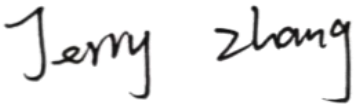
RF Test Report

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 15E
Report No.:	PD20240017RF10
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.

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
PD20240017RF10	1	Initial Report	2024/07/10	Valid

CONTENTS

Summary of Test Results

No.	Test Case	FCC Rules	Verdict
1	Occupied Bandwidth Measurement	15.407(e)	PASS
2	Maximum Conducted Output Power Measurement	15.407(a)	PASS
3	Power Spectral Density Measurement	15.407(a)	PASS
4	Unwanted Emissions Measurement	15.407(b)	PASS
5	AC Conducted Emission Measurement	15.207	NA
6	Antenna Requirements	15.203 & 15.407(a)	PASS
7	Frequency Stability[Note1]	15.407(g)	NA

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.

Note1: Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the users manual.

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	/
Antenna Type	PCB Antenna
Max. Conducted Power	Wi-Fi 5G: 16.94dBm
WLAN Mode Supported:	802.11a 802.11n 20M/40M
Antenna Gain	5150MHz to 5250MHz: 2.50dBi 5250MHz to 5350MHz: 2.60dBi 5470MHz to 5725MHz: 2.70dBi 5725MHz to 5850MHz: 2.00dBi
Directional Gain	/
Test Band	U-NII-1(5150MHz-5250MHz) U-NII-2A(5250MHz-5350MHz) U-NII-2C(5470MHz-5725MHz) U-NII-3(5725MHz-5850MHz)
Operating voltage	Typical 3.3Vdc
Modulation Type	802.11a/n: BPSK,QPSK,16QAM,64QAM
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 E
- FCC KDB 789033 D02 General UN ll Test Procedures New Rules v02r01
- 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)
802.11a	6
802.11n 20M	MCS0
802.11n 40M	MCS0

3.2 Wireless Technology and Frequency Range

Wireless Technology	Bandwidth		Channel	Frequency
Wi-Fi	U-NII-1	20MHz	36	5180 MHz
			40	5200 MHz
			44	5220 MHz
			48	5240 MHz
		40MHz	38	5190 MHz
			46	5230 MHz
	U-NII-2A	20MHz	52	5260 MHz
			56	5280 MHz
			60	5300 MHz
			64	5320 MHz
		40MHz	54	5270 MHz
			62	5310 MHz
	U-NII-2C	20MHz	100	5500 MHz
			104	5520 MHz
			108	5540 MHz
			112	5560 MHz
			116	5580 MHz
			120	5600 MHz
			124	5620 MHz
			128	5640 MHz
			132	5660 MHz
			136	5680 MHz
			140	5700 MHz
			144	5720 MHz
		40MHz	102	5510 MHz
			110	5550 MHz
			118	5590 MHz
			126	5630 MHz
			134	5670 MHz
			142	5710 MHz
	U-NII-3	20MHz	149	5745 MHz
			153	5765 MHz
			157	5785 MHz
			161	5805 MHz
			165	5825 MHz
		40MHz	151	5755 MHz

			159	5795 MHz
Does this device support TPC function?		☐ Yes	☑ No	
Does this device support TDWR band?		☑ Yes	☐ No	

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	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	2024/10/13
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	Emission Bandwidth	1.9%
2	Occupied channel bandwidth	1.9%
3	Min emission bandwidth	1.9%
4	Unwanted Emissions Measurement	9kHz-7GHz: 1.21dB 7GHz-40GHz: 3.31dB
5	Radiated Band Edges and Spurious Emission	Below 1GHz: 4.88 dB Above 1GHz: 5.06 dB
6	Temperature	3 °C
7	Humidity	1.3 %
8	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 6dB and 26dB and 99% Occupied Bandwidth Measurement

4.1.1 6dB and 26dB and 99% Occupied Bandwidth Measurement

The minimum 6 dB bandwidth shall be at least 500 kHz

26dB and 99% Occupied bandwidth are reporting only.

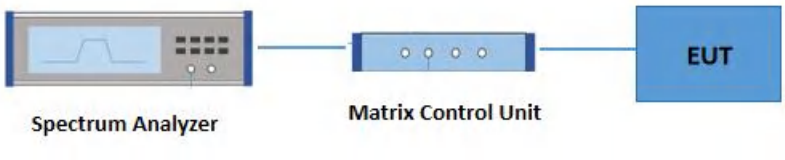
4.1.2 Measuring Instruments

The measuring equipment is listed in the section 3.3 of this test report.

4.1.3 Test Procedures

1. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01Section C) Emission bandwidth.
2. For 6dB BW, Set RBW = 100kHz.
   For 26dB BW, Set RBW = approximately 1% of the emission bandwidth.
   For 99% OBW, Set RBW = 1% to 5% of the OBW.
3. For 26dB BW. Set the VBW > RBW.
   For 6dB BW & 99% OBW. Set the VBW ≥ 3 × RBW
4. Detector = Peak.
5. Trace mode = max hold
6. Measure the maximum width of the emission that is 26 dB down from the peak of the emission.Compare this with the RBW setting of the analyzer, Readjust RBW and repeat measurements needed until the RBW/EBW ratio is approximately 1%.
7. For 99% Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) is set1% to 5% of the OBW and set the Video bandwidth (VBW) ≥ 3* RBW.
8. Measure and record the results in the test report.

4.1.4 Test Setup



4.1.5 Test Results

See Appendix A.1.

4.2 Maximum Conducted Output Power Measurement

4.2.1 Limit of Maximum Conducted Output Power

<FCC 14 -30 CFR 15.407>

For the band 5.15–5.25 GHz.

(i) For an outdoor access point operating in the band 5.15–5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

(ii) For an indoor access point operating in the band 5.15–5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(iii) For fixed point-to-point access points operating in the band 5.15–5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. Fixed point-to-point U–NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U–NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(iv) For client devices in the 5.15–5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(2)For the 5.25 – 5.35 GHz and 5.47 – 5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(3)For the band 5.725–5.850 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

4.2.2 Measuring Instruments

The measuring equipment is listed in the section 3.3 of this test report.

4.2.3 Test Procedures

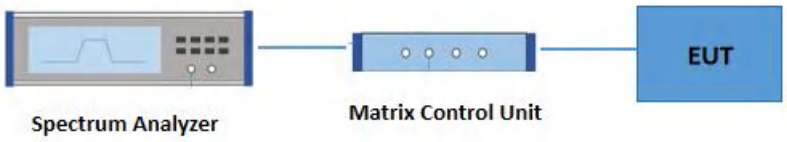
The testing follows Method PM of FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.

Method SA-2 (trace averaging across on and off times of the EUT transmissions, followed by duty cycle correction).

1. Measure the duty cycle, x, of the transmitter output signal as described in II.B.
2. Set span to encompass the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal.
3. Set RBW = 1 MHz.
4. Set VBW ≥ 3 MHz.
5. Number of points in sweep ≥ 2 × span / RBW. (This ensures that bin-to-bin spacing is ≤ RBW/2, so that narrowband signals are not lost between frequency bins.)
6. Sweep time = auto.
7. Detector = power averaging (rms), if available. Otherwise, use 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 to ensure 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 EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal using the instrument's band power measurement function with band limits set equal to the EBW (or occupied bandwidth) band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at 1 MHz intervals extending across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal.
11. Add 10 log (1/x), where x is the duty cycle, to the measured power in order 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 dB if the duty cycle is 25%.

For Straddle Channel, According to KDB 789033 D02 General UNll Test Procedures New Rules v02r01, If the power and PSD of the devices are uniform and comply with the lower limits specified for the U-Nl-2 bands, a single measurement over the entire emission bandwidth can be performed to show compliance.

4.2.4 Test Setup



4.2.5 Test Result of Maximum Conducted Output Power

Please refer to Appendix A.2.

4.3 Power Spectral Density Measurement

4.3.1 Limit of Power Spectral Density

Rule FCC Part 15.407(a)(1)/ Part 15.407(a)(2)/Part 15.407(a)(3

For an indoor access point operating in the band 5.15–5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band.

For client devices in the 5.15–5.25 GHz band, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band.

For the 5.25-5.725 GHz bands, the maximum power spectral density shall not exceed 11 dBm in any1 megahertz band.

For the band 5.725-5.85 GHz, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band.

For Straddle Channel, According to KDB 789033 D02 General UNll Test Procedures New Rules v02r01, If the power and PSD of the devices are uniform and comply with the lower limits specified for the U-Nll-2 bands, a single measurement over the entire emission bandwidth can be performed to show compliance.

If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

4.3.2 Measuring Instruments

The measuring equipment is listed in the section 3.3 of this test report.

4.3.3 Test Procedures

The testing follows FCC KDB 789033 D02 General UNll Test Procedures New Rules v02r01 Section F) Maximum power spectral density.

1.Measure the duty cycle.

2.Set span to encompass the entire emission bandwidth (EBW) of the signal.

3.Set RBW ≥ 1/T, where T is defined in II.B.I.a).

4.Set VBW ≥ 3 RBW.

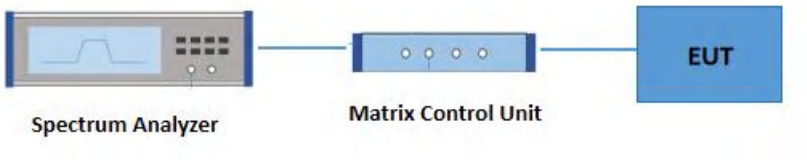
5.If measurement bandwidth of Maximum PSD is specified in 500 kHz, add 10 log (500 kHz/RBW) to the measured result, whereas RBW (<500 kHz) is the reduced resolution bandwidth of the spectrum analyzer set during measurement.

6.If measurement bandwidth of Maximum PSD is specified in 1 MHz, add 10 log (1MHz/RBW) to the measured result, whereas RBW (< 1 MHz) is the reduced resolution bandwidth of spectrum analyzer set during measurement.

7. Care must be taken to ensure that the measurements are performed during a period of continuous

transmission or are corrected upward for duty cycle.

4.3.4 Test Setup



4.3.5 Test Result of Power Spectral Density

Please refer to Appendix A.3.

4.4 Unwanted Emissions Measurement

This section is to measure unwanted emissions through radiated measurement for band edge spurious emissions and out of band emissions measurement.

4.4.1 Limit of Unwanted Emissions

(1) For transmitters operating in the 5150-5250 MHz band: all emissions outside of the 5150-5350 MHz band shall not exceed an EIRP of -27dBm/MHz.

For transmitters operating in the 5250-5350 MHz band: all emissions outside of the 5150-5350 MHz band shall not exceed an EIRP of-27 dBm/MHz. Devices operating in the 5250-5350 MHz band that generate emissions in the 5150-5250 MHz band must meet all applicable technical requirements for operation in the 5150-5250 MHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of -27 dBm/MHz in the 5150-5250 MHz band.

For transmitters operating in the 5470-5725 MHz band: all emissions outside of the 5470-5725MHz band shall not exceed an EIRP of -27 dBm/MHz.

For transmitters operating in the 5.725-5.85 GHz band:
15.407(b)(4)(i) All emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

(2) Unwanted spurious emissions fallen in restricted bands shall comply with the general field strength limits as below table.

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	3
Above 960	500	3

EIRP (dBm)	Field Strength at 3m (dB μ V/m)
- 27	68.2

Note: The following formula is used to convert the EIRP to field strength.

$$EIRP = E_{Meas} + 20\log(d_{Meas}) - 104.7$$

where

EIRP is the equivalent isotropically radiated power, in dBm

E_{Meas} is the field strength of the emission at the measurement distance, in dBμV/m

d_{Meas} is the measurement distance, in m

4.4.2 Measuring Instruments

The measuring equipment is listed in the section 3.3 of this test report.

4.4.3 Test Procedures

1. The testing follows FCC KDB 789033 D02 General UNll Test Procedures New Rules v02r01 Section G) Unwanted emissions measurement.

   (1)Procedure for Unwanted Emissions Measurements Below 1000MHz
   - RBW = 120 kHz
   - VBW = 300 kHz
   - Detector = Peak
   - Trace mode = max hold

   (2)Procedure for Peak Unwanted Emissions Measurements Above 1000 MHz
   - RBW= 1 MHz
   - VBW ≥ 3 MHz
   - Detector = Peak
   - Sweep time = auto
   - Trace mode = max hold

   (3)Procedures for Average Unwanted Emissions Measurements Above 1000MHz
   - RBW = 1 MHz
   - 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.
2. 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.
3. The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.

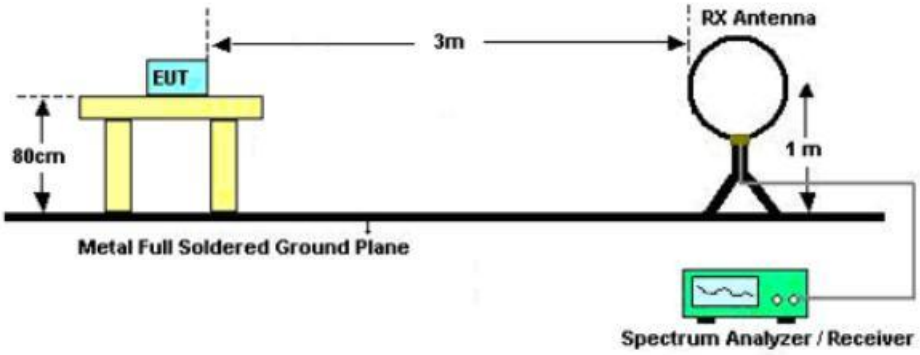
4.. The antenna is a broadband antenna and its height is adjusted between one meter and four.

meters above ground to find the maximum value of the field strength for both horizontal polarization and vertical polarization of the antenna.

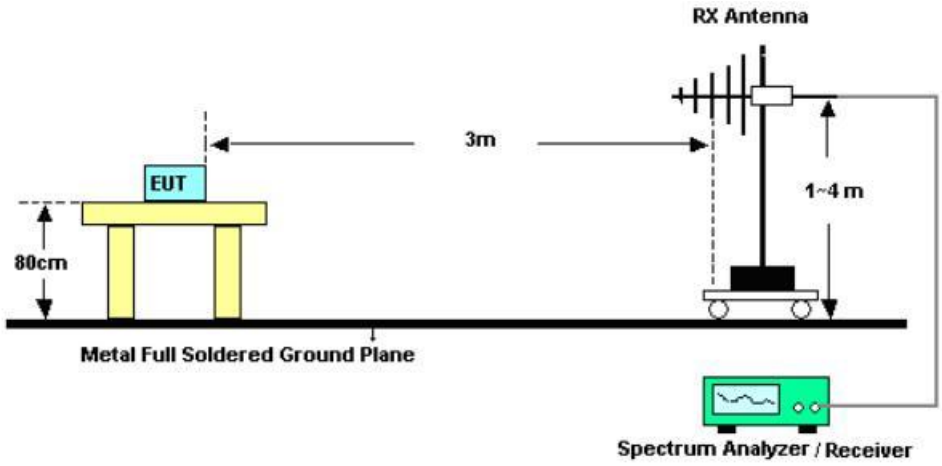
5. For each suspected emission, the EUT was arranged to its worst case and then adjust the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading.
6. For testing below 1GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, 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.

4.4.4 Test Setup

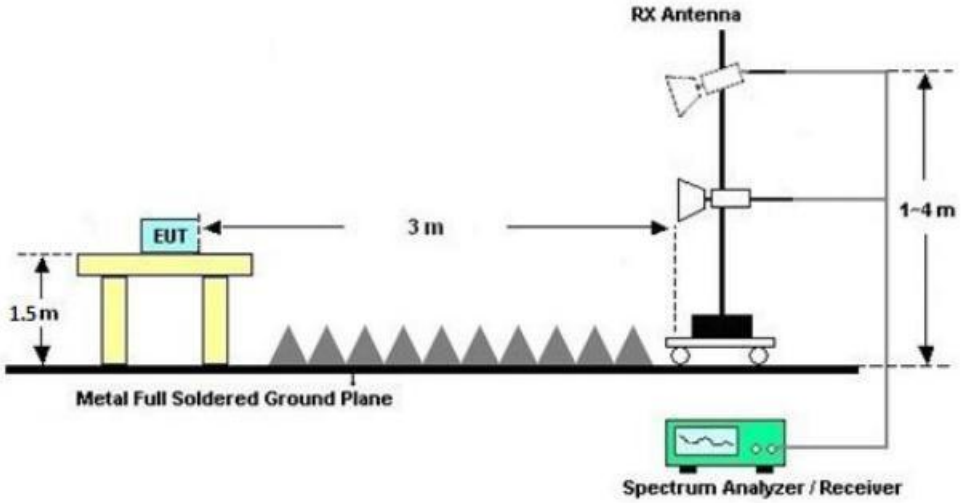
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



4.4.5Test 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.

4.4.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix B.1.

4.4.7 Test Result of Radiated Spurious Emissions (30MHz - 10th Harmonic or 40GHz whichever is lower)

Please refer to Appendix B.1

4.4.8 Duty Cycle

Please refer to Appendix A.4.

4.5 AC Conducted Emission Measurement

4.5.1 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.

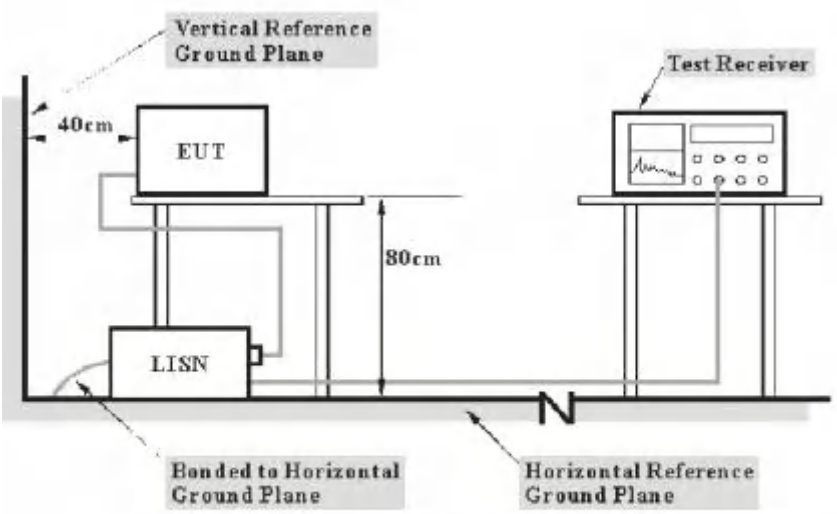
4.5.2 Measuring Instruments

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

4.5.3 Test Procedures

1. The 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.

4.5.4 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.

4.5.5 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

4.5.6 Test Result

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

4.6 Antenna Requirements

4.6.1 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.

4.6.2 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 2.70dBi.

Appendix A – Test Results of Conducted Test

A.1 6dB and 26dB and 99% Occupied Bandwidth Measurement

Test Result_26dB Bandwidth

Test Mode	Antenna	Frequency[MHz]	26db EBW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11A	Ant1	5180	20.760	5169.320	5190.080	---	---
11A	Ant1	5220	20.520	5210.120	5230.640	---	---
11A	Ant1	5240	20.080	5230.120	5250.200	---	---
11A	Ant1	5260	20.840	5249.520	5270.360	---	---
11A	Ant1	5300	20.320	5289.960	5310.280	---	---
11A	Ant1	5320	21.480	5309.480	5330.960	---	---
11A	Ant1	5500	20.280	5489.840	5510.120	---	---
11A	Ant1	5580	20.720	5569.640	5590.360	---	---
11A	Ant1	5700	20.520	5689.760	5710.280	---	---
11A	Ant1	5720	20.960	5709.400	5730.360	---	---
11A	Ant1	5720_UNII-2C	15.6	5709.400	5725	---	---
11A	Ant1	5720_UNII-3	5.36	5725	5730.360	---	---
11A	Ant1	5745	19.800	5735.160	5754.960	---	---
11A	Ant1	5785	20.760	5774.520	5795.280	---	---
11A	Ant1	5825	20.800	5814.480	5835.280	---	---
11N20SISO	Ant1	5180	21.280	5169.200	5190.480	---	---
11N20SISO	Ant1	5220	20.640	5209.600	5230.240	---	---
11N20SISO	Ant1	5240	20.640	5229.720	5250.360	---	---
11N20SISO	Ant1	5260	21.480	5249.400	5270.880	---	---
11N20SISO	Ant1	5300	21.680	5289.240	5310.920	---	---
11N20SISO	Ant1	5320	21.120	5309.560	5330.680	---	---
11N20SISO	Ant1	5500	20.960	5489.760	5510.720	---	---
11N20SISO	Ant1	5580	21.080	5569.360	5590.440	---	---
11N20SISO	Ant1	5700	20.600	5689.680	5710.280	---	---
11N20SISO	Ant1	5720	20.840	5709.600	5730.440	---	---
11N20SISO	Ant1	5720_UNII-2C	15.4	5709.600	5725	---	---
11N20SISO	Ant1	5720_UNII-3	5.44	5725	5730.440	---	---
11N20SISO	Ant1	5745	21.160	5734.200	5755.360	---	---
11N20SISO	Ant1	5785	20.800	5774.760	5795.560	---	---
11N20SISO	Ant1	5825	20.840	5814.440	5835.280	---	---
11N40SISO	Ant1	5190	38.720	5170.560	5209.280	---	---
11N40SISO	Ant1	5230	38.160	5211.120	5249.280	---	---

11N40SISO	Ant1	5270	38.320	5250.800	5289.120	---	---
11N40SISO	Ant1	5310	38.720	5290.720	5329.440	---	---
11N40SISO	Ant1	5510	38.320	5490.880	5529.200	---	---
11N40SISO	Ant1	5550	38.480	5530.720	5569.200	---	---
11N40SISO	Ant1	5670	38.480	5650.880	5689.360	---	---
11N40SISO	Ant1	5710	37.920	5691.040	5728.960	---	---
11N40SISO	Ant1	5710_UNII-2C	33.96	5691.040	5725	---	---
11N40SISO	Ant1	5710_UNII-3	3.96	5725	5728.960	---	---
11N40SISO	Ant1	5755	38.080	5735.960	5774.040	---	---
11N40SISO	Ant1	5795	38.320	5775.720	5814.040	---	---

Test Result_6dB Bandwidth

U-NII-3

Test Mode	Antenna	Frequency[MHz]	6db EBW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11A	Ant1	5745	16.320	5736.800	5753.120	0.5	PASS
11A	Ant1	5785	16.360	5776.760	5793.120	0.5	PASS
11A	Ant1	5825	16.400	5816.760	5833.160	0.5	PASS
11N20SISO	Ant1	5745	17.520	5736.200	5753.720	0.5	PASS
11N20SISO	Ant1	5785	17.120	5776.600	5793.720	0.5	PASS
11N20SISO	Ant1	5825	17.080	5816.440	5833.520	0.5	PASS
11N40SISO	Ant1	5755	35.040	5737.400	5772.440	0.5	PASS
11N40SISO	Ant1	5795	34.000	5778.440	5812.440	0.5	PASS

Test Result_99% Bandwidth

Test Mode	Antenna	Frequency[MHz]	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11A	Ant1	5180	16.788	5171.6057	5188.3937	---	---
11A	Ant1	5220	16.701	5211.6881	5228.3891	---	---
11A	Ant1	5240	16.748	5231.6284	5248.3764	---	---
11A	Ant1	5260	16.846	5251.5944	5268.4404	---	---
11A	Ant1	5300	16.646	5291.7312	5308.3772	---	---
11A	Ant1	5320	16.824	5311.5607	5328.3847	---	---
11A	Ant1	5500	16.752	5491.5566	5508.3086	---	---
11A	Ant1	5580	16.764	5571.5323	5588.2963	---	---
11A	Ant1	5700	16.701	5691.7044	5708.4054	---	---
11A	Ant1	5720	16.730	5711.7107	5728.4407	---	---
11A	Ant1	5720_UNII-2C	13.289	5711.7107	5725	---	---
11A	Ant1	5720_UNII-3	3.441	5725	5728.4407	---	---
11A	Ant1	5745	16.692	5736.5868	5753.2788	---	---
11A	Ant1	5785	16.819	5776.5405	5793.3595	---	---

11A	Ant1	5825	16.698	5816.5808	5833.2788	---	---
11N20SISO	Ant1	5180	17.838	5171.1786	5189.0166	---	---
11N20SISO	Ant1	5220	17.866	5211.1511	5229.0171	---	---
11N20SISO	Ant1	5240	17.864	5231.0299	5248.8939	---	---
11N20SISO	Ant1	5260	17.876	5251.1262	5269.0022	---	---
11N20SISO	Ant1	5300	17.901	5291.1211	5309.0221	---	---
11N20SISO	Ant1	5320	17.848	5311.0613	5328.9093	---	---
11N20SISO	Ant1	5500	17.851	5491.0520	5508.9030	---	---
11N20SISO	Ant1	5580	17.838	5571.0182	5588.8562	---	---
11N20SISO	Ant1	5700	17.785	5691.1403	5708.9253	---	---
11N20SISO	Ant1	5720	17.799	5711.0918	5728.8908	---	---
11N20SISO	Ant1	5720_UNII-2C	13.908	5711.0918	5725	---	---
11N20SISO	Ant1	5720_UNII-3	3.891	5725	5728.8908	---	---
11N20SISO	Ant1	5745	17.814	5736.0156	5753.8296	---	---
11N20SISO	Ant1	5785	17.785	5776.0724	5793.8574	---	---
11N20SISO	Ant1	5825	17.753	5816.0981	5833.8511	---	---
11N40SISO	Ant1	5190	36.024	5172.0155	5208.0395	---	---
11N40SISO	Ant1	5230	35.897	5212.1121	5248.0091	---	---
11N40SISO	Ant1	5270	35.956	5252.0636	5288.0196	---	---
11N40SISO	Ant1	5310	35.790	5292.0910	5327.8810	---	---
11N40SISO	Ant1	5510	35.942	5492.0091	5527.9511	---	---
11N40SISO	Ant1	5550	35.934	5532.0458	5567.9798	---	---
11N40SISO	Ant1	5670	35.933	5652.0227	5687.9557	---	---
11N40SISO	Ant1	5710	35.893	5692.0469	5727.9399	---	---
11N40SISO	Ant1	5710_UNII-2C	32.953	5692.0469	5725	---	---
11N40SISO	Ant1	5710_UNII-3	2.94	5725	5727.9399	---	---
11N40SISO	Ant1	5755	35.939	5737.0007	5772.9397	---	---
11N40SISO	Ant1	5795	35.871	5777.0470	5812.9180	---	---

Test Graphs

26dB Occupied Bandwidth

11A-Ant1-5180	11A-Ant1-5220
	
11A-Ant1-5240	11A-Ant1-5260
	
11A-Ant1-5300	11A-Ant1-5320
	
11A-Ant1-5500	11A-Ant1-5580
	
11A-Ant1-5700	11A-Ant1-5720

11A-Ant1-5745

11A-Ant1-5785

11A-Ant1-5825

11N20SISO-Ant1-5180

11N20SISO-Ant1-5220

11N20SISO-Ant1-5240

11N20SISO-Ant1-5260

11N20SISO-Ant1-5300

11N20SISO-Ant1-5320

11N20SISO-Ant1-5500

11N20SISO-Ant1-5580

11N20SISO-Ant1-5700

11N20SISO-Ant1-5720

11N20SISO-Ant1-5745

11N20SISO-Ant1-5785

11N20SISO-Ant1-5825

11N40SISO-Ant1-5190

11N40SISO-Ant1-5230

11N40SISO-Ant1-5270

11N40SISO-Ant1-5310

11N40SISO-Ant1-5510

11N40SISO-Ant1-5550

11N40SISO-Ant1-5670

11N40SISO-Ant1-5710

	
11N40SISO-Ant1-5755	11N40SISO-Ant1-5795
	

6dB Bandwidth

U-NII-3

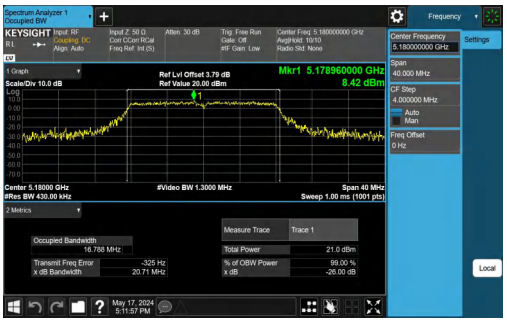
11A-Ant1-5745-PASS	11A-Ant1-5785-PASS
	
11A-Ant1-5825-PASS	11N20SISO-Ant1-5745-PASS
	
11N20SISO-Ant1-5785-PASS	11N20SISO-Ant1-5825-PASS

11N40SISO-Ant1-5755-PASS

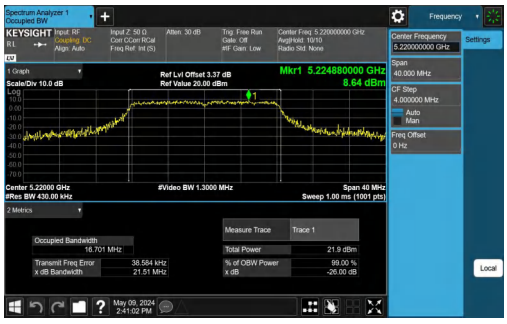
11N40SISO-Ant1-5795-PASS

99% Bandwidth

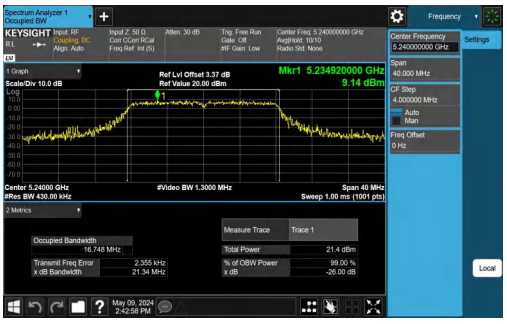
11A-Ant1-5180



11A-Ant1-5220



11A-Ant1-5240



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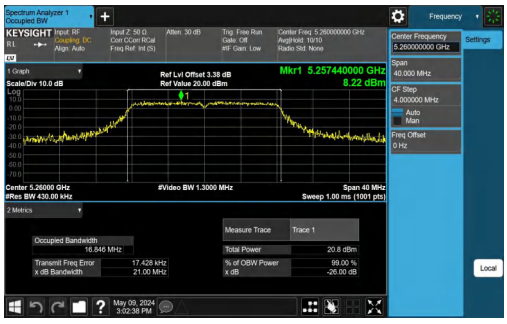
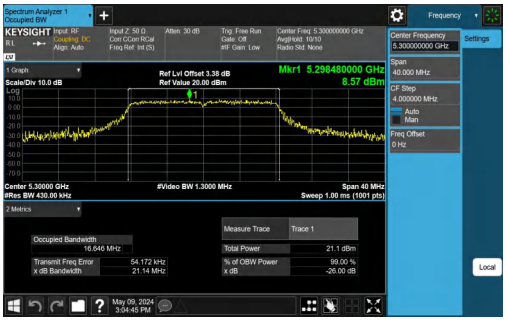
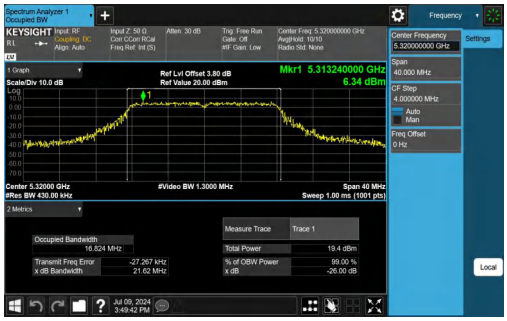


11A-Ant1-5300

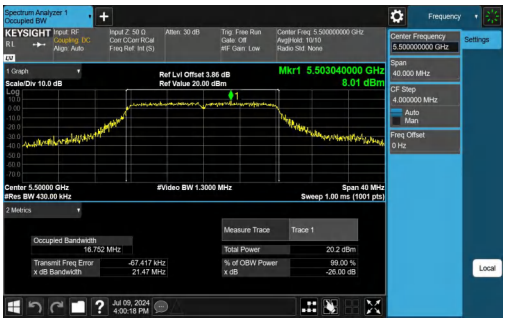
11A-Ant1-5320



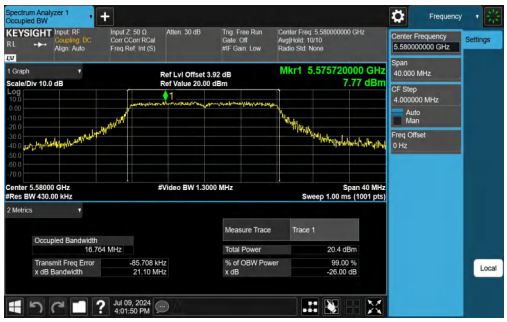
11A-Ant1-5500



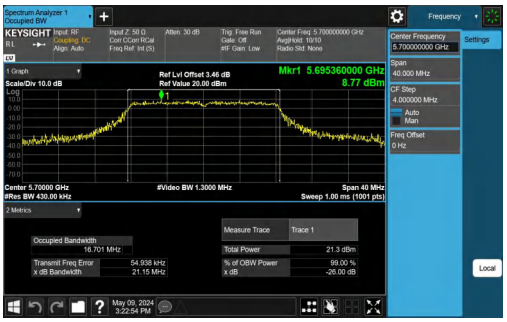
11A-Ant1-5580



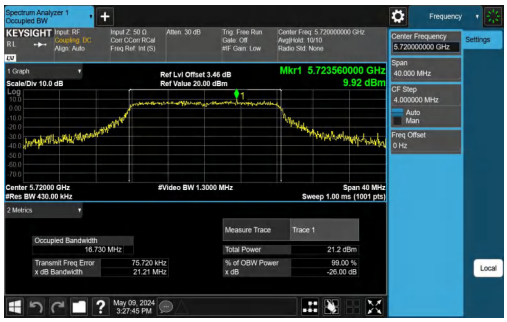
11A-Ant1-5700



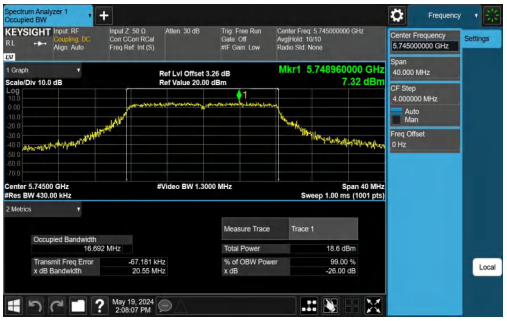
11A-Ant1-5720



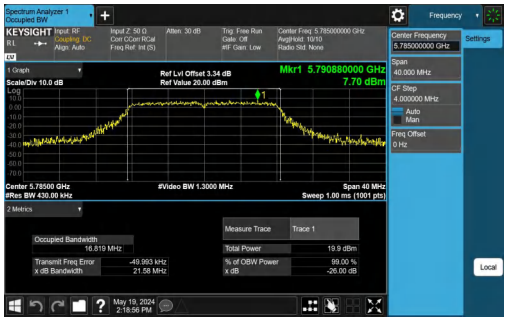
11A-Ant1-5745



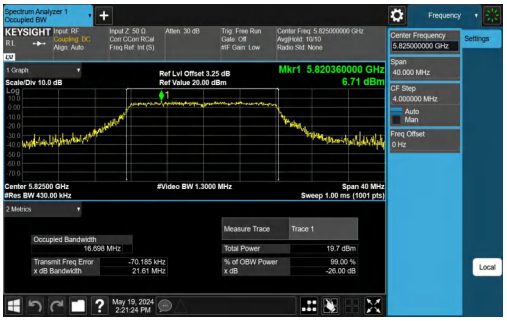
11A-Ant1-5785



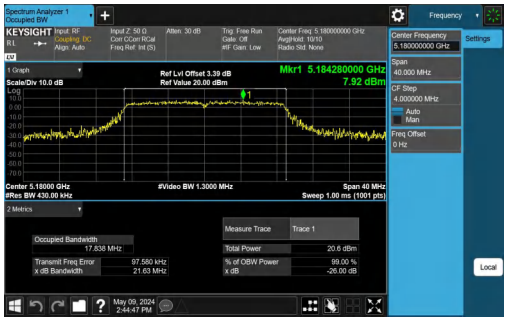
11A-Ant1-5825



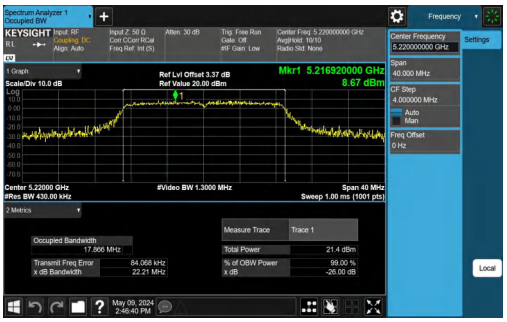
11N20SISO-Ant1-5180



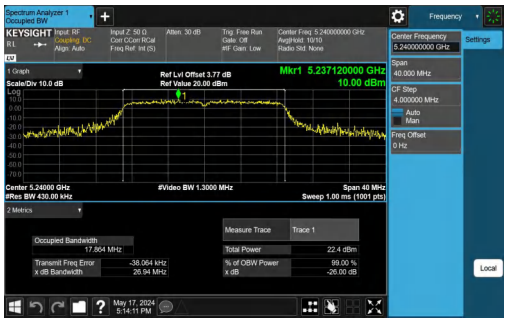
11N20SISO-Ant1-5220



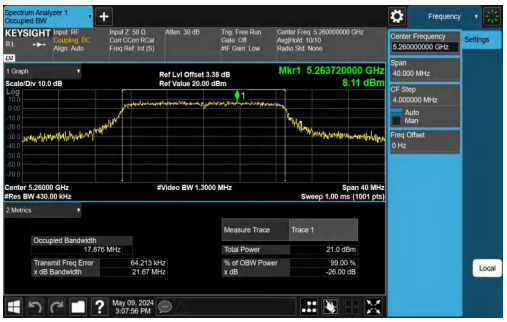
11N20SISO-Ant1-5240



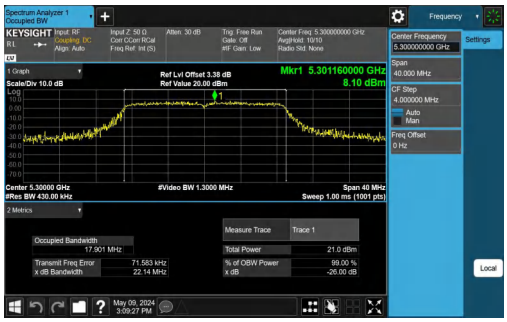
11N20SISO-Ant1-5260



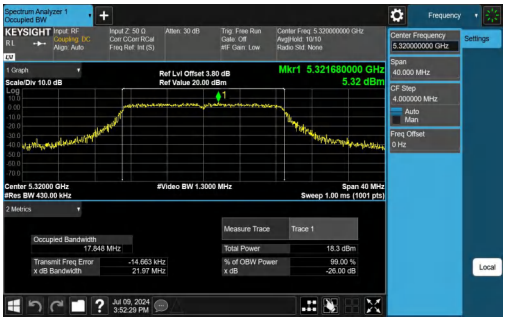
11N20SISO-Ant1-5300



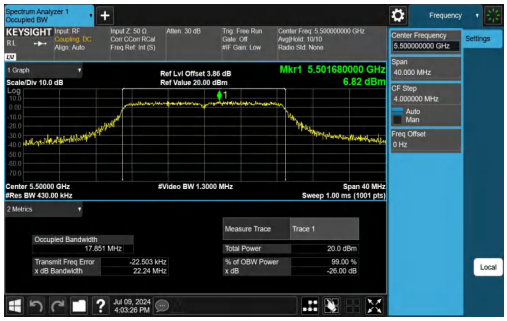
11N20SISO-Ant1-5320



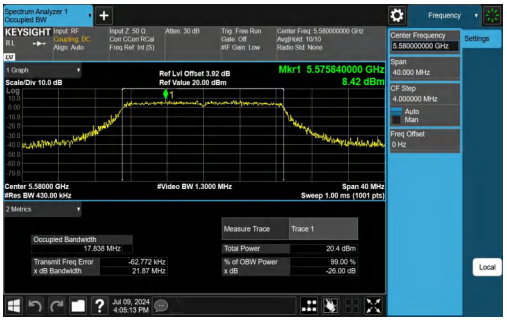
11N20SISO-Ant1-5500



11N20SISO-Ant1-5580



11N20SISO-Ant1-5700



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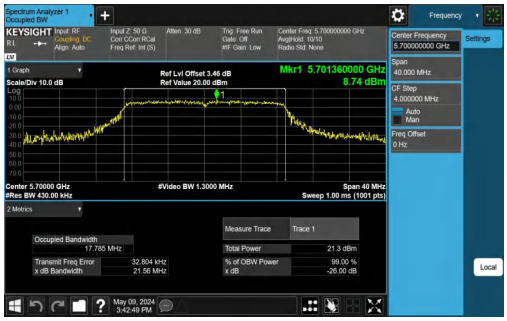

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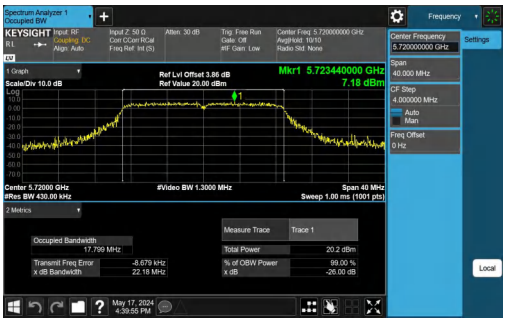

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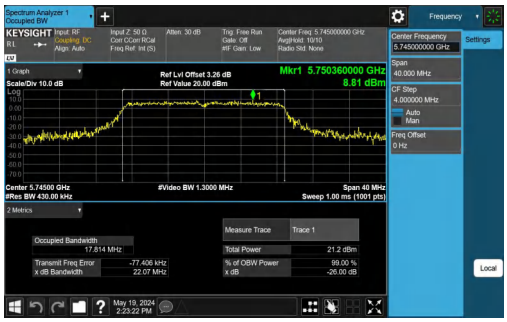

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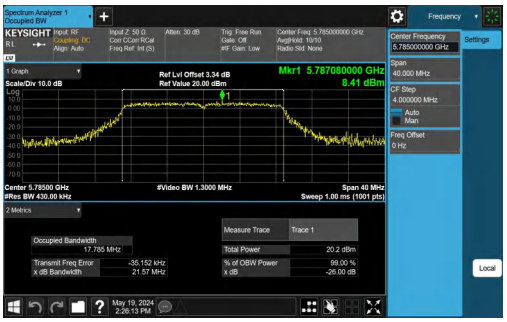
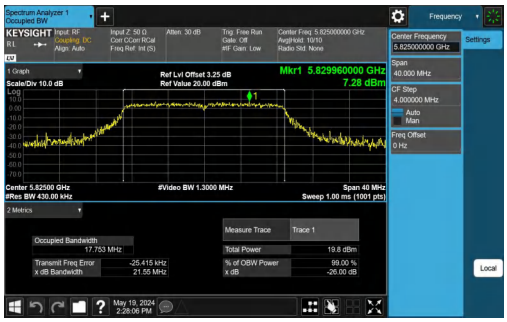
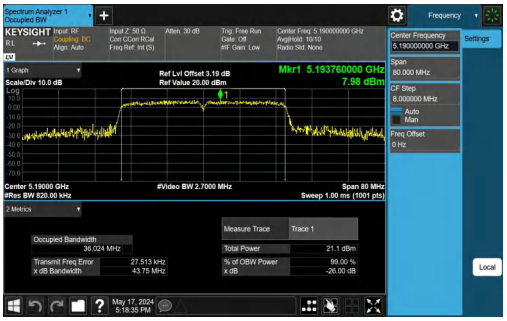


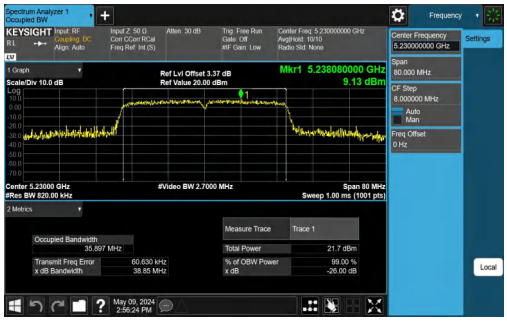
11N40SISO-Ant1-5190



11N40SISO-Ant1-5230



11N40SISO-Ant1-5270



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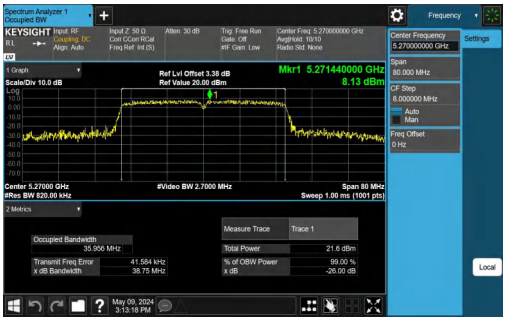

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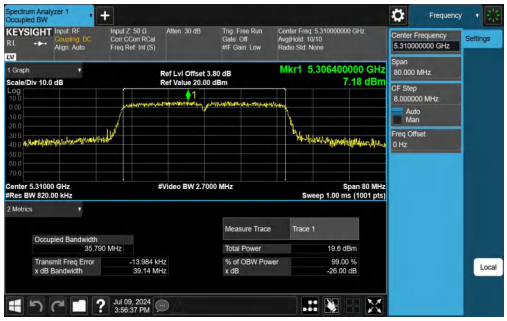

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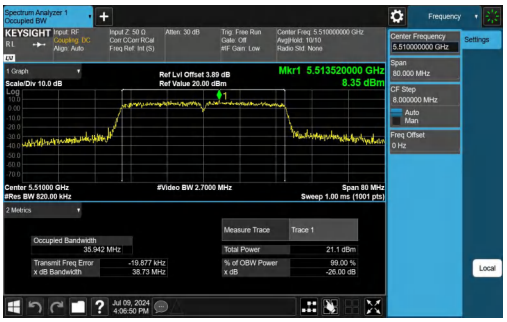

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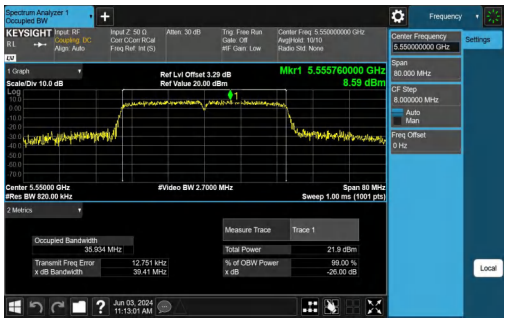

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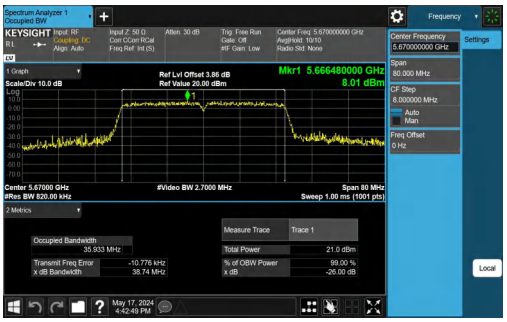

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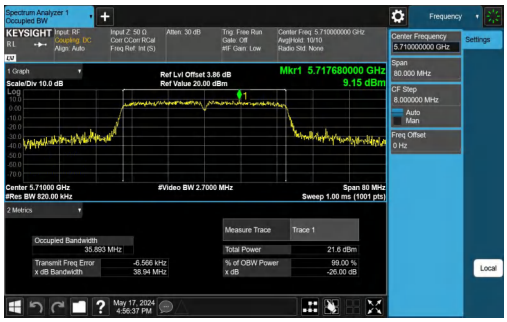

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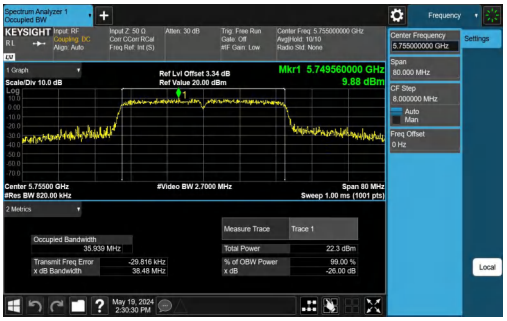

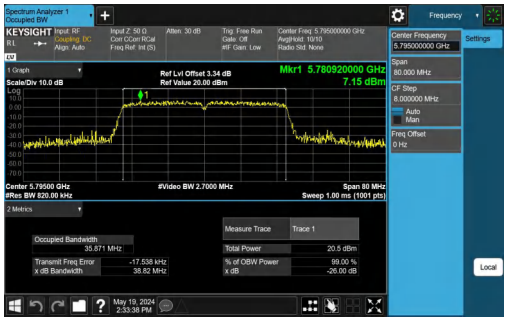

A.2 Maximum Conducted Output Power Measurement

Test Result

Test Mode	Antenna	Frequency [MHz]	Channel Power [dBm]	Duty Cycle [%]	DC Factor [dBm]	Result [dBm]	Limit [dBm]	Verdict
11A	Ant1	5180	15.87	94.06	0.27	16.14	≤23.98	PASS
11A	Ant1	5220	16.65	93.64	0.29	16.94	≤23.98	PASS
11A	Ant1	5240	16.27	94.09	0.26	16.53	≤23.98	PASS
11A	Ant1	5260	15.99	93.61	0.29	16.28	≤23.98	PASS
11A	Ant1	5300	16.18	93.64	0.29	16.47	≤23.98	PASS
11A	Ant1	5320	14.38	93.64	0.29	14.67	≤23.98	PASS
11A	Ant1	5500	14.72	94.06	0.27	14.99	≤23.98	PASS
11A	Ant1	5580	14.73	93.64	0.29	15.02	≤23.98	PASS
11A	Ant1	5700	15.98	94.09	0.26	16.24	≤23.98	PASS
11A	Ant1	5720_UNII-2C	15.00	94.09	0.26	15.26	≤22.93	PASS
11A	Ant1	5720_UNII-3	8.16	94.09	0.26	8.42	≤30.00	PASS
11A	Ant1	5745	16.15	94.09	0.26	16.41	≤30.00	PASS
11A	Ant1	5785	15.48	93.64	0.29	15.77	≤30.00	PASS
11A	Ant1	5825	15.14	94.09	0.26	15.40	≤30.00	PASS
11N20SISO	Ant1	5180	15.34	93.66	0.28	15.62	≤23.98	PASS
11N20SISO	Ant1	5220	16.52	93.66	0.28	16.80	≤23.98	PASS
11N20SISO	Ant1	5240	16.57	93.66	0.28	16.85	≤23.98	PASS
11N20SISO	Ant1	5260	16.03	94.12	0.26	16.29	≤23.98	PASS
11N20SISO	Ant1	5300	15.98	93.66	0.28	16.26	≤23.98	PASS
11N20SISO	Ant1	5320	13.14	93.66	0.28	13.42	≤23.98	PASS
11N20SISO	Ant1	5500	14.59	93.66	0.28	14.87	≤23.98	PASS
11N20SISO	Ant1	5580	14.75	93.66	0.28	15.03	≤23.98	PASS
11N20SISO	Ant1	5700	15.93	93.17	0.31	16.24	≤23.98	PASS
11N20SISO	Ant1	5720_UNII-2C	15.14	93.66	0.28	15.42	≤22.88	PASS
11N20SISO	Ant1	5720_UNII-3	8.52	93.66	0.28	8.80	≤30.00	PASS
11N20SISO	Ant1	5745	15.87	93.66	0.28	16.15	≤30.00	PASS
11N20SISO	Ant1	5785	15.45	94.12	0.26	15.71	≤30.00	PASS
11N20SISO	Ant1	5825	14.99	93.66	0.28	15.27	≤30.00	PASS
11N40SISO	Ant1	5190	15.34	87.85	0.56	15.90	≤23.98	PASS
11N40SISO	Ant1	5230	16.08	87.85	0.56	16.64	≤23.98	PASS
11N40SISO	Ant1	5270	15.89	87.85	0.56	16.45	≤23.98	PASS
11N40SISO	Ant1	5310	13.71	87.96	0.56	14.27	≤23.98	PASS
11N40SISO	Ant1	5510	14.85	87.96	0.56	15.41	≤23.98	PASS