

RF Test Report

Applicant: Quectel Wireless Solutions Co., Ltd.

Address: Building 5, Shanghai Business Park Phase III (Area B), No.1016
Tianlin Road, Minhang District, Shanghai, China 200233

Product: Wi-Fi & Bluetooth Module

Model No.: FLM540R

Brand Name: QUECTEL

FCC ID: XMR2024FLM540R

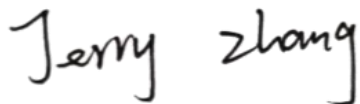
Standards: FCC CFR47 Part 15C

Report No.: PD20240017RF09

Issue Date: 2024/07/10

Test Result: PASS *

* Testing performed at Hefei Panwin Technology Co., Ltd. on the above equipment indicates the product meets the requirements of the relevant standards.



Reviewed By: Jerry Zhang



Approved By: Alec Yang

Hefei Panwin Technology Co., Ltd.

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Test Report

Report No.: PD20240017RF09

Report Version: 01

Revision History

Report No.	Version	Description	Issue Date	Note
PD20240017RF09	1	Initial Report	2024/07/10	Valid

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Test Summary

No.	Test Case	FCC Rules	Verdict
1	Output Power Measurement	15.247(b)	PASS
2	6dB and 99% Bandwidth Measurement	15.247(a)(2)	PASS
3	Power Spectral Density Measurement	15.247(e)	PASS
4	Conducted Band Edges and Spurious Emission Measurement	15.247(d)	PASS
5	Radiated Band Edges and Spurious Emission Measurement	15.247(d)	PASS
6	AC Conducted Emission Measurement	15.207	NA
7	Antenna Requirements	15.203 & 15.247(b)	PASS
Date of Testing: 2024/05/09 to 2024/07/09			
Date of Sample Received: 2024/05/07			
■ The samples tested have been evaluated in accordance with the procedures given in the application standards in Section 2.3 of this report and have been shown to comply with the applicable technical standards. ■ All indications of PASS/FAIL in this report are based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only.			

1 General Information

1.1 Notes of the Test Report

This report is invalid without signature of auditor and approver or with any alterations. The report shall not be partially reproduced without written approval of the testing company. Entrusted test results are only responsible for incoming samples. If there is any objection to the testing report, it shall be raised to the testing company within 15 days from the date of receiving the report. In the test results, "NA" means "not applicable", and the test items marked with "Δ" are subcontracted projects.

1.2 Test Facility

A2LA (Certificate Number: 6849.01)

Hefei Panwin Technology Co., Ltd. has been accredited by American Association for Laboratory Accreditation to perform measurement.

FCC (Designation Number: CN1361, Test Firm Registration Number: 473156)

Hefei Panwin Technology Co., Ltd. has been accredited on the US Federal Communications Commission list of test facilities recognized to perform measurements.

1.3 Testing Laboratory

Company Name	Hefei Panwin Technology Co., Ltd.
Address	Floor 1, Zone E, Plant 2#, Mingzhu Industrial Park, No.106 Chuangxin Avenue, High-tech Zone, Hefei City, Anhui Province, China
Telephone	+86-0551-63811775
Post Code	230031

2 General Description of Equipment under Test

2.1 Details of Application

Applicant	Quectel Wireless Solutions Co., Ltd.
Applicant Address	Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, China 200233
Manufacturer	Quectel Wireless Solutions Co., Ltd.
Manufacturer Address	Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, China 200233

2.2 General Information

Product	Wi-Fi & Bluetooth Module
Model	FLM540R
SN	1. E1N24A30S000002 2. E1N24A30S000077
Hardware Version	R1.0
Software Version	/
Directional Gain	NA
Antenna Type	PCB Antenna
Antenna Gain	2.30dBi
Additional Beamforming Gain	NA
Max. Conducted Power	Wi-Fi 2.4G: 16.93dBm
Operating voltage	Typical 3.3Vdc
Type of Modulation	WLAN 802.11b/g/n HT20/n HT40: CCK,BPSK,QPSK,16QAM,64QAM
Operating Frequency Range(s)	802.11b/g/n HT20: 2412 to 2462MHz 802.11n HT40: 2422 to 2452MHz
Note: The declared of product specification for EUT and/or Antenna presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.	

2.3 Application Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- 47 CFR Part 15 Subpart C §15.247
- FCC KDB 558074 D01 15.247 Meas Guidance v05r02
- ANSI C63.10-2013

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.

3 Test Condition

3.1 Test Configuration

Test mode

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture). The worst cases were recorded in this report.

Radiated measurements are performed by rotating the EUT in three different orthogonal test planes (Z, X, Y axis), receiver antenna polarization (horizontal and vertical), the worst emission was found in Z position and the worst case was recorded. This report presents the data for the worst polarity.

Test Mode	Data Rate(Mbps)
802.11b_SISO	1
802.11g_SISO	6
802.11n HT20_SISO	MCS0
802.11n HT40_SISO	MCS0

3.2 Carrier Frequency and Channel

Frequency Band	Channel	Freq.(MHz)	Channel	Freq.(MHz)
2400-2483.5 MHz	1	2412	7	2442
	2	2417	8	2447
	3	2422	9	2452
	4	2427	10	2457
	5	2432	11	2462
	6	2437	/	/

3.3 Equipment List

Conducted

Instrument	Manufacturer	Model	Asset No.	Cal. Interval	Cal. Due Date
Spectrum Analyzer	KEYSIGHT	N9020B	PWC0048	1 Year	2024/10/10
RF Control Unit	Tonsecod	JS0806-2	PWC0055	/	/
Shielded Chamber	Maorui	MR543	PWC0041	3 Years	2026/08/26
Test Software	Tonsecod	JS1120-3 V3.2.22	/	/	/

Radiated

Instrument	Manufacturer	Model	Asset No.	Cal. Interval	Cal. Due Date
EMI Test Receiver	R&S	ESR7	PWB0023	1 Year	2024/10/11
Spectrum Analyzer	R&S	FSV3044	PWB0024	1 Year	2024/10/11
Loop Antenna	R&S	HFH2-Z2E	PWB0026	1 Year	2024/10/21
TRILOG Broadband Antenna	Schwarzbeck	VULB9162	PWB0029	1 Year	2024/10/13
Double-Ridged Guide Antenna	ETS-Lindgren	3117	PWB0031	1 Year	2024/10/11
k Type Horn Antenna	Steatite Antennas	QMS-00880	PWB0035	1 Year	2024/10/17
Pre-Amplifier	R&S	OSP220 (OSP-B155G)	PWB0042	1 Year	2024/10/13
Anechoic Chamber	ETS.LINDGREN	Fact 3-2m	PWB0003	3 Years	2026/06/05
Pre-Amplifier	R&S	SCU18F	PWB0034	1 Year	2024/10/11

Pre-Amplifier	R&S	SCU40F1	PWB0036	1 Year	2024/10/11
Pre-Amplifier	COM-MW	DLNA8	PWB0094	1 Year	2024/11/08
Test Software	R&S	ELEKTRA 4.20.2	/	/	/

3.4 Support Equipment List

Equipment	Manufacturer	Description	Model	Serial Number
EVB	QUECTEL	/	/	/
Laptop	Lenovo	/	/	/

3.5 Test Uncertainty

No.	Parameter	Uncertainty
1	DTS Bandwidth	1.9 %
2	Occupied channel bandwidth	1.9 %
3	Duty Cycle	0.11 %
4	Maximum Conducted Output Power	1.18 dB
5	Maximum Power Spectral Density Level	0.98 dB
6	Band-edge Compliance	1.21dB
7	Unwanted Emissions In Non-restricted Frequency Bands	9kHz-7GHz: 1.21 dB 7GHz-40GHz: 3.31 dB
8	Radiated Band Edges and Spurious Emission	Below 1GHz: 4.88 dB Above 1GHz: 5.06 dB
9	Temperature	3 °C
10	Humidity	1.3 %
11	Supply Voltages	0.006 V

4 Test Items Description

Ambient condition

Shielded Chamber

Temperature [°C]	21.4 to 25.4
Humidity [%RH]	37 to 52
Pressure [kPa]	100.2 to 101.8

Anechoic Chamber

Temperature [°C]	20.1 to 25.6
Humidity [%RH]	44 to 55
Pressure [kPa]	99.8 to 100.8

4.1 Output Power Measurement

4.1.1 Limit of 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.

4.1.2 Measuring Instruments

The section 2.3 of List of Measuring Equipment of this test report is used for test.

4.1.3 Test Procedures

The testing follows the Measurement Procedure of ANSI C63.10-2013 clause 11.9.2.2.4 Method AVGSA-2. Method AVGSA-2 uses trace averaging across ON and OFF times of the EUT transmissions, followed by duty cycle correction. The procedure for this method is as follows:

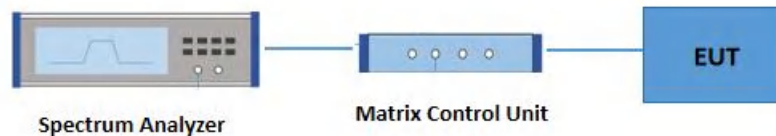
1. Measure the duty cycle D of the transmitter output signal as described in 11.6.
2. Set span to at least 1.5 times the OBW.
3. Set RBW = 1% to 5% of the OBW, not to exceed 1 MHz.
4. Set VBW $\geq [3 \times \text{RBW}]$.
5. Number of points in sweep $\geq [2 \times \text{span} / \text{RBW}]$. (This gives bin-to-bin spacing $\leq \text{RBW} / 2$, so that narrowband signals are not lost between frequency bins.)
6. Sweep time = auto.
7. Detector = RMS (i.e., power averaging), if available. Otherwise, use the sample detector mode.
8. Do not use sweep triggering. Allow the sweep to “free run.”
9. Trace average at least 100 traces in power averaging (rms) mode; however, the number of traces

to be averaged shall be increased above 100 as needed such that the average accurately represents the true average over the ON and OFF periods of the transmitter.

10. Compute power by integrating the spectrum across the OBW of the signal using the Instrument's band power measurement function with band limits set equal to the OBW band edges. If the instrument does not have a band power function, then sum the spectrum levels (in power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.

11. Add $[10 \log (1 / D)]$, where D is the duty cycle, to the measured power to compute the average power during the actual transmission times (because the measurement represents an average over both the ON and OFF times of the transmission). For example, add $[10 \log (1/0.25)] = 6 \text{ dB}$ if the duty cycle is 25%.

4.1.4 Test Setup



4.1.5 Test Results

See Appendix A.1.

4.2 6dB and 99% Bandwidth Measurement

4.2.1 Limit of 6dB and 99% Bandwidth

The minimum 6 dB bandwidth shall be at least 500 kHz

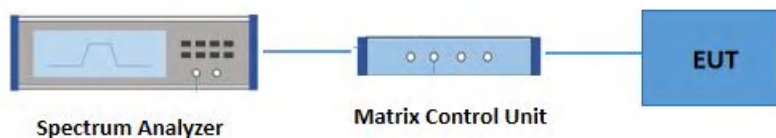
4.2.2 Measuring Instruments

The section 3.3 of List of Measuring Equipment of this test report is used for test.

4.2.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 11.8.
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 6 dB bandwidth must be greater than 500 kHz.
5. For 99% Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) is set 1% to 5% of the 99% OBW and the VBW is set to 3 times of the RBW.
6. Measure and record the results in the test report.

4.2.4 Test Setup



4.2.5 Test Results

See Appendix A.2.

4.3 Power Spectral Density Measurement

4.3.1 Limit of Power Spectral Density

Rule Part 15.247(e) specifies that " For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

4.3.2 Measuring Instruments

The section 3.3 of List of Measuring Equipment of this test report is used for test.

4.3.3 Test Procedures

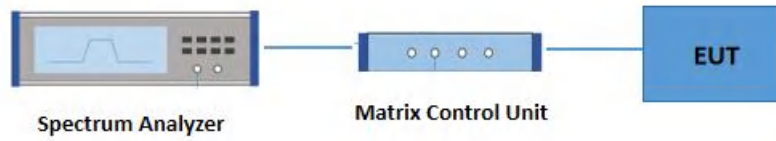
The testing follows ANSI C63.10-2013 clause 11.10.5.

Method AVGPS-2 uses trace averaging across ON and OFF times of the EUT transmissions, followed by duty cycle correction.

The following procedure is applicable when the EUT cannot be configured to transmit continuously (i.e., $D < 98\%$), when sweep triggering/signal gating cannot be used to measure only when the EUT is transmitting at its maximum power control level, and when the transmission duty cycle is constant (i.e., duty cycle variations are less than $\pm 2\%$):

1. Measure the duty cycle (D) of the transmitter output signal as described in 11.6.
2. Set instrument center frequency to DTS channel center frequency.
3. Set span to at least 1.5 times the OBW.
4. Set RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
5. Set VBW $\geq [3 \times \text{RBW}]$.
6. Detector = power averaging (rms) or sample detector (when rms not available).
7. Ensure that the number of measurement points in the sweep $\geq [2 \times \text{span} / \text{RBW}]$.
8. Sweep time = auto couple.
9. Do not use sweep triggering; allow sweep to "free run."
10. Employ trace averaging (rms) mode over a minimum of 100 traces.
11. Use the peak marker function to determine the maximum amplitude level.
12. Add $[10 \log (1 / D)]$, where D is the duty cycle measured in step a), to the measured PSD to compute the average PSD during the actual transmission time.
13. If measured value exceeds requirement specified by regulatory agency, then reduce RBW (but no less than 3 kHz) and repeat (note that this may require zooming in on the emission of interest and reducing the span to meet the minimum measurement point requirement as the RBW is reduced).

4.3.4 Test Setup



4.3.5 Test Result of Power Spectral Density

Please refer to Appendix A.3.

4.4 Conducted Band Edges and Spurious Emission Measurement

4.4.1 Limit of Conducted Band Edges and Spurious Emission

All harmonics/spurious must be at least 20 dB down from the highest emission level within the authorized band. In any 100 kHz bandwidth outside of the authorized frequency band, the emissions which fall in the non-restricted bands shall be attenuated at least 20 dB relative to the maximum PSD level in 100 kHz by RF conducted measurement.

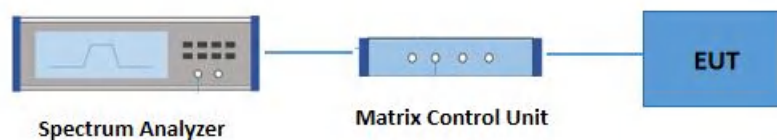
4.4.2 Measuring Instruments

The section 3.3 of List of Measuring Equipment of this test report is used for test

4.4.3 Test Procedure

1. The testing follows ANSI C63.10-2013 clause 11.13.
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 100 kHz 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.
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.

4.4.4 Test Setup



4.4.5 Test Result

Please refer to Appendix A.4.

4.5 Radiated Band Edges and Spurious Emission Measurement

4.5.1 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 limits as below.

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
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	8
Above 960	500	3

4.5.2 Measuring Instruments

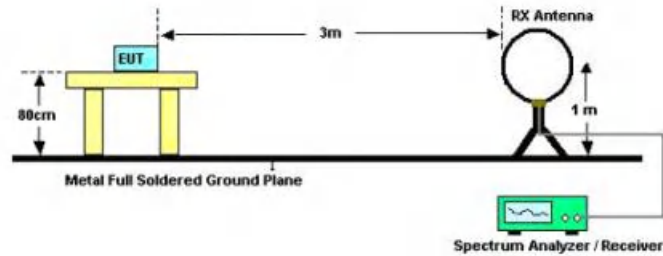
The section 3.3 of List of Measuring Equipment of this test report is used for test.

4.5.3 Test Procedures

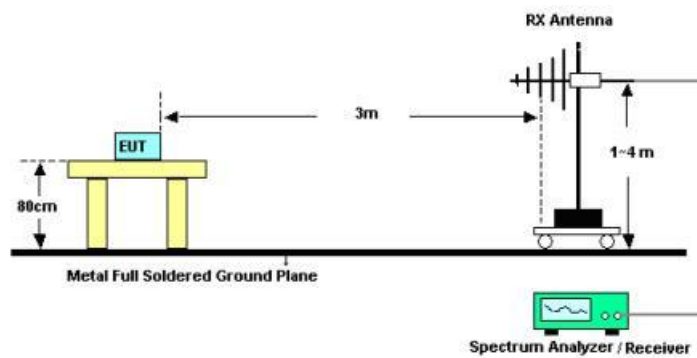
1. The testing follows ANSI C63.10-2013 clause 11.11 & 11.12
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
3. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
5. Corrected Reading: Antenna Factor + Cable Loss + Read Level -Pre-amp Factor = Level
6. For testing below 1GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the CISPR quasi-peak method and reported.
7. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than peak limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
8. Use the following spectrum analyzer settings:
 - (1) Span shall wide enough to fully capture the emission being measured.
 - (2) Set RBW=100 kHz for $f < 1 \text{ GHz}$; $\text{VBW} \geq \text{RBW}$; Sweep = auto; Detector function = peak; Trace = max hold.
 - (3) Set RBW = 1 MHz, VBW= 3MHz for $\geq 1 \text{ GHz}$ for peak measurement
For average measurement:
VBW= 10 Hz, when duty cycle is no less than 98 percent.
 $\text{VBW} \geq 1/T$, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

4.5.4 Test Setup

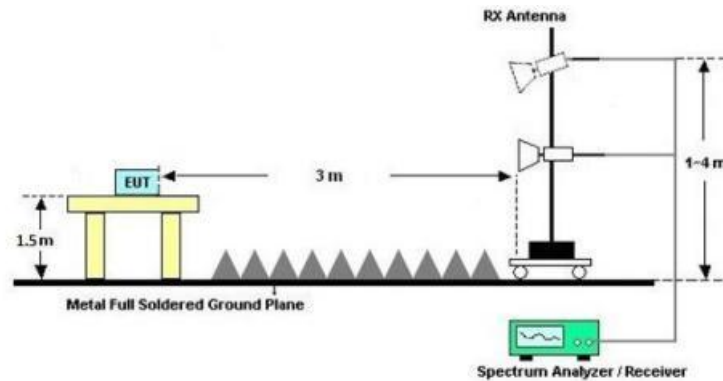
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



4.5.5 Test Results of Radiated Spurious Emissions (9 kHz ~ 30 MHz)

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line was not reported.

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

4.5.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix B.1.

4.5.7 Test Result of Radiated Spurious Emission (30MHz ~ 10th Harmonic or 40GHzwhichever is lower)

Please refer to Appendix B.1.

4.5.8 Duty Cycle

Please refer to Appendix A.5.

4.6 AC Conducted Emission Measurement

4.6.1 Limit of AC 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 of emission (MHz)	Conducted limit (dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

Decreases with the logarithm of the frequency.

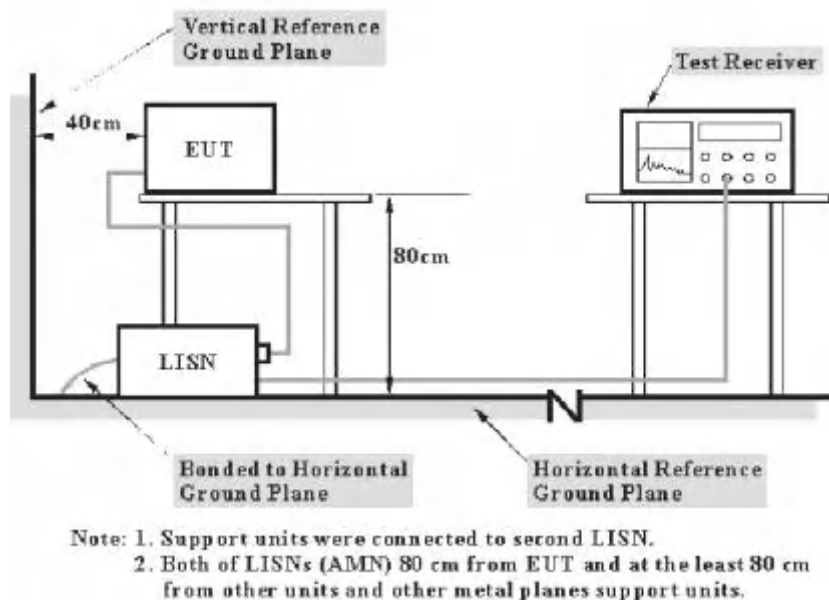
4.6.2 Measuring Instruments

The section 3.3 of List of Measuring Equipment of this test report is used for test.

4.6.3 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 microhenry 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.

4.6.4 Test Setup



4.6.5 Uncertainty Measurement

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT. The listed uncertainties are the worst case uncertainty for the entire range of measurement. Please note that the uncertainty values are provided for informational purposes only and are not used in determining the PASS/FAIL results. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$.

CASE	Uncertainty
Continuous Emission (AC port)	2.92 dB

4.6.6 Test Result

Remark: The product is DC powered, this test item is not applicable.

4.7 Antenna Requirements

4.7.1 Standard Applicable

15.203 requirement: 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, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

15.247(b) (4) requirement: The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and(b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6dBi.

4.7.2 Antenna Anti-Replacement Construction

The antenna is internal on the main PCB and no consideration of replacement. The best case gain of the antenna is 2.30dBi.

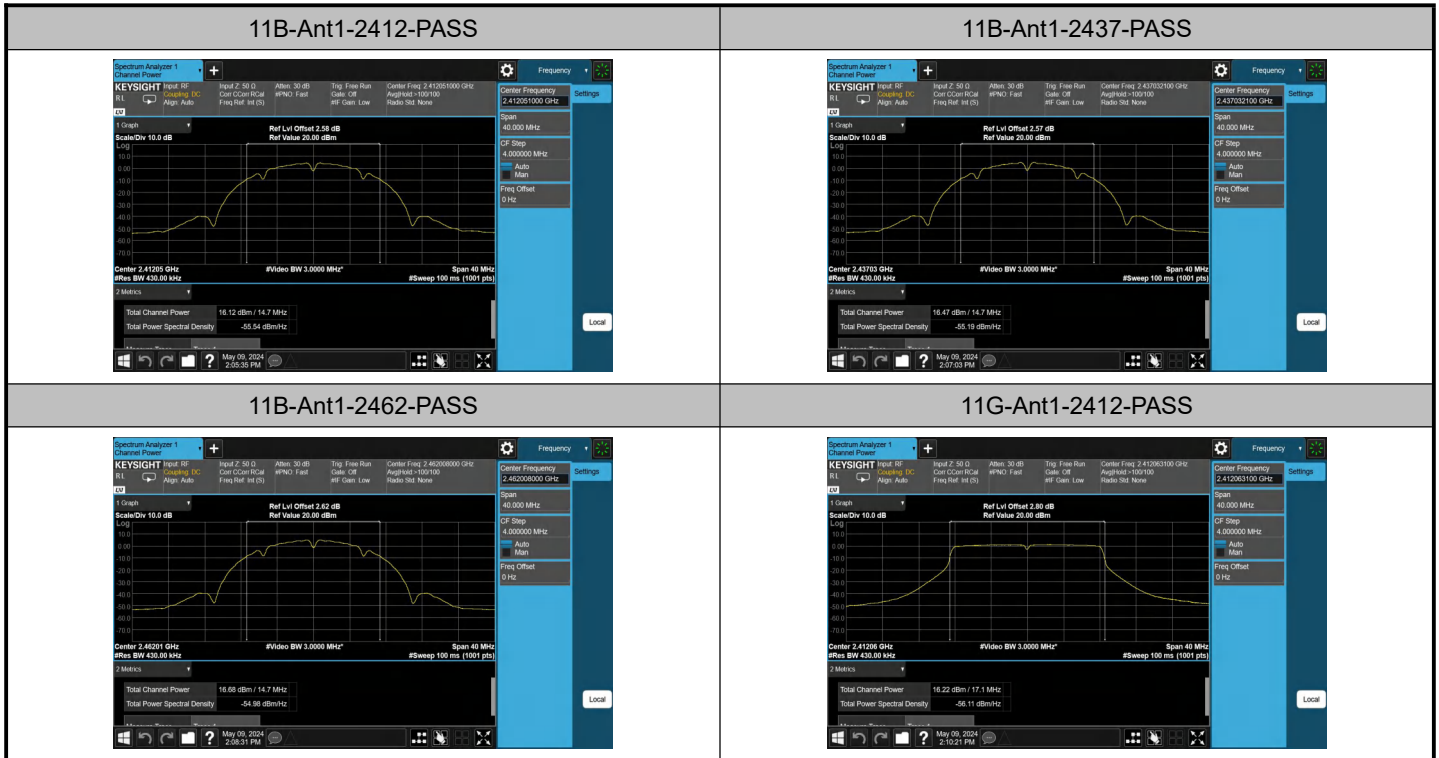
Appendix A – Test Results of Conducted Test

A.1 Conducted Output Power

Test Result

Test Mode	Antenna	Frequency [MHz]	Average power [dBm]	Duty Cycle [%]	DC Factor [dBm]	Result [dBm]	Limit [dBm]	Verdict
11B	Ant1	2412	16.07	98.89	0.05	16.12	≤30.00	PASS
11B	Ant1	2437	16.43	99.04	0.04	16.47	≤30.00	PASS
11B	Ant1	2462	16.63	98.89	0.05	16.68	≤30.00	PASS
11G	Ant1	2412	15.94	94.06	0.27	16.21	≤30.00	PASS
11G	Ant1	2437	16.67	94.09	0.26	16.93	≤30.00	PASS
11G	Ant1	2462	15.70	94.09	0.26	15.96	≤30.00	PASS
11N20SISO	Ant1	2412	15.87	93.66	0.28	16.15	≤30.00	PASS
11N20SISO	Ant1	2437	16.64	93.66	0.28	16.92	≤30.00	PASS
11N20SISO	Ant1	2462	15.84	93.66	0.28	16.12	≤30.00	PASS
11N40SISO	Ant1	2422	15.32	87.85	0.56	15.88	≤30.00	PASS
11N40SISO	Ant1	2437	15.35	87.85	0.56	15.91	≤30.00	PASS
11N40SISO	Ant1	2452	15.84	87.85	0.56	16.40	≤30.00	PASS

Test Graphs



11G-Ant1-2437-PASS



11G-Ant1-2462-PASS



11N20SISO-Ant1-2412-PASS



11N20SISO-Ant1-2437-PASS



11N20SISO-Ant1-2462-PASS



11N40SISO-Ant1-2422-PASS



11N40SISO-Ant1-2437-PASS



11N40SISO-Ant1-2452-PASS



A.2 6dB and 99% Bandwidth

Test Result 6dB Bandwidth

Test Mode	Antenna	Frequency[MHz]	DTS BW[MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11B	Ant1	2412	9.560	2407.480	2417.040	0.5	PASS
11B	Ant1	2437	10.040	2432.000	2442.040	0.5	PASS
11B	Ant1	2462	10.000	2457.040	2467.040	0.5	PASS
11G	Ant1	2412	16.320	2403.880	2420.200	0.5	PASS
11G	Ant1	2437	16.320	2428.880	2445.200	0.5	PASS
11G	Ant1	2462	15.040	2454.480	2469.520	0.5	PASS
11N20SISO	Ant1	2412	17.080	2403.480	2420.560	0.5	PASS
11N20SISO	Ant1	2437	17.520	2428.280	2445.800	0.5	PASS
11N20SISO	Ant1	2462	15.080	2454.440	2469.520	0.5	PASS
11N40SISO	Ant1	2422	35.040	2404.480	2439.520	0.5	PASS
11N40SISO	Ant1	2437	35.120	2419.400	2454.520	0.5	PASS
11N40SISO	Ant1	2452	35.120	2434.400	2469.520	0.5	PASS

Test Result 99% Bandwidth

Test Mode	Antenna	Frequency[MHz]	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11B	Ant1	2412	14.650	2404.7260	2419.3760	---	---
11B	Ant1	2437	14.651	2429.7066	2444.3576	---	---
11B	Ant1	2462	14.650	2454.6830	2469.3330	---	---
11G	Ant1	2412	17.099	2403.5136	2420.6126	---	---
11G	Ant1	2437	17.050	2428.5208	2445.5708	---	---
11G	Ant1	2462	16.133	2453.9240	2470.0570	---	---
11N20SISO	Ant1	2412	18.107	2403.0075	2421.1145	---	---
11N20SISO	Ant1	2437	18.098	2427.9531	2446.0511	---	---
11N20SISO	Ant1	2462	17.351	2453.3153	2470.6663	---	---
11N40SISO	Ant1	2422	35.795	2404.1303	2439.9253	---	---
11N40SISO	Ant1	2437	35.788	2419.1282	2454.9162	---	---
11N40SISO	Ant1	2452	35.817	2434.1059	2469.9229	---	---

Test Graphs_6dB Bandwidth

11B-Ant1-2412-PASS



11B-Ant1-2437-PASS



11B-Ant1-2462-PASS



11G-Ant1-2412-PASS



11G-Ant1-2437-PASS



11G-Ant1-2462-PASS



11N20SISO-Ant1-2412-PASS



11N20SISO-Ant1-2437-PASS



11N20SISO-Ant1-2462-PASS

11N40SISO-Ant1-2422-PASS



11N40SISO-Ant1-2437-PASS



11N40SISO-Ant1-2452-PASS



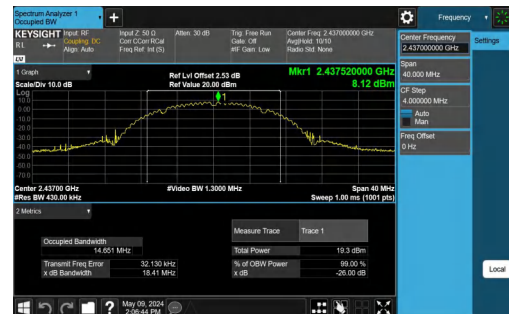
11B-Ant1-2412



11B-Ant1-2437



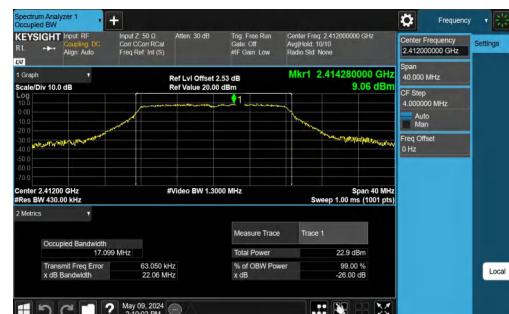
11B-Ant1-2462



11G-Ant1-2412



11G-Ant1-2437



11G-Ant1-2462

Test Graphs_99% Bandwidth



11N20SISO-Ant1-2412



11N20SISO-Ant1-2437



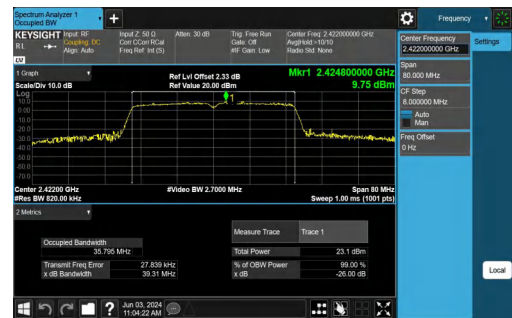
11N20SISO-Ant1-2462



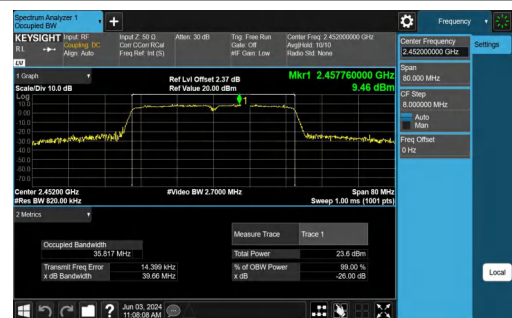
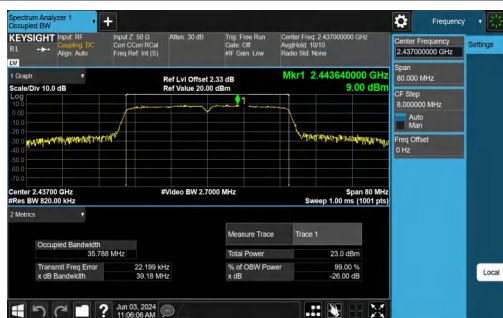
11N40SISO-Ant1-2422



11N40SISO-Ant1-2437



11N40SISO-Ant1-2452

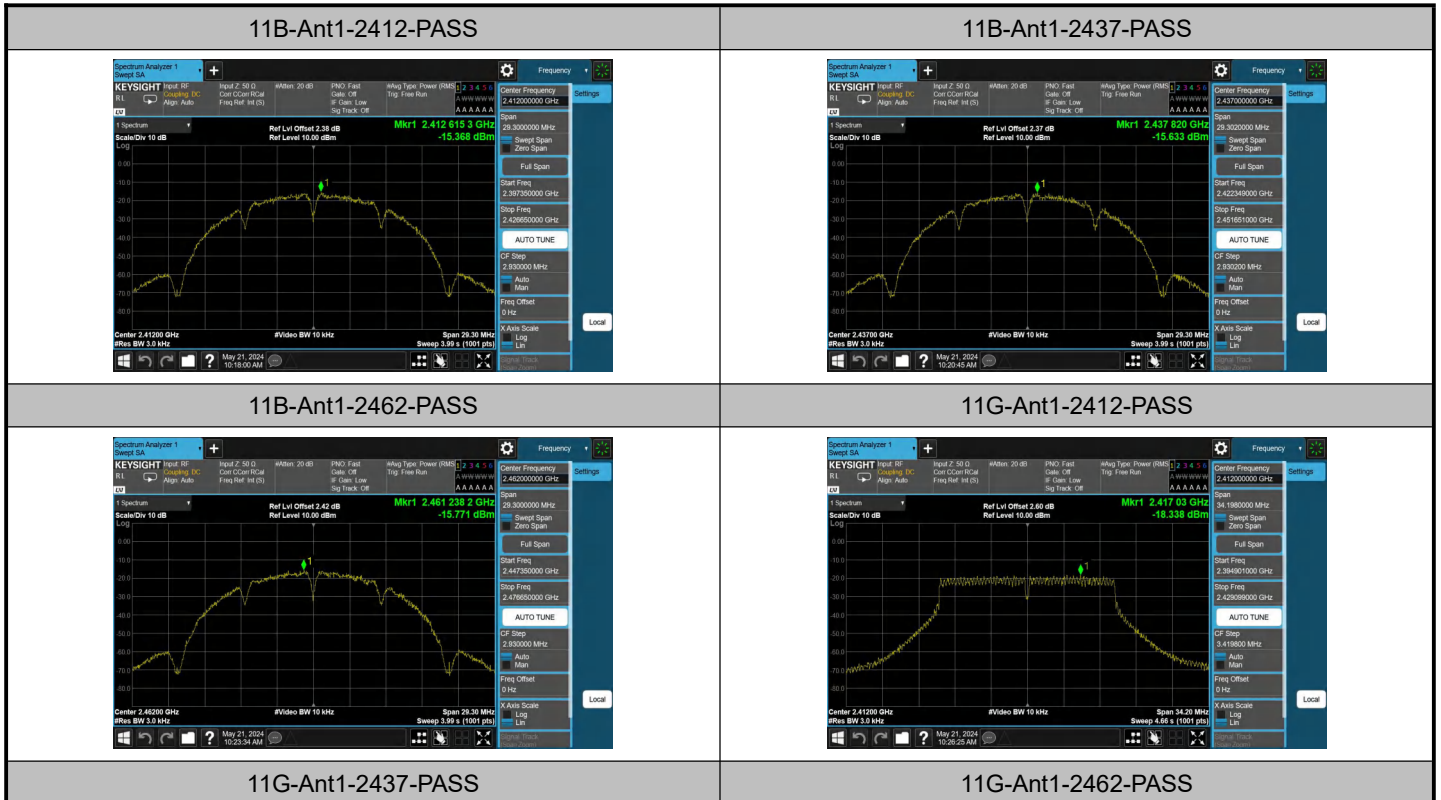


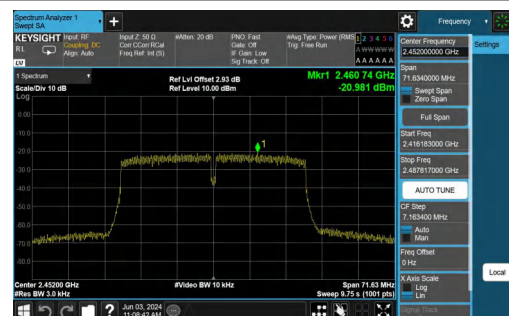
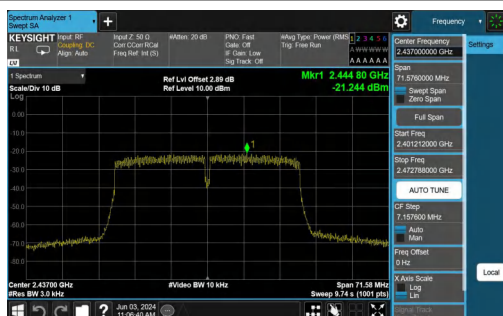
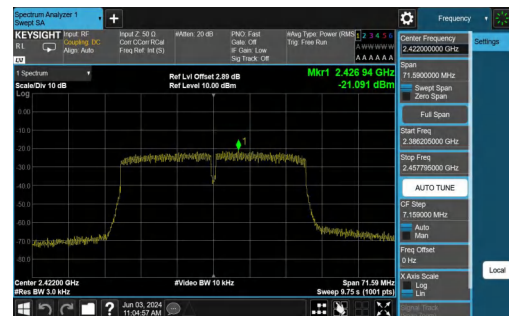
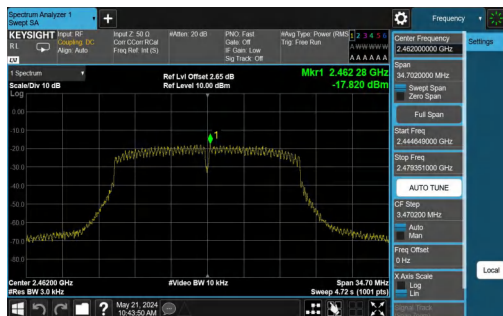
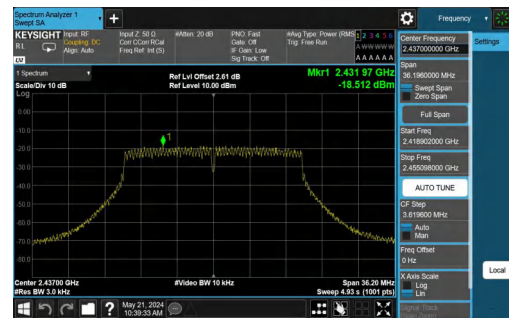
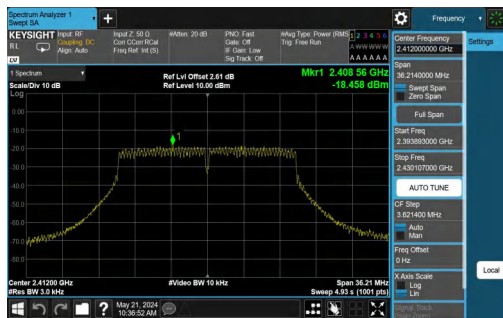
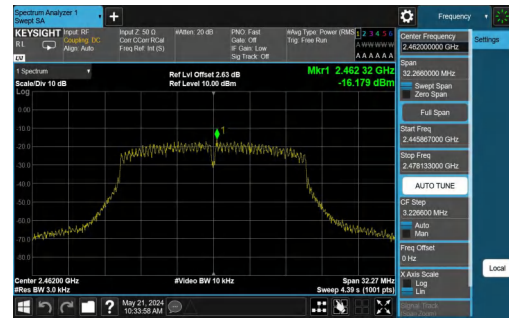
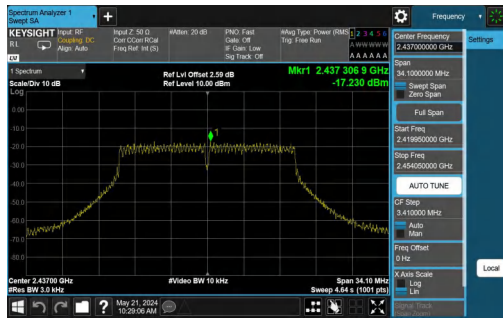
A.3 Power Spectral Density

Test Result

Test Mode	Antenna	Frequency[MHz]	Result[dBm/3-100kHz]	Limit[dBm/3kHz]	Verdict
11B	Ant1	2412	-15.37	≤8.00	PASS
11B	Ant1	2437	-15.63	≤8.00	PASS
11B	Ant1	2462	-15.77	≤8.00	PASS
11G	Ant1	2412	-18.34	≤8.00	PASS
11G	Ant1	2437	-17.23	≤8.00	PASS
11G	Ant1	2462	-16.18	≤8.00	PASS
11N20SISO	Ant1	2412	-18.46	≤8.00	PASS
11N20SISO	Ant1	2437	-18.51	≤8.00	PASS
11N20SISO	Ant1	2462	-17.82	≤8.00	PASS
11N40SISO	Ant1	2422	-21.09	≤8.00	PASS
11N40SISO	Ant1	2437	-21.24	≤8.00	PASS
11N40SISO	Ant1	2452	-20.98	≤8.00	PASS

Test Graphs





A.4 Conducted Band Edges and Spurious Emission

Test Result

Band Edges

Test Mode	Antenna	Ch Name	Frequency [MHz]	Ref Level[dBm]	Result[dBm]	Limit[dBm]	Verdict
11B	Ant1	Low	2412	7.38	-35.83	≤-22.62	PASS
11B	Ant1	High	2462	7.50	-50.48	≤-22.5	PASS
11G	Ant1	Low	2412	4.79	-32.91	≤-25.21	PASS
11G	Ant1	High	2462	6.06	-44.65	≤-23.94	PASS
11N20SISO	Ant1	Low	2412	5.05	-32.13	≤-24.95	PASS
11N20SISO	Ant1	High	2462	5.90	-43.5	≤-24.1	PASS
11N40SISO	Ant1	Low	2422	2.74	-36.02	≤-27.26	PASS
11N40SISO	Ant1	High	2452	2.67	-36.08	≤-27.33	PASS

Spurious Emission

Test Mode	Antenna	Frequency[MHz]	Freq Range[MHz]	Ref Level[dBm]	Result[dBm]	Limit[dBm]	Verdict
11B	Ant1	2412	30~1000	7.38	-68.35	≤-22.62	PASS
11B	Ant1	2412	1000~26500	7.38	-52.31	≤-22.62	PASS
11B	Ant1	2437	30~1000	7.43	-69.14	≤-22.57	PASS
11B	Ant1	2437	1000~26500	7.43	-52.77	≤-22.57	PASS
11B	Ant1	2462	30~1000	7.50	-69.1	≤-22.5	PASS
11B	Ant1	2462	1000~26500	7.50	-54.19	≤-22.5	PASS
11G	Ant1	2412	30~1000	4.79	-68.57	≤-25.21	PASS
11G	Ant1	2412	1000~26500	4.79	-55.14	≤-25.21	PASS
11G	Ant1	2437	30~1000	5.48	-69.43	≤-24.52	PASS
11G	Ant1	2437	1000~26500	5.48	-54.44	≤-24.52	PASS
11G	Ant1	2462	30~1000	6.06	-69.24	≤-23.94	PASS
11G	Ant1	2462	1000~26500	6.06	-55.08	≤-23.94	PASS
11N20SISO	Ant1	2412	30~1000	5.05	-68.59	≤-24.95	PASS
11N20SISO	Ant1	2412	1000~26500	5.05	-54.9	≤-24.95	PASS
11N20SISO	Ant1	2437	30~1000	5.02	-68.81	≤-24.98	PASS
11N20SISO	Ant1	2437	1000~26500	5.02	-54.84	≤-24.98	PASS
11N20SISO	Ant1	2462	30~1000	5.90	-69.06	≤-24.1	PASS
11N20SISO	Ant1	2462	1000~26500	5.90	-54.81	≤-24.1	PASS
11N40SISO	Ant1	2422	30~1000	2.74	-68.75	≤-27.26	PASS
11N40SISO	Ant1	2422	1000~26500	2.74	-54.84	≤-27.26	PASS
11N40SISO	Ant1	2437	30~1000	2.44	-67.86	≤-27.56	PASS
11N40SISO	Ant1	2437	1000~26500	2.44	-55.11	≤-27.56	PASS
11N40SISO	Ant1	2452	30~1000	2.67	-68.85	≤-27.33	PASS

11N40SISO	Ant1	2452	1000~26500	2.67	-55.19	≤-27.33	PASS
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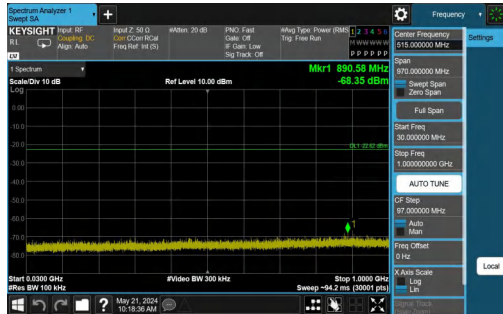
Test Graphs

Band Edges



Spurious Emission

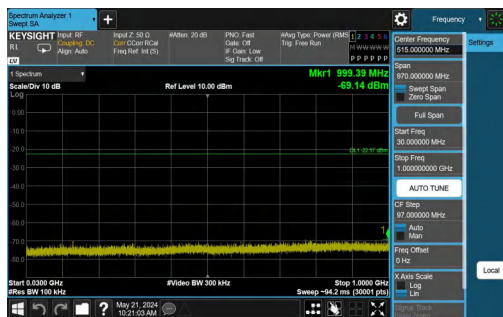
11B-Ant1-2412-30~1000-PASS



11B-Ant1-2412-1000~26500-PASS



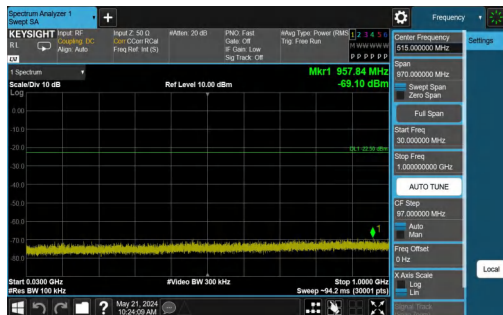
11B-Ant1-2437-30~1000-PASS



11B-Ant1-2437-1000~26500-PASS



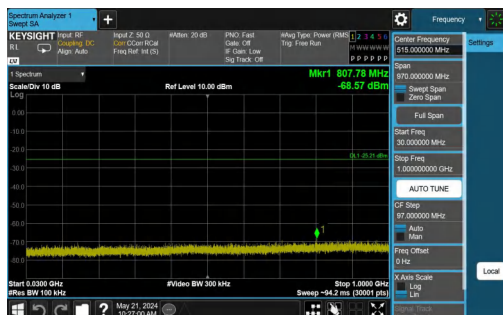
11B-Ant1-2462-30~1000-PASS



11B-Ant1-2462-1000~26500-PASS



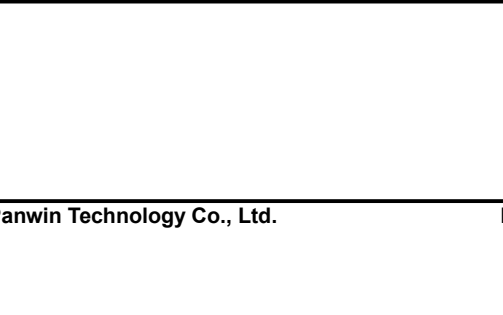
11G-Ant1-2412-30~1000-PASS



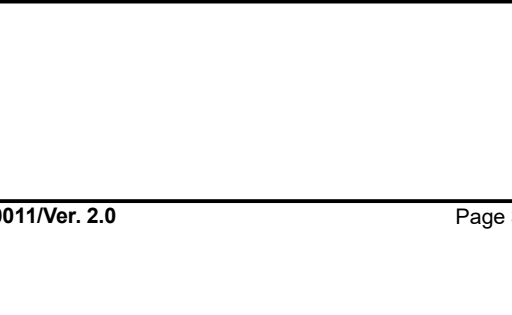
11G-Ant1-2412-1000~26500-PASS



11G-Ant1-2437-30~1000-PASS



11G-Ant1-2437-1000~26500-PASS

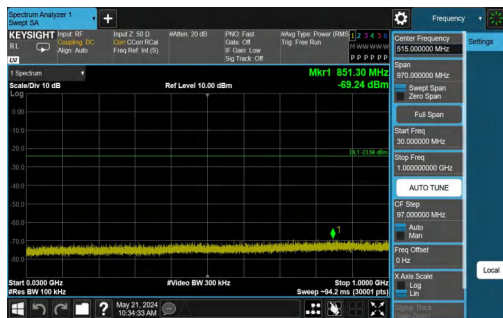




11G-Ant1-2462-30~1000-PASS



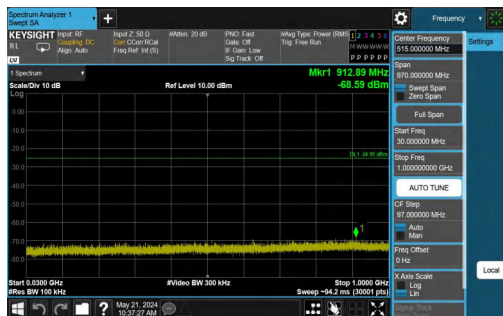
11G-Ant1-2462-1000~26500-PASS



11N20SISO-Ant1-2412-30~1000-PASS



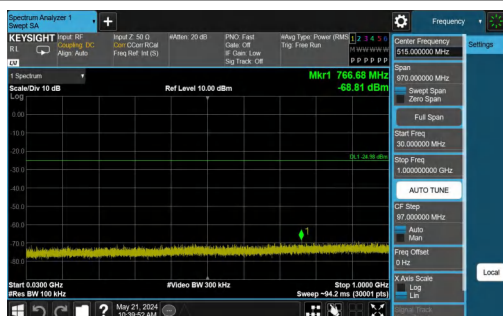
11N20SISO-Ant1-2412-1000~26500-PASS



11N20SISO-Ant1-2437-30~1000-PASS



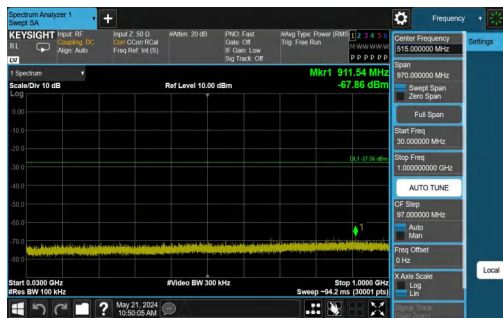
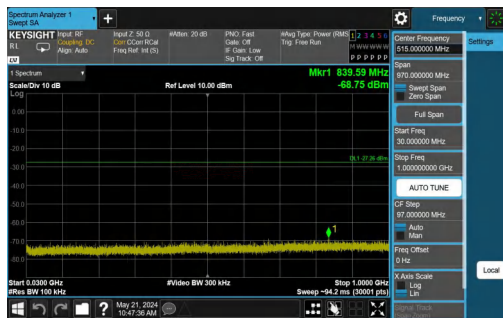
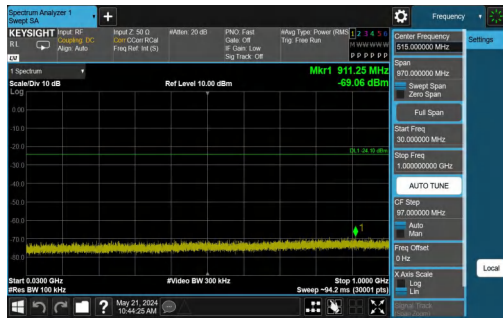
11N20SISO-Ant1-2437-1000~26500-PASS



11N20SISO-Ant1-2462-30~1000-PASS



11N20SISO-Ant1-2462-1000~26500-PASS



A.5 Duty Cycle

Test Result

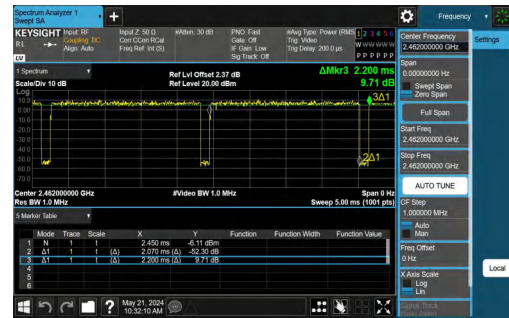
Test Mode	Antenna	Frequency[MHz]	Transmission Duration [ms]	Transmission Period [ms]	Duty Cycle [%]	Factor
11B	Ant1	2412	12.42	12.56	98.89	0.05
11B	Ant1	2437	12.42	12.54	99.04	0.04
11B	Ant1	2462	12.42	12.56	98.89	0.05
11G	Ant1	2412	2.06	2.19	94.06	0.27
11G	Ant1	2437	2.07	2.20	94.09	0.26
11G	Ant1	2462	2.07	2.20	94.09	0.26
11N20SISO	Ant1	2412	1.92	2.05	93.66	0.28
11N20SISO	Ant1	2437	1.92	2.05	93.66	0.28
11N20SISO	Ant1	2462	1.92	2.05	93.66	0.28
11N40SISO	Ant1	2422	0.94	1.07	87.85	0.56
11N40SISO	Ant1	2437	0.94	1.07	87.85	0.56
11N40SISO	Ant1	2452	0.94	1.07	87.85	0.56

Test Graphs

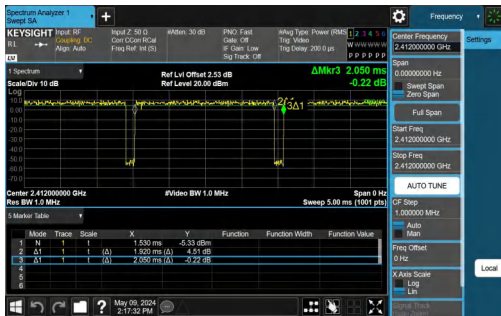




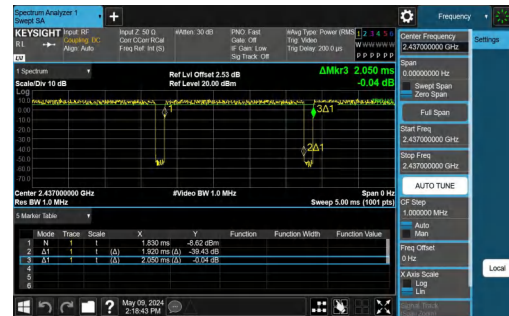
NTNV-11N20SISO-Ant1-2412



NTNV-11N20SISO-Ant1-2437



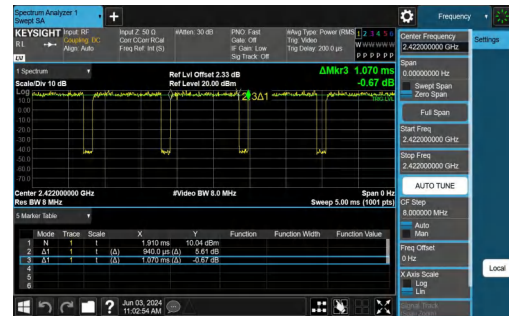
NTNV-11N20SISO-Ant1-2462



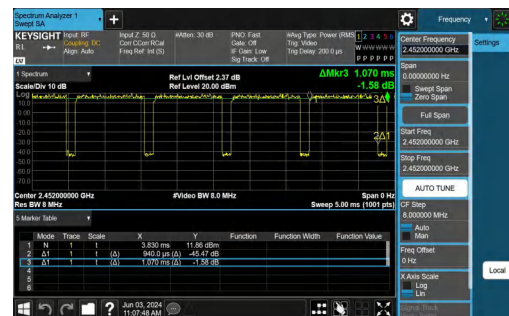
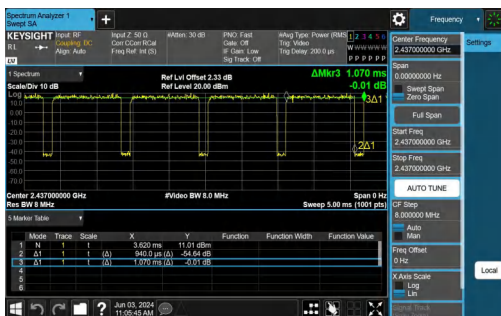
NTNV-11N40SISO-Ant1-2422



NTNV-11N40SISO-Ant1-2437



NTNV-11N40SISO-Ant1-2452



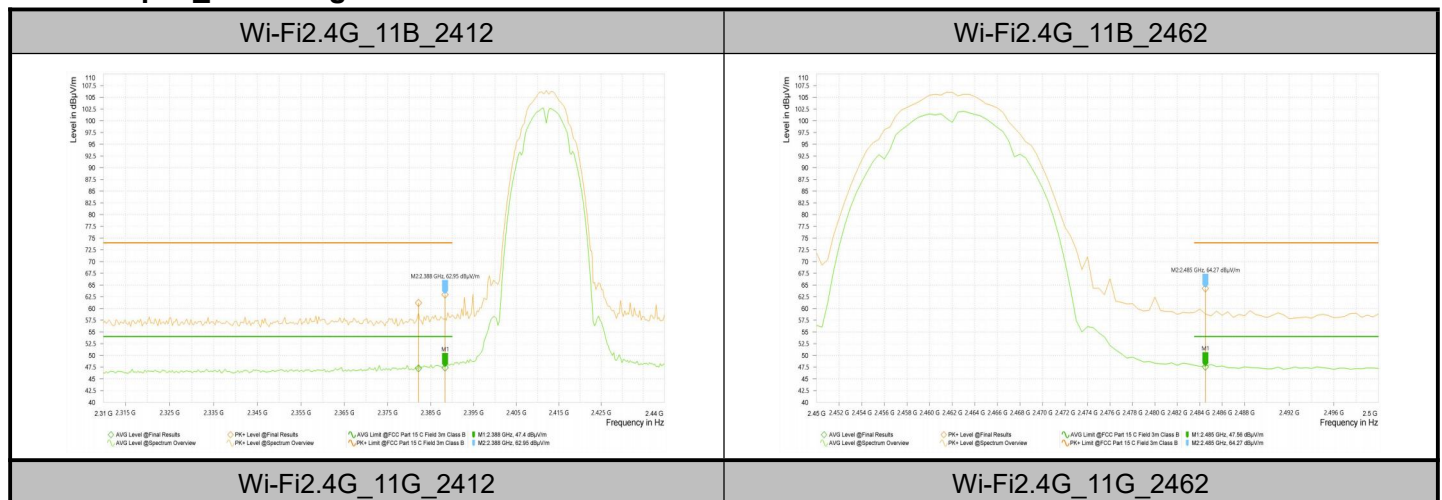
Appendix B – Test Results of Radiated Test

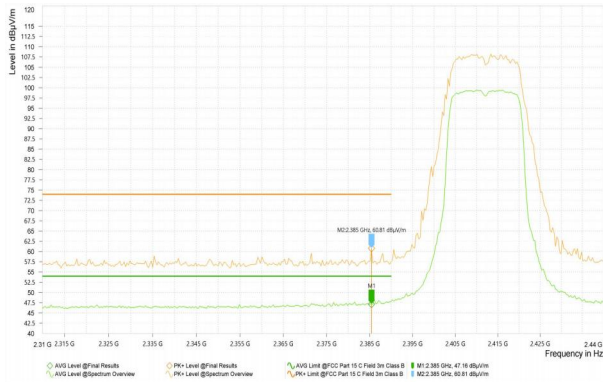
B.1 Radiated Band Edges and Spurious Emission

Test Result_Band Edges

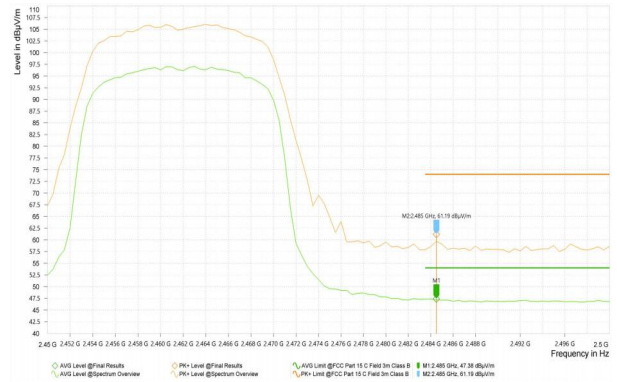
Test Mode & Test Freq.[MHz]	Frequency [MHz]	PK+ Level [dBμV/m]	PK+ Limit [dBμV/m]	PK+ Margin [dB]	AVG Level [dBμV/m]	AVG Limit [dBμV/m]	AVG Margin [dB]	Polarization	Azimuth [deg]
Wi-Fi2.4G_11B_2412	2,382.150	61.18	74.00	12.82	47.26	54.00	6.74	H	5.6
	2,388.325	62.95	74.00	11.05	47.40	54.00	6.60	H	20.3
Wi-Fi2.4G_11B_2462	2,484.500	64.27	74.00	9.73	47.56	54.00	6.44	H	360
Wi-Fi2.4G_11G_2412	2,385.400	60.81	74.00	13.19	47.16	54.00	6.84	H	1.8
Wi-Fi2.4G_11G_2462	2,484.500	61.19	74.00	12.81	47.38	54.00	6.62	H	18.4
Wi-Fi2.4G_11N20_2412	2,386.050	60.81	74.00	13.19	47.04	54.00	6.96	H	16.7
Wi-Fi2.4G_11N20_2462	2,487.500	60.63	74.00	13.37	47.25	54.00	6.75	H	10.2
Wi-Fi2.4G_11N40_2422	2,387.025	61.30	74.00	12.70	47.31	54.00	6.69	H	0
Wi-Fi2.4G_11N40_2452	2,484.500	66.04	74.00	7.96	47.97	54.00	6.03	H	7.5

Test Graphs_Band Edges

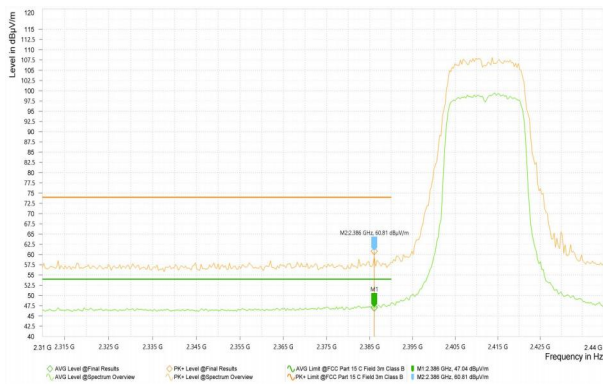




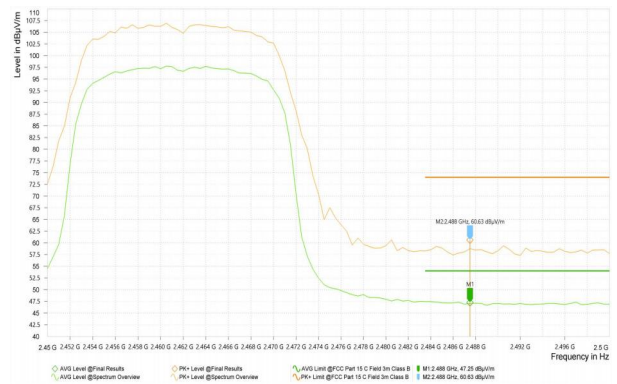
Wi-Fi2.4G_11N20_2412



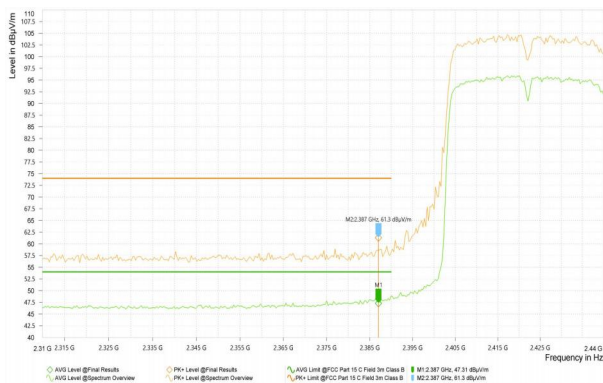
Wi-Fi2.4G_11N20_2462



Wi-Fi2.4G_11N40_2422



Wi-Fi2.4G_11N40_2452



Test Result_Spurious Emission

Note1: Test result Sweep the whole frequency band through the range from 9kHz to the 10th harmonic of the carrier the Emissions in the frequency band 9kHz-30MHz and above 18GHz are more than 20dB below the limit are not reported.

Note2: 'Low' indicates a frequency range below 1GHz, and 'High' indicates a frequency range above 1GHz.

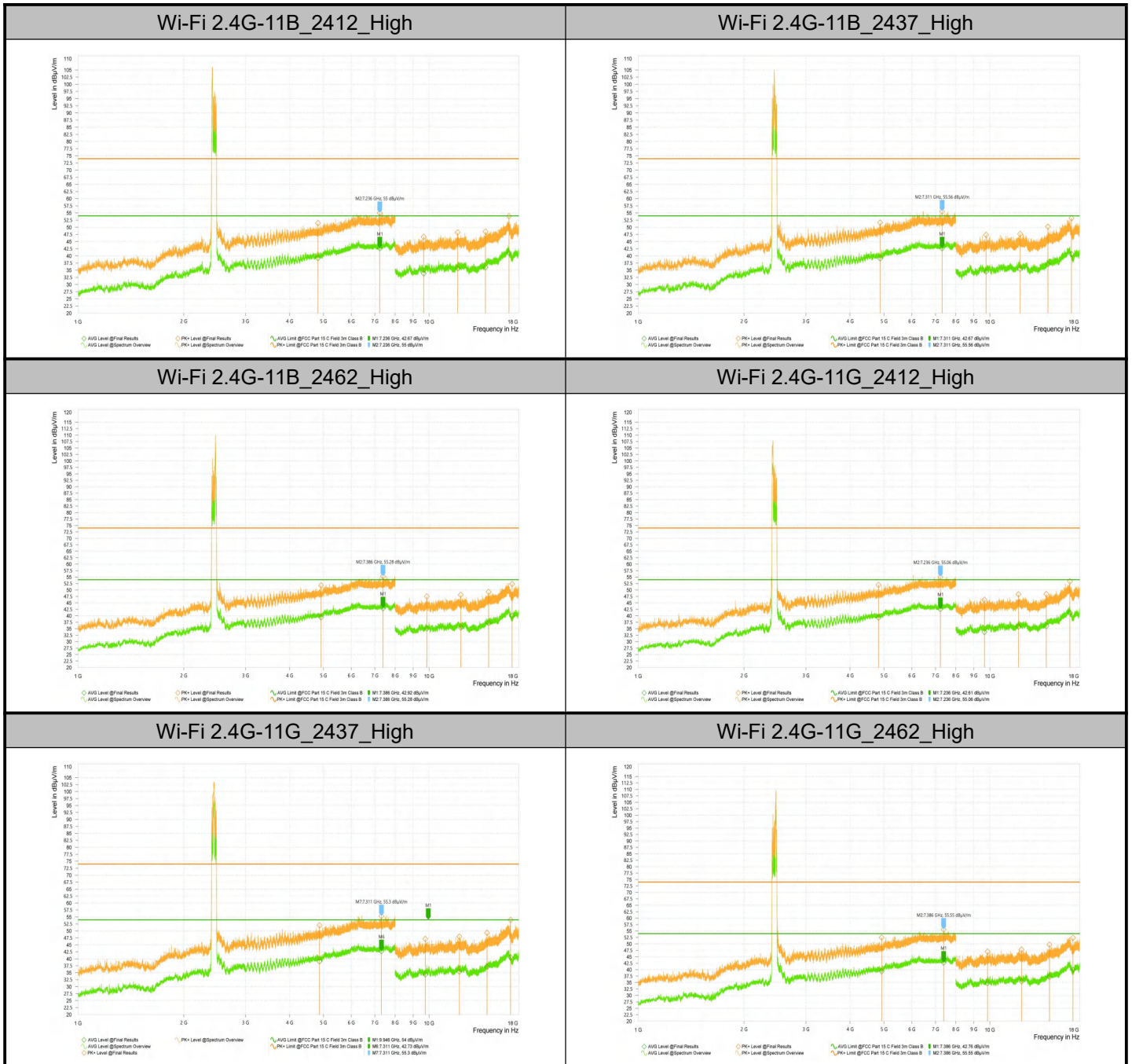
Test Mode & Test Freq.[MHz]	Frequency [MHz]	PK+ Level [dBμV/m]	PK+ Limit [dBμV/m]	PK+ Margin [dB]	AVG Level [dBμV/m]	AVG Limit [dBμV/m]	AVG Margin [dB]	Polarization	Azimuth [deg]
Wi-Fi 2.4G-11B_2412_High	4,823.500	51.42	74.00	22.58	39.25	54.00	14.75	H	45.1
	7,235.500	55.00	74.00	19.00	42.67	54.00	11.33	H	335.3
	9,648.000	46.65	74.00	27.35	33.88	54.00	20.12	H	0
	12,059.500	48.19	74.00	25.81	35.60	54.00	18.40	H	145.4
	14,472.000	48.49	74.00	25.51	35.98	54.00	18.02	V	78.5
	16,884.000	53.86	74.00	20.14	41.06	54.00	12.94	H	204.1
Wi-Fi 2.4G-11B_2437_High	4,874.000	51.62	74.00	22.38	39.11	54.00	14.89	H	308
	7,311.000	55.56	74.00	18.44	42.67	54.00	11.33	H	330.6
	9,747.500	47.34	74.00	26.66	34.51	54.00	19.49	V	144.2
	12,185.500	47.68	74.00	26.32	35.47	54.00	18.53	H	215.8
	14,622.500	50.19	74.00	23.81	37.09	54.00	16.91	H	204
	17,060.000	53.26	74.00	20.74	40.62	54.00	13.38	H	156
Wi-Fi 2.4G-11B_2462_High	4,923.500	51.77	74.00	22.23	39.42	54.00	14.58	H	2.6
	7,386.000	55.28	74.00	18.72	42.92	54.00	11.08	H	0
	9,848.000	47.49	74.00	26.51	35.07	54.00	18.93	H	83.4
	12,309.500	48.09	74.00	25.91	35.41	54.00	18.59	H	359.9
	14,771.500	49.25	74.00	24.75	37.24	54.00	16.76	H	0
	17,233.500	52.31	74.00	21.69	40.00	54.00	14.00	V	277.9
Wi-Fi 2.4G-11G_2412_High	4,823.500	51.97	74.00	22.03	39.28	54.00	14.72	V	109.7
	7,235.500	55.06	74.00	18.94	42.61	54.00	11.39	H	0.6
	9,648.000	46.17	74.00	27.83	33.75	54.00	20.26	H	0
	12,059.500	48.30	74.00	25.70	35.78	54.00	18.22	V	16.7
	14,471.500	48.38	74.00	25.62	35.98	54.00	18.02	H	360
	16,883.500	53.36	74.00	20.64	41.15	54.00	12.85	H	343.2
Wi-Fi 2.4G-11G_2437_High	4,873.500	51.98	74.00	22.02	39.08	54.00	14.92	V	308
	7,311.000	55.30	74.00	18.70	42.73	54.00	11.27	V	360
	9,747.500	47.08	74.00	26.92	34.36	54.00	19.64	H	0
	12,185.000	47.98	74.00	26.02	35.39	54.00	18.61	V	76.1
	14,621.500	49.32	74.00	24.68	37.07	54.00	16.93	H	76.1
	17,058.500	53.92	74.00	20.08	40.54	54.00	13.46	V	0
Wi-Fi 2.4G-11G_2462_High	4,923.500	52.50	74.00	21.50	39.39	54.00	14.61	V	175.4
	7,386.000	55.55	74.00	18.45	42.76	54.00	11.24	H	0

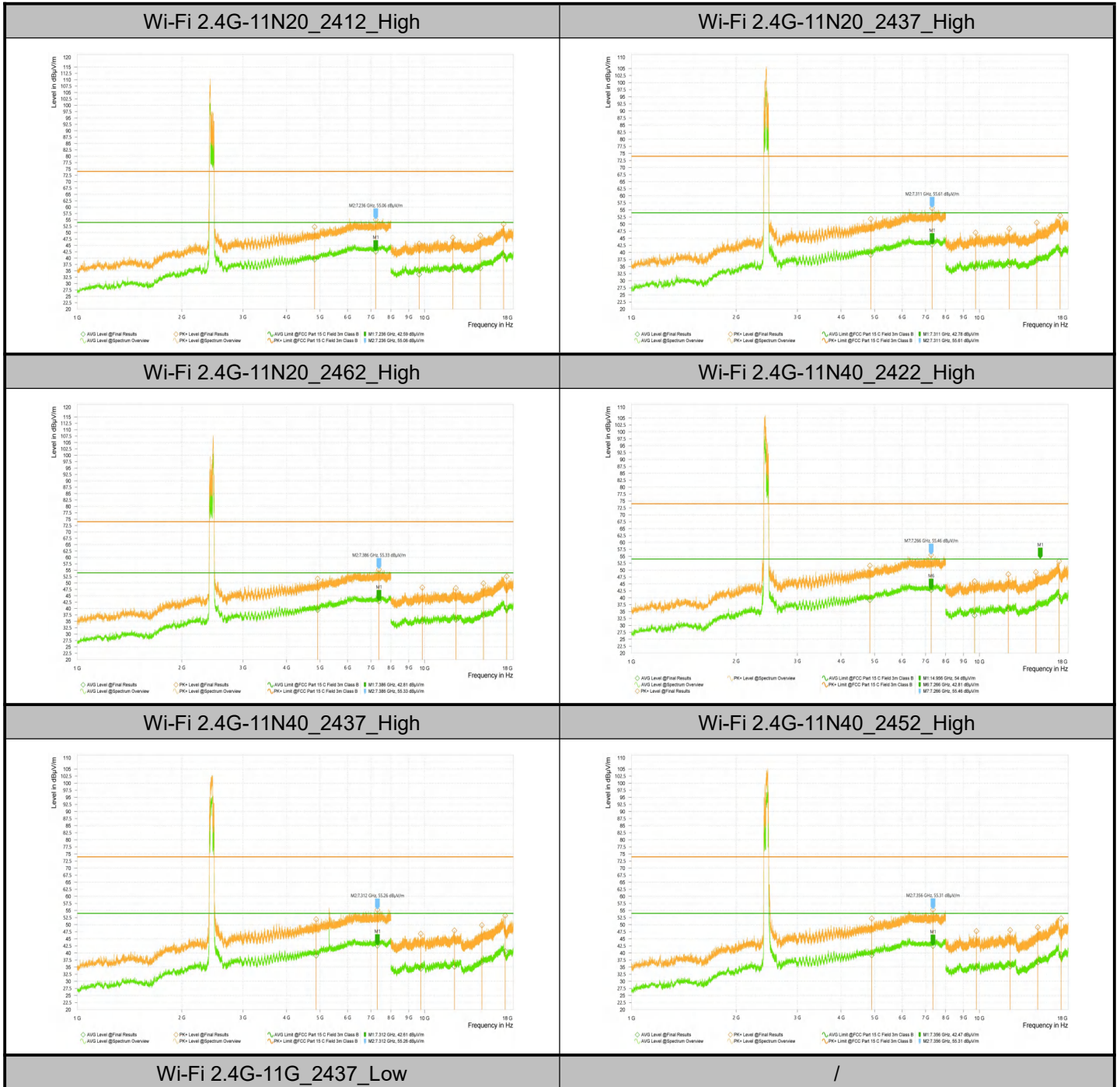
	9,847.500	46.99	74.00	27.01	34.74	54.00	19.26	H	360
	12,310.000	47.80	74.00	26.20	35.43	54.00	18.57	H	276.7
	14,772.000	49.70	74.00	24.30	37.20	54.00	16.80	H	204.2
	17,235.000	52.38	74.00	21.62	39.96	54.00	14.04	H	204.2
Wi-Fi 2.4G-11N20_2412_High	4,824.000	52.23	74.00	21.77	39.44	54.00	14.56	H	317.4
	7,236.000	55.06	74.00	18.94	42.59	54.00	11.41	H	349.4
	9,648.000	45.62	74.00	28.38	33.61	54.00	20.39	H	263.8
	12,059.500	48.01	74.00	25.99	35.61	54.00	18.39	H	360
	14,471.500	48.85	74.00	25.15	36.03	54.00	17.97	V	42.4
	16,883.500	53.36	74.00	20.64	41.23	54.00	12.77	V	360
Wi-Fi 2.4G-11N20_2437_High	4,874.000	51.84	74.00	22.16	39.14	54.00	14.86	H	341.7
	7,311.000	55.61	74.00	18.39	42.78	54.00	11.22	H	255
	9,747.500	46.98	74.00	27.02	34.41	54.00	19.59	H	46.9
	12,186.000	48.36	74.00	25.64	35.42	54.00	18.58	V	240.4
	14,622.500	50.50	74.00	23.50	37.19	54.00	16.81	H	360
	17,060.000	53.00	74.00	21.00	40.61	54.00	13.39	V	4.2
Wi-Fi 2.4G-11N20_2462_High	4,924.000	51.62	74.00	22.38	39.43	54.00	14.57	H	190.7
	7,386.000	55.33	74.00	18.67	42.81	54.00	11.19	H	22.4
	9,848.000	48.21	74.00	25.79	34.91	54.00	19.09	H	220.6
	12,310.000	47.97	74.00	26.03	35.59	54.00	18.41	H	360
	14,771.500	49.82	74.00	24.18	37.23	54.00	16.77	V	0
	17,234.500	52.56	74.00	21.44	40.12	54.00	13.88	H	0
Wi-Fi 2.4G-11N40_2422_High	4,844.500	51.57	74.00	22.43	39.21	54.00	14.79	H	359.8
	7,265.500	55.46	74.00	18.54	42.81	54.00	11.19	H	155.3
	9,688.000	45.94	74.00	28.06	33.63	54.00	20.37	H	266.6
	12,110.500	48.47	74.00	25.53	35.86	54.00	18.14	H	193.8
	14,532.000	49.21	74.00	24.79	36.48	54.00	17.52	V	143.6
	16,953.500	53.23	74.00	20.77	40.46	54.00	13.54	H	94.3
Wi-Fi 2.4G-11N40_2437_High	4,873.500	51.90	74.00	22.10	39.08	54.00	14.92	V	0.3
	7,311.500	55.26	74.00	18.74	42.61	54.00	11.39	V	360
	9,748.500	46.79	74.00	27.21	34.45	54.00	19.55	H	95.2
	12,185.000	47.95	74.00	26.05	35.21	54.00	18.79	H	360
	14,622.500	49.83	74.00	24.17	36.75	54.00	17.25	H	355
	17,060.000	53.24	74.00	20.76	40.61	54.00	13.39	V	194.7
Wi-Fi 2.4G-11N40_2452_High	4,903.500	52.16	74.00	21.84	39.25	54.00	14.75	H	0
	7,355.500	55.31	74.00	18.69	42.47	54.00	11.53	V	51.4
	9,807.500	47.71	74.00	26.29	34.72	54.00	19.28	H	39.7
	12,259.500	48.11	74.00	25.89	35.23	54.00	18.77	H	118.7
	14,711.500	49.08	74.00	24.92	36.64	54.00	17.36	H	266.6

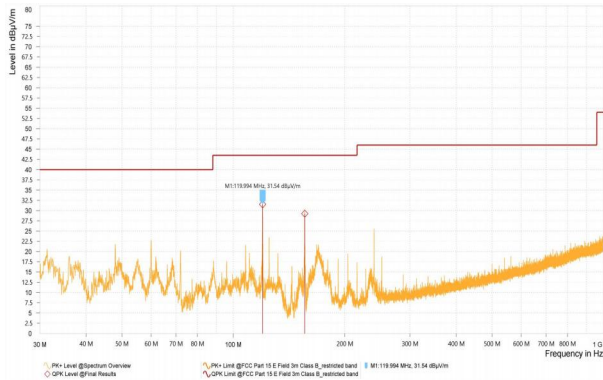
	17,164.500	52.15	74.00	21.85	39.47	54.00	14.53	H	266.6
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Test Mode & Test Freq.[MHz]	Frequency [MHz]	QPK Level [dBμV/m]	QPK Limit [dBμV/m]	QPK Margin [dB]	Polarization	Azimuth [deg]
Wi-Fi 2.4G-11G_2437_Low	119.994	31.54	43.50	11.96	V	360
	155.992	29.23	43.50	14.27	V	315

Test Graphs_Spurious Emission







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Appendix C – The EUT Appearance

Refer to “Attachment 1: External Photograph” and “ Attachment 2: Internal Photograph” file.

Appendix D – Test Setup Photograph

Refer to “Attachment 5: RF Test Setup Photograph” file.

*****End of the Report*****