

MEASUREMENT REPORT

FCC ID: XMR2023EM160RGL
Application: Quectel Wireless Solutions Co., Ltd
Product: LTE-A Cat 16 M.2 Module
Model No.: EM160R-GL
Brand Name: QUECTEL
FCC Rule Part(s): Part 22, 24, 27
Result: Complies
Test Date: 2021-01-10 ~ 2021-01-20

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
2306RSU048-U8	Rev. 01	Initial Report	2023-07-14	Valid

Note: This report is based on MRT report "2101RSU060", FCC ID: XMR2020EM160RGL updating FCC ID.

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2. PRODUCT INFORMATION

2.1. Equipment Description

Product Name:	LTE-A Cat 16 M.2 Module
Model No.:	EM160R-GL
Brand Name:	Quectel
IMEI.:	864292950003514
Single Band:	Band 2, 4, 5, 7, 12, 13, 14, 25, 26, 30, 38, 41, 48, 66
Intra-Band:	CA_41C
Category:	Category 16
Operating Temperature:	-25 ~ 75 °C
Power Type:	3.1 ~ 4.4Vdc, typical 3.7Vdc

2.2. Product Specification Subjective to this Report

FDD T _x Frequency Range:	Band 2: 1850 ~ 1910 MHz; Band 4: 1710 ~ 1755 MHz Band 5: 824 ~ 849 MHz; Band 7: 2500 ~ 2570 MHz Band 12: 699 ~ 716 MHz; Band 13: 777 ~ 787 MHz Band 25: 1850 ~ 1915 MHz; Band 26: 824 ~ 849 MHz Band 66: 1710 ~ 1780 MHz
FDD R _x Frequency Range:	Band 2: 1930 ~ 1990 MHz; Band 4: 2110 ~ 2155 MHz Band 5: 869 ~ 894 MHz; Band 7: 2620 ~ 2690 MHz Band 12: 729 ~ 746 MHz; Band 13: 746 ~ 756 MHz Band 25: 1930 ~ 1995 MHz; Band 26: 869 ~ 894 MHz Band 66: 2110 ~ 2200 MHz
TDD T _x & R _x Frequency Range:	Band 38: 2570 ~ 2620 MHz; Band 41: 2496 ~ 2690 MHz;
Uplink CA Band:	Intra-Band CA_41C
Type of Modulation:	QPSK, 16QAM, 64QAM, 256QAM (DL)

Note 1: For other features of this EUT, test report will be issued separately.

Note 2: The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

Note 3: LTE band 26 transmit frequency for part 90 rule is 814 ~ 824MHz and part 22 rule is 824 ~ 849MHz. ERP over 15MHz bandwidth complies the ERP limit line of part 22 rule, therefore ERP of the partial frequency spectrum which falls within part 22 also complies.

2.3. Device Capabilities

This device contains the following capabilities:

Working on LTE Band 2, 4, 5, 7, 12, 13, 14, 25, 26, 30, 38, 41, 66; Intra-band CA_41C LTE Module. LTE Band 66 (1710 ~ 1780 MHz) overlaps the entire frequency range of LTE Band 4 (1710 ~ 1755 MHz). Therefore, test data provided in this report covers Band 4 as well as Band 66.

LTE Band 25 (1850 ~ 1915 MHz) overlaps the entire frequency range of LTE Band 2 (1850 ~ 1910 MHz). Therefore, test data provided in this report covers Band 2 as well as Band 25.

LTE Band 26 (814 ~ 849 MHz) overlaps the entire frequency range of LTE Band 5 (824 ~ 849 MHz). Therefore, test data provided in this report covers Band 5 as well as Band 26.

LTE Band 41 (2496 ~ 2690 MHz) overlaps the entire frequency range of LTE Band 38 (2570 ~ 2620 MHz). Therefore, test data provided in this report covers Band 38 as well as Band 41.

2.4. Test Methodology

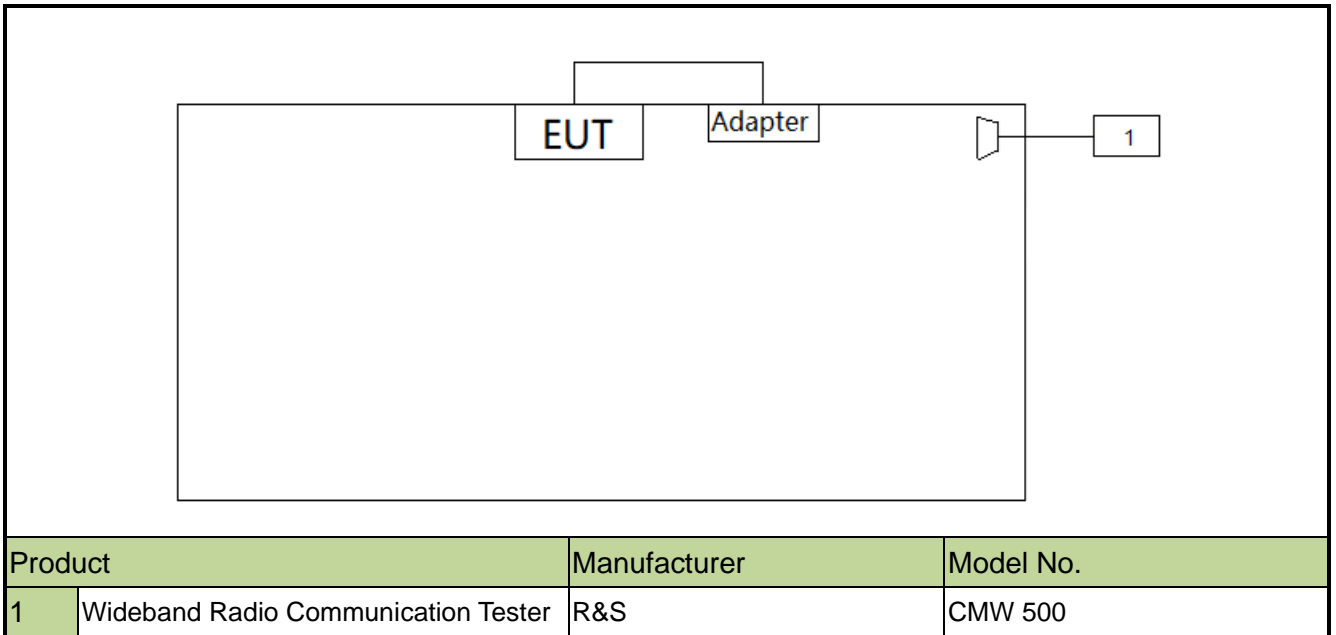
According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ANSI C63.26:2015
- FCC CFR 47 Part 2, Part 22, Part 24, Part 27
- FCC KDB 971168 D01 v03r01: Power Meas License Digital Systems
- FCC KDB 971168 D02 v02r01: Misc Rev Approv License Devices
- FCC KDB 412172 D01 v01r01: Determining ERP and EIRP

2.5. EMI Suppression Device(s)/Modifications

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

2.6. Configuration of Tested System



2.7. Test Environment Condition

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

3. TEST EQUIPMENT CALIBRATION DATE

Radiated Emission (WZ-AC1)

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EMI Test Receiver	R&S	ESR7	MRTSUE06001	1 year	2021/08/01
Wideband Radio Communication Tester	R&S	CMW 500	MRTSUE06243	1 year	2021/11/07
PXA Signal Analyzer	Keysight	9030B	MRTSUE06395	1 year	2021/09/03
Loop Antenna	Schwarzbeck	FMZB 1519	MRTSUE06025	1 year	2021/11/10
Bilog Period Antenna	Schwarzbeck	VULB 9168	MRTSUE06172	1 year	2021/03/31
Broad Band Horn Antenna	Schwarzbeck	BBHA 9120D	MRTSUE06023	1 year	2021/10/13
Broad Band Horn Antenna	Schwarzbeck	BBHA 9170	MRTSUE06597	1 year	2021/02/23
Microwave System Amplifier	Agilent	83017A	MRTSUE06076	1 year	2021/11/15
Preamplifier	Schwarzbeck	BBV 9721	MRTSUE06121	1 year	2021/06/11
Thermohygrometer	Testo	608-H1	MRTSUE06403	1 year	2021/08/08
Anechoic Chamber	TDK	Chamber-AC1	MRTSUE06212	1 year	2021/04/30

Radiated Emission (WZ-AC2)

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
Spectrum Analyzer	Keysight	N9038A	MRTSUE06125	1 year	2021/08/01
Wideband Radio Communication Tester	R&S	CMW 500	MRTSUE06243	1 year	2021/11/07
Loop Antenna	Schwarzbeck	FMZB 1519	MRTSUE06025	1 year	2021/11/10
Bilog Period Antenna	Schwarzbeck	VULB 9162	MRTSUE06022	1 year	2021/10/13
Horn Antenna	Schwarzbeck	BBHA9120D	MRTSUE06171	1 year	2021/10/27
Broad Band Horn Antenna	Schwarzbeck	BBHA 9170	MRTSUE06597	1 year	2021/02/23
Broad Band Coaxial Preamplifier	Schwarzbeck	BBV 9718	MRTSUE06176	1 year	2021/11/15
Preamplifier	Schwarzbeck	BBV 9721	MRTSUE06121	1 year	2021/06/11
Temperature/Humidity Meter	Minggao	ETH529	MRTSUE06170	1 year	2021/12/15
Anechoic Chamber	RIKEN	Chamber-AC2	MRTSUE06213	1 year	2021/04/30

Software	Version	Function
EMI Software	V3	EMI Test Software

4. 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 $k = 2$.

Radiated Emission Measurement

Measurement Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$):

Horizontal: 9kHz~300MHz: 5.04dB

300MHz~1GHz: 4.95dB

1GHz~40GHz: 6.40dB

Vertical: 9kHz~300MHz: 5.24dB

300MHz~1GHz: 6.03dB

1GHz~40GHz: 6.40dB

5. TEST RESULT

5.1. Summary

FCC Part Section(s)	Test Description	Test Condition	Test Result
2.1053, 22.917(a) 24.238(a), 27.53(c) (f) (g) (h)(m)	Spurious Emissions	Radiated	Pass

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) All supported modulation types were evaluated. The worst-case emission of modulation was selected. Therefore, the Frequency Stability, Channel Band Edge, Radiated & Conducted Spurious Emission were presented in the test report.
- 3) This report is based on the original application to change antenna and evaluate the radiated spurious emission.

5.2. Radiated Spurious Emissions Measurements

5.2.1. Test Limit

Out of band emissions: The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB. The emission limit equal to -13dBm.

For Band 7, 38/41, the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $55 + 10 \log(P)$ dB. The emission limit equal to -25dBm.

For LTE Band 13, For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands, emissions in the band 1559-1610 MHz shall be limited to -70 dBW/MHz (-40dBm/MHz) equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW (-50dBm) EIRP for discrete emissions of less than 700 Hz bandwidth.

E (dB μ V/m) = EIRP (dBm) - 20 log D + 104.8; where D is the measurement distance in meters. The emission limit equal to 82.3dB μ V/m or 70.3dB μ V/m.

5.2.2. Test Procedure Used

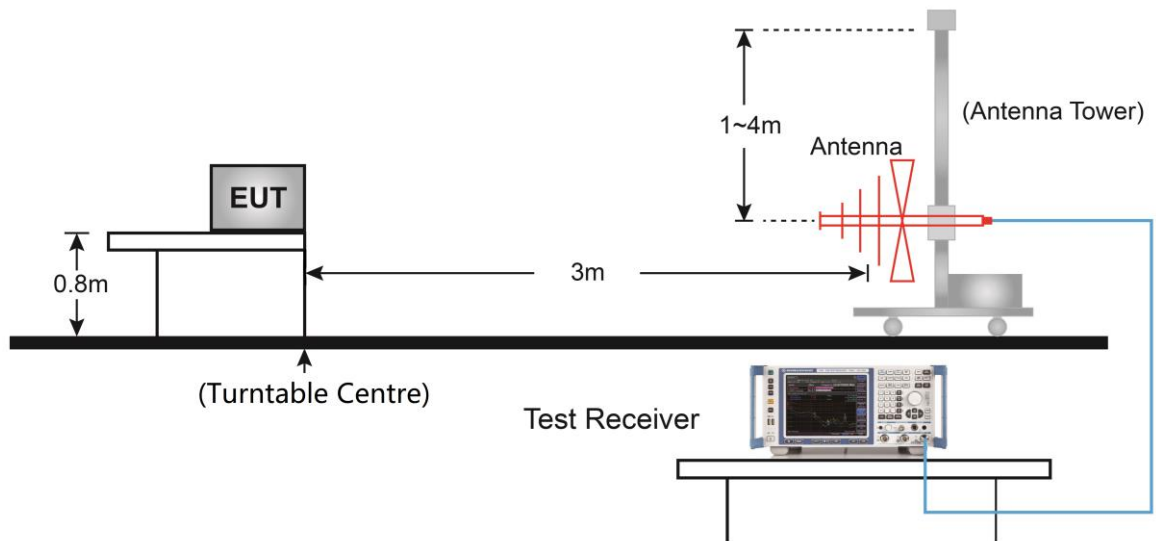
ANSI C63.26-2015 - Section 5.2.7 & 5.5

5.2.3. Test Setting

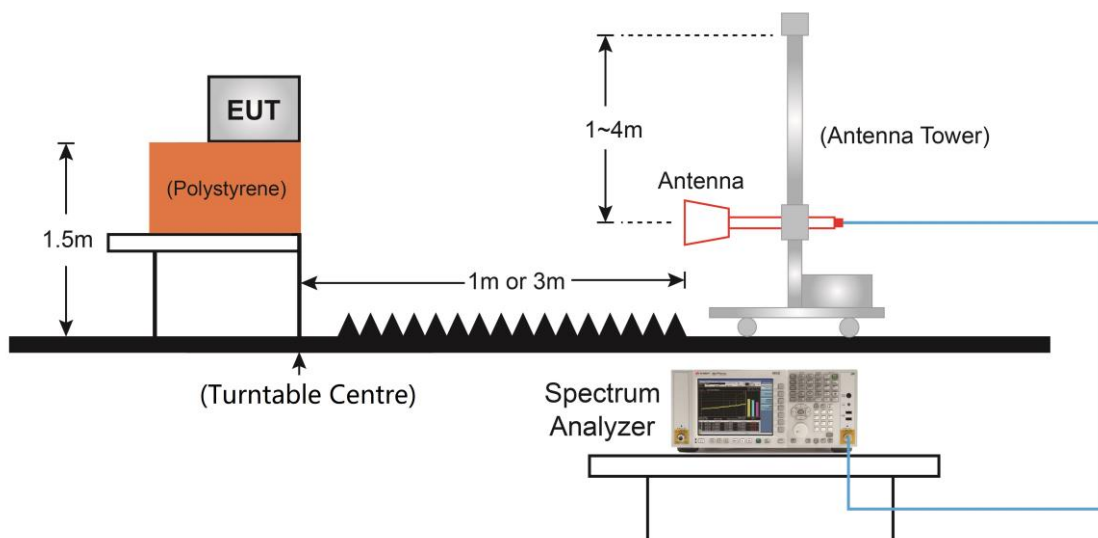
1. RBW = 1MHz
2. VBW \geq 3*RBW
3. Sweep time \geq 10 \times (number of points in sweep) \times (transmission symbol period)
4. Detector = Peak
5. Trace mode = max hold
6. The trace was allowed to stabilize

5.2.4. Test Setup

Below 1GHz Test Setup:



Above 1GHz Test Setup:



5.2.5. Test Result

Product	LTE-A Cat 16 M.2 Module	Test Site	WZ-AC2
Test Engineer	Buter Shi	Test Date	2021/01/16
Test Band	LTE Band 2/25 - 1.4MHz Bandwidth, 1RB, QPSK		

Frequency (MHz)	Reading Level (dB μ V)	Factor (dB)	Measure Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Detector	Polarization
Bottom CH 26047 (1850.7MHz)							
3703.0	56.9	1.0	57.9	82.3	-24.4	Peak	Horizontal
9908.0	33.2	15.6	48.8	82.3	-33.5	Peak	Horizontal
3703.0	60.8	1.0	61.8	82.3	-20.5	Peak	Vertical
10605.0	31.4	17.8	49.2	82.3	-33.1	Peak	Vertical
Middle CH 26365 (1882.5MHz)							
3762.5	46.8	0.7	47.5	82.3	-34.8	Peak	Horizontal
9219.5	32.0	14.9	46.9	82.3	-35.4	Peak	Horizontal
3762.5	48.8	0.7	49.5	82.3	-32.8	Peak	Vertical
7392.0	31.6	12.3	43.9	82.3	-38.4	Peak	Vertical
Top CH 26683 (1914.3MHz)							
3830.5	48.1	0.7	48.8	82.3	-33.5	Peak	Horizontal
6652.5	34.2	9.3	43.5	82.3	-38.8	Peak	Horizontal
3830.5	49.4	0.7	50.1	82.3	-32.2	Peak	Vertical
9568.0	36.6	14.8	51.4	82.3	-30.9	Peak	Vertical
Note: Measure Level (dBm) = Reading Level (dBm) + Factor (dB).							

Product	LTE-A Cat 16 M.2 Module	Test Site	WZ-AC2
Test Engineer	Buter Shi	Test Date	2021/01/16
Test Band	LTE Band 4/66 - 1.4MHz Bandwidth, 1RB, QPSK		

Frequency (MHz)	Reading Level (dBμV)	Factor (dB)	Measure Level(dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
Bottom CH 131979 (1710.7MHz)							
9185.5	33.0	15.1	48.1	82.3	-34.2	Peak	Horizontal
10953.5	32.3	18.8	51.1	82.3	-31.2	Peak	Horizontal
4034.5	36.3	1.5	37.8	82.3	-44.5	Peak	Vertical
10248.0	33.4	16.5	49.9	82.3	-32.4	Peak	Vertical
Middle CH 132322 (1745.0MHz)							
8004.0	32.4	12.6	45.0	82.3	-37.3	Peak	Horizontal
13894.5	30.5	23.7	54.2	82.3	-28.1	Peak	Horizontal
3490.5	40.7	0.3	41.0	82.3	-41.3	Peak	Vertical
4034.5	37.5	1.5	39.0	82.3	-43.3	Peak	Vertical
Top CH 132665 (1779.3MHz)							
3558.5	47.7	0.5	48.2	82.3	-34.1	Peak	Horizontal
7043.5	32.6	11.4	44.0	82.3	-38.3	Peak	Horizontal
3558.5	53.1	0.5	53.6	82.3	-28.7	Peak	Vertical
7604.5	32.3	12.3	44.6	82.3	-37.7	Peak	Vertical
Note: Measure Level (dBm) = Reading Level (dBm) + Factor (dB).							

Product	LTE-A Cat 16 M.2 Module	Test Site	WZ-AC2
Test Engineer	Buter Shi	Test Date	2021/01/16
Test Band	LTE Band 5/26 - 1.4MHz Bandwidth, 1RB, QPSK		

Frequency (MHz)	Reading Level (dBμV)	Factor (dB)	Measure Level(dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
Bottom CH 26697 (814.7MHz)							
7536.5	31.7	12.2	43.9	82.3	-38.4	Peak	Horizontal
12194.5	30.6	20.5	51.1	82.3	-31.2	Peak	Horizontal
6644.0	33.5	9.2	42.7	82.3	-39.6	Peak	Vertical
10724.0	31.6	18.3	49.9	82.3	-32.4	Peak	Vertical
Middle CH 26865 (831.5MHz)							
7681.0	32.3	12.2	44.5	82.3	-37.8	Peak	Horizontal
12237.0	30.7	20.9	51.6	82.3	-30.7	Peak	Horizontal
8029.5	32.4	12.6	45.0	82.3	-37.3	Peak	Vertical
12228.5	30.4	21.4	51.8	82.3	-30.5	Peak	Vertical
Top CH 27033 (848.3MHz)							
2411.0	37.7	-0.8	36.9	82.3	-45.4	Peak	Horizontal
7757.5	32.3	12.2	44.5	82.3	-37.8	Peak	Horizontal
7162.5	32.4	11.8	44.2	82.3	-38.1	Peak	Vertical
10885.5	31.0	18.4	49.4	82.3	-32.9	Peak	Vertical

Note: Measure Level (dBm) = Reading Level (dBm) + Factor (dB).

Product	LTE-A Cat 16 M.2 Module	Test Site	WZ-AC2
Test Engineer	Buter Shi	Test Date	2021/01/16
Test Band	LTE Band 7 - 5MHz Bandwidth, 1RB, QPSK		

Frequency (MHz)	Reading Level (dBμV)	Factor (dB)	Measure Level(dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
Bottom CH 20775 (2502.5MHz)							
4102.5	36.3	1.9	38.2	70.3	-32.1	Peak	Horizontal
8624.5	32.8	13.4	46.2	70.3	-24.1	Peak	Horizontal
5573.0	34.7	5.2	39.9	70.3	-30.4	Peak	Vertical
11752.5	31.4	20.0	51.4	70.3	-18.9	Peak	Vertical
Middle CH 21100 (2535.0MHz)							
5607.0	35.4	5.0	40.4	70.3	-29.9	Peak	Horizontal
12636.5	32.0	20.1	52.1	70.3	-18.2	Peak	Horizontal
7035.0	32.7	11.5	44.2	70.3	-26.1	Peak	Vertical
12279.5	31.9	21.0	52.9	70.3	-17.4	Peak	Vertical
Top CH 21425 (2567.5MHz)							
5573.0	34.6	5.2	39.8	70.3	-30.5	Peak	Horizontal
12636.5	32.4	20.1	52.5	70.3	-17.8	Peak	Horizontal
5377.5	37.4	4.5	41.9	70.3	-28.4	Peak	Vertical
10953.5	32.4	18.8	51.2	70.3	-19.1	Peak	Vertical
Note: Measure Level (dBm) = Reading Level (dBm) + Factor (dB).							

Product	LTE-A Cat 16 M.2 Module	Test Site	WZ-AC2
Test Engineer	Buter Shi	Test Date	2021/01/16
Test Band	LTE Band 12 - 1.4MHz Bandwidth, 1RB, QPSK		

Frequency (MHz)	Reading Level (dBμV)	Factor (dB)	Measure Level(dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
Bottom CH 23017 (699.7MHz)							
6015.0	33.6	7.0	40.6	82.3	-41.7	Peak	Horizontal
11693.0	31.3	20.5	51.8	82.3	-30.5	Peak	Horizontal
2411.0	40.0	-0.8	39.2	82.3	-43.1	Peak	Vertical
7553.5	32.3	12.3	44.6	82.3	-37.7	Peak	Vertical
Bottom CH 23095 (707.5MHz)							
7672.5	32.4	12.1	44.5	82.3	-37.8	Peak	Horizontal
12271.0	30.8	21.4	52.2	82.3	-30.1	Peak	Horizontal
2411.0	38.6	-0.8	37.8	82.3	-44.5	Peak	Vertical
8046.5	32.5	12.7	45.2	82.3	-37.1	Peak	Vertical
Bottom CH 23173 (715.3MHz)							
2411.0	37.5	-0.8	36.7	82.3	-45.6	Peak	Horizontal
7995.5	32.9	12.5	45.4	82.3	-36.9	Peak	Horizontal
2411.0	38.7	-0.8	37.9	82.3	-44.4	Peak	Vertical
6652.5	33.2	9.3	42.5	82.3	-39.8	Peak	Vertical

Note: Measure Level (dBm) = Reading Level (dBm) + Factor (dB).

Product	LTE-A Cat 16 M.2 Module	Test Site	WZ-AC2
Test Engineer	Buter Shi	Test Date	2021/01/16
Test Band	LTE Band 13 - 5MHz Bandwidth, 1RB, QPSK		

Frequency (MHz)	Reading Level (dBμV)	Factor (dB)	Measure Level(dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
Bottom CH 2305 (779.5MHz)							
2411.0	37.7	-0.8	36.9	82.3	-45.4	Peak	Horizontal
7562.0	32.8	12.2	45.0	82.3	-37.3	Peak	Horizontal
2411.0	39.5	-0.8	38.7	82.3	-43.6	Peak	Vertical
14005.0	31.2	23.3	54.5	82.3	-27.8	Peak	Vertical
Middle CH 23230 (782.0MHz)							
9109.0	31.3	14.9	46.2	82.3	-36.1	Peak	Horizontal
14285.5	30.6	24.5	55.1	82.3	-27.2	Peak	Horizontal
2411.0	38.7	-0.8	37.9	82.3	-44.4	Peak	Vertical
5802.5	33.0	5.9	38.9	82.3	-43.4	Peak	Vertical
Top CH 23255 (784.5MHz)							
3397.0	37.2	-0.1	37.1	82.3	-45.2	Peak	Horizontal
7137.0	32.2	11.6	43.8	82.3	-38.5	Peak	Horizontal
7545.0	32.9	12.3	45.2	82.3	-37.1	Peak	Vertical
12194.5	31.1	20.5	51.6	82.3	-30.7	Peak	Vertical
Note: Measure Level (dBm) = Reading Level (dBm) + Factor (dB).							

Product	LTE-A Cat 16 M.2 Module	Test Site	WZ-AC2
Test Engineer	Buter Shi	Test Date	2021/01/16
Test Band	LTE Band 38/41 For HPUE - 5MHz Bandwidth, 1RB, QPSK		

Frequency (MHz)	Reading Level (dBμV)	Factor (dB)	Measure Level(dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
Bottom CH 39675 (2498.5MHz)							
5564.5	35.0	5.1	40.1	70.3	-30.2	Peak	Horizontal
10273.5	32.6	17.0	49.6	70.3	-20.7	Peak	Horizontal
5573.0	35.2	5.2	40.4	70.3	-29.9	Peak	Vertical
12211.5	30.7	21.0	51.7	70.3	-18.6	Peak	Vertical
Middle CH 40620 (2593.0MHz)							
9194.0	32.7	15.2	47.9	70.3	-22.4	Peak	Horizontal
14345.0	32.0	24.3	56.3	70.3	-14.0	Peak	Horizontal
4723.0	34.0	4.0	38.0	70.3	-32.3	Peak	Vertical
9109.0	31.4	14.9	46.3	70.3	-24.0	Peak	Vertical
Top CH 40565 (2687.5MHz)							
7494.0	32.7	12.2	44.9	70.3	-25.4	Peak	Horizontal
13903.0	30.3	24.0	54.3	70.3	-16.0	Peak	Horizontal
5233.0	35.4	4.1	39.5	70.3	-30.8	Peak	Vertical
10681.5	32.6	18.0	50.6	70.3	-19.7	Peak	Vertical

Note: Measure Level (dBm) = Reading Level (dBm) + Factor (dB).

6. CONCLUSION

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

Appendix A - Test Setup Photograph

Refer to "2306RSU048-UT" file.

Appendix B - EUT Photograph

Refer to "2306RSU048-UE" file.