RF Test Report

Applicant:	Quectel Wireless Solutions Company Limited
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.:	FCMA62N
Brand Name:	QUECTEL
FCC ID:	XMR2024FCMA62N
Standards:	FCC CFR47 Part 15E
Report No.:	PD20240077RF10
Issue Date:	2024/08/15
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
PD20240077RF10	1	Initial Report	2024/08/15	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	15.407(g)	PASS Note1

Date of Testing: 2024/06/14 to 2024/08/15
Date of Sample Received: 2024/06/12

- 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 Company Limited
Applicant Address	Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, China, 200233
Manufacturer	Quectel Wireless Solutions Company Limited
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	FCMA62N	
SN	Conducted	E1Y24E64X000025 E1Y24E64X000061
	Radiated	E1Y24E64X000047 E1Y24E64X000060
Hardware Version	R1.0	
Software Version	/	
Antenna Type	PCB Antenna	
Max. Conducted Power	Wi-Fi 5G: 18.75dBm	
WLAN Mode Supported:	802.11a 802.11n 20M 802.11ac 20M 802.11ax 20M	
Antenna Gain	5150MHz to 5250MHz: -0.35dBi 5250MHz to 5350MHz: 1.14dBi 5470MHz to 5725MHz: 1.03dBi 5725MHz to 5850MHz: -0.29dBi	
Directional Gain	NA	
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 5.0Vdc
Modulation Type	802.11a/n/ac/ax: OFDM, DBPSK, DQPSK, BPSK, QPSK, 16QAM, 64QAM, 256QAM
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
802.11ac 20M	MCS0
802.11ax 20M	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
	U-NII-2A	20MHz	52	5260 MHz
			56	5280 MHz
			60	5300 MHz
			64	5320 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
	U-NII-3	20MHz	149	5745 MHz
			153	5765 MHz
			157	5785 MHz
			161	5805 MHz
			165	5825 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
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
Anechoic Chamber	ETS.LINDGREN	Fact 3-2m	PWB0003	3 Years	2026/06/05
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 24.2
Humidity [%RH]	47 to 55
Pressure [kPa]	100.2 to 101.4

Anechoic Chamber

Temperature [°C]	20.1 to 27.1
Humidity [%RH]	42 to 62
Pressure [kPa]	99.4 to 100.9

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.

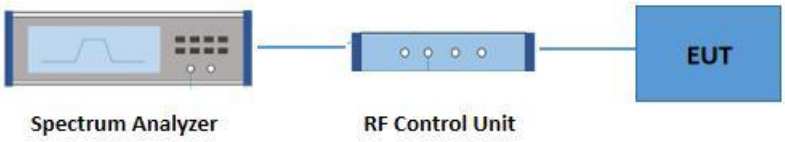
4.1.2 Measuring Instruments

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

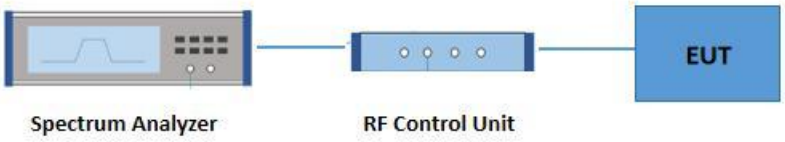
The testing follows Method PM of FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.

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.

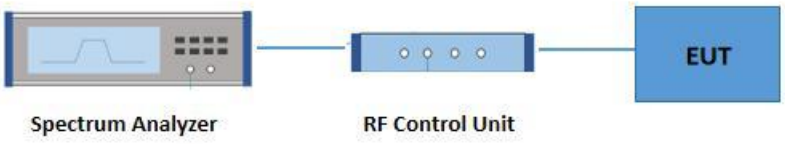
5.If measurement bandwidth of Maximum PSD is specified in 500 kHz, add 10 log (500 kHz/RBW) to the measured result, whereas RBW (<500 kHz) is the reduced resolution bandwidth of the spectrum analyzer set during measurement.

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.

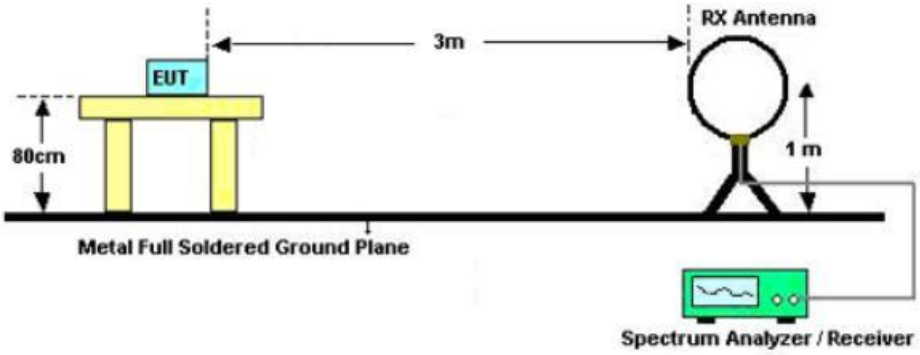
4.. The antenna is a broadband antenna and its height is adjusted between one meter and four.

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

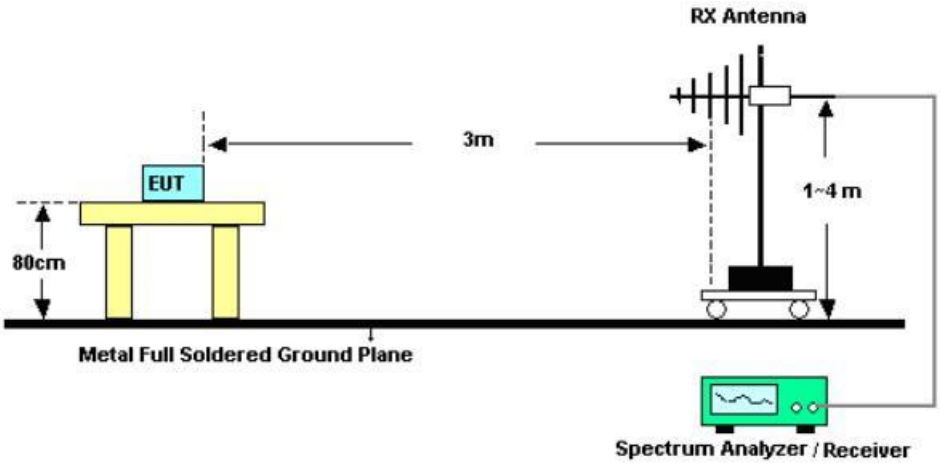
5. For each suspected emission, the EUT was arranged to its worst case and then adjust the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading.
6. For testing below 1GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified,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

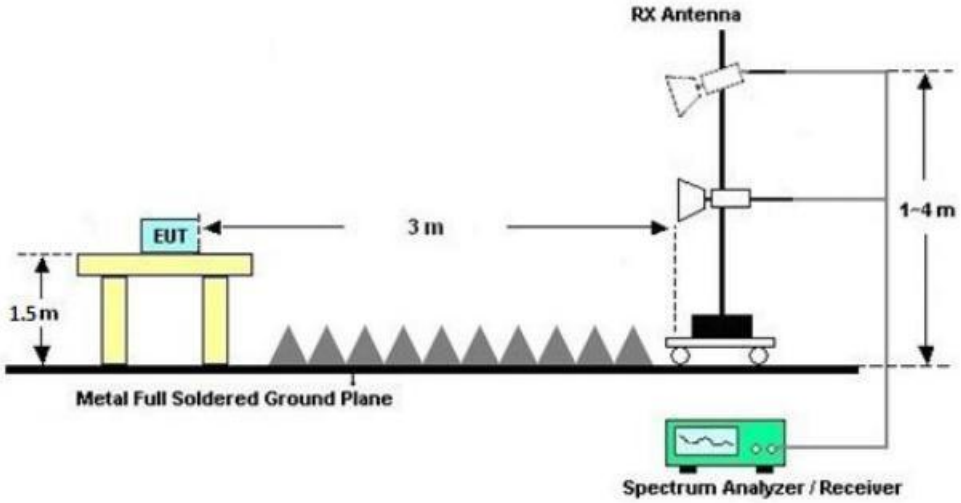
For radiated emissions below 30MHz



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.

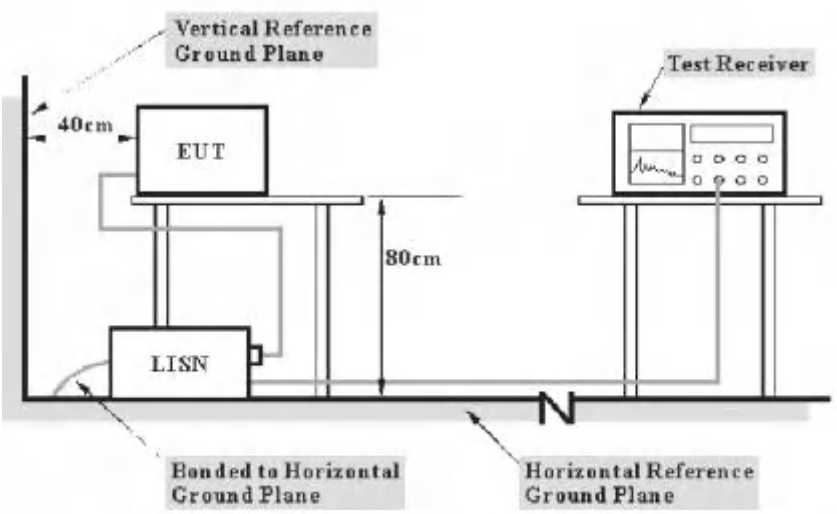
4.5.2 Measuring Instruments

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 1.14dBi.

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	19.960	5170.040	5190.000	---	---
11A	Ant1	5220	19.920	5209.960	5229.880	---	---
11A	Ant1	5240	20.320	5229.960	5250.280	---	---
11A	Ant1	5260	19.800	5250.120	5269.920	---	---
11A	Ant1	5300	20.440	5289.760	5310.200	---	---
11A	Ant1	5320	20.280	5309.920	5330.200	---	---
11A	Ant1	5500	19.880	5490.000	5509.880	---	---
11A	Ant1	5580	19.880	5570.200	5590.080	---	---
11A	Ant1	5700	19.800	5690.000	5709.800	---	---
11A	Ant1	5720	19.640	5710.120	5729.760	---	---
11A	Ant1	5720_UNII-2C	14.88	5710.120	5725	---	---
11A	Ant1	5720_UNII-3	4.76	5725	5729.760	---	---
11A	Ant1	5745	19.720	5735.040	5754.760	---	---
11A	Ant1	5785	20.000	5775.080	5795.080	---	---
11A	Ant1	5825	20.200	5814.800	5835.000	---	---
11N20SISO	Ant1	5180	20.280	5169.720	5190.000	---	---
11N20SISO	Ant1	5220	20.920	5209.560	5230.480	---	---
11N20SISO	Ant1	5240	20.560	5229.560	5250.120	---	---
11N20SISO	Ant1	5260	20.240	5250.080	5270.320	---	---
11N20SISO	Ant1	5300	20.240	5289.760	5310.000	---	---
11N20SISO	Ant1	5320	20.600	5309.640	5330.240	---	---
11N20SISO	Ant1	5500	19.840	5490.040	5509.880	---	---
11N20SISO	Ant1	5580	20.160	5570.000	5590.160	---	---
11N20SISO	Ant1	5700	20.360	5689.760	5710.120	---	---
11N20SISO	Ant1	5720	20.320	5709.880	5730.200	---	---
11N20SISO	Ant1	5720_UNII-2C	15.12	5709.880	5725	---	---
11N20SISO	Ant1	5720_UNII-3	5.2	5725	5730.200	---	---
11N20SISO	Ant1	5745	20.120	5735.040	5755.160	---	---
11N20SISO	Ant1	5785	20.040	5774.960	5795.000	---	---
11N20SISO	Ant1	5825	20.440	5814.640	5835.080	---	---
11AC20SISO	Ant1	5180	20.440	5169.960	5190.400	---	---
11AC20SISO	Ant1	5220	20.360	5209.880	5230.240	---	---
11AC20SISO	Ant1	5240	20.520	5229.880	5250.400	---	---

11AC20SISO	Ant1	5260	20.240	5249.960	5270.200	---	---
11AC20SISO	Ant1	5300	20.200	5289.880	5310.080	---	---
11AC20SISO	Ant1	5320	20.840	5309.640	5330.480	---	---
11AC20SISO	Ant1	5500	19.960	5490.000	5509.960	---	---
11AC20SISO	Ant1	5580	20.320	5569.880	5590.200	---	---
11AC20SISO	Ant1	5700	19.880	5690.040	5709.920	---	---
11AC20SISO	Ant1	5720	19.880	5709.960	5729.840	---	---
11AC20SISO	Ant1	5720_UNII-2C	15.04	5709.960	5725	---	---
11AC20SISO	Ant1	5720_UNII-3	4.84	5725	5729.840	---	---
11AC20SISO	Ant1	5745	20.160	5735.040	5755.200	---	---
11AC20SISO	Ant1	5785	20.280	5774.840	5795.120	---	---
11AC20SISO	Ant1	5825	20.360	5814.840	5835.200	---	---
11AX20SISO	Ant1	5180	20.840	5169.480	5190.320	---	---
11AX20SISO	Ant1	5220	20.080	5209.880	5229.960	---	---
11AX20SISO	Ant1	5240	20.520	5229.640	5250.160	---	---
11AX20SISO	Ant1	5260	20.920	5249.480	5270.400	---	---
11AX20SISO	Ant1	5300	20.760	5289.840	5310.600	---	---
11AX20SISO	Ant1	5320	20.360	5309.880	5330.240	---	---
11AX20SISO	Ant1	5500	20.600	5489.600	5510.200	---	---
11AX20SISO	Ant1	5580	20.520	5569.680	5590.200	---	---
11AX20SISO	Ant1	5700	20.200	5689.960	5710.160	---	---
11AX20SISO	Ant1	5720	20.120	5709.920	5730.040	---	---
11AX20SISO	Ant1	5720_UNII-2C	15.08	5709.920	5725	---	---
11AX20SISO	Ant1	5720_UNII-3	5.04	5725	5730.040	---	---
11AX20SISO	Ant1	5745	20.400	5734.680	5755.080	---	---
11AX20SISO	Ant1	5785	20.120	5774.920	5795.040	---	---
11AX20SISO	Ant1	5825	20.160	5814.880	5835.040	---	---

Test Result_26dB Bandwidth for AX Part RU

Test Mode	Antenna	Frequency [MHz]	Ru Size	Ru Index	26db BW [MHz]	FL [MHz]	FH [MHz]	Limit [MHz]	Verdict
11AX20SISO	Ant1	5180	26Tone	RU0	16.480	5169.840	5186.320	---	---
11AX20SISO	Ant1	5180	52Tone	RU37	17.600	5170.080	5187.680	---	---
11AX20SISO	Ant1	5180	106Tone	RU53	15.840	5170.080	5185.920	---	---
11AX20SISO	Ant1	5220	26Tone	RU4	17.440	5211.040	5228.480	---	---
11AX20SISO	Ant1	5220	52Tone	RU39	16.360	5211.480	5227.840	---	---
11AX20SISO	Ant1	5220	106Tone	RU53	15.920	5210.080	5226.000	---	---
11AX20SISO	Ant1	5240	26Tone	RU8	18.760	5231.080	5249.840	---	---
11AX20SISO	Ant1	5240	52Tone	RU40	18.200	5231.600	5249.800	---	---

11AX20SISO	Ant1	5240	106Tone	RU54	19.480	5230.720	5250.200	---	---
11AX20SISO	Ant1	5260	26Tone	RU0	19.120	5249.840	5268.960	---	---
11AX20SISO	Ant1	5260	52Tone	RU37	16.680	5250.040	5266.720	---	---
11AX20SISO	Ant1	5260	106Tone	RU53	18.880	5250.080	5268.960	---	---
11AX20SISO	Ant1	5300	26Tone	RU4	15.720	5291.600	5307.320	---	---
11AX20SISO	Ant1	5300	52Tone	RU39	16.680	5291.640	5308.320	---	---
11AX20SISO	Ant1	5300	106Tone	RU53	16.040	5290.240	5306.280	---	---
11AX20SISO	Ant1	5320	26Tone	RU8	18.240	5311.840	5330.080	---	---
11AX20SISO	Ant1	5320	52Tone	RU40	17.160	5312.840	5330.000	---	---
11AX20SISO	Ant1	5320	106Tone	RU54	17.560	5312.480	5330.040	---	---
11AX20SISO	Ant1	5500	26Tone	RU0	13.800	5489.880	5503.680	---	---
11AX20SISO	Ant1	5500	52Tone	RU37	17.240	5490.120	5507.360	---	---
11AX20SISO	Ant1	5500	106Tone	RU53	16.880	5490.080	5506.960	---	---
11AX20SISO	Ant1	5580	26Tone	RU4	16.000	5571.800	5587.800	---	---
11AX20SISO	Ant1	5580	52Tone	RU39	14.640	5573.840	5588.480	---	---
11AX20SISO	Ant1	5580	106Tone	RU53	19.120	5570.000	5589.120	---	---
11AX20SISO	Ant1	5700	26Tone	RU8	18.960	5691.040	5710.000	---	---
11AX20SISO	Ant1	5700	52Tone	RU40	18.400	5691.440	5709.840	---	---
11AX20SISO	Ant1	5700	106Tone	RU54	17.880	5692.360	5710.240	---	---
11AX20SISO	Ant1	5745	26Tone	RU0	18.160	5734.840	5753.000	---	---
11AX20SISO	Ant1	5745	52Tone	RU37	15.920	5735.120	5751.040	---	---
11AX20SISO	Ant1	5745	106Tone	RU53	19.000	5735.040	5754.040	---	---
11AX20SISO	Ant1	5785	26Tone	RU4	17.600	5775.960	5793.560	---	---
11AX20SISO	Ant1	5785	52Tone	RU39	17.880	5776.080	5793.960	---	---
11AX20SISO	Ant1	5785	106Tone	RU53	18.720	5775.120	5793.840	---	---
11AX20SISO	Ant1	5825	26Tone	RU8	18.600	5816.600	5835.200	---	---
11AX20SISO	Ant1	5825	52Tone	RU40	18.440	5816.600	5835.040	---	---
11AX20SISO	Ant1	5825	106Tone	RU54	19.360	5815.760	5835.120	---	---

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	16.440	5736.760	5753.200	0.5	PASS
11A	Ant1	5785	16.280	5776.840	5793.120	0.5	PASS
11A	Ant1	5825	16.360	5816.800	5833.160	0.5	PASS
11N20SISO	Ant1	5745	16.520	5736.840	5753.360	0.5	PASS
11N20SISO	Ant1	5785	17.240	5776.480	5793.720	0.5	PASS
11N20SISO	Ant1	5825	16.920	5816.440	5833.360	0.5	PASS
11AC20SISO	Ant1	5745	17.560	5736.200	5753.760	0.5	PASS

11AC20SISO	Ant1	5785	16.560	5776.800	5793.360	0.5	PASS
11AC20SISO	Ant1	5825	17.600	5816.160	5833.760	0.5	PASS
11AX20SISO	Ant1	5745	17.000	5736.120	5753.120	0.5	PASS
11AX20SISO	Ant1	5785	17.600	5776.000	5793.600	0.5	PASS
11AX20SISO	Ant1	5825	17.680	5816.320	5834.000	0.5	PASS

Test Result_99% Bandwidth

Test Mode	Antenna	Frequency[MHz]	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11A	Ant1	5180	16.783	5171.6016	5188.3846	---	---
11A	Ant1	5220	16.728	5211.6541	5228.3821	---	---
11A	Ant1	5240	16.770	5231.6393	5248.4093	---	---
11A	Ant1	5260	16.729	5251.6226	5268.3516	---	---
11A	Ant1	5300	16.863	5291.5724	5308.4354	---	---
11A	Ant1	5320	16.801	5311.5432	5328.3442	---	---
11A	Ant1	5500	16.768	5491.5832	5508.3512	---	---
11A	Ant1	5580	16.724	5571.6082	5588.3322	---	---
11A	Ant1	5700	16.809	5691.5833	5708.3923	---	---
11A	Ant1	5720	16.828	5711.5944	5728.4224	---	---
11A	Ant1	5720_UNII-2C	13.406	5711.5944	5725	---	---
11A	Ant1	5720_UNII-3	3.422	5725	5728.4224	---	---
11A	Ant1	5745	16.761	5736.5852	5753.3462	---	---
11A	Ant1	5785	16.816	5776.5301	5793.3461	---	---
11A	Ant1	5825	16.815	5816.5913	5833.4063	---	---
11N20SISO	Ant1	5180	17.814	5171.0975	5188.9115	---	---
11N20SISO	Ant1	5220	17.818	5211.0813	5228.8993	---	---
11N20SISO	Ant1	5240	17.798	5231.0964	5248.8944	---	---
11N20SISO	Ant1	5260	17.777	5251.1191	5268.8961	---	---
11N20SISO	Ant1	5300	17.790	5291.0950	5308.8850	---	---
11N20SISO	Ant1	5320	17.751	5311.0956	5328.8466	---	---
11N20SISO	Ant1	5500	17.764	5491.1173	5508.8813	---	---
11N20SISO	Ant1	5580	17.758	5571.1017	5588.8597	---	---
11N20SISO	Ant1	5700	17.776	5691.0947	5708.8707	---	---
11N20SISO	Ant1	5720	17.761	5711.1182	5728.8792	---	---
11N20SISO	Ant1	5720_UNII-2C	13.882	5711.1182	5725	---	---
11N20SISO	Ant1	5720_UNII-3	3.879	5725	5728.8792	---	---
11N20SISO	Ant1	5745	17.787	5736.0713	5753.8583	---	---
11N20SISO	Ant1	5785	17.749	5776.1031	5793.8521	---	---
11N20SISO	Ant1	5825	17.777	5816.0923	5833.8693	---	---
11AC20SISO	Ant1	5180	17.784	5171.1037	5188.8877	---	---

11AC20SISO	Ant1	5220	17.859	5211.0735	5228.9325	---	---
11AC20SISO	Ant1	5240	17.847	5231.0662	5248.9132	---	---
11AC20SISO	Ant1	5260	17.797	5251.1143	5268.9113	---	---
11AC20SISO	Ant1	5300	17.797	5291.0954	5308.8924	---	---
11AC20SISO	Ant1	5320	17.773	5311.0923	5328.8653	---	---
11AC20SISO	Ant1	5500	17.811	5491.0859	5508.8969	---	---
11AC20SISO	Ant1	5580	17.791	5571.0997	5588.8907	---	---
11AC20SISO	Ant1	5700	17.793	5691.0828	5708.8758	---	---
11AC20SISO	Ant1	5720	17.723	5711.1181	5728.8411	---	---
11AC20SISO	Ant1	5720_UNII-2C	13.882	5711.1181	5725	---	---
11AC20SISO	Ant1	5720_UNII-3	3.841	5725	5728.8411	---	---
11AC20SISO	Ant1	5745	17.781	5736.1000	5753.8810	---	---
11AC20SISO	Ant1	5785	17.773	5776.0864	5793.8594	---	---
11AC20SISO	Ant1	5825	17.803	5816.0659	5833.8689	---	---
11AX20SISO	Ant1	5180	18.846	5170.5706	5189.4166	---	---
11AX20SISO	Ant1	5220	18.844	5210.5884	5229.4324	---	---
11AX20SISO	Ant1	5240	18.889	5230.5907	5249.4797	---	---
11AX20SISO	Ant1	5260	18.816	5250.5560	5269.3720	---	---
11AX20SISO	Ant1	5300	18.837	5290.5663	5309.4033	---	---
11AX20SISO	Ant1	5320	18.809	5310.5585	5329.3675	---	---
11AX20SISO	Ant1	5500	18.829	5490.5482	5509.3772	---	---
11AX20SISO	Ant1	5580	18.792	5570.5845	5589.3765	---	---
11AX20SISO	Ant1	5700	18.805	5690.5632	5709.3682	---	---
11AX20SISO	Ant1	5720	18.862	5710.5376	5729.3996	---	---
11AX20SISO	Ant1	5720_UNII-2C	14.462	5710.5376	5725	---	---
11AX20SISO	Ant1	5720_UNII-3	4.4	5725	5729.3996	---	---
11AX20SISO	Ant1	5745	18.829	5735.5629	5754.3919	---	---
11AX20SISO	Ant1	5785	18.861	5775.5373	5794.3983	---	---
11AX20SISO	Ant1	5825	18.867	5815.5621	5834.4291	---	---

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

11AC20SISO-Ant1-5180

11AC20SISO-Ant1-5220

11AC20SISO-Ant1-5240

11AC20SISO-Ant1-5260

11AC20SISO-Ant1-5300

11AC20SISO-Ant1-5320

11AC20SISO-Ant1-5500

11AC20SISO-Ant1-5580

11AC20SISO-Ant1-5700

11AC20SISO-Ant1-5720

11AC20SISO-Ant1-5745

11AC20SISO-Ant1-5785

11AC20SISO-Ant1-5825

11AX20SISO-Ant1-5180

11AX20SISO-Ant1-5220

11AX20SISO-Ant1-5240

11AX20SISO-Ant1-5260

11AX20SISO-Ant1-5300

11AX20SISO-Ant1-5320

11AX20SISO-Ant1-5500

11AX20SISO-Ant1-5580

11AX20SISO-Ant1-5700

11AX20SISO-Ant1-5720

11AX20SISO-Ant1-5745

	
11AX20SISO-Ant1-5785	11AX20SISO-Ant1-5825
	

26dB Occupied Bandwidth for AX Part RU

11AX20SISO-Ant1-5180-26Tone-RU0	11AX20SISO-Ant1-5180-52Tone-RU37
	
11AX20SISO-Ant1-5180-106Tone-RU53	11AX20SISO-Ant1-5220-26Tone-RU4
	
11AX20SISO-Ant1-5220-52Tone-RU39	11AX20SISO-Ant1-5220-106Tone-RU53

11AX20SISO-Ant1-5240-26Tone-RU8

11AX20SISO-Ant1-5240-52Tone-RU40

11AX20SISO-Ant1-5240-106Tone-RU54

11AX20SISO-Ant1-5260-26Tone-RU0

11AX20SISO-Ant1-5260-52Tone-RU37

11AX20SISO-Ant1-5260-106Tone-RU53

11AX20SISO-Ant1-5300-26Tone-RU4

11AX20SISO-Ant1-5300-52Tone-RU39

	
11AX20SISO-Ant1-5300-106Tone-RU53	11AX20SISO-Ant1-5320-26Tone-RU8
	
11AX20SISO-Ant1-5320-52Tone-RU40	11AX20SISO-Ant1-5320-106Tone-RU54
	
11AX20SISO-Ant1-5500-26Tone-RU0	11AX20SISO-Ant1-5500-52Tone-RU37
	
11AX20SISO-Ant1-5500-106Tone-RU53	11AX20SISO-Ant1-5580-26Tone-RU4

11AX20SISO-Ant1-5580-52Tone-RU39

11AX20SISO-Ant1-5580-106Tone-RU53

11AX20SISO-Ant1-5700-26Tone-RU8

11AX20SISO-Ant1-5700-52Tone-RU40

11AX20SISO-Ant1-5700-106Tone-RU54

11AX20SISO-Ant1-5745-26Tone-RU0

11AX20SISO-Ant1-5745-52Tone-RU37

11AX20SISO-Ant1-5745-106Tone-RU53

11AX20SISO-Ant1-5785-26Tone-RU4

11AX20SISO-Ant1-5785-52Tone-RU39

11AX20SISO-Ant1-5785-106Tone-RU53

11AX20SISO-Ant1-5825-26Tone-RU8

11AX20SISO-Ant1-5825-52Tone-RU40

11AX20SISO-Ant1-5825-106Tone-RU54

6dB Bandwidth
U-NII-3

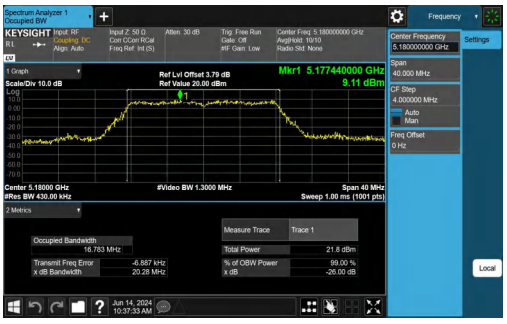
11A-Ant1-5745-PASS	11A-Ant1-5785-PASS
	
11A-Ant1-5825-PASS	11N20SISO-Ant1-5745-PASS
	
11N20SISO-Ant1-5785-PASS	11N20SISO-Ant1-5825-PASS
	
11AC20SISO-Ant1-5745-PASS	11AC20SISO-Ant1-5785-PASS
	
11AC20SISO-Ant1-5825-PASS	11AX20SISO-Ant1-5745-PASS

11AX20SISO-Ant1-5785-PASS

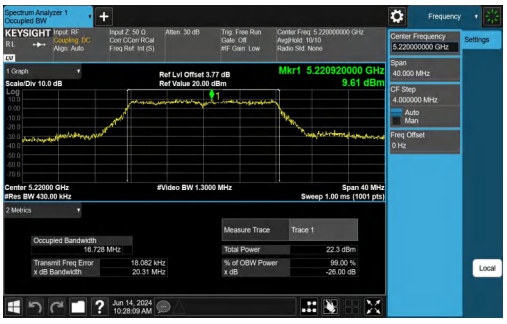
11AX20SISO-Ant1-5825-PASS

99% Bandwidth

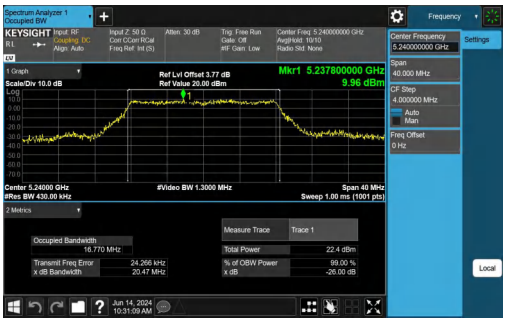
11A-Ant1-5180



11A-Ant1-5220



11A-Ant1-5240



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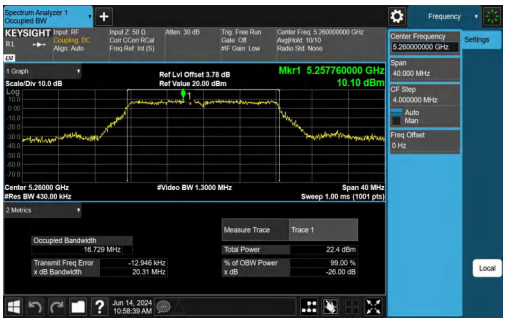
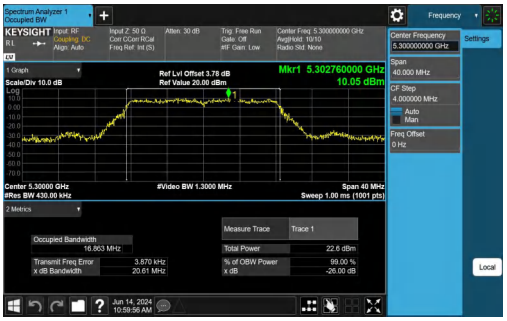


11A-Ant1-5300

11A-Ant1-5320



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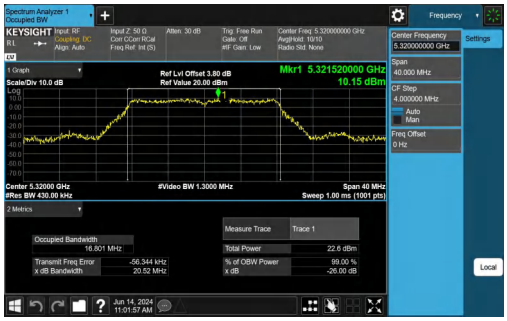

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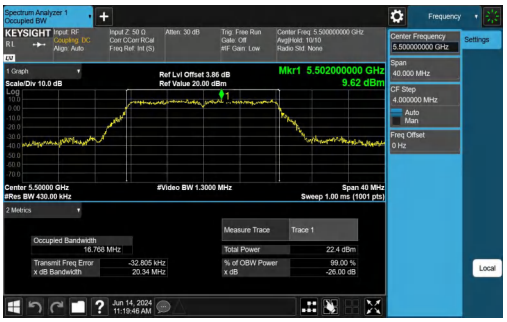

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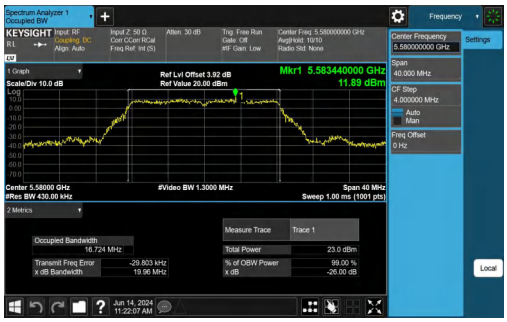

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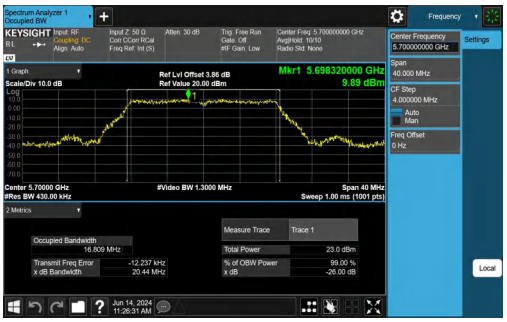

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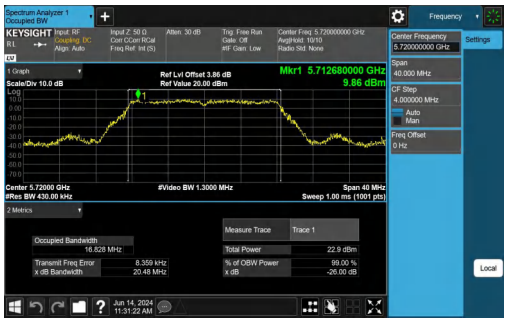

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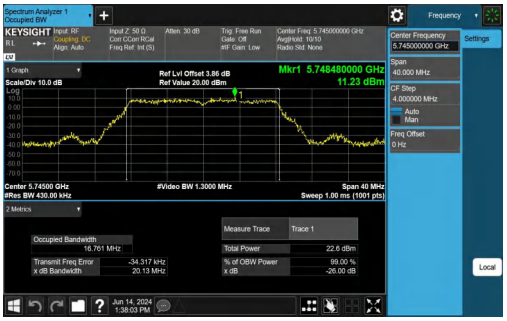

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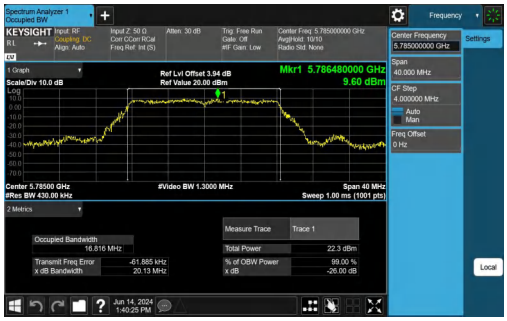

11N20SISO-Ant1-5180