

SPOT CHECK REPORT

FCC PART 96

FCC ID: XMR2021EM121RGL
Application: Quectel Wireless Solutions Company Limited

Application Type: Certification
Product: LTE-A Cat 12 M.2 Module
Model No.: EM121R-GL
Brand Name: Quectel
FCC Rule Part(s): Part 96
Test Procedure(s): ANSI C63.26: 2015
Test Date: April 28, 2021 ~ May 18, 2021

Reviewed By: 

Sunny Sun

Approved By: 

Robin Wu



The test results relate only to the samples tested.

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.26-2015. Test results reported herein relate only to the item(s) tested.

The test report shall not be reproduced except in full without the written approval of MRT Technology (Suzhou) Co., Ltd.

Revision History

Report No.	Version	Description	Issue Date	Note
2104RSU063-U1	Rev. 01	Initial Report	05-30-2021	Valid

Note: This application for certification is leveraging the data reuse procedures from KDB 484596 based on reference FCC ID: XMR2020EM120RGL to cover variant FCC ID: XMR2021EM121RGL.

CONTENTS

Description	Page
1. GENERAL INFORMATION	4
1.1. Applicant	4
1.2. Manufacturer	4
1.3. Testing Facility	4
1.4. Product Information	5
1.5. Radio Specification under Test	5
1.6. Description of Available Antennas.....	6
1.7. Test Methodology	6
1.8. EMI Suppression Device(s)/Modifications.....	6
1.9. Configuration of Tested System	7
1.10. Test Environment Condition.....	7
2. TEST EQUIPMENT CALIBRATION DATE.....	8
3. MEASUREMENT UNCERTAINTY	9
4. TEST RESULT	10
4.1. Summary.....	10
4.2. Equivalent Isotropically Radiated Power Measurement	11
4.2.1. Test Limit	11
4.2.2. Test Procedures Used	11
4.2.3. Test Setting.....	11
4.2.4. Test Setup	12
4.2.5. Test Result.....	13
4.3. Conducted Spurious Emissions.....	14
4.3.1. Test Limit	14
4.3.2. Test Procedure Used	14
4.3.3. Test Setting.....	14
4.3.4. Test Setup	15
4.3.5. Test Result.....	16
5. CONCLUSION	17
Appendix A - Test Setup Photograph	18
Appendix B - EUT Photograph.....	19
Appendix C - Reference Test Report	20

1. GENERAL INFORMATION

1.1. Applicant

Quectel Wireless Solutions Company Limited
 Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District,
 Shanghai, China 200233

1.2. Manufacturer

Quectel Wireless Solutions Company Limited
 Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District,
 Shanghai, China 200233

1.3. Testing Facility

<input checked="" type="checkbox"/>	Test Site - MRT Suzhou Laboratory
	Laboratory Location (Suzhou - Wuzhong)
	D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China
	Laboratory Location (Suzhou - SIP)
	4b Building, Liando U Valley, No.200 Xingpu Rd., Shengpu Town, Suzhou Industrial Park, China
	Laboratory Accreditations
	A2LA: 3628.01 CNAS: L10551
	FCC: CN1166 ISED: CN0001
	VCCI: R-20025, G-20034, C-20020, T-20020
<input type="checkbox"/>	Test Site - MRT Shenzhen Laboratory
	Laboratory Location (Shenzhen)
	1G, Building A, Junxiangda Building, Zhongshanyuan Road West, Nanshan District, Shenzhen, China
	Laboratory Accreditations
	A2LA: 3628.02 CNAS: L10551
	FCC: CN1284 ISED: CN0105
<input type="checkbox"/>	Test Site - MRT Taiwan Laboratory
	Laboratory Location (Taiwan)
	No. 38, Fuxing 2 nd Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)
	Laboratory Accreditations
	TAF: L3261-190725
	FCC: 291082, TW3261 ISED: TW3261

1.4. Product Information

Product Name:	LTE-A Cat 12 M.2 Module
Model No.:	EM121R-GL
Brand Name:	Quectel
IMEI:	862718050001670
Operating Temperature:	-25 ~ 75 °C
Power Type:	3.1 ~ 4.4Vdc, typical 3.7Vdc
UMTS Specification	
Single Band:	Band 2, 5
Modulation:	Uplink up to 16QAM, Downlink up to 64QAM
E-UTRA Specification	
Single Band:	Band 2, 4, 5, 7, 12, 13, 14, 25, 26, 30, 38, 41, 48, 66
Uplink CA Band:	Intra-Band CA_41C
Modulation:	Uplink up to 64QAM, Downlink up to 256QAM

1.5. Radio Specification under Test

Frequency Range:	TDD Band 48: 3550 ~ 3700 MHz
Device Type:	End User Device

Note: For other features of this EUT, test report will be issued separately.

1.6. Description of Available Antennas

Technology	Frequency Range (MHz)	Antenna Type	Max Peak Gain (dBi)
LTE Band 2	1850 ~ 1910	Dipole	1.15
LTE Band 4	1710 ~ 1755		-0.50
LTE Band 5	824 ~ 849		1.85
LTE Band 7	2500 ~ 2570		1.32
LTE Band 12	699 ~ 716		-2.43
LTE Band 13	777 ~ 787		-0.10
LTE Band 14	788 ~ 798		2.40
LTE Band 25	1850 ~ 1915		1.15
LTE Band 26	814 ~ 849		1.85
LTE Band 30	2305 ~ 2315		-3.64
LTE Band 38	2570 ~ 2620		0.93
LTE Band 41	2496 ~ 2690		0.93
LTE Band 48	3550 ~ 3700		-3.37
LTE Band 66	1710 ~ 1780		-0.50

Note: All antenna information (Antenna type and Peak Gain) is provided by the manufacturer.

1.7. Test Methodology

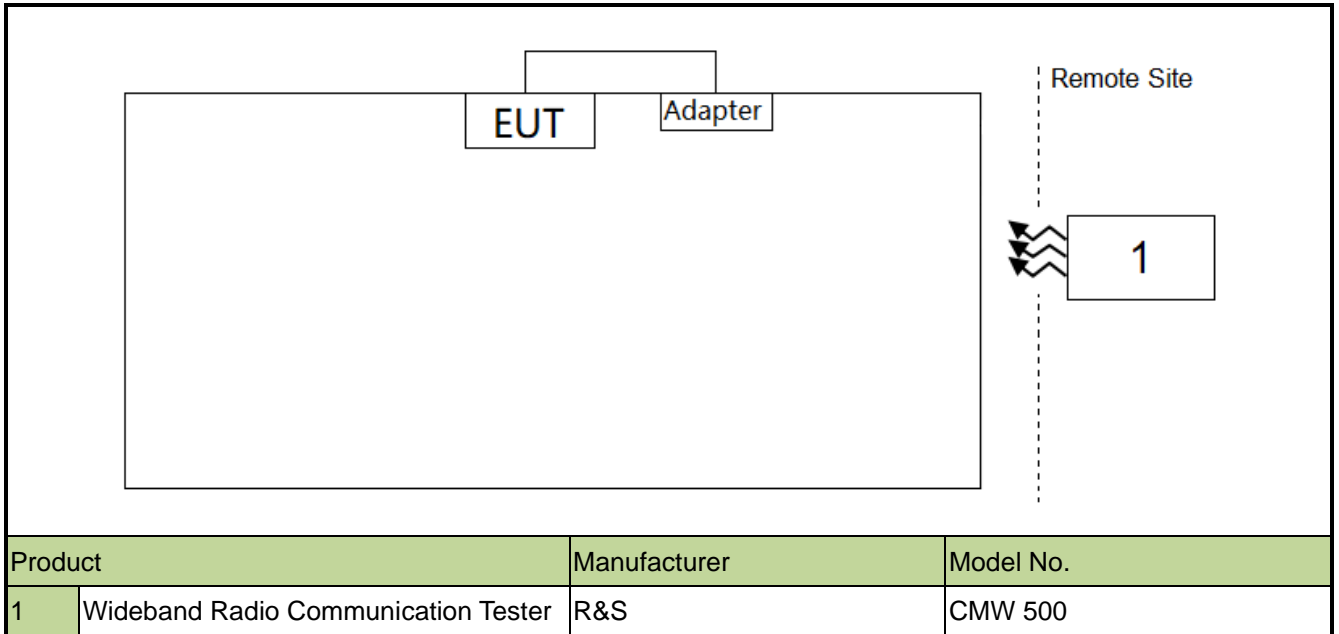
According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ANSI C63.26:2015
- FCC CFR 47 Part 96
- FCC KDB 971168 D01 v03r01: Power Meas License Digital Systems
- FCC KDB 971168 D02 v02r01: Misc Rev Approv License Devices
- FCC KDB 940660 D01 v03 Part 96 CBRS Eqpt
- WINNF-TS-0122 V1.0.0: Test and Certification for Citizens Broadband Radio Service (CBRS); Conformance and Performance Test Technical Specification; CBS/D/DP as Unit Under Test (UUT)

1.8. EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and/or no modifications were made during testing.

1.9. Configuration of Tested System



1.10. Test Environment Condition

Ambient Temperature	15 ~ 35°C
Relative Humidity	20% ~ 75%RH

2. TEST EQUIPMENT CALIBRATION DATE

Conducted Test Equipment (WZ-SR6, WZ-TR3)

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EXA Signal Analyzer	Agilent	N9020A	MRTSUE06106	1 year	2022/04/13
EXA Signal Analyzer	Keysight	N9010B	MRTSUE06452	1 year	2021/07/11
Signal Analyzer	R&S	FSV40	MRTSUE06218	1 year	2022/04/13
Wideband Radio Communication Tester	R&S	CMW 500	MRTSUE06243	1 year	2021/11/07
Power Meter	Agilent	U2021XA	MRTSUE06030	1 year	2021/11/18
DC Power Supply	GWINSTEK	DPS-3303C	MRTSUE06064	N/A	N/A
True RMS Clamp Meter	Fluke	319	MRTSUE06080	1 year	2022/05/05
Directional Coupler	Agilent	87301D	MRTSUE06082	1 year	2022/03/08
Dual Directional Coupler	Agilent	7778D	MRTSUE06083	1 year	2022/03/24
Attenuator	MVE	6dB	MRTSUE06534	1 year	2021/12/12
Attenuator	MVE	10dB	MRTSUE06543	1 year	2021/12/12
Temperature & Humidity Chamber	BAOYT	BYH-150CL	MRTSUE06051	1 year	2021/11/07
Thermohygrometer	testo	608-H1	MRTSUE06401	1 year	2021/08/08

3. MEASUREMENT UNCERTAINTY

Where relevant, the following test uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k = 2$.

Conducted Spurious Emissions
Measuring Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$): 0.78dB
Output Power
Measuring Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$): 1.13dB

4. TEST RESULT

4.1. Summary

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
96.41(b)	Equivalent Isotropic Radiated Power	Refer to section 5.1	Conducted	Pass	Section 4.2
2.1051 96.41(e)	Spurious Emissions	Refer to section 5.2		Pass	Section 4.3

Notes:

- 1) The analyzer plots shown in this section were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables and attenuators used as part of the system to connect the EUT to the analyzer at all frequencies of interest.
- 2) The difference compared with the original report is only different GNSS Bands. Output power and conducted spurious emissions verification worst test refer to original report.

4.2. Equivalent Isotropically Radiated Power Measurement

4.2.1. Test Limit

The maximum effective isotropic radiated power (EIRP) End User Device is 23dBm/10MHz

4.2.2. Test Procedures Used

ANSI C63.26-2015 - Section 5.2.4.4.2 & 5.2.5.5

4.2.3. Test Setting

When the fundamental condition for average power measurements cannot be realized (i.e., the EUT can not be configured to transmit at full-power on a continuous basis (i.e., duty cycle < 98%) and the instrumentation cannot be configured to measure only during active full-power transmissions), then the following procedure can be used if the EUT duty cycle is constant (i.e., duty cycle variations are less than or equal to $\pm 2\%$).

- a) Set span to 2 x to 3 x the OBW.
- b) Set RBW = 1% to 5% of the OBW.
- c) Set VBW $\geq 3 \times$ RBW.
- d) Set number of measurement points in sweep $\geq 2 \times$ span / RBW.
- e) Sweep time:
 - 1) Set = auto-couple, or
 - 2) Set $\geq [10 \times (\text{number of points in sweep}) \times (\text{transmission symbol period})]$ for single sweep (automation-compatible) measurement.
- f) Detector = power averaging (rms).
- g) Set sweep trigger to "free run."
- h) Trace average at least 100 traces in power averaging (rms) mode if sweep is set to auto-couple. To accurately determine the average power over the on and off time of the transmitter, it can be necessary to increase the number of traces to be averaged above 100, or if using a manually configured sweep time, increase the sweep time.
- i) Using the marker function to identify the maximum PSD.
- j) Add $10 \log (1/\text{duty cycle})$ to the measured power level to compute the average power during continuous transmission. For example, add $[10 \log (1/0.25)] = 6 \text{ dB}$ if the duty cycle is a constant 25%.

The relevant equation for determining the maximum ERP or EIRP from the measured RF output

power is given in Equation (1) as follows:

$$\text{ERP or EIRP} = P_{\text{Meas}} + G_{\text{T}} \quad (1)$$

where

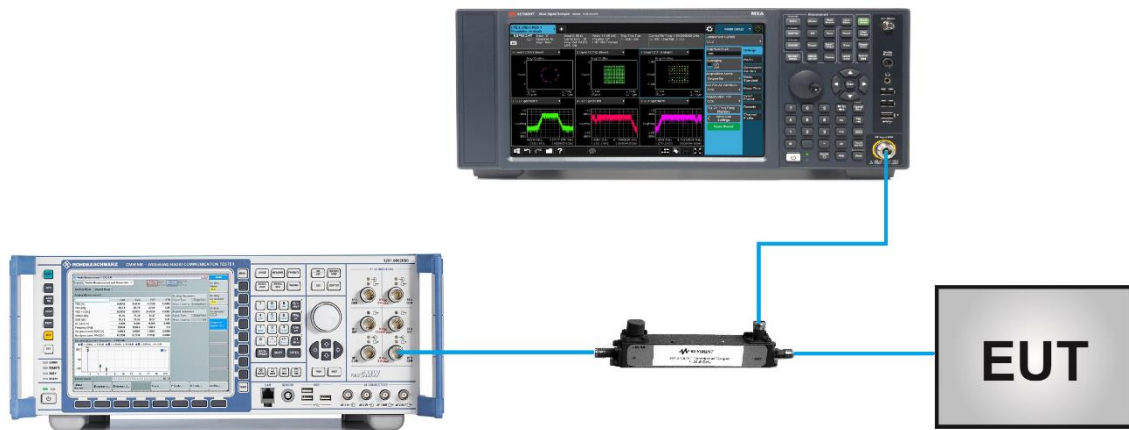
ERP or EIRP effective radiated power or equivalent isotropically radiated power, respectively (expressed in the same units as P_{Meas} , e.g., dBm or dBW)

P_{Meas} measured transmitter output power or PSD, in dBm or dBW

G_{T} gain of the transmitting antenna, in dBd (ERP) or dBi (EIRP)

For devices utilizing multiple antennas, see 6.4 for guidance with respect to determining the effective array transmit antenna gain term to be used in the above equation.

4.2.4. Test Setup



4.2.5. Test Result

Product	LTE-A Cat 12 M.2 Module	Test Site	WZ-SR6
Test Engineer	Larry Yan	Test Date	2021/04/28

Channel No.	Frequency (MHz)	Channel Bandwidth (MHz)	RB Size	RB Offset	Output Power (dBm/10MHz)	EIRP (dBm/10MHz)	Limit (dBm/10MHz)
QPSK							
55265	3552.50	5	25	0	22.47	19.10	<23.00
55900	3625.00				21.89	18.52	<23.00
56715	3697.50				21.42	18.05	<23.00
55290	3555.00	10	50	0	21.85	18.48	<23.00
55900	3625.00				20.99	17.62	<23.00
56690	3695.00				20.76	17.39	<23.00
55315	3557.50	15	75	0	21.25	17.88	<23.00
55990	3625.00				20.50	17.13	<23.00
56665	3692.50				20.31	16.94	<23.00
55340	3560.00	20	100	0	20.01	16.64	<23.00
55990	3625.00				19.47	16.10	<23.00
56640	3690.00				19.31	15.94	<23.00
Note: The EIRP (dBm/10MHz) = Output Power (dBm/10MHz) + Antenna Gain (dBi)							

4.3. Conducted Spurious Emissions

4.3.1. Test Limit

The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10th harmonic. All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst-case configuration. All modes of operation were investigated, and the worst-case configuration results are reported in this section.

The conducted power of any emissions below 3530MHz or above 3720MHz shall not exceed -40dBm/MHz.

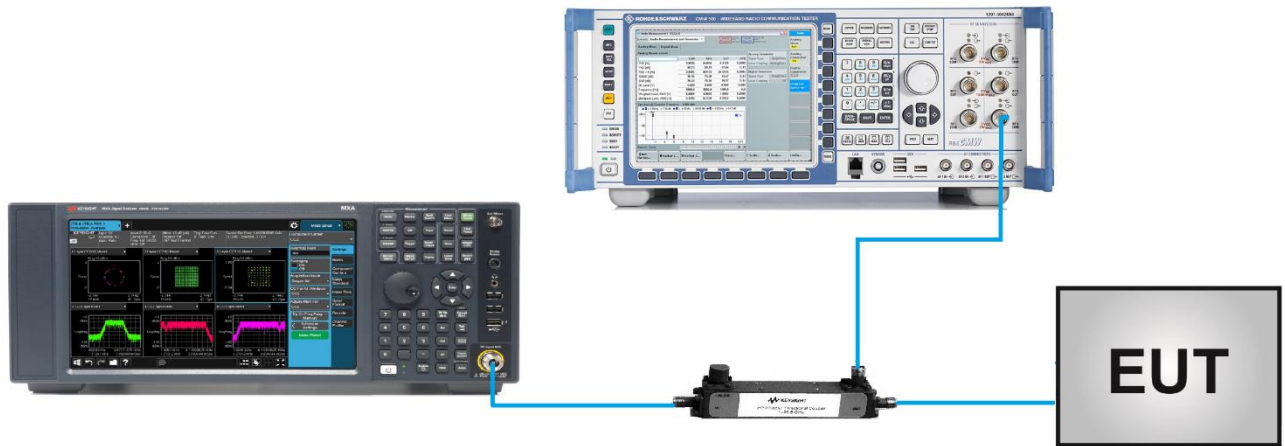
4.3.2. Test Procedure Used

ANSI C63.26-2015 - Section 5.7

4.3.3. Test Setting

1. Set the analyzer frequency to low, mid, high channel.
2. RBW = 1MHz
3. VBW \geq 3*RBW
4. Sweep time = auto
5. Detector = power averaging (rms)
6. Set sweep trigger to "free run."
7. User gate triggered such that the analyzer only sweeps when the device is transmitting at full power.
8. Trace average at least 100 traces in power averaging (rms) mode if sweep is set to auto-couple. To accurately determine the average power over the on and off time of the transmitter, it can be necessary to increase the number of traces to be averaged above 100, or if using a manually configured sweep time, increase the sweep time.

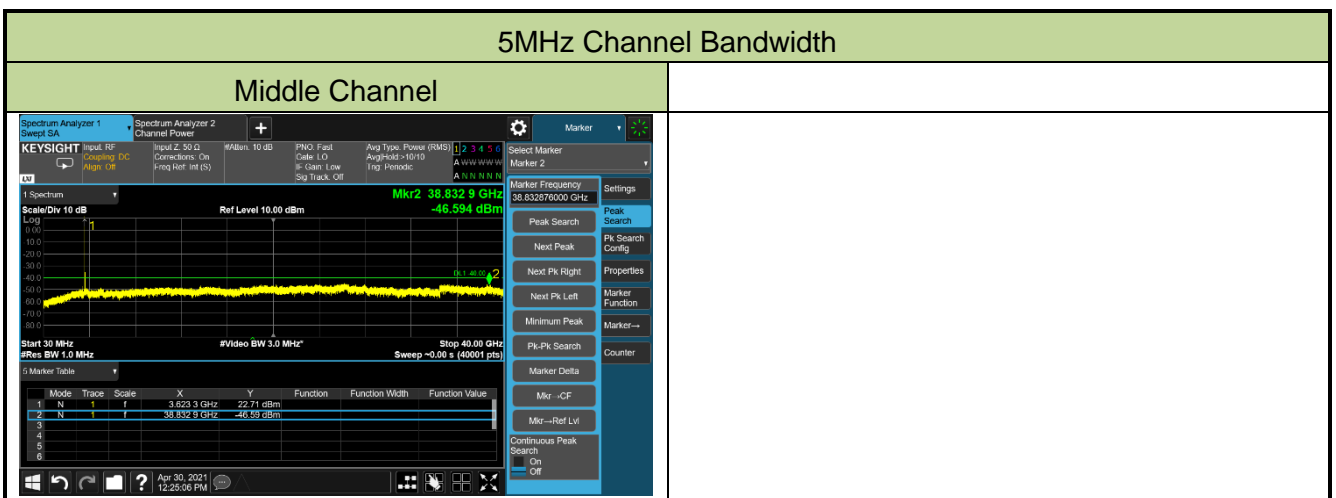
4.3.4. Test Setup



4.3.5. Test Result

Product	LTE-A Cat 12 M.2 Module	Test Site	WZ-SR6
Test Engineer	Edgar Ma	Test Date	2021/04/30

Channel	Frequency (MHz)	Channel Bandwidth (MHz)	Frequency Range (MHz)	Max Spurious Emissions (dBm/MHz)	Limit (dBm/MHz)	Result
QPSK						
55900	3625.0	5	30 ~ 40000	-46.59	≤ -40.00	Pass



5. CONCLUSION

The data collected relate only the item(s) tested and show that unitis compliance with FCC Rules.

Appendix A - Test Setup Photograph

Refer to "2104RSU063-UT" file.

Appendix B - EUT Photograph

Refer to "2104RSU063-UE" file.

Appendix C - Reference Test Report