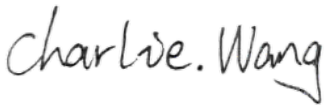
RF Test Report

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.:	AF61Y
Brand Name:	QUECTEL
FCC ID:	XMR2024AF61Y
Standards:	FCC CFR47 Part 15C
Report No.:	PD20230182RF10
Issue Date:	2024/04/23
Test Result:	PASS *

* **The above equipment has been tested and compliance with the requirement of the relative standards by Hefei Panwin Technology Co., Ltd.**



Reviewed By: Charlie Wang **Approved By:** Alec Yang

Hefei Panwin Technology Co., Ltd.

Floor 1, Zone E, Plant 2#, Mingzhu Industrial Park, No.106 Chuangxin Avenue, High-tech Zone, Hefei City, Anhui Province,China

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Revision History

Report No.	Version	Description	Issue Date	Note
PD20230182RF10	1	Initial Report	2024/04/23	Valid

CONTENTS

Test Summary

No.	Test Case	FCC Rules	Verdict
1	Output Power Measurement △	15.247(b)	PASS Note 1
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: 2024/01/17 to 2024/04/22
Date of Sample Received: 2023/12/15

• We, Hefei Panwin Technology Co., Ltd., would like to declare that the tested sample has been evaluated in accordance with the procedures given in applied standard(s) in **Section 2.3** of this report and shown compliance 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.

Note 1: This test item is subcontracted to Compliance Certification Services (Kunshan) Inc for testing, and the data is provided by Compliance Certification Services (Kunshan) Inc. **FCC** (Designation Number: CN1172). **A2LA** (Certificate No. 2541.01).

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

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

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

A2LA (Certificate Number: 6849.01)

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

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	AF61Y
SN	1. E1C23HN1C000231 2. E1C23HN1C000307
Hardware Version	R1.0
Software Version	NA
Directional Gain	MIMO For Power: -0.10dBi MIMO For PSD: 2.91dBi
Antenna Type	External Antenna
Antenna Gain	Ant0: -0.10dBi Ant1: -0.10dBi
Additional Beamforming Gain	NA
Max. Conducted Power	Wi-Fi 2.4G: 23.31dBm
Operating voltage range	Typical VDD_CORE: 1.8V Typical VDD_IO: 1.8V Typical VDD_PA: 2.2V
Type of Modulation	WLAN 802.11b/g/n HT20/n HT40: CCK,BPSK,QPSK,16QAM,64QAM and 256QAM
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 Applicable Standard(s)

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
- FCC KDB 662911 D01 Multiple Transmitter Output v02r01

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.

Test Mode	Data Rate(Mbps)
802.11b	1
802.11g	6
802.11n HT20	MCS0
802.11n HT40	MCS0

The worst case Antenna mode for each of the following tests for Wi-Fi:

Test Cases	Antenna 0	Antenna 1	MIMO/CDD
Output Power Measurement	O	O	O
Power Spectral Density Measurement	O	O	O
99% Bandwidth Measurement	O	O	O
6dB Bandwidth Measurement	O	O	O
Conducted Band Edges and Spurious Emission Measurement	O	O	O
Radiated Band Edges and Spurious Emission Measurement	/	/	O
AC Conducted Emission Measurement	/	/	/
Note: “O”: test all bands			

According to RF Output power results in Appendix A.1, we picked the worst antenna mode to RSE test.

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
Power Meter Note	Anritsu	ML2495A	1445010	1 Year	2024/03/15
DC Power	KEYSIGHT	E3640A	PWC0046	1 Year	2024/10/11
RF Control Unit	Tonseced	JS0806-2	PWC0055	/	/
Shielded Chamber	Maorui	MR543	PWC0041	3 Years	2026/08/26
Test Software	Tonseced	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	2024/10/14
Double-Ridged Guide Antenna	ETS-Lindgren	3117	PWB0031	1 Year	2024/10/12
k Type Horn Antenna	Steatite Antennas	QMS-00880	PWB0035	1 Year	2024/10/17
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
External Antenna	QUECTEL	/	/	/
EVB	QUECTEL	/	/	/
USB Cable	/	/	/	/
Adapter	Dong Guan City GangQi Electronic Co., Ltd	Output:12V 3A	GQ36-120300-AX	/

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 Note	0.6 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

Note: This uncertainty is provided by Compliance Certification Services (Kunshan) Inc.

4 Test Items Description

Ambient condition

Shielded Chamber

Temperature [°C]	21.8 to 23.4
Humidity [%RH]	31 to 48
Pressure [kPa]	101.0 to 102.1

Anechoic Chamber

Temperature [°C]	20.3 to 22.5
Humidity [%RH]	40 to 43
Pressure [kPa]	102.1 to 102.3

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.

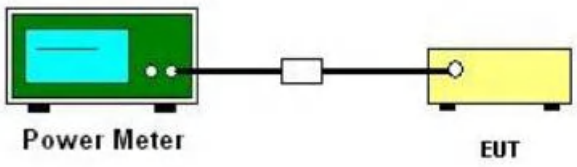
4.1.2 Measuring Instruments

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

4.1.3 Test Procedures

1. The testing follows the Measurement Procedure of ANSI C63.10-2013 clause 11.9.1.3 PKPM1Peak power meter or ANSI C63.10-2013 clause 11.9.2.3.1 Method AVGPM method.
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.
5. Duty factor =10 log (1/x), where x is the measured duty cycle.

4.1.4 Test Setup



4.1.5Test Results

See Appendix A.1.

Remark:

This test item is subcontracted to SGS laboratories for testing, and the data is provided by Compliance Certification Services (Kunshan) Inc.

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

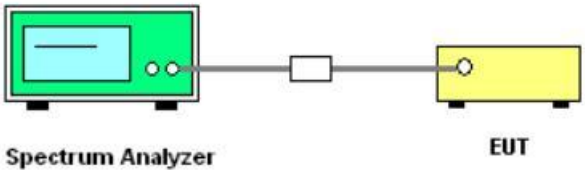
The section 3.3 of List of Measuring Equipment of this test report is used for test.

4.3.3 Test Procedures

4.3.3 Test Procedures

1. The testing follows Measurement Procedure of ANSI C63.10-2013 clause 11.10.2 Method PKPSD.
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.

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.

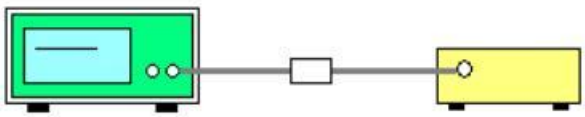
4.4.2 Measuring Instruments

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

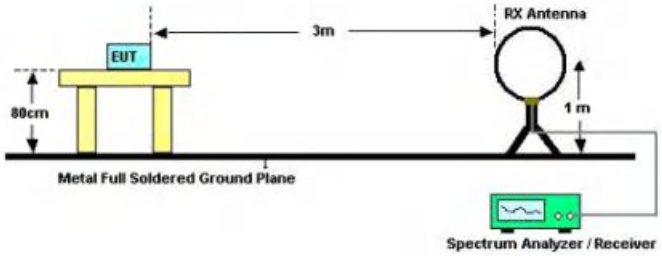
The section 3.3 of List of Measuring Equipment of this test report is used for test.

4.5.3 Test Procedures

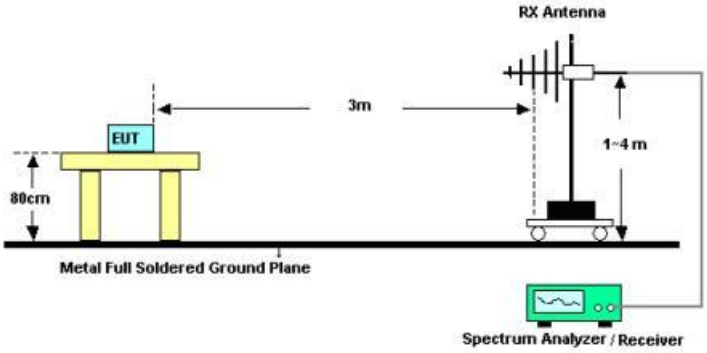
1. The testing follows ANSI C63.10-2013 clause 11.11 & 11.12
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better 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 GHz; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold.
   (3) Set RBW = 1 MHz, VBW= 3MHz for ≥ 1 GHz for peak measurement
   For average measurement:
   VBW= 10 Hz, when duty cycle is no less than 98 percent.
   VBW ≥ 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

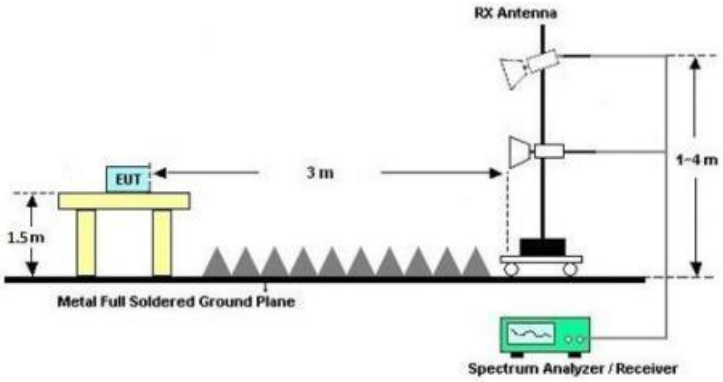
For radiated emissions below 30MHz



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 B.2.

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.

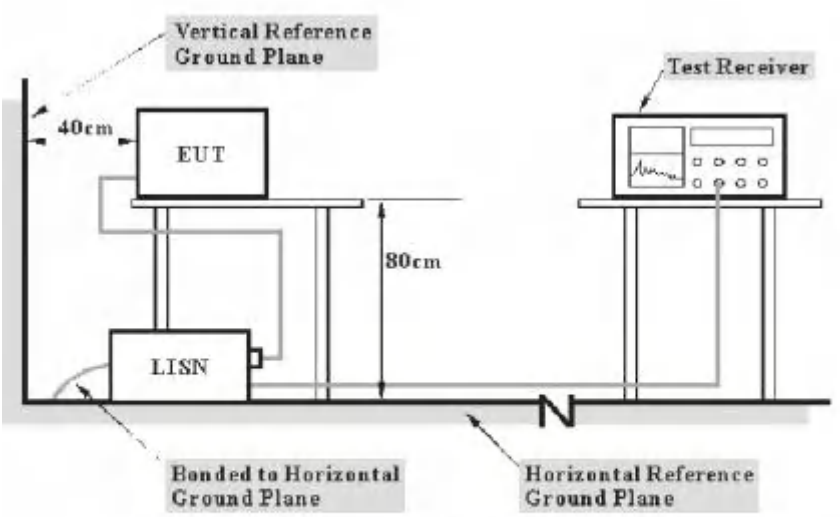
4.6.2 Measuring Instruments

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



Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

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 External on the main PCB and no consideration of replacement. The best case gain of the antenna is -0.10dBi(Ant0&1).

Appendix A – Test Results of Conducted Test

A.1 Conducted Output Power Δ

Test Result Peak

Test Mode	Antenna	Frequency [MHz]	Result [dBm]	Limit [dBm]	Gain [dBi]	EIRP [dBm]	EIRP Limit [dBm]	Verdict
11B	Ant0	2412	19.87	≤30.00	-0.10	19.77	≤36.00	PASS
11B	Ant1	2412	20.63	≤30.00	-0.10	20.53	≤36.00	PASS
11B	Ant0	2437	19.61	≤30.00	-0.10	19.51	≤36.00	PASS
11B	Ant1	2437	19.82	≤30.00	-0.10	19.72	≤36.00	PASS
11B	Ant0	2462	19.76	≤30.00	-0.10	19.66	≤36.00	PASS
11B	Ant1	2462	20.38	≤30.00	-0.10	20.28	≤36.00	PASS
11B-CDD	Ant0	2412	17.03	≤30.00	-0.10	16.93	≤36.00	PASS
11B-CDD	Ant1	2412	17.76	≤30.00	-0.10	17.66	≤36.00	PASS
11B-CDD	total	2412	20.42	≤30.00	-0.10	20.32	≤36.00	PASS
11B-CDD	Ant0	2437	16.71	≤30.00	-0.10	16.61	≤36.00	PASS
11B-CDD	Ant1	2437	17.19	≤30.00	-0.10	17.09	≤36.00	PASS
11B-CDD	total	2437	19.97	≤30.00	-0.10	19.87	≤36.00	PASS
11B-CDD	Ant0	2462	17.12	≤30.00	-0.10	17.02	≤36.00	PASS
11B-CDD	Ant1	2462	17.51	≤30.00	-0.10	17.41	≤36.00	PASS
11B-CDD	total	2462	20.33	≤30.00	-0.10	20.23	≤36.00	PASS
11G	Ant0	2412	21.48	≤30.00	-0.10	21.38	≤36.00	PASS
11G	Ant1	2412	22.06	≤30.00	-0.10	21.96	≤36.00	PASS
11G	Ant0	2437	21.24	≤30.00	-0.10	21.14	≤36.00	PASS
11G	Ant1	2437	21.28	≤30.00	-0.10	21.18	≤36.00	PASS
11G	Ant0	2462	21.31	≤30.00	-0.10	21.21	≤36.00	PASS
11G	Ant1	2462	21.82	≤30.00	-0.10	21.72	≤36.00	PASS
11G-CDD	Ant0	2412	19.06	≤30.00	-0.10	18.96	≤36.00	PASS
11G-CDD	Ant1	2412	19.36	≤30.00	-0.10	19.26	≤36.00	PASS
11G-CDD	total	2412	22.22	≤30.00	-0.10	22.12	≤36.00	PASS
11G-CDD	Ant0	2437	18.73	≤30.00	-0.10	18.63	≤36.00	PASS
11G-CDD	Ant1	2437	18.62	≤30.00	-0.10	18.52	≤36.00	PASS
11G-CDD	total	2437	21.69	≤30.00	-0.10	21.59	≤36.00	PASS
11G-CDD	Ant0	2462	18.79	≤30.00	-0.10	18.69	≤36.00	PASS
11G-CDD	Ant1	2462	19.03	≤30.00	-0.10	18.93	≤36.00	PASS
11G-CDD	total	2462	21.92	≤30.00	-0.10	21.82	≤36.00	PASS
11N20SISO	Ant0	2412	21.48	≤30.00	-0.10	21.38	≤36.00	PASS

11N20SISO	Ant1	2412	22.09	≤30.00	-0.10	21.99	≤36.00	PASS
11N20SISO	Ant0	2437	21.26	≤30.00	-0.10	21.16	≤36.00	PASS
11N20SISO	Ant1	2437	21.16	≤30.00	-0.10	21.06	≤36.00	PASS
11N20SISO	Ant0	2462	21.21	≤30.00	-0.10	21.11	≤36.00	PASS
11N20SISO	Ant1	2462	21.74	≤30.00	-0.10	21.64	≤36.00	PASS
11N20MIMO	Ant0	2412	18.45	≤30.00	-0.10	18.35	≤36.00	PASS
11N20MIMO	Ant1	2412	19.32	≤30.00	-0.10	19.22	≤36.00	PASS
11N20MIMO	total	2412	21.92	≤30.00	-0.10	21.82	≤36.00	PASS
11N20MIMO	Ant0	2437	18.11	≤30.00	-0.10	18.01	≤36.00	PASS
11N20MIMO	Ant1	2437	18.61	≤30.00	-0.10	18.51	≤36.00	PASS
11N20MIMO	total	2437	21.38	≤30.00	-0.10	21.28	≤36.00	PASS
11N20MIMO	Ant0	2462	18.15	≤30.00	-0.10	18.05	≤36.00	PASS
11N20MIMO	Ant1	2462	19.04	≤30.00	-0.10	18.94	≤36.00	PASS
11N20MIMO	total	2462	21.63	≤30.00	-0.10	21.53	≤36.00	PASS
11N40SISO	Ant0	2422	22.75	≤30.00	-0.10	22.65	≤36.00	PASS
11N40SISO	Ant1	2422	23.27	≤30.00	-0.10	23.17	≤36.00	PASS
11N40SISO	Ant0	2437	22.59	≤30.00	-0.10	22.49	≤36.00	PASS
11N40SISO	Ant1	2437	22.77	≤30.00	-0.10	22.67	≤36.00	PASS
11N40SISO	Ant0	2452	22.66	≤30.00	-0.10	22.56	≤36.00	PASS
11N40SISO	Ant1	2452	23.26	≤30.00	-0.10	23.16	≤36.00	PASS
11N40MIMO	Ant0	2422	20.06	≤30.00	-0.10	19.96	≤36.00	PASS
11N40MIMO	Ant1	2422	20.52	≤30.00	-0.10	20.42	≤36.00	PASS
11N40MIMO	total	2422	23.31	≤30.00	-0.10	23.21	≤36.00	PASS
11N40MIMO	Ant0	2437	19.81	≤30.00	-0.10	19.71	≤36.00	PASS
11N40MIMO	Ant1	2437	20.19	≤30.00	-0.10	20.09	≤36.00	PASS
11N40MIMO	total	2437	23.01	≤30.00	-0.10	22.91	≤36.00	PASS
11N40MIMO	Ant0	2452	19.84	≤30.00	-0.10	19.74	≤36.00	PASS
11N40MIMO	Ant1	2452	20.45	≤30.00	-0.10	20.35	≤36.00	PASS
11N40MIMO	total	2452	23.17	≤30.00	-0.10	23.07	≤36.00	PASS

Note: The manufacturer declared the transmitter output signals is CDD mode. And N_{SS}=1.According to KDB 662911 D01Multiple Transmitter Output v02r01 2)f(i): If all antennas have the same gain, Directional gain = G_{ANT} + Array Gain,For power measurements on IEEE 802.11 devices.

Array Gain = 0 dB (i.e., no array gain) for N_{ANT} ≤4;

Array Gain = 0 dB (i.e., no array gain) for channel widths≥40 MHz for any N_{ANT};

Array Gain = 5 log(N_{ANT}/N_{SS}) dB or 3 dB, whichever is less, for 20-MHz channel widths with N_{ANT}≥5.

So directional gain = G_{ANT} + Array Gain <6dBi. So the power limit is 30dBm.

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	8.080	2407.960	2416.040	0.5	PASS
11B	Ant0	2412	8.080	2407.960	2416.040	0.5	PASS
11B	Ant1	2437	8.080	2432.960	2441.040	0.5	PASS
11B	Ant0	2437	8.080	2432.960	2441.040	0.5	PASS
11B	Ant0	2462	8.080	2457.960	2466.040	0.5	PASS
11B	Ant1	2462	8.080	2457.960	2466.040	0.5	PASS
11B-CDD	Ant0	2412	8.080	2407.960	2416.040	0.5	PASS
11B-CDD	Ant1	2412	8.080	2407.960	2416.040	0.5	PASS
11B-CDD	Ant0	2437	8.080	2432.960	2441.040	0.5	PASS
11B-CDD	Ant1	2437	8.080	2432.960	2441.040	0.5	PASS
11B-CDD	Ant0	2462	8.080	2457.960	2466.040	0.5	PASS
11B-CDD	Ant1	2462	8.080	2457.960	2466.040	0.5	PASS
11G	Ant0	2412	15.120	2404.440	2419.560	0.5	PASS
11G	Ant1	2412	15.680	2404.120	2419.800	0.5	PASS
11G	Ant0	2437	15.680	2429.120	2444.800	0.5	PASS
11G	Ant1	2437	15.640	2429.120	2444.760	0.5	PASS
11G	Ant0	2462	15.520	2454.240	2469.760	0.5	PASS
11G	Ant1	2462	15.280	2454.280	2469.560	0.5	PASS
11G-CDD	Ant0	2412	16.040	2403.840	2419.880	0.5	PASS
11G-CDD	Ant1	2412	15.640	2404.240	2419.880	0.5	PASS
11G-CDD	Ant0	2437	16.080	2428.840	2444.920	0.5	PASS
11G-CDD	Ant1	2437	15.440	2429.480	2444.920	0.5	PASS
11G-CDD	Ant0	2462	15.400	2454.440	2469.840	0.5	PASS
11G-CDD	Ant1	2462	15.520	2454.240	2469.760	0.5	PASS
11N20SISO	Ant0	2412	16.800	2403.600	2420.400	0.5	PASS
11N20SISO	Ant1	2412	15.440	2404.120	2419.560	0.5	PASS
11N20SISO	Ant0	2437	16.800	2428.600	2445.400	0.5	PASS
11N20SISO	Ant1	2437	16.880	2428.600	2445.480	0.5	PASS
11N20SISO	Ant0	2462	15.920	2453.600	2469.520	0.5	PASS
11N20SISO	Ant1	2462	17.280	2453.240	2470.520	0.5	PASS
11N20MIMO	Ant0	2412	17.320	2403.240	2420.560	0.5	PASS
11N20MIMO	Ant1	2412	16.960	2403.600	2420.560	0.5	PASS
11N20MIMO	Ant0	2437	16.000	2429.120	2445.120	0.5	PASS
11N20MIMO	Ant1	2437	15.720	2429.440	2445.160	0.5	PASS
11N20MIMO	Ant0	2462	17.560	2453.200	2470.760	0.5	PASS

11N20MIMO	Ant1	2462	15.920	2453.600	2469.520	0.5	PASS
11N40SISO	Ant0	2422	36.320	2403.840	2440.160	0.5	PASS
11N40SISO	Ant1	2422	36.320	2403.840	2440.160	0.5	PASS
11N40SISO	Ant0	2437	36.320	2418.840	2455.160	0.5	PASS
11N40SISO	Ant1	2437	36.320	2418.840	2455.160	0.5	PASS
11N40SISO	Ant0	2452	36.320	2433.840	2470.160	0.5	PASS
11N40SISO	Ant1	2452	36.320	2433.840	2470.160	0.5	PASS
11N40MIMO	Ant0	2422	35.520	2404.080	2439.600	0.5	PASS
11N40MIMO	Ant1	2422	35.600	2404.560	2440.160	0.5	PASS
11N40MIMO	Ant0	2437	36.240	2418.840	2455.080	0.5	PASS
11N40MIMO	Ant1	2437	35.600	2419.560	2455.160	0.5	PASS
11N40MIMO	Ant0	2452	36.320	2433.840	2470.160	0.5	PASS
11N40MIMO	Ant1	2452	35.920	2434.240	2470.160	0.5	PASS

Test Result 99% Bandwidth

Test Mode	Antenna	Channel Frequency[MHz]	OCB [MHz]	FL[MHz]	FH[MHz]
11B	Ant1	2412	14.396	2404.7912	2419.1872
11B	Ant0	2412	14.358	2404.8000	2419.1580
11B	Ant1	2437	14.371	2429.7931	2444.1641
11B	Ant0	2437	14.363	2429.7934	2444.1564
11B	Ant0	2462	14.345	2454.8044	2469.1494
11B	Ant1	2462	14.354	2454.7771	2469.1311
11B-CDD	Ant0	2412	14.353	2404.6568	2419.0098
11B-CDD	Ant1	2412	14.184	2405.0919	2419.2759
11B-CDD	Ant0	2437	14.290	2429.8307	2444.1207
11B-CDD	Ant1	2437	14.418	2429.9654	2444.3834
11B-CDD	Ant0	2462	14.257	2454.8682	2469.1252
11B-CDD	Ant1	2462	14.346	2454.6966	2469.0426
11G	Ant0	2412	16.847	2403.5838	2420.4308
11G	Ant1	2412	16.849	2403.5682	2420.4172
11G	Ant0	2437	16.861	2428.5489	2445.4099
11G	Ant1	2437	16.918	2428.5337	2445.4517
11G	Ant0	2462	16.888	2453.5516	2470.4396
11G	Ant1	2462	16.836	2453.5629	2470.3989
11G-CDD	Ant0	2412	16.705	2403.6592	2420.3642
11G-CDD	Ant1	2412	16.854	2403.5825	2420.4365
11G-CDD	Ant0	2437	16.719	2428.6516	2445.3706
11G-CDD	Ant1	2437	16.866	2428.6668	2445.5328
11G-CDD	Ant0	2462	16.722	2453.6467	2470.3687

11G-CDD	Ant1	2462	16.923	2453.4969	2470.4199
11N20SISO	Ant0	2412	18.019	2403.0155	2421.0345
11N20SISO	Ant1	2412	18.039	2403.0000	2421.0390
11N20SISO	Ant0	2437	18.037	2427.9890	2446.0260
11N20SISO	Ant1	2437	18.012	2428.0105	2446.0225
11N20SISO	Ant0	2462	18.004	2453.0273	2471.0313
11N20SISO	Ant1	2462	18.029	2453.0073	2471.0363
11N20MIMO	Ant0	2412	17.913	2403.0615	2420.9745
11N20MIMO	Ant1	2412	18.025	2403.0498	2421.0748
11N20MIMO	Ant0	2437	17.944	2428.0349	2445.9789
11N20MIMO	Ant1	2437	18.054	2428.1060	2446.1600
11N20MIMO	Ant0	2462	17.949	2453.0529	2471.0019
11N20MIMO	Ant1	2462	18.040	2452.9651	2471.0051
11N40SISO	Ant0	2422	36.420	2403.8044	2440.2244
11N40SISO	Ant1	2422	36.457	2403.7957	2440.2527
11N40SISO	Ant0	2437	36.414	2418.8090	2455.2230
11N40SISO	Ant1	2437	36.385	2418.8350	2455.2200
11N40SISO	Ant0	2452	36.430	2433.8403	2470.2703
11N40SISO	Ant1	2452	36.429	2433.7844	2470.2134
11N40MIMO	Ant0	2422	36.356	2403.8559	2440.2119
11N40MIMO	Ant1	2422	36.522	2403.9691	2440.4911
11N40MIMO	Ant0	2437	36.375	2418.8375	2455.2125
11N40MIMO	Ant1	2437	36.355	2419.0437	2455.3987
11N40MIMO	Ant0	2452	36.375	2433.8590	2470.2340
11N40MIMO	Ant1	2452	36.314	2433.9124	2470.2264

Test Graphs_6dB Bandwidth

11B-Ant1-2412-PASS	11B-Ant0-2412-PASS
	
11B-Ant1-2437-PASS	11B-Ant0-2437-PASS

11B-Ant0-2462-PASS

11B-Ant1-2462-PASS

11B-CDD-Ant0-2412-PASS

11B-CDD-Ant1-2412-PASS

11B-CDD-Ant0-2437-PASS

11B-CDD-Ant1-2437-PASS

11B-CDD-Ant0-2462-PASS

11B-CDD-Ant1-2462-PASS

11G-Ant0-2412-PASS

11G-Ant1-2412-PASS

11G-Ant0-2437-PASS

11G-Ant1-2437-PASS

11G-Ant0-2462-PASS

11G-Ant1-2462-PASS

11G-CDD-Ant0-2412-PASS

11G-CDD-Ant1-2412-PASS

11G-CDD-Ant0-2437-PASS

11G-CDD-Ant1-2437-PASS

11G-CDD-Ant0-2462-PASS

11G-CDD-Ant1-2462-PASS

11N20SISO-Ant0-2412-PASS

11N20SISO-Ant1-2412-PASS

11N20SISO-Ant0-2437-PASS

11N20SISO-Ant1-2437-PASS

11N20SISO-Ant0-2462-PASS

11N20SISO-Ant1-2462-PASS

11N20MIMO-Ant0-2412-PASS

11N20MIMO-Ant1-2412-PASS

11N20MIMO-Ant0-2437-PASS

11N20MIMO-Ant1-2437-PASS

11N20MIMO-Ant0-2462-PASS

11N20MIMO-Ant1-2462-PASS

11N40SISO-Ant0-2422-PASS

11N40SISO-Ant1-2422-PASS

11N40SISO-Ant0-2437-PASS

11N40SISO-Ant1-2437-PASS

11N40SISO-Ant0-2452-PASS

11N40SISO-Ant1-2452-PASS

11N40MIMO-Ant0-2422-PASS

11N40MIMO-Ant1-2422-PASS

11N40MIMO-Ant0-2437-PASS

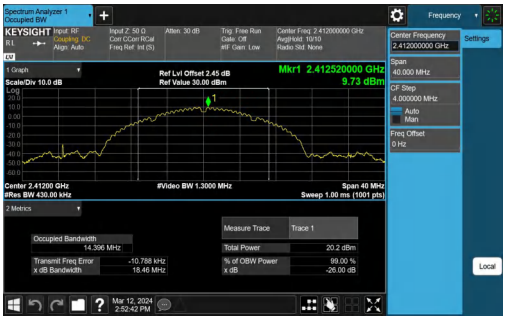
11N40MIMO-Ant1-2437-PASS

11N40MIMO-Ant0-2452-PASS

11N40MIMO-Ant1-2452-PASS

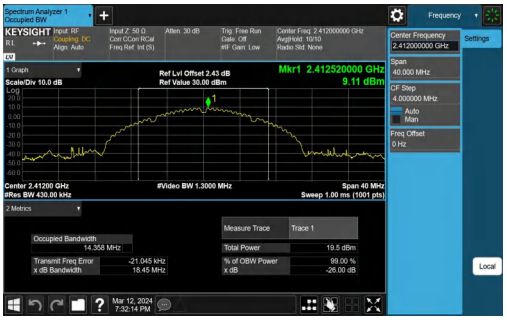
Test Graphs_99% Bandwidth

11B-Ant1-2412

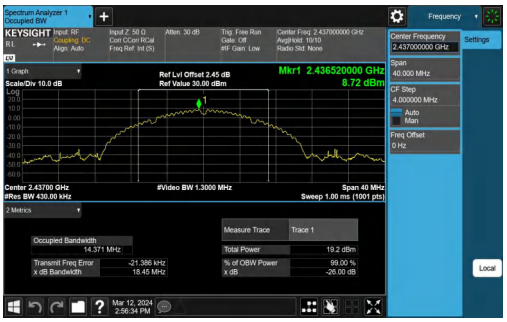


11B-Ant1-2437

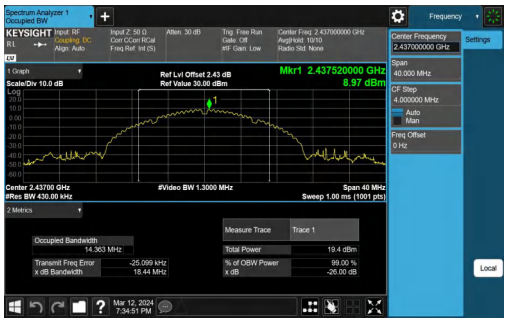
11B-Ant0-2412



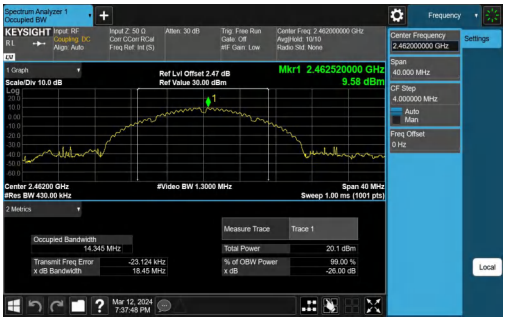
11B-Ant0-2437



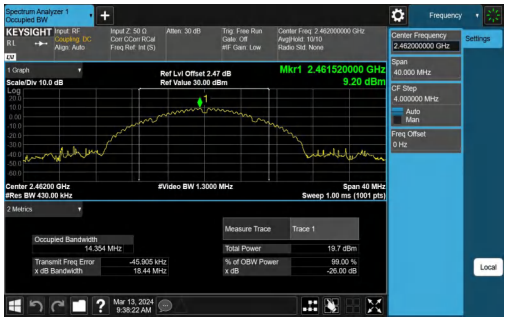
11B-Ant0-2462



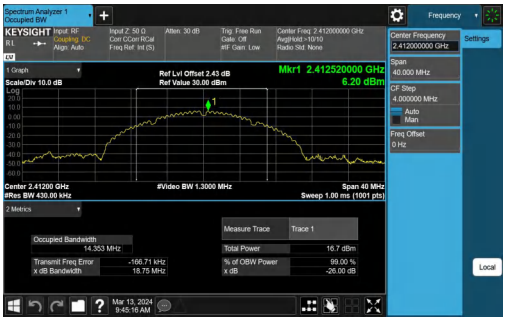
11B-Ant1-2462



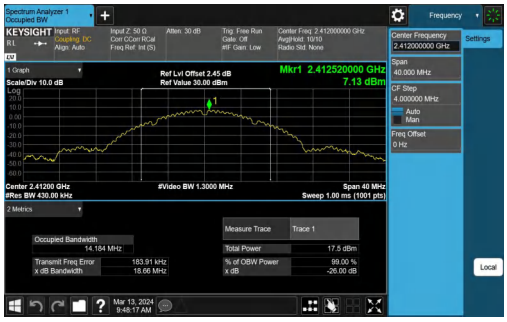
11B-CDD-Ant0-2412



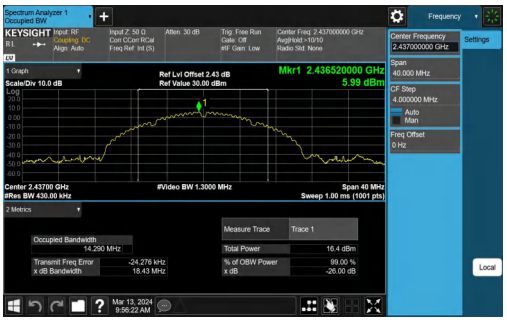
11B-CDD-Ant1-2412



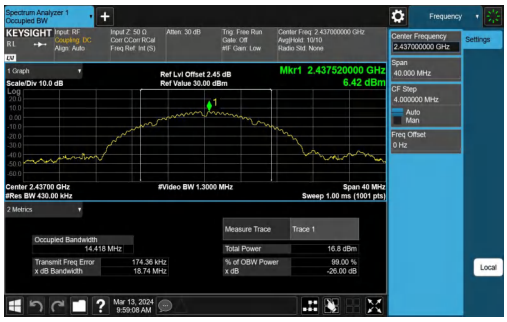
11B-CDD-Ant0-2437



11B-CDD-Ant1-2437



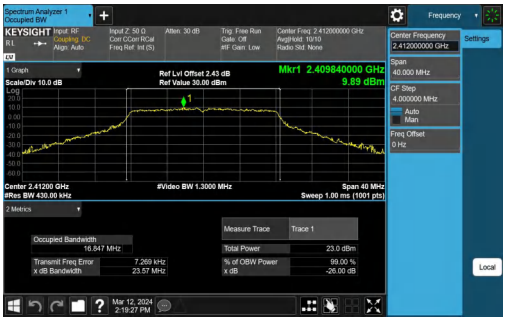
11B-CDD-Ant0-2462



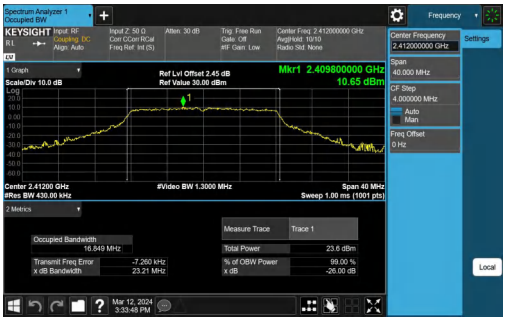
11B-CDD-Ant1-2462

11G-Ant0-2412

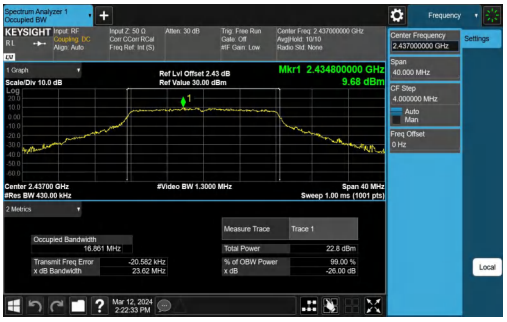
11G-Ant1-2412



11G-Ant0-2437

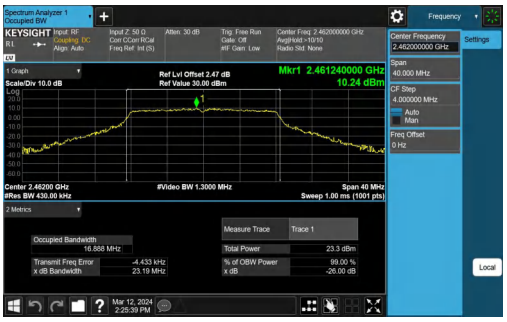


11G-Ant1-2437



11G-Ant0-2462

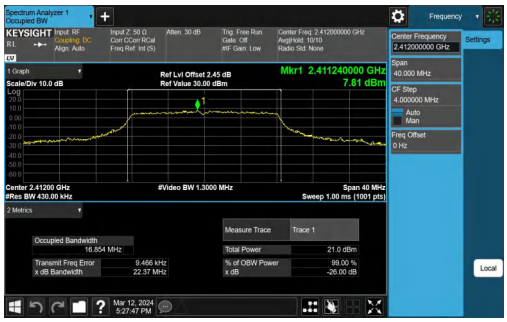
11G-Ant1-2462



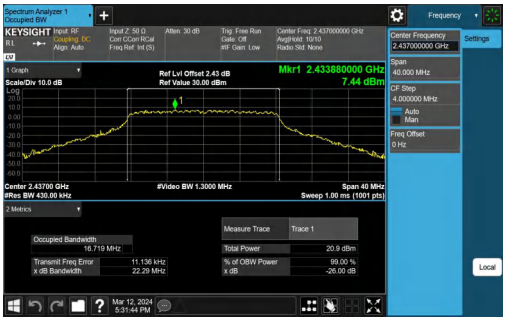
11G-CDD-Ant0-2412

11G-CDD-Ant1-2412

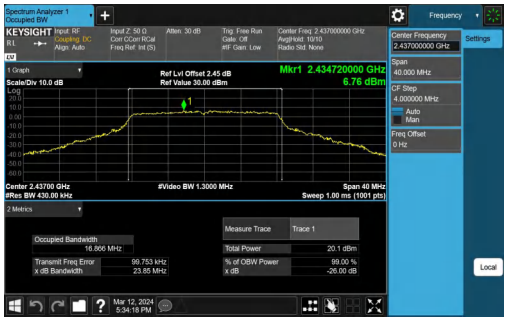
11G-CDD-Ant0-2437



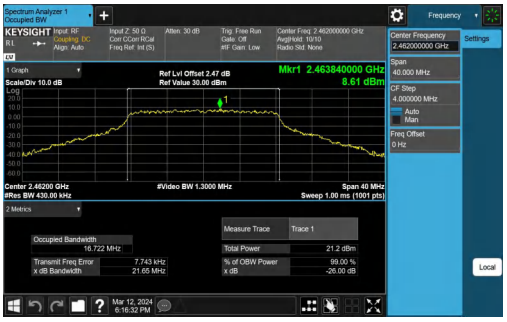
11G-CDD-Ant1-2437



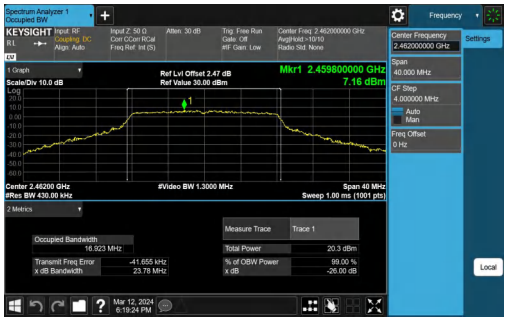
11G-CDD-Ant0-2462



11G-CDD-Ant1-2462



11N20SISO-Ant0-2412



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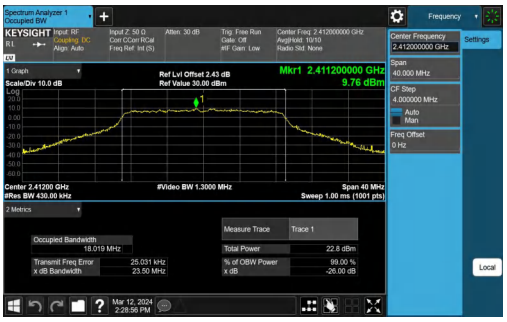

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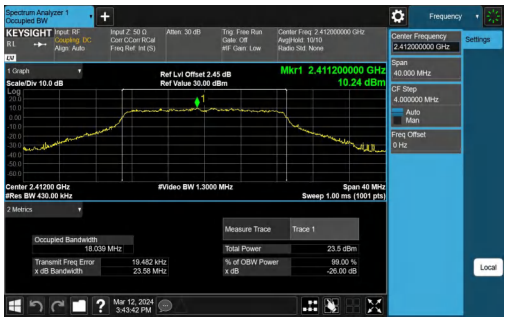
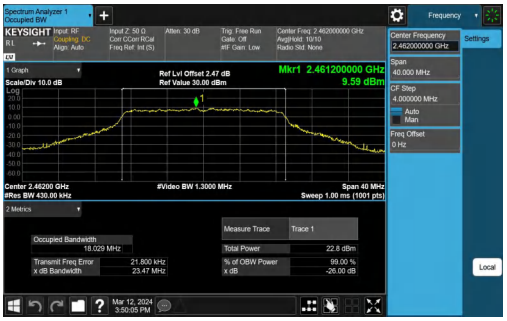


11N20SISO-Ant1-2437

11N20SISO-Ant0-2462

11N20SISO-Ant1-2462

11N20MIMO-Ant0-2412



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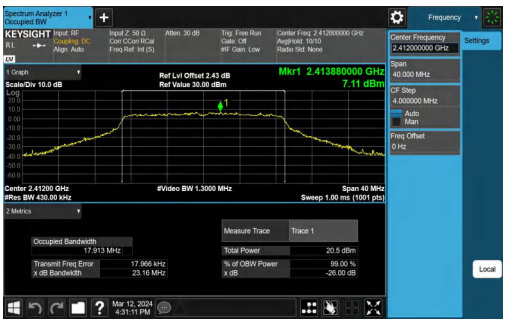

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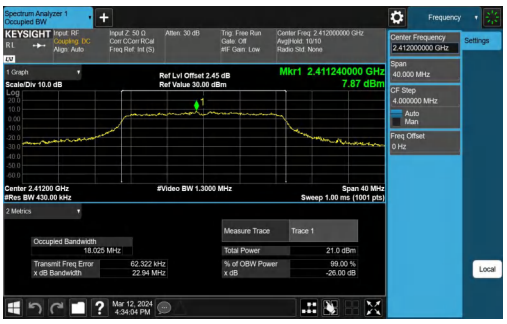

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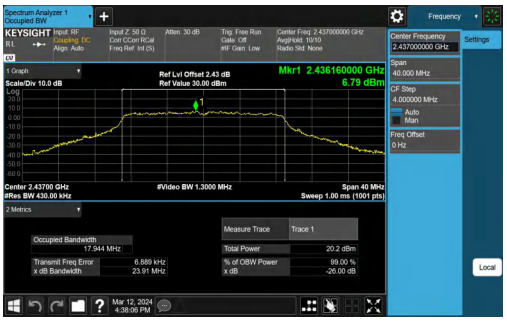

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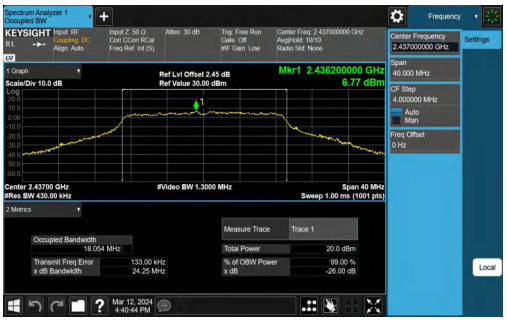

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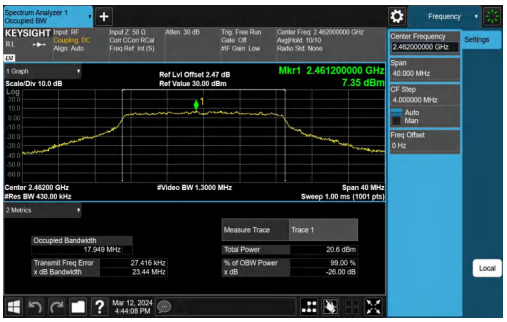

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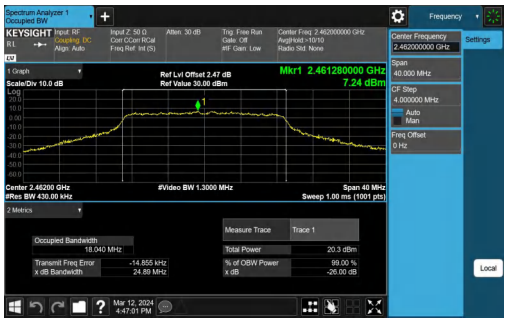

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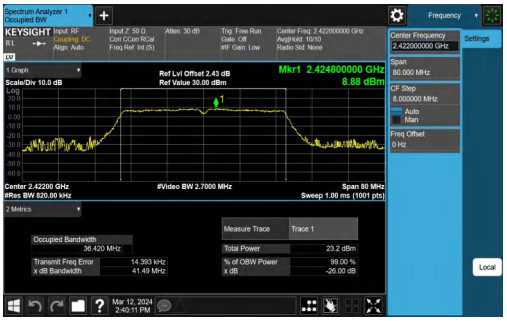

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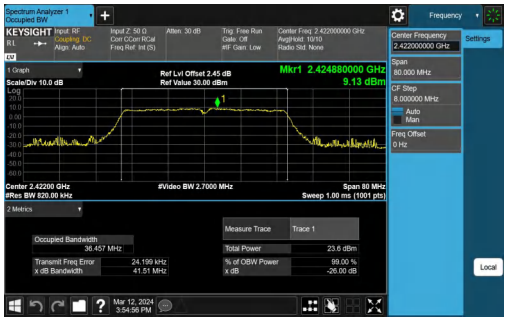

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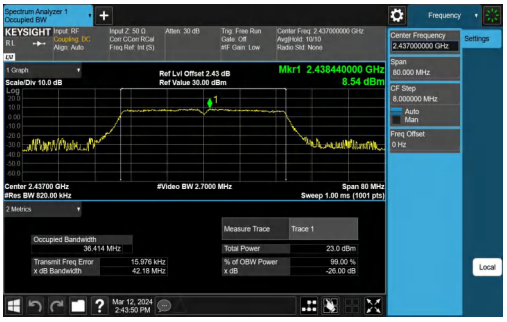

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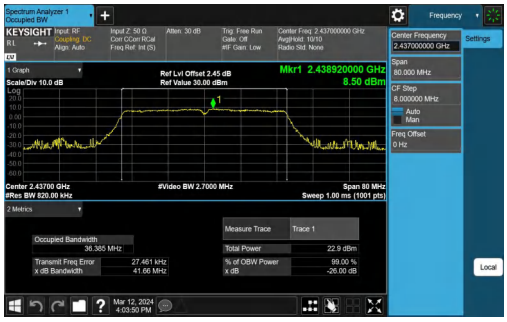

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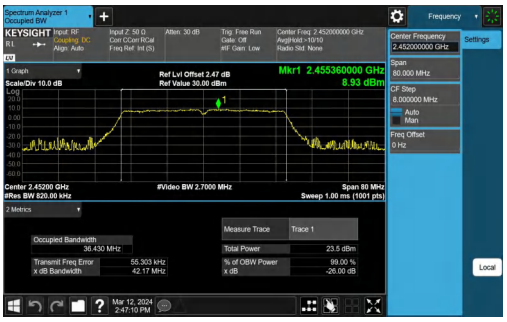

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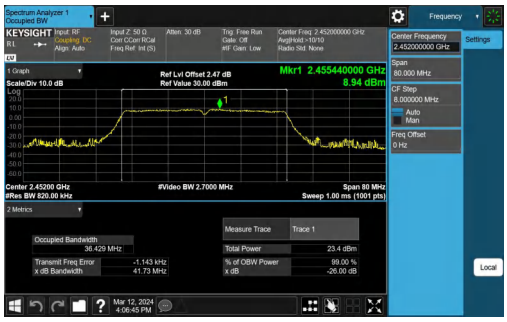

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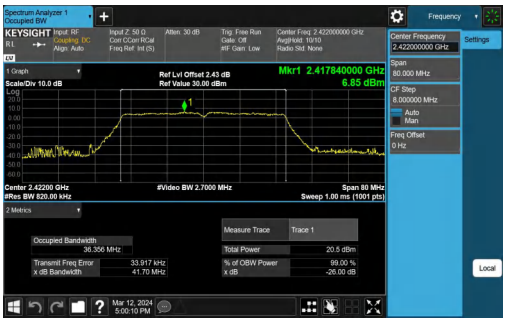

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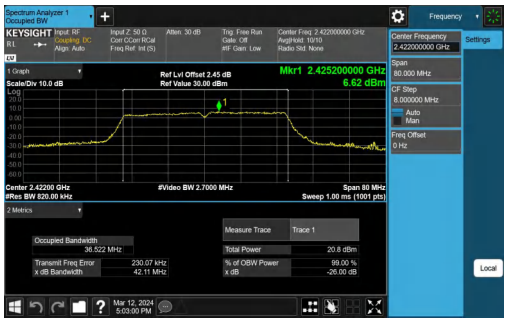

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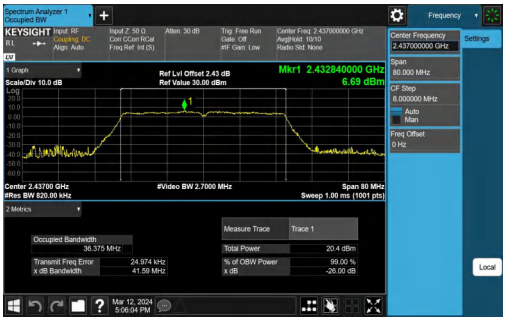

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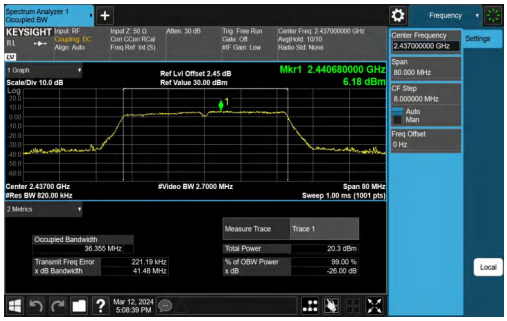

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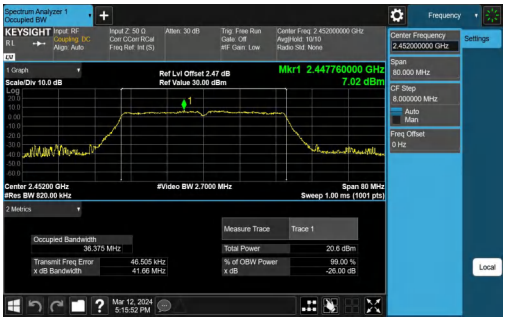

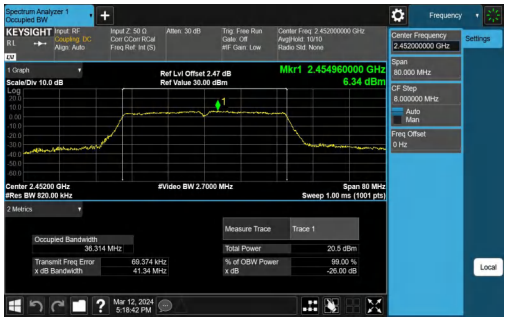

A.3 Power Spectral Density

Test Result

Test Mode	Antenna	Frequency[MHz]	Result[dBm/3-100kHz]	Limit[dBm/3kHz]	Verdict
11B	Ant1	2412	-7.62	≤8.00	PASS
11B	Ant0	2412	-7.79	≤8.00	PASS
11B	Ant0	2437	-1.91	≤8.00	PASS
11B	Ant1	2437	-9.81	≤8.00	PASS
11B	Ant0	2462	-1.59	≤8.00	PASS
11B	Ant1	2462	-8.41	≤8.00	PASS
11B-CDD	Ant0	2412	-11.27	≤8.00	PASS
11B-CDD	Ant1	2412	-9.14	≤8.00	PASS
11B-CDD	total	2412	-7.07	≤8.00	PASS
11B-CDD	Ant0	2437	-11.43	≤8.00	PASS
11B-CDD	Ant1	2437	-10.37	≤8.00	PASS
11B-CDD	total	2437	-7.86	≤8.00	PASS
11B-CDD	Ant0	2462	-11.31	≤8.00	PASS
11B-CDD	Ant1	2462	-10.65	≤8.00	PASS
11B-CDD	total	2462	-7.96	≤8.00	PASS
11G	Ant0	2412	-9.92	≤8.00	PASS
11G	Ant1	2412	-10.33	≤8.00	PASS
11G	Ant0	2437	-11.43	≤8.00	PASS
11G	Ant1	2437	-11.50	≤8.00	PASS
11G	Ant0	2462	-11.16	≤8.00	PASS
11G	Ant1	2462	-10.56	≤8.00	PASS
11G-CDD	Ant0	2412	-13.29	≤8.00	PASS
11G-CDD	Ant1	2412	-12.86	≤8.00	PASS
11G-CDD	total	2412	-10.06	≤8.00	PASS
11G-CDD	Ant0	2437	-14.15	≤8.00	PASS
11G-CDD	Ant1	2437	-14.24	≤8.00	PASS
11G-CDD	total	2437	-11.18	≤8.00	PASS
11G-CDD	Ant0	2462	-11.70	≤8.00	PASS
11G-CDD	Ant1	2462	-13.83	≤8.00	PASS
11G-CDD	total	2462	-9.63	≤8.00	PASS
11N20SISO	Ant0	2412	-11.35	≤8.00	PASS
11N20SISO	Ant1	2412	-10.64	≤8.00	PASS
11N20SISO	Ant0	2437	-11.66	≤8.00	PASS
11N20SISO	Ant1	2437	-9.74	≤8.00	PASS
11N20SISO	Ant0	2462	-9.90	≤8.00	PASS