

SPOT CHECK REPORT

FCC ID: XMR2022EM060KGL
Applicant: Quectel Wireless Solutions Co., Ltd
Product: LTE-A Cat 6 M.2 Module
Model No.: EM060K-GL
Brand Name: Quectel
FCC Rule(s): Part 2, 22 (H), 24 (E), 27
Result: Complies
Received Date: 2023-09-22
Test Date: 2023-09-29 ~ 2023-10-09

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 |
|---------------|---------|----------------|------------|-------|
| 2309RSU052-U6 | V01 | Initial Report | 2023-10-26 | Valid |
| | | | | |

Note: This report is prepared for FCC Class II permissive supplement to FCC ID: XMR2022EM060KGL adding a new antenna & modify the tune up power and related data.

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1.4. Product Information

| | |
|-----------------------------|---|
| Product Name | LTE-A Cat 6 M.2 Module |
| Model No. | EM060K-GL |
| Brand Name | Quectel |
| IMEI | Conducted sample: 867228050091049 Radiated sample: 857228050091213 |
| 3GPP Specification | WCDMA Band II/IV/V LTE FDD Band 2, 4, 5, 7, 12, 13, 14, 17, 25, 26, 30, 66, 71 LTE TDD Band 38, 41, 42, 43, 46, 48 |
| GNSS Specification | GPS, GLONASS, Bei Dou, Galileo |
| Temperature Operating Range | -25 ~ 75 °C |
| Power Supply Rating | 3.135 ~ 4.4Vdc, typical 3.7Vdc |
| Remark: | The information of EUT was provided by the manufacturer, and the accuracy of the information shall be the responsibility of the manufacturer. |

1.5. Radio Specification under Test

| | |
|---------------------|--|
| UMTS Specification | |
| TX Frequency Range: | WCDMA Band II: 1850 ~ 1910MHz, WCDMA Band IV: 1710 ~ 1755MHz WCDMA Band V: 824 ~ 849MHz |
| RX Frequency Range: | WCDMA Band II: 1930 ~ 1990MHz, WCDMA Band IV: 2110 ~ 2155MHz WCDMA Band V: 869 ~ 894MHz |
| Modulation | UL up to 16QAM, DL up to 64QAM |
| Power Class | 3 |
| Category | HSDPA: 24; HSUPA: 6 |

1.6. Description of Available Antennas

| Technology | Frequency Range (MHz) | Antenna Type | Max Peak Gain (dBi) |
|---------------|-----------------------|----------------|---------------------|
| WCDMA Band II | 1850 ~ 1910 | Dipole PIFA | 0.25 |
| WCDMA Band IV | 1710 ~ 1755 | | 1.47 |
| WCDMA Band V | 824 ~ 849 | | 1.10 |

Note 1: All antenna information (Antenna type and Peak Gain) is provided by the manufacturer.

Note 2: The typical antennas used to calculate the ERP (EIRP).

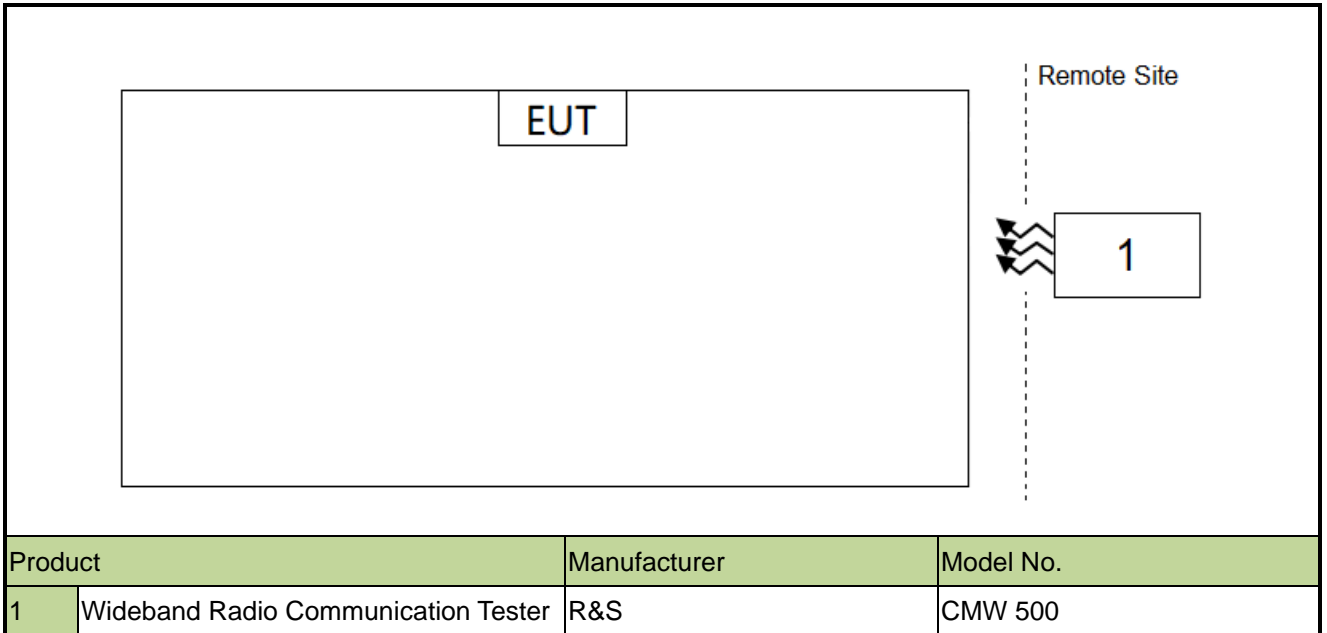
1.7. Test Methodology

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 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. Test Configuration

2.1. Test System Connection Diagram



2.2. Test Environment Condition

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

3. Measuring Instrument

| Instrument | Manufacturer | Model No. | Asset No. | Cali. Interval | Cali. Due Date | Test Site |
|----------------------|--------------|-------------|-------------|----------------|----------------|-----------|
| TRILOG Antenna | Schwarzbeck | VULB 9162 | MRTSUE06022 | 1 year | 2024-05-15 | WZ-AC2 |
| Loop Antenna | Schwarzbeck | FMZB 1519 | MRTSUE06025 | 1 year | 2024-09-17 | WZ-AC2 |
| EMI Test Receiver | Agilent | N9038A | MRTSUE06125 | 1 year | 2024-05-23 | WZ-AC2 |
| Thermohygrometer | Mingle | ETH529 | MRTSUE06170 | 1 year | 2023-11-27 | WZ-AC2 |
| Horn Antenna | Schwarzbeck | BBHA 9120D | MRTSUE06171 | 1 year | 2023-10-13 | WZ-AC2 |
| Preamplifier | Schwarzbeck | BBV 9718 | MRTSUE06176 | 1 year | 2024-05-07 | WZ-AC2 |
| Anechoic Chamber | RIKEN | WZ-AC2 | MRTSUE06213 | 1 year | 2024-04-20 | WZ-AC2 |
| Horn Antenna | ETS | 3117 | MRTSUE06257 | 1 year | 2024-09-23 | WZ-AC2 |
| Horn Antenna | Schwarzbeck | BBHA 9170 | MRTSUE06597 | 1 year | 2023-11-05 | WZ-AC2 |
| Preamplifier | EMCI | EMC184045SE | MRTSUE06640 | 1 year | 2024-01-12 | WZ-AC2 |
| Preamplifier | EMCI | EMC051845SE | MRTSUE06987 | 1 year | 2024-09-07 | WZ-AC2 |
| Thermohygrometer | testo | 608-H1 | MRTSUE11038 | 1 year | 2023-11-01 | WZ-AC2 |
| Communication Tester | R&S | CMW500 | MRTSUE06243 | 1 year | 2024-09-27 | SIP-SR1 |
| Communication Tester | R&S | CMW500 | MRTSUE06243 | 1 year | 2023-10-08 | SIP-SR1 |
| Thermohygrometer | testo | 622 | MRTSUE06629 | 1 year | 2024-01-03 | SIP-SR1 |
| Communication Tester | R&S | CMW500 | MRTSUE06881 | 1 year | 2024-05-23 | SIP-SR1 |
| DC POWER MODULE | Keysight | N6743B | MRTSUE06905 | N/A | N/A | SIP-SR1 |
| DC POWER MODULE | Keysight | N6743B | MRTSUE06906 | N/A | N/A | SIP-SR1 |
| Signal Analyzer | Keysight | N9021B | MRTSUE06915 | 1 year | 2023-12-28 | SIP-SR1 |
| Temperature Chamber | BAOYT | BYG-80CL | MRTSUE06932 | 1 year | 2024-02-12 | SIP-SR1 |
| Shielding Room | MIX-BEP | SIP-SR1 | MRTSUE06948 | N/A | N/A | SIP-SR1 |

| Software | Version | Function |
|--------------------|---------|------------------------|
| EMI Software | V3.0.0 | EMI Test Software |
| Controller_MF 7802 | 2.03C | RE Antenna & Turntable |

4. Decision Rules and Measurement Uncertainty

4.1. Decision Rules

The Decision Rule is based on Simple Acceptance in accordance with ISO Guide 98-4: 2012 Clause 8.2. (Measurement uncertainty is not taken into account when stating conformity with a specified requirement.)

4.2. 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 Spurious Emissions | |
|--|----------------------|
| The maximum measurement uncertainty is evaluated as: | |
| Coaxial: | 9kHz~30MHz: 2.59dB |
| Coplanar: | 9kHz~30MHz: 2.60dB |
| Horizontal: | 30MHz~200MHz: 3.85dB |
| | 200MHz~1GHz: 4.36dB |
| | 1GHz~40GHz: 4.98dB |
| Vertical: | 30MHz~200MHz: 4.06dB |
| | 200MHz~1GHz: 5.28dB |
| | 1GHz~40GHz: 4.91dB |
| Output Power | |
| Measuring Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$): | |
| 1.5dB | |

5. Test Result

5.1. Summary

| FCC Part Section(s) | Test Description | Test Condition | Verdict |
|--|--|----------------|---------|
| 22.913(a)(5), 24.232(c) 27.50(d)(4) | Equivalent Radiated Power / Equivalent Isotropic Radiated Power | Conducted | Pass |
| 2.1053, 22.917(a) 24.238(a), 27.53(h) | 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) For radiated emission tests, every axis (X, Y, Z) was also verified. The test results shown in the following sections represent the worst-case emissions.

5.2. Equivalent Isotropically Radiated Power Measurement

5.2.1. Test Limit

Band 2:

Mobile and portable stations are limited to 2 watts EIRP and the equipment must employ a means for limiting power to the minimum necessary for successful communications.

Band 4:

Fixed, mobile, and portable (hand-held) stations operating in the 1710-1755 MHz band and mobile and portable stations operating in the 1695-1710 MHz and 1755-1780 MHz bands are limited to 1 watt EIRP.

Band 5:

The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 watts.

5.2.2. Test Procedure

ANSI C63.26-2015 - Section 5.2

5.2.3. Test Setting

Average power measurements were performed only when the EUT was transmitting at its maximum power control level using a broadband power meter with a pulse sensor. The power meter implemented triggering and gating capabilities which were set up such that power measurements were recorded only during the ON time of the transmitter.

The relevant equation for determining the maximum ERP or EIRP from the measured RF output power is given in Equation (1) as follows:

$$\text{ERP or EIRP} = P_{\text{Meas}} + G_T$$

where

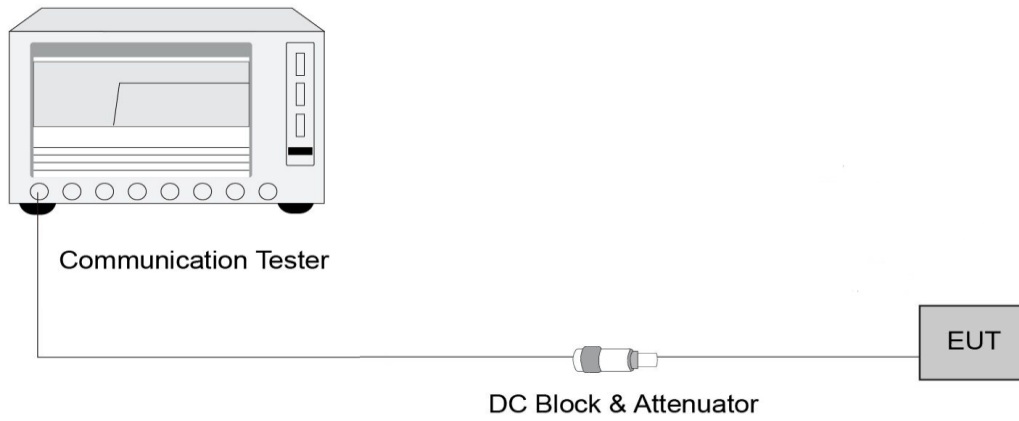
ERP or EIRP effective radiated power or equivalent isotropically radiated power, respectively (expressed in the same units as P_{Meas} , e.g., dBm or dBW)

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)

$$\text{ERP} = \text{EIRP} - 2.15$$

5.2.4. Test Setup



5.2.5. Test Result

Refer to Appendix A.1.

5.3. Radiated Spurious Emissions Measurement

5.3.1. 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.

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.

5.3.2. Test Procedure

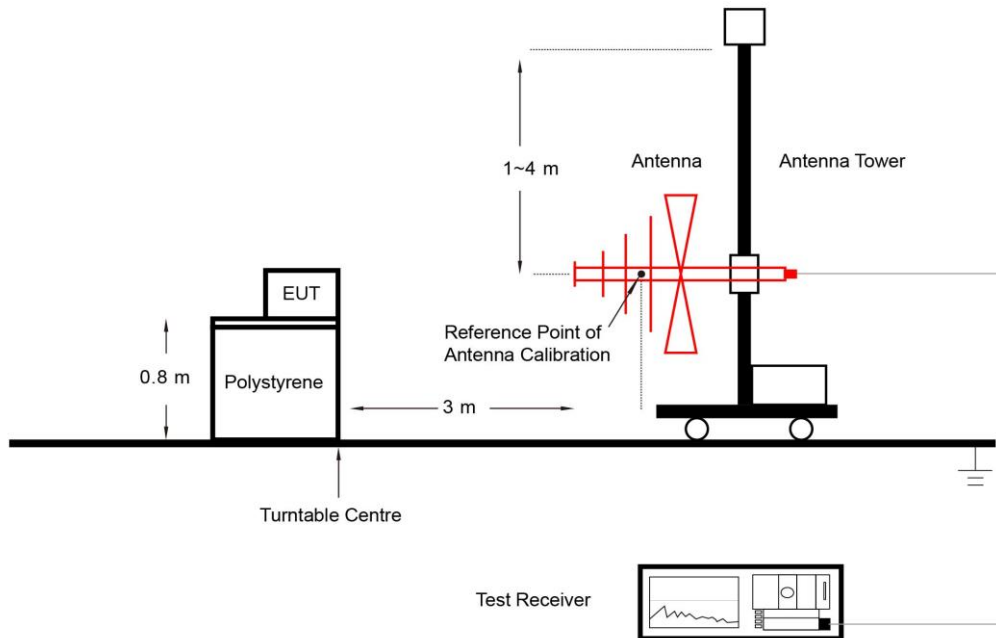
ANSI C63.26-2015 - Section 5.2.7 & 5.5

5.3.3. Test Setting

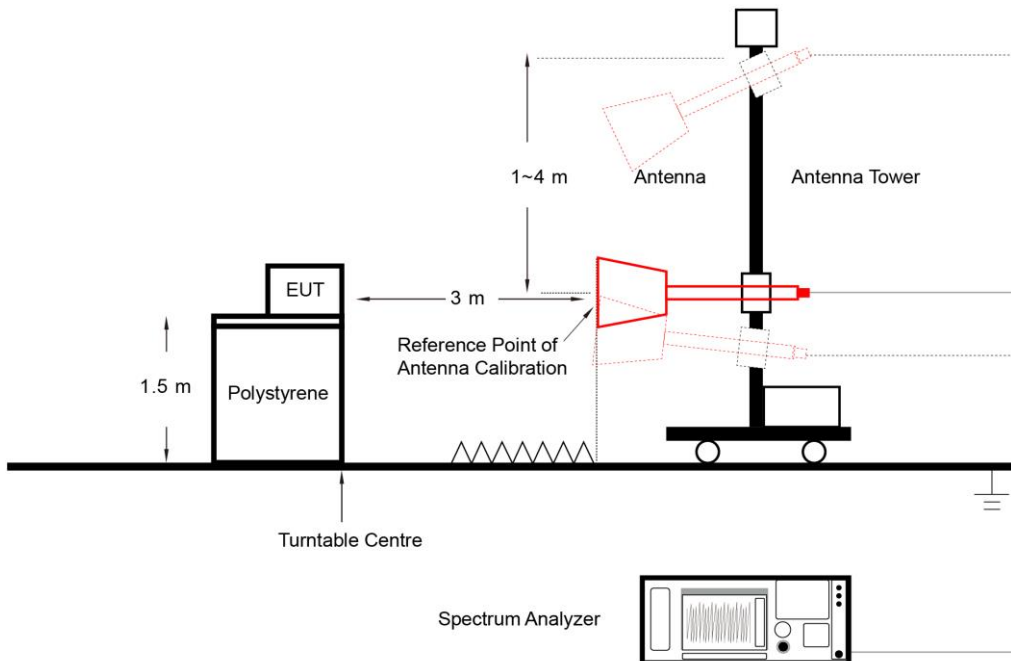
1. RBW = 1MHz
2. VBW \geq 3*RBW
3. Sweep time \geq 10 \times (number of points in sweep) \times (transmission symbol period)
4. Detector = Peak
5. Trace mode = max hold
6. The trace was allowed to stabilize

5.3.4. Test Setup

Below 1GHz Test Setup:



Above 1GHz Test Setup:



5.3.5. Test Result

Refer to Appendix A.2.

Appendix A - Test Result

A.1 Equivalent Isotropically Radiated Power Test Result

| | | | |
|-----------|-------------------------|---------------|---------------|
| Test Site | SIP-SR1 | Test Engineer | Yoniter Yang |
| Test Date | 2023-10-08 ~ 2023-10-09 | Test Band | WCDMA Band II |

| Mode | 3GPP Subtest | Conducted Power (dBm) | | | Antenna Gain (dBi) | EIRP (dBm) | | |
|-----------|--------------|-----------------------|--------|-------|--------------------|------------|--------|-------|
| | | Channel | | | | Channel | | |
| | | Low | Middle | High | | Low | Middle | High |
| WCDMA R99 | 1 | 23.55 | 23.60 | 23.67 | 0.25 | 23.80 | 23.85 | 23.92 |
| HSDPA | 1 | 22.54 | 22.65 | 22.72 | 0.25 | 22.79 | 22.90 | 22.97 |
| | 2 | 22.40 | 22.55 | 22.61 | 0.25 | 22.65 | 22.80 | 22.86 |
| | 3 | 21.93 | 22.08 | 22.14 | 0.25 | 22.18 | 22.33 | 22.39 |
| | 4 | 21.90 | 22.01 | 22.16 | 0.25 | 22.15 | 22.26 | 22.41 |
| HSUPA | 1 | 22.50 | 22.50 | 22.69 | 0.25 | 22.75 | 22.75 | 22.94 |
| | 2 | 20.39 | 20.40 | 20.47 | 0.25 | 20.64 | 20.65 | 20.72 |
| | 3 | 21.40 | 21.43 | 21.66 | 0.25 | 21.65 | 21.68 | 21.91 |
| | 4 | 20.38 | 20.52 | 20.59 | 0.25 | 20.63 | 20.77 | 20.84 |
| | 5 | 22.50 | 22.54 | 22.55 | 0.25 | 22.75 | 22.79 | 22.80 |
| Limit | 33.01dBm | | | | | | | |

Note: The EIRP (dBm) = Output Power (dBm) + Antenna Gain (dBi)

| | | | |
|-----------|-------------------------|---------------|---------------|
| Test Site | SIP-SR1 | Test Engineer | Yoniter Yang |
| Test Date | 2023-10-08 ~ 2023-10-09 | Test Band | WCDMA Band IV |

| Mode | 3GPP Subtest | Conducted Power (dBm) | | | Antenna Gain (dBi) | EIRP (dBm) | | |
|-----------|--------------|-----------------------|--------|-------|--------------------|------------|--------|-------|
| | | Channel | | | | Channel | | |
| | | Low | Middle | High | | Low | Middle | High |
| WCDMA R99 | 1 | 23.53 | 23.59 | 23.51 | 1.47 | 25.00 | 25.06 | 24.98 |
| HSDPA | 1 | 22.49 | 22.61 | 22.52 | 1.47 | 23.96 | 24.08 | 23.99 |
| | 2 | 22.49 | 22.57 | 22.44 | 1.47 | 23.96 | 24.04 | 23.91 |
| | 3 | 21.98 | 22.10 | 21.98 | 1.47 | 23.45 | 23.57 | 23.45 |
| | 4 | 21.89 | 22.03 | 22.00 | 1.47 | 23.36 | 23.50 | 23.47 |
| HSUPA | 1 | 22.52 | 22.72 | 22.51 | 1.47 | 23.99 | 24.19 | 23.98 |
| | 2 | 20.46 | 20.56 | 20.38 | 1.47 | 21.93 | 22.03 | 21.85 |
| | 3 | 21.35 | 21.44 | 21.44 | 1.47 | 22.82 | 22.91 | 22.91 |
| | 4 | 20.53 | 20.54 | 20.48 | 1.47 | 22.00 | 22.01 | 21.95 |
| | 5 | 22.40 | 22.55 | 22.34 | 1.47 | 23.87 | 24.02 | 23.81 |
| Limit | 30.00dBm | | | | | | | |

Note: The EIRP (dBm) = Output Power (dBm) + Antenna Gain (dBi)

| | | | |
|-----------|-------------------------|---------------|--------------|
| Test Site | SIP-SR1 | Test Engineer | Yoniter Yang |
| Test Date | 2023-10-08 ~ 2023-10-09 | Test Band | WCDMA Band V |

| Mode | 3GPP Subtest | Conducted Power (dBm) | | | Antenna Gain (dBi) | ERP (dBm) | | |
|-----------|--------------|-----------------------|--------|-------|--------------------|-----------|--------|-------|
| | | Channel | | | | Channel | | |
| | | Low | Middle | High | | Low | Middle | High |
| WCDMA R99 | 1 | 23.61 | 23.54 | 23.48 | 1.1 | 22.56 | 22.49 | 22.43 |
| HSDPA | 1 | 22.62 | 22.58 | 22.51 | 1.1 | 21.57 | 21.53 | 21.46 |
| | 2 | 22.62 | 22.56 | 22.48 | 1.1 | 21.57 | 21.51 | 21.43 |
| | 3 | 22.10 | 22.02 | 22.02 | 1.1 | 21.05 | 20.97 | 20.97 |
| | 4 | 22.09 | 22.08 | 22.01 | 1.1 | 21.04 | 21.03 | 20.96 |
| HSUPA | 1 | 22.55 | 22.52 | 22.50 | 1.1 | 21.50 | 21.47 | 21.45 |
| | 2 | 20.65 | 20.65 | 20.54 | 1.1 | 19.60 | 19.60 | 19.49 |
| | 3 | 21.64 | 21.46 | 21.34 | 1.1 | 20.59 | 20.41 | 20.29 |
| | 4 | 20.64 | 20.55 | 20.54 | 1.1 | 19.59 | 19.50 | 19.49 |
| | 5 | 22.50 | 22.48 | 22.44 | 1.1 | 21.45 | 21.43 | 21.39 |
| Limit | 38.45dBm | | | | | | | |

Note: The ERP (dBm) = Output Power (dBm) + Antenna Gain (dBi) – 2.15

A.2 Radiated Spurious Emissions Test Result

| | | | |
|-----------|-------------------------|---------------|---------------|
| Test Site | WZ-AC2 | Test Engineer | Carl Jiang |
| Test Date | 2023-09-29 ~ 2023-09-30 | Test Band | WCDMA Band II |

| Frequency (MHz) | Reading Level (dB μ V) | Factor (dB/m) | Measure Level (dB μ V/m) | Limit (dB μ V/m) | Margin (dB) | Detector | Polarization |
|-----------------|----------------------------|---------------|------------------------------|----------------------|-------------|----------|--------------|
| Middle Channel | | | | | | | |
| 10928.000 | 32.0 | 16.9 | 48.9 | 82.3 | -33.4 | Peak | Horizontal |
| 14515.000 | 32.5 | 18.6 | 51.1 | 82.3 | -31.2 | Peak | Horizontal |
| 11480.500 | 31.6 | 17.5 | 49.1 | 82.3 | -33.2 | Peak | Vertical |
| 14940.000 | 32.2 | 19.7 | 51.9 | 82.3 | -30.4 | Peak | Vertical |

Note: Measure Level (dB μ V/m) = Reading Level (dB μ V) + Factor (dB/m)

Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m).

| | | | |
|-----------|-------------------------|---------------|---------------|
| Test Site | WZ-AC2 | Test Engineer | Carl Jiang |
| Test Date | 2023-09-29 ~ 2023-09-30 | Test Band | WCDMA Band IV |

| Frequency (MHz) | Reading Level (dB μ V) | Factor (dB/m) | Measure Level (dB μ V/m) | Limit (dB μ V/m) | Margin (dB) | Detector | Polarization |
|---|----------------------------|---------------|------------------------------|----------------------|-------------|----------|--------------|
| Middle Channel | | | | | | | |
| 3482.000 | 46.4 | -1.3 | 45.1 | 82.3 | -37.2 | Peak | Horizontal |
| 13478.000 | 31.5 | 19.5 | 51.0 | 82.3 | -31.3 | Peak | Horizontal |
| 10919.500 | 31.8 | 16.8 | 48.6 | 82.3 | -33.7 | Peak | Vertical |
| 14923.000 | 31.8 | 19.6 | 51.4 | 82.3 | -30.9 | Peak | Vertical |
| Note: Measure Level (dB μ V/m) = Reading Level (dB μ V) + Factor (dB/m) Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m). | | | | | | | |

| | | | |
|-----------|-------------------------|---------------|--------------|
| Test Site | WZ-AC2 | Test Engineer | Carl Jiang |
| Test Date | 2023-09-29 ~ 2023-09-30 | Test Band | WCDMA Band V |

| Frequency (MHz) | Reading Level (dB μ V) | Factor (dB/m) | Measure Level (dB μ V/m) | Limit (dB μ V/m) | Margin (dB) | Detector | Polarization |
|---|----------------------------|---------------|------------------------------|----------------------|-------------|----------|--------------|
| Middle Channel | | | | | | | |
| 5080.000 | 34.8 | 3.5 | 38.3 | 82.3 | -44.0 | Peak | Horizontal |
| 13478.000 | 31.1 | 19.5 | 50.6 | 82.3 | -31.7 | Peak | Horizontal |
| 7638.500 | 33.2 | 11.5 | 44.7 | 82.3 | -37.6 | Peak | Vertical |
| 15016.500 | 32.5 | 19.5 | 52.0 | 82.3 | -30.3 | Peak | Vertical |
| Note: Measure Level (dB μ V/m) = Reading Level (dB μ V) + Factor (dB/m) Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m). | | | | | | | |

Appendix B - Test Setup Photograph

Refer to "2309RSU052-UT" file.

Appendix C - EUT Photograph

Refer to "2309RSU052-UE" file.