

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT



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

Product Name: Clover Mini

Brand Name: clover

Model No.: C302U

HVIN: C302W

Model Difference: N/A

Report Number: E2/2021/60025

FCC ID HFS-C302W

IC: 1787B-C302W

Issue Date: August 4, 2021

Date of Test: June 19, 2021 ~ July 8, 2021

Date of EUT Received: June 10, 2021

Approved By Arno Hsieh
Arno Hsieh

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, ISSED RSS-247.

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

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Revision History

Report Number	Revision	Description	Issue Date	Revised By
E2/2021/60025	00	Original	August 4, 2021	Susan Lin

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1 GENERAL INFORMATION

1.1 Product Description

Product Name:	Clover Mini
Brand Name:	clover
Model No.:	C302U
HVIN:	C302W
Model Difference:	N/A
Hardware Version:	C302W
Firmware Version:	N/A
EUT Series No.:	PJ216092003
Power Supply:	12V from AC/DC Adapter

Wi-Fi 802.11	Frequency Range	Channels	Rated Power (dBm)	Modulation Technology
b	2412-2462	11	18.38	DSSS
g			20.13	OFDM
n_HT20			HT: 23.69 (MIMO)	
n_HT40	2422-2452	7	HT: 24.46 (MIMO)	
Modulation type:	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM			
Transission 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 – 300.0Mbps			

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1.2 Antenna Designation

Antenna Type	Supplier	Antenna Part No.	Freq. (MHz)	Peak Antenna Gain (dBi)	Worst Antenna Gain
PIFA	SAA	GD9320-15-001-R	2402~2480	1.15	
	SAA	GD9321-15-001-R	2402~2480	-0.2	
	Luxshare-ICT	LA81FP017-1H	2402~2480	2.1	V
	Luxshare-ICT	LA81FP018-1H	2402~2480	0.9	

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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1.3 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

ANSI C63.10:2013

1.4 Test Facility

Laboratory	Test Site Address	Test Site Name	FCC Designa- tion 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 A	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 indica- tion where measurements occurred in specific test site and address.				

1.5 Special Accessories

There are no special accessories used while test was conducted.

1.6 Equipment Modifications

There was no modification incorporated into the EUT.

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2 SYSTEM TEST CONFIGURATION

2.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

2.2 EUT Exercise

An engineering test mode (software/firmware) that applicant provided was utilized to manipulate the EUT into transmit, selection of the test channel, and modulation scheme.

2.3 Test Procedure

2.3.1 Conducted Emissions

The EUT is placed on a table which is 0.8 m above ground plane. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz. The CISPR Quasi-Peak and Average detector mode is employed. The two LISNs provide 50uH/50 ohm of coupling impedance for the measuring instrument. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

2.3.2 Conducted Test (RF)

The active antenna port of the unlicensed wireless device is connected to the spectrum analyzer with attenuator to protect the instrumentation. If a second antenna port is available, it is tested at one operating frequency, with other port(s) appropriately terminated, to verify it has similar output characteristics as the fully tested port.

2.3.3 Radiated Emissions

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

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2.4 Measurement Results Explanation Example

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

Radiated emission below 30MHz is measured in a 9m*9m*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 Configuration of Tested System

Fig. 2-1 Conduction (AC Power Line) & Radiated Emission

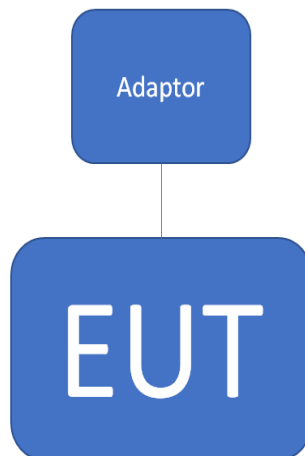


Fig. 2-2 Conducted (Antenna Port) Configuration

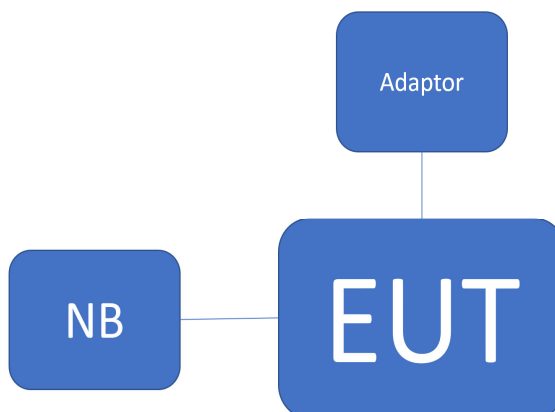


Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Data Cable	Power Cord
1.	WLAN Test Software	N/A	N/A	N/A	N/A	N/A
2.	Notebook	Lenovo	T420	S0012599	N/A	N/A

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3 SUMMARY OF TEST RESULTS

FCC Rules	IC 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 §15.247(b)	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 given UE is pre-scanned among below modes.

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

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4.3 Radiated Emission Test:

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	MCS8	MIMO

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	MCS8	MIMO
802.11n (HT40)	3 to 9	3,6,9	OFDM	MCS8	MIMO

Note:

The field strength of radiation emission was measured as EUT three orthogonal planes, E1 / E2 / H, are positioned to pre-scan the emission generating the highest one. The worst position is tested and recorded.

4.4 Antenna Port Conducted Measurement:

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	MCS8	MIMO
802.11n (HT40)	3 to 9	3,6,9	OFDM	MCS8	MIMO

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5 MEASUREMENT UNCERTAINTY

Test Items	Uncertainty
AC Power Line Conducted Emission	+/- 2.34 dB
Emission Bandwidth	+/- 1.53 Hz
The Maximum Output Power Measurement	+/- 1 dB
Peak Power Spectral Density Measurement	+/- 1.53 dB
Frequency Stability	+/- 1.53 Hz
Temperature	+/- 0.4 °C
Humidity	+/- 3.5 %
DC / AC Power Source	+/- 1 %

Radiated Spurious Emission Measurement Uncertainty			
Polarization: Vertical	+/-	2.64 dB	9kHz~30MHz
	+/-	4.93 dB	30MHz - 1000MHz
	+/-	4.81 dB	1GHz - 18GHz
	+/-	4.52 dB	18GHz - 40GHz
Polarization: Horizontal	+/-	2.64 dB	9kHz~30MHz
	+/-	4.45 dB	30MHz - 1000MHz
	+/-	4.81 dB	1GHz - 18GHz
	+/-	4.52 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 CONDUCTED EMISSION TEST

6.1 Standard Applicable

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

Frequency range MHz	Limits (dBuV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50
Note 1.The lower limit shall apply at the transition frequencies 2.The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.		

6.2 Measurement Equipment Used

Radiated Emission Test Site: Conduction A					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Test Software	audix	e3	Ver. 6.11-20180419c	N.C.R	N.C.R
LISN	SCHWARZBECK Mess-Elektronik	NSLK8127	973	03/25/2021	03/24/2022
EMI Test Receiver	R&S	ESCI	101342	04/27/2021	04/26/2022
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

6.3 EUT Setup

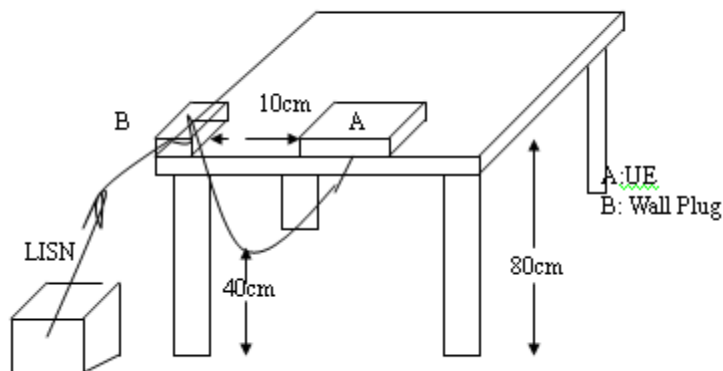
1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.10:2013.
2. The AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.
3. The LISN was connected with 120Vac/60Hz power source.

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6.4 Test SET-UP (Block Diagram of Configuration)



6.5 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

6.6 Measurement Result

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

Note2: The * reveals the worst-case results that closet to the limit.

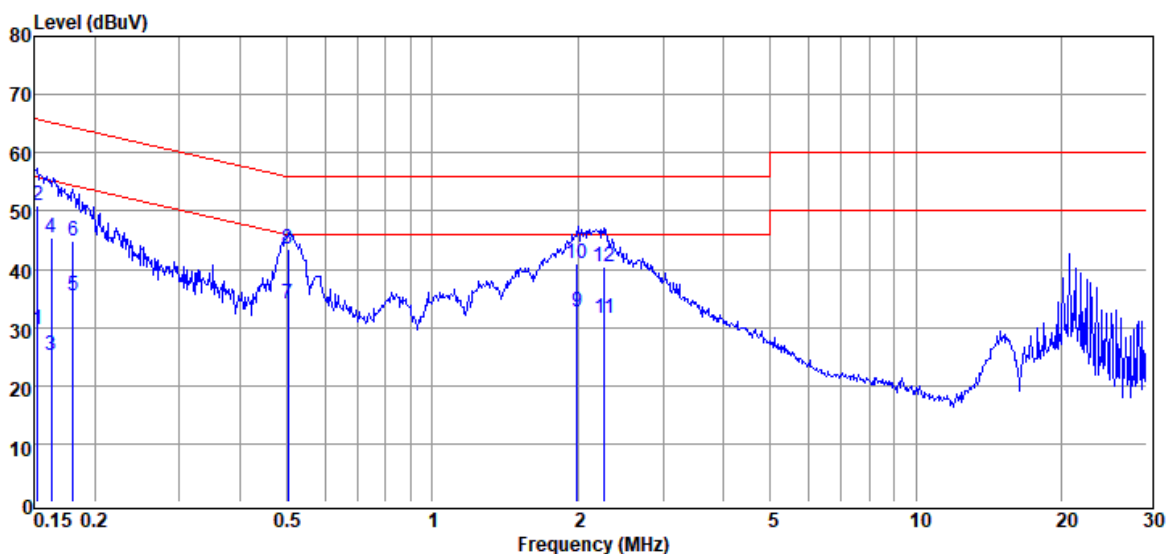
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AC POWER LINE CONDUCTED EMISSION TEST DATA

Report Number :E2-2021-60025 Test Site :Conduction Room C
 Test Mode :WLAN 2.4G Test Date :2021-06-28
 Power :120V/60Hz Temp./Humi. :25.4/52
 Probe :L1 Engineer :Jack Tseng
 Note: : Adapter:FSP040-RHBN2



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV	Limit dBuV	Margin dB
0.15	Average	19.22	10.30	29.52	55.87	-26.35
0.15	QP	40.50	10.30	50.80	65.87	-15.07
0.16	Average	14.87	10.30	25.17	55.30	-30.13
0.16	QP	35.13	10.30	45.43	65.30	-19.87
0.18	Average	25.28	10.22	35.50	54.46	-18.96
0.18	QP	34.57	10.22	44.79	64.46	-19.67
0.50	Average	23.82	10.31	34.13	46.00	-11.87
0.50	QP	33.27	10.31	43.58	56.00	-12.42
1.99	Average	21.37	11.17	32.54	46.00	-13.46
1.99	QP	29.93	11.17	41.10	56.00	-14.90
2.27	Average	20.35	11.09	31.44	46.00	-14.56
2.27	QP	29.24	11.09	40.33	56.00	-15.67

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Report Number :E2-2021-60025

Test Site :Conduction Room C

Test Mode :WLAN 2.4G

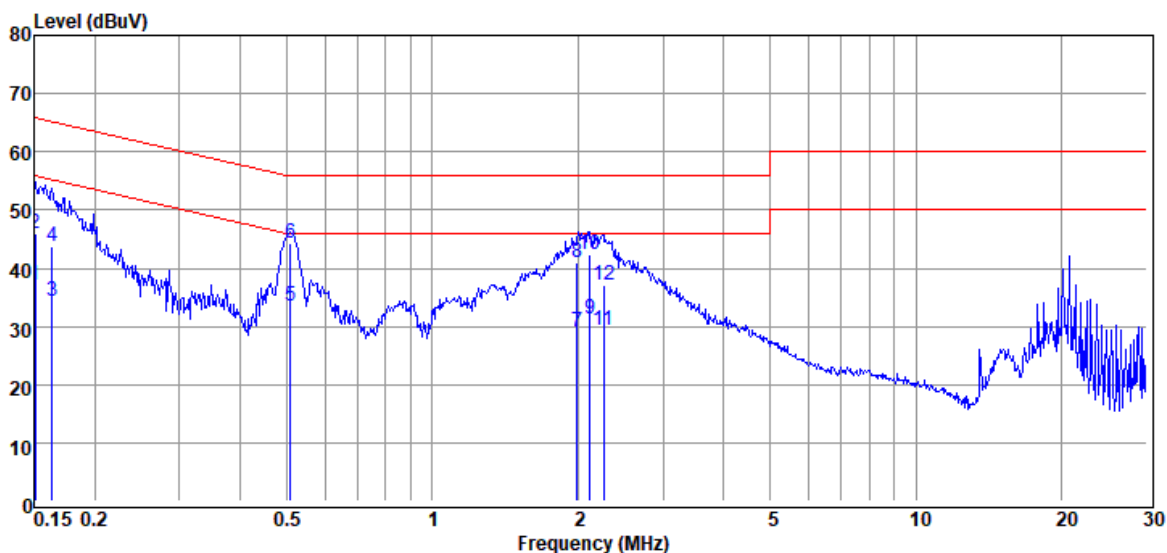
Test Date :2021-06-28

Power :120V/60Hz

Temp./Humi. :25.4/52

Probe :N

Engineer :Jack Tseng

Note: : Adapter:FSP040-RHBN2


Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV	Limit dBμV	Margin dB
0.15	Average	26.78	10.21	36.99	55.96	-18.97
0.15	QP	35.84	10.21	46.05	65.96	-19.91
0.16	Average	24.19	10.21	34.40	55.30	-20.90
0.16	QP	33.46	10.21	43.67	65.30	-21.63
0.51	Average	23.15	10.32	33.47	46.00	-12.53
0.51	QP	33.96	10.32	44.28	56.00	-11.72
1.99	Average	17.91	11.18	29.09	46.00	-16.91
1.99	QP	29.71	11.18	40.89	56.00	-15.11
2.12	Average	20.11	11.14	31.25	46.00	-14.75
2.12	QP	31.11	11.14	42.25	56.00	-13.75
2.26	Average	18.88	10.46	29.34	46.00	-16.66
2.26	QP	26.58	10.46	37.04	56.00	-18.96

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7 DUTY CYCLE OF TEST SIGNAL

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.

7.1 Measurement Procedure:

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

7.2 Duty Cycle:

	Duty Cycle (%) = Ton / (Ton+Toff)	Duty Factor (dB) =10*log (1/Duty Cycle)	1/T (kHz)	VBW setting (kHz)
802.11b	99.17	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

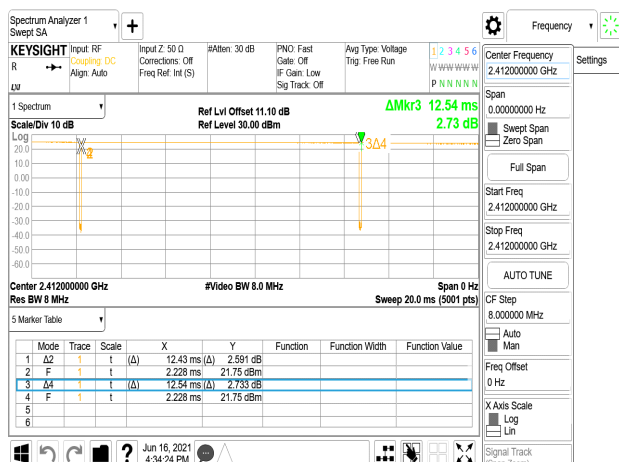
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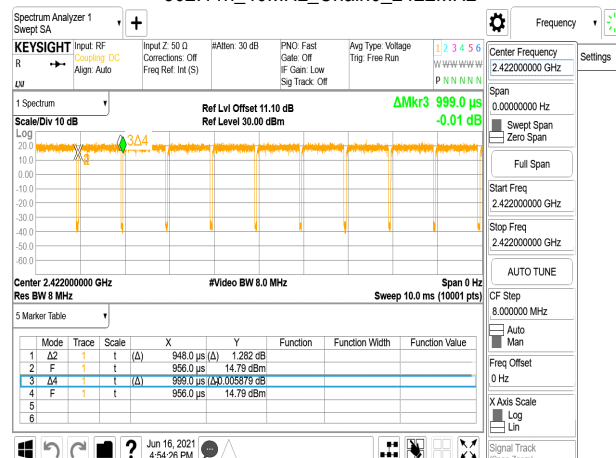
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7.3 Duty Cycle test plots

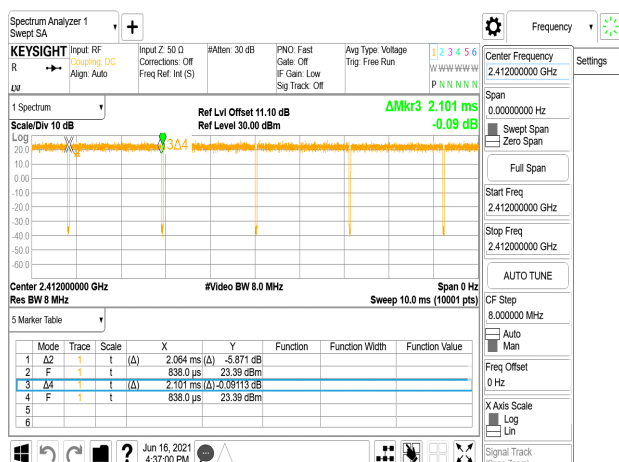
802.11b_20MHz_Chain0_2412MHz



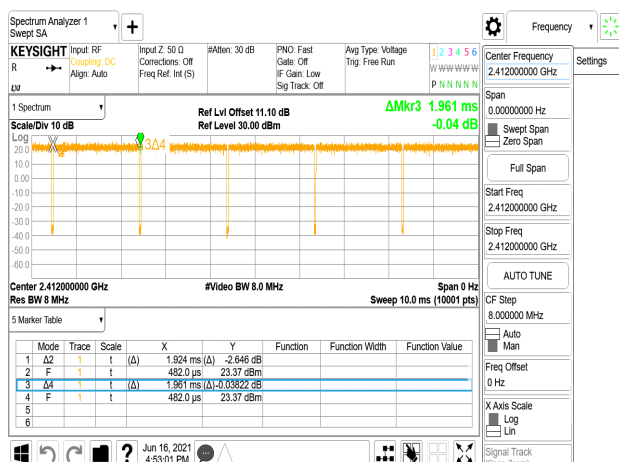
802.11n_40MHz_Chain0_2422MHz



802.11g_20MHz_Chain0_2412MHz



802.11n_20MHz_Chain0_2412MHz



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8 PEAK OUTPUT POWER MEASUREMENT

8.1 Standard Applicable

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 from the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the Antenna exceeds 6dBi.

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

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.

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

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

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

G_k is the gain in dBi of the kth antenna.

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

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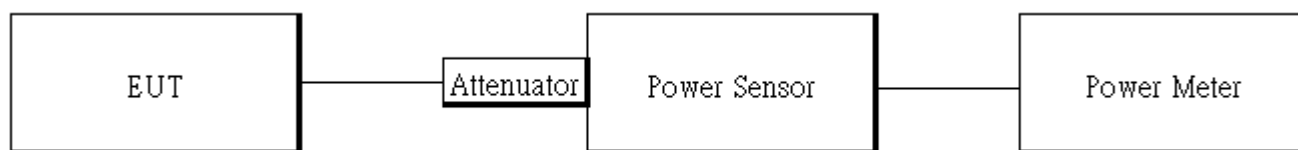
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8.2 Measurement Equipment Used

Conducted Emission Test Site: Conducted G					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	KEYSIGHT	N9010B	MY59071570	06/01/2021	05/31/2022
Attenuator	Marvelous	WATT-218FS-10	RF16	11/19/2020	11/18/2021
DC Block	PASTERNAK	PE8210	RF154	11/19/2020	11/18/2021
Power Meter	Anritsu	ML2496A	1326001	08/05/2020	08/04/2021
Power Sensor	Anritsu	MA2411B	1315048	08/05/2020	08/04/2021
Power Sensor	Anritsu	MA2411B	1315049	08/05/2020	08/04/2021
Attenuator	Marvelous	MVE2213-10	RF12	11/19/2020	11/18/2021
Attenuator	Marvelous	WATT-218FS-10	RF18	11/19/2020	11/18/2021

8.3 Test Set-up

Power Meter:



8.4 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 power meter.

Power Meter:

It is used as the auxiliary test equipment to conduct the output power measurement.

4. Record the max. Reading as observed from Spectrum or Power Meter.

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

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8.5 Measurement Result

802.11b Ch0						
CH	Freq. (MHz)	Data Rate	Power set	Peak Output Power (dBm)	Limit (dBm)	RESULT
1	2412	1	15.5	18.14	30.00	PASS
6	2437	1	15.5	18.19	30.00	PASS
11	2462	1	15.5	18.38	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	15.5	15.96	30.00	PASS
6	2437	1	15.5	15.97	30.00	PASS
11	2462	1	15.5	15.95	30.00	PASS
802.11b Ch1						
CH	Freq. (MHz)	Data Rate	Power set	Peak Output Power (dBm)	Limit (dBm)	RESULT
1	2412	1	15	18.03	30.00	PASS
6	2437	1	15	17.87	30.00	PASS
11	2462	1	15.5	18.28	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	15	15.88	30.00	PASS
6	2437	1	15	15.80	30.00	PASS
11	2462	1	15.5	15.84	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	14.5	20.13	30.00	PASS
6	2437	6	14.5	19.74	30.00	PASS
11	2462	6	14.5	19.83	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	14.5	14.96	30.00	PASS
6	2437	6	14.5	14.94	30.00	PASS
11	2462	6	14.5	14.93	30.00	PASS
802.11g Ch1						
CH	Freq. (MHz)	Data Rate	Power set	Peak Output Power (dBm)	Limit (dBm)	RESULT
1	2412	6	14	19.97	30.00	PASS
6	2437	6	14	19.60	30.00	PASS
11	2462	6	14.5	19.73	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	14	14.91	30.00	PASS
6	2437	6	14	14.90	30.00	PASS
11	2462	6	14.5	14.88	30.00	PASS

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802.11n_HT20M Ch0						
CH	Freq. (MHz)	Data Rate	Power set	Peak Output Power (dBm)	Limit (dBm)	RESULT
1	2412	MCS0	15	20.51	30.00	PASS
6	2437	MCS0	15	20.39	30.00	PASS
11	2462	MCS0	15	20.10	30.00	PASS
802.11n_HT20M Ch0						
CH	Freq. (MHz)	Data Rate	Power set	Max. Avg. Output include tune up tolerance Power (dBm)	Limit (dBm)	RESULT
1	2412	MCS0	15	15.47	30.00	PASS
6	2437	MCS0	15	15.44	30.00	PASS
11	2462	MCS0	15	15.42	30.00	PASS

802.11n_HT20M Ch1						
CH	Freq. (MHz)	Data Rate	Power set	Peak Output Power (dBm)	Limit (dBm)	RESULT
1	2412	MCS0	14.5	20.37	30.00	PASS
6	2437	MCS0	14.5	20.24	30.00	PASS
11	2462	MCS0	15	20.04	30.00	PASS
802.11n_HT20M Ch1						
CH	Freq. (MHz)	Data Rate	Power set	Max. Avg. Output include tune up tolerance Power (dBm)	Limit (dBm)	RESULT
1	2412	MCS0	14.5	15.37	30.00	PASS
6	2437	MCS0	14.5	15.25	30.00	PASS
11	2462	MCS0	15	15.20	30.00	PASS

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802.11n_HT20M MIMO								
CH	Freq. (MHz)	Data Rate	Power set	Peak Output Power (dBm)		Total Peak Output Power (dBm)	Limit (dBm)	RESULT
				CH 0	CH 1			
1	2412	MCS8	15	20.98	20.35	23.69	30.00	PASS
6	2437	MCS8	15	20.85	20.24	23.57	30.00	PASS
11	2462	MCS8	15	20.73	20.01	23.40	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	MCS8	15	15.57	15.18	18.47	30.00	PASS
6	2437	MCS8	15	15.50	15.23	18.46	30.00	PASS
11	2462	MCS8	15	15.44	15.27	18.45	30.00	PASS

802.11n_HT40M Ch0						
CH	Freq. (MHz)	Data Rate	Power set	Peak Output Power (dBm)	Limit (dBm)	RESULT
3	2422	MCS0	14.5	21.53	30.00	PASS
6	2437	MCS0	14.5	21.34	30.00	PASS
9	2452	MCS0	14.5	21.75	30.00	PASS

802.11n_HT40M Ch0						
CH	Freq. (MHz)	Data Rate	Power set	Max. Avg. Output include tune up tolerance Power (dBm)	Limit (dBm)	RESULT
3	2422	MCS0	14.5	14.47	30.00	PASS
6	2437	MCS0	14.5	14.43	30.00	PASS
9	2452	MCS0	14.5	14.41	30.00	PASS

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802.11n_HT40M Ch1						
CH	Freq. (MHz)	Data Rate	Power set	Peak Output Power (dBm)	Limit (dBm)	RESULT
3	2422	MCS0	14	21.40	30.00	PASS
6	2437	MCS0	14	21.20	30.00	PASS
9	2452	MCS0	14.5	21.56	30.00	PASS
802.11n_HT40M Ch1						
CH	Freq. (MHz)	Data Rate	Power set	Max. Avg. Output include tune up tolerance Power (dBm)	Limit (dBm)	RESULT
3	2422	MCS0	14	14.40	30.00	PASS
6	2437	MCS0	14	14.33	30.00	PASS
9	2452	MCS0	14.5	14.36	30.00	PASS

802.11n_HT40M MIMO									
CH	Freq. (MHz)	Data Rate	Power set	Peak Output Power (dBm)		Total Peak Output Power (dBm)	Limit (dBm)		RESULT
				CH 0	CH 1				
3	2422	MCS8	14.5	21.35	20.98	24.18		30.00	PASS
6	2437	MCS8	14.5	21.39	21.18	24.30		30.00	PASS
9	2452	MCS8	14.5	21.67	21.22	24.46		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	MCS8	14.5	14.37	14.12	17.48		30.00	PASS
6	2437	MCS8	14.5	14.35	14.15	17.49		30.00	PASS
9	2452	MCS8	14.5	14.37	14.10	17.48		30.00	PASS

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

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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	15.96	0.90	16.86	36	PASS
6	2437	1	15.97	0.90	16.87	36	PASS
11	2462	1	15.95	0.90	16.85	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	15.88	2.10	17.98	36	PASS
6	2437	1	15.80	2.10	17.90	36	PASS
11	2462	1	15.84	2.10	17.94	36	PASS

802.11g Ch0							
CH	Freq. (MHz)	Data Rate	Avg. Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	RESULT
1	2412	6	14.96	0.90	15.86	36	PASS
6	2437	6	14.94	0.90	15.84	36	PASS
11	2462	6	14.93	0.90	15.83	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	14.91	2.10	17.01	36	PASS
6	2437	6	14.90	2.10	17.00	36	PASS
11	2462	6	14.88	2.10	16.98	36	PASS

802.11n_HT20M Ch0							
CH	Freq. (MHz)	Data Rate	Avg. Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	RESULT
1	2412	HT0	15.47	0.90	16.37	36	PASS
6	2437	HT0	15.44	0.90	16.34	36	PASS
11	2462	HT0	15.42	0.90	16.32	36	PASS

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802.11n_HT20M Ch1							
CH	Freq. (MHz)	Data Rate	Avg. Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	RESULT
1	2412	HT0	15.37	2.10	17.47	36	PASS
6	2437	HT0	15.25	2.10	17.35	36	PASS
11	2462	HT0	15.20	2.10	17.30	36	PASS

802.11n_HT20M MIMO									
CH	Freq. (MHz)	Data Rate	Avg. Output Power (dBm)		Total Avg. Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	RESULT
			CH 0	CH 1					
1	2412	HT8	20.98	20.35	18.47	4.53	23.00	36	PASS
6	2437	HT8	20.85	20.24	18.46	4.53	22.99	36	PASS
11	2462	HT8	20.73	20.01	18.45	4.53	22.98	36	PASS

802.11n_HT40M Ch0							
CH	Freq. (MHz)	Data Rate	Avg. Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	RESULT
3	2422	HT0	14.47	0.90	15.37	36	PASS
6	2437	HT0	14.43	0.90	15.33	36	PASS
9	2452	HT0	14.41	0.90	15.31	36	PASS

802.11n_HT40M Ch1							
CH	Freq. (MHz)	Data Rate	Avg. Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	RESULT
3	2422	HT0	14.40	2.10	16.50	36	PASS
6	2437	HT0	14.33	2.10	16.43	36	PASS
9	2452	HT0	14.36	2.10	16.46	36	PASS

802.11n_HT40M MIMO									
CH	Freq. (MHz)	Data Rate	Avg. Output Power (dBm)		Total Avg. Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	RESULT
			CH 0	CH 1					
3	2422	HT8	14.37	14.12	17.48	4.53	22.01	36	PASS
6	2437	HT8	14.35	14.15	17.49	4.53	22.02	36	PASS
9	2452	HT8	14.37	14.10	17.48	4.53	22.01	36	PASS

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9 EMISSION BANDWIDTH MEASUREMENT

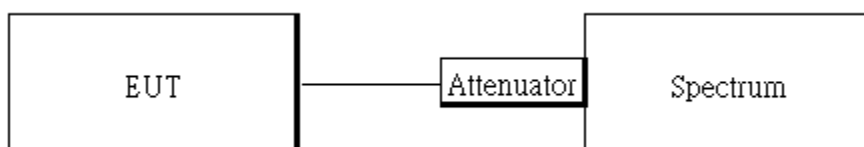
9.1 Standard Applicable

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

9.2 Measurement Equipment Used

Conducted Emission Test Site: Conducted G					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	KEYSIGHT	N9010B	MY59071570	06/01/2021	05/31/2022
Attenuator	Marvelous	WATT-218FS-10	RF16	11/19/2020	11/18/2021
DC Block	PASTERNAK	PE8210	RF154	11/19/2020	11/18/2021

9.3 Test Set-up



9.4 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 ≥ 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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9.5 6dB Bandwidth

802.11b Ch0				802.11g Ch0			
Freq. (MHz)	6dB BW (kHz)	Limit (kHz)	Result	Freq. (MHz)	6dB BW (kHz)	Limit (kHz)	Result
2412	8110.00	≥ 500	PASS	2412	15180.00	≥ 500	PASS
2437	8113.00	≥ 500	PASS	2437	15180.00	≥ 500	PASS
2462	8112.00	≥ 500	PASS	2462	15740.00	≥ 500	PASS

802.11_n_HT20 Ch0				802.11_n_HT20 Ch1			
Freq. (MHz)	6dB BW (kHz)	Limit (kHz)	Result	Freq. (MHz)	6dB BW (kHz)	Limit (kHz)	Result
2412	15490.00	≥ 500	PASS	2412	15470.00	≥ 500	PASS
2437	15450.00	≥ 500	PASS	2437	15490.00	≥ 500	PASS
2462	16370.00	≥ 500	PASS	2462	16140.00	≥ 500	PASS

802.11_n_HT40 Ch0				802.11_n_HT40 Ch1			
Freq. (MHz)	6dB BW (kHz)	Limit (kHz)	Result	Freq. (MHz)	6dB BW (kHz)	Limit (kHz)	Result
2422	35320.00	≥ 500	PASS	2422	35200.00	≥ 500	PASS
2437	35320.00	≥ 500	PASS	2437	35190.00	≥ 500	PASS
2452	35170.00	≥ 500	PASS	2452	35300.00	≥ 500	PASS

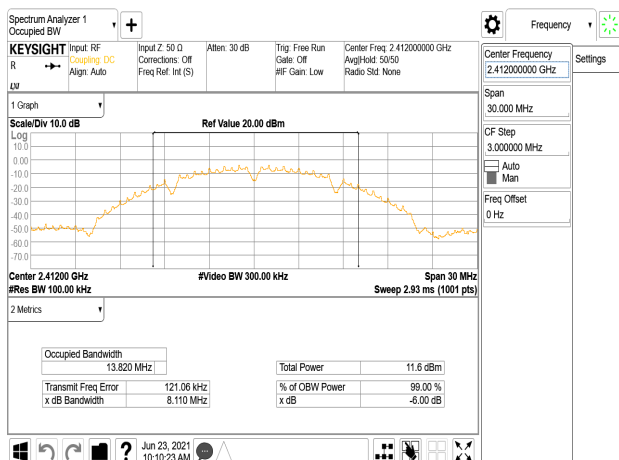
*Refer to next page for plots

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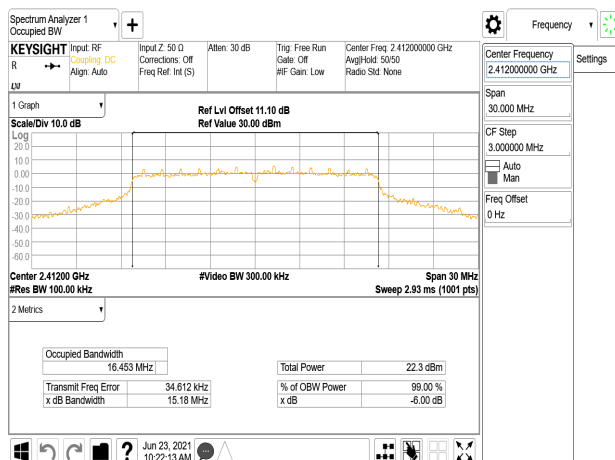
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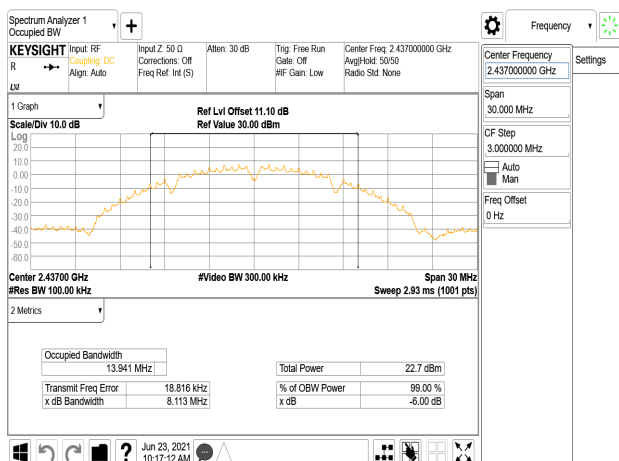
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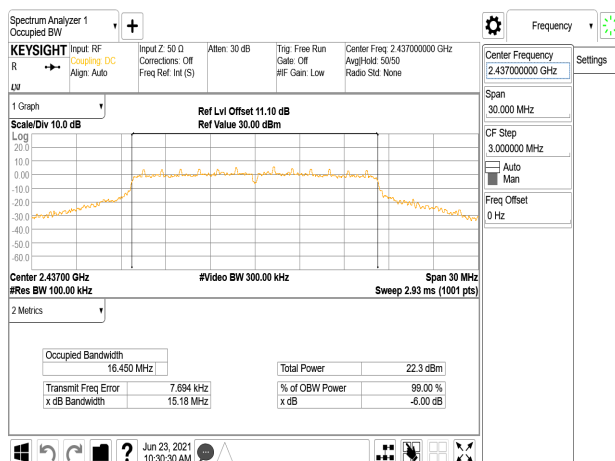
802.11g_20MHz_Chain0_2412MHz



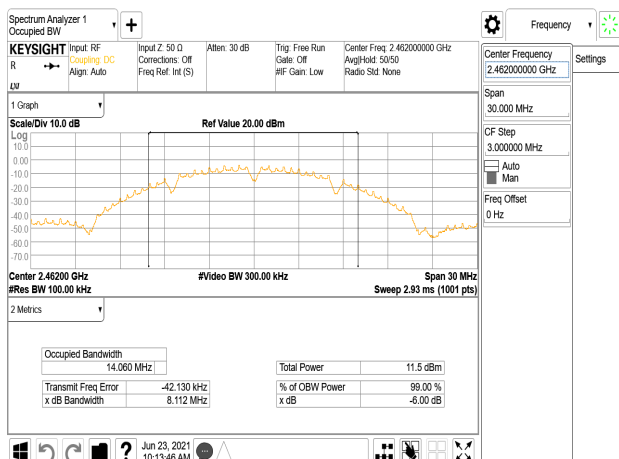
802.11b_20MHz_Chain0_2437MHz



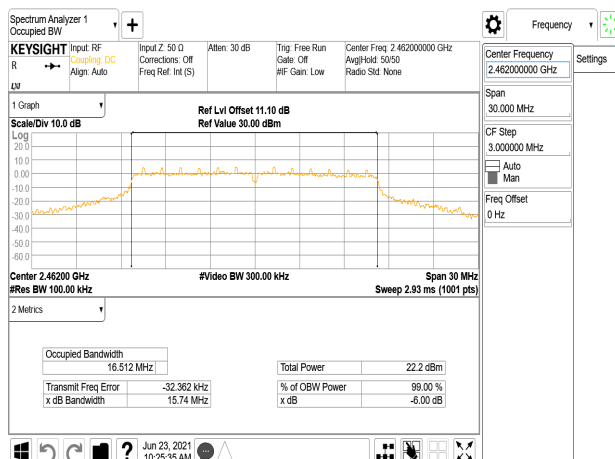
802.11g_20MHz_Chain0_2437MHz



802.11b_20MHz_Chain0_2462MHz



802.11g_20MHz_Chain0_2462MHz



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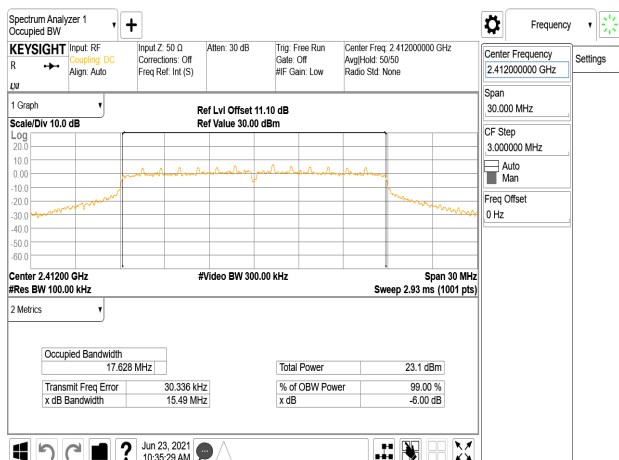
台灣檢驗科技股份有限公司 t (886-2) 2299-3279

f (886-2) 2298-0488

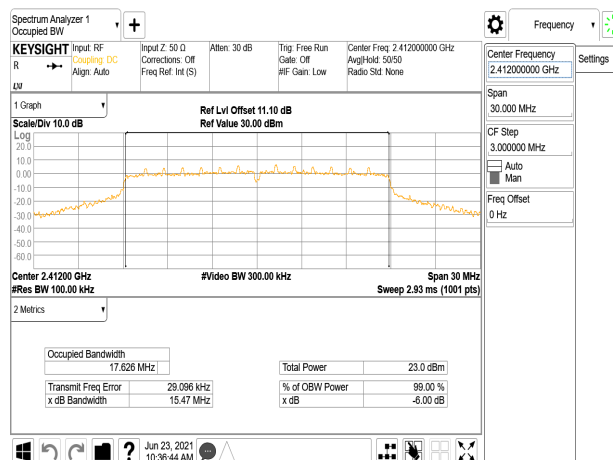
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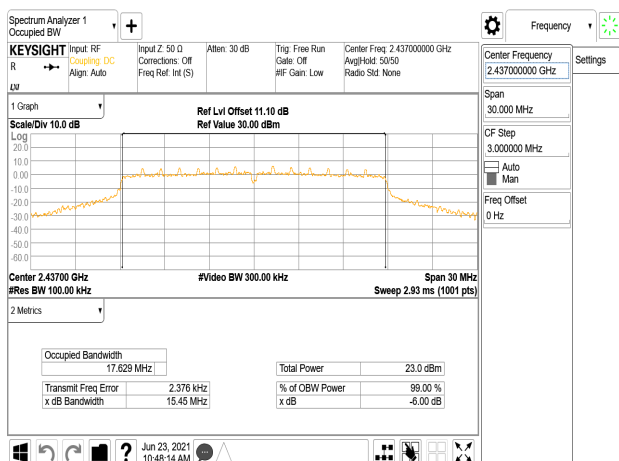
802.11n_20MHz_Chain0_2412MHz



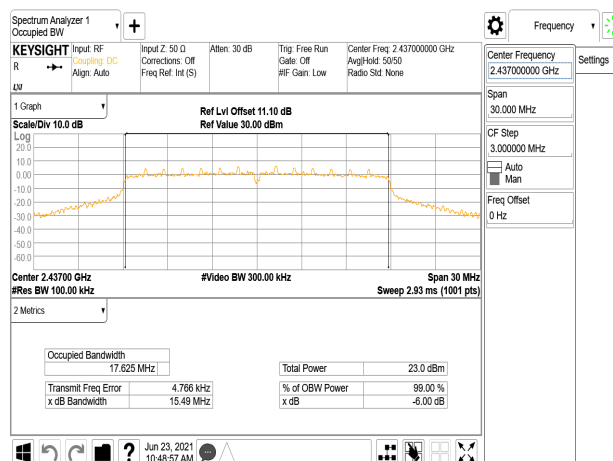
802.11n_20MHz_Chain1_2412MHz



802.11n_20MHz_Chain0_2437MHz



802.11n_20MHz_Chain1_2437MHz



802.11n_20MHz_Chain0_2462MHz



802.11n_20MHz_Chain1_2462MHz



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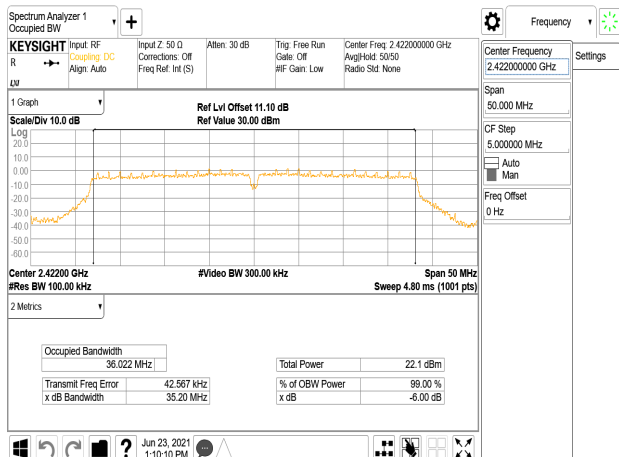
台灣檢驗科技股份有限公司 t (886-2) 2299-3279

f (886-2) 2298-0488

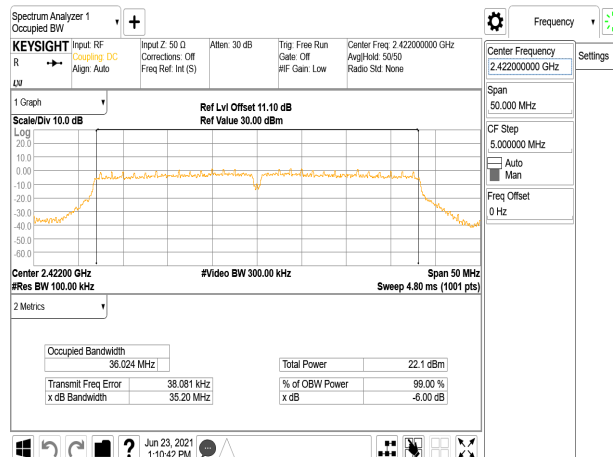
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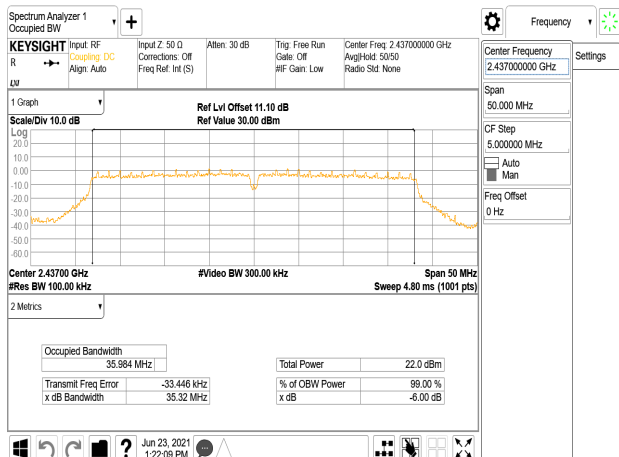
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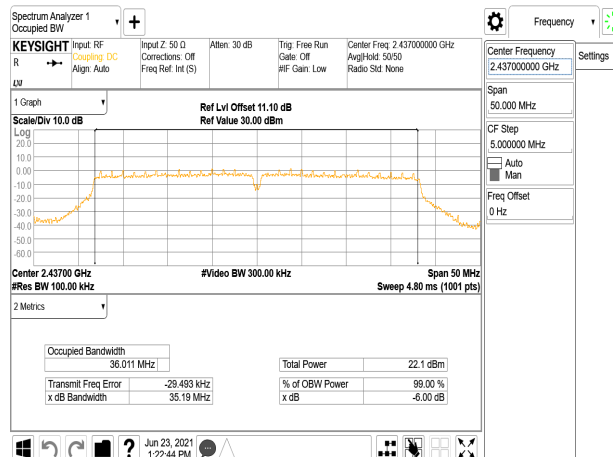
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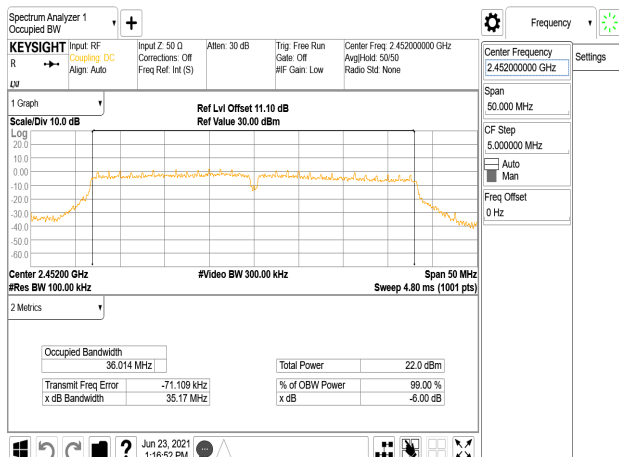
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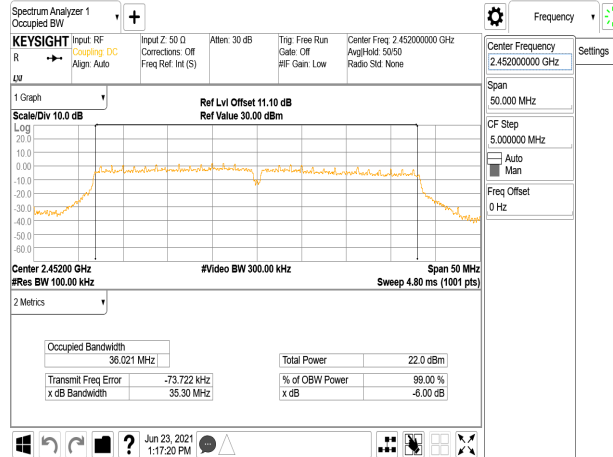
802.11n_40MHz_Chain1_2437MHz



802.11n_40MHz_Chain0_2452MHz



802.11n_40MHz_Chain1_2452MHz



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9.6 99% Bandwidth

802.11b Ch0		802.11g Ch0	
Freq. (MHz)	99% BW (MHz)	Freq. (MHz)	99% BW (MHz)
2412	13.808	2412	16.703
2437	13.918	2437	16.715
2462	14.057	2462	16.847

802.11n_HT20M Ch0		802.11n_HT20M Ch1	
Freq. (MHz)	99% BW (MHz)	Freq. (MHz)	99% BW (MHz)
2412	17.853	2412	17.856
2437	17.889	2437	17.882
2462	17.993	2462	17.997

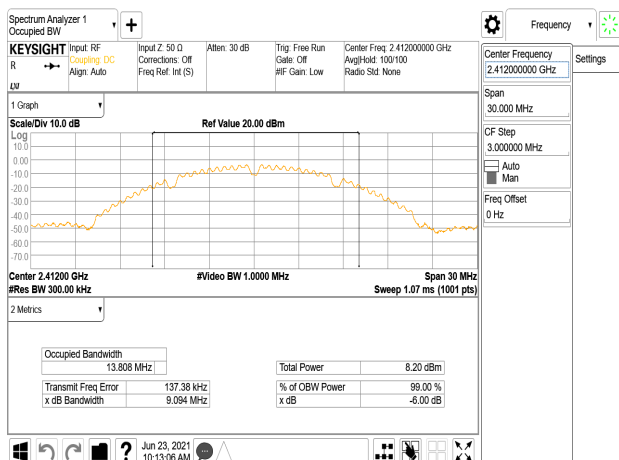
802.11n_HT40M Ch0		802.11n_HT40M Ch1	
Freq. (MHz)	99% BW (MHz)	Freq. (MHz)	99% BW (MHz)
2422	36.168	2422	36.174
2437	36.148	2437	36.159
2452	36.225	2452	36.218

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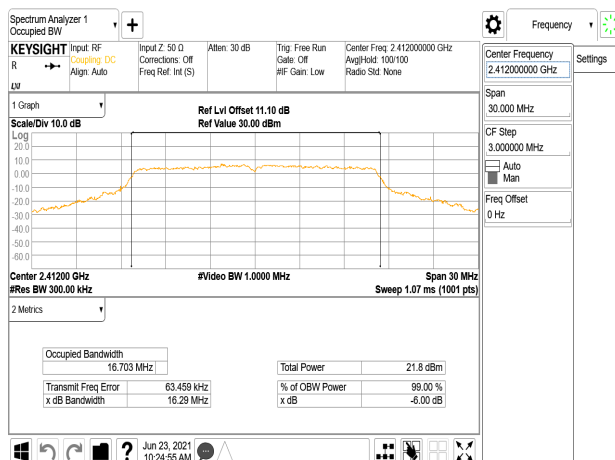
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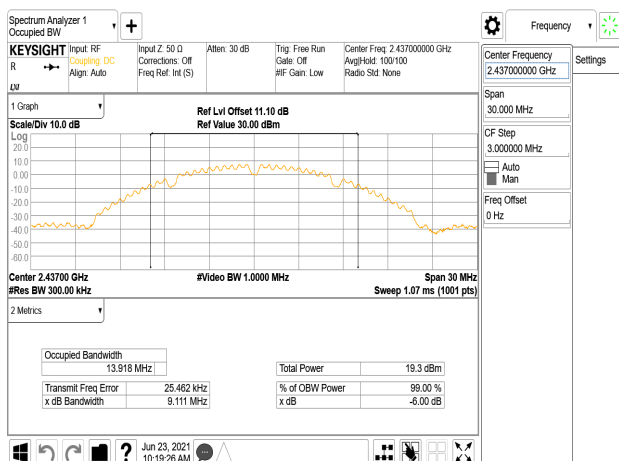
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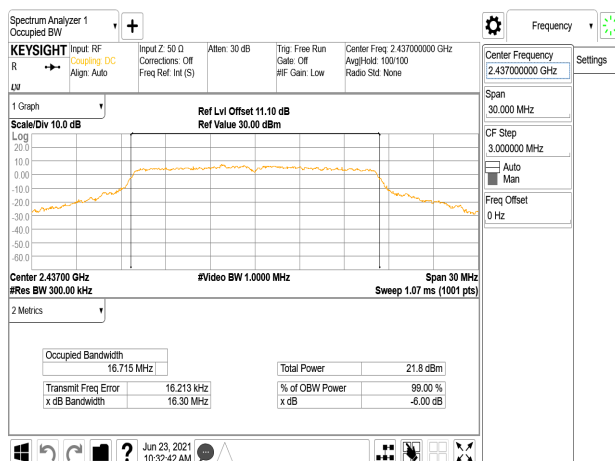
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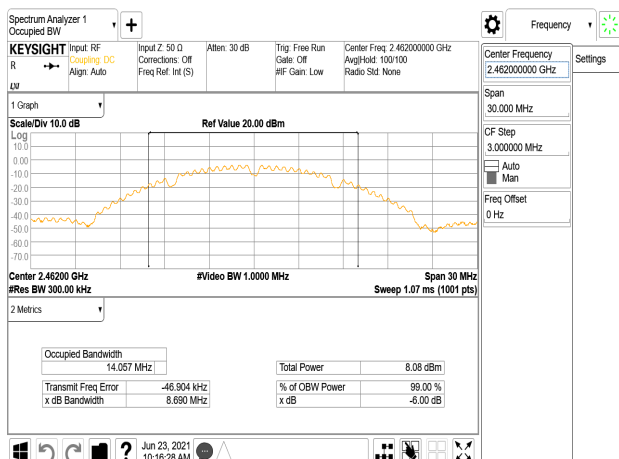
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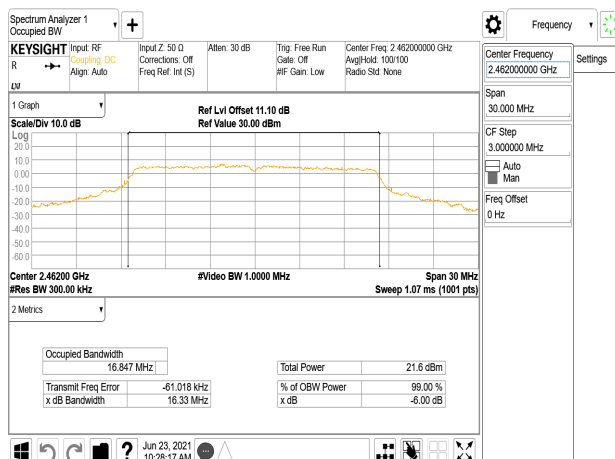
802.11g_20MHz_Chain0_2437MHz



802.11b_20MHz_Chain0_2462MHz



802.11g_20MHz_Chain0_2462MHz



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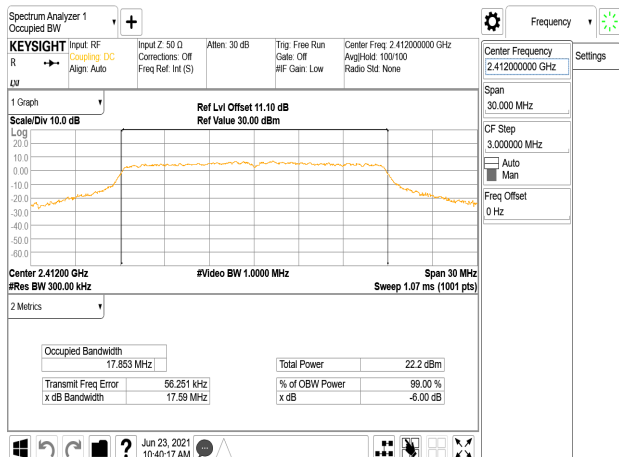
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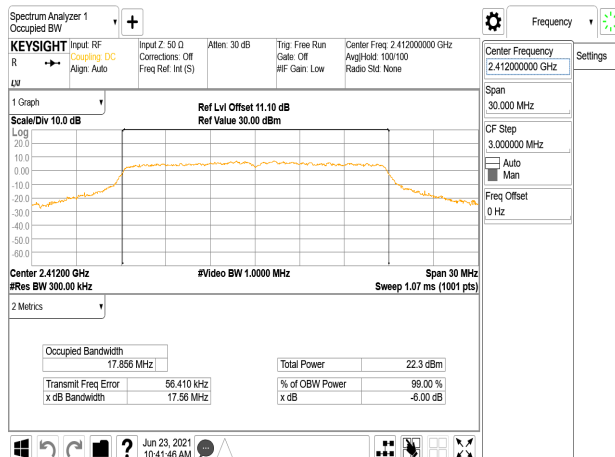
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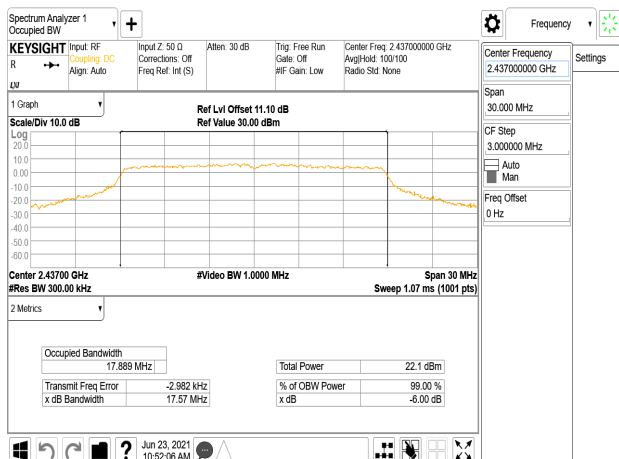
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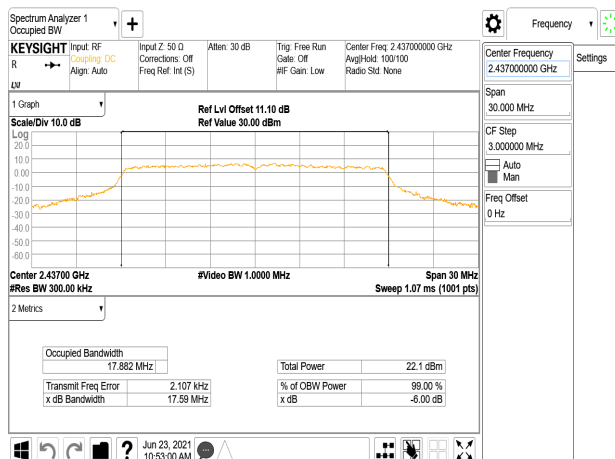
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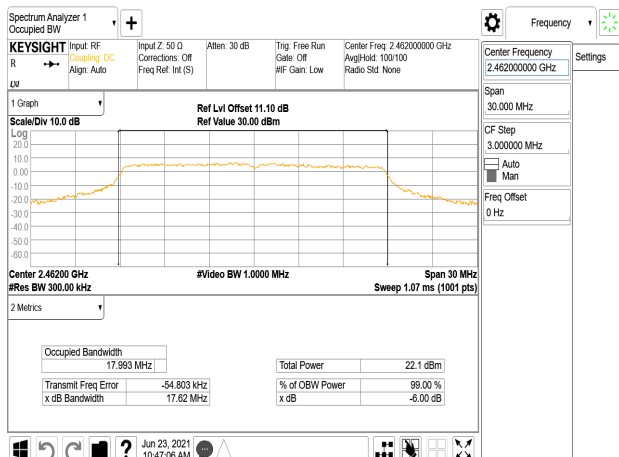
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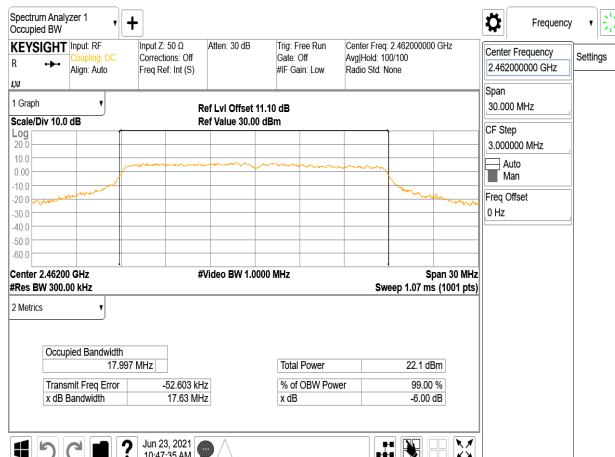
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802.11n_20MHz_Chain0_2462MHz



802.11n_20MHz_Chain1_2462MHz

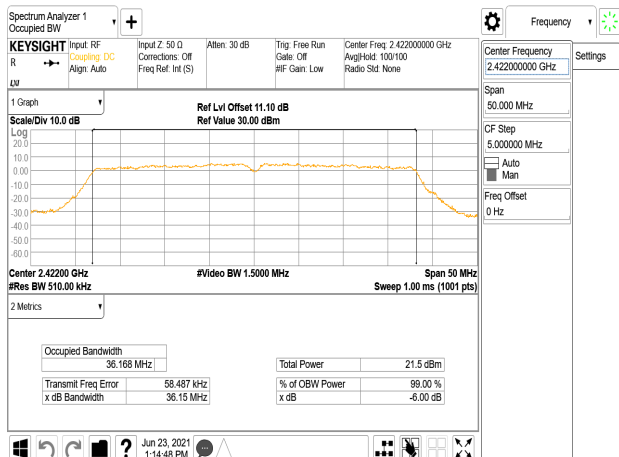


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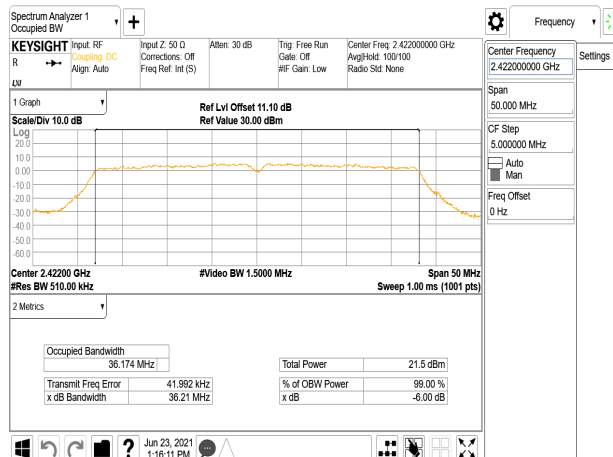
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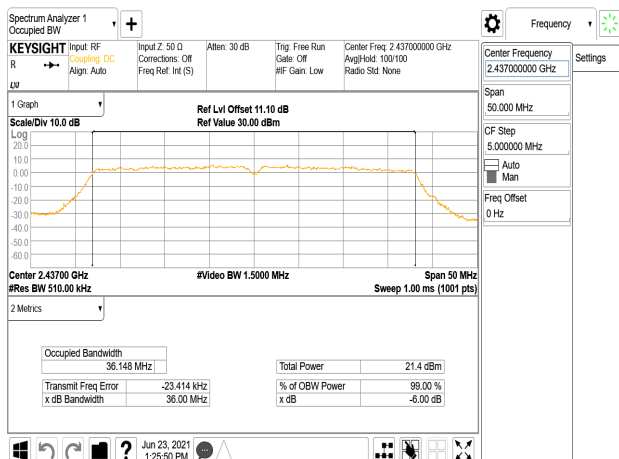
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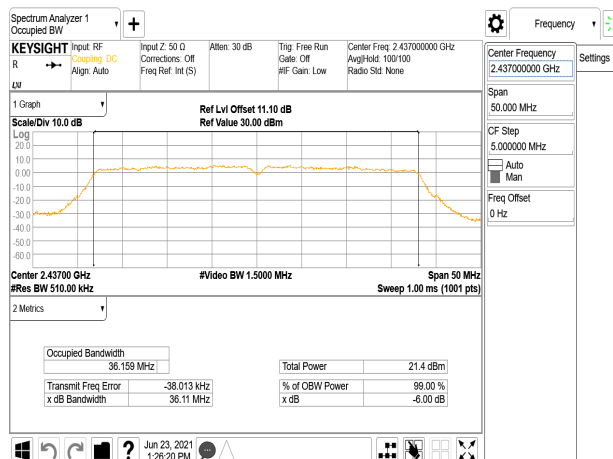
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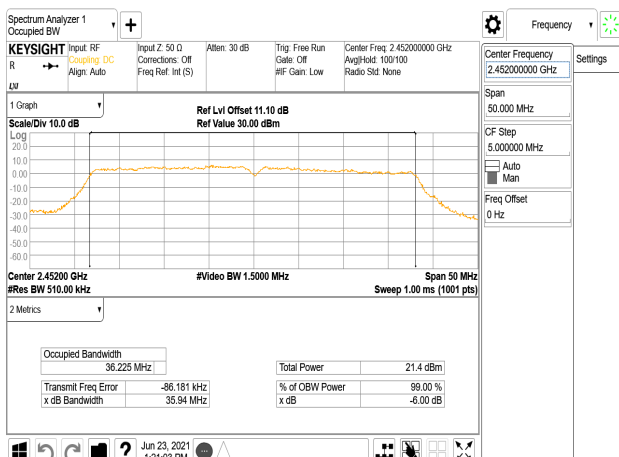
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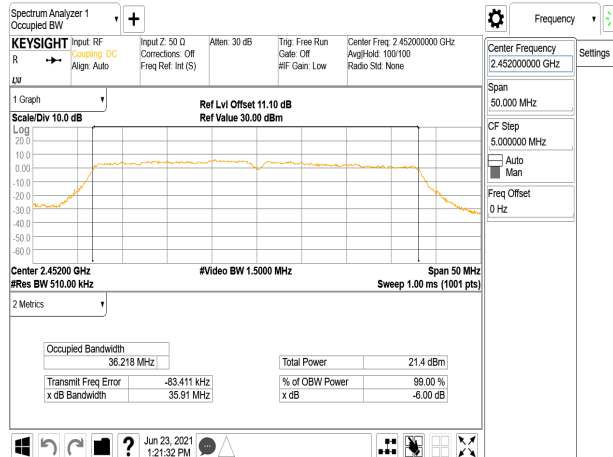
802.11n_40MHz_Chain1_2437MHz



802.11n_40MHz_Chain0_2452MHz



802.11n_40MHz_Chain1_2452MHz



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10 CONDUCTED BAND EDGES AND SPURIOUS EMISSION MEASUREMENT

10.1 Standard Applicable

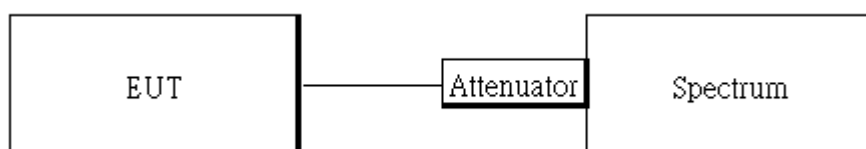
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the 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 Measurement Equipment Used

Conducted Emission Test Site: Conducted G					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	KEYSIGHT	N9010B	MY59071570	06/01/2021	05/31/2022
Attenuator	Marvelous	WATT-218FS-10	RF16	11/19/2020	11/18/2021
DC Block	PASTERNAK	PE8210	RF154	11/19/2020	11/18/2021

10.3 Test SET-UP



10.4 Measurement Procedure

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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.

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.

10.5 Measurement Result

Reference Level of Limit 802.11b mode			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	-3.74	-23.74	2412	5.82	-14.18
2437	7.34	-12.66	2437	5.54	-14.46
2462	-3.77	-23.77	2462	5.09	-14.91

Reference Level of Limit 802.11n20 mode			Reference Level of Limit 802.11n40 MODE		
Freq. (MHz)	PSD (dBm)	Reference Level of Limit (dBm)	Freq. (MHz)	PSD (dBm)	Reference Level of Limit (dBm)
2412	9.55	-10.45	2422	4.63	-15.37
2437	9.22	-10.78	2437	4.38	-15.63
2462	8.80	-11.20	2452	5.13	-14.87

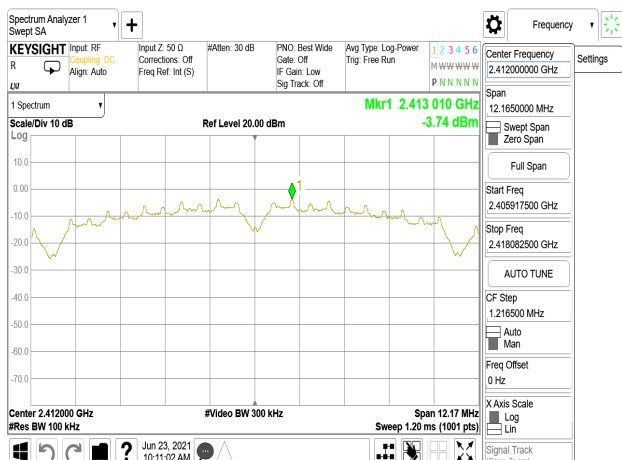
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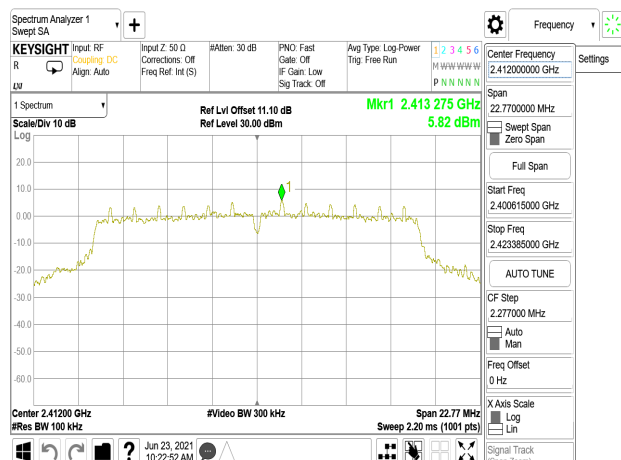
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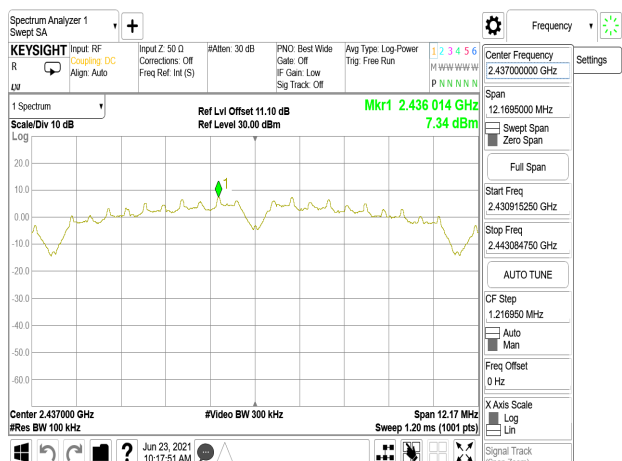
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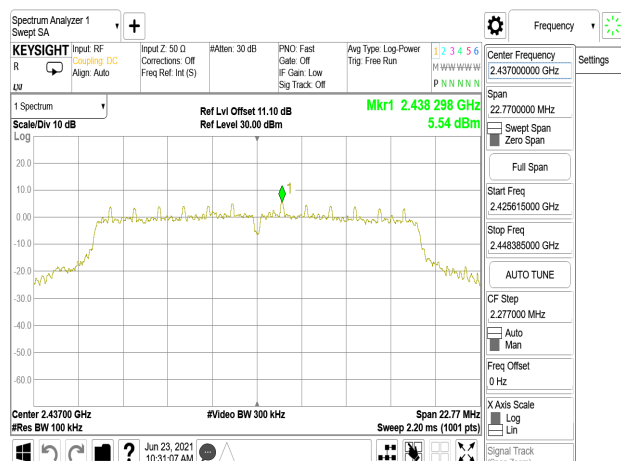
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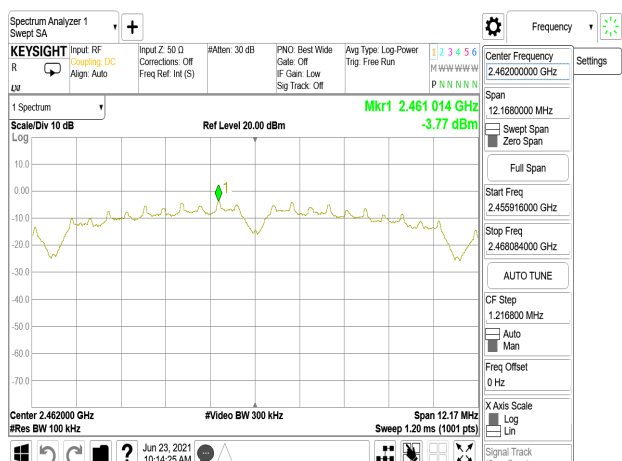
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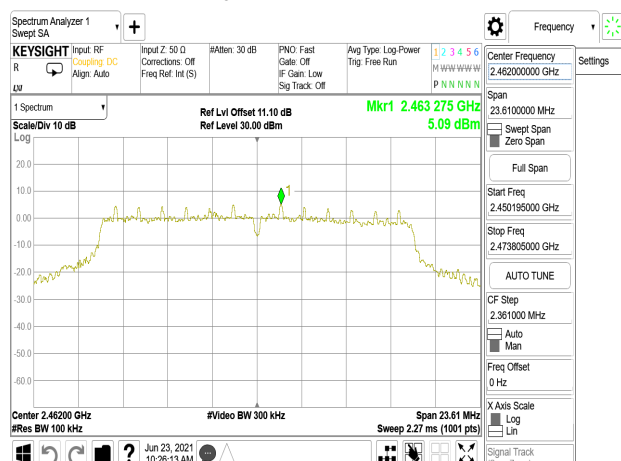
802.11g_20MHz_Chain0_2437MHz



802.11b_20MHz_Chain0_2462MHz



802.11g_20MHz_Chain0_2462MHz



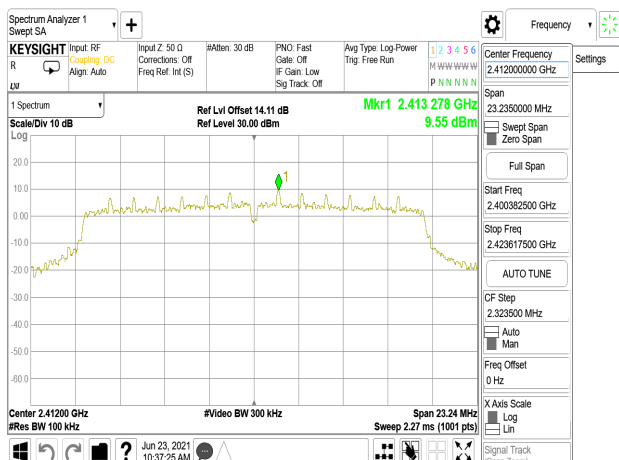
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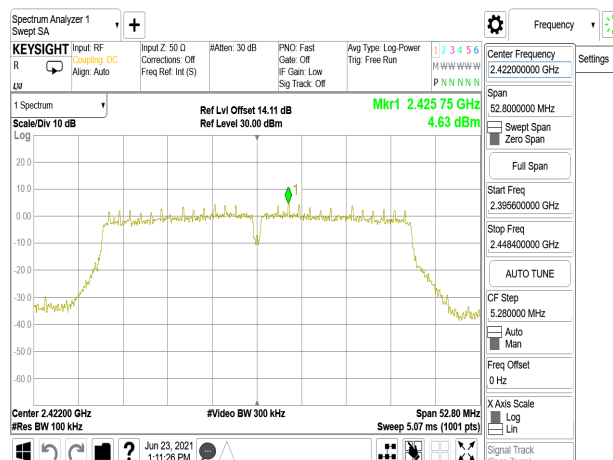
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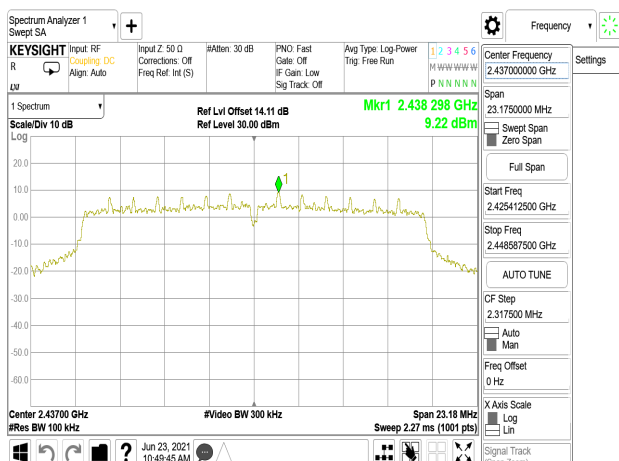
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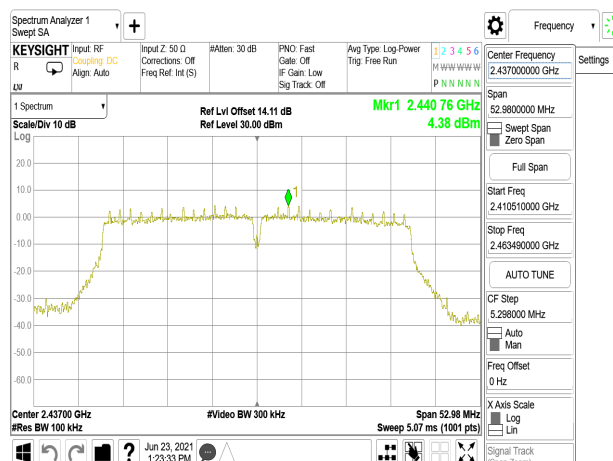
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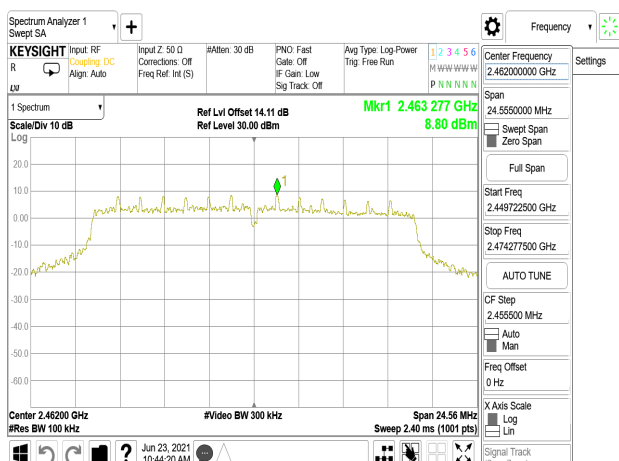
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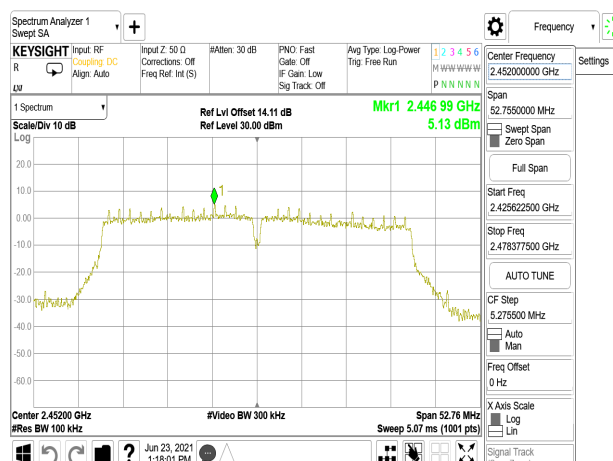
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802.11n_20MHz_Chain0_2462MHz



802.11n_40MHz_Chain0_2452MHz



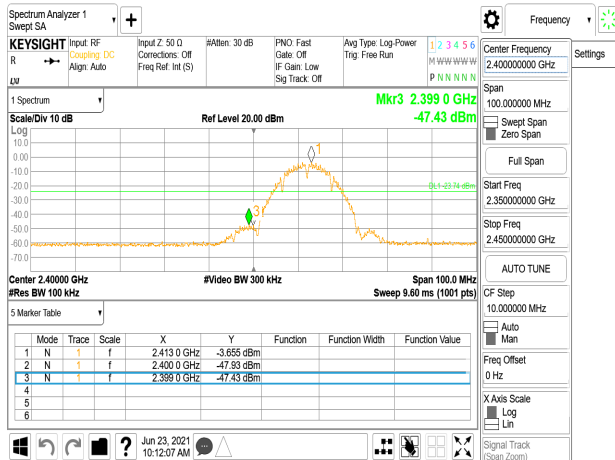
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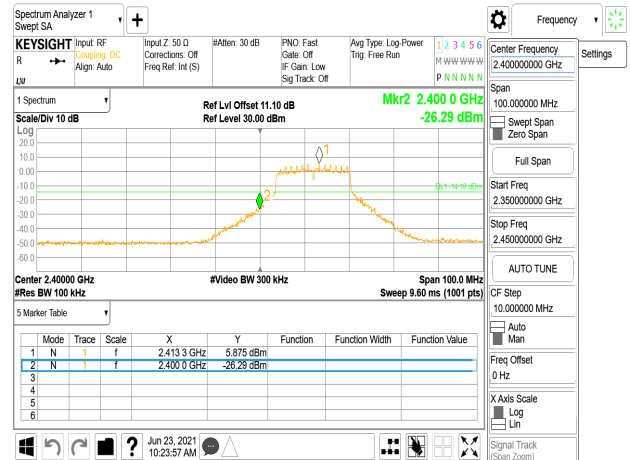
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Band_Edge 802.11b_20MHz_Chain0_2412MHz



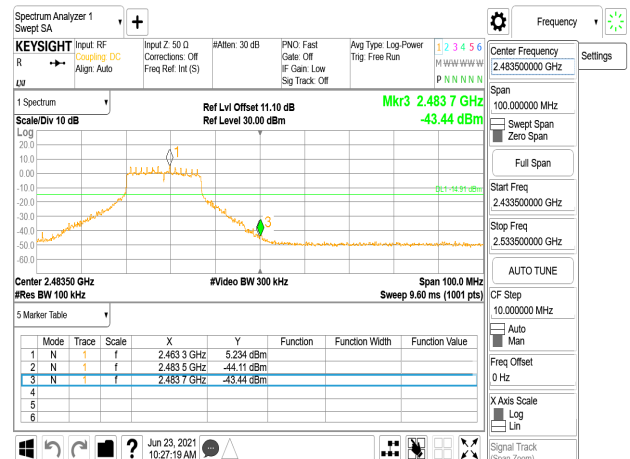
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802.11b_20MHz_Chain0_2462MHz



802.11g_20MHz_Chain0_2462MHz



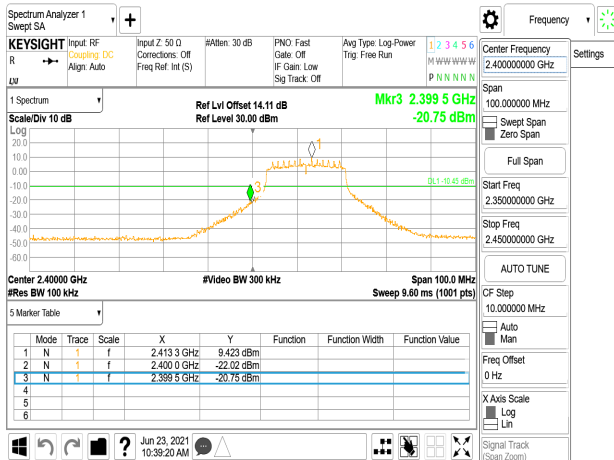
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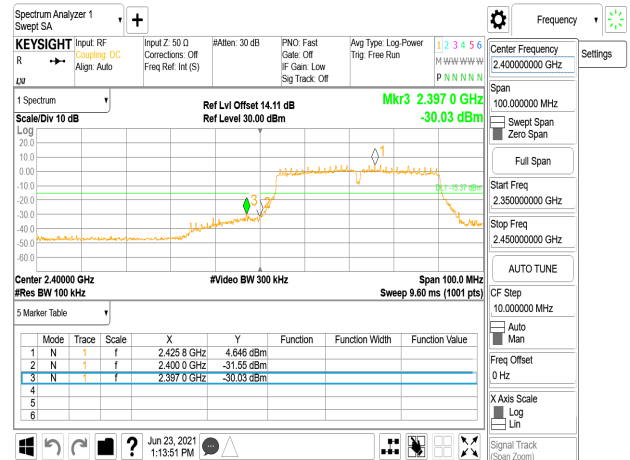
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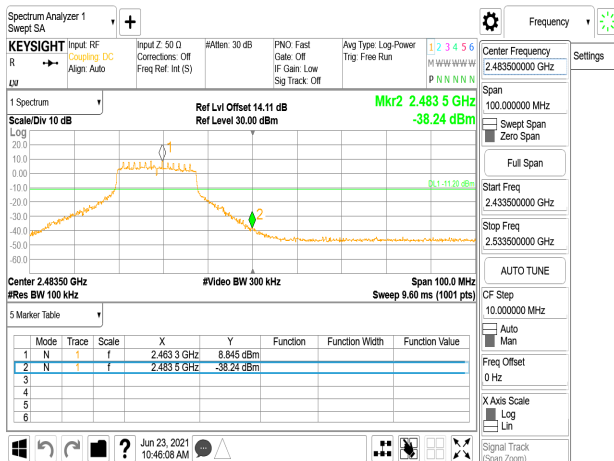
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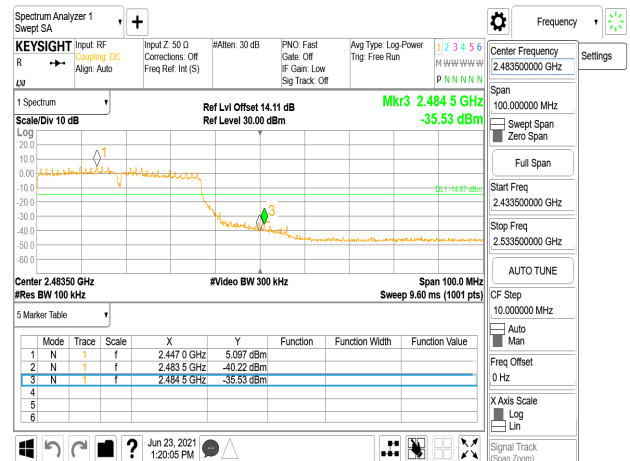
802.11n_40MHz_Chain0_2422MHz



802.11n_20MHz_Chain0_2462MHz



802.11n_40MHz_Chain0_2452MHz



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