RF TEST REPORT

Report No.: SET2021-17644

Product Name: TUBE THERMAL IMAGING SCOPE

Model No. : TD50L

FCC ID: 2AYGT-TD50L

Applicant: IRay Techonlogy Co.,Ltd

Address: 11GUIYANG STREET, YANTAI ECONOMY AND TECHNOLOGY DEVELOPMENT DISTRICT, YANTAI SHANDONG P.R.CHINA

Dates of Testing: 07/05/2021 - 12/10/2021

Issued by: CCIC Southern Testing Co., Ltd.

Lab Location: Electronic Testing Building, No. 43 Shahe Road, Xili Street, Nanshan District, Shenzhen, Guangdong, China.

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Test Report

Product Name.....:	TUBE THERMAL IMAGING SCOPE
Brand Name.....:	InfiRay
Trade Name.....:	InfiRay
Applicant.....:	IRay Techonlogy Co.,Ltd
Applicant Address.....:	11GUIYANG STREET, YANTAI ECONOMY AND TECHNOLOGY DEVELOPMENT DISTRICT, YANTAI SHANDONG P.R.CHINA
Manufacturer.....:	IRay Techonlogy Co.,Ltd
Manufacturer Address .....:	11GUIYANG STREET, YANTAI ECONOMY AND TECHNOLOGY DEVELOPMENT DISTRICT, YANTAI SHANDONG P.R.CHINA
Test Standards.....:	47 CFR Part 15 Subpart C 15.247 ANSI C63.10-2013
Test Result.....:	PASS
Tested by .....:	Sun 2021.12.29 Sun, Test Engineer
Reviewed by .....:	Chris You 2021.12.29 Chris You, Senior Engineer
Approved by .....:	ShuangwenZhang 2021.12.29 ShuangwenZhang, Manager

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Change History		
Issue	Date	Reason for change
1.0	2021.12.29	First edition

1. General Information

1.1. EUT Description

EUT Type	TUBE THERMAL IMAGING SCOPE
Model No.	TD50L
EUT supports Radios application	WLAN2.4GHz 802.11b/g/n (HT20)
Frequency Range	802.11b/g/n-20MHz: 2.412GHz - 2.462GHz
Channel Number	802.11b/g/n-20MHz: 11
Bit Rate of Transmitter	802.11b: 11/5.5/2/1 Mbps 802.11g: 54/48/36/24/18/12/9/6 Mbps 802.11n : up to 72.2Mbps
Modulation Type	DSSS (802.11b), OFDM (802.11g/n)
MIMO	Not support
Antenna Type	IPX Antenna
Antenna Gain	3 dBi
Power supply	Brand Name : JUDA Battery Model No.: 36AQ517-02 Capacitance: 6200mA Rated Voltage: 3.6V Charge Limit: 4.3V Manufacturer: DONGGUAN LARGE ELECTRONICS CO., LTD.

Note 1: For a more detailed description, please refer to Specification or User's Manual supplied by the applicant and/or manufacturer.

Note 2: The EUT was programmed to be in continuously transmitting mode and the transmit duty cycle is not less than 98%.

Note 3: The antenna gain and RF adapter/cable insert loss provided by manufacture.

1.2. Test Standards and Results

The objective of the report is to perform testing according to FCC Certification:

No.	Identity	Document Title
1	47 CFR Part 15 Subpart C	Radio Frequency Devices
2	ANSI C63.10-2013	American National Standard for Testing Unlicensed Wireless Devices

Test detailed items/section required by FCC rules and results are as below:

No.	Section in CFR 47	Description	Result
1	15.203	Antenna Requirement	PASS
2	15.247 (b)(3)	RF Output Power	PASS
3	15.247 (a)(2)	6dB Occupied Bandwidth	PASS
4	15.247 (d)	Conducted Band Edges and Spurious Emission	PASS
5	15.247 (e)	Power spectral density (PSD)	PASS
6	15.207	AC Power Line Conducted Emission	PASS
7	15.205 15.209 15.247 (d)	Radiated Band Edges and Spurious Emission	PASS

Note: The tests of Conducted Emission and Radiated Emission were performed according to the method of measurements prescribed in ANSI C63.10-2013.These RF tests were performed according to the method of measurements prescribed in KDB558074 D01 v05r02.

Preliminary tests were performed in different data rate to find the worst radiated emission. The data rate shown in the table below is the worst-case rate with respect to the specific test item. Investigation has been done on all the possible configurations for searching the worst cases. The following table is a list of the test modes shown in this test report.

For 20MHz bandwidth systems, use Channel 1~ Channel 11

Channel No.	Frequency	Channel No.	Frequency	Channel No.	Frequency
1	2412MHz	5	2432MHz	9	2452MHz
2	2417MHz	6	2437MHz	10	2457MHz
3	2422MHz	7	2442MHz	11	2462MHz
4	2427MHz	8	2447MHz		
Note: Channel 1, 6 & 11 selected for 802.11b/g/n-HT20 as Lowest, Middle and Highest channel.					

Test Items	Mode	Data Rate	Channel
RF Conducted Output Power Power Spectral Density 6dB Bandwidth Conducted and Spurious Emission	11b/DSSS	1 Mbps	1/6/11
	11g/OFDM	6 Mbps	1/6/11
	11n(20MHz)/OFDM	MCS 0	1/6/11
Band Edge	11b/DSSS	1 Mbps	1/11
	11g/OFDM	6 Mbps	1/11
	11n(20MHz)/OFDM	MCS 0	1/11

1.3. Table for Supporting Units

No.	Equipment	Brand Name	Model Name	Manufacturer	Serial No.	Note
1	Notebook	DELL	PP11L	DELL	H5914A03	FCC DOC

1.4. EUT Operation Test Setup

For RF test items, an engineering test program was provided and enable to make EUT transmitting.

1.5. Facilities and Accreditations

1.5.1. Facilities

CNAS-Lab Code: L1659

CCIC-SET is a third party testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is L1659.

FCC-Registration No.: 406086

CCIC Southern Testing Co., Ltd EMC Laboratory has been registered and fully described in a re port filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintained in our files. Designation Number: CN1283, valid time is until April 19th, 2023.

ISED Registration: 11185A-1

CAB identifier: CN0064

CCIC Southern Testing Co., Ltd. EMC Laboratory has been registered by Certification and Engi neering Bureau of Industry Canada for the performance of radiated measurements with Registrati on No. 11185A-1 on Aug. 04, 2016, valid time is until Jun. 30th, 2023.

A2LA Code: 5721.01

CCIC-SET is a third party testing organization accredited by A2LA according to ISO/IEC 17025. The accreditation certificate number is 5721.01.

1.5.2. Test Environment Conditions

During the measurement, the environmental conditions were within the listed ranges:

Temperature (°C):	15°C - 35°C
Relative Humidity (%):	30% -60%
Atmospheric Pressure (kPa):	86KPa-106KPa

2. Test Requirements

2.1. Antenna requirement

2.1.1. Applicable Standard

According to FCC 15.203, 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.

And according to FCC 47 CFR Section 15.247(c), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

2.1.2. Antenna Information

Antenna Category: Internal Antenna

A internal Antenna was soldered to the antenna port of EUT via an adaptor cable, can't be removed.

Antenna General Information:

No.	EUT	Ant. Type	Operating frequency range	Ant. Gain
1	TUBE THERMAL IMAGING SCOPE	IPX Antenna	2412-2462MHz	3 dBi

2.1.3. Result: comply

The EUT has a permanently and irreplaceable attached antenna. Please refer to the EUT internal photos.

2.2. Maximum Conducted Output Power

2.2.1. Limit of Peak Output Power

For systems using digital modulation in the 2400-2483.5MHz, the limit for peak output power is 30dBm. If transmitting antenna of directional gain greater than 6dBi is 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 6 dBi. In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

2.2.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

2.2.3. Test Setup

2.2.4. Test Procedures

1. The testing follows the Measurement Procedure of ANSI C63.10:2013.
2. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Measure the conducted output power and record the results in the test report.

2.2.5. Test Result

Please refer to Appendix A for detail

2.3. 6dB Occupied Bandwidth

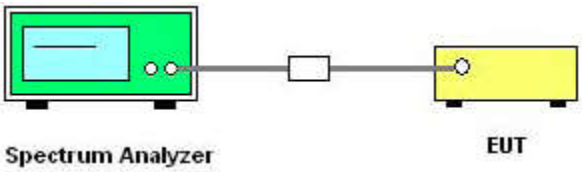
2.3.1. Limit of 6dB Bandwidth

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

2.3.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

2.3.3. Test Setup



2.3.4. Test Procedures

1. The testing follows FCC KDB558074 D01 v05r02.

2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.

3. Set to the maximum power setting and enable the EUT transmit continuously.

4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6dB bandwidth must be greater than 500 kHz.

5. Measure and record the results in the test report.

2.3.5. Test Results of 6dB Bandwidth

Please refer to Appendix A for detail

2.4. Conducted Band Edges and Spurious Emissions

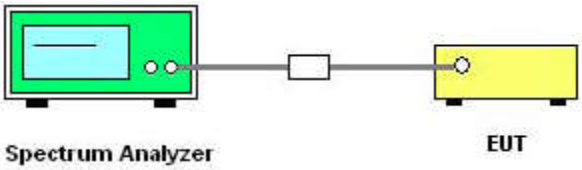
2.4.1. Limit of Conducted Band Edges and Spurious Emissions

All harmonics/spurious must be at least 30 dB down from the highest emission level within the authorized band.

2.4.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

2.4.3. Test Setup



2.4.4. Test Procedure

1. The testing follows FCC KDB558074 D01 v05r02.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Set RBW = 100 kHz, VBW=300 kHz, Peak Detector. Unwanted Emissions measured in any 100kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when maximum peak conducted output power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB per 15.247(d).
5. Measure and record the results in the test report.
6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

2.4.5. Test Results of Conducted Band Edges

Please refer to Appendix A for detail

2.5. Power spectral density (PSD)

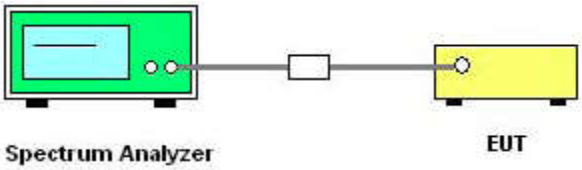
2.5.1. Limit of Power Spectral Density

The peak power spectral density shall not be greater than 8dBm in any 3kHz band at any time interval of continuous transmission.

2.5.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

2.5.3. Test Setup



2.5.4. Test Procedures

1. The testing follows Measurement Procedure 10.2 Method PKPSD of FCC KDB558074 D01 v05r02.

2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.

3. Set to the maximum power setting and enable the EUT transmit continuously.

4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 3 kHz. Video bandwidth VBW = 10 kHz In order to make an accurate measurement, set the span to 1.5 times DTS Channel Bandwidth. (6dB BW)

5. Detector = peak, Sweep time = auto couple, Trace mode = max hold, Allow trace to fully stabilize. Use the peak marker function to determine the maximum power level.

6. Measure and record the results in the test report.

7. The Measured power density (dBm)/ 100kHz is a reference level and used as 20dBc down limit line for Conducted Band Edges and Conducted Spurious Emission.

2.5.5. Test Results of Power spectral density

Please refer to Appendix A for detail

2.6. Radiated Band Edge and Spurious Emission

2.6.1. Limit of Radiated Band Edges and Spurious Emission

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. If the output power of this device was measured by spectrum analyzer, the attenuation under this paragraph shall be 30 dB instead of 20 dB. In addition, radiated emissions which fall in the restricted bands must also comply with the FCC section 15.209 limits as below.

Note: Wireless charger configuration was evaluated.

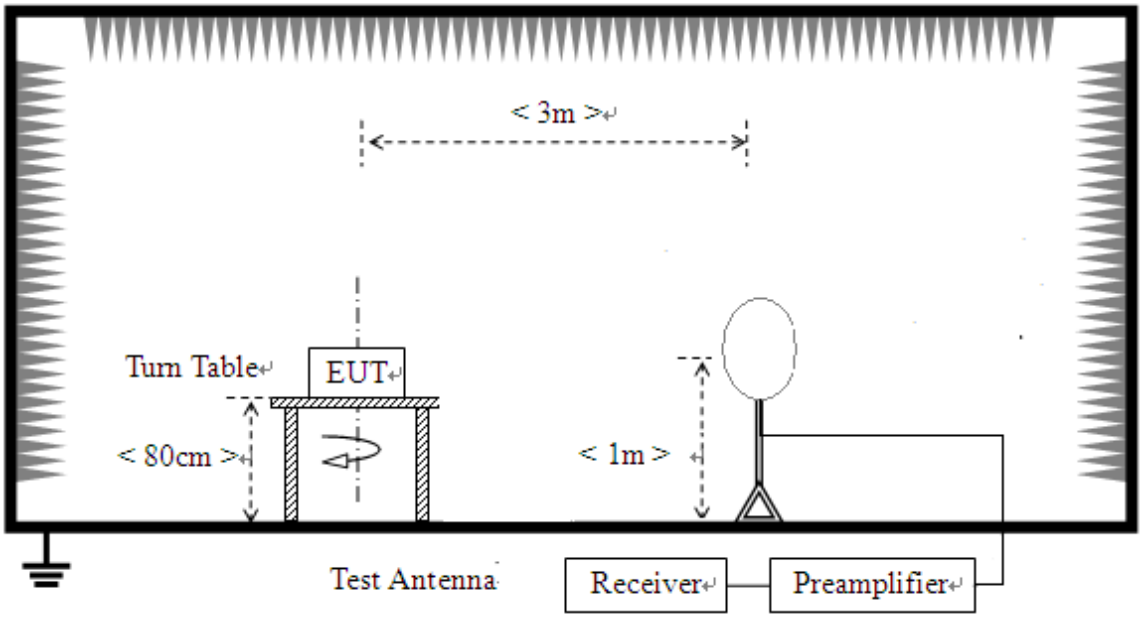
Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (m)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

2.6.2. Measuring Instruments

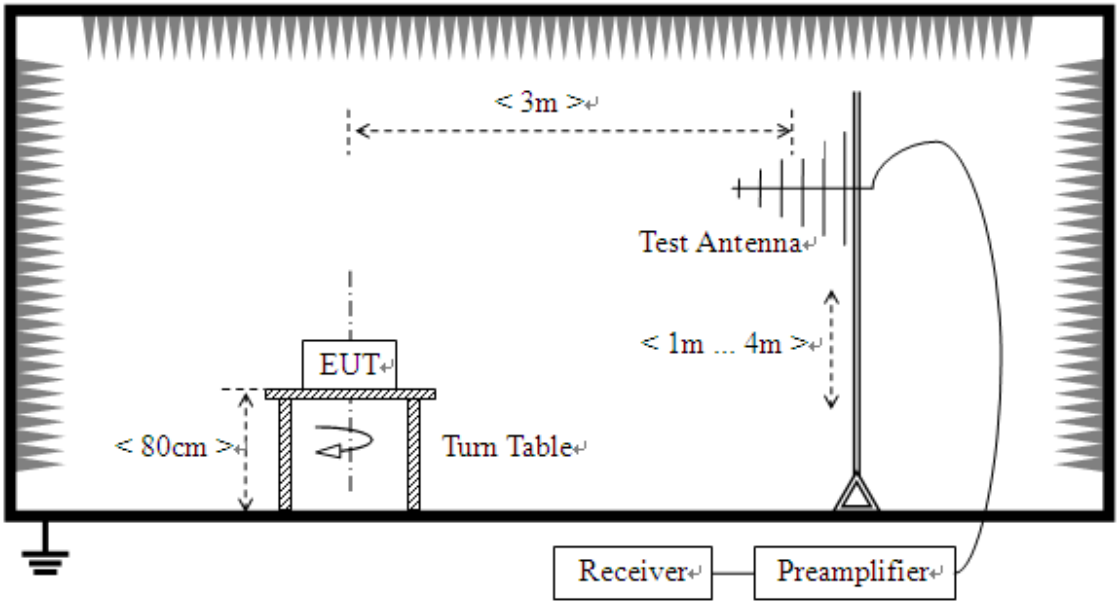
The measuring equipment is listed in the section 3 of this test report.

2.6.3. Test Setup

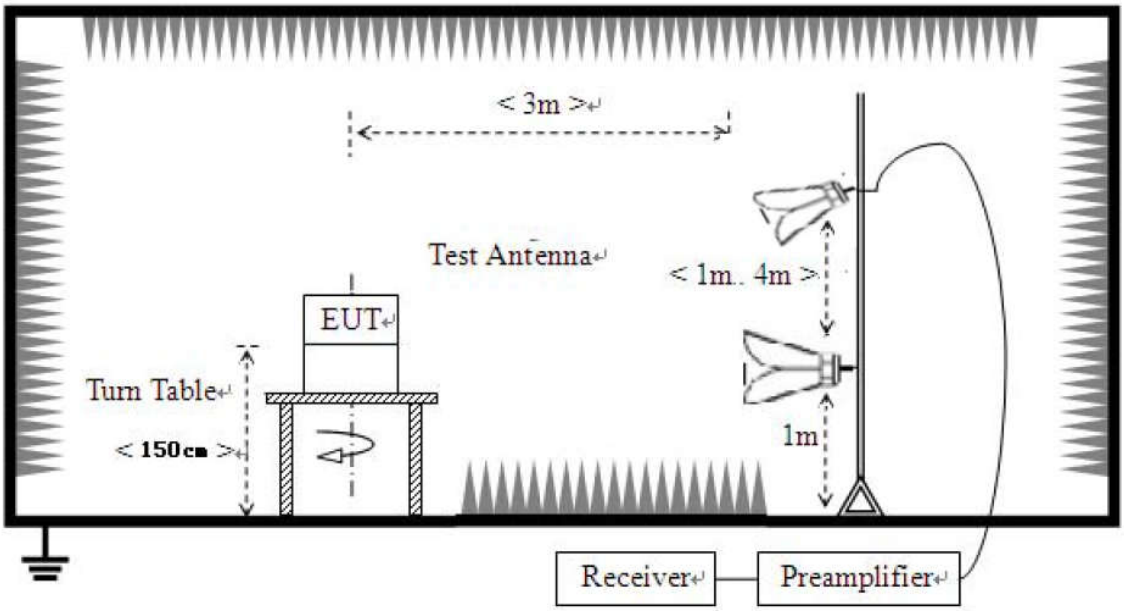
For radiated emissions from 9 KHz to 30 MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



2.6.4. Test Procedures

1. The EUT was placed on the top of a rotating table 0.8m for below 1GHz/1.5m for above 1GHz above the ground at a 3 meters semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
3. Height of receiving antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. If the emission level of the EUT in peak mode was lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported.
   Otherwise the emissions would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
7. For the radiated emission test above 1GHz:
   Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.

NOTE:

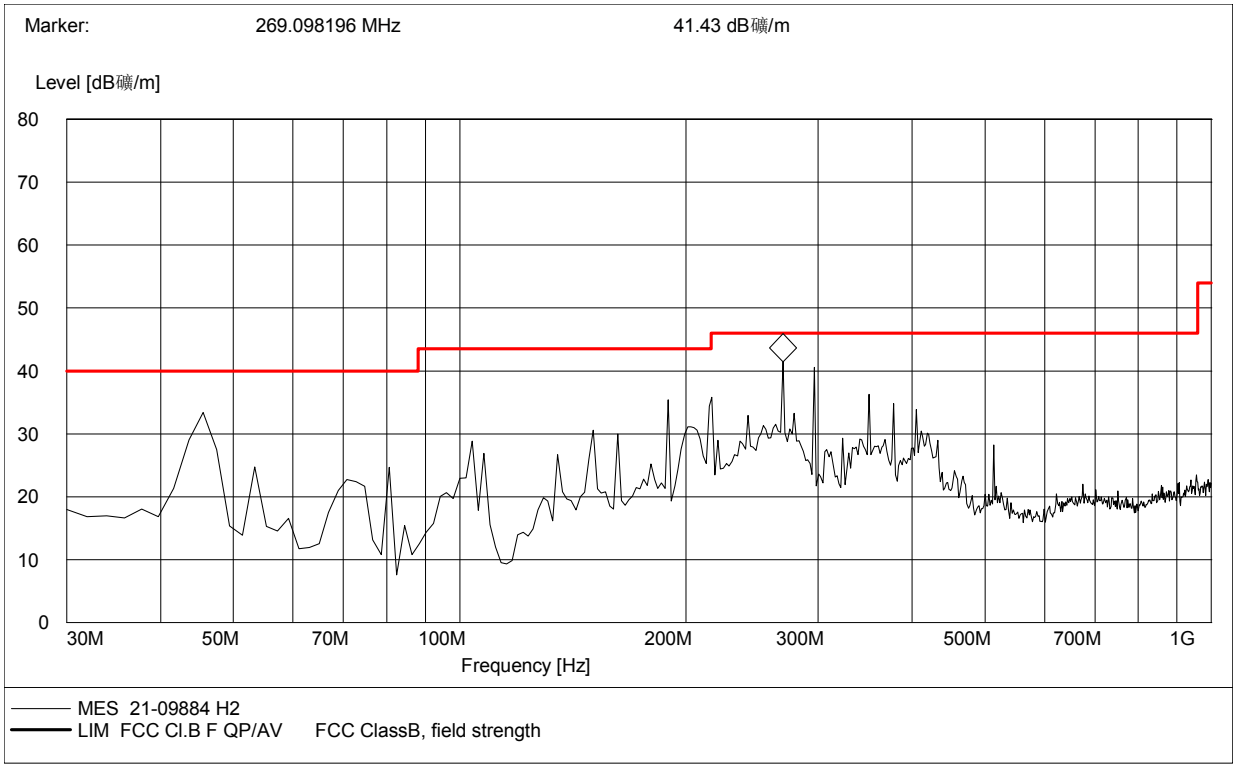
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is≥ 1/T (Duty cycle < 98%) or 10Hz(Duty cycle > 98%) for Average detection (AV) at frequency above 1GHz.
4. All radiated emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.

2.6.5. Test Results of Radiated Band Edge and Spurious Emission

For 9 kHz to 30MHz

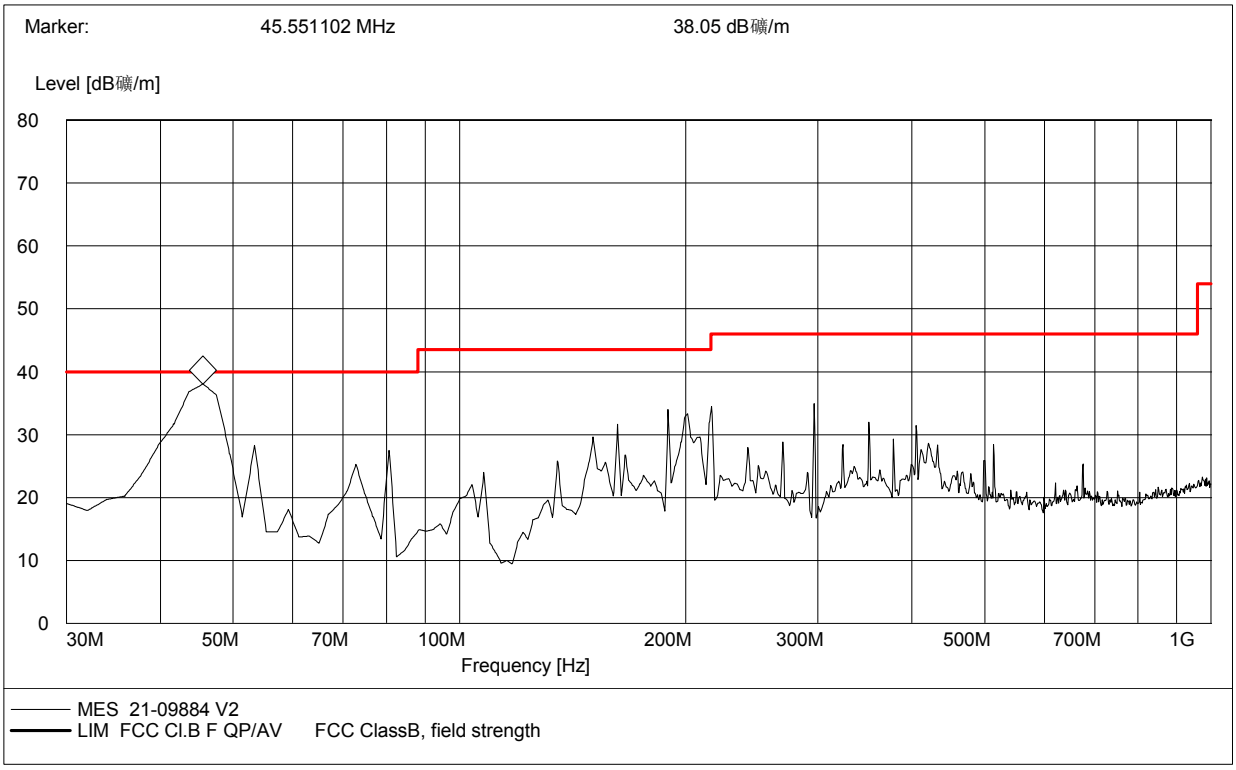
The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

For 30MHz to 1000 MHz



30MHz to 1GHz, Antenna Horizontal

Frequency (MHz)	QuasiPeak (dBμV/m)	Bandwidth (kHz)	Corr. Factor (dB/m)	Antenna height (cm)	Limit (dBμV/m)	Margin	Antenna	Verdict
44.890000	32.82	120.000	11.20	100.0	40.0	7.18	Horizontal	Pass
53.440000	23.67	120.000	8.60	100.0	40.0	16.33	Horizontal	Pass
150.130000	30.02	120.000	12.40	100.0	43.5	13.48	Horizontal	Pass
189.370000	34.89	120.000	10.00	100.0	43.5	8.61	Horizontal	Pass
268.530000	40.30	120.000	14.60	100.0	46.0	5.70	Horizontal	Pass
294.490000	22.64	120.000	15.40	100.0	46.0	23.36	Horizontal	Pass



30MHz to 1GHz, Antenna Vertical

Frequency (MHz)	QuasiPeak (dB µ V/m)	Bandwidth (kHz)	Corr. Factor (dBµV/m)	Antenna height (cm)	Limit (dB µ V/m)	Margin	Antenna	Verdict
45.280000	36.05	120.000	11.20	100.0	40.0	3.95	Vertical	Pass
80.050000	26.90	120.000	8.50	100.0	40.0	13.10	Vertical	Pass
188.520000	32.59	120.000	10.00	100.0	43.5	10.91	Vertical	Pass
201.050000	32.59	120.000	10.00	100.0	43.5	10.91	Vertical	Pass
216.600000	33.58	120.000	11.90	100.0	46.0	12.42	Vertical	Pass
295.230000	33.25	120.000	15.40	100.0	46.0	12.75	Vertical	Pass

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB)
3. Margin value = Limit value – Emission Level
4. The other emission levels were very low against the limit.

For 1GHz to 25 GHz

2.4G Wi-Fi 802.11b_2412MHz									
Frequency (MHz)	Emssion Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Correction Factor (dB/m)	Polarity	Detector
2390.00	46.00	74.00	-28.00	1.60	190	44.70	1.30	Horizontal	Peak
2390.00	36.60	54.00	-17.40	1.60	190	35.30	1.30	Horizontal	Average
4824.00	46.94	74.00	-27.06	1.60	190	40.54	6.40	Horizontal	Peak
4824.00	36.58	54.00	-17.42	1.60	190	30.18	6.40	Horizontal	Average
7236.00	49.04	74.00	-24.96	1.60	190	38.54	10.50	Horizontal	Peak
7236.00	38.36	54.00	-15.64	1.60	190	27.86	10.50	Horizontal	Average
2390.00	45.74	74.00	-28.26	1.80	170	44.44	1.30	Vertical	Peak
2390.00	36.27	54.00	-17.73	1.80	170	34.97	1.30	Vertical	Average
4824.00	46.32	74.00	-27.68	1.80	170	39.92	6.40	Vertical	Peak
4824.00	35.84	54.00	-18.16	1.80	170	29.44	6.40	Vertical	Average
7236.00	48.40	74.00	-25.60	1.80	170	37.90	10.50	Vertical	Peak
7236.00	38.46	54.00	-15.54	1.80	170	27.96	10.50	Vertical	Average
2.4G Wi-Fi 802.11b_2437MHz									
Frequency (MHz)	Emssion Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Correction Factor (dB/m)	Polarity	Detector
4874.00	46.64	74.00	-27.36	1.60	190	40.84	5.80	Horizontal	Peak
4874.00	36.00	54.00	-18.00	1.60	190	30.20	5.80	Horizontal	Average
7311.00	48.11	74.00	-25.89	1.60	190	37.31	10.80	Horizontal	Peak
7311.00	38.26	54.00	-15.74	1.60	190	27.46	10.80	Horizontal	Average
4874.00	46.53	74.00	-27.47	1.80	170	40.73	5.80	Vertical	Peak
4874.00	35.23	54.00	-18.77	1.80	170	29.43	5.80	Vertical	Average
7311.00	48.79	74.00	-25.21	1.80	170	37.99	10.80	Vertical	Peak
7311.00	38.21	54.00	-15.79	1.80	170	27.41	10.80	Vertical	Average

Remark:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)

2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) - Pre-Amplifier Factor(dB)

3. Margin value = Emission Level – Limit value

4.The emission levels of other frequencies are very lower than the limit and not show in test report.

2.4G Wi-Fi 802.11b_2462MHz									
Frequency (MHz)	Emssion Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Correction Factor (dB/m)	Polarity	Detector
2483.50	47.28	74.00	-26.72	1.60	190	45.68	1.60	Horizontal	Peak
2483.50	37.33	54.00	-16.67	1.60	190	35.73	1.60	Horizontal	Average
4924.00	46.61	74.00	-27.39	1.60	190	40.91	5.70	Horizontal	Peak
4924.00	36.45	54.00	-17.55	1.60	190	30.75	5.70	Horizontal	Average
7386.00	48.57	74.00	-25.43	1.60	190	37.77	10.80	Horizontal	Peak
7386.00	38.69	54.00	-15.31	1.60	190	27.89	10.80	Horizontal	Average
2483.50	47.09	74.00	-26.91	1.80	170	45.49	1.60	Vertical	Peak
2483.50	36.83	54.00	-17.17	1.80	170	35.23	1.60	Vertical	Average
4924.00	46.98	74.00	-27.02	1.80	170	41.28	5.70	Vertical	Peak
4924.00	35.40	54.00	-18.60	1.80	170	29.70	5.70	Vertical	Average
7386.00	48.42	74.00	-25.58	1.80	170	37.62	10.80	Vertical	Peak
7386.00	37.98	54.00	-16.02	1.80	170	27.18	10.80	Vertical	Average

Remark:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)

2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) - Pre-Amplifier Factor(dB)

3. Margin value = Emission Level – Limit value

4.The emission levels of other frequencies are very lower than the limit and not show in test report.

2.4G Wi-Fi 802.11g_2412MHz									
Frequency (MHz)	Emssion Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Correction Factor (dB/m)	Polarity	Detector
2390.00	46.13	74.00	-27.87	1.60	190	44.83	1.30	Horizontal	Peak
2390.00	36.65	54.00	-17.35	1.60	190	35.35	1.30	Horizontal	Average
4824.00	46.46	74.00	-27.54	1.60	190	40.06	6.40	Horizontal	Peak
4824.00	36.72	54.00	-17.28	1.60	190	30.32	6.40	Horizontal	Average
7236.00	48.68	74.00	-25.32	1.60	190	38.18	10.50	Horizontal	Peak
7236.00	38.75	54.00	-15.25	1.60	190	28.25	10.50	Horizontal	Average
2390.00	46.09	74.00	-27.91	1.80	170	44.79	1.30	Vertical	Peak
2390.00	35.83	54.00	-18.17	1.80	170	34.53	1.30	Vertical	Average
4824.00	46.50	74.00	-27.50	1.80	170	40.10	6.40	Vertical	Peak
4824.00	35.70	54.00	-18.30	1.80	170	29.30	6.40	Vertical	Average
7236.00	48.62	74.00	-25.38	1.80	170	38.12	10.50	Vertical	Peak
7236.00	38.43	54.00	-15.57	1.80	170	27.93	10.50	Vertical	Average
2.4G Wi-Fi 802.11g_2437MHz									
Frequency (MHz)	Emssion Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Correction Factor (dB/m)	Polarity	Detector
4874.00	46.33	74.00	-27.67	1.60	190	40.53	5.80	Horizontal	Peak
4874.00	36.34	54.00	-17.66	1.60	190	30.54	5.80	Horizontal	Average
7311.00	48.11	74.00	-25.89	1.60	190	37.31	10.80	Horizontal	Peak
7311.00	38.41	54.00	-15.59	1.60	190	27.61	10.80	Horizontal	Average
4874.00	46.18	74.00	-27.82	1.80	170	40.38	5.80	Vertical	Peak
4874.00	34.84	54.00	-19.16	1.80	170	29.04	5.80	Vertical	Average
7311.00	48.36	74.00	-25.64	1.80	170	37.56	10.80	Vertical	Peak
7311.00	37.71	54.00	-16.29	1.80	170	26.91	10.80	Vertical	Average

Remark:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)

2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) - Pre-Amplifier Factor(dB)

3. Margin value = Emission Level – Limit value

4.The emission levels of other frequencies are very lower than the limit and not show in test report.

2.4G Wi-Fi 802.11g_2462MHz									
Frequency (MHz)	Emssion Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Correction Factor (dB/m)	Polarity	Detector
2483.50	46.79	74.00	-27.21	1.60	190	45.19	1.60	Horizontal	Peak
2483.50	36.95	54.00	-17.05	1.60	190	35.35	1.60	Horizontal	Average
4924.00	46.61	74.00	-27.39	1.60	190	40.91	5.70	Horizontal	Peak
4924.00	36.21	54.00	-17.79	1.60	190	30.51	5.70	Horizontal	Average
7386.00	48.11	74.00	-25.89	1.60	190	37.31	10.80	Horizontal	Peak
7386.00	38.27	54.00	-15.73	1.60	190	27.47	10.80	Horizontal	Average
2483.50	47.34	74.00	-26.66	1.80	170	45.74	1.60	Vertical	Peak
2483.50	36.84	54.00	-17.16	1.80	170	35.24	1.60	Vertical	Average
4924.00	47.22	74.00	-26.78	1.80	170	41.52	5.70	Vertical	Peak
4924.00	35.10	54.00	-18.90	1.80	170	29.40	5.70	Vertical	Average
7386.00	48.76	74.00	-25.24	1.80	170	37.96	10.80	Vertical	Peak
7386.00	37.89	54.00	-16.11	1.80	170	27.09	10.80	Vertical	Average

Remark:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)

2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) - Pre-Amplifier Factor(dB)

3. Margin value = Emission Level – Limit value

4.The emission levels of other frequencies are very lower than the limit and not show in test report.

2.4G Wi-Fi 802.11n-HT20_2412MHz									
Frequency (MHz)	Emssion Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Correction Factor (dB/m)	Polarity	Detector
2390.00	46.02	74.00	-27.98	1.60	190	44.72	1.30	Horizontal	Peak
2390.00	36.81	54.00	-17.19	1.60	190	35.51	1.30	Horizontal	Average
4824.00	46.80	74.00	-27.20	1.60	190	40.40	6.40	Horizontal	Peak
4824.00	37.02	54.00	-16.98	1.60	190	30.62	6.40	Horizontal	Average
7236.00	48.56	74.00	-25.44	1.60	190	38.06	10.50	Horizontal	Peak
7236.00	38.65	54.00	-15.35	1.60	190	28.15	10.50	Horizontal	Average
2390.00	45.75	74.00	-28.25	1.80	170	44.45	1.30	Vertical	Peak
2390.00	35.51	54.00	-18.49	1.80	170	34.21	1.30	Vertical	Average
4824.00	46.36	74.00	-27.64	1.80	170	39.96	6.40	Vertical	Peak
4824.00	35.53	54.00	-18.47	1.80	170	29.13	6.40	Vertical	Average
7236.00	49.09	74.00	-24.91	1.80	170	38.59	10.50	Vertical	Peak
7236.00	38.74	54.00	-15.26	1.80	170	28.24	10.50	Vertical	Average
2.4G Wi-Fi 802.11n-HT20_2437MHz									
Frequency (MHz)	Emssion Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Correction Factor (dB/m)	Polarity	Detector
4874.00	46.28	74.00	-27.72	1.60	190	40.48	5.80	Horizontal	Peak
4874.00	36.24	54.00	-17.76	1.60	190	30.44	5.80	Horizontal	Average
7311.00	48.25	74.00	-25.75	1.60	190	37.45	10.80	Horizontal	Peak
7311.00	37.97	54.00	-16.03	1.60	190	27.17	10.80	Horizontal	Average
4874.00	46.20	74.00	-27.80	1.80	170	40.40	5.80	Vertical	Peak
4874.00	34.71	54.00	-19.29	1.80	170	28.91	5.80	Vertical	Average
7311.00	48.43	74.00	-25.57	1.80	170	37.63	10.80	Vertical	Peak
7311.00	37.74	54.00	-16.26	1.80	170	26.94	10.80	Vertical	Average

Remark:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)

2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) - Pre-Amplifier Factor(dB)

3. Margin value = Emission Level – Limit value

4.The emission levels of other frequencies are very lower than the limit and not show in test report.

2.4G Wi-Fi 802.11n-HT20_2462MHz									
Frequency (MHz)	Emssion Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Correction Factor (dB/m)	Polarity	Detector
2483.50	47.13	74.00	-26.87	1.60	190	45.53	1.60	Horizontal	Peak
2483.50	37.43	54.00	-16.57	1.60	190	35.83	1.60	Horizontal	Average
4924.00	46.21	74.00	-27.79	1.60	190	40.51	5.70	Horizontal	Peak
4924.00	36.19	54.00	-17.81	1.60	190	30.49	5.70	Horizontal	Average
7386.00	48.25	74.00	-25.75	1.60	190	37.45	10.80	Horizontal	Peak
7386.00	38.46	54.00	-15.54	1.60	190	27.66	10.80	Horizontal	Average
2483.50	47.14	74.00	-26.86	1.80	170	45.54	1.60	Vertical	Peak
2483.50	37.00	54.00	-17.00	1.80	170	35.40	1.60	Vertical	Average
4924.00	47.40	74.00	-26.60	1.80	170	41.70	5.70	Vertical	Peak
4924.00	35.05	54.00	-18.95	1.80	170	29.35	5.70	Vertical	Average
7386.00	48.81	74.00	-25.19	1.80	170	38.01	10.80	Vertical	Peak
7386.00	37.90	54.00	-16.10	1.80	170	27.10	10.80	Vertical	Average

Remark:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)

2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) - Pre-Amplifier Factor(dB)

3. Margin value = Emission Level – Limit value

4.The emission levels of other frequencies are very lower than the limit and not show in test report.

2.7. AC Power Line Conducted Emission

2.7.1. Limit of AC Power Line Conducted Emission

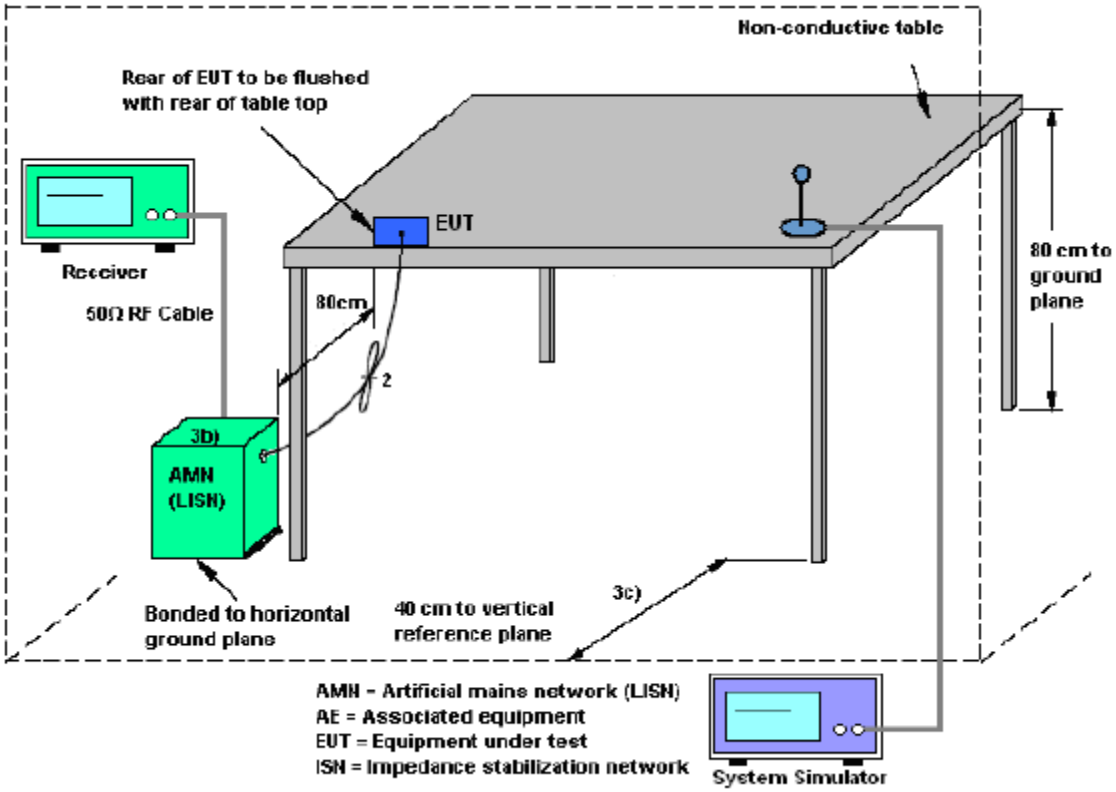
For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency range (MHz)	Conducted Limit (dBμV)	
	Quai-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
5 - 30	60	50

2.7.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

2.7.3. Test Setup

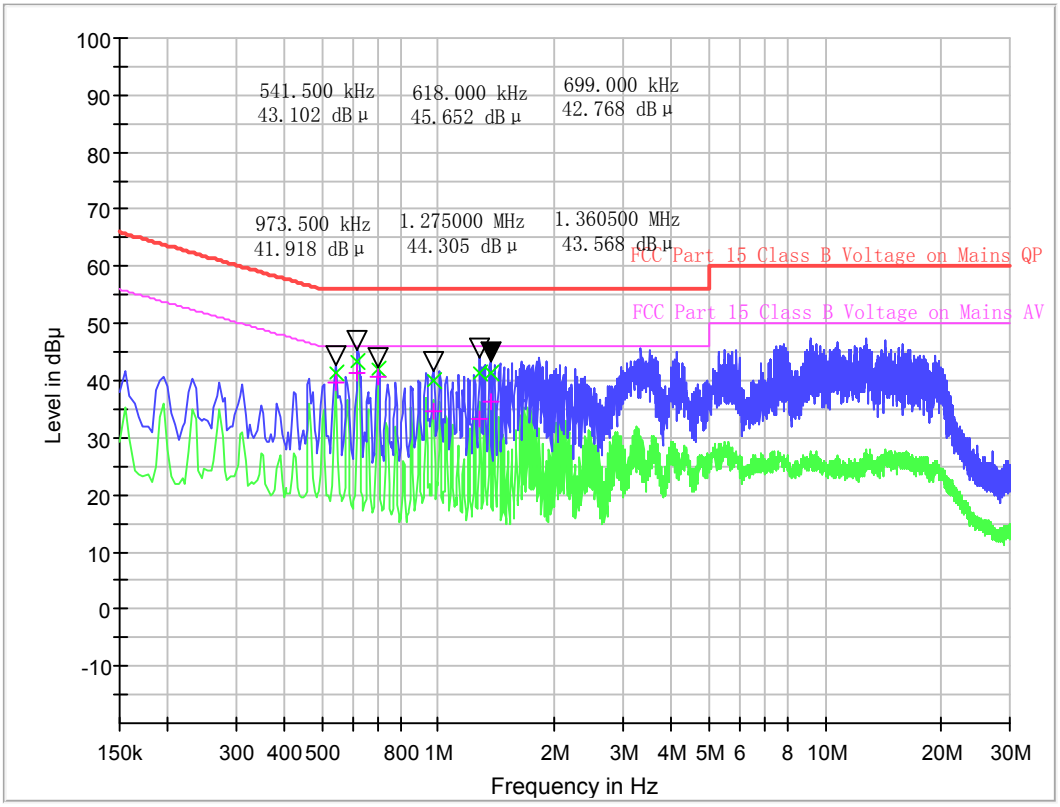


2.7.4. Test Procedures

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 micrometry LISN should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

2.7.5. Test Results of Conducted Emission

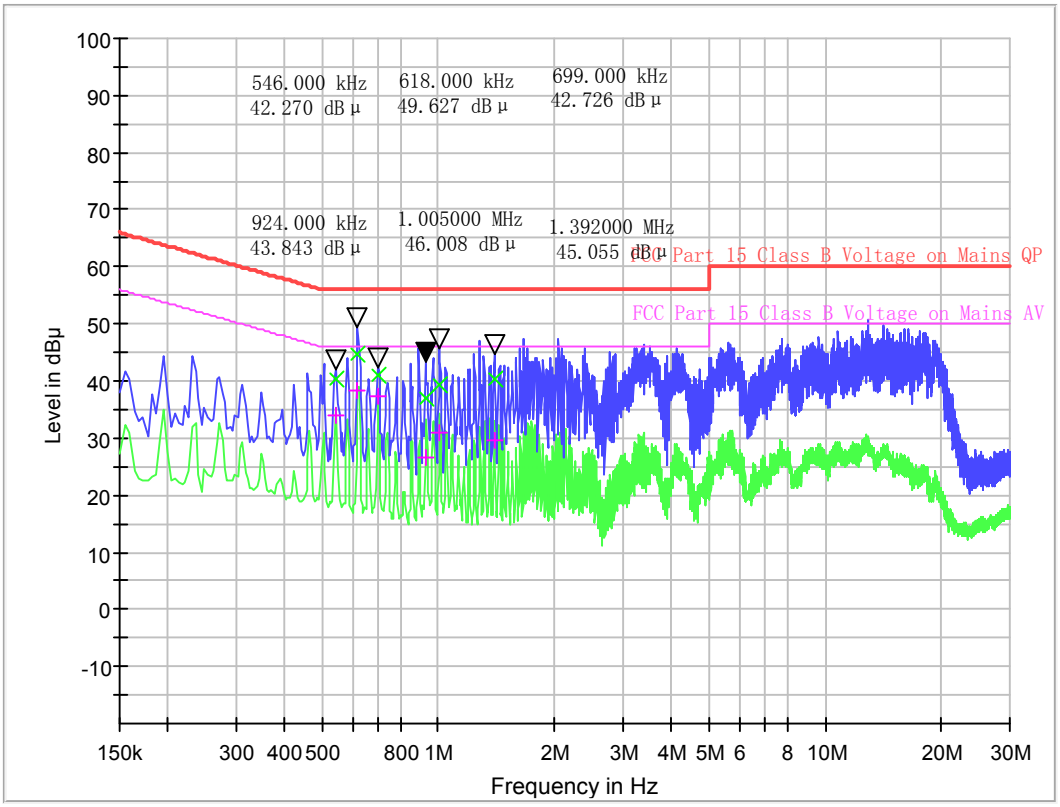
1. The EUT configuration of the emission tests is WLAN Link + USB Cable (Charging from Adapter)



(Plot A: L Phase)

Frequency (MHz)	QuasiPeak (dB μ V)	CAverage (dB μ V)	Cabel Loss (dB)	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dB μ V)	Margin - AV (dB)	Limit - AV (dB μ V)
0.541500	41.32	39.77	0.2	10.2	14.68	56.0	6.23	46.0
0.618000	43.36	41.38	0.2	10.2	12.64	56.0	4.62	46.0
0.699000	42.14	40.76	0.2	10.2	13.86	56.0	5.24	46.0
0.973500	40.08	34.71	0.2	10.2	15.92	56.0	11.29	46.0
1.275000	41.40	33.38	0.2	10.2	14.60	56.0	12.62	46.0
1.360500	41.46	36.28	0.2	10.2	14.54	56.0	9.72	46.0

Note: Correction factor=Cabel loss+ attenuation factor
attenuation factor=10dB



(Plot B: N Phase)

Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Cabel Loss (dB)	Corr. (dB)	Margin - QPK	Limit - QPK	Margin - AV	Limit - AV (dBµV)
0.546000	40.42	33.99	0.2	10.2	15.58	56.0	12.01	46.0
0.618000	44.72	38.26	0.2	10.2	11.28	56.0	7.74	46.0
0.699000	41.17	37.16	0.2	10.2	14.83	56.0	8.84	46.0
0.924000	37.14	26.51	0.2	10.2	18.86	56.0	19.49	46.0
1.005000	39.22	31.08	0.2	10.2	16.78	56.0	14.92	46.0
1.392000	40.29	29.74	0.2	10.2	15.71	56.0	16.26	46.0

Note: Correction factor=Cabel loss+ attenuation factor
attenuation factor=10dB

Test Result : Pass

3. List of measuring equipment

Item	Test Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1	EMI TEST RECEIVER	KEYSIGHT	N9038A	A141202036	2021.04.26	2022.04.25
2	Power Meter	R&S	NRP-Z31	102872	2021.04.26	2022.04.25
3	TURNTABLE	ETS	2088	2149	N/A	N/A
4	ANTENNA MAST	ETS	2075	2346	N/A	N/A
5	EMI TEST Software	R&S	ESK1	N/A	N/A	N/A
6	Horn antenna (18GHz~26.5GHz)	AR	AT4003A	325306	2020.09.16	2022.09.15
7	Amplifier 30M~1GHz	MILMEGA	80RF1000-10004	A140101634	2021.01.26	2022.01.25
8	Amplifier 1G~18GHz	MILMEGA	AS0104R-800/400	A160302517	2021.01.26	2022.01.25
9	High pass filter	Compliance Direction systems	BSU-6	34202	2021.11.09	2022.11.08
10	Horn Antenna	R&S	HF906	A0304225	2019.04.17	2022.04.16
11	Horn Antenna	R&S	ESIB7	A0501375	2020.06.24	2022.06.22
12	ULTRA-BROADBAND ANTENNA	SCHWARZBECK	VULB9160	A0805560	2019.05.24	2022.05.23
13	Passive Loop Antenna	R&S	HFH2-Z2	100047	2019.04.26	2022.04.25
14	Temperature chamber	TABAI	PS-232	A8708054	2021.09.24	2022.09.23
15	Spectrum Analyzer	KEYSIGHT	N9030A	A160702554	2021.04.26	2022.04.25
16	Power Supply	R&S	ESIB26	A0304218	2021.01.04	2022.01.03
17	LISN	ROHDE&SCHWARZ	ENV216	A140701847	2021.08.11	2022.08.10
18	Test software	ECIT	Eagle	V2.0	N/A	N/A

4. Uncertainty of Evaluation

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.10-2013. All the measurement uncertainty value were shown with a coverage K=2 to indicate 95% level of confidence . The measurement data show herein meets or exceeds the CISPR measurement uncertainty values specified in CISPR 16-4-2 and can be compared directly to specified limit to determine compliance.

Uncertainty of Conducted Emission Measurement (150KHz~30MHz)

Measuring Uncertainty for a level of confidence of 95%(U=2Uc(y))	2.8dB

Uncertainty of Radiated Emission Measurement (30MHz~1GHz)

Measuring Uncertainty for a level of confidence of 95%(U=2Uc(y))	3.91dB

Uncertainty of Radiated Emission Measurement (1GHz~18GHz)

Measuring Uncertainty for a level of confidence of 95%(U=2Uc(y))	4.5dB

Uncertainty of Radiated Emission Measurement (18GHz~40GHz)

Measuring Uncertainty for a level of confidence of 95%(U=2Uc(y))	4.9dB

Appendix A

RF Output Power

Test Result and Data

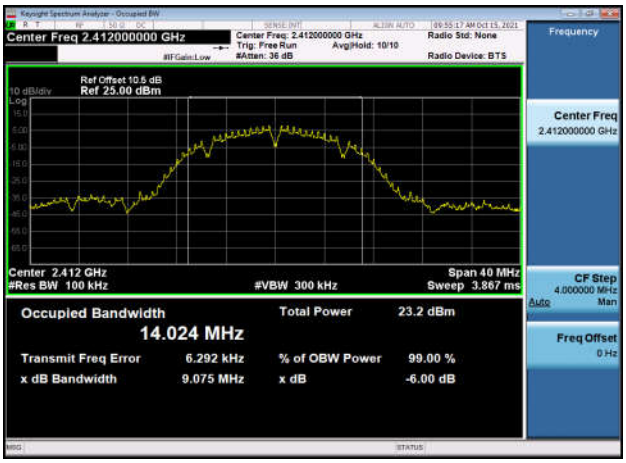
Conducted Output Power				
Mode	Test Frequency (MHz)	Max Conducted Output Power (dBm)	Limit (dBm)	Result
802.11b	2412	15.91	30	Pass
802.11b	2437	16.43	30	Pass
802.11b	2462	16.86	30	Pass
802.11g	2412	14.31	30	Pass
802.11g	2437	14.92	30	Pass
802.11g	2462	14.96	30	Pass
802.11n (HT20)	2412	12.07	30	Pass
802.11n (HT20)	2437	12.85	30	Pass
802.11n (HT20)	2462	12.99	30	Pass

6dB Bandwidth

Test Result and Data

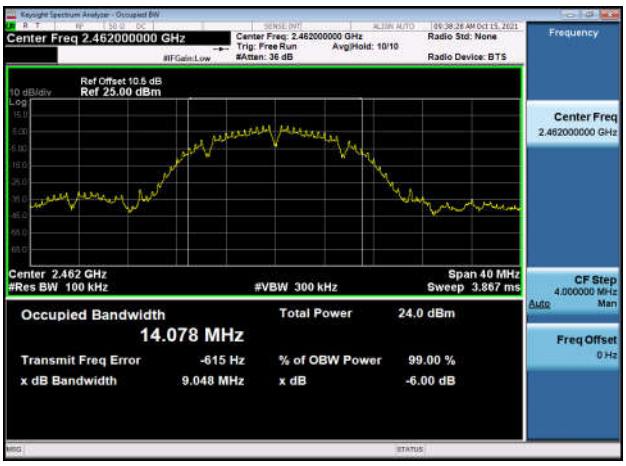
WLAN Occupied 6dB Bandwidth				
Mode	Test Frequency (MHz)	Occupied Bandwidth (MHz)	Limit (KHz)	Result
802.11b	2412	9.07	500	Pass
802.11b	2437	9.05	500	Pass
802.11b	2462	9.05	500	Pass
802.11g	2412	16.38	500	Pass
802.11g	2437	16.40	500	Pass
802.11g	2462	16.39	500	Pass
802.11n (HT20)	2412	15.56	500	Pass
802.11n (HT20)	2437	17.13	500	Pass
802.11n (HT20)	2462	16.30	500	Pass

6dB Bandwidth-802.11b,2412MHz,Ant0

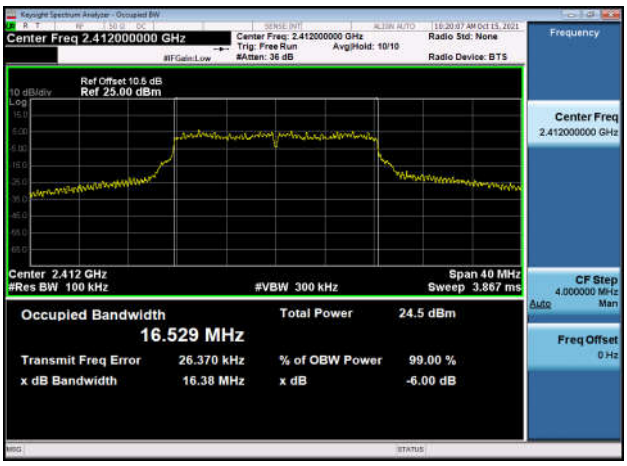


6dB Bandwidth-802.11b,2437MHz,Ant0

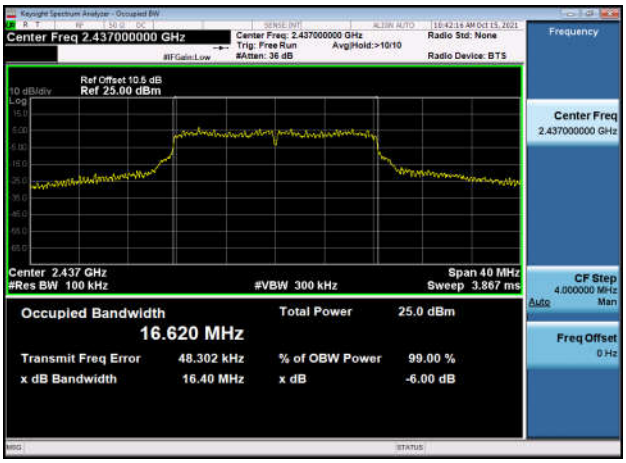
6dB Bandwidth-802.11b,2462MHz,Ant0



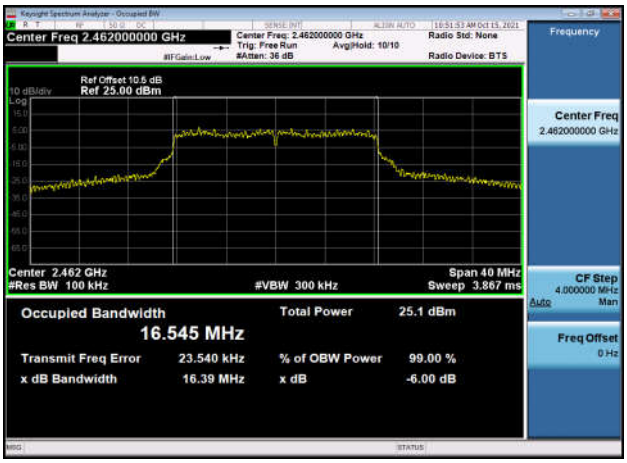
6dB Bandwidth-802.11g,2412MHz,Ant0

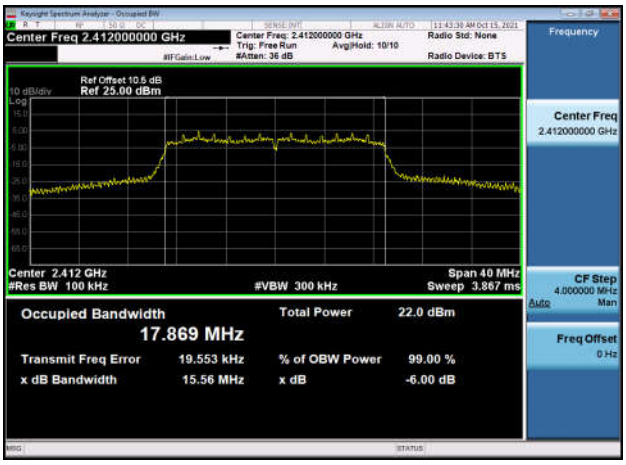
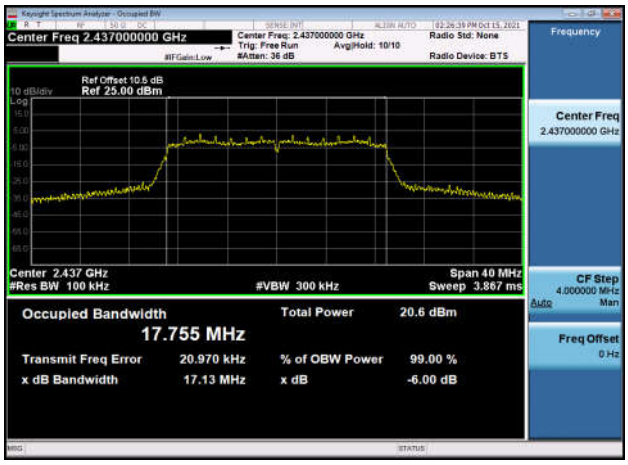
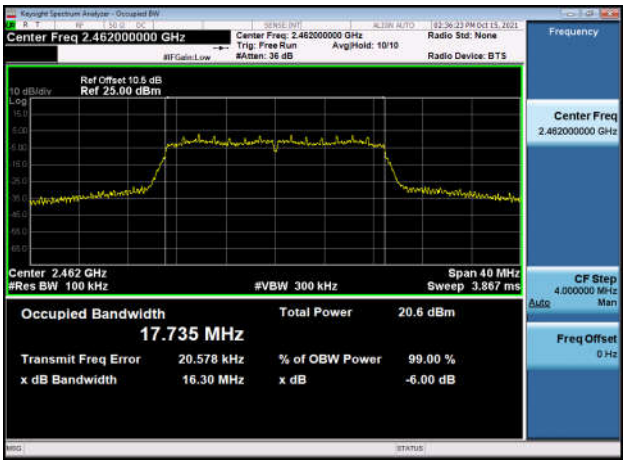


6dB Bandwidth-802.11g,2437MHz,Ant0



6dB Bandwidth-802.11g,2462MHz,Ant0

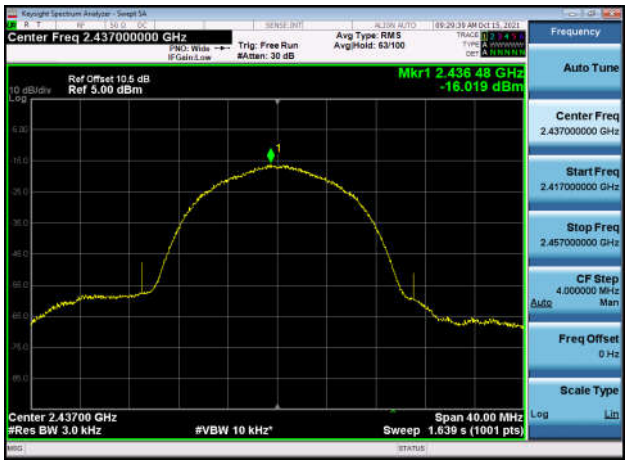
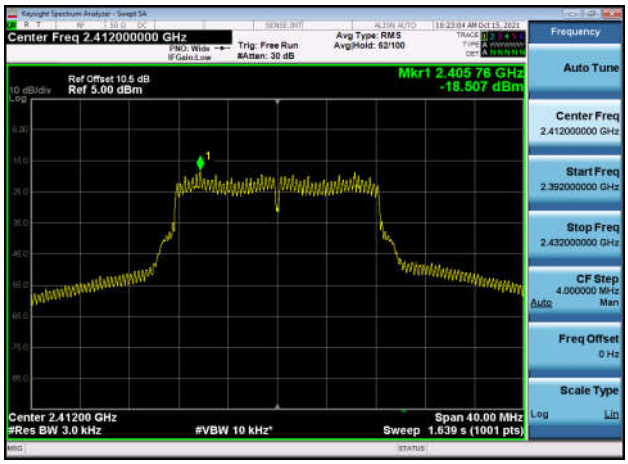
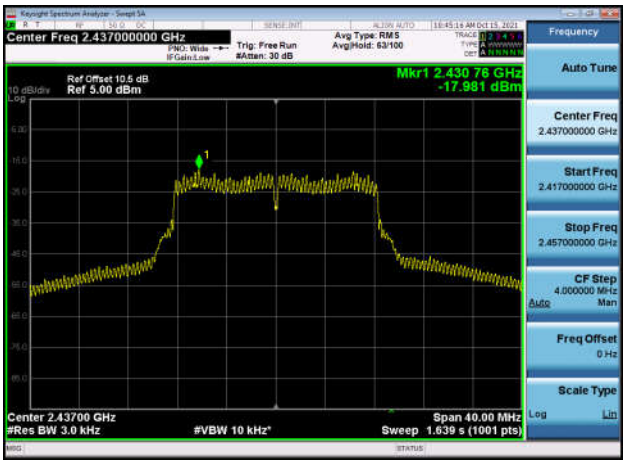
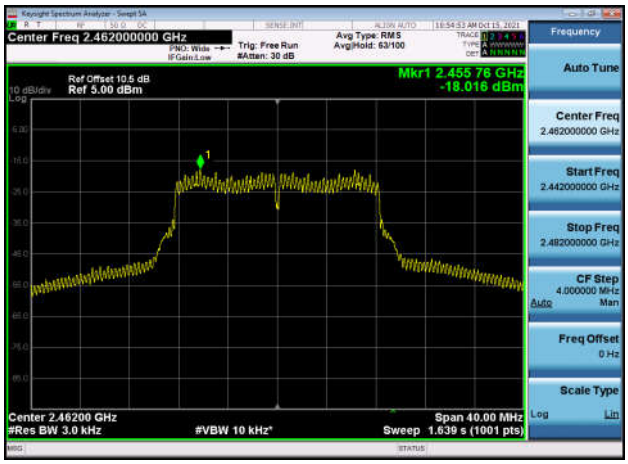


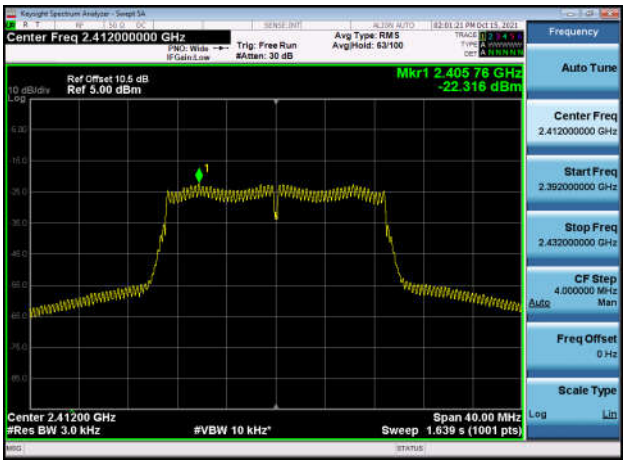
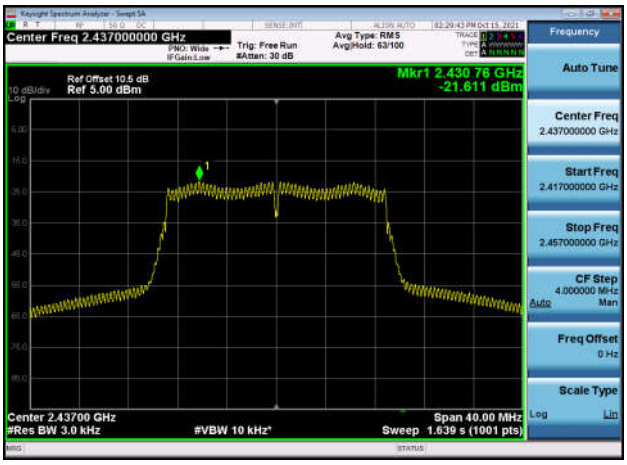
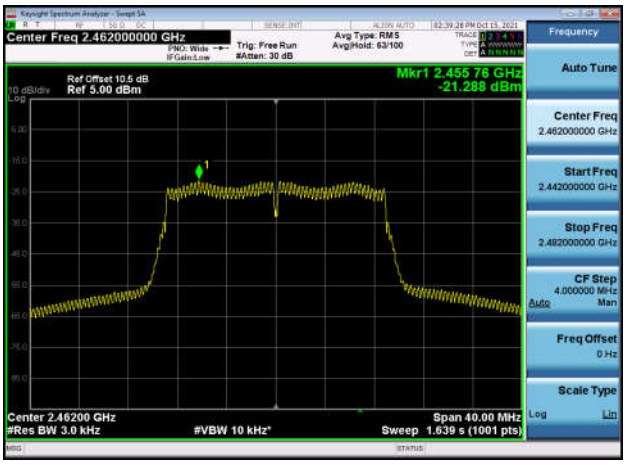
6dB Bandwidth-802.11n(HT20),2412MHz ,Ant0	6dB Bandwidth-802.11n(HT20),2437MHz ,Ant0
	
6dB Bandwidth-802.11n(HT20),2462MHz ,Ant0	
	

Power Spectral Density

Test Result and Data

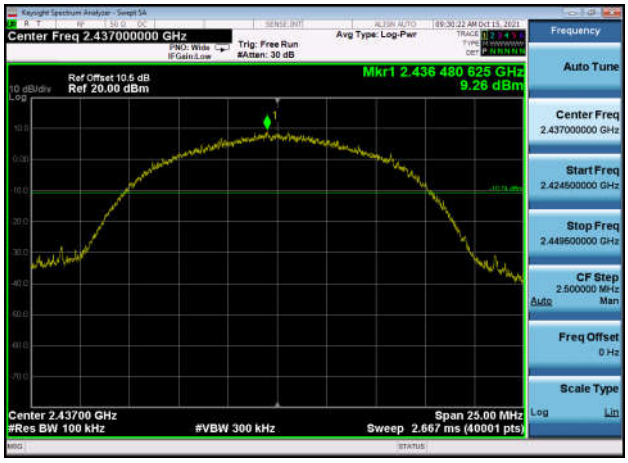
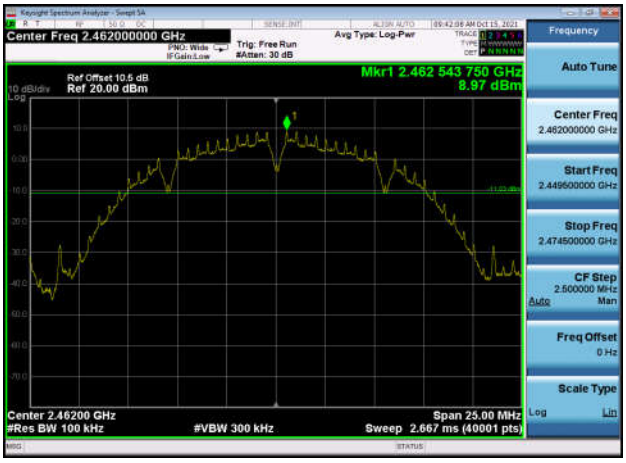
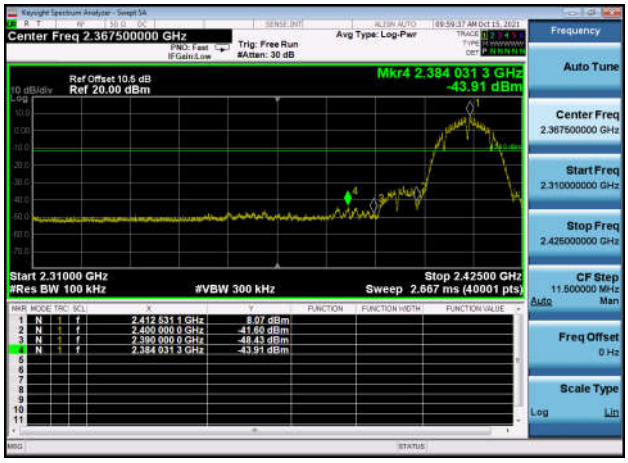
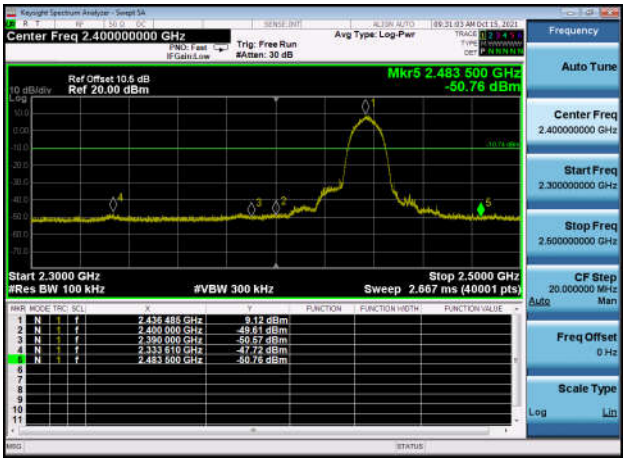
Power Spectral Density					
Mode	Test Frequency (MHz)	PSD (dBm/3KHz)	RBW (kHz)	Limit (dBm/3KHz)	Result
802.11b	2412	-15.909	3	8	Pass
802.11b	2437	-16.019	3	8	Pass
802.11b	2462	-14.594	3	8	Pass
802.11g	2412	-18.507	3	8	Pass
802.11g	2437	-17.981	3	8	Pass
802.11g	2462	-18.016	3	8	Pass
802.11n (HT20)	2412	-22.316	3	8	Pass
802.11n (HT20)	2437	-21.611	3	8	Pass
802.11n (HT20)	2462	-21.288	3	8	Pass

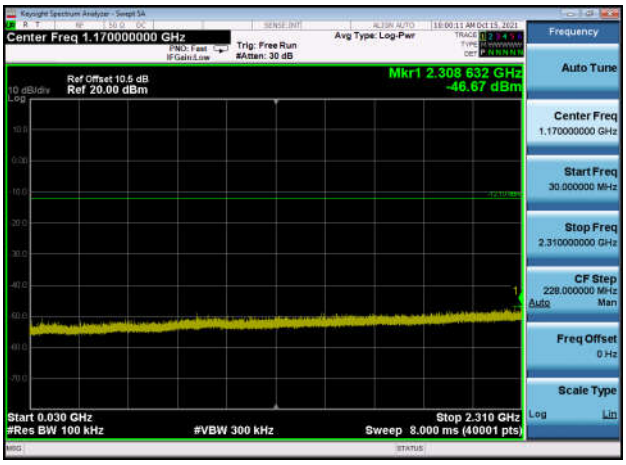
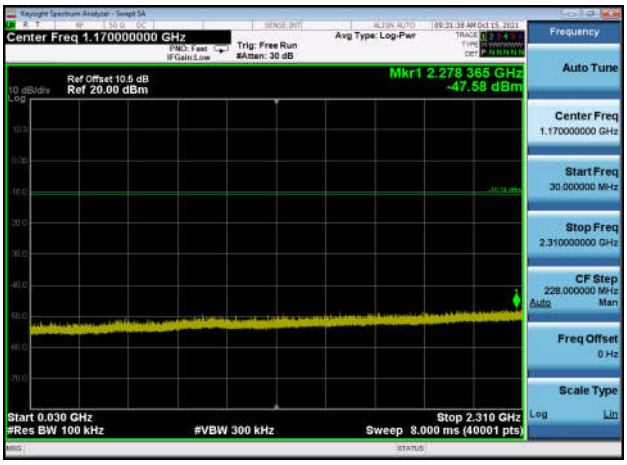
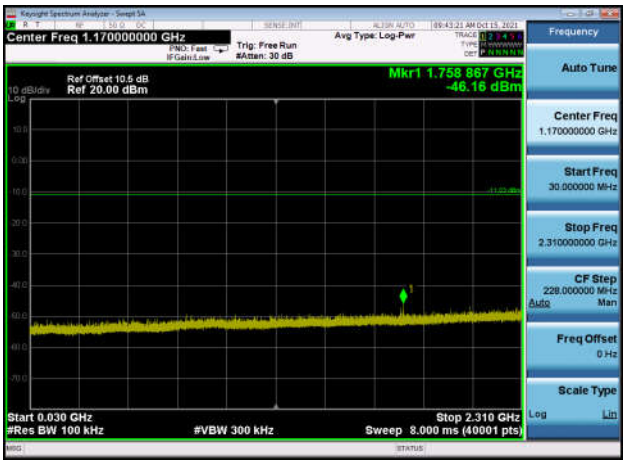
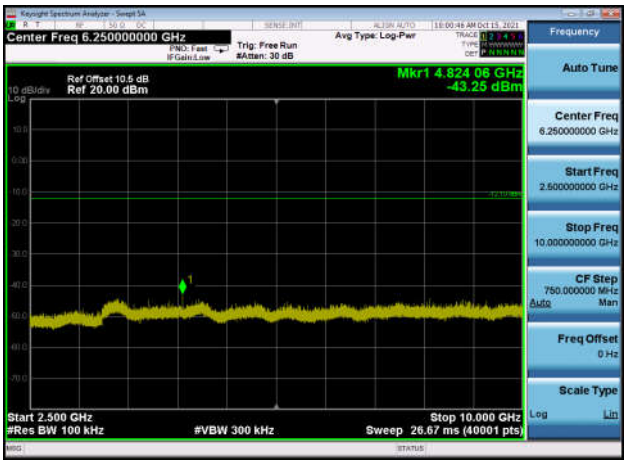
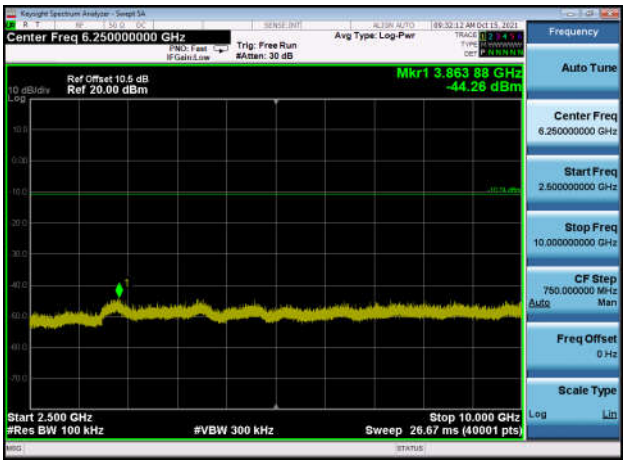
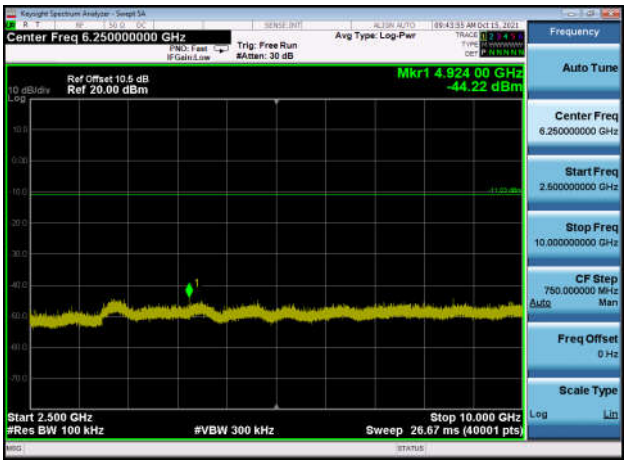
Power spectral density-802.11b ,2412MHz,Ant0	Power spectral density-802.11b ,2437MHz,Ant0
	
Power spectral density-802.11b ,2462MHz,Ant0	Power spectral density-802.11g ,2412MHz,Ant0
	
Power spectral density-802.11g ,2437MHz,Ant0	Power spectral density-802.11g ,2462MHz,Ant0
	

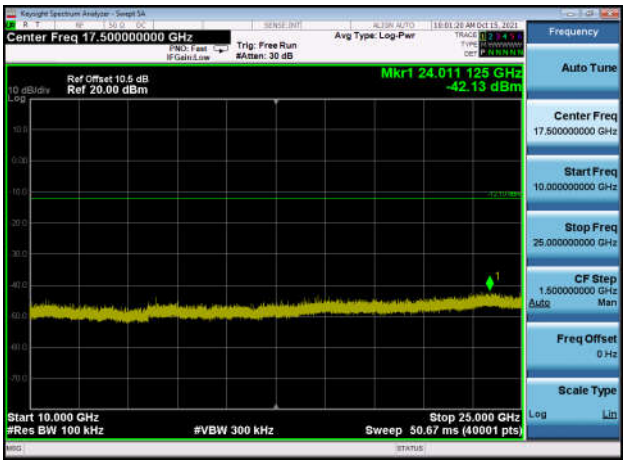
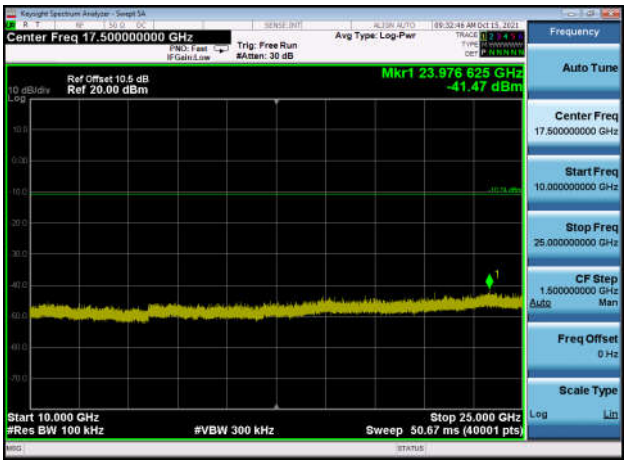
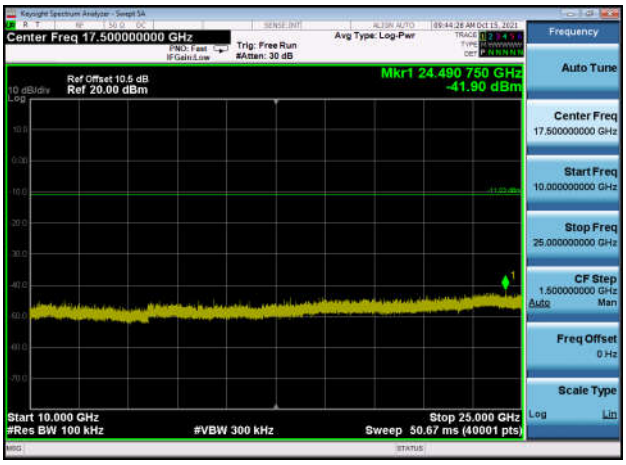
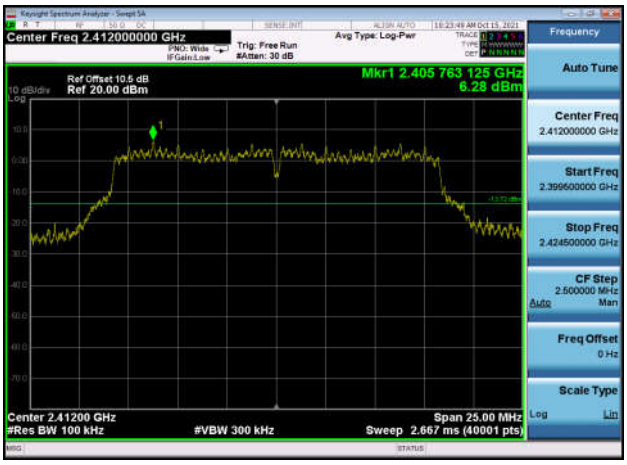
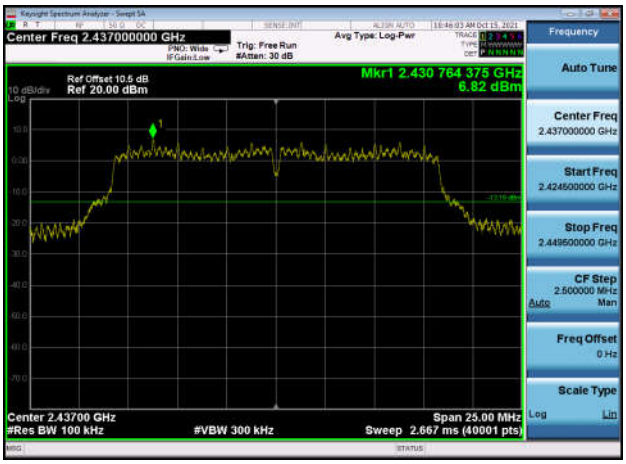
Power spectral density-802.11n(HT20) ,2412MHz,Ant0	Power spectral density-802.11n(HT20) ,2437MHz,Ant0
	
Power spectral density-802.11n(HT20) ,2462MHz,Ant0	
	

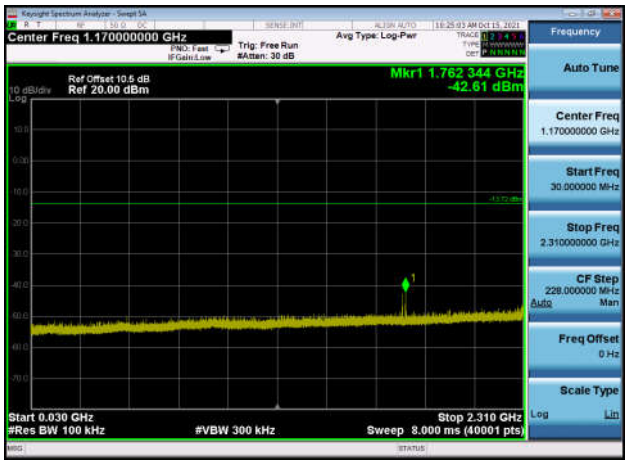
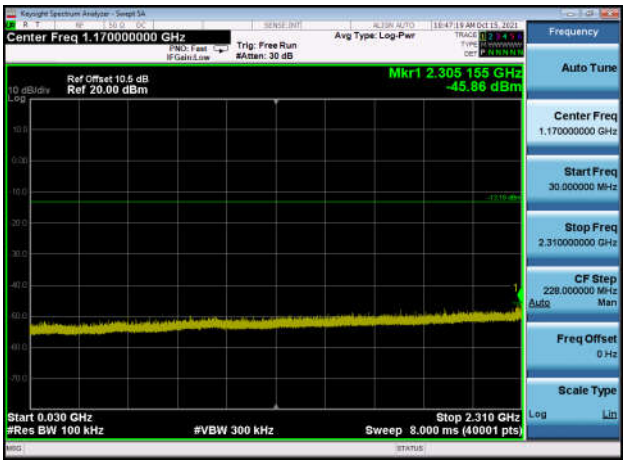
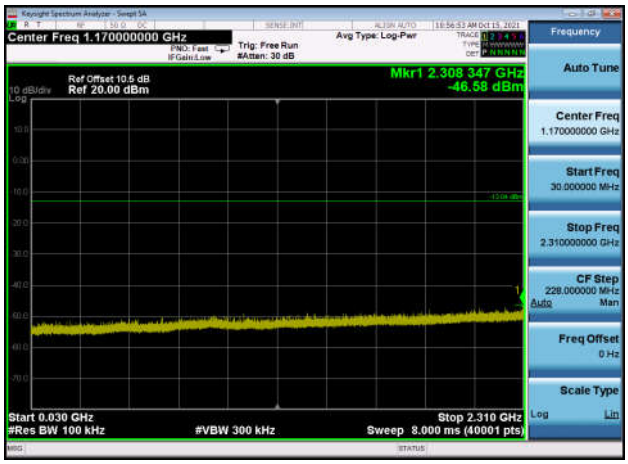
Conducted Band Edges and Spurious Emissions

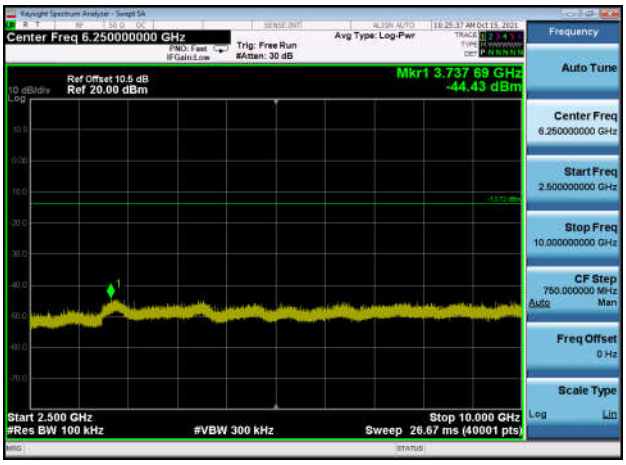
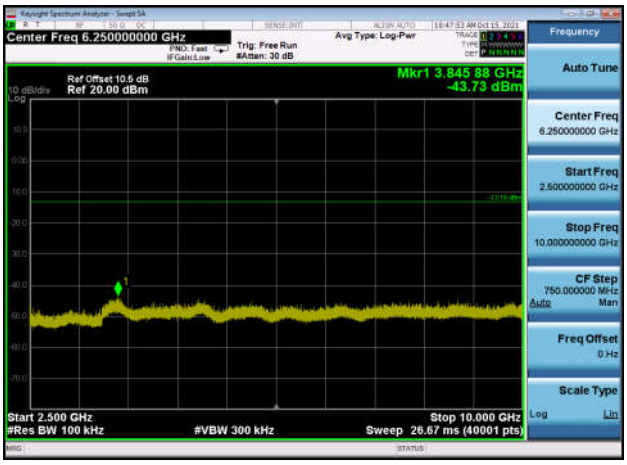
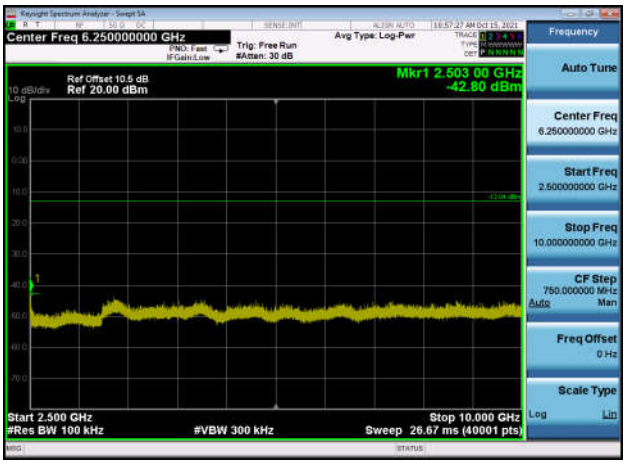
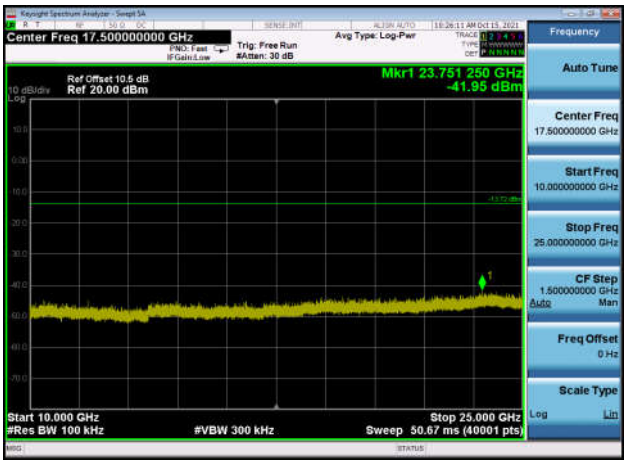
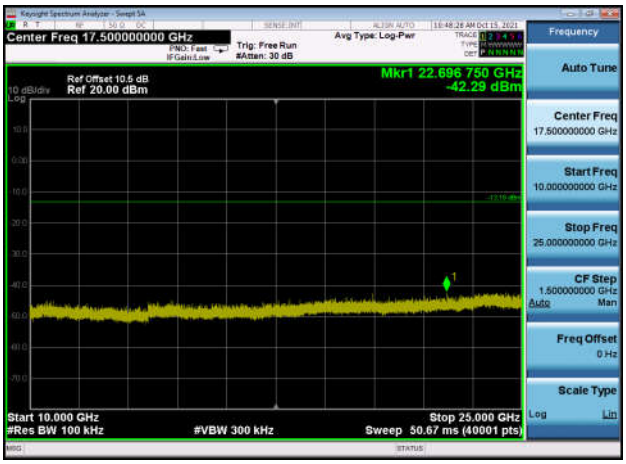
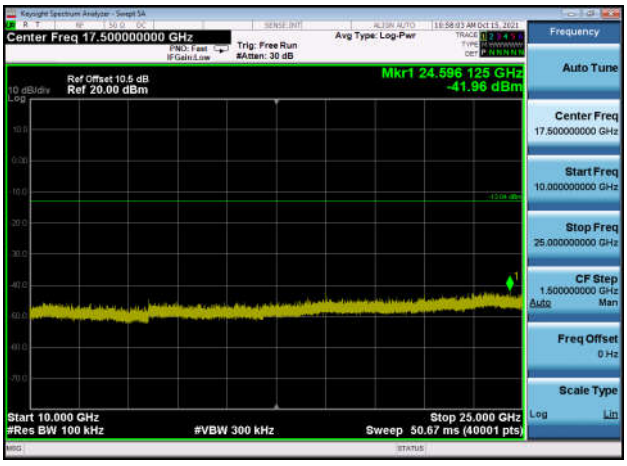
Test Result and Data

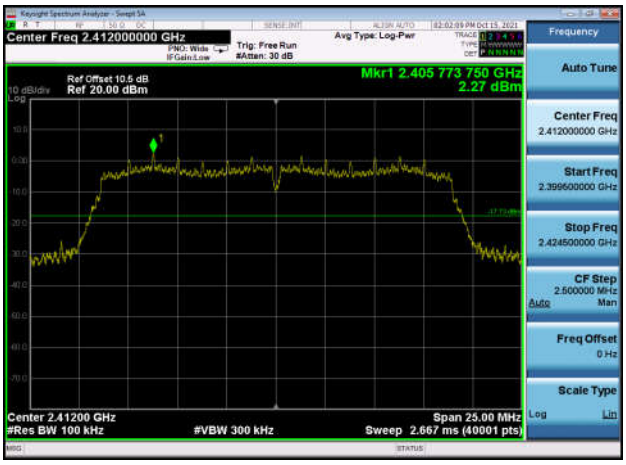
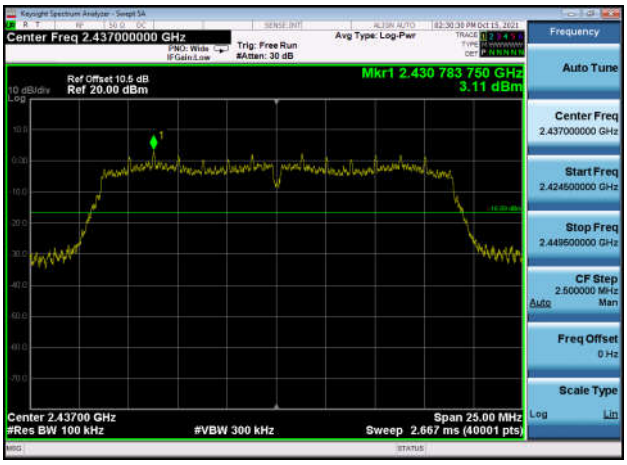
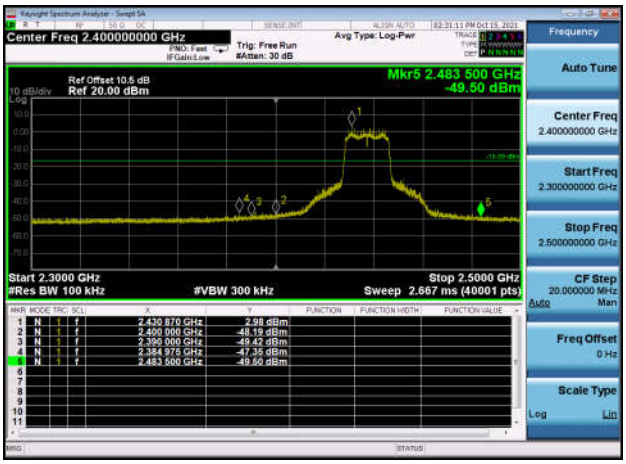
,Plot 1,Reference Level-802.11b ,2412MHz,Ant0	,Plot 1,Reference Level-802.11b ,2437MHz,Ant0
	
,Plot 1,Reference Level-802.11b ,2462MHz,Ant0	,Plot 2,Band Edge-802.11b,2412MHz ,Ant0
	
,Plot 2,Band Edge-802.11b,2437MHz ,Ant0	,Plot 2,Band Edge-802.11b,2462MHz ,Ant0
	

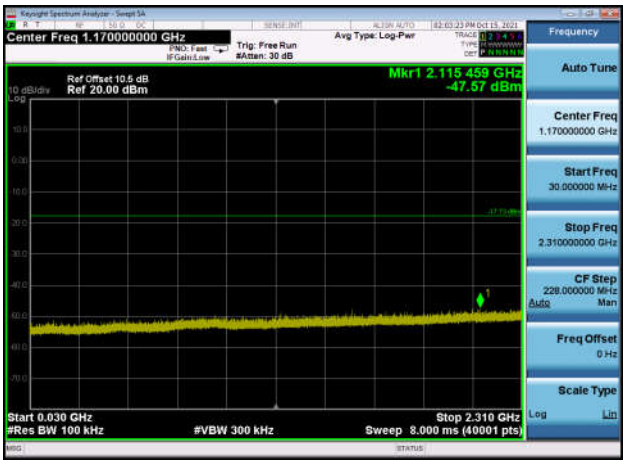
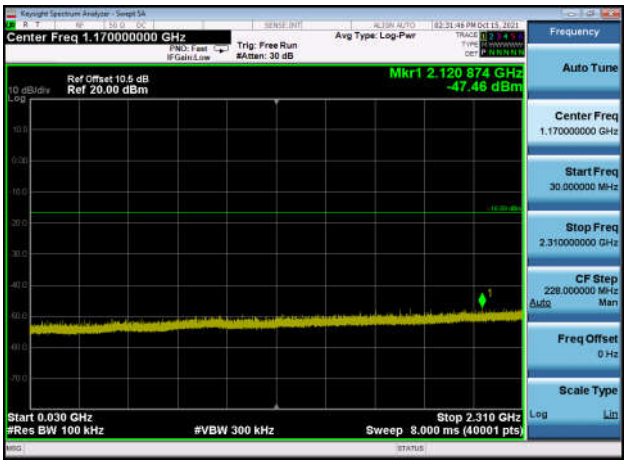
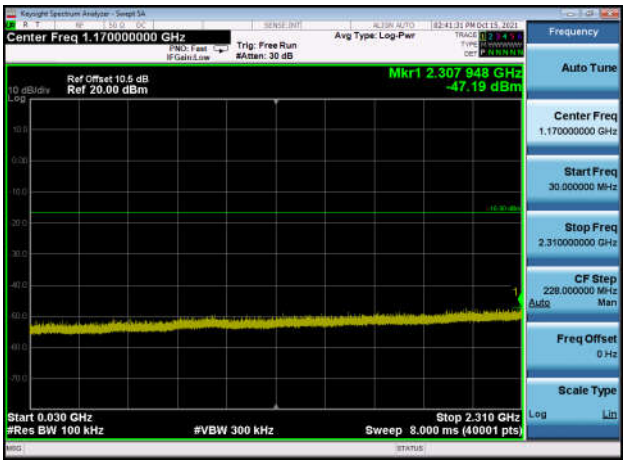
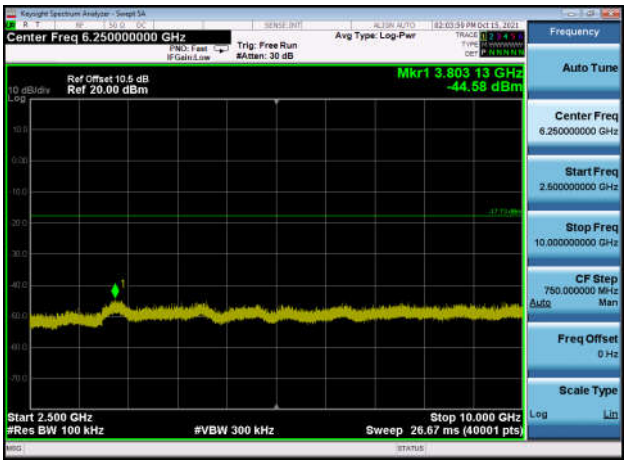
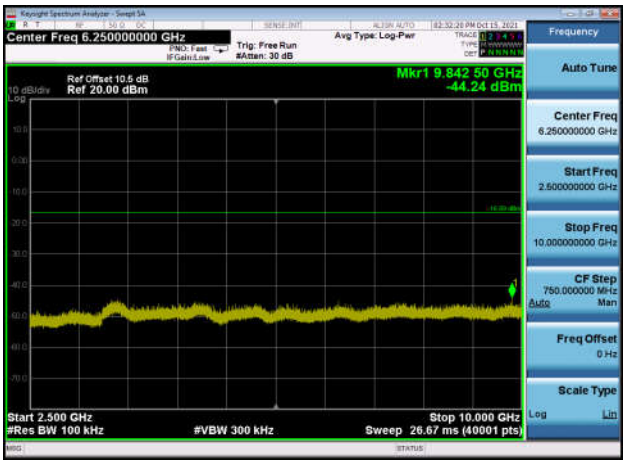
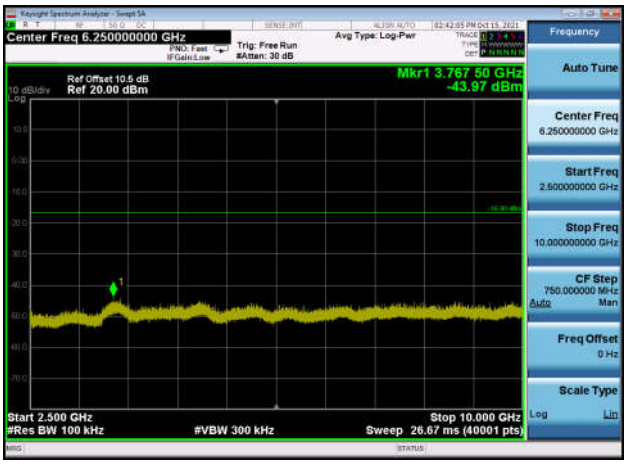
,Plot 3,30MHz~2310MHz-802.11b,2412MHz ,Ant0	,Plot 3,30MHz~2310MHz-802.11b,2437MHz ,Ant0
	
,Plot 3,30MHz~2310MHz-802.11b,2462MHz ,Ant0	,Plot 4,2500MHz~10000MHz-802.11b ,2412MHz,Ant0
	
,Plot 4,2500MHz~10000MHz-802.11b ,2437MHz,Ant0	,Plot 4,2500MHz~10000MHz-802.11b ,2462MHz,Ant0
	

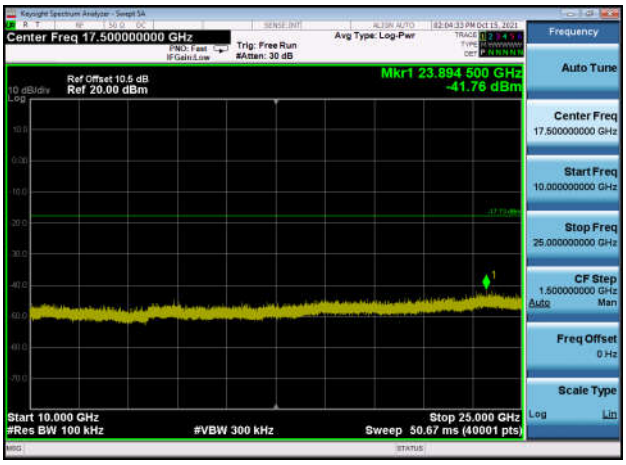
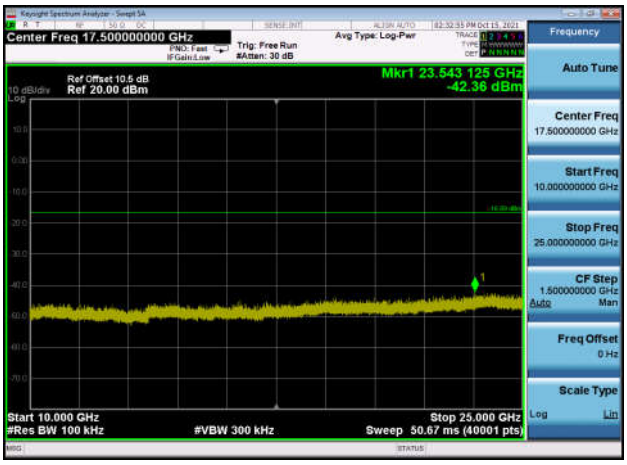
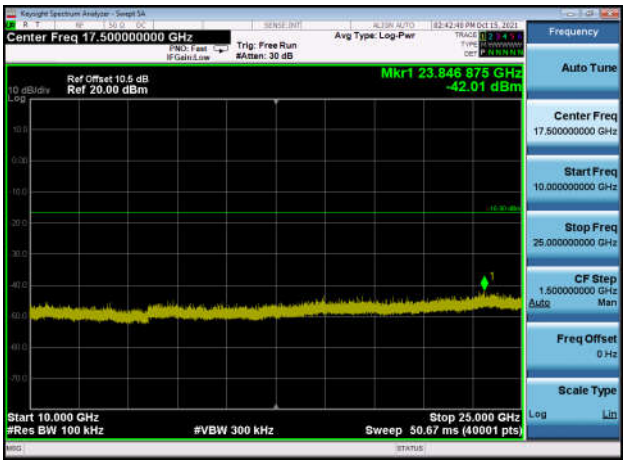
,Plot 5,10000MHz~25000MHz-802.11b ,2412MHz,Ant0	,Plot 5,10000MHz~25000MHz-802.11b ,2437MHz,Ant0
	
,Plot 5,10000MHz~25000MHz-802.11b ,2462MHz,Ant0	,Plot 1,Reference Level-802.11g ,2412MHz,Ant0
	
,Plot 1,Reference Level-802.11g ,2437MHz,Ant0	,Plot 1,Reference Level-802.11g ,2462MHz,Ant0
	

,Plot 2,Band Edge-802.11g,2412MHz ,Ant0	,Plot 2,Band Edge-802.11g,2437MHz ,Ant0
,Plot 2,Band Edge-802.11g,2462MHz ,Ant0	,Plot 3,30MHz~2310MHz-802.11g,2412MHz ,Ant0
	
,Plot 3,30MHz~2310MHz-802.11g,2437MHz ,Ant0	,Plot 3,30MHz~2310MHz-802.11g,2462MHz ,Ant0
	

,Plot 4,2500MHz~10000MHz-802.11g ,2412MHz,Ant0	,Plot 4,2500MHz~10000MHz-802.11g ,2437MHz,Ant0
	
,Plot 4,2500MHz~10000MHz-802.11g ,2462MHz,Ant0	,Plot 5,10000MHz~25000MHz-802.11g ,2412MHz,Ant0
	
,Plot 5,10000MHz~25000MHz-802.11g ,2437MHz,Ant0	,Plot 5,10000MHz~25000MHz-802.11g ,2462MHz,Ant0
	

,Plot 1,Reference Level-802.11n(HT20) ,2412MHz,Ant0	,Plot 1,Reference Level-802.11n(HT20) ,2437MHz,Ant0
	
,Plot 1,Reference Level-802.11n(HT20) ,2462MHz,Ant0	,Plot 2,Band Edge-802.11n(HT20) ,2412MHz,Ant0
,Plot 2,Band Edge-802.11n(HT20) ,2437MHz,Ant0	,Plot 2,Band Edge-802.11n(HT20) ,2462MHz,Ant0
	

,Plot 3,30MHz~2310MHz-802.11n(HT20) ,2412MHz,Ant0	,Plot 3,30MHz~2310MHz-802.11n(HT20) ,2437MHz,Ant0
	
,Plot 3,30MHz~2310MHz-802.11n(HT20) ,2462MHz,Ant0	,Plot 4,2500MHz~10000MHz-802.11n(HT20),2412MHz,Ant0
	
,Plot 4,2500MHz~10000MHz-802.11n(HT20),2437MHz,Ant0	,Plot 4,2500MHz~10000MHz-802.11n(HT20),2462MHz,Ant0
	

,Plot 5,10000MHz~25000MHz-802.11n(HT20),2412MHz,Ant0	,Plot 5,10000MHz~25000MHz-802.11n(HT20),2437MHz,Ant0
	
,Plot 5,10000MHz~25000MHz-802.11n(HT20),2462MHz,Ant0	
	

END OF REPORT