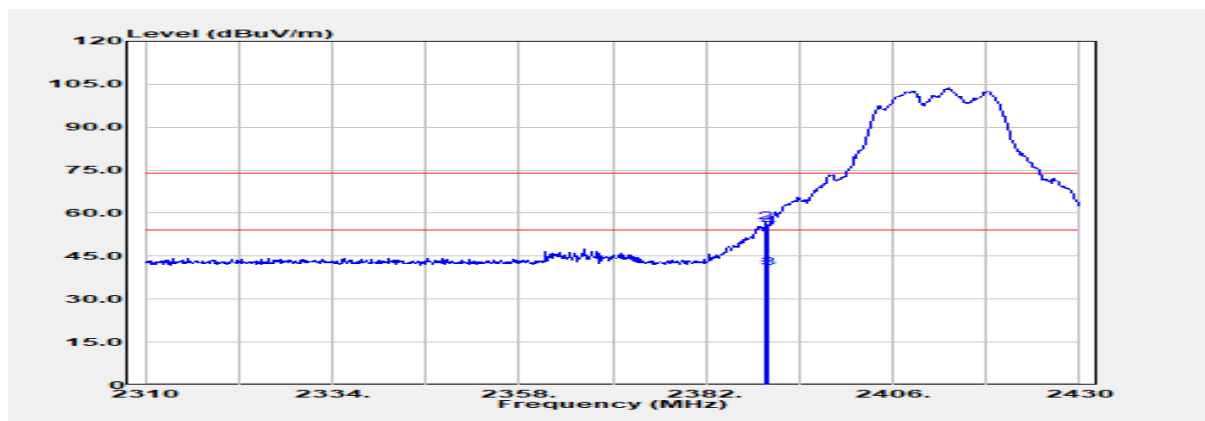
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Report Number :E2/2022/20119
Operation Mode :802.11n20
Test Frequency :2412 MHz
Test Mode :BE CH LOW
EUT Pol :E2 Plane
Ant :MIMO

Test Site :SAC D
Test Date :2022-03-15
Temp./Humi. :22.1/63
Antenna Pol. :Vertical
Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
2389.800	Average	50.18	-9.80	40.38	54.00	-13.62
2389.800	Peak	66.60	-9.80	56.81	74.00	-17.19
2390.000	Average	50.78	-9.80	40.99	54.00	-13.01
2390.000	Peak	65.21	-9.80	55.42	74.00	-18.58

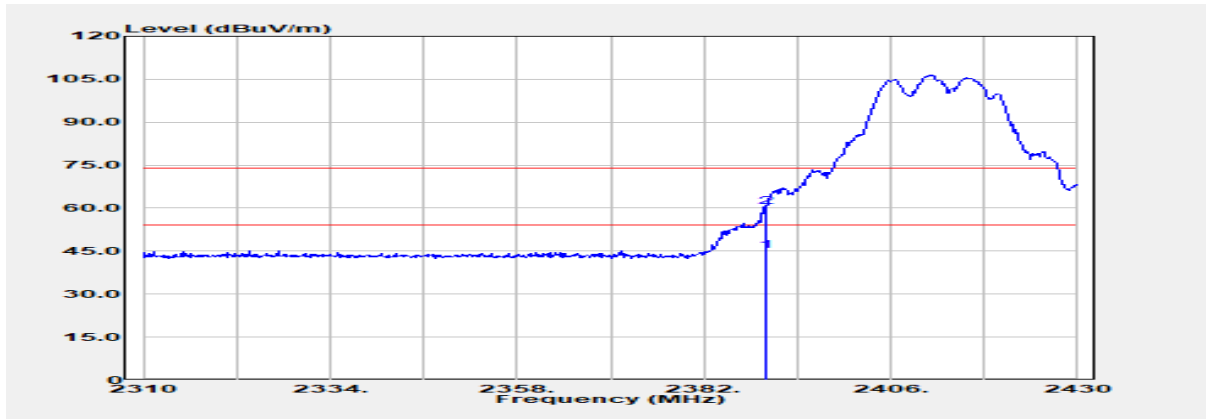
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Report Number :E2/2022/20119
Operation Mode :802.11n20
Test Frequency :2412 MHz
Test Mode :BE CH LOW
EUT Pol :E2 Plane
Ant :MIMO

Test Site :SAC D
Test Date :2022-03-15
Temp./Humi. :22.1/63
Antenna Pol. :Horizontal
Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
2390.000	Average	54.95	-9.80	45.15	54.00	-8.85
2390.000	Peak	70.34	-9.80	60.54	74.00	-13.46

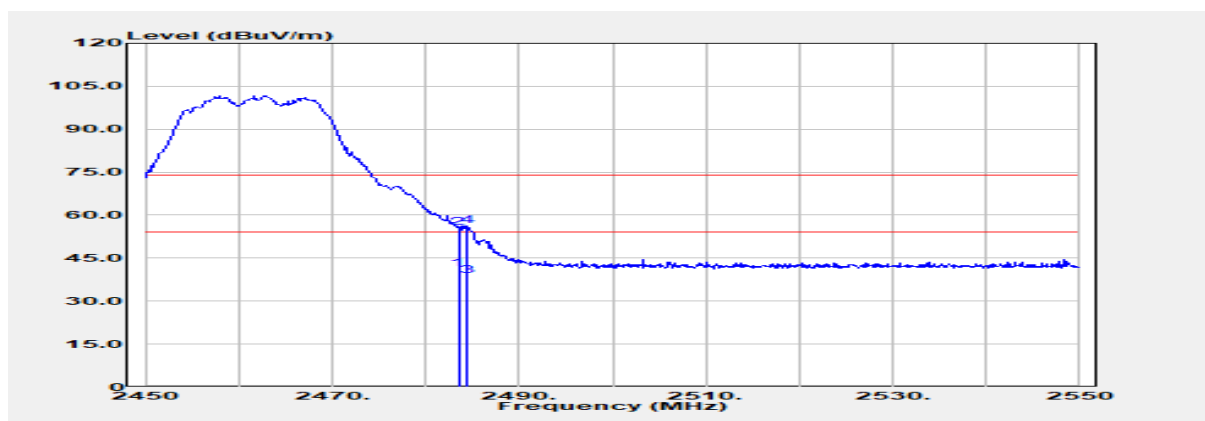
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Report Number :E2/2022/20119
Operation Mode :802.11n20
Test Frequency :2462 MHz
Test Mode :BE CH HIGH
EUT Pol :E2 Plane
Ant :MIMO

Test Site :SAC D
Test Date :2022-03-15
Temp./Humi. :22.1/63
Antenna Pol. :Vertical
Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
2483.500	Average	51.51	-10.17	41.33	54.00	-12.67
2483.500	Peak	65.92	-10.17	55.75	74.00	-18.25
2484.500	Average	49.06	-10.17	38.89	54.00	-15.11
2484.500	Peak	66.54	-10.17	56.36	74.00	-17.64

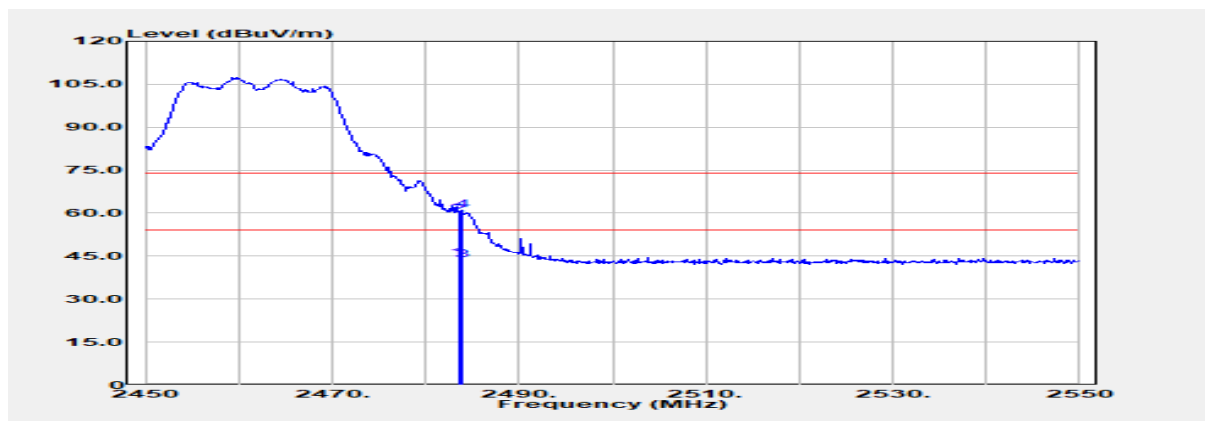
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Report Number :E2/2022/20119
 Operation Mode :802.11n20
 Test Frequency :2462 MHz
 Test Mode :BE CH HIGH
 EUT Pol :E2 Plane
 Ant :MIMO

Test Site :SAC D
 Test Date :2022-03-15
 Temp./Humi. :22.1/63
 Antenna Pol. :Horizontal
 Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
2483.500	Average	54.33	-10.17	44.16	54.00	-9.84
2483.500	Peak	69.86	-10.17	59.69	74.00	-14.31
2483.800	Average	53.64	-10.17	43.46	54.00	-10.54
2483.800	Peak	71.18	-10.17	61.00	74.00	-13.00

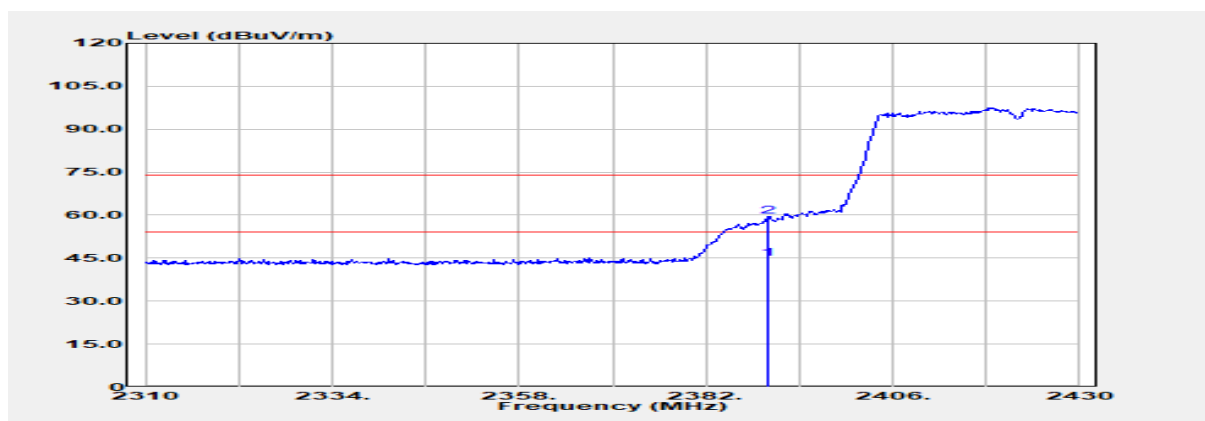
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Report Number :E2/2022/20119
Operation Mode :802.11n40
Test Frequency :2422 MHz
Test Mode :BE CH LOW
EUT Pol :E2 Plane
Ant :MIMO

Test Site :SAC D
Test Date :2022-03-15
Temp./Humi. :22.1/63
Antenna Pol. :Vertical
Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
2390.000	Average	54.73	-9.80	44.94	54.00	-9.06
2390.000	Peak	69.24	-9.80	59.44	74.00	-14.56

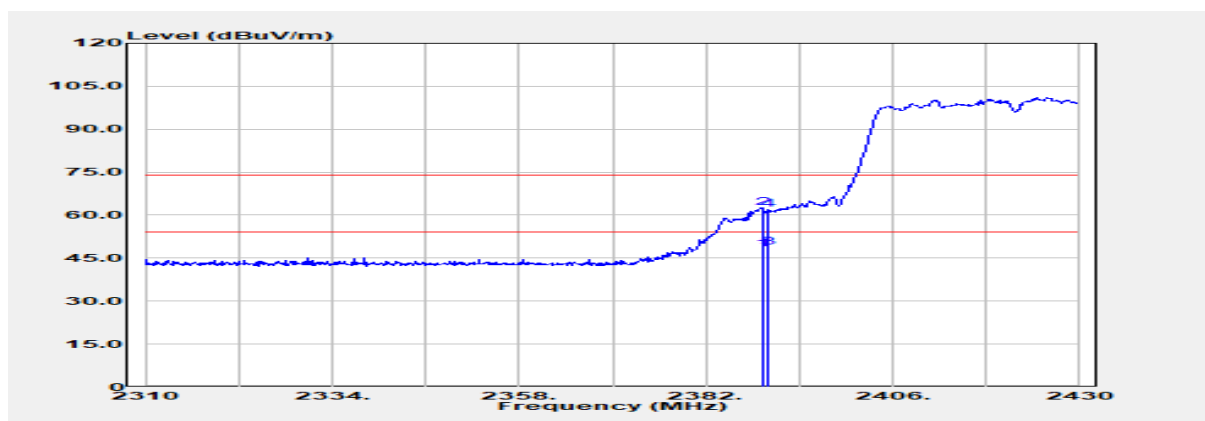
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Report Number :E2/2022/20119
 Operation Mode :802.11n40
 Test Frequency :2422 MHz
 Test Mode :BE CH LOW
 EUT Pol :E2 Plane
 Ant :MIMO

Test Site :SAC D
 Test Date :2022-03-15
 Temp./Humi. :22.1/63
 Antenna Pol. :Horizontal
 Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
2389.200	Average	57.92	-9.79	48.13	54.00	-5.87
2389.200	Peak	72.46	-9.79	62.67	74.00	-11.33
2390.000	Average	58.45	-9.80	48.65	54.00	-5.35
2390.000	Peak	71.64	-9.80	61.84	74.00	-12.16

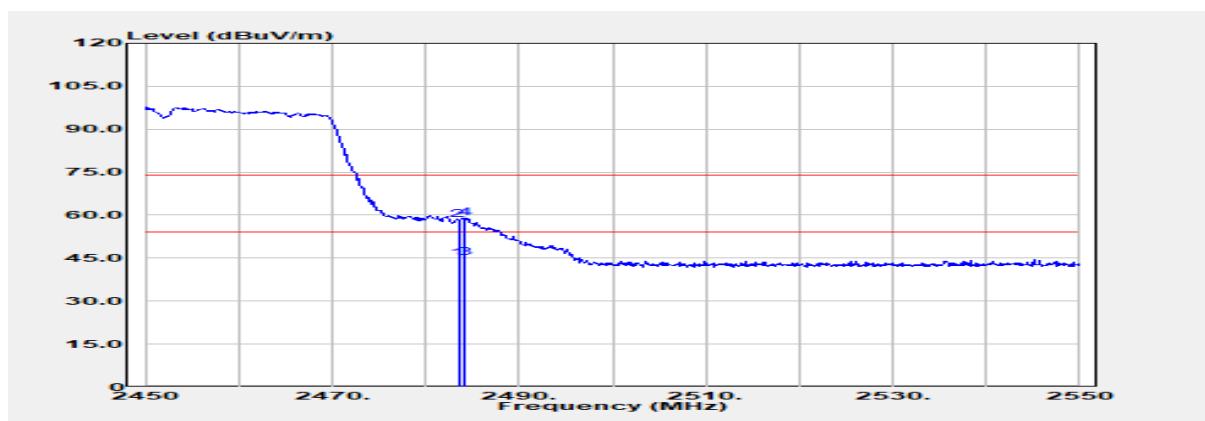
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Report Number :E2/2022/20119
Operation Mode :802.11n40
Test Frequency :2452 MHz
Test Mode :BE CH HIGH
EUT Pol :E2 Plane
Ant :MIMO

Test Site :SAC D
Test Date :2022-03-15
Temp./Humi. :22.1/63
Antenna Pol. :Vertical
Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
2483.500	Average	55.05	-10.17	44.88	54.00	-9.12
2483.500	Peak	68.44	-10.17	58.27	74.00	-15.73
2484.100	Average	55.25	-10.17	45.08	54.00	-8.92
2484.100	Peak	69.11	-10.17	58.93	74.00	-15.07

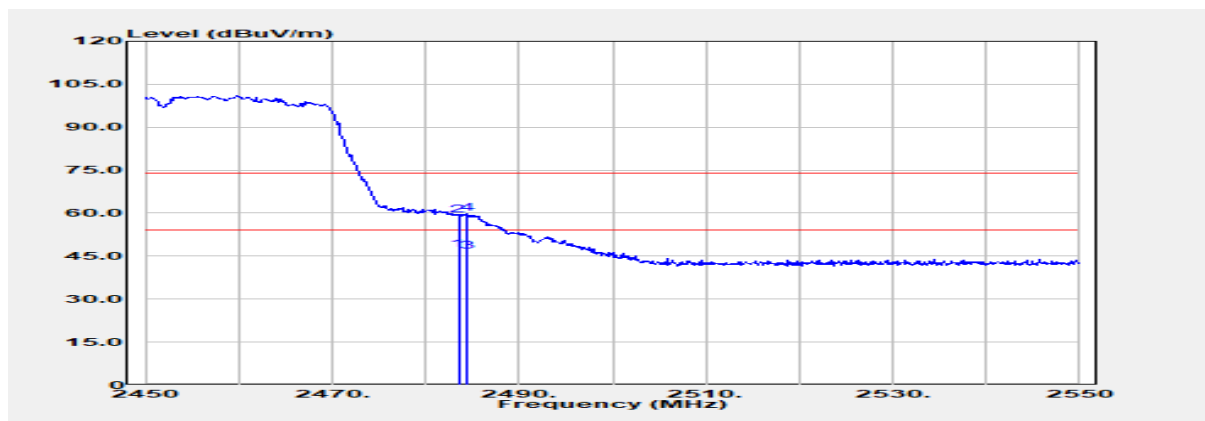
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Report Number :E2/2022/20119
 Operation Mode :802.11n40
 Test Frequency :2452 MHz
 Test Mode :BE CH HIGH
 EUT Pol :E2 Plane
 Ant :MIMO

Test Site :SAC D
 Test Date :2022-03-15
 Temp./Humi. :22.1/63
 Antenna Pol. :Horizontal
 Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
2483.500	Average	57.53	-10.17	47.36	54.00	-6.64
2483.500	Peak	69.41	-10.17	59.24	74.00	-14.76
2484.300	Average	56.88	-10.17	46.71	54.00	-7.29
2484.300	Peak	70.13	-10.17	59.95	74.00	-14.05

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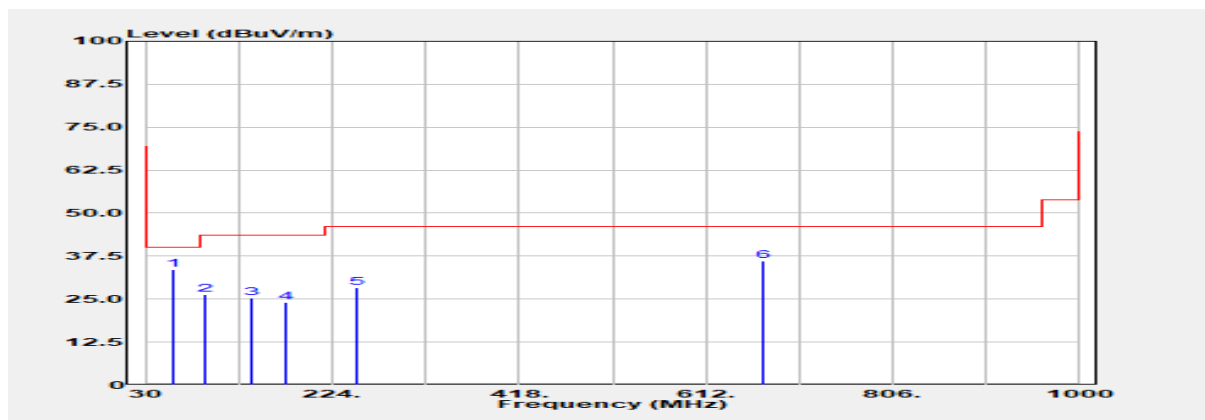
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11.6.2 Spurious Emission:

Report Number :E2/2022/20119
 Operation Mode :802.11g
 Test Frequency :2437 MHz
 Test Mode :TX CH MID
 EUT Pol :E2 Plane
 Ant :CHAIN 0

Test Site :SAC D
 Test Date :2022-03-19
 Temp./Humi. :22.3/63
 Antenna Pol. :Vertical
 Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
59.100	Peak	51.46	-17.95	33.51	40.00	-6.49
93.050	Peak	48.70	-22.48	26.22	43.50	-17.28
140.580	Peak	42.51	-17.26	25.25	43.50	-18.25
175.500	Peak	41.48	-17.51	23.97	43.50	-19.53
250.190	Peak	45.92	-17.65	28.27	46.00	-17.73
672.140	Peak	44.13	-8.04	36.10	46.00	-9.90

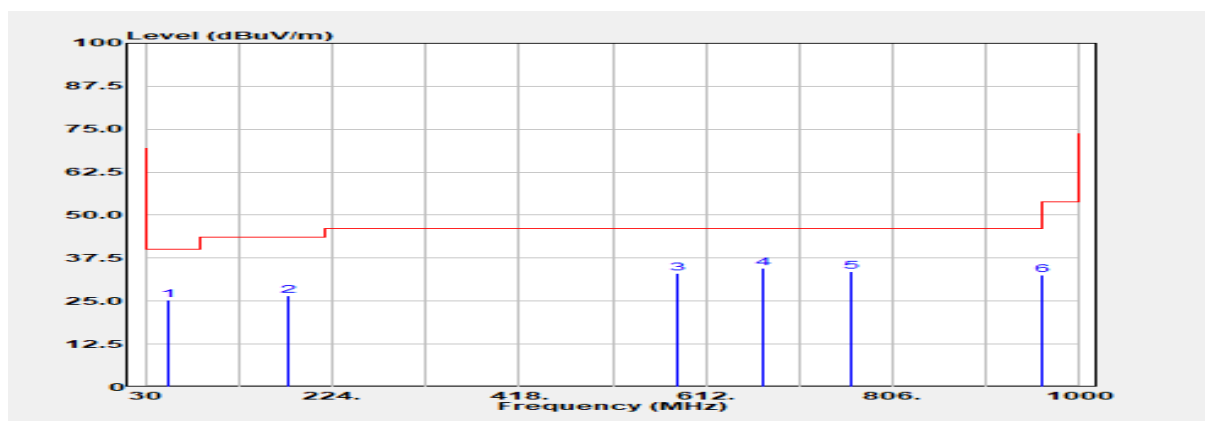
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Report Number :E2/2022/20119
Operation Mode :802.11g
Test Frequency :2437 MHz
Test Mode :TX CH MID
EUT Pol :E2 Plane
Ant :CHAIN 0

Test Site :SAC D
Test Date :2022-03-19
Temp./Humi. :22.3/63
Antenna Pol. :Horizontal
Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
53.280	Peak	42.76	-17.43	25.32	40.00	-14.68
178.410	Peak	44.46	-17.99	26.47	43.50	-17.03
582.900	Peak	43.63	-10.42	33.21	46.00	-12.79
672.140	Peak	42.61	-8.04	34.57	46.00	-11.43
762.350	Peak	40.29	-6.71	33.58	46.00	-12.42
960.230	Peak	36.92	-4.23	32.69	54.00	-21.31

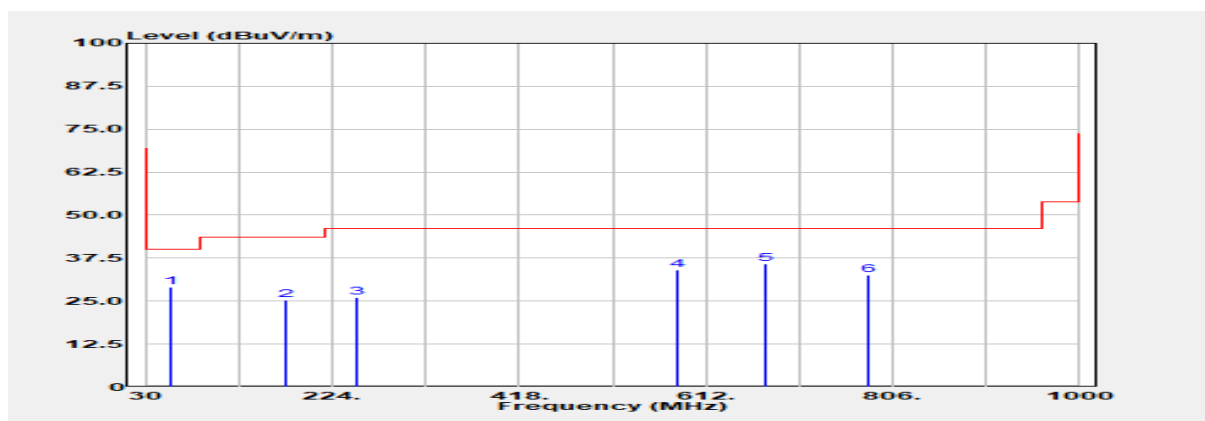
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Report Number :E2/2022/20119
 Operation Mode :802.11n40
 Test Frequency :2437 MHz
 Test Mode :TX CH MID
 EUT Pol :E2 Plane
 Ant :MIMO

Test Site :SAC D
 Test Date :2022-03-19
 Temp./Humi. :22.3/63
 Antenna Pol. :Vertical
 Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
56.190	Peak	46.79	-17.61	29.18	40.00	-10.82
176.470	Peak	43.00	-17.66	25.34	43.50	-18.16
250.190	Peak	43.79	-17.65	26.14	46.00	-19.86
582.900	Peak	44.43	-10.42	34.01	46.00	-11.99
673.110	Peak	43.75	-8.01	35.74	46.00	-10.26
779.810	Peak	39.40	-6.93	32.47	46.00	-13.53

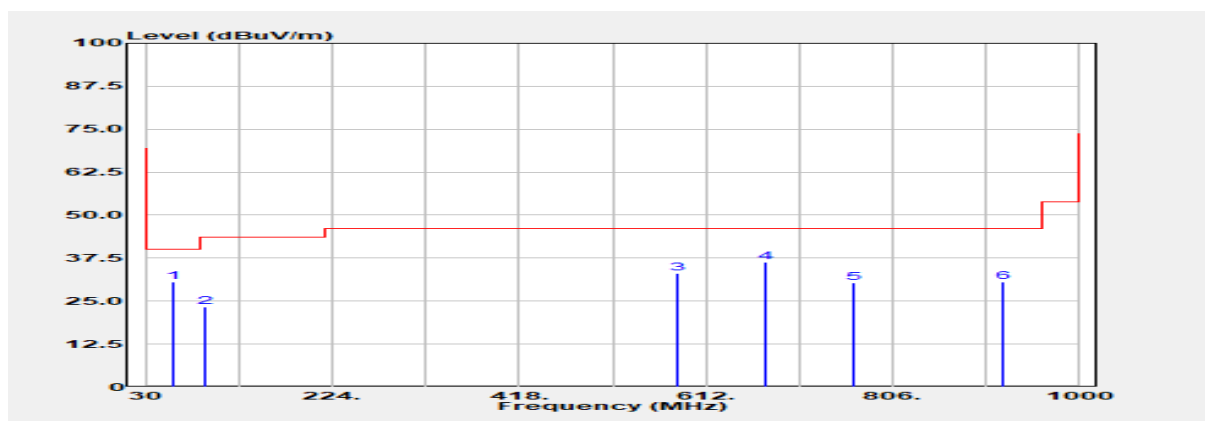
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Report Number :E2/2022/20119
 Operation Mode :802.11n40
 Test Frequency :2437 MHz
 Test Mode :TX CH MID
 EUT Pol :E2 Plane
 Ant :MIMO

Test Site :SAC D
 Test Date :2022-03-19
 Temp./Humi. :22.3/63
 Antenna Pol. :Horizontal
 Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
59.100	Peak	48.51	-17.95	30.55	40.00	-9.45
93.050	Peak	45.76	-22.48	23.28	43.50	-20.22
582.900	Peak	43.46	-10.42	33.04	46.00	-12.96
673.110	Peak	44.28	-8.01	36.27	46.00	-9.73
764.290	Peak	37.06	-6.63	30.43	46.00	-15.57
920.460	Peak	35.55	-4.91	30.64	46.00	-15.36

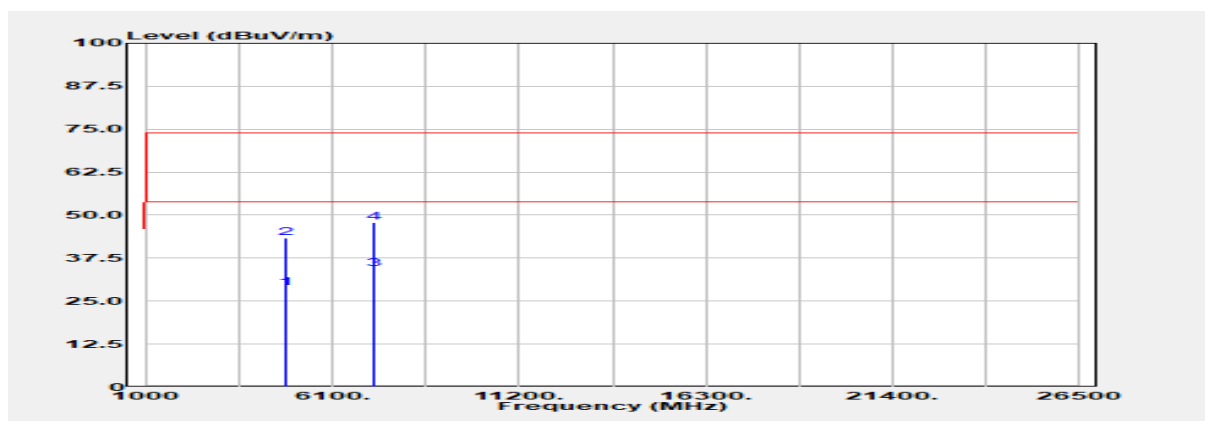
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Report Number :E2/2022/20119
 Operation Mode :802.11b
 Test Frequency :2412 MHz
 Test Mode :TX CH LOW
 EUT Pol :E2 Plane
 Ant :CHAIN 0

Test Site :SAC D
 Test Date :2022-03-15
 Temp./Humi. :22.1/63
 Antenna Pol. :Vertical
 Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
4824.000	Average	28.90	-0.10	28.80	54.00	-25.20
4824.000	Peak	43.55	-0.10	43.45	74.00	-30.55
7236.000	Average	26.87	7.57	34.44	54.00	-19.56
7236.000	Peak	40.28	7.57	47.85	74.00	-26.15

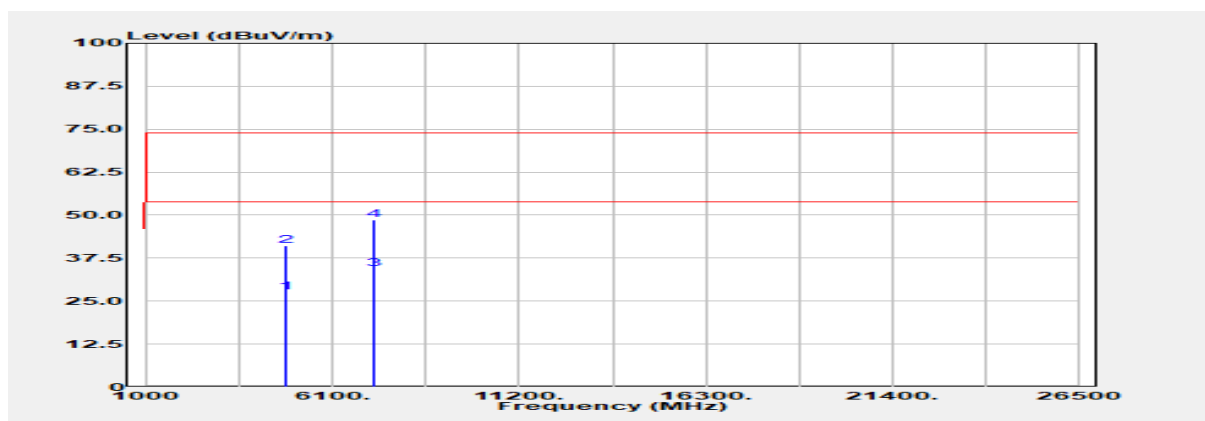
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Report Number :E2/2022/20119
 Operation Mode :802.11b
 Test Frequency :2412 MHz
 Test Mode :TX CH LOW
 EUT Pol :E2 Plane
 Ant :CHAIN 0

Test Site :SAC D
 Test Date :2022-03-15
 Temp./Humi. :22.1/63
 Antenna Pol. :Horizontal
 Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
4824.000	Average	27.71	-0.10	27.61	54.00	-26.39
4824.000	Peak	41.24	-0.10	41.14	74.00	-32.86
7236.000	Average	26.67	7.57	34.24	54.00	-19.76
7236.000	Peak	40.98	7.57	48.55	74.00	-25.45

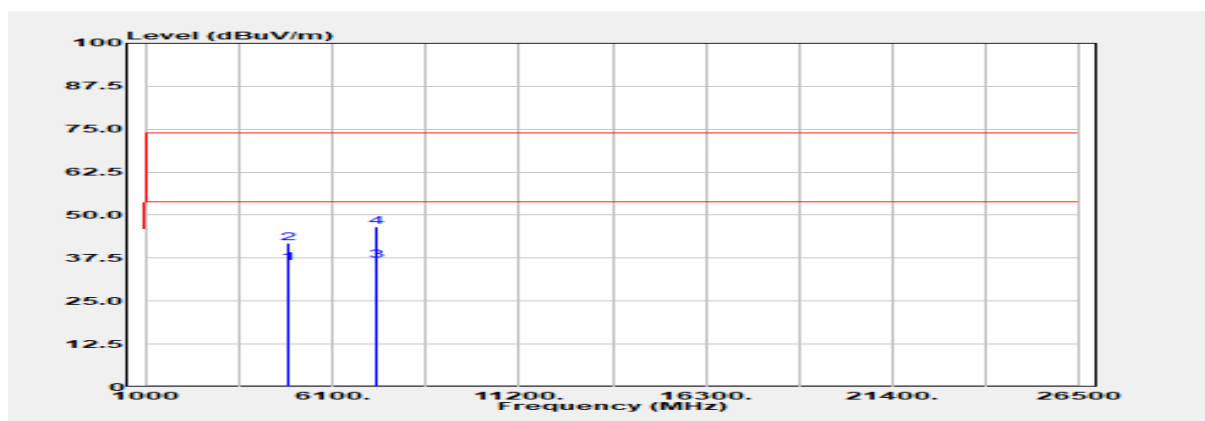
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Report Number :E2/2022/20119
Operation Mode :802.11b
Test Frequency :2437 MHz
Test Mode :TX CH MID
EUT Pol :E2 Plane
Ant :CHAIN 0

Test Site :SAC D
Test Date :2022-03-15
Temp./Humi. :22.1/63
Antenna Pol. :Vertical
Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
4874.000	Average	36.27	-0.26	36.01	54.00	-17.99
4874.000	Peak	42.12	-0.26	41.86	74.00	-32.14
7311.000	Average	30.12	6.68	36.80	54.00	-17.20
7311.000	Peak	39.86	6.68	46.54	74.00	-27.46

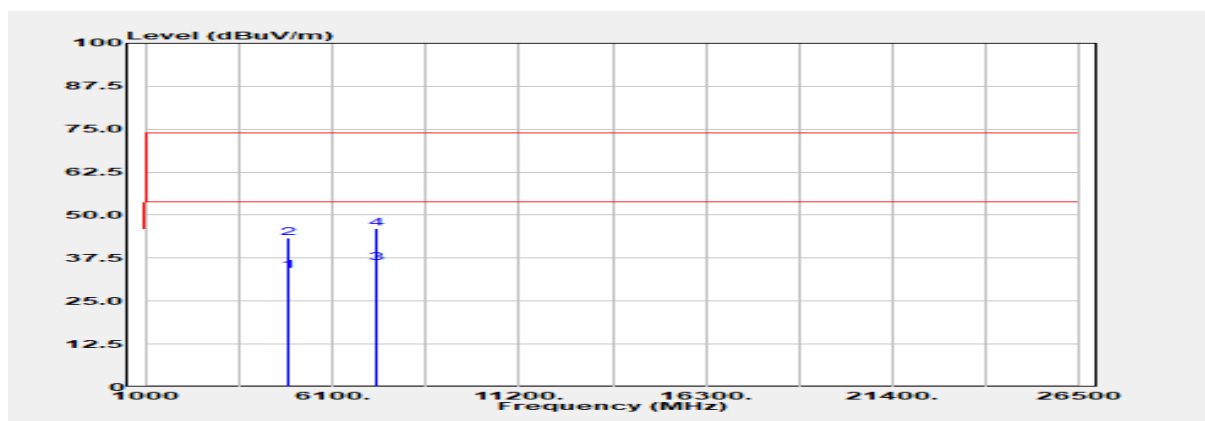
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Report Number :E2/2022/20119
Operation Mode :802.11b
Test Frequency :2437 MHz
Test Mode :TX CH MID
EUT Pol :E2 Plane
Ant :CHAIN 0

Test Site :SAC D
Test Date :2022-03-15
Temp./Humi. :22.1/63
Antenna Pol. :Horizontal
Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
4874.000	Average	33.98	-0.26	33.71	54.00	-20.29
4874.000	Peak	43.66	-0.26	43.39	74.00	-30.61
7311.000	Average	29.37	6.68	36.05	54.00	-17.95
7311.000	Peak	39.32	6.68	46.00	74.00	-28.00

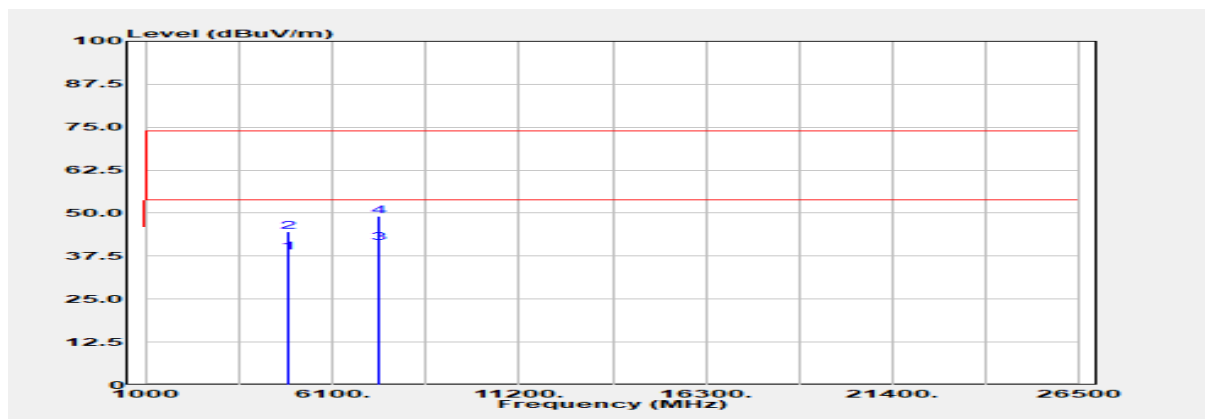
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Report Number :E2/2022/20119
 Operation Mode :802.11b
 Test Frequency :2462 MHz
 Test Mode :TX CH HIGH
 EUT Pol :E2 Plane
 Ant :CHAIN 0

Test Site :SAC D
 Test Date :2022-03-15
 Temp./Humi. :22.1/63
 Antenna Pol. :Vertical
 Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
4924.000	Average	38.78	-0.13	38.65	54.00	-15.35
4924.000	Peak	44.77	-0.13	44.63	74.00	-29.37
7386.000	Average	33.81	7.63	41.44	54.00	-12.56
7386.000	Peak	41.38	7.63	49.01	74.00	-24.99

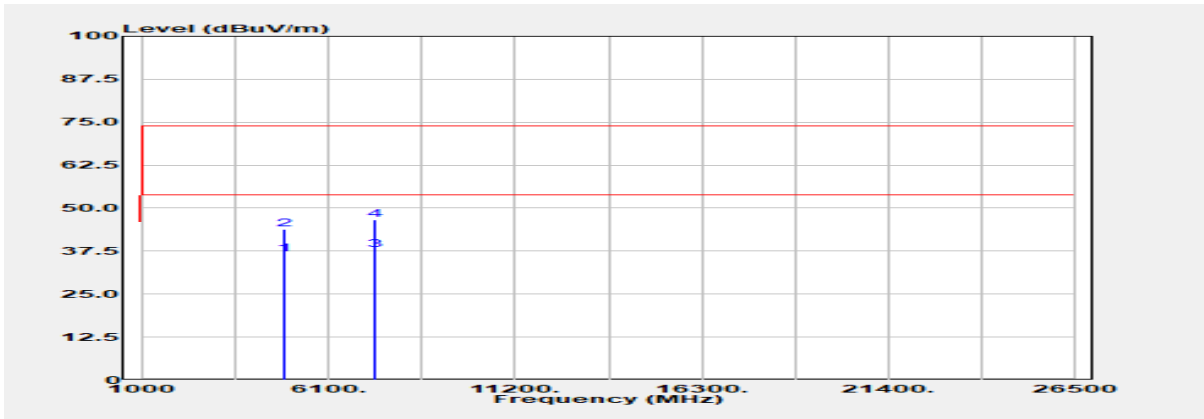
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Report Number :E2/2022/20119
Operation Mode :802.11b
Test Frequency :2462 MHz
Test Mode :TX CH HIGH
EUT Pol :E2 Plane
Ant :CHAIN 0

Test Site :SAC D
Test Date :2022-03-15
Temp./Humi. :22.1/63
Antenna Pol. :Horizontal
Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
4924.000	Average	36.73	-0.13	36.60	54.00	-17.40
4924.000	Peak	44.10	-0.13	43.96	74.00	-30.04
7386.000	Average	30.12	7.63	37.75	54.00	-16.25
7386.000	Peak	38.91	7.63	46.54	74.00	-27.46

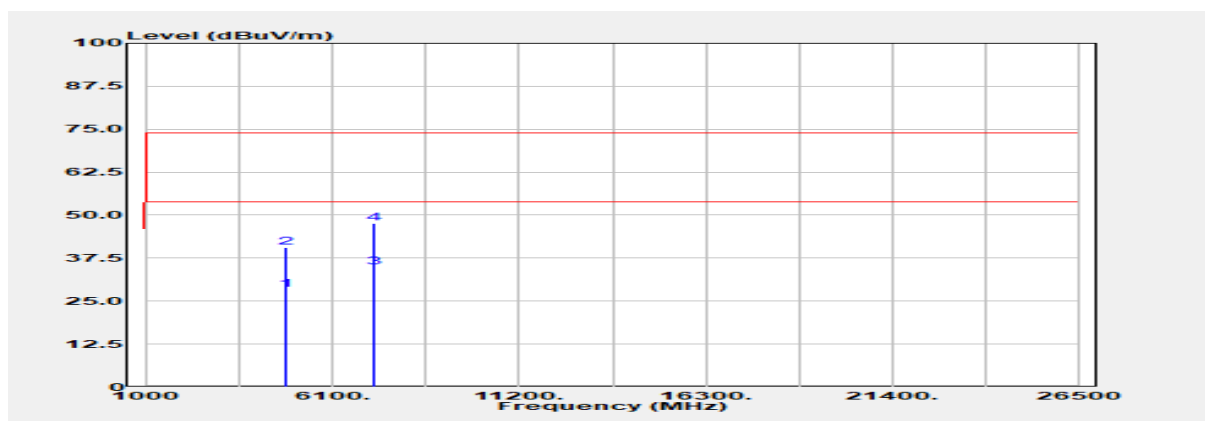
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Report Number :E2/2022/20119
 Operation Mode :802.11g
 Test Frequency :2412 MHz
 Test Mode :TX CH LOW
 EUT Pol :E2 Plane
 Ant :CHAIN 0

Test Site :SAC D
 Test Date :2022-03-15
 Temp./Humi. :22.1/63
 Antenna Pol. :Vertical
 Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
4824.000	Average	28.33	-0.10	28.23	54.00	-25.77
4824.000	Peak	40.72	-0.10	40.62	74.00	-33.38
7236.000	Average	27.34	7.57	34.91	54.00	-19.09
7236.000	Peak	39.96	7.57	47.53	74.00	-26.47

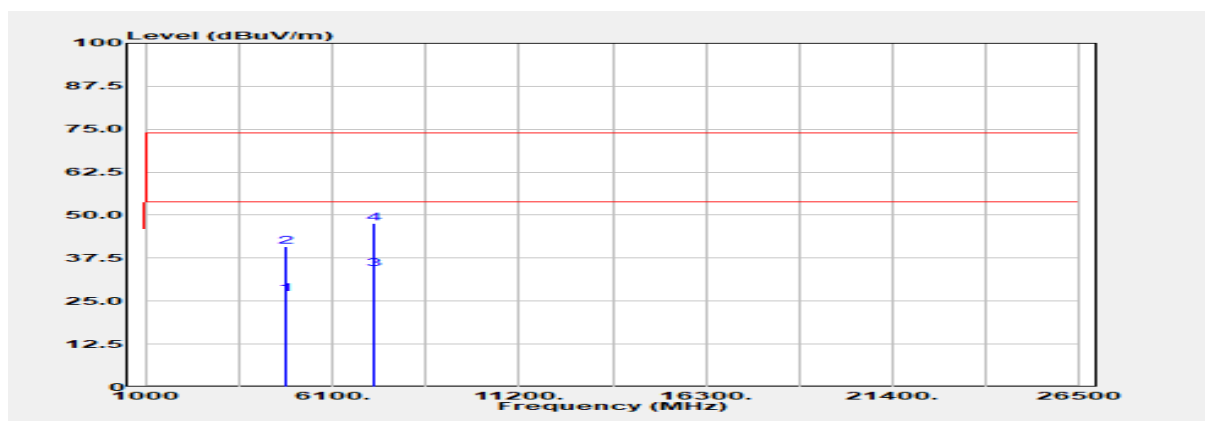
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Report Number :E2/2022/20119
 Operation Mode :802.11g
 Test Frequency :2412 MHz
 Test Mode :TX CH LOW
 EUT Pol :E2 Plane
 Ant :CHAIN 0

Test Site :SAC D
 Test Date :2022-03-15
 Temp./Humi. :22.1/63
 Antenna Pol. :Horizontal
 Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
4824.000	Average	27.16	-0.10	27.06	54.00	-26.94
4824.000	Peak	41.02	-0.10	40.92	74.00	-33.08
7236.000	Average	26.84	7.57	34.41	54.00	-19.59
7236.000	Peak	40.15	7.57	47.72	74.00	-26.28

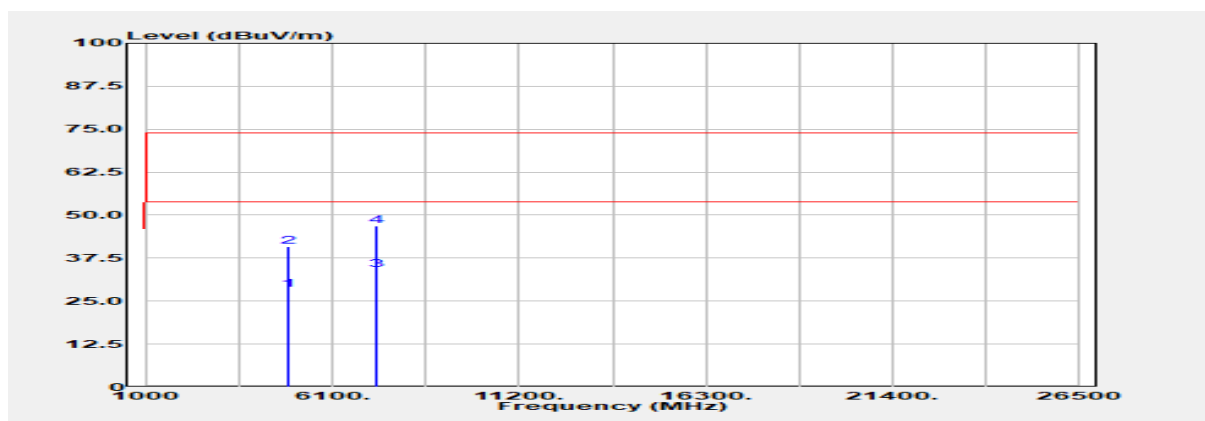
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Report Number :E2/2022/20119
 Operation Mode :802.11g
 Test Frequency :2437 MHz
 Test Mode :TX CH MID
 EUT Pol :E2 Plane
 Ant :CHAIN 0

Test Site :SAC D
 Test Date :2022-03-15
 Temp./Humi. :22.1/63
 Antenna Pol. :Vertical
 Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
4874.000	Average	28.66	-0.26	28.40	54.00	-25.60
4874.000	Peak	41.17	-0.26	40.90	74.00	-33.10
7311.000	Average	27.41	6.68	34.09	54.00	-19.91
7311.000	Peak	40.24	6.68	46.92	74.00	-27.08

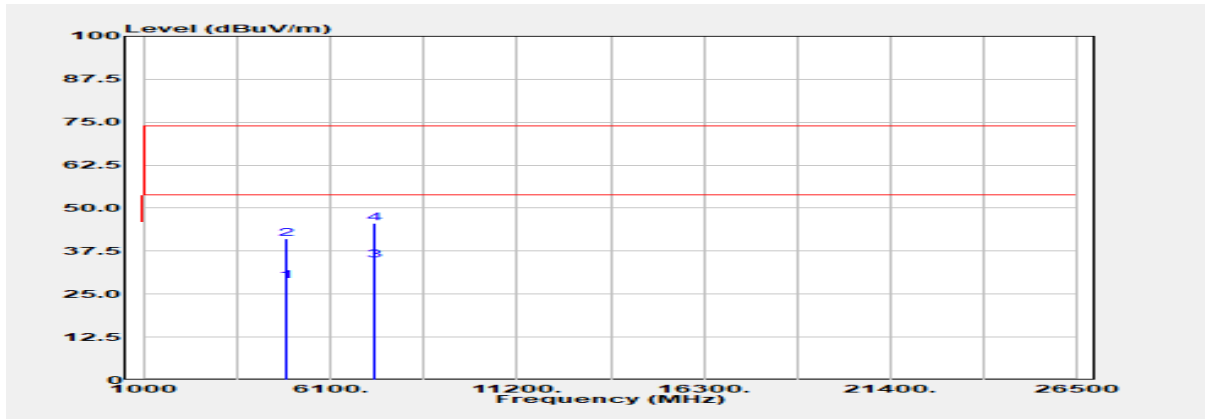
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Report Number :E2/2022/20119
Operation Mode :802.11g
Test Frequency :2437 MHz
Test Mode :TX CH MID
EUT Pol :E2 Plane
Ant :CHAIN 0

Test Site :SAC D
Test Date :2022-03-15
Temp./Humi. :22.1/63
Antenna Pol. :Horizontal
Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
4874.000	Average	29.02	-0.26	28.76	54.00	-25.24
4874.000	Peak	41.45	-0.26	41.18	74.00	-32.82
7311.000	Average	28.22	6.68	34.90	54.00	-19.10
7311.000	Peak	38.95	6.68	45.63	74.00	-28.37

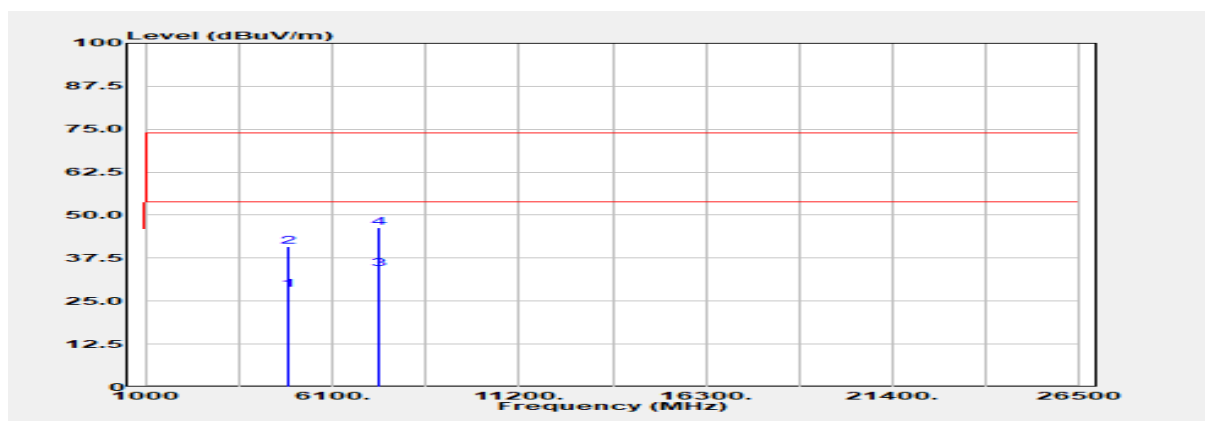
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Report Number :E2/2022/20119
 Operation Mode :802.11g
 Test Frequency :2462 MHz
 Test Mode :TX CH HIGH
 EUT Pol :E2 Plane
 Ant :CHAIN 0

Test Site :SAC D
 Test Date :2022-03-15
 Temp./Humi. :22.1/63
 Antenna Pol. :Vertical
 Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
4924.000	Average	28.55	-0.13	28.42	54.00	-25.58
4924.000	Peak	41.10	-0.13	40.96	74.00	-33.04
7386.000	Average	26.77	7.63	34.40	54.00	-19.60
7386.000	Peak	38.65	7.63	46.28	74.00	-27.72

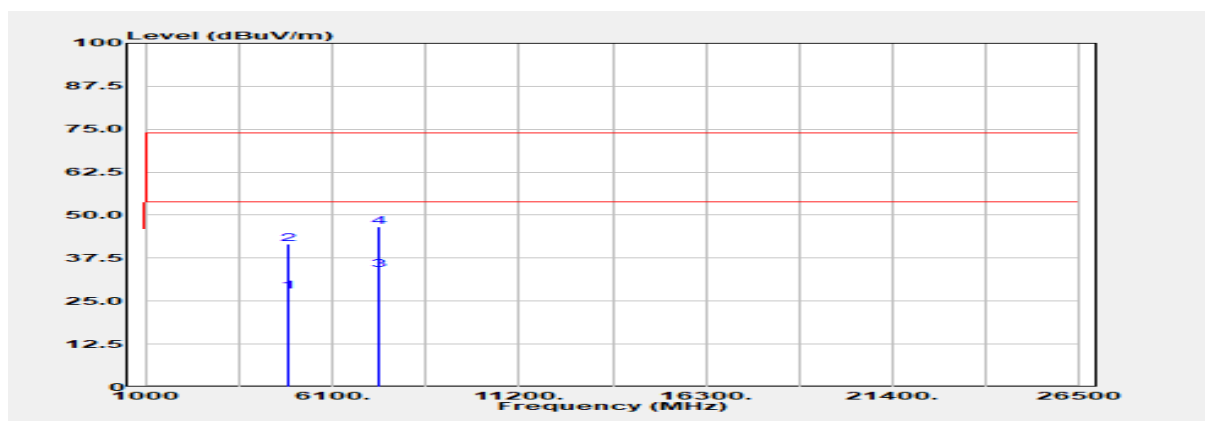
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Report Number :E2/2022/20119
 Operation Mode :802.11g
 Test Frequency :2462 MHz
 Test Mode :TX CH HIGH
 EUT Pol :E2 Plane
 Ant :CHAIN 0

Test Site :SAC D
 Test Date :2022-03-15
 Temp./Humi. :22.1/63
 Antenna Pol. :Horizontal
 Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
4924.000	Average	27.86	-0.13	27.73	54.00	-26.27
4924.000	Peak	41.69	-0.13	41.56	74.00	-32.44
7386.000	Average	26.48	7.63	34.11	54.00	-19.89
7386.000	Peak	38.88	7.63	46.51	74.00	-27.49

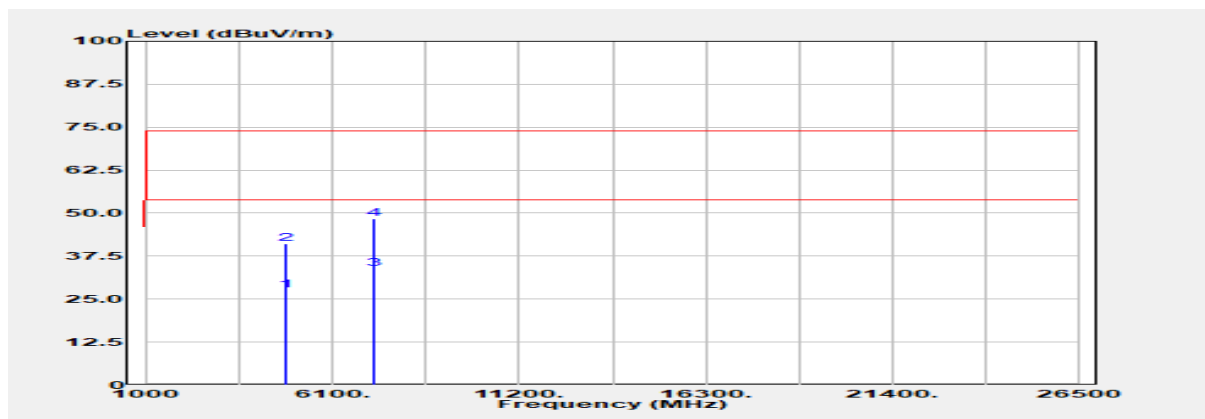
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Report Number :E2/2022/20119
 Operation Mode :802.11n20
 Test Frequency :2412 MHz
 Test Mode :TX CH LOW
 EUT Pol :E2 Plane
 Ant :MIMO

Test Site :SAC D
 Test Date :2022-03-15
 Temp./Humi. :22.1/63
 Antenna Pol. :Vertical
 Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
4824.000	Average	27.56	-0.10	27.46	54.00	-26.54
4824.000	Peak	41.18	-0.10	41.07	74.00	-32.93
7236.000	Average	26.37	7.57	33.94	54.00	-20.06
7236.000	Peak	40.70	7.57	48.26	74.00	-25.74

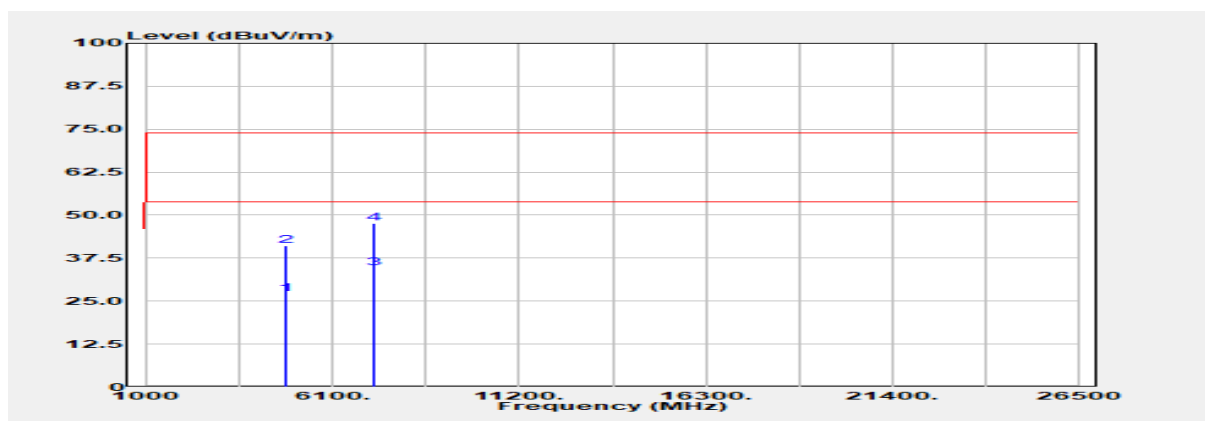
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Report Number :E2/2022/20119
Operation Mode :802.11n20
Test Frequency :2412 MHz
Test Mode :TX CH LOW
EUT Pol :E2 Plane
Ant :MIMO

Test Site :SAC D
Test Date :2022-03-15
Temp./Humi. :22.1/63
Antenna Pol. :Horizontal
Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
4824.000	Average	27.24	-0.10	27.14	54.00	-26.86
4824.000	Peak	41.19	-0.10	41.09	74.00	-32.91
7236.000	Average	26.97	7.57	34.54	54.00	-19.46
7236.000	Peak	40.05	7.57	47.62	74.00	-26.38

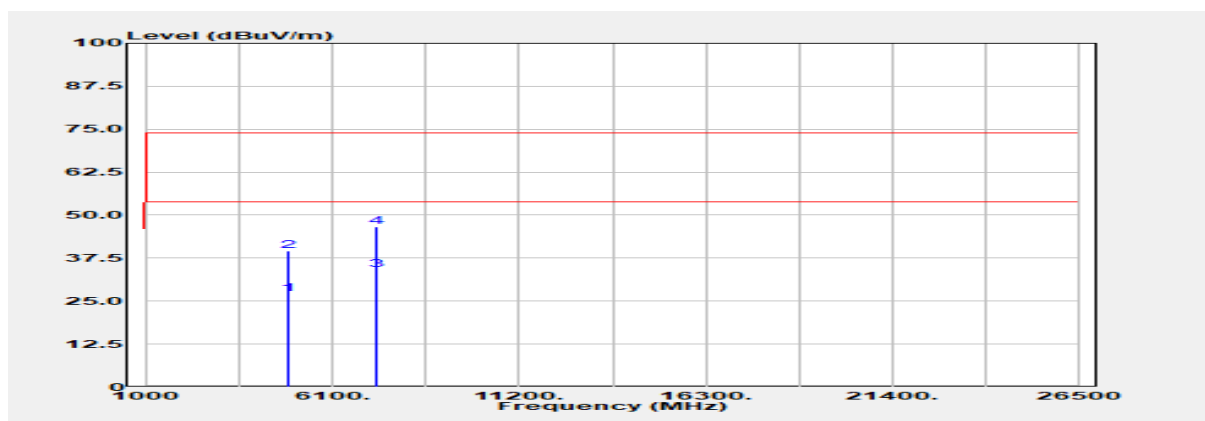
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Report Number :E2/2022/20119
Operation Mode :802.11n20
Test Frequency :2437 MHz
Test Mode :TX CH MID
EUT Pol :E2 Plane
Ant :MIMO

Test Site :SAC D
Test Date :2022-03-15
Temp./Humi. :22.1/63
Antenna Pol. :Vertical
Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
4874.000	Average	27.44	-0.26	27.18	54.00	-26.82
4874.000	Peak	39.96	-0.26	39.70	74.00	-34.30
7311.000	Average	27.31	6.68	33.99	54.00	-20.01
7311.000	Peak	40.04	6.68	46.72	74.00	-27.28

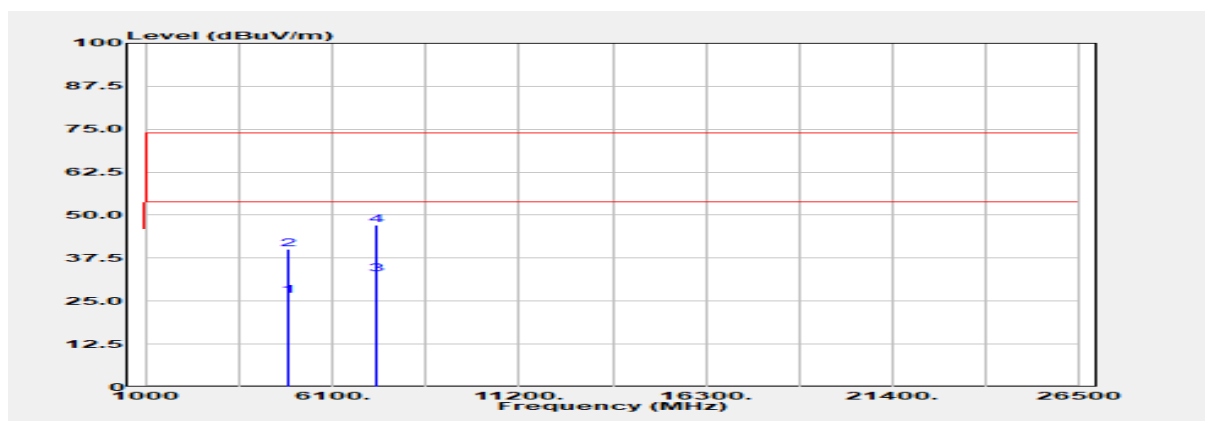
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Report Number :E2/2022/20119
Operation Mode :802.11n20
Test Frequency :2437 MHz
Test Mode :TX CH MID
EUT Pol :E2 Plane
Ant :MIMO

Test Site :SAC D
Test Date :2022-03-15
Temp./Humi. :22.1/63
Antenna Pol. :Horizontal
Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
4874.000	Average	26.88	-0.26	26.62	54.00	-27.38
4874.000	Peak	40.42	-0.26	40.16	74.00	-33.84
7311.000	Average	26.12	6.68	32.80	54.00	-21.20
7311.000	Peak	40.36	6.68	47.04	74.00	-26.96

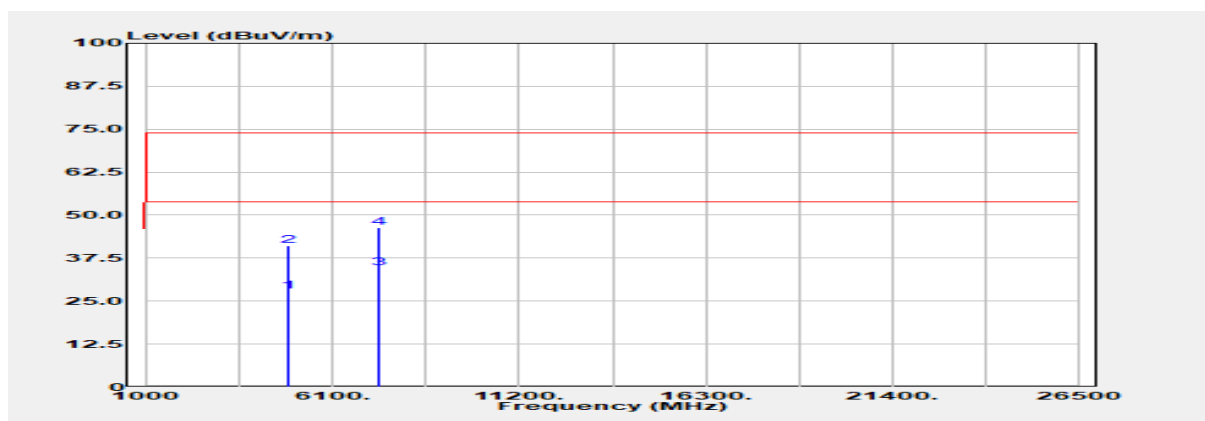
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Report Number :E2/2022/20119
Operation Mode :802.11n20
Test Frequency :2462 MHz
Test Mode :TX CH HIGH
EUT Pol :E2 Plane
Ant :MIMO

Test Site :SAC D
Test Date :2022-03-15
Temp./Humi. :22.1/63
Antenna Pol. :Vertical
Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
4924.000	Average	27.88	-0.13	27.75	54.00	-26.25
4924.000	Peak	41.28	-0.13	41.15	74.00	-32.85
7386.000	Average	26.98	7.63	34.61	54.00	-19.39
7386.000	Peak	38.80	7.63	46.43	74.00	-27.57

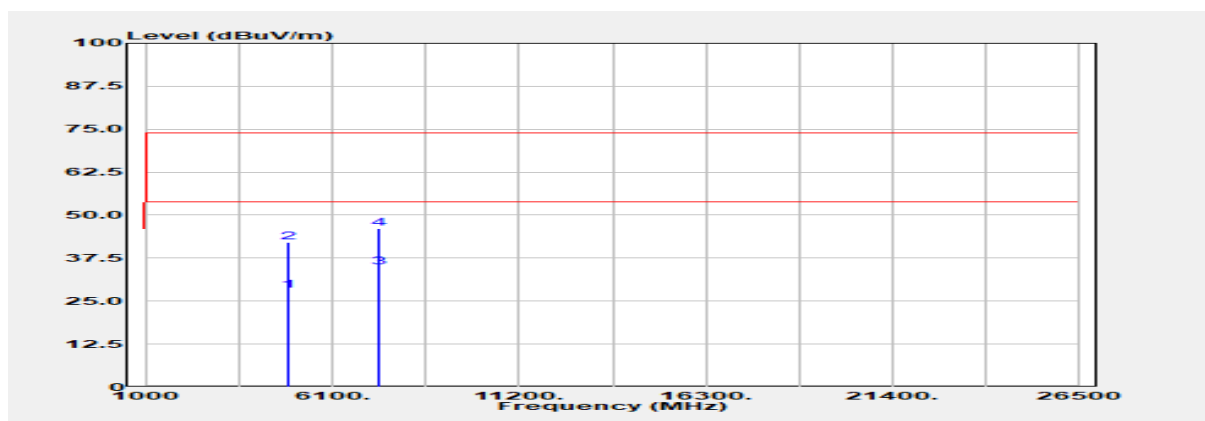
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Report Number :E2/2022/20119
 Operation Mode :802.11n20
 Test Frequency :2462 MHz
 Test Mode :TX CH HIGH
 EUT Pol :E2 Plane
 Ant :MIMO

Test Site :SAC D
 Test Date :2022-03-15
 Temp./Humi. :22.1/63
 Antenna Pol. :Horizontal
 Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
4924.000	Average	28.13	-0.13	28.00	54.00	-26.00
4924.000	Peak	42.29	-0.13	42.16	74.00	-31.84
7386.000	Average	27.16	7.63	34.79	54.00	-19.21
7386.000	Peak	38.46	7.63	46.10	74.00	-27.90

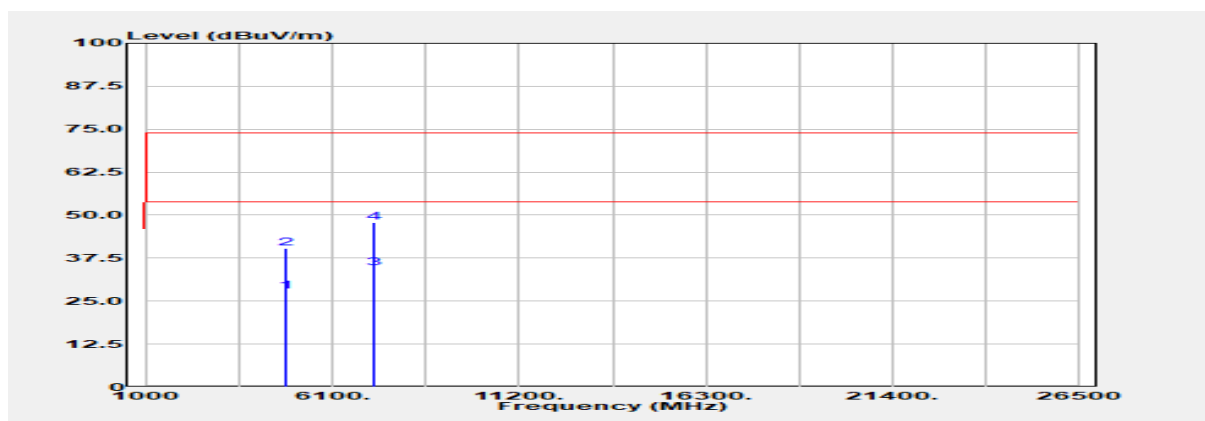
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Report Number :E2/2022/20119
Operation Mode :802.11n40
Test Frequency :2422 MHz
Test Mode :TX CH LOW
EUT Pol :E2 Plane
Ant :MIMO

Test Site :SAC D
Test Date :2022-03-15
Temp./Humi. :22.1/63
Antenna Pol. :Vertical
Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
4844.000	Average	27.86	0.08	27.94	54.00	-26.06
4844.000	Peak	40.38	0.08	40.46	74.00	-33.54
7266.000	Average	27.12	7.53	34.65	54.00	-19.35
7266.000	Peak	40.24	7.53	47.76	74.00	-26.24

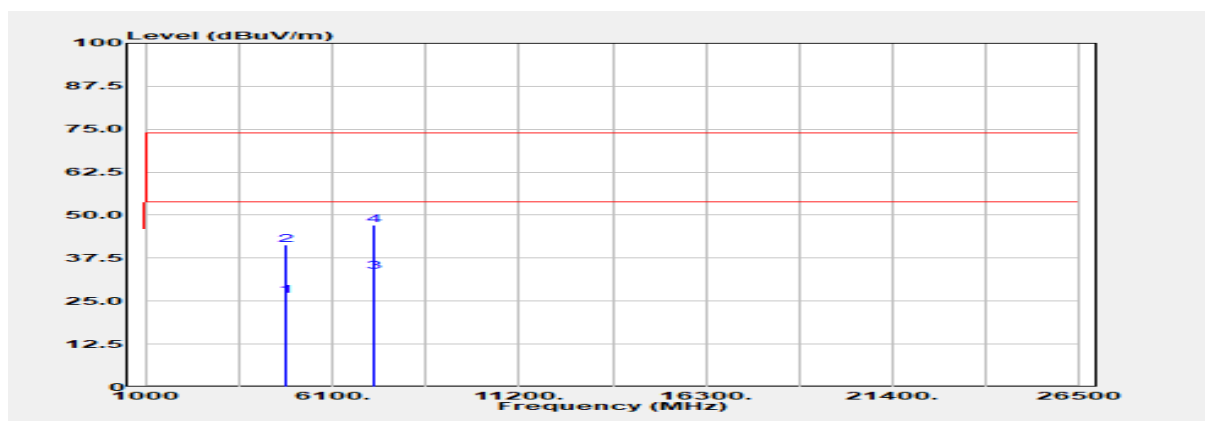
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Report Number :E2/2022/20119
 Operation Mode :802.11n40
 Test Frequency :2422 MHz
 Test Mode :TX CH LOW
 EUT Pol :E2 Plane
 Ant :MIMO

Test Site :SAC D
 Test Date :2022-03-15
 Temp./Humi. :22.1/63
 Antenna Pol. :Horizontal
 Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
4844.000	Average	26.58	0.08	26.66	54.00	-27.34
4844.000	Peak	41.28	0.08	41.37	74.00	-32.63
7266.000	Average	26.03	7.53	33.56	54.00	-20.44
7266.000	Peak	39.59	7.53	47.12	74.00	-26.88

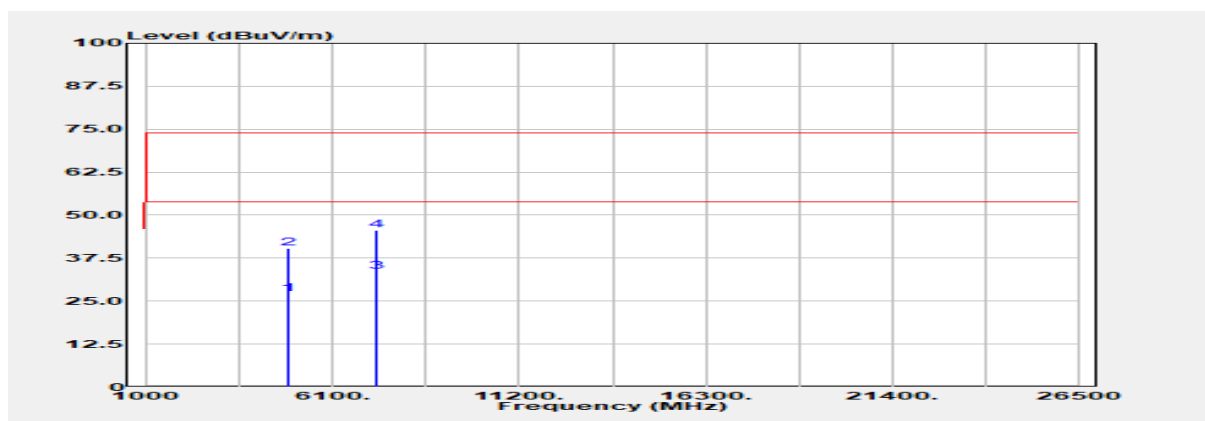
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Report Number :E2/2022/20119
 Operation Mode :802.11n40
 Test Frequency :2437 MHz
 Test Mode :TX CH MID
 EUT Pol :E2 Plane
 Ant :MIMO

Test Site :SAC D
 Test Date :2022-03-15
 Temp./Humi. :22.1/63
 Antenna Pol. :Vertical
 Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
4874.000	Average	27.34	-0.26	27.08	54.00	-26.92
4874.000	Peak	40.61	-0.26	40.35	74.00	-33.65
7311.000	Average	27.01	6.68	33.69	54.00	-20.31
7311.000	Peak	39.00	6.68	45.68	74.00	-28.32

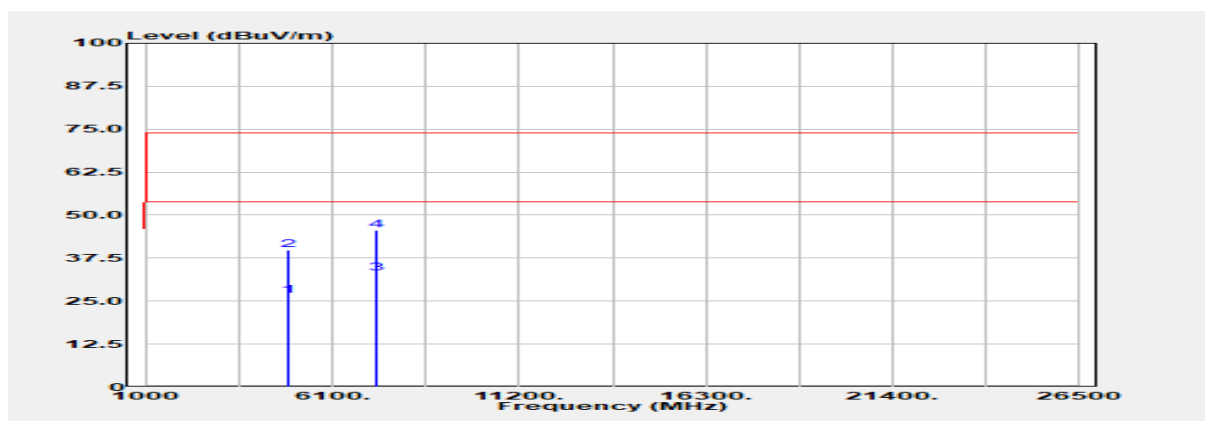
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Report Number :E2/2022/20119
Operation Mode :802.11n40
Test Frequency :2437 MHz
Test Mode :TX CH MID
EUT Pol :E2 Plane
Ant :MIMO

Test Site :SAC D
Test Date :2022-03-15
Temp./Humi. :22.1/63
Antenna Pol. :Horizontal
Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
4874.000	Average	26.95	-0.26	26.69	54.00	-27.31
4874.000	Peak	40.23	-0.26	39.96	74.00	-34.04
7311.000	Average	26.46	6.68	33.14	54.00	-20.86
7311.000	Peak	39.05	6.68	45.73	74.00	-28.27

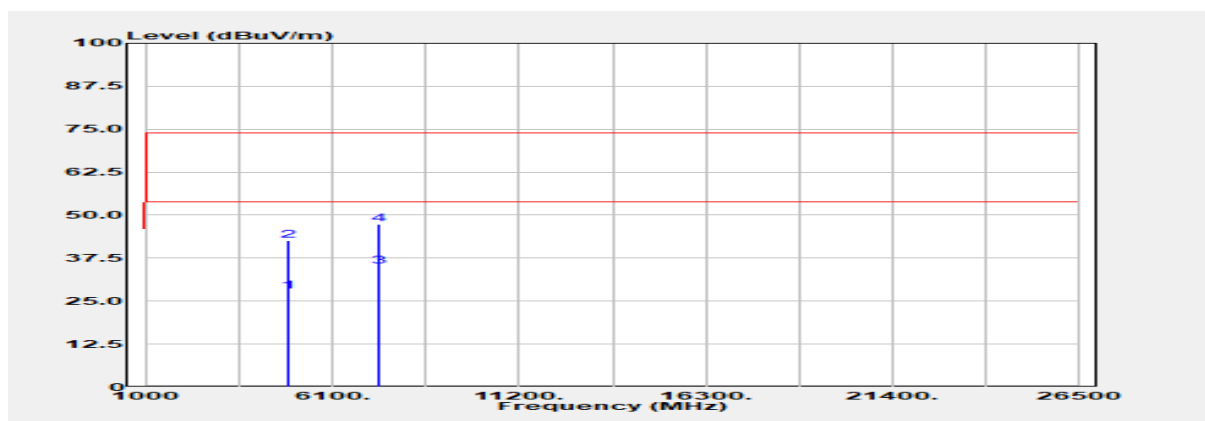
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Report Number :E2/2022/20119
 Operation Mode :802.11n40
 Test Frequency :2452 MHz
 Test Mode :TX CH HIGH
 EUT Pol :E2 Plane
 Ant :MIMO

Test Site :SAC D
 Test Date :2022-03-15
 Temp./Humi. :22.1/63
 Antenna Pol. :Vertical
 Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
4904.000	Average	28.34	-0.60	27.74	54.00	-26.26
4904.000	Peak	43.20	-0.60	42.60	74.00	-31.40
7356.000	Average	27.56	7.53	35.09	54.00	-18.91
7356.000	Peak	39.87	7.53	47.40	74.00	-26.60

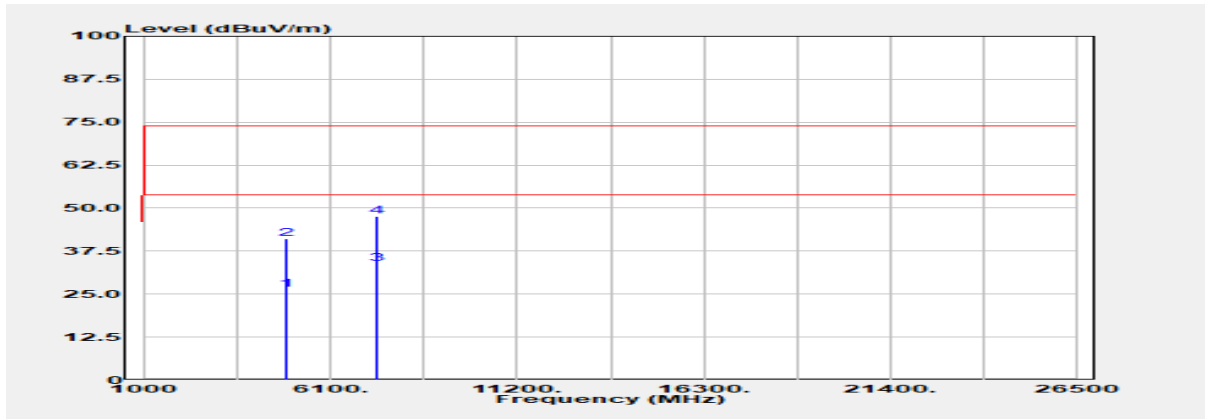
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Report Number :E2/2022/20119
Operation Mode :802.11n40
Test Frequency :2452 MHz
Test Mode :TX CH HIGH
EUT Pol :E2 Plane
Ant :MIMO

Test Site :SAC D
Test Date :2022-03-15
Temp./Humi. :22.1/63
Antenna Pol. :Horizontal
Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
4904.000	Average	26.85	-0.60	26.25	54.00	-27.75
4904.000	Peak	41.78	-0.60	41.17	74.00	-32.83
7356.000	Average	26.37	7.53	33.90	54.00	-20.10
7356.000	Peak	40.21	7.53	47.74	74.00	-26.26

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12 POWER SPECTRAL DENSITY

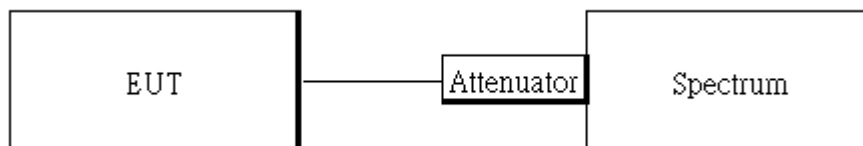
12.1 Standard Applicable

Per Part 15.247 (e)

The power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3 kHz band during any time interval of continuous transmission.

This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

12.2 Test Setup



12.3 Measurement Procedure

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 = 3 kHz & VBW = 10 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 with “measure and add 10 Log (N)” to measurement for MIMO mode. Offset = cable loss + 10 log (N), where N is number of transmitting antenna, cable loss is specified below.

Note:

For the 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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12.4 As per FCC KDB 662911 D01

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

$g_{j,k} = \sqrt{20 \cdot 10^{G_k}}$ 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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12.5 Power spectral density

POWER DENSITY 802.11b				
Freq. (MHz)	Ch0 PSD	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Result
2412	-8.62	-8.62	8.00	PASS
2437	-8.54	-8.54	8.00	PASS
2462	-8.68	-8.68	8.00	PASS

POWER DENSITY 802.11g				
Freq. (MHz)	Ch0 PSD	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Result
2412	-10.51	-10.51	8.00	PASS
2437	-9.93	-9.93	8.00	PASS
2462	-10.51	-10.51	8.00	PASS

POWER DENSITY 802.11n HT20					
Freq. (MHz)	Ch0 PSD	Ch1 PSD	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Result
2412	-10.1	-11.1	-7.56	8.00	PASS
2437	-9.56	-10.21	-6.86	8.00	PASS
2462	-10.4	-10.32	-7.35	8.00	PASS

POWER DENSITY 802.11n HT40					
Freq. (MHz)	Ch0 PSD	Ch1 PSD	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Result
2422	-14.24	-13.76	-10.98	8.00	PASS
2437	-14.25	-14.797	-11.50	8.00	PASS
2452	-13.71	-14.46	-11.06	8.00	PASS

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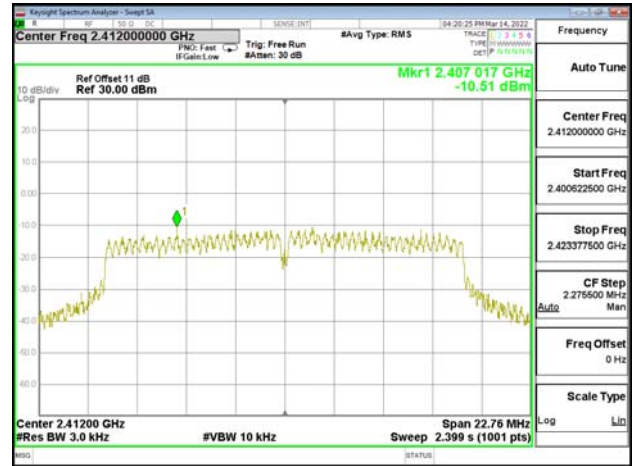
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802.11b_20MHz_Chain0_2412MHz



802.11g_20MHz_Chain0_2412MHz



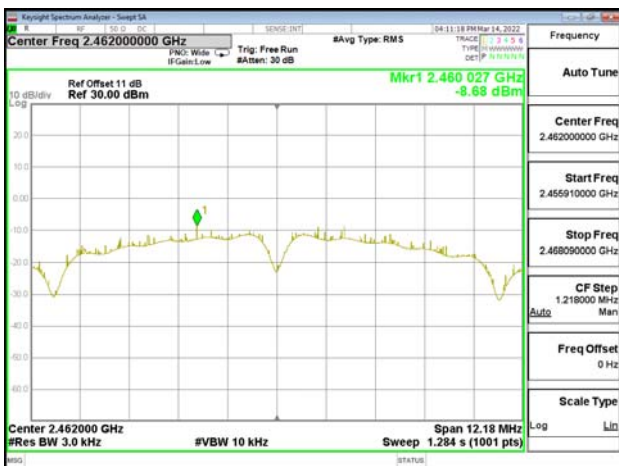
802.11b_20MHz_Chain0_2437MHz



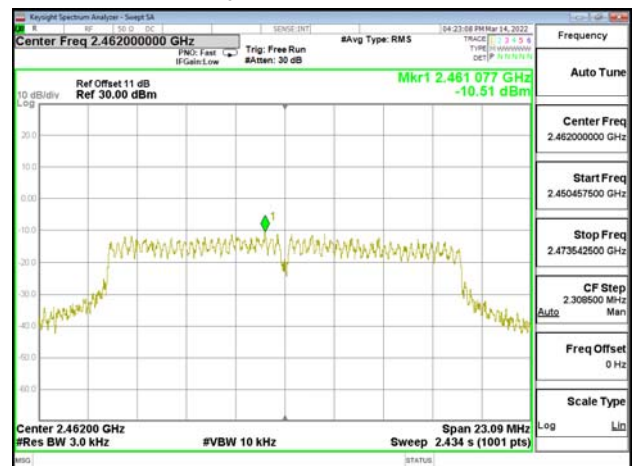
802.11g_20MHz_Chain0_2437MHz



802.11b_20MHz_Chain0_2462MHz



802.11g_20MHz_Chain0_2462MHz



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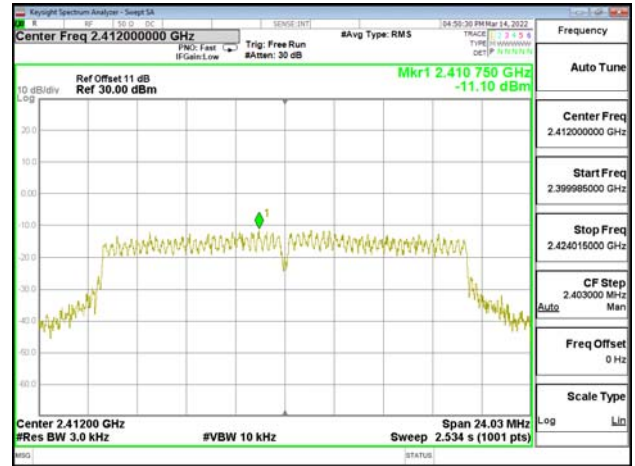
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802.11n_20MHz_Chain0_2412MHz



802.11n_20MHz_Chain1_2412MHz



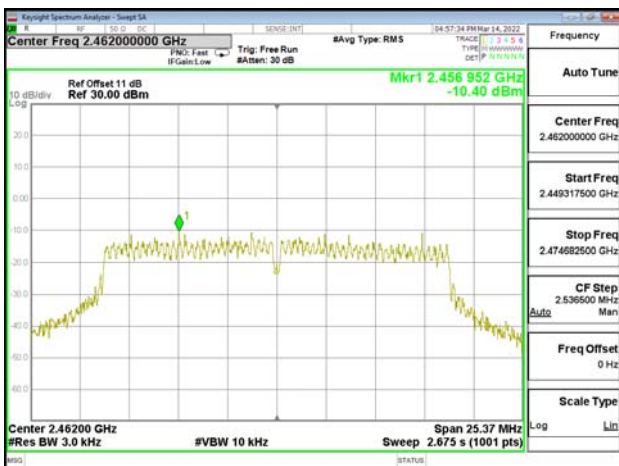
802.11n_20MHz_Chain0_2437MHz



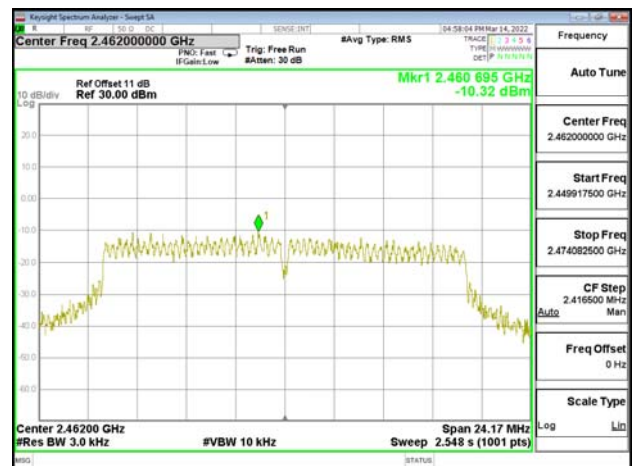
802.11n_20MHz_Chain1_2437MHz



802.11n_20MHz_Chain0_2462MHz



802.11n_20MHz_Chain1_2462MHz

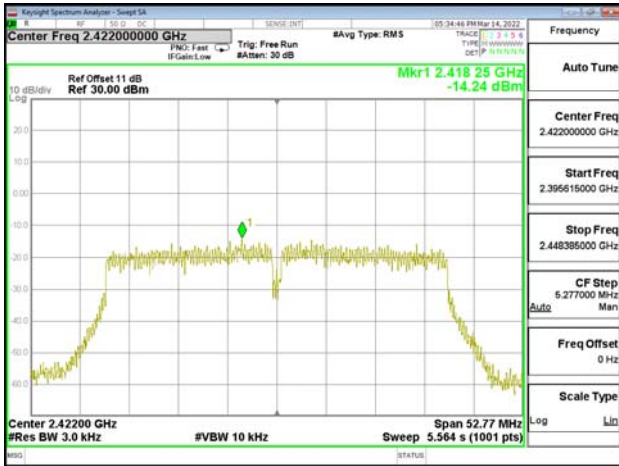


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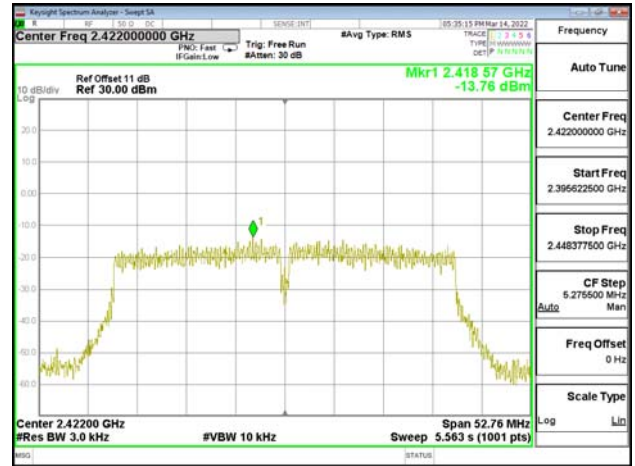
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802.11n_40MHz_Chain0_2422MHz



802.11n_40MHz_Chain1_2422MHz



802.11n_40MHz_Chain0_2437MHz



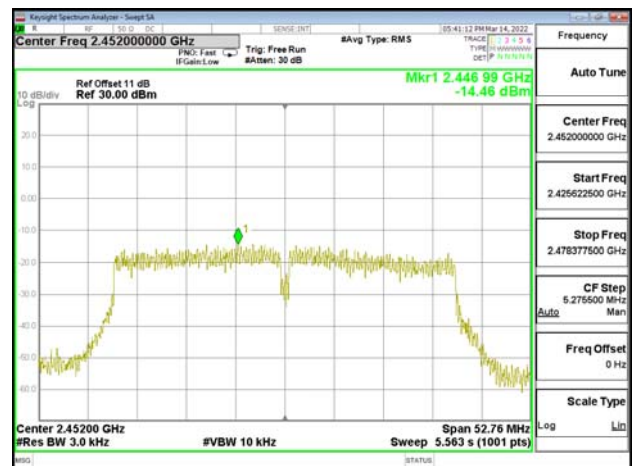
802.11n_40MHz_Chain1_2437MHz



802.11n_40MHz_Chain0_2452MHz



802.11n_40MHz_Chain1_2452MHz



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13 ANTENNA REQUIREMENT

13.1 Standard Applicable

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §§ 15.211, 15.213, 15.217, 15.219, 15.221, or § 15.236. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with § 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

13.2 Antenna Connected Construction

The antenna is designed as permanently attached and no consideration of replacement. Please see EUT photo for details.

~ End of Report ~

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